Bombardier Recreational Products Inc.

ski-doo®

2005

Shop Manual

REV Series

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2005
Shop Manual

REV SERIES

BOMBARDIER RECREATIONAL PRODUCTS INC.

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TABLE OF CONTENTS

SAFETY NOTICE ..... **XI**

INTRODUCTION ..... **XII**
VEHICLE IDENTIFICATION NUMBER XIV
ENGINE SERIAL NUMBER XIV
LIST OF ABBREVIATIONS USED IN THIS MANUAL XIV
ARRANGEMENT OF THIS MANUAL XVI
GENERAL INFORMATION XVIII
ILLUSTRATIONS AND PROCEDURES XVIII
SELF-LOCKING FASTENERS PROCEDURE XVIII
LOCTITE APPLICATION PROCEDURE XIX
THREADLOCKER XIX
STRIPPED THREAD REPAIR XX
GASKET COMPOUND XXI
MOUNTING ON SHAFT XXI
CASE-IN COMPONENTS XXII
TIGHTENING TORQUE XXIII

01 MAINTENANCE
01 – MAINTENANCE CHART **1**
02 – STORAGE **3**
GENERAL 3
ENGINE 3
FUEL SYSTEM 4
DRIVE SYSTEM 4
STEERING/FRONT SUSPENSION 5
SUSPENSION 5
ELECTRICAL 5
VEHICLE 5
03 – PRESEASON PREPARATION **7**
ENGINE 7
FUEL SYSTEM 7
DRIVE SYSTEM 8
ELECTRICAL SYSTEM 8
VEHICLE 8

02 TROUBLESHOOTING
01 – ENGINE **9**
02 – FUEL AND OIL SYSTEMS **21**
03 – DRIVE AND BRAKE SYSTEMS **25**
DRIVE SYSTEM 25
BRAKE SYSTEM 32
04 – ELECTRICAL SYSTEM **33**
05 – STEERING AND SUSPENSION **43**

03 ENGINES
01 – LEAK TEST **47**
PREPARATION 47
PROCEDURE 48
FINALIZING REASSEMBLY 49
ENGINE LEAK VERIFICATION FLOW CHART 50

TABLE OF CONTENTS

02 – EXHAUST SYSTEM 51
377 AND 552 ENGINES 52
593, 593 HO, 593 HO SDI AND 793 HO ENGINES 53
TUNED PIPE 54
MANIFOLD 55
MUFFLER 55
03 – ENGINE REMOVAL AND INSTALLATION 57
REMOVAL FROM VEHICLE 59
INSPECTION 63
INSTALLATION 63
REMOVAL FROM VEHICLE 65
INSPECTION 69
INSTALLATION 69
04 – MAGNETO SYSTEM 71
GENERAL 76
MAGNETO FLYWHEEL 76
STATOR 78
CPS/TRIGGER COIL 78
05 – TOP END 81
TROUBLESHOOTING 84
CLEANING 84
DISASSEMBLY 84
INSPECTION 86
ASSEMBLY 86
TROUBLESHOOTING 98
COMPONENT REMOVAL WITH THE ENGINE INSTALLED 98
CLEANING 98
RAVE VALVE BASIC OPERATION 98
DISASSEMBLY 98
INSPECTION 103
ASSEMBLY 104
06 – BOTTOM END 109
CLEANING 112
DISASSEMBLY 112
INSPECTION 113
ASSEMBLY 113
BREAK-IN 118
CLEANING 122
DISASSEMBLY 122
INSPECTION 123
ASSEMBLY 123
BREAK-IN 128
07 – ENGINE MEASUREMENT 129
CYLINDER HEAD WARPAGE 129
CYLINDER TAPER 129
CYLINDER OUT OF ROUND 129
COMBUSTION CHAMBER VOLUME MEASUREMENT 130
USED PISTON MEASUREMENT 131
CYLINDER/PISTON CLEARANCE 131
RING/PISTON GROOVE CLEARANCE 133
RING END GAP 133
CRANKSHAFT DEFLECTION 133

CONNECTING ROD BIG END AXIAL PLAY 134
CHECKING CRANKSHAFT ALIGNMENT 134
08 – COOLING SYSTEM 135
COOLING FAN REMOVAL AND INSTALLATION 138
COOLING FAN BEARING REPLACEMENT 138
FAN BELT REPLACEMENT AND DEFLECTION ADJUSTMENT 139
LIQUID COOLING SYSTEM 142
COOLING SYSTEM LEAK TEST 145
INSPECTION 145
DRAINING THE SYSTEM 145
DISASSEMBLY AND ASSEMBLY 145
COOLING SYSTEM REFILLING PROCEDURE 146
09 – REWIND STARTER 147
INSPECTION 150
REMOVAL 150
ROPE REPLACEMENT 150
DISASSEMBLY 151
ASSEMBLY 151
INSTALLATION 154
10 – OIL INJECTION SYSTEM 155
GENERAL 158
OIL TYPE 158
OIL SYSTEM LEAK TEST 158
OIL PUMP IDENTIFICATION 159
CLEANING 159
CHECKING OPERATION 159
DISASSEMBLY 160
ASSEMBLY 161
BLEEDING PROCEDURE 162
ADJUSTMENT 162

04 FUEL SYSTEM
01 – FUEL TANK AND FUEL PUMP 165
IN-TANK FUEL FILTER 168
IN-LINE FUEL FILTER 168
FUEL TANK 169
FLOAT-TYPE FUEL LEVEL GAUGE 170
ELECTRIC FUEL LEVEL SENSOR 171
FUEL SYSTEM PRESSURIZATION 171
DIAPHRAGM FUEL PUMP 172
REMOVAL 174
PUMP VERIFICATION 174
CLEANING AND INSPECTION 174
INSTALLATION 174
02 – CARBURETORS, THROTTLE AND CHOKE CABLES 175
CARBURETOR — VM TYPE 176
IDENTIFICATION 177
REMOVAL 177
CLEANING AND INSPECTION 177
DISASSEMBLY AND ASSEMBLY 177
CARBURETOR ADJUSTMENTS 178
INSTALLATION 181

TABLE OF CONTENTS

CHOKE 182
CARBURETOR TM TYPE 184
IDENTIFICATION 185
REMOVAL 185
CLEANING AND INSPECTION 187
DISASSEMBLY AND ASSEMBLY 187
INSTALLATION 189
CARBURETOR ADJUSTMENTS 189
CHOKE CABLE 191
03 – DPM SYSTEM 193
OVERVIEW 195
SYSTEM TESTING 195
PARTS REMOVAL AND INSTALLATION 195
DPM MANIFOLD TESTING 196

05 ENGINE MANAGEMENT (POWER TEK)
01 – OVERVIEW 199
OPERATING PRINCIPLE 200
FUEL DELIVERY SYSTEM 200
ENGINE MANAGEMENT SYSTEM (EMS) 200
EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS 201
POWER DISTRIBUTION 202
IGNITION SYSTEM 202
ELECTRONICALLY CONTROLLED RAVE 202
DIGITALLY ENCODED SECURITY SYSTEM (DESS) 202
ROTAX ELECTRONIC REVERSE (RER) 203
MONITORING SYSTEM 203
DIAGNOSTIC MODE 203
02 – DIAGNOSTIC PROCEDURES 205
GENERAL 205
TROUBLESHOOTING 205
EMS FAULT CODES 206
VCK (VEHICLE COMMUNICATION KIT) 209
03 – COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT 213
GENERAL 213
ELECTRICAL SYSTEM 213
FUEL SYSTEM 215
ENGINE MANAGEMENT SYSTEM 216
ENGINE CONTROL MODULE (ECM) 216
POWER RELAY 216
THROTTLE POSITION SENSOR (TPS) 217
AIR TEMPERATURE SENSOR (ATS) 221
COOLANT TEMPERATURE SENSOR (CTS) 222
AIR PRESSURE SENSOR (APS) 223
KNOCK SENSOR (KS) 224
E-RAVE SOLENOID 225
DPM SOLENOID 226
IGNITION COIL 226
ENGINE START/RER SWITCH 227
DIGITALLY ENCODED SECURITY SYSTEM (DESS) 228

TABLE OF CONTENTS

06 ENGINE MANAGEMENT (SDI)

01 – OVERVIEW 231
OPERATING PRINCIPLE 232
CHARGING SYSTEM 232
IGNITION SYSTEM 232
AIR INDUCTION 232
FUEL DELIVERY SYSTEM 233
ENGINE MANAGEMENT SYSTEM (EMS) 234
ECM — GENERAL FUNCTIONS 235
EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS 237
ELECTRONIC FUEL INJECTION 237
IGNITION TIMING 238
ELECTRONICALLY CONTROLLED RAVE 238
KNOCK SENSOR 238
ENGINE MODES OF OPERATION 238
FLOODED ENGINE (DROWNED MODE) 238
MONITORING SYSTEM 238
LIMP HOME MODES 238
DIAGNOSTIC MODE 239
ROTAX ELECTRONIC REVERSE (RER) 239

02 – DIAGNOSTIC PROCEDURES 241
GENERAL 241
TROUBLESHOOTING 241
VCK (VEHICLE COMMUNICATION KIT) 245
2-TEC SYSTEM FAULT CODES 247

03 – COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT 249
GENERAL 249
FUEL SYSTEM 249
ELECTRICAL SYSTEM 250
RESISTANCE MEASUREMENT 251
ENGINE CONNECTOR PIN-OUTS 252
RELAY 253
AIR INDUCTION SYSTEM 254
THROTTLE BODY 254
FUEL DELIVERY 257
ELECTRIC FUEL PUMP 258
FUEL RAIL 261
FUEL INJECTORS 262
ELECTRONIC MANAGEMENT 265
ECM REPLACEMENT 265
ENGINE WIRING HARNESS 265
THROTTLE POSITION SENSOR (TPS) 266
CRANKSHAFT POSITION SENSOR (CPS) 268
AIR TEMPERATURE SENSOR (ATS) 269
COOLANT TEMPERATURE SENSOR (CTS) 270
AIR PRESSURE SENSOR (APS) 271
EXHAUST GAS TEMPERATURE SENSOR (EGTS) 271
KNOCK SENSOR (KS) 272
E-RAVE SOLENOID 273
DOUBLE IGNITION COIL 273
IGNITION TIMING 275
BATTERY 275

TABLE OF CONTENTS

CAPACITOR 275
ENGINE START/RER SWITCH VERIFICATION 276
DESS POST VERIFICATION 277

07 ELECTRICAL SYSTEM

01 – IGNITION SYSTEM 279
GENERAL 279
IGNITION TIMING 282
SPARK PLUG 291
DESIGN SYMBOLS USED IN NGK SPARK PLUGS 292
02 – CHARGING SYSTEM 293
GENERAL 293
CHARGING GENERATOR COIL (STATOR) 293
VOLTAGE REGULATOR/RECTIFIER 294
BATTERY 295
CABLE TERMINAL INSTALLATION 297
03 – STARTING SYSTEM 299
TROUBLESHOOTING 301
04 – ACCESSORIES 307
GENERAL 307
12-VOLT POWER OUTLET (CIGARETTE-LIGHTER TYPE) 308
BEEPER (REVERSE ALARM) 308
ENGINE TEMPERATURE GAUGE 309
ELECTRIC FUEL GAUGE 310
HEADLAMP 310
HEADLAMP BEAM AIMING 311
HEATING ELEMENTS 312
RELAY 312
SPEEDOMETER 313
SPEED SENSOR 313
TACHOMETER 314
TAILLIGHT 314
VISOR OUTLET 315

08 DRIVE SYSTEM

01 – DRIVE BELT 317
APPLICATION CHART 317
INSPECTION 317
CHECKING NEUTRAL FUNCTION 317
ROTATION DIRECTION 317
DRIVE BELT HEIGHT MEASUREMENT AND ADJUSTMENT 318
DRIVE BELT DEFLECTION MEASUREMENT (REFERENCE ONLY) 320
02 – DRIVE PULLEY 323
BOMBARDIER LITE 324
GENERAL 325
REMOVAL 325
DISASSEMBLY 325
CLEANING 326
INSPECTION 326
ASSEMBLY 326
INSTALLATION 327
TRA III 328

GENERAL 329
REMOVAL 329
DISASSEMBLY 329
CLEANING 331
INSPECTION 331
ASSEMBLY 333
INSTALLATION 337
DRIVE PULLEY ADJUSTMENT 337
03 – DRIVEN PULLEY 339
FORMULA RER AND FORMULA VSA-R 340
REMOVAL 341
DISASSEMBLY 341
CLEANING 341
INSPECTION 341
BUSHING REPLACEMENT 342
ASSEMBLY 342
INSTALLATION 343
ADJUSTMENT 344
HPV VSA 345
REMOVAL 346
DISASSEMBLY 346
CLEANING 346
INSPECTION 346
ASSEMBLY 346
INSTALLATION 347
ADJUSTMENT 347
04 – PULLEY ALIGNMENT 349
GENERAL 349
MEASURING PROCEDURE 349
ALIGNMENT PROCEDURE 351
05 – BRAKE 353
HYDRAULIC BRAKE 354
BRAKE FLUID 355
MASTER CYLINDER 355
CALIPER 355
BRAKE PADS 356
BRAKE DISC 357
COUNTERSHAFT BEARING 357
COUNTERSHAFT 358
BRAKE LIGHT SWITCH 358
BLEEDING 359
06 – CHAINCASE 361
GENERAL 363
CHAINCASE OIL LEVEL 363
OIL CHANGE 363
DRIVE CHAIN ADJUSTMENT 364
REMOVAL AND DISASSEMBLY 364
INSPECTION 365
INSTALLATION AND ASSEMBLY 365
SILENT CHAIN 365
07 – DRIVE AXLE 367
REMOVAL 371

TABLE OF CONTENTS

ASSEMBLY 372
LUBRICATION 373
ADJUSTMENT 373
08 – TRACK 375
TRACK TYPE APPLICATION 375
GENERAL 375
INSPECTION 375
REMOVAL 375
INSTALLATION 375
ADJUSTMENT 375
TRACK CLEAT 377
TRACTION ENHANCING PRODUCTS (STUDS) 377

09 REAR SUSPENSION
01 – SC SUSPENSION 381
AXLE SELF-LOCKING SCREWS REMOVAL 386
REAR AXLE REMOVAL 386
REAR AXLE INSTALLATION 386
REAR SHOCK ABSORBER REMOVAL 386
REAR SHOCK ABSORBER INSTALLATION 387
FRONT SHOCK ABSORBER REMOVAL 387
FRONT SHOCK ABSORBER INSTALLATION 387
REAR SPRING REMOVAL 388
REAR SPRING INSTALLATION 388
SLIDER SHOE VERIFICATION 388
SLIDER SHOE REMOVAL 389
SLIDER SHOE INSTALLATION 390
SUSPENSION REMOVAL 390
SUSPENSION INSTALLATION 391
FRONT ARM REMOVAL 391
FRONT ARM INSTALLATION 391
REAR ARM/PIVOT ARM REMOVAL 392
REAR ARM INSTALLATION 392
STOPPER STRAP 392
RIDE ADJUSTMENT 393
LUBRICATION 393
02 – SC 3 SUSPENSION 395
AXLE SELF-LOCKING SCREWS REMOVAL 399
REAR AXLE REMOVAL 399
REAR AXLE INSTALLATION 399
REAR SHOCK ABSORBER REMOVAL 399
REAR SHOCK ABSORBER INSTALLATION 400
FRONT SHOCK ABSORBER REMOVAL 400
FRONT SHOCK ABSORBER INSTALLATION 400
REAR SPRING REMOVAL 400
REAR SPRING INSTALLATION 401
SLIDER SHOE VERIFICATION 402
SLIDER SHOE REMOVAL 402
SLIDER SHOE INSTALLATION 403
SUSPENSION REMOVAL 403
SUSPENSION INSTALLATION 404
FRONT ARM REMOVAL 404

FRONT ARM INSTALLATION 405
REAR ARM/PIVOT ARM REMOVAL 405
REAR ARM/PIVOT ARM INSTALLATION 405
STOPPER STRAP 406
RIDE ADJUSTMENT 406
LUBRICATION 406
03 – SC 4 SUSPENSION 409
AXLE SELF-LOCKING SCREW REMOVAL 413
REAR AXLE REMOVAL 413
REAR AXLE INSTALLATION 413
REAR SHOCK ABSORBER REMOVAL 413
REAR SHOCK ABSORBER INSTALLATION 414
FRONT SHOCK ABSORBER REMOVAL 414
FRONT SHOCK ABSORBER INSTALLATION 415
REAR SPRING REMOVAL 415
REAR SPRING INSTALLATION 416
SLIDER SHOE VERIFICATION 416
SLIDER SHOE REMOVAL 417
SLIDER SHOE INSTALLATION 418
SUSPENSION REMOVAL 418
SUSPENSION INSTALLATION 418
FRONT ARM REMOVAL 418
FRONT ARM INSTALLATION 419
REAR ARM/PIVOT ARM REMOVAL 419
REAR ARM/PIVOT ARM INSTALLATION 419
BLOCK INSTALLATION 420
IDLER WHEELS INSTALLATION 420
STOPPER STRAP 420
RIDE ADJUSTMENT 420
LUBRICATION 421
04 – SHOCK ABSORBER INSPECTION AND SERVICING 423
SPRING REMOVAL 423
SHOCK ABSORBER INSPECTION 424
DISASSEMBLY AND ASSEMBLY 425

10 STEERING/FRONT SUSPENSION
01 – STEERING SYSTEM 433
DISASSEMBLY AND ASSEMBLY 437
INSPECTION 440
ADJUSTMENT 440
STEERING ADJUSTMENT (SKIS) 444
LUBRICATION 446
02 – FRONT SUSPENSION 447
GENERAL INSPECTION 450
DISASSEMBLY 450
INSPECTION 454
INSTALLATION 455

11 BODY/FRAME
01 – BODY 461
INSTALLATION AND ADJUSTMENT 461
DECAL 461

TABLE OF CONTENTS

WINDSHIELD 461
GUARD 461
WIRING HARNESS 461
CABLES 462
TUBING 462
PLASTIC MAINTENANCE AND REPAIR 462
MAINTENANCE 462
REPAIR 462
02 – FRAME 463
FRAME CLEANING 463
FRAME WELDING 463
FRAME COMPONENT REPLACEMENT 463

12 TECHNICAL DATA
01 – FAN COOLED MODELS 465
02 – LIQUID COOLED MODELS 471
03 – LIQUID COOLED (SDI) MODELS 479

13 WIRING DIAGRAM
01 – WIRING DIAGRAMS 485
WIRING DIAGRAM LEGEND 485
WIRE COLORS 485
CONNECTOR HOUSING AREA 485
HOUSING REFERENCE PER AREA 486
WIRE LOCATION IN CONNECTOR HOUSING 486
SYMBOLS DESCRIPTION 488
UNPLUGING CONNECTORS 489
TAB AND RECEPTACLE CONNECTORS REMOVAL 489
TAB AND RECEPTACLE CONNECTORS INSTALLATION 495

SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair some 2005 Ski-Doo snowmobiles. See model list below.

This edition was primarily published to be used by snowmobile mechanic technicians who are already familiar with all service procedures relating to BRP made snowmobiles. Mechanic technicians should attend continuous training courses given by BRP Training Dept.

Please note that the instructions will apply only if proper hand tools and special service tools are used.

This shop manual uses technical terms which may be slightly different from the ones used in the Parts Catalog.

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

The content depicts parts and/or procedures applicable to the particular product at time of writing. Service and Warranty Bulletins may be published to update the content of this manual. Make sure to read and understand them.

In addition, the sole purpose of the illustrations throughout the manual, is to assist identification of the general configuration of the parts. They are not to be interpreted as technical drawings or exact replicas of the parts.

The use of BRP parts is most strongly recommended when considering replacement of any component. Dealer and/or distributor assistance should be sought in case of doubt.

The engines and the corresponding components identified in this document should not be utilized on product(s) other than those mentioned in this document.

This manual emphasizes particular information denoted by the wording and symbols:

⚠ WARNING

Identifies an instruction which, if not followed, could cause serious personal injury including possibility of death.

CAUTION: Denotes an instruction which, if not followed, could severely damage vehicle components.

NOTE: Indicates supplementary information needed to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use. Always use common shop safety practice.

Bombardier Recreational Products Inc. (BRP) disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that any services be carried out and/or verified by a highly skilled professional mechanic. It is understood that certain modifications may render use of the vehicle illegal under existing federal, provincial and state regulations.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (ex.: locking tab, self-locking fasteners, etc.) must be installed or replaced with new ones. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Unless otherwise specified, engine should be turned OFF and cold for all maintenance and repair procedures.

INTRODUCTION

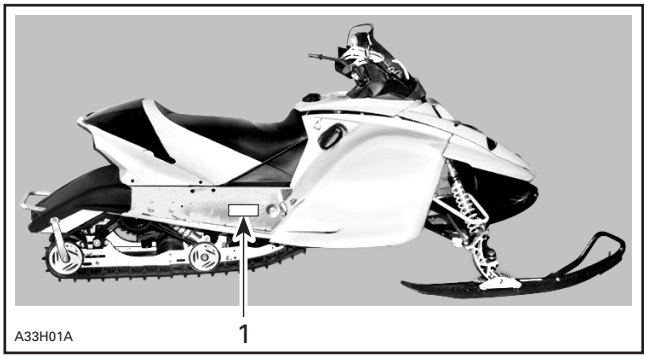
This shop manual covers the following BRP made 2005 REV Series models:

TYPICAL — REV SERIES

MODEL	ENGINE	MODEL NUMBER
EXPEDITION	550F	FJ5A, FJ5B
GSX	380F	DG5B
	550F	DF5A
	500 SS	DC5A, DC5B
	600 HO	DB5A, DB5B
	600 HO SDI	DD5A, DD5B, DE5A, DE5B
	800 HO DPM Power Tek	DA5A, DA5B
GTX	380F	EM5A, EM5B
	550F	EL5A, EL5B
	500 SS	ED5A, ED5B, ED5C
	600 HO	EC5A, EC5B
	600 HO SDI	EH5A, EH5B, EJ5A, EJ5B, EJ5C
	800 HO DPM Power Tek	EA5A, EA5B, EA5C
MX Z	380F	BR5A, BR5B, BR5C
	550F	BP5A, BP5B, BP5C
	500 SS	BF5A, BF5B, BF5C, BF5G, BF5H, BF5J, BF5L, BH5B, BH5C, BH5D, BH5A, BH5E
	600 HO	BC5A, BC5C, BC5F, BC5G, BC5H, BC5J, BC5K, BC5L, BC5M, BE5A, BE5B, BE5C, BE5G, BE5H, BE5J, BE5K, BE5L, BE5M, BE5N, BG5A, BG5B, BV5A, BV5B, BV5C, BV5D
	600 HO SDI	BK5A, BK5B, BK5C, BK5D, BK5F, BK5G, BK5H, BK5J, BK5K, BK5L, BK5M, BK5N, BL5A, BL5B, BL5C, BL5G, BL5H, BL5J, BL5K, BL5L, BL5M, BW5C, BW5F, BW5G, BW5H, BW5J, BW5K, BW5L, BW5M, BX5C, BX5D, BX5E, BX5F, BX5G
MX Z (Adrenaline)	800 HO	BD5A, BD5B, BD5C, BD5G, BD5H, BD5J, BD5K, BD5L, BD5M
MX Z	800 HO DPM Power Tek	BB5A, BB5B, BB5C, BB5D, BB5F, BB5G, BB5H, BB5J, BB5K, BB5L, BB5M, BB5N, BS5C, BS5D, BS5E, BS5F, BS5G, BS5H, BS5J, BS5K, BS5L, BS5M, BS5N, BU5A, BU5B, BU5C, BU5D
SUMMIT	550F	CM5A, CM5B
	800 HO DPM	CG5A, CG5B, CG5C, CG5D, CH5A, CH5B, CH5C, CH5D, CJ5A, CJ5B, CJ5C, CK5A, CK5B, CL5A, CL5B, CL5C, CP5A, CP5B, CP5C, CP5D

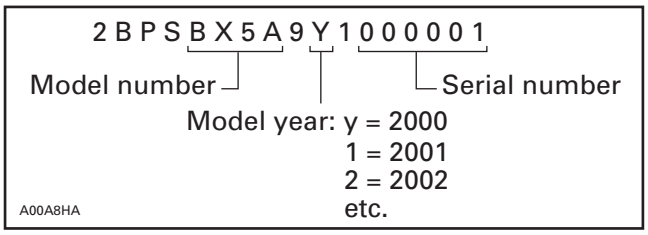
VEHICLE IDENTIFICATION NUMBER

Vehicle Identification Number Location



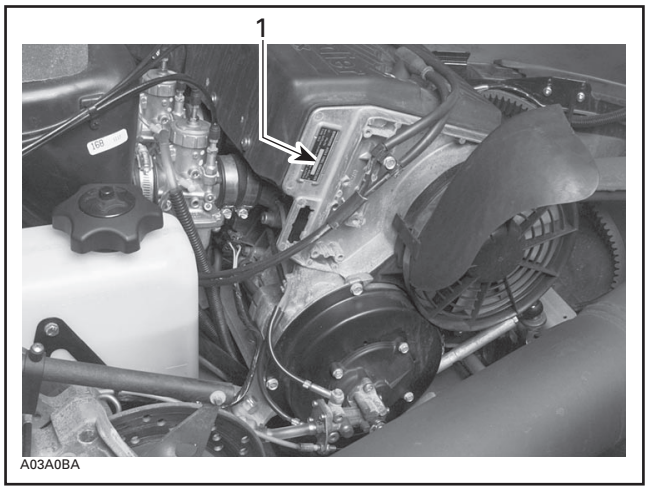
TYPICAL
1. Vehicle identification number

Identification Number Meaning

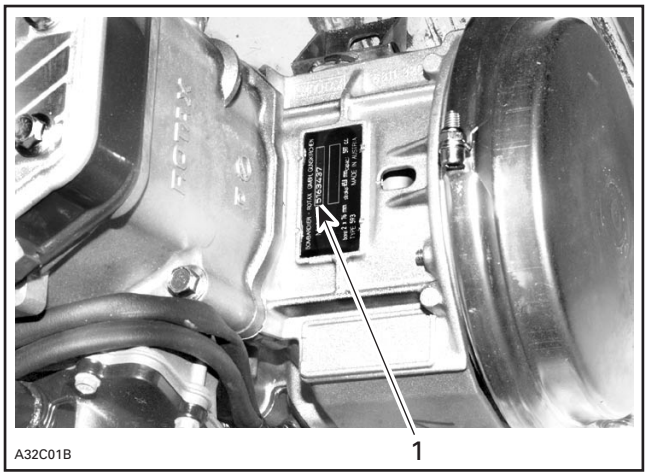


ENGINE SERIAL NUMBER

Engine Serial Number Location



TYPICAL — 2–STROKE FAN-COOLED ENGINES
1. Engine serial number



TYPICAL — 2–STROKE LIQUID-COOLED ENGINES
1. Engine serial number

LIST OF ABBREVIATIONS USED IN THIS MANUAL

ABBREVIATION	MEANING
A	ampere
amp	ampere
A•h	ampere-hour
AC	alternate current
ACM	acceleration and control modulator
AMG	absorbed glass mat
BDC	bottom dead center
BTDC	before top dead center
°C	degree Celsius
cc	cubic centimeter
CDI	capacitor discharge ignition
CTR	center
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
DC	direct current
DESS	digitally encoded security system
DPM	digital performance management

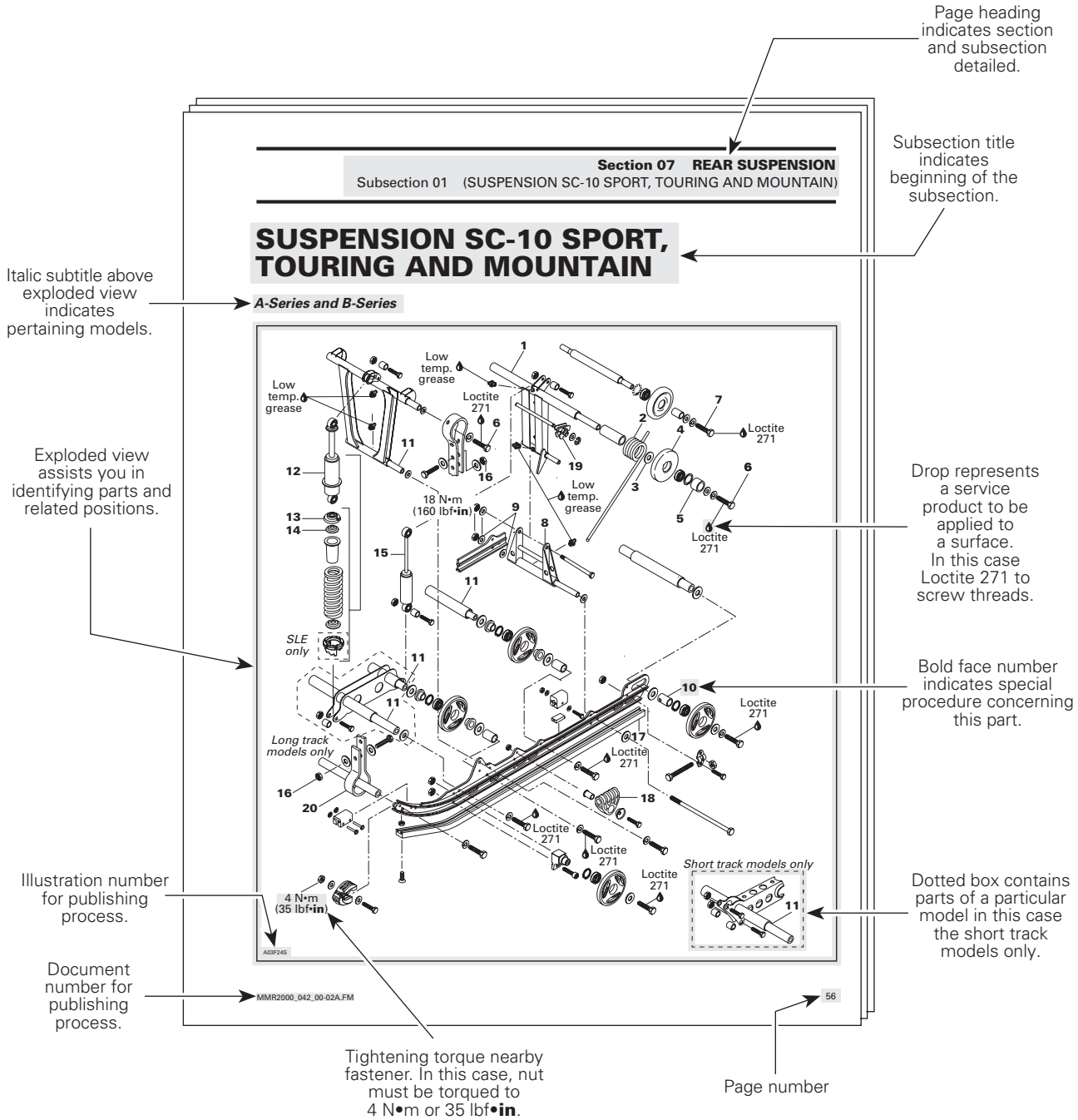
ABBREVIATION	MEANING
°F	degree Fahrenheit
FC	fan cooled
fl. oz	fluid ounce
ft	foot
GRD	ground
H.A.C.	high altitude compensator
hal.	halogen
HI	high
IFP	internal floating piston
imp. oz	imperial ounce
in	inch
in^2	square inch
in^3	cubic inch
k	kilo (thousand)
kg	kilogram
km/h	kilometer per hour
kPa	Kilopascal
L	liter
lb	pound
lbf	pound (force)
lbf/in^2	pound per square inch
LH	left hand
LO	low
LT	long track
m	meter
MAG	magneto
Max.	maximum
Min.	minimum
mL	milliliter
mm	millimeter
M.E.	millennium edition
MPEM	multi-purpose electronic module
MPH	mile per hour
N	newton

ABBREVIATION	MEANING
N.A.	not applicable
no.	number
0	continuity
0.L	open line (open circuit)
O.D.	outside diameter
OPT	optional
oz	ounce
P/N	part number
PSI	pound per square inch
PTO	power take off
R	rectangular
RH	right hand
R.A.S.	response angle suspension
RAVE	Rotax adjustable variable exhaust
RER	Rotax electronic reverse
RPM	revolution per minute
RMS	root mean square
RRIM	reinforced reaction injection molding
SDI	semi-direct injection
Sp. Gr.	specific gravity
ST	semi-trapez
TDC	top dead center
TRA	total range adjustable
U.S. oz	ounce (United States)
V	volt
Vac	volt (alternative current)
VSA	variable sheave angle

ARRANGEMENT OF THIS MANUAL

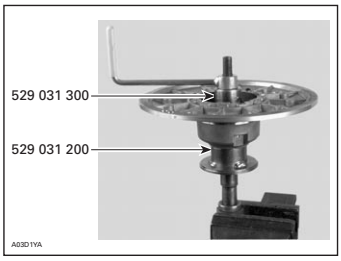
This *Shop Manual* uses technical terms wich may be slightly different from the ones in the parts catalog.

TYPICAL PAGE



TYPICAL PAGE

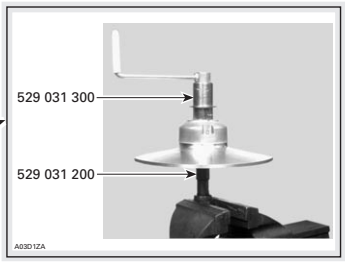
Turn puller handle and sliding half at once to extract the bushing.



IMPORTANT: Large bushing retaining screws and washers must be removed before small bushing installation.

Coat bushing outside diameter with Loctite 609 (P/N 413 703 100).

Install bushing as following photo.



ASSEMBLY

Came Slider Shoe

When replacing slider shoes **no. 4**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Assemble driven pulley components by reversing the disassembly procedure.

Cam

Coat cam **no. 18** interior with anti-seize lubricant.

INSTALLATION

Countershaft

CAUTION: Always apply anti-seize lubricant (P/N 413 701 000) on the countershaft before final pulley installation.

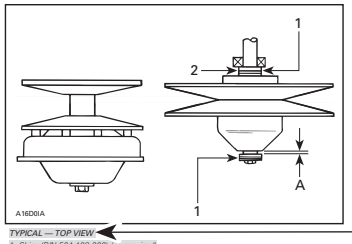
A-Series and B-Series Only

Should installation procedure be required, refer to BRAKE then look for **Brake Disc and Countershaft Bearing Adjustment**.

Reinstall the pulley on the countershaft by reversing the removal procedure.

All Models

Check end play of driven pulley on countershaft by pushing pulley towards outer housing so that the inner shims (P/N 504 108 200) contact it. Measure end play at the mounting screw end between shim(s) and puley. See illustration.



TYPICAL — TOP VIEW

1. Shim (P/N 504 108 200) (as required)
2. Contact
A. 0 to 1 mm (0 to 3/64 in)

Torque retaining screw **no. 13** to 25 N•m (18 lbf•ft).

ADJUSTMENT

Refer to PULLEY DISTANCE AND ALIGNMENT to adjust pulley distance. Adjust drive belt height between pulley halves to obtain specified belt deflection.

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57

Title indicates main procedure to be carried-out.

Italic bold face type setting indicates a particular procedure concerning a model.

Italic bold face setting in this case indicates that particular procedure for A and B-Series is finished, so from this point, all models are concerned.

"TYPICAL" caption indicates a general view which does not represent full detail. "TOP VIEW" caption helps you in understanding illustration.

Call-outs for above illustration.

Illustration always follows text to which it pertains.

Reference to look up a certain section and subsection. In this case it concerns pulleys adjustment.

Subtitle indicates a particular procedure for the named part.

Bold face number following part name refers to exploded view at beginning of subsection.

A00A7YS

GENERAL INFORMATION

The information and component/system descriptions contained in this manual are correct at time of publication. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Due to late changes, it may have some differences between the manufactured product and the description and/or specifications in this document.

BRP reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

ILLUSTRATIONS AND PROCEDURES

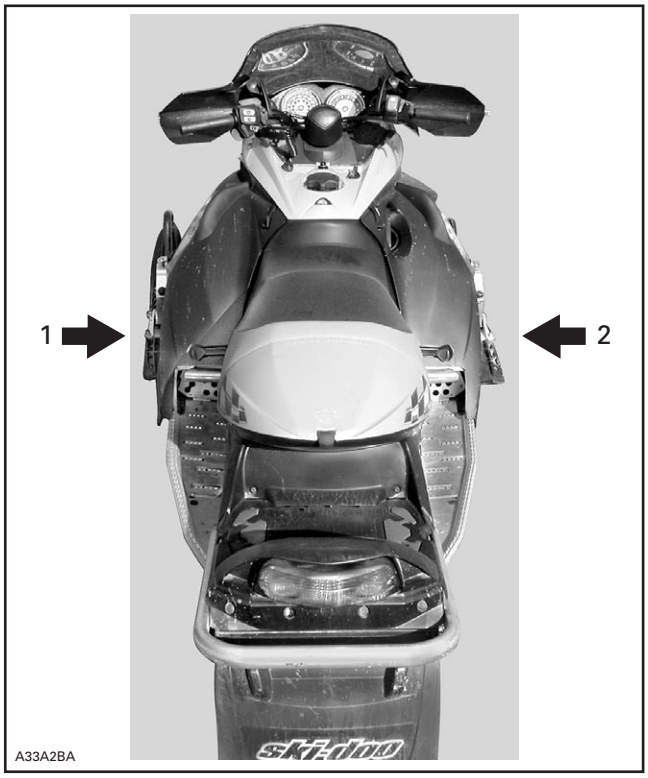
Illustrations and photos show the typical construction of the different assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts shown. However, they represent parts which have the same or a similar function.

CAUTION: Most components of those vehicles are built with parts dimensioned in the metric system. Most fasteners are metric and must not be replaced by customary fasteners or vice-versa. Mismatched or incorrect fasteners could cause damage to the vehicle or possible personal injury.

As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or subsection in which the procedure is contained.

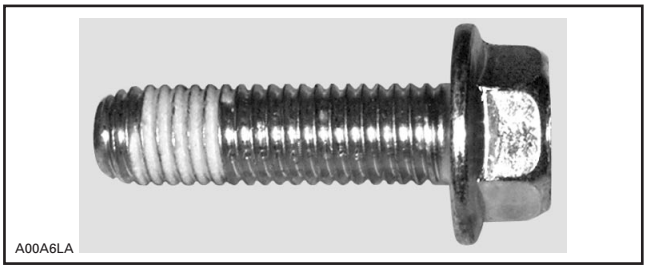
A number of procedures throughout the book require the use of special tools. Before commencing any procedure, be sure that you have on hand all the tools required, or approved equivalents.

The use of RIGHT and LEFT indications in the text, always refers to driving position (when sitting on vehicle).



TYPICAL
1. Left
2. Right

SELF-LOCKING FASTENERS PROCEDURE



TYPICAL — SELF-LOCKING FASTENER

The following describes the most common application procedures when working with self-locking fasteners.

Use a metal brush or a tap to clean the hole properly then use a solvent (Methyl-Chloride), let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

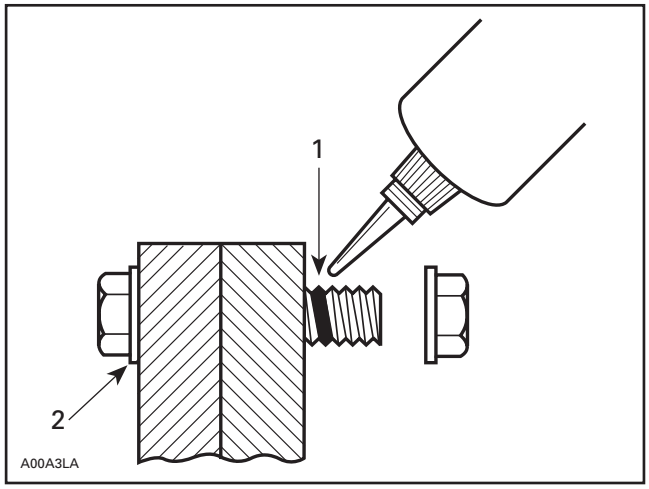
LOCTITE APPLICATION PROCEDURE

The following describes the most common application procedures when working with Loctite products.

NOTE: Always use proper strength Loctite product as recommended in this shop manual.

THREADLOCKER

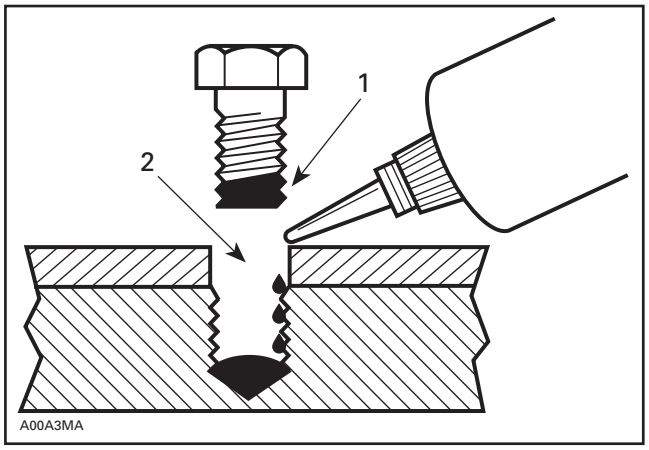
Uncovered Holes (bolts and nuts)



1. Apply here
2. Do not apply

– Clean threads (bolt and nut) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
– Choose proper strength Loctite threadlocker.
– Fit bolt in the hole.
– Apply a few drops of threadlocker at proposed tightened nut engagement area.
– Position nut and tighten as required.

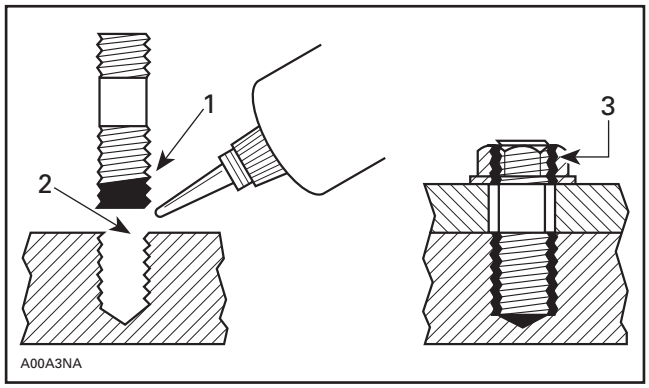
Blind Holes



1. On threads
2. On threads and at the bottom of hole

– Clean threads (bolt and hole) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads (bolt and nut) and allow to dry for 30 seconds.
– Choose proper strength Loctite threadlocker.
– Apply several drops along the threaded hole and at the bottom of the hole.
– Apply several drops on bolt threads.
– Tighten as required.

Stud in Blind Holes

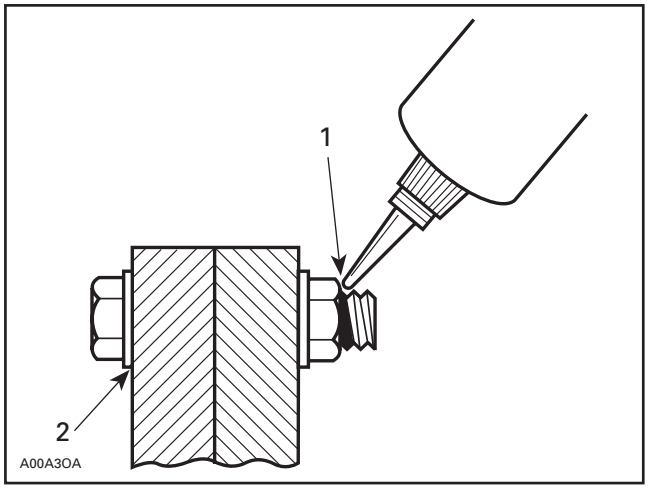


1. On threads
2. On threads and in the hole
3. Onto nut threads

– Clean threads (stud and hole) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
– Put several drops of proper strength Loctite threadlocker on female threads and in hole.

– Apply several drops of proper strength Loctite on stud threads.
– Install stud.
– Install cover, etc.
– Apply drops of proper strength Loctite on uncovered threads.
– Tighten nuts as required.

Preassembled Parts

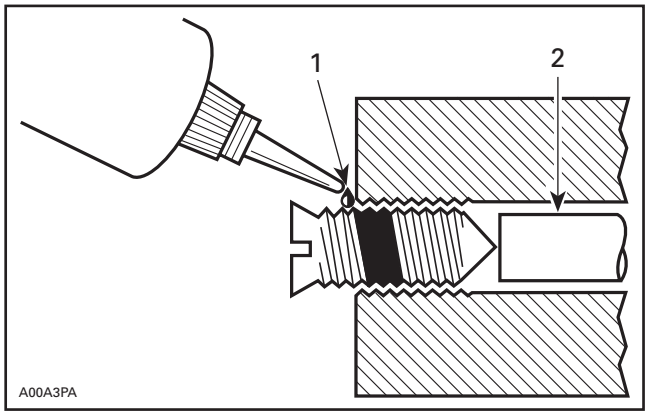


1. Apply here
2. Do not apply

– Clean bolts and nuts with solvent.
– Assemble components.
– Tighten nuts.
– Apply drops of proper strength Loctite on bolt/nut contact surfaces.
– Avoid touching metal with tip of flask.

NOTE: For preventive maintenance on existing equipment, retighten nuts and apply proper strength Loctite on bolt/nut contact surfaces.

Adjusting Screw



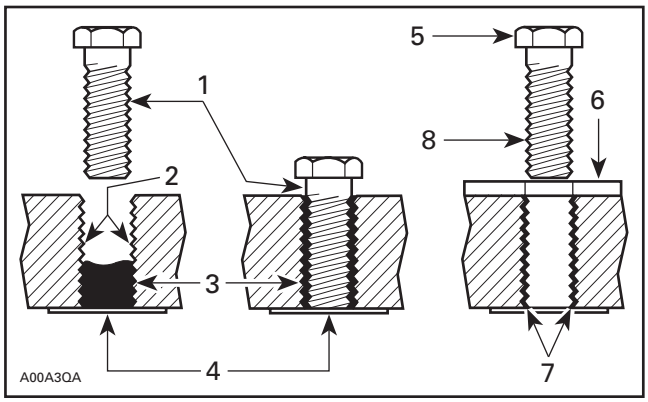
1. Apply here
2. Plunger

– Adjust screw to proper setting.
– Apply drops of proper strength Loctite threadlocker on screw/body contact surfaces.
– Avoid touching metal with tip of flask.

NOTE: If it is difficult to readjust, heat screw with a soldering iron (232°C (450°F)).

STRIPPED THREAD REPAIR

Stripped Threads



1. Release agent
2. Stripped threads
3. Form-A-Thread
4. Tape
5. Cleaned bolt
6. Plate
7. New threads
8. Threadlocker

Standard Thread Repair

– Follow instructions on Loctite FORM-A-THREAD 81668 package.

– If a plate is used to align bolt:
  – Apply release agent on mating surfaces.
  – Put waxed paper or similar film on the surfaces.
  – Twist bolt when inserting it to improve thread conformation.

NOTE: NOT intended for engine stud repairs.

Repair of Small Holes/Fine Threads

Option 1: Enlarge damaged hole, then follow STANDARD THREAD REPAIR procedure.

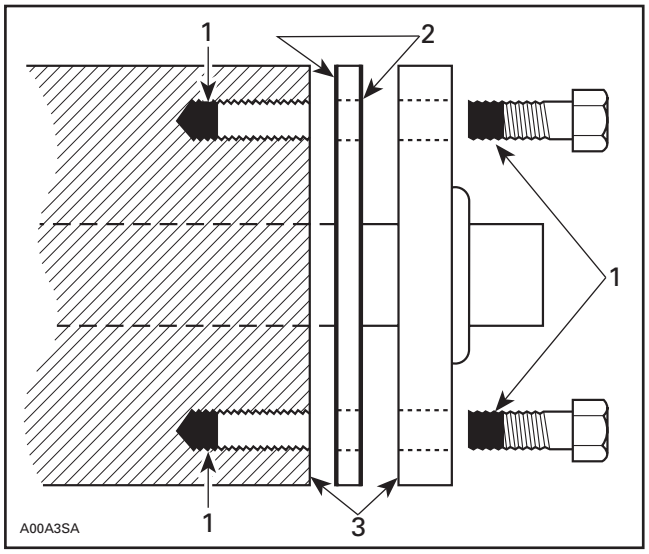
Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

Permanent Stud Installation (light duty)

– Use a stud or thread on desired length.
– DO NOT apply release agent on stud.
– Do a STANDARD THREAD REPAIR.
– Allow to cure for 30 minutes.
– Assemble.

GASKET COMPOUND

All Parts



1. Proper strength Loctite
2. Loctite Primer N (P/N 413 708 100) and Gasket Eliminator 515 (P/N 413 702 700) on both sides of gasket
3. Loctite Primer N only

– Remove old gasket and other contaminants with Loctite Chisel remover (P/N 413 708 500). Use a mechanical mean if necessary.

NOTE: Avoid grinding.

– Clean both mating surfaces with solvent.
– Spray Loctite Primer N on both mating surfaces and on both sides of gasket. Allow to dry 1 or 2 minutes.
– Apply GASKET ELIMINATOR 515 (P/N 413 702 700) on both sides of gasket, using a clean applicator.
– Place gasket on mating surfaces and assemble immediately.

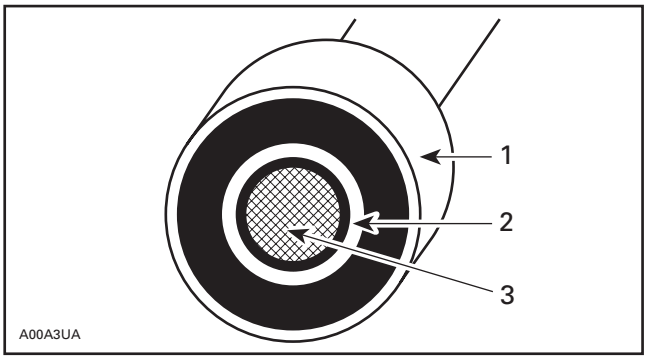
NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

If holes are sunken, apply proper strength Loctite on bolt threads.

– Tighten as usual.

MOUNTING ON SHAFT

Mounting with a Press



1. Bearing
2. Proper strength Loctite
3. Shaft

Standard

– Clean shaft external part and element internal part.
– Apply a strip of proper strength Loctite on shaft circumference at insert or engagement point.

NOTE: Retaining compound is always forced out when applied on shaft.

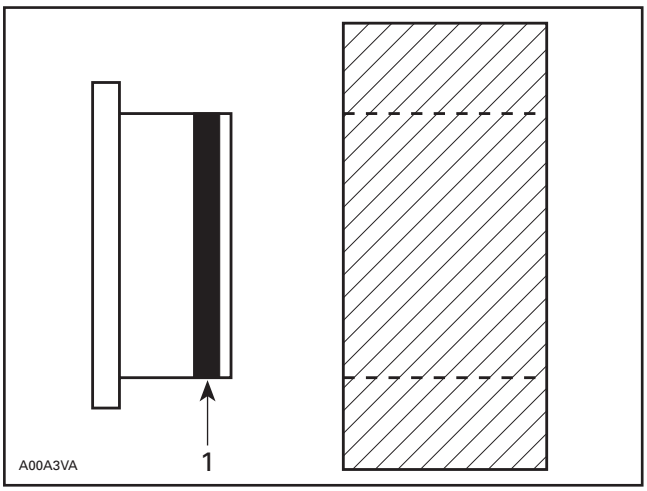
– DO NOT use anti-seize Loctite or any similar product.
– No curing period is required.

Mounting in Tandem

– Apply retaining compound on internal element bore.
– Continue to assemble as shown above.

CASE-IN COMPONENTS

Metallic Gaskets



1. Proper strength Loctite

– Clean inner housing diameter and outer gasket diameter.
– Spray housing and gasket with Loctite Primer N (P/N 293 800 041).
– Apply a strip of proper strength Loctite on leading edge of outer metallic gasket diameter.

NOTE: Any Loctite product can be used here. A low strength liquid is recommended as normal strength and gap are required.

– Install according to standard procedure.
– Wipe off surplus.
– Allow it to cure for 30 minutes.

NOTE: Normally used on worn-out housings to prevent leaking or sliding.

It is generally not necessary to remove gasket compound applied on outer gasket diameter.

TIGHTENING TORQUE

Tighten fasteners to torque mentioned in exploded views and/or text, When they are not specified, refer to following table. The table also gives the metric conversion.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (ex.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones, where specified. If the efficiency of a locking device is impaired, it must be renewed.

In order to avoid a poor assembling, tighten screws, bolts or nuts in accordance with the following procedure:

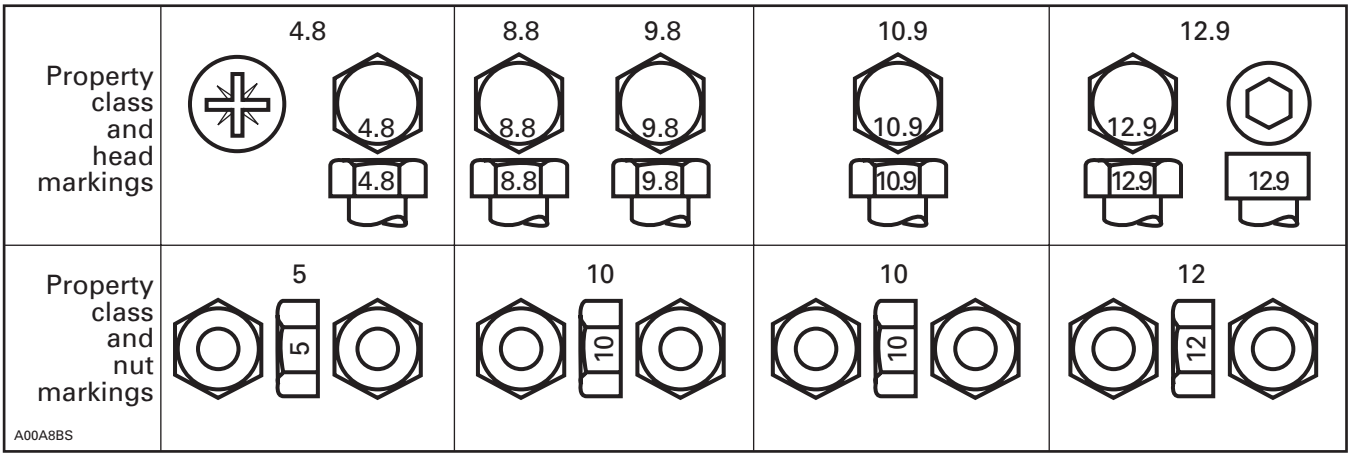
– Manually screw all screws, bolts and/or nuts.
– Apply the half of the recommended torque value.

CAUTION: Be sure to use proper tightening torque for the proper strength grade.

NOTE: When possible, always apply torque on the nut.

– Torque at the recommended torque value.

NOTE: Always torque screws, bolts and/or nuts in a criss-cross sequence.



FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	**8.8** Grade	**10.9** Grade	**12.9** Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 – 4 N•m (31 – 35 lbf•**in**)	4 – 5 N•m (35 – 44 lbf•**in**)
M5	3 – 3.5 N•m (27 – 31 lbf•**in**)	4.5 – 5.5 N•m (40 – 47 lbf•**in**)	7 – 8.5 N•m (62 – 75 lbf•**in**)	8 – 10 N•m (71 – 89 lbf•**in**)
M6	6.5 – 8.5 N•m (58 – 75 lbf•**in**)	8 – 12 N•m (71 – 106 lbf•**in**)	10.5 – 15 N•m (93 – 133 lbf•**in**)	16 N•m (142 lbf•**in**)
M8	15 N•m (11 lbf•ft)	24.5 N•m (18 lbf•ft)	31.5 N•m (23 lbf•ft)	40 N•m (30 lbf•ft)
M10	29 N•m (21 lbf•ft)	48 N•m (35 lbf•ft)	61 N•m (45 lbf•ft)	72.5 N•m (53 lbf•ft)
M12	52 N•m (38 lbf•ft)	85 N•m (63 lbf•ft)	105 N•m (77 lbf•ft)	127.5 N•m (94 lbf•ft)
M14	85 N•m (63 lbf•ft)	135 N•m (100 lbf•ft)	170 N•m (125 lbf•ft)	200 N•m (148 lbf•ft)

MAINTENANCE CHART

A: ADJUST
I: INSPECT (clean, inspect, repair, adjust)
L: LUBRICATE
R: REPLACE
C: CLEAN
T: PROCEED WITH TASK

PART/TASK	10-HOUR OR 500 KM (300 mi) INSPECTION (to be performed by dealer)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	6000 KM (3700 mi)	STORAGE (to be performed by dealer)	PRESEASON PREPARATION (to be performed by dealer)	REFER TO SECTION(S) AND SUBSECTION(S)
ENGINE								
Rewind starter and rope						I,L	I	03-09
Engine motor mounts	I			I		I		Section 03, see the appropriate subsection
Exhaust system	I		I			I		03-02
Engine lubrication						L		01-02
Cooling system	I			I			I	03-08
Coolant	I					R		03-08
Crankshaft PTO Seal (4)						I		Section 03, see the appropriate subsection
RAVE valves (4)				C				03-05
RAVE valves solenoid (SDI and Power Tek)				I				03-05
Injection oil filter			I			R		03-10
Oil injection pump	A			A			A	03-10
FUEL SYSTEM								
Add fuel stabilizer						T		01-02
Fuel filter							R	01-03
Fuel lines, fuel rail and connections	I						I	Section 03, 05-03 or 06-03
Carburetor	A			A			A,C	04-02
Throttle cable	I			I			I	04-02
Air filter			C				C	01-03
Injection oil						T		01-02
Throttle body (SDI) (4)							C	05-03 or 06-03
DRIVE SYSTEM								
Drive belt	I	I					I	08-01
Drive and driven pulley	I		I	C		I	C	08-02 and 08-03
Tightening torque of drive pulley screw	I			I			I	08-02
Brake fluid	I	I				R	I	08-05
Brake hose, pads and disk	I	I					I	08-05
Drive chain tension	A		A			A		08-06
Chaincase oil	I		I			R	I	08-06
Drive axle end bearing (2)	L		L			L		08-07

A: ADJUST I: INSPECT (clean, inspect, repair, adjust) L: LUBRICATE R: REPLACE C: CLEAN T: PROCEED WITH TASK	10-HOUR OR 500 KM (300 mi) INSPECTION (to be performed by dealer)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	6000 KM (3700 mi)	STORAGE (to be performed by dealer)	PRESEASON PREPARATION (to be performed by dealer)	REFER TO SECTION(S) AND SUBSECTION(S)
PART/TASK								
Countershaft	L		L			L		08-07
Track	I		I			I		08-08
Track tension and alignment	A	AS REQUIRED						08-08
STEERING/FRONT SUSPENSION								
Steering and front suspension mechanism (2)	I,L		I	L		I,L		10-01 and 10-02
Wear and condition of skis and runners	I	I				I		10-02
SUSPENSION								
Suspension adjustments	A	AS REQUIRED						Section 09, see the appropriate subsection
Suspension (2)	I		I,L			I,L		
Suspension stopper strap				I		I		
ELECTRICAL								
EMS fault codes (4)	I				I			05-03 or 06-03
Spark plugs (1) (4)	I		I				R	07-01
Battery (if so equipped)	I		I			I	I	07-02
Wiring harnesses, cables and lines (4)	I		I			I		11-01
Operation of lighting system (HI/LO beam, brake light, etc.) test operation of engine cut-out switch and tether cut-out switch	I	I				I		*Operator's Guide*
VEHICLE								
Headlamp beam aiming				A			A	11-01
Rags in air intake and exhaust system						T	T	01-02 and 01-03
Engine compartment	C		C			C		01-02
Vehicle cleaning and protection	C		C			C		01-02

(1) TO BE PERFORMED BY AN AUTHORIZED SKI-DOO DEALER.

(2) Lubricate whenever the vehicle is used in wet conditions (wet snow, rain, puddles).

(3) Before installing new spark plugs at preseason preparation, it is suggested to burn excess storage oil by starting the engine with the old spark plugs. Only perform this operation in a well-ventilated area.

(4) Emission-related

STORAGE

SERVICE TOOLS

Description	Part Number	Page
cleat remover	529 028 700	5
narrow-cleat installer	529 028 800	5

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	5
BOMBARDIER LUBE	293 600 016	4, 6
BOMBARDIER scratch remover kit	861 774 800	6
fuel stabilizer	413 408 600	4
heavy duty cleaner (4 L)	293 110 002	6
heavy duty cleaner (spray can 400 g)	293 110 001	6
storage oil (Canada)	413 711 600	4
storage oil (USA)	413 711 900	4
suspension synthetic grease	293 550 033	5
vinyl & plastic cleaner (6 x 1 L)	413 711 200	6

GENERAL

Proper snowmobile storage is a necessity during the summer months or when a vehicle is not being used for more than one month.

Refer to storage column from MAINTENANCE CHART jointly with the present storage procedure in order to cover each and every aspect of the snowmobile storage procedure. Any worn, broken or damaged parts should be replaced.

⚠ WARNING

Unless otherwise specified, engine should be turned off for storage procedure.

ENGINE

Rewind Starter and Rope

For inspection, cleaning and lubrication, refer to ENGINE section.

Engine Motor Mounts

Check if engine support is cracked, bent or otherwise damaged. Replace if necessary.

Check rubber mounts on engine support. Replace them if brittle, cracked or otherwise damaged.

Exhaust System

Check and replace if necessary:

– tuned pipe shield for damages
– tuned pipe ends for cracks or damages
– manifold for cracks or damages.

Engine Lubrication

NOTE: Be sure to add fuel stabilizer before starting the engine.

Engine internal parts must be lubricated to protect them from possible rust formation during the storage period.

Proceed as follows:

Start the engine and allow it to run at idle speed until the engine reaches its operating temperature.

⚠ WARNING

Ensure the track is free of particles which could be thrown out while it is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle.

Stop the engine.

Remove air silencer to spray storage oil into each carburetor/throttle body.

Restart engine and run at idle speed.

Inject storage oil until the engine stalls or until a sufficient quantity of oil has entered the engine (approximately half a can).

With the engine stopped, remove the spark plug and spray storage oil (Canada) (P/N 413 711 600) or storage oil (USA) (P/N 413 711 900) into each cylinder.

Crank slowly 2 or 3 revolutions to lubricate cylinders.

Reinstall the spark plugs and air silencer.

⚠ WARNING

This procedure must only be performed in a well-ventilated area. Do not run engine during storage period.

Cooling System

For coolant replacement on liquid cooled models, refer to ENGINE section.

Crankshaft PTO Seal

Make sure there is no grease coming out from crankshaft PTO seal, if so replace seal, refer to ENGINE section.

Injection Oil Filter

Replace injection oil filter, refer to ENGINE section.

Rags in Air Intake and Exhaust System

Block air intake hole and exhaust system hole using clean rags.

FUEL SYSTEM

Fuel Stabilizer

It is critical to use the fuel stabilizer (P/N 413 408 600) (250 mL) to prevent fuel deterioration, gum formation and fuel system components corrosion. Follow manufacturer's instructions for proper use.

Pour fuel stabilizer in fuel tank prior to starting engine for internal parts lubrication so that stabilizer flows everywhere in fuel system. Fill up fuel tank completely. Ensure there is no water inside fuel tank.

CAUTION: Should any water be trapped inside fuel tank, severe internal damage will occur to the fuel injection system (if so equipped).

Do not drain fuel system.

CAUTION: Fuel stabilizer should be added prior to engine lubrication to ensure carburetor protection against varnish deposit.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Fuel tank may be pressurized, slowly turn cap when opening. Never use an open flame to check fuel level. When fueling, keep vehicle level. Do not overfill or top off the fuel tank and leave vehicle in the sun. As temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage from the vehicle. Periodically inspect fuel system.

DRIVE SYSTEM

Drive and Driven Pulley

After inspection and interior cleaning of pulleys, spray BOMBARDIER LUBE (P/N 293 600 016) on sheaves. Do not reinstall drive belt.

Brake Fluid

Replace brake fluid, refer to DRIVE SYSTEM section.

Drive Chain Tension

Check drive chain tension and adjust if necessary, refer to DRIVE SYSTEM section.

Chaincase Oil

Replace chaincase oil, refer to DRIVE SYSTEM section.

Drive Axle End Bearing

Lubricate end housing bearing with suspension synthetic grease (P/N 293 550 033). Continue lubricating until grease flows out of the pilot hole on speedometer sensor.

Countershaft

Driven pulley and brake disc must be floating on the countershaft for efficient operation. Lubricate with anti-seize lubricant (P/N 293 800 070).

CAUTION: Do not lubricate excessively as lubricant could contact and soil brake pads and/or drive belt.

Track

Visually inspect track for:

– cuts and abnormal wear
– broken rods
– broken or missing track cleats.

If track is damaged or rods are broken, replace track, refer to DRIVE SYSTEM section.

For damaged or missing cleats, replace by new ones, using cleat remover (P/N 529 028 700). Use narrow-cleat installer (P/N 529 028 800).

STEERING/FRONT SUSPENSION

Steering and Front Suspension Mechanism Lubrication

Lubricate the steering mechanism if needed. **Inspect all components for tightness.**

Wear and Condition of Skis and Runners

Inspect skis and runners for wear, deterioration or damage, replace if necessary.

SUSPENSION

Rear Suspension Lubrication

Inspect rear suspension components for wear, deterioration or damage, replace defective parts if necessary.

Lubricate front and rear arms at grease fittings using suspension synthetic grease (P/N 293 550 033).

Suspension Stopper Strap

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace if necessary.

ELECTRICAL

Battery (if so equipped)

Remove battery, clean its tray and close area with water and baking soda.

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery.

Charge battery as explained in ELECTRICAL section.

Wiring Harnesses, Cables and Lines

Inspect for wear, deterioration or damage, replace defective parts if necessary.

VEHICLE

Engine Compartment

Keep clean of grass, twigs, cloth, etc. These are combustible under certain conditions.

Vehicle Cleaning

To facilitate the inspection and ensure adequate lubrication of components, it is recommended to clean the entire vehicle.

Remove any dirt or rust.

To clean the entire vehicle, use only flannel cloths or equivalent.

CAUTION: It is necessary to use flannel cloths or equivalent on windshield and hood to avoid further damaging surfaces to clean.

To clean the entire vehicle, including bottom pan and metallic parts use heavy duty cleaner (spray can 400 g) (P/N 293 110 001) or heavy duty cleaner (4 L) (P/N 293 110 002).

CAUTION: Do not use Heavy duty cleaner on decals or vinyl.

For vinyl and plastic parts use vinyl & plastic cleaner (6 x 1 L) (P/N 413 711 200).

To remove scratches on windshield or hood use BOMBARDIER scratch remover kit (P/N 861 774 800).

CAUTION: Never clean plastic parts or hood with strong detergent, degreasing agent, paint thinner, acetone, products containing chlorine, etc.

Inspect the hood and repair any damage.

Touch up all metal spots with touch-up paint where paint has been scratched off.

Spray all bare metal parts including shock chromed rods with BOMBARDIER LUBE (P/N 293 600 016).

Wax the hood and the painted portion of the frame for better protection. Use a non-abrasive wax such as silicone wax.

NOTE: Apply non-abrasive wax on glossy finish only.

Vehicle Protection

Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: The snowmobile has to be stored in a cool and dry place and covered with an opaque but ventilated tarpaulin. This will prevent sun rays and grime from affecting plastic components and vehicle finish.

Lift rear of vehicle until track is clear of the ground. Install on a snowmobile mechanical stand.

NOTE: Do not release track tension.

PRESEASON PREPARATION

SERVICE PRODUCTS

Description	Part Number	Page
pulley flange cleaner	413 711 809	8
XP-S chaincase oil	413 801 900	8
XP-S synthetic chaincase oil	413 803 300	8

Proper vehicle preparation is necessary after the summer months or when a vehicle has not been used for more than one month.

Refer to preseason preparation column from MAINTENANCE CHART jointly with the present preseason preparation procedure in order to cover each and every aspect of the snowmobile preseason preparation procedure.

Any worn, broken or damaged parts found during the storage procedure should have been replaced. If not, proceed with the replacement.

⚠ WARNING

Unless otherwise specified, engine should be turned off for preparation procedure.

ENGINE

Rags in Air Intake and Exhaust System

Remove rags that were installed during STORAGE preparation.

Rewind Starter and Rope

Check if rope is fraying, replace if so.

When pulling starter grip, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

Cooling System

Fan Cooled

Inspect fan drive belt, adjust or replace if required.

Liquid Cooled

Inspect cooling system for leaks, to perform a cooling system leak test, refer to ENGINE section and the appropriate subsection.

Check coolant level in coolant reservoir. Add coolant if necessary.

If engine is cold, refill up to 15 mm (5/8 in) over COLD level line.

If engine is hot, refill up to 25 mm (1 in) over COLD level line.

Oil Injection Pump

Make sure oil injection pump is properly adjusted, refer to ENGINE section and the appropriate subsection.

FUEL SYSTEM

Fuel Filter

Replace fuel filter, refer to FUEL SYSTEM section and the appropriate subsection.

Fuel Lines, Fuel Rails and Connections

Inspect fuel system for leaks, to perform a fuel system pressurization, refer to FUEL SYSTEM section and the appropriate subsection.

Carburetor (if so equipped)

Disassemble carburetors in order to clean all internal parts. Do not hesitate to replace any jets having gum or varnish on their surfaces.

Make sure carburetors are properly adjusted, refer to FUEL SYSTEM section and the appropriate subsection.

Throttle Cable

Make sure that throttle cable operate freely, replace if necessary, refer to FUEL SYSTEM and the appropriate subsection.

Air Filter

Check that inside of air silencer is clean and dry then properly reinstall the filter.

CAUTION: These snowmobiles have been calibrated with the filter installed. Operating the snowmobile without it, may cause engine damage.

Throttle Body (SDI)

Remove the throttle body from vehicle.

Using the pulley flange cleaner (P/N 413 711 809), remove the dirt ejected by the drive belt from the throttle plate and from both throttle body bores. After throttle body installation, adjust throttle and injection oil cables.

Injection Oil

Add 500 mL (17 U.S. oz) of recommended injection oil to the first full filled fuel tank.

DRIVE SYSTEM

Drive Belt

Inspect belt for cracks, fraying or abnormal wear. Replace if necessary.

Make sure to install the proper belt with arrow printed on belt pointing front of vehicle.

Drive and Driven Pulley

Clean drive and driven pulleys sheaves with pulley flange cleaner (P/N 413 711 809).

Retorque if necessary drive pulley screw to 90 to 100 N•m (66 to 74 lbf•ft).

Brake Fluid

Check brake fluid in reservoir for proper level. Add fluid (DOT 4) as required.

CAUTION: Use only (DOT 4) brake fluid from a sealed container. Do not store or use a started bottle of brake fluid.

Brake Hose, Pads and Disk

Inspect brake hose for wear, deterioration or damage, replace if necessary.

Inspect brake pads for proper thickness. Refer to DRIVETRAIN section and the appropriate subsection.

Remove any rust built-up on braking surfaces. Clean brake disk braking surfaces with pulley flange cleaner (P/N 413 711 809).

Chaincase Oil

Check chaincase oil for proper level. Add recommended chaincase oil as required.

MODELS	CHAINCASE OIL
Fan Cooled	XP-S chaincase oil (P/N 413 801 900)
Liquid Cooled	XP-S synthetic chaincase oil (P/N 413 803 300)

Track Tension and Alignment

Verify track tension and alignment, refer to DRIVE SYSTEM section and the appropriate subsection.

NOTE: Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

ELECTRICAL SYSTEM

Battery (if so equipped)

Verify that battery is fully charged, if not, refer to the appropriate charging procedure in ELECTRICAL SYSTEM section and the appropriate subsection.

⚠ WARNING

Always wear safety glasses and charge in a ventilated area. Never charge or boost battery while installed on vehicle. Do not open the sealed caps during charging. Do not place battery near open flame.

Spark Plugs

Once preseason preparation is done, start engine with the old spark plug(s) to burn excess storage oil. Then, install new properly gapped spark plug(s).

VEHICLE

Headlamp Beam Aiming

Verify beam aiming and adjust if necessary, refer to ELECTRICAL SYSTEM section and the appropriate subsection.

ENGINE

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

NOTE: For engine management system troubleshooting (SDI and Power Tek engines), refer to appropriate subsection.

SYMPTOM	**ENGINE BACKFIRES.**
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check spark plugs. a. Carbon accumulation caused by defective spark plug(s). *Clean carbon accumulation from piston and cylinder head and install dry properly gapped spark plug(s).*
	2. Check ignition timing. a. Timing is too advanced. *Set timing according to specifications (refer to TECHNICAL DATA).*
	3. Check for erratic sparks. a. Poor electrical connections. *Repair.* b. Faulty stator. *Replace defective parts.*
	4. Check carburetor. a. Fuel passages obstructed. *Clean carburetor and install new filter(s).* b. Fuel level too low. *Adjust float level according to specifications.*
	5. Check cooling system. a. Low antifreeze level. *Adjust antifreeze level. Proceed with a leakage test (refer to COOLING SYSTEM) and repair as required.* b. Defective tank cap. *Replace cap.* c. Defective thermostat. *Replace thermostat.* d. Air in system. *Bleed system.*

SYMPTOM	**ENGINE SUDDENLY TURNS OFF AT HIGH RPM AND/OR WITH LIGHT LOAD.**
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check spark plugs. a. Non-resistor type spark plugs installed. 2. Check that all 3 ground wires are well connected. a. Loose or corroded ground.

SYMPTOM	ENGINE SUDDENLY TURNS OFF.
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Perform engine leak test. Refer to LEAK TEST. Check possible piston seizure. a. Damaged gasket and/or seal. *Replace defective parts.*
	2. "Four-corner" seizure of piston(s). a. High acceleration when engine is cold. Piston expands faster than cylinder. *Replace piston(s). Ask driver to refer to the WARM-UP PROCEDURE in the* Operator's Guide.
	3. Piston(s) seizure on exhaust side (color on piston dome is correct). a. Kinked fuel tank vent tube. *Relocate fuel tank vent tube.* b. Leaks at fuel line connections or damaged fuel lines. *Replace defective lines.* c. Fuel does not flow through carburetor(s) (foreign particles in needle area and/or varnish formation in carburetor(s)). *Clean carburetor(s) and install new filter(s).* d. Spark plug heat range is too warm. *Install spark plugs with appropriate heat range (refer to TECHNICAL DATA).* e. Improper ignition timing. *Adjust according to specifications (refer to TECHNICAL DATA).* f. Restriction in exhaust system. *Replace.* g. Compression ratio is too high. *Install genuine parts.* h. Too low fuel octane number. *Use proper fuel octane number.* i. Carburetor calibration is too lean. *Adjust according to specifications (refer to TECHNICAL DATA).* j. Improper reed valve adjustment or damage. *Adjust according to specifications (refer to appropriate ENGINE subsection) and/or install BRP's recommended reed valve.* k. Poor quality oil. *Use XP-S injection oil.* l. Leaks at air intake silencer. *Replace air intake silencer grommets.* m. Excessive wear of piston rings. *Replace piston rings.*

SYMPTOM	ENGINE SUDDENLY TURNS OFF.
CONDITION	NORMAL USE.
TEST/INSPECTION	4. Melted and/or perforated piston dome; melted section at ring end gap. a. When piston reaches TDC, mixture is ignited by heated areas in combustion chamber. This is due to an incomplete combustion of a poor quality oil. *Clean residue accumulation in combustion chamber and replace piston(s). Use XP-S injection oil.* b. Spark plug heat range is too high. *Install recommended dry properly gapped spark plugs (refer to TECHNICAL DATA).* c. Ignition timing is too advanced. *Adjust according to specifications (refer to TECHNICAL DATA).* d. Inadequate fuel quality. *Use appropriate fuel.* e. Carburetion is too lean. *Adjust according to specifications (refer to TECHNICAL DATA).*
	5. Seized piston all around the circumference (dry surface). a. Lack of oil, damaged oil line or defective injection pump. *Replace defective part(s).*
	6. Grooves on intake side of piston only. a. Oil film eliminated by water (snow infiltration in engine). This can also be caused by running engine on choke for too long. Excessive fuel will remove the oil film on the piston and make marks. *Replace piston(s) and check if intake system leaks.*
	7. Piston color is dark due to seizure on intake and exhaust sides. a. Cooling system leaks and lowers coolant level. *Proceed with a leakage test (refer to COOLING SYSTEM) and repair as required. Add coolant in cooling system until appropriate level is reached.* b. Accumulation of foreign particles in needle valve and/or main jet area. *Clean carburetor(s).*
	8. Cracked or broken piston(s). a. Cracked or broken piston(s) due to excessive piston/cylinder clearance or engine over-revving. *Replace piston(s). Check piston/cylinder clearance (refer to TOP END). Adjust drive pulley according to specifications (refer to TECHNICAL DATA) and/or clean pulley sheaves if they are contaminated with greasy particles.*
	9. DPM manifold air vent is obstructed. a. Carburetion is too lean. *Ensure proper air vent.*

SYMPTOM	PISTON RING AND CYLINDER SURFACES ARE SCRATCHED.
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check oil quality. a. Poor quality oil. *Use XP-S injection oil.*
	2. Check injection pump and its hoses. a. Inadequate injection pump adjustment and/or defective hoses. *Adjust pump according to specifications (refer to ENGINE) and/or replace hoses.*

SYMPTOM	ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check spark plug condition and gap. a. Fouled spark plugs or wrong spark plug gap. *Replace or readjust gap.*
	2. Check if there is water in fuel. a. There is water in fuel. *Drain fuel system, then fill with appropriate fuel.*
	RAVE Equipped Engines 3. Check proper operation of RAVE valves. (Refer to ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM LOWER). *Repair.*
	4. Check items listed in ENGINE RUNS OUT OF FUEL (refer to FUEL AND OIL SYSTEMS subsection).
	5. Check carburetor adjustments and cleanliness. a. Inadequate carburetor adjustments or dirt accumulation. *Adjust according to specifications (refer to TECHNICAL DATA) or clean.*
	6. Check drive belt. a. Worn belt. *Replace belt if width is 3 mm (1/8 in) less than nominal dimension (refer to TECHNICAL DATA).*
	7. Check track adjustment. a. Too much tension and/or improper alignment. *Align track and adjust its tension to specifications (refer to TECHNICAL DATA).*
	8. Check drive pulley. a. Improper calibration screw adjustments (TRA pulley) and/or worn bushing(s). *Adjust according to specifications (refer to TECHNICAL DATA) and/or replace bushing(s).*
	9. Check driven pulley. a. Worn bushing and/or spring tension. *Replace spring and/or adjust its tension according to specifications (refer to TECHNICAL DATA).*
	10. Check exhaust system. a. Restriction or exhaust system leakage. *Replace or reseal with Ultra Copper.*
	11. Check ignition timing. a. Decrease in power due to delayed ignition. *Adjust according to specifications (refer to TECHNICAL DATA).*
	12. Check engine compression. a. Worn piston(s) and ring(s). *Replace (refer to TECHNICAL DATA for specifications).*
	13. Check engine cooling system. a. Coolant level is low, cap fails to pressurize system or air circulates through lines. *Adjust level, replace cap or bleed cooling system.*
	14. Check reed valve. a. Improper tightness and/or opening. *Replace or adjust. (Refer to proper ENGINE subsection).*

SYMPTOM	**ENGINE DETONATION AT MAXIMUM RPM.**
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check which type of fuel is used. a. Octane number is too low and/or alcohol level is too high. *Use recommended fuel type.*
	2. Check spark plug type. a. Improper spark plug heat range. *Install recommended spark plugs (refer to TECHNICAL DATA).*
	3. Check exhaust system. a. Too much restriction. *Replace.*
	4. Check ignition timing. a. Timing is too advanced. *Adjust according to specifications (refer to TECHNICAL DATA).*
	5. Check if engine is overheating. (Refer to HIGH ENGINE OPERATING TEMPERATURE).
	6. Check carburetion. a. Fouled and/or improper carburetor components. *Clean or replace according to specifications (refer to TECHNICAL DATA).*
	7. Check compression ratio and combustion chamber volume. a. Compression ratio is too high. *Install genuine parts.*

SYMPTOM	ENGINE TURNS OVER BUT FAILS TO START.
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check switches. a. Ignition switch, emergency cut-out switch or tether switch is OFF. *Place all switches in the RUN or ON position. If it still does not work, connect DESS switch BK/GN and BK/WH wires together (harness side).*
	2. Check fuel level. a. Mixture too lean to start cold engine. *Check fuel tank level and use choke.*
	3. Check spark plug. a. Defective spark plug (no spark) or wrong spark plug gap. *Replace spark plugs or readjust gap.*
	4. Check amount of fuel on spark plug. a. Flooded engine (spark plug wet when removed). *Do not overprime or overchoke. Remove wet spark plugs, turn ignition switch to OFF and crank engine several times. Install clean dry properly gapped spark plugs. Start engine following usual starting procedure.*
	5. Check fuel lines. a. No fuel to the engine (spark plugs dry when removed). *Check fuel tank level ; turn fuel valve on if applicable; check fuel filter, replace if clogged ; check condition of fuel and impulse lines and their connections.*
	6. Check engine compression. a. Insufficient engine compression. *Replace defective part(s) (ex.: piston(s), ring(s), etc.).*
	7. On SDI manual start models, check capacitor. a. Damaged capacitor. *Replace.*

SYMPTOM	**IRREGULAR ENGINE IDLE.**
CONDITION	NORMAL USE AFTER ENGINE WARM UP.
TEST/INSPECTION	1. Check choke. a. Choke plunger may be partially opened. *Readjust.*
	2. Check carburetor adapter. a. Air enters through a crack. *Replace.*
	3. Check air screw position. a. Inadequate fuel/air mixture. *Adjust according to specifications (refer to TECHNICAL DATA).*
	4. Check dimension of pilot jet. a. Inadequate fuel/air mixture. *Adjust according to specifications (refer to TECHNICAL DATA).*
	5. Check reed valve. a. Improper tightness and/or opening. *Replace or adjust. Refer to proper ENGINE subsection.*
	6. Perform engine leak test. a. Leaking gaskets allow air to enter in engine. *Replace defective parts.*
	7. DPM manifold air vent is obstructed. a. Carburetion is too lean. *Ensure proper air vent.*
	8. On models with carburetors, check throttle slide height. a. Incorrect throttle slide height. *Readjust according to specifications.*
	9. On SDI models, check cleanness of throttle body. a. Deposits inside throttle body. *Clean throttle body bores and plates.*

SYMPTOM	HIGH ENGINE OPERATING TEMPERATURE.
CONDITION	NORMAL USE.
TEST/INSPECTION	Fan-Cooled Engines 1. Check cooling system. a. Loose fan belt. *Adjust or replace fan belt (refer to COOLING SYSTEM).* b. Dirty cooling fins or blocked air ducts. *Clean.*
	Liquid-Cooled Engines 1. Check coolant level and check if there is air infiltration in the system or if there are leaks in gasket areas. a. Low coolant level or air in system. *Add coolant until recommended level is reached, bleed system and/or tighten clamps.* 2. Check temperature gauge sensor. a. False reading. *Check terminal connections. If problem persists, replace sensor.* 3. Check if heat exchangers are clean. a. Dirty heat exchangers. *Clean heat exchangers.* 4. Check if coolant flows through system properly. a. Foreign particles and/or broken coolant pump impeller. *Clean cooling system and/or replace coolant pump impeller.* 5. Check antifreeze concentration. a. Antifreeze concentration is too high. *Adjust concentration according to BRP's recommendations.* 6. Check thermostat. a. Thermostat reacts slowly or not at all. *Replace.* 7. Check tank cap. a. Cap does not hold pressure. *Replace.* 8. Check condition and heat range of spark plugs. a. Melted spark plug tip or inadequate heat range. *Replace.* 9. Check carburetion. a. Improperly adjusted or inadequate carburetor components. *Adjust according to specifications (refer to TECHNICAL DATA) or replace inadequate component(s).* 10. Check cylinder O-rings. a. Worn O-rings. *Replace.*

SYMPTOM	HIGH ENGINE OPERATING TEMPERATURE.
CONDITION	NORMAL USE.
TEST/INSPECTION	Liquid-Cooled Engines (cont'd) 11. Check ignition timing. a. Ignition timing is too advanced. *Adjust according to specifications (refer to TECHNICAL DATA).* 12. Check if there are leaks at air intake silencer and/or engine crankcase. a. Leak(s). *Repair or replace.* 13. Check cylinder head gaskets. a. Worn gaskets. *Replace.*

SYMPTOM	ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM SLOWER).
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check RAVE valve pistons. a. Valve piston(s) is (are) not screwed to the bottom. *Screw valve piston(s) to bottom.*
	2. Check that valve moves freely. a. Valve stuck in closed position. *Clean.*
	3. Check RAVE valve stems. a. Bent RAVE valve stem(s). *Replace.*
	4. Check RAVE valves. a. Jammed valve(s). *Clean.*
	5. Check tension of RAVE springs. a. Inadequate spring tension. *Replace.* b. Inadequate red cap adjustment. *Adjust according to specifications.*
	6. Check RAVE pressure holes. (except SDI and Power Tek) a. Clogged holes. *Clean.*
	7. Check clamps or sleeves. a. Damaged clamp(s) or sleeve(s). *Replace.*
	8. Check exhaust tightness. (except SDI and Power Tek) a. Exhaust system is leaking leading to a too low back pressure. *Replaces parts and reseal.*

SYMPTOM	ENGINE EQUIPPED WITH RAVE. ENGINE HESITATES AT LOW OR MID-SPEED AND REACHES MAXIMUM PERFORMANCE ONLY AFTER A WHILE.
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check RAVE valve spring(s). a. Spring tension is too low or spring(s) is (are) broken. *Replace.*
	2. Check RAVE valve cover red adjustment screws. a. Adjustment screw(s) is (are) too loose. *Adjust according to ASSEMBLY PROCEDURE in appropriate engine subsections.*
	3. Check RAVE valve movement (RAVE movement indicator P/N 861 725 800). a. Valve(s) is (are) stuck in open position. *Clean.*

SYMPTOM	REWIND STARTER ROPE DOES NOT REWIND.
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check rewind spring. a. Broken spring. *Replace spring.*

SYMPTOM	REWIND STARTER PAWL DOES NOT ENGAGE.
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check stopper spring. a. Broken stopper spring. *Replace.*
	2. Check pawl and pawl lock. a. Pawl and pawl lock have stuck together because of heat. *Replace.*
	3. Check pawl and rope sheave. a. Pawl and rope sheave have stuck together because of heat. *Replace.*

SYMPTOM	**ENGINE PINGING.**
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check for proper fuel octane number according to engine type. a. Too low fuel octane number. *Use appropriate fuel octane number (Refer to Operator's Guide).*
	2. Check fuel lines. a. Bent fuel lines (preventing fuel from flowing through). *Relocate or replace fuel lines.*
	3. Check if carburetor(s) is (are) clean. a. Dirt prevents fuel from flowing through. *Clean.*
	4. Check ignition timing. a. Timing is too advanced. *Adjust according to specifications (refer to TECHNICAL DATA).*
	5. Check compression ratio. a. Compression ratio is too high. *Replace inadequate part(s) to obtain manufacturer's recommended compression ratio or use a higher grade fuel.*
	6. Check for carbon accumulation in combustion chamber and/or on piston dome. a. Carbon accumulation. *Remove carbon accumulation.*

SYMPTOM	**ENGINE GENERATES A LOT OF VIBRATIONS.**
CONDITION	NORMAL USE.
TEST/INSPECTION	1. Check engine supports and stopper. a. Loose and/or broken supports or interference between support(s) and chassis. *Retighten to specification (refer to TECHNICAL DATA) or replace.*
	2. Check drive pulley.
	3. Check carburetor synchronization. a. Throttle slide height is not the same on each carburetor and/or throttle slides opening is unsynchronized. *Adjust throttle slide heights and throttle cable.*
	4. Check for crankshaft and bearings. a. Loose crankshaft bearings or uneven crankshaft. *Retighten or replace the parts.*

FUEL AND OIL SYSTEMS

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

NOTE: For the SDI and Power Tek engines, also refer to appropriate ENGINE MANAGEMENT section.

SYMPTOM	**HIGH FUEL CONSUMPTION OR RICH MIXTURE (MODELS WITH CARBURETOR ONLY).**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check fuel tank. a. Perforated fuel tank. *Replace fuel tank.*
	2. Check fuel pump, reservoir and carburetor fittings. a. Leaking fittings. *Replace defective part.*
	3. Check choke adjustment. a. Fuel flows through choke circuit while engine runs. *Readjust choke.*
	4. Check float height in carburetor(s). a. Fuel level is too high in float bowl(s). *Adjust according to specifications (refer to TECHNICAL DATA).*
	5. Check needle valve on each carburetor. a. Foreign particles prevent needle valve from closing and/or pounded seating area. *Clean or replace needle valve, then clean seating area.*

SYMPTOM	**FUEL LEAKS IN ENGINE BASE WHEN ENGINE IS STOPPED (MODELS WITH CARBURETOR ONLY).**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check items 3, 4 and 5 of HIGH FUEL CONSUMPTION.
	2. Check fuel pump diaphragm. a. Cracked diaphragm. *Replace.*

SYMPTOM	**ENGINE LACKS POWER OR STALLS AT HIGH RPM (MODELS WITH CARBURETOR ONLY).**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check fuel tank vent hose. a. Kinked or clogged hose. *Relocate or replace.*
	2. Check in-tank fuel filter. a. Clogged filter. *Replace.*
	3. Check fuel lines. a. Kinked or clogged lines. *Relocate or replace.*
	4. Check fuel pump flow. a. Check impulse hose. *Replace.* b. Dried diaphragm. *Replace.*
	5. Check if carburetor(s) is (are) clean. a. Varnish. *Clean.*

SYMPTOM	**HIGH INJECTION OIL CONSUMPTION.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check oil injection pump adjustment. a. Oil injection pump adjusted too rich. *Adjust.*
	2. Check injection pump identification. a. Wrong pump. *Replace with the appropriate pump. Refer to OIL INJECTION SYSTEM.*
	3. Check injection oil lines and their fitting. a. Leaking lines and/or cover. *Replace defective part(s).*
	4. Check injection pump cover gasket. a. Broken gasket. *Replace.*
	5. Check nipple check valve. a. Check valve stuck open.*Replace.*
	6. Check pump. a. Defective pump. *Replace pump or connecting cable.*
	7. Test pump shaft gear reservoir for leaks. a. Leaking seal(s). *Replace seal(s).*

SYMPTOM	**ENGINE LACKS FUEL/WILL NOT RESTART (SDI MODELS ONLY).**
CONDITION	AFTER RUNNING OUT OF FUEL
TEST/INSPECTION	1. Fuel tank is not filled up. a. Electric fuel pump reservoir inside fuel tank is empty. *Fill up fuel tank or pull start engine several times to activate diaphragm fuel pump.*

SYMPTOM	**ENGINE LACKS FUEL (SDI MODELS ONLY).**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check in-tank and in-line fuel filters. a. Clogged filter(s). *Replace fuel filter(s).*
	2. Check if lines are perforated, kinked, or if they leak at fittings. *Replace lines.*
	3. Check diaphragm fuel pump. a. Check impulse hose. *Replace.* b. Dried diaphragm. *Replace.*
	4. Check electric fuel pump pressure. a. Electric fuel pump defective. b. Regulator defective. *Replace.*
	5. Check fuel injectors flow. a. Dirty or defective injectors. *Replace.*

SYMPTOM	**ENGINE IS TOO RICH OR TOO LEAN (MODELS WITH DPM SYSTEM ONLY).**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check electrical connections of DPM solenoid. a. Corroded terminals. *Clean or replace.*
	2. Fuel mixture is too rich or too poor. a. Possible damage to DPM. *If DPM does not operate properly, unplug compensation solenoid connector while engine is running. The carburetion is now identical to that of carburetors without a DPM, provided that all pipe fittings are tight and that solenoid is in good condition, (it must not be half-open). If problem is resolved with this procedure, DPM is faulty.*
	3. Check for DPM manifold leaking. a. DPM manifold is leaking. *Repair or replace.*

DRIVE AND BRAKE SYSTEMS

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

DRIVE SYSTEM

SYMPTOM	**THE SNOWMOBILE ACCELERATES SLOWLY, ESPECIALLY FROM A STANDING START.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check drive belt condition. a. Belt is too narrow (drive belt engagement is higher in drive pulley). *Replace belt if width is less than specified in DRIVE BELT.*
	2. Check drive belt deflection. a. Deflection is too high (drive belt engagement is higher in drive pulley). *Adjust drive belt height according to specifications (refer to PULLEY ALIGNMENT and DRIVE BELT).*
	3. Check if driven pulley sliding half slides freely. a. Jammed sliding half. *Replace.*
	4. Check spring tension of driven pulley sliding half. a. Sliding half rotation is accelerated when spring tension is too weak. *Adjust according to specifications (refer to TECHNICAL DATA).*
	5. Refer to VIBRATIONS ORIGINATING FROM DRIVE PULLEY and VIBRATIONS ORIGINATING FROM DRIVEN PULLEY and check items listed.
	6. Check drive pulley spring tension. a. Spring tension is too weak. *Replace.*

SYMPTOM	**ENGINE MAXIMUM RPM IS TOO HIGH AND TOP SPEED IS NOT REACHED.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check items 1, 2 and 3 of THE SNOWMOBILE ACCELERATES SLOWLY, ESPECIALLY FROM A STANDING START.
	2. Check driven pulley spring tension. a. Spring tension is too stiff. *Adjust according to specifications (refer to TECHNICAL DATA).*
	3. Check position of the calibration screws. (TRA drive pulley) a. Selected numbers are too high. *Adjust according to specifications (refer to TECHNICAL DATA).*
	4. Refer to VIBRATIONS ORIGINATING FROM DRIVE PULLEY and check items listed.
	5. Check the driven pulley. a. Driven pulley does not open completely. *Clean, readjust or replace driven pulley.*
	6. Check if levers of drive pulley move freely. a. Stuck levers. *Replace lever bushings.*

SYMPTOM	LOOSE IN DRIVE SYSTEM WHEN ACCELERATING/DECELERATING.
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check drive chain tension. a. Drive chain is too loose. *Adjust.*
	2. Check radial play of driven pulley. a. Worn splines. *Replace pulley.*

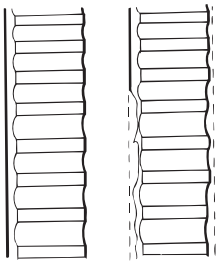
SYMPTOM	VIBRATIONS ORIGINATING FROM DRIVE PULLEY.
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check drive belt. a. Belt width is uneven on several places. *Replace.*
	2. Check tightening torque of drive pulley screw. a. Moving governor cup. *Retighten screw.*
	3. Spring cover screws. a. Spring cover moves and restrains sliding half movement. *Retighten screws.*
	4. Check spring cover (TRA TYPE) and/or sliding half bushings. a. Excessive gap between bushings and fixed half shaft, thus restraining sliding half movements. *Replace bushing(s).*
	5. Check governor cup splines. a. Excessive radial play. *Replace governor cup.*
	6. Check lever assembly. a. Lever assembly is damaged (worn bushing, bent lever etc.). *Replace damaged part.*

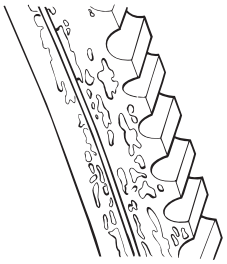
SYMPTOM	VIBRATIONS ORIGINATING FROM DRIVEN PULLEY.
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check sliding half side play. a. Sliding half bushing worn out. *Replace sliding half bushing.*
	2. Check sliding half and fixed half straightness. a. Sliding half/fixed half warped. *Replace.*
	3. Check cam slider shoes. a. One or two slider shoes out of three are broken. *Replace.*

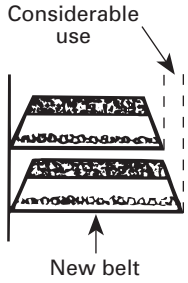
SYMPTOM	**PULLEYS DO NOT DOWN SHIFT PROPERLY.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check driven pulley spring tension. a. Spring tension is too low. *Adjust according to specifications (refer to TECHNICAL DATA) or replace spring.*
	2. Refer to VIBRATIONS COMING FROM DRIVEN PULLEY and check items listed.
	3. Check drive pulley bushings (cleanliness, wear, etc.). a. Bushings stick to fixed half pulley shaft. *Clean or replace.*

SYMPTOM	**IN REVERSE ENGINE FAILS AND DRIVEN PULLEY OPENS TOO FAST (DRIVE BELT IS LOW IN DRIVEN PULLEY).**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check pulley alignment. a. Improper adjustment. *Adjust according to specifications (refer to PULLEY ALIGNMENT) and make sure that engine stopper is resting against engine.*
	2. Check for reverse sliding shoes. a. Sliding shoes are worn or missing. *Replace sliding shoes.*
	3. Check spring. a. Spring is weak or insufficient tension. *Replace spring.*

SYMPTOM	**UNEVEN BELT WEAR ON ONE SIDE.**
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check tightening torque of engine mount bolts. a. Loose engine mount. *Tighten mount nuts/bolts equally.*
	2. Check pulley alignment. a. Pulley misalignment. *Align pulleys.*
	3. Check drive belt contact area on pulleys. a. Rough or scratched pulley surfaces. *Repair or replace pulley half.*
	4. Check driven pulley sliding half play. a. Driven pulley bushing worn. *Replace bushing.*

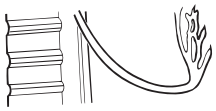
SYMPTOM	BELT TOO NARROW ON ONE SECTION.
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check for frozen track. a. Frozen track. *Free track from ice.*
	2. Check parking brake. a. Parking brake is engaged. *Release parking brake.*
	3. Check track tension/alignment. a. Track too tight. *Adjust track tension and alignment.*
	4. Check drive pulley. a. Drive pulley does not operate properly. *Repair or replace drive pulley.*
	5. Check idle speed. a. Engine idle speed is too high. *Adjust according to specifications.*
	6. Check drive belt length. a. Incorrect belt length. *Replace with an appropriate drive belt (refer to TECHNICAL DATA).*
	7. Check belt height. a. Belt height is incorrect. *Adjust according to specifications.*

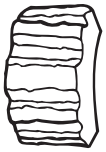
SYMPTOM	BELT GLAZED EXCESSIVELY OR HAVING BAKED APPEARANCE.
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check if drive pulley bushings are worn. a. Slipping due to insufficient pressure on belt sides. *Replace bushing.*
	2. Check condition of drive pulley fixed half shaft. a. Slipping due to rusted drive or driven pulley shafts. *Clean shaft with fine steel wool.*
	3. Check if pulley halves are clean. a. Slipping due to oily pulley surfaces. *Clean pulley halves.*
	4. Check pulley calibration. a. Slipping due to improper pulley calibration. *Calibrate according to specifications.*

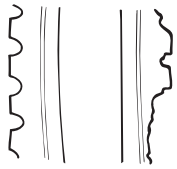
SYMPTOM	**BELT WORN EXCESSIVELY IN TOP WIDTH.**
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check drive pulley. a. Excessive slippage due to jamming of drive pulley. *Inspect drive pulley.*
	2. Check drive belt identification number. a. Improper belt angle (wrong type of belt). *Replace belt with an appropriate drive belt.*
	3. Check drive belt width. a. Considerable use. *Replace belt if less than specified in DRIVE BELT.*

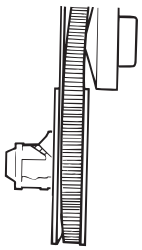
SYMPTOM	**BELT SIDES WORN CONCAVE.**
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check pulley half surfaces. a. Rough or scratched pulley half surfaces. *Repair or replace.*
	2. Check drive belt identification number. a. Wrong belt. *Replace with an appropriate drive belt (refer to TECHNICAL DATA).*

SYMPTOM	**BELT DISINTEGRATION.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check drive belt identification number. a. Excessive belt speed. *Wrong type of belt. Replace with proper type of belt (refer to TECHNICAL DATA).*
	2. Check if pulley halves are clean. a. Oil on pulley surfaces. *Clean pulley surfaces with fine emery cloth and wipe clean using pulley flange cleaner (P/N 413 711 809) and a cloth.*

SYMPTOM	**BELT CORD POP OUT.**
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check pulley alignment. a. Pulley misalignment. *Align pulley according to specifications (refer to TECHNICAL DATA).*

SYMPTOM	**FATIGUE CRACKS BETWEEN COGS.**
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check drive belt condition. a. Belt considerably worn, worn out. *Replace.* b. Distortion of natural belt shape due to improper storage. *Store properly.*

SYMPTOM	**TOOTH CHUNK OUT.**
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check drive belt rotational direction. a. Improper belt installation. *Replace.*
	2. Check if drive belt rubs against components. a. Belt rubs against fixed components. *Relocate components.*
	3. Check drive pulley. a. Violent engagement of drive pulley. *Check drive pulley engagement speed, drive pulley bushings and components.*

SYMPTOM	**BELT "FLIP-OVER" AT HIGH SPEED.**
CONDITION	NORMAL USE
TEST/INSPECTION 	1. Check pulley alignment. a. Pulley misalignment. *Align pulley according to specifications (refer to TECHNICAL DATA).*
	2. Check drive belt identification number. a. Wrong type of belt. *Replace with an appropriate drive belt.*

SYMPTOM	SLIDER SHOES WEAR OUT PREMATURELY/OR TRACK CLEATS BECOME BLUE.
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check track tension. a. Pressure is too great on slider shoes. *Adjust according to specifications (refer to TECHNICAL DATA). Replace defective parts.*
	2. Check idler wheel condition. a. Stuck bearing, flat spot on wheel or damaged wheel. *Replace defective parts.*
	3. Check snow conditions or lack of snow. a. Lack of lubrication of slider shoes. *Ask driver to ride in appropriate snow conditions (see Operator's Guide).*
	4. Check slider shoes and/or suspension retaining screws. a. Twisted slider shoes or loose retaining screws. *Replace defective parts and/or tighten loose screws.*

SYMPTOM	DERAILING TRACK.
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check track tension. a. Track is too loose. *Adjust.*
	2. Check if track and slider shoes are properly aligned. a. Improper alignment. *Adjust.*

SYMPTOM	NOISE OR VIBRATION COMING FROM THE TRACK.
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check slide suspension retaining bolts. a. Missing bolt(s) (some components interfere with track rotation). *Replace missing bolt(s).*
	2. Check condition of idler wheel(s). a. Idler wheel rubber is damaged. *Replace.*
	3. Check guide cleats. a. Top portion of guide cleat(s) is bent. *Replace.*
	4. Check sprockets. a. One or several teeth of drive shaft sprockets are broken. *Replace sprocket(s).*
	5. Check track tension. a. Track is too loose. *Adjust to recommended tension.*
	6. Check track rods and/or internal traction teeth. a. One or several track rods and/or teeth are broken. *Replace track.*

BRAKE SYSTEM

SYMPTOM	**SPONGY BRAKE CONDITION.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Contaminated brake fluid. *Replace brake fluid and bleed system. If the problem persists, replace master cylinder.*

SYMPTOM	**BRAKE FLUID LEAKAGE.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check for loosen hose connectors. *Replace copper washers and retighten.*
	2. Check for damaged hose, master cylinder and caliper. *Replace part(s) and check for proper mounting.*

SYMPTOM	**BRAKE SYSTEM IS NOISY.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check brake pad thickness. a. Pads are worn out. *Replace.*
	2. Check key and/or key way. a. Key and/or key way is(are) worn out. *Replace.*

ELECTRICAL SYSTEM

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

SYMPTOM	**STARTER DOES NOT TURN.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check fuse. a. Burnt fuse. *Check wiring condition and replace fuse.*
	2. On (**SDI models**), check sensors, ECM or MPEM. a. Faulty sensors or defective ECM or MPEM. *Using BUDS software, check faulty codes and diagnose all components. Repair defective part.*
	3. Check battery charge. a. Discharged or disconnected battery. *Recharge battery and check charging system and wires.*
	4. Check ground. a. Poor, or corroded ground contacts. *Check, clean and tighten.*
	5. Check continuity of starter switch contact points. a. Poor contact of starter switch contact points. *Repair or replace switch.*
	6. Check continuity between starter switch and solenoid on (**fan-cooled models**) or between starter switch and MPEM on (**liquid-cooled models**). a. Open circuit. *Repair.*
	7. On (**liquid-cooled models**), check continuity between MPEM and solenoid switch. a. Open circuit. *Repair.*
	8. On (**SDI models**), check relay no. 1. a. Poor connection or defective relay. *Clean, reconnect and/or replace.*
	9. Check starter solenoid. a. Inadequate connection (too much resistance) or defective solenoid. *Clean, reconnect and/or replace.*
	10. Check starter. a. Inadequate connection (too much resistance) or defective starter. *Reconnect and/or replace.*
	11. Check engine problems. a. Damaged engine. *Check and repair.*

SYMPTOM	**STARTER TURNS BUT DOES NOT CRANK THE ENGINE.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check battery capacity. a. Shorted battery cell(s). *Replace.*
	2. Check battery charge. a. Low battery. *Recharge battery and check recharge system and wires.*
	3. Check wire connection. a. Inadequate connection (too much resistance). *Clean and reconnect.*
	4. Check solenoid switch contact disc. a. Burnt or poor contact of solenoid switch contact disc. *Replace solenoid switch.*
	5. Check brushes. a. Poor contact of brushes. *Replace brushes.*
	6. Check commutator. a. Burnt commutator. *Machine commutator on a lathe. Respect outer diameter wear limit. Refer to ELECTRIC STARTER.*
	7. Check engine. a. Engine seized. *Overhaul the engine.*
	8. Check height of commutator mica. a. Commutator mica too high. *Undercut mica.*
	9. Check field coil resistance. a. Shorted field coil. *Repair or replace yoke.*
	10. Check armature resistance. a. Shorted armature. *Repair or replace armature.*
	11. Check tension of brush springs. a. Weak brush spring tension. *Replace springs.*
	12. Check yoke assembly magnets. a. Weak magnets. *Replace yoke assembly.*
	13. Check if bushings are worn. a. Worn bushings. *Replace bushings.*

SYMPTOM	**STARTER TURNS, BUT OVERRUNNING CLUTCH PINION DOES NOT MESH WITH RING GEAR.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check clutch pinion gear. a. Worn clutch pinion gear. *Replace clutch.*
	2. Check clutch. a. Defective clutch. *Replace clutch.*
	3. Check brackets. a. Worn or broken brackets. *Replace brackets.*
	4. Check movement of clutch on splines. a. Poor movement of clutch on splines. *Clean and correct.*
	5. Check clutch bushing. a. Worn clutch bushing. *Replace clutch.*
	6. Check starter bushings. a. Worn starter bushing(s). *Replace bushing(s).*
	7. Check ring gear. a. Worn ring gear. *Replace ring gear.*
	8. Check for proper starter rotation direction. a. Starter turns in wrong direction, incorrectly installed brushes, wrong polarity or wrong starter. *Replace starter or reconnect properly.*

SYMPTOM	**ELECTRIC STARTER KEEPS TURNING WHEN ENGINE IS STARTED.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check clutch. a. Jammed clutch pinion gear. *Replace or clean.*
	2. Check movement of clutch on splines. a. Clutch is stuck on splines. *Clean.*
	3. Check starter brackets. a. Broken bracket(s). *Replace bracket(s).*
	4. On (fan-cooled models), check ignition switch. a. Ignition switch does not return to its ON position or is short-circuited. *Adjust switch position. Face nut is too far in..*
	5. Check starter relay. a. Shorted starter relay winding(s). *Replace starter relay.* b. Melted starter relay contacts. *Replace starter relay.* c. Starter relay returns poorly. *Replace starter relay.*
	6. Check start switch contacts. a. Contacts shorted. *Replace start switch.*

SYMPTOM	**NOISE OCCURRENCE WHEN STARTING ENGINE.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check if ring gear is well-mounted to drive pulley fixed half. a. Loose and/or broken bolts. *Retighten bolts using thread locker or replace ring gear and drive pulley fixed half.*

SYMPTOM	**ON FAN-COOLED MODELS, 20 A FUSE ON BLACK WIRE IN FRONT OF VEHICLE IS BURNT OUT.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check that big ground wire at battery is well connected to chassis. a. Corroded and/or loose connection(s). *Clean and/or retighten.*

SYMPTOM	**ELECTRIC STARTER SOMETIMES DOES NOT WORK WHEN ACTIVATED.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check battery cables and starter wires. a. Corroded and/or loose connection(s). *Clean and/or retighten.*
	2. Check fuse. a. Oxidized or burnt fuse. *Clean or replace.*
	3. Check wiring harness connections. a. Oxidized connections. *Clean or replace defective terminals.*
	4. Check ignition switch or START/RER switch. a. Defective contacts in ignition switch or in START/RER switch. *Replace.* b. Moisture in START/RER switch. *Blow dry START/RER switch.*
	5. Check solenoid of electric starter. a. Shorted solenoid wiring harness or corroded contact washer. *Replace.*

SYMPTOM	**THE ECM AND/OR MPEM DOES NOT WORK.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check that high tension coil wires do not touch any metal parts. a. Short circuit. *Isolate and reroute wires.*
	1. On (**SDI models**), check codes in BUDS. a. Defective connections or faulty ECM. *Repair or replace.*

SYMPTOM	**ENGINE STALLS.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Refer to IGNITION SYSTEM DIAGNOSTIC FLOW CHART.

SYMPTOM	**ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG.**
CONDITION	RIDING ON WET SNOW.
TEST/INSPECTION	1. Check if spark plug wires and/or spark plug cap seals are sealing out moisture. a. Defective wires and/or seals. *Replace defective part.*
	2. Check if ignition system wiring harness connectors are in good condition and/or are sealing out moisture. a. Loose connectors, corroded terminals or defective parts. *Clean terminals and apply silicone dielectric grease. Replace defective parts.*
CONDITION	NORMAL USE
TEST/INSPECTION	1. Verify misfiring by observing flash of stroboscopic timing light; unplug connectors between magneto/generator and vehicle wiring harness to isolate problem. Check condition of connectors. a. Defective spark plug(s) and/or cable(s)/cap(s). Defective electrical system wiring harness and/or accessories and/ignition cut-out switches. Condition of connector terminals. *Replace defective parts and/or repair damaged wires. Replace defective switch(es). Clean terminals and apply silicone dielectric grease.*
CONDITION	RIDING IN DEEP AND THICK SNOW.
TEST/INSPECTION	1. Perform all verifications outlined under ENGINE DOES NOT START — NO SPARK AT SPARK PLUG.
	2. Check spark plugs. Proceed with spark plug analysis in order to identify source of problem. a. Defective and/or worn spark plug(s) and/or cable(s) and/or cap(s). Engine related problem. *Replace defective part(s). Proceed with ignition system testing procedures. Perform engine analysis.*

SYMPTOM	**FOULED (BLACK) SPARK PLUG TIP.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check carburetor. a. Carburetion is too rich. *Adjust according to specifications (refer to TECHNICAL DATA).*
	2. Check injection oil consumption. a. Injection pump flow is too high. *Adjust according to specifications or replace.*
	3. Check oil quality. a. Poor quality oil (creation of deposits). *Use BRP XP-S injection oil.*
	4. Check engine compression. a. Leaking piston ring(s). *Replace.*

SYMPTOM	**SPARK PLUG TIP IS LIGHT GRAY.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Refer to ENGINE SLOWS DOWN OR STOPS AT HIGH RPM and check items listed.
	2. Check spark plug heat range. a. Spark plug heat range is too high. *Replace by BRP's recommended spark plug (refer to TECHNICAL DATA).*
	3. Check if air intake silencer leaks. a. Air surplus coming from opening(s) located between halves. *Seal.*
	4. Check carburetor adapter collars. a. Loose collar(s). *Tighten.*
	5. Check carburetor adapter(s). a. Cracked or deformed adapter(s). *Replace.*
	6. Check if primary compression leaks. a. Primary compression leaks. *Perform leak down test and repair as necessary.*

SYMPTOM	**RER (ROTAX ELECTRONIC REVERSE) DOES NOT WORK.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check idle speed. a. Wrong idle speed. *Adjust according to specification (refer to TECHNICAL DATA).*
	2. Check spark plug. a. Faulty spark plug. *Replace.*
	3. Check engine compression. a. Too low engine compression; engine stalls when pushing RER button. *Rebuilt the engine.*
	4. Check drive belt height. a. Wrong belt height. *Adjust according to specification (refer to DRIVE BELT).*
	5. Check carburetor synchronization and air screw adjustment. a. Wrong adjustment. *Adjust according to specification (refer to TECHNICAL DATA) and read carburetor subsection.*
	6. Check switch electrical connections. a. Bad electrical connections or damaged wires. *Clean or replace.*
	7. Check ECM or MPEM. a. Faulty ECM or MPEM. *Replace.*

SYMPTOM	**HEADLAMP NOT LIGHTING.**
CONDITION	WHITE BULB.
TEST/INSPECTION	1. Check bulb. a. Gas leak. *Replace bulb.*
CONDITION	BROKEN ELEMENT.
TEST/INSPECTION	1. Check for loose headlamp housing and bulb socket. a. Vibration problem. *Tighten headlamp mounting screws. Lock bulb in socket. Replace bulb.*
CONDITION	MELTED FILAMENT (ENDS OF ELEMENT HOLDER) AND BLACK BULB.
TEST/INSPECTION	1. Check voltage at headlamp at different speeds. It must not be above 15 Vdc. NOTE: If quartz halogen bulb is involved, ensure that proper voltage regulator is installed. a. Excessive voltage in lighting circuit. *Replace voltage regulator and ensure proper grounding. Retest.*

SYMPTOM	**HEADLAMP DIMMING.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check voltage at headlamp at different speeds. It must not be below 11 Vdc. a. Insufficient voltage in lighting circuit. *Replace voltage regulator and retest.*
	2. Visually inspect wiring harness for damaged and/or melted wires and/or bad wire terminal crimping and/or connections. a. Heating, rotating or sharp part in contact with harness. Improper harness routing. *Repair/replace damaged wires and/or terminals. Reroute harness where necessary.*
	3. On manual start models: Verify regulator ground. a. Rusted or loose retaining screws. *Clean, apply lithium grease (LMZ1) and firmly tighten screws.*
	3. On (fan-cooled models), verify if there is an interconnection between AC and DC current. a. Faulty installation of optional equipment. *Find optional equipment connected directly to DC ground (BLACK wire or chassis) or to any DC hot wire (RED or RED/BLUE). Disconnect and reconnect to AC current (YELLOW and YELLOW/BLACK wires). Refer to the appropriate section.*
	5. Check if optional electric accessories are overloading the magneto/generator. a. Excessive electrical load to magneto/generator. *Reduce the electrical load by removing excess accessories. Reconnect as recommended by manufacturer.*
	6. Hot Grips brand: Verify if they were connected in parallel by mistake. a. Excessive electrical load to magneto/generator. *Reconnect as recommended by manufacturer.*
	7. BRP heating grips: Verify if the return wires of the elements were grounded to the chassis by mistake. a. Faulty installation of optional equipment. *Reconnect as recommended by manufacturer.*
	8. Check if heating grips installation overloads the magneto capacity. a. Excessive electrical load to magneto/generator. *Reduce the electrical load by removing accessories.*

SYMPTOM	**FALSE FUEL AND/OR TEMPERATURE GAUGE READINGS.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. On (**fan-cooled models**), verify if gauge was connected on DC current by mistake (in case of optional installation). a. Faulty installation of optional equipment. *Find optional wires connected directly to DC ground (BLACK wire to chassis) or to any DC hot wire (RED or RED/BLUE). Disconnect and reconnect to AC current (YELLOW and YELLOW/BLACK wires)*
	2. Verify sender unit for free movement and/or correct arm position. a. Defective or damaged part. *Correct or replace sender unit.*
	3. Verify sender unit/gauge wiring harness condition. a. Heating, rotating or sharp part in contact with harness. Improper harness routing. *Replace or repair damaged wires. Reroute where necessary.*

SYMPTOM	**NO ELECTRICAL ACCESSORIES WORK WHEN ENGINE IS ON IDLE.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check idle speed. a. Too low idle speed. *Readjust to specifications.*
	2. Verify regulator. a. Faulty regulator. *Replace.*

SYMPTOM	**BRAKE LIGHT REMAINS ON.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check if bulb is properly installed. a. Bulb is not installed correctly (contact elements are reversed). *Install bulb correctly.*
	2. Check brake switch. a. Switch contact remains closed. *Replace brake switch.*
	3. Check wiring harness. a. Shorted wiring harness. *Replace or repair wiring harness.*

SYMPTOM	**REAR LIGHT BULB FLASHES.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check bulb tightness in housing. a. Looseness at bulb contact elements. *Install bulb correctly.*
	2. Check if rear light is properly connected. a. Connector housing is partially connected. *Install connector housing properly.*
	3. Check continuity of wires. a. Corroded terminals and/or broken wires. *Replace terminal(s) or crimp defective wires.*

SYMPTOM	**TACHOMETER DOES NOT WORK.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check continuity of wires. a. Corroded terminals and/or broken wires. *Replace terminal(s) or crimp defective wires.*
	2. Check tachometer part number. a. Models with 360 W magneto have a different tachometer. *Replace with appropriate one.*

STEERING AND SUSPENSION

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

SYMPTOM	**SUSPENSION IS TOO LOW.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check condition of springs. a. Springs are weakened or broken. *Replace springs.*
	2. Check springs preload. a. Low spring preload. *Increase preload to the recommended position.*
	3. Check springs. a. Installed springs are too soft. *Install optional stiffer springs, refer to service bulletin SPRING REFERENCE ACCORDING TO LOAD.*

SYMPTOM	**REAR SUSPENSION BOTTOMS OUT.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check condition of springs. a. Springs are weakened or broken. *Replace springs.*
	2. Check springs preload. a. Low spring preload. *Increase preload to the recommended position.*
	3. Check springs. a. Springs installed are too soft. *Install optional stiffer springs, refer to service bulletin SPRING REFERENCE ACCORDING TO LOAD.*
	4. Check the rear shock motion ratio position. a. It is adjusted in soft position. *Adjust rear shock motion ratio to firm position.*
	5. Check condition of the rear shock absorber. a. Damaged rear shock absorber. *Replace rear shock absorber.*

SYMPTOM	**REAR SUSPENSION IS TOO STIFF.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check rear spring preload. a. Too much preload. *Adjust to a softer position.*
	2. Check springs. a. Springs installed are too stiff. *Install optional softer springs, refer to service bulletin SPRING REFERENCE ACCORDING TO LOAD.*
	3. Check the rear shock motion ratio position. a. It is adjusted in firm position. *Adjust rear shock motion ratio to soft position.*
	4. Check track tension. a. Track is too tight. *Adjust.*
	5. Check if axles are properly lubricated. a. Improper lubrication and/or contaminated grease (sticky oil sludge). *Clean and/or lubricate.*
	6. Check condition of the rear shock absorber. a. Damaged rear shock absorber. *Replace rear shock absorber.*

SYMPTOM	**WHEN HANDLEBAR IS TURNED, SNOWMOBILE UNDERSTEERS.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check ski runner condition. a. Worn ski runners. *Replace.*
	2. Check ski spring preload. a. Insufficient ski pressure on the ground. *Increase spring preload.*
	3. Check if front arm stopper strap is too long. a. Insufficient ski pressure on the ground. *Shorten stopper strap.*
	4. Check front arm spring preload. a. Insufficient ski pressure on the ground. *Loosen spring tension.*

SYMPTOM	**HANDLEBAR IS DIFFICULT TO TURN.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check if the handlebar turns freely when skis are off the ground. a. Ball joints corrosion restrains movement. *Lubricate or replace the ball joint.* b. Component need proper lubrication. *Lubricate. Refer to MAINTENANCE.* c. Bent parts. *Replace parts.*
	2. Check ski spring preload. a. Too much preload. *Reduce ski spring preload.*
	3. Check position of stopper strap. a. Too much weight when stopper strap is short. *Lengthen front arm stopper strap.*
	4. Check position of front arm spring adjustment cam(s). a. When spring tension is weak, more weight is transferred to the skis. *Increase spring preload.*
	5. Check swing arm camber. a. Too much ski leg inclination. *Adjust camber to specifications.*

SYMPTOM	**THE SNOWMOBILE ZIGZAGS.**
CONDITION	NORMAL USE
TEST/INSPECTION	1. Check ski runner condition. a. Worn or bent ski runners. *Replace ski runners.*
	2. Check ski alignment. a. Improper ski alignment. *Align skis in order to obtain proper toe-out (opening) (to adjust, refer to STEERING SYSTEM).*
	3. Check if bushings are too loose in steering system. a. Bushings are too loose. *Replace.*
	4. Check ski pressure. a. Too much pressure on skis. *Reduce ski spring preload and/or increase center spring preload.*
	NOTE: If all parts are in good condition and the customer still complains about an unstable snowmobile, consider the installation of optional Proactive Control System.

LEAK TEST

SERVICE TOOLS

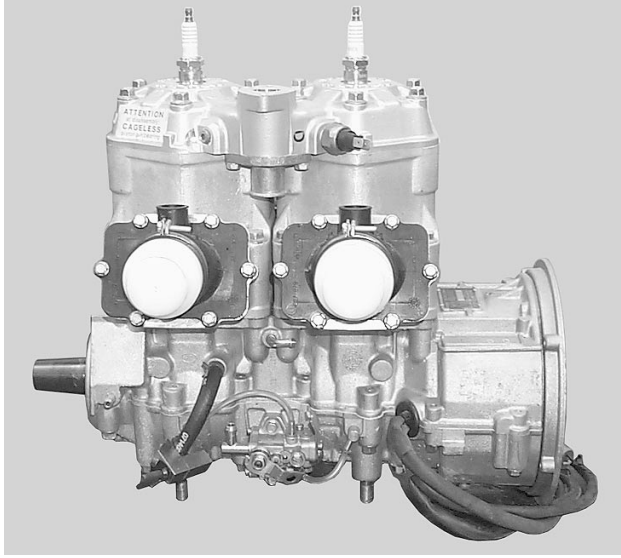
Description	Part Number	Page
hose pincher	295 000 076	47
vacum/pressure pump kit	529 021 800	47

PREPARATION

Use vacum/pressure pump kit (P/N 529 021 800) to pressure test engine. The following gives verification procedures for liquid cooled engines though it also applies to fan cooled engines. For FC engines, do not consider information pertaining to coolant system and pump shaft oil gear reservoir.

On FC twin-cylinder engines, each cylinder cannot be verified individually due to leakage from one cylinder to the other through labyrinth sleeve in center of crankshaft.

– Remove tuned pipe.
– Install plug over exhaust manifold.
– Remove carburetors/throttle body assembly (as applicable).
– Unplug fuel inlet line from fuel rail.
– Insert plugs in intake rubber boots. Tighten with existing clamps.

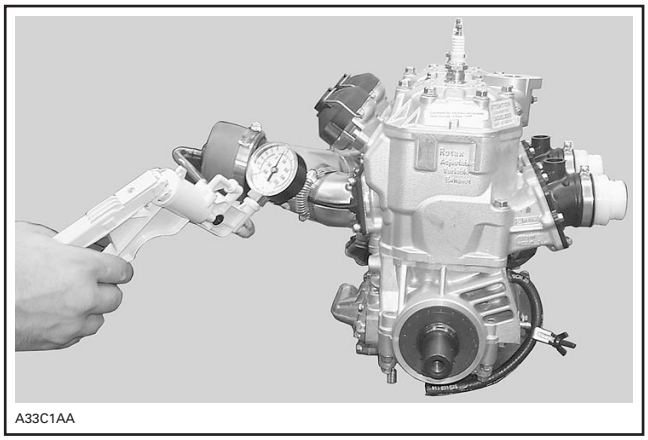


A33C19A

– Using a hose pincher (P/N 295 000 076), block impulse hose.
– Install air pump on exhaust plug.

NOTE: If necessary, lubricate air pump piston with mild soap.

CAUTION: Using hydrocarbon lubricant (such as engine oil) will damage rubber seal of pump piston.


A33C1AA

– Activate pump and pressurize engine to 34 kPa (5 PSI). Do not exceed this pressure.
– Engine must stand this pressure during 3 minutes. If pressure drops before 3 minutes, check tester kit by spraying a soapy solution on pump cylinder, all plugs and fittings.
  • If tester kit is leaking, bubbles will indicate where leak comes from.
  • If tester kit is not leaking, check engine as per following procedure.

PROCEDURE

NOTE: A flow chart has been prepared as a visual reference. See last page of this chapter.

Using flow chart and following text, pressurize area to be tested and spray soapy solution at the indicated location.

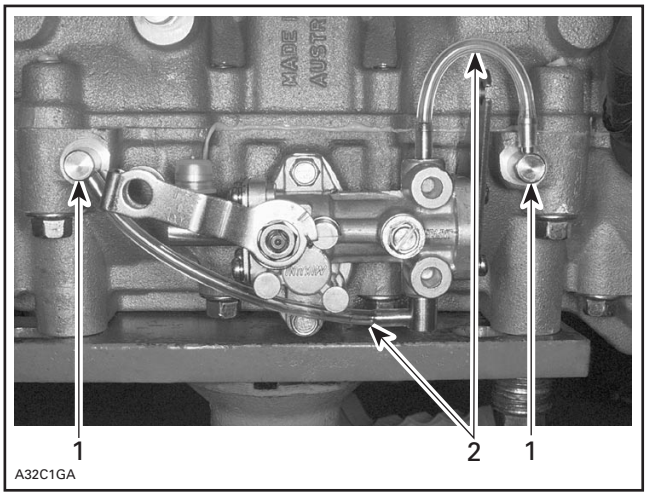
TEST PRESSURE: 34 KPA (5 PSI) FOR 3 MINUTES

  • If there is a leak at the tested location, it is recommended to continue testing next items before overhauling engine. There is a possibility of more than one leak.
  • If there is no leak at the tested location, continue pumping to maintain pressure and continue with next items until leak is found.

Engine

Check the following:

– All jointed surfaces and screw/stud threads of engine:
  • spark plug base, insulator
  • cylinder head
  • RAVE valve bellows, piston and housing
  • cylinder crankcase halves (joint)
  • oil injection pump mounting flange (O-ring)
  • coolant pump housing
  • bleed screws/plugs
  • crankcase grease reservoir fitting.
– Small injection oil lines coming from pump.



A32C1GA

TYPICAL
1. Injection nipples
2. Small injection oil lines

Check for air bubbles or oil column going toward pump. It indicates defective check valve in injection nipples.

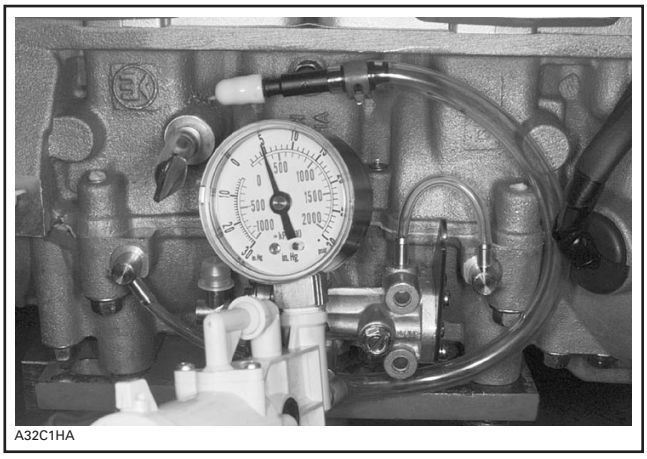
– Remove cooling system cap.

Check for air bubbles in antifreeze. It indicates defective cylinder head O-ring or cylinder base gasket.

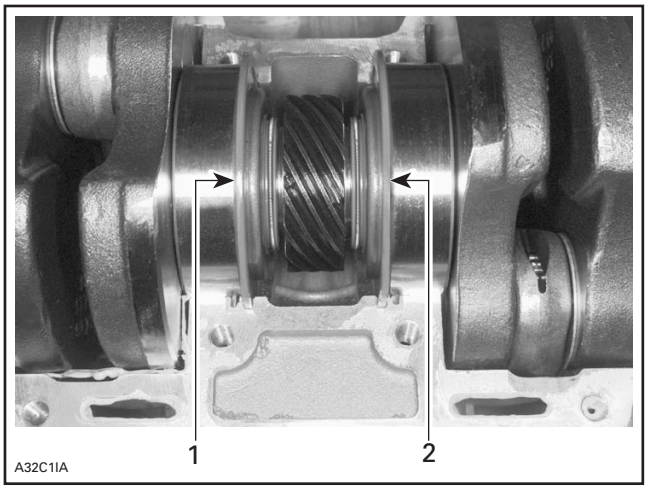
– Remove drive pulley then check crankshaft outer seal.
– Remove rewind starter and magneto system then check crankshaft outer seal.
– Check pump shaft gear oil reservoir.

Pump Shaft Oil Gear Reservoir

Install air pump on adapter and pressurize as above.


A32C1HA

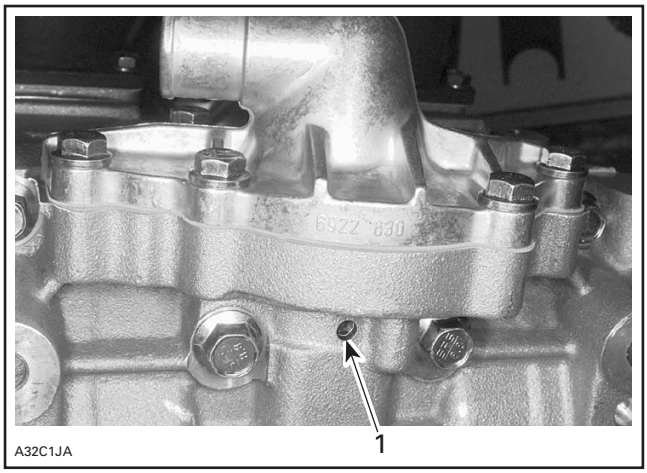
If pressure drops, it indicates a defective crankshaft inner seal.



A32C1IA

TYPICAL — CRANKSHAFT INSTALLED IN UPPER HALF CRANKCASE
1. *Crankshaft inner seal on PTO side*
2. *Crankshaft inner seal on MAG side*

– Check weep hole below coolant pump housing with soapy water.

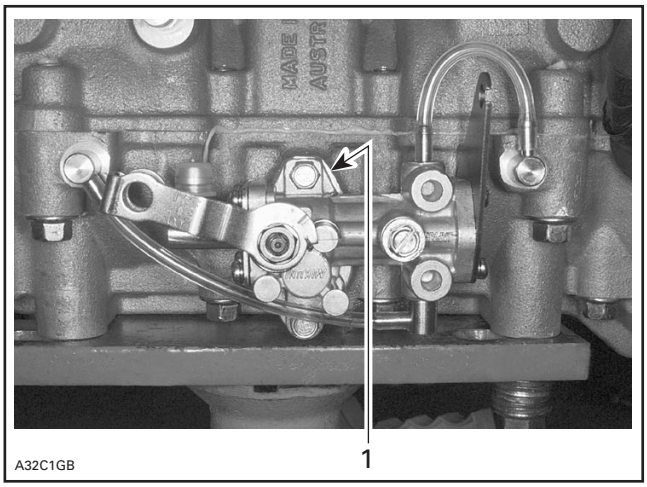


A32C1JA

1. Weep hole

If there is a leak, it indicates that a pump shaft is defective (oil seal beside coolant ceramic seal).

– Leaks can be also on oil pump side. Check mounting area for leaks.



A32C1GB

TYPICAL
1. *Check mounting area*

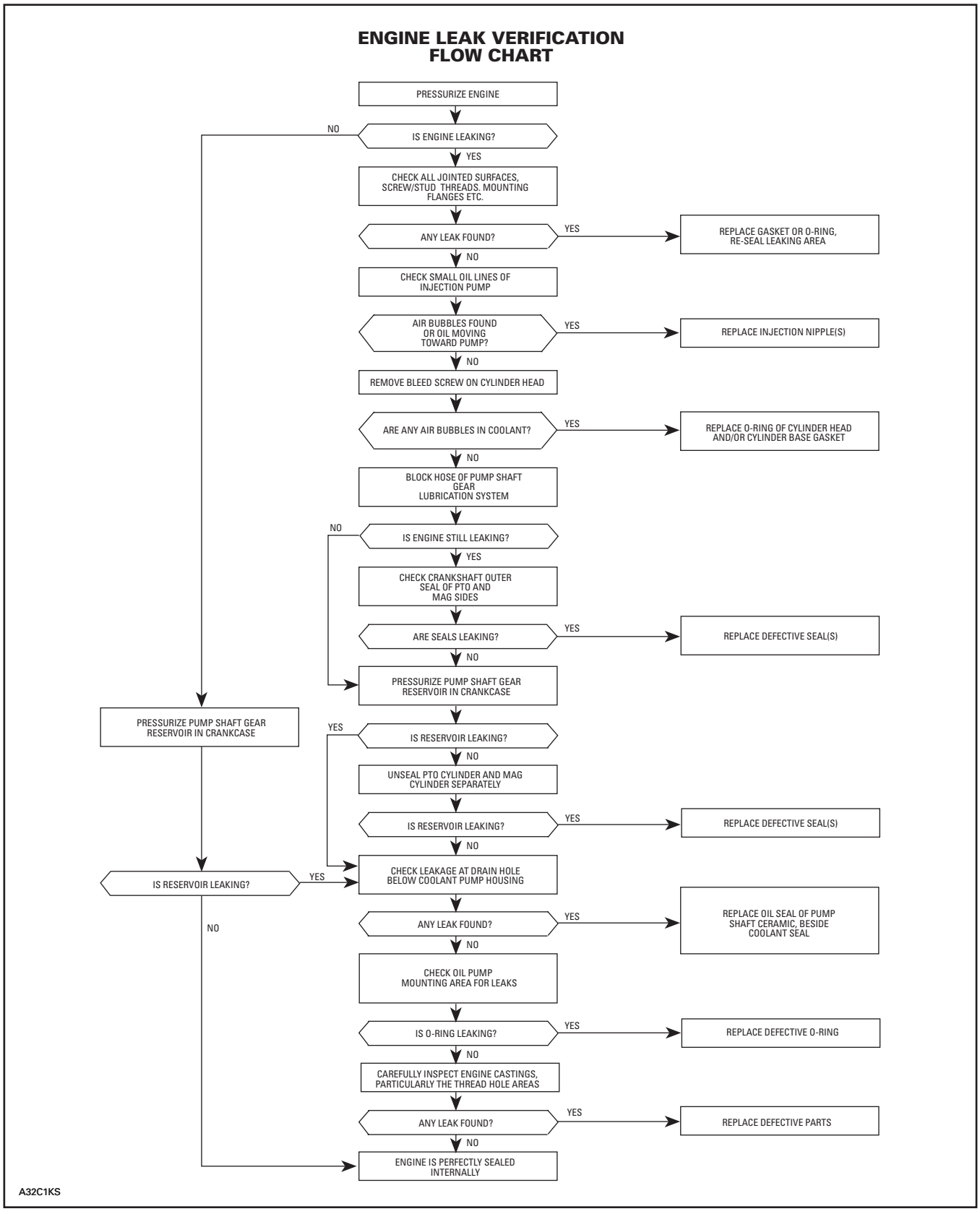
– If leak still persists, it indicates a defective casting somewhere in engine.

Disassemble engine and carefully check for defects in castings. Pay attention to tapped holes which may go through engine sealed area and thus lead to leakage.

FINALIZING REASSEMBLY

After reassembling engine, always recheck for leakage.

ENGINE LEAK VERIFICATION FLOW CHART



EXHAUST SYSTEM

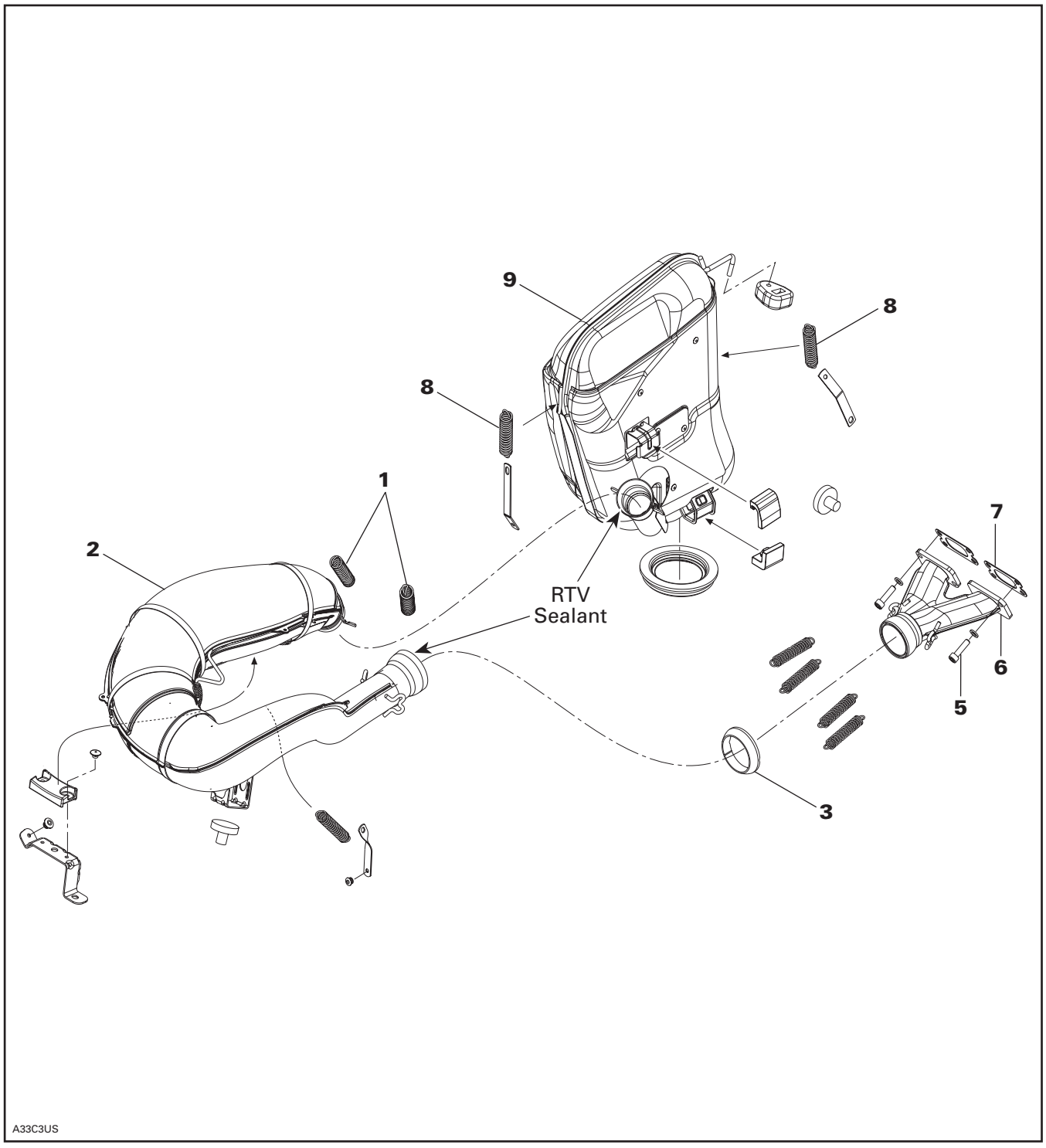
SERVICE TOOLS

Description	Part Number	Page
exhaust spring installer/remover	529 035 401	54–55

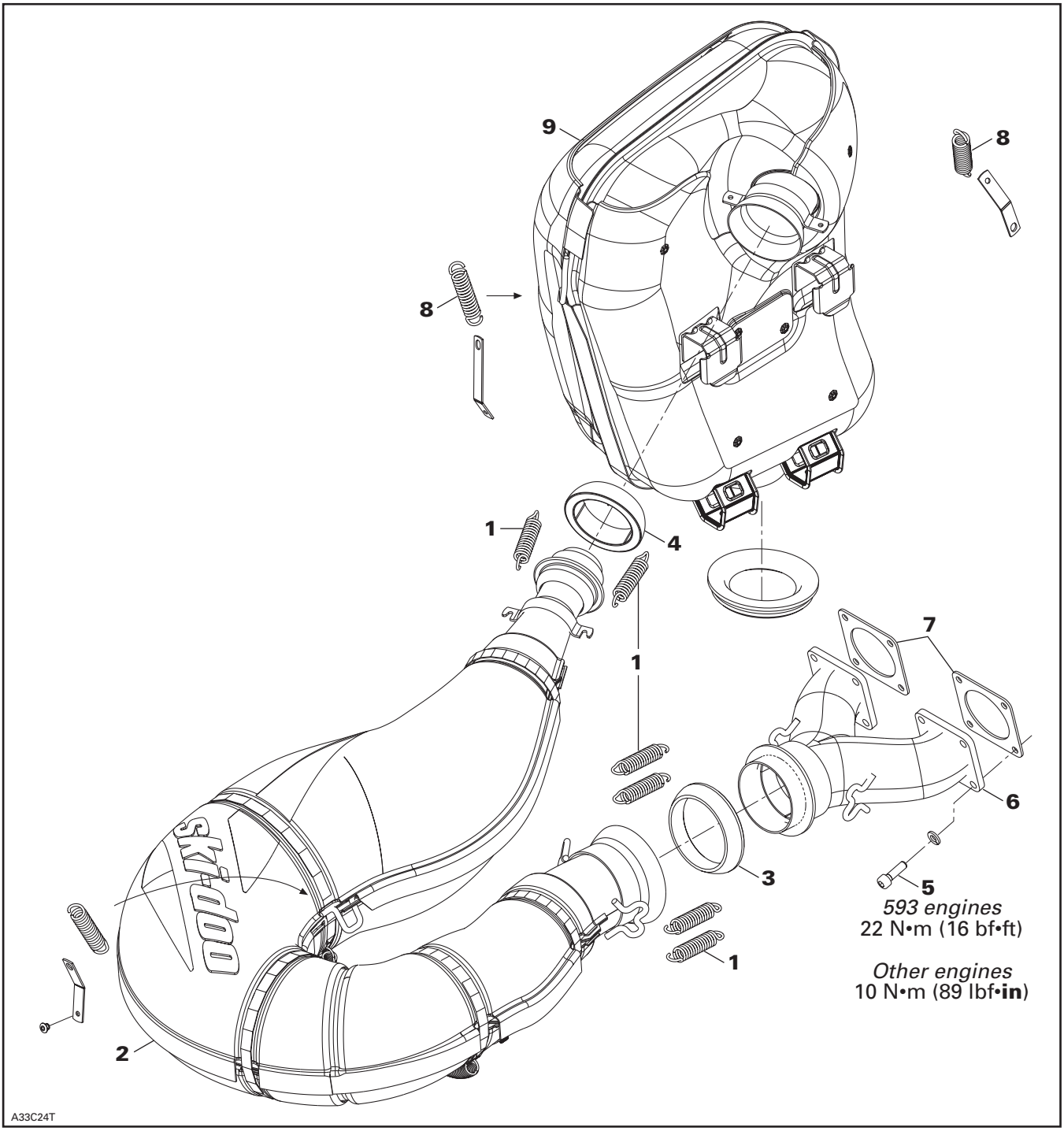
SERVICE PRODUCTS

Description	Part Number	Page
RTV sealant	293 800 090	55

377 AND 552 ENGINES



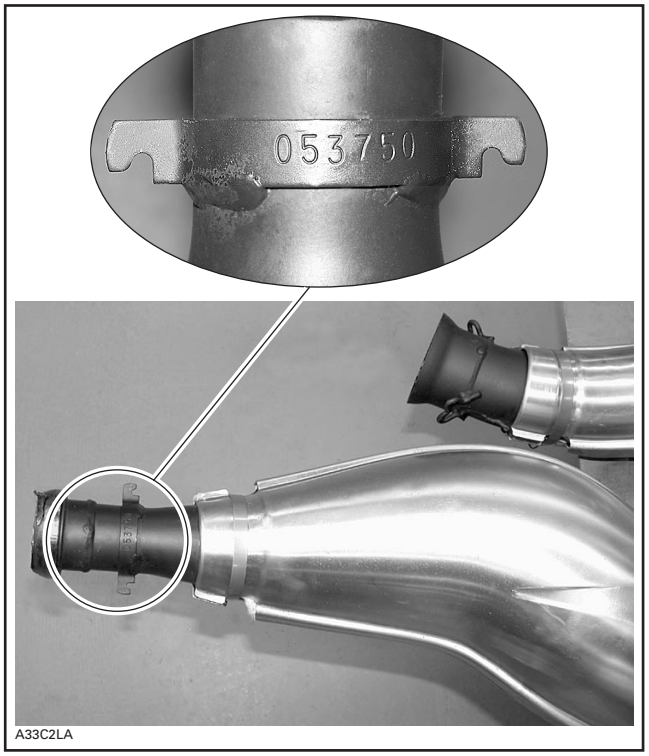
593, 593 HO, 593 HO SDI AND 793 HO ENGINES



TUNED PIPE

Identification

Each tuned pipe is identified by a number. To use the proper tuned pipe with the proper vehicle, check the number on the welded clamp at the end of tuned pipe. This number depicts the 6 last numbers of BRP part number.



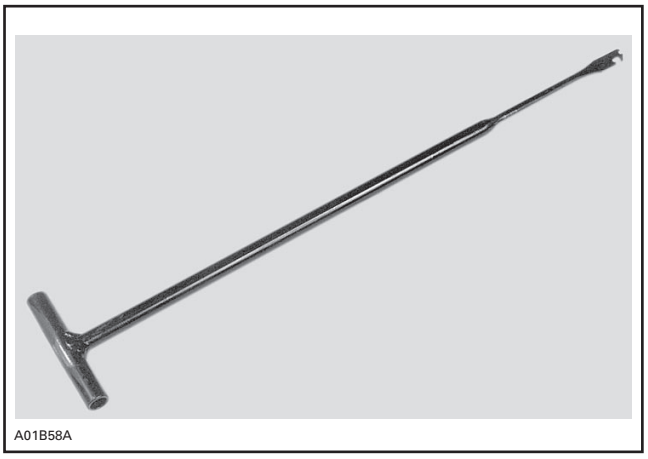
TYPICAL

Removal

Open hood and right side panel.

Remove:

– all exhaust springs **no. 1** using exhaust spring installer/remover (P/N 529 035 401)



– tuned pipe **no. 2**
– exhaust gasket **no. 3** and **no. 4** if applicable.

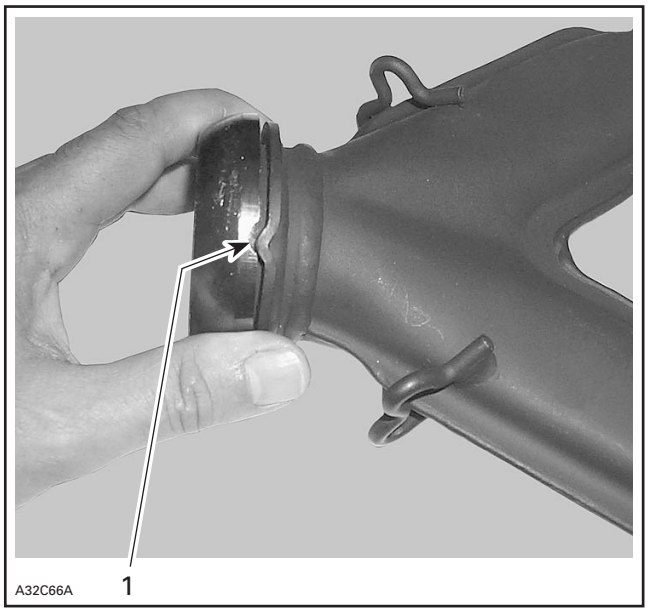
Inspection

Check:

– tuned pipe shield for damages
– tuned pipe ends for cracks or damages.

Installation

Install doughnut shaped exhaust gasket **no. 3** with both of its notches aligned with Y-manifold protrusions.



1. Align notches

If the gaskets are damaged, replace them.

Fan Cooled Engines

Apply RTV sealant (P/N 293 800 090) on gasket contact surfaces.

All Engines

Install all exhaust springs using exhaust spring installer/remover (P/N 529 035 401).

MANIFOLD

Removal

Remove:

– tuned pipe **no. 2**
– doughnut shaped exhaust gasket **no. 3**
– manifold screws **no. 5**

CAUTION: On engines with 6 mm (1/4 in) screws, heat screws for 30 seconds before loosening to prevent screw breakage.

– manifold **no. 6**
– gaskets **no. 7**.

Inspection

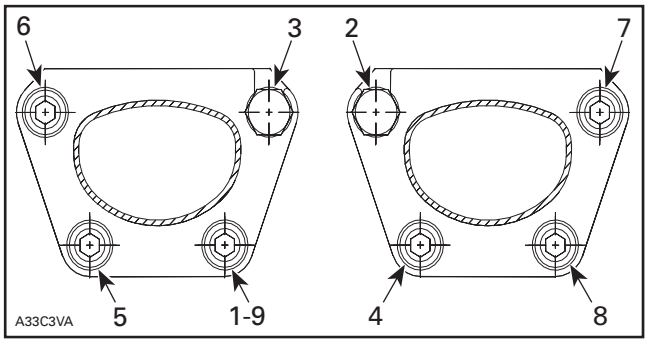
Check if the manifold is cracked or damaged. Replace if necessary.

Installation

Install the manifold with new gaskets.

Torque manifold screws **no. 5**.

NOTE: On liquid cooled engines, use the following tightening sequence.



ENGINE	TORQUE
377/552/593	22 N•m (16 lbf•ft)
593 HO, 593 HO SDI and 793 HO	11 N•m (97 lbf•**in**)

Install tuned pipe.

MUFFLER

Identification

Each muffler is identified by a number. To use the proper muffler with the proper vehicle, check the number on the welded clamp at the end of muffler. This number depicts the 6 last numbers of BRP part number.

TYPICAL

Removal

Remove tuned pipe **no. 2**.

Disconnect the EGTS (Exhaust Gas Temperature Sensor) on SDI models.

Remove springs **no. 8** retaining the muffler **no. 9**. Use exhaust spring installer/remover (P/N 529 035 401).

Remove the muffler.

Inspection

Check the muffler for cracks or other damages.

Refer to the COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT section to verify the EGTS.

Installation

For installation, reverse the removal procedure.

ENGINE REMOVAL AND INSTALLATION

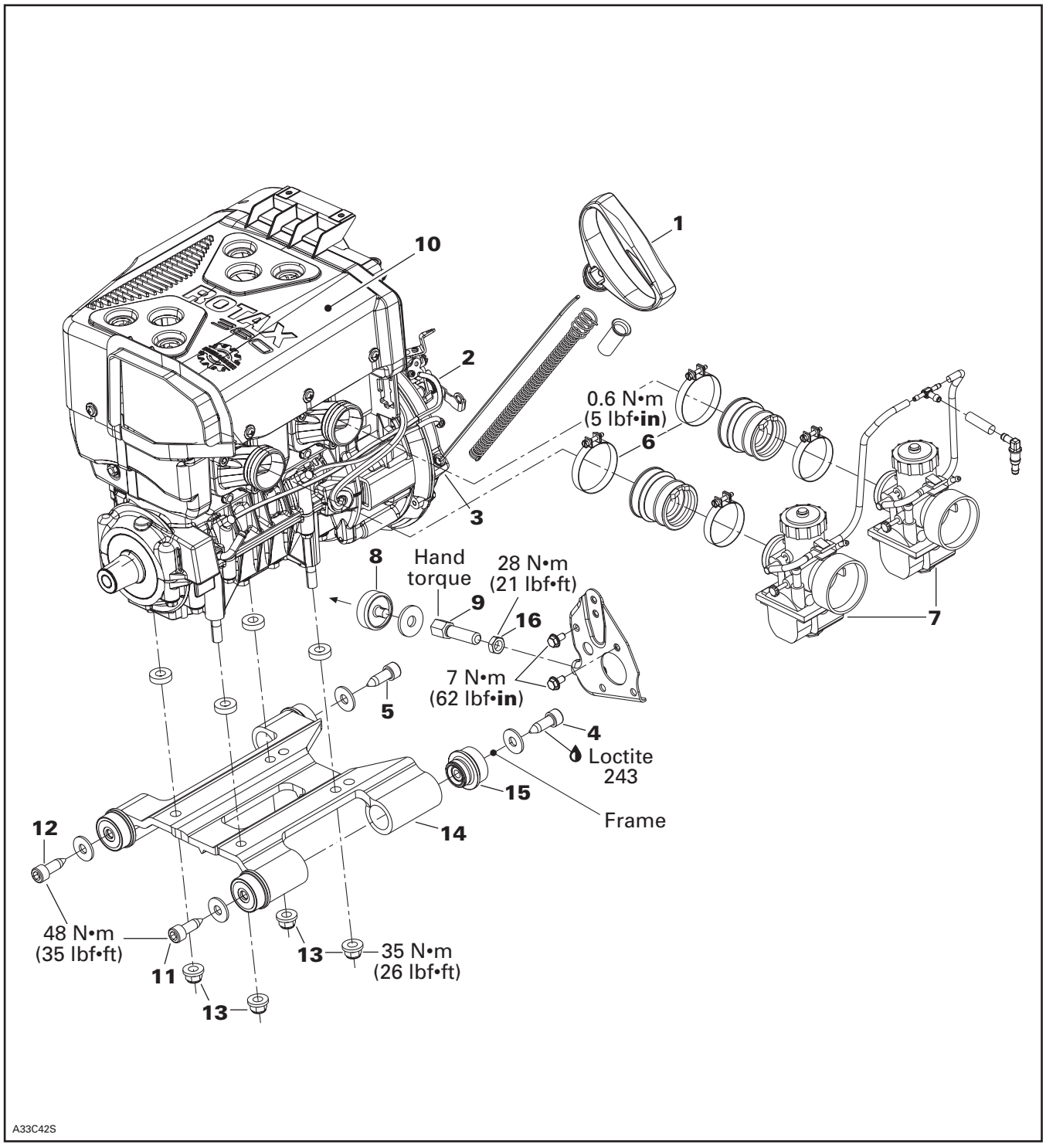
SERVICE TOOLS

Description	Part Number	Page
engine removal hook	529 035 829	69
pump	529 035 880	65
small hose pincher	295 000 076	60
spark plug lift ring	529 035 830	68

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	63, 69

Fan-Cooled Engines



REMOVAL FROM VEHICLE

Vehicule and Engine Preparation

Place vehicle at workstation that will have access to an engine-lifting hoist. Then start with initial preparation of vehicle by doing the following.

Remove the RH and the LH side panels.

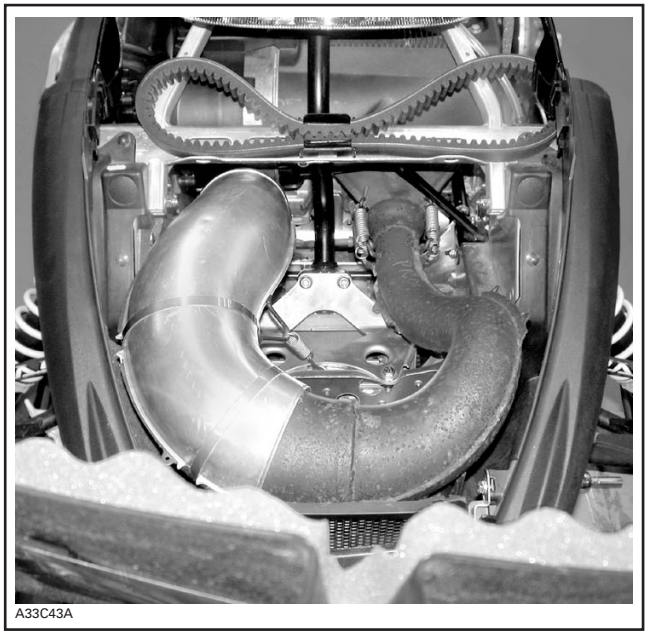
Disconnect BLACK (-) cable from battery, then the RED (+) cable.

⚠ WARNING

Always disconnect battery or starter cables exactly in the specified order, BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

From the front of vehicle

Remove tuned pipe and manifold, refer to EXHAUST SYSTEM.



A33C43A

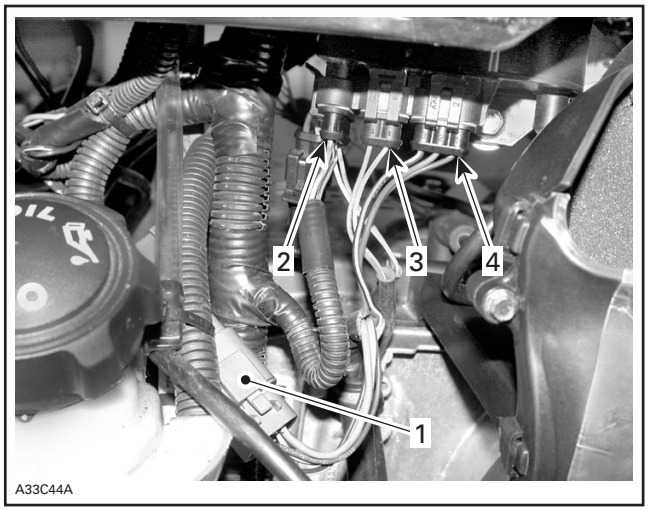
Disconnect starter cables.

On right side of vehicle, do the following:

Remove muffler.

Unfasten the screws retaining the air duct inlet, lift up the retaining tabs and remove the air duct inlet.

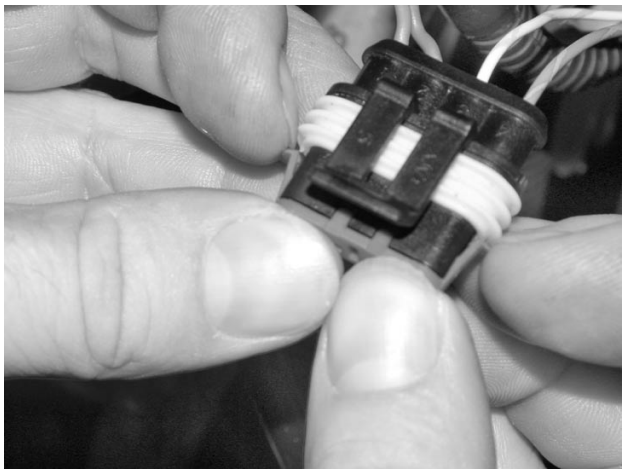
Unplug the magneto, the reverse, the trigger coil and the engine stop switch connectors.



A33C44A

1. Magneto connector
2. Reverse connector
3. Trigger coil connector
4. Engine stop switch connector

On the reverse connector, disconnect the BLUE/YELLOW and the WHITE/YELLOW wires from the connector. To do this, remove the lock then using a small tool extract wires from connector.

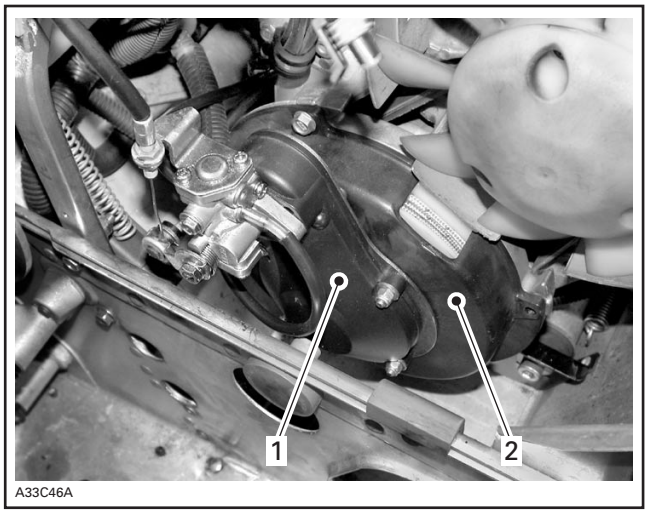


A33C45A

MOVE ASIDE BOTH TABS TO REMOVE LOCK

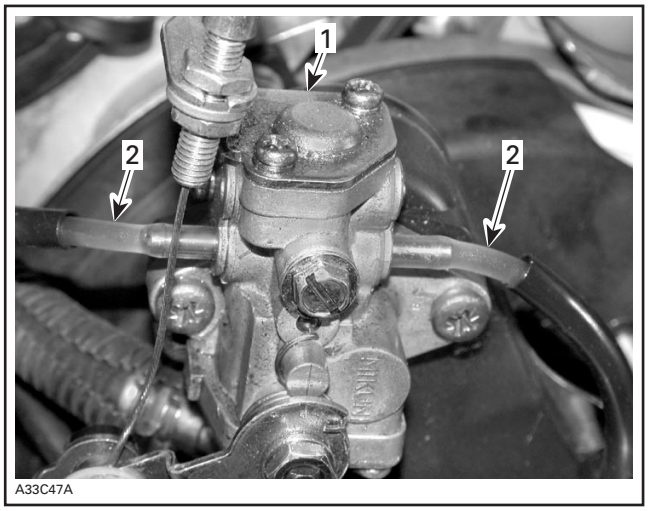
Remove the rewind starter handle **no. 1**.

Unscrew oil pump **no. 2** from rewind starter housing **no. 3**.



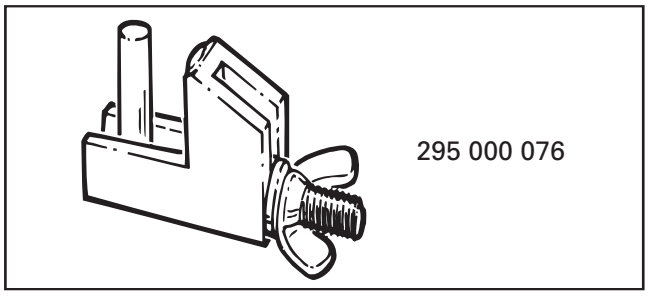
552 ENGINE SHOWN
1. *Oil pump*
2. *Rewind starter housing*

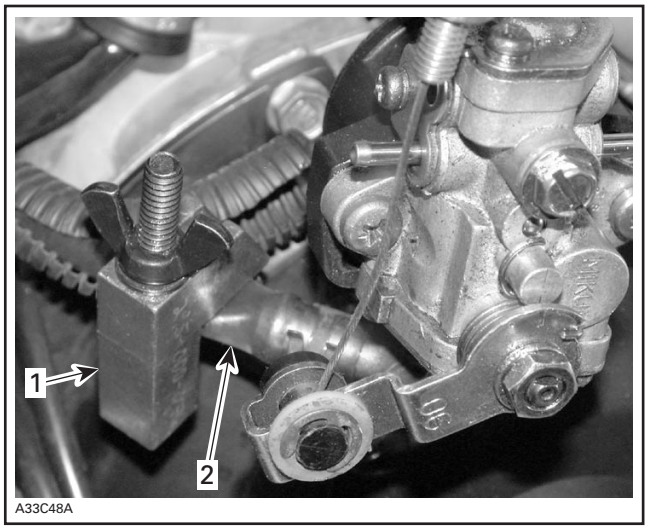
Unplug both outlet hoses from oil pump.



1. *Oil pump*
2. *Outlet hoses*

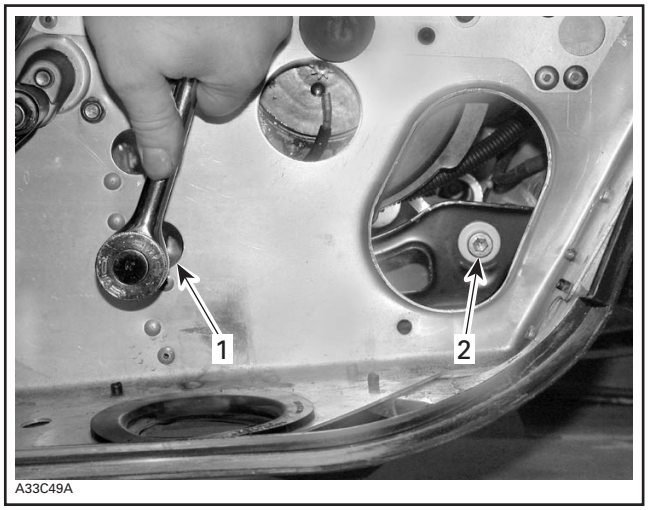
Install a small hose pincher (P/N 295 000 076) on the inlet oil line and disconnect it from oil pump. Catch any spillage.





1. *Hose pincher*
2. *Inlet oil line*

Unscrew engine support bolts **no. 4** and **no. 5**.



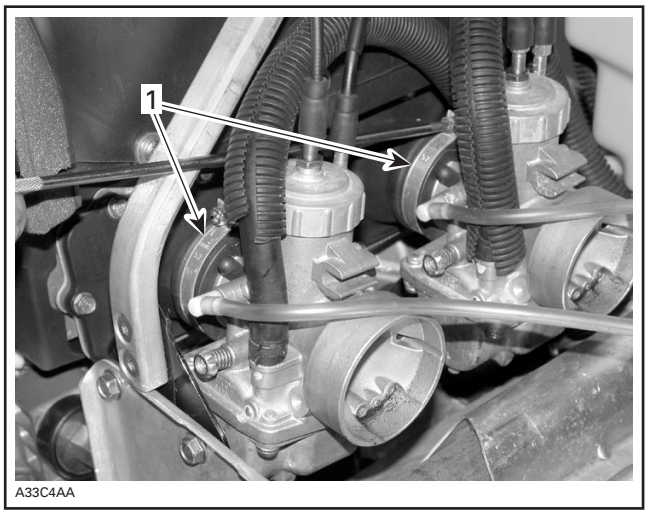
1. *Rear engine support bolt location*
2. *Front engine support bolt*

On left side of vehicle, do the following:

Remove drive and driven pulleys. Refer to the appropriate section.

Remove air box.

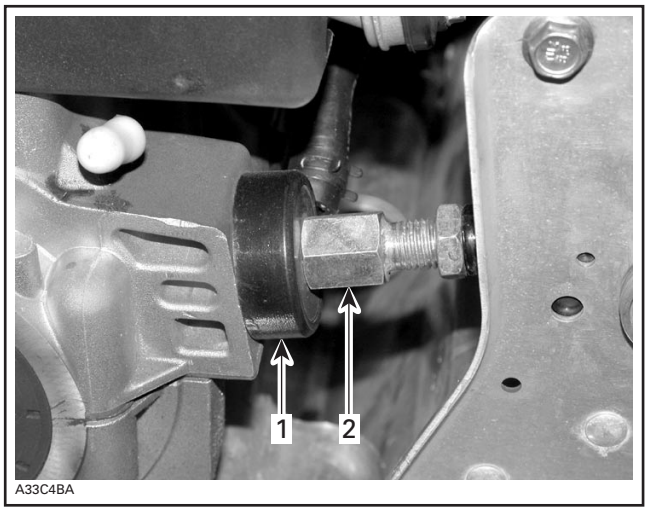
Unscrew carburetor clamps **no. 6** then separate the carburetors **no. 7** from the engine.



A33C4AA

1. Carburetor clamps

Unscrew and remove the engine stopper. Do not remove rubber end **no. 8** only, unscrew the screwed rod **no. 9** completely.



A33C4BA

1. Rubber end
2. Screwed rod

Remove the impulse line from crankcase.

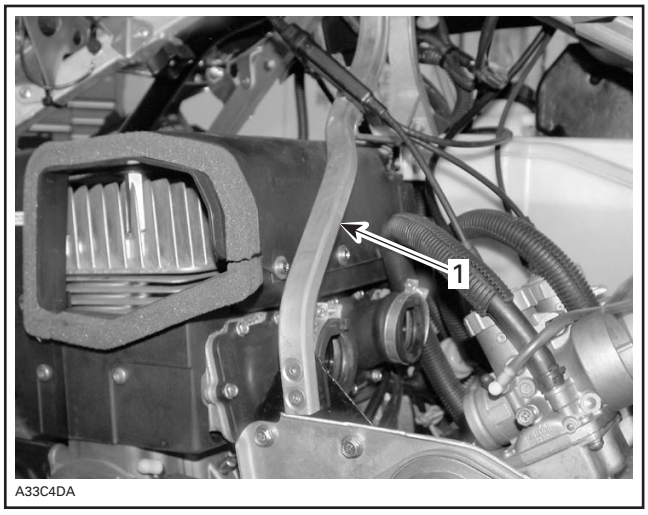
Disconnect the spark plug cables.

Remove front brace.

A33C4CA

1. Front brace

Unscrew the rear brace.



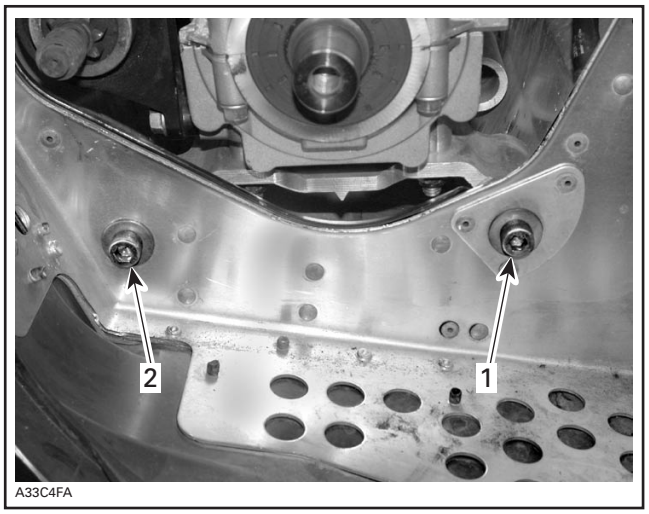
A33C4DA

1. Rear brace

Remove the cylinder cowl **no. 10**.

A33C4EA

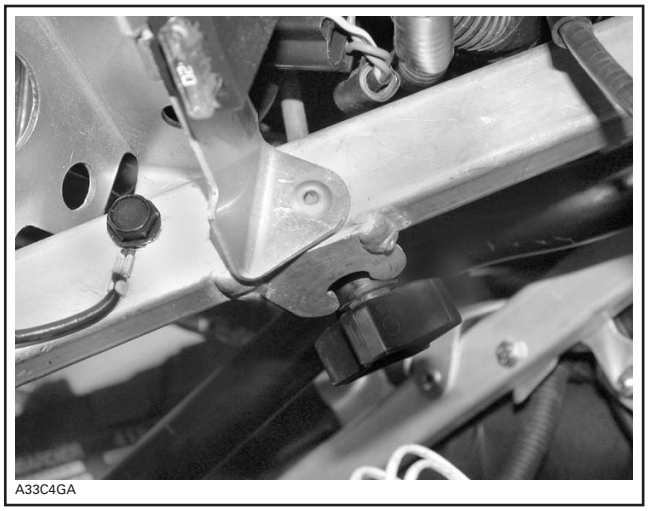
Remove the engine support bolts **no. 11** and **no. 12**.



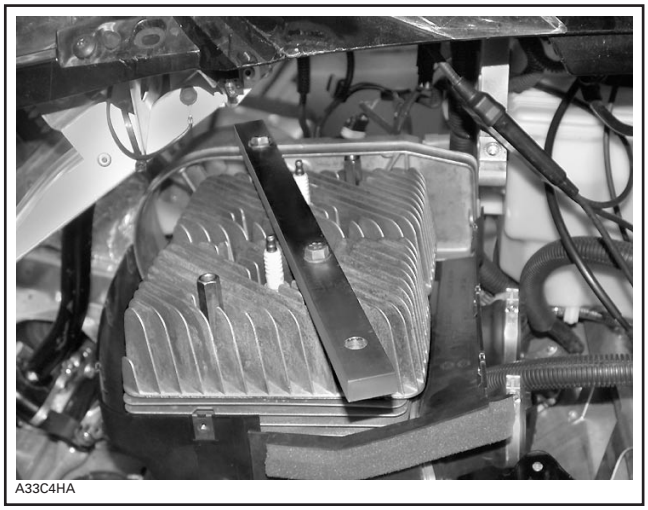
A33C4FA

1. Rear engine support bolt
2. Front engine support bolt

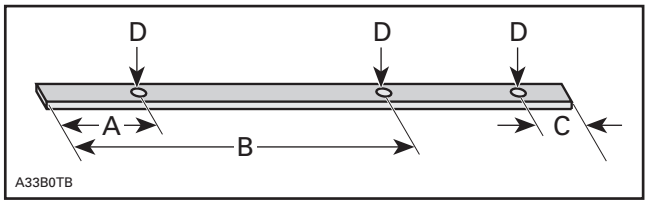
Remove headlamp adjusting knob from its support.


A33C4GA

Install the homemade lifting tool.


A33C4HA

Use the following illustration to make the tool.

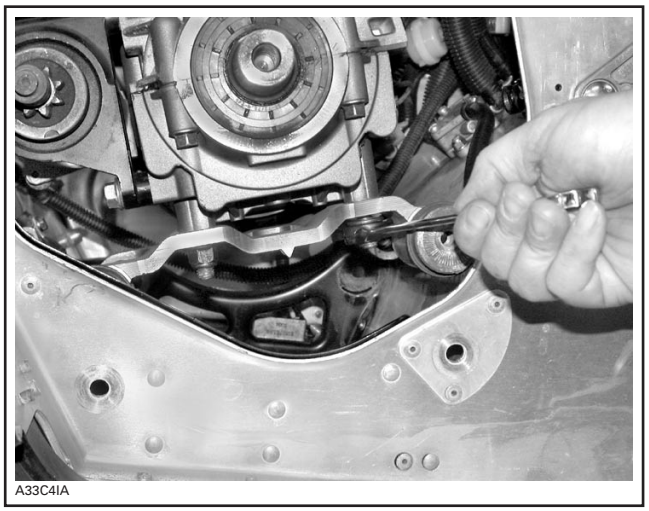


A33B0TB

FLAT BAR 152 X 25.4 X 13 MM (16 X 1 X 1/2 IN)
A. 51 mm (2 in)
B. 260 mm (10–1/4 in)
C. 38 mm (1–1/2 in)
D. Diameter: 13 mm (1/2 in)

Lift up the engine.

Unscrew the nuts **no. 13** retaining engine support **no. 14** to engine.


A33C4IA

Remove the support from engine and lower it in frame.

Remove engine from vehicle.

INSPECTION

Check if engine support **no. 14** is cracked, bent or otherwise damaged. Replace if necessary.

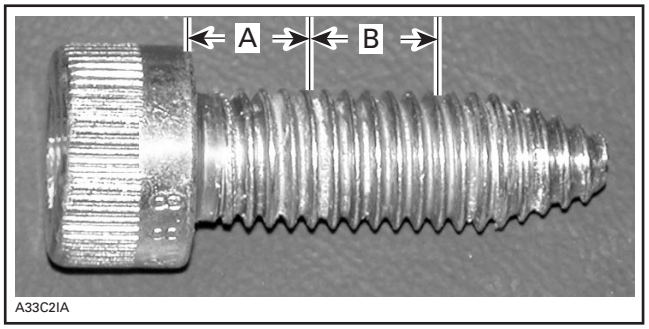
Check rubber mounts **no. 15** on engine support. Replace them if brittle, cracked or otherwise damaged.

INSTALLATION

To install engine in vehicle, reverse the removal procedure. However, pay attention to the following.

Install engine support under engine then torque engine support nuts to 35 N•m (26 lbf•ft).

Before installing engine support bolts , apply Loctite 243 (blue) (P/N 293 800 060) as shown in the following illustration.



A33C2IA

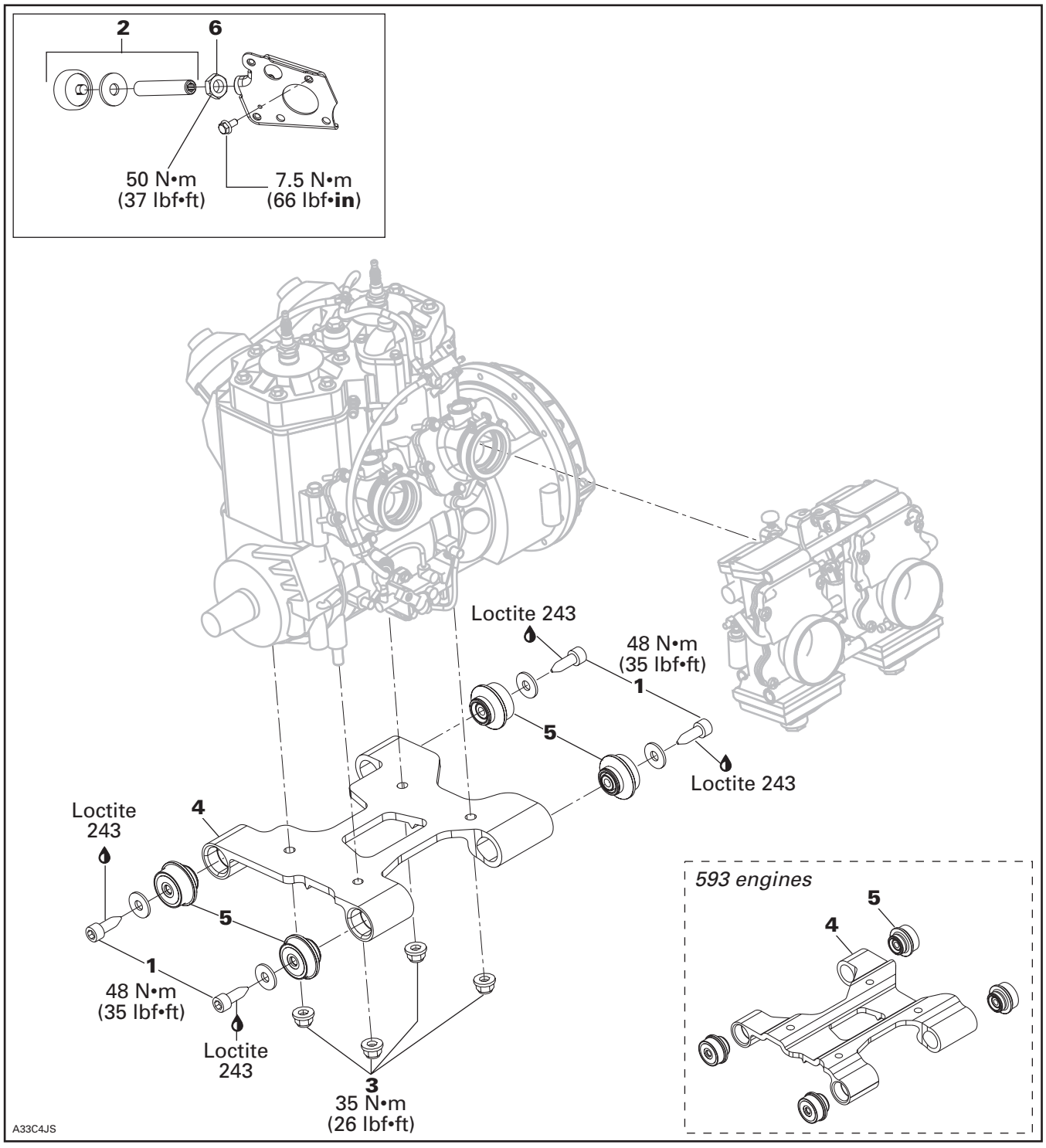
A. Do not apply Loctite in this area, ± 10 mm (.39 in)
B. Loctite area, ± 8 mm (.31 in)

Torque engine support bolts to 48 N•m (35 lbf•ft).

Hand torque engine stopper **no. 9** then torque its nut **no. 16** to 50 N•m (37 lbf•ft).

Reinstall all removed parts by using the appropriate component/system reinstallation procedures described in this shop.

Liquid-Cooled Engines



REMOVAL FROM VEHICLE

Vehicle and Engine Preparation

Place vehicle at workstation that will have access to an engine-lifting hoist. Then start with initial preparation of vehicle by doing the following.

Remove windshield.

Remove the RH side panel.

Disconnect BLACK (-) cable from battery, then the RED (+) cable.

⚠ WARNING

Always disconnect battery or starter cables exactly in the specified order, BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

On **SDI models**, release the fuel pressure of the system. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

From the Front of Vehicle

Remove tuned pipe and manifold, refer to EXHAUST SYSTEM.

Remove starter.

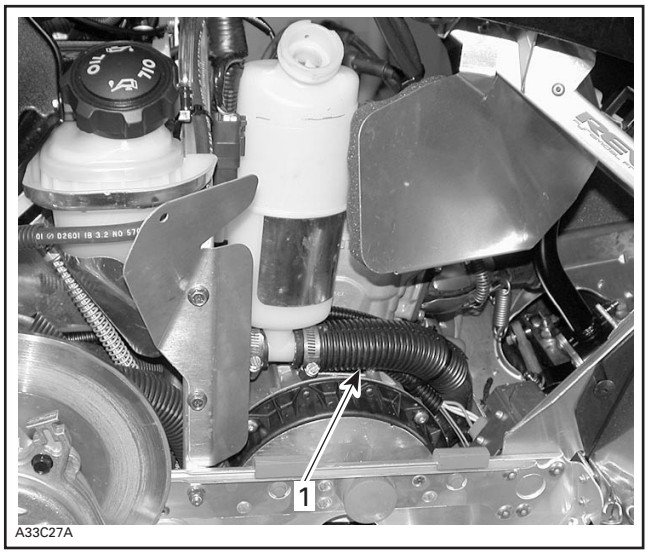
NOTE: Remove BLACK starter cable from vehicle, not from starter.

On right side of vehicle, do the following:

Remove muffler.

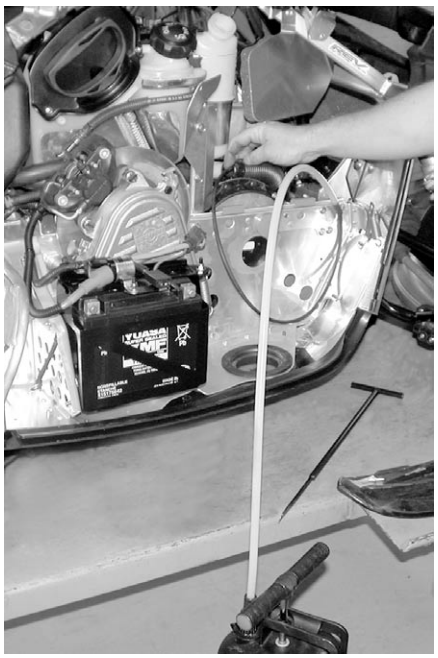
Drain coolant reservoir.

Unplug from the coolant reservoir the hose going to the engine.

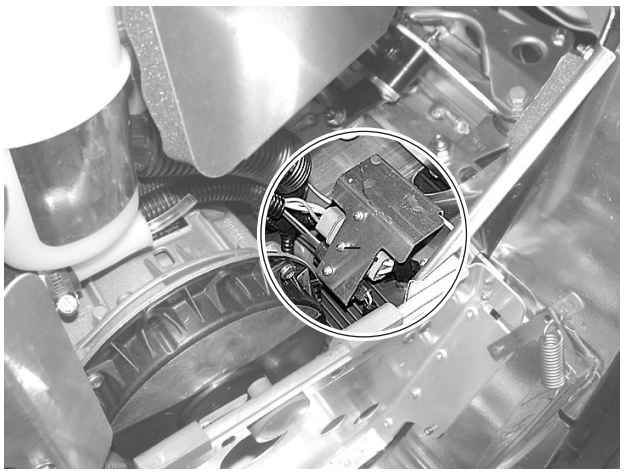


1. Coolant hose between reservoir and engine

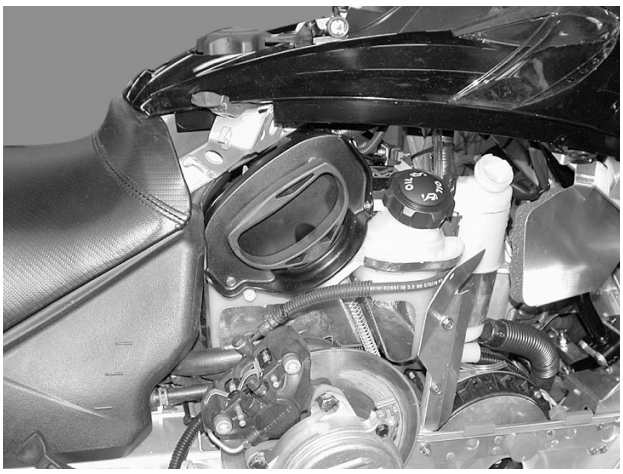
Using pump (P/N 529 035 880), drain maximum coolant from hose and engine.


A33C28A

Unplug magneto and trigger coil connectors.


A33C29A

Remove rewind starter handle.


A33C2AA

Unplug heather carburetor hose from coolant reservoir.

Unscrew oil injection reservoir then separate coolant reservoir.

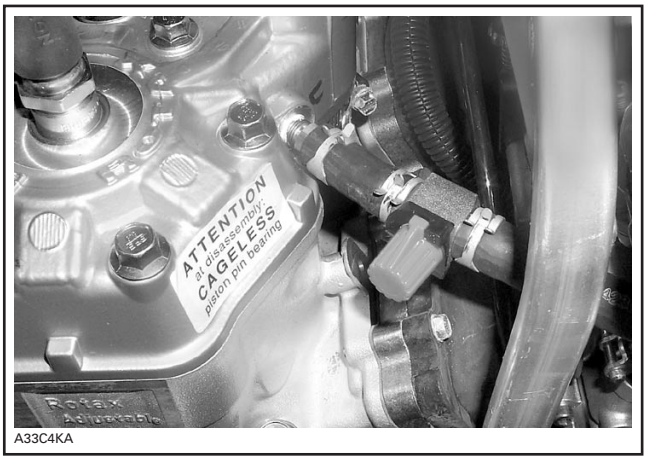
On left side of vehicle, do the following:

Remove:

– LH side panel
– tool box
– belt guard
– belt drive
– drive pulley (refer to DRIVE PULLEY)
– air intake silencer (unplug ATS (Air Temperature Sensor) connector).

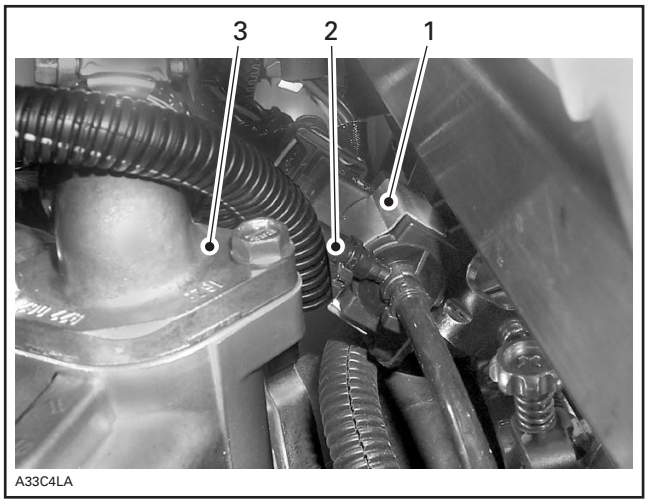
NOTE: On **SDI models**, unplug APS (Air Pressure Sensor) and ATS (Air Temperature Sensor) connectors.

Unplug coolant hose between engine and carburetor or throttle body.



A33C4KA

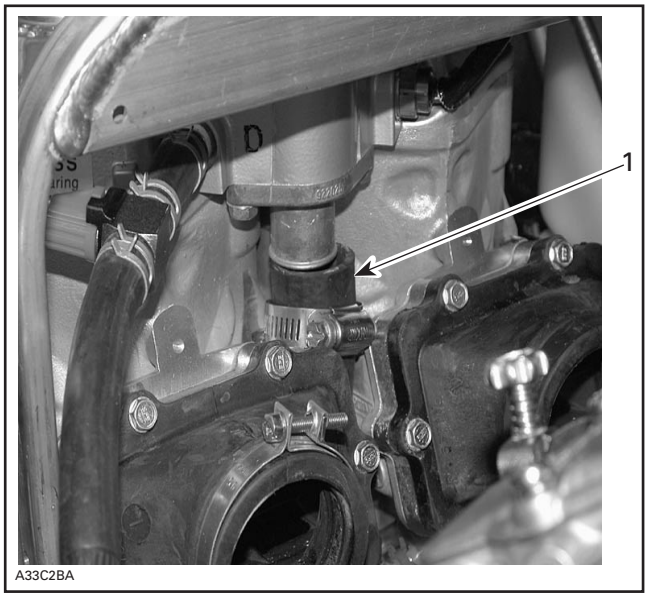
Unplug RAVE valve line from solenoid.



1. *Solenoid*
2. *RAVE valve line*
3. *Thermostat housing*

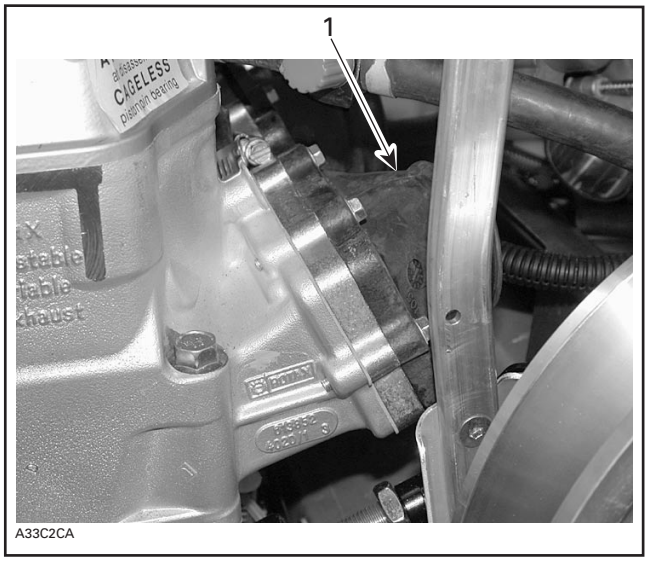
Separate carburetors or throttle body from engine.

Unplug coolant hose located between cylinder head and radiator.



1. *Coolant hose between cylinder head and radiator*

Remove reed valves with their gaskets.



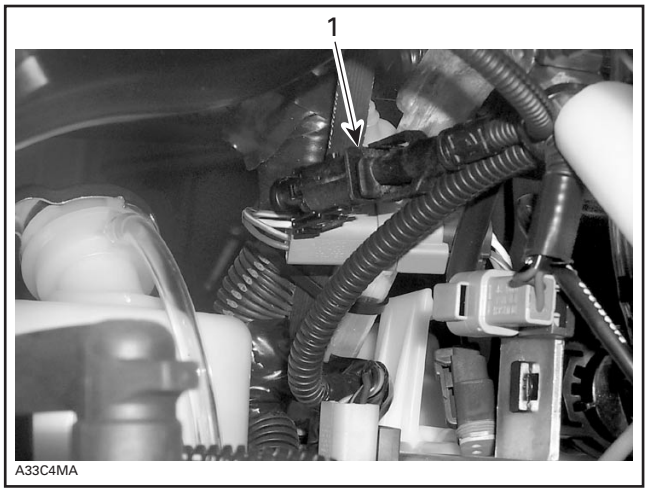
TYPICAL — 793 HO ENGINE TYPE SHOWN
1. *Reed valve*

Unplug magneto connector from MPEM.

Detach oil pump cable from oil pump.

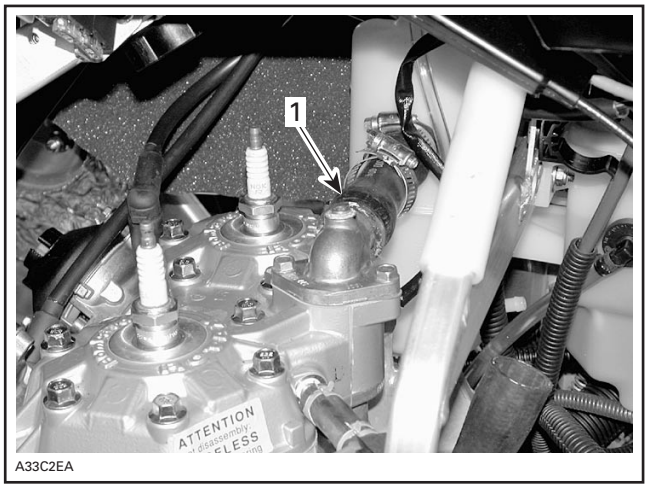
Unplug spark plug cables.

Cut all ties retaining the knock sensor wire and disconnect its connector.



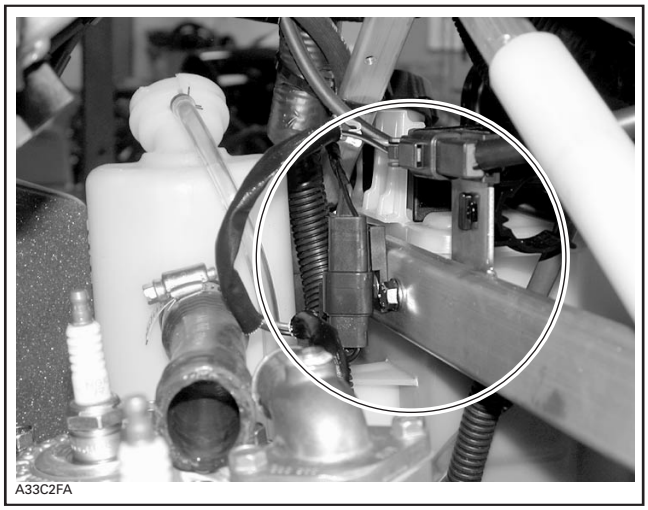
1. Knock sensor connector

Detach upper thermostat hose from thermostat housing.

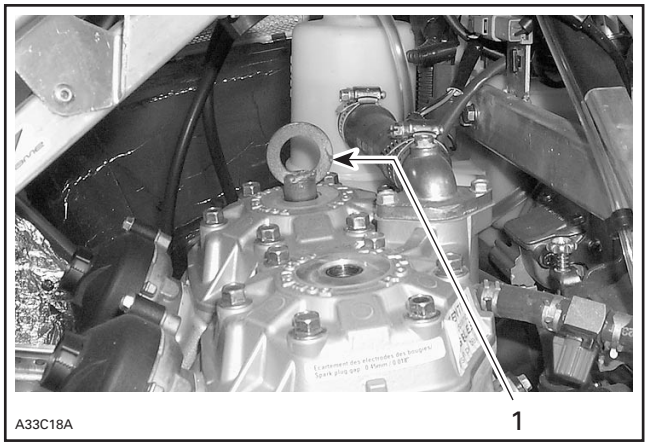


1. Remove this hose

Disconnect temperature sensor connectors.



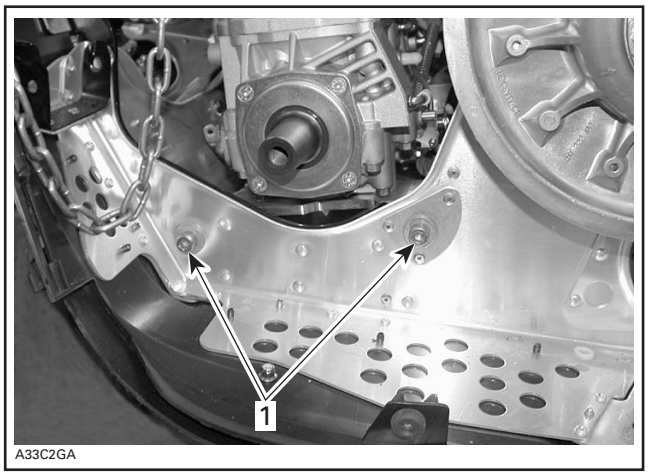
Remove spark plugs and install the spark plug lift ring (P/N 529 035 830) at the farthest spark plug hole.



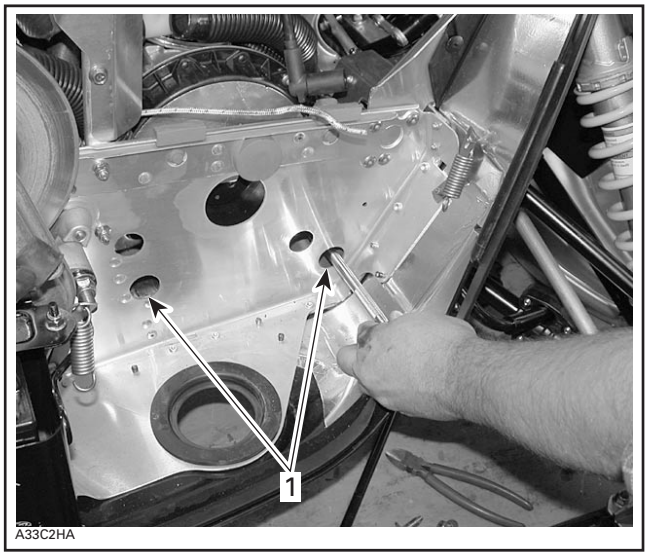
1. Spark plug lift ring

Remove RAVE valves.

Unscrew engine support bolts **no. 1**.



LEFT SIDE OF VEHICLE
1. Engine support bolts



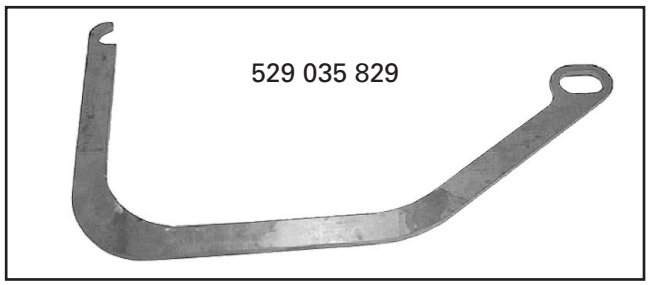
RIGHT SIDE OF VEHICLE
1. Holes to reach engine support bolts

Unscrew the engine stopper **no. 2** completely.

Lift the engine a little then unplug oil pump hoses and the crankcase vent hose.

On **SDI models**, disconnect all engine connectors (CPS, WTS, KS and injectors).

Lift and slide out engine using the engine removal hook (P/N 529 035 829).



Unscrew engine support nuts **no. 3** then separate support **no. 4** from engine.

INSPECTION

Check if engine support **no. 4** is cracked, bent or otherwise damaged. Replace if necessary.

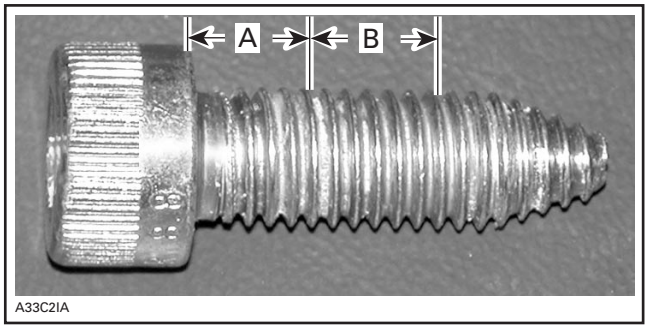
Check rubber mounts **no. 5** on engine support. Replace them if brittle, cracked or otherwise damaged.

INSTALLATION

To install engine in vehicle, reverse the removal procedure. However, pay attention to the following.

Install engine support under engine then torque engine support nuts to 35 N•m (26 lbf•ft).

Before installing engine support bolts **no. 1**, apply Loctite 243 (blue) (P/N 293 800 060) as shown in the following illustration.



A. Do not apply Loctite in this area, ± 10 mm (.39 in)
B. Loctite area, ± 8 mm (.31 in)

Torque engine support bolts to 48 N•m (35 lbf•ft).

Hand torque engine stopper **no. 2** then torque its nut **no. 6** to 50 N•m (37 lbf•ft).

Reinstall all removed parts by using the appropriate component/system reinstallation procedures described in this shop.

MAGNETO SYSTEM

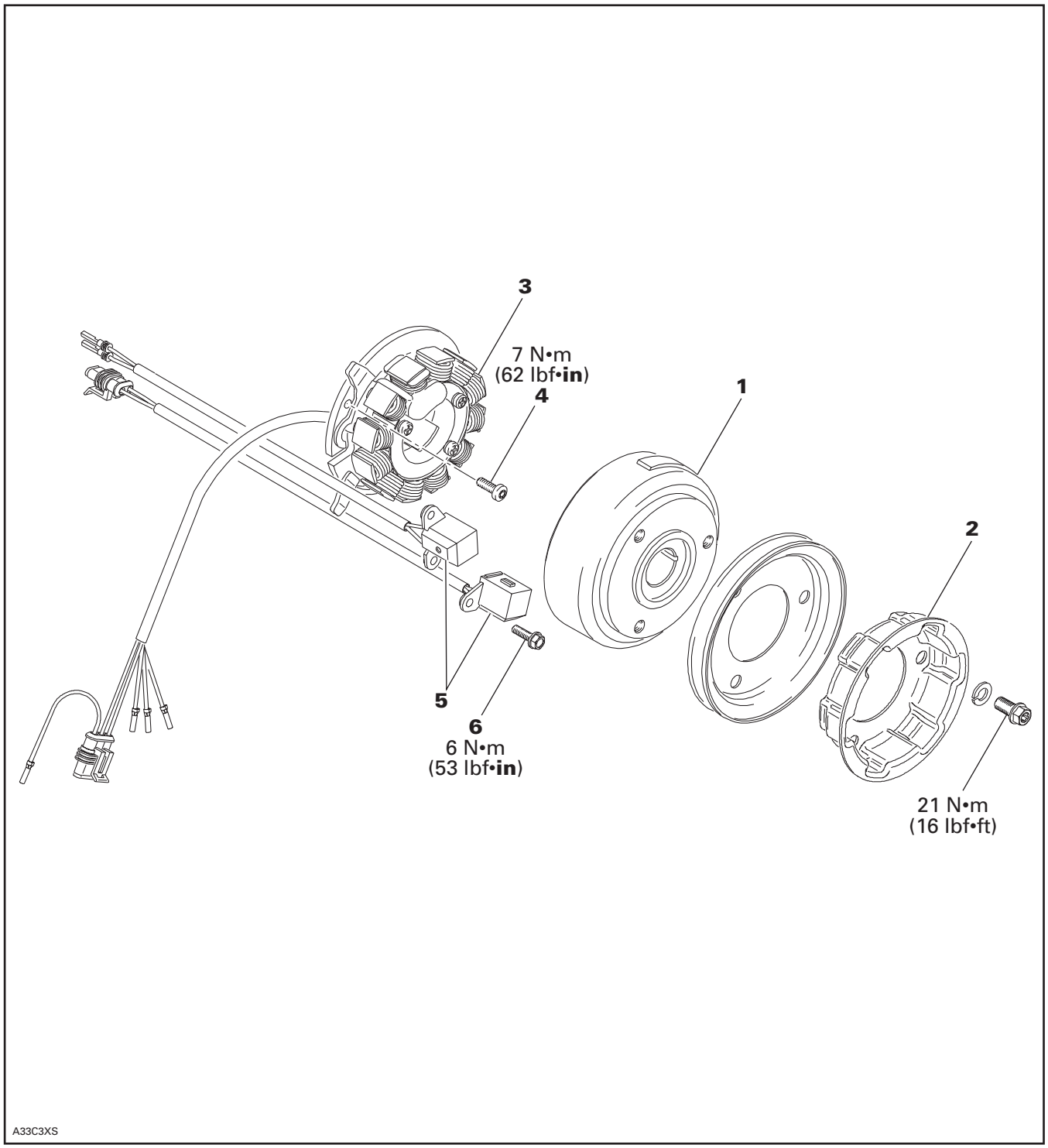
SERVICE TOOLS

Description	Part Number	Page
crankshaft protector	420 876 557	77
magneto puller	529 035 547	77
puller ring	420 876 080	76

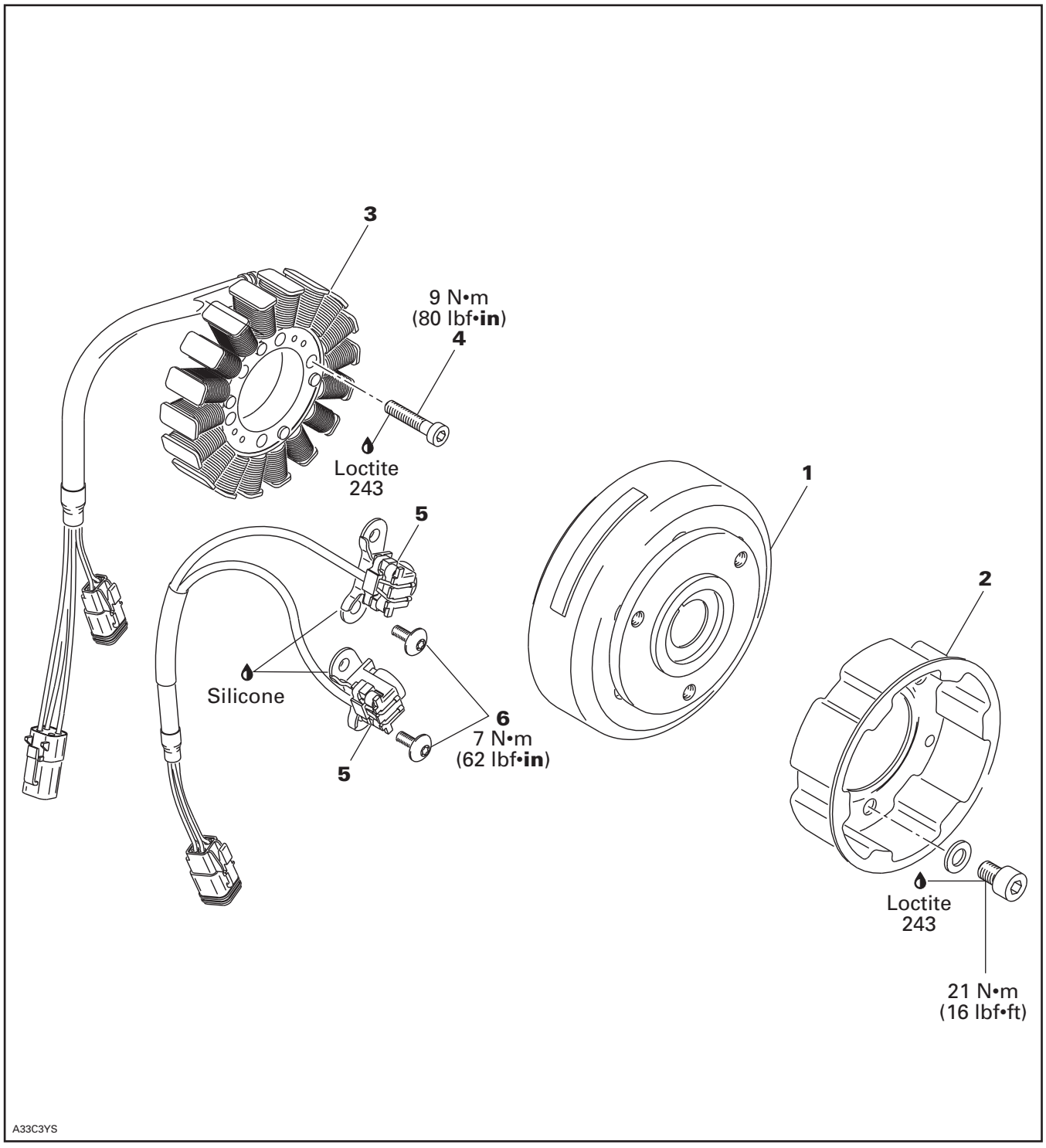
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	77–78
silicone dielectric grease	293 550 004	77

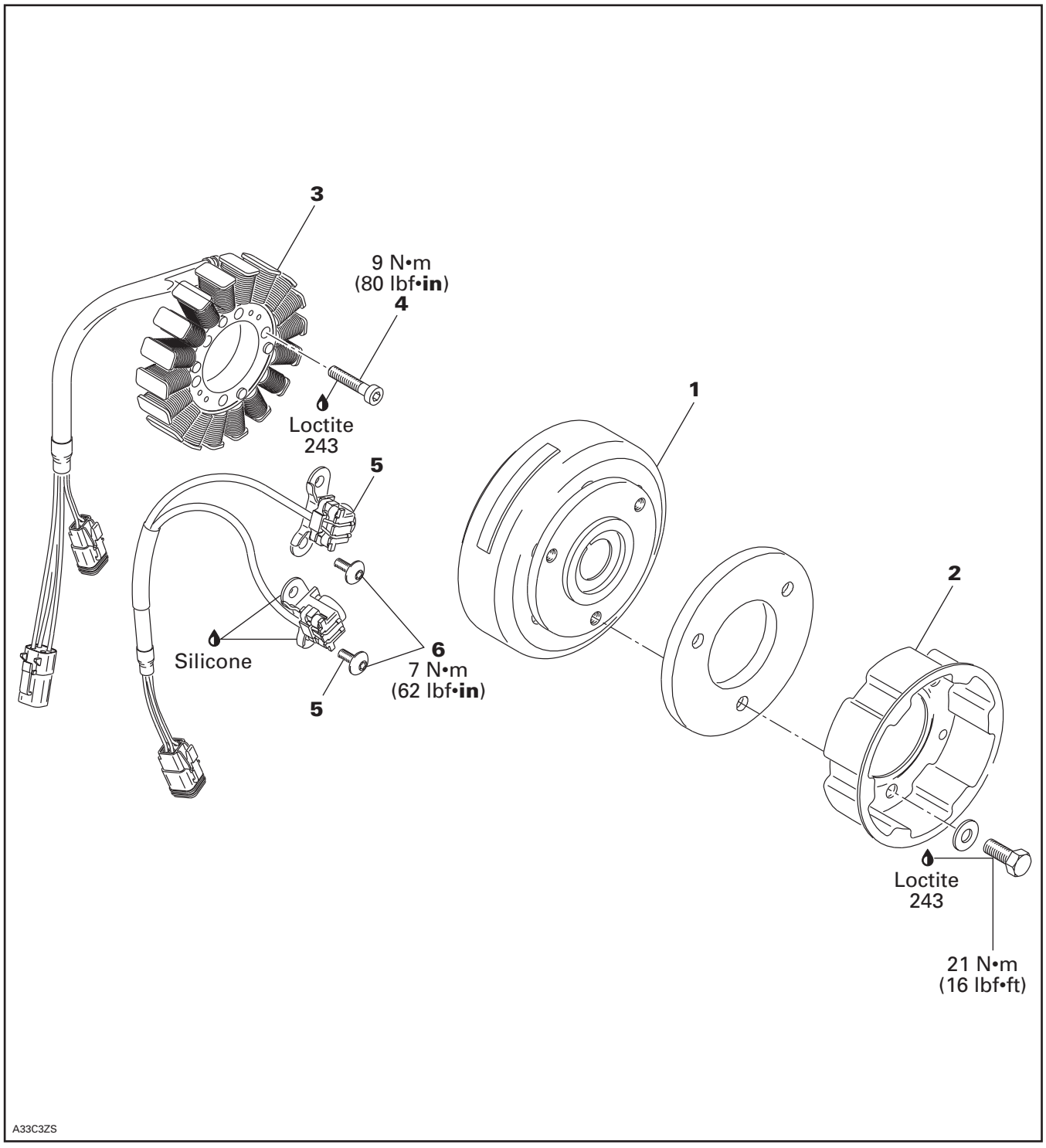
377 and 552 Engines



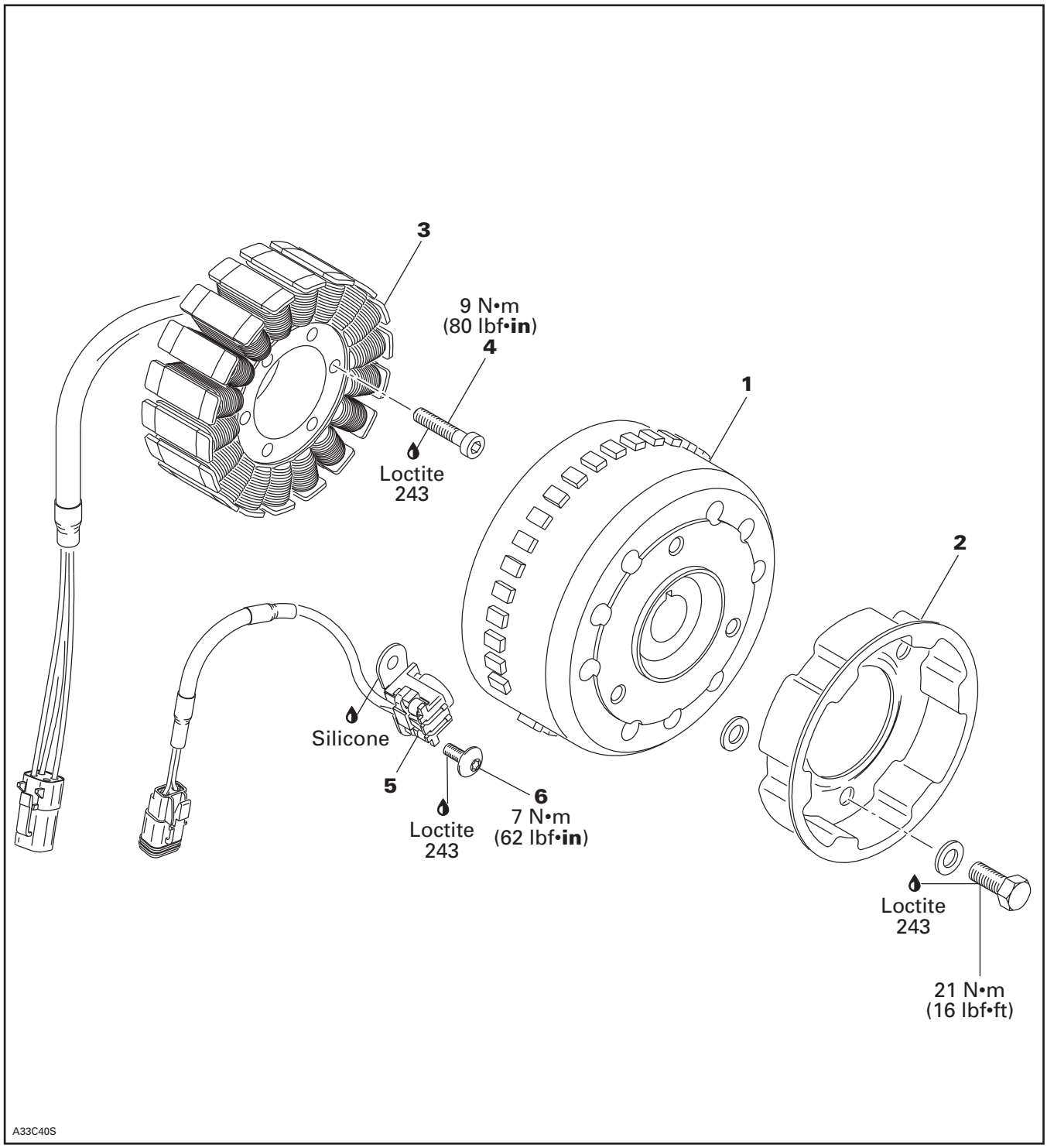
593 Engines


3
9 N•m
(80 lbf•in)
4
Loctite
243
5
Silicone
6
7 N•m
(62 lbf•in)
5
1
2
Loctite
243
21 N•m
(16 lbf•ft)
A33C3YS

593 HO and 793 HO Engines



593 HO SDI Engines



GENERAL

NOTE: The following procedures can be done without removing the engine. To facilitate magneto removal, hold drive pulley with the appropriate tool.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

MAGNETO FLYWHEEL

Cleaning

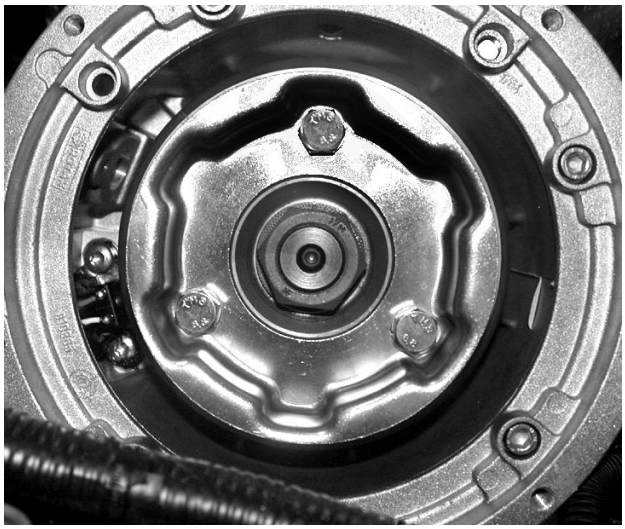
Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

Removal

To gain access to magneto flywheel no. 1 assembly, remove the following parts as needed on different engines:

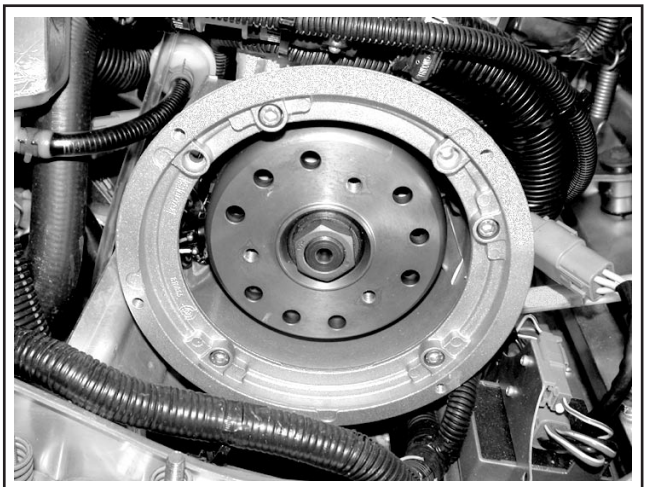
– tuned pipe and muffler
– rewind starter
– starting pulley no. 2.



A32C8KA

TYPICAL

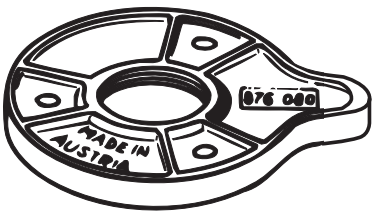
Remove the connecting flange retaining the rewind starter to the engine housing.



A32C8LA

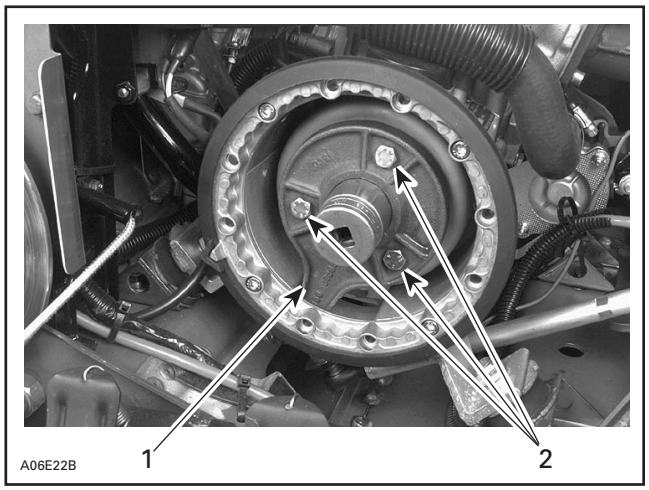
TYPICAL

– Install the puller ring (P/N 420 876 080) in magneto housing opening.



420 876 080

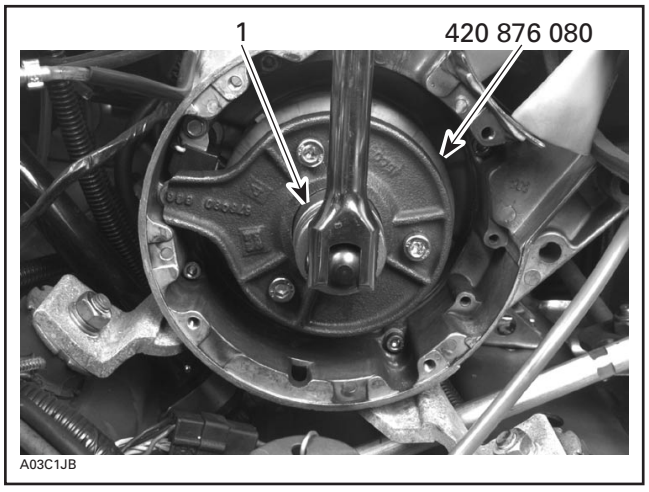
CAUTION: Use only M8 x 20 mm screws to bolt puller to magneto flywheel. When a counterweight is installed on magneto flywheel use M8 x 30 mm screws.



TYPICAL
1. Tab in magneto housing opening
2. M8 screws

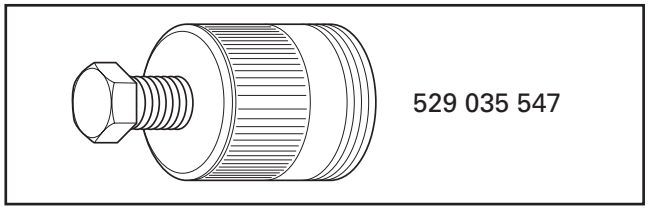
– Remove magneto flywheel nut, using a 30 mm socket machined to 40 mm (1.580 in) outside diameter by 16 mm (5/8 in) long.

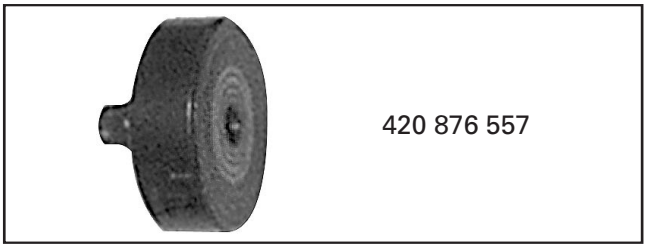
NOTE: To correctly remove a threadlocked fastener, first tap on the fastener to break threadlocker bond. This will avoid thread breakage.



TYPICAL
1. 30 mm socket

To remove magneto flywheel, install the crankshaft protector (P/N 420 876 557) on crankshaft end. Screw the magneto puller (P/N 529 035 547) into puller ring.





Tighten puller bolt and at the same time, tap on bolt head using a hammer to release magneto flywheel from its taper.

Installation

Clean crankshaft extension (taper) and apply Loctite 243 (blue) (P/N 293 800 060) on taper, then position Woodruff key, magneto flywheel **no. 1** and lock washer on crankshaft.

Clean magneto flywheel nut threads and apply Loctite 243 (blue) (P/N 293 800 060) then tighten nut.

ENGINES	TORQUE
377 and 552	105 N•m (77 lbf•ft)
593, 593 HO, 593 HO SDI and 793 HO Power Tek	125 N•m (92 lbf•ft)

At reassembly coat all electric connections except Deutsch housings (waterproof housing) with silicone dielectric grease (P/N 293 550 004) to prevent corrosion or moisture penetration.

CAUTION: Do not use silicone «sealant», this product will corrode contacts. Do not apply silicone dielectric grease on any Deutsch waterproof housing otherwise housing seal will be damaged.

Ignition Timing

Check as described in IGNITION TIMING.

STATOR

Inspection

Always check stator **no. 3** before changing it. Refer to CHARGING SYSTEM.

Cleaning

Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean stator using only a clean cloth.

Removal

Remove:

– magneto flywheel **no. 1**
– all Allen socket screws **no. 4** retaining stator to magneto housing
– grommet from crankcase where CPS/trigger coils **no. 5** and stator wires exit magneto housing.

Unplug the CPS/trigger coil connectors and pull the wires through the grommet location.

NOTE: To pass the stator connector into the grommet location it is necessary to pass the CPS/trigger coil connector first.

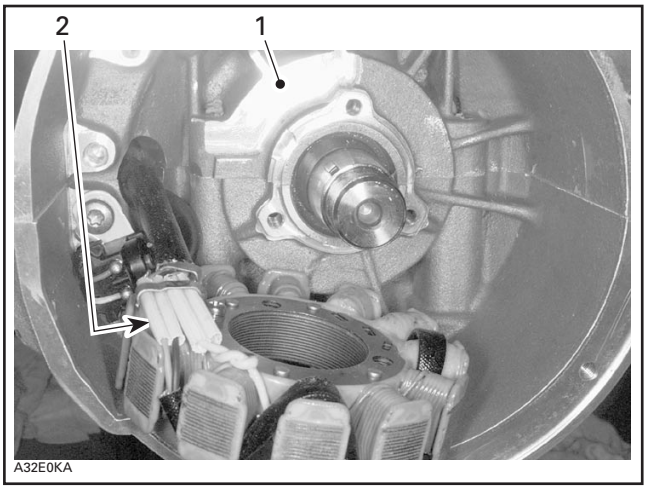
Unplug the stator connector and remove the stator **no. 3**.

Installation

Insert the stator connector into crankcase grommet then the CPS/trigger coil connector(s).

Install the grommet on crankcase

Position stator **no. 3** so that its wire protectors are over crankcase recess.



1. Crankcase recess
2. Wire protectors

NOTE: During installation, make sure the stator harness is located on the left side.

Apply Loctite 243 (blue) (P/N 293 800 060) on threads of stator screws then torque them to 9 N•m (80 lbf•**in**).

Reinstall all other removed parts.

CPS/TRIGGER COIL

Inspection

Always check CPS or trigger coils before changing it. Refer to iGNITION SYSTEM.

Removal

NOTE: Always check CPS or trigger coils **no. 5** before changing them. Refer to OVERVIEW section.

To replace the CPS or the trigger coil(s), remove or disconnect the following:

– magneto flywheel **no. 1**
– air intake silencer to allow an access to the CPS/trigger coil connectors (if necessary)
– trigger coil connector housing(s)
– grommet from crankcase where CPS/trigger coil wire(s) exit(s) magneto housing
– retaining screws **no. 6**
– CPS or trigger coil(s) and carefully pull wires.

Installation

For installation, reverse the removal procedure.

NOTE: It is important to remove the old silicon at CPS/trigger coil location then apply new silicon. Screw CPS/trigger coil then stick the CPS/trigger coil wires in the silicon.

TOP END

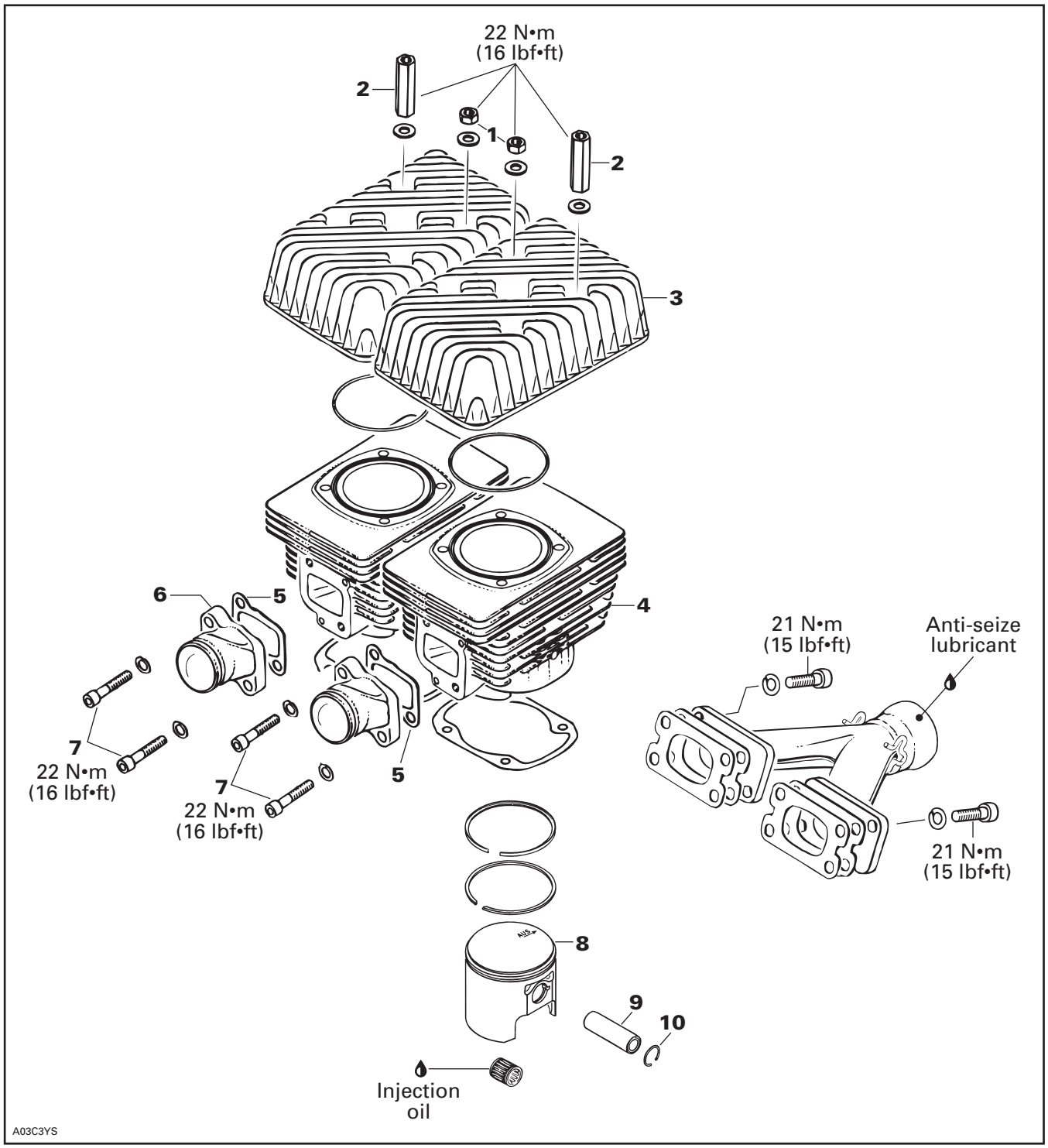
SERVICE TOOLS

Description	Part Number	Page
bearing heater	529 035 969	86, 105
centering tool	529 009 100	87
piston circlip installer	529 035 561	87
piston circlip installer	529 035 686	89, 106
piston pin puller	529 035 503	87
rubber pad	529 023 400	84, 101

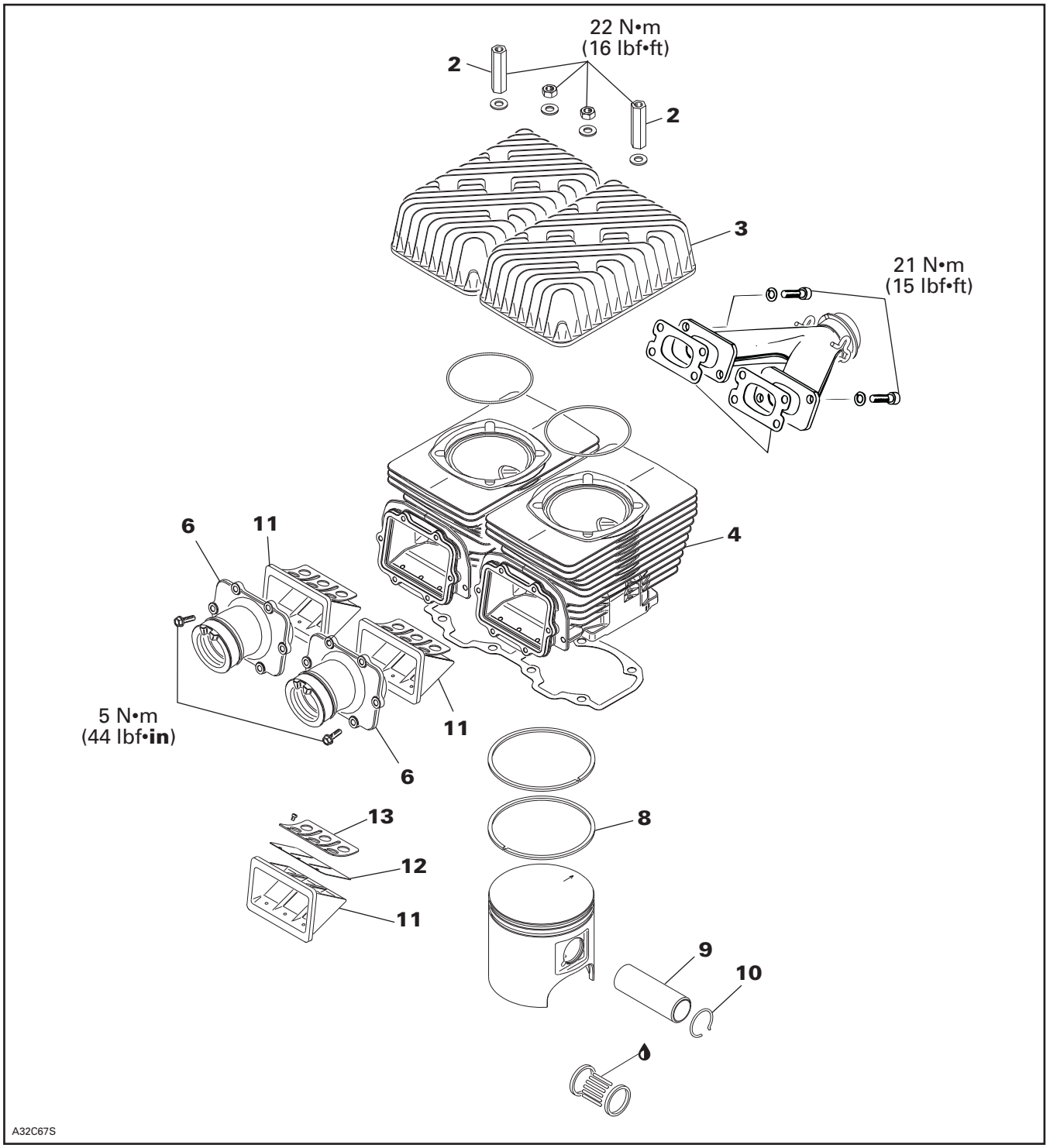
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	107
Loctite 518	293 800 038	90, 107
Loctite Chisel	413 708 500	84, 98
sealing compound Drei Bond	420 297 906	104

377 Engine


22 N•m
(16 lbf•ft)
2
1
2
3
4
5
6
7
22 N•m
(16 lbf•ft)
7
22 N•m
(16 lbf•ft)
5
21 N•m
(15 lbf•ft)
Anti-seize
lubricant
21 N•m
(15 lbf•ft)
8
9
10
Injection
oil
A03C3YS

552 Engine


22 N•m
(16 lbf•ft)
2
2
3
21 N•m
(15 lbf•ft)
4
6
11
5 N•m
(44 lbf•in)
11
6
13
12
11
8
9
10
A32C67S

TROUBLESHOOTING

Before completely disassemble engine, proceed with an engine leak test. Refer to LEAK TEST.

Component Removal with the Engine Installed

Most engine components can be removed with engine on vehicle such as:

– engine fan cowls
– cylinder head
– cylinder(s)
– piston(s)
– reed valve(s).

CLEANING

Discard all gaskets. Use Loctite Chisel (P/N 413 708 500) to clean mating surfaces.

Clean all metal components in a non-ferrous metal cleaner.

Scrape off carbon formation from cylinder exhaust port, cylinder head and piston dome.

NOTE: The letters "AUS" and arrow on the piston dome must be visible after cleaning.

Clean the piston ring grooves with a groove cleaner tool, or with a piece of broken ring.

DISASSEMBLY

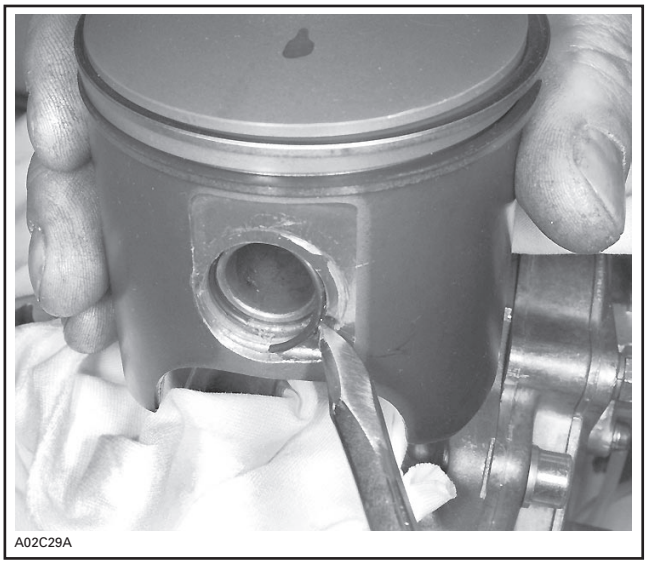
Remove top fan cowl, intake sockets and lower fan cowl.

Remove cylinder heads.

Remove cylinders.

NOTE: If engine is being taken apart in vehicle, cylinder studs must be removed first.

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase to prevent circlips no. 10 from falling into crankcase. Then with a pointed tool inserted in piston notch, remove both circlips from piston no. 8.



TYPICAL

To remove piston no. 8, use the following tools:

NOTE: The PTO cylinder or fan housing have to be removed to give access to MAG piston with puller.

377 Engine

ENGINE	PULLER P/N
377	529 035 503

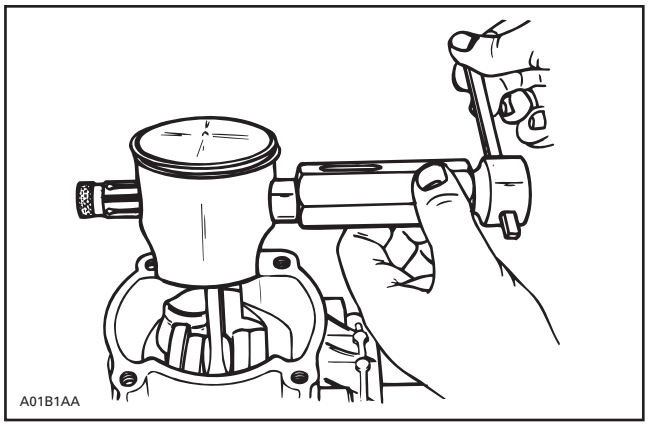
Extract piston pin no. 9, with puller.

Fully screw puller handle.

Insert puller end into piston pin.

Screw (LH threads) extracting nut.

Hold puller firmly and rotate puller handle counterclockwise to pull piston pin.



TYPICAL

552 Engine

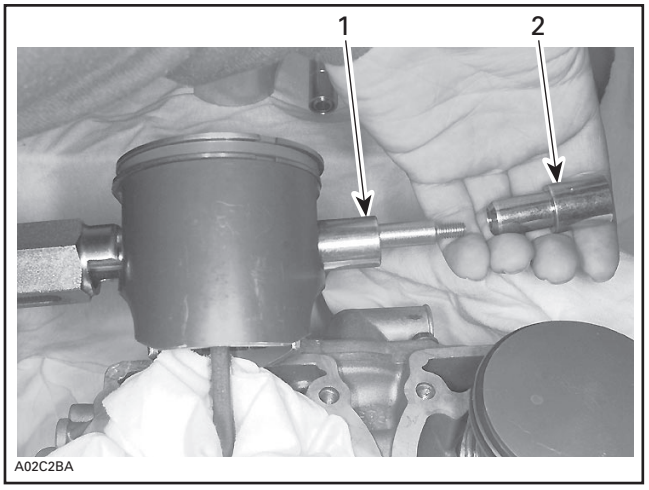
ENGINE	PULLER P/N	SLEEVE KIT P/N	LOCATING SLEEVE P/N
552	529 035 503	529 035 542 (20 mm)	529 023 800

NOTE: On this engine, piston pin needle bearing is mounted without a cage. The locating sleeve is the same that contains new cageless bearing.

Insert piston pin puller making sure it sits squarely against piston.

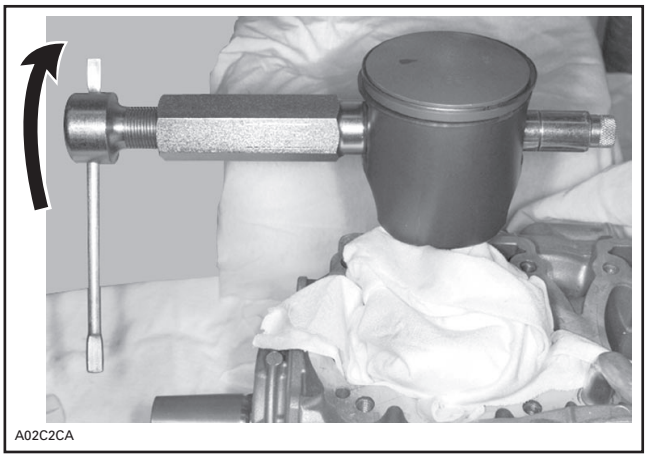
TYPICAL
1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.

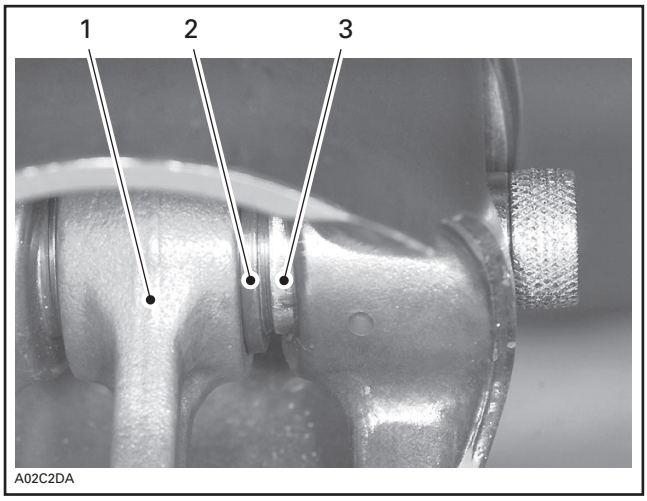


TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Extract piston pin no. 10 by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

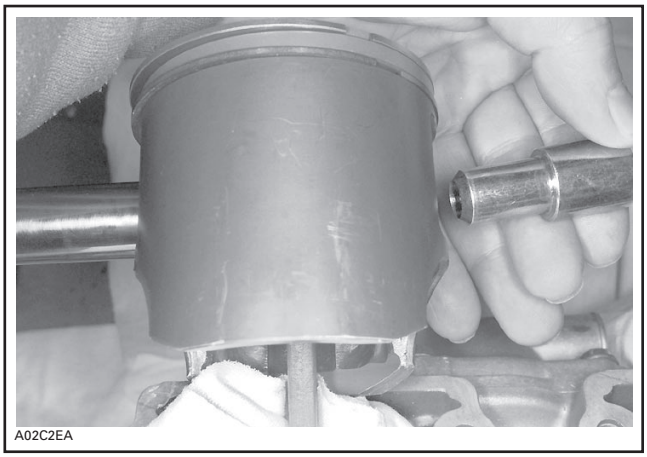


TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

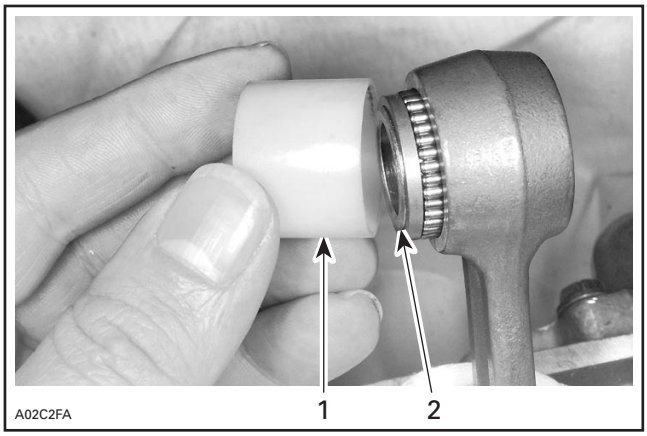
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

NOTE: 0.25 and 0.5 mm oversized pistons are available if necessary.

Use a locking tie to fasten all needles and thrust washers along with locating sleeve.

INSPECTION

NOTE: Refer to table below to find top end engine dimension specifications. For dimension measurement procedures, refer to ENGINE MEASUREMENT.

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Cylinder head volume **377 engine**	19.55 cc	21.15 cc	N.A.
Cylinder head volume **552 engine**	34.34 cc	36.74 cc	N.A.
Cylinder head warpage	N.A.	N.A.	0.5 mm (.02 in)
Cylinder taper	N.A.	0.05 mm (.002 in)	0.1 mm (.004 in)
Cylinder out of round	N.A.	0.010 mm (.0004 in)	0.08 mm (.003 in)
Piston/cylinder wall clearance **377 engine**	0.054 mm (.002 in)	0.086 mm (.003 in)	0.20 mm (.008 in)
Piston/cylinder wall clearance **552 engine**	0.12 mm (.005 in)	0.17 mm (.007 in)	0.20 mm (.008 in)
Ring/piston groove clearance **377 engine**	0.040 mm (.0016 in)	0.110 mm (.0043 in)	0.20 mm (.008 in)
Ring/piston groove clearance **552 engine**	0.037 mm (.0015 in)	0.077 mm (.003 in)	0.20 mm (.008 in)
Ring end gap **377 engine**	0.20 mm (.008 in)	0.35 mm (.014 in)	1.0 mm (.039 in)
Ring end gap **552 engine**	0.40 mm (.016 in)	0.55 mm (.022 in)	1.0 mm (.039 in)

ASSEMBLY

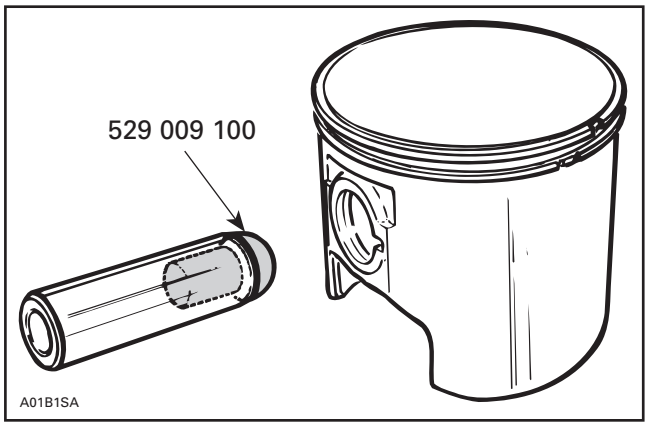
To ease piston installation, heat piston using bearing heater (P/N 529 035 969).

A32CBHA

CAUTION: Piston temperature must not exceed 46°C (115°F). NEVER USE DIRECT FLAME to heat the piston and never freeze the pin. Inappropriate heating procedure(s) may damage the piston.

377 Engine

To center the piston pin with the connecting rod bearing, use centering tool (P/N 529 009 100).



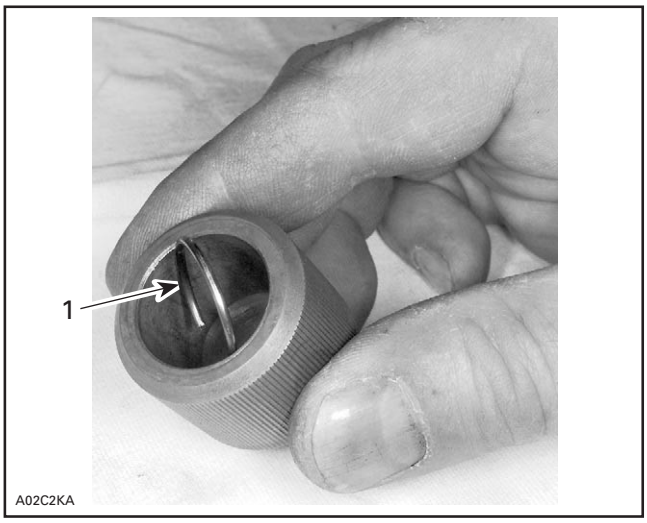
A01B1SA

NOTE: The circlip on the opposite side can be installed before pin installation, the tool will easily go out.

Use piston pin puller (P/N 529 035 503) to install a piston pin that cannot be installed as described above.

To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use piston circlip installer (P/N 529 035 561).

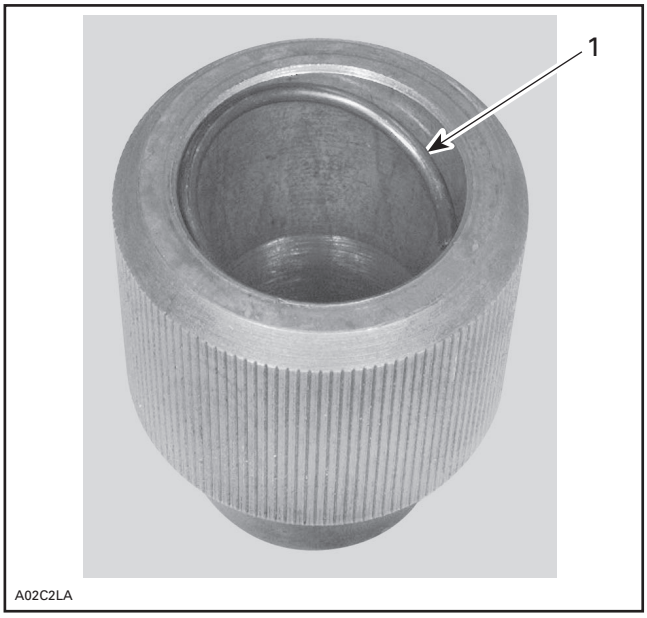
Insert circlip in tool at an angle.



A02C2KA

1. Circlip

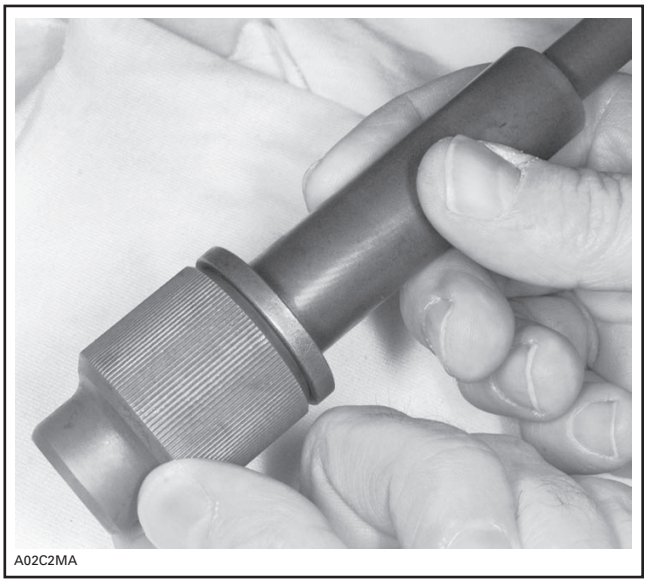
Square it up using a finger.



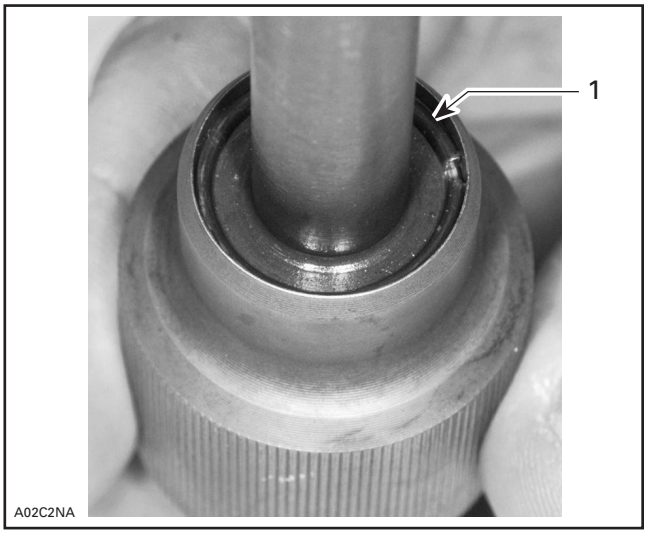
A02C2LA

1. Circlip

Continue to square it up using round end of circlip installer.

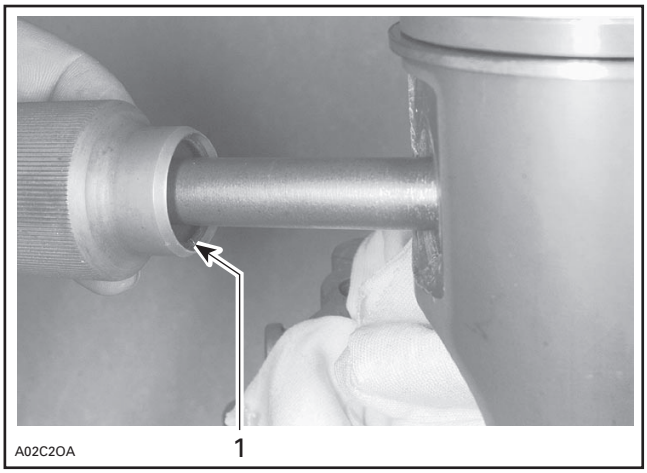

A02C2MA

Using square end of tool, push circlip in until it rests in groove.



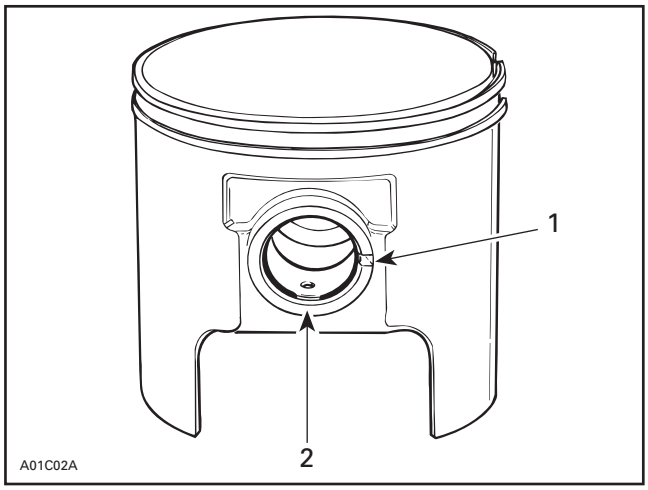
1. Circlip in groove

Mount tool in piston making sure that circlip break is facing down.



TYPICAL
1. Circlip break facing down

Hold tool firmly against piston then strike on round end of tool with a plastic hammer. Circlip will move from tool groove to piston groove.



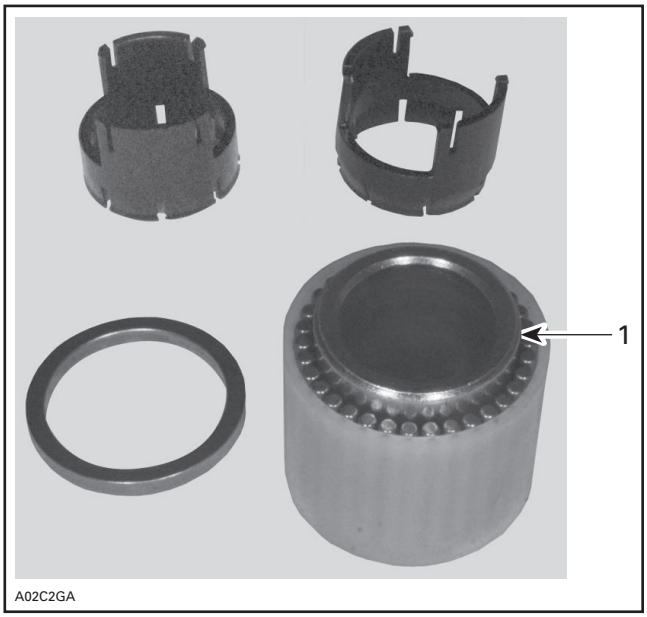
1. Piston notch
2. Circlip break at 6 o'clock

CAUTION: Circlips must not move freely in the groove after installation. If so, replace them.

552 Engine

When reinstalling original needle bearings, make sure that 34 needles are inserted between sleeve and locating sleeve.

When installing a new cageless bearing, replace half plastic cages by sleeve.



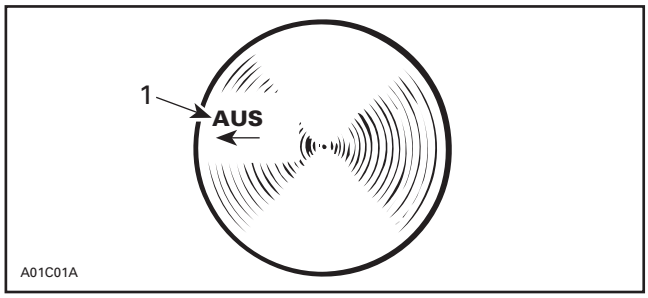
TYPICAL
1. Sleeve

Grease thrust washers and install them on each end of needles.

Insert cageless bearing into connecting rod.

TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Mount piston over connecting rod with the letters "AUS" (over an arrow on the piston dome) facing in the direction of exhaust port.

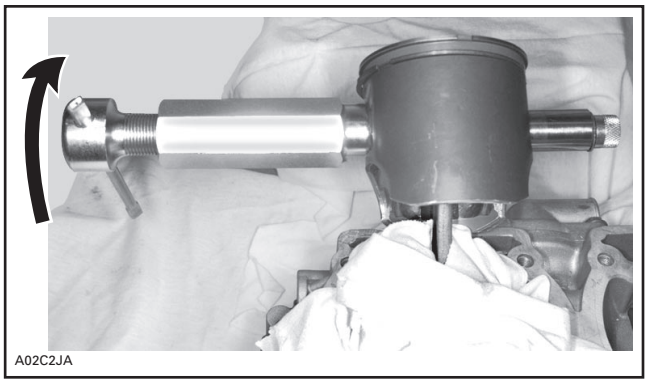


1. Exhaust

Install shouldered sleeve.

TYPICAL — SHOULDERED SLEEVE INSTALLATION

Install piston pin puller and turn handle until piston pin is correctly positioned in piston.



TYPICAL

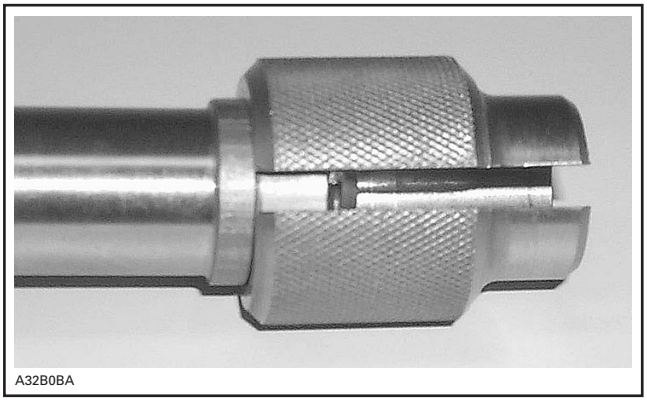
– Remove piston pin puller and sleeve kit.

Use piston circlip installer (P/N 529 035 686) to install new mono-hook circlips **no. 10**.

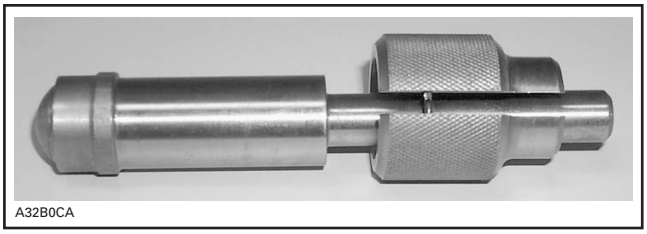
Insert circlip into support in such a way that when installed in piston groove, the tab will face upward.

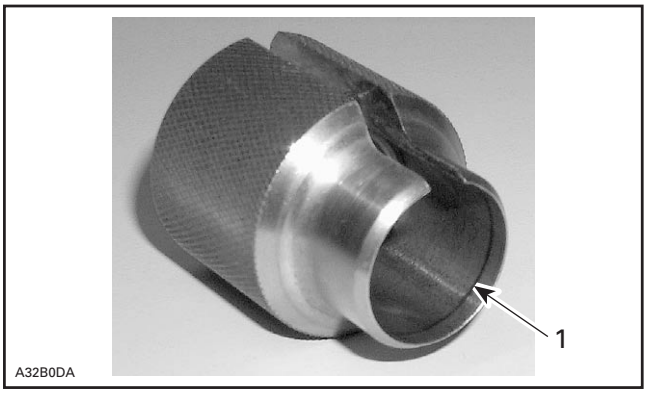
A32B0AA

With round end of pusher, position circlip perpendicular to the support axis.


A32B0BA

With the other end of the pusher, push circlip into the support groove.


A32B0CA



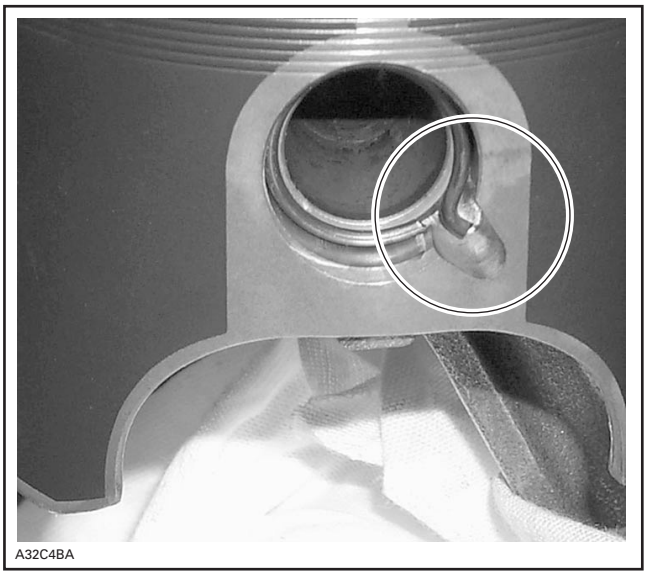
A32B0DA

1. Groove

A32B0EA

CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to insert circlip in place. Take care to install new circlips with tab toward top as per following photo.


A32C4BA

TAB TOWARD TOP

CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one as on a second attempt circlip will lose its normal retaining capabilities.

CAUTION: Circlips must not move freely after installation; if so, replace them.

377 and 552 Engines

Apply a thin layer of Loctite 518 (P/N 293 800 038) to crankcase mating surface of base gasket. Choose the right gasket thickness according to combustion chamber volume. Install it on crankcase. Apply a thin layer of Loctite 518 to gasket surface area.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.

NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.

Before inserting piston in cylinder **no. 4**, lubricate the cylinder with new injection oil or equivalent.

Install proper ring compressor on piston assembly.

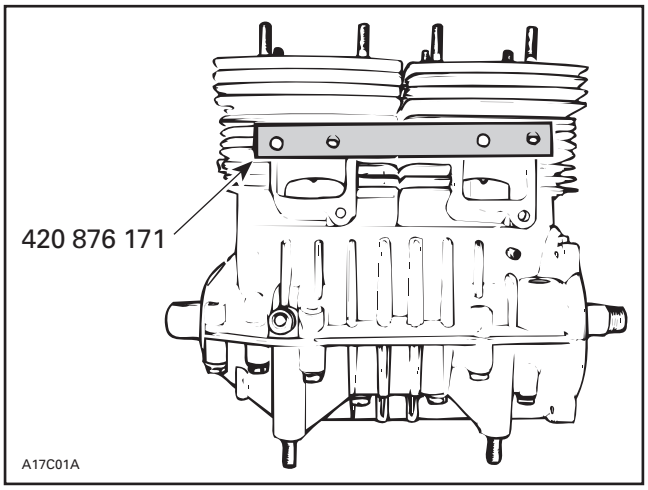
ENGINE	RING COMPRESSOR P/N
377	420 876 090
552	420 876 972

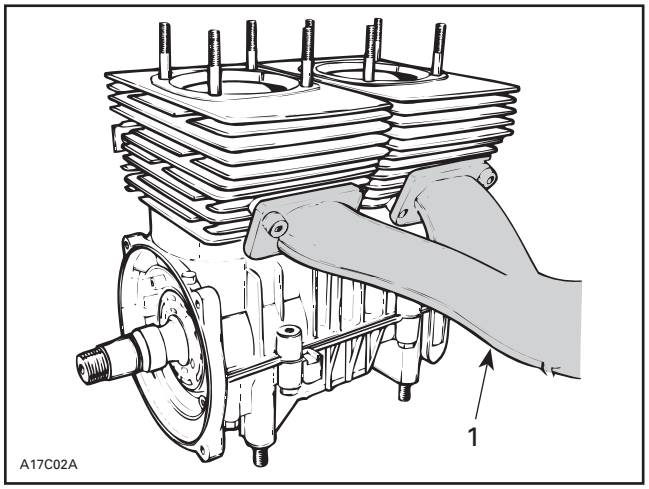
NOTE: The ring compressor will not fit on over size pistons.

Check flatness of intake sockets **no. 6**.

At cylinder **no. 4** and/or cylinder head **no. 3** installation, use aligning tool or exhaust manifold itself to ensure sealing of intake manifold and exhaust before tightening cylinder head nuts.

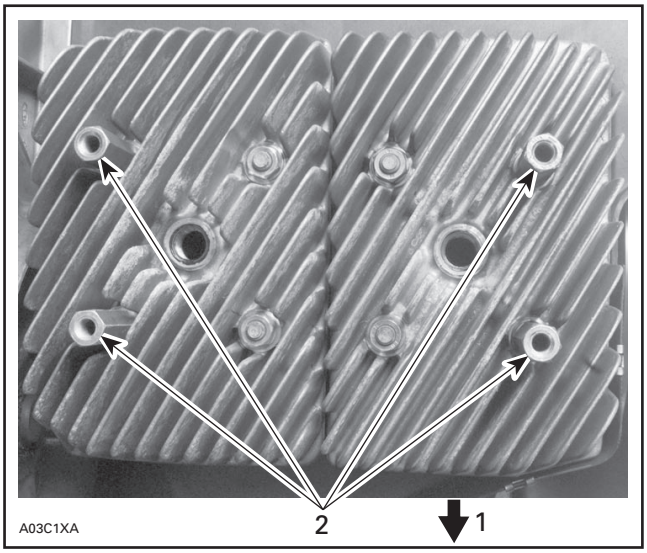
ENGINE	ALIGNING TOOL P/N
377 and 552	420 876 171





1. Or use exhaust manifold to align cylinders

Position distance nuts **no. 2** as shown below.



1. Exhaust
2. Distance nuts

Cross torque cylinder head nuts **no. 1** and **no. 2** to 22 N•m (16 lbf•ft); torque each cylinder head individually.

Torque intake socket bolts to 22 N•m (16 lbf•ft).

Install engine fan cowls.

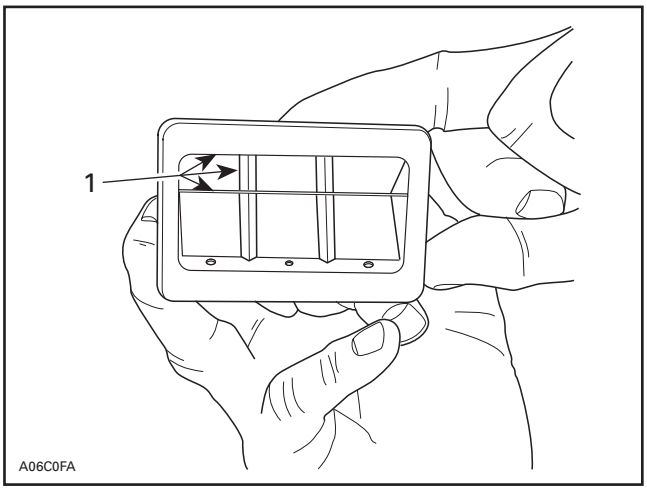
552 Engine

12, Reed Valve

Blades **no. 12**have a curved shape. Install with their curve facing reed block.

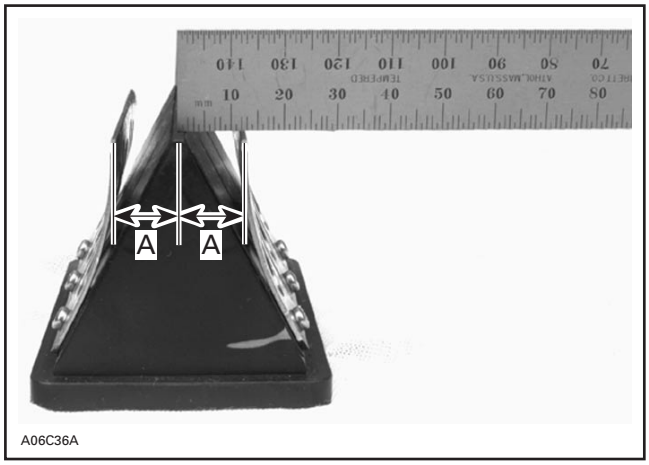
With blade stopper **no. 13** removed, check reed valve for proper tightness. There must be no play between blade and valve body when exerting a finger pressure on blade at blade stopper location.

In case of a play, turn blade upside down and recheck. If there is still a play, replace blade and/or valve body.



1. No play

Check distance from blade stopper inner edge and distance from center of reed valve block.

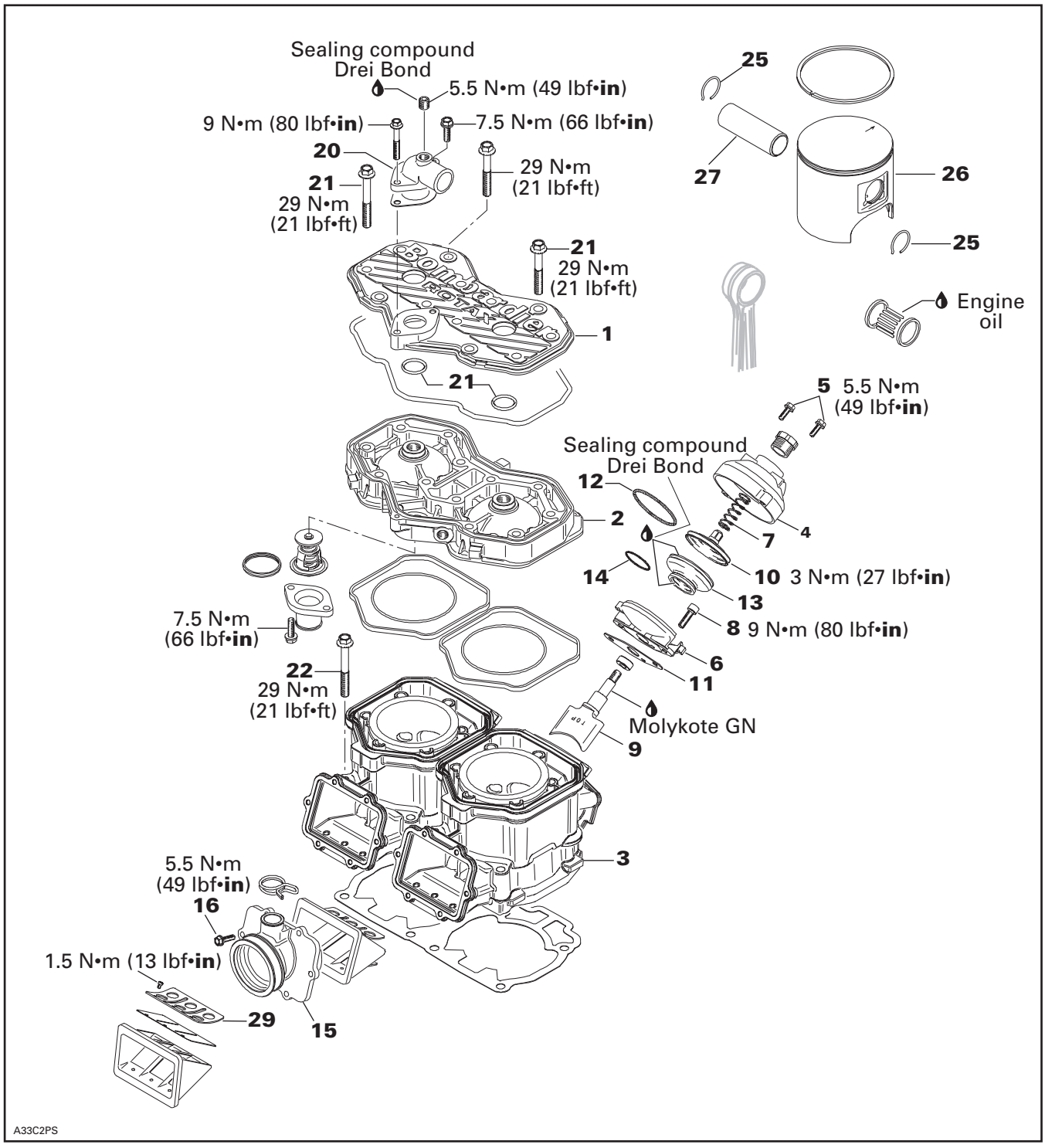


TYPICAL
A. 14.75 - 0, + 0.75 mm (.580 - 0, + .030 in)

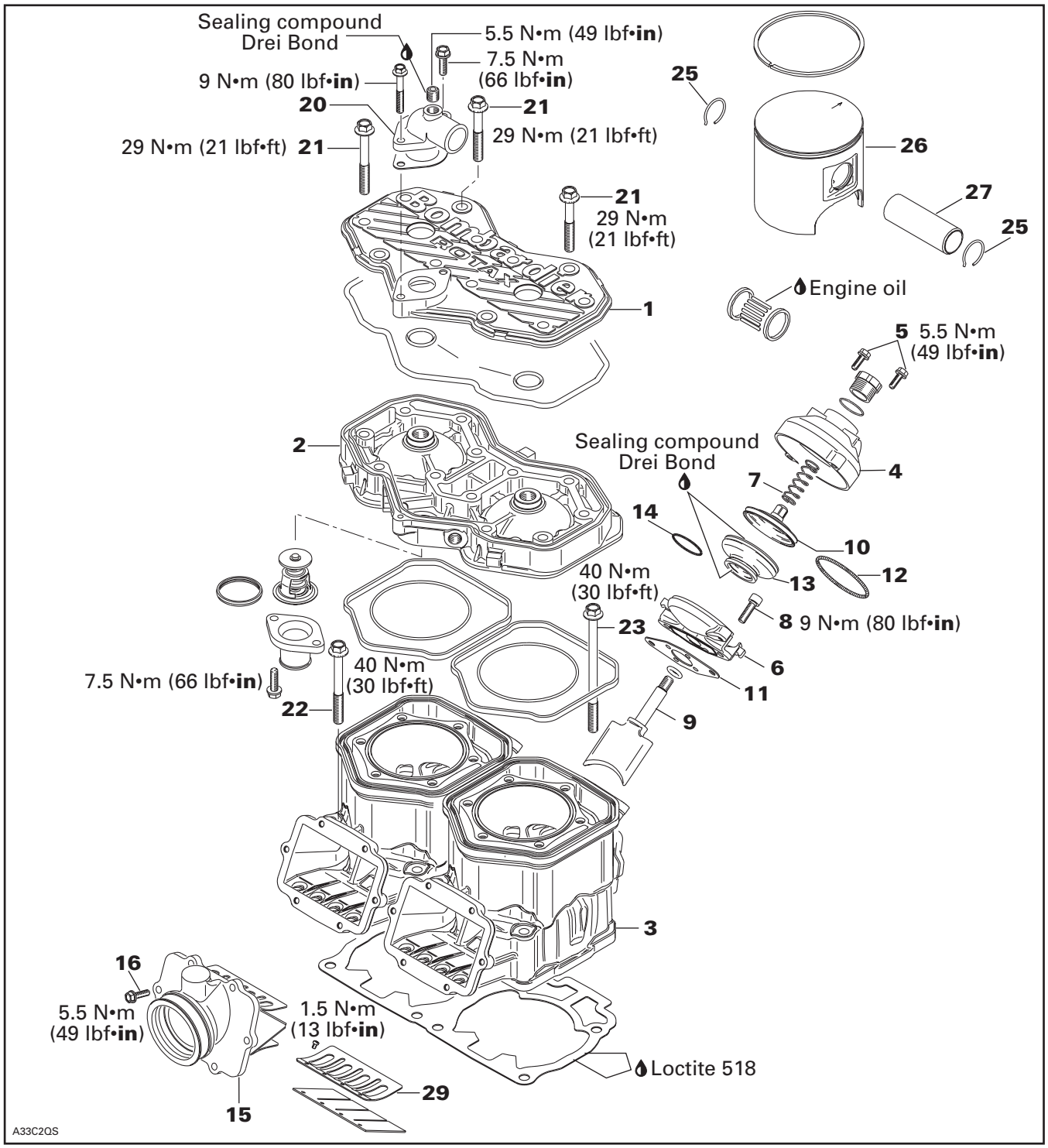
Bent blade stopper as required to obtain the proper distance.

Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

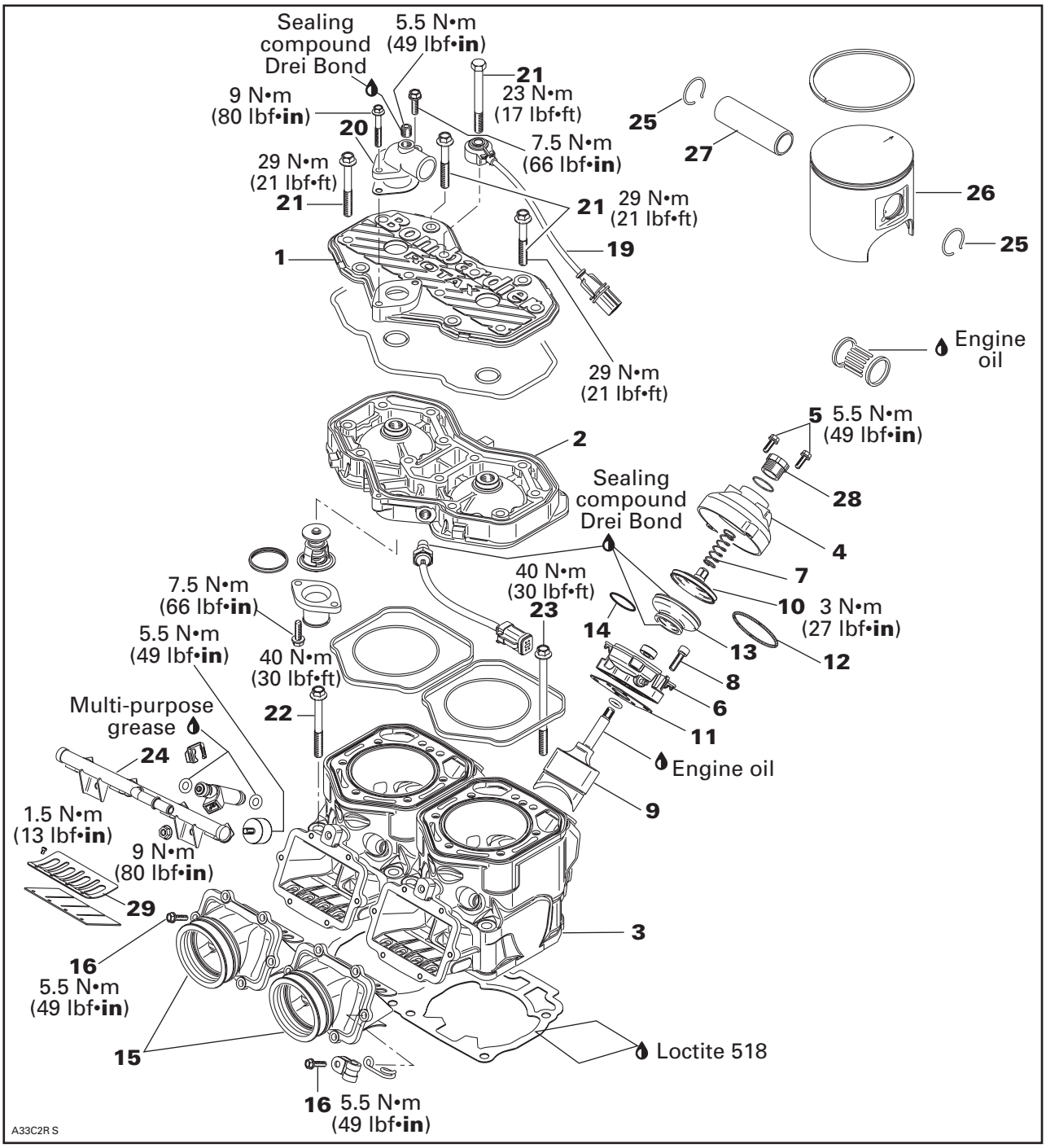
593 Engine


Sealing compound
Drei Bond
5.5 N•m (49 lbf•in)
9 N•m (80 lbf•in)
7.5 N•m (66 lbf•in)
20
21
29 N•m
(21 lbf•ft)
29 N•m
(21 lbf•ft)
21
29 N•m
(21 lbf•ft)
1
21
25
27
26
25
Engine
oil
5 5.5 N•m
(49 lbf•in)
Sealing compound
Drei Bond
12
2
7
4
14
10 3 N•m (27 lbf•in)
13
8 9 N•m (80 lbf•in)
6
11
7.5 N•m
(66 lbf•in)
22
29 N•m
(21 lbf•ft)
Molykote GN
9
3
5.5 N•m
(49 lbf•in)
16
1.5 N•m (13 lbf•in)
29
15
A33C2PS

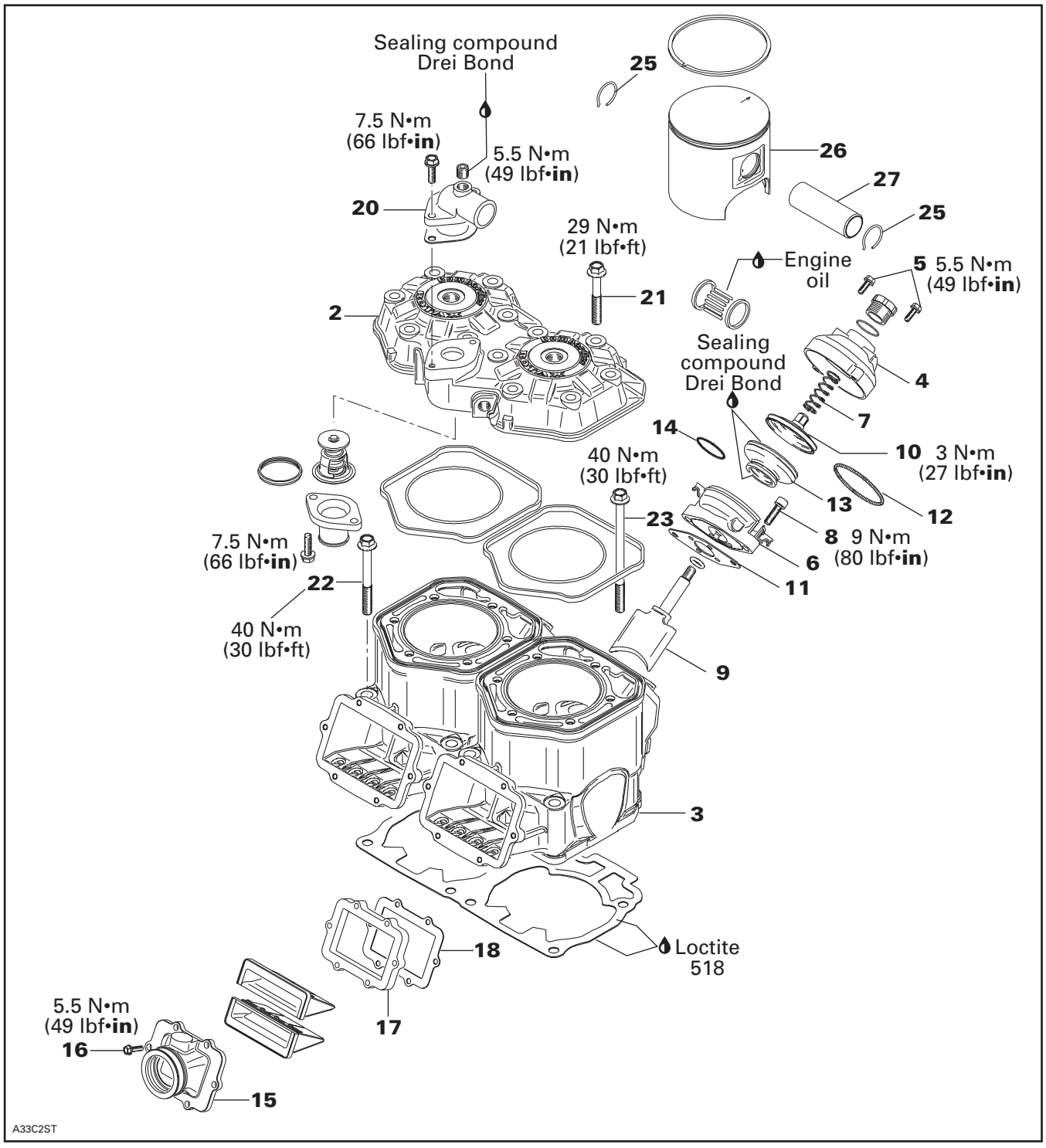
593 HO Engine



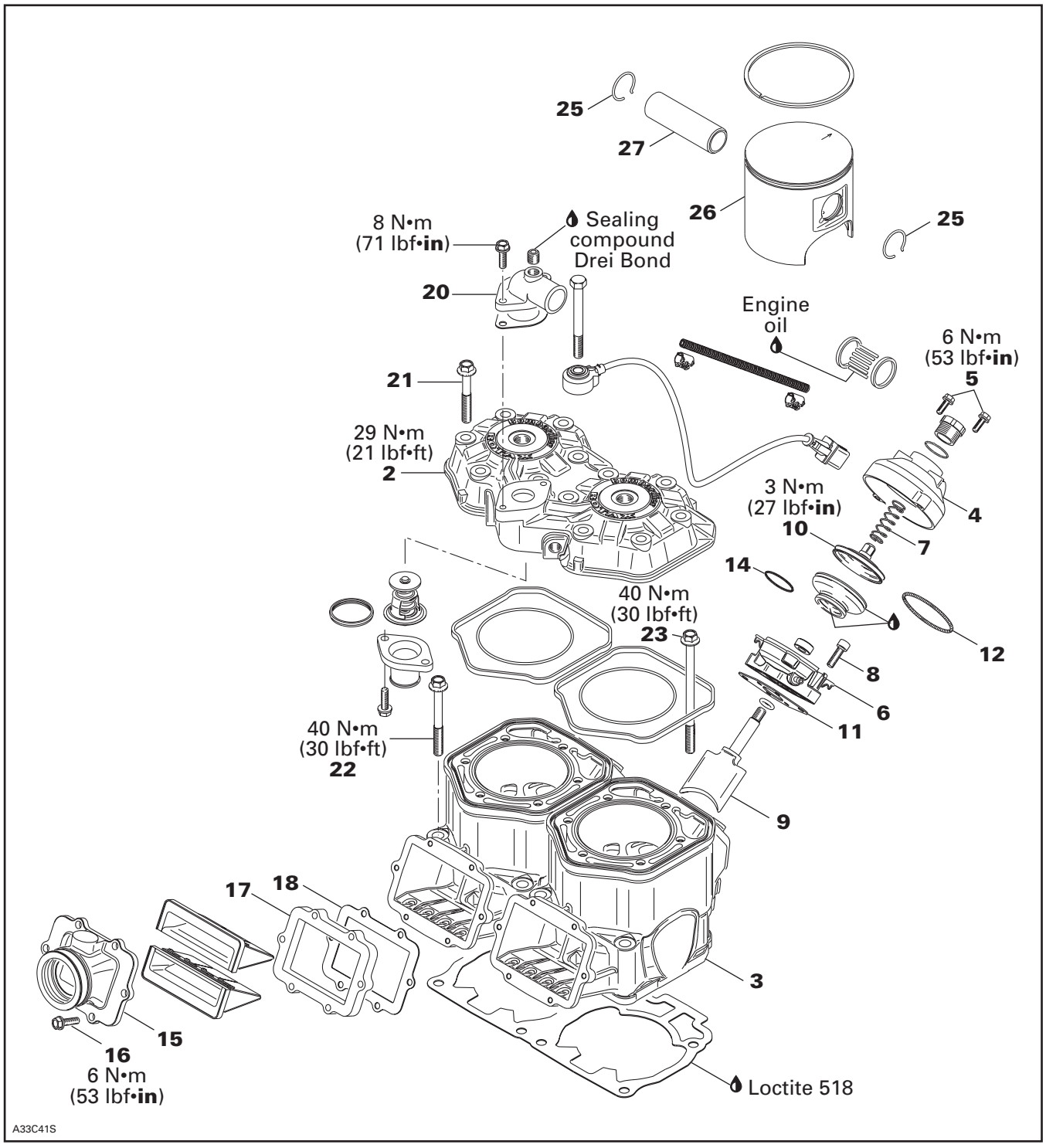
593 HO SDI Engine



793 HO Engine



793 HO Engine (Power Tek)



TROUBLESHOOTING

Before completely disassembling the engine, proceed with an engine leak test. Refer to LEAK TEST.

COMPONENT REMOVAL WITH THE ENGINE INSTALLED

Most engine components can be removed with engine on vehicle such as:

– cylinder head
– cylinder(s)
– piston(s)
– RAVE valve(s)
– reed valve(s).

CLEANING

Discard all gaskets and O-rings. Use Loctite Chisel (P/N 413 708 500) to clean mating surfaces.

Clean all metal components in a non-ferrous metal cleaner.

Scrape off carbon formation from cylinder exhaust port cylinder head and piston dome.

NOTE: The letters "AUS" (over an arrow on the piston dome) must be visible after cleaning.

Clean the piston ring groove with a groove cleaner tool or with a piece of broken ring.

RAVE VALVE BASIC OPERATION

NOTE: RAVE stands for Rotax Adjustable Variable Exhaust.

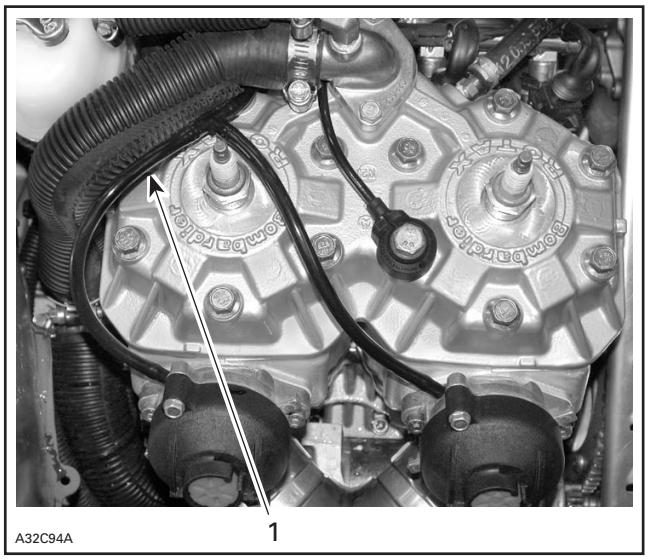
The RAVE valves change the height of the exhaust port to enhance the engine powerband and torque according to the engine RPM and throttle position (e-RAVE on Power Tek and SDI engines).

All Engines except Power Tek and SDI

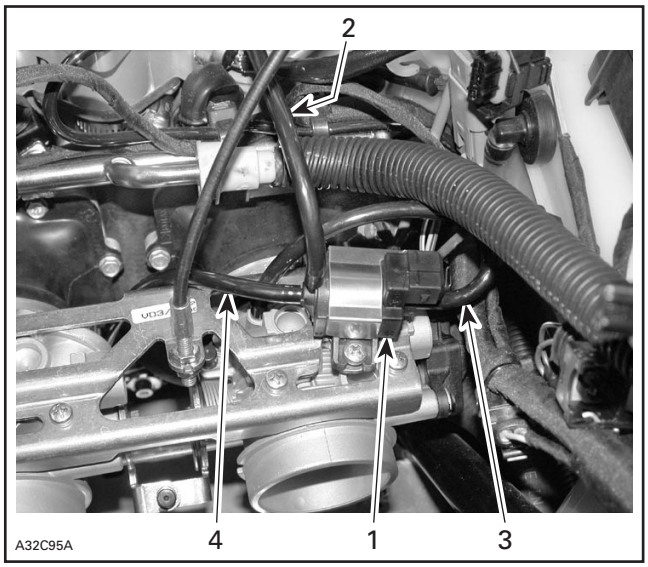
Exhaust pressure is used to inflate the bellows and open the RAVE valves at the proper engine RPM.

Power Tek and SDI Engines with E-RAVE

According to engine RPM and throttle position, the ECM activates a solenoid which allows crankcase positive pressure to inflate the bellows and open the RAVE valves.



TYPICAL — SDI ENGINE SHOWN
1. Pressure from solenoid



TYPICAL — SDI ENGINE SHOWN
1. Solenoid
2. Pressure to RAVE valves
3. Vent to throttle body
4. Pressure with check valve from crankcase

To close the RAVE valves, the ECM deactivates the solenoid. The RAVE valves are opened to the intake.

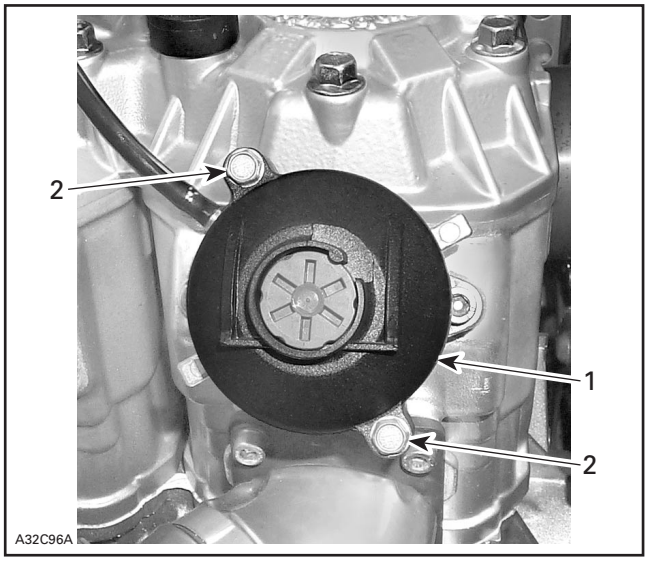
DISASSEMBLY

RAVE Valves

Remove RAVE valve cover **no. 4** by removing screws **no. 5**.

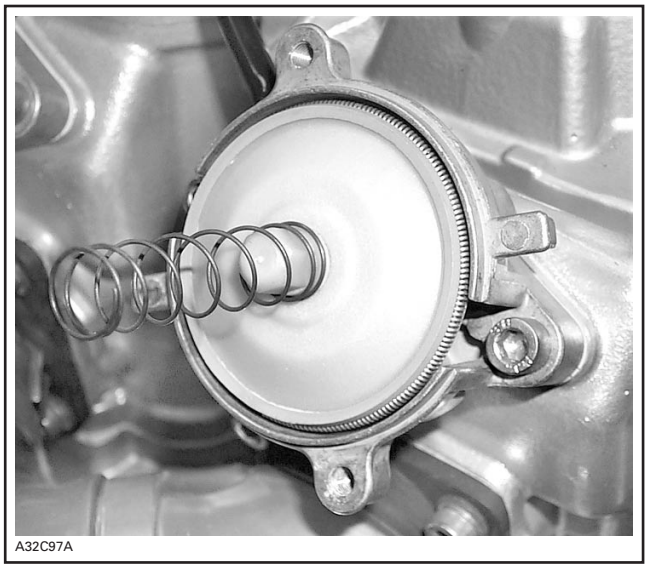
⚠ WARNING

Firmly hold cover to valve base **no. 6**. The compression spring **no. 7** inside the valve is applying pressure against the cover.



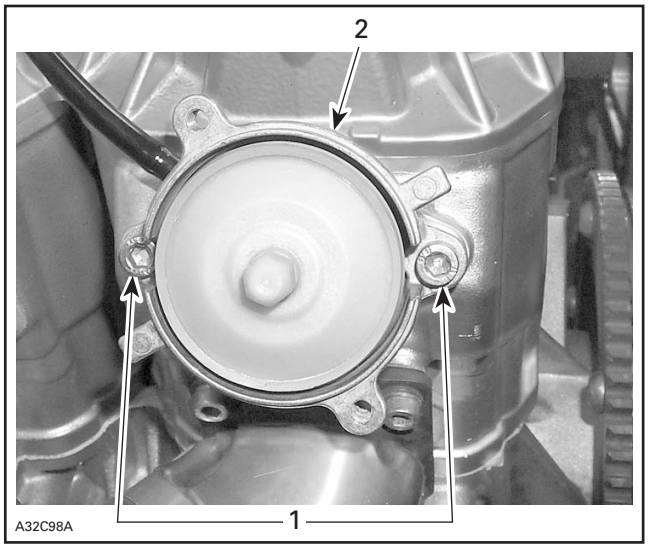
TYPICAL
1. *Cover*
2. *Retaining screws*

Remove the compression spring **no. 7**.



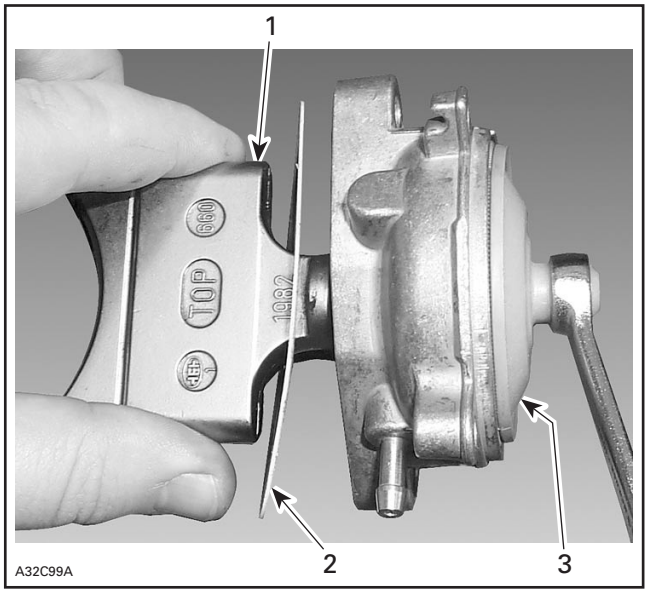
TYPICAL

Unscrew the Allen socket screw **no. 8** then remove the RAVE valve base **no. 6**.



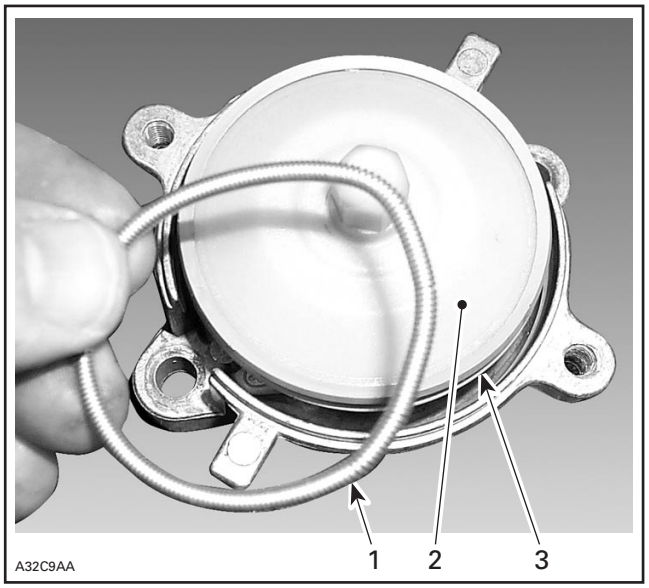
TYPICAL
1. *Allen socket screws*
2. *RAVE valve base*

Unscrew and remove the guillotine **no. 9** from the valve piston **no. 10** than remove the gasket **no. 11**.



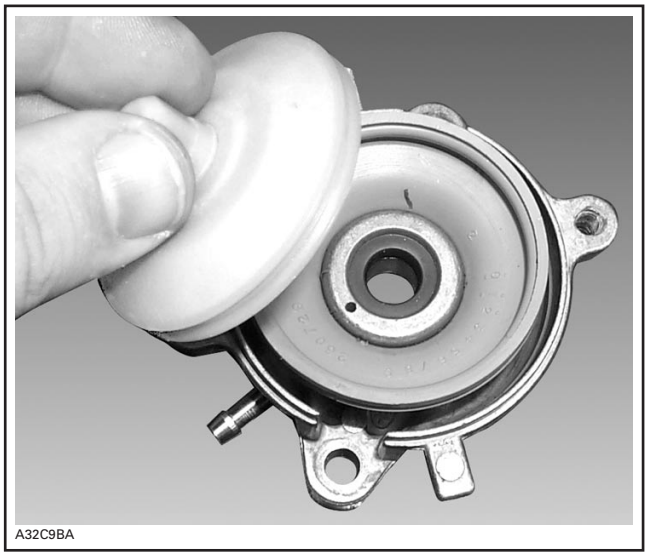
TYPICAL
1. *Guillotine*
2. *Gasket*
3. *Valve piston*

Remove spring **no. 12** retaining bellows **no. 13** to valve piston.



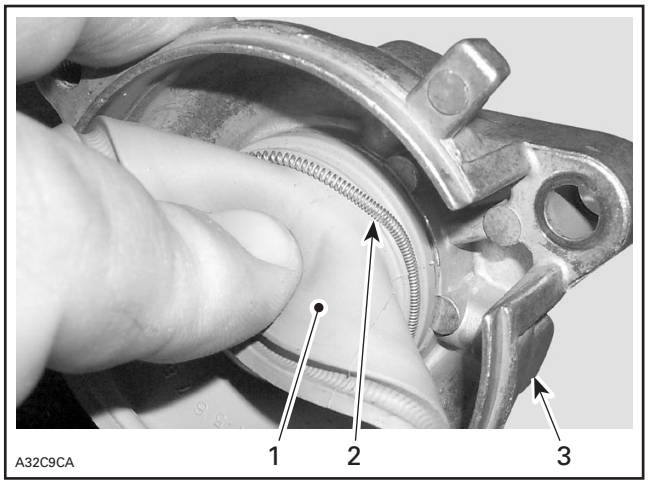
TYPICAL
1. *Spring*
2. *Valve piston*
3. *Bellows*

Remove valve piston.



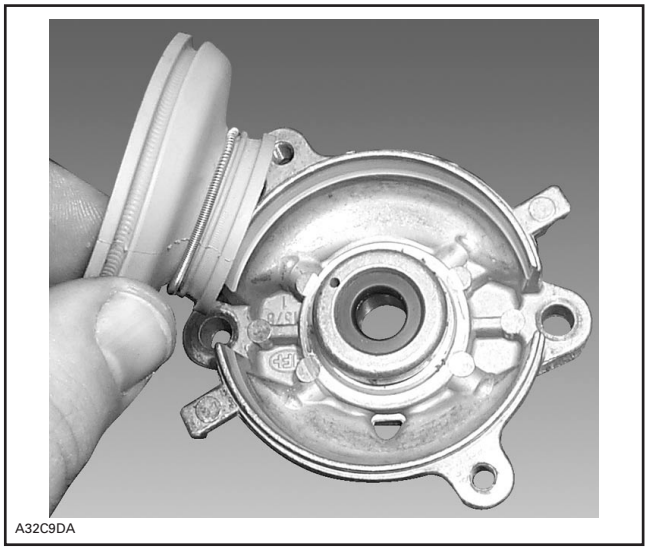
TYPICAL

Remove the small spring **no. 14** retaining bellows to valve base.



TYPICAL
1. *Bellows*
2. *Small spring*
3. *Valve base*

Remove bellows from valve base.



TYPICAL

REED Valve

593 Engine

Remove intake resonator on top of reed valves **no. 15**.

All Engines

Unscrew reed valve screws **no. 16** then remove reed valve(s).

793 HO Engine

Remove connecting flange **no. 17** and gasket **no. 18**.

Cylinder Head Cover

All Engines Except 793 HO

Unplug spark plug cables.

Disconnect the knock sensor **no. 19** (**593 HO SDI engine**).

Unplug coolant hose from upper thermostat housing **no. 20**.

Unscrew all cylinder head cover screws **no. 21**.

Cylinder Head

All Engines except 793 HO

Remove the cylinder head cover **no. 1** as explained above.

Disconnect the temperature sensor connector.

Remove the cylinder head **no. 2**.

793 HO Engines

Unplug spark plug cables.

Disconnect the knock sensor **no. 19** (793 HO Power Tek engine).

Disconnect the temperature sensor connector.

Unplug coolant hose from upper thermostat housing **no. 20**.

Unscrew all cylinder head screws **no. 21**.

Remove the cylinder head **no. 2**.

Cylinder

593 HO SDI Engine

Release the fuel pressure of the system.

Unplug fuel injector connectors then remove the fuel rail **no. 24**. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

All Engines

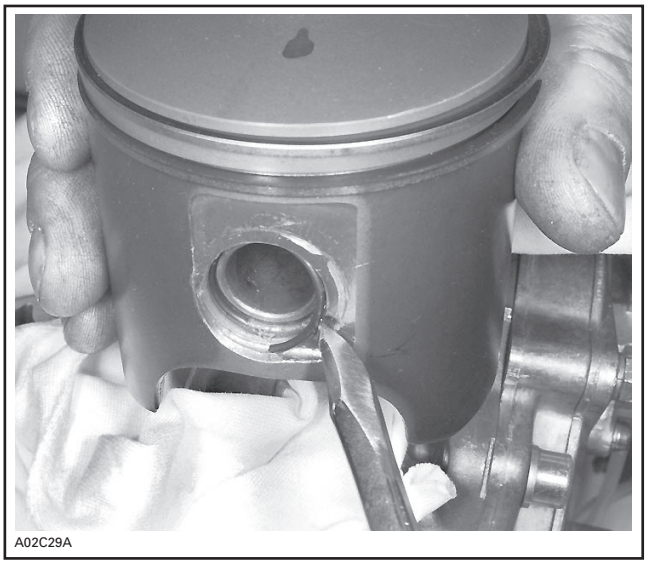
Remove cylinder head **no. 2** as explained above.

Remove manifold and RAVE valves.

Unscrew cylinder screws **no. 22** and **no. 23** then remove the cylinder(s) **no. 3**.

Piston

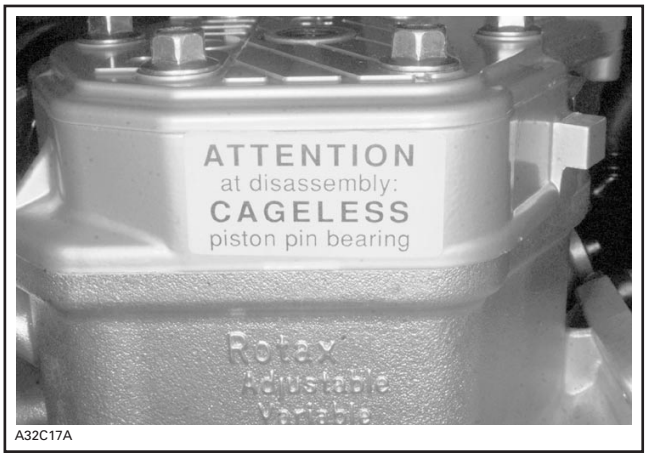
Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase. Then with a pointed tool inserted in piston notch, remove both circlips **no. 25** from piston **no. 26**.



A02C29A

TYPICAL

NOTE: All engines are equipped with cageless piston pin bearings.



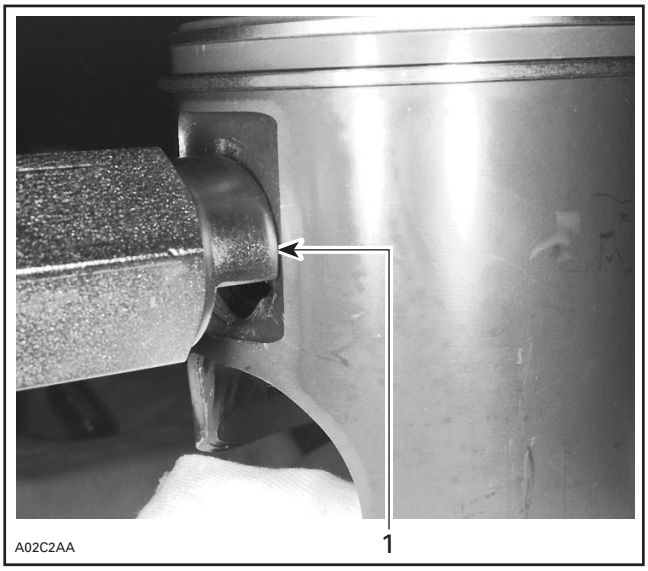
A32C17A

To remove piston **no. 26**, use the following tools:

ENGINE	PULLER P/N	SLEEVE KIT P/N	LOCATING SLEEVE P/N
All	529 035 503	529 035 542 (20 mm)	529 023 800

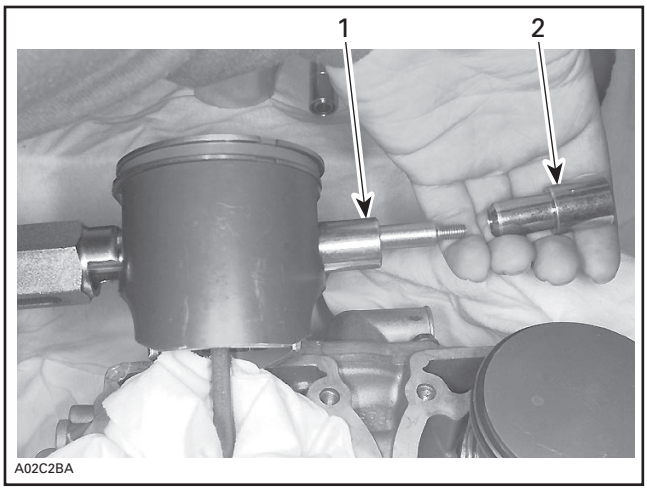
NOTE: The locating sleeve is the same that contains new cageless bearing.

Insert piston pin puller making sure it sits squarely against piston.



TYPICAL
1. Properly seated all around

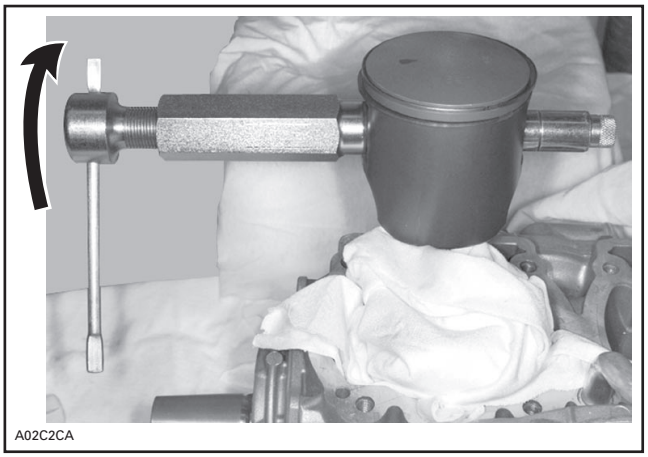
Install sleeve then shouldered sleeve over puller rod.



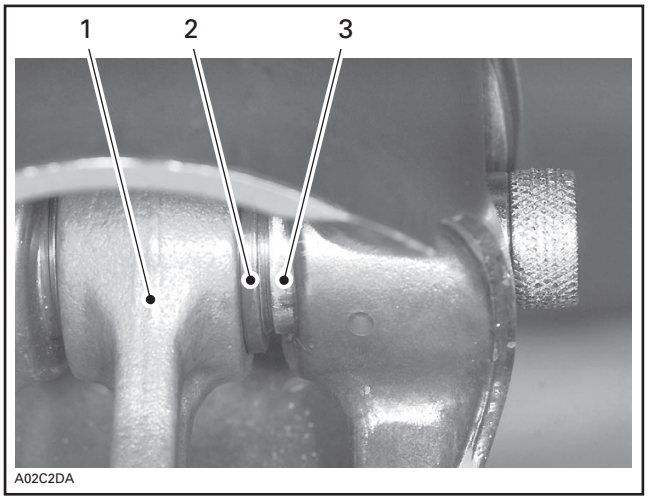
TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Screw (LH threads) extracting nut.

Pull out piston pin **no. 27** by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

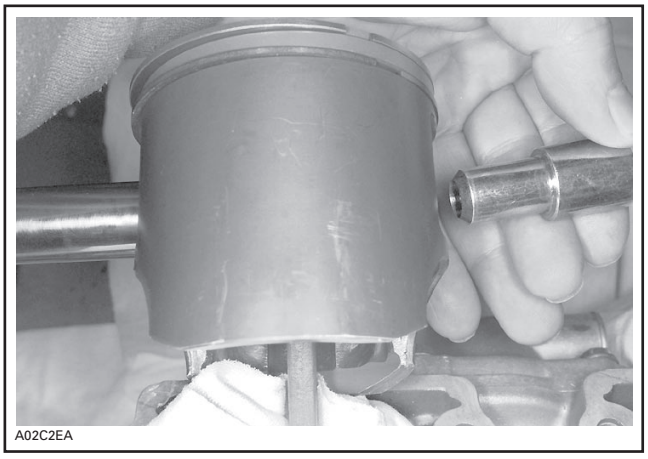


TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

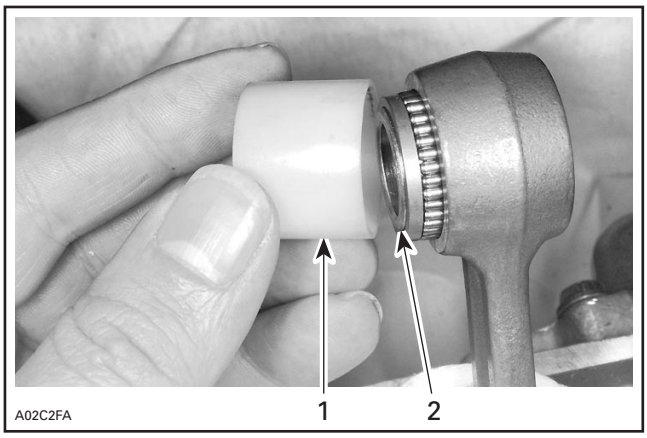
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

INSPECTION

NOTE: For dimension measurement procedures, refer to ENGINE MEASUREMENT.

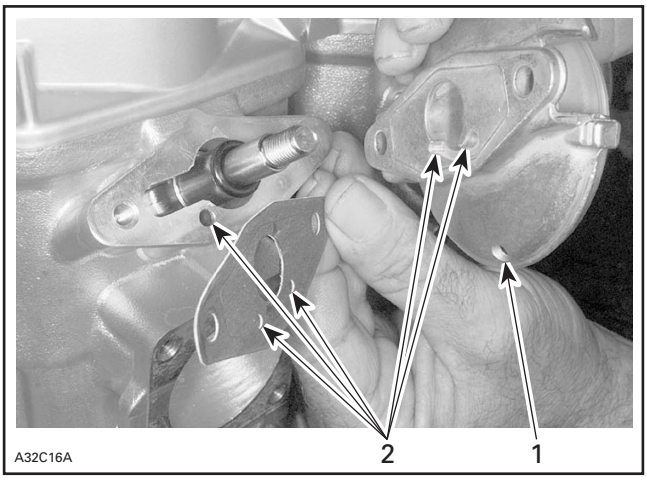
RAVE Valves

There are no wear parts anywhere in the system and there are no adjustments to be periodically checked. The only possible maintenance required would be cleaning of carbon deposits from the guillotine slide. Cleaning intervals would depend upon the user's riding style and the quality of the oil used.

BRP suggests annual cleaning of the valve. If a customer uses lower quality oil, than recommended, more frequent cleaning may be required.

No special solvents or cleaners are required when cleaning the valve.

Check valve rod housing and cylinder for clogged passages (**all models except Power Tek and SDI**).



1. Draining hole
2. Passages

NOTE: Oil dripping from draining hole indicates a loosen spring or damaged bellows.

Check for cracked, dried or perforated bellows **no. 13**.

Check if the compression springs **no. 7** are in specifications.

ENGINE	SPRING P/N	COLOR	WIRE DIA. mm (in)	FREE LENGTH mm (in)
593	420 239 944	Brown	0.9 (.035)	48.5 (1.91)
593 HO	420 239 944	Brown	0.9 (.035)	48.5 (1.91)
593 HO SDI	420 239 942	Black	0.8 (.031)	42.5 (1.67)
793 HO (All models except Summit)	420 239 941	Blue	0.8 (.031)	52.5 (2.07)
793 HO (Summit)	420 239 942	Black	0.8 (.031)	42.5 (1.67)

Power Tek and SDI Engines

Check if solenoid heating element is still functional once a year, the element should be warm after one minute of riding. At the same time, check if crankcase check valve is still functional.

NOTE: Make sure hoses are not kinked or damaged.

Cylinder Head, Cylinder and Piston

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Cylinder head volume 593 engine	25.49 cc	27.96 cc	N.A.
Cylinder head volume 593 HO/SDI engine	25.30 cc	27.60 cc	N.A.
Cylinder head volume 793 HO engine	34.76 cc	38.07 cc	N.A.
Cylinder head warpage All engines	N.A	N.A.	0.50 mm (.02 in)
Cylinder taper All engines	N.A.	0.05 mm (.002 in)	0.10 mm (.004 in)
Cylinder out of round All engines	N.A.	0.010 mm (.0004 in)	0.08 mm (.003 in)
Piston/cylinder wall clearance 593 engine	0.104 mm (.004 in)	0.136 mm (.005 in)	0.20 mm (.008 in)
Piston/cylinder wall clearance 593 HO/SDI engines	0.092 mm (.0036 in)	0.118 mm (.0046 in)	0.18 mm (.007 in)
Piston/cylinder wall clearance 793 HO engine	0.103 mm (.002 in)	0.147 mm (.003 in)	0.20 mm (.008 in)
Ring/piston groove clearance 593 engine	0.040 mm (.002 in)	0.090 mm (.004 in)	0.20 mm (.008 in)
Ring/piston groove clearance 593 HO/SDI and 793 HO engines	0.050 mm (.002 in)	0.100 mm (.004 in)	0.20 mm (.008 in)
Ring end gap All engines	0.40 mm (.016 in)	0.55 mm (.022 in)	1.0 mm (.039 in)

Cylinder Boring Precaution

593 Engine

In its stock configuration, the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

ASSEMBLY

RAVE Valves

Apply sealing compound Drei Bond (P/N 420 297 906) in the groove of valve base and in the piston valve groove, then install bellows.

Install RAVE valve with its mention top as illustrated in the following photo.

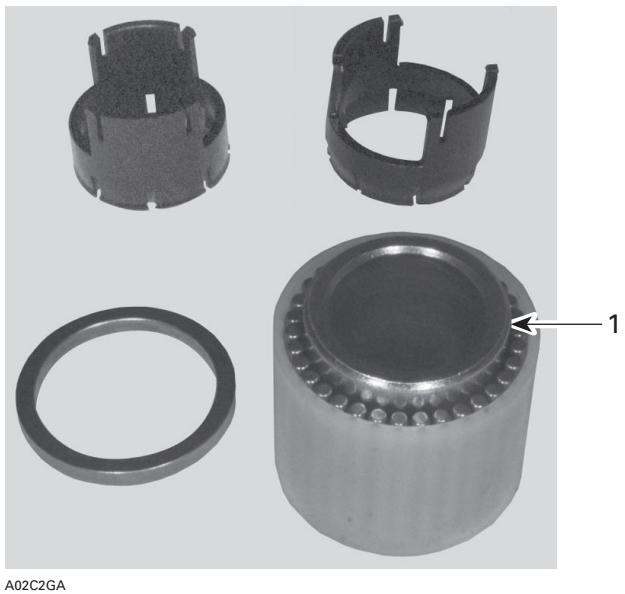
A32C15A

Tighten red cap screw **no. 28** to bottom.

Piston

When installing a new cageless bearing, replace half plastic cages with sleeve.

NOTE: Cageless bearing contains 28 needles on all engines.



A02C2GA

TYPICAL
1. Sleeve

Lubricate needle bearings and thrust washers with injection oil then install washers on each end of needles.

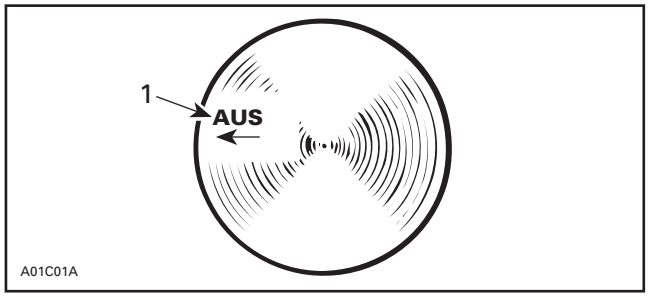
Insert cageless bearing into connecting rod.

TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Heat piston using bearing heater (P/N 529 035 969).

CAUTION: Piston temperature must not exceed 46°C (115°F). Never use direct flame to heat the piston and never freeze the pin.

At assembly, place the pistons over the connecting rods with the letters "AUS" (over an arrow on the piston dome) facing towards the exhaust port.

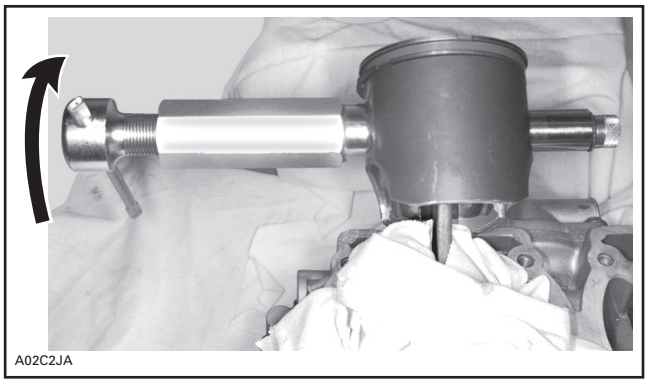


1. Exhaust

Install shouldered sleeve.

TYPICAL — SHOULDERED SLEEVE INSTALLATION

Install piston pin puller and turn handle until piston pin is correctly positioned in piston.



TYPICAL

CAUTION: Always install new circlips.

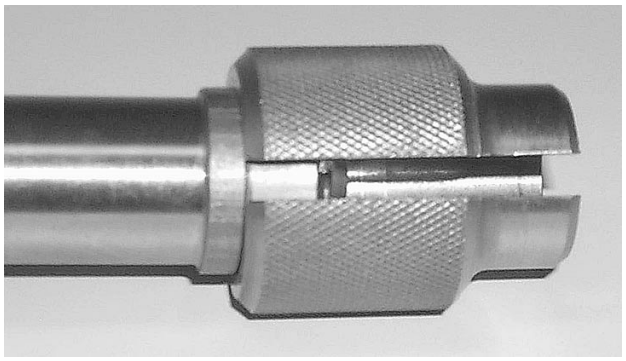
To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use appropriate piston circlip installer to install mono-hook circlips **no. 25**.

ENGINE	TOOL
All	piston circlip installer (P/N 529 035 686)

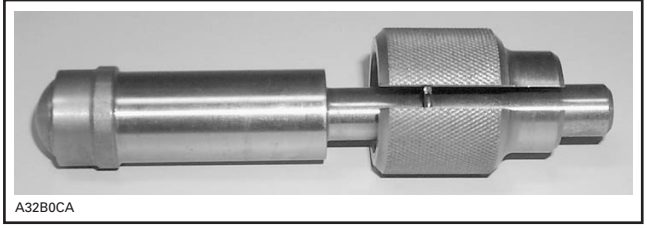
Insert circlip into support so that, when installed in piston groove, the tab faces upward.

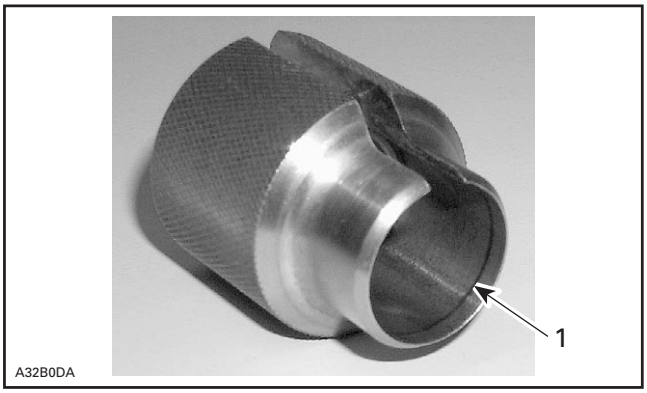
A32B0AA

With round end of pusher, position circlip perpendicularly to the support axis.


A32B0BA

With the other end of the pusher, push circlip into the support groove.


A32B0CA



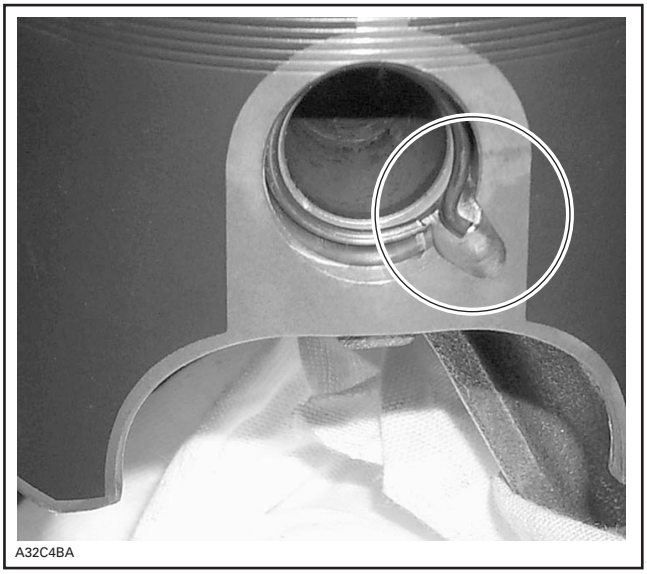
A32B0DA

1. Groove

A32B0EA

CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to put circlip in place. Make sure to install new circlips with tab toward top as per following photo.


A32C4BA

TAB TOWARD TOP

CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one because, on a second attempt, the circlip will lose its normal retaining capabilities.

CAUTION: Circlips must not move freely after installation; if so, replace them.

Before inserting piston in cylinder, lubricate the cylinder with new injection oil or equivalent.

Cylinder Head Cover, Cylinder Head and Cylinder

Apply a thin layer of Loctite 518 (P/N 293 800 038) to crankcase mating surface of base gasket. Choose the right gasket thickness according to combustion chamber volume. Refer to ENGINE MEASUREMENT. Install it on crankcase. Coat gasket with Loctite 518.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.

Before inserting piston in cylinder, lubricate the cylinder with new injection oil or equivalent.

Install cylinders. Do not tighten.

Install new rubber ring and round O-rings on each cylinder.

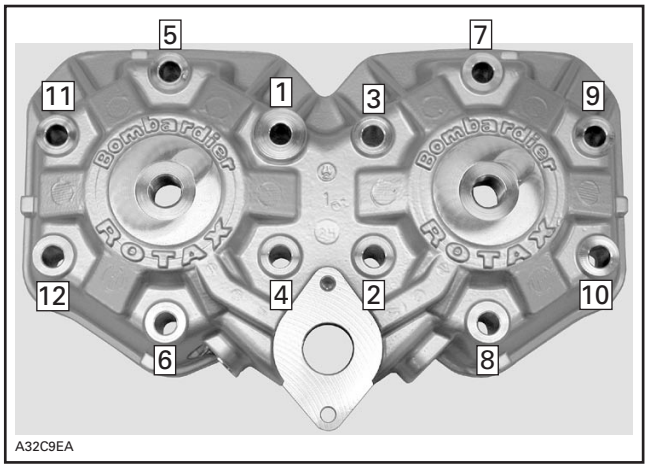
NOTE: Carefully clean screws before reinstallation, specifically under screw head.

Install exhaust manifold with gaskets. Do not tighten yet.

Torque cylinder screws in a crisscross sequence as per the following table.

M8	29 N•m (21 lbf•ft)
M10	40 N•m (29 lbf•ft)

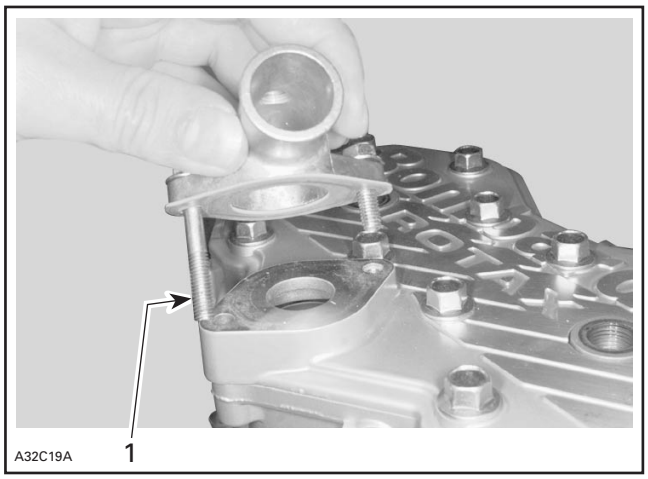
At assembly, torque cylinder head screws to 29 N•m (21 lbf•ft) in the following illustrated sequence.



TYPICAL

Tighten exhaust manifold bolts in a criss-cross sequence.

Apply Loctite 243 (P/N 293 800 060) on screw threads. Install outlet socket and tighten screws. Note position of longer screw.



1. Longer screw

Reed Valve

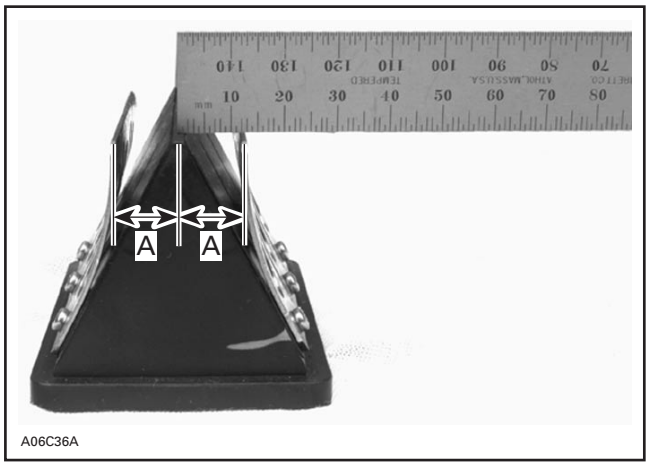
Blades have a curved shape. Install with their curve facing reed block.

Check reed valve for proper tightness. There must not be any play between blade and valve body when exerting a finger pressure on blade at blade stopper location.

In case of a play, turn blade upside down and recheck. If there is still a play, replace blade and/or valve body.

All Engines Except 793 HO

Check distance from blade stopper no. 29 outer edge and distance from center of reed valve block.



TYPICAL
A. 18.7 - 0, + 0.75 mm (.736 - 0, + .030 in)

Bent blade stopper as required to obtain the proper distance.

Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

BOTTOM END

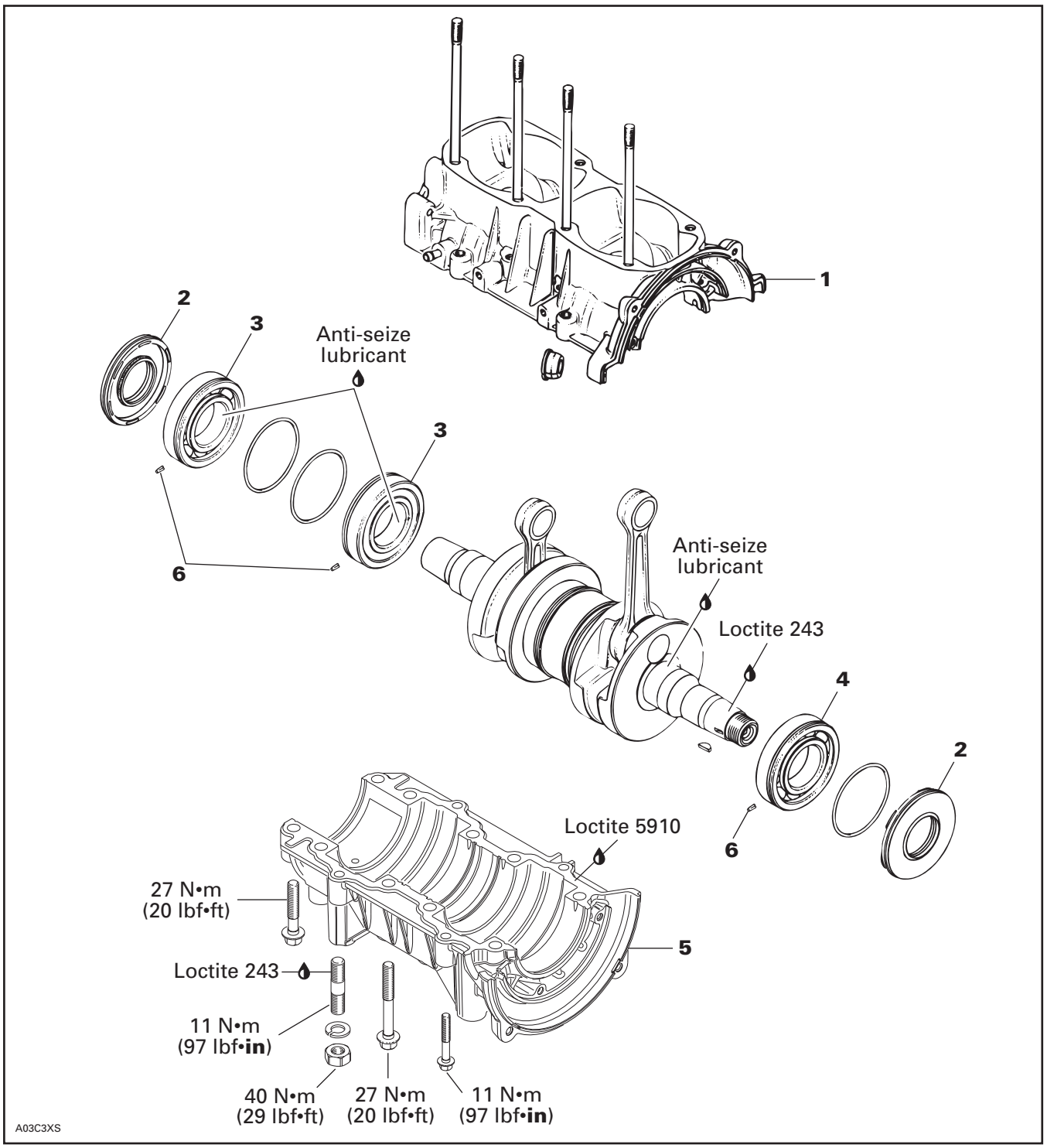
SERVICE TOOLS

Description	Part Number	Page
bearing heater	529 035 969	114, 124
bearing puller	420 877 635	112, 122
crankshaft protector	420 876 552	112, 122
crankshaft protector	420 876 557	113, 122
distance gauge	420 876 822	115
distance gauge	529 035 965	115
Distance gauge	529 035 966	125
Distance gauge	529 035 967	125
Distance gauge	529 035 968	125
feeler gauge	420 876 620	115
half rings	420 977 475	112
half rings	420 977 479	122
indicator stick	529 035 970	114
puller ring	420 977 490	112
puller ring	420 977 494	122
screws	420 840 681	112, 122
support plate	529 035 976	115, 125

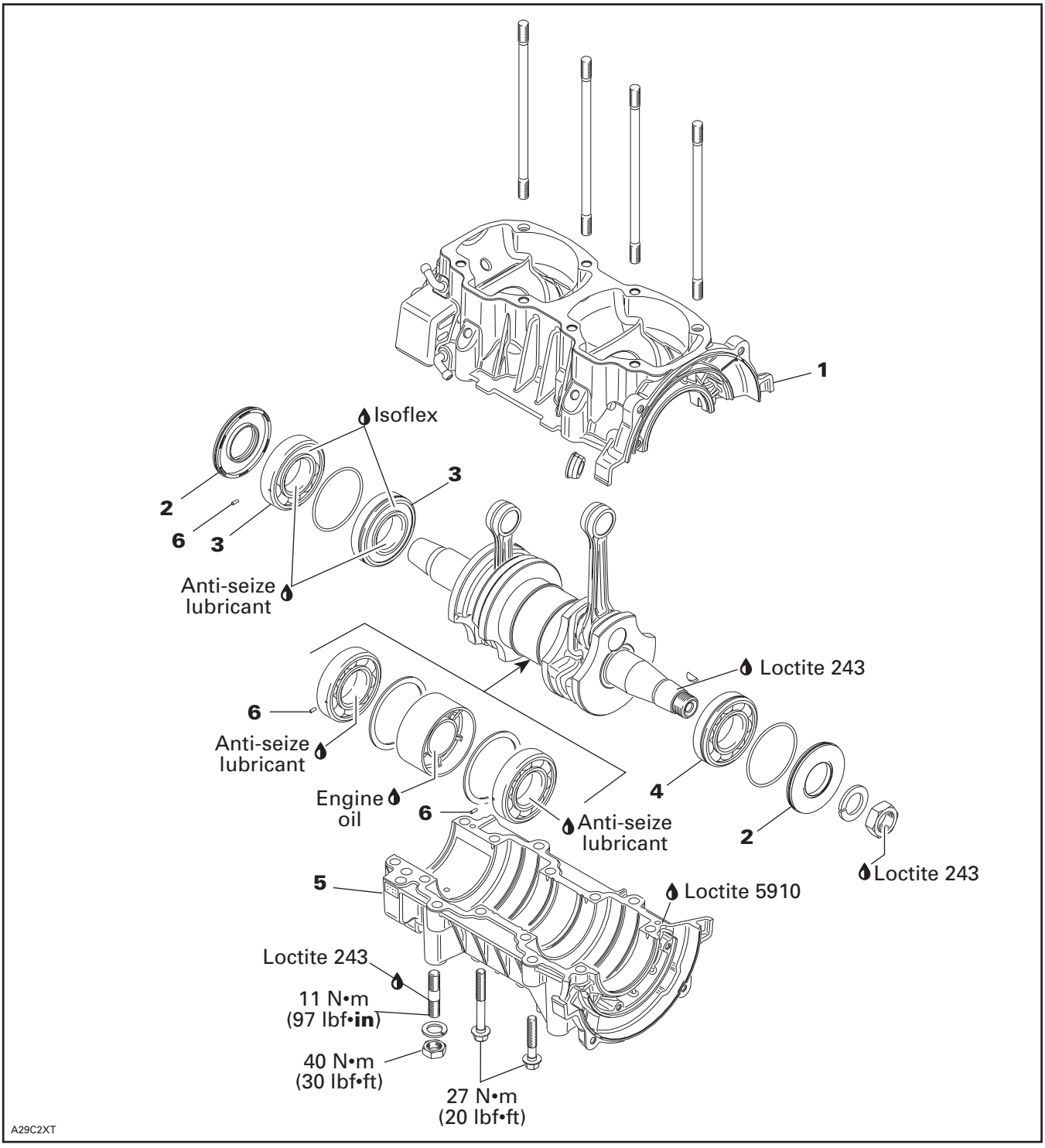
SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	413 701 000	113, 123
Bombardier Lube	293 600 016	122
Isoflex grease	293 550 021	117
Loctite 5910	293 800 081	117, 127
Loctite Chisel	413 708 500	112, 122
Petamo grease	420 899 271	123
pulley flange cleaner	413 711 809	113, 123
synthetic grease	413 711 500	112

377 Engine


1
2
3
Anti-seize lubricant
3
6
Anti-seize lubricant
Loctite 243
4
2
6
Loctite 5910
27 N•m (20 lbf•ft)
5
Loctite 243
11 N•m (97 lbf•in)
40 N•m (29 lbf•ft)
27 N•m (20 lbf•ft)
11 N•m (97 lbf•in)
A03C3XS

552 Engine


1
Isoflex
2
3
6
3
Anti-seize lubricant
Loctite 243
6
Anti-seize lubricant
Engine oil
6
Anti-seize lubricant
4
2
Loctite 243
5
Loctite 5910
Loctite 243
11 N•m (97 lbf•in)
40 N•m (30 lbf•ft)
27 N•m (20 lbf•ft)
A29C2XT

Remove engine from chassis. Refer to REMOVAL AND INSTALLATION.

Remove engine fan cowls, cylinder heads and cylinders. Refer to TOP END.

Remove rewind starter. Refer to REWIND STARTER.

Remove fan belt pulley, trigger coils, magneto flywheel and stator plate. Refer to MAGNETO SYSTEM.

CLEANING

Discard all seals, gaskets and O-rings.

Clean all metal components in a non-ferrous metal cleaner. Use Loctite Chisel (P/N 413 708 500) accordingly.

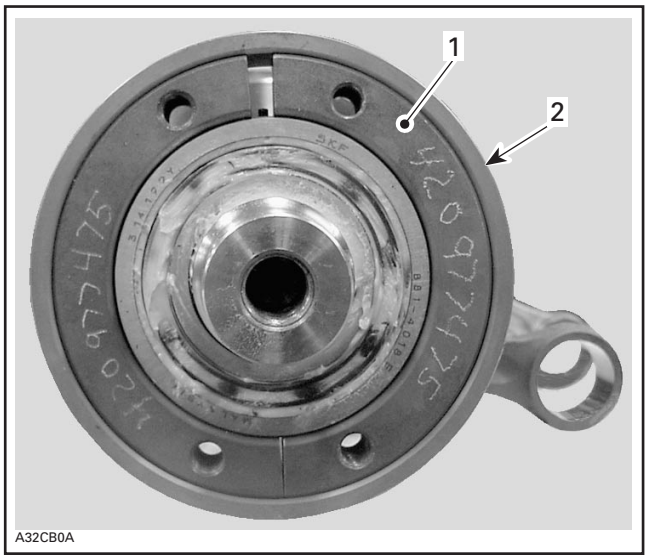
Remove all trace of Loctite 243 from crankshaft taper.

Remove old sealant from crankcase mating surfaces with Loctite Chisel.

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

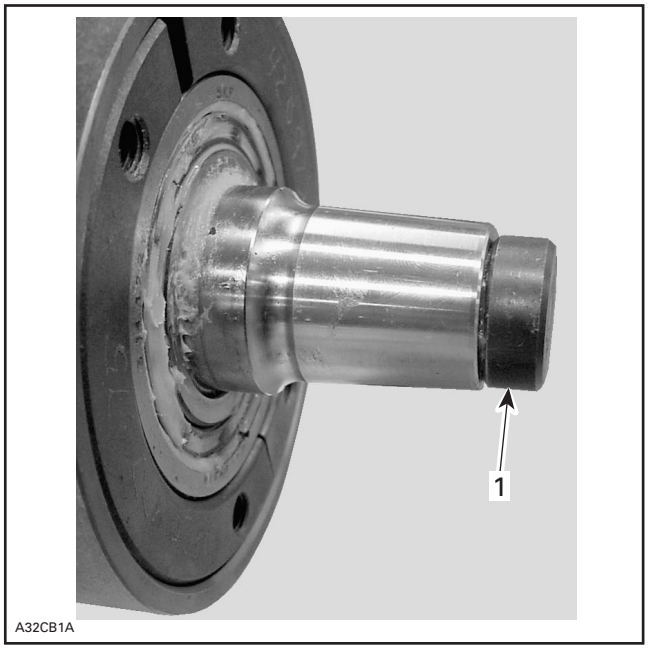
DISASSEMBLY

To remove PTO side bearings **no. 3** from crankshaft, install half rings (P/N 420 977 475) and puller ring (P/N 420 977 490) on the bearing.



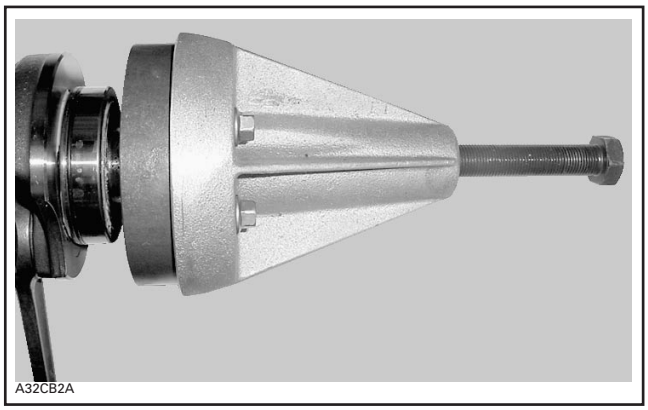
1. *Half ring*
2. *Puller ring*

Apply synthetic grease (P/N 413 711 500) on the crankshaft end and install crankshaft protector (P/N 420 876 552).



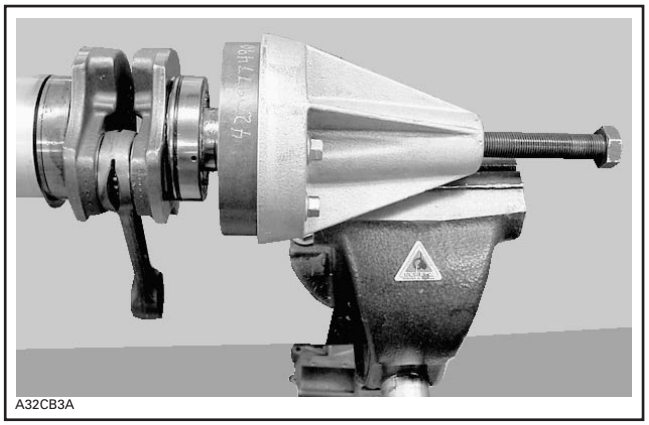
1. *Crankshaft protector*

Install bearing puller (P/N 420 877 635) and secure to half rings using screws (P/N 420 840 681).



PULLER INSTALLED ON THE HALF RINGS

Secure the bearing puller in a vise by one of its rib.


A32CB3A

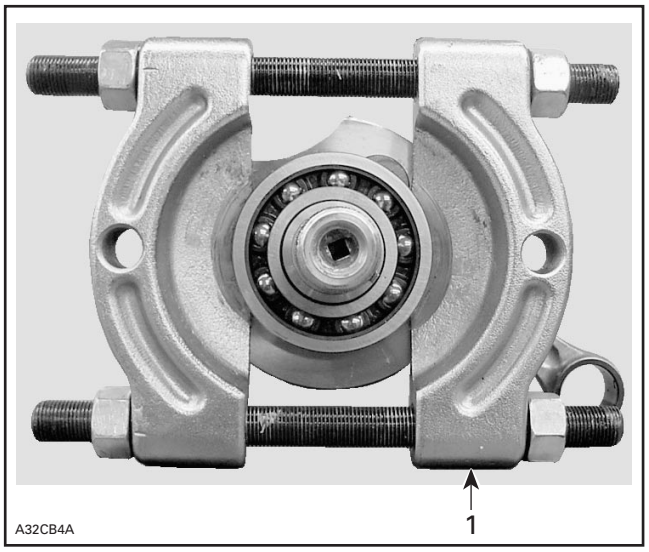
BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool for tightening the puller bolt.

Lubricate the puller bolt and then proceed with tightening the puller bolt until the bearing comes out.

Follow the same procedure for the inner bearing.

NOTE: In the case of damaged bearing or less clearance between crankshaft counterbalance and the bearing or on the MAG side bearing, use bearing separator (SNAP-ON tool (P/N CJ951 or SPX/OTC) tool (P/N 1124) to facilitate the removal.



A32CB4A

1. Bearing separator

Procedure for MAG side bearings **no. 4** is same as of PTO side with the exception of the crankshaft protector (P/N 420 876 557).

INSPECTION

Refer to table below to find bottom end engine dimension specifications. For dimension measurement procedures, refer to ENGINE MEASUREMENT.

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Crankshaft deflection on PTO side	N.A.	0.06 mm (.0024 in)	N.A.
Crankshaft deflection on MAG side	N.A.	0.03 mm (.001 in)	N.A.
Crankshaft Deflection in center of crankshaft	N.A.	0.08 mm (.0031 in)	N.A.
Connecting rod big end axial play	0.2 mm (.007 in)	0.53 mm (.026 in)	1.20 mm (.047 in)
Crankshaft end-play	0.10 mm (.004 in)	0.30 mm (.012 in)	N.A.

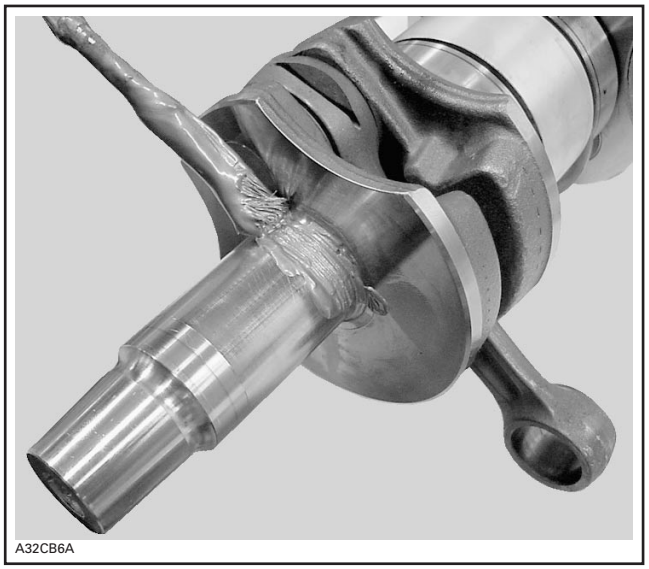
ASSEMBLY

Crankshaft Preparation

Clean crankshaft end with sand paper no. 180 and remove all residue using pulley flange cleaner (P/N 413 711 809).

A32CB5A

Smear anti-seize lubricant (P/N 413 701 000) on part of crankshaft where bearing fits.


A32CB6A

Crankshaft Bearing Preparation

Heat up the bearing(s) using bearing heater (P/N 529 035 969). This will expand bearings and ease installation. If required, put a suitable plate or shim to avoid the direct contact between integrated seal (if applicable) with the heating surface.

A32CB7A

CAUTION: Bearing should not be heated to more than 80°C (176°F). Do not heat bearing with direct flame or heat gun or heated oil. Inappropriate heating procedure(s) may cause inner seal failure.

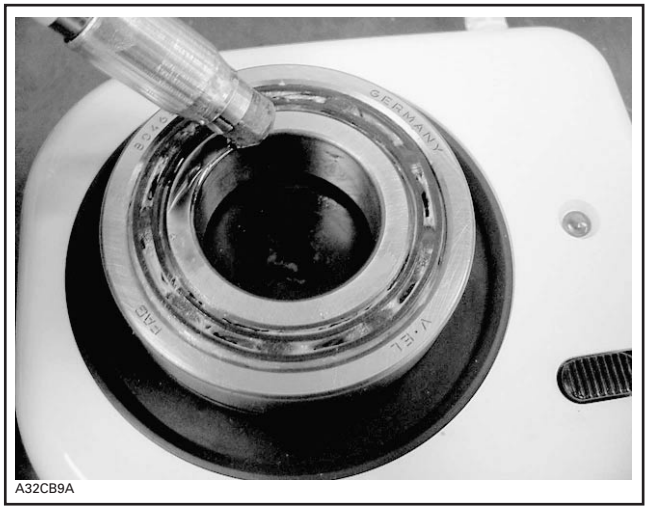
Turn bearing(s) several times during heating process for heating it (them) properly.

NOTE: Normally it takes approximately 10 minutes to heat up a bearing so in the event of replacing bearing, it's recommended to start the bearing heating process prior to removal operation. Two bearings can be heated at the same time on one bearing heater.

A32CB8A

1. Bearings

Touch the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reach the proper temperature.


A32CB9A

⚠ WARNING

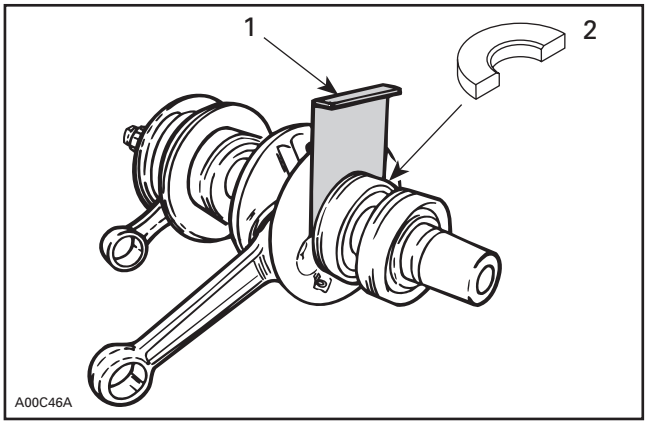
Do not touch heated bearing with bare hands. Wear heat resisting gloves before handling the heated bearing(s).

Crankshaft Bearing Installation

377 Engine

To check proper clearance between bearing no. 3 and crankshaft counterbalance , use feeler gauge (P/N 420 876 620).

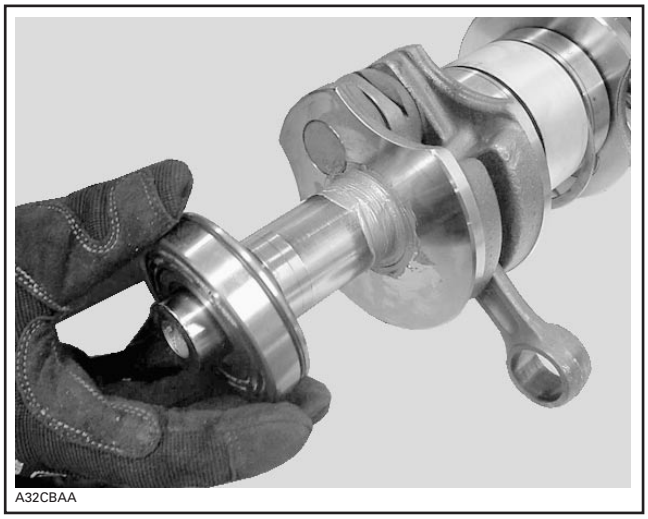
Mount second bearing with distance gauge (P/N 420 876 822) for proper positioning.

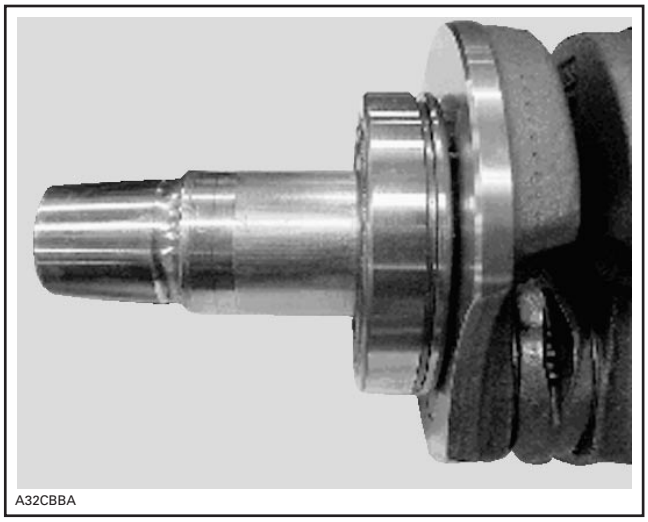


1. Feeler gauge
2. Distance gauge

552 Engine

Slide in the inner PTO bearing with the integrated seal facing crankshaft. Push bearing to end position.

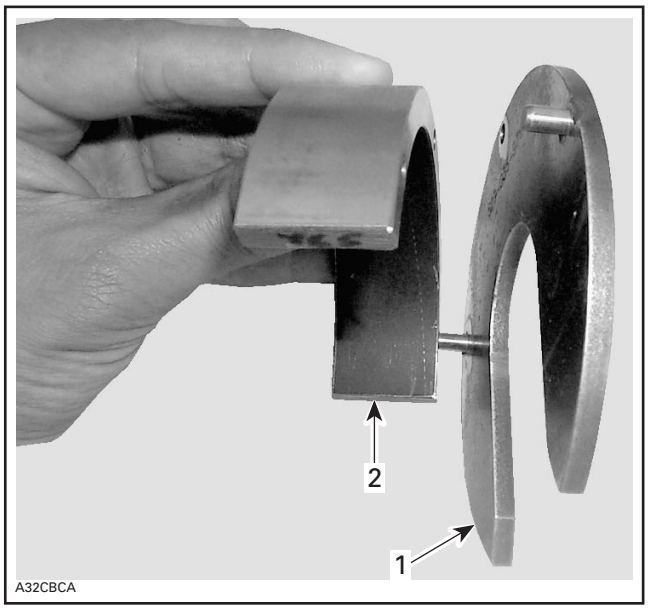




BEARING TO END POSITION

Install the O-ring.

Make a bearing locator tool using support plate (P/N 529 035 976) and distance gauge (P/N 529 035 965).



1. Support plate
2. Distance gauge

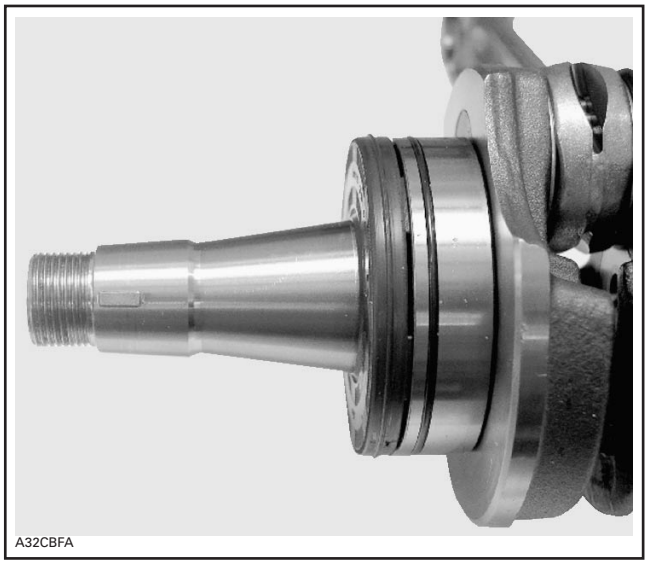
Install bearing locator tool.

A32CBDA

Slide in the heated outer PTO bearing onto the crankshaft.

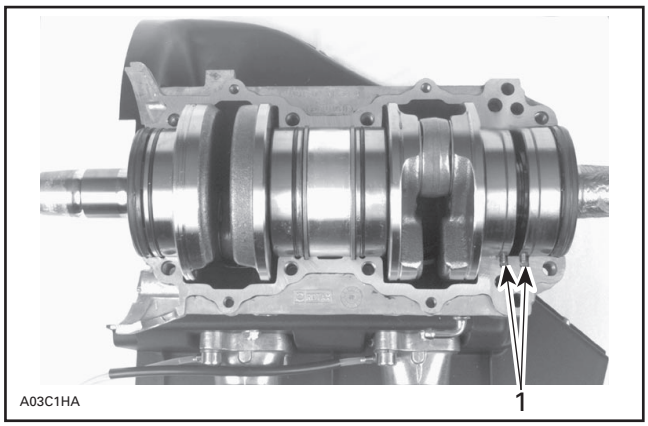
A32CBEA

Install the MAG side heated bearing.


A32CBFA

Crankshaft Installation

When installing crankshaft, position drive pins no. 6 as illustrated.



A03C1HA

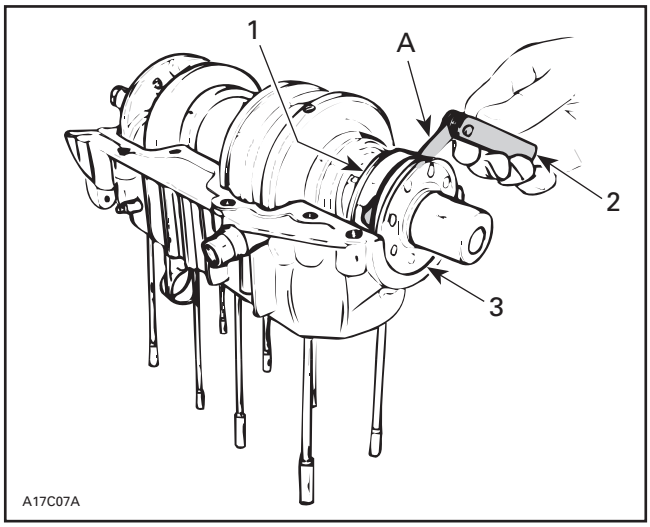
TYPICAL
1. Drive pins

At seal no. 2 assembly, apply a light coat of lithium grease on seal lip.

377 Engine

For bearing lubrication purpose, a gap of 1.0 mm (.040 in) must be maintained between seals and bearings.

When installing plain oil seals (seal without locating ring or without spacing legs), ensure to maintain 1.0 mm (.040 in) gap.

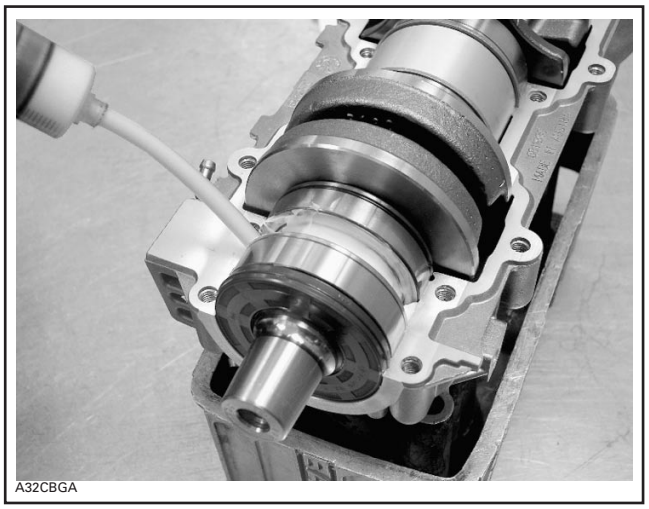


1. Bearing
2. Feeler gauge
3. Plain oil seal
A. 1 mm (.040 in)

552 Engine

Put 27 to 32 mL of grease in a syringe.

With the syringe, fill in the PTO side ball bearings of Isoflex grease as shown below.



TYPICAL — BALLS COATED WITH A SEAM OF GREASE

CAUTION: Use only the recommended Isoflex grease (P/N 293 550 021). Make sure not to push Isoflex grease between outside bearing race and half crankcase.

Crankcase Assembly

Crankcase halves **nos.1** and **5** are factory matched and therefore, are not interchangeable as single halves.

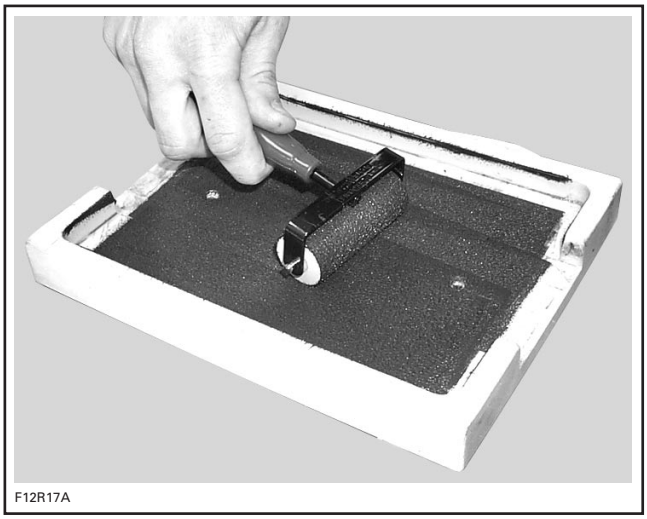
IMPORTANT: The total assembly sequence, including sealing compound spreading, screwing and torquing of bolts according to the proper sequence must be performed within 10 minutes. Do not wait between each bolt torquing. All bolts must be torqued in a row.

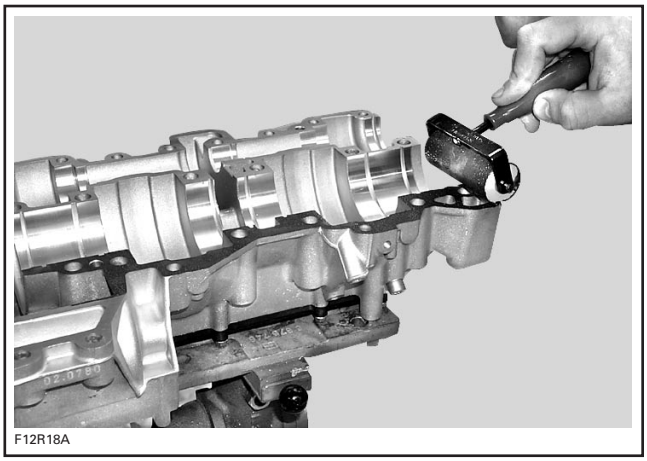
Before screwing both parts of crankcase, seal it with Loctite 5910 (P/N 293 800 081).

NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant.

CAUTION: Do not use Loctite Primer N with the Loctite 5910. Using these products or non silicone-based sealant over a previously sealed crankcase with Loctite 5910 will lead to poor adhesion and possibly a leaking crankcase. These products are chemically incompatibles. Even after cleaning, the Loctite 5910 would leave incompatible microscopic particles.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.

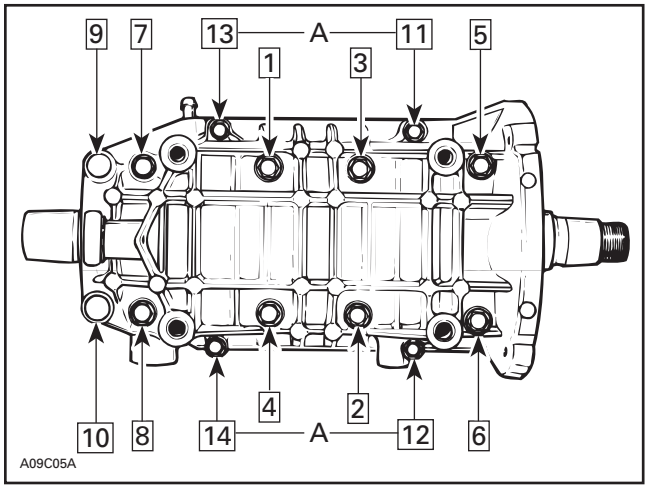




TYPICAL

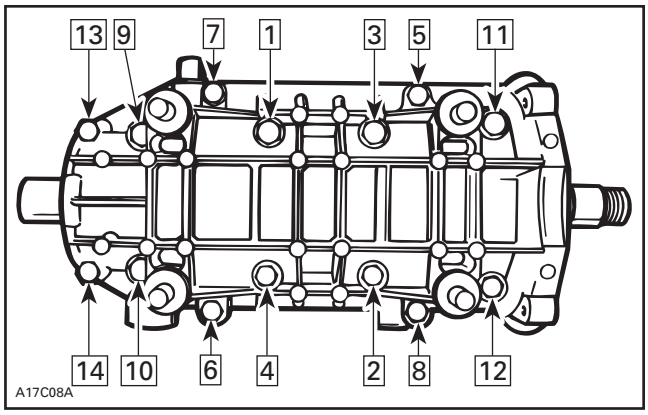
Screw all crankcase bolts in place in the following sequence and to the appropriate torque through a two steps torquing: first, screw bolts up to 60% of the final torque 13 N•m (115 lbf•**in**) for M8 bolts), then, tighten to the required torque (i.e. 22 N•m (16 lbf•ft).

377 Engine



TIGHTENING SEQUENCE FOR 377 ENGINE TYPE
*A. 10 N•m (89 lbf•**in**)*
All the other screws are torqued to 22 N•m (16 lbf•ft)

552 Engine

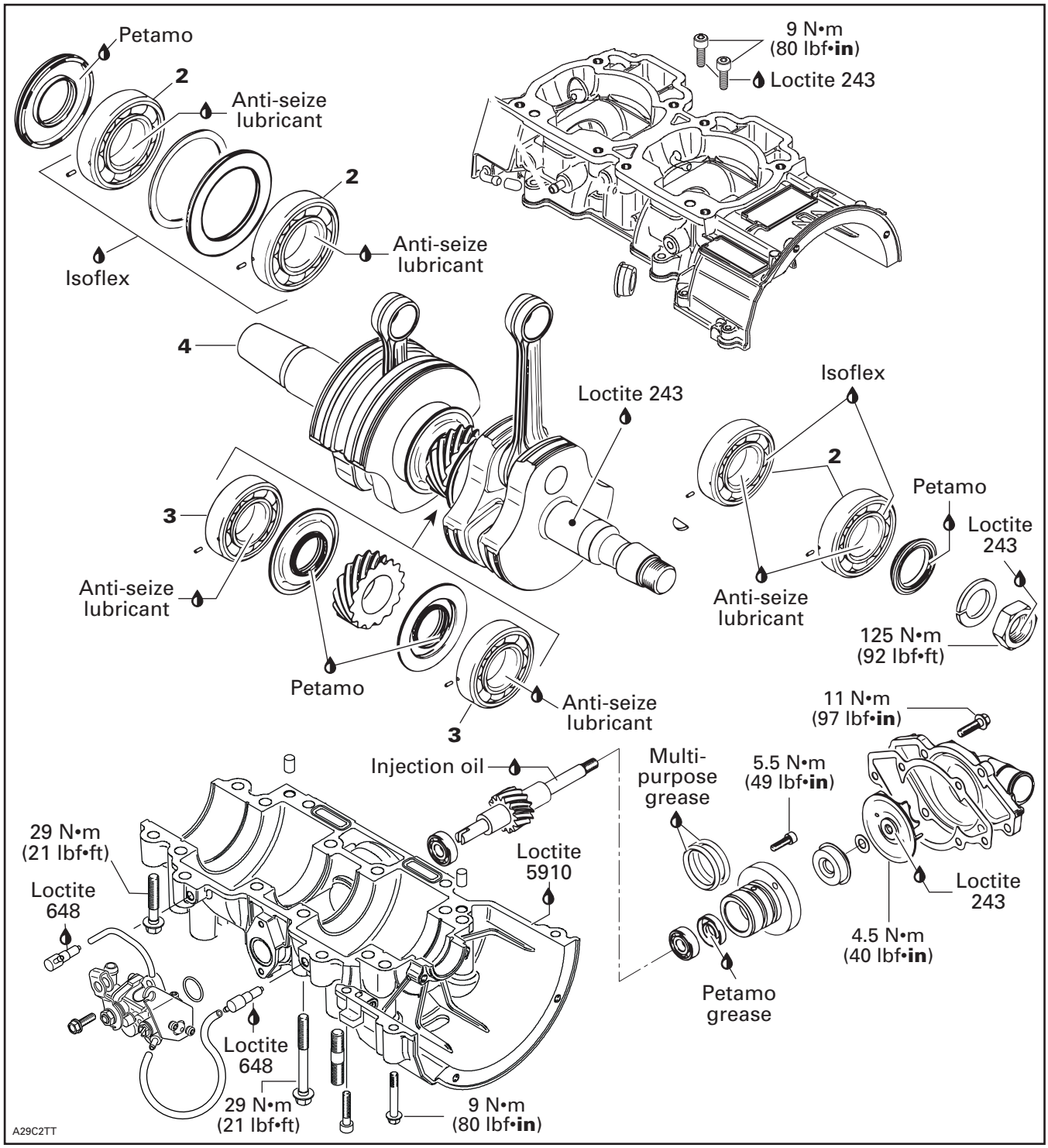


TIGHTENING SEQUENCE FOR 552 ENGINE TYPE

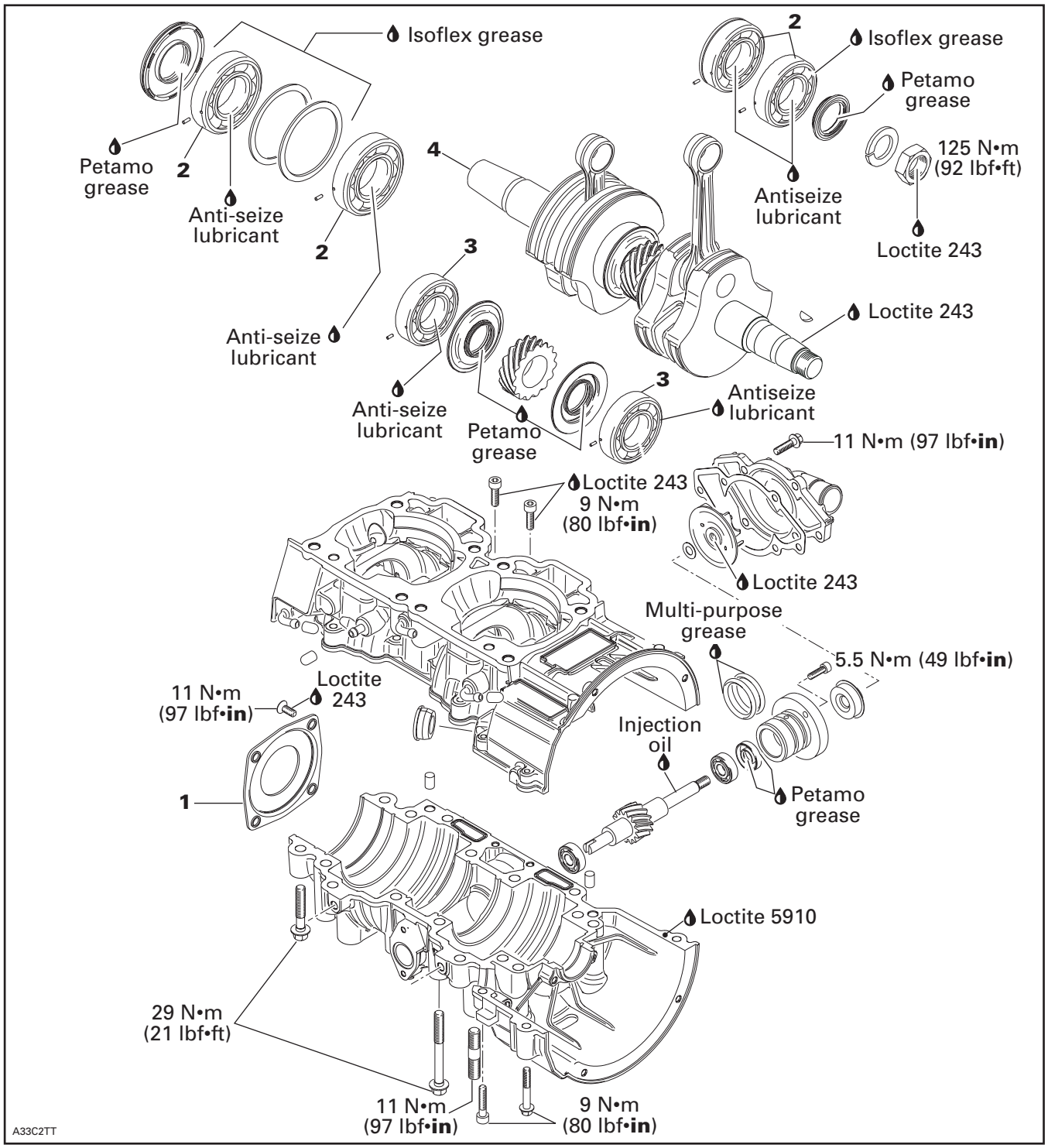
BREAK-IN

After rebuilding an engine always observe a break-in period as described in *Operator's Guide*.

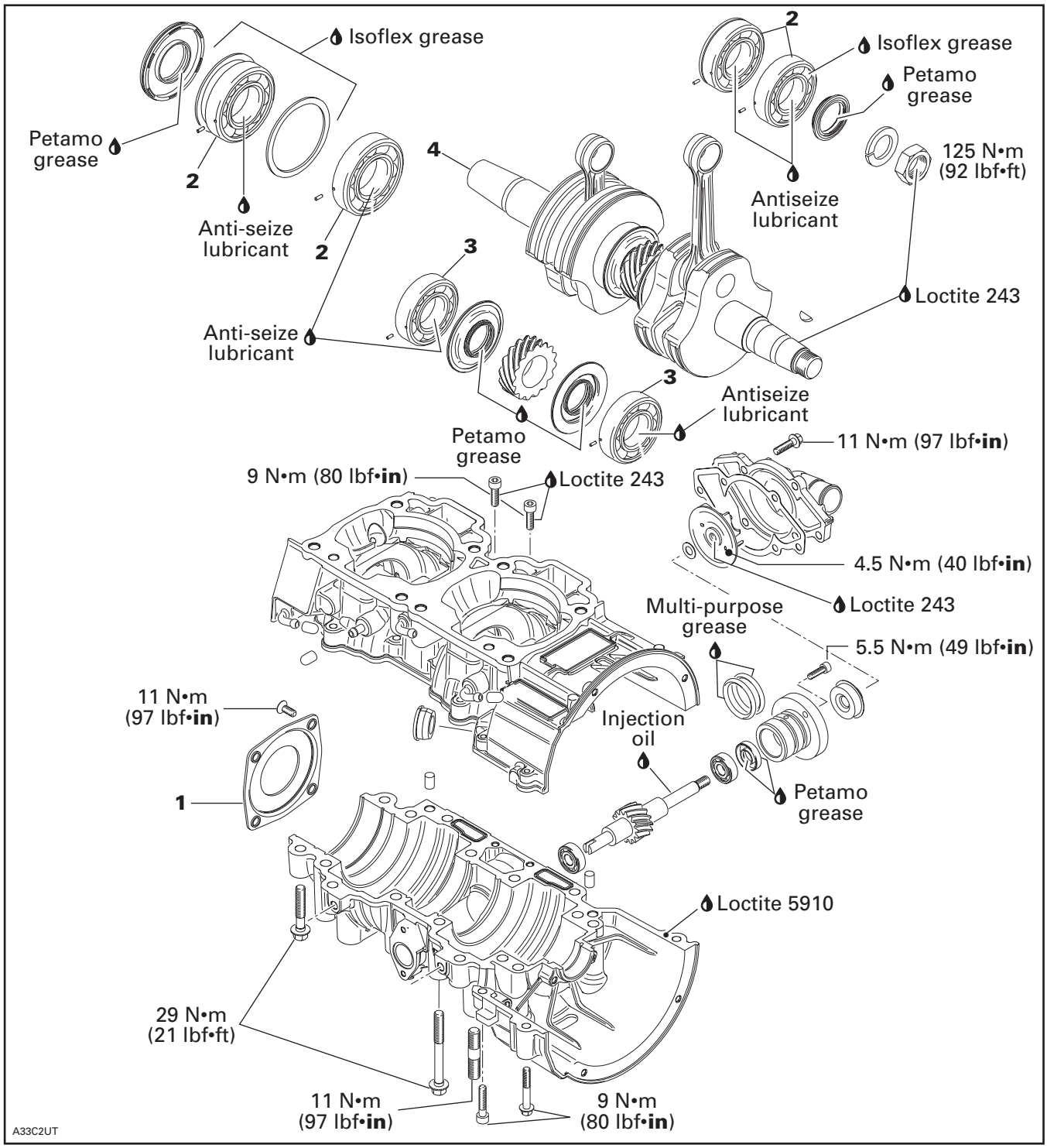
593 Engine


Petamo
2
Anti-seize lubricant
2
Anti-seize lubricant
Isoflex
9 N•m (80 lbf•in)
Loctite 243
4
Loctite 243
Isoflex
2
Petamo
Loctite 243
3
Anti-seize lubricant
Anti-seize lubricant
125 N•m (92 lbf•ft)
Petamo
Anti-seize lubricant
3
11 N•m (97 lbf•in)
Injection oil
Multi-purpose grease
5.5 N•m (49 lbf•in)
29 N•m (21 lbf•ft)
Loctite 5910
Loctite 648
Loctite 243
4.5 N•m (40 lbf•in)
Petamo grease
Loctite 648
29 N•m (21 lbf•ft)
9 N•m (80 lbf•in)
A29C2TT

593 HO Engine



593 HO SDI and 793 HO Engines



CLEANING

Discard all oil seals, gaskets, O-rings and sealing rings.

Clean all metal components in a non-ferrous metal cleaner. Use Loctite Chisel (P/N 413 708 500) accordingly.

Remove old paste gasket from crankcase mating surfaces using also Loctite Chisel.

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are harmful to crankcase sealing.

DISASSEMBLY

General

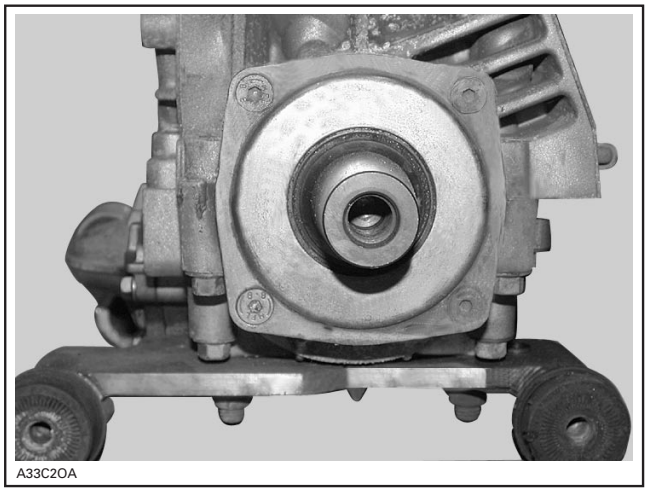
Remove cylinder head and cylinder. Refer to TOP END.

Remove rewind starter. Refer to REWIND STARTER.

Remove trigger coils, magneto flywheel and stator. Refer to MAGNETO SYSTEM.

593 HO, 593 SDI and 793 HO Engines

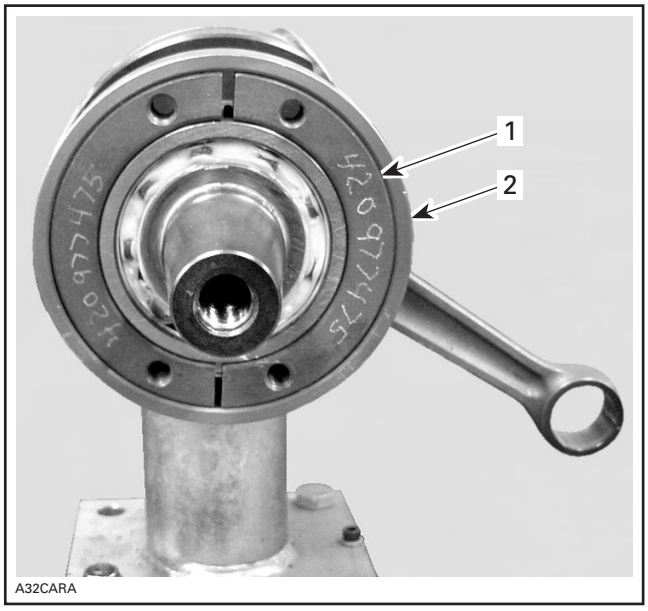
Remove oil seal cover no. 1.


A33C2OA

TYPICAL

Crankshaft Bearing

To remove bearings no. 2 and no. 3 from crankshaft no. 4, install half rings (P/N 420 977 479) and puller ring (P/N 420 977 494) on the outer bearing.



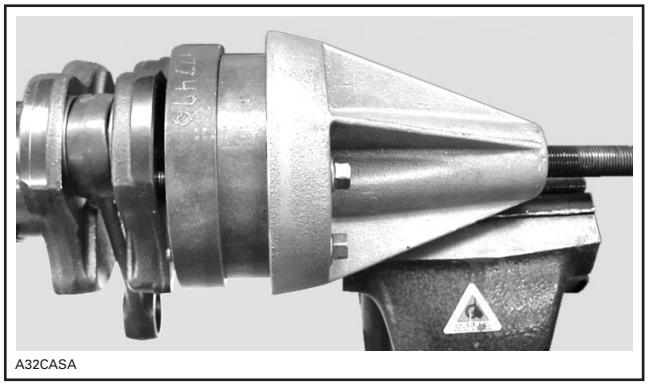
A32CARA

1. Half ring
2. Puller ring

NOTE: Apply grease on crankshaft end in order to hold in place the crankshaft protector (P/N 420 876 552) on PTO side and crankshaft protector (P/N 420 876 557) on MAG side.

Using screws (P/N 420 840 681), install bearing puller (P/N 420 877 635) on the half rings.

Secure the bearing puller in a vise by one of its rib.


A32CASA

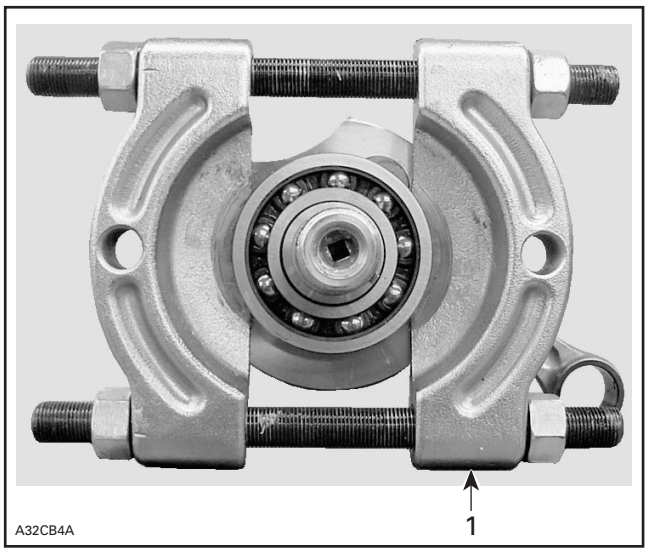
BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool for tightening the puller bolt. Lubricate the bolt with Bombardier Lube (P/N 293 600 016) to avoid damaging the threads.

Screw in the puller bolt until the bearing comes out.

Follow the same procedure for the inner bearing

NOTE: In the case of damaged bearing or less clearance between crankshaft counterbalance and the bearing or on the MAG side bearing, use a bearing separator such as Snap-On tool CJ 951 or SPX/OTC tool 1124 to facilitate the removal.



1. Bearing separator

INSPECTION

Refer to table below to find bottom end engine dimension specifications. For dimension measurement procedures, refer to ENGINE MEASUREMENT.

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Crankshaft deflection on PTO side	N.A.	0.06 mm (.0024 in)	N.A.
Crankshaft deflection on MAG side	N.A.	0.05 mm (.002 in)	N.A.
Crankshaft Deflection in center of crankshaft	N.A.	0.08 mm (.0031 in)	N.A.
Connecting rod big end axial play	0.39 mm (.015 in)	0.74 mm (.029 in)	1.20 mm (.047 in)
Crankshaft end-play	0.10 mm (.004 in)	0.30 mm (.012 in)	N.A.

ASSEMBLY

Coat lip of all seals with Petamo grease (P/N 420 899 271).

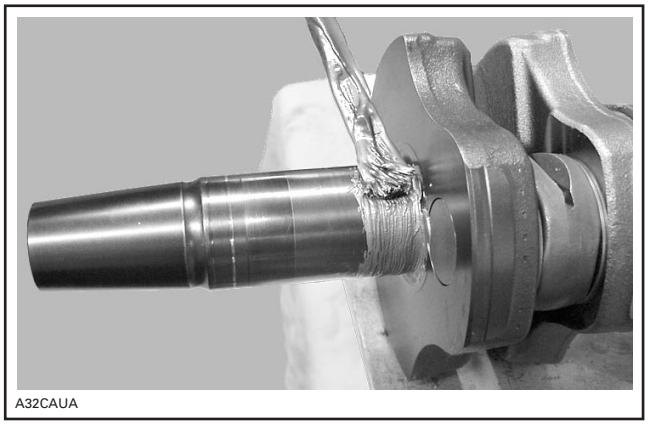
Crankshaft Preparation

Inspect crankshaft ends for damage.

Clean crankshaft ends with sand paper no. 180 to remove possible seal marks and debris.

Remove all residue using pulley flange cleaner (P/N 413 711 809).

Smear anti-seize lubricant (P/N 413 701 000) on part of crankshaft where bearing fits.


A32CAUA

Crankshaft Bearing Preparation

Heat up the bearing(s) using bearing heater (P/N 529 035 969). This will expand bearings and ease installation. If required, put a suitable plate or shim to avoid the direct contact between integrated seal with the heating surface.

A32CB7A

CAUTION: Bearing(s) should not be heated to more than 80°C (176°F). Do not heat bearing(s) on direct flame, or with a heat gun or in an oil bath. Inappropriate bearing(s) heating may result in inner seals or cage failure.

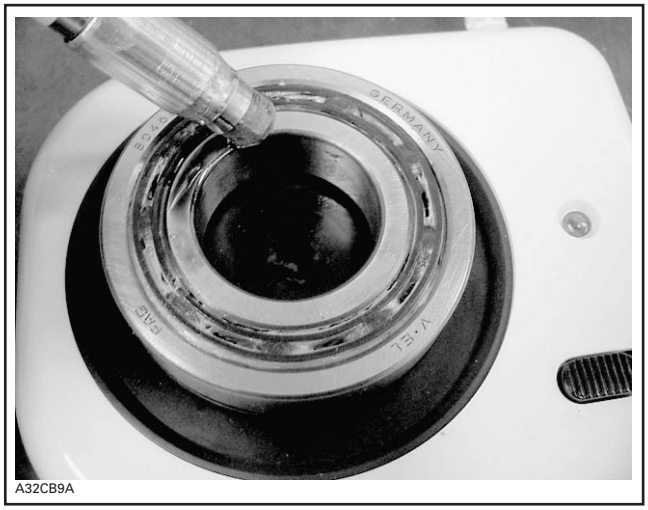
Turn bearing several times to obtain an even heating process.

NOTE: Normally it takes approximately 10 minutes to heat up a bearing so in the event of replacing bearing, it's recommended to start the bearing heating process prior to removal operation. Two bearings can be heated at the same time on one bearing heater.

A32CB8A

1. Bearings

Probe the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reach the proper temperature


A32CB9A

⚠ WARNING

Do not touch heated bearing with bare hands. Always wear heat resisting gloves before handling the heated bearing(s).

Crankshaft Bearing Installation

CAUTION: Never reinstall a bearing that has been removed.

Slide in the inner PTO bearing with the integrated seal facing crankshaft. Push bearing to end position.

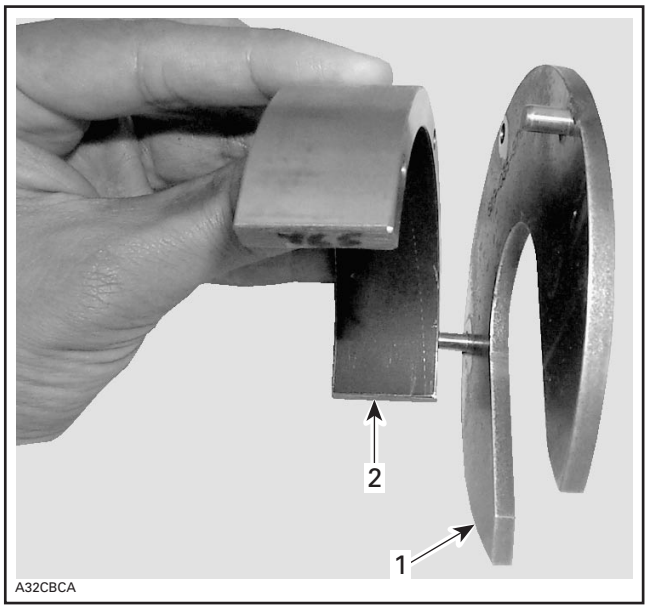
A32CAVA

NOTE: Heated bearings will slide onto the crankshaft. If required, push with a steel tube on the inner ring of the bearing. **Pay special attention to correct positioning of the drive pins and/or retaining discs.**

Install retaining discs.

Install support plate (P/N 529 035 976) with appropriate distance gauge; refer to following table.

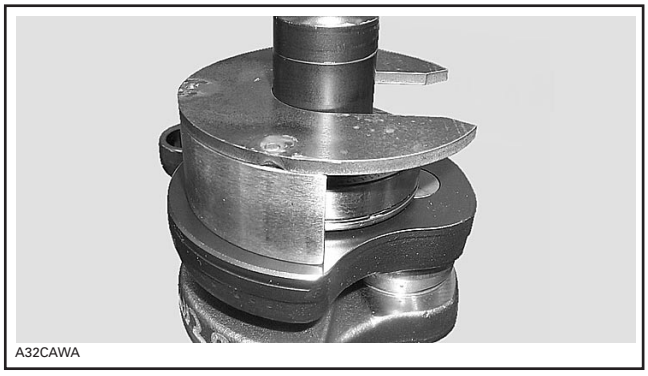
TOOL	ENGINE
Distance gauge (P/N 529 035 966)	593
Distance gauge (P/N 529 035 967)	593 HO
Distance gauge (P/N 529 035 968)	593 HO SDI and 793 HO



A32CBCA

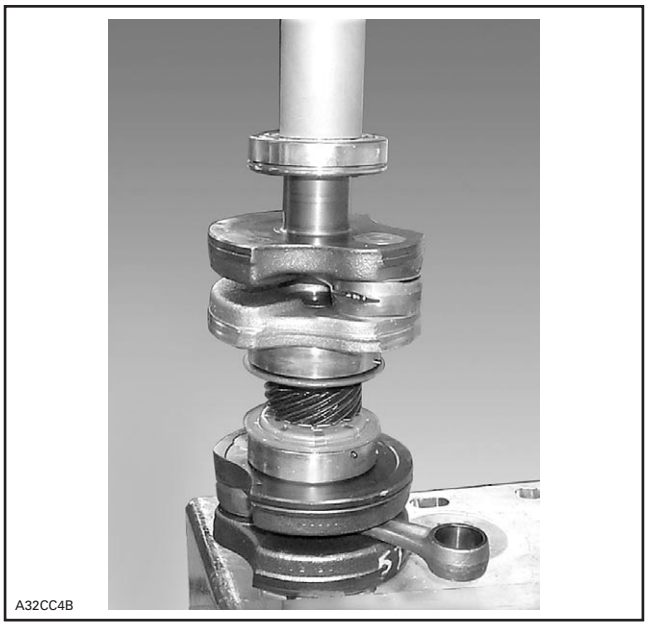
1. Support plate
2. Distance gauge

Install bearing locator tool.


A32CAWA

Slide in the heated outer PTO bearing onto the crankshaft until it contacts the distance gauge.

Slide-in the first MAG bearing **with the integrated seal facing crankshaft**. Push bearing to the bottom with pusher, using a rubber hammer.

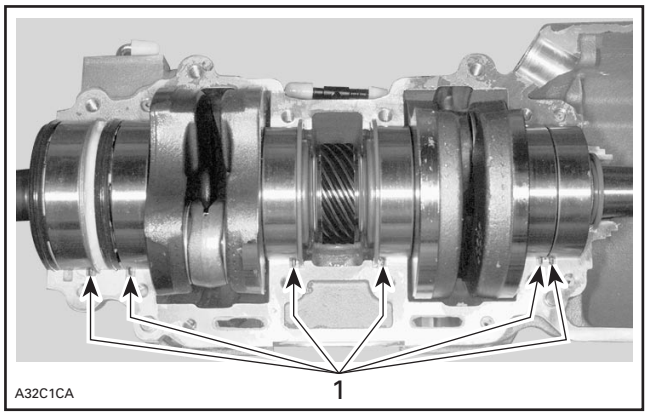

A32CC4B

Slide-in the second bearing until it contacts the first one.

A32CC5B

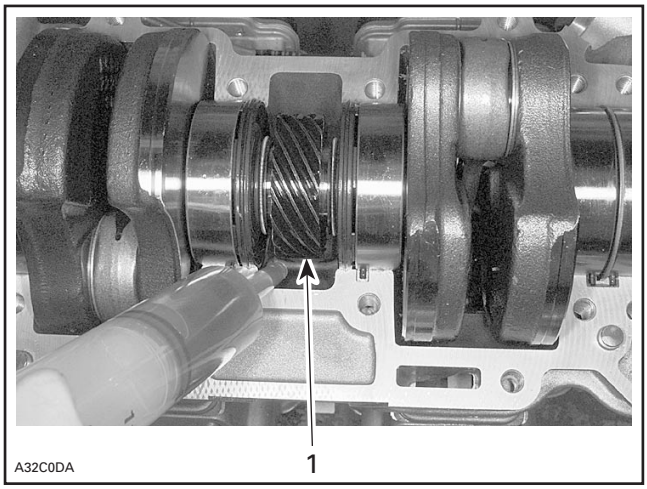
Crankshaft Installation

At crankshaft installation, position drive pins as illustrated.



TYPICAL
1. Position pins

Pour 50 mL (2 U.S. oz) of injection oil in the pan under central gear to lubricate pump gearing as per photo.



1. Oil bath

Apply Isoflex grease as per following procedure:

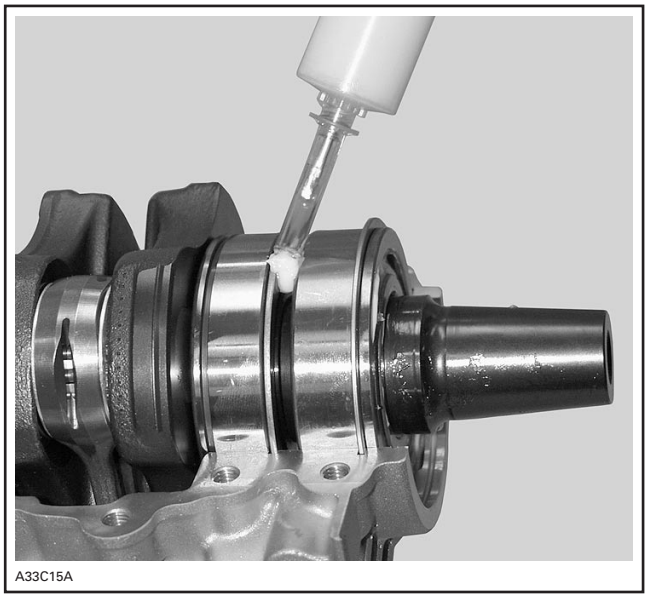
CAUTION: Use only the recommended Isoflex grease. Make sure not to push Isoflex grease between outside bearing race and half crankcase.

NOTE: The 50 g tube corresponds to 50 cc of grease.

Put 50 to 55 mL of grease in a syringe.

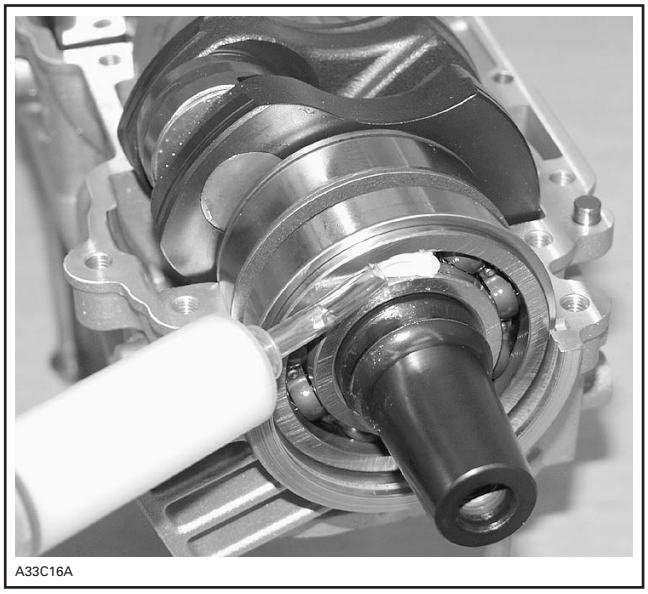
CAUTION: Do not exceed the recommended amount of grease

Fill inner side of PTO side bearing with Isoflex grease (about 10 mL).

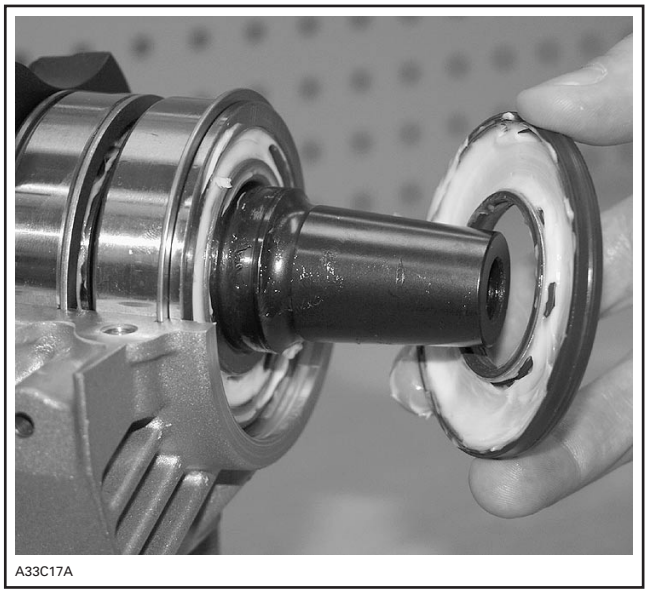

A33C15A

PTO SIDE BEARING FILLED WITH ISOFLEX GREASE

With the syringe, fill the outer ball bearing and inner side of outer seal with 40 to 45 mL of Isoflex grease.


A33C16A

BALLS COATED WITH A SEAM OF GREASE


A33C17A

TYPICAL — FILL WITH GREASE AND SET IN PLACE

Apply 6 mL of grease to MAG side outer bearing.

NOTE: If replaced with new bearing, do not apply grease as new bearings come with grease already applied.

Crankcase Assembly

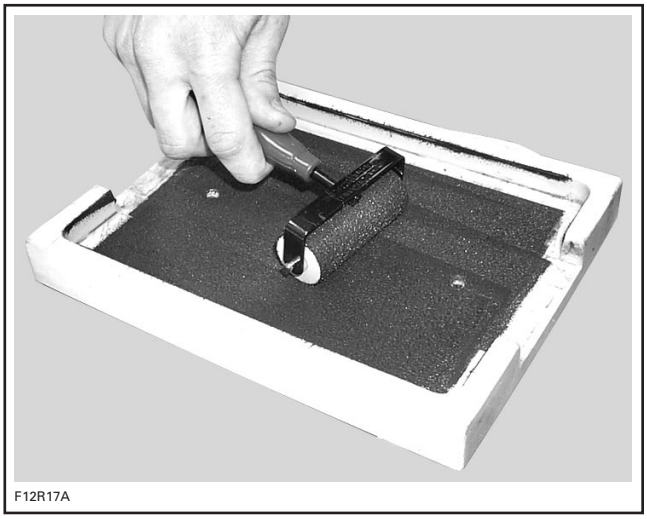
IMPORTANT: The total assembly sequence, including sealing compound spreading, screwing and torquing of bolts according to the proper sequence, must be performed within 10 minutes. Do not wait between each bolt torquing. All bolts must be torqued in a row.

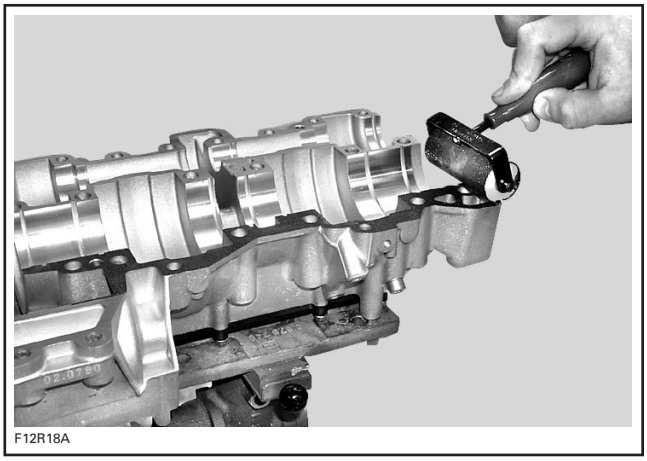
Before screwing both parts of crankcase, seal it with a Loctite 5910 (P/N 293 800 081).

NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant.

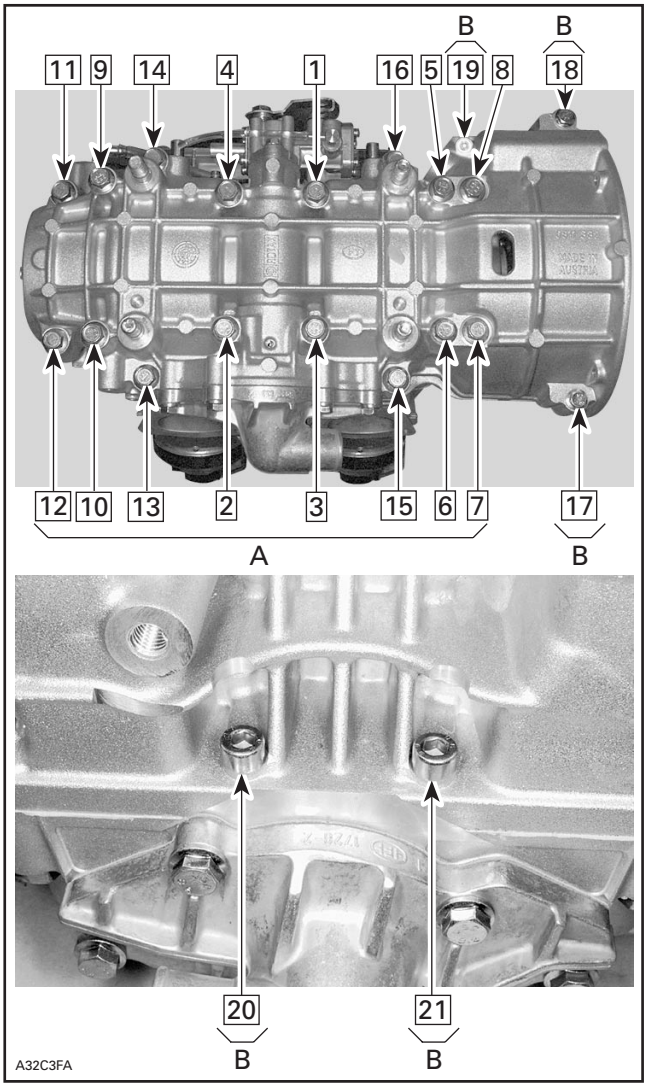
CAUTION: Do not use Loctite Primer N with the Loctite 5910. Using these products or non silicone-based sealant over a previously sealed crankcase with Loctite 5910 will lead to poor adhesion and possibly a leaking crankcase. These products are chemically incompatibles. Even after cleaning, the Loctite 5910 would leave incompatible microscopic particles.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.


F12R17A


F12R18A

Screw all crankcase bolts in place in the following sequence and to the appropriate torque; this must be done in two steps torquing: first, screw bolts up to 60% of the final torque (18 N•m (13.5 lbf•ft) for most of the bolts), then, tighten to the required torque (i.e. 29 N•m (21 lbf•ft)).



A. Torque bolts 1 through 16 to 29 N•m (21 lbf•ft)
*B. Torque bolts 17 through 21 to 9 N•m (80 lbf•**in**)*

593 HO, 593 HO SDI and 793 HO Engines

Install oil seal cover.

BREAK-IN

After rebuilding an engine, always observe a break-in period as described in *Operator's Guide*.

ENGINE MEASUREMENT

SERVICE TOOLS

Description	Part Number	Page
degree wheel	529 035 607	134
TDC gauge	414 104 700	130, 134

NOTE: This subsection explains the procedures to correctly measure engine components. For the engine technical specifications, refer to INSPECTION in the appropriate engine subsection.

CYLINDER HEAD WARPAGE

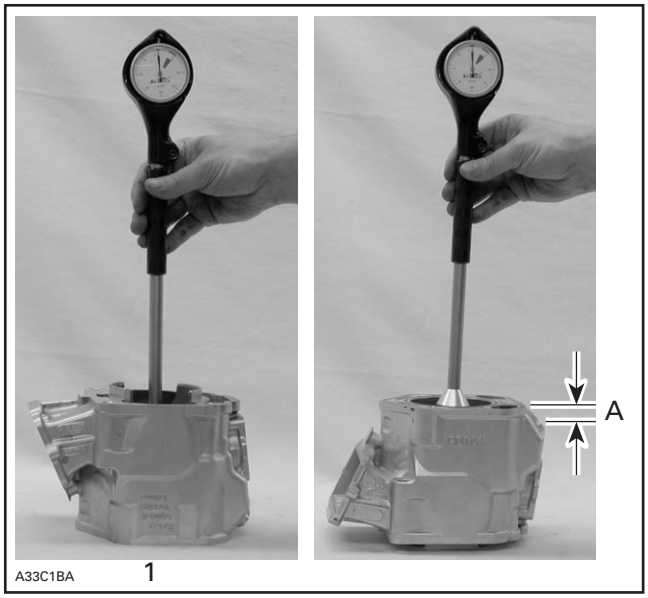
Check gasketed surface of the cylinder head with a straightedge and a feeler gauge. Make sure part is within the given specification. If cylinder head is out of specification, replace it. Verify combustion chamber volume to use the correct cylinder base gasket with the new part.

CYLINDER TAPER

Compare cylinder diameter 16 mm (5/8 in) from top of cylinder to just below its intake port area.

If the difference exceeds the specified dimension the cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but can not be rebored.

NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.

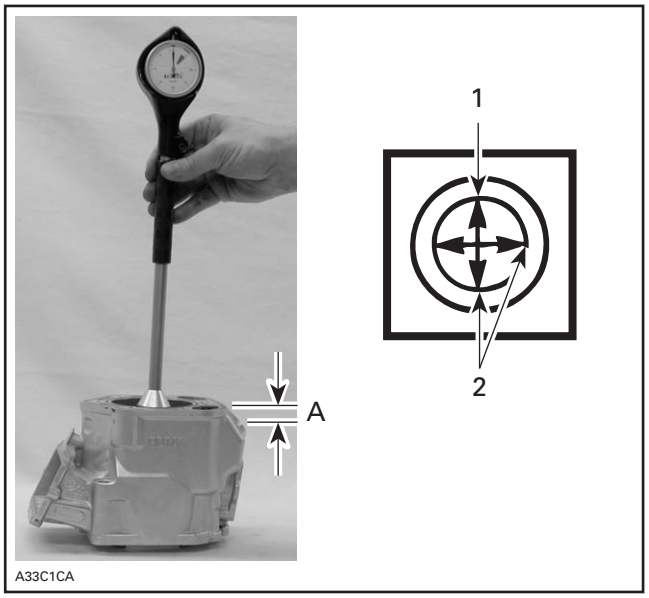


1. Below the intake port
A. 16 mm (5/8 in) from top

CYLINDER OUT OF ROUND

Measuring 16 mm (5/8 in) from top of cylinder with a cylinder gauge, check if the cylinder out of round is more than the specified dimension. If larger, cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but cannot be rebored.

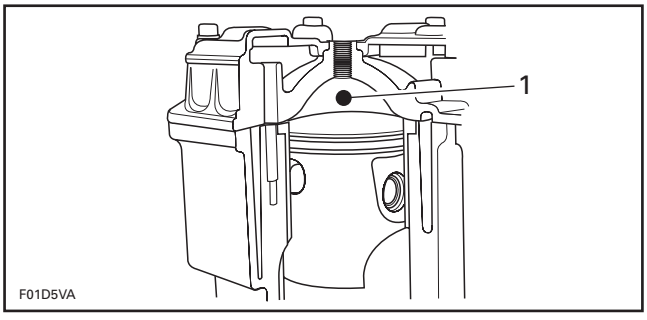
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



1. Piston pin position
2. Measures to be compared
A. 16 mm (5/8 in)

COMBUSTION CHAMBER VOLUME MEASUREMENT

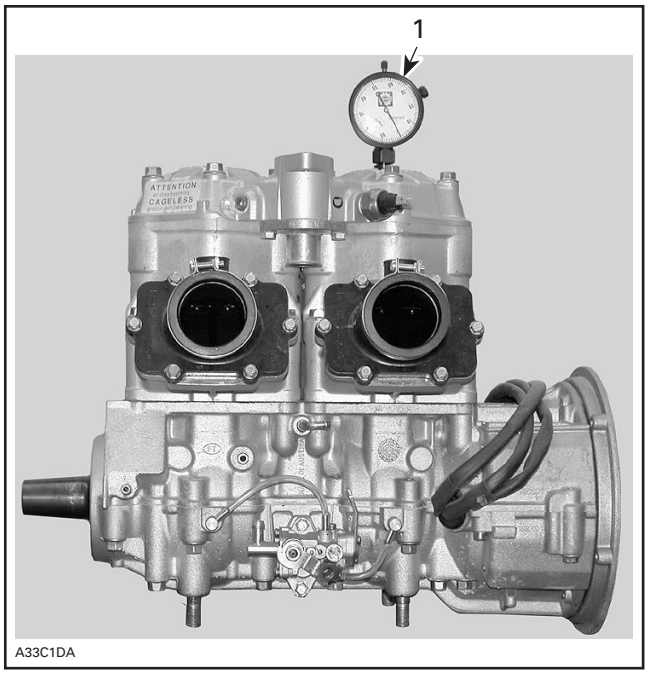
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center. It is measured with the cylinder head installed on the engine.



1. Combustion chamber

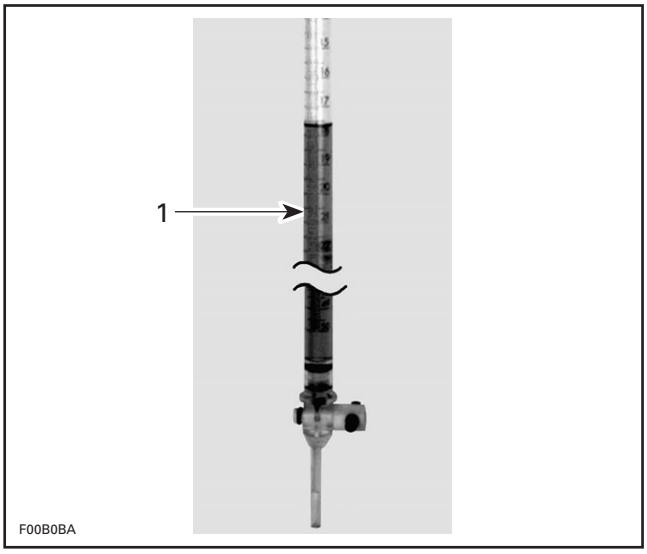
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposits and cylinder head must be leveled.

– Remove both spark plugs and bring one piston to Top Dead Center a using a TDC gauge (P/N 414 104 700).



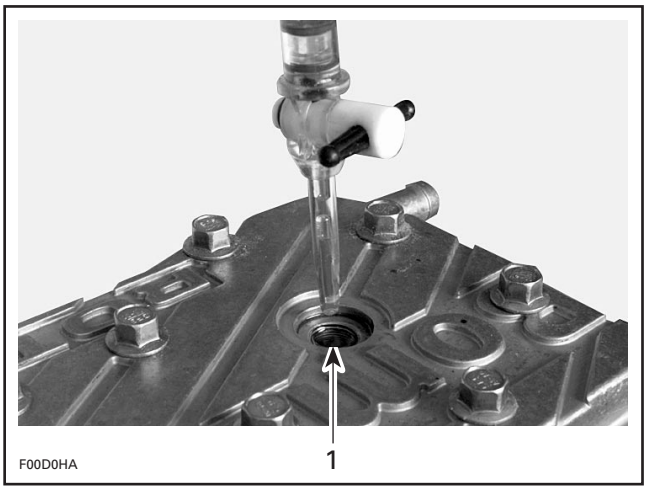
1. Bring piston to TDC

– Obtain a graduated burette (capacity 0 - 50 cc) and fill with an equal part (50/50) of gasoline and injection oil.



1. Graduated burette (0 - 50 cc)

– Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.
– Inject the burette content through the spark plug hole until liquid touches the top spark plug hole.



1. Top of spark plug hole

NOTE: The liquid level in cylinder must not drop for a few seconds after filling. If so, there is a leak between piston and cylinder. The recorded volume would be false.

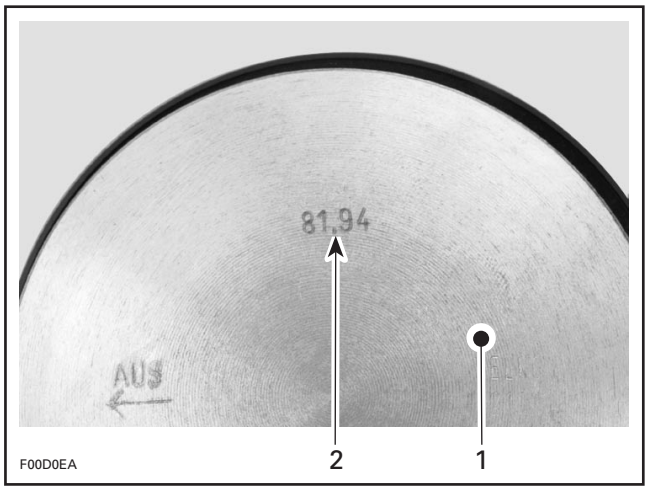
– Let burette stand upward for about 10 minutes, until liquid level is stabilized.
– Read the burette scale to obtain the quantity of liquid injected in the combustion chamber.

NOTE: When the combustion chamber is filled to top of spark plug hole, it includes an amount of 2.25 cc corresponding to the spark plug well.

– Repeat the procedure for the other cylinder.
– Install a thicker or thinner cylinder/crankcase gasket (refer to *Parts Catalogs*) in order to obtain the specified combustion chamber volume or the nearest.

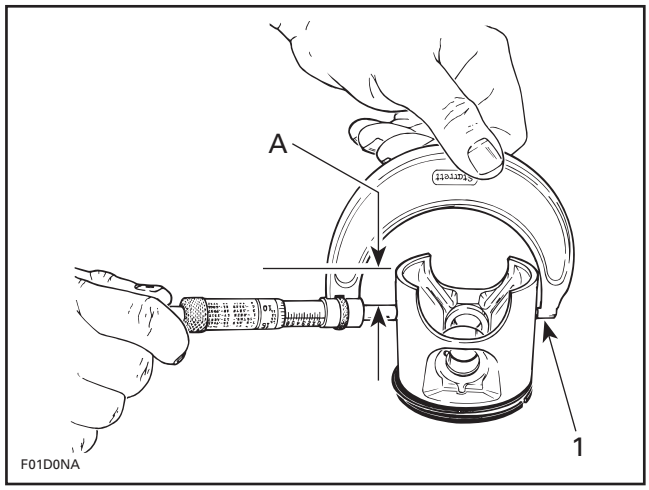
USED PISTON MEASUREMENT

Note the measurement on the piston dome.



1. Piston dome
2. Piston measurement

Using a micrometer, measure piston skirt at 15 mm (.590 in) perpendicularly (90°) to piston pin.



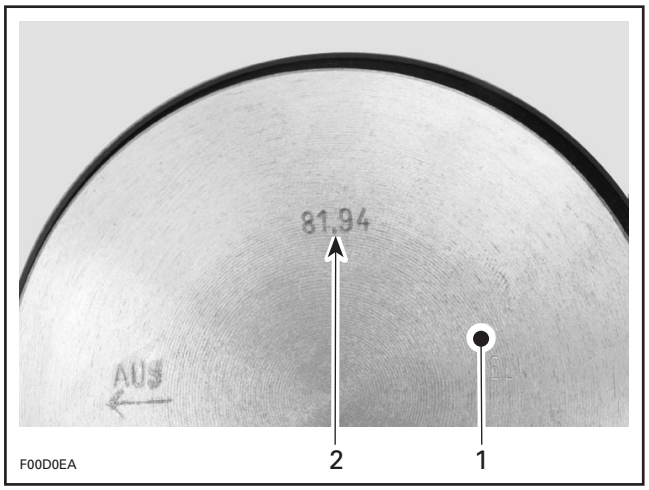
1. Measuring perpendicularly (90°) to piston pin axis
A. 15 mm (.590 in)

CYLINDER/PISTON CLEARANCE

Used and New Pistons

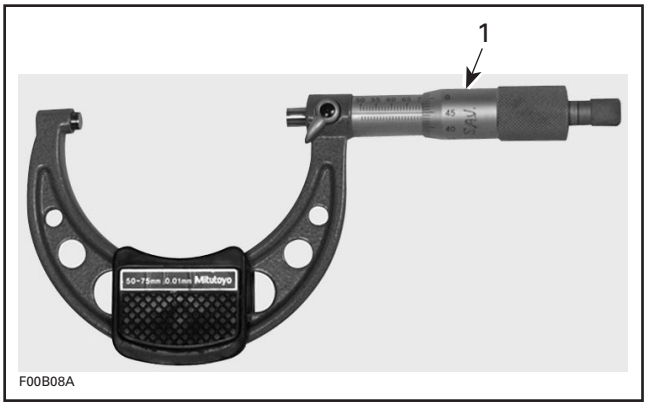
IMPORTANT: Make sure used piston is not worn more than specified. See USED PISTON MEASUREMENT above.

Take the measurement on the piston dome.



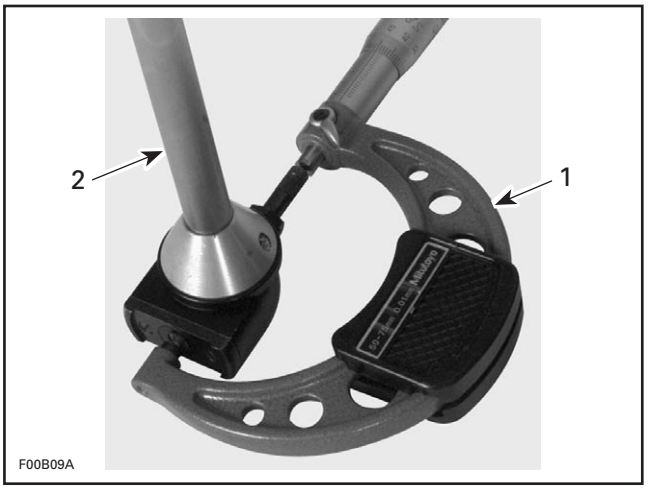
1. Piston dome
2. Piston measurement

Adjust and lock a micrometer to the specified value on the piston dome.

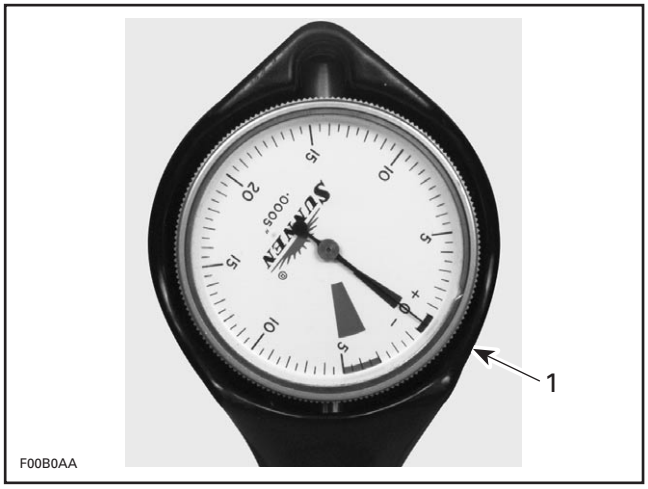


1. Micrometer set to the piston dimension

With the micrometer set to the piston dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0.



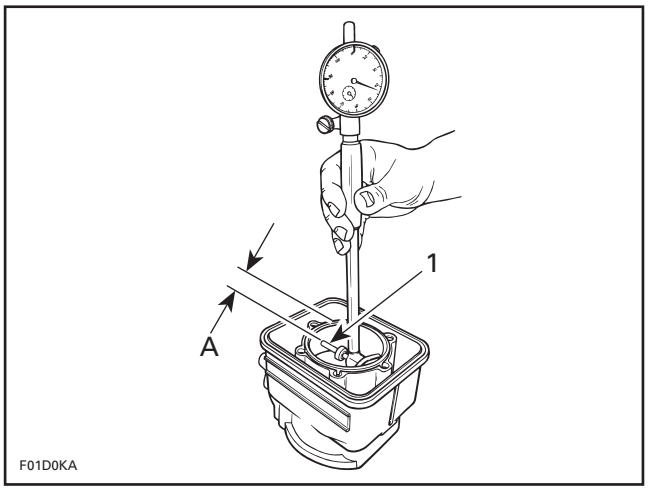
1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



1. Indicator set to 0 (zero)

IMPORTANT: Always remove cylinders from crankcase before measuring.

Position the dial bore gauge at 16 mm (5/8 in) below cylinder top edge.



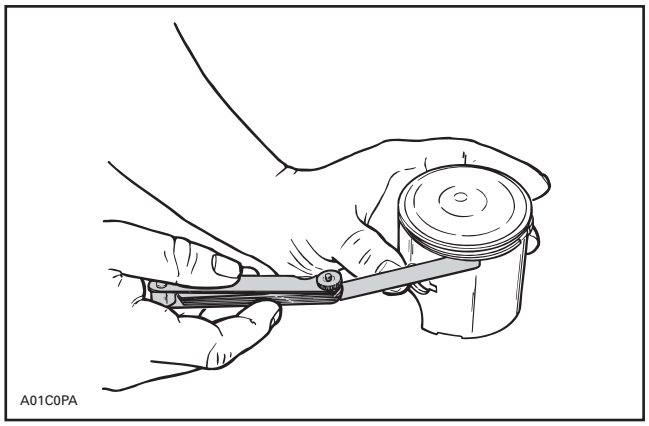
1. Measuring perpendicularly (90°) to piston pin axis
A. 16 mm (5/8 in)

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance. If clearance exceeds specified tolerance, replace cylinder or rebore and install oversize piston depending on engine.

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

RING/PISTON GROOVE CLEARANCE

Using a feeler gauge check clearance between rectangular ring and groove. Replace piston if clearance exceeds specified tolerance.

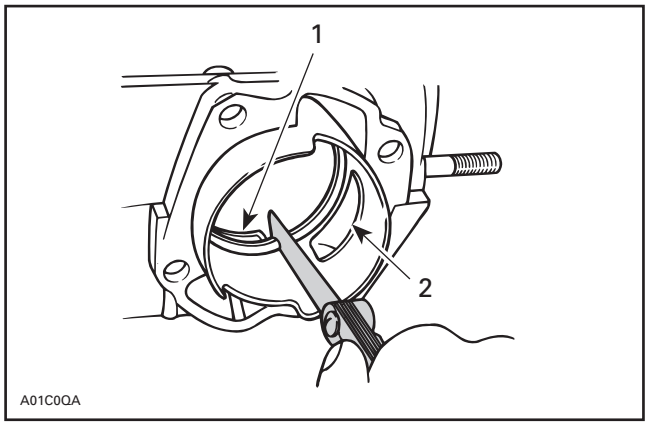


RING END GAP

Position ring half-way between transfer ports and intake port.

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds specified tolerance.



1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

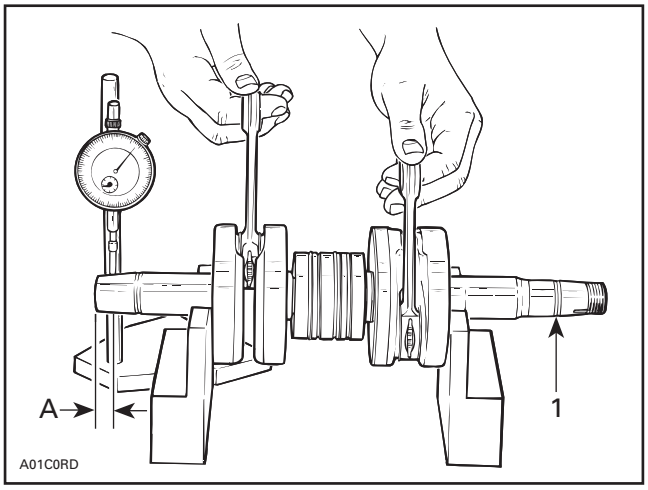
Crankshaft deflection is measured with a dial indicator.

Measuring (in crankcase)

First, check deflection with crankshaft in crankcase. If deflection exceeds the specified tolerance, recheck deflection using V-shaped blocks to determine the defective part(s). See below.

Measuring (on bench)

Once engine is disassembled, check crankshaft deflection on V-shaped blocks. If deflection exceeds the specified tolerance, it can be worn bearings or a bent crankshaft. Remove crankshaft bearings and check deflection again on V-shaped blocks to determine the defective part(s). See measurement A in following illustration.



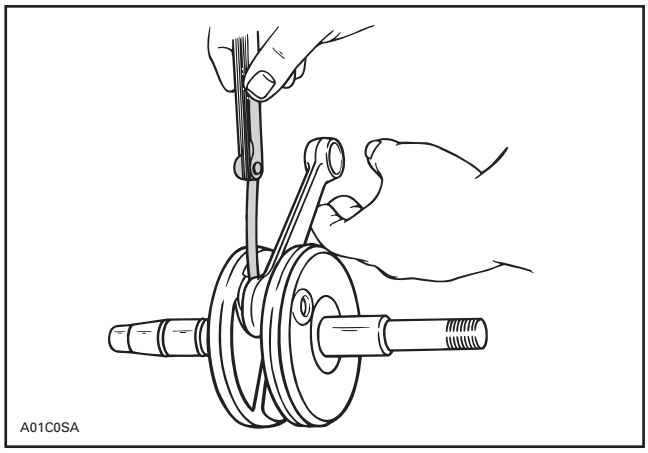
TYPICAL
1. Measure at mid point between the key and the first thread
A. 3 mm (1/8 in)

NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

If the deflection exceeds the specified tolerance, crankshaft should be repaired or replaced.

CONNECTING ROD BIG END AXIAL PLAY

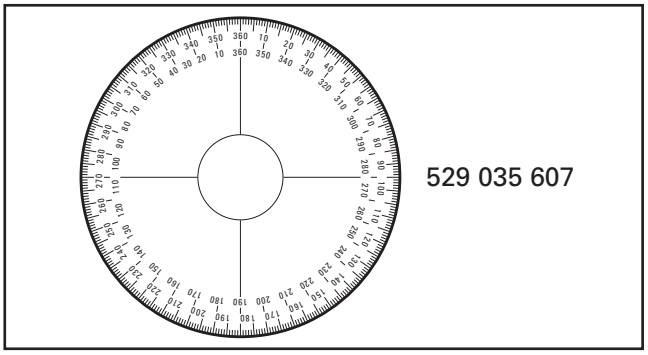
Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight. If the distance exceeds specified tolerance, repair or replace the crankshaft.



TYPICAL

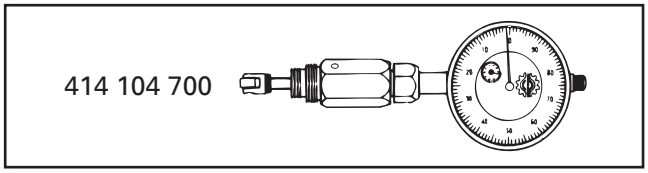
CHECKING CRANKSHAFT ALIGNMENT

Install a degree wheel (P/N 529 035 607) on crankshaft end.



Remove both spark plugs.

Install a TDC gauge (P/N 414 104 700) in spark plug hole on MAG side.

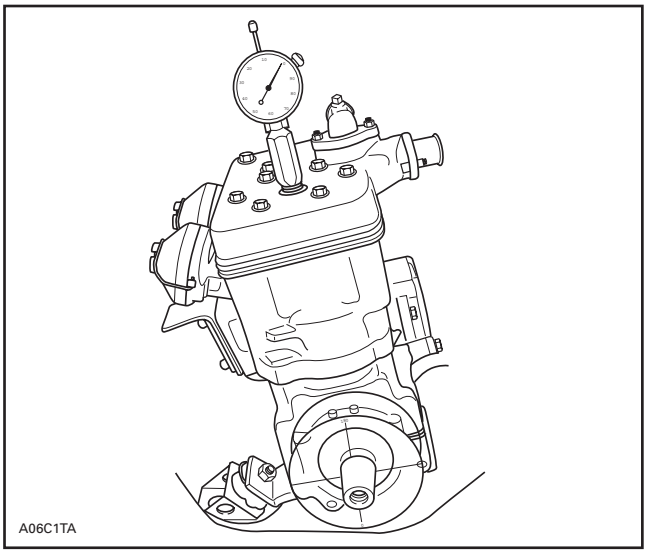


Bring MAG piston at top dead center.

Rotate degree wheel (not crankshaft) so that 360° mark aligns with center of crankcase. Scribe a mark on crankcase.

Remove TDC gauge and install it on center cylinder.

Bring PTO piston to top dead center. Degree wheel must rotate with crankshaft.



TYPICAL

Interval between cylinders must be 180° ± 0.5.

Any other reading indicates a misaligned (twisted) crankshaft.

COOLING SYSTEM

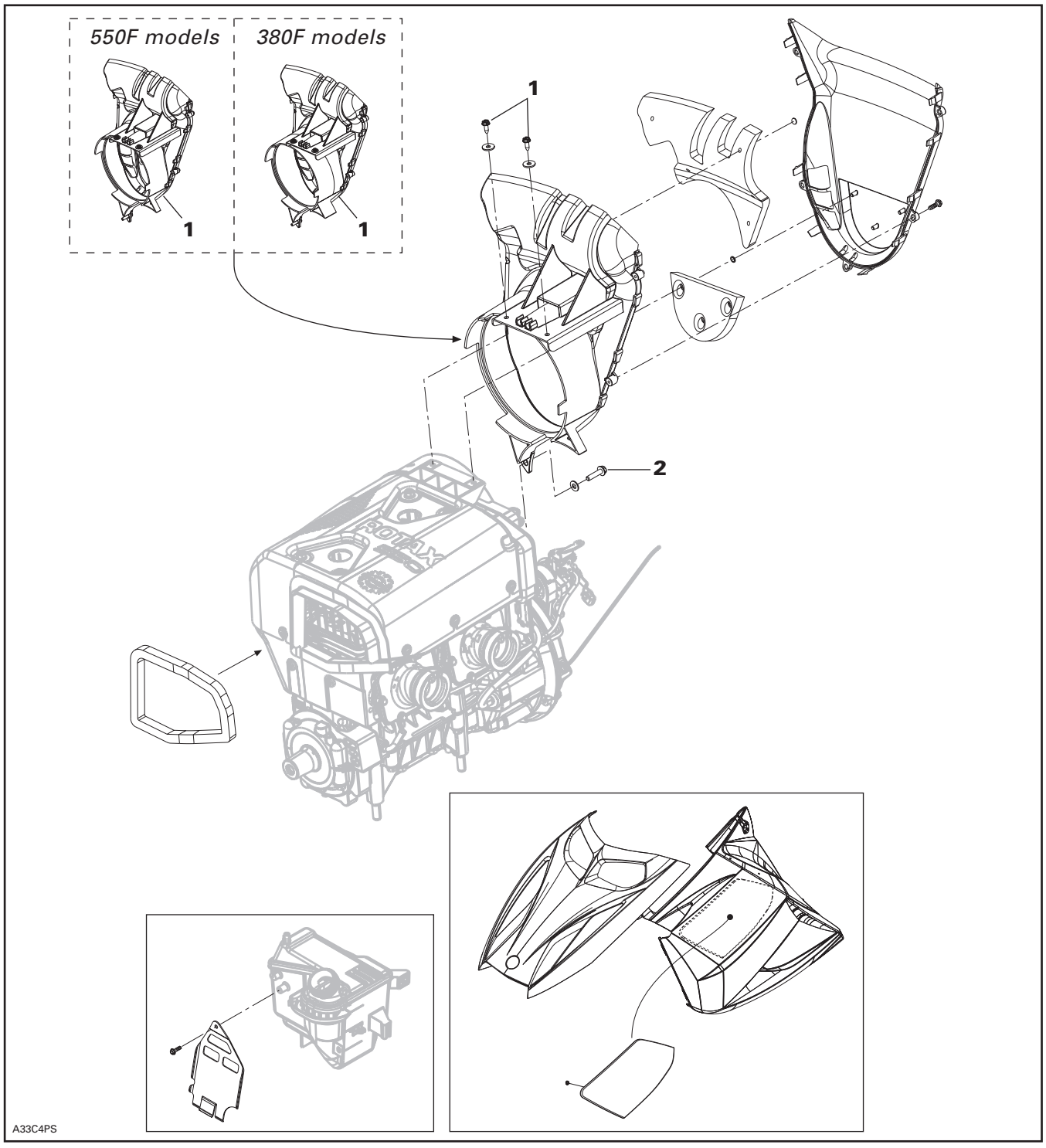
SERVICE TOOLS

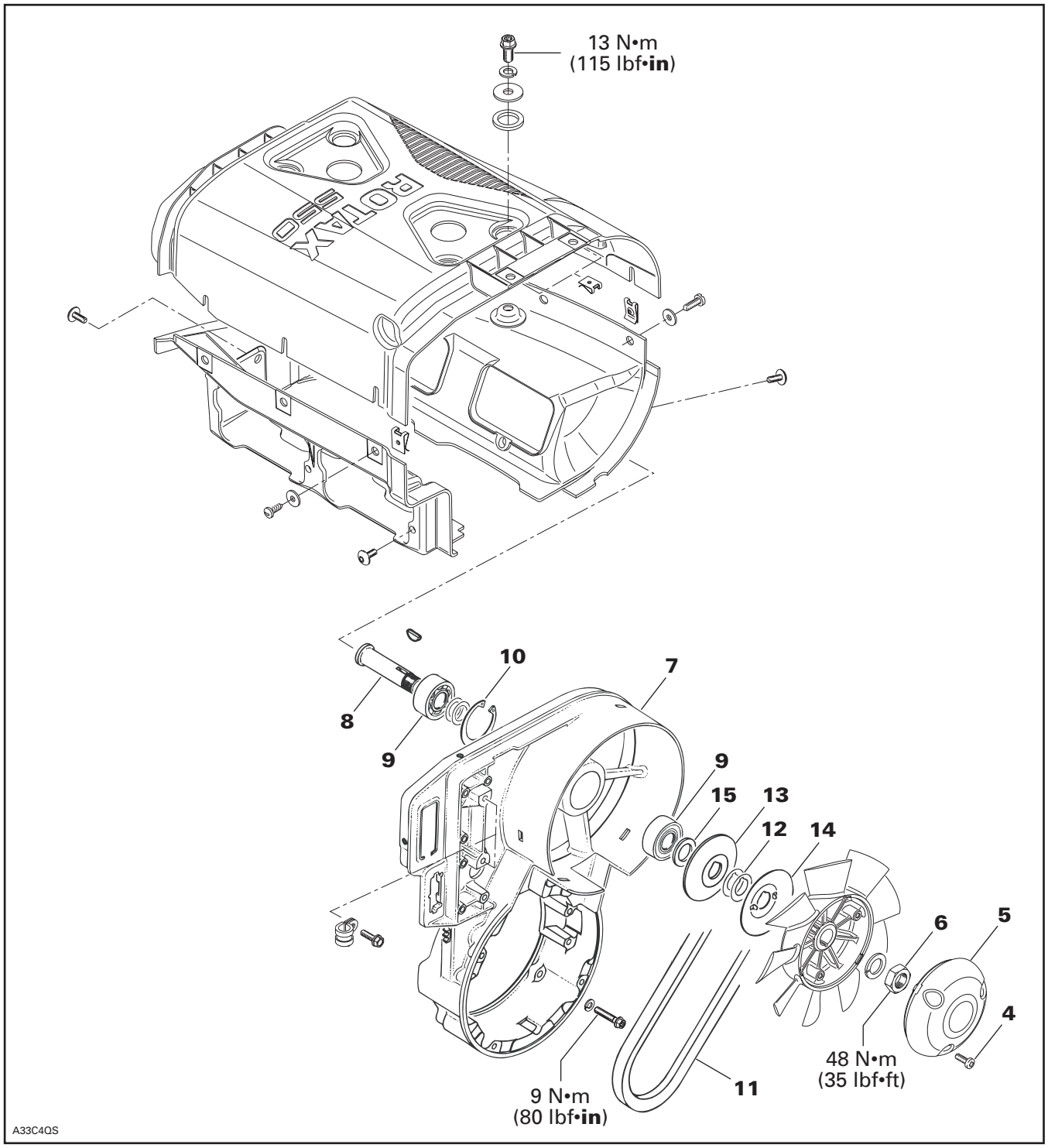
Description	Part Number	Page
engine leak tester kit	861 749 100	145
Holder wrench	420 876 357	138
Holder wrench	529 036 006	138
hose pincher	295 000 076	145
siphon tool	529 035 880	145
special radiator cap	529 021 400	145
Supertanium™ bit	529 031 800	145

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 592	293 800 018	145
PREMIXED COOLANT	293 600 038	146

Axial Fan Cooling System

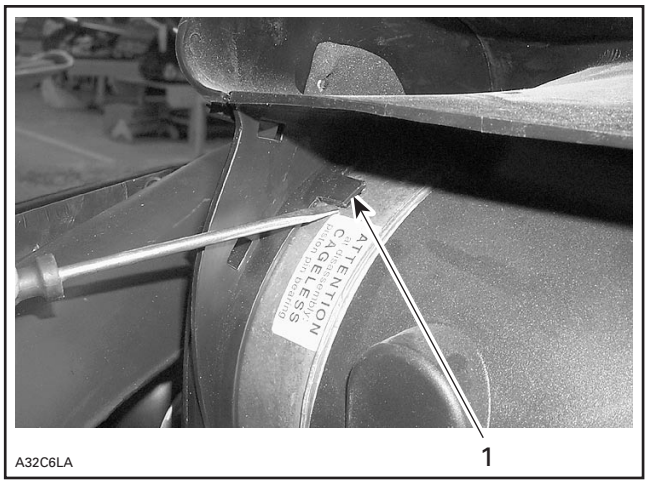



13 N•m
(115 lbf•**in**)
10
7
8
9
9
15
13
12
14
6
5
4
48 N•m
(35 lbf•ft)
11
9 N•m
(80 lbf•**in**)
A33C4QS

COOLING FAN REMOVAL AND INSTALLATION

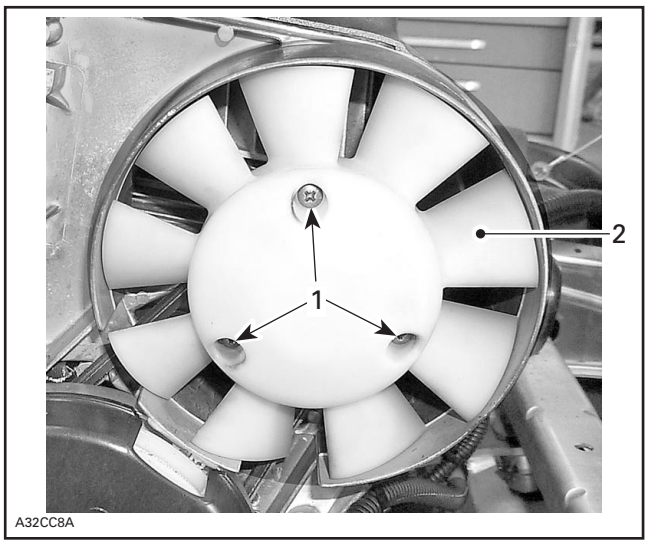
Remove the tuned pipe to gain access. Refer to EXHAUST SYSTEM.

Unscrew the 2 screws **no. 1** and **no. 2** of inlet duct **no. 3**. Remove the inlet duct by unclipping the tabs using a flat screwdriver from the engine fan housing.



TYPICAL
1. Tab

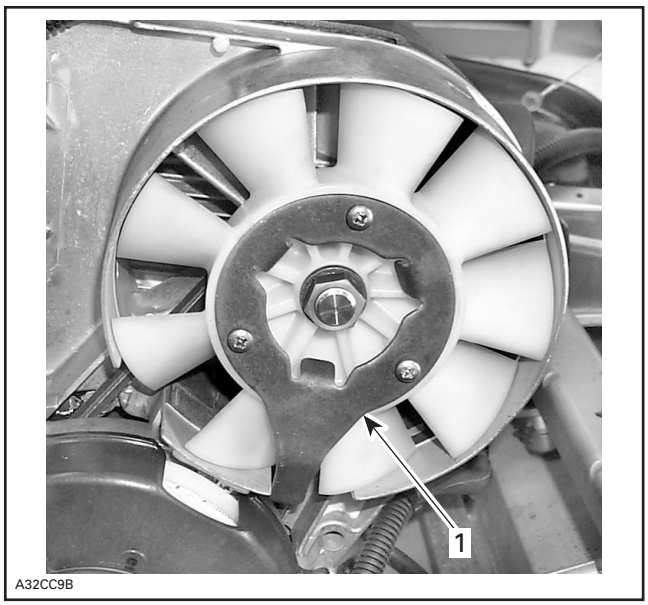
Unscrew the screws **no. 4** to remove the fan cover **no. 5**.



1. Screws
2. Cover

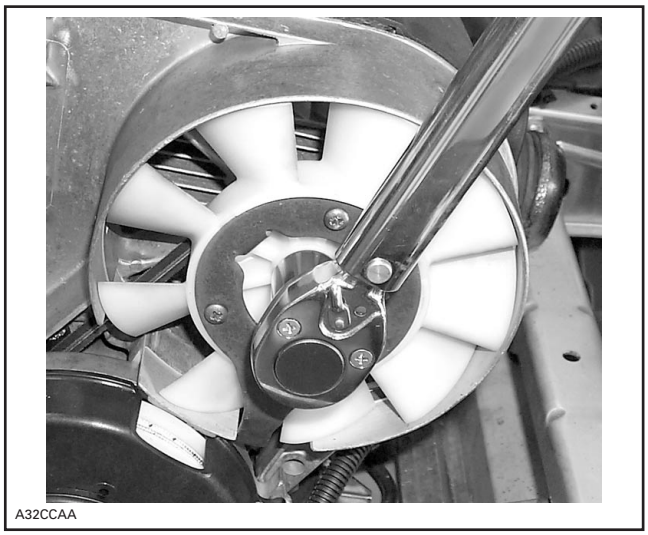
To remove or install fan pulley retaining nut **no. 6**, lock fan pulley with special holder wrench and 3 screws as per following table:

ENGINE	TOOL
377	Holder wrench (P/N 420 876 357)
552	Holder wrench (P/N 529 036 006)



1. Holder wrench

At assembly, torque nut **no. 6** to 48 N•m (35 lbf•ft).



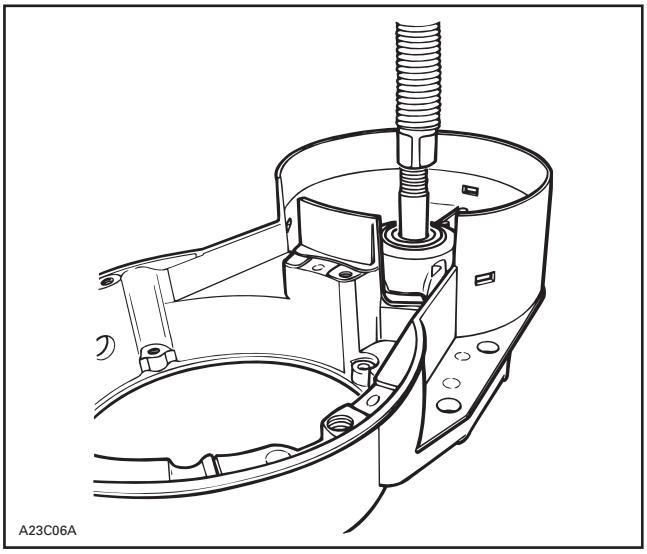
TYPICAL

COOLING FAN BEARING REPLACEMENT

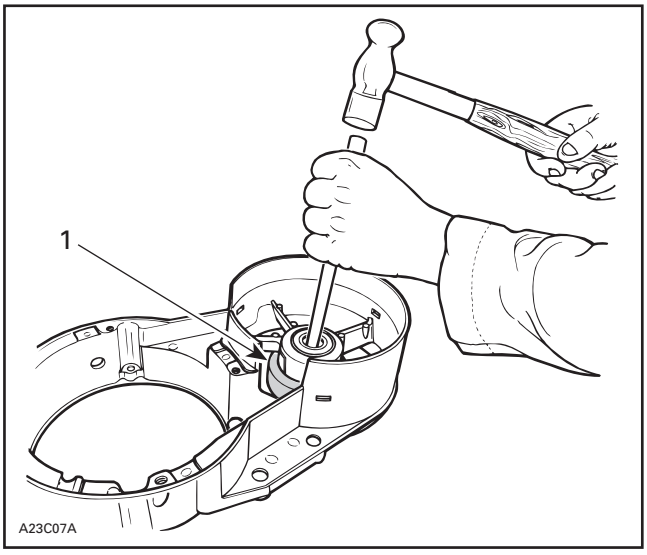
Remove cooling fan as explained in this section.

Remove support fan housing **no. 7**. Refer to TOP END and MAGNETO SYSTEM.

Using a press, drive the fan shaft **no. 8** out.



Support fan housing **no. 7** with a ring. With a punch, working all around bearing **no. 9** inner race, drive bearing out of fan housing. Keep shims for installation.



1. Ring supporting fan housing

Remove circlip **no. 10** then remaining bearing.

To install, press one bearing in place then install circlip and shims. Press the other bearing from opposite side until it is flush with housing. Press fan shaft from engine side of fan housing. Check for free rolling action.

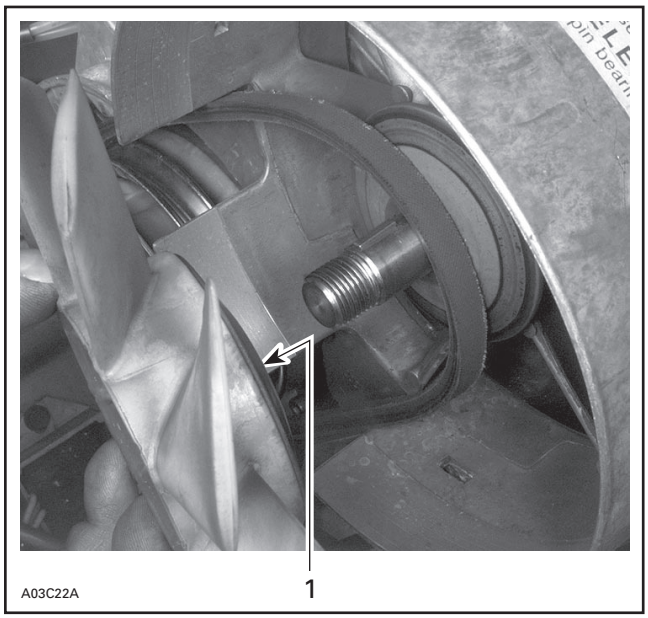
FAN BELT REPLACEMENT AND DEFLECTION ADJUSTMENT

Remove tuned pipe and muffler. Refer to EXHAUST SYSTEM.

Remove rewind starter and oil pump with gear case. Refer to REWIND STARTER.

Remove cooling fan as explained in this section.

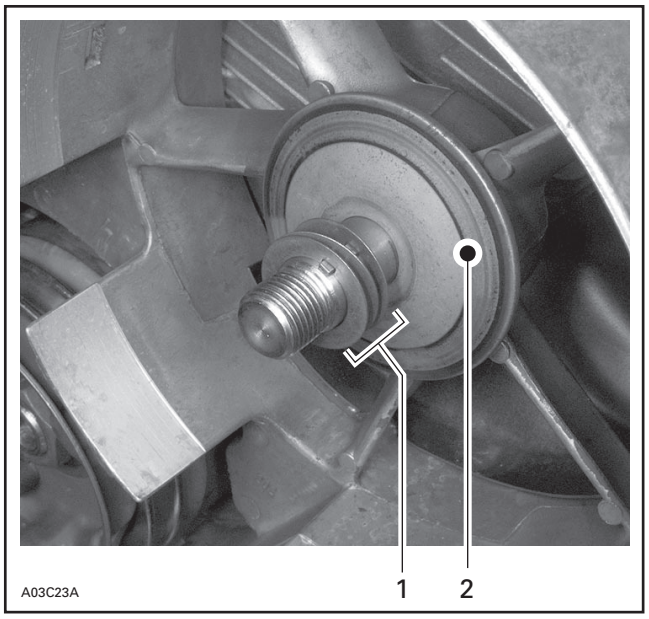
Remove pulley half.



1. Fan with pulley half

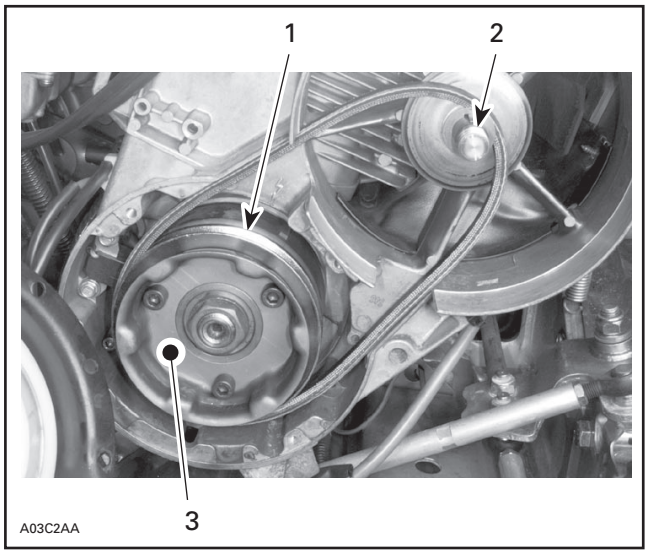
Remove fan belt **no. 11**.

Leave shims and second half pulley in place. Refer to the following photo.



1. Keep shims
2. Leave second half pulley in place

Install new fan belt on bottom pulley first then position onto fan shaft, as shown in the next photo.



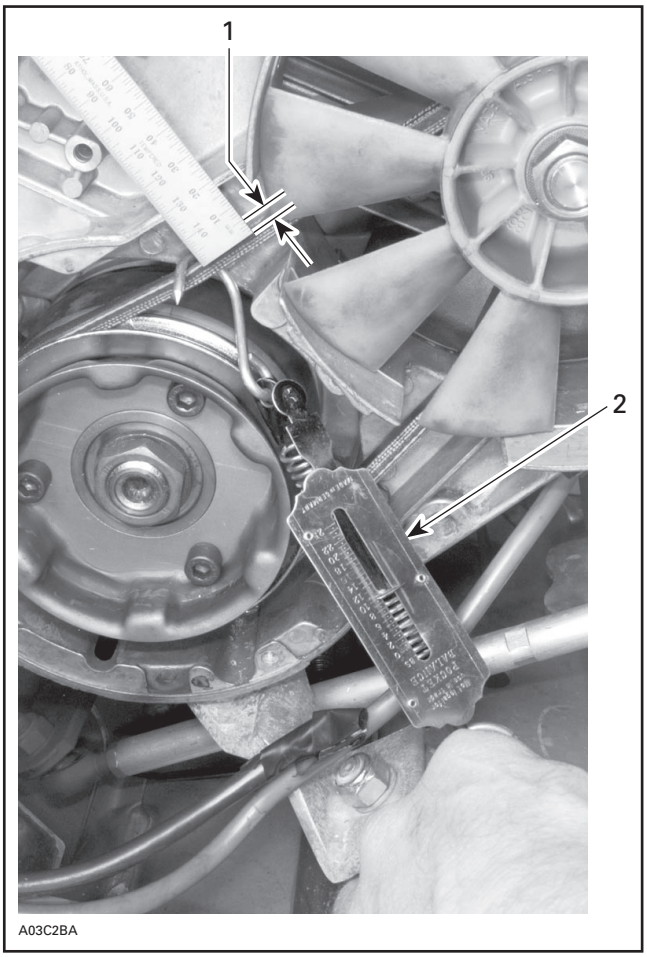
FAN BELT PROPERLY INSTALLED ON BOTTOM PULLEY AND FAN SHAFT
1. Bottom pulley
2. Fan shaft
3. Starting pulley

Reinstall fan assembly on fan shaft. Temporarily tighten fan nut.

CAUTION: When reinstalling fan assembly, ensure that key is properly positioned into fan shaft keyway.

Fan Belt Deflection Adjustment

Check fan belt deflection using a ruler and a fish scale positioned midway between pulleys as per following photo.

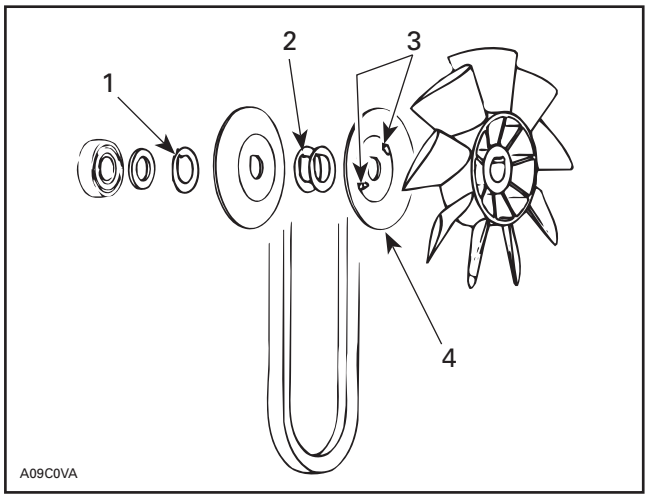


TYPICAL
1. Measure deflection here
2. Fish scale

Belt deflection must be according to the following specifications:

ENGINE	BELT DEFLECTION	FORCE APPLIED
377 and 552	9.5 mm (3/8 in)	5 kg (11 lb)

To adjust deflection tension, add or remove shim(s) **no. 12** between pulley halves **no. 13** and **no. 14**. Install excess shim(s) between distance sleeve **no. 15** and pulley half **no. 13** (housing side).



TYPICAL

1. *Unused shim(s) here*
2. *Adjust here*
3. *Positioning noses*
4. *Some engines only*

Select pulley halves so that the one with 2 positioning noses will be on fan side. Ensure to insert these noses into fan notches.

Once fan belt is properly adjusted, torque fan nut to 48 N•m (35 lbf•ft) using holder wrench, as shown in the following photo.

TYPICAL — TORQUE FAN NUT USING HOLDER WRENCH

Finalizing Reassembly

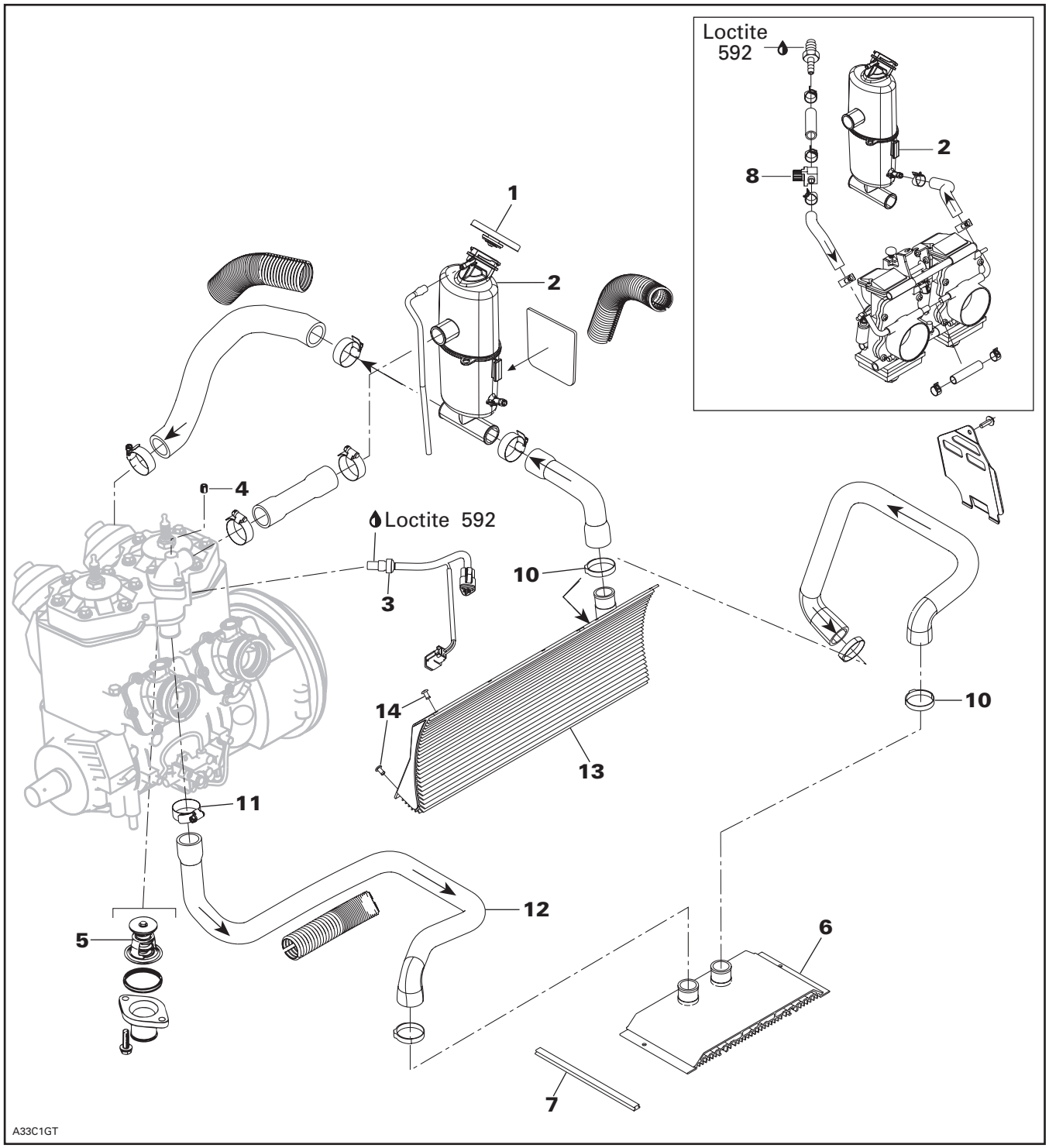
Reinstall rewind starter and oil pump with gear case. Refer to REWIND STARTER.

Install the air inlet duct **no. 3** with screws **no. 1** and **no. 2**.

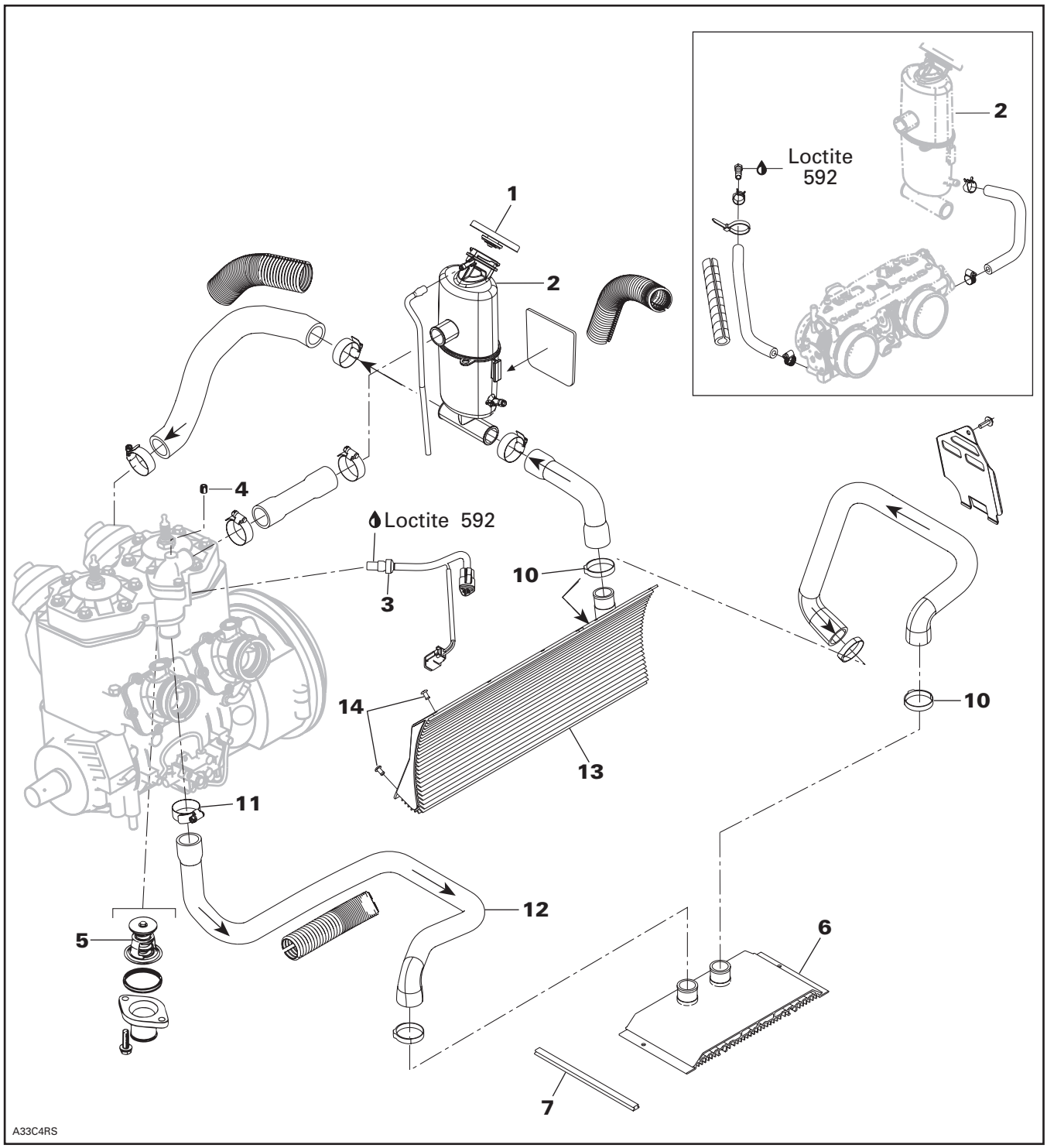
Reinstall tuned pipe and muffler. Refer to EXHAUST SYSTEM.

LIQUID COOLING SYSTEM

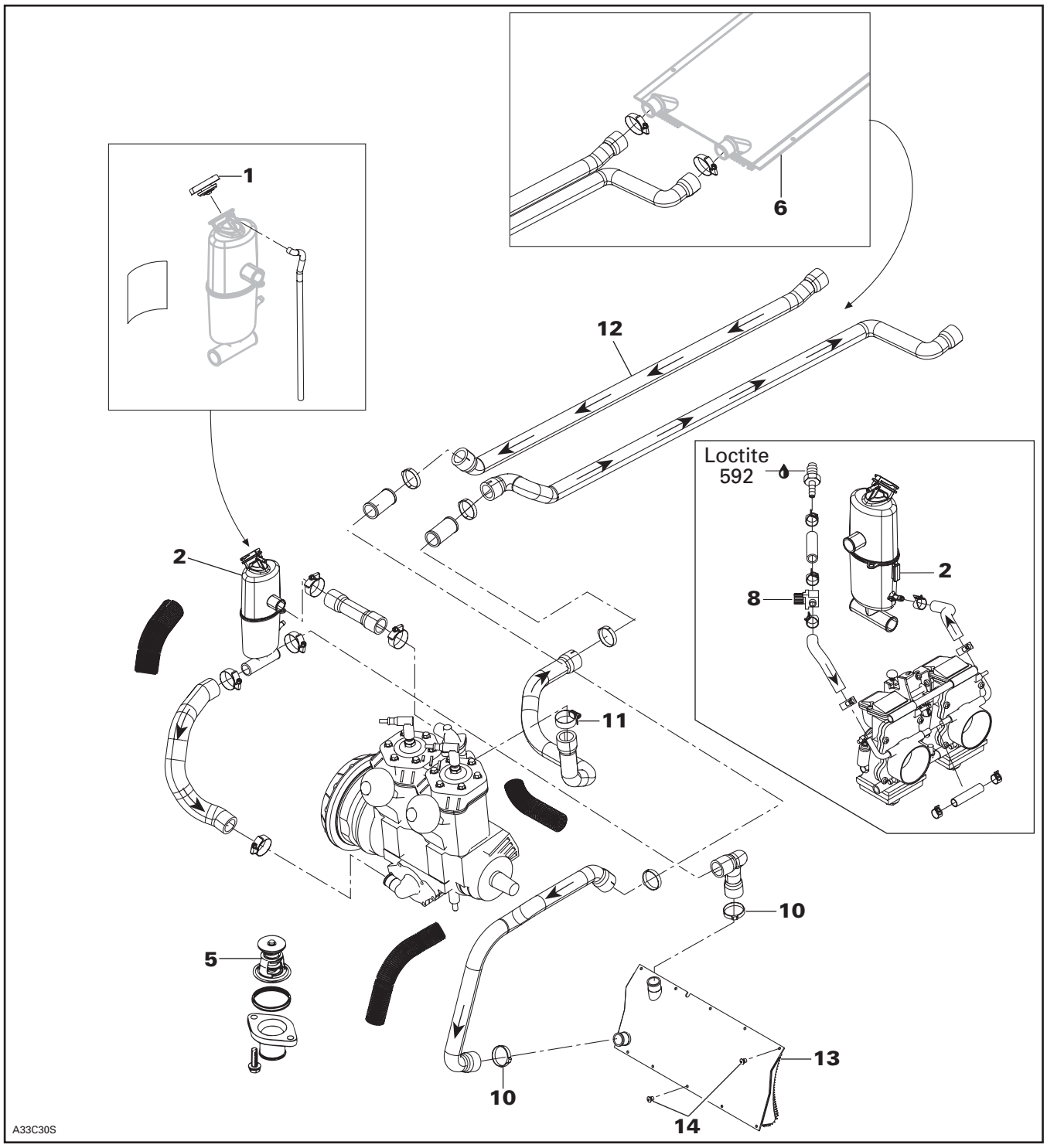
Carbureted Models except Summit



SDI Models



Summit Models



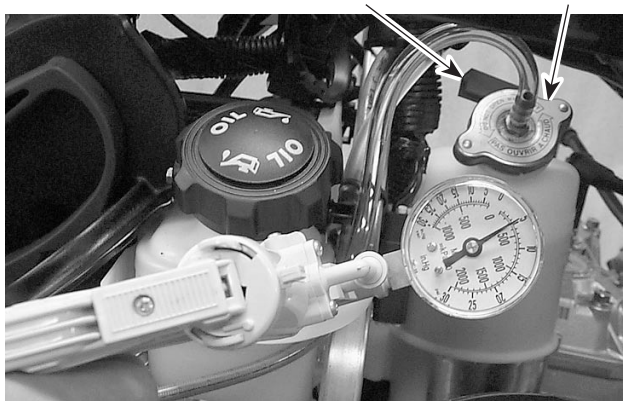
COOLING SYSTEM LEAK TEST

⚠ WARNING

To prevent burning yourself, do not remove the radiator cap if the engine is hot.

Install special radiator cap (P/N 529 021 400) included in the engine leak tester kit (P/N 861 749 100) on coolant tank. Install hose pincher (P/N 295 000 076) on overflow hose. Using pump also included in kit pressurize all system through coolant reservoir to 100 kPa (15 PSI).

Check all hoses and cylinder/base for coolant leaks. Spray a soap/water solution and look for air bubbles.



A33C1HA

INSPECTION

Check general condition of hoses and clamp tightness.

DRAINING THE SYSTEM

⚠ WARNING

Never drain or refill the cooling system when engine is hot.

To drain the cooling system, siphon the coolant mixture from the coolant tank **no. 2** using the siphon tool (P/N 529 035 880). Disconnect hose at water pump to drain coolant from engine.

When the coolant level is low enough, lift the rear of vehicle to drain the radiator.

DISASSEMBLY AND ASSEMBLY

Coolant Pump

Refer to BOTTOM END section.

Sender and Plug

Apply Loctite 592 (P/N 293 800 018) thread sealant on sender **no. 3** and plug **no. 4** to avoid leaks.

Pressure Cap

Check if the cap **no. 1** pressurizes the system for 3 minutes. If not, install a new 90 kPa (13 PSI) cap (do not exceed this pressure).

Coolant Tank

For removal, drain cooling system before removing coolant tank **no. 2**.

Remove all hoses from coolant tank.

Remove injection oil reservoir retaining screws to slide down the coolant tank to disengage it from oil tank.

NOTE: It is necessary to move oil tank for an easier removal/installation of coolant tank.

Check if the tank is cracked or melted. Replace if necessary.

For installation, reverse the removal procedure.

Front Radiator

Remove all debris between radiator fins. A clean radiator is more efficient than a dirty one.

Check if the radiator fins are damaged. Replace the front radiator **no. 13** if necessary.

NOTE: A radiator with many broken fins does not work properly.

For disassembly, drain cooling system.

Remove rear suspension (refer to REAR SUSPENSION).

Using Supertanium™ bit (P/N 529 031 800), drill all rivets **no. 14** retaining front radiator to the frame or grind the rivets with a grinding disk.

Pull the radiator a little and remove the Oetiker clamps **no. 10**.

For installation, reverse the removal procedure.

Rear Radiator and Rear Radiator Protector

Refer to FRAME for rear radiator removal/installation procedures.

For cleaning and inspection refer to FRONT RADIATOR.

Radiator and Radiator Protector

Insert radiator protector **no. 7** into radiator C-rail and crimp C-rail at rear end. Refer to FRAME for radiator **no. 6** removal.

Thermostat

For disassembly of thermostat **no. 5**, drain the cooling system (see above).

Unscrew clamp **no. 11** retaining hose **no. 12** to the water outlet socket.

Remove:

– water outlet
– socket screws
– gasket thermostat.

To check thermostat, put in water and heat water. Thermostat should start to open when water temperature reaches the following degree.

To check thermostat, put in water and heat water. Thermostat should start to open when water temperature reaches the following degree.

ENGINE	TEMPERATURE
All	42°C (108°F)

It will be almost fully open at 50°C (122°F).

For installation, reverse the removal procedure.

COOLING SYSTEM REFILLING PROCEDURE

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% water. Pure antifreeze without water freezes (like slush ice). Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

System Capacity

Refer to TECHNICAL DATA.

Refilling Procedure

IMPORTANT: USE THE PREMIXED COOLANT (P/N 293 600 038). Do not reinstall pressure cap.

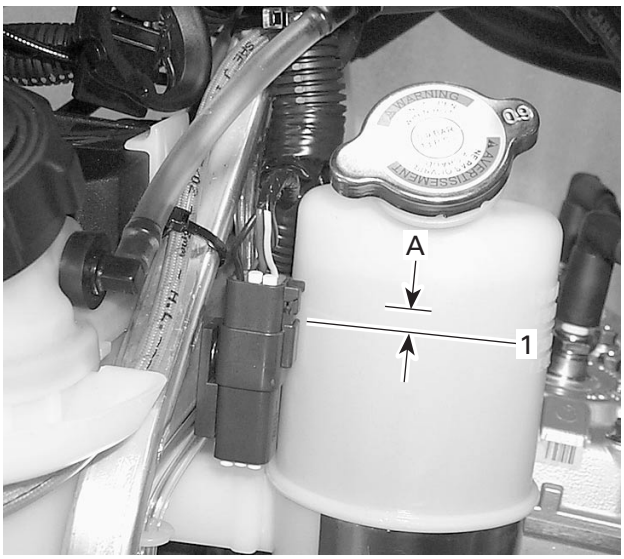
With engine cold, refill coolant tank up to COLD LEVEL line. Start engine. Refill up to line while engine is idling until rear radiators are warm to the touch (about 4 to 5 minutes). Always monitor coolant level while filling tank to avoid emptying. Install pressure cap.

Lift rear of vehicle and support it safely.

Activate throttle lever 3 - 4 times to bring engine speed to 7000 RPM.

Apply the brake.

Lower vehicle back on ground and add coolant up to 15 mm (1/2 in) above the COLD LEVEL line.



A33C1IA

1. Cold level line
A. 15 mm (1/2 in)

Lift front of vehicle of 60 cm (24 in) and support it safely. Let the vehicle idle for two minutes.

Put vehicle back on ground and add coolant up to 15 mm (1/2 in) over COLD LEVEL line.

When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line if needed.

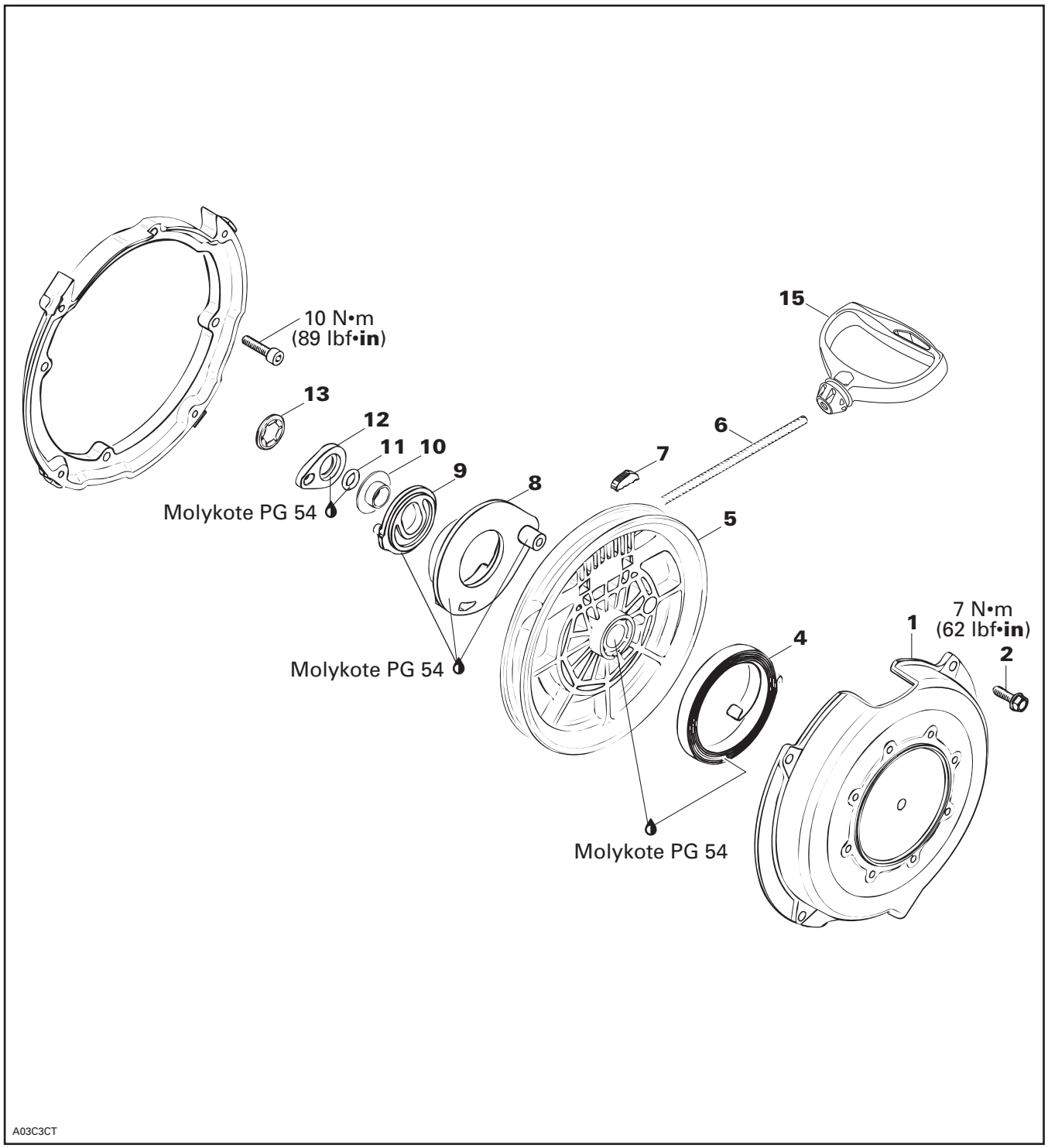
Check for coolant mixture freezing point. Specification is - 37°C (- 35°F). Adjust as necessary.

REWIND STARTER

SERVICE PRODUCTS

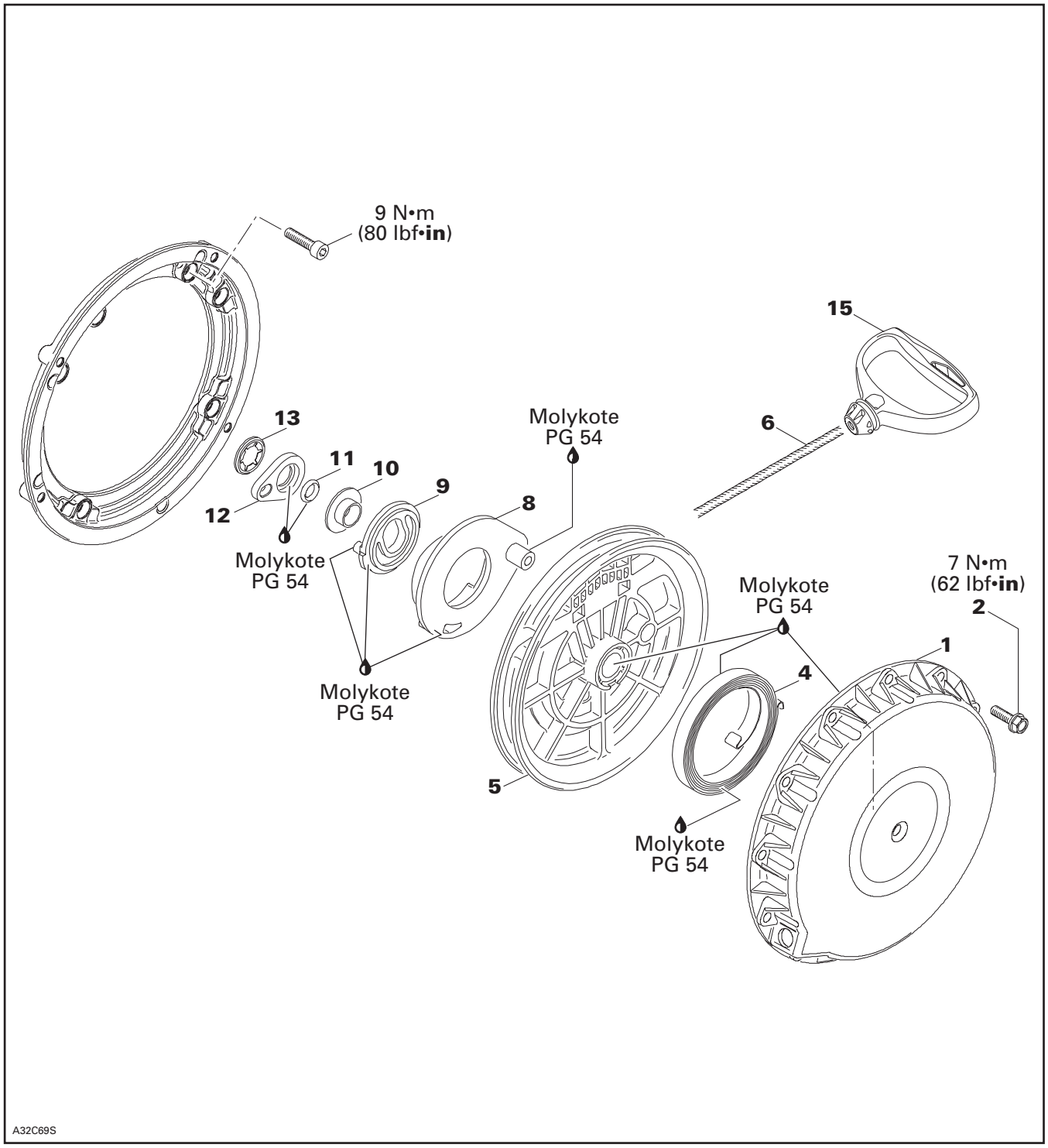
Description	Part Number	Page
Molykote PG 54	420 899 763	151, 153

Rewind Starter on Fan Cooled Models



TYPICAL

Rewind Starter on Liquid Cooled Models



INSPECTION

NOTE: Due to dust accumulation, rewind starter must be periodically cleaned, inspected and relubricated.

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using specific lubricant. Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

Check if rope **no. 6** is fraying, replace if so.

When pulling starter grip, mechanism must engage within 30 cm (1 ft) of rope pulled. If not, disassemble rewind starter, clean and check for damaged plastic parts. Replace as required, lubricate, reassemble and recheck. Always replace O-ring **no. 11** every time rewind starter is disassemble.

When releasing starter grip, it must return to its stopper and stay against it. If not, check for proper spring preload or damages. Readjust or replace as required.

When pulling starter grip 10 times in a row, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

REMOVAL

Using a small screwdriver, extract rope knot from starter grip **no. 15**. Cut rope close to knot. Tie a knot near starter.

Remove screws **no. 2** securing rewind starter **no. 1** to engine then remove rewind starter.

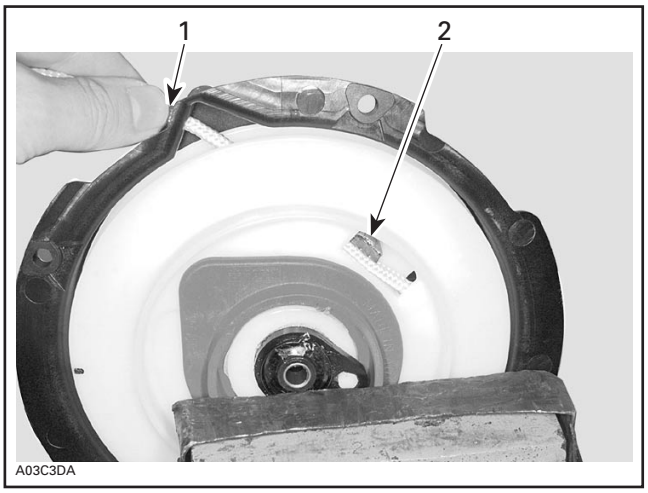
Fan Cooled Models Only

Remove pump from rewind starter cover.

ROPE REPLACEMENT

Fan Cooled Models Only

Completely pull out rope. Hold rewind starter in a vise.



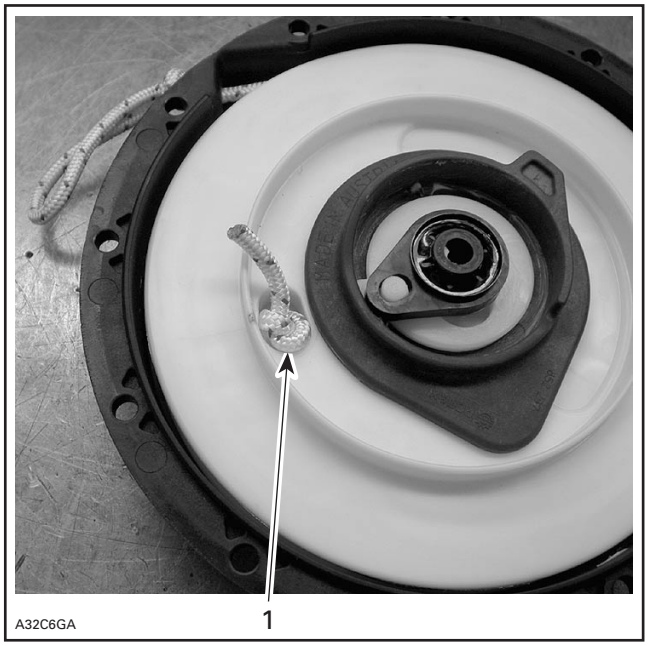
1. Rope exit hole
2. Key to be removed

With a long thin pin punch inserted through rope exit hole, push key **no. 7**. Remove key and rope. Install a new rope and lock it using key **no. 7**.

NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

Liquid Cooled Models Only

Pull out rope. Hold rewind starter in a vise. Slide rope and untie the knot. Pull out the rope completely.



1. Knot to be untied

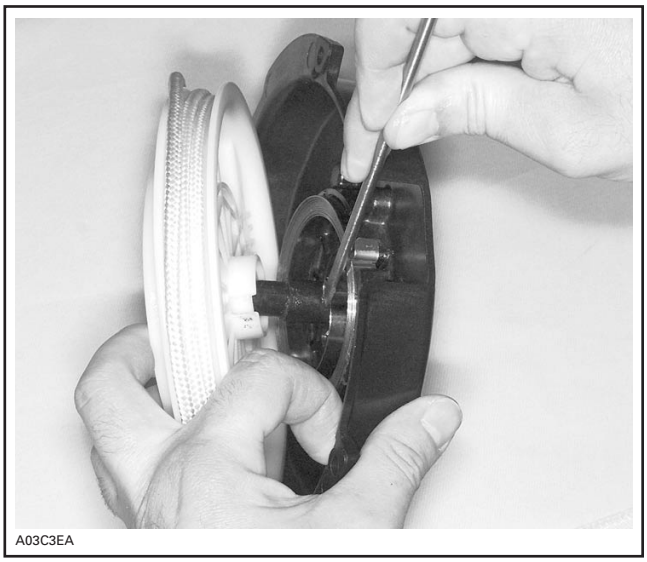
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

DISASSEMBLY

Undo knot previously tied at removal. Let sheave get free to release spring preload.

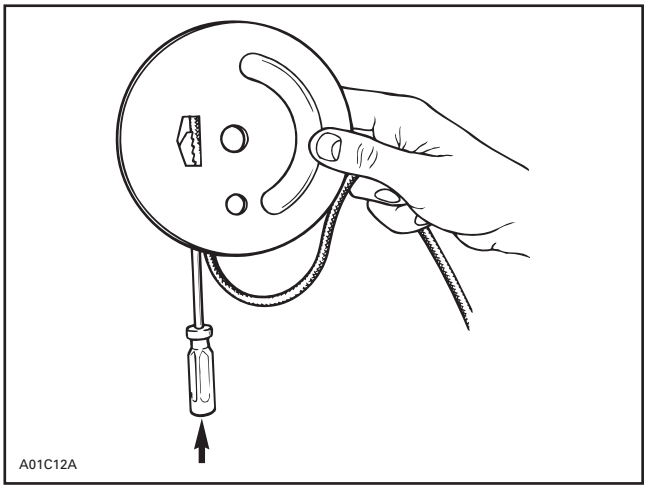
Cut push nut **no. 13** and discard. Remove locking element **no. 12**, O-ring **no. 11**, step collar **no. 10**, pawl lock **no. 9** and pawl **no. 8**.

Remove sheave **no. 5** from starter housing **no. 1**. Hold spring with a screwdriver.


A03C3EA

Fan Cooled Models Only

Disengage key **no. 7** and pull out rope **no. 6**.


A01C12A

GENTLY TAP ON KEY

Liquid Cooled Models Only

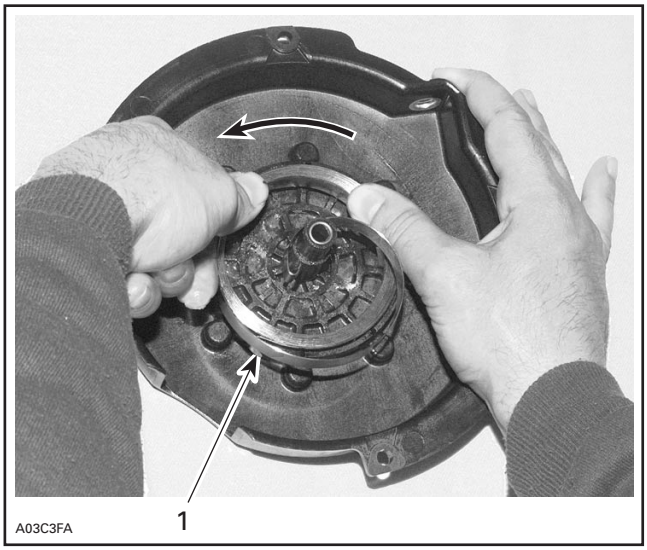
Take out the knot and then rope **no. 6**.

ASSEMBLY

At assembly, position spring **no. 4** outer end into spring guide notch then wind the spring counterclockwise into guide.

⚠ WARNING

Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.

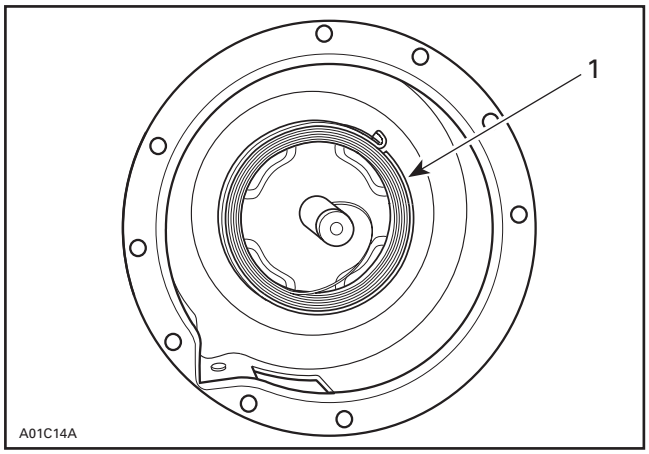


A03C3FA

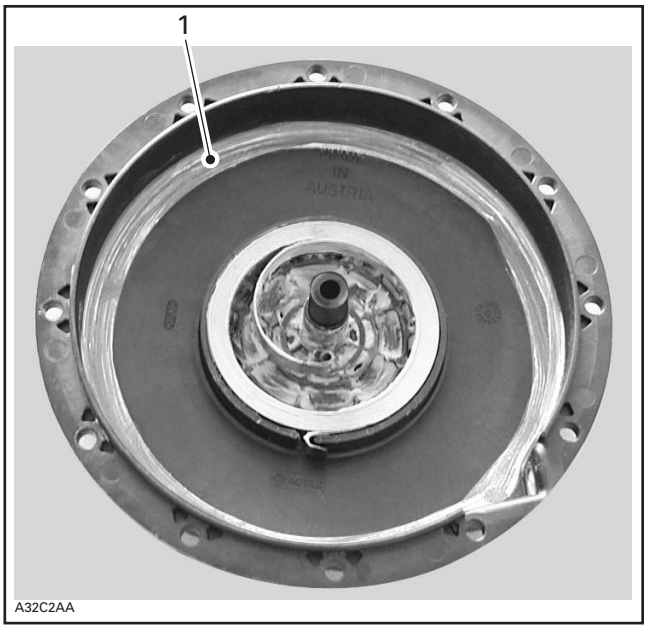
1. Outer end into guide notch

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using Molykote PG 54 (P/N 420 899 763). Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

Lubricate spring assembly and 1 cm (1/2 in) wide on bottom of housing with Molykote PG 54 (P/N 420 899 763).



TYPICAL
1. Molykote PG 54 inside spring guide

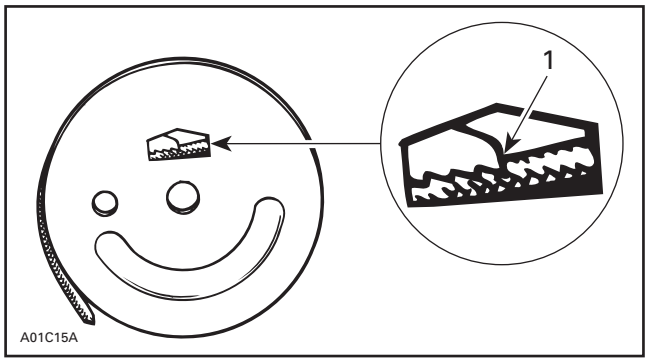


1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing

CAUTION: The use of standard multipurpose grease could result in rewind starter malfunction.

Fan Cooled Models Only

To install rope no. 6, insert rope into sheave no. 5 orifice and lock it with the key no. 7 as illustrated.

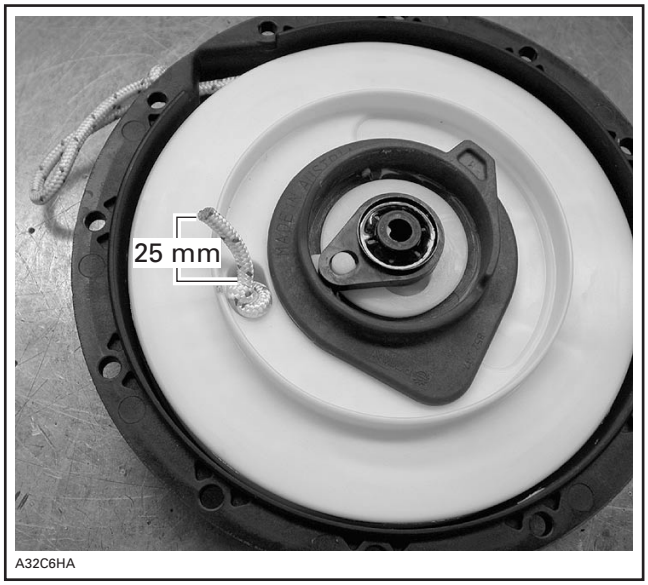


1. Push to lock

Lubricate housing post with silicone compound grease. Install sheave.

Liquid Cooled Models Only

To install rope no. 6, insert rope into sheave no. 5 orifice and lock it by making a knot, leaving behind a free portion of about 25 mm in length. Fuse rope end with a lit match and insert it into sheave.



FREE PORTION

A32C6IA

FREE PORTION INSERTED INTO SHEAVE

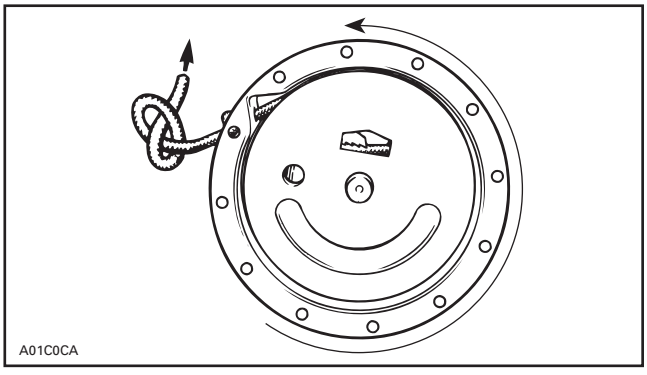
Lubricate housing post with silicone compound grease. Install sheave.

To adjust rope tension:

Wind rope on sheave and place rope sheave into starter housing making sure that the sheave hub notch engages in the rewind spring hook.

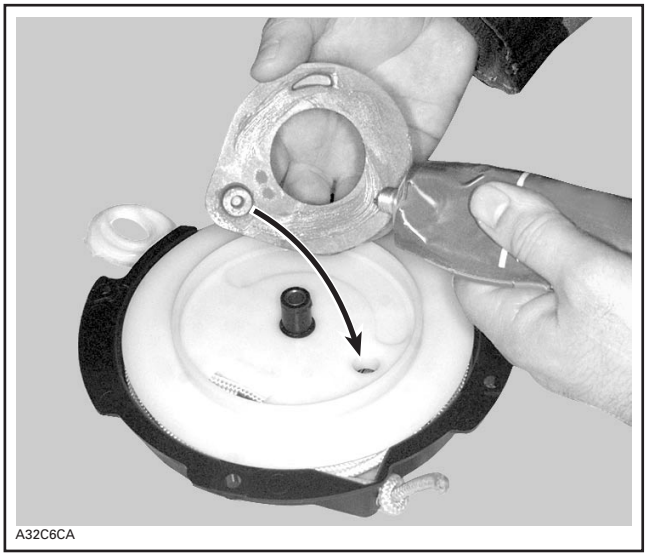
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will give 1/2 turn of preload.

Pull the rope out of the starter housing and temporarily make a knot to hold it.

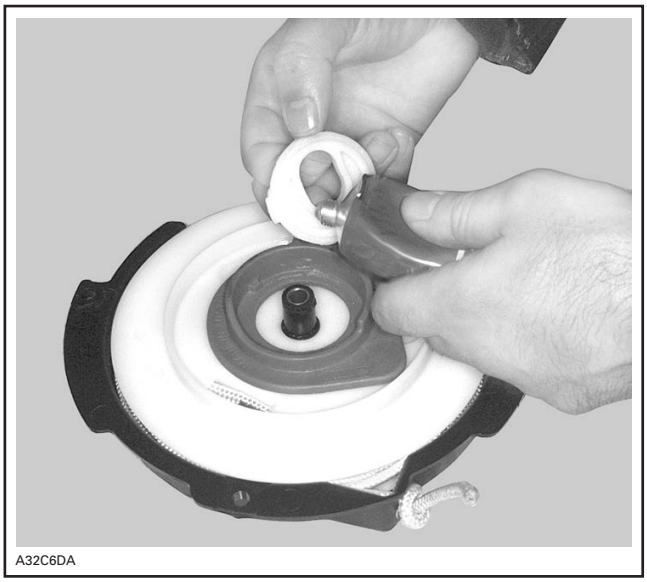

A01C0CA

TYPICAL

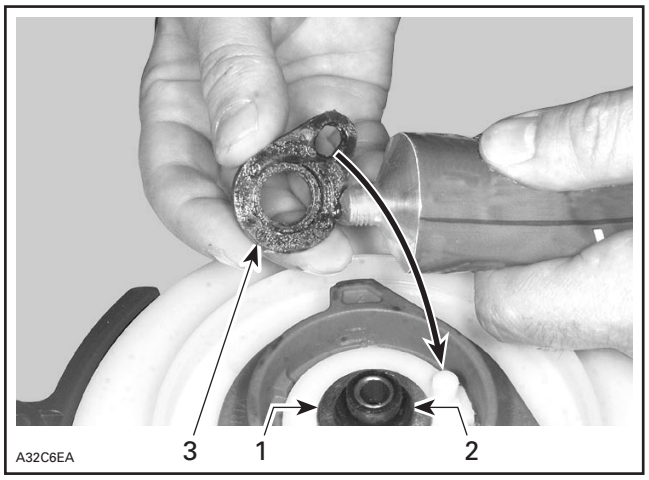
Lubricate pawl **no. 8** with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.


A32C6CA

Lubricate pawl lock **no. 9** with Molykote PG 54 (P/N 420 899 763). Install over pawl.


A32C6DA

Install step collar **no. 10** with its sleeve first. Lubricate a new O-ring **no. 11** and locking element **no. 9** with Molykote PG 54 (P/N 420 899 763). Install over pawl lock.

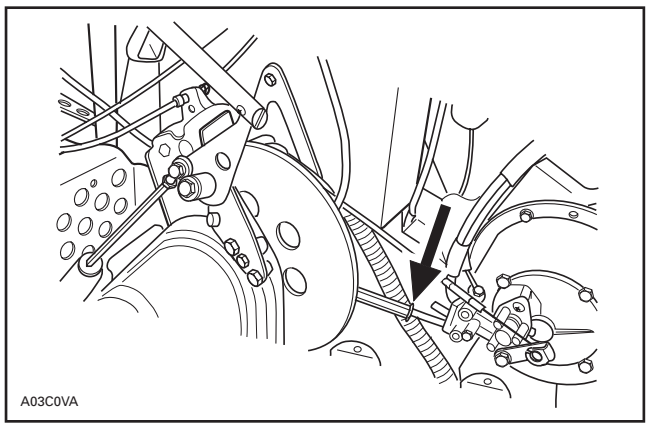


1. *Step collar*
2. *O-ring*
3. *Locking element*

Position a new push nut **no. 13**.

INSTALLATION

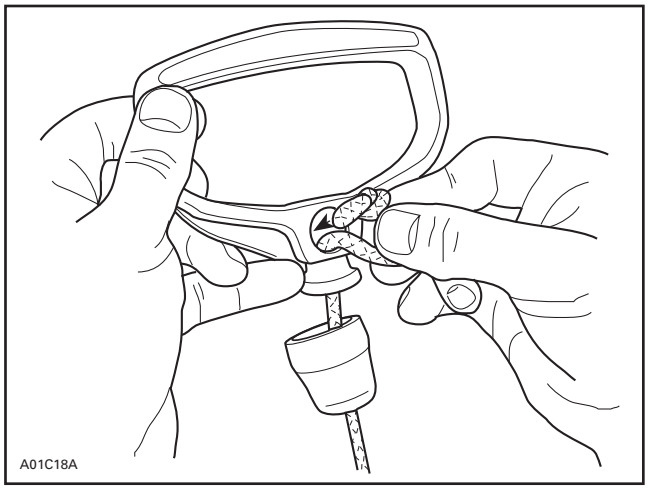
Thread starter rope **no. 6** through rope guide when applicable.



TYPICAL

Reinstall rewind starter assembly on engine.

Prior to installing starter grip **no. 15** on new rope, it is first necessary to fuse the rope end with a lit match. Pass rope through starter grip and tie a knot in the rope end. Fuse the knot with a lit match then insert rope end down and pull the starter grip over the knot.



TYPICAL

Fan Cooled Models Only

Reinstall oil pump with gear case (552 engine). Refer to LUBRICATION SYSTEM.

OIL INJECTION SYSTEM

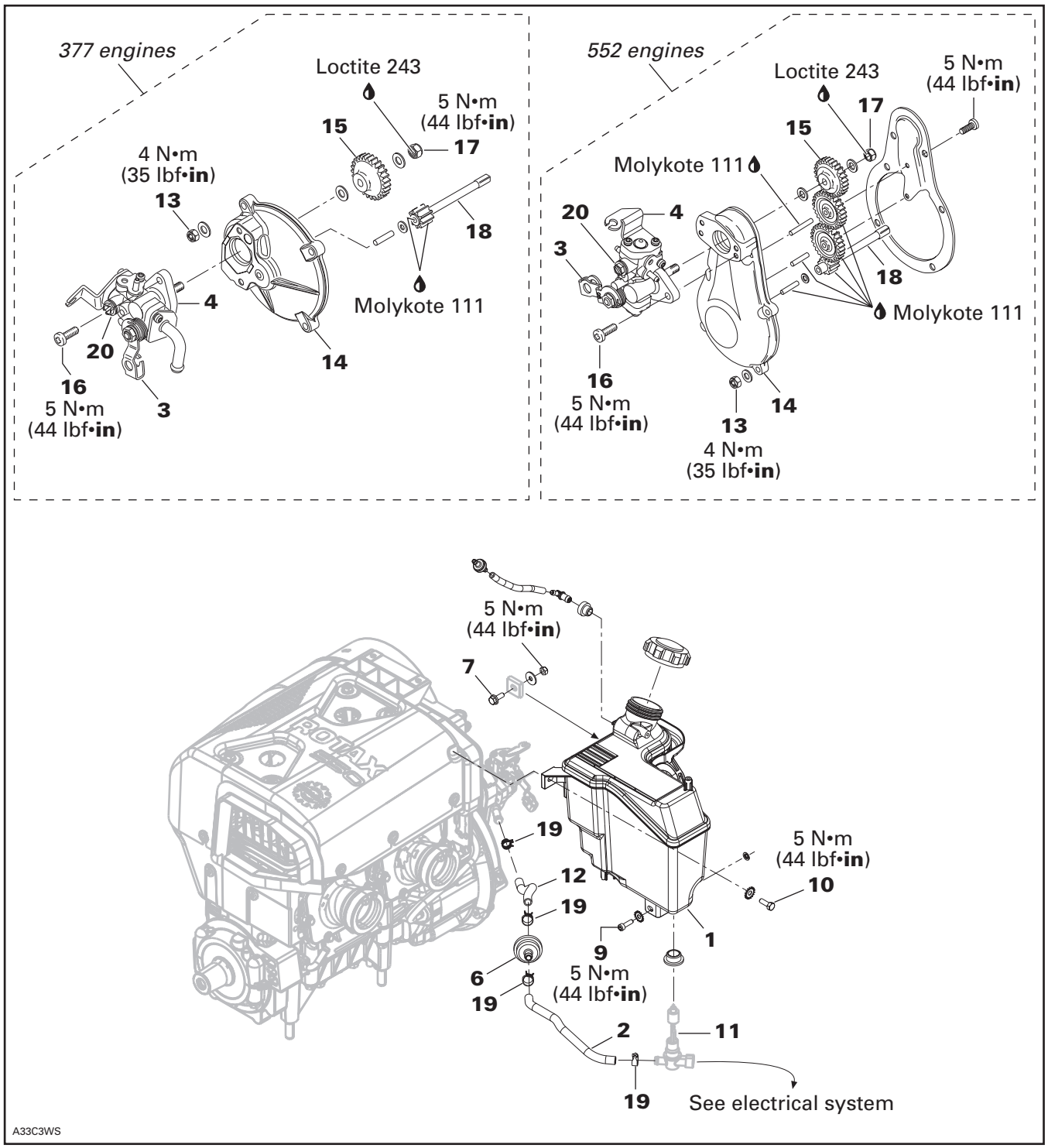
SERVICE TOOLS

Description	Part Number	Page
gear holder	420 876 695	161
hose pincher	295 000 076	158, 160
leak testing kit	529 033 100	158
small hose pincher	295 000 076	158

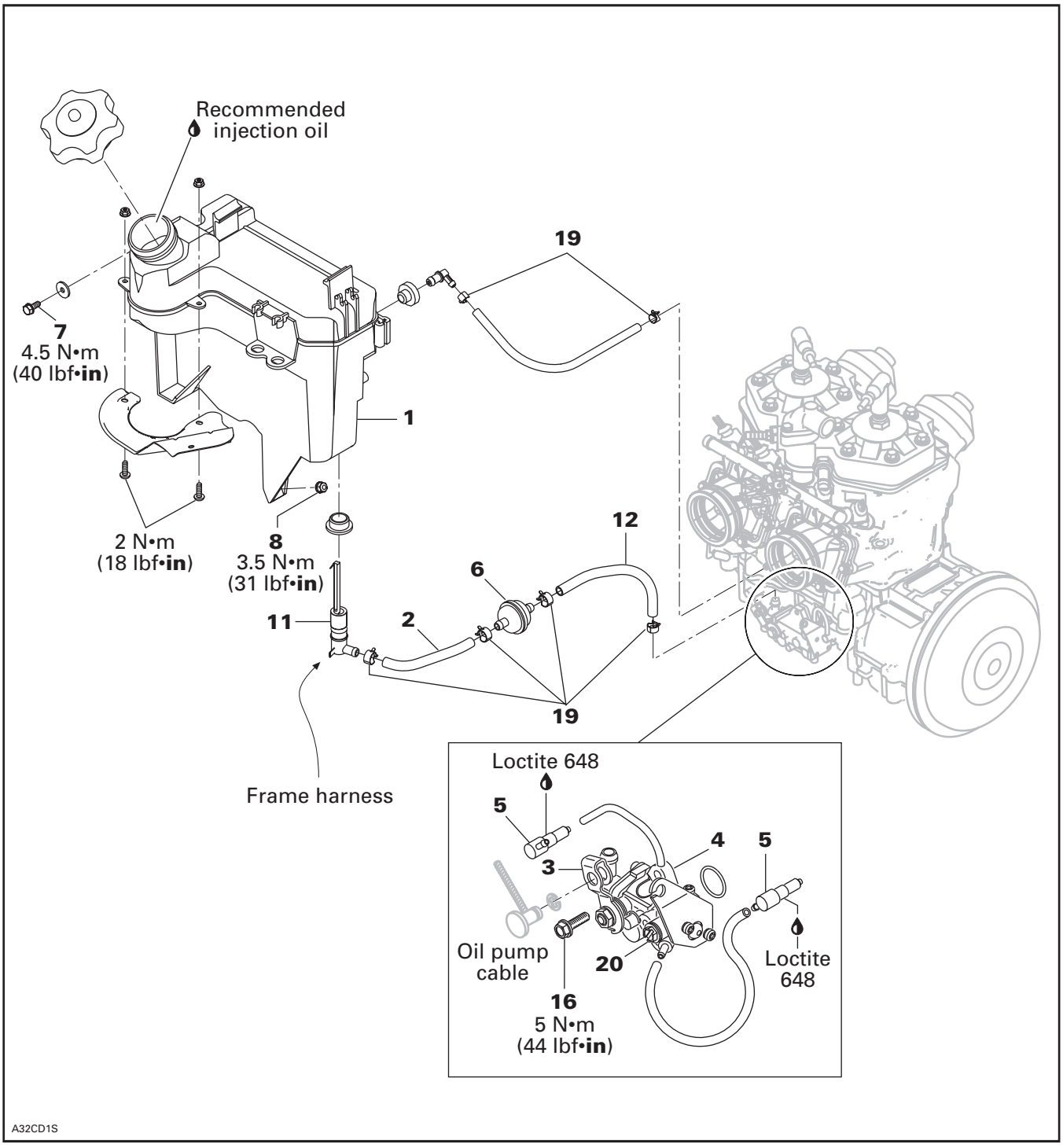
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 648 (green)	413 711 400	161
Molykote 111	413 707 000	161
pulley flange cleaner	413 711 809	161

Fan-cooled Models



Liquid-cooled Models



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Wipe off any oil spills. Oil is highly flammable.

NOTE: The following procedures can be done without removing the engine from chassis.

OIL TYPE

MODEL	OIL TYPE
2-TEC SDI	XP-S synthetic 2–stroke oil or XP-S synthetic blend 2–stroke oil(1)
All others 2-stroke engines	All XP-S 2–stroke oil (synthetic, synthetic blend or mineral) can be used.(2) (3)

(1) **CAUTION: The XP-S synthetic 2–stroke oil and the XP-S synthetic blend 2–stroke oil are specially formulated and tested for the severe requirement of these engines. Use of any other brand two-stroke oil may void the limited warranty. Use only XP-S synthetic 2–stroke oil or XP-S synthetic blend 2–stroke oil. There is no known equivalent on the market for the moment. If a high quality equivalent were available, it could be used.**

(2) If XP-S 2–stroke oil (synthetic, synthetic blend or mineral) is not available, API TC high-quality low ash two-stroke injection oil may be used.

(3) XP-S synthetic 2–stroke oil, XP-S synthetic blend 2–stroke and XP-S mineral injection oil are compatible, they can be mixed together.

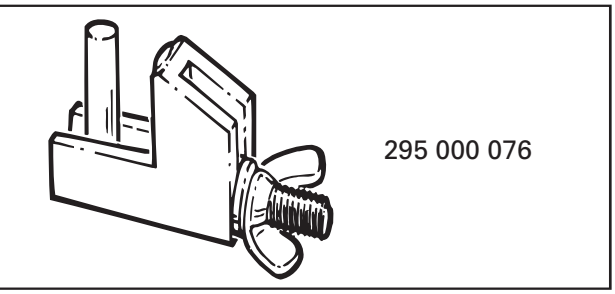
OIL SYSTEM LEAK TEST

The following test will indicate any leak from oil reservoir **no. 1** and all other component of oil system.

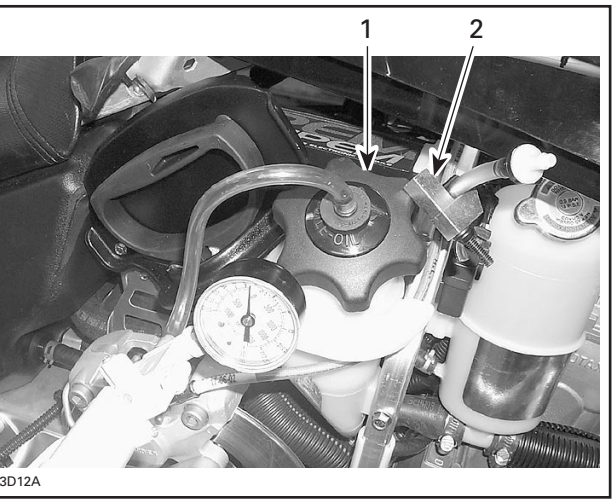
Install on oil reservoir special cap of leak testing kit (P/N 529 033 100).

529 033 100

Install hose pincher (P/N 295 000 076) on oil reservoir check valve outlet hose **no. 2**.

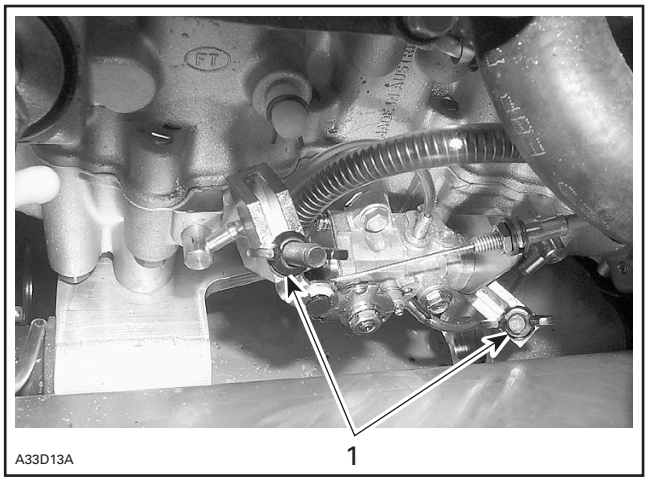


295 000 076



1. Special cap on reservoir
2. Hose pincher on check valve outlet hose

Remove air silencer and carburetor or throttle body to gain access to the oil pump hoses. Install small hose pincher (P/N 295 000 076) on outlet hoses.



1. Hose pinchers on outlet hoses

Connect leak testing kit pump to special cap.

Pressurize oil system to 21 kPa (3 PSI). That pressure must not drop during 3 minutes.

If pressure drops, locate leak(s) and repair/replace leaking component(s).

NOTE: An oil pump shaft test must be done to complete the oil system leak test. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT for the procedure.

OIL PUMP IDENTIFICATION

Different engines need different pumps. See identification on lever **no. 3**.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
377	05
552	06
593, 593 HO and 593 HO SDI	02
793 HO	01
793 HO POWER TEK	08

CLEANING

Clean all metal components in a non-ferrous metal cleaner.

CHECKING OPERATION

Oil Pump

On Vehicle

NOTE: Main oil line must be full of oil. See bleeding procedure below.

Lift rear of vehicle and support with a mechanical stand. Unplug small oil lines from pump. Start engine and stop it as soon as it fires.

Check that oil in small oil lines has been sucked up (this will be indicated by a clear section of small oil lines). Repeat the procedure until this condition is attained.

Reconnect small oil lines, start engine and run at idle while holding the pump lever **no. 3** in fully open position. Oil columns must advance into small oil lines.

If not, remove pump assembly **no. 4** and check the pump gear and drive shaft (if applicable) for defects, replace as necessary. Test pump as describes below.

NOTE: Through normal use, oil level must not drop in small tubes. If oil drops, verify check valve **no. 5** operation in injection nozzle. Replace as necessary.

Test Bench

Connect a hose filled with injection oil to main line fitting. Insert other hose end in an injection oil container. Using a clockwise rotating drill rotate pump shaft. Oil must drip from outer fittings while holding lever in a fully open position. If not replace pump.

Check Valve

For all engines, check valve **no. 5** is part (built-in) of injection nozzle.

To verify the check valve, proceed the same as for checking pump operation on vehicle. First unplug oil line from check valve. After restarting the engine, check that a clear section in small oil line is present. Reconnect oil line.

Run engine at idle. Oil column must advance. If the check valve is faulty, oil column will go back and forth. Replace if so.

Oil Reservoir Check Valve

It allows air to get into the reservoir. To verify this one-way check valve, remove it along with the hose. Make sure that it holds pressure and that it does not let air go through.

While installing this check valve make sure that the black side is towards the reservoir.

DISASSEMBLY

NOTE: Some oil pump components are not available as single parts.

Injection Oil Reservoir

Empty injection oil reservoir **no. 1** by siphoning injection oil.

Remove:

– air box
– upper screw **no. 7** (near reservoir cap)
– rewind starter support and grip
– hose protector support
– electronic module (if the module is located on the reservoir)
– lower nut **no. 8** or screw **no. 9** and **no. 10**.

NOTE: Cut the ties retaining the wiring harness if necessary.

Injection Oil Level Sensor

To remove the switch **no. 11**, use the following procedure.

Remove injection oil reservoir, as mentioned above.

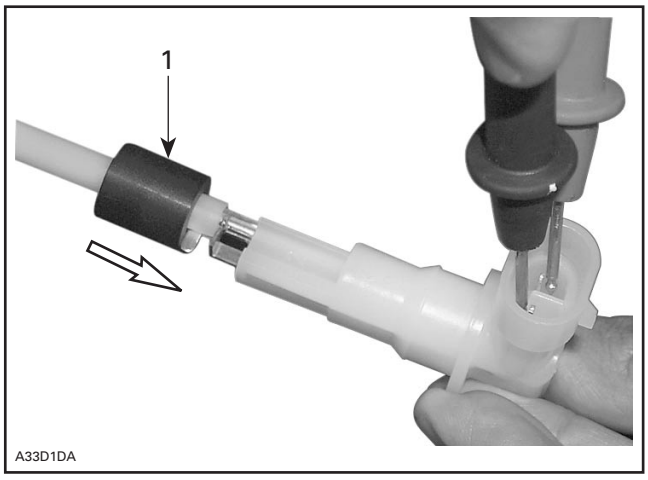
Unplug switch connector.

Pull oil level switch **no. 7** out of reservoir.

Before replacing the injection oil level switch **no. 11**, check it according to the following procedure:

CAUTION: Do not remove or bend the reed switch protective float lock. It can damage the reed switch glass.

With the float magnet ring at the lowest position. Using an ohmmeter, probe the connector.



1. Float magnet at the lowest position

Reading below 0 ohm reflects the proper switch function. Replace the oil level switch if reading above 0 ohm.

Injection Oil Filter

Remove air box and carburetor or throttle body.

Siphon injection oil reservoir.

Disconnect oil filter hose **no. 2** from the reservoir **no. 1**.

Disconnect oil hoses **no. 2** and **no. 12** from the oil filter **no. 6** and remove it.

Injection Oil Pump

NOTE: Before removing the injection oil pump **no. 4**, check its operation. Refer to CHECKING OPERATION, above in this section.

Fan-cooled Models

Drain injection oil reservoir.

Remove the muffler.

Disconnect oil pump cable.

Install a hose pincher (P/N 295 000 076) on each oil pump outlet hoses then disconnect them.

NOTE: Mark hoses locations for installation.

Unscrew nut **no. 13**.

Remove oil pump mounting flange **no. 14**.

Remove oil pump gear **no. 5**.

Remove screws **no. 16**.

Remove oil pump.

Liquid-cooled Models

Remove:
– air box
– carburetor or throttle body
– screw **no. 16**.

Unplug all hoses connected to oil pump **no. 4**.

NOTE: Mark hose locations for installation.

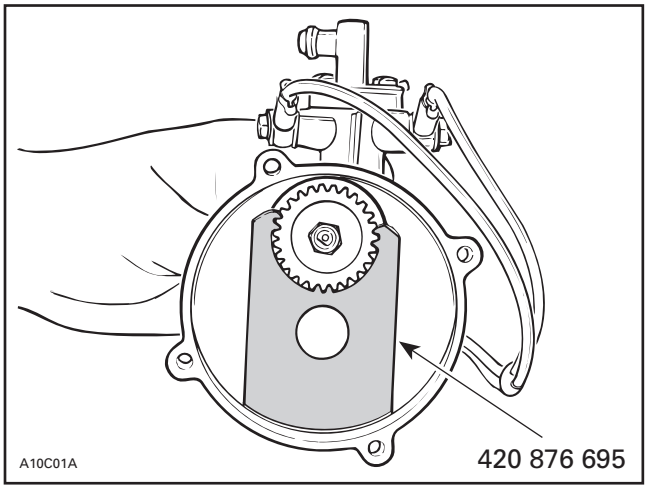
Disconnect the oil pump cable.

Oil Pump Gear

Fan-cooled Models

Remove the oil pump from engine.

To remove the gear retaining nut **no. 17**, first extract the needle roller **no. 18** with pliers then lock gear in place using the gear holder (P/N 420 876 695).



TYPICAL

Separate the oil pump from the pump mounting flange **no. 14** by removing oil pump screws **no. 16**.

Check Valve

Liquid-cooled Models

NOTE: Before removing check valve **no. 5**, check its operation. Refer to the end of this section.

Remove air box and carburetor or throttle body.

Clean check valve area to remove oil or dirt.

Heat check valve **no. 5** then pull it out of crankcase.

ASSEMBLY

CAUTION: Always bleed oil pump when the system has been opened.

NOTE: During installation, always check for spring clips **no. 19** tightness.

Injection Oil Reservoir

For installation, reverse the removal procedure.

Injection Oil Level sensor

For installation, reverse the removal procedure.

Injection Oil Filter

For installation, reverse the removal procedure.

NOTE: The filter must be installed with the arrow pointing toward the pump.

Injection Oil Pump

For installation, reverse the removal procedure. However, pay attention to the following.

Torque the screws **no. 16** to 5 N•m (44 lbf•**in**).

Make sure cable barrel is well seated in oil pump lever.

Secure barrel with plastic washer and circlip.

Install cable lock washer on left side of support.

Verify cable and oil pump lever operation then adjust cable.

Oil Pump Gear

Fan-cooled Models

The installation is the reverse of the removal procedure. However, pay attention to the following details.

At gear assembly, apply a light coat of Molykote 111 (P/N 413 707 000) on gear teeth.

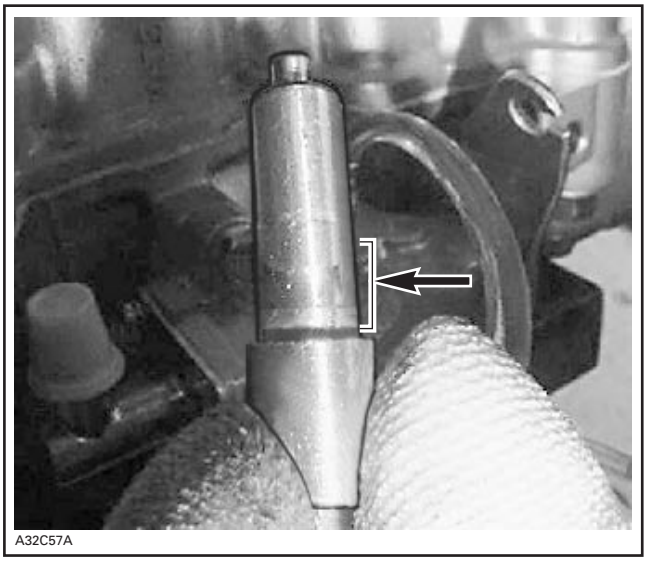
The needle roller **no. 18** must be engaged as deep as possible in the pump mounting flange.

Check Valve

Liquid-cooled Models

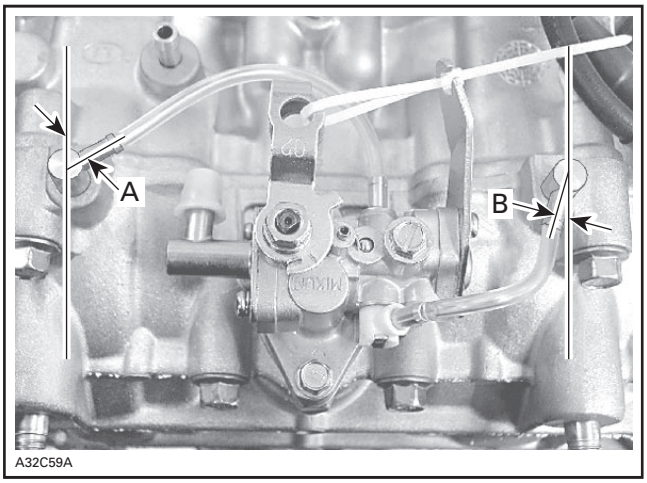
Prior to coating it with Loctite, make sure check valve body is clean and dry. Clean from dirt or oil, if any, with pulley flange cleaner (P/N 413 711 809).

Apply Loctite 648 (green) (P/N 413 711 400) on the outer diameter of the check valve (machined section). Take care that Loctite is ONLY in this area.


A32C57A

APPLY LOCTITE ON THIS AREA ONLY

Install the check valve in the correct position as described on next photos into the crankcase lower side.



A32C59A

TYPICAL
A. PTO side 45° ± 5° from cylinder axis to the top
B. MAG side 20° ± 5° from cylinder axis to the bottom

Punch in the check valve carefully with a plastic hammer.

Clean the crankcase from surplus of Loctite 648 with a rag.

BLEEDING PROCEDURE

Bleed main oil line (between reservoir and pump) by loosening the bleeder screw **no. 20** until air has escaped from the line. Add injection oil as required.

Reinstall all parts.

Bleed the small oil line between pump and engine by running engine at idle while holding the pump lever in fully open position.

NOTE: Make a J hook out of mechanical wire to lift the lever.

⚠ WARNING

No ensure not operate carburetor throttle mechanism. Secure the rear of the vehicle on a stand.

ADJUSTMENT

Oil Pump Cable

Fan-cooled Models

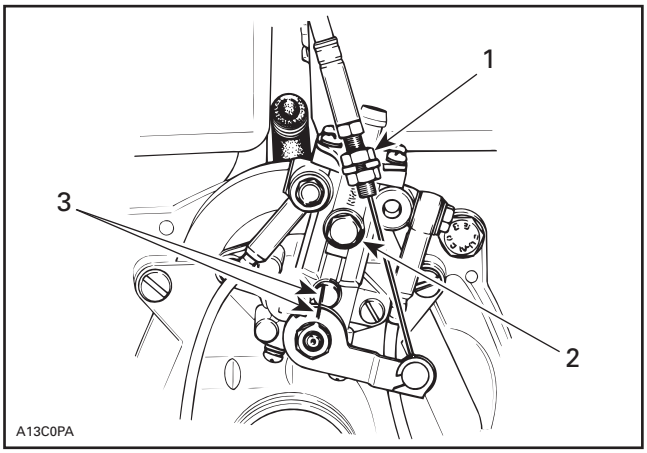
Prior to adjusting the pump, make sure all carburetor adjustments are completed and engine is stopped.

Eliminate the throttle cable free-play by pressing the throttle lever until a light resistance is felt, then hold in place.

The mark on the pump casting and on the lever must align. Width of lever mark is the tolerance.

Loosen the adjuster nut and adjust accordingly.

Retighten the adjuster nut.



A13C0PA

TYPICAL
1. Adjuster nut
2. Bleeder screw
3. Marks

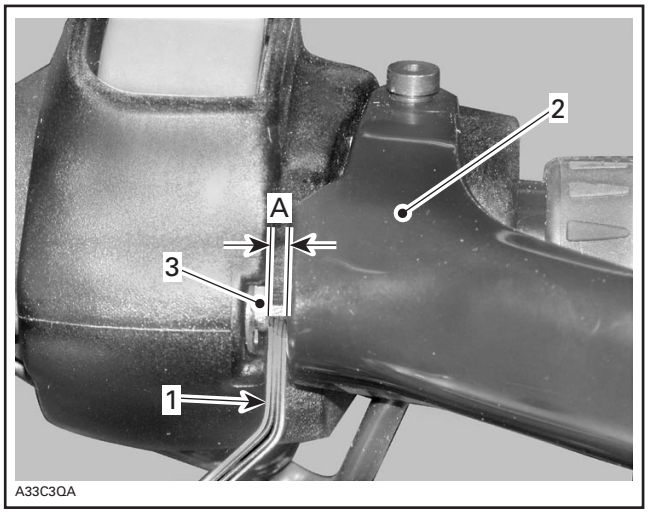
CAUTION: Proper oil injection pump adjustment is very important. Any delay in the opening of the pump can result in serious engine damage.

Liquid-cooled Models

Before processing with the oil pump cable adjustment, verify throttle cable adjustment. Refer to CARBURETOR AND THROTTLE CABLE or COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT (SDI models).

Depress the throttle lever lightly until the cable is under tension but carburetors or throttle body are not yet opened.

Using a feeler gauge, measure the visible distance between throttle lever and the end of cable housing.



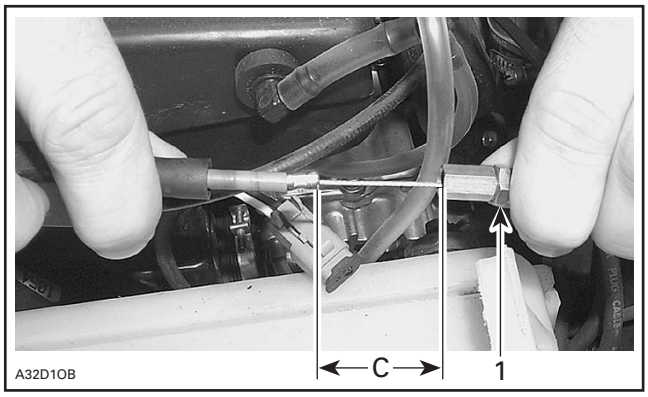
1. Feeler gauge
2. Throttle lever
3. End of cable housing
A. Visible distance

Note this measure.

Next, add to measurement "A" the appropriate specification "B", using the chart below.

ENGINE TYPE	SPECIFICATION "B"
All liquid-cooled engines except SDI models	16.5 mm (.650 in)
SDI engines	18 mm (.709 in)

Stretch oil pump cable with a force of 32 N (7.2 lbf) and measure the length of its visible distance "C".



1. Adjusting screw lock nut
C. Visible distance for oil pump adjustment

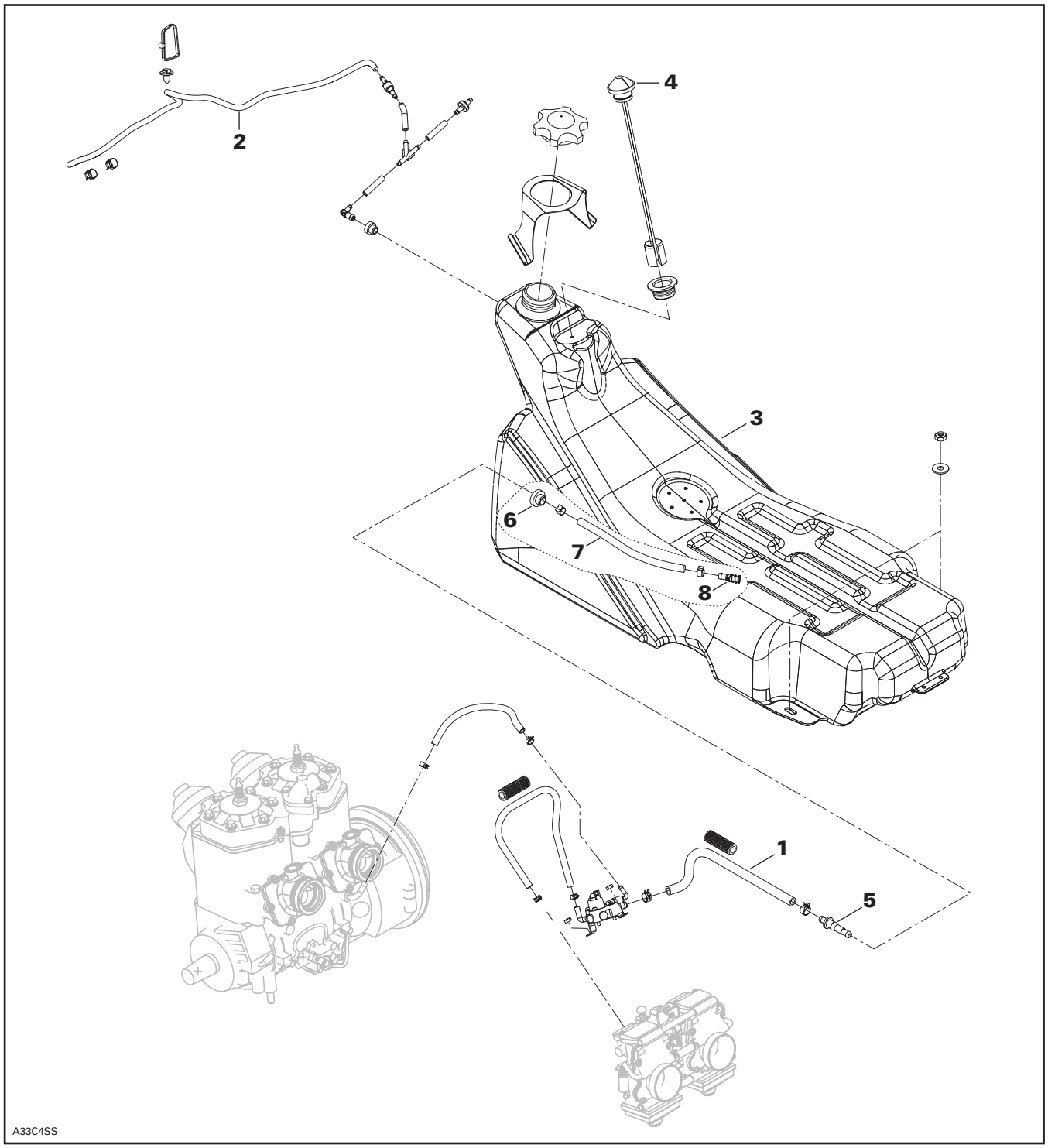
If the visible distance is less or more than "A" + "B", adjust cable distance. To do so, loosen lock nut, turn adjusting screw in or out and retighten lock nut.

FUEL TANK AND FUEL PUMP

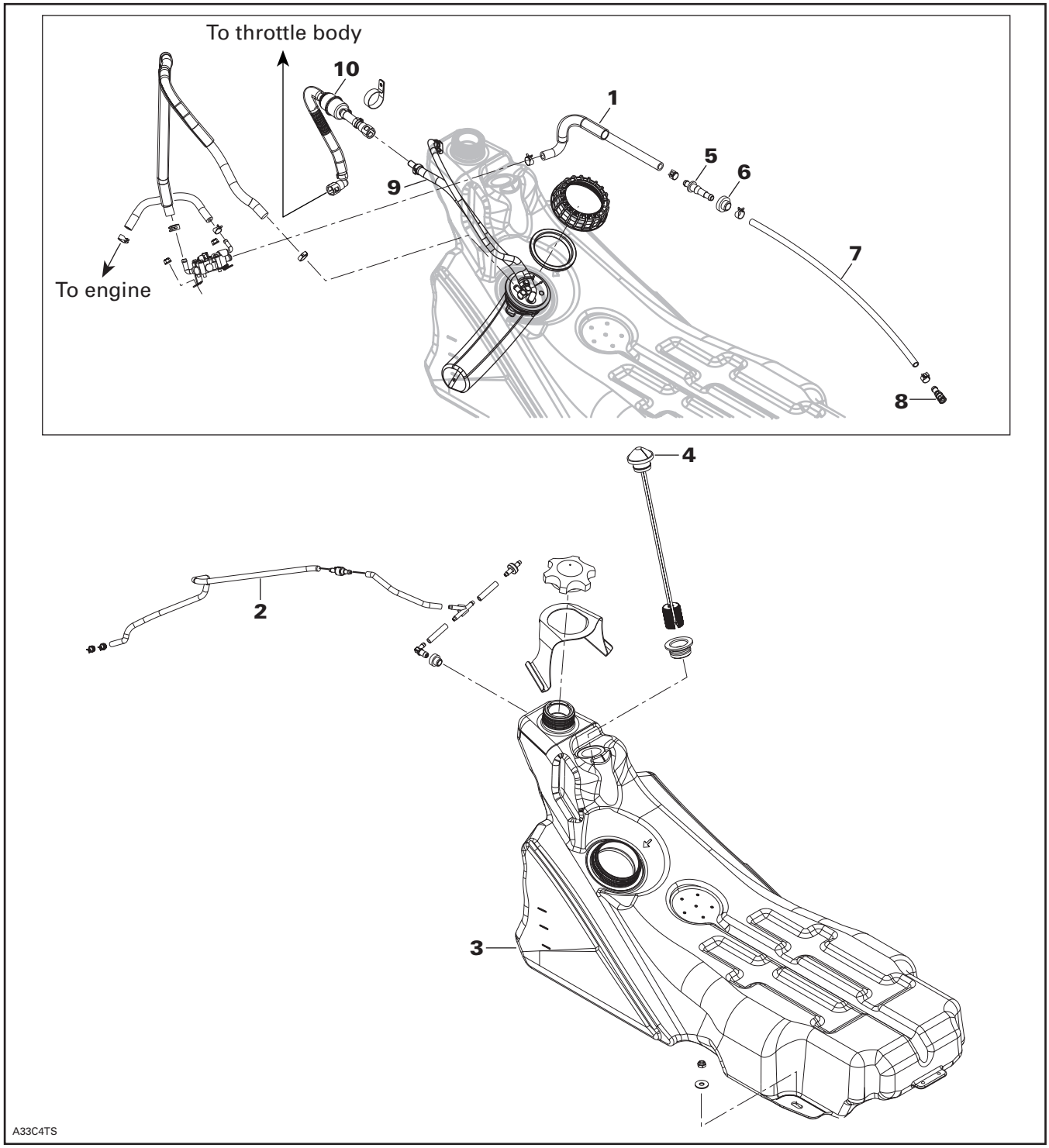
SERVICE TOOLS

Description	Part Number	Page
hose pincher	295 000 076	168, 174
leak tester kit	529 033 100	171
vacum/pressure pump kit	529 021 800	171
wrench	529 035 891	169

All Models except SDI



SDI Models



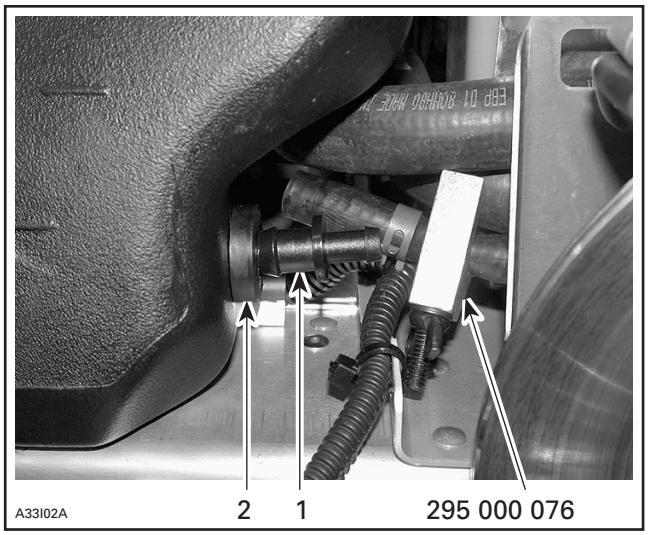
IN-TANK FUEL FILTER

Replacement

Drain fuel tank.

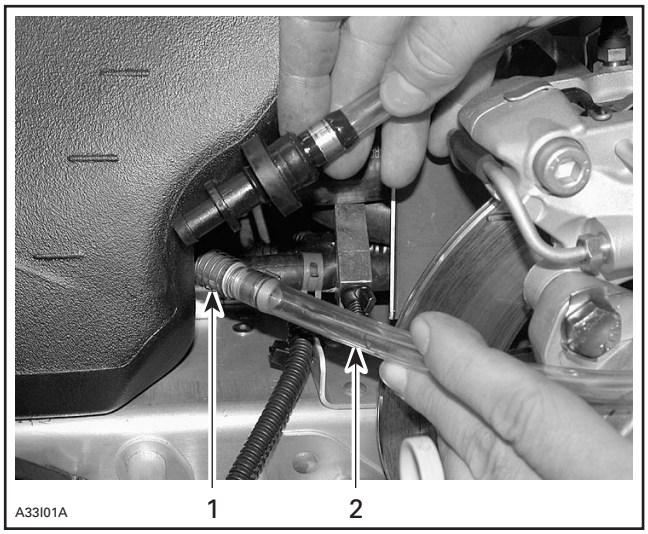
Install a hose pincher (P/N 295 000 076) on supply hose then, unplug support hose.

Pull out male connector **no. 5** from grommet.



1. *Male connector*
2. *Grommet*

Pull out grommet **no. 6** from fuel tank **no. 3** then, pull out pickup hose **no. 7** and fuel filter **no. 8**.



1. *Fuel filter*
2. *Pickup hose*

Replace fuel filter and grommet. To facilitate the installation, grommet should be on smaller diameter of male connector. Install grommet on fuel tank and push male connector through grommet.

IN-LINE FUEL FILTER

Replacement

SDI Models Only

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the VCK to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery prior to working on the fuel system.

Fuel filter, inlet and outlet hoses come as an assembly.

The fuel filter **no. 10** is located beside the steering column, next to coolant tank.

Using B.U.D.S. release the fuel pressure. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

Remove console to gain access to top of fuel pump module.

Disconnect both ends of fuel filter line.

Unfasten clip retaining fuel line to fuse box support.

Unscrew the fuel filter support nut then remove the filter.

The installation is the reverse of removal procedure.

FUEL TANK

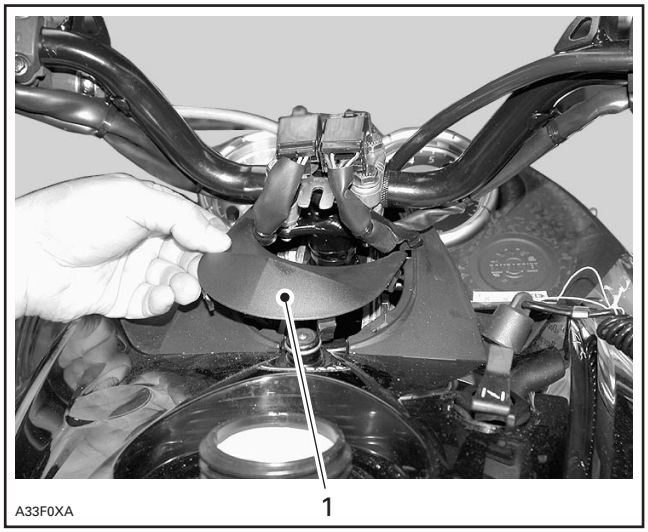
Removal

Remove seat, refer to BODY.

Remove fuel tank cap.

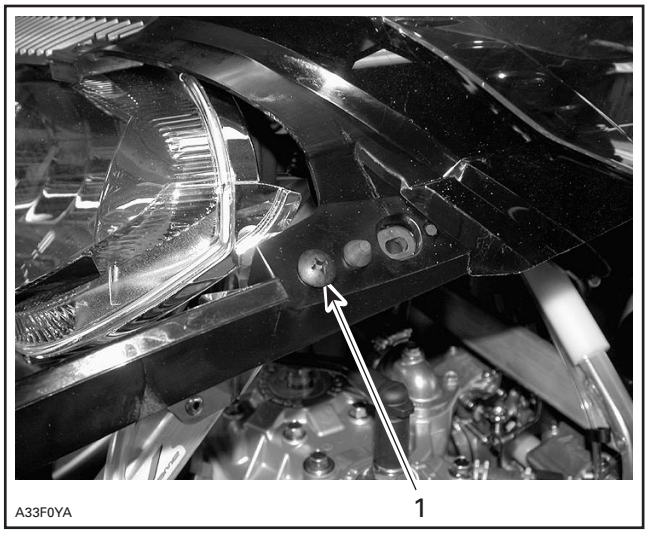
Remove filler neck plastic nut using wrench (P/N 529 035 891).

Unclip and remove console center trim cap.



1. Remove this cap

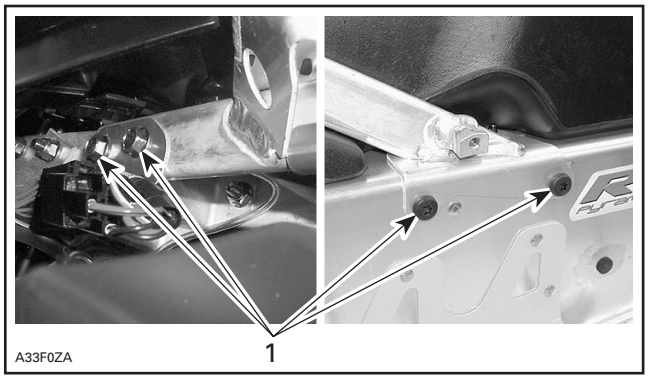
Remove retaining screw on both sides of center console; this will allow lifting of console just enough to ease tank removal.



1. Remove this screw on both sides

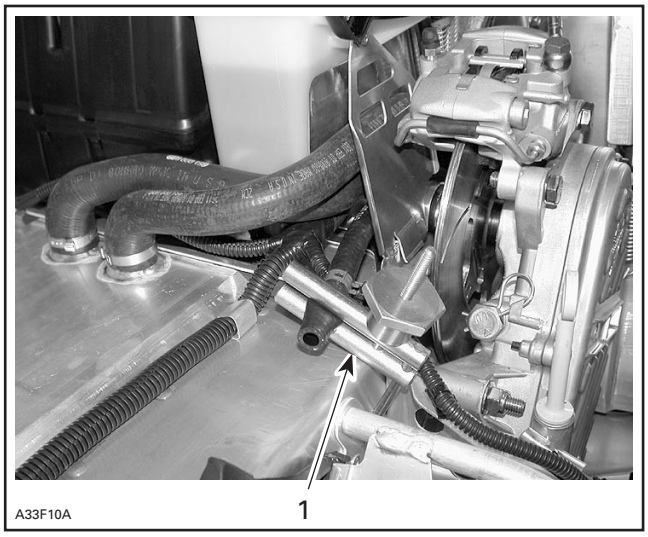
Remove both sides fuel tank aluminum braces:

– by removing and discarding lower M8 x 20 Torx screws (2 on each side);
– and by removing upper M8 flanged hexagonal bolts (2 on each side) and discarding their nuts.



1. Remove and discard lower Torx screws on both sides — remove upper flanged hexagonal bolts and discard their nuts on both sides

Empty fuel tank and install a hose pincher on fuel line **no. 1** as shown in following photo.



FUEL TANK REMOVED
1. Hose pincher installed on fuel line

SDI Models

Release fuel pressure of the system. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

Install a hose pincher on fuel pump hose **no. 9** then disconnect it from fuel filter hose **no. 10**.

Unplug electric fuel pump connector.

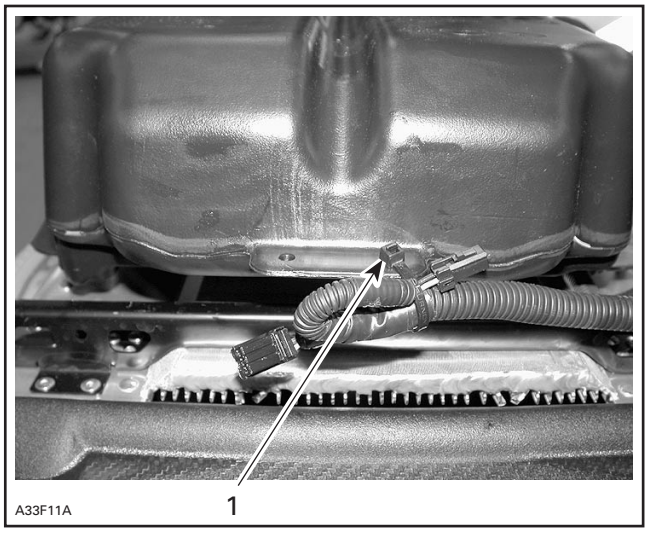
All Models

⚠ WARNING

Whenever a fuel line is disconnected, obstruct line with a hose pincher. Fuel is flammable and explosive under certain conditions. Always wipe off any fuel or oil spillage from the vehicle. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

Unplug vent tube **no. 2** from tank.

If applicable, cut locking tie holding wiring harness to fuel tank at rear.



1. Cut this locking tie

Remove fuel tank **no. 3** and set it aside.

Installation

Reinstall fuel tank and plug-in vent tube.

⚠ WARNING

Make sure vent tube is not kinked.

Connect fuel line and remove hose pincher.

Reinstall right and left fuel tank aluminum braces using new lower Torx screws (with Scotch Grip) and previously removed upper flanged hexagonal bolts with new M8 flanged elastic stop nuts.

Reinstall filler neck nut using special tool (P/N 529 035 891).

Reinstall fuel cap.

Reinstall center console.

Reinstall console center trim cap.

Reinstall seat.

SDI Models

Reinstall fuel filter hose.

Reconnect electric fuel pump connector.

Perform a fuel pressure test.

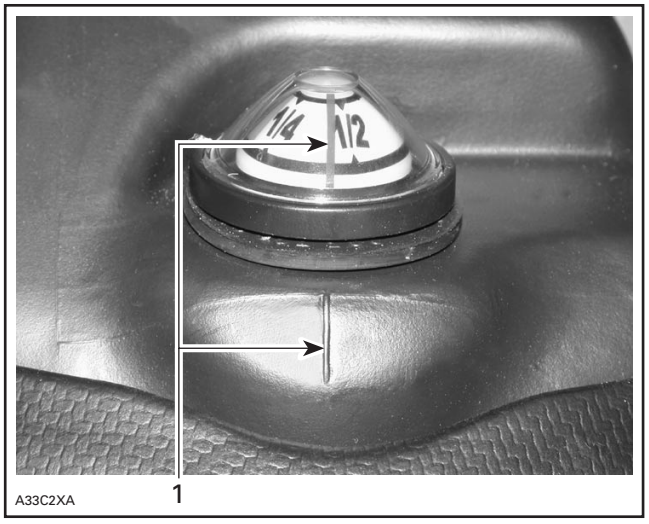
FLOAT-TYPE FUEL LEVEL GAUGE

To remove gauge **no. 4** from fuel tank, pull gauge out of its grommet then remove grommet.

For reinstallation, proceed as follows:

– Install grommet halfway on gauge.

– Insert grommet in fuel tank until it bottoms.
– Firmly push gauge in grommet until it bottoms and so that its red line aligns with the line on the fuel tank.



1. Align red line with line on tank

ELECTRIC FUEL LEVEL SENSOR

Inspection

All Models except SDI

Visually inspect the condition of connectors and wiring throughout the circuit. Connections must be clean and tight, and wiring free of damage. Repair as necessary. Use silicone dielectric grease to prevent corrosion at the connectors. Operate the engine to see if the problem has been corrected.

A 0.25 ampere fuse protects fuel level sensor circuitry. Remove seat to gain access.

Torque fuel level sensor retaining screws to 1 N•m (8 lbf•**in**) in a criss-cross sequence and then to 2.4 N•m (21 lbf•**in**), using the same sequence.

SDI Models

Fuel level sensor is integrated to the fuel pump. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

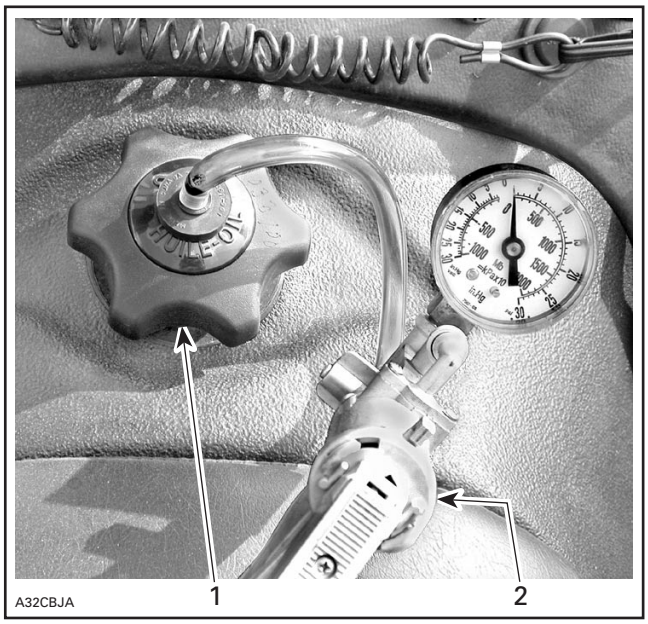
A 0.5 amp. fuse protects fuel level sensor circuity in fuse box.

FUEL SYSTEM PRESSURIZATION

Fill up fuel tank.

Install on fuel tank, the special cap of leak tester kit (P/N 529 033 100).

Using vacum/pressure pump kit (P/N 529 021 800), inject air into fuel tank. See next photo.



TYPICAL
1. Special cap on tank
2. Air pump

Pressurize fuel system to 21 kPa (3 PSI). The pressure must not drop during 3 minutes.

If pressure drops, locate fuel leak(s) and repair/replace leaking component(s).

To ease locating leak(s) at fuel tank vent fitting, fuel gauge or fuel cap, spray soapy water on components; bubbles will indicate leak location(s).

High Pressure Test (Electric Fuel Pump Circuit)

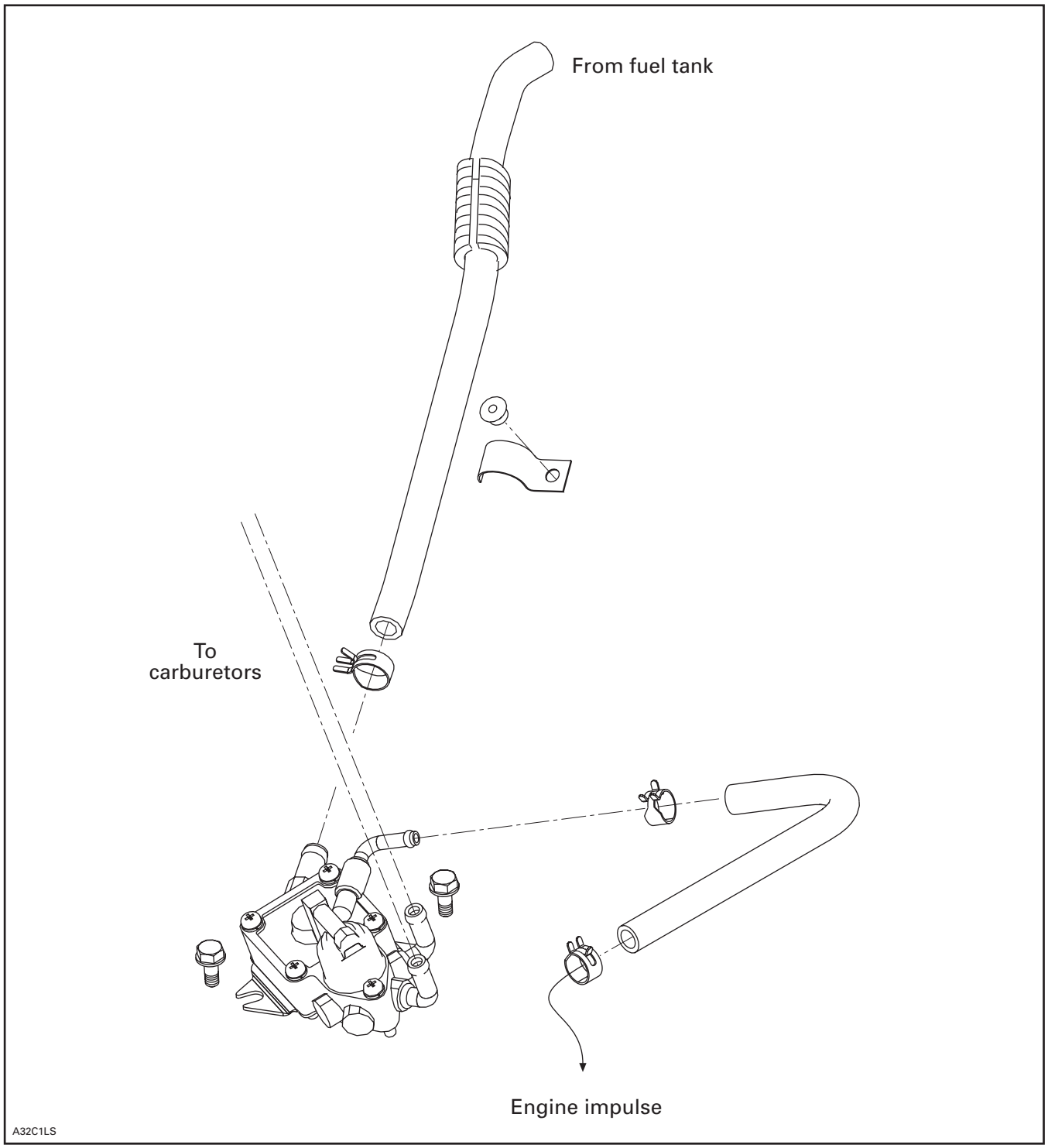
SDI Models Only

Install tether cord on DESS post. Push the emergency switch to OFF position. Push on start button to activate fuel pump.

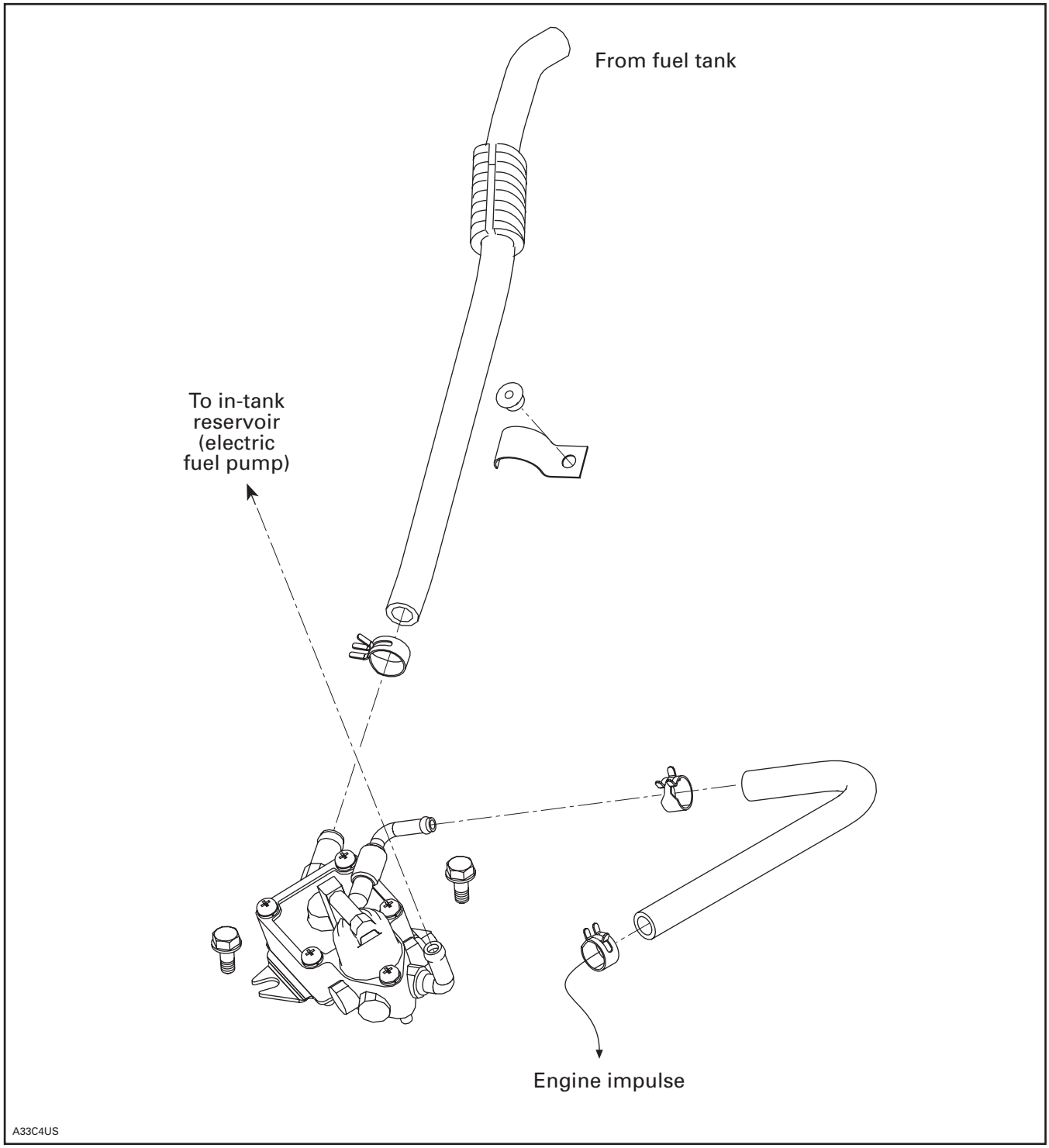
Check for any leakage at fuel rail, injectors, in-line fuel filter and fuel hose.

DIAPHRAGM FUEL PUMP

All Models except SDI



SDI Models


From fuel tank
To in-tank reservoir (electric fuel pump)
Engine impulse
A33C4US

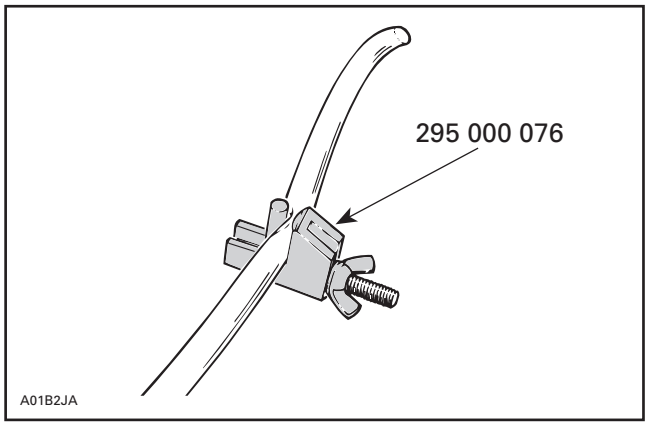
NOTE: The following instructions are applicable on SDI models for the diaphram fuel pump. See COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT concerning the electric fuel pump.

REMOVAL

Remove air intake silencer and carburetors (throttle body for the SDI models).

NOTE: Do not disconnect cables from carburetors or throttle body.

Install a hose pincher (P/N 295 000 076) on fuel supply line close to pump inlet.



Disconnect fuel outlet line(s).

Disconnect impulse line.

Remove screws securing fuel pump to chassis.

PUMP VERIFICATION

Check fuel pump valves operation as follows:

Connect a clean plastic tubing to the inlet nipple and alternately apply pressure and vacuum with pump of leak test kit. The inlet valve should release with pressure and hold under vacuum.

Repeat the same procedure at the outlet nipple. This time the outlet valve should hold with pressure and also under vacuum.

NOTE: Plug remaining outlet with finger while checking outlet valve.

Check impulse diaphragm and gasket on fuel pump with twin outlets as follows:

Connect a clean plastic tubing to the impulse nipple and plug vent hole on top cover on so equipped models. Either apply pressure or vacuum. The diaphragm/gasket must not leak.

CLEANING AND INSPECTION

The entire pump should be cleaned with general purpose solvent before disassembly.

Fuel pump components should be cleaned in general purpose solvent and dried with compressed air.

⚠ WARNING

Solvent with low flash point such as gasoline, naphtha, benzol, etc, should not be used as each is flammable and explosive.

Inspect diaphragm. The pumping area should be free of holes, tears or imperfections. Replace as needed.

INSTALLATION

Inverse removal procedure.

⚠ WARNING

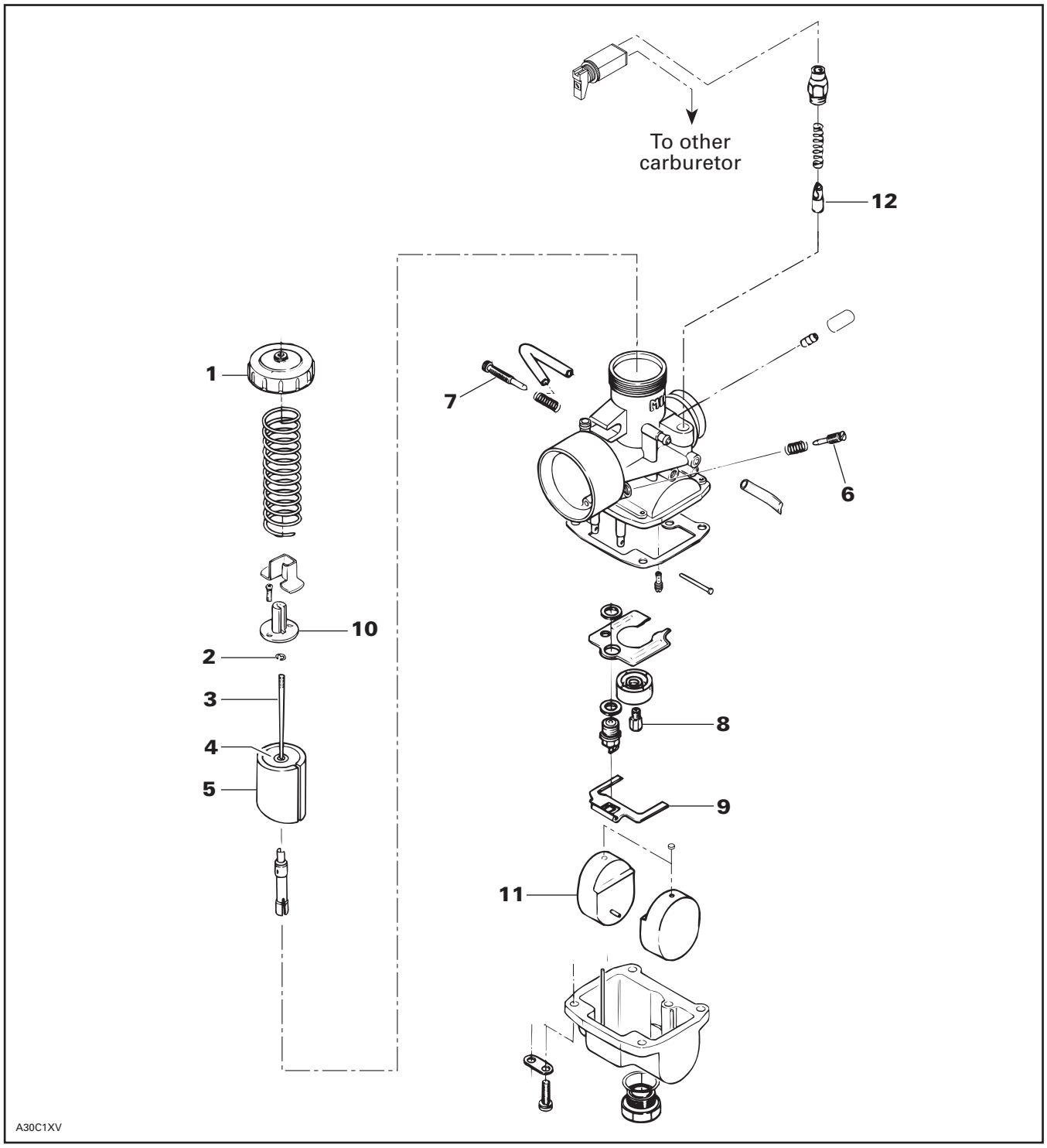
Pressure test to ensure there is no leak in fuel system.

CARBURETORS, THROTTLE AND CHOKE CABLES

SERVICE TOOLS

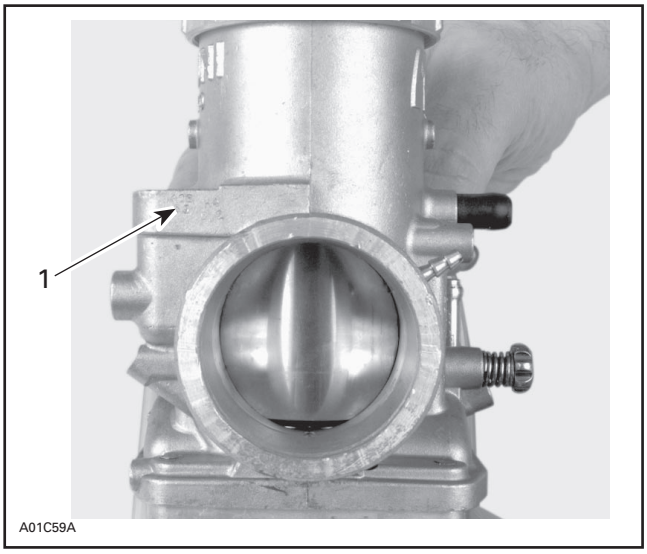
Description	Part Number	Page
carburetor tool kit	404 112 000	177–178, 187–188
choke plunger tool	529 035 602	182
float gauge	529 035 520	179

CARBURETOR — VM TYPE



IDENTIFICATION

All carburetors are identified on their body.



TYPICAL
1. Identification: 34-482

REMOVAL

Lift hood and open LH side panel.

Disconnect carburetor vent hose from air intake silencer.

Loosen clamps retaining air intake silencer adapter to carburetors.

Remove air intake silencer.

NOTE: The following procedure applies to both carburetors. Carburetors can be removed individually.

Disconnect fuel inlet line.

Unscrew carburetor cover **no. 1** then pull out throttle slide **no. 5** from carburetor.

Disconnect throttle cable from throttle slide.

Loosen clamp retaining carburetor to intake adapter.

Remove carburetor from engine.

Unscrew choke plunger from carburetor.

CLEANING AND INSPECTION

The entire carburetor should be cleaned with a general solvent and dried with compressed air before disassembly.

CAUTION: Heavy duty carburetor cleaner may be harmful to the float material and to the rubber parts, O-rings, etc. Therefore, it is recommended to remove those parts prior to cleaning.

Carburetor body and pilot/main jets should be cleaned in a carburetor cleaner following manufacturer's instructions.

⚠ WARNING

Solvent with a low flash point such as gasoline, naphtha, benzol, etc., should not be used as they are flammable and explosive.

Check inlet needle tip condition. If worn, the inlet needle and seat must be replaced as a matched set.

NOTE: Install needle valve for snowmobile carburetor only. It is designed to operate with a fuel pump system.

Check throttle slide **no. 5** for wear. Replace as necessary.

Check idle speed screw straightness. Replace as necessary.

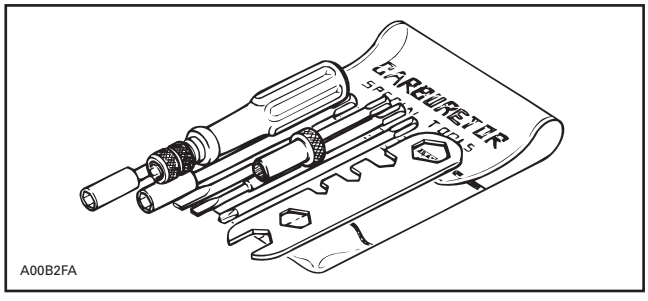
Check for fuel soaked into float **no. 11**; replace as necessary.

Check float for cracks or other damages affecting free movement; replace as necessary.

Inspect throttle cable and housing for any damages. Replace as necessary.

DISASSEMBLY AND ASSEMBLY

NOTE: To ease the carburetor disassembly and assembly procedures it is recommended to use carburetor tool kit (P/N 404 112 000).



E-Clip and Needle

Remove screws from needle retaining plate **no. 10** to remove the needle **no. 3**.

Float Bowl

Unscrew drain plug of float bowl. Recover the remaining fuel in a container.

Unscrew the 4 screws retaining the float bowl to the carburetor body. Remove float bowl.

NOTE: Upon float bowl removal, make sure not to drop carburetor floats.

Needle Valve Assembly

Remove float bowl as explained above.

Pull out pin retaining float arm to carburetor body. Remove float arm.

Unscrew needle valve.

Pilot Jet

Remove float bowl as explained above.

Unscrew pilot jet using narrow screwdriver from carburetor tool kit (P/N 404 112 000).

Main Jet

Remove float bowl as explained above.

Unscrew main jet from carburetor body.

NOTE: To replace main jet by a different size, main jet is accessible through the drain plug without removing float bowl.

CARBURETOR ADJUSTMENTS

NOTE: Carburetor is calibrated at the factory for a temperature of - 20°C (0°F) at sea level. For colder temperature or high altitude applications, carburetor must be recalibrated. A Service Bulletin gives information about carburetor calibration according to altitude and temperature.

Adjustments should be performed following this sequence:

- float arm adjustment
- e-clip and needle
- air screw adjustment
- throttle slide height (preliminary idle speed adjustment)
- throttle cable adjustment
- carburetor synchronization
- idle speed adjustment (engine running)

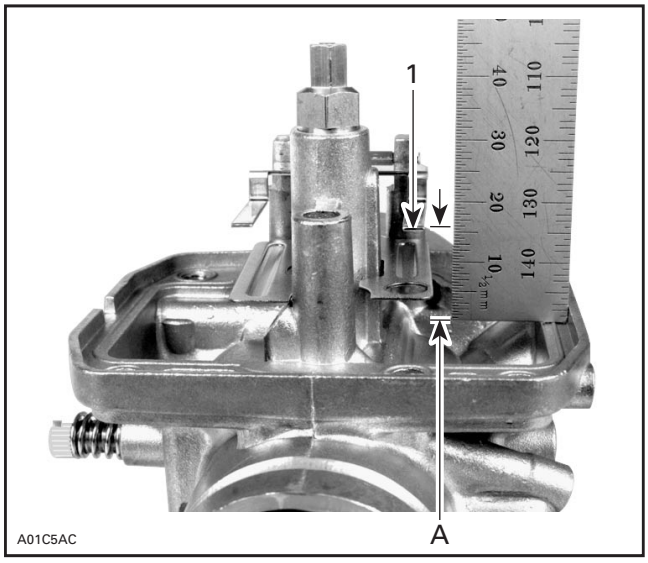
CAUTION: Oil pump cable must be readjusted whenever throttle cable or idle speed adjustment are changed, otherwise serious engine damaged may occurs.

Float Arm

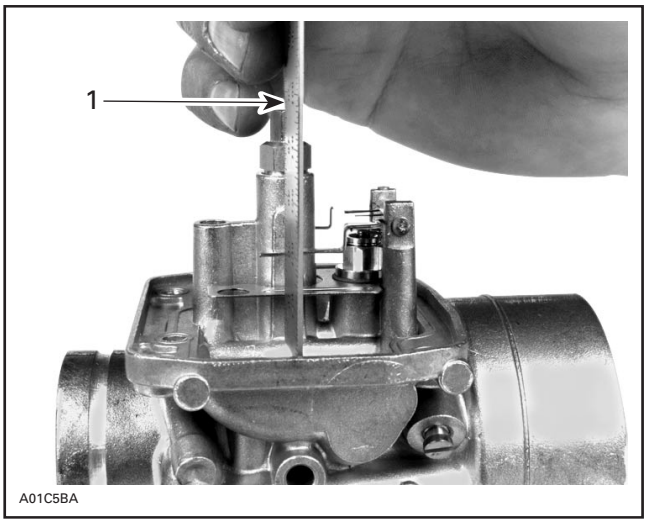
CAUTION: Spark plugs will foul if float is adjusted too low. Engine may be damaged if float is adjusted too high.

Correct fuel level in float chamber is vital toward maximum engine efficiency. To check for correct float level proceed as follows:

- Make sure that float arm **no. 9** is symmetrical — not distorted.
- Remove float bowl and gasket from carburetor.
- With carburetor chamber upside-down on a level surface, measure height H between bowl seat and top edge of float arm. Keep ruler perfectly vertical and in line with main jet hole.

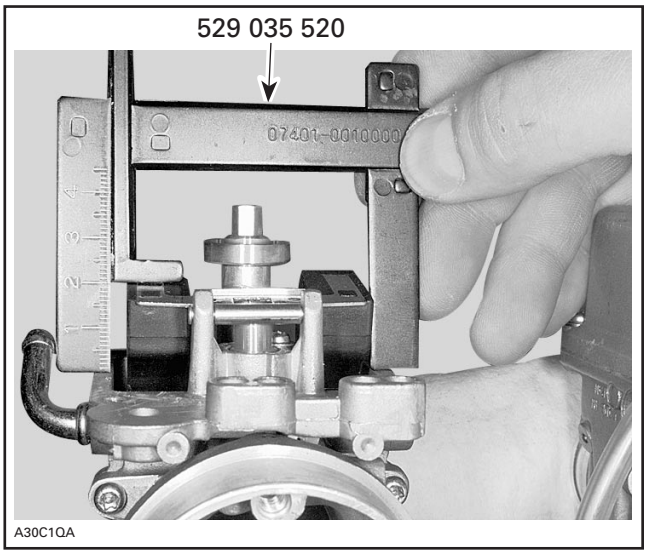


TYPICAL — VM TYPE
1. Measure from top of float arm
A. Float height (including float arm thickness)



TYPICAL — VM TYPE
1. Ruler vertical and in line with main jet

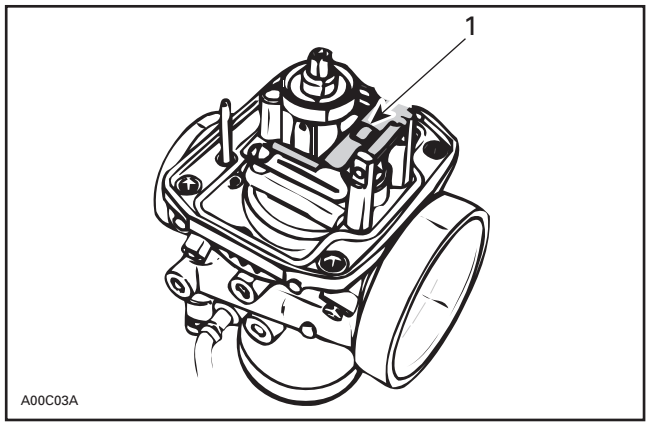
Float level height can be checked using float gauge (P/N 529 035 520). Keep tool in line with main jet as explained above.



CARBURETOR	FLOAT HEIGHT
VM 30-213 (377 engine)	23.9 ± 1.0 mm (.941 ± .039 in)
VM 34-617 (552 engine)	

To Adjust Height

– Bend the contact tab of float arm until the specified height is reached.

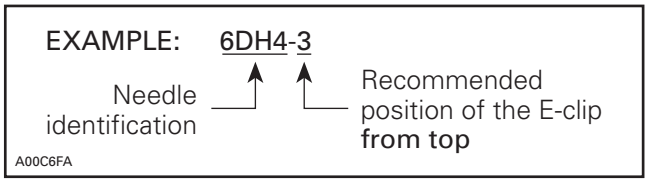


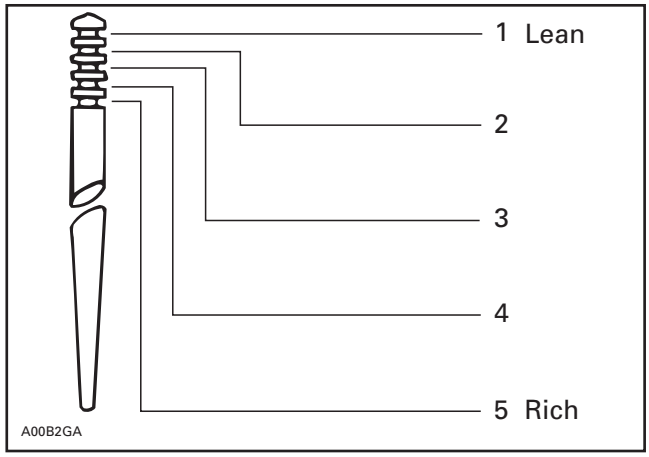
TYPICAL
1. Contact tab

E-Clip and Needle

The position of the needle in the throttle slide is adjustable by means of an E-clip **no. 2** inserted into 1 of 5 grooves located on the upper part of the needle. Position 1 (at top) is the leanest, 5 (at bottom) the richest.

NOTE: The last digit of the needle identification number gives the recommended calibrated position of the E-clip **from the top** of the needle.

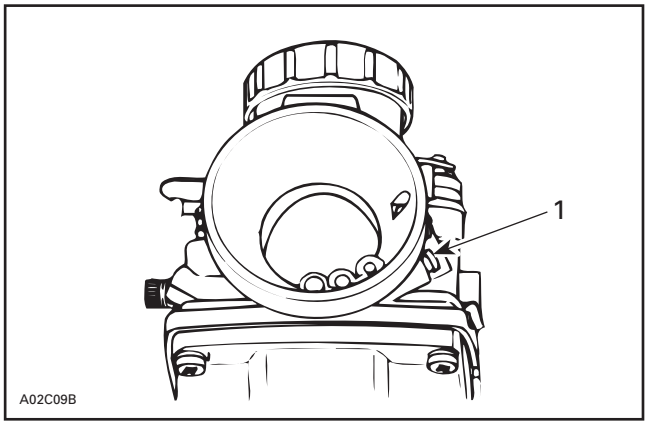




CLIP POSITIONS

Air Screw Adjustment

Completely close the **air screw no. 6** (until a slight seating resistance is felt) then back off as specified.



1. Air screw

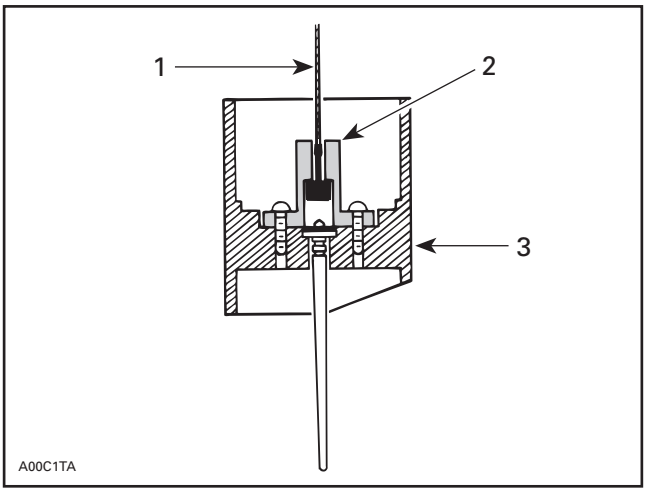
NOTE: Turning screw in clockwise enriches mixture and conversely, turning it out counterclockwise leans mixture.

CARBURETOR	AIR SCREW
VM-30 213 (377 engine)	2.0 turns
VM-34–617 (552 engine)	2.0 turns

Throttle Slide Height (preliminary idle speed adjustment)

Hook throttle cable into the needle retainer plate.

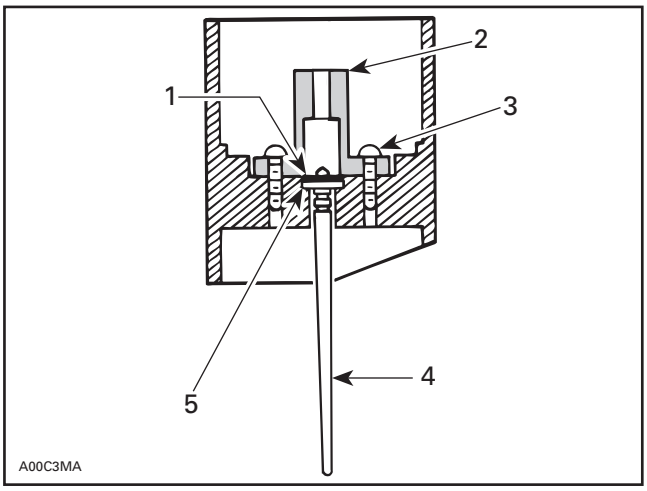
NOTE: Do not obstruct hole in throttle slide when installing needle retaining plate. This is important to allow air escaping through and thus allowing a quick response.



CENTER POST TYPE
1. Throttle cable
2. Needle retaining plate
3. Throttle slide

Make sure the nylon packing **no. 4** is installed on all applicable throttle slides.

CAUTION: Serious engine damage can occur if this notice is disregarded.



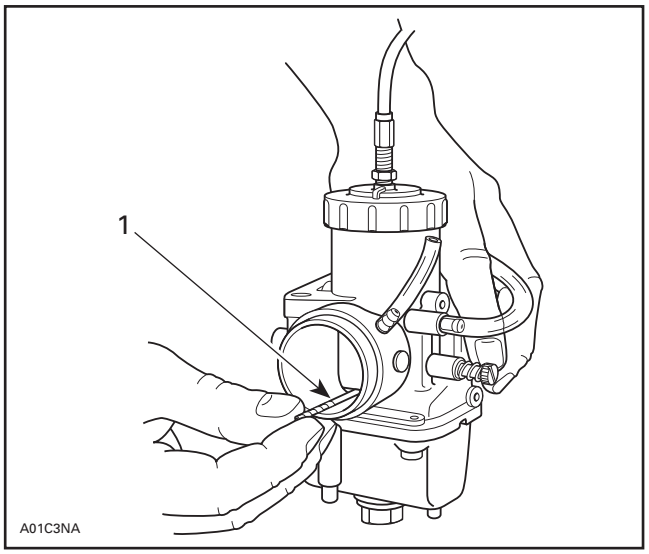
CENTER POST TYPE
1. E-clip
2. Needle retaining plate
3. Screw
4. Needle
5. Nylon packing

Using a drill bit, adjust throttle slide height (see following table) by turning idle speed screw **no. 7**.

Throttle slide height is measured on outlet side of carburetor (engine side).

NOTE: Make sure that throttle cable does not hold throttle slide. Loosen cable adjuster accordingly.

ENGINE	THROTTLE SLIDE HEIGHT (drill bit size) ± 0.1 mm (± .004 in)
377 engine	1.7 (.067)
552 engine except in Summit	1.6 (.063)
552 engine in Summit	1.9 (.075)



TYPICAL
1. Drill bit used as gauge for throttle slide height

Final idle speed adjustment (engine running at idle speed) should be within 1/2 turn of idle speed screw from preliminary adjustment.

NOTE: Remaining carburetor adjustments are performed once carburetor is installed in vehicle. Refer to INSTALLATION BELOW.

INSTALLATION

CAUTION: Never allow throttle slide(s) to snap shut.

Prior to installing carburetor, adjust air screw and preliminary idle speed as described above.

To install carburetor on engine, inverse removal procedure.

However, pay attention to the following:

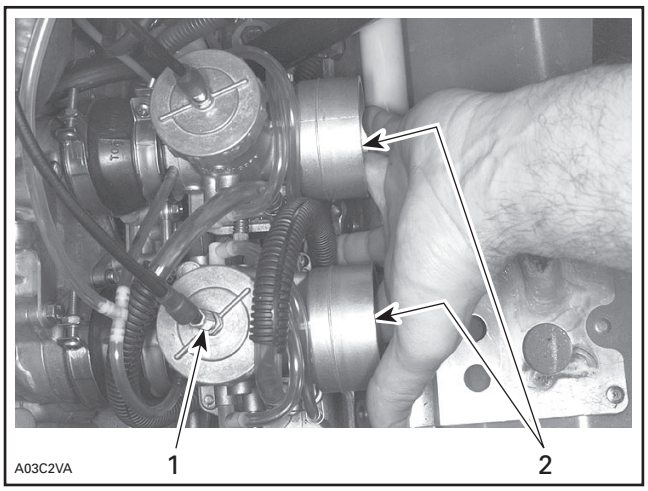
On applicable models, make sure to align tab of carburetor with notch of intake adapter.

CAUTION: The rubber intake adapter must be checked for cracks and/or damage. At assembly, the intake adapater must be perfectly matched with carburetor and engine otherwise severe engine damage will occur.

Carburetor Synchronization

When depressing throttle lever, both carburetor slides must start to open at same time.

Unlock cable adjustment lock nut on one carburetor. Screw or unscrew cable adjuster until all carburetor slides start to open at same time. Cable play will be identical on all carburetors. Retighten jam nut.



TYPICAL
1. Screw or unscrew adjuster
2. Check that all slides start to open at the same time

Check throttle slide position at wide open throttle. Throttle slide must be flush or 1.0 mm (.040 in) lower than carburetor **outlet** bore. At that same position, check that throttle slide does not contact carburetor cover. Turn cable adjuster and recheck synchronization.

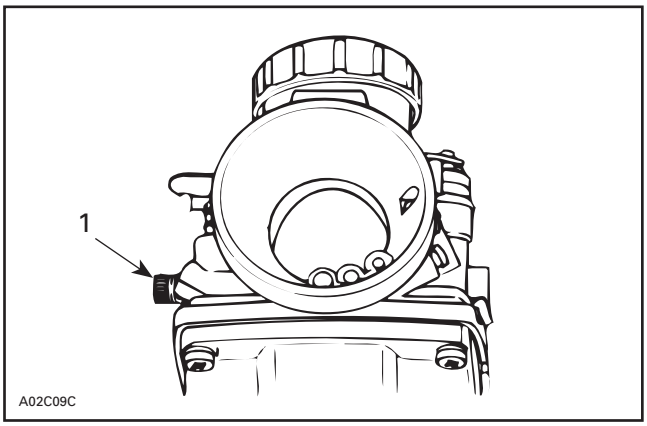
CAUTION: If the throttle slide rests against the carburetor cover at full throttle opening, this will create too much strain and may damage the throttle cable or other components in throttle mechanism.

CAUTION: Make sure all carburetors start to operate simultaneously.

Idle Speed Adjustment

CAUTION: Before starting engine for the final idle adjustment, make sure that oil pump is adjusted. The oil injection pump adjustment must be checked after each time carburetor idle is adjusted. Refer to OIL INJECTION SYSTEM.

Start engine and allow it to warm then adjust idle speed to specifications by turning **idle speed** screw clockwise to increase engine speed or counterclockwise to decrease it.



1. Idle speed screw

ENGINE	IDLE SPEED (RPM)
377 and 552	1650

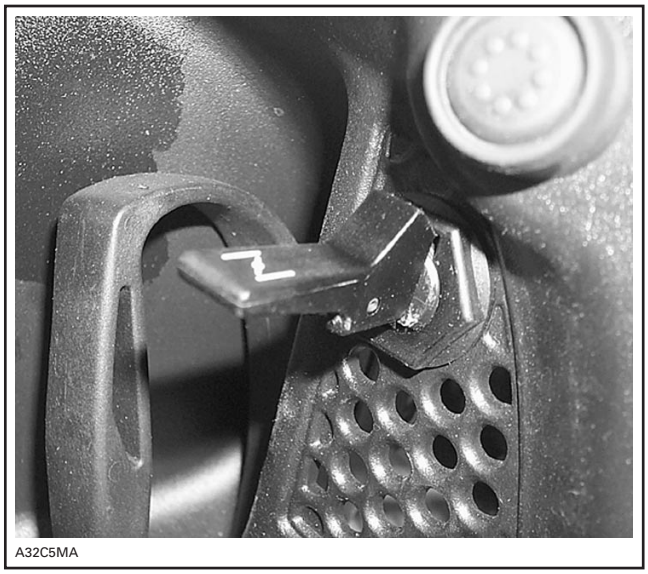
NOTE: Turn adjustment screw the same amount on each carburetor to keep carburetors synchronized.

CAUTION: Do not attempt to set the idle speed by using the air screw. Severe engine damage can occur.

CHOKE

Choke Plunger Adjustment

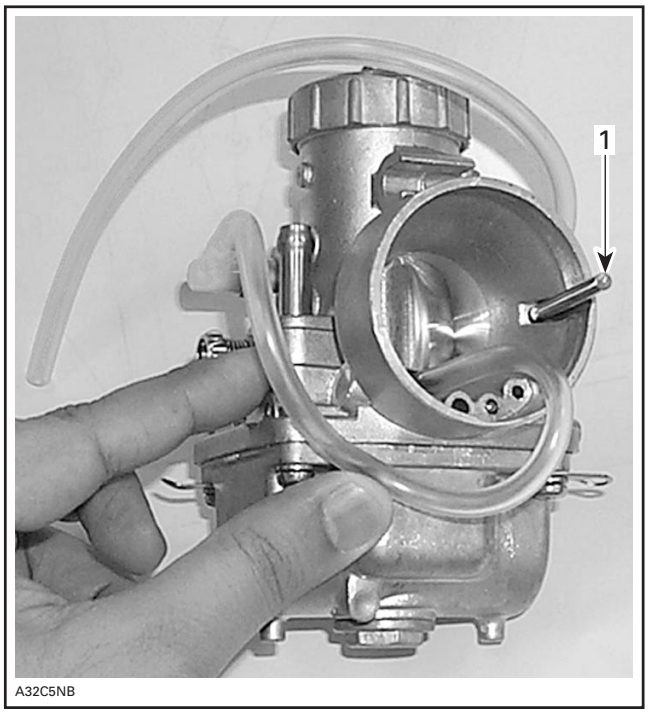
Set choke lever to half open position.



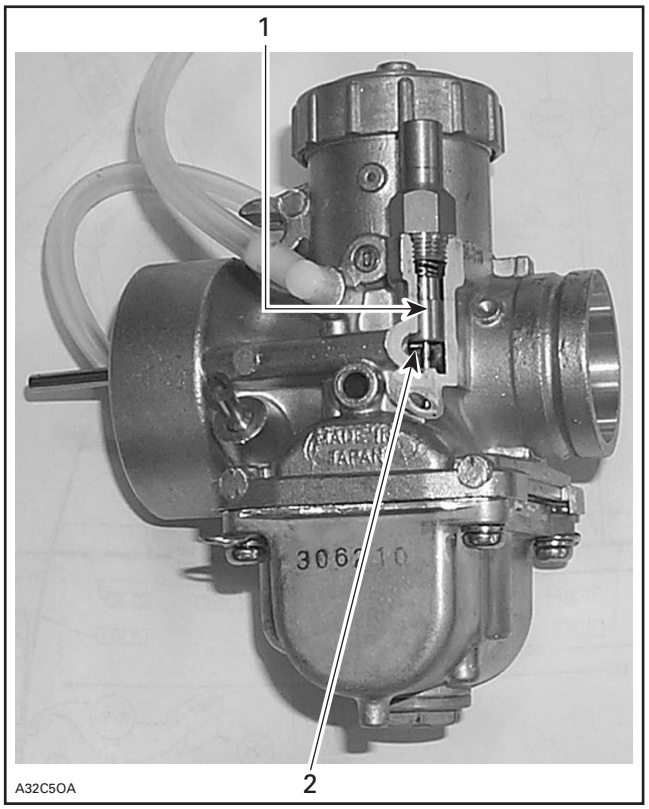
TYPICAL — CHOKE LEVER – HALF OPEN POSITION

Use choke plunger tool (P/N 529 035 602).

Insert the choke plunger tool into choke air inlet of carburetor. Tool stopper may not lean against recess wall.



AIR SILENCER SIDE SHOWN
1. Choke plunger tool



CUT-AWAY (ENGINE SIDE SHOWN)
1. *Choke plunger*
2. *Tool properly seated under choke plunger*

If tool tip does not seat under choke plunger **no. 12**, adjust as follows:

Make sure choke lever is at half open position.

Turn choke cable adjustment nut by hand until tool properly seats under choke plunger.

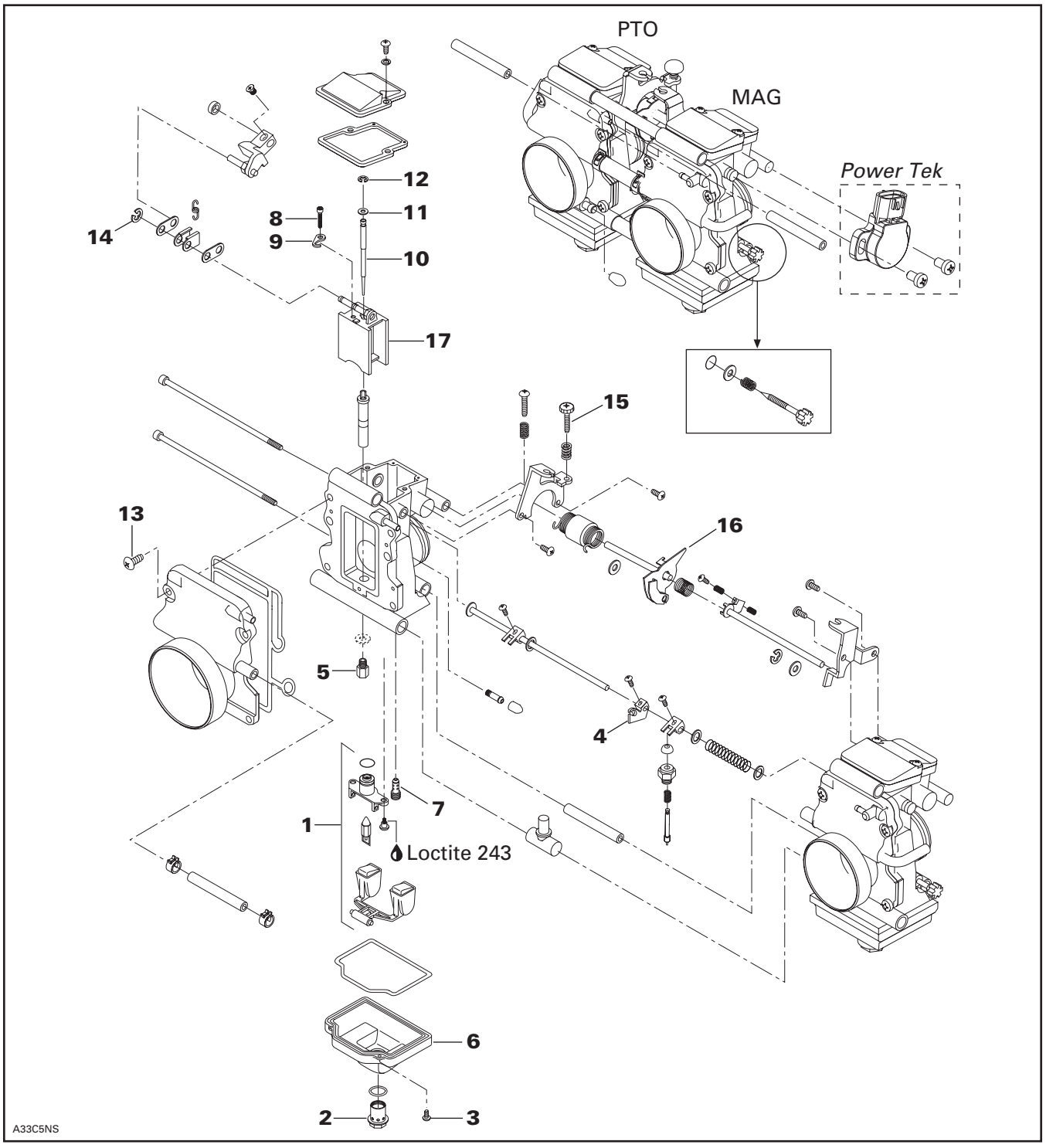
NOTE: A light pressure should be needed to position tool under plunger.

Tighten choke cable lock nut and reinstall protector cap.

Set choke lever to close and open positions and ensure that tool properly seats under plunger **only** when lever is set to half open position.

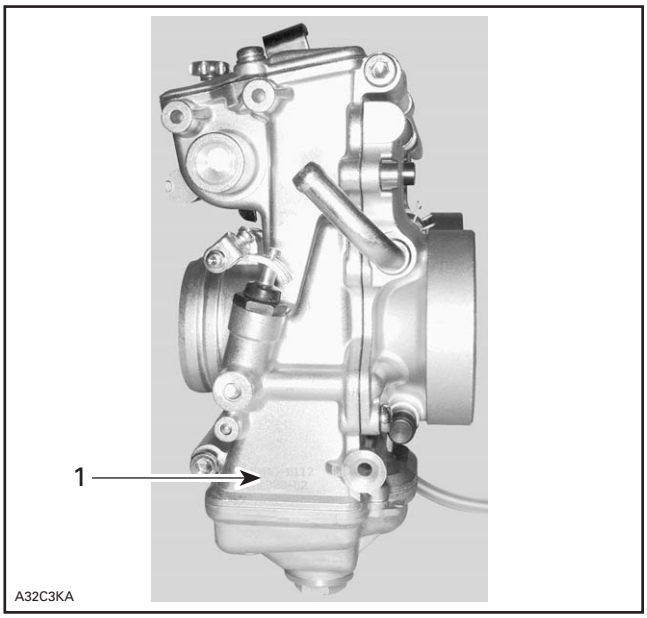
Set choke lever to close position and, by pulling and pushing choke lever, make sure there is no tension on cable (free play).

CARBURETOR TM TYPE



IDENTIFICATION

TM type dual carburetor ass'y is identified on PTO side carburetor body.



TYPICAL
1. Identification: TM 40-B112

REMOVAL

Throttle Position Sensor (TPS)

793 HO Power Tek Engine Only

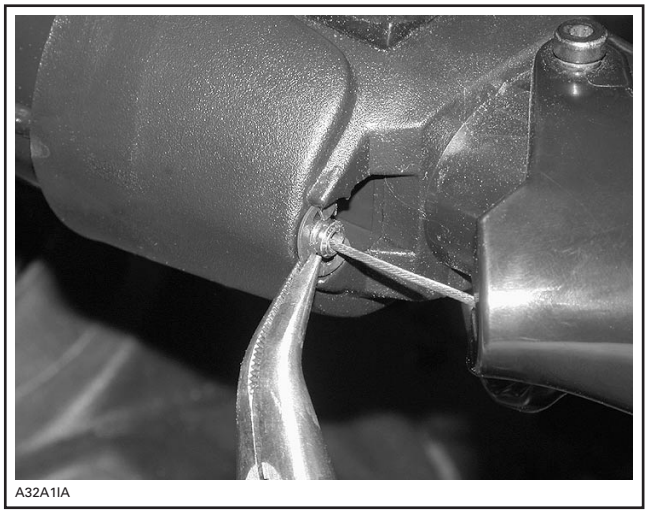
For replacement procedure, refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT in ENGINE MANAGEMENT (Power Tek).

Throttle/Oil Pump Cable

NOTE: Before removing the cable from vehicle, note its routing for installation.

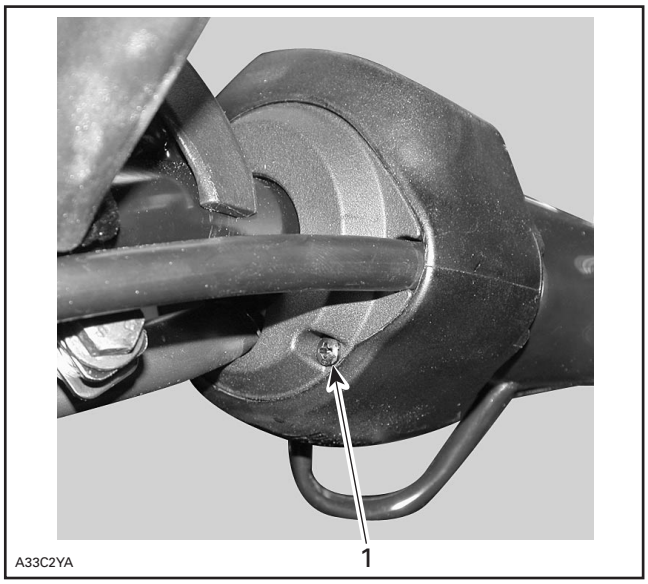
Using long nose pliers to hold the cable, push the end of cable out of its location.

Remove the retaining circlip.



TYPICAL

Remove the handle cover.



1. Handle cover screw

Unhook the cable sheath then remove the cable from handle.

Remove air intake silencer.

Disconnect the cable end from carburetors or throttle body.

Disconnect cable end from oil pump.

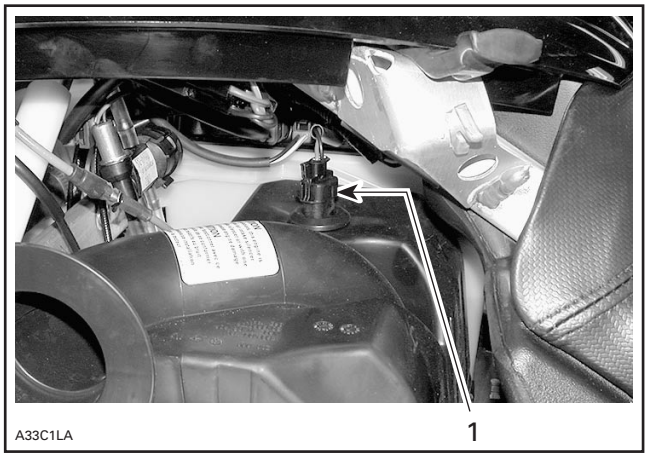
NOTE: The carburetors or the throttle body can be removed to allow an easier access to the oil pump.

Carburetors

Lift hood and open LH side panel.

DPM Models

Disconnect air temperature sensor connector at air intake silencer.



1. Disconnect

All Models

Loosen clamps retaining air intake silencer adapter to carburetors and remove air intake silencer.

DPM Models

Unhook DPM manifold from its support.

Disconnect carburetor vent hose form DPM manifold.

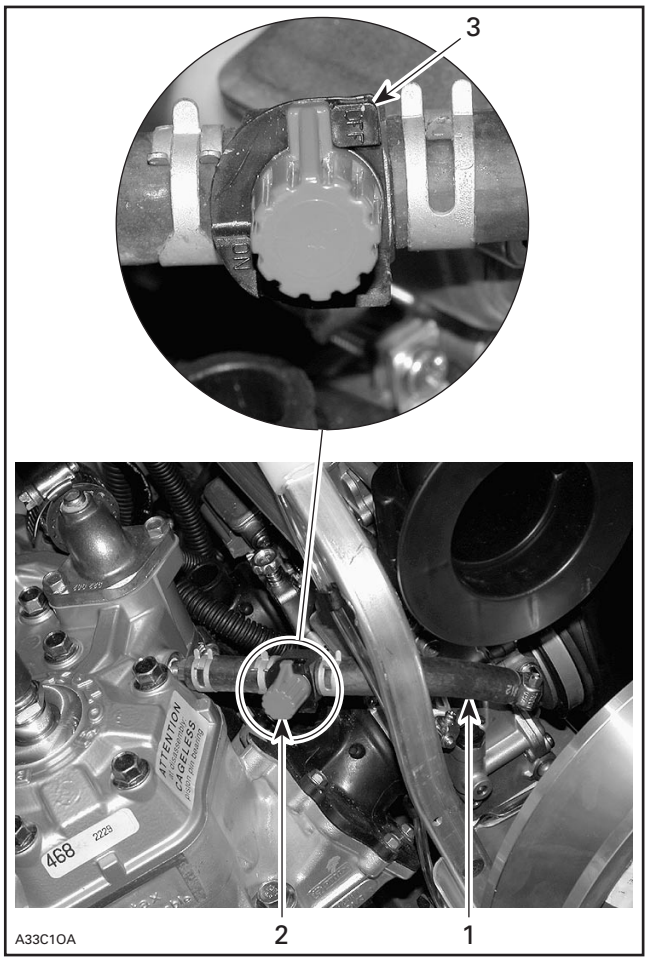
Disconnect TPS connector at carburetor (Power Tek models).

Non-DPM Models

Disconnect carburetor float bowl vent hose.

All Models

Close valve at heated carburetor coolant inlet line.



1. Inlet line
2. Valve
3. OFF

Disconnect heated carburetor coolant **inlet** line taking care to recuperate coolant.

Disconnect throttle and choke cables.

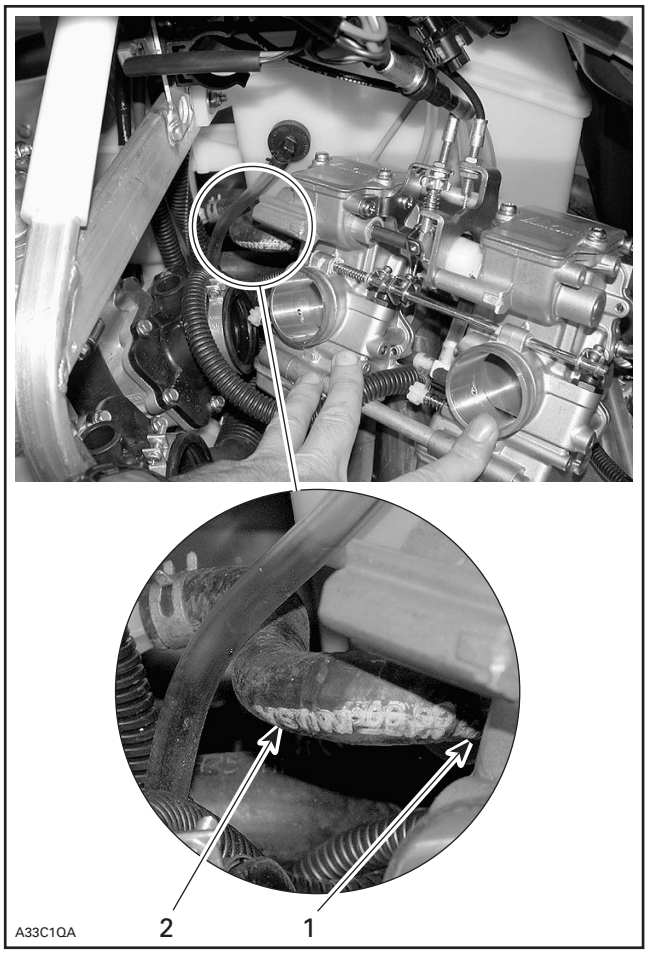
Loosen clamps retaining carburetors to intake adapters.

Remove carburetors, pinch and disconnect fuel line. Take care to recuperate fuel in a proper container.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always wipe off any fuel or oil spillage from the vehicle. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

Pinch heated carburetor coolant **outlet** line.



1. Outlet line
2. Pinch here

Disconnect **outlet** line from carburetor assembly taking care to recuperate coolant.

CLEANING AND INSPECTION

The entire carburetor should be cleaned with a general solvent and dried with compressed air before disassembly.

CAUTION: Heavy duty carburetor cleaner may be harmful to the float material and to the rubber parts, O-rings, etc. Therefore, it is recommended to remove those parts prior to cleaning.

Carburetor body and jets should be cleaned in a carburetor cleaner following manufacturer's instructions. When jets are very dirty or coated with varnish and gum, replace them.

⚠ WARNING

Solvent with a low flash point such as gasoline, naphtha, benzol, etc., should not be used as they are flammable and explosive.

Check throttle slide for wear. Replace as necessary.

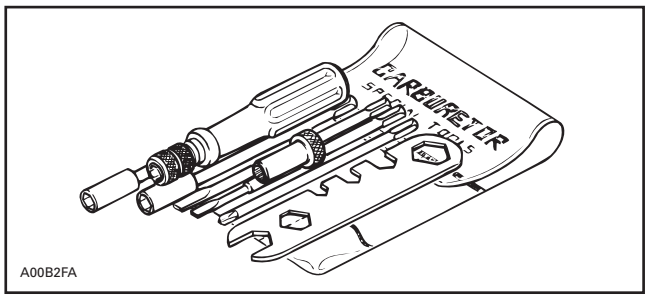
Check for fuel soaked into float **no. 1**; replace as necessary.

Check float for cracks or other damages affecting free movement; replace as necessary.

Inspect throttle and choke cables and housings for any damage. Replace as necessary.

DISASSEMBLY AND ASSEMBLY

NOTE: To ease the carburetor disassembly and assembly procedures, it is recommended to use carburetor tool kit (P/N 404 112 000).



Float Bowl

Unscrew drain plug **no. 2** and screw **no. 3**. Remove float bowl **no. 6**.

Float and Needle Valve Assembly

Unfasten both screws then, pull out float and needle valve assembly.

At assembly, apply Loctite 243 on screw threads.

Main Jet

The main jet **no. 5** installed in the carburetor has been selected for a temperature of -20°C (0°F) at sea level (except Power Tek models, refer to ENGINE MANAGEMENT). Different jetting can be installed to suit temperature and/or altitude changes. A service bulletin gives information about calibration according to altitude and temperature.

Main jet **no. 5** may be removed without removing float bowl **no. 6** by first removing drain plug **no. 2**.

Pilot Jet

Use narrow screwdriver from carburetor tool kit (P/N 404 112 000) to unscrew pilot jet **no. 7**.

Throttle Slide

⚠ WARNING

It is critical to the free operation of the throttle slide that the 2 connecting plates as assembled in one carburetor be of the exact same length. Always replace the connecting plates by a pair of new ones that were matched at the factory for length and discard the old ones. Simultaneously replace all the plates of the carburetors of a same rack.

Do not disassemble throttle slide **no. 17** needlessly.

CAUTION: After throttle slide reassembly, proceed with a leak test. See below for procedure.

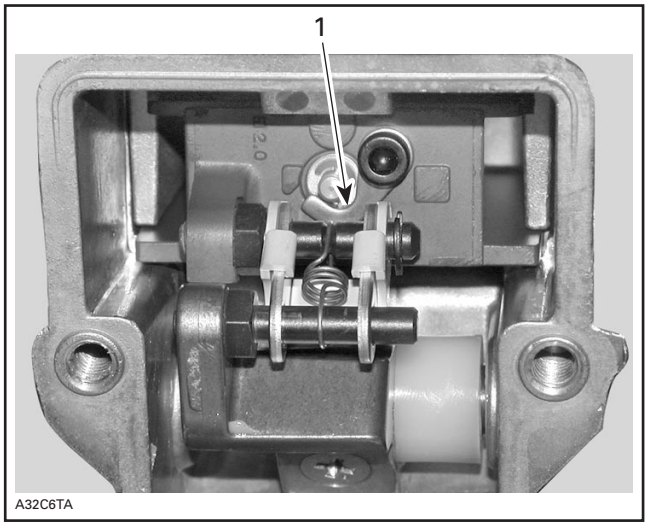
Disassemble both carburetors at the same time. Coolant hose between carburetor throttle slide covers must remain in place during the complete disassembly and assembly.

Remove carburetor cover.

Loosen needle retainer screw **no. 8**.

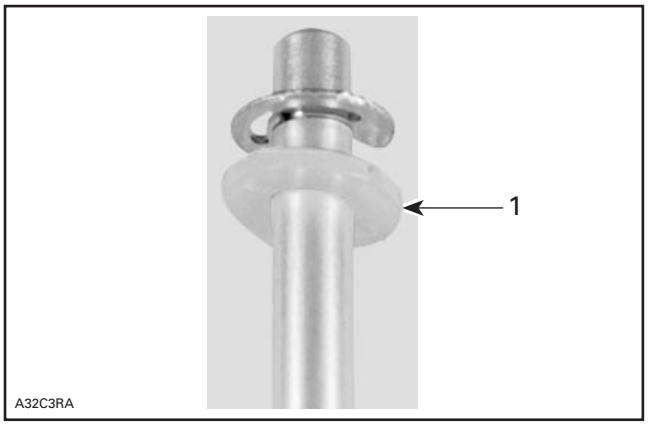
Fully open throttle and hold in this position for the following step.

Move aside needle retainer **no. 9**.



1. Needle retainer moved aside

Turn dual carburetor assembly upside down to free needle **no. 10**. Take care not to loose plastic washer **no. 11** under needle circlip **no. 12**.

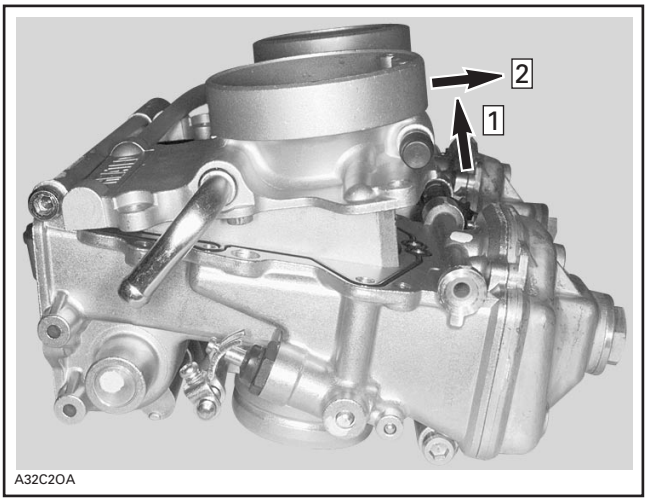


1. Plastic washer

Unscrew throttle slide cover screws **no. 13**.

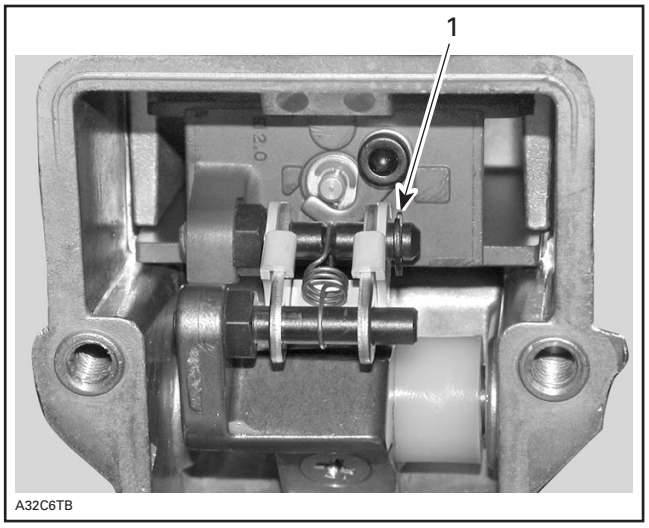
Open throttle 3/4 wide and keep that opening.

Lift throttle slide covers bottom first until they are free from carburetor bodies. Then, slide them out.



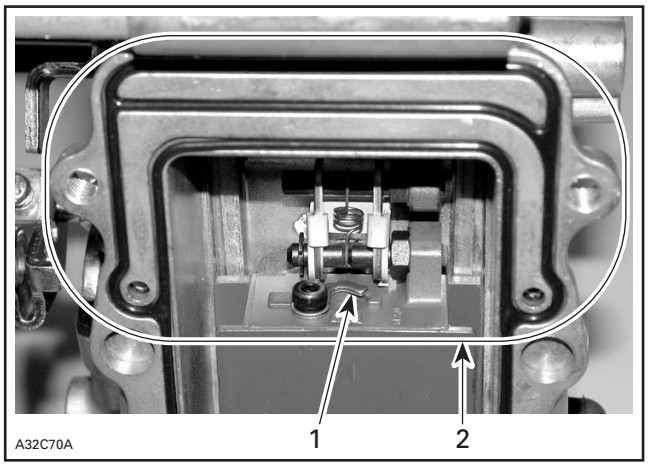
1. Lift bottom first
2. Slide out

Remove circlip **no. 14** retaining throttle slide.



1. Circlip

At throttle slide assembly, needle retainer must face carburetor body.



1. Needle retainer
2. Ensure O-ring gasket is properly seated in nipple area

After inserting throttle slide cover in place and before installing screws, ensure O-ring gasket is properly seated in its groove especially in the area around vent nipple. See illustration above.

INSTALLATION

Throttle/Oil Pump Cable

For installation, reverse the removal procedure.

To adjust throttle and oil pump cables see further in this section.

Carburetors

CAUTION: Never allow throttle slide(s) to snap shut.

Install throttle cable to cam lever no. 16.

Install choke cable to cam lever no. 4.

Install dual carburetor assembly.

Make sure dual carburetor assembly is properly inserted into intake adapters, hold it in place and tighten retaining clamps.

Secure heated carburetor inlet and outlet lines with clamps, tighten to 1.5 to 2.0 N•m (13 to 18 lbf•**in**) and remove pincher on outlet line.

Allow coolant to flow from coolant tank to carburetor before opening valve.

Connect all hoses to dual carburetor assembly and to DPM (if applicable), making sure there are no kinked hoses after reconnection.

Reconnect TPS connector (Power Tek models).

Reinstall air intake silencer.

Make sure dual carburetor assembly properly slides into air intake silencer adapters; hold it in place and tighten clamps.

Non-DPM Models

Reconnect carburetor vent hose.

DPM Models

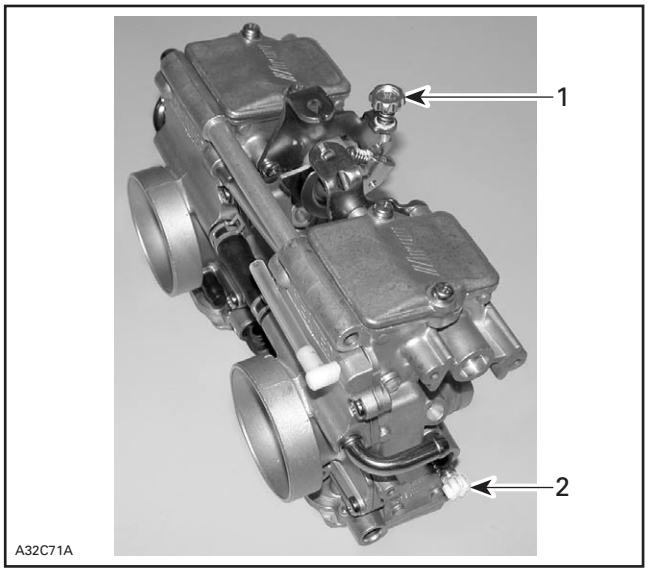
Reinstall DPM manifold in its support.

Reconnect air temperature sensor connector to air intake silencer.

CARBURETOR ADJUSTMENTS

Adjustments should be performed following this sequence:

– pilot screw adjustment
– carburetor synchronization and throttle slide height (preliminary idle speed adjustment)
– throttle cable adjustment
– TPS reset (Power Tek engine)
– idle speed adjustment (engine warmed up, all components installed).



1. Idle speed screw
2. Pilot screw (one on each carburetor)

Pilot Screw Adjustment

Completely close the pilot screw (until a slight seating resistance is felt) then back off as specified.

Turning screw in clockwise leans mixture and conversely, turning it out counterclockwise enriches mixture.

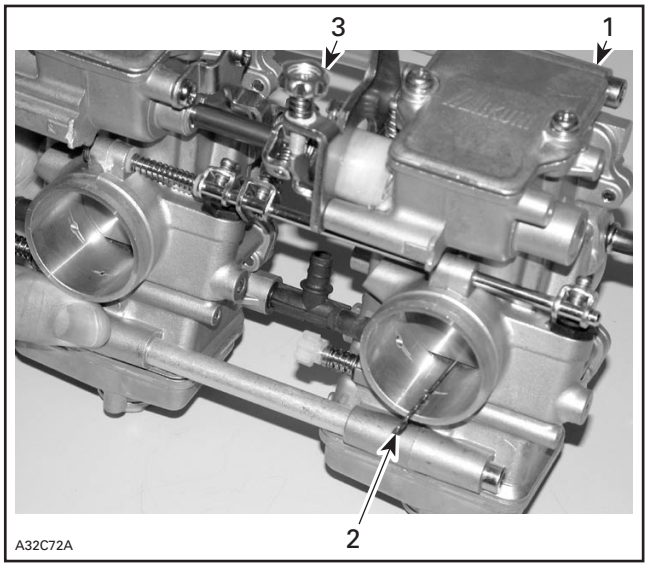
ENGINE	TURNS
All	1.5

Carburetor Synchronization and Throttle Slide Height (preliminary idle speed adjustment)

First proceed on PTO carburetor.

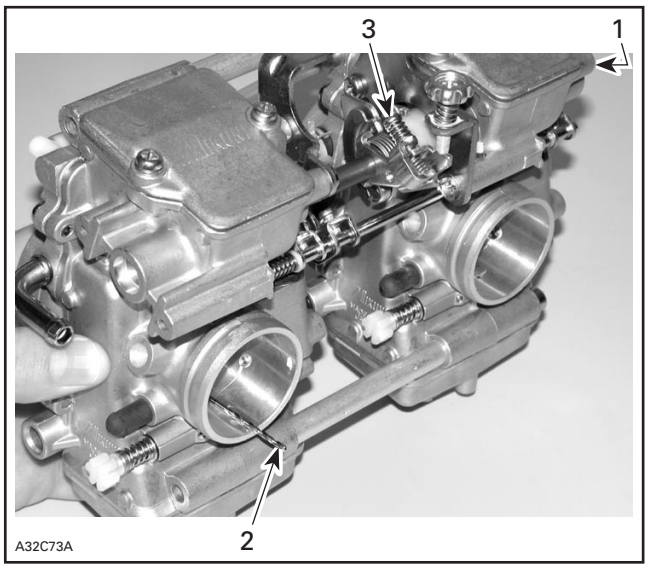
Use a drill bit to measure throttle slide height (see following table) on **outlet** side of carburetor (engine side).

Adjust by turning idle speed screw **no. 15**.



1. Adjust PTO carburetor first
2. Drill bit used as a gauge to measure throttle height
3. Idle speed screw

For MAG carburetor use synchronization screw. Use same drill bit as for PTO carburetor to measure throttle slide height. Turn synchronization screw to adjust.



1. PTO carburetor adjusted first
2. Drill bit used as a gauge to measure throttle height
3. Synchronization screw

NOTE: Make sure that throttle cable does not hold throttle slide. Loosen cable adjuster accordingly.

Final idle speed adjustment (engine running at idle speed) should be within 1/2 turn of idle speed screw from preliminary adjustment.

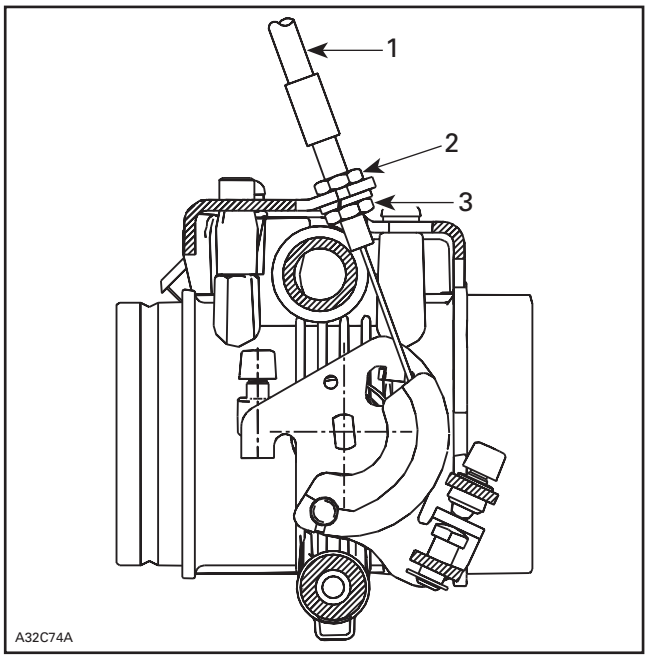
MODELS	THROTTLE SLIDE HEIGHT (drill bit size) ± 0.1 mm (± .004 in)
593 engine	1.5 (.059)
593 HO engine except in Summit models	1.6 (0.063)
793 HO engines except in Summit Models	1.7 (0.067)
593 HO and 793 HO engines in Summit models	2.0 (.079)

Throttle Cable Adjustment

NOTE: For SDI models, refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT in ENGINE MANAGEMENT (SDI).

Adjust throttle cable as per following procedure:

Loosen throttle cable housing adjusting and locking nuts.



1. Throttle cable
2. Adjusting nut
3. Locking nut

While holding throttle lever to wide open throttle position, adjust throttle cable until cut-away lower edge is equal or 1.0 mm (.04 in) lower than the venturi bore on engine side. In this position, turn cable housing adjusting nut and tighten lock nut.

Also ensure that, when throttle is released to idle position, the idle adjusting screw end touches its stopper. No tension should be applied to throttle cable.

CAUTION: Oil pump cable must be readjusted whenever throttle cable adjustment or idle speed are changed, otherwise serious engine damage may occurs.

793 HO Power Tek Engine

NOTE: On a Power Tek engine, if there is any tension on the throttle cable, it will not be possible to reset the TPS (TPS will be out of range).

Use the VCK (Vehicle Communication Kit) to reset the TPS. For further information, refer to COMPONENT INSPECTION, REPLACMENT AND ADJUSTMENT in ENGINE MANAGEMENT (Power Tek) section.

CAUTION: Whenever throttle cable is replaced or readjusted, the TPS reset must be performed, otherwise serious engine damaged may occurs.

Idle Speed Adjustment

CAUTION: Before starting engine for the idle adjustment, make sure that oil pump is adjusted. The oil injection pump adjustment must be checked after each time carburetor idle is adjusted. Refer to OIL INJECTION SYSTEM.

Start engine and allow it to warm then adjust idle speed to specifications by turning idle speed screw clockwise to increase engine speed or counterclockwise to decrease it.

ENGINE	IDLE SPEED (RPM)
593 and 593 HO	1600
793 HO	1500

CAUTION: Do not attempt to set the idle speed by using the pilot screw. Severe engine damage can occur.

CHOKE CABLE

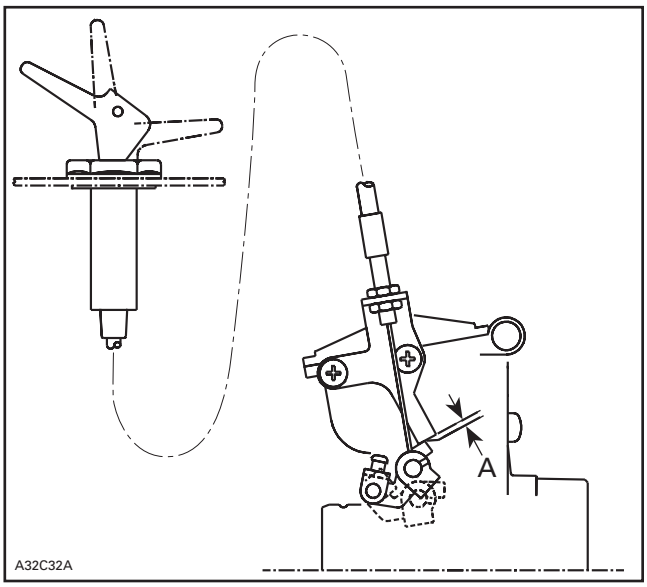
Adjustment

Adjust choke cable as per following procedure:

Loosen choke cable housing adjusting and locking nuts.

While choke lever is fully open, pull choke cable until cam lever reaches the stopper. Tighten cable housing adjusting and locking nuts in this position.

As a confirmation, the gap between the stopper and the cam lever should be within 0 and 0.5 mm (0 and 1/64 in).

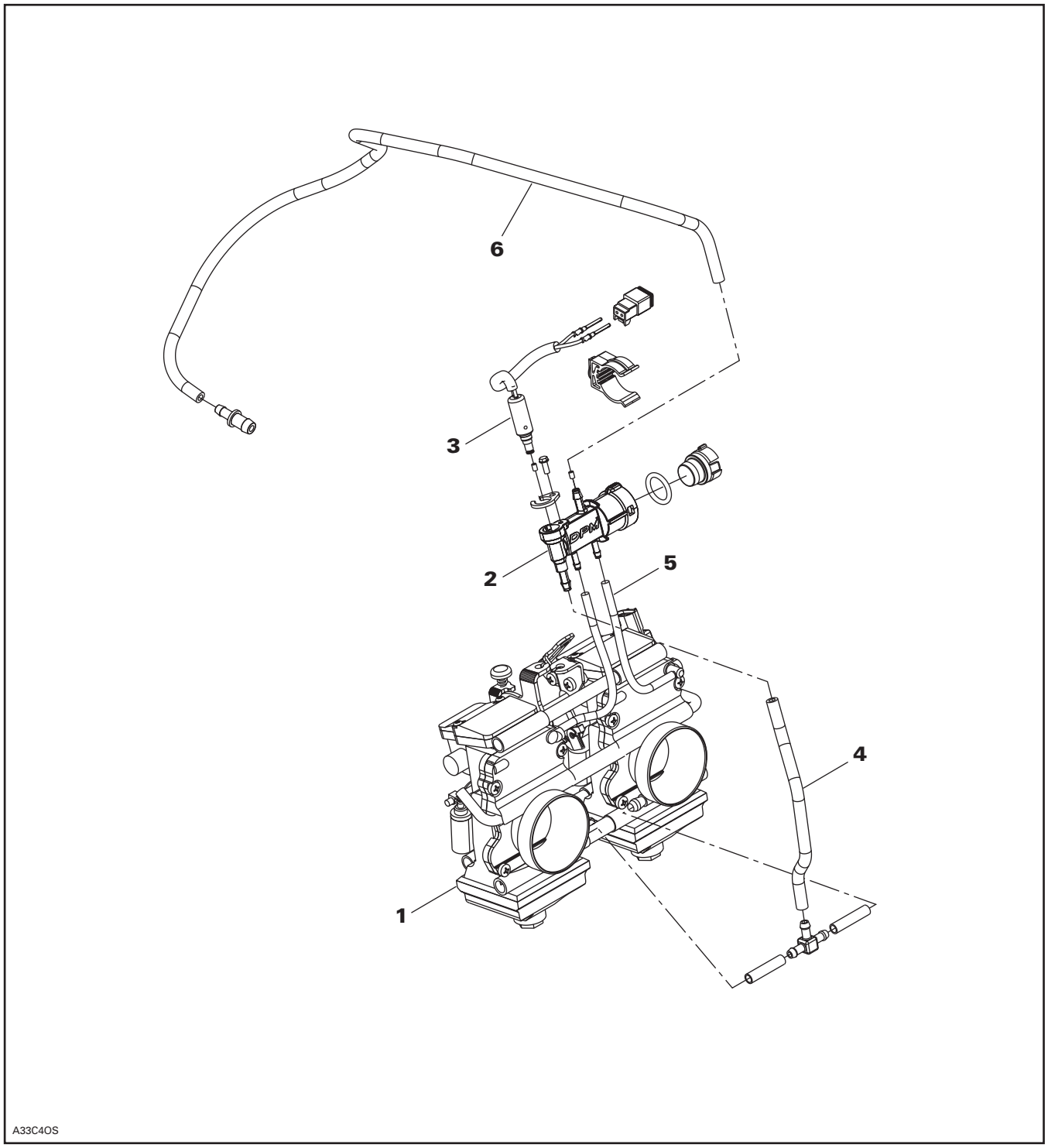


A. Within 0 and 0.5 mm (0 and 1/64 in)

DPM SYSTEM

SERVICE TOOLS

Description	Part Number	Page
Engine leak test kit	529 021 800	196



1. *TM carburetor*
2. *DPM manifold*
3. *DPM solenoid*
4. *Negative pressure tubes connected to venturi*
5. *Float bowl tubes*
6. *Vent tube connected to air intake silencer*

OVERVIEW

NOTE: For Power TEK engines, refer to ENGINE MANAGEMENT.

The carburetors are calibrated to operate at -20°C (-4°F), at sea level. Under these conditions the carburetors will properly fulfill engine air/fuel requirements and the DPM is not used. Therefore, the carburetor bowls are under atmospheric pressure and the carburetors work as conventional carburetors.

NOTE: For engine starting and warm-up, the required richer mixture is supplied by a conventional choke (enricher type).

When the temperature and/or altitude increases, then the carburetor jetting becomes inappropriate because engine needs less fuel. The DPM will then decrease the carburetor bowl pressure which in turn, leans the fuel mixture.

The DPM receives negative pressure created in the carburetor venturi. A solenoid (controlled by MPEM) opens the passage, when activated, to decrease the pressure in the carburetor bowls.

SYSTEM TESTING

All DPM Models except Power Tek Engines

NOTE: For Power TEK engines, refer to ENGINE MANAGEMENT.

Air Temperature Sensor

At 20°C (68°F), the sensor resistance must be 2500 Ω ± 300.

Sensor should also be tested through all its operating range. Use the following chart.

Replace sensor if not within specifications.

TEMPERATURE		RESISTANCE (OHMS)
°C	°F	
- 30	- 22	28 000
- 20	- 4	14 500
0	32	5 500
20	68	2 500
40	104	1 200
60	140	600
80	176	320
100	212	180
120	248	120

Solenoid and MPEM

Static Test

Unplug electric connector of solenoid and connect it to a 12 V battery. The solenoid must sound when it opens. Otherwise, replace solenoid. Repeat test several times.

Dynamic Test

Air temperature sensor must be at 20°C (68°F). For the test, operate the engine at the RPM specified in the following chart.

MODEL	TEST RPM
All	3800

The solenoid must vibrate.

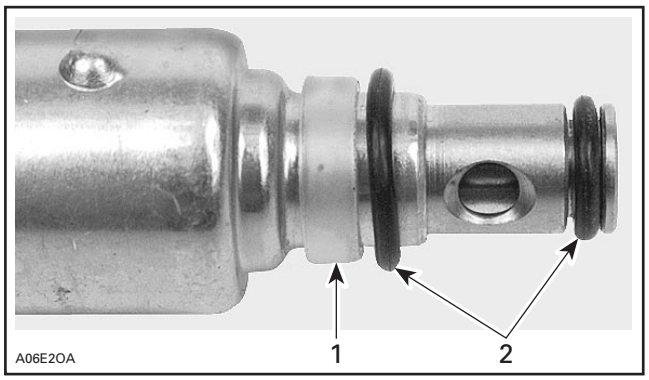
Otherwise, ensure fuse(s), wiring harness and connections are in good condition and if so, try a new MPEM and retest. Refer to ELECTRICAL section.

PARTS REMOVAL AND INSTALLATION

All DPM Models

Solenoid

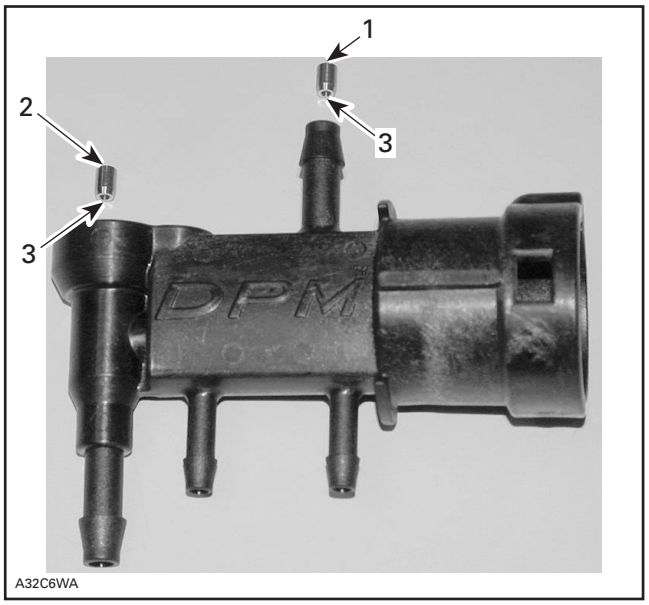
At reassembly, ensure that solenoid seals are in place.



1. Plastic seal
2. O-rings

Jet

When installing jet in DPM, ensure to position the taper end as shown.



1. Vent jet
2. Lean jet
3. Taper end here

Pay also attention not to mix jets. Refer to the following table for the proper inner diameter size. Refer to the illustration above for the jet location.

MODEL	INSIDE DIAMETER mm (in)	
	VENT JET	LEAN JET
All	1.2 (.047)	2.0 (.079)

Cap

Prior to installing DPM cap, ensure O-ring is in good condition. To install cap, firmly push until tabs click and lock on both sides in DPM.

DPM MANIFOLD TESTING

All DPM Models

Visual Inspection

With DPM manifold removed from vehicle and all hoses disconnected from DPM manifold, inspect for any broken fittings or missing dust caps. If any part is broken, replace DPM manifold and **do not proceed** with leak test procedure. If any part is missing, order necessary part as listed in parts catalog, replace, **then perform leak test procedure**.

If there is no apparent breakage or missing part on DPM manifold, perform the following leak test procedure.

Leak Testing

Required Items

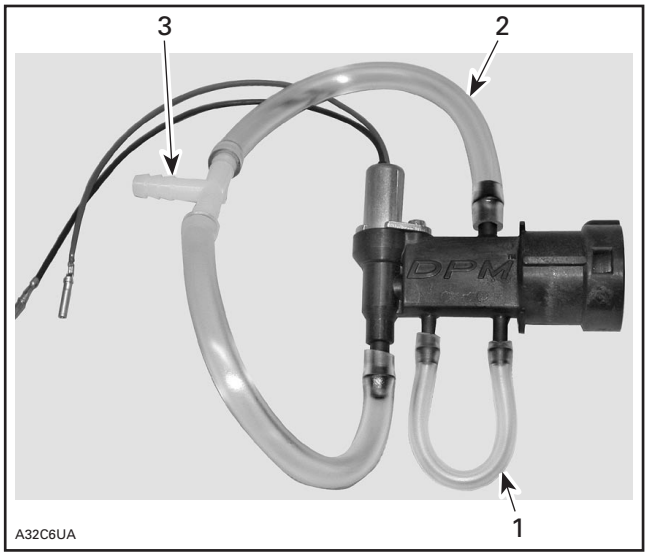
The following items will be required:

– Water column with at least 350 mm (13-3/4 in) in height.
– Engine leak test kit (P/N 529 021 800) .

– 4.8 mm (3/16 in) T-fitting.
– 6 mm (15/64 in) T-fitting.
– 3.5 mm (9/64 in) ID x 100 mm (4 in) hose.
– 6 mm (15/64 in) ID x 300 mm (12 in) hose.

DPM Manifold Preparation

Connect hoses as shown.

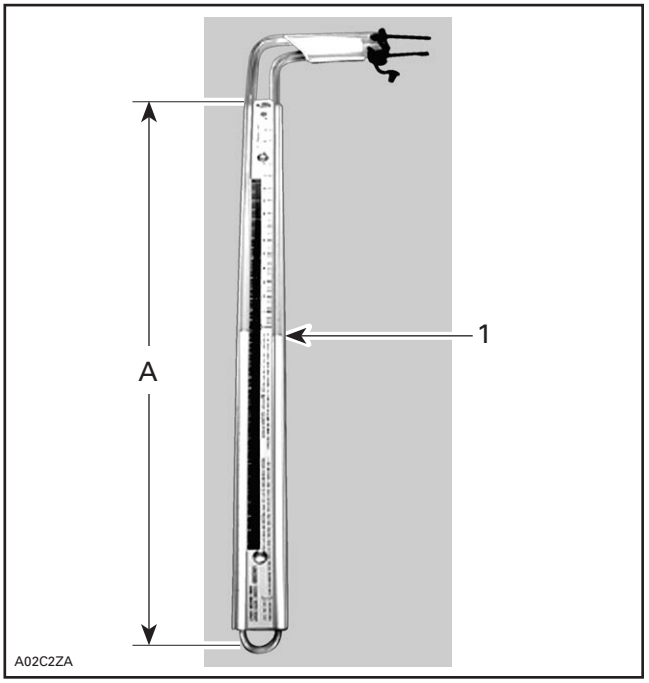


1. 3.5 mm (9/64 in) ID hose
2. 6.0 mm (15/64 in) ID hose
3. 6.0 mm (15/64 in) T-fitting

Water Column Preparation

Mount water column vertically and secure it to a wall or workbench.

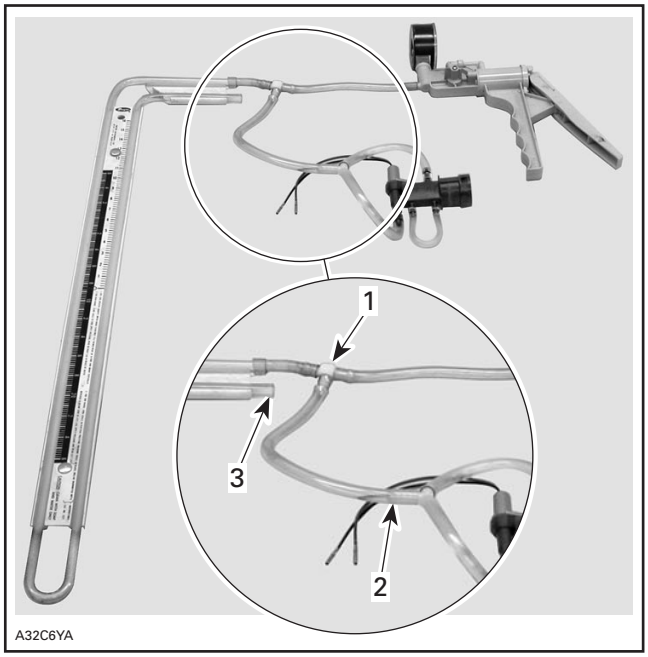
Fill water column to center line (at least 175 mm (6-7/8 in)) in height. Refer to following photo.



1. Center line at 175 mm (6-7/8 in)
A. 350 mm (13-3/4 in)

Connecting the Pump, DPM Manifold and Water Column

Connect hoses as shown.



1. 4.8 mm (3/16 in) T-fitting
2. T-fitting
3. Vented to atmosphere

Collect hose into one of the water column tubes, leave the other tube at atmospheric pressure.

Testing

Set pump to «vacuum».

CAUTION: Never use pump directly on DPM to make a pressure test. The vacuum produced by the pump is too high and would damage DPM components. Use the water column as explained above.

Apply negative pressure (vacuum) until the extremities of the water in the tube attain a difference of 350 mm (13-3/4 in).

Stop pumping and allow water levels to stabilize in tube.

Analysis

If water level remains unchanged, the DPM manifold **is not** defective.

If water level drops slowly to return to an even level in **more than** 10 seconds, the DPM manifold **is not** defective.

If water level drops to an even level in **less than** 10 seconds, the DPM manifold **is** defective. Replace DPM manifold parts, (refer to *Parts Catalog*) and re-test. If test fails again, replace DPM manifold.

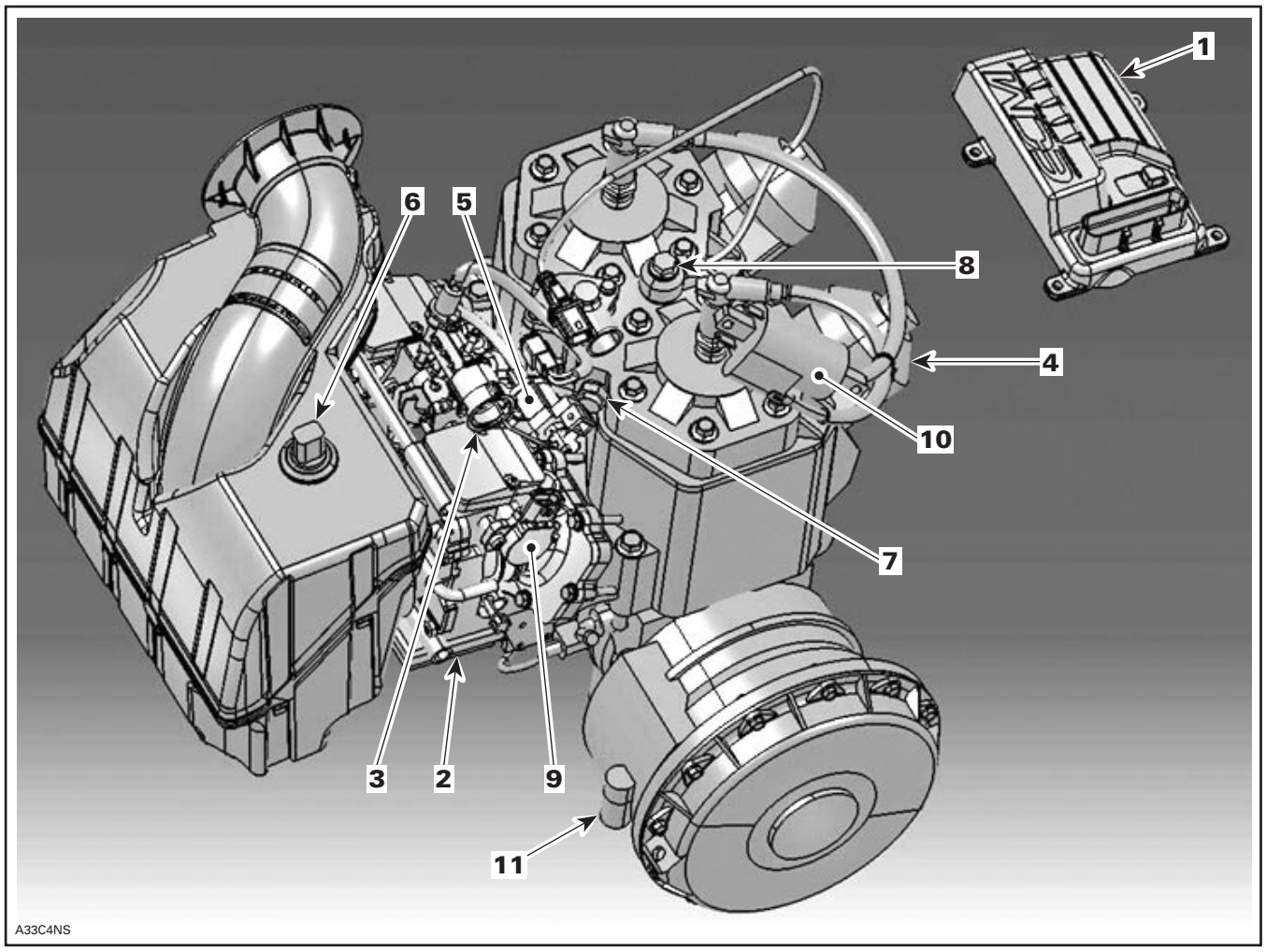
If you are unable to attain any amount of vacuum (water level increases and decreases immediately in tube), check your set-up and re-do the test.

If you still cannot attain any vacuum, DPM manifold **is** defective. Replace DPM manifold.

OVERVIEW

SERVICE TOOLS

Description	Part Number	Page
VCK (Vehicle Communication Kit)	529 035 981	202–203



1. Engine control module (ECM) including air pressure sensor (APS)
2. TM carburetors
3. DPM manifold
4. RAVE valves
5. RAVE valve solenoid
6. Air temperature sensor (ATS)
7. Coolant temperature sensor (CTS)
8. Knock sensor (KS)
9. Throttle position sensor (TPS)
10. Ignition coil
11. Trigger coil

OPERATING PRINCIPLE

Power TEK

The acronym Power TEK refers to the following technologies found on this engine:

Throttle position sensor
Electronic RAVE
Knock sensor

For this Power TEK 2-stroke engine, a TPS and a knock sensor have been added to provide inputs to the ECM. The engine is equipped with two traditional TM carburetors coupled with the DPM system (Digital Performance Management). The ECM electronically controls the electric RAVE valve solenoid and the DPM solenoid. This achieves an improved fuel economy, a cleaner engine for emission requirements and improved engine protection (against seizure). The use of a TPS along with the trigger coils (engine RPM) allows the ECM to recognize the engine load and thus using 3D DPM and ignition maps. The ECM applies the proper ignition and DPM maps for optimum engine operation in all riding conditions.

FUEL DELIVERY SYSTEM

Fuel Pump

The fuel pump is a conventional diaphragm type that supplies fuel to the carburetors. Refer to FUEL SYSTEM

Carburetors and DPM System

The carburetors are calibrated with the richest jetting required to fulfil the worse operating conditions.

The DPM manifold receives negative pressure created in the carburetor venturi. The DPM solenoid opens the passage from the venturi to decrease the pressure in the carburetor bowls which in turn, lean the fuel mixture.

Using predefined maps, the ECM is constantly activating (duty cycle) the DPM solenoid to optimize the air/fuel mixture.

The ECM receives the signals from different sensors which indicate engine operating conditions at millisecond intervals.

The engine RPM (through the trigger coils) and TPS are the primary sensors used to control the DPM. Other sensors (air pressure, air and coolant temperature) are used as secondary inputs.

As air temperature and altitude change, the ECM uses its 3D mapping to maintain the air/fuel mixture at an optimum.

The ECM begins to lean fuel mixture when engine RPM is above approximately 3500 RPM.

NOTE: For engine starting and warm-up, the required richer mixture is supplied by a conventional choke (enricher type).

For more detailed informations regarding the carburetors and DPM manifold, refer to FUEL SYSTEM section.

ENGINE MANAGEMENT SYSTEM (EMS)

The EMS (Engine Management System) is equipped with an ECM. The ECM is responsible for the following engine management/electrical functions:

– power distribution
– ignition system
– e-RAVE valves
– DESS (Digitally Encoded Security System)
– start/stop functions
– RER (Rotax Electronic Reverse)
– monitoring system
– diagnostic mode
– DPM system

The ECM is the central point of the engine management system. It reads the inputs, makes computations, uses predetermined parameters and sends the proper signals to the outputs for proper engine management.

The ECM also stores the fault codes and general information such as: vehicle hours, serial numbers, customer and maintenance information.

The ECM features a permanent memory that will keep the programmed tether cord cap(s) code, fault codes and other vehicle information, even when the battery is removed from the vehicle on electric start models.

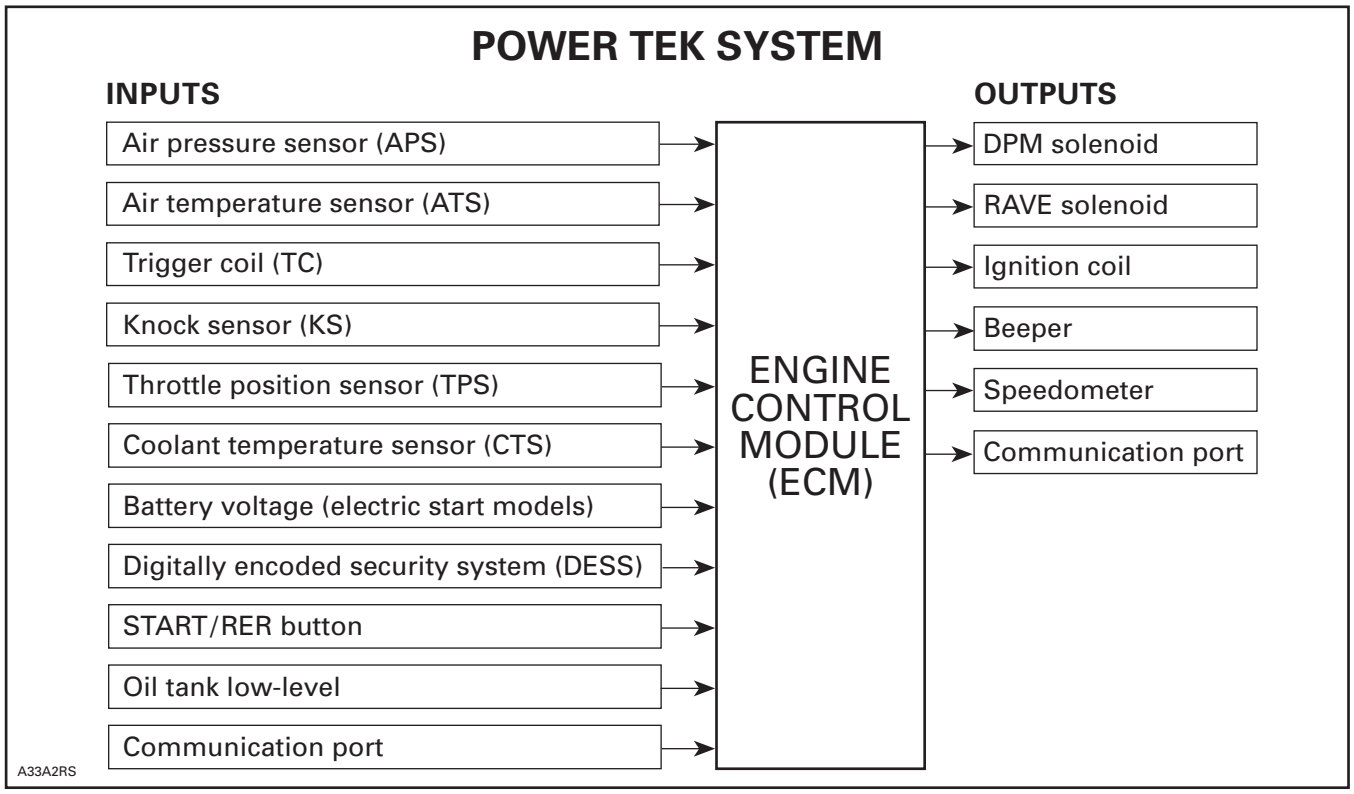
Manual Start Models

At cranking, the magneto sends AC current to the voltage regulator/rectifier that in turn, supplies the ECM with DC current. The ECM then supplies critical functions such as the ignition for engine starting. When engine reaches approximately 800 RPM, the ECM activates the relay that in turn, supplies the electrical loads (lights, accessories etc.).

Electric Start Models

The ECM is directly powered by the battery. When the start switch is activated, it wakes up the ECM which activates the ignition and starting system. When engine reaches approximately 800 RPM, the ECM activates the relay and in turn, it allows current from the voltage regulator/rectifier (supplied by the magneto) to go either to supply the electrical loads (lights, accessories etc.) or to charge the battery through the relay.

EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS



POWER DISTRIBUTION

Accessories are protected by fuses. ECM distributes current to low-power devices.

IMPORTANT: Engine-related sensors and actuators are continuously powered when engine runs. **The ECM switches the ground to complete the electrical circuits it controls.** Take this into account when troubleshooting the electrical system.

IGNITION SYSTEM

A CDI ignition system is used. The ECM sends the current to the primary winding of the ignition coil.

Ignition coil induces voltage to a high level in the secondary windings to produce a spark at both spark plugs simultaneously.

Trigger coils are used for:

1) Forward engine rotation.
2) Reverse engine rotation.
3) As a crankshaft position sensor (CPS). This information is sent to the ECM.

The ECM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the ECM controls the ignition timing for optimum engine operation.

Knock Sensor

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation.

When knocking occurs, a fault code is generated. Refer to DIAGNOSTIC PROCEDURES.

When knocking occurs, the ECM temporarily retards ignition timing and enrichens fuel mixture until knocking disappears. Then, previous parameters automatically resume as required.

Engine RPM Limiter

The ECM will limit the maximum engine speed (approximately 8600 RPM).

ELECTRONICALLY CONTROLLED RAVE

The electronically controlled RAVE (e-RAVE) offers two performance enhancements to conventional RAVE system.

– The opening of the valve is activated electronically. A solenoid holds the valve closed. The ECM monitors throttle position and RPM to operates the solenoid in optimal conditions.
– The valve is opened by crankcase pressure. The greater and more constant pressure from the crankcase opens the valve more crisply.

NOTE: An electric heating element to the RAVE valve solenoid ensures proper function in very cold weather.

Although RAVE valve opening varies according to engine load and RPM, most of the time in usual riding the RAVE valves are held closed up to 50% of throttle opening and 7300 RPM. This gives a quieter engine, better engine efficiency and fuel economy.

DIGITALLY ENCODED SECURITY SYSTEM (DESS)

The following components are specially designed for this system: ECM, tether cord cap and DESS post.

This system allows the engine to reach pulley engagement speed only if a programmed tether cord cap is installed on DESS post. See below for details.

The DESS circuitry is already activated on replacement ECMs.

The tether cord cap contains a magnet and a ROM chip. The magnet actually closes the reed switch inside the post which is the equivalent of a mechanical ON/OFF switch. The chip has a unique digital code.

NOTE: Actually, it is the memory of the ECM which is programmed to recognize the digital code of the tether cord cap. This is achieved with the VCK (Vehicle Communication Kit) (P/N 529 035 981). Refer to its operation manual or help system to program a tether cord cap.

The system is quite flexible. Up to 8 tether cord caps may be programmed in the memory of the ECM. They can also be erased individually.

NOTE: If desired, a tether cord cap can be used on other vehicle equipped with the DESS. It only needs to be programmed for that vehicle.

When starting the engine with a tether cord cap on the post, the DESS is activated and will emit audible signals:

– 2 short beeps indicate a working tether cord cap. Vehicle can be driven.
– 1 short beep indicates a wrong tether cord cap is being used or that something is defective. Vehicle can not be driven.

Engine Starting

If the ECM recognizes a valid tether cord cap, it allows engine to rev above 3000 RPM.

The ECM will shut down immediately after stopping the engine.

ROTAX ELECTRONIC REVERSE (RER)

The ECM recognizes a signal sent by the START/RER switch.

When switch is activated and engine is not running, ECM allows normal engine starting.

When switch is activated and engine is running at idle, the ECM cuts ignition. Therefore, engine RPM gradually drops. When engine reaches a low threshold RPM, the ECM sends an ignition spark at a great advance creating a thrust which reverses engine rotation.

On liquid cooled engines, both trigger coils work all the time.

Under a threshold low RPM or above drive pulley engagement speed, the RER function is disabled. Nothing takes place when pressing Start/RER button.

MONITORING SYSTEM

The ECM monitors the electronic components of the engine and some components of the electrical system.

When a fault occurs, it sends visual messages through the referring LED in speedometer and/or audible signals through a beeper to inform you of a particular condition. Refer to the DIAGNOSTIC PROCEDURES.

Low-Oil Level Warning Device

When the oil falls under a certain level, the low oil level LED will be illuminated.

High Coolant Temperature Warning Device

When the coolant temperature is getting to high, the ECM sends out signals to the beeper and the high temperature LED.

Idle Overheat Protection

If engine overheats when running at idle speed for more than 4 minutes without touching the throttle lever, the beeper will send an audible signal then engine will be automatically stopped.

DIAGNOSTIC MODE

The malfunctions are recorded in the memory of the ECM. The memory of the ECM can be checked using the VCK (Vehicle Communication Kit) (P/N 529 035 981)) to see the fault codes. Refer to the DIAGNOSTIC PROCEDURES.

DIAGNOSTIC PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
12V battery supply cable	529 035 997	210
9V battery supply cable	529 035 675	210
supply harness	529 035 869	209
VCK (Vehicle Communication Kit)	529 035 981	209

GENERAL

Here is the basic order suggested to diagnose a suspected engine management related problem:

– Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.
– Check if the engine management system (EMS) pilot lamp lights up. If so, use the VCK (Vehicle Communication Kit) and look for fault codes to diagnose the trouble.
– Check all fuses, relay(s) and battery (if so equipped).
– Check spark plugs condition.
– Check all connections of the wiring harness.

Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT section for procedures.

TROUBLESHOOTING

The following chart is provided to help in diagnosing the probable source of simple troubles.

Monitoring Beeper and Light Coded Signals

WARNING SIGNALS				POSSIBLE CAUSE	REMEDY
BEEPER CODE	LED				
	WARNING	DESS/RER	HI-TEMP		
2 short beeps (when engine is started).		Blink		Confirms that proper tether cord cap is installed. NOTE: Engine can rev above clutch engagement.	Normal condition. No problem detected.
2 short beeps every second.				Closed throttle reset was not performed	Perform closed throttle reset.
1 short beep followed by 1 long beep (when engine is running).				Engine overheat at idle NOTE: Engine stops automatically after 4 minutes of idling (without depressing the throttle lever) and engine temperature is higher than 85°C (185°F).	Refer to TROUBLESHOOTING. NOTE: Depressing throttle lever within 4 minutes will reset timer.

WARNING SIGNALS				POSSIBLE CAUSE	REMEDY
BEEPER CODE	LED				
	WARNING	DESS/RER	HI-TEMP		
1 long beep per second.		Blink		Reverse is selected.	Normal condition. No problem detected. Vehicle can be driven in reverse.
1 short beep every 1.5 seconds (when engine is started). NOTE: Engine cannot reach pulley engagement speed. Vehicle cannot be driven.				Bad DESS system connection.	Reinstall tether cord cap correctly over post.
				Defective tether cord.	Use another programmed tether cord cap.
				Dirt or snow in tether cord cap.	Clean tether cord cap.
				Defective DESS post.	Replace DESS post.
Quick beeping.		Blink		Wrong tether cord cap is installed. NOTE: Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Install proper tether cord cap. Program tether cord into ECM.
2 short beeps every 15 minutes.	Blink		Blink	Engine overheat	Refer to TROUBLESHOOTING.
				EMS fault (1).	Use B.U.D.S. and check fault codes

(1) See EMS Fault code table for more details.

EMS FAULT CODES

General

The faults registered in the ECM (engine control module) are kept when the battery is disconnected.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. This will properly reset their states.

Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the code faults status and report, refer to B.U.D.S. online help or to the EMS fault code table.

Supplemental Information

When using the service action suggested in the Fault section of B.U.D.S., the system circuits are referred to as DA-41, which means connector on the ECM and the circuit 41.

Fault code P0654

If this code occurs and tachometer works normally, disregard this fault code.

Fault code P0336

This code occurs when engine RPM goes too high which could happen under some mechanical-related circumstances and is not necessarily related to a problem with the engine management system.

Fault code P1102 (TPS "Out of Range" Fault)

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS	Reconnect.
Check if sensor is loose	Tighten sensor and reset **Closed Throttle**.
Inspect sensor for damage or corrosion	Replace sensor and reset **Closed Throttle**.
Inspect wiring (voltage test)	Repair.
Inspect wiring and sensor (resistance test)	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle**.
Test sensor operation (wear test)	Replace sensor and reset **Closed Throttle**.

Fault code P1104 (TPS "Adaptation Failure" Fault)

It is caused by the idle position moving out of an acceptable range.

Following problems can be caused by a TPS "Adaption Failure":

– Idle speed is out of range.
– Engine stops, when throttle is released quickly.
– Engine runs inconsistent in low partload or low RPM.

POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
Carburetor has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
EMS has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
Throttle cable too tight	Adjust cable and reset **Closed Throttle**.
Sensor is loose	Tighten sensor and reset **Closed Throttle**.
Throttle bracket is loose	Fix and reset **Closed Throttle**.

EMS Fault Code Table

FAULT CODE (P-CODE)	BLINKING LAMP/LED	BEEPER	DESCRIPTION
P0079	Warning light	1 short beep followed by 1 long beep	R.A.V.E.® selenoïd open circuit or shorted to ground.
P0080	Warning light	1 short beep followed by 1 long beep	R.A.V.E.® selenoïd shorted to battery.
P0107	Warning light	1 short beep followed by 1 long beep	Air pressure sensor voltage too low.
P0108	Warning light	1 short beep followed by 1 long beep	Air pressure sensor voltage too high.
P0112	Warning light	1 short beep followed by 1 long beep	Air temperature sensor voltage too low.
P0113	Warning light	1 short beep followed by 1 long beep	Air temperature sensor voltage too high.
P0117	Warning light	1 short beep followed by 1 long beep	Engine temperature sensor voltage too low.
P0118	Warning light	1 short beep followed by 1 long beep	Engine temperature sensor voltage too high.
P0122	Warning light	1 short beep followed by 1 long beep	Throttle position sensor voltage too low.
P0123	Warning light	1 short beep followed by 1 long beep	Throttle position sensor voltage too high.
P0217	HI-TEMP	1 short beep followed by 1 long beep	High engine temperature detected
P0326	Warning light	1 short beep followed by 1 long beep	Knock sensor reference signal voltage too low.
P0336	None	OFF	High engine RPM detected.
P0513	DESS/RER	3 short beeps every second	Anti-theft security: Invalid key or key not programmed.
P0605	Warning light	1 short beep followed by 1 long beep	ECM Calibration checksum fault.
P0648	None	OFF	DESS lamp shorted to battery, open circuit or shorted to ground.
P0650	None	OFF	Warning light shorted to battery, open circuit or shorted to ground.
P0654	None	OFF	Tachometer RPM signal shorted to battery, open circuit or shorted to ground.
P0655	None	OFF	Engine temperature lamp shorted to battery, open circuit or shorted to ground.
P1102	Warning light	1 short beep followed by 1 long beep	Throttle position sensor learns out of range.
P1104	Warning light	2 short beeps every second	Throttle position sensor offset not programmed.
P1217	HI-TEMP	1 short beep followed by 1 long beep	Overheat shutdown occurred.
P1261	Warning light	1 short beep followed by 1 long beep	DPM selenoïd open circuit or shorted to ground.
P1262	Warning light	1 short beep followed by 1 long beep	DPM selenoïd shorted to battery.
P1326	Warning light	1 short beep followed by 1 long beep	Engine detonation level too high.
P1655	Warning lamp	1 short beep followed by 1 long beep	DESS® shorted to battery.
P1656	Warning lamp	1 short beep followed by 1 long beep	DESS® line shorted to ground.
P1670	None	OFF	Beeper shorted to battery.
P1671	None	OFF	Beeper open circuit or shorted to ground.
P1675	None	OFF	Relay shorted to battery.
P1676	None	OFF	Relay open circuit or shorted to ground.

VCK (VEHICLE COMMUNICATION KIT)

General

The VCK (Vehicle Communication Kit) (P/N 529 035 981) is the primary tool to diagnose engine management related problems.

529 035 981

NOTE: The MPEM programmer does not work on Power TEK models.

Ensure to use the latest version of B.U.D.S. available on BOSSWeb.

B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow electrical component inspection, diagnostic options and reset such as the closed throttle.

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

⚠ WARNING

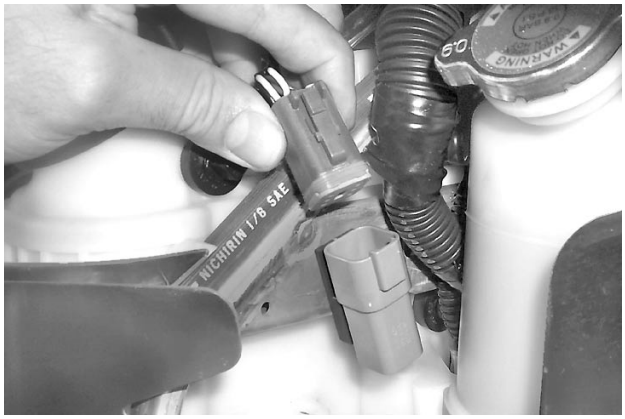
If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

VCK Supply

The VCK (MPI box) can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

Connecting VCK to Vehicle

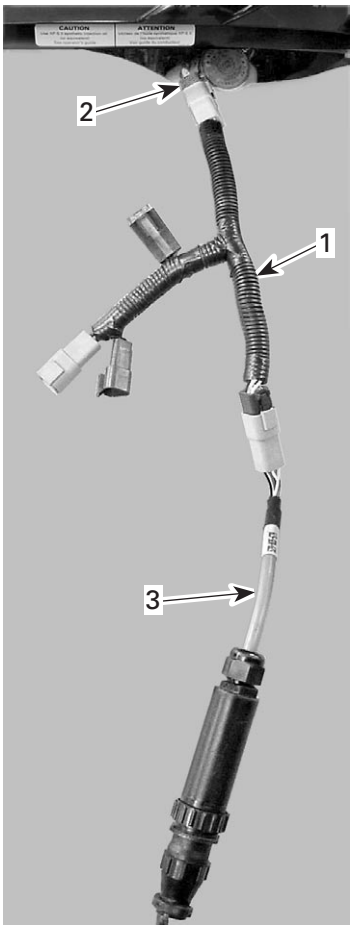
Remove the 6 pin connector from the protective cap on the right side of the vehicle.



A00I0YA

Connect supply harness (P/N 529 035 869), to vehicle 6-pin connector.

Connect the 6 pin diagnostic cable from VCK to supply harness.



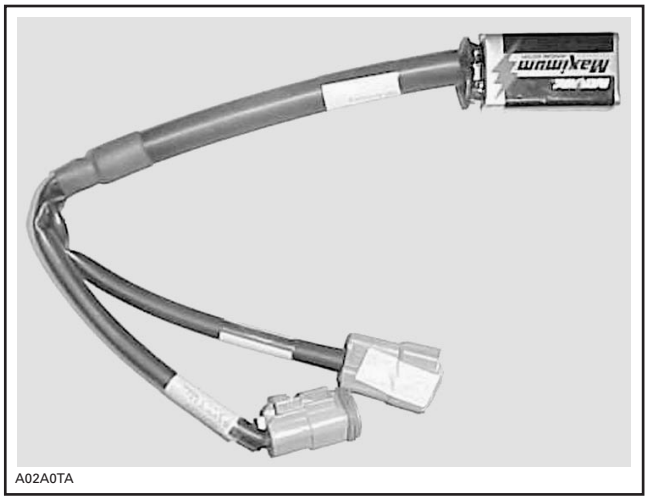
A33E0YA

1. *Supply harness*
2. *Vehicle 6-pin connector*
3. *VCK cable*

CAUTION: Connecting VCK directly to vehicle connector (without supply harness) will damage the ECM. Always use the proper supply harness

Connect supply harness to a 12V battery, using 12V battery supply cable (P/N 529 035 997); or to a 9V battery, using 9V battery supply cable (P/N 529 035 675).

12V BATTERY SUPPLY CABLE



9V BATTERY SUPPLY CABLE

NOTE: The 9V battery allows programming keys, setting ignition timing, reset closed throttle, etc. The 12V battery allows to activate solenoids, spark plugs, etc., from B.U.D.S. Activation tab. In this case, all sensors and actuators will be continuously supplied from the battery. The ECM will switch the circuit to the ground when activated through B.U.D.S. If engine starting is required, disconnect clips from battery.

CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

NOTE

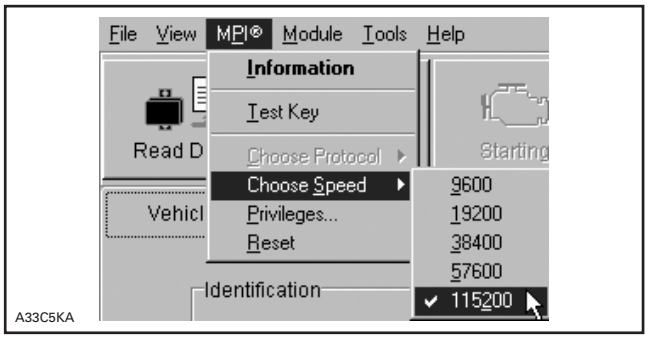
On all models, it is suggested to disconnect headlights fuse to reduce battery discharge rate.

On manual start models, it is necessary to use an external 12V battery and to connect the supply cable clips on it to supply sensors/actuators.

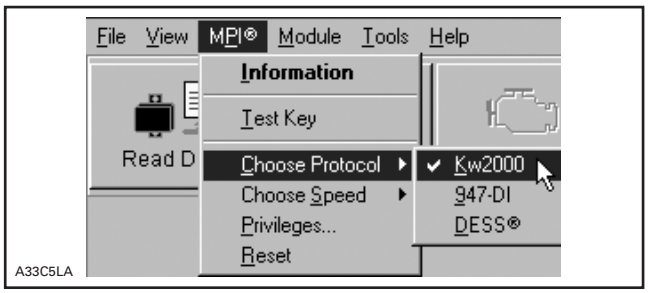
On electric start models, it is necessary to connect the supply cable clips to the battery to supply sensors/actuators.

When using the software B.U.D.S., with the Power TEK:

– ensure that 115200 speed is properly selected in "**MPI**" under "**Choose speed**"

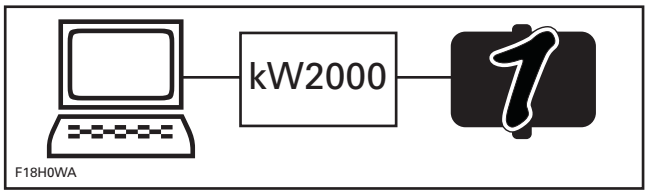


– ensure that the protocol "KW2000" is properly selected in "**MPI**" under "**Choose protocol**



– ensure the status bar shows the KW2000 and the number 1 to the right. To communicate with the ECM, number 1 must be displayed.

Number 1 indicates that the module is recognized by the MPI.



CONNECTION SUCCESSFUL

If an "X" is shown, this means that no communication between the MPI and the ECM is possible. In this case possible causes are:

– ECM is not powered-up
– wrong protocol is used
– bad connection between MPI and module.

When connection is established, a beep pattern will confirm the diagnostic mode is active.

NOTE: Leaving vehicle in diagnostic mode for a long period will discharge battery. Be also aware that some components will generate heat. Always disconnect VCK supply harness and supply cable from vehicle/battery when not working on vehicle.

NOTE: After disconnecting ECM connector for a test and then reconnecting it, it will be necessary to READ data from vehicle again to re-enable B.U.D.S. communication. Otherwise, the following message will occur.

COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
Fluke 111	529 035 868	213
small hose pinchers	295 000 076	218, 225

GENERAL

Engine problems are not necessarily related to the engine management system.

It is important to ensure that the mechanical integrity of the engine/drive systems are present:

– good transmission system operation
– good engine compression and properly operating mechanical components, no leaks etc.

Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.

When replacing a component, always check its operation after installation.

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

– battery
– fuses
– power relay
– DESS
– ignition (spark)
– ground connections
– wiring connectors.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

On electric start models, never use a battery charger to substitute temporarily the battery, as it may cause the ECM (engine control module) to work erratically or not to work at all.

Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

To perform verifications, a good quality multimeter such as Fluke 111 (P/N 529 035 868)should be used.

529 035 868

Pay particular attention to ensure that pins are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

CAUTION: Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

CAUTION: Check if wiring harness shows any signs of scoring prior to replace the ECM.

Before replacing an ECM, always check electrical connections. Make sure that they are very tight and they make good contact and that they are corrosion- free. Particularly check ECM ground connections. Ensure that contacts are good and clean. A "defective module" could possibly be repaired simply by unplugging and replugging the ECM. The voltage and current might be too weak to go through dirty wire pins. Check carefully if pins show signs of moisture, corrosion or if they look dull. Clean pins properly and then coat them prior to assembling as follows:

NOTE: Do not apply dielectric grease or other lubricant on the ECM connectors.

If the newly replaced ECM works, try the old one and recheck if it works.

Ensure that all electronic components are genuine.Any modification on the wiring harness may lead to generate fault codes or bad operation.

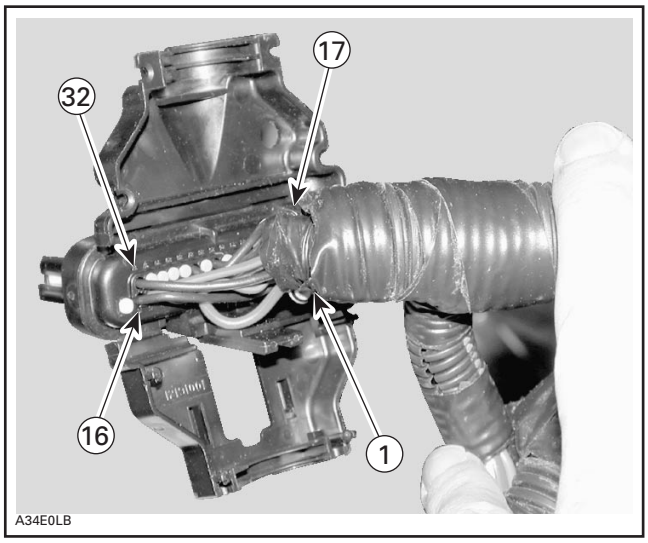
NOTE: For diagnostics purposes, use Vehicle Communication Kit (VCK). See DIAGNOSTIC PROCEDURES for proper connectors/adaptors.

NOTE: After disconnecting ECM connector for a test and then reconnecting it, it will be necessary to READ data from vehicle again to re-enable B.U.D.S. communication. Otherwise, the following message will appear at some point.

After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. Refer to DIAGNOSTIC PROCEDURES subsection.

ECM Connector

Use this diagram to locate the pin numbers on the ECM connector of the wiring harness when performing tests.



ECM CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The resistance value of a resistance varies with the temperature. The resistance value for usual resistor or windings (such as solenoid) **increases** as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value **decreases** as the temperature increases. Take it into account when measuring at temperatures different from 20°C (68°F). Use this table for resistance variation relative to temperature for **temperature** sensors.

TEMPERATURE SENSOR TABLE				
TEMPERATURE		**RESISTANCE (ohms)**		
°C	°F	**ATS**	**CTS FOR**	
			GAUGE	ECM
- 40	- 40			72412
- 35	- 31			52637
- 30	- 22	28000		38681
- 25	- 13			28718
- 20	- 4	14500	733.8	21529
- 15	5		587.7	16288
- 10	14		474	12431

TEMPERATURE SENSOR TABLE				
TEMPERATURE		RESISTANCE (ohms)		
°C	°F	ATS	CTS FOR	
			GAUGE	ECM
- 5	23		384.8	9565
0	32	5500	314.3	7418
5	41		258.4	5807
10	50		213.7	4582
15	59		177.7	3644
20	68	2500	148.7	2919
25	77		125	2355
30	86		105.6	1912
35	95		98.69	1562
40	104	1200	76.5	1284
45	113		65.54	1062
50	122		56.38	882.6
55	131		48.72	738.9
60	140	600	42.28	622
65	149		36.82	526.3
70	158		32.19	447.5
75	167		28.24	382.3
80	176	320	24.86	328.1
85	185		21.95	282.8
90	194		19.45	244.8
95	203		17.28	212.8
100	212	180	15.4	185.6
105	221			162.4
110	230			142.7
115	239			125.9
120	248			111.5
125	257			99.02
130	266	90		88.26
135	275			78.93
140	284			70.81

TEMPERATURE SENSOR TABLE				
TEMPERATURE		RESISTANCE (ohms)		
°C	°F	ATS	CTS FOR	
			GAUGE	ECM
145	293			63.71
150	302			57.49

The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine/air silencer and heated with a heat gun while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

FUEL SYSTEM

Refer to FUEL SYSTEM as necessary.

Check that the throttle slides move freely and smoothly when depressing throttle lever.

Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is not running.

- Throttle cable adjustment too tight or there is not enough free-play. Not returning fully to idle stop.
- Throttle idle set screw is loose or worn.
- TPS is loose.
- Corroded or damaged wiring or connectors.
- Throttle cable or carburetor(s) has(ve) been replaced and the **Closed Throttle** reset has not been performed.
- ECM has been replaced and the **Closed Throttle** reset has not been performed.

DPM (Digital Performance Management)

To test DPM manifold, refer to FUEL SYSTEM. The DPM solenoid verification is covered in this section.

ENGINE MANAGEMENT SYSTEM

ENGINE CONTROL MODULE (ECM)

General

Prior to replacing a suspected ECM, ensure that all the recommendations in the general introduction of this section have been followed.

NOTE: All information from the ECM will be lost and will have to be reentered using B.U.D.S. software.

ECM Replacement

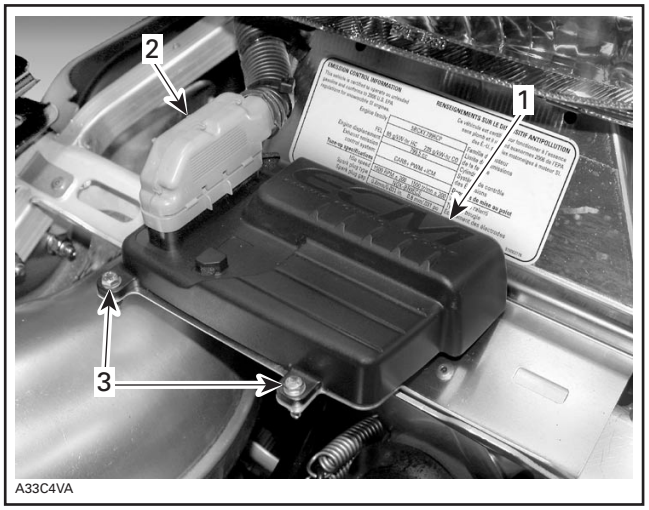
Disconnect battery cables on electric start models.

⚠ WARNING

Battery BLACK (-) cable must always be disconnected first and connected last.

Disconnect connector from ECM.

Unscrew retaining screws and remove the engine ECM from its support.



1. ECM
2. ECM connector
3. Retaining screws

Install the new ECM to its support.

Replug ECM connector and then battery cables (if applicable).

Manually enter information in **Vehicle** tab.

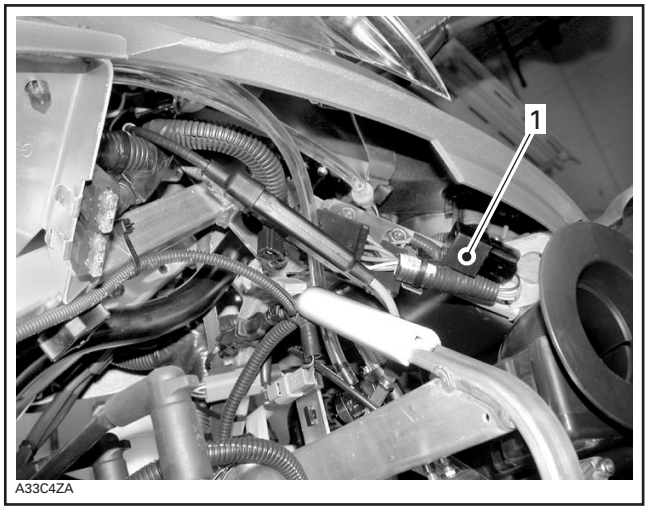
IMPORTANT: Pay particular attention when typing the VIN and model numbers. Once **Write Data** button is pressed, numbers cannot be modified.

Reprogram DESS tether cord(s) in **Keys** tab.

Perform **Closed throttle** and **Ignition offset** in **Setting** tab. Refer to appropriate sections.

Start the engine and increase engine speed above 5500 RPM to be sure no fault appears.

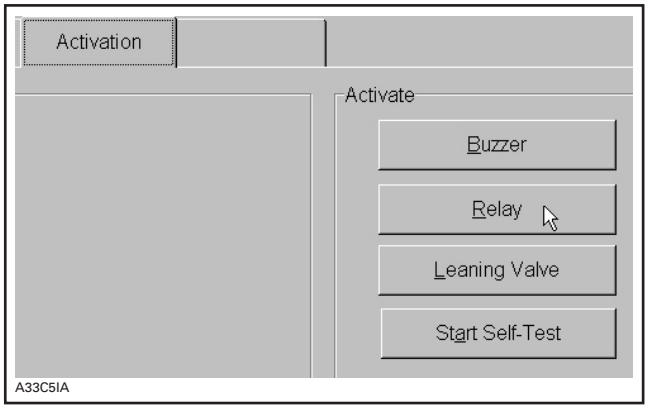
POWER RELAY



LH SIDE OF VEHICLE
1. Power relay

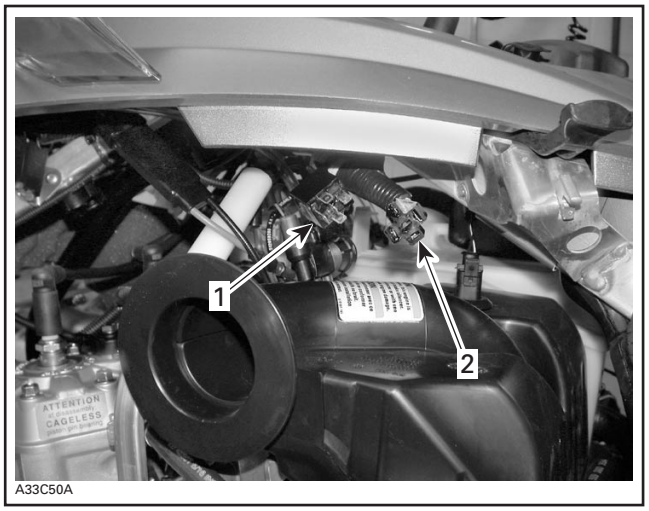
Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Energize **relay** from **Activation**.



Listen to or touch relay to feel it clicks.

If the relay does not work, disconnect the connector from the relay to test the input side.



LH SIDE OF VEHICLE
1. *Relay*
2. *Power relay connector*

Connect a voltmeter between wires as indicated in the following table.

VEHICLES	FROM	TO
	CONNECTOR	
Manual start models	ORANGE/WHITE	Engine ground
Electric start models	WHITE/GREEN	Battery ground

Voltage should be 12 V.

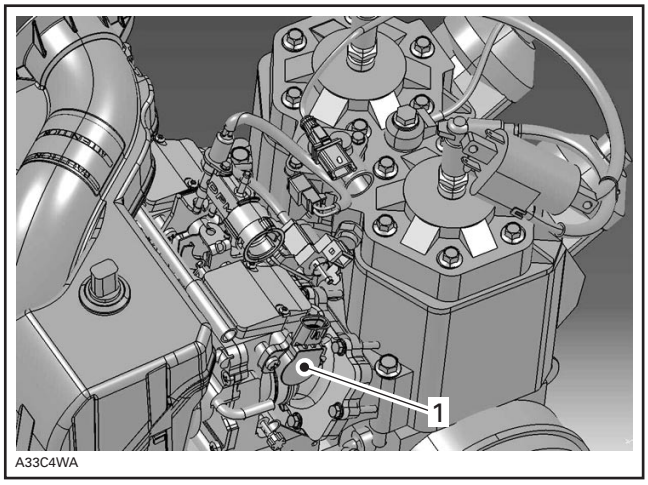
If voltage reads 12 V, check continuity of wire between BLACK wire of relay connector and pin DA-28 of ECM connector. If faulty, repair/replace wire/connector. If wire/connector tests good, try a new ECM.

If voltage does not read 12 V, check continuity of wire on supply side. If faulty, repair/replace wire/connector. If wire/connector tests good, refer to ELECTRICAL SYSTEM to test output side or relay.

THROTTLE POSITION SENSOR (TPS)

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle shaft angle.



1. *Throttle position sensor (TPS)*

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to CARBURETOR in AIR INDUCTION SYSTEM above.

IMPORTANT: Pin-out of TPS harness connector does not match the TPS sensor pin-out. The pin-out used in the following tests is the TPS harness connector pin-out.

CORRESPONDING PIN-OUT OF TPS HARNESS AND TPS SENSOR	
TPS HARNESS CONNECTOR	TPS CONNECTOR
pin 1	pin 3
pin 2	pin 2
pin 3	pin 1

The ECM may generate several fault codes pertaining to the TPS. Refer to SYSTEM FAULT CODES in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

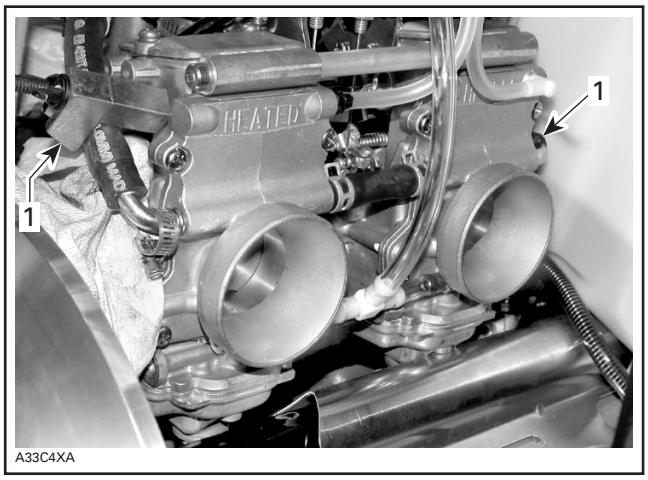
Use the **Throttle Opening** display under **Monitoring**.

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle "sticks", bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

Voltage Test

To gain access to TPS, do the following:

– remove air intake silencer
– loosen carburetor clamps
– install small hose pinchers (P/N 295 000 076)on inlet and outlet coolant hoses connected to carburetor



1. Install hose pinchers

– disconnect inlet and outlet coolant hoses from carburetors

NOTE: Keep throttle cable installed to avoid further adjustment.

– properly rotate and slightly pull out carburetors to gain access to TPS.

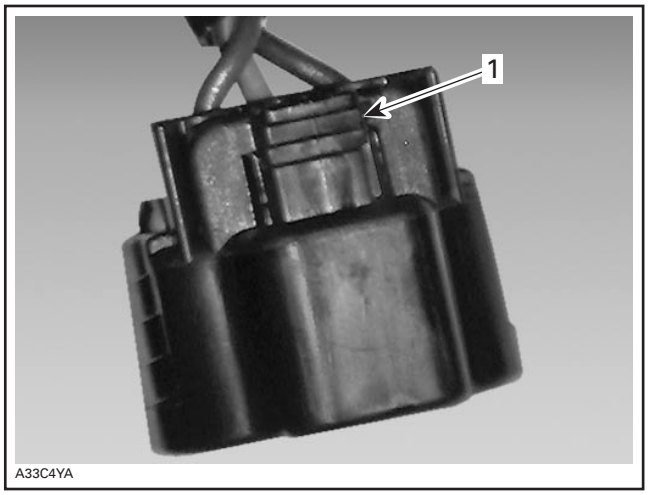
Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Validation of Pins 2 and 3

Disconnect TPS connector. A fault code should appear in B.U.D.S. If so, it confirms pins 2 and 3 of TPS connector are working. Therefore, continue with validation of pins 1 and 3 below. If no fault code appears, do the following.

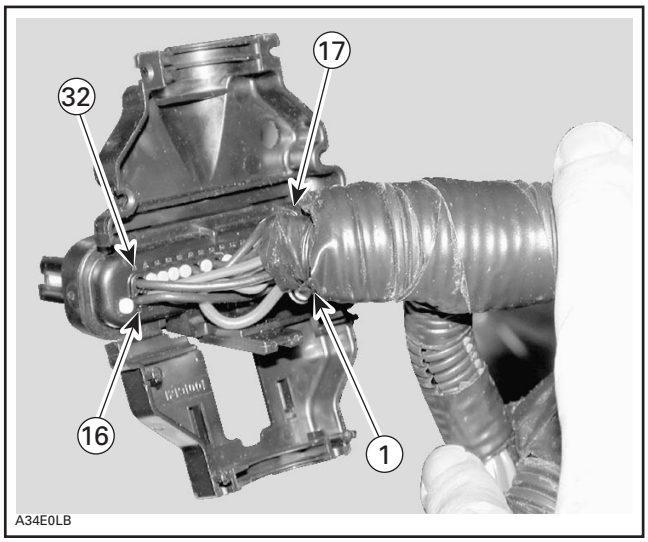
Disconnect TPS connector.

NOTE: To disconnect TPS connector, firmly press locking tab on top outer side of connector to release it.



1. Firmly squeeze here

Disconnect ECM connector and check continuity of wires between TPS connector and ECM connector.



ECM CONNECTOR

TPS CONNECTOR	ECM CONNECTOR
PIN 2	DA-4
PIN 3	DA-1

If wire/connectors does not test good, repair/replace wire/connector. Otherwise, try a new ECM.

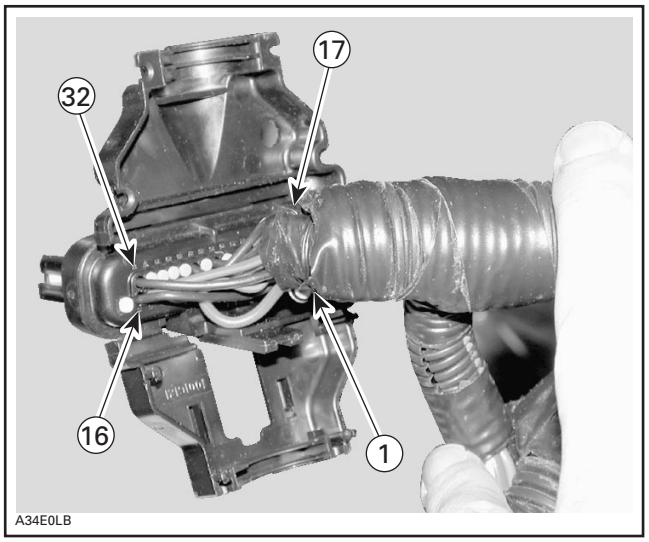
Validation of Pins 1 and 3

Reconnect ECM connector.

Connect a voltmeter between pin 1 and 3 in TPS connector of wiring harness.

Voltage should be 5 V.

Otherwise, disconnect ECM connector and check continuity of wires between TPS connector and ECM connector.



ECM CONNECTOR

TPS CONNECTOR	ECM CONNECTOR
PIN 1	DA-22
PIN 3	DA-1

If wire/connectors do not test good, repair/replace wire/connector. Otherwise, try a new ECM.

Perform resistance test to validate the TPS sensor.

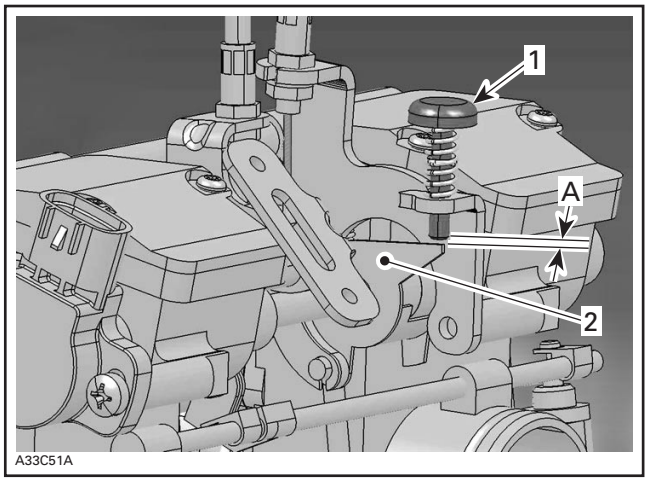
Resistance Test

Reconnect the TPS connector.

Disconnect ECM connector.

Unscrew idle speed screw until there is a gap with the throttle lever stopper.

NOTE: The gap between idle speed screw and stopper is important to ensure throttle slide is completely closed to read TPS resistance values.



1. Idle screw
2. Throttle lever stopper
A. Gap required here

Activate throttle lever 2 – 3 times to make sure throttle slides are fully closed.

Using a multimeter, check resistance values as per the following table.

ECM CONNECTOR		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
PIN	PIN	Resistance Ω	
22	4	3680 – 5520	480 – 720
22	1	4000 – 6000	4000 – 6000
4	1	480 – 720	3680 – 5520

NOTE: The resistance value should change smoothly and proportionally to the throttle movement. Otherwise, replace TPS.

If resistance values fail, replace TPS.

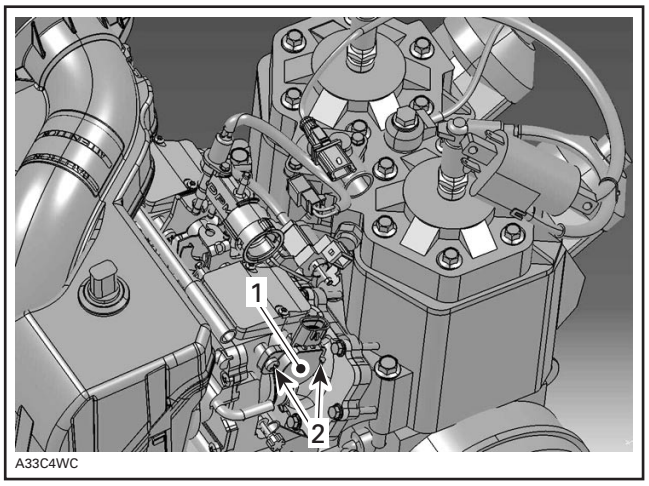
Since the idle screw was loosened, perform the **Closed Throttle Reset** procedure.

Replacement

See above to gain access to TPS.

Loosen two screws retaining the TPS.

Remove TPS.



CARBURETOR
1. *Throttle position sensor (TPS)*
2. *Screws*

Install the new TPS.

Apply Loctite 243 on the TPS retaining screws, then torque to 3 N•m (27 lbf•**in**).

Reinstall remaining removed parts.

Proceed with the **Closed Throttle Reset**. See below.

Closed Throttle Reset (TPS)

Preparation

NOTE: This operation performs a reset of the values in the ECM.

This reset is very important. The setting of the TPS will determine the basic parameters for all fuel and ignition mappings.

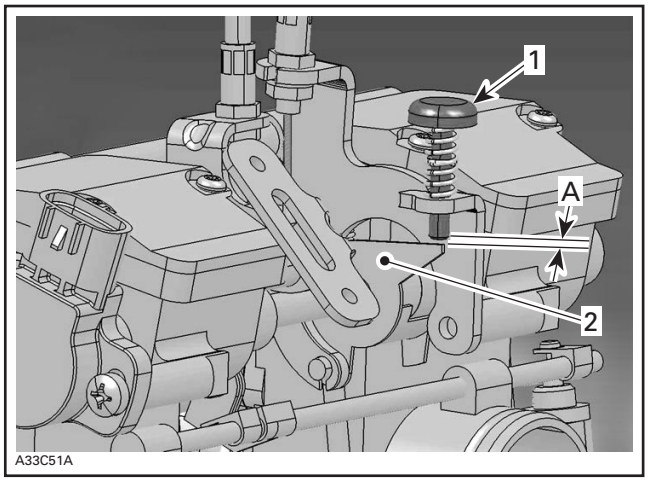
NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened or removed or carburetor or ECM is replaced. An improperly set TPS may lead to poor engine performance.

Ensure carburetor synchronization and throttle cable are properly adjusted prior to performing this setting. Refer to FUEL SYSTEM.

IMPORTANT: Having enough free-play in throttle lever is critical to properly set the values in ECM.

Setting Closed Throttle (TPS)

Unscrew idle speed screw until there is a gap with the throttle lever stopper.



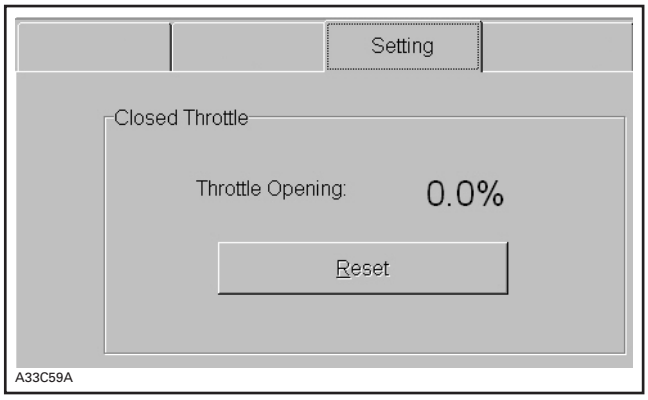
1. *Idle screw*
2. *Throttle lever stopper*

A. Gap required here

Activate throttle lever 2 – 3 times to make sure throttle slides are fully closed.

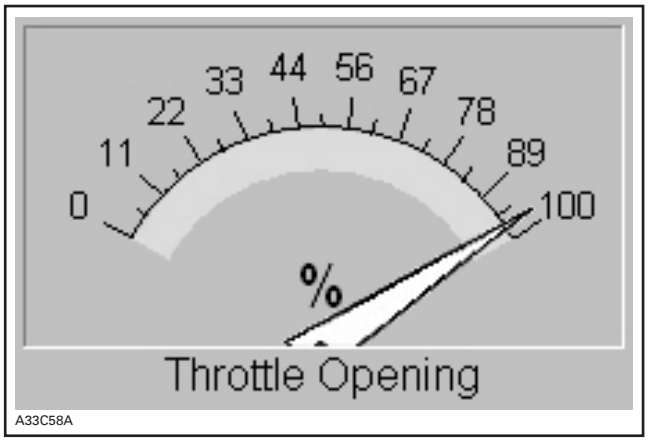
Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Push the **Reset** button in the **Setting** tab of B.U.D.S.



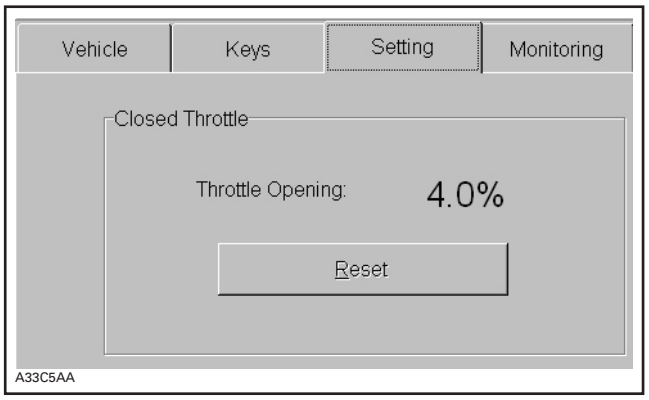
If TPS is not within the allowed range while resetting the **Closed Throttle**, the ECM will generate a fault code and will not accept the setting.

Perform the wide open throttle verification. In **Monitoring Tab** of B.U.D.S., check if throttle opening is within 95 and 100% when throttle lever is fully depressed.



Adjust throttle cable as required to be within this value. Ensure that some free-play remains in the throttle cable at idle position.

As a preliminary setup, tighten idle screw until 4% appears under **Throttle opening** in **Setting** tab of B.U.D.S.



Adjusting Idle Speed

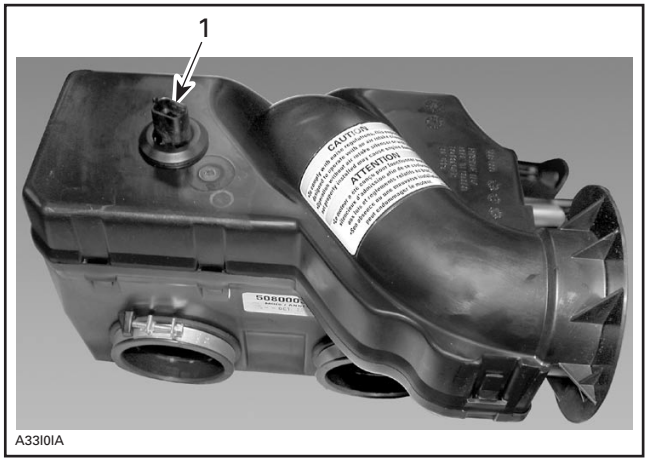
Disconnect VCK supply cable clips from battery.

Start engine and bring it to its normal operating temperature.

Adjust idle speed to 1500 RPM.

If fault code(s) appear, refer to SYSTEM FAULT CODES in the DIAGNOSTIC PROCEDURES section for more information.

AIR TEMPERATURE SENSOR (ATS)

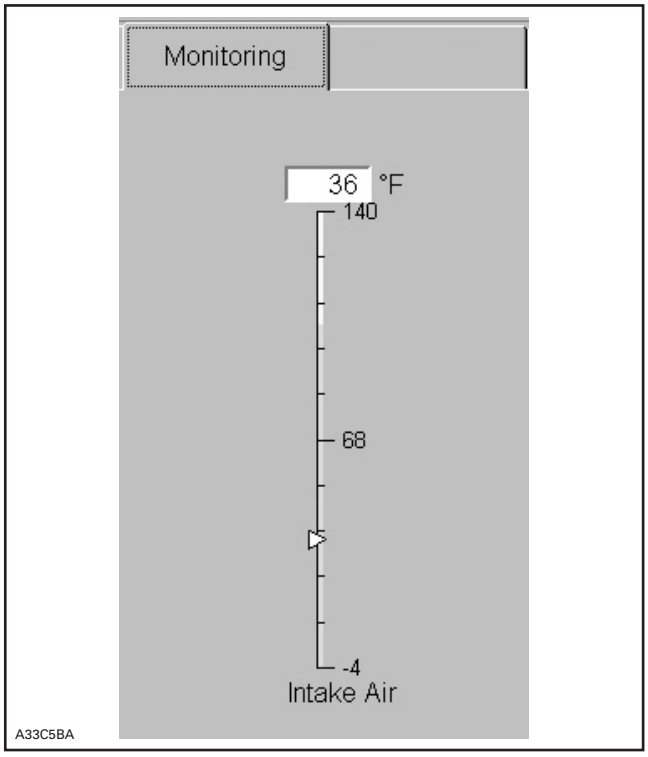


1. Air temperature sensor (ATS)

Dynamic Test

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Look **intake air** in **Monitoring** tab of B.U.D.S. It should show the ambient temperature. Otherwise, perform the following test.

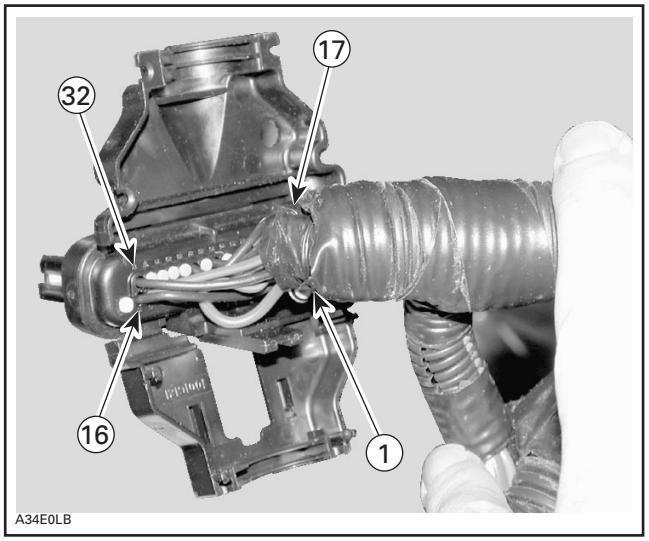


Resistance Test

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section.

Disconnect sensor connector and measure sensor resistance. If out of specifications, replace sensor.

If resistance tests good, **reconnect** the ATS and disconnect the ECM connector.



ECM CONNECTOR

Using a multimeter, measure resistance value again between terminals DA-19 and DA-1.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the ATS.

Replacement

Unplug ATS connector.

Pull the ATS out of the air intake silencer.

Spray soapy water on ring. Install ring on air intake silencer then push the sensor in place.

Reconnect it.

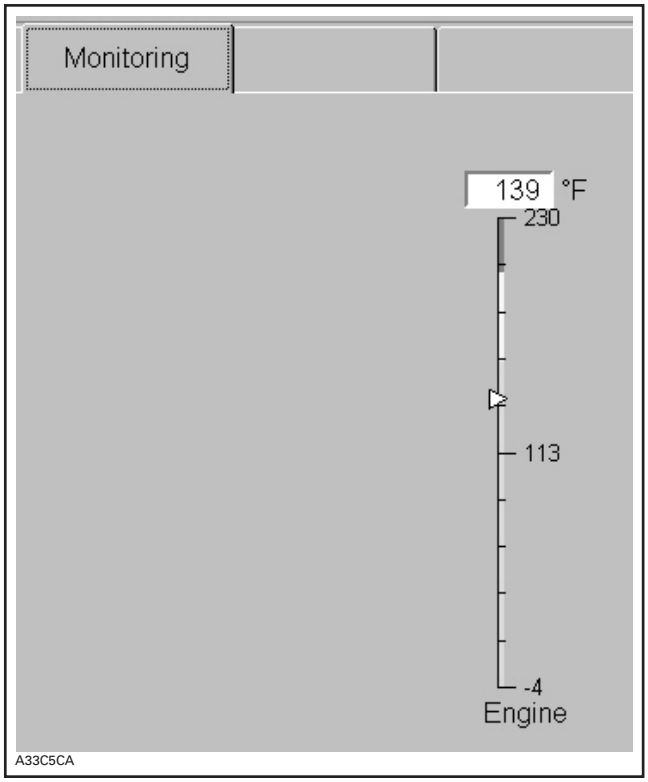
COOLANT TEMPERATURE SENSOR (CTS)

NOTE: A dual sensor is used on this system. It supplies information to the ECM and to the temperature gauge.

Dynamic Test

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Look engine temperature in **Monitoring** tab of B.U.D.S. It should show the coolant temperature. Otherwise, perform the following test.



Resistance Test

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section.

CTS Sensor for EMS

Disconnect sensor connector and measure sensor resistance between BLACK/GREEN and BEIGE/ORANGE wires of sensor. If out of specifications, replace sensor.

If resistance tests good, **reconnect** the CTS and disconnect the ECM connector.

Measure resistance value again between terminals DA-1 and DA-21 on ECM connector.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

CTS Sensor for Temperature Gauge

Disconnect sensor connector and measure resistance value between BLACK and VIOLET wires of sensor.

If resistance value is incorrect, replace CTS sensor.

If resistance value is correct, check continuity of circuit and repair wiring harness/connectors.

Replacement

Lift rear of vehicle and securely support.

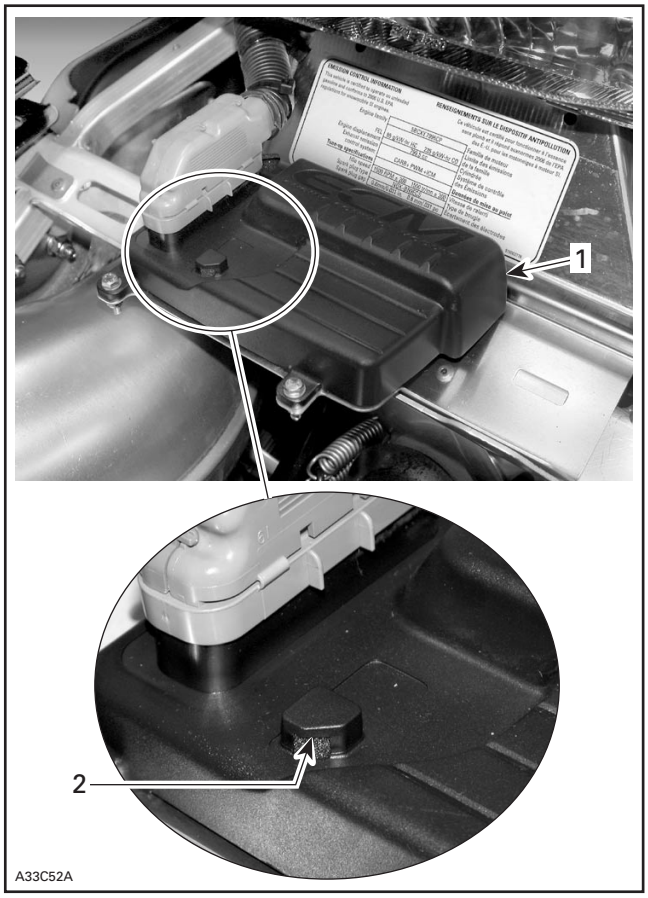
Disconnect CTS connector and remove CTS. Install the new CTS and torque to 12 N•m (106 lbf•**in**).

Reinstall remaining removed parts.

Refill engine coolant. If an important quantity of coolant spilled, bleed cooling system. Refer to LIQUID COOLING SYSTEM section.

AIR PRESSURE SENSOR (APS)

Sensor is integrated in ECM.

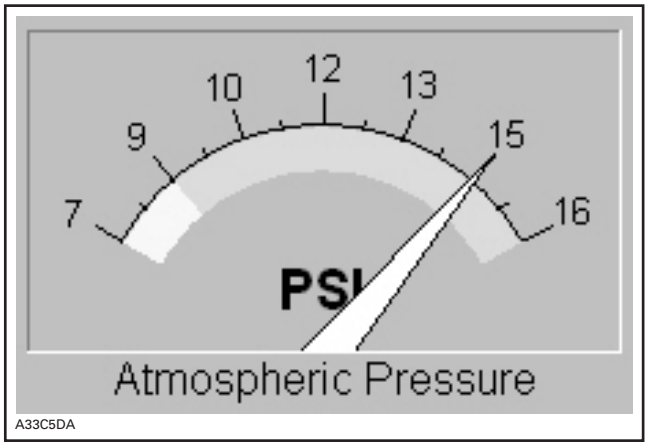


1. ECM
2. Air pressure sensor (APS)

Dynamic Test

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Look **atmospheric pressure** in **Monitoring** tab of B.U.D.S. It should show the actual pressure. Otherwise, perform the following.

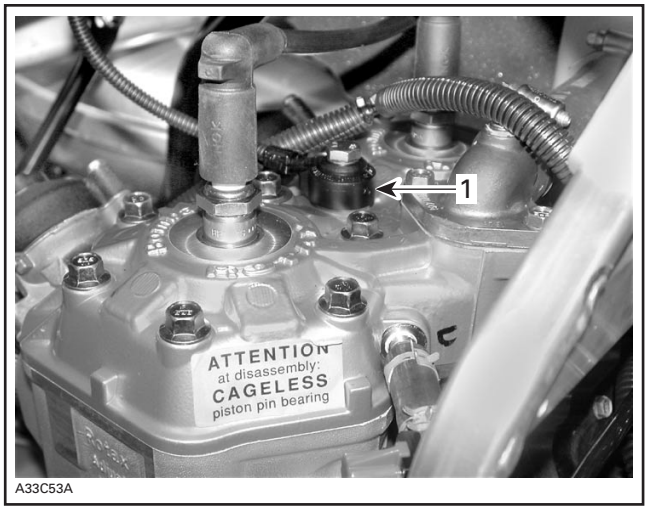


Ensure pressure orifice is free of snow, ice and dirt. Temporarily remove the orifice filter and clean the area.

Check for fault codes in B.U.D.S.

If sensor does not work replace ECM.

KNOCK SENSOR (KS)



1. Knock sensor (KS)

Dynamic Test

Lift rear of vehicle off the ground and support it with a wide-base mechanical stand.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, monitor the knock sensor using the Faults section.

Start the engine and bring engine speed above 5000 RPM. If no fault code occurs, the knock sensor is good.

NOTE: Ensure ignition coil cables are not close to knock sensor harness. This might generate a false fault code.

NOTE: Fault code P1326 might occurs but it is not related with the knock sensor. If this code occurs, refer to B.U.D.S. for proper action to take.

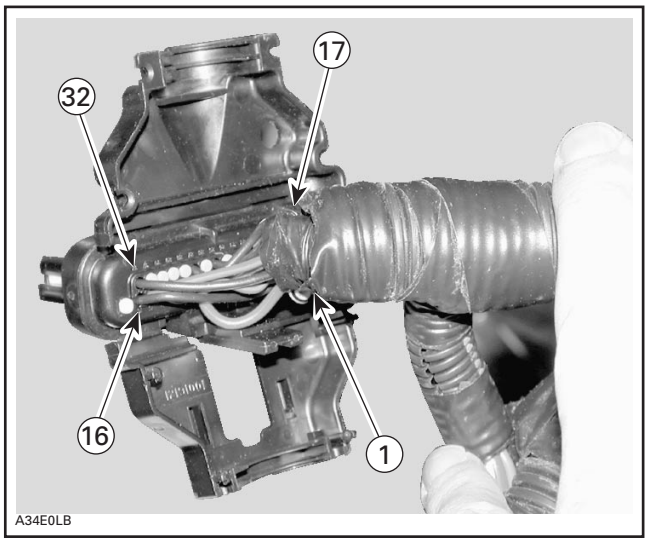
Otherwise, do the following.

Ensure sensor and head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.

Check the knock sensor circuit on wiring harness.

Disconnect the connector from knock sensor harness.

Disconnect connector DA form the ECM and check continuity of circuit as per following table.



ECM CONNECTOR

CIRCUIT NUMBER (ECM connector)	KS CONNECTOR
DA-2	PIN 1
DA-20	PIN 2

If test is not good, repair the connector or replace the wiring harness between ECM connector and knock sensor.

If test is good, try a new knock sensor. If problem persists, try a new ECM.

Replacement

Unscrew and remove knock sensor from cylinder head.

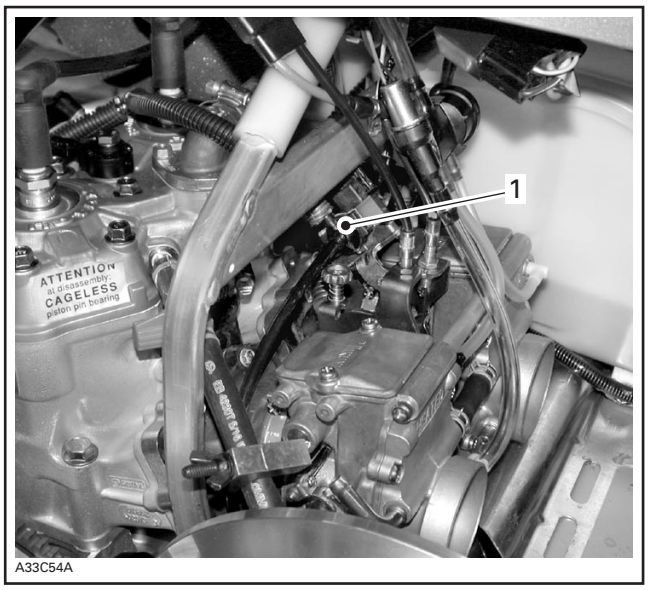
Clean contact surface, then install the new knock sensor.

Torque screw to 29 N•m (21 lbf•ft).

CAUTION: Improper torque might prevent sensor to work properly and lead engine to severe damage of internal components.

Replug connector.

E-RAVE SOLENOID

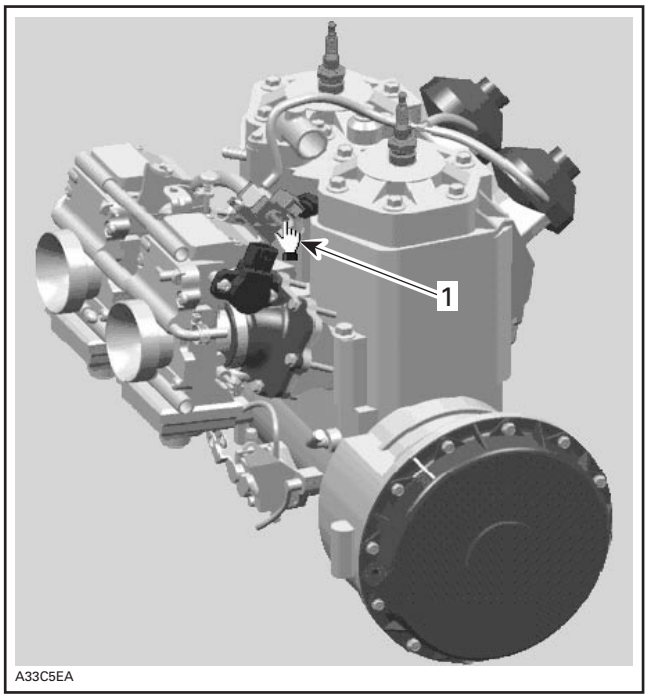


1. E-RAVE solenoid

NOTE: First ensure the problem is not related with tubes connection and RAVE valves themselves.

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Energize **RAVE solenoid** from **Activation** tab.



1. Activate here

This will validate the injector mechanical and electrical operation.

If the solenoid does not work, disconnect the connector from the solenoid.

Measure voltage between pin 2 (on harness side) and battery ground (engine ground on manual start models).

If 12 V is read, disconnect connector from the ECM and check continuity of circuit between pin DA-13 and pin 1. If continuity tests good, try a new ECM. Refer to ECM for replacement procedures.

If 12 V is not read, check the corresponding fuse(s), relay and continuity of circuit V V-2. If continuity is faulty, repair wiring/connector.

Heating Element

Unplug the 2-pin connector located besides E-RAVE.

Measure voltage between RED/YELLOW and BLACK wires of heating element.

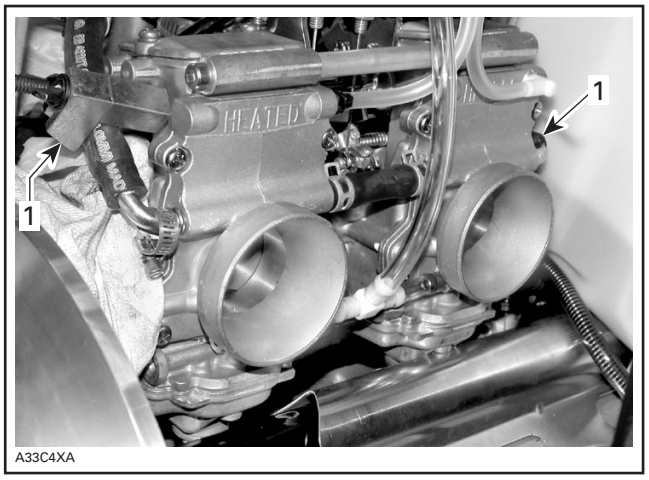
If 12 V is read, check BLACK wire circuit. If good, replace E-RAVE solenoid.

If 12 V is not read, check the corresponding fuse(s), relay and continuity of circuits VH-1 and VH-2. If continuity is faulty, repair wiring/connector.

Replacement

To replace the E-RAVE solenoid, do the following:

– remove air intake silencer.
– slacken carburetor clamps
– install small hose pinchers (P/N 295 000 076) on inlet and outlet coolant hoses connected to carburetor



1. Install hose pinchers

– disconnect inlet and outlet coolant hoses from carburetors

NOTE: Keep throttle cable installed to avoid further adjustment.

– properly rotate and slightly pull out carburetors to gain access to TPS

NOTE: Mark hose locations of E-RAVE solenoid for reinstallation.

– remove solenoid screws and solenoid.

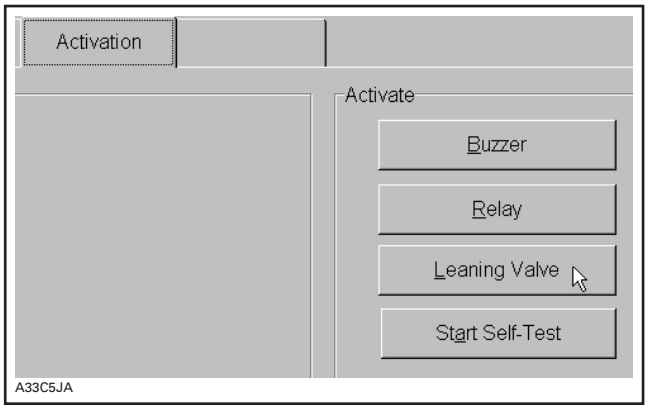
For installation, reverse the removal procedure. Check/adjust engine idle speed.

DPM SOLENOID

Electrical Test

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Energize **Leaning valve** (DPM solenoid) from **Activation** tab.



This will validate the solenoid mechanical and electrical operation.

Listen to or touch relay to feel it clicks.

If the solenoid does not work, disconnect the connector from the solenoid.

NOTE: To gain access to connector pins, unlock connector and slide it out toward oil tank. Refer to WIRING DIAGRAMS.

Measure voltage between pin 2 of DPM solenoid on harness side, and battery ground (engine ground on manual start models).

If 12 V is read, disconnect connector from the ECM and check continuity of circuit between pin DA-29 and pin 1. If wire/connector tests good, try a new ECM. Refer to ECM for replacement procedures.

If it does not read 12 V, check the corresponding fuse(s), relay and continuity of circuit DP-2. If continuity is faulty, repair/replace wire/connector.

Replacement

Refer to FUEL SYSTEM.

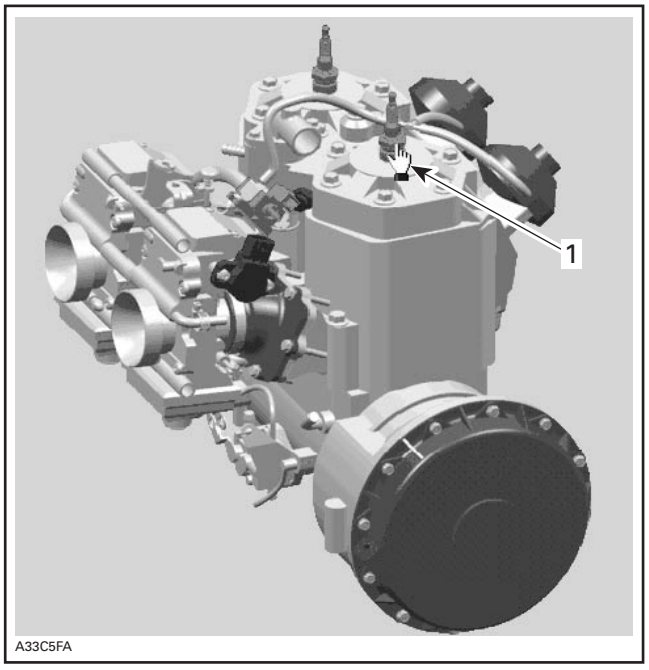
IGNITION COIL

RH SIDE OF VEHICLE
1. Ignition coil

The ECM energizes the primary side of ignition coil.

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Energize **ignition coil** from **Activation** tab.



1. Activate here

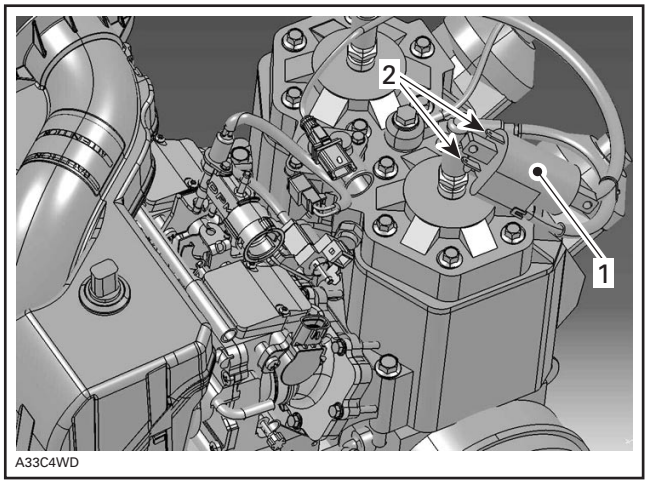
Remove spark plugs and reconnect to cable. While spark plug rests against a metallic part of the engine, activate ignition coil with B.U.D.S. and check if there is a spark. Otherwise, perform the following checks.

NOTE: Keep in mind that ignition coil can still be faulty particularly at high RPM with higher voltage requirements.

Resistance Test

NOTE: Keep in mind that an ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

Using a multimeter, check the resistance of primary winding.



1. Ignition coil
2. Terminals

For primary winding, check the resistance between terminals on ignition coil.

The resistance should be between 0.41 and .46 Ω at 20°C (68°F).

If the resistance of winding is not good, replace the ignition coil.

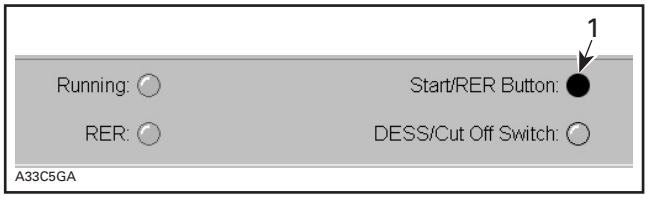
Measure secondary winding through ignition cable caps.

The resistance should be around 13.85 kΩ to 21.65 kΩ at 20°C (68°F).

ENGINE START/RER SWITCH

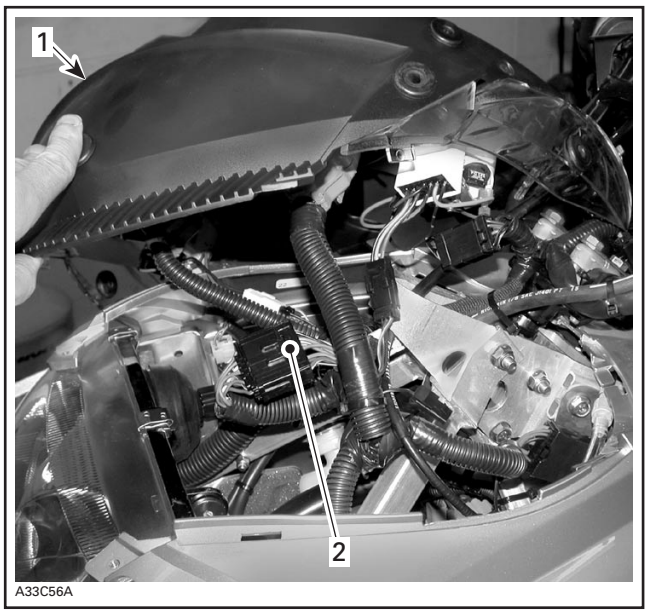
Connect vehicle communication kit (VCK) and use B.U.D.S. software.

A quick operation test can be done using the **Monitoring** section. With engine cut-out at OFF, press the START/RER button and look at the START/RER button LED. It should turn on, indicating the starting system is working on the input side of the starting system (START/RER button, ECM and wiring). If it does not turn on, you know now the problem is on the output side of the starting system (ECM output signal to starting solenoid, wiring harness going to the solenoid and starter motor. Refer to STARTING SYSTEM. Otherwise, check the input side as follows.



1. Activate here

Disconnect 8-pin connector of the steering harness.



1. Dashboard
2. 8-pin connector

Measure resistance at connector between pins HG-5 and HG-8. The reading should change from infinitely high to 0 Ω when pressing start/RER button.

If resistance test fails, check wires continuity up to start/RER switch. If resistance is good, replace switch.

Measure voltage between pin HG-5 and battery ground (engine ground on manual start models). If it reads 12 V, disconnect ECM connector and check ground circuit between HG-8 and DA-8. If it tests good, try a new ECM.

If it does not read 12 V, check supply circuit wires at HG-5 going back to battery (voltage regulator on manual start models).

RER Operation

When RER works erratically or engine stalls, do the following.

– Check both trigger coils and corresponding wiring. Refer to TESTING PROCEDURES
– Check engine compression. A low compression engine may result in engine stall making you think the problem is an electronic problem.
– Check piston condition. Remove exhaust system and reed valves on intake side. Verify piston condition through the intake and exhaust ports. Look for scoring on piston skirts. Scored piston skirts may result in RER working erratically making you think the problem is an electronic problem.

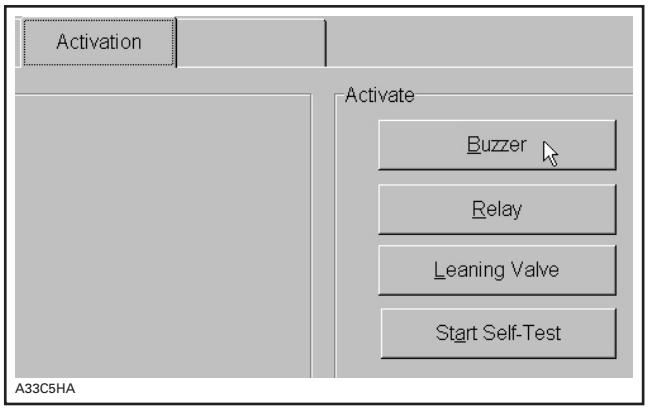
When it does not work at all, check start/RER switch as explained above.

DIGITALLY ENCODED SECURITY SYSTEM (DESS)

If 2 short beeps are not heard when starting the engine, test beeper operation.

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Energize **Buzzer** from **Activation** tab.



If beeper properly works, refer to DIAGNOSTIC PROCEDURES.

The following continuity tests can also be performed using an ohmmeter.

Disconnect DESS switch wires.

DESS Post Verification — Tether Cord Cap Removed

Connect test probes to switch BLACK/GREEN and BLACK/WHITE wires. Measure resistance, there should be NO continuity (open circuit).

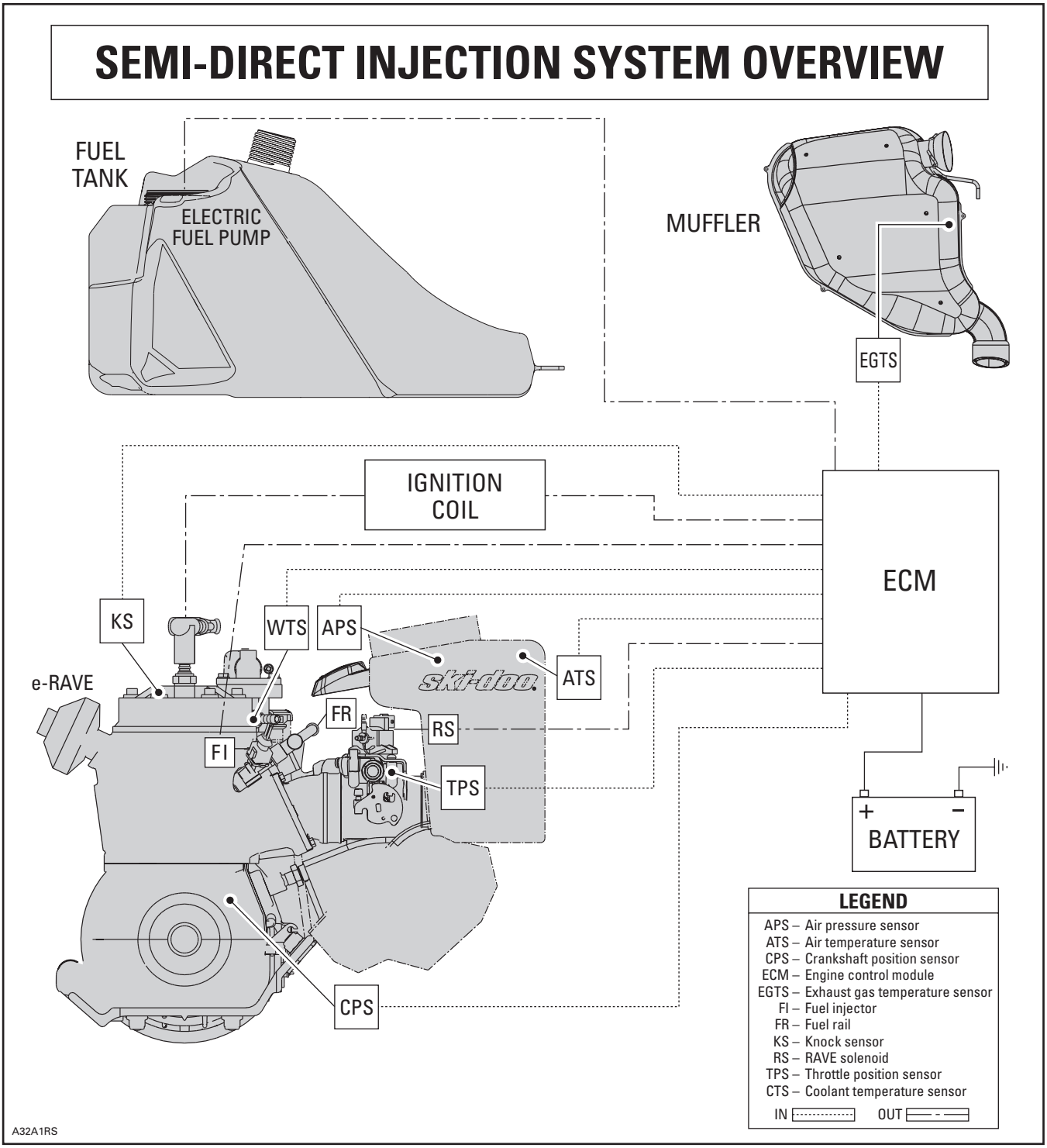
Connect one test probe to the WHITE/GREY wire and the other test probe to the switch top terminal. Measure resistance, it must be close to 0 ohm.

Connect one test probe to the BLACK/GREEN wire and the other test probe to the switch ring. Measure resistance, it must be close to 0 ohm.

DESS Post Verification — Tether Cord Cap on DESS Post

Connect test probes to switch BLACK/GREEN and BLACK/WHITE wires. Measure resistance, it must be close to 0 ohm.

OVERVIEW



TYPICAL

OPERATING PRINCIPLE

For this SDI 2-stroke engine, a highly advanced engine management system (EMS) has been used to ensure a high power output combined with cleaner combustion. An ECM (Engine Control Module) calculates the proper air/fuel mixture and ignition timing for each cylinder separately. The fuel is injected into the transfer port of each cylinder.

CHARGING SYSTEM

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

The magneto has a 3 phases, delta wound stator on 18 poles. Capacity is 480 watts.

AC current is rectified and regulated between 13.4 and 15 volts for the vehicle electrical system. It supplies the ECM with DC current.

Vehicle 12-volt battery supplies the ECM with DC current.

IGNITION SYSTEM

Double ignition coil has two separate windings, one for each spark plug.

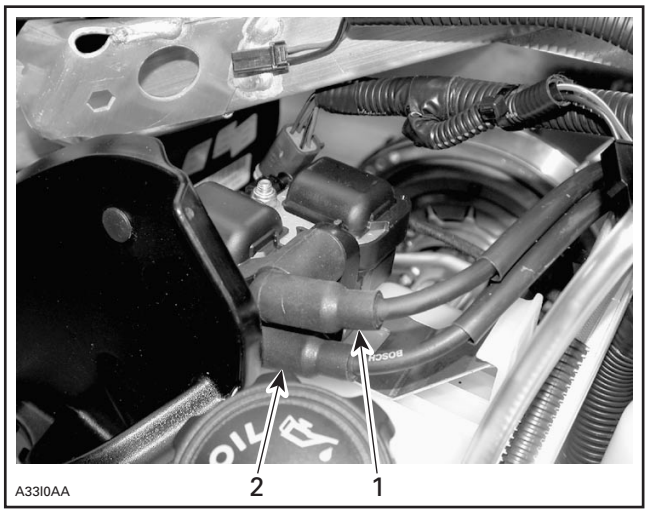
Ignition coil induces voltage to a high level in the secondary windings to produce a spark at the spark plug.

Two separate windings circuits are switched to ground through the ECM. Each winding provides high voltage to its corresponding spark plug.

This ignition system allows spark plugs to spark independently.

CAUTION: Do not interchange spark plug cables. Match reference (PTO or MAG printed on high tension cable yellow tag) with corresponding cylinder spark plug.

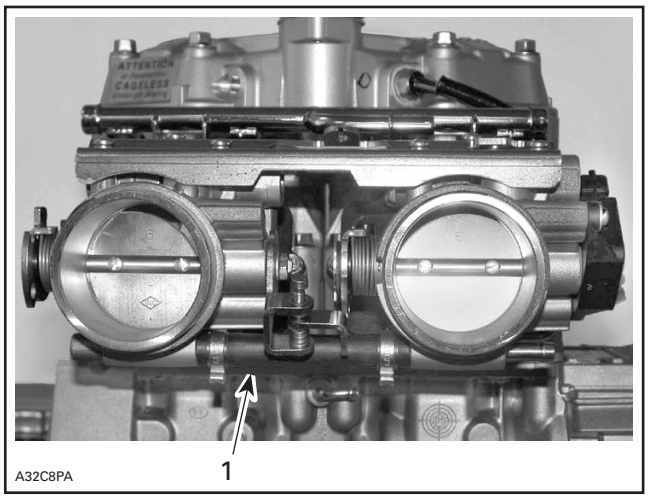
Double ignition coil is located underneath air silencer.



TYPICAL
1. PTO side high tension cable
2. MAG side high tension cable

AIR INDUCTION

Through air filter mounted LH side panel, air goes into air silencer. The ECM measures at this point air pressure and temperature. Then, air for combustion is drawn through two throttle bodies. The air flow is controlled by two throttle plates. The air continues through the reed valves into the cylinder base then the crankcase.



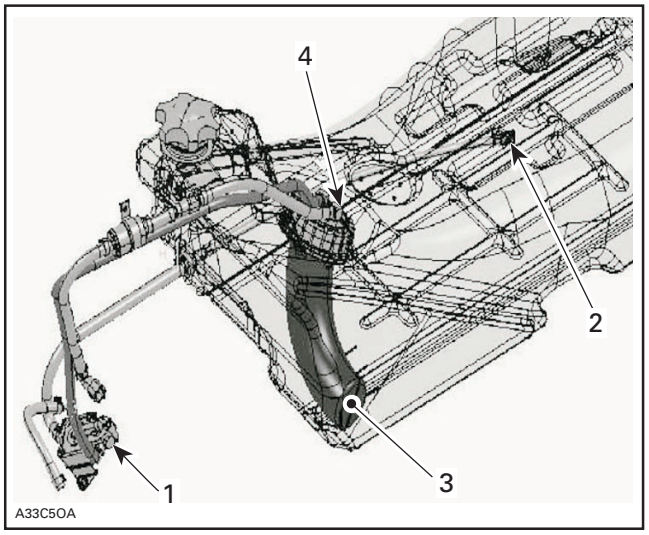
THROTTLE BODY ASSEMBLY
1. Coolant-heated line

FUEL DELIVERY SYSTEM

Diaphragm Fuel Pump

A conventional diaphragm fuel pump is used to supply fuel to the electric fuel pump reservoir located inside fuel tank. This reservoir is the fuel supply for the electric fuel pump. This system allows a more consistent fuel delivery under extreme riding angles and when the fuel tank level is low, which increases the fuel range per tank.

NOTE: A bypass hole in the upper section of the pump reservoir allows fuel to enter or exit the reservoir depending of the conditions.

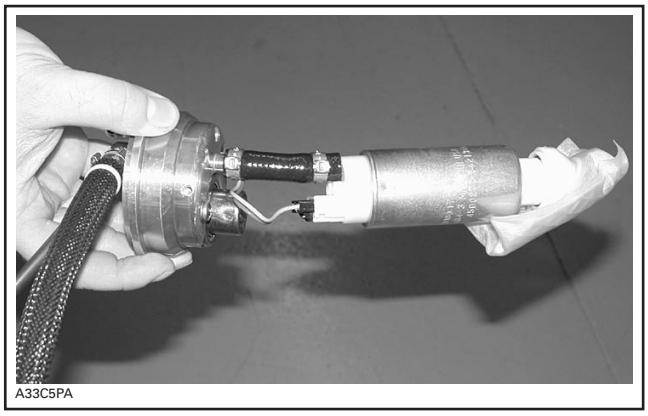


1. Diaphragm pump
2. Fuel pick-up
3. Pump reservoir
4. Electric fuel pump

Electric Fuel Pump and Fuel Pressure Regulator

They provide fuel pressure and flow rate to the system.

The fuel pump module is located inside the fuel tank. The module includes the fuel pump and the fuel pressure regulator. The fuel pump inlet includes a filter.



The fuel pressure regulator controls the pressure in the system and allows the excess of fuel to return to the fuel tank. The fuel pressure regulator regulates the fuel pressure at 400 kPa (58 PSI).

Fuel Rail

The fuel rail is a small tube on which the four injectors are mounted. It ensures at all times that enough fuel at the right pressure can be delivered to the fuel injectors. The fuel rail is fed by the fuel pump module.

Fuel Injectors

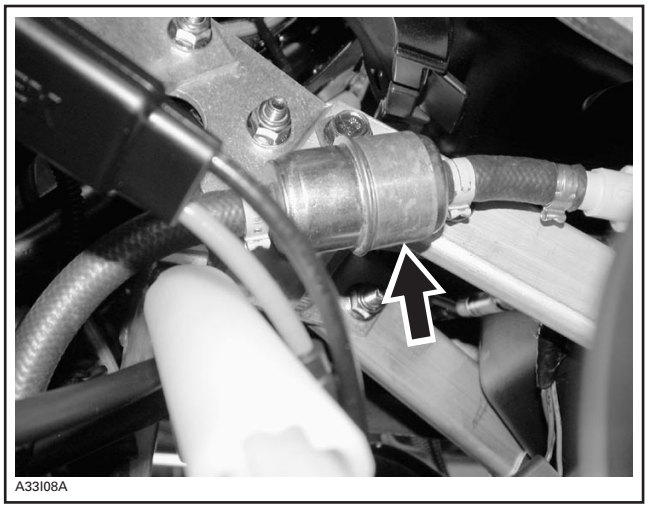
Fuel injectors (two per cylinder) are used to inject fuel into the transfer port of cylinder.

Throttle Body

It is a dual throttle body mounted on the engine intake side. Fitted on this dual throttle body, there is a TPS (Throttle Position Sensor) that sends information to the ECM.

In-Line Fuel Filter

The in-line 10 micron fuel filter is fastened under the steering console. It should be replaced annually.


A33I08A

ENGINE MANAGEMENT SYSTEM (EMS)

The EMS (Engine Management System) is equipped with an ECM which controls the ignition system, the vehicle electrical system, the fuel injection system and the electronically controlled RAVE.

A32E3AA

TYPICAL — ECM

The ECM is mounted in the front of the vehicle.

A33I09A

The ECM is directly powered by the battery. It is responsible for the following engine management/electrical functions:

– interpreting information
– distributing information
– start/stop function
– DESS (Digitally Encoded Security System)
– ignition control
– injection control

NOTE: The ECM applies the proper maps (injection and ignition) for optimum engine operation in all conditions.

– engine RPM limiter
– RER (Rotax Electronic Reverse)
– etc.

The ECM features a permanent memory that will keep the programmed tether cord cap(s) code, fault codes and other vehicle information, even when the battery is removed from the vehicle.

Manual Start Models

While cranking, the magneto sends AC current to the voltage regulator/rectifier that in turn, sends a signal to the ECM. This wakes up the Engine Management System and activate the starting system relay (R1) and the capacitor relay (R4). Just a small rotation of the engine is needed to wake-up the ECM.

The RER switch may also be used to wake-up the Engine Management System.

Waking-up the EMS before doing a start attempt result in faster start-up.

Waking-up the Engine Management System powers the ECM, the fuel pump, the ignition coil, the injectors, and the gauges.

The battery is required to supply current mainly to the fuel pump to allow a fuel pressure buildup. An easy way to acknowledge if the Engine Management System is woken-up, verify if gauges are lit up.

The capacitor has two functions. It is used to stabilize battery voltage when voltage from the voltage regulator/rectifier is charging the small battery. It also gives the possibility to be able to start the engine even if the battery is very low. In this case, starting the engine may be more difficult and will require the very complete stroke of the starting rope.

The capacitor relay prevents the capacitor to be connected to the battery when the engine is not running to allow safe vehicle maintenance (disconnection and reconnection of the capacitor).

Electric Start Models

When the start/RER switch is activated, it wakes up the EMS and power the starting system relay (R1), the ECM, the fuel pump, the ignition coil, the injectors, and the gauges. Then, if the cut-off switch and the DESS switch are in position to allow starting and start/RER switch is hold, the starter solenoid relay is activated.

All Models

When engine reaches approximately 800 RPM, the ECM activates the headlights and accessory relay (R2).

ECM — GENERAL FUNCTIONS

Automatic Power Shut-Down

The ECM is equipped with an automatic power shut-down. This feature prevents the battery from losing its charge if the tether cord cap is left on the post when the engine is not running for more then 30 seconds. The ECM will remain offline until the electric starter or the rewind starter is activated. The ECM will shut down all outputs after 5 seconds when the tether cord cap is removed.

Digitally Encoded Security System (DESS)

The following components are specially designed for this system: ECM, tether cord cap and DESS post.

This system allows the engine to reach pulley engagement speed only if a programmed tether cord cap is installed on DESS post.

The tether cord cap contains a magnet and a ROM chip. The magnet actually closes the reed switch inside the post which is the equivalent of a mechanical ON/OFF switch. The chip has a unique digital code.

NOTE: Actually, it is the memory of the ECM which is programmed to recognize the digital code of the tether cord cap. This is achieved with the VCK (Vehicle Communication Kit) (P/N 529 035 981). Refer to their operation manual or help system to program a tether cord cap.

529 035 981

The system is quite flexible. Up to 8 tether cord caps may be programmed in the memory of the ECM. They can also be erased individually.

NOTE: If desired, a tether cord cap can be used on other vehicle equipped with the DESS. It only needs to be programmed for that vehicle.

When starting the engine with a tether cord cap on the post, the DESS is activated and will emit audible signals:

– 2 short beeps indicate a working tether cord cap. Vehicle can be driven.
– short repetitive beeps indicates a wrong tether cord cap is being used or that something is defective. Vehicle can not be driven.

Gauges Current Supply

Gauges are supplied with current for 30 seconds when connecting the tether cord cap on its postand momentarily pressing the START/RER switch.

NOTE: On electric start models, setting engine cut-out switch to OFF will prevent engine starting.

NOTE: Each time the tether cord cap is connected to the post and START/RER switch is depressed, the fuel pump is activated for 2 seconds to build up pressure in the fuel injection system.

Engine Starting

If the ECM recognizes a valid tether cord cap, it allows engine to rev above 3000 RPM.

Engine RPM Limiter

The ECM will limit the maximum engine speed.

Low-Oil Level Warning Device

When the oil falls under a certain level, the low oil level LED will be illuminated. The beeper will also be activated intermittently.

High Coolant Temperature Warning Device

When the coolant temperature is getting too high, the ECM sends out signals to the beeper and the high temperature LED.

Power Distribution

Accessories are protected by fuses located in the fuse holder. Fuses are identified besides their holder.

IMPORTANT: Engine-related sensors and injectors are continuously powered from the battery. **The ECM switches the ground to complete the electrical circuits it controls.** Take this into account when troubleshooting the electrical system.

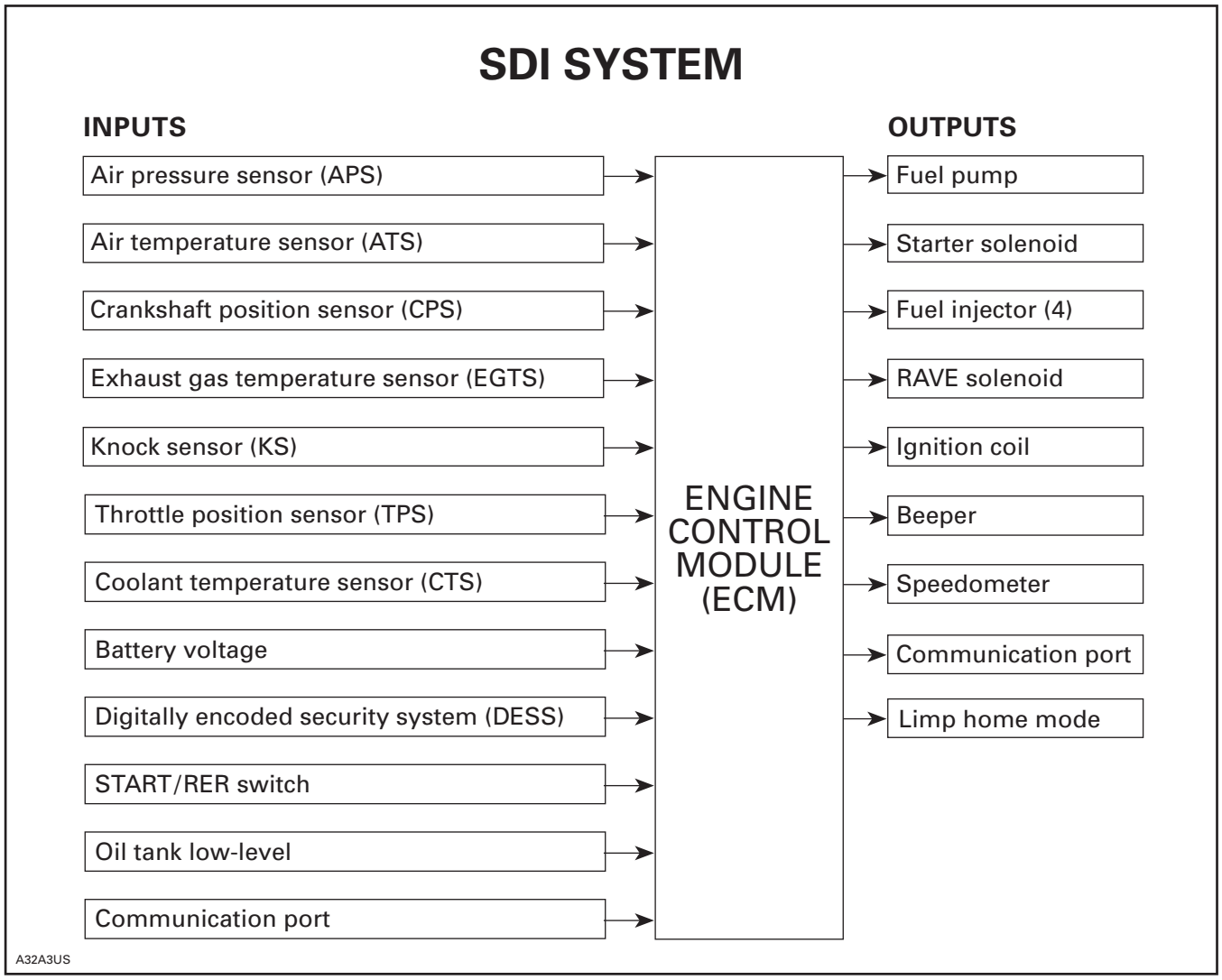
Manual Start Models

The system uses 3 relays: an ignition/injectors, electric fuel pump and starting system relay (R1), a second for the lighting system and the accessories (R2) and a third for the capacitor circuit (R4).

Electric Start Models

The system uses 2 relays: an ignition/injectors, fuel pump and starting system relay (R1) and a headlights and accessories relay (R2).

EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS



This engine management system controls the fuel injection, the ignition timing and the electronically controlled RAVE.

As shown in the SDI CONTROL SYSTEM illustration, the ECM is the central point of the engine management system. It reads the inputs, makes computations, uses pre-determined parameters and sends the proper signals to the outputs for proper engine management.

The ECM also stores the fault codes and general information such as: operating conditions, vehicle hours, serial numbers, customer and maintenance information.

ELECTRONIC FUEL INJECTION

The ECM receives the signals from different sensors which indicate engine operating conditions at milli-second intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS and TPS are the primary sensors used to control the injection and ignition timing. Other sensors are used for secondary input.

IGNITION TIMING

The ECM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the ECM controls the ignition timing for optimum engine operation.

ELECTRONICALLY CONTROLLED RAVE

The electronically controlled RAVE (E-RAVE) offers two performance enhancements to conventional RAVE system.

– The opening of the valve is activated electronically. A solenoid holds the valve closed. The ECM monitors altitude, engine temperature, throttle position and RPM, and operates the solenoid in optimal conditions.
– The valve is opened by crankcase pressure. The greater and more constant pressure from the crankcase opens the valve more crisply.

NOTE: An electric heating element has been added to the RAVE solenoid to ensure proper function in very cold weather.

KNOCK SENSOR

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation. If detonation occurs, the knock sensor detects it and the ECMs retards the ignition advance and extend the injection period temporarily (it goes in a specific mode) until detonation stops.

ENGINE MODES OF OPERATION

The ECM controls different operation modes of the engine to allow proper operation for all possible conditions: Cranking, start up, idle, warm up, normal operation, engine speed limiter, flooded engine and limp home (see below).

FLOODED ENGINE (DROWNED MODE)

If the engine does not start and it is fuel-flooded, this special mode can be activated to prevent fuel injection and to cut ignition while cranking. Proceed as follows:

With tether cord cap on its post while engine is stopped, press completely and HOLD throttle lever.

Manual Start Models

Crank engine several times.

Electric Start Models

Press the START/RER button.

The engine should be cranked for 20 seconds. Release start/RER button.

All Models

In the engine drowned mode, engine cannot start. It is required to release throttle lever and to start/crank engine again to allow starting.

NOTE: If the engine does not start, it may be necessary to replace the spark plugs.

MONITORING SYSTEM

The ECM monitors the electronic components of the engine management system and other components of the electrical system.

When a fault occurs, it sends a signal to the check engine LED or also to the beeper to inform the driver of a particular condition. Refer to the DIAGNOSTIC PROCEDURES.

LIMP HOME MODES

Besides the signals as seen above, the ECM may automatically set default parameters to ensure the adequate operation of the vehicle if a component of the engine management system is not operating properly.

NOTE: Sensor failures will not lead automatically to a limp home mode. The check engine LED will turn on and in some cases the beeper.

The engine RPM may be limited if some critical components fail. In this case, releasing throttle and letting the engine returning to idle speed may allow normal operation to come back. If it does not work, try removing and reinstalling the tether cord cap on DESS post.

These performance-reduced modes allow the rider to go back home which would not be possible without this advanced system. Refer to the DIAGNOSTIC PROCEDURES for a complete chart.

DIAGNOSTIC MODE

The malfunctions are recorded in the memory of the ECM. The memory of the ECM can be checked using the VCK (Vehicle Communication Kit) (P/N 529 035 981) to see the fault codes. Refer to the DIAGNOSTIC PROCEDURES section.

ROTAX ELECTRONIC REVERSE (RER)

There is 3 main components used for the RER system : the start/RER switch, the ECM and the crankshaft position sensor.

The ECM receives signals from the crankshaft position sensor (CPS) for the following functions:

– Forward engine rotation.
– Reverse engine rotation.
– Crankshaft position and engine RPM.

The ECM recognizes a signal sent by the START/RER switch.

When switch is activated and engine is not running, ECM allows normal engine starting.

When switch is activated and engine is running, ECM cuts off ignition. Therefore, engine RPM gradually drops. When engine reaches a low threshold RPM, ECM sends an ignition spark at a great advance creating a thrust which reverses engine rotation.

Under a threshold low RPM or above drive pulley engagement speed, the RER function is disabled. Nothing takes place when pressing Start/RER button.

DIAGNOSTIC PROCEDURES

SERVICE TOOLS

Description	Part Number	Page
GRAY diagnostic key	529 035 896	246
supply harness	529 035 869	245
VCK (Vehicle Communication Kit)	529 035 981	245

GENERAL

Here is the basic order suggested to diagnose a suspected engine management or fuel injection related problem:

– Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.
– Check if the engine management system (EMS) pilot lamp lights up. If so, use the VCK (Vehicle Communication Kit) and look for fault codes to diagnose the trouble.
– Check all fuses, relay(s), battery and capacitor (on so equipped models).
– Check fuel pressure.
– Check spark plugs condition.
– Check all connections of the wiring harness.

Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT section for procedures.

TROUBLESHOOTING

The following chart is provided to help in diagnosing the probable source of simple troubles.

Monitoring Beeper Coded Signals

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
2 short beeps (when engine is started). DESS/RER pilot lamp also blinks.	Confirms that proper tether cord cap is installed. Engine can rev above clutch engagement.	No problem detected. Good ride.
1 short beep every 1.5 seconds (when engine is started). DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Bad DESS system connection. Defective tether cord cap. Dirt or snow in tether cord cap. Defective DESS post.	Reinstall tether cord cap correctly over post. Use another programmed tether cord cap. Clean tether cord cap. Replace DESS post.
1 long beep per second.	Reverse is selected.	Vehicle can be driven in reverse.
3 short beeps per second. DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Wrong tether cord cap is installed.	Install proper tether cord cap. Program key into ECM.
3 short beeps per second. Engine overheating pilot lamp also blinks.	Engine is overheating.	Stop engine immediately and allow to cool. Check cooling system.

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
1 long beep (2 seconds) every 15 minutes.	Low battery voltage.	Check battery and charging system.
4 short beeps every 2 minutes. Oil pilot lamp also lights up.	Low oil level on 2-TEC models.	Check oil level and replenish as soon as possible.

Many other codes use the engine pilot lamp and the beeper to indicate a problem. Refer to B.U.D.S. for possible causes and service actions.

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
P0106	OFF	OFF	Air pressure sensor voltage out of range.
P0337	OFF	OFF	No crankshaft signal detected.
P0336	OFF	OFF	High engine RPM detected.
P0339	OFF	OFF	Crankshaft signal fault.
P0654	OFF	OFF	Tachometer RPM signal shorted to battery.
P0654	OFF	OFF	Tachometer RPM signal open circuit or shorted to ground.
P0617	OFF	OFF	Starter relay shorted to battery.
P0616	OFF	OFF	Starter relay open circuit or shorted to ground.
P1670	OFF	OFF	Beeper shorted to battery.
P1671	OFF	OFF	Beeper open circuit or shorted to ground.
P0650	OFF	OFF	EMS pilot lamp shorted to battery.
P0650	OFF	OFF	EMS pilot lamp open circuit or shorted to ground.
P1675	OFF	OFF	Relay 2 shorted to battery.
P1676	OFF	OFF	Relay 2 open circuit or shorted to ground.
P1148	OFF	OFF	Safety fuel cut off detected.
P1611	OFF	OFF	P+ Test of ISC output signal failed.
P0513	OFF	OFF	Incorrect DESS® key.
P0601	OFF	OFF	Faulty module (software of hardware damaged).
P1677	OFF	OFF	Relay 3 shorted to battery.
P1678	OFF	OFF	Relay 3 open circuit or shorted to ground.
P1648	OFF	OFF	Battery lamp shorted to battery.
P1649	OFF	OFF	Battery lamp open circuit or shorted to ground.
P0655	OFF	OFF	Engine temperature lamp shorted to battery.
P0655	OFF	OFF	Engine temperature lamp open circuit or shorted to ground.
P1646	OFF	OFF	Engine temperature lamp shorted to battery.

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
P1647	OFF	OFF	Engine temperature lamp open circuit or shorted to ground.
P0648	OFF	OFF	DESS lamp shorted to battery.
P0648	OFF	OFF	DESS lamp open circuit or shorted to ground.
P1654	OFF	OFF	Oil lamp shorted to battery.
P1658	OFF	OFF	Oil lamp open circuit or shorted to ground.
P0117	BLINK	OFF	Engine temperature sensor voltage too low.
P0118	BLINK	OFF	Engine temperature sensor voltage too high.
P0116	BLINK	OFF	Engine temperature sensor functional problem.
P0112	BLINK	OFF	Air temperature sensor voltage too low.
P0113	BLINK	OFF	Air temperature sensor voltage too high.
P0111	BLINK	OFF	Air temperature sensor functional problem.
P0427	BLINK	OFF	Exhaust temperature sensor voltage too low.
P0428	BLINK	OFF	Exhaust temperature sensor voltage too high.
P0426	BLINK	OFF	Exhaust temperature sensor functional problem.
P0107	BLINK	OFF	Air pressure sensor voltage too low.
P0108	BLINK	OFF	Air pressure sensor voltage too high.
P0608	BLINK	OFF	Sensor's power supply voltage too low.
P0608	BLINK	OFF	Sensor's power supply voltage too high.
P0232	BLINK	OFF	Fuel pump shorted to battery.
P0231	BLINK	OFF	Fuel pump open circuit or shorted to ground.
P0080	BLINK	OFF	RAVE® solenoid shorted to battery.
P0079	BLINK	OFF	RAVE® solenoid open circuit or shorted to ground.
P0326	BLINK	OFF	Knock sensor signal below minimum noise.
P1502	BLINK	OFF	TOPS functional problem.
P0351	BLINK	OFF	No ignition output cylinder # 1 (MAG for 2 cyl. engine).
P0352	BLINK	OFF	No ignition output cylinder # 2 (PTO for 2 cyl. engine).
P0262	BLINK	OFF	Injector cyl. # 1 OR outer MAG injector (2 cyl.), shorted to battery.
P0261	BLINK	OFF	Injector cyl. # 1 OR outer MAG injector (2 cyl.), open circuit or shorted to ground.
P0265	BLINK	OFF	Injector cyl. # 2 OR outer PTO injector (2 cyl.), shorted to battery.

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
P0264	BLINK	OFF	Injector cyl. # 2 OR outer PTO injector (2 cyl.), open circuit or shorted to ground.
P0268	BLINK	OFF	Injector cyl. # 3 OR inner MAG injector (2 cyl.), shorted to battery.
P0267	BLINK	OFF	Injector cyl. # 3 OR inner MAG injector (2 cyl.), open circuit or shorted to ground.
P0271	BLINK	OFF	Inner PTO injector shorted to battery.
P0270	BLINK	OFF	Inner PTO injector open circuit or shorted to ground.
P0122	BLINK	OFF	Throttle position sensor voltage too low.
P0123	BLINK	OFF	Throttle position sensor voltage too high.
P0601	BLINK	OFF	TPS learns unlikely or checksum fault.
P1102	BLINK	OFF	Throttle position sensor adaptation failure.
P1104	BLINK	OFF	Throttle position sensor adaptation canceled.
P1655	BLINK	OFF	DESS® shorted to battery.
P1656	BLINK	OFF	DESS® line shorted to ground.
P0604	BLINK	OFF	RAM fault.
P0605	BLINK	OFF	EEPROM fault.
P0602	BLINK	OFF	MPEM not coded.
P0605	BLINK	OFF	EEPROM checksum fault.
P0605	BLINK	OFF	Coding ID checksum fault.
P0605	BLINK	OFF	Coding checksum fault.
P0605	BLINK	OFF	Programming checksum fault.
P1549	BLINK	OFF	Very high exhaust temperature detected (1)
P0562	OFF	2 s beep/min.	Battery voltage too low.
P0563	BLINK	2 s beep/min.	Battery voltage too high.

(1) The beeper turns on when exhaust temperature is higher than 800°C (1472°F). When exhaust temperature reaches 850°C (1562°F), engine speed is limited to 5250 RPM.

VCK (VEHICLE COMMUNICATION KIT)

The VCK (Vehicle Communication Kit) (P/N 529 035 981) is the primary tool to diagnose engine management and fuel injection related problems.

529 035 981

NOTE: The MPEM programmer does not work on SDI models.

Ensure to use the latest version of B.U.D.S. available on BOSSWeb.

B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow actuators, sensors and electronic equipments inspection, diagnostic options and reset such as the closed throttle.

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

⚠ WARNING

If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

VCK Supply

The VCK (MPI box) can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

Connecting VCK to Vehicle

Remove the 6 pin connector from the protective cap on the right side of the vehicle.

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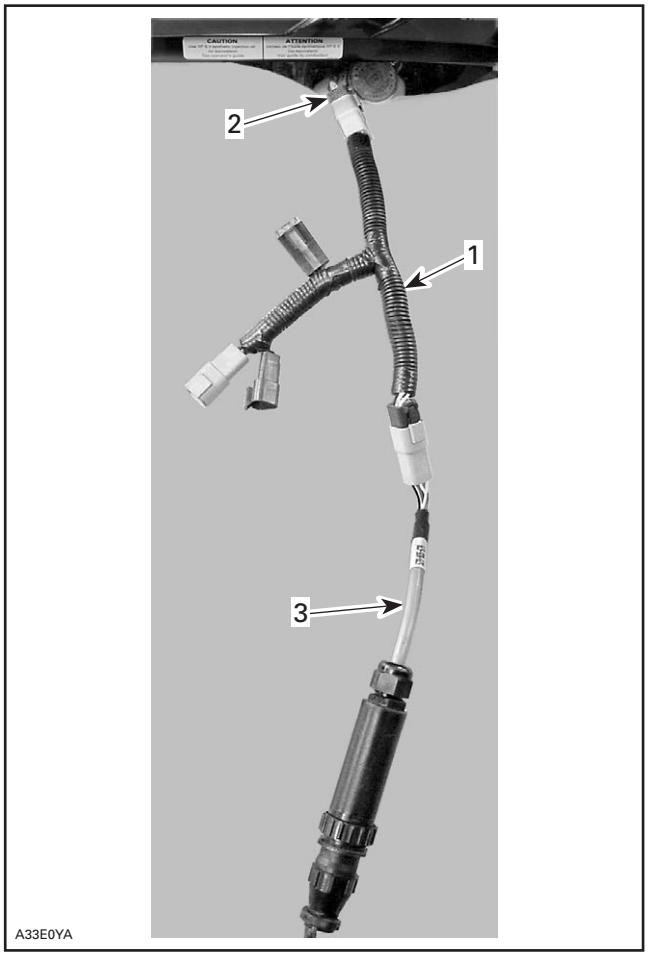
Connect supply harness (P/N 529 035 869), to vehicle 6-pin connector.

Connect the 6 pin diagnostic cable from VCK to supply harness.

NOTE: SDI engines already have a 12 V battery; they do not need any external 9 V or 12 V power to allow programming and troubleshooting. The use of the supply harness will keep the ECM ON. Not using it will make the ECM shuts-off after a few seconds.



1. Supply harness
2. Vehicle 6-pin connector
3. VCK cable

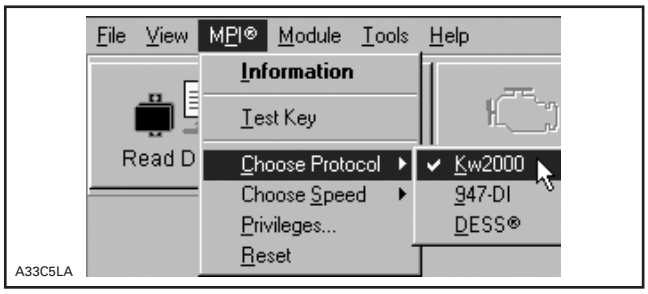
CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

Set engine cut-out switch to OFF.

Install the GRAY diagnostic key (P/N 529 035 896) or any DESS cap onto the vehicle DESS post.

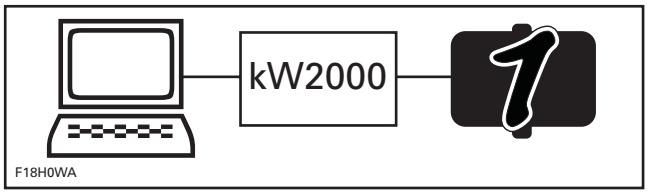
When using the software B.U.D.S., with the SDI:

– ensure that the protocol "KW2000" is properly selected in "**MPI**" under "**Choose protocol**



– ensure the status bar shows the KW2000 and the number 1 to the right. To communicate with the ECM, number 1 must be displayed.

Number 1 means that one module is connected with the PC.



ONE MODULE IS CONNECTED

If an "X" is shown, this means that no communication between the MPI and the ECM is possible. In this case possible causes are:

– ECM is not powered-up
– wrong protocol is used
– bad connection between MPI and module.

Writing in ECM

When writing in ECM through B.U.D.S., there will be an "EMS Tracking" message that will say "Remove key from vehicle". When this occurs, remove the tether cord cap from its post and wait until the message disappears (it lasts approximately 15 seconds after tether cord cap removal).

2-TEC SYSTEM FAULT CODES

General

The faults registered in the ECM (engine control module) are kept when the battery is disconnected.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. This will properly reset the appropriate counter(s). This will also record that the problem has been fixed in the ECM memory.

Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the code faults (state, count, first, etc.) and report, refer to B.U.D.S. online help.

Supplemental Information

When using the service action suggested in the Fault section of B.U.D.S., the system circuits are referred to as DA-41, which means connector "A" on the ECM and the circuit D41.

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups TPS faults and adaption faults. These are displayed on the B.U.D.S. system as TPS OUT OF RANGE and TPS ADAPTION FAILURE.

TPS "OUT OF RANGE" Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS	Reconnect.
Check if sensor is loose	Tighten sensor and reset **Closed Throttle**.
Inspect sensor for damage or corrosion	Replace sensor and reset **Closed Throttle**.
Inspect wiring (voltage test)	Repair.
Inspect wiring and sensor (resistance test)	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle**.
Test sensor operation (wear test)	Replace sensor and reset **Closed Throttle**.

TPS "ADAPTATION FAILURE" Fault

It is caused by the idle position moving out of an acceptable range.

Following problems can be caused by a TPS "Adaption Failure":

– Idle speed is out of range.
– Engine stops, when throttle is released quickly.
– Engine runs inconsistent in low partload or low RPM.

POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
Throttle body has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
ECM has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
Throttle cable too tight	Adjust cable and reset **Closed Throttle**.
Sensor is loose	Tighten sensor and reset **Closed Throttle**.
Throttle bracket is loose	Fix and reset **Closed Throttle**.
Adjustment screw worn or loose	Adjust idle speed screw using B.U.D.S.

COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
Fluke 111	529 035 868	251
hose pinchers	295 000 076	254
pressure gauge	529 035 591	258
VCK (Vehicle Communication Kit)	529 035 981	249, 259
wrench	529 035 899	259–260

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	272
dielectric grease	293 550 004	261
Loctite 5910	293 800 081	269, 272
pulley flange cleaner	413 711 809	255

GENERAL

Engine problems are not necessarily related to the engine management system.

It is important to ensure that the mechanical integrity of the engine and drive system are present:

– good transmission system operation
– good engine compression and properly operating mechanical components, no leaks etc.
– fuel pump connection and fuel lines without leaks.

Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.

When replacing a component, always check its operation after installation.

FUEL SYSTEM

⚠ WARNING

The fuel system of a fuel injection system holds much more pressure than that of a carbureted snowmobile. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here. Pay attention that some hoses may have more than one clamp at their ends. Ensure to reinstall the same quantity of clamps at assembly.

– Use the VCK (Vehicle Communication Kit) (P/N 529 035 981) to release the fuel pressure in the system. Look in the **Activation** section of the software B.U.D.S. (ensure to use the latest version available on BOSSWeb).

529 035 981

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the VCK to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery or remove 30 A fuse prior to working on the fuel system. After performing a pressure test, release the pressure.

– Always disconnect battery properly or remove 30 A fuse prior to working on the fuel system. Refer to BATTERY section.

When the job is done, ensure that hoses from fuel rail going to fuel pump are properly secured in their supports. Then, pressurize the fuel system. Perform the fuel pressure test as explained in this section.

Properly reconnect the battery or reinstall 30 A fuse.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the tether cord cap on the DESS post. Always perform the high pressure test if any component has been removed. The fuel pump is started and pressure quickly builds-up each time the tether cord cap is installed and the START/RER button is depressed (or rewind starter is pulled).

To check fuel rail for leaks, first pressurize the system then spray soapy water on all hose connections, regulators and injectors. Air bubbles will show the leaking area. Check also for leaking fuel or fuel odor.

⚠ WARNING

Never use a hose pincher on injection system high pressure hoses.

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

– battery
– capacitor (manual start models)
– fuses
– relays
– DESS
– ignition (spark)
– ground connections
– wiring connectors.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

Never use a battery charger to substitute temporarily the battery, as it may cause the ECM (engine control module) to work erratically or not to work at all. Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

⚠ WARNING

All electrical actuators (injectors, fuel pump, ignition coils and starter solenoid) are continuously supplied by the battery when the start button is depressed or if engine is rotated (with the rewind starter). Always disconnect the tether cord cap and the battery prior to disconnecting any electric or electronic parts.

To perform verifications, a good quality multimeter such as Fluke 111 (P/N 529 035 868) should be used.

Pay particular attention to ensure that pins are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

CAUTION: Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

Before replacing an ECM, always check electrical connections. Make sure that they are very tight and they make good contact and that they are corrosion-free. Check if wiring harness shows any signs of scoring. Particularly check ECM ground connections. Ensure that contacts are good and clean. A "defective module" could possibly be repaired simply by unplugging and replugging the ECM. The voltage and current might be too weak to go through dirty wire pins. Check carefully if pins show signs of moisture, corrosion or if they look dull. Clean pins properly and then coat them prior to assembling as follows:

NOTE: Do not apply dielectric grease or other lubricant on the ECM connectors.

If the newly replaced ECM works, try the old one and recheck if it works.

Ensure that all electronic components are genuine – any modification on the wiring harness may lead to generate fault codes or bad operation.

NOTE: For diagnostics purposes, use Vehicle Communication Kit (VCK). See DIAGNOSTIC PROCEDURES for proper connectors/adaptors.

After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. Refer to DIAGNOSTIC PROCEDURES subsection.

RESISTANCE MEASUREMENT

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The resistance value of a resistance varies with the temperature. The resistance value for usual resistor or windings (such as injectors) **increases** as the temperature increases. However, some of our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value **decreases** as the temperature increases. Take it into account when measuring at temperatures different from 20°C (68°F). Use this table for resistance variation relative to temperature for **temperature** sensors.

TEMPERATURE SENSOR TABLE

TEMPERATURE		RESISTANCE (OHMS)			
°C	°F	ATS	EGTS	CTS FOR	
				GAUGE	ECM
- 40	- 40		169.7		72412
- 35	- 31				52637
- 30	- 22	28000			38681
- 25	- 13				28718
- 20	- 4	14500	185.1	733.8	21529
- 15	5			587.7	16288
- 10	14			474	12431
- 5	23			384.8	9565
0	32	5500	200.5	314.3	7418
5	41			258.4	5807
10	50			213.7	4582
15	59			177.7	3644
20	68	2500		148.7	2919
25	77		219.6	125	2355
30	86			105.6	1912
35	95			98.69	1562
40	104	1200		76.5	1284
45	113			65.54	1062
50	122		238.5	56.38	882.6
55	131			48.72	738.9
60	140	600		42.28	622

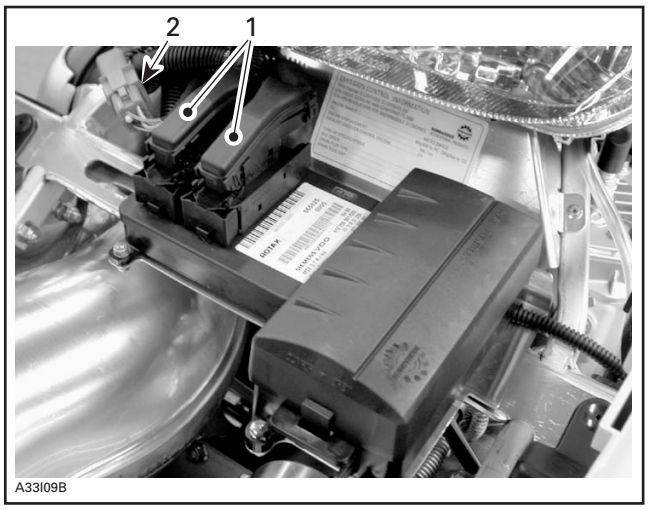
TEMPERATURE SENSOR TABLE					
TEMPERATURE		RESISTANCE (OHMS)			
°C	°F	ATS	EGTS	CTS FOR	
				GAUGE	ECM
65	149			36.82	526.3
70	158			32.19	447.5
75	167			28.24	382.3
80	176	320		24.86	328.1
85	185			21.95	282.8
90	194			19.45	244.8
95	203			17.28	212.8
100	212	180	275.9	15.4	185.6
105	221				162.4
110	230				142.7
115	239				125.9
120	248				111.5
125	257				99.02
130	266	90			88.26
135	275				78.93
140	284				70.81
145	293				63.71
150	302		312.7		57.49
200	392		349.0		
250	482		384.6		
300	572		419.7		
350	662		454.2		
400	752		488.1		
450	842		521.4		
500	932		554.1		
600	1112		617.8		
700	1292		679.2		
800	1472		738.2		
900	1652		794.9		
1000	1832		849.2		

The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine/air silencer and heated with a heat gun while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

ENGINE CONNECTOR PIN-OUTS

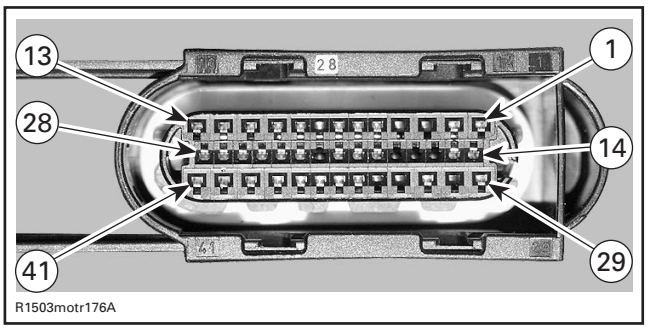
Connector Position



1. ECM connectors
2. Engine connector

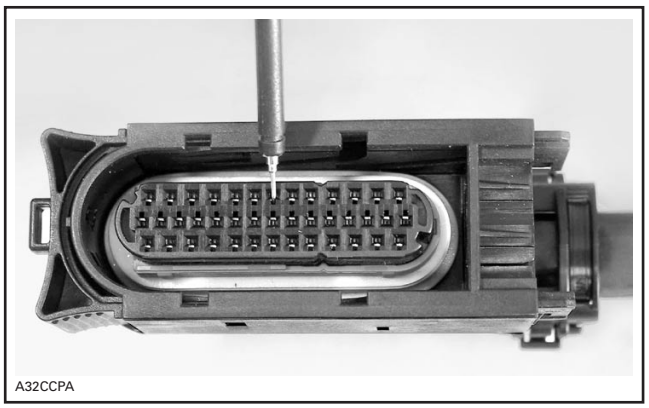
ECM Connector

Use this diagram to locate the pin numbers on the ECM connector of the wiring harness when performing tests.



ECM CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

CAUTION: Probe on top of terminal only. Do not try to probe inside terminal or to use a paper clip to probe inside terminal, it will damage the square-shaped terminal and this could lead to improper function of the engine management system.

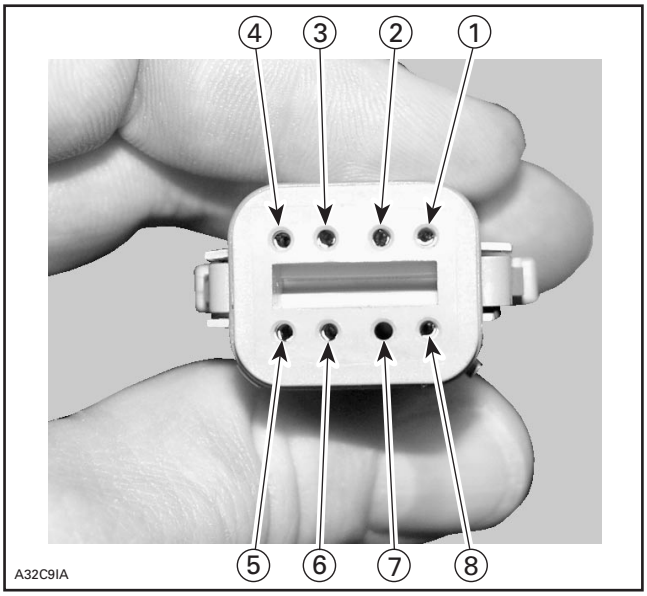


PROBE ONLY ON THE PIN NOZZLE OF FEMALE CONNECTOR

CAUTION: Do not disconnect the ECM connector needlessly. They are not designed to be disconnected/reconnected repeatedly.

Engine Connector

Use this illustration to locate the pin numbers on the engine connector of the wiring harness when performing tests.



ENGINE CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

RELAY

Relay 2

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Energize **relay 2** from **Activation tab**.

Listen to or touch relay to feel it click.

If the relay does not work, disconnect the connector from the relay to test the input side.

Connect a voltmeter as indicated in the following table.

TEST PROBE (+)	TEST PROBE (-)
RED/GRAY wire	Battery ground

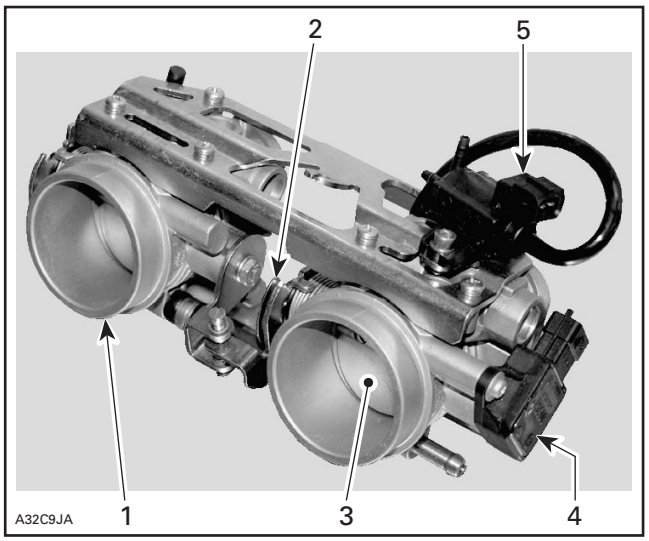
Battery voltage (12 V) should be read.

If voltage reads 12 V, check continuity of ORANGE/GREEN wire between relay connector and pin B-16 of ECM connector. If faulty, repair wire/connector. If wire/connectors test good, try a new ECM.

If voltage does not read 12 V, check continuity of wire on supply side of relay. If faulty, repair wire/connector. If wire/connectors test good, refer to ELECTRICAL SYSTEM to test output side or relay.

AIR INDUCTION SYSTEM

THROTTLE BODY



1. Throttle body
2. Throttle cable attachment
3. Throttle plate
4. TPS
5. E-RAVE solenoid

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever.

IMPORTANT: The throttle body is designed to be tamper proof. Changing the zero position stop screw or synchronization screw or modifying them in any way will not increase performance but may cause poor startability and erratic idling.

Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is not running.

– Throttle cable adjustment too tight. Not returning fully to idle stop.
– Throttle body idle set screw is loose or worn.
– TPS is loose.
– Corroded or damaged wiring or connectors.
– Throttle body has been replaced and the **Closed Throttle** reset has not been performed.
– ECM has been replaced and the **Closed Throttle** reset has not been performed.

Electrical Inspection

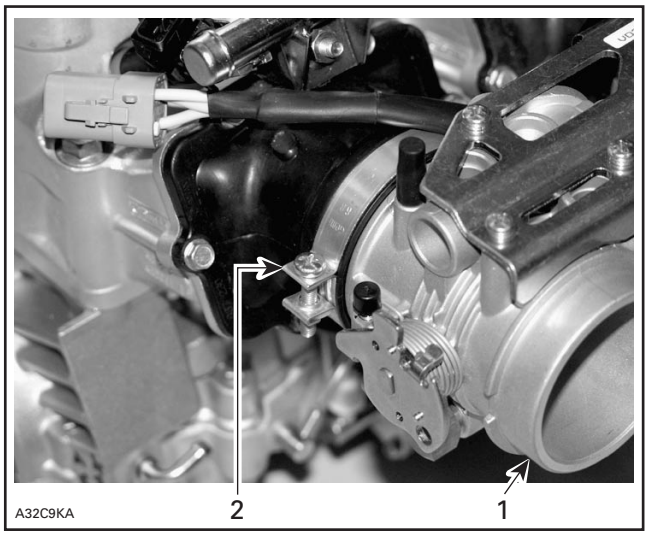
Refer to THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

Replacement

Removal

To remove the throttle body from engine, proceed as follows:

– Disconnect connectors from ATS (Air Temperature Sensor) and APS (Air Pressure Sensor).
– Disconnect air intake silencer from throttle body. Move boot away.
– Install hose pinchers (P/N 295 000 076) on inlet and outlet coolant hoses connected to throttle body.
– Remove clamps and hoses for throttle body heating from nipples.
– Disconnect connectors and hoses from E-RAVE solenoid and TPS.
– Disconnect throttle cable.
– Unscrew retaining clamps of throttle body.



1. Throttle body
2. Clamp

– Slightly pull throttle body out.

Installation

Installation of the new throttle body is the reverse of the removal procedure. Pay attention to the following details.

Refill engine coolant. If an important quantity of coolant was spilled, bleed cooling system. Refer to COOLING SYSTEM section.

For TPS and E-RAVE solenoid replacement procedures, refer to the paragraph ELECTRONIC MANAGEMENT in this section.

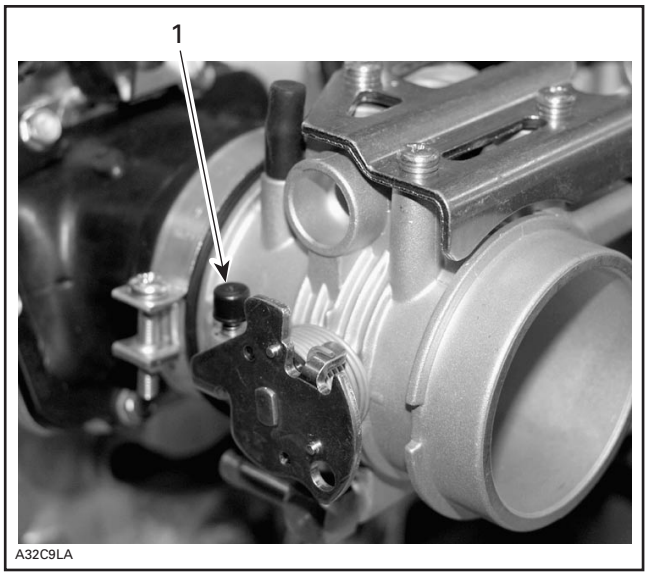
Adjustment

Throttle Body Synchronization

CAUTION: It is not allowed to perform any change on the synchronization screw.

Before installation, clean throttle plates and bores with pulley flange cleaner (P/N 413 711 809).

NOTE: The throttle body is designed as a single part for both cylinders. No synchronization is required as it has already been done at the factory. However, proceed with throttle cable and closed TPS adjustments as described below.

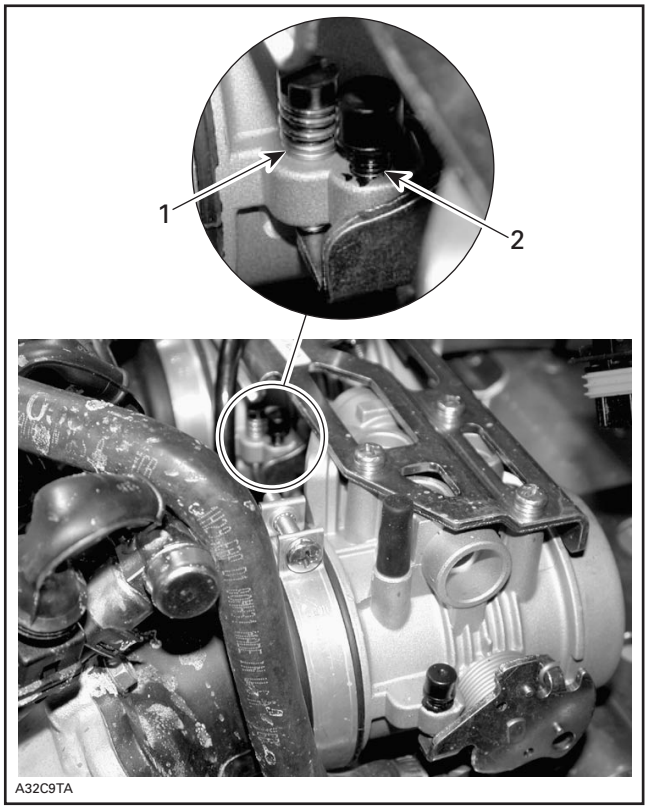


THROTTLE BODY
1. Zero position stopper screw

CAUTION: It is not allowed to perform any change on the zero position stopper screw.

The adjustment of the zero position stopper screw is optimized by the throttle body manufacturer and locked to prevent any modification.

CAUTION: Never attempt to adjust the zero position stopper screw (the capped one) or the idle speed adjustment would be impaired. Besides, no adjustment could be performed by the dealer nor the factory to correct the zero position stopper screw. The throttle body would need to be replaced.



1. Idle speed screw
2. Zero position stopper screw

CAUTION: Do not alter or tamper with throttle cable adjustment or routing. It may cause poor startability and erratic idling.

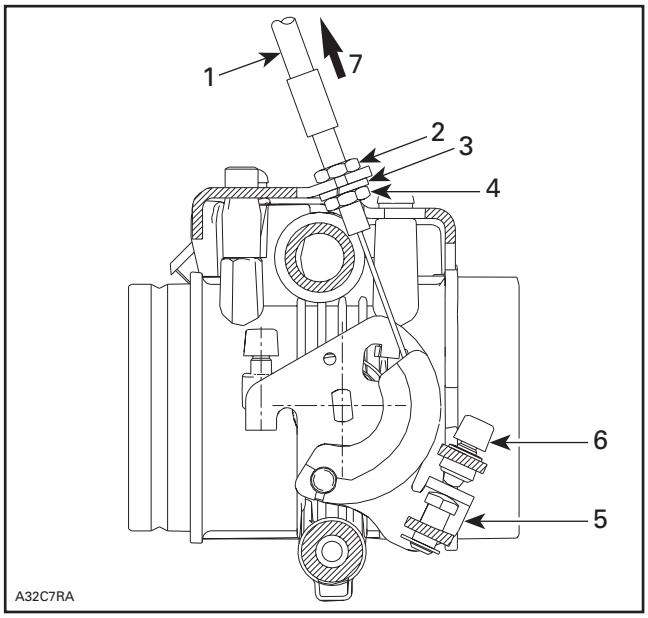
The only screw that has to be adjusted is the idle speed screw and it has to be adjusted only with the closed throttle reset procedure or for high altitude application. This has to be done only if the ECM or throttle body are replaced or if screw has been tampered with by mistake. Refer to THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

Throttle Cable Adjustment

Handlebar and throttle cable must be at their normal position.

Adjust top nut to have a small cable free-play at idle position.

Tighten bottom nut to 4.5 N•m (40 lbf•**in**).



1. Cable sheath
2. Upper nut
3. Lock washer
4. Lower nut
5. Throttle lever
6. Adjusting screw
7. Pull in this direction

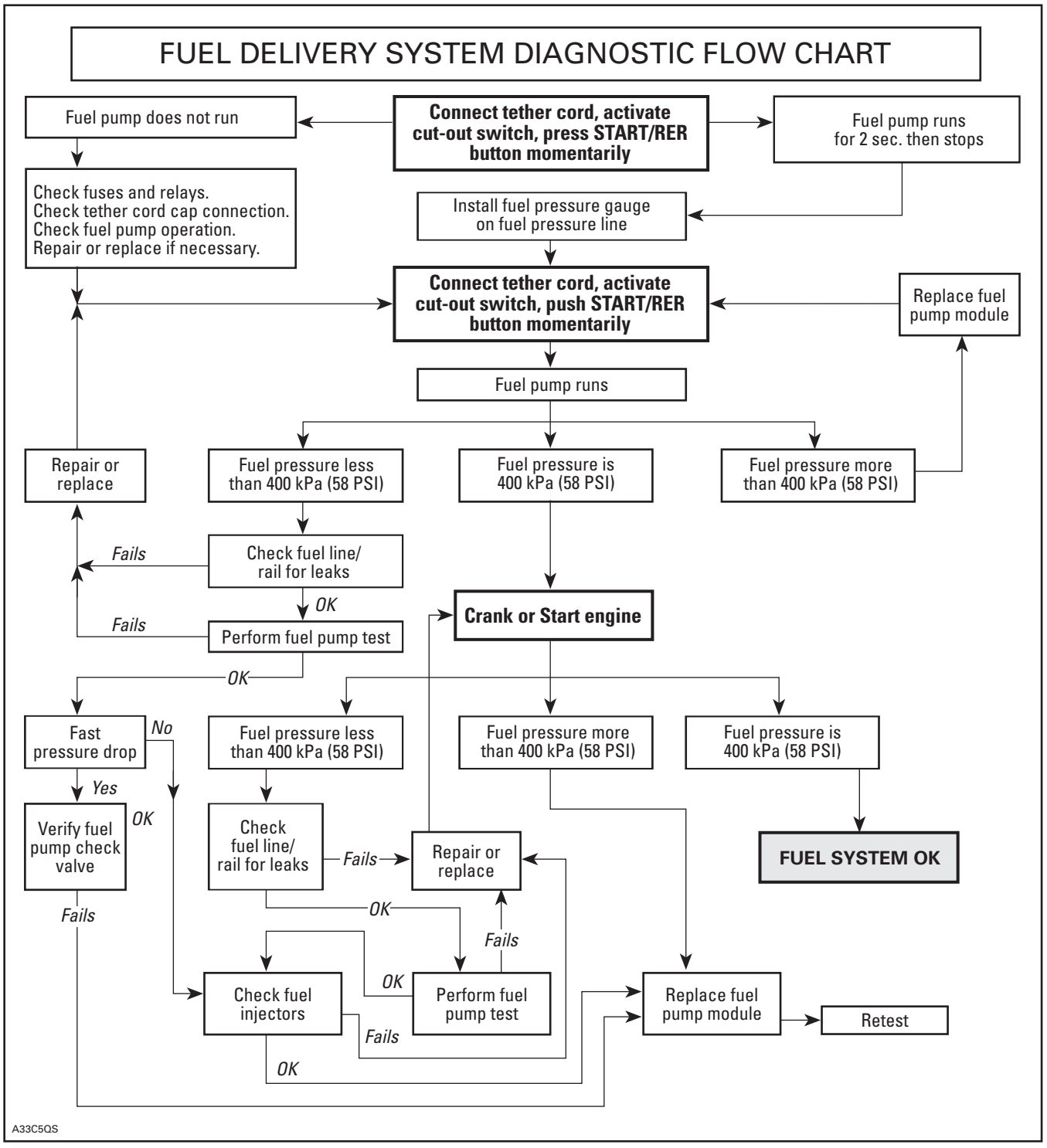
Activate the throttle lever a few times. Make sure throttle cam of throttle body rests against idle speed screw without any tension on the cable.

Using the VCK with B.U.D.S., perform the wide open verification. In **Monitoring** tab check if throttle opening is within 82° to 86° when in wide open position on throttle lever.

Closed Throttle Reset

Perform the **Closed Throttle** reset as described in THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

FUEL DELIVERY



ELECTRIC FUEL PUMP

NOTE: For the diaphragm fuel pump, refer to FUEL SYSTEM.

Fuel Pressure Test

Before proceeding to the pressure test, ensure the battery is fully charged. Battery voltage must be over 12 volts.

Release the fuel pressure in the system using B.U.D.S. Refer to the **Activation** tab.

⚠ WARNING

The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside engine compartment.

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.

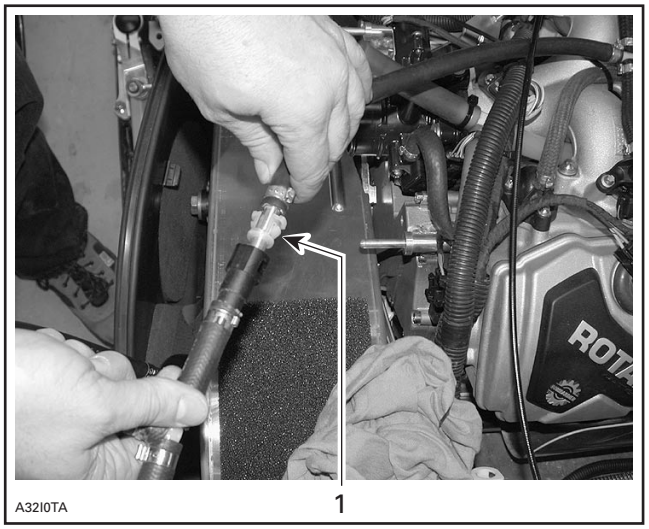
Ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Disconnect outlet hose from fuel pump.

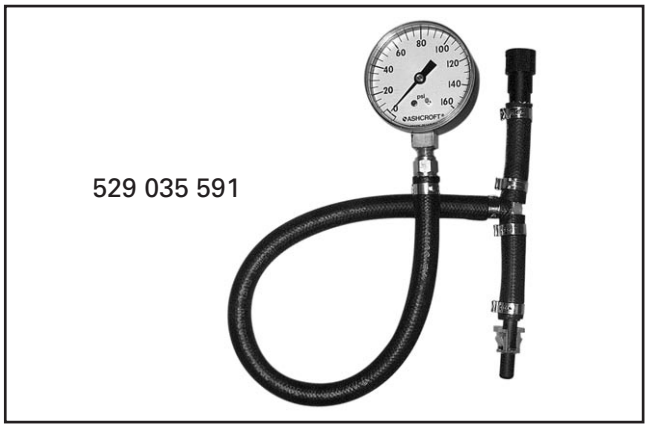
Remove plastic clip (P/N 275 500 429) from male fitting of pressure gauge (P/N 529 035 591).

Install the clip on male fitting of fuel rail inlet hose.



TYPICAL
1. Clip installed on male fitting of fuel rail inlet hose

Install fuel pressure gauge (P/N 529 035 591) between disconnected hoses (in-line installation).



Remove tether cord cap. Depress START/RER button and observe fuel pressure. **Do not crank engine.** Repeat twice. Release pressure using B.U.D.S. between tests so that the gauge is "reset" to zero (0).

FUEL PRESSURE (WHEN DEPRESSING START BUTTON)
400 kPa (58 PSI)

Crank or start engine and observe fuel pressure. The fuel pressure should be the same as above.

If pressure is within limits, fuel pump and pressure regulator are working adequately.

A rapid pressure drop indicates leakage either from the fuel rail or from the fuel pump check valve. Check fuel rail for leaks. If it is not leaking then replace fuel pump.

A slow pressure drop indicates leakage either from the fuel injector or from the fuel pressure regulator. Check fuel injector for leaks (see below). If it is not leaking then replace fuel pump module.

Release fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Remove pressure gauge and plastic clip from inlet hose. Reinstall fuel hose.

⚠ WARNING

Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Reinstall removed parts.

Electrical Test

When depressing the START/RER button, the fuel pump should run for 2 seconds to build up the pressure in the system.

If the pump does not work, disconnect the plug connector from the fuel pump.

Install a temporary connector to the fuel pump connector. Apply 12 V (+) on pin 2 and (–) on pin 1 to this test harness.

If pump does not run, replace the fuel pump module.

Otherwise, probe pin 2 and battery ground of fuel pump connector on vehicle harness side. When depressing the START/RER button, you should read battery voltage for approximately 2 seconds (then, the voltage will drop). If battery voltage does not appear, the problem can be in fuse, relay(s), harness or in fuel pump connector. Repair or replace appropriate part.

Check continuity between pin 1 of the fuel pump connector on the vehicle harness side and terminal 29 of the ECM connector B. If there is no continuity the problem is in the harness. Otherwise, try a new ECM.

In-line Fuel Filter Replacement

Connect VCK (Vehicle Communication Kit) (P/N 529 035 981). Use B.U.D.S. to release fuel pressure.

Disconnect fuel filter line assembly from fuel rail and from fuel supply hose.

Install a new fuel filter line assembly.

Electric Fuel Pump Replacement

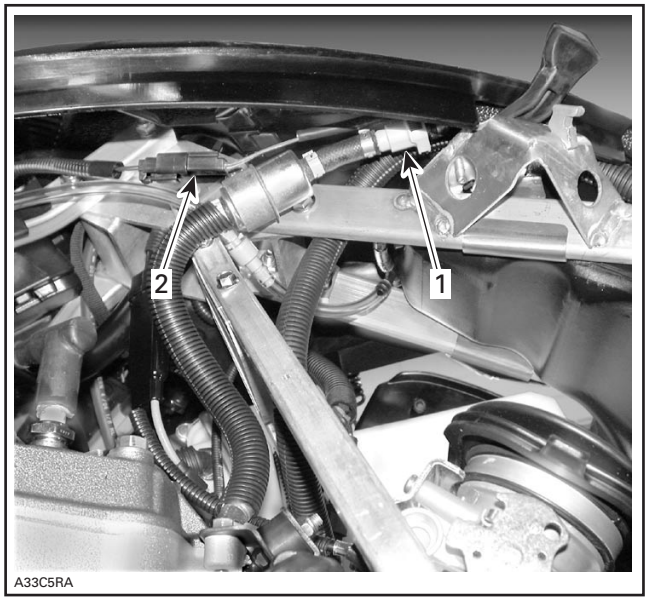
Removal

Remove seat. Connect VCK (Vehicle Communication Kit) (P/N 529 035 981). Use B.U.D.S. to release fuel pressure.

Drain fuel tank as much as possible.

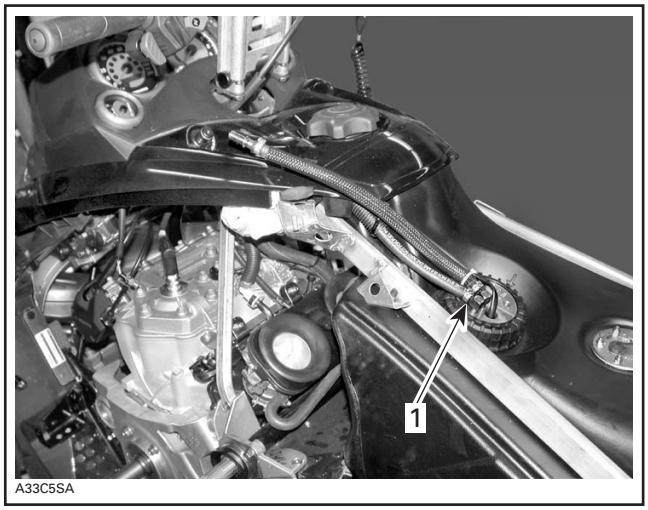
Disconnect fuel supply hose from fuel filter line ass'y.

Disconnect fuel pump electrical connector.



1. Disconnect hose from filter
2. Unplug connector

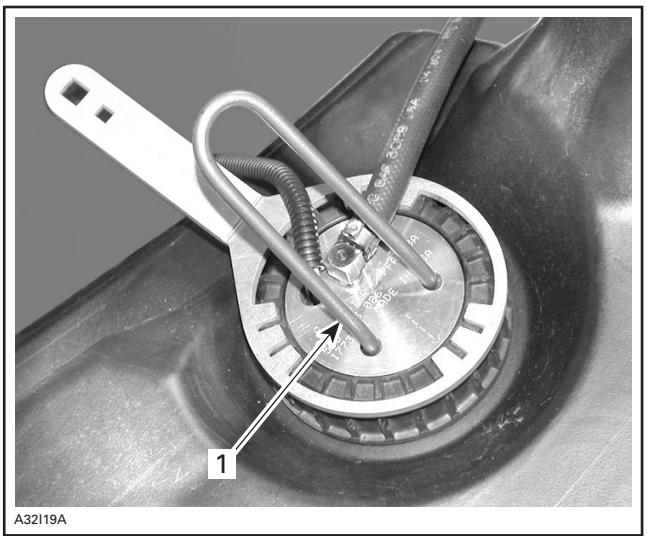
Disconnect hose coming from diaphragm pump.



1. Disconnect hose

With two screwdrivers or a bent rod holding the flange, unscrew fuel pump nut using fuel pump nut wrench (P/N 529 035 899).

A32I11A



A32I19A

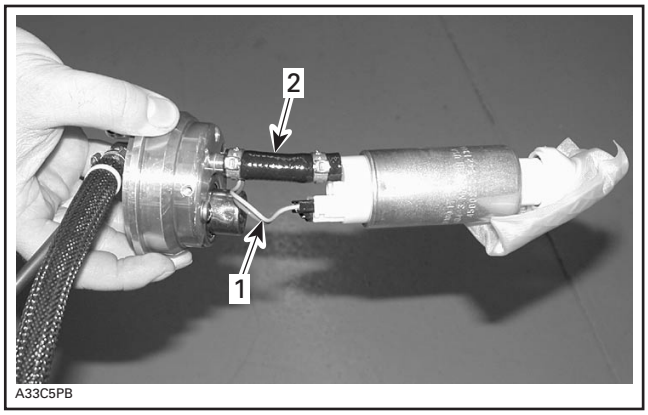
1. Bent rod

Remove fuel pump assembly.

A33C5TA

Disconnect pump electric connector.

Disconnect hose from pump.



A33C5PB

1. Electrical connect
2. Pump hose

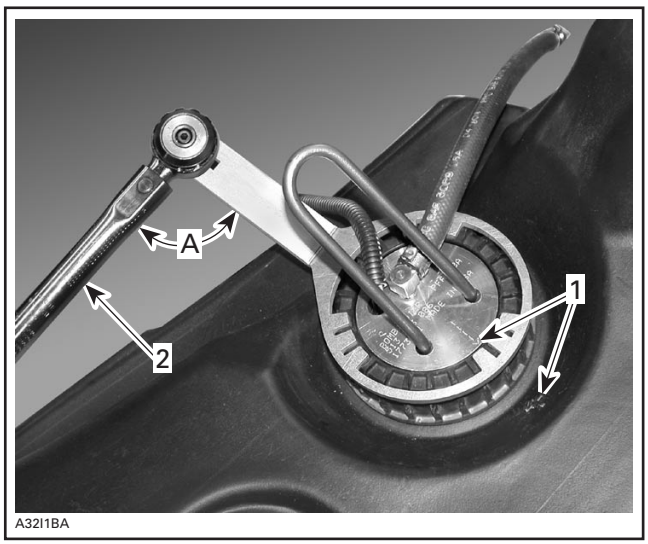
Installation

For installation, reverse the removal process but pay attention to the following.

Install a new gasket.

Align the arrow on fuel pump assembly with the one on fuel tank. Keep arrows aligned when tightening fuel pump assembly.

Install a torque wrench perpendicularly (90°) to fuel pump nut wrench (P/N 529 035 899). Torque fuel pump nut to 27 - 30 N•m (20 - 22 lbf•ft).



A32I1BA

1. Arrows
2. Torque wrench
A. 90°

Use a new clamp to secure hose to fuel pump fitting.

CAUTION: Make sure that hose clamps are tight to avoid that they turn on their fittings.

Fuel Bleeding Procedure

Manual Start Models

When fuel tank is completely emptied, it may require up to 25-30 pull on rewind starter to fill the electric fuel pump reservoir. Filling the fuel tank will solve this problem. The fuel inside the fuel tank will flow through the bypass hole of the electric fuel pump reservoir.

Fuel Pressure Regulator Replacement

Remove fuel pump assembly as explained above.

Remove 2 screws retaining regulator to pump assembly flange.

Replace O-rings with new ones. Install them in pump assembly flange bore.

CAUTION: Regulator O-rings must be installed in pump assembly flange bore.

Reverse removal procedure for installation.

Install a new gasket, then reinstall fuel pump assembly as explained above.

FUEL RAIL

Pressure at fuel rail is supplied and controlled by the fuel pump module. Refer to FUEL PUMP for pressure test.

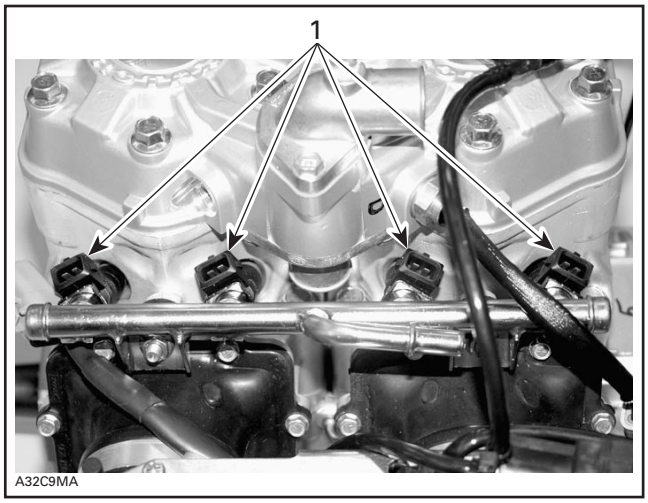
Fuel Rail Replacement

Removal

Release the fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Disconnect fuel hose at the connector.

Wrap a rag around the hose end to prevent rail draining.



1. Fuel injectors

Disconnect wiring harness from the four fuel injectors.

Cut tie raps and remove the wiring harness from the fuel rail.

Unscrew rail retaining nuts.

Gently pull rail up by hand, working each side slightly at a time.

Pull rail out with fuel injectors.

If necessary remove fuel injectors as described below.

Installation

For installation, reverse the removal process but pay attention to the following.

Replace O-rings with new ones.

A thin film of injection oil should be applied to O-rings of fuel injectors to ease installation in cylinder.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

Make sure that injector clips are well in place.

Add dielectric grease (P/N 293 550 004) to injector electrical connector.

When installing fuel line connector to the fuel rail, put some oil on the O-ring to ease installation.

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

FUEL INJECTORS

Leakage Test and Fuel Flow Measurement

Preparation

First ensure fuel pressure is within specifications.

The injectors and fuel rail have to be removed together from the engine. Do not remove injectors from the fuel rail. Refer to REMOVAL in FUEL RAIL REPLACEMENT as necessary.

To ensure continuous fuel availability for the electric fuel pump, first fill up fuel tank prior to performing the following tests. This is required because engine is not running to activate diaphragm fuel pump with the crankcase pulses.

Leakage Test

Place each injector in a clean bowl.

Install the tether cord cap on the DESS post and press the engine START/RER button to activate the fuel pump.

Check for fuel leakage from the injector nozzle. There should be less than 1 drop per minute. Perform the test for 2 minutes.

If not within specification, replace the fuel injector(s).

Fuel Injector Flow Measurement

Manual Start Models

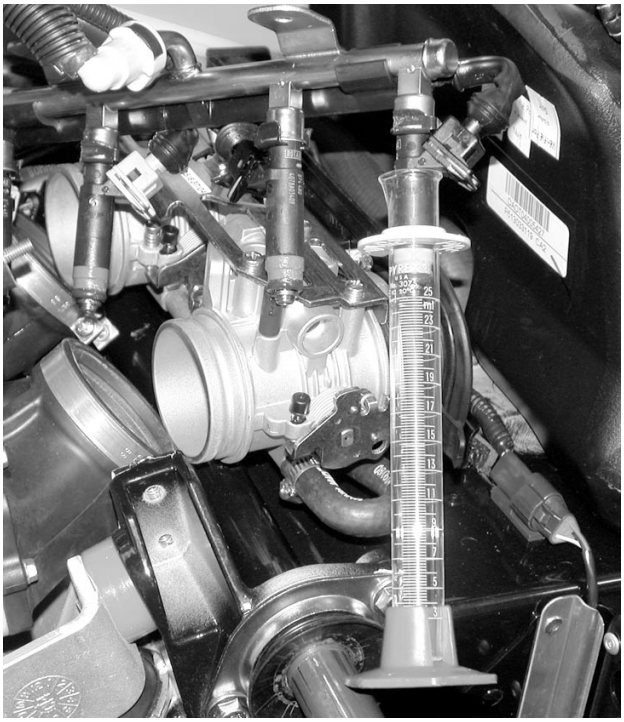
To continuously supply the electric fuel pump for the tests, an external 12V battery is required. The small battery on the vehicle is not sufficient.

All Models

Use an appropriate burette graduated for 25 mL (.85 US on). The Pirex® no 3075 (or equivalent) works fine.

A33C5VA

Place injector inside top of burette.


A33C5WA

Connect vehicle communication kit (VCK) and use B.U.D.S. software. Install the tether cord cap on the DESS post and press the engine START/RER button to wake up the ECM.

Use appropriate wires and connect fuel pump directly to battery posts to continuously supply fuel pump.

Energize the appropriate injector under **Injector Flow Measurement** in **Activation** tab.

Energize each injector individually and measure the gas volume injected. Quantity of gas must be within the following specifications.

INJECTOR	VOLUME of FUEL mL (US oz)
Blue	16 ±1 (.54 ±.03)

If an injector is out of specification, retest it 2-3 times. If it still fails, replace it.

If all injectors fail, it is unlikely a failure of injectors. First ensure your reading from the burette is appropriate (pay attention to the division lines). Ensure fuel tank is full. Test for leaks in fuel system, fuel pump pressure, filter condition (in-line and in tank).

Properly reinstall parts.

Electrical Test

Voltage Test

Tether cord cap must be on DESS post.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the fuel injector from the **Activation** section.

If the injector does not work, disconnect the plug connector from the injector.

Install a temporary connector to the injector with wires long enough to make the connection outside the engine compartment and apply voltage (12 V) to this test harness.

This will validate the injector mechanical and electrical operation.

If it does not work, replace it. If it works, continue procedure.

Wake up ECM using START button and measure voltage between pin 1 (of injector on harness side) and battery ground.

If 12 V is read, disconnect connector A from the ECM and check continuity of circuit as per following table. If it is good, try a new ECM.

CIRCUIT NUMBER (ECM CONNECTOR «A»)	PIN 2 OF INJECTOR HARNESS
A-15	MAG external
A-33	PTO external
A-14	MAG internal
A-30	PTO internal

If it does not read 12 V, check the corresponding fuse(s), relay and continuity of circuit. If continuity is faulty, repair wiring harness.

Resistance Test

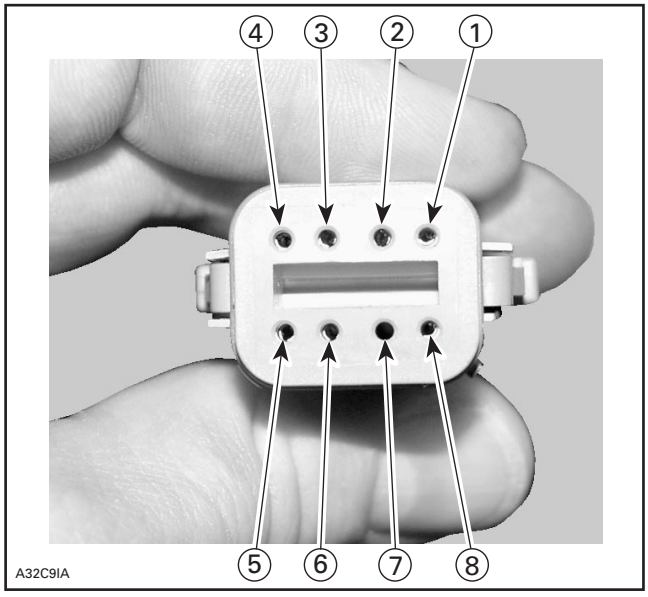
Disconnect the injector from the wiring harness and check the resistance of the injector itself.

The resistance should be around 14.5 Ω.

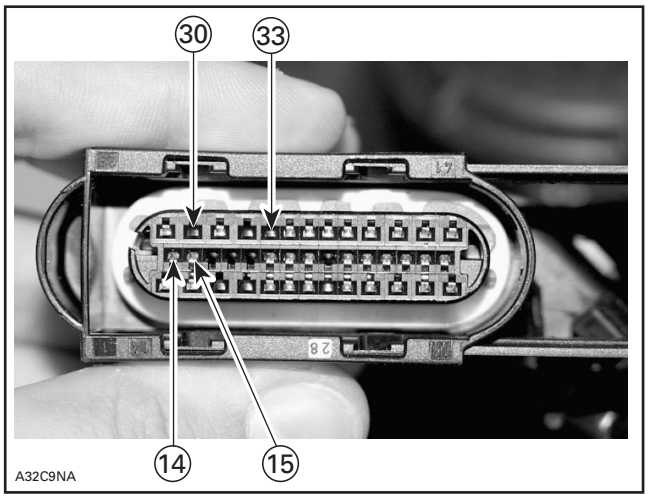
If resistance value is incorrect, replace the injector.

Reconnect the injector and disconnect the connector A from the ECM as well as the engine connector.

Using a multimeter, check resistance value between terminals as shown in the table below.



ENGINE CONNECTOR



ECM CONNECTOR

COMPONENT	CONTACT LOCATION
Fuel injector, MAG external	4 (Engine Connector) and A-15 (ECM connector)
Fuel injector, MAG internal	3 (Engine Connector) and A-14 (ECM connector)
Fuel injector, MAG external	4 (Engine Connector) and A-33 (ECM connector)
Fuel injector, MAG internal	3 (Engine Connector) and A-30 (ECM connector)

The resistance should be around 14.5 Ω.

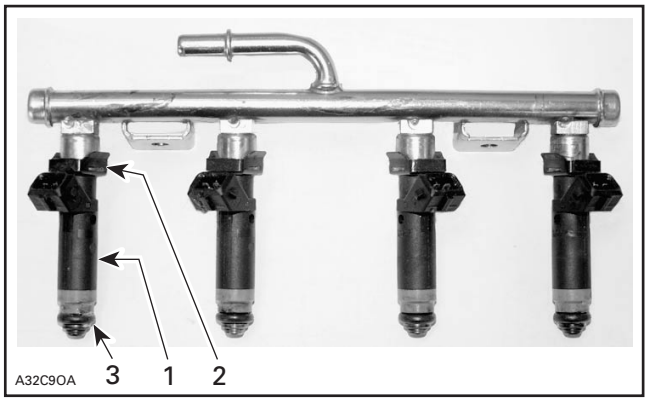
If resistance value is correct, check wiring of corresponding relay. If good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors or replace the wiring harness between ECM connector and fuel injector.

Fuel Injector Replacement

Removal

Before removing the injectors, the fuel rail has to be removed from the engine. Refer to REMOVAL in FUEL RAIL REPLACEMENT for the procedure.



FUEL RAIL ASS'Y
1. *Fuel injector*
2. *Injector clip*
3. *O-ring*

Then remove the injector clip. Now the fuel injector can be easily pulled out of the fuel rail.

Installation

For the installation, reverse the removal procedure. Pay attention to the following details.

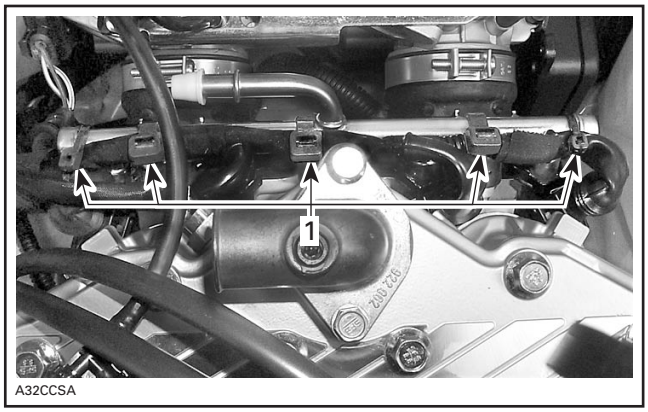
Insert injectors with your hand. Do not use any tool. Ensure clip and injector are properly installed.

Replace O-rings with new ones.

NOTE: A thin film of engine oil should be applied to O-rings to ease insertion in rail.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

Attach injector wires with locking tie as shown in following photo.



1. Locking ties

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

ELECTRONIC MANAGEMENT

ECM REPLACEMENT

General

Prior to replacing a suspected ECM, ensure that all the recommendations in the general introduction of this section have been followed.

IMPORTANT: When the ECM is replaced, the tether cord cap(s) and the **Closed Throttle** must be reprogrammed/reset. Refer to their specific section for adjustment.

To allow transferring the previous recorded information from the old ECM to the new one, use the vehicle communication kit (VCK) with the B.U.D.S. software. Use **Replace ECM** in the **ECM** menu. Follow instructions provided by the help system.

NOTE: If the old ECM can still communicate, it must be read inside B.U.D.S. prior to removing it from the vehicle to carry vehicle information and history to the new ECM.

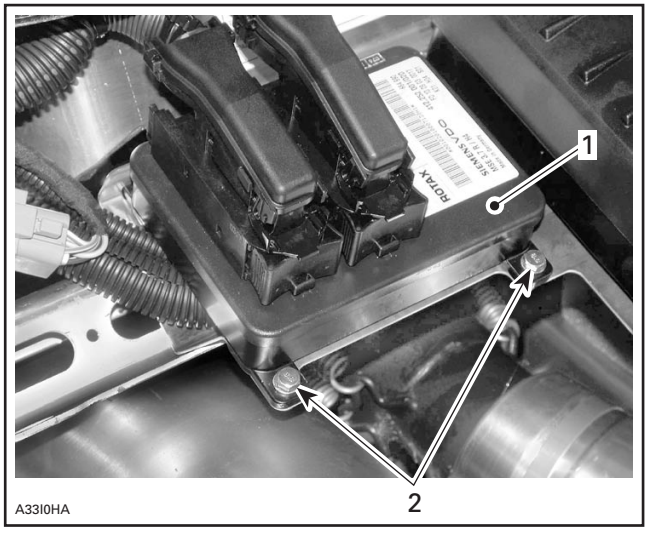
ECM Replacement

Disconnect battery cables.

⚠ WARNING

Battery BLACK (-) cable must always be disconnected first and connected last.

Disconnect both connectors from ECM.



1. ECM
2. Retaining screws

Unscrew all retaining screws and remove the engine ECM from its support.

Install the new ECM to the support.

Reconnect ECM connectors to ECM, and then battery cables.

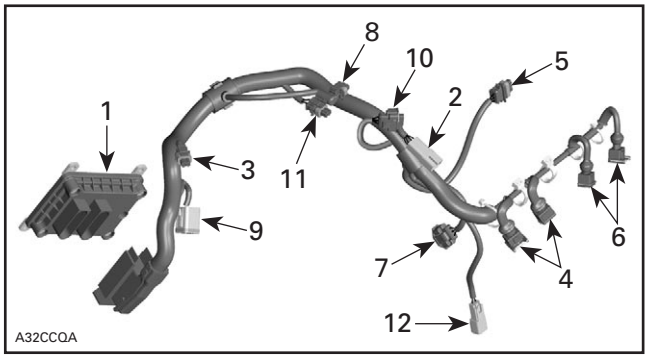
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

NOTE: If data cannot be transferred, manually enter information in **Vehicle** tab.

After performing the required resets, ensure to clear all faults from the newly replaced ECM.

Start the engine and increase engine speed above 6000 RPM to be sure no fault appears.

ENGINE WIRING HARNESS



1. ECM
2. CTS connector
3. EGTS connector
4. Fuel injector connector (cylinder MAG side)
5. Ignition coil connector
6. Fuel injector connector (cylinder PTO side)
7. TPS connector
8. ATS connector
9. Engine connector
10. APS connector
11. KS connector
12. CPS connector

Resistance Test

Check continuity of the circuits according to the wiring diagram in the WIRING DIAGRAMS section of this manual.

If wiring harness is good, check the respective sensor/actuator as described in this section.

Otherwise, repair the connectors, replace the wiring harness or the ECM as diagnosed.

Removal

Remove air intake silencer.

Disconnect the wiring harness from all sensors/actuators.

Disconnect the connector from the ECM.

Cut all locking tie which are holding the wiring harness in position.

Remove complete wiring harness.

Installation

First connect the connector A to the ECM and the engine connector to the vehicle wiring harness.

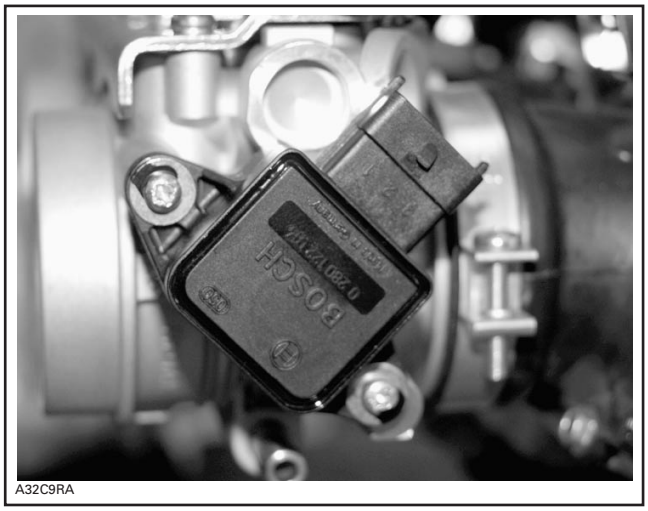
Reconnect the wiring harness to all sensors/actuators and reinstall all locking tie that have been removed.

Install all remaining parts, which have been removed.

THROTTLE POSITION SENSOR (TPS)

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle shaft angle.



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THROTTLE POSITION SENSOR (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to THROTTLE BODY in AIR INDUCTION SYSTEM above.

The ECM may generate several fault codes pertaining to the TPS. Refer to SYSTEM FAULT CODES in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

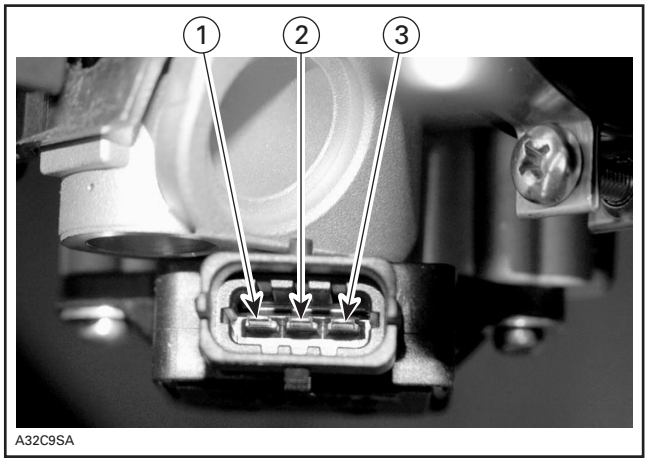
While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, use the **Throttle Opening** display under **Monitoring**.

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle "sticks", bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

Voltage Test

Check the voltage output from ECM to the throttle position sensor.



A32C9SA

TPS

Disconnect plug connector from throttle position sensor. To unlock connector, insert a small screwdriver between the folded tab. To see the connector pin-out and its pin numbers, temporarily remove the connector shield joining the harness.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Connect a voltmeter between pin 1 and 2 in the wiring harness.

Voltage should be 5 V.

Check the continuity between pin 3 on wiring harness TPS connector and pin 24 on wiring harness ECM connector.

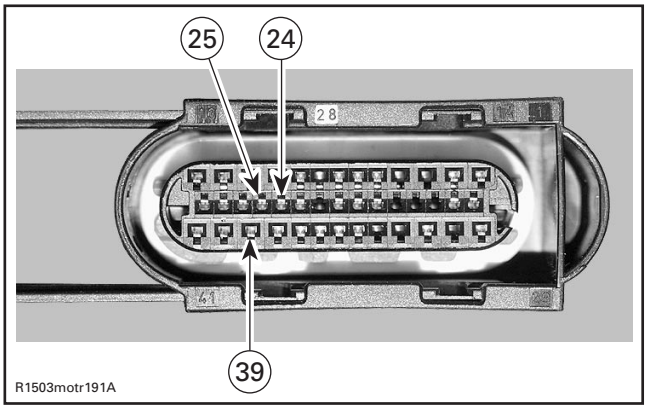
If tests are good, replace the TPS.

If voltage tests are not good, continue to check the resistance of the rest of the TPS circuit.

Resistance Test

Reconnect the TPS.

Disconnect the connector A from the ECM.



Using a multimeter, check resistance value as per the following table.

ECM CONNECTOR		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
PIN	PIN	Resistance Ω	
A-24	A-25	2500	1000
A-25	A-39	1600-2400	1600-2400
A–24	A-39	1000	2500

NOTE: The resistance value should change smoothly and proportionally to the throttle movement. Otherwise, replace TPS.

If resistance values are correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

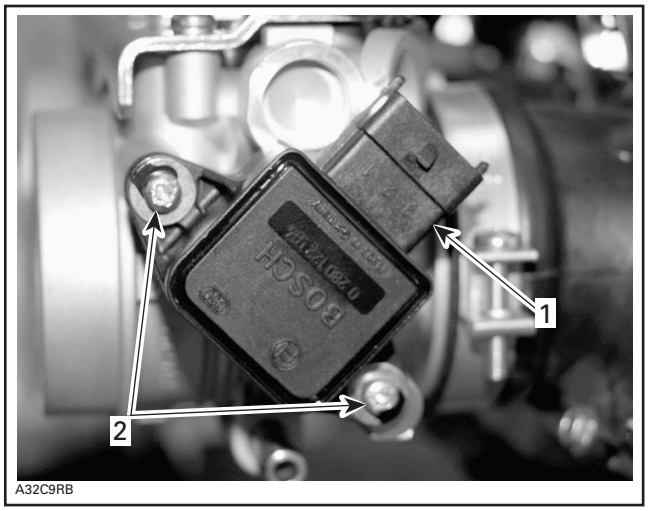
If resistance values are incorrect, replace TPS.

Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



THROTTLE BODY
1. *Throttle position sensor (TPS)*
2. *Screws*

Install the new TPS.

Apply Loctite 243 on the TPS retaining screws, then torque to 3 N•m (27 lbf•**in**).

Reinstall remaining removed parts.

Proceed with the **Closed Throttle Reset**. See below.

Closed Throttle Reset

Ensure throttle body synchronization and throttle cable are properly adjusted prior to performing this setting.

NOTE: This operation performs a reset of the values in the ECM.

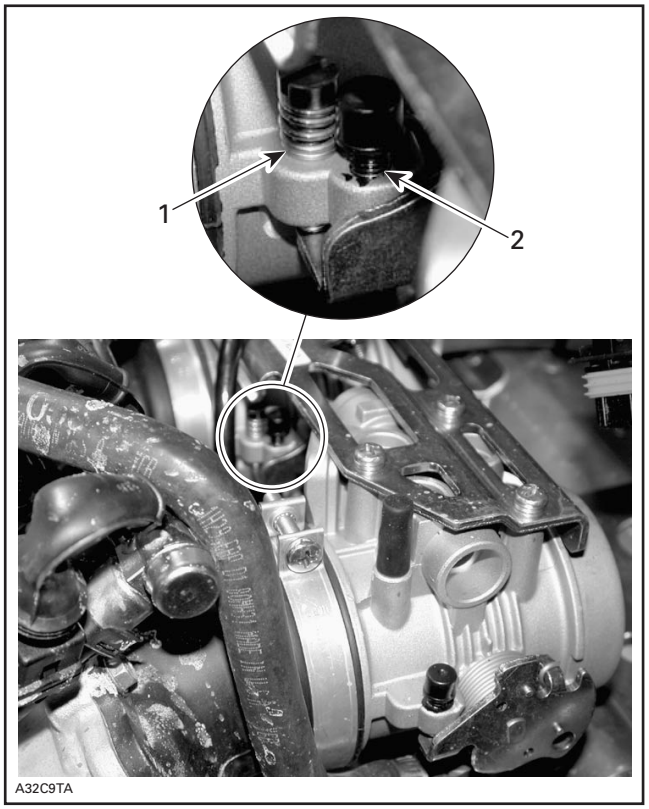
This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations in idle speed control of the engine.

NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened or removed or throttle body or ECM is replaced.

CAUTION: An improperly set TPS may lead to poor engine performance.

Use the vehicle communication kit (VCK) with the B.U.D.S. software to perform this adjustment.

Unscrew idle speed screw until the throttle body plate stop lever rest against its zero position stopper screw (capped screw). If necessary, loosen the throttle cable. Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate.



1. Idle speed screw
2. Zero position stopper screw

Push the **Reset** button in the **Setting** section of B.U.D.S.

Re-power up the ECM by pushing the START/RER button momentarily.

The throttle opening displayed in B.U.D.S. should be 0.00 (0.1 maximum).

If TPS is not within the allowed range while resetting the **Closed Throttle**, the ECM will generate a fault code and will not accept the setting.

Now, the idle speed screw has to be adjusted. To do this, screw in the idle speed screw until B.U.D.S. throttle opening displays value as per following table.

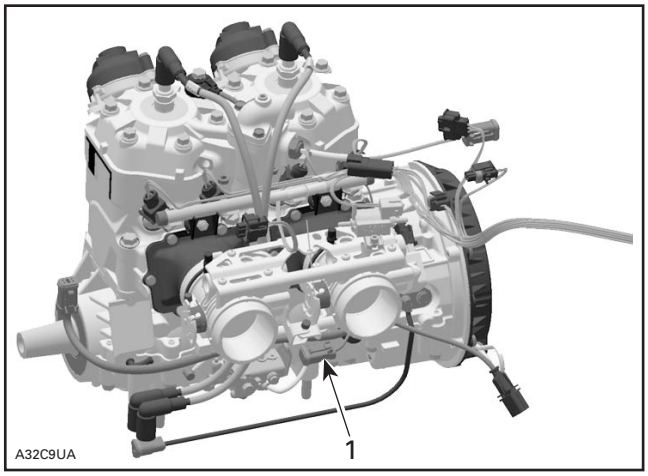
ENGINE	VALUE	
	AT SEA LEVEL	ABOVE 1800 m (6000 ft)
593 HO SDI	3.9° ±0.1	4.9° ±0.1

If throttle cable has been loosen during the procedure, adjust a throttle cable.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to SYSTEM FAULT CODES in the DIAGNOSTIC PROCEDURES section for more information.

CRANKSHAFT POSITION SENSOR (CPS)

NOTE: The CPS is used for forward and reverse.



1. CPS connector

NOTE: Take into account that a CPS fault can be triggered by missing encoder wheel teeth. First check fault codes then check the teeth condition if necessary. See below.

Disconnect CPS wiring harness connector. Probe terminals coming from CPS while cranking engine. Voltage should be within 1-2 Vac. Otherwise, inspect wiring and replace CPS if wiring is good.

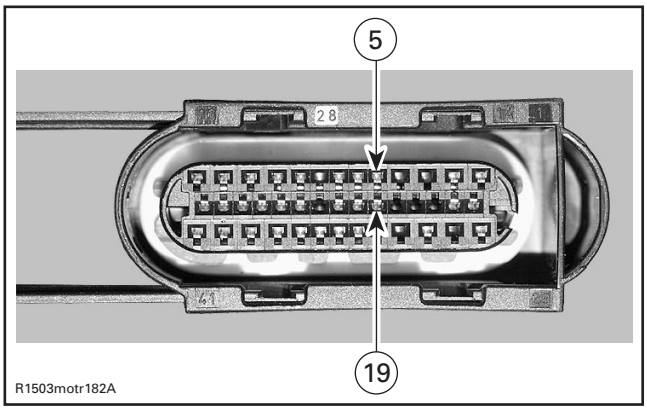
Resistance Test

Disconnect the CPS plug connector from the wiring harness and check the resistance of the sensor itself.

The resistance should be between 190 Ω and 300 Ω.

Otherwise, replace the CPS.

If resistance tests good, **reconnect** the CPS and disconnect the connector A on the ECM.



Using a multimeter, recheck resistance value between terminals 5 and 19.

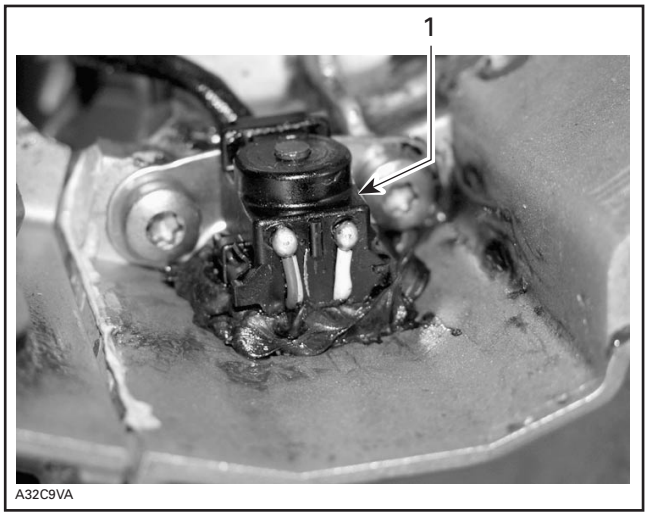
If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

Replacement

Disconnect connectors and remove the rewind starter, then the magneto flywheel. Refer to MAGNETO SYSTEM.

Remove CPS.



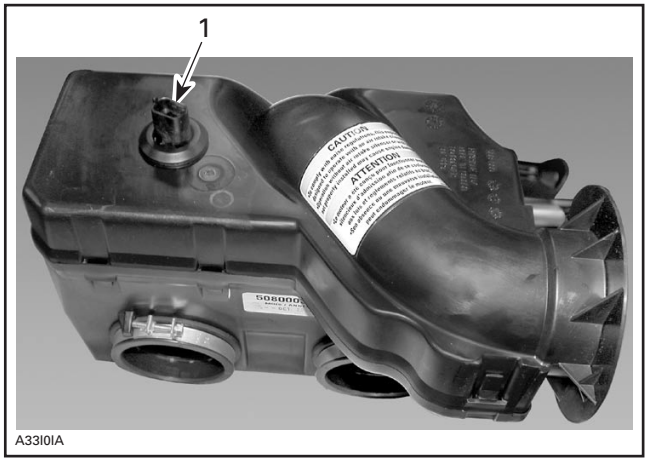
1. CPS inside crankcase

When installing new CPS apply Loctite 5910 (P/N 293 800 081) between CPS and crankcase.

Torque to 8 N•m (71 lbf•**in**).

Reinstall remaining removed parts.

AIR TEMPERATURE SENSOR (ATS)



1. Air temperature sensor (ATS)

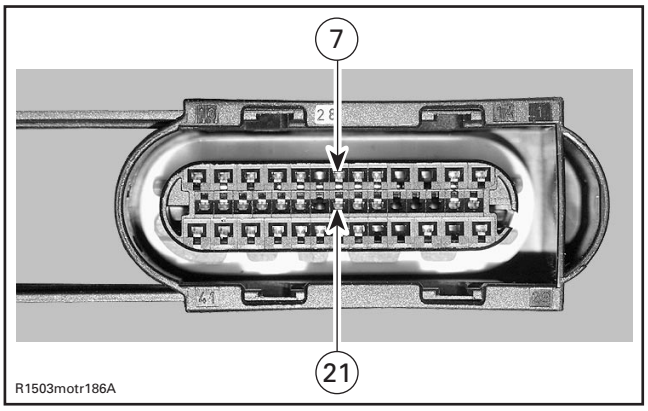
Resistance Test

Disconnect the plug connector from the ATS and check the resistance of the sensor itself.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the ATS and disconnect the connector A on the ECM.



Using a multimeter, recheck resistance value between terminals 7 and 21.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the ATS.

Replacement

Unplug ATS connector.

Pull the ATS out of the air intake silencer.

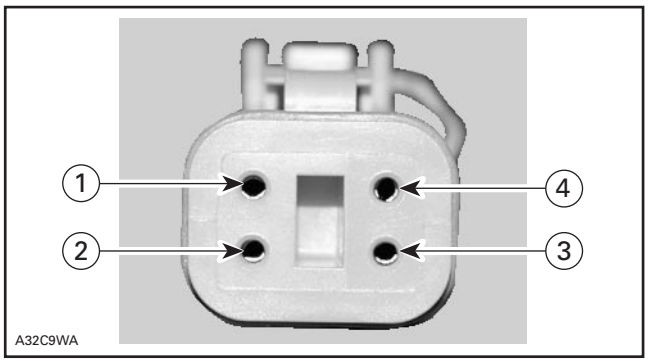
Spray soapy water on grommet. Install grommet on air intake silencer then push the sensor in place.

Reconnect it.

COOLANT TEMPERATURE SENSOR (CTS)

Resistance Test

Disconnect the plug connector from the CTS and check the resistance of the sensor itself.



The resistance between pin 1 and 2 is used for temperature gauge.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

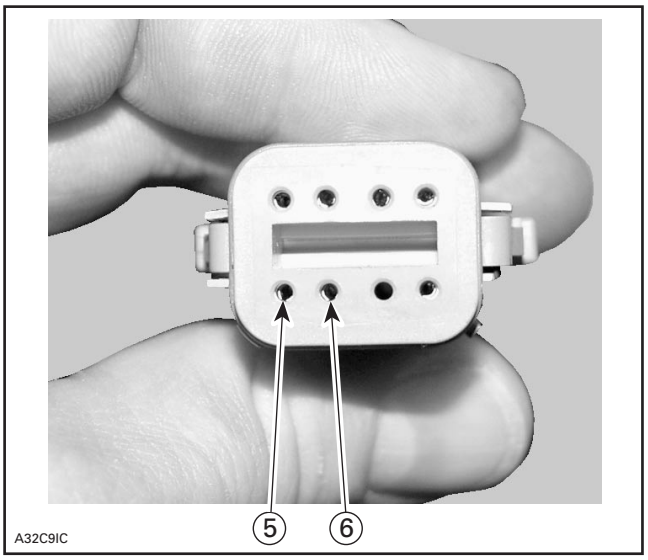
If out of specification, replace the sensor.

The resistance between pin 3 and 4 is used for ECM.

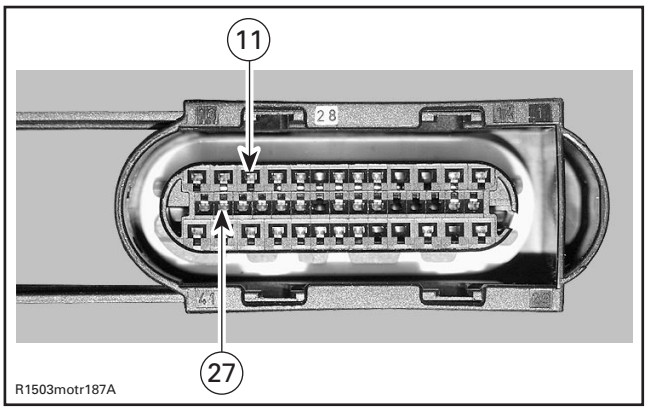
Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the CTS and disconnect the connector A on the ECM as well as the engine connector.



ENGINE CONNECTOR



ECM CONNECTOR A

Using a multimeter, recheck resistance value between terminals 5 and 6 on engine connector. This resistance is used for temperature gauge.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

Recheck also resistance value between terminals 11 and 27 on ECM connector A. This resistance is used for ECM.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

Replacement

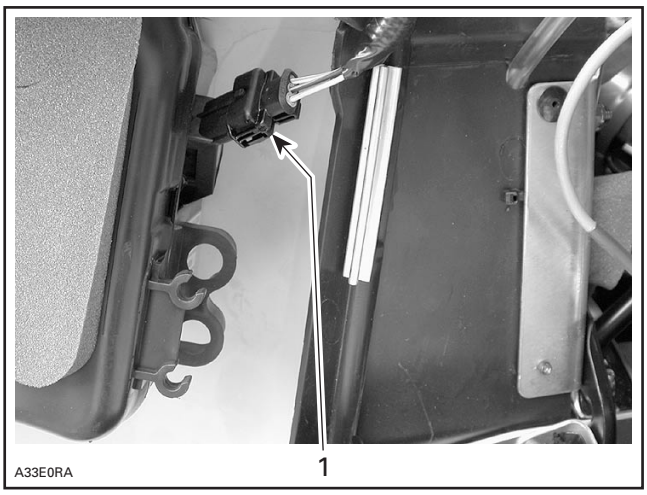
Drain cooling system.

Disconnect CTS connector and remove CTS. Install the new CTS and torque to 12 N•m (106 lbf•**in**).

Reinstall remaining removed parts.

Refill engine coolant and bleed cooling system. Refer to LIQUID COOLING SYSTEM section.

AIR PRESSURE SENSOR (APS)



INSIDE LH SIDE PANEL
1. Air pressure sensor (APS)

Ensure sensor is correctly installed on air intake silencer. Otherwise, the APS could generate a fault code. Remove sensor and check for oil or dirt on its end and if problem persists, check the wiring harness. Perform the following tests.

Voltage Test

Check the voltage output from ECM to the APS.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Disconnect plug connector from APS and connect a voltmeter between pin 1 and 2 of wiring harness.

Voltage should be 5 V.

Check the continuity between pin 3 on APS connector and pin 18 on ECM connector.

If tests are good, replace the APS.

If tests are not good, continue to check the continuity of the rest of the APS circuit on the harness.

Disconnect the connector A from the ECM.

Using a multimeter, check continuity of circuits as per following table.

CIRCUIT NUMBER (ECM CONNECTOR A)	APS CONNECTOR
A-3	PIN 1
A-4	PIN 2
A-18	PIN 3

If wiring harness is good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

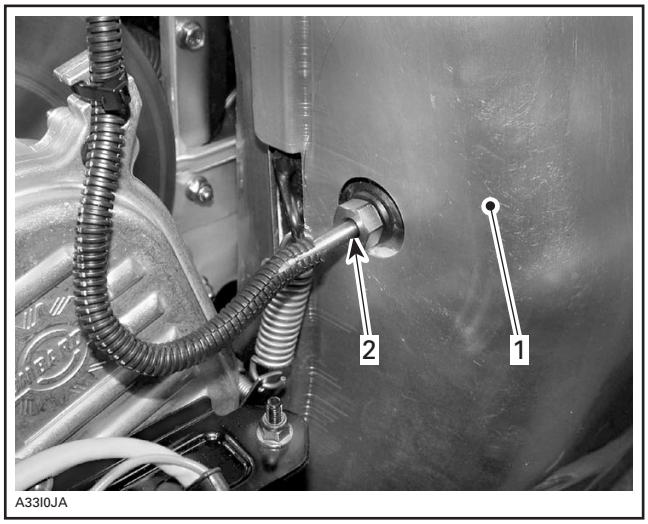
Otherwise, repair the connectors or replace the wiring harness between ECM connector and the APS.

Replacement

Disconnect APS connector and remove the APS. The ATS is retained with a screw.

Install the new APS.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)



1. Muffler
2. Exhaust gas temperature sensor (EGTS)

Resistance Test

Disconnect the plug connector from the EGTS and check sensor resistance.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the EGTS and disconnect the connector A on the ECM.

Using a multimeter, recheck resistance value between terminals 10 and 26.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connector or replace the wiring harness between ECM connector and the EGTS.

Replacement

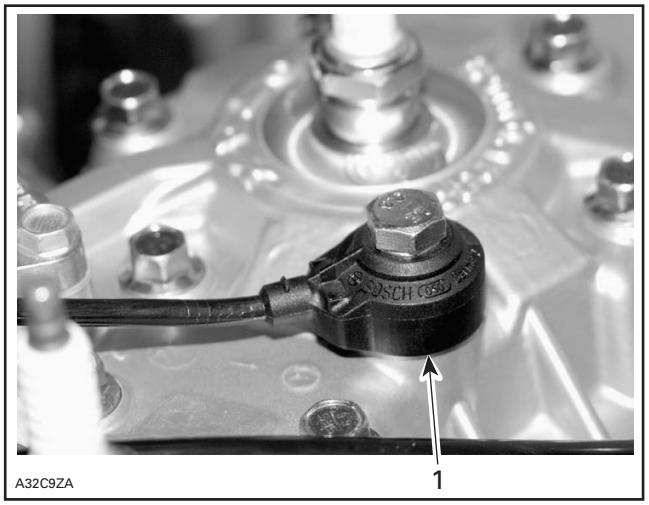
Disconnect EGTS connector and remove EGTS.

Apply anti-seize lubricant (P/N 293 800 070) over EGTS threads to prevent possible seizure.

Torque the new EGTS to 45 N•m (33 lbf•ft).

Replug connector.

KNOCK SENSOR (KS)



1. Knock sensor (KS)

Dynamic Test

Lift rear of vehicle off the ground and support it with a wide-base mechanical stand.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, monitor the knock sensor using the Faults section.

Start the engine and bring engine RPM above 6000 RPM. If no fault code occurs, the knock sensor is good.

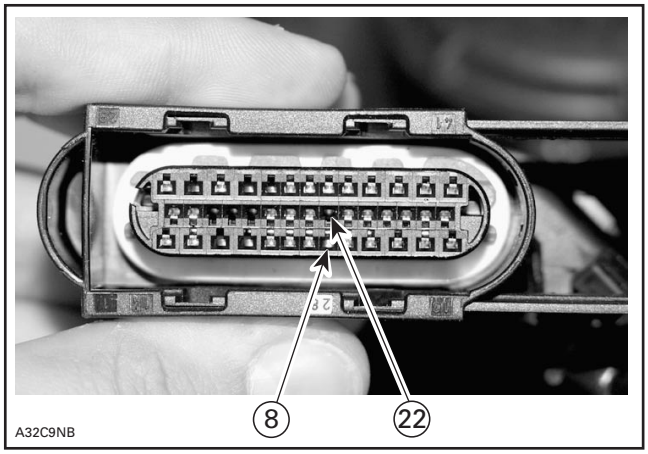
Otherwise, do the following.

Ensure sensor and head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.

Check the knock sensor circuit on wiring harness.

Disconnect the connector from knock sensor harness.

Disconnect connector A form the ECM and check continuity of circuit as per following table.



CIRCUIT NUMBER (ECM CONNECTOR A)	KS CONNECTOR
A-22	PIN 1
A-8	PIN 2

If test is not good, repair the connector or replace the wiring harness between ECM connector and knock sensor.

Replacement

Unscrew and remove knock sensor from cylinder head.

Clean contact surface, apply Loctite 5910 (P/N 293 800 081) on both contact surfaces on the knock sensor then install the new sensor.

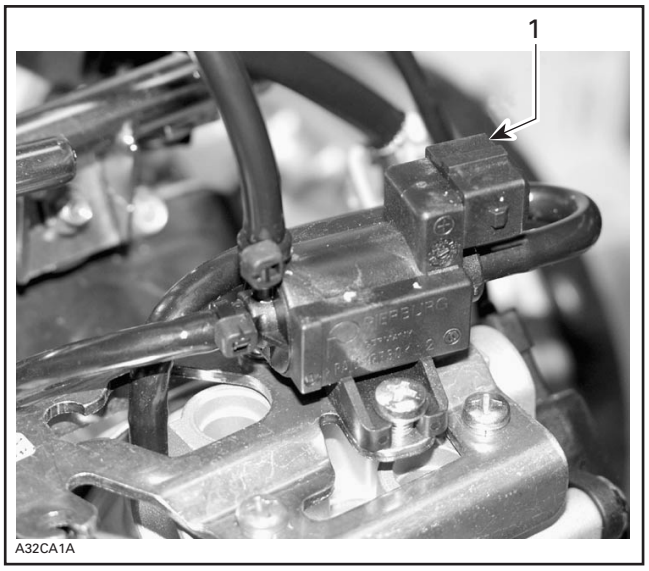
CAUTION: Install screw and torque it within 10 minutes to prevent the sealant to dry before torquing. A dried sealant before torquing would impair the knock sensor operation.

Torque screw to 24 N•m (18 lbf•ft).

CAUTION: Improper torque might prevent sensor to work properly and lead engine to severe damage of internal components.

Replug connector.

E-RAVE SOLENOID



1. E-RAVE solenoid

Resistance Test

Disconnect the solenoid connector.

Check resistance value between both terminals of the solenoid.

The resistance value should be approximately 30 Ω.

Voltage Test

Install the tether cord cap and push the START/RER button momentarily to activate ECM.

Battery voltage should be present on VIOLET/GREY wire. If test fail, fuse may be blown.

Continuity Test

BROWN/WHITE wire must show continuity between solenoid connector and pin 15 on connector B from the ECM.

If test fail, repair connector or replace wiring harness between ECM connector and solenoid.

Replacement

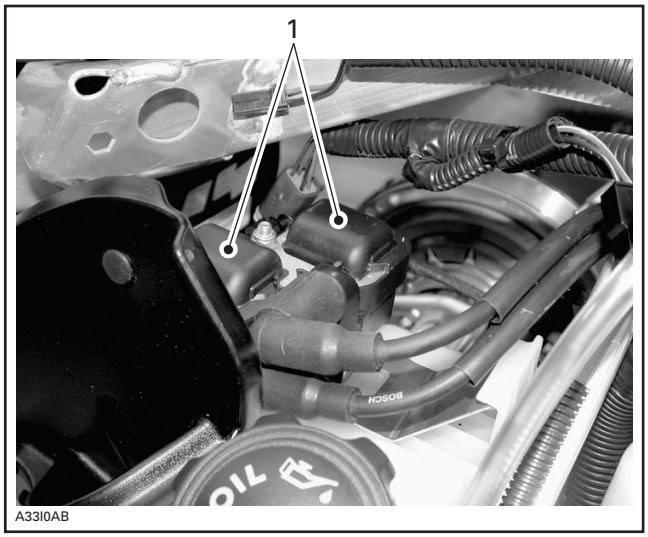
Remove the air intake silencer. Unplug the solenoid connector and all hoses.

NOTE: Mark hose locations for installation.

Remove solenoid screws then the solenoid.

For installation, reverse the removal procedure.

DOUBLE IGNITION COIL



1. Ignition coil

NOTE: The ECM energizes the primary side of each ignition coil individually. It can detect if the double ignition coil is connected otherwise a trouble code will appear upon starting.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the ignition coil from the **Activation** section.

You should hear the spark occurring. In doubt, use an inductive spark tester or a sealed tester – available from after-market tool/equipment suppliers – to prevent spark occurring in the engine compartment. Otherwise, perform the following checks.

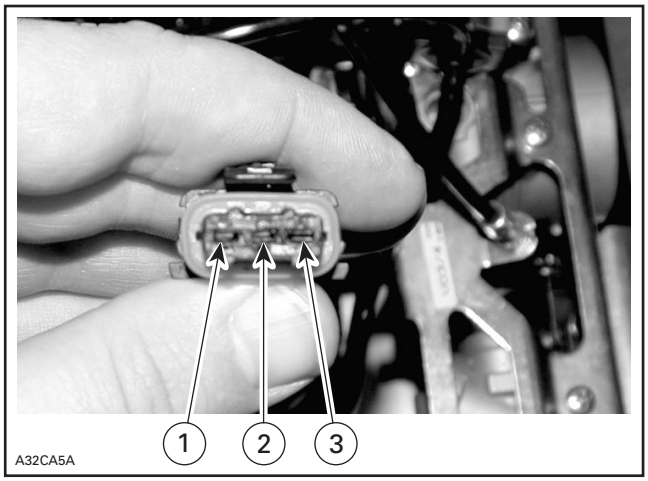
An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

Voltage Test

⚠ WARNING

When disconnecting coil from spark plug, always disconnect coil from main harness first. Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as spark may cause fuel vapor to ignite.

Disconnect the plug connector from the ignition coil and check the voltage supplied by the battery.



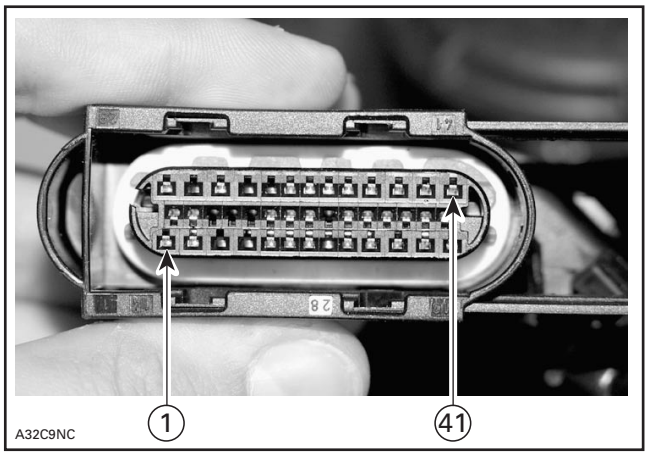
Install **tether cord cap** on the DESS post and push the START/RER button momentarily to activate the ECM.

Check voltage between terminal 2 of ignition coil connector on the wiring harness and battery ground.

Battery voltage should be present (approx. 12 V).

If 12 V is NOT read, check continuity between terminal 2 of ignition coil and the corresponding fuse. Otherwise repair wiring harness.

If 12 V is read, disconnect the connector A from the ECM and check the continuity of appropriate circuit 41 (cylinder 1) or 1 (cylinder 2) and of ignition coil connector, pin 3 and pin 1 respectively.



ECM CONNECTOR

If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

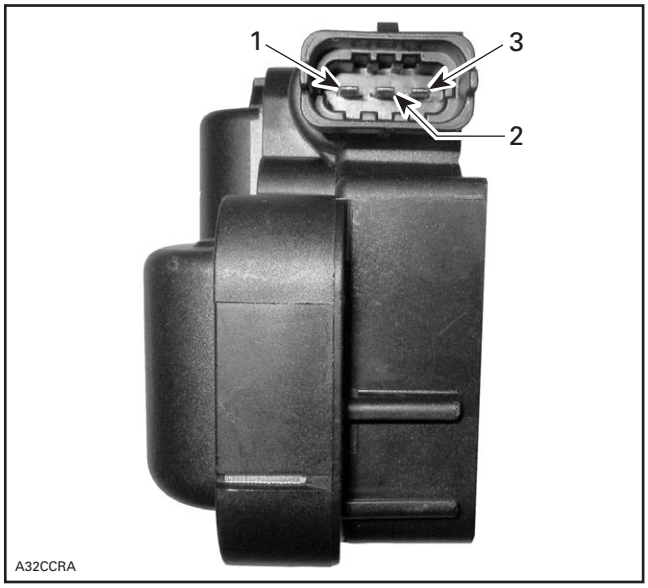
If wiring harness is good, test resistance of primary winding of ignition coil.

Resistance Test

Remove spark plug cables from ignition coil.

Using a multimeter, check the resistance of primary winding.

NOTE: The secondary winding can not be measured with an ohmmeter. Try a new double ignition coil if necessary.



1. *Terminal 1a*
2. *Terminal 15*
3. *Terminal 1b*

For primary winding, check the resistance between terminal 15 and terminal 1a (cylinder 1) of the ignition coil and between terminal 15 and terminal 1b (cylinder 2) respectively.

The resistance should be between 0.40 and 1.15 Ω at 20°C (68°F).

If the resistance of one of both windings is not good, replace the ignition coil.

If the windings test good, try a new ECM.

⚠ WARNING

Always reconnect ignition coil cables at the same spark plugs where they come from. Otherwise, severe backfire may occur with possible damage to exhaust system components.

IGNITION TIMING

Refer to IGNITION SYSTEM section.

BATTERY

Manual Start Models

These models are equipped with a YT4L-BS type battery that requires a specific charging procedure at predelivery.

Battery Charge Testing

⚠ WARNING

Always wear safety glasses and charge in a ventilated area.
Never charge or boost battery while installed on vehicle.
Do not open the sealed caps during charging.
Do not place battery near open flame.

These sealed batteries have to be tested with a voltmeter.

Batteries with a voltage of 12.8 volts and above, no charge is required

Batteries with a voltage of 12.7 volts and below must be charged as follows:

BATTERY TYPE	STANDARD CHARGE	QUICK CHARGE
YT4L-BS	0.3 Amps/hour for 5 to 10 hours	3.0 Amps/hour for 30 min.

Electric Start Models

Refer to CHARGING SYSTEM section for the charging procedure of the battery.

CAPACITOR

Manual Start Models

⚠ WARNING

Capacitor may be charged. Once discharged, a transient recovery voltage may be generated in the capacitor after a while. Always discharge capacitor before servicing.

Removal

Remove the 30 A fuse.

Connect a test light to capacitor terminals during a complete minute to discharge capacitor.

⚠ WARNING

Do not short–circuit both capacitor terminals.

Disconnect capacitor terminals and unfasten capacitor.

Inspection

Visual Inspection

Check for pin holes in the pressure relief valve on top of capacitor. If any pin hole is present, discard capacitor.

Charge Hold Test

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Connect a switch (in OFF position) between a 12 V battery positive post and the capacitor positive post. Connect the battery negative post to the capacitor negative post. Turn on the switch for 2 seconds. Disconnect the capacitor from the battery.

Note battery voltage.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Wait 5 minutes, then measure capacitor voltage. It must be within 1 V maximum of battery voltage.

If in doubt, proceed with the following residual voltage test.

Residual Voltage Test

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Connect a switch (in OFF position) between a 12 V battery positive post and the capacitor positive post. Connect the battery negative post to the capacitor negative post. Turn on the switch for 2 seconds. Disconnect the capacitor from the battery. Note battery voltage.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Connect a switch (in OFF position) and a 300 Ω 5 W resistor to the capacitor. Turn on the switch for 12 seconds ± 1 second of discharge.

Residual voltage after 12 seconds ± 1 second of discharge must be above 5 volts.

Installation

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Make sure 30 A fuse is removed.

Install the capacitor.

Make sure to connect BLACK wire to negative terminal and RED/WHITE to positive terminal.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Install the 30 A fuse.

ENGINE START/RER SWITCH VERIFICATION

All Models

A quick operation test can be done using the vehicle communication kit (VCK) with the B.U.D.S. software, using the **Monitoring** section. Press the START/RER button and look at the START/RER button LED. It should turn on, indicating the starting system is working on the input side of the starting system (START/RER button, ECM and wiring). If so, you know now the problem is on the output side of the starting system (ECM output signal to starting solenoid, wiring harness going to the solenoid and starter motor. Otherwise, check the input side as follows.

Test corresponding fuse, relay and wiring.

Disconnect the two connectors of the steering harness.

Measure the resistance of the two wires on the small connector (BEIGE and BLACK/BROWN) for 0 Ω. Depress start button and the reading should change from 0 Ω to infinitely high.

Release the start button and measure the resistance between pin 2 (BEIGE wire) of the small connector and pin 6 (RED/BROWN wire) on the big connector for infinitely high resistance to 0 Ω while the start button is depressed.

⚠ WARNING

Always respect the wire position when connecting the switch. Refer to the wiring diagram.

Test continuity of circuit B-19. If it is good, try a new ECM. Otherwise, repair harness/connectors.

RER Operation

When RER works erratically or if engine idle slow down then engine stalls, do the following.

– Check engine compression. A low compression engine may result in RER working erratically making you think the problem is an electronic problem.

– Check piston condition. Remove exhaust system and reed valves on intake side. Verify piston condition through the intake and exhaust ports. Look for scoring on piston skirts. Scored piston skirts may result in RER working erratically making you think the problem is an electronic problem.

When it does not work at all, check wiring and START/RER switch as explained above. If everything is normal, try another ECM.

DESS POST VERIFICATION

If 2 short beeps are not heard when starting the engine, refer to DIAGNOSTIC PROCEDURES.

The following continuity tests can also be performed using an ohmmeter.

Disconnect DESS post wires.

Tether Cord Cap Removed

Connect test probes to post BLACK/GREEN and BLACK/WHITE wires. Measure resistance, there should be NO continuity (open circuit).

Connect one test probe to the WHITE/GREY wire and the other test probe to the switch top terminal. Measure resistance, it must be close to 0 ohm.

Connect one test probe to the BLACK/GREEN wire and the other test probe to the post ring. Measure resistance, it must be close to 0 ohm.

Tether Cord Cap on DESS Post

Connect test probes to switch BLACK/GREEN and BLACK/WHITE wires. Measure resistance, it must be close to 0 ohm.

IGNITION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
9-volt adaptor	529 035 675	288
digital/inductive type tachometer	529 014 500	284, 287
MPEM programmer	529 035 878	288
supply harness	529 035 869	288
Vehicle Communication Kit (VCK)	529 035 981	287

SERVICE PRODUCTS

Description	Part Number	Page
antiseize lubricant	293 800 070	291

GENERAL

Ignition System Testing Sequence

In the case of ignition problems, check the following in the prescribed order until the problem can be solved.

1) Spark testing.
2) Electrical connectors.
3) Ignition switch.
4) DESS post or tether cut-out switch.
5) Engine cut-out switch.
6) Ignition coil.
7) Trigger coil.
8) MPEM voltage (liquid cooled models only).
9) High voltage coil (liquid cooled models only).
10)Relay
11)Beeper.

Testing Conditions

Voltage measurements are always taken upon vehicle starting. Readings when the engine is running will be higher than indicated range. Part temperature must be approximately 20 °C (68 °F) (room temperature), otherwise readings could be distorted.

Analysis of Readings

- Voltage Readings

When testing the different magneto components, it is important to take into consideration that readings vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

The reading must be 3 times within or above the range indicated in the corresponding table. If the reading is too low, the part is considered to be defective and must be replaced.

- Resistance Readings

Place multimeter selector switch to Ω in order to measure resistance. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

CAUTION: When taking measurements, it is useless to try to start the vehicle since readings would then be distorted.

- Intermittent Ignition Problems

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

- Multiple Problems

As a matter of fact, more that one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

Spark Testing

During this operation, it is important to use the snowmobile spark plug and not a new one. Bring the plug in contact with the engine. Pull rewind starter. If no spark is produced, replace the spark plug with a new one and do the test again.

For more information on spark plug condition, refer to SPARK PLUG further in this section.

Electrical Connector

Make sure that none of the connectors are disconnected.

Ignition Switch or Start/RER Button

Refer to STARTING SYSTEM.

DESS Post or Tether Cut-Out Switch

DESS Post

Liquid-Cooled Engines

DESS POST		
TEST	Open circuit	Continuity
TEST PROBES	BLACK/WHITE and BLACK/GREEN wires	BLACK/WHITE and BLACK/GREEN wires
RESISTANCE	O.L.	00.0 to 00.5 Ω
VOLTAGE	—	—
NOTE	DESS key removed	DESS key installed

If readings do not correspond to the above mentioned indications, replace post.

If none of these verifications are conclusive, the problem finds its source in the main wiring harness. Do the following.

NOTE: For the next step, no switch must be connected to the main wiring harness.

Disconnect all switches from the main wiring harness and check the continuity of each wire by connecting probes to the end of wires of the same color. Repeat with all other wires. It is important to mention that all wires of the same color within a given harness are connected together. These wires should therefore have a closed circuit. On the other hand, BLACK and BLACK/YELLOW wires must have an open circuit (0.L MΩ).

Repair or replace if necessary.

Tether Cut-Out Switch

Fan-Cooled Engines

TETHER CUT-OUT SWITCH		
TEST	Open circuit	Continuity
TEST PROBES	BLACK/YELLOW and BLACK wires	BLACK/YELLOW and BLACK wires
RESISTANCE	O.L.	00.0 to 00.5 Ω
VOLTAGE	—	—
NOTE	Engine cut-out switch must be in RUN position	Engine cut-out switch must be in STOP position

If readings do not correspond to the above mentioned indications, replace switch.

If none of these verifications are conclusive, the problem finds its source in the main wiring harness. Do the following.

NOTE: For the next step, no switch must be connected to the main wiring harness.

Disconnect all switches from the main wiring harness and check the continuity of each wire by connecting probes to the end of wires of the same color. Repeat with all other wires. It is important to mention that all wires of the same color within a given harness are connected together. These wires should therefore have a closed circuit. On the other hand, BLACK and BLACK/YELLOW wires must have an open circuit (0.L MΩ).

Repair or replace if necessary.

Engine Cut-Out Switch

Check the condition of engine cut-out switch.

ENGINE CUT-OUT SWITCH		
TEST	Open circuit	Continuity
TEST PROBES	BLACK/YELLOW and BLACK wires	BLACK/YELLOW and BLACK wires
RESISTANCE	O.L.	00.0 to 00.5
VOLTAGE	—	—
NOTE	Engine cut-out switch must be in RUN position.	Engine cut-out switch must be in STOP position.

Ignition Coil

Disconnect housing between the magneto and the MPEM.

Compare readings with those appearing in the IGNITION COIL table.

During voltage testing, when manually starting the engine while the spark plug is installed, the engine will tend to accelerate beyond the compression point. This will result in higher magneto output. Always repeat the procedure 3 times.

IGNITION COIL				
LIQUID-COOLED ENGINES				
TEST	Primary winding resistance	Secondary winding voltage	Secondary winding resistance spark plug wires and cap included	Secondary winding resistance spark plug wires removed
TEST PROBES	WHITE/BLUE and BLACK wires	On spark plug wire insulation and on engine	Between both spark plug caps	Male terminals of coil
RESISTANCE	00.2 to 0.5	—	14.5 kΩ to 23.5 kΩ	9.6 kΩ to 14.4 kΩ
VOLTAGE	—	1.5 to 2.5 Vdc	—	—
NOTE	Disconnect the ignition coil from the MPEM	Do not probe into spark plug cap with spark plug wire removed from spark plug.	Do not attempt to remove spark plug caps from the wires.	With spark plug wires removed from high voltage coil.

IGNITION COIL				
FAN-COOLED ENGINES				
TEST	Output	Ground continuity	Secondary winding voltage	Cable resistance
TEST PROBES	RED and BLACK wires	BLACK wire and engine wires	BLACK wire and engine	Spark plug cable and cap
RESISTANCE	4.5 to 6.5 Ω	00.0 to 00.5 Ω	—	4.0 kΩ to 6.0 kΩ
VOLTAGE	7.0 to 15.0 Vac	—	.100 to .250 Vac	—
NOTE	—	Engine refers to the engine metal parts connected to the magneto housing.	The measurement must be taken on the spark plug cable (without the spark plug).	—

Trigger Coil

NOTE: For **SDI engine**, refer to ENGINE MANAGEMENT.

Check the resistance and the voltage for each trigger coil.

TRIGGER COIL				
LIQUID-COOLED ENGINES				
TEST	Continuity		Output	
TEST PROBES	Trigger coil #1	Trigger coil #2	Trigger coil #1	Trigger coil #2
	BLUE/YELLOW and WHITE/YELLOW wires	GREEN/YELLOW and GRAY/YELLOW wires	BLUE/YELLOW and WHITE/YELLOW wires	GREEN/YELLOW and GRAY/YELLOW wires
RESISTANCE	190 to 300 Ω	190 to 300 Ω	—	—
VOLTAGE	—	—	.200 to .350 Vdc	.200 to .350 Vdc
NOTE	—	—	While cranking engine.	While cranking engine.

TRIGGER COIL				
FAN-COOLED ENGINES				
TEST	Continuity		Output	
TEST PROBES	Trigger coil #1	Trigger coil #2	Trigger coil #1	Trigger coil #2
	BLUE/YELLOW and WHITE/YELLOW wires		BLUE/YELLOW and WHITE/YELLOW wires	
RESISTANCE	160 to 180 Ω	160 to 180 Ω	—	—
VOLTAGE	—	—	.150 to .350 Vac	.150 to .350 Vac
NOTE	—	—	—	—

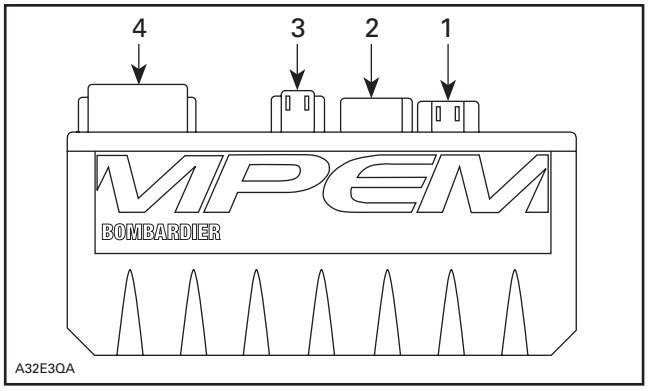
If a trigger coil is out of specification, replace it.

MPEM

NOTE: For SDI and Power Tek engines, refer to ENGINE MANAGEMENT for more information concerning the Engine Control Module (ECM).

When other components have been tested above and are good, the electronic module can be suspected. Ensure wiring and connectors are in good condition and perform the following tests prior to replacing the electronic module.

Disconnect the connector housing between module and high voltage coil.



1. *Trigger coil*
2. *Cooling temperature sensor*
3. *High tension coil*
4. *DESS, ignition and engine cut-out switches, DESS pilot lamp*

Install probes on wires in accordance with the following table.

Activate the manual starter and check values indicated by the multimeter.

Repeat test 3 times.

MPEM ON VEHICLE WITH MANUAL STARTER			
TEST	Ground connection	Power from regulator	Voltage to ignition coil
TEST PROBES	BLACK wire and negative battery terminal or frame	RED/BLUE and BLACK wires	WHITE/BLUE and BLACK wires
RESISTANCE	00.0 to 00.5	—	—
VOLTAGE	—	3 to 5 Vdc	225.0 to 275.0 Vdc
NOTE	—	While cranking engine	With tether cap in place and engine cut-out switch in run position. While cranking engine.

MPEM ON VEHICLE WITH ELECTRIC STARTER				
TEST	Ground connection	Power from battery	Power from regulator	Voltage to ignition coil
TEST PROBES	BLACK and negative battery terminal or frame	RED/GREY and BLACK	RED/BROWN and BLACK	WHITE/BLUE and BLACK
RESISTANCE	00.0 to 00.5	—	—	—
VOLTAGE	—	Same as battery voltage	3 to 5 Vdc	225.0 to 275.0 Vdc
NOTE	—	Voltage always present.	While cranking engine.	With tether cap in place and engine cut-out switch in run position. While cranking engine.

Relay

Refer to ACCESSORIES or ENGINE MANAGEMENT (Power Tek and SDI engines).

Beeper

Refer to ACCESSORIES.

IGNITION TIMING

Fan-Cooled Engines

If for any reason, ignition timing accuracy is suspected, it can be verified as follows.

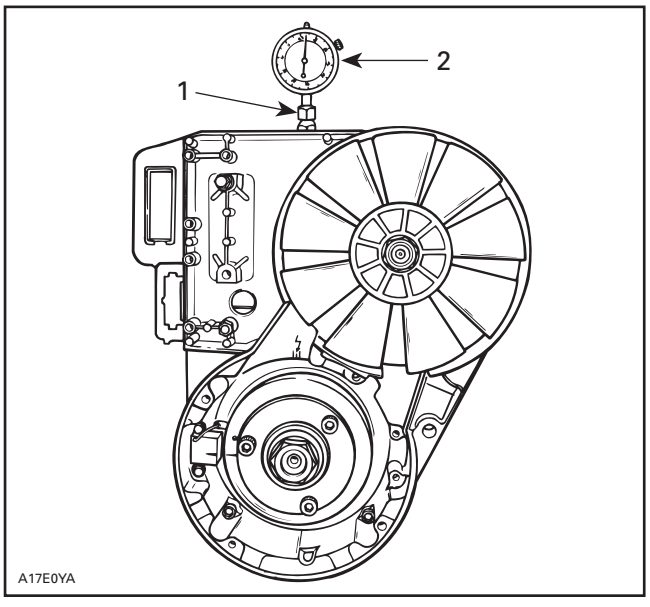
Verifying Magneto Flywheel Timing Mark Position

Prior to checking the timing, it may be necessary to verify the position of the timing mark on the magneto flywheel, for the following reasons:

- To detect a missing or broken magneto flywheel Woodruff key which would allow a change of timing to occur, with eventual breakdown of the engine.
- To correctly locate and mark a timing mark on a new service magneto flywheel.
- To verify the correct location of the factory timing mark.
- To detect a wrong magneto flywheel corresponding to a different engine type.

To verify the position of the timing mark on the magneto flywheel, proceed as follows:

- Clean the area around the spark plugs, and remove them.
- Remove the rewind starter from the engine.
- Install the TDC gauge in the spark plug hole, (magneto/generator side) and adjust as follows:
  - Position the magneto flywheel at approximately TDC.

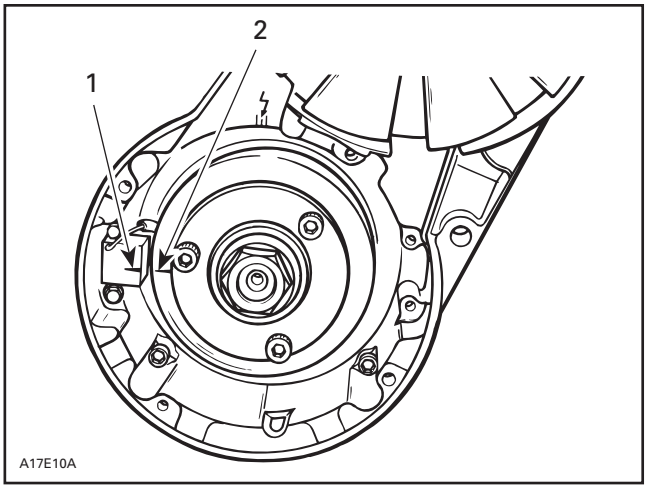


TYPICAL — INSTALLATION OF TDC GAUGE
1. Adaptor lock nut
2. Gauge on MAG side cylinder

  - Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.
  - Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.
  - Position the dial face toward the magneto/generator. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.
- Locate the piston TDC position as follows:
  - Slowly rotate the magneto flywheel back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston is changing direction.
  - Rotate the dial face so that «0» is in line with the needle when it stops moving.
  - Again, slowly rotate the magneto flywheel back and forth across TDC and adjust the dial face to «0», until the needle always stops exactly at «0» before changing direction.
  - «0» now indicates exact TDC.
- Verify the position of the timing mark on the magneto flywheel as follows:

NOTE: When checking timing, certain procedures require that the magneto flywheel be turned in a clockwise direction, viewed facing the magneto/generator. If it is necessary to turn back (counterclockwise) for any reason, rotate the magneto flywheel at least one-quarter turn counterclockwise, and then rotate it clockwise. The last magneto flywheel movement when making a critical check must always be in a clockwise direction, to ensure that the slack in engine moving parts is taken-up.

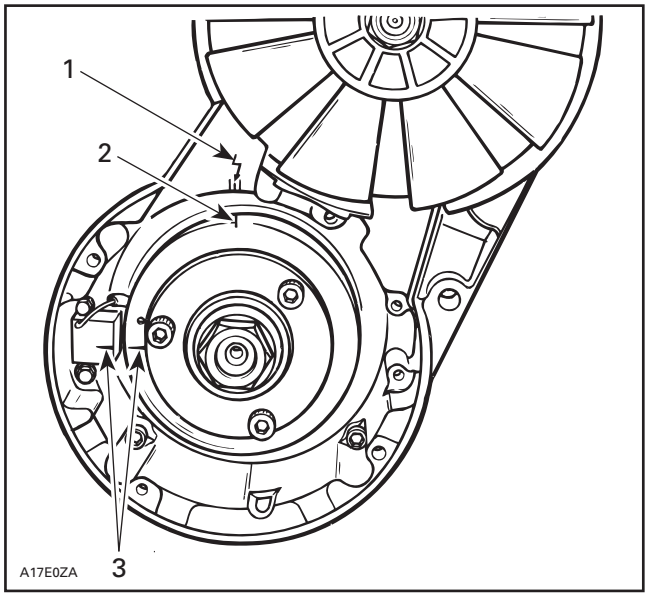
  - Rotate the magneto flywheel counterclockwise, one-quarter turn then carefully rotate it clockwise until the needle indicates the specified measurement. Refer to TECHNICAL DATA.
  - Verify that the magneto flywheel mark perfectly aligns with the mark on the trigger coil, refer to illustration.
  - If the marks do not align, check magneto flywheel and trigger coil part numbers and check Woodruff key condition. If all parts are the appropriate ones and if Woodruff key is in good condition, continue the procedure.



TYPICAL
1. *Trigger coil mark*
2. *Magneto flywheel mark*

NOTE: These marks cannot be used to check dynamic (with engine running) ignition timing with a timing light: a new mark must be scribed on magneto flywheel for this purpose.

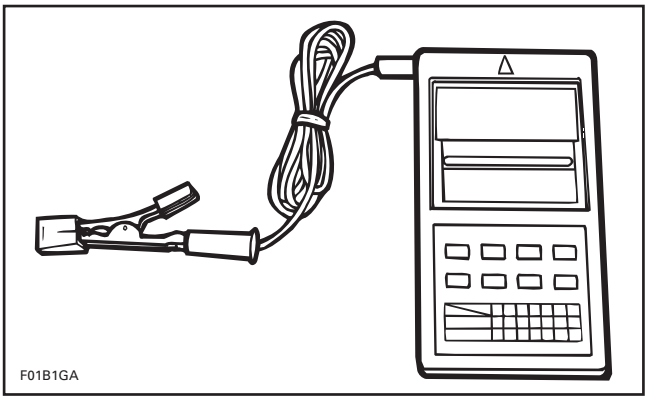
- Scribe a new mark on magneto flywheel as follows.
  - Remove the fan cover from the engine.
  - Maintain magneto flywheel so that previous marks remain aligned.
  - Scribe or punch a mark on magneto flywheel so that it perfectly aligns with the arrow on crankcase, refer to illustration. This new timing mark should be used for future timing checks (dynamic timing).
  - Reinstall rewind starter.
  - Check the timing with a timing light.



TYPICAL
1. *Crankcase arrow*
2. *Scribe a mark here*
3. *Maintain verified timing marks aligned (static timing)*

Checking Ignition Timing

Use a timing light and the digital/inductive type tachometer (P/N 529 014 500).



TACHOMETER

To check the ignition timing, refer to illustration and proceed as follows:

- Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground.

⚠ WARNING

Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

- Connect the timing light pick-up to a spark plug cable.

NOTE: To avoid an incorrect reading due to parallax, view the magneto flywheel and the crankcase timing marks in a straight line.

- Connect tachometer wire to spark plug wire or aim tachometer toward spark plug wire without using any connection wire.
- Start the engine and raise the engine speed at least to 3500 RPM (± 500 RPM) while observing the timing marks, refer to illustration. The magneto flywheel mark scribed previously and the crankcase arrow should be perfectly aligned. If the marks do not align, a faulty trigger coil (check proper grounding of coil), a faulty flywheel, a faulty Woodruff key, a misaligned (twisted) crankshaft or a faulty CDI module could be the cause: substitute one part at a time and recheck timing marks (check connectors condition prior to substituting any part).

NOTE: Ignition timing may be verified when engine speed is anywhere within 3000 - 4000 RPM.

A30E1UA

TYPICAL

- Install parts which were removed.

Liquid-Cooled Engines

Normally ignition timing adjustment should not be required. It has been set at factory and it should remain correctly adjusted since every part is fixed and not adjustable. The only time the ignition timing might have to be changed would be when removing and reinstalling the magneto housing, replacing the crankshaft, the magneto flywheel, the trigger coil or the MPEM or ECM. If the ignition timing is found incorrect, first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

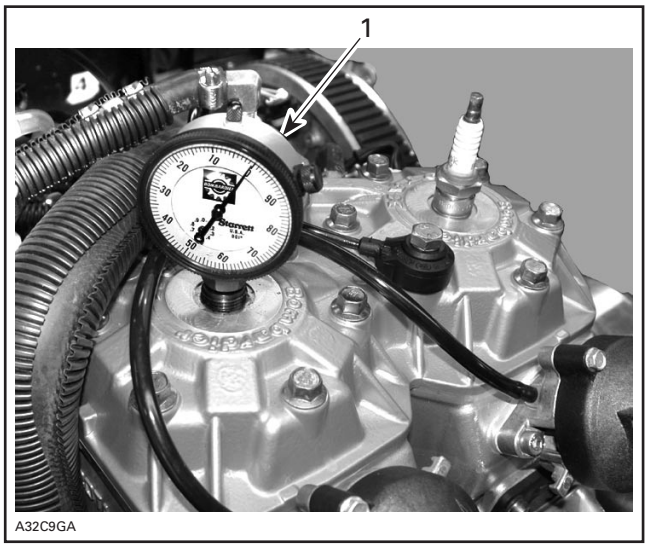
The ignition timing can be checked with either the engine hot or cold. Also, the ignition timing is to be checked at 3500 RPM with a timing light except on **SDI engines**. On these engine the ignition timing must be checked at 4000 RPM.

NOTE: Except on the **SDI models**, between 3000 and 4000 RPM, the spark advance does not change. So when checking ignition timing at 3500 RPM, a change in engine speed within ± 500 RPM will not affect the timing mark when checked with the timing light.

Scribing a Timing Mark

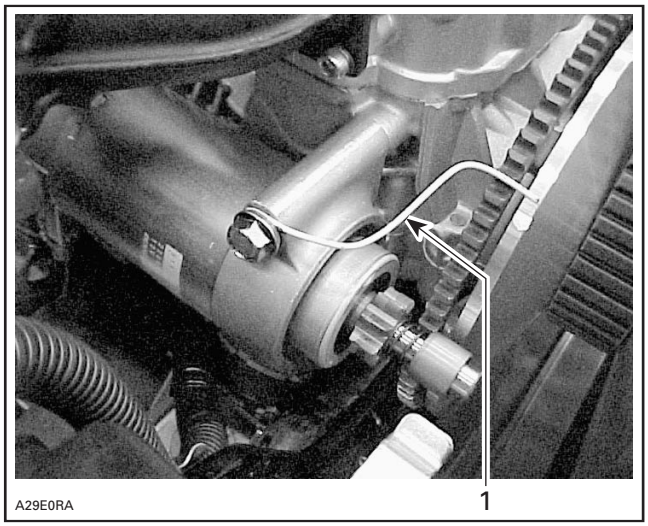
NOTE: Before performing ignition timing on **793 HO Power TEK engines**, disconnect the TPS.

- Clean the area around the MAG spark plug, and remove it.
- Install the TDC gauge in the spark plug hole, (magneto side) and adjust as follows:
  - Position the MAG piston at approximately TDC.



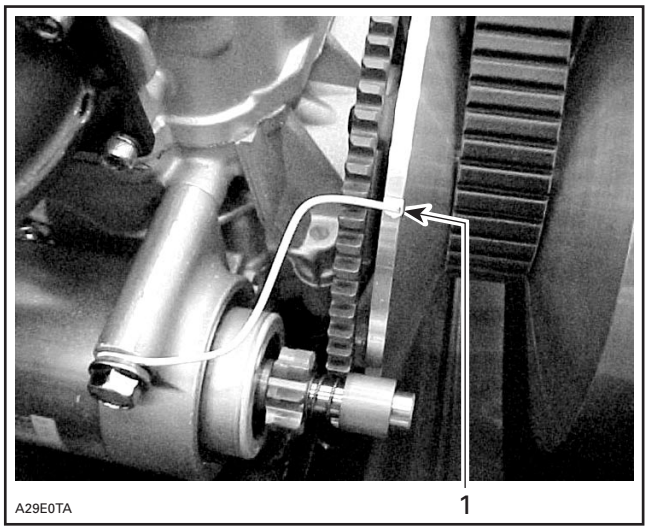
TYPICAL
1. TDC gauge on MAG side

  - Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.
  - Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.
  - Position the dial face toward the PTO. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.
- Locate the piston TDC position as follows:
  - Slowly rotate the drive pulley back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston is changing direction.
  - Rotate the dial face so that «0» is in line with the needle when it stops moving.
  - Again, slowly rotate the drive pulley back and forth across TDC and adjust the dial face to «0», until the needle always stops exactly at «0» before changing direction.
  - «0» now indicates exact TDC.
- Rotate the drive pulley clockwise, one-quarter turn then carefully rotate it counterclockwise until the needle indicates the specified measurement, indicated in TECHNICAL DATA.
- Twist a wire as shown and use it as a pointer. Install the wire on upper starter bolt.



1. Pointer

- With the TDC gauge indicating specified timing, scribe a mark on drive pulley inner half in line with pointer end.



1. TIMING MARK IN LINE WITH POINTER END

Checking Ignition Timing

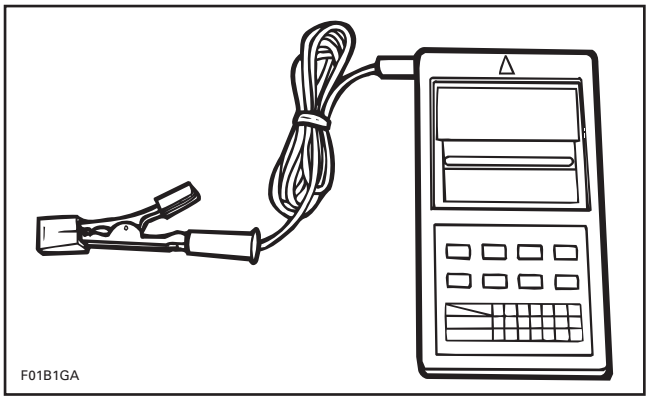
To check the ignition timing proceed as follows:

⚠ WARNING

Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

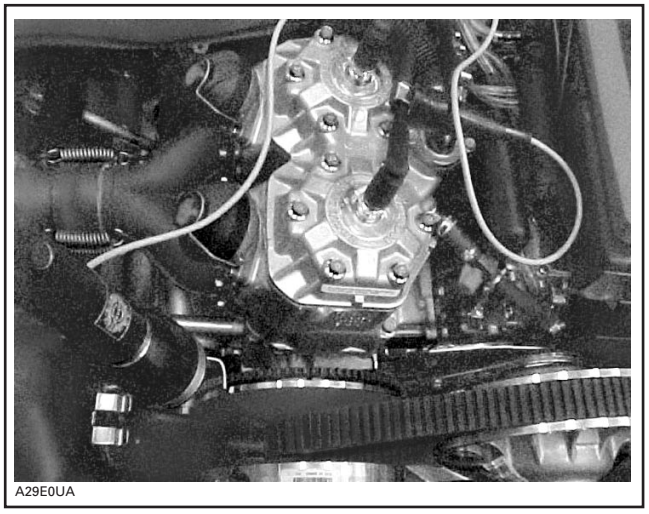
Connect the timing light pick-up to a spark plug cable.

Connect the digital/inductive type tachometer (P/N 529 014 500).



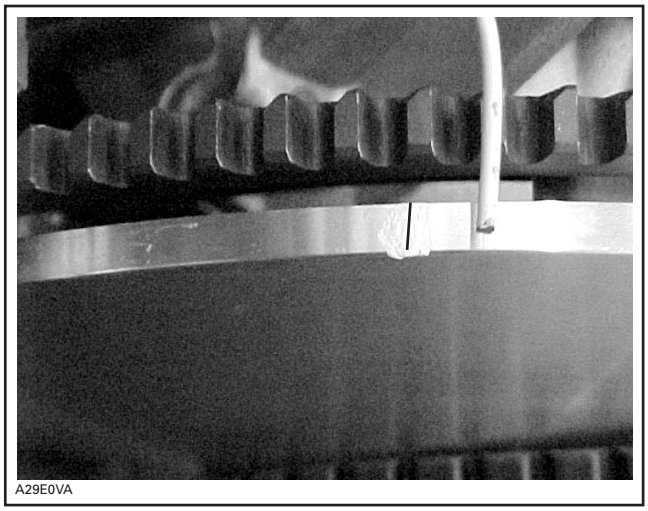
TACHOMETER

Start the engine and point timing light on timing mark. Bring engine to 3500 RPM for a brief instant.

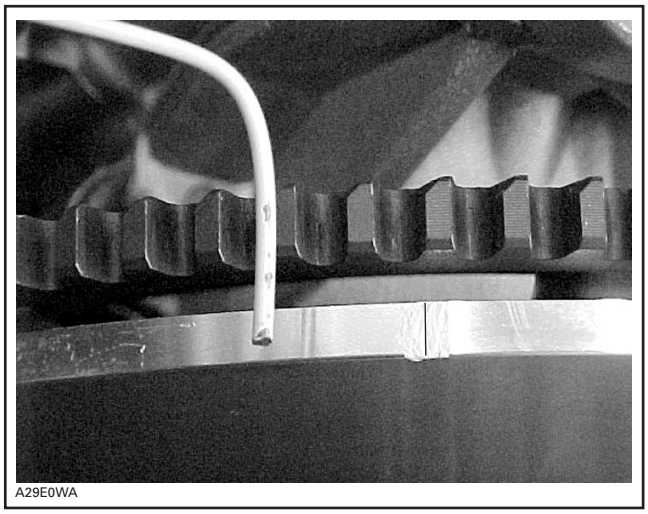


The timing mark must be aligned with pointer end. If such is not the case, note if timing is retarded or advanced.

ENGINE TYPE	TOLERANCE
593	± 1°
593 HO, 593 HO SDI, 793 HO	± 0.5°



TIMING RETARDED BY ABOUT 1°



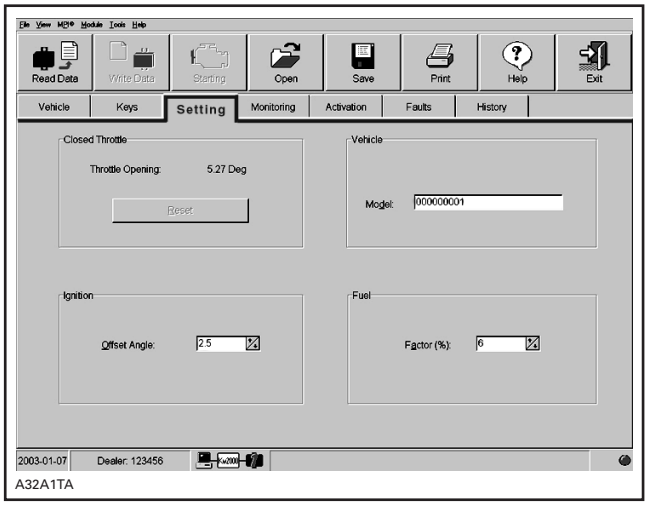
TIMING ADVANCED BY ABOUT 2°

Changing Timing

NOTE: To change the timing on **SDI and Power TEK engines**, the Vehicle Communication Kit (VCK) (P/N 529 035 981) is mandatory. The MPEM programmer cannot be used with these engines.

VCK (Vehicle Communication Kit)

The VCK must be used, with B.U.D.S. software to change the ignition timing. Look under the proper **Setting** section of the B.U.D.S. software to change the ignition timing.



A32A1TA

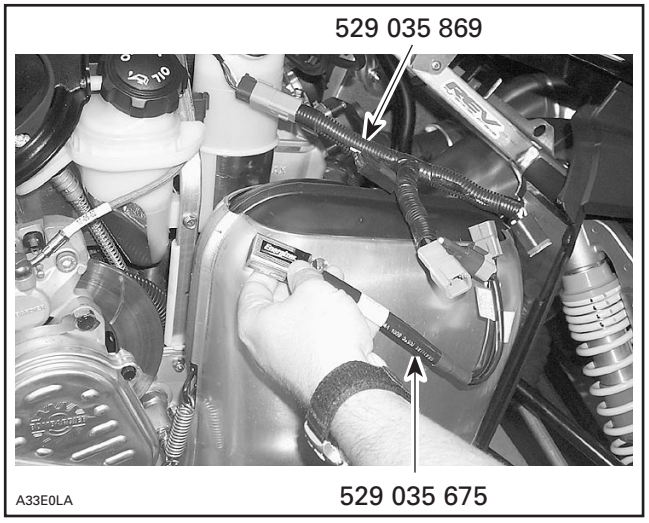
Detailed information about the B.U.D.S. software and its usage is available under its **Help** section.

MPEM Programmer

All Engines except SDI and Power TEK

Timing can also be changed using the MPEM programmer (P/N 529 035 878).

Connect the 9-volt adaptor (P/N 529 035 675) to the supply harness (P/N 529 035 869) and supply harness to diagnostic connector, located on right side of the vehicle.

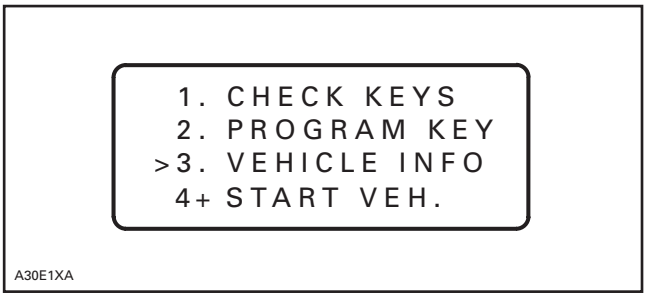


A33E0LA

Connect MPEM programmer to DESS post.

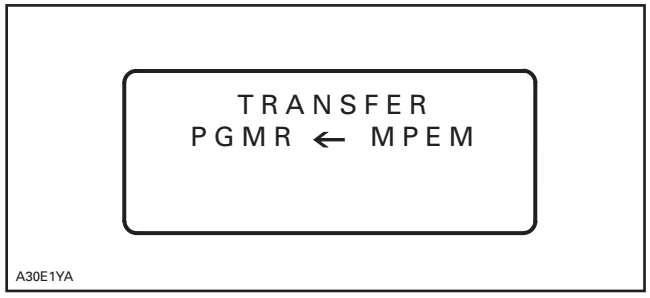
Turn on programmer then enter password.

From main menu select no. 3. INFO VEHICLE.



A30E1XA

Vehicle information is transferred from MPEM to programmer.



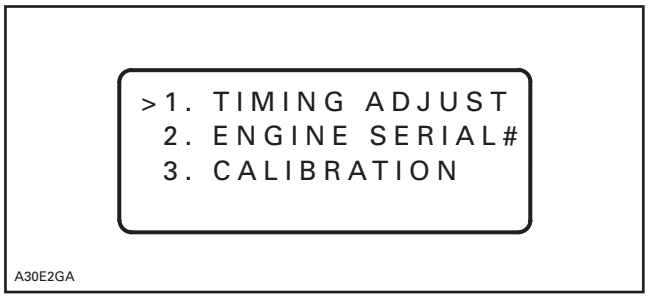
A30E1YA

NOTE: In fact the programmer takes a **copy** of all vehicle parameters scribed in MPEM. This copy will be modified within the programmer then transferred to the MPEM.

Select no. 4. ENGINE PARAMETER.

A30E1ZA

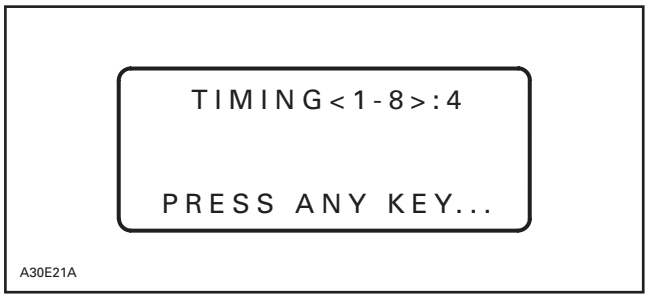
Select no. 1 TIMING ADJUSTMENT.



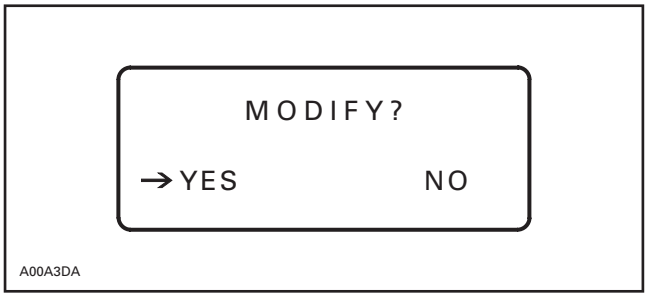
A30E2GA

Press ENTER.

Now the display shows the engine timing correction factor that is programmed in the MPEM. In the following example timing correction factor is no. 4.

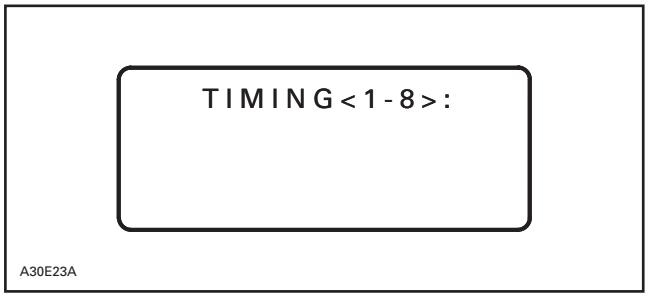


Press any key.



Select YES using the key ↔.

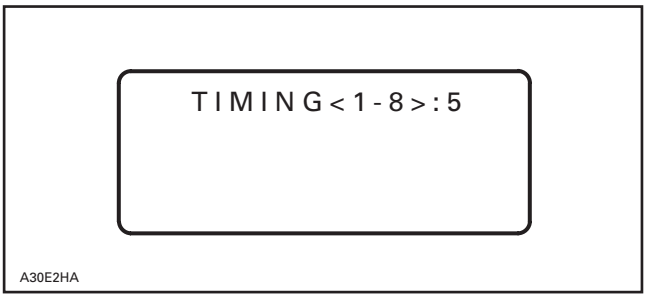
Press ENTER.



Select a timing correction factor corresponding to correction needed.

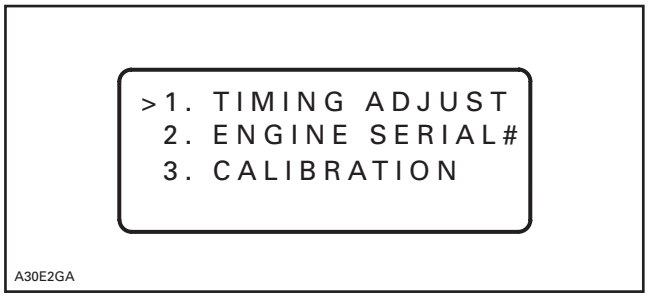
Example: Timing mark as verified with a timing light at 3500 RPM was too early by 2°. The correction factor programmed is no. 4.

Select correction factor no. 5. This will retard the timing by 2° because the difference between correction factor no. 4 and no. 5 is - 2° (passing from 1° to - 1°).

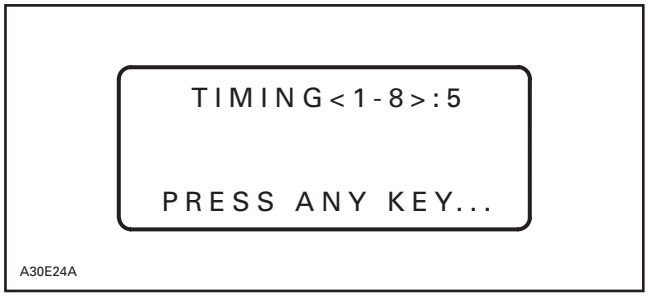


IGNITION CORRECTION FACTOR	
CORRECTION FACTOR PROGRAMMED IN MPEM	IGNITION TIMING CORRECTION
2	3°
3	2°
4	1°
1	0°
5	- 1°
6	- 2°
7	- 3°
8	- 4°

Press ENTER.

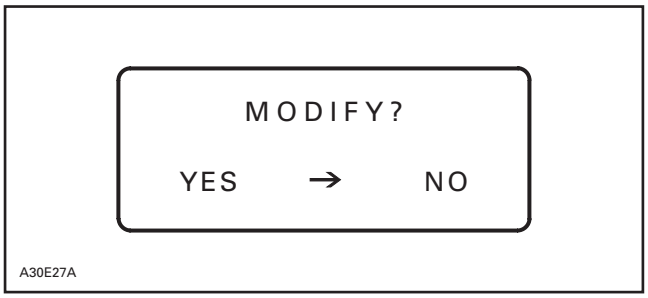


Press ENTER.

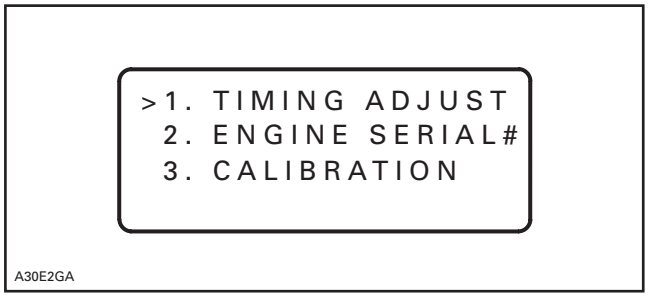


The display confirms that correction factor has been changed to no. 5.

Press any key.

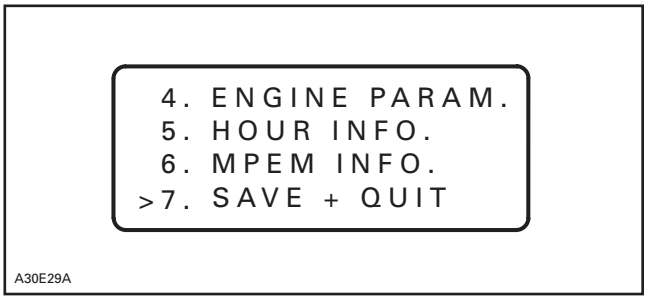


If the new correction factor selected above is the good one select NO and press ENTER. Otherwise select YES to choose an other correction factor.

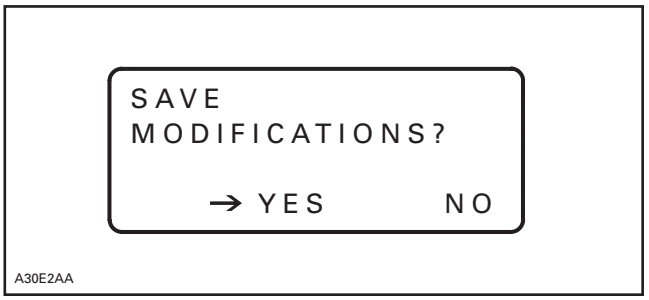


Press MENU.

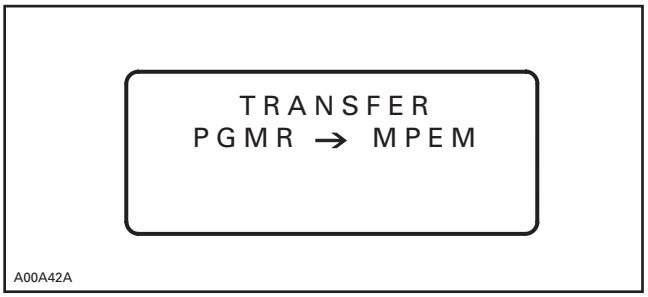
Scroll to no. 7 SAVE AND QUIT.



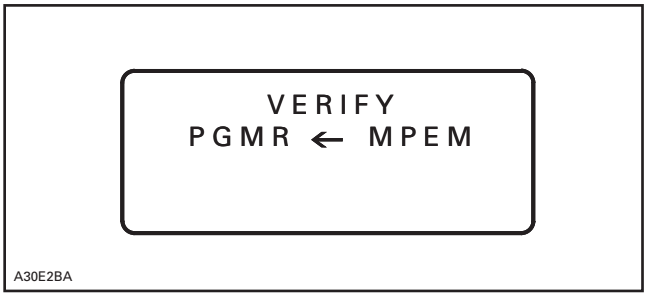
Press ENTER.



Press ENTER.

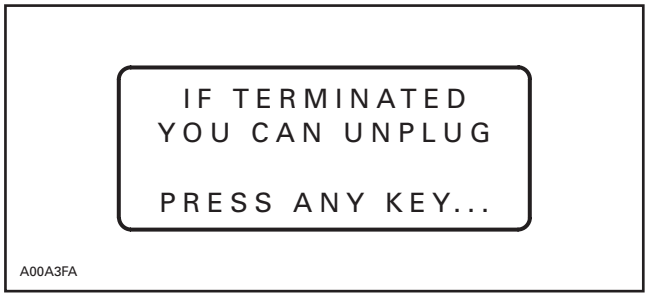


During a very short period of time the following message will appear.

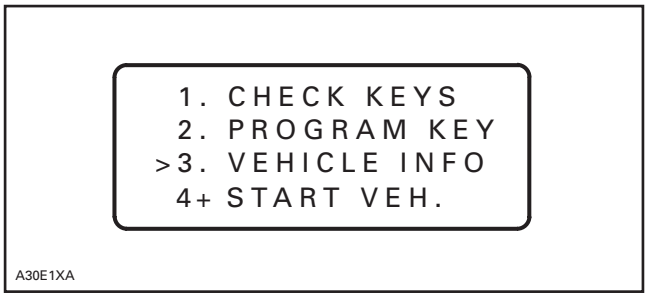


After the programmer has verified, following message will appear.

Press any key.



Press any key.



Unplug supply harness and 9-volt adaptor.

Recheck ignition timing with timing light when completed.

SPARK PLUG

Removal

First unscrew the spark plug 1 turn.

Clean the spark plug and cylinder head with pressurized air, then completely unscrew.

⚠ WARNING

Whenever using compressed air, always wear protective eye wear.

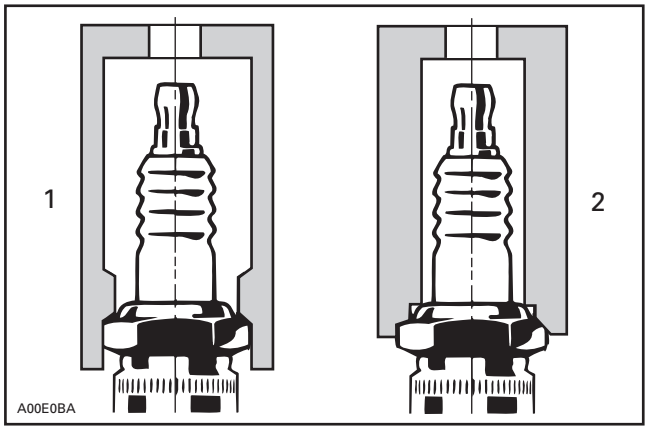
Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

Using a feeler gauge, set electrode at the proper gap except if the spark plus is a BR9ECS. Refer to TECHNICAL DATA.

CAUTION: Do not adjust electrode gap of BR9ECS spark plug.

1) Apply antiseize lubricant (P/N 293 800 070) over the spark plug threads to prevent possible seizure.
2) Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.

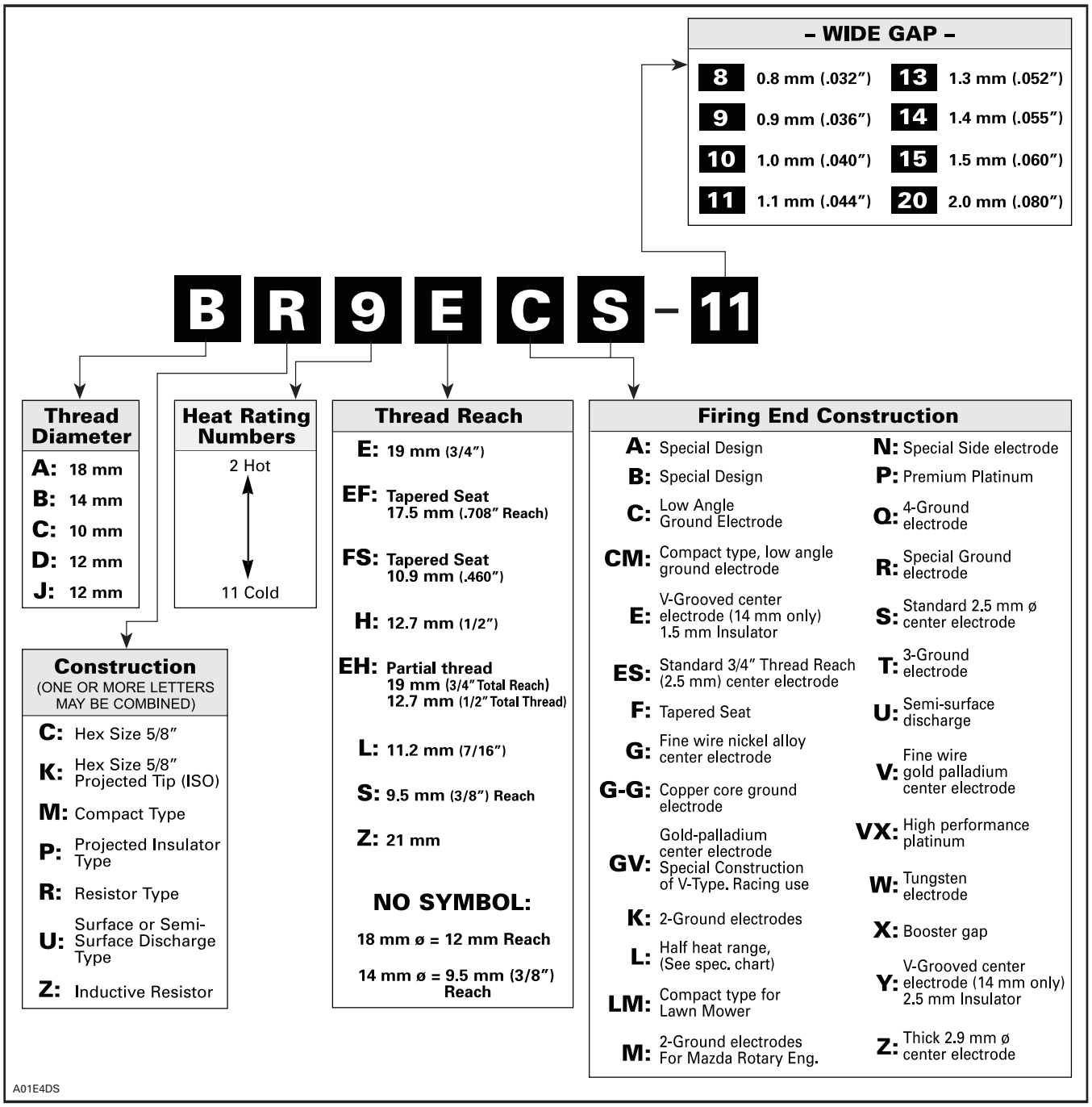


TYPICAL
1. Proper socket
2. Improper socket

Use the following table to torque the spark plugs.

MODEL	SPARK PLUGS	TORQUE N•m (lbf•ft)
All models	NGK	27 (20)

DESIGN SYMBOLS USED IN NGK SPARK PLUGS



CHARGING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
crimp pliers	529 035 730	297
multimeter FLUKE 111	529 035 868	293

SERVICE PRODUCTS

Description	Part Number	Page
silicone dielectric grease	293 550 004	296–297

GENERAL

Voltage measurements are always taken upon vehicle starting. Reading when the engine is running will be higher than indicated range. Part temperature must be approximately 20°C (68°F) (room temperature), otherwise reading could be distorted.

When testing the different magneto components, it is important to take into consideration that reading vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

The reading must be 3 times within or above the range indicated in the corresponding table. If the reading is too low, the part is considered to be defective and must be replaced.

Place the selector switch of the multimeter FLUKE 111 (P/N 529 035 868) to Ω in order to measure resistance. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

CAUTION: When taking measurements, it is useless to try to start the vehicle since readings would then be distorted.

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

As a matter of fact, more that one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

CHARGING GENERATOR COIL (STATOR)

First measure the resistance. To do this, disconnect connector.

Connect multimeter probes to YELLOW wires, then place selector switch to Ω.

Compare reading with those appearing in the table further.

Now measure the voltage.

Connect the multimeter probes to appropriate wires, refer to table below.

Bring the selector switch of multimeter to V and the scale to 00.0 Vac.

Activate the manual starter and check values.

Repeat operation 3 times.

Compare reading with those appearing in the following table.

FAN-COOLED ENGINES			
PART	Charging generator coil		
TEST	Power	Insulation	Ground continuity
TEST PROBES	YELLOW and YELLOW/BLACK	YELLOW and ENGINE	BLACK and ENGINE
RESISTANCE	00.0 to 00.6	O.L.	00.0 to 00.5
VOLTAGE	3.0 to 7.0	—	—
NOTE	—	Engine refers to the engine parts connected to the magneto housing.	

LIQUID-COOLED ENGINES		
PART	Stator	
TEST	Output	Coil insulation
TEST PROBES	YELLOW, YELLOW and GREEN	YELLOW and ENGINE
RESISTANCE	00.0 to 00.5 3 times	O.L.
VOLTAGE	3.5 to 5.5 3 times	—
NOTE	Do the test between A and B, A and C and B and C using manual starter	Engine refers to the engine parts connected to the magneto housing.

VOLTAGE REGULATOR/ RECTIFIER

Test

To test the voltage regulator/rectifier use the following table.

FAN-COOLED ENGINES WITH MANUAL STARTER		
TEST	Charging voltage	Current to battery
TEST PROBES	RED/GREEN and negative battery terminal	RED and RED/WHITE
RESISTANCE	—	—
VOLTAGE	Battery voltage	2 to 4 A
NOTE	The 5 A fuse is located on the electrical supply harness	Engine @ 5000 RPM with fully charged battery. With 30 A fuse removed and ammeter in series.

FAN-COOLED ENGINES WITH ELECTRIC STARTER		
TEST	Charging voltage	Current to battery
TEST PROBES	RED/GREEN and negative battery terminal	RED and RED/WHITE
RESISTANCE	—	—
VOLTAGE	Battery voltage	2 to 4 A
NOTE	The 5 A fuse is located on the electrical supply harness	Engine @ 5000 RPM with fully charged battery. With 30 A fuse removed and ammeter in series.

LIQUID-COOLED ENGINES WITH MANUAL STARTER		
TEST	Charging voltage	Current to battery
TEST PROBES		RED and RED/WHITE
RESISTANCE	—	—
VOLTAGE	Battery voltage	2 to 4 A
NOTE	—	Engine @ 5000 RPM with fully charged battery. With 30 A fuse removed and ammeter in series.

LIQUID-COOLED ENGINES WITH ELECTRIC STARTER		
TEST	Charging voltage	Current to battery
TEST PROBES	RED/GREEN and negative battery terminal	RED and RED/WHITE
RESISTANCE	—	—
VOLTAGE	Battery voltage	2 to 4 A
NOTE	—	Engine @ 5000 RPM with fully charged battery. With 30 A fuse removed and ammeter in series.

If the voltage regulator/rectifier is within the specification, the wiring harness between the voltage regulator/rectifier and battery is defective. If the voltage regulator/rectifier is out of specification and the stator tests good, the voltage regulator/rectifier is defective.

Removal

MODEL	LOCATION
Fan-cooled engines	RH side of vehicle, under chaincase
Liquid-cooled engine	LH side of vehicle, behind driven pulley

All Models

Disconnect battery (if so equipped).

Unplug the voltage regulator/rectifier connector.

Remove screws that attach the voltage regulator/rectifier to the frame.

Installation

The installation is the reverse of the removal procedure.

Torque voltage regulator/rectifier screws to 5 N•m (44 lbf•**in**).

BATTERY

NOTE: For manual start SDI models with a small battery/capacitor arrangement, refer to ENGINE MANAGEMENT SECTION.

General

Sealed valve regulated lead acid (VRLA) battery are used. They are non-spillable and maintenance reduced — no electrolyte level to be checked and readjusted. No ventilation tube is attached to the battery.

SUPPLIER P/N	BRP P/N
YTX20L-BS	515 175 642

Removal

⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Open right side panel of vehicle.

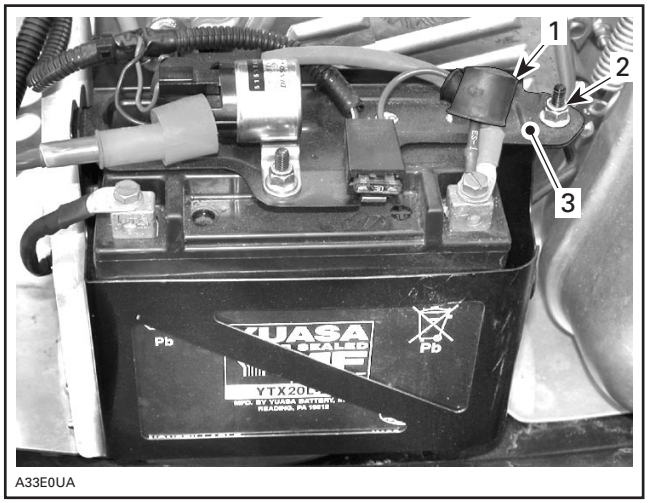
Disconnect BLACK (–) cable end from the terminal.

Slide off rubber boot from RED (+) cable and disconnect it.

Unscrew the bracket retaining nut and lift bracket to remove it.

Put bracket aside.

Remove battery.



A33E0UA

1. Rubber boot of RED (+) cable terminal
2. Bracket retaining nut
3. Battery bracket

CAUTION: Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water to prevent damage to vehicle components.

Cleaning

Clean the battery, battery casing, cables and battery posts using a solution of baking soda and water.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Battery top should be cleaned by soft brush and any grease-cutting soap or baking soda solution.

Inspection

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Inspect battery posts for security of mounting.

Battery Charge Testing

Voltmeter Test

NOTE: To determine the battery state of charge, these sealed batteries have to be tested with a voltmeter. They also need to be tested when their voltage is stabilized. Disconnect battery to have open connectors and wait 1-2 hours prior to reading the voltage. The same condition is required after a battery has been charged.

Batteries with a voltage above 12.8 V do not need to be charged.

Batteries with a voltage of 12.8 V and below need to be charged. Refer to BATTERY CHARGING below.

BATTERY STORAGE

CAUTION: A discharged battery will freeze and it may damage its casing. A damaged casing will allow electrolyte spillage that may damage surrounding parts.

Disconnect and remove battery from the vehicle.

The battery must always be stored in fully charged condition.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of silicone dielectric grease (P/N 293 550 004) or petroleum jelly on terminals.

Clean battery casing using a solution of baking soda and water. Rinse battery with clear water and dry well using a clean cloth.

Charge the battery every month if stored at temperature **below** 15°C (60°F).

Charge the battery every two week if stored at temperature **above** 15°C (60°F).

Activation of New Battery

Refer to the instructions provided with the battery.

Battery Charging

⚠ WARNING

Always wear safety glasses and charge in a ventilated area. Never charge or boost battery while installed on vehicle. Do not open the sealed caps during charging. Do not place battery near open flame.

CAUTION: If battery becomes hot, stop charging and allow it to cool before continuing.

NOTE: Sealed VRLA batteries have an internal safety valve. If battery pressure increases due to overcharging, the valve opens to release excess pressure, preventing battery damage.

Perform BATTERY CHARGE TESTING above then proceed as described here.

An automatic charger is the fastest and most convenient way for error-proof charging.

When using a constant current charger, charge battery according to the chart below.

Battery Voltage Below 12.8 V and Above 11.5 V

STANDARD CHARGING (RECOMMENDED)		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	4–9 HOURS	2 A

QUICK CHARGING		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	50 MINUTES	10 A

Battery Voltage Below 11.5 V

Batteries with voltage below 11.5 V requires special procedures to recharge. In charging an over discharged battery, its internal resistance may be too high to charge at a normal charging voltage. Therefore, it may be necessary to raise the voltage of the battery initially to 25 V as a maximum, and charge for approximately 5 minutes.

If the charger ammeter shows no change in current after 5 minutes, you need a new battery. Current flowing into the battery at high voltage can become excessive. Monitor amperage and adjust voltage as necessary to keep current at the battery's standard amp rating. Charge for approximately 20 hours.

Installation

Reinstall battery and secure bracket properly.

Connect RED (+) cable it to positive battery terminal. Connect RED wire (coming from 30 A fuse).

Connect BLACK (–) cable LAST.

⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and connected last.

⚠ WARNING

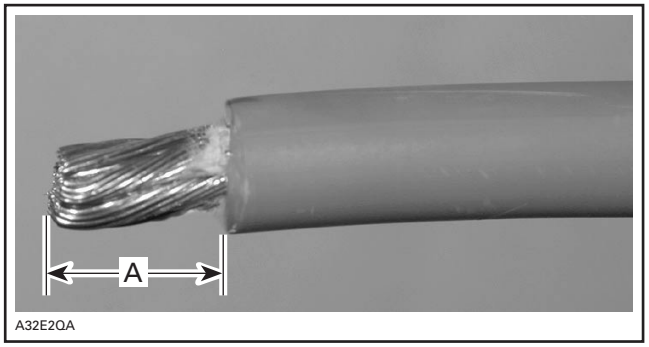
Never charge or boost battery while installed on vehicle.

Cover the RED (+) terminal with rubber boot.

Apply silicone dielectric grease (P/N 293 550 004) on battery posts and connectors.

CABLE TERMINAL INSTALLATION

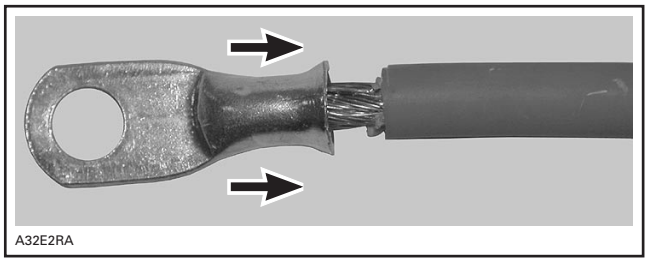
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (1/2 in)

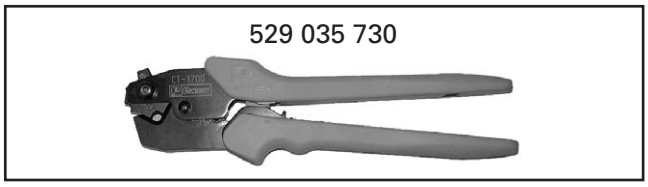
NOTE: Make sure not to cut wire strands while stripping the wire.

Install the appropriate terminal on the wire according to the requirement. Refer to appropriate parts catalog.

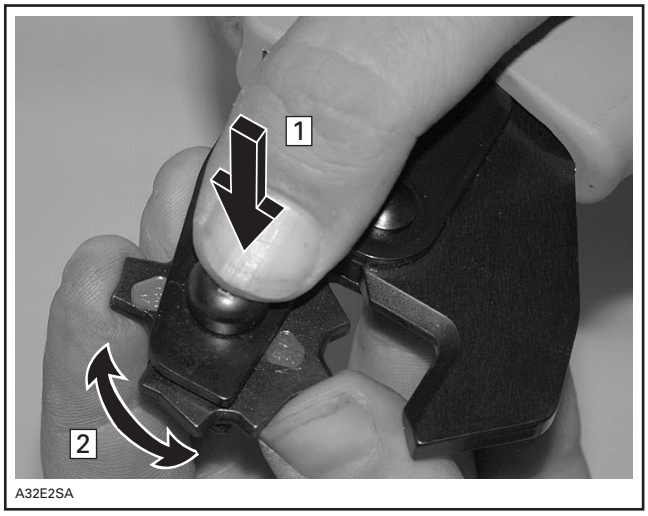


INSTALLATION OF TERMINAL

Follow the instructions provided with the crimp pliers (P/N 529 035 730) to select the proper position of the tool.

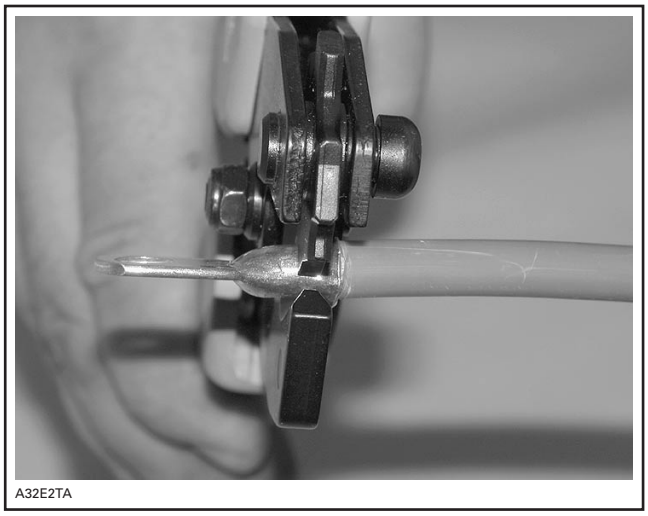


NOTE: Different wires require different crimp pliers settings, so make sure to follow the instruction supplied with the tool.



POSITIONING THE CRIMP PLIERS
1. Press
2. Rotate

After positioning the crimp pliers, crimp the terminal already installed on wire.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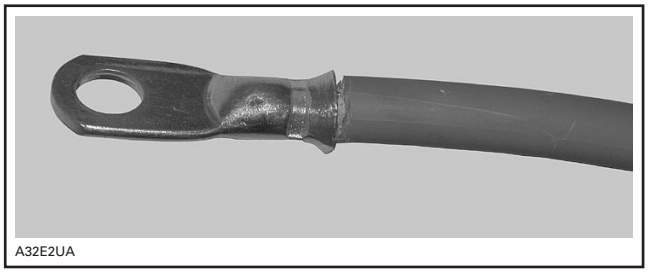
CRIMPING OF WIRE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PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

CAUTION: Never solder the wire to the terminal. Soldering can change the property of the wire and it can become brittle and break.

Install the protective heat shrink rubber tube on the terminal. Heat the heat shrink rubber tube using the heat gun so that it grasps the wire and the terminal.

CAUTION: Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

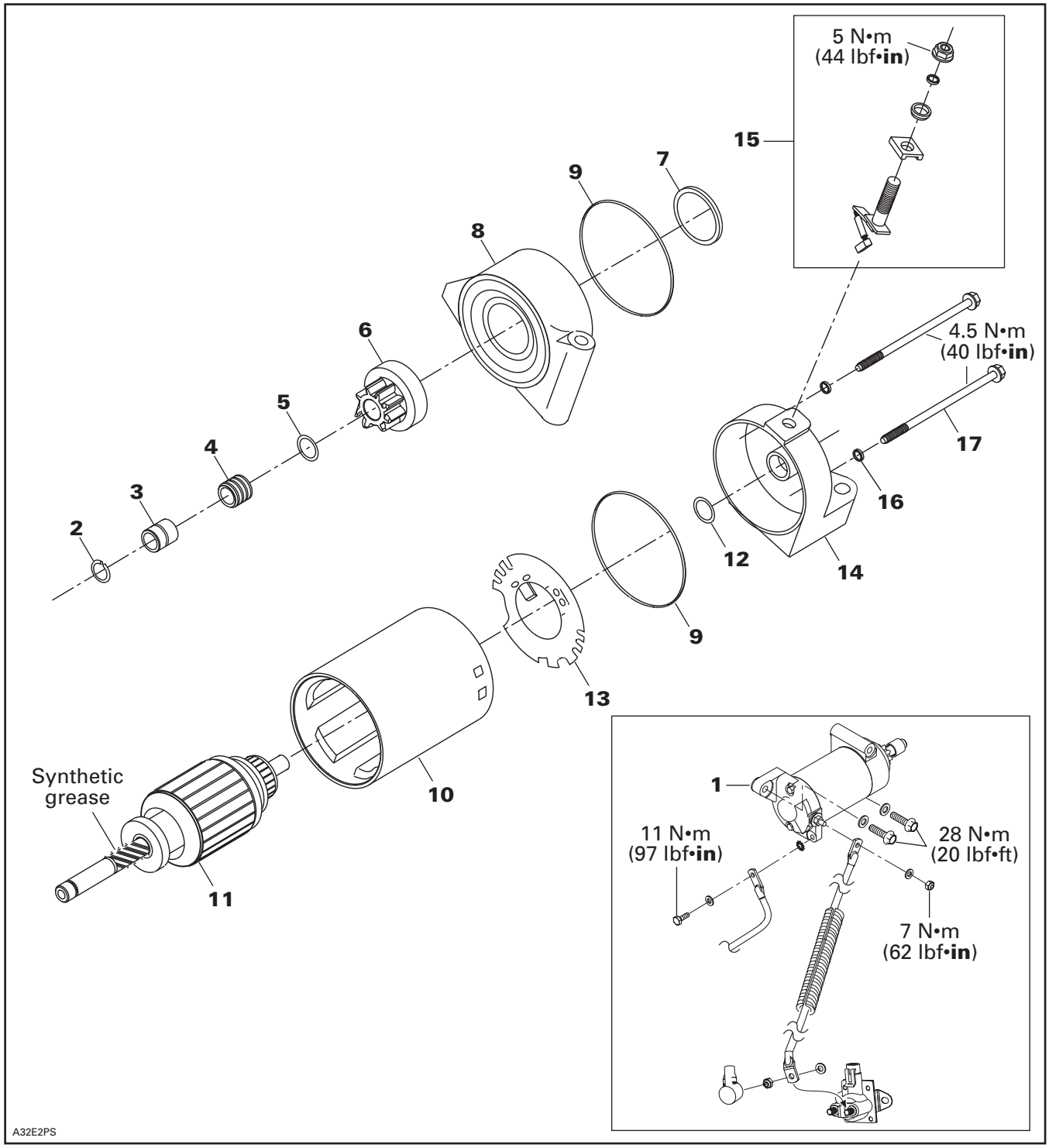
STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
multimeter FLUKE 111	529 035 868	301–302

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	413 711 500	303, 305



ELECTRIC STARTER

TROUBLESHOOTING

When the ignition switch is turned on or the start button is pressed, a signal is sent to the starting solenoid. The battery then supplies current to the starter through the starting solenoid to turn the engine.

In case of problems, first ensure the problem is not related to engine mechanical components. If not, test the starting system.

Causes of problems are not necessarily related to starter but may be due to a burnt fuse, faulty battery, start button or ignition switch, engine cut-out switch, starting solenoid, electrical cables and connections or the electronic module.

Check these components before removing starter.

Fuses

Make sure the charging fuse (30 A) on battery and the MPEM fuse (5 A) on electrical harness are in good condition. If the fuses test good, continue with the next tests.

Battery

Refer to CHARGING SYSTEM to check battery condition. If the test is good, continue with the next tests.

Start/RER Button

Liquid-Cooled Engines Models

Check if the start/RER button works perfectly.

START/RER BUTTON ON VEHICLES WITH ELECTRIC STARTER		
All engines except SDI		
TEST	Continuity from start/RER button to MPEM	Voltage from voltage regulator/rectifier
WIRE COLOR	RED/GREY and BEIGE	RED/GREY and BEIGE
RESISTANCE	1.0 Ω	—
VOLTAGE	—	Above battery voltage and below 15 volts
NOTE	—	—
SDI engines		
TEST	Continuity from start/RER button to MPEM	Voltage from voltage regulator/rectifier
WIRE COLOR	BLACK and BLACK/BLUE	BLACK and BLACK/BLUE
RESISTANCE	1.0 Ω	—
VOLTAGE	—	Above battery voltage and below 15 volts
NOTE	—	—

If the switch functions correctly, continue with the next tests.

Ignition Switch

Fan-Cooled Engines Models

Disconnect switch housing. Using the multimeter FLUKE 111 (P/N 529 035 868), check between MAG and GRD terminals if the circuit is open (O.L.) in operating position and if it is closed (0 Ω) in off position.

Engine Cut-Out Switch

Check the condition of engine cut-out switch.

ENGINE CUT-OUT SWITCH ON VEHICLE WITH ELECTRIC STARTER		
TEST	Running insulation	Continuity in STOP position
WIRE COLOR	BLACK/YELLOW and BLACK	BLACK/YELLOW and BLACK
RESISTANCE	O.L.	00.0 to 00.5
VOLTAGE	—	—
NOTE	Engine cut-out switch must be in run position.	Engine cut-out switch must be in stop position.

Starting Solenoid

Ensure the solenoid receives electric current as follows. Using the multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between the wires, indicate in the following table, when starting the vehicle. The tether cord must be installed.

ENGINE TYPES	COLOR OF WIRES
ALL SDI ENGINES	RED/GREY and ORANGE/BLACK
ALL POWER TEK ENGINES	RED/GREEN and ORANGE/BLACK
ALL OTHER ENGINES	RED/GREEN and BLACK

If the solenoid does not properly receive current, the electronic module can be suspected.

If the solenoid receives current, test it as follows.

– Disconnect battery and starter cables from solenoid.
– Inspect connections and clean as necessary.
– Solenoid condition can be checked with an ohmmeter. Install probes on large connectors of solenoid.
– Measure the resistance when current is applied to small connectors; if it is more than a few ohms, replace solenoid.

If solenoid tests good, check the electric starter. If electric starter tests good, the electronic module can be suspected.

Electrical Cables and Connections

Check all connections, harnesses and wires.

Tighten any loose connections.

Replace any chafed wires.

If wires, harnesses and connections are good, check the electric starter.

Electric Starter

Remove the tuned pipe and disconnect spark plug cables.

Using booster cable, carefully supply current from the battery directly to the starter. Connect the BLACK cable first. Connect the remaining booster cable from the battery then to the starter.

If the starter turns, ensure wiring harness and connectors between battery and starter are in good condition. If they test good, the electronic module can be suspected.

If the starter does not turn, check for mechanical problem in the starter.

Electronic Module

Check the MPEM condition, refer to IGNITION SYSTEM. For **SDI and Power TEK engines**, refer to ENGINE MANAGEMENT.

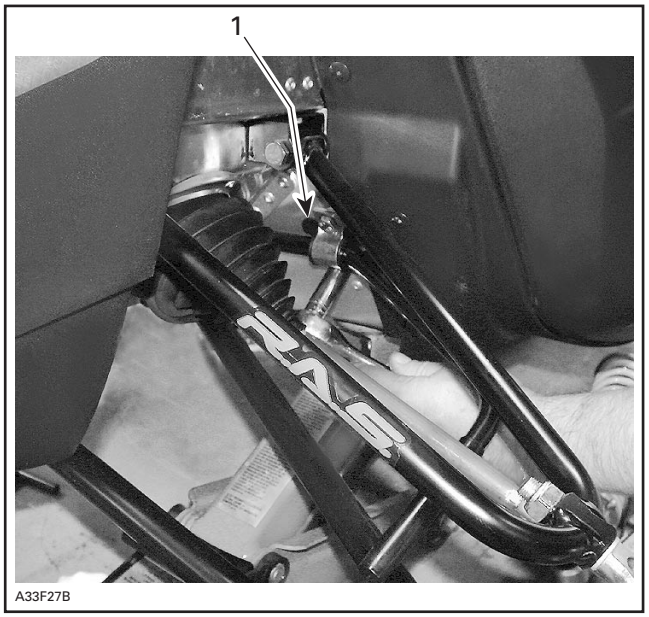
STARTER REMOVAL

– Disconnect BLACK (-) cable from battery.
– Disconnect RED (+) cable from battery.

⚠ WARNING

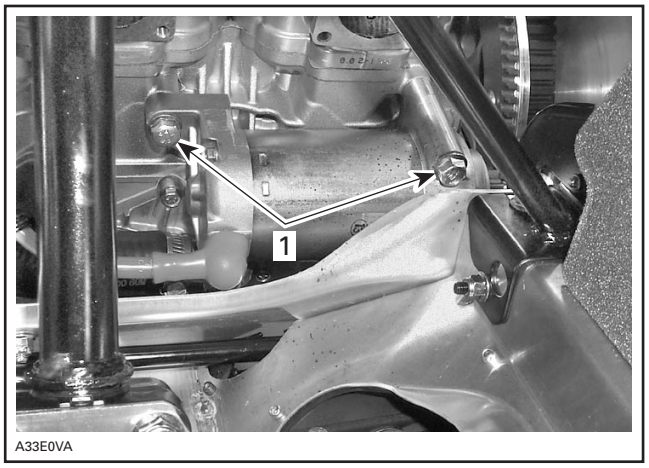
Always disconnect BLACK (-) cable first and connect last.

– Remove tuned pipe.
– Disconnect RED cable from starter.
– Disconnect ground cable from starter.
– Remove stabilizer bar clamp to access the lower starter retaining bolt.



1. Clamp

– Unbolt and remove starter from engine.



1. Bolts to be removed

STARTER DISASSEMBLY

Before disassembling, trace index marks on starter housing **no. 10** and starter housing assembly **no. 8** to ease further assembly.

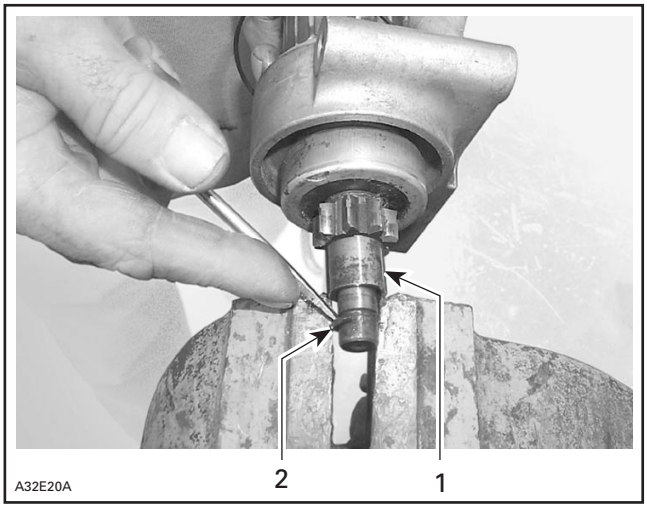
Remove starter through bolts **no. 17**. Separate end frame housing **no. 14** from starter housing **no. 10**. Withdraw starter housing from armature **no. 11**.

Brush holder **no. 13** can be removed from end frame housing **no. 14** by disconnecting the end frame attached brush from brush holder **no. 13**.

Check the radial play between the armature shaft and end frame bearing. Replace the end frame bearing or replace starter. If parts are in good condition then coat with synthetic grease (P/N 413 711 500) before reinstalling them.

Push back the collar **no. 3** using a screwdriver.

Remove snap ring **no. 2**. Remove collar **no. 3** and spring **no. 4**.



1. Collar
2. Snap ring

Turn starter clutch **no. 6** clockwise to remove it from armature assembly **no. 11**.

Pull housing from armature.

STARTER CLEANING

CAUTION: Yoke assembly and drive unit assembly must not be immersed in cleaning solvent.

Clean brushes and holders with a clean cloth soaked in solvent. Brushes must be dried thoroughly with a clean cloth.

Blow brush holders clean using compressed air.

⚠ WARNING

Always wear safety glasses when using compressed air.

Remove dirt, oil or grease from commutator using a clean cloth soaked in suitable solvent. Dry well using a clean and dry cloth.

Clean engine ring gear teeth and drive unit (clutch).

NOTE: Bushings or bearings must not be cleaned with grease dissolving agents.

Immerse all metal components in cleaning solution. Dry using a clean and dry cloth.

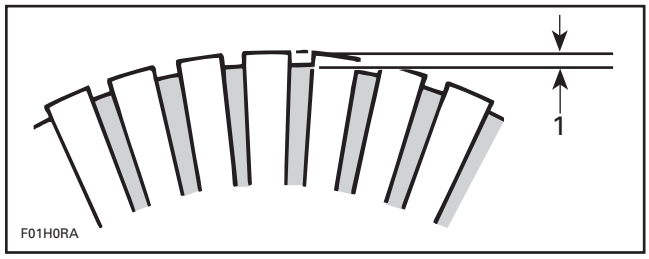
STARTER INSPECTION

Armature

NOTE: An ohmmeter may be used for the following testing procedures, except for the one concerning the shorted windings in the armature.

Check the commutator for roughness, burnt or scored surface. If necessary, turn the commutator on a lathe, enough to remove grime only.

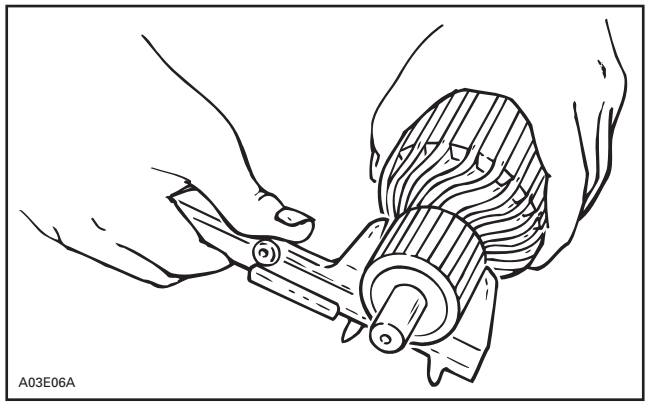
Check the commutator for mica depth. If the depth is less than 0.20 mm (.008 in), undercut the mica. Be sure that no burrs are left and no copper dust remains between the segments after the undercutting operation is completed.



1. Commutator undercut 0.20 mm (.008 in)

Check the commutator out-of-round condition with V Blocks and an indicator. If the commutator out-of-round is more than 0.40 mm (.016 in), the commutator should be turned on a lathe.

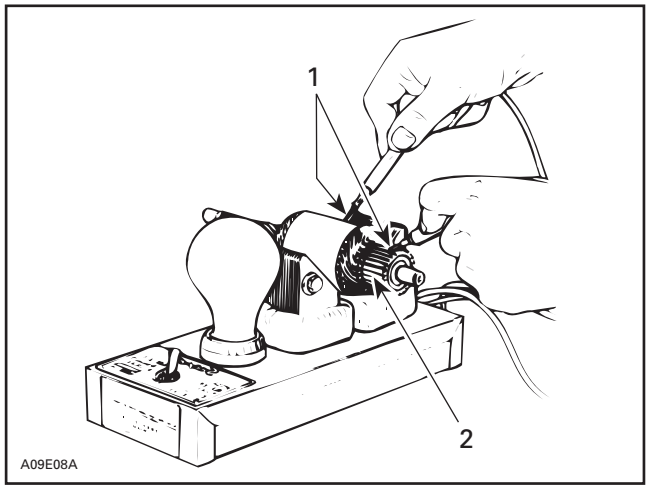
Check commutator outer diameter. If less than specified value, replace.



MODEL	WEAR LIMIT
All models	27 mm (1.063 in)

Test for Ground Circuit in the Armature

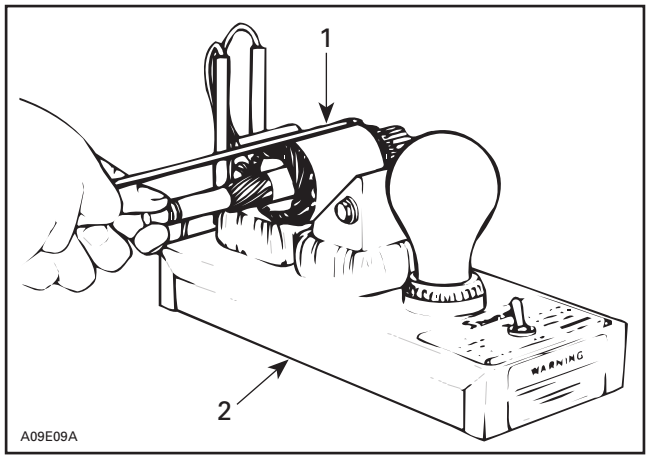
Use growler test probes. Check between armature core and the commutator bars. If growler lamp turns on, bars are grounded. If so, replace armature.



1. Test probes
2. Commutator bars

Test Armature for Shorted Winding

When the armature is rotated in the growler with a steel strip (hacksaw blade) held above it, the strip will vibrate over that area of the armature which has short circuit. Replace armature if so.



1. Steel strip (hack-saw blade)
2. Growler

Test the Armature for Open Circuit

Use growler test probes. Place one test probe on a commutator bar and the other test probe on the neighboring bar. Repeat this operation for all bars, moving one test probe at a time. If the growler lamp does not turn on, the armature circuit between these 2 bars is opened. The armature should be replaced or repaired; open circuits most often occur at the commutator riser where coils are soldered. (Burnt commutator bars are usually an indication of an open-circuit armature coil).

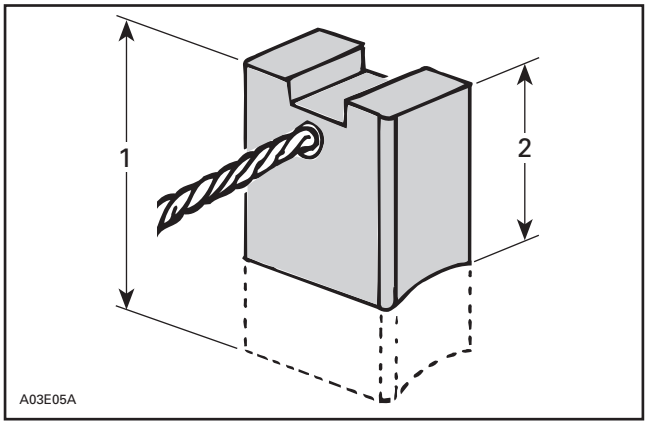
Brush Holder

Check the brush holder for insulation using growler test probes. Place one test probe on the insulated brush holder and the other test probe on the brush holder plate. If the growler lamp turns on, the brush holder has to be repaired or replaced.

Brush Length

Measure brush length. If less than the specified value, replace them.

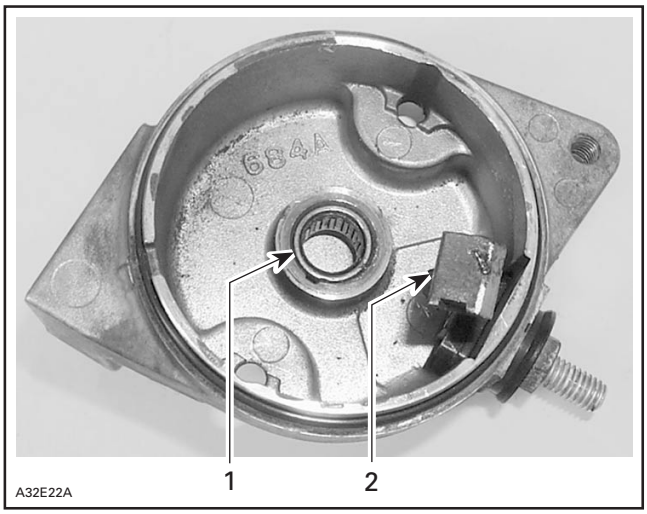
MODEL	LENGTH	
	NEW	WEAR LIMIT
All	10 mm (.400 in)	6 mm (.236 in)



TYPICAL
1. *New*
2. *Wear limit*

End Housing

Check the mica insulation of the positive brush and also the roller bearing condition. Replace, if necessary.



1. *Roller bearing*
2. *Positive brush*

Overrunning Clutch

The pinion of the overrunning clutch should turn smoothly in a clockwise direction, and should not slip in a counterclockwise direction. If defective, replace.

Check the pinion teeth for wear and damage. If defective, replace.

Relay

Inspect connections and clean as necessary. Relay condition can be checked with an ohmmeter. Install test probes on large connectors of relay when it is activated ((+) on RED/GREEN wire and (-) on relay body for the fan cooled models and (-) on the BLACK wire for liquid cooled models).

IMPORTANT: No current must be present on large cables when using ohmmeter, otherwise meter could be damaged.

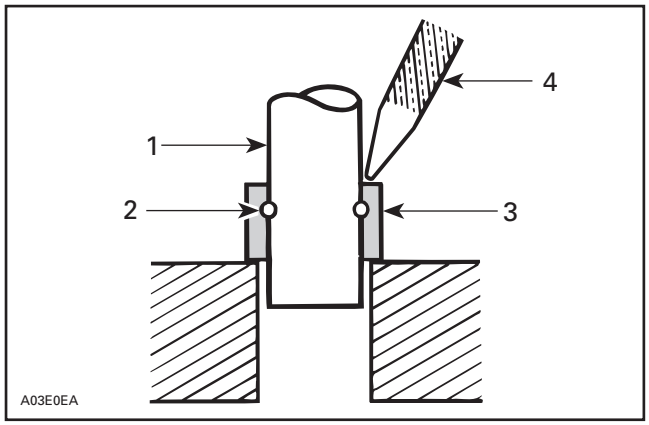
STARTER ASSEMBLY

Reverse the order of disassembly to reassemble starter. However, attention should be paid to the following operations.

Prior to assembling, coat sliding surfaces on armature shaft splines, overrunning clutch and bushing with synthetic grease (P/N 413 711 500).

After placing collar **no. 3** on armature shaft **no. 11**, fit new snap ring **no. 2** on armature shaft, then make sure that it is properly secured.

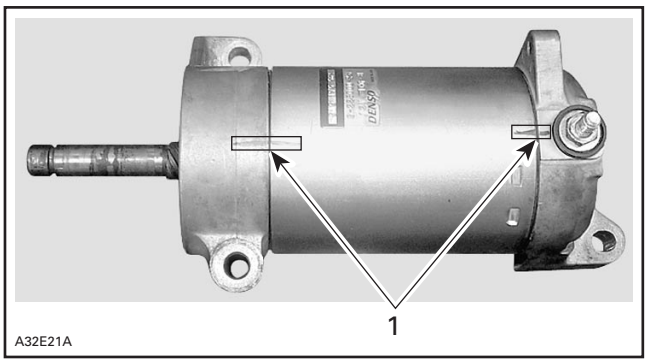
Slide collar **no. 3** over snap ring **no. 2** and secure in place by punching it at two or three places.



1. Armature shaft
2. Snap ring
3. Collar
4. Punch

Starter Housing Assembly and Starter Housing

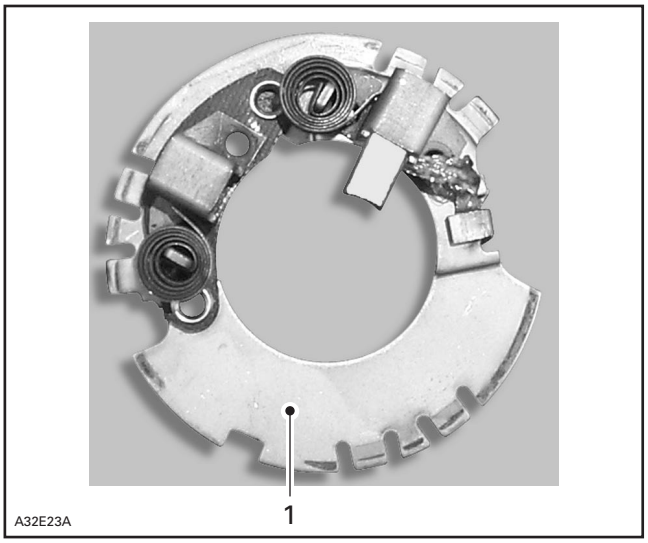
Align previously traced indexing marks.



TYPICAL
1. Aligned indexing marks

Open brushes and slide over commutator.

Align end frame locating notch with yoke locating protrusion and properly sit brush holder **no. 13** into housing **no. 14**.



1. Brush holder

To ease end frame installation, retain brush holder with a small screwdriver while installing armature assembly.

CAUTION: Make sure to place two end housings on a flat surface before tightening the through bolts.

CAUTION: Make sure end frame fits perfectly on yoke.

STARTER INSTALLATION

– Use new teflon washers on the 3 bolts retaining starter to engine.
– Torque the bolts to 28 N•m (20 lbf•ft).
– Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.
– Connect the RED battery cable and the RED wire to the large terminal of the starter.

⚠ WARNING

Always disconnect ground cable first and connect last.

– Torque large terminal nut to 7 N•m (62 lbf•**in**).
– Connect ground cable to the starter with star washer in between.
– Torque ground cable connecting bolt to 11 N•m (97 lbf•**in**).

ACCESSORIES

SERVICE TOOLS

Description	Part Number	Page
multimeter FLUKE 111	529 035 868	308, 312, 314–315
supply cable	529 035 997	307, 313
supply harness	529 035 869	307, 313
VCK (Vehicle Communication Kit)	529 035 981	308

GENERAL

⚠ WARNING

It is recommended to always disconnect the battery when replacing any electric or electronic parts. Always disconnect battery exactly in the specified order, BLACK (-) cable first. Do not place tools on battery.

During assembly/installation, use the torque values and service products as in the exploded views.

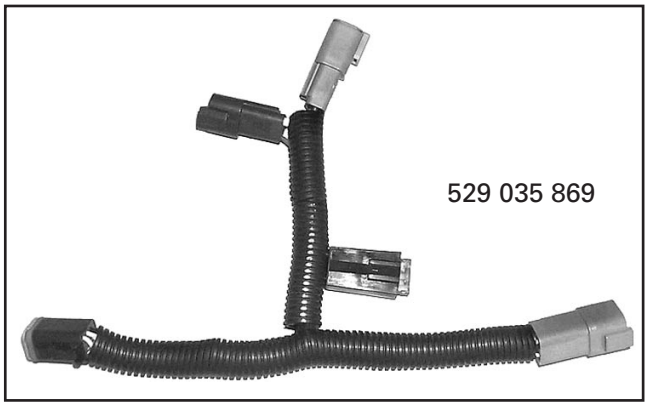
Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

Lighting and Accessories System Testing

Connect the supply cable (P/N 529 035 997) to the supply harness (P/N 529 035 869). Respect polarity by connecting 12V to RED wire and ground to BLACK wire.



Connect the supply harness (P/N 529 035 869) to diagnostic connector, located on right side of the vehicle. Now the headlight and accessories systems are supplied with 12 volts. Refer to appropriate wiring diagram in WIRING DIAGRAM section to troubleshoot lighting system.

CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

Once lighting system testing is done, disconnect supply cable from vehicle and then 12-Volt supply from the supply cable.

480 W Models (SDI engines)

Connect the VCK (Vehicle Communication Kit) (P/N 529 035 981). In BUDS, click on the relay 2 (R2) button to supply lighting system with 12 volts.

529 035 981

To supply 12 volts to the accessories, click on the relay 3 (R3) button.

Use the wiring diagram in WIRING DIAGRAM section to troubleshoot lighting and accessories systems.

12-VOLT POWER OUTLET (cigarette-lighter type)

Removal

Remove the console.

Remove connectors from the power outlet housing.

Unscrew the large nut then remove the 12-volt power outlet.

Test

Remove power outlet.

Unplug the power outlet connectors.

Using the multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between RED/BLACK and BLACK wires.

529 035 868

The obtained value should be between 12 and 14.5 Vdc.

– No voltage:
  • Check accessories fuse (20 A), connectors and wiring harness.
– Voltage is good:
  • After checking the accessories, change the power outlet.

Installation

The installation is the reverse of the removal procedure.

BEEPER (reverse alarm)

Removal

The beeper is located near the ignition coil.

Open the front hood, remove the windshield then remove screws retaining the accessories panel.

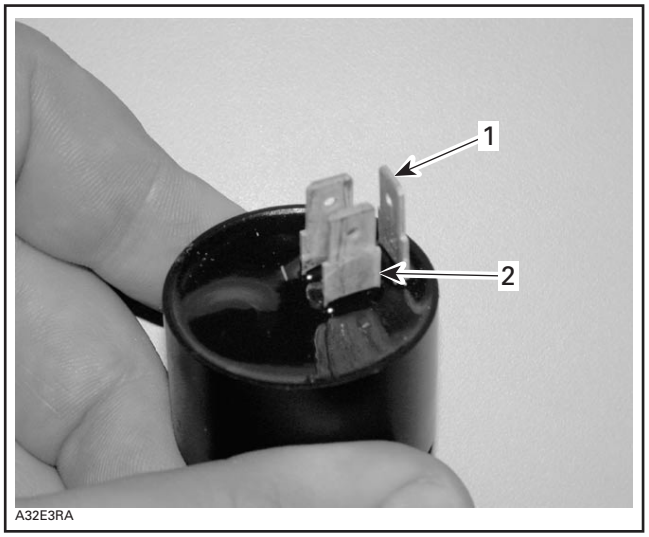
Unplug connector from beeper.

Unscrew retaining ring then remove beeper.

Test

NOTE: Before testing the beeper, make sure the connectors are installed on proper beeper tabs.

ENGINE TYPE	TAB LOCATION
All carburetor equipped engines except Power Tek	BEIGE/BLACK on positive tab BLACK on negative tab
SDI engines	RED/GREEN on positive tab BEIGE/BLACK on negative tab
Power Tek	RED/YELLOW on positive tab BEIGE/BLACK on negative tab

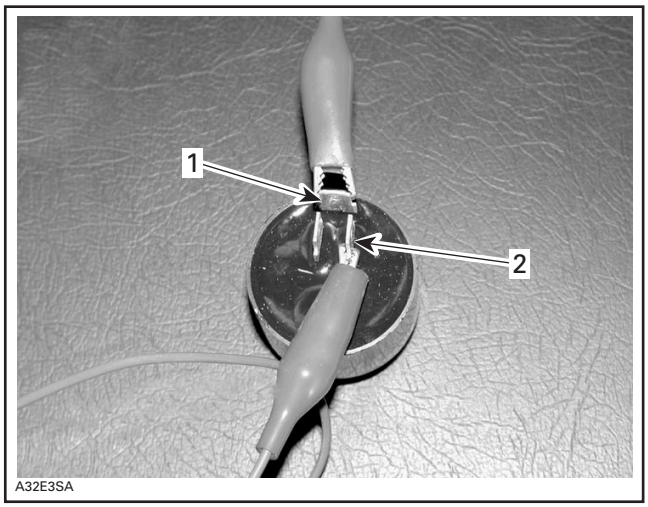


1. GREEN/RED wire on positive tab
2. BEIGE/BLACK wire on negative tab

Using jumper wires, connect battery positive post to beeper positive tab.

Connect battery negative post to beeper negative tab. See next photo.

CAUTION: To avoid beeper damage, ensure that polarity is respected.



TYPICAL — 12-VOLT BATTERY PLUGGED TO BEEPER
1. Beeper positive tab
2. Beeper negative tab

A continuous sound should be heard. If not, replace the beeper with a new one.

If the beeper is good, check connectors, fuse and wiring harness.

Installation

To install beeper, reverse the removal procedure. Check connectors position.

ENGINE TEMPERATURE GAUGE

Test

Fan-cooled Models

Check if the speedometer works properly.

Check connector and wiring harness.

Check the engine temperature sensor on engine.

If all other parts work properly, replace the engine temperature gauge.

Liquid-cooled Models except SDI

Check fuses, connectors and harness.

Check condition of relay, refer to RELAY further in this section.

Check temperature sensor on engine.

Replace temperature gauge.

SDI Models

Check fuse, connectors and harness.

Check the condition of relay 2 by using the BUDS software.

Check temperature sensor.

Replace the gauge.

Removal

Remove the accessories panel.

Remove the ring around the gauge by pressing both tabs.

Unscrew the central nut and remove the support.

Unplug connector.

Remove gauge.

Installation

The installation is the reverse of removal procedure.

ELECTRIC FUEL GAUGE

Test

Liquid-cooled Models except SDI

Check fuses, connectors and harness.

Check the condition of the relay, refer to RELAY further in this section.

Check fuel sensor on fuel tank.

Replace electric fuel gauge.

SDI Models

Check fuse, connectors and harness.

Check relay 2 by using BUDS software.

Check fuel sensor on fuel tank.

Replace electric fuel gauge.

Removal

Remove the accessories panel.

Remove the ring around the gauge by pressing both tabs.

Unscrew the central nut and remove the support.

Unplug connector and remove gauge.

Installation

The installation is the reverse of the removal procedure.

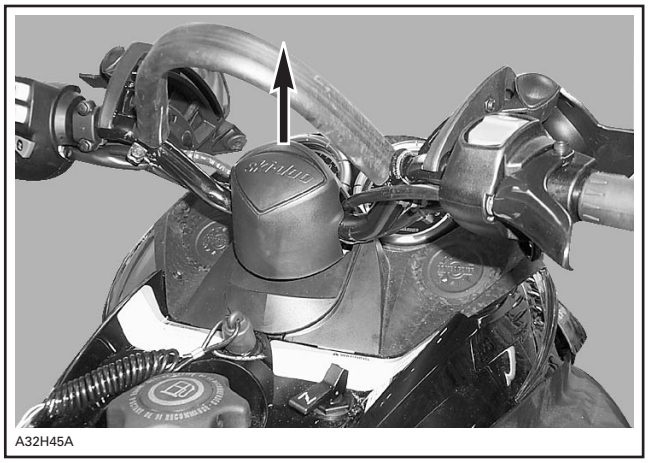
HEADLAMP

Bulb Replacement

If any headlight bulb is burnt, proceed as follows.

Remove windshield.

Pull out steering support cap.

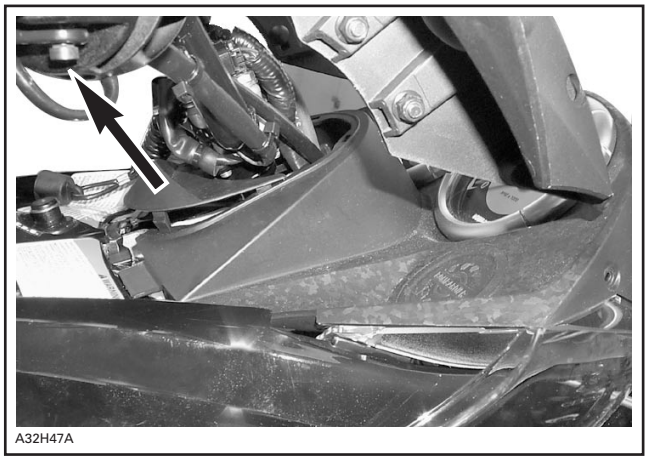


A32H45A

TYPICAL

Lift hood.

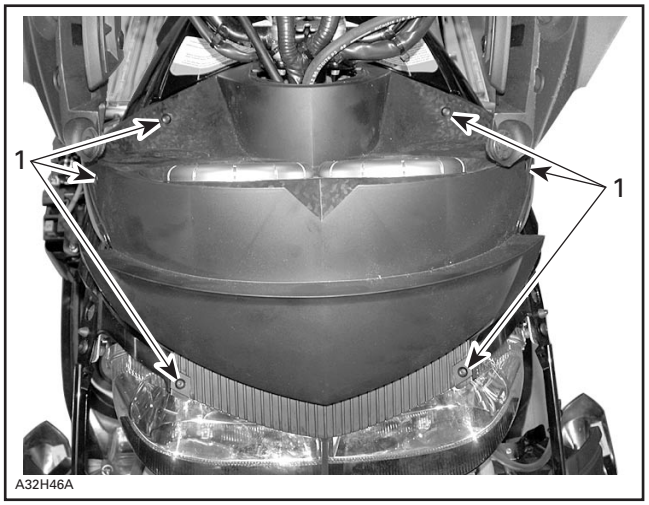
Pull up front console end cap.



A32H47A

TYPICAL

Remove retaining screws and slightly lift accessories panel.

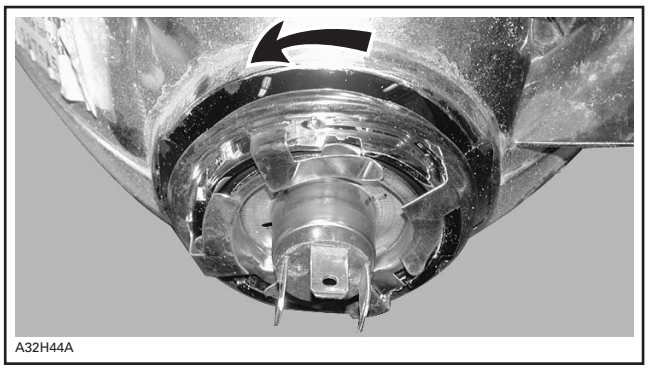


TYPICAL
1. Remove screws

Place the accessories panel out of way.

Unplug burnt bulb connector. Remove the rubber boot.

Turn bulb retainer ring counterclockwise to unlock. Detach the bulb and replace.



TYPICAL

CAUTION: Never touch glass portion of an halogen bulb with bare fingers, as it shortens its operating life. If by mistake glass is touched, clean it with isopropyl alcohol which will not leave a film on the bulb. After locking ring installation, ensure bulb is properly secured in place.

Properly reinstall removed parts.

Test

If the new bulb do not work correctly, check connector, wiring harness or HI-LOW beam switch.

Removal

Remove the accessories panel.

Disconnect headlamps.

On RH side of vehicle, remove the push nut then remove the headlamp housing.

Installation

Reverse the removal procedure.

HEADLAMP BEAM AIMING

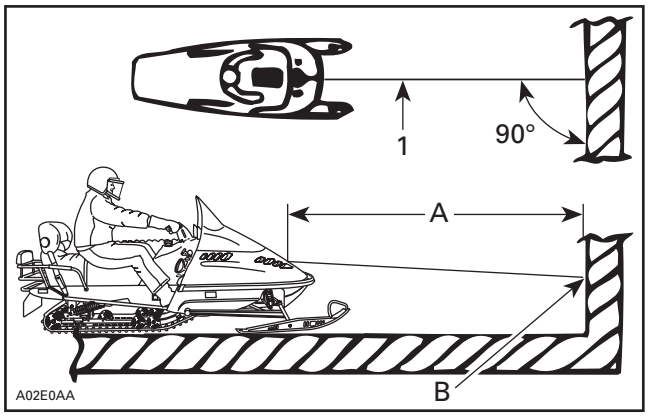
Beam aiming is correct when center of high beam is 25 mm (1 in) below the headlamp horizontal center line, scribed on a test surface, 381 cm (12 ft 6 in) away.

Place the vehicle on a flat surface perpendicular to test surface (wall or screen) and 381 cm (12 ft 6 in) away from it.

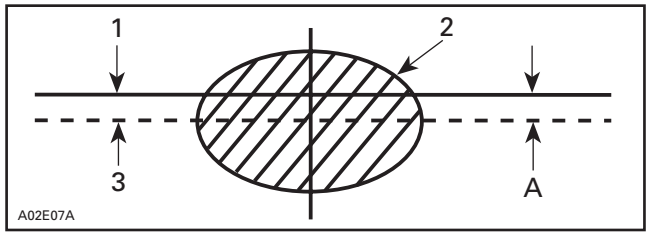
Rider or equivalent weight must be on the vehicle.

Select **high** beam.

Measure headlamp center distance from ground. Scribe a line at this height on test surface (wall or screen). Light beam center should be 25 mm (1 in) below scribed line.



TYPICAL
1. Headlamp center line
A. 381 cm (12 ft 6 in)
B. 25 mm (1 in) below center line



1. Headlamp horizontal
2. Light beam (high beam) (projected on the wall)
3. Light beam center
A. 25 mm (1 in)

HEATING ELEMENTS

NOTE: All measurements must be performed at 21°C (70°F).

Throttle Lever Heating Element

Current Measurement

HIGH INTENSITY	BROWN wire	0.23 A minimum
LOW INTENSITY	BROWN/YELLOW wire	0.13 A minimum

Handlebar Grip Heating Element

Resistance Measurement

All Models except SDI

INTENSITY	WIRES	OHMS
HIGH	BLACK and ORANGE/VIOLET	13.7 to 16.7*
LOW	BLACK and ORANGE	6.8 to 8.4*

SDI Models

INTENSITY	WIRES	OHMS
HIGH	BLACK and ORANGE/VIOLET	17 to 23.5*
LOW	BLACK and ORANGE	8.5 to 11.8*

*When measuring resistance at terminals the actual value will be half the measurement in table. The reason for that is the elements are connected in parallel. Therefore the total resistance is half the resistance of one element.

If the heating elements are good, check connectors and wiring harness.

RELAY

Voltage Test

RELAY		
TEST	Coil	Contact
WIRE COLOR	WHITE/GREEN and BLACK	BLACK/YELLOW and BLACK
RESISTANCE	—	—
VOLTAGE	10.5 to 13.5 Vdc	00.0 to 0.10 Vdc
NOTE	Engine idling (1500 to 1600 RPM)	Engine idling (1500 to 1600 RPM)

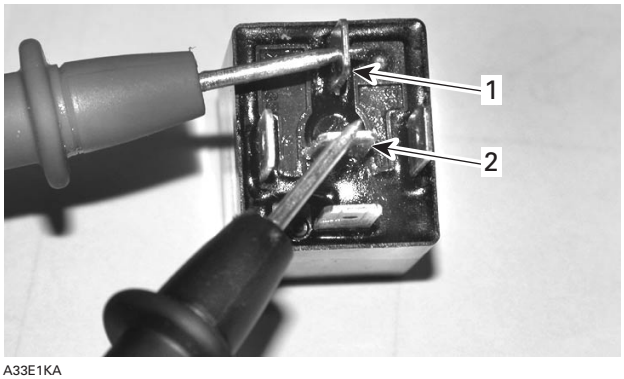
Continuity Test

Remove the relay from vehicle.

Using the multimeter FLUKE 111 (P/N 529 035 868), select the beeper position.

A33E1JA

Position the RED probe on the terminal 30 and the BLACK probe on the terminal 87a.

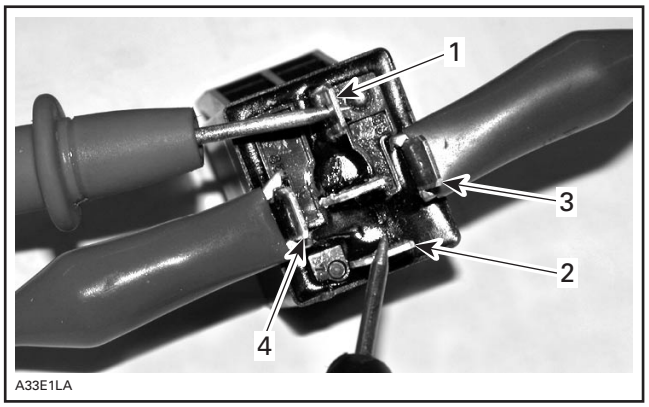


A33E1KA

1. Terminal 30
2. Terminal 87a

A continuous signal should be audible. If not, replace the relay.

If a signal is audible, apply 12 volts on terminals 85 and 86 then place the RED probe on terminal 30 and the BLACK on the terminal 87.



1. Terminal 30
2. Terminal 87
3. Terminal 85
4. Terminal 86

The continuous signal should be audible. If not, replace the relay.

SPEEDOMETER

Removal

Insert a little flat screwdriver into the slot at the bottom of the speedometer. Slightly, pry the speedometer and turn it clockwise then remove it from accessories panel.

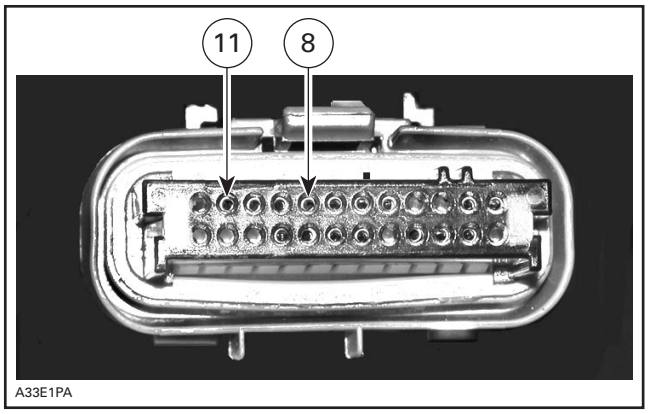
Unplug connector.

Test

No lights and the needle does not move

Remove the speedometer. Apply 12 volts between pin 8 and pin 11. Place the positive probe on pin 8 and the negative on pin 11.

NOTE: Respect positive and negative positions if not the speedometer could be damaged.



If the speedometer stays off, change it.

If the speedometer is lighted, check connector and wiring harness. Repair defective parts.

The speedometer is lighted but the needle does not move

Check the speed sensor and the wiring harness.

If the speed sensor and the wiring harness are good, change the speedometer.

Installation

The installation is the reverse of the removal procedure.

SPEED SENSOR

Test

Fan-cooled Engines

To perform the speed sensor test, the engine must turn.

Liquid-cooled Engines

Install the supply harness (P/N 529 035 869) with the supply cable (P/N 529 035 997).

NOTE: Remove the headlight system fuse to save the battery during the test.

All Models

Static Test

Unplug the speed sensor connector.

A33E1MA

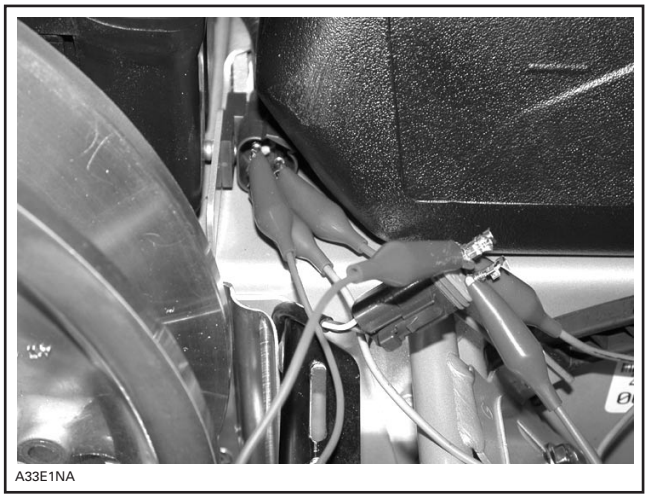
Using the multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between BLACK/BLUE and RED/GREY wires. The obtained value should be the battery voltage.

Measure the voltage between BLACK/BLUE and GREEN/WHITE wires. The obtained value should be ±1 volt under battery voltage.

Dynamic Test

Install 3 pins in each speed sensor connector.

Install wire jumpers between pins.


A33E1NA

Lift the rear of the vehicle.

Connect multimeter probe on GREEN/WHITE and BLACK/BLUE wires.

Turn the track slowly. The voltage should be 12 volts then drop to O.L.

If the obtained value is out of specifications, change it.

TACHOMETER

Test

No light but the needle moves

The tachometer is supplied through the speedometer. Check the voltage between pins 9 and 10 of speedometer.

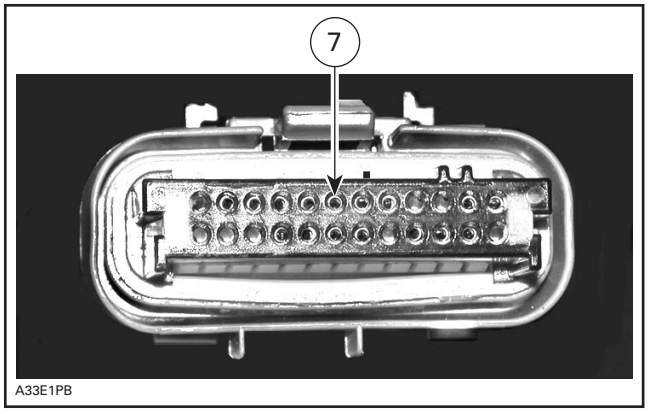
The obtained value should be the battery voltage. If not, check connections and wiring harness.

If the voltage is good, replace the tachometer.

The needle does not move

No lights, see speedometer

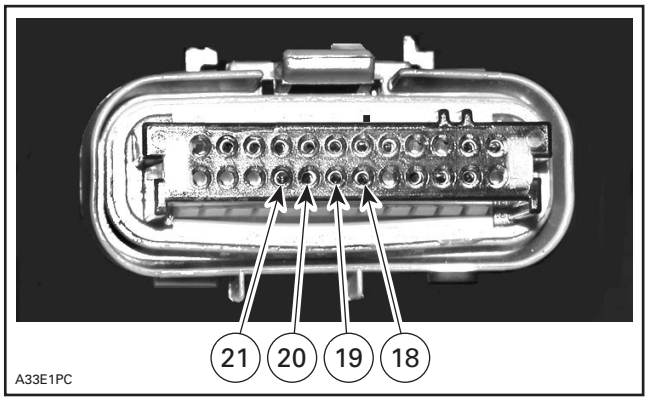
With lights, check RPM signal on pin 7.



A33E1PB

Crazy needle

Check wire connections on pin 18, 19, 20 and 21.



A33E1PC

TAILLIGHT

Bulb Replacement

Unscrew lens screws to expose bulb.

Push the bulb in and hold while turning counterclockwise to release.

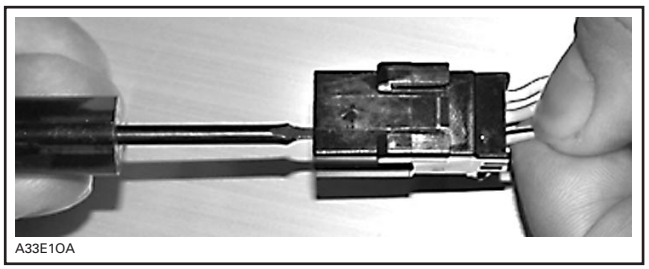
Install the new bulb by first pushing in while turning clockwise.

Removal

Remove the radiator cover by removing the retaining screws. On all GTX models and the EXPEDITION SPORT, remove the seat studs and the seat fixation plates.

Disconnect taillight connector.

Remove the wires from connector. Open the connector on wire side then with a small tool extract the wires from the connector.


A33E1OA

NOTE: Note the location of each wire.

Unscrew the screws retaining the rack to the side of frame.

A33H8BA

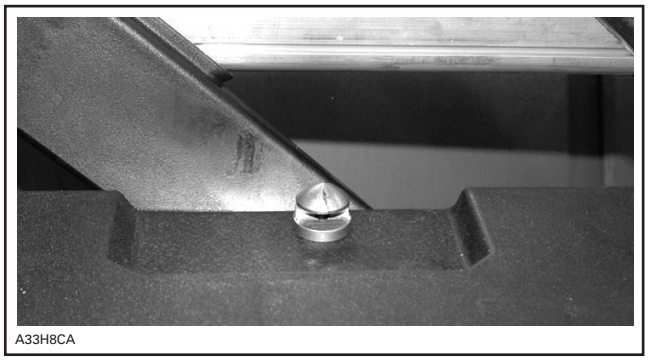
Unscrew the other screws that attach the rack near the radiator.

Unscrew taillight lens and pull the wire.

Installation

The installation is the reverse of the removal procedure. On all GTX models and the EXPEDITION SPORT, pay attention to the following details.

Install the seat studs with the slot inside.


A33H8CA

Torque the seat stud screws to 10 N•m (89 lbf•**in**).

VISOR OUTLET

Removal

Remove the console.

Unplug the visor connector.

Unscrew visor outlet.

Test

Unplug the visor connector.

Using the multimeter FLUKE 111 (P/N 529 035 868), check voltage between RED/YELLOW and BLACK wires. The obtained value should be ± 12 Vdc.

Before changing the visor outlet, try another accessory, if the accessory does not work, change visor outlet.

Installation

The installation is the reverse of the removal procedure.

DRIVE BELT

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	320
drive belt tension adjuster	529 008 700	319

APPLICATION CHART

MODEL	PART NUMBER	MINIMUM WIDTH (wear limit) mm (in)
All 377 and 552 engines	415 060 600	32.3 (1–9/32)
All 593/HO/SDI engines	417 300 197	34.9 (1–3/8)
All 793 HO engines	417 300 166	35.3 (1–13/32)

INSPECTION

Inspect belt for cracks, fraying or abnormal wear (uneven wear, wear on one side, missing cogs, cracked fabric). If abnormal wear is noted, probable cause could be pulley misalignment, excessive RPM with frozen track, fast starts without warm-up period, burred or rusty sheave, oil on belt or distorted spare belt.

Check drive belt width. Replace the drive belt if width is under minimum recommended width (see table above).

CHECKING NEUTRAL FUNCTION

⚠ WARNING

Always check neutral function when servicing.

Apply parking brake. Vehicle must be on the ground and on a plane level surface. No one should be in front of vehicle.

Attach vehicle tether cord to your clothing. Stand aside of vehicle, then start engine.

⚠ WARNING

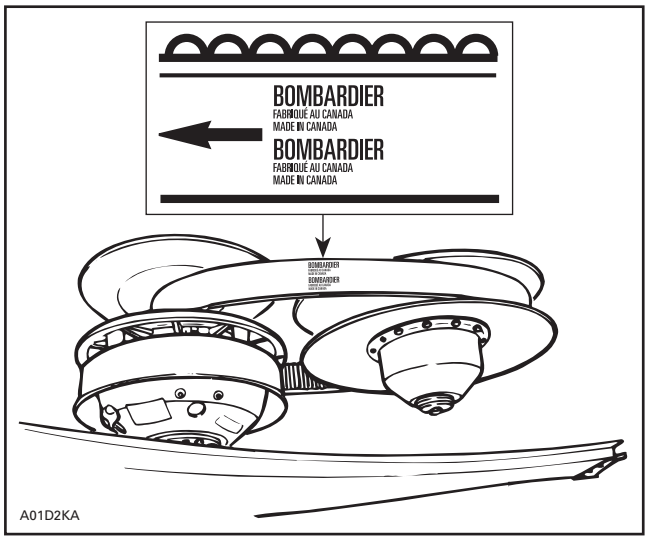
Do not sit on vehicle.

Release parking brake. Vehicle must not creep when engine is idling. Otherwise, make sure that:

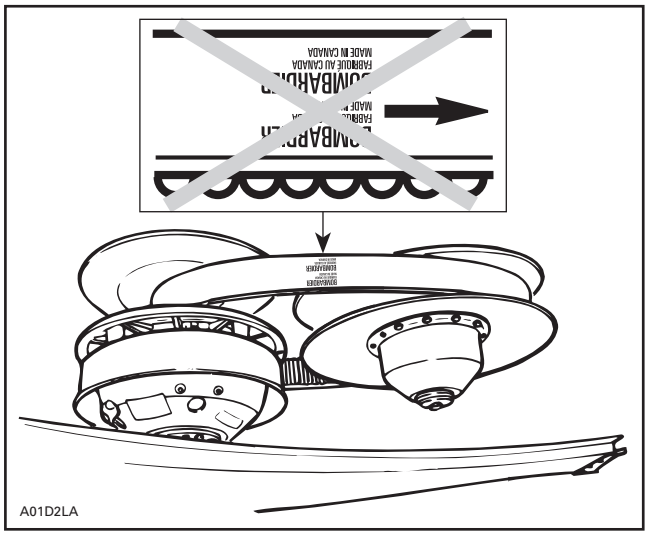
- idle speed is as specified
- proper belt is installed
- pulley center-to-center is as specified
- belt deflection is as specified.

ROTATION DIRECTION

The maximum drive belt life span is obtained when the drive belt is installed as shown. This will ensure that correct direction of rotation is respected.



CORRECT



INCORRECT

NOTE: For used drive belt, mark and reinstall in the same position.

DRIVE BELT HEIGHT MEASUREMENT AND ADJUSTMENT

Measurement

NOTE: The drive belt height measurement must be performed each time a new drive belt is installed.

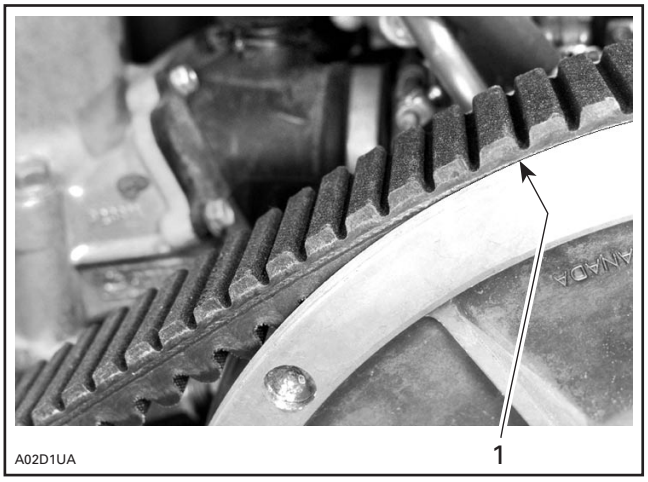
NOTE: To obtain an accurate drive belt height measurement, it is suggested to allow a break-in period of 50 km (30 miles).

Before checking the belt height, ensure that a good-condition proper belt (refer to the APPLICATION CHART) is installed.

Adjust pulley distance and alignment. Refer to PULLEY DISTANCE AND ALIGNMENT.

To obtain maximum vehicle performance, the belt height must be adjusted according to specifications shown in the accompanying chart.

MODEL	BELT HEIGHT
All models	Top edge of drive belt cord should be flush with driven pulley edge.



1. Flush

Adjustment

Before adjusting the belt height, ensure that a good-condition proper belt (refer to the APPLICATION CHART) is installed.

Adjust pulley distance according to specification, refer to PULLEY DISTANCE AND ALIGNMENT.

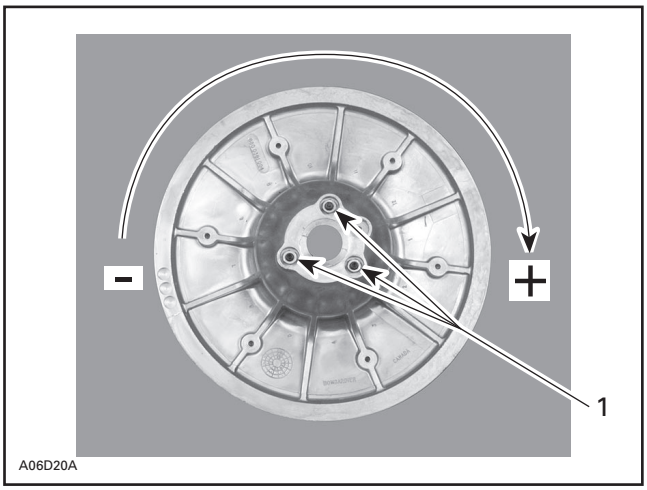
Models Equipped with Formula Type Driven Pulley

Adjust drive belt height using Allen screws, as shown.

To lower belt in driven pulley: turn Allen screws clockwise.

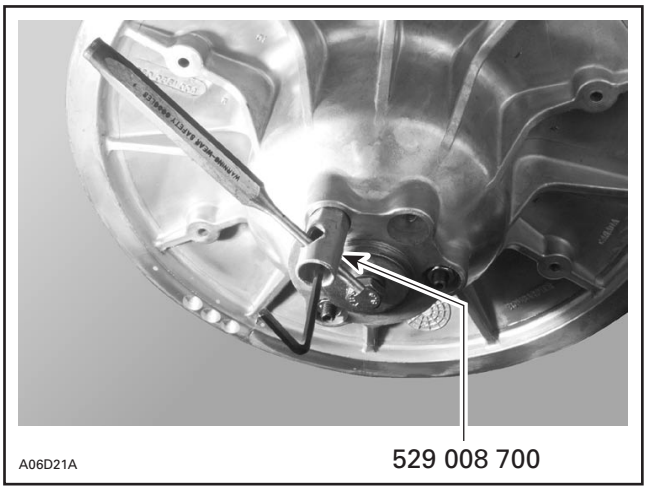
To raise belt in driven pulley: turn Allen screws counterclockwise.

NOTE: Turn Allen screws 1/4 turn at a time, then rotate driven pulley to allow drive belt to settle in pulley. Check height, repeat as required.



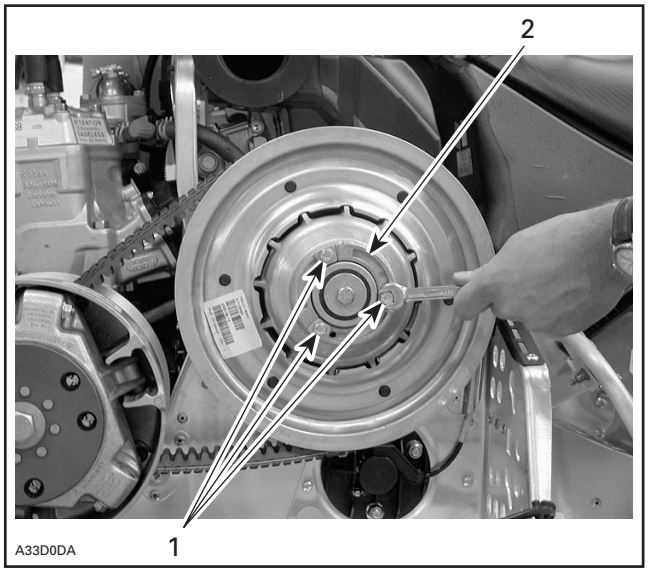
TYPICAL
1. Allen screws with jam nuts

Allen screws must be restrained while tightening jam nut to prevent throwing adjustment out. Use drive belt tension adjuster (P/N 529 008 700).



TYPICAL

Models Equipped with HPV Type Driven Pulley

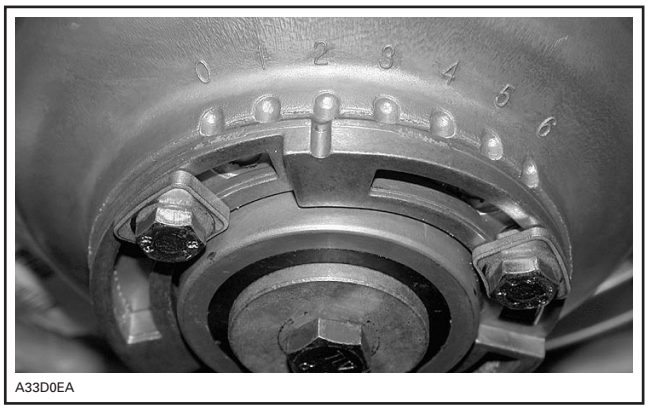


1. Screws
2. Adjustment ring

Loosen screws and turn adjustment ring as follows:

To lower belt in driven pulley: turn adjustment ring counterclockwise and tighten the screws.

To raise belt in driven pulley: turn ring clockwise and tighten the adjustment screws.



DRIVEN PULLEY NOTCHES

Turn the adjustment ring up to one notch, tighten the screws, then rotate driven pulley to allow drive belt to settle in pulley. Check height, if required the adjustment ring can be turned up to 1/4 or 1/2 the notch. Check height, repeat as required.

NOTE: Notches are there on the driven pulley for reference purpose only and the desired adjustment can be attained at any point.

DRIVE BELT DEFLECTION MEASUREMENT (REFERENCE ONLY)

NOTE: The drive belt deflection measurement must be performed each time a new drive belt is installed.

NOTE: To obtain an accurate drive belt deflection measurement, it is suggested to allow a break-in period of 50 km (30 miles).

Before checking the belt deflection, ensure vehicle has the proper belt (refer to the APPLICATION CHART).

Adjust pulley distance and alignment. Refer to PULLEY DISTANCE AND ALIGNMENT.

To obtain maximum vehicle performance, the belt tension must be adjusted according to specifications shown in the accompanying chart.

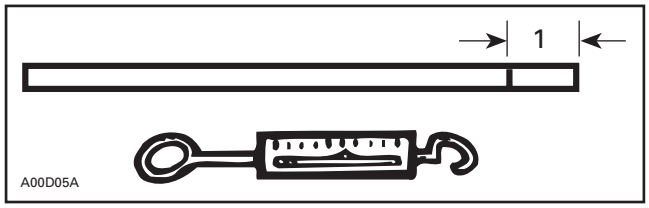
MODEL	DEFLECTION † mm (in)	FORCE kg (lb)
All models	32 ± 5 (1.260 ± .197)	11.5 (25)

† FOR REFERENCE ONLY

To Check Tension

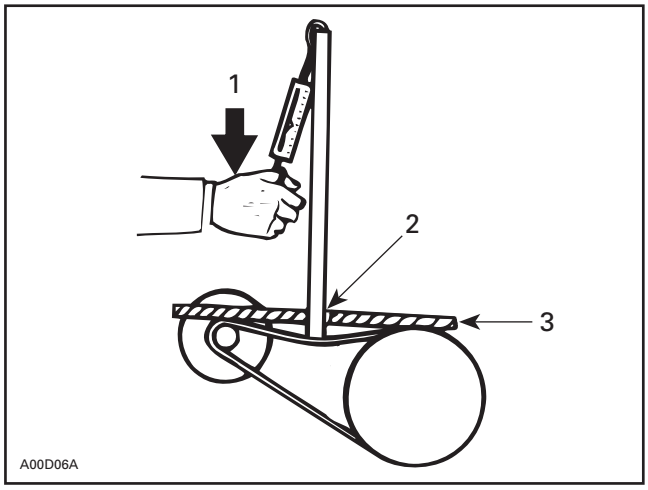
Position a reference rule on drive belt.

Wooden Stick and Spring Scale Method



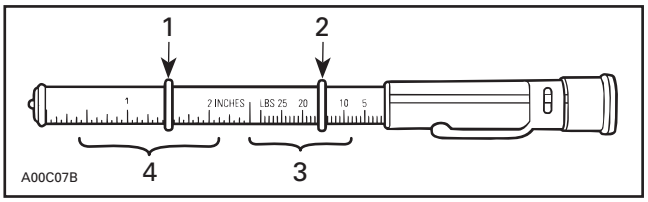
1. Mark specified deflection

Using spring scale and stick, apply specified force on drive belt halfway between pulleys as shown.



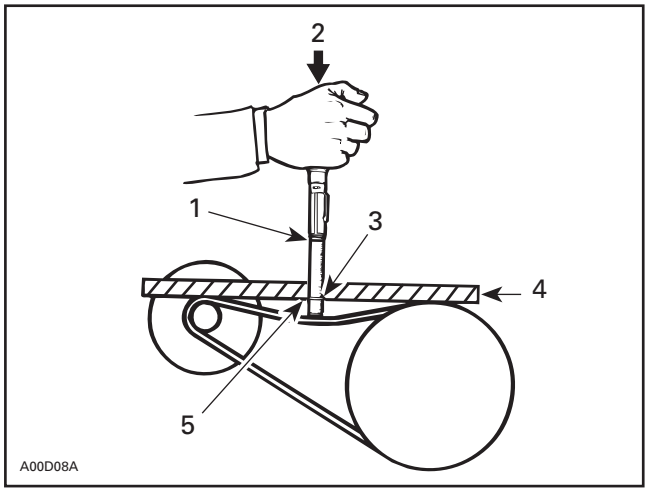
1. Force
2. Read deflection here
3. Reference rule

Or use the belt tension tester (P/N 414 348 200).



1. Lower O-ring
2. Upper O-ring
3. Force (read down)
4. Deflection (read up)

1) Slide lower O-ring of deflection scale to specified measure.
2) Slide upper O-ring to 0 (zero) on the force scale.
3) Apply pressure until lower O-ring is flush with edge of rule and read force on the upper scale at top edge of O-ring.



1. Upper O-ring — force
2. Force
3. Lower O-ring — deflection
4. Reference rule
5. Deflection

DRIVE PULLEY

SERVICE TOOLS

Description	Part Number	Page
bushing remover/installer	529 031 200	332
drive pulley holder	529 027 600	325, 327
drive pulley holder	529 035 674	329, 337
drive pulley puller	529 022 400	325–326, 329
slider shoe fork	529 005 500	330, 336
sliding half bushing remover/installer	529 035 931	332–333
spring compressor	529 035 524	330, 332–333, 335
spring cover tool	529 027 300	326

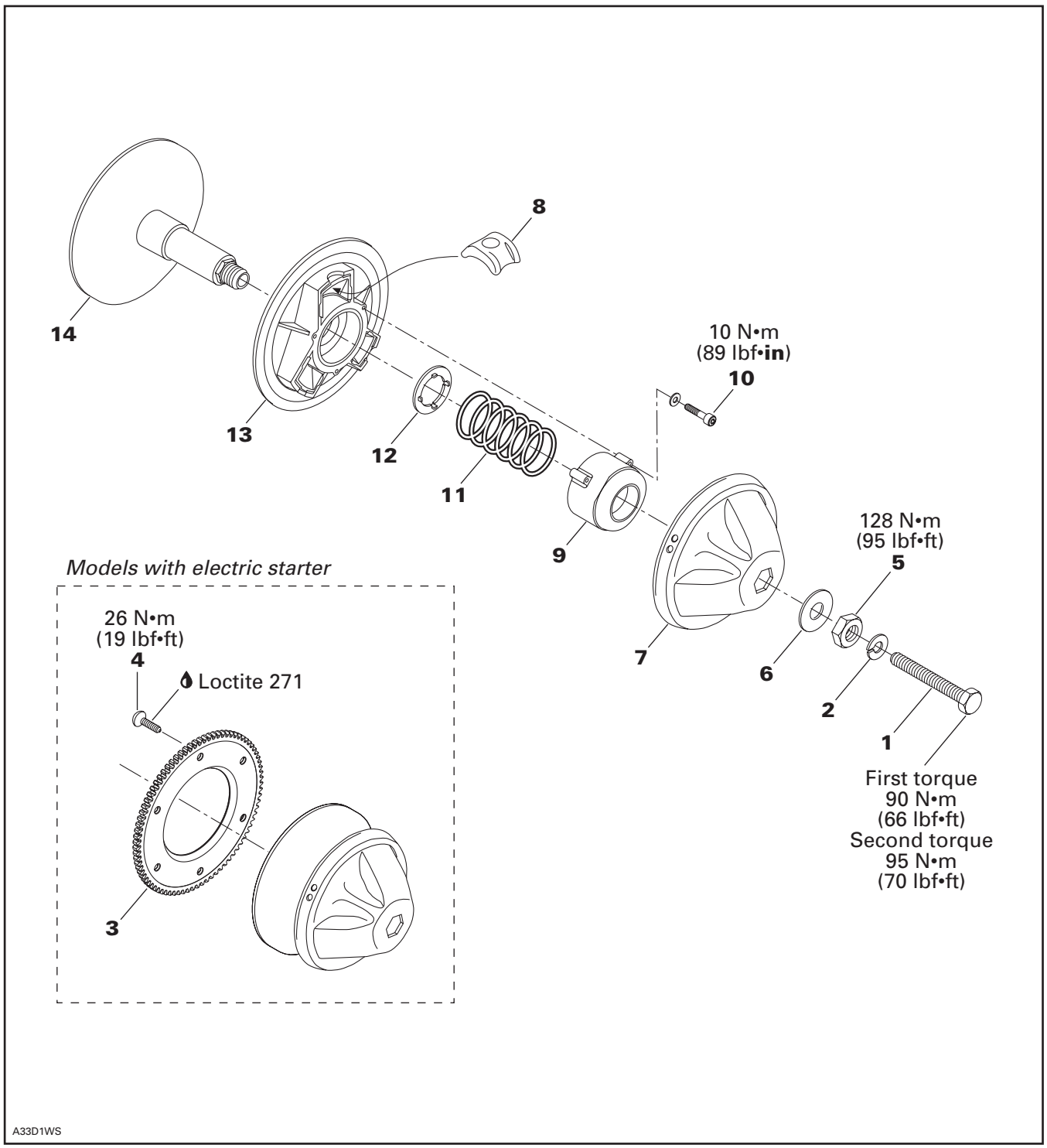
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271	293 800 005	327, 333
Loctite 609	413 703 100	333
pulley flange cleaner	413 711 809	327, 331, 333

BOMBARDIER LITE

All Fan-cooled Models

NOTE: This drive pulley is lubrication free.



GENERAL

Some drive pulley components (return spring, calibration disk) can be changed to improve vehicle performance in high altitude regions. A service bulletin gives information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experience mechanics since they can greatly affect vehicle performance.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized Ski-Doo dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

REMOVAL

NOTE: If disassembling drive pulley, first straighten tab washer **no. 6** then untighten nut **no. 5**.

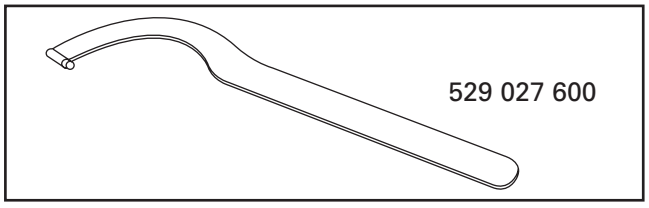
⚠ WARNING

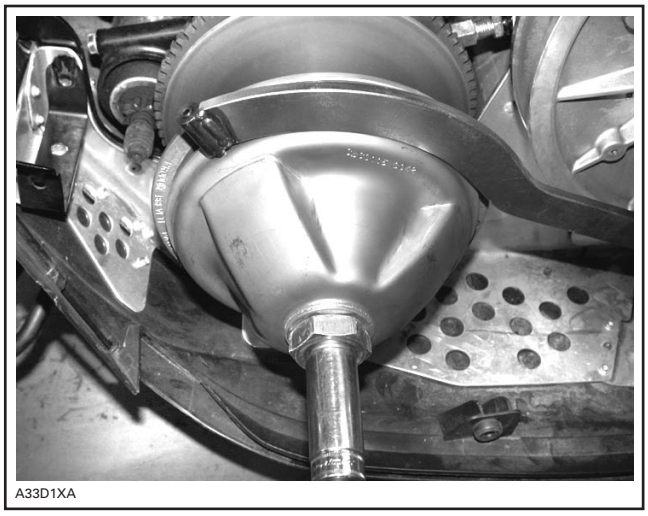
Never use an impact wrench to remove or install the drive pulley.

⚠ WARNING

The drive pulley assembly is a precisely balanced unit. Never replace parts with used parts from another drive pulley assembly.

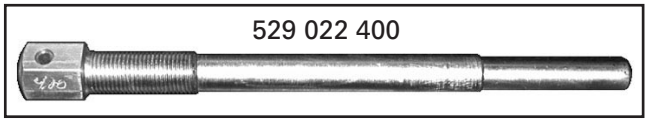
Using the drive pulley holder (P/N 529 027 600), hold the drive pulley to remove the drive bolt **no. 1** and its lock washer **no. 2**.



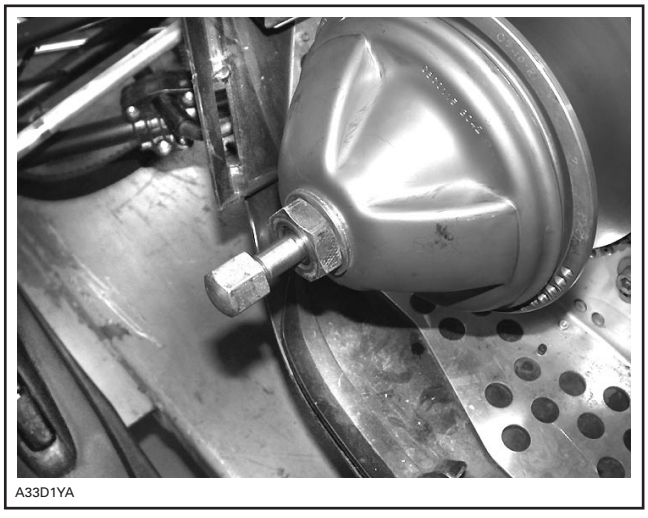


TYPICAL

With the drive pulley holder still installed, install the drive pulley puller (P/N 529 022 400) through the drive pulley.



Hold the drive pulley and screw in the puller then remove drive pulley.



TYPICAL

DISASSEMBLY

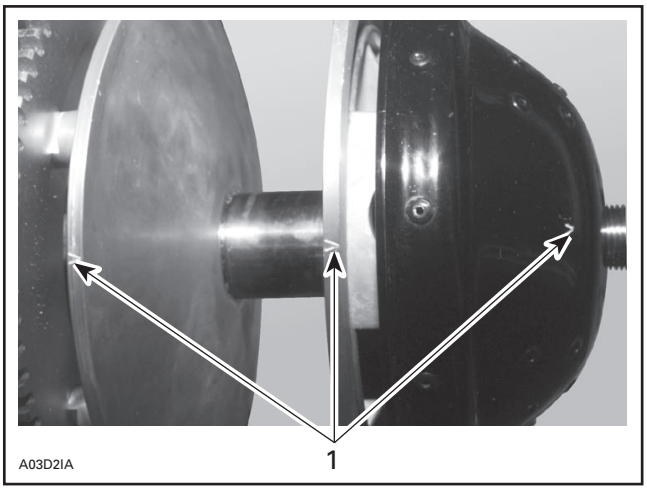
To remove the ring gear **no. 3**, use a heat gun to break the threadlocker on ring gear screws **no. 4** before disassembly.

CAUTION: If another tool than a heat gun is used, do not exceed 150°C (300°F).

NOTE: The ring gear removal is not necessary to disassemble the drive pulley.

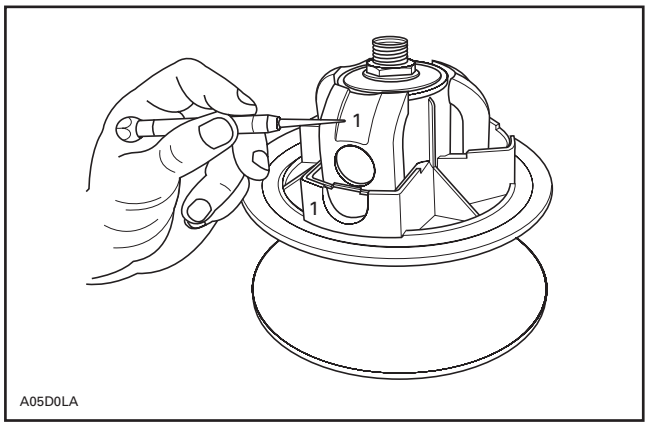
Unscrew nut **no. 5**. Remove washer **no. 6**.

Remove the drive puller cap **no. 7**. Check for alignment marks for proper indexing at reassembly.



1. Alignment marks

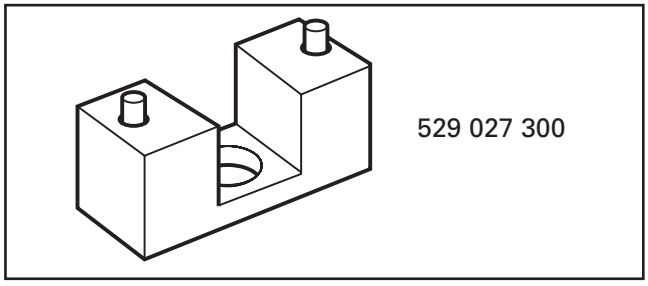
Identify blocks **no. 8** and their respective positive positions for reassembly.

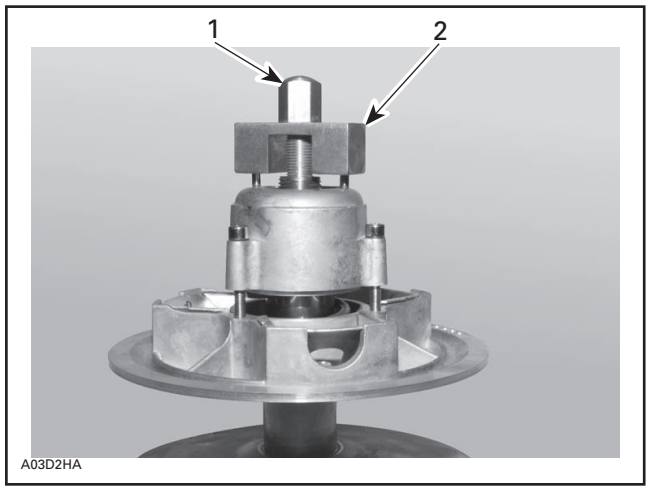


1. Identify

Remove blocks with their calibration weights.

Install the spring cover tool (P/N 529 027 300) with the drive pulley puller (P/N 529 022 400) on spring cover **no. 9**.





1. Drive pulley puller tool
2. Spring cover tool

Screw puller (hand tight) to hold spring cover and remove screws **no. 10** holding spring cover.

Slowly unscrew puller to release spring pressure.

Remove spring cover **no. 9**, spring **no. 11** and spring seat **no. 12**.

CLEANING

Clean pulley faces and shaft with fine steel wool and clean dry cloth. Clean sliding half bushing with clean dry cloth.

INSPECTION

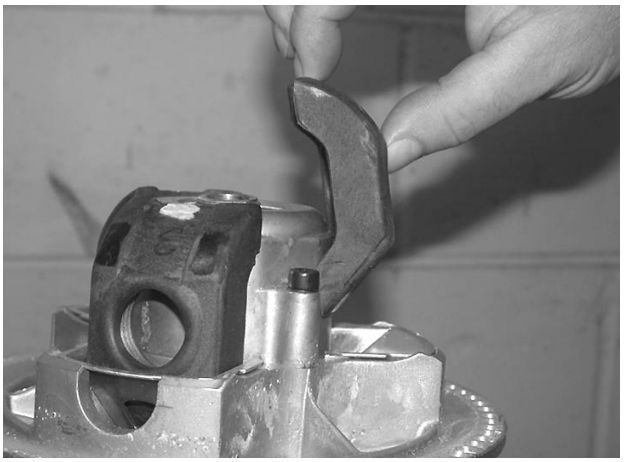
Check surface of sliding half **no. 13** and fixed half **no. 14** for scratches, excessive wear or other damages. Replace if necessary.

Check sliding half for excessive lateral play and fixed half shaft for scratches. Replace as required.

ASSEMBLY

Install spring seat **no. 12** then the spring **no. 11** and its cover **no. 9**.

Make sure to install blocks **no. 8** at their original position and with their curved end toward governor cup. See following illustration.



A33D1ZA

Install washer **no. 6** and nut **no. 5**.

Tighten nut to 128 N•m (95 lbf•ft).

To assemble ring gear **no. 3** on drive pulley, clean threads on back of fixed half **no. 14** and threads of screws **no. 4**.

Apply Loctite 271 (P/N 293 800 005) on screw threads and torque them to 26 N•m (19 lbf•ft).

INSTALLATION

Clean crankshaft taper and inner pulley taper with pulley flange cleaner (P/N 413 711 809).

Install the drive clutch bolt **no. 1** and its lock washer **no. 2**.

Hold the drive clutch with the drive pulley holder (P/N 529 027 600) then torque bolt to 90 N•m (66 lbf•ft).

Install drive belt and belt guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Make sure the track is free of particles that could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Retorque bolt to 95 N•m (70 lbf•ft).

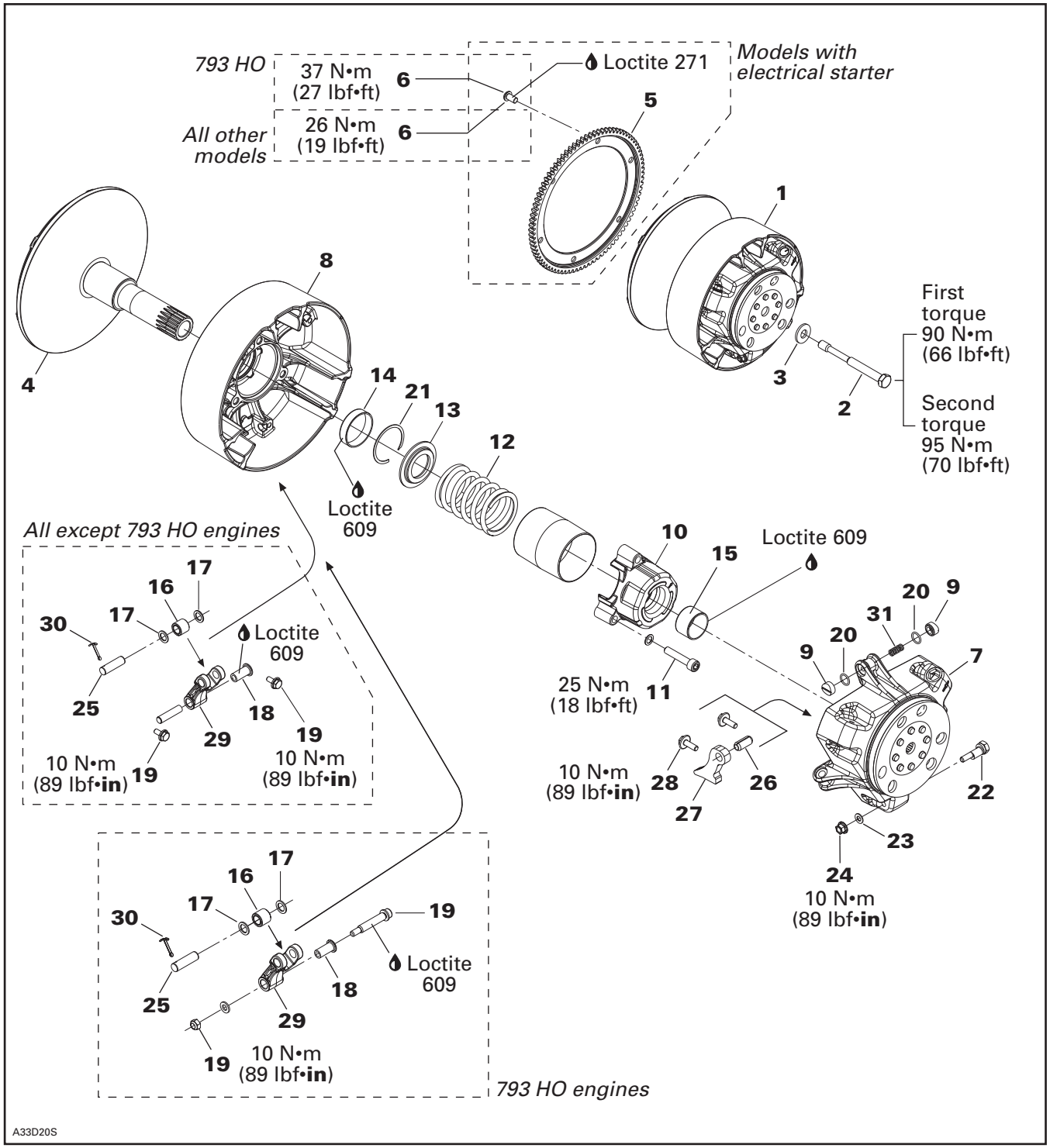
⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

TRA III

All Liquid-cooled Models

NOTE: These are lubrication free drive pulleys. Always refer to appropriate parts catalog for replacement part. Most parts of TRA III are not interchangeable with those of the TRA.



GENERAL

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation. The use of impact wrench could damage the drive pulley and modify the calibration.

Some drive pulley components (return spring, ramp) can be changed to improve vehicle performance in high altitude regions. A service bulletin gives information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance. Verify spring specifications before installation. Do not only refer to the spring color code.

NOTE: TRA drive pulley stands for Total Range Adjustable drive pulley.

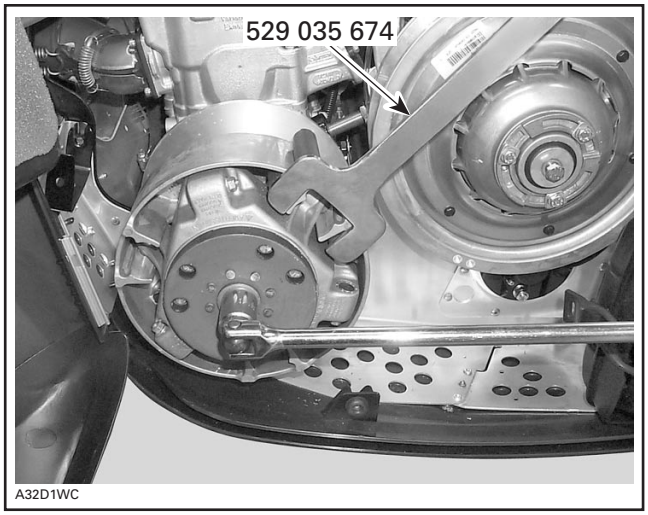
⚠ WARNING

Any drive pulley repairs must be performed by an authorized Ski-Doo dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

REMOVAL

Remove drive belt.

Secure drive pulley **no. 1** with the drive pulley holder (P/N 529 035 674). Install it over a sliding half tower.



INSERT THE TOOL IN SLIDING FLANGE TOWER

Remove the drive pulley bolt **no. 2** and its conical spring washer **no. 3**.

To remove drive pulley **no. 1** and/or fixed half **no. 4** from engine, use the drive pulley puller (P/N 529 022 400).

Retain drive pulley with the drive pulley holder (P/N 529 035 674), and install the puller in pulley shaft then tighten.

CAUTION: These pulleys have metric threads. Do not use imperial threads puller. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs imperial) prior to fully tightening.

DISASSEMBLY

Ring Gear

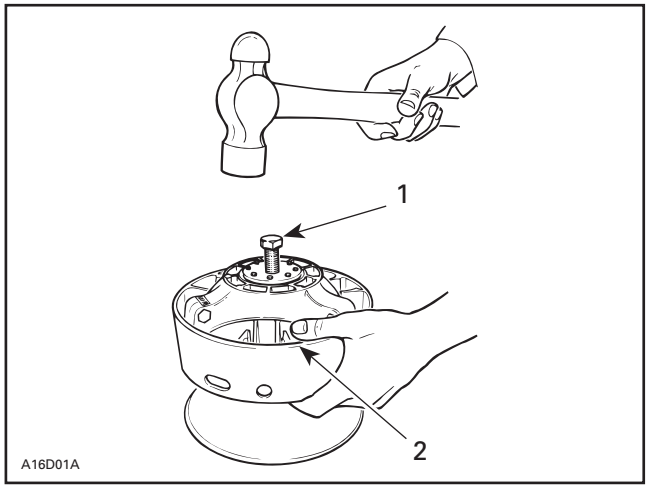
To remove the ring gear **no. 5**, use a heat gun to break the threadlocker on ring gear screws **no. 6** before disassembly.

CAUTION: If another tool than a heat gun is used, do not exceed 150°C (300°F).

Fixed Half

CAUTION: NEVER tap on governor cup no. 7.

To separate fixed half **no. 4** from sliding half **no. 8**, screw puller into fixed half shaft about 13 mm (1/2 in). Raise drive pulley and hold it by the sliding half while knocking on puller head to disengage fixed half.



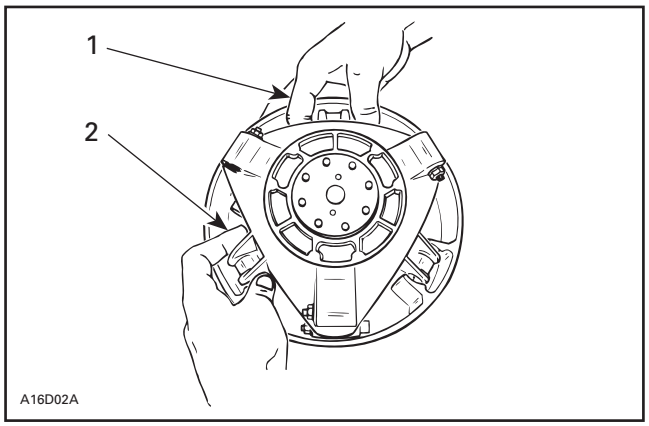
TYPICAL
1. Puller
2. Holding sliding half

NOTE: No components marking is required before disassembling this drive pulley since it has factory mark and arrows as indexing reference.

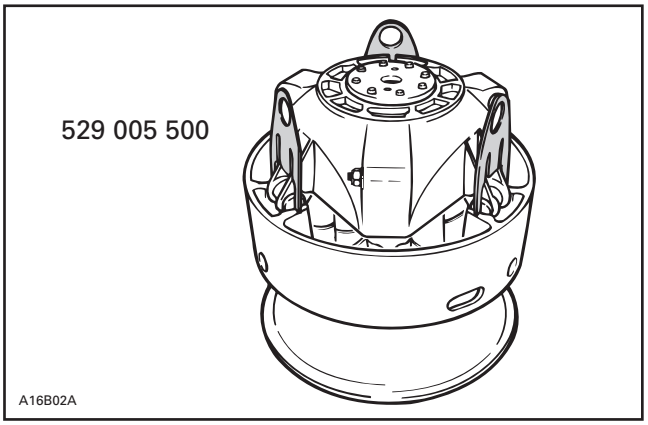
Slider Shoe and Governor Cup

Carefully lift governor cup **no. 7** until slider shoes **no. 9** come at their highest position into guides.

Hold a slider shoe set then carefully lift its housing and install a slider shoe fork (P/N 529 005 500). Proceed the same way for other housings lifting one at a time.



1. Hold slider shoes
2. Lift one housing at a time



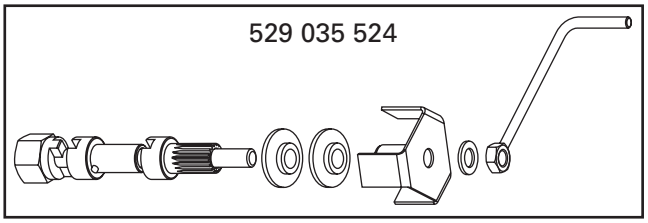
When all slider shoes are held with the forks, remove the governor cup.

Spring Cover

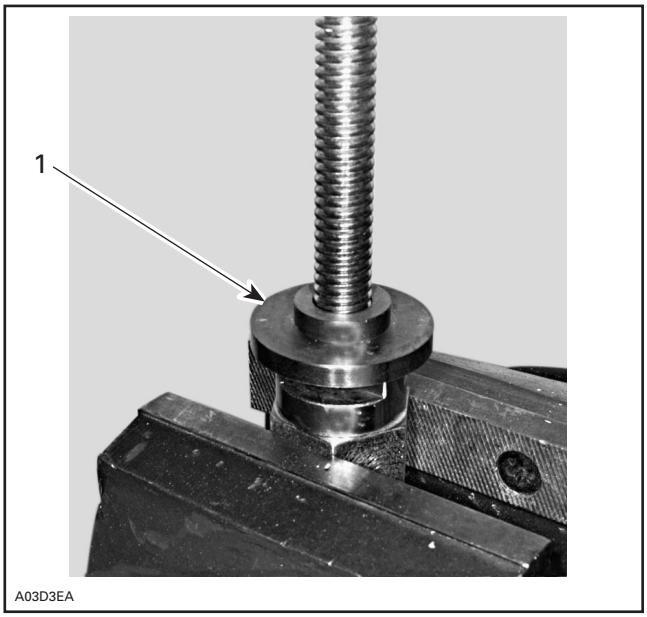
To remove the spring cover **no. 10**, always use the spring compressor (P/N 529 035 524). The spring cover is pushed by clutch spring pressure.

⚠ WARNING

Clutch spring is very strong. Never attempt to remove spring cover without the recommended tools.

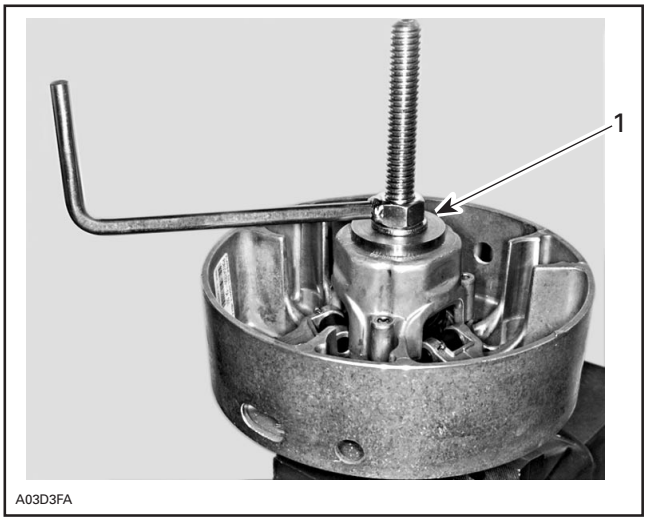


Install support guide of spring compressor in vice.



1. Support guide

Install sliding half **no. 8** then a second support guide. These support guides will prevent bushing damages.



1. Support guide

Remove 3 Allen screws **no. 11** retaining spring cover then unscrew compressor.

Remove spring cover, spring **no. 12** and spring seat **no. 13**.

CLEANING

Fixed and Sliding Halves

Parts must be at room temperature before cleaning.

Clean pulley halves and shaft with fine steel wool and dry cloth.

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean crankshaft tapered end and the taper inside the fixed half of the drive pulley, crankshaft threads and retaining screw threads.

CAUTION: Avoid contact between cleaner and crankshaft seal because damage may occur.

Remove all hardened oil deposits that have baked on crankshaft and pulley tapered surfaces with coarse or medium steel wool and/or sand paper no. 600.

CAUTION: Do not use any other type of abrasive.

Reclean mounting surfaces with paper towel and cleaning solvent.

Wipe off the mounting surfaces with a clean, dry paper towel.

CAUTION: Mounting surfaces must be free of any oil, cleaner or towel residue.

Bushings

Clean sliding half bushing **no. 14** and spring cover bushing **no. 15** only with a petrol-based cleaner.

CAUTION: Do not use acetone to clean bushing.

INSPECTION

Drive pulley should be inspected annually.

Thrust Washer and Roller

Check rollers **no. 16** for roundness of external diameter. Check thrust washers **no. 17** for thickness wear. Replace as required.

CAUTION: Ensure rollers are in good condition. Replace as required.

Lever Bolt and Flanged Bushing

Check the flanged bushings **no. 18** for wear. Replace if necessary.

Check lever bolts **no. 19** for wear, replace as required.

O-ring and Slider Shoe

Check if O-rings **no. 20** are cracked, cut or crushed. Replace as required.

Check slider shoes **no. 9** for wear. Replace if groove is not apparent on top.

Fixed Half and Governor Cup

Inspect splines and free play between both parts. Maximum free play is 0.5 mm (.020 in) measured at calibration screw radius. Replace if required.

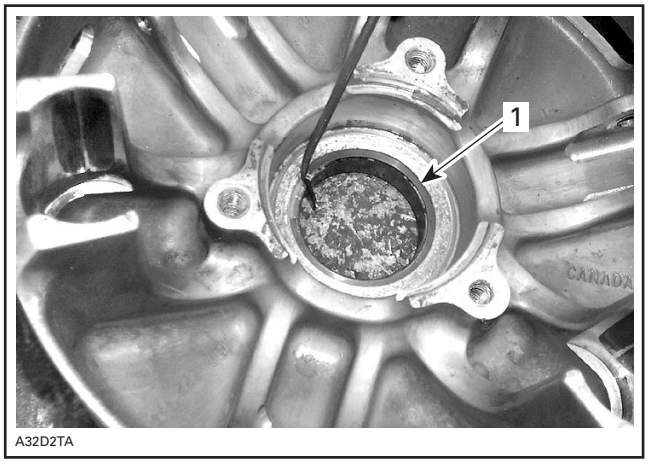
Sliding Half and Spring Cover Bushings

Visually inspect coating of bushings **no. 14** and **no. 15**. Replace if worn.

Sliding Half Bushing Replacement

NOTE: In case of worn out bushing, it is advisable to replace whole sliding half assembly as replacing just the bushing may reduce the drive pulley performance.

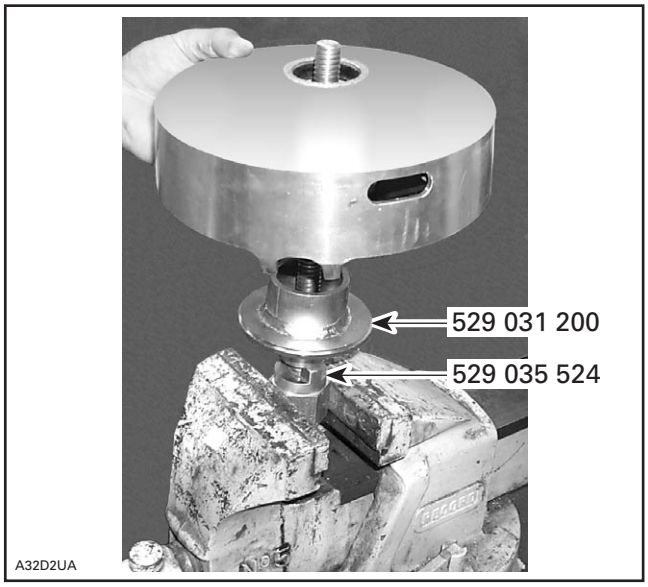
Remove circlip **no. 21** from the sliding half.



A32D2TA

1. Circlip

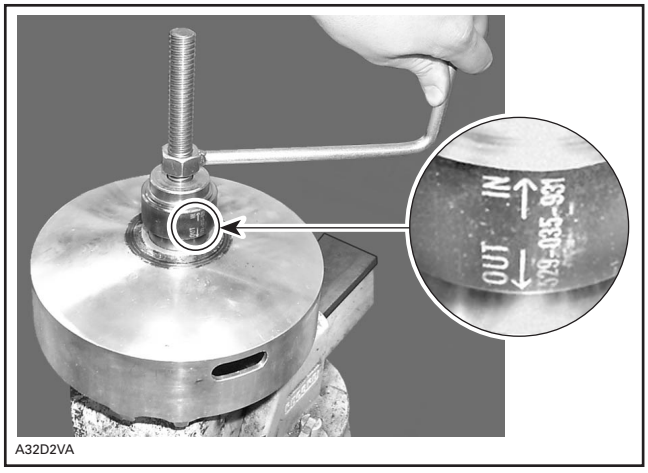
Secure the spring compressor (P/N 529 035 524) in a vice. Mount the bushing remover/installer (P/N 529 031 200) and the sliding half assembly on it.



A32D2UA

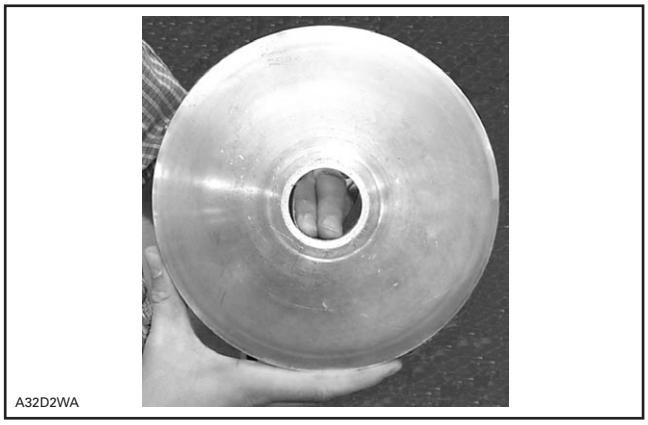
Use the sliding half bushing remover/installer (P/N 529 035 931) to press out old bushing.

NOTE: Make sure to use the tool as marked; to remove the bushing press using the side marked "OUT", as shown below in the picture.



A32D2VA

Use a soft sand paper to clean sliding half bushing mounting surface.


A32D2WA

Clean sliding half bushing mounting surface with pulley flange cleaner (P/N 413 711 809).

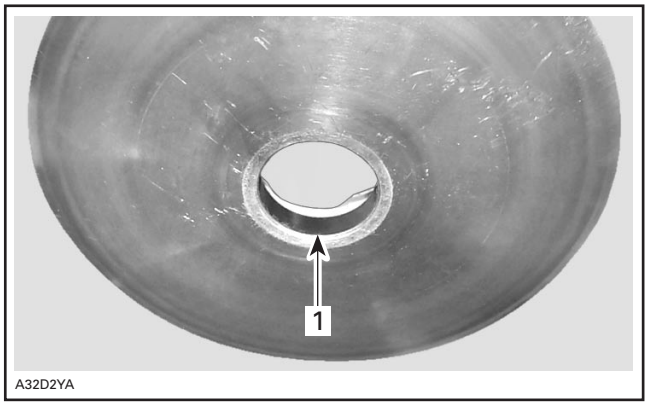
To install a new bushing, secure the spring compressor (P/N 529 035 524) in a vice and mount the sliding half.

Apply Loctite 609 (P/N 413 703 100) on the outside of bushing face then insert the bushing from inner side of sliding half.

Mount the sliding half bushing remover/installer (P/N 529 035 931) with side marked "IN" to press in a new bushing.

A32D2XA

NOTE: Make sure that the bushing is well seated on the sliding half.



A32D2YA

1. Bushing

Install the circlip.

A32D2ZA

1. Circlip

Spring Cover Bushing Replacement

Under normal use there is no need to replace this bushing **no. 15**.

In case of replacement, it's recommended to replace spring cover ass'y.

ASSEMBLY

NOTE: This drive pulley is lubrication free. Do not lubricate any component.

Ring Gear

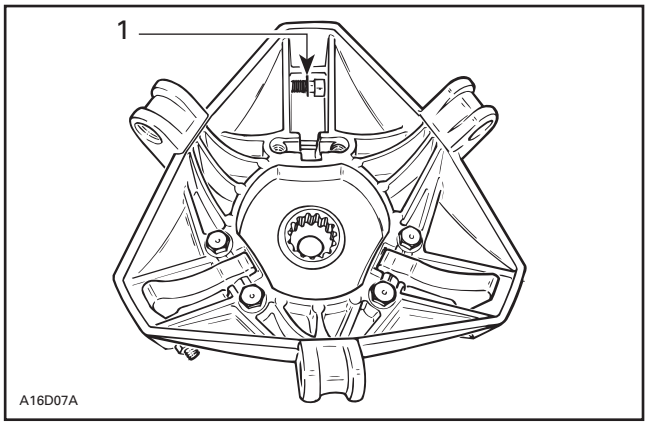
Clean ring gear **no. 5** and the inner threads of fixed half **no. 4**.

Apply Loctite 271 (P/N 293 800 005) on ring gear screw threads and then torque.

RING GEAR ON TRA III	
ENGINES	TORQUE
All models except 793 HO	37 N•m (27 lbf•ft)
All 793 HO	27 N•m (20 lbf•ft)

Calibration Screw, Washer and Locking Nut

When installing calibration screw **no. 22**, make sure to install washer **no. 23** as shown.



TYPICAL
1. Washer

The calibration screws should be installed at the following position.

CALIBRATION SCREW		
MODELS	ENGINES	POSITION
GSX	593 and 593 HO SDI	4
	593 HO and 793 HO	3
GTX	593 and 593 HO SDI	4
	593 HO and 793 HO	3
MXZ	593, 593 HO and 793 HO	3
	593 HO SDI	4
Summit	593 HO and 793 HO	1

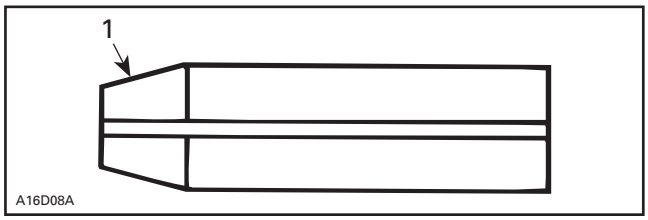
Torque locking nut **no. 24** to 10 N•m (89 lbf•**in**).

Pin

Always use the same type of pin **no. 25** as originally installed when servicing. Different types have different weights for calibration purpose. Refer to TECHNICAL DATA.

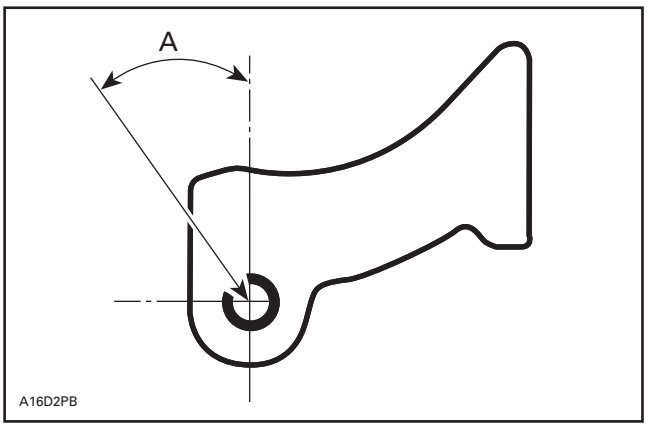
Dowel Tube and Ramp

Insert dowel tube **no. 26** from chamfered side. Make sure ramp **no. 27** is centered on dowel tube.

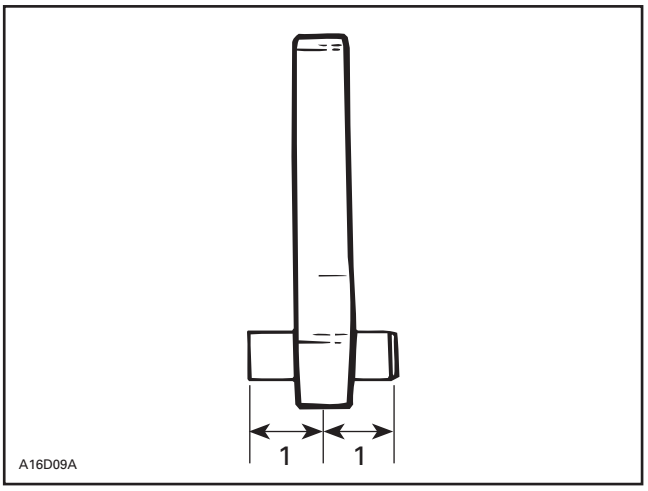


1. Chamfered side

Position dowel tube split at the angle A.



MODEL	ANGLE (A)
With TRA III	45 ± 3°



1. Equal distance

Torque screws **no. 28** to 10 N•m (89 lbf•**in**).

Lever, Nut and Cotter Pin

NOTE: While installing lever no. 29 make sure that the curved sides of the levers are outwards as shown.

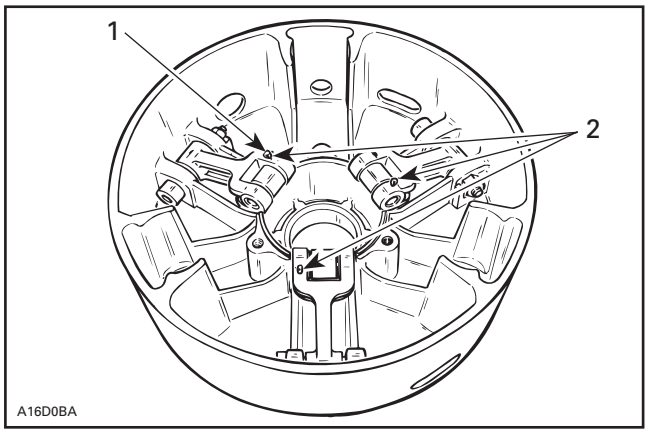
Always install lever assemblies so that cotter pins no. 30 are on the shown side. Besides install cotter pin head on top when lever is sat at bottom of sliding half. Bend cotter pin ends to sit perfectly against lever.

⚠ WARNING

Whenever replacing centrifugal levers, always replace all 3 at the same time. Otherwise, drive pulley misbalancing will occur because of levers difference.

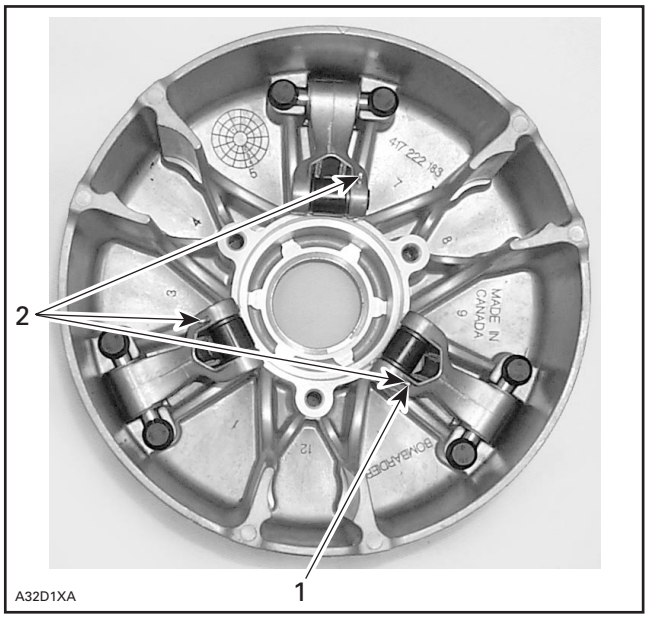
CAUTION: Lever assemblies must be installed so that cotter pins are on the same side.

793 HO Engine Equipped Models Only



TYPICAL
1. Head on top
2. All on the same side

593 /HO/SDI Engine Equipped Models Only



1. Head on top
2. All on the same side

All Models

Torque screws no. 19 as per the exploded view.

CAUTION: Lever ass'y and rollers must move easily after installation.

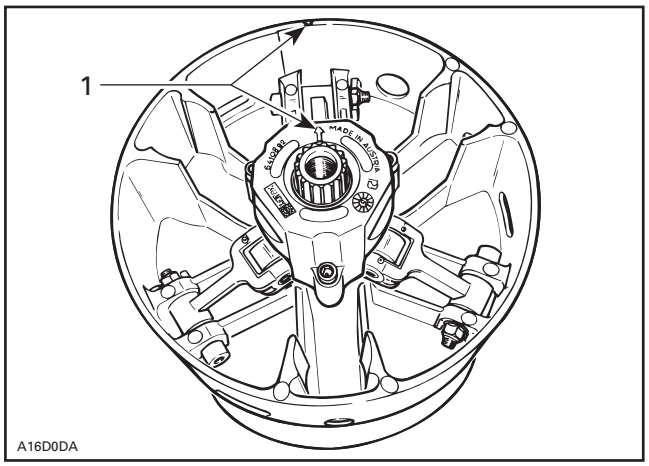
Fixed Half, Sliding Half, Spring and Spring Cover

To install spring cover, use spring compressor (P/N 529 035 524).

Assemble fixed and sliding halves. Note that fixed halves have different taper angle. Match taper angle with crankshaft.

Lift sliding half against spring cover and align spring cover arrow with sliding half mark.

793 HO Engine Equipped Models



TYPICAL
1. Align

593/HO/SDI Engine Equipped Models Only

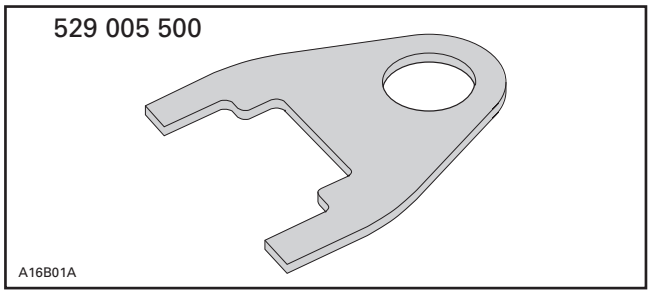
1. Align

All Models

Tighten screws **no. 11** to proper torque as mentioned in exploded view.

Sliding Half, Slider Shoe and Governor Cup

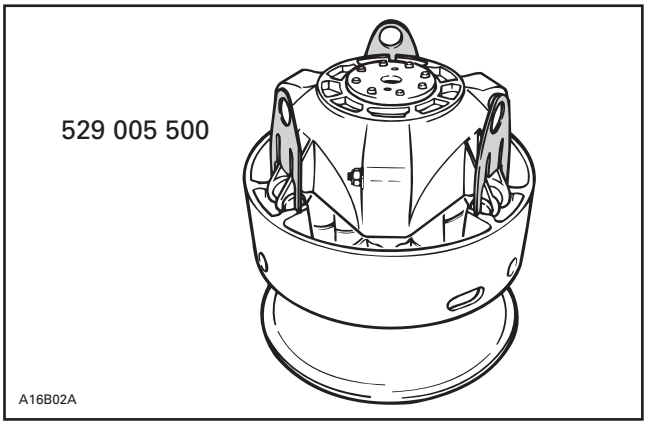
To install governor cup, use the slider shoe fork (P/N 529 005 500) following tool:



Insert spring **no. 31** and slider shoes **no. 9** into governor cup **no. 7** so that groove in each slider shoe is vertical to properly slide in guides.

CAUTION: Make sure O-rings are installed on slider shoes.

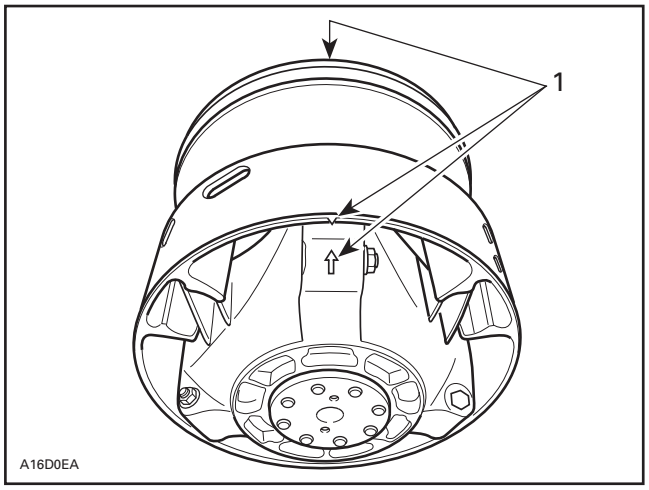
Install a slider shoe fork into slider shoe grooves to maintain them for governor cup installation. Proceed on 3 set of slider shoes.



TYPICAL

Make sure to align governor cup arrow with sliding half and fixed half mark.

NOTE: If fixed half has no mark, align governor cup mark with **segment no. 1 of inner half**. Segments are identified on engine side.



TYPICAL
1. Align

Carefully slide governor cup into sliding half. Align mark of governor cup with mark of fixed half.

Remove forks and push governor cup so that its splines engage with fixed half shaft splines.

INSTALLATION

⚠ WARNING

Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

Clean mounting surfaces as described in CLEANING above.

Drive Pulley Ass'y

The following installation procedure must be strictly adhered.

Install drive pulley on crankshaft extension.

Install a new conical spring washer **no. 3** with its concave side towards drive pulley then install drive pulley bolt **no. 2**.

⚠ WARNING

Never substitute conical spring washer and/or bolt with jobber ones. Always use BRP genuine parts for this particular case.

Use the drive pulley holder (P/N 529 035 674). See removal procedure.

Torque screw to 90 N•m (66 lbf•ft).

Install drive belt and guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Retorque screw to 95 N•m (70 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

DRIVE PULLEY ADJUSTMENT

The drive pulley is factory calibrated to transmit maximum engine power at a predefined RPM. Factors such as ambient temperature, altitude or surface condition may vary this critical engine RPM thus affecting snowmobile efficiency.

This adjustable drive pulley allows setting maximum engine RPM in the vehicle to maintain maximum power.

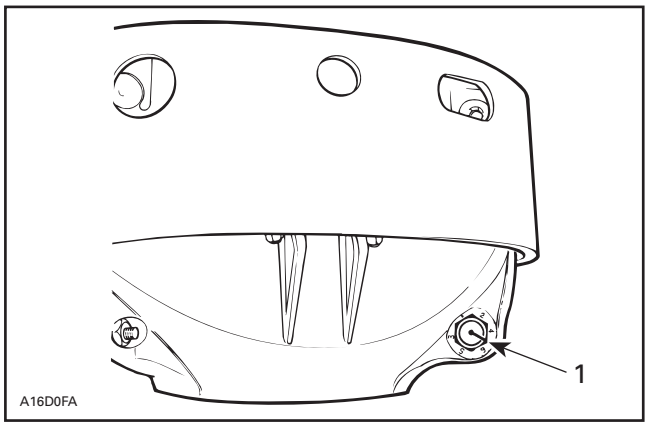
Calibration screws should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in TECHNICAL DATA.

NOTE: Use precision digital tachometer for engine RPM adjustment.

NOTE: The adjustment has an effect on high RPM only.

To adjust, modify ramp end position by turning calibration screws.

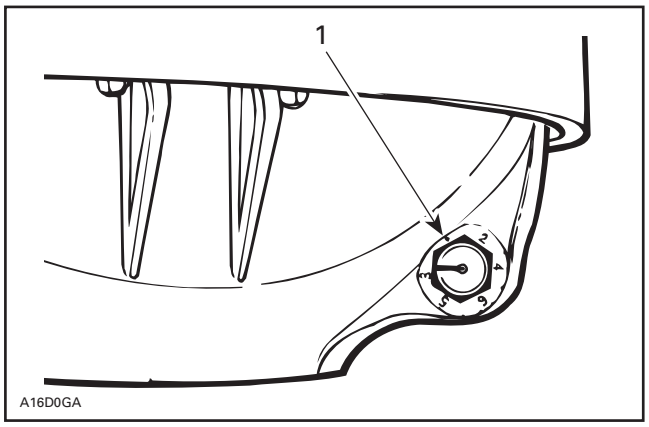
Calibration screw has a notch on top of its head.



1. Notch

Governor cup has 6 positions numbered 2 to 6. Note that in position 1 there is no stamped number (due to its location on casting).

See TECHNICAL DATA for original setting.



1. Position 1 (not numbered)

Each number modifies maximum engine RPM by about 200 RPM.

Lower numbers decrease engine RPM in steps of 200 RPM and higher numbers increase it in steps of 200 RPM.

Example:

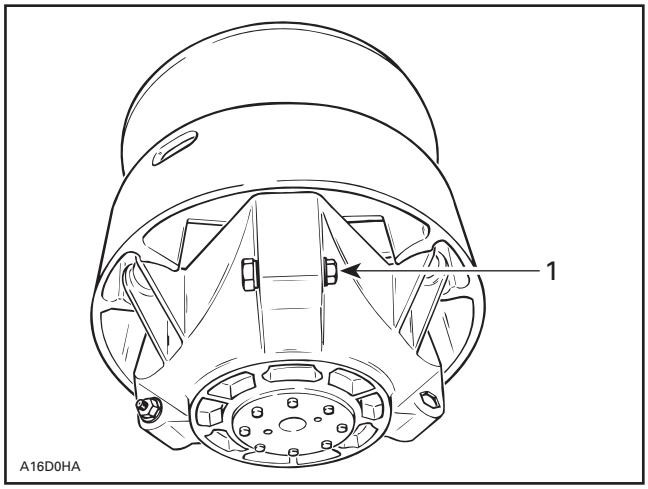
Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

To Adjust:

Just loosen locking nut enough to pull calibration screw **partially** out and adjust to desired position. Do not completely remove the locking nut. Torque locking nuts to 10 N•m (89 lbf•**in**).

CAUTION: Do not completely remove calibration screw otherwise its inside washer will fall off.

CAUTION: Always adjust all 3 calibration screws and make sure they are all set at the same number.



TYPICAL
1. Loosen just enough to permit rotating of calibration screw

DRIVEN PULLEY

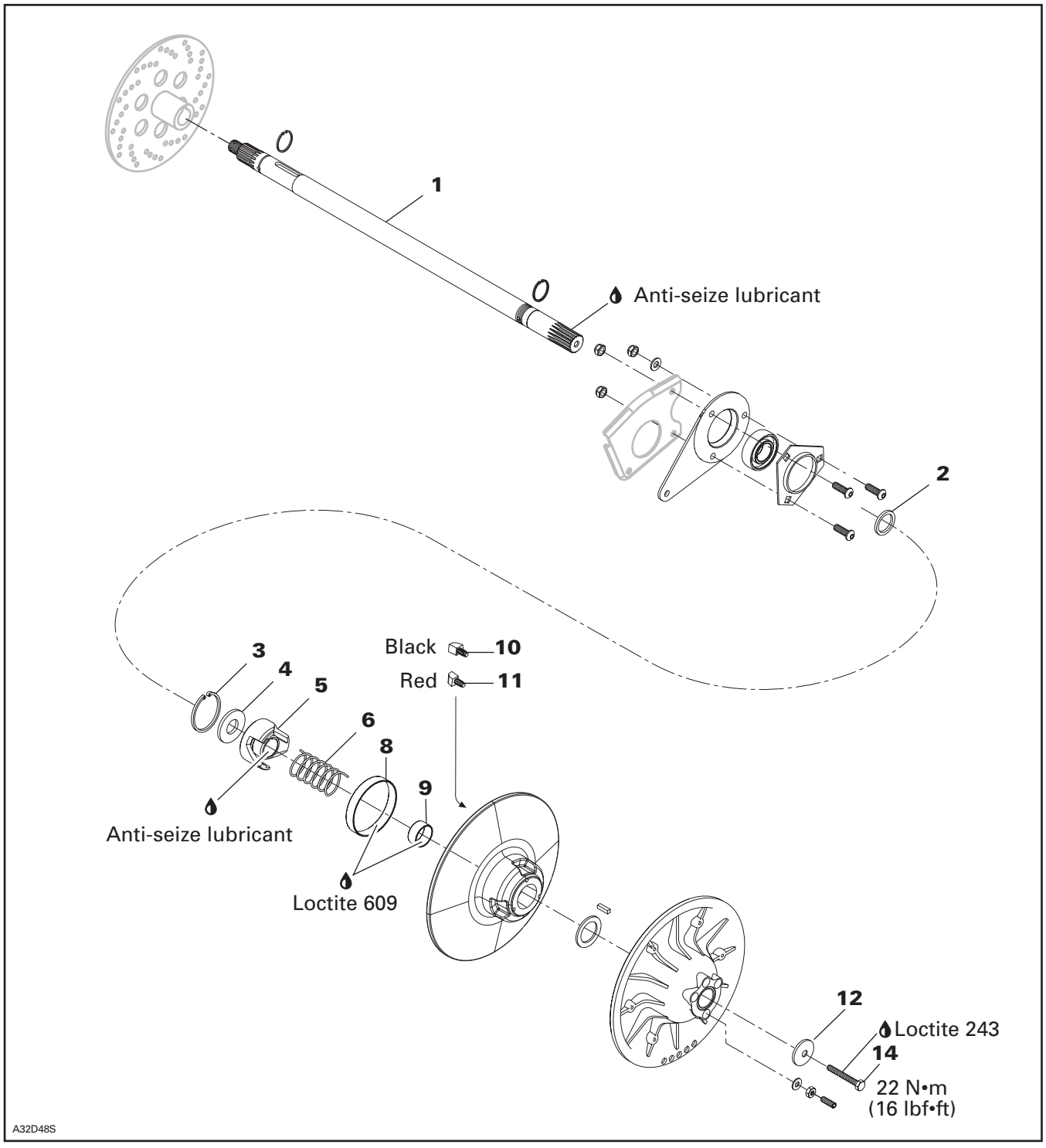
SERVICE TOOLS

Description	Part Number	Page
clutch spring compressor	529 035 524	341–343, 346
large bushing extractor	529 031 100	342
large bushing extractor	529 035 575	342
spring scale hook	529 006 500	344, 347

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 609	413 703 100	342
Loctite antiseize lubricant	293 800 070	343, 347
pulley flange cleaner	413 711 809	341, 346

FORMULA RER AND FORMULA VSA-R



REMOVAL

Remove guard and drive belt from vehicle.

Remove pulley retaining screw **no. 14** and shouldered washer **no. 12** then pull the driven pulley from the countershaft.

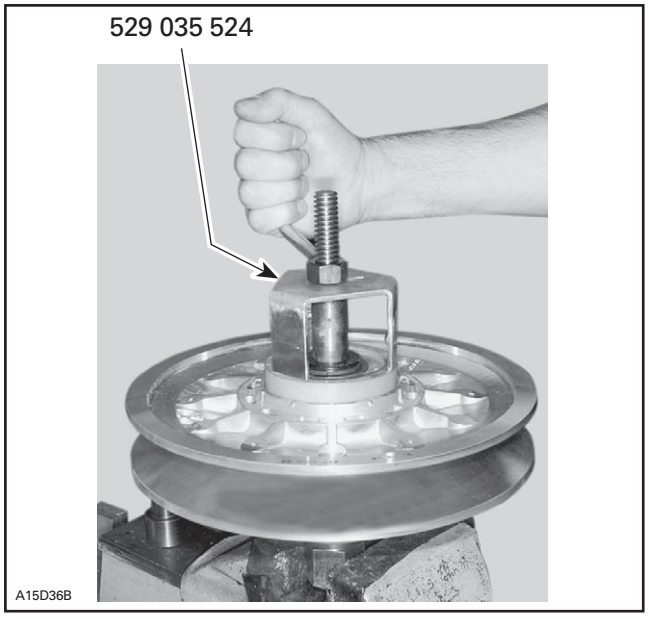
Take care not to lose spacer **no. 2**.

Countershaft

Should countershaft **no. 1** removal be required, refer to BRAKE then look for COUNTERSHAFT and BRAKE DISC REMOVAL.

DISASSEMBLY

Use clutch spring compressor (P/N 529 035 524).



TYPICAL

Remove circlip **no. 3** and washer **no. 4** to disassemble the outer cam and the 2 pulley halves.

NOTE: Before removing cam and spring, note position of spring in fixed half (position A,B or C) and the position in the cam (1 to 6). These positions will help during assembly.

⚠ WARNING

Driven pulley cam is spring loaded, use above mentioned tool.

CLEANING

Large Bushing and Small Bushing

During break-in period (about 10 hours of use), teflon from bushing **no. 8** and **no. 9** moves to cam or shaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or shaft. Do not remove that deposit, it is not dust.

When a dust deposit has to be removed from the cam or the shaft, use dry cloth to avoid removing transferred teflon.

Pulley Half Cleaning

Use pulley flange cleaner (P/N 413 711 809) to clean pulley halves.

INSPECTION

Bushings

Check the bushings **no. 8** and **no. 9** for cracks, scratch and for free movement when assembled to fixed half.

Using a dial bore gauge measure bushing diameter. Measuring point must be at least 5 mm (1/4 in) from bushing edge.

Replace bushing(s) if worn more than specified.

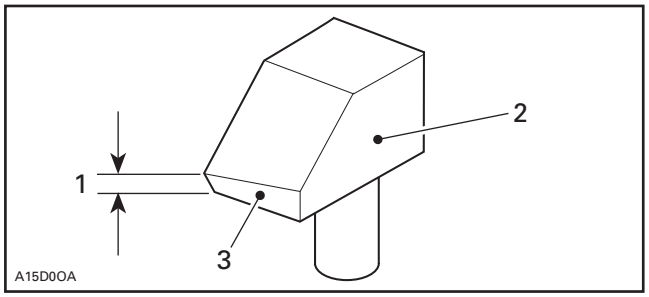
DRIVEN PULLEY BUSHING WEAR LIMIT mm (in)	
Small bushing	38.30 (1.508)
Large bushing	108.2 (4.260)

Slider Shoe

Black slider shoe = forward.

Red slider shoe = reverse.

Check cam slider shoes **no. 10** and **no. 11** for wear. Replace when inside edge thickness of cam slider shoe slope base is worn to 1 mm (.039 in) or less.



1. Measure thickness of slope base here
2. Sliding pulley side
3. Slope base

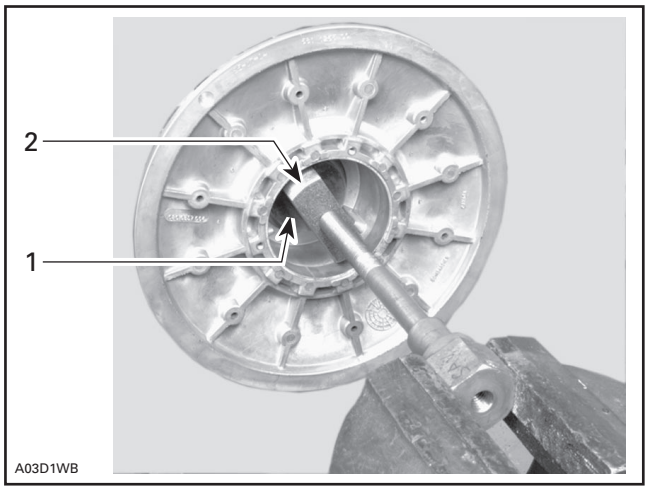
BUSHING REPLACEMENT

Large Bushing

Remove Allen screws if applicable. Heat to break Loctite bond.

Install the support plate included in the large bushing extractor (P/N 529 031 100) inside sliding half.

Place the large bushing extractor (P/N 529 035 575) below bushing.



TYPICAL
1. Support plate
2. Extractor

Mount screw head of the clutch spring compressor (P/N 529 035 524) in a vise.

Turn pulley half by hand to extract old bushing.

Before bushing installation, file sliding half bore to remove burrs from crimping areas.

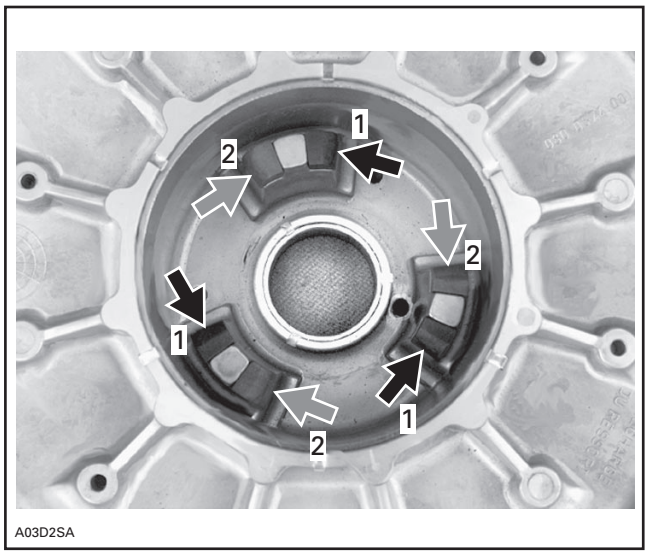
Coat bushing outside diameter with Loctite 609 (P/N 413 703 100). Place new bushing on sliding half and slightly tap to engage squarely the bushing in the sliding.

ASSEMBLY

Cam Slider Shoe

When replacing slider shoes **no. 10** and **no. 11**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Install slider shoes as per following photo. Red slider shoes are being used for reverse and black ones for forward.



A03D2SA

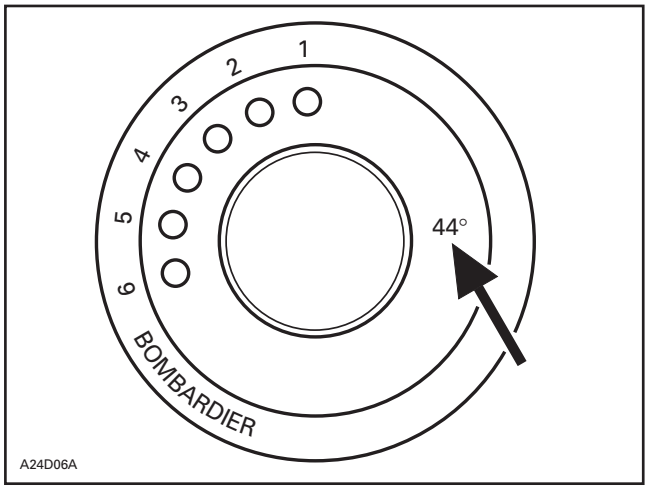
1. BLACK slider shoe
2. RED slider shoe

Assemble driven pulley components by reversing the disassembly procedure.

Cam and Spring

Make sure to install proper cam. Refer to TECHNICAL DATA.

Cam angle is identified on cam.



A24D06A

Install spring **no. 6** in sliding half with its end inserted in hole B.

Position cam **no. 5** then insert spring in adjusting hole no. 2 into outer cam.

IMPORTANT: With the spring ends at positions B and 2, spring preload is equal to zero (0). To work properly, the driven pulley must have a zero preload.

Compress outer cam using the clutch spring compressor (P/N 529 035 524). Install washer **no. 4** then secure outer cam with circlip **no. 3**.

CAUTION: Ensure that circlip is properly inserted into shaft groove and that spacer recess is facing circlip.

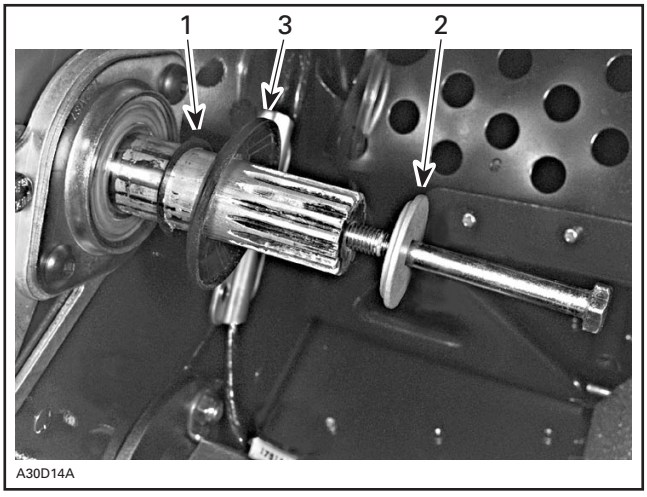
INSTALLATION

Countershaft

Apply Loctite antiseize lubricant (P/N 293 800 070) on countershaft splines.

CAUTION: Always apply antiseize on the countershaft before final pulley installation to prevent a possible seizing up between pulley and countershaft.

Make sure that spacer **no. 2** is on countershaft **no. 1** before installing driven pulley. Note also that washer shoulder is facing driven pulley.



A30D14A

TYPICAL
1. Spacer
2. Shoulder on this side
3. Concave side facing driven pulley

Should installation procedure be required, refer to BRAKE then look for BRAKE DISC and COUNTERSHAFT BEARING ADJUSTMENT.

Reinstall the pulley on the countershaft by reversing the removal procedure.

Pulley Retaining Screw

Torque pulley retaining screw **no. 14** to 25 N•m (18 lbf•ft).

ADJUSTMENT

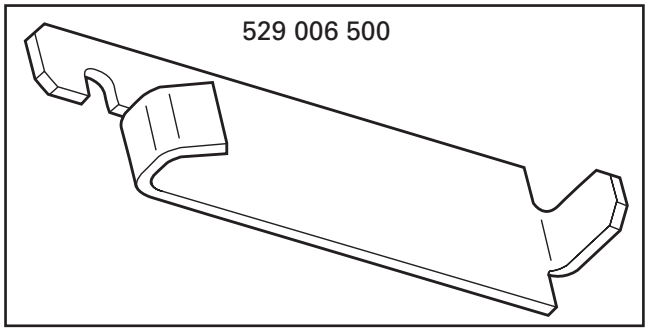
Cam

Make sure to install proper cam. Refer to TECHNICAL DATA.

Cam angle is identified on cam.

Spring

To check spring preload adjustment, use the spring scale hook (P/N 529 006 500) and a spring scale.



Remove drive belt.

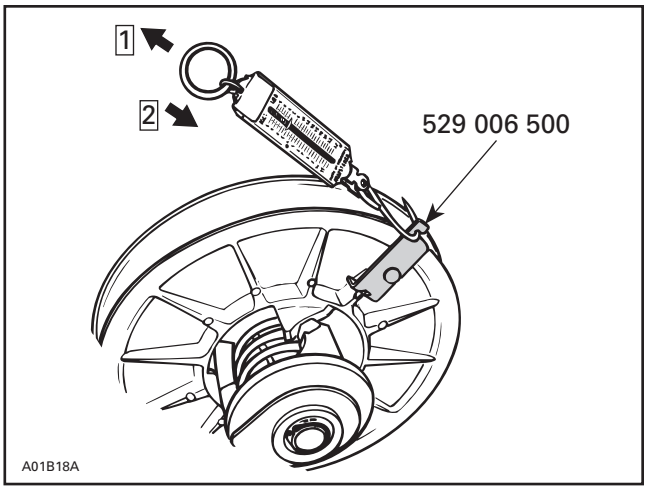
Install the hook on the sliding half. Preventing fixed half from turning, pull sliding half with the spring scale perpendicularly with pulley axle.

Take first measurement when sliding half begins to turn. Rotate sliding half to 10 mm (3/8 in) of rotation. Hold spring scale at this position. Slowly release tension from spring scale and take second measurement when sliding half begins to return. Spring preload is the average measurement between these 2.

$$\frac{\text{First measurement (when opening)} + \text{Second measurement (when closing)}}{2} = \text{Spring preload}$$

EXAMPLE:

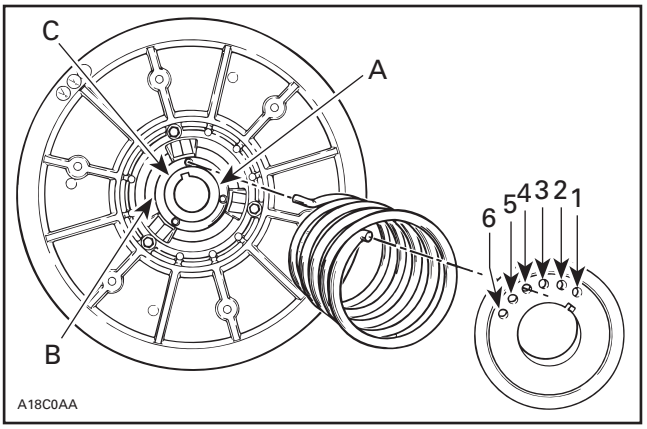
$$\frac{3.8\ \text{kg}\ (8.4\ \text{lb})\ \text{(when opening)} + 3.4\ \text{kg}\ (7.5\ \text{lb})\ \text{(when closing)}}{2} = 3.6\ \text{kg}\ (8\ \text{lb})\ \text{actual spring preload}$$



TYPICAL
1. *Pull for the first measurement*
2. *Release slowly for the second measurement*

To adjust spring preload, relocated spring end in cam, moving it clockwise to increase the preload and counterclockwise to decrease it. Refer to TECHNICAL DATA.

NOTE: If the spring preload can not be adjusted, try to relocate the other end of spring in sliding pulley (holes A, B or C).



LETTERS AND NUMBERS SHOWN IN ILLUSTRATION ARE ACTUAL LETTERS AND NUMBERS EMBOSSED ON PARTS

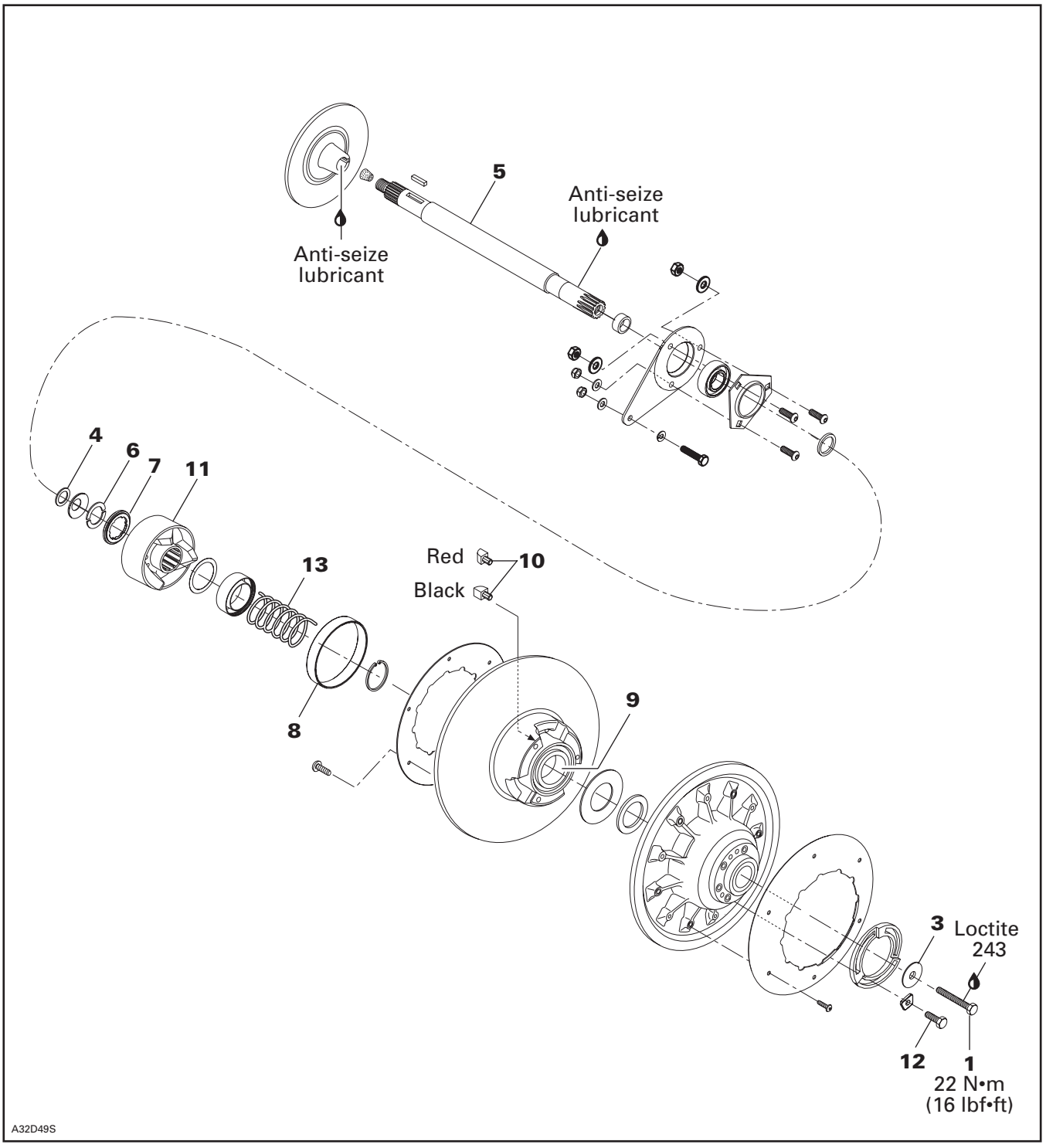
NOTE: Always recheck torsional preload after adjusting.

Pulley Alignment and Drive Belt Deflection

Refer to PULLEY ALIGNMENT and DRIVE BELT to perform adjustments.

CAUTION: Drive belt and pulley alignment must always be checked whenever pulleys have been removed, replaced or disassembled.

HPV VSA

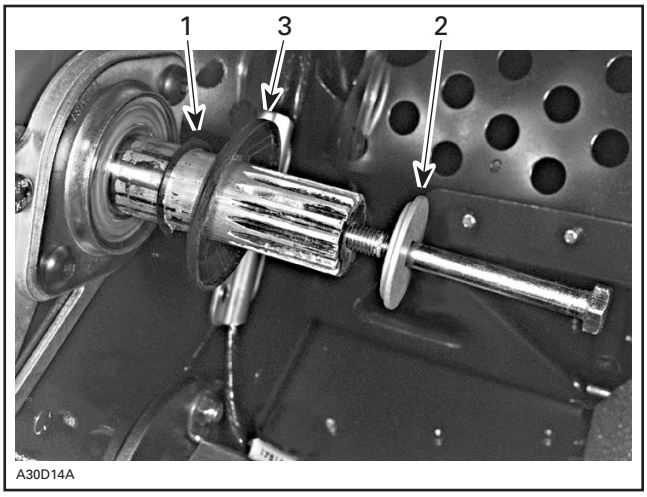

5
Anti-seize lubricant
Anti-seize lubricant
4
6
7
11
13
Red
10
Black
8
9
3
Loctite 243
12
1
22 N•m
(16 lbf•ft)
A32D49S

REMOVAL

Remove guard and drive belt from vehicle.

Remove cap screw **no. 1** and shouldered washer **no. 3** then pull the driven pulley from the countershaft.

Note shouldered washer position for reinstallation. Take care not to lose spacer **no. 4**.



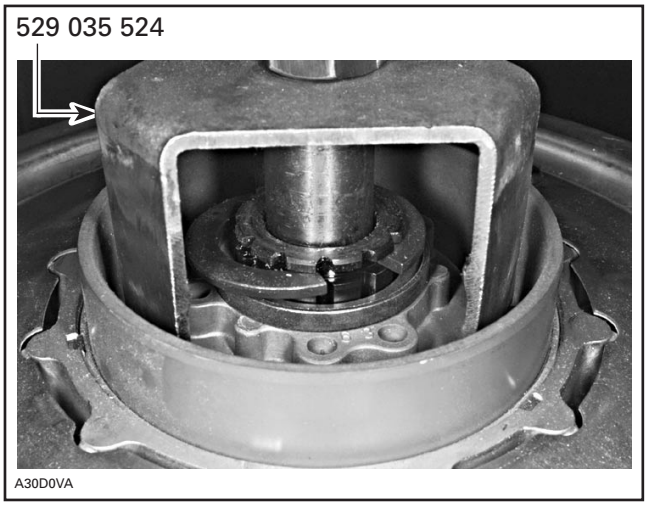
1. Spacer
2. Shoulder on this side
3. Concave side facing driven pulley

Countershaft

Should countershaft **no. 5** removal be required, refer to BRAKE then look for COUNTERSHAFT AND BRAKE DISC REMOVAL.

DISASSEMBLY

Use clutch spring compressor (P/N 529 035 524).



Remove half keys **no. 6** and washer **no. 7** to disassemble the cam and the 2 pulley halves.

⚠ WARNING

Driven pulley cam is spring loaded, use above mentioned tool.

CLEANING

Large Bushing and Small Bushing

During break-in period (about 10 hours of use), teflon from bushing **no. 8** and **no. 9** moves to cam or shaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or shaft. Do not remove that deposit, it is not dust.

When a dust deposit has to be removed from the cam or the shaft, use dry cloth to avoid removing transferred teflon.

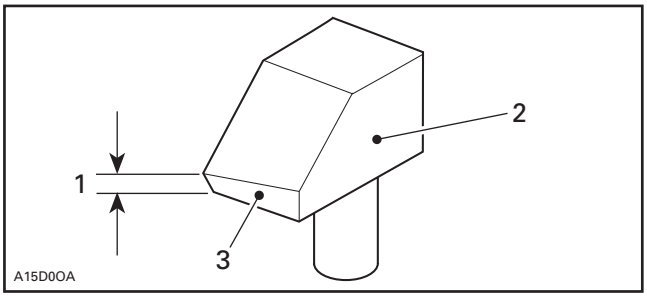
Pulley Half Cleaning

Use pulley flange cleaner (P/N 413 711 809) to clean pulley halves.

INSPECTION

Slider Shoe

Check cam slider shoes **no. 10** for wear. Replace when inside edge thickness of cam slider shoe slope base is worn to 1 mm (.039 in) or less.



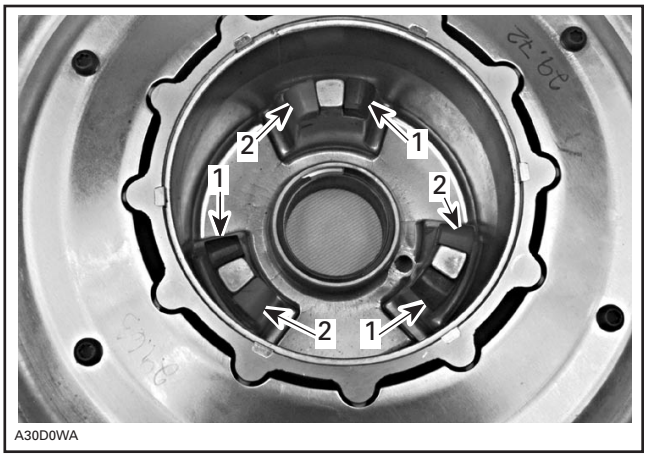
1. Measure thickness of slope base here
2. Sliding pulley side
3. Slope base

ASSEMBLY

Cam Slider Shoe

When replacing slider shoes **no. 10**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Install slider shoes as per following photo. Red slider shoes are being used for reverse and black ones for forward.



1. BLACK slider shoe
2. RED slider shoe

Screws

Screws **no. 12** are machined at their end. With the adjustment ring steel to position 0 (zero), screw ends are flush with inner side of fixed pulley half when tighten.

CAUTION: If any of these screws is not flush with inner side of sliding pulley, bushings will worn unequally.

Assemble driven pulley components by reversing the disassembly procedure.

Cam

Coat cam **no. 11** interior with Loctite antiseize lubricant (P/N 293 800 070).

INSTALLATION

Countershaft

Apply Loctite antiseize lubricant (P/N 293 800 070) on countershaft splines.

CAUTION: Always apply antiseize lubricant on the countershaft before final pulley installation to prevent a possible seizing up between pulley and countershaft.

Should installation procedure be required, refer to BRAKE then look for BRAKE DISC and COUNTERSHAFT BEARING ADJUSTMENT.

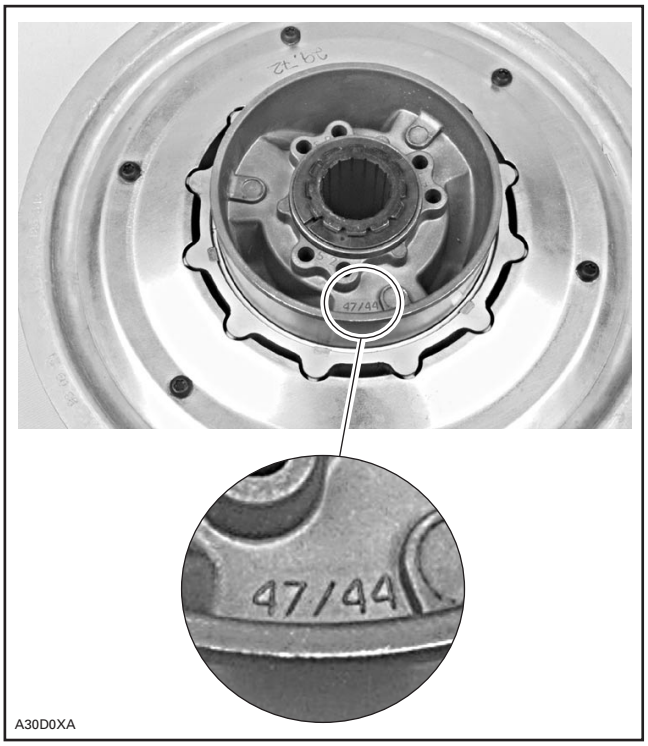
Reinstall the pulley on the countershaft **no. 5** by reversing the removal procedure.

ADJUSTMENT

Cam

Make sure to install proper cam **no. 11**. Refer to TECHNICAL DATA.

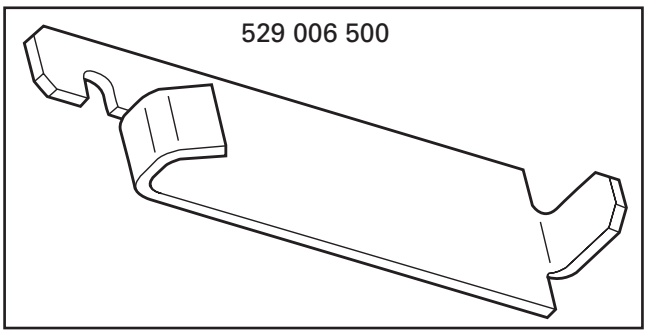
Cam angle is identified on cam.



NOTE: For high altitude regions, a service bulletin will give information about calibration according to altitude.

Spring

To check spring preload adjustment, use the spring scale hook (P/N 529 006 500) and a spring scale.



Remove drive belt.

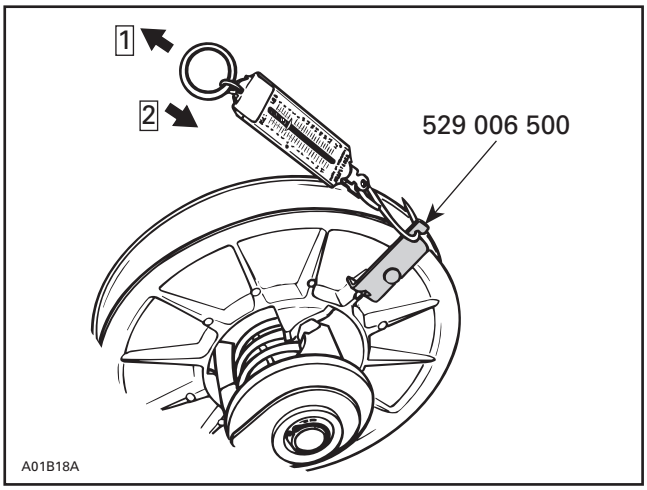
Install the hook on the sliding half. Preventing fixed half from turning, pull sliding half with the spring scale perpendicularly with pulley axle.

Take first measurement when sliding half begins to turn. Rotate sliding half to 10 mm (3/8 in) of rotation. Hold spring scale at this position. Slowly release tension from spring scale and take second measurement when sliding half begins to return. Spring preload is the average measurement between these 2.

$$\frac{\text{First measurement (when opening)} + \text{Second measurement (when closing)}}{2} = \text{Spring preload}$$

EXAMPLE:

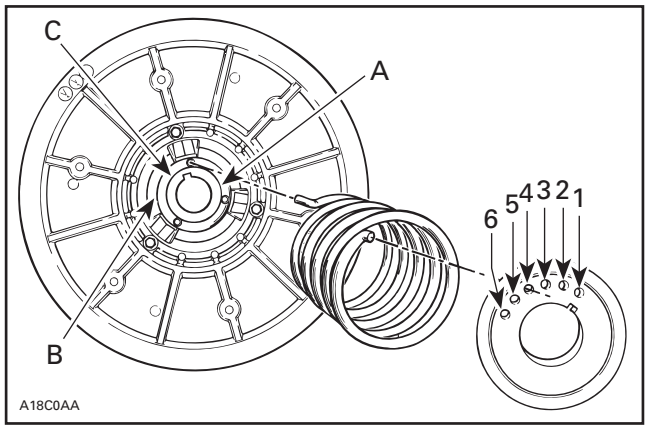
$$\frac{\text{3.8 kg (8.4 lb) (when opening)} + \text{3.4 kg (7.5 lb) (when closing)}}{2} = \text{3.6 kg (8 lb) actual spring preload}$$



TYPICAL
1. *Pull for the first measurement*
2. *Release slowly for the second measurement*

To adjust spring preload, relocated spring end in cam, moving it clockwise to increase the preload and counterclockwise to decrease it. Refer to TECHNICAL DATA.

NOTE: If the spring preload can not be adjusted, try to relocate the other end of spring in sliding pulley (holes A, B or C).



LETTERS AND NUMBERS SHOWN IN ILLUSTRATION ARE ACTUAL LETTERS AND NUMBERS EMBOSSED ON PARTS

NOTE: Always recheck torsional preload after adjusting.

Pulley Alignment and Drive Belt Height

Refer to PULLEY DISTANCE AND ALIGNMENT and DRIVE BELT to perform adjustments.

CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

PULLEY ALIGNMENT

SERVICE TOOLS

Description	Part Number	Page
alignment bar	529 035 831	350
driven pulley opening tool	529 017 200	349

GENERAL

Pulley alignment must be checked out to ensure the highest efficiency of the transmission system. Furthermore, optimum drive belt operation and minimal wear will be obtained only with proper pulley alignment.

CAUTION: Before checking pulley adjustment, the rear suspension must be mounted on the vehicle and track tension/alignment must be done. Always check pulley adjustment after suspension is adjusted.

⚠ WARNING

Failure to correctly perform pulley alignment may cause the vehicle to creep forward at idle.

All Pulley Alignment Specifications Refer to:

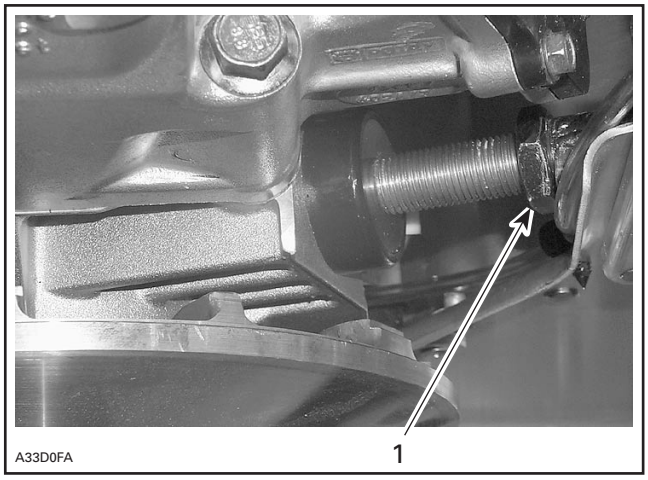
X = Distance between straight bar and drive pulley fixed half edge, measured between pulleys.

Y = Distance between straight bar and drive pulley fixed half edge, measured at the end of straight bar.

MEASURING PROCEDURE

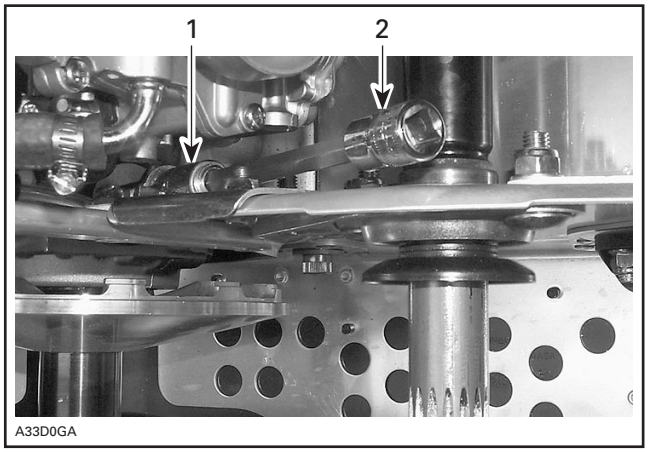
Remove guard, drive belt and air silencer.

Loosen lock nut.



1. Lock nut

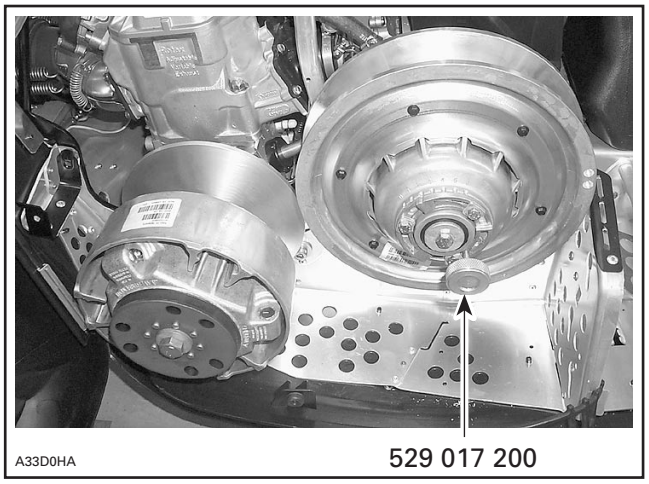
Untighten torque rod using a long hexagonal key.



TYPICAL

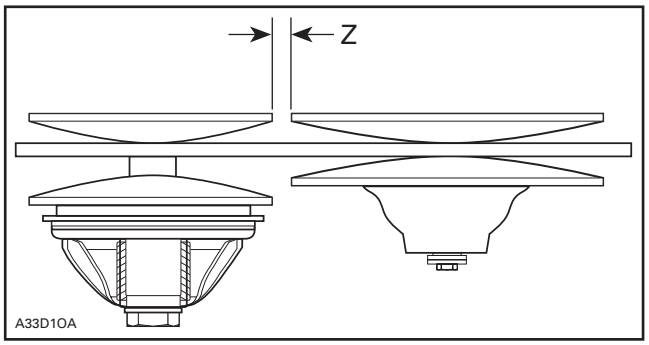
1. Torque rod
2. Hexagonal key

By using driven pulley opening tool (P/N 529 017 200) push the sliding half to open the driven pulley.



DRIVEN PULLEY OPENING TOOL

Measure the distance between both pulleys to know if the engine and the frame are positioned correctly. The distance pulley is not adjustable on the REV serie vehicles.



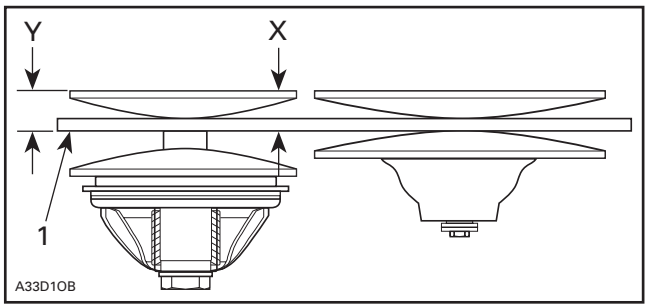
TYPICAL
Z = Distance between both pulleys

PULLEY DISTANCE	
MODEL	DISTANCE
Formula RER	17.5 mm (.689 in)
Formula VSA and VSA RER	19 mm (.748 in)
HPV VSA	20 mm (.787 in)

Insert the alignment bar (P/N 529 035 831)into the opened driven pulley.

ALIGNMENT BAR IN PULLEYS

Always measure distances X and Y from the farther straight bar side (including its thickness to the fixed half edge).



TYPICAL
1. Straight bar

The distance Y **must** exceed distance X to compensate for the twist due to the engine torque.

DRIVE PULLEYS ALIGNMENT		
MODEL	OFFSET mm (in)	
	X	Y-X
	± 0.50 (.020)	
Formula RER	33.4 (1.315)	0.46 (.018) maximum
Formula VSA or Formula VSA RER	37.0 (1.456)	0.82 (0.032) maximum
HPV VSA	37.0 (1.456)	0.82 (0.032) maximum

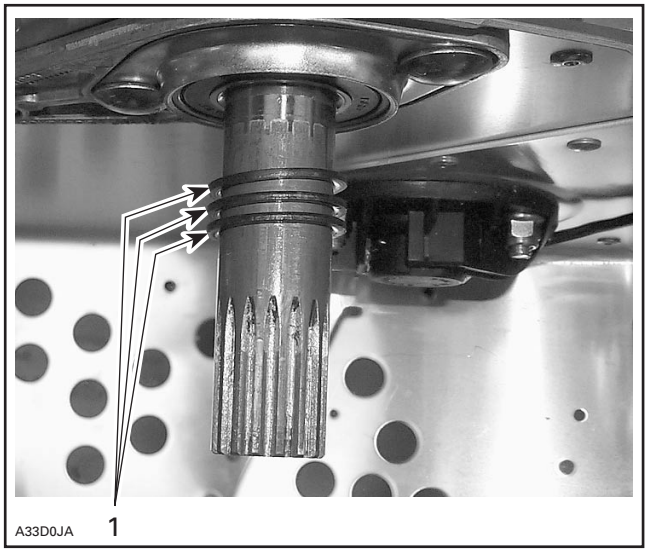
If an alignment is necessary, see ALIGNMENT PROCEDURE below.

If the alignment is good, hand torque the torque rod so it slightly contacts engine crankcase. Do not over tighten, it will disalign pulleys.

When the alignment is done, refer to DRIVE BELT to adjust the drive belt deflection.

ALIGNMENT PROCEDURE

Remove driven pulley and add or remove spacer(s) as required to obtain the specified alignment.



1. Spacers

Use the following table to choose the proper shim(s).

SHIM CHART	
SHIM NUMBER	SHIM THICKNESS mm (in)
504 112 000	0.42 ± 0.05 (.017 ± .002)
417 300 265	1.02 ± 0.10 (.040 ± .004)
417 300 252	2.06 ± 0.15 (.081 ± .006)

After alignment, hand tighten torque rod so it slightly contacts engine crankcase. Do not over tighten, it will disalign pulleys.

When the alignment is done, refer to DRIVE BELT to adjust the drive belt deflection.

BRAKE

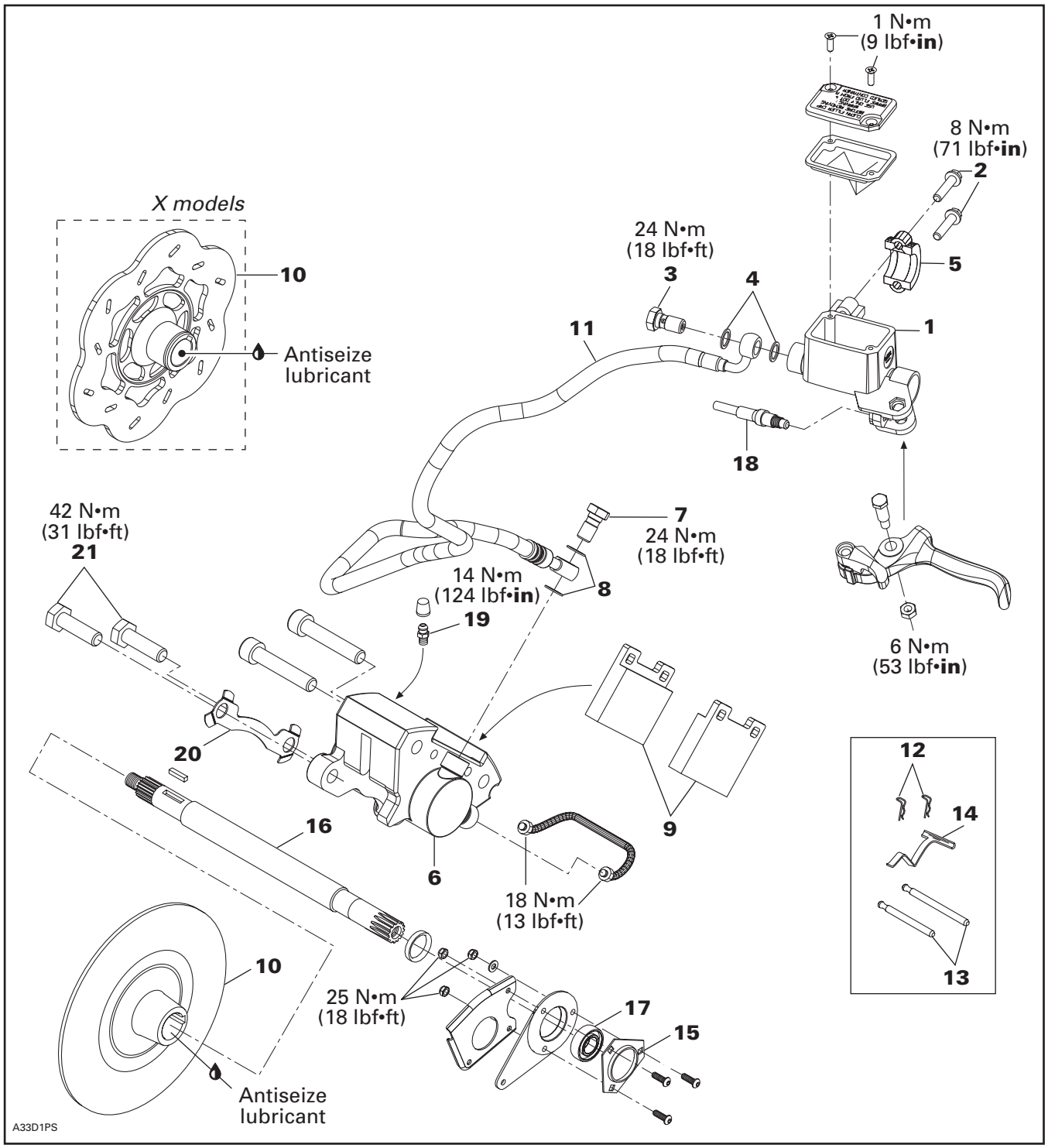
SERVICE TOOLS

Description	Part Number	Page
countershaft bearing remover/installer	529 035 699	357–358

SERVICE PRODUCTS

Description	Part Number	Page
antiseize lubricant	293 800 070	357
DOT 4 brake fluid GTLMA	293 600 062	355, 359
DOT 4 brake fluid SRF	293 600 063	355, 359
Loctite 609	413 703 100	359

HYDRAULIC BRAKE



BRAKE FLUID

The brake fluid must be changed in accordance with the maintenance chart.

Use recommended DOT 4 brake fluid SRF (P/N 293 600 063) or DOT 4 brake fluid GTLMA (P/N 293 600 062).

CAUTION: Use only DOT 4 brake fluid. Do not use fluids other than the recommended one, nor mix different fluids for topping up.

MASTER CYLINDER

Removal

The master cylinder **no. 1** is located on the LH side of handlebar. To remove it, unscrew both screws **no. 2** retaining the brake lever to the handlebar.

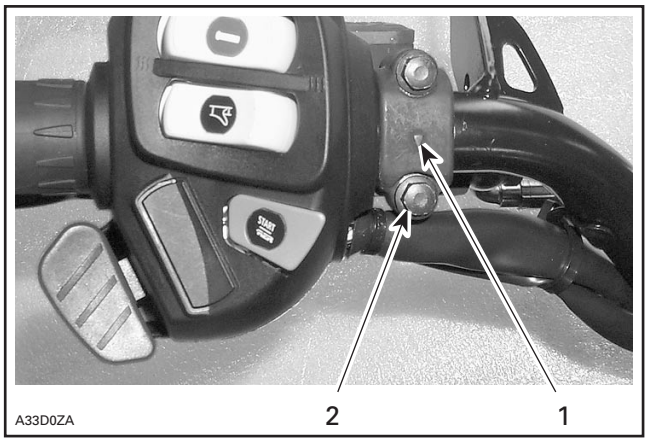
Place a container under Banjo bolt **no. 3** then unscrew it. Discard the sealing rings **no. 4**.

Installation

The installation is the reverse of removal procedure. Pay attention to the following.

Always use new sealing rings **no. 4** during installation.

Install clamp **no. 5** with its arrow pointing at downwards. Tighten to 8 N•m (71 lbf•**in**) lower screw before upper one.



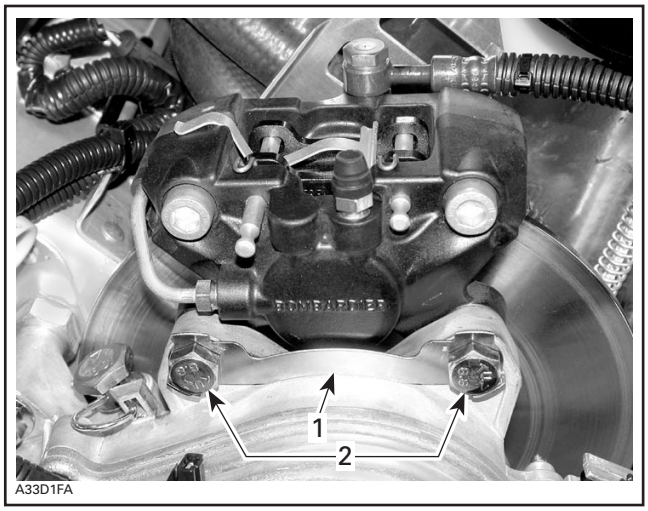
TYPICAL
1. *Arrow on upper clamp pointing downwards*
2. *Tighten lower screw first*

Bleed the brake system. Refer to BLEEDING.

CALIPER

Removal

Unscrew screws **no. 21** and remove locking tab **no. 20** to pull out caliper **no. 6** from chaincase.



1. *Locking tab*
2. *Screws*

CAUTION: Do not let the caliper hang by the hose and do not stretch or twist the hose.

Place a container under caliper. Unscrew the bleeder screw **no. 19** and drain the brake system. Do not remove the Banjo bolt **no. 7** completely during draining.

To completely drain the brake fluid, continuous press the brake lever until all fluid escaped out.

CAUTION: Spilling brake fluid on plastic, rubber or painted parts can cause severe damage. Protect these parts by covering them with rags while servicing brake system.

When the system is empty, remove the Banjo bolt. Discard the sealing washers **no. 8**.

Inspection

Check brake pads **no. 9**, refer further in this section.

Check pistons for scratches , rust or other damages. If so, replace the caliper as an assembly.

NOTE: Only brake pads are available as spare parts.

Installation

Push pistons all the way in to allow caliper installation over brake disc.

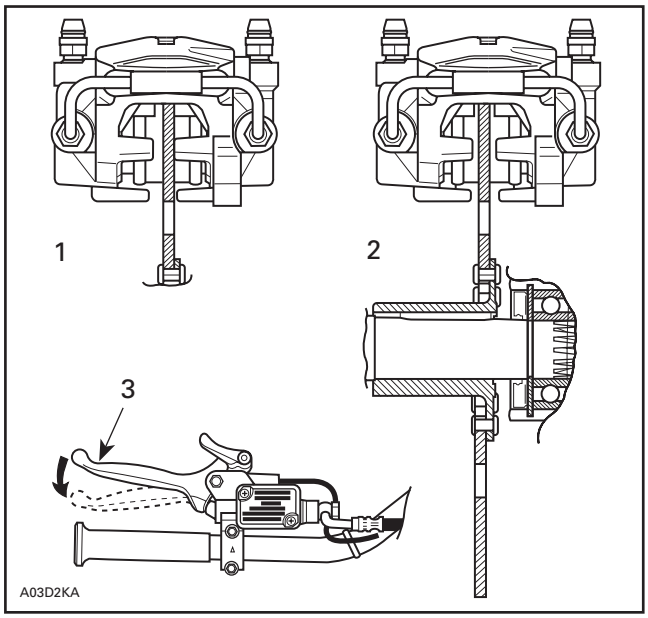
Install the Banjo bolt **no. 7** with two new sealing rings **no. 8**.

Fasten caliper on chaincase. Do not forget to install and fold locking tab over caliper bolt.

Fill the brake system and bleed it. Refer to BLEEDING at the end of this section.

The brake disc **no. 10** must be centered in caliper. Apply brake then check for proper brake disc positioning.

Push on appropriate caliper piston in order to move pad inward allowing proper brake disc positioning.



TYPICAL
1. *Brake disc not centered*
2. *Brake disc centered*
3. *Apply brake before checking*

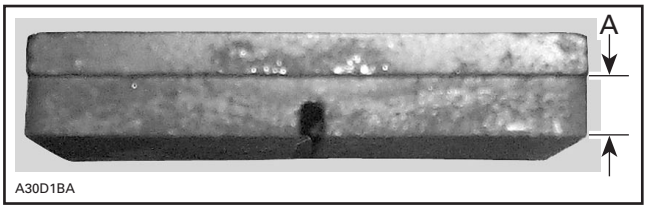
Apply brake then recheck.

BRAKE PADS

Inspection

Brake pads **no. 7** must be replaced when lining is 1 mm (1/32 in) thick or less or if the hollow place, on lining pad, is not visible.

CAUTION: **Brake pads must always be replaced in pairs.**

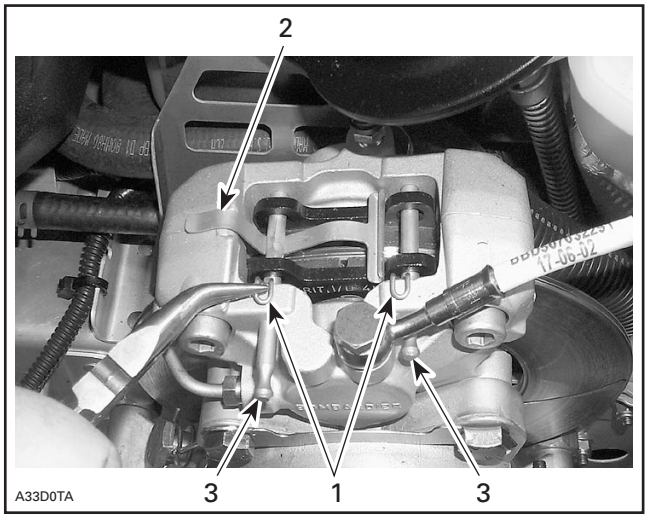


A. 1 mm (1/32 in) minimum

Removal

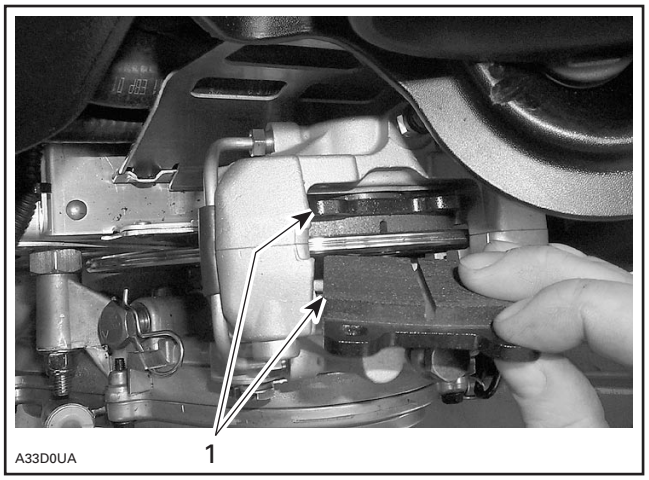
Brake pads removal procedure is as follows:

– Remove 2 retainers **no. 12** from the pins **no. 13**.
– Pull out the pins which releases the spring **no. 14**.



TYPICAL
1. *Retainer*
2. *Spring*
3. *Pins*

– Remove the brake pads **no. 9**.



TYPICAL
1. Brake pad

Installation

Install:

– new brake pads
– spring and push 2 pins to lock the brake pads
– 2 retainers in the pin holes.

⚠ WARNING

Avoid getting fluid, oil or grease on brake pads. Contaminated brake pads can affect stopping capacities.

Press the brake lever until both new pads are touching the brake disc.

Center the brake disc into the caliper. Refer to CALIPER.

BRAKE DISC

Inspection

The brake disc **no. 10** can be inspected without removing it from the vehicle.

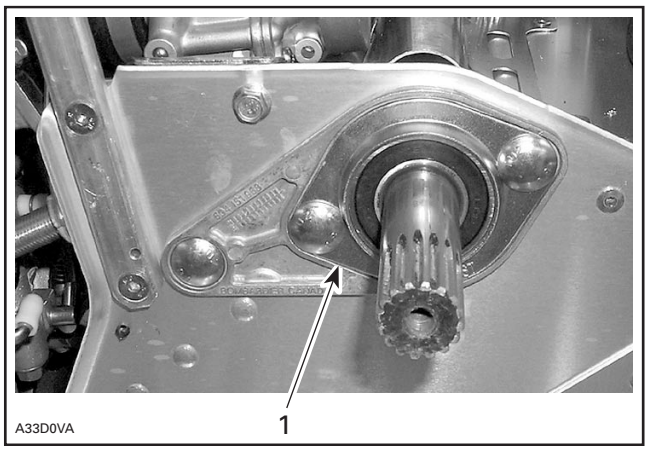
Check for scoring, cracking or bending, replace as required.

CAUTION: Brake disc should never be machined.

Removal

Brake disc **no. 10** can be removed without removing chaincase. Proceed as follows:

– Remove belt guard, belt and driven pulley.
– Remove air silencer.
– Unbolt bearing support **no. 15** from chassis.



1. Bearing support

– Unscrew caliper from chaincase.
– Open chaincase and remove upper sprocket.
– Pull countershaft **no. 16** toward driven pulley side to free from chaincase and disc.
– Remove disc.

Installation

Apply antiseize lubricant (P/N 293 800 070) on shaft.

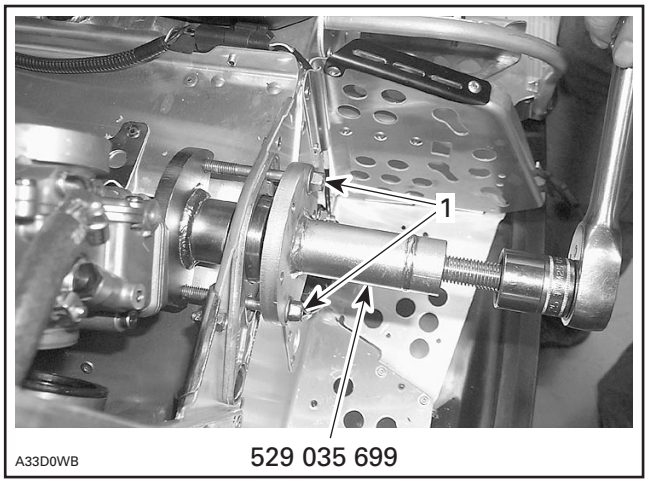
The disc hub exceeds the disc more from one side than from the other. Install disc with the longer exceeding portion toward driven pulley.

Reinstall all removed parts.

COUNTERSHAFT BEARING

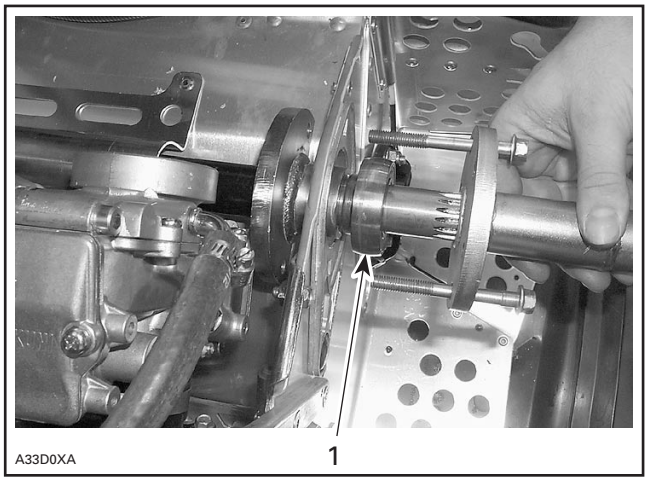
Removal

Unbolt bearing support **no. 15**. Install the countershaft bearing remover/installer (P/N 529 035 699).



1. Screws replacing bearing support screws

Tighten the countershaft bearing remover/installer bolt to pull the bearing out of it housing.



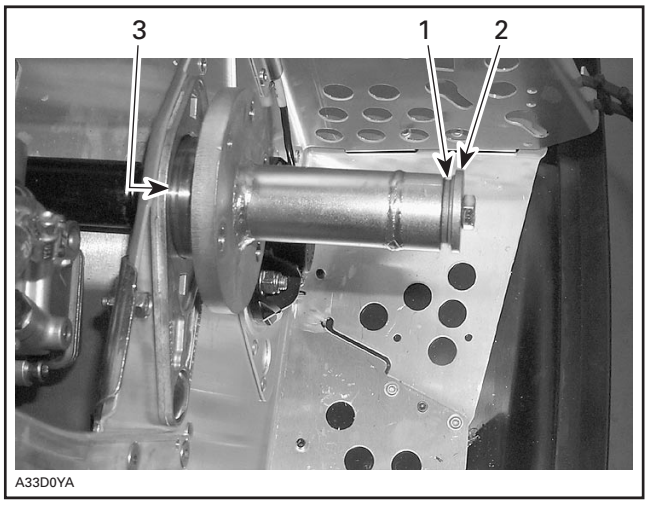
TYPICAL
1. Bearing

Installation

Insert countershaft (with brake disc) from chaincase side through countershaft support (driven pulley side), then insert into chaincase.

Install countershaft bearing **no. 17** using proper tool.

To install bearing on countershaft, use the countershaft bearing remover/installer (P/N 529 035 699) and some flat washers of 3 mm (1/8 in) total thickness. Using original retaining screw and shouldered washer tighten until bearing rests against circlip.



1. Washers use as a 3 mm (1/8 in) spacer
2. Original retaining screw and shouldered washer
3. Bearing against circlip

Ensure that countershaft is properly aligned, then tighten 3 retaining screws.

NOTE: A misaligned countershaft will result in difficulty to center the bearing in its support.

Torque castellated nut of upper sprocket to 60 N•m (44 lbf•ft).

Close chaincase referring to CHAINCASE.

COUNTERSHAFT

Removal

Proceed the same as for countershaft bearing removal and then remove the countershaft **no. 16**.

Inspection

Check countershaft for bending, rust or other damages. Replace if necessary.

Installation

The installation is the reverse of removal procedure.

BRAKE LIGHT SWITCH

Removal

The brake light switch **no. 18** is located near the brake lever. To remove the switch, use the following.

Disconnect the switch.

Take out the master cylinder from the handlebar.

Overturn the master cylinder so that the bottom is on the top.

Fix the master cylinder in a rigid way preferably in a vise.

Pull out the switch wire and rubber cover.

Activate the parking brake.

With the help of a proper tool, unscrew the switch body pay attention to apply a torque in axial direction with steps of little torque angles and pay attention to not apply a force in radial direction (flexion).

Remove the glue remaining with alcohol on a piece of cotton and then clean the seat threads with the clamp screw. If there is resistance to the advance of the clamp screw, use a proper wrench.

NOTE: In case of switch body breaking during the unscrewing activity, act mechanical restoring the threads on master cylinder seat and then go on with the installation procedure.

Installation

NOTE: The brake light switch is not adjustable.

Put the switch on the seat, rotating it only for 1 or 1.5 turns.

Put one drop of Loctite 609 (P/N 413 703 100) on the free switch threads.

Screw the switch by hand until it is in a correct position.

For safety reasons, check the activation of the switch by pulling the brake lever. In case of no switch activation, repeat all the procedure replacing a new switch.

NOTE: If parking brake release during the mounting operations, set the master cylinder in a sloping position (with lever on the top) and hold the master cylinder lever for 3/4 times.

Reinstall the master cylinder on the handlebar taking it in a horizontal position avoiding the risk of glue contamination for the switch rod.

Release the parking brake.

Wait 24 hours to allow glue to set.

Recheck if switch is working properly.

BLEEDING

Bleed brake system as follows:

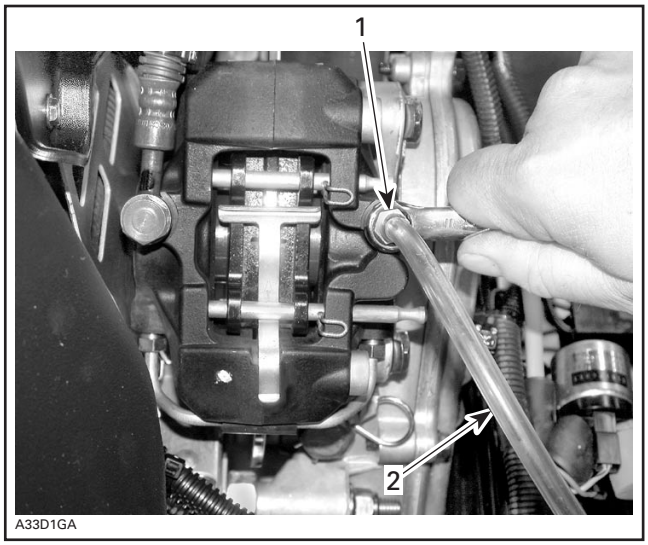
Keep sufficient recommended DOT 4 brake fluid SRF (P/N 293 600 063) or DOT 4 brake fluid GTLMA (P/N 293 600 062) in reservoir at all times.

CAUTION: Use only DOT 4 brake fluid. Do not use fluids other than the recommended one, nor mix different fluids for topping up.

Install a clear hose on bleeder **no. 19**. Route this hose to a container. Open bleeder.

Pump brake lever until no air escapes from hose.

Close bleeder.



1. Open bleeder
2. Clear hose to catch used brake fluid

⚠ WARNING

Avoid getting oil on brake pads.

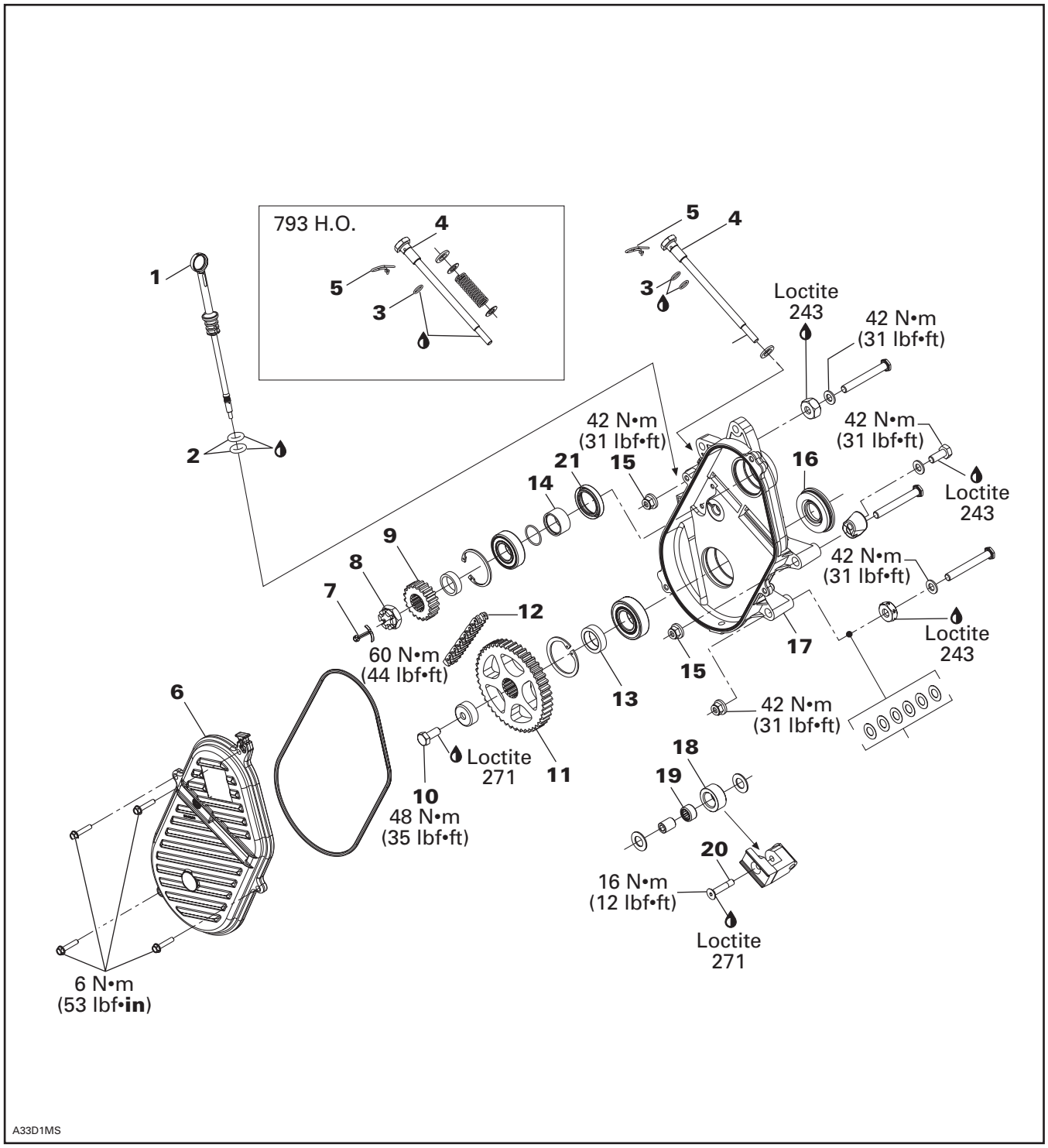
CHAINCASE

SERVICE TOOLS

Description	Part Number	Page
drive axle holder	529 007 200	364

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	365
XP-S chaincase oil	413 801 900	363
XP-S synthetic chaincase oil	413 803 300	363


793 H.O.
4
5
3
1
2
5
4
3
Loctite
243
42 N•m
(31 lbf•ft)
42 N•m
(31 lbf•ft)
21
15
16
14
42 N•m
(31 lbf•ft)
Loctite
243
9
8
7
12
42 N•m
(31 lbf•ft)
60 N•m
(44 lbf•ft)
Loctite
243
17
15
13
42 N•m
(31 lbf•ft)
6
Loctite
271
11
18
19
10
48 N•m
(35 lbf•ft)
20
16 N•m
(12 lbf•ft)
Loctite
271
6 N•m
(53 lbf•in)
A33D1MS

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

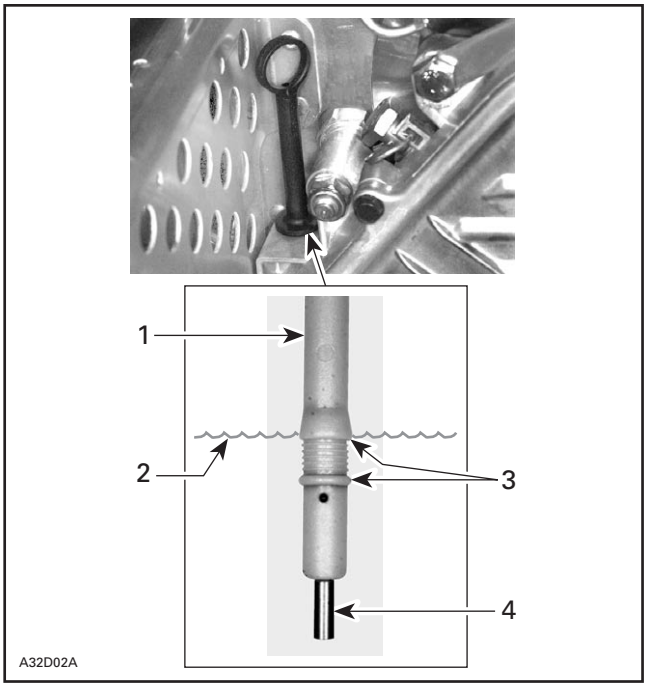
Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

CHAINCASE OIL LEVEL

With the vehicle on a level surface, check the oil level by removing dipstick no. 1. Oil level must be between lower and upper marks.



TYPICAL
1. *Dipstick*
2. *Oil level*
3. *Level between marks*
4. *Magnet*

NOTE: It is normal to find metallic particles stuck to dipstick magnet. If bigger pieces of metal are found, remove the chaincase cover and inspect the chaincase parts.

Remove metal particles from magnet.

Refill to upper mark. See OIL CHANGE for the proper chaincase oil to use.

CAUTION: Do not use unrecommended types of oil when servicing. Do not mix synthetic oil with other types of oil.

Check O-rings no. 2. If the O-rings are brittle, hard or otherwise damaged, replace them.

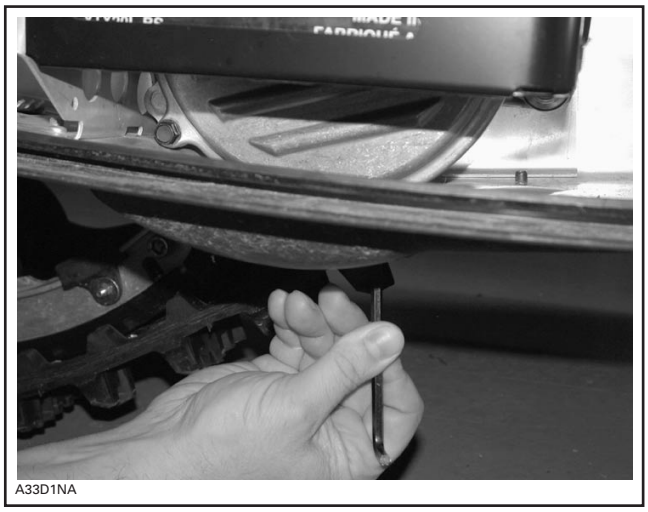
OIL CHANGE

Draining Procedure

Place a drain pan under chaincase drain plug area.

Remove dipstick no. 1.

Using an Allen key, remove the drain plug.



Wait a while to allow oil to flow out of chaincase.

Filling Procedure

Place the vehicle on a level surface.

Using a funnel, pour 250 mL (8.5 U.S. oz) of chaincase oil.

Fan-cooled Models

Use XP-S chaincase oil (P/N 413 801 900).

Liquid-cooled Models

Use XP-S synthetic chaincase oil (P/N 413 803 300).

All Models

Check oil level with the dipstick and add oil if necessary. The level must be between lower and upper dipstick's marks.

DRIVE CHAIN ADJUSTMENT

NOTE: Brake disc key must be in good condition before checking if chain is loose.

Before performing the drive chain adjustment, check the tensioner adjustment screw O-ring(s) no. 3 and replace if necessary.

Fully tighten tensioner adjustment screw no. 4 BY HAND, then back off only far enough for hair pin no. 5 to engage in locking hole.

This initial adjustment should provide 3 - 5 mm (1/8 - 13/64 in) free-play when measured at the outer circumference of the brake disc.

CAUTION: Free-play must not exceed 5 mm (13/64 in), readjust if necessary.

⚠ WARNING

If the specified free-play is not reached with the tensioner screw fully tightened, replace chain and check the condition of sprockets.

REMOVAL AND DISASSEMBLY

To remove chaincase proceed as follows.

Remove battery and battery rack (if so equipped) to gain access, refer to BATTERY section.

Remove hair pin no. 5. Release drive chain tension by unscrewing tensioner adjustment screw no. 4.

Drain oil by removing drain plug.

Apply parking brake.

Remove chaincase cover no. 6.

Remove cotter pin no. 7 and nut no. 8 retaining upper sprocket no. 9 and screw no. 10 retaining lower sprocket no. 11. Pull sprockets and drive chain no. 12 simultaneously. Remove shims no. 13 and no. 14. Take note that shim no. 14 is not installed on fan-cooled models.

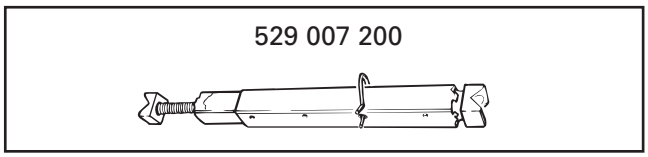
NOTE: Should countershaft removal be required, refer to BRAKE then look for COUNTERSHAFT REMOVAL.

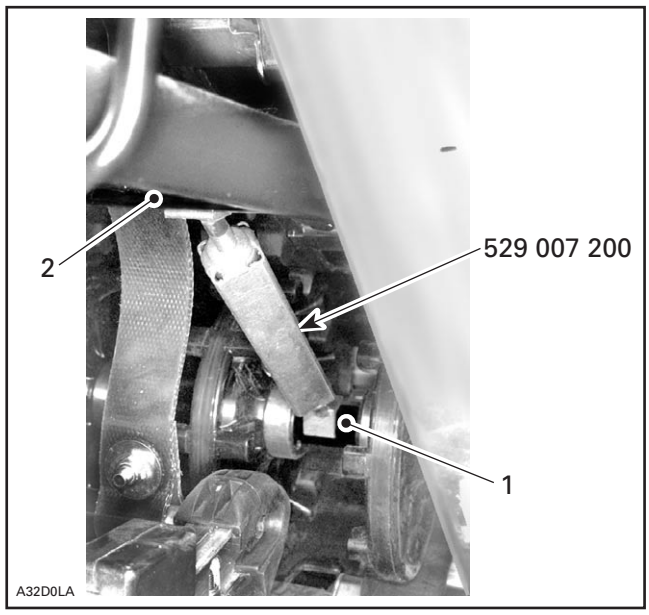
Release parking brake.

Remove 3 nuts no. 15.

Unfold locking tab then remove caliper retaining screws.

Release track tension, use the drive axle holder (P/N 529 007 200).



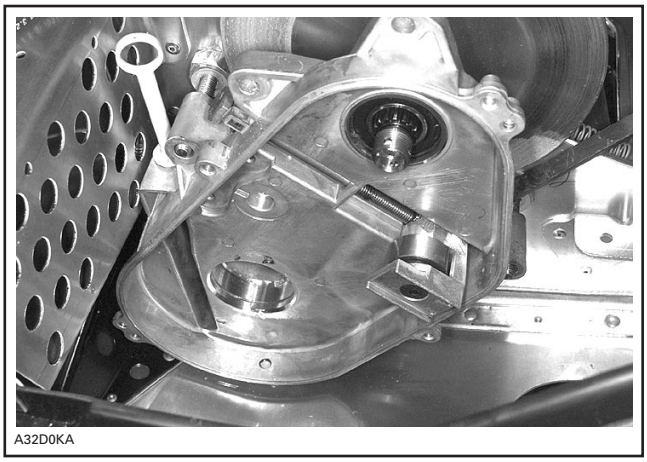


TYPICAL
1. Drive axle
2. Suspension front arm upper axle

Pry out drive axle oil seal no. 16 from chaincase.

Pull chaincase from drive axle and countershaft.

Using 2 large prybars inserted between chaincase housing no. 17 and frame, pry complete assembly from vehicle.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TYPICAL — CHAINCASE HOUSING REMOVAL

INSPECTION

Visually inspect the chain and sprockets for wear, cracked, damaged or missing links. If a problem is detected, replace drive chain and sprockets as an assembly.

Check the drive chain deflection. If the deflection is greater than 38 mm (1-1/2 in) without the chain tensioner, replace the chain.

Check for worn or defective bearings.

Check chain tensioner roller **no. 18** for wear or other damages. If the roller does not turn smoothly, replace the needle bearing **no. 19**.

NOTE: Heat the roller screw **no. 20** to break the threadlocker. During installation of screw, apply Loctite 271 (red) (P/N 293 800 005) under the screw's head only, no on threads.

INSTALLATION AND ASSEMBLY

Reverse removal and disassembly procedure and pay attention to the following.

Using an appropriate pusher, press the oil seal **no. 21** into chaincase hub. Oil seal must fit flush with the chaincase edge.

NOTE: Should installation procedure for countershaft be required, refer to BRAKE.

Install the circlip **no. 22** on drive axle.

CAUTION: It is of the utmost importance to install the circlip otherwise damage to the chaincase components may occur.

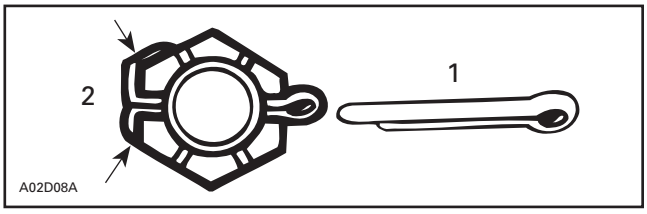
Position the sprockets **no. 9** and **no. 11** with the backside of writing facing the chaincase cover. Sprocket hub faces toward chaincase.

Install the castellated nut **no. 8** and torque to 60 N•m (44 lbf•ft).

Apply Loctite 271 (red) (P/N 293 800 005) on lower sprocket screw threads and torque to 48 N•m (35 lbf•ft).

Install new cotter pin **no. 7** in the position shown.

CAUTION: When removing a cotter pin always replace with a new one. Cotter pin will rub on chaincase cover if installed otherwise.



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1. *New*
2. *Fold cotter pin over castellated nut flats only*

SILENT CHAIN

Do not use chain other that the 13-plates wide on REV series models. Fit chain on top sprocket to make sure that you are using right one according to width. Refer to TECHNICAL DATA.

NOTE: No work (separation, lengthening) can be done on the silent chain type.

DRIVE AXLE

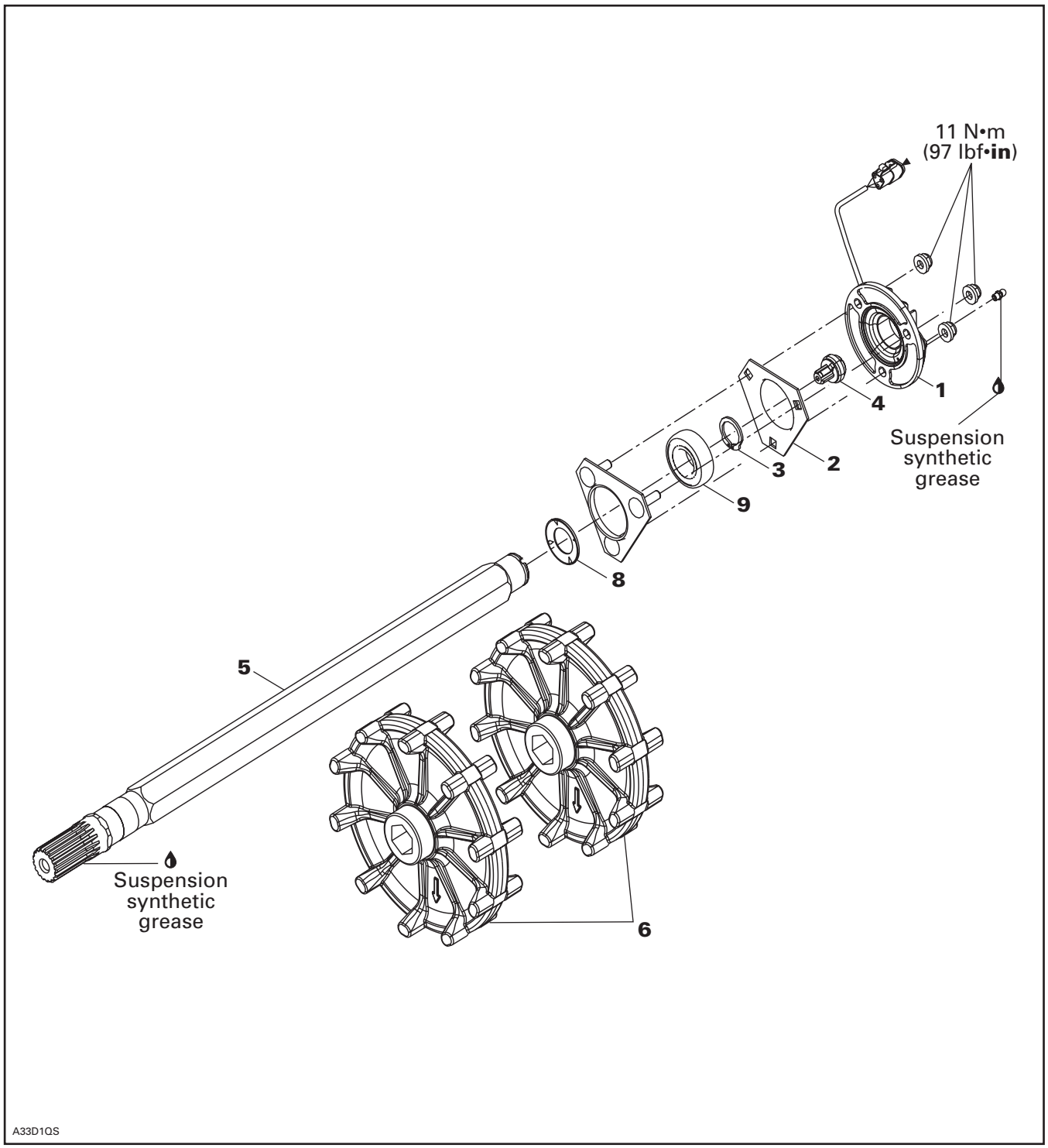
SERVICE TOOLS

Description	Part Number	Page
drive axle sprocket adjuster kit	861 725 700	373

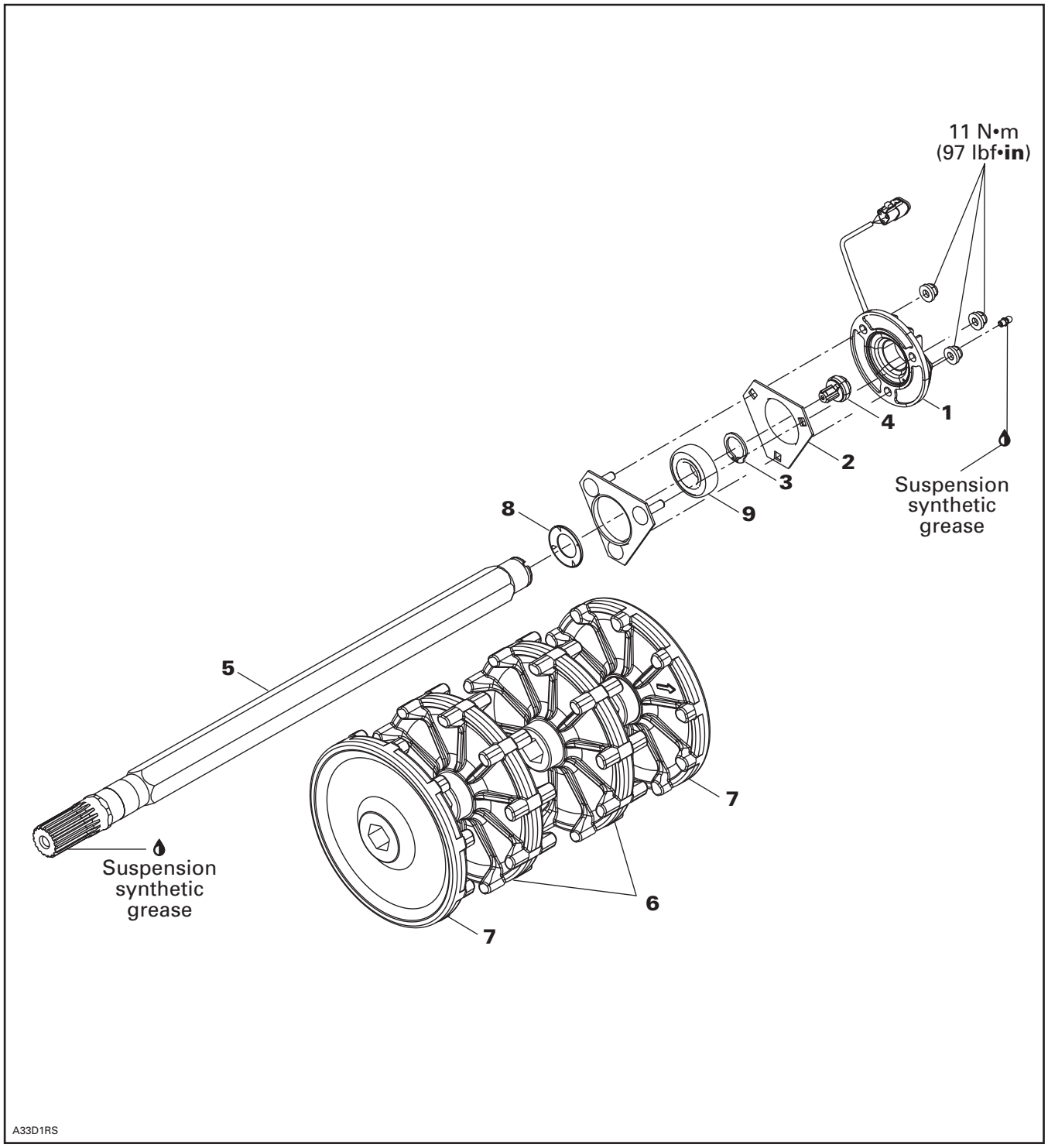
SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	373

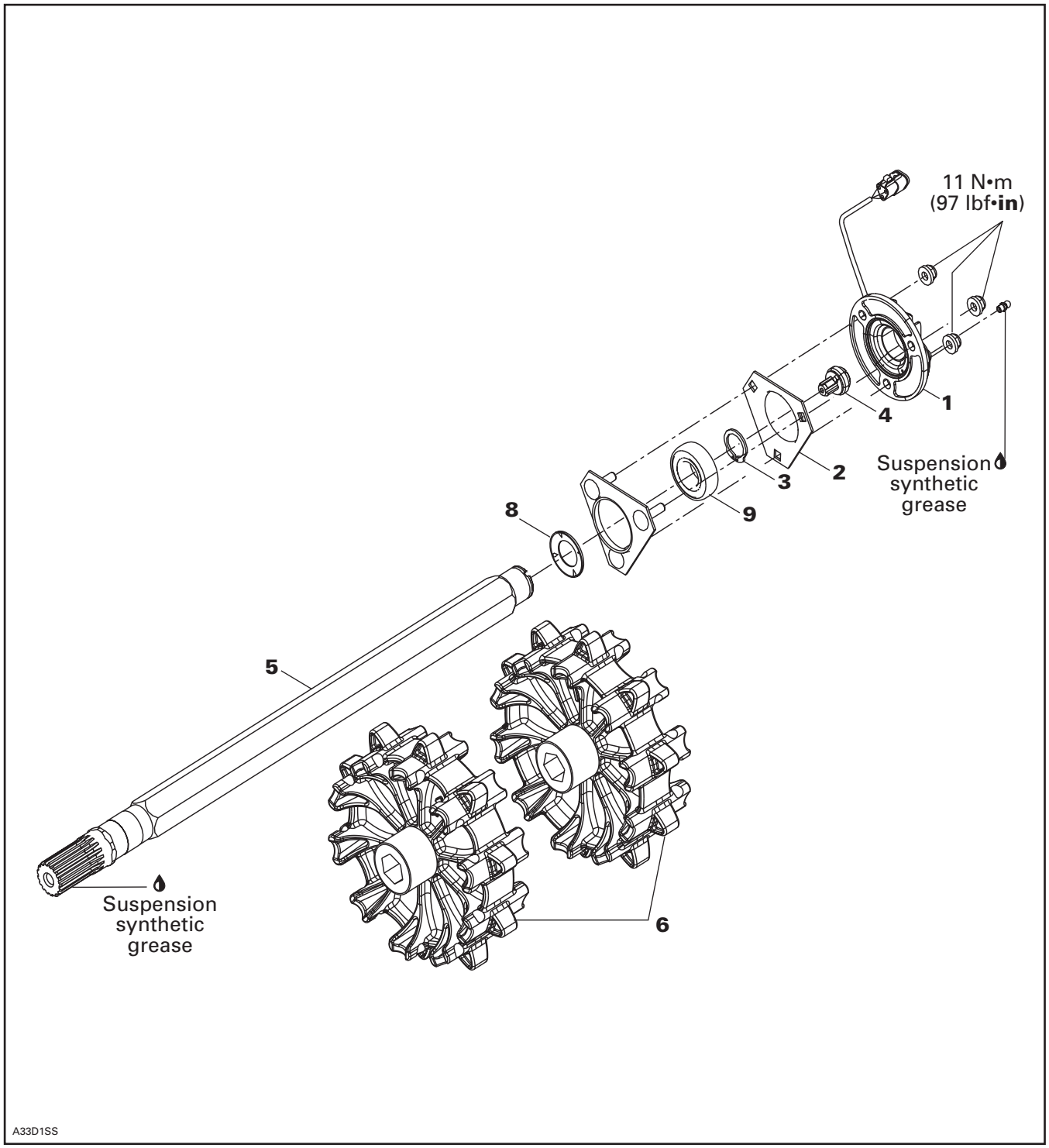
All Fan-cooled Models



GSX Limited and Sport, GTX Limited and Sport, MX-Z Adrenaline, Renegade, Renegade X and Trail Models



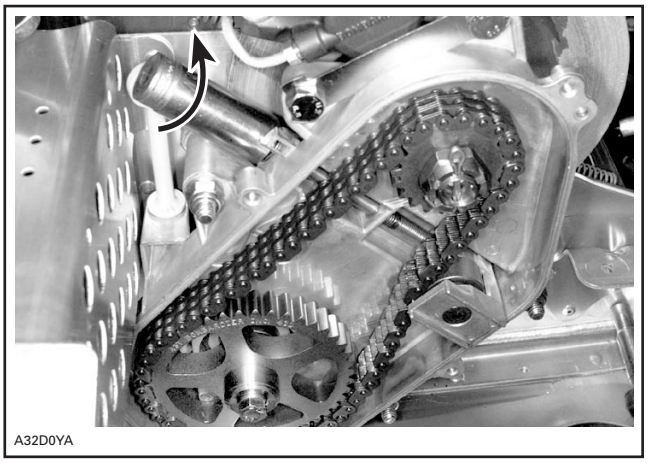
MX-Z X, Summit Adrenaline and Summit X Models



REMOVAL

Remove battery (if so equipped) to gain access, refer to CHARGING section.

Drain oil from chaincase. Remove chaincase cover. Release drive chain tension.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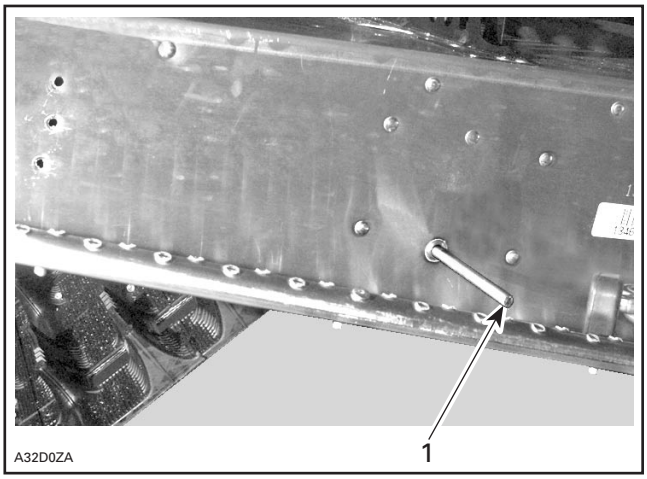
Raise and block rear of vehicle off the ground.

Remove suspension. Refer to proper subsection.

On some models, track can be held in tunnel using a rod in place of center idler wheel axle.



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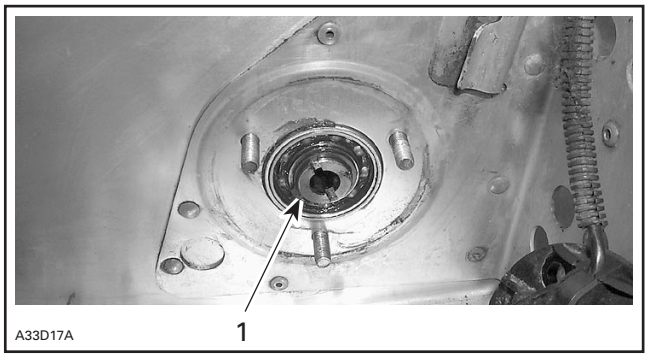
TYPICAL
1. Rod

Remove driven pulley. Refer to DRIVEN PULLEY.

Remove speedometer sensor **no. 1**, outer flange **no. 2** and circlip **no. 3** from left side.

Unscrew then pull speedometer magnetic adapter **no. 4** from drive axle **no. 5**.



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1. Circlip

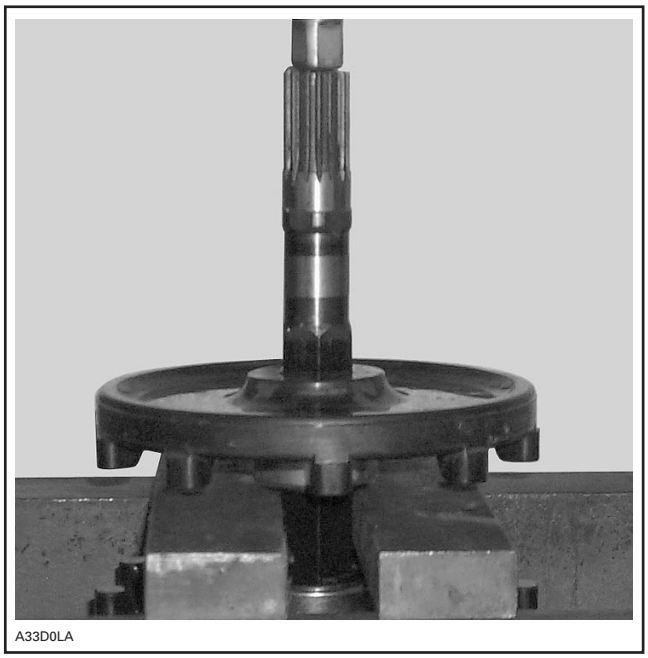
Apply parking brake.

Remove chain and sprockets then circlip from right side.

Release drive axle sprocket from track and at the same time, push the drive axle **no. 5** toward the right side. Drive axle bearing in chaincase will fall off.

Sprocket and Half-Sprocket

To remove press fit sprockets **no. 6** and **no. 7**, use a press and a suitable support as illustrated.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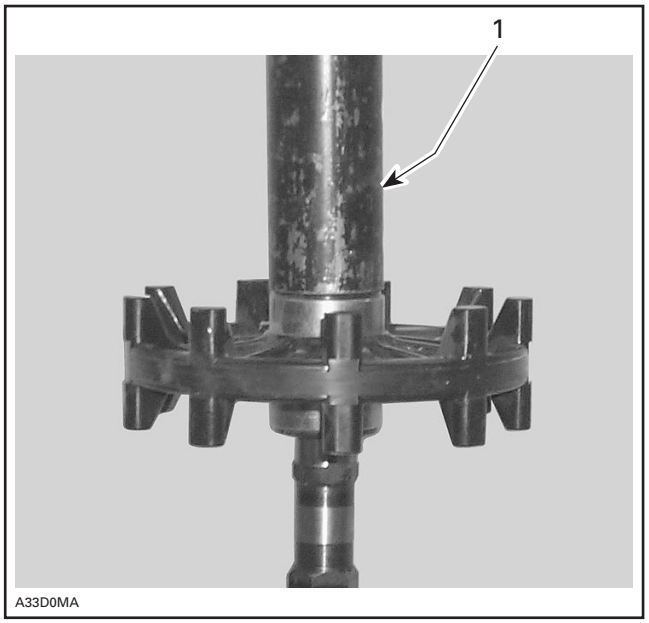
1. Support sprocket near hub

ASSEMBLY

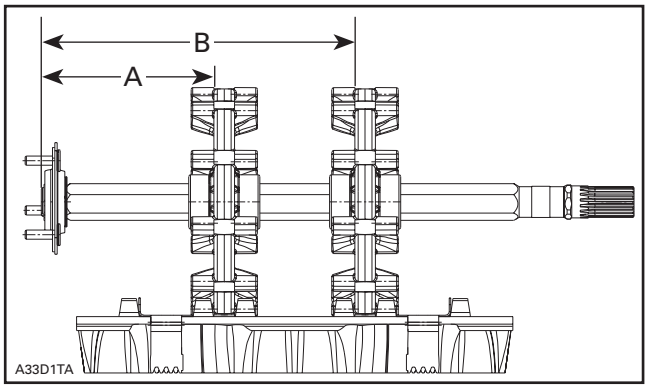
Drive Axle and Sprocket

To assemble press fit sprockets **no. 6** and **no. 7**, use a press and a suitable pipe as illustrated. Sprockets must be assembled according to the following dimensions measured from drive axle end.



1. Pipe

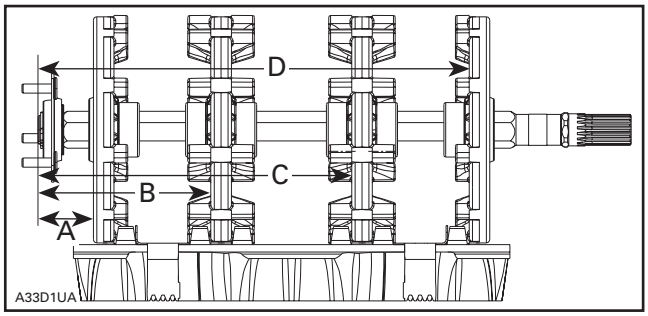
All Fan-cooled Models



MEASURE FROM END OF DRIVE SHAFT

A. 150.8 mm (5.937 in)
B. 273.8 mm (10.790 in)

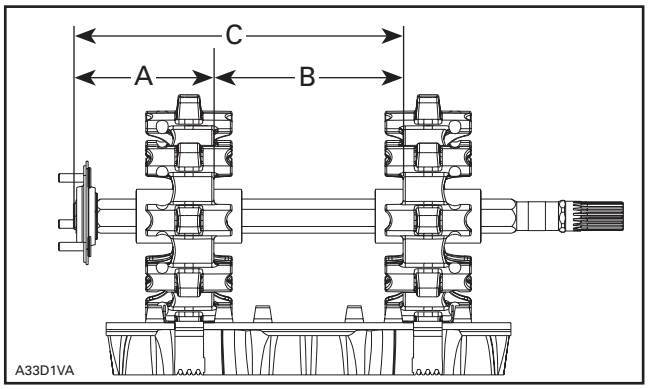
GSX Limited and Sport, GTX Limited and Sport, MX-Z Adrenaline, Renegade, Renegade X and Trail Models



MEASURE FROM END OF DRIVE SHAFT

A. 48.3 mm (1.902 in)
B. 150.8 mm (5.937 in)
C. 273.8 mm (10.780 in)
D. 376.3 mm (14.815 in)

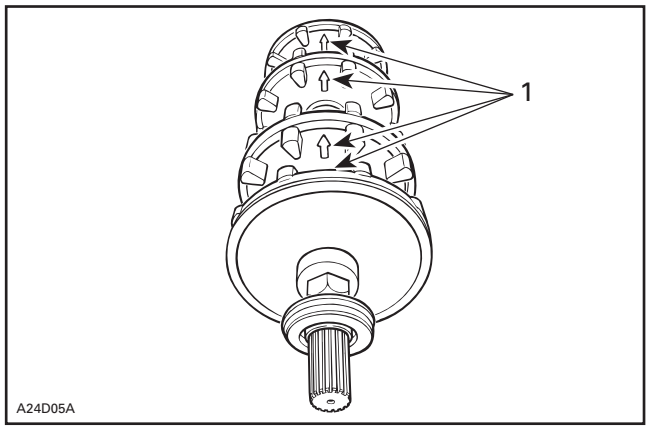
MX-Z X, Summit Adrenaline and Summit X Models



MEASURE FROM END OF DRIVE SHAFT

A. 132.2 mm (5.205 in)
B. 178.1 mm (7.0118 in)
C. 310.4 mm (12.220 in)

Ensure to align indexing marks of each sprocket when assembling.



TYPICAL
1. Indexing marks aligned

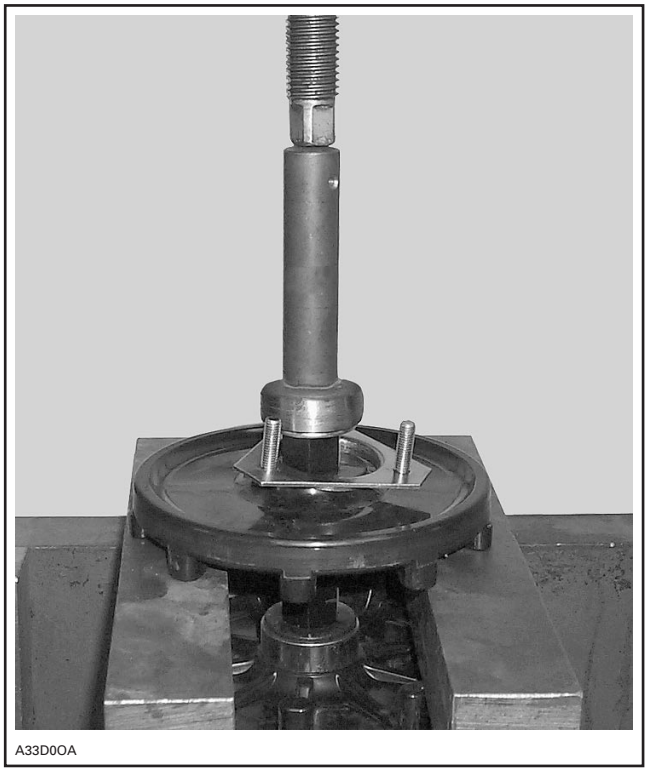
CAUTION: The same sprocket must not be pressed twice on the axle. When sprocket has been removed from drive axle, use a new sprocket at the installation.

Bearing Protector

At assembly, flat side of bearing protector **no. 8** must be against bearing **no. 9**.

Bearing

Always push bearing **no. 9** by inner race.



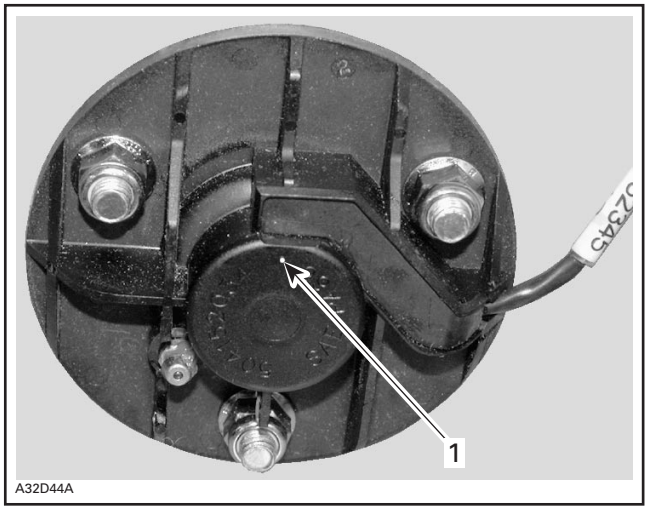
The bearing **no. 9** must have its shield facing the sprocket.

The drive axle bearing in chaincase must have its shield facing right side (cover).

Index speedometer magnetic adapter **no. 4** in drive axle and push until it is completely inserted in its hole.

LUBRICATION

Lubricate end housing bearing with suspension synthetic grease (P/N 293 550 033). Continue lubricating until grease flows out of the pilot hole on speedometer sensor.



1. Lubricate until grease flows out here

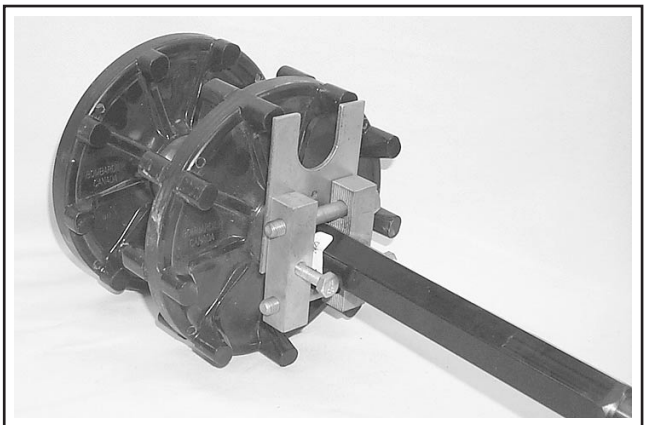
ADJUSTMENT

Sprocket/Track Alignment

CAUTION: Do not tamper with sprocket/track alignment if frame or suspension is damaged.

Sprockets may be repositioned to fit lugs without removing drive axle.

Use drive axle sprocket adjuster kit (P/N 861 725 700).



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TRACK

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	376
cleat remover	529 028 700	375, 377
narrow-cleat installer	529 028 800	375, 377

TRACK TYPE APPLICATION

Refer to TECHNICAL DATA.

GENERAL

This section gives guidelines for track removal. Some components require more detailed disassembly procedures. In these particular cases, refer to the pertaining section in this manual.

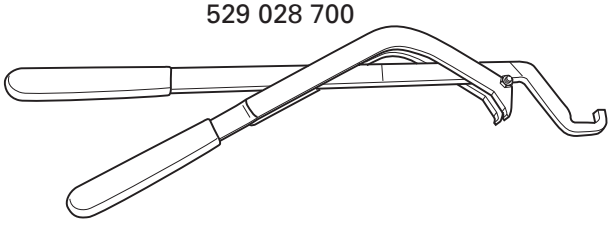
INSPECTION

Visually inspect track for:

– cuts and abnormal wear
– broken rods
– broken or missing track cleats.

If track is damaged or rods are broken, replace track. For damaged or missing cleats, replace by new ones, using cleat remover (P/N 529 028 700). Use narrow-cleat installer (P/N 529 028 800).

529 028 700



529 028 800

⚠ WARNING

Do not operate a snowmobile with a cut, torn or damaged track.

REMOVAL

Remove the following parts:

– rear suspension (refer to SUSPENSION)
– drive axle (refer to DRIVE AXLE)
– track.

INSTALLATION

Reverse the removal procedure.

NOTE: When installing the track, respect rotation direction indicated by an arrow on track thread.

Check sprocket/track alignment as described in DRIVE AXLE.

ADJUSTMENT

Track Tension and Alignment

Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

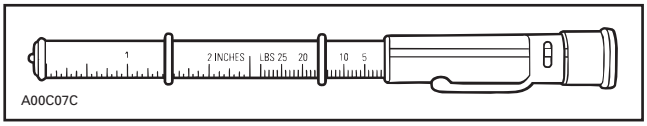
Tension

NOTE: Ride the snowmobile in snow about 15 to 20 minutes prior to adjusting track tension.

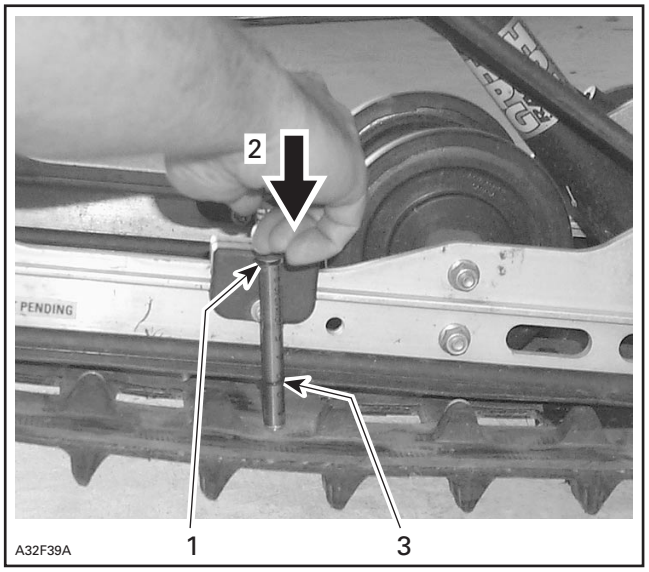
Lift snowmobile by a rope, chain or lift strap hooked to rear bumper.

Allow the rear suspension to fully extend and check gap halfway between front and rear idler wheels. Measure between slider shoe bottom and inside of track. The gap should be as given in SPECIFICATIONS. If the track tension is too loose, track will have a tendency to thump.

NOTE: The belt tension tester (P/N 414 348 200) may be used to measure deflection as well as force applied.



BELT TENSION TESTER

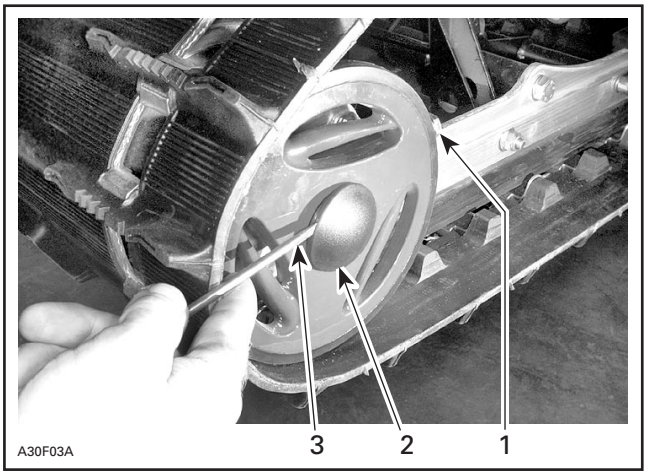


1. *Top tool O-ring positioned at 7.3 kg (16 lb)*
2. *Push on top portion of tool until it contacts the top O-ring*
3. *Measured track deflection*

CAUTION: Too much tension will result in power loss and excessive stresses on suspension components.

To Adjust Tension:

– Remove wheel caps.
– Loosen the rear idler wheel retaining screws.
– Turn adjustment screws to adjust.



TYPICAL
1. *Adjustment screw*
2. *Retaining screw*
3. *Wheel cap removal*

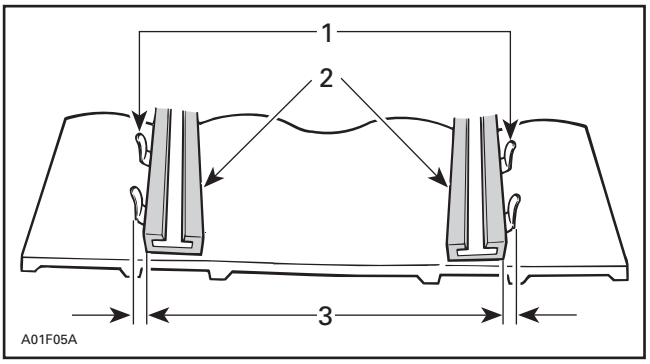
Alignment

⚠ WARNING

Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

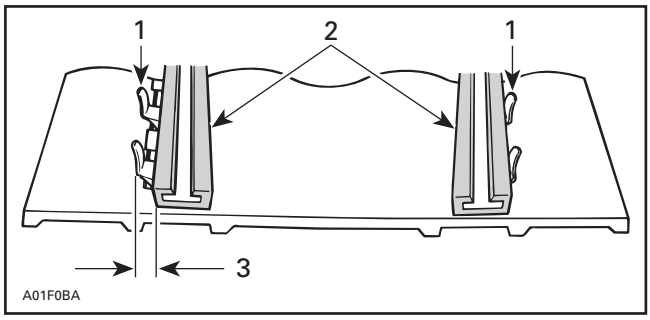
Start the engine and accelerate slightly so that track barely turns. This must be done in a short period of time (1 to 2 minutes).

Check that the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. *Guides*
2. *Slider shoes*
3. *Equal distance*

To correct, stop engine, loosen rear wheel screws, then tighten the adjustment screw on side where the slider shoe is the farthest from the track insert guides.



1. Guides
2. Slider shoes
3. Tighten on this side

Restart engine, rotate track slowly and recheck alignment. If the satisfactory alignment is achieved, then tighten the idler wheel retaining screws to 48 N•m (35 lbf•ft). Reinstall the wheel caps.

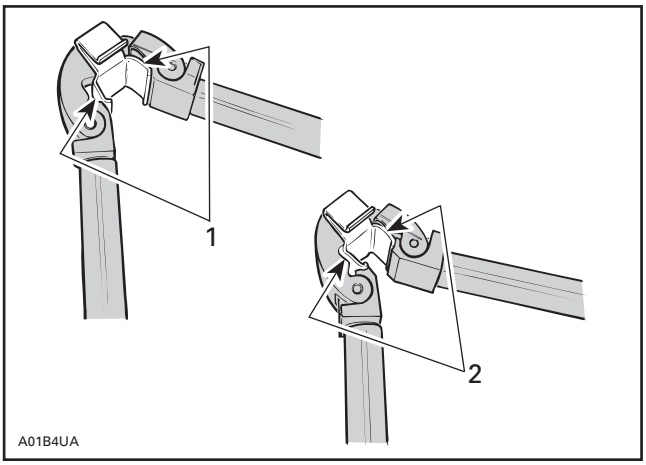
TRACK CLEAT

Removal

– Raise rear of vehicle off the ground and lift snow guard then hand rotate track to expose a cleat to be replaced.
– Use track cleat remover (P/N 529 028 700) for all models.

Installation

– Place new cleat in position on the track and using the narrow-cleat installer (P/N 529 028 800) bend cleat then push tabs into rubber.
– Re-open installer, then position cleat tabs on open end of tool and squeeze tabs until they are indented in rubber.



TYPICAL
1. First step
2. Second step (to push tabs into rubber)

TRACTION ENHANCING PRODUCTS (STUDS)

Important Safety Rules

⚠ WARNING

To prevent serious injury to individuals near the snowmobile:

– NEVER stand behind or near a moving track.
– ALWAYS use a wide-base snowmobile stand with a rear deflector panel.
– When the track is raised off the ground, only run it at lowest possible speed.

Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force, possibly resulting in the loss of a leg or other serious injury.

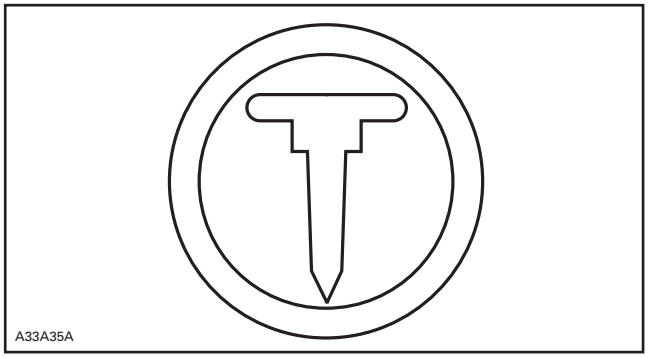
Effects of Studding on the Life of the Snowmobile

The use of traction enhancing products can increase the load and the stress on certain snowmobile components, as well as the vibration level. This can cause premature wear on parts such as belts, brake lining, bearings, chain, and chaincase sprockets, and shorten track life. For this reason, it is even more important to follow the detailed maintenance program given in the MAINTENANCE CHART.

Studs can also cause serious damage to the snowmobile if it is not equipped with the tunnel protectors designed for the particular model. Damage to the electrical wiring or perforation of the heat exchangers are potential hazards, that could cause the engine to overheat and be severely damaged.

⚠ WARNING

If tunnel protectors are excessively worn or not installed, the gas tank could be punctured, causing a fire.



APPROVED TRACKS CAN BE IDENTIFIED BY THIS SYMBOL

Maintenance/Replacement

A visual inspection of the track should be performed before each use.

Look for any defects, such as:

– perforations in the track
– tears in the track (particularly around traction holes)
– lugs that are broken or torn off, exposing portion of rods
– delamination of the rubber
– broken rods
– broken studs
– bent studs
– studs that are torn off the track
– missing track guide(s).

Replace broken or damaged studs immediately. If the track shows signs of deterioration, it must be replaced immediately. In doubt, replace the track.

⚠ WARNING

Riding with a damaged track or studs could lead to loss of control, resulting in a risk of serious injury or death.

Installation

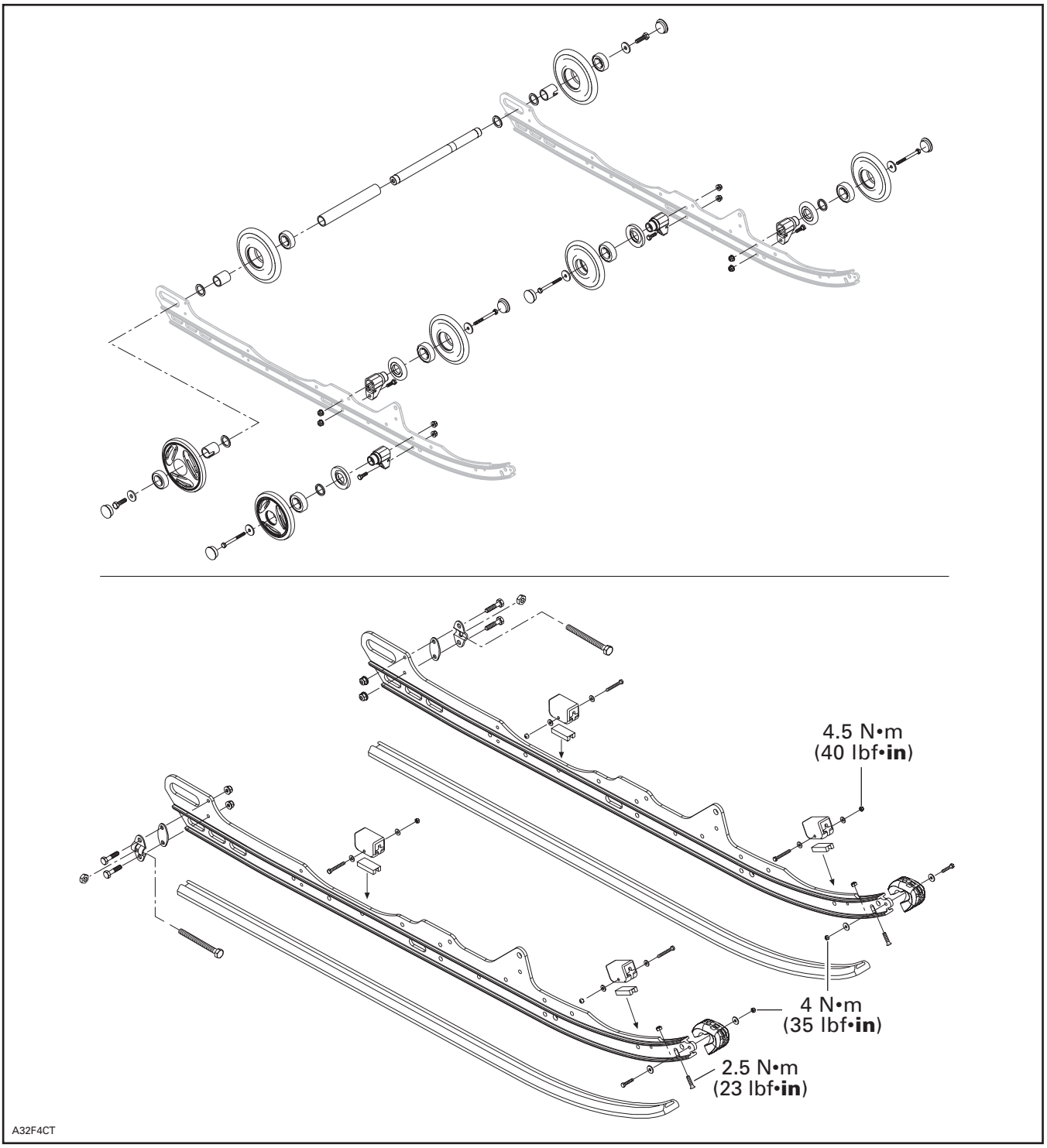
To install studs, refer to the manufacturer's instructions.

TRACK		MODELS	FRONT PROTECTOR	REAR PROTECTOR	SUPPORT
Profile height	Track length				
22 mm (7/8 in) and 25.4 mm (1 in)	3.07 m (121 in)	GSX (fan-cooled)	N/A	12.9 mm (1/2 in)	Required
		MX-Z (fan-cooled)	N/A	12.9 mm (1/2 in)	Required
		GSX	N/A	20 mm (25/32 in)	—
		MX-Z	N/A	20 mm (25/32 in)	—
	3.45 m (136 in)	GTX	N/A	20 mm (25/32 in)	—
		MX-Z	N/A	20 mm (25/32 in)	—
		Summit (fan-cooled)	N/A	12.9 mm (1/2 in)	Required
31.8 mm (1.25 in)	3.07 m (121 in)	GSX (fan-cooled)	N/A	12.9 mm (1/2 in)	Required
		MX-Z (fan-cooled)	N/A	12.9 mm (1/2 in)	Required
		GSX	Standard	20 mm (25/32 in)	—
		MX-Z	Standard	20 mm (25/32 in)	—
	3.45 m (136 in)	Expedition (fan-cooled)	N/A	12.9 mm (1/2 in)	Required
		GTX	Required	20 mm (25/32 in)	—
		MX-Z	Standard	20 mm (25/32 in)	—
		Summit (fan-cooled)	N/A	12.9 mm (1/2 in)	Required

SC SUSPENSION

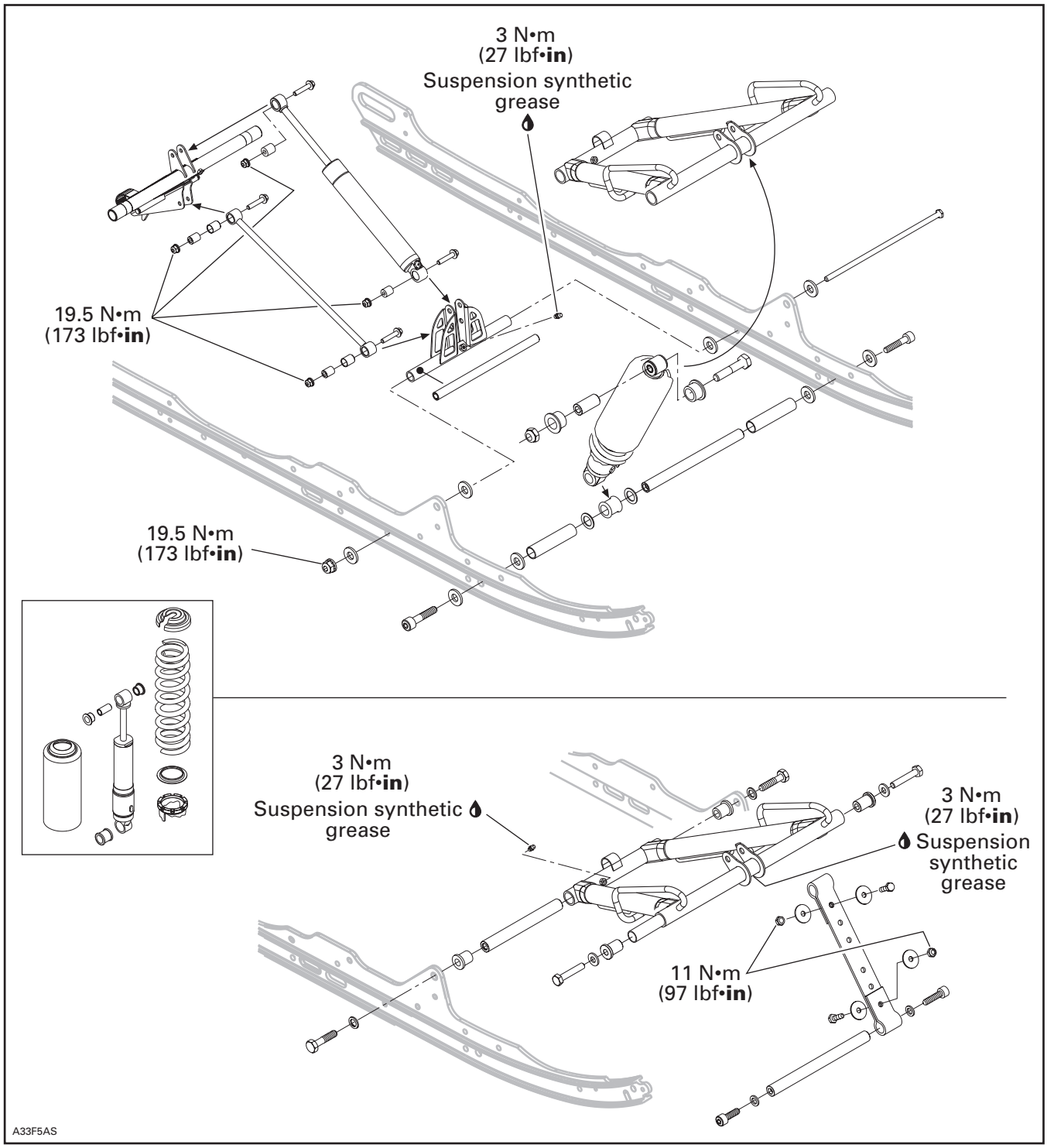
SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	393



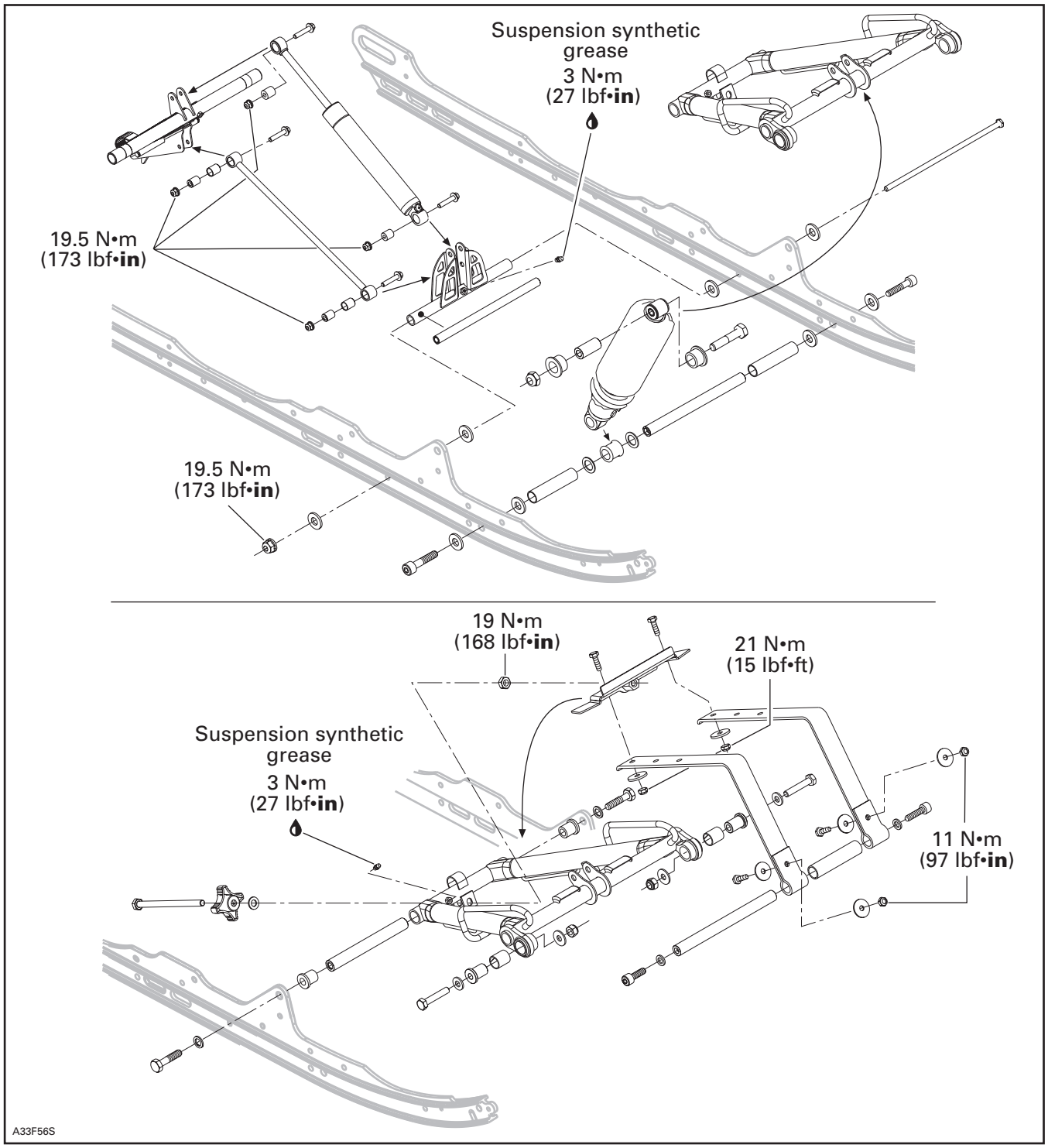
RAILS AND IDLER WHEELS

Expedition (Sport)/GTX/Summit Fan Cooled Models

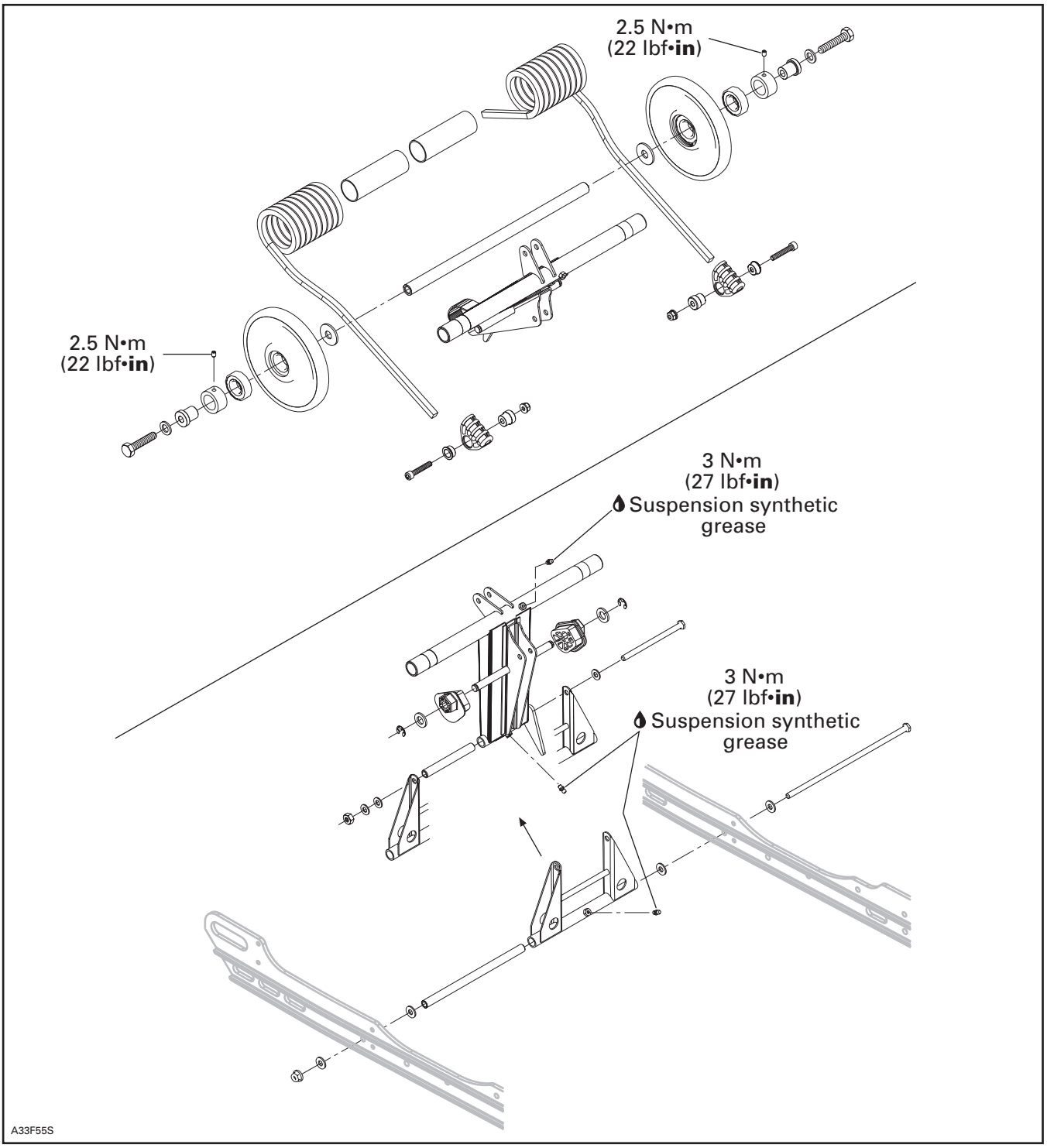


ARMS AND SHOCK ABSORBERS

Summit Liquid Cooled Models



ARMS AND SHOCK ABSORBERS



REAR ARM, SPRINGS AND TOP IDLER WHEELS

AXLE SELF-LOCKING SCREWS REMOVAL

CAUTION: These self-locking screws must always be replaced by new ones everytime they are removed.

NOTE: To prevent axle from turning when unscrewing self-locking screws, proceed as follows:

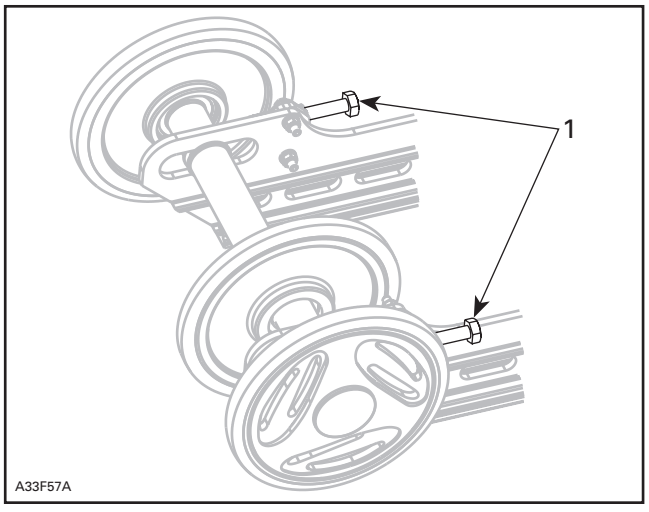
– Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
– Remove the opposite self-locking screw.
– Remove the temporary installed non-self-locking screw.
– If it doesn't work, heat bolt head to melt threadlocker.

REAR AXLE REMOVAL

Lift rear of vehicle and support it off the ground.

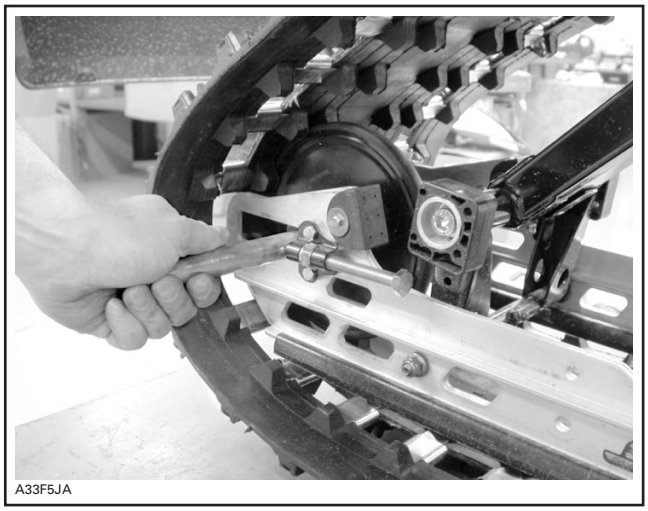
Remove screws on rear axle.

Completely loosen track tension.



1. Completely loosen track tension

Pull out rear axle from RH side of vehicle.



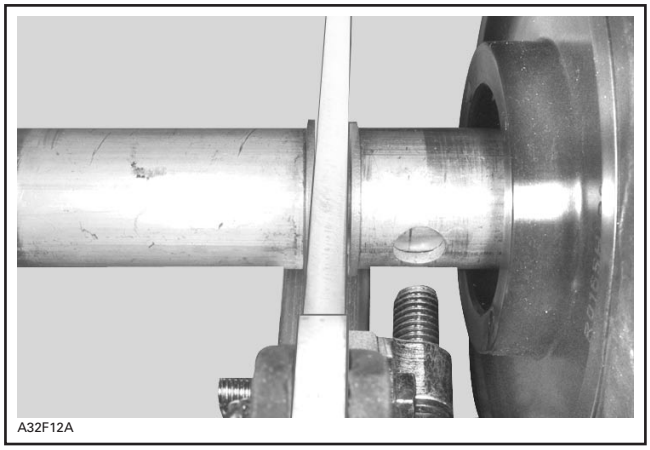
TYPICAL — PULL OUT REAR AXLE

REAR AXLE INSTALLATION

Installation is the reverse of removal procedure. Pay attention to the following details.

Hole of outer bushing must face adjustment screw.

Make sure to reinstall washer on each side of runner.



OUTER BUSHING POSITION

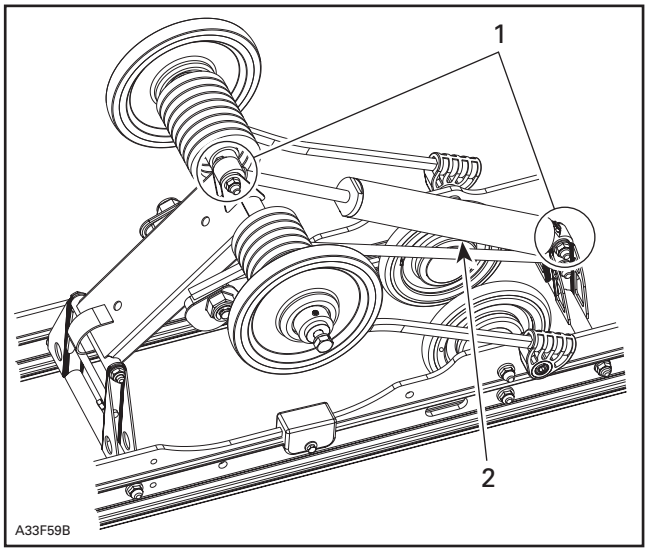
REAR SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

Remove shock upper and lower bolt and nut

NOTE: If necessary, to ease shock removal, unfasten one end of stopper straps to release shock pressure.

Remove rear shock absorber.



TYPICAL
1. *Upper/lower bolt and nut*
2. *Rear shock absorber*

REAR SHOCK ABSORBER INSTALLATION

Installation is the reverse of removal procedure.

CAUTION: Take care not to damage grease fitting.

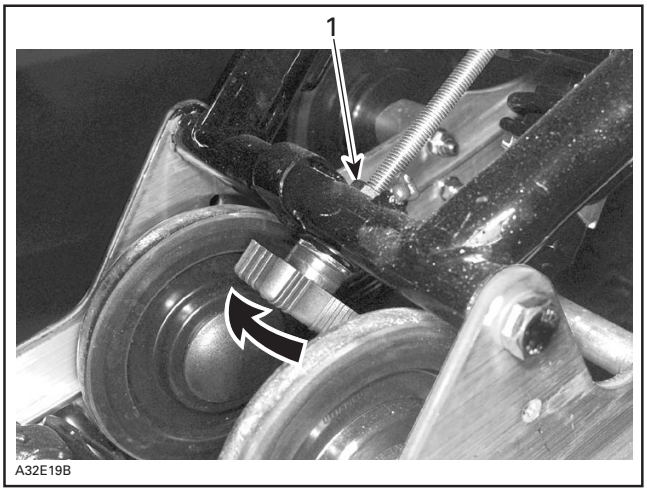
Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Shock upper and lower nut	19.5 N•m (173 lbf•**in**)

FRONT SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

Unfasten one end of stopper strap(s) or loosen the adjuster knob to release shock pressure.

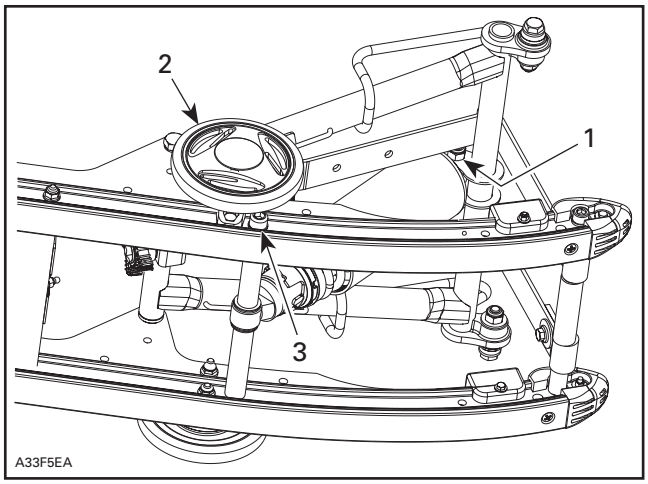


SUMMIT LIQUID COOLED MODELS
1. *Loosen lock nut, turn adjuster knob counterclockwise*

Unbolt front shock from the top.

Remove the front idler wheels to gain access to the axle retaining self-locking screws.

Unbolt axle screws and slide out axle to remove shock.



TYPICAL
1. *Front shock upper bolt and nut*
2. *Idler wheel*
3. *Axle screw*

FRONT SHOCK ABSORBER INSTALLATION

Installation is the reverse of removal procedure.

Respect the following tightening torque specification.

DESCRIPTION	TIGHTENING TORQUE
Adjuster lock nut	19 N•m (168 lbf•**in**)
Stopper straps nuts (on Summit strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap(s) nuts	11 N•m (97 lbf•**in**)

REAR SPRING REMOVAL

Lift rear of vehicle and support it off the ground.

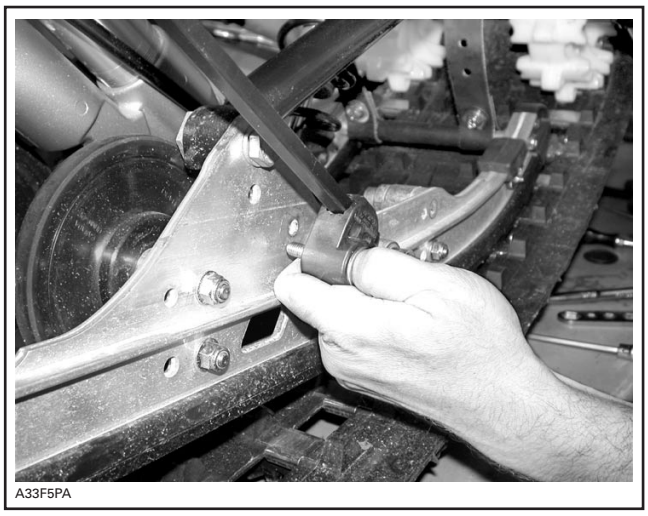
Decrease spring preload by turning cams accordingly.

Unbolt rear arm top axle from chassis.

Remove spring supports.

⚠ WARNING

Supports are spring loaded.



TYPICAL — REMOVE SPRING SUPPORTS

Loosen set screw from locking rings.

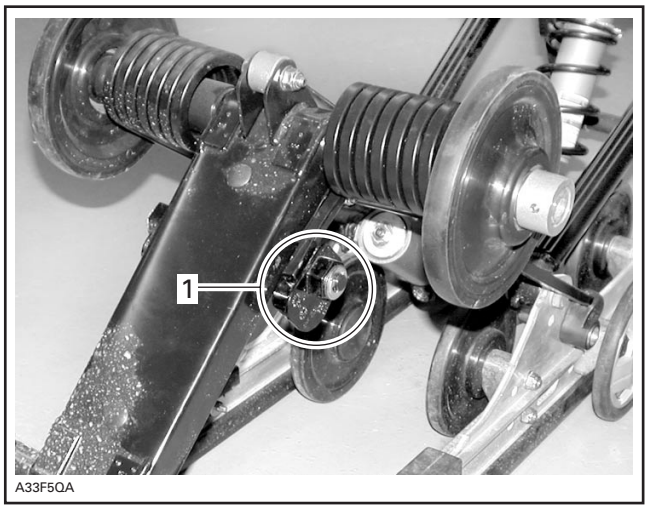
Remove the following on both sides:
– locking ring
– top idler wheel
– spring.

REAR SPRING INSTALLATION

Installation is the reverse of removal procedure. Pay attention to the following details.

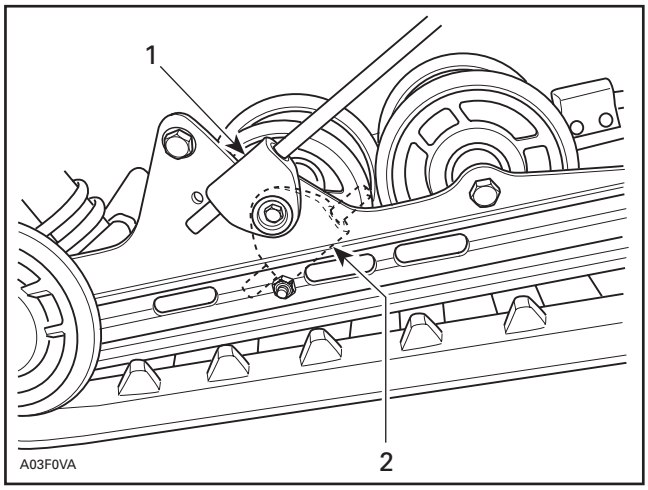
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

At assembly, make sure that spring end is in cam adjuster.



TYPICAL — ON BOTH SIDES
1. Spring end in cam adjuster

CAUTION: To avoid track damage, spring supports must be mounted upward.



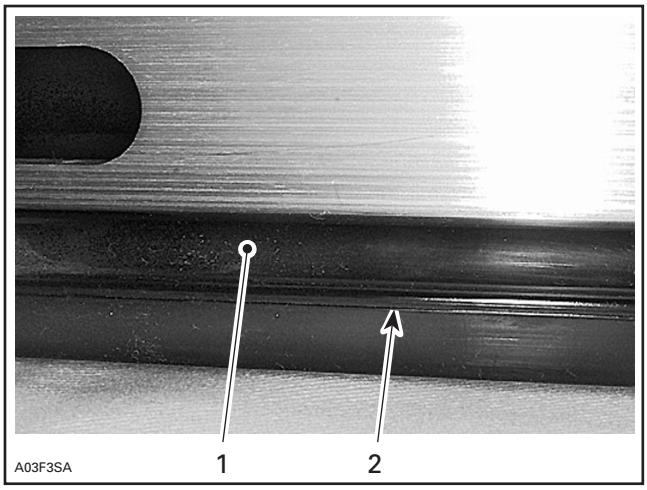
TYPICAL — RIGHT SIDE SHOWN
1. Right position: upward
2. Wrong position

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)

SLIDER SHOE VERIFICATION

Molding line is the wear limit indicator.



TYPICAL
1. Slider shoe
2. Molding line (wear limit indicator)

Replace slider shoes when wear limit is reached.

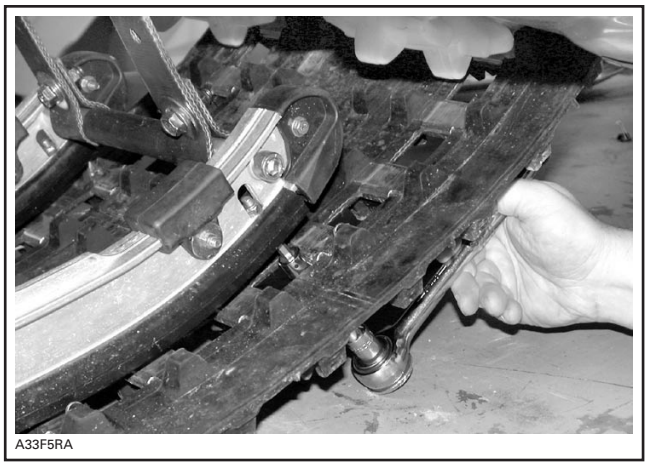
CAUTION: Slider shoes must always be replaced in pairs.

SLIDER SHOE REMOVAL

Lift rear of vehicle and support it off the ground.

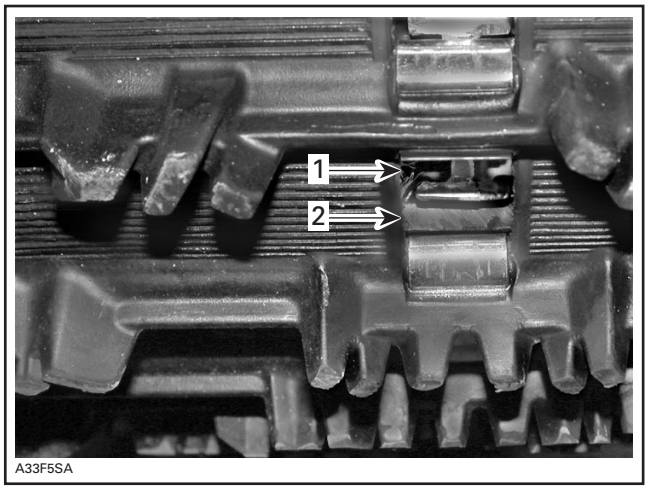
Completely loosen track tension.

Remove front runners nut and screw.



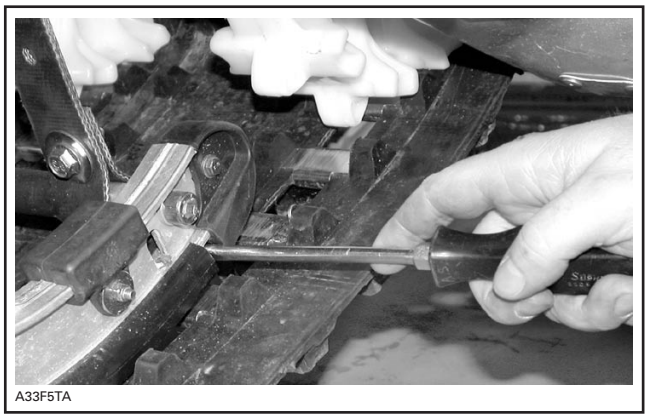
TYPICAL — REMOVE NUT AND SCREW

Align track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

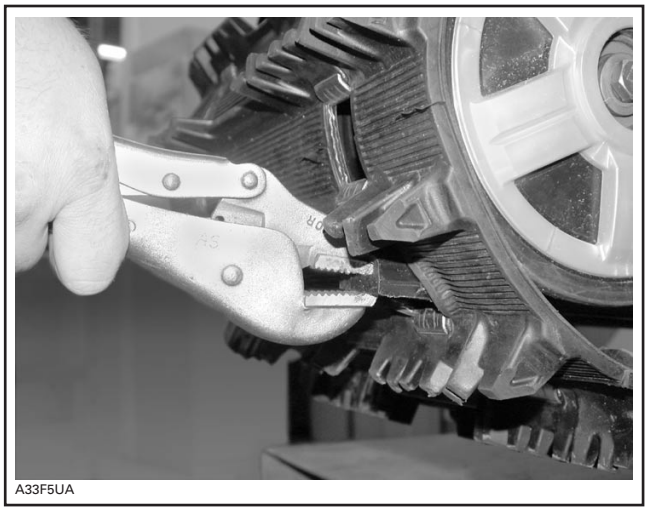
Using a pry bar or screw driver, push slider shoe until it comes in contact with track.



TYPICAL — PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe thru track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.


A33F5UA

TYPICAL — PULL ON SLIDER SHOE TO REMOVE

SLIDER SHOE INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Make sure to insert slider shoe end with hole first.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Slider shoe nut	2.5 N•m (22 lbf•**in**)

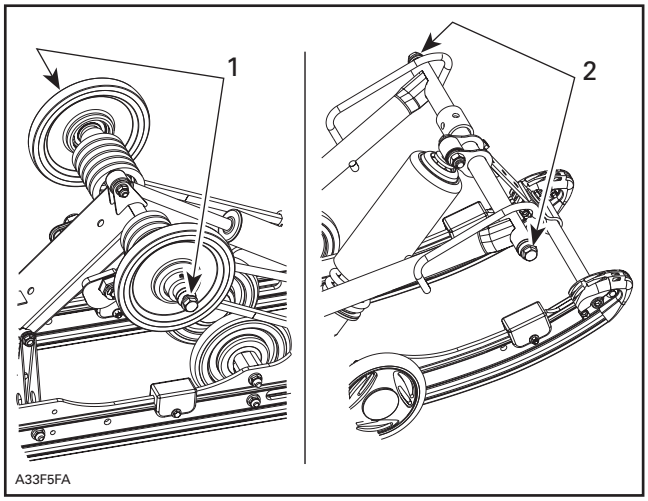
SUSPENSION REMOVAL

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

Remove rear arm top axle bolts from chassis.

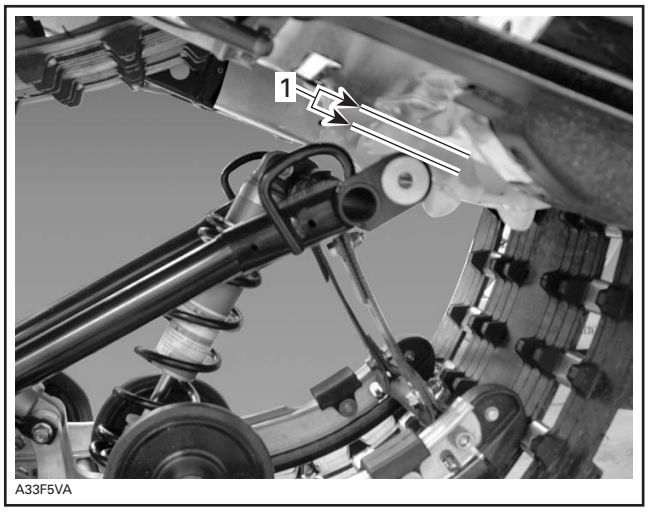
Remove bolts retaining front arm to tunnel.



A33F5FA

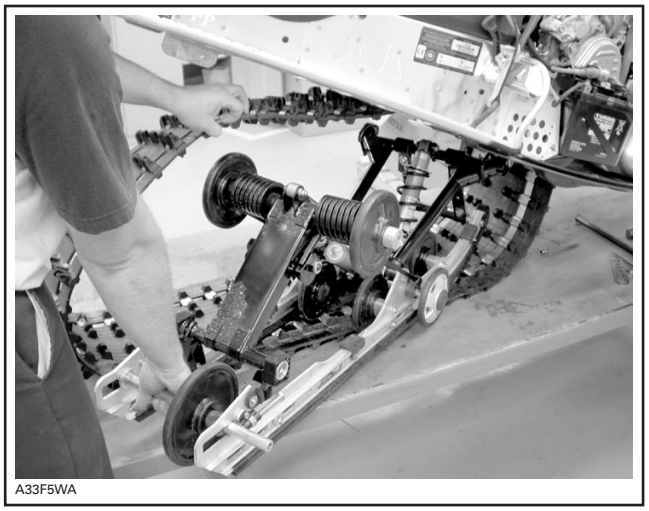
TYPICAL
1. Rear arm bolts
2. Front arm bolts

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



A33F5VA

TYPICAL
1. Enough clearance


A33F5WA

TYPICAL — REMOVE SUSPENSION

SUSPENSION INSTALLATION

Installation is the reverse of removal procedure. Pay attention to the following details.

Inspect track thoroughly before reinstalling suspension. Refer to TRACK.

Install suspension into track with front portion first.

Adjust track tension.

FRONT ARM REMOVAL

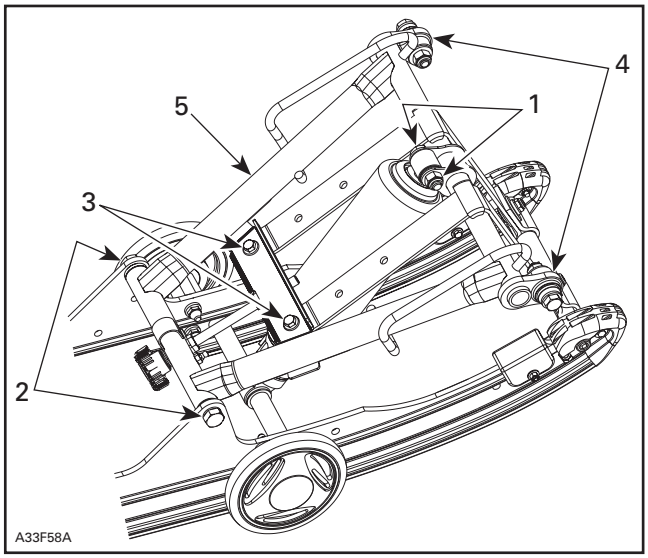
NOTE: Front arm can be removed with suspension in place.

Lift rear of vehicle and support it off the ground.

Remove the following:

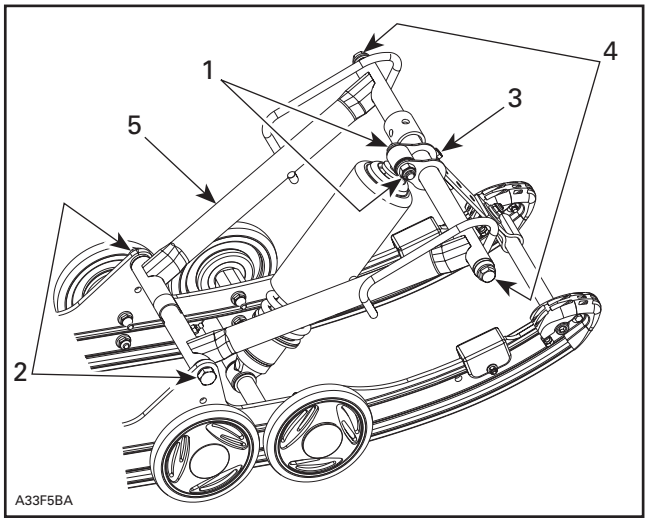
– shock upper bolt and nut
– front arm lower bolts and washers
– unfasten one end of stopper strap(s)
– remove front arm upper bolts, nuts and washers.

Remove front arm.



A33F58A

SUMMIT LIQUID COOLED MODELS
1. *Shock upper bolt and nut*
2. *Front arm lower bolts and washers*
3. *Unfasten one end of stopper straps*
4. *Front arm upper bolts, nuts and washers*
5. *Front arm*



A33F5BA

EXPEDITION/GTX/SUMMIT FAN COOLED MODELS
1. *Shock upper bolt and nut*
2. *Front arm lower bolts and washers*
3. *Unfasten one end of stopper strap*
4. *Front arm upper bolts, nuts and washers*
5. *Front arm*

FRONT ARM INSTALLATION

Installation is reverse of removal procedure.

Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Stopper strap nuts (on Summit strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap nuts	11 N•m (97 lbf•**in**)

REAR ARM/PIVOT ARM REMOVAL

NOTE: Rear arm can be removed with suspension in place.

For rear arm removal, remove the following:

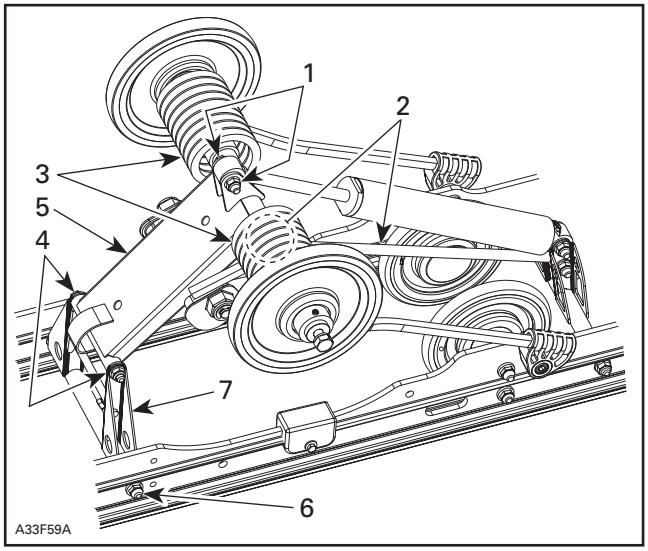
– shock upper bolt and nut
– throttle rod upper bolt and nut
– rear springs (refer to procedure above in this section)
– screws and washers holding rear arm to pivot arm

Remove rear arm.

For pivot arm removal, remove the following:

– bolt, nut and washers holding pivot arm to runners

Remove pivot arm.

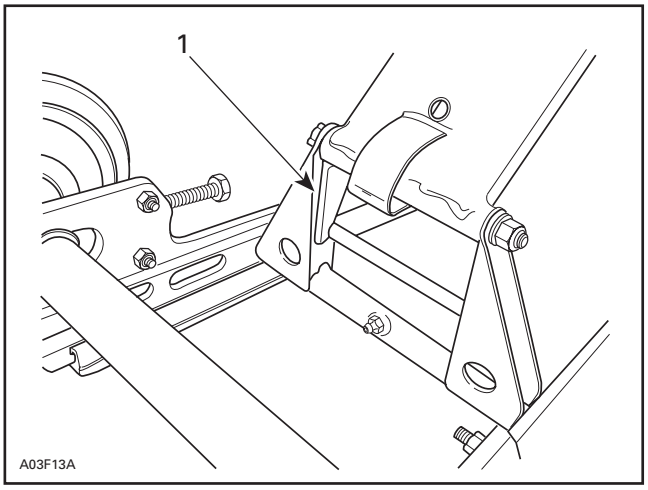


TYPICAL
1. *Shock upper bolt and nut*
2. *Throttle rod upper bolt and nut*
3. *Rear springs*
4. *Rear arm/pivot arm screws and washers*
5. *Rear arm*
6. *Pivot arm/runners bolts, nuts and washers*
7. *Pivot arm*

REAR ARM INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

At installation, rear arm stroke limiter must be on rear side.



1. Stroke limiter on rear side

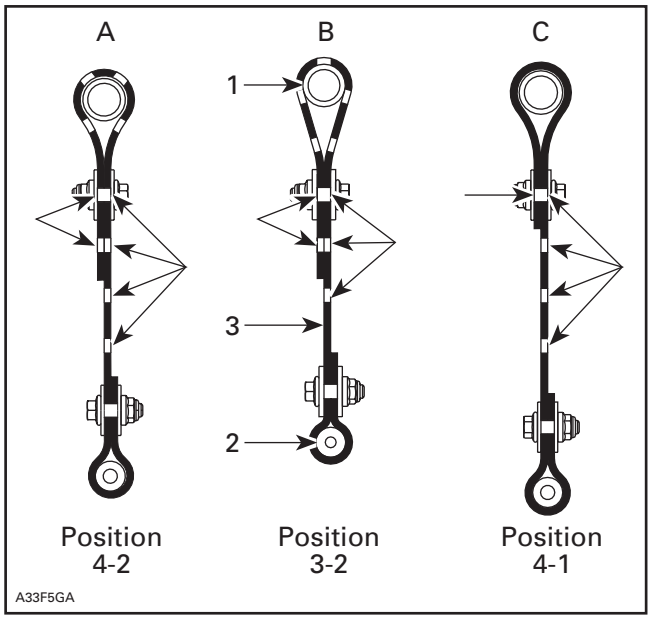
Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)
Rear arm shock upper nut	19.5 N•m (173 lbf•**in**)
Throttle rod upper nut	19.5 N•m (173 lbf•**in**)

STOPPER STRAP

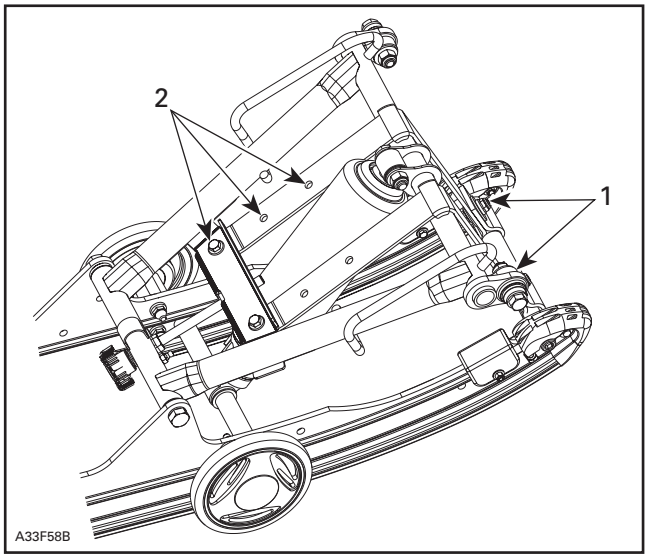
Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace as required.

Make sure it is attached through proper hole from the end.



FAN COOLED MODELS
1. *Front arm (top)*
2. *Front axle*
3. *Rear of vehicle*

A. GTX/Expedition
B. Summit
C. GTX (EUR)/Summit (EUR)



TYPICAL — SUMMIT LIQUID COOLED MODELS
1. *No adjustment possible*
2. *3 adjustments possible*

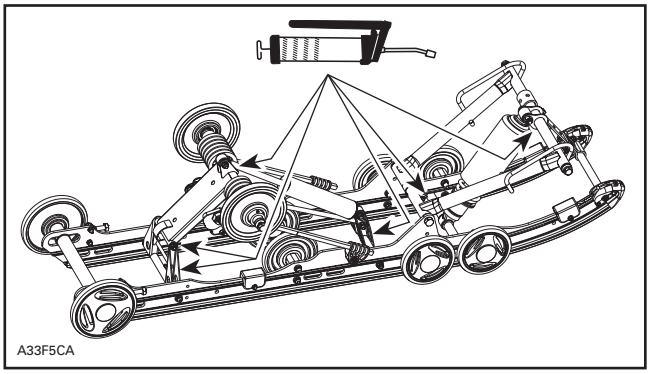
DESCRIPTION	TIGHTENING TORQUE
Stopper strap nuts (on Summit strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap nuts	11 N•m (97 lbf•**in**)

RIDE ADJUSTMENT

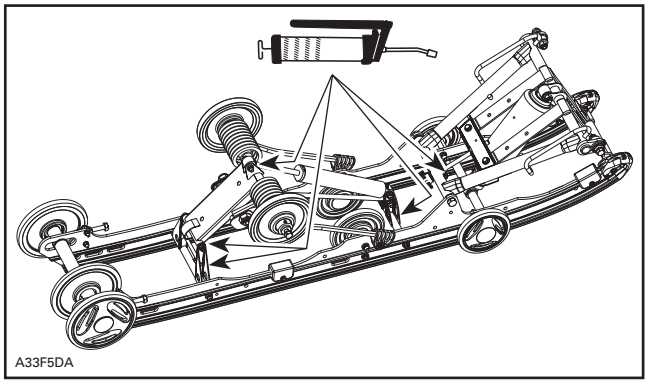
Refer to the appropriate *Operator's Guide*.

LUBRICATION

Lubricate front and rear arms at grease fittings using suspension synthetic grease (P/N 293 550 033).



EXPEDITION/GTX/SUMMIT FAN COOLED MODELS

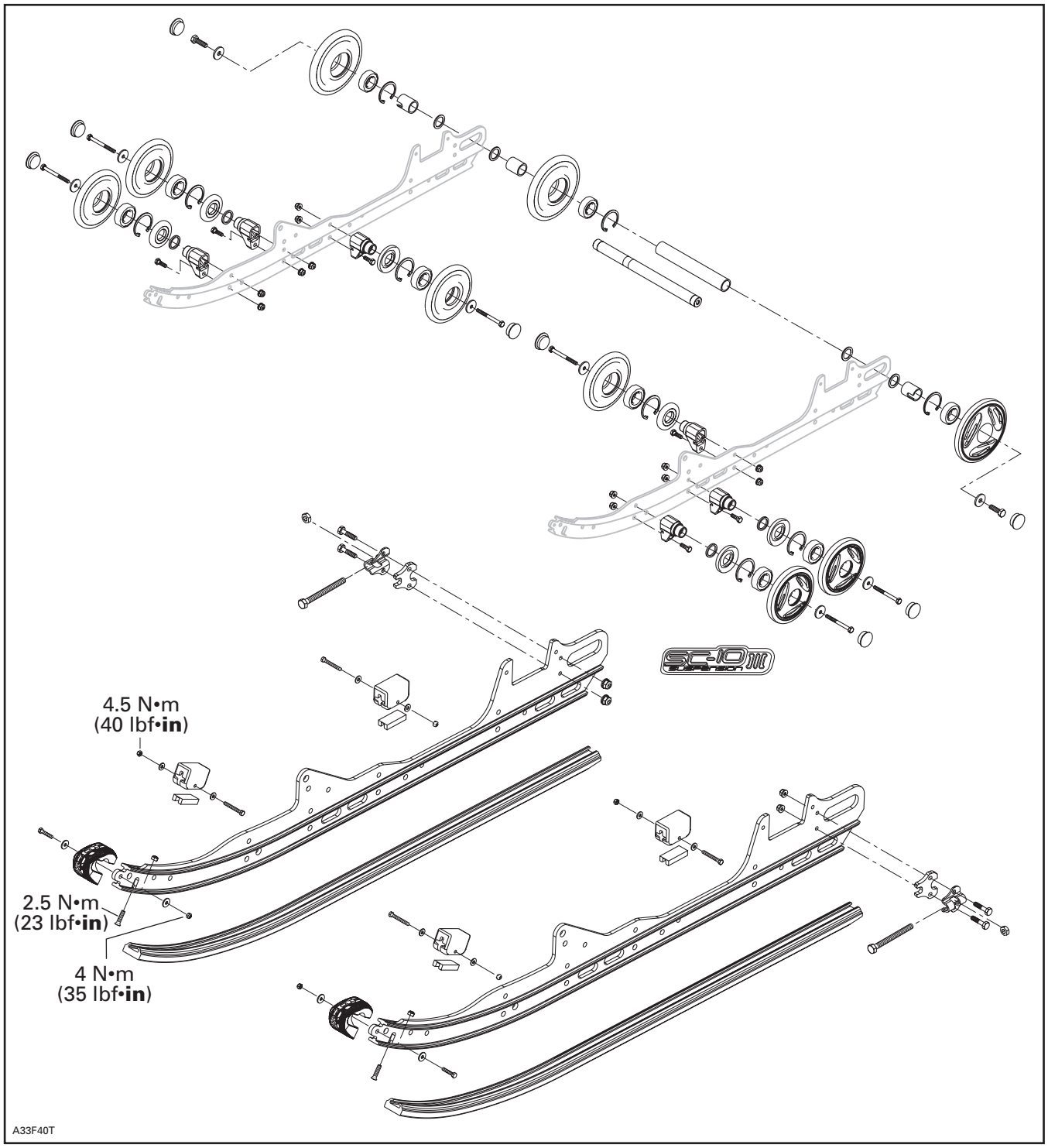


SUMMIT LIQUID COOLED MODELS

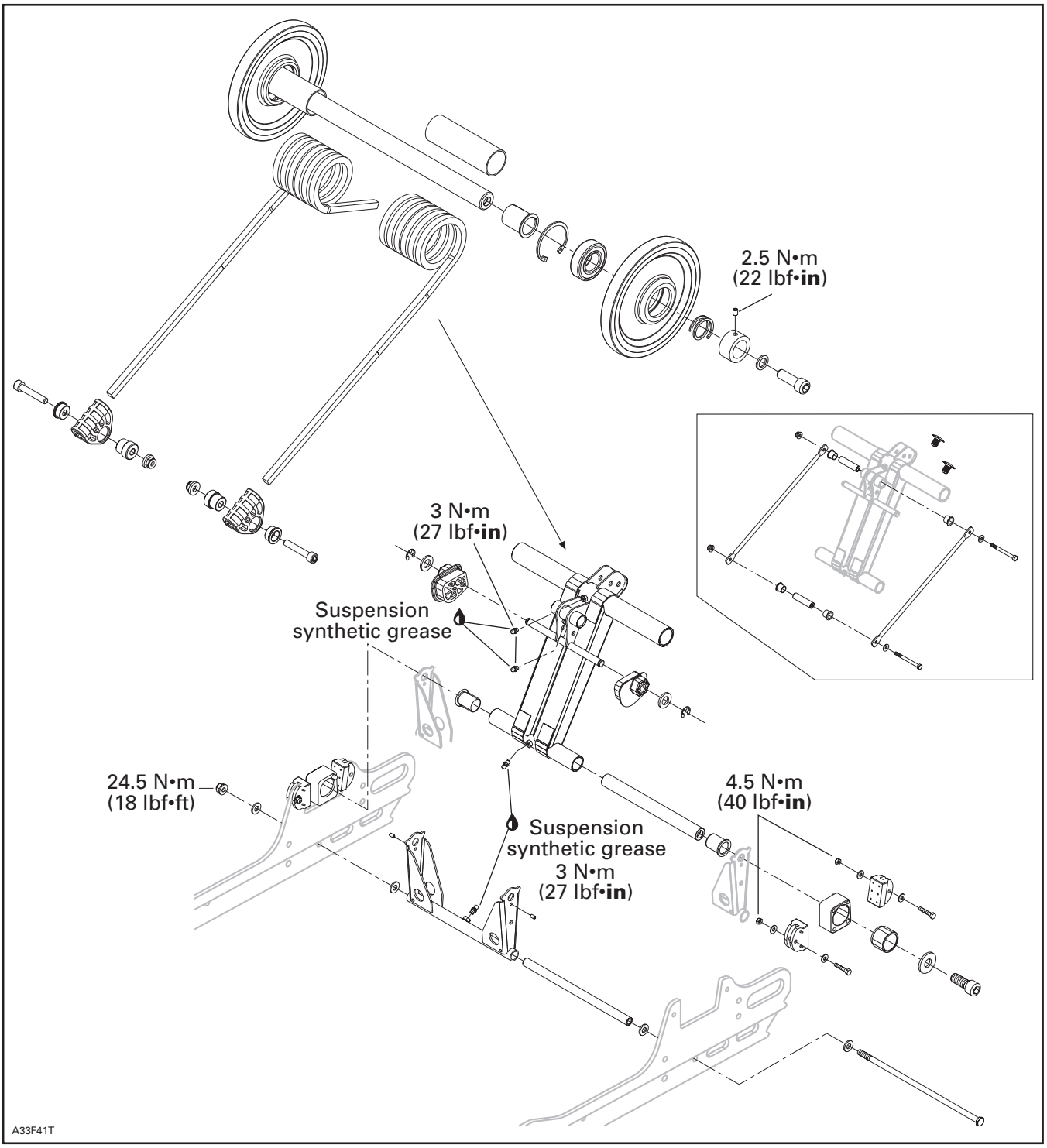
SC 3 SUSPENSION

SERVICE PRODUCTS

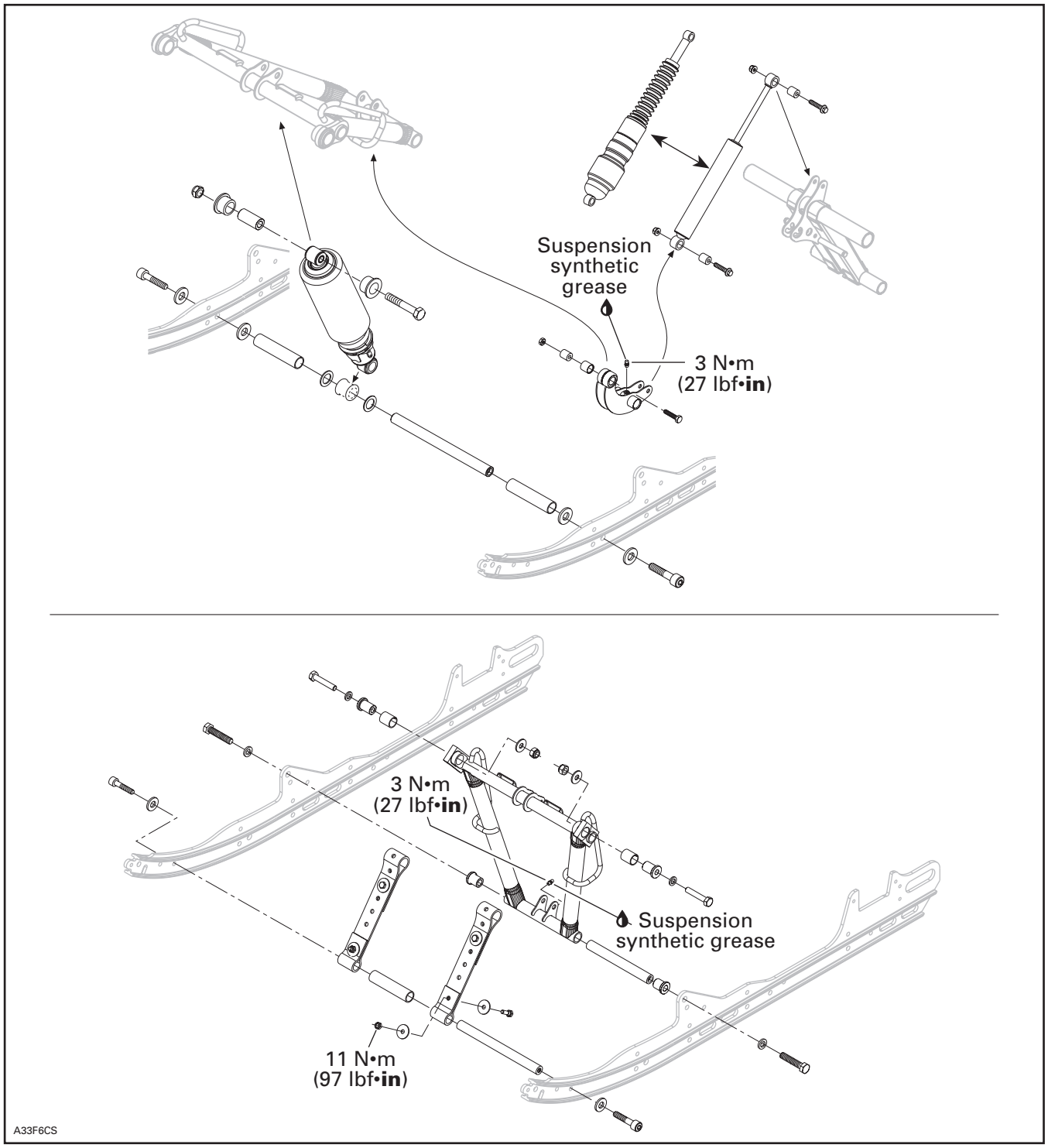
Description	Part Number	Page
suspension synthetic grease	293 550 033	406



RAILS AND IDLER WHEELS



REAR ARM AND UPPER IDLER WHEELS



FRONT ARM AND SHOCK ABSORBERS

AXLE SELF-LOCKING SCREWS REMOVAL

CAUTION: These self-locking screws must always be replaced by new ones everytime they are removed.

NOTE: To prevent axle from turning when unscrewing self-locking screws, proceed as follows:

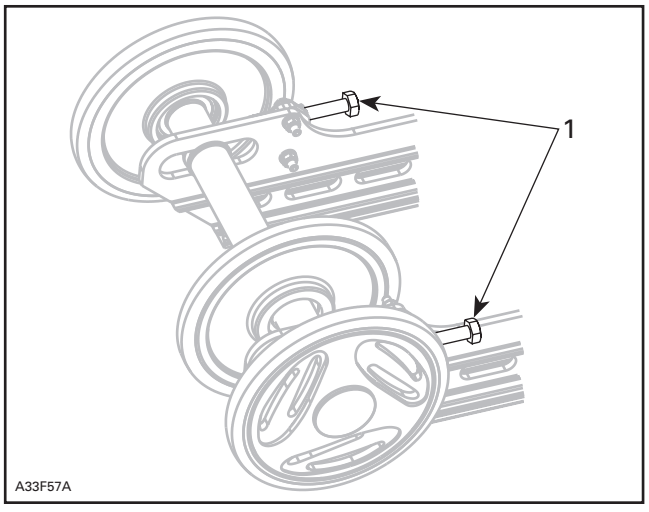
– Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
– Remove the opposite self-locking screw.
– Remove the temporary installed non-self-locking screw.
– If it doesn't work, heat bolt head to melt threadlocker.

REAR AXLE REMOVAL

Lift rear of vehicle and support it off the ground.

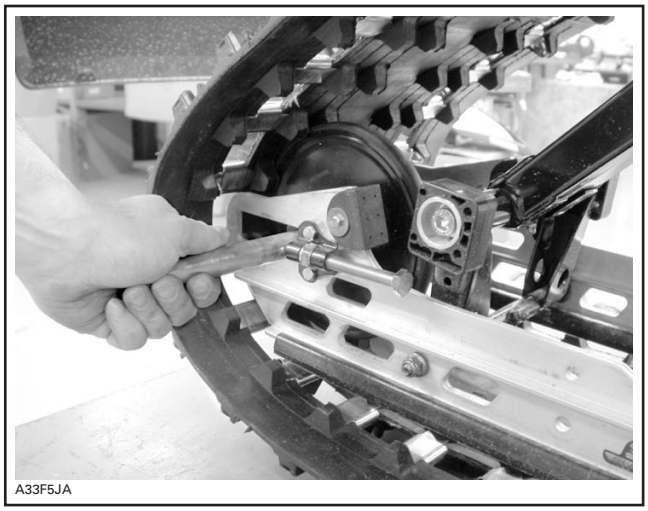
Remove screws on rear axle.

Completely loosen track tension.



TYPICAL
1. Completely loosen track tension

Pull out rear axle from RH side of vehicle.



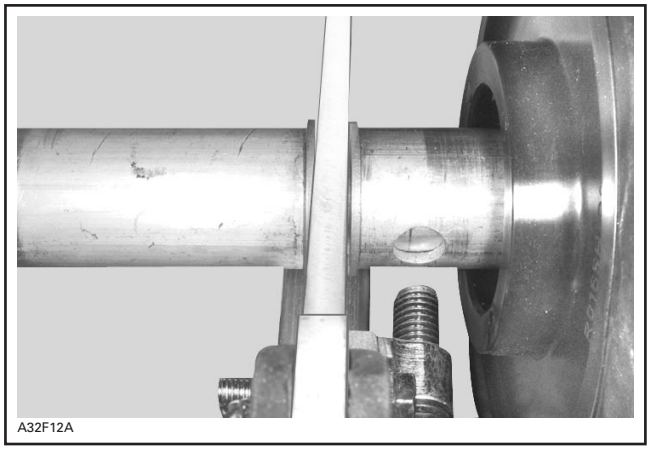
TYPICAL — PULL OUT REAR AXLE

REAR AXLE INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Hole of outer bushing must face adjustment screw.

Make sure to reinstall washer on each side of runner.



OUTER BUSHING POSITION

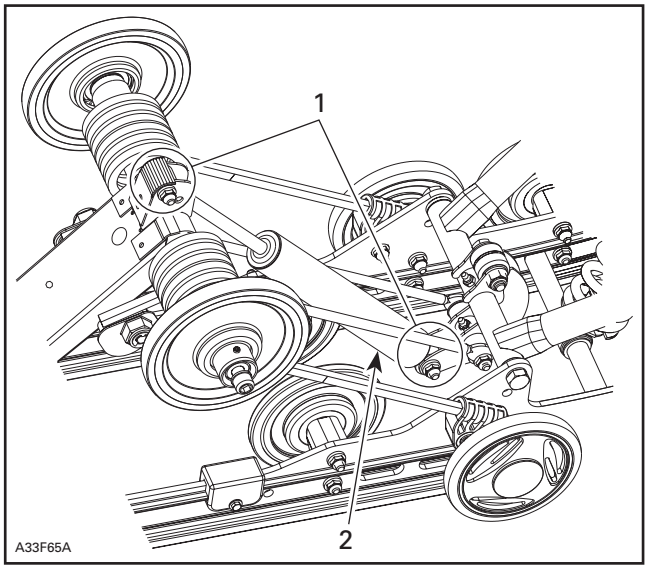
REAR SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

Remove shock upper and lower bolt and nut

NOTE: If necessary, to ease shock removal, unfasten one end of stopper straps to release shock pressure.

Remove rear arm shock.

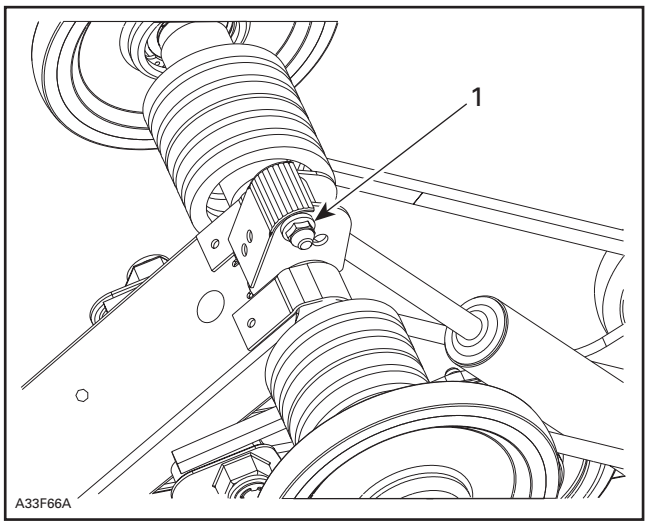


TYPICAL
1. *Upper/lower bolt and nut*
2. *Rear shock absorber*

REAR SHOCK ABSORBER INSTALLATION

Installation is reverse of removal procedure.

CAUTION: Take care not to damage grease fitting.



REAR SHOCK ABSORBER POSITION
1. *Shock installed using upper hole*

FRONT SHOCK ABSORBER REMOVAL

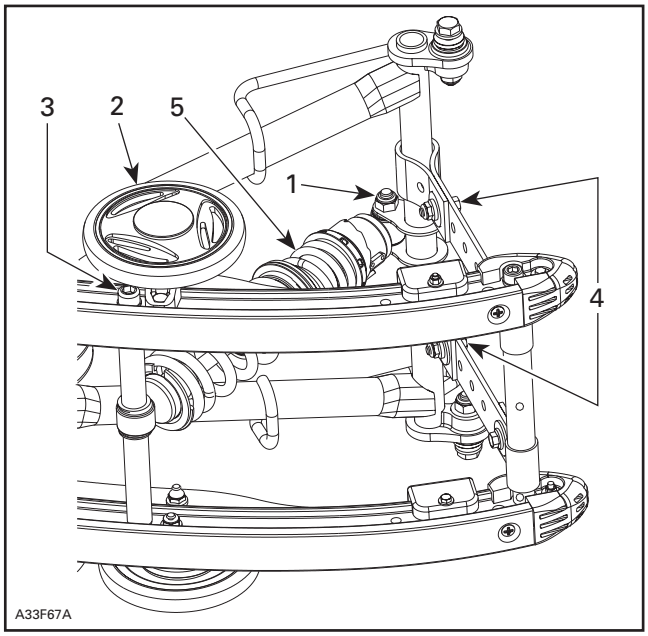
Lift rear of vehicle and support it off the ground.

Unfasten one end of stopper straps to release shock pressure.

Unbolt front shock from the top.

Remove the front idler wheels to gain access to the axle retaining self-locking screws.

Unbolt axle screws and slide out axle to remove shock.



TYPICAL
1. *Front shock upper bolt and nut*
2. *Idler wheel*
3. *Axle screw*
4. *Unfasten one end of stopper straps*
5. *Front shock*

FRONT SHOCK ABSORBER INSTALLATION

Installation is reverse of removal procedure.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Stopper strap(s) nuts	11 N•m (97 lbf•**in**)

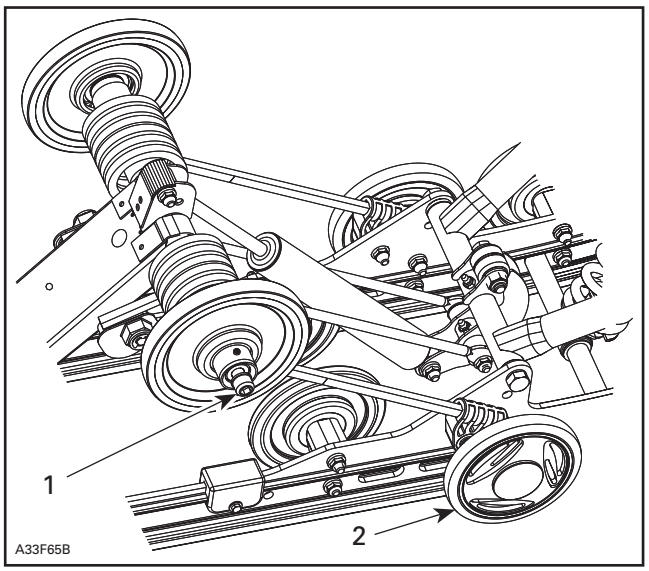
REAR SPRING REMOVAL

Lift rear of vehicle and support it off the ground.

Decrease spring preload by turning cams accordingly.

Loosen rear arm top axle from chassis.

Remove idler wheels to have access to spring supports screws.

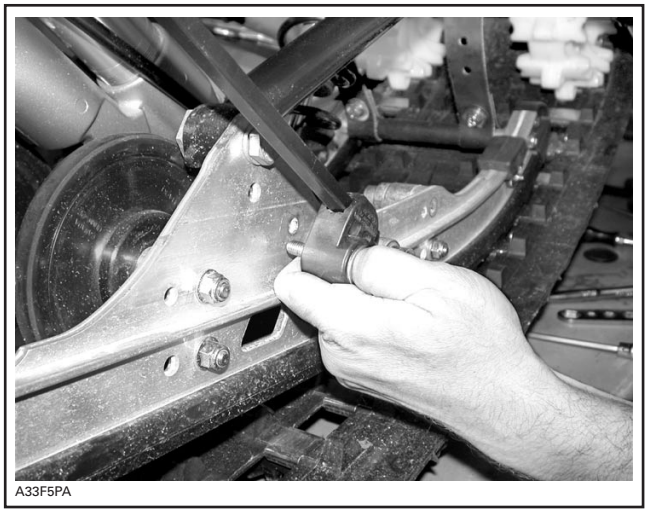


TYPICAL
1. *Loosen rear arm top axle from chassis*
2. *Remove idler wheels (if necessary)*

Remove spring supports.

⚠ WARNING

Supports are spring loaded.



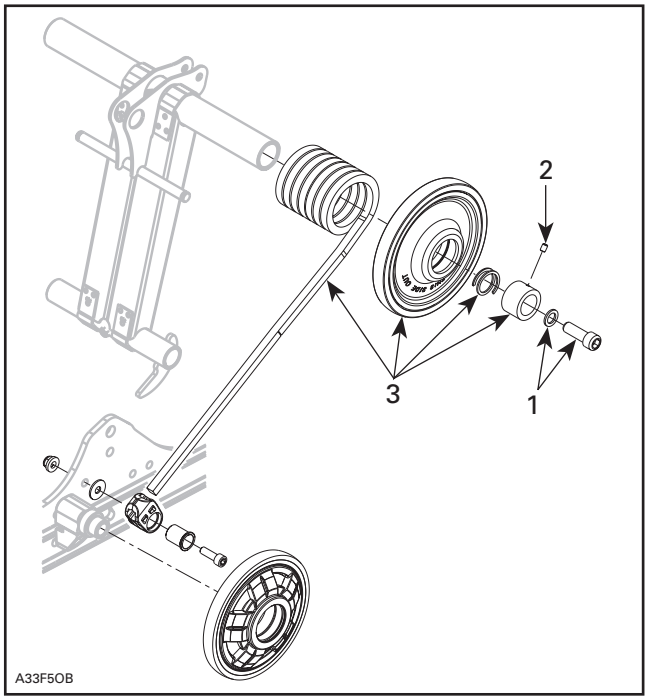
REMOVE SPRING SUPPORTS

Remove screws and washers from rear arm top axle.

Loosen set screw from locking rings.

Remove the following on both sides:

– locking ring
– axle spring
– top idler wheel
– rear springs.



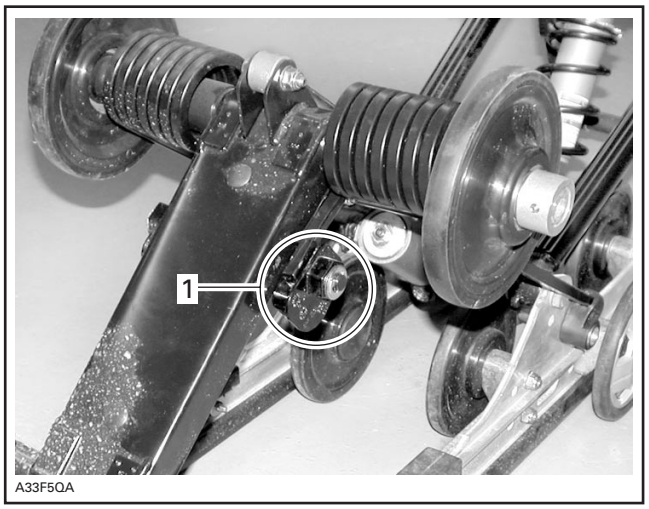
TYPICAL — ON BOTH SIDES
1. *Remove screws*
2. *Loosen set screw*
3. *Remove the following*

REAR SPRING INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

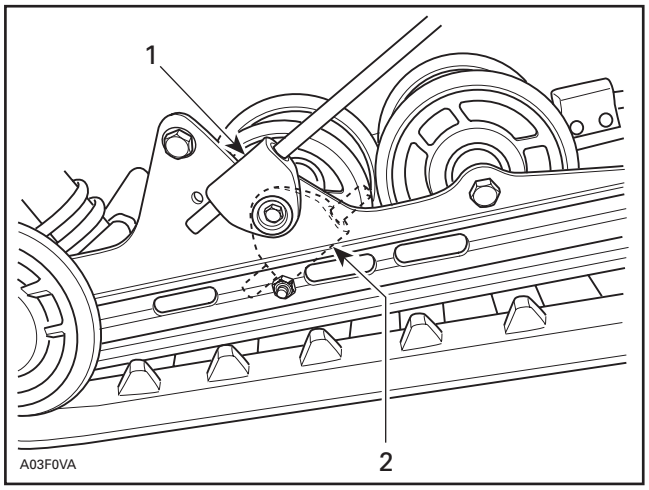
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

At assembly, make sure that spring end is in cam adjuster.



ON BOTH SIDES
1. Spring end in cam adjuster

CAUTION: To avoid track damage, spring supports must be mounted upward.



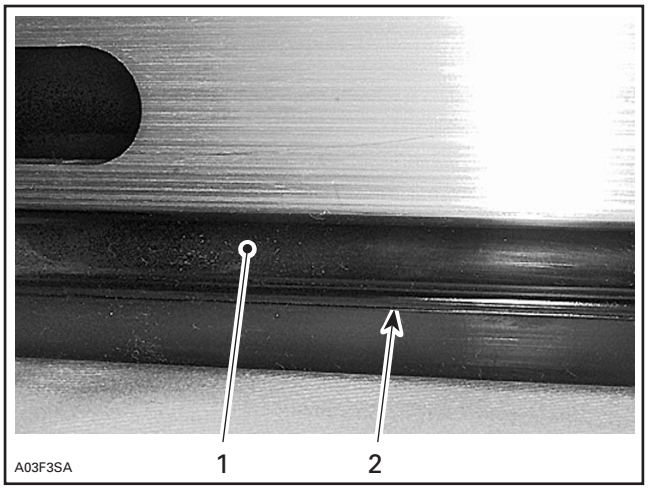
TYPICAL — RIGHT SIDE SHOWN
1. Right position: upward
2. Wrong position

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)

SLIDER SHOE VERIFICATION

Molding line is the wear limit indicator.



TYPICAL
1. Slider shoe
2. Molding line (wear limit indicator)

Replace slider shoes when wear limit is reached.

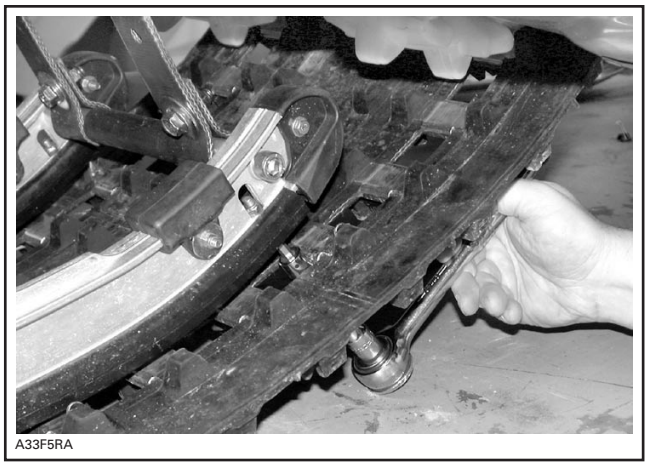
CAUTION: Slider shoes must always be replaced in pairs.

SLIDER SHOE REMOVAL

Lift rear of vehicle and support it off the ground.

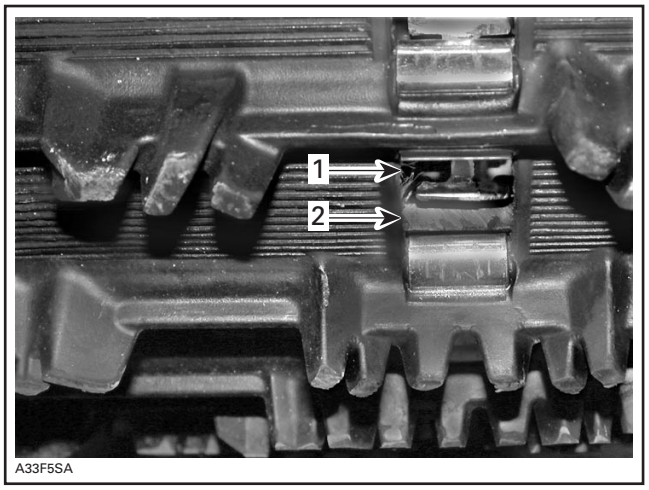
Completely loosen track tension.

Remove front runners nut and screw.



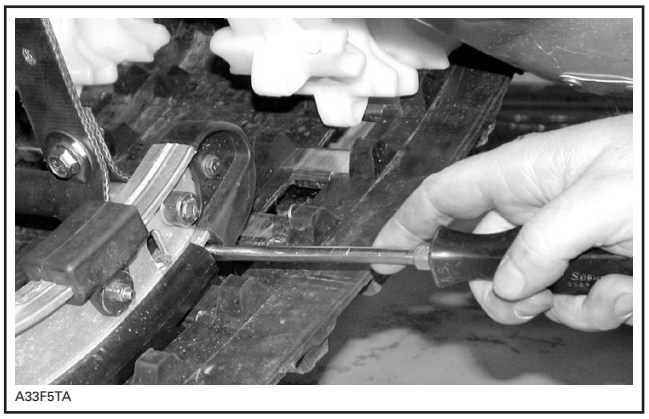
TYPICAL — REMOVE NUT AND SCREW

Align track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

Using a pry bar or screw driver, push slider shoe until it comes in contact with track.



TYPICAL — PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe thru track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.

TYPICAL — PULL ON SLIDER SHOE TO REMOVE

SLIDER SHOE INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Make sure to insert slider shoe end with hole first.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Slider shoe nut	2.5 N•m (22 lbf•**in**)

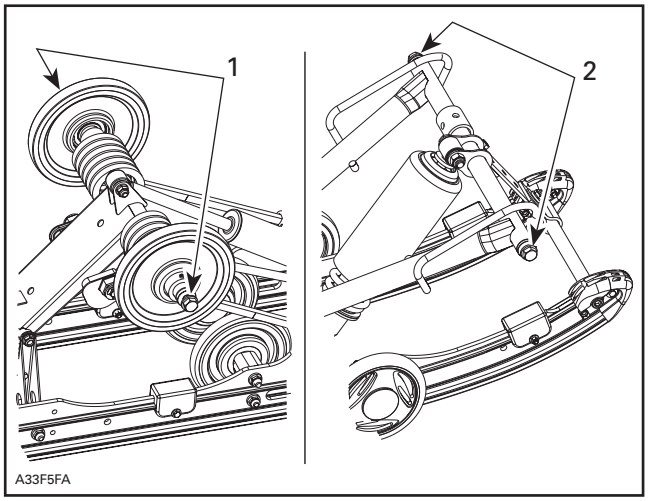
SUSPENSION REMOVAL

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

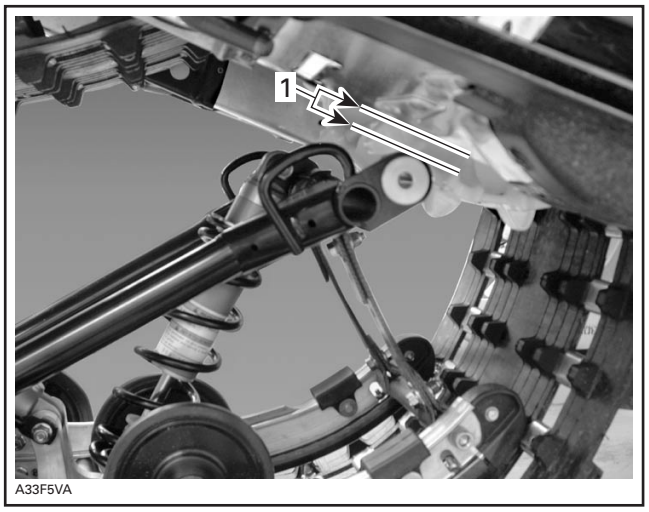
Remove rear arm top axle bolts from chassis.

Remove bolts retaining front arm to tunnel.

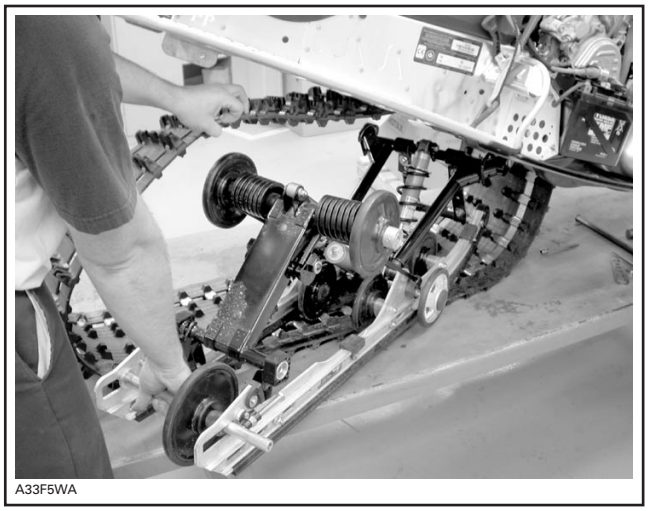


TYPICAL
1. Rear arm bolts
2. Front arm bolts

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



TYPICAL
1. Enough clearance



TYPICAL — REMOVE SUSPENSION

SUSPENSION INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Inspect track thoroughly before reinstalling suspension. Refer to TRACK.

Install assembled suspension into track with front portion first.

Adjust track tension.

FRONT ARM REMOVAL

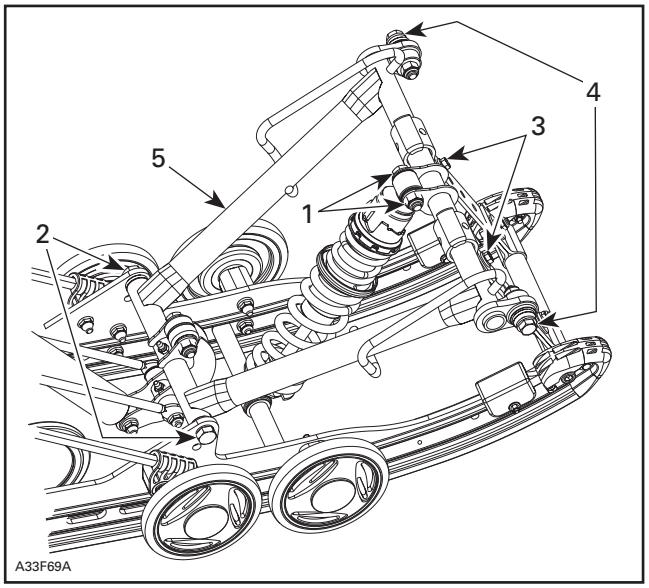
NOTE: Front arm can be removed with suspension assembly in place.

Lift rear of vehicle and support it off the ground.

Remove the following:

– shock upper bolt and nut
– front arm lower bolts and washers
– unfasten one end of stopper strap(s)
– remove front arm upper bolts, nuts and washers.

Remove front arm.



TYPICAL
1. *Shock upper bolt and nut*
2. *Front arm lower bolts and washers*
3. *Unfasten one end of stopper straps*
4. *Front arm upper bolts, nuts and washers*
5. *Front arm*

FRONT ARM INSTALLATION

Installation is reverse of removal procedure.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Stopper strap(s) nuts	11 N•m (97 lbf•**in**)

REAR ARM/PIVOT ARM REMOVAL

NOTE: Rear arm can be removed with suspension assembly in place.

For rear arm removal, remove the following:

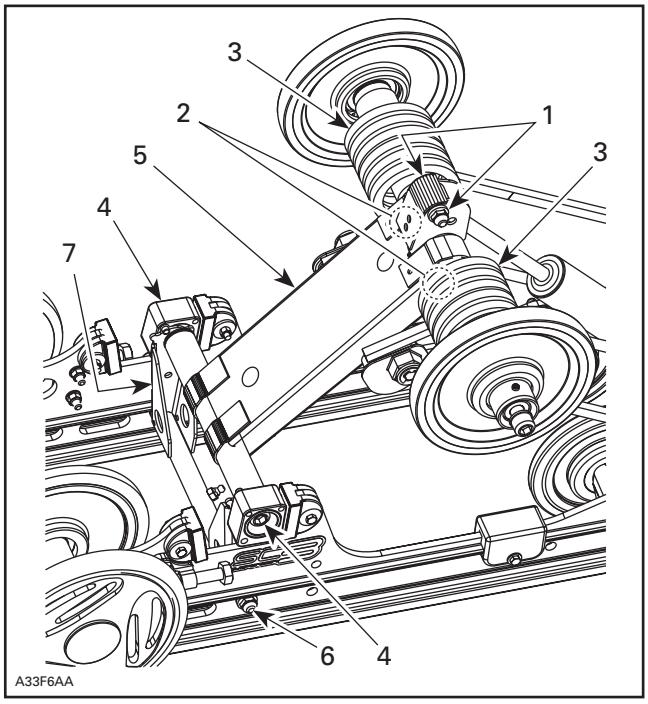
– shock upper bolt and nut
– throttle rods upper bolt and nut
– rear springs (refer to procedure above in this section)
– screws and washers holding rear arm to pivot arm.

Remove rear arm.

For pivot arm removal, remove the following:

– bolt, nut and washers holding pivot arm to runners.

Remove pivot arm.



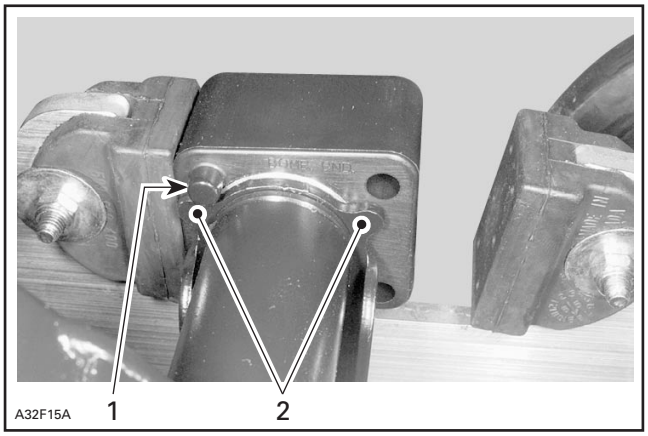
TYPICAL
1. *Shock upper bolt and nut*
2. *Throttle rods upper bolt and nut*
3. *Rear springs*
4. *Rear arm/pivot arm screws and washers*
5. *Rear arm*
6. *Pivot arm/runners bolt, nut and washers*
7. *Pivot arm*

REAR ARM/PIVOT ARM INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Both blocks are identified R or L (right or left), see second following photo. At installation, make sure to install proper block on proper side.

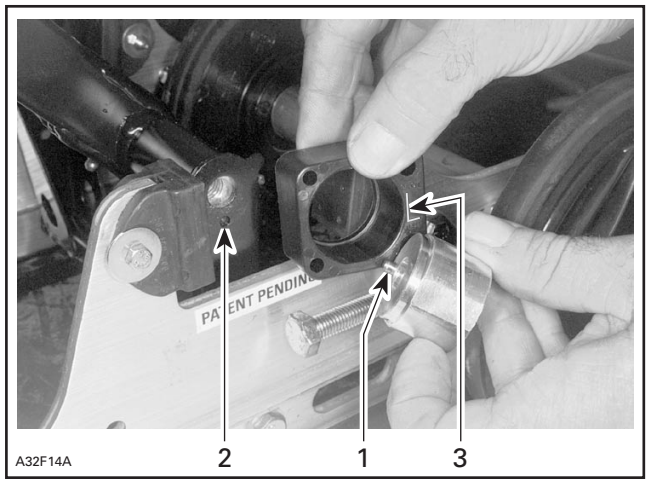
Also, note that protrusion must be positioned above stoppers.



1. Protrusion
2. Stoppers

Dowel pin must exceed block guide by 2 to 2.3 mm (.079 to .091 in).

At installation, insert dowel pin into pivot arm hole.



LEFT SIDE SHOWN
1. Dowel pin
2. Pivot arm hole
3. «L» identification for left side

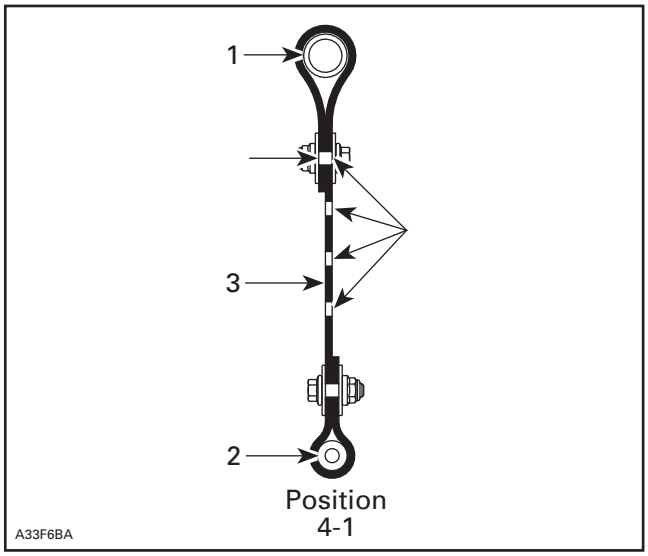
Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)
Pivot arm lower nut	24.5 N•m (18 lbf•ft)

STOPPER STRAP

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace as required.

Make sure it is attached through proper hole from the end.



1. Front arm (top)
2. Front axle
3. Rear of vehicle

Respect the following tightening torque specification:

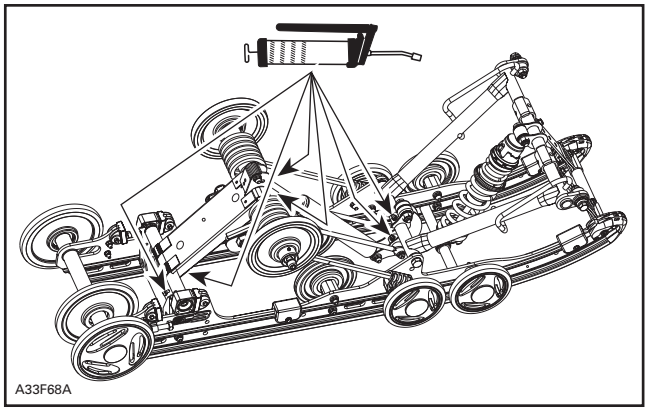
DESCRIPTION	TIGHTENING TORQUE
Stopper strap nuts	11 N•m (97 lbf•**in**)

RIDE ADJUSTMENT

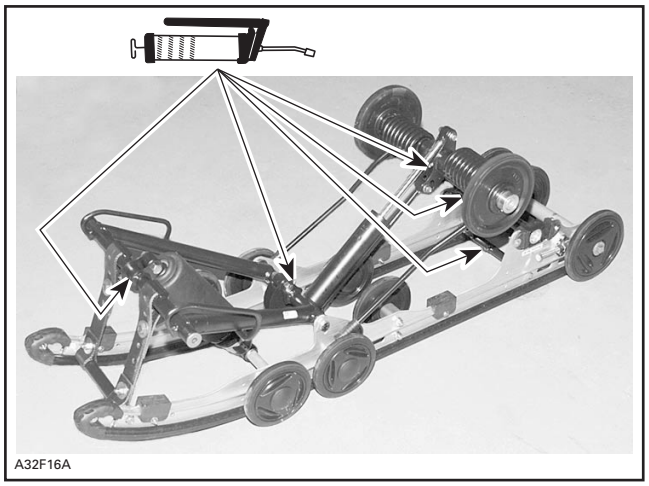
Refer to the appropriate *Operator's Guide*.

LUBRICATION

Lubricate front and rear arms at grease fittings using suspension synthetic grease (P/N 293 550 033).



TYPICAL

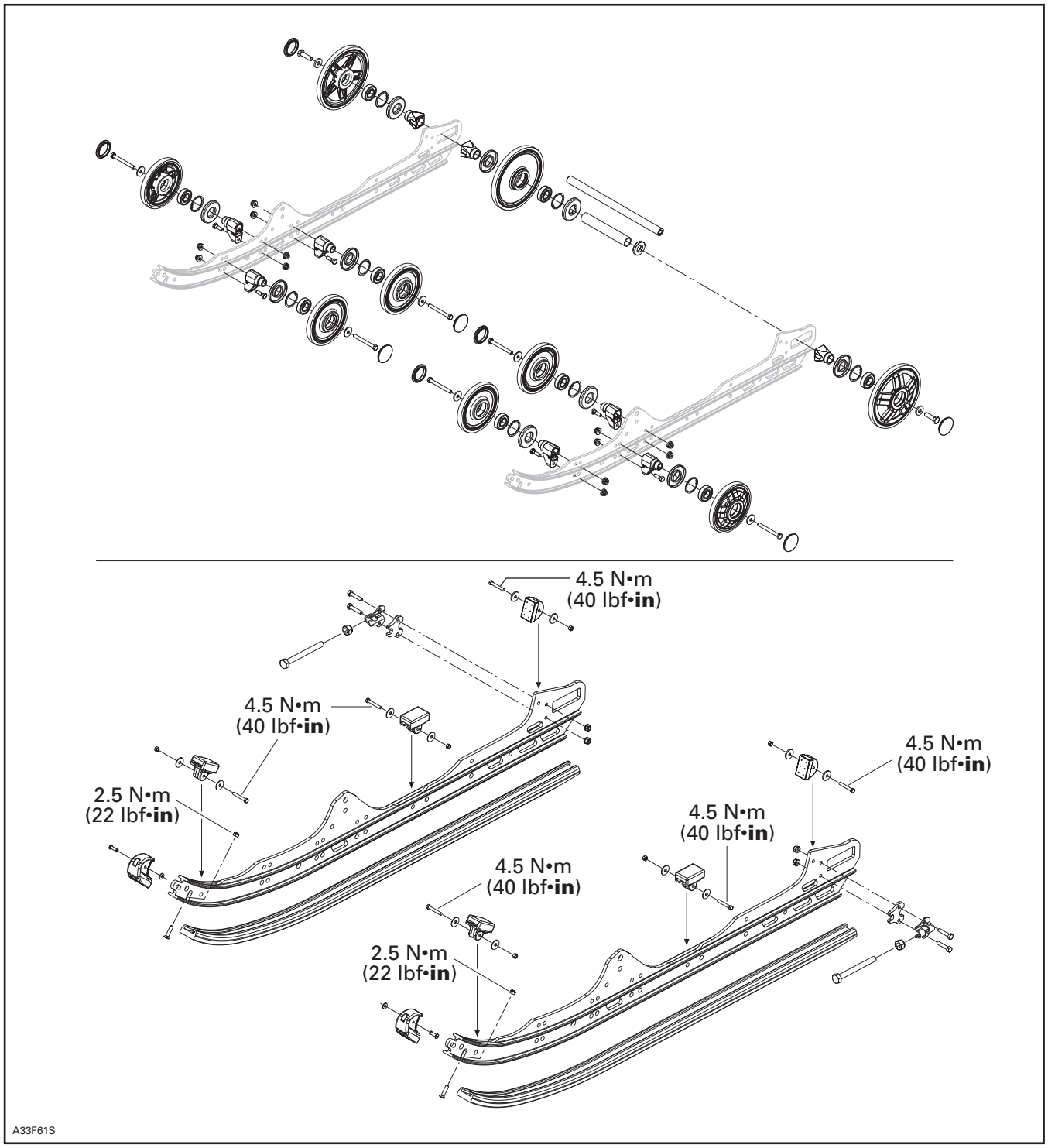

A32F16A

TYPICAL

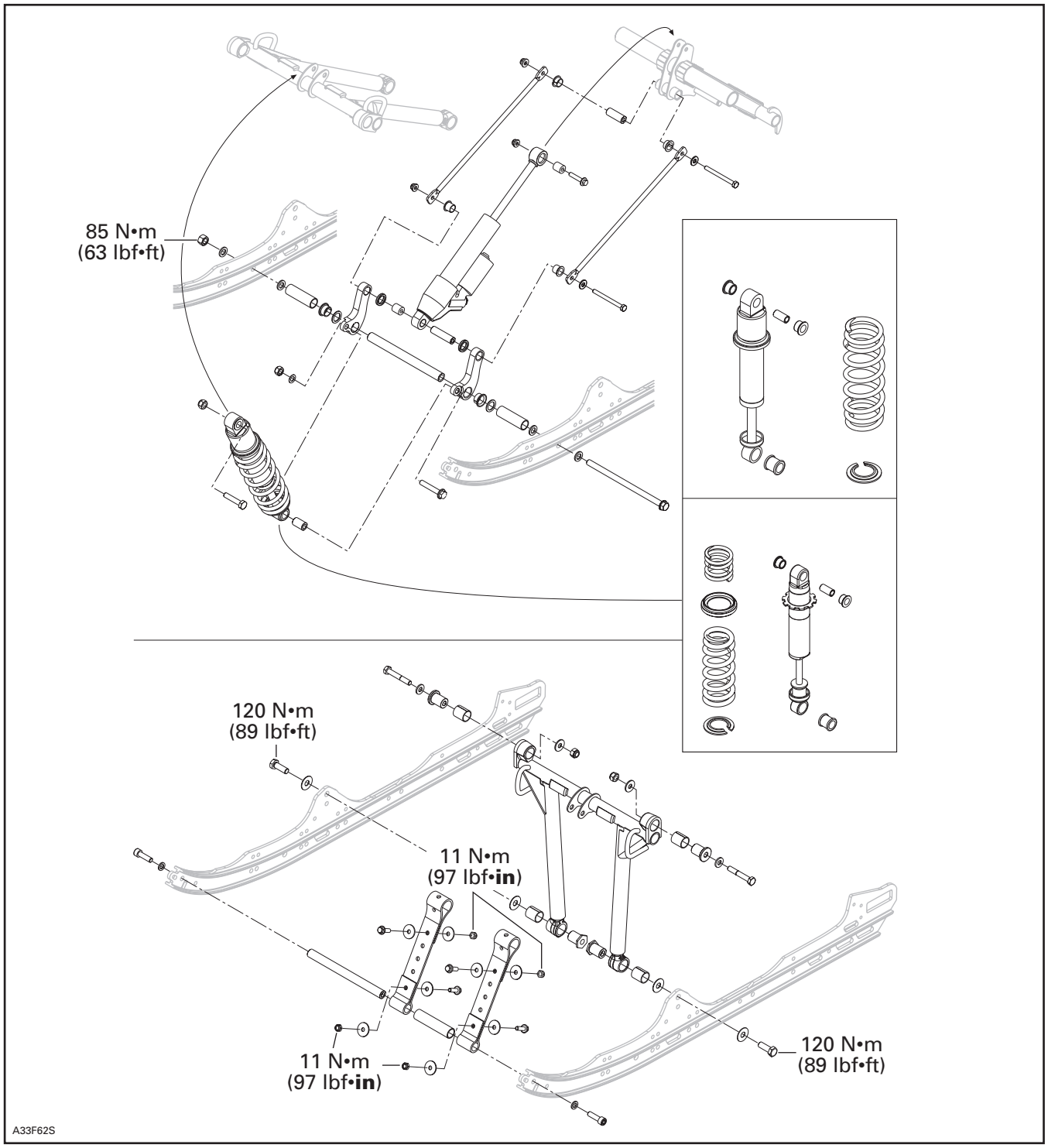
SC 4 SUSPENSION

SERVICE PRODUCTS

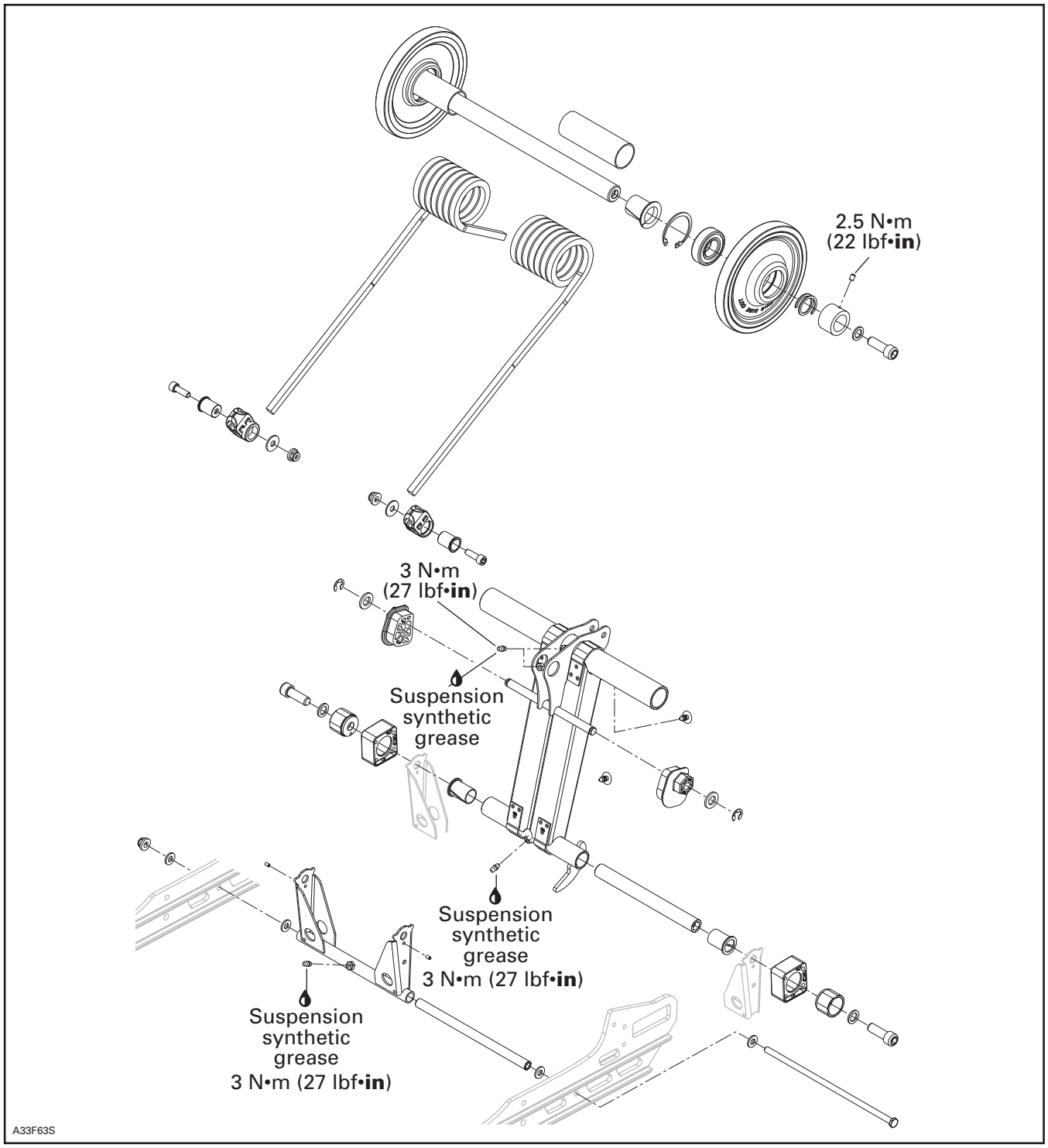
Description	Part Number	Page
suspension synthetic grease	293 550 033	421



RAILS AND IDLER WHEELS



ARMS AND SHOCK ABSORBERS



REAR ARM, SPRINGS AND IDLER WHEELS

AXLE SELF-LOCKING SCREW REMOVAL

CAUTION: These self-locking screws must always be replaced by new ones everytime they are removed.

NOTE: To prevent an axle from turning when unscrewing self-locking screws, proceed as follows:

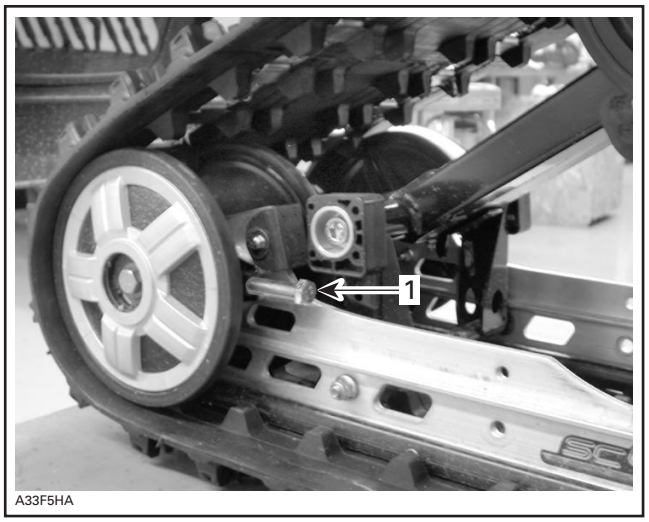
– Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
– Remove the opposite self-locking screw.
– Remove the temporary installed non-self-locking screw.
– If it doesn't work, heat bolt head to melt threadlocker.

REAR AXLE REMOVAL

Lift rear of vehicle and support it off the ground.

Remove screws on rear axle.

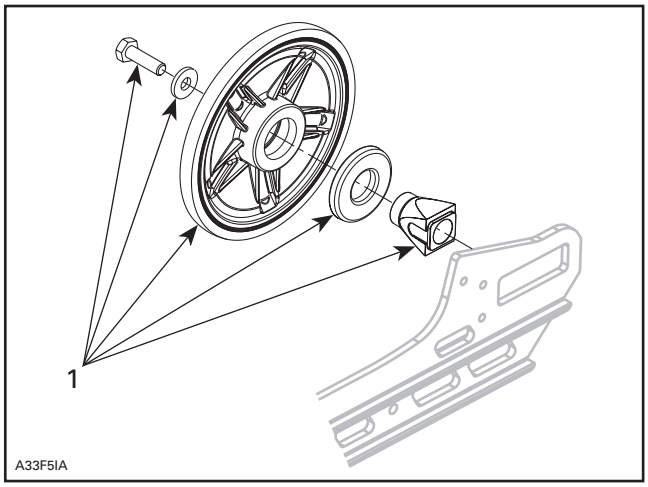
Completely loosen track tension.



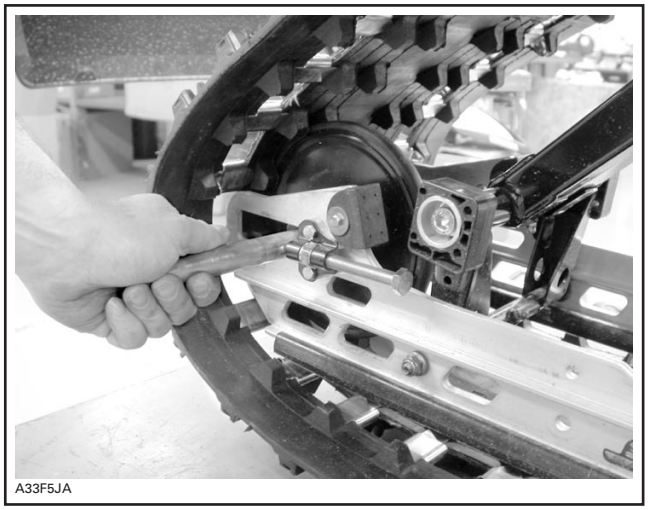
1. Completely loosen track tension

Remove the following:

– rear idler wheels
– idler wheels bearing protector
– idler wheels spacer.



ON BOTH SIDES
1. Remove the following



PULL OUT REAR AXLE

REAR AXLE INSTALLATION

Installation is reverse of removal procedure.

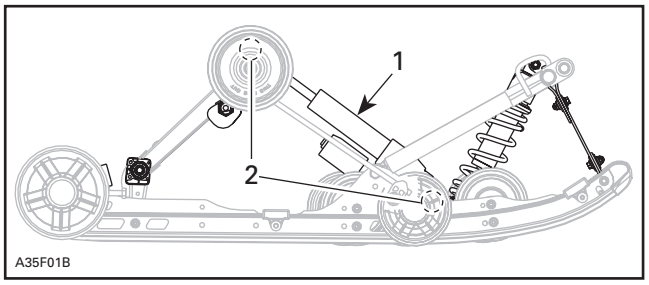
REAR SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

NOTE: If necessary, to ease shock removal, unfasten one end of stopper straps to release shock pressure.

Remove bolts and nuts from shock.

NOTE: If necessary, remove idler wheel(s) to ease lower shock component removal.

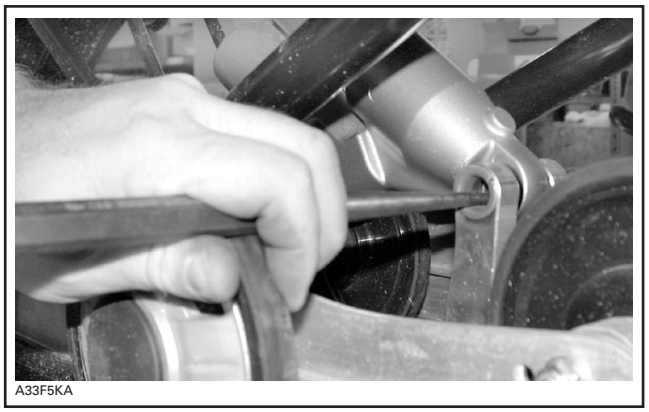


1. Rear shock absorber
2. Remove bolts and nuts

Using a punch, remove lower shock bar axle.

Pay attention to plastic spacers.

Remove shock.



REMOVE BAR AXLE

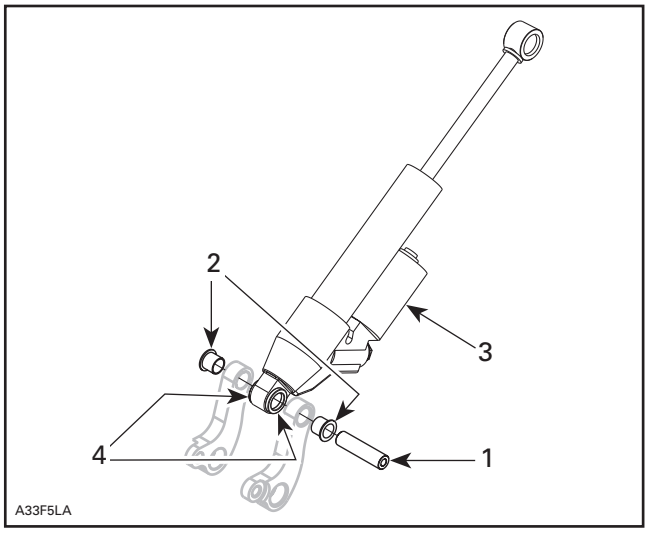
REAR SHOCK ABSORBER INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

To ease shock installation, secure upper shock first.

CAUTION: Make sure shock bar axle is aligned with swivel bushings before inserting it.

CAUTION: Shock reservoir must be towards track.

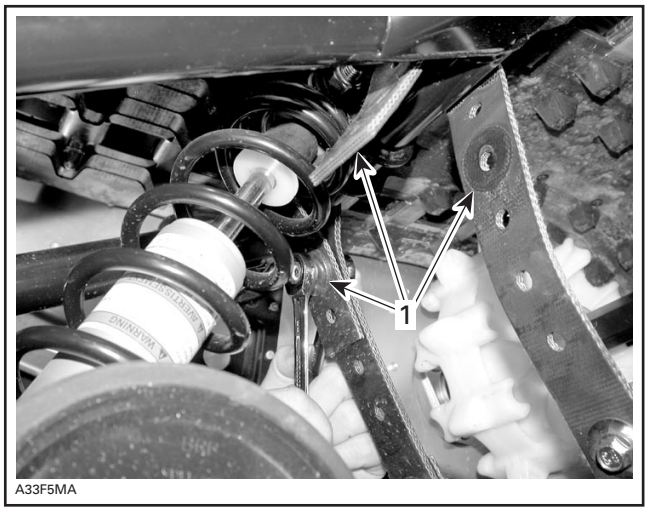


1. Bar axle
2. Swivel bushings
3. Shock reservoir position
4. Plastic spacers

FRONT SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

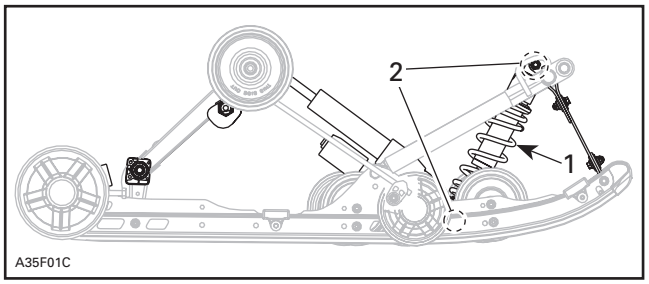
Unfasten one end of stopper straps.



1. Unfasten one end of stopper straps

Remove bolts and nuts from shock.

NOTE: If necessary, remove idler wheel(s) to ease lower shock component removal.



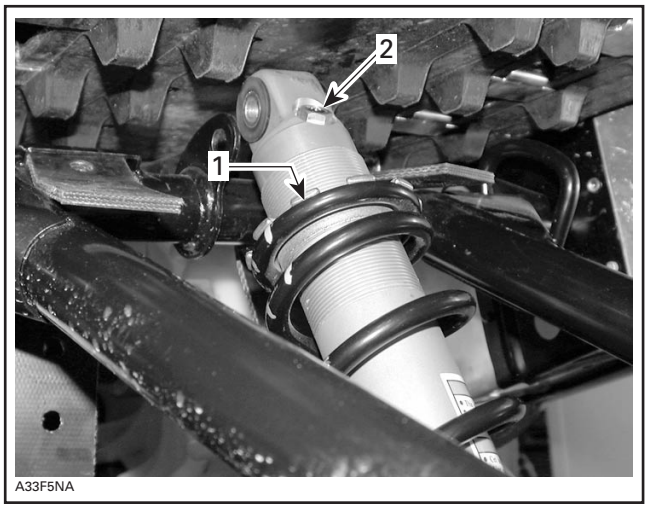
1. Front shock absorber
2. Remove bolts and nuts

FRONT SHOCK ABSORBER INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Shock absorber nuts should be on the RH side.

Install shock adjustment ring towards the top and valve towards tunnel, see photo.



1. Adjustment ring
2. Valve

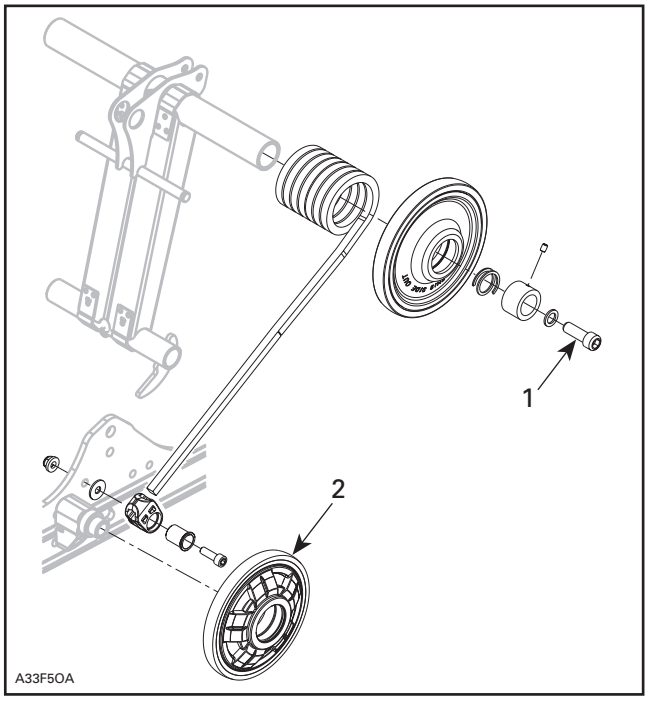
REAR SPRING REMOVAL

Lift rear of vehicle and support it off the ground.

Decrease spring preload by turning cams accordingly.

Loosen rear arm top axle from chassis.

Remove idler wheels to have access to spring support screws.

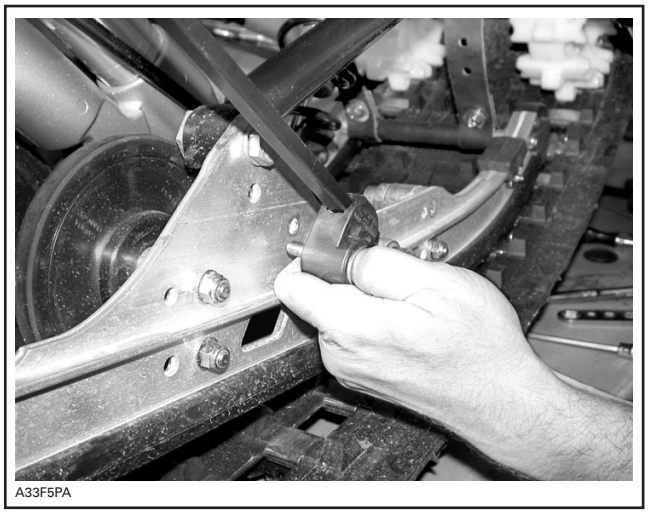


1. Loosen rear arm top axle from chassis
2. Remove idler wheels

Remove spring supports.

⚠ WARNING

Supports are spring loaded.



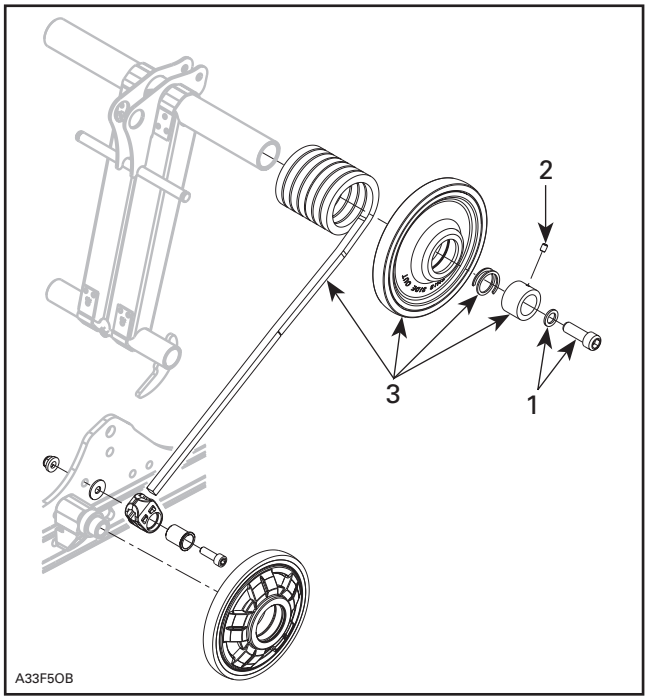
REMOVE SPRING SUPPORTS

Remove screws and washers from rear arm top axle.

Loosen set screw from locking rings.

Remove the following on both sides:

– locking ring
– axle spring
– top idler wheel
– rear spring.



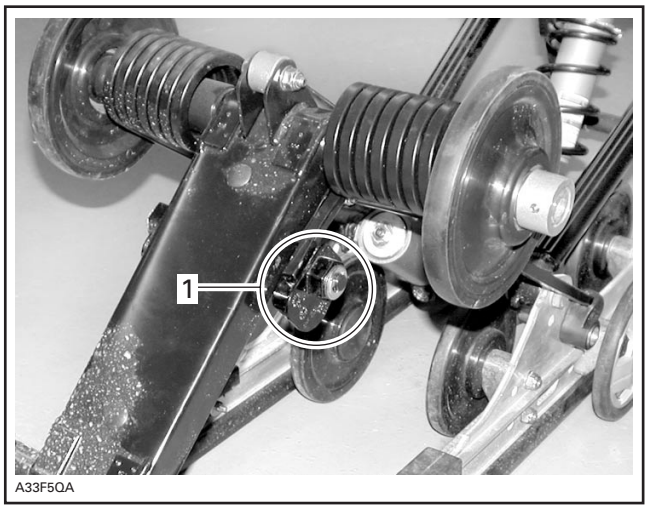
ON BOTH SIDES
1. Remove screws
2. Loosen set screw
3. Remove the following

REAR SPRING INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

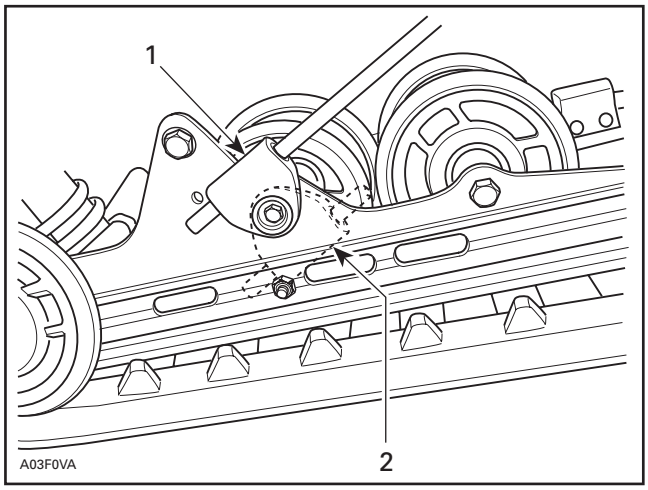
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

At assembly, make sure that spring end is in cam adjuster.



ON BOTH SIDES
1. Spring end in cam adjuster

CAUTION: To avoid track damage, spring supports must be mounted upward.



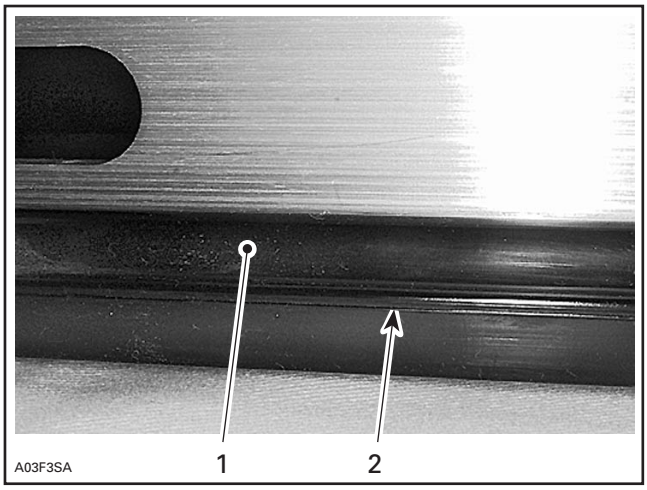
TYPICAL — RIGHT SIDE SHOWN
1. Right position: upward
2. Wrong position

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)

SLIDER SHOE VERIFICATION

Molding line is the wear limit indicator.



TYPICAL
1. Slider shoe
2. Molding line (wear limit indicator)

Replace slider shoes when wear limit is reached.

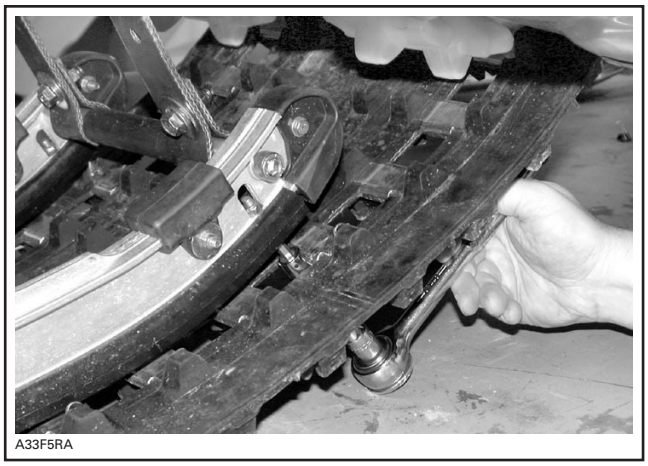
CAUTION: Slider shoes must always be replaced in pairs.

SLIDER SHOE REMOVAL

Lift rear of vehicle and support it off the ground.

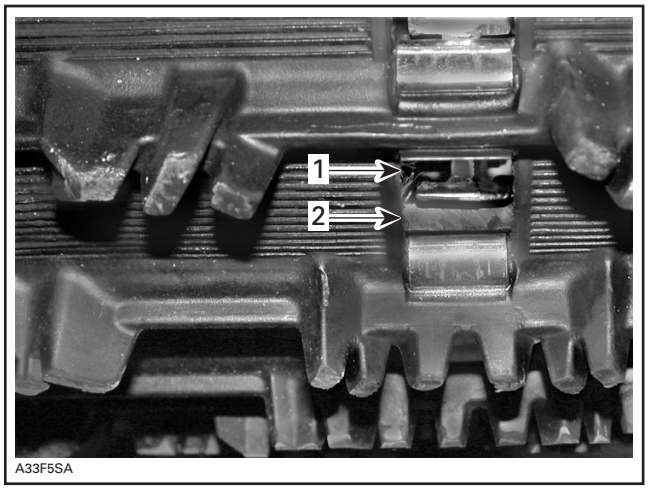
Completely loosen track tension.

Remove nut and screw of each runner.



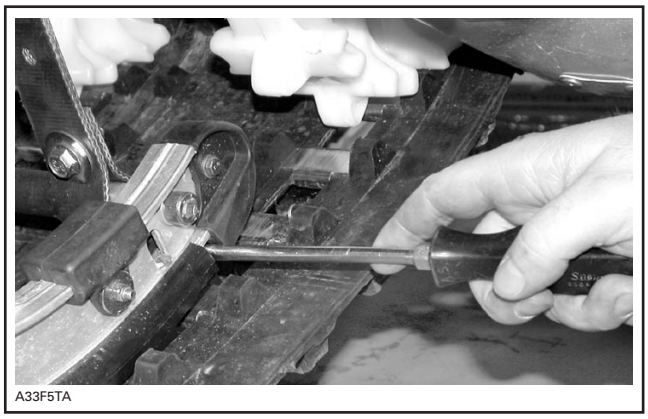
REMOVE NUT AND SCREW OF EACH RUNNER

Align track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

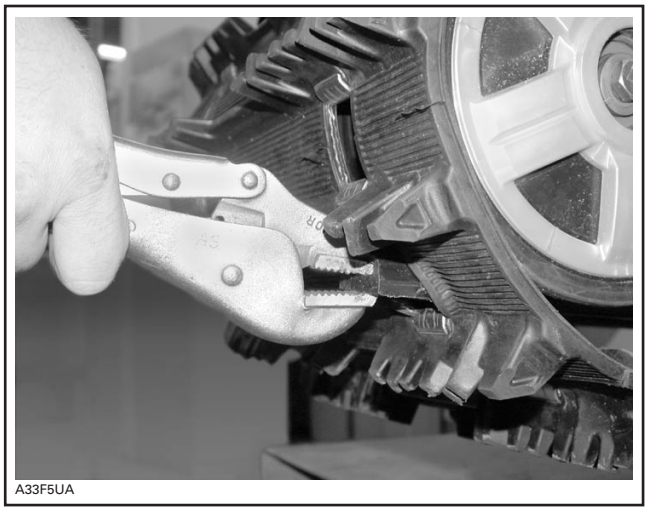
Using a pry bar or screw driver, push slider shoe until it comes in contact with track.



PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe thru track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.


A33F5UA

PULL ON SLIDER SHOE TO REMOVE

SLIDER SHOE INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Make sure to insert slider shoe end with hole first.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Slider shoe nut	2.5 N•m (22 lbf•**in**)

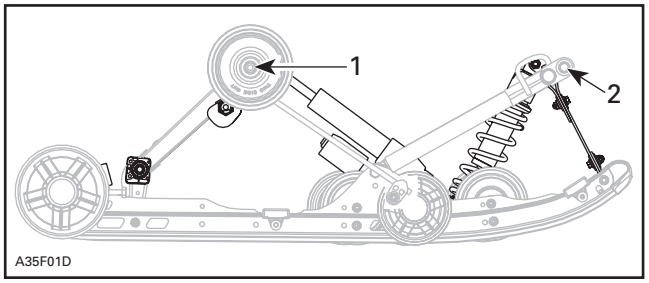
SUSPENSION REMOVAL

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

Remove rear arm top axle screws.

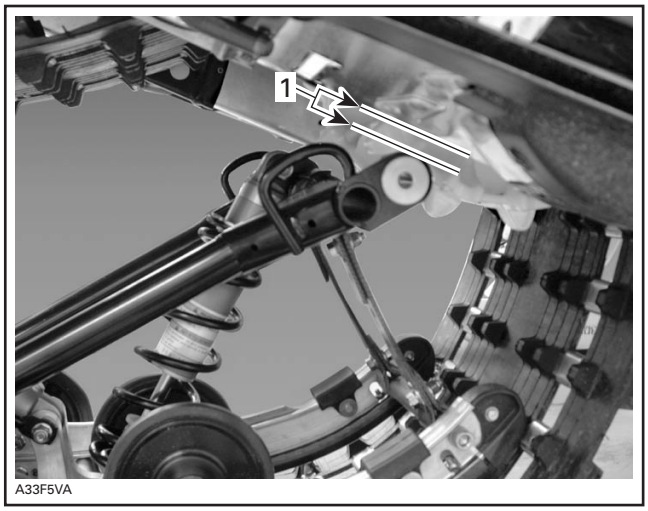
Remove front arm top bolts.



A35F01D

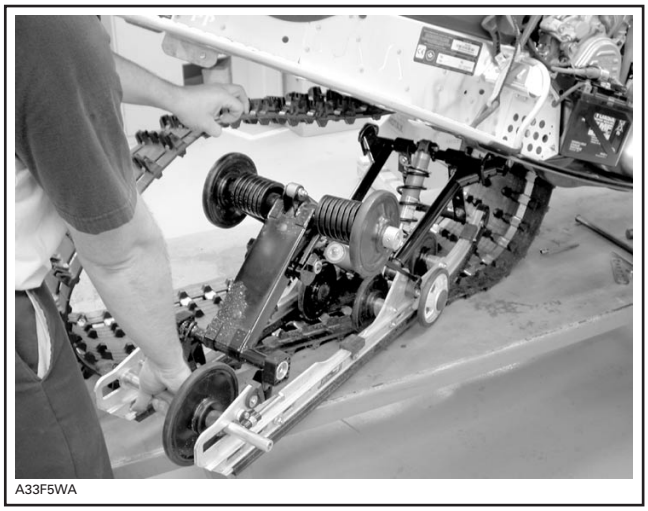
1. *Remove rear arm top axle screws*
2. *Remove front arm top bolts*

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



A33F5VA

1. *Enough clearance*


A33F5WA

REMOVE SUSPENSION

SUSPENSION INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Inspect track thoroughly before reinstalling suspension. Refer to TRACK.

Install suspension into track with front portion first.

Adjust track tension.

FRONT ARM REMOVAL

NOTE: Front arm can be removed with suspension assembly in place.

Lift rear of vehicle and support it off the ground.

Remove the following:

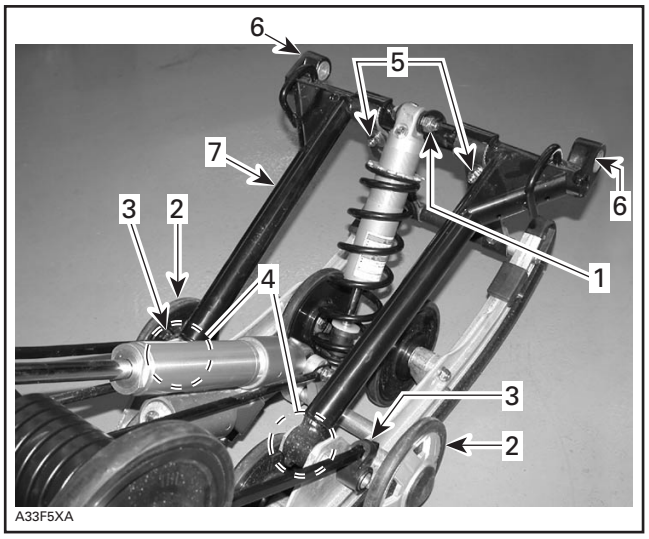
– shock upper bolt and nut
– front idler wheels
– spring supports (to gain access to front arm lower bolts)

⚠ WARNING

Supports are spring loaded.

– front arm lower bolts and washers
– unfasten one end of stopper straps
– remove front arm upper bolts, nuts and washers.

Remove front arm.



A33F5XA

SUSPENSION REMOVED FOR CLARITY
1. *Shock upper bolt and nut*
2. *Front idler wheels*
3. *Spring supports*
4. *Front arm lower bolts and washers*
5. *Unfasten one end of stopper straps*
6. *Front arm upper bolts, nuts and washers*
7. *Front arm*

FRONT ARM INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

To properly hold front arm axles when applying tightening torque to front arm lower bolts, it may be necessary to remove idle wheels.

Respect the following tightening torque specifications.

DESCRIPTION	TIGHTENING TORQUE
Stopper straps nuts	11 N•m (97 lbf•**in**)
Front arm lower bolts	120 N•m (89 lbf•ft)

REAR ARM/PIVOT ARM REMOVAL

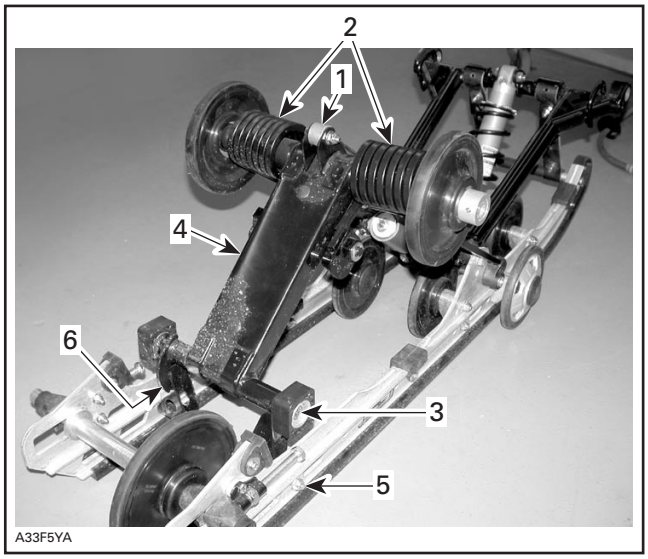
NOTE: Rear arm can be removed with suspension assembly in place.

For rear arm removal, remove the following:

– shock upper bolt and nut
– rear springs (refer to procedure above in this section)
– screws and washers holding rear arm to pivot arm.

For pivot arm removal, remove the following:

– bolts, nuts and washers holding pivot arm to runners.



A33F5YA

SUSPENSION REMOVED FOR CLARITY
1. *Shock upper bolt and nut*
2. *rear srings*
3. *Rear arm/pivot arm screws and washers*
4. *Rear arm*
5. *Pivot arm/runner bolts, nuts and washers*
6. *Pivot arm*

REAR ARM/PIVOT ARM INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Pivot arm grease fitting must be towards the front of the vehicle.

At installation, rear arm stroke limiter must be on rear side.

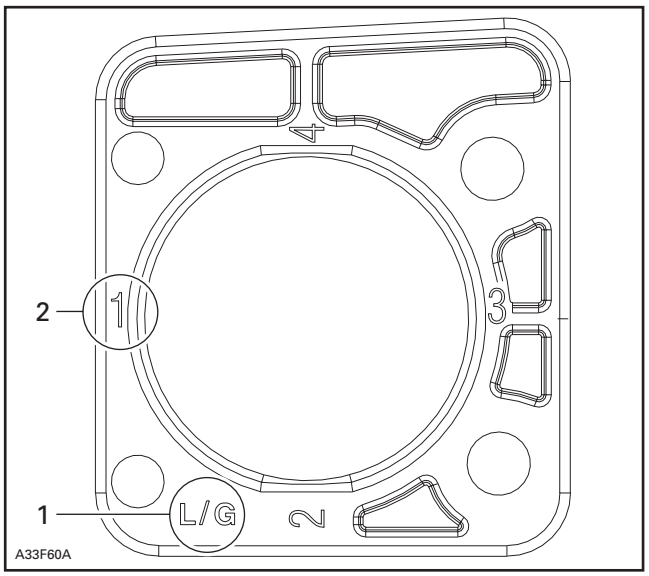
Insert dowel pin into pivot arm hole, dowel pin must exceed block guide by 2 to 2.3 mm (.079 to .091 in).

Respect the following tightening torque specifications.

DESCRIPTION	TIGHTENING TORQUE
Pivot arm/runners nut	25 N•m (18 lbf•ft)
Locking ring set screw	2.5 N•m (22 lbf•**in**)

BLOCK INSTALLATION

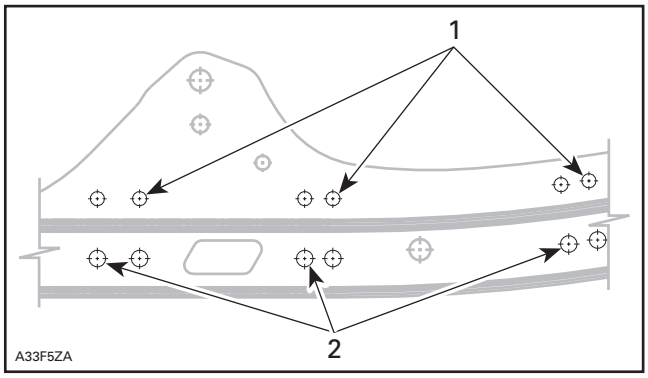
Both blocks are identified R or L (right or left) and have position number (from 1 to 4). At installation make sure to install proper block on proper side with the same adjustment position on both sides.



TYPICAL
1. Blocks are identified R or L (right or left)
2. Blocks position number (from 1 to 4)

IDLER WHEELS INSTALLATION

Refer to illustration for idler wheels position at installation.



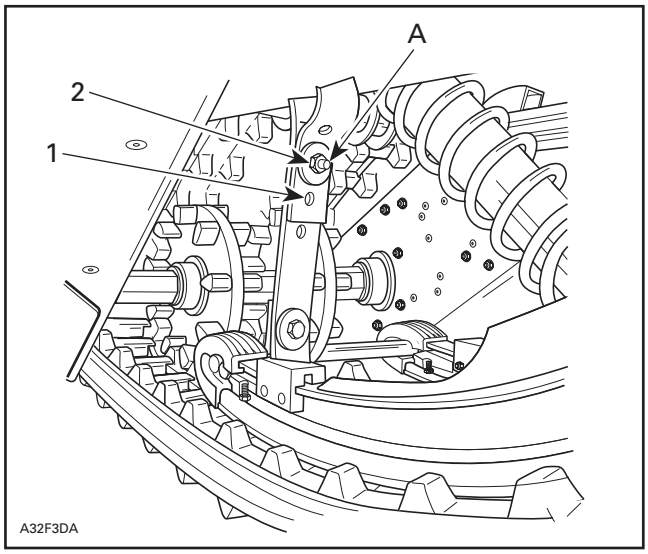
1. RH side wheels position
2. LH side wheels position

STOPPER STRAP

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace as required.

Make sure it is attached through proper hole from the end.

Torque nut to 11 N•m (97 lbf•**in**).



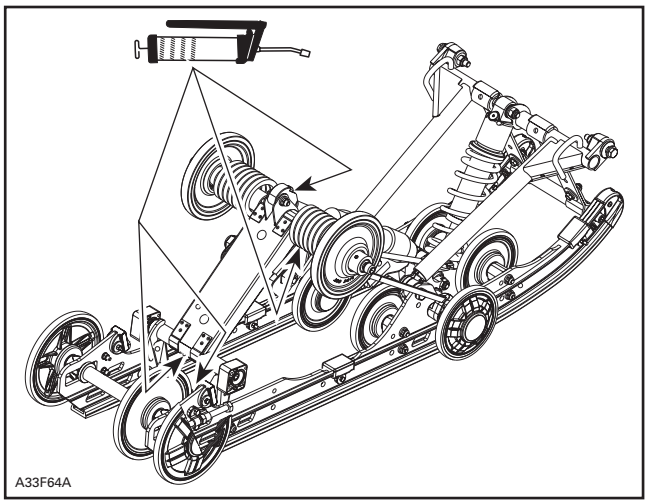
TYPICAL
1. 1st hole
2. 2nd hole
*A. 11 N•m (97 lbf•**in**)*

RIDE ADJUSTMENT

Refer to the appropriate *Operator's Guide*.

LUBRICATION

Lubricate pivot arm and rear arm at grease fittings using suspension synthetic grease (P/N 293 550 033).



SHOCK ABSORBER INSPECTION AND SERVICING

SERVICE TOOLS

Description	Part Number	Page
floating piston remover tool	529 035 907	426
gas fill tool kit (needle type)	503 190 102	425, 431–432
gas shock valve tool (tire valve type)	529 035 570	431
HPG shock holding tool	529 035 769	425
shock spring remover	529 035 504	423
shock wrench	529 035 727	425

SERVICE PRODUCTS

Description	Part Number	Page
Bombardier HPG shock oil	293 600 035	429
Loctite 271	293 800 005	427
Molykote G-n paste	711 297 433	429

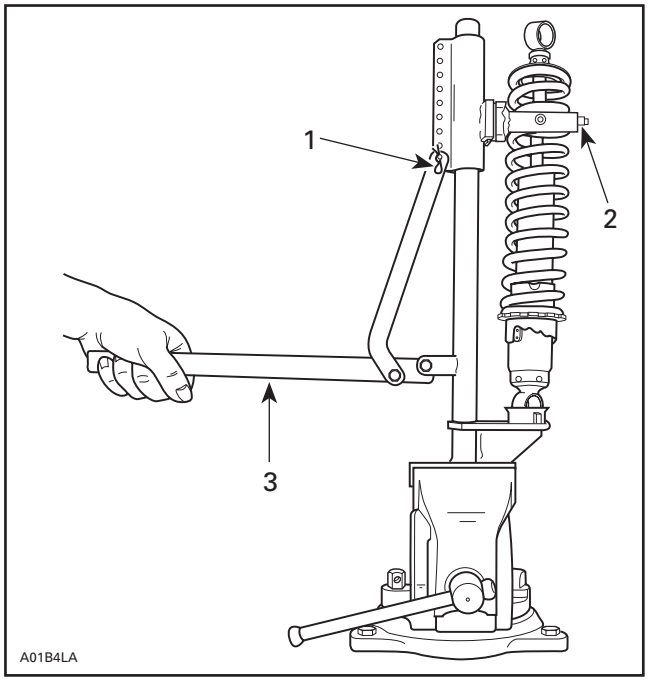
SPRING REMOVAL

Remove shock absorber from vehicle. Refer to the appropriate subsection.

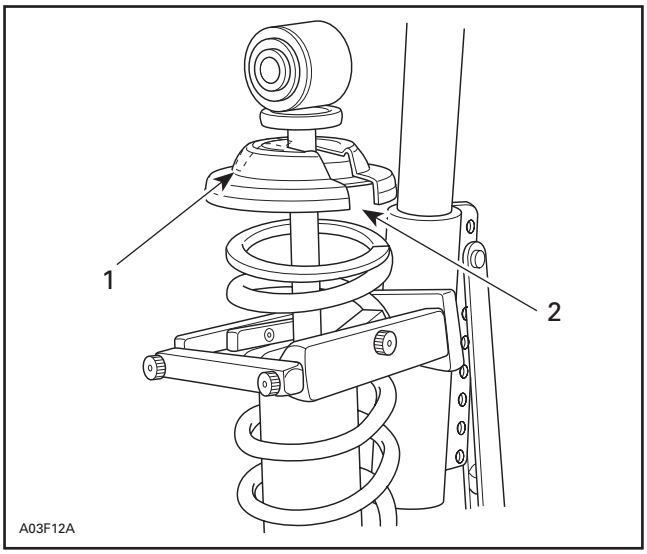
Use shock spring remover (P/N 529 035 504) and put it in a vise. Mount shock in it and turn shock so that a spring coil rests against spring compressor jaw.

Close and lock bar. Place handle horizontally by changing position of clevis pin.

Push down on handle until it locks. Remove spring stopper and cap then release handle.



1. *Clevis pin*
2. *Bar*
3. *Handle placed horizontally*



1. Cap opening
2. Spring stopper opening

Remove stopper.

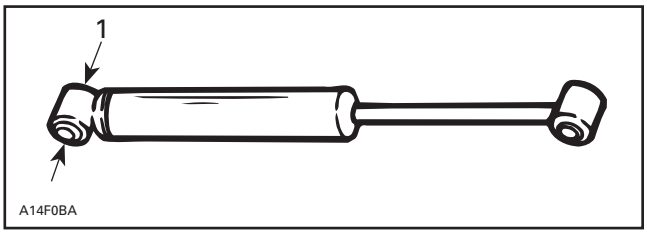
Remove tool and spring from shock absorber.

SHOCK ABSORBER INSPECTION

Hydraulic Shock

Secure the shock body end in a vise with its rod upward.

CAUTION: Do not clamp directly on shock body.



1. Clamp

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke. Check that it moves smoothly and with uniform resistance with its rod upward.

After at least 5 complete strokes, pay attention to the following conditions that will denote a defective shock:

– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme end of either stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any faults are present.

Gas Shock Except Variable Rate

Because of gas pressure, strong resistance is felt when compressing shock.

For the verification of stroke, or if suspecting an internal leak between oil chamber and gas chamber, check shock as follows:

Install shock in a vise clamping on its bottom eyelet with its rod upward. Verify the stroke compression when the rod is fully extended.

Let it stand for 5 minutes.

Completely push down the shock rod then release.

The shock should extend unassisted. Rod must come out at a steady speed. If speed suddenly increases particularly at end of extension, replace shock.

Variable Rate Gas Shock

Because of gas pressure, strong resistance is felt when compressing shock.

For the verification of stroke, or if suspecting an internal leak between oil chamber and gas chamber, check shock as follows:

Install shock in a vise clamping on its bottom eyelet with its rod upward. Verify the stroke compression when the rod is fully extended.

Let it stand for 5 minutes.

Push down the shock rod. The feeling will be stiff for around first 25 mm (1 in), soft up to 25 to 50 mm (1 to 2 in) and stiff after that. This stiff, soft and stiff phenomenon shows the normal operation of shock.

When released, the shock should extend unassisted. The rod speed coming out will go slow - faster and slow again due to the VR zone.

All Gas Shock

If suspecting a frozen shock proceed as follows:

Place shock in a freezer (temperature below 0°C (32°F)) for 4 hours.

Push down on rod and note its resistance. If shock is frozen it will be much more difficult to compress than for the new one.

DISASSEMBLY AND ASSEMBLY

High Pressure Gas Take Apart Shock (HPG T/A)

There are two types of high pressure gas take apart (HPG T/A) shock. One type has a tire valve and the other has a needle valve.

SHOCK TYPE	INFLATION TOOL
Tire valve type	529 035 570
Needle valve type	503 190 102

HPG T/A shocks come in two sizes. C-36 shock is 36 mm (1.417 in) in diameter and C-46 shock is 46 mm (1.811 in).

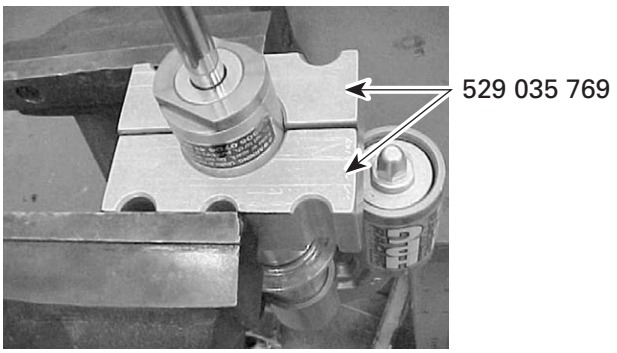
SHOCK SIZE	SERVICING TOOL	(P/N)
C-36	Piston guide	529 026 600
	Seal guide	529 026 500
	Shock wrench	529 035 727
C-46	Piston guide	529 035 608
	Seal guide	529 035 728
	Shock wrench	529 035 727

Release nitrogen (N) pressure on any HPG T/A shock with internal floating piston (IFP).

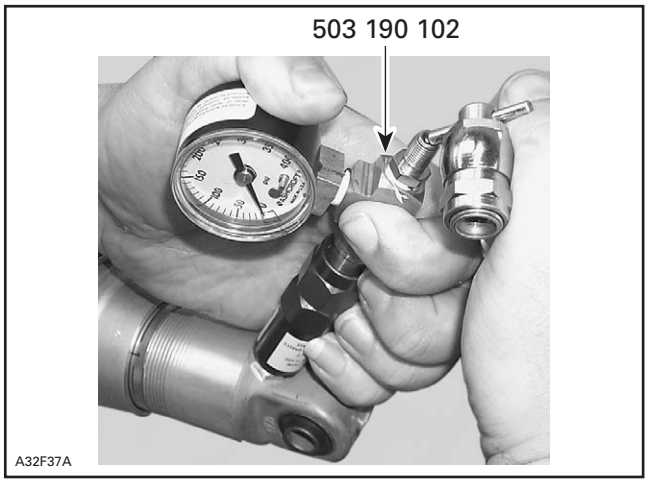
⚠ WARNING

Nitrogen gas is under extreme pressure. Use caution when releasing this gas volume. Protective eye wear should be used.

Mount shock in a vise with HPG shock holding tool (P/N 529 035 769).



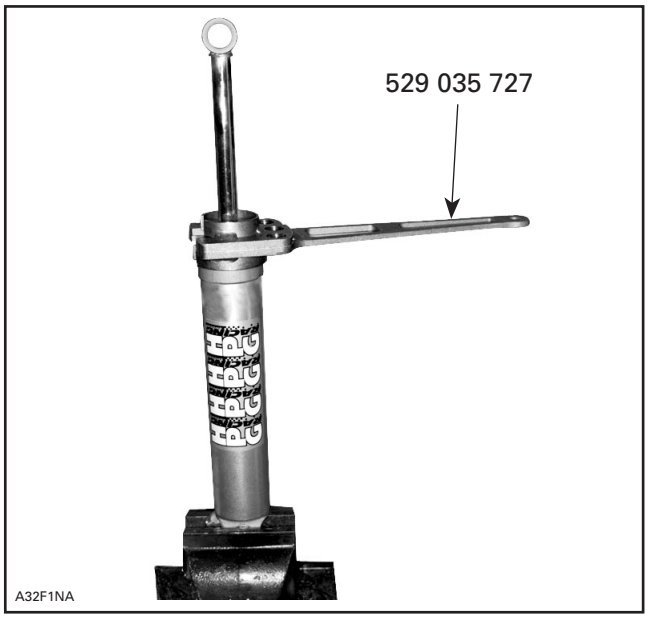
Remove screw on top of valve. Place the needle guide of gas fill tool kit (needle type) (P/N 503 190 102) on the shock valve. Press the detent pin and push forward the needle assembly very slowly towards rubber of needle valve. Push on shock tool valve center rod to release gas pressure.



Remove tool from shock.

Screw Cap Type HPG T/A Shock

Using appropriate size of shock wrench (P/N 529 035 727) unscrew seal carrier.



TYPICAL

Snap Ring Cap Type HPG T/A Shock

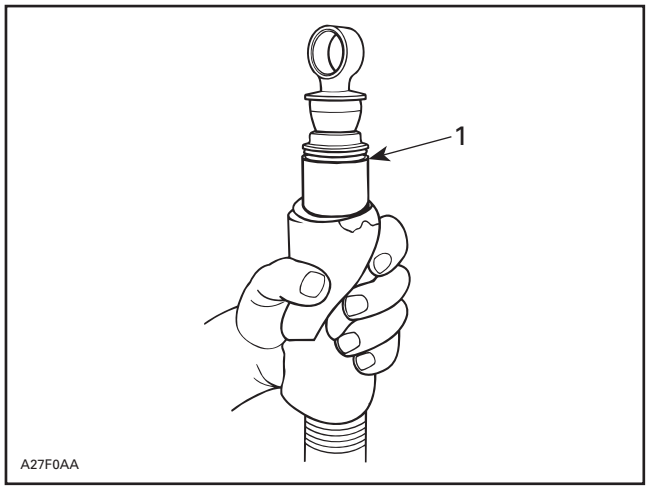
Using a flat tool, pop-out the cap.

Compress the carrier to access and remove the snap ring.

All HPG T/A Shocks

With the seal carrier removed, slowly lift and remove damper rod assembly from the damper body.

NOTE: Remove damper rod assembly slowly to reduce oil spillage and prevent piston seal damage by damper body threads. Wrap the damper body with a shop cloth to capture possible overflow oil while removing the damper piston.

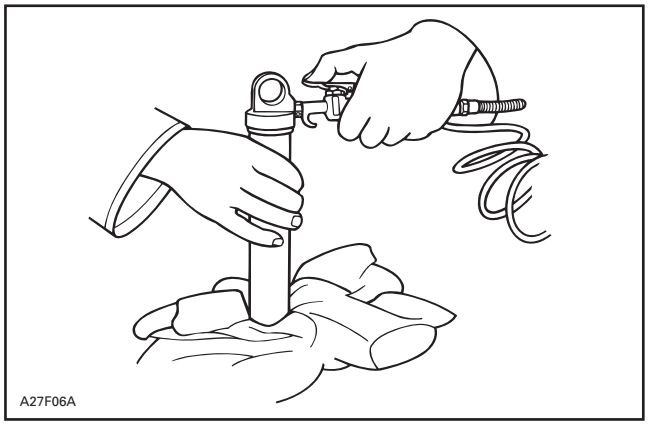


1. Oil flows

Discard old oil into storage container. Never reuse damper oil during shock rebuild.

HPG T/A Shocks Except with External Reservoir

Remove valve core. Using compressed air pressure, carefully remove floating piston from damper body. Hold shop cloth over damper body opening to catch released floating piston. Allow room for floating piston to leave damper body.



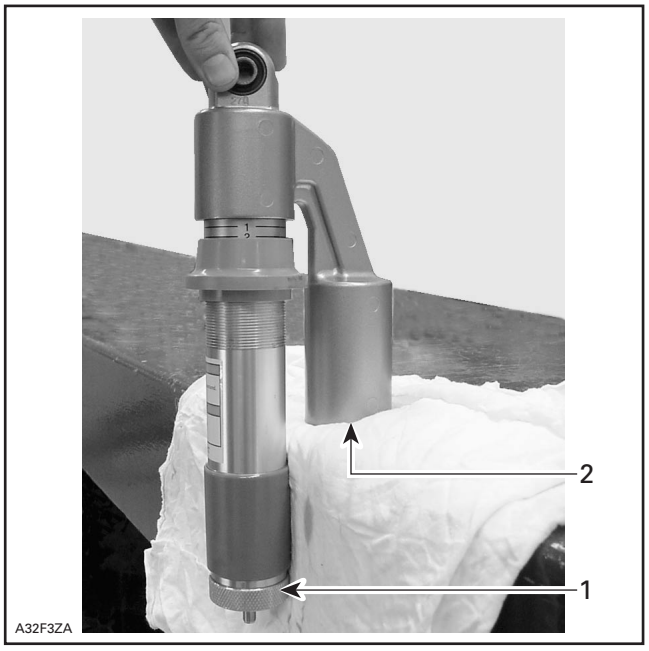
TYPICAL

HPG T/A Shocks with External Reservoir

Install floating piston remover tool (P/N 529 035 907) on shock absorber, as shown below.

1. Floating piston remover tool (P/N 529 035 907)

Place shock absorber in a position where external gas reservoir opened extremity is blocked. Refer to following photo.



1. Tool
2. Reservoir opened extremity blocked by leaning on work bench

With a low pressure hand pump, pressurize shock absorber until external reservoir piston pops-out.

NOTE: Use towels to prevent damaging external reservoir piston when it pops-out.

⚠ WARNING

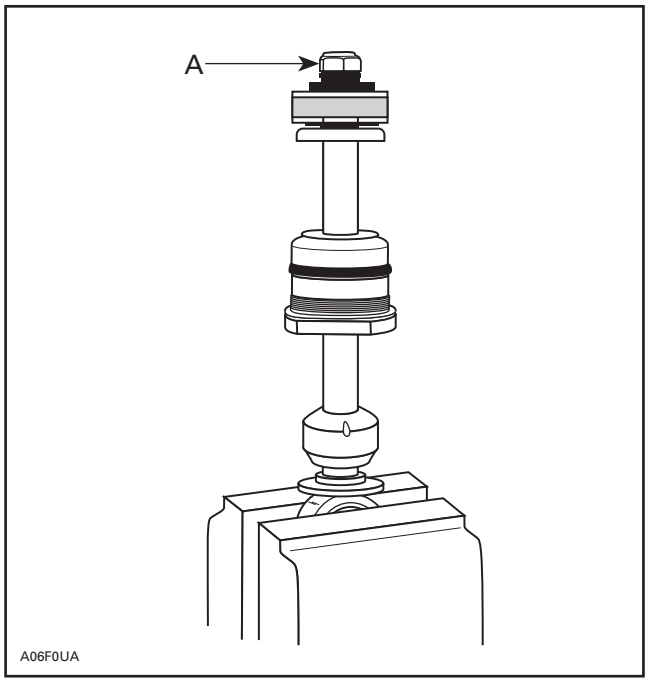
Whenever using compressed air, use an O.S.H.A. approved air gun and wear protective eye wear.

Thoroughly clean, with a typical cleaning solution, and blow dry using low pressure air. Carefully inspect the damper body for any imperfections or signs of wear in the damper bore.

Replace damper body if wear is identified.

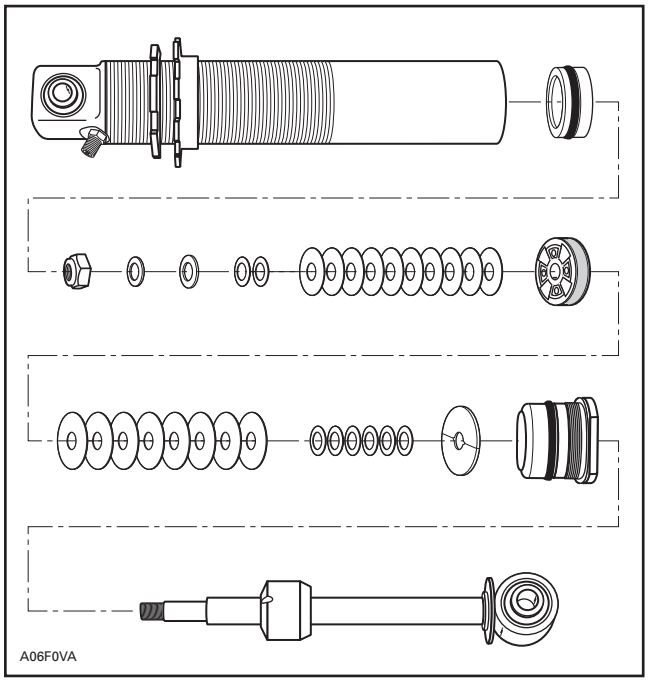
All HPG T/A Shocks

Holding the damper rod assembly in a bench vise, begin piston and valve removal.



A. Remove damper nut

Always arrange parts removed in the sequence of disassembly.



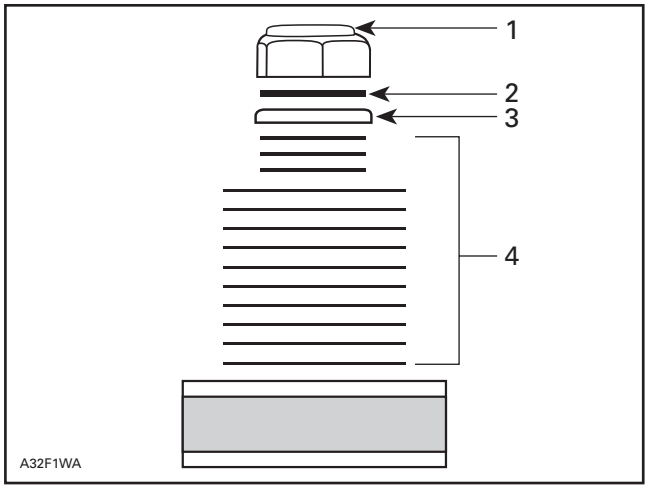
NOTE: As a general rule we suggest replacing the damper rod lock-nut after 4 rebuilds to ensure good locking friction and use Loctite 271 (P/N 293 800 005) each time.

NOTE: If revalving is to be done, it is imperative that you identify the original shim pack (size and number of shims). There is no need to remove seal carrier if only revalving is to be done.

Shims can be measured by using a vernier caliper or a micrometer.

NOTE: All shims should be carefully inspected and any bent or broken shims must be replaced for the shock to function properly.

After the new or replacement shim pack has been selected, reassemble in the reverse order of disassembly. Torque piston nut to 27 - 29 N•m (20 - 21 lbf•ft).



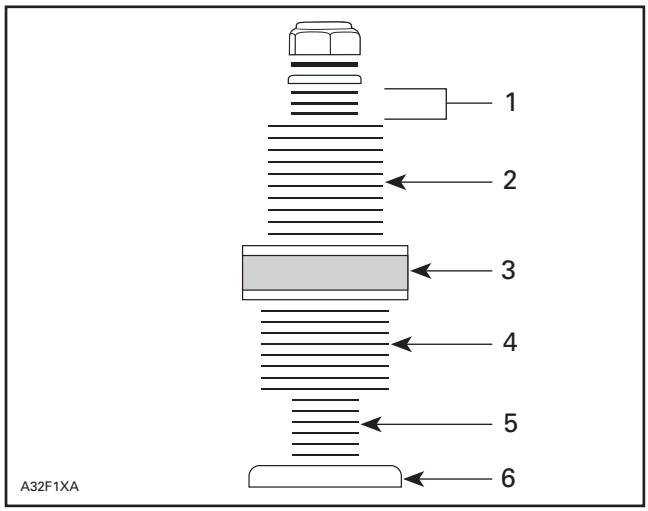
1. *Damper nut*
2. *Spacer*
3. *Stopper with its round edge facing nut*
4. *Shim pack*

CAUTION: The damper rod nut can only be reused 4 times, then, must be replaced. Do not substitute this part for non - O.E.M. use Loctite 271 on nut each time.

This (these) spacer washer(s) must be used as shown to ensure damper rod nut does not bottom out or contact shaft threads.

Rebound valve stopper with round edge facing nut.

NOTE: Rebound shim stack must not reach into threads of damper shaft. Spacer under damper shaft nut is used to prevent damper shaft nut from bottoming on threads.

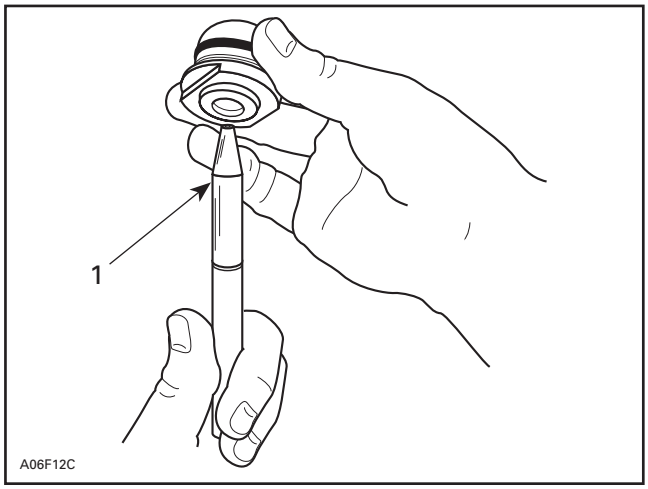


1. *Rebound dampening shim pack*
2. *Rebound dampening shim pack*
3. *Piston*
4. *Compression dampening shim pack*
5. *Compression dampening shim pack*
6. *Stopper*

If the seal carrier assembly is replaced, use seal pilot to guide seal over damper shaft. Lubricate seal carrier guide pilot before use.

CAUTION: Failure to use seal pilot will result in seal damage.

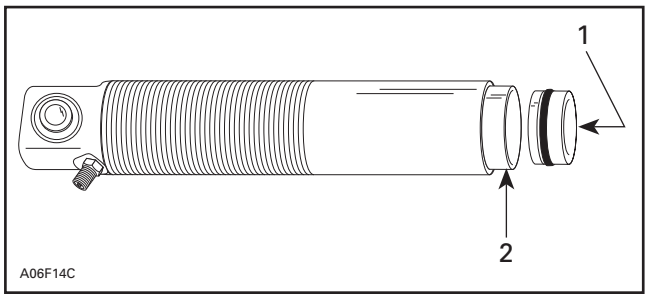
Reassemble damper rod assembly, taking care to properly assemble shim packs as required for your dampening needs. Ensure that the shaft piston is installed with the slits/larger intake holes facing the rebound shim stack.



1. *Seal guide*

If floating piston has been removed, reinstall floating piston into damper body (ensure that valve core has been removed). Use Molykote G-n paste (P/N 711 297 433) to ease O-ring past damper body threads with floating piston guide.

CAUTION: Failure to install IFP correctly could result in shock damage.

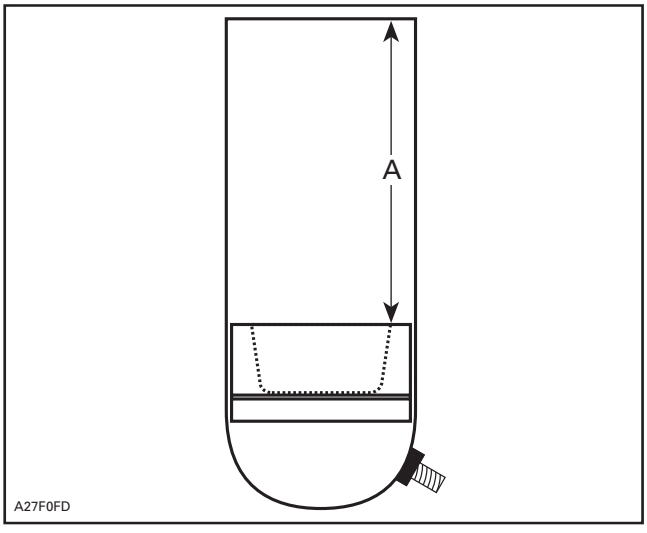


1. Push (slowly) by hand
2. Floating piston guide

NOTE: Lubricate inside of piston guide with Molykote G-n paste (P/N 711 297 433).

Install floating piston to the proper depth refer to following the table.

On all HPG take apart shocks, the floating piston is installed hollow side up.



A. Installation distance for floating piston installation

SHOCK P/N	INSTALLATION DISTANCE OF FLOATING PISTON MM
503 190 306	54.5
503 190 987	54.5
503 190 445	119.5
503 190 655	119.5
503 190 747	119.5
503 190 973	119.5
503 191 043	119.5
503 190 975	121.5
503 190 980	168
503 190 808	171.5
503 190 978	171.5
503 190 994	171.5
503 190 382	178.5
503 190 449	188

NOTE: If the floating piston is installed too far into the damper body, light air pressure through valve (with core removed) will move piston outward.

NOTE: Reinstall tire valve core after IFP has been installed at correct height and before adding oil.

⚠ WARNING

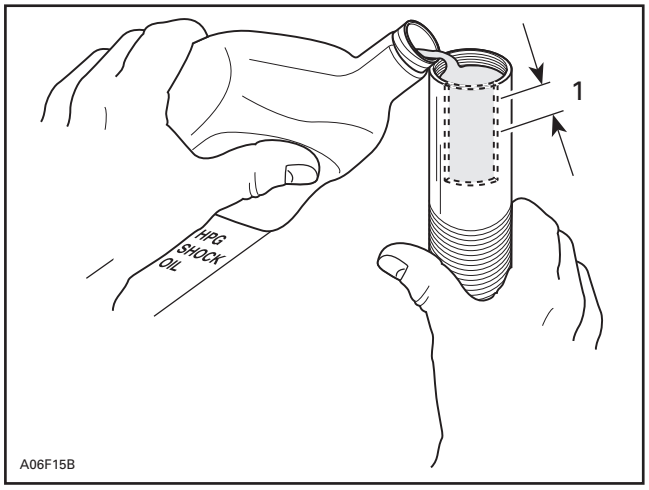
Whenever using compressed air exercise extreme caution, cover damper opening with shop cloth to reduce chance of possible injury.

CAUTION: Moisture laden compressed air will contaminate the gas chamber and rust floating piston.

⚠ WARNING

Always wear protective eye wear whenever using compressed air.

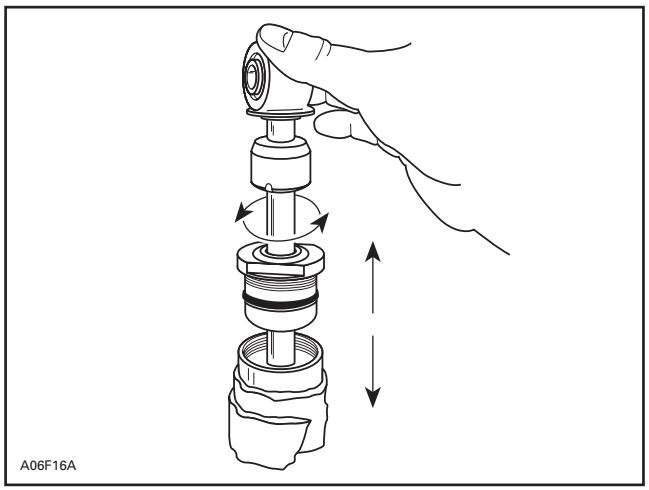
Fill the shock with Bombardier HPG shock oil (P/N 293 600 035) to approximately 10 mm (.393 in), from the base of seal carrier threads.



1. Fill to 10 mm (.393 in)

NOTE: Although we do not measure the exact amount of oil added to the damper, approximately 252 mL (8.52 oz. U.S.) will be used.

Carefully insert damper rod into the damper body. Lightly oil damper piston seal ring with shock oil to ease installation.



NOTE: Some shock oil will overflow when installing damper. Wrap damper with shop cloth to catch possible overflow oil.

CAUTION: Use care when passing piston into damper body at damper body threads.

Slight oscillation of damper rod may be required to allow piston to enter damper body bore.

Slowly push piston into damper body. Slight up and down movement may be required on short stroke to allow all air to pass through piston assembly. The gentle tapping of a small wrench, on the shock eye, may help dislodge air trapped in the submersed piston. Be careful not to drive the shaft any deeper into the oil than is necessary to just cover the shim stack.

NOTE: Fast installation of the damper rod may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed.

With damper rod piston into oil, TOP OFF damper oil volume. Oil level should be to damper body thread base.

Screw Cap Type HPG T/A Shock

Seal carrier assembly can now be threaded into damper body. This should be done slowly to allow weapage of oil and to minimize IFP displacement. Torque seal carrier to 90 to 100 N•m (66 to 74 lbf•ft).

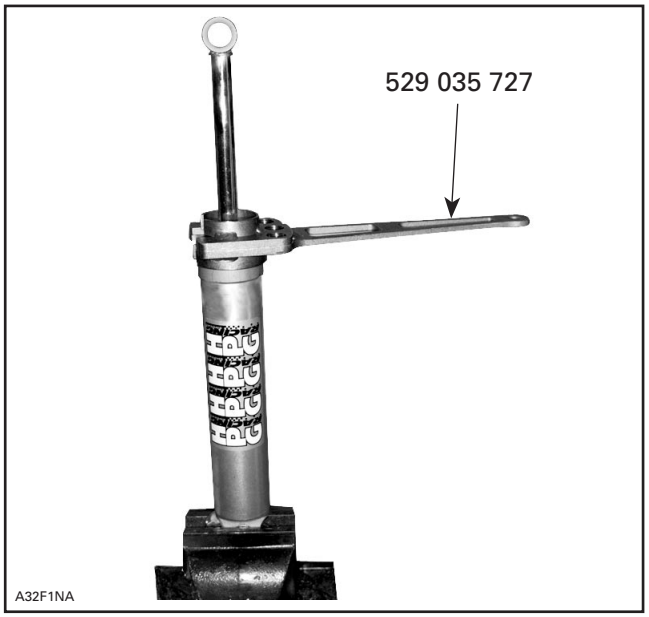
Snap Ring Cap Type HPG T/A Shock

Seal carrier assembly can now be pushed into damper body to pass snap ring grove. Install snap ring into groove.

Tap the cap on the shock body.

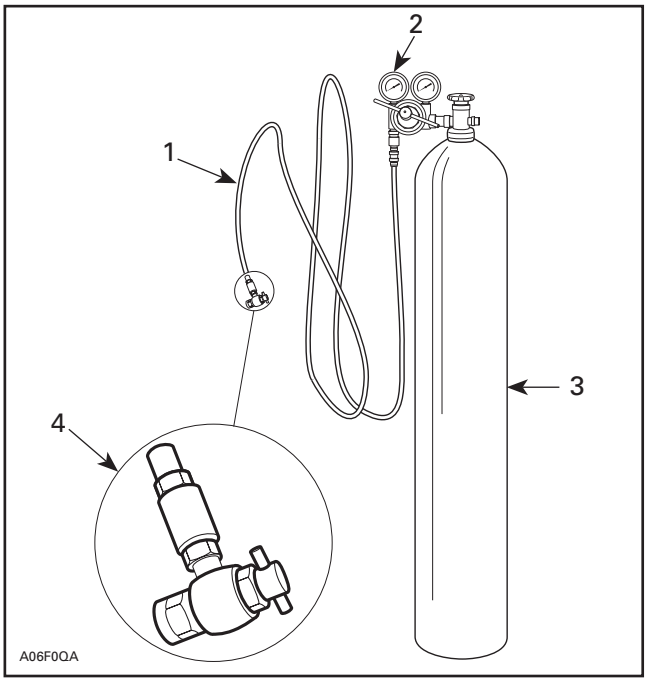
All HPG T/A Shocks

After the seal carrier is fully in place avoid pushing the shaft into the body until the nitrogen charge is added.



When removing and retightening the tire valve acorn nut use minimal torque. When the cap is over tightened and subsequently removed it may prematurely break the seal of the tire valve to the shock body and cause a loss of nitrogen charge without being noticed. If you suspect this has happened then recharge the shock as a precaution. Inspect the tire valve cap before installation to ensure that the internal rubber gasket is in its proper position.

Nitrogen (N) can now be added to damper body.



1. High pressure hose
2. Stage regulator, delivery pressure range 2070 kPa (300 PSI)
3. High pressure cylinder filled with industrial grade nitrogen
4. Valve tip (P/N 529 035 570) permanently installed

NOTE: Never substitute another gas for nitrogen. Nitrogen has been selected for its inert qualities and will not contaminate the gas chamber of the shock.

Preset your pressure regulator to 2070 kPa (300 PSI) nitrogen (N), this gas pressure will restore the correct pressure for your damper.

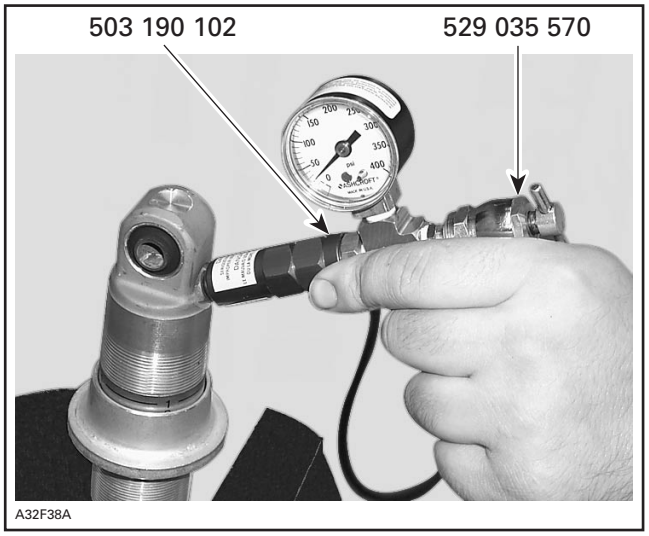
CAUTION: Do not exceed the recommended pressure values.

⚠ WARNING

Whenever working with high pressure gas, use eye wear protection. Never direct gas pressure toward anybody.

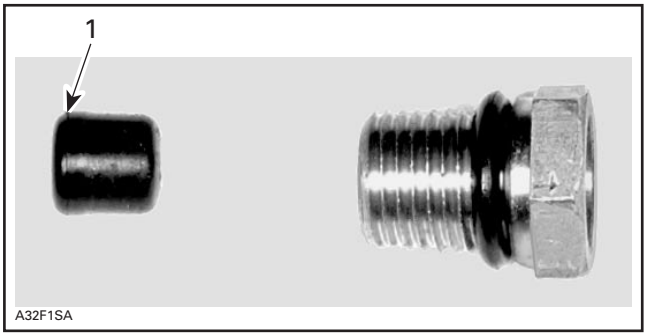
Install the gas fill tool kit (needle type) (P/N 503 190 102) on gas shock valve tool (tire valve type) (P/N 529 035 570). Set the regulator pressure on the nitrogen cylinder as per the shock requirement.

Mount the shock on vise. Remove screw on top of valve. Place the needle guide of gas refill tool on the shock valve. While depressing the detent pin of the gas refill tool and pushing forward the needle assembly, insert the needle through the rubber core of the pressure valve assembly of the shock.



NOTE: For replacement of the needle or filling the shock, carefully follow the instructions provided with the gas fill tool kit (needle type) (P/N 503 190 102).

On some models, rubber may pop out of needle valve when inserting tool needle. If so, remove valve core and rubber then, reinstall rubber with its larger diameter last.



1. Larger diameter

When the shock is filled with gas, install back the screw on top of the valve.

NOTE: Carefully inspect damper for gas or oil leaks. Any leaks must be corrected before continuing.

Damper gas pressure cannot be confirmed by using a pressure gauge. The volume of gas in the shock is very small, and the amount lost during gauge installation will lower the pressure too much and require refilling.

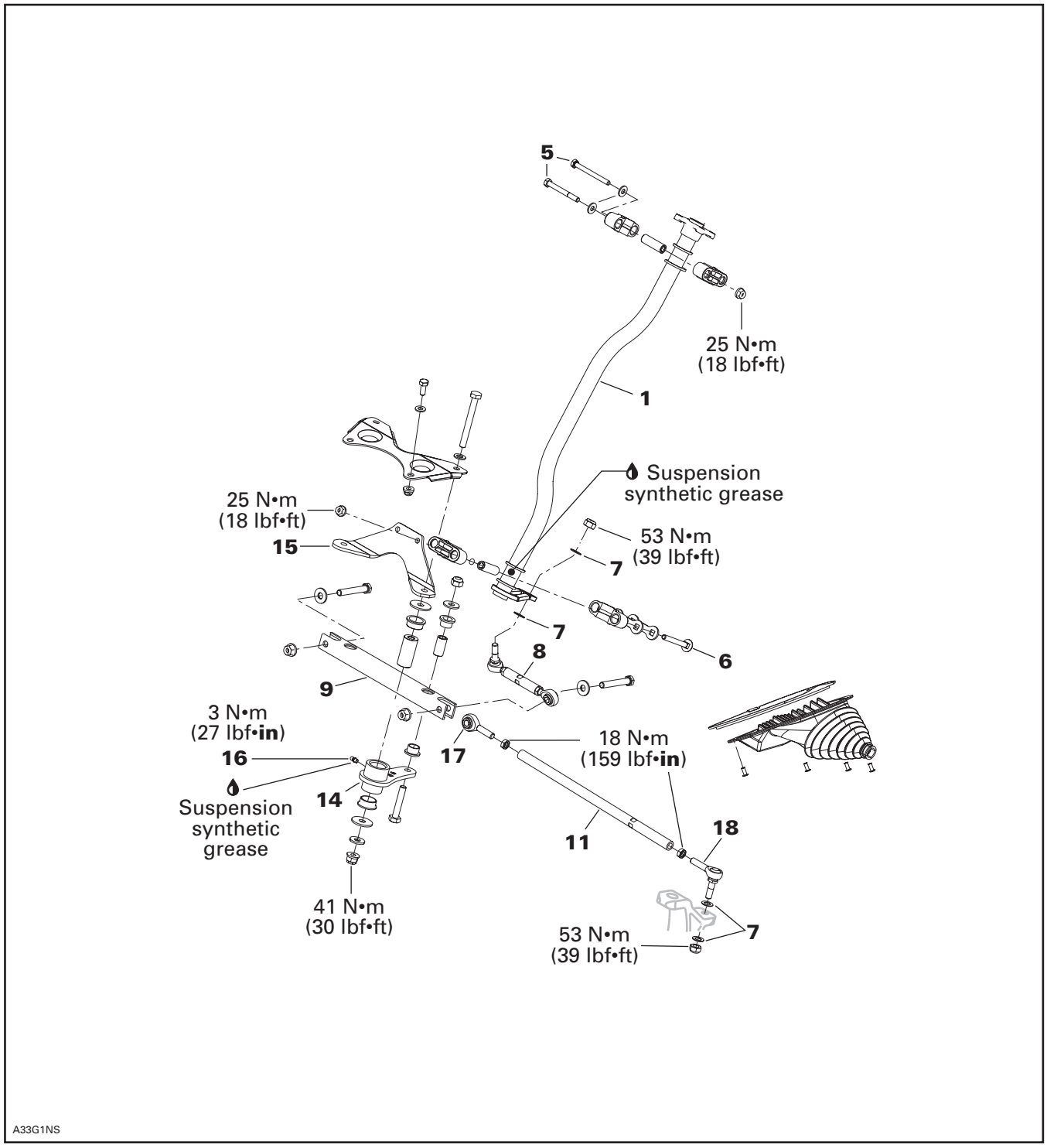
After recharging is complete the rebuilt shock should be bench-tested. Stroke the shock to ensure full travel and smooth compression and rebound action. If the shaft moves in or out erratically this could indicate too much air is trapped inside. If the shaft will not move or has partial travel then it may be hydraulically locked. In either event the shock must be rebuilt again. Pay particular attention to the placement of the IFP, quantity of oil and shim stack/piston assembly.

STEERING SYSTEM

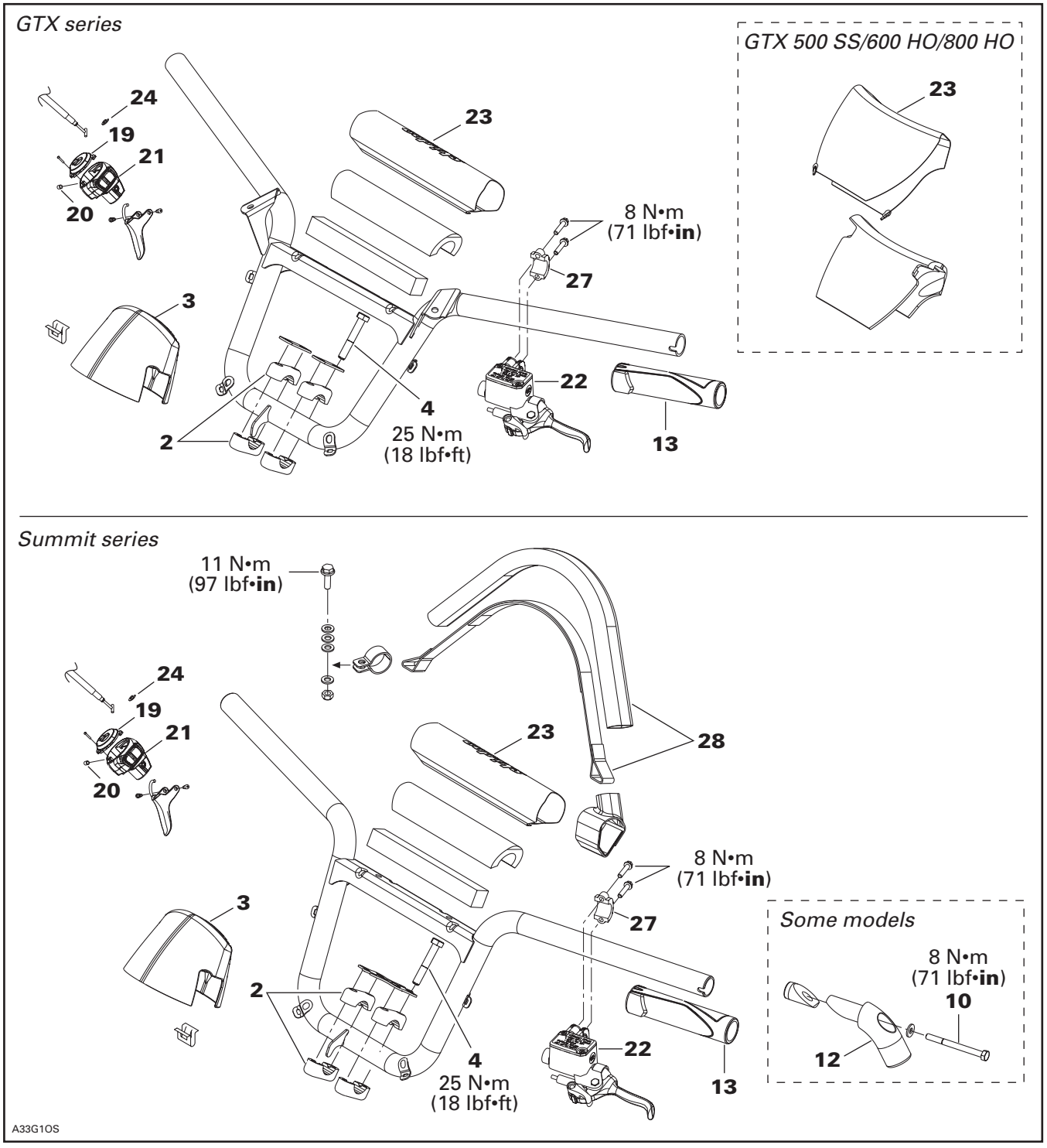
SERVICE PRODUCTS

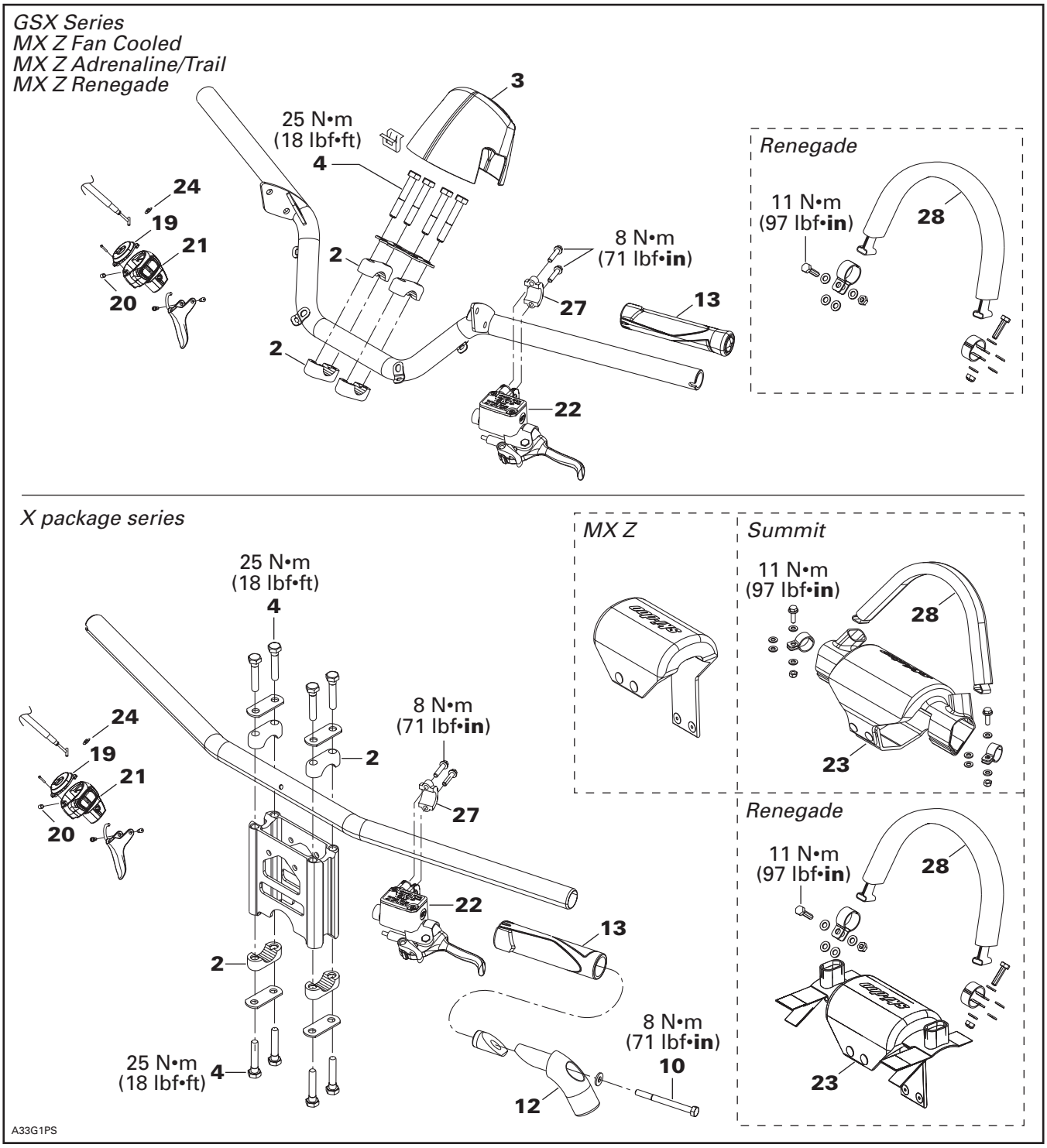
Description	Part Number	Page
BOMBARDIER LUBE	293 600 016	446
suspension synthetic grease	293 550 033	446

Linkage Arrangement



Handlebar Arrangement




GSX Series
MX Z Fan Cooled
MX Z Adrenaline/Trail
MX Z Renegade
25 N•m
(18 lbf•ft)
3
4
24
19
21
20
2
2
8 N•m
(71 lbf•in)
27
13
22
Renegade
11 N•m
(97 lbf•in)
28
X package series
MX Z
Summit
25 N•m
(18 lbf•ft)
4
8 N•m
(71 lbf•in)
24
19
21
20
2
27
22
13
2
25 N•m
(18 lbf•ft)
4
8 N•m
(71 lbf•in)
10
12
11 N•m
(97 lbf•in)
28
23
Renegade
11 N•m
(97 lbf•in)
28
23
A33G1PS

DISASSEMBLY AND ASSEMBLY

Grip

NOTE: These models feature an integrated heating element in the plastic sleeve of the grip **no. 13**.

CAUTION: Removing grip from handlebar might damage the heating element. Do not remove needlessly.

NOTE: If heating grip does not work and needs to be replaced, the grip can be cut with a knife for removal.

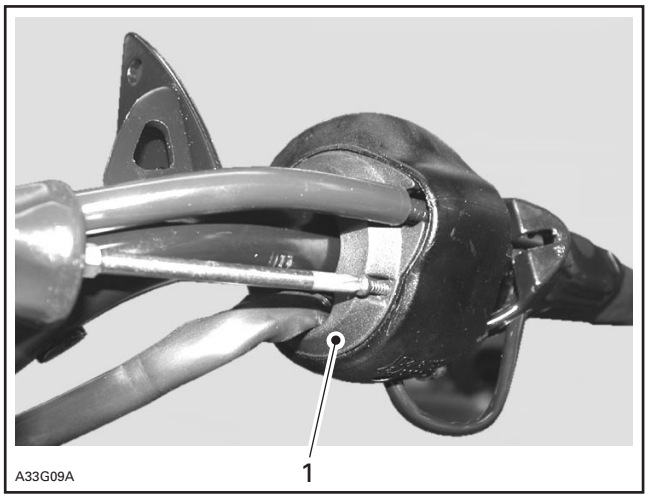
Throttle Side:

Unfasten windshield (if necessary).

NOTE: Throttle lever housing **no. 21** must come off handlebar along with grip.

Remove cap **no. 3** or steering padding **no. 23** according to model. Unplug RH harness on top of steering column. Cut locking ties retaining RH harness to handlebar.

Remove throttle lever housing cover **no. 19**.



1. Throttle lever housing cover

Remove circlip **no. 24** from throttle cable housing. Unfasten throttle cable from throttle lever, then pull out throttle cable housing from throttle lever housing **no. 21**.

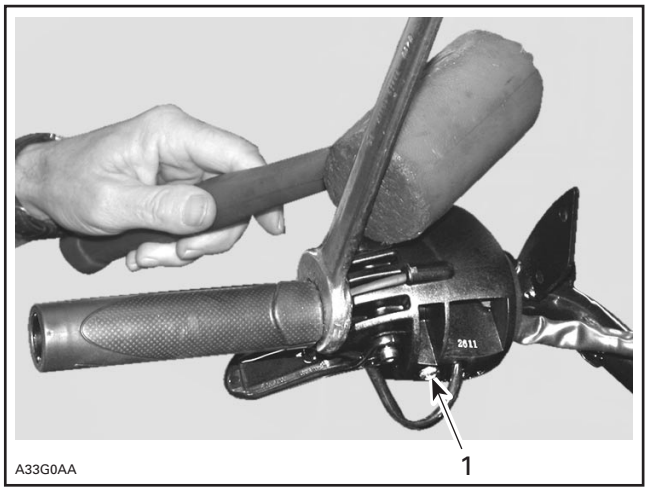
Unscrew screws **no. 10** and remove J-hook **no. 12** from end of grip on so equipped models.

Loosen screw **no. 20** retaining throttle lever housing to handlebar. See photo below.

Insert the open side of a 23 mm (7/8 in) wrench against the inner end of grip.

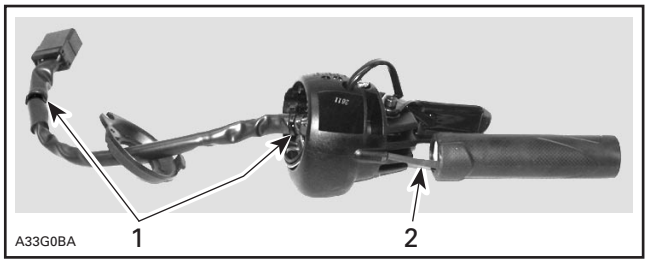
CAUTION: Pay attention not to damage wires with the wrench.

Using a plastic hammer, tap on the side of the wrench end to make the grip slide out.



1. Screw retaining throttle lever housing

Cut locking ties on harness. Using the multilock-terminal housing extraction tool AMP (P/N 755430-2), push the 3 wires of the heating grip harness out of connector housing. Note the position of the wires for reinstallation.



1. Locking ties
2. Heating grip harness

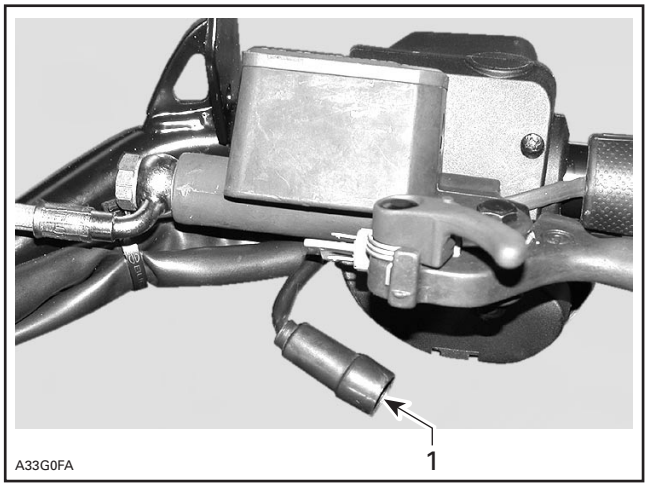
Pull heating grip harness out of throttle lever housing.

For installation refer to GRIP INSTALLATION below.

Brake Side:

Unclip windshield.

Unplug connectors from brake light switch located on master cylinder **no. 22**.



1. Connectors unplugged

Unplug LH harness on top of steering column. Cut locking ties retaining brake light switch/heating grip harness to handlebar.

Using the multilock-terminal housing extraction tool AMP (P/N 755430-2), push the 3 wires of the heating grip harness out of connector housing. Note the position of the wires for reinstallation.

Pull heating grip wires out of brake light switch/heating grip harness.

Insert the open side of a 23 mm (7/8 in) wrench against the inner end of grip.

CAUTION: Pay attention not to damage wires with the wrench.

Using a plastic hammer, tap on the side of the wrench end to make the grip sliding out.

Grip Installation:

Installation is the opposite procedure of the removal but pay attention to the following.

Clean handlebar ends and inside of heating grip with isopropyl alcohol. Let dry before installation.

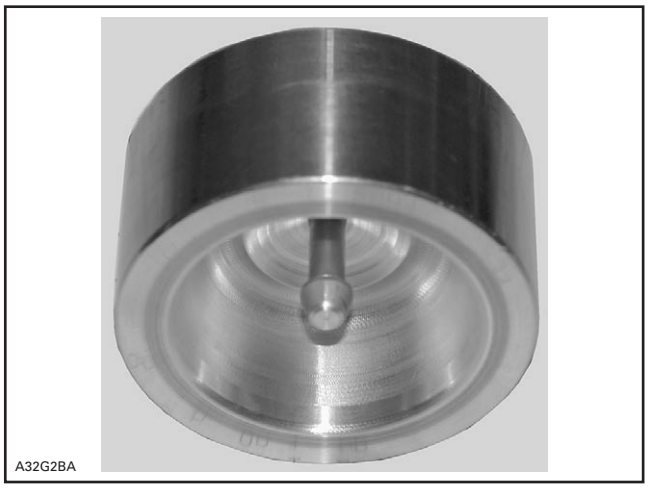
⚠ WARNING

Handlebar end and inside of heating grip must be clean and dry before installing heating grip to ensure proper adhesion.

Position grip on handlebar with its harness aligned with windshield bracket. See next photo.

Use the appropriate insertion tool to properly install grip.

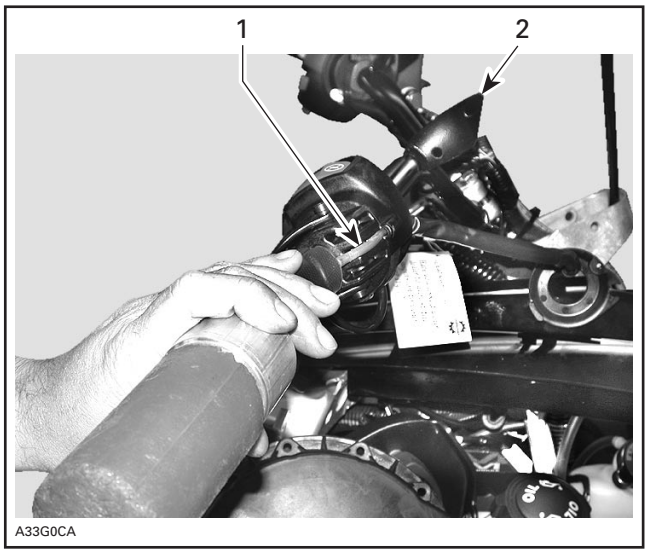
MODEL	TOOL PART NUMBER
Models with straight grips	529 035 897
Models with J-hooks	529 035 936



CAUTION: Installing grip without the insertion tool is likely to damage its heating element.

Position the insertion tool at the outside end of grip.

Using a plastic hammer, tap on tool to push grip on. Continue to tap until grip bottoms.



1. Harness
2. Windshield bracket

Properly route harness then reinstall removed parts.

Reinstall terminals and replug connectors. Test grips to ensure they heat properly.

Steering Column

Unfasten windshield. Remove cap **no. 3** or steering padding **no. 23** according to model.

Remove console. Refer to STEERING COLUMN POSITION ADJUSTMENT below.

Cut locking ties retaining harnesses to steering column **no. 1**.

Unbolt handlebar ass'y and move it aside.

Remove tuned pipe.

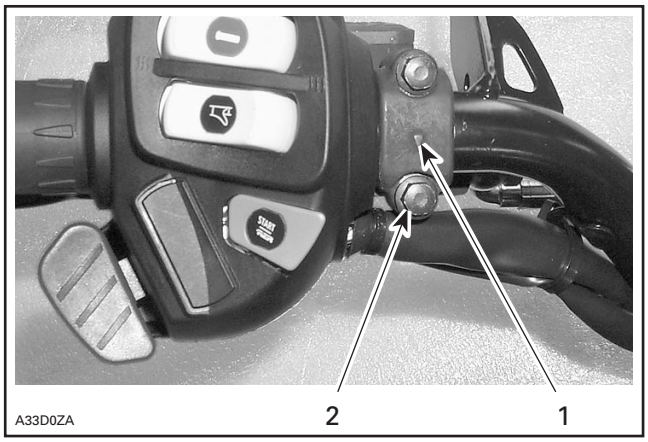
Detach the short tie rod **no. 8** from the steering column. Note that a hardened flat washer **no. 7** goes on each side of steering column lever.

Disengage carriage bolts **no. 6** from steering column support **no. 15**. Remove lower plastic U-clamps from steering column.

Disengage carriage bolts **no. 5** from steering support. Remove upper plastic U-clamps from steering column.

Pull steering column from top.

If, for any reason, the master cylinder has been removed from handlebar note that its clamp **no. 27** must be installed with the embossed arrow pointing downward. Torque screws to 8 N•m (71 lbf•**in**) beginning with the bottom screw.



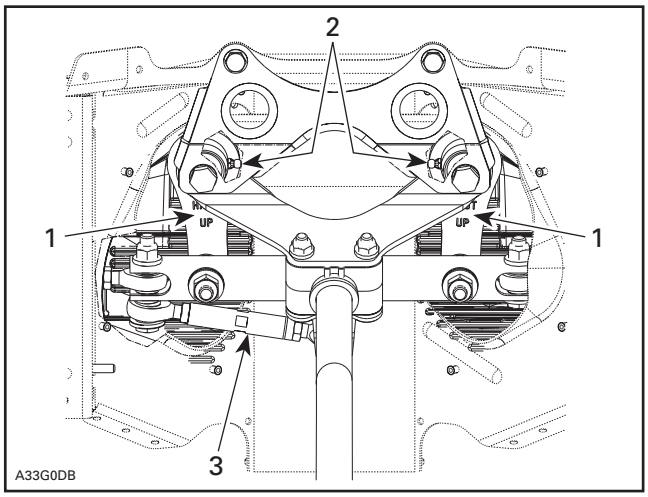
1. Arrow on clamp pointing downward
2. Tighten bottom screw first

Refer to HANDLEBAR POSITION ADJUSTMENT for handlebar reinstallation.

RH and LH Swivel Arm

At assembly respect UP mention.

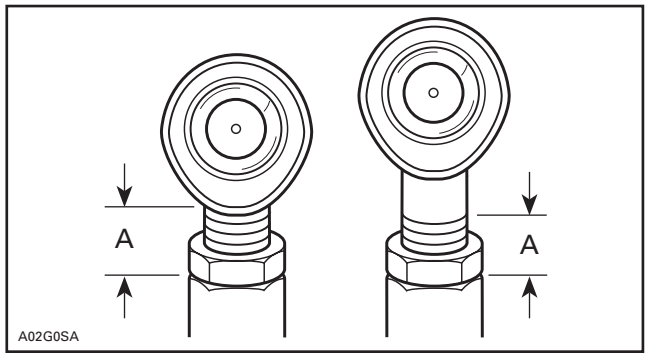
Grease fitting **no. 16** of swivel arms **no. 14** must face toward center of vehicle.



1. UP mention
2. Grease fittings
3. Small tie rod

Ball Joint (left hand and right hand threads)

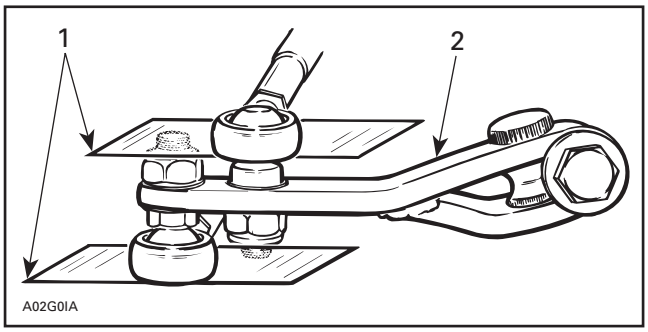
The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).



TYPICAL
A. 20 mm (25/32 in) max.

The ball joint **no. 17** and **no. 18** should be restrained when tightening the tie rod end lock nut. Align it so the tie rod end is parallel to the steering arm when assembled on the vehicle, refer to the following illustration.

For proper torque specifications refer to the specific exploded view for the vehicle being serviced.



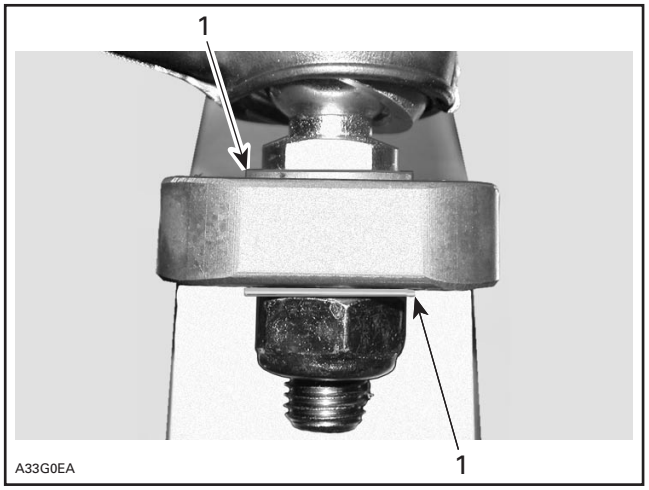
TYPICAL
1. Parallel with steering arm
2. Steering arm

⚠ WARNING

The cut off section of the ball joint must run parallel with the swivel bar no. 9. When tightening lock nuts, restrain ball joint with appropriate size wrench. The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).

Hardened Washer

Install a hardened washer **no. 7** on each side of the ski leg and each side of the steering column lever.



TYPICAL
1. Hardened washers

INSPECTION

Check skis and runners for wear. Replace as necessary. Refer to FRONT SUSPENSION.

Check the general condition of the steering system components for wear. Replace if necessary.

Heating Grip Element

Refer to TESTING PROCEDURE for checking heating element **no. 13** of grip.

Ball Joint (left hand and right hand threads)

Inspect ball joint ends **no. 17** and **no. 18** and small tie rod ends for wear or looseness, if excessive, replace them.

ADJUSTMENT

Steering Column Position Adjustment

Some Models

⚠ WARNING

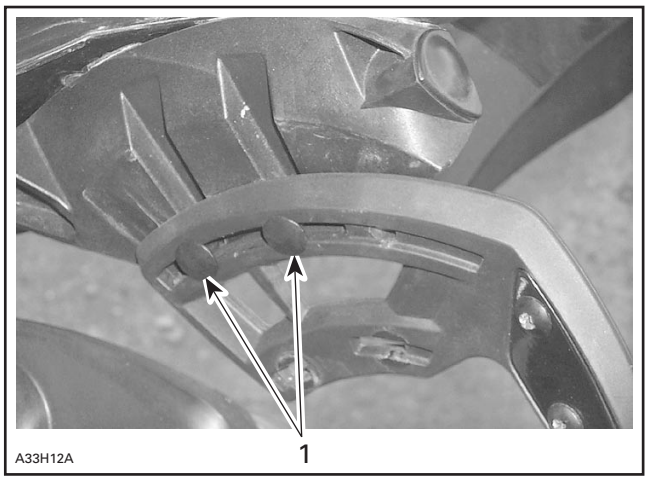
Do not drill additional holes to customize steering column position.

Steering column position is adjustable. Proceed as follows.

There are 2 positions.

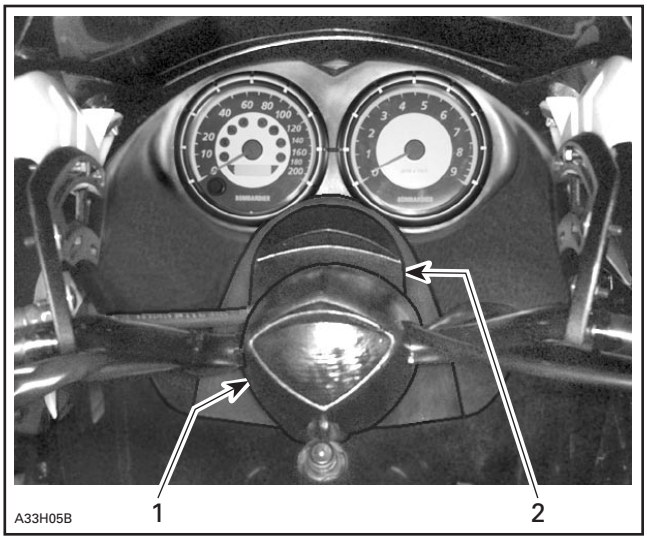
NOTE: Following procedure describes how to change steering column position from rearward to forward position.

Unscrew 4 bolts retaining windshield assembly to handlebar. Remove windshield assembly.



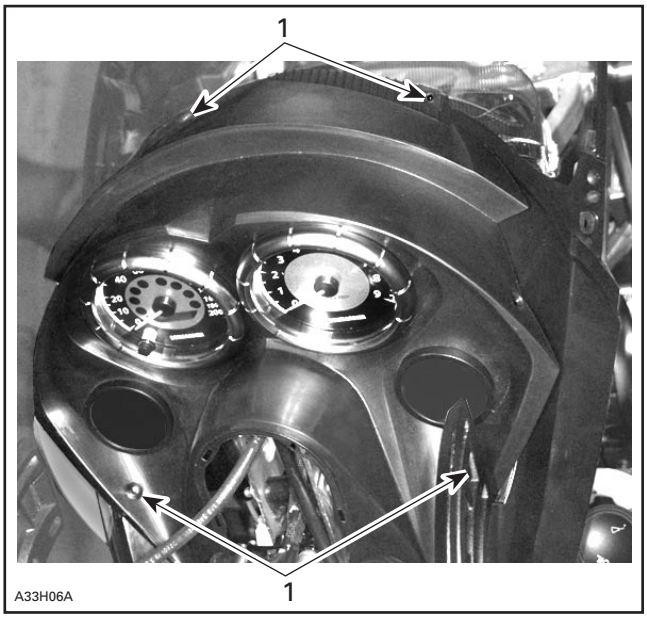
ONE SIDE SHOWN — REARWARD POSITION
1. Bolts retaining windshield assembly

Remove cap **no. 3** or steering padding **no. 23** according to model and remove console cap.



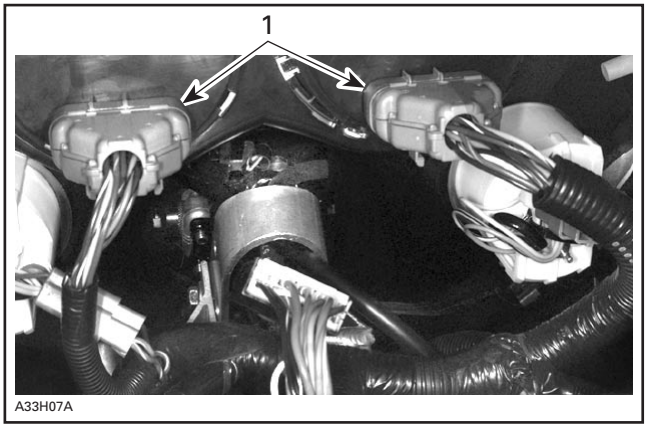
1. Cap
2. Console cap

Unscrew 4 bolts retaining console.



1. Bolts retaining console

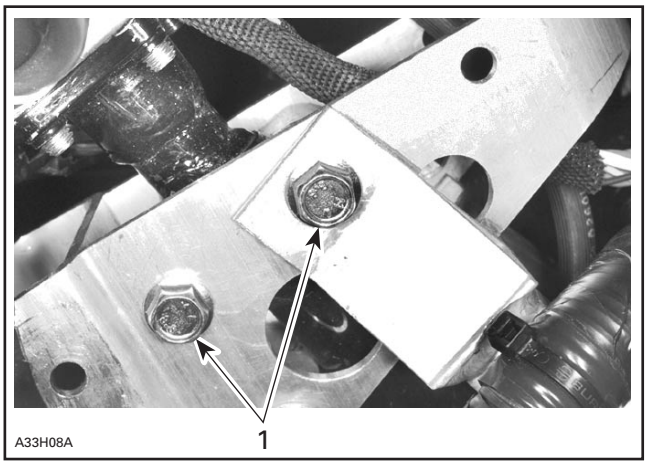
Slightly lift console to gain access to electrical connector housings. Unplug the 2 large connector housings and then separate 3-wire connector.



TYPICAL
1. Large connector housings

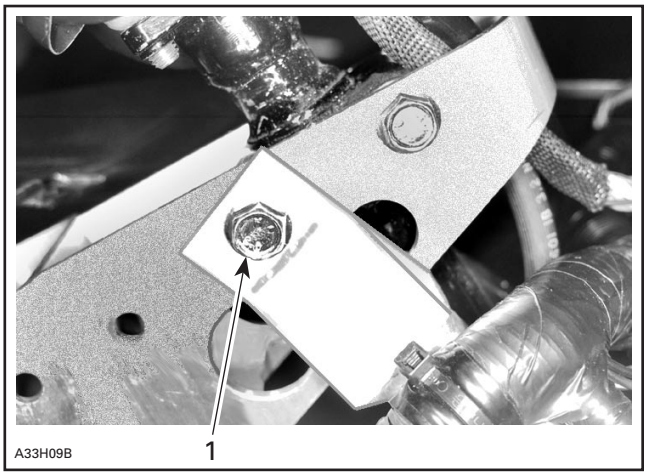
Remove console.

Remove 2 bolts **no. 5** retaining top of steering column.



STEERING COLUMN IN REARWARD POSITION
1. Two bolts retaining top of steering column

Move steering column to forward position.

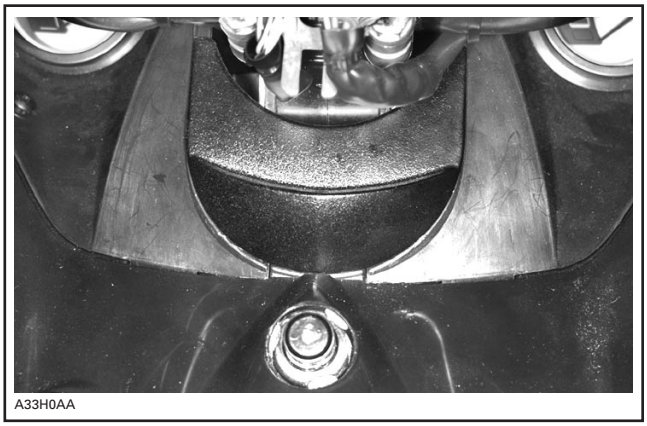


STEERING COLUMN IN FORWARD POSITION
1. Longer bolt

Reinstall the 2 bolts **no. 5**. Always install the longer bolt on thicker portion to be bolted. Use new lock nuts. Torque nuts to 25 N•m (18 lbf•ft).

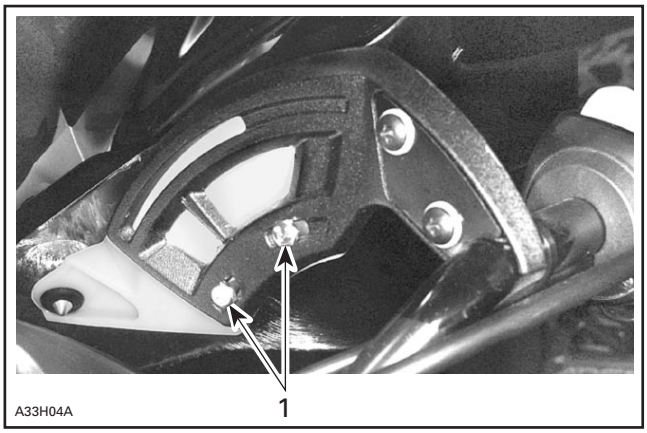
Reconnect the electrical connectors and reinstall all removed parts.

Position of console cap will be inverted. Instead of being above it will be beneath steering column.



CONSOLE CAP INSTALLED BENEATH STEERING COLUMN

Reinstall windshield assembly to handlebar. Refer to WINDSHIELD ADJUSTMENT below.



ONE SIDE SHOWN — FORWARD POSITION
1. Bolts retaining windshield assembly

Readjust throttle lever housing **no. 21** and switch housing accordingly to optimal angle so that you will not need to release your grip to operate levers.

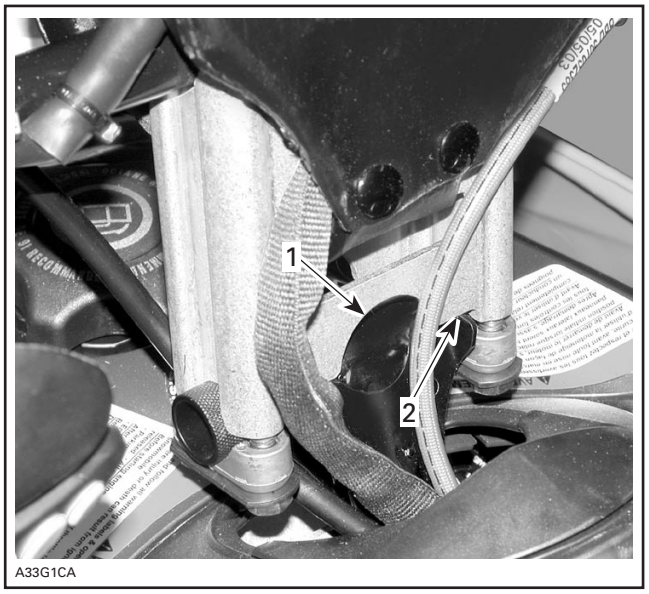
⚠ WARNING

Adjust with vehicle at rest in a safe place. Securely retighten all fasteners. Never rotate throttle lever to operate with fingers instead of thumb.

Handlebar Extension

Some Models

When installing handlebar extension **no. 29**, ensure to position the rounded opening at the bottom and to tilt the extension so that it rests against steering support stopper.

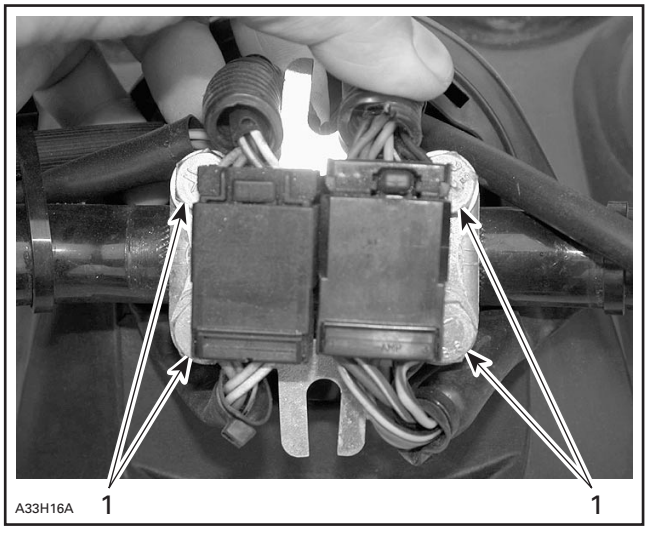


1. Opening here
2. Extension against stopper

Handlebar Position Adjustment

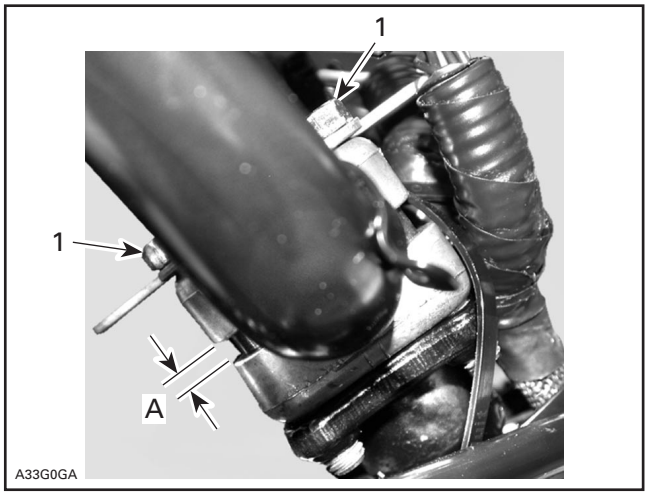
The handlebar position can be adjusted to suit driver's preferences.

Loosen all 4 bolts **no. 4** retaining handlebar to steering column.



1. Four bolts

Move handlebar to the desired position. Torque all 4 bolts **no. 4** to 25 N•m (18 lbf•ft).



1. Torque to 25 N•m (18 lbf•ft)
A. Equal gap all around

CAUTION: Tighten the bolts equally in a criss-cross sequence and ensure there is an equal gap on each side of the clamps no. **2.**

⚠ WARNING

Avoid contact between the brake handle and the windshield by NOT adjusting the handlebar too high.

Readjust throttle lever housing **no. 21** and switch housing accordingly to optimal angle so that you will not need to release your grip to operate levers.

⚠ WARNING

Adjust with vehicle at rest in a safe place. Securely retighten all fasteners. Never rotate throttle lever to operate with fingers instead of thumb.

Readjust windshield for proper fit with console. Refer to WINDSHIELD ADJUSTMENT below.

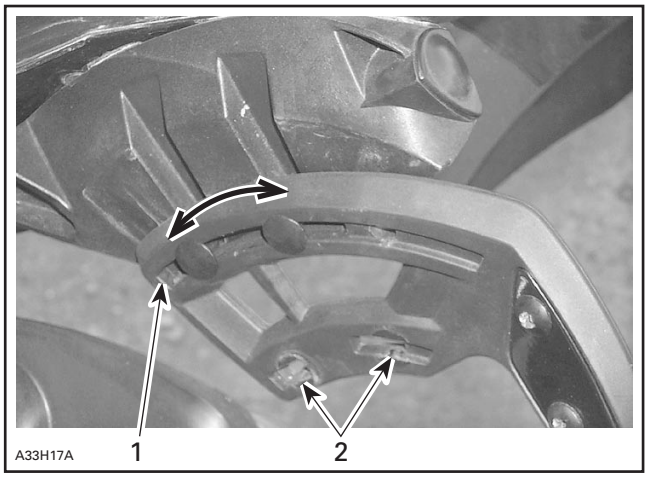
Windshield Adjustment

The windshield can be adjusted to properly fit with console.

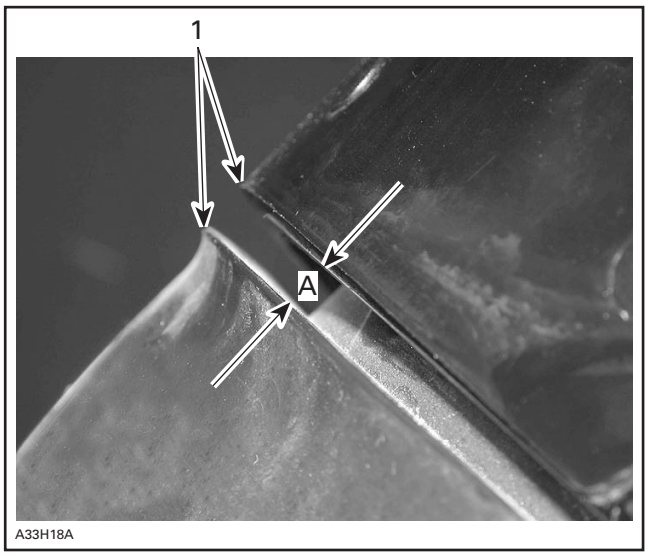
Before adjusting windshield, make sure it is installed on the proper bracket slots according to steering column position. See photos below.

Slots in brackets allow different windshield positions. Move windshield to fit with console. Retighten 4 nuts to 5 N•m (44 lbf•**in**).

Check that windshield does not touch console after adjustment.



1. *Slot when windshield is installed in rearward steering column position*
2. *Slots when windshield is installed in forward steering column position*



PROPER FIT OF WINDSHIELD VERSUS CONSOLE
1. *In line*

A. 8 to 12 mm (3/8 to 1/2 in)

Handlebar Strap

Some Models

Ensure to position strap **no. 28** symmetrically each side of steering support and so that its rubber band is on the inner side. Tilt strap 5° towards driver relative to steering column axis or relative to handlebar extension on so equipped models.

On Renegade X and Summit Series, position strap between rubber band and screw end to protect the rubber band.

Retaining clip and hardware must be installed in the same position on both strap ends.

J-Hook Adjustment

Some Models

Position J-hook so that its curved end is pointing downward and is roughly vertical. Ensure to adjust J-hooks at the same position each side.

Hand Guard Adjustment

Some Models

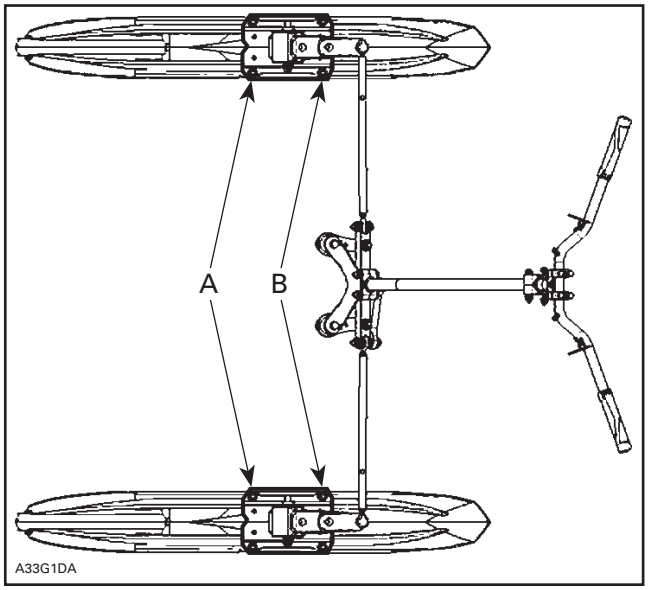
Position RH guard 8 mm (5/16 in) from throttle housing and LH guard 4 mm (5/32 in) from brake retaining clamp. Position hand guards so that their inner face is roughly vertical. Torque top screw first to 3.5 N•m (31 lbf•**in**) then torque bottom screw.

STEERING ADJUSTMENT (SKIS)

Definitions

TOE-OUT:

A difference measured between the front edge of the ski bridge «A» and rear edge of ski bridge «B» as viewed from the top.



Adjustments

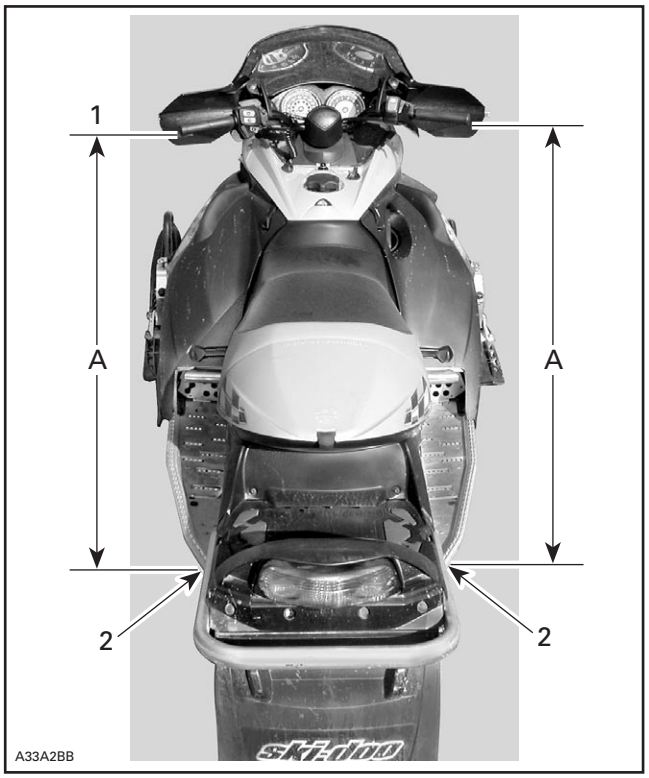
SKI ALIGNMENT AND TOE-OUT

Ski alignment and toe-out are performed by adjusting length of left and right tie rods **no. 11**.

Procedure:

– Position handlebar so that it is in straight ahead position by measuring from the extremities of the grips to the rear most edge of the tunnel, as shown.

NOTE: The reference point must be the same relative to each side.

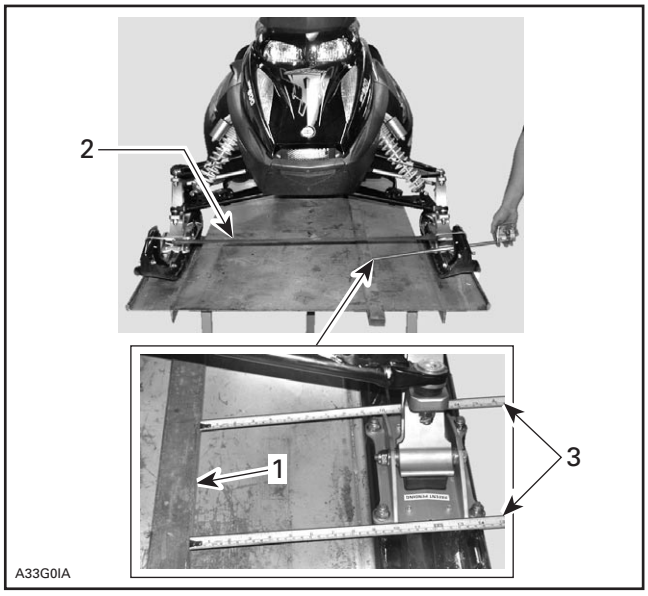


1. Equal distance «A» on each side
2. Same reference point

– Hook a rubber cord in front of skis to keep them closed and to take all slack from steering mechanism.
– Leave the vehicle on the ground on its own weight.
– Place a straight edge against pre-adjusted track and measure the distance between front and rear of ski bridge.

MODEL	TOTAL TOE-OUT ± 1 mm (± 3/64 in)
All REV Series	2 (5/64)

NOTE: To reduce tolerance when measuring, set one ski to proper toe-out (half the total toe-out) then measure from that ski to the opposite ski.



TYPICAL
1. Straight edge
2. Rubber cord
3. Measure at rear and front of ski bridge

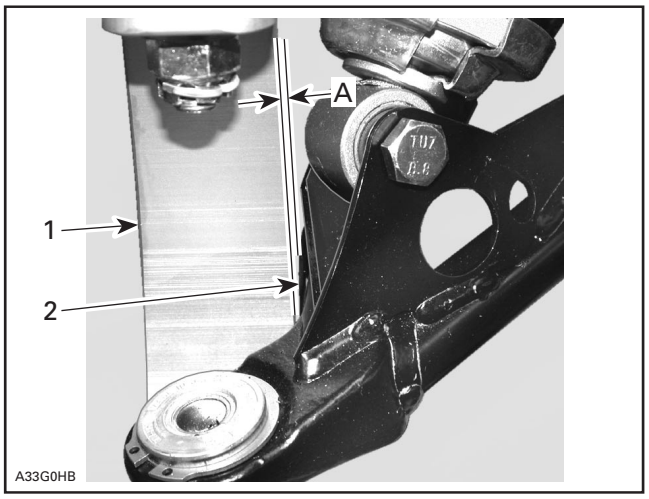
If adjustment is needed:

– Loosen jam nuts of both tie rods no. 11.
– Turn the tie rod to change its length.
– Retighten jam nuts.

⚠ WARNING

Never lengthen tie rod so that the external unengaged threaded portion of ball joint exceeds 20 mm (25/32 in).

Once ski alignment is done check that ski leg rests against lower arm or is not more than 2 mm (5/64 in) from lower arm when the handlebar is fully turned.



RIGHT HAND SIDE SHOWN
1. Ski leg
2. Lower arm
A. 2 mm (5/64 in)

If the distance is more than the specified distance on one side then check for bent parts.

LUBRICATION

⚠ WARNING

Do not lubricate throttle cable or housing.

Use suspension synthetic grease (P/N 293 550 033) on:

– Grease fitting **no. 16** of LH and RH swivel arms.
– Lower steering column bushing.

Use BOMBARDIER LUBE (P/N 293 600 016) on:

– Tie rod ball joints.

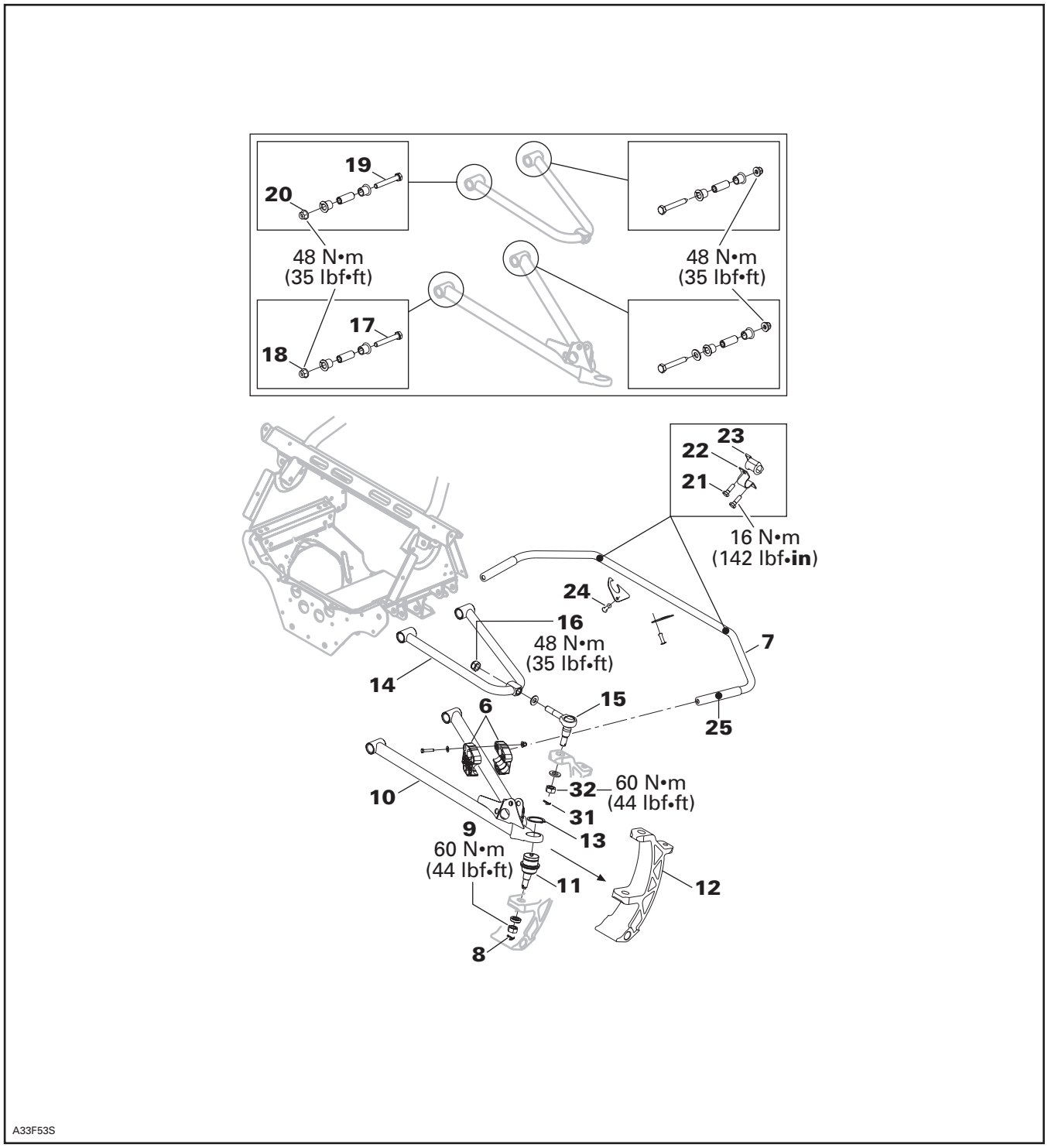
FRONT SUSPENSION

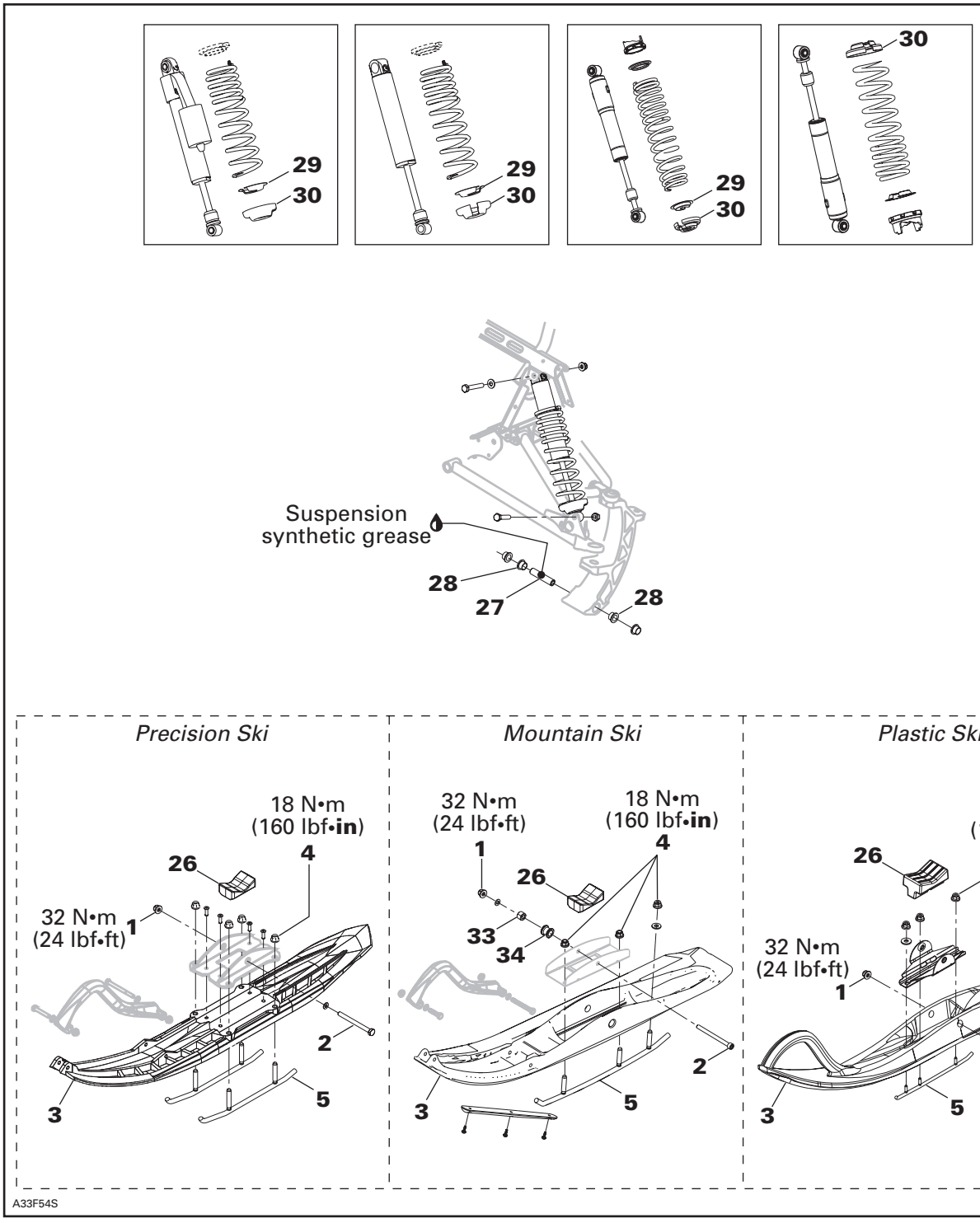
SERVICE TOOLS

Description	Part Number	Page
A-arm nut wrench	529 035 876	456
ball joint installer	529 035 975	456
ball joint lock tool	529 035 945	456
ball joint remover	529 035 827	452–453
ball joint remover support	529 035 873	452
ball joint support	529 035 875	456
shock absorber spring remover	529 035 504	451

SERVICE PRODUCTS

Description	Part Number	Page
pulley flange cleaner	413 711 809	456
suspension synthetic grease	293 550 033	459


19
20
48 N•m
(35 lbf•ft)
48 N•m
(35 lbf•ft)
17
18
23
22
21
16 N•m
(142 lbf•in)
24
16
48 N•m
(35 lbf•ft)
7
14
15
6
25
10
32
60 N•m
(44 lbf•ft)
31
9
13
60 N•m
(44 lbf•ft)
11
12
8
A33F53S



NOTE: The same procedure applies on both sides.

GENERAL INSPECTION

Check for looseness, bent, worn out, rusted or other damage on components. Ensure cotter pins are in good condition and properly secured. Replace the faulty component.

To check upper arm bushings and ball joint:

– Let vehicle weight compress the suspension.
– Firmly grab upper part of ski leg and try to move sideways to feel the free-play.
– If excessive play is felt, replace the faulty component.

To check lower arm bushings and ball joint:

– Raise front of vehicle off the ground from the frame to release the suspension.
– Firmly grab lower part of ski leg and try to move sideways to feel the free-play.
– If excessive play is felt, replace the faulty component.

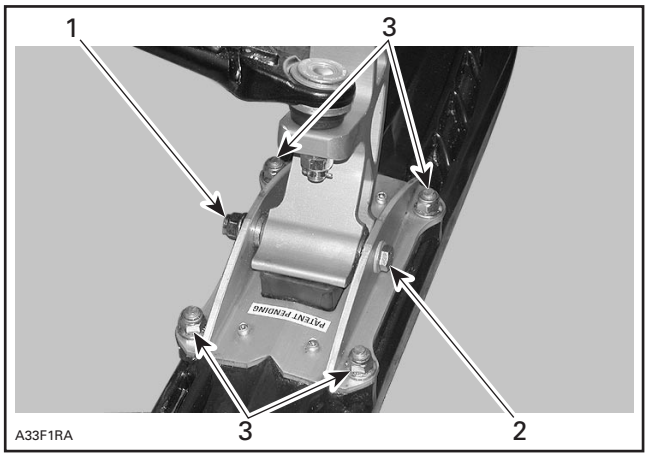
DISASSEMBLY

Ski

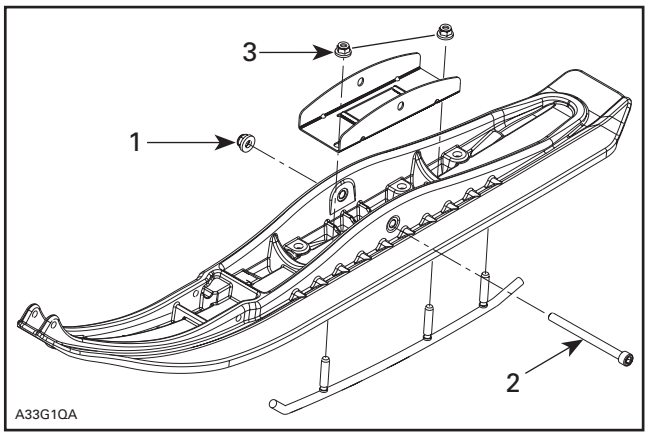
Lift front of vehicle and support it off the ground.

Unscrew nut **no. 1** then pull screw **no. 2** out. Remove ski **no. 3**.

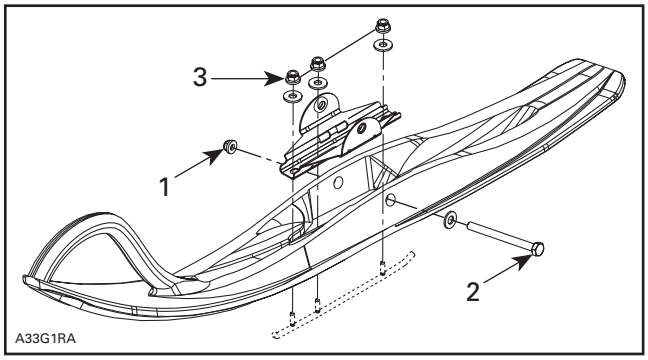
Unscrew nuts **no. 4** and remove ski runners **no. 5**.



PRECISION SKI
1. Unscrew nut
2. Remove screw
3. Ski runner nuts



MOUNTAIN SKI
1. Unscrew nut
2. Remove screw
3. Ski runner nuts

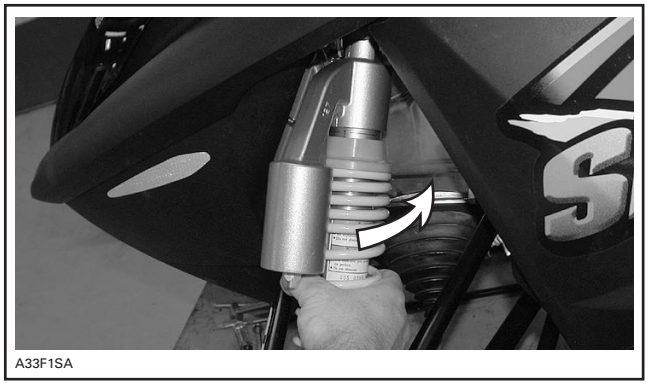


PLASTIC SKI
1. Unscrew nut
2. Remove screw
3. Ski runner nuts

Shock Absorber

Open hood and remove side panels.

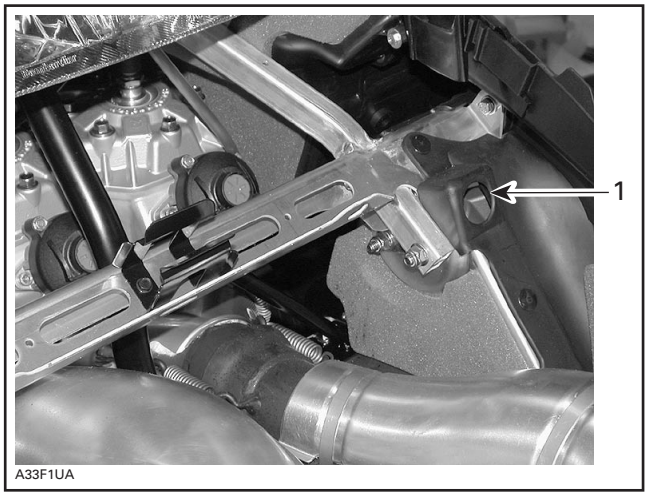
Reduce spring preload by turning adjusting ring towards position 1 and continue until it stops.



A33F1TA

Remove lower screw then upper screw of shock absorber.

NOTE: To retain upper screw while unscrewing nut, remove access plug in engine compartment.

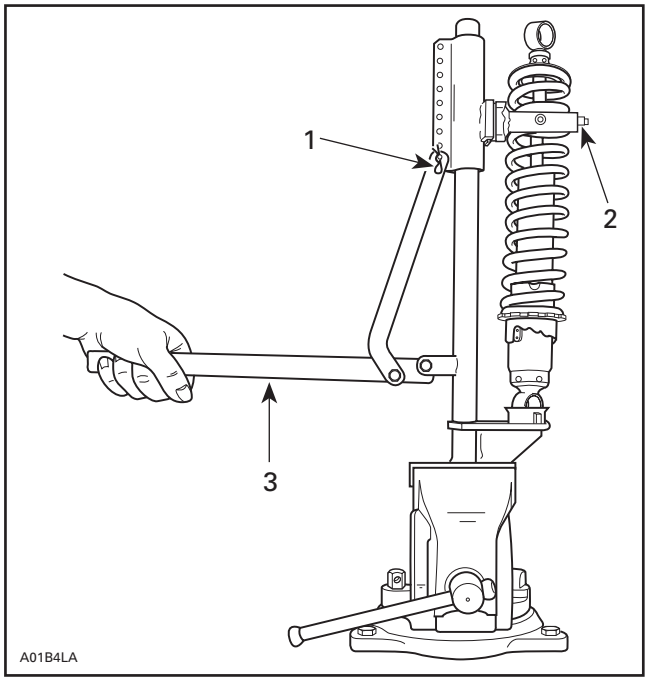


A33F1UA

1. Access hole to reach upper screw

For shock absorber spring disassembly use shock absorber spring remover (P/N 529 035 504) in a vise. Mount shock absorber in it and turn shock absorber so that spring coils match spring compressor.

Close and lock the bar. Adjust the handle at horizontal position by changing the position of the clevis pin.



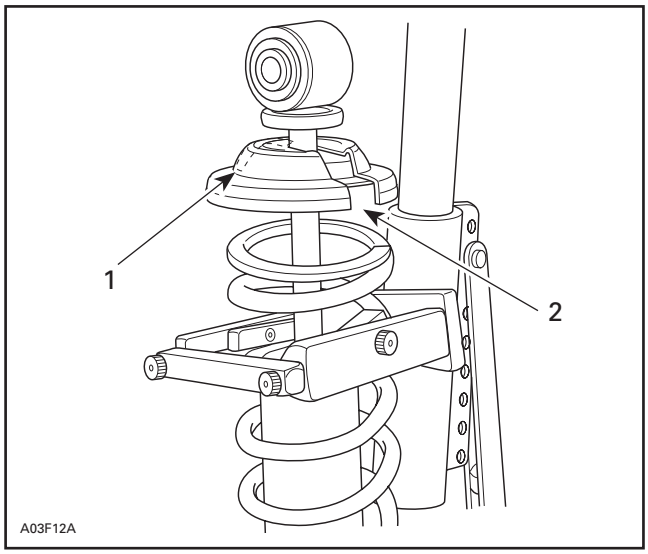
A01B4LA

TYPICAL
1. Clevis pin
2. Bar
3. Handle horizontal

Push down on the handle until it locks. Remove spring stopper then release handle.

Some Models

At installation, cap opening **no. 30** must be 180° from spring stopper **no. 29** opening.



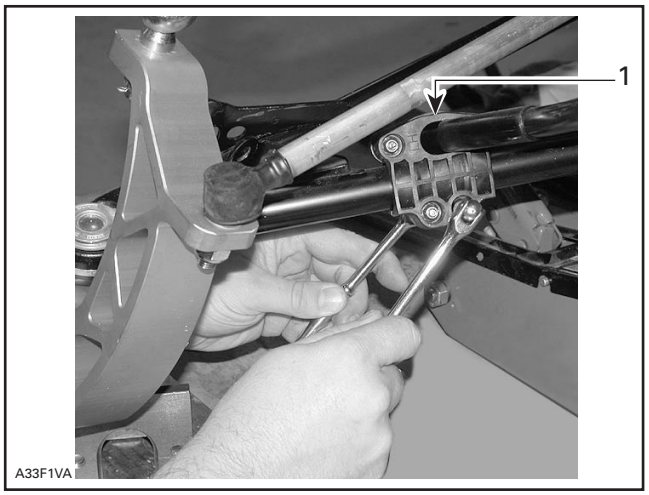
A03F12A

1. Cap opening
2. Spring stopper opening

Lower Arm

Remove shock absorber.

Remove sliding blocks **no. 6** of stabilizer bar **no. 7**.

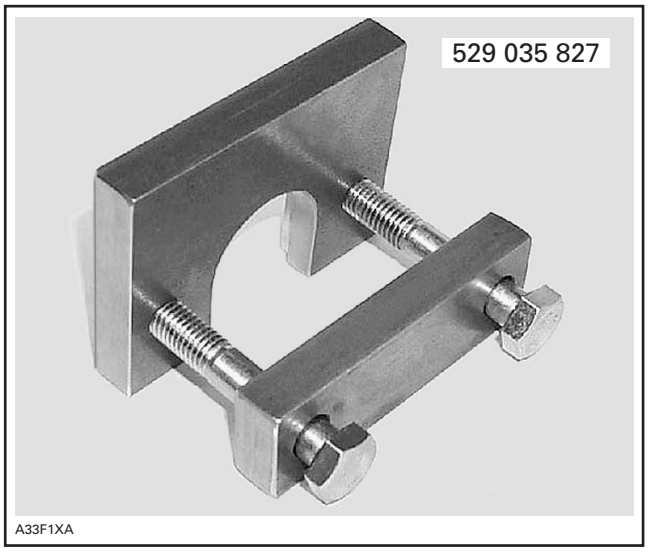


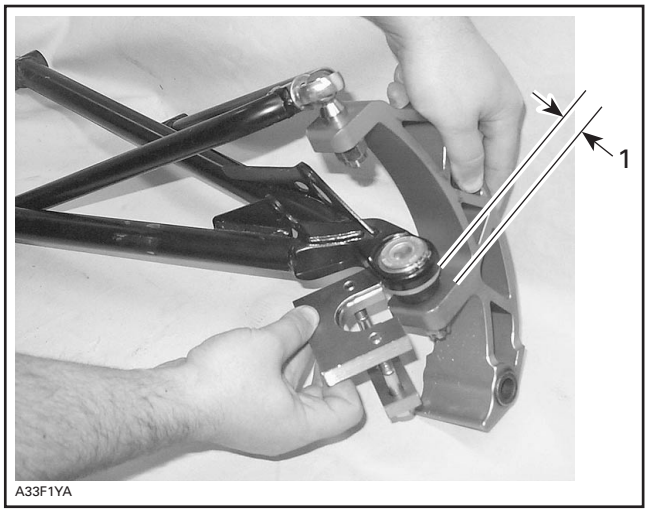
1. Sliding blocks

Remove cotter pin **no. 8** and unscrew ball joint nut **no. 9**.

Raise lower arm **no. 10** so that ball joint **no. 11** becomes parallel with ski leg **no. 12**.

Install ball joint remover (P/N 529 035 827) and detach ball joint from ski leg.



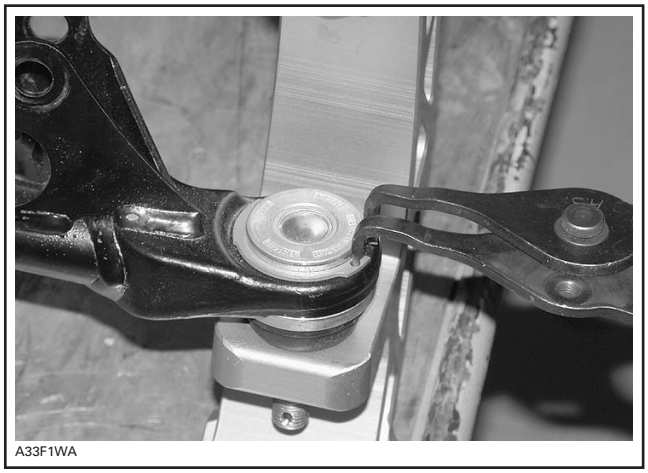


TYPICAL
1. Ball joint parallel with ski leg

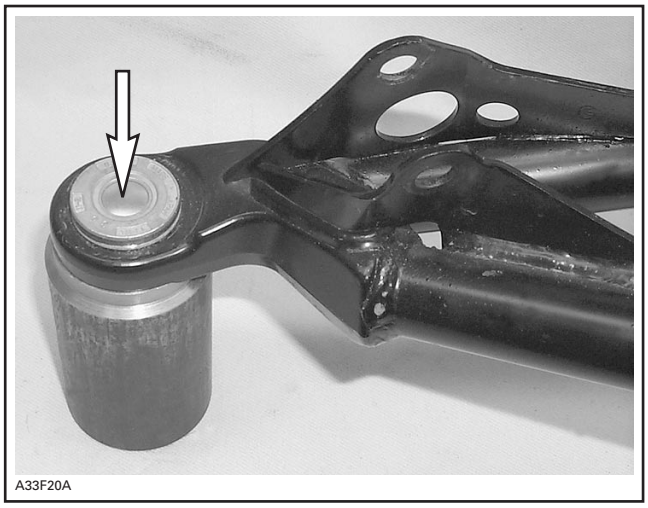
Remove lower arm **no. 10** from frame. For front screw **no. 17** removal, hold nut **no. 18** from engine compartment.

To remove ball joint, proceed as follows:

– Remove snap ring **no. 13**.
– Install ball joint remover support (P/N 529 035 873) under joint.
– Press joint out.



TYPICAL



TYPICAL

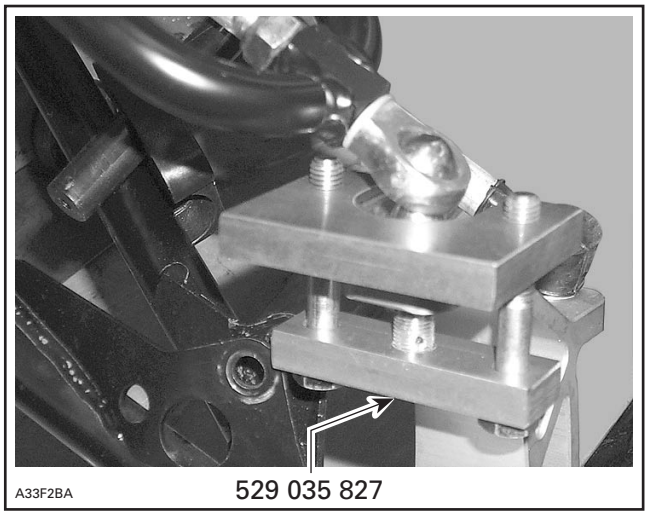
Tie Rod

Refer to STEERING SYSTEM section and remove tie rod from ski leg.

Upper Arm

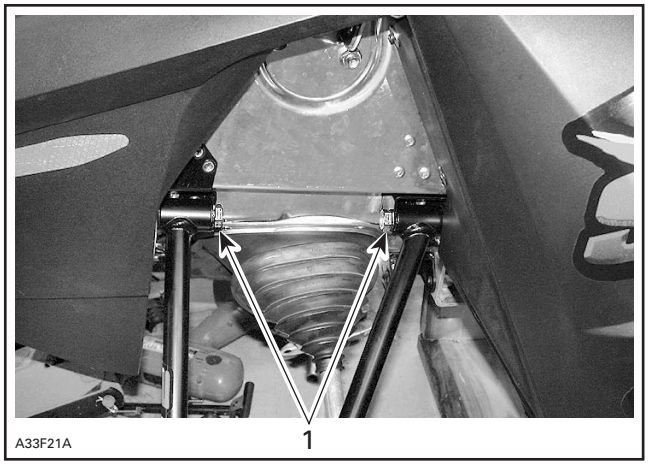
Remove cotter pin **no. 31** and unscrew ball joint nut **no. 32**.

Install ball joint remover (P/N 529 035 827) and detach ball joint **no. 15** from ski leg.



Use a 11 mm (7/16 in) open wrench to hold ball joint housing and unscrew nut **no. 16**, then remove ball joint from upper arm.

Remove upper arm **no. 14** from frame. For screws **no. 19** removal, hold nuts **no. 20** from engine compartment.

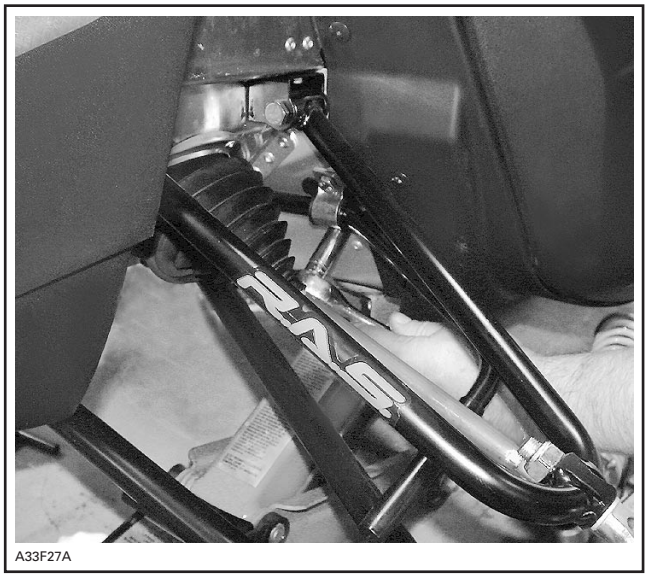


1. Remove screws while holding nuts from engine compartment

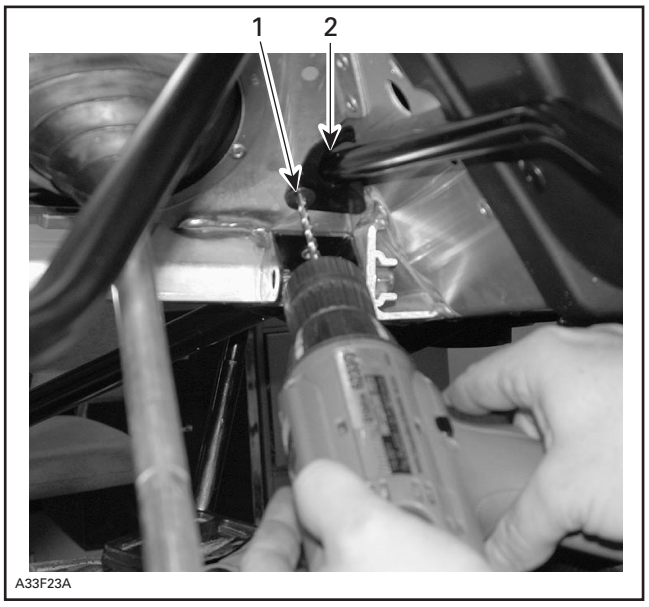
Stabilizer Bar

Remove shock absorbers, stabilizer bar slider blocks and unfasten lower ball joints from ski legs.

Remove screws **no. 21** from clamps **no. 22**.


A33F27A

Using a 4.8 mm (3/16 in) drill bit, drill rivet **no. 24** out. Remove cap.



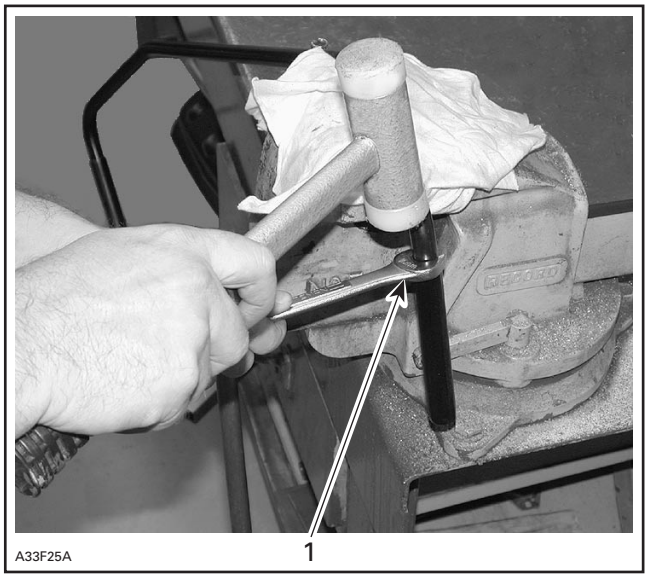
A33F23A

1. Drill rivet out with a 4.8 mm (3/16 in) drill bit
2. Cap

Lift front of vehicle enough so that stabilizer bar **no. 7** can be rotated downward to allow to slide it out.

A33F24A

To remove bushing **no. 25**, use a 13 mm (1/2 in) open wrench and tap bushing out as shown.



A33F25A

1. Use a 13 mm (1/2 in) open wrench to push bushing out

INSPECTION

Check all plastic bushings for wear. Replace as required.

Check condition of ski leg **no. 12**. Replace as required.

Check for straightness of lower and upper arms. Replace as required.

Check condition of ball joints. Replace as required.

Check skis and runners **no. 5** for wear, replace as necessary.

Check condition of ski stopper **no. 26**. Replace it when deteriorated.

To check condition of shock absorber, refer to sub-section SHOCK ABSORBER INSPECTION AND SERVICING in section REAR SUSPENSION.

INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Tighten nuts and screws to proper torque as mentioned in exploded view.

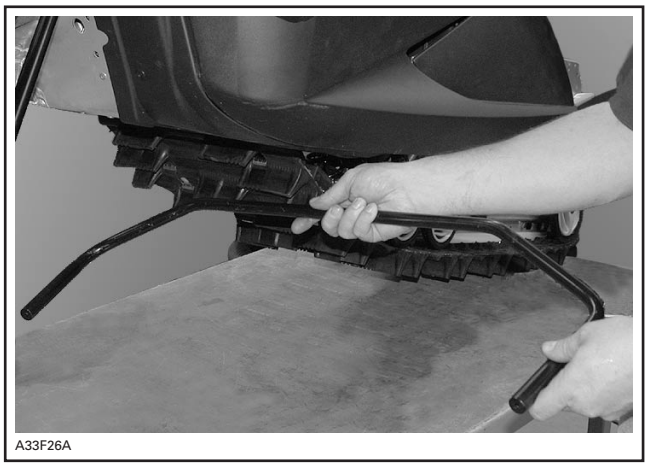
Nuts with a cotter pin: After applying the proper torque, continue tightening as necessary to allow cotter pin insertion. Ensure to properly secure cotter pin.

⚠ WARNING

Always install new cotter pins at assembly and properly bend their ends.

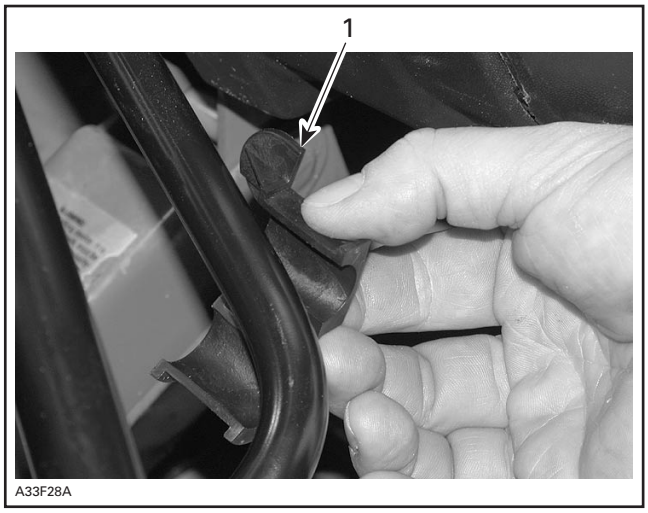
Stabilizer Bar

Ensure to properly position stabilizer bar before insertion in frame.



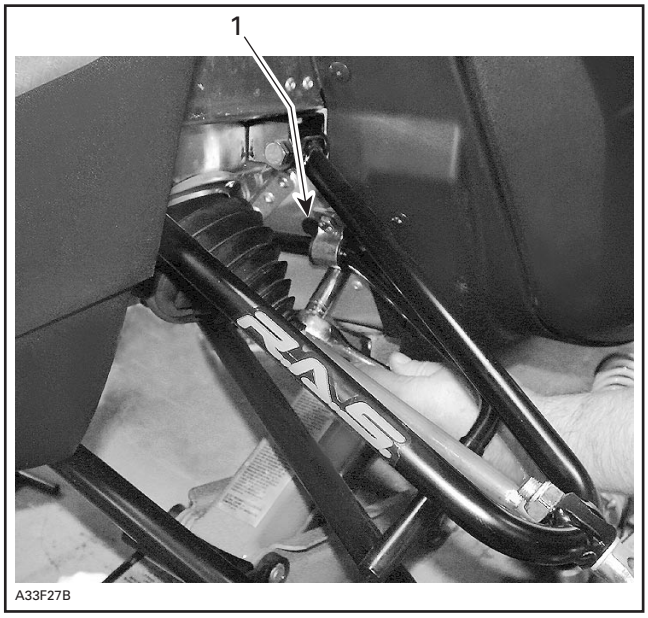
A33F26A

Install the stabilizer bar bushing **no. 23** making sure to place its tab over the access hole located on the LH side.



A33F28A

1. Install bushing as shown

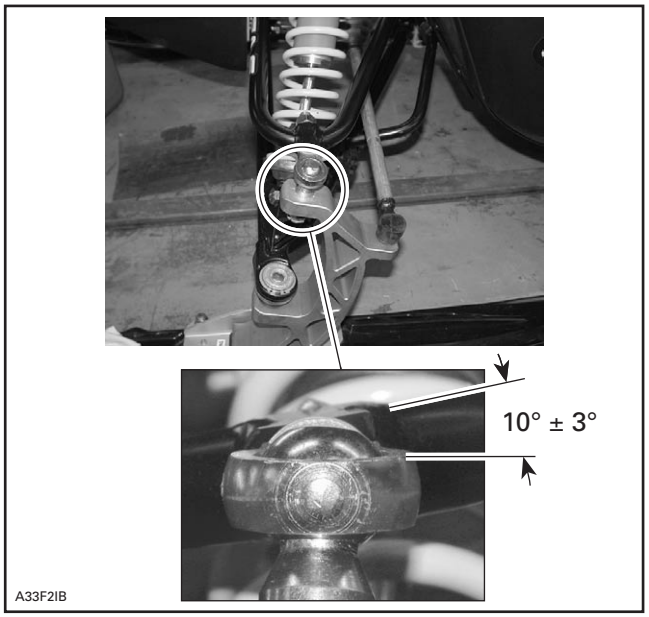


A33F27B

1. Tab here to obstruct access hole

Upper Arm

When installing ball joint **no. 15** to upper arm, ensure to tilt it with the proper angle as shown. The ball joint housing must be parallel to ski leg tab. This mounting position corresponds to 10° ± 3° angle from upper arm.



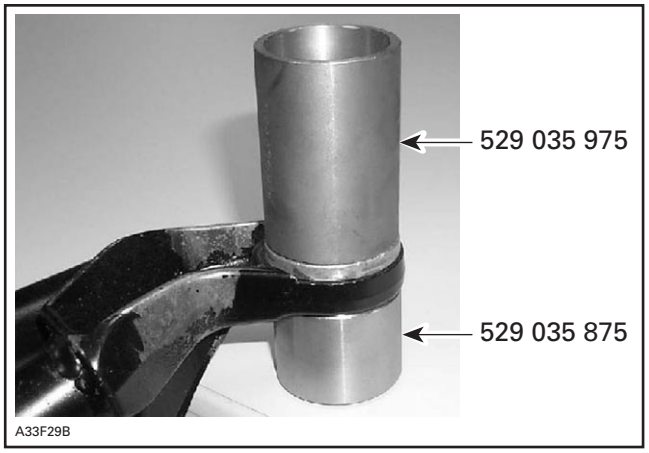
Lower Arm

Position lower arm below stabilizer bar.

Prior to installing ball joint in lower arm, ensure to clean the tapered surfaces with the pulley flange cleaner (P/N 413 711 809). Surface contacts must be clean and free of dirt, oil and grease. Apply the cleaner on a rag then use the rag to clean the surfaces of ball joint and ski leg.

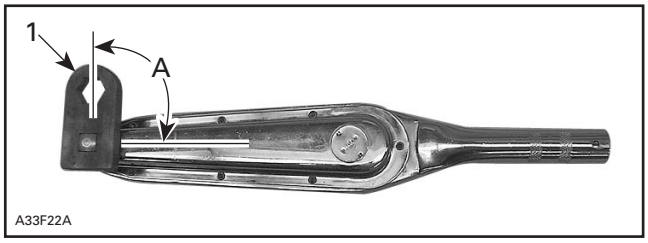
To install ball joint, proceed as follows:

– Install ball joint support (P/N 529 035 875) on top side of lower arm (operating position).
– Position ball joint installer (P/N 529 035 975) on bottom side of lower arm (operating position).
– Press joint in.
– Install snap ring **no. 13** with its opening toward front of vehicle.

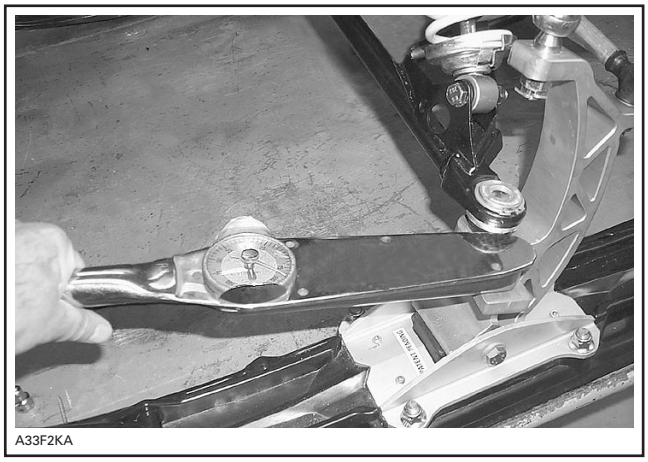


To properly torque ball joint nut, use the A-arm nut wrench (P/N 529 035 876).

Ensure to install the tool perpendicularly (90°) to torque wrench.

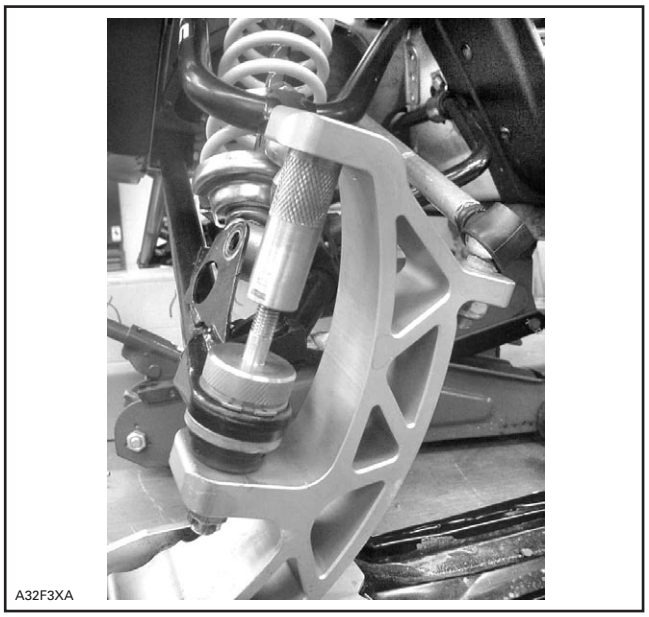


1. Tool perpendicular (90°) to torque wrench
A. 90°



Use ball joint lock tool (P/N 529 035 945) to restrain ball joint during nut tightening.

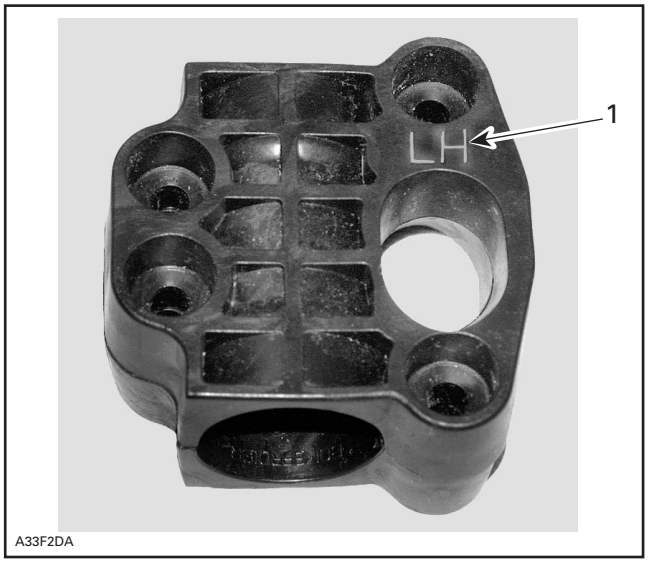
NOTE: The upper arm ball joint has to be removed in order to use this tool. Also remove the small screw from top of ball joint to allow proper seating of tool.



TYPICAL

Stabilizer Bar

Notice that LH and RH sliding blocks are different. Look for their molded identification with LH or RH letters.

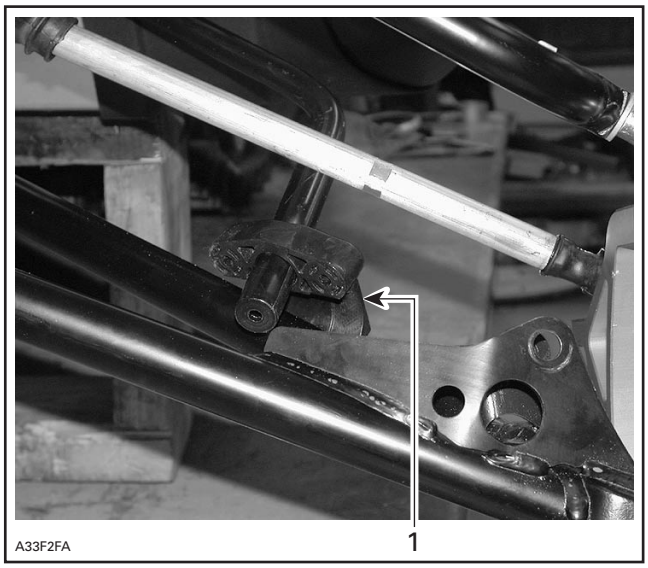


1. Molded identification for proper side installation

To install sliding blocks:

– Temporarily rotate the rear block by 180°.
– Insert on stabilizer bar end and push beyond the lower arm.
– Rotate block back by 180° to its normal position.
– Install the other block half.
– Install screws and nuts.
– Ensure blocks slide easily when compressing and releasing suspension.

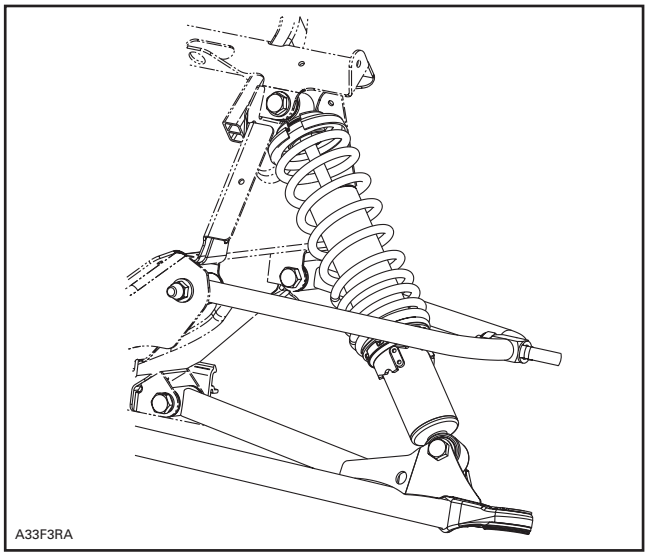
1. Temporarily rotate block by 180° for its insertion



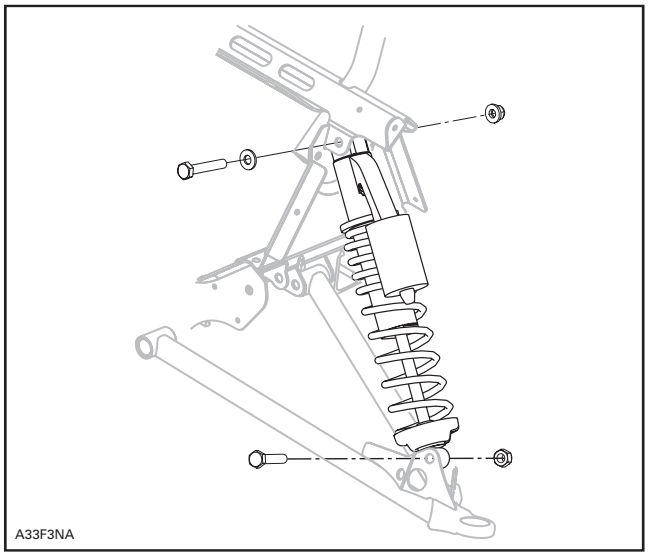
1. Push block on bar end beyong lower arm then rotate back to its normal position

Shock Absorber

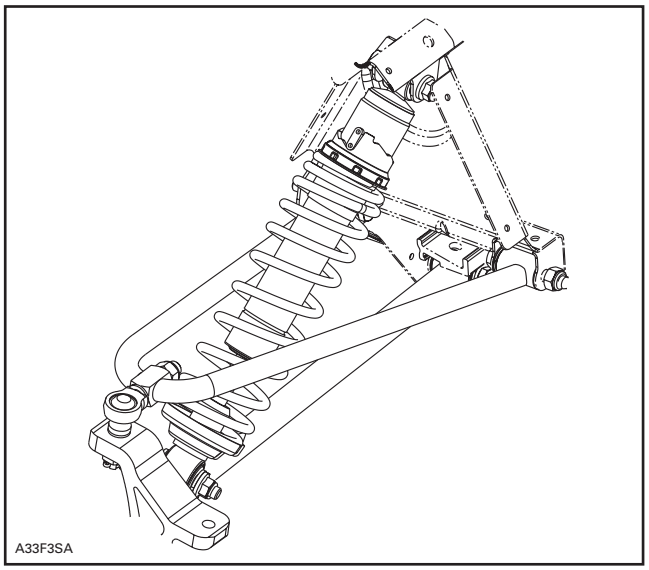
Ensure to reinstall shock absorber in the proper position according to model.



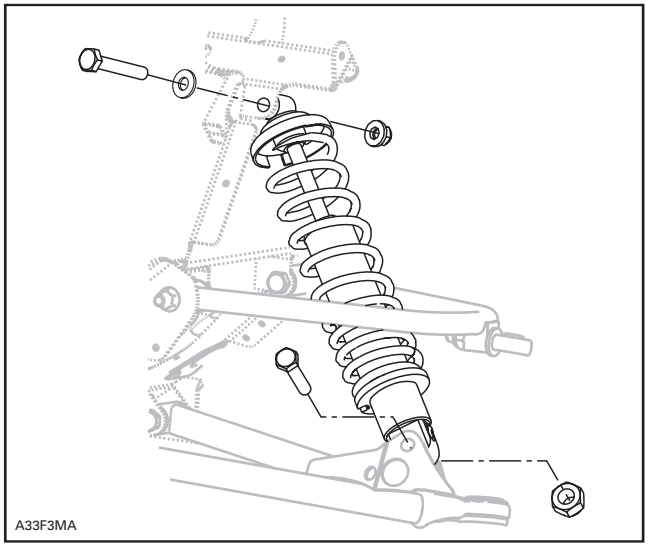
GSX Sport
GTX Sport
MX Z Trail
Summit Adrenaline



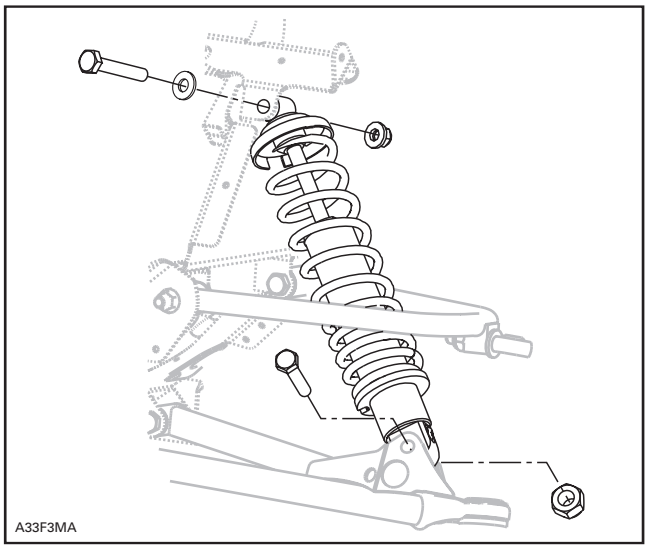
MX Z
All X package
Adrenaline (Europe)
Trail (Europe)



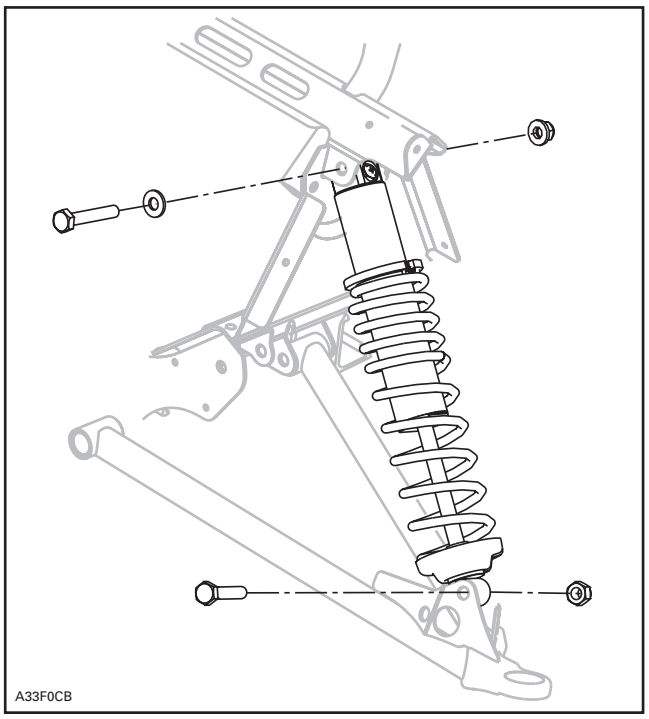
GSX Limited
GTX Limited
GTX 600 HO SDI Sport (Europe)
MX Z Adrenaline
MX Z Renegade



GSX 380F/550F
GTX 380F/550F
MX Z 380F/550F
Summit 550F
Expedition Sport 550F



Summit X



MX Z 380F (Europe)
MX Z Renegade (Europe)

Readjust spring preload.

Ski

Apply suspension synthetic grease (P/N 293 550 033) between bushing **no. 28** and spacer **no. 27** and also on inner tube of ski leg.

Summit Only

Install bushing **no. 29** and spacer **no. 30** inward on each ski leg for the wide ski stance. Install outward for narrow ski stance.

⚠ WARNING

Install skis with proper side facing inward. Refer to warning on ski.

Adjustment

All Models

Proceed with ski alignment. Refer to STEERING SYSTEM.

BODY

INSTALLATION AND ADJUSTMENT

DECAL

To remove a decal; heat old decal with a heat gun and peel off slowly.

Using isopropyl alcohol, clean the surface and dry thoroughly.

Apply liquid soap to new decal and carefully position the decal. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

CAUTION: Do not apply isopropyl alcohol or solvent directly on decals. Use only in a well ventilated area.

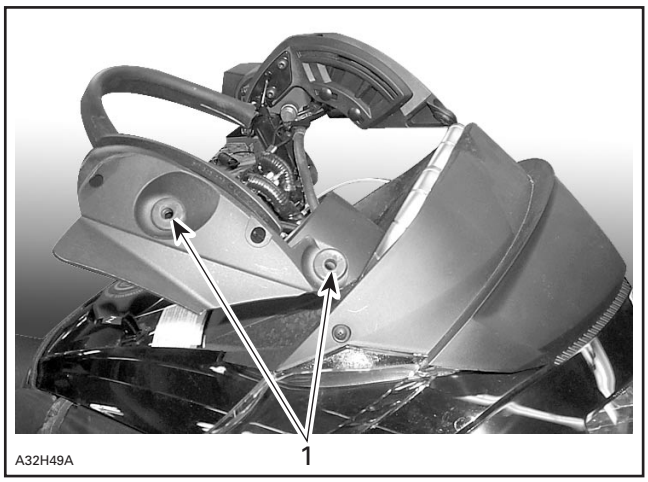
WINDSHIELD

Pull windshield one side at a time as shown to remove it.

A32H48A

Remove protective film when installing a new windshield.

Apply liquid soap on grommets prior to installing windshield to ease pin insertion.



A32H49A

1. Grommets

Position the windshield on the windshield supports then push it down until the pins are fully inserted into the grommets.

GUARD

Disassembly and Assembly

NOTE: For additional information (e.g.: exploded view) refer to the correspondent *Parts Catalog*.

⚠ WARNING

Engine should be running only with guard well secured in place.

Inspection

Check guard mounting bosses, clips and retainers for wear.

WIRING HARNESS

⚠ WARNING

Ensure all terminals are properly crimped on the wires and that all connector housings are properly fastened. Keep wires away from any rotating, moving, heating and vibrating parts. Use proper fastening devices as required.

CABLES

⚠ WARNING

Before installation, ensure that all cables are in perfect condition. Properly install the cable ends and secure them in place. Pay attention to route them properly, away from any rotating, moving, heating or vibrating parts.

TUBING

⚠ WARNING

Always ensure that the fuel, vent, primer, impulse, injection oil and rotary valve oil lines are properly fixed to their connectors, that they are not perforated or kinked and that they are properly routed away from any rotating, moving, heating or vibrating parts. Also check for leaks. Replace if required.

NOTE: Refer to proper *Parts Catalog* to find suitable clip part numbers.

PLASTIC MAINTENANCE AND REPAIR

MAINTENANCE

Clean the vehicle thoroughly, removing all dirt and grease accumulation.

To clean use a soft clean cloth and either soapy water or isopropyl alcohol.

To remove grease, oil or glue use isopropyl alcohol.

CAUTION: Do not apply isopropyl alcohol or acetone directly on decals.

CAUTION: The following products must not be used to clean or wax any of the plastic components used on the vehicles:

- gasoline
- brake fluid
- kerosene
- diesel fuel
- lighter fluid
- varsol
- naphtha
- acetone
- strong detergents
- abrasive cleaners
- waxes containing an abrasive or a cleaning agent in their formula.

Apply wax on glossy finish only. Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: If for some reason the snowmobile has to be stored outside, it is preferable to cover it with an opaque tarpaulin. This will prevent the sun rays from affecting the plastic components and the vehicle finish.

REPAIR

The very first step before repairing plastic materials is to find out exactly which type of material is involved.

CAUTION: Some repair products are not compatible with certain plastics.

⚠ WARNING

Polycarbonate windshields must never be repaired by welding or otherwise.

For hood repair, refer to a specialized shop.

The following company provides a complete line of products to repair plastic materials:

CREST INDUSTRIES, INC. TRENTON, MI 48183	PHONE: (734) 479-4141 TOLL FREE: 1 800 822-4100 FAX: 734-479-4040 E-MAIL: INFO@CRESTAUTO.COM WWW.CRESTAUTO.COM

FRAME

SERVICE TOOLS

Description	Part Number	Page
Supertanium drill bit	529 031 800	463

SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic chaincase oil	413 803 300	463

FRAME CLEANING

NOTE: For bare aluminum frames use only aluminum cleaner and follow instructions on container. (Dursol cleaner or equivalent).

Clean frame and tunnel with appropriate cleaners and rinse with high pressure hose.

CAUTION: Never direct high-pressure water jet towards decals. They will peel off.

Touch up all metal spots where paint has been scratched off. Spray all bare metal parts of vehicle with metal protector.

Seat Cleaning

For all models, it is recommend to clean the seat with a solution of **warm soapy water**, using a soft clean cloth.

CAUTION: Avoid use of harsh detergents such as strong soaps, degreasing solvents, abrasive cleaners, paint thinners, etc., that may cause damage to the seat cover.

FRAME WELDING

Aluminum Frame

– No welds should be done on aluminum frame except if mentioned or required on a BRP *bulletin*.
– Use ER-5356 rods for MIG or TIG welding.

CAUTION: Before performing electrical welding anywhere on the vehicle, unplug electronic module. On models equipped with a battery, also unplug the negative cable. This will protect the electronic module and battery against damage caused by flowing current when welding.

CAUTION: If welding is to be done near plastic material, it is recommended to either remove the part from the area or to protect it with aluminum foil to prevent damage.

FRAME COMPONENT REPLACEMENT

Drilling Procedure

When drilling self-piercing rivets, use the Supertanium drill bit (P/N 529 031 800), available in a 5 mm (3/16 in) size and shipped in packs of 2.

For proper drilling instructions and to prevent premature wear, follow the procedure below.

Always use a variable speed drill.

Partially drill rivet end — not the rivet head.

Maintain a slow to medium speed at all times when drilling. The proper speed is attained when a constant chip is ejected.

NOTE: To increase bit life, use XP-S synthetic chaincase oil (P/N 413 803 300) as a cutting oil.

CAUTION: High speed drilling will cause excessive heat which may destroy the cutting edge of the bit; therefore, avoid using pneumatic drills.

A03H2FA

TYPICAL

Cut rivet using a chisel.

Remove riveted part.

Drive out remaining rivet head using a punch.

FAN COOLED MODELS

MODEL			GSX/GTX/MX Z	EXPEDITION/SUMMIT/ GSX/GTX/MX Z
			380 F	550 F
ENGINE				
Engine type			377	552
Number of cylinder			2	
Bore	Standard	mm (in)	62 (2.441)	76 (2.992)
Stroke		mm (in)	61.00 (2.402)	
Displacement		cm^3 (in^3)	368.30 (22.475)	553.40 (33.771)
Compression ratio			11.2 ± 0.5	9.6 ± 0.5
Maximum power engine speed (1)		± 100 RPM	7000	
Piston ring type		1st	Semi-trapezoidal	
		2nd	Rectangular	
Ring end gap	New	mm (in)	0.20 to 0.35 (.008 to .0138)	0.40 to 0.55 (.016 to .022)
	Wear limit	mm (in)	1.0 (.039)	
Ring/piston groove clearance	New	mm (in)	0.040 to 0.110 (.0016 to .0043)	0.04 to 0.08 (.0016 to .0030)
	Wear limit	mm (in)	0.2 (.0079)	
Piston/cylinder wall clearance	New	mm (in)	0.070 ± 0.016 (.0028 ± .0006)	0.147 ± 0.026 (.0058 ± .0010)
	Wear limit	mm (in)	0.2 (.0079)	
Maximum crankshaft end play (2)	New	mm (in)	0.3 (.012)	
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.06 (.0024)	
Connecting rod big end axial paly	New	mm (in)	0.200 to 0.527 (.0079 to .0207)	
	Wear limit	mm (in)	1.2 (.0472)	
ELECTRICAL				
Magneto generator output			340 W	
Ignition type			CDI	
Spark plug	Make and type		NGK BR9ES (6)	
	Gap	mm (in)	0.40 to 0.50 (.016 to .020)	
Ignition timing BTDC (3)		mm (in)	2.79 (.110)	2.77 (.109)
Trigger coil (4)		Ω	160 to 180	
Generating coil (4)	Low speed	Ω	6.3	
	High speed	Ω	7.7	
Lighting coil (4)		Ω	0.145 to 0.175	
High tension coil (4)	Primary		N.A.	
	Secondary		N.A.	
Battery			12 V, 18 A•h (if applicable)	
Headlamp		W	60/55 (H4)	
Taillight and stoplight		W	8/27	
Tachometer and speedometer bulbs		W	2 x 3	
Fuel and temperature gauge bulbs		W	N.A.	
Fuse	Starter solenoid	A	30 (if applicable)	
	Fuel level sensor	A	N.A.	

MODEL			GSX/GTX/MX Z	EXPEDITION/SUMMIT/ GSX/GTX/MX Z
			380 F	550 F
FUEL SYSTEM				
Carburetor type		EXPEDITION	—	VM34–617
		GSX/GTX/MX Z	VM30–213	VM34–617
		SUMMIT	—	VM34–616
		SUMMIT (EUR)	—	VM34–617
Main jet		EXPEDITION	—	260
		GSX/GTX/MX Z	195	260
		SUMMIT	—	220
		SUMMIT (EUR)	—	260
Needle jet			Q-2	P-7
Pilot jet			35	45
Needle identification		EXPEDITION	—	6BCY40-4
		GSX/GTX/MX Z	6DEY13-3	6BCY40-4
		SUMMIT	—	6BCY40-3
		SUMMIT (EUR)	—	6BCY40-4
Slide cut-away			2.0	2.5
Float adjustment		mm (in)	23.90 ± 1 (.941 ± .040)	
Air or pilot screw adjustment		± 1/16 turn	N.A.	
Idle speed		± 200 RPM	1650	
Gas type			Unleaded	
Pump octane number	Inside North America	(R+M)/2	87 or higher	
	Outside North America	RON	91 or higher	
Gas/oil ratio			Injection	
Injection oil			XP-S mineral injection oil	
COOLING SYSTEM				
Type			Fan	
Axial fan belt adjustment	Deflection	mm (in)	9.5 ± 0.5 (.374 ± .020)	
	Force	kg (lbf)	5.0 (11.0)	
Thermostat opening temperature			N.A.	
Radiator cap opening pressure			N.A.	
DRIVE SYSTEM				
Chaincase Oil			XP-S synthetic chaincase oil	
Chain drive ratio		GSX/MX Z	19/45	19/43
		GTX	19/45	21/45
		GTX (EUR)	19/45	19/43
		EXPEDITION/SUMMIT	—	19/43
Chain	Pitch	in	3/8	
	Type/links qty/plate qty	GSX/MX Z/ GTX (EUR)	Silent 74/13	Silent 72/13
		GTX	Silent 74/13	
		EXPEDITION/SUMMIT	—	Silent 72/13
Drive pulley Type			Bombardier Lite	

MODEL			GSX/GTX/MX Z	EXPEDITION/SUMMIT/ GSX/GTX/MX Z
			380 F	550 F
Drive pulley calibration	Clutch engagement ± 100 RPM	GSX/MX Z	3300	3500
		GTX	3300	3000
		EXPEDITION/SUMMIT	—	3300
		SUMMIT (EUR)	—	3000
	Spring color	GSX/MX Z	Blue/Pink	Purple/Yellow
		GTX	Blue/Pink	Blue/Orange
		EXPEDITION/SUMMIT	—	Purple/Yellow
		SUMMIT (EUR)	—	Blue/Orange
	Spring length		—	
	Weight 417 120 400 = 21 g 417 114 400 = 3.4 g	EXPEDITION/ SUMMIT (EUR)	—	1 x 417 120 400 + 2 x 417 114 400
		GSX/GTX/MX Z	1 x 417 120 400 + 1 x 417 114 400	1 x 417 120 400 + 2 x 417 114 400
		SUMMIT	—	5 x 417 114 400
	Block	EXPEDITION/ SUMMIT (EUR)	—	3 x 417 128 932
		GSX/GTX/MX Z	3 x 417 128 605	3 x 417 128 932
		SUMMIT	—	3 x 415 128 968
	Cap		1 x 417 114 500	
	Pin		—	
	Ramp		—	
	Screw position		—	
Driven pulley	Type		Formula RER	
	Spring preload		N.A.	
	Cam angle		44°	
Pulley distance	Z	mm (in)	17.5 (0.689)	
Offset	X	mm (in)	33.4 ± 0.5 (1.315 ± 0.2)	
	Y – X	mm (in)	0.46 (.0.181)	
Drive belt part number		P/N	415 060 600	
Drive belt	Width (10)	mm (in)	34.70 (1.366)	
	Wear limit	mm (in)	32.30 (1.272)	
Drive belt adjustment	Deflection	mm (in)	32 ± 5 (1.260 ± .197)	
	Force (8)	kg (lbf)	11.34 (25)	

MODEL			GSX/GTX/MX Z	EXPEDITION/SUMMIT/ GSX/GTX/MX Z
			380 F	550 F
Track	Width	GSX/GTX/MX Z	381 mm (15 in)	
		SUMMIT	—	381 mm (15 in)
		EXPEDITION/ SUMMIT (EUR)	—	406 mm (16 in)
	Length	GSX/MX Z	3074 mm (121 in)	
		GTX	3456 mm (136 in)	
		EXPEDITION/SUMMIT	—	3456 mm (136 in)
	Profile height	GSX/MXZ	18.4 mm (.724 in)	22.3 mm (.878 in)
		MX Z (EUR)	25.4 mm (1.0 in)	31.8 mm (1.25 in)
		GTX	18.4 mm (.724 in)	22.3 mm (.878 in)
		GTX (EUR)	22.3 mm (.878 in)	22.3 mm (.878 in)
		EXPEDITION/ SUMMIT (EUR)	—	31.8 mm (1.25 in)
		SUMMIT	—	38.1 mm (1.50 in)
Track adjustment	Deflection mm (in)		30 to 35 (1-3/16 to 1-3/8)	
	Force (9) kg (lbf)		7.3 (16)	
Suspension type	Track	GSX/MX Z	SC 3 121 in	
		GTX	SC-136 in	
		EXPEDITION/SUMMIT	—	SC-136 in
	Ski		R.A.S. A-Arm	
BRAKE				
Brake fluid reservoir mL (U.S. oz)			60 (2.0)	
Brake fluid			GTLMA (DOT 4) (P/N 293 600 062) Racing brake fluid SRF (DOT 4) (P/N 293 600 063)	
VEHICLE INFORMATIONS				
Mass (dry)	EXPEDITION	Manual start	—	208 kg (458 lb)
		Electric start	—	220 kg (484 lb)
	GSX	Electric start	200 kg (440 lb)	209 kg (460 lb)
	GTX	Electric start	210 kg (462 lb)	220 kg (484 lb)
	MX Z	Manual start	186 kg (409 lb)	195 kg (429 lb)
	SUMMIT	Manual start	—	200 kg (440 lb)
Length		EXPEDITION	—	3072 mm (121 in)
		GSX/MX Z	2830 mm (111 in)	
		GTX	3072 mm (121 in)	
		SUMMIT	—	3045 mm (120 in)
Width		EXPEDITION	—	1150 mm (45.2 in)
		GSX/GTX/MX Z	1150 mm (45.2 in)	
		SUMMIT	—	1139 mm (44.8 in)
Height		EXPEDITION	—	1230 mm (48.4 in)
		GSX	1160 mm (45.6 in)	
		GTX	1230 mm (48.4 in)	
		MX Z	1105 mm (43.5 in)	
		SUMMIT	—	1122 mm (44.1 in)

MODEL		GSX/GTX/MX Z	EXPEDITION/SUMMIT/ GSX/GTX/MX Z
		380 F	550 F
Ski stance (carbide to carbide) mm (in)		1080 (42.5)	
Toe-out mm (in)		0.00	
Camber		0°	
Ground contact area	EXPEDITION	—	7968 cm^2 (1235 in^2)
	GSX/MX Z	6947 cm^2 (1077 in^2)	
	GTX	7633 cm^2 (1183 in^2)	
	SUMMIT	—	8210 cm^2 (1273 in^2)
	SUMMIT (EUR)	—	8545 cm^2 (1324 in^2)
Ground contact pressure	EXPEDITION	—	2.56 kPa (.371 PSI)
	GSX	2.82 kPa (.409 PSI)	2.95 kPa (.428 PSI)
	GTX	2.70 kPa (.392 PSI)	2.83 kPa (.410 PSI)
	MX Z	2.63 kPa (.381 PSI)	2.75 kPa (.399 PSI)
	SUMMIT	—	2.39 kPa (.347 PSI)
	SUMMIT (EUR)	—	2.30 kPa (.334 PSI)
Frame material		Aluminum	
Bottom pan material		Impact Copolymer	
Hood material		Surlyn	
Side Panels		Polypropylene	
CAPACITIES			
Fuel tank L (U.S. gal)		40 (10.6)	
Chaincase/gearbox mL (U.S. oz)		250 (8.5)	
Cooling system L (U.S. oz)		N.A.	
Injection oil reservoir L (U.S. oz)		3.5 (118.4)	
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw		(5)	
Exhaust manifold nuts or bolts		22 N•m (16 lbf•ft)	
Magneto ring nut		105 N•m (77 lbf•ft)	
Crankcase nuts or screws	M6	N.A.	
	M8	22 N•m (16 lbf•ft)	
Crankcase/engine support nuts or screws		40 N•m (30 lbf•ft)	
Cylinder head screws		22 N•m (16 lbf•ft)	
Crankcase/cylinder nuts or screws		N.A.	
Axial fan shaft nut		48 N•m (35 lbf•ft)	

LIQUID COOLED MODELS

MODEL			GSX/GTX/MX Z	GSX/GTX/MX Z/SUMMIT	
			500 SS	600 HO	800 HO
ENGINE					
Engine type			593	593 HO	793 HO
Number of cylinder			2		
Bore	Standard	mm (in)	76 (2.992)	72 (2.835)	82 (3.228)
Stroke		mm (in)	65.80 (2.591)	73 (2.874)	75.70 (2.980)
Displacement		cm^3 (in^3)	597.00 (36.431)	594.40 (36.273)	799.50 (48.789)
Compression ratio			12.00 ± 0.5	12.25 ± 0.5	12.00 ± 0.5
Maximum power engine speed (1)		593/593 HO/793 HO	8000 ± 100 RPM		7850 ± 100 RPM
		793 HO Power TEK	N.A.	N.A.	7950± 100 RPM
Piston ring type		1st	Semi-trapezoidal		
		2nd	—		
Ring end gap	New	mm (in)	0.40 to 0.55 (.016 to .022)		
	Wear limit	mm (in)	1.0 (.039)		
Ring/piston groove clearance	New	mm (in)	0.04 to 0.09 (.0016 to .0035)	0.05 to 0.1 (.0020 to .0039)	
	Wear limit	mm (in)	0.2 (.0079)		
Piston/cylinder wall clearance	New	mm (in)	0.120 ± 0.016 (.0047 ± .0006)	0.105 ± 0.013 (.0041 ± .0005)	0.125 ± 0.022 (.0049 ± .0009)
	Wear limit	mm (in)	0.20 (.0079)	0.18 (.0071)	0.20 (.0079)
Maximum crankshaft end play (2)	New	mm (in)	0.3 (.012)		
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.06 (.0024)		
Connecting rod big end axial play	New	mm (in)	0.390 to 0.737 (.0154 to .0290)	0.310 to 0.677 (.0122 to .0267)	
	Wear limit	mm (in)	1.2 (.0472)		
ELECTRICAL					
Magneto generator output			360 W		
Ignition type			CDI		
Spark plug	Make and type		NGK BR9ECS (6)		
	Gap	mm (in)	0.40 to 0.50 (.016 to .020)		
Ignition timing BTDC (3) (7)		mm (in)	2.49 (.0980)	2.79 (.110)	2.37 (.0933)
Trigger coil (4)		Ω	190 to 300		
Generating coil (4)	Low speed	Ω	—		
	High speed	Ω	—		
Lighting coil (4)		Ω	0.1 to 1.0		
High tension coil (4)	Primary		—		
	Secondary		—		

MODEL			GSX/GTX/MX Z	GSX/GTX/MX Z/SUMMIT	
			500 SS	600 HO	800 HO
ELECTRICAL					
Battery			12 V, 18 A•h (if applicable)		
Headlamp		W	60/55 (H4)		
Taillight and stoplight		W	8/27		
Tachometer and speedometer bulbs		W	2 x 3		
Fuel and temperature gauge bulbs		W	—		
Fuse	Starter solenoid	A	30 (if applicable)		
	Fuel level sensor	A	—		
FUEL SYSTEM					
Carburetor type	GSX/GTX/MX Z		TM40 – B313	TM40 – B316	TM40–B319
	SUMMIT		—	TM40 – B325	TM40 – B328
	793 HO Power TEK (GSX/GTX/MX Z)		N.A.	N.A.	TM40–B322
Main jet	GSX/GTX/MX Z/SUMMIT		360	380	400
	793 HO Power TEK (GSX/GTX/MX Z)		N.A.	N.A.	440
Needle jet			P-0M		
Pilot jet			17.5		
Needle identification	GSX/GTX/MX Z		9DGM15–58	9DHI14–58	9DGI16–58
	SUMMIT		—	9DGK11–58	9EGY2–58
	793 HO Power TEK (GSX/GTX/MX Z)		N.A.	N.A.	9EGI04–58
Clip position	GSX/GTX/MX Z		1		
	SUMMIT		—	3	
	793 HO Power TEK (GSX/GTX/MX Z)		N.A.	N.A.	—
Slide cut-away			2.0		
Float adjustment		mm (in)	—		
Air or pilot screw adjustment		± 1/16 turn	1.5		
Idle speed		± 200 RPM	1600		1500
Gas type	GSX/GTX/MX Z		Unleaded		
	SUMMIT		—	Unleaded	Premium unleaded
Pump octane number	Inside North America	(R+M)/2	87 or higher (SUMMIT 800 HO: 91)		
	Outside North America	RON	91 or higher (SUMMIT 800 HO: 95)		
Gas/oil ratio			Injection		
Injection oil			XP-S mineral injection oil		
COOLING SYSTEM					
Type			Liquid		
Coolant		Mixture	Ethyl glycol/water mix (50% coolant, 50% distilled water). Use coolant specifically designed for aluminum engines.		
		Premix	P/N 219 700 362 — 12 x 1 L		
Thermostat opening temperature		°C (°F)	42 (108)		
Radiator cap opening pressure		kPa (PSI)	90 (13)		

MODEL			GSX/GTX/MX Z	GSX/GTX/MX Z/SUMMIT	
			500 SS	600 HO	800 HO
DRIVE					
Chaincase oil			XP-S Synthetic chaincase oil		
Chain drive ratio	GSX		22/43		23/43
	GTX		21/43		23/45
	MX Z	Adrenaline	22/43		25/45
		Ren./Ren. X	—	21/43	23/43
		Trail	22/43	22/43	—
		Trail (EUR)	21/43	—	—
	SUMMIT	Adrenaline/X	—	19/45	
		Adrenaline (EUR)	—	19/45	21/45
Chain	Pitch in		3/8		
	Type/links qty/plate qty	GSX	Silent 74/13		
		GTX	Silent 74/13		Silent 76/13
		MX Z (Adr./Trail)	Silent 74/13		Silent 76/13
		MX Z (Ren./Ren. X)	—	Silent 74/13	
		SUMMIT	—	Silent 74/13	
Drive pulley type			TRA III		
Drive pulley calibration	Clutch engagement ± 100 RPM	MX Z	3800		
		GSX	3400	3800	3600
		GTX	3400	3800	
		SUMMIT	—	3600	3800
	Spring color	MX Z	Green/White	Purple/Blue	Violet/Green
		GSX/GTX	Purple/Pink	Purple/Blue	Blue/Green
		SUMMIT	—	Purple/White	Violet/Yellow
	Spring length	MX Z	110.7 mm (4.358 in)	114.6 mm (4.5 in)	133.5 mm (5.256 in)
		GSX/GTX	101.8 mm (4.008 in)	114.6 mm (4.5 in)	105.7 mm (4.161 in)
		SUMMIT	—	98.5 mm (3.878 in)	157.9 mm (6.217 in)
	Weight		—		
	Block		—		
	Cap		—		
	Pin (with roller (P/N 417 003 900))	GSX/GTX/MX Z	Solid (P/N 417 004 308)		Solid (P/N 417 222 594)
		SUMMIT	—	Solid (P/N 417 222 478)	Solid (P/N 417 222 707)
		SUMMIT (EUR)	—	Solid (P/N 417 004 308)	
	Ramp	GSX/GTX/MX Z	412	410	414
		793 HO Power TEK (GSX/GTX/MX Z)	N.A.	N.A.	415
		SUMMIT	—	417	415
		SUMMIT (EUR)	—	410	415
	Screw position	MX Z	3		
		GSX/GTX	4	3	
		SUMMIT	—	1	
		SUMMIT (EUR)	—	3	

MODEL			GSX/GTX/MX Z	GSX/GTX/MX Z/SUMMIT	
			500 SS	600 HO	800 HO
DRIVE					
Driven pulley type	Type		HPV VSA		
	Spring preload		0		
	Cam angle	GSX	44°	47°/44°	50°/40°
		GTX	44°	47°/44°	47°/40°
		MX Z (Adrenaline)	44°	47°/44°	50°/40°
		MX Z (Ren./Ren. X)	—	44°	47°/40°
		MX Z (Trail)	44°	47°/44°	—
		SUMMIT (Adr.)	—	47°/44°	44°
		SUMMIT (Adr. 144")	—	47°/44°	
		SUMMIT (EUR)	—	44°	
		SUMMIT (X)	—	—	44°
		SUMMIT (X 144")	—	—	47°/44°
Pulley distance	Z mm (in)		19.0 (.748)	20.0 (.787)	
Offset	X mm (in)		37.0 ± 0.5 (1.457 ± 0.2)		
	Y – X mm (in)		0.82 (.0032)		
Drive belt part number	P/N		417 300 197		417 300 166
Drive belt	Width (10) mm (in)		37.3 (1.327)		37.7 (1.484)
	Wear limit mm (in)		34.9 (1.374)		35.3 (1.390)
Drive belt adjustment	Deflection mm (in)		32 ± 5 (1.260 ± .197)		
	Force (8) kg (lbf)		11.30 (24.91)		
Track (width)		GSX/GTX	381 mm (15 in)		
		MX Z (Adrenaline)	381 mm (15 in)		
		MX Z (Ren./Ren. X)	—	406 mm (16 in)	
		MX Z (Trail)	381 mm (15 in)		—
		SUMMIT	—	406 mm (16 in)	
Track (length)		GSX	3074 mm (121 in)		
		GTX	3456 mm (136 in)		
		MX Z (Adrenaline)	3074 mm (121 in)		
		MX Z (Ren./Ren. X)	—	3456 mm (136 in)	
		MX Z (Trail)	3074 mm (121 in)		—
		SUMMIT (Adr.)	—	3648 mm (144 in)	
			—	—	3840 mm (151 in)
		SUMMIT (X)	—	—	3648 mm (144 in)
			—	—	3840 mm (151 in)
			—	—	4038 mm (159 in)

MODEL			GSX/GTX/MX Z	GSX/GTX/MX Z/SUMMIT	
			500 SS	600 HO	800 HO
DRIVE					
Track (profile height)		GSX	25.4 mm (1.0 in)		
		GTX	22.3 mm (.878 in)		
		GTX (EUR)	31.8 mm (1.25 in)	—	31.8 mm (1.25 in)
		MX Z (Adrenaline)	25.4 mm (1.0 in)		
			31.8 mm (1.25 in)		
		MX Z (Ren./Ren. X)	—	31.8 mm (1.25 in)	
			—	—	44.5 mm (1.75 in)
		MX Z (Trail)	25.4 mm (1.0 in)	25.4 mm (1.0 in)	—
		MX Z (Trail EUR)	31.8 mm (1.25 in)	31.8 mm (1.25 in)	—
		SUMMIT (Adr.)	—	50.8 mm (2.0 in)	
		SUMMIT (X)	—	—	50.8 mm (2.0 in)
			—	—	57.2 mm (2.25 in)
Track adjustment	Adjustment Deflection mm (in)		30 to 35 (1.181 to 1.378)		
	Force (9) kg (lbf)		7.3 (16)		
Suspension type	Track	GSX	SC 3 121 in		
		GTX	SC 3 136 in		
		MX Z (Adrenaline)	SC 3 121 in		
		MX Z (Ren./Ren. X)	—	SC 3 136 in	
		MX Z (Trail)	SC 3 121 in		—
		SUMMIT (Adr.)	—	SC 144 in	
			—	—	SC 151 in
		SUMMIT (X)	—	—	SC 144 in
			—	—	SC 151 in
			—	—	SC 159 in
	Ski		R.A.S. A-arm		
BRAKE					
Brake fluid reservoir mL (U.S. oz)			60 (2.0)		
Brake fluid (P/N)			GTLMA (DOT 4) (P/N 293 600 062) Racing brake fluid SRF (DOT 4) (P/N 293 600 063)		

MODEL			GSX/GTX/MX Z	GSX/GTX/MX Z/SUMMIT	
			500 SS	600 HO	800 HO
VEHICLE INFORMATIONS					
Mass (dry)	GSX	Electric start	222 kg (488 lb)	225 kg (495 lb)	225 kg (495 lb)
	GTX	Electric start	231 kg (508 lb)	233 kg (513 lb)	238 kg (524 lb)
	MX Z (Adrenaline)	Manual start	209 kg (460 lb)	211 kg (464 lb)	
		Electric start	220 kg (484 lb)	223 kg (491 lb)	
	MX Z (Ren./Ren. X)	Manual start	—	218 kg (480 lb)	
		Electric start	—	230 kg (506 lb)	
	MX Z (Trail)	Manual start	209 kg (460 lb)	211 kg (464 lb)	—
		Electric start	220 kg (484 lb)	223 kg (491 lb)	—
	SUMMIT (Adrenaline)	144 in Manual start	—	222 kg (488 lb)	
		151 in Manual start	—	—	224 kg (493 lb)
	SUMMIT (X)	144 in Manual start	—	—	222 kg (488 lb)
		144 in Electric start	—	—	234 kg (515 lb)
		151 in Manual start	—	—	224 kg (493 lb)
		151 in Electric start	—	—	236 kg (519 lb)
		159 in Manual start	—	—	226 kg (497 lb)
		159 in Electric start	—	—	238 kg (524 lb)
Length	GSX		2882 mm (113.464 in)		
	GTX		3072 mm (120.945 in)		
	MX Z	Adrenaline	2882 mm (113.464 in)		
		Renegade	—	3055 mm (120.276 in)	
		Trail	2882 mm (113.464 in)		—
	SUMMIT (Adrenaline)	144 in	—	3125 mm (123.031 in)	
		151 in	—	—	3216 mm (126.614 in)
	SUMMIT (X)	144 in	—	—	3125 mm (123.031 in)
		151 in	—	—	3216 mm (126.614 in)
		159 in	—	—	3825 mm (150.591 in)
Width		GSX/GTX/MX Z	1217 mm (48 in)		
		SUMMIT	—	1139 mm (45 in)	
Height		GSX	1160 mm (45.669 in)		
		GTX	1230 mm (48.425 in)		
		MX Z	1105 mm (43.5 in)		
		MX Z (Renegade X)	—	—	1022 mm (40 in)
		SUMMIT	—	1122 mm (44 in)	
Ski stance (carbide to carbide)		GSX/GTX/MX Z	1195 mm (47 in)		
		SUMMIT	—	1080 mm (42.520 in)	

MODEL			GSX/GTX/MX Z	GSX/GTX/MX Z/SUMMIT	
			500 SS	600 HO	800 HO
VEHICLE INFORMATIONS					
Toe-out mm (in)			0.00		
Camber			0°		
Ground contact area	GSX		6910.2 cm² (1071 in²)		
	GTX		7596 cm² (1177.382 in²)		
	MX Z	Adrenaline	6910.2 cm² (1071 in²)		
		Renegade	—	7931.3 cm² (1229 in²)	7926 cm² (1229 in²)
		Renegade X	—	—	7931.3 cm² (1229 in²)
		Trail	6910.2 cm² (1071 in²)		—
	SUMMIT (Adrenaline)	144 in	—	9049.86 cm² (1402.731 in²)	
		151 in	—	—	9537.54 cm² (1478.322 in²)
	SUMMIT (X)	144 in	—	—	9049.86 cm² (1402.731 in²)
		151 in	—	—	9537.54 cm² (1478.322 in²)
		159 in	—	—	10025.22 cm² (1553.912 in²)
Ground contact pressure	GSX	Electric start	3.15 kPa (.457 PSI)	3.19 kPa (.463 PSI)	
	GTX	Electric start	2.98 kPa (.432 PSI)	3.01 kPa (.436 PSI)	3.07 kPa (.445 PSI)
	MX Z (Adrenaline)	Manual start	2.97 kPa (.431 PSI)	3.00 kPa (.435 PSI)	
		Electric start	3.12 kPa (.452 PSI)	3.17 kPa (.460 PSI)	3.00 kPa (.435 PSI)
	MX Z (Ren./Ren. X)	Manual start	—	2.70 kPa (.392 PSI)	
		Electric start	—	2.84 kPa (.412 PSI)	
	MX Z (Trail)	Manual start	2.97 kPa (.431 PSI)	3.00 kPa (.435 PSI)	—
		Electric start	3.12 kPa (.452 PSI)	3.17 kPa (.460 PSI)	—
	SUMMIT (Adrenaline)	144 in Manual start	—	2.41 kPa (.349 PSI)	
		151 in Manual start	—	—	2.30 kPa (.334 PSI)
	SUMMIT (X)	144 in Manual start	—	—	2.41 kPa (.349 PSI)
		144 in Electric start	—	—	2.54 kPa (.368 PSI)
		151 in Manual start	—	—	2.30 kPa (.334 PSI)
		151 in Electric start	—	—	2.43 kPa (.352 PSI)
		159 in Manual start	—	—	2.21 kPa (.320 PSI)
		159 in Electric start	—	—	2.33 kPa (.338 PSI)
Frame material			Aluminum		
Bottom pan material			Impact resistant copolymer		
Hood material			Surlyn		

MODEL			GSX/GTX/MX Z	GSX/GTX/MX Z/SUMMIT	
			500 SS	600 HO	800 HO
CAPACITIES					
Fuel tank		L (U.S. gal)	40 (10.6)		
Chaincase/gearbox		mL (U.S. oz)	250 (8.5)		
Cooling system	GSX		4.9 L (165.7 U.S. oz)		
	GTX		5.17 L (174.8 U.S. oz)		
	MX Z	Adrenaline	4.9 L (165.7 U.S. oz)		
		Ren./Ren. X	—	5.17 L (174.8 U.S. oz)	
		Trail	4.9 L (165.7 U.S. oz)		—
	SUMMIT (Adrenaline)	144 in	—	4.59 L (152.2 U.S. oz)	
		151 in	—	—	4.9 L (165.7 U.S. oz)
	SUMMIT (X)	144 in	—	—	4.59 L (152.2 U.S. oz)
		151 in	—	—	4.9 L (165.7 U.S. oz)
		159 in	—	—	4.69 L (158.6 U.S. oz)
Injection oil reservoir			3.5 L (118 U.S. oz)		
TIGHTENING TORQUE (engine cold)					
Drive pulley retaining screw			(5)		
Exhaust manifold nuts or bolts			22 N•m (16 lbf•ft)		
Magneto ring nut			125 N•m (92 lbf•ft)		
Crankcase nuts or screws		M6	9 N•m (80 lbf•**in**)		
		M8	29 N•m (21 lbf•ft)		
Crankcase/engine support nuts or screws			35 N•m (26 lbf•ft)		
Cylinder head screws			29 N•m (21 lbf•ft)		
Crankcase/cylinder nuts or screws			40 N•m (30 lbf•ft)		
Axial fan shaft nut			N.A.		

LIQUID COOLED (SDI) MODELS

MODEL			GSX/GTX/MX Z
			600 HO SDI
ENGINE			
Engine type			593 HO
Number of cylinder			2
Bore	Standard	mm (in)	72 (2.835)
Stroke		mm (in)	73 (2.874)
Displacement		cm^3 (in^3)	594.40 (36.273)
Compression ratio			12.25 ± 0.5
Maximum power engine speed (1)		± 100 RPM	8100
Piston ring type		1st	Semi-trapezoidal
		2nd	—
Ring end gap	New	mm (in)	0.40 to 0.55 (.016 to .022)
	Wear limit	mm (in)	1.0 (.039)
Ring/piston groove clearance	New	mm (in)	0.05 to 0.1 (.0020 to .0039)
	Wear limit	mm (in)	0.2 (.0079)
Piston/cylinder wall clearance	New	mm (in)	0.105 ± 0.013 (.0041 ± .0005)
	Wear limit	mm (in)	0.18 (.0071)
Maximum crankshaft end play (2)	New	mm (in)	0.3 (.012)
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.06 (.0024)
Connecting rod big end axial play	New	mm (in)	0.310 to 0.677 (.0122 to .0267)
	Wear limit	mm (in)	1.2 (.0472)
ELECTRICAL			
Magneto generator output		W	480
Ignition type			Inductive
Spark plug	Make and type		NGK BR9ECS (6)
	Gap	mm (in)	0.75 to 0.85 (.0303 to .0327)
Ignition timing BTDC (3) (7)		mm (in)	5.39 (.2122)
Trigger coil (4)		Ω	190 to 290
Generating coil (4)	Low speed	Ω	—
	High speed	Ω	—
Lighting coil (4)		Ω	0.175 to 0.180
High tension coil (4)	Primary		—
	Secondary		—
Battery			12 V, 18 A•h (if applicable)
Headlamp		W	60/55 (H4)
Taillight and stoplight		W	8/27
Tachometer and speedometer bulbs		W	2 x 3
Fuel and temperature gauge bulbs		W	3 (if applicable)
Fuse	Starter solenoid	A	30 (if applicable)
	Fuel level sensor	A	—

MODEL			GSX/GTX/MX Z
			600 HO SDI
FUEL SYSTEM			
Throttle body type			Dell'Orto
Idle speed		± 200 RPM	1600
Gas type			Unleaded
Pump octane number	Inside North America	(R+M)/2	87 or higher
	Outside North America	RON	91 or higher
Gas/oil ratio			Injection
Injection oil			XP-S 2-stroke synthetic blend
COOLING SYSTEM			
Type			Liquid
Coolant		Mixture	Ethyl glycol/water mix (50% coolant, 50% distilled water). Use coolant specifically designed for aluminum engines.
		Premix	P/N 219 700 362 — 12 x 1 L
Thermostat opening temperature		°C (°F)	42 (108)
Radiator cap opening pressure		kPa (PSI)	90 (13)
DRIVE			
Chaincase oil			XP-S Synthetic chaincase oil
Chain drive ratio	GTX		21/43
	GSX/MX Z		22/43
	MX Z	Adrenaline/Renegade/X	22/43
		Renegade (EUR)	21/43
		Renegade X (1.25 in track)	21/43
		Renegade X (1.75 in track)	19/43
Chain	Pitch	in	3/8
	Type/links qty/plate qty	GSX	Silent 74/13
		GTX	Silent 74/13
		MX Z (Adrenaline/Renegade/X)	Silent 74/13
		MX Z (Renegade X, 1.25 in track)	Silent 74/13
		MX Z (Renegade X, 1.75 in track)	Silent 72/13
Drive pulley type			TRA III
Drive pulley calibration	Clutch engagement	± 100 RPM	3800
	Spring color		Blue/Yellow
	Spring length		115.1 mm (4.531 in)
	Weight		—
	Block		—
	Cap		—
	Pin (with roller (P/N 417 003 900))		Solid (P/N 417 004 308)
	Ramp		410
	Screw position		4

MODEL			GSX/GTX/MX Z
			600 HO SDI
DRIVE			
Driven pulley type	Type		HPV VSA
	Spring preload		0
	Cam angle	GSX/GTX/MX Z (Adrenaline/X)	47°/44°
		MX Z (Renegade/Renegade X)	44°
Pulley distance	Z mm (in)		20.0 (.787)
Offset	X mm (in)		37.0 ± 0.5 (1.457 ± 0.2)
	Y – X mm (in)		0.82 (.0032)
Drive belt part number	P/N		417 300 197
Drive belt	Width (10) mm (in)		37.3 (1.327)
	Wear limit mm (in)		34.9 (1.374)
Drive belt adjustment	Deflection mm (in)		32 ± 5 (1.260 ± .197)
	Force (8) kg (lbf)		11.30 (24.91)
Track (with)		GSX/GTX/MX Z (Adrenaline/X)	381 mm (15 in)
		MX Z (Renegade/Renegade X)	406.4 mm (16 in)
Track (length)		GSX/MX Z (Adrenaline/X)	3074 mm (121 in)
		GTX	3456 mm (136 in)
		MX Z (Renegade/Renegade X)	3456 mm (136 in)
Track (profile height)		GSX	25.4 mm (1.0 in)
		GTX	22.3 mm (.878 in)
		GTX (EUR)	31.8 mm (1.25 in)
		MX Z (Adrenaline/X)	25.4 mm (1.0 in)
			31.8 mm (1.25 in)
		MX Z (Renegade)	31.8 mm (1.25 in)
		MX Z (Renegade X, 1.25 in track)	31.8 mm (1.25 in)
		MX Z (Renegade X, 1.75 in track)	44.5 mm (1.75 in)
Track adjustment	Adjustment deflection mm (in)		30 to 35 (1.181 to 1.378)
	Force (9) kg (lbf)		7.3 (16)
Suspension type	Track	GSX/MX Z (Adrenaline)	SC 3 121 in
		GTX	SC 3 136 in
		MX Z (Renegade/Renegade X)	SC 3 136 in
		MX Z (X)	SC 4
	Ski		R.A.S. A-arm
BRAKE			
Brake fluid reservoir	mL (U.S. oz)		60 (2.0)
Brake fluid (P/N)			GTLMA (DOT 4) (P/N 293 600 062) Racing brake fluid SRF (DOT 4) (P/N 293 600 063)

MODEL			GSX/GTX/MX Z
			600 HO SDI
VEHICLE INFORMATIONS			
Mass (dry)	GSX	Electric start	229 kg (504 lb)
	GTX (Sport)	Electric start	238 kg (524 lb)
	GTX (Limited)	Electric start	242 kg (532 lb)
	MX Z (Adrenaline/X)	Manual start	215 kg (473 lb)
		Electric start	227 kg (499 lb)
	MX Z (Renegade/Renegade X)	Manual start	222 kg (488 lb)
		Electric start	234 kg (515 lb)
Length	GSX		2882 mm (113.464 in)
	GTX	Sport	2882 mm (113.464 in)
		Sport (EUR)	3072 mm (120.945 in)
		Limited	3072 mm (120.945 in)
	MX Z	Adrenaline/X	2882 mm (113.464 in)
		Renegade	3055 mm (120.276 in)
Width			1217 mm (48 in)
Height	GSX		1160 mm (45.669 in)
	GTX	Sport	1160 mm (45.669 in)
		Sport (EUR)	1230 mm (48.425 in)
		Limited	1230 mm (48.425 in)
	MX Z	Adrenaline/Renegade	1105 mm (43.5 in)
		Renegade X/X	1022 mm (40.236 in)
Ski stance (carbide to carbide)			1195 mm (47 in)
Toe-out		mm (in)	0.00
Camber			0°
Ground contact area	GSX		6910.2 cm^2 (1071 in^2)
	GTX	Sport	2566.8 cm^2 (397.855 in^2)
		Sport (EUR)	7596 cm^2 (1177.382 in^2)
		Limited	7596 cm^2 (1177.382 in^2)
	MX Z	Adrenaline/X	6910.2 cm^2 (1071 in^2)
		Renegade/Renegade X	7931.3 cm^2 (1229 in^2)
Ground contact pressure	GSX	Electric start	3.25 kPa (.471 PSI)
	GTX (Sport)	Electric start	9.10 kPa (1.320 PSI)
	GTX (Limited)	Electric start	3.13 kPa (.454 PSI)
	MX Z (Adrenaline/X)	Manual start	3.05 kPa (.442 PSI)
		Electric start	3.22 kPa (.467 PSI)
	MX Z (Renegade/Renegade X)	Manual start	2.75 kPa (.399 PSI)
		Electric start	2.89 kPa (.419 PSI)
Frame material			Aluminum
Bottom pan material			Impact resistant copolymer
Hood material			Surlyn

MODEL			GSX/GTX/MX Z
			600 HO SDI
CAPACITIES			
Fuel tank		L (U.S. gal)	40 (10.6)
Chaincase/gearbox		mL (U.S. oz)	250 (8.5)
Cooling system	GSX		4.9 L (165.7 U.S. oz)
	GTX		5.17 L (174.8 U.S. oz)
	MX Z	Adrenaline/X	4.9 L (165.7 U.S. oz)
		Renegade/Renegade X	5.17 L (174.8 U.S. oz)
Injection oil reservoir			3.5 L (118 U.S. oz)
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw			(5)
Exhaust manifold nuts or bolts			22 N•m (16 lbf•ft)
Magneto ring nut			125 N•m (92 lbf•ft)
Crankcase nuts or screws		M6	9 N•m (80 lbf•**in**)
		M8	29 N•m (21 lbf•ft)
Crankcase/engine support nuts or screws			35 N•m (26 lbf•ft)
Cylinder head screws			29 N•m (21 lbf•ft)
Crankcase/cylinder nuts or screws			40 N•m (30 lbf•ft)
Axial fan shaft nut			N.A.

TECHNICAL DATA LEGEND

BTDC:	Before Top Dead Center
CDI:	Capacitor Discharge Ignition
MAG:	Magneto
N.A.:	Not Applicable
P/N:	Part Number
PTO:	Power Take Off
R.A.S.:	Response Angle Suspension
RER:	Rotax Electronic Reverse
RPM:	Revolution Per Minute
TRA:	Total Range Adjustable
VSA:	Variable Sheave Angle
W:	Watt

(1) The maximum horsepower RPM applicable on the vehicle. It may be different under certain circumstances and BRP reserves the right to modify it without obligation.
(2) Crankshaft end-play is not adjustable on these models. Specification is given for verification purposes only.
(3) At 3500 RPM with headlamp turned on.
(4) All resistance measurements must be performed with parts at room temperature (approx. 20°C (68°F)). Temperature greatly affects resistance measurements.
(5) Drive pulley retaining screw: torque to 80 to 100 N•m (59 to 74 lbf•ft), install drive belt, accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake; repeat 5 times. Retorque screw to 90 to 100 N•m (66 to 74 lbf•ft).
(6) **CAUTION: Do not attempt to adjust gap on spark plug BR 9 ECS. The specification is given for verification purpose only. If found out of specification, replace with a new one.**
(7) 793 HO Power TEK: with TPS (Throttle positioning Sensor) disconnected.
995 SDI: with APS (Air pressure Sensor) disconnected.
(8) Force applied midway between pulleys to obtain specified tension deflection.
(9) Force or downward pull applied to track to obtain specified tension deflection.
(10) Minimum allowable width may not be less than 3.0 mm (1/8 in) of new drive belt.

WIRING DIAGRAMS

SERVICE TOOLS

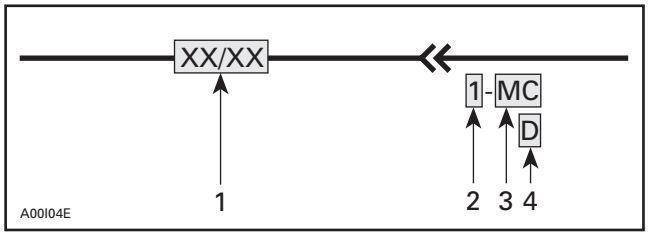
Description	Part Number	Page
connector crimping tool	529 035 909	494
crimper die	529 035 906	494

Wiring diagrams can be found at the end of this subsection.

WIRING DIAGRAM LEGEND

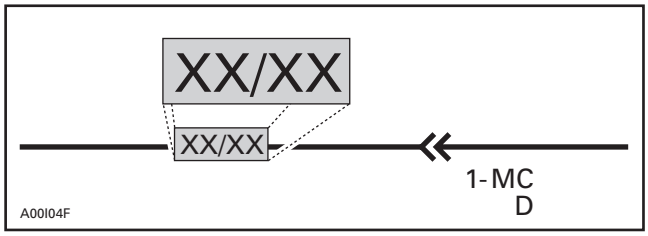
⚠ WARNING

Ensure all terminals are properly crimped on the wires and all connector housings are properly fastened.



1. *Wire colors*
2. *Connector housing area*
3. *Housing code per area*
4. *Wire connector location in housing*

WIRE COLORS



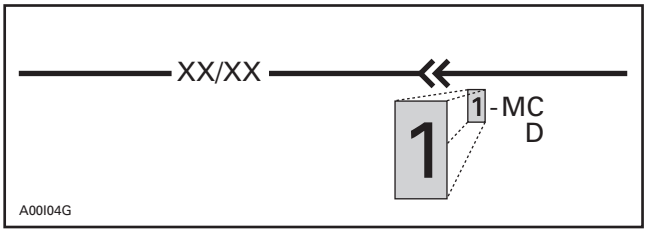
The first color of a wire is the main color, second color is the stripe.

Example: YL / BK is a YELLOW wire with a BLACK stripe.

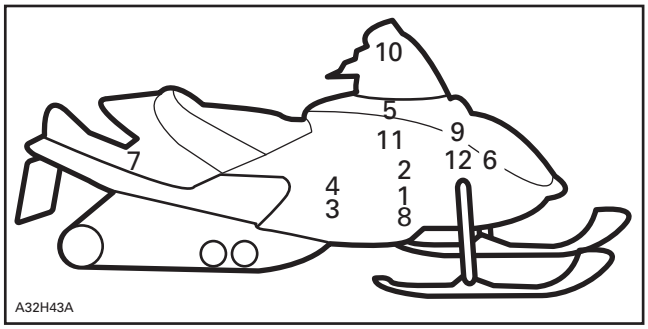
COLOR CODE					
BE	—	BEIGE	OR	—	ORANGE
BK	—	BLACK	RD	—	RED
BU	—	BLUE	VI	—	VIOLET
BR	—	BROWN	WH	—	WHITE
GN	—	GREEN	YL	—	YELLOW
GY	—	GREY			

CONNECTOR HOUSING AREA

The first digit of the connector identification number presents the location of the connector on the vehicle.



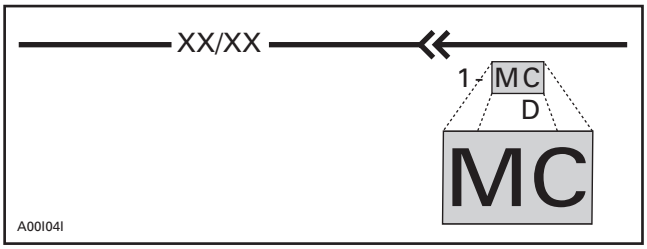
The following illustration shows the snowmobile with number on it. These numbers will correspond with the locations of the connector on the vehicle along with a brief description.



AREA	LOCATION
1	Right hand side of engine
2	Engine
3	Near right hand side footrest
4	Near driven pulley
5	Under console
6	Under hood
7	Near fuel tank
8	Under engine
9	Near steering column or on primary air intake silencer
10	On handlebar
11	Injection oil tank
12	Secondary air intake silencer

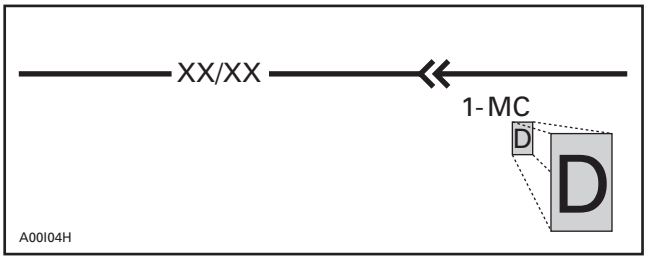
HOUSING REFERENCE PER AREA

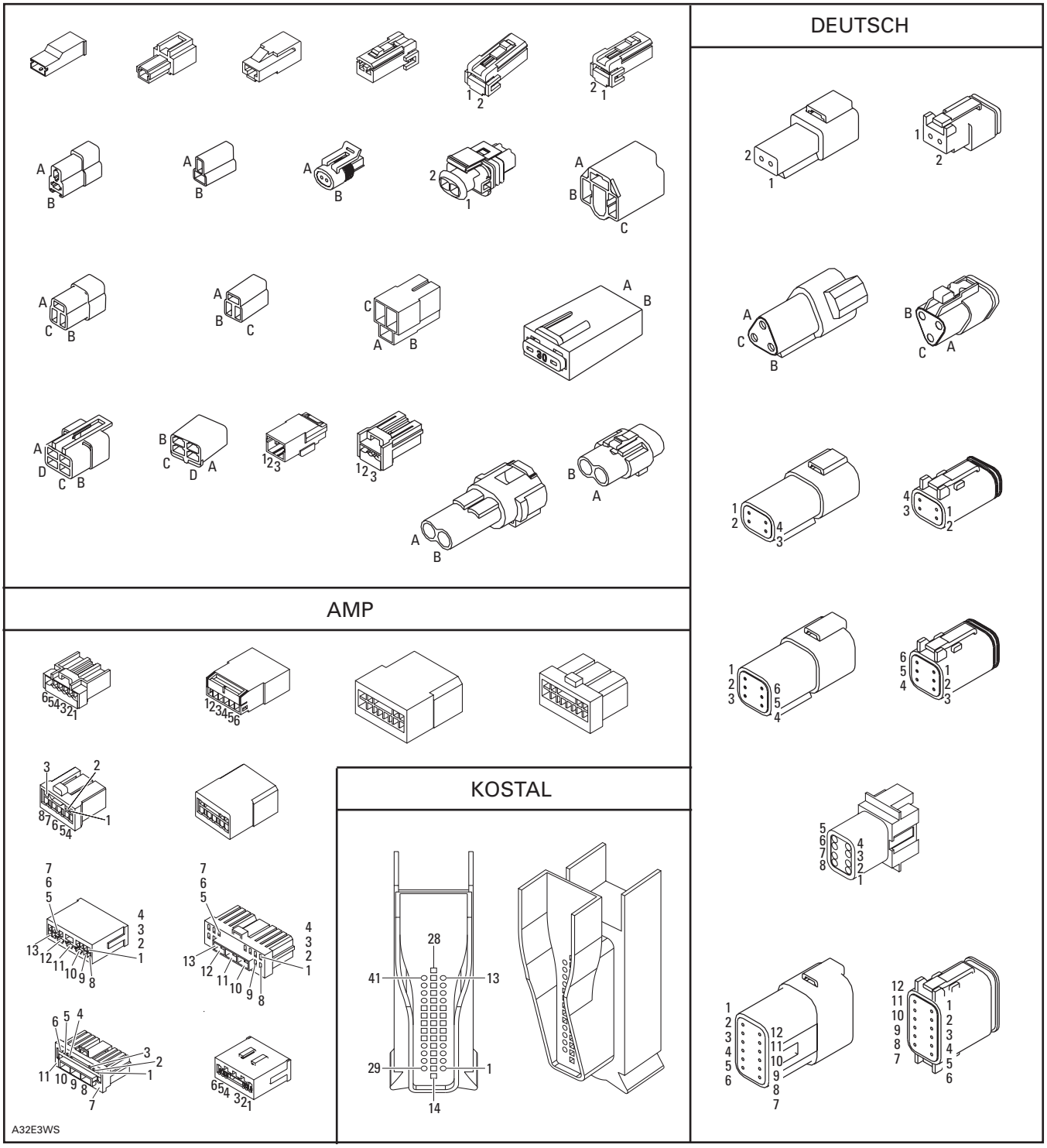
The next two letters of the connector identification number represents a connector reference. If there are many connectors in the same area this helps identify which wire is in which connector.



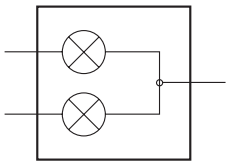
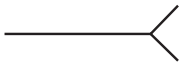
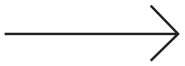
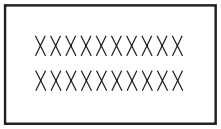
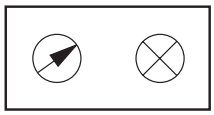
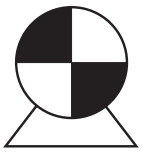
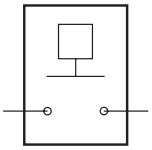
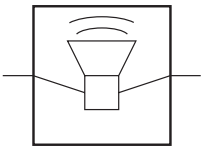
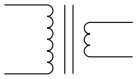
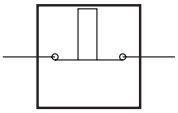
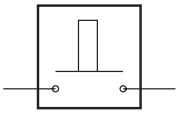
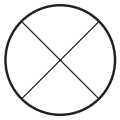
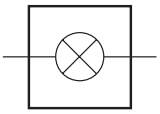
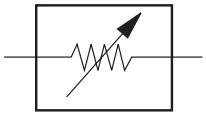
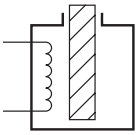
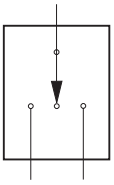
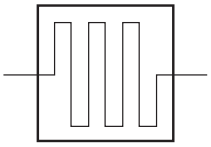
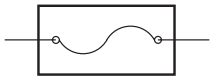
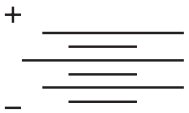
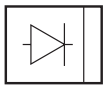
WIRE LOCATION IN CONNECTOR HOUSING

The third portion of the connector identification number represents the location of the wire in the connector housing. This could be identified by either a number such as 1, 2, 3 or by a letter such as A, B, C depending on the type of connector used.




DEUTSCH
AMP
KOSTAL
A32E3WS

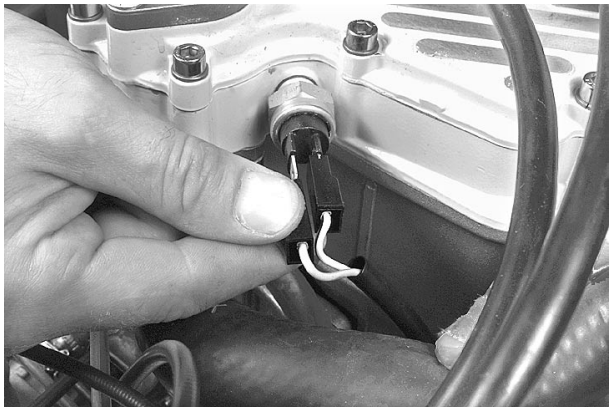
SYMBOLS DESCRIPTION

Beam and tail light 	Female terminal 	Male terminal 	Electronic module 
Meter 	Electric motor 	Low level sensor 	Buzzer 
Ignition coil 	Normally close switch 	Normally open switch 	Male terminal on instrument
Engine ground	Frame ground Frame	Spark plug	Meter movement
Bulb 	Pilot 	Analog sensor 	Solenoid valve 
Magneto (Delta)	3 position switch 	Heating element 	Fuse 
Trigger coil	Battery 	Diode 	Partially illustrated component

A00E9PS

UNPLUGING CONNECTORS

Always unplug connectors by pulling on housing not on wire.


A06E1PA

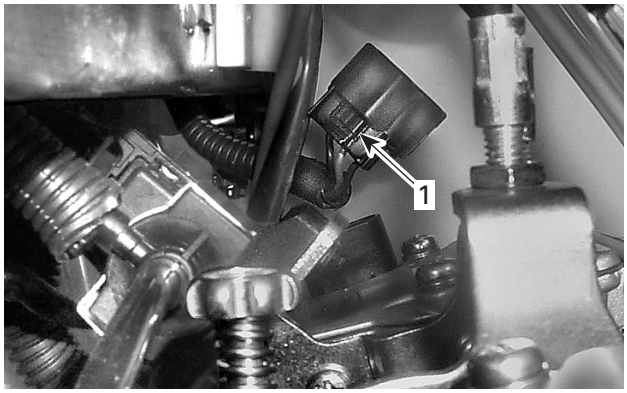
TYPICAL

Throttle Position Sensor (TPS) Connector

A33I0QA

TPS CONNECTOR
1. Release button

To disconnect the Sumitomo TPS connector from carburetor, press the release button on the other side of the connector.



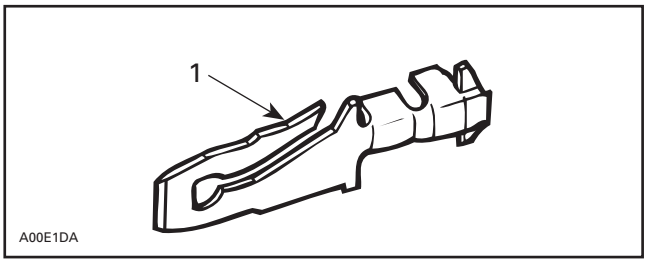
A33I0RA

TPS CONNECTOR UNPLUGGED
1. Release button

TAB AND RECEPTACLE CONNECTORS REMOVAL

Tab Connector

It is locked in its housing by a spring tab on its side. Removal is done by squeezing this tab.

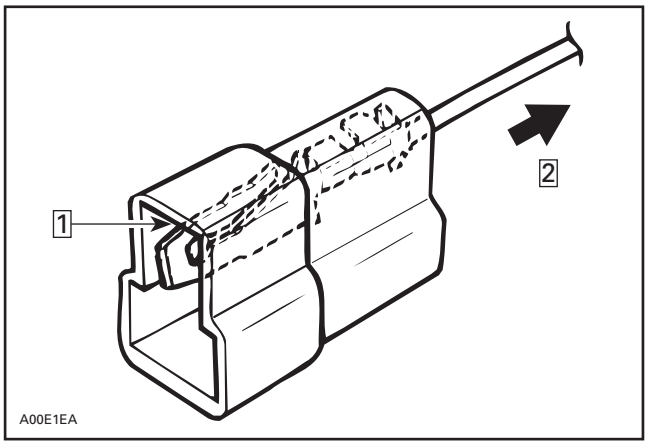


A00E1DA

TAB CONNECTOR
1. Locking tab

To remove:

– Insert a screwdriver or Snap-on TT 600-5 from opposite side of wire and pry locking tab.
– While holding locking tab pried, pull connector toward wire side.

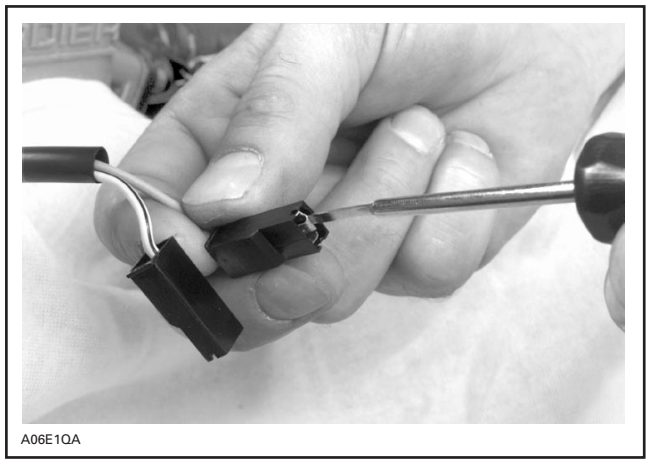


1. Insert screwdriver here
2. Pull this side

Locking Receptacle Connector

To remove:

– Insert tool Snap-on TT 600-5 in access opening then pull housing toward wire side.

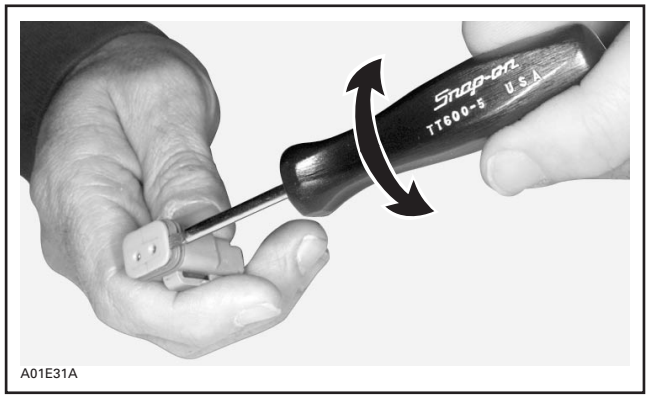


Waterproof Connector Housing

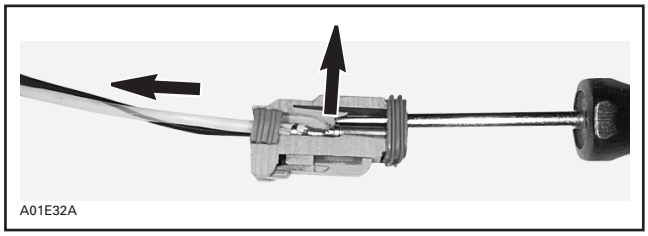
Female Connector Housing

To remove:

– Insert tool Snap-on TT 600-5 under lock and twist to lift it.



– Pry tab to free connector then pull wire out of housing.

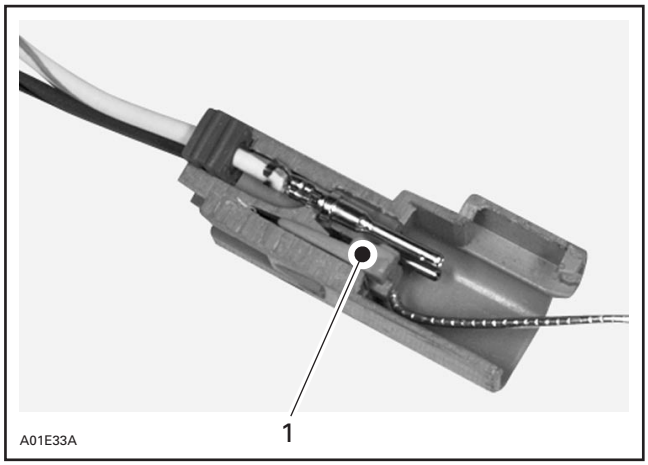


FEMALE CONNECTOR HOUSING — CUT-AWAY

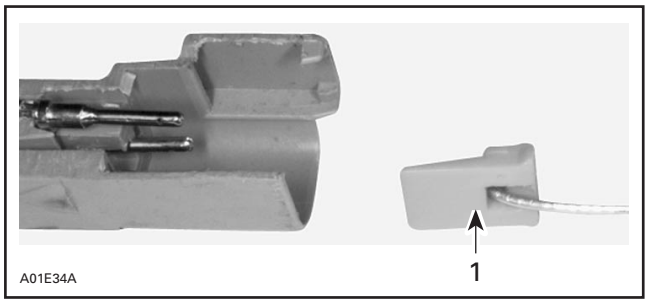
Male Connector Housing

To remove:

– Using a small hook, pull out the lock.

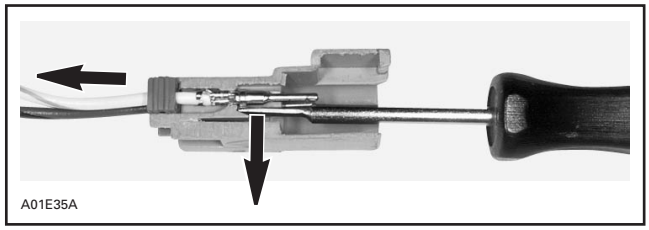


1. Lock



1. Lock

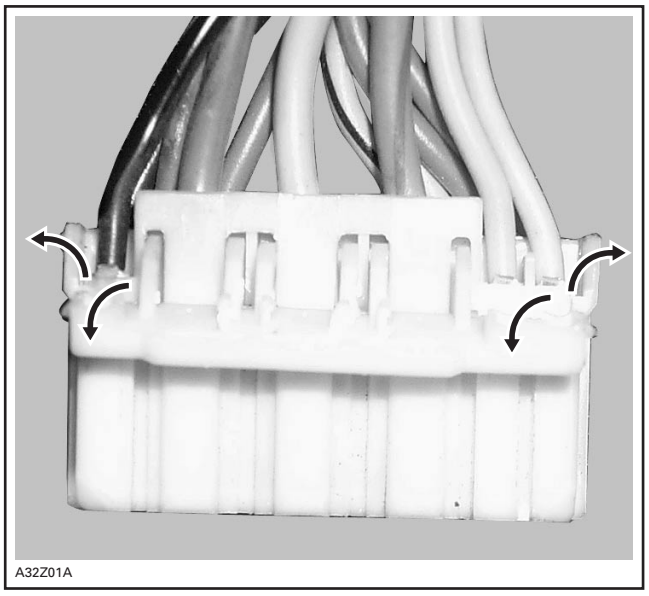
– Pry tab to free connector then pull wire out of housing.



MALE CONNECTOR HOUSING — CUT-AWAY

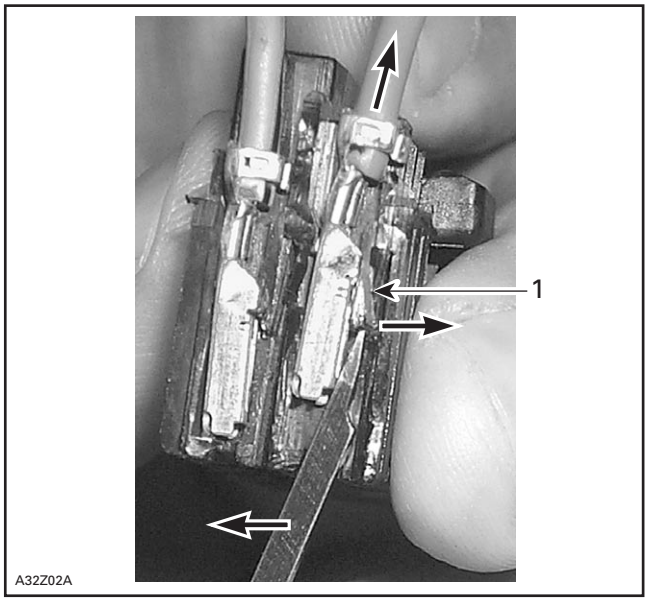
Multilock Connector Housing

Female Connector Housing



To remove:

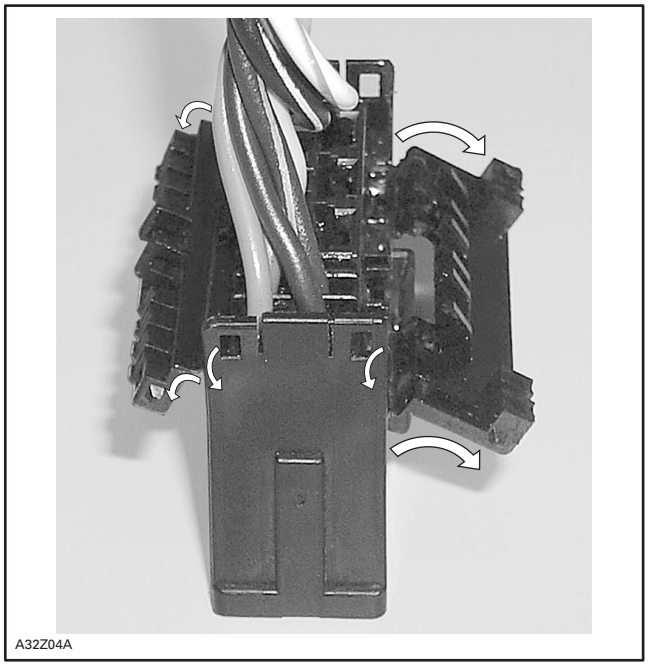
– Insert tool AMP- 755430-2 under lock and twist to lift it.



FEMALE CONNECTOR HOUSING — CUT-AWAY
1. Lock

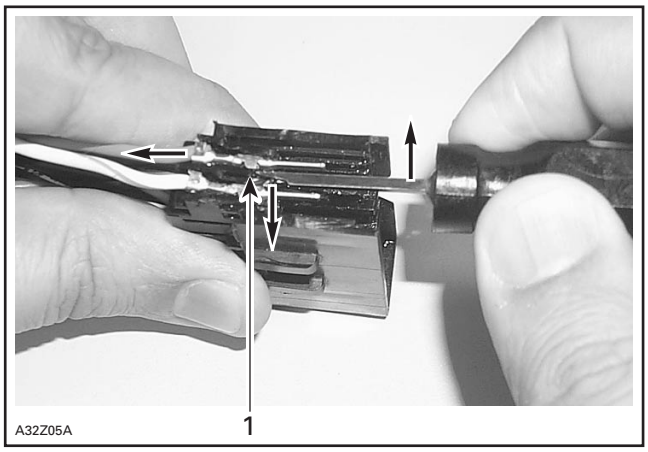
Receptacle connectors can be removed from female housing with sharp head pin.

Male Connector Housing



To remove:

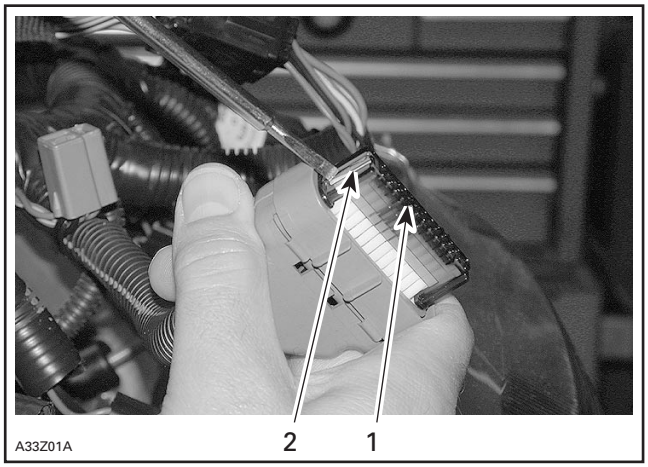
– Insert tool AMP-755430-2 under lock and twist to lift it.



MALE CONNECTOR HOUSING — CUT-AWAY
1. Lock

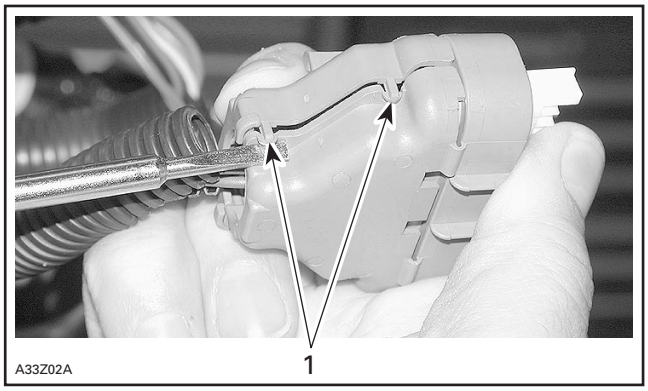
24-Circuit Connector Housing

Push on both tabs to remove retainer.



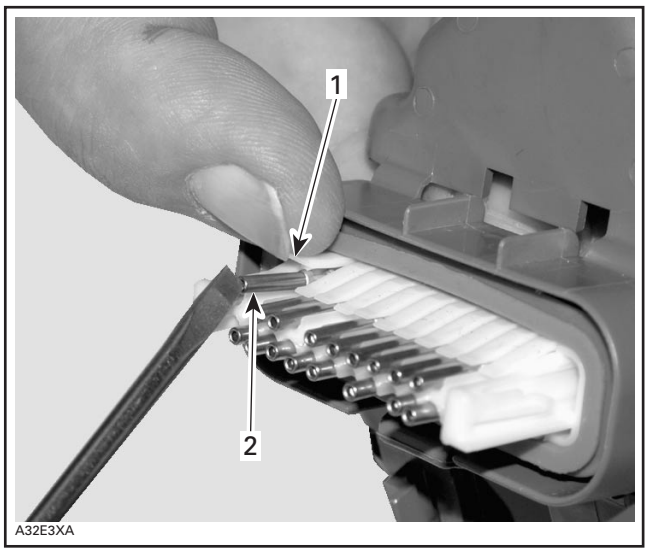
1. Retainer
2. Tab (one on each side)

Open housing by lifting 4 tabs.



1. Tabs (2 on each side)

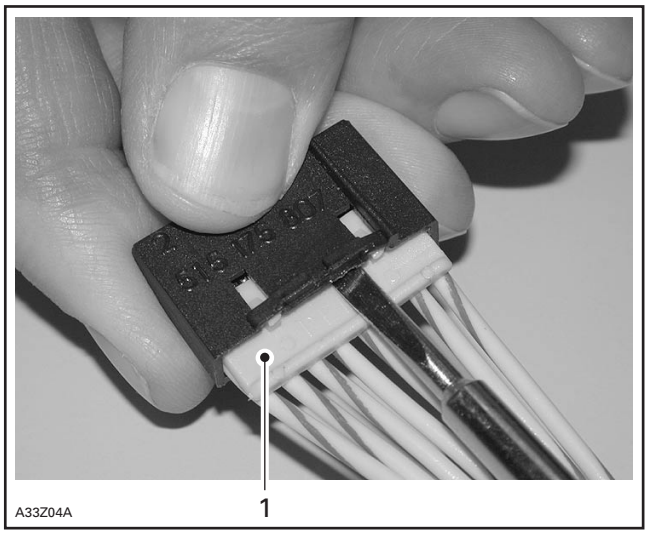
Lift the top plastic lock of the female terminal to be removed and hold in position. Lift the female terminal to unlock from the housing and push out of housing.



1. Lift and hold plastic lock
2. Lift to unlock and push out

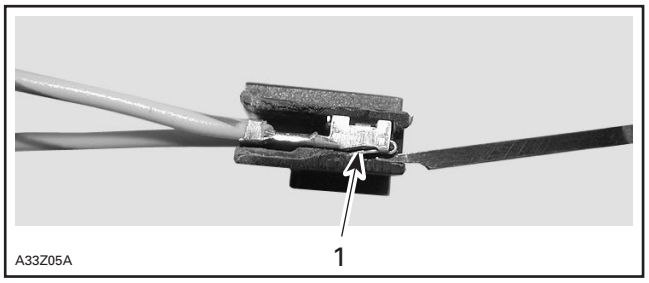
8-Circuit Connector Housing

Pry housing to release lock.



1. Lock

Insert tool AMP-755430-2 under tab and pry it to free connector. Pull on the female terminal wire to remove female terminal from housing.

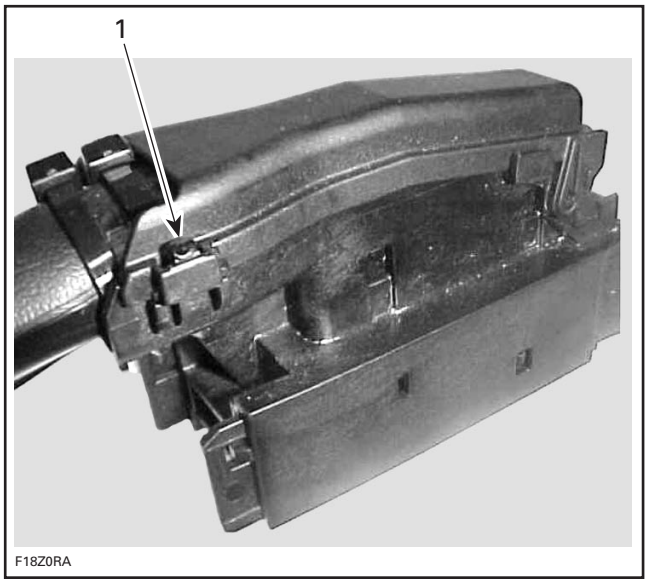


8-CIRCUIT CONNECTOR HOUSING — CUT-AWAY
1. Tab

Connector housing A and B on ECM

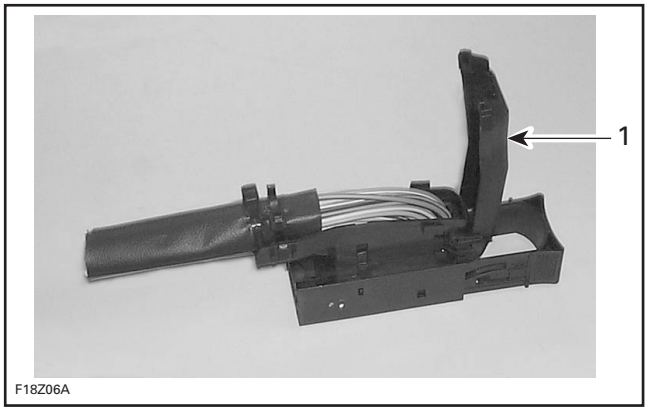
Terminal Removal

Unlock the connector housing cover by pushing in the tabs on top of the housing with a flat screwdriver to be able to flip the top cover up.



1. Push in tab

Lift the cover by pushing it forward.

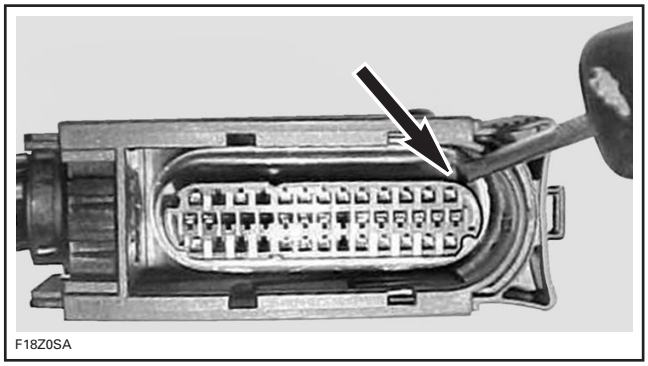


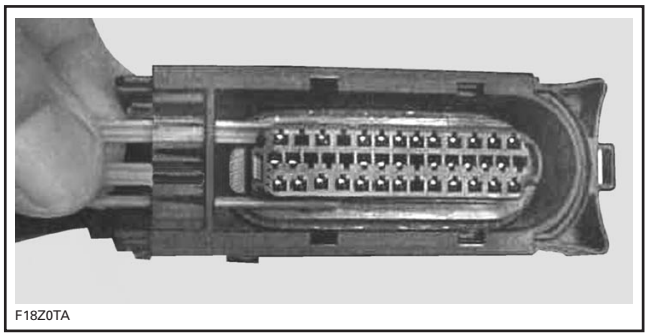
1. Cover

Cut both locking ties that secure the harness to the housing.

1. Locking ties

Turn the housing over and remove the lock by pushing and then pulling toward the wire harness.

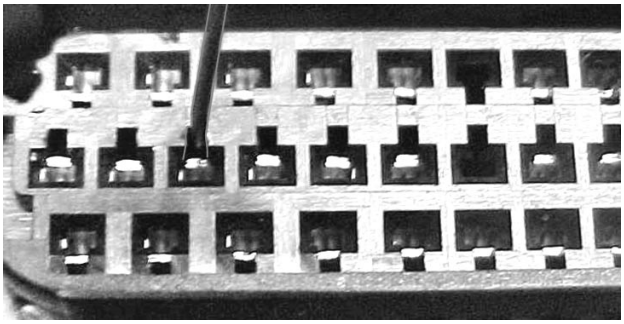


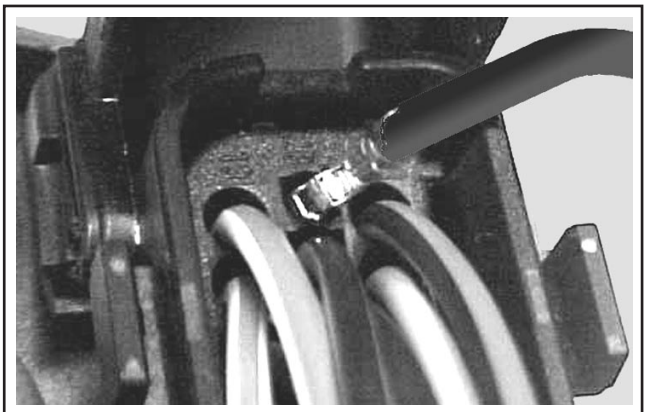


Use a 0.76 mm (.030 in) oxyacetylene torch tip cleaner or a no. 68 drill bit inserted down into the housing to release the locking tab on the connector.

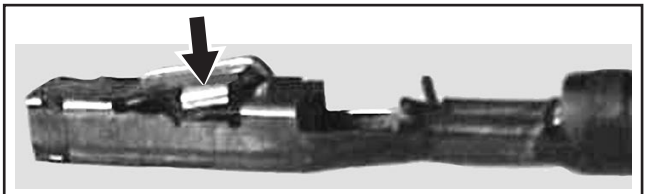
CAUTION: Using a probe larger than 0.76 mm (.030 in) may damage the terminal.

Insert the probe into the housing as shown, and locate the appropriate wire in the back of the housing. You may have to slightly cam the probe against the locking tab to release it, then remove the terminal from the housing.


F18Z0UA


F18Z0VA

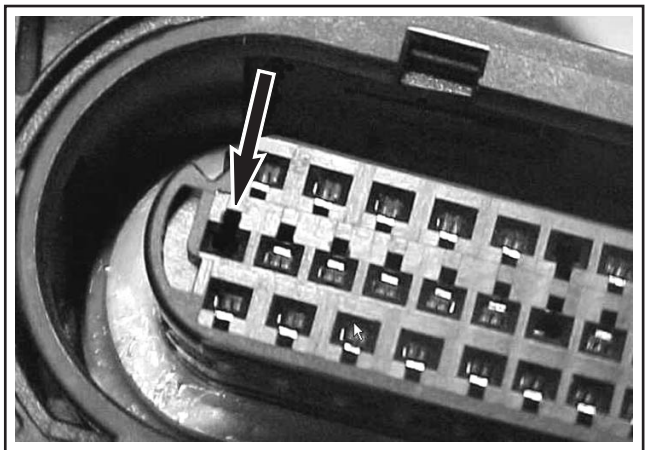
The locking tab on the connector may have to be bent out a little so it will lock in the housing when it's re-inserted.


F18Z0WA

If the wire is in good condition but the terminal is rusted or corroded, remove defective terminal and crimp a new one. If wire and terminal are defective, acquire a new genuine wire and new terminal and crimp them together as explained below.

IMPORTANT: Use genuine wires only. Otherwise wires will not fit properly.

When re-inserting the connector, the locking tab must be installed facing the smaller cutout of the connector cavity.

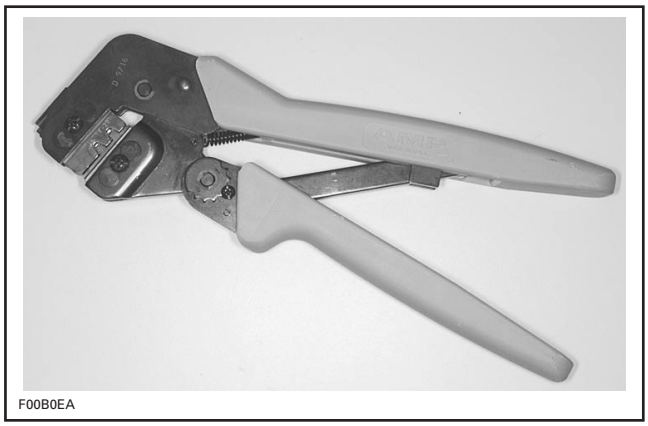

F18Z0XA

Insert the connector, ensuring the locking tab snaps into the housing.

Re-install the lock, attach the 2 tie raps, and close the housing cover.

Terminal Crimping (Kostal and AMP multilock)

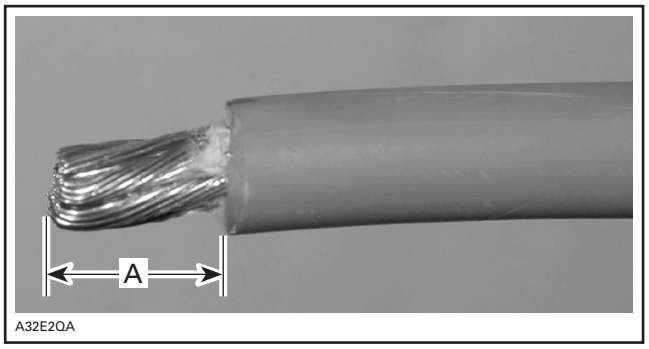
To crimp a new connector terminal, use the connector crimping tool (P/N 529 035 909) and the crimper die (P/N 529 035 906).


F00B0EA

CRIMPING TOOL

To properly crimp the wires, strictly follow this procedure.

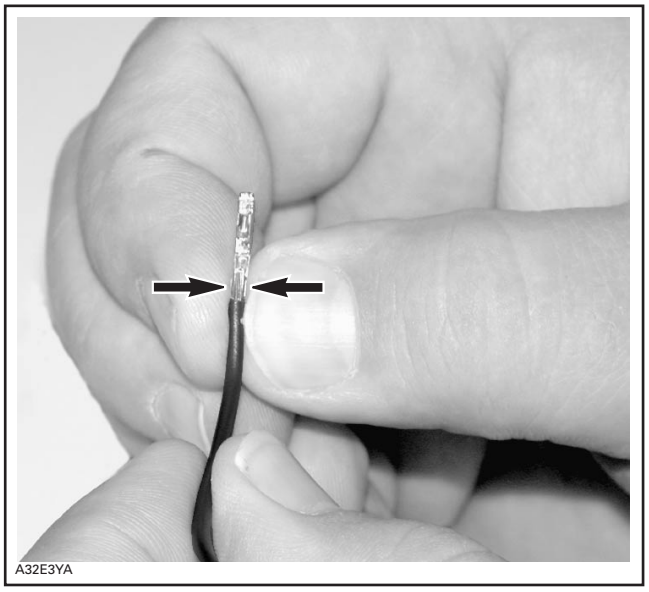
Strip the wire to a maximum of 3 mm (1/8 in).



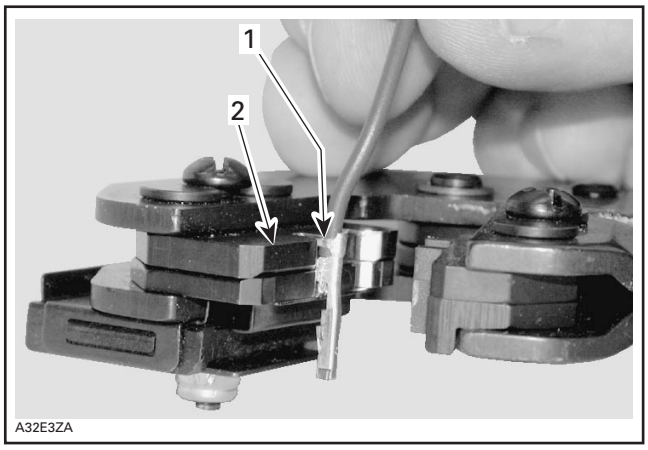
TYPICAL
A. 3 mm (1/8 in) max.

Position wire in terminal.

Squeeze the terminal tabs with your fingers to temporarily retain terminal in place.



Insert terminal with wire in crimping pliers and position so that top of terminal tabs are flush with pliers edge or a little bit lower as shown.



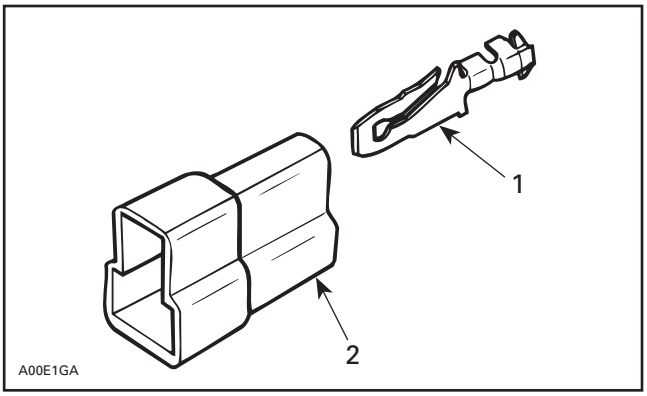
1. Top of terminal tabs
2. Align tabs with pliers edge

Crimp terminal. Ensure no tiny wire goes out of terminal. This might cause strange problems of the electrical system.

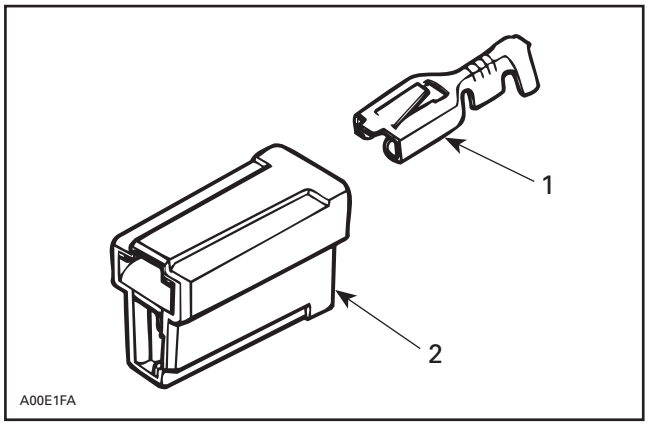
TAB AND RECEPTACLE CONNECTORS INSTALLATION

Prior to installing, make sure locking tab is sufficiently lifted to properly lock.

Insert tab and receptacle connectors in their respective housings as shown in following illustrations. Push sufficiently so that they snap. Try pulling wire to ensure they are properly locked.



1. Tab
2. Housing

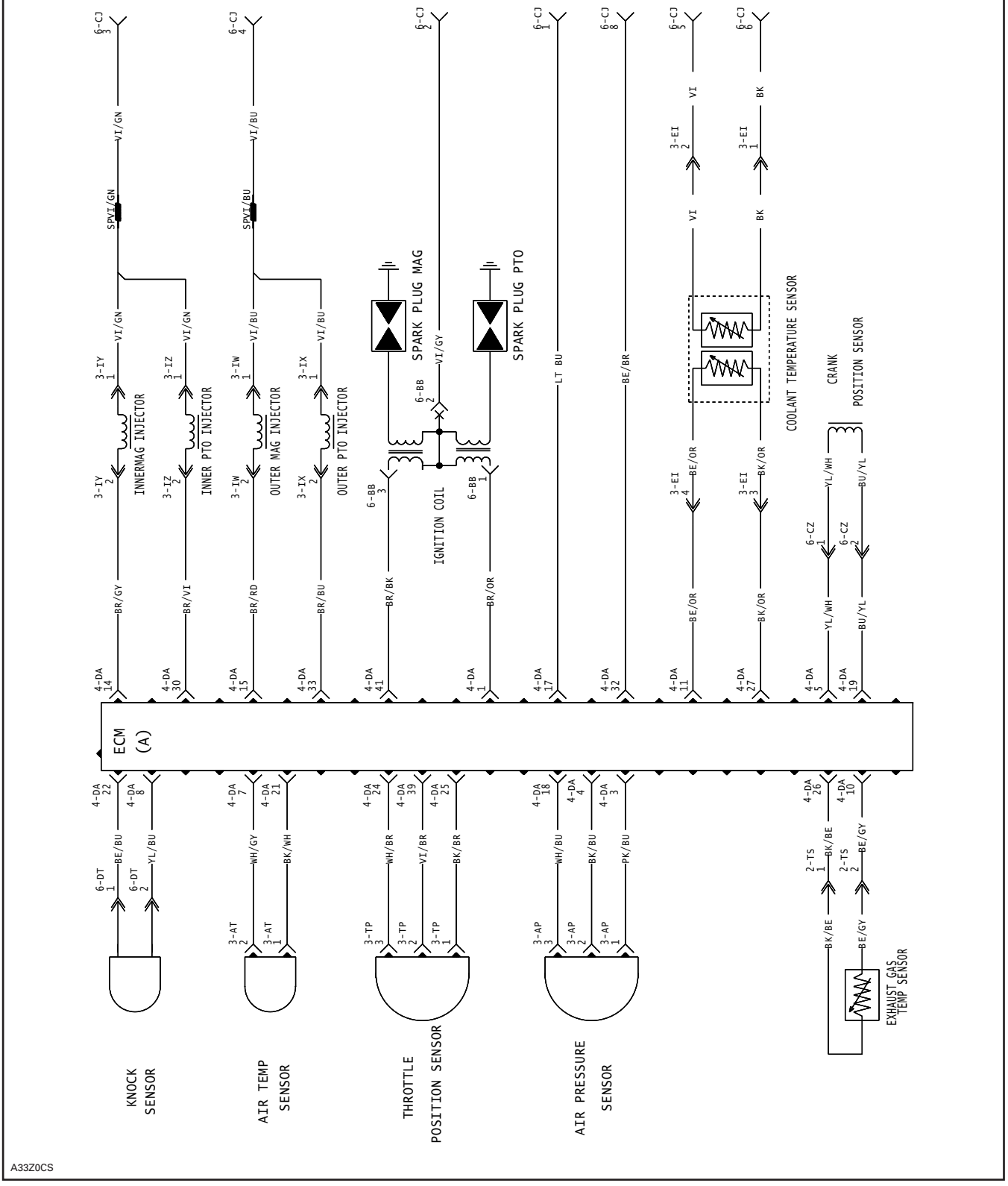


TYPICAL
1. Receptacle
2. Housing

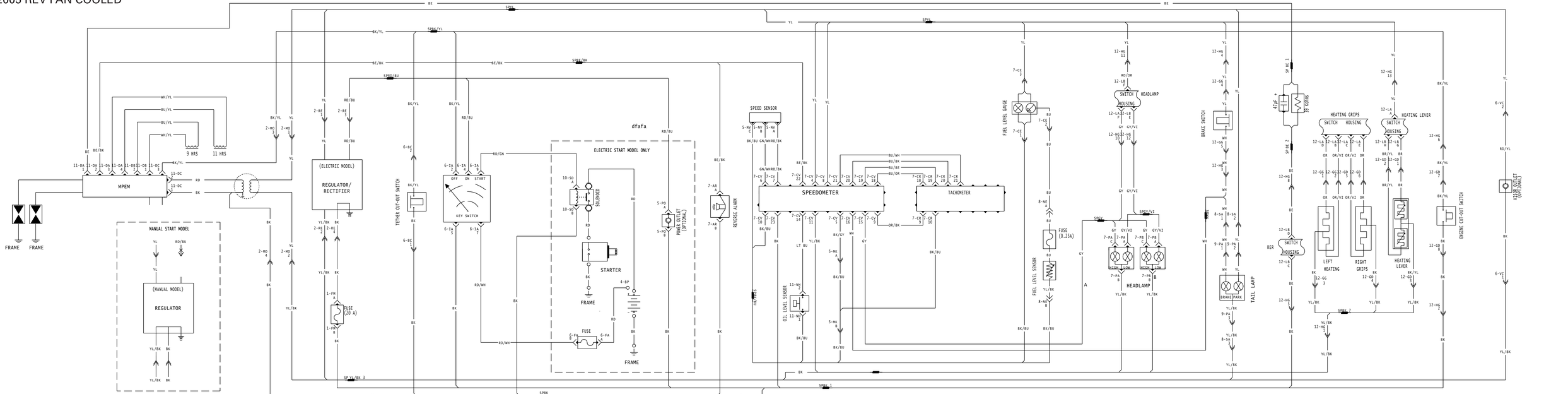
⚠ WARNING

Keep wires away from any rotating, moving, heating, vibrating or sharp edge. Use proper fastening devices as required.

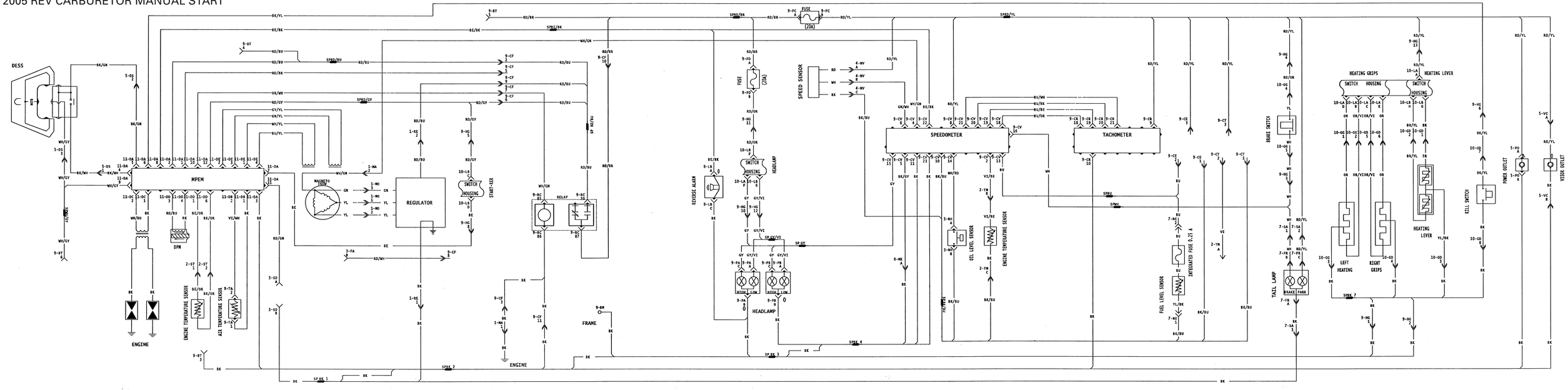
2005 REV SDI - ENGINE



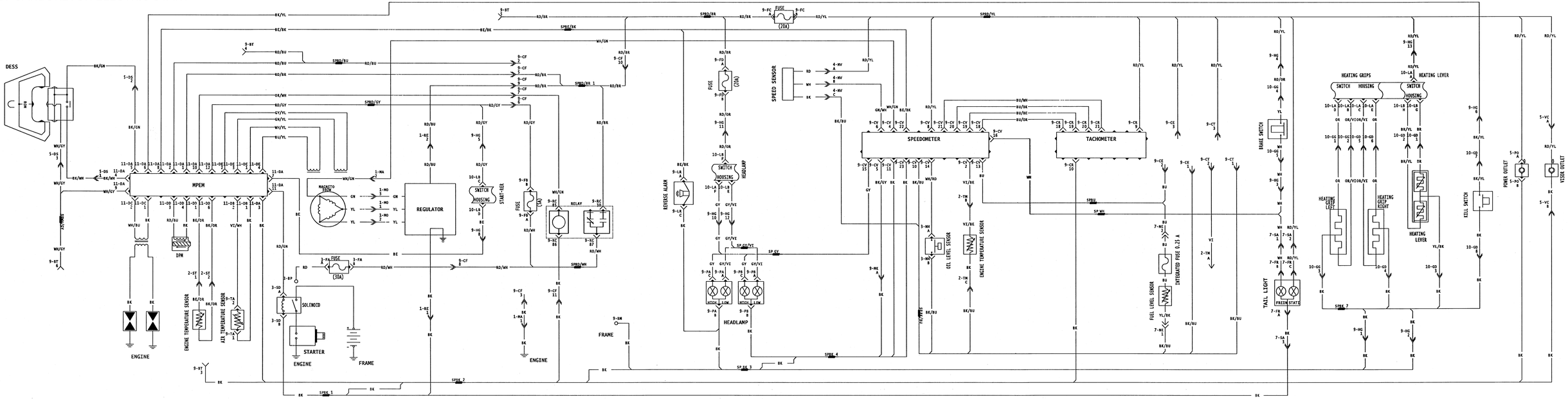
2005 REV FAN COOLED



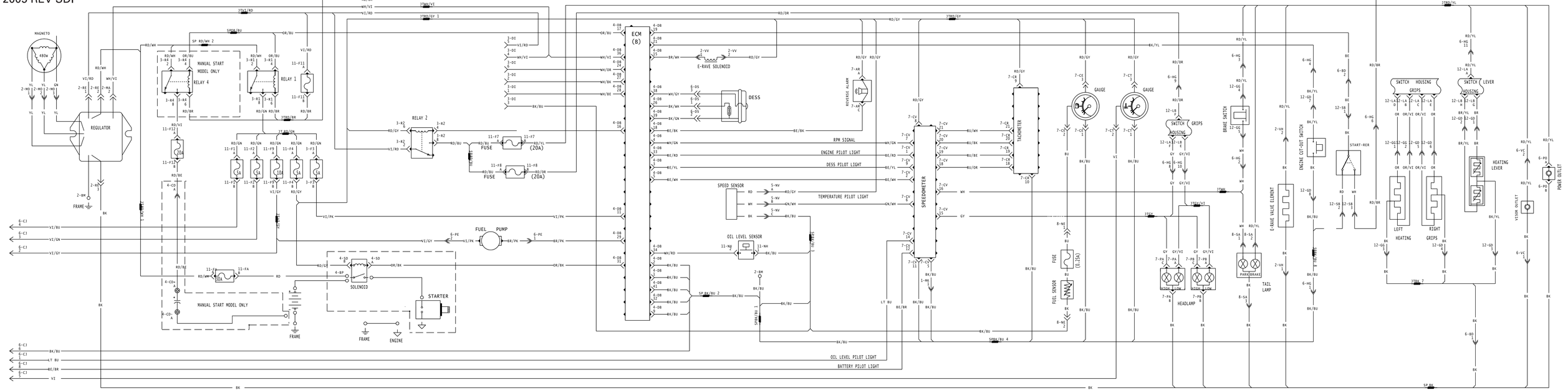
2005 REV CARBURETOR MANUAL START



2005 REV CARBURETOR ELECTRIC START



2005 REV SDI



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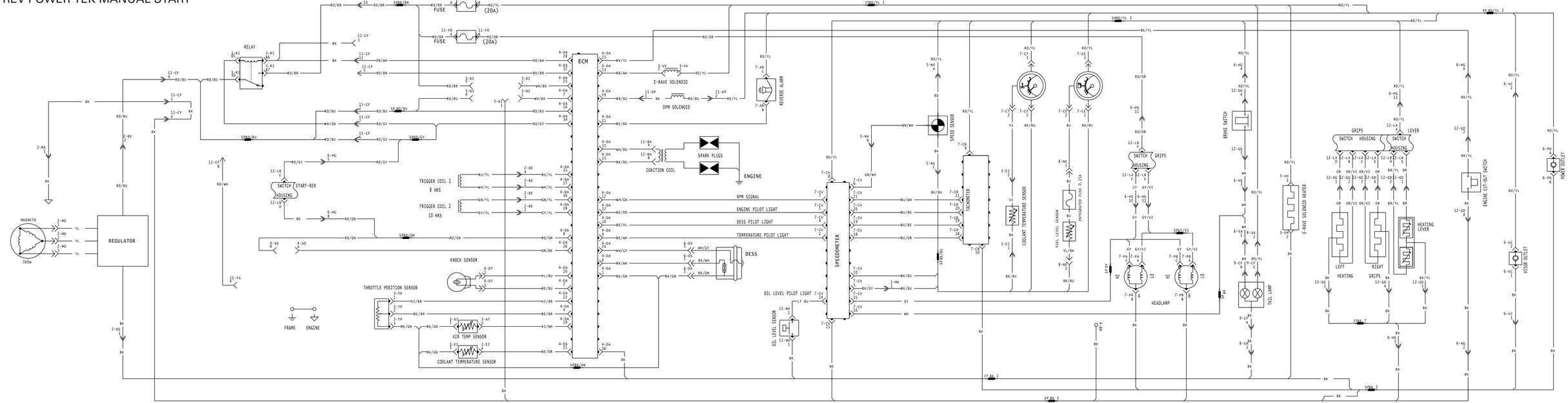
2005 REV POWER TEK MANUAL START



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2005 REV POWER TEK ELECTRIC START

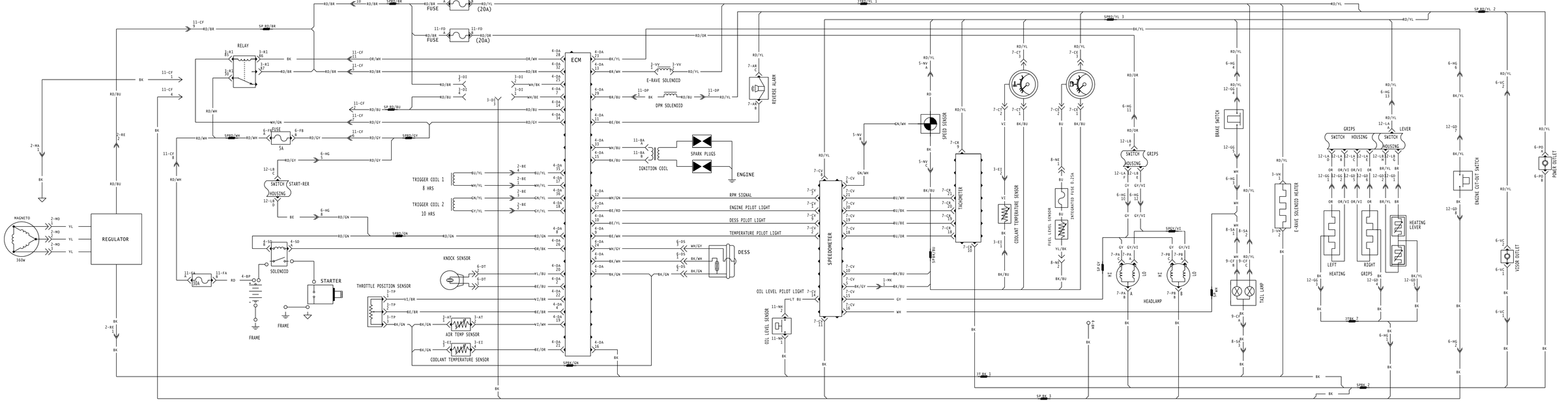

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TABLE OF CONTENTS

SAFETY NOTICE ..... **IX**

INTRODUCTION ..... **X**
VEHICLE IDENTIFICATION NUMBER X
ENGINE SERIAL NUMBER X
LIST OF ABBREVIATIONS USED IN THIS MANUAL X
ARRANGEMENT OF THIS MANUAL XII
GENERAL INFORMATION XIV
ILLUSTRATIONS AND PROCEDURES XIV
SELF-LOCKING FASTENERS PROCEDURE XIV
LOCTITE APPLICATION PROCEDURE XV
THREADLOCKER XV
STRIPPED THREAD REPAIR XVI
GASKET COMPOUND XVII
MOUNTING ON SHAFT XVII
CASE-IN COMPONENTS XVIII
TIGHTENING TORQUE XVIII

01 MAINTENANCE
01 – MAINTENANCE CHART **1**
02 – STORAGE **3**
GENERAL 3
ENGINE 3
FUEL SYSTEM 4
DRIVE SYSTEM 4
STEERING/FRONT SUSPENSION 5
SUSPENSION 5
ELECTRICAL 5
VEHICLE 5
03 – PRESEASON PREPARATION **7**
ENGINE 7
FUEL SYSTEM 7
DRIVE SYSTEM 8
ELECTRICAL SYSTEM 8
VEHICLE 8

02 ENGINE
01 – LEAK TEST **9**
LEAK TEST 9
PREPARATION 9
PROCEDURE 11
FINALIZING REASSEMBLY 13
ENGINE LEAK VERIFICATION FLOW CHART 14
02 – AIR INTAKE SYSTEM **15**
AIR FILTER/AIR INTAKE SILENCER REMOVAL (BODY SIDE) 16
AIR FILTER/AIR INTAKE SILENCER INSTALLATION (BODY SIDE) 16
AIR INTAKE SILENCER REMOVAL (ENGINE SIDE) 16
AIR INTAKE SILENCER INSTALLATION (ENGINE SIDE) 17
ADAPTOR PLATE REMOVAL 17
ADAPTOR PLATE INSTALLATION 17
INTAKE DEFLECTOR/FILTER REMOVAL 17

TABLE OF CONTENTS

TUNED PIPE 21
MANIFOLD 22
MUFFLER 22
04 – ENGINE REMOVAL AND INSTALLATION 25
REMOVAL FROM VEHICLE 27
INSPECTION 31
INSTALLATION 32
05 – MAGNETO SYSTEM 35
GENERAL 37
MAGNETO FLYWHEEL 37
STATOR 38
CPS 39
06 – E-RAVE SYSTEM 41
GENERAL 43
E-RAVE SYSTEM DYNAMIC TEST 43
E-RAVE CABLES 43
E-RAVE ACTUATOR 46
E-RAVE COVER 47
E-RAVE SHAFT 47
E-RAVE HOUSING 49
E-RAVE VALVES 49
07 – TOP END 51
TROUBLESHOOTING 53
GENERAL 53
COMPONENT REMOVAL WITH THE ENGINE INSTALLED 53
DISASSEMBLY 53
CLEANING 54
INSPECTION 55
ASSEMBLY 56
08 – BOTTOM END 61
TROUBLESHOOTING 64
GENERAL 64
PREPARATION 64
CLEANING 64
DISASSEMBLY 64
INSPECTION 69
ASSEMBLY 69
BREAK-IN 73
09 – ENGINE MEASUREMENT 75
CYLINDER HEAD WARPAGE 75
CYLINDER TAPER 75
CYLINDER OUT OF ROUND 75
COMBUSTION CHAMBER VOLUME MEASUREMENT 76
USED PISTON MEASUREMENT 77
CYLINDER/PISTON CLEARANCE 78
RING/PISTON GROOVE CLEARANCE 79
RING END GAP 79
CRANKSHAFT DEFLECTION 79
CONNECTING ROD BIG END AXIAL PLAY 80
CHECKING CRANKSHAFT ALIGNMENT 80
10 – COOLING SYSTEM 83
COOLING SYSTEM LEAK TEST 85

TABLE OF CONTENTS

INSPECTION 85
DRAINING THE SYSTEM 85
DISASSEMBLY AND ASSEMBLY 86
COOLING SYSTEM REFILLING PROCEDURE 87
11 – REWIND STARTER 89
GENERAL 91
INSPECTION 91
REMOVAL 91
ROPE REPLACEMENT 91
DISASSEMBLY 91
ASSEMBLY 92
INSTALLATION 94
12 – OIL INJECTION SYSTEM 95
GENERAL 97
OIL TYPE 97
OIL SYSTEM LEAK TEST 97
OIL PUMP IDENTIFICATION 98
CLEANING 98
REMOVAL 98
CHECKING OPERATION 99
INSTALLATION 99
BLEEDING PROCEDURE 100
ADJUSTMENT 101

03 FUEL SYSTEM
01 – FUEL TANK AND FUEL PUMPS 103
FUEL TANK 104
IN-TANK FUEL FILTER REMOVAL 105
IN-TANK FUEL FILTER INSTALLATION 105
IN-LINE FUEL FILTER REMOVAL 106
IN-LINE FUEL FILTER INSTALLATION 106
FUEL TANK REMOVAL 106
FUEL TANK INSTALLATION 107
FLOAT-TYPE FUEL LEVEL GAUGE REMOVAL/INSTALLATION 107
ELECTRIC FUEL LEVEL SENSOR INSPECTION 108
FUEL SYSTEM PRESSURIZATION 108
ELECTRIC FUEL PUMP 109
DIAGNOSTIC FLOW CHART 109
ELECTRIC FUEL PUMP PRESSURE TEST 110
ELECTRIC FUEL PUMP 111
ELECTRIC FUEL PUMP REMOVAL 112
ELECTRIC FUEL PUMP INSTALLATION 113
ELECTRIC FUEL PUMP PRESSURE REGULATOR REMOVAL/INSTALLATION 113
DIAPHRAGM FUEL PUMP 114
DIAPHRAGM FUEL PUMP REMOVAL 115
DIAPHRAGM FUEL PUMP VERIFICATION 115
DIAPHRAGM FUEL PUMP CLEANING AND INSPECTION 116
DIAPHRAGM FUEL PUMP INSTALLATION 116

04 ENGINE MANAGEMENT (SDI)
01 – OVERVIEW 117
OPERATING PRINCIPLE 118

TABLE OF CONTENTS

CHARGING SYSTEM 118
IGNITION SYSTEM 118
AIR INDUCTION 118
FUEL DELIVERY SYSTEM 119
ENGINE MANAGEMENT SYSTEM (EMS) 120
EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS 122
POWER DISTRIBUTION 122
FUEL INJECTION 123
IGNITION SYSTEM 123
ELECTRONICALLY CONTROLLED RAVE (E-RAVE) 123
DIGITALLY ENCODED SECURITY SYSTEM (DESS) 123
ROTAX ELECTRONIC REVERSE (RER) 124
MONITORING SYSTEM 124
DIAGNOSTIC MODE 125
02 – DIAGNOSTIC PROCEDURE 127
GENERAL 127
TROUBLESHOOTING 128
EMS FAULT CODES 128
VCK (VEHICLE COMMUNICATION KIT) 132
03 – COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT 135
GENERAL 135
FUEL SYSTEM 135
ELECTRICAL SYSTEM 136
TESTING PROCEDURES 140
ELECTRIC FUEL PUMP 140
FUEL INJECTORS 140
ENGINE CONTROL MODULE (ECM) 144
ENGINE WIRING HARNESS 145
THROTTLE BODY 145
THROTTLE POSITION SENSOR (TPS) 148
CRANKSHAFT POSITION SENSOR (CPS) 150
AIR TEMPERATURE SENSOR (ATS) 151
COOLANT TEMPERATURE SENSOR (CTS) 152
AIR PRESSURE SENSOR (APS) 153
KNOCK SENSOR (KS) 154
E-RAVE ACTUATOR 154
DOUBLE IGNITION COIL 155
BATTERY 157
CAPACITOR 157
ENGINE START/RER SWITCH VERIFICATION 158
DESS POST VERIFICATION 158

05 ELECTRICAL SYSTEM
01 – IGNITION SYSTEM 159
GENERAL 159
IGNITION TIMING 160
SPARK PLUG 162
DESIGN SYMBOLS USED IN NGK SPARK PLUGS 164
02 – CHARGING SYSTEM 165
GENERAL 165
CHARGING GENERATOR COIL (STATOR) 165
VOLTAGE REGULATOR/RECTIFIER 166

BATTERY ... 166
CABLE TERMINAL INSTALLATION ... 168
03 – STARTING SYSTEM ... 171
GENERAL ... 171
COMPONENT TESTING ... 171
STARTER REMOVAL ... 174
STARTER INSTALLATION ... 174
04 – ROTAX ELECTRONIC REVERSE (RER) ... 175
TROUBLESHOOTING ... 175
05 – ACCESSORIES AND LIGHTING SYSTEM ... 177
GENERAL ... 177
12-VOLT POWER OUTLET (CIGARETTE-LIGHTER TYPE) ... 178
BEEPER (REVERSE ALARM) ... 178
ENGINE TEMPERATURE GAUGE ... 179
ELECTRIC FUEL GAUGE ... 179
HEADLAMP ... 180
HEADLAMP BEAM AIMING ... 181
HEATING ELEMENTS ... 181
RELAY ... 181
SPEEDOMETER ... 182
SPEED SENSOR ... 183
TACHOMETER ... 183
TAILLIGHT ... 184
VISOR OUTLET ... 184

06 DRIVE SYSTEM
01 – DRIVE BELT ... 185
APPLICATION CHART ... 185
INSPECTION ... 185
CHECKING NEUTRAL FUNCTION ... 185
ROTATION DIRECTION ... 185
DRIVE BELT HEIGHT MEASUREMENT AND ADJUSTMENT ... 186
DRIVE BELT DEFLECTION MEASUREMENT (REFERENCE ONLY) ... 187
02 – DRIVE PULLEY ... 189
TRA V ... 190
GENERAL ... 191
REMOVAL ... 191
DISASSEMBLY ... 191
CLEANING ... 193
INSPECTION ... 193
ASSEMBLY ... 195
INSTALLATION ... 198
DRIVE PULLEY ADJUSTMENT ... 199
03 – DRIVEN PULLEY ... 201
HPV ROLLER ... 202
GENERAL ... 203
REMOVAL ... 203
DISASSEMBLY ... 203
CLEANING ... 204
INSPECTION ... 204
ASSEMBLY ... 205
INSTALLATION ... 205

TABLE OF CONTENTS

BUSHING REPLACEMENT 205
HPV VSA 208
GENERAL 209
REMOVAL 209
DISASSEMBLY 209
CLEANING 209
INSPECTION 209
ASSEMBLY 210
INSTALLATION 210
ADJUSTMENT 210
04 – PULLEY ALIGNMENT 213
GENERAL 213
MEASURING PROCEDURE 213
ALIGNMENT PROCEDURE 214
05 – BRAKE 215
GENERAL 217
COUNTERSHAFT BEARING 217
COUNTERSHAFT 217
BRAKE FLUID 217
DRAINING 217
BLEEDING 217
MASTER CYLINDER 217
BRAKE PADS 218
CALIPER 219
BRAKE DISC 220
BRAKE LIGHT SWITCH 221
06 – CHAINCASE 223
GENERAL 225
CHAINCASE OIL LEVEL 225
OIL CHANGE 225
DRIVE CHAIN ADJUSTMENT 225
CHAINCASE COVER 225
TENSIONER 226
TENSIONER ROLLER BEARING 226
DRIVE CHAIN AND SPROCKETS 227
CHAINCASE HOUSING 228
CHAINCASE HOUSING BEARINGS 229
COUNTERSHAFT 229
COUNTERSHAFT BEARING 229
07 – DRIVE AXLE 233
REMOVAL 236
ASSEMBLY 236
LUBRICATION 238
ADJUSTMENT 238
08 – TRACK 239
TRACK TYPE APPLICATION 239
GENERAL 239
INSPECTION 239
REMOVAL 239
INSTALLATION 239
ADJUSTMENT 239
TRACK CLEAT 241

TRACTION ENHANCING PRODUCTS (STUDS) 241

07 REAR SUSPENSION

01 – SC SUSPENSION 243
AXLE SELF-LOCKING SCREWS REMOVAL 247
REAR AXLE REMOVAL 247
REAR AXLE INSTALLATION 247
REAR SHOCK ABSORBER REMOVAL 247
REAR SHOCK ABSORBER INSTALLATION 248
FRONT SHOCK ABSORBER REMOVAL 248
FRONT SHOCK ABSORBER INSTALLATION 248
REAR SPRING REMOVAL 249
REAR SPRING INSTALLATION 249
SLIDER SHOE VERIFICATION 250
SLIDER SHOE REMOVAL 250
SLIDER SHOE INSTALLATION 251
FRONT ARM REMOVAL 251
FRONT ARM INSTALLATION 252
REAR ARM/PIVOT ARM REMOVAL 252
REAR ARM INSTALLATION 252
STOPPER STRAP 253
SUSPENSION REMOVAL 253
SUSPENSION INSTALLATION 254
RIDE ADJUSTMENT 254
LUBRICATION 254

02 – SC 4 SUSPENSION 255
AXLE SELF-LOCKING SCREW REMOVAL 259
REAR AXLE REMOVAL 259
REAR AXLE INSTALLATION 259
REAR SHOCK ABSORBER REMOVAL 259
REAR SHOCK ABSORBER INSTALLATION 260
FRONT SHOCK ABSORBER REMOVAL 260
FRONT SHOCK ABSORBER INSTALLATION 261
REAR SPRING REMOVAL 261
REAR SPRING INSTALLATION 262
SLIDER SHOE VERIFICATION 262
SLIDER SHOE REMOVAL 263
SLIDER SHOE INSTALLATION 264
FRONT ARM REMOVAL 264
FRONT ARM INSTALLATION 264
REAR ARM/PIVOT ARM REMOVAL 264
REAR ARM/PIVOT ARM INSTALLATION 265
BLOCK INSTALLATION 265
IDLER WHEELS INSTALLATION 265
STOPPER STRAP 265
SUSPENSION REMOVAL 266
SUSPENSION INSTALLATION 266
RIDE ADJUSTMENT 266
LUBRICATION 267

03 – SHOCK ABSORBER INSPECTION AND SERVICING 269
SPRING REMOVAL 269
SHOCK ABSORBER INSPECTION 270

TABLE OF CONTENTS

DISASSEMBLY AND ASSEMBLY 270

08 STEERING/FRONT SUSPENSION

01 – STEERING SYSTEM 279
DISASSEMBLY AND ASSEMBLY 282
INSPECTION 286
ADJUSTMENT 286
STEERING ADJUSTMENT (SKIS) 288
LUBRICATION 289

02 – FRONT SUSPENSION 291
GENERAL INSPECTION 295
DISASSEMBLY 295
INSPECTION 300
INSTALLATION 300

09 BODY/FRAME

01 – BODY 305
DECAL 305
HOOD 305
FRONT BUMPER 305
BOTTOM PAN 306
WINDSHIELD 306
ACCESS PANEL 306
INDICATOR PANEL 306
CONSOLE 307
SEAT 307
PLASTIC MAINTENANCE AND REPAIR 308

02 – FRAME 311
FRAME CLEANING 311
FRAME WELDING 311
FRAME COMPONENT REPLACEMENT 311

10 TECHNICAL DATA

01 – MACH Z/SUMMIT 1000 SDI 317
TECHNICAL DATA LEGEND 321

11 WIRING DIAGRAMS

01 – WIRING DIAGRAMS 323
WIRING DIAGRAM LEGEND 323
WIRE COLORS 323
CONNECTOR HOUSING AREA 323
HOUSING REFERENCE PER AREA 324
WIRE LOCATION IN CONNECTOR HOUSING 324
SYMBOLS DESCRIPTION 326
UNPLUGGING CONNECTORS 327
TAB AND RECEPTACLE CONNECTORS REMOVAL 327
TAB AND RECEPTACLE CONNECTORS INSTALLATION 333

SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair some 2005 Ski-Doo snowmobiles. See model list below.

This edition was primarily published to be used by snowmobile mechanic technicians who are already familiar with all service procedures relating to BRP made snowmobiles. Mechanic technicians should attend continuous training courses given by BRP Training Dept.

Please note that the instructions will apply only if proper hand tools and special service tools are used.

This shop manual uses technical terms which may be slightly different from the ones used in the Parts Catalog.

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

The content depicts parts and/or procedures applicable to the particular product at time of writing. Service and Warranty Bulletins may be published to update the content of this manual. Make sure to read and understand them.

In addition, the sole purpose of the illustrations throughout the manual, is to assist identification of the general configuration of the parts. They are not to be interpreted as technical drawings or exact replicas of the parts.

The use of BRP parts is most strongly recommended when considering replacement of any component. Dealer and/or distributor assistance should be sought in case of doubt.

The engines and the corresponding components identified in this document should not be utilized on product(s) other than those mentioned in this document.

This manual emphasizes particular information denoted by the wording and symbols:

⚠ WARNING

Identifies an instruction which, if not followed, could cause serious personal injury including possibility of death.

CAUTION: Denotes an instruction which, if not followed, could severely damage vehicle components.

NOTE: Indicates supplementary information needed to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use. Always use common shop safety practice.

Bombardier Recreational Products Inc. (BRP) disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that any services be carried out and/or verified by a highly skilled professional mechanic. It is understood that certain modifications may render use of the vehicle illegal under existing federal, provincial and state regulations.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (ex.: locking tab, self-locking fasteners, etc.) must be installed or replaced with new ones. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Unless otherwise specified, engine should be turned OFF and cold for all maintenance and repair procedures.

INTRODUCTION

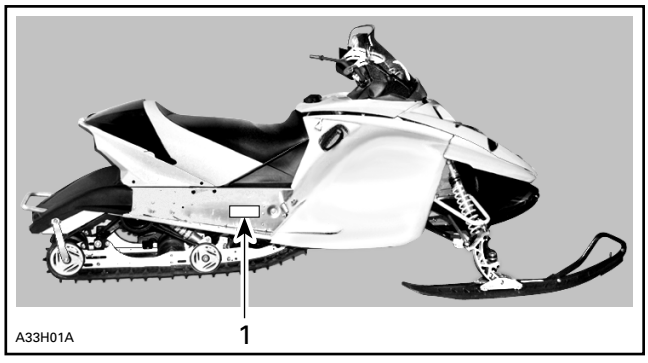
This shop manual covers the following BRP made 2005 RT Series models:

TYPICAL — RT SERIES

MODEL	ENGINE TYPE	MODEL NUMBER
MACH Z	995 SDI	AB5A, AB5B, AB5C
SUMMIT HIGHMARK	995 SDI	CD5A, CD5B, CD5C
SUMMIT HIGHMARK X	995 SDI	CA5A, CA5B, CA5C, CA5D

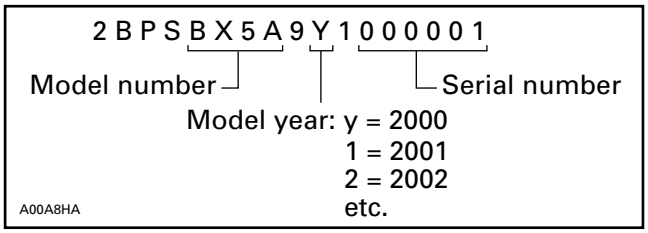
VEHICLE IDENTIFICATION NUMBER

Vehicle Identification Number Location



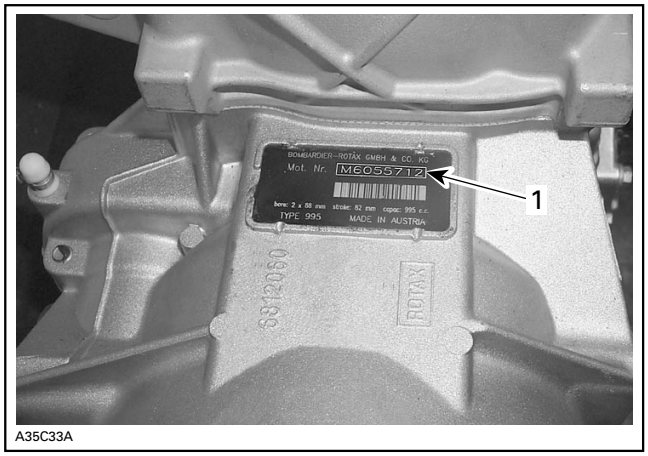
TYPICAL
1. Vehicle identification number

Identification Number Meaning



ENGINE SERIAL NUMBER

Engine Serial Number Location



1. Engine serial number

LIST OF ABBREVIATIONS USED IN THIS MANUAL

ABBREVIATION	MEANING
A	ampere
amp	ampere
A•h	ampere-hour
AC	alternate current
ACM	acceleration and control modulator
AMG	absorbed glass mat
BDC	bottom dead center
BTDC	before top dead center
°C	degree Celsius
cc	cubic centimeter

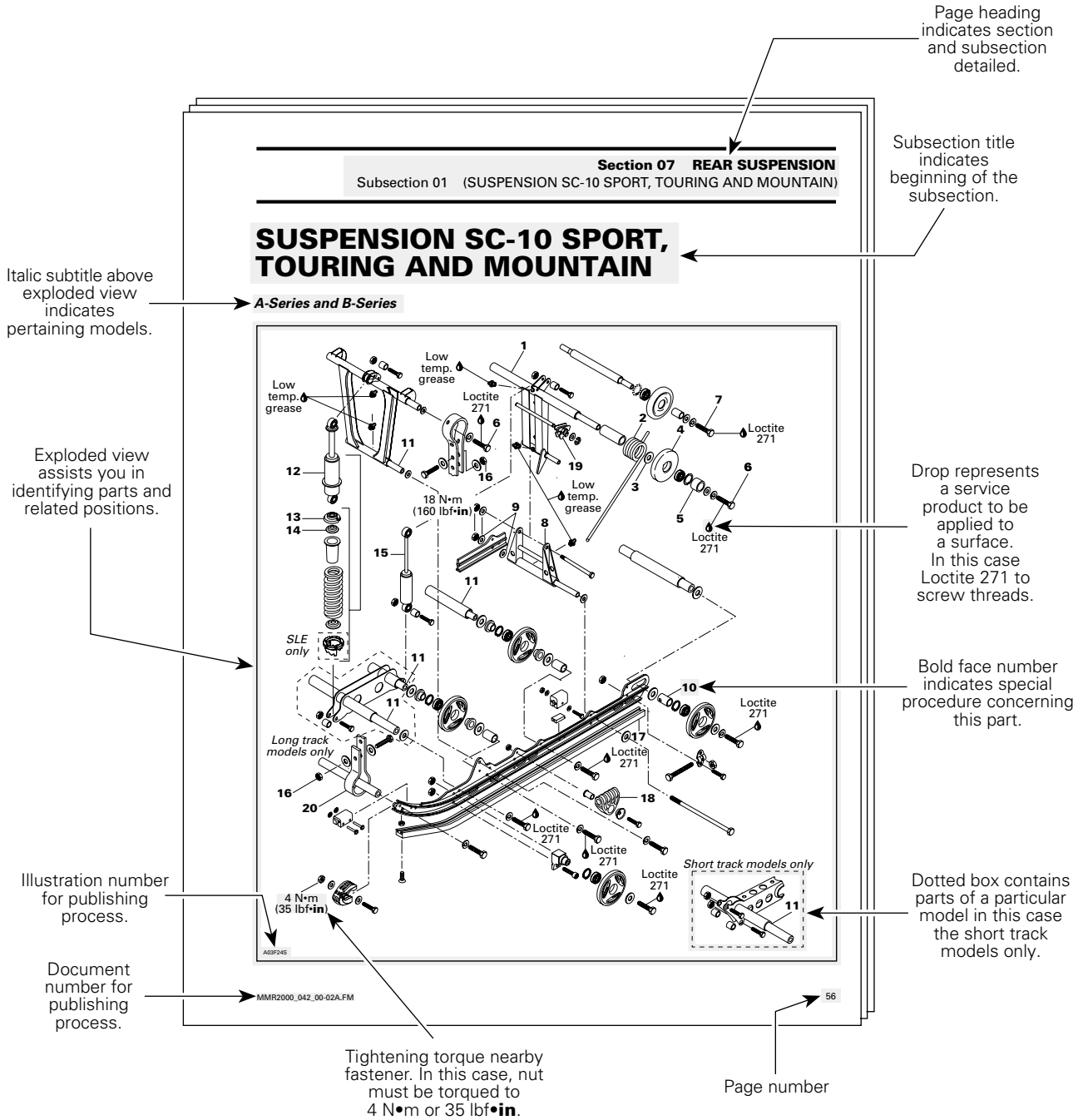
ABBREVIATION	MEANING
CDI	capacitor discharge ignition
CTR	center
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
DC	direct current
DESS	digitally encoded security system
DPM	digital performance management
°F	degree Fahrenheit
FC	fan cooled
fl. oz	fluid ounce
ft	foot
GRD	ground
H.A.C.	high altitude compensator
hal.	halogen
HI	high
IFP	internal floating piston
imp. oz	imperial ounce
in	inch
in^2	square inch
in^3	cubic inch
k	kilo (thousand)
kg	kilogram
km/h	kilometer per hour
kPa	Kilopascal
L	liter
lb	pound
lbf	pound (force)
lbf/in^2	pound per square inch
LH	left hand
LO	low
LT	long track
m	meter
MAG	magneto
Max.	maximum
Min.	minimum
mL	milliliter

ABBREVIATION	MEANING
mm	millimeter
M.E.	millennium edition
MPEM	multi-purpose electronic module
MPH	mile per hour
N	newton
N.A.	not applicable
no.	number
0	continuity
0.L	open line (open circuit)
O.D.	outside diameter
OPT	optional
oz	ounce
P/N	part number
PSI	pound per square inch
PTO	power take off
R	rectangular
RH	right hand
R.A.S.	response angle suspension
RAVE	Rotax adjustable variable exhaust
RER	Rotax electronic reverse
RPM	revolution per minute
RMS	root mean square
RRIM	reinforced reaction injection molding
SDI	semi-direct injection
Sp. Gr.	specific gravity
ST	semi-trapez
TDC	top dead center
TRA	total range adjustable
U.S. oz	ounce (United States)
V	volt
Vac	volt (alternative current)
VSA	variable sheave angle

ARRANGEMENT OF THIS MANUAL

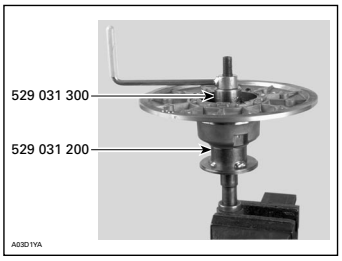
This *Shop Manual* uses technical terms wich may be slightly different from the ones in the parts catalog.

TYPICAL PAGE



TYPICAL PAGE

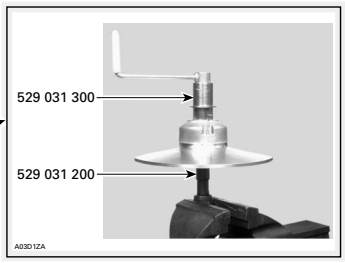
Turn puller handle and sliding half at once to extract the bushing.



IMPORTANT: Large bushing retaining screws and washers must be removed before small bushing installation.

Coat bushing outside diameter with Loctite 609 (P/N 413 703 100).

Install bushing as following photo.



ASSEMBLY

Came Slider Shoe

When replacing slider shoes **no. 4**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Assemble driven pulley components by reversing the disassembly procedure.

Cam

Coat cam **no. 18** interior with anti-seize lubricant.

INSTALLATION

Countershaft

CAUTION: Always apply anti-seize lubricant (P/N 413 701 000) on the countershaft before final pulley installation.

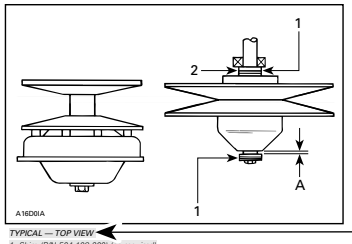
A-Series and B-Series Only

Should installation procedure be required, refer to BRAKE then look for **Brake Disc and Countershaft Bearing Adjustment**.

Reinstall the pulley on the countershaft by reversing the removal procedure.

All Models

Check end play of driven pulley on countershaft by pushing pulley towards outer housing so that the inner shims (P/N 504 108 200) contact it. Measure end play at the mounting screw end between shim(s) and puley. See illustration.



TYPICAL — TOP VIEW

1. Shim (P/N 504 108 200) (as required)
2. Contact
A. 0 to 1 mm (0 to 3/64 in)

Torque retaining screw **no. 13** to 25 N•m (18 lbf•ft).

ADJUSTMENT

Refer to PULLEY DISTANCE AND ALIGNMENT to adjust pulley distance. Adjust drive belt height between pulley halves to obtain specified belt deflection.

MMR2000_042_00-02A.FM

57

Illustration always follows text to which it pertains.

Subtitle indicates a particular procedure for the named part.

Bold face number following part name refers to exploded view at beginning of subsection.

Title indicates main procedure to be carried-out.

Italic bold face type setting indicates a particular procedure concerning a model.

Italic bold face setting in this case indicates that particular procedure for A and B-Series is finished, so from this point, all models are concerned.

"TYPICAL" caption indicates a general view which does not represent full detail. "TOP VIEW" caption helps you in understanding illustration.

Call-outs for above illustration.

Reference to look up a certain section and subsection. In this case it concerns pulleys adjustment.

A00A7YS

GENERAL INFORMATION

The information and component/system descriptions contained in this manual are correct at time of publication. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Due to late changes, it may have some differences between the manufactured product and the description and/or specifications in this document.

BRP reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

ILLUSTRATIONS AND PROCEDURES

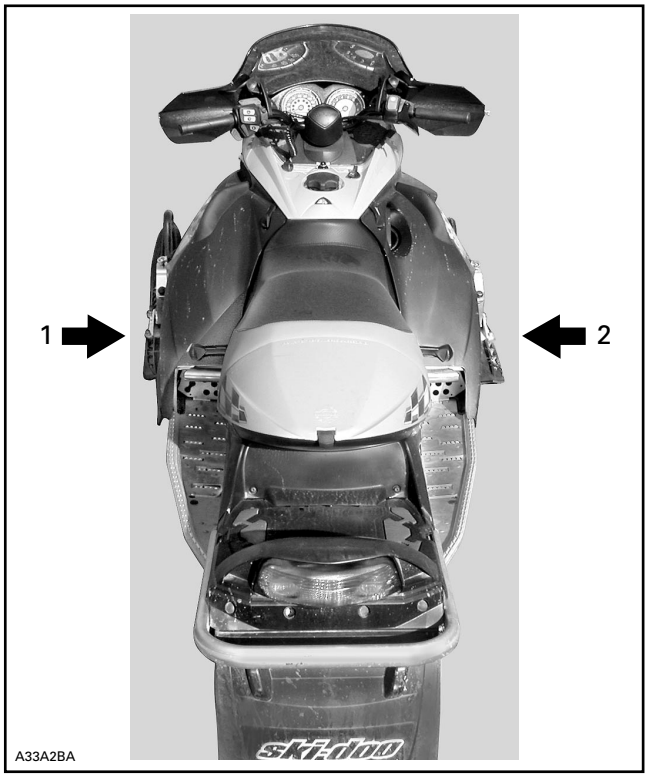
Illustrations and photos show the typical construction of the different assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts shown. However, they represent parts which have the same or a similar function.

CAUTION: Most components of those vehicles are built with parts dimensioned in the metric system. Most fasteners are metric and must not be replaced by customary fasteners or vice-versa. Mismatched or incorrect fasteners could cause damage to the vehicle or possible personal injury.

As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or subsection in which the procedure is contained.

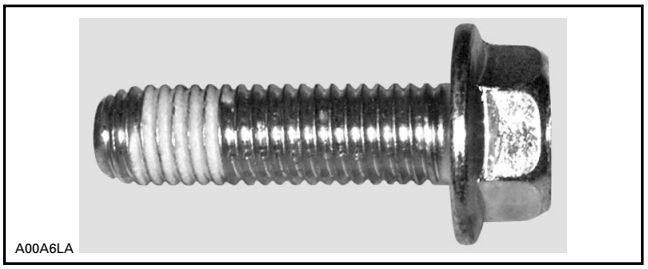
A number of procedures throughout the book require the use of special tools. Before commencing any procedure, be sure that you have on hand all the tools required, or approved equivalents.

The use of RIGHT and LEFT indications in the text, always refers to driving position (when sitting on vehicle).



TYPICAL
1. Left
2. Right

SELF-LOCKING FASTENERS PROCEDURE



TYPICAL — SELF-LOCKING FASTENER

The following describes the most common application procedures when working with self-locking fasteners.

Use a metal brush or a tap to clean the hole properly then use a solvent (Methyl-Chloride), let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

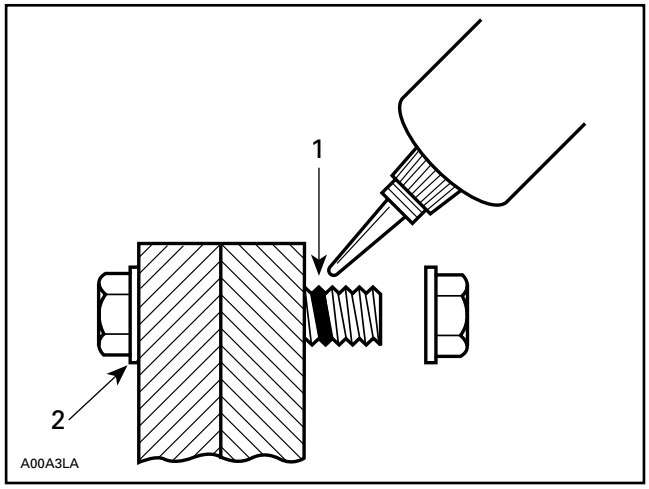
LOCTITE APPLICATION PROCEDURE

The following describes the most common application procedures when working with Loctite products.

NOTE: Always use proper strength Loctite product as recommended in this shop manual.

THREADLOCKER

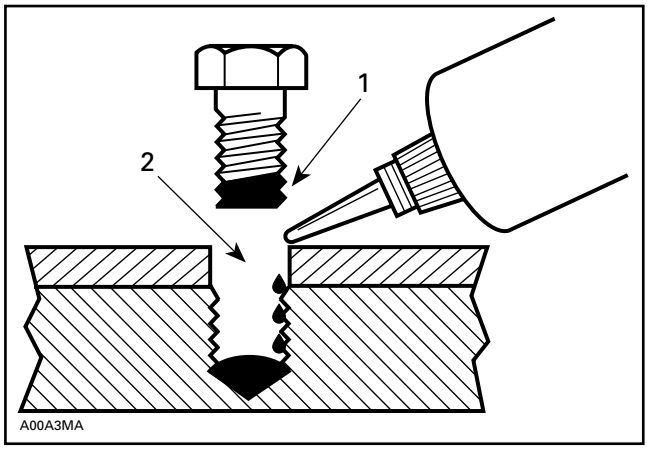
Uncovered Holes (bolts and nuts)



1. Apply here
2. Do not apply

– Clean threads (bolt and nut) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
– Choose proper strength Loctite threadlocker.
– Fit bolt in the hole.
– Apply a few drops of threadlocker at proposed tightened nut engagement area.
– Position nut and tighten as required.

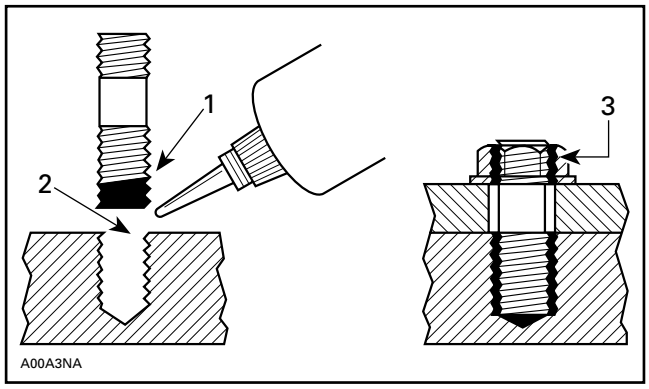
Blind Holes



1. On threads
2. On threads and at the bottom of hole

– Clean threads (bolt and hole) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads (bolt and nut) and allow to dry for 30 seconds.
– Choose proper strength Loctite threadlocker.
– Apply several drops along the threaded hole and at the bottom of the hole.
– Apply several drops on bolt threads.
– Tighten as required.

Stud in Blind Holes

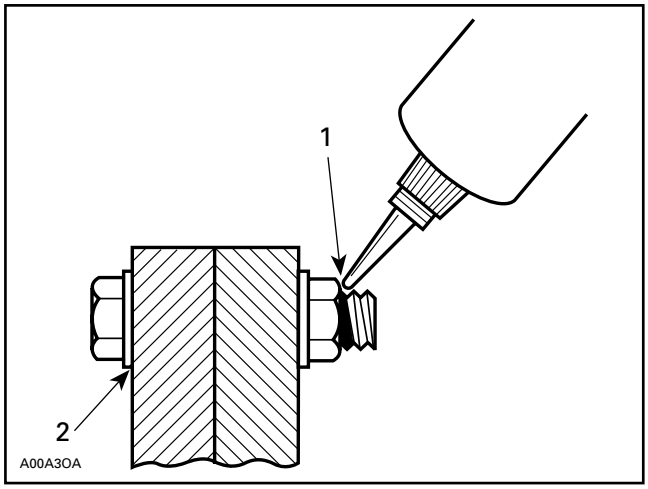


1. On threads
2. On threads and in the hole
3. Onto nut threads

– Clean threads (stud and hole) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
– Put several drops of proper strength Loctite threadlocker on female threads and in hole.

– Apply several drops of proper strength Loctite on stud threads.
– Install stud.
– Install cover, etc.
– Apply drops of proper strength Loctite on uncovered threads.
– Tighten nuts as required.

Preassembled Parts

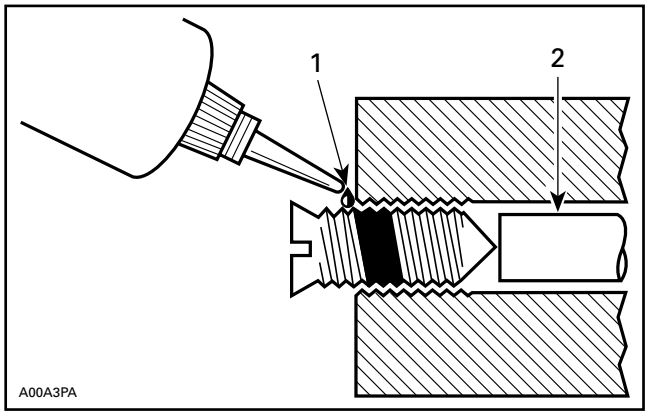


1. Apply here
2. Do not apply

– Clean bolts and nuts with solvent.
– Assemble components.
– Tighten nuts.
– Apply drops of proper strength Loctite on bolt/nut contact surfaces.
– Avoid touching metal with tip of flask.

NOTE: For preventive maintenance on existing equipment, retighten nuts and apply proper strength Loctite on bolt/nut contact surfaces.

Adjusting Screw



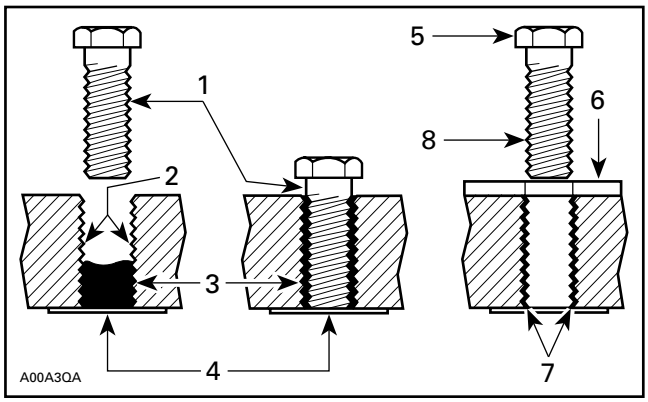
1. Apply here
2. Plunger

– Adjust screw to proper setting.
– Apply drops of proper strength Loctite threadlocker on screw/body contact surfaces.
– Avoid touching metal with tip of flask.

NOTE: If it is difficult to readjust, heat screw with a soldering iron (232°C (450°F)).

STRIPPED THREAD REPAIR

Stripped Threads



1. Release agent
2. Stripped threads
3. Form-A-Thread
4. Tape
5. Cleaned bolt
6. Plate
7. New threads
8. Threadlocker

Standard Thread Repair

– Follow instructions on Loctite FORM-A-THREAD 81668 package.

– If a plate is used to align bolt:
  • Apply release agent on mating surfaces.
  • Put waxed paper or similar film on the surfaces.
  • Twist bolt when inserting it to improve thread conformation.

NOTE: NOT intended for engine stud repairs.

Repair of Small Holes/Fine Threads

Option 1: Enlarge damaged hole, then follow STANDARD THREAD REPAIR procedure.

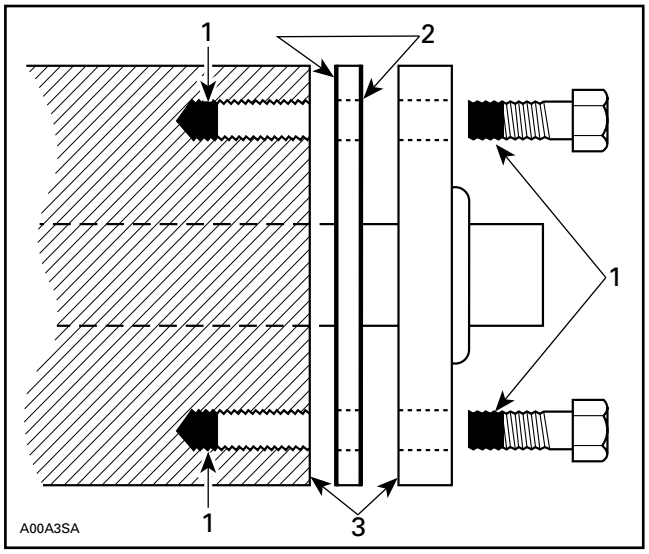
Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

Permanent Stud Installation (light duty)

– Use a stud or thread on desired length.
– DO NOT apply release agent on stud.
– Do a STANDARD THREAD REPAIR.
– Allow to cure for 30 minutes.
– Assemble.

GASKET COMPOUND

All Parts



1. Proper strength Loctite
2. Loctite Primer N (P/N 413 708 100) and Gasket Eliminator 515 (P/N 413 702 700) on both sides of gasket
3. Loctite Primer N only

– Remove old gasket and other contaminants with Loctite Chisel remover (P/N 413 708 500). Use a mechanical mean if necessary.

NOTE: Avoid grinding.

– Clean both mating surfaces with solvent.
– Spray Loctite Primer N on both mating surfaces and on both sides of gasket. Allow to dry 1 or 2 minutes.
– Apply GASKET ELIMINATOR 515 (P/N 413 702 700) on both sides of gasket, using a clean applicator.
– Place gasket on mating surfaces and assemble immediately.

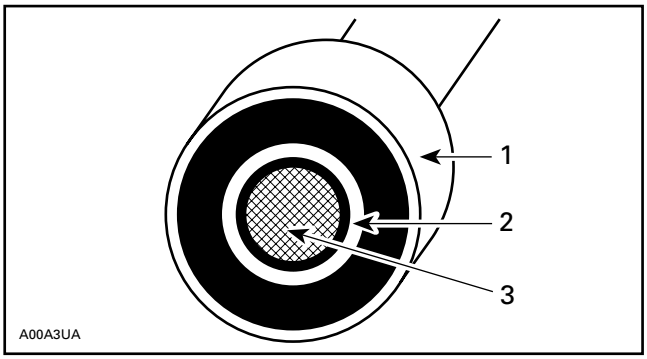
NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

If holes are sunken, apply proper strength Loctite on bolt threads.

– Tighten as usual.

MOUNTING ON SHAFT

Mounting with a Press



1. Bearing
2. Proper strength Loctite
3. Shaft

Standard

– Clean shaft external part and element internal part.
– Apply a strip of proper strength Loctite on shaft circumference at insert or engagement point.

NOTE: Retaining compound is always forced out when applied on shaft.

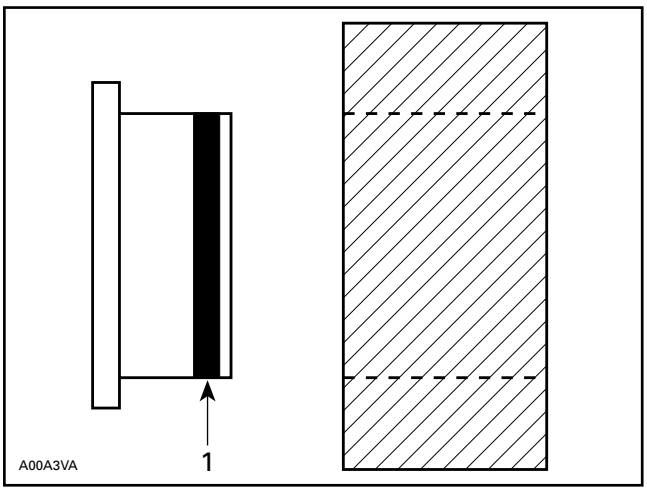
– DO NOT use anti-seize Loctite or any similar product.
– No curing period is required.

Mounting in Tandem

– Apply retaining compound on internal element bore.
– Continue to assemble as shown above.

CASE-IN COMPONENTS

Metallic Gaskets



1. Proper strength Loctite

– Clean inner housing diameter and outer gasket diameter.
– Spray housing and gasket with Loctite Primer N (P/N 293 800 041).
– Apply a strip of proper strength Loctite on leading edge of outer metallic gasket diameter.

NOTE: Any Loctite product can be used here. A low strength liquid is recommended as normal strength and gap are required.

– Install according to standard procedure.
– Wipe off surplus.
– Allow it to cure for 30 minutes.

NOTE: Normally used on worn-out housings to prevent leaking or sliding.

It is generally not necessary to remove gasket compound applied on outer gasket diameter.

TIGHTENING TORQUE

Tighten fasteners to torque mentioned in exploded views and/or text, When they are not specified, refer to following table. The table also gives the metric conversion.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (ex.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones, where specified. If the efficiency of a locking device is impaired, it must be renewed.

In order to avoid a poor assembling, tighten screws, bolts or nuts in accordance with the following procedure:

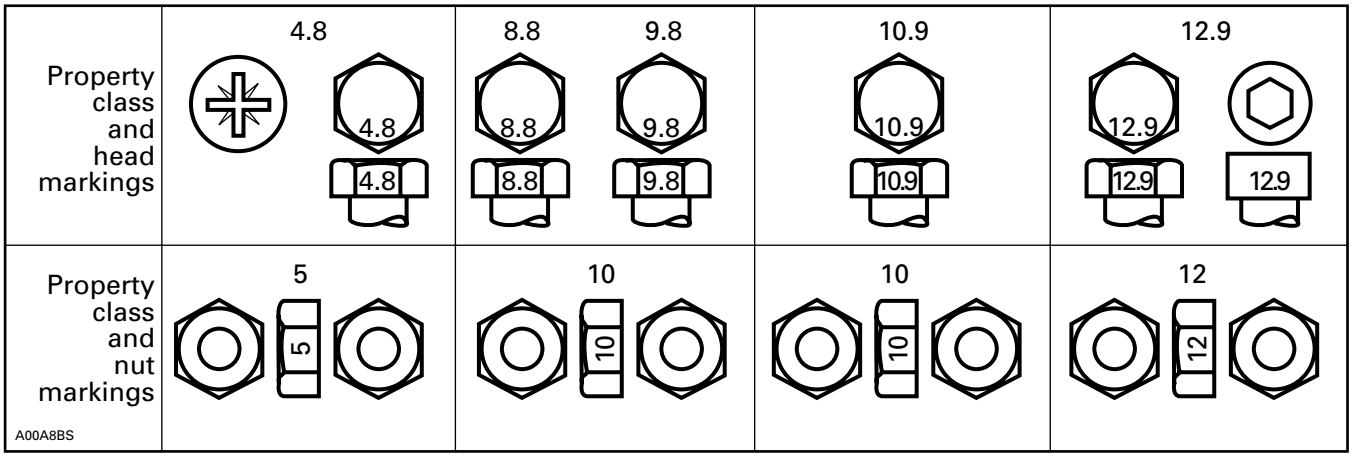
– Manually screw all screws, bolts and/or nuts.
– Apply the half of the recommended torque value.

CAUTION: Be sure to use proper tightening torque for the proper strength grade.

NOTE: When possible, always apply torque on the nut.

– Torque at the recommended torque value.

NOTE: Always torque screws, bolts and/or nuts in a criss-cross sequence.



FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	**8.8** Grade	**10.9** Grade	**12.9** Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 – 4 N•m (31 – 35 lbf•**in**)	4 – 5 N•m (35 – 44 lbf•**in**)
M5	3 – 3.5 N•m (27 – 31 lbf•**in**)	4.5 – 5.5 N•m (40 – 47 lbf•**in**)	7 – 8.5 N•m (62 – 75 lbf•**in**)	8 – 10 N•m (71 – 89 lbf•**in**)
M6	6.5 – 8.5 N•m (58 – 75 lbf•**in**)	8 – 12 N•m (71 – 106 lbf•**in**)	10.5 – 15 N•m (93 – 133 lbf•**in**)	16 N•m (142 lbf•**in**)
M8	15 N•m (11 lbf•ft)	24.5 N•m (18 lbf•ft)	31.5 N•m (23 lbf•ft)	40 N•m (30 lbf•ft)
M10	29 N•m (21 lbf•ft)	48 N•m (35 lbf•ft)	61 N•m (45 lbf•ft)	72.5 N•m (53 lbf•ft)
M12	52 N•m (38 lbf•ft)	85 N•m (63 lbf•ft)	105 N•m (77 lbf•ft)	127.5 N•m (94 lbf•ft)
M14	85 N•m (63 lbf•ft)	135 N•m (100 lbf•ft)	170 N•m (125 lbf•ft)	200 N•m (148 lbf•ft)

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MAINTENANCE CHART

A: ADJUST
I: INSPECT
L: LUBRICATE
R: REPLACE
C: CLEAN
T: PROCEED WITH TASK

SYSTEM	10-HOUR OR 500 KM (300 mi) INSPECTION (to be performed by dealer)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	6000 KM (3700 mi)	STORAGE (to be performed by dealer)	PRESEASON PREPARATION (to be performed by dealer)	REFER TO SECTION(S) AND SUBSECTION(S)
ENGINE								
Rewind starter and rope						I,L	I	02-11
Engine motor mounts	I			I		I		Section 02, see the appropriate subsection
Exhaust system (4)	I		I			I		02-03
Engine lubrication						L		01-02
Cooling system	I			I			I	02-10
Coolant	I					R		02-10
Crankshaft PTO Seal (4)						I		Section 02, see the appropriate subsection
E-RAVE actuator (4)	A			A				02-06
Injection oil filter			I			R		02-12
Oil injection pump	A			A			A	02-12
Rags in air intake and exhaust system						T	T	01-02 and 01-03
FUEL SYSTEM								
Fuel stabilizer						T		01-02
Fuel filter							R	01-03
Fuel lines, fuel rail and connections	I						I	Section 02 or 04-03
Throttle cable	I			I			I	04-03
Air filter(4)			C				C	01-03
Throttle body (4)							C	04-03
Air intake system (4)							I	02-02
DRIVE SYSTEM								
Drive belt	I	I					I	06-01
Drive and driven pulley	I		I	C		I	C	06-02 and 06-03
Tightening torque of drive pulley screw	I			I			I	06-02
Tightening torque of ring gear screws							I	06-02
Brake fluid	I	I				R	I	06-05
Drive pulley ramp and roller							I	06-02
Brake hose, pads and disk	I	I					I	06-05
Drive chain tension	A(5)		A(5)			I		06-06
Chaincase oil	I		I			R	I	06-06

A: ADJUST I: INSPECT L: LUBRICATE R: REPLACE C: CLEAN T: PROCEED WITH TASK	10-HOUR OR 500 KM (300 mi) INSPECTION (to be performed by dealer) WEEKLY OR EVERY 240 KM (150 mi) MONTHLY OR EVERY 800 KM (500 mi) ONCE A YEAR OR EVERY 3200 KM (2000 mi) 6000 KM (3700 mi) STORAGE (to be performed by dealer) PRESEASON PREPARATION (to be performed by dealer)							
SYSTEM								**REFER TO SECTION(S) AND SUBSECTION(S)**
Drive axle end bearing (2)	L		L			L		06-07
Countershaft (2)	L		L			L		06-07
Track	I		I			I		06-08
Track tension and alignment	A	AS REQUIRED						06-08
STEERING/FRONT SUSPENSION								
Steering and front suspension mechanism (2)	I,L		I	L		I,L		08-01 and 08-02
Wear and condition of skis and runners	I	I				I		08-02
SUSPENSION								
Suspension adjustments	A	AS REQUIRED						Section 07 or 08, see the appropriate subsection
Suspension (2)	I		I,L			I,L		
Suspension stopper strap				I		I		
ELECTRICAL								
EMS fault codes (4)	I				I			04-03
Spark plugs (1) (4)	I		I				R	05-01
Battery (if so equipped)	I		I			I	I	05-02
Wiring harnesses, cables and lines (4)	I		I			I		09-01
Operation of lighting system (HI/LO beam, brake light, etc.) test operation of engine cut-out switch and tether cut-out switch	I	I				I		Operator's Guide and/or 05–05
VEHICLE								
Headlamp beam aiming				A			A	05-04
Engine compartment	C		C			C		01-02
Vehicle cleaning and protection	C		C			C		01-02

(1) To be performed by an authorized ski-doo dealer.

(2) Lubricate whenever the vehicle is used in wet conditions (wet snow, rain, puddles).

(3) Before installing new spark plugs at preseason preparation, it is suggested to burn excess storage oil by starting the engine with the old spark plugs. Only perform this operation in a well-ventilated area.

(4) Emission-related.

(5) Summit models only.

STORAGE

SERVICE TOOLS

Description	Part Number	Page
cleat remover	529 028 700	5
narrow-cleat installer	529 028 800	5

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	5
BOMBARDIER LUBE	293 600 016	4, 6
BOMBARDIER scratch remover kit	861 774 800	6
fuel stabilizer	413 408 600	4
heavy duty cleaner (4 L)	293 110 002	6
heavy duty cleaner (spray can 400 g)	293 110 001	6
storage oil (Canada)	413 711 600	4
storage oil (USA)	413 711 900	4
suspension synthetic grease	293 550 033	5
vinyl & plastic cleaner (6 x 1 L)	413 711 200	6

GENERAL

Proper snowmobile storage is a necessity during the summer months or when a vehicle is not being used for more than one month.

Refer to storage column from MAINTENANCE CHART jointly with the present storage procedure in order to cover each and every aspect of the snowmobile storage procedure. Any worn, broken or damaged parts should be replaced.

⚠ WARNING

Unless otherwise specified, engine should be turned off for storage procedure.

ENGINE

Rewind Starter and Rope

For inspection, cleaning and lubrication, refer to ENGINE section.

Engine Motor Mounts

Check if engine supports are cracked, bent or otherwise damaged. Replace if necessary.

Check rubber mount on engine supports. Replace them if brittle, cracked or otherwise damaged.

Exhaust System

Check and replace if necessary:

– tuned pipe shield for damages
– tuned pipe ends for cracks or damages
– manifold for cracks or damages.

Engine Lubrication

NOTE: Be sure to add fuel stabilizer before starting the engine.

Engine internal parts must be lubricated to protect them from possible rust formation during the storage period.

Proceed as follows:

Start the engine and allow it to run at idle speed until the engine reaches its operating temperature.

⚠ WARNING

Ensure the track is free of particles which could be thrown out while it is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle.

Stop the engine.

Remove air silencer to spray storage oil into each carburetor/throttle body.

Restart engine and run at idle speed.

Inject storage oil until the engine stalls or until a sufficient quantity of oil has entered the engine (approximately half a can).

With the engine stopped, remove the spark plug and spray storage oil (Canada) (P/N 413 711 600) or storage oil (USA) (P/N 413 711 900) into each cylinder.

Crank slowly 2 or 3 revolutions to lubricate cylinders.

Reinstall the spark plugs and air silencer.

⚠ WARNING

This procedure must only be performed in a well-ventilated area. Do not run engine during storage period.

Cooling System

For coolant replacement, refer to ENGINE section.

Crankshaft PTO Seal

Make sure there is no grease coming out from crankshaft PTO seal, if so replace seal, refer to ENGINE section.

Injection Oil Filter

Replace injection oil filter, refer to ENGINE section.

Rags in Air Intake and Exhaust System

Block air intake hole and exhaust system hole using clean rags.

FUEL SYSTEM

Fuel Stabilizer

It is critical to use the fuel stabilizer (P/N 413 408 600) (250 mL) to prevent fuel deterioration, gum formation and fuel system components corrosion. Follow manufacturer's instructions for proper use.

Pour fuel stabilizer in fuel tank prior to starting engine for internal parts lubrication so that stabilizer flows everywhere in fuel system. Fill up fuel tank completely. Ensure there is no water inside fuel tank.

CAUTION: Should any water be trapped inside fuel tank, severe internal damage will occur to the fuel injection system (if so equipped).

Do not drain fuel system.

CAUTION: Fuel stabilizer should be added prior to engine lubrication to ensure carburetor protection against varnish deposit.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Fuel tank may be pressurized, slowly turn cap when opening. Never use an open flame to check fuel level. When fueling, keep vehicle level. Do not overfill or top off the fuel tank and leave vehicle in the sun. As temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage from the vehicle. Periodically inspect fuel system.

DRIVE SYSTEM

Drive and Driven Pulley

After inspection and interior cleaning of pulleys, spray BOMBARDIER LUBE (P/N 293 600 016) on sheaves. Do not reinstall drive belt.

Brake Fluid

Replace brake fluid, refer to DRIVE SYSTEM section.

Drive Chain Tension

Summit Models

Check drive chain tension and adjust if necessary, refer to DRIVE SYSTEM section.

Mach Z

There is no adjustments possible on this model, refer to DRIVE SYSTEM section for details.

Chaincase Oil

Replace chaincase oil, refer to DRIVE SYSTEM section.

Drive Axle End Bearing

Lubricate end housing bearing with suspension synthetic grease (P/N 293 550 033). Continue lubricating until grease flows out of the pilot hole on speedometer sensor.

Countershaft

Driven pulley and brake disc must be floating on the countershaft for efficient operation. Lubricate with anti-seize lubricant (P/N 293 800 070).

CAUTION: Do not lubricate excessively as lubricant could contact and soil brake pads and/or drive belt.

Track

Visually inspect track for:

– cuts and abnormal wear
– broken rods
– broken or missing track cleats.

If track is damaged or rods are broken, replace track, refer to DRIVE SYSTEM section.

For damaged or missing cleats, replace by new ones, using cleat remover (P/N 529 028 700). Use narrow-cleat installer (P/N 529 028 800).

STEERING/FRONT SUSPENSION

Steering and Front Suspension Mechanism Lubrication

Lubricate the steering mechanism if needed. Inspect all components for tightness.

Wear and Condition of Skis and Runners

Inspect skis and runners for wear, deterioration or damage, replace if necessary.

SUSPENSION

Rear Suspension Lubrication

Inspect rear suspension components for wear, deterioration or damage, replace defective parts if necessary.

Lubricate front and rear arms at grease fittings using suspension synthetic grease (P/N 293 550 033).

Suspension Stopper Strap

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace if necessary.

ELECTRICAL

Battery (if so equipped)

Remove battery, clean its tray and close area with water and baking soda.

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery.

Charge battery as explained in ELECTRICAL section.

Wiring Harnesses, Cables and Lines

Inspect for wear, deterioration or damage, replace defective parts if necessary.

VEHICLE

Engine Compartment

Keep clean of grass, twigs, cloth, etc. These are combustible under certain conditions.

Vehicle Cleaning

To facilitate the inspection and ensure adequate lubrication of components, it is recommended to clean the entire vehicle.

Remove any dirt or rust.

To clean the entire vehicle, use only flannel cloths or equivalent.

CAUTION: It is necessary to use flannel cloths or equivalent on windshield and hood to avoid further damaging surfaces to clean.

To clean the entire vehicle, including bottom pan and metallic parts use heavy duty cleaner (spray can 400 g) (P/N 293 110 001) or heavy duty cleaner (4 L) (P/N 293 110 002).

CAUTION: Do not use Heavy duty cleaner on decals or vinyl.

For vinyl and plastic parts use vinyl & plastic cleaner (6 x 1 L) (P/N 413 711 200).

To remove scratches on windshield or hood use BOMBARDIER scratch remover kit (P/N 861 774 800).

CAUTION: Never clean plastic parts or hood with strong detergent, degreasing agent, paint thinner, acetone, products containing chlorine, etc.

Inspect the hood and repair any damage.

Touch up all metal spots with touch-up paint where paint has been scratched off.

Spray all bare metal parts including shock chromed rods with BOMBARDIER LUBE (P/N 293 600 016).

Wax the hood and the painted portion of the frame for better protection. Use a non-abrasive wax such as silicone wax.

NOTE: Apply non-abrasive wax on glossy finish only.

Vehicle Protection

Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: The snowmobile has to be stored in a cool and dry place and covered with an opaque but ventilated tarpaulin. This will prevent sun rays and grime from affecting plastic components and vehicle finish.

Lift rear of vehicle until track is clear of the ground. Install on a snowmobile mechanical stand.

NOTE: Do not release track tension.

PRESEASON PREPARATION

SERVICE PRODUCTS

Description	Part Number	Page
pulley flange cleaner	413 711 809	7–8
XP-S synthetic chaincase oil	413 803 300	8

Proper vehicle preparation is necessary after the summer months or when a vehicle has not been used for more than one month.

Refer to preseason preparation column from MAINTENANCE CHART jointly with the present preseason preparation procedure in order to cover each and every aspect of the snowmobile preseason preparation procedure.

Any worn, broken or damaged parts found during the storage procedure should have been replaced. If not, proceed with the replacement.

⚠ WARNING

Unless otherwise specified, engine should be turned off for preparation procedure.

ENGINE

Rags in Air Intake and Exhaust System

Remove rags that were installed during STORAGE preparation.

Rewind Starter and Rope

Check if rope is fraying, replace if so.

When pulling starter grip, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

Cooling System

Inspect cooling system for leaks, to perform a cooling system leak test, refer to ENGINE section.

Check coolant level in coolant reservoir. Add coolant if necessary.

If engine is cold, refill up to 15 mm (5/8 in) over COLD level line.

If engine is hot, refill up to 25 mm (1 in) over COLD level line.

Oil Injection Pump

Make sure oil injection pump is properly adjusted, refer to ENGINE section.

FUEL SYSTEM

Fuel Filter

Replace fuel filter, refer to FUEL SYSTEM section.

Fuel Lines, Fuel Rails and Connections

Inspect fuel system for leaks, to perform a fuel system pressurization, refer to FUEL SYSTEM.

Throttle Cable

Make sure that throttle cable operate freely, replace if necessary, refer to ENGINE MANAGEMENT SYSTEM.

Air Filter/Air Intake System

Check that inside of air silencer is clean and dry then properly reinstall the filter, refer to ENGINE SYSTEM.

CAUTION: These snowmobiles have been calibrated with the filter installed. Operating the snowmobile without it, may cause engine damage.

Throttle Body

Remove the throttle body from vehicle.

Using the pulley flange cleaner (P/N 413 711 809), remove the dirt ejected by the drive belt from the throttle plate and from both throttle body bores. After throttle body installation, adjust throttle and injection oil cables.

DRIVE SYSTEM

Drive Belt

Inspect belt for cracks, fraying or abnormal wear. Replace if necessary.

Make sure to install the proper belt with arrow printed on belt pointing front of vehicle.

Drive and Driven Pulley

Clean drive and driven pulleys sheaves with pulley flange cleaner (P/N 413 711 809).

Tightening Torque of Drive Pulley Screw

Retorque if necessary drive pulley screw to 88 N•m (65 lbf•ft).

Tightening Torque of Ring Gear Screws

Retorque if necessary ring gear screws to 53 N•m (39 lbf•ft).

NOTE: If a screw is loose, remove screw, clean screw and pulley flange hole. Retorque screw to 53 N•m (39 lbf•ft).

Brake Fluid

Check brake fluid in reservoir for proper level. Add fluid (DOT 4) as required.

CAUTION: Use only (DOT 4) brake fluid from a sealed container. Do not store or use a started bottle of brake fluid.

Drive Pulley Ramp and Roller

Check drive pulley ramps and rollers for wear, refer to DRIVE SYSTEM.

Brake Hose, Pads and Disk

Inspect brake hose for wear, deterioration or damage, replace if necessary.

Inspect brake pads for proper thickness. Refer to DRIVE TRAIN section and the appropriate subsection.

Remove any rust built-up on braking surfaces. Clean brake disk braking surfaces with pulley flange cleaner (P/N 413 711 809).

Chaincase Oil

Check chaincase oil for proper level. Add XP-S synthetic chaincase oil (P/N 413 803 300) chaincase oil as required.

Track Tension and Alignment

Verify track tension and alignment, refer to DRIVE SYSTEM section and the appropriate subsection.

NOTE: Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

ELECTRICAL SYSTEM

Battery (if so equipped)

Verify that battery is fully charged, if not, refer to the appropriate charging procedure in ELECTRICAL SYSTEM section.

⚠ WARNING

Always wear safety glasses and charge in a ventilated area. Never charge or boost battery while installed on vehicle. Do not open the sealed caps during charging. Do not place battery near open flame.

Spark Plugs

Once preseason preparation is done, start engine with the old spark plug(s) to burn excess storage oil. Then, install new properly gapped spark plug(s).

VEHICLE

Headlamp Beam Aiming

Verify beam aiming and adjust if necessary, refer to ELECTRICAL SYSTEM section.

LEAK TEST

SERVICE TOOLS

Description	Part Number	Page
exhaust plates	529 035 999	9
intake plugs	529 036 000	10
RAVE plates	529 036 003	11
small hose pincher	295 000 076	10
vacuum/pressure pump kit	529 021 800	9

LEAK TEST

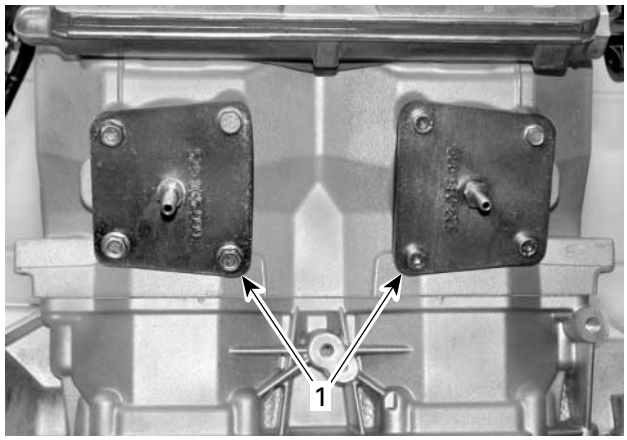
Use vacuum/pressure pump kit (P/N 529 021 800) to pressure test engine. The following gives verification procedures for liquid cooled engines.

529 021 800

PREPARATION

Remove tuned pipe and install two exhaust plates (P/N 529 035 999).

529 035 999



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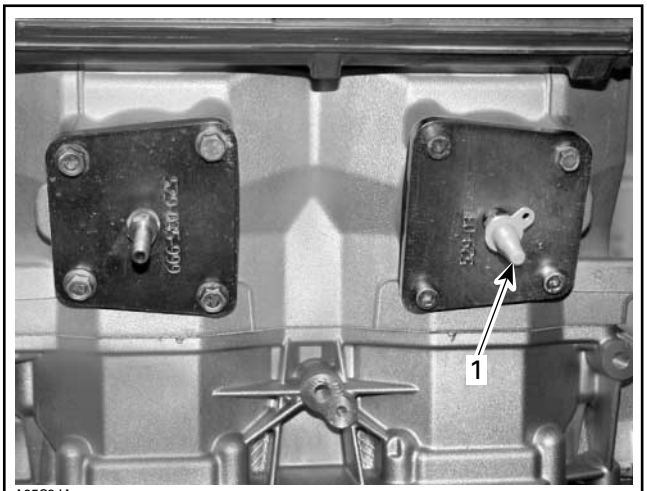
1. Exhaust plates

Block one fitting with a cap.



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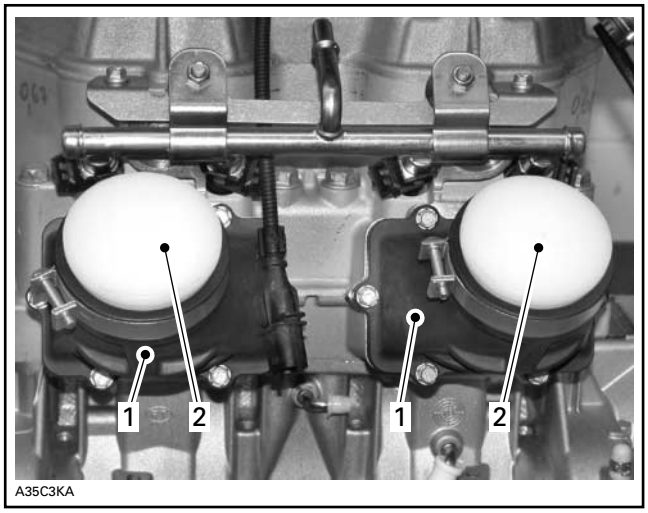
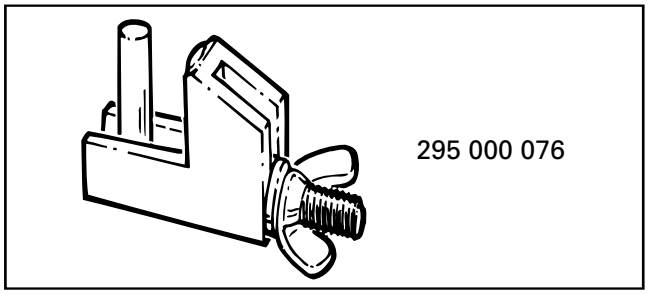
1. Rubber cap

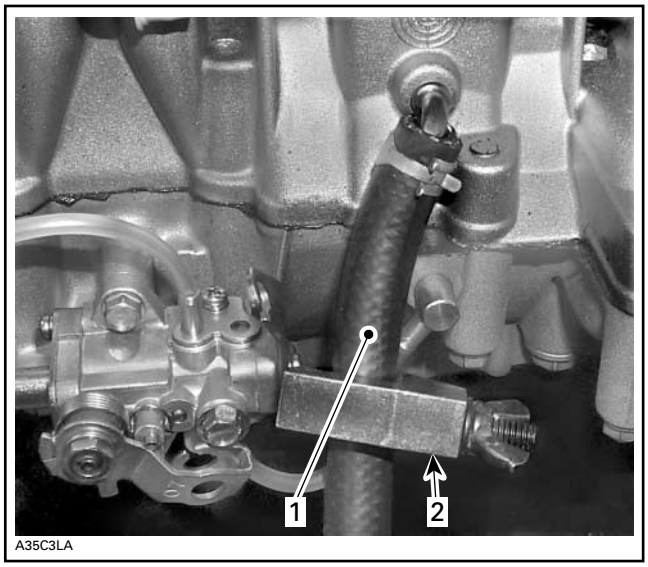
Install intake plugs (P/N 529 036 000) in the intake rubber boots.



1. Intake rubber boots
2. Intake plugs

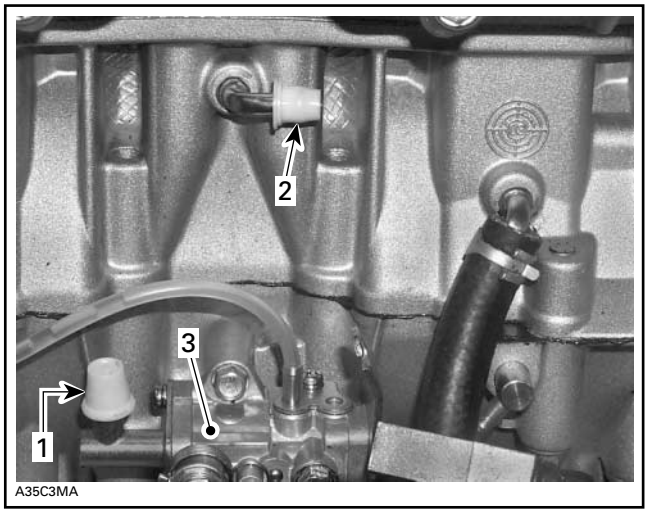
Using a small hose pincher (P/N 295 000 076), block impulse hose.





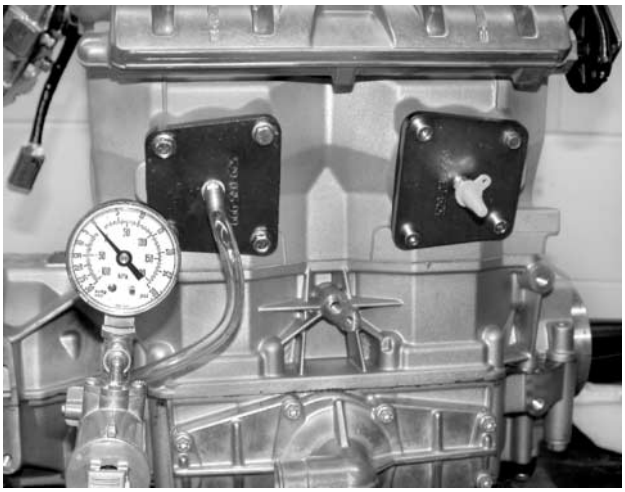
1. Impulse line
2. Hose pincher

Block inlet and outlet fitting of oil injection system with rubber cap.



1. Inlet fitting
2. Outlet fitting
3. Oil injection pump

Install the vacuum/pressure pump on exhaust plate fitting.

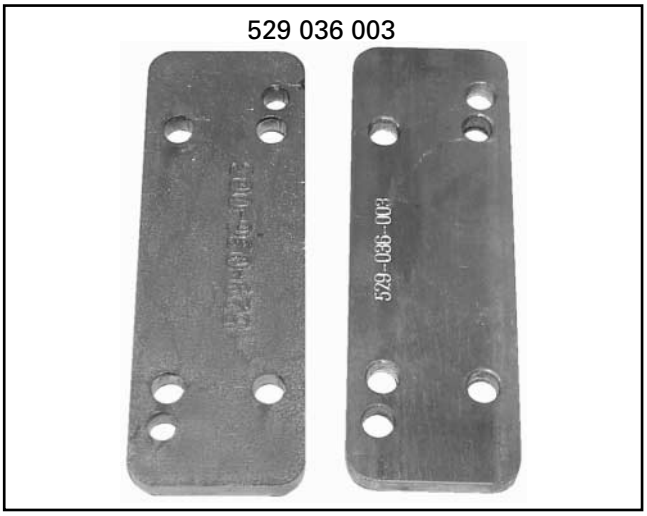

A35C3NA

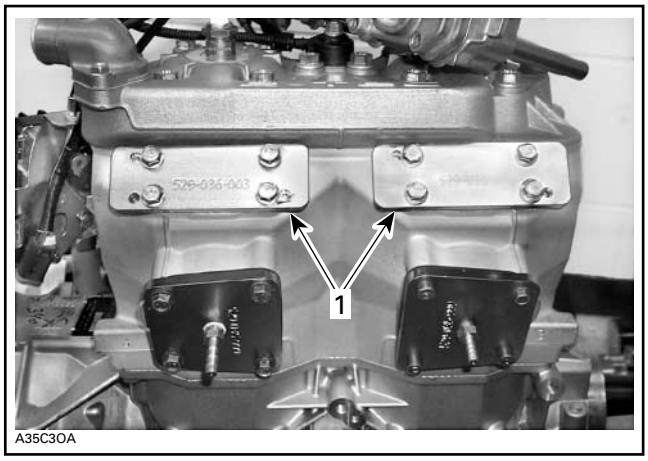
NOTE: If necessary, lubricate air pump piston with mild soap.

CAUTION: Using hydrocarbon lubricant (such as engine oil) will damage rubber seal of pump piston.

Two leak tests must be performed, without RAVE valves and with RAVE valves.

To perform the first test, remove the RAVE valve cover and its gasket then replace the cover by two RAVE plates (P/N 529 036 003).



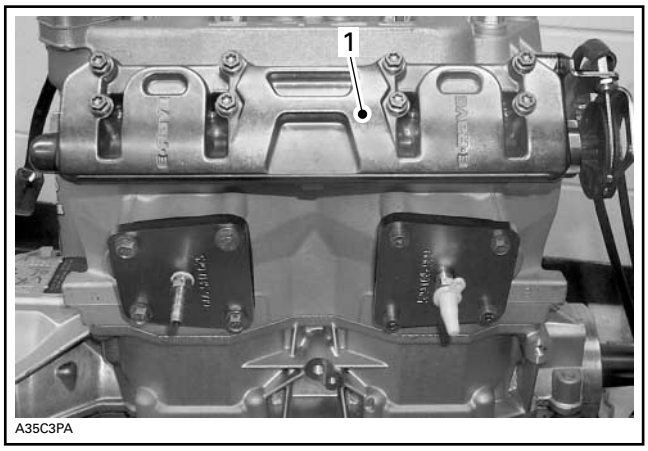


A35C3OA

1. RAVE plates

Execute the test. Refer to PROCEDURE further in this section.

To perform the second test, the RAVE cover must be in place.



A35C3PA

1. RAVE cover

PROCEDURE

Using flow chart at the end of this section and following text, pressurize area to be tested and spray soapy solution at the indicated location.

TEST PRESSURE: 34 KPA (5 PSI) FOR 3 MINUTES

- If there is a leak at the tested location, it is recommended to continue testing next items before overhauling engine. There is a possibility of more than one leak.

- If there is no leak at the tested location, continue pumping to maintain pressure and continue with next items until leak is found.

Tools

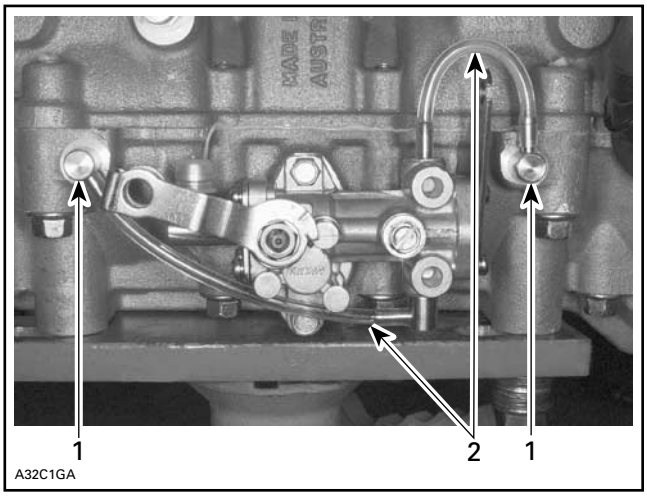
Check all tools used for the test:

– exhaust plates and the cap on the fitting
– plugs in intake rubber boots
– hose pincher on impulse hose
– rubber caps on inlet and outlet fittings of oil injection system
– RAVE plates (if so installed)
– pump and hose.

Engine

Check the following:

– Spark plugs base and insulators.
– All jointed surfaces:
  - cylinder head
  - cylinder
  - RAVE valve cover (if so installed)
  - injectors area
  - decompressor areas
  - cylinder crankcase halves (joint)
  - counter balancing shaft outer seals and their filling tubes
  - crankshaft seals (PTO and MAG sides)
  - oil injection pump mounting flange (O-ring)
  - coolant pump housing
  - crankcase grease reservoir fitting.
– Small injection oil lines coming from pump.



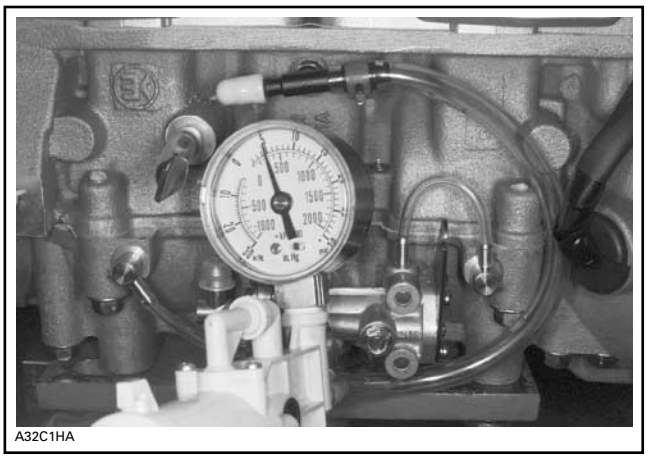
TYPICAL
1. Injection nipples
2. Small injection oil lines

Check for air bubbles or oil column going toward pump. It indicates defective check valve in injection nipples.

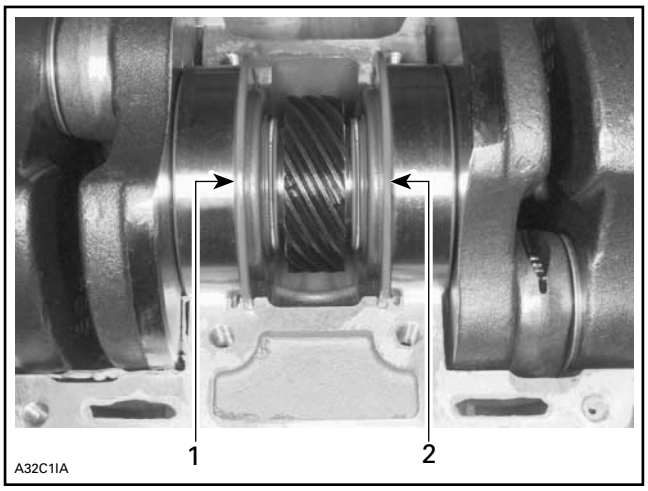
Check pump shaft gear oil reservoir.

Pump Shaft Oil Gear Reservoir

Install air pump on adapter and pressurize as above.

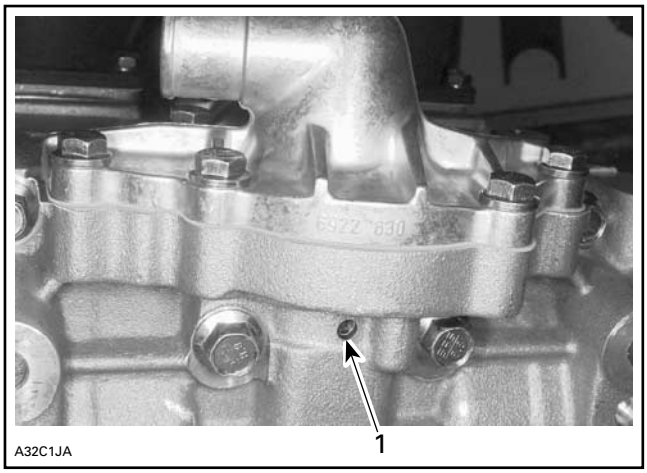


If pressure drops, it indicates a defective crankshaft inner seal.



TYPICAL — CRANKSHAFT INSTALLED IN UPPER HALF CRANKCASE
1. Crankshaft inner seal on PTO side
2. Crankshaft inner seal on MAG side

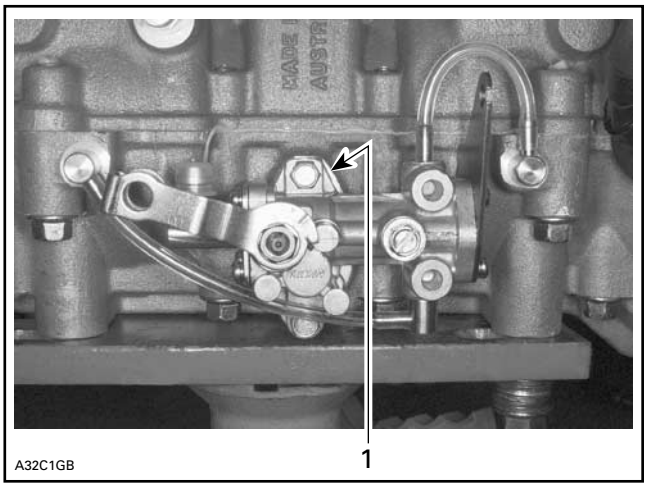
– Check leak indicator hole below coolant pump housing with soapy water.



1. Leak indicator hole

If there is a leak, it indicates that a pump shaft is defective (oil seal beside coolant ceramic seal).

– Leaks can be also on oil pump side. Check mounting area for leaks.



TYPICAL
1. Check mounting area

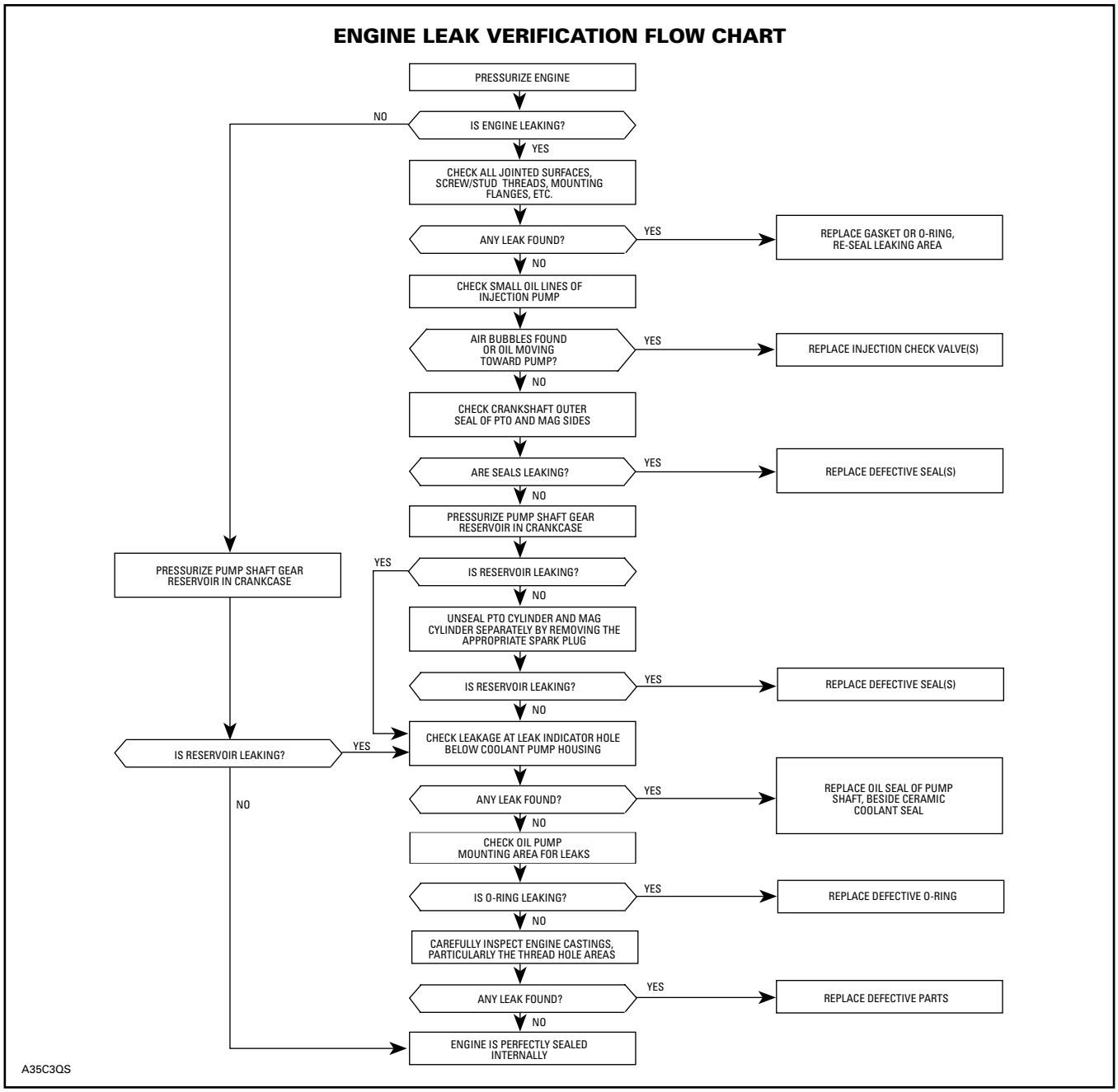
– If leak still persists, it indicates a defective casting somewhere in engine.

Disassemble engine and carefully check for defects in castings. Pay attention to tapped holes which may go through engine sealed area and thus lead to leakage.

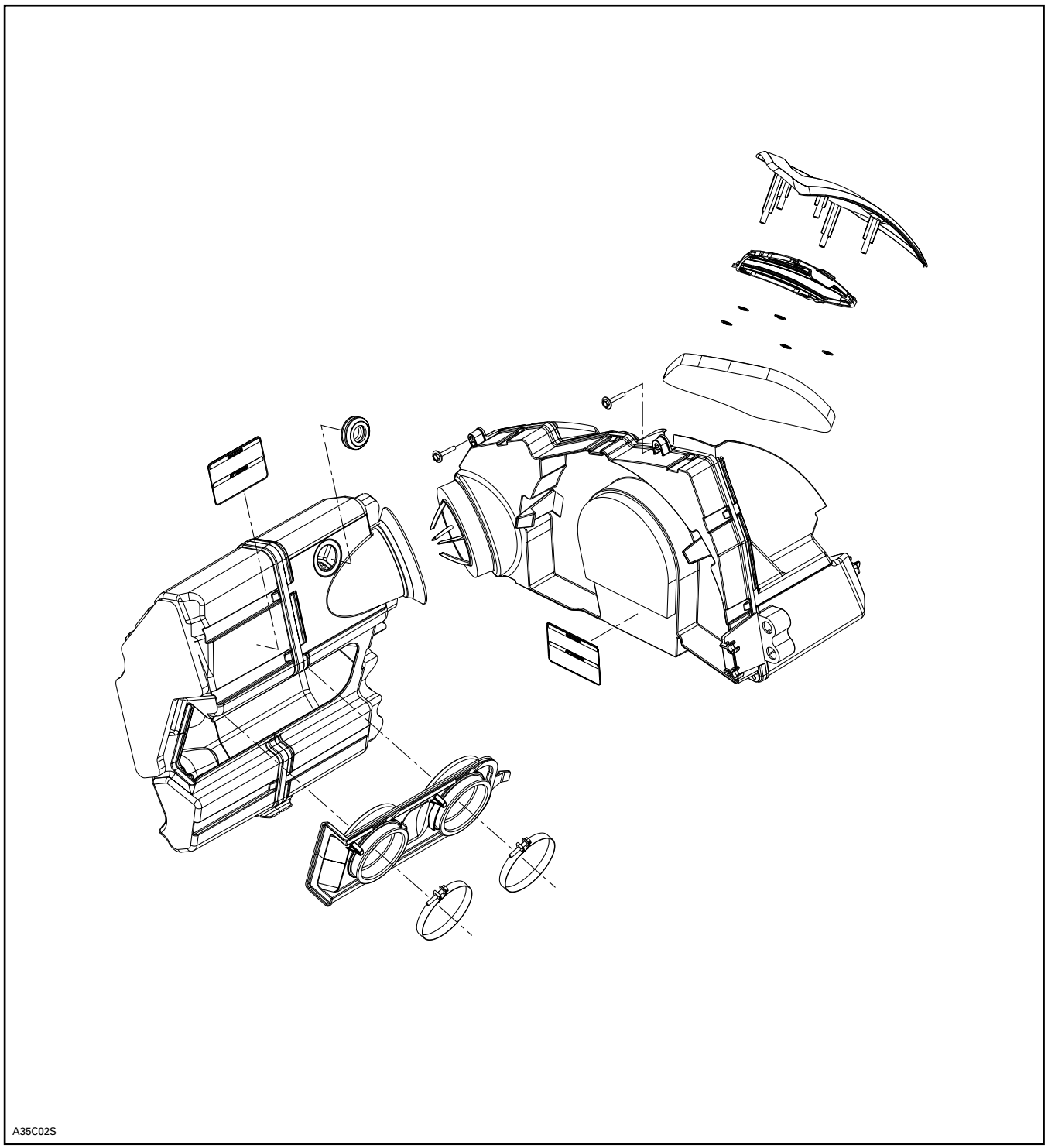
FINALIZING REASSEMBLY

After reassembling engine, always recheck for leakage.

ENGINE LEAK VERIFICATION FLOW CHART



AIR INTAKE SYSTEM



A35C02S

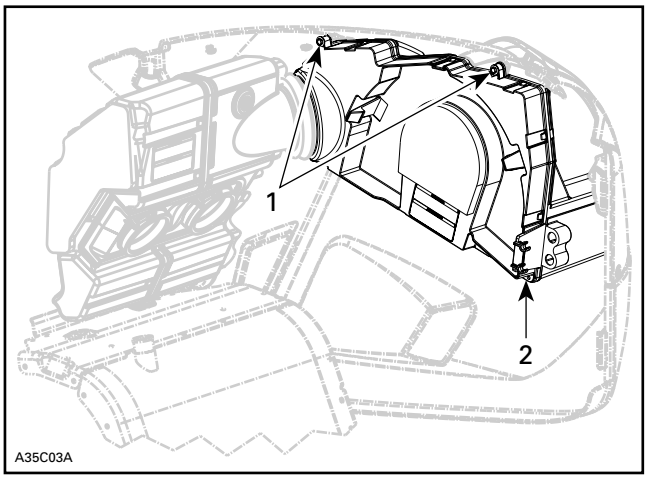
AIR FILTER/AIR INTAKE SILENCER REMOVAL (BODY SIDE)

Open LH side panel.

Unplug air pressure sensor connector.

Remove screws retaining air intake silencer to LH side panel.

Remove air intake silencer (body side).

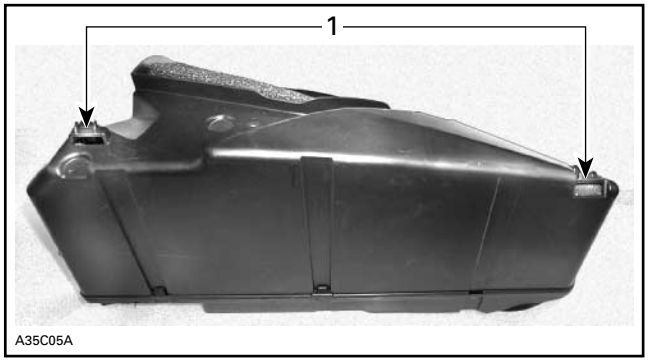


1. Remove screws
2. Air intake silencer (body side)

1. Remove air filter

AIR FILTER/AIR INTAKE SILENCER INSTALLATION (BODY SIDE)

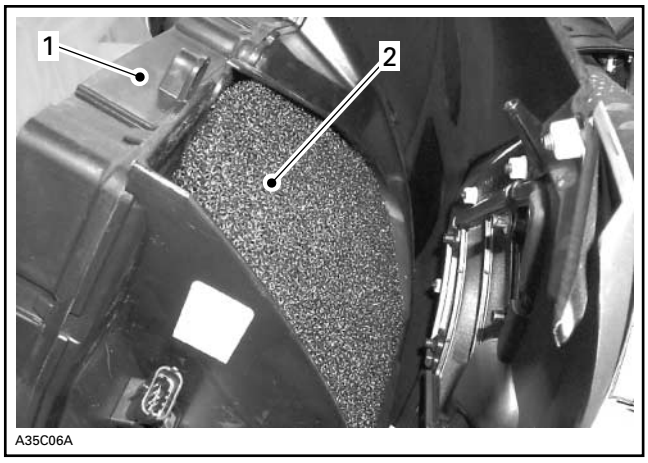
Position lower section of air intake silencer on LH side panel using locating holes.



1. Locating holes

Install air filter on air intake silencer.

NOTE: Make sure air filter stays in place at installation.



1. Air intake silencer (body side)
2. Air filter

Position upper section of air intake silencer on LH side panel and secure with screws.

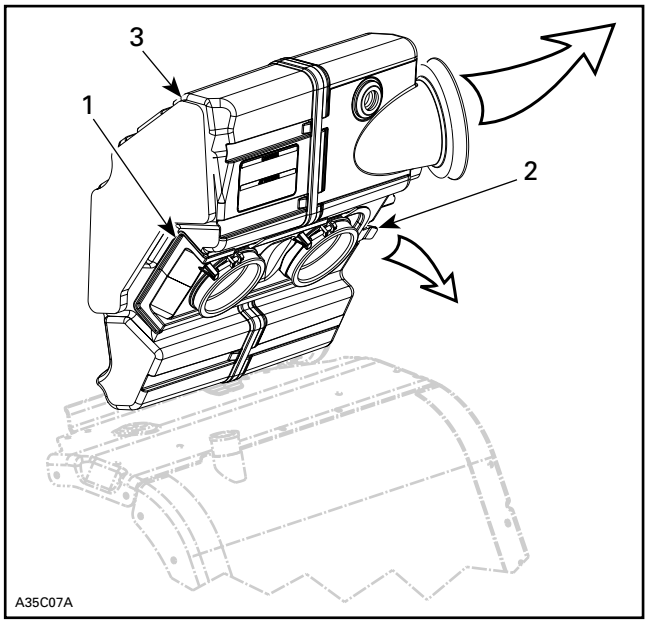
AIR INTAKE SILENCER REMOVAL (ENGINE SIDE)

Open LH side panel.

Unplug air temperature sensor connector.

Release locking tab of adapter plate.

Pull on air intake silencer to remove.



1. Adaptor plate
2. Locking tab
3. Air intake silencer

AIR INTAKE SILENCER INSTALLATION (ENGINE SIDE)

The installation is the reverse of the removal procedure.

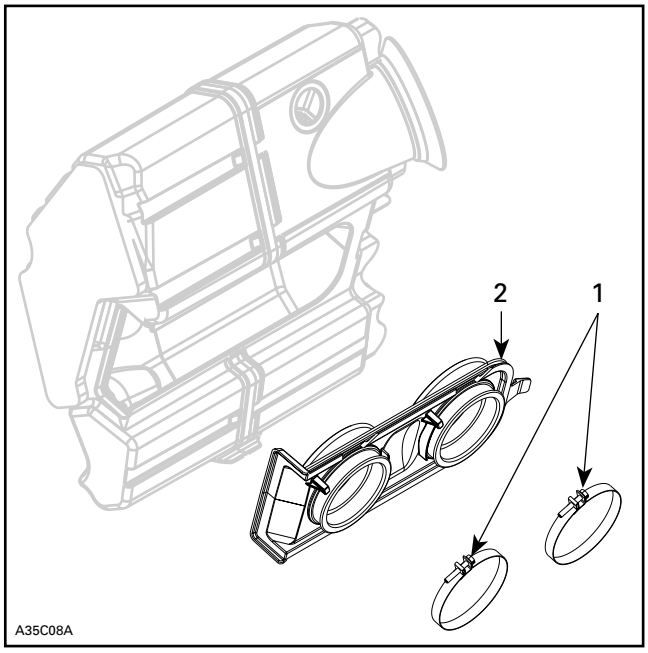
ADAPTOR PLATE REMOVAL

Open LH side panel.

Remove air intake silencer (engine side), refer to procedure above.

Unscrew clamps from throttle body.

Remove adaptor plate.



1. Clamps
2. Adaptor plate

ADAPTOR PLATE INSTALLATION

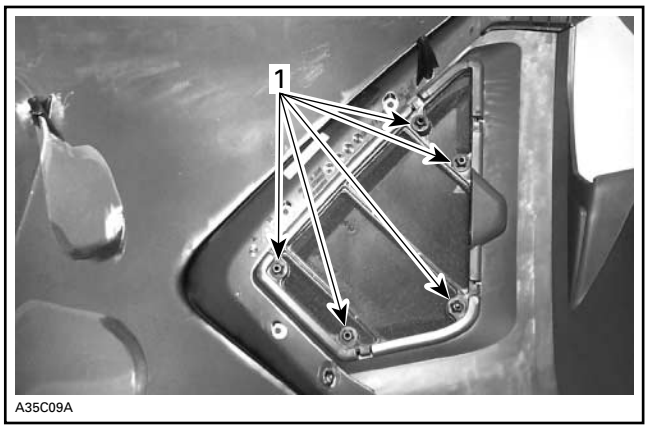
The installation is the reverse of the removal procedure.

INTAKE DEFLECTOR/FILTER REMOVAL

Open LH side panel.

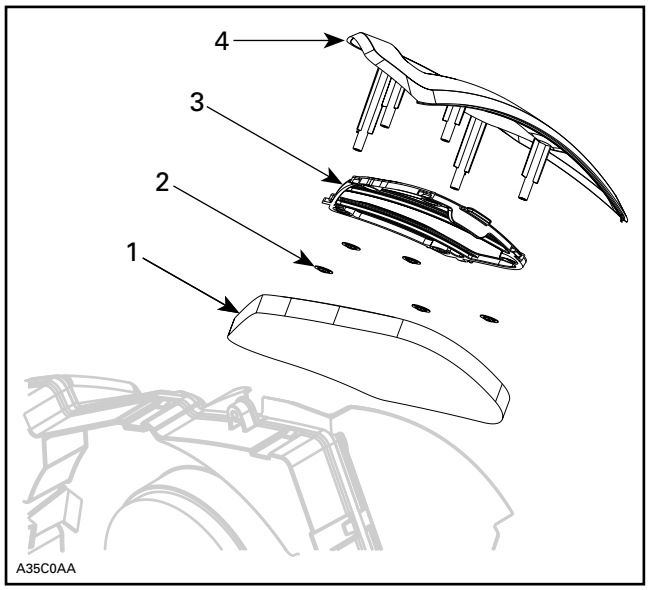
Remove air intake silencer (body side), refer to procedure above.

Remove push nuts retaining intake deflector to LH side panel.



1. Push nuts

Remove intake deflector and filter.



1. Air filter
2. Push nut
3. Intake filter
4. Intake deflector

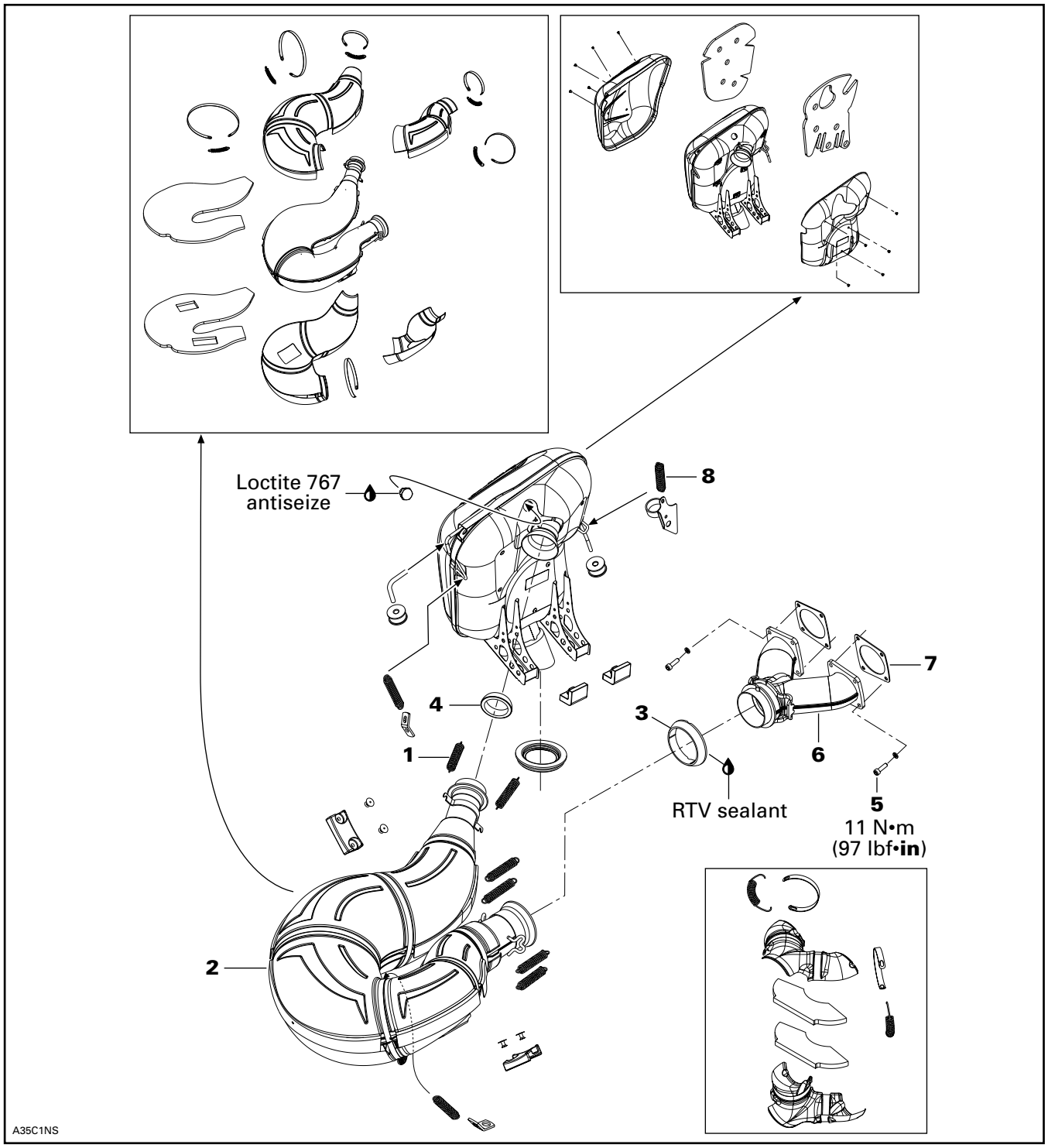
EXHAUST SYSTEM

SERVICE TOOLS

Description	Part Number	Page
exhaust spring installer/remover	529 035 401	23
exhaust spring installer/remover	529 035 989	21–22

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 767 antiseize	293 800 070	23
RTV sealant	293 800 090	22


Loctite 767
antiseize
8
7
4
3
6
1
RTV sealant
5
11 N•m
(97 lbf•in)
2
A35C1NS

GENERAL

During assembly/installation, use torque values and service products as shown in exploded view(s).

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

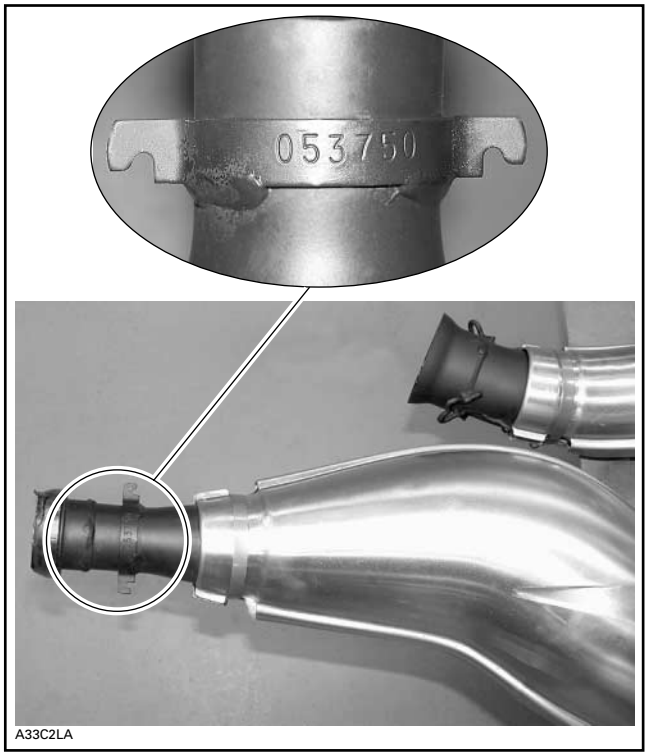
⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

TUNED PIPE

Identification

Each tuned pipe is identified by a number. To use the proper tuned pipe with the proper vehicle, check the number on the welded clamp at the end of tuned pipe. This number depicts the 6 last numbers of BRP part number.



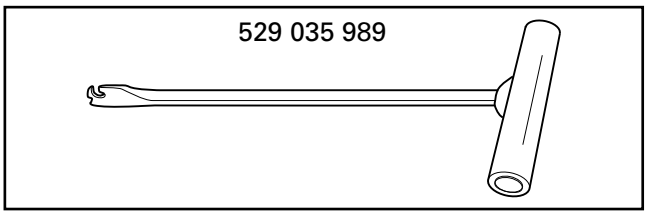
TYPICAL

Removal

Open hood and right side panel.

Remove:

– all exhaust springs **no. 1** using exhaust spring installer/remover (P/N 529 035 989)



– tuned pipe **no. 2**
– exhaust gasket **no. 3** and **no. 4**.

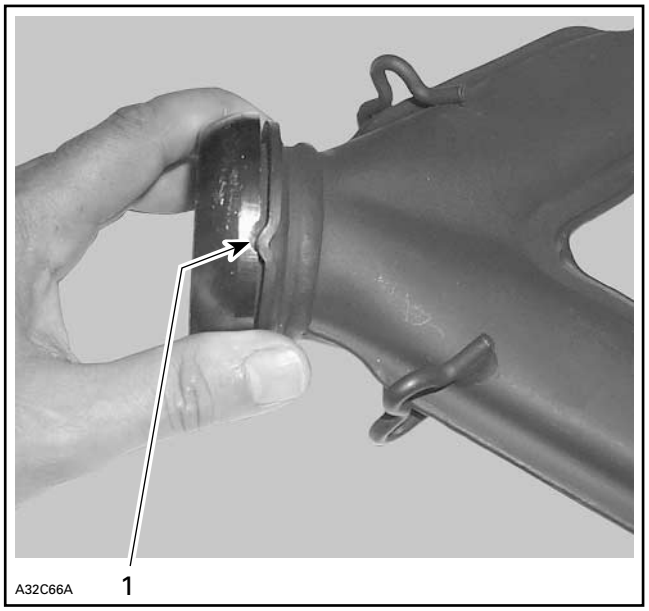
Inspection

Check:

– tuned pipe shield for damages
– tuned pipe ends for cracks or damages.

Installation

Install doughnut shaped exhaust gasket **no. 3** with both of its notches aligned with Y-manifold protrusions.



1. Align notches

If the gaskets are damaged, replace them.

Use RTV sealant (P/N 293 800 090) on doughnut gasket prior to install tuned pipe.

Install all exhaust springs using exhaust spring installer/remover (P/N 529 035 989).

MANIFOLD

Removal

Remove:

– tuned pipe **no. 2**
– doughnut shaped exhaust gasket **no. 3**
– manifold screws **no. 5**

CAUTION: On engines with 6 mm (1/4 in) screws, heat screws for 30 seconds before loosening to prevent screw breakage.

– manifold **no. 6**
– gaskets **no. 7**.

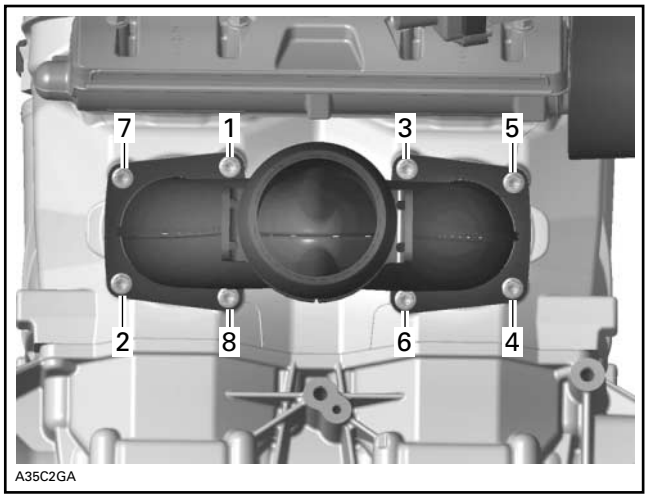
Inspection

Check if the manifold is cracked or damaged. Replace if necessary.

Installation

Install the manifold with new gaskets.

Torque manifold screws **no. 5** following this sequence.



Install tuned pipe.

MUFFLER

Identification

Each muffler is identified by a number. To use the proper muffler with the proper vehicle, check the number on the welded clamp at the end of muffler. This number depicts the 6 last numbers of BRP part number.

TYPICAL

Removal

Remove tuned pipe **no. 2**.

Remove springs no. 8 retaining the muffler no. 9. Use exhaust spring installer/remover (P/N 529 035 401).

Remove the muffler.

Inspection

Check the muffler for cracks or other damages.

Installation

For installation, reverse the removal procedure.

If the EGTS plug on muffler was removed, use Loctite 767 antiseize (P/N 293 800 070).

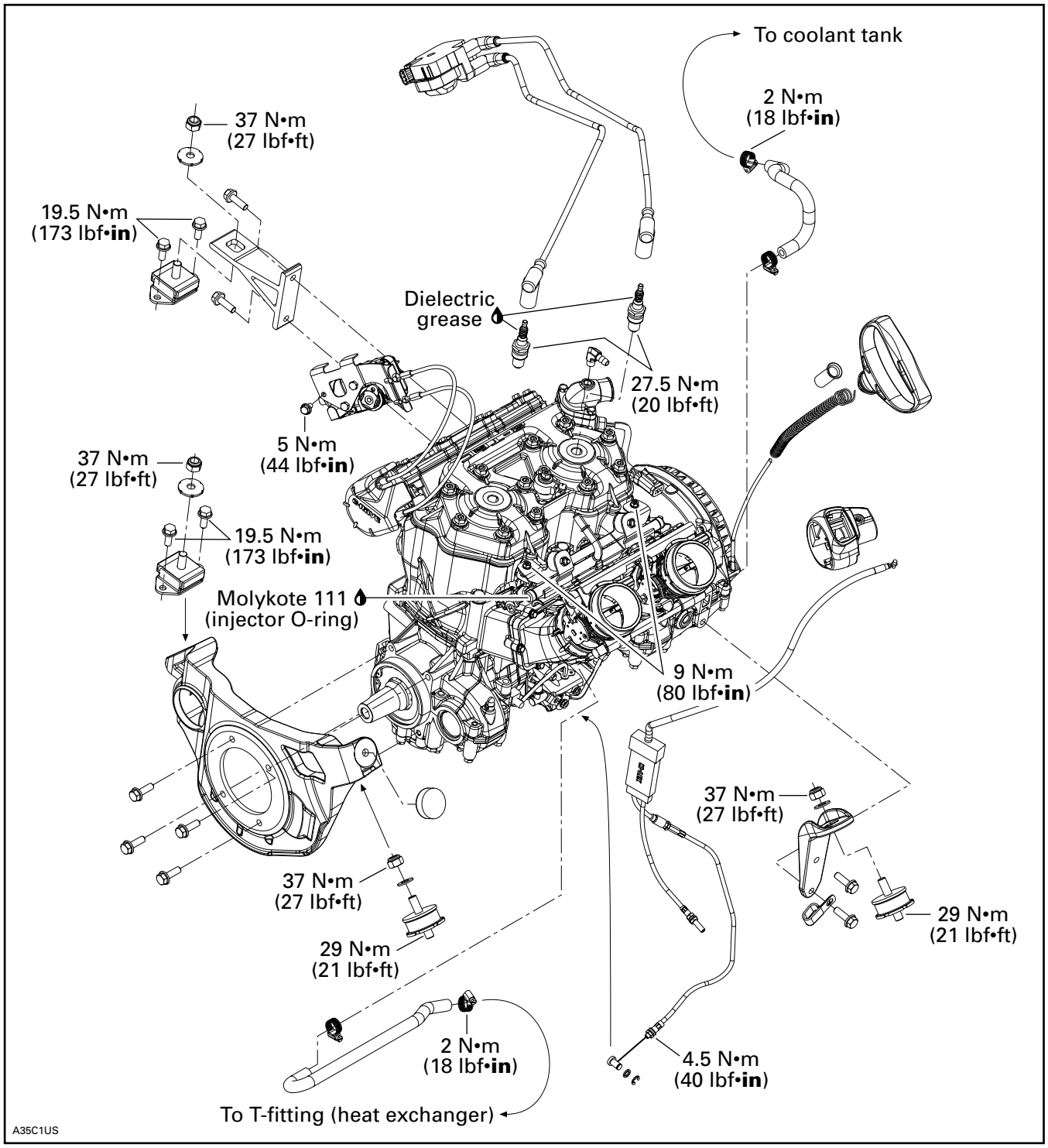
ENGINE REMOVAL AND INSTALLATION

SERVICE TOOLS

Description	Part Number	Page
engine removal hook	529 035 829	30
hose pincher	295 000 076	31
spark plug lift ring	529 035 830	30

SERVICE PRODUCTS

Description	Part Number	Page
Dielectric grease	293 550 004	33
Molykote 111	413 707 000	33


To coolant tank
2 N•m
(18 lbf•**in**)
37 N•m
(27 lbf•ft)
19.5 N•m
(173 lbf•**in**)
Dielectric
grease
27.5 N•m
(20 lbf•ft)
5 N•m
(44 lbf•**in**)
37 N•m
(27 lbf•ft)
19.5 N•m
(173 lbf•**in**)
Molykote 111
(injector O-ring)
9 N•m
(80 lbf•**in**)
37 N•m
(27 lbf•ft)
29 N•m
(21 lbf•ft)
37 N•m
(27 lbf•ft)
29 N•m
(21 lbf•ft)
2 N•m
(18 lbf•**in**)
4.5 N•m
(40 lbf•**in**)
To T-fitting (heat exchanger)
A35C1US

REMOVAL FROM VEHICLE

Place vehicle at workstation that will have access to an engine-lifting hoist.

Remove the following:

– windshield
– RH and LH side panels.

NOTE: On LH side panel, unplug APS (Air Pressure Sensor) connector.

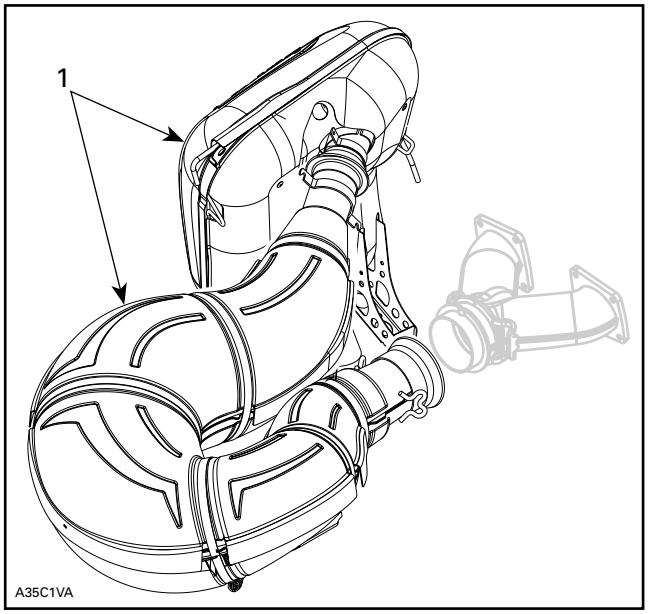
Using B.U.D.S., release fuel pressure from fuel system. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

Disconnect BLACK (-) cable from battery, then the RED (+) cable.

⚠ WARNING

Always disconnect battery or starter cables exactly in the specified order, BLACK (-) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

Remove tuned pipe and muffler. Refer to EXHAUST SYSTEM sub-section.

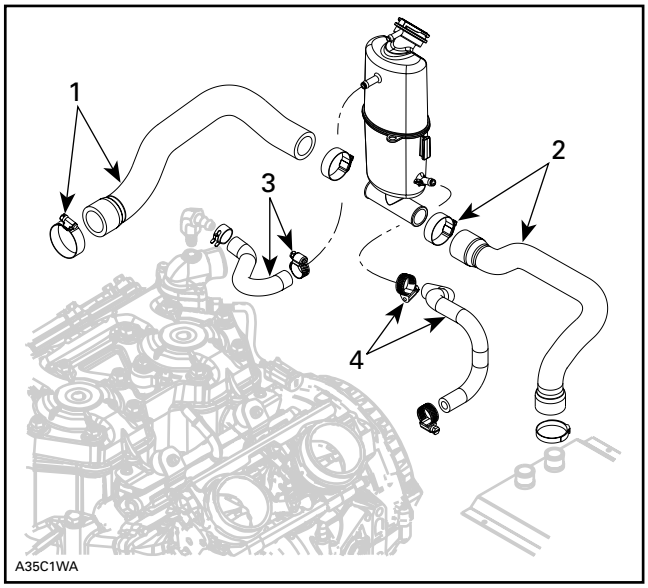


REMOVE
1. Tuned pipe and muffler

On Right Side of Vehicle, do the Following:

Drain cooling system. Refer to COOLING SYSTEM sub-section.

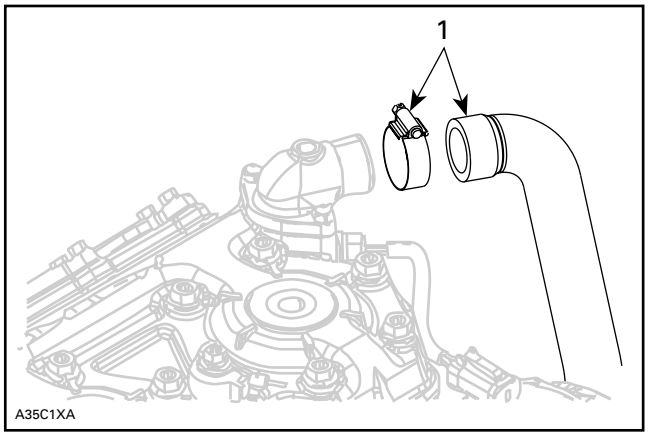
Unplug from the coolant reservoir the following:



UNPLUG
1. Engine inlet hose
2. Heat exchanger outlet hose
3. Bleed hose
4. Throttle body inlet hose

Remove coolant reservoir.

Unplug engine outlet hose.

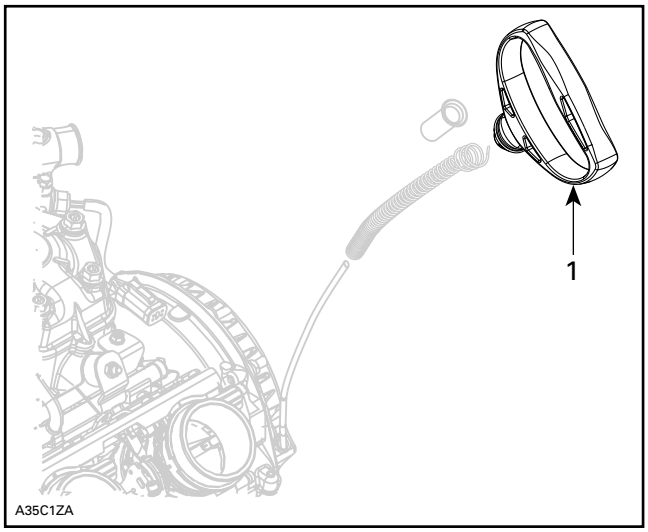


UNPLUG
1. Engine outlet hose

Unplug the following connectors:

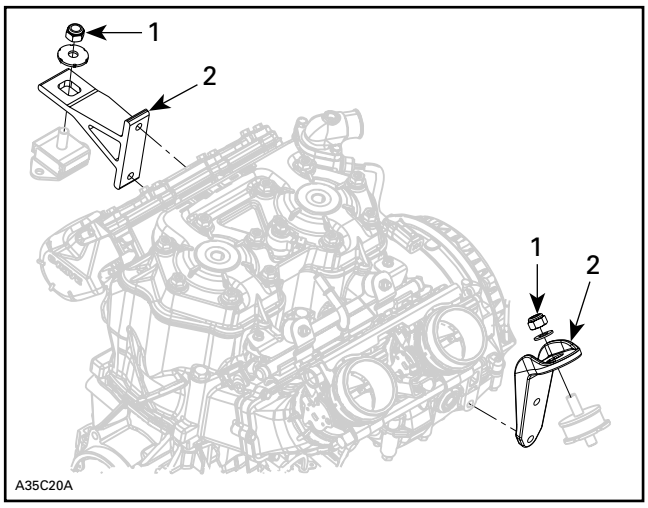
– magneto
– crankshaft position sensor (CPS)
– coolant temperature sensor (CTS)
– spark plug cables
– knock sensor
– ground cable from engine to frame.

Remove the following:



REWIND STARTER HANDLE REMOVAL
1. Rewind starter handle

NOTE: As an alternative method, the rewind starter can be removed from the engine and put aside.



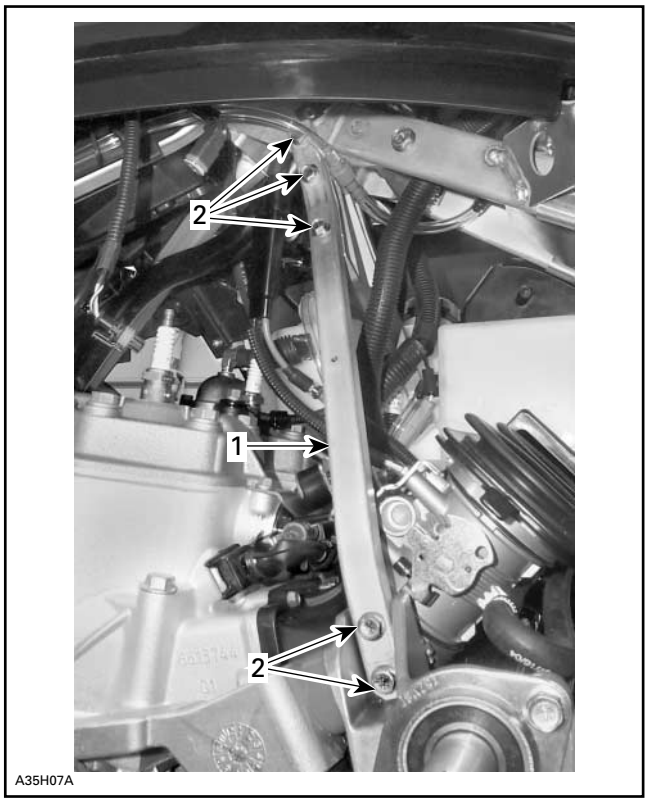
ENGINE SUPPORT NUTS REMOVAL
1. Nuts
2. Engine support

On Left Side of Vehicle, do the Following:

Remove:

– belt guard
– drive belt
– drive pulley (refer to DRIVE PULLEY subsection)
– driven pulley (refer to DRIVEN PULLEY subsection)
– air intake silencer (engine side), refer to AIR INTAKE SYSTEM section.

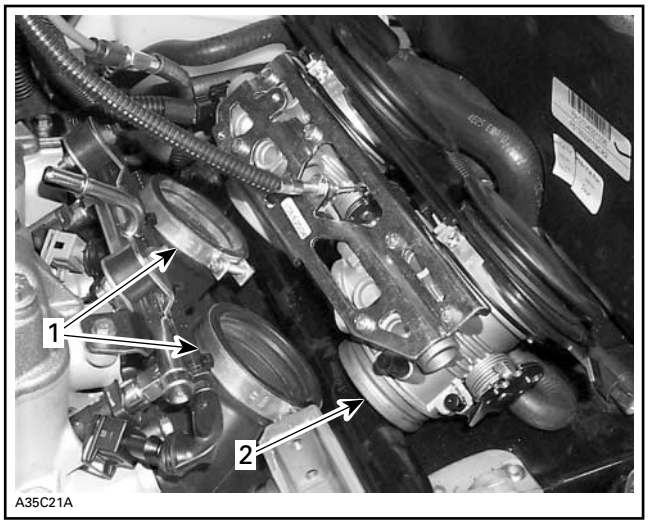
Remove LH handlebar support.



HANDLEBAR SUPPORT REMOVAL
1. Handle support
2. Bolts

Unscrew throttle body clamps.

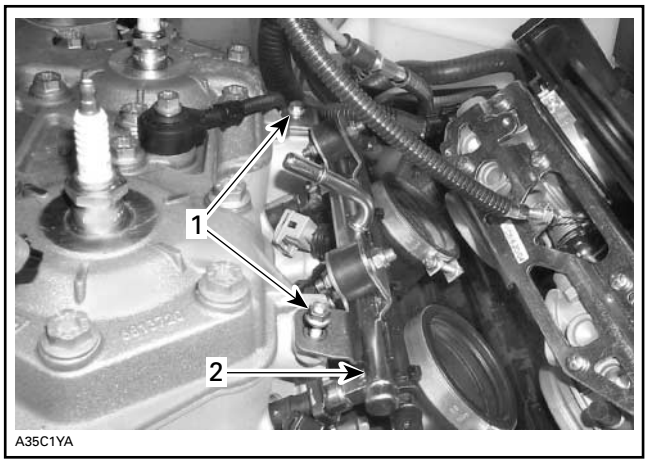
Remove throttle body from intake adapters with throttle cable and TPS connector in place.



THROTTLE BODY REMOVAL
1. *Clamps*
2. *Throttle body*

Unplug fuel filter line from fuel rail.

Unscrew and remove fuel rail from engine.

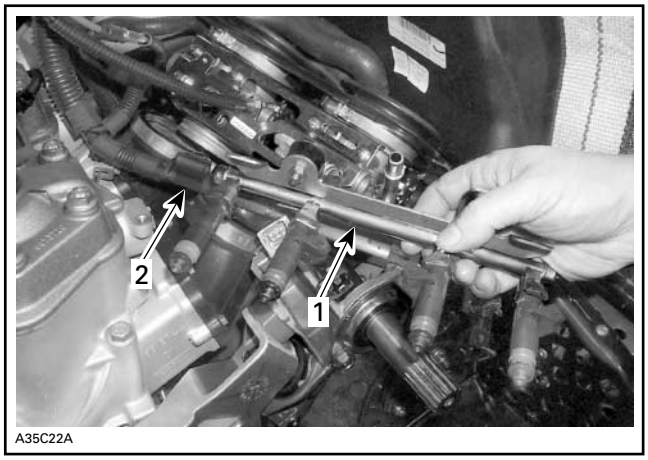


FUEL RAIL REMOVAL
1. *Screws*
2. *Fuel rail*

Unplug injectors and remove fuel rail from plastic retaining plate.

Put fuel rail aside.

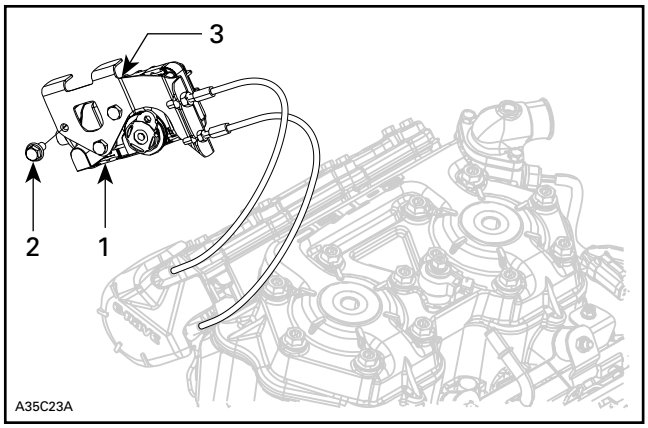
CAUTION: Take care not to damage fuel injectors.



FUEL RAIL DISASSEMBLY
1. *Fuel rail*
2. *Plastic retainer plate*

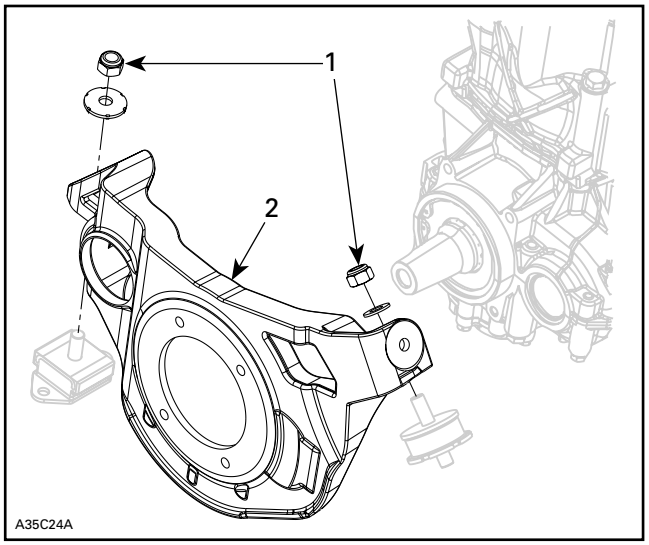
Unscrew E-RAVE actuator from frame.

Unplug connector and put E-RAVE actuator on top of engine.



E-RAVE ACTUATOR REMOVAL
1. *E-RAVE actuator*
2. *Unscrew*
3. *Connector*

Remove LH engine support nuts.

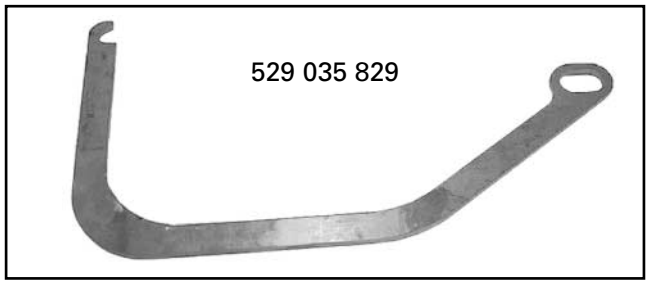


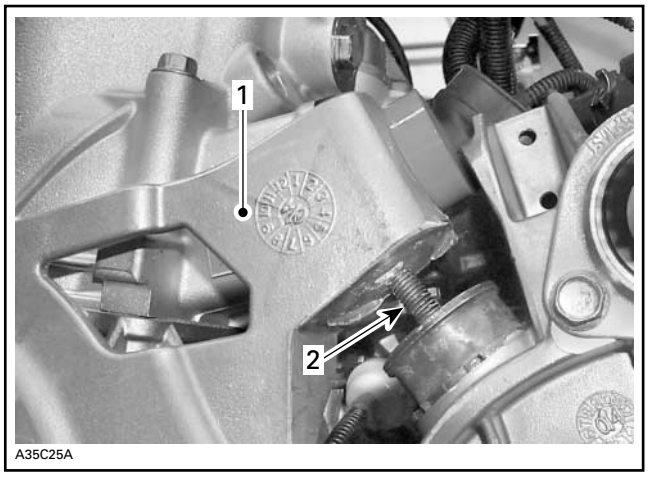
ENGINE SUPPORT NUTS REMOVAL
1. Nuts
2. Engine support

Remove both spark plugs.

Install in the MAG side spark plug hole the spark plug lift ring (P/N 529 035 830).

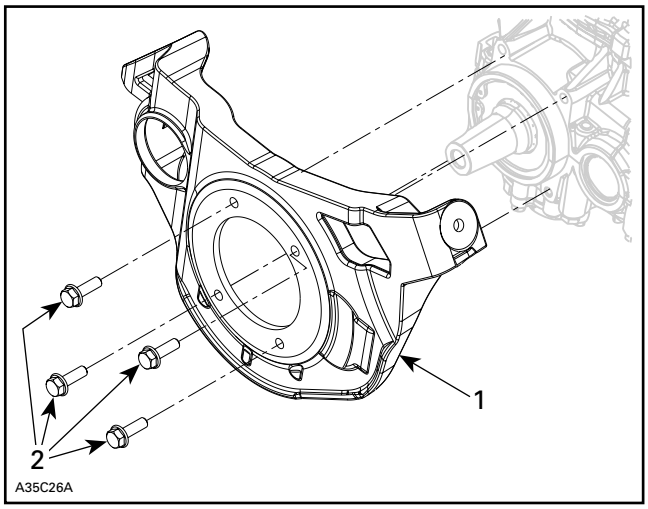
Using the engine removal hook (P/N 529 035 829), lift engine until engine supports are free from rubber mount studs.





PTO ENGINE SUPPORT LIFTED
1. Engine support
2. Rubber mount stud

Remove PTO engine support.



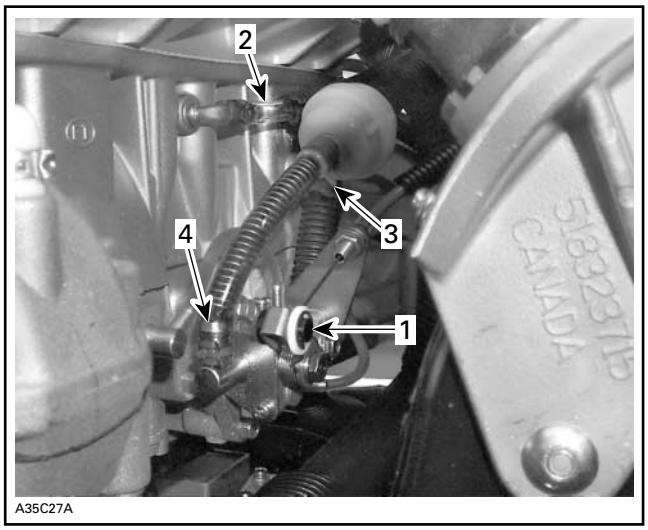
PTO ENGINE SUPPORT REMOVAL
1. Remove
2. PTO engine support

Detach oil pump cable from oil pump.

Unplug oil outlet hose.

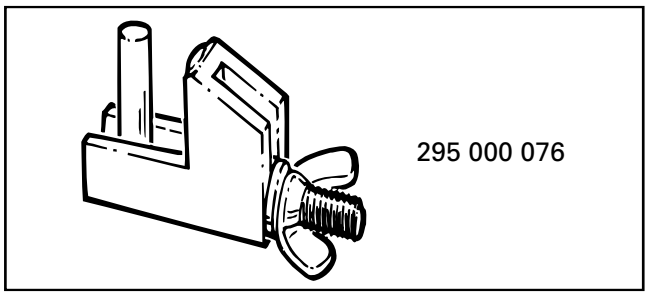
Unplug diaphragm fuel pump pulse hose.

Unplug oil inlet hose.

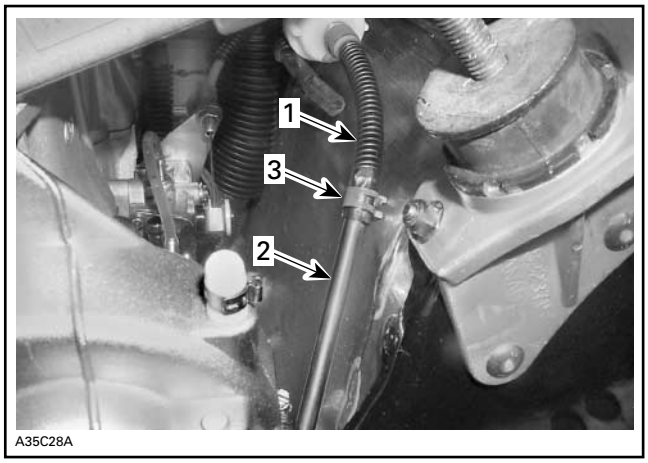


DETACH AND UNPLUG
1. *Detach oil pump cable*
2. *Unplug oil return hose*
3. *Unplug engine vacuum hose*
4. *Unplug oil inlet hose*

NOTE: For oil outlet hose, install a hose pincher (P/N 295 000 076) to avoid oil spillage.



NOTE: For oil inlet hose, use a standard 1/4 inch ratchet extension to block up hose. Secure hose with existing clamp.



BLOCK UP OIL INLET HOSE
1. *Oil inlet hose*
2. *Standard 1/4 inch ratchet extension*
3. *Spring clamp*

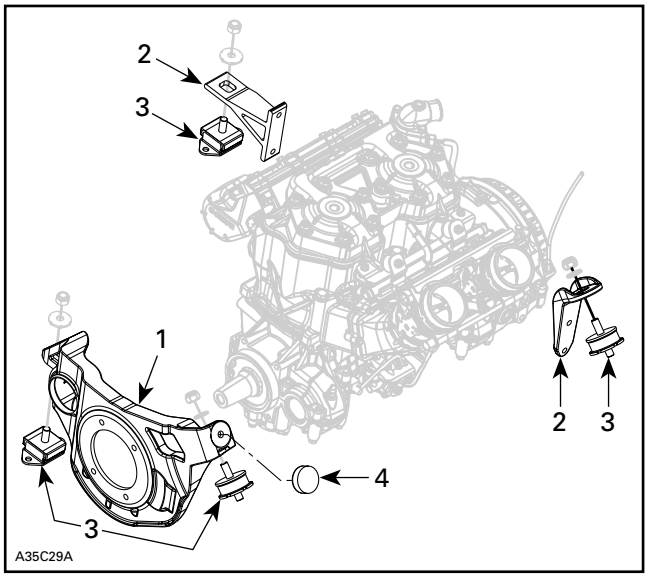
Remove engine from vehicle.

REMOVE ENGINE

INSPECTION

Check if engine supports are cracked, bent or otherwise damaged. Replace if necessary.

Check rubber mounts and engine stopper on engine support. Replace them if brittle, cracked or otherwise damaged.



ENGINE SUPPORTS
1. *LH support*
2. *RH supports*
3. *Rubber mounts*
4. *Engine stopper*

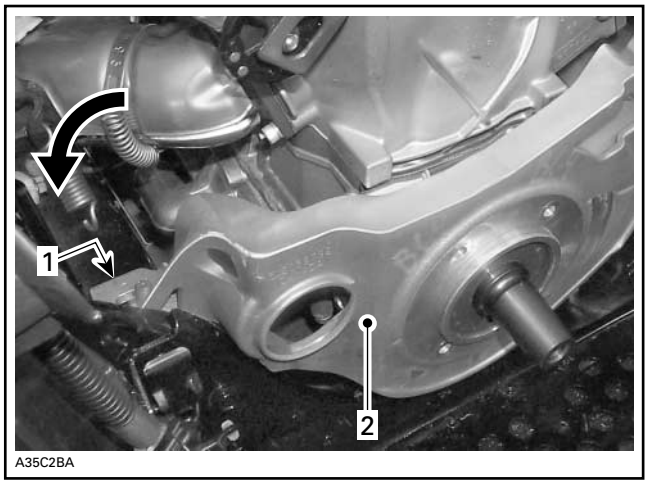
INSTALLATION

To install engine in vehicle, reverse the removal procedure. However, pay attention to the following.

PTO Engine Support

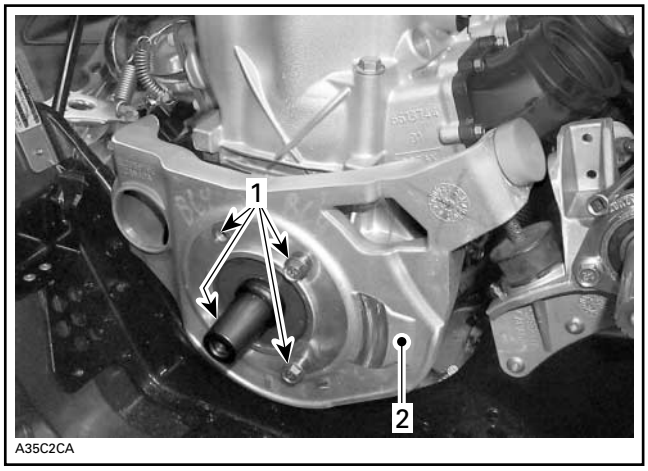
Lower engine as close as possible to its original position.

First, position PTO engine support on engine and insert front tab of PTO engine support on rubber mount.



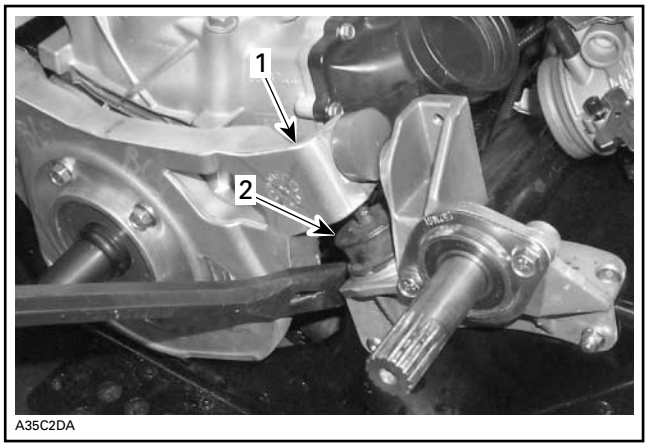
INSERT FRONT TAB FIRST
1. *Front tab*
2. *PTO engine support*

Secure PTO engine support.



1. *Secure*
2. *PTO engine support*

Using a pry bar, position rear tab of PTO engine support in place on rubber mount.

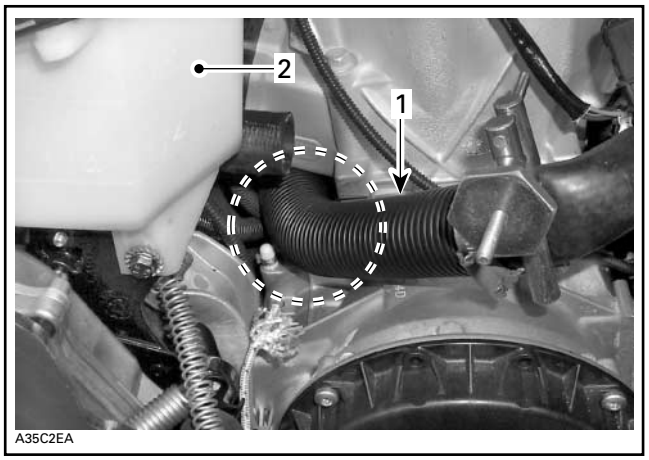


INSERT REAR TAB
1. *Rear tab*
2. *Rubber mount*

Make sure RH side engine supports are properly positioned on rubber mounts.

Heat Exchanger Outlet Hose

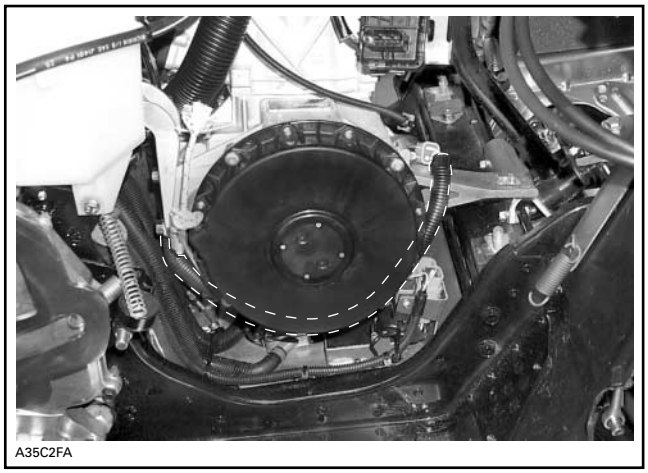
Make sure that heat exchanger outlet hose is routed as per photo.



RH SIDE — HEAT EXCHANGER OUTLET HOSE ROUTING
1. *Radiator outlet hose*
2. *Oil tank*

Magneto Harness

Make sure to position magneto harness in place before lowering engine.



RH SIDE — MAGNETO HARNESS ROUTING

Oil Pump Adjustment

After engine installation, verify oil pump adjustment, adjust if necessary. Refer to OIL INJECTION SYSTEM sub-section.

Fuel Injectors

Lubricate fuel injectors O-ring with Molykote 111 (P/N 413 707 000) before fuel rail installation.

Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Rear rubber mount	29 N•m (21 lbf•ft)
Front rubber mount bolts	19.5 N•m (173 lbf•**in**)
Engine support nuts	37 N•m (27 lbf•ft)
E-RAVE actuator bolts	5 N•m (44 lbf•**in**)
Throttle body hose clamps	2 N•m (18 lbf•**in**)
Fuel rail	9 N•m (80 lbf•**in**)
Spark plugs	27.5 N•m (20 lbf•ft)
Oil pump cable adjustment nut	4.5 N•m (40 lbf•**in**)

Make sure to apply the following product on the appropriate parts:

DESCRIPTION	PRODUCT
Fuel injectors O-ring	Molykote 111 (P/N 413 707 000)
Spark plug caps	Dielectric grease (P/N 293 550 004)

Reinstall all removed parts by using the appropriate component/system reinstallation procedures described in this shop.

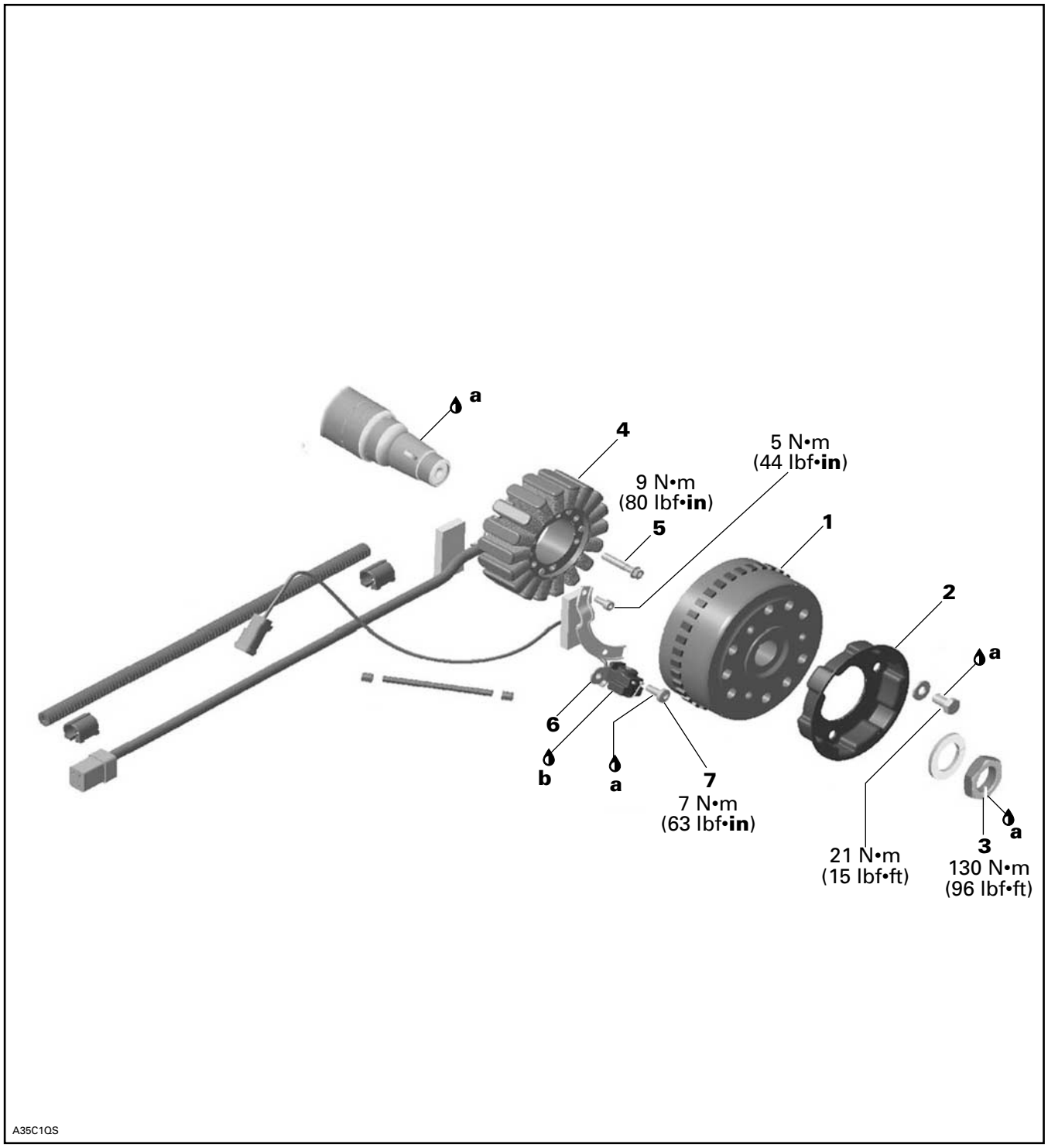
MAGNETO SYSTEM

SERVICE TOOLS

Description	Part Number	Page
crankshaft protector	420 876 557	37
magneto puller	529 035 547	37
puller ring	529 036 001	37

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	36
Loctite 5910	293 800 081	36
silicone dielectric grease	293 550 004	38



a) Loctite 243 (blue) (P/N 293 800 060)
b) Loctite 5910 (P/N 293 800 081)

GENERAL

NOTE: The following procedures can be done without removing the engine. To facilitate magneto removal, hold drive pulley with the appropriate tool.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

MAGNETO FLYWHEEL

Cleaning

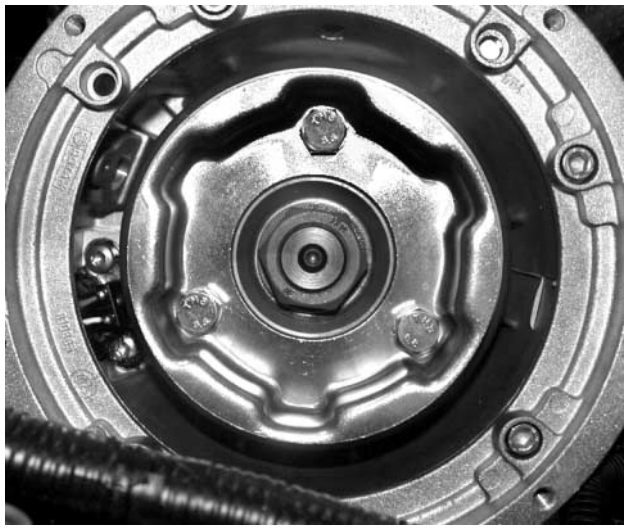
Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean magneto flywheel using only a clean cloth.

Removal

To gain access to magneto flywheel no. 1 assembly, remove the following parts:

– tuned pipe and muffler
– rewind starter
– starting pulley no. 2.

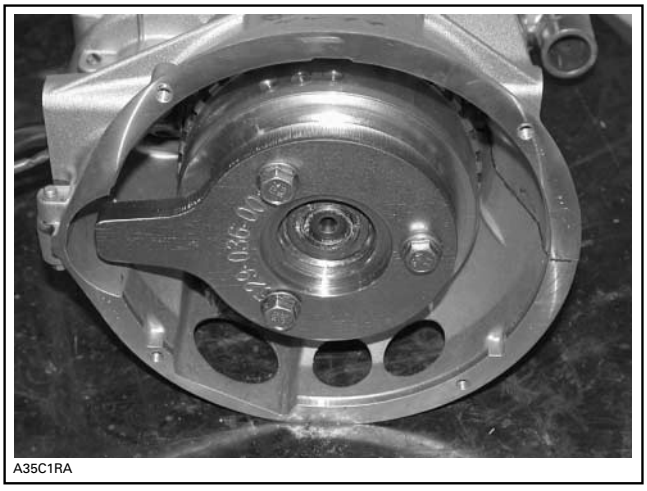


A32C8KA

TYPICAL

– Install the puller ring (P/N 529 036 001) in magneto housing opening.

CAUTION: Use only M8 x 20 mm screws to bolt puller to magneto flywheel.

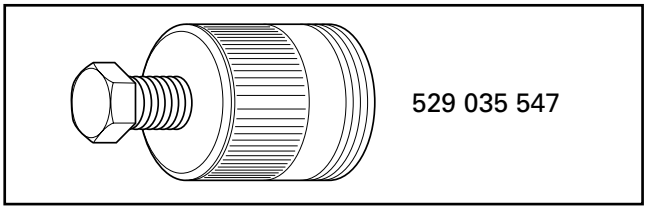


A35C1RA

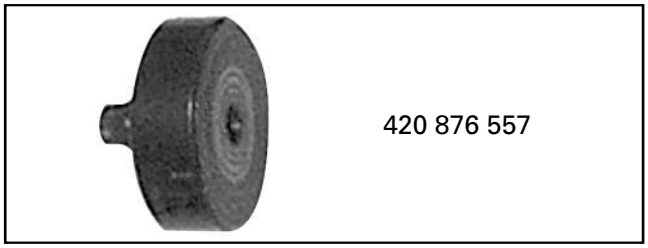
– Remove magneto flywheel nut.

NOTE: To correctly remove a threadlocked fastener, first tap on the fastener to break threadlocker bond. This will avoid thread breakage.

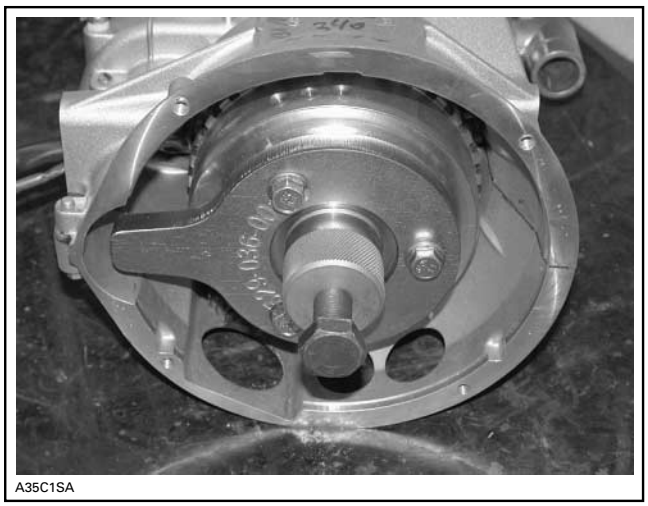
To remove magneto flywheel, install the crankshaft protector (P/N 420 876 557) on crankshaft end. Screw the magneto puller (P/N 529 035 547) into puller ring.



529 035 547



420 876 557



A35C1SA

Tighten puller bolt and at the same time, tap on bolt head using a hammer to release magneto flywheel from its taper.

Installation

Clean crankshaft taper. Install magneto flywheel **no. 1** on crankshaft. Torque nut **no. 3**.

Coat all electric connections except Deutsch housings (waterproof housing) with silicone dielectric grease (P/N 293 550 004) to prevent corrosion or moisture penetration.

CAUTION: Do not use silicone "sealant", this product will corrode contacts. Do not apply silicone dielectric grease on any Deutsch waterproof housing otherwise housing seal will be damaged.

Ignition Timing

Check as described in IGNITION TIMING.

STATOR

Inspection

Always check stator **no. 4** before changing it. Refer to CHARGING SYSTEM.

Cleaning

Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean stator using only a clean cloth.

Removal

Remove:

– magneto flywheel **no. 1**
– screws **no. 5** retaining stator to magneto housing
– grommet from crankcase where wires exit magneto housing.

Pull the wires through the crankcase hole.

Remove the stator **no. 4**.

Installation

Insert the stator wire into crankcase hole.

Ensure foam is located where stator wires will run to crankcase hole.

A35C1TA

Install stator **no. 4** and torque screws **no. 5** in a criss-cross sequence.

Install the grommet on crankcase.

Reinstall all other removed parts.

CPS

Inspection

Always check CPS before changing it. Refer to ENGINE MANAGEMENT.

Removal

To replace the CPS, remove or disconnect the following:

– magneto flywheel **no. 1**
– grommet from crankcase where CPS wire exits magneto housing
– retaining screws **no. 7**
– CPS **no. 6** and carefully pull wires.

Installation

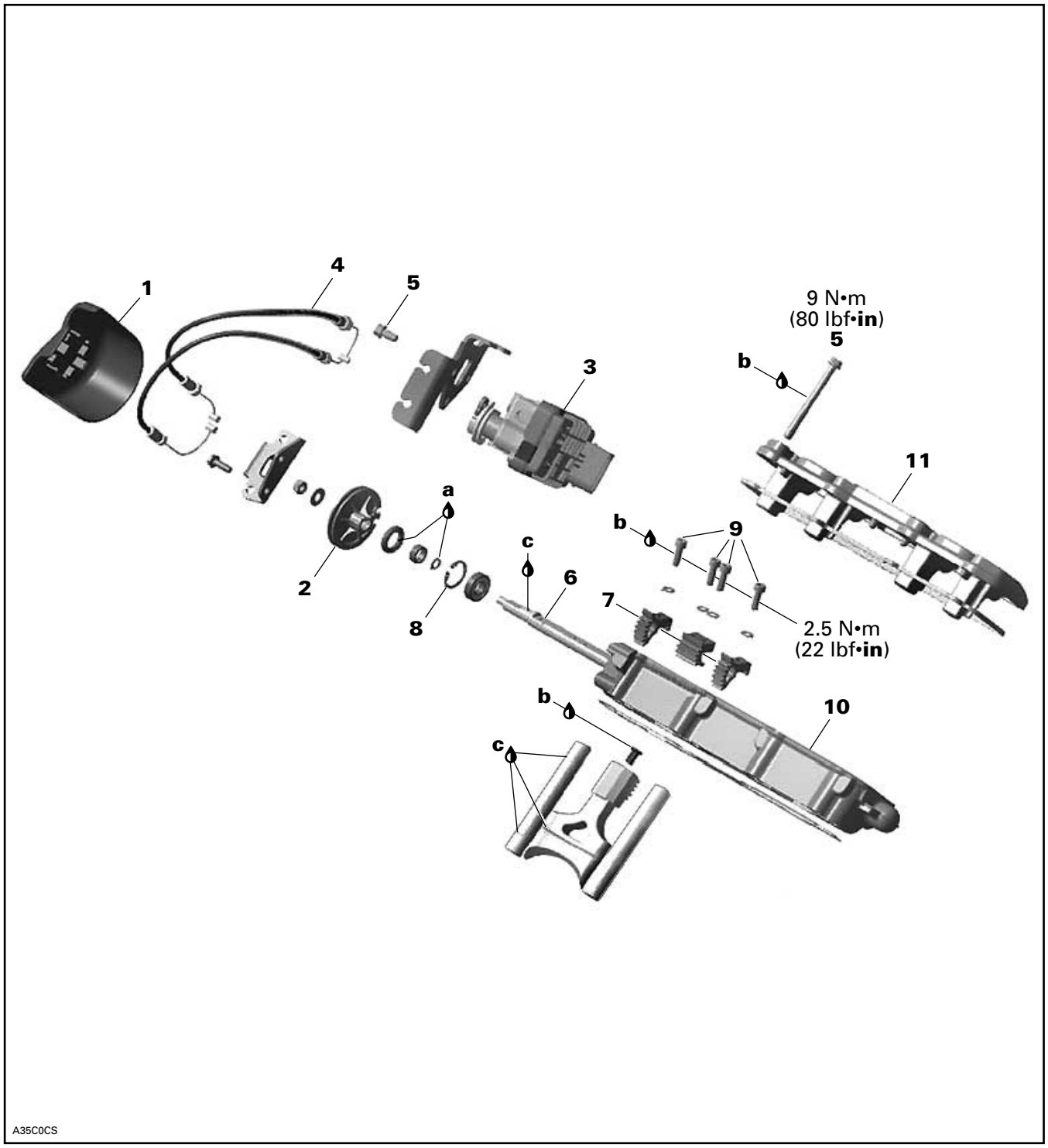
For installation, reverse the removal procedure.

Remove the old sealant at CPS location then apply new one. Screw CPS then stick the CPS wires in the sealant.

E-RAVE SYSTEM

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	42
Molykote 111	413 707 000	42
XPS-synthetic blend Injection oil	293 600 071	42



a. Molykote 111 (P/N 413 707 000)
b. Loctite 243 (P/N 293 800 060)
c. XPS-synthetic blend Injection oil (P/N 293 600 071)

GENERAL

The E-RAVE system can be serviced with engine on vehicle.

During assembly/installation, use torque values and service products as shown in exploded view.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

E-RAVE SYSTEM DYNAMIC TEST

Lift rear of vehicle off the ground and support it with a stand.

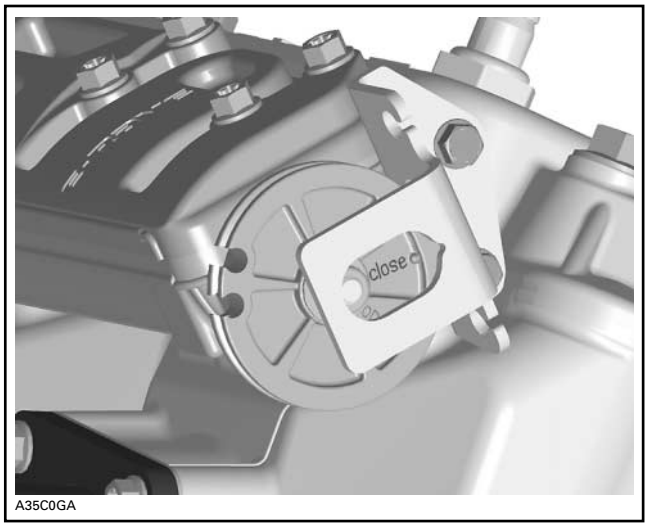
⚠ WARNING

To prevent serious injury to individuals near the snowmobile:

- **NEVER stand behind or near a moving track**
- **always use a wide-base snowmobile stand with a rear deflector panel**
- **when the track is raised off the ground, only run it at the lowest possible speed.**

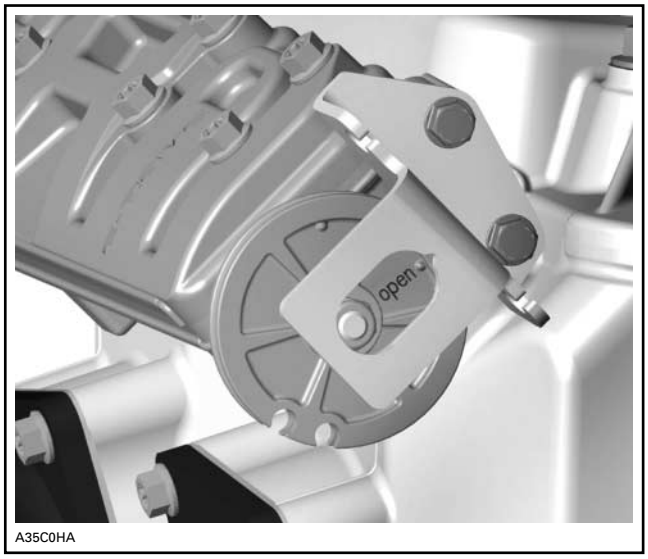
Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force, possibly resulting in the loss of a leg or other serious injury.

Start engine and while at idle speed, check position of the E-RAVE shaft pulley. It should be in the **Close** position.



A35C0GA

Bring the engine above 6500 RPM while in wide open throttle and check position of the E-RAVE shaft pulley. It should be in the **Open** position.



A35C0HA

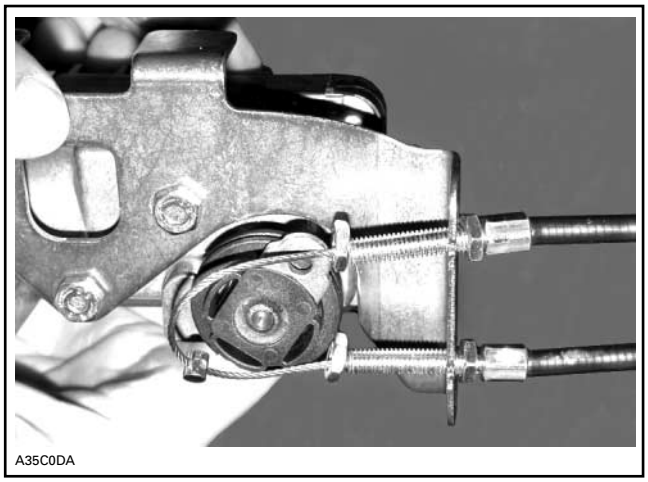
If test fails, check cables and pulleys condition and adjustment. If correct, disconnect cable from E-RAVE actuator **no. 3** and check for smooth mechanical movement of the E-RAVE system by turning the pulley. If it works, check the E-RAVE actuator. Refer to ENGINE MANAGEMENT.

E-RAVE CABLES

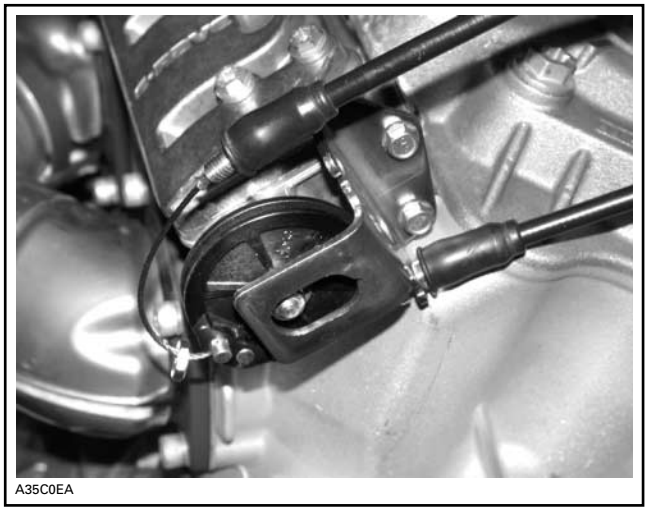
Removal

Completely unscrew adjuster nuts from E-RAVE actuator bracket.

Detach cables from E-RAVE actuator pulley.


A35C0DA

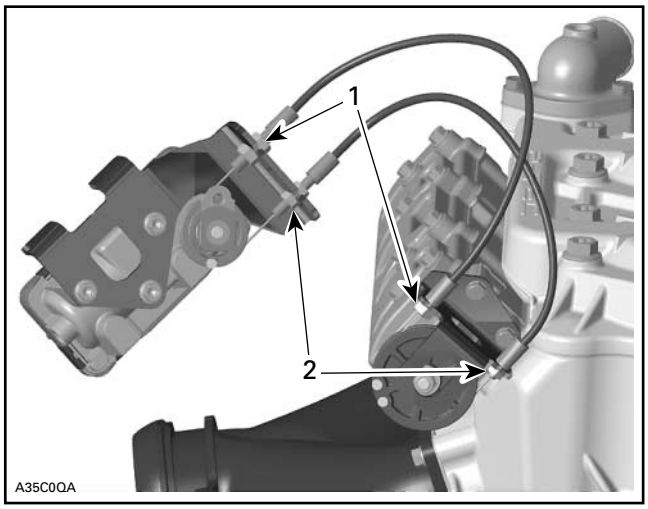
Detach cables from E-RAVE shaft pulley **no. 2**.


A35C0EA

Installation

Reverse removal steps. However, pay attention to the following.

Connect E-RAVE cables as per following photo:



A35C0QA

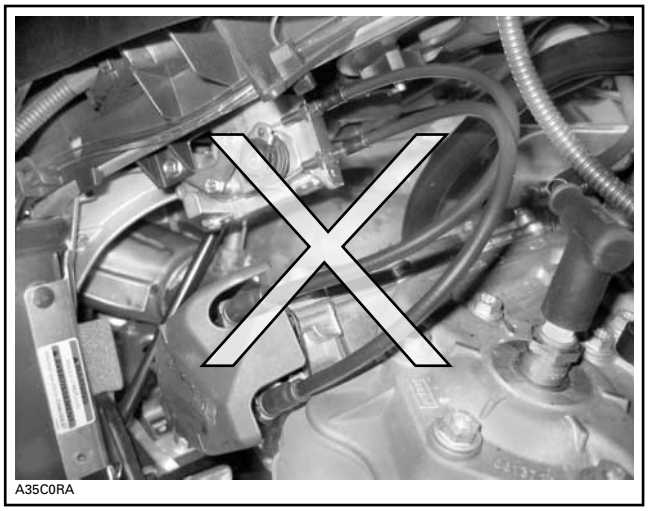
CABLE POSITIONS
1. Cable ends in top holes
2. Cable ends in bottom holes

Tighten nut of each cable to E-RAVE shaft pulley bracket.

Ensure cables are parallel to each other.

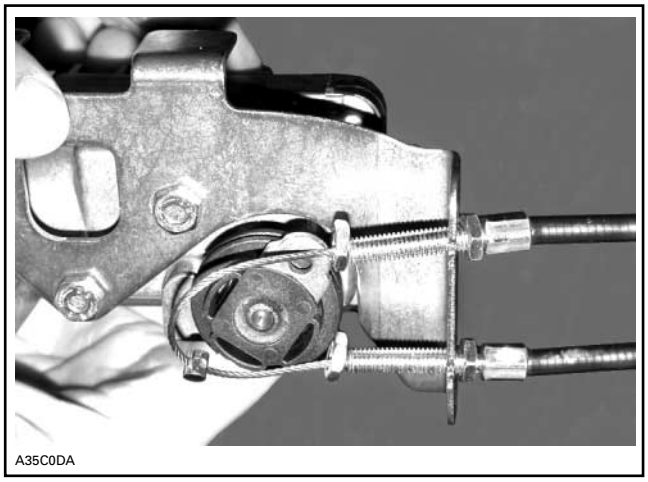
A35C0SB

RIGHT


A35C0RA

WRONG

Insert cables in E-RAVE actuator pulley.


A35C0DA

Loosely install adjuster nuts. Do not tighten adjusters yet, proceed with adjustment as described below.

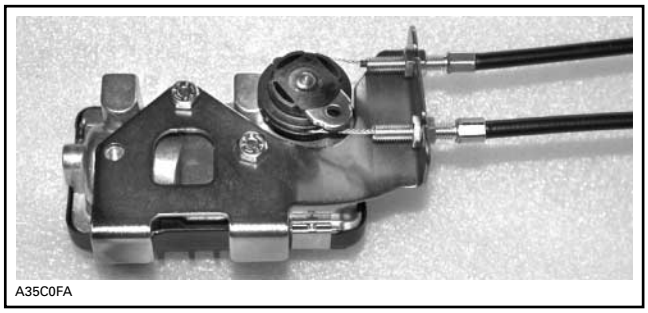
Adjustment

IMPORTANT: Ensure all components are properly installed to their operating position and that proper routing of cable is achieved. Otherwise, improper E-RAVE operation will result leading to poor engine performance.

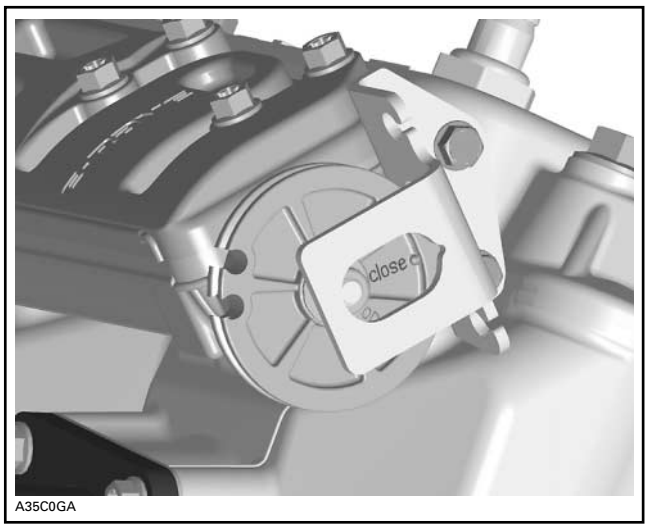
Remove DESS key and wait until lights of speedometer turn off. ECM must be off.

NOTE: Ensure there is no VCK supply harness connected to the EMS diagnostic connector.

Ensure cable adjusters and cable ends on E-RAVE actuator pulley are loose.


A35C0FA

Turn E-RAVE shaft pulley clockwise to the **Close** position.



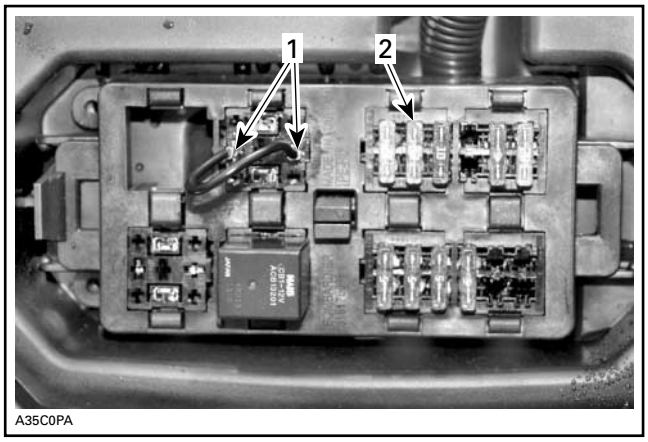
A35C0GA

Remove the headlight relay (R2).

NOTE: To prevent battery discharge, headlight fuse (F8) can be removed.

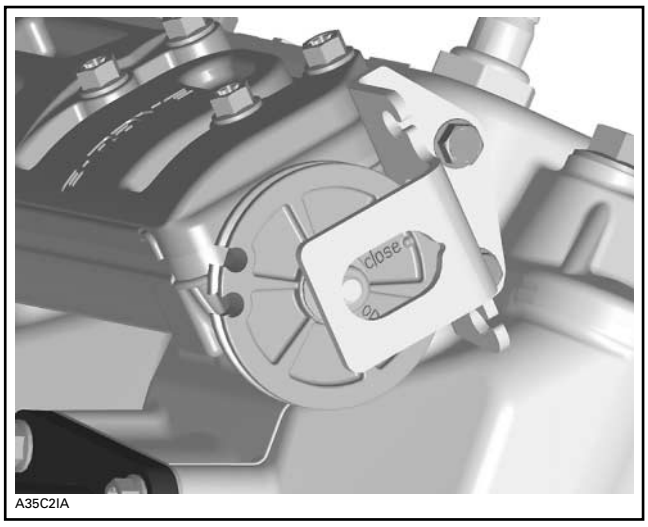
Bypass relay with a jumper. This will turn the E-RAVE shaft pulley to the adjustment position.

NOTE: If pulley does not turn, E-RAVE actuator was already in right position.



A35C0PA

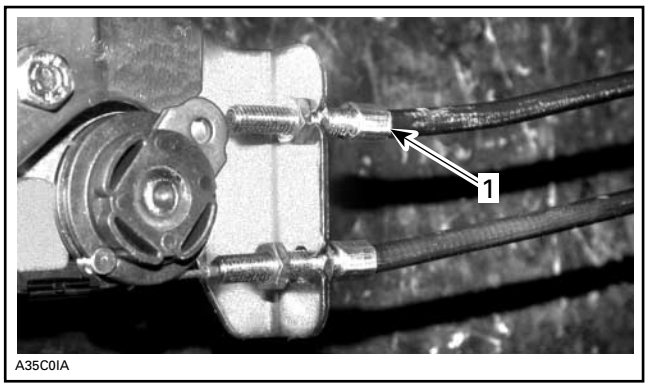
1. Jumper
2. Headlight fuse



A35C2IA

ADJUSTMENT POSITION

Tighten top cable adjuster (closing cable) with just enough force to remove play in cable.

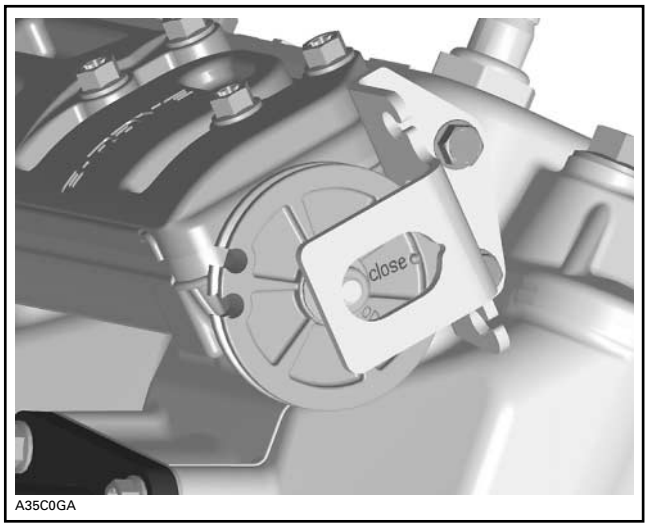


A35C0IA

1. Top (closing) cable adjuster

Install DESS key and set engine cut-out switch to OFF.

Press START/RER button. E-RAVE shaft pulley should turn to the **Close** position.

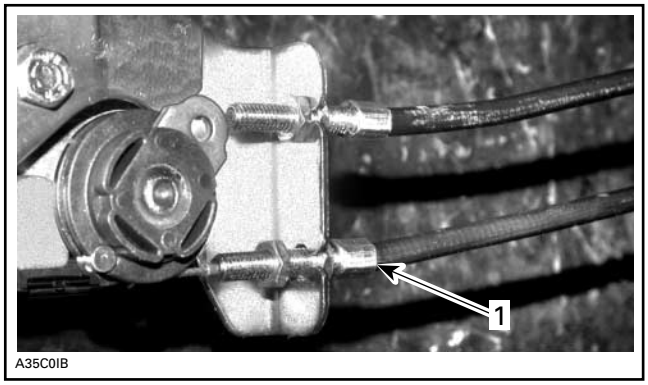


A35C0GA

Readjust top (closing) cable as necessary.

Remove relay jumper.

Tighten bottom cable adjuster (opening cable) to remove play in cable.



A35C0IB

1. Bottom (opening) cable adjuster

NOTE: A cable that is too tight will make the system too stiff to operate smoothly.

Repeat the E-RAVE DYNAMIC TEST above 2-3 times then recheck the cables free-play. Readjust as necessary. Check with VCK and B.U.D.S. for fault codes.

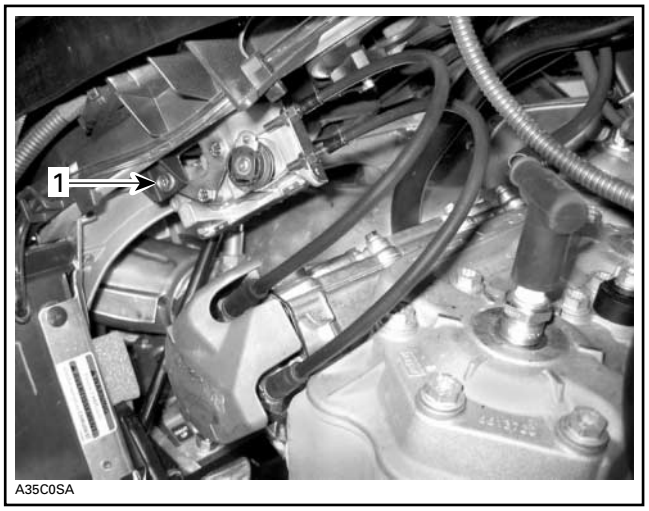
E-RAVE ACTUATOR

Inspection

Refer to E-RAVE DYNAMIC TEST above.

Removal

Remove retaining screw **no. 5**.



1. Remove screw

Slide E-RAVE actuator **no. 3** out.

Disconnect electrical connector.

Detach cable **no. 4**.

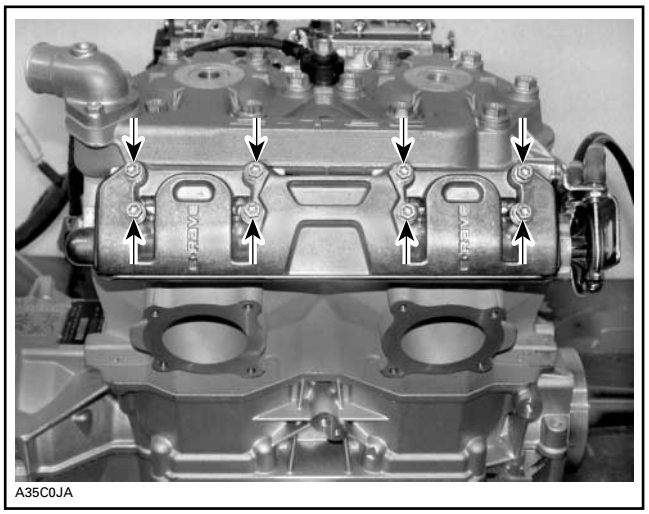
Installation

Reverse removal steps.

E-RAVE COVER

Removal

Remove retaining screws **no. 5**.



Remove cover **no. 11**.

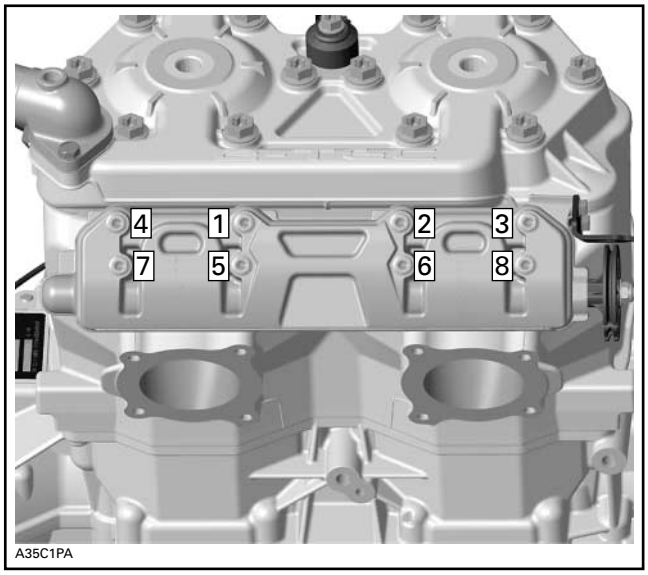
Inspection

Check seal condition. If it is cracked or hard, replace seal. Check cover condition.

1. Seal

Installation

Follow this tightening sequence.



E-RAVE SHAFT

Inspection

Check for smooth mechanical movement of the E-RAVE system. Feel the bearing radial play. If excessive, replace bearing.

Check seal area for leaks. If so, replace seal.

Removal

Remove the following:

E-RAVE cables **no. 4**.

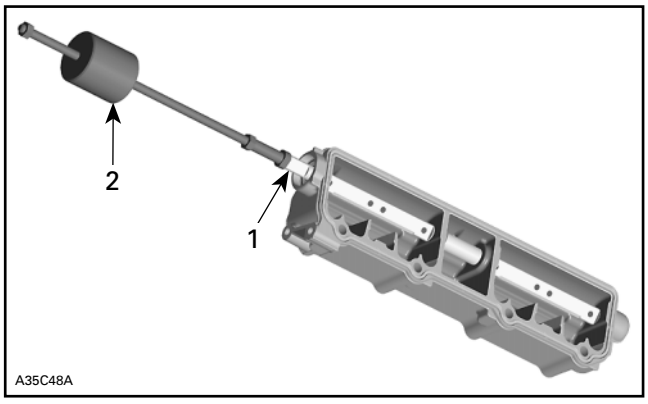
Pulley **no. 2**.

Seal then snap ring **no. 8**.

Drive gears **no. 7**.

A35C0KB

Reinstall shaft nut then use a hammer puller to pull shaft out by the nut.



A35C48A

1. E-RAVE shaft
2. Hammer puller

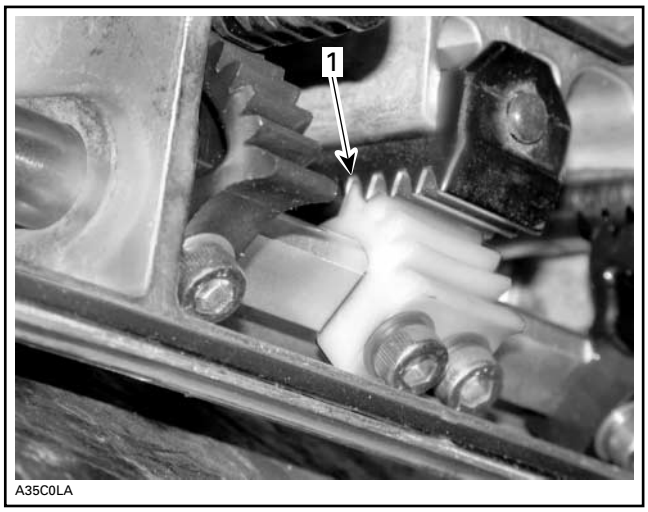
Push bearing out of shaft.

Installation

Reverse removal steps. However, pay attention to the following.

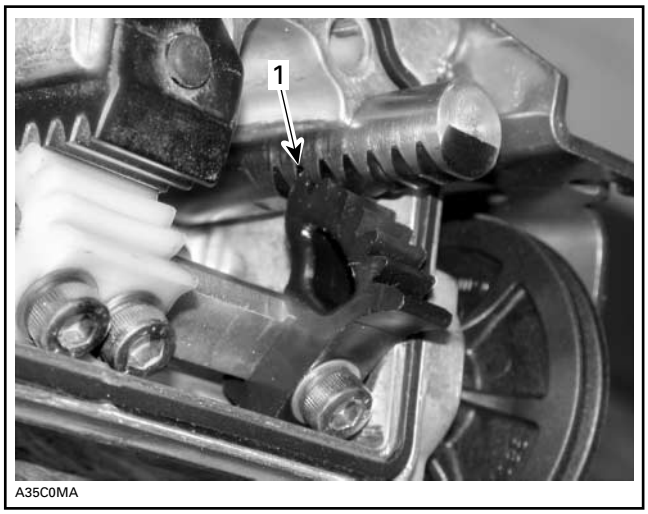
When installing new bearing on shaft, use an appropriate pusher that seats against the inner race of bearing. Drive shaft in housing until it bottoms.

When installing drive gears **no. 7**, ensure to mesh gears as shown.



A35C0LA

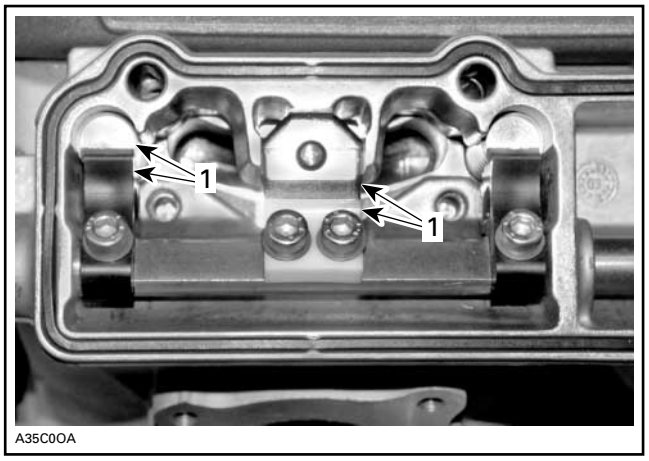
CENTER VALVE
1. Mesh in 1st tooth of center valve gear



A35C0MA

SIDE VALVE
1. Mesh gear in 2nd tooth of side valve gear

Ensure that after torquing screws, the shaft gears are properly aligned with valve gears.



1. Gears aligned

After assembly, check for smooth mechanical movement of the E-RAVE system.

E-RAVE HOUSING

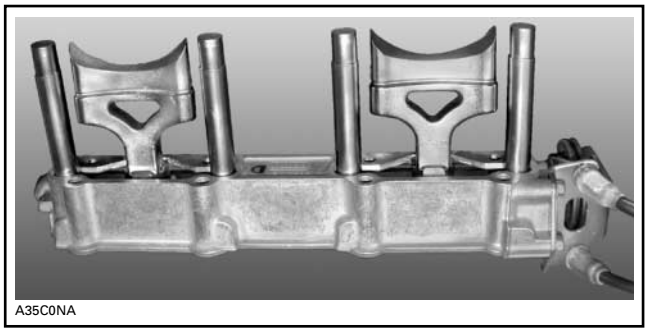
Removal

Remove the following:

E-RAVE cables **no. 4**.

Cover **no. 11**.

NOTE: E-RAVE housing with shaft and E-RAVE valves can be removed altogether if desired.



Drive gears **no. 7**.

Inspection

Check housing condition.

Installation

Reverse removal steps.

E-RAVE VALVES

Removal

Remove the following:

Cover **no. 11**.

Drive gears **no. 7**.

Housing **no. 10**.

Inspection

Clean carbon deposits on parts. Check gears condition.

Installation

Reverse removal steps.

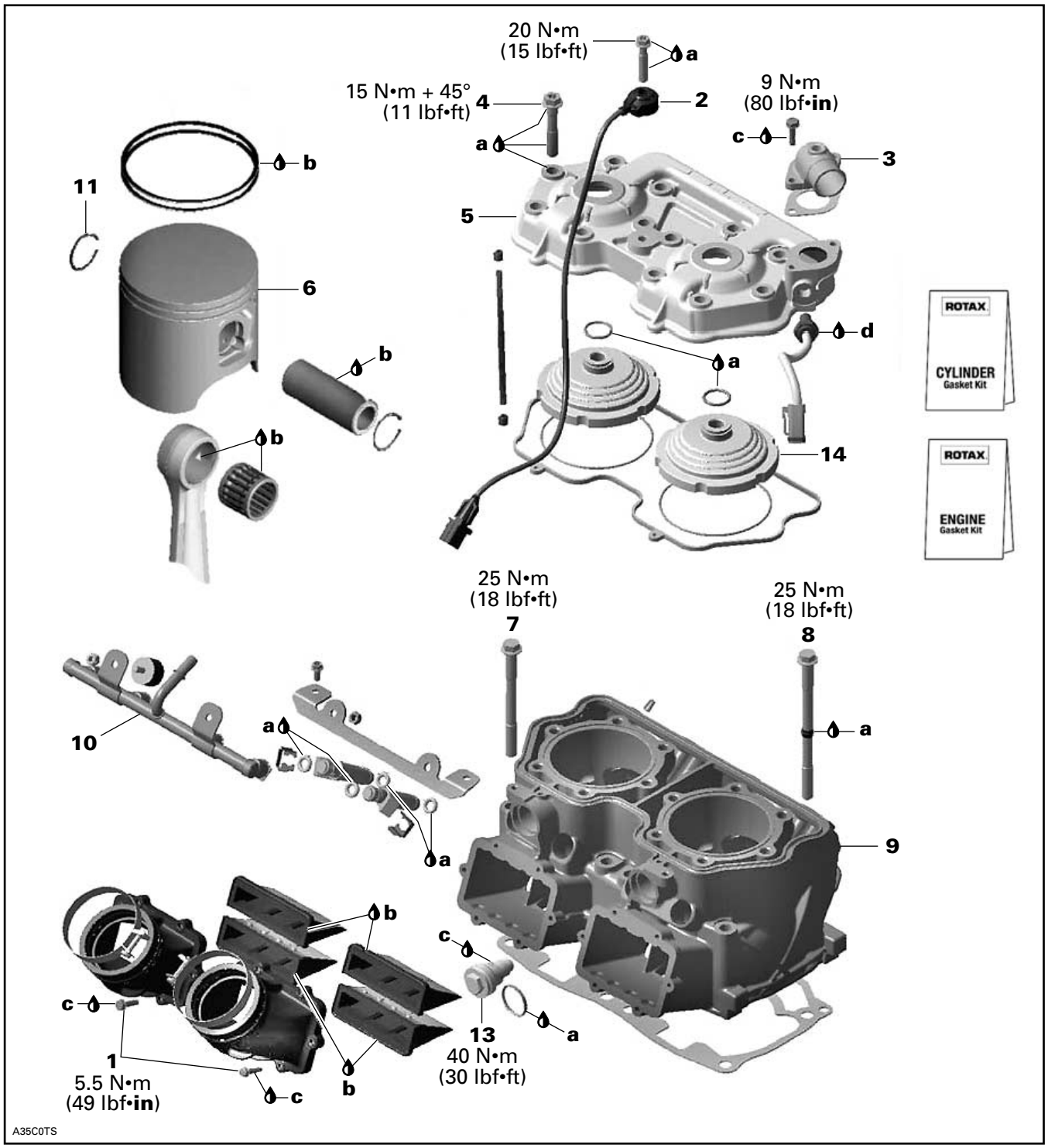
TOP END

SERVICE TOOLS

Description	Part Number	Page
Piston circlip installer	529 035 998	57
piston pin puller/installer	529 036 002	54

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	52
Loctite 5910	293 800 081	52
Loctite Chisel	413 708 500	54
Molykote 111	413 707 000	52
XP-S synthetic blend injection oil	293 600 071	52



a. Molykote 111 (P/N 413 707 000)
b. XP-S synthetic blend injection oil (P/N 293 600 071)
c. Loctite 243 (P/N 293 800 060)
d. Loctite 5910 (P/N 293 800 081)

TROUBLESHOOTING

Before completely disassembling the engine, proceed with an engine leak test. Refer to LEAK TEST.

GENERAL

During assembly/installation, use torque values and service products as shown in exploded view(s).

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

It is not mandatory to remove engine from chassis for top end repair. To proceed with engine removal, refer to REMOVAL AND INSTALLATION.

COMPONENT REMOVAL WITH THE ENGINE INSTALLED

The following engine components can be removed with engine on vehicle such as:

– cylinder head
– cylinder block
– piston(s)
– reed valve(s).

NOTE: Since the cylinder block is heavy and the working space is limited, being assisted by someone will ease the cylinder block removal/installation.

DISASSEMBLY

RAVE System

Remove RAVE system. Refer to RAVE SYSTEM.

Fuel Rail

Remove fuel rail **no. 10**. Refer to ENGINE MANAGEMENT.

REED Valve

Unscrew reed valve screws **no. 1** then remove reed valves.

A35C0UA

Cylinder Head

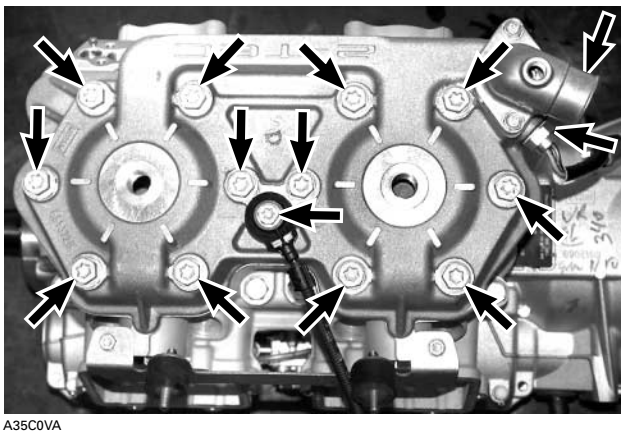
Remove the knock sensor **no. 2**.

Disconnect the temperature sensor connector.

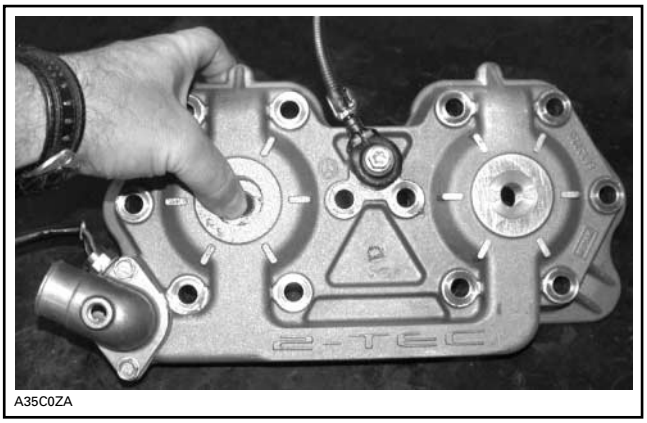
Unplug coolant hose from upper thermostat housing **no. 3**.

Unscrew cylinder block head screws **no. 4**.

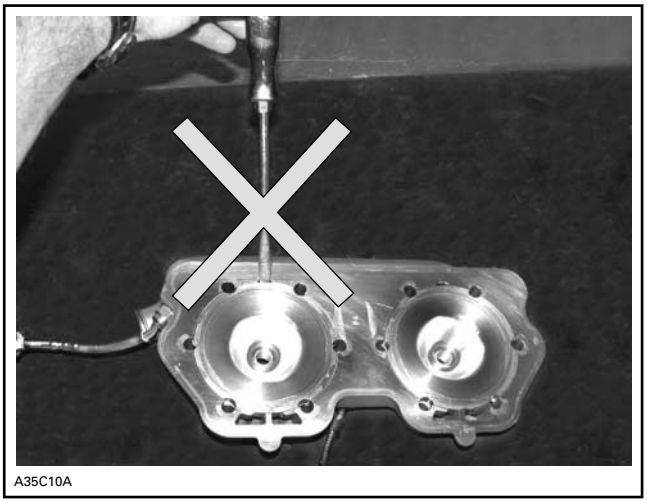
Remove the cylinder head **no. 5**.


A35C0VA

If it is necessary to withdraw the removable combustion chamber **no. 14**, push out by spark plug hole area.


A35C0ZA

CAUTION: Do not pry out combustion chamber. It could damage the surface contact of cylinder head.


A35C10A

Cylinder Block

Unscrew cylinder block screws **no. 7** and **no. 8** then remove the cylinder block **no. 9**.

NOTE: If engine is in vehicle, lean cylinder block toward rear to withdraw.

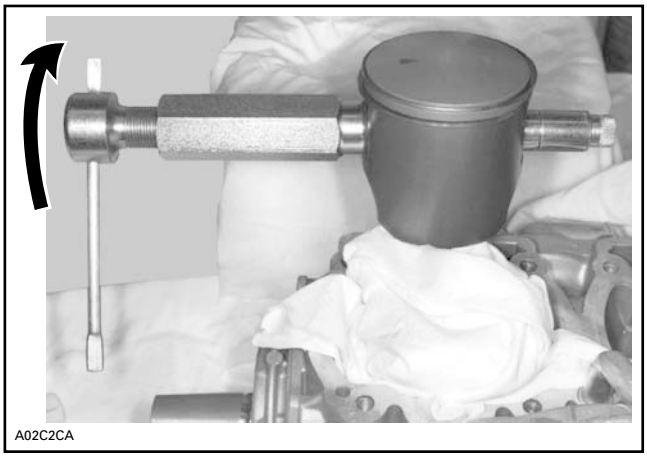
Piston

With a pointed tool inserted in piston notch, remove circlips **no. 11** from piston **no. 6**.

A02C29A

TYPICAL

Using piston pin puller/installer (P/N 529 036 002), extract piston pin from piston.


A02C2CA

TYPICAL — PISTON PIN EXTRACTION

Decompressor

Mach Z

Do not remove decompressor plug **no. 23** needlessly.

CLEANING

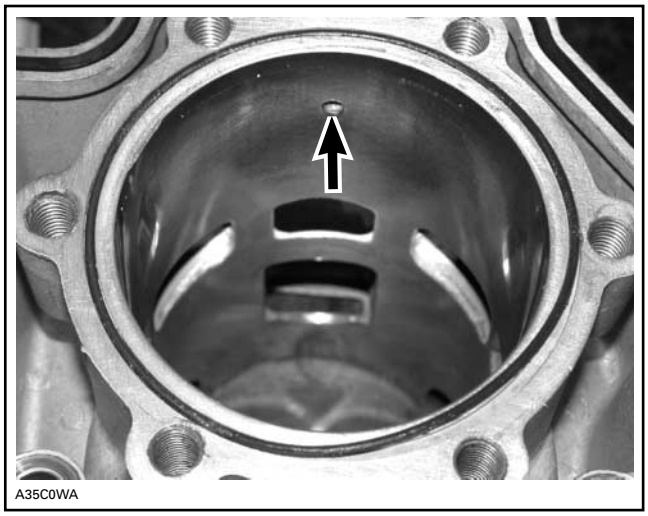
Discard all gaskets and O-rings. Use Loctite Chisel (P/N 413 708 500) to clean mating surfaces.

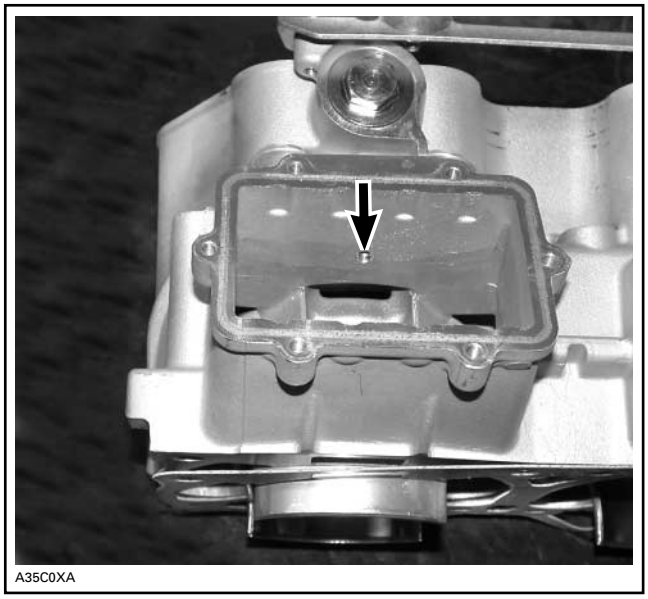
Clean all metal components in a non-ferrous metal cleaner.

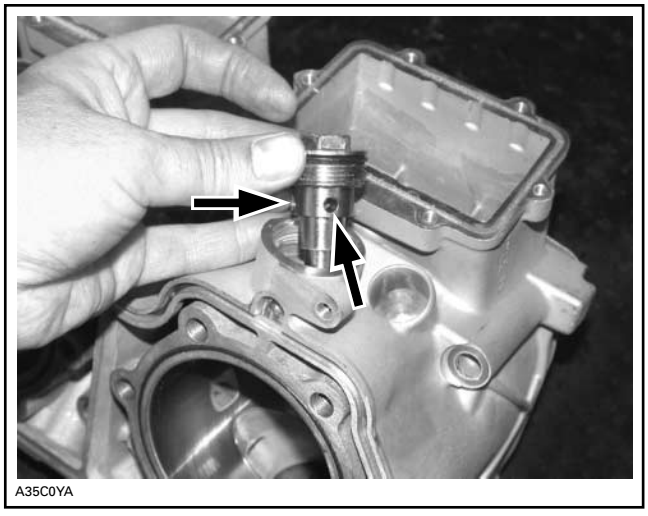
Scrape off carbon formation from cylinder block exhaust port, cylinder head and piston dome.

NOTE: The letters "A or B" (beside an arrow on the piston dome) must be visible after cleaning.

Clean the piston ring groove with a groove cleaner tool or with a piece of broken ring.


A35C0WA


A35C0XA

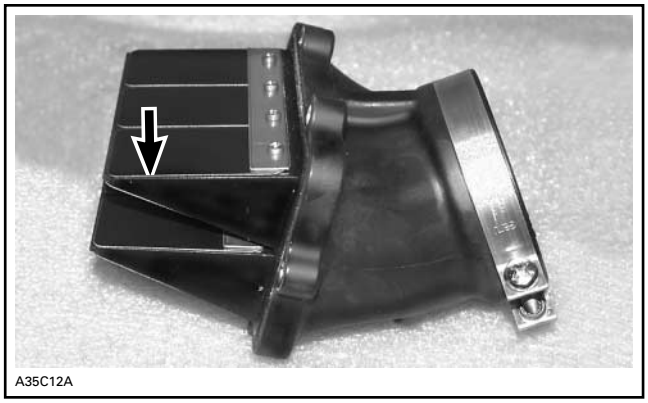

A35C0YA

INSPECTION

NOTE: For dimension measurement procedures, refer to ENGINE MEASUREMENT.

Reed Valve

There must not be any play between any blade and valve body when exerting a finger pressure on blade. Inspect adapter condition.


A35C12A

If a play is felt, replace reed valve.

Check the rubber flange for cracks and/or damage.

Decompressor

Mach Z

Inspect holes for carbon deposits and if clogged, remove decompressor plug to allow proper cleaning.

Cylinder Head, Cylinder Block and Piston

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Cylinder head volume	44.84 cc	48.97 cc	N.A.
Cylinder taper	N.A.	0.04 mm (.0016 in)	0.10 mm (.004 in)
Cylinder out of round	0.008mm (.0003 in)	0.015 mm (.0006 in)	0.08 mm (.003 in)
Piston/cylinder wall clearance	0.115 mm (.0045 in)	0.151 mm (.0059) in)	0.20 mm (.008 in)
Ring/piston groove clearance	0.045 mm (.002 in)	0.090 mm (.004 in)	0.20 mm (.008 in)
Ring end gap	0.550 mm (.022 in)	0.70 mm (.027 in)	1.0 mm (.039 in)

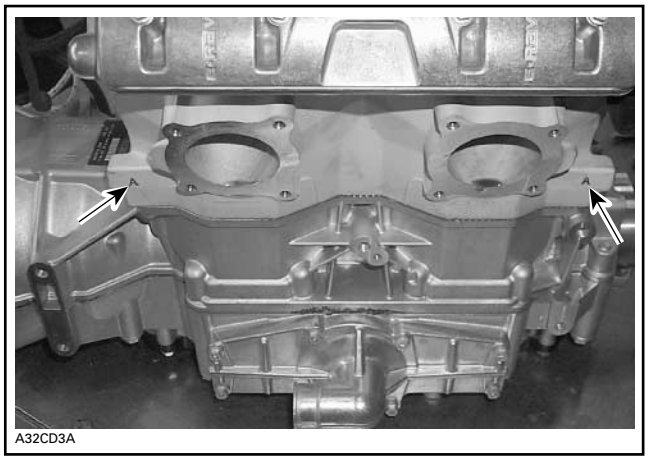
Piston and Cylinder Block Replacement

NOTE: There is no oversize piston available.

This engine uses pistons with 2 tolerance groups; therefore, when a piston needs to be replaced, it is important to correctly identify its tolerance group before proceeding with its replacement.

The pistons and cylinders are identified by the letters "A" or "B".

A32CD2A


A32CD3A

NOTE: A cylinder block may use pistons of 2 different tolerance groups. **Always match piston "A" with cylinder "A" and piston "B" with cylinder "B".**

When a cylinder block needs to be replaced, the replacement part is provided with 2 matching pistons.

ASSEMBLY

Piston

Lubricate needle bearings and insert into connecting rod.

A02C2HA

TYPICAL

At assembly, place the pistons over the connecting rods with the arrow pointing toward the exhaust port.

1. Arrow pointing toward exhaust port

Install piston pin puller/installer and turn handle until piston pin is correctly positioned in piston.

TYPICAL

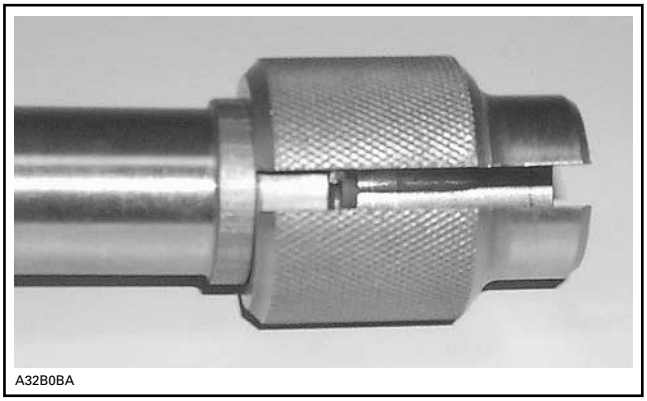
CAUTION: Always install new circlips.

Use a piston circlip installer to install mono-hook circlips no. 11.

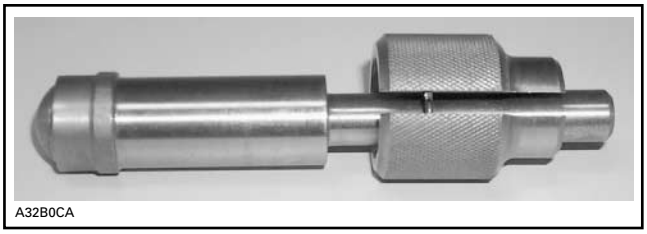
ENGINE	TOOL
995	Piston circlip installer (P/N 529 035 998)

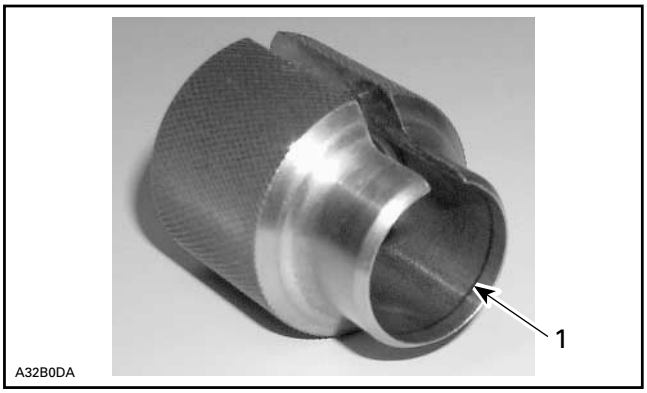
Insert circlip into support so that, when installed in piston groove, the tab faces upward.

With round end of pusher, position circlip perpendicularly to the support axis.



With the other end of the pusher, push circlip into the support groove.



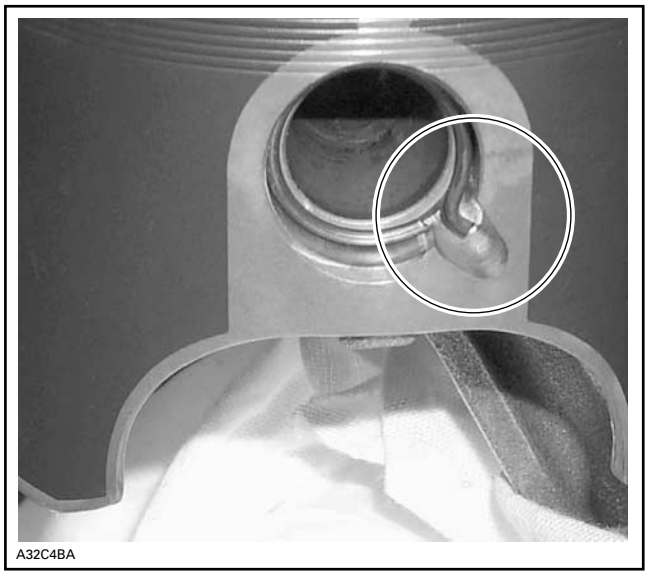


1. Groove

A32B0EA

CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to put circlip in place. Make sure to install new circlips with tab toward top as per following photo.


A32C4BA

TAB TOWARD TOP

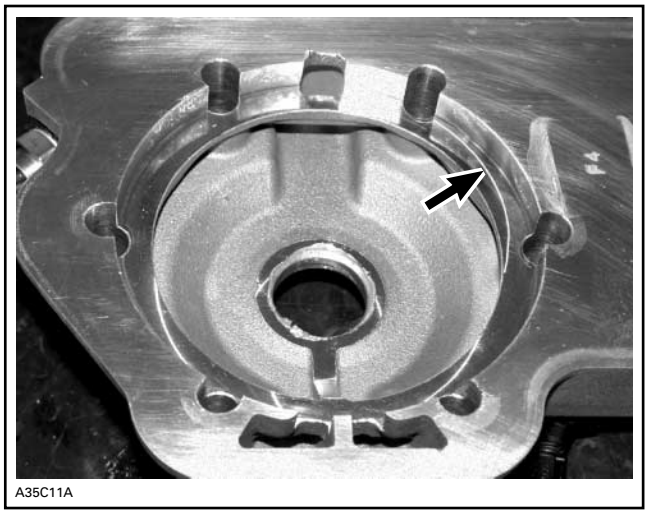
CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one because, on a second attempt, the circlip will lose its normal retaining capabilities.

CAUTION: Circlips must not move freely after installation; if so, replace them.

Before inserting piston in cylinder, lubricate the cylinder with new injection oil or equivalent.

Cylinder Head and Cylinder Block

If combustion chamber no. 14 was removed, ensure its contact surface is clean before installing it.


A35C11A

Ensure to properly align mounting holes.

Choose the right gasket thickness according to combustion chamber volume. Refer to ENGINE MEASUREMENT. Install selected gasket on crankcase.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may lead engine to poor performance.

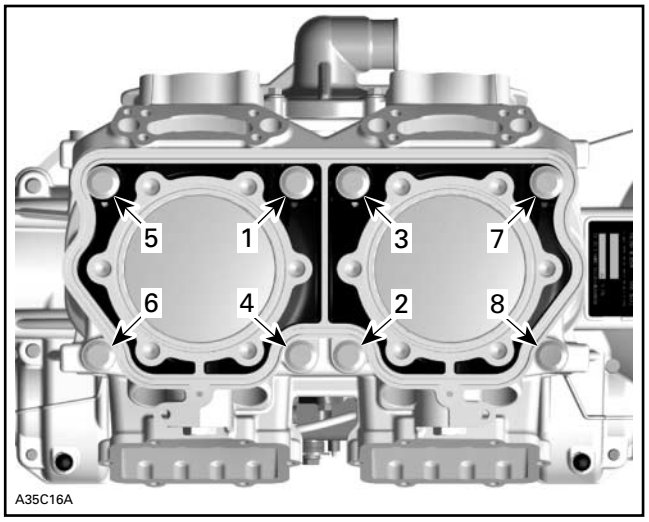
Before inserting piston in cylinder, lubricate the cylinder with new injection oil or equivalent.

To ease cylinder block installation, it is recommended to use a piston ring compressor pliers such as Snap-ON RC-980 or equivalent.

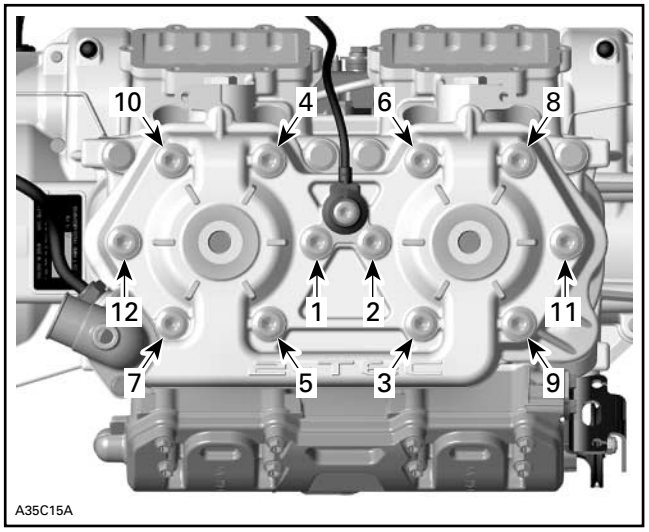
Bring one piston close to TDC then carefully slide piston into cylinder.

A35C13A

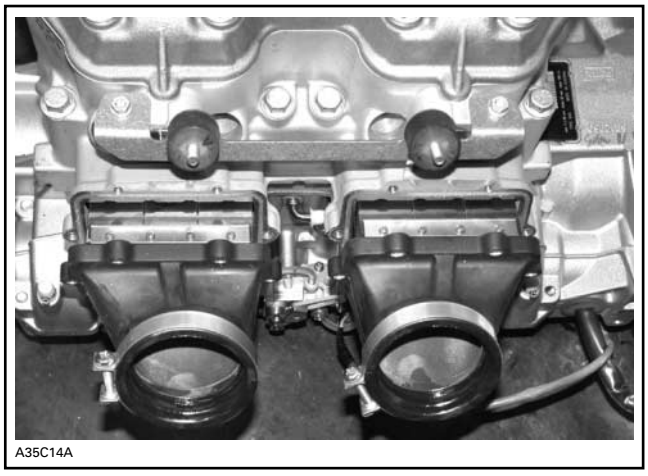
Torque cylinder block screws following this sequence. Torque screws in 2 steps, half torque first, then to final torque.



Install cylinder head and torque screws following this sequence.



LH and RH side intake adapters are different. Install as shown.



Properly seat adapters against engine flanges and torque screws **no. 1** in a criss-cross sequence.

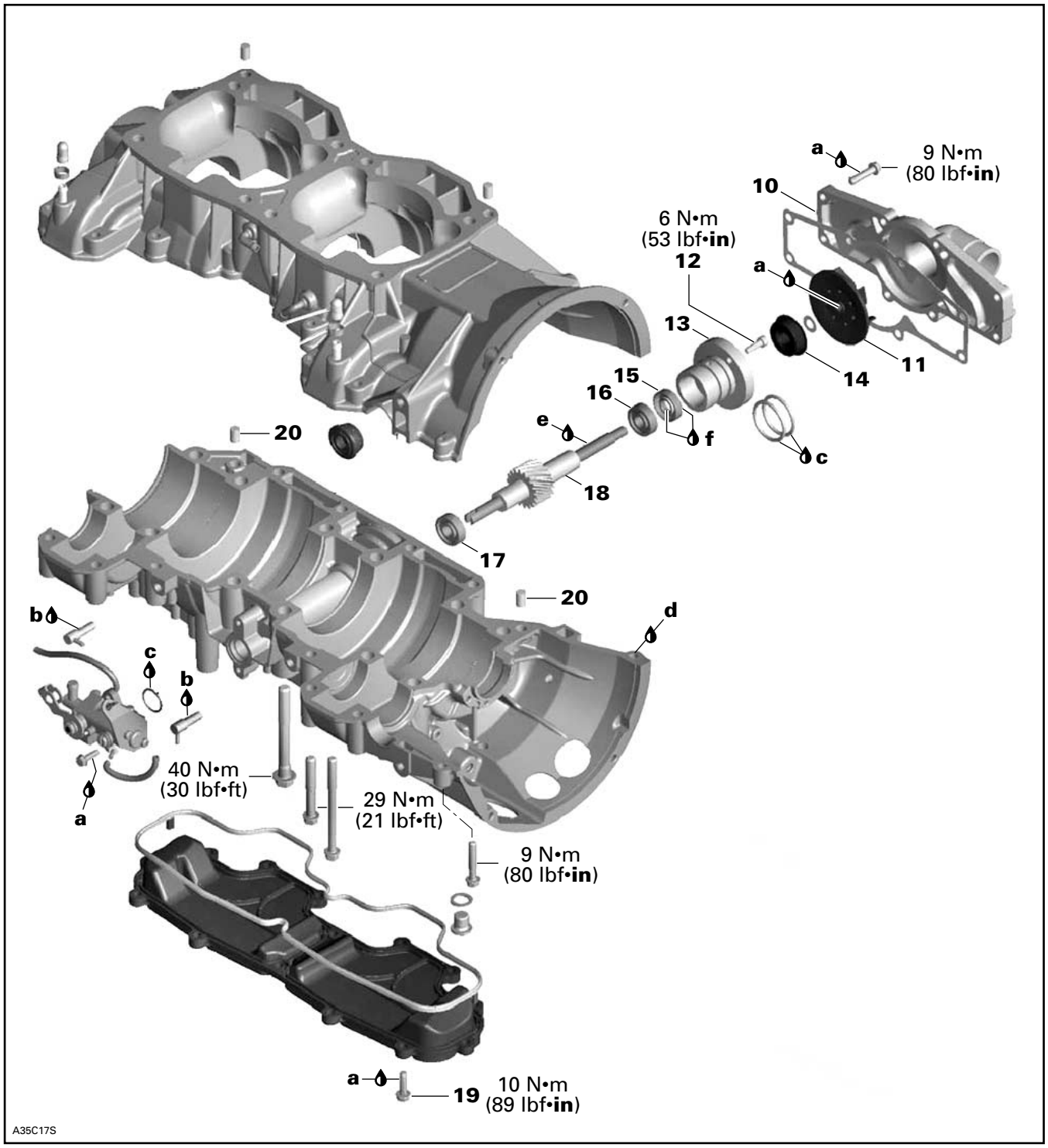
BOTTOM END

SERVICE TOOLS

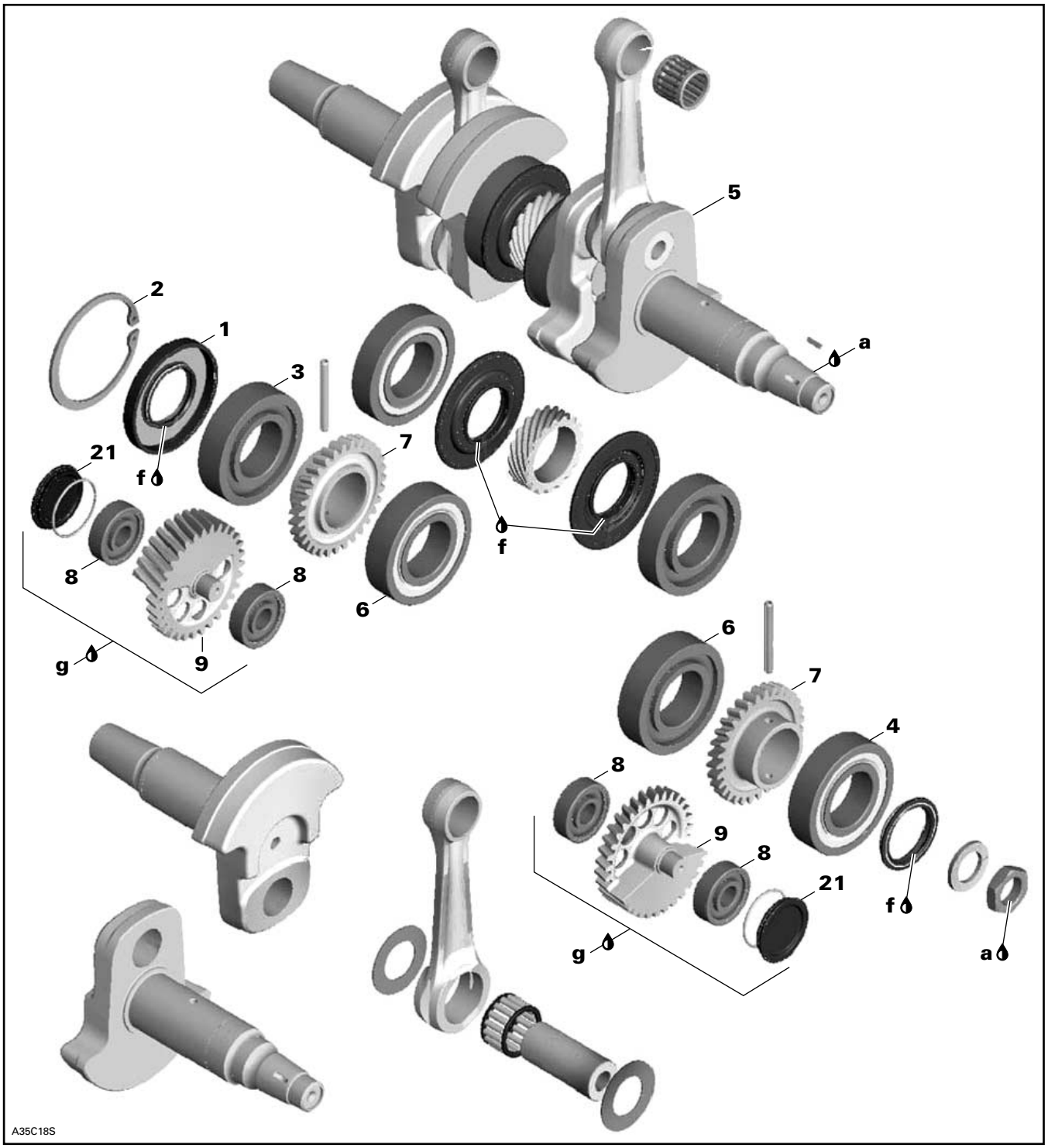
Description	Part Number	Page
bearing heater	529 035 969	70
bearing puller	529 036 004	65
ceramic seal installer	529 036 014	68–69
crankshaft protector	420 876 552	65
crankshaft protector	420 876 557	65
half rings	420 977 479	64
oil seal protector	529 035 822	68
oil seal pusher	529 035 757	67
puller ring	420 977 494	64
screws	420 840 681	65
temperature indicator stick	529 035 970	71

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	413 701 000	70
BOMBARDIER LUBE	293 600 016	65
Loctite chisel	413 708 500	64
pulley flange cleaner	413 711 809	70



a. Loctite 243 (P/N 293 800 060)
b. Loctite 648 (P/N 413 711 400)
c. Molykote 111 grease, 150 g (P/N 413 707 000)
d. Loctite 5910 (P/N 293 800 081)
e. Injection oil
f. Petamo grease GHY133N (P/N 420 899 271)
g. Isoflex grease 500 g (P/N 420 898 351)



a. Loctite 243 (P/N 293 800 060)
b. Loctite 648 (P/N 413 711 400)
c. Molykote 111 grease, 150 g (P/N 413 707 000)
d. Loctite 5910 (P/N 293 800 081)
e. Injection oil
f. Petamo grease GHY133N (P/N 420 899 271)
g. Isoflex grease 500 g (P/N 420 898 351)

TROUBLESHOOTING

Before completely disassembling the engine, proceed with an engine leak test. Refer to LEAK TEST.

GENERAL

During assembly/installation, use torque values and service products as shown in exploded view(s).

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

PREPARATION

Remove engine from chassis. Refer to REMOVAL AND INSTALLATION.

Remove cylinder head and cylinder block. Refer to TOP END.

Remove rewind starter. Refer to REWIND STARTER.

Remove magneto flywheel, stator plate and CPS. Refer to MAGNETO SYSTEM.

CLEANING

Discard all oil seals, gaskets, O-rings and sealing rings.

Clean all metal components in a non-ferrous metal cleaner.

Crankcase mating surfaces are best cleaned using a combination of the Loctite chisel (P/N 413 708 500) and a brass brush. Brush a first pass in one direction then make the final brushing perpendicularly (90°) to the first pass cross (hatch).

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are harmful to crankcase sealing. Do not wipe with rags. Use a new clean hand towel only.

DISASSEMBLY

General

Remove cylinder head and cylinder block. Refer to TOP END.

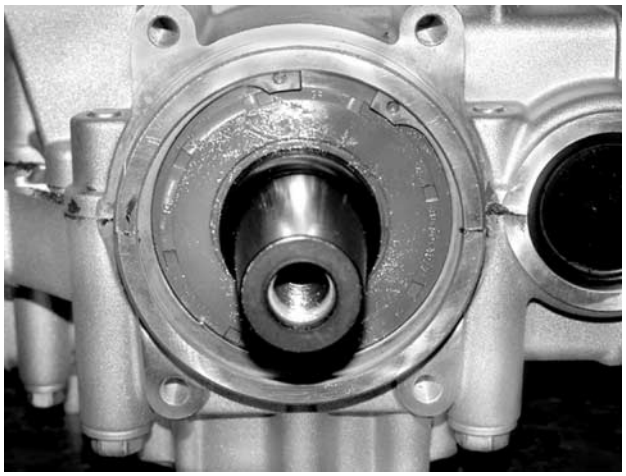
Remove rewind starter. Refer to REWIND STARTER.

Remove magneto flywheel and stator. Refer to MAGNETO SYSTEM.

PTO Seal

PTO seal **no. 1** may be removed without splitting up crankcase.

Remove snap ring **no. 2** then extract seal.



A35C19A

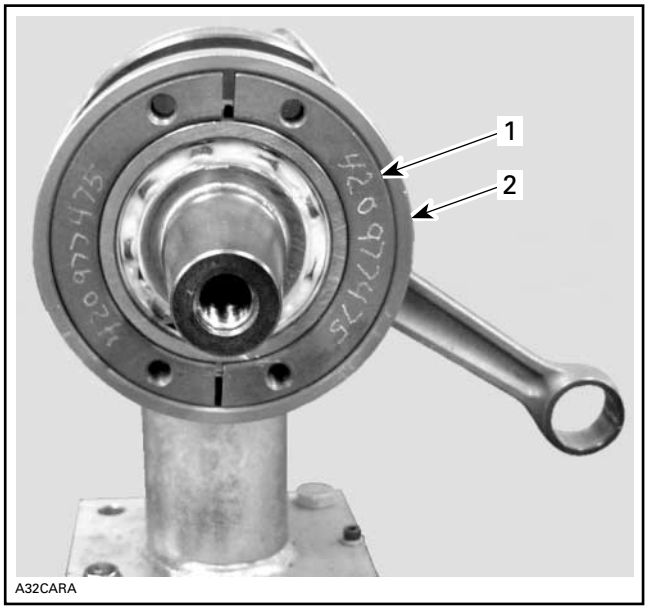
Crankcase

Remove crankcase screws and split up crankcase.

Withdraw crankshaft **no. 5** and counterbalance gears **no. 9**.

Crankshaft Bearing

To remove bearings **no. 3** and **no. 4** from crankshaft **no. 5**, install half rings (P/N 420 977 479) and puller ring (P/N 420 977 494) on the outer bearing.

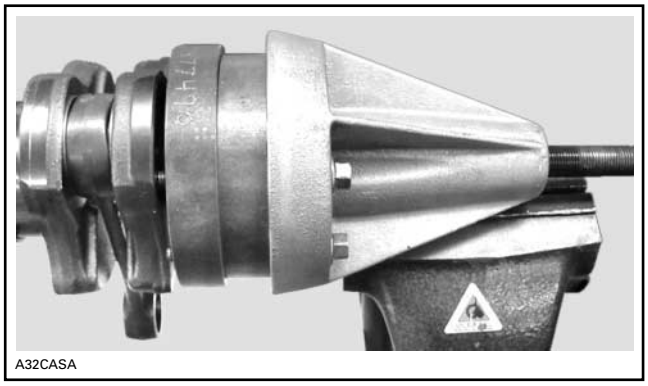


1. Half ring
2. Puller ring

NOTE: Apply grease on crankshaft end in order to hold in place the crankshaft protector (P/N 420 876 552) on PTO side and crankshaft protector (P/N 420 876 557) on MAG side.

Using screws (P/N 420 840 681), install bearing puller (P/N 529 036 004) on the half rings.

Secure the bearing puller in a vise by one of its rib.



BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool for tightening the puller bolt. Lubricate the bolt with BOMBARDIER LUBE (P/N 293 600 016) to avoid damaging the threads.

Screw in the puller bolt until the bearing comes out.

Counterbalance Drive Gear

NOTE: To remove/install bearing **no. 6** and gear **no. 7** from crankshaft, refer to a specialized shop. Special tools and accurate procedures are required.

CAUTION: Do not attempt to remove inner bearing or gear. Gear could be damaged.

Coolant/Injection Oil Pump Shaft

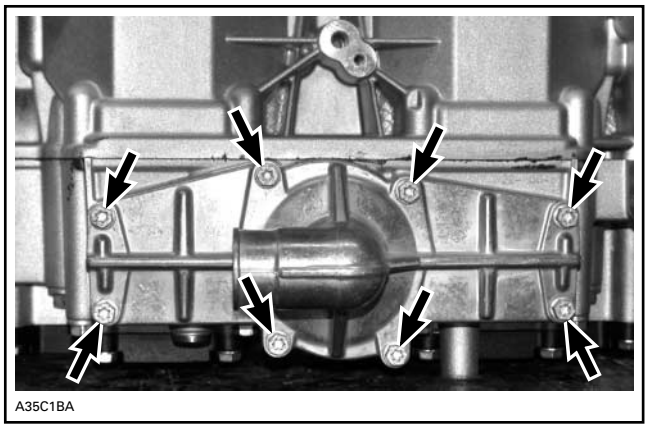
Removal

NOTE: It is not necessary to split up crankcase halves to pull out shaft.

Remove:

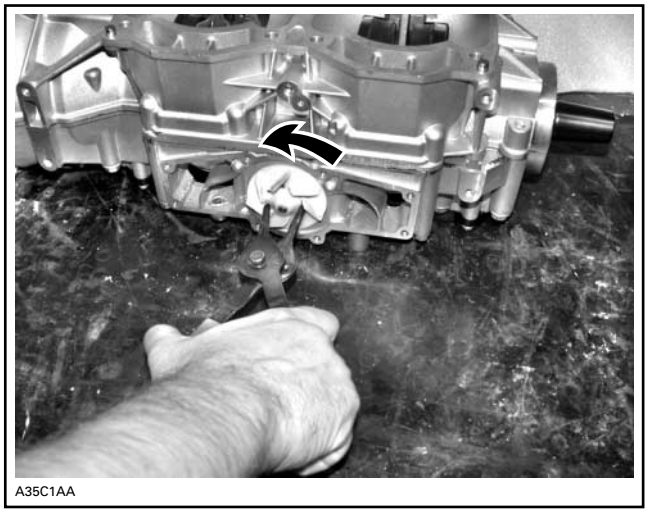
– Injection oil pump.

– Coolant pump housing **no. 10**.

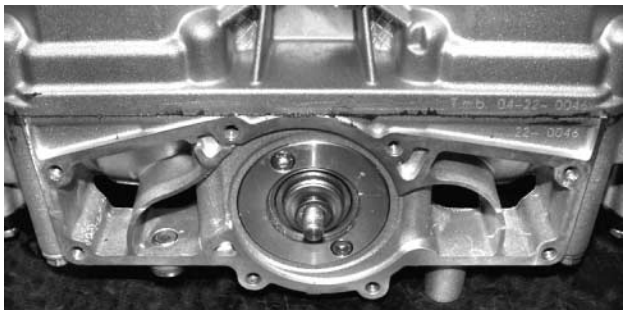


– Impeller **no. 11**.

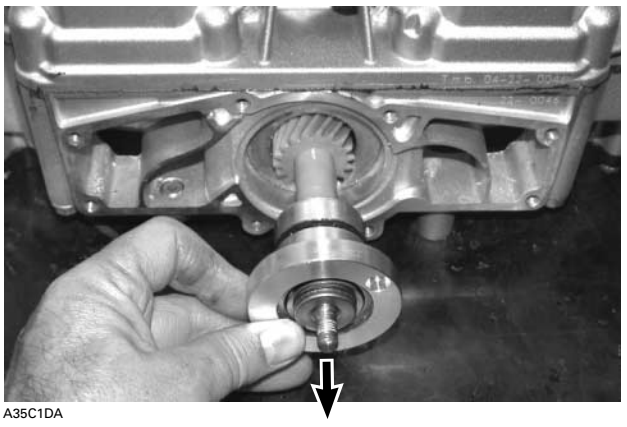
CAUTION: Be careful not to damage impeller fins.



– Bearing housing screws **no. 12**.


A35C1CA

From injection oil pump side, push shaft out while turning shaft to release it from worm gear.

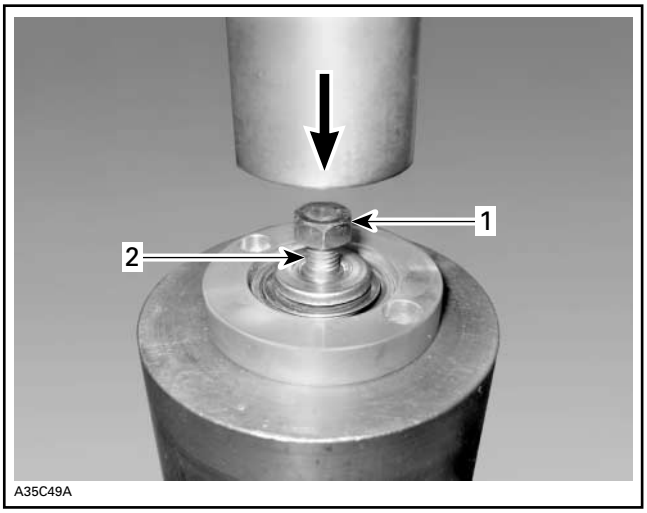

A35C1DA

Disassembly

CAUTION: Pay attention not to damage the bearing housing no. **13** during disassembly. Marks or other damages will lead to coolant and/or oil leaking.

NOTE: For disassembly/assembly procedure a press is required.

Protect the threads of shaft with a suitable M8 nut. Properly support bearing housing and push shaft out.

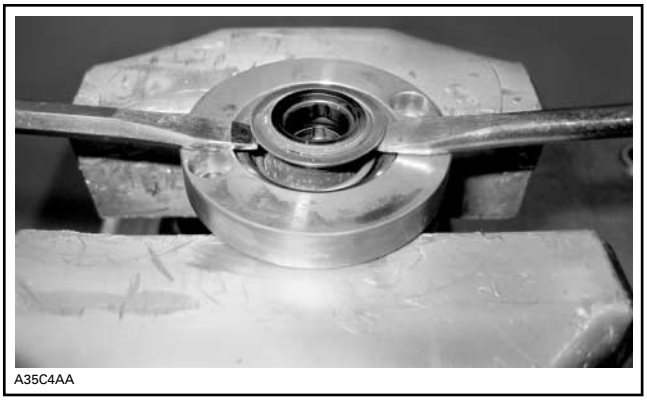


A35C49A

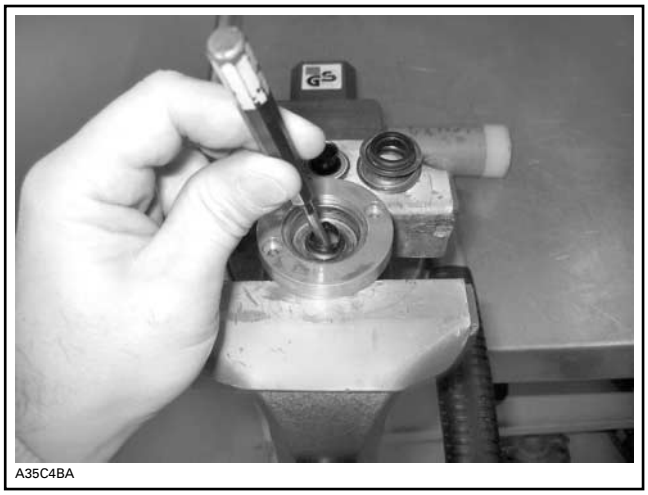
1. M8 nut
2. Shaft

CAUTION: When removing coolant pump shaft, always replace ceramic seal no. **14** and oil seal no. **15**. Ceramic seal cannot be removed without damage.

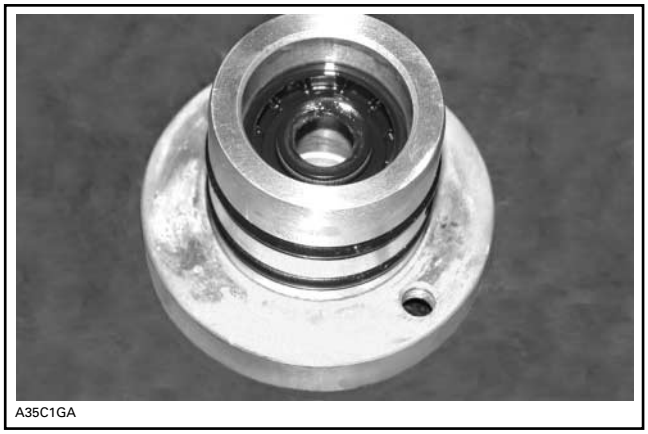
Pry inner part of ceramic seal **no. 14** out.


A35C4AA

Extract bearing **no. 16** from the bearing housing using an appropriate pusher.

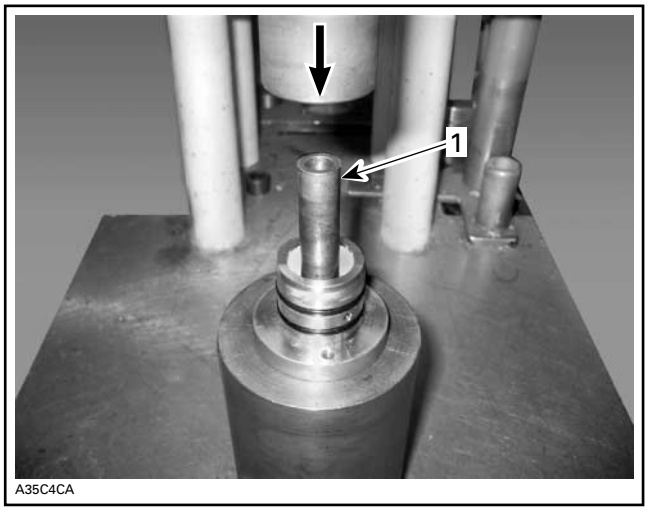

A35C4BA

Push oil seal **no. 15** out.


A35C1GA

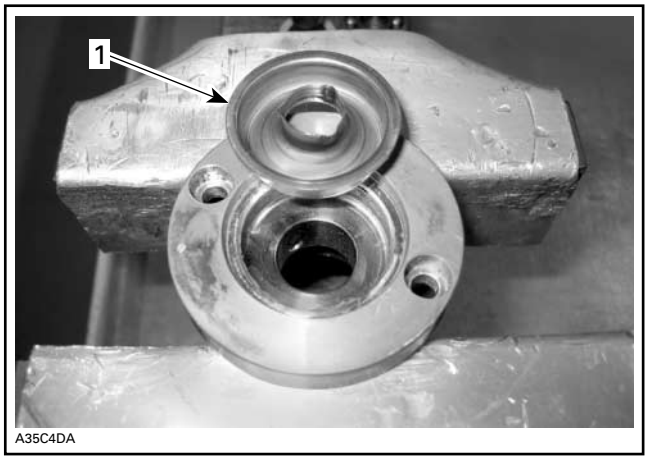
Carefully press the outer part of ceramic seal out.

NOTE: Use a mandrel with diameter of approximately 16 mm (0.63 in).



A35C4CA

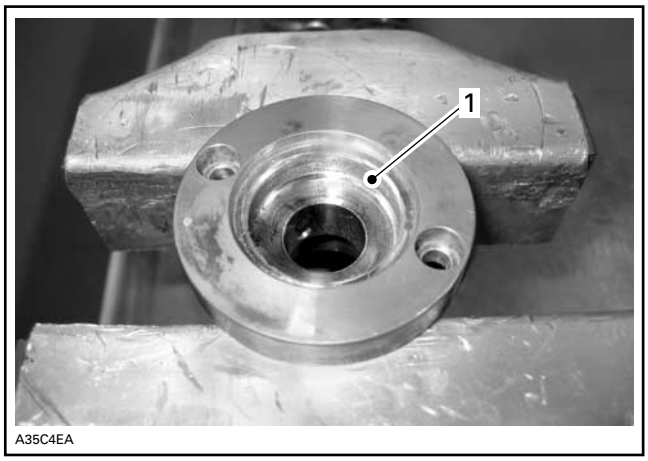
1. 16 mm (.63 in) mandrel



A35C4DA

1. Outer part of ceramic seal

Remove sealant from bearing housing with sand paper no. 180.



A35C4EA

1. Remove sealant

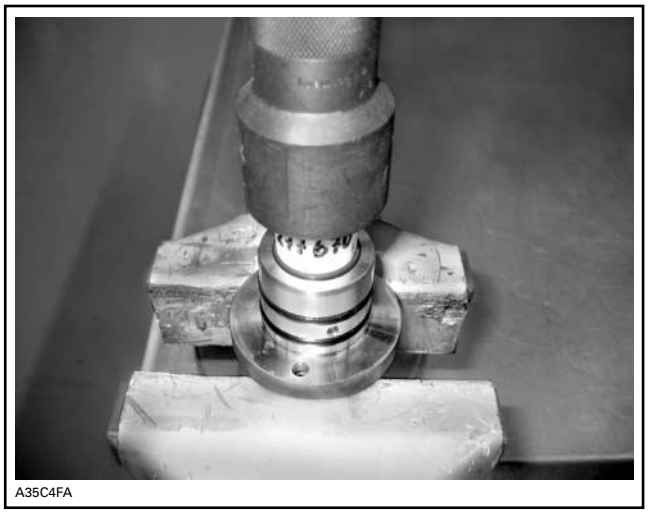
To extract bearing **no. 17** either use a hammer puller or an appropriate pusher.

Assembly

Reverse disassembly procedure and pay attention to the following.

NOTE: Never put oil in the press fit area of the oil seal and ceramic seal.

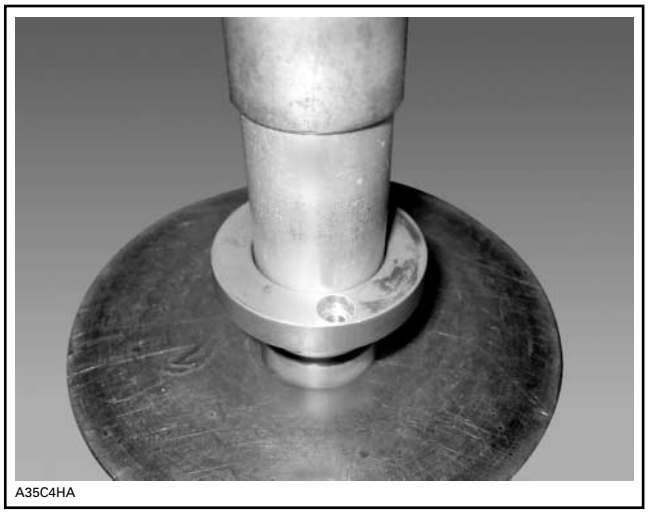
Push the new oil seal **no. 15** in bearing housing using the oil seal pusher (P/N 529 035 757).


A35C4FA

Press bearing **no. 16** into bearing housing **no. 13**.

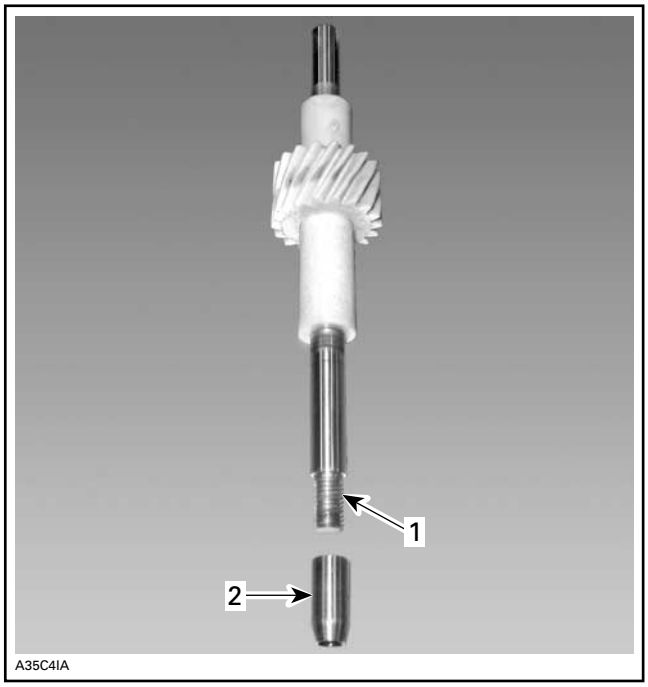
A35C4GA

Push the new ceramic seal **no. 14** in bearing housing **no. 13** using the coolant pump ceramic seal installer (P/N 529 036 014).


A35C4HA

CAUTION: Never use a hammer for the ceramic seal installation. Only use a press to avoid damaging the ceramic component.

Put oil seal protector (P/N 529 035 822) on coolant/oil pump shaft **no. 18**.



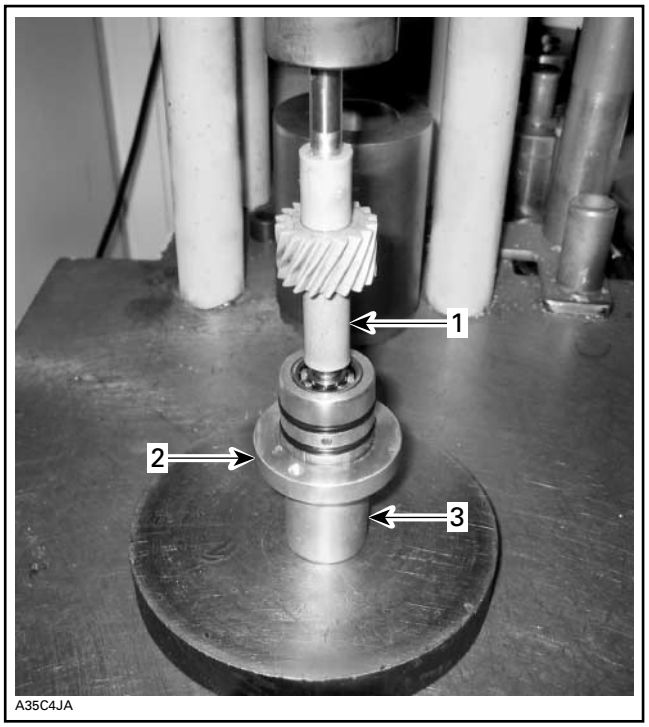
A35C4IA

1. Coolant/oil pump shaft
2. Oil seal protector

Press coolant/oil pump shaft **no. 18** into the bearing housing **no. 13** with appropriate force.

CAUTION: Inadequate force will damage the oil seal no. **15** and bearing no. **16**.

NOTE: During installation support the ceramic seal using the ceramic seal installer (P/N 529 036 014) as shown on the following illustration.



1. Coolant/oil pump shaft
2. Bearing housing
3. Ceramic seal installer

Remove oil seal protector from coolant/oil pump shaft.

Installation

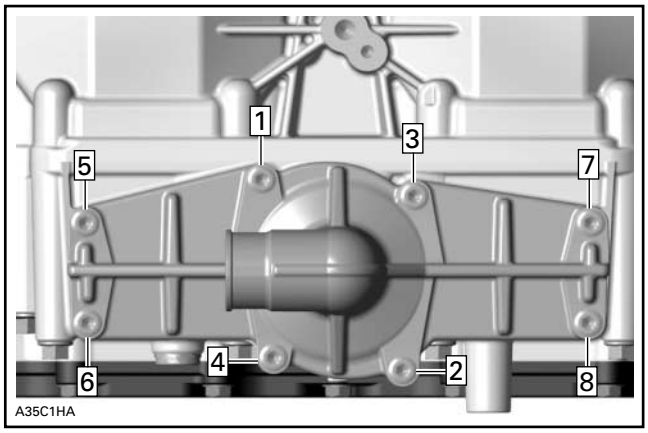
Pour 50 mL (2 U.S. oz) of injection oil in the pan under worm gear to lubricate pump gearing.

Install pump shaft assembly in crankcase half while turning shaft to mesh gears.

Torque housing screws **no. 12**.

After impeller installation, ensure shaft turns properly.

Torque impeller housing screws in the following sequence.



Reinstall oil injection pump.

INSPECTION

Refer to table below to find bottom end engine dimension specifications. For dimension measurement procedures, refer to ENGINE MEASUREMENT.

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	(max.)	WEAR LIMIT
Crankshaft deflection on PTO side	N.A.	0.03 mm (.0012 in)	0.06 mm (.0025 in)
Crankshaft deflection on MAG side	N.A.	0.05 mm (.002 in)	N.A.
Crankshaft deflection in center of crankshaft	N.A.	0.08 mm (.0031 in)	N.A.
Connecting rod big end axial play	0.23 mm (.009 in)	0.62 mm (.024 in)	1.20 mm (.047 in)
Crankshaft end-play	0.10 mm (.004 in)	0.30 mm (.012 in)	N.A.

Inspect crankshaft ends for damage.

ASSEMBLY

Crankshaft Preparation

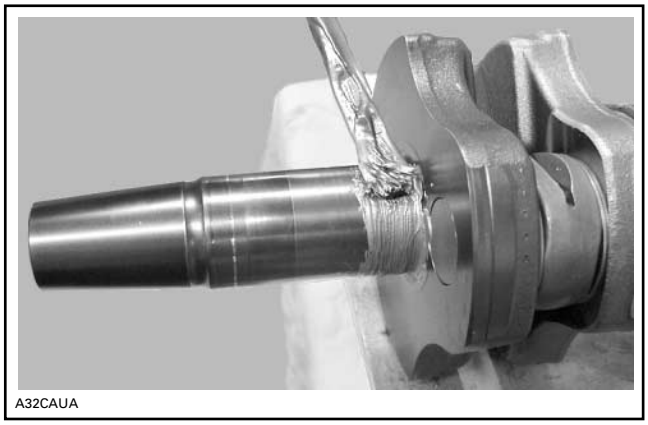
Clean crankshaft ends with sand paper no. 180 to remove possible seal marks and debris.

A32CB5A

A32CBWB

Remove all residue using pulley flange cleaner (P/N 413 711 809).

Smear anti-seize lubricant (P/N 413 701 000) on part of crankshaft where bearing fits.


A32CAUA

Crankshaft Bearing Preparation

Heat up the bearing(s) using bearing heater (P/N 529 035 969). This will expand bearings and ease installation. If required, put a suitable plate or shim to avoid the direct contact between integrated seal with the heating surface.

A32CB7A

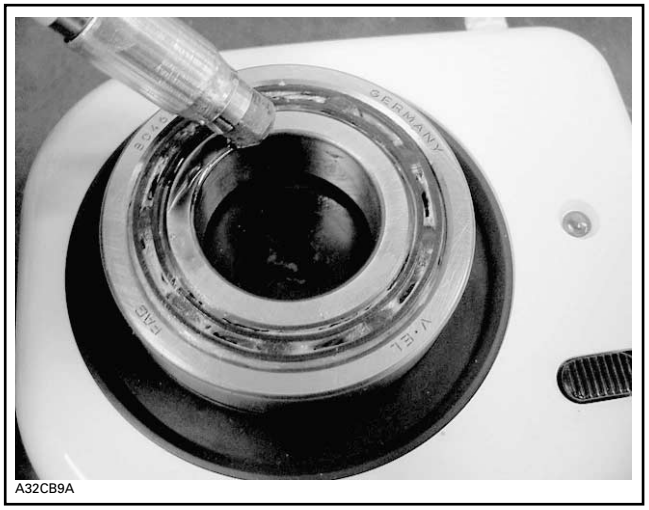
CAUTION: Bearing(s) should not be heated to more than 80°C (176°F). Do not heat bearing(s) on direct flame, or with a heat gun or in an oil bath. Inappropriate bearing(s) heating may result in inner seals or cage failure.

Turn bearing several times to obtain an even heating process.

NOTE: Normally it takes approximately 10 minutes to heat up a bearing so in the event of replacing bearing, it's recommended to start the bearing heating process prior to removal operation. Two bearings can be heated at the same time on one bearing heater.

1. Bearings

Probe the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reach the proper temperature.



⚠ WARNING

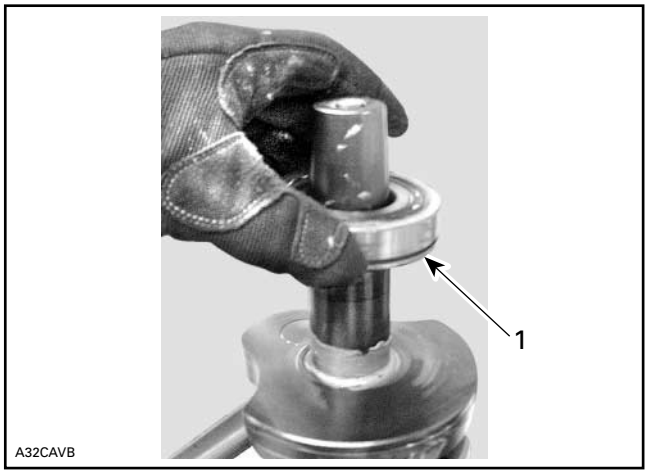
Do not touch heated bearing with bare hands. Always wear heat resisting gloves before handling the heated bearing(s).

Crankshaft Bearing Installation

CAUTION: Never reinstall a bearing that has been removed.

NOTE: To install bearings **no. 6** and gears **no. 7** onto the crankshaft, refer to a specialized shop. Special tools and accurate procedures are required.

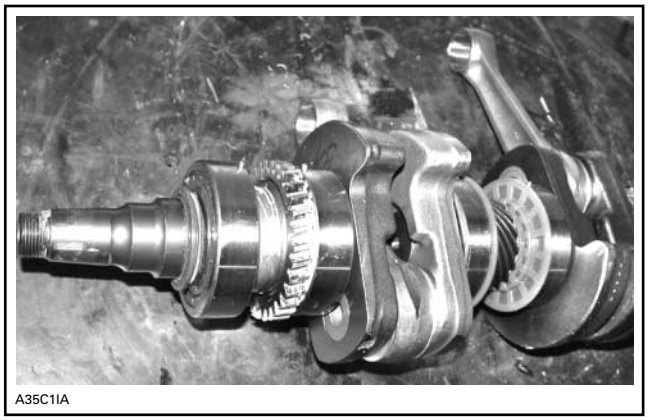
Slide bearings **no. 3** and **no. 4** with the integrated seal facing crankshaft. Push bearing to end position.

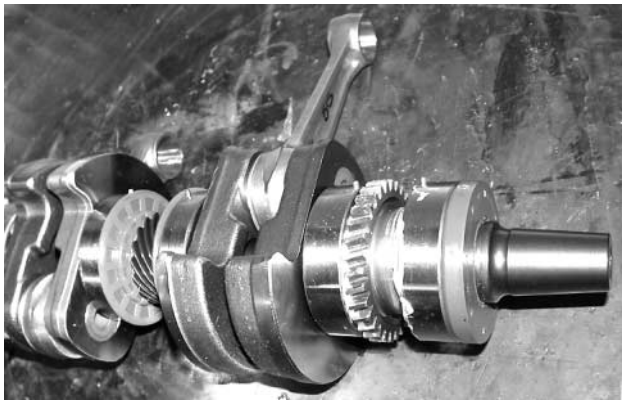


TYPICAL
1. Integrated seal this side

NOTE: Heated bearings will slide onto the crankshaft. If required, push with a steel tube on the inner ring of the bearing. **Pay special attention to correct positioning of the locating pins.**

Install seals on crankshaft.

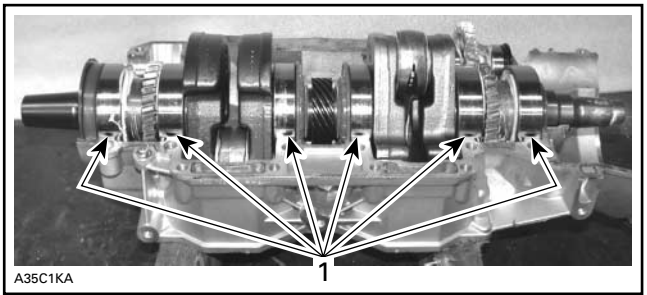



A35C1JA

Crankshaft Installation

NOTE: Although not mandatory, it is recommended to have the coolant/oil pump shaft installed prior to installing crankshaft.

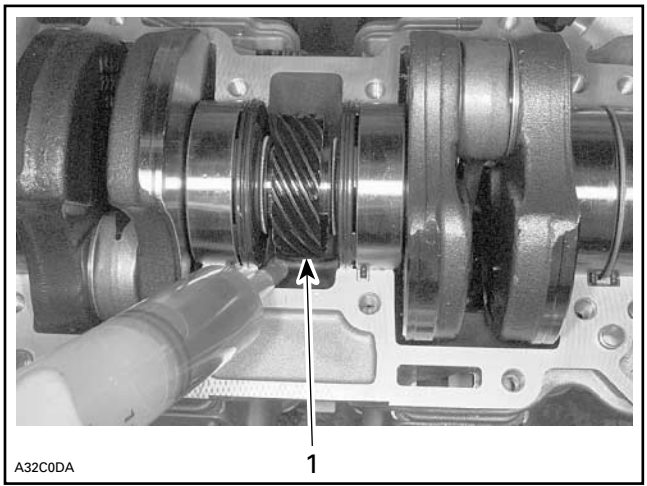
At crankshaft installation, position locating pins as illustrated.



A35C1KA

1. Locating pins

Pour 50 mL (2 U.S. oz) of injection oil in the pan under worm gear to lubricate pump gearing.



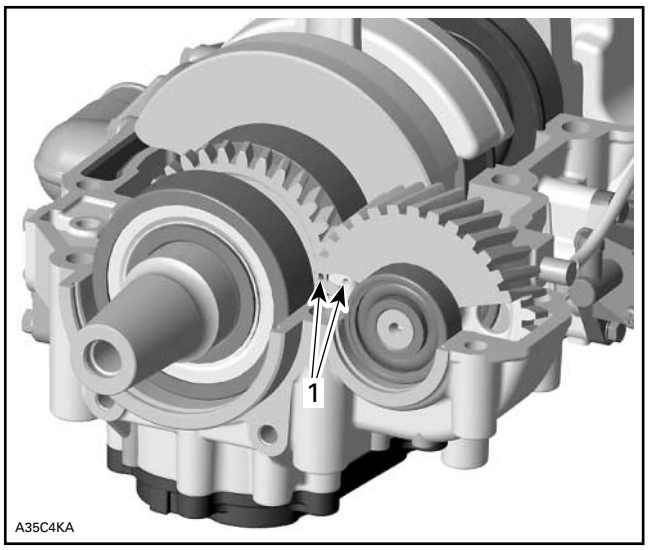
A32C0DA

TYPICAL
1. Oil bath

Counterbalance Gear

Make sure to properly index gears of crankshaft and counterbalance shaft with the aligning marks.

CAUTION: Marks on the gears must be aligned, otherwise engine will vibrate and premature wear will occur.



A35C4KA

1. Marks on gears aligned

Apply 40 mL (1.4 on) of Isoflex grease on counterbalance shaft gear **no. 9** and 5 mL (.2 on) on drive gear **no. 7**. Repeat on each side (PTO/MAG).

CAUTION: Use only the recommended Isoflex grease.

NOTE: If it is necessary to add grease when crankcase is assembled, remove caps **no. 20** and apply grease through the filling nipples.

Install caps **no. 21**.

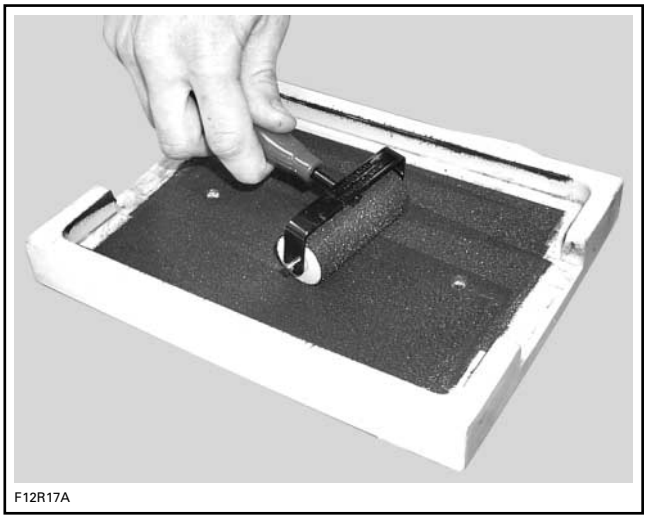
Crankcase Assembly

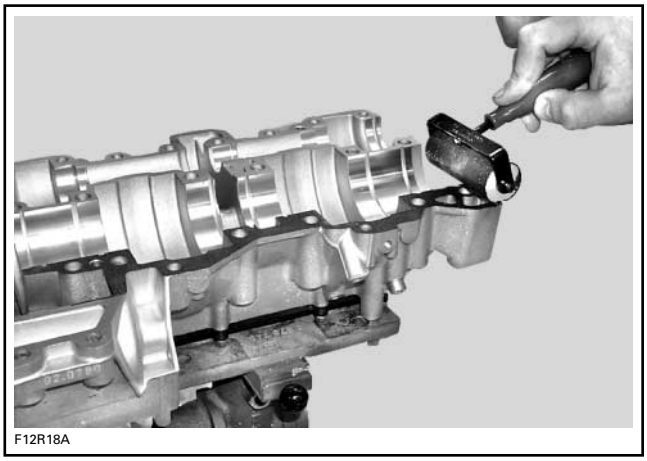
IMPORTANT: The total assembly sequence, including sealing compound spreading, screwing and torquing of bolts according to the proper sequence, must be performed within 10 minutes. Do not wait between each bolt torquing. All bolts must be torqued in a row.

NOTE: It is recommended to apply the specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant.

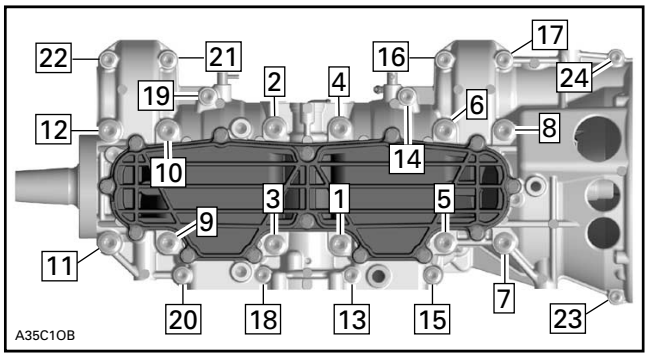
CAUTION: Do not use Loctite Primer N with the Loctite 5910. Do not use Dreibond to seal crankcase. Using these products or non silicone-based sealant over a previously sealed crankcase with Loctite 5910 will lead to poor adhesion and possibly a leaking crankcase. These products are chemically incompatibles. Even after cleaning, these products would leave incompatible microscopic particles.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.

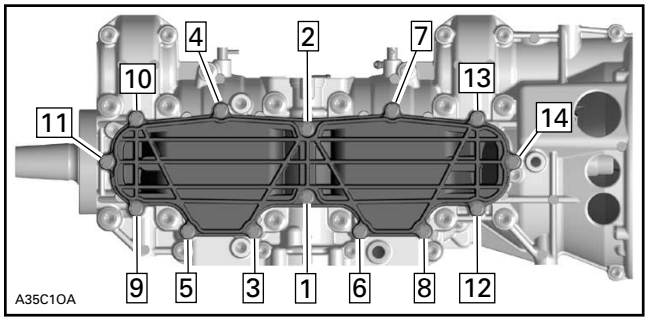

F12R17A


F12R18A

Torque crankcase screws in the following sequence. Initially torque M10 screws half the final torque then, tighten all screws to the required torque.



Torque heat exchanger cover screws **no. 19** following this sequence.



Ensure snap ring **no. 2** is properly installed in crankcase.

BREAK-IN

After rebuilding an engine, always observe a break-in period as described in *Operator's Guide*.

ENGINE MEASUREMENT

SERVICE TOOLS

Description	Part Number	Page
degree wheel	529 035 607	80
TDC gauge	414 104 700	76, 80

NOTE: This subsection explains the procedures to correctly measure engine components. For the engine technical specifications, refer to INSPECTION in the appropriate ENGINE subsection.

CYLINDER HEAD WARPAGE

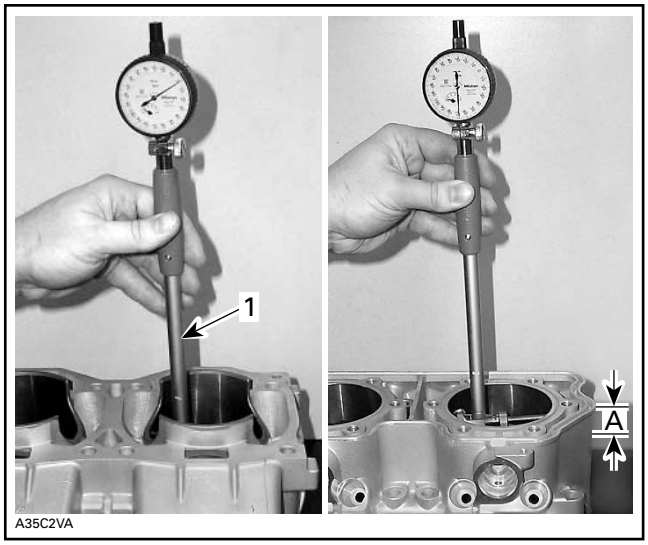
Check gasketed surface of the cylinder head with a straight edge and a feeler gauge. Make sure part is within the given specification. If cylinder head is out of specification, replace it. Verify combustion chamber volume to use the correct cylinder base gasket with the new part.

CYLINDER TAPER

Compare cylinder diameter 33 mm (1.3 in) from top of cylinder to just below its intake port area.

If the difference exceeds the specified dimension the cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but can not be rebored.

NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.

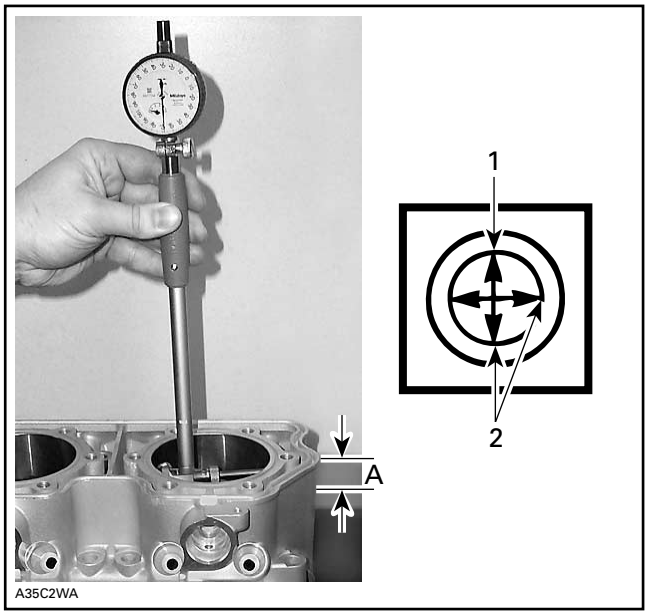


1. Below the intake port
A. .33 mm (1.3 in) from top

CYLINDER OUT OF ROUND

Measuring 33 mm (1.3 in) from top of cylinder with a cylinder gauge, check if the cylinder out of round is more than the specified dimension. If larger, cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but cannot be rebored.

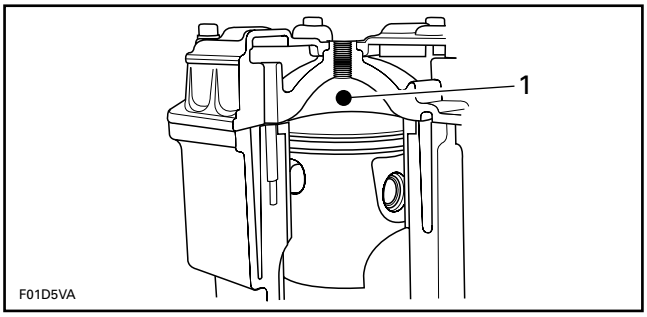
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



1. Piston pin position
2. Measures to be compared
A. 33 mm (1.3 in)

COMBUSTION CHAMBER VOLUME MEASUREMENT

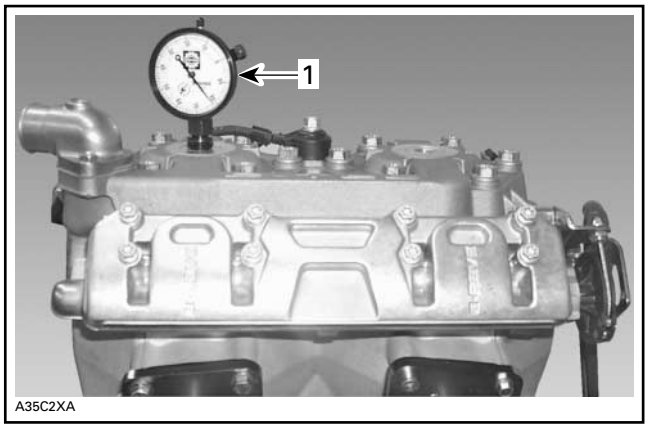
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center. It is measured with the cylinder head installed on the engine.



TYPICAL
1. Combustion chamber

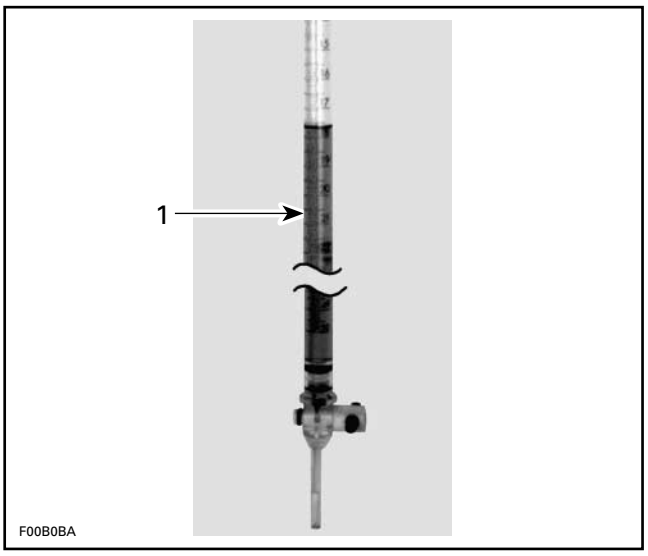
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposits and cylinder head must be leveled.

– Remove both spark plugs and bring one piston to Top Dead Center a using a TDC gauge (P/N 414 104 700).



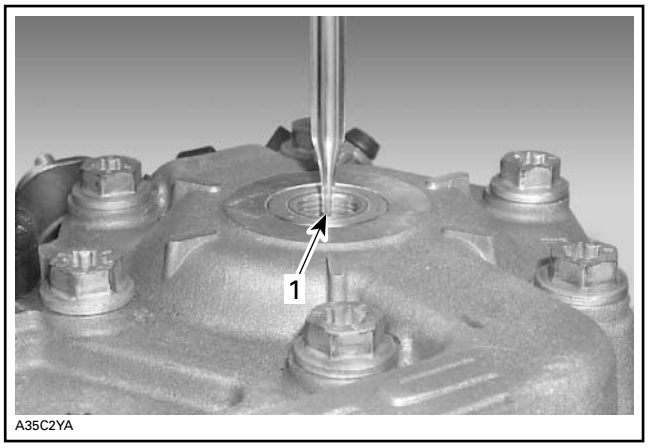
1. Bring piston to TDC

– Obtain a graduated burette (capacity 0 - 50 cc) and fill with an equal part (50/50) of gasoline and injection oil.



1. Graduated burette (0 - 50 cc)

– Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.
– Inject the burette content through the spark plug hole until liquid touches the top spark plug hole.



1. Top of spark plug hole

NOTE: The liquid level in cylinder must not drop for a few seconds after filling. If so, there is a leak between piston and cylinder. The recorded volume would be false.

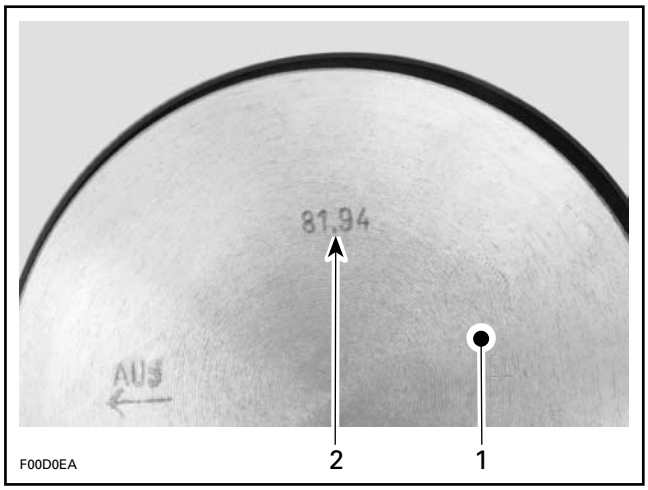
– Let burette stand upward for about 10 minutes, until liquid level is stabilized.
– Read the burette scale to obtain the quantity of liquid injected in the combustion chamber.

NOTE: When the combustion chamber is filled to top of spark plug hole, it includes an amount of 2.25 cc corresponding to the spark plug well.

– Repeat the procedure for the other cylinder.
– Install a thicker or thinner cylinder/crankcase gasket (refer to *Parts Catalogs*) in order to obtain the specified combustion chamber volume or the nearest.

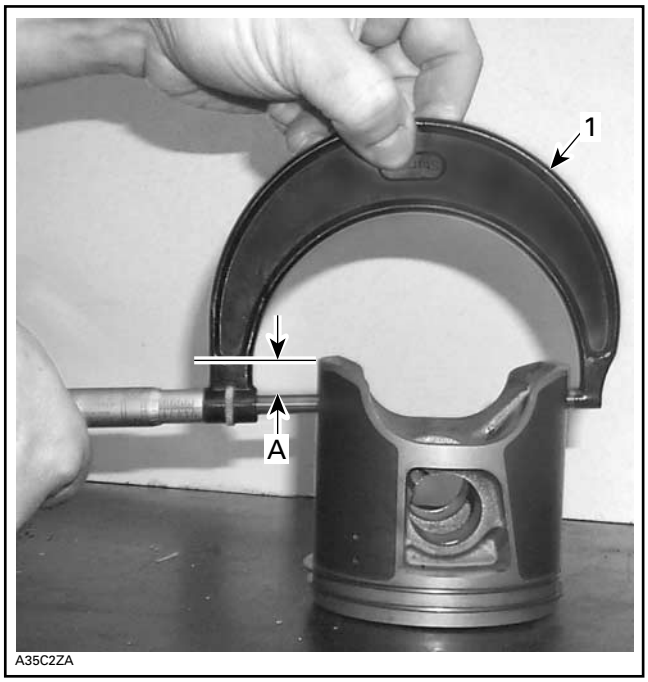
USED PISTON MEASUREMENT

Note the measurement on the piston dome.



1. Piston dome
2. Piston measurement

Using a micrometer, measure piston skirt at 29 mm (1.142 in) perpendicularly (90°) to piston pin.



1. Measuring perpendicularly (90°) to piston pin axis
A. 29 mm (1.142 in)

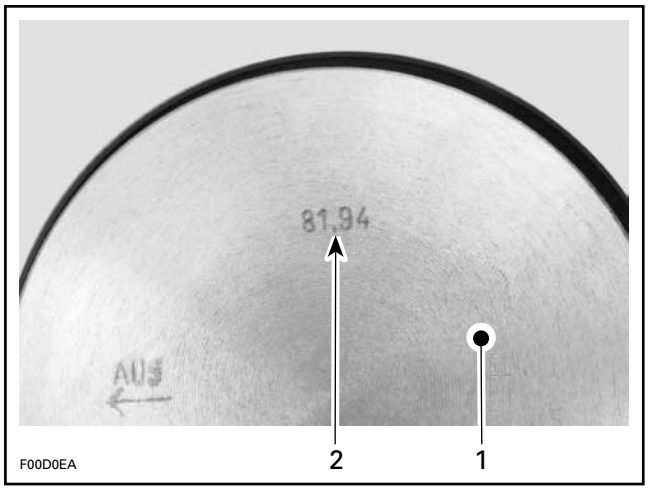
The measured dimension must not be less than 0.15 mm (.006 in) of the one scribed on piston dome. Otherwise, replace piston.

CYLINDER/PISTON CLEARANCE

Used and New Pistons

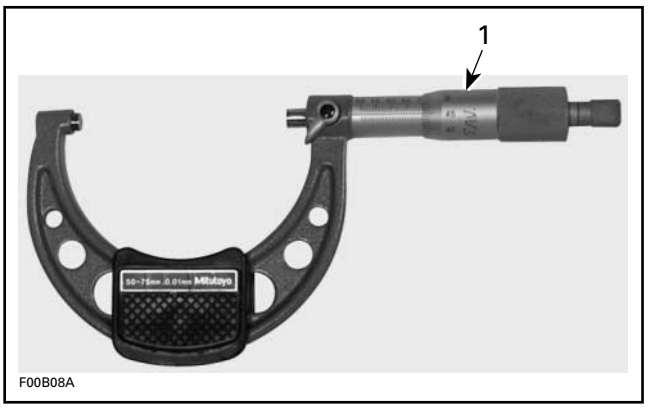
IMPORTANT: Make sure used piston is not worn more than specified. See USED PISTON MEASUREMENT above.

Take the measurement on the piston dome.



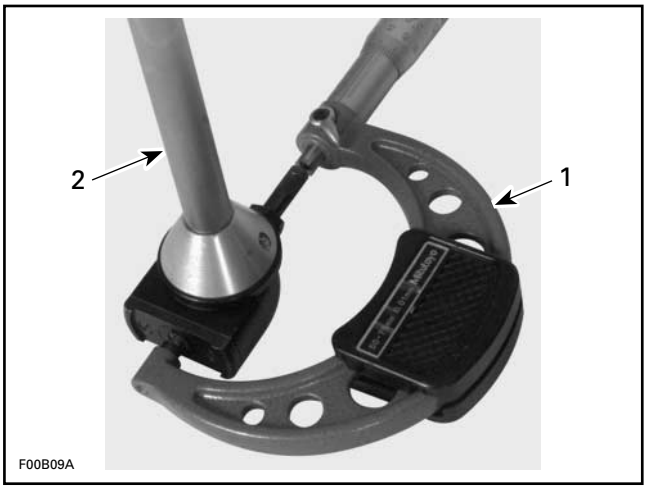
1. Piston dome
2. Piston measurement

Adjust and lock a micrometer to the specified value on the piston dome.

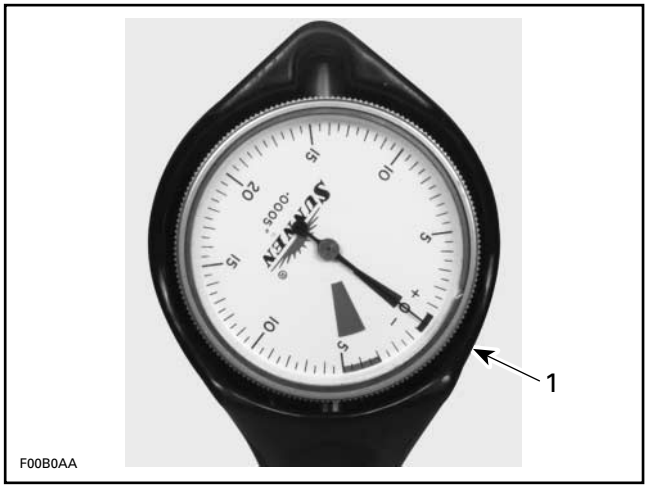


1. Micrometer set to the piston dimension

With the micrometer set to the piston dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0.



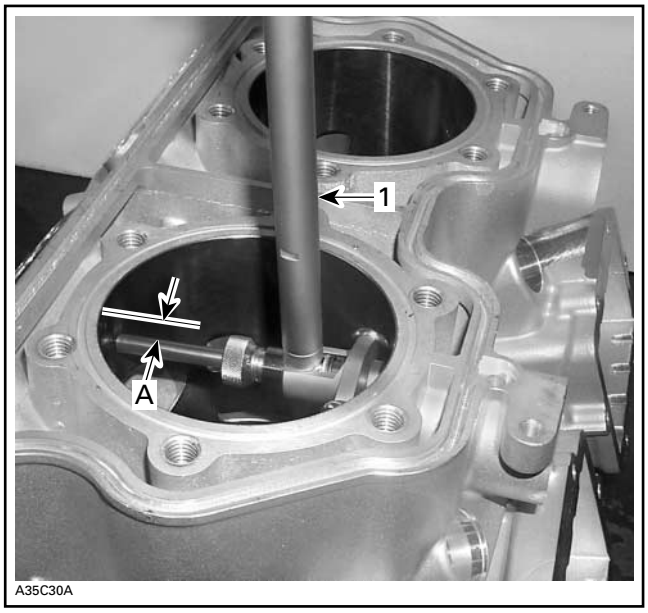
1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



1. Indicator set to 0 (zero)

IMPORTANT: Always remove cylinders from crankcase before measuring.

Position the dial bore gauge at 33 mm (1.3 in) below cylinder top edge.



1. Measuring perpendicularly (90°) to piston pin axis
A. 33 mm (1.3 in)

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance. If clearance exceeds specified tolerance, replace cylinder or rebore and install oversize piston depending on engine.

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

RING/PISTON GROOVE CLEARANCE

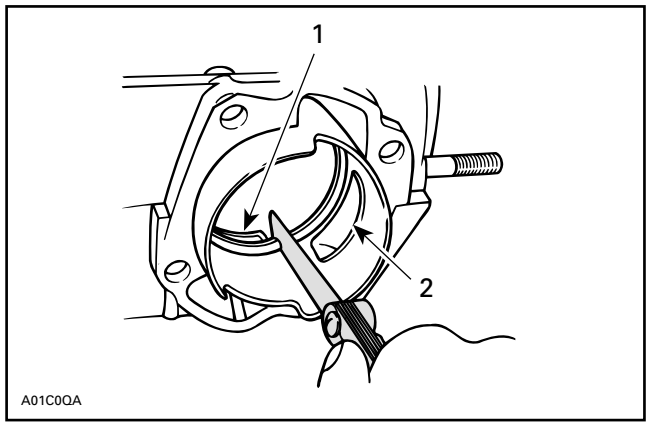
Using a feeler gauge check clearance between rectangular ring and groove. Replace piston if clearance exceeds specified tolerance.

RING END GAP

Position ring halfway between transfer ports and intake port.

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds specified tolerance.



TYPICAL
1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

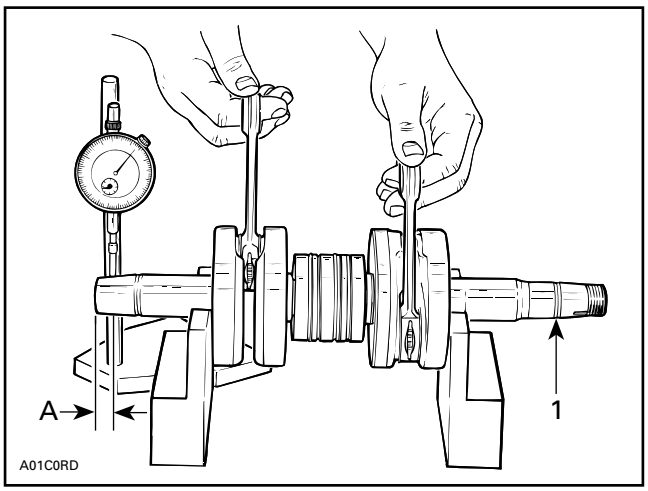
Crankshaft deflection is measured with a dial indicator.

Measuring in Crankcase

First, check deflection with crankshaft in crankcase. If deflection exceeds the specified tolerance, recheck deflection using V-shaped blocks to determine the defective part(s). See below.

Measuring on Bench

Once engine is disassembled, check crankshaft deflection on V-shaped blocks. If deflection exceeds the specified tolerance, it can be worn bearings or a bent crankshaft. Remove crankshaft bearings and check deflection again on V-shaped blocks to determine the defective part(s). See measurement "A" in following illustration.



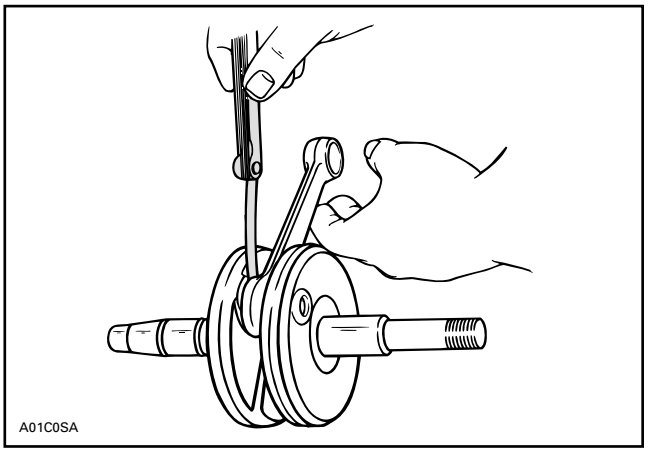
TYPICAL
1. Measure at mid point between the key and the first thread
A. 3 mm (1/8 in)

NOTE: Crankshaft deflection cannot be correctly measured on a lathe.

If the deflection exceeds the specified tolerance, crankshaft should be repaired or replaced.

CONNECTING ROD BIG END AXIAL PLAY

Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight. If the distance exceeds specified tolerance, repair or replace the crankshaft.

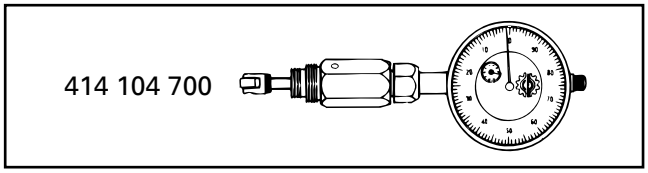


TYPICAL

CHECKING CRANKSHAFT ALIGNMENT

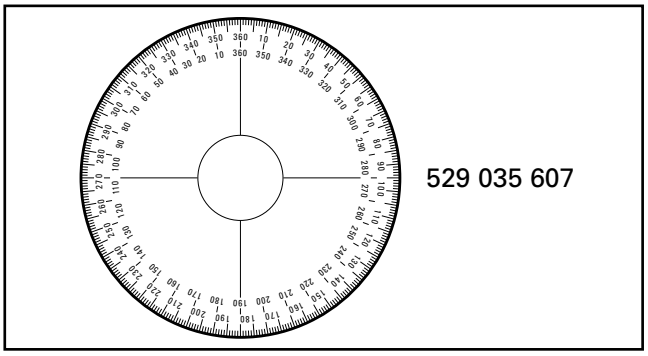
Remove both spark plugs.

Install a TDC gauge (P/N 414 104 700) in spark plug hole on MAG side.



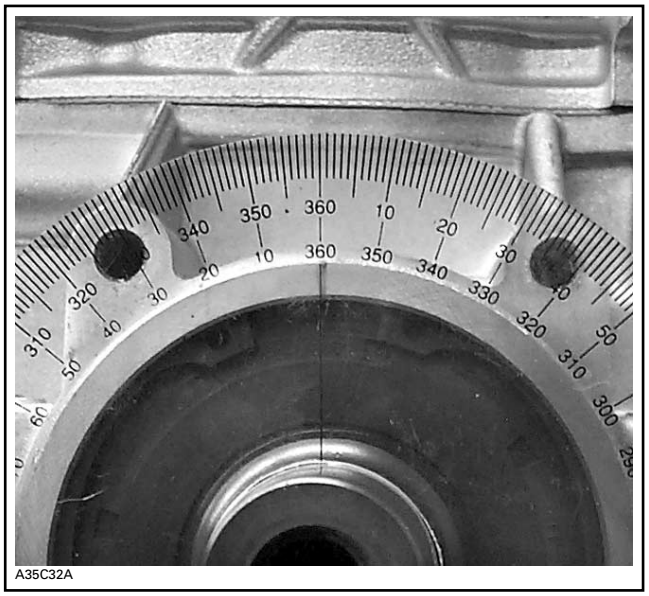
Bring MAG piston at top dead center.

Install the degree wheel (P/N 529 035 607) on crankshaft end.



Scribe a mark on crankcase.

Install degree wheel so that 360° mark aligns with the mark on crankcase. Do not rotate crankshaft.



A35C32A

Remove TDC gauge and install it in spark plug hole on PTO side.

Bring PTO piston to top dead center. Degree wheel must rotate with crankshaft.

Interval between cylinders must be 180° ± 0.5.

Any other reading indicates a misaligned (twisted) crankshaft.

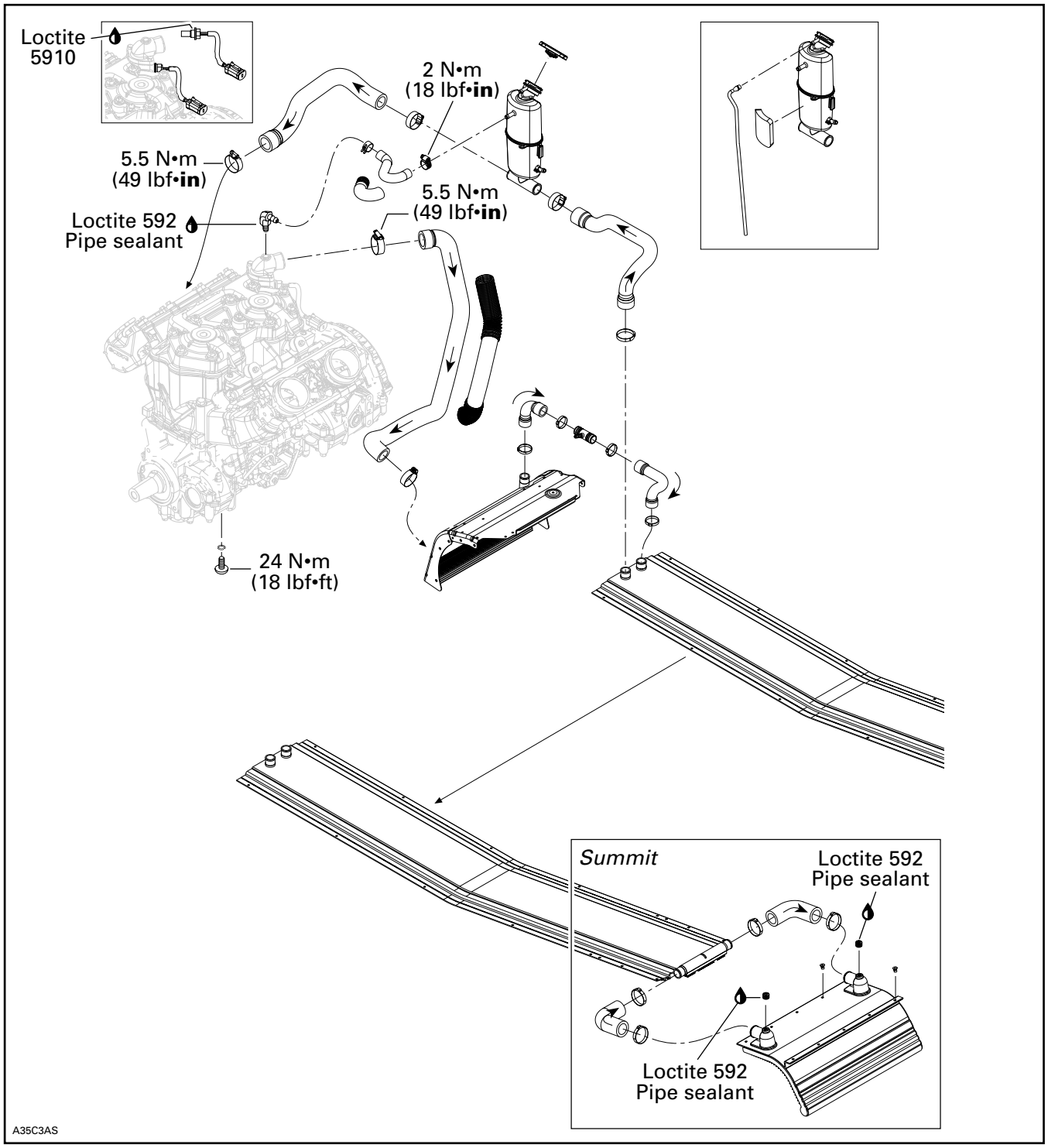
COOLING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
engine leak tester kit	861 749 100	85
hose pincher	295 000 076	85
siphon tool	529 035 880	85
special coolant tank cap	529 021 400	85

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 5910	293 800 081	86
Loctite 592	293 800 018	86
PREMIXED COOLANT	293 600 038	87


Loctite 5910
2 N•m (18 lbf•**in**)
5.5 N•m (49 lbf•**in**)
5.5 N•m (49 lbf•**in**)
Loctite 592 Pipe sealant
24 N•m (18 lbf•ft)
Summit
Loctite 592 Pipe sealant
Loctite 592 Pipe sealant
A35C3AS

COOLING SYSTEM LEAK TEST

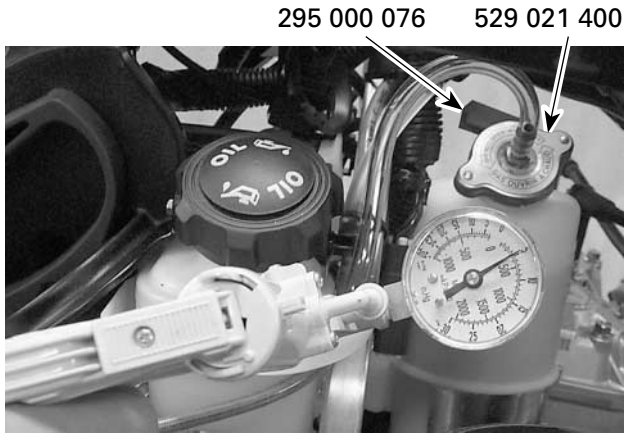
⚠ WARNING

To prevent burning yourself, do not remove the coolant tank cap if the engine is hot.

Install special coolant tank cap (P/N 529 021 400) included in the engine leak tester kit (P/N 861 749 100) on coolant tank.

Install hose pincher (P/N 295 000 076) on overflow hose.

Using pump also included in kit pressurize all system through coolant tank to 100 kPa (15 PSI).



TYPICAL

INSPECTION

Check general condition of hoses and clamp tightness.

Check all hoses and cylinder/base for coolant leaks.

Spray a soap/water solution and look for air bubbles.

Check weep hole for leaks.

NOTE: Oil leak from weep hole indicates a pump shaft defective seal, coolant leak indicates a damaged ceramic seal.

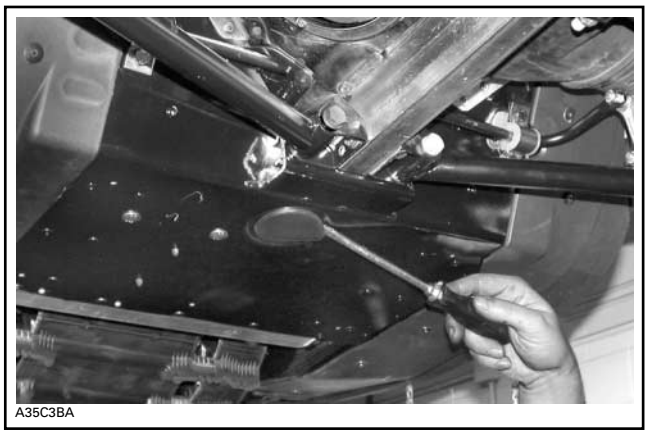
DRAINING THE SYSTEM

⚠ WARNING

Never drain or refill the cooling system when engine is hot.

Remove coolant tank cap.

Lift front of the vehicle and remove bottom pan cap.

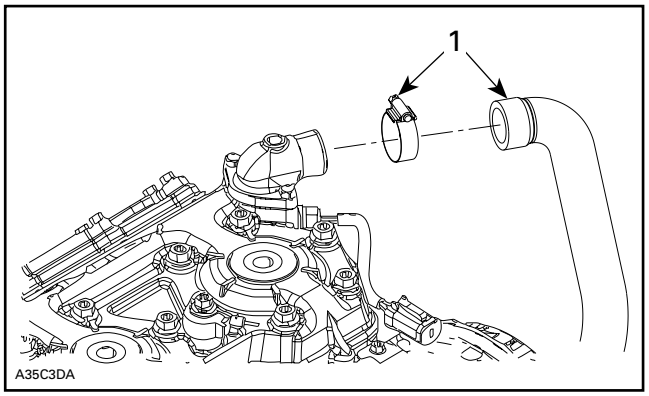


Place a drain pan under the drain hole.

Unscrew drain plug.

1. Drain plug

Disconnect engine outlet hose and siphon remaining of coolant mixture from heat exchangers using the siphon tool (P/N 529 035 880).



1. Disconnect engine outlet hose

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Engine drain plug	24 N•m (18 lbf•ft)

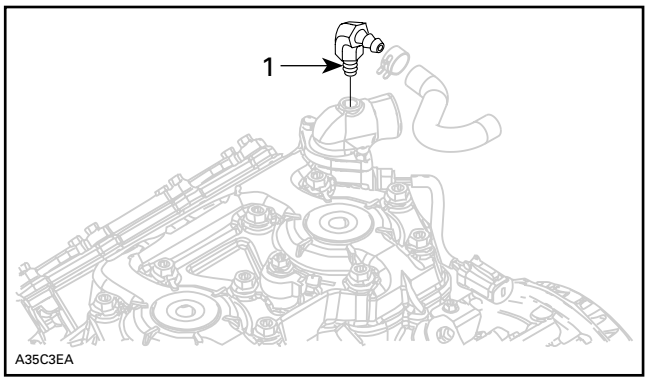
DISASSEMBLY AND ASSEMBLY

Coolant Pump

Refer to BOTTOM END section.

Bleed Hose Elbow Fitting

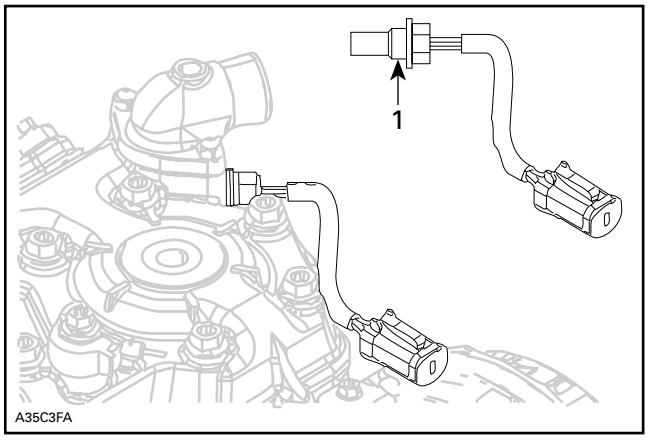
Apply Loctite 592 (P/N 293 800 018) thread sealant on elbow fitting.



BLEED HOSE ELBOW FITTING
1. Apply Loctite 592

Temperature Sensor

Apply some Loctite 5910 (P/N 293 800 081) on engine temperature sensor threads.



TEMPERATURE SENSOR
1. Apply Loctite 5910

Pressure Cap

Check if coolant tank cap pressurizes the system for 3 minutes. If not, install a new 90 kPa (13 PSI) cap (do not exceed this pressure).

Coolant Tank

For removal, drain cooling system before removing coolant tank.

Remove all hoses from coolant tank.

Slide up coolant tank to disengage it from oil tank.

Check if the tank is cracked or melted. Replace if necessary.

For installation, reverse the removal procedure.

Rear Heat Exchanger

Remove all debris between heat exchanger fins. A clean heat exchanger is more efficient than a dirty one.

Check if the heat exchanger fins are damaged. Replace heat exchanger if necessary.

NOTE: A heat exchanger with many broken fins does not work properly.

For disassembly, drain cooling system.

Remove seat, refer to BODY/FRAME.

Remove trunk and rear luggage rack.

Remove Oetiker clamps and unplug hoses.

Drill all rivets retaining heat exchanger to frame.

Remove heat exchanger.

For installation, reverse the removal procedure and make sure to use new Oetiker clamps.

Rear Cap Heat Exchanger

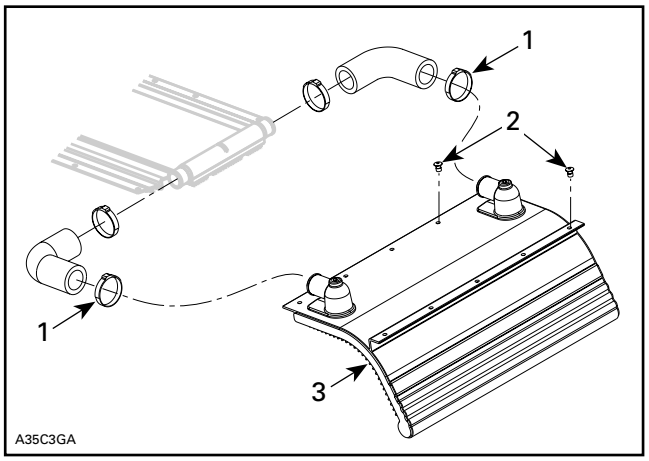
Summit Models Only

For disassembly, drain cooling system.

Remove rear hose cover.

Remove Oetiker clamps and unplug rear cap heat exchanger hoses.

Drill all rivets retaining rear cap heat exchanger to frame.



REAR CAP HEAT EXCHANGER
1. *Remove Oetiker clamps*
2. *Drill all rivets*
3. *Rear cap heat exchanger*

Remove rear cap heat exchanger.

For installation, reverse the removal procedure.

Heat Exchanger Protector

Insert heat exchanger protector into rear heat exchanger C-rail and crimp C-rail at rear end.

Thermostat

There is no thermostat on those models.

COOLING SYSTEM REFILLING PROCEDURE

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the BRP premixed coolant or with 50% antifreeze and 50% water. Pure antifreeze without water freezes (like slush ice). Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

System Capacity

Refer to TECHNICAL DATA.

Refilling Procedure

IMPORTANT: USE THE PREMIXED COOLANT (P/N 293 600 038). Do not reinstall pressure cap.

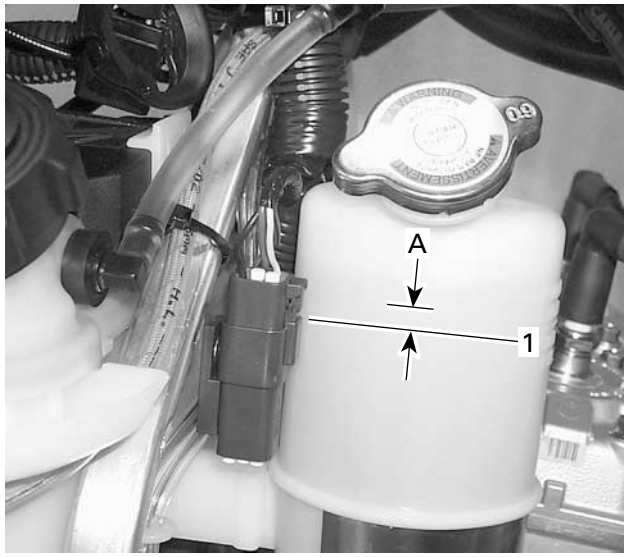
With engine cold, refill coolant tank up to COLD LEVEL line. Start engine. Refill up to line while engine is idling until rear heat exchangers are warm to the touch (about 4 to 5 minutes). Always monitor coolant level while filling tank to avoid emptying. Install pressure cap.

Lift rear of vehicle and support it safely.

Activate throttle lever 3 - 4 times to bring engine speed to 7000 RPM.

Apply the brake.

Lower vehicle back on ground and add coolant up to 15 mm (1/2 in) above the COLD LEVEL line.



TYPICAL
1. *Cold level line*

A. 15 mm (1/2 in)

Lift front of vehicle of 60 cm (24 in) and support it safely. Let the vehicle idle for two minutes.

Put vehicle back on ground and add coolant up to 15 mm (1/2 in) over COLD LEVEL line.

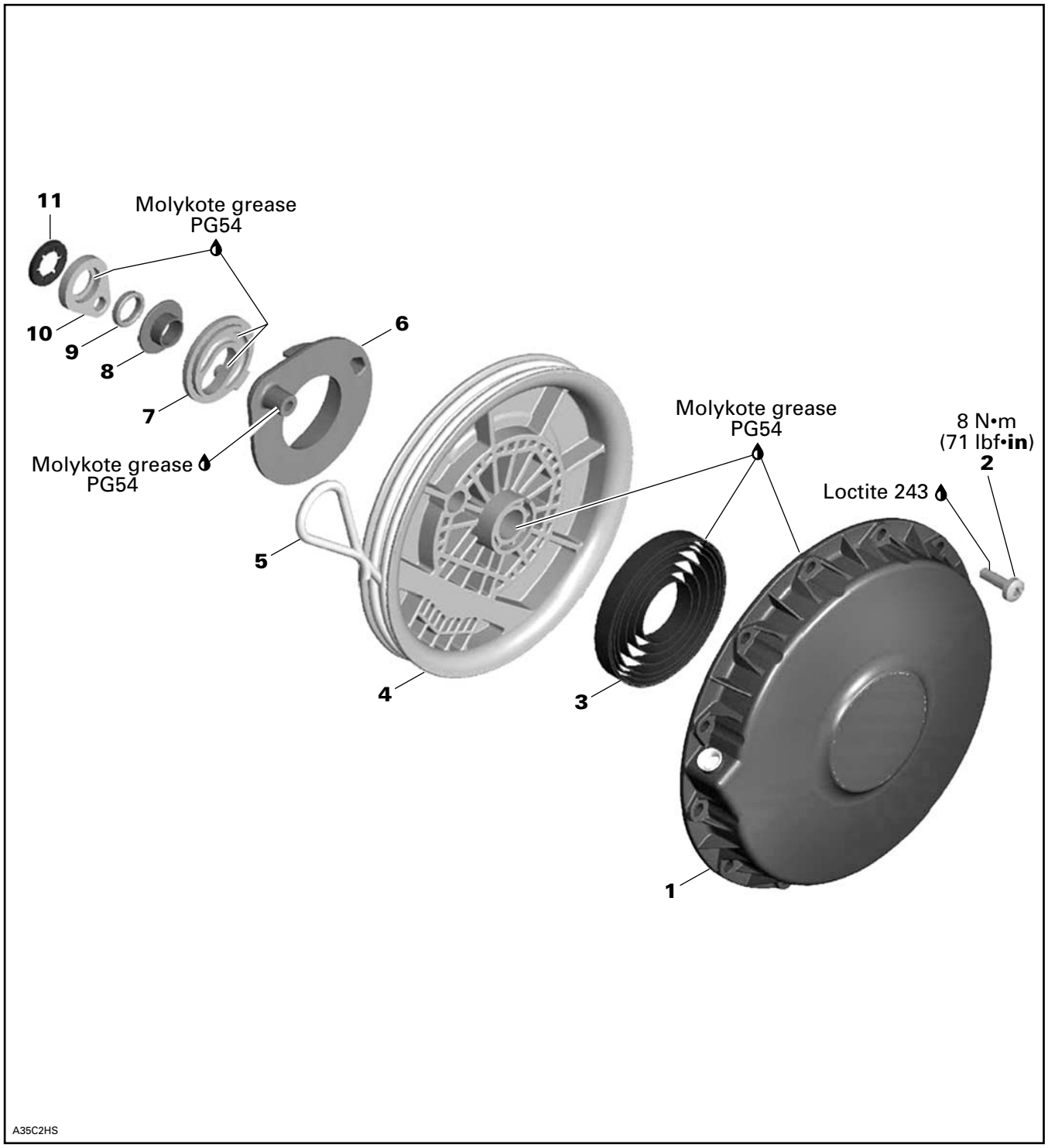
When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line if needed.

Check for coolant mixture freezing point. Specification is - 37°C (- 35°F). Adjust as necessary.

REWIND STARTER

SERVICE PRODUCTS

Description	Part Number	Page
Molykote PG 54	420 899 763	92–93


11
Molykote grease
PG54
10
9
8
7
6
Molykote grease
PG54
5
4
Molykote grease
PG54
8 N•m
(71 lbf•in)
2
Loctite 243
3
1
A35C2HS

GENERAL

During assembly/installation, use torque values and service products as shown in exploded view(s).

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

INSPECTION

NOTE: Due to dust accumulation, rewind starter must be periodically cleaned, inspected and relubricated.

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using specific lubricant. Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

Check if rope no. 5 is fraying, replace if so.

When pulling starter grip, mechanism must engage within 30 cm (1 ft) of rope pulled. If not, disassemble rewind starter, clean and check for damaged plastic parts. Replace as required, lubricate, reassemble and recheck. Always replace O-ring no. 9 every time rewind starter is disassembled.

When releasing starter grip, it must return to its stopper and stay against it. If not, check for proper spring preload or damages. Readjust or replace as required.

When pulling starter grip 10 times in a row, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

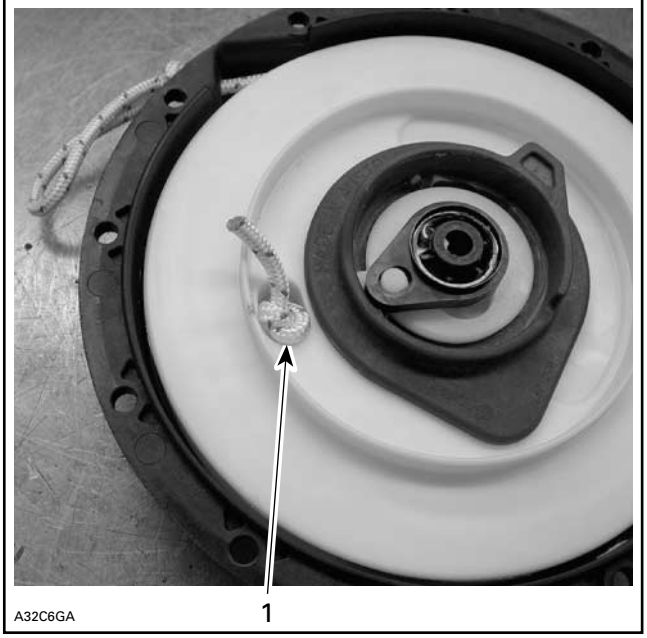
REMOVAL

Using a small screwdriver, extract rope knot from starter grip. Cut rope close to knot. Tie a knot near starter.

Remove screws no. 2 securing rewind starter no. 1 to engine then remove rewind starter.

ROPE REPLACEMENT

Pull out rope. Hold rewind starter in a vise. Slide rope and untie the knot. Pull out the rope completely.



1. Knot to be untied

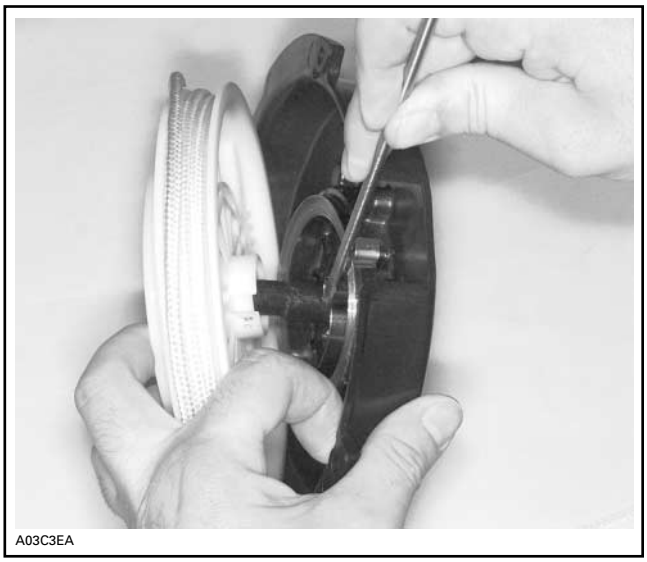
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

DISASSEMBLY

Undo knot previously tied at removal. Let sheave get free to release spring preload.

Cut push nut no. 11 and discard. Remove locking element no. 10, O-ring no. 9, step collar no. 8, pawl lock no. 7 and pawl no. 6.

Remove sheave no. 4 from starter housing no. 1. Hold spring with a screwdriver.


A03C3EA

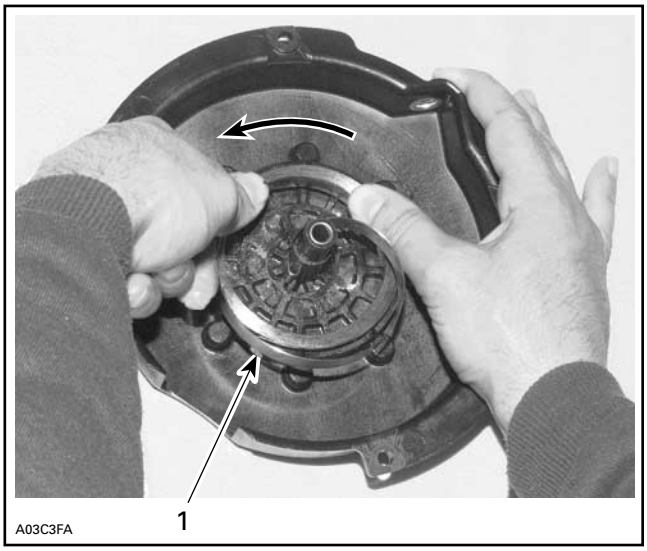
Take out the knot and then rope **no. 5**.

ASSEMBLY

At assembly, position spring **no. 3** outer end into spring guide notch then wind the spring counterclockwise into guide.

⚠ WARNING

Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.

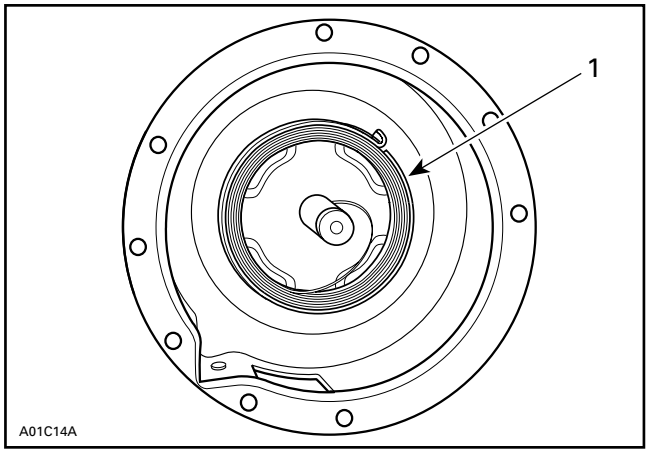


A03C3FA

1. Outer end into guide notch

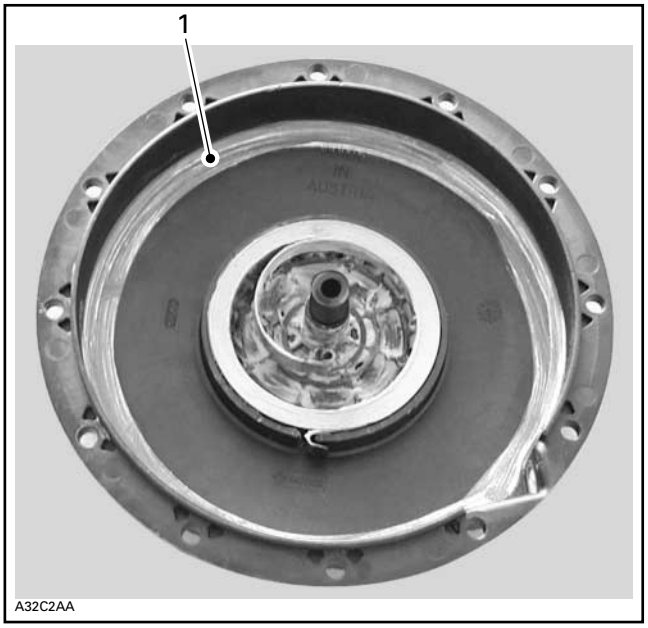
CAUTION: **It is of the utmost importance that the rewind starter spring be lubricated periodically using Molykote PG 54 (P/N 420 899 763). Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.**

Lubricate spring assembly and 1 cm (1/2 in) wide on bottom of housing with Molykote PG 54 (P/N 420 899 763).



A01C14A

TYPICAL
1. Molykote PG 54 inside spring guide

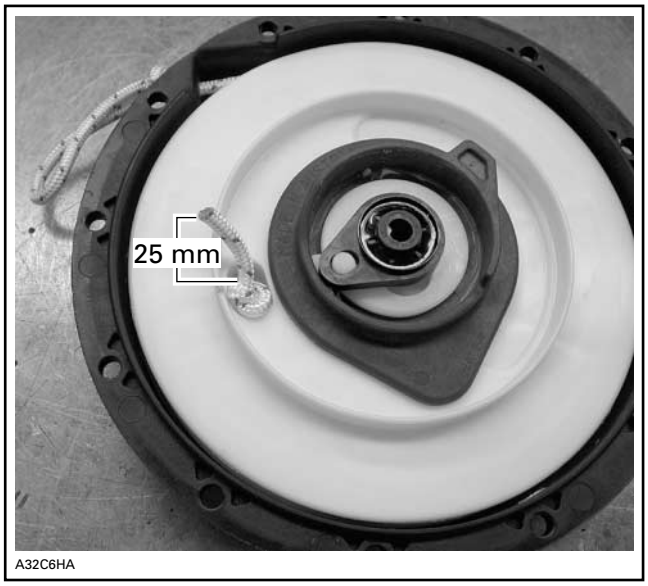


A32C2AA

1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing

CAUTION: **The use of standard multipurpose grease could result in rewind starter malfunction.**

To install rope **no. 5**, insert rope into sheave **no. 4** orifice and lock it by making a knot, leaving behind a free portion of about 25 mm in length. Fuse rope end with a lit match and insert it into sheave.



FREE PORTION

FREE PORTION INSERTED INTO SHEAVE

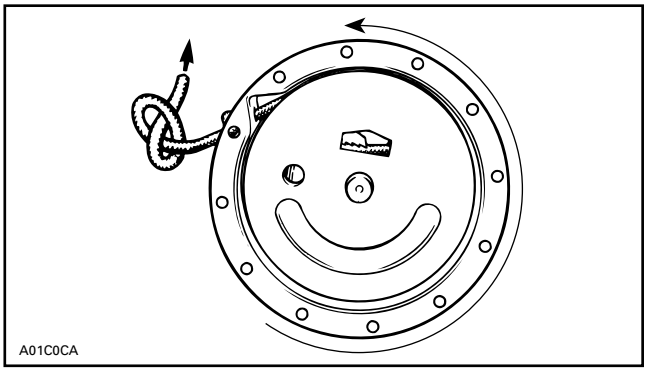
Lubricate housing post with silicone compound grease. Install sheave.

To adjust rope tension:

Wind rope on sheave and place rope sheave into starter housing making sure that the sheave hub notch engages in the rewind spring hook.

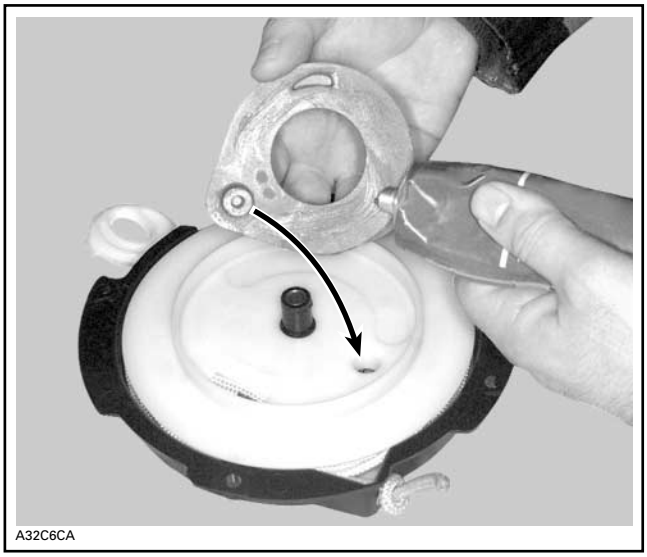
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will give 1/2 turn of preload.

Pull the rope out of the starter housing and temporarily make a knot to hold it.

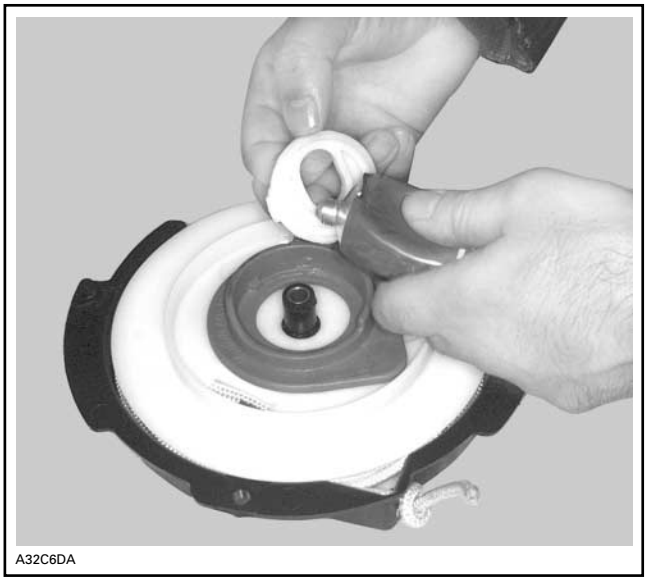


TYPICAL

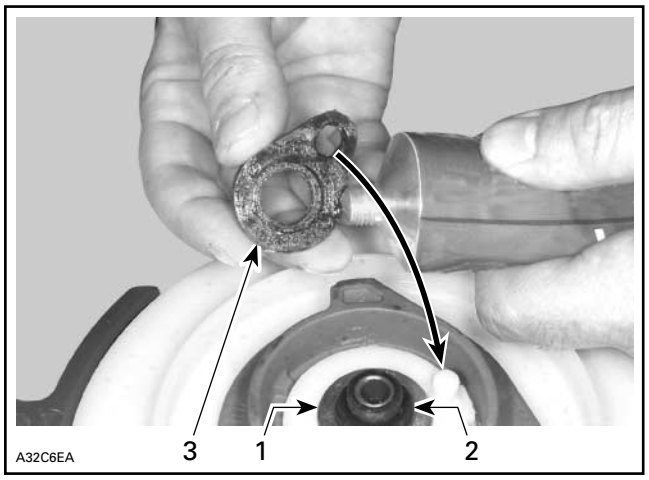
Lubricate pawl **no. 6** with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.



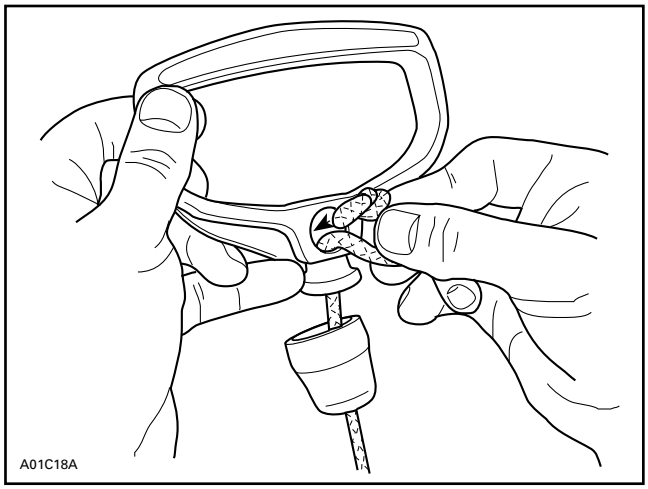
Lubricate pawl lock **no. 7** with Molykote PG 54 (P/N 420 899 763). Install over pawl.



Install step collar **no. 8** with its sleeve first. Lubricate a new O-ring **no. 9** and locking element **no. 7** with Molykote PG 54 (P/N 420 899 763). Install over pawl lock.



1. *Step collar*
2. *O-ring*
3. *Locking element*

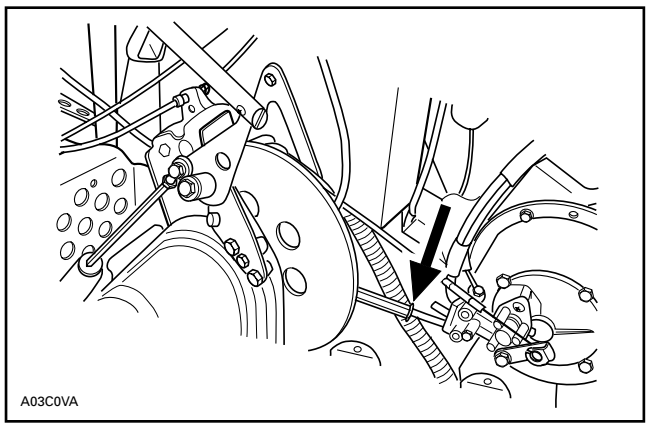


TYPICAL

Position a new push nut **no. 11**.

INSTALLATION

Thread starter rope **no. 5** through rope guide when applicable.



TYPICAL

Reinstall rewind starter assembly on engine.

Prior to installing starter grip on new rope, it is first necessary to fuse the rope end with a lit match. Pass rope through starter grip and tie a knot in the rope end. Fuse the knot with a lit match then insert rope end down and pull the starter grip over the knot.

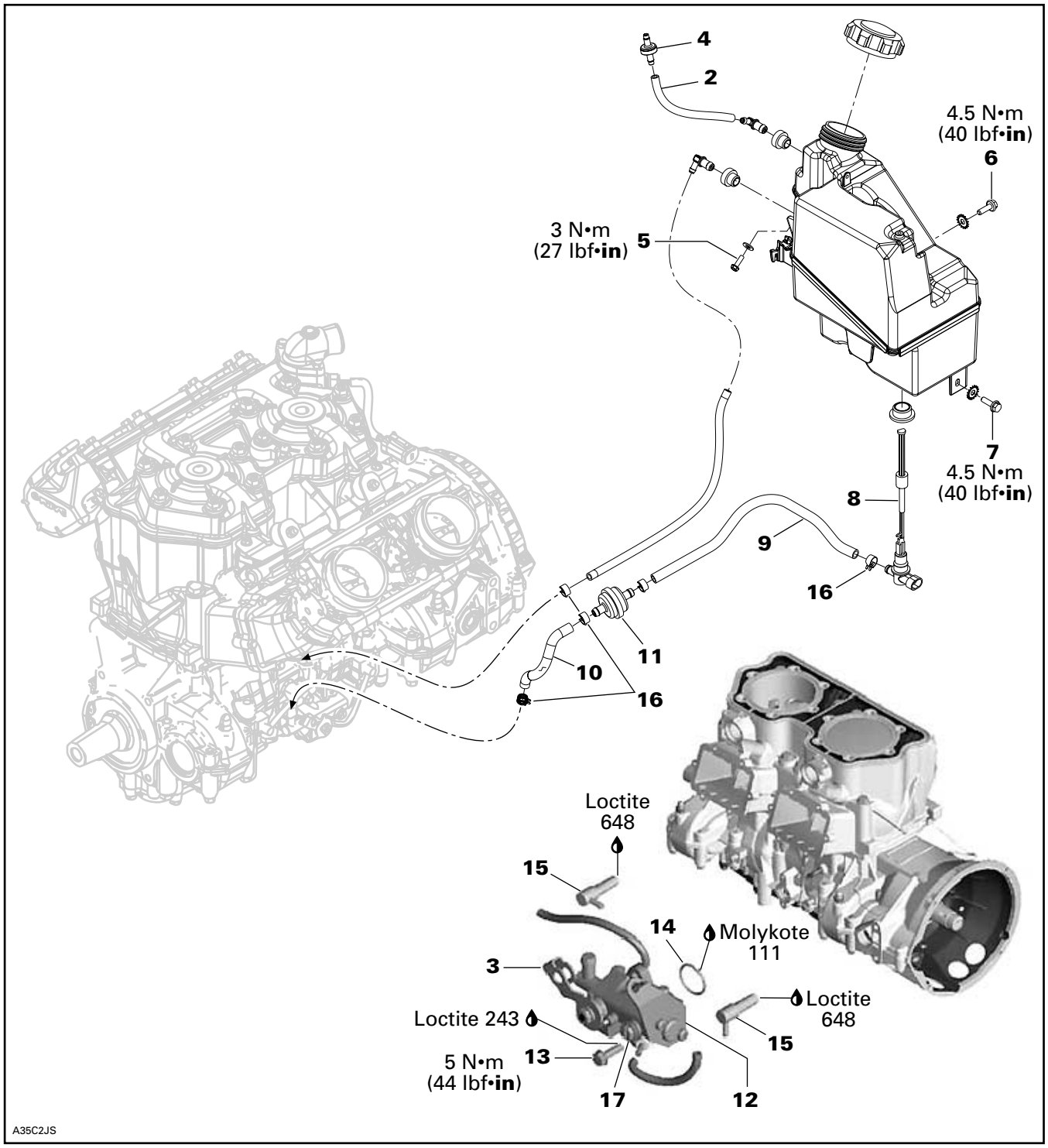
OIL INJECTION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
hose pincher	295 000 076	97
leak testing kit	529 033 100	97
small hose pincher	295 000 076	97
spark plug lift ring	529 035 830	99

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 648 (green)	413 711 400	100
Molykote 111	413 707 000	100
pulley flange cleaner	413 711 809	100


4
2
4.5 N•m
(40 lbf•in)
6
3 N•m
(27 lbf•in)
5
7
4.5 N•m
(40 lbf•in)
8
9
16
11
10
16
Loctite
648
15
14
Molykote
111
3
Loctite
648
Loctite 243
15
5 N•m
(44 lbf•in)
13
17
12
A35C2JS

GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Wipe off any oil spills. Oil is highly flammable.

OIL TYPE

MODEL	OIL TYPE
2-TEC SDI	XP-S synthetic 2-stroke oil or XP-S synthetic blend 2-stroke oil(1)

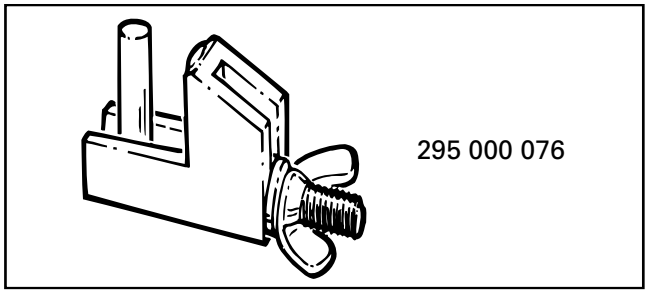
(1) **CAUTION: The XP-S synthetic 2-stroke oil and the XP-S synthetic blend 2-stroke oil are specially formulated and tested for the severe requirement of these engines. Use of any other brand two-stroke oil may void the limited warranty. Use only XP-S synthetic 2-stroke oil or XP-S synthetic blend 2-stroke oil. There is no known equivalent on the market for the moment. If a high quality equivalent were available, it could be used.**

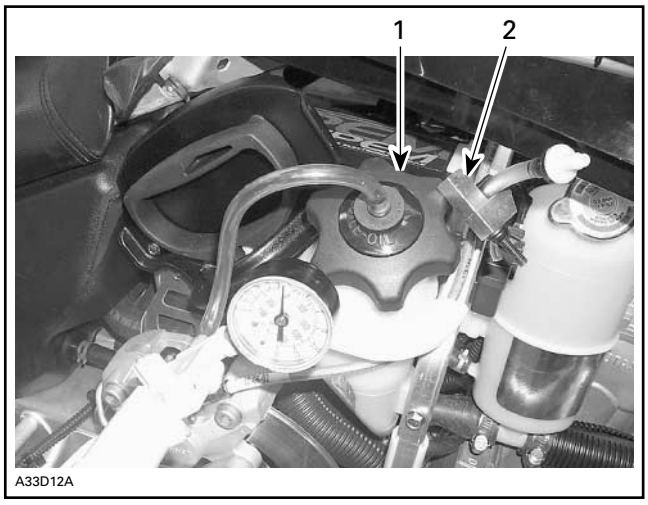
OIL SYSTEM LEAK TEST

The following test will indicate any leak from oil reservoir **no. 1** and all other component of oil system.

Install on oil reservoir special cap of leak testing kit (P/N 529 033 100).

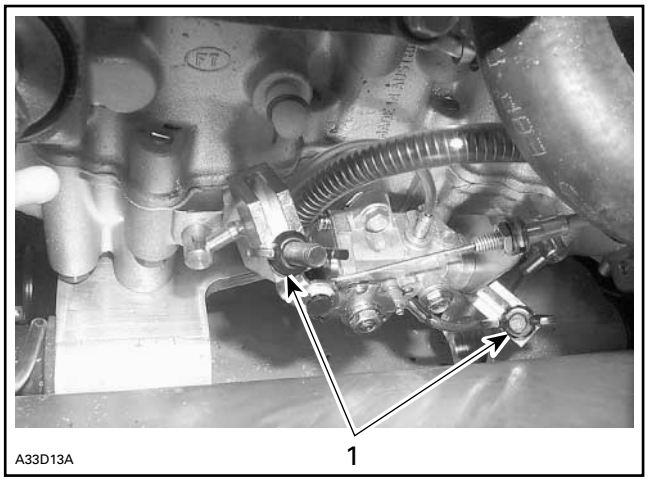
Install hose pincher (P/N 295 000 076) on oil reservoir check valve outlet hose **no. 2**.





TYPICAL
1. Special cap on reservoir
2. Hose pincher on check valve outlet hose

Remove air silencer and throttle body. Lift engine to gain access to the oil pump hoses. Install small hose pincher (P/N 295 000 076) on outlet hoses.



TYPICAL
1. Hose pinchers on outlet hoses

Connect leak testing kit pump to special cap.

Pressurize oil system to 21 kPa (3 PSI). That pressure must not drop during 3 minutes.

If pressure drops, locate leak(s) and repair/replace leaking component(s).

NOTE: An oil pump shaft test must be done to complete the oil system leak test. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT for the procedure.

OIL PUMP IDENTIFICATION

Different engines need different pumps. See identification on lever **no. 3**.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
995	07

CLEANING

Clean all metal components in a non-ferrous metal cleaner.

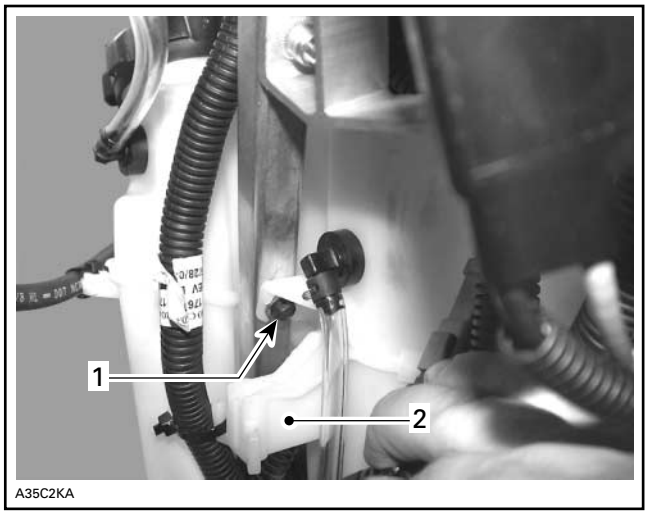
REMOVAL

Injection Oil Reservoir

On Left Side of Vehicle:

Remove air box and throttle body.

Remove upper screw **no. 5** that attach oil injection reservoir **no. 1** to frame.



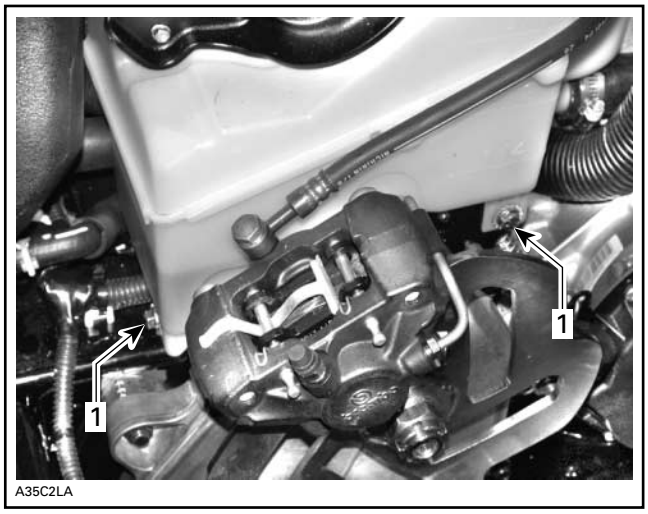
1. Upper reservoir screw
2. Location of cooling reservoir

On Right Side of Vehicle:

Empty injection oil reservoir **no. 1** by siphoning injection oil.

Remove:

– rewind starter handle
– lower screws **no. 6** and **no. 7**.



1. Lower reservoir screws

NOTE: Cut the ties retaining the wiring harness and brake hose.

Injection Oil Level Sensor

To remove the sensor **no. 8**, use the following procedure.

Remove injection oil reservoir, as mentioned above.

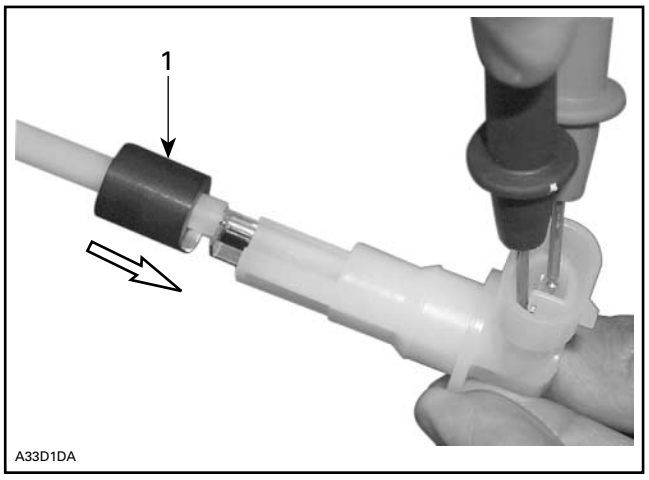
Unplug sensor connector.

Pull injection oil level sensor **no. 8** out of reservoir.

Before replacing the injection oil level sensor **no. 8**, check it according to the following procedure:

CAUTION: Do not remove or bend the reed switch protective float lock. It can damage the reed switch glass.

With the float magnet ring at the lowest position. Using an ohmmeter, probe the connector.



1. Float magnet at the lowest position

Reading below 0 ohm reflects the proper switch function. Replace the injection oil level sensor if reading above 0 ohm.

Injection Oil Filter

Lift engine. Use the following procedure:

- Remove drive and driven pulleys.
- Remove air box and throttle body.
- Unscrew engine support nuts.
- Remove the first spark plug and install the spark plug lift ring (P/N 529 035 830).
- Lift engine and remove the left engine support from engine.
- Remove the MAG intake adaptor.

Siphon injection oil reservoir.

Disconnect oil filter hose **no. 9** from the injection oil level sensor **no. 8**.

Disconnect oil hoses **no. 9** and **no. 10** from the oil filter **no. 11** and remove it.

Injection Oil Pump

Lift engine.

Remove oil pump screws **no. 13**

Unplug all hoses connected to oil pump **no. 12**.

NOTE: Mark hose locations for installation.

Disconnect the oil pump cable.

Remove oil pump and its O-ring **no. 14**.

Check Valve

NOTE: Before removing check valve **no. 15**, check its operation. Refer to the end of this section.

Remove air box and throttle body.

Clean check valve area to remove oil or dirt.

Heat check valve **no. 15** then pull it out of crankcase.

CHECKING OPERATION

Oil Pump

Connect a hose filled with injection oil to main line fitting. Insert other hose end in an injection oil container. Using a clockwise rotating drill rotate pump shaft. Oil must drip from outer fittings while holding lever in a fully open position. If not replace pump.

Oil Reservoir Check Valve

It allows air to get into the reservoir. To verify this one-way check valve **no. 4**, remove it along with the hose. Make sure that it holds pressure and that it does not let air go through.

While installing this check valve make sure that the black side is inserted in the hose.

INSTALLATION

CAUTION: Always bleed oil pump when the system has been opened.

NOTE: During installation, always check for spring clips **no. 16** tightness.

Injection Oil Reservoir

For installation, reverse the removal procedure.

Injection Oil Level sensor

For installation, reverse the removal procedure.

Injection Oil Filter

For installation, reverse the removal procedure.

NOTE: The filter must be installed with the arrow pointing toward the pump.

Injection Oil Pump

For installation, reverse the removal procedure. However, pay attention to the following.

Apply Molykote 111 (P/N 413 707 000) on O-ring **no. 14** before installation.

Torque the oil pump screws **no. 13** to 5 N•m (44 lbf•**in**).

Make sure cable barrel is well seated in oil pump lever.

Secure barrel with plastic washer and circlip.

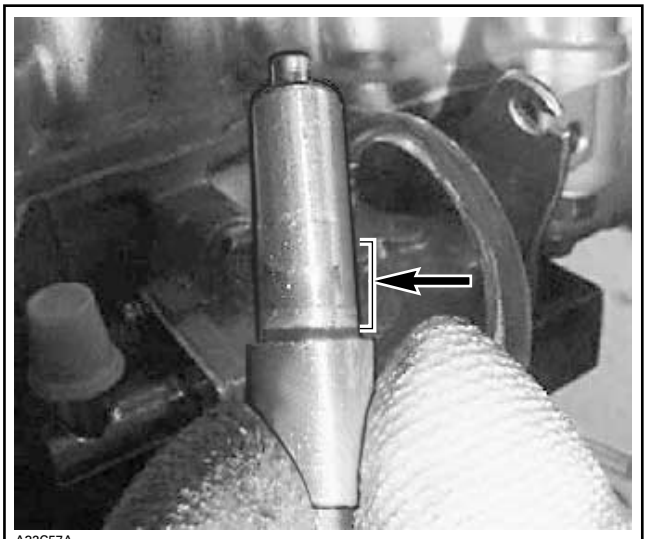
Install cable lock washer on left side of support.

Verify cable and oil pump lever operation then adjust cable.

Check Valve

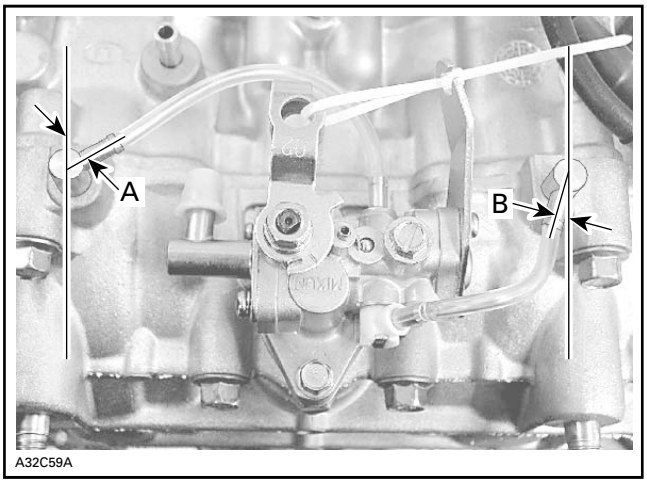
Prior to coating the check valve **no. 15** with Loctite, make sure check valve body is clean and dry. Clean from dirt or oil, if any, with pulley flange cleaner (P/N 413 711 809).

Apply Loctite 648 (green) (P/N 413 711 400) on the outer diameter of the check valve (machined section). Take care that Loctite is ONLY in this area.


A32C57A

APPLY LOCTITE ON THIS AREA ONLY

Install the check valve in the correct position as described on next photos into the crankcase lower side.



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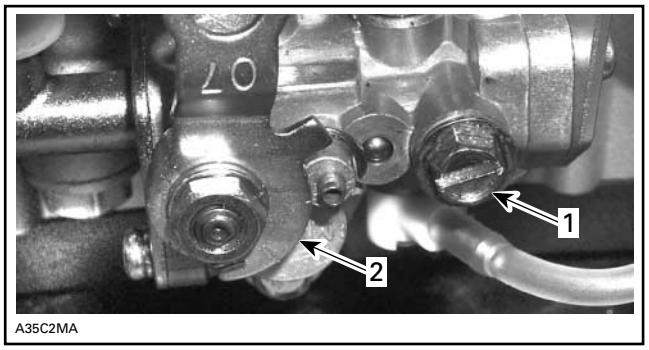
TYPICAL
A. PTO side 45° ± 5° from cylinder axis to the top
B. MAG side 20° ± 5° from cylinder axis to the bottom

Punch in the check valve carefully with a plastic hammer.

Clean the crankcase from surplus of Loctite 648 with a rag.

BLEEDING PROCEDURE

Bleed main oil line (between reservoir and pump) by loosening the bleeder screw **no. 17** until air has escaped from the line. Add injection oil as required.



1. Bleeder screw
2. Oil pump lever

Reinstall all parts.

Bleed the small oil line between pump and engine by running engine at idle while holding the pump lever in fully open position.

NOTE: Make a J hook out of mechanical wire to lift the lever.

⚠ WARNING

No ensure not operate carburetor throttle mechanism. Secure the rear of the vehicle on a stand.

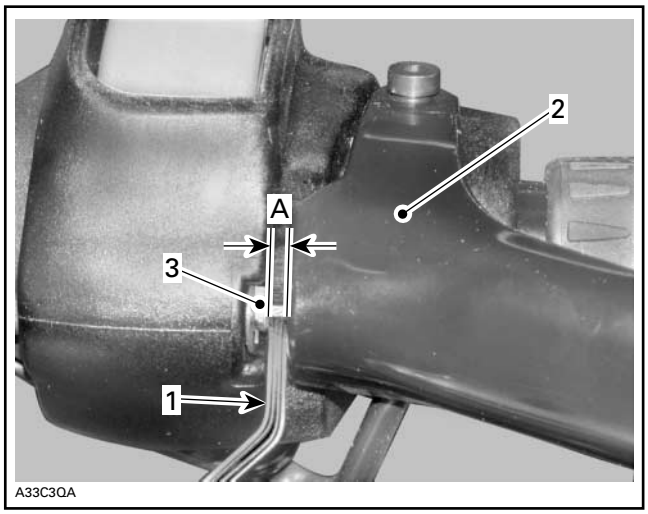
ADJUSTMENT

Oil Pump Cable

Before processing with the oil pump cable adjustment, verify throttle cable adjustment. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT).

Depress the throttle lever lightly until the cable is under tension but throttle body are not yet opened.

Using a feeler gauge, measure the visible distance between throttle lever and the end of cable housing.



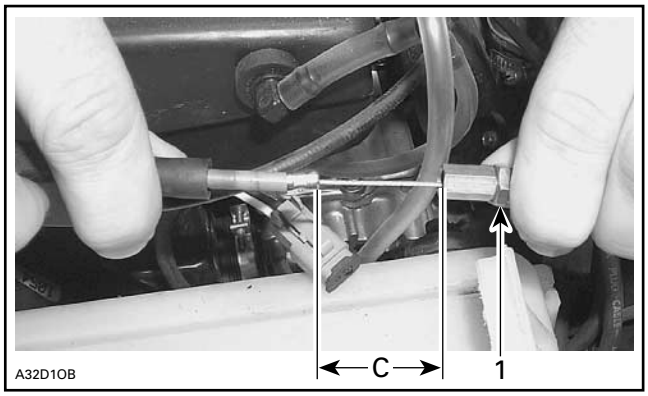
TYPICAL
1. Feeler gauge
2. Throttle lever
3. End of cable housing
A. Visible distance

Note this measure.

Next, add to measurement "A" the appropriate specification "B", using the chart below.

MODELS	SPECIFICATION "B"
Mach Z, Summit Highmark and Summit Highmark X	16.5 mm (.650 in)

Stretch oil pump cable with a force of 34 N (7.6 lbf) and measure the length of its visible distance "C".



TYPICAL
1. Adjusting screw lock nut
C. Visible distance for oil pump adjustment

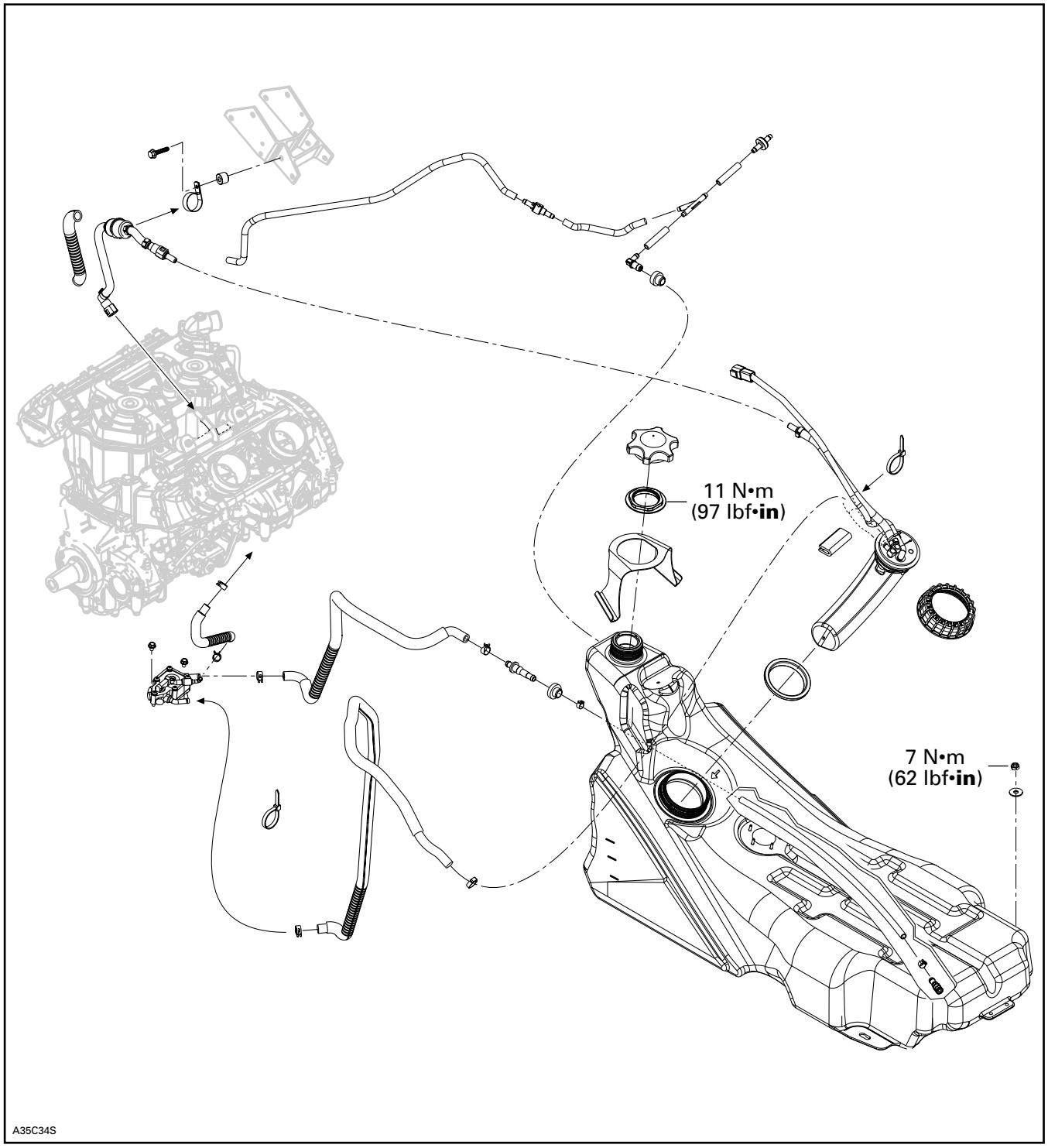
If the visible distance "C" is less or more than "A" + "B", adjust cable distance. To do so, loosen lock nut, turn adjusting screw in or out and retighten lock nut.

FUEL TANK AND FUEL PUMPS

SERVICE TOOLS

Description	Part Number	Page
engine removal hook	529 035 829	115
hose pincher	295 000 076	105, 115
leak tester kit	529 033 100	108
pressure gauge	529 035 591	110
spark plug lift ring	529 035 830	115
vacuum/pressure pump kit	529 021 800	108
wrench	529 035 891	106
wrench	529 035 899	112–113

FUEL TANK



⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the VCK to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery or remove 30 amp. fuse prior to working on the fuel system.

Before working on any procedure of the fuel system, always disconnect BLACK (–) cable from battery, then the RED (+) cable.

⚠ WARNING

Always disconnect battery or starter cables exactly in the specified order, BLACK (–) cable first. It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

⚠ WARNING

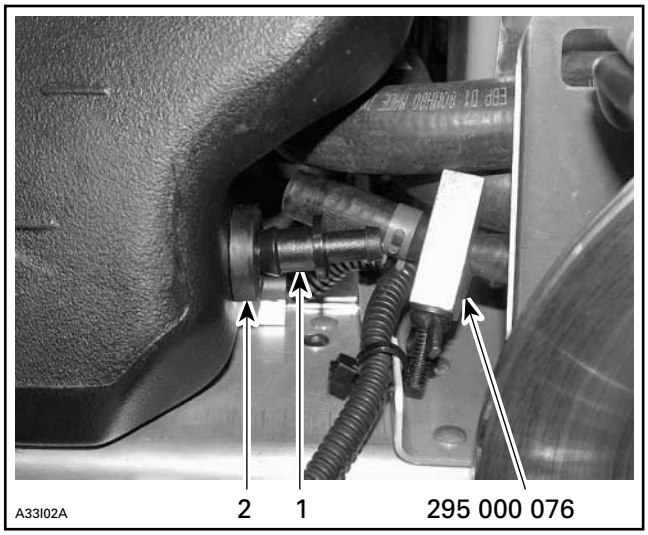
Whenever a fuel line is disconnected, obstruct line with a hose pincher (P/N 295 000 076) or (P/N 529 032 500). Fuel is flammable and explosive under certain conditions. Always wipe off any fuel or oil spillage from the vehicle. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.

IN-TANK FUEL FILTER REMOVAL

Drain fuel tank.

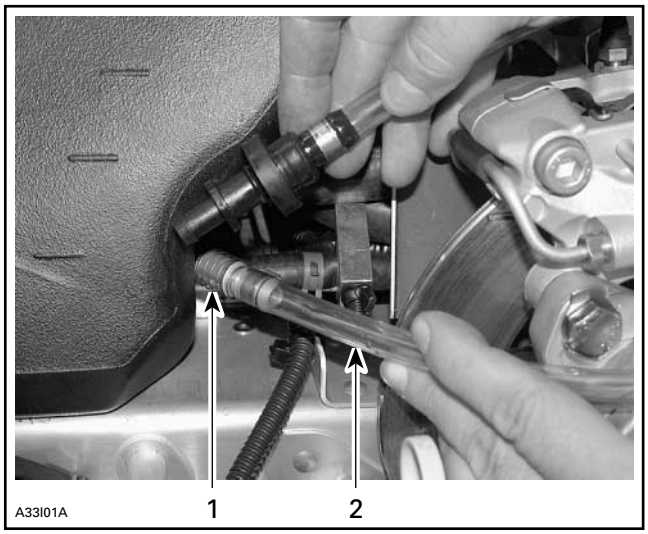
Install a hose pincher (P/N 295 000 076) on supply hose then, unplug hose.

Pull out male connector from grommet.



TYPICAL
1. *Male connector*
2. *Grommet*

Pull out grommet from fuel tank then, pull out pick-up hose and fuel filter.



TYPICAL
1. *Fuel filter*
2. *Pickup hose*

Replace fuel filter and grommet.

IN-TANK FUEL FILTER INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

To facilitate the installation, grommet should be on smaller diameter of male connector.

Install grommet on fuel tank and push male connector through grommet.

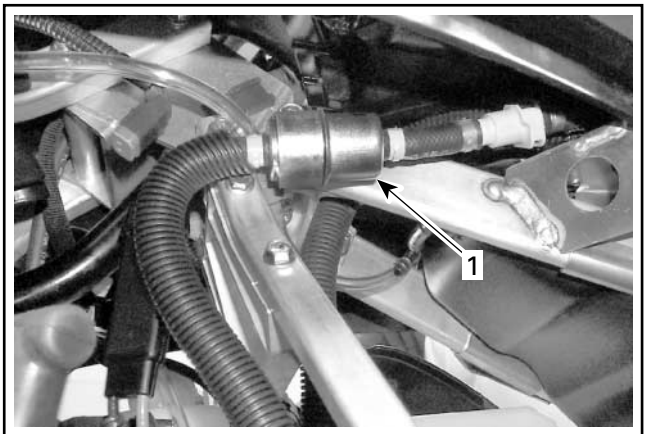
IN-LINE FUEL FILTER REMOVAL

Fuel filter, inlet and outlet hoses come as an assembly.

A35I04A

FUEL FILTER LINE ASS'Y

The fuel filter line ass'y is located on LH side of the vehicle underneath console.



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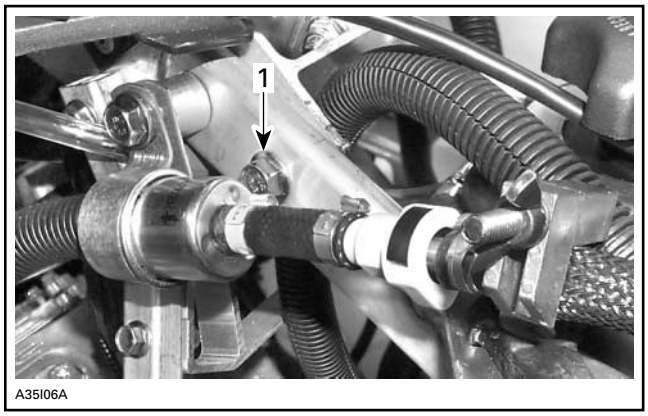
1. Fuel filter line ass'y

Using B.U.D.S. release pressure from fuel system. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

Disconnect both ends of fuel filter line ass'y.

Unscrew fuel filter support nut then remove the filter.



A35I06A

1. Unscrew fuel filter support

IN-LINE FUEL FILTER INSTALLATION

Installation is reverse of removal procedure.

FUEL TANK REMOVAL

Using B.U.D.S., release pressure from fuel system. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

Remove seat, refer to BODY.

Remove fuel tank cap.

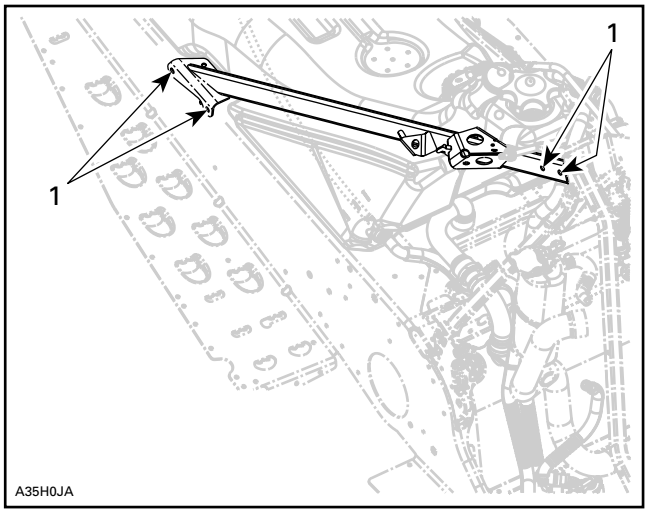
Remove filler neck plastic nut using wrench (P/N 529 035 891).

A33C1TA

TYPICAL

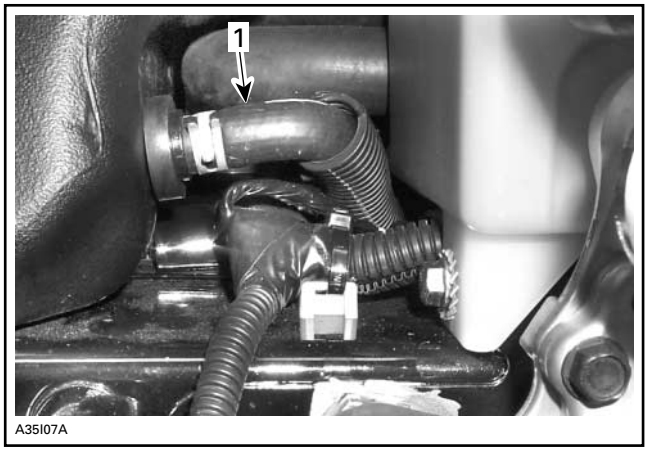
Remove on both sides, fuel tank aluminum braces and discard the following:

– Torx screws M8 x 13
– elastic flanged nuts M8.

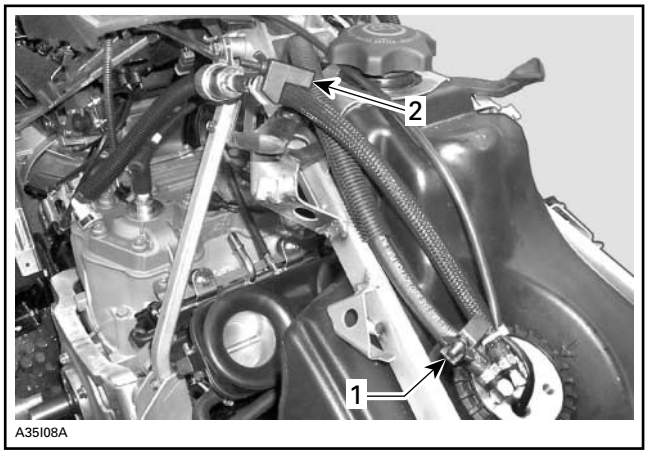


1. Unscrew the following on both sides

Install a hose pincher on the following hoses:



1. Fuel tank outlet hose



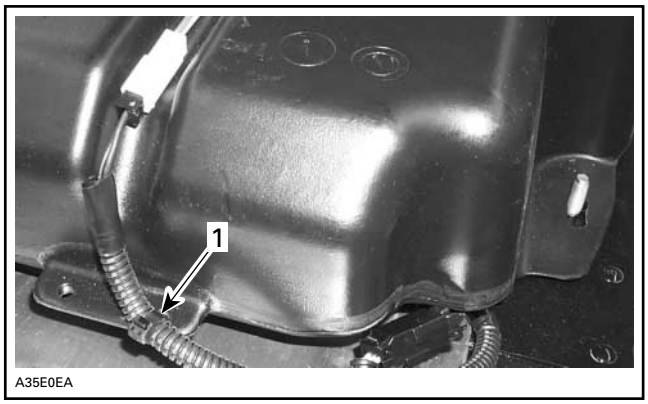
1. Fuel pump module INLET hose
2. Fuel pump module OUTLET hose

Unplug the following hoses:

– fuel tank outlet hose
– fuel pump module inlet hose
– fuel pump module outlet hose from fuel filter line ass'y
– fuel tank vent hose.

Unplug fuel pump module connector.

Cut locking tie holding wiring harness to fuel tank at rear.



1. Cut locking tie

Slightly lift console then remove fuel tank.

FUEL TANK INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Replace clip on fuel pump module inlet hose.

⚠ WARNING

Make sure vent tube is not kinked.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Aluminum braces Torx screws M8 x 13	2.5 N•m (22 lbf•**in**)
Seat/fuel tank	7 N•m (62 lbf•**in**)
Filler neck plastic nut	11 N•m (97 lbf•**in**)

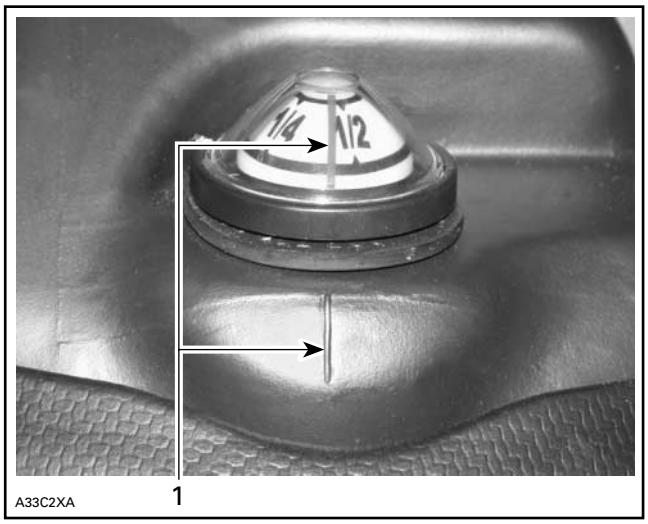
FLOAT-TYPE FUEL LEVEL GAUGE REMOVAL/INSTALLATION

Summit Highmark

To remove gauge from fuel tank, pull gauge out of its grommet then remove grommet.

For reinstallation, proceed as follows:

– Install grommet halfway on gauge.
– Insert grommet in fuel tank until it bottoms.
– Firmly push gauge in grommet until it bottoms and so that its red line aligns with the line on the fuel tank.



1. Align red line with line on tank

ELECTRIC FUEL LEVEL SENSOR INSPECTION

Mach Z

Fuel level sensor is integrated to the fuel pump. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

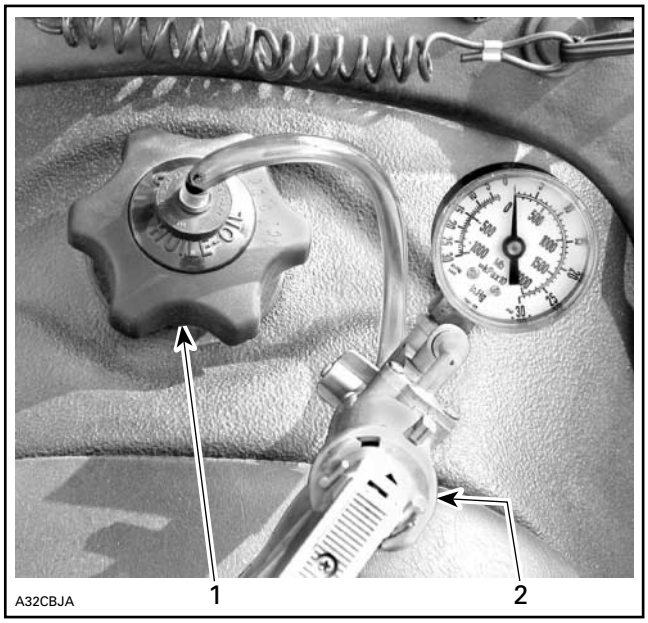
A 0.5 amp. fuse protects fuel level sensor circuity in fuse box.

FUEL SYSTEM PRESSURIZATION

Fill up fuel tank.

Install on fuel tank, the special cap of leak tester kit (P/N 529 033 100).

Using vacuum/pressure pump kit (P/N 529 021 800), inject air into fuel tank. See next photo.



TYPICAL
1. Special cap on tank
2. Air pump

Pressurize fuel system to 21 kPa (3 PSI). The pressure must not drop during 3 minutes.

If pressure drops, locate fuel leak(s) and repair/replace leaking component(s).

To ease locating leak(s) at fuel tank vent fitting, fuel gauge or fuel cap, spray soapy water on components; bubbles will indicate leak location(s).

High Pressure Test (Electric Fuel Pump Circuit)

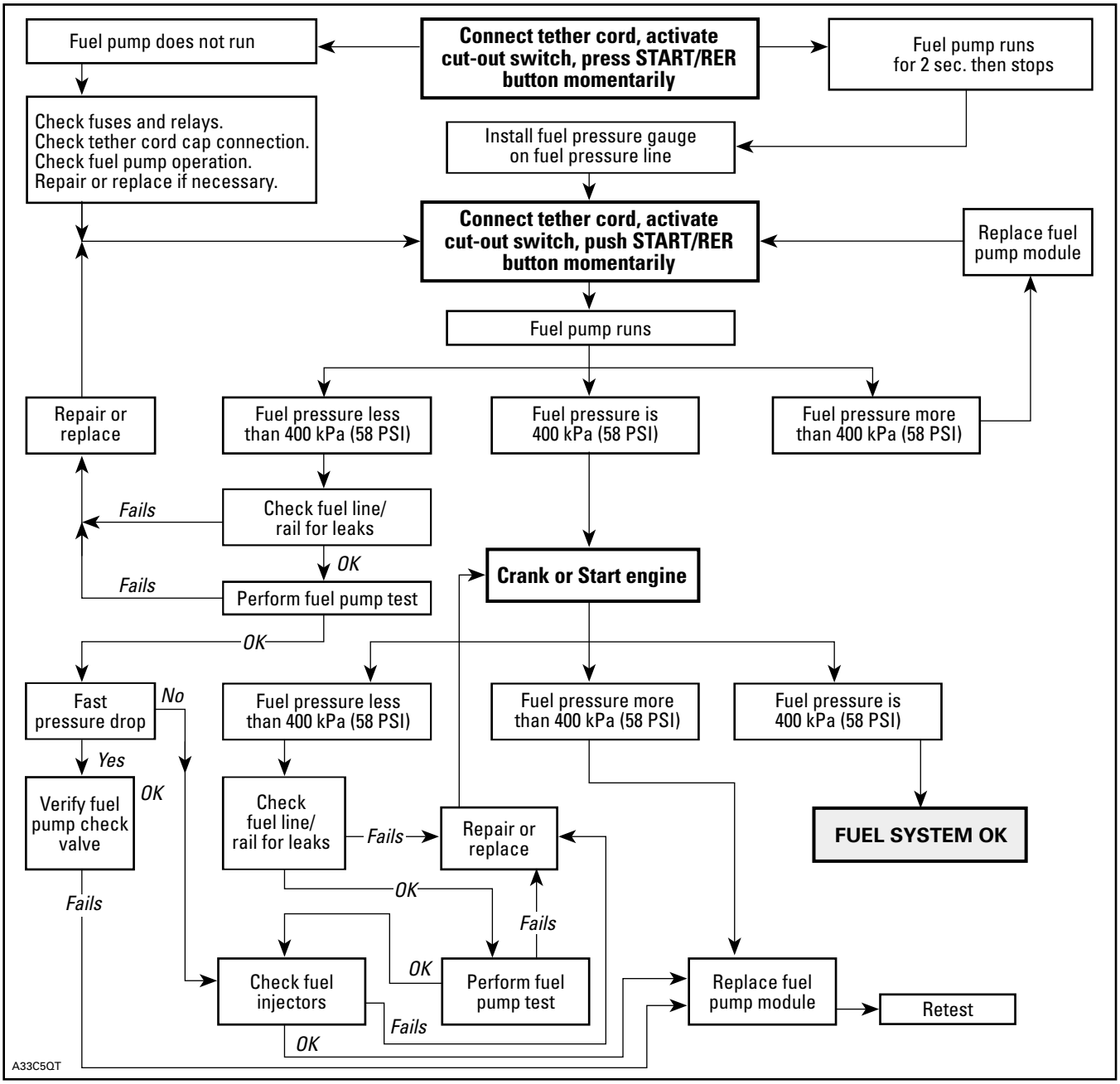
Install tether cord on DESS post. Push the emergency switch to OFF position. Push on start button to activate fuel pump.

Check for any leakage at fuel rail, injectors, in-line fuel filter and fuel hose.

ELECTRIC FUEL PUMP

DIAGNOSTIC FLOW CHART

NOTE: Before proceeding with any test, make sure that diaphragm fuel pump works properly.



ELECTRIC FUEL PUMP PRESSURE TEST

Before proceeding to the pressure test, ensure the battery is fully charged. Battery voltage must be over 12 volts.

Release the fuel pressure in the system using B.U.D.S. Refer to the **Activation** tab.

⚠ WARNING

The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside engine compartment.

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.

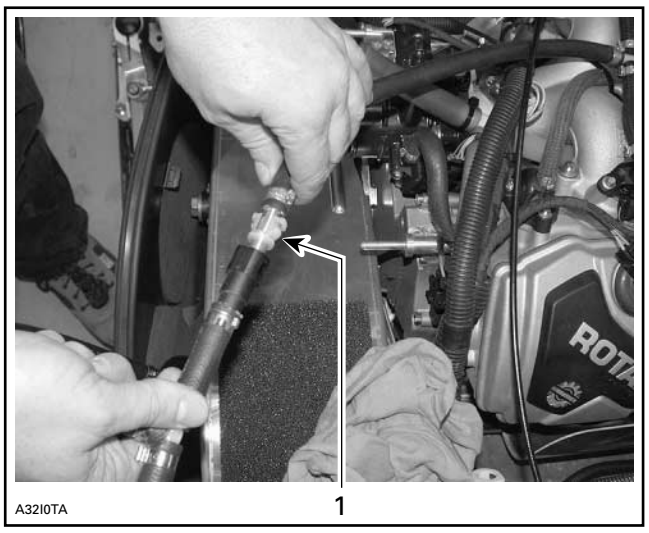
Ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Disconnect outlet hose from fuel pump.

Remove plastic clip (P/N 275 500 429) from male fitting of pressure gauge (P/N 529 035 591).

Install the clip on male fitting of fuel rail inlet hose.



TYPICAL
1. Clip installed on male fitting of fuel rail inlet hose

Install fuel pressure gauge (P/N 529 035 591) between disconnected hoses (in-line installation).

Remove tether cord cap. Depress START/RER button and observe fuel pressure. **Do not crank engine.** Repeat twice. Release pressure using B.U.D.S. between tests so that the gauge is "reset" to zero (0).

FUEL PRESSURE (when depressing start button)
400 kPa (58 PSI)

Crank or start engine and observe fuel pressure. The fuel pressure should be the same as above.

If pressure is within limits, fuel pump and pressure regulator are working adequately.

A rapid pressure drop indicates leakage either from the fuel rail or from the fuel pump check valve. Check fuel rail for leaks. If it is not leaking then replace fuel pump.

A slow pressure drop indicates leakage either from the fuel injector or from the fuel pressure regulator. Check fuel injector for leaks (see below). If it is not leaking then replace fuel pump module.

Release fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

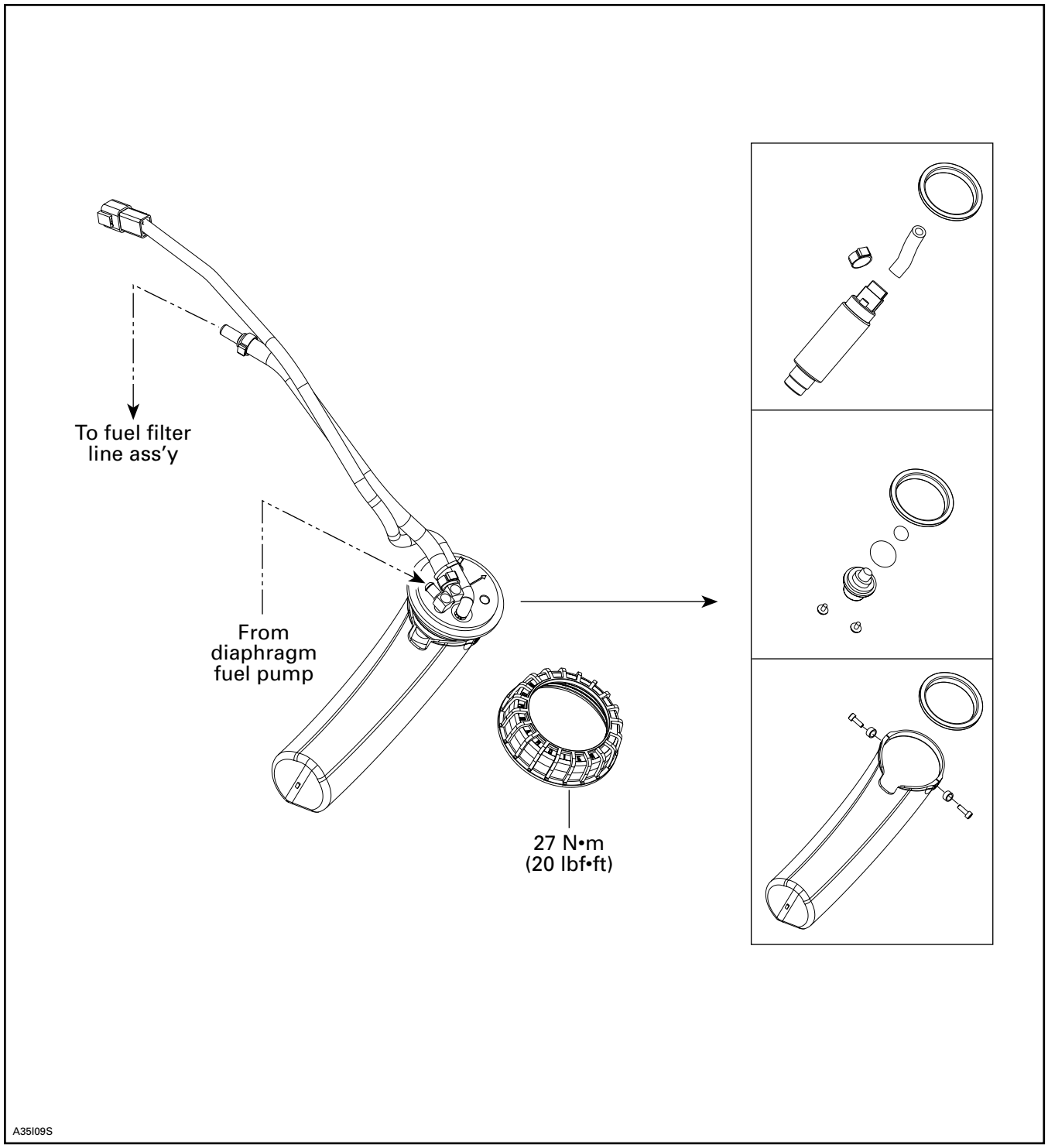
Remove pressure gauge and plastic clip from inlet hose. Reinstall fuel hose.

⚠ WARNING

Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Reinstall removed parts.

ELECTRIC FUEL PUMP



ELECTRIC FUEL PUMP REMOVAL

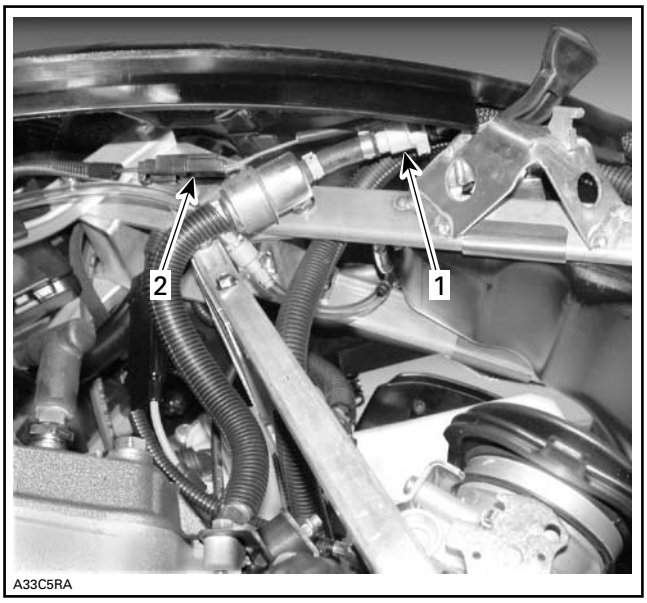
Remove seat, refer to BODY.

Using B.U.D.S., release pressure from fuel system. Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT.

Drain fuel tank as much as possible.

Disconnect fuel supply hose from fuel filter line ass'y.

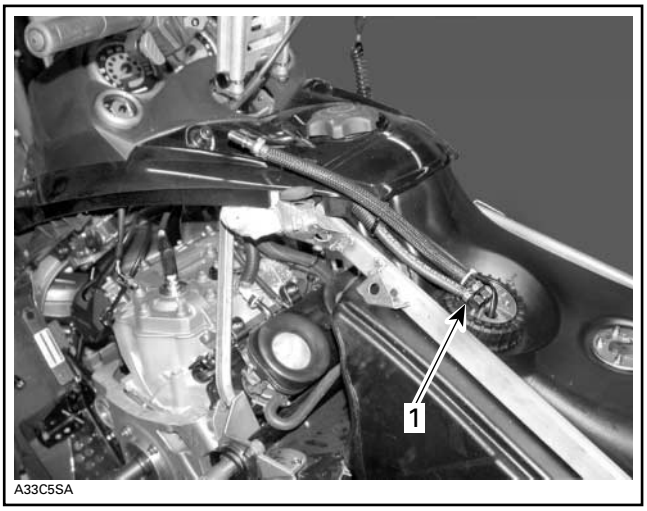
Disconnect fuel pump electrical connector.



A33C5RA

1. Disconnect fuel filter line ass'y
2. Unplug connector

Disconnect hose coming from diaphragm pump.

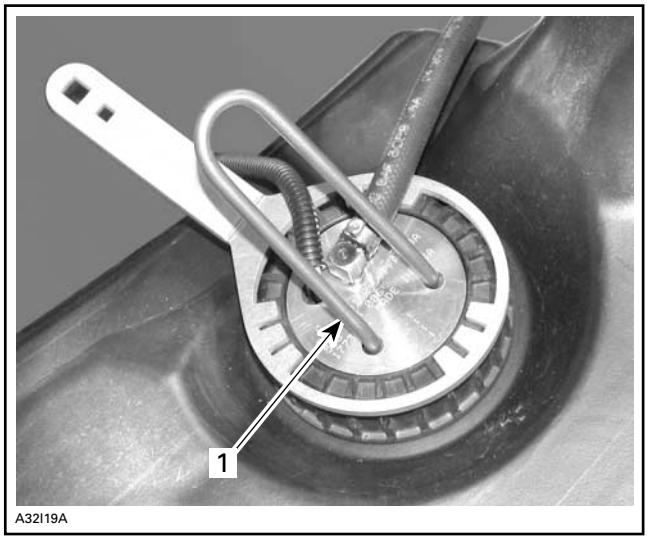


A33C5SA

1. Disconnect hose

With two screwdrivers or a bent rod holding the flange, unscrew fuel pump nut using fuel pump nut wrench (P/N 529 035 899).

A32I11A



A32I19A

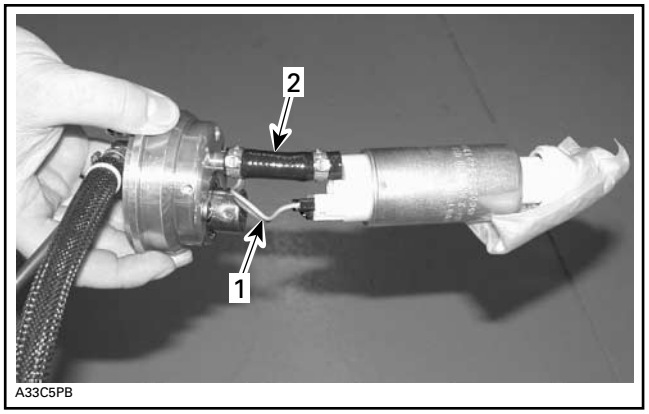
1. Bent rod

Remove fuel pump assembly.

A33C5TA

Disconnect pump electric connector.

Disconnect hose from pump.



A33C5PB

1. Electrical connect
2. Pump hose

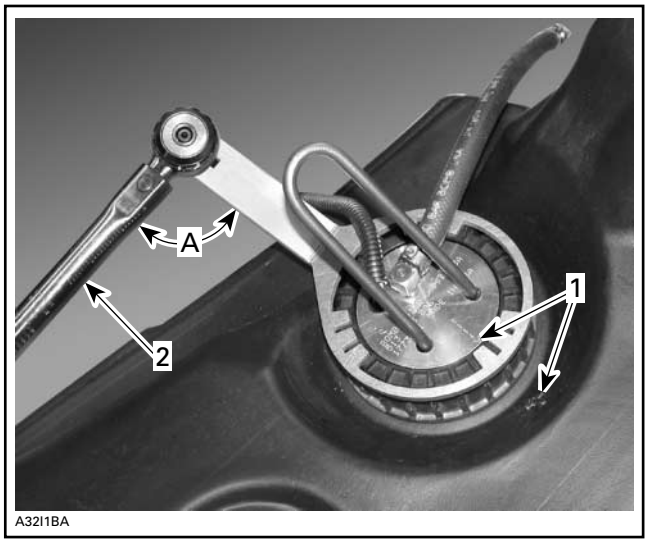
ELECTRIC FUEL PUMP INSTALLATION

For installation, reverse the removal process but pay attention to the following.

Install a new gasket.

Align the arrow on fuel pump assembly with the one on fuel tank. Keep arrows aligned when tightening fuel pump assembly.

Install a torque wrench perpendicularly (90°) to fuel pump nut wrench (P/N 529 035 899). Torque fuel pump nut to 27 - 30 N•m (20 - 22 lbf•ft).



A32I1BA

1. Arrows
2. Torque wrench
A. 90°

Use a new clamp to secure hose to fuel pump fitting.

CAUTION: Make sure that hose clamps are tight to avoid that they turn on their fittings.

Manual Start Models

NOTE: When fuel tank is completely emptied, it may require up to 25 - 30 pull on rewind starter to fill the electric fuel pump reservoir. Filling the fuel tank will solve this problem. The fuel inside the fuel tank will flow through the bypass hole of the electric fuel pump reservoir.

ELECTRIC FUEL PUMP PRESSURE REGULATOR REMOVAL/INSTALLATION

Remove fuel pump assembly as explained above.

Remove 2 screws retaining regulator to pump assembly flange.

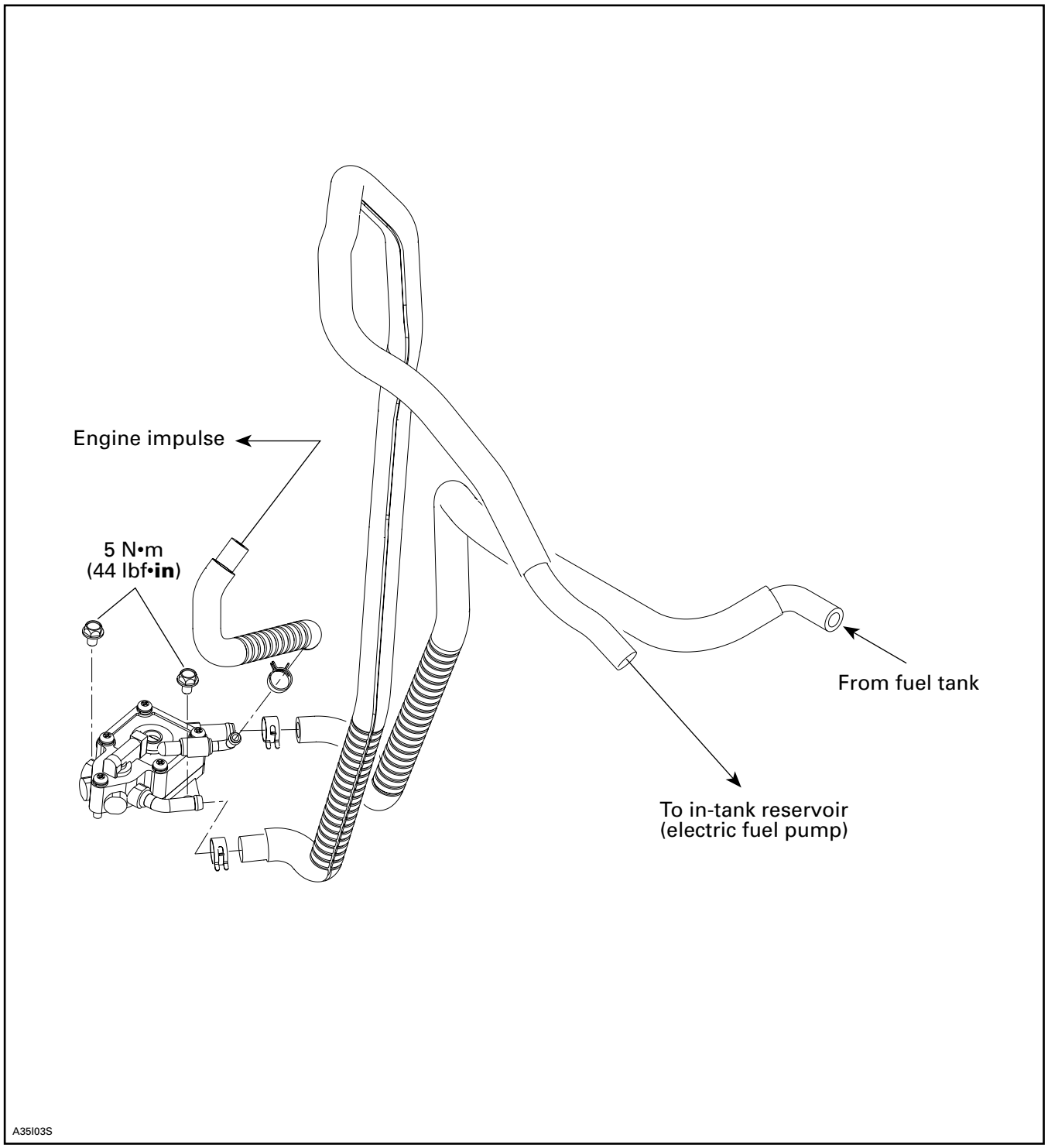
Replace O-rings with new ones. Install them in pump assembly flange bore.

CAUTION: Regulator O-rings must be installed in pump assembly flange bore.

Reverse removal procedure for installation.

Install a new gasket, then reinstall fuel pump assembly as explained above.

DIAPHRAGM FUEL PUMP



DIAPHRAGM FUEL PUMP REMOVAL

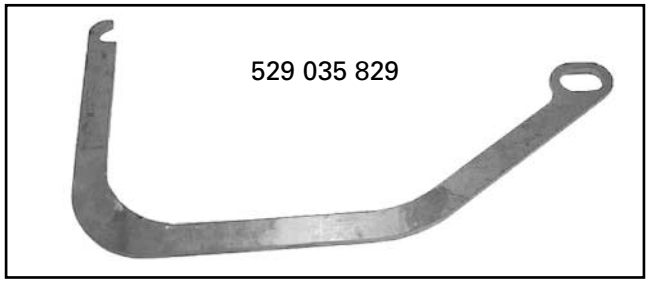
Remove the following:
- muffler, refer to ENGINE
- belt guard
- air silencer (engine side), refer to ENGINE
- engine supports elastic nuts.

Unplug magneto connector.

Remove both spark plugs.

Install in the MAG side spark plug hole the spark plug lift ring (P/N 529 035 830).

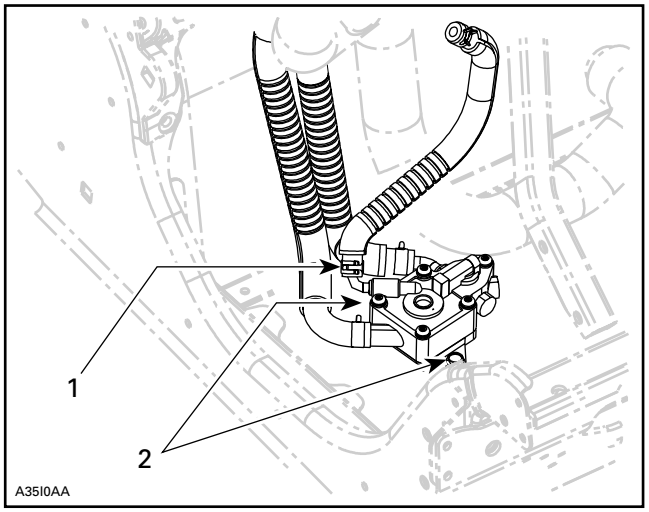
Using the engine removal hook (P/N 529 035 829), lift engine until engine supports are free from rubber mount studs.



Unplug engine vacuum hose from pump.

Cut locking tie holding fuel pump inlet and outlet hoses.

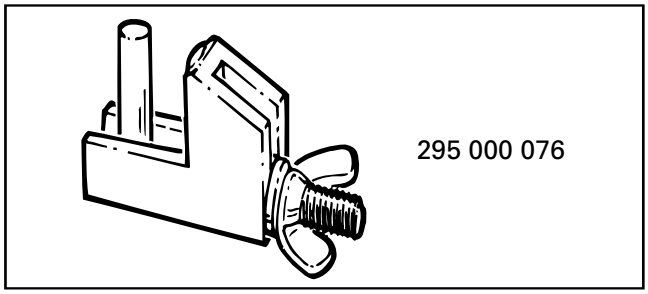
Remove screws retaining fuel pump to frame.



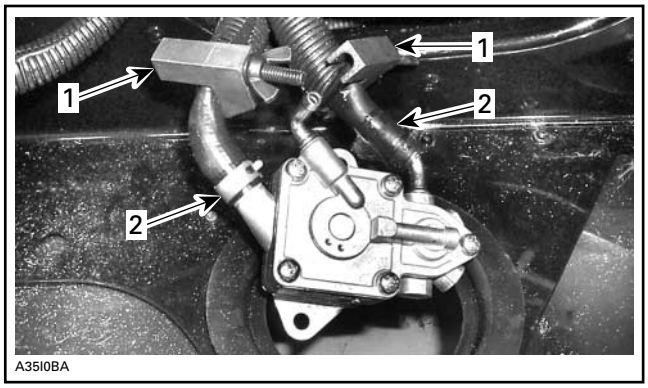
1. Unplug vacuum hose
2. Remove screws

Pull out fuel pump from under the engine.

Install a hose pincher (P/N 295 000 076) on inlet and outlet hoses.



Unplug inlet and outlet hoses then remove fuel pump.



1. Install hose pincher
2. Unplug hoses

DIAPHRAGM FUEL PUMP VERIFICATION

Check fuel pump valves operation as follows:

Connect a clean plastic tubing to the inlet nipple and alternately apply pressure and vacuum with pump of leak test kit. The inlet valve should release with pressure and hold under vacuum.

Repeat the same procedure at the outlet nipple. This time the outlet valve should hold with pressure and also under vacuum.

NOTE: Plug remaining outlet with finger while checking outlet valve.

Check impulse diaphragm and gasket on fuel pump with twin outlets as follows:

Connect a clean plastic tubing to the impulse nipple and plug vent hole on top cover on so equipped models. Either apply pressure or vacuum. The diaphragm/gasket must not leak.

DIAPHRAGM FUEL PUMP CLEANING AND INSPECTION

The entire pump should be cleaned with general purpose solvent before disassembly.

Fuel pump components should be cleaned in general purpose solvent and dried with compressed air.

⚠ WARNING

Solvent with low flash point such as gasoline, naphtha, benzol, etc, should not be used as each is flammable and explosive.

Inspect diaphragm. The pumping area should be free of holes, tears or imperfections. Replace as needed.

DIAPHRAGM FUEL PUMP INSTALLATION

For installation, reverse the removal process but pay attention to the following.

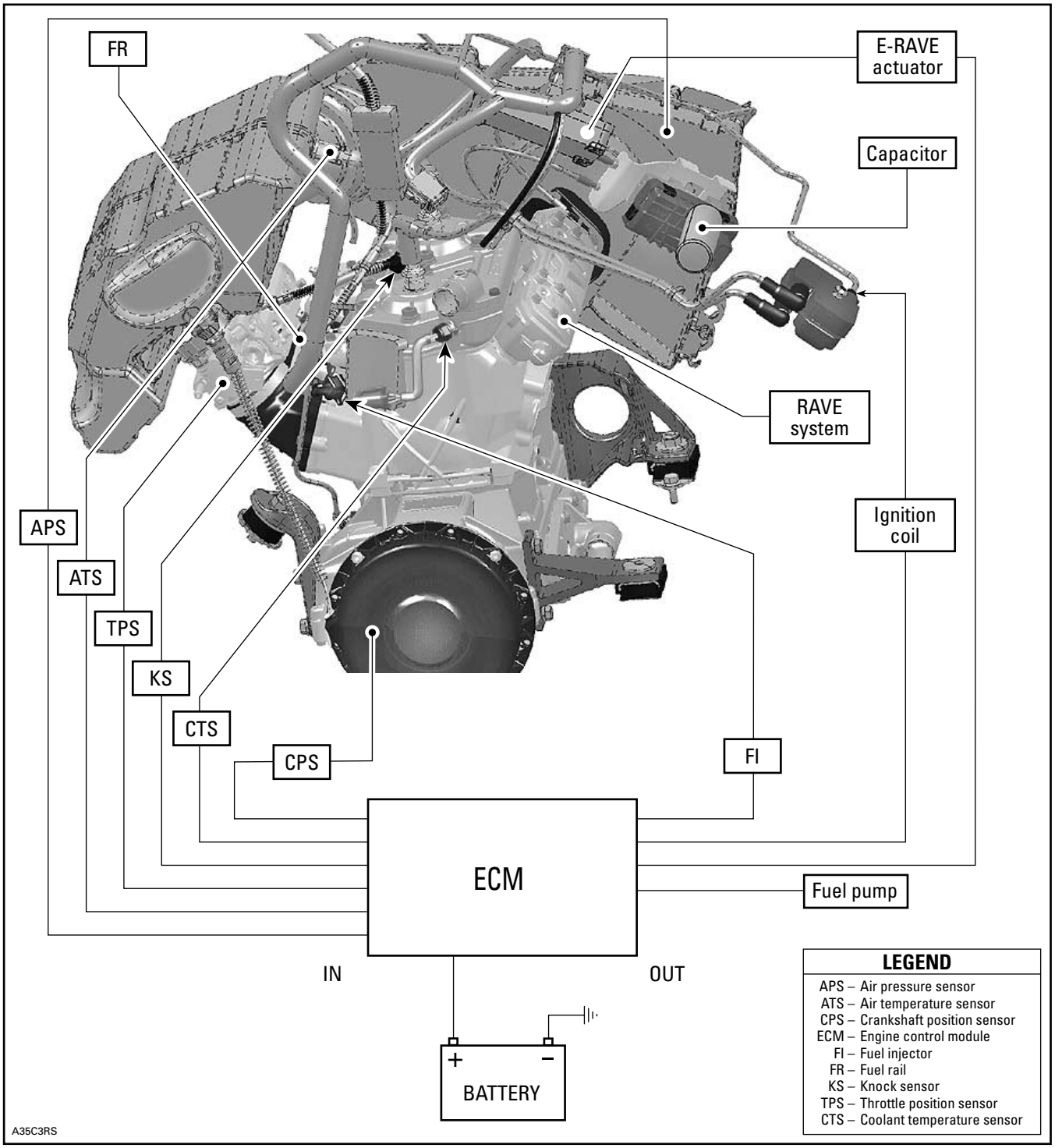
⚠ WARNING

Pressure test to ensure there is no leak in fuel system.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Pump retaining screws	5 N•m (44 lbf•**in**)

OVERVIEW


FR
E-RAVE actuator
Capacitor
RAVE system
Ignition coil
APS
ATS
TPS
KS
CTS
CPS
FI
ECM
Fuel pump
IN
OUT
BATTERY
+
–
A35C3RS
LEGEND
APS – Air pressure sensor
ATS – Air temperature sensor
CPS – Crankshaft position sensor
ECM – Engine control module
FI – Fuel injector
FR – Fuel rail
KS – Knock sensor
TPS – Throttle position sensor
CTS – Coolant temperature sensor

OPERATING PRINCIPLE

For this SDI 2-stroke engine, a highly advanced engine management system (EMS) has been used to ensure a high power output combined with cleaner combustion. An ECM (Engine Control Module) calculates the proper air/fuel mixture and ignition timing for each cylinder separately. The fuel is injected into the transfer port of each cylinder.

CHARGING SYSTEM

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

The magneto has a 3 phases, delta wound stator on 18 poles. Capacity is 480 watts.

AC current is rectified and regulated between 13.4 and 15 volts for the vehicle electrical system. It supplies the ECM with DC current.

Vehicle 12-volt battery supplies the ECM with DC current.

IGNITION SYSTEM

Double ignition coil has two separate windings, one for each spark plug.

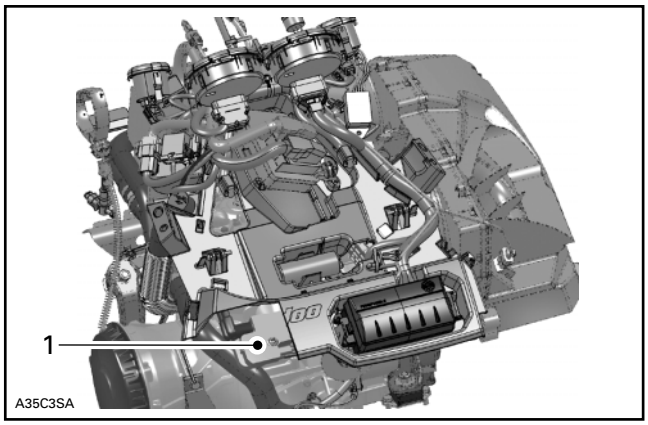
Ignition coil induces voltage to a high level in the secondary windings to produce a spark at the spark plug.

Two separate windings circuits are switched to ground through the ECM. Each winding provides high voltage to its corresponding spark plug.

This ignition system allows spark plugs to spark independently.

CAUTION: Do not interchange spark plug cables. Match reference (PTO and MAG printed on high tension cable yellow tag) with corresponding cylinder spark plug.

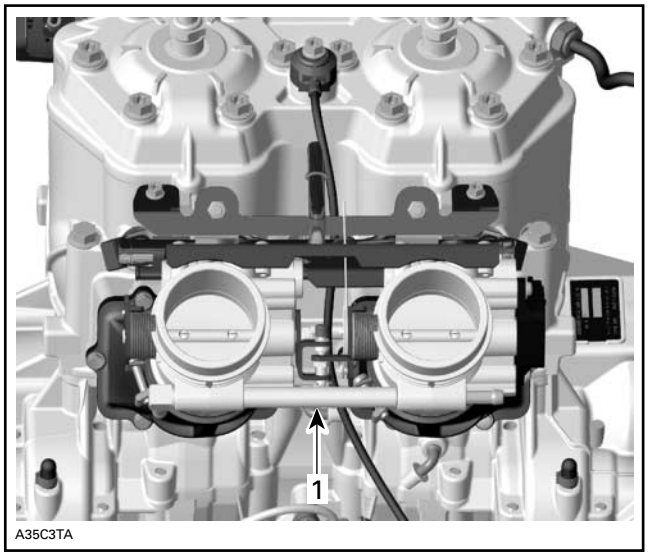
Double ignition coil is located underneath multi function plate.



1. Ignition coil

AIR INDUCTION

Through air filter mounted LH side panel, air goes into air silencer. The ECM measures at this point air pressure and temperature. Then, air for combustion is drawn through two throttle bodies. The air flow is controlled by two throttle plates. The air continues through the reed valves into the cylinder base then the crankcase.



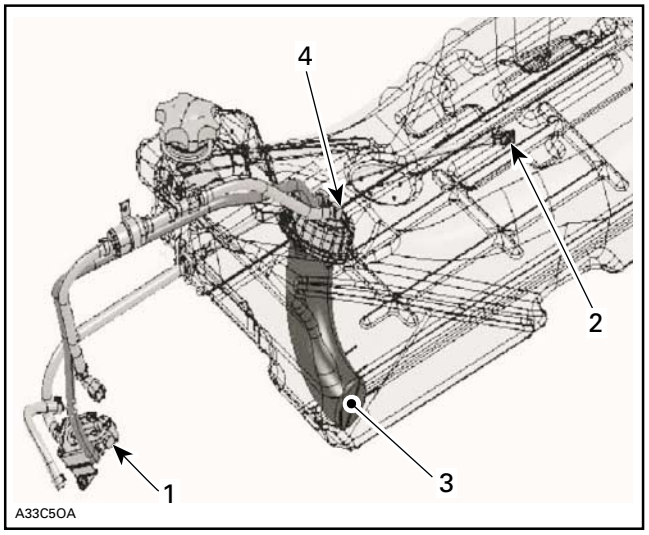
THROTTLE BODY ASSEMBLY
1. Coolant-heated line

FUEL DELIVERY SYSTEM

Diaphragm Fuel Pump

A conventional diaphragm fuel pump is used to supply fuel to the electric fuel pump reservoir located inside fuel tank. This reservoir is the fuel supply for the electric fuel pump. This system allows a more consistent fuel delivery under extreme riding angles and when the fuel tank level is low, which increases the fuel range per tank.

NOTE: A bypass hole in the upper section of the pump reservoir allows fuel to enter or exit the reservoir depending of the conditions.

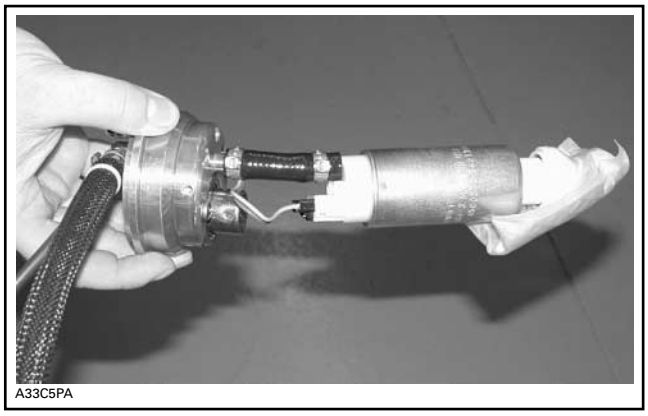


1. Diaphragm pump
2. Fuel pick-up
3. Pump reservoir
4. Electric fuel pump

Electric Fuel Pump and Fuel Pressure Regulator

They provide fuel pressure and flow rate to the system.

The fuel pump module is located inside the fuel tank. The module includes the fuel pump and the fuel pressure regulator. The fuel pump inlet includes a filter.



The fuel pressure regulator controls the pressure in the system and allows the excess of fuel to return to the fuel tank. The fuel pressure regulator regulates the fuel pressure at 400 kPa (58 PSI).

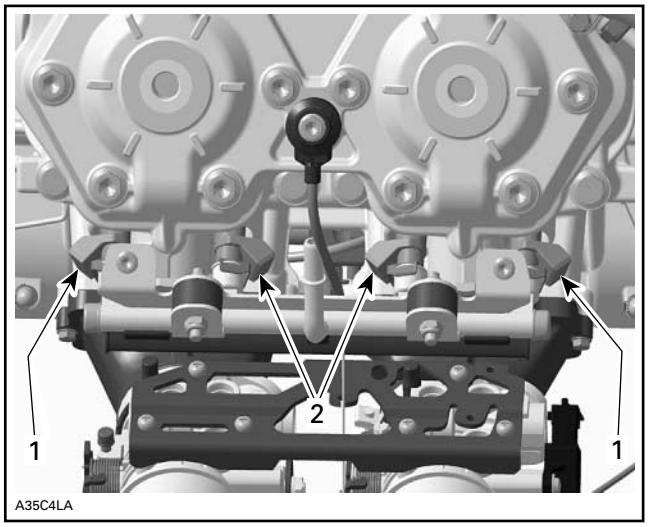
Fuel Rail

The fuel rail is a small tube on which the four injectors are mounted. It ensures at all times that enough fuel at the right pressure can be delivered to the fuel injectors. The fuel rail is fed by the fuel pump module.

Fuel Injectors

Fuel injectors (two different types per cylinder) are used to inject fuel into the transfer port of cylinder.

– Outer injectors are responsible for idle speed and part load condition.
– Inner injectors will be activated at 6500 RPM for wide open throttle condition.



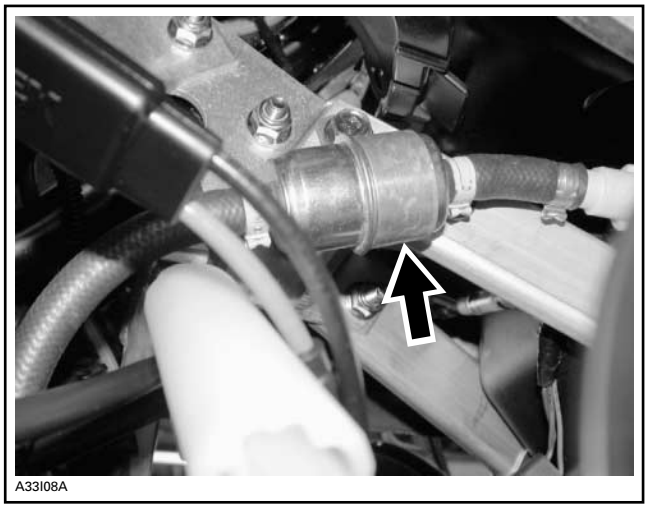
1. Outer injectors (blue)
2. Inner injectors (brown)

Throttle Body

It is a dual throttle body mounted on the engine intake side. Fitted on this dual throttle body, there is a TPS (Throttle Position Sensor) that sends information to the ECM.

In-Line Fuel Filter

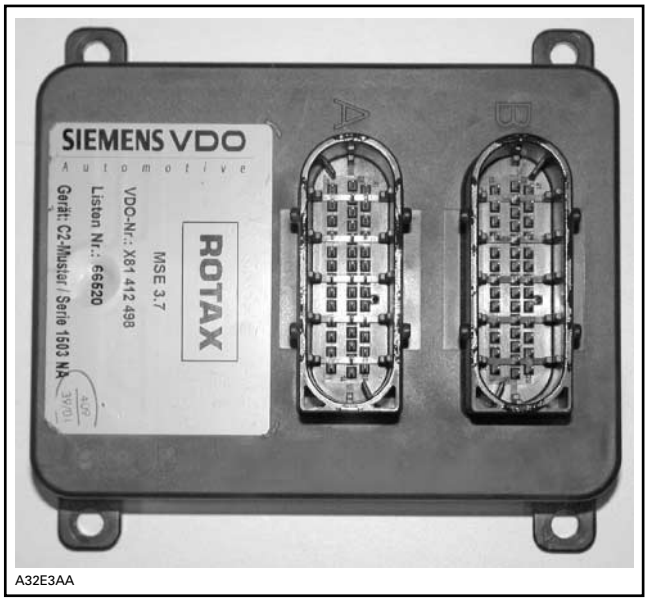
The in-line 10 micron fuel filter is fastened under the steering console. It should be replaced annually.



TYPICAL

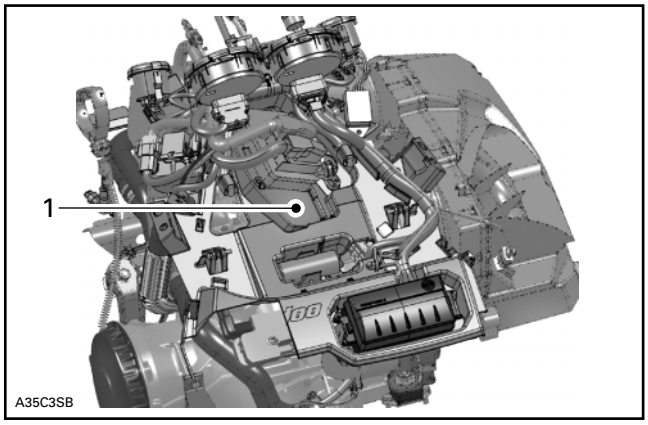
ENGINE MANAGEMENT SYSTEM (EMS)

The EMS (Engine Management System) is equipped with an engine control module (ECM).



TYPICAL — ECM

The ECM is mounted in the front of the vehicle above the multi function plate.



1. ECM location

The ECM is responsible for the following functions:

- power distribution
- fuel injection
- ignition system
- start/stop functions
- E-RAVE actuator control
- DESS (Digitally Encoded Security System)
- RER (Rotax Electronic Reverse)
- monitoring system
- diagnostic mode

The ECM also stores general informations such as: operating conditions, vehicle hours, serial numbers, customer and maintenance information.

The ECM features a permanent memory that will keep the programmed tether cord cap(s) code, fault codes and other vehicle information, even when the battery is removed from the vehicle.

As shown in the SDI CONTROL SYSTEM illustration, the ECM is the central point of the engine management system. It reads the inputs, makes computations, uses pre-determined parameters and sends the proper signals to the outputs for proper engine management.

Manual Start Models

While cranking, the magneto sends AC current to the voltage regulator/rectifier that in turn, sends a signal to the ECM. This wakes up the Engine Management System and activate the starting system relay (R1) and the capacitor relay (R4). Just a small rotation of the engine is needed to wake-up the ECM.

The RER switch may also be used to wake-up the Engine Management System.

Waking-up the EMS before doing a start attempt result in faster start-up.

Waking-up the Engine Management System powers the ECM, the fuel pump, the ignition coil, the injectors, and the gauges.

The battery is required to supply current mainly to the fuel pump to allow a fuel pressure buildup. An easy way to acknowledge if the Engine Management System is woken-up, verify if gauges are lit up.

The capacitor has two functions. It is used to stabilize battery voltage when voltage from the voltage regulator/rectifier is charging the small battery. It also gives the possibility to be able to start the engine even if the battery is very low. In this case, starting the engine may be more difficult and will require the very complete stroke of the starting rope.

The capacitor relay prevents the capacitor to be connected to the battery when the engine is not running to allow safe vehicle maintenance (disconnection and reconnection of the capacitor).

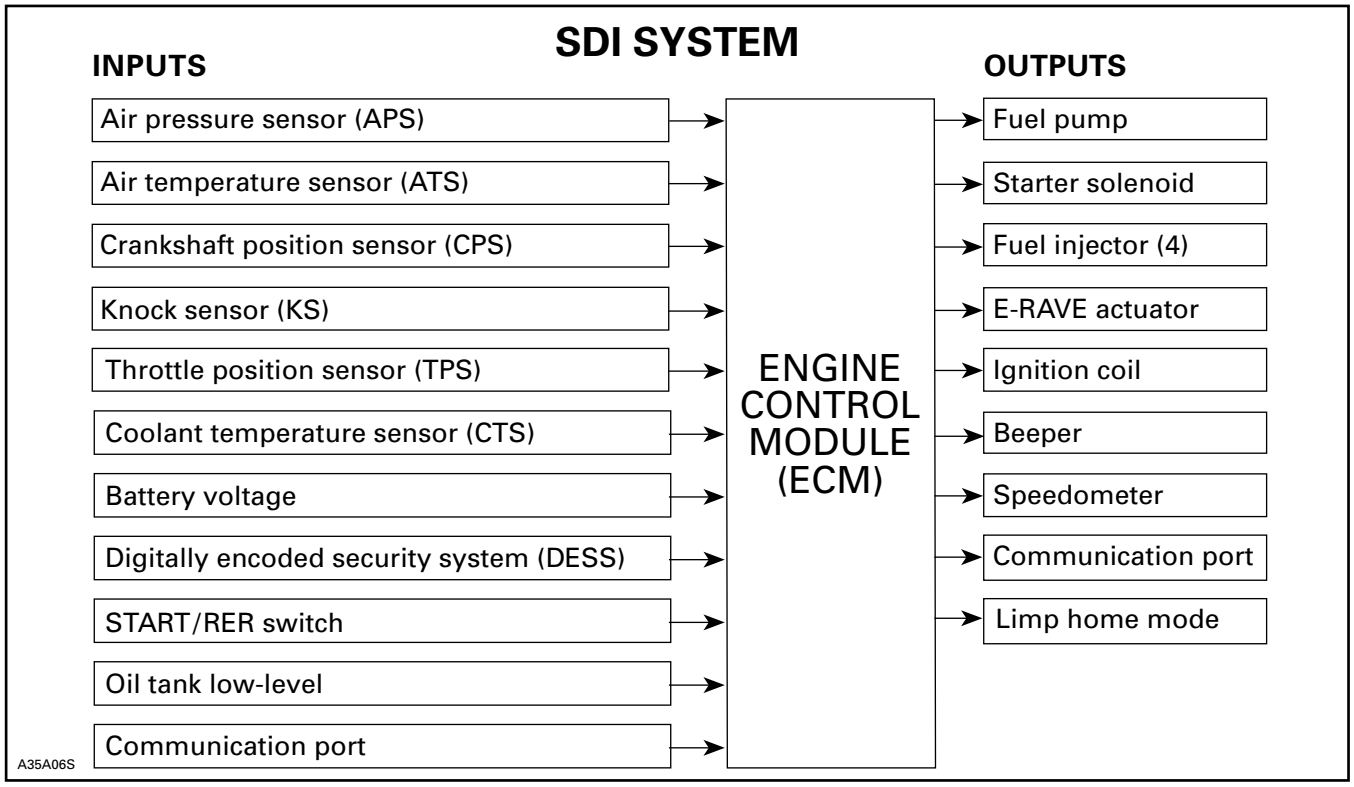
Electric Start Models

When the START/RER switch is activated, it wakes up the EMS and power the starting system relay (R1), the ECM, the fuel pump, the ignition coil, the injectors, and the gauges. Then, if the cut-off switch and the DESS switch are in position to allow starting and START/RER switch is hold, the starter solenoid relay is activated.

All Models

When engine reaches approximately 800 RPM, the ECM activates the headlights and accessory relay (R2).

EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS



POWER DISTRIBUTION

Accessories are protected by fuses located in the fuse holder. Fuses are identified besides their holder.

IMPORTANT: Engine-related sensors and injectors are continuously powered from the battery. **The ECM switches the ground to complete the electrical circuits it controls.** Take this into account when troubleshooting the electrical system.

Manual Start Models

The system uses 3 relays: an ignition/injectors, electric fuel pump and starting system relay (R1), a second for the lighting system and the accessories (R2) and a third for the capacitor circuit (R4).

Electric Start Models

The system uses 2 relays: an ignition/injectors, fuel pump and starting system relay (R1) and a headlights and accessories relay (R2).

Gauges Current Supply

Gauges are supplied with current for 30 seconds when connecting the tether cord cap on its post and momentarily pressing the START/RER switch.

NOTE: On electric start models, setting engine cut-out switch to OFF will prevent engine starting.

NOTE: Each time the tether cord cap is connected to the post and START/RER switch is depressed, the fuel pump is activated for 2 seconds to build up pressure in the fuel injection system.

Automatic Power Shut-Down

The ECM is equipped with an automatic power shut-down. This feature prevents the battery from losing its charge if the tether cord cap is left on the post when the engine is not running for more then 30 seconds. The ECM will remain offline until the electric starter or the rewind starter is activated. The ECM will shut down all outputs after 5 seconds when the tether cord cap is removed.

FUEL INJECTION

The ECM receives the signals from different sensors which indicate engine operating conditions at milli-second intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS and TPS are the primary sensors used to control the injection and ignition timing. Other sensors are used for secondary input.

Flooded Engine Mode (Drowned Mode)

If the engine does not start and it is fuel-flooded, this special mode can be activated to prevent fuel injection and to cut ignition while cranking. Proceed as follows:

With tether cord cap on its post while engine is stopped, press completely and HOLD throttle lever.

Manual Start Models

Crank engine several times.

Electric Start Models

Press the START/RER button.

The engine should be cranked for 20 seconds. Release START/RER button.

All Models

In the engine drowned mode, engine cannot start. It is required to release throttle lever and to start/crank engine again to allow starting.

NOTE: If the engine does not start, it may be necessary to replace the spark plugs.

IGNITION SYSTEM

The ECM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the ECM controls the ignition timing for optimum engine operation.

Engine RPM Limiter

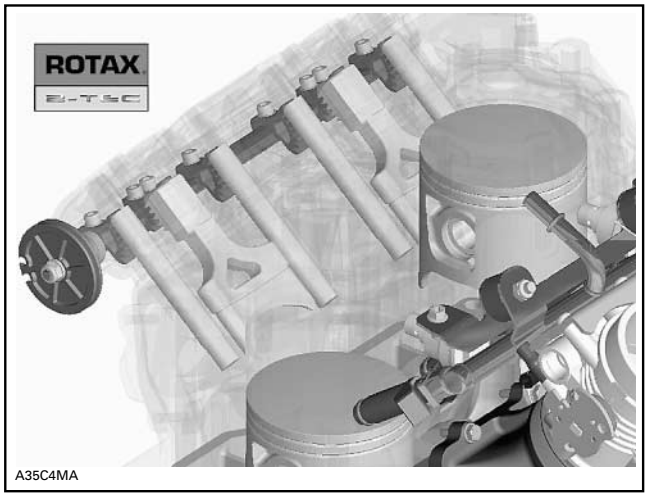
The ECM will limit the maximum engine speed.

Knock Sensor

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation. If detonation occurs, the knock sensor detects it and the ECMs retards the ignition advance and extend the injection period temporarily (it goes in a specific mode) until detonation stops.

ELECTRONICALLY CONTROLLED RAVE (E-RAVE)

An electronically controlled RAVE (E-RAVE) system with side exhaust port control is used. This system offers more torque and less fuel consumption in part load operation, compared to conventional RAVE system.



A35C4MA

The opening of the valve is activated electronically by a rotary electronic actuator (REA). The ECM monitors altitude, engine temperature, throttle position and RPM to operate the actuator for optimum engine operation.

The RAVE valves are all either closed or fully opened.

DIGITALLY ENCODED SECURITY SYSTEM (DESS)

The following components are specially designed for this system: ECM, tether cord cap and DESS post.

This system allows the engine to reach pulley engagement speed only if a programmed tether cord cap is installed on DESS post.

The tether cord cap contains a magnet and a ROM chip. The magnet actually closes the reed switch inside the post which is the equivalent of a mechanical ON/OFF switch. The chip has a unique digital code.

NOTE: Actually, it is the memory of the ECM which is programmed to recognize the digital code of the tether cord cap. This is achieved with the VCK (Vehicle Communication Kit) (P/N 529 035 981). Refer to their operation manual or help system to program a tether cord cap.

529 035 981

The system is quite flexible. Up to 8 tether cord caps may be programmed in the memory of the ECM. They can also be erased individually.

NOTE: If desired, a tether cord cap can be used on other vehicle equipped with the DESS. It only needs to be programmed for that vehicle.

When starting the engine with a tether cord cap on the post, the DESS is activated and will emit audible signals:

– 2 short beeps indicate a working tether cord cap. Vehicle can be driven.
– short repetitive beeps indicates a wrong tether cord cap is being used or that something is defective. Vehicle can not be driven.

Engine Starting

If the ECM recognizes a valid tether cord cap, it allows engine to rev above 3000 RPM.

ROTAX ELECTRONIC REVERSE (RER)

There is 3 main components used for the RER system: the START/RER switch, the ECM and the crankshaft position sensor.

The ECM receives signals from the crankshaft position sensor (CPS) for the following functions:

– Forward engine rotation.
– Reverse engine rotation.
– Crankshaft position and engine RPM.

The ECM recognizes a signal sent by the START/RER switch.

When switch is activated and engine is not running, ECM allows normal engine starting.

When switch is activated and engine is running, ECM cuts off ignition. Therefore, engine RPM gradually drops. When engine reaches a low threshold RPM, ECM sends an ignition spark at a great advance creating a thrust which reverses engine rotation.

Under a threshold low RPM or above drive pulley engagement speed, the RER function is disabled. Nothing takes place when pressing START/RER button.

MONITORING SYSTEM

The ECM monitors the electronic components of the engine management system and other components of the electrical system.

When a fault occurs, it sends a signal to the check engine LED or also to the beeper to inform the driver of a particular condition. Refer to the DIAGNOSTIC PROCEDURES.

Low-Oil Level Warning Device

When the oil falls under a certain level, the low oil level LED will be illuminated. The beeper will also be activated intermittently.

High Coolant Temperature Warning Device

When the coolant temperature is getting too high, the ECM sends out signals to the beeper and the high temperature LED.

Limp Home Mode

Besides the signals as seen above, the ECM may automatically set default parameters to ensure the adequate operation of the vehicle if a component of the engine management system is not operating properly.

NOTE: Sensor failures will not lead automatically to a limp home mode. The check engine LED will turn on and in some cases the beeper.

The engine RPM may be limited if some critical components fail. In this case, releasing throttle and letting the engine returning to idle speed may allow normal operation to come back. If it does not work, try removing and reinstalling the tether cord cap on DESS post.

These performance-reduced modes allow the rider to go back home which would not be possible without this advanced system. Refer to the DIAGNOSTIC PROCEDURES for a complete chart.

DIAGNOSTIC MODE

The malfunctions are recorded in the memory of the ECM. The memory of the ECM can be checked using the VCK (Vehicle Communication Kit) (P/N 529 035 981) to see the fault codes. Refer to the DIAGNOSTIC PROCEDURES section.

DIAGNOSTIC PROCEDURE

SERVICE TOOLS

Description	Part Number	Page
GRAY diagnostic key	529 035 896	134
supply harness	529 035 869	133
VCK (Vehicle Communication Kit)	529 035 981	132

GENERAL

Here is the basic order suggested to diagnose a suspected engine management or fuel injection related problem:

- Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.
- Check if the engine management system (EMS) pilot lamp lights up. If so, use the VCK (Vehicle Communication Kit) and look for fault codes to diagnose the trouble.
- Check all fuses, relay(s), battery and capacitor (on so equipped models).
- Check fuel pressure.
- Check spark plugs condition.
- Check all connections of the wiring harness.

Refer to COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT section for procedures.

TROUBLESHOOTING

The following chart is provided to help in diagnosing the probable source of simple troubles.

Monitoring Beeper Coded Signals

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
2 short beeps (when engine is started). DESS/RER pilot lamp also blinks.	Confirms that proper tether cord cap is installed. Engine can rev above clutch engagement.	No problem detected. Good ride.
1 short beep every 1.5 seconds (when engine is started). DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Bad DESS system connection. Defective tether cord cap. Dirt or snow in tether cord cap. Defective DESS post.	Reinstall tether cord cap correctly over post. Use another programmed tether cord cap. Clean tether cord cap. Replace DESS post.
1 long beep per second.	Reverse is selected.	Vehicle can be driven in reverse.
3 short beeps per second. DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Wrong tether cord cap is installed.	Install proper tether cord cap. Program key into ECM.
3 short beeps per second. Engine overheating pilot lamp also blinks.	Engine is overheating.	Stop engine immediately and allow to cool. Check cooling system.
1 long beep (2 seconds) every 15 minutes.	Low battery voltage.	Check battery and charging system.
4 short beeps every 2 minutes. Oil pilot lamp also lights up.	Low oil level on 2-TEC models.	Check oil level and replenish as soon as possible.

Many other codes use the engine pilot lamp and the beeper to indicate a problem. Refer to B.U.D.S. for possible causes and service actions.

EMS FAULT CODES

General

The faults registered in the ECM (engine control module) are kept when the battery is disconnected.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. This will properly reset the appropriate counter(s). This will also record that the problem has been fixed in the ECM memory.

Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the code faults (state, count, first, etc.) and report, refer to B.U.D.S. online help.

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups TPS faults and adaption faults. These are displayed on the B.U.D.S. system as TPS OUT OF RANGE and TPS ADAPTATION FAILURE.

TPS "OUT OF RANGE" Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS.	Reconnect.
Check if sensor is loose.	Tighten sensor and reset **Closed Throttle**.
Inspect sensor for damage or corrosion.	Replace sensor and reset **Closed Throttle**.
Inspect wiring (voltage test).	Repair.
Inspect wiring and sensor (resistance test).	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle**.
Test sensor operation (wear test).	Replace sensor and reset **Closed Throttle**.

TPS "ADAPTATION FAILURE" Fault

It is caused by the idle position moving out of an acceptable range.

Following problems can be caused by a TPS "Adaption Failure":

– Idle speed is out of range.
– Engine stops, when throttle is released quickly.
– Engine runs inconsistent in low partload or low RPM.

POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset.	Reset **Closed Throttle**.
Throttle body has been replaced and TPS closed position not reset.	Reset **Closed Throttle**.
ECM has been replaced and TPS closed position not reset.	Reset **Closed Throttle**.
Throttle cable too tight.	Adjust cable and reset **Closed Throttle**.
Sensor is loose.	Tighten sensor and reset **Closed Throttle**.
Throttle bracket is loose.	Fix and reset **Closed Throttle**.
Adjustment screw worn or loose.	Adjust idle speed screw using B.U.D.S.

Supplemental Information

When using the service action suggested in the Fault section of B.U.D.S., the system circuits are referred to as DA-41, which means connector "A" on the ECM and the circuit 41.

Manual Start Models

Fault code P0616: This code will always be present. Disregard this code, as it is not applicable. Since the starter relay wiring is factory-installed, the ECM detects an open circuit because the starting relay is not installed.

EMS Fault Code Table

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
P0106	OFF	OFF	Air pressure sensor voltage out of range.
P0337	OFF	OFF	No crankshaft signal detected.
P0336	OFF	OFF	High engine RPM detected.
P0339	OFF	OFF	Crankshaft signal fault.
P0654	OFF	OFF	Tachometer RPM signal shorted to battery.
P0654	OFF	OFF	Tachometer RPM signal open circuit or shorted to ground.
P0617	OFF	OFF	Starter relay shorted to battery.
P0616	OFF	OFF	Starter relay open circuit or shorted to ground.
P1670	OFF	OFF	Beeper shorted to battery.
P1671	OFF	OFF	Beeper open circuit or shorted to ground.
P0650	OFF	OFF	EMS pilot lamp shorted to battery.
P0650	OFF	OFF	EMS pilot lamp open circuit or shorted to ground.
P1675	OFF	OFF	Relay 2 shorted to battery.
P1676	OFF	OFF	Relay 2 open circuit or shorted to ground.
P1148	OFF	OFF	Safety fuel cut off detected.
P1611	OFF	OFF	P+ Test of ISC output signal failed.
P0513	OFF	OFF	Incorrect DESS® key.
P0601	OFF	OFF	Faulty module (software of hardware damaged).
P1677	OFF	OFF	Relay 3 shorted to battery.
P1678	OFF	OFF	Relay 3 open circuit or shorted to ground.
P1648	OFF	OFF	Battery lamp shorted to battery.
P1649	OFF	OFF	Battery lamp open circuit or shorted to ground.
P0655	OFF	OFF	Engine temperature lamp shorted to battery.
P0655	OFF	OFF	Engine temperature lamp open circuit or shorted to ground.
P1646	OFF	OFF	Engine temperature lamp shorted to battery.
P1647	OFF	OFF	Engine temperature lamp open circuit or shorted to ground.
P0648	OFF	OFF	DESS lamp shorted to battery.
P0648	OFF	OFF	DESS lamp open circuit or shorted to ground.
P1654	OFF	OFF	Oil lamp shorted to battery.
P1658	OFF	OFF	Oil lamp open circuit or shorted to ground.
P0117	BLINK	OFF	Engine temperature sensor voltage too low.

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
P0118	BLINK	OFF	Engine temperature sensor voltage too high.
P0116	BLINK	OFF	Engine temperature sensor functional problem.
P0112	BLINK	OFF	Air temperature sensor voltage too low.
P0113	BLINK	OFF	Air temperature sensor voltage too high.
P0111	BLINK	OFF	Air temperature sensor functional problem.
P0078	BLINK	OFF	E-RAVE actuator functional problem.
P0107	BLINK	OFF	Air pressure sensor voltage too low.
P0108	BLINK	OFF	Air pressure sensor voltage too high.
P0600	BLINK	OFF	E-RAVE actuator communication problem.
P0608	BLINK	OFF	Sensor's power supply voltage too low.
P0608	BLINK	OFF	Sensor's power supply voltage too high.
P0232	BLINK	OFF	Fuel pump shorted to battery.
P0231	BLINK	OFF	Fuel pump open circuit or shorted to ground.
P0080	BLINK	OFF	RAVE® solenoid shorted to battery.
P0079	BLINK	OFF	RAVE® solenoid open circuit or shorted to ground.
P0326	BLINK	OFF	Knock sensor signal below minimum noise.
P1502	BLINK	OFF	TOPS functional problem.
P0351	BLINK	OFF	No ignition output cylinder # 1 (MAG for 2 cyl. engine).
P0352	BLINK	OFF	No ignition output cylinder # 2 (PTO for 2 cyl. engine).
P0262	BLINK	OFF	Injector cyl. # 1 OR outer MAG injector (2 cyl.), shorted to battery.
P0261	BLINK	OFF	Injector cyl. # 1 OR outer MAG injector (2 cyl.), open circuit or shorted to ground.
P0265	BLINK	OFF	Injector cyl. # 2 OR outer PTO injector (2 cyl.), shorted to battery.
P0264	BLINK	OFF	Injector cyl. # 2 OR outer PTO injector (2 cyl.), open circuit or shorted to ground.
P0268	BLINK	OFF	Injector cyl. # 3 OR inner MAG injector (2 cyl.), shorted to battery.
P0267	BLINK	OFF	Injector cyl. # 3 OR inner MAG injector (2 cyl.), open circuit or shorted to ground.
P0271	BLINK	OFF	Inner PTO injector shorted to battery.
P0270	BLINK	OFF	Inner PTO injector open circuit or shorted to ground.
P0122	BLINK	OFF	Throttle position sensor voltage too low.
P0123	BLINK	OFF	Throttle position sensor voltage too high.

P CODE	EMS PILOT LAMP	BEEPER	DESCRIPTION
P0601	BLINK	OFF	TPS learns unlikely or checksum fault.
P1102	BLINK	OFF	Throttle position sensor adaptation failure.
P1104	BLINK	OFF	Throttle position sensor adaptation canceled.
P1655	BLINK	OFF	DESS® shorted to battery.
P1656	BLINK	OFF	DESS® line shorted to ground.
P0604	BLINK	OFF	RAM fault.
P0605	BLINK	OFF	EEPROM fault.
P0602	BLINK	OFF	MPEM not coded.
P0605	BLINK	OFF	EEPROM checksum fault.
P0605	BLINK	OFF	Coding ID checksum fault.
P0605	BLINK	OFF	Coding checksum fault.
P0605	BLINK	OFF	Programming checksum fault.
P0562	OFF	2 s beep/min.	Battery voltage too low.
P0563	BLINK	2 s beep/min.	Battery voltage too high.

VCK (Vehicle Communication Kit)

The VCK (Vehicle Communication Kit) (P/N 529 035 981) is the primary tool to diagnose engine management and fuel injection related problems.

529 035 981

NOTE: The MPEM programmer does not work on SDI models.

Ensure to use the latest version of B.U.D.S. available on BOSSWeb.

B.U.D.S. (BRP Utility and Diagnostic Software) is designed to allow actuators, sensors and electronic equipments inspection, diagnostic options and reset such as the closed throttle.

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

⚠ WARNING

If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

VCK Supply

The VCK (MPI box) can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

Connecting VCK to Vehicle

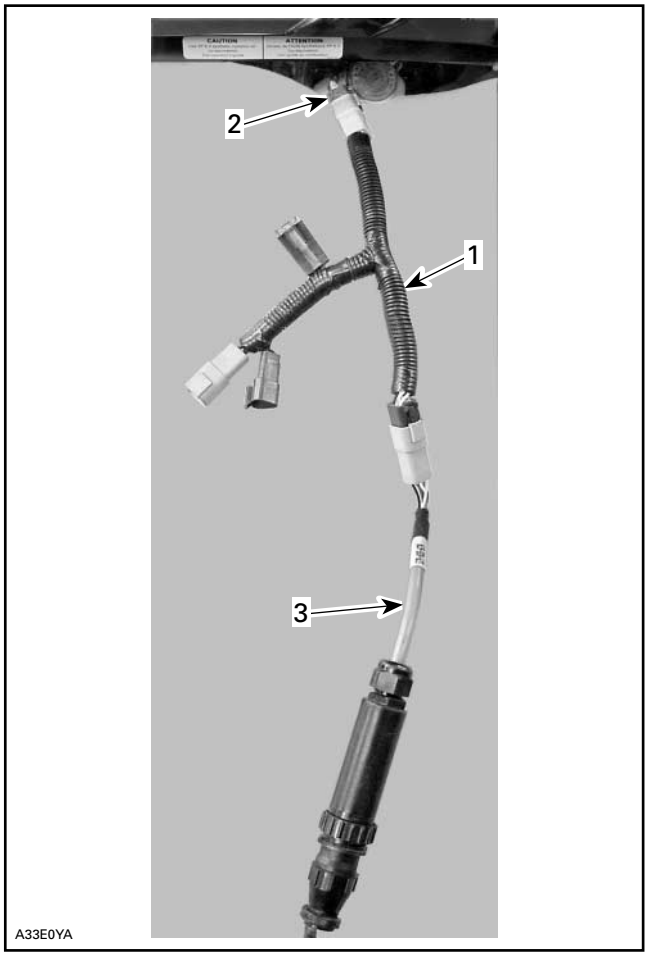
Remove the 6 pin connector from the protective cap on the right side of the vehicle.

1. Remove connector from cap

Connect supply harness (P/N 529 035 869), to vehicle 6-pin connector.

Connect the 6 pin diagnostic cable from VCK to supply harness.

NOTE: SDI engines already have a 12 V battery; they do not need any external 9 V or 12 V power to allow programming and troubleshooting. The use of the supply harness will keep the ECM ON. Not using it will make the ECM shuts-off after a few seconds if no communication takes place.



1. Supply harness
2. Vehicle 6-pin connector
3. VCK cable

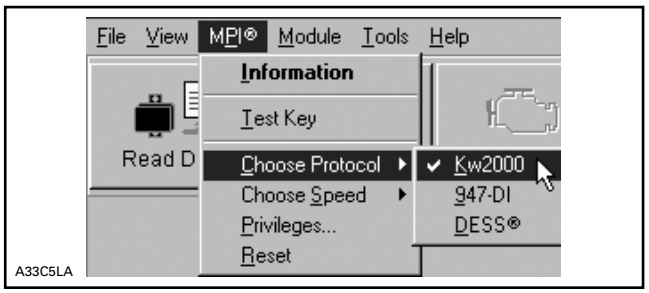
CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

Set engine cut-out switch to OFF.

Install the GRAY diagnostic key (P/N 529 035 896) or any DESS cap onto the vehicle DESS post.

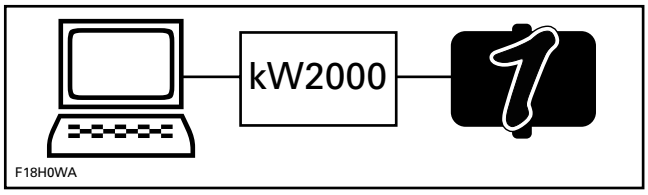
When using the software B.U.D.S., with the SDI:

– ensure that the protocol "KW2000" is properly selected in "**MPI**" under "**Choose protocol**



– ensure the status bar shows the KW2000 and the number 1 to the right. To communicate with the ECM, number 1 must be displayed.

Number 1 means that one module is connected with the PC.



ONE MODULE IS CONNECTED

If an "X" is shown, this means that no communication between the MPI and the ECM is possible. In this case possible causes are:

– ECM is not powered-up
– wrong protocol is used
– bad connection between MPI and module.

Writing in ECM

When writing in ECM through B.U.D.S., there will be an "EMS Tracking" message that will say "Remove key from vehicle". When this occurs, remove the tether cord cap from its post and wait until the message disappears (it lasts approximately 5 seconds after tether cord cap removal).

COMPONENT INSPECTION, REPLACEMENT AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
ECM adapter	420 277 010	138
Fluke 111	529 035 868	137
hose pinchers	295 000 076	146
VCK (Vehicle Communication Kit)	529 035 981	135

SERVICE PRODUCTS

Description	Part Number	Page
dielectric grease	293 550 004	143
Loctite 5910	293 800 081	151, 154
pulley flange cleaner	413 711 809	147

GENERAL

Engine problems are not necessarily related to the engine management system.

It is important to ensure that the mechanical integrity of the engine and drive system are present:

– good transmission system operation
– good engine compression and properly operating mechanical components, no leaks etc.
– fuel pump connection and fuel lines without leaks.

When replacing a component, always check its operation after installation.

FUEL SYSTEM

⚠ WARNING

The fuel system of a fuel injection system holds much more pressure than that of a carbureted snowmobile. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here. Pay attention that some hoses may have more than one clamp at their ends. Ensure to reinstall the same quantity of clamps at assembly.

– Use the VCK (Vehicle Communication Kit) (P/N 529 035 981) to release the fuel pressure in the system. Look in the **Activation** section of the software B.U.D.S. (ensure to use the latest version available on BOSSWeb).

529 035 981

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the VCK to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always disconnect battery or remove 30 A fuse prior to working on the fuel system. After performing a pressure test, release the pressure.

– Always disconnect battery properly or remove 30 A fuse prior to working on the fuel system. Refer to BATTERY section.

Fuel Rail and Hose

Pressure at fuel rail is supplied and controlled by the electric fuel pump.

When a repair is completed, ensure that hose between fuel rail and fuel pump is properly secured in the supports. Then, perform a fuel pressure test. Refer to FUEL SYSTEM.

To remove fuel rail, refer to FUEL INJECTORS in this section.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the tether cord cap on the DESS post. Always perform the high pressure test if any component has been removed. The fuel pump is started and pressure quickly builds-up each time the tether cord cap is installed and the START/RER button is depressed (or rewind starter is pulled).

⚠ WARNING

Never use a hose pincher on injection system high pressure hoses.

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

– battery
– capacitor (manual start models)
– fuses
– relays
– DESS
– ignition (spark)
– ground connections
– wiring connectors.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

Never use a battery charger to substitute temporarily the battery, as it may cause the ECM (engine control module) to work erratically or not to work at all. Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

⚠ WARNING

All electrical actuators (injectors, fuel pump, ignition coils and starter solenoid) are continuously supplied by the battery when the start button is depressed or if engine is rotated (with the rewind starter). Always disconnect the tether cord cap and the battery prior to disconnecting any electric or electronic parts.

To perform verifications, a good quality multimeter such as Fluke 111 (P/N 529 035 868) should be used.

Pay particular attention to ensure that terminals are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

CAUTION: Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

Before replacing an ECM, always check electrical connections. Make sure that they are very tight and they make good contact and that they are corrosion-free. Check if wiring harness shows any signs of scoring. Particularly check ECM ground connections. Ensure that contacts are good and clean. A "defective module" could possibly be repaired simply by unplugging and replugging the ECM. The voltage and current might be too weak to go through dirty wire terminals. Check carefully if terminals show signs of moisture, corrosion or if they look dull. Clean terminals properly and then coat them prior to assembling as follows:

If the newly replaced ECM works, try the old one and recheck if it works.

Ensure that all electronic components are genuine – any modification on the wiring harness may lead to generate fault codes or bad operation.

NOTE: For diagnostics purposes, use Vehicle Communication Kit (VCK). See DIAGNOSTIC PROCEDURES for proper connectors/adaptors.

After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. Refer to DIAGNOSTIC PROCEDURES subsection.

Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The resistance value of a resistance varies with the temperature. Do not touch the sensor itself. It may cause wrong result during measurement, because of body heat.

The resistance value for usual resistor or windings (such as injectors) **increases** as the temperature increases. However, some of our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value **decreases** as the temperature increases. Take it into account when measuring at temperatures different from 20°C (68°F). Use this table for resistance variation relative to temperature for **temperature** sensors.

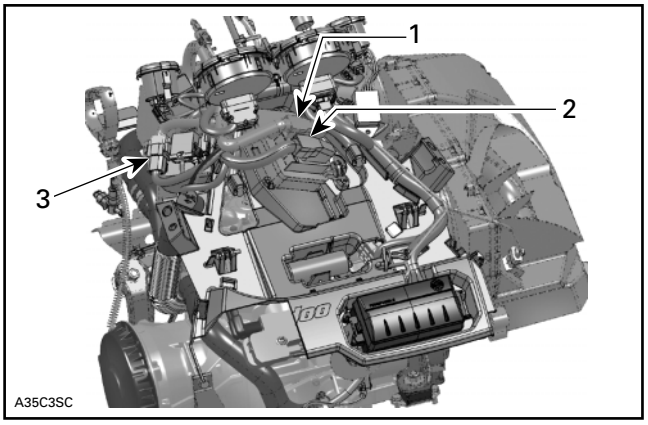
TEMPERATURE SENSOR TABLE				
TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	ATS	CTS FOR	
			GAUGE	ECM
- 40	- 40			72412
- 35	- 31			52637
- 30	- 22	28000		38681
- 25	- 13			28718
- 20	- 4	14500	733.8	21529
- 15	5		587.7	16288
- 10	14		474	12431
- 5	23		384.8	9565
0	32	5500	314.3	7418
5	41		258.4	5807
10	50		213.7	4582
15	59		177.7	3644
20	68	2500	148.7	2919
25	77		125	2355
30	86		105.6	1912
35	95		98.69	1562
40	104	1200	76.5	1284
45	113		65.54	1062
50	122		56.38	882.6
55	131		48.72	738.9
60	140	600	42.28	622
65	149		36.82	526.3
70	158		32.19	447.5
75	167		28.24	382.3
80	176	320	24.86	328.1

TEMPERATURE SENSOR TABLE				
TEMPERATURE		RESISTANCE (OHMS)		
°C	°F	ATS	CTS FOR	
			GAUGE	ECM
85	185		21.95	282.8
90	194		19.45	244.8
95	203		17.28	212.8
100	212	180	15.4	185.6
105	221			162.4
110	230			142.7
115	239			125.9
120	248			111.5
125	257			99.02
130	266	90		88.26
135	275			78.93
140	284			70.81
145	293			63.71
150	302			57.49

The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine/air silencer and heated with a heat gun while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

Connector Identifications



1. ECM A-connector
2. ECM B-connector
3. Engine/vehicle connector

ECM Connectors

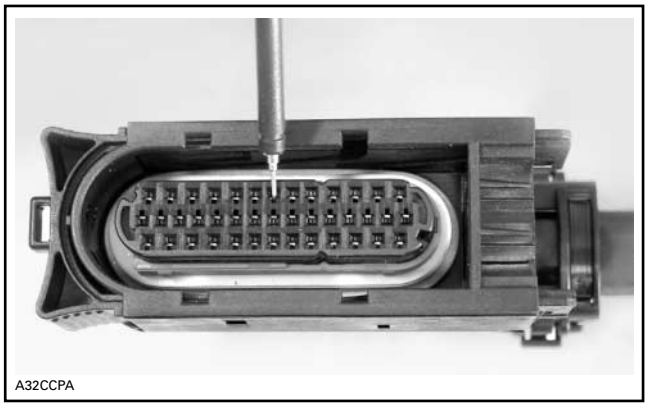
The most recommended and safest method to probe ECM connector terminals is to use the ECM adapter (P/N 420 277 010). This tool will prevent deforming or enlarging terminals which would lead to bad ECM terminal contact creating intermittent or permanent problems.

420 277 010

Disconnect the desired connector from ECM and reconnect on the tool connector. Probe required terminals directly in the tool holes.

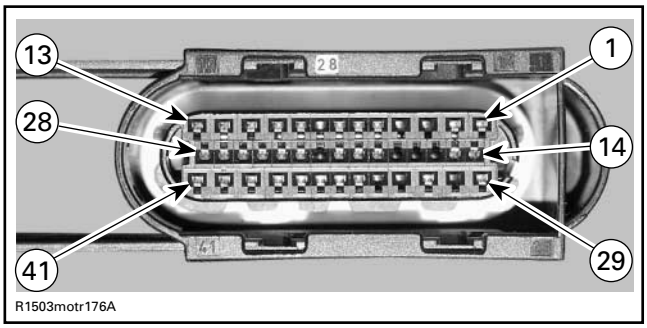
A35C3UA

CAUTION: If not using the ECM adapter, probe on top of terminal only. Do not try to probe inside terminal or to use a paper clip to probe inside terminal, it will damage the square-shaped terminal and this could lead to improper function of the engine management system.


A32CCPA

PROBE ONLY TOP OF TERMINAL

Use this diagram to locate the pin numbers on the ECM connector of the wiring harness when performing tests.



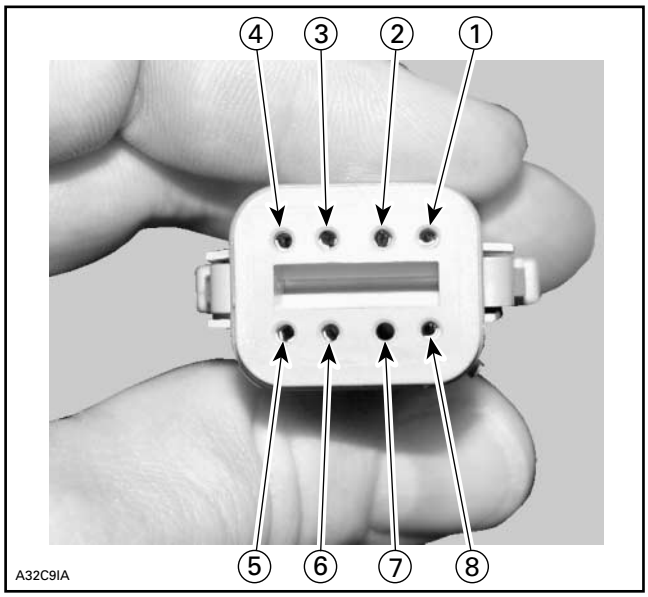
R1503motr176A

TERMINAL IDENTIFICATION OF ECM CONNECTOR (WIRING HARNESS SIDE)

CAUTION: Do not disconnect the ECM connector needlessly. They are not designed to be disconnected/reconnected repeatedly.

Engine/Vehicle Connector

Use this illustration to locate the terminal numbers on the engine/vehicle connector of the wiring harness when performing tests.



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TERMINAL IDENTIFICATION OF ENGINE/VEHICLE CONNECTOR (WIRING HARNESS SIDE)

Relay 2

Connect vehicle communication kit (VCK) and use B.U.D.S. software.

Energize relay 2 from Activation tab.

Listen to or touch relay to feel it click.

If the relay does not work, disconnect the connector from the relay to test the input side.

Connect a voltmeter as indicated in the following table.

TEST PROBE (+)	TEST PROBE (–)
RED/GRAY wire	Battery ground

Battery voltage (12 V) should be read.

If voltage reads 12 V, check continuity of ORANGE/GREEN wire between relay connector and terminal B-16 of ECM connector. If faulty, repair wire/connector. If wire/connectors test good, try a new ECM.

If voltage does not read 12 V, check continuity of wire on supply side of relay. If faulty, repair wire/connector. If wire/connectors test good, refer to ELECTRICAL SYSTEM to test output side or relay.

TESTING PROCEDURES

ELECTRIC FUEL PUMP

Electrical Test

When depressing the START/RER button, the fuel pump should run for 2 seconds to build up the pressure in the system.

If the pump does not work and there is no fault codes, disconnect the plug connector from the fuel pump.

Install a temporary connector to the fuel pump connector. Apply 12 V (+) on terminal 2 and (–) on terminal 1 to this test harness.

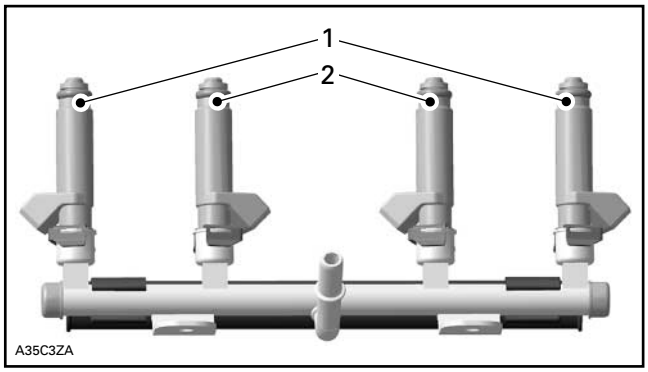
If pump does not run, replace the fuel pump module. Refer to FUEL SYSTEM section.

Otherwise, probe terminal 2 and battery ground of fuel pump connector on vehicle harness side. When depressing the START/RER button, you should read battery voltage for approximately 2 seconds (then, the voltage will drop). If battery voltage does not appear, the problem can be in fuse, relay(s), harness or in fuel pump connector. Repair or replace appropriate part.

Check continuity between terminal 1 of the fuel pump connector on the vehicle harness side and terminal 29 of the ECM connector B. If there is no continuity the problem is in the harness. Otherwise, try a new ECM.

FUEL INJECTORS

NOTE: Two different types of fuel injectors per cylinder are used.



1. MAG/PTO outer injectors (blue)
2. MAG/PTO inner injectors (brown)

Leakage Test and Fuel Flow Measurement

Preparation

First ensure fuel pressure is within specifications.

The injectors and fuel rail have to be removed together from the engine. Do not remove injectors from the fuel rail. Refer to REMOVAL in FUEL RAIL REPLACEMENT as necessary.

To ensure continuous fuel availability for the electric fuel pump, first fill up fuel tank prior to performing the following tests. This is required because engine is not running to activate diaphragm fuel pump with the crankcase pulses.

Leakage Test

Place each injector in a clean bowl.

Install the tether cord cap on the DESS post and press the engine START/RER button to activate the fuel pump.

Check for fuel leakage from the injector nozzle. There should be less than 1 drop per minute. Perform the test for 2 minutes.

If not within specification, replace the fuel injector(s).

Fuel Injector Flow Measurement

Manual Start Models

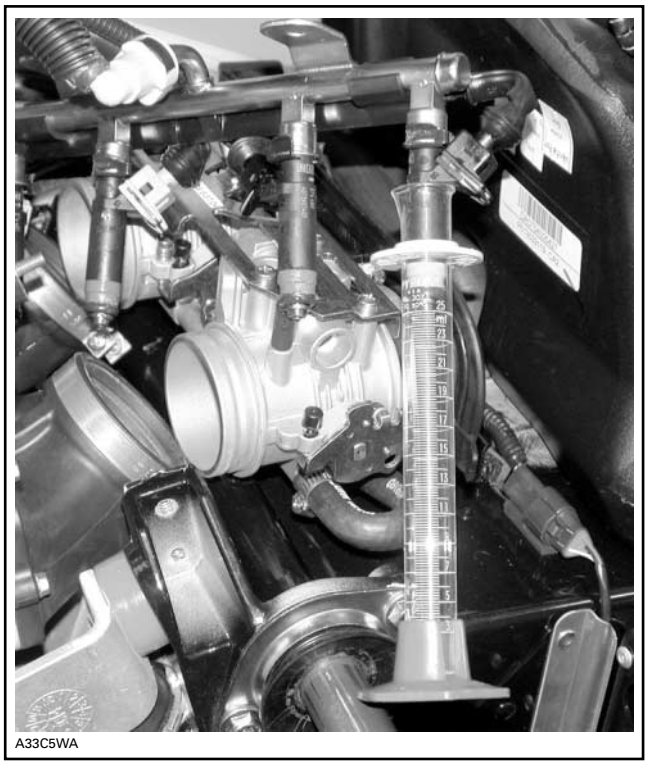
To continuously supply the electric fuel pump for the tests, an external 12 V battery is required. The small battery on the vehicle is not sufficient.

All Models

Use an appropriate burette graduated for 25 mL (.85 US on). The Pirex® no 3075 (or equivalent) works fine.

A33C5VA

Place injector inside top of burette.


A33C5WA

Connect vehicle communication kit (VCK) and use B.U.D.S. software. Install the tether cord cap on the DESS post and press the engine START/RER button to wake up the ECM.

Use appropriate wires and connect fuel pump directly to battery posts to continuously supply fuel pump.

Energize the appropriate injector under **Injector Flow Measurement** in **Activation** tab.

Energize each injector individually and measure the gas volume injected. Quantity of gas must be within the following specifications.

INJECTOR	VOLUME OF FUEL mL (US oz)
Blue	16 ± 1 (.54 ± .03)
Brown	21 ± 1.5 (.71 ± .03)

If an injector is out of specification, retest it 2 - 3 times. If it still fails, replace it.

If all injectors fail, it is unlikely a failure of injectors. First ensure your reading from the burette is appropriate (pay attention to the division lines). Ensure fuel tank is full. Test for leaks in fuel system, fuel pump pressure, filter condition (in-line and in tank).

Properly reinstall parts.

Electrical Test

Voltage Test

Tether cord cap must be on DESS post.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the fuel injector from the **Activation** section.

If the injector does not work, disconnect the plug connector from the injector.

Install a temporary connector to the injector with wires long enough to make the connection outside the engine compartment and apply voltage (12 V) to this test harness.

This will validate the injector mechanical and electrical operation.

If it does not work, replace it. If it works, continue procedure.

Wake up ECM using START button and measure voltage between terminal 1 (of injector on harness side) and battery ground.

If 12 V is read, disconnect connector A from the ECM and check continuity of circuit as per following table. If it is good, try a new ECM.

CIRCUIT NUMBER (ECM connector "A")	TERMINAL 2 OF INJECTOR HARNESS
A-15	MAG (outer)
A-33	PTO (outer)
A-14	MAG (inner)
A-30	PTO (inner)

If it does not read 12 V, check the corresponding fuse(s), relay and continuity of circuit. If continuity is faulty, repair wiring harness.

Resistance Test

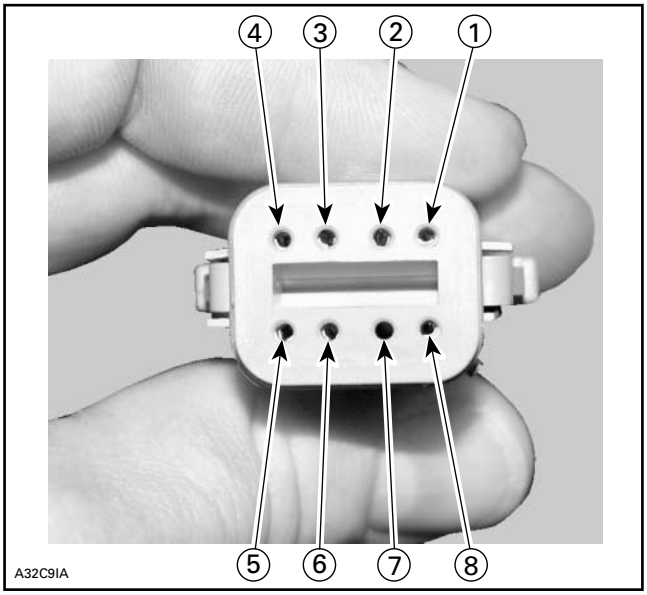
Disconnect the injector from the wiring harness and check the resistance of the injector itself.

The resistance should be around 14.5 Ω.

If resistance value is incorrect, replace the injector.

Reconnect the injector and disconnect the connector A from the ECM as well as the engine/vehicle connector.

Using a multimeter, check resistance value between terminals as shown in the table below.



ENGINE/VEHICLE CONNECTOR

COMPONENT	CONTACT LOCATION
Fuel injector, MAG (outer)	4 (Engine/vehicle connector) and A-15 (ECM connector)
Fuel injector, MAG (inner)	3 (Engine/vehicle connector) and A-14 (ECM connector)
Fuel injector, MAG (outer)	4 (Engine/vehicle connector) and A-33 (ECM connector)
Fuel injector, MAG (inner)	3 (Engine/vehicle connector) and A-30 (ECM connector)

The resistance should be around 14.5 Ω.

If resistance value is correct, check wiring of corresponding relay. If good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors or replace the wiring harness between ECM connector and fuel injector.

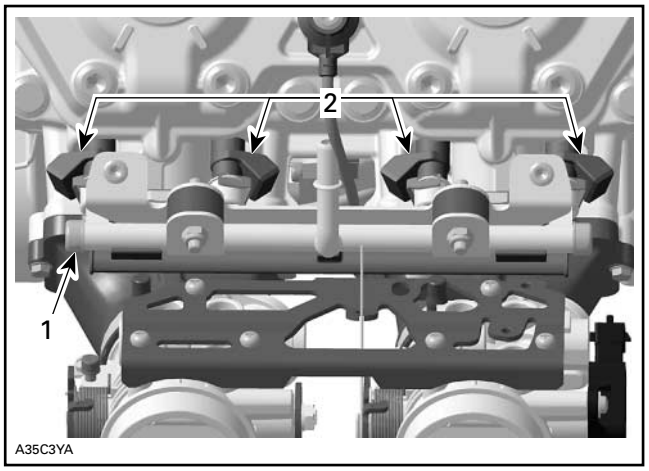
Fuel Injector Replacement

Removal

Release the fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Disconnect fuel hose at the connector.

Wrap a rag around the hose end to prevent rail draining.



1. Fuel rail
2. Fuel injectors

Disconnect wiring harness from the four fuel injectors.

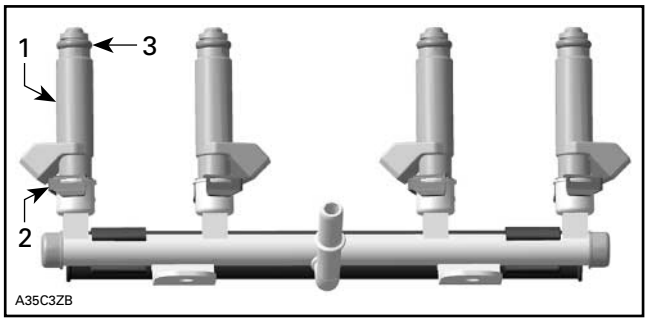
Remove the harness support from the fuel rail.

NOTE: It is not necessary to cut the tie raps of the harness support.

Unscrew rail retaining nuts.

Gently pull rail up by hand, working each side slightly at a time.

Pull rail out with fuel injectors.



FUEL RAIL AND INJECTORS
1. Fuel injector
2. Injector clip
3. O-ring

Remove the injector clip. Fuel injector can be easily pulled out of the fuel rail.

Installation

For the installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Pay attention not to mix up the inner and outer injectors. Refer to table and illustration above.

Replace O-rings with new ones.

NOTE: A thin film of engine oil should be applied to O-rings to ease fuel injector installation in fuel rail and cylinders.

Insert injectors with your hand. Do not use any tool. Ensure clip and injector are properly installed.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

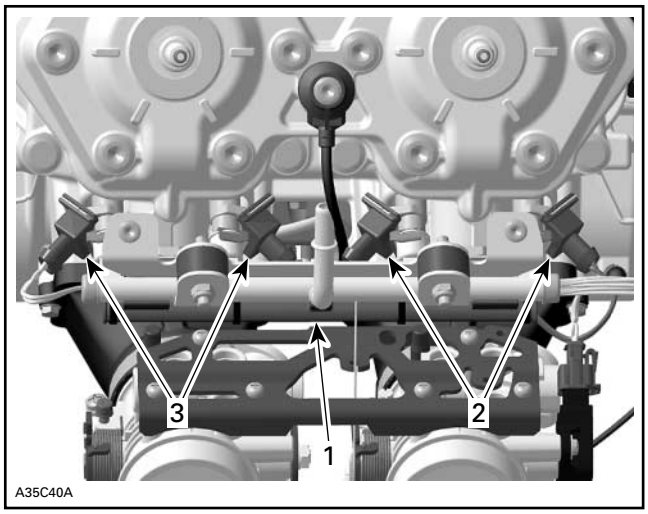
When installing fuel line connector to the fuel rail, put some oil on the O-ring to ease installation.

Attach the harness support to the fuel rail.

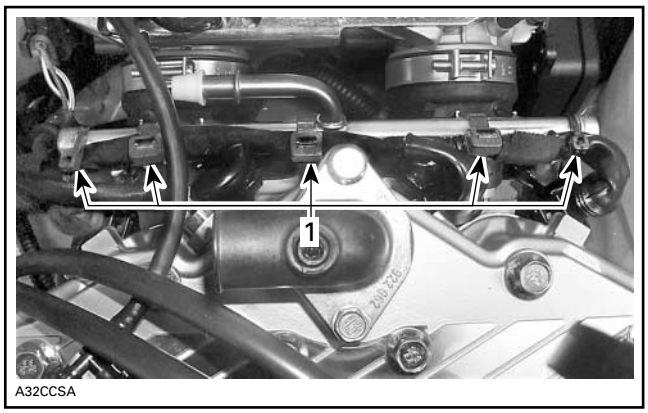
Add dielectric grease (P/N 293 550 004) to injector electrical connector.

Reconnect fuel injector connectors.

NOTE: The grey colored connectors are for cylinder MAG side.



1. Harness support
2. Grey fuel injector connectors — MAG
3. Black fuel injector connectors — PTO



1. Locking ties

⚠ WARNING

Perform a fuel high pressure test and ensure that there is no leak. Refer to FUEL SYSTEM.

ENGINE CONTROL MODULE (ECM)

General

Prior to replacing a suspected ECM, ensure that all the recommendations in the general introduction of this section have been followed.

IMPORTANT: When the ECM is replaced, the tether cord cap(s) and the **Closed Throttle** must be reprogrammed/reset. Refer to their specific section for adjustment.

To allow transferring the previous recorded information from the old ECM to the new one, use the vehicle communication kit (VCK) with the B.U.D.S. software. Use **Replace ECM** in the **ECM** menu. Follow instructions provided by the help system.

NOTE: If the old ECM can still communicate, it must be read inside B.U.D.S. prior to removing it from the vehicle to carry vehicle information and history to the new ECM.

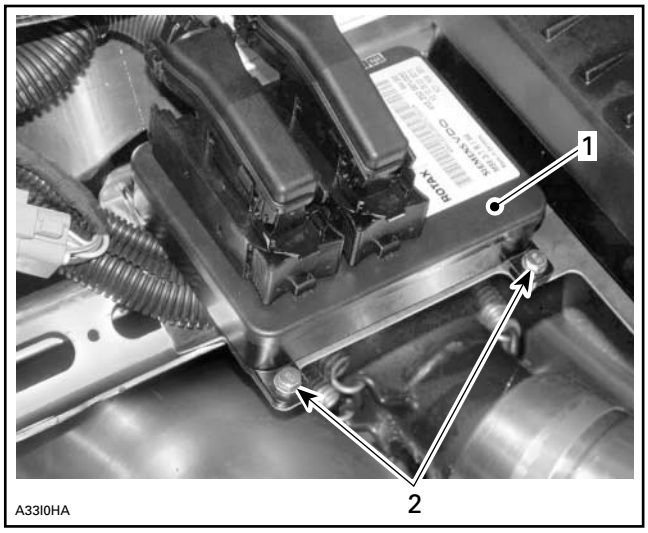
ECM Replacement

Disconnect battery cables.

⚠ WARNING

Battery BLACK (-) cable must always be disconnected first and connected last.

Disconnect both connectors from ECM.



1. ECM
2. Retaining screws

Unscrew all retaining screws and remove the engine ECM from its support.

Install the new ECM to the support.

Reconnect ECM connectors to ECM, and then battery cables.

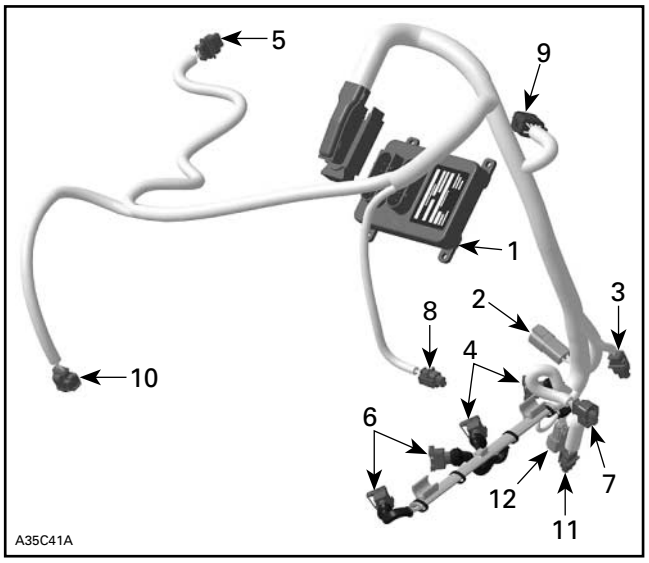
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

NOTE: If data cannot be transferred, manually enter information in **Vehicle** tab.

After performing the required resets, ensure to clear all faults from the newly replaced ECM.

Start the engine and increase engine speed above 6000 RPM to be sure no fault appears.

ENGINE WIRING HARNESS



1. *ECM*
2. *CTS connector*
3. *EGTS connector (NOT USED)*
4. *Fuel injector connector (cylinder MAG side)*
5. *Ignition coil connector*
6. *Fuel injector connector (cylinder PTO side)*
7. *TPS connector*
8. *ATS connector*
9. *Engine/vehicle connector*
10. *APS connector*
11. *KS connector*
12. *CPS connector*

Resistance Test

Check continuity of the circuits according to the wiring diagram in the WIRING DIAGRAMS section of this manual.

If wiring harness is good, check the respective sensor/actuator as described in this section.

Otherwise, repair the connectors, replace the wiring harness or the ECM as diagnosed.

Removal

Remove air intake silencer.

Disconnect the wiring harness from all sensors/actuators.

Disconnect the connector from the ECM.

Cut all locking tie which are holding the wiring harness in position.

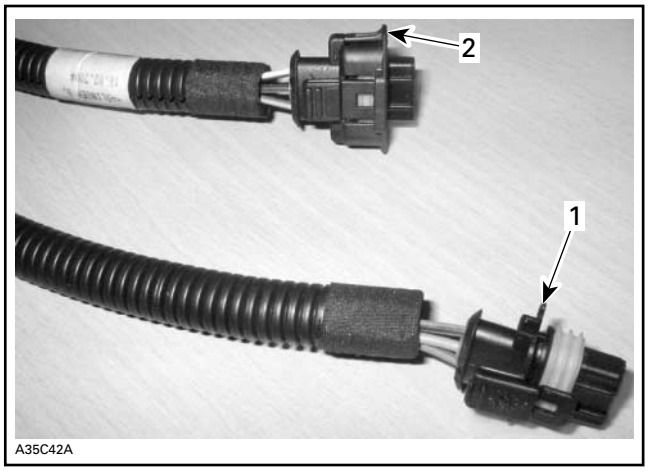
Remove complete wiring harness.

Installation

First connect the connector A to the ECM and the engine/vehicle connector to the vehicle wiring harness.

Reconnect the wiring harness to all sensors/actuators and reinstall all locking tie that have been removed.

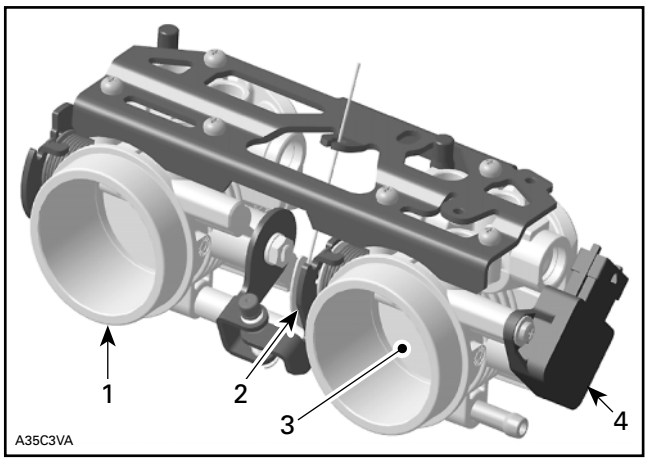
NOTE: Pay attention not to mix the ignition coil connector and the APS connector. Refer to the illustration below for visual difference.



1. *Ignition coil connector — open housing*
2. *APS connector — closed housing*

Install all remaining parts, which have been removed.

THROTTLE BODY



1. *Throttle body*
2. *Throttle cable attachment*
3. *Throttle plate*
4. *TPS*

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever.

IMPORTANT: The throttle body is designed to be tamper proof. Changing the zero position stop screw or synchronization screw or modifying them in any way will not increase performance but may cause poor startability and erratic idling.

Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is not running.

– Throttle cable adjustment too tight. Not returning fully to idle stop.
– Throttle body idle set screw is loose or worn.
– Throttle plate is loose, worn or damaged.
– TPS is loose.
– Corroded or damaged wiring or connectors.
– Throttle body has been replaced and the **Closed Throttle** reset has not been performed.
– ECM has been replaced and the **Closed Throttle** reset has not been performed.

Electrical Inspection

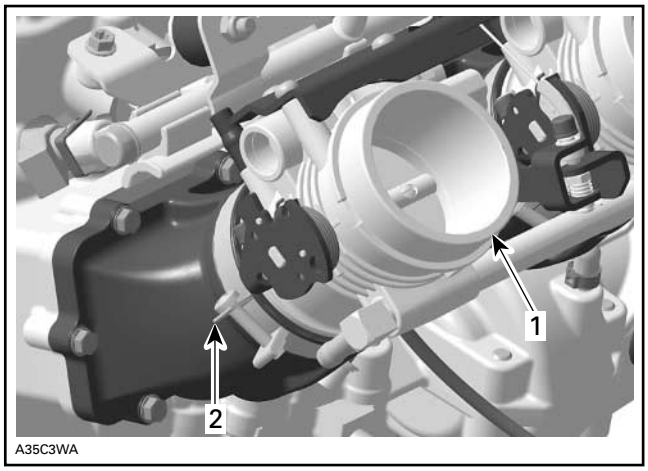
Refer to THROTTLE POSITION SENSOR (TPS) in this section.

Replacement

Removal

To remove the throttle body from engine, proceed as follows:

– Disconnect connectors from ATS (Air Temperature Sensor) and APS (Air Pressure Sensor).
– Remove air intake silencer from throttle body.
– Install hose pinchers (P/N 295 000 076) on inlet and outlet coolant hoses connected to throttle body.
– Disconnect fuel line.
– Remove clamps and hoses for throttle body heating from nipples.
– Disconnect connector from TPS.
– Disconnect throttle cable.
– Unscrew retaining clamps of throttle body.



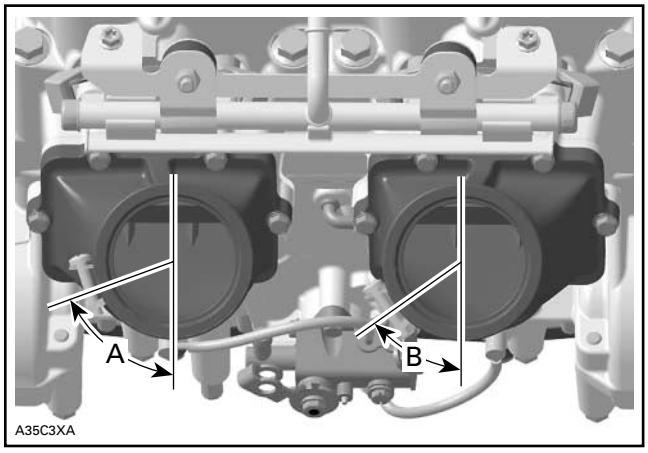
1. Throttle body
2. Clamp

– Slightly pull throttle body out.

Installation

Installation of the new throttle body is the reverse of the removal procedure. Pay attention to the following details.

Make sure that the retaining clamps are positioned as shown in the following illustration.



A. PTO side — 70°
B. MAG side — 55°

Refill engine coolant. If an important quantity of coolant was spilled, bleed cooling system. Refer to COOLING SYSTEM section.

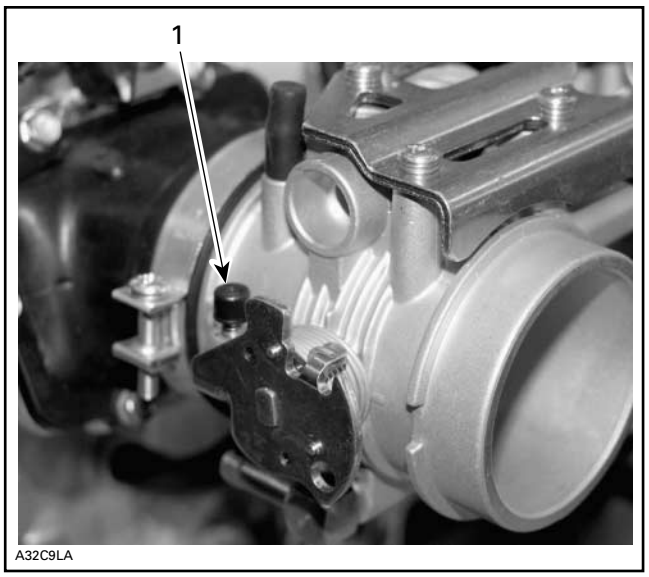
Adjustment

Throttle Body Synchronization

CAUTION: It is not allowed to perform any change on the synchronization screw.

Before installation, clean throttle plates and bores with pulley flange cleaner (P/N 413 711 809).

NOTE: The throttle body is designed as a single part for both cylinders. No synchronization is required as it has already been done at the factory. However, proceed with throttle cable and closed TPS adjustments as described below.

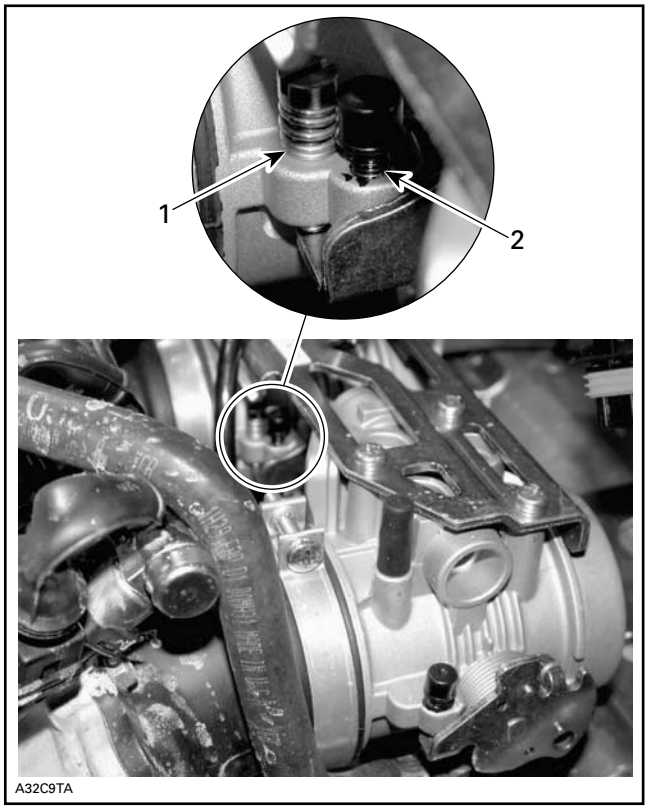


THROTTLE BODY
1. Zero position stopper screw

CAUTION: It is not allowed to perform any change on the zero position stopper screw.

The adjustment of the zero position stopper screw is optimized by the throttle body manufacturer and locked to prevent any modification.

CAUTION: Never attempt to adjust the zero position stopper screw (the capped one) or the idle speed adjustment would be impaired. Besides, no adjustment could be performed by the dealer nor the factory to correct the zero position stopper screw. The throttle body would need to be replaced.



TYPICAL
1. Idle speed screw
2. Zero position stopper screw

CAUTION: Do not alter or tamper with throttle cable adjustment or routing. It may cause poor startability and erratic idling.

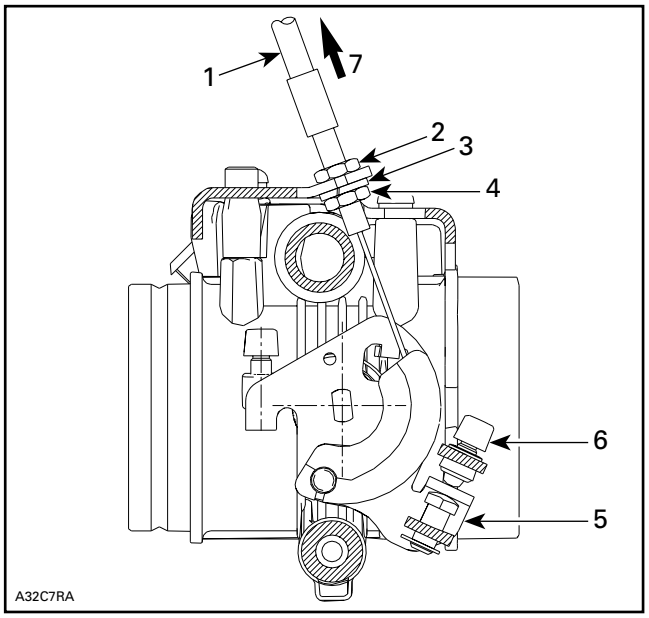
The only screw that has to be adjusted is the idle speed screw and it has to be adjusted only with the closed throttle reset procedure or for high altitude application. This has to be done only if the ECM or throttle body are replaced or if screw has been tampered with by mistake. Refer to THROTTLE POSITION SENSOR (TPS) in this section.

Throttle Cable Adjustment

Handlebar and throttle cable must be at their normal position.

Adjust top nut to have a small cable free-play at idle position.

Tighten bottom nut to 4.5 N•m (40 lbf•**in**).



1. *Cable sheath*
2. *Upper nut*
3. *Lock washer*
4. *Lower nut*
5. *Throttle lever*
6. *Adjusting screw*
7. *Pull in this direction*

Activate the throttle lever a few times. Make sure throttle cam of throttle body rests against idle speed screw without any tension on the cable.

Using the VCK with B.U.D.S., perform the wide open verification. In **Monitoring** tab check if throttle opening is within 82° to 86° when in wide open position on throttle lever.

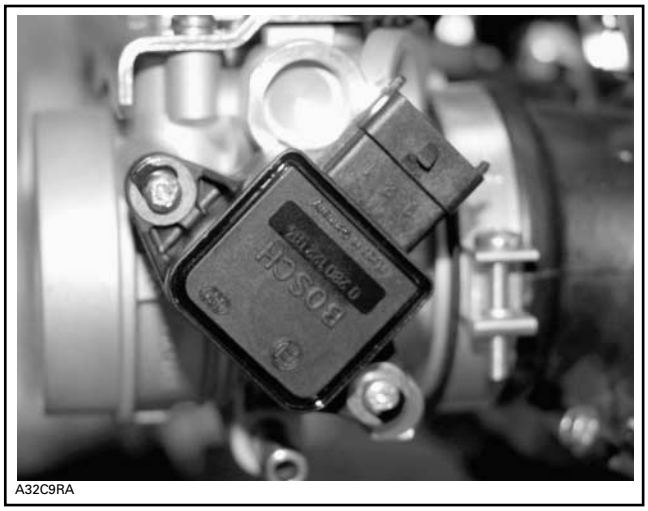
Closed Throttle Reset

Perform the **Closed Throttle** reset as described in THROTTLE POSITION SENSOR (TPS) below.

THROTTLE POSITION SENSOR (TPS)

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle shaft angle.



TYPICAL — THROTTLE POSITION SENSOR (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to THROTTLE BODY above.

The ECM may generate several fault codes pertaining to the TPS. Refer to EMS FAULT CODES in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

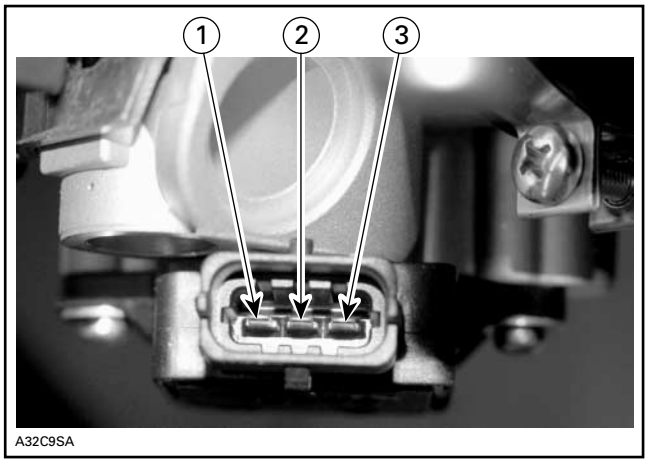
While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, use the **Throttle Opening** display under **Monitoring**.

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle "sticks", bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

Voltage Test

Check the voltage output from ECM to the throttle position sensor.



TPS

Disconnect plug connector from throttle position sensor. To unlock connector, insert a small screwdriver between the folded tab. To see the connector terminal locations, temporarily remove the connector shield joining the harness.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Connect a voltmeter between terminal 1 and 2 in the wiring harness.

Voltage should be 5 V.

Check the continuity between terminal 3 on wiring harness TPS connector and terminal 24 on wiring harness ECM connector.

If tests are good, replace the TPS.

If voltage tests are not good, continue to check the resistance of the rest of the TPS circuit.

Resistance Test

Reconnect the TPS.

Disconnect the connector A from the ECM.

Using a multimeter, check resistance value as per the following table.

ECM CONNECTOR		THROTTLE IDLE POSITION	WIDE OPEN THROTTLE POSITION
TERMINAL	TERMINAL	RESISTANCE Ω	
A-24	A-25	2500	1000
A-25	A-39	1600 - 2400	1600 - 2400
A-24	A-39	1000	2500

NOTE: The resistance value should change smoothly and proportionally to the throttle movement. Otherwise, replace TPS.

If resistance values are correct, try a new ECM. Refer to ENGINE CONTROL MODULE (ECM) in this section.

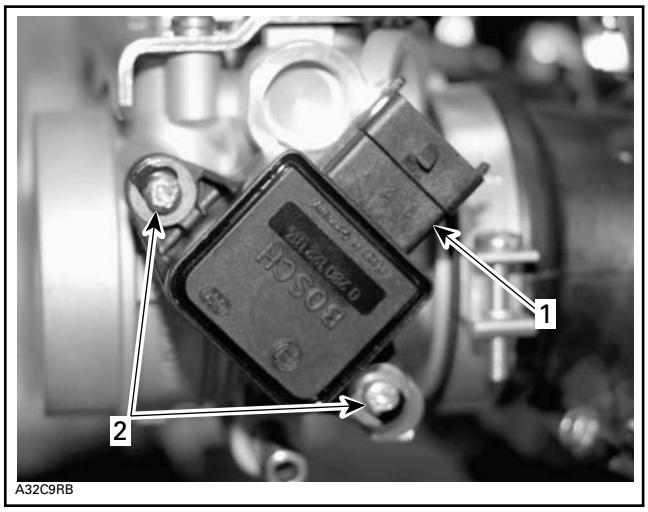
If resistance values are incorrect, replace TPS.

Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



TYPICAL — THROTTLE BODY
1. Throttle position sensor (TPS)
2. Screws

Install the new TPS.

Apply Loctite 243 on the TPS retaining screws, then torque to 3 N•m (27 lbf•**in**).

Reinstall remaining removed parts.

Proceed with the **Closed Throttle Reset**. See below.

Closed Throttle Reset

Ensure throttle body synchronization and throttle cable are properly adjusted prior to performing this setting.

NOTE: This operation performs a reset of the values in the ECM.

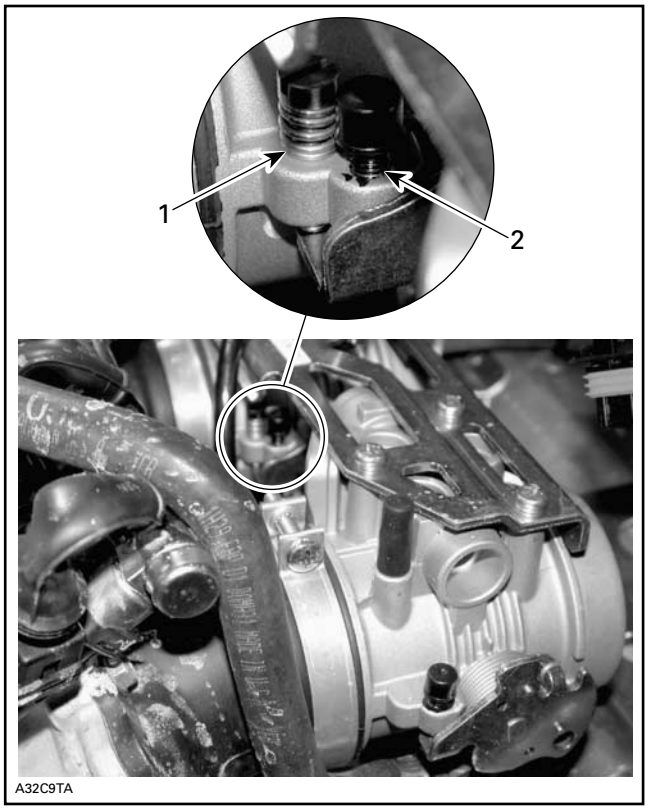
This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations in idle speed control of the engine.

NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened or removed or throttle body or ECM is replaced.

CAUTION: An improperly set TPS may lead to poor engine performance.

Use the vehicle communication kit (VCK) with the B.U.D.S. software to perform this adjustment.

Unscrew idle speed screw until the throttle body plate stop lever rest against its zero position stopper screw (capped screw). If necessary, loosen the throttle cable. Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate.



1. Idle speed screw
2. Zero position stopper screw

Push the **Reset** button in the **Setting** section of B.U.D.S.

Re-power up the ECM by pushing the START/RER button momentarily.

The throttle opening displayed in B.U.D.S. should be 0.00 (0.1 maximum).

If TPS is not within the allowed range while resetting the **Closed Throttle**, the ECM will generate a fault code and will not accept the setting.

Now, the idle speed screw has to be adjusted. To do this, screw in the idle speed screw until B.U.D.S. throttle opening displays value as per following table.

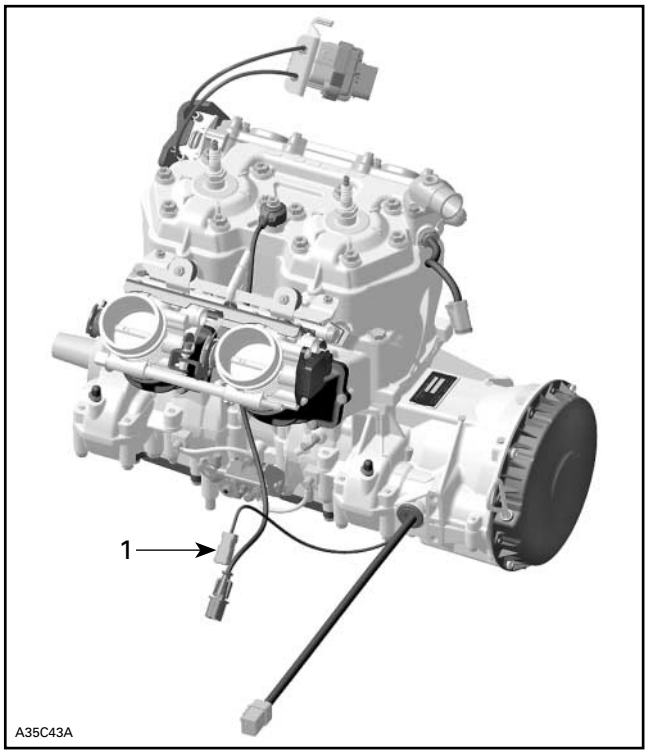
MODEL	VALUE	
	AT SEA LEVEL	ABOVE 1800 m (6000 ft)
Mach Z	4.8°	N.A.°
Summit	4.5°	5.0°

If throttle cable has been loosen during the procedure, adjust throttle cable.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to EMS FAULT CODES in the DIAGNOSTIC PROCEDURES section for more information.

CRANKSHAFT POSITION SENSOR (CPS)

NOTE: The CPS is used for forward and reverse.



1. CPS connector

NOTE: Take into account that a CPS fault can be triggered by missing encoder wheel teeth. First check fault codes then check the teeth condition if necessary. See below.

Disconnect CPS wiring harness connector. Probe terminals coming from CPS while cranking engine. Voltage should be within 1-2 Vac. Otherwise, inspect wiring and replace CPS if wiring is good.

Resistance Test

Disconnect the CPS plug connector from the wiring harness and check the resistance of the sensor itself.

The resistance should be between 190 Ω and 300 Ω.

Otherwise, replace the CPS.

If resistance tests good, **reconnect** the CPS and disconnect the connector A on the ECM.

Using a multimeter, recheck resistance value between terminals 5 and 19.

If resistance value is correct, try a new ECM. Refer to ENGINE CONTROL MODULE (ECM) in this section.

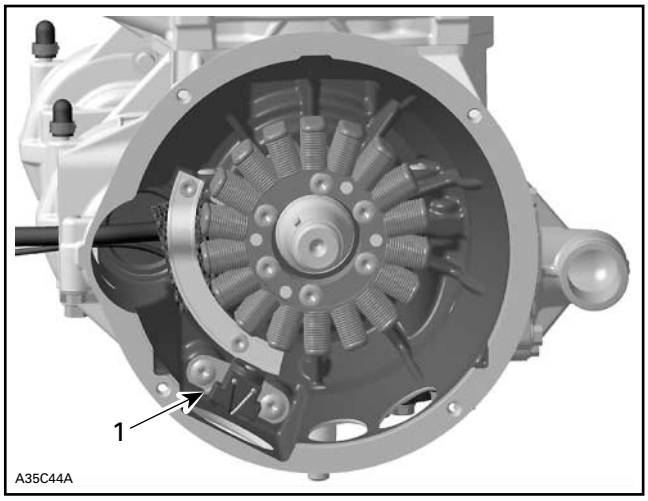
If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

Replacement

Remove muffler.

Disconnect connectors and remove the rewind starter, then the magneto flywheel. Refer to MAGNETO SYSTEM.

Remove CPS.



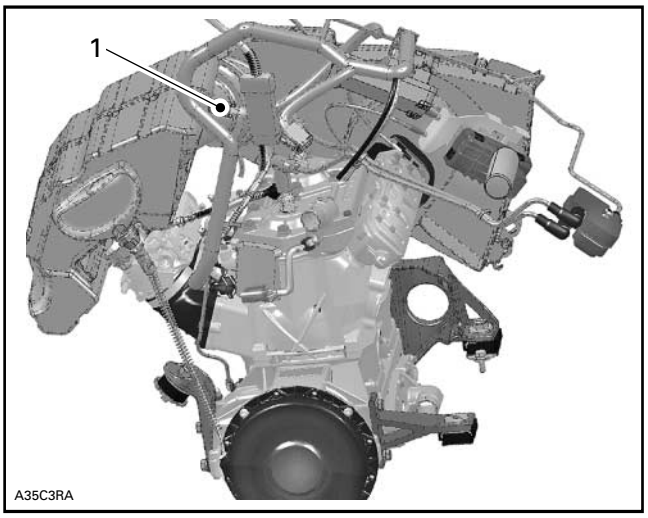
1. CPS inside crankcase

When installing new CPS apply Loctite 5910 (P/N 293 800 081) between CPS and crankcase.

Apply Loctite 243 on the CPS retaining screws, then torque to 8 N•m (71 lbf•**in**).

Reinstall remaining removed parts.

AIR TEMPERATURE SENSOR (ATS)



1. Air temperature sensor (ATS)

Resistance Test

Disconnect the plug connector from the ATS and check the resistance of the sensor itself.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the ATS and disconnect the connector A on the ECM.

Using a multimeter, recheck resistance value between terminals 7 and 21.

If resistance value is correct, try a new ECM. Refer to ENGINE CONTROL MODULE (ECM) in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the ATS.

Replacement

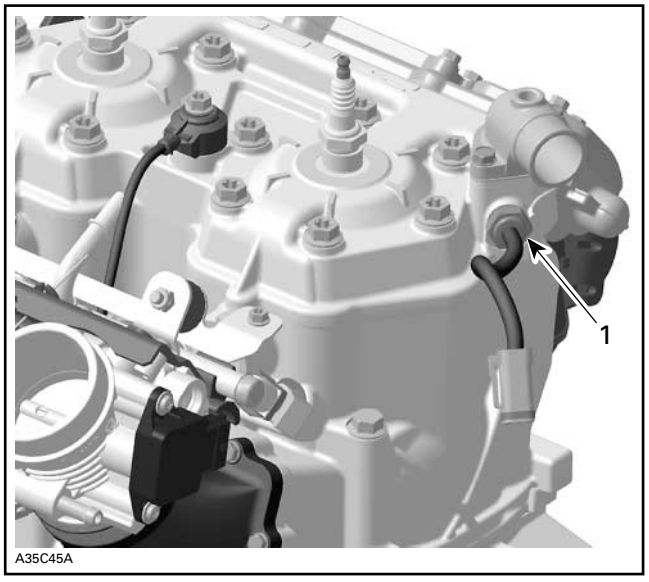
Unplug ATS connector.

Pull the ATS out of the air intake silencer.

Spray soapy water on grommet. Install grommet on air intake silencer then push the sensor in place.

Reconnect it.

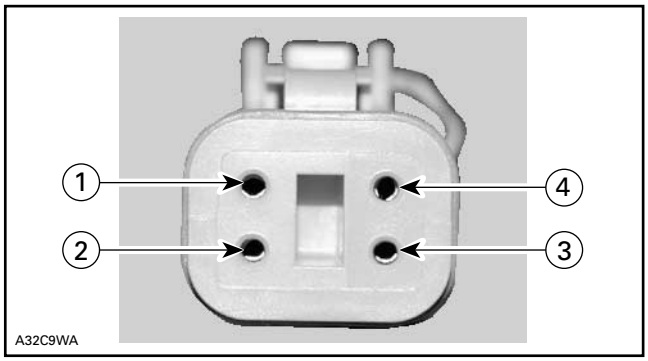
COOLANT TEMPERATURE SENSOR (CTS)



1. Coolant temperature sensor (CTS)

Resistance Test

Disconnect the plug connector from the CTS and check the resistance of the sensor itself.



The resistance between terminal 1 and 2 is used for temperature gauge.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

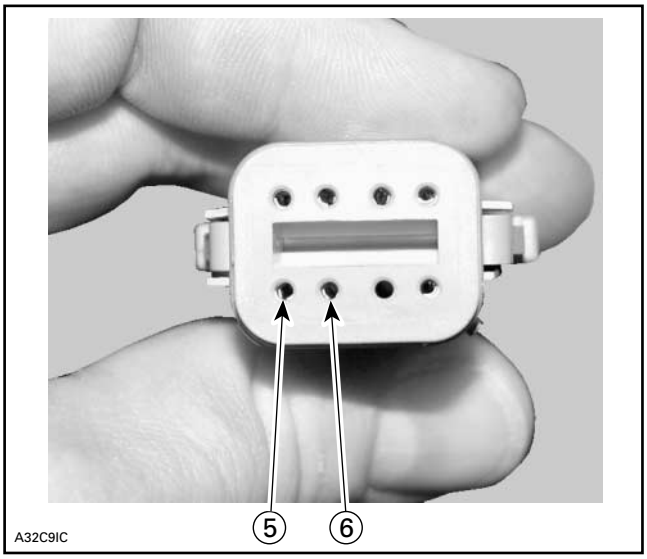
If out of specification, replace the sensor.

The resistance between terminal 3 and 4 is used for the ECM.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the CTS and disconnect the connector A on the ECM as well as the engine/vehicle connector.



ENGINE/VEHICLE CONNECTOR

Using a multimeter, recheck resistance value between terminals 5 and 6 on engine/vehicle connector. This resistance is used for temperature gauge.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

Recheck also resistance value between terminals 11 and 27 on ECM connector A. This resistance is used for ECM.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If resistance value is correct, try a new ECM. Refer to ENGINE CONTROL MODULE (ECM) in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

Replacement

Drain cooling system.

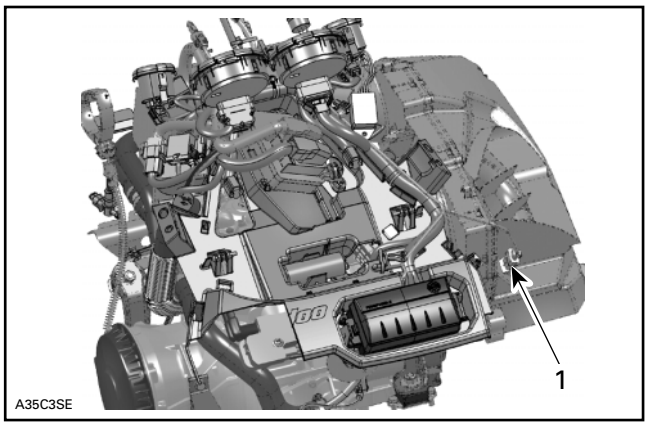
Disconnect CTS connector and remove CTS.

Apply Loctite 5910 on the new CTS and torque to 12 N•m (106 lbf•**in**).

Reinstall remaining removed parts.

Refill engine coolant and bleed cooling system. Refer to LIQUID COOLING SYSTEM section.

AIR PRESSURE SENSOR (APS)



INSIDE LH SIDE PANEL
1. Air pressure sensor (APS)

Ensure sensor is correctly installed on air intake silencer. Otherwise, the APS could generate a fault code. Remove sensor and check for oil or dirt on its end and if problem persists, check the wiring harness. Perform the following tests.

Voltage Test

Check the voltage output from ECM to the APS.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Disconnect plug connector from APS and connect a voltmeter between terminal 1 and 2 of wiring harness.

Voltage should be 5 V.

Check the continuity between terminal 3 on APS connector and terminal 18 on ECM connector.

If tests are good, replace the APS.

If tests are not good, continue to check the continuity of the rest of the APS circuit on the harness.

Disconnect the connector "A" from the ECM.

Using a multimeter, check continuity of circuits as per following table.

CIRCUIT NUMBER (ECM CONNECTOR "A")	APS CONNECTOR
A-3	TERMINAL 1
A-4	TERMINAL 2
A-18	TERMINAL 3

If wiring harness is good, try a new ECM. Refer to ENGINE CONTROL MODULE (ECM) in this section.

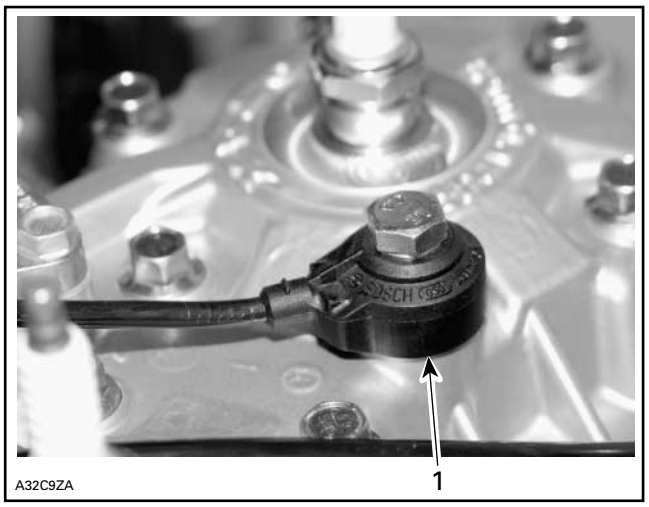
Otherwise, repair the connectors or replace the wiring harness between ECM connector and the APS.

Replacement

Disconnect APS connector and remove the APS. The ATS is retained with a screw.

Install the new APS.

KNOCK SENSOR (KS)



TYPICAL
1. Knock sensor (KS)

Dynamic Test

Lift rear of vehicle off the ground and support it with a wide-base mechanical stand.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, monitor the knock sensor using the Faults section.

Start the engine and bring engine RPM above 6000 RPM. If no fault code occurs, the knock sensor is good.

Otherwise, do the following.

Ensure sensor and head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.

Check the knock sensor circuit on wiring harness.

Disconnect the connector from knock sensor harness.

Disconnect connector "A" form the ECM and check continuity of circuit as per following table.

CIRCUIT NUMBER (ECM CONNECTOR "A")	KS CONNECTOR
A-22	TERMINAL 1
A-8	TERMINAL 2

If test is not good, repair the connector or replace the wiring harness between ECM connector and knock sensor.

Replacement

Unscrew and remove knock sensor from cylinder head.

Clean contact surface, apply Loctite 5910 (P/N 293 800 081) on both contact surfaces on the knock sensor then install the new sensor.

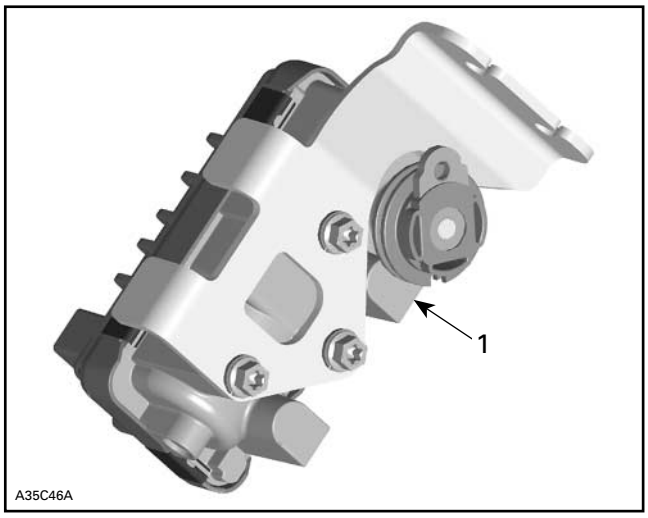
CAUTION: Install screw and torque it within 10 minutes to prevent the sealant to dry before torquing. A dried sealant before torquing would impair the knock sensor operation.

Torque screw to 20 N•m (15 lbf•ft).

CAUTION: Improper torque might prevent sensor to work properly and lead engine to severe damage of internal components.

Replug connector.

E-RAVE ACTUATOR



1. E-RAVE actuator

IMPORTANT: Prior to testing the E-RAVE actuator, check for fault codes in B.U.D.S. using the vehicle communication kit (VCK).

NOTE:

If no fault code is displayed in B.U.D.S., the E-RAVE actuator can still be faulty. It could be a mechanical problem.

If actuator overheating occurs, fault code P0078 will appear. It could be caused by mechanical problems such as overtighten cables or damaged pulleys.

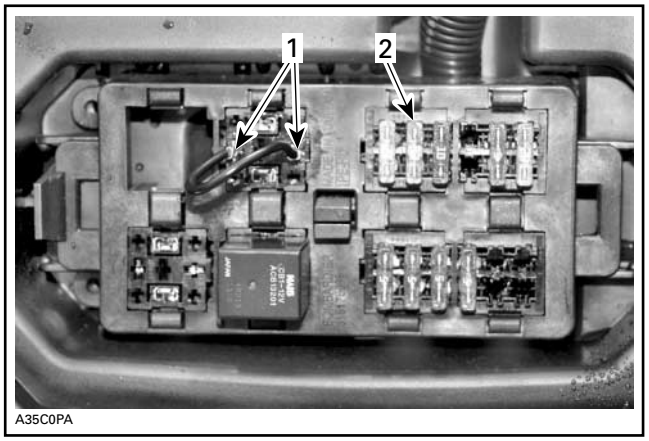
If a communication problem occurs between ECM and actuator, fault code P0600 will appear. It could also be caused by a not-powered actuator.

Voltage Test

Remove the headlight relay (R2).

NOTE: To prevent battery discharge, headlight fuse (F8) can be removed.

Bypass relay with a jumper.



1. Jumper
2. Headlight fuse

Disconnect the E-RAVE actuator connector.

Measure voltage between terminal 1 (on harness side) and battery ground.

If battery voltage is read, check continuity between terminal 2 (on harness side) and battery ground. If continuity is faulty, repair/replace wiring/connector.

If battery voltage is not read, check the corresponding fuse(s), relay and continuity of circuit V V-1. If continuity is faulty, repair wiring/connector.

Communication Test

A not-working actuator can be caused by a communication problem between ECM and E-RAVE actuator.

If no power goes to the E-RAVE actuator, no communication can take place.

If B.U.D.S. works, it validates the ECM works and can communicate. Therefore the problem is in the wires going to the E-RAVE actuator.

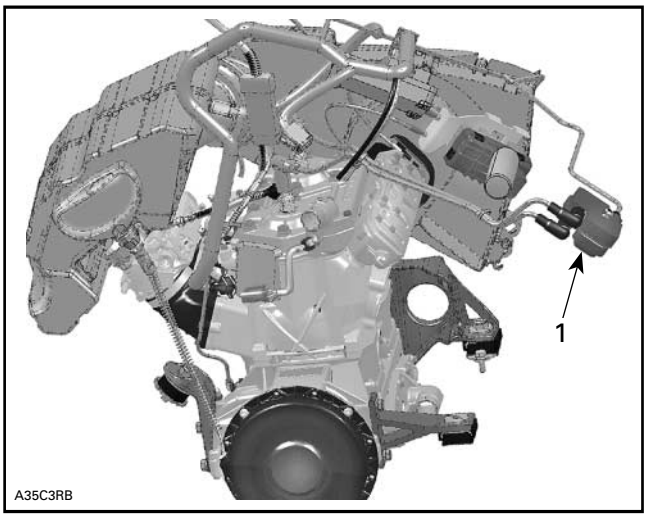
Check continuity of wires V V-3 and V V-5. If continuity is faulty, repair wiring/connector.

If continuity is good, try a new actuator.

Dynamic Test, Replacement and Cable Adjustment

Refer to RAVE system.

DOUBLE IGNITION COIL



1. Ignition coil

NOTE: The ECM energizes the primary side of each ignition coil individually. It can detect if the double ignition coil is connected otherwise a trouble code will appear upon starting.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the ignition coil from the **Activation** section.

You should hear the spark occurring. In doubt, use an inductive spark tester or a sealed tester – available from after-market tool/equipment suppliers – to prevent spark occurring in the engine compartment. Otherwise, perform the following checks.

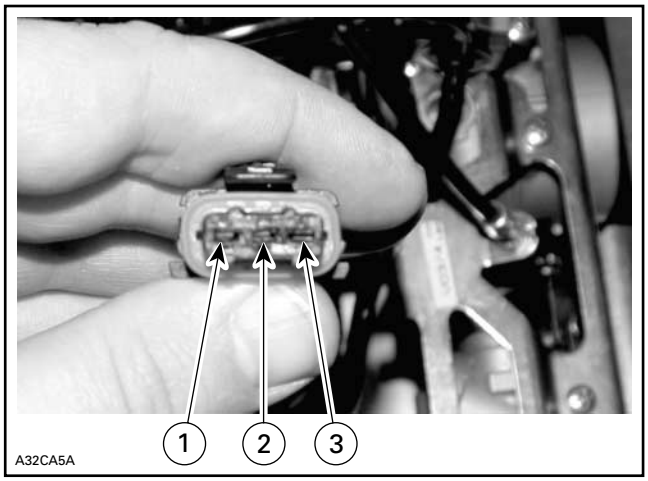
An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

Voltage Test

⚠ WARNING

When disconnecting coil from spark plug, always disconnect coil from main harness first. Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as spark may cause fuel vapor to ignite.

Disconnect the plug connector from the ignition coil and check the voltage supplied by the battery.



Install **tether cord cap** on the DESS post and push the START/RER button momentarily to activate the ECM.

Check voltage between terminal 2 of ignition coil connector on the wiring harness and battery ground.

Battery voltage should be present (approx. 12 V).

If 12 V is NOT read, check continuity between terminal 2 of ignition coil and the corresponding fuse. Otherwise repair wiring harness.

If 12 V is read, disconnect the connector A from the ECM and check the continuity of appropriate circuit 41 (cylinder 1) or 1 (cylinder 2) and of ignition coil connector, terminal 3 and terminal 1 respectively.

If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

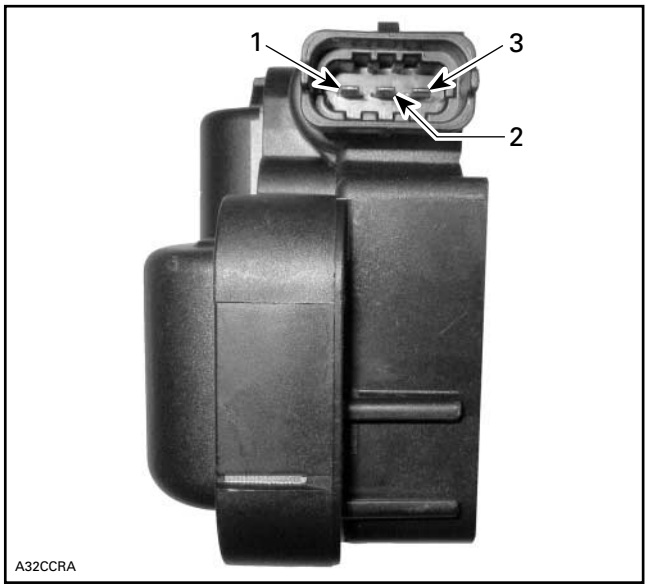
If wiring harness is good, test resistance of primary winding of ignition coil.

Resistance Test

Remove spark plug cables from ignition coil.

Using a multimeter, check the resistance of primary winding.

NOTE: The secondary winding can not be measured with an ohmmeter. Try a new double ignition coil if necessary.



1. Terminal 1a
2. Terminal 15
3. Terminal 1b

For primary winding, check the resistance between terminal 15 and terminal 1a (cylinder 1) of the ignition coil and between terminal 15 and terminal 1b (cylinder 2) respectively.

The resistance should be between 0.40 and 1.15 Ω at 20°C (68°F).

If the resistance of one of both windings is not good, replace the ignition coil.

If the windings test good, try a new ECM.

⚠ WARNING

Always reconnect ignition coil cables at the same spark plugs where they come from. Otherwise, severe backfire may occur with possible damage to exhaust system components.

BATTERY

Manual Start Models

These models are equipped with a YT4L-BS type battery that requires a specific charging procedure at predelivery.

Battery Charge Testing

⚠ WARNING

Always wear safety glasses and charge in a ventilated area.
Never charge or boost battery while installed on vehicle.
Do not open the sealed caps during charging.
Do not place battery near open flame.

These sealed batteries have to be tested with a voltmeter.

Batteries with a voltage of 12.8 volts and above, no charge is required

Batteries with a voltage of 12.7 volts and below must be charged as follows:

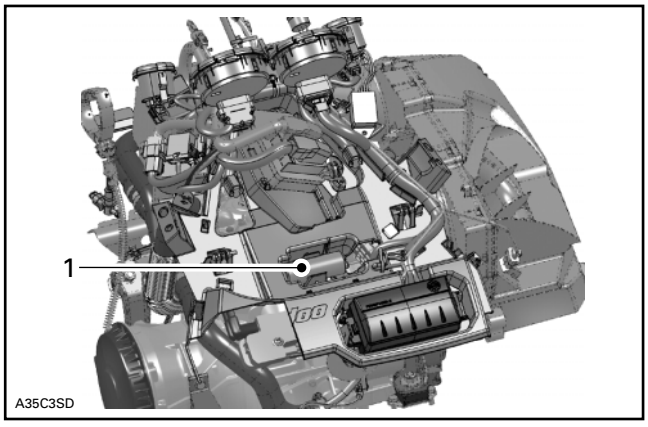
BATTERY TYPE	STANDARD CHARGE	QUICK CHARGE
YT4L-BS	0.3 Amps/hour for 5 to 10 hours	3.0 Amps/hour for 30 min.

Electric Start Models

Refer to CHARGING SYSTEM section for the charging procedure of the battery.

CAPACITOR

Manual Start Models



1. Capacitor

⚠ WARNING

Capacitor may be charged. Once discharged, a transient recovery voltage may be generated in the capacitor after a while. Always discharge capacitor before servicing.

Removal

Remove the 30 A fuse.

Connect a test light to capacitor terminals during a complete minute to discharge capacitor.

⚠ WARNING

Do not short-circuit both capacitor terminals.

Disconnect capacitor terminals and unfasten capacitor.

Inspection

Visual Inspection

Check for pin holes in the pressure relief valve on top of capacitor. If any pin hole is present, discard capacitor.

Charge Hold Test

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Connect a switch (in OFF position) between a 12 V battery positive post and the capacitor positive post. Connect the battery negative post to the capacitor negative post. Turn on the switch for 2 seconds. Disconnect the capacitor from the battery.

Note battery voltage.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Wait 5 minutes, then measure capacitor voltage. It must be within 1 V maximum of battery voltage.

If in doubt, proceed with the following residual voltage test.

Residual Voltage Test

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Connect a switch (in OFF position) between a 12 V battery positive post and the capacitor positive post. Connect the battery negative post to the capacitor negative post. Turn on the switch for 2 seconds. Disconnect the capacitor from the battery. Note battery voltage.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Connect a switch (in OFF position) and a 300 Ω 5 W resistor to the capacitor. Turn on the switch for 12 seconds ± 1 second of discharge.

Residual voltage after 12 seconds ± 1 second of discharge must be above 5 volts.

Installation

Connect a 12 V test lamp to capacitor terminals during a complete minute to discharge capacitor.

Make sure 30 A fuse is removed.

Install the capacitor.

Make sure to connect BLACK wire to negative terminal and RED/WHITE to positive terminal.

⚠ WARNING

Always respect the polarity when connecting the capacitor.

Install the 30 A fuse.

ENGINE START/RER SWITCH VERIFICATION

Refer to STARTING SYSTEM and Rotax Electronic Reverse (RER).

DESS POST VERIFICATION

If 2 short beeps are not heard when starting the engine, refer to DIAGNOSTIC PROCEDURES.

The following continuity tests can also be performed using an ohmmeter.

Disconnect DESS post wires.

Tether Cord Cap Removed

Connect test probes to post BLACK/GREEN and BLACK/WHITE wires. Measure resistance, there should be NO continuity (open circuit).

Connect one test probe to the WHITE/GREY wire and the other test probe to the switch top terminal. Measure resistance, it must be close to 0 ohm.

Connect one test probe to the BLACK/GREEN wire and the other test probe to the post ring. Measure resistance, it must be close to 0 ohm.

Tether Cord Cap on DESS Post

Connect test probes to switch BLACK/GREEN and BLACK/WHITE wires. Measure resistance, it must be close to 0 ohm.

IGNITION SYSTEM

SERVICE TOOLS

Description	Part Number	Page
digital/inductive type tachometer	529 014 500	161
Vehicle Communication Kit (VCK)	529 035 981	159, 162

SERVICE PRODUCTS

Description	Part Number	Page
antiseize lubricant	293 800 070	162

GENERAL

Ignition System Testing Sequence

In the case of ignition problems, check the following in the prescribed order until the problem can be solved.

1) Fault codes.
2) Spark testing.
3) Ignition coil.
4) DESS post.
5) Engine cut-out switch.
6) Crankshaft Position Sensor (CPS).

Analysis of Readings

- Resistance Readings

Place multimeter selector switch to Ω in order to measure resistance. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

CAUTION: When taking measurements, it is useless to try to start the vehicle since readings would then be distorted.

- Intermittent Ignition Problems

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

Using the Vehicle Communication Kit (VCK) (P/N 529 035 981) and B.U.D.S. software, verify which fault codes occurred. Refer to ENGINE MANAGEMENT for complete list of codes.

Spark Testing

B.U.D.S. can be used to perform this test. Connect the VCK and go to the ACTIVATION folder.

A manual test can be performed too. Do the following.

During this operation, it is important to use the snowmobile spark plug and not a new one. Bring the plug in contact with the engine. Pull rewind starter. If no spark is produced, replace the spark plug with a new one and do the test again.

For more information on spark plug condition, refer to SPARK PLUG further in this section.

Ignition Coil

Disconnect ignition coil connector.

Compare readings with those appearing in the IGNITION COIL table.

IGNITION COIL			
TEST	Primary winding resistance	Secondary winding resistance spark plug wires and cap included	Secondary winding resistance spark plug wires removed
TEST PROBES	BROWN/ BLACK and BROWN/ ORANGE wires	Between both spark plug caps	Male terminals of coil
RESISTANCE	00.2 to 0.5	14.5 kΩ to 23.5 kΩ	9.6 kΩ to 14.4 kΩ
VOLTAGE	—	—	—
NOTE	Disconnect the ignition coil from the ECM	Do not attempt to remove spark plug caps from the wires.	With spark plug wires removed from high voltage coil.

DESS Post

DESS POST		
TEST	Open circuit	Continuity
TEST PROBES	BLACK/WHITE and BLACK/GREEN wires	BLACK/WHITE and BLACK/GREEN wires
RESISTANCE	O.L.	00.0 to 00.5 Ω
VOLTAGE	—	—
NOTE	DESS key removed	DESS key installed

If readings do not correspond to the above mentioned indications, replace post.

Engine Cut-Out Switch

Check the condition of engine cut-out switch.

ENGINE CUT-OUT SWITCH		
TEST	Open circuit	Continuity
TEST PROBES	BLACK/YELLOW and BLACK wires	BLACK/YELLOW and BLACK wires
RESISTANCE	O.L.	00.0 to 00.5
VOLTAGE	—	—
NOTE	Engine cut-out switch must be in RUN position.	Engine cut-out switch must be in STOP position.

Crankshaft Position Sensor (CPS)

NOTE: Refer to ENGINE MANAGEMENT.

IGNITION TIMING

Normally ignition timing adjustment should not be required. It has been set at factory and it should remain correctly adjusted since every part is fixed and not adjustable. The only time the ignition timing might have to be changed would be when removing and reinstalling the magneto housing, replacing the crankshaft, the magneto flywheel, the CPS or the ECM. If the ignition timing is found incorrect, first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

The ignition timing can be checked with either the engine hot or cold. Also, the ignition timing is to be checked at 3500 RPM with a timing light.

NOTE: Between 3000 and 4000 RPM, the spark advance does not change. So when checking ignition timing at 3500 RPM, a change in engine speed within ± 500 RPM will not affect the timing mark when checked with the timing light.

Scribing a Timing Mark

- Clean the area around the MAG spark plug, and remove it.
- Install the TDC gauge in the spark plug hole, (magneto side) and adjust as follows:
  - Position the MAG piston at approximately TDC.

A35C2NA

TYPICAL

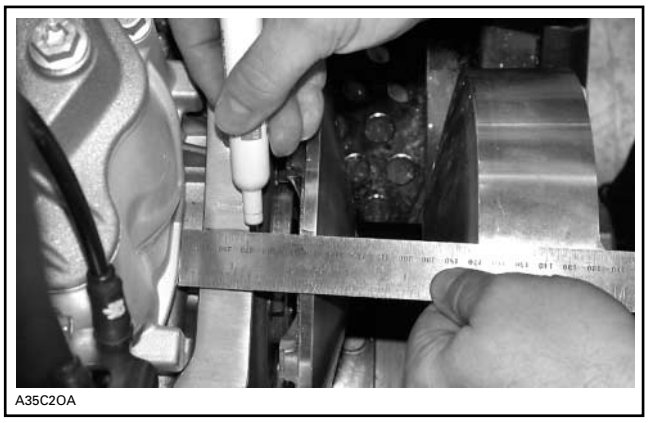
  - Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.

– Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.
– Position the dial face toward the PTO. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.

- Locate the piston TDC position as follows:
  – Slowly rotate the drive pulley back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston is changing direction.
  – Rotate the dial face so that "0" is in line with the needle when it stops moving.
  – Again, slowly rotate the drive pulley back and forth across TDC and adjust the dial face to "0", until the needle always stops exactly at "0" before changing direction.
  – "0" now indicates exact TDC.
- Rotate the drive pulley counterclockwise, one-quarter turn then carefully rotate it clockwise until the needle indicates the specified measurement.

ENGINE	MEASUREMENT
995 SDI	7.87 mm (0.310 in)

- With the TDC gauge indicating specified timing, scribe a mark on drive pulley inner half and on engine support.



TIMING MARKS

Remove TDC gauge.

Checking Ignition Timing

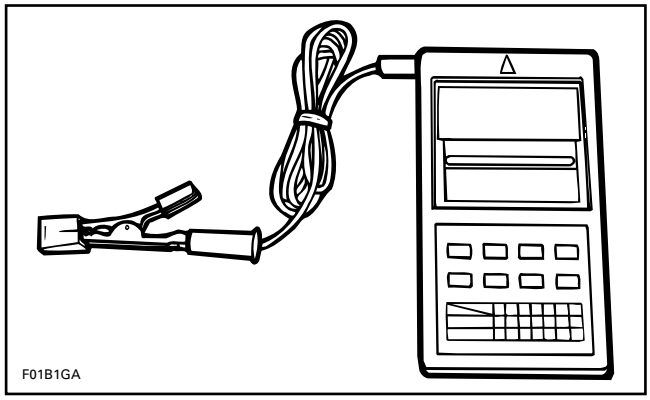
To check the ignition timing proceed as follows:

⚠ WARNING

Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

Connect the timing light pick-up to a spark plug cable on MAG side.

Connect the digital/inductive type tachometer (P/N 529 014 500) on same spark plug cable.



TACHOMETER

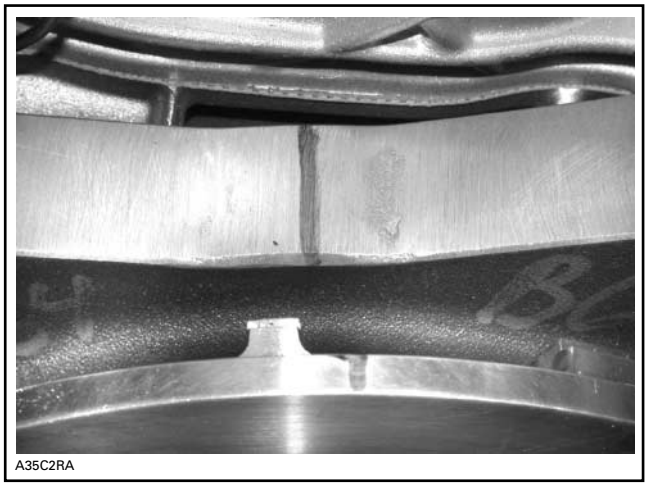
Start the engine and point timing light on timing mark.

The timing marks must be aligned with pointer end. If such is not the case, note if timing is retarded or advanced.

ENGINE	TOLERANCE
995 SDI	± 0.5°

A35C2QA

TIMING RETARDED BY ABOUT 1°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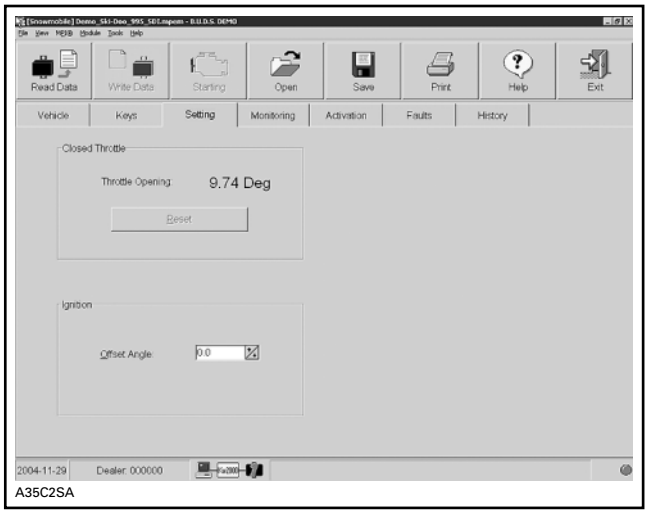
TIMING ADVANCED BY ABOUT 1°

Changing Timing

VCK (Vehicle Communication Kit)

The Vehicle Communication Kit (VCK) (P/N 529 035 981) must be used, with B.U.D.S. software to change the ignition timing. Look under the proper **Setting** section of the B.U.D.S. software to change the ignition timing.



A35C2SA

Detailed information about the B.U.D.S. software and its usage is available under its **Help** section.

SPARK PLUG

Removal

First unscrew the spark plug 1 turn.

Clean the spark plug and cylinder head with pressurized air, then completely unscrew.

⚠ WARNING

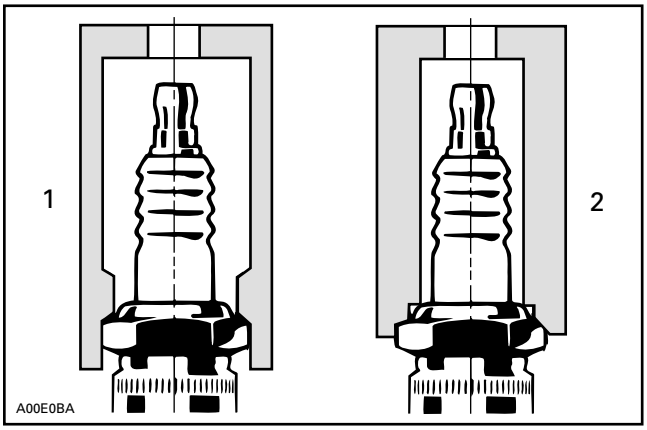
Whenever using compressed air, always wear protective eye wear.

Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

CAUTION: Do not adjust electrode gap of BR9ECS spark plug.

1) Apply antiseize lubricant (P/N 293 800 070) over the spark plug threads to prevent possible seizure.
2) Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.

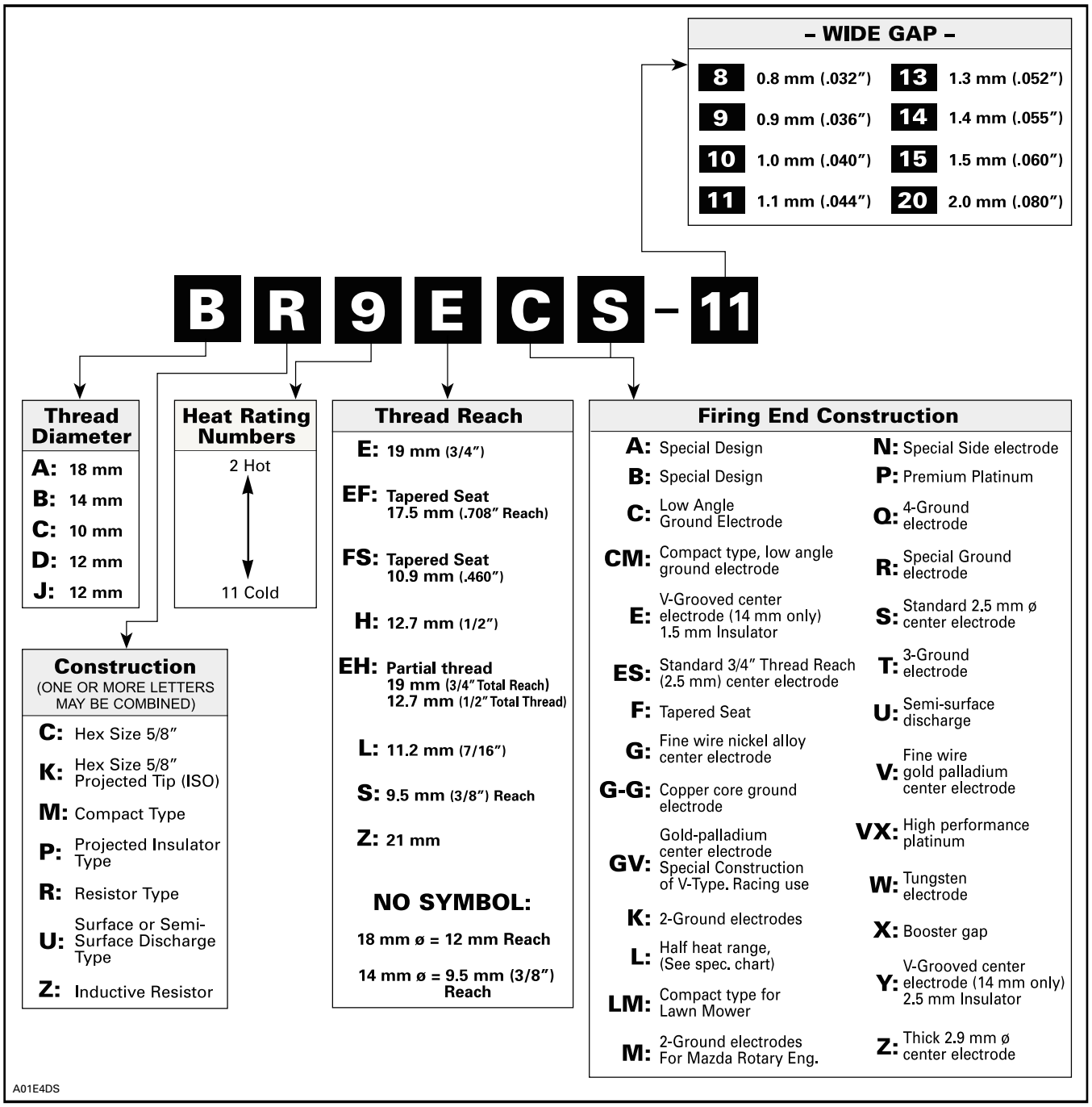


TYPICAL
1. Proper socket
2. Improper socket

Use the following table to torque the spark plugs.

ENGINE	SPARK PLUG	TORQUE N•m (lbf•ft)
995 SDI	NGK	27 (20)

DESIGN SYMBOLS USED IN NGK SPARK PLUGS



CHARGING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
crimp pliers	529 035 730	169
multimeter FLUKE 111	529 035 868	165

SERVICE PRODUCTS

Description	Part Number	Page
silicone dielectric grease	293 550 004	167–168

GENERAL

Voltage measurements are always taken upon vehicle starting. Reading when the engine is running will be higher than indicated range. Part temperature must be approximately 20°C (68°F) (room temperature), otherwise reading could be distorted.

When testing the different magneto components, it is important to take into consideration that reading vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

The reading must be 3 times within or above the range indicated in the corresponding table. If the reading is too low, the part is considered to be defective and must be replaced.

Place the selector switch of the multimeter FLUKE 111 (P/N 529 035 868) to Ω in order to measure resistance. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

CAUTION: When taking measurements, it is useless to try to start the vehicle since readings would then be distorted.

It is difficult to make a diagnostic in the case of intermittent problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

As a matter of fact, more that one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

CHARGING GENERATOR COIL (STATOR)

First measure the resistance.

To do this:

Disconnect connector.

Connect multimeter probes to YELLOW and/or GREEN wires, then place selector switch to Ω.

Compare reading with those appearing in the table further.

Now measure the voltage.

Connect the multimeter probes to appropriate wires, refer to table below.

Bring the selector switch of multimeter to V and the scale to 00.0 Vac.

Activate the manual starter and check values.

Repeat operation 3 times.

Compare reading with those appearing in the following table.

STATOR		
TEST	Output	Coil insulation
TEST PROBES	YELLOW, YELLOW and GREEN	YELLOW and ENGINE
RESISTANCE	00.0 to 00.5 3 times	O.L.
VOLTAGE	3.5 to 5.5 3 times	—
NOTE	Do the test between A and B, A and C and B and C using manual starter	Engine refers to the engine parts connected to the magneto housing.

VOLTAGE REGULATOR/ RECTIFIER

Test

To test the voltage regulator/rectifier use the following table.

VOLTAGE REGULATOR/RECTIFIER		
TEST	Charging voltage	Current to battery
TEST PROBES	RED/GREEN and negative battery terminal	RED and RED/WHITE
RESISTANCE	—	—
VOLTAGE	Battery voltage	2 to 4 A
NOTE	—	Engine @ 5000 RPM with fully charged battery. With 30 A fuse removed and ammeter in series.

If the voltage regulator/rectifier is within the specification, the wiring harness between the voltage regulator/rectifier and battery is defective. If the voltage regulator/rectifier is out of specification and the stator tests good, the voltage regulator/rectifier is defective.

Removal

MODEL	LOCATION
All models of RT series	Under engine and behind muffler

All Models

Disconnect battery.

Remove muffler.

Unplug all connectors located on connector support.

Remove nuts that attach the voltage regulator/rectifier to the frame.

Installation

The installation is the reverse of the removal procedure. Pay attention to the following.

Remove the rubber plug under frame to gain access to install the nut on PTO side. Install this nut first.

Torque voltage regulator/rectifier nuts to 10 N•m (89 lbf•**in**).

BATTERY

NOTE: For manual start models with a small battery/capacitor arrangement, refer to ENGINE MANAGEMENT SECTION.

General

Sealed valve regulated lead acid (VRLA) battery are used. They are non-spillable and maintenance reduced — no electrolyte level to be checked and readjusted. No ventilation tube is attached to the battery.

SUPPLIER P/N	BRP P/N
YTX20L-BS	410 301 203

Removal

⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Open right side panel of vehicle.

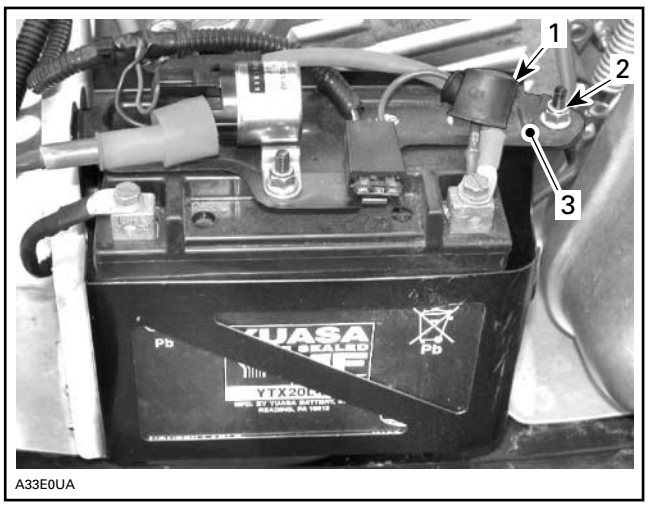
Disconnect BLACK (–) cable end from the terminal.

Slide off rubber boot from RED (+) cable and disconnect it.

Unscrew the bracket retaining nut and lift bracket to remove it.

Put bracket aside.

Remove battery.



TYPICAL
1. *Rubber boot of RED (+) cable terminal*
2. *Bracket retaining nut*
3. *Battery bracket*

CAUTION: Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water to prevent damage to vehicle components.

Cleaning

Clean the battery, battery casing, cables and battery posts using a solution of baking soda and water.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Battery top should be cleaned by soft brush and any grease-cutting soap or baking soda solution.

Inspection

Visually inspect battery casing for cracks, leaks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of rubber gloves when removing the battery by hand.

Inspect battery posts for security of mounting.

Battery Charge Testing

Voltmeter Test

NOTE: To determine the battery state of charge, these sealed batteries have to be tested with a voltmeter. They also need to be tested when their voltage is stabilized. Disconnect battery to have open connectors and wait 1-2 hours prior to reading the voltage. The same condition is required after a battery has been charged.

Batteries with a voltage above 12.8 V do not need to be charged.

Batteries with a voltage of 12.8 V and below need to be charged. Refer to BATTERY CHARGING below.

Battery Storage

CAUTION: A discharged battery will freeze and it may damage its casing. A damaged casing will allow electrolyte spillage that may damage surrounding parts.

Disconnect and remove battery from the vehicle.

The battery must always be stored in fully charged condition.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of silicone dielectric grease (P/N 293 550 004) or petroleum jelly on terminals.

Clean battery casing using a solution of baking soda and water. Rinse battery with clear water and dry well using a clean cloth.

Charge the battery every month if stored at temperature **below** 15°C (60°F).

Charge the battery every two week if stored at temperature **above** 15°C (60°F).

Activation of New Battery

Refer to the instructions provided with the battery.

Battery Charging

⚠ WARNING

Always wear safety glasses and charge in a ventilated area. Never charge or boost battery while installed on vehicle. Do not open the sealed caps during charging. Do not place battery near open flame.

CAUTION: If battery becomes hot, stop charging and allow it to cool before continuing.

NOTE: Sealed VRLA batteries have an internal safety valve. If battery pressure increases due to overcharging, the valve opens to release excess pressure, preventing battery damage.

Perform BATTERY CHARGE TESTING above then proceed as described here.

An automatic charger is the fastest and most convenient way for error-proof charging.

When using a constant current charger, charge battery according to the chart below.

Battery Voltage Below 12.8 V and Above 11.5 V

STANDARD CHARGING (RECOMMENDED)		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	4–9 hours	2 A

QUICK CHARGING		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	50 minutes	10 A

Battery Voltage Below 11.5 V

Batteries with voltage below 11.5 V requires special procedures to recharge. In charging an over discharged battery, its internal resistance may be too high to charge at a normal charging voltage. Therefore, it may be necessary to raise the voltage of the battery initially to 25 V as a maximum, and charge for approximately 5 minutes.

If the charger ammeter shows no change in current after 5 minutes, you need a new battery. Current flowing into the battery at high voltage can become excessive. Monitor amperage and adjust voltage as necessary to keep current at the battery's standard amp rating. Charge for approximately 20 hours.

Installation

Reinstall battery and secure bracket properly.

Connect RED (+) cable it to positive battery terminal. Connect RED wire (coming from 30 A fuse).

Connect BLACK (–) cable LAST.

⚠ WARNING

Battery BLACK (–) cable must always be disconnected first and connected last.

⚠ WARNING

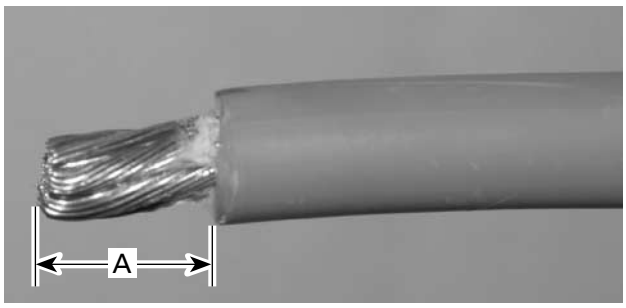
Never charge or boost battery while installed on vehicle.

Cover the RED (+) terminal with rubber boot.

Apply silicone dielectric grease (P/N 293 550 004) on battery posts and connectors.

CABLE TERMINAL INSTALLATION

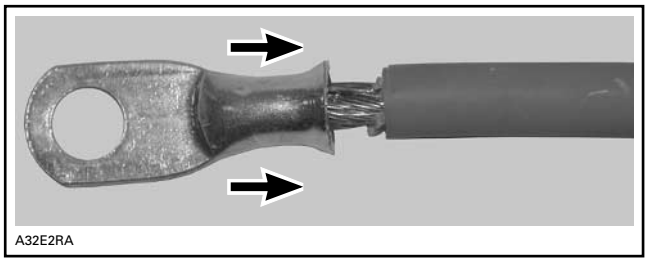
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (1/2 in)

NOTE: Make sure not to cut wire strands while stripping the wire.

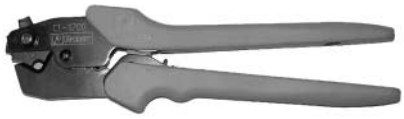
Install the appropriate terminal on the wire according to the requirement. Refer to appropriate parts catalog.


A32E2RA

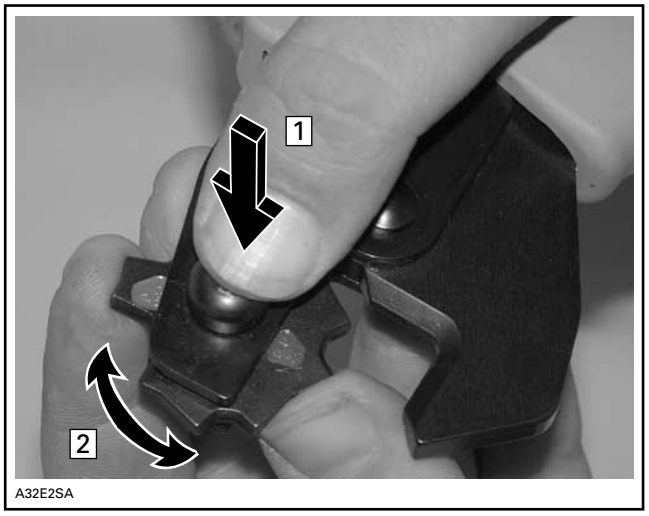
INSTALLATION OF TERMINAL

Follow the instructions provided with the crimp pliers (P/N 529 035 730) to select the proper position of the tool.

529 035 730



NOTE: Different wires require different crimp pliers settings, so make sure to follow the instruction supplied with the tool.



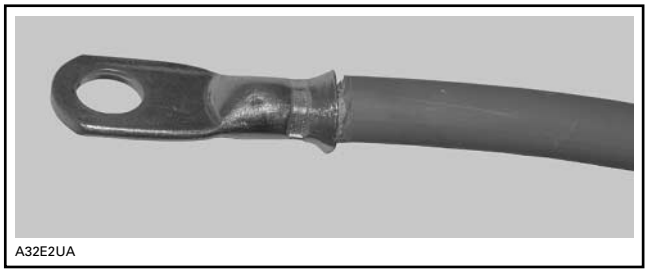
A32E2SA

POSITIONING THE CRIMP PLIERS
1. *Press*
2. *Rotate*

After positioning the crimp pliers, crimp the terminal already installed on wire.

A32E2TA

CRIMPING OF WIRE


A32E2UA

PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

CAUTION: Never solder the wire to the terminal. Soldering can change the property of the wire and it can become brittle and break.

Install the protective heat shrink rubber tube on the terminal. Heat the heat shrink rubber tube using the heat gun so that it grasps the wire and the terminal.

CAUTION: Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

STARTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
multimeter FLUKE 111	529 035 868	171

GENERAL

When the start button is pressed, a signal is sent to the starting solenoid. The battery then supplies current to the starter through the starting solenoid to turn the engine.

In case of problems, first ensure the problem is not related to engine mechanical components. If not, test the starting system.

NOTE: Make sure problem is not related with engine. Pull rewind starter, engine should rotate normally. If not, problem is not related with starting system.

Causes of problems are not necessarily related to starter but may be due to a burnt fuse, faulty battery, start button, engine cut-out switch, starting solenoid, electrical cables and connections or the electronic module.

NOTE: The flooded engine mode can be used to accomplish some tests, to avoid engine starting or injecting fuel in the engine. Refer to ENGINE MANAGEMENT for more details on this feature.

COMPONENT TESTING

Fuses

Make sure the charging fuse (30 A) on battery and the ECM fuse (5 A) on electrical harness are in good condition. If the fuses test good, continue with the next tests.

Battery

Check battery voltage. Make sure battery cables are cleaned and properly tightened.

Refer to CHARGING SYSTEM to check battery condition. If the test is good, continue with the next tests.

START/RER Switch

Check if the start/RER switch works normally.

Refer to the following:

NOTE: Start/RER switch operation can be confirmed also with BUDS software. Use the tab **Monitoring**. Refer to ENGINE MANAGEMENT for further informations.

START/RER SWITCH				
TEST	Continuity			
TEST PROBES	BLACK and RED wires		BLACK and WHITE wires	
RESISTANCE	0.3 Ω	O.L.	O.L.	0.3 Ω
VOLTAGE	—	—	—	—
NOTE	With button released	With button depressed	With button released	With button depressed

Starting Solenoid

NOTE: When testing the start switch with B.U.D.S., the starting solenoid signal from the ECM is also confirmed. Refer to ENGINE MANAGEMENT for further informations.

The starting solenoid can also be verified as follows.

Use multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between the wires, indicate in the following table, when starting the vehicle. The tether cord must be installed.

ENGINE TYPES	COLOR OF WIRES
995 SDI ENGINES	RED/GREY and ORANGE/BLACK

If the solenoid does not receive a signal and the start switch test good, make sure it is not a bad connection between the engine control module (ECM) and the starting solenoid. If not, the ECM can be suspected.

If the solenoid receives current, test it as follows.

– Disconnect battery and starter cables from solenoid.
– Inspect connections and clean as necessary.
– Solenoid condition can be checked with an ohmmeter. Install probes on large connectors of solenoid.
– Measure the resistance when current is applied to small connectors; if it is more than a few ohms, replace solenoid.

If solenoid tests good, check the electric starter.

Engine Control Module (ECM)

NOTE: When testing the start switch with B.U.D.S., the starting solenoid signal from the ECM is also confirmed. If the test is conclusive, the ECM is in good condition.

Check if there are any fault codes. Refer to ENGINE MANAGEMENT.

Engine Cut-Out Switch

Check the condition of engine cut-out switch as per following table.

ENGINE CUT-OUT SWITCH		
TEST	Running insulation	Continuity in STOP position
TEST PROBES	BLACK/YELLOW and BLACK wires	BLACK/YELLOW and BLACK wires
RESISTANCE	O.L.	00.0 to 00.5
VOLTAGE	—	—
NOTE	Engine cut-out switch must be in run position.	Engine cut-out switch must be in stop position.

Electrical Cables and Connections

Check all connections, harnesses and wires.

Tighten any loose connections.

Replace any chafed wires.

A voltage drop test can be performed in order to find a poor connection, defective wire or component, causing parasite resistance in the system.

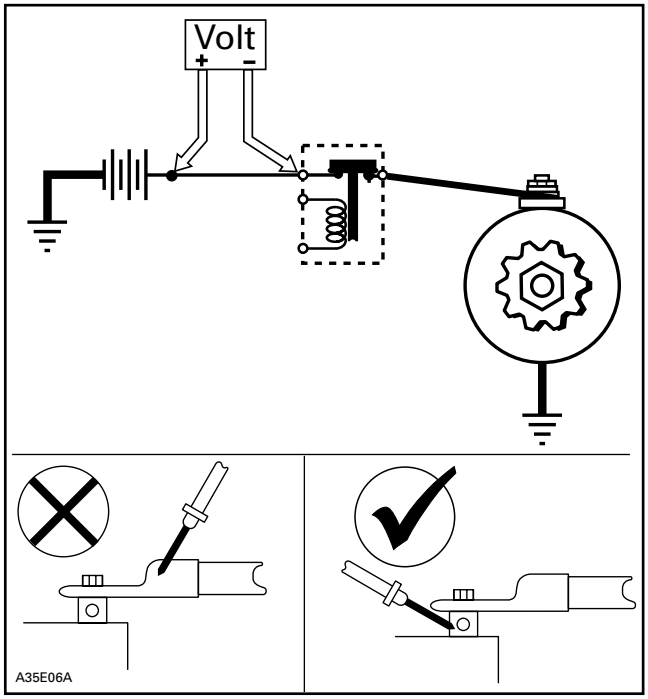
To perform a voltage drop test, proceed as follows:

CAUTION: Do not active starter more than 15 seconds. Wait 2 minutes between each test.

NOTE: Place probes to terminals not to the connectors. More that one component can be defective. Repair any defective component before performing the next test.

TEST 1

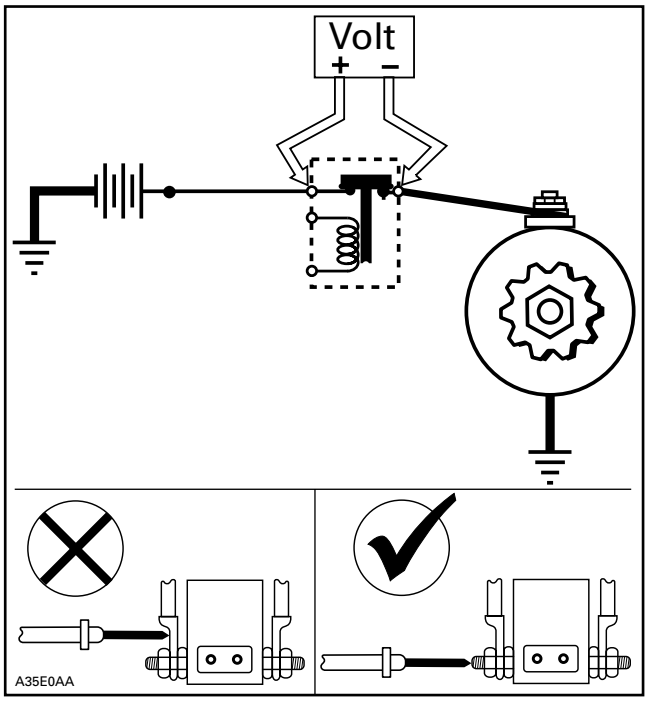
– Place the positive probe of multimeter on positive battery terminal and the negative probe on the high-current input of starter solenoid.



– Crank engine and record the result.
– The voltage reading should not exceed 0.2 volt. If the result is over 0.2 volt, verify connections and wire condition.

TEST 2

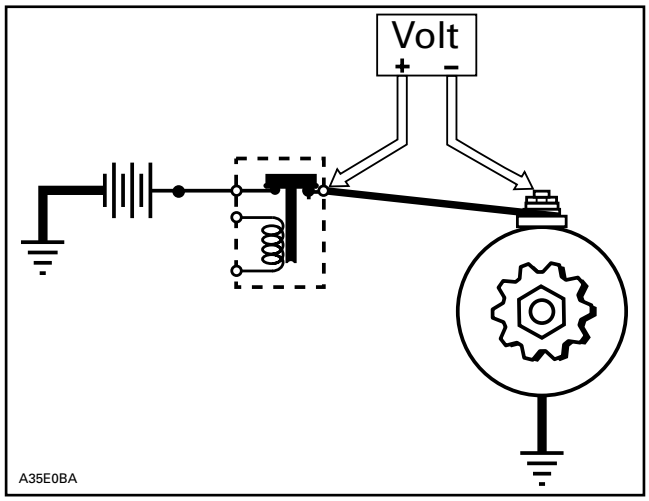
– Check solenoid by placing the test probes to the solenoid terminals.



– Crank engine and record the result.
– The voltage reading should not exceed 0.2 volt. If the result is over 0.2 volt, the solenoid is defective or there is a bad connection.

TEST 3

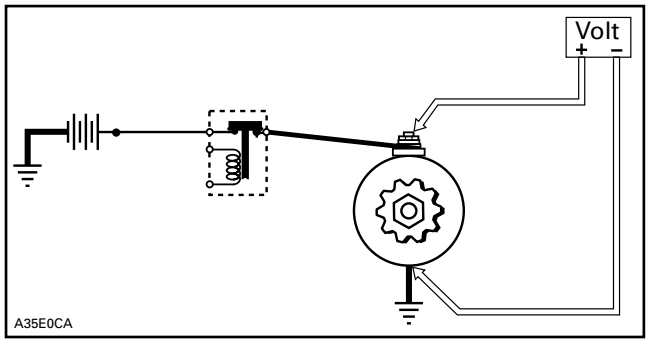
– Place the positive probe of multimeter to the output terminal of solenoid and the negative probe to the starter positive terminal.



– Crank engine and record the result.
– The voltage reading should not exceed 0.2 volt. If the result is over 0.2 volt, verify connections and wire condition.

TEST 4

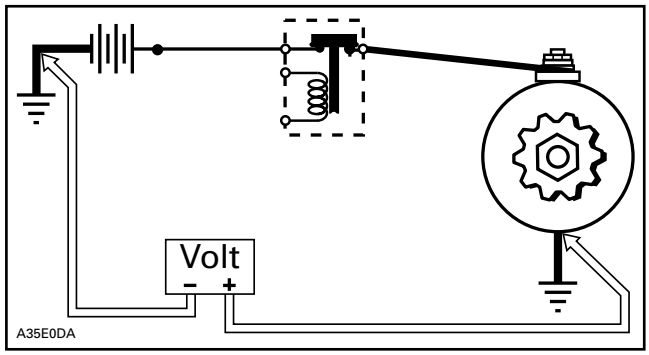
– Measure voltage to starter. Place the positive probe to the starter positive terminal and the negative probe to the starter housing.



– Crank engine and record the result.
– The voltage reading should not drop below 9 volts. If the result is under 9 volts, the starter is defective or there is a bad connection.

TEST 5

– Place the positive probe to the starter housing and the negative probe to negative battery terminal.



– Crank engine and record the result.
– The voltage reading should not exceed 0.2 volt. If the result is over 0.2 volt, verify connections and battery/engine ground wire conditions.

Electric Starter

Remove the tuned pipe and disconnect spark plug cables.

Using booster cables, carefully supply current from the battery directly to the starter. Connect the BLACK cable first to the ground. Connect the other booster cable from the battery to the starter positive terminal.

If the starter turns, ensure wiring harness and connectors between battery and starter are in good condition. See procedure above.

If the starter does not turn, replace it.

STARTER REMOVAL

Disconnect BLACK (-) cable from battery then the RED (+) cable.

⚠ WARNING

Always disconnect BLACK (-) cable first.

Remove tuned pipe.

Disconnect RED cable from starter.

Disconnect ground cable from starter.

Unbolt and remove starter from engine.

STARTER INSTALLATION

Use new teflon washers on the 3 bolts retaining starter to engine.

Torque the bolts to 28 N•m (20 lbf•ft).

Connect the RED wire to the large terminal of the starter.

Torque large terminal nut to 7 N•m (62 lbf•**in**).

Connect ground cable to the starter with star washer in between.

Torque ground cable connecting bolt to 11 N•m (97 lbf•**in**).

Install battery cables.

⚠ WARNING

Always connect RED (+) cable first.

ROTAX ELECTRONIC REVERSE (RER)

TROUBLESHOOTING

RER Does Not Response When Depressing START/RER Button

– Check for faults using the vehicle communication kit (VCK) and B.U.D.S. software.
– Check if engine START/RER button works normally, refer to ENGINE MANAGEMENT.

RER Works Erratically

– Check engine compression. A low compression engine may result in RER working erratically making you think the problem is an electronic problem.
– Check piston condition. Remove exhaust system and reed valves on intake side. Verify piston condition through the intake and exhaust ports. Look for scoring on piston skirts. Scored piston skirts may result in RER working erratically making you think the problem is an electronic problem.

When it does not work at all, check wiring and START/RER switch as explained above.

ACCESSORIES AND LIGHTING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
multimeter FLUKE 111	529 035 868	178, 182–184
supply cable	529 035 997	177, 183
supply harness	529 035 869	177–178, 183
VCK (Vehicle Communication Kit)	529 035 981	177

GENERAL

⚠ WARNING

It is recommended to always disconnect the battery when replacing any electric or electronic parts. Always disconnect battery exactly in the specified order, BLACK (-) cable first. Do not place tools on battery.

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must be strictly be adhered to. Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

Lighting and Accessories System Testing

Connect the VCK (Vehicle Communication Kit) (P/N 529 035 981).

529 035 981

In BUDS, click on the relay 2 (R2) button to supply lighting system with 12 volts.

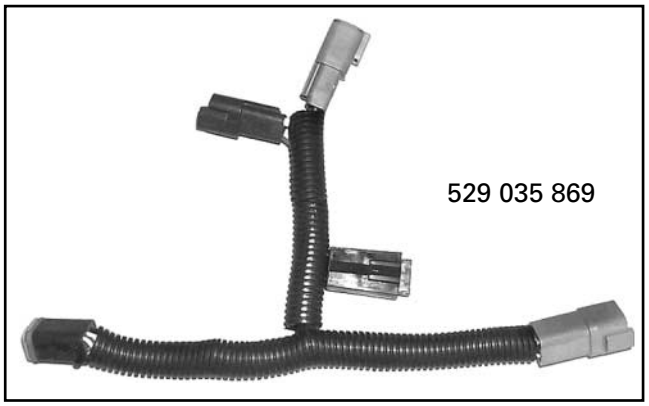
To supply 12 volts to the accessories, click on the relay 3 (R3) button.

Once this test is done, disconnect the VCK.

Connect the supply cable (P/N 529 035 997) to the supply harness (P/N 529 035 869).

CAUTION: Respect polarity by connecting 12V to RED wire and ground to BLACK wire.

529 035 997



Connect the supply harness (P/N 529 035 869) to diagnostic connector, located on right side of the vehicle. Now the headlight and accessories systems are supplied with 12 volts. Refer to WIRING DIAGRAM section to troubleshoot lighting system.

CAUTION: Always use the proper supply harness and cables. Ensure to respect polarity when connecting cable clips to battery. Match RED cables together.

Once lighting system testing is done, disconnect supply cable from vehicle and then 12-Volt supply from the supply cable.

12-VOLT POWER OUTLET (cigarette-lighter type)

Removal

Remove the console.

Remove connectors from the power outlet housing.

Unscrew the large nut then remove the 12-Volt power outlet.

Test

Remove power outlet.

Unplug the power outlet connectors.

Using the multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between RED/YELLOW and BLACK wires.

The obtained value should be between 12 and 14.5 Vdc.

– No voltage:
  - Check accessories fuse (20 A), connectors and wiring harness.

– Voltage is good:
  - After checking the accessories, change the power outlet.

Installation

The installation is the reverse of the removal procedure.

BEEPER (reverse alarm)

Removal

The beeper is located near the ignition coil.

Open the front hood, remove the windshield then remove screws retaining the accessories panel.

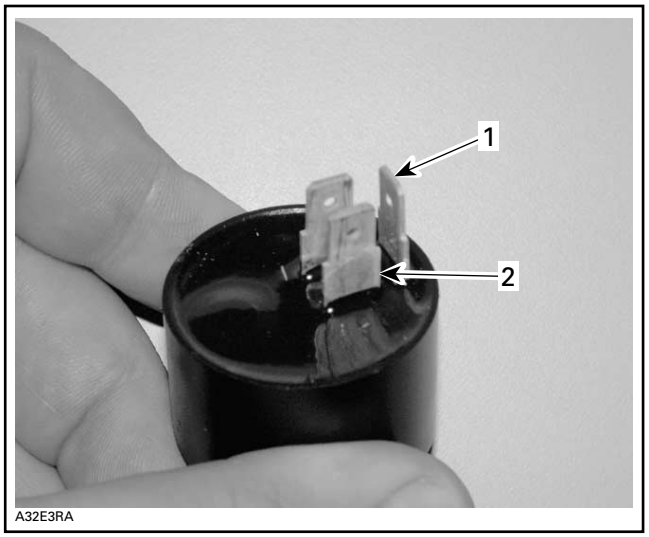
Unplug connector from beeper.

Unscrew retaining ring then remove beeper.

Test

NOTE: Before testing the beeper, make sure the connectors are installed on proper beeper tabs.

ENGINE	TAB LOCATION
995 SDI engines	RED/GREY on positive tab BEIGE/BLACK on negative tab

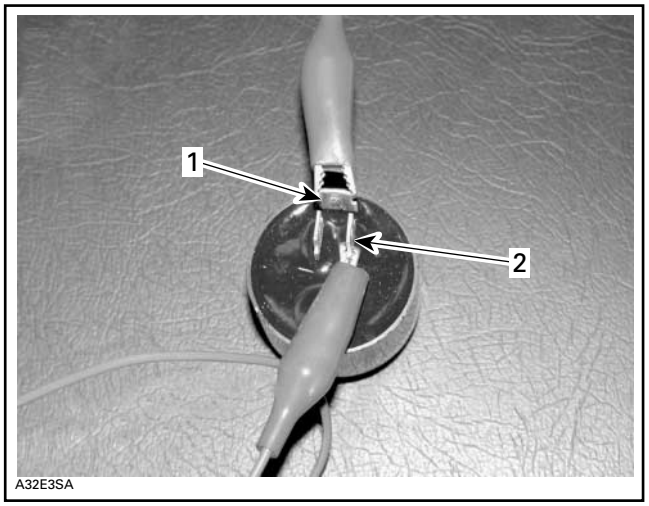


1. RED/GREY wire on positive tab
2. BEIGE/BLACK wire on negative tab

Using jumper wires, connect battery positive post to beeper positive tab.

Connect battery negative post to beeper negative tab. See next photo.

CAUTION: To avoid beeper damage, ensure that polarity is respected.



TYPICAL — 12-VOLT BATTERY PLUGGED TO BEEPER
1. Beeper positive tab
2. Beeper negative tab

A continuous sound should be heard. If not, replace the beeper with a new one.

If the beeper is good, check connectors, fuse and wiring harness.

Installation

To install beeper, reverse the removal procedure. Check connectors position.

ENGINE TEMPERATURE GAUGE

Test

Check fuse, connectors and harness.

Check the condition of relay 2 by using the BUDS software.

Check temperature sensor.

Replace the gauge.

Removal

Remove the accessories panel.

Remove the ring around the gauge by pressing both tabs.

Unscrew the central nut and remove the support.

Unplug connector.

Remove gauge.

Installation

The installation is the reverse of removal procedure.

ELECTRIC FUEL GAUGE

Test

Check fuse, connectors and harness.

Check relay 2 by using BUDS software.

Check fuel sensor on fuel tank.

Replace electric fuel gauge.

Removal

Remove the accessories panel.

Remove the ring around the gauge by pressing both tabs.

Unscrew the central nut and remove the support.

Unplug connector and remove gauge.

Installation

The installation is the reverse of the removal procedure.

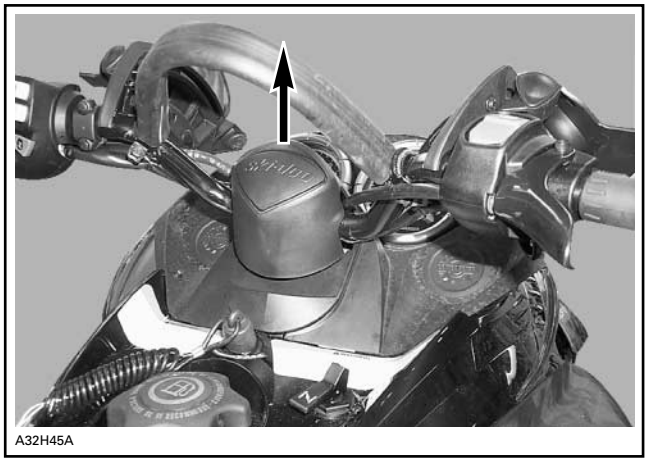
HEADLAMP

Bulb Replacement

If any headlight bulb is burnt, proceed as follows.

Remove windshield.

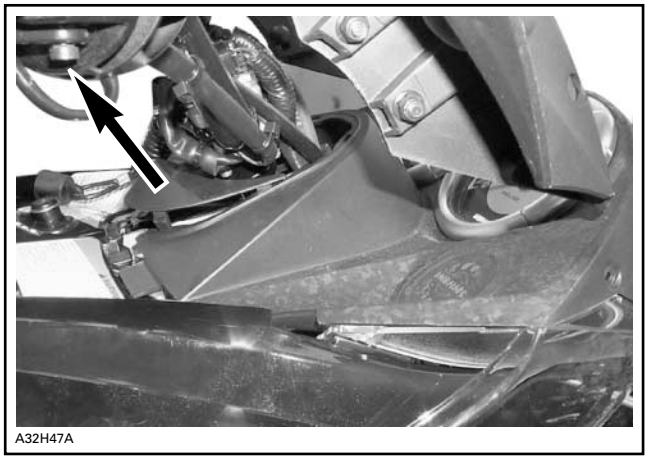
Pull out steering support cap.


A32H45A

TYPICAL

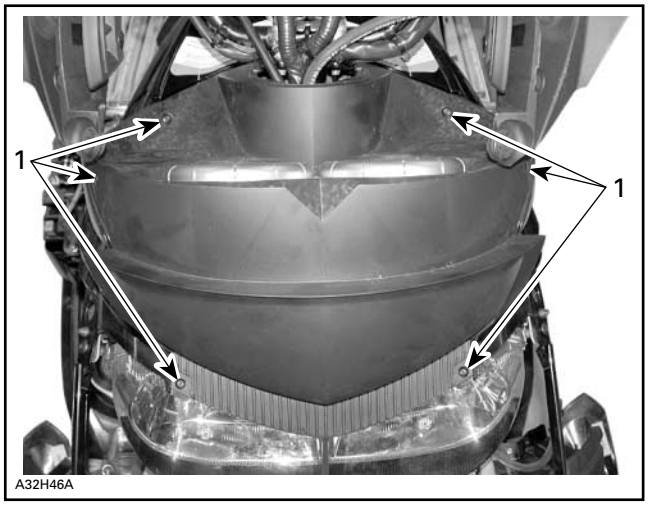
Lift hood.

Pull up front console end cap.


A32H47A

TYPICAL

Remove retaining screws and slightly lift accessories panel.



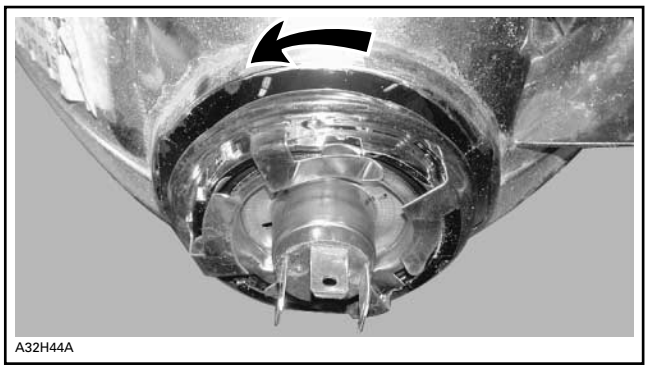
A32H46A

TYPICAL
1. Remove screws

Place the accessories panel out of way.

Unplug burnt bulb connector. Remove the rubber boot.

Turn bulb retainer ring counterclockwise to unlock. Detach the bulb and replace.


A32H44A

TYPICAL

CAUTION: Never touch glass portion of an halogen bulb with bare fingers, as it shortens its operating life. If by mistake glass is touched, clean it with isopropyl alcohol which will not leave a film on the bulb. After locking ring installation, ensure bulb is properly secured in place.

Properly reinstall removed parts.

Test

If the new bulb do not work correctly, check connector, wiring harness or HI-LOW beam switch.

Removal

Remove the accessories panel.

Disconnect headlamps.

On RH side of vehicle, remove the push nut then remove the headlamp housing.

Installation

Reverse the removal procedure.

HEADLAMP BEAM AIMING

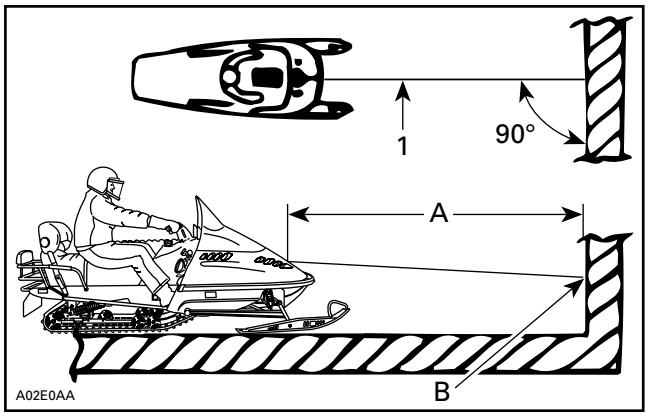
Beam aiming is correct when center of high beam is 25 mm (1 in) below the headlamp horizontal center line, scribed on a test surface, 381 cm (12 ft 6 in) away.

Place the vehicle on a flat surface perpendicular to test surface (wall or screen) and 381 cm (12 ft 6 in) away from it.

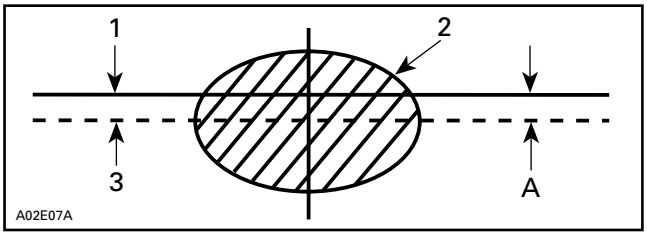
Rider or equivalent weight must be on the vehicle.

Select **high** beam.

Measure headlamp center distance from ground. Scribe a line at this height on test surface (wall or screen). Light beam center should be 25 mm (1 in) below scribed line.



TYPICAL
1. Headlamp center line
A. 381 cm (12 ft 6 in)
B. 25 mm (1 in) below center line



1. Headlamp horizontal
2. Light beam (high beam) (projected on the wall)
3. Light beam center
A. 25 mm (1 in)

HEATING ELEMENTS

NOTE: All measurements must be performed at 21°C (70°F).

Throttle Lever Heating Element

Resistance Measurement

THROTTLE LEVER HEATING ELEMENT		
TEST	High Intensity	Low Intensity
WIRE COLOR	BROWN and YELLOW/BLACK	BROWN/YELLOW and YELLOW/BLACK
RESISTANCE	1.73 to 4.22 Ω	5.73 to 18.54 Ω
NOTE	—	—

Handlebar Grip Heating Element

Resistance Measurement

HANDLEBAR GRIP HEATING ELEMENT		
TEST	High Intensity	Low Intensity
WIRE COLOR	ORANGE/VIOLET and BLACK	ORANGE and BLACK
RESISTANCE	17 to 23.5 Ω	8.5 to 11.8 Ω
NOTE	When measuring resistance at terminals the actual value will be half the measurement in table. The reason for that is the elements are connected in parallel. Therefore the total resistance is half the resistance of one element.	

If the heating elements are good, check connectors and wiring harness.

RELAY

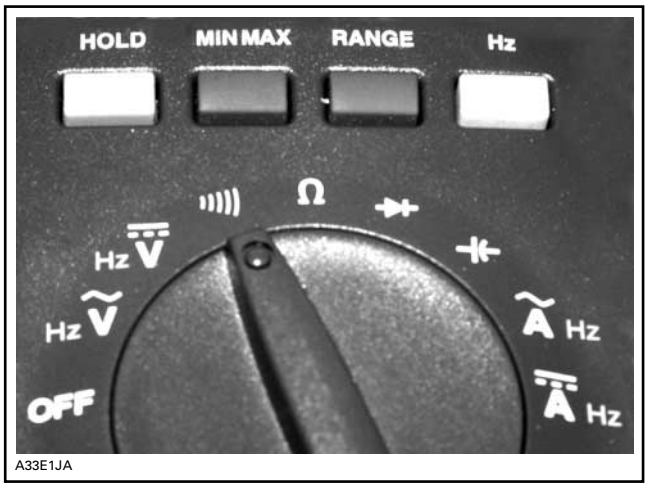
Voltage Test

RELAY		
TEST	Coil	Contact
WIRE COLOR	WHITE/GREEN and BLACK	BLACK/YELLOW and BLACK
RESISTANCE	—	—
VOLTAGE	10.5 to 13.5 Vdc	00.0 to 0.10 Vdc
NOTE	Engine idling (1500 to 1600 RPM)	Engine idling (1500 to 1600 RPM)

Continuity Test

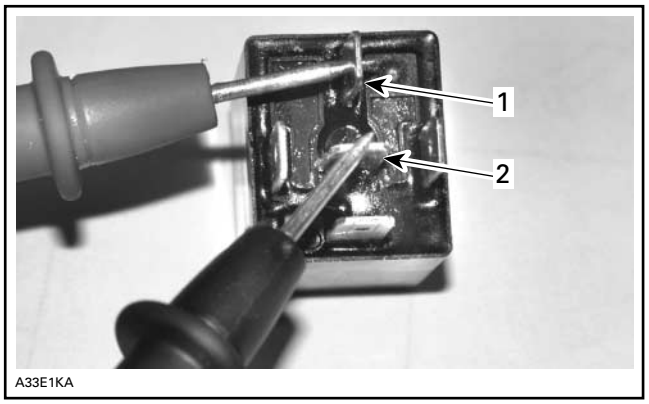
Remove the relay from vehicle.

Using the multimeter FLUKE 111 (P/N 529 035 868), select the beeper position.



A33E1JA

Position the RED probe on the terminal 30 and the BLACK probe on the terminal 87a.

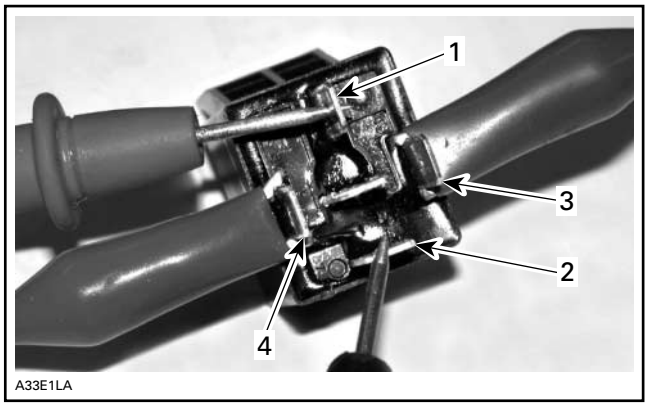


A33E1KA

1. Terminal 30
2. Terminal 87a

A continuous signal should be audible. If not, replace the relay.

If a signal is audible, apply 12 volts on terminals 85 and 86 then place the RED probe on terminal 30 and the BLACK on the terminal 87.



A33E1LA

1. Terminal 30
2. Terminal 87
3. Terminal 85
4. Terminal 86

The continuous signal should be audible. If not, replace the relay.

SPEEDOMETER

Removal

Insert a little flat screwdriver into the slot at the bottom of the speedometer. Slightly, pry the speedometer and turn it clockwise then remove it from accessories panel.

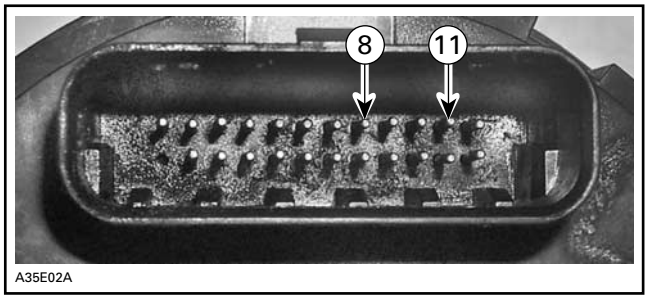
Unplug connector.

Test

No Lights and the Needle Does Not Move

Remove the speedometer. Apply 12 volts between pin 8 and pin 11. Place the positive probe on pin 8 and the negative on pin 11.

NOTE: Respect positive and negative positions if not the speedometer could be damaged.



A35E02A

If the speedometer stays off, change it.

If the speedometer is lighted, check connector and wiring harness. Repair defective parts.

The Speedometer Is Lighted But the Needle Does Not Move

Check the speed sensor and the wiring harness.

If the speed sensor and the wiring harness are good, change the speedometer.

Installation

The installation is the reverse of the removal procedure.

SPEED SENSOR

Test

Install the supply harness (P/N 529 035 869) with the supply cable (P/N 529 035 997).

NOTE: Remove the headlight system fuse to save the battery during the test.

Static Test

Unplug the speed sensor connector.

A33E1MA

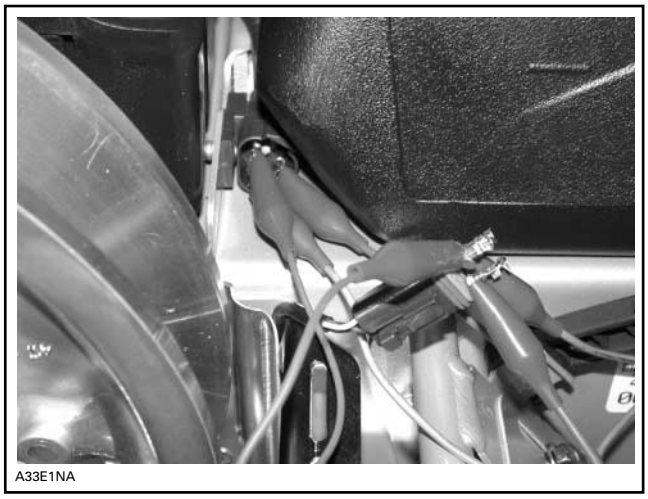
Using the multimeter FLUKE 111 (P/N 529 035 868), measure the voltage between BLACK/BLUE and RED/GREY wires. The obtained value should be the battery voltage.

Measure the voltage between BLACK/BLUE and GREEN/WHITE wires. The obtained value should be ±1 volt under battery voltage.

Dynamic Test

Install 3 pins in each speed sensor connector.

Install wire jumpers between pins.



A33E1NA

Lift the rear of the vehicle.

Connect multimeter probe on GREEN/WHITE and BLACK/BLUE wires.

Turn the track slowly. The voltage should be 12 volts then drop to O.L.

If the obtained value is out of specifications, change it.

TACHOMETER

Test

No Light But the Needle Moves

The tachometer is supplied through the speedometer. Check the voltage between pins 9 and 10 of tachometer connector.

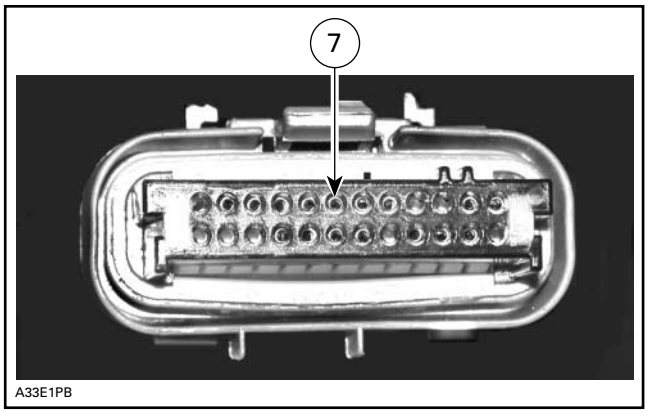
The obtained value should be the battery voltage. If not, check connections and wiring harness.

If the voltage is good, replace the tachometer.

The Needle Does Not Move

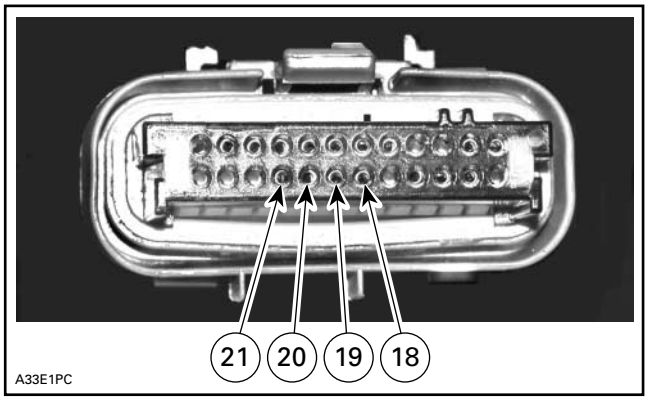
No lights, see speedometer

With lights, check RPM signal on pin 7 of speedometer connector.



Crazy Needle

Check wire connections on pin 18, 19, 20 and 21 of tachometer connector.



TAILLIGHT

Bulb Replacement

Unscrew lens screws to expose bulb.

Push the bulb in and hold while turning counterclockwise to release.

Install the new bulb by first pushing in while turning clockwise.

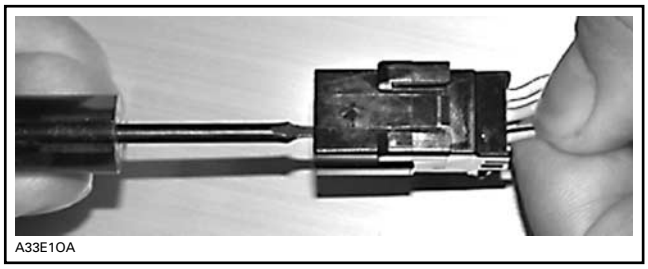
Removal

Remove the radiator cover by removing the retaining screws.

Remove trunk behind seat.

Disconnect taillight connector.

Remove the wires from connector. Open the connector on wire side then with a small tool extract the wires from the connector.



NOTE: Note the location of each wire.

Summit Highmark and Summit Highmark X

Unscrew the screws retaining the rack to the side of frame.

Unscrew the other screws that attach the rack near the radiator.

All Models

Unscrew taillight lens and pull the wire.

NOTE: Attach a cord at the end of wire to reinstall the new wire easily.

Installation

The installation is the reverse of the removal procedure.

VISOR OUTLET

Removal

Remove the console.

Unplug the visor connector.

Unscrew visor outlet.

Test

Unplug the visor connector.

Using the multimeter FLUKE 111 (P/N 529 035 868), check voltage between RED/YELLOW and BLACK wires. The obtained value should be ± 12 Vdc.

Before changing the visor outlet, try another accessory, if the accessory does not work, change visor outlet.

Installation

The installation is the reverse of the removal procedure.

DRIVE BELT

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	187

APPLICATION CHART

MODEL	PART NUMBER	MINIMUM WIDTH (wear limit) mm (in)
995 SDI engines	417 300 189	35.9 (1.413)

INSPECTION

Inspect belt for cracks, fraying or abnormal wear (uneven wear, wear on one side, missing cogs, cracked fabric). If abnormal wear is noted, probable cause could be pulley misalignment, excessive RPM with frozen track, fast starts without warm-up period, burred or rusty sheave, oil on belt or distorted spare belt.

Check drive belt width. Replace the drive belt if width is under minimum recommended width (see table above).

CHECKING NEUTRAL FUNCTION

⚠ WARNING

Always check neutral function when servicing.

Apply parking brake. Vehicle must be on the ground and on a plane level surface. No one should be in front of vehicle.

Attach vehicle tether cord to your clothing. Stand aside of vehicle, then start engine.

⚠ WARNING

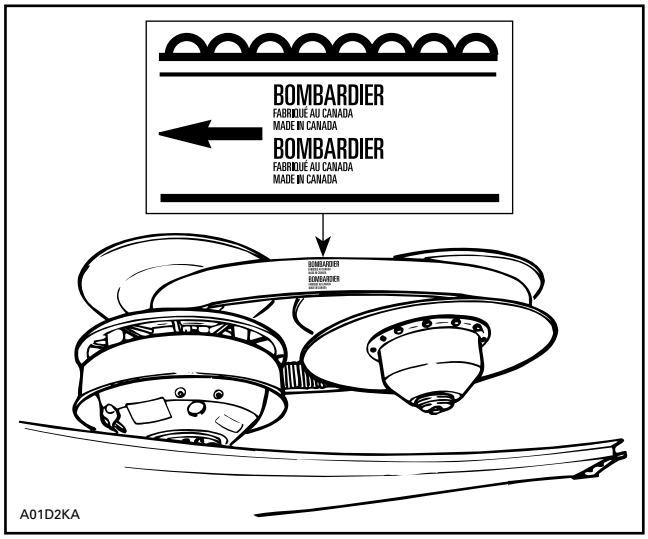
Do not sit on vehicle.

Release parking brake. Vehicle must not creep when engine is idling. Otherwise, make sure that:

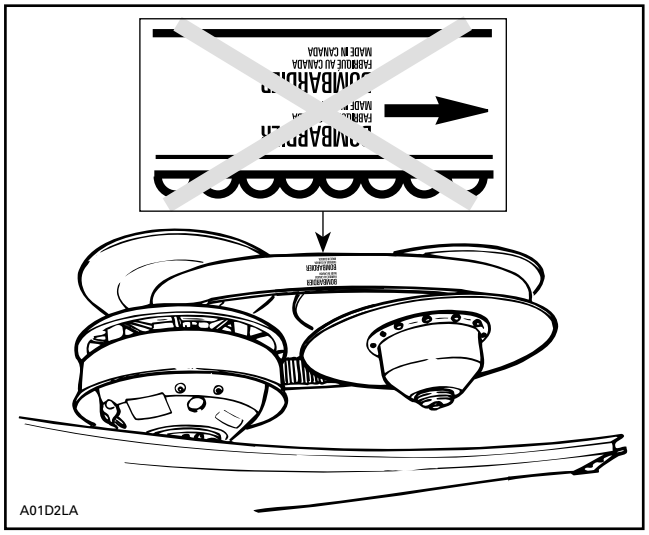
- idle speed is as specified
- proper belt is installed
- pulley center-to-center is as specified
- belt deflection is as specified.

ROTATION DIRECTION

The maximum drive belt life span is obtained when the drive belt is installed as shown. This will ensure that correct direction of rotation is respected.



CORRECT



INCORRECT

NOTE: For used drive belt, mark and reinstall in the same position.

DRIVE BELT HEIGHT MEASUREMENT AND ADJUSTMENT

Measurement

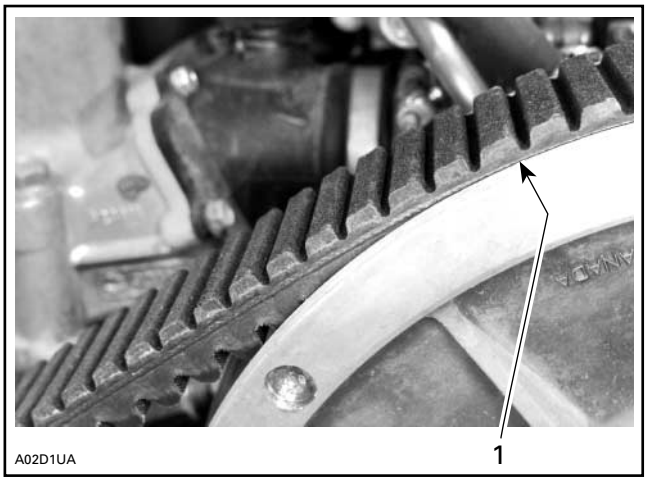
NOTE: The drive belt height measurement must be performed each time a new drive belt is installed. To obtain an accurate drive belt height measurement, it is suggested to allow a break-in period of 50 km (30 miles).

Before checking the belt height, ensure that a good-condition proper belt (refer to the APPLICATION CHART) is installed.

Adjust pulley alignment. Refer to PULLEY ALIGNMENT.

To obtain maximum vehicle performance, the belt height must be adjusted according to specifications shown in the accompanying chart.

MODEL	BELT HEIGHT
All models	Top edge of drive belt cord should be flush with driven pulley edge.

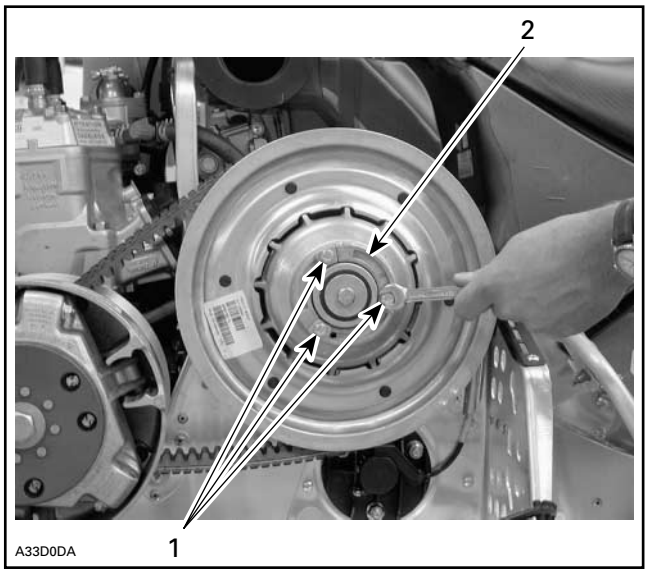


TYPICAL
1. Flush

Adjustment

Before adjusting the belt height, ensure that a good-condition proper belt (refer to the APPLICATION CHART) is installed.

Align pulleys according to specification, refer to PULLEY ALIGNMENT.

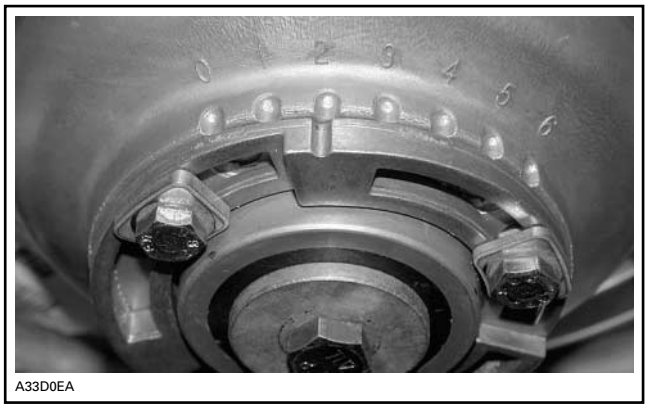


TYPICAL
1. Screws
2. Adjustment ring

Loosen screws and turn adjustment ring as follows:

To lower belt in driven pulley: turn adjustment ring counterclockwise and tighten the screws.

To raise belt in driven pulley: turn ring clockwise and tighten the adjustment screws.



DRIVEN PULLEY NOTCHES

Turn the adjustment ring up to one notch, tighten the screws, then rotate driven pulley to allow drive belt to settle in pulley. Check height, if required the adjustment ring can be turned up to 1/4 or 1/2 the notch. Check height, repeat as required.

NOTE: Notches are there on the driven pulley for reference purpose only and the desired adjustment can be attained at any point.

DRIVE BELT DEFLECTION MEASUREMENT (reference only)

NOTE: The drive belt deflection measurement must be performed each time a new drive belt is installed. To obtain an accurate drive belt deflection measurement, it is suggested to allow a break-in period of 50 km (30 miles).

Before checking the belt deflection, ensure vehicle has the proper belt (refer to the APPLICATION CHART).

Adjust pulley distance and alignment. Refer to PULLEY DISTANCE AND ALIGNMENT.

To obtain maximum vehicle performance, the belt tension must be adjusted according to specifications shown in the accompanying chart.

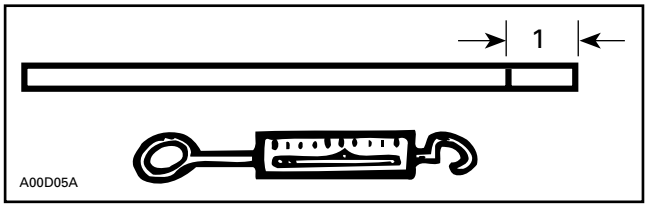
MODEL	DEFLECTION † mm (in)	FORCE kg (lb)
All models	32 ± 5 (1.260 ± .197)	11.5 (25)

† FOR REFERENCE ONLY

To Check Tension

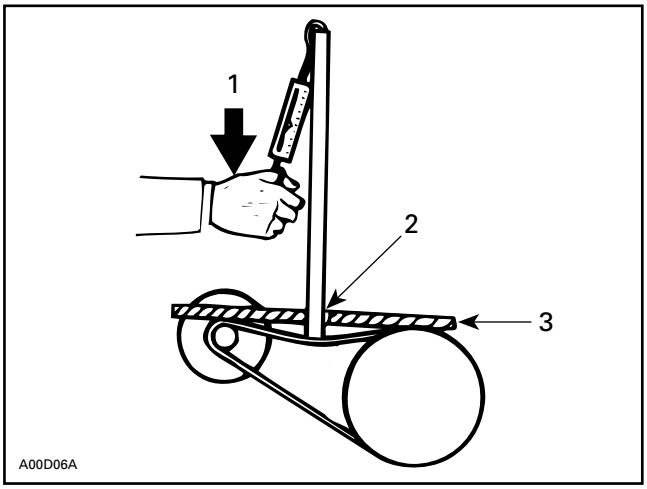
Position a reference rule on drive belt.

Wooden Stick and Spring Scale Method



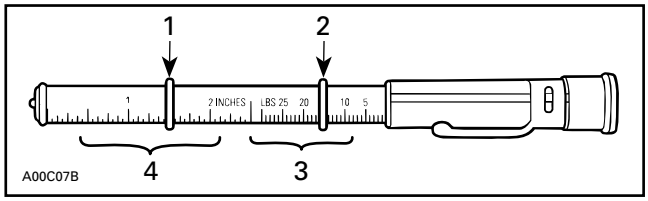
1. Mark specified deflection

Using spring scale and stick, apply specified force on drive belt halfway between pulleys as shown.



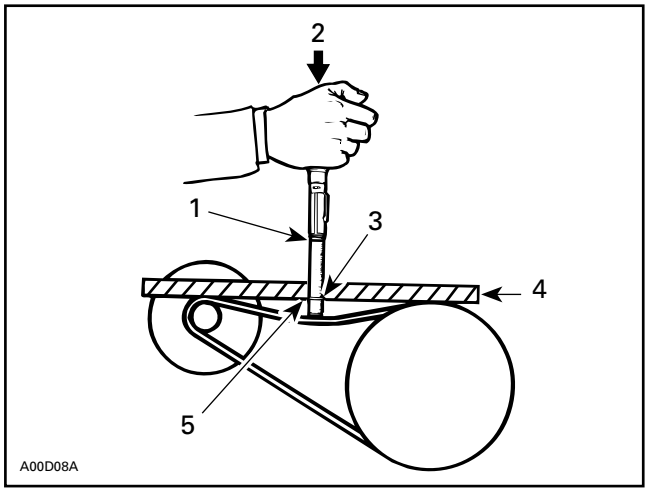
1. Force
2. Read deflection here
3. Reference rule

Or use the belt tension tester (P/N 414 348 200).



1. Lower O-ring
2. Upper O-ring
3. Force (read down)
4. Deflection (read up)

1) Slide lower O-ring of deflection scale to specified measure.
2) Slide upper O-ring to 0 (zero) on the force scale.
3) Apply pressure until lower O-ring is flush with edge of rule and read force on the upper scale at top edge of O-ring.



1. Upper O-ring — force
2. Force
3. Lower O-ring — deflection
4. Reference rule
5. Deflection

DRIVE PULLEY

SERVICE TOOLS

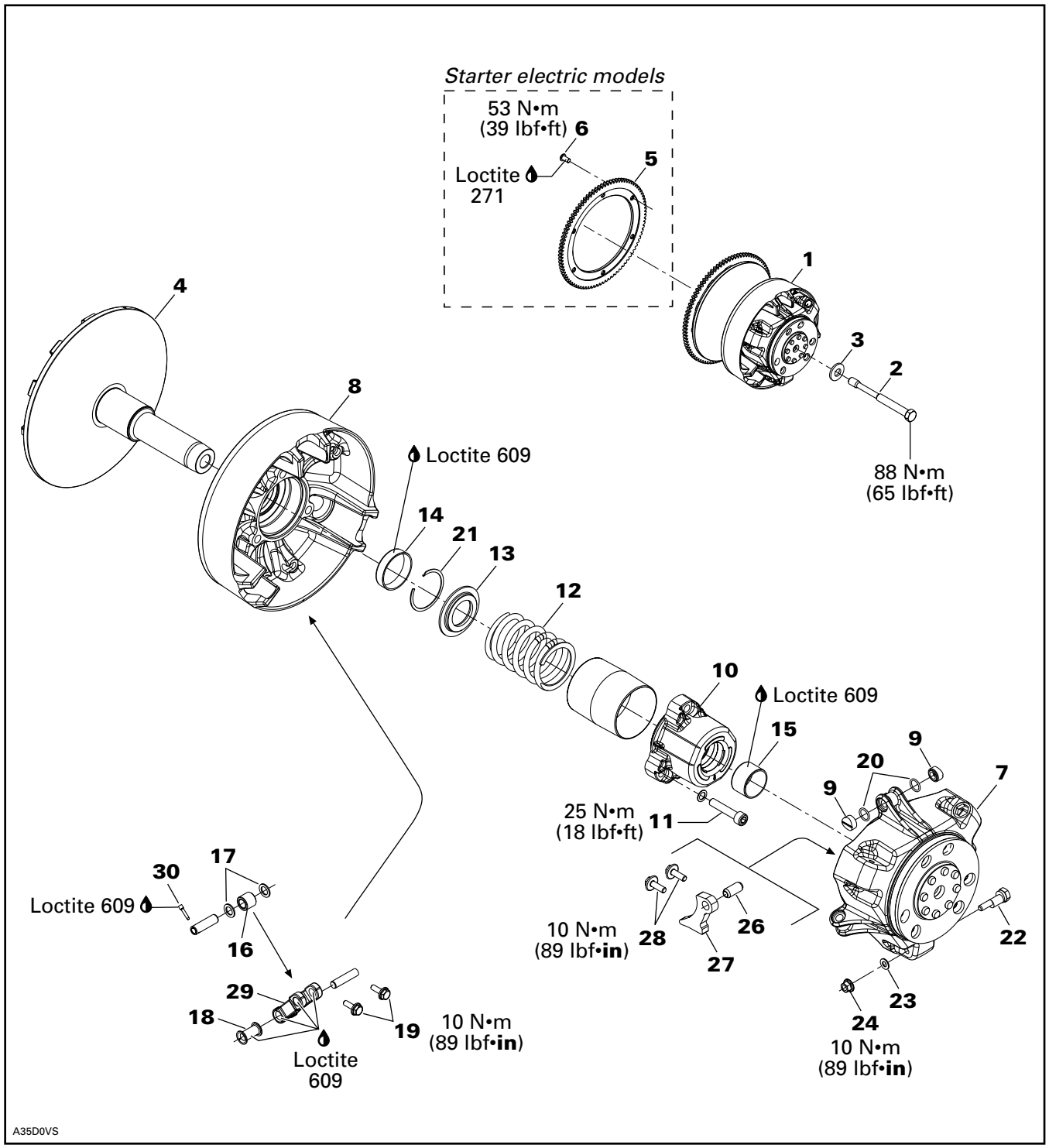
Description	Part Number	Page
bushing remover/installer	529 031 200	194
drive pulley holder	529 035 674	191, 198
drive pulley puller	529 022 400	191
slider shoe fork	529 005 500	192, 197
sliding half bushing remover/installer	529 035 931	194–195
spring compressor	529 035 524	192, 194–195, 197

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	195
Loctite 609	413 703 100	195–197
pulley flange cleaner	413 711 809	193, 195

TRA V

NOTE: This is a lubrication free drive pulley. Always refer to appropriate parts catalog for replacement parts. Most parts of TRA V are not interchangeable with other TRA models.



GENERAL

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation. The use of impact wrench could damage the drive pulley and modify the calibration.

Some drive pulley components (return spring, ramp) can be changed to improve vehicle performance in high altitude regions. A service bulletin will give information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance. Verify spring specifications before installation. Do not only refer to the spring color code.

NOTE: TRA drive pulley stands for Total Range Adjustable drive pulley.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized Ski-Doo dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

Ring Gear

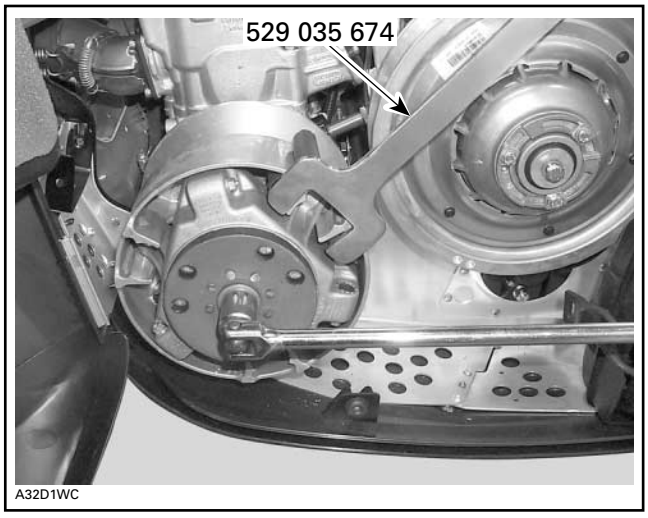
Each time the drive pulley is removed from the engine, check the tightening of ring gear screws. Torque them if necessary.

CAUTION: All 995 engines are equipped with a ring gear, even though the vehicle does not have an electric starter. The ring gear is used as a damper. Do not remove it.

REMOVAL

Remove drive belt.

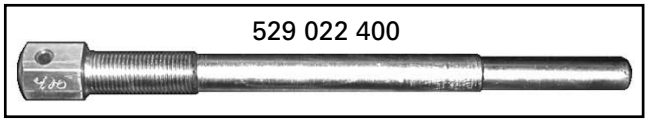
Secure drive pulley **no. 1** with the drive pulley holder (P/N 529 035 674). Install it over a sliding half tower.



TYPICAL — INSERT THE TOOL IN SLIDING FLANGE TOWER

Remove the drive pulley bolt **no. 2** and its conical spring washer **no. 3**.

To remove drive pulley **no. 1** and/or fixed half **no. 4** from engine, use the drive pulley puller (P/N 529 022 400).



Retain drive pulley with the drive pulley holder (P/N 529 035 674), and install the puller in pulley shaft then tighten.

CAUTION: These pulleys have metric threads. Do not use imperial threads puller. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs imperial) prior to fully tightening.

DISASSEMBLY

Ring Gear

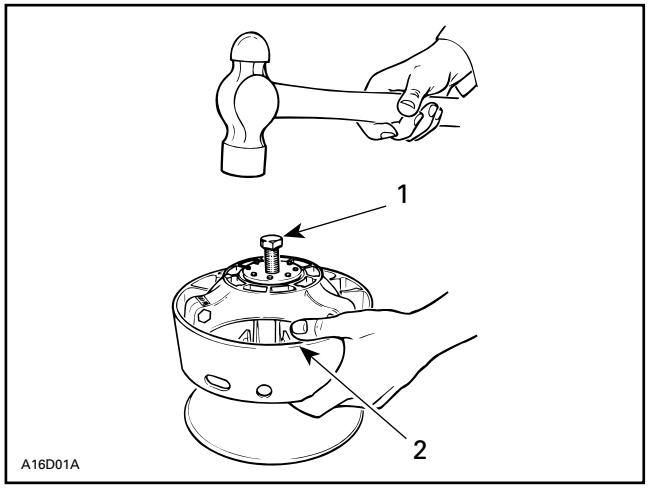
To remove the ring gear **no. 5**, use a heat gun to break the threadlocker on ring gear screws **no. 6** before disassembly.

CAUTION: If another tool than a heat gun is used, do not exceed 150°C (300°F).

Fixed Half

CAUTION: NEVER tap on governor cup no. **7**.

To separate fixed half **no. 4** from sliding half **no. 8**, heat the stop plate with a heat gun then screw puller into fixed half shaft about 13 mm (1/2 in). Raise drive pulley and hold it by the sliding half while knocking on puller head to disengage fixed half.



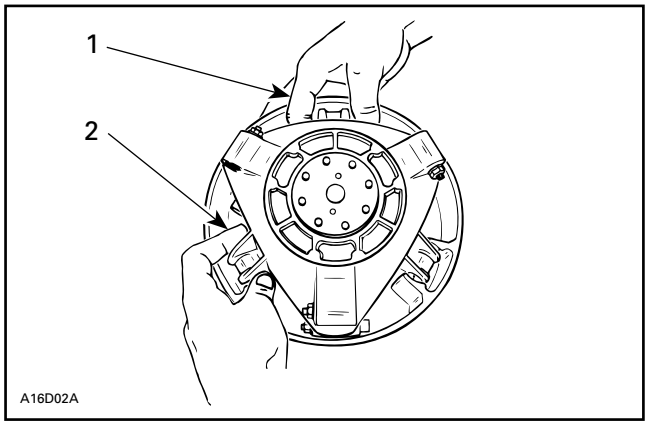
TYPICAL
1. Puller
2. Holding sliding half

NOTE: No components marking is required before disassembling this drive pulley since it has factory mark and arrows as indexing reference.

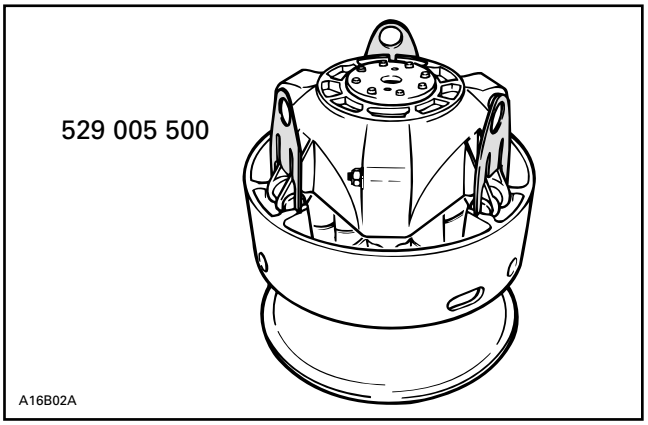
Slider Shoe and Governor Cup

Carefully lift governor cup **no. 7** until slider shoes **no. 9** come at their highest position into guides.

Hold a slider shoe set then carefully lift its housing and install a slider shoe fork (P/N 529 005 500). Proceed the same way for other housings lifting one at a time.



TYPICAL
1. Hold slider shoes
2. Lift one housing at a time



TYPICAL

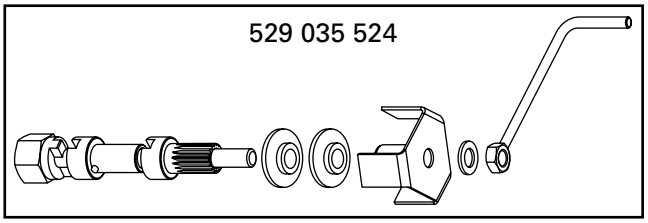
When all slider shoes are hold with the forks, remove the governor cup.

Spring Cover

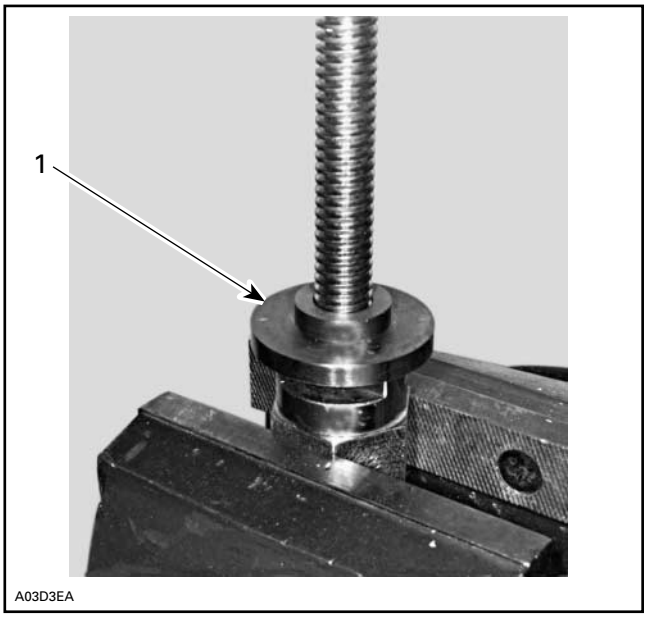
To remove the spring cover **no. 10**, always use the spring compressor (P/N 529 035 524). The spring cover is pushed by clutch spring pressure.

⚠ WARNING

Clutch spring is very strong. Never attempt to remove spring cover without the recommended tools.

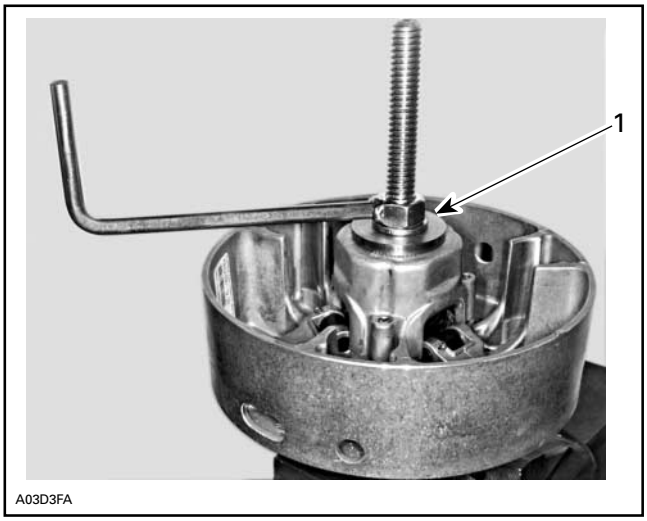


Install support guide of spring compressor in vice.



1. Support guide

Install sliding half **no. 8** then a second support guide. These support guides will prevent bushing damages.



TYPICAL
1. Support guide

Remove 3 Allen screws **no. 11** retaining spring cover then unscrew compressor.

Remove spring cover, spring **no. 12** and spring seat **no. 13**.

CLEANING

Fixed and Sliding Halves

Parts must be at room temperature before cleaning.

Clean pulley halves and shaft with fine steel wool and dry cloth.

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean crankshaft tapered end and the taper inside the fixed half of the drive pulley, crankshaft threads and retaining screw threads.

CAUTION: Avoid contact between cleaner and crankshaft seal because damage may occur.

Remove all hardened oil deposits that have baked on crankshaft and pulley tapered surfaces with coarse or medium steel wool and/or sand paper no. 600.

CAUTION: Do not use any other type of abrasive.

Reclean mounting surfaces with paper towel and cleaning solvent.

Wipe off the mounting surfaces with a clean, dry paper towel.

CAUTION: Mounting surfaces must be free of any oil, cleaner or towel residue.

Bushings

Clean sliding half bushing **no. 14** and spring cover bushing **no. 15** only with a petrol-based cleaner.

CAUTION: Do not use acetone to clean bushing.

INSPECTION

Drive pulley should be inspected annually.

Ring Gear

Check torque of ring gear screws. If a screw turns, verify screw surface and ring gear surface. If surface is worn, replace ring gear and screws. If screw is only loose, refer to ASSEMBLY for procedure and torque.

Thrust Washer and Roller

Check rollers **no. 16** for roundness of external diameter. Check thrust washers **no. 17** for thickness wear. Replace as required.

CAUTION: Ensure rollers are in good condition. Replace as required.

Lever Bolt and Flanged Bushing

Check the flanged bushing **no. 18** for wear. Replace if necessary.

Check lever bolts **no. 19** for wear, replace as required.

O-ring and Slider Shoe

Check if O-rings **no. 20** are cracked, cut or crushed. Replace as required.

Check slider shoes **no. 9** for wear. Replace if groove is not apparent on top.

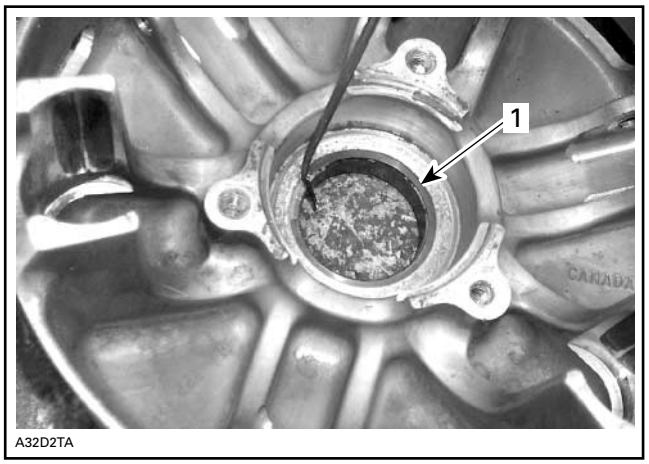
Sliding Half and Spring Cover Bushings

Visually inspect coating of bushings **no. 14** and **no. 15**. Replace if worn.

Sliding Half Bushing Replacement

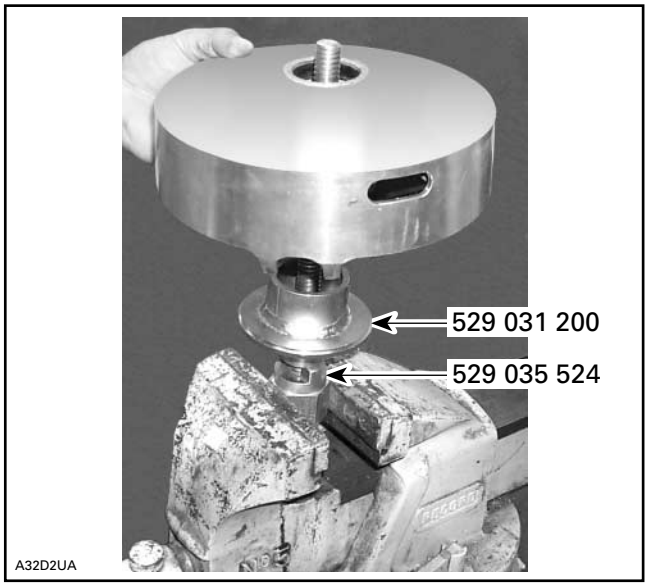
NOTE: In case of worn out bushing, it is advisable to replace whole sliding half assembly as replacing just the bushing may reduce the drive pulley performance.

Remove circlip **no. 21** from the sliding half.



TYPICAL
1. Circlip

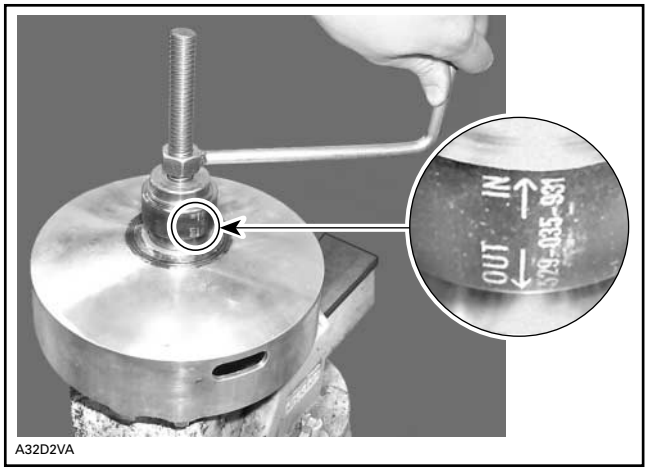
Secure the spring compressor (P/N 529 035 524) in a vice. Mount the bushing remover/installer (P/N 529 031 200) and the sliding half assembly on it.



TYPICAL

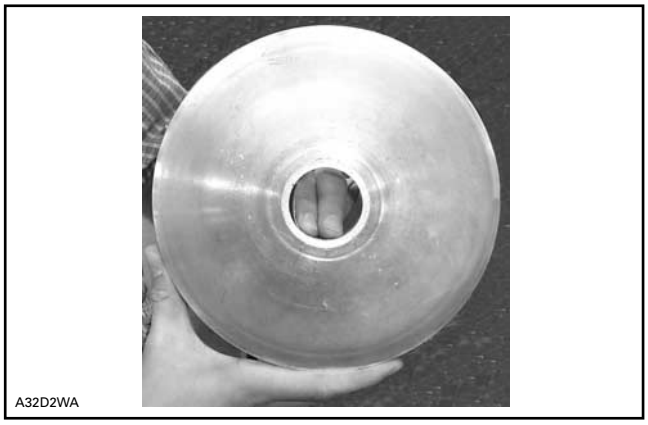
Use the sliding half bushing remover/installer (P/N 529 035 931) to press out old bushing.

NOTE: Make sure to use the tool as marked; to remove the bushing press using the side marked "OUT", as shown below in the picture.



TYPICAL

Use a soft sand paper to clean sliding half bushing mounting surface.


A32D2WA

Clean sliding half bushing mounting surface with pulley flange cleaner (P/N 413 711 809).

To install a new bushing, secure the spring compressor (P/N 529 035 524) in a vice and mount the sliding half .

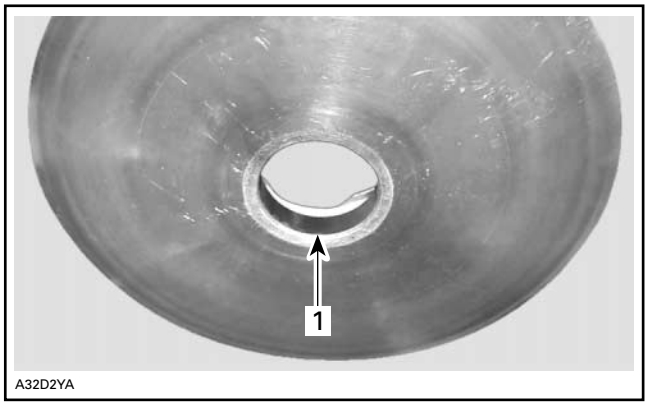
Apply Loctite 609 (P/N 413 703 100) on the outside of bushing face then insert the bushing from inner side of sliding half.

Mount the sliding half bushing remover/installer (P/N 529 035 931) with side marked "IN" to press in a new bushing.

A32D2XA

TYPICAL

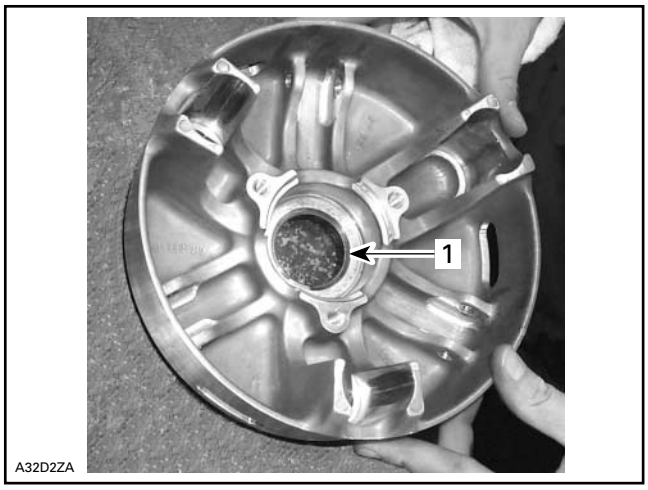
NOTE: Make sure that the bushing is well seated on the sliding half.



A32D2YA

1. Bushing

Install the circlip.



A32D2ZA

TYPICAL
1. Circlip

Spring Cover Bushing Replacement

Under normal use there is no need to replace this bushing **no. 15**.

In case of replacement, it's recommended to replace spring cover assembly.

ASSEMBLY

NOTE: This drive pulley is lubrication free. Do not lubricate any component.

Ring Gear

Clean ring gear **no. 5** and the inner threads of fixed half **no. 4**.

Apply few drop of Loctite 271 (red) (P/N 293 800 005) along the ring gear screw threads and at the bottom of the fixed half holes.

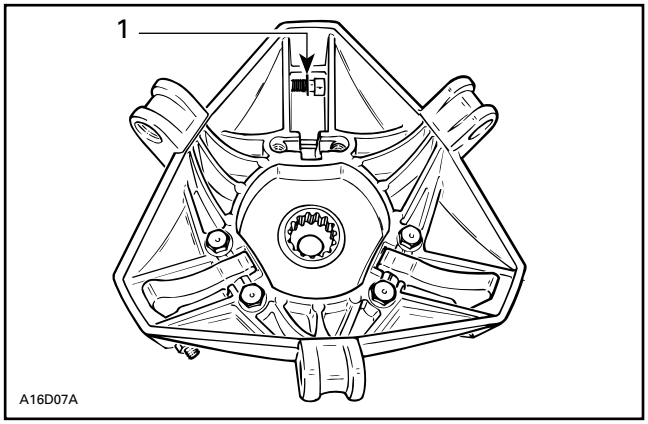
Torque ring gear screws.

CAUTION: Do not use other screws than recommended ones in the parts catalog. Never use bolts coming from another type of pulley.

RING GEAR ON TRA V	
ENGINE	TORQUE
All 995 SDI	53 N•m (39 lbf•ft)

Calibration Screw, Washer and Locking Nut

When installing calibration screw **no. 22**, make sure to install washer **no. 23** as shown.



TYPICAL
1. Washer

The calibration screws should be installed at the following position.

CALIBRATION SCREW POSITION		
MODEL	ENGINE	POSITION
Mach Z	995 SDI	6
Summit (Canada and U.S.A.)	995 SDI	4
Summit (Europe)	995 SDI	3

Torque locking nut **no. 24** to 10 N•m (89 lbf•**in**).

Pin

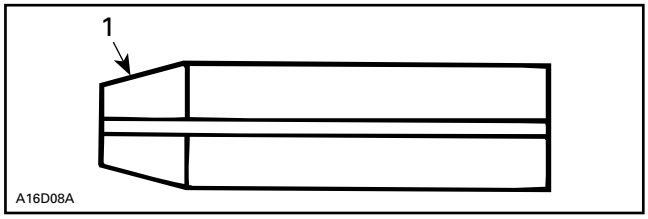
Always use the same type of pin **no. 25** as originally installed when servicing. Different types have different weights for calibration purpose. Refer to TECHNICAL DATA.

Use a heat gun for pin removal.

Apply Loctite 609 (P/N 413 703 100) between pin and lever when assembling.

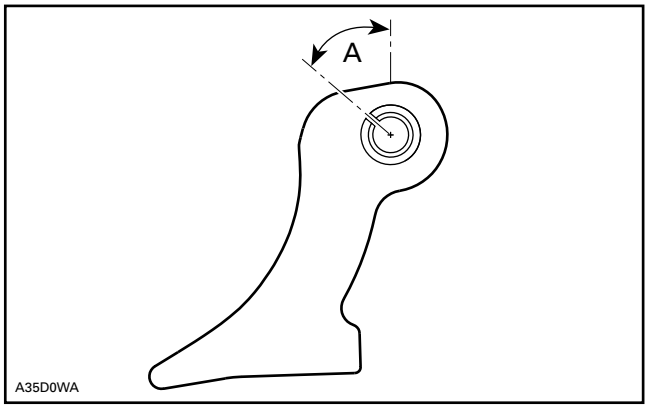
Dowel Tube and Ramp

Insert dowel tube **no. 26** from chamfered side. Make sure ramp **no. 27** is centered on dowel tube.

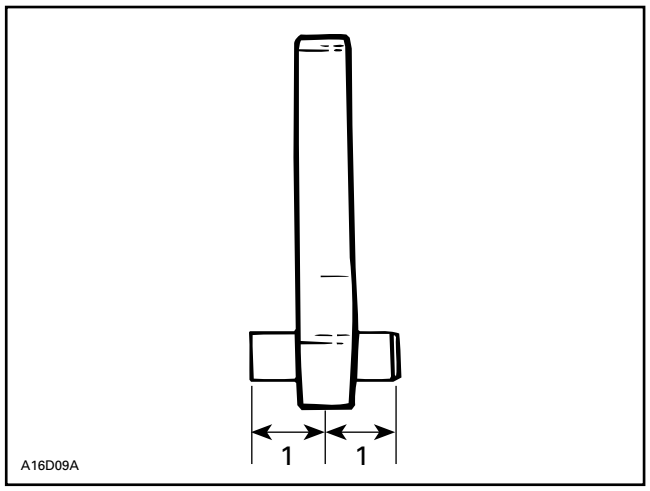


1. Chamfered side

Position dowel tube split at the angle A.



MODEL	ANGLE (A)
With TRA V	45 ± 3°



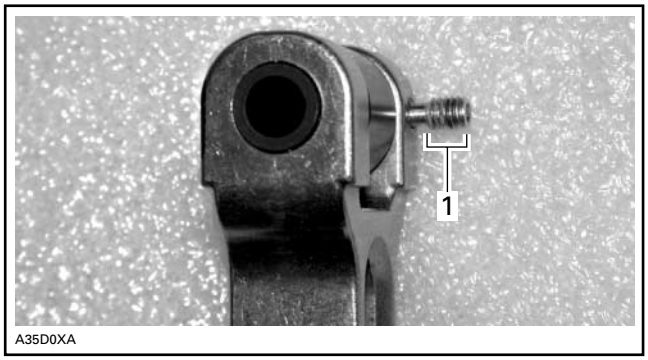
1. Equal distance

Torque screws **no. 28** to 10 N•m (89 lbf•**in**).

Lever, Roller and Set Screw

CAUTION: Although rollers of TRA V drive pulley can be replaced by other rollers from other TRA drive pulleys, such modifications should not be performed. The time life of the parts can be greatly affected. Use only recommended rollers specific for the TRA V drive pulley.

During set screw **no. 30** assembling, apply one drop of Loctite 609 (P/N 413 703 100) on set screw threads.



1. Set screw threads

While installing levers **no. 29** make sure that the BRP part number is visible.

⚠ WARNING

Whenever replacing centrifugal levers, always replace all 3 at the same time. Otherwise, drive pulley misbalancing will occur because of levers difference.

Torque lever bolts **no. 19** as per the exploded view.

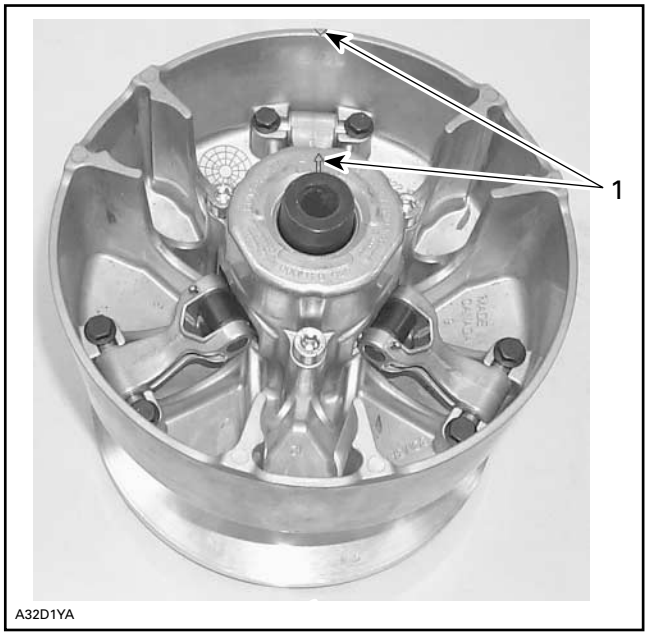
CAUTION: Lever assembly and rollers must move easily after installation.

Fixed Half, Sliding Half, Spring and Spring Cover

To install spring cover, use spring compressor (P/N 529 035 524).

Assemble fixed and sliding halves. Note that fixed halves have different taper angle. Match taper angle with crankshaft.

Lift sliding half against spring cover and align spring cover arrow with sliding half mark.

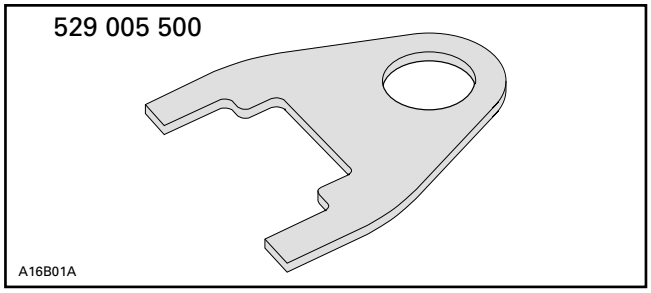


TYPICAL
1. Align

Tighten screws **no. 11** to proper torque as mentioned in exploded view.

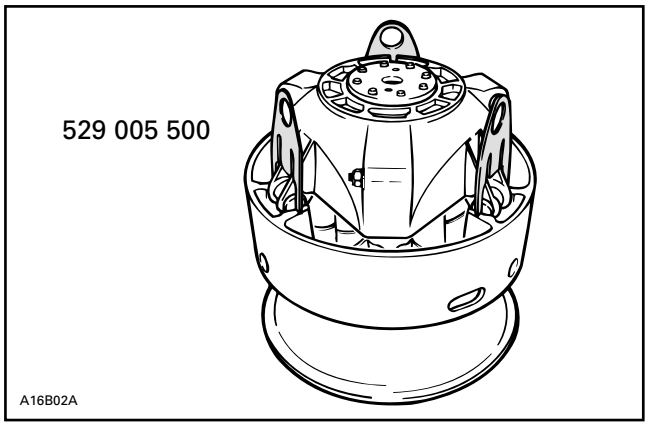
Sliding Half, Slider Shoe and Governor Cup

To install governor cup, use the slider shoe fork (P/N 529 005 500) following tool:



Insert O-rings **no. 20** and slider shoes **no. 9** into governor cup **no. 7** so that groove in each slider shoe is vertical to properly slide in guides.

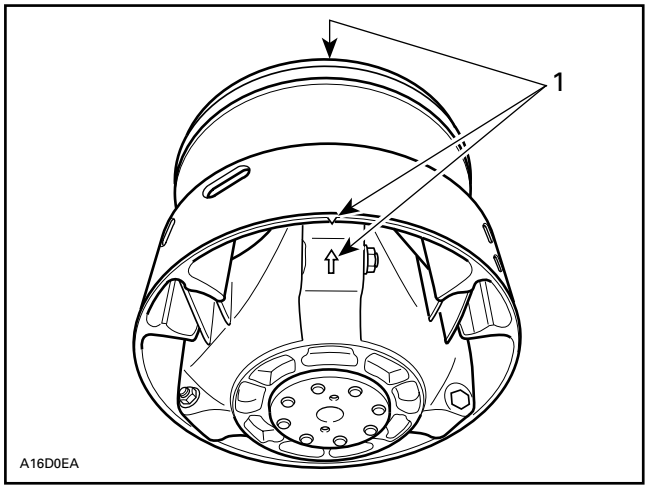
Install a slider shoe fork into slider shoe grooves to maintain them for governor cup installation. Proceed on 3 set of slider shoes.



TYPICAL

Make sure to align governor cup arrow with sliding half and fixed half mark.

NOTE: If fixed half has no mark, align governor cup mark with **segment no. 1 of inner half**. Segments are identified on engine side.



TYPICAL
1. Align

Carefully slide governor cup into sliding half. Align mark of governor cup with mark of fixed half.

Remove forks and push governor cup down.

INSTALLATION

CAUTION: Do not apply antiseize or any lubricant on crankshaft and drive pulley tapers.

CAUTION: Never use any type of impact wrench at drive pulley removal and installation.

Clean mounting surfaces as described in CLEANING above.

Drive Pulley Assembly

The following installation procedure must be strictly adhered.

Install drive pulley on crankshaft extension.

Install a new conical spring washer **no. 3** with its concave side towards drive pulley then install drive pulley bolt **no. 2**.

⚠ WARNING

Never substitute conical spring washer and/or bolt with jobber ones. Always use BRP genuine parts for this particular case.

Use the drive pulley holder (P/N 529 035 674). See removal procedure.

Torque drive pulley bolt to 120 N•m (89 lbf•ft).

Install drive belt and guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Retorque drive pulley bolt to 120 N•m (89 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the drive pulley bolt is properly torqued.

DRIVE PULLEY ADJUSTMENT

The drive pulley is factory calibrated to transmit maximum engine power at a predefined RPM. Factors such as ambient temperature, altitude or surface condition may vary this critical engine RPM thus affecting snowmobile efficiency.

This adjustable drive pulley allows setting maximum engine RPM in the vehicle to maintain maximum power.

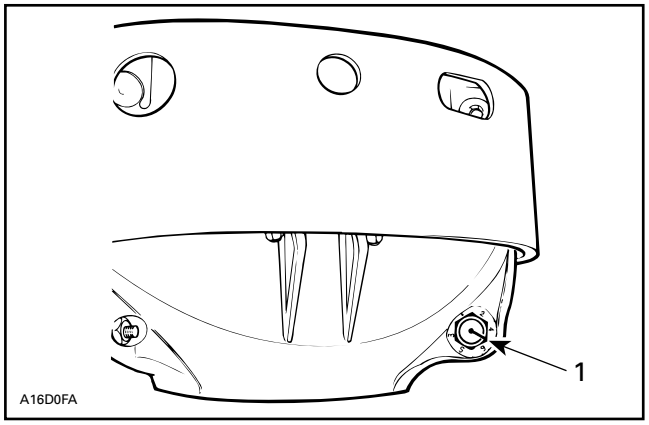
Calibration screws should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in TECHNICAL DATA.

NOTE: Use precision digital tachometer for engine RPM adjustment.

NOTE: The adjustment has an effect on high RPM only.

To adjust, modify ramp end position by turning calibration screws.

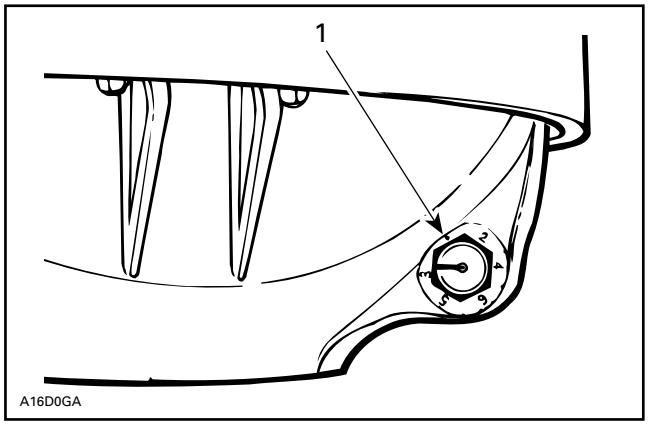
Calibration screw has a notch on top of its head.



TYPICAL
1. Notch

Governor cup has 6 positions numbered 1 to 6.

See the CALIBRATION SCREW POSITION table, above in this section, for original setting.



TYPICAL
1. Position 1 (not numbered)

Each number modifies maximum engine RPM by about 200 RPM.

Lower numbers decrease engine RPM in steps of 200 RPM and higher numbers increase it in steps of 200 RPM.

Example:

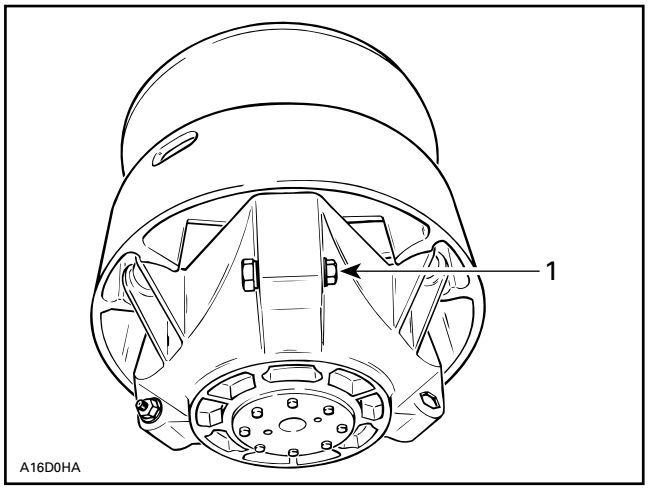
Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

To Adjust:

Just loosen locking nut enough to pull calibration screw **partially** out and adjust to desired position. Do not completely remove the locking nut. Torque locking nuts to 10 N•m (89 lbf•**in**).

CAUTION: Do not completely remove calibration screw otherwise its inside washer will fall off.

CAUTION: Always adjust all 3 calibration screws and make sure they are all set at the same number.



TYPICAL
1. Loosen just enough to permit rotating of calibration screw

DRIVEN PULLEY

SERVICE TOOLS

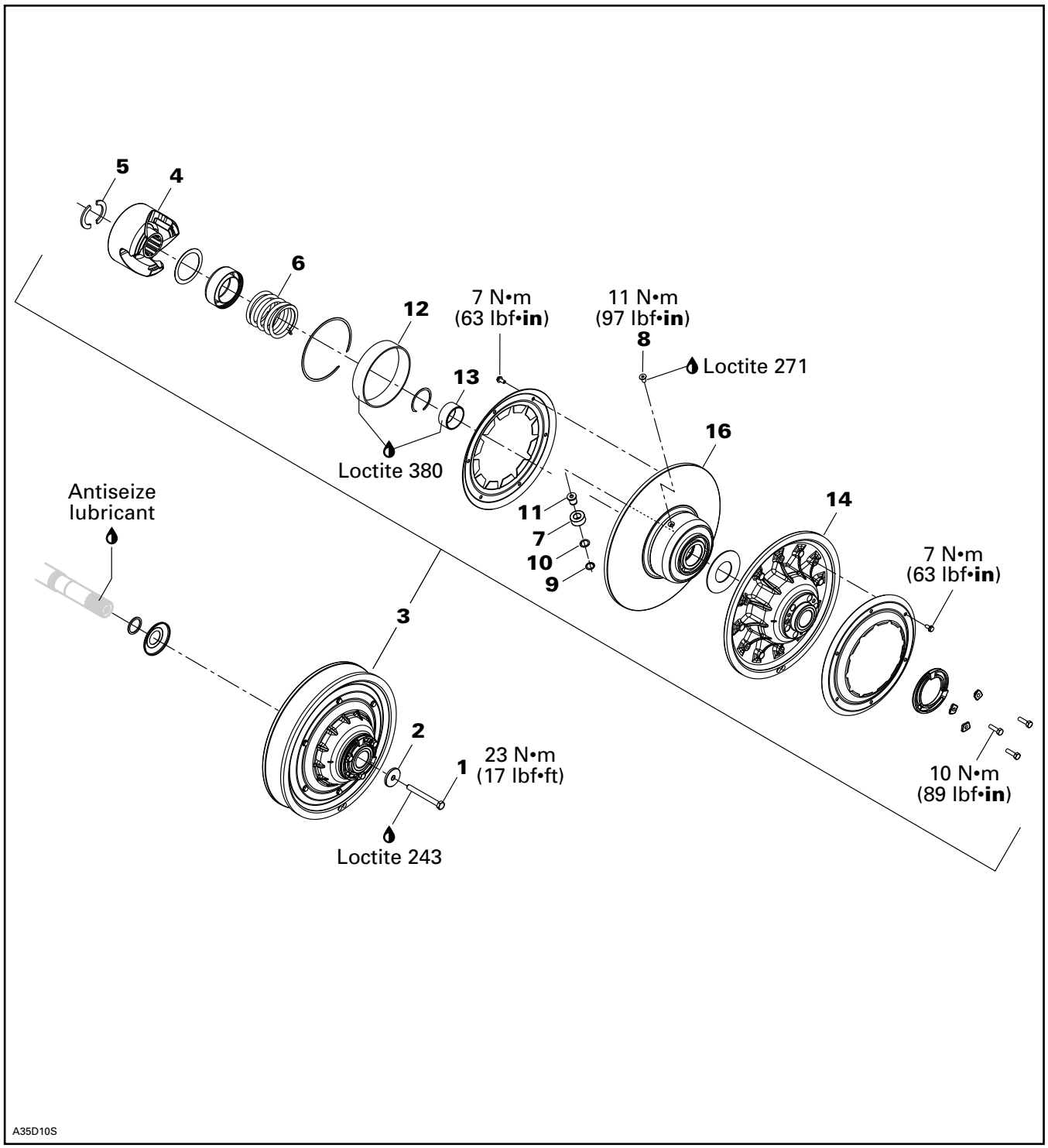
Description	Part Number	Page
bushing extractor/installer	529 031 300	206
clutch spring compressor	529 035 524	209
clutch spring compressor	529 036 012	203, 206
crankshaft protector	420 876 552	206
large bushing extractor	529 031 100	205
large bushing extractor	529 035 575	206
spring scale hook	529 006 500	211

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243 (blue)	293 800 060	205
Loctite 271 (red)	293 800 005	205
Loctite 380 (Black MAX)	413 408 300	206
Loctite antiseize lubricant	293 800 070	205, 210
pulley flange cleaner	413 711 809	204, 206, 209

HPV ROLLER

Mach Z Models



GENERAL

During assembly/installation, use the torque values and the service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Never start engine when the pulley guard is removed.

⚠ WARNING

The driven pulley is a precisely balanced unit. Never replace parts with used parts from another driven pulley.

REMOVAL

Driven Pulley

Remove belt guard and drive belt.

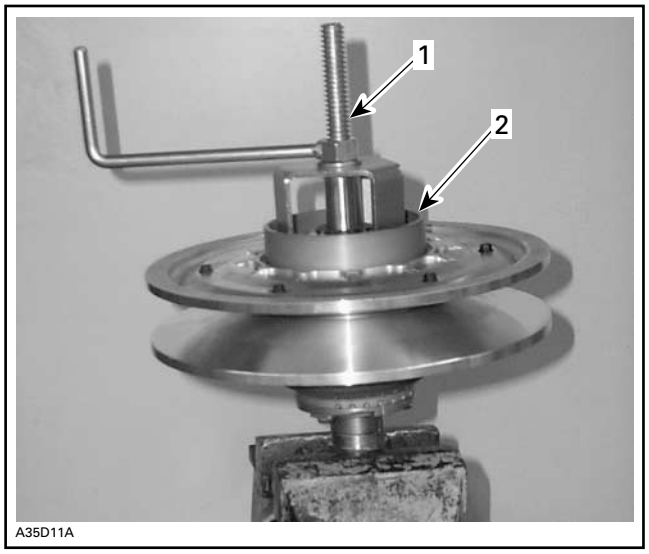
Remove driven pulley bolt **no. 1** and shouldered washer **no. 2** then pull the driven pulley **no. 3** from the countershaft.

Countershaft and Countershaft Bearing

To remove and install countershaft and its bearing refer to CHAINCASE.

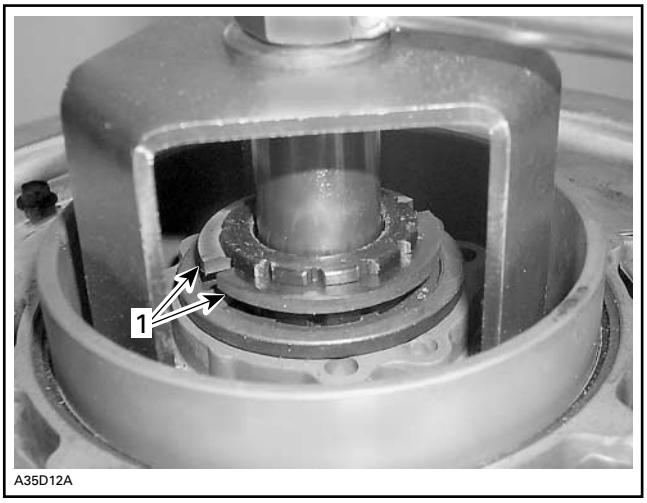
DISASSEMBLY

Using the clutch spring compressor (P/N 529 036 012), push the cam **no. 4**.



1. Clutch spring compressor
2. Cam

Remove the half keys **no. 5**.



1. Half keys

⚠ WARNING

Driven pulley cam is spring loaded, use only the above mentioned tool. Do not use other clutch spring compressor.

Unscrew clutch spring compressor then remove cam and spring **no. 6** and separate the 2 pulley halves.

Remove the circlip **no. 9** and the washer **no. 10** then remove the roller **no. 7** from the roller axle **no. 11**.

Remove the rollers axles in sliding half **no. 16** by unscrewing the roller axle screws **no. 8**. Heat screws to break the threadlocker.

CLEANING

Pulley Halves

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean pulley halves.

If necessary, use a fine steel wool and a dry cloth to remove a stubborn deposit.

Bushings and Cam

During break-in period (about 10 hours of use), teflon from bushing **no. 12** and **no. 13** moves to cam or shaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or shaft. Do not remove that deposit, it is not dust.

When a dust deposit has to be removed from the cam or the shaft, use dry cloth to avoid removing transferred teflon.

INSPECTION

NOTE: Inner flanges, threads, countershaft and all surfaces which have contacts with other moving parts must be free of dust, scratches or rust.

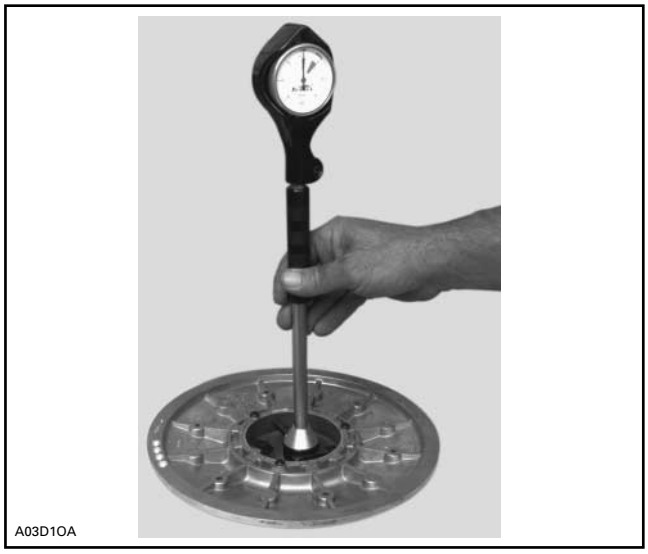
Pulley Halves

Check pulley halves for marks or scratches.

Check splines in fixed half pulley **no. 14**.

Bushings

Using a dial bore gauge, measure the inner diameter of small and large bushings **no. 12** and **no. 13**. Measuring point must be at least 5 mm (1/4 in) from bushing edge.



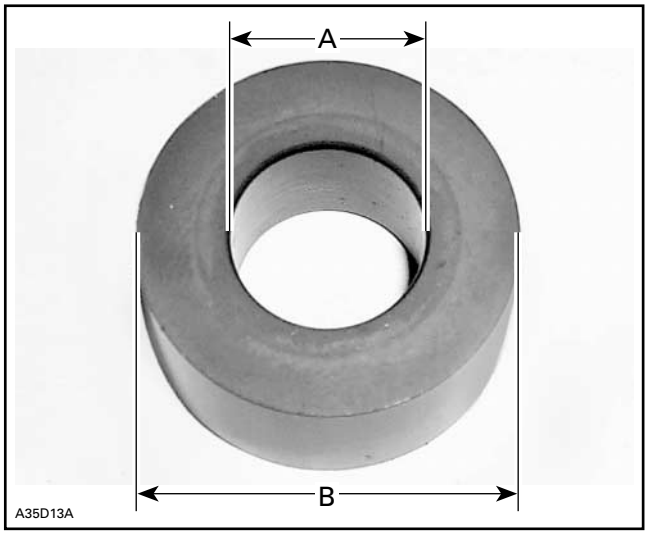
BUSHING	SERVICE LIMIT
Small bushing	38.30 mm (1.508 in)
Large bushing	108.2 mm (4.260 in)

Replace the bushing if the measurement is out of specification. Refer to BUSHING REPLACEMENT at the end of this section.

Rollers

Check the rollers **no. 7** for flat spots, cracks or other visible damages.

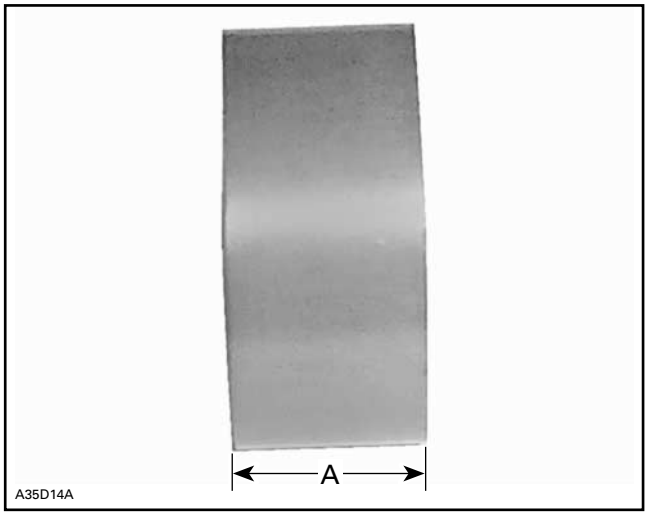
Measure inner and outer diameter of rollers.



A. Inner diameter
B. Outer diameter

ROLLER DIAMETER	SERVICE LIMIT
Inner diameter	12.5 mm (.492 in)
Outer diameter	23.5 mm (.925 in)

Measure the roller thickness.



A. Thickness of roller

ROLLER THICKNESS	
Service limit	10.5 mm (.413 in)

Cam

Verify contact surfaces of cam **no. 4** for visible damages.

Check splines condition.

ASSEMBLY

The assembly is the reverse of the disassembly procedure. However, pay attention to the following details.

Clean threads of roller axles **no. 11** before installing their screws **no. 8**. Apply Loctite 271 (red) (P/N 293 800 005) on screw threads. Torque screws to 11 N•m (97 lbf•**in**).

Make sure to install the proper cam. The cam angle is indicated on the cam. Refer to TECHNICAL DATA to know which cam must be used.

During cam installation, make sure to align the cam slides with the rollers.

INSTALLATION

The installation is the reverse of the removal procedure. However, pay attention to the following details.

Apply Loctite antiseize lubricant (P/N 293 800 070) on countershaft splines.

Apply Loctite 243 (blue) (P/N 293 800 060) on driven pulley bolt.

Perform a pulley alignment before starting engine and verify drive belt height. Refer to PULLEY ALIGNMENT and DRIVE BELT.

BUSHING REPLACEMENT

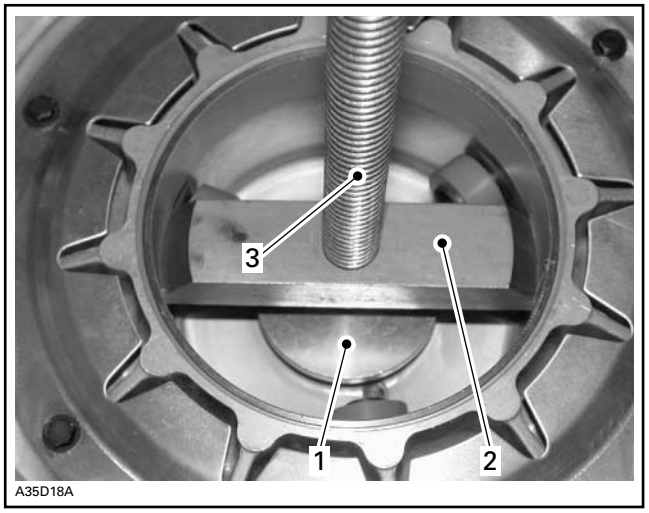
Large Bushing

Remove circlip.

Install the support plate included in the large bushing extractor (P/N 529 031 100) inside sliding half.

A35D17A

Place the large bushing extractor (P/N 529 035 575) below bushing and screw the threaded rod of the clutch spring compressor (P/N 529 036 012) in the large bushing extractor hole until the end of threaded rod reaches against the support plate.



A35D18A

TYPICAL
1. *Support plate*
2. *Large bushing extractor*
3. *Threaded rod of spring compressor*

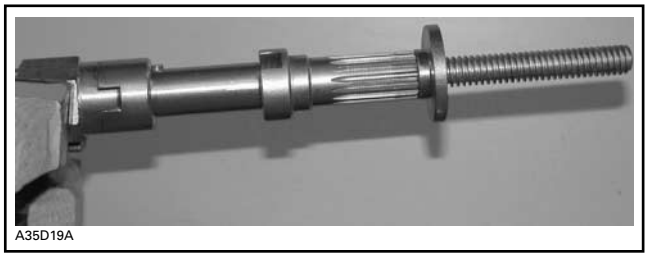
Mount the clutch spring compressor head in a vise.

Using a heat gun, heat bushing to break the adhesive product.

Turn pulley half by hand to extract old bushing.

Before bushing installation, clean residues of adhesive product by using pulley flange cleaner (P/N 413 711 809).

On threaded rod install both sleeves and one spacer included with the clutch spring compressor (P/N 529 036 012).


A35D19A

Coat bushing outside diameter with Loctite 380 (Black MAX) (P/N 413 408 300). Place new bushing on sliding half and slightly tap to engage squarely the bushing in the sliding.

Install the sliding pulley on threaded rod and screw in the large bushing extractor (P/N 529 035 575).

A35D1AA

Turn pulley half by hand to insert the new bushing.

NOTE: Change the position of extractor often to push the bushing straight.

Install circlip.

Small Bushing

Remove circlip.

Using a press, extract the small bushing. Push the bushing out of its location by using a pipe with proper diameter.

Clean residues of adhesive product by using pulley flange cleaner (P/N 413 711 809).

Coat bushing outside diameter with Loctite 380 (Black MAX) (P/N 413 408 300).

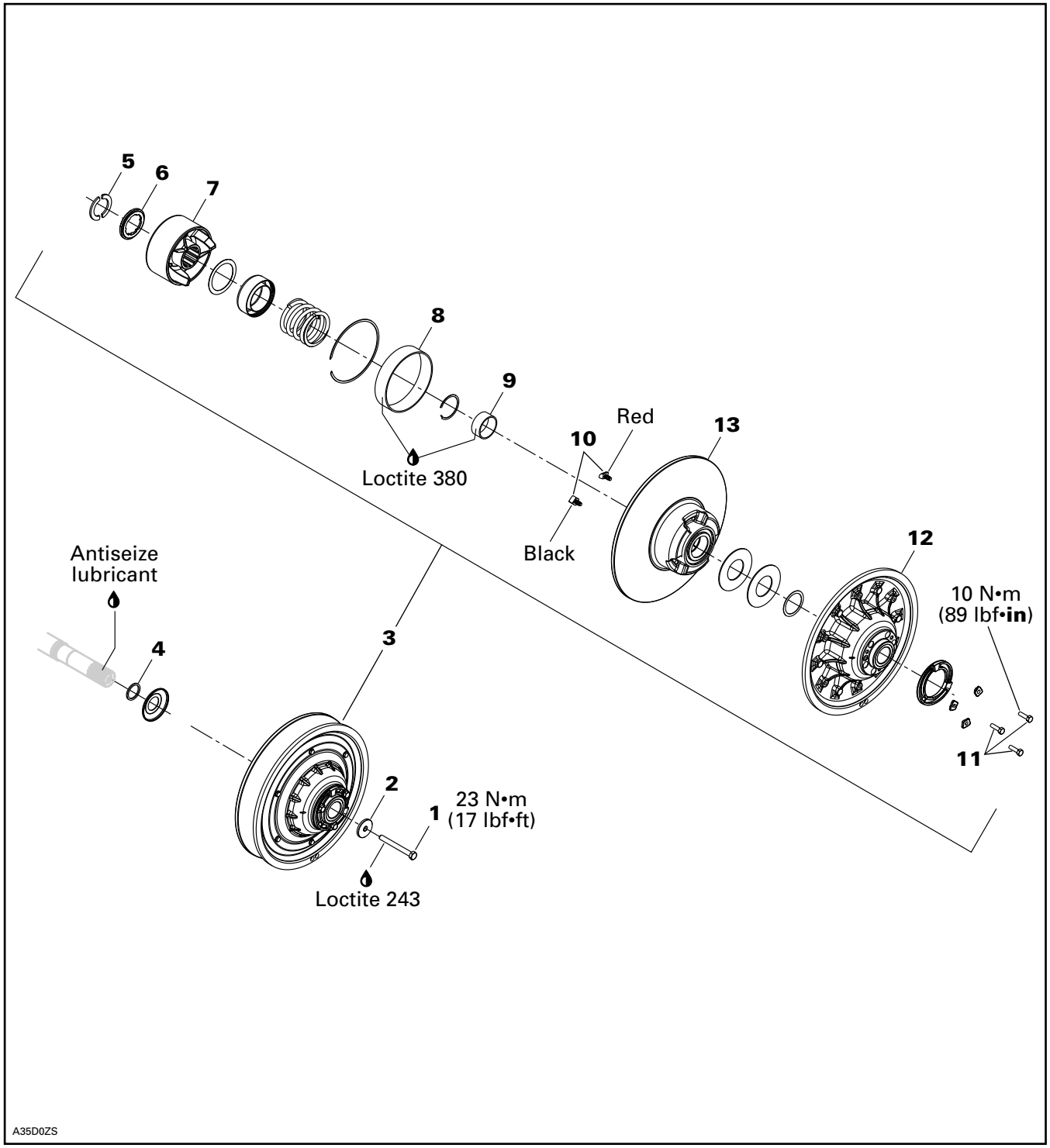
Using press, bushing extractor/installer (P/N 529 031 300) and the crankshaft protector (P/N 420 876 552), insert small bushing in its location.

A35D1BA

Install circlip.

HPV VSA

Summit Highmark and Summit Highmark X Models



GENERAL

During assembly/installation, use the torque values and the service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Never start engine when the pulley guard is removed.

⚠ WARNING

The driven pulley is a precisely balanced unit. Never replace parts with used parts from another driven pulley.

REMOVAL

Remove guard and drive belt from vehicle.

Remove driven pulley bolt **no. 1** and shouldered washer **no. 2** then pull the driven pulley **no. 3** from the countershaft.

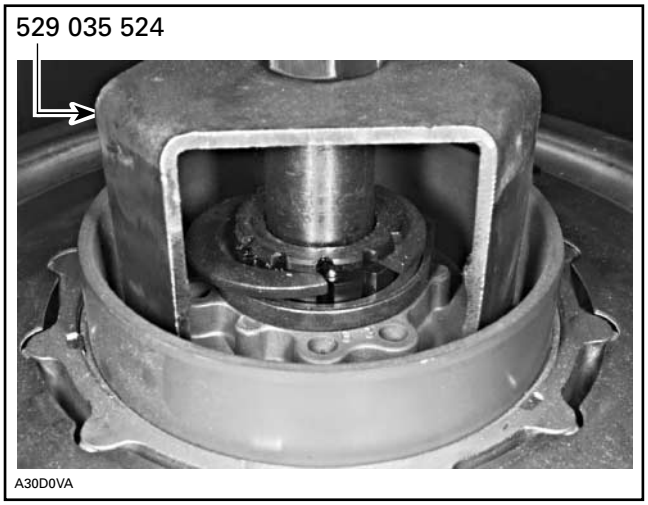
Note shouldered washer position for reinstallation. Take care not to lose spacer **no. 4**.

Countershaft

Should countershaft removal be required, refer to CHAINCASE.

DISASSEMBLY

Use clutch spring compressor (P/N 529 035 524).



TYPICAL

Remove half keys **no. 5** and washer **no. 6** to disassemble the cam **no. 7** and the 2 pulley halves.

⚠ WARNING

Driven pulley cam is spring loaded, use above mentioned tool.

CLEANING

Large Bushing and Small Bushing

During break-in period (about 10 hours of use), teflon from bushing **no. 8** and **no. 9** moves to cam or shaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or shaft. Do not remove that deposit, it is not dust.

When a dust deposit has to be removed from the cam or the shaft, use dry cloth to avoid removing transferred teflon.

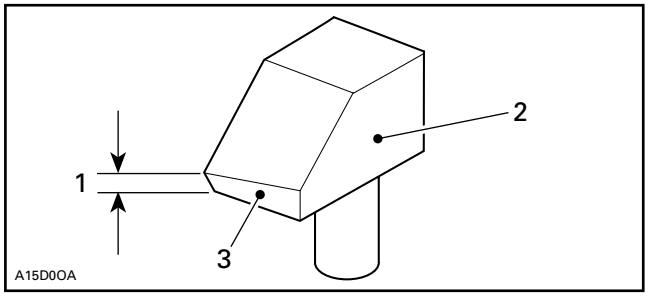
Pulley Half Cleaning

Use pulley flange cleaner (P/N 413 711 809) to clean pulley halves.

INSPECTION

Slider Shoe

Check cam slider shoes **no. 10** for wear. Replace when inside edge thickness of cam slider shoe slope base is worn to 1 mm (.039 in) or less.



1. Measure thickness of slope base here
2. Sliding pulley side
3. Slope base

Bushings

Measure the inner diameter of small and large bushings **no. 8** and **no. 9**.

BUSHING	SERVICE LIMIT
Small bushing	38.30 mm (1.508 in)
Large bushing	108.2 mm (4.260 in)

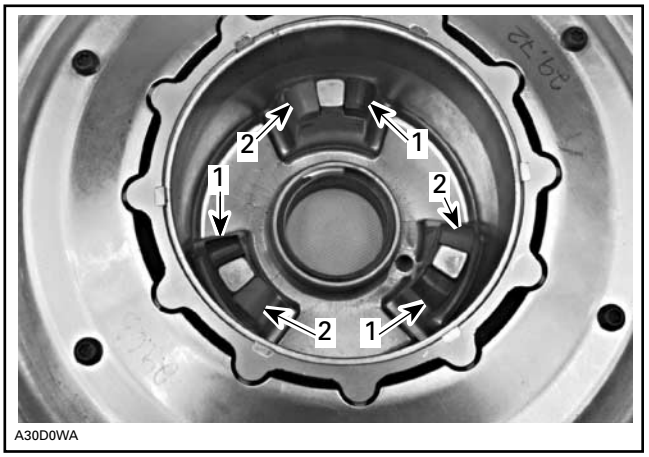
Replace the bushing if the measurement is out of specification. Refer to BUSHING REPLACEMENT at the end of this section.

ASSEMBLY

Cam Slider Shoe

When replacing slider shoes **no. 10**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Install slider shoes as per following photo. Red slider shoes are being used for reverse and black ones for forward.



1. BLACK slider shoe
2. RED slider shoe

Screws

Screws **no. 11** are machined at their end. With the adjustment ring steel to position 0 (zero), screw ends are flush with inner side of fixed pulley half **no. 12** when tighten.

CAUTION: If any of these screws is not flush with inner side of sliding pulley no. 13, bushings will worn unequally.

Assemble driven pulley components by reversing the disassembly procedure.

Cam

Coat cam **no. 7** interior with Loctite antiseize lubricant (P/N 293 800 070).

INSTALLATION

Apply Loctite antiseize lubricant (P/N 293 800 070) on countershaft splines.

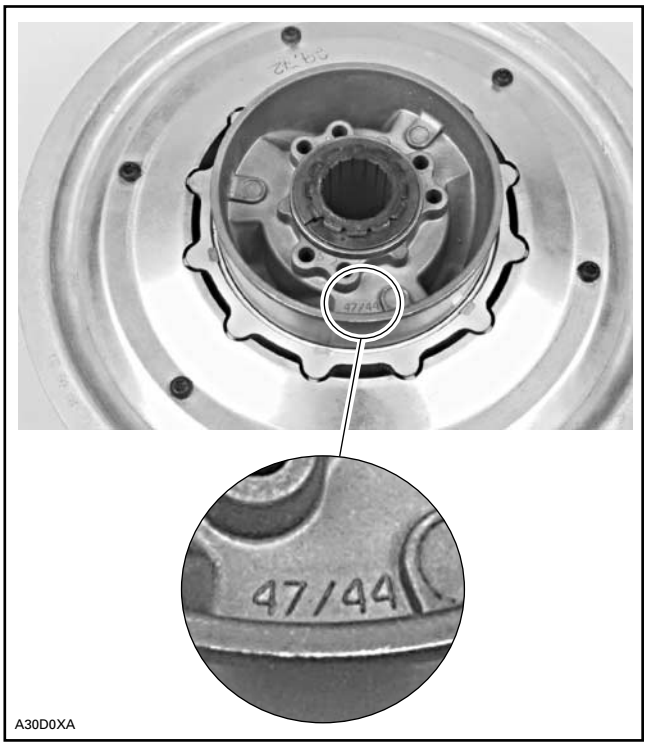
Reinstall the driven pulley on the countershaft by reversing the removal procedure.

ADJUSTMENT

Cam

Make sure to install proper cam **no. 7**. Refer to TECHNICAL DATA.

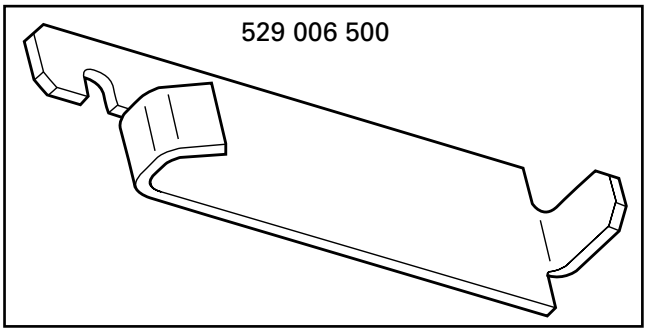
Cam angle is identified on cam.



NOTE: For high altitude regions, a service bulletin will give information about calibration according to altitude.

Spring

To check spring preload adjustment, use the spring scale hook (P/N 529 006 500) and a spring scale.



Remove drive belt.

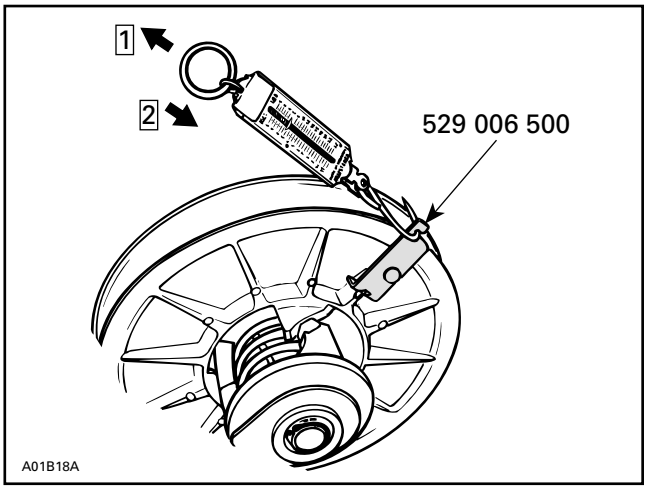
Install the hook on the sliding half **no. 12**. Preventing fixed half from turning, pull sliding half with the spring scale perpendicularly with pulley axle.

Take first measurement when sliding half begins to turn. Rotate sliding half to 10 mm (3/8 in) of rotation. Hold spring scale at this position. Slowly release tension from spring scale and take second measurement when sliding half begins to return. Spring preload is the average measurement between these 2.

$$\frac{\text{First measurement (when opening)} + \text{Second measurement (when closing)}}{2} = \text{Spring preload}$$

EXAMPLE:

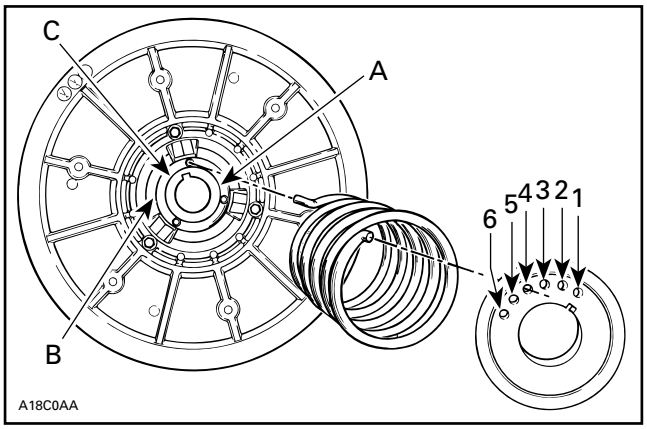
$$\frac{3.8\ \text{kg}\ (8.4\ \text{lb})\ \text{(when opening)} + 3.4\ \text{kg}\ (7.5\ \text{lb})\ \text{(when closing)}}{2} = 3.6\ \text{kg}\ (8\ \text{lb})\ \text{actual spring preload}$$



TYPICAL
1. Pull for the first measurement
2. Release slowly for the second measurement

To adjust spring preload, relocated spring end in cam, moving it clockwise to increase the preload and counterclockwise to decrease it. Refer to TECHNICAL DATA.

NOTE: If the spring preload can not be adjusted, try to relocate the other end of spring in sliding pulley (holes A, B or C).



LETTERS AND NUMBERS SHOWN IN ILLUSTRATION ARE ACTUAL LETTERS AND NUMBERS EMBOSSED ON PARTS

NOTE: Always recheck torsional preload after adjusting.

Pulley Alignment and Drive Belt Height

Refer to PULLEY ALIGNMENT and DRIVE BELT to perform adjustments.

CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

PULLEY ALIGNMENT

SERVICE TOOLS

Description	Part Number	Page
alignment bar	529 035 831	214
driven pulley opening tool	529 017 200	213

GENERAL

Pulley alignment must be checked out to ensure the highest efficiency of the transmission system. Furthermore, optimum drive belt operation and minimal wear will be obtained only with proper pulley alignment.

CAUTION: Before checking pulley adjustment, the rear suspension must be mounted on the vehicle and track tension/alignment must be done. Always check pulley adjustment after suspension is adjusted.

⚠ WARNING

Failure to correctly perform pulley alignment may cause the vehicle to creep forward at idle.

All Pulley Alignment Specifications Refer to:

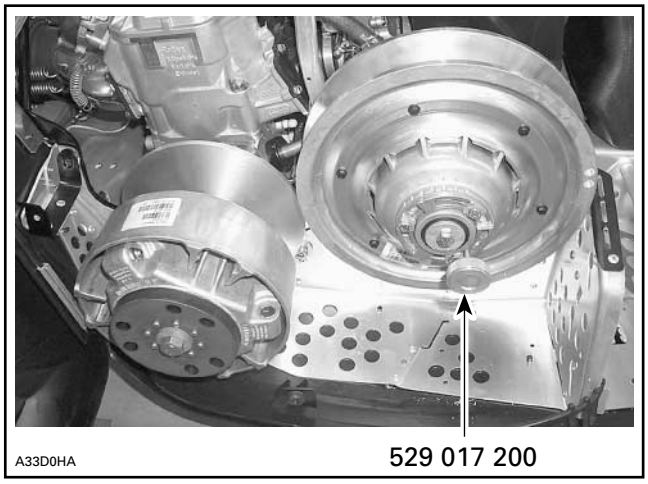
X = Distance between straight bar and drive pulley fixed half edge, measured between pulleys.

Y = Distance between straight bar and drive pulley fixed half edge, measured at the end of straight bar.

MEASURING PROCEDURE

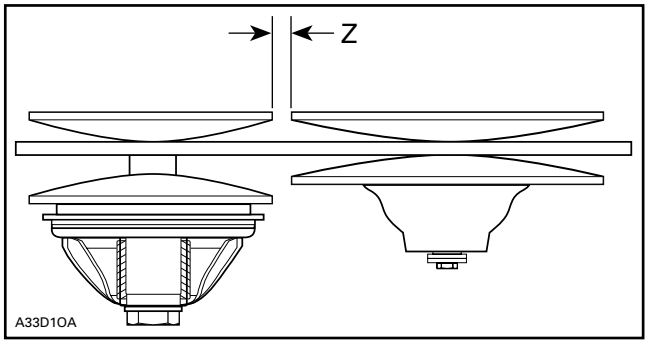
Remove guard, drive belt and air silencer.

By using driven pulley opening tool (P/N 529 017 200) push the sliding half to open the driven pulley.



TYPICAL — DRIVEN PULLEY OPENING TOOL

Measure the distance between both pulleys to know if the engine and the frame are positioned correctly. The distance pulley is not adjustable on the RT series vehicles.



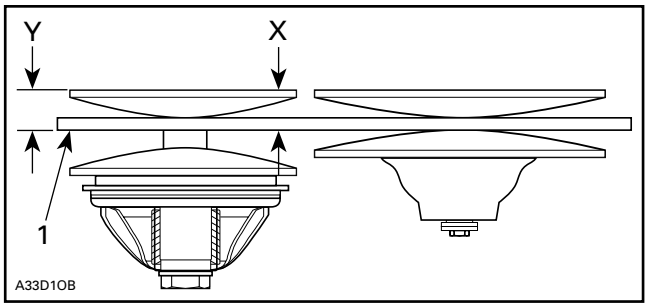
TYPICAL
Z = Distance between both pulleys

PULLEY DISTANCE	
MODEL	DISTANCE
HPV roller	27.5 mm (1.083 in)

Insert the alignment bar (P/N 529 035 831) into the opened driven pulley.

TYPICAL — ALIGNMENT BAR IN PULLEYS

Always measure distances X and Y from the farther straight bar side (including its thickness to the fixed half edge).



TYPICAL
1. Straight bar

The distance Y **must** exceed distance X to compensate for the twist due to the engine torque.

DRIVE PULLEYS ALIGNMENT		
MODEL	OFFSET mm (in)	
	X	Y-X
	± 0.50 (.020)	
HPV roller	37.0 (1.456)	1.23 (0.048)

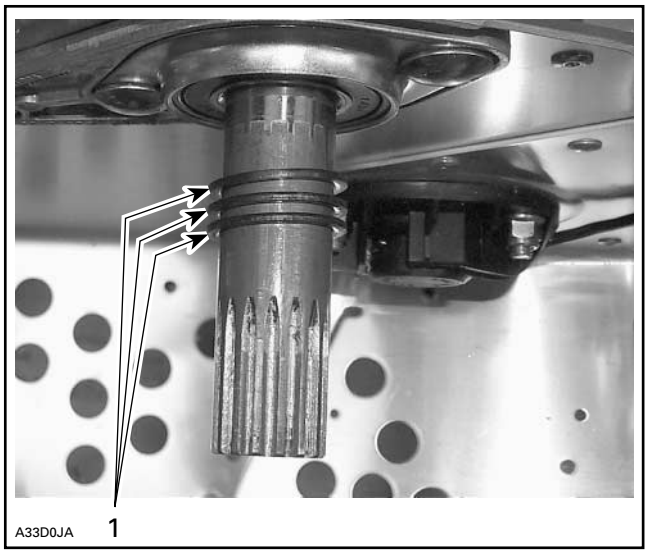
If an alignment is necessary, see ALIGNMENT PROCEDURE below.

If the alignment is good, hand torque the torque rod so it slightly contacts engine crankcase. Do not over tighten, it will disalign pulleys.

When the alignment is done, refer to DRIVE BELT to adjust the drive belt deflection.

ALIGNMENT PROCEDURE

Remove driven pulley and add or remove spacer(s) as required to obtain the specified alignment.



TYPICAL
1. Spacers

Use the following table to choose the proper shim(s).

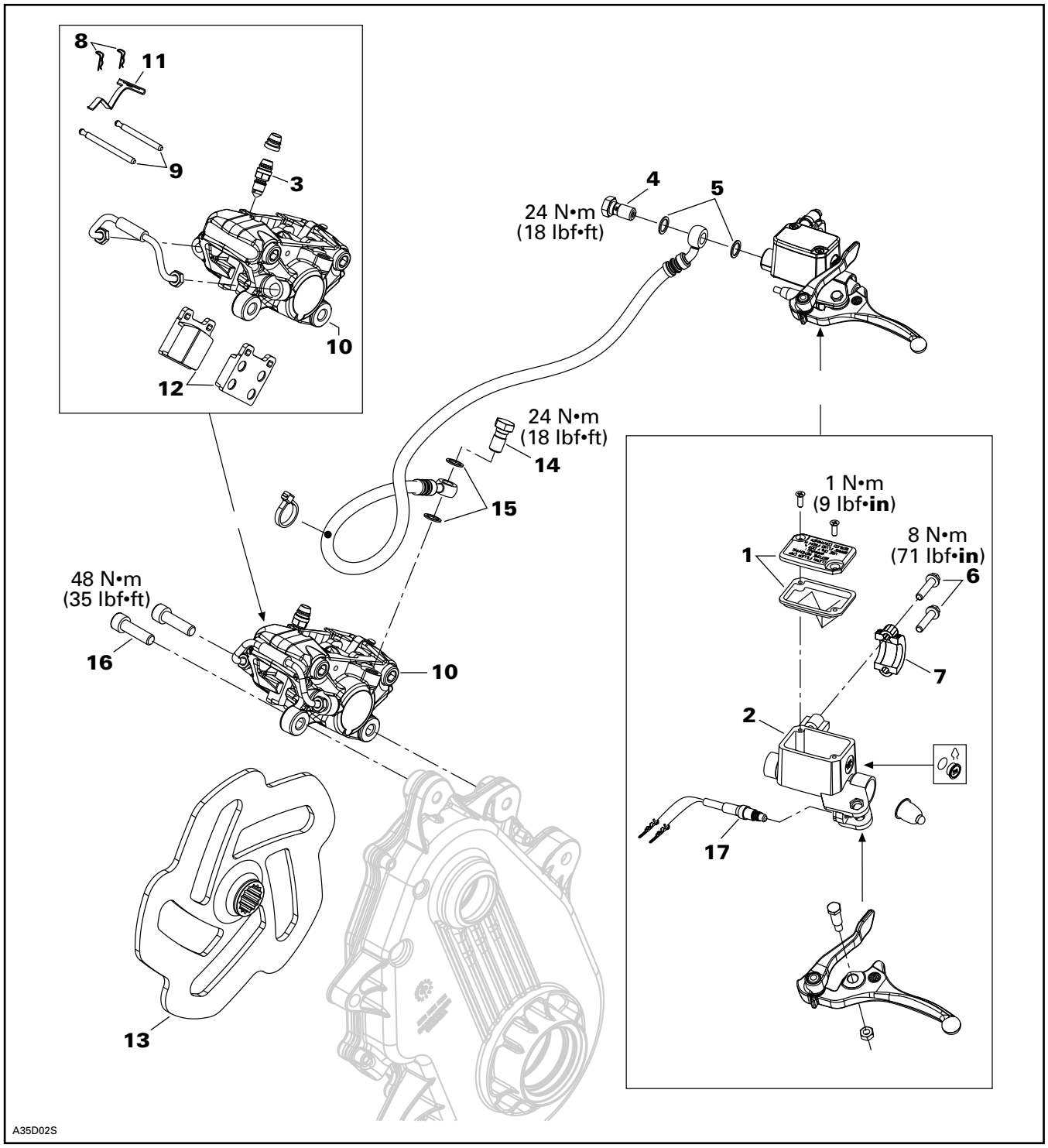
SHIM CHART	
SHIM NUMBER	SHIM THICKNESS mm (in)
504 112 000	0.42 ± 0.05 (.017 ± .002)
417 300 265	1.02 ± 0.10 (.040 ± .004)
417 300 252	2.06 ± 0.15 (.081 ± .006)

When the alignment is done, refer to DRIVE BELT to adjust the drive belt deflection.

BRAKE

SERVICE PRODUCTS

Description	Part Number	Page
DOT 4 brake fluid GTLMA	293 600 062	217
DOT 4 brake fluid SRF	293 600 063	217
Loctite 609	413 703 100	221


8
11
9
3
10
12
4
5
24 N•m
(18 lbf•ft)
24 N•m
(18 lbf•ft)
14
15
48 N•m
(35 lbf•ft)
16
10
13
1 N•m
(9 lbf•in)
8 N•m
(71 lbf•in)
1
6
7
2
17
A35D02S

GENERAL

During assembly/installation, use torque values and service products as in the exploded view.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pins, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

A contaminated brake disc or pad reduces stopping power. Discard contaminated pads and clean contaminated disc with a high quality brake degreasing agent.

CAUTION: Avoid spilling brake fluid on plastic, rubber or painted parts. Protect these parts with a rag when servicing brake system.

COUNTERSHAFT BEARING

Refer to CHAINCASE for complete procedure.

COUNTERSHAFT

Refer to CHAINCASE for complete procedure.

BRAKE FLUID

The brake fluid must be changed in accordance with the maintenance chart.

Use recommended DOT 4 brake fluid SRF (P/N 293 600 063) or DOT 4 brake fluid GTLMA (P/N 293 600 062).

CAUTION: Use only DOT 4 brake fluid. Do not use fluids other than the recommended one, nor mix different fluids for topping up.

DRAINING

Remove reservoir cover **no. 1** on master cylinder **no. 2**.

Install a clear hose on caliper bleed valve **no. 3**. Route this hose to a container.

Loosen bleed valve and pump brake lever until no more fluid flows out of bleed valve.

Close bleed valve and remove bleed hose.

BLEEDING

Bleed brake system as follows:

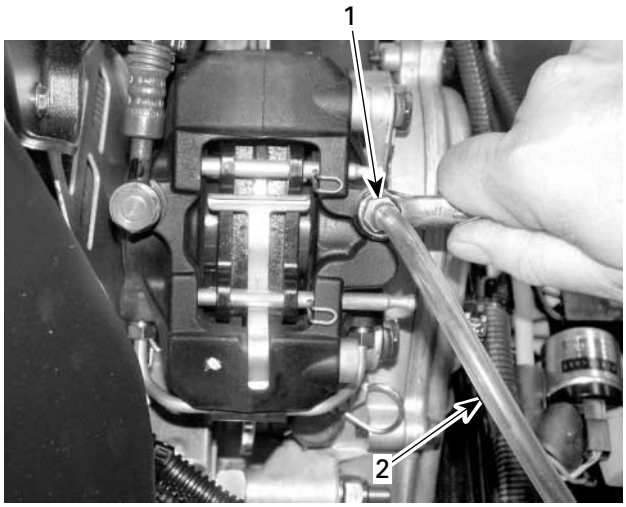
Keep sufficient recommended DOT 4 brake fluid SRF (P/N 293 600 063) or DOT 4 brake fluid GTLMA (P/N 293 600 062) in reservoir at all times.

CAUTION: Use only DOT 4 brake fluid. Do not use fluids other than the recommended one, nor mix different fluids for topping up.

Install a clear hose on bleed valve **no. 3**. Route this hose to a container. Open bleed valve.

Pump brake lever until no air escapes from hose.

Close bleed valve.



TYPICAL
1. *Open bleed valve*
2. *Clear hose to catch used brake fluid*

⚠ WARNING

Avoid getting oil on brake pads.

MASTER CYLINDER

Removal

Drain brake fluid until master cylinder **no. 2** is empty.

Remove the Banjo bolt **no. 4** and discard the sealing rings **no. 5**.

Unscrew master cylinder screws **no. 6** from the master cylinder holder **no. 7** then remove master cylinder from handlebar.

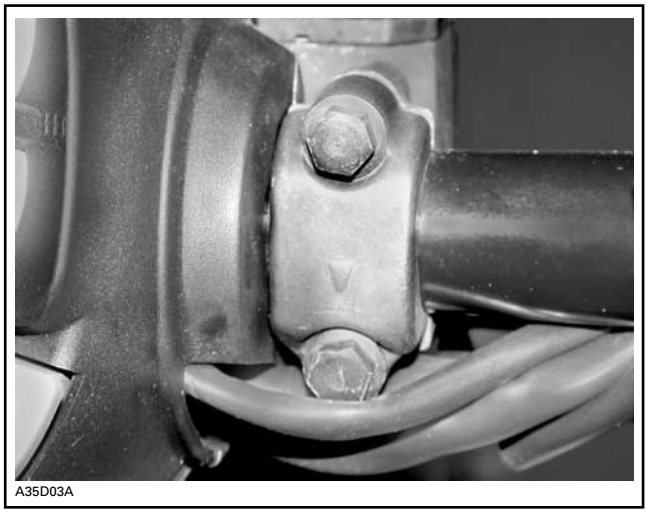
Inspection

Check master cylinder for cracks or leakage. Replace if necessary.

Installation

The installation is essentially the reverse of the removal procedure but pay attention at the following.

Install the master cylinder holder **no. 7** with the arrow pointing downwards.

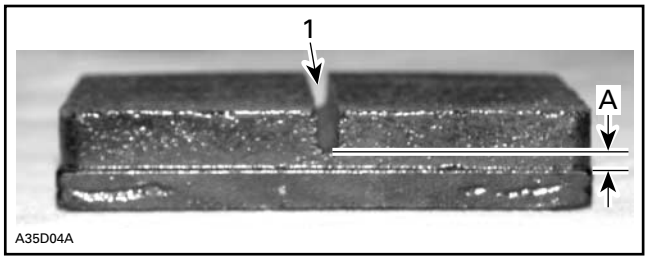

A35D03A

Torque the lower screw first to 8 N•m (71 lbf•**in**) then the upper screw to the same torque.

BRAKE PADS

Inspection

Look the slot on pad lining. Replace brake pads when the slot is disappeared. If the slot disappears, the lining is less than 1 mm (1/32 in).

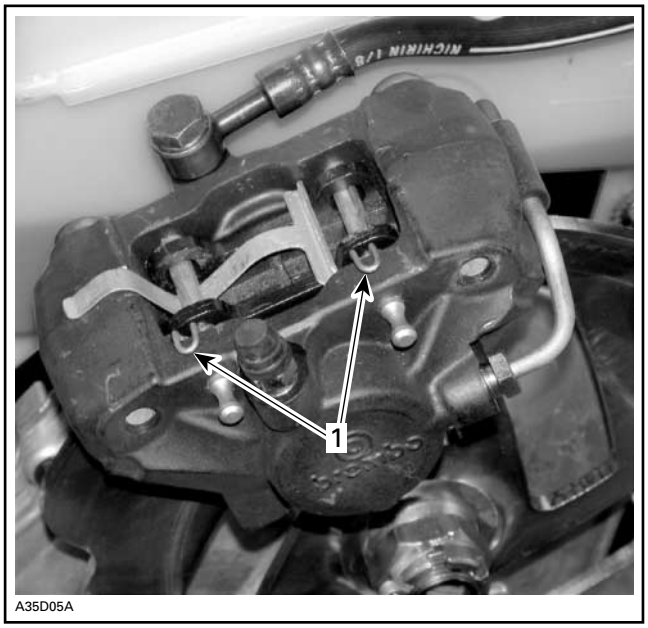


A35D04A

1. Slot on pad lining
A. Brake pad minimum thickness 1 mm (1/32 in)

Removal

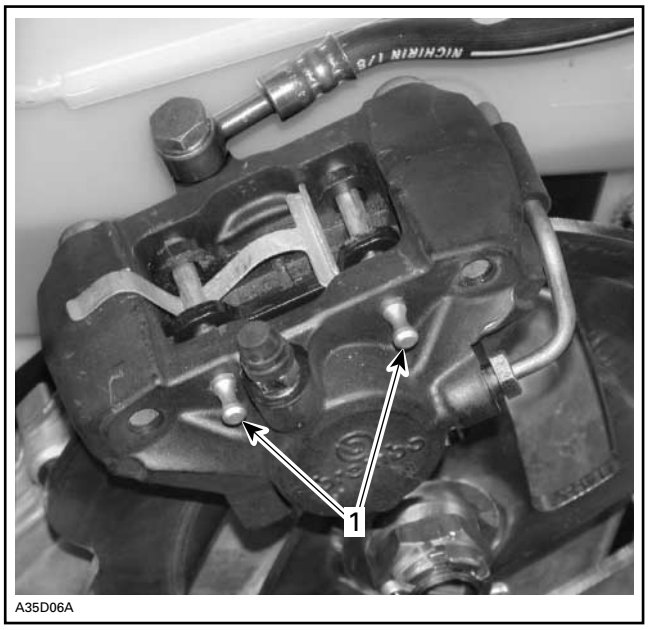
Remove clips **no. 8** that retain pad pins **no. 9**.



A35D05A

1. Clips

Pull pad pins out of caliper **no. 10**.



1. Pad pins

Remove pad spring **no. 11**.

1. Pad spring

Remove brake pads **no. 12** from caliper.

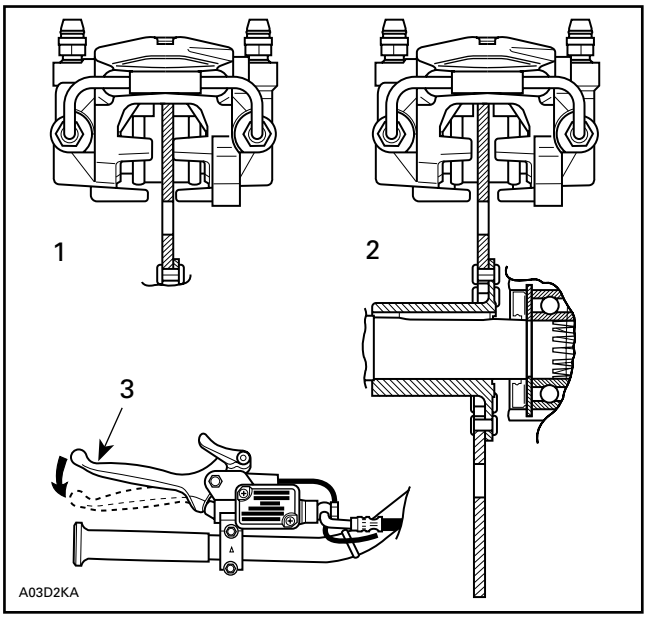
Installation

Clean pistons then push them inward before installing new brake pads.

Install brake pads and all other removed parts.

The brake disc **no. 13** must be centered in caliper. Apply brake then check for proper brake disc positioning.

Push on appropriate caliper piston in order to move pad inward allowing proper brake disc positioning.



TYPICAL
1. Brake disc not centered
2. Brake disc centered
3. Apply brake before checking

Apply brake then recheck.

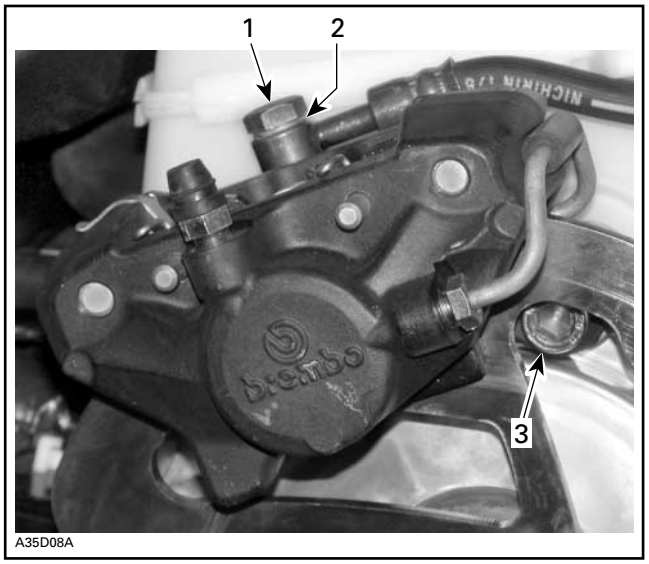
CALIPER

Removal

Drain brake system.

Unscrew Banjo bolt **no. 14** and discard sealing rings **no. 15**.

Align brake disc slots with caliper bolts **no. 16** then unscrew them.



1. Banjo bolt
2. Sealing ring
3. Caliper bolt

Remove caliper.

Inspection

Check caliper for cracks or leakages. Replace if necessary.

Installation

The installation is the reverse of the removal procedure.

NOTE: Bleed brake system before using the vehicle.

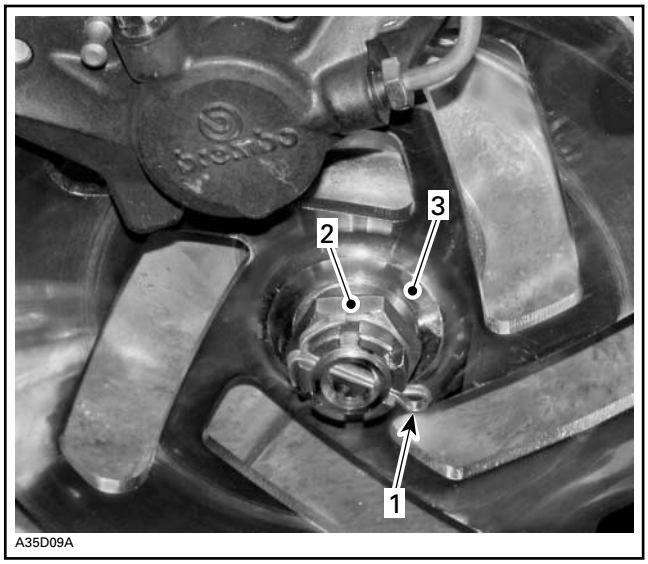
BRAKE DISC

Removal

Apply parking brake.

Remove the cotter pin and discard it.

Unscrew the brake disc nut then remove it with the spacer .



1. Cotter pin
2. Brake disc nut
3. Spacer

Unscrew caliper bolts **no. 16** and place caliper out of the way.

CAUTION: Do not let the caliper hang by the hose and do not stretch or twist the hose.

Remove the brake disc **no. 13**.

Inspection

Before removing disc brake, measure its thickness. The minimum thickness should be 4.5 mm (.177 in).

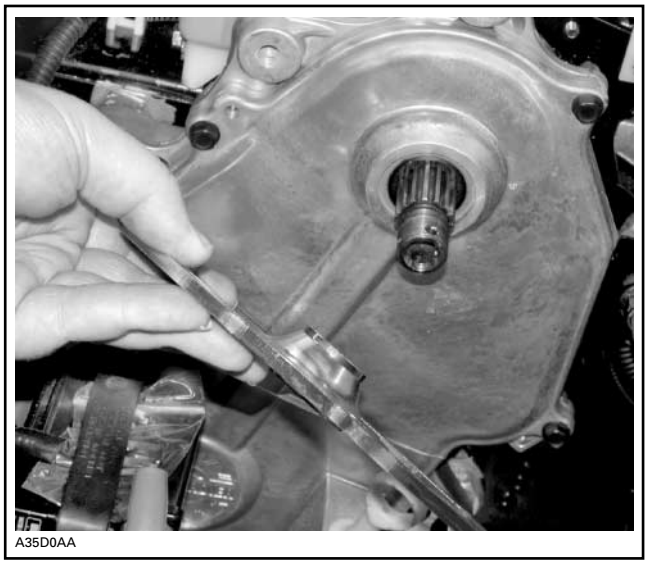
If the brake disc is out of specification, replace it by a new one.

CAUTION: The brake disc should never be machined.

Installation

The installation is the reverse of removal procedure. However, pay attention to the following.

Install the brake disc with the collar toward chaincase.


A35D0AA

Torque brake disc nut to 60 N•m (44 lbf•ft) and further tighten until its grooves align with the next cotter pin hole.

Install a new cotter pin. Both end of cotter pin must be folded over nut.

BRAKE LIGHT SWITCH

Removal

The brake light switch **no. 17** is located near the brake lever. To remove the switch, use the following.

Disconnect the switch.

Take out the master cylinder from the handlebar.

Overturn the master cylinder so that the bottom is on the top.

Fix the master cylinder in a rigid way preferably in a vise.

Pull out the switch wire and rubber cover.

Activate the parking brake.

With the help of a proper tool, unscrew the switch body pay attention to apply a torque in axial direction with steps of little torque angles and pay attention to not apply a force in radial direction (flexion).

Remove the glue remaining with alcohol on a piece of cotton and then clean the seat threads with the clamp screw. If there is resistance to the advance of the clamp screw, use a proper wrench.

NOTE: In case of switch body breaking during the unscrewing activity, act mechanical restoring the threads on master cylinder seat and then go on with the installation procedure.

Installation

NOTE: The brake light switch is not adjustable.

Put the switch on the seat, rotating it only for 1 or 1.5 turns.

Put one drop of Loctite 609 (P/N 413 703 100) on the free switch threads.

Screw the switch by hand until it is in a correct position.

For safety reasons, check the activation of the switch by pulling the brake lever. In case of no switch activation, repeat all the procedure replacing a new switch.

NOTE: If parking brake release during the mounting operations, set the master cylinder in a sloping position (with lever on the top) and hold the master cylinder lever for 3/4 times.

Reinstall the master cylinder on the handlebar taking it in a horizontal position avoiding the risk of glue contamination for the switch rod.

Release the parking brake.

Wait 24 hours to allow glue to set.

Recheck if switch is working properly.

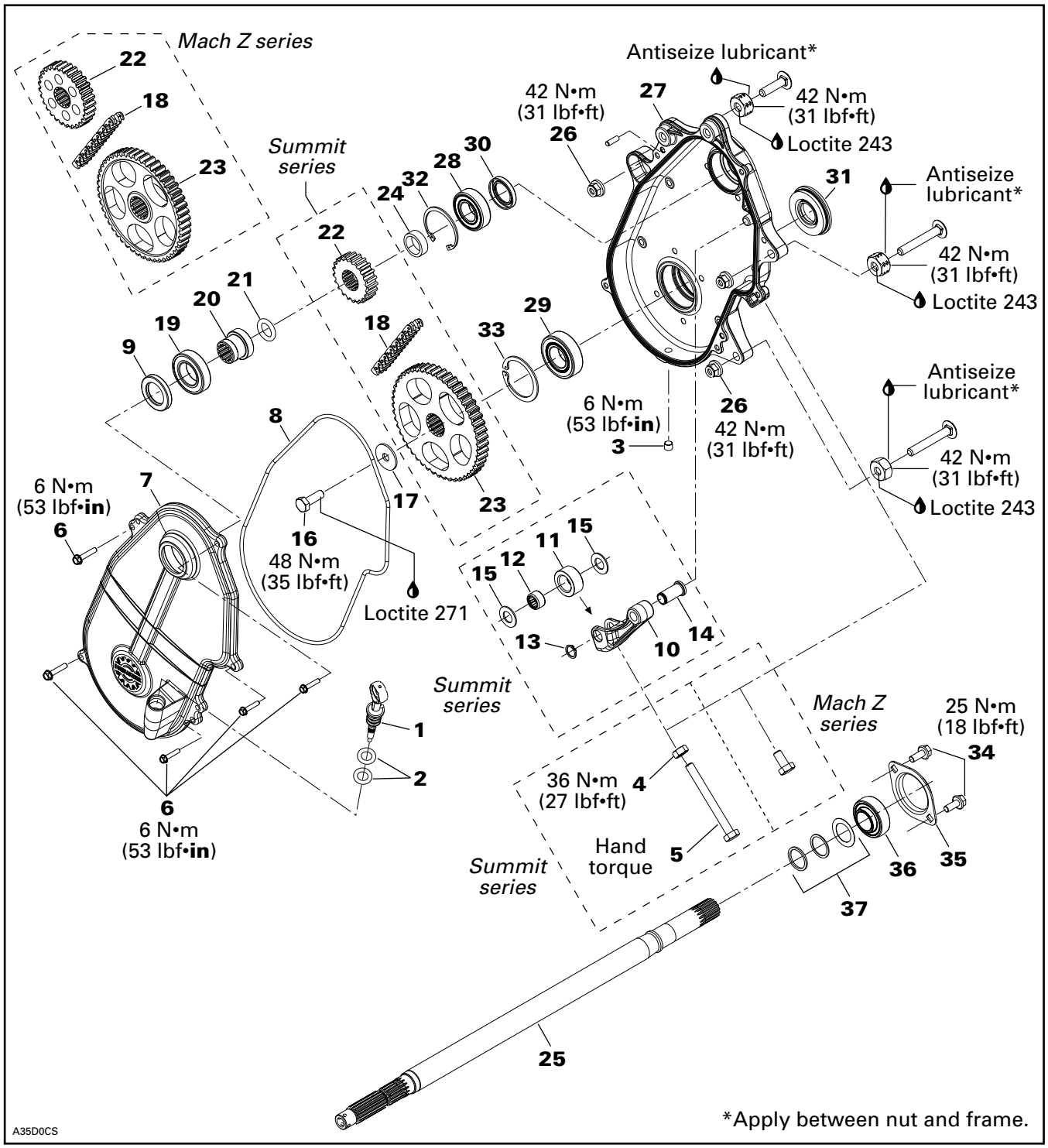
CHAINCASE

SERVICE TOOLS

Description	Part Number	Page
countershaft bearing remover/installer	529 036 010	230–231
countershaft measurement tool	529 036 009	230

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271 (red)	293 800 005	228
XP-S chaincase oil	413 801 900	225
XP-S synthetic chaincase oil	413 803 300	225


Mach Z series
22
18
23
Summit series
22
24
32
28
30
21
20
19
9
18
33
29
8
6 N•m (53 lbf•in)
7
6
16
48 N•m (35 lbf•ft)
17
23
Loctite 271
6 N•m (53 lbf•in)
6
Antiseize lubricant*
42 N•m (31 lbf•ft)
27
42 N•m (31 lbf•ft)
Loctite 243
26
31
Antiseize lubricant*
42 N•m (31 lbf•ft)
Loctite 243
6 N•m (53 lbf•in)
3
26
42 N•m (31 lbf•ft)
Antiseize lubricant*
42 N•m (31 lbf•ft)
Loctite 243
15
11
12
15
13
10
14
Summit series
1
2
Mach Z series
25 N•m (18 lbf•ft)
34
36 N•m (27 lbf•ft)
4
Hand torque
5
Summit series
36
35
37
25
A35D0CS
*Apply between nut and frame.

GENERAL

During assembly/installation, use the torque values and service products as in the exploded view.

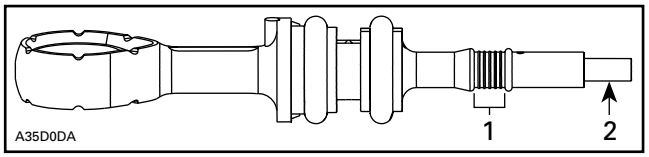
Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, cotter pin, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

CHAINCASE OIL LEVEL

With the vehicle on a level surface, check the oil level by removing dipstick **no. 1**. Oil level must be between lower and upper marks.



TYPICAL
1. Level between marks
2. Magnet

NOTE: It is normal to find metallic particles stuck to dipstick magnet. If bigger pieces of metal are found, remove the chaincase cover and inspect the chaincase parts.

Remove metal particles from magnet.

Refill to upper mark using XP-S chaincase oil (P/N 413 801 900) or the XP-S synthetic chaincase oil (P/N 413 803 300).

CAUTION: Do not use unrecommended types of oil when servicing. Do not mix synthetic oil with other types of oil.

Check O-rings **no. 2**. If the O-rings are brittle, hard or otherwise damaged, replace them.

OIL CHANGE

Draining Procedure

Place a drain pan under chaincase drain plug area.

Remove dipstick **no. 1**.

Using an Allen key, remove the drain plug **no. 3**.

Wait a while to allow oil to flow out of chaincase.

Filling Procedure

Place the vehicle on a level surface.

Using a funnel, pour 250 mL (8.5 U.S. oz) of XP-S chaincase oil (P/N 413 801 900) or the XP-S synthetic chaincase oil (P/N 413 803 300).

Check oil level with the dipstick and add oil if necessary. The level must be between lower and upper dipstick's marks.

DRIVE CHAIN ADJUSTMENT

Summit Series

NOTE: Brake disc and countershaft splines must be in good condition before checking if chain is loose.

Unscrew lock nut **no. 4**.

Tighten tensioner adjustment screw **no. 5 BY HAND**, then unscrew 1/2 turn. Hold tensioner screw and tighten lock nut **no. 4**.

CHAINCASE COVER

Removal

Drain chaincase, see the above procedure.

Remove battery, battery rack and toe hold to allow a better access.

Remove the brake disc. Refer to BRAKE.

Unscrew the chaincase cover screws **no. 6** then remove chaincase cover **no. 7**.

Inspection

Check the cover for cracks or distortion.

Check if the O-ring **no. 8** is brittle, hard or otherwise damaged.

Verify if the oil seal **no. 9** is in good condition.

Replace any defective parts.

Installation

The installation is the reverse of removal procedure.

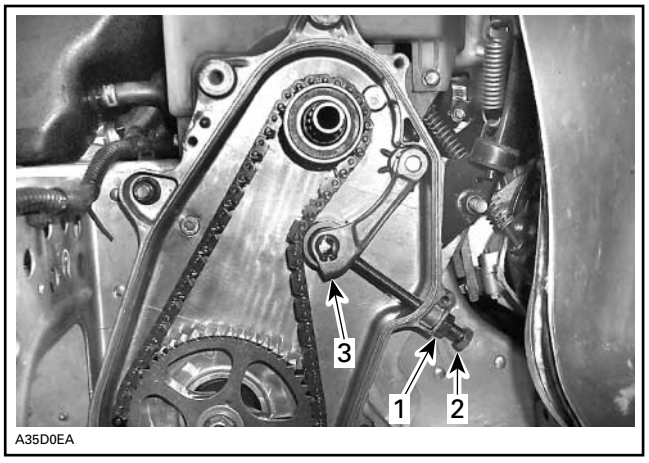
TENSIONER

Summit Series Only

Removal

Drain chaincase and remove chaincase cover.

Unscrew the lock nut **no. 4** then release drive chain tension by unscrewing the tensioner bolt **no. 5**.



A35D0EA

1. Lock nut
2. Tensioner bolt
3. Tensioner lever

Pull tensioner lever **no. 10** out of chaincase housing.

Inspection

Check if the roller **no. 11** turns smoothly and freely. If not replace the needle bearing **no. 12**.

Check tensioner lever for cracks or other damages, replace if necessary.

Installation

The installation is the reverse of the removal procedure. When the installation is completed, perform the drive chain adjustment.

TENSIONER ROLLER BEARING

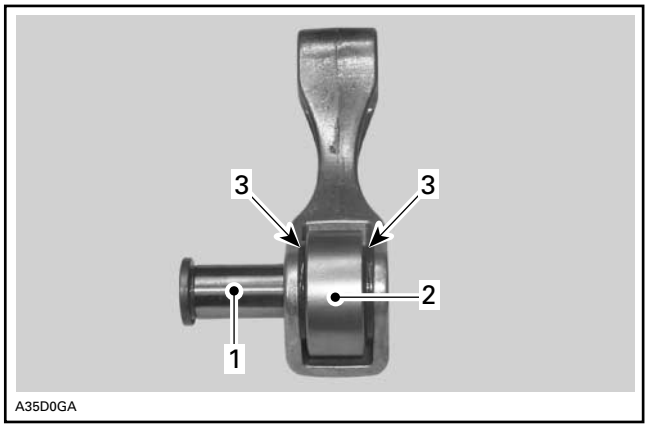
Summit Series Only

Removal

First, remove the tensioner lever **no. 10** then remove the circlip **no. 13**.

A35D0FA

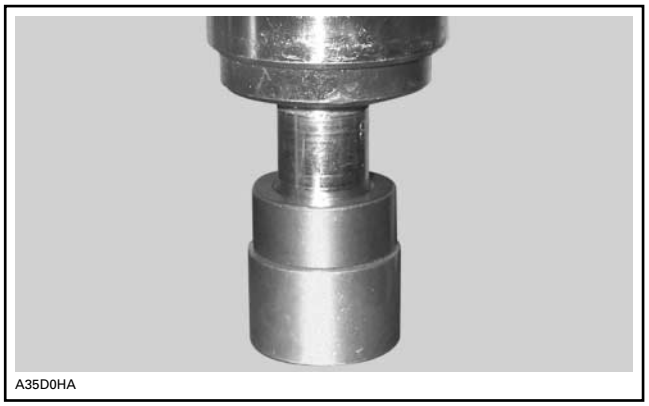
Remove tensioner axle **no. 14**, roller **no. 11** and washers **no. 15**.



A35D0GA

1. Tensioner axle
2. Roller
3. Washers

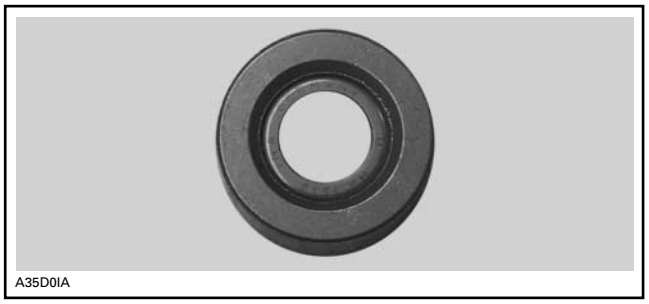
Using a press machine and suitable tappet, push needle bearing **no. 12** out of roller.


A35D0HA

Installation

The installation is the reverse of the removal procedure. However, pay attention to the following.

The needle bearing must be installed with the engraved side toward the circlip and this circlip must be visible when the tensioner is installed.


A35D0IA

ENGRAVED SIDE OF NEEDLE BEARING

DRIVE CHAIN AND SPROCKETS

Removal

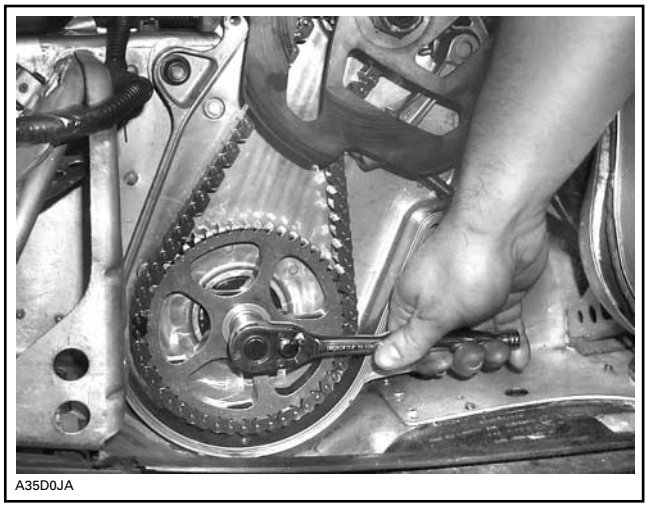
Remove chaincase cover.

Temporarily, install the brake disc and its nut, do not torque nut.

Install the caliper. Torque bolts.

Apply parking brake.

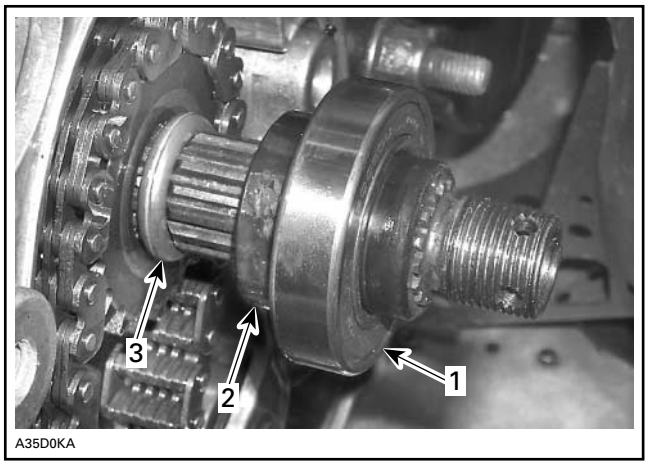
Remove the lower sprocket bolt **no. 16** and its washer **no. 17**.


A35D0JA

Release parking brake and remove caliper and brake disc.

On **Summit series**, release tension on drive chain **no. 18** and remove the tensioner lever **no. 10**.

Remove bearing **no. 19** and splined spacer **no. 20** then O-ring **no. 21**.



A35D0KA

1. *Bearing*
2. *Splined spacer*
3. *O-ring*

Pull the upper sprocket **no. 22** and the lower sprocket **no. 23** with the drive chain out of chaincase housing.

Inspection

Check sprocket teeth for wear or cracks. Replace if necessary.

CAUTION: Replace sprockets and chain as an assembly to prevent accelerated wear.

Check if O-ring **no. 21** is brittle, hard or damaged. Replace if necessary.

Check splines inside spacer **no. 20** for wear. Replace if necessary.

Check if the bearing **no. 19** turns smoothly and freely. Replace if defective.

Installation

On **MACH Z series**, the rocker style chain can not be used with an upper sprocket having fewer than 29 teeth. On **Summit series**, do not use another chain than the 13-plates wide one.

IMPORTANT: Due to the difference in pitch between the rocker type chain and the standard type chain, it is necessary to use a standard chain and a standard lower sprocket if a smaller upper sprocket is used. The chaincase housing is threaded to accept a tensioner.

Fit chain on upper sprocket to make sure that you are using right one according to width.

NOTE: No work (separation, lengthening) can be done on the silent chain type.

The installation is the reverse of the removal procedure. Pay attention to the following details.

Reinstall the brake disc and the caliper to torque the lower sprocket bolt. Apply Loctite 271 (red) (P/N 293 800 005) on sprocket bolt threads before torquing.

CHAINCASE HOUSING

Removal

Remove chaincase cover, drive chain and sprockets.

Remove spacer **no. 24** on countershaft **no. 25**.

A35D0LA

Unscrew nuts **no. 26** that attach the chaincase housing **no. 27** to the vehicle.

Remove chaincase housing from vehicle.

NOTE: Note quantity and location of shims to reposition them correctly during installation.

Inspection

Check housing for cracks or distortion.

Verify if ball bearings **no. 28** and **no. 29** turn smoothly and freely.

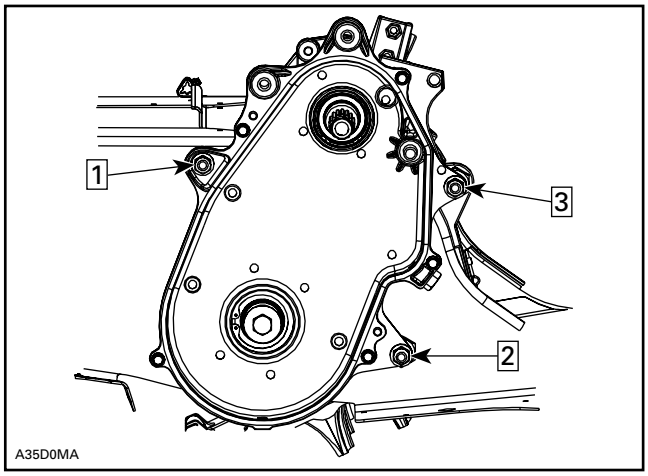
Check condition of oil seals **no. 30** and **no. 31**.

Replace all defective parts.

Installation

Install all removed shims at their original locations.

Install chaincase housing and screw in nuts. Use the following sequence to torque nuts to 42 N•m (31 lbf•ft).



A35D0MA

Install all other removed parts.

CHAINCASE HOUSING BEARINGS

Inspection

The bearings must turn smoothly and freely. If not, replace them.

Removal

To remove the upper bearing **no. 28**, remove the circlip **no. 32** and pull the bearing out of the housing. The bearing is not installed press fit in the housing.

For the lower bearing **no. 29** a press machine will be necessary.

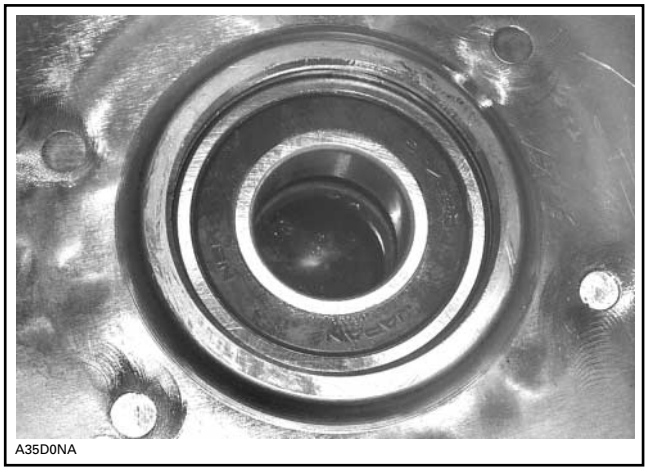
Remove the circlip **no. 33**. Turn the housing and remove the oil seal **no. 31**.

Support the housing around bearing location and push the bearing out of housing with the press.

Installation

The installation is the reverse of the removal procedure.

NOTE: Always install bearings with their seals towards inside of chaincase.



A35D0NA

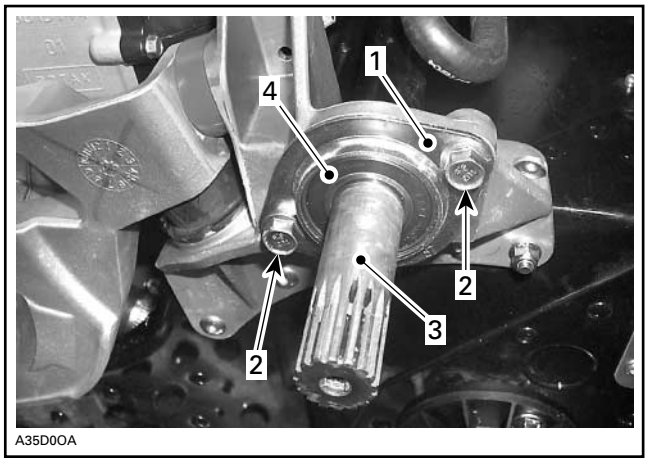
COUNTERSHAFT

Removal

On Left Side of Vehicle:

Remove driven pulley and its shims, refer to DRIVEN PULLEY.

Unscrew the bearing flange bolts **no. 34** and remove the bearing flange **no. 35**.



A35D0OA

1. Bearing flange
2. Bearing flange bolts
3. Countershaft
4. Countershaft bearing

On the Right Side of Vehicle:

Remove:

– drive chain and sprockets
– spacer **no. 24**.

Using a plastic hammer, knock on the countershaft **no. 25** until the countershaft bearing comes out of its support.

Remove countershaft.

To remove the countershaft bearing **no. 36**, see COUNTERSHAFT BEARING further in this section.

Inspection

Check countershaft for wear, bend or cracks.

Check splines for wear or damages.

Replace countershaft if any damage is detected.

Installation

The installation is the reverse of the removal procedure.

NOTE: If a new countershaft is installed, perform bearing shimming procedure. Refer to COUNTERSHAFT BEARING.

COUNTERSHAFT BEARING

Inspection

No play must be felt between countershaft bearing **no. 36** and countershaft **no. 25**.

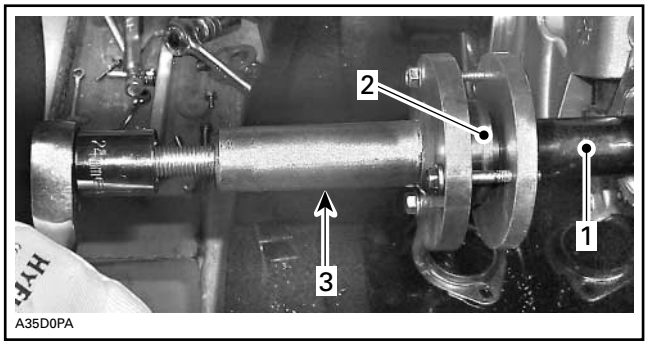
Check if the bearing turns smoothly and freely.

Replace bearing if any damage is detected.

Removal

Remove the countershaft.

Install the countershaft bearing remover/installer (P/N 529 036 010) on the end of countershaft to remove the bearing.



A35D0PA

1. Countershaft
2. Countershaft bearing
3. Countershaft bearing remover/installer

Remove bearing and its shim(s) **no. 37**.

Discard the bearing.

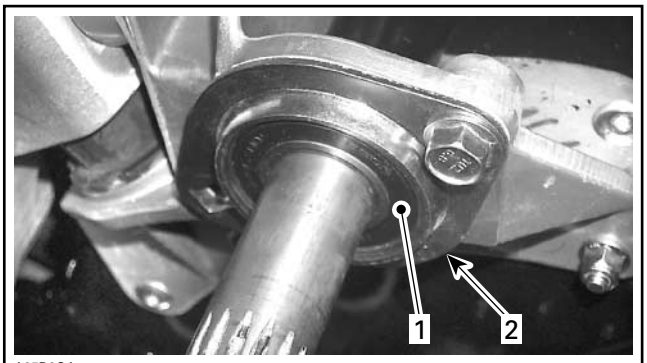
CAUTION: Never use a countershaft bearing a second time, each time when it is removed it must be replaced by a new one.

Installation

NOTE: If a new countershaft or a new bearing support is installed, it will be necessary to measure shims thickness between bearing and countershaft shoulder.

Shimming Procedure

To perform the measurement of shims, install the countershaft measurement tool (P/N 529 036 009) instead of the countershaft bearing **no. 36** and install the bearing flange **no. 35**.

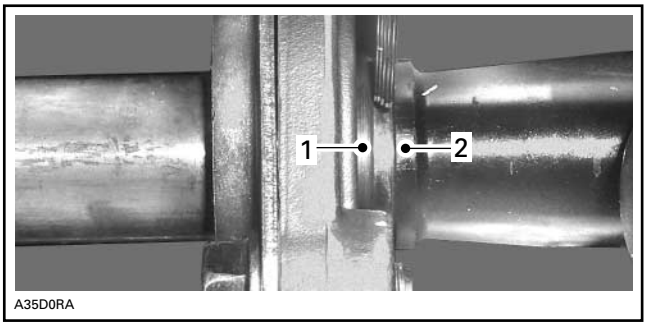


A35D0QA

1. Countershaft measurement tool
2. Bearing flange

CAUTION: The countershaft measurement tool is a countershaft bearing modified. Never use the tool instead of the bearing. Damages to the countershaft, support and chaincase could occur.

Using a feeler gauge, measure the gap between inner race of bearing and countershaft shoulder.



A35D0RA

1. Bearing inner race
2. Countershaft shoulder

Round up or down to the nearest 0.5 mm (.020 in).

Use the following table to select the proper shim(s).

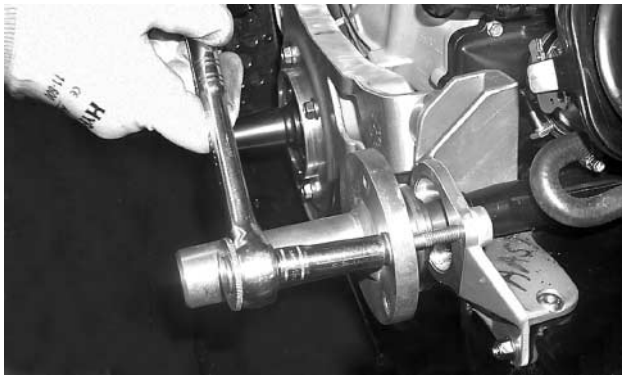
SHIM CHART	
SHIM NUMBER	SHIM THICKNESS mm (in)
504 112 000	0.42 ± 0.05 (.017 ± .002)
417 300 265	1.02 ± 0.10 (.040 ± .004)
417 300 252	2.06 ± 0.15 (.081 ± .006)

Countershaft Bearing Installation

Remove countershaft measurement tool from countershaft.

Install shim(s) then place the new countershaft bearing on countershaft.

Install the countershaft bearing remover/installer (P/N 529 036 010) and push bearing in its location.



A35D0SA

Install all other removed parts in the reverse order of their removal.

DRIVE AXLE

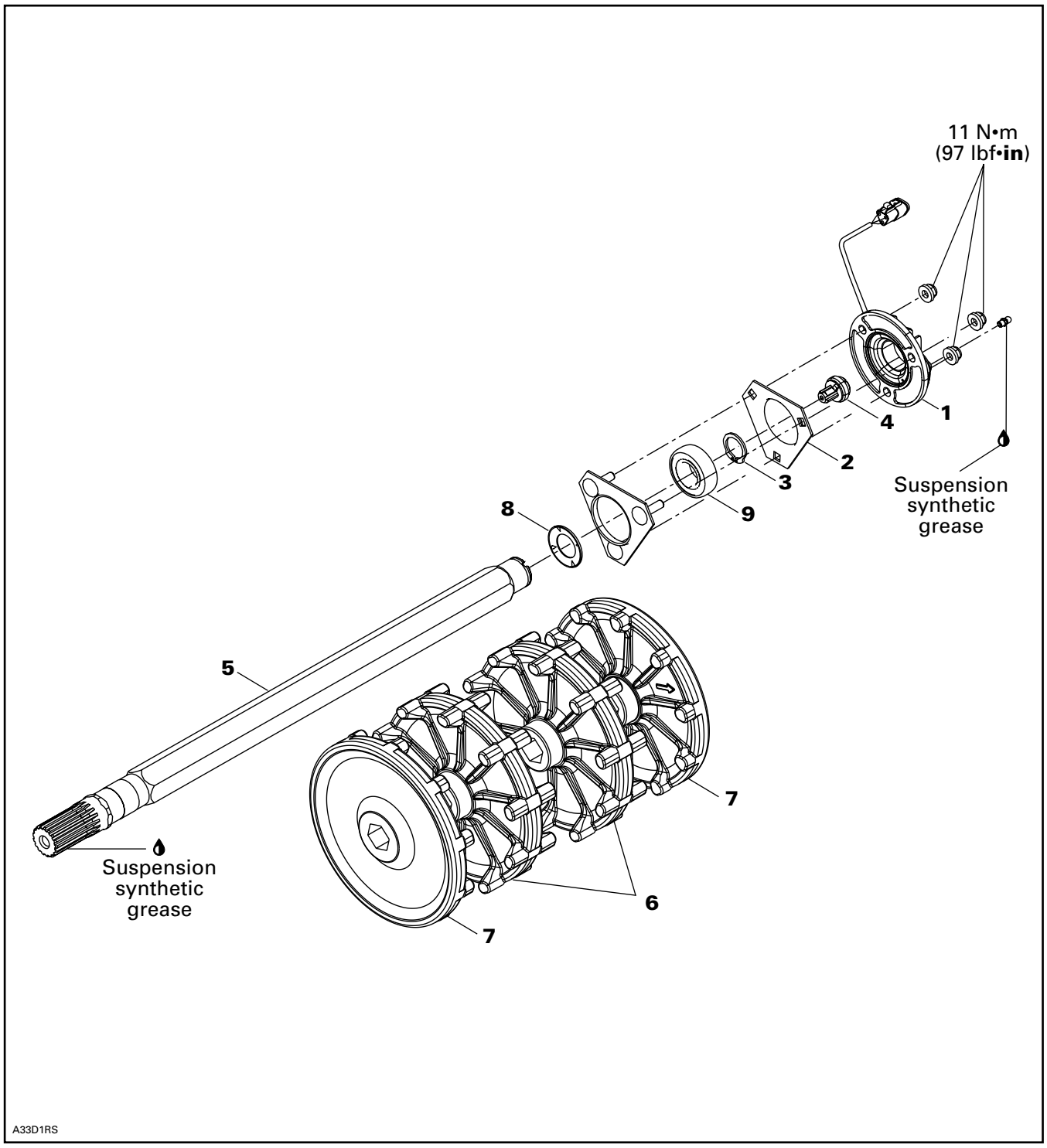
SERVICE TOOLS

Description	Part Number	Page
drive axle sprocket adjuster kit	861 725 700	238

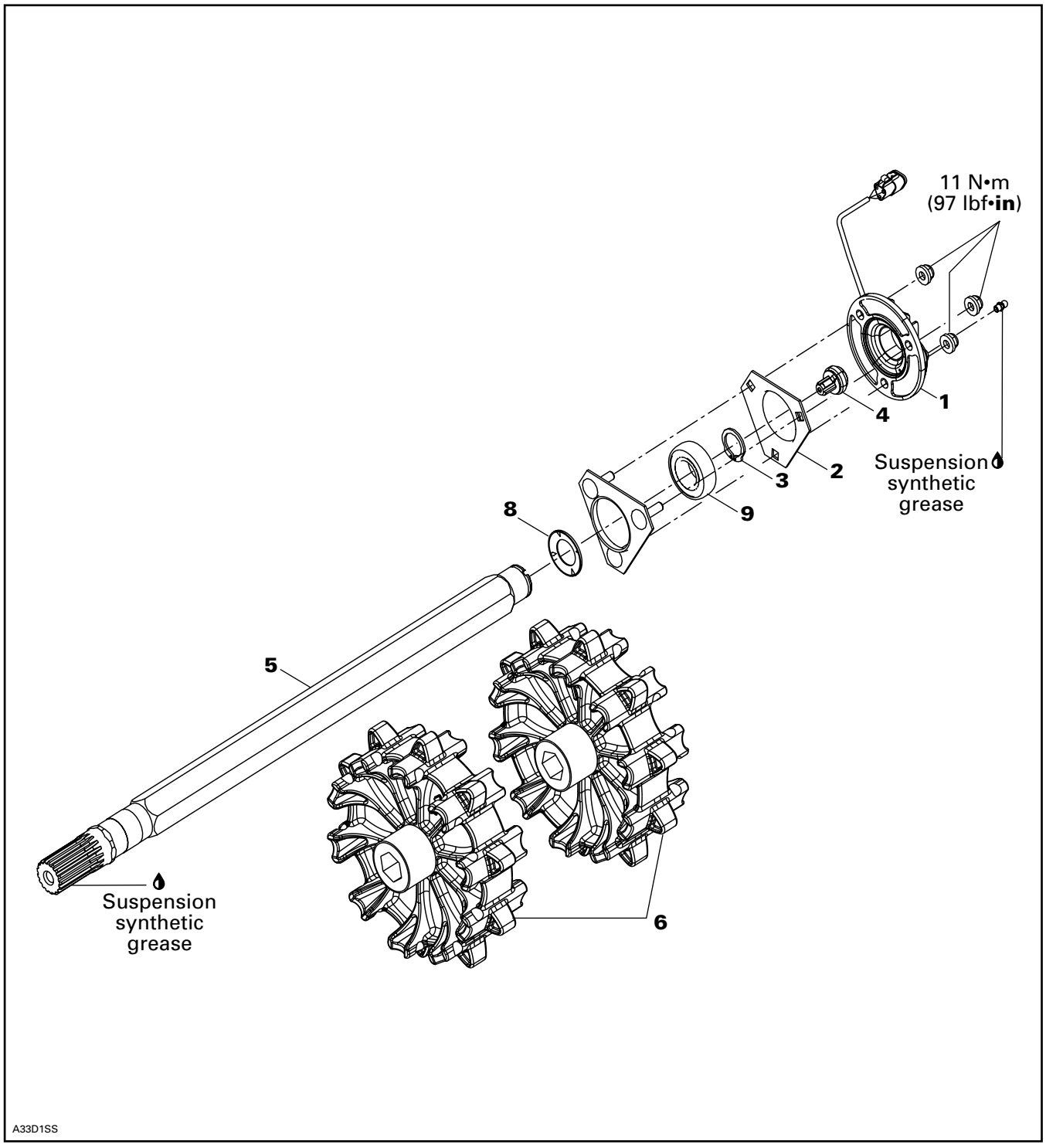
SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	219 700 417	238

MACH Z Models



Summit Highmark and Summit Highmark X Models



REMOVAL

Remove battery, battery rack and toe-hold to gain access.

Drain oil from chaincase. Remove chaincase cover. On **Summit series**, release drive chain tension.

Raise and block rear of vehicle off the ground.

Remove suspension. Refer to proper subsection.

Remove driven pulley. Refer to DRIVEN PULLEY.

Remove speedometer sensor **no. 1**, outer flange **no. 2** and circlip **no. 3** from left side.

TYPICAL
1. Circlip

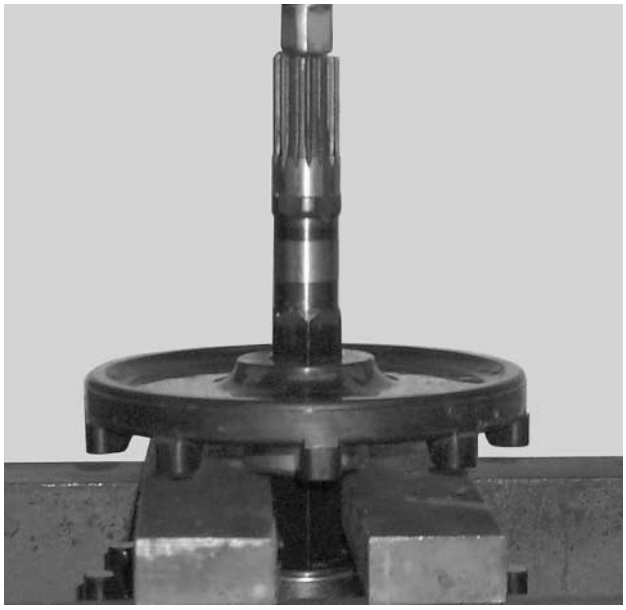
Unscrew then pull speedometer magnetic adapter **no. 4** from drive axle **no. 5**.

Remove chain and sprockets then circlip from right side.

Release drive axle sprocket from track and at the same time, push the drive axle **no. 5** toward the right side. Drive axle bearing in chaincase will fall off.

Sprocket and Half-Sprocket

To remove press fit sprockets **no. 6** and **no. 7**, use a press and a suitable support as illustrated.



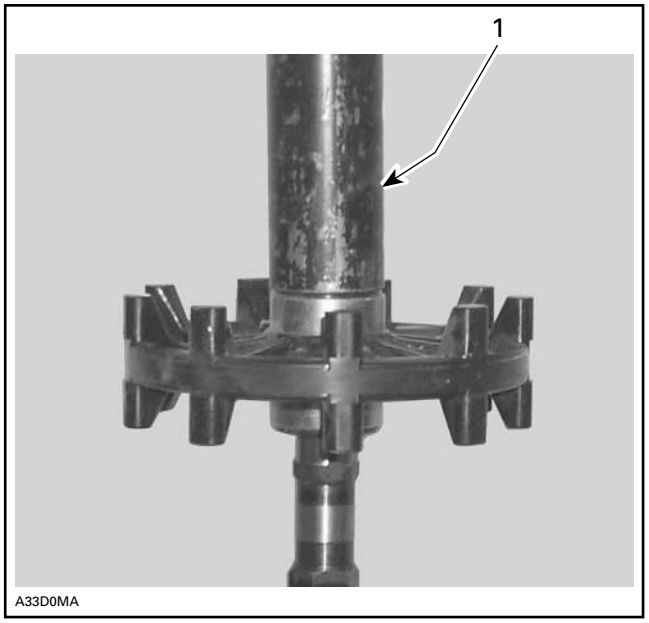
TYPICAL — SUPPORT SPROCKET NEAR HUB

ASSEMBLY

CAUTION: The same sprocket must not be pressed twice on the axle. When sprocket has been removed from drive axle, use a new sprocket at the installation.

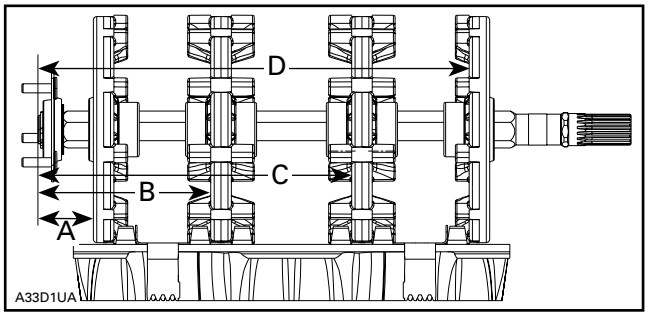
Drive Axle and Sprocket

To assemble press fit sprockets **no. 6** and **no. 7**, use a press and a suitable pipe as illustrated. Sprockets must be assembled according to the following dimensions measured from drive axle end.



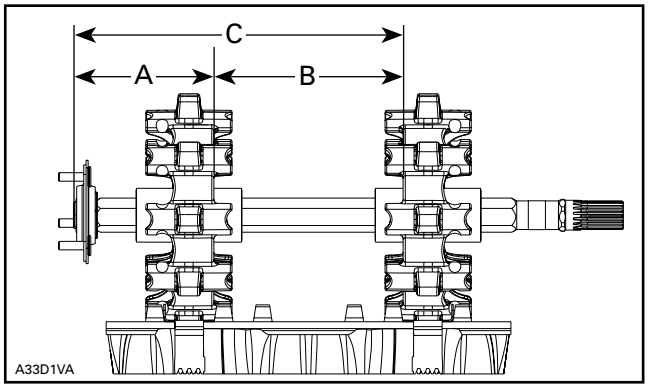
TYPICAL
1. Pipe

MACH Z Models



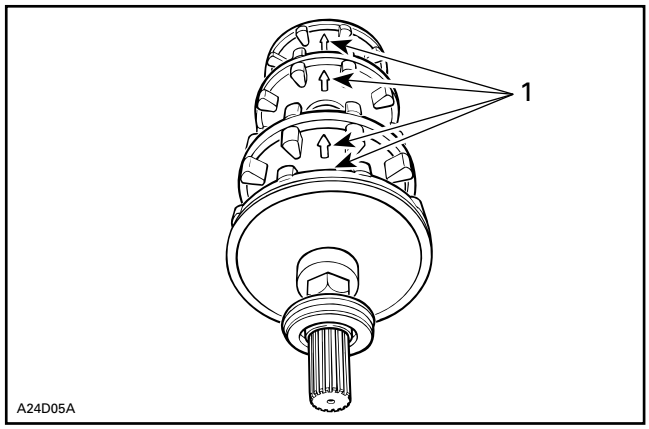
MEASURE FROM END OF DRIVE SHAFT
A. 48.3 mm (1.902 in)
B. 150.8 mm (5.937 in)
C. 273.8 mm (10.780 in)
D. 376.3 mm (14.815 in)

Summit Highmark and Summit Highmark X Models



MEASURE FROM END OF DRIVE SHAFT
A. 132.2 mm (5.205 in)
B. 178.1 mm (7.0118 in)
C. 310.4 mm (12.220 in)

Ensure to align indexing marks of each sprocket when assembling.



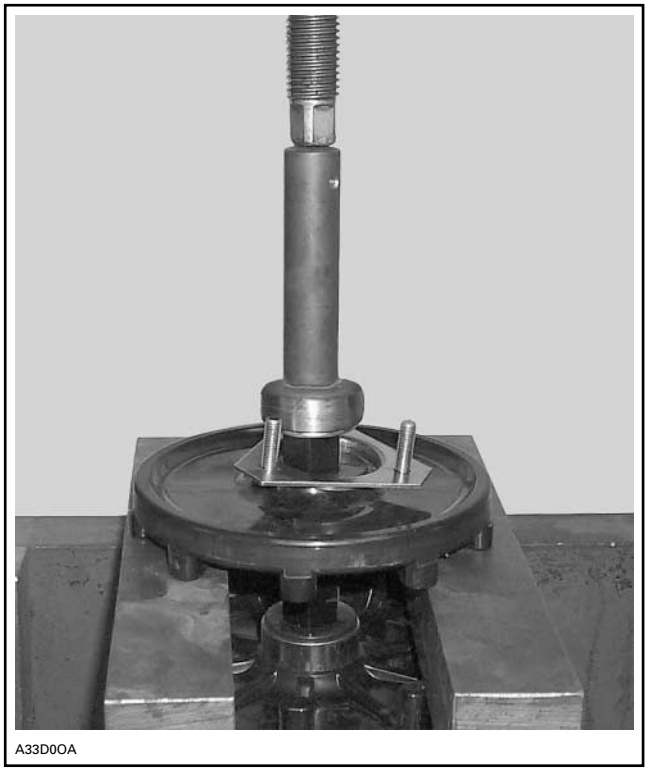
TYPICAL
1. Indexing marks aligned

Bearing Protector

At assembly, flat side of bearing protector **no. 8** must be against bearing **no. 9**.

Bearing

Always push bearing **no. 9** by inner race.



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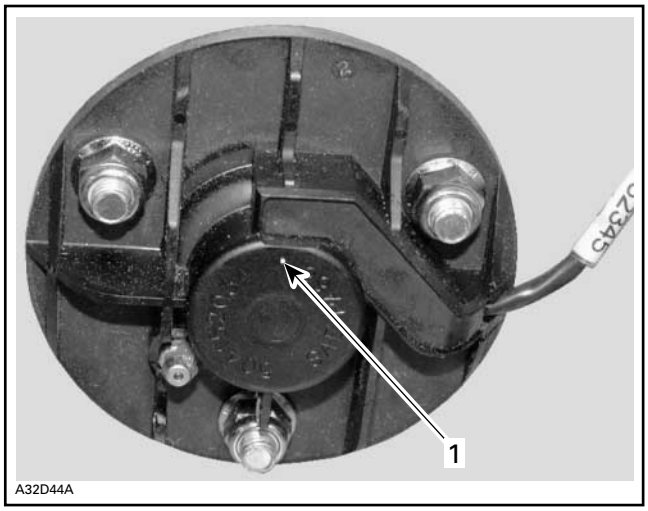
The bearing **no. 9** must have its shield facing the sprocket.

The drive axle bearing in chaincase must have its shield facing right side (cover).

Index speedometer magnetic adapter **no. 4** in drive axle and push until it is completely inserted in its hole.

LUBRICATION

Lubricate end housing bearing with synthetic grease (P/N 219 700 417). Continue lubricating until grease flows out of the pilot hole on speedometer sensor.



A32D44A

TYPICAL
1. Lubricate until grease flows out here

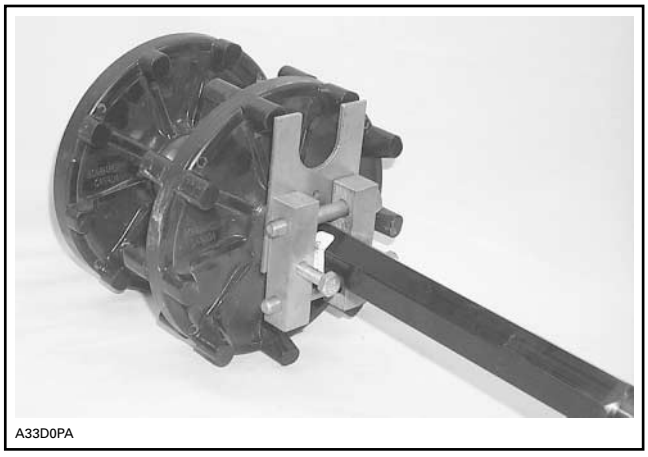
ADJUSTMENT

Sprocket/Track Alignment

CAUTION: Do not tamper with sprocket/track alignment if frame or suspension is damaged.

Sprockets may be repositioned to fit lugs without removing drive axle.

Use drive axle sprocket adjuster kit (P/N 861 725 700).



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TYPICAL

TRACK

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	240
cleat remover	529 028 700	239, 241
narrow-cleat installer	529 028 800	239, 241

TRACK TYPE APPLICATION

Refer to TECHNICAL DATA.

GENERAL

This section gives guidelines for track removal. Some components require more detailed disassembly procedures. In these particular cases, refer to the pertaining section in this manual.

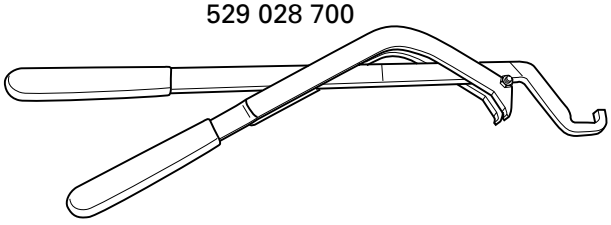
INSPECTION

Visually inspect track for:

– cuts and abnormal wear
– broken rods
– broken or missing track cleats.

If track is damaged or rods are broken, replace track. For damaged or missing cleats, replace by new ones, using cleat remover (P/N 529 028 700). Use narrow-cleat installer (P/N 529 028 800).

529 028 700



529 028 800

⚠ WARNING

Do not operate a snowmobile with a cut, torn or damaged track.

REMOVAL

Remove the following parts:

– rear suspension (refer to SUSPENSION)
– drive axle (refer to DRIVE AXLE)
– track.

INSTALLATION

Reverse the removal procedure.

NOTE: When installing the track, respect rotation direction indicated by an arrow on track thread.

Check sprocket/track alignment as described in DRIVE AXLE.

ADJUSTMENT

Track Tension and Alignment

Track tension and alignment are interrelated. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

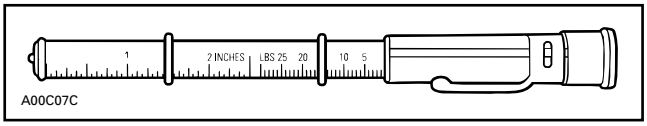
Tension

NOTE: Ride the snowmobile in snow about 15 to 20 minutes prior to adjusting track tension.

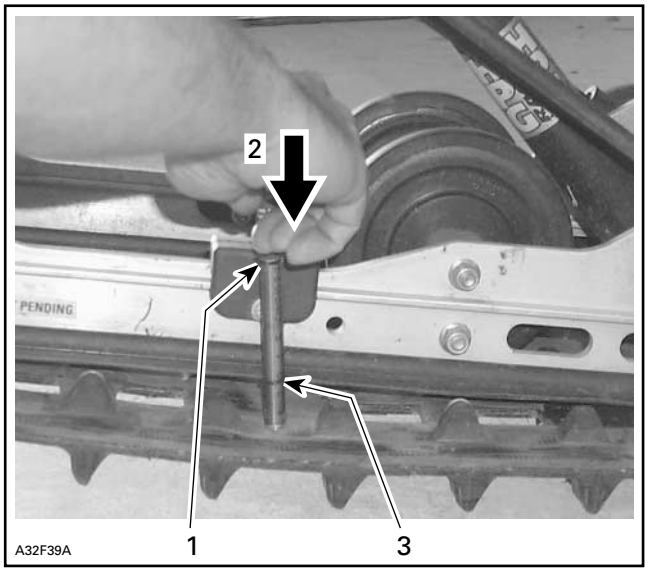
Lift snowmobile by a rope, chain or lift strap hooked to rear bumper.

Allow the rear suspension to fully extend and check gap halfway between front and rear idler wheels. Measure between slider shoe bottom and inside of track. The gap should be as given in SPECIFICATIONS. If the track tension is too loose, track will have a tendency to thump.

NOTE: The belt tension tester (P/N 414 348 200) may be used to measure deflection as well as force applied.



BELT TENSION TESTER

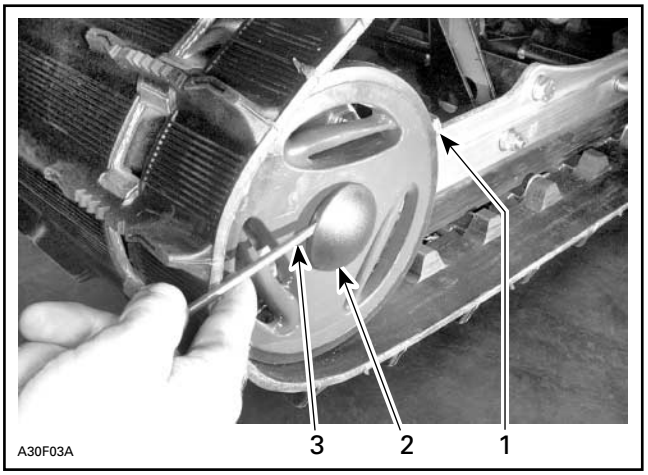


1. *Top tool O-ring positioned at 7.3 kg (16 lb)*
2. *Push on top portion of tool until it contacts the top O-ring*
3. *Measured track deflection*

CAUTION: Too much tension will result in power loss and excessive stresses on suspension components.

To Adjust Tension:

– Remove wheel caps.
– Loosen the rear idler wheel retaining screws.
– Turn adjustment screws to adjust.



TYPICAL
1. *Adjustment screw*
2. *Retaining screw*
3. *Wheel cap removal*

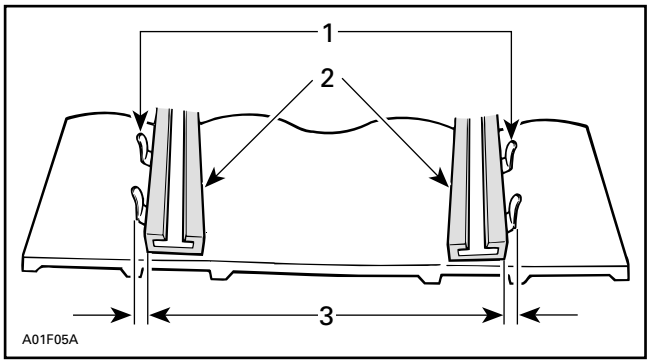
Alignment

⚠ WARNING

Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle. Never rotate at high speed.

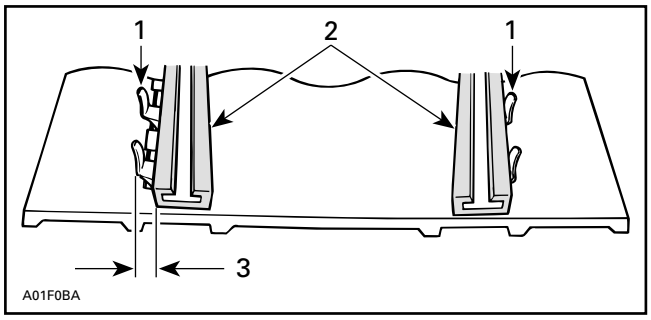
Start the engine and accelerate slightly so that track barely turns. This must be done in a short period of time (1 to 2 minutes).

Check that the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. *Guides*
2. *Slider shoes*
3. *Equal distance*

To correct, stop engine, loosen rear wheel screws, then tighten the adjustment screw on side where the slider shoe is the farthest from the track insert guides.



1. Guides
2. Slider shoes
3. Tighten on this side

Restart engine, rotate track slowly and recheck alignment. If the satisfactory alignment is achieved, then tighten the idler wheel retaining screws to 48 N•m (35 lbf•ft). Reinstall the wheel caps.

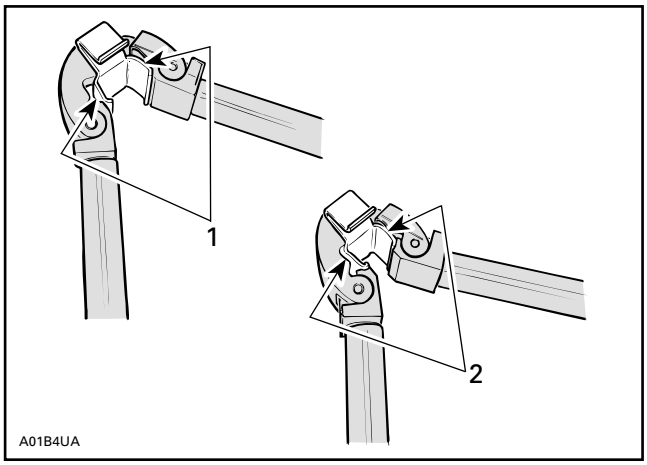
TRACK CLEAT

Removal

– Raise rear of vehicle off the ground and lift snow guard then hand rotate track to expose a cleat to be replaced.
– Use track cleat remover (P/N 529 028 700) for all models.

Installation

– Place new cleat in position on the track and using the narrow-cleat installer (P/N 529 028 800) bend cleat then push tabs into rubber.
– Re-open installer, then position cleat tabs on open end of tool and squeeze tabs until they are indented in rubber.



TYPICAL
1. First step
2. Second step (to push tabs into rubber)

TRACTION ENHANCING PRODUCTS (studs)

Important Safety Rules

⚠ WARNING

To prevent serious injury to individuals near the snowmobile:

– NEVER stand behind or near a moving track.
– ALWAYS use a wide-base snowmobile stand with a rear deflector panel.
– When the track is raised off the ground, only run it at lowest possible speed.

Centrifugal force could cause debris, damaged or loose studs, pieces of torn track, or an entire severed track to be violently thrown backwards out of the tunnel with tremendous force, possibly resulting in the loss of a leg or other serious injury.

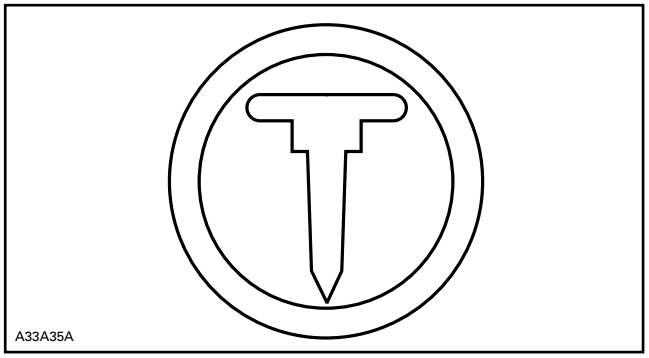
Effects of Studding on the Life of the Snowmobile

The use of traction enhancing products can increase the load and the stress on certain snowmobile components, as well as the vibration level. This can cause premature wear on parts such as belts, brake lining, bearings, chain, and chaincase sprockets, and shorten track life. For this reason, it is even more important to follow the detailed maintenance program given in the MAINTENANCE CHART.

Studs can also cause serious damage to the snowmobile if it is not equipped with the tunnel protectors designed for the particular model. Damage to the electrical wiring or perforation of the heat exchangers are potential hazards, that could cause the engine to overheat and be severely damaged.

⚠ WARNING

If tunnel protectors are excessively worn or not installed, the gas tank could be punctured, causing a fire.



APPROVED TRACKS CAN BE IDENTIFIED BY THIS SYMBOL

Maintenance/Replacement

A visual inspection of the track should be performed before each use.

Look for any defects, such as:

– perforations in the track
– tears in the track (particularly around traction holes)
– lugs that are broken or torn off, exposing portion of rods
– delamination of the rubber
– broken rods
– broken studs
– bent studs
– studs that are torn off the track
– missing track guide(s).

Replace broken or damaged studs immediately. If the track shows signs of deterioration, it must be replaced immediately. In doubt, replace the track.

⚠ WARNING

Riding with a damaged track or studs could lead to loss of control, resulting in a risk of serious injury or death.

Installation

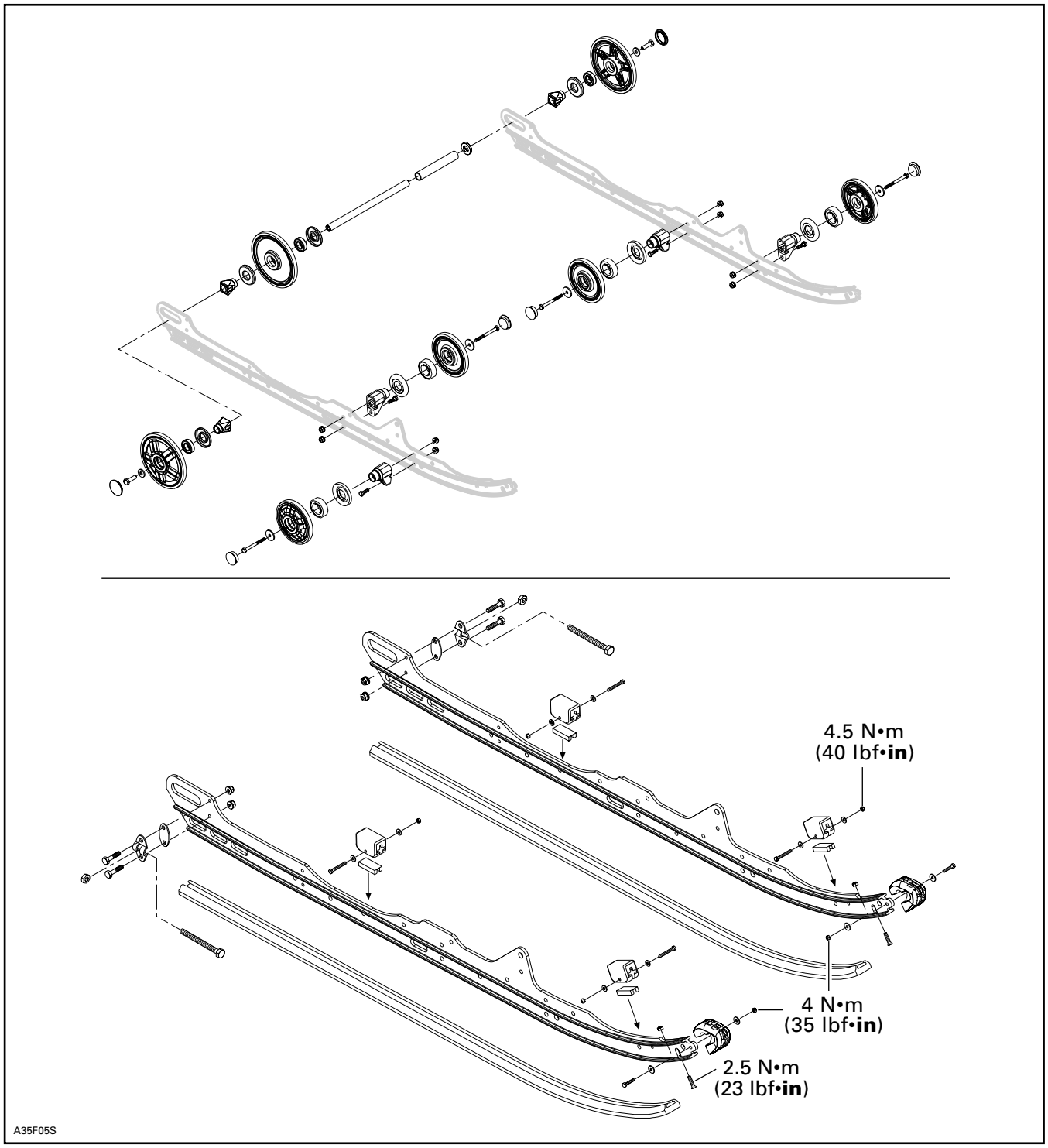
To install studs, refer to the manufacturer's instructions.

MODELS		MACH Z	
TRACK	Profile height	25.4 mm (1 in)	31.8 mm (1.25 in)
	Track length	3.07 m (121 in)	
FRONT PROTECTOR		Standard	
REAR PROTECTOR		25.4 mm (1 in)	
SUPPORT		—	

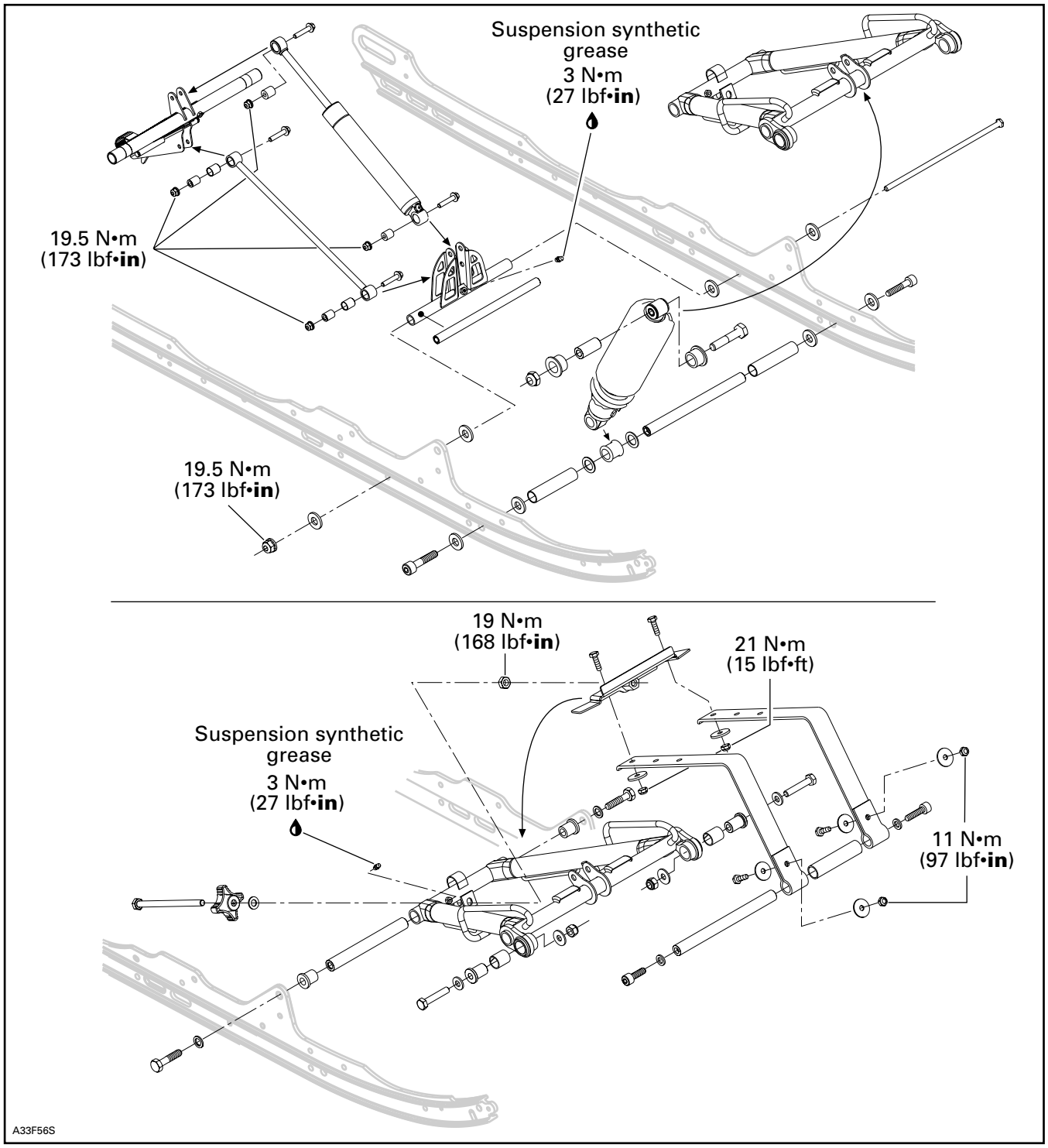
SC SUSPENSION

SERVICE PRODUCTS

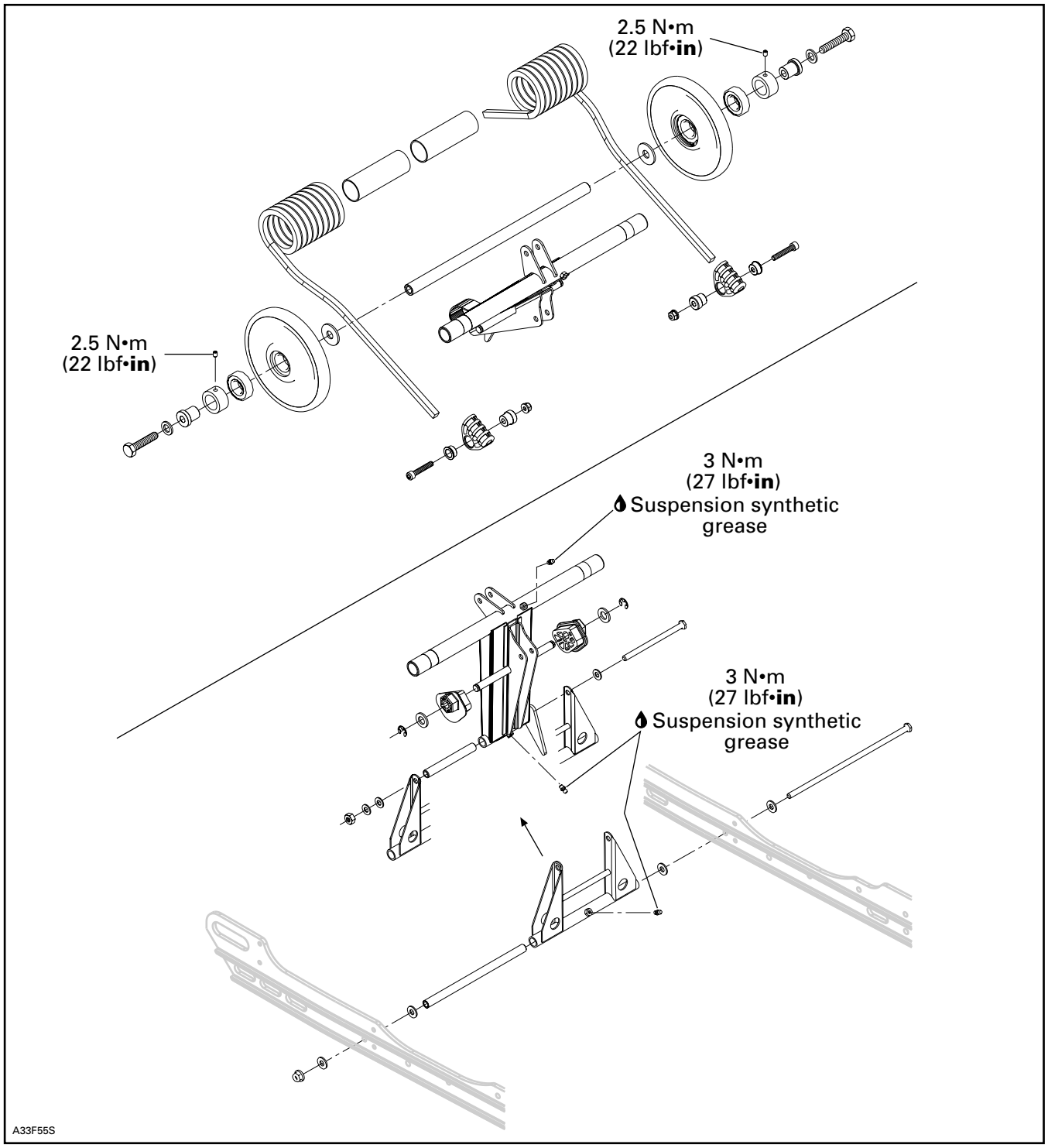
Description	Part Number	Page
suspension synthetic grease	293 550 033	254



RAILS AND IDLER WHEELS



ARMS AND SHOCK ABSORBERS



REAR ARM, SPRINGS AND TOP IDLER WHEELS

AXLE SELF-LOCKING SCREWS REMOVAL

CAUTION: These self-locking screws must always be replaced by new ones everytime they are removed.

NOTE: To prevent axle from turning when unscrewing self-locking screws, proceed as follows:

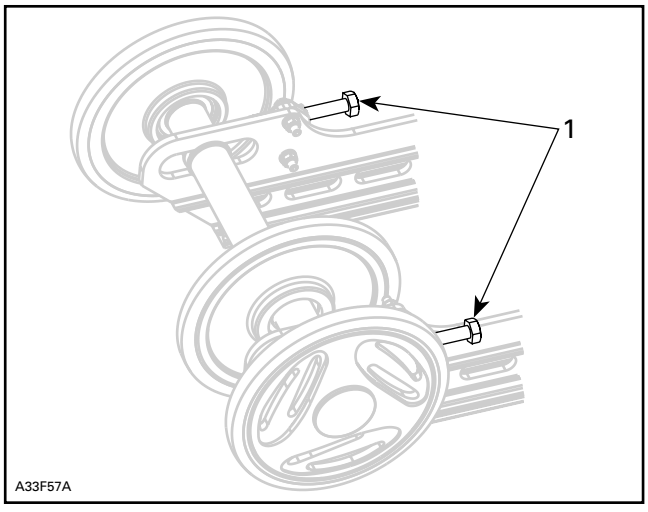
– Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
– Remove the opposite self-locking screw.
– Remove the temporary installed non-self-locking screw.
– If it doesn't work, heat bolt head to melt threadlocker.

REAR AXLE REMOVAL

Lift rear of vehicle and support it off the ground.

Remove screws on rear axle.

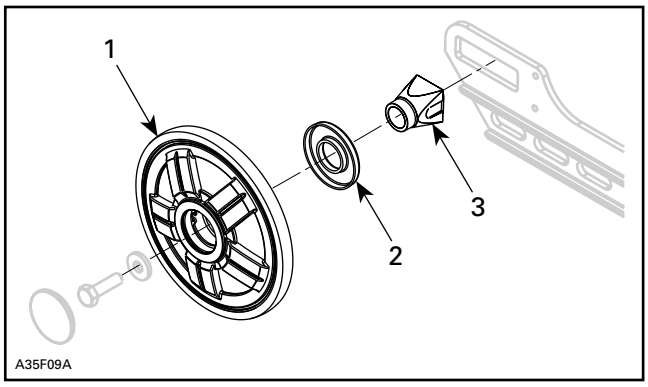
Completely loosen track tension.



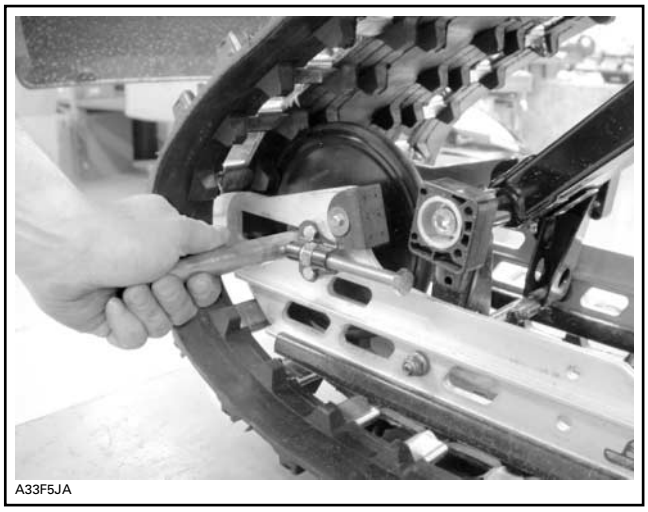
1. Completely loosen track tension

Remove the following on each side of vehicle:

– rear idler wheel
– idler wheel bearing protector
– idler wheel spacer.



REMOVE THE FOLLOWING
1. Idler wheel
2. Bearing protector
3. Spacer



TYPICAL — PULL OUT REAR AXLE

REAR AXLE INSTALLATION

Installation is the reverse of removal procedure.

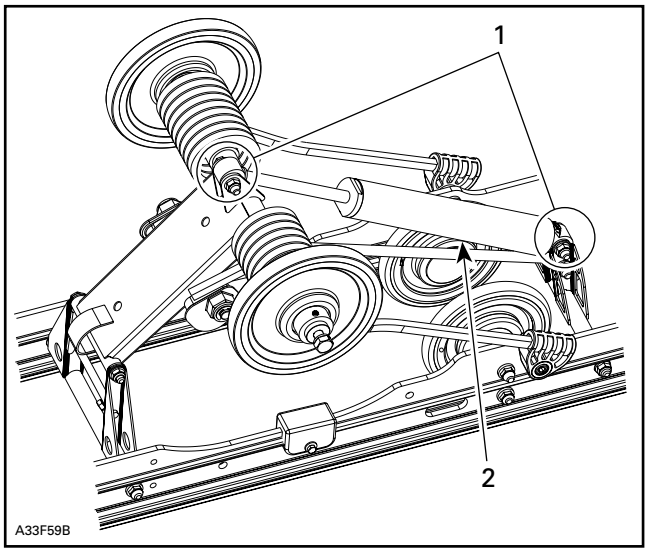
REAR SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

Remove shock upper and lower bolt and nut

NOTE: If necessary, to ease shock removal, unfasten one end of stopper straps to release shock pressure.

Remove rear shock absorber.



TYPICAL
1. *Upper/lower bolt and nut*
2. *Rear shock absorber*

REAR SHOCK ABSORBER INSTALLATION

Installation is the reverse of removal procedure.

CAUTION: Take care not to damage grease fitting.

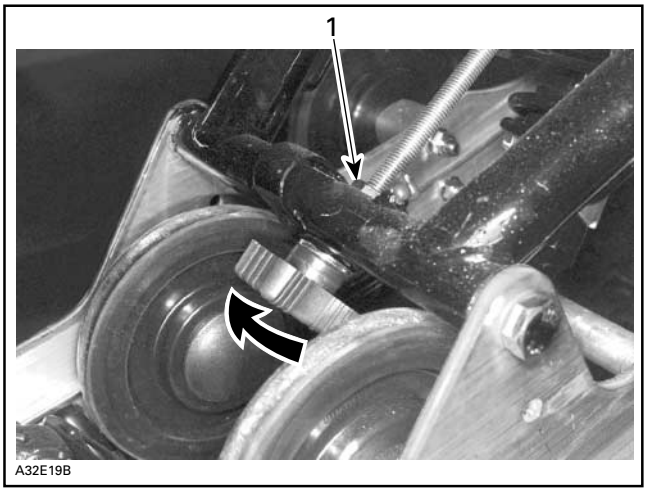
Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Shock upper and lower nut	19.5 N•m (173 lbf•**in**)

FRONT SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

Unfasten one end of stopper strap(s) or loosen the adjuster knob to release shock pressure.

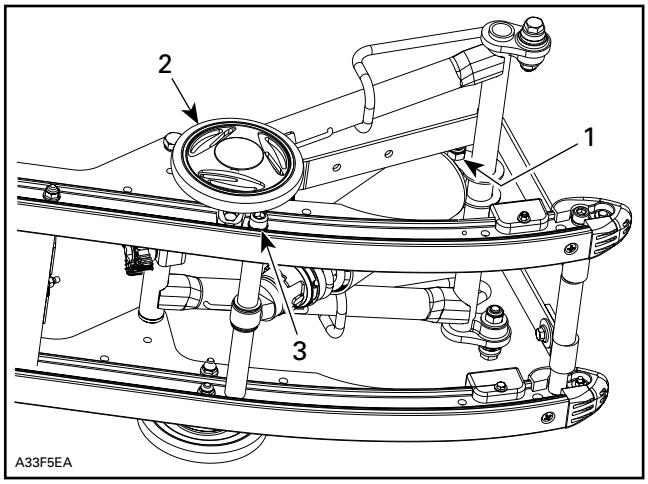


1. Loosen lock nut, turn adjuster knob counterclockwise

Unbolt front shock from the top.

Remove front idler wheels to gain access to axle retaining self-locking screws.

Unbolt axle screws and slide out axle to remove shock.



TYPICAL
1. *Front shock upper bolt and nut*
2. *Idler wheel*
3. *Axle screw*

FRONT SHOCK ABSORBER INSTALLATION

Installation is the reverse of removal procedure.

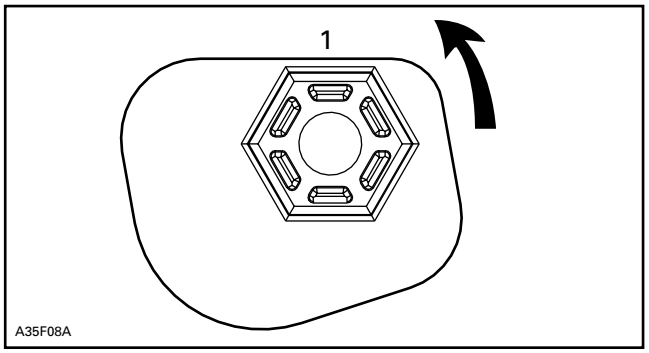
Respect the following tightening torque specification.

DESCRIPTION	TIGHTENING TORQUE
Adjuster lock nut	19 N•m (168 lbf•**in**)
Stopper straps nuts (on strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap(s) nuts	11 N•m (97 lbf•**in**)

REAR SPRING REMOVAL

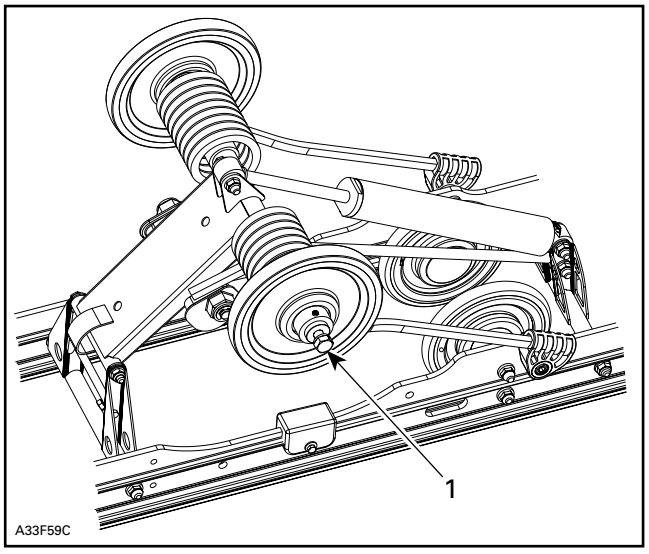
Lift rear of vehicle and support it off the ground.

Decrease spring preload by turning cams accordingly.



DECREASE SPRING PRELOAD

Unbolt rear arm top axle from chassis.

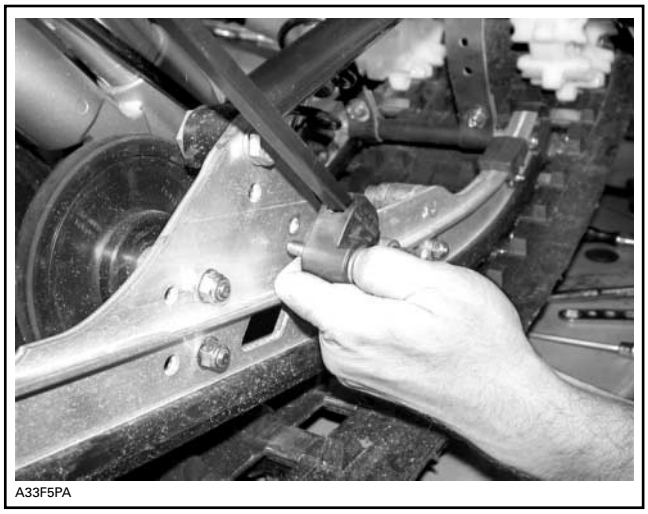


1. Unbolt rear arm

Remove spring supports.

⚠ WARNING

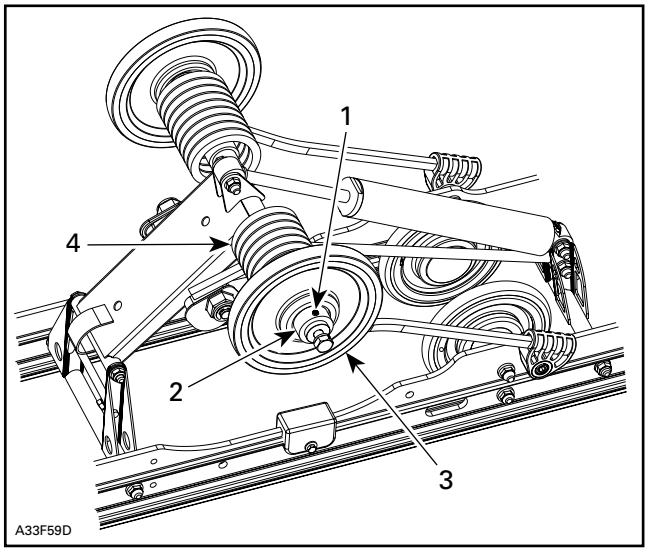
Supports are spring loaded.



TYPICAL — REMOVE SPRING SUPPORTS

Loosen set screw from locking rings.

Remove the following on both sides:
– locking ring
– top idler wheel
– spring.



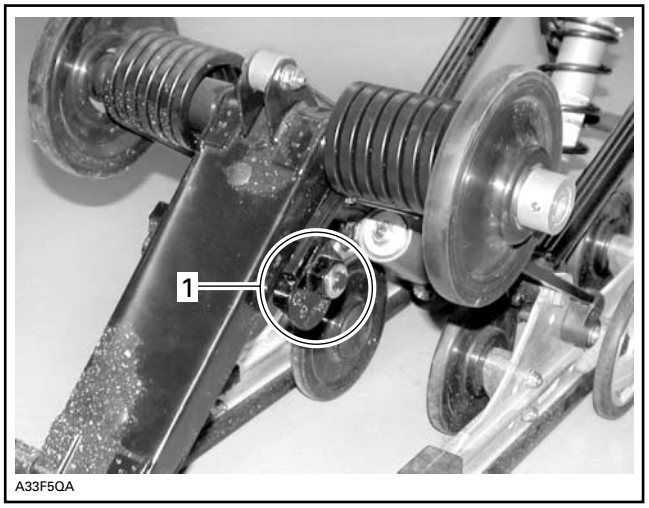
1. Set screw
2. Locking ring
3. Idler wheel
4. Spring

REAR SPRING INSTALLATION

Installation is the reverse of removal procedure. Pay attention to the following details.

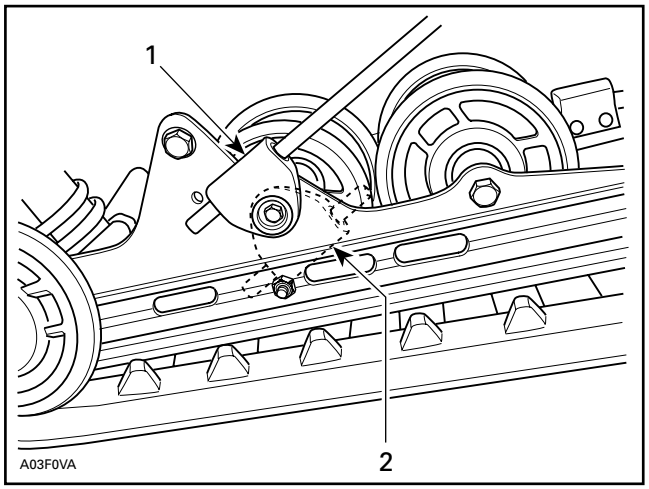
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

At assembly, make sure that spring end is in cam adjuster.



TYPICAL — ON BOTH SIDES
1. Spring end in cam adjuster

CAUTION: To avoid track damage, spring supports must be mounted upward.



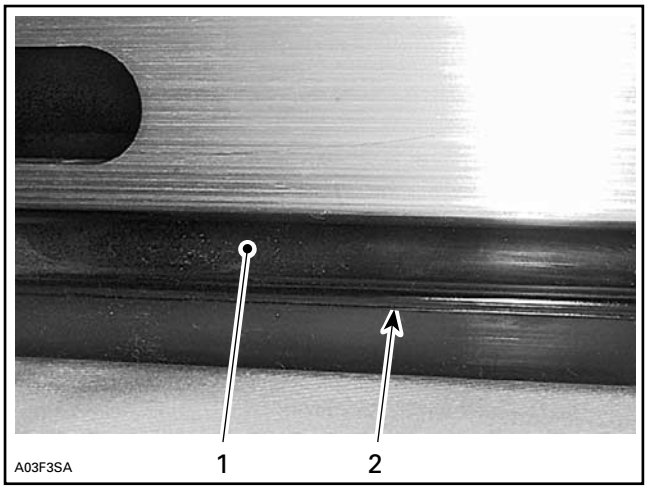
TYPICAL — RIGHT SIDE SHOWN
1. Right position: upward
2. Wrong position

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)

SLIDER SHOE VERIFICATION

Molding line is the wear limit indicator.



TYPICAL
1. Slider shoe
2. Molding line (wear limit indicator)

Replace slider shoes when wear limit is reached.

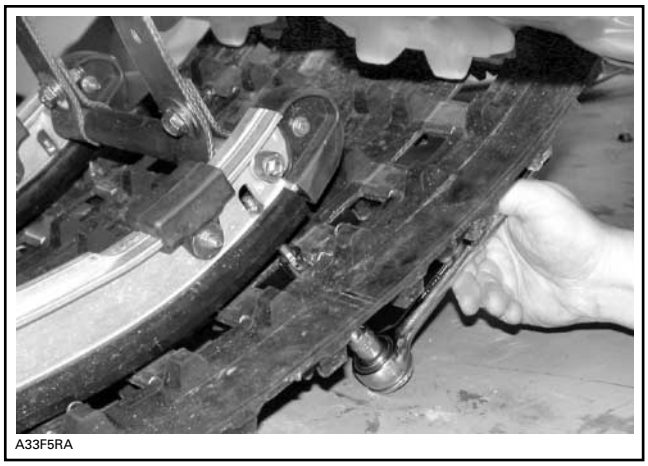
CAUTION: Slider shoes must always be replaced in pairs.

SLIDER SHOE REMOVAL

Lift rear of vehicle and support it off the ground.

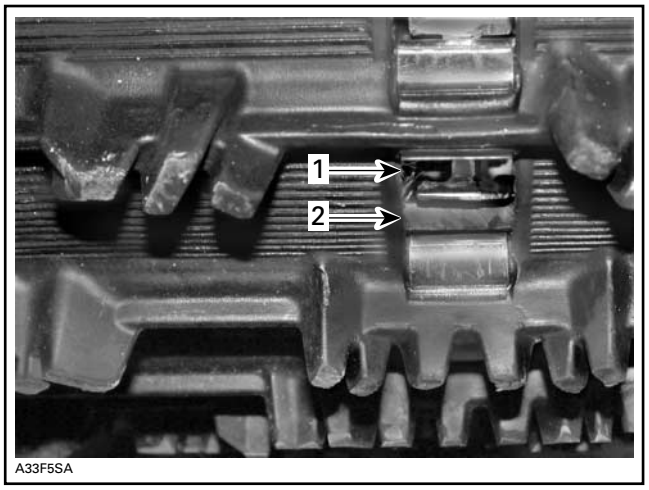
Completely loosen track tension.

Remove front runners nut and screw.



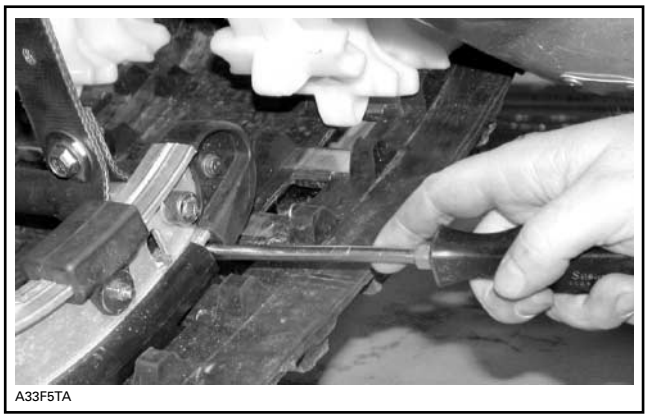
TYPICAL — REMOVE NUT AND SCREW

Align track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

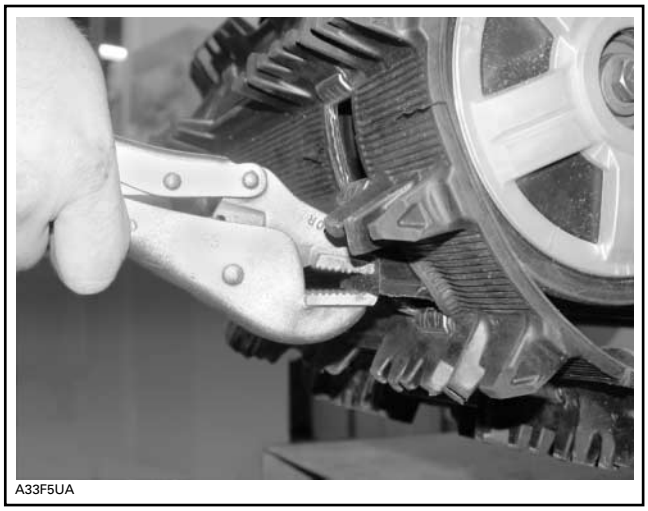
Using a pry bar or screw driver, push slider shoe until it comes in contact with track.



TYPICAL — PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe thru track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.



TYPICAL — PULL ON SLIDER SHOE TO REMOVE

SLIDER SHOE INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Make sure to insert slider shoe end with hole first.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Slider shoe nut	2.5 N•m (22 lbf•**in**)

FRONT ARM REMOVAL

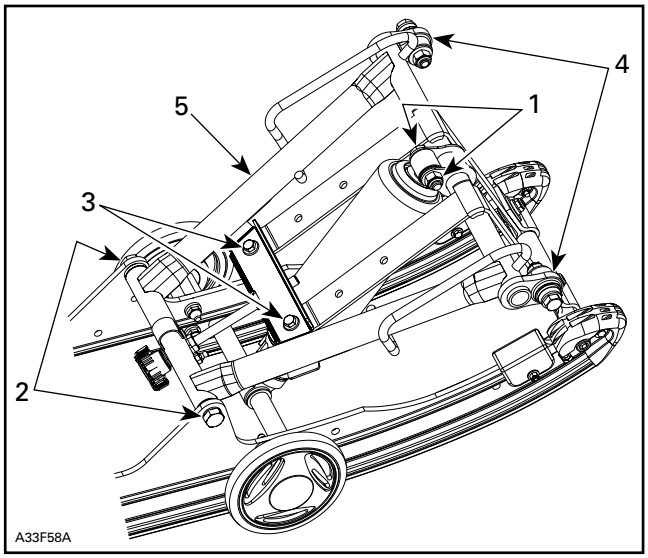
NOTE: Front arm can be removed with suspension in place.

Lift rear of vehicle and support it off the ground.

Remove the following:

– shock upper bolt and nut
– front arm lower bolts and washers
– unfasten one end of stopper strap(s)
– remove front arm upper bolts, nuts and washers.

Remove front arm.



1. Shock upper bolt and nut
2. Front arm lower bolts and washers
3. Unfasten one end of stopper straps
4. Front arm upper bolts, nuts and washers
5. Front arm

FRONT ARM INSTALLATION

Installation is reverse of removal procedure.

Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Stopper strap nuts (on strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap nuts	11 N•m (97 lbf•**in**)

REAR ARM/PIVOT ARM REMOVAL

NOTE: Rear arm can be removed with suspension in place.

For rear arm removal, remove the following:

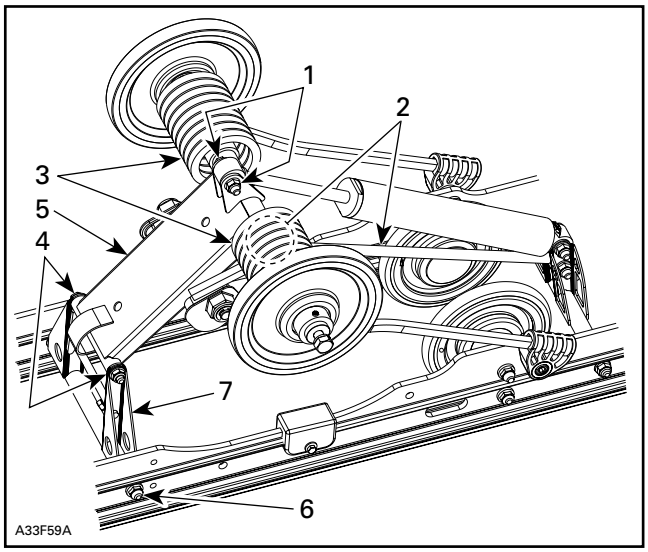
– shock upper bolt and nut
– throttle rod upper bolt and nut
– rear springs (refer to procedure above in this section)
– screws and washers holding rear arm to pivot arm

Remove rear arm.

For pivot arm removal, remove the following:

– bolt, nut and washers holding pivot arm to runners

Remove pivot arm.

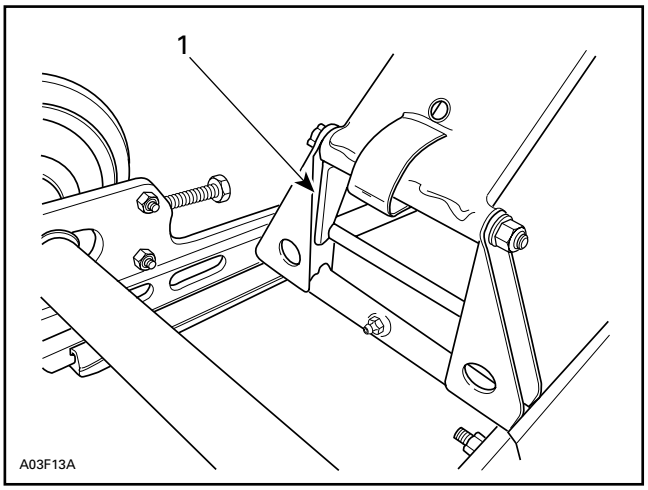


TYPICAL
1. Shock upper bolt and nut
2. Throttle rod upper bolt and nut
3. Rear springs
4. Rear arm/pivot arm screws and washers
5. Rear arm
6. Pivot arm/runners bolts, nuts and washers
7. Pivot arm

REAR ARM INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

At installation, rear arm stroke limiter must be on rear side.



TYPICAL
1. Stroke limiter on rear side

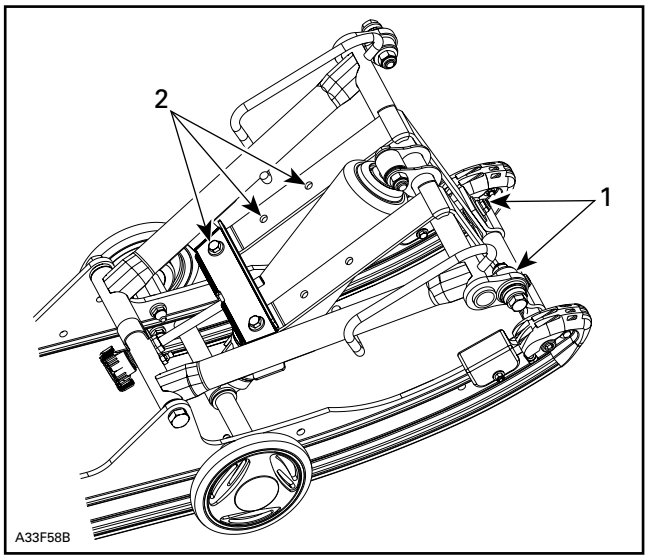
Respect the following tightening torque specifications:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)
Rear arm shock upper nut	19.5 N•m (173 lbf•**in**)
Throttle rod upper nut	19.5 N•m (173 lbf•**in**)

STOPPER STRAP

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace as required.

Make sure it is attached through proper hole from the end.



1. No adjustment possible
2. 3 adjustments possible

DESCRIPTION	TIGHTENING TORQUE
Stopper strap nuts (on strap adjuster)	21 N•m (15 lbf•ft)
Stopper strap nuts	11 N•m (97 lbf•**in**)

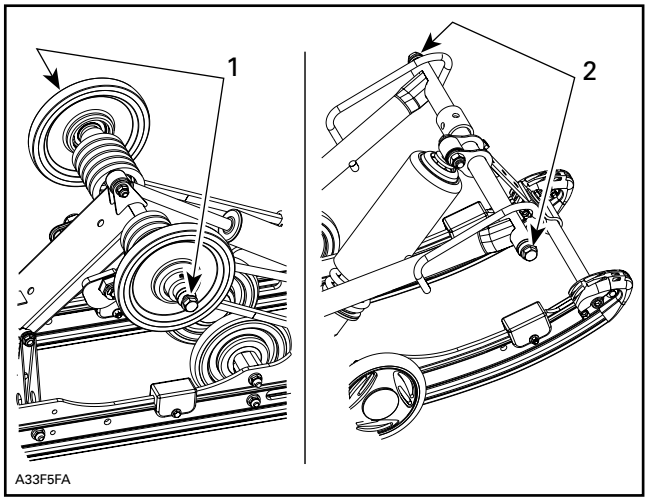
SUSPENSION REMOVAL

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

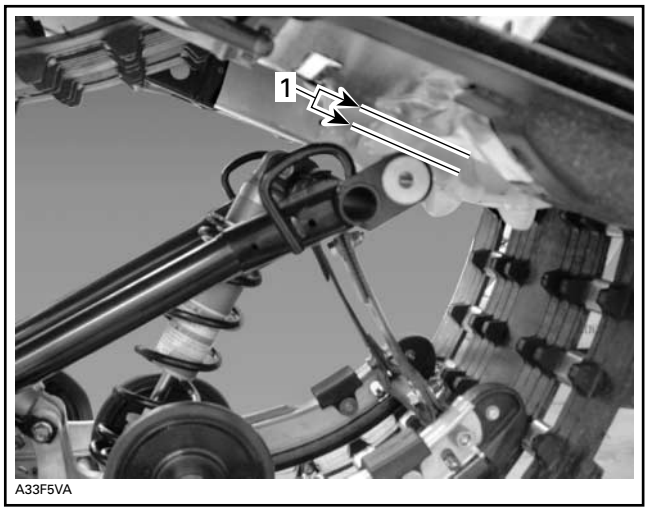
Remove rear arm top axle bolts from chassis.

Remove bolts retaining front arm to tunnel.

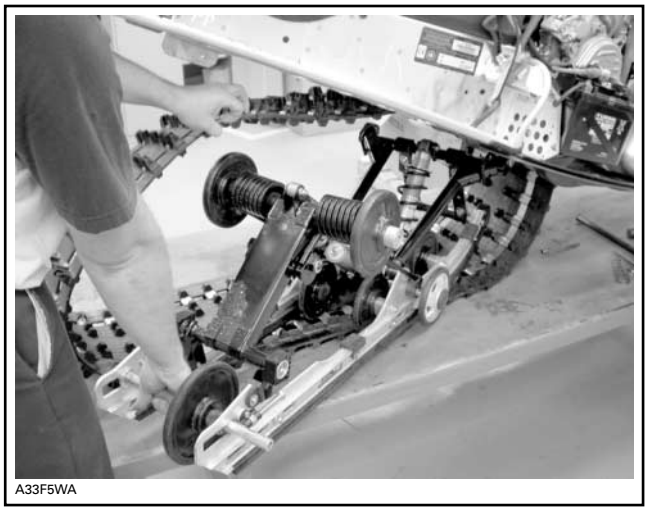


TYPICAL
1. Rear arm bolts
2. Front arm bolts

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



TYPICAL
1. Enough clearance


A33F5WA

TYPICAL — REMOVE SUSPENSION

SUSPENSION INSTALLATION

Installation is the reverse of removal procedure. Pay attention to the following details.

Inspect track thoroughly before reinstalling suspension. Refer to TRACK.

Install suspension into track with front portion first.

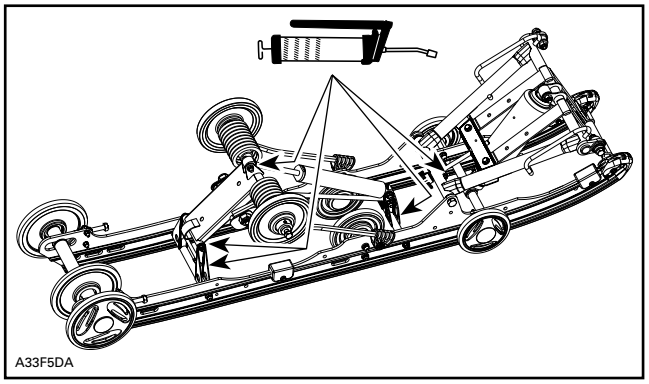
Adjust track tension.

RIDE ADJUSTMENT

Refer to the appropriate *Operator's Guide*.

LUBRICATION

Lubricate front and rear arms at grease fittings using suspension synthetic grease (P/N 293 550 033).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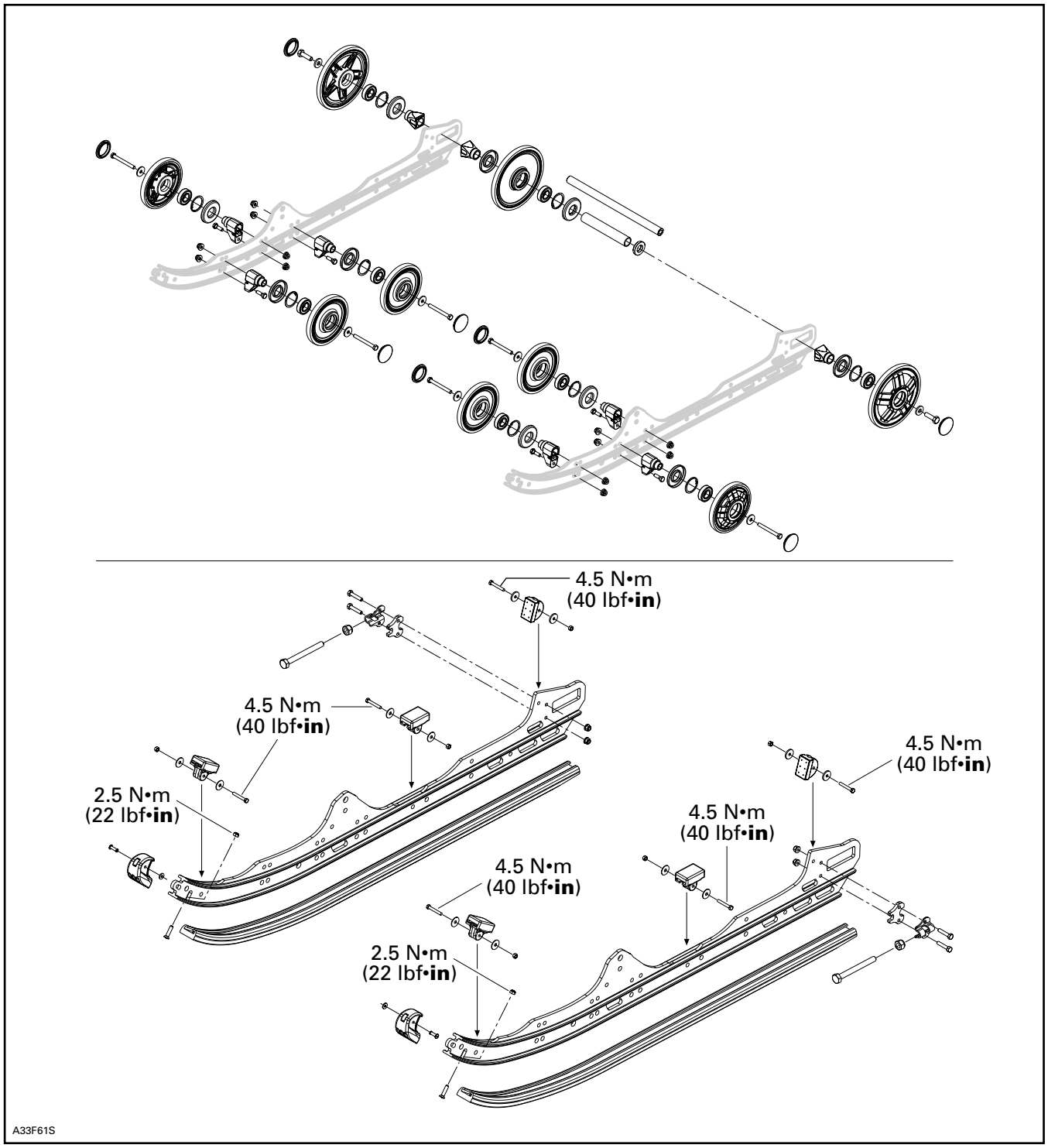
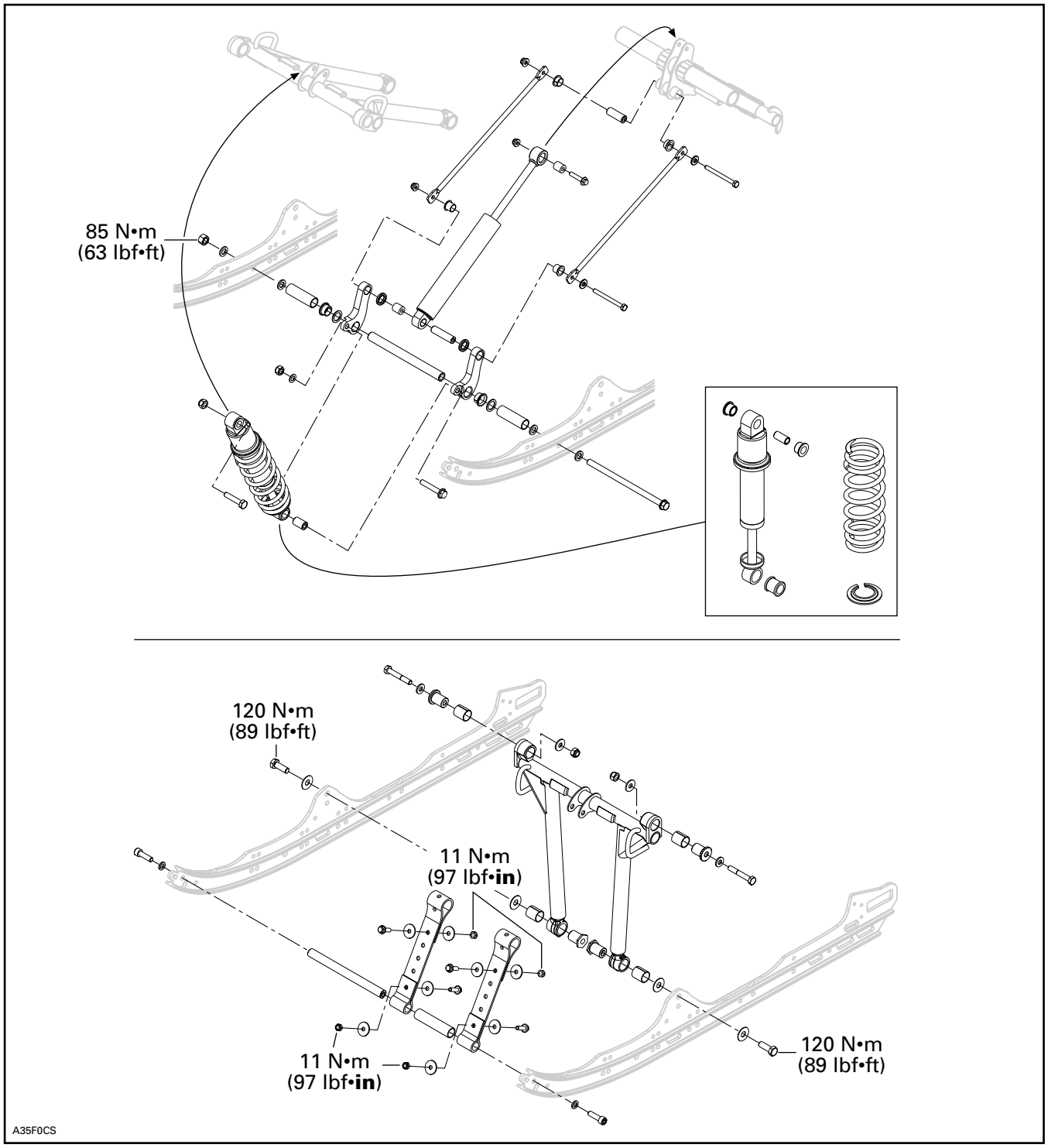
SC 4 SUSPENSION

SERVICE PRODUCTS

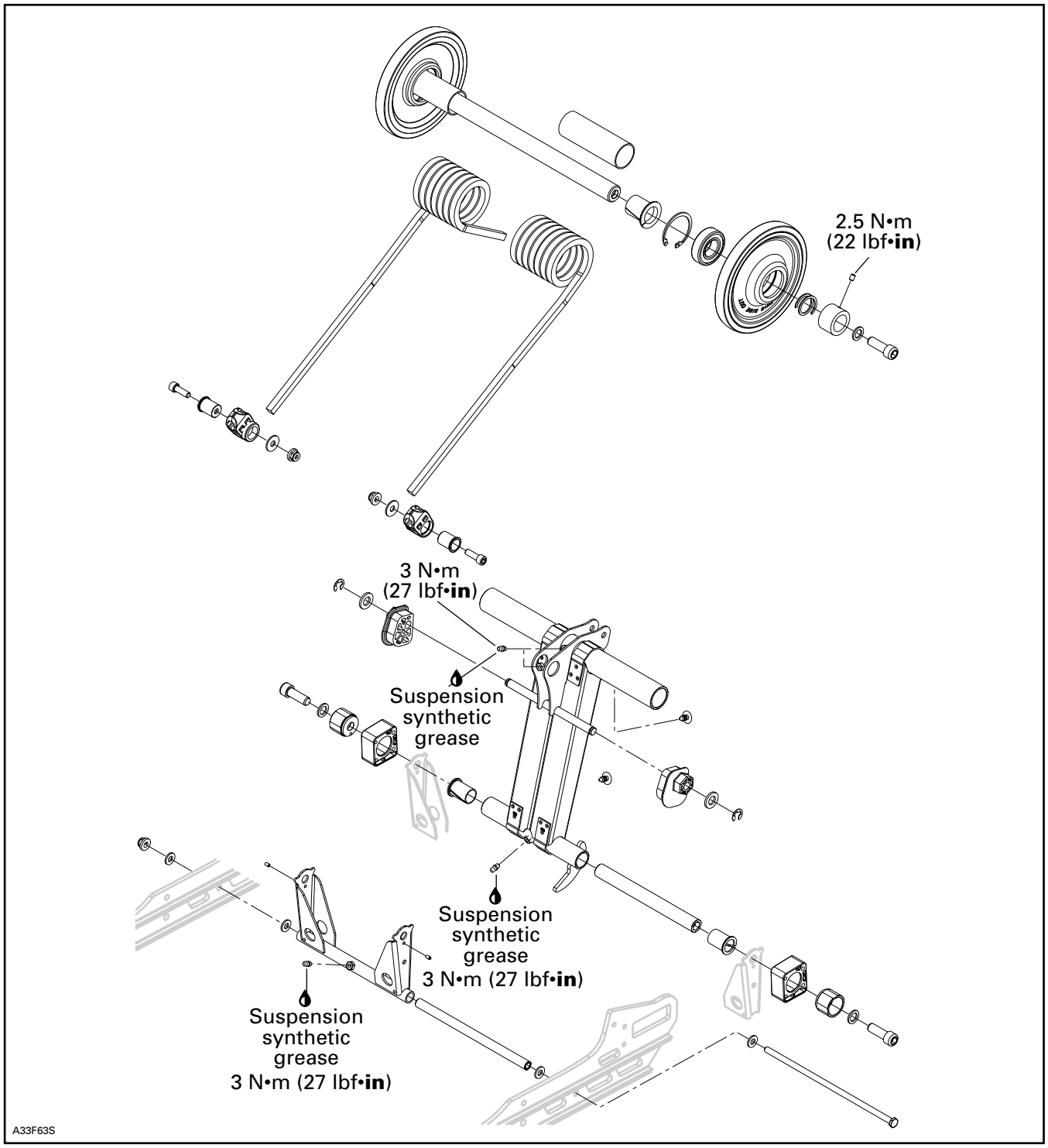
Description	Part Number	Page
suspension synthetic grease	293 550 033	267



RAILS AND IDLER WHEELS



ARMS AND SHOCK ABSORBERS



REAR ARM, SPRINGS AND IDLER WHEELS

AXLE SELF-LOCKING SCREW REMOVAL

CAUTION: These self-locking screws must always be replaced by new ones everytime they are removed.

NOTE: To prevent an axle from turning when unscrewing self-locking screws, proceed as follows:

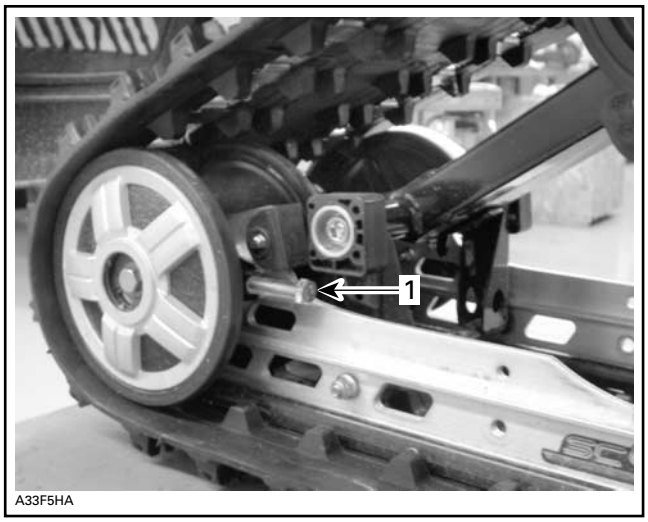
– Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
– Remove the opposite self-locking screw.
– Remove the temporary installed non-self-locking screw.
– If it doesn't work, heat bolt head to melt threadlocker.

REAR AXLE REMOVAL

Lift rear of vehicle and support it off the ground.

Remove screws on rear axle.

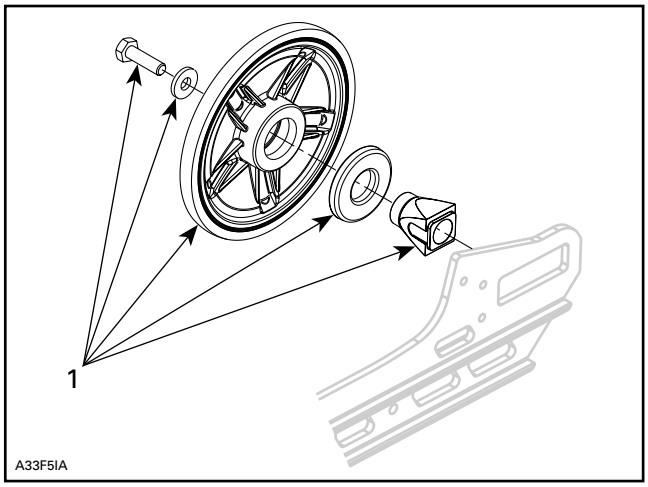
Completely loosen track tension.



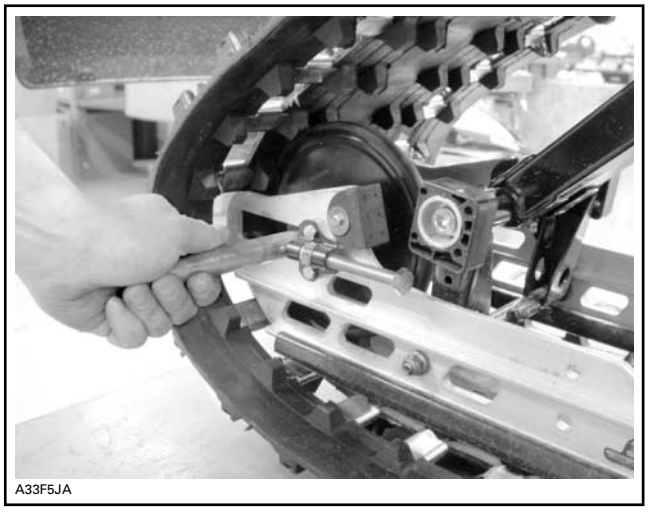
1. Completely loosen track tension

Remove the following:

– rear idler wheels
– idler wheels bearing protector
– idler wheels spacer.



ON BOTH SIDES
1. Remove the following



PULL OUT REAR AXLE

REAR AXLE INSTALLATION

Installation is reverse of removal procedure.

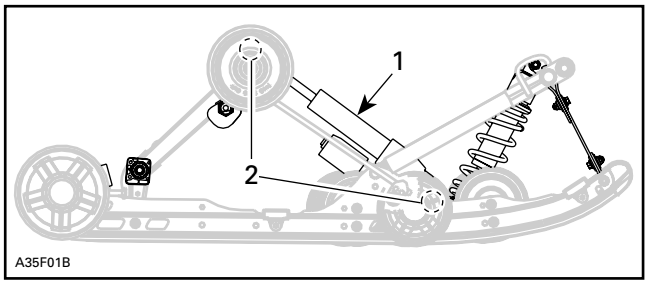
REAR SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

NOTE: If necessary, to ease shock removal, unfasten one end of stopper straps to release shock pressure.

Remove bolts and nuts from shock.

NOTE: If necessary, remove idler wheel(s) to ease lower shock component removal.

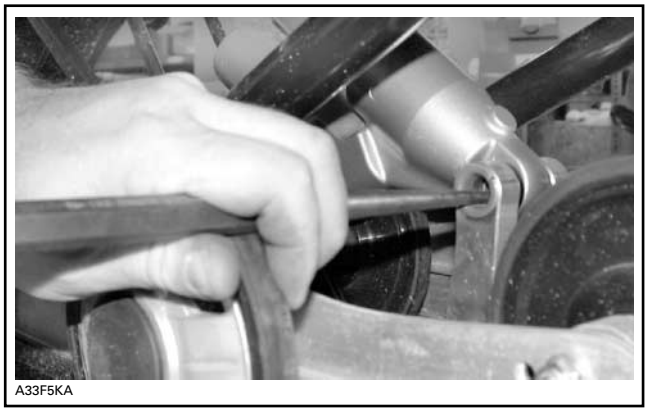


TYPICAL
1. Rear shock absorber
2. Remove bolts and nuts

Using a punch, remove lower shock bar axle.

Pay attention to plastic spacers.

Remove shock.



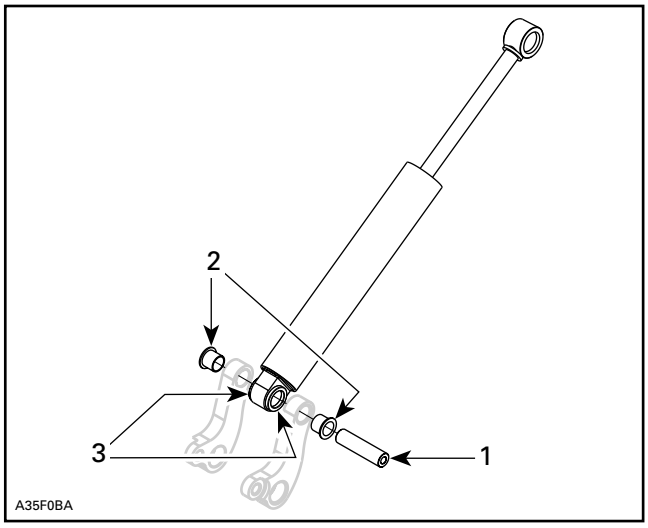
TYPICAL — REMOVE BAR AXLE

REAR SHOCK ABSORBER INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

To ease shock installation, secure upper shock first.

CAUTION: Make sure shock bar axle is aligned with swivel bushings before inserting it.

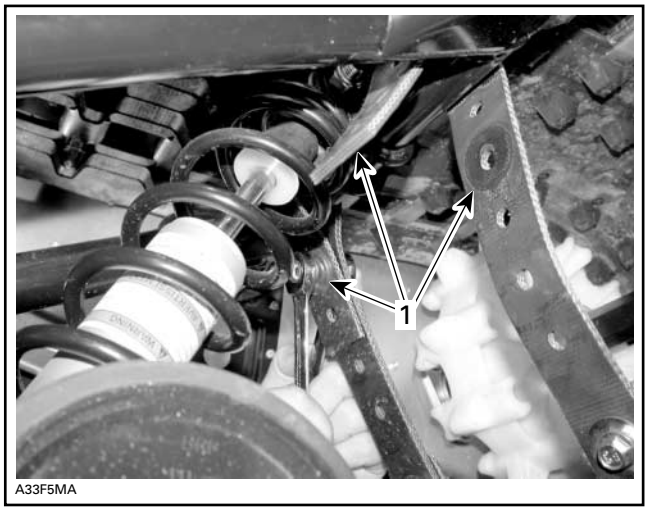


1. Bar axle
2. Swivel bushings
3. Plastic spacers

FRONT SHOCK ABSORBER REMOVAL

Lift rear of vehicle and support it off the ground.

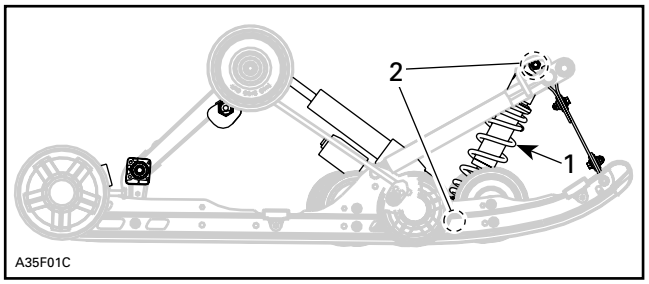
Unfasten one end of stopper straps.



TYPICAL
1. Unfasten one end of stopper straps

Remove bolts and nuts from shock.

NOTE: If necessary, remove idler wheel(s) to ease lower shock component removal.



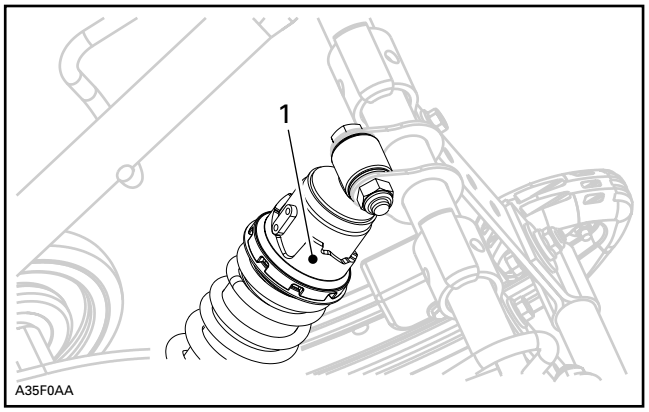
TYPICAL
1. *Front shock absorber*
2. *Remove bolts and nuts*

FRONT SHOCK ABSORBER INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Shock absorber nuts should be on the RH side.

Install shock adjustment ring towards the top, see photo.



1. *Adjustment ring*

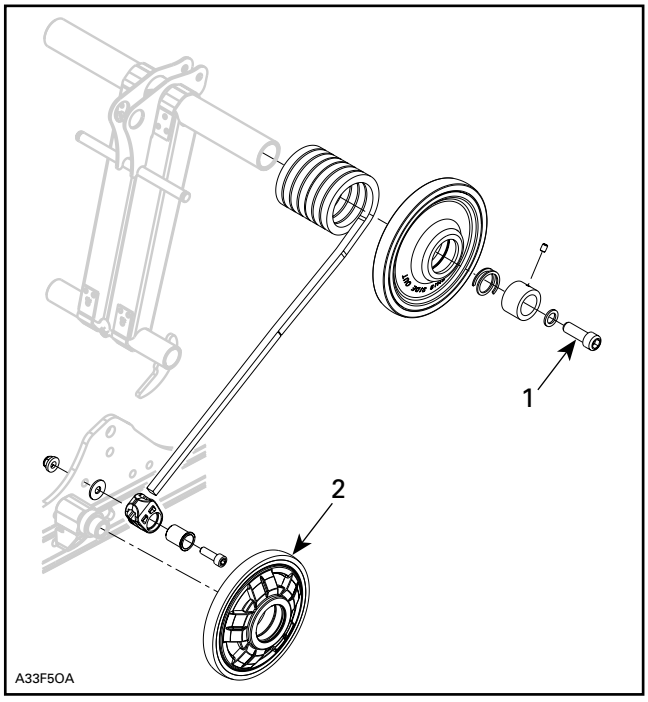
REAR SPRING REMOVAL

Lift rear of vehicle and support it off the ground.

Decrease spring preload by turning cams accordingly.

Loosen rear arm top axle from chassis.

Remove idler wheels to have access to spring support screws.

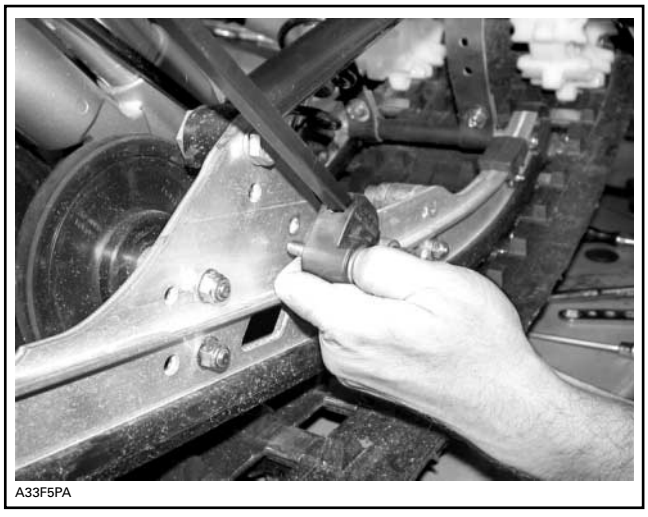


1. *Loosen rear arm top axle from chassis*
2. *Remove idler wheels*

Remove spring supports.

⚠ WARNING

Supports are spring loaded.



REMOVE SPRING SUPPORTS

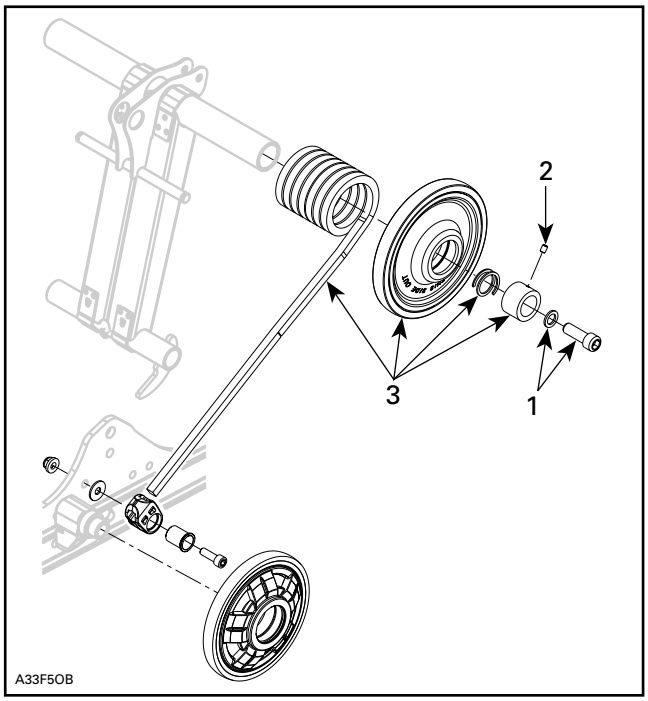
Remove screws and washers from rear arm top axle.

Loosen set screw from locking rings.

Remove the following on both sides:

– locking ring

– axle spring
– top idler wheel
– rear spring.



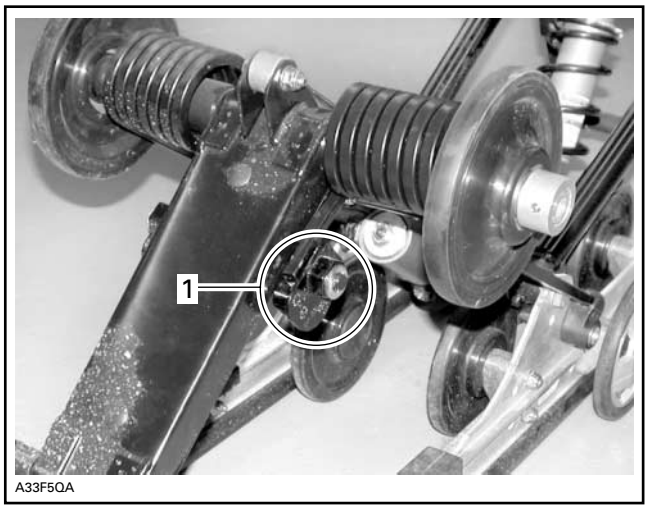
ON BOTH SIDES
1. *Remove screws*
2. *Loosen set screw*
3. *Remove the following*

REAR SPRING INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

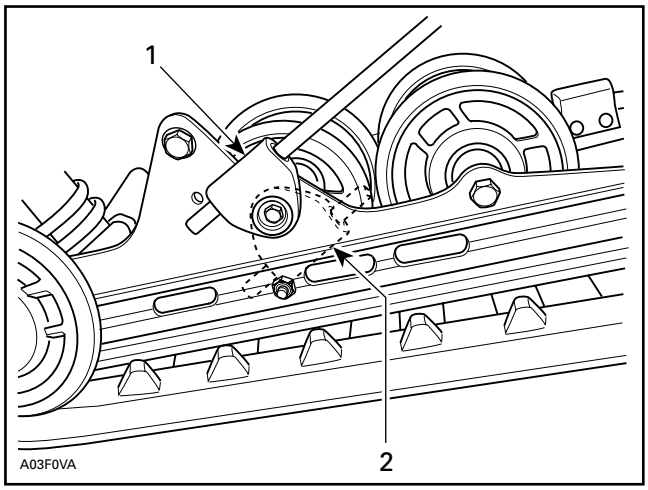
At assembly, respect THIS SIDE OUT inscription on top idler wheels.

At assembly, make sure that spring end is in cam adjuster.



ON BOTH SIDES
1. *Spring end in cam adjuster*

CAUTION: To avoid track damage, spring supports must be mounted upward.



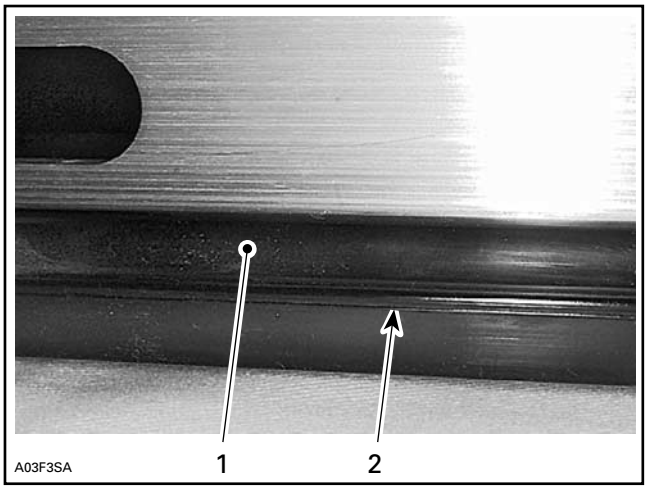
TYPICAL — RIGHT SIDE SHOWN
1. *Right position: upward*
2. *Wrong position*

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Locking ring set screw	2.5 N•m (22 lbf•**in**)

SLIDER SHOE VERIFICATION

Molding line is the wear limit indicator.



TYPICAL
1. Slider shoe
2. Molding line (wear limit indicator)

Replace slider shoes when wear limit is reached.

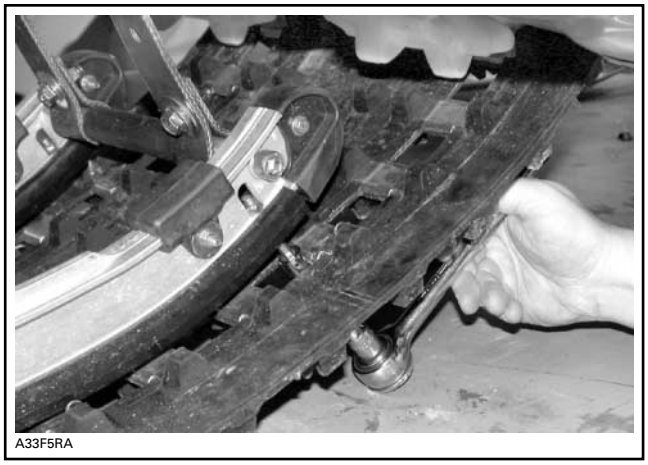
CAUTION: Slider shoes must always be replaced in pairs.

SLIDER SHOE REMOVAL

Lift rear of vehicle and support it off the ground.

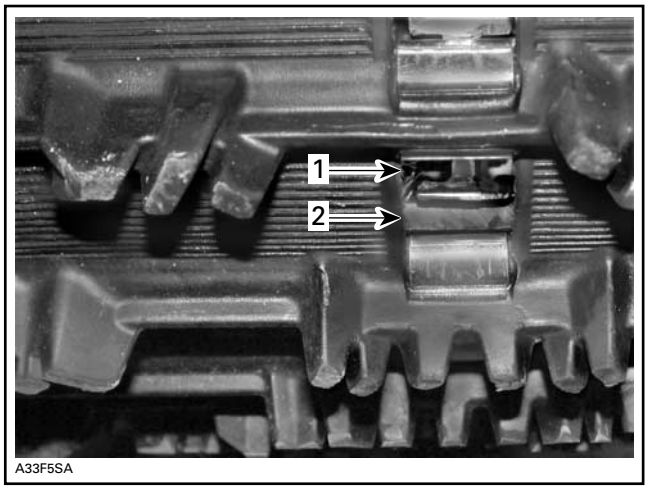
Completely loosen track tension.

Remove nut and screw of each runner.



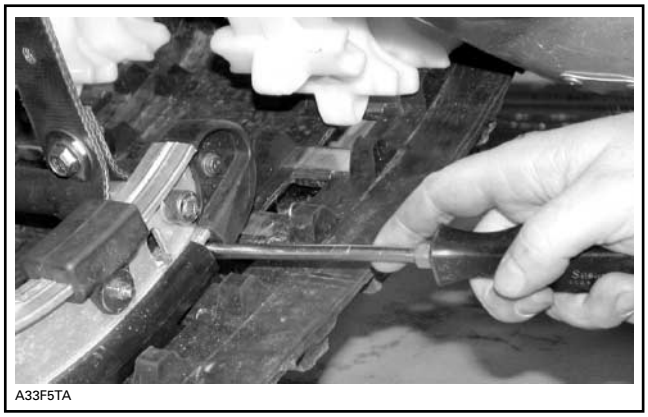
REMOVE NUT AND SCREW OF EACH RUNNER

Align track window with slider shoe.



TYPICAL
1. Track window
2. Slider shoe

Using a pry bar or screw driver, push slider shoe until it comes in contact with track.



PUSH ON SLIDER SHOE

Using locking pliers, pull slider shoe thru track window to remove.

NOTE: If necessary, lubricate track window to facilitate slider shoe removal.

PULL ON SLIDER SHOE TO REMOVE

SLIDER SHOE INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Make sure to insert slider shoe end with hole first.

Respect the following tightening torque specification:

DESCRIPTION	TIGHTENING TORQUE
Slider shoe nut	2.5 N•m (22 lbf•**in**)

FRONT ARM REMOVAL

NOTE: Front arm can be removed with suspension assembly in place.

Lift rear of vehicle and support it off the ground.

Remove the following:

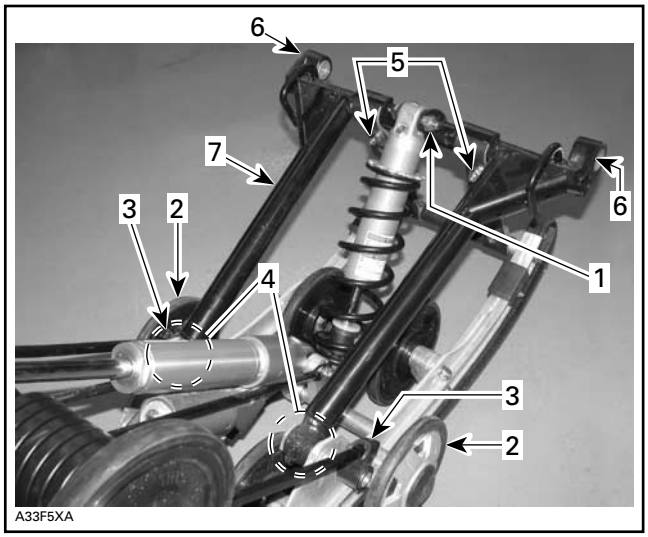
– shock upper bolt and nut
– front idler wheels
– spring supports (to gain access to front arm lower bolts)

⚠ WARNING

Supports are spring loaded.

– front arm lower bolts and washers
– unfasten one end of stopper straps
– remove front arm upper bolts, nuts and washers.

Remove front arm.



TYPICAL — SUSPENSION REMOVED FOR CLARITY
1. *Shock upper bolt and nut*
2. *Front idler wheels*
3. *Spring supports*
4. *Front arm lower bolts and washers*
5. *Unfasten one end of stopper straps*
6. *Front arm upper bolts, nuts and washers*
7. *Front arm*

FRONT ARM INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

To properly hold front arm axles when applying tightening torque to front arm lower bolts, it may be necessary to remove idle wheels.

Respect the following tightening torque specifications.

DESCRIPTION	TIGHTENING TORQUE
Stopper straps nuts	11 N•m (97 lbf•**in**)
Front arm lower bolts	120 N•m (89 lbf•ft)

REAR ARM/PIVOT ARM REMOVAL

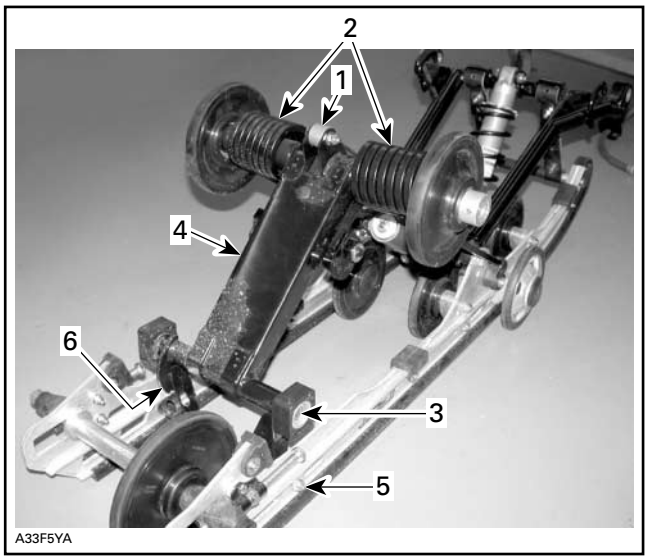
NOTE: Rear arm can be removed with suspension assembly in place.

For rear arm removal, remove the following:

– shock upper bolt and nut
– rear springs (refer to procedure above in this section)
– screws and washers holding rear arm to pivot arm.

For pivot arm removal, remove the following:

– bolts, nuts and washers holding pivot arm to runners.



SUSPENSION REMOVED FOR CLARITY
1. *Shock upper bolt and nut*
2. *Rear springs*
3. *Rear arm/pivot arm screws and washers*
4. *Rear arm*
5. *Pivot arm/runner bolts, nuts and washers*
6. *Pivot arm*

REAR ARM/PIVOT ARM INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Pivot arm grease fitting must be towards the front of the vehicle.

At installation, rear arm stroke limiter must be on rear side.

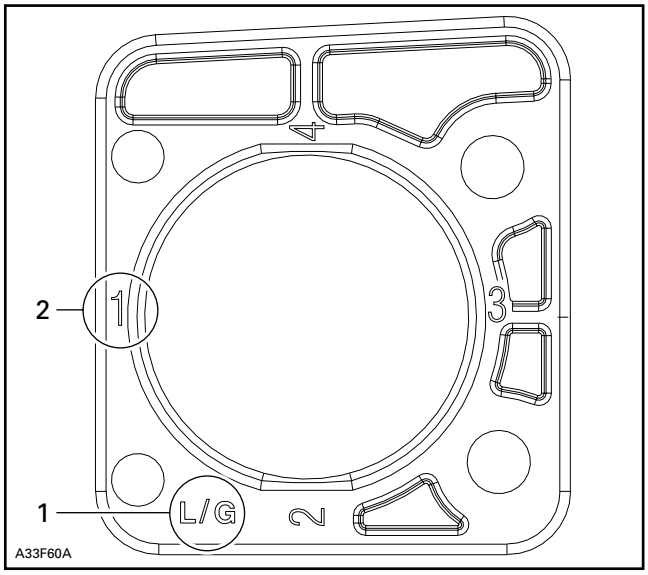
Insert dowel pin into pivot arm hole, dowel pin must exceed block guide by 2 to 2.3 mm (.079 to .091 in).

Respect the following tightening torque specifications.

DESCRIPTION	TIGHTENING TORQUE
Pivot arm/runners nut	25 N•m (18 lbf•ft)
Locking ring set screw	2.5 N•m (22 lbf•**in**)

BLOCK INSTALLATION

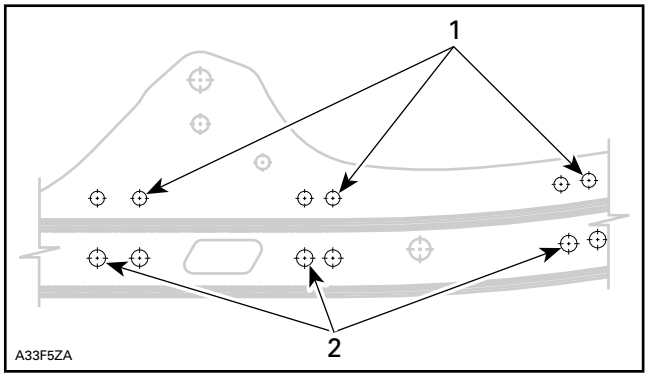
Both blocks are identified R or L (right or left) and have position number (from 1 to 4). At installation make sure to install proper block on proper side with the same adjustment position on both sides.



TYPICAL
1. *Blocks are identified R or L (right or left)*
2. *Blocks position number (from 1 to 4)*

IDLER WHEELS INSTALLATION

Refer to illustration for idler wheels position at installation.



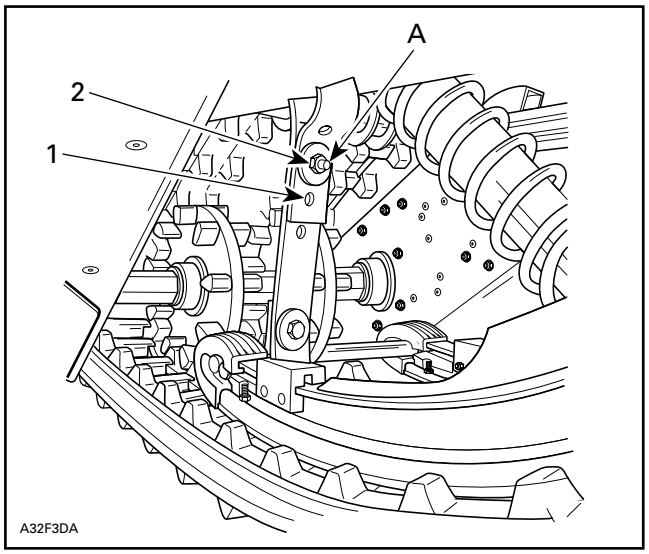
1. *RH side wheels position*
2. *LH side wheels position*

STOPPER STRAP

Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace as required.

Make sure it is attached through proper hole from the end.

Torque nut to 11 N•m (97 lbf•**in**).



TYPICAL
1. 1st hole
2. 2nd hole
*A. 11 N•m (97 lbf•**in**)*

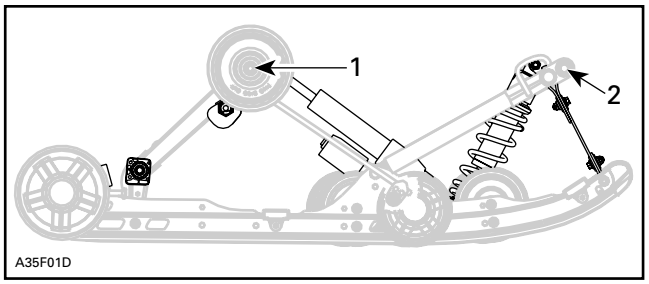
SUSPENSION REMOVAL

Lift rear of vehicle and support it off the ground.

Completely loosen track tension.

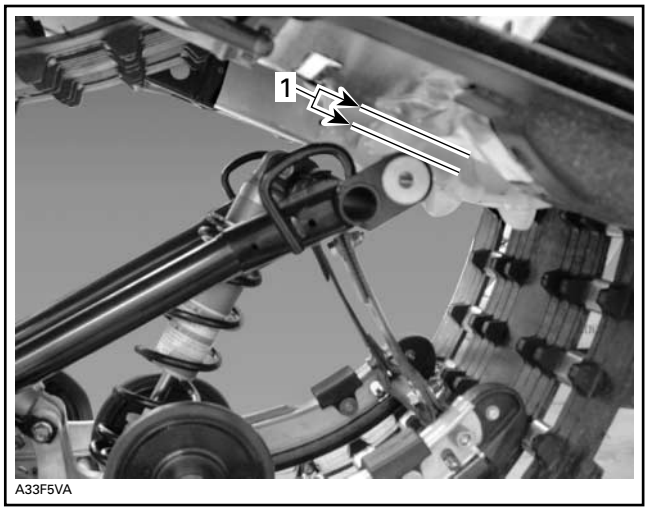
Remove rear arm top axle screws.

Remove front arm top bolts.

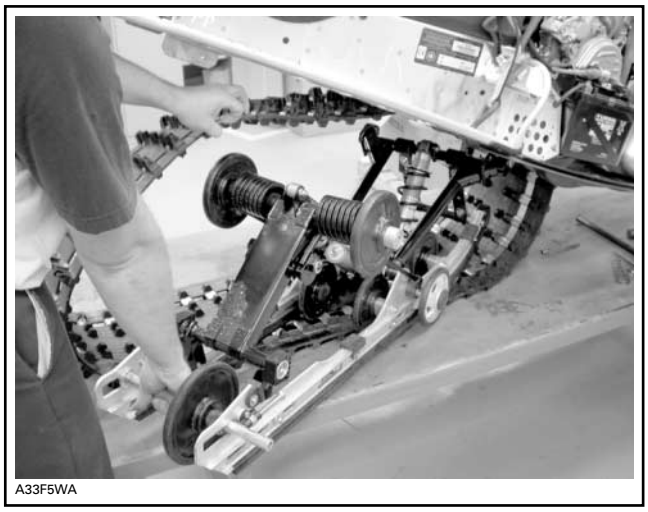


TYPICAL
1. Remove rear arm top axle screws
2. Remove front arm top bolts

Lift rear of vehicle until front arm as enough clearance to pass underneath tunnel.



1. Enough clearance



REMOVE SUSPENSION

SUSPENSION INSTALLATION

Installation is reverse of removal procedure. Pay attention to the following details.

Inspect track thoroughly before reinstalling suspension. Refer to TRACK.

Install suspension into track with front portion first.

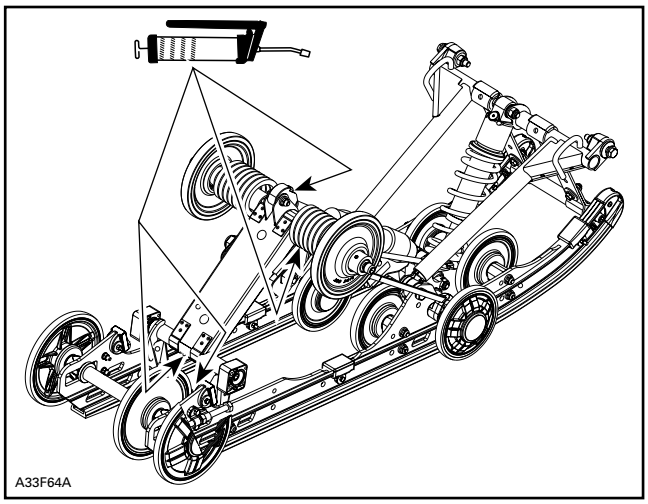
Adjust track tension.

RIDE ADJUSTMENT

Refer to the appropriate *Operator's Guide*.

LUBRICATION

Lubricate pivot arm and rear arm at grease fittings using suspension synthetic grease (P/N 293 550 033).



SHOCK ABSORBER INSPECTION AND SERVICING

SERVICE TOOLS

Description	Part Number	Page
gas fill tool kit (needle type)	503 190 102	271, 276
Gas fill tool kit (needle type)	503 190 102	270
gas shock valve tool (tire valve type)	529 035 570	276
HPG shock holding tool	529 035 769	270
Piston guide	529 026 600	270
Seal guide	529 026 500	270
shock spring remover	529 035 504	269
shock wrench	529 035 727	271
Shock wrench	529 035 727	270

SERVICE PRODUCTS

Description	Part Number	Page
Bombardier HPG shock oil	293 600 035	274
Loctite 271	293 800 005	272
Molykote G-n paste	711 297 433	274

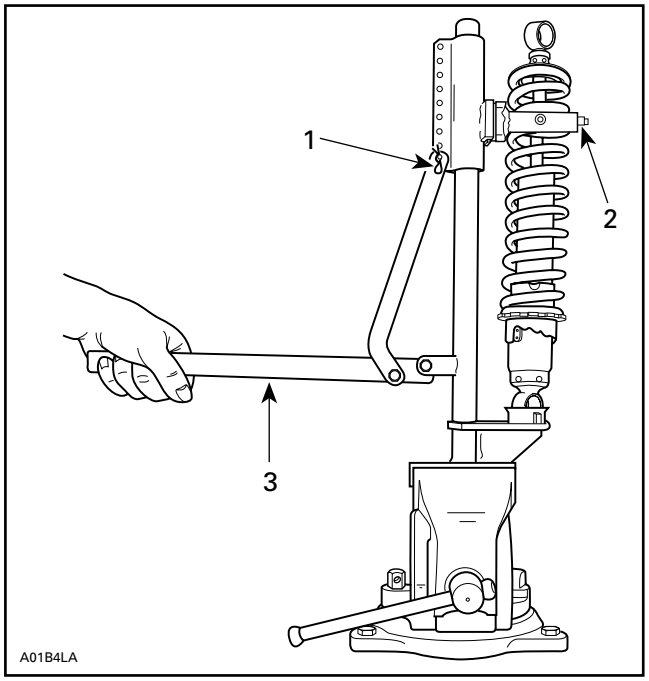
SPRING REMOVAL

Remove shock absorber from vehicle. Refer to the appropriate subsection.

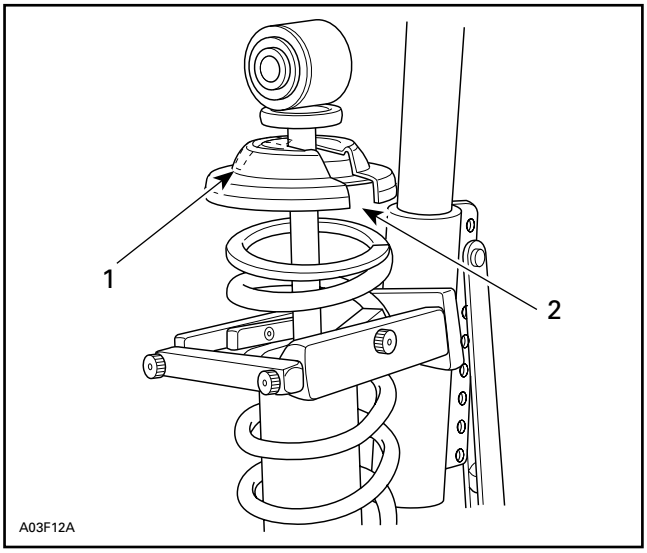
Use shock spring remover (P/N 529 035 504) and put it in a vise. Mount shock in it and turn shock so that a spring coil rests against spring compressor jaw.

Close and lock bar. Place handle horizontally by changing position of clevis pin.

Push down on handle until it locks. Remove spring stopper and cap then release handle.



TYPICAL
1. *Clevis pin*
2. *Bar*
3. *Handle placed horizontally*



TYPICAL
1. *Cap opening*
2. *Spring stopper opening*

Remove stopper.

Remove tool and spring from shock absorber.

SHOCK ABSORBER INSPECTION

Gas Shock

Because of gas pressure, strong resistance is felt when compressing shock.

For the verification of stroke, or if suspecting an internal leak between oil chamber and gas chamber, check shock as follows:

Install shock in a vise clamping on its bottom eyelet with its rod upward. Verify the stroke compression when the rod is fully extended.

Let it stand for 5 minutes.

Completely push down the shock rod then release.

The shock should extend unassisted. Rod must come out at a steady speed. If speed suddenly increases particularly at end of extension, replace shock.

If suspecting a frozen shock proceed as follows:

Place shock in a freezer (temperature below 0°C (32°F)) for 4 hours.

Push down on rod and note its resistance. If shock is frozen it will be much more difficult to compress than for the new one.

DISASSEMBLY AND ASSEMBLY

High Pressure Gas Take Apart Shock (HPG T/A)

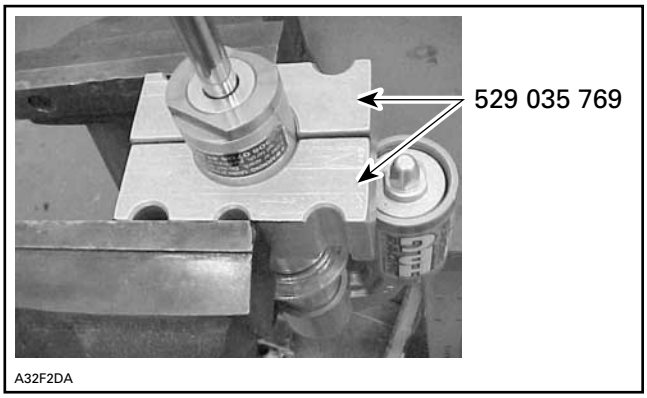
SERVICING TOOL	
SHOCK GAS FILLING	
Gas fill tool kit (needle type) (P/N 503 190 102)	
SHOCK ABSORBER DISASSEMBLY	
Shock size	Tool
C-36 36 mm (1.417 in)	Piston guide (P/N 529 026 600) Seal guide (P/N 529 026 500) Shock wrench (P/N 529 035 727)

Release nitrogen (N) pressure on any HPG T/A shock with internal floating piston (IFP).

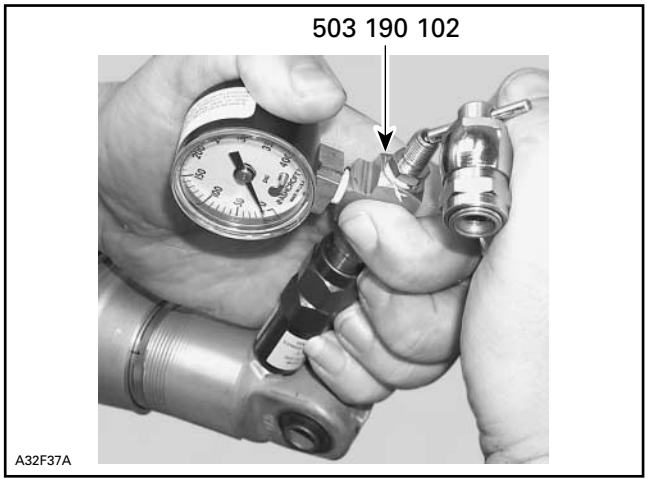
⚠ WARNING

Nitrogen gas is under extreme pressure. Use caution when releasing this gas volume. Protective eye wear should be used.

Mount shock in a vise with HPG shock holding tool (P/N 529 035 769).



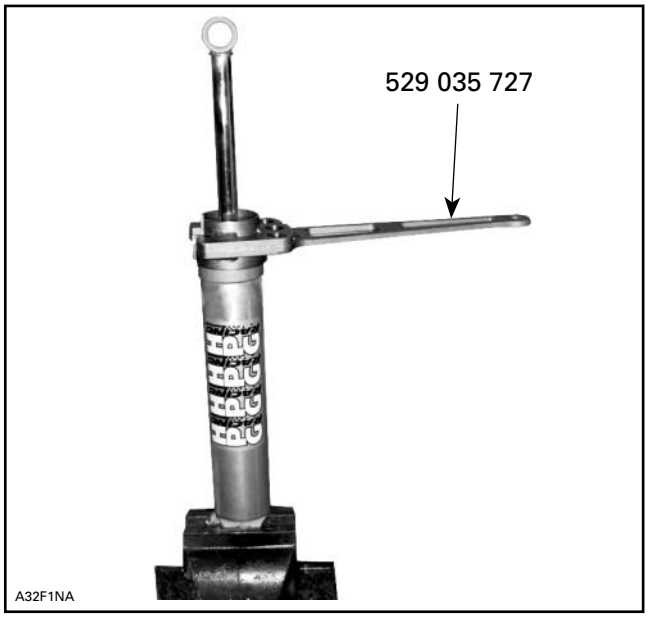
Remove screw on top of valve. Place the needle guide of gas fill tool kit (needle type) (P/N 503 190 102) on the shock valve. Press the detent pin and push forward the needle assembly very slowly towards rubber of needle valve. Push on shock tool valve center rod to release gas pressure.



Remove tool from shock.

Screw Cap Type HPG T/A Shock

Using appropriate size of shock wrench (P/N 529 035 727) unscrew seal carrier.



TYPICAL

Snap Ring Cap Type HPG T/A Shock

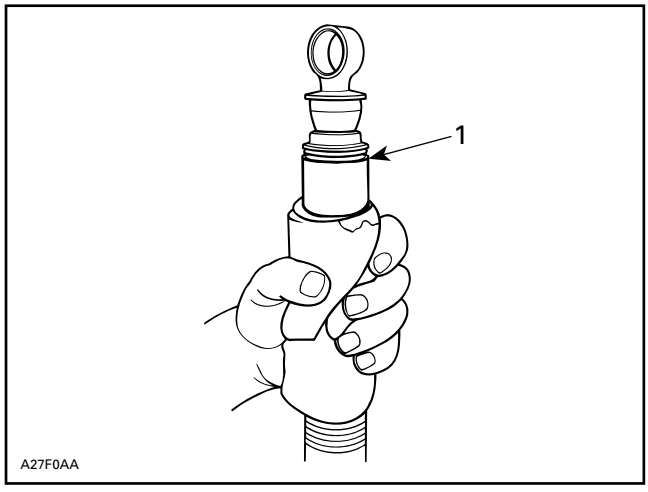
Using a flat tool, pop-out the cap.

Compress the carrier to access and remove the snap ring.

All HPG T/A Shocks

With the seal carrier removed, slowly lift and remove damper rod assembly from the damper body.

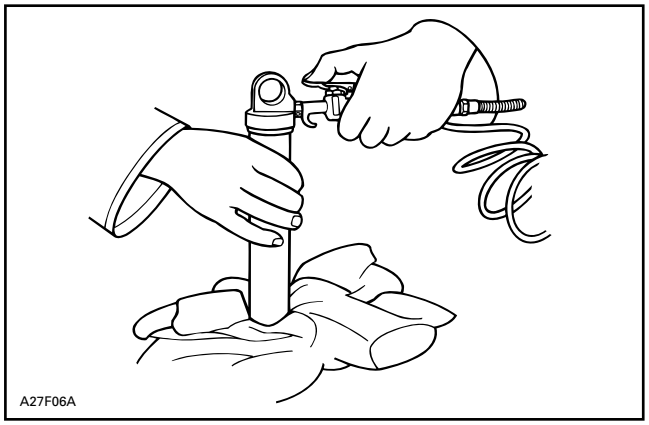
NOTE: Remove damper rod assembly slowly to reduce oil spillage and prevent piston seal damage by damper body threads. Wrap the damper body with a shop cloth to capture possible overflow oil while removing the damper piston.



1. Oil flows

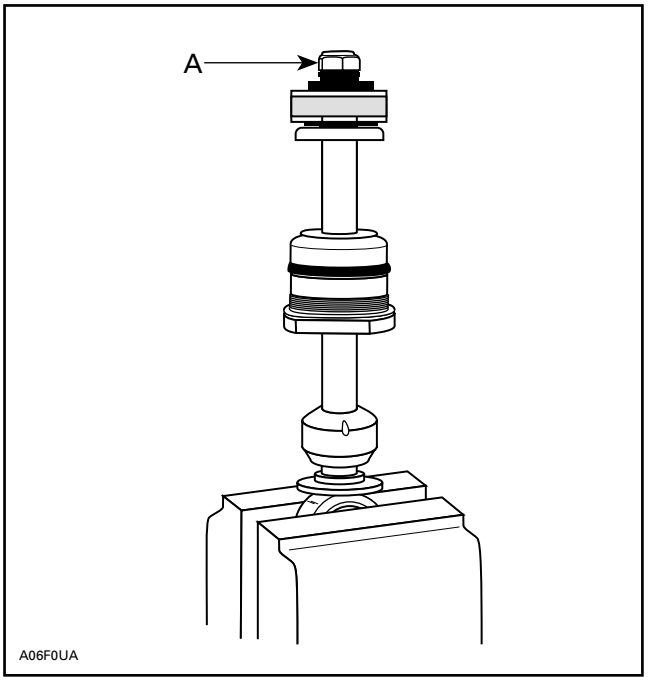
Discard old oil into storage container. Never reuse damper oil during shock rebuild.

Remove valve. Using compressed air pressure, carefully remove floating piston from damper body. Hold shop cloth over damper body opening to catch released floating piston. Allow room for floating piston to leave damper body.



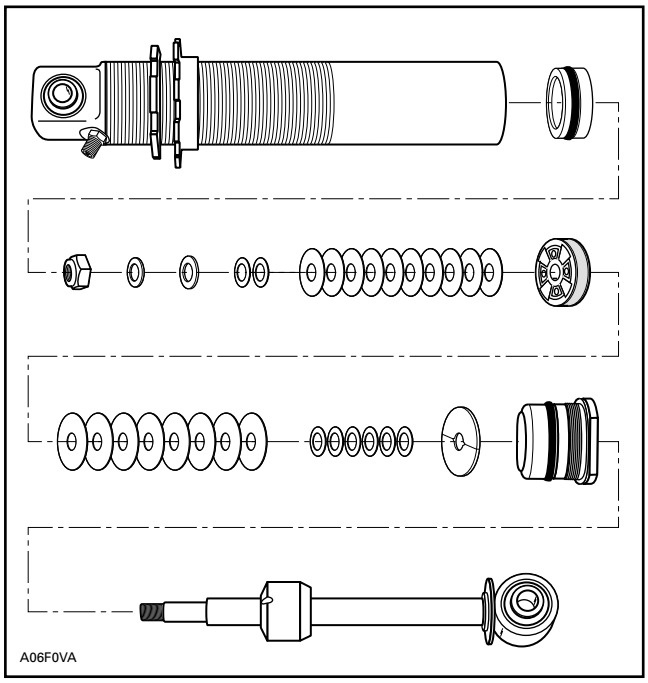
TYPICAL

Holding the damper rod assembly in a bench vise, begin piston and valve removal.



A. Remove damper nut

Always arrange parts removed in the sequence of disassembly.



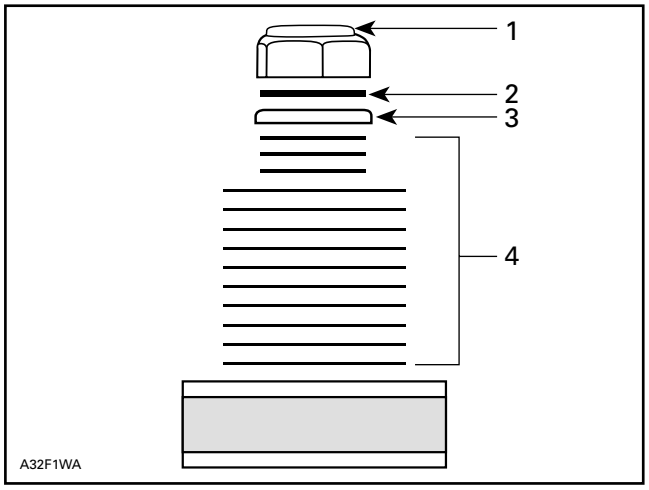
NOTE: As a general rule we suggest replacing the damper rod lock-nut after 4 rebuilds to ensure good locking friction and use Loctite 271 (P/N 293 800 005) each time.

NOTE: If revalving is to be done, it is imperative that you identify the original shim pack (size and number of shims). There is no need to remove seal carrier if only revalving is to be done.

Shims can be measured by using a vernier caliper or a micrometer.

NOTE: All shims should be carefully inspected and any bent or broken shims must be replaced for the shock to function properly.

After the new or replacement shim pack has been selected, reassemble in the reverse order of disassembly. Torque piston nut to 27 - 29 N•m (20 - 21 lbf•ft).



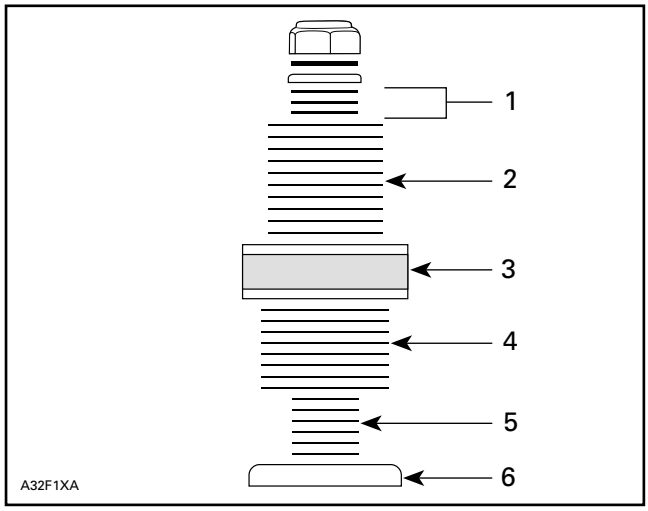
1. Damper nut
2. Spacer
3. Stopper with its round edge facing nut
4. Shim pack

CAUTION: The damper rod nut can only be reused 4 times, then, must be replaced. Do not substitute this part for non - O.E.M. Use Loctite 271 on nut each time.

This (these) spacer washer(s) must be used as shown to ensure damper rod nut does not bottom out or contact shaft threads.

Rebound valve stopper with round edge facing nut.

NOTE: Rebound shim stack must not reach into threads of damper shaft. Spacer under damper shaft nut is used to prevent damper shaft nut from bottoming on threads.

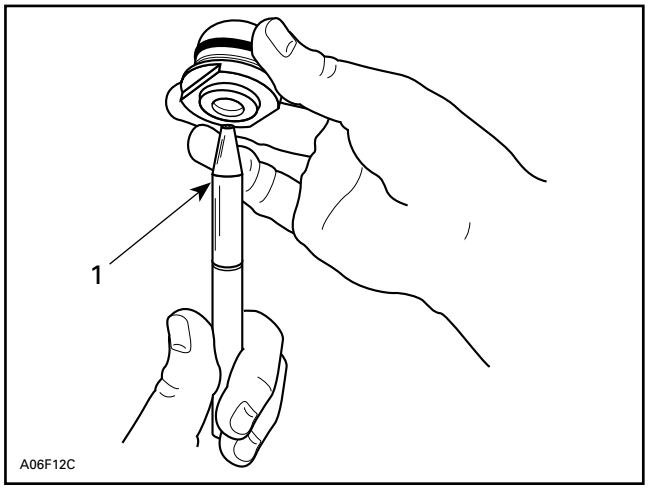


1. Rebound dampening shim pack
2. Rebound dampening shim pack
3. Piston
4. Compression dampening shim pack
5. Compression dampening shim pack
6. Stopper

If the seal carrier assembly is replaced, use seal pilot to guide seal over damper shaft. Lubricate seal carrier guide pilot before use.

CAUTION: Failure to use seal pilot will result in seal damage.

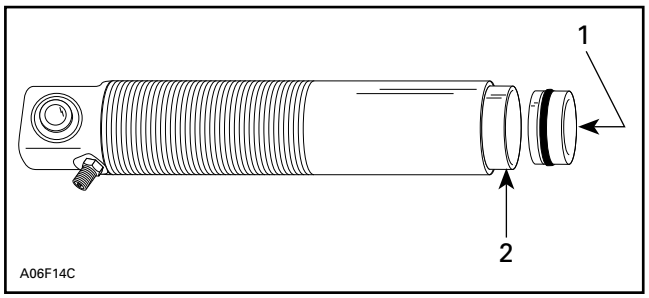
Reassemble damper rod assembly, taking care to properly assemble shim packs as required for your dampening needs. Ensure that the shaft piston is installed with the slits/larger intake holes facing the rebound shim stack.



1. Seal guide

If floating piston has been removed, reinstall floating piston into damper body (ensure that valve has been removed). Use Molykote G-n paste (P/N 711 297 433) to ease O-ring past damper body threads with floating piston guide.

CAUTION: Failure to install IFP correctly could result in shock damage.

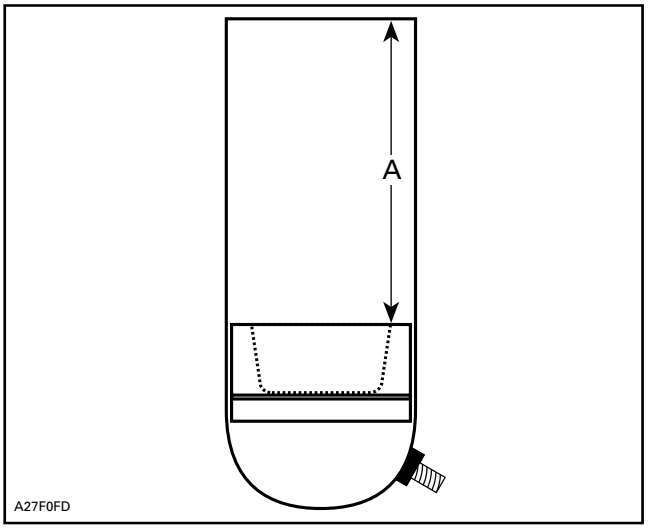


1. Push (slowly) by hand
2. Floating piston guide

NOTE: Lubricate inside of piston guide with Molykote G-n paste (P/N 711 297 433).

Install floating piston to the proper depth refer to following the table.

On all HPG take apart shocks, the floating piston is installed hollow side up.



A. Installation distance for floating piston installation

SHOCK P/N	INSTALLATION DISTANCE OF FLOATING PISTON mm (in)
503 190 655	119.5 (4.70)
503 190 662	121.5 (4.78)
503 190 834	134 (5.28)
503 190 990	171.5 (6.75)
503 190 994	171.5 (6.75)

NOTE: If the floating piston is installed too far into the damper body, light air pressure through damper body valve hole will move piston outward.

NOTE: Reinstall valve after IFP has been installed at correct height and before adding oil.

⚠ WARNING

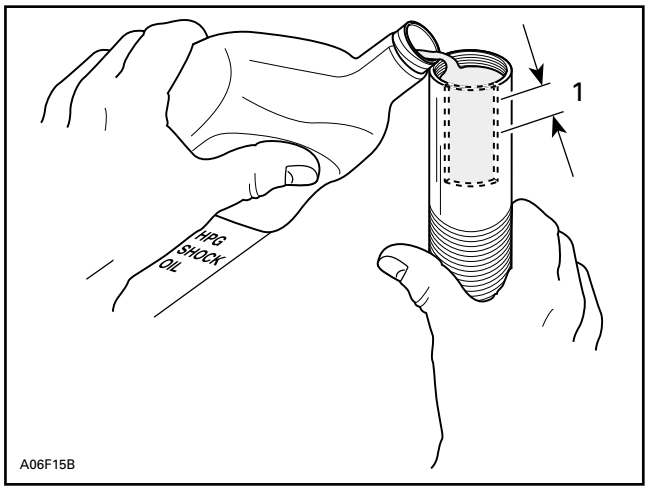
Whenever using compressed air exercise extreme caution, cover damper opening with shop cloth to reduce chance of possible injury.

CAUTION: Moisture laden compressed air will contaminate the gas chamber and rust floating piston.

⚠ WARNING

Always wear protective eye wear whenever using compressed air.

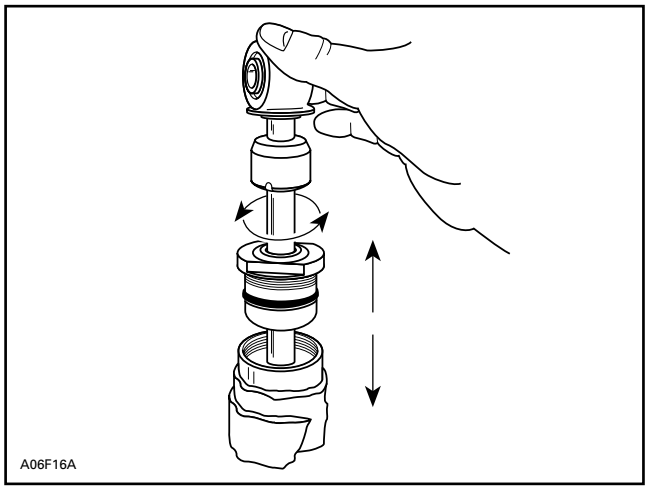
Fill the shock with Bombardier HPG shock oil (P/N 293 600 035) to approximately 10 mm (.393 in), from the base of seal carrier threads.



1. Fill to 10 mm (.393 in)

NOTE: Although we do not measure the exact amount of oil added to the damper, approximately 252 mL (8.52 oz. U.S.) will be used.

Carefully insert damper rod into the damper body. Lightly oil damper piston seal ring with shock oil to ease installation.



NOTE: Some shock oil will overflow when installing damper. Wrap damper with shop cloth to catch possible overflow oil.

CAUTION: Use care when passing piston into damper body at damper body threads.

Slight oscillation of damper rod may be required to allow piston to enter damper body bore.

Slowly push piston into damper body. Slight up and down movement may be required on short stroke to allow all air to pass through piston assembly. The gentle tapping of a small wrench, on the shock eye, may help dislodge air trapped in the submersed piston. Be careful not to drive the shaft any deeper into the oil than is necessary to just cover the shim stack.

NOTE: Fast installation of the damper rod may displace the floating piston from its original position. This must not occur if the damper is expected to perform as designed.

With damper rod piston into oil, TOP OFF damper oil volume. Oil level should be to damper body thread base.

Screw Cap Type HPG T/A Shock

Seal carrier assembly can now be threaded into damper body. This should be done slowly to allow weapage of oil and to minimize IFP displacement. Torque seal carrier to 90 to 100 N•m (66 to 74 lbf•ft).

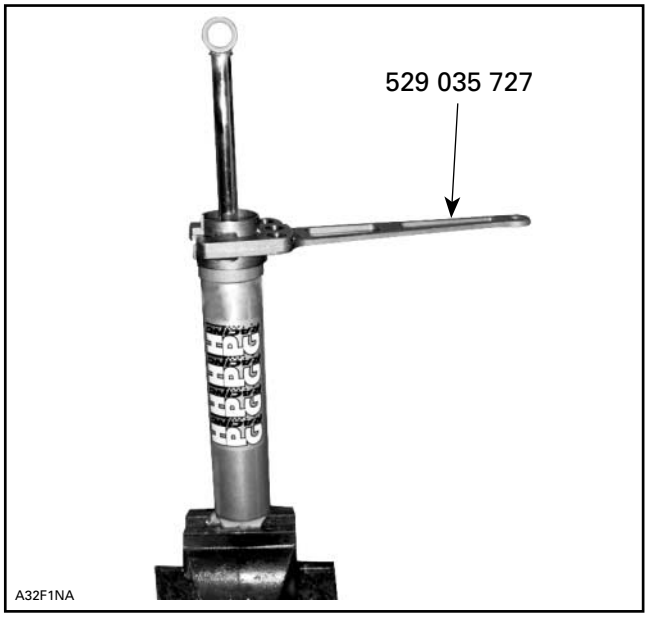
Snap Ring Cap Type HPG T/A Shock

Seal carrier assembly can now be pushed into damper body to pass snap ring grove. Install snap ring into groove.

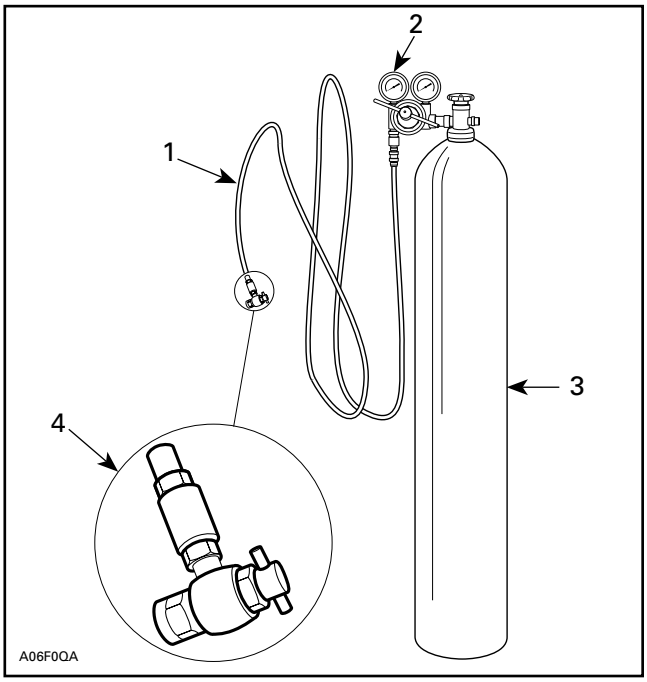
Tap the cap on the shock body.

All HPG T/A Shocks

After the seal carrier is fully in place avoid pushing the shaft into the body until the nitrogen charge is added.



Nitrogen (N) can now be added to damper body.



1. High pressure hose
2. Stage regulator, delivery pressure range 2070 kPa (300 PSI)
3. High pressure cylinder filled with industrial grade nitrogen
4. Valve tip (P/N 529 035 570) permanently installed

NOTE: Never substitute another gas for nitrogen. Nitrogen has been selected for its inert qualities and will not contaminate the gas chamber of the shock.

Preset your pressure regulator to 2070 kPa (300 PSI) nitrogen (N), this gas pressure will restore the correct pressure for your damper.

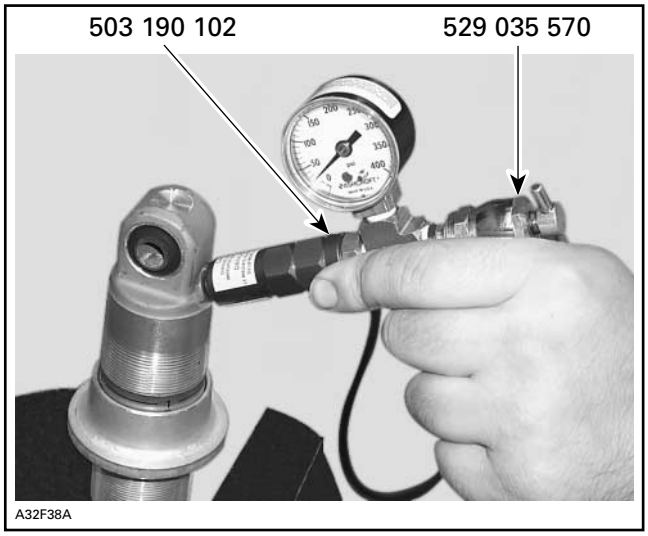
CAUTION: Do not exceed the recommended pressure values.

⚠ WARNING

Whenever working with high pressure gas, use eye wear protection. Never direct gas pressure toward anybody.

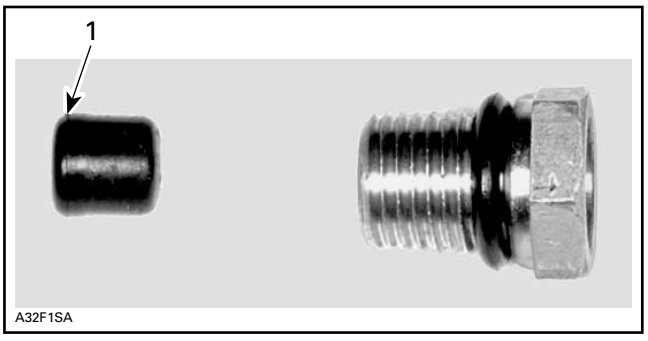
Install the gas fill tool kit (needle type) (P/N 503 190 102) on gas shock valve tool (tire valve type) (P/N 529 035 570). Set the regulator pressure on the nitrogen cylinder as per the shock requirement.

Mount the shock on vise. Remove screw on top of valve. Place the needle guide of gas refill tool on the shock valve. While depressing the detent pin of the gas refill tool and pushing forward the needle assembly, insert the needle through the rubber core of the pressure valve assembly of the shock.



NOTE: For replacement of the needle or filling the shock, carefully follow the instructions provided with the gas fill tool kit (needle type) (P/N 503 190 102).

On some models, rubber may pop out of needle valve when inserting tool needle. If so, remove valve and rubber, reinstall rubber with its larger diameter last.



1. Larger diameter

When the shock is filled with gas, install back the screw on top of the valve.

NOTE: Carefully inspect damper for gas or oil leaks. Any leaks must be corrected before continuing.

Damper gas pressure cannot be confirmed by using a pressure gauge. The volume of gas in the shock is very small, and the amount lost during gauge installation will lower the pressure too much and require refilling.

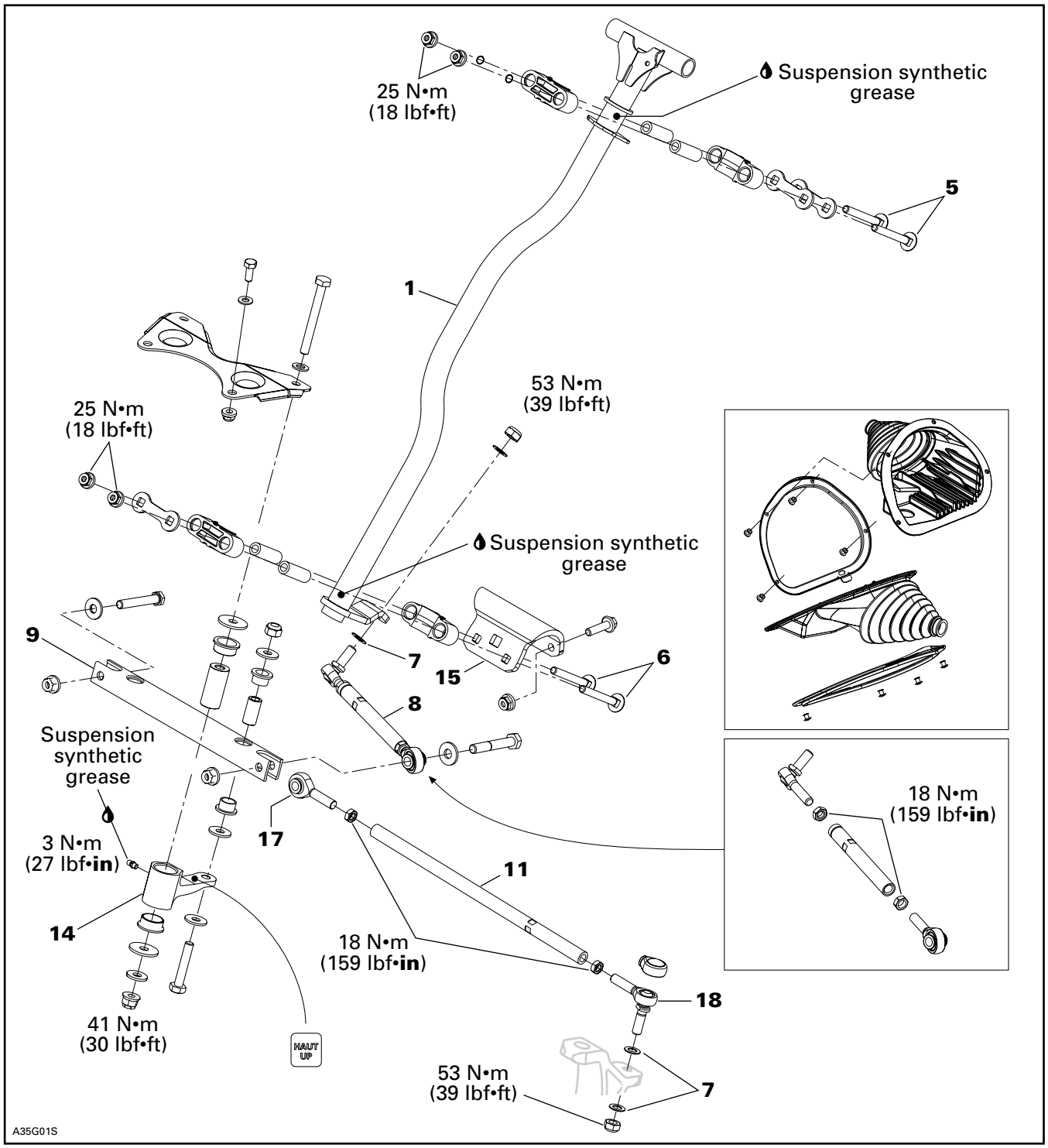
After recharging is complete the rebuilt shock should be bench-tested. Stroke the shock to ensure full travel and smooth compression and rebound action. If the shaft moves in or out erratically this could indicate too much air is trapped inside. If the shaft will not move or has partial travel then it may be hydraulically locked. In either event the shock must be rebuilt again. Pay particular attention to the placement of the IFP, quantity of oil and shim stack/piston assembly.

STEERING SYSTEM

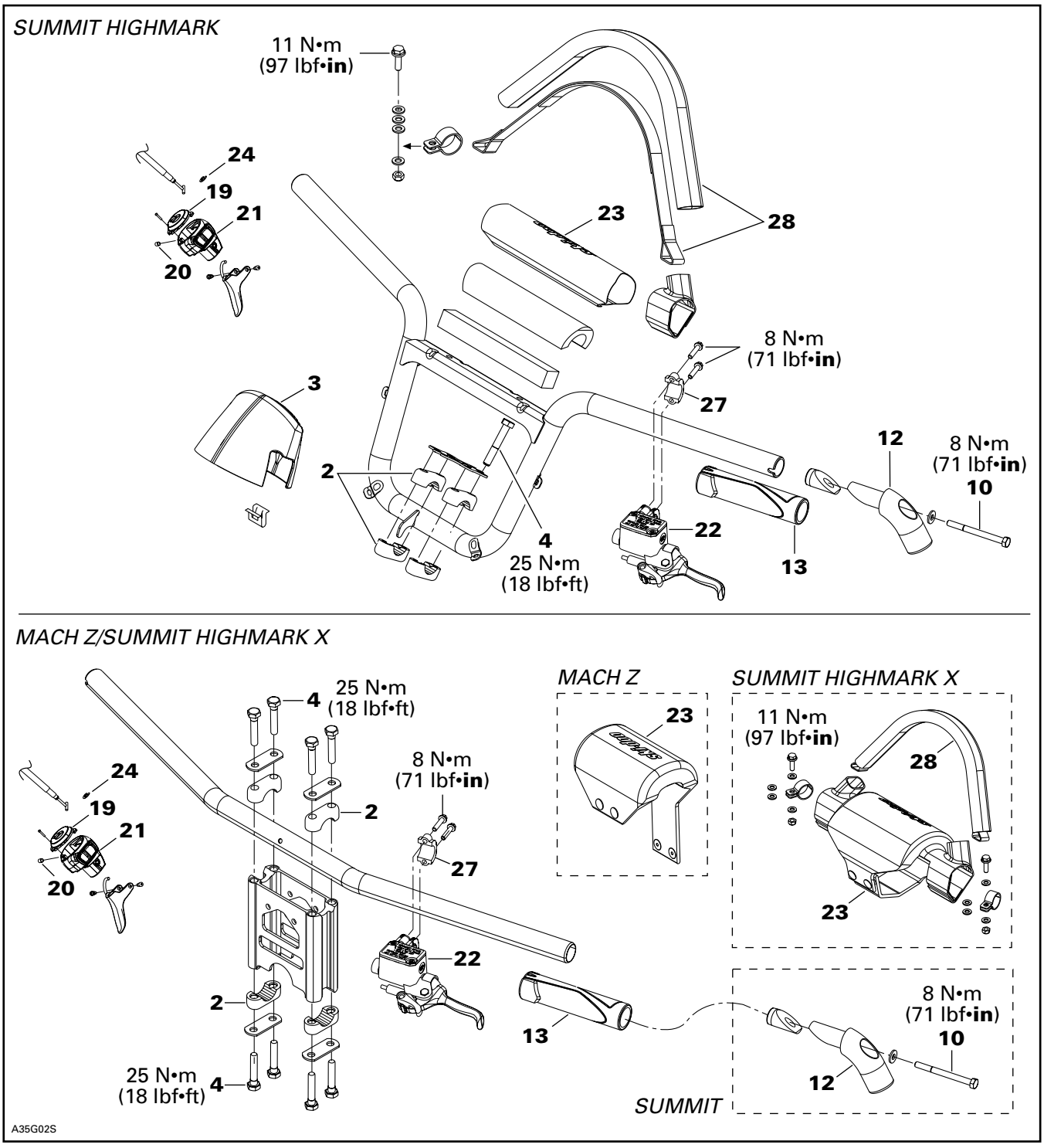
SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	289

Linkage Arrangement



Handlebar Arrangement



DISASSEMBLY AND ASSEMBLY

Grip

NOTE: These models feature an integrated heating element in the plastic sleeve of the grip **no. 13**.

CAUTION: Removing grip from handlebar might damage the heating element. Do not remove needlessly.

NOTE: If heating grip does not work and needs to be replaced, the grip can be cut with a knife for removal.

Throttle Side:

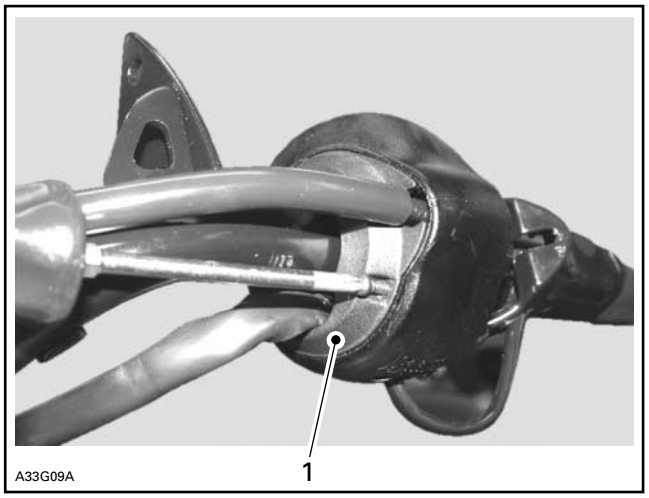
NOTE: Throttle lever housing **no. 21** must come off handlebar along with grip.

Remove steering padding **no. 23**.

Unplug RH harness on top of steering column.

Cut locking ties retaining RH harness to handlebar.

Remove throttle lever housing cover **no. 19**.



1. Throttle lever housing cover

Remove circlip **no. 24** from throttle cable housing.

Unfasten throttle cable from throttle lever, then pull out throttle cable housing from throttle lever housing **no. 21**.

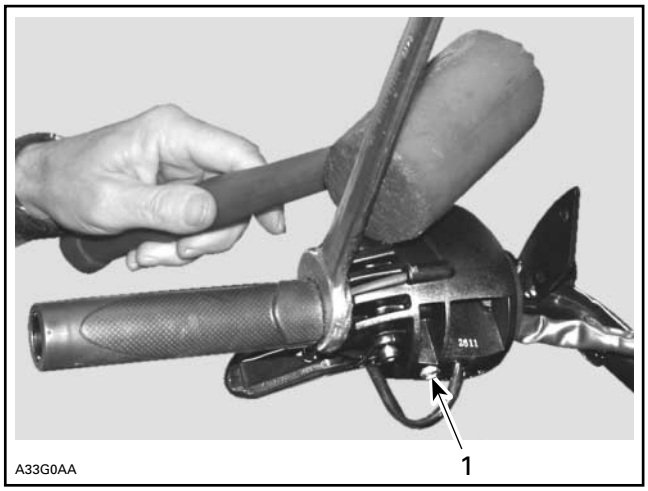
Unscrew screws **no. 10** and remove J-hook **no. 12** from end of grip on so equipped models.

Loosen screw **no. 20** retaining throttle lever housing to handlebar. See photo below.

Insert the open side of a 23 mm (7/8 in) wrench against the inner end of grip.

CAUTION: Pay attention not to damage wires with the wrench.

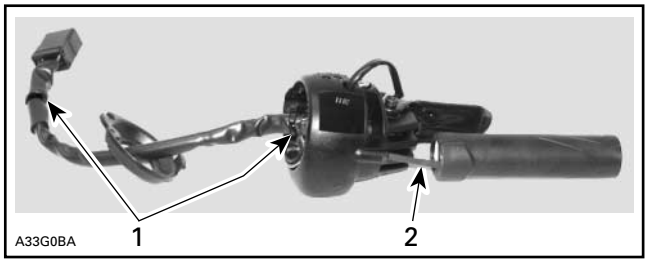
Using a plastic hammer, tap on the side of the wrench end to make the grip slide out.



1. Screw retaining throttle lever housing

Cut locking ties on harness.

Using the multilock-terminal housing extraction tool AMP (P/N 755430-2), push the 3 wires of the heating grip harness out of connector housing. Note the position of the wires for reinstallation.



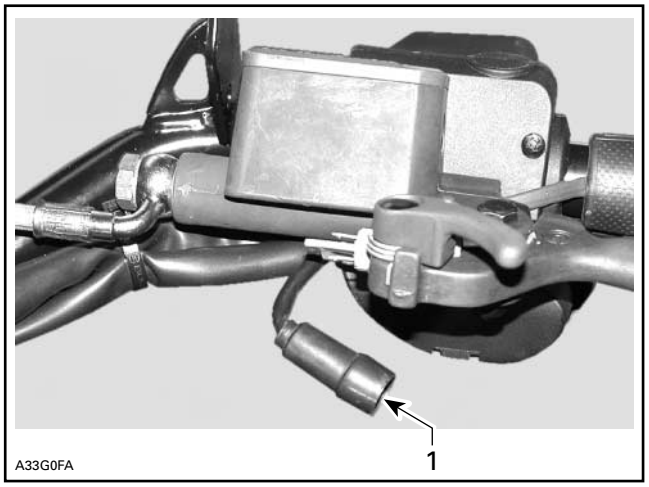
1. Locking ties
2. Heating grip harness

Pull heating grip harness out of throttle lever housing.

For installation refer to GRIP INSTALLATION below.

Brake Side:

Unplug connectors from brake light switch located on master cylinder **no. 22**.



1. Connectors unplugged

Unplug LH harness on top of steering column.

Cut locking ties retaining brake light switch/heating grip harness to handlebar.

Using the multilock-terminal housing extraction tool AMP (P/N 755430-2), push the 3 wires of the heating grip harness out of connector housing. Note the position of the wires for reinstallation.

Pull heating grip wires out of brake light switch/heating grip harness.

Insert the open side of a 23 mm (7/8 in) wrench against the inner end of grip.

CAUTION: Pay attention not to damage wires with the wrench.

Using a plastic hammer, tap on the side of the wrench end to make the grip sliding out.

Grip Installation:

Installation is the opposite procedure of the removal but pay attention to the following.

Clean handlebar ends and inside of heating grip with isopropyl alcohol. Let dry before installation.

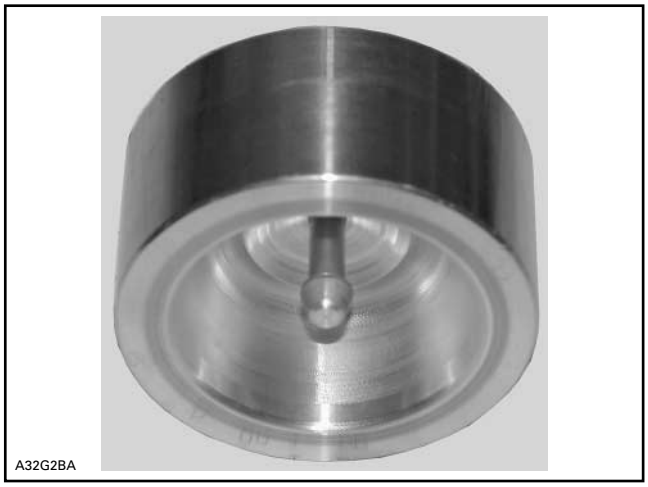
⚠ WARNING

Handlebar end and inside of heating grip must be clean and dry before installing heating grip to ensure proper adhesion.

Position grip on handlebar with its harness aligned with windshield bracket. See next photo.

Use the appropriate insertion tool to properly install grip.

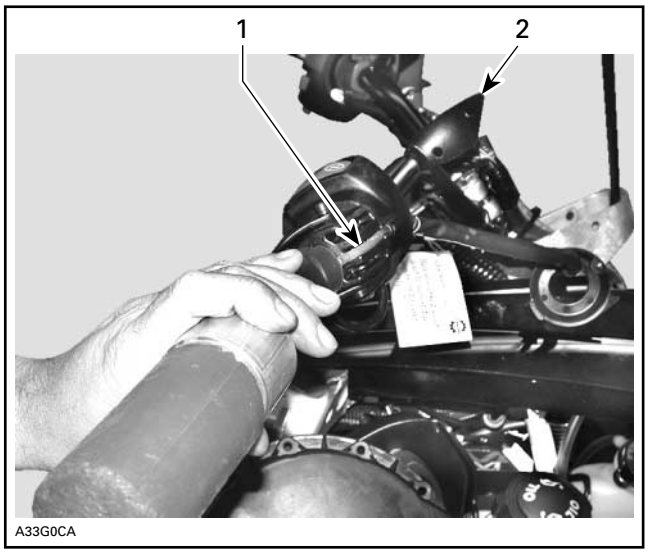
MODEL	TOOL PART NUMBER
Models with straight grips	529 035 897
Models with J-hooks	529 035 936



CAUTION: Installing grip without the insertion tool is likely to damage its heating element.

Position the insertion tool at the outside end of grip.

Using a plastic hammer, tap on tool to push grip on. Continue to tap until grip bottoms.



1. Harness
2. Windshield bracket

Properly route harness then reinstall removed parts.

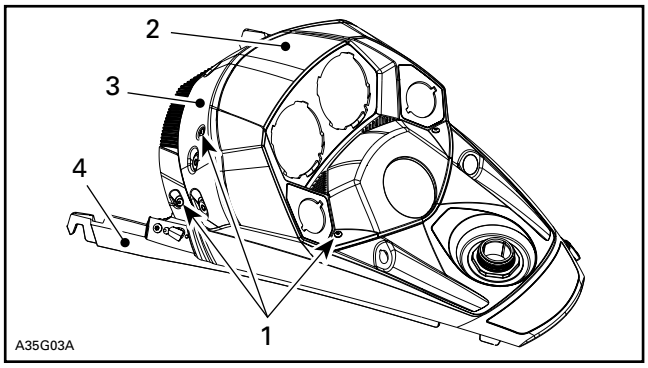
Reinstall terminals and replug connectors. Test grips to ensure they heat properly.

Steering Column

Remove windshield.

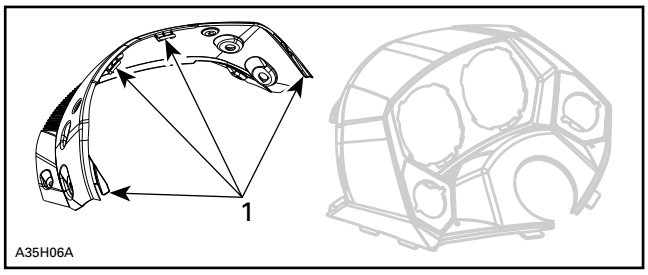
Remove steering padding no. 23.

Remove screws retaining indicator support and indicator support door.



1. Remove screws
2. Indicator support
3. Indicator support door
4. Center console

Remove indicator support door.

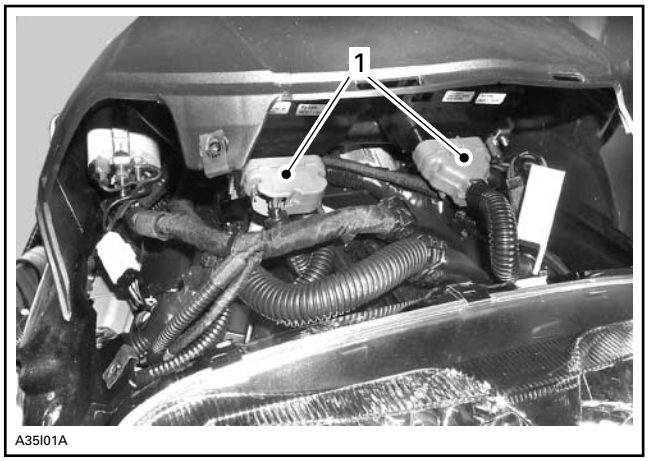


INDICATOR SUPPORT DOOR
1. Locking tab

Slightly lift console to gain access to electrical connector housings.

Unplug the 2 large connector housings.

NOTE: Only one connector for Summit models.

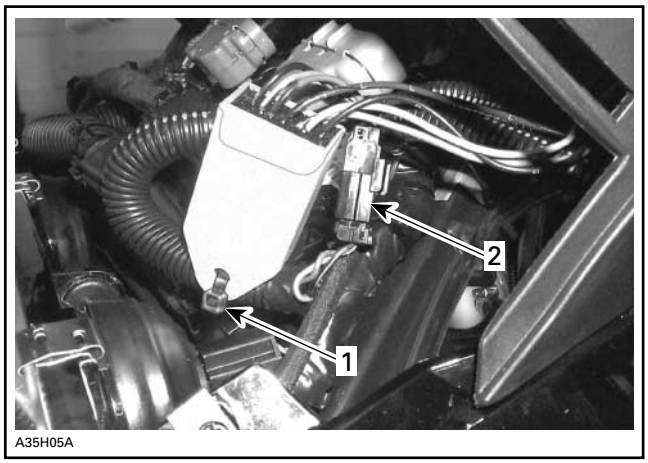


TYPICAL
1. Unplug

Mach Z

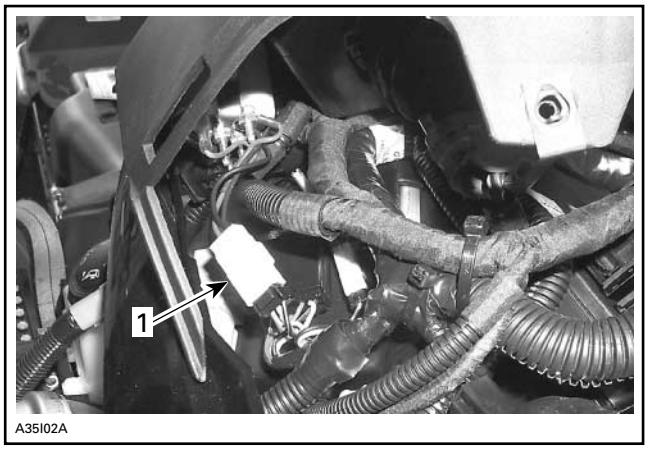
Cut locking tie holding temperature gauge electrical box to harness.

Unplug temperature gauge connector.



TEMPERATURE GAUGE
1. Cut
2. Unplug

Unplug fuel gauge connector.



FUEL GAUGE
1. Unplug

Remove console.

Mach Z and Summit

If applicable, cut locking ties retaining harnesses to steering column **no. 1**.

Unbolt handlebar ass'y from steering column and move it aside.

Remove tuned pipe.

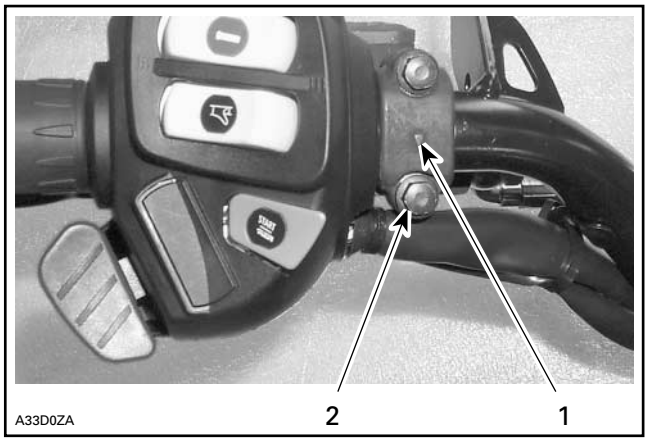
Detach the short tie rod **no. 8** from the steering column. Note that a hardened flat washer **no. 7** goes on each side of steering column lever.

Disengage carriage bolts **no. 5** and **no. 6** from steering column.

Remove plastic U-clamps from steering column.

Pull steering column from top.

If, for any reason, the master cylinder has been removed from handlebar note that its clamp **no. 27** must be installed with the embossed arrow pointing downward. Torque screws to 8 N•m (71 lbf•**in**) beginning with the bottom screw.



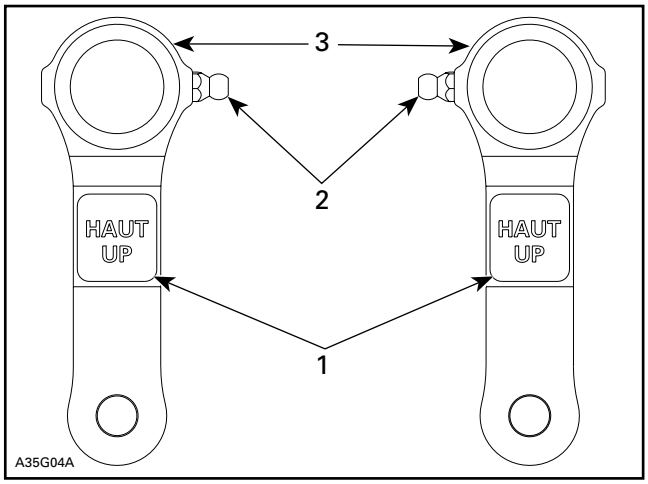
1. Arrow on clamp pointing downward
2. Tighten bottom screw first

Refer to HANDLEBAR POSITION ADJUSTMENT for handlebar reinstallation.

RH and LH Swivel Arm

At assembly respect UP mention.

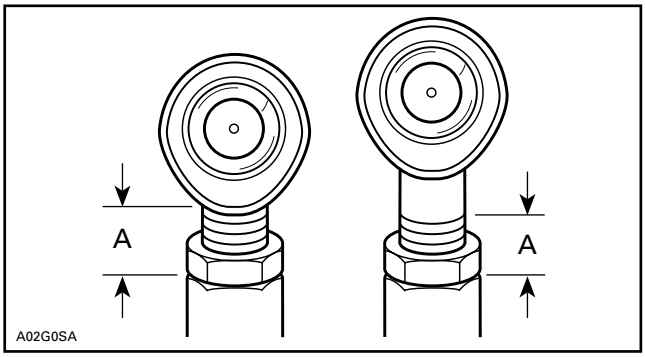
Grease fitting **no. 16** of swivel arms **no. 14** must face toward center of vehicle.



1. UP mention
2. Grease fittings
3. Swivel arms

Ball Joint (left hand and right hand threads)

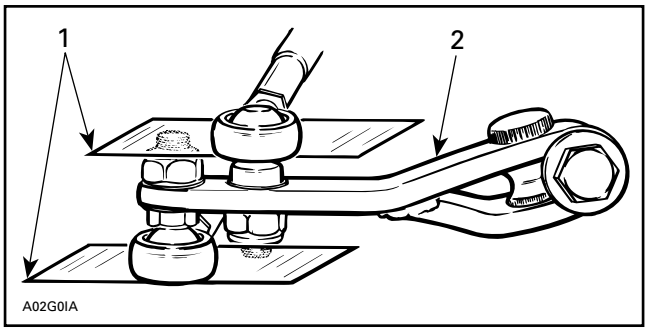
The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).



TYPICAL
A. 20 mm (25/32 in) max.

The ball joint **no. 17** and **no. 18** should be restrained when tightening the tie rod end lock nut. Align it so the tie rod end is parallel to the steering arm when assembled on the vehicle, refer to the following illustration.

For proper torque specifications refer to the specific exploded view for the vehicle being serviced.



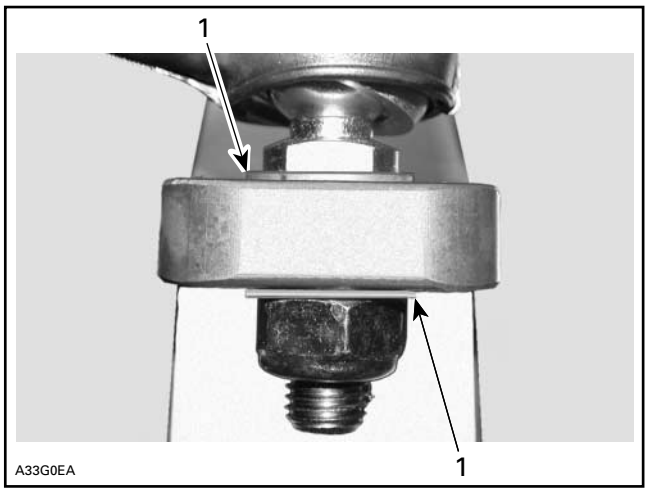
TYPICAL
1. Parallel with steering arm
2. Steering arm

⚠ WARNING

The cut off section of the ball joint must run parallel with the swivel bar no. 9. When tightening lock nuts, restrain ball joint with appropriate size wrench. The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).

Hardened Washer

Install a hardened washer **no. 7** on each side of the ski leg and each side of the steering column lever.



TYPICAL
1. Hardened washers

INSPECTION

Check skis and runners for wear. Replace as necessary. Refer to FRONT SUSPENSION.

Check the general condition of the steering system components for wear. Replace if necessary.

Heating Grip Element

Refer to ELECTRICAL SYSTEM section for checking heating element **no. 13** of grip.

Ball Joint (left hand and right hand threads)

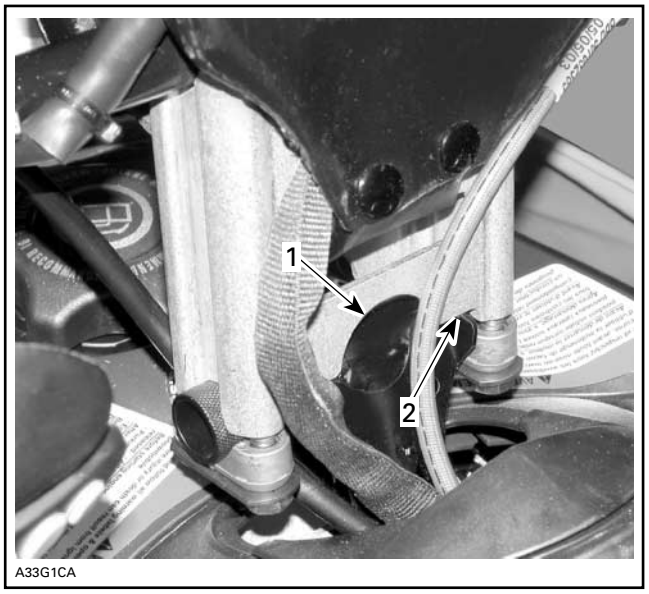
Inspect ball joint ends **no. 17** and **no. 18** and small tie rod ends for wear or looseness, if excessive, replace them.

ADJUSTMENT

Handlebar Extension

Mach Z/Summit Highmark X

When installing handlebar extension **no. 29**, ensure to position the rounded opening at the bottom and to tilt the extension so that it rests against steering support stopper.

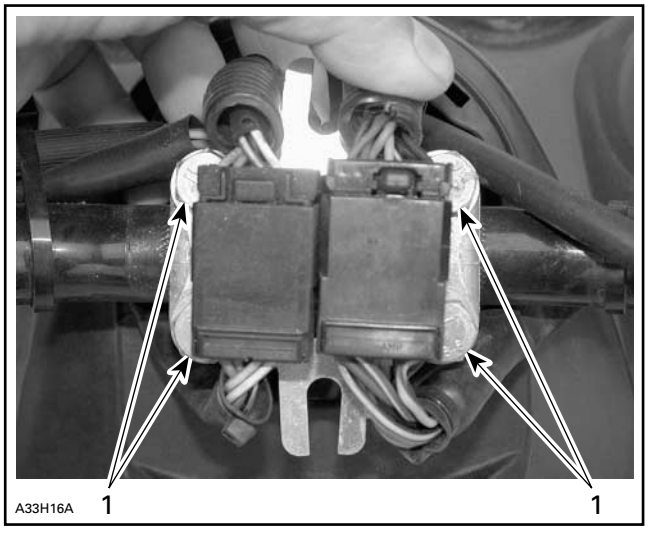


1. Opening here
2. Extension against stopper

Handlebar Position Adjustment

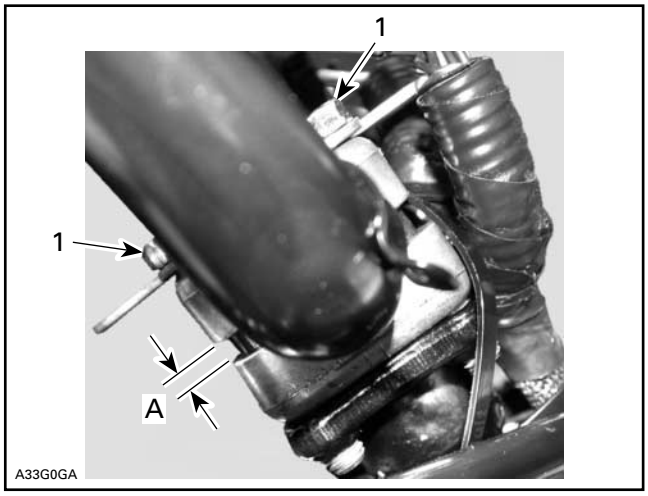
The handlebar position can be adjusted to suit driver's preferences.

Loosen all 4 bolts **no. 4** retaining handlebar to steering column.



TYPICAL
1. Four bolts

Move handlebar to the desired position. Torque all 4 bolts **no. 4** to 25 N•m (18 lbf•ft).



TYPICAL
1. Torque to 25 N•m (18 lbf•ft)
A. Equal gap all around

CAUTION: Tighten the bolts equally in a criss-cross sequence and ensure there is an equal gap on each side of the clamps no. **2.**

⚠ WARNING

Avoid contact between the brake handle and the windshield by NOT adjusting the handlebar too high.

Readjust throttle lever housing **no. 21** and switch housing accordingly to optimal angle so that you will not need to release your grip to operate levers.

⚠ WARNING

Adjust with vehicle at rest in a safe place. Securely retighten all fasteners. Never rotate throttle lever to operate with fingers instead of thumb.

Handlebar Strap

Summit

Ensure to position strap **no. 28** symmetrically each side of steering support and so that its rubber band is on the inner side. Tilt strap 5° towards driver relative to steering column axis or relative to handlebar extension on so equipped models.

Position strap between rubber band and screw end to protect the rubber band.

Retaining clip and hardware must be installed in the same position on both strap ends.

J-Hook Adjustment

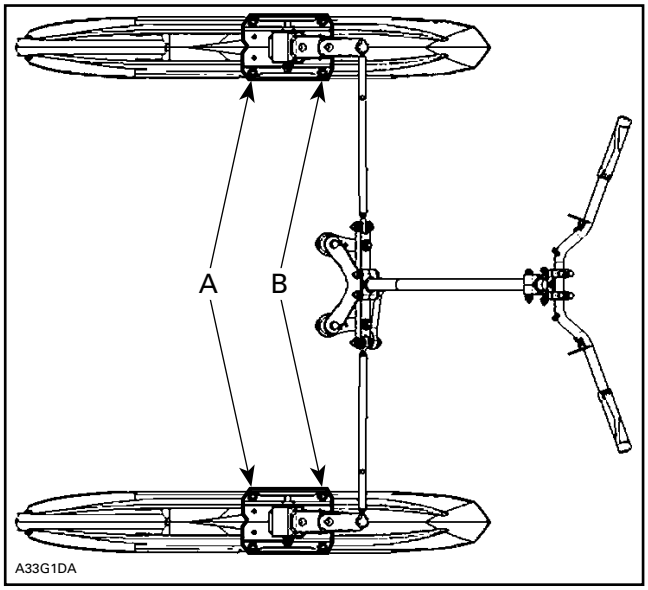
Summit

Position J-hook so that its curved end is pointing downward and is roughly vertical. Ensure to adjust J-hooks at the same position each side.

STEERING ADJUSTMENT (SKIS)

Toe-Out

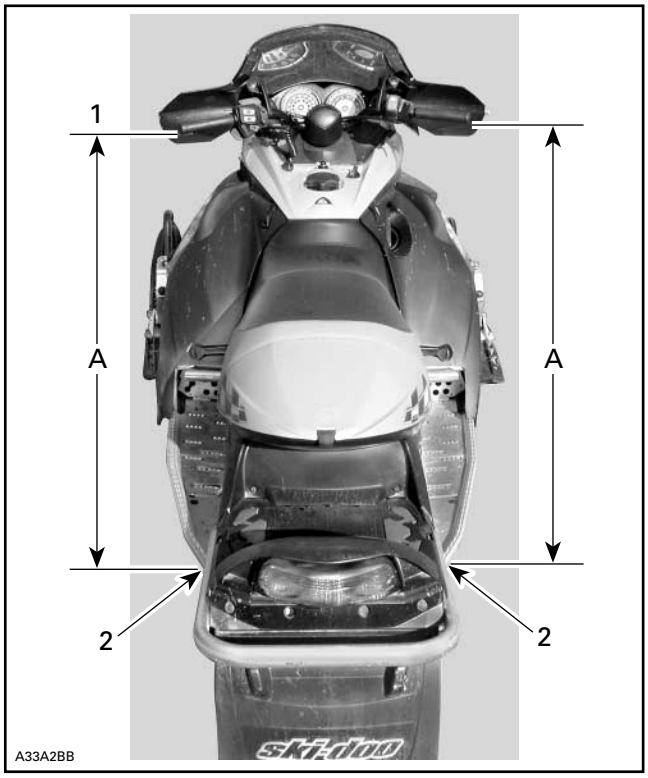
A difference measured between the front edge of the ski bridge "A" and rear edge of ski bridge "B" as viewed from the top.



Ski alignment and toe-out are performed by adjusting length of left and right tie rods no. 11.

– Position handlebar so that it is in straight ahead position by measuring from the extremities of the grips to the rear most edge of the tunnel, as shown.

NOTE: The reference point must be the same relative to each side.

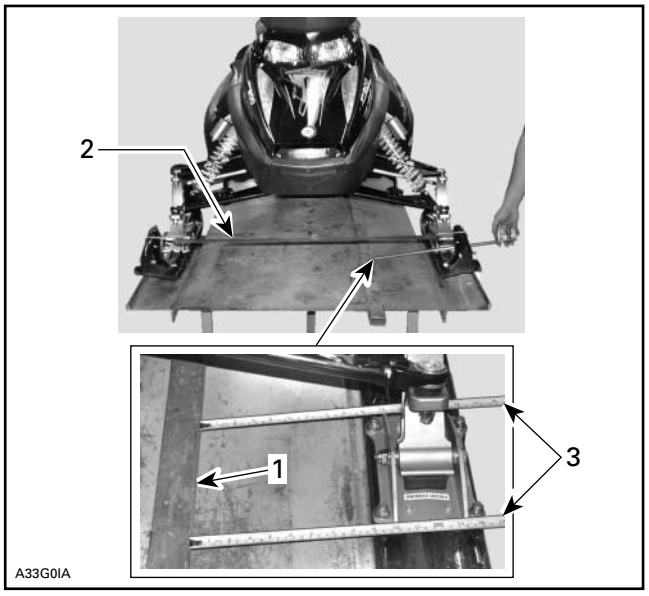


1. Equal distance "A" on each side
2. Same reference point

– Hook a rubber cord in front of skis to keep them closed and to take all slack from steering mechanism.
– Leave the vehicle on the ground on its own weight.
– Place a straight edge against pre-adjusted track and measure the distance between front and rear of ski bridge.

MODEL	TOTAL TOE-OUT ± 1 mm (± 3/64 in)
All RT Series	2 (5/64)

NOTE: To reduce tolerance when measuring, set one ski to proper toe-out (half the total toe-out) then measure from that ski to the opposite ski.



TYPICAL
1. *Straight edge*
2. *Rubber cord*
3. *Measure at rear and front of ski bridge*

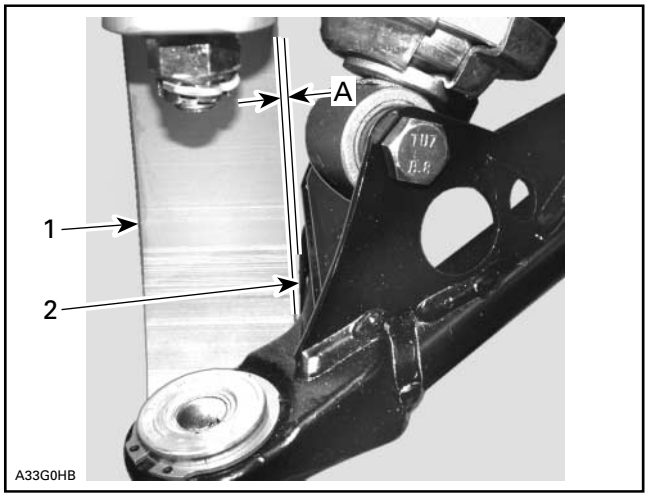
If adjustment is needed:

– Loosen jam nuts of both tie rods **no. 11**.
– Turn the tie rod to change its length.
– Retighten jam nuts.

⚠ WARNING

Never lengthen tie rod so that the external unengaged threaded portion of ball joint exceeds 20 mm (25/32 in).

Once ski alignment is done check that ski leg rests against lower arm or is not more than 2 mm (5/64 in) from lower arm when the handlebar is fully turned.



RIGHT HAND SIDE SHOWN
1. *Ski leg*
2. *Lower arm*

A. 2 mm (5/64 in)

If the distance is more than the specified distance on one side then check for bent parts.

LUBRICATION

⚠ WARNING

Do not lubricate throttle cable or housing.

Use suspension synthetic grease (P/N 293 550 033) on:

– Grease fitting **no. 16** of LH and RH swivel arms.
– Lower and upper steering column bushings.

FRONT SUSPENSION

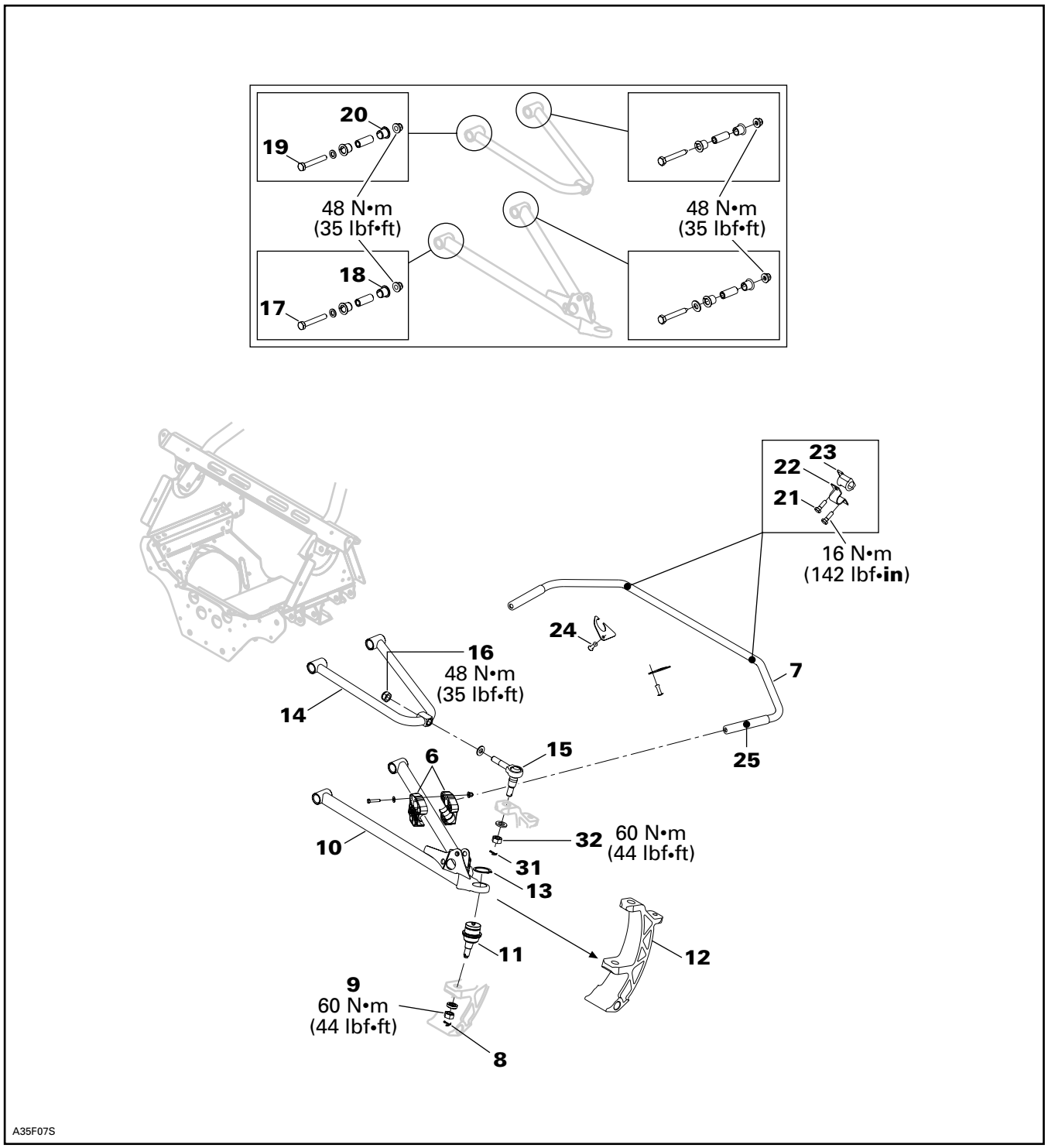
SERVICE TOOLS

Description	Part Number	Page
A-arm nut wrench	529 035 876	301
ball joint installer	529 035 975	301
ball joint lock tool	529 035 945	302
ball joint remover	529 035 827	297–298
ball joint remover support	529 035 873	297
ball joint support	529 035 875	301
shock absorber spring remover	529 035 504	295

SERVICE PRODUCTS

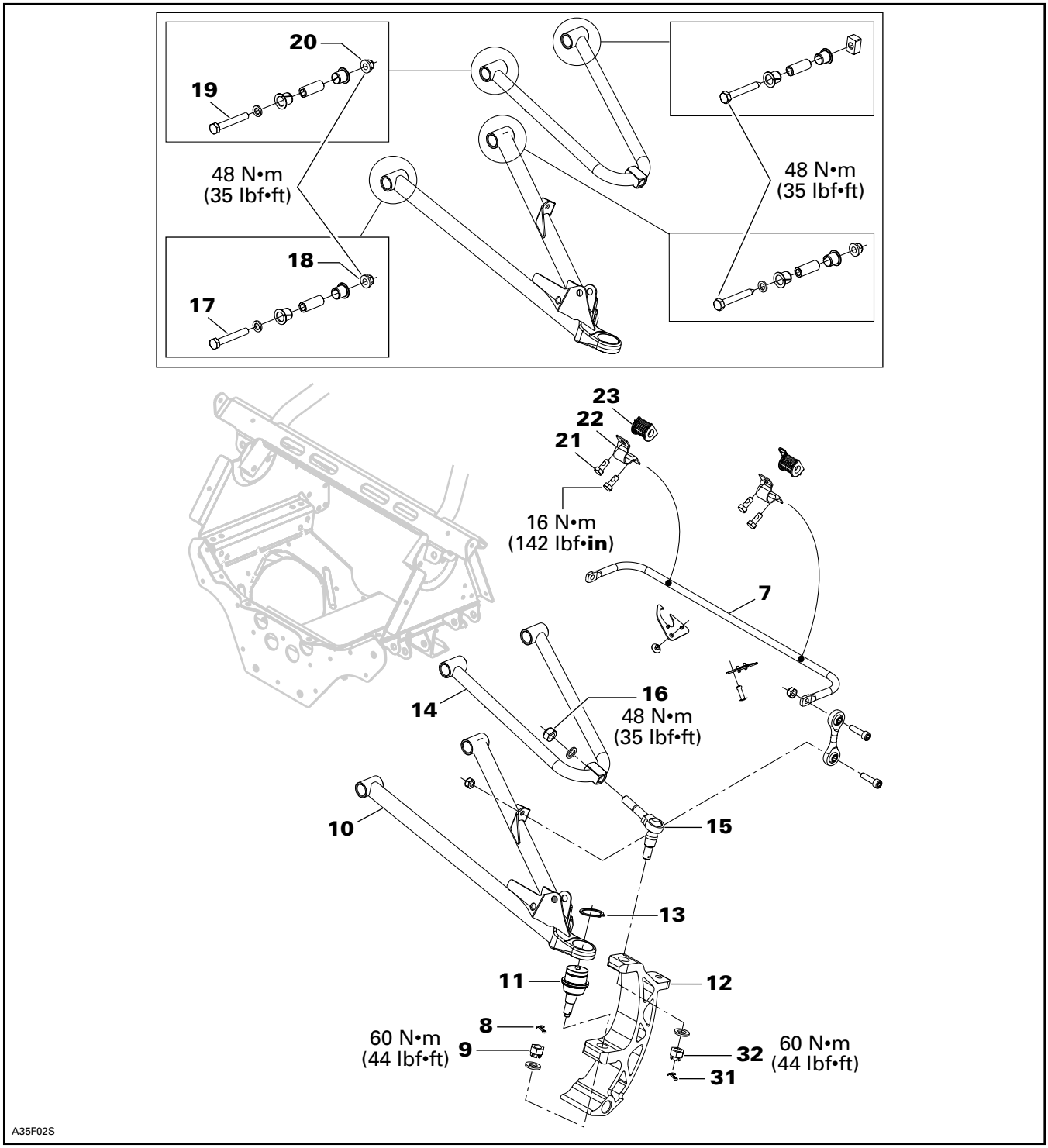
Description	Part Number	Page
pulley flange cleaner	413 711 809	301
suspension synthetic grease	293 550 033	304

Summit



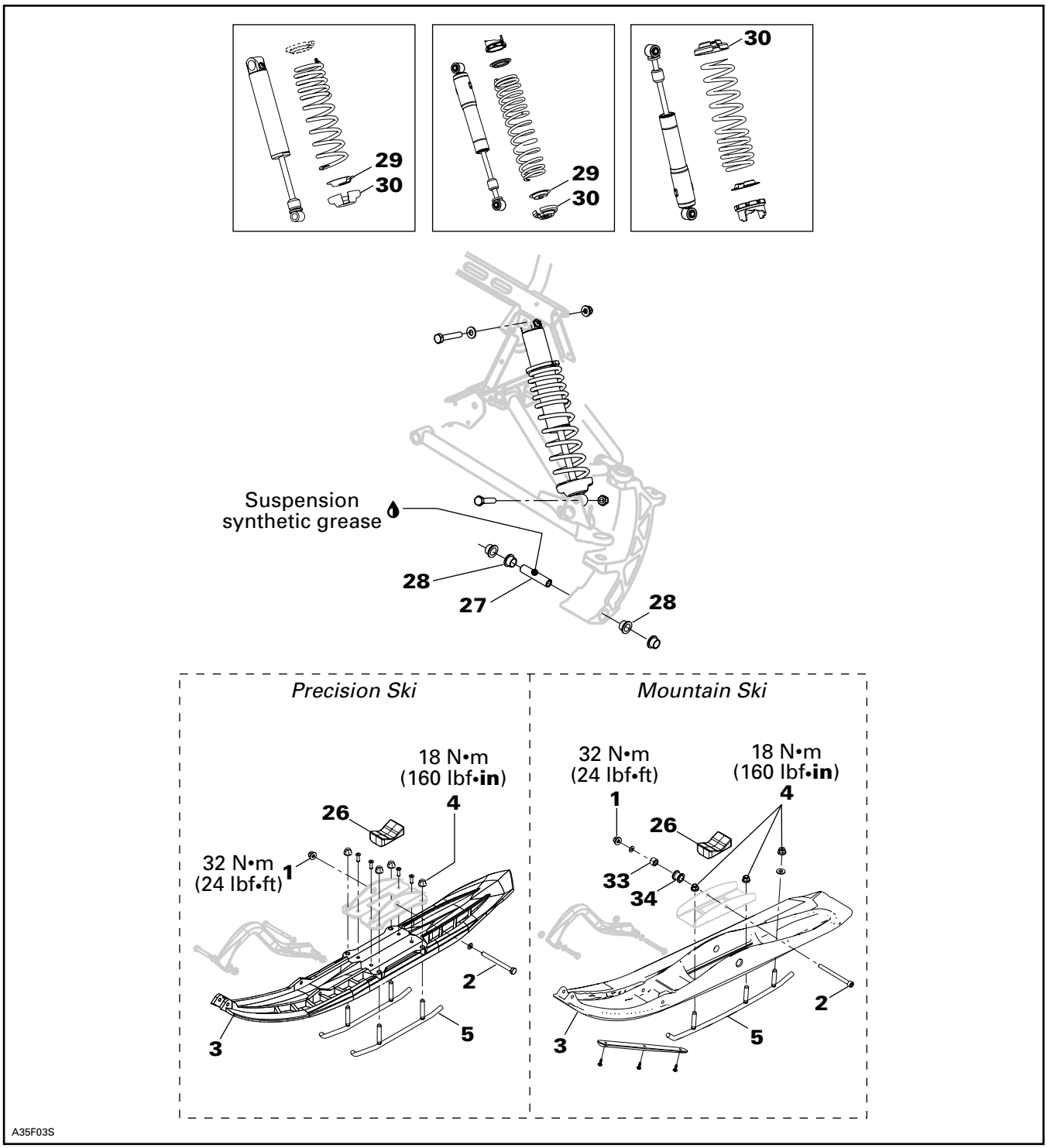
SUSPENSION ARMS, SKI LEG AND ANTI-SWAY BAR

Mach Z



ARMS, SKI LEG AND ANTI-SWAY BAR

Summit and Mach Z



SHOCK ABSORBERS AND SKIS

NOTE: The same procedure applies on both sides.

GENERAL INSPECTION

Check for looseness, bent, worn out, rusted or other damage on components. Ensure cotter pins are in good condition and properly secured. Replace the faulty component.

To check upper arm bushings and ball joint:

– Let vehicle weight compress the suspension.
– Firmly grab upper part of ski leg and try to move sideways to feel the free-play.
– If excessive play is felt, replace the faulty component.

To check lower arm bushings and ball joint:

– Raise front of vehicle off the ground from the frame to release the suspension.
– Firmly grab lower part of ski leg and try to move sideways to feel the free-play.
– If excessive play is felt, replace the faulty component.

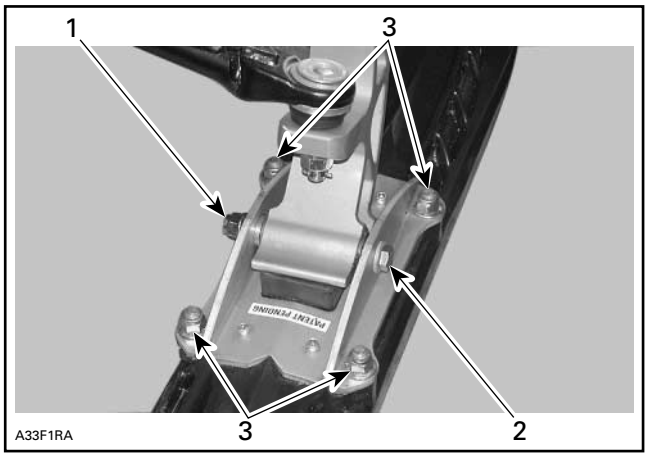
DISASSEMBLY

Ski

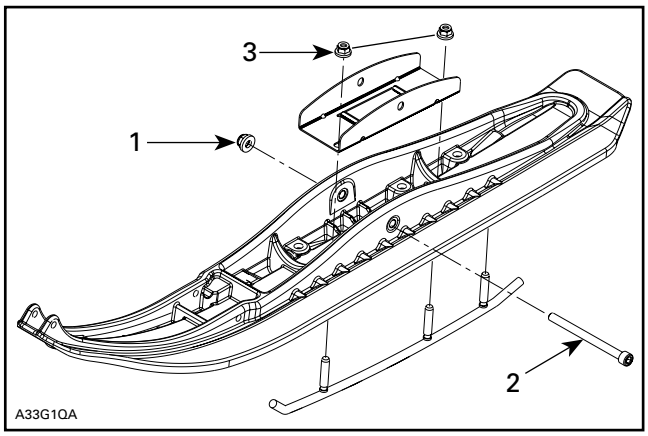
Lift front of vehicle and support it off the ground.

Unscrew nut **no. 1** then pull screw **no. 2** out. Remove ski **no. 3**.

Unscrew nuts **no. 4** and remove ski runners **no. 5**.



PRECISION SKI
1. Unscrew nut
2. Remove screw
3. Ski runner nuts



MOUNTAIN SKI
1. Unscrew nut
2. Remove screw
3. Ski runner nuts

Shock Absorber

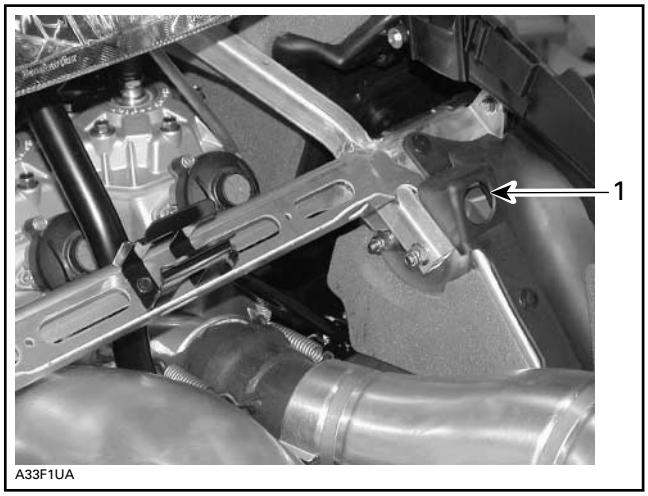
Lift front of vehicle and support it off the ground.

Open hood.

Reduce spring preload by turning adjusting cam accordingly.

Remove lower screw then upper screw of shock absorber.

NOTE: To retain upper screw while unscrewing nut, remove access plug in engine compartment.

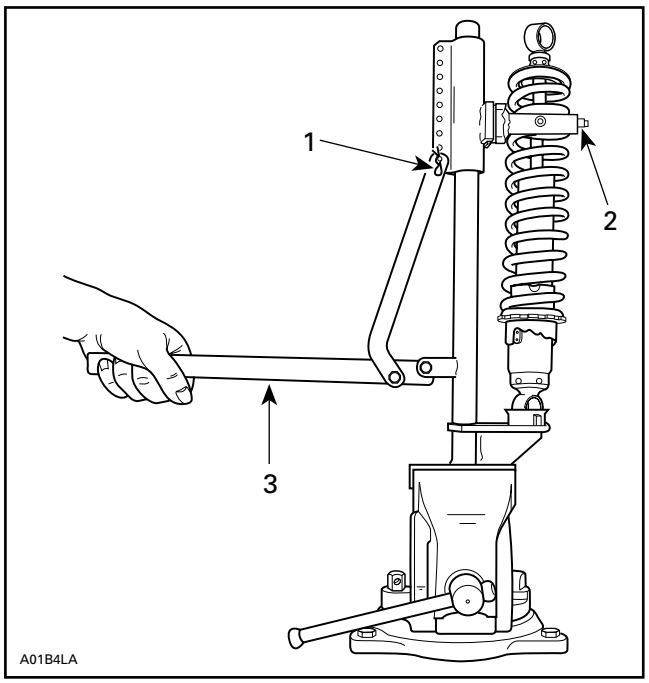


TYPICAL
1. Access hole to reach upper screw

For shock absorber spring disassembly use shock absorber spring remover (P/N 529 035 504) in a vise.

Mount shock absorber in it and turn shock absorber so that spring coils match spring compressor.

Close and lock the bar. Adjust the handle at horizontal position by changing the position of the clevis pin.

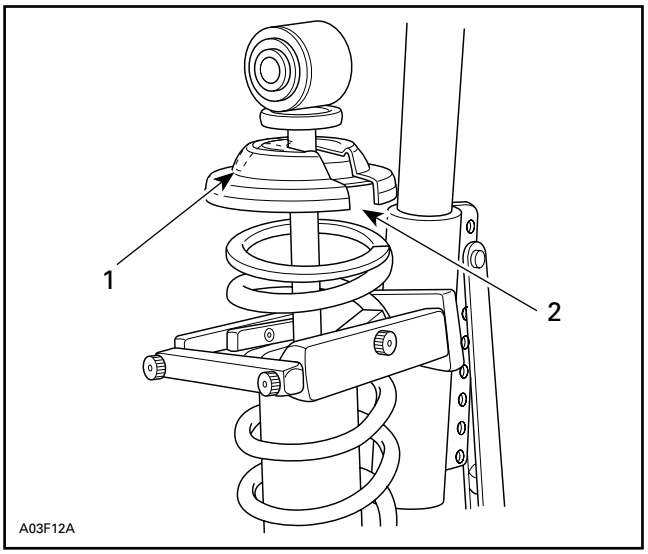


TYPICAL
1. *Clevis pin*
2. *Bar*
3. *Handle horizontal*

Push down on the handle until it locks. Remove spring stopper then release handle.

Mach Z

At assembly, cap opening **no. 30** must be 180° from spring stopper **no. 29** opening.



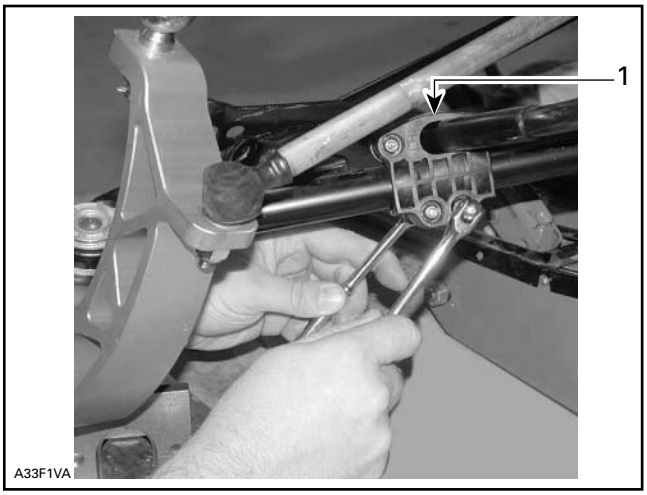
1. *Cap opening*
2. *Spring stopper opening*

Lower Arm

Remove shock absorber.

Summit

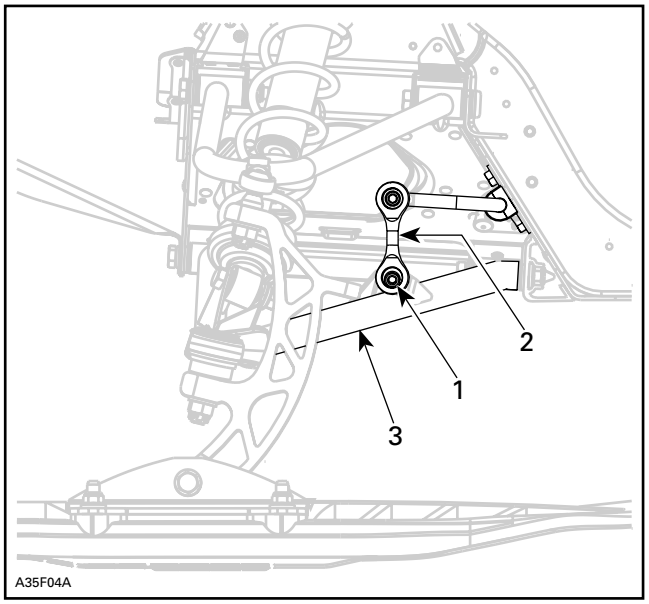
Remove sliding blocks **no. 6** of anti-sway bar **no. 7**.



1. *Sliding blocks*

Mach Z

Remove screw retaining link rod to lower A-arm.



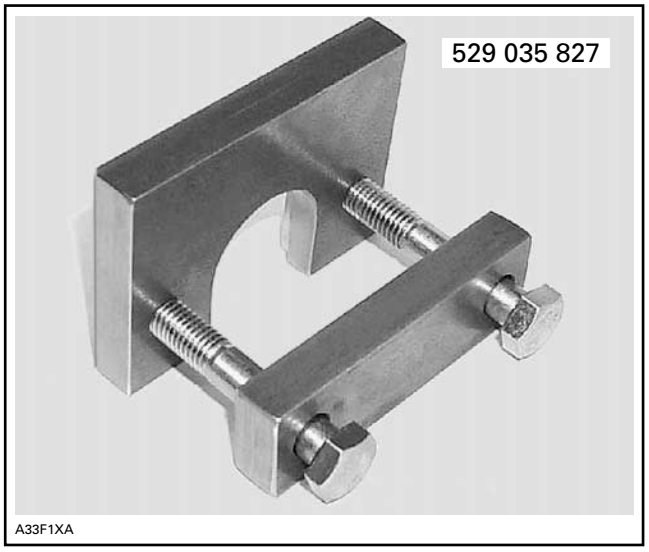
1. *Remove screw*
2. *Link rod*
3. *Lower A-arm*

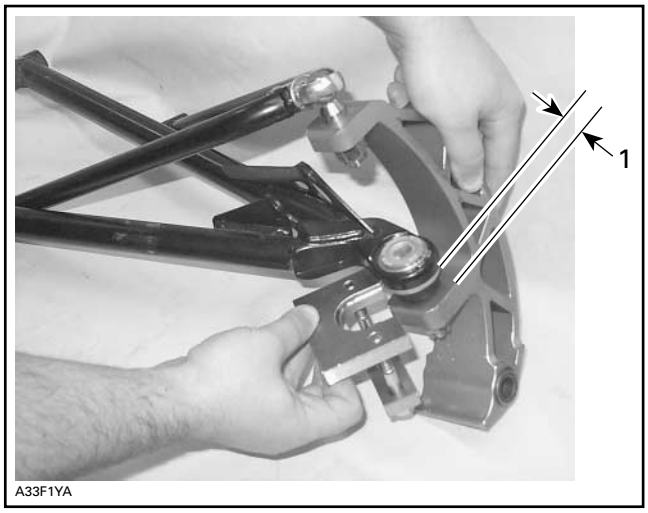
Summit and Mach Z

Remove cotter pin **no. 8** and unscrew ball joint nut **no. 9**.

Raise lower arm **no. 10** so that ball joint **no. 11** becomes parallel with ski leg **no. 12**.

Install ball joint remover (P/N 529 035 827) and detach ball joint from ski leg.



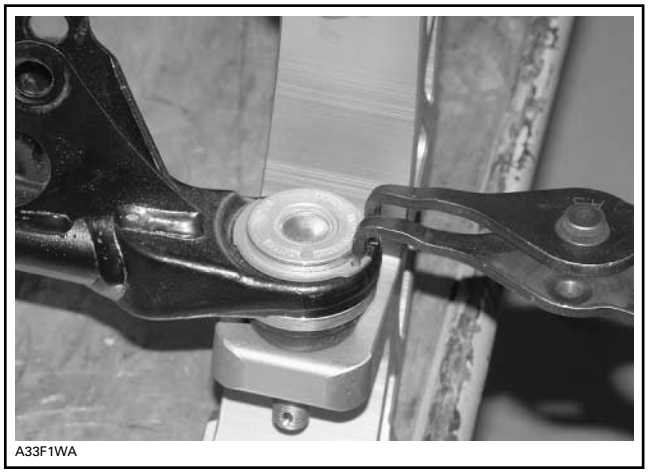


TYPICAL
1. *Ball joint parallel with ski leg*

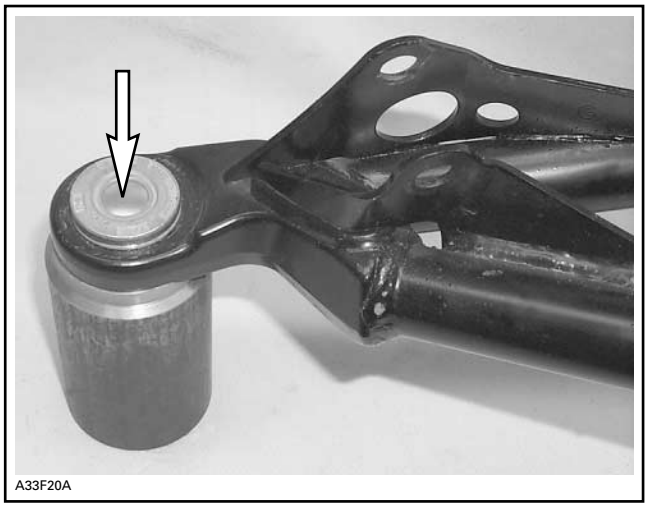
Remove lower arm **no. 10** from frame. For front screw **no. 17** removal, hold nut **no. 18** from engine compartment.

To remove ball joint, proceed as follows:

– Remove snap ring **no. 13**.
– Install ball joint remover support (P/N 529 035 873) under joint.
– Press joint out.



TYPICAL



TYPICAL

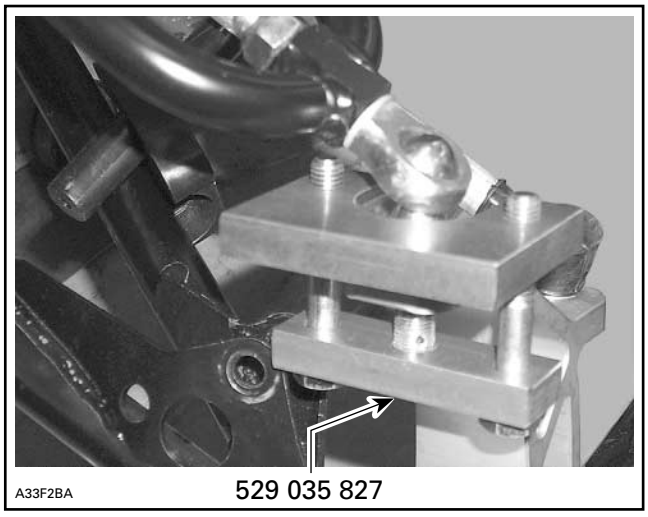
Tie Rod

Refer to STEERING SYSTEM section and remove tie rod from ski leg.

Upper Arm

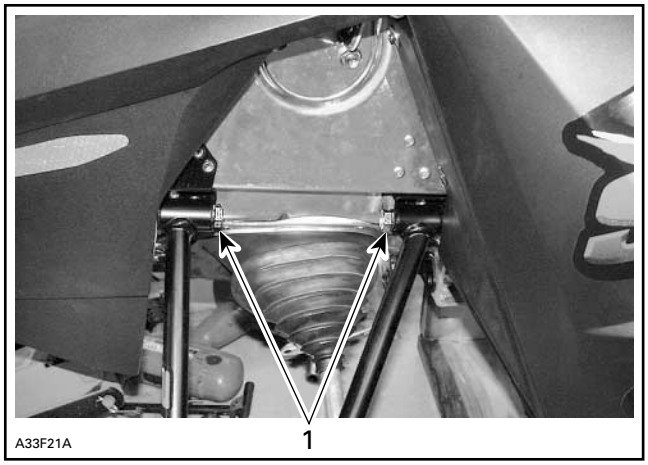
Remove cotter pin **no. 31** and unscrew ball joint nut **no. 32**.

Install ball joint remover (P/N 529 035 827) and detach ball joint **no. 15** from ski leg.



Use a 11 mm (7/16 in) open wrench to hold ball joint housing and unscrew nut **no. 16**, then remove ball joint from upper arm.

Remove upper arm **no. 14** from frame. For screws **no. 19** removal, hold nuts **no. 20** from engine compartment.



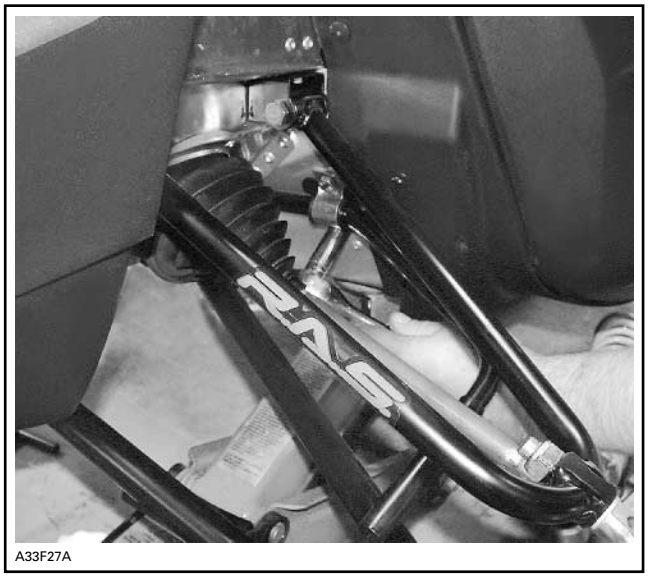
1. Remove screws while holding nuts from engine compartment

Anti-Sway Bar

Summit

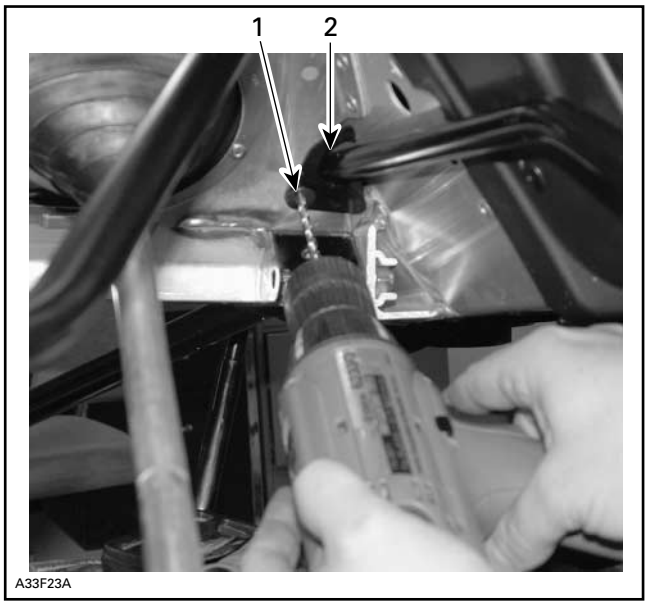
Remove shock absorbers, anti-sway bar slider blocks and unfasten lower ball joints from ski legs.

Remove screws **no. 21** from retaining clamps.


A33F27A

Remove clamps **no. 22** and bushings **no. 23**.

Using a 4.8 mm (3/16 in) drill bit, drill rivet **no. 24** out. Remove cap.



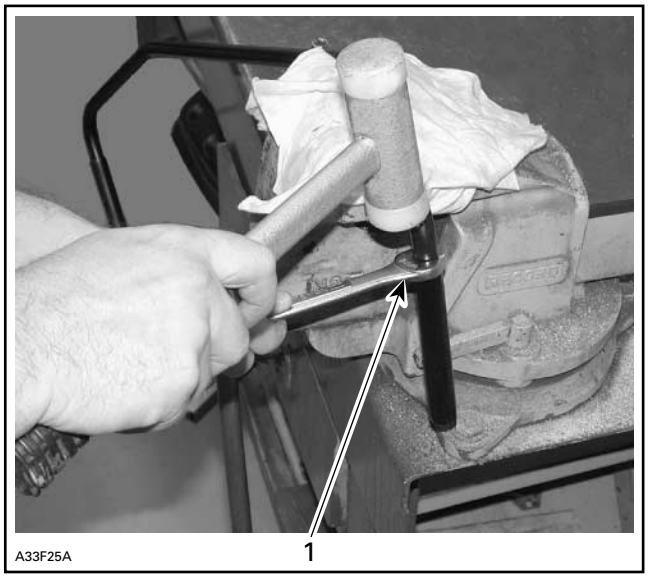
A33F23A

1. Drill rivet out with a 4.8 mm (3/16 in) drill bit
2. Cap

Lift front of vehicle enough so that anti-sway bar **no. 7** can be rotated downward to allow to slide it out.

A33F24A

To remove bushing **no. 25**, use a 13 mm (1/2 in) open wrench and tap bushing out as shown.



A33F25A

1. Use a 13 mm (1/2 in) open wrench to push bushing out

Mach Z

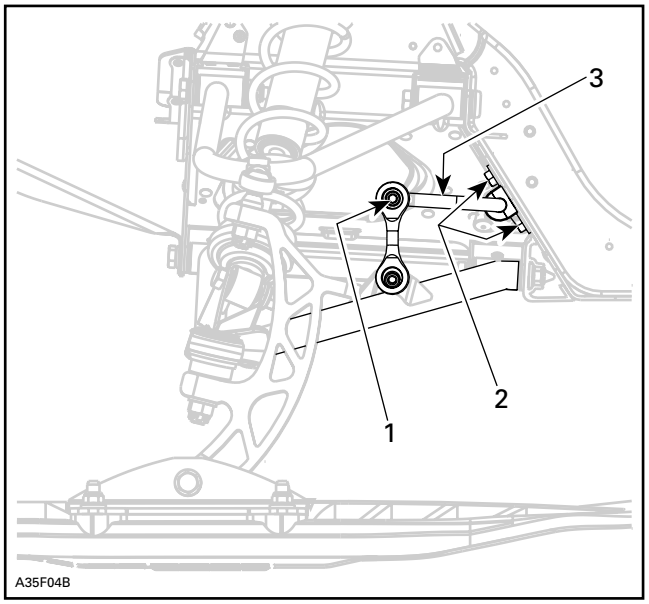
Remove screws retaining link rod to anti-sway bar.

Remove screws **no. 21** from retaining clamps.

Remove retaining clamps **no. 22** and bushings **no. 23**.

Turn handlebar completely to the right.

Remove anti-sway bar **no. 7**.



1. Remove screws
2. Remove retaining clamps and bushings
3. Anti-sway bar

INSPECTION

Check all plastic bushings for wear. Replace as required.

Check condition of ski leg **no. 12**. Replace as required.

Check for straightness of lower and upper arms. Replace as required.

Check condition of ball joints. Replace as required.

Check skis and runners **no. 5** for wear, replace as necessary.

Check condition of ski stopper **no. 26**. Replace it when deteriorated.

To check condition of shock absorber, refer to sub-section SHOCK ABSORBER INSPECTION AND SERVICING in section REAR SUSPENSION.

INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Tighten nuts and screws to proper torque as mentioned in exploded view.

Nuts with a cotter pin: After applying the proper torque, continue tightening as necessary to allow cotter pin insertion. Ensure to properly secure cotter pin.

⚠ WARNING

Always install new cotter pins at assembly and properly bend their ends.

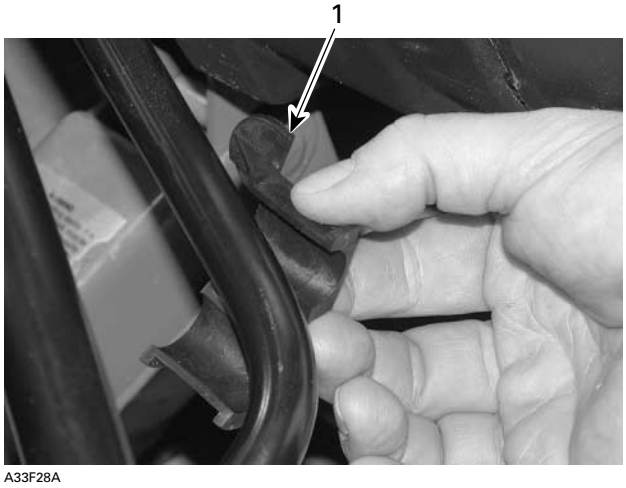
Anti-Sway Bar

Summit

Ensure to properly position anti-sway bar before insertion in frame.

Summit and Mach Z

Install the anti-sway bar bushing **no. 23** making sure to place its tab over the access hole located on the LH side.

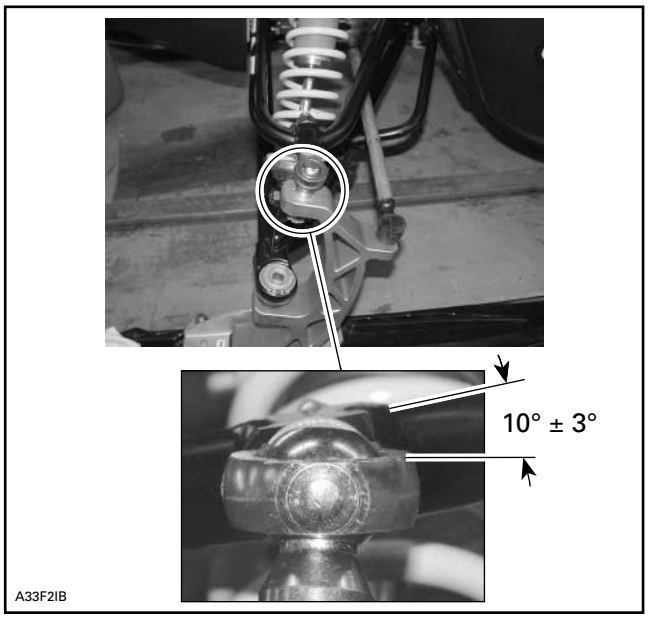


1. Install bushing as shown

TYPICAL
1. Tab here to obstruct access hole

Upper Arm

When installing ball joint **no. 15** to upper arm, ensure to tilt it with the proper angle as shown. The ball joint housing must be parallel to ski leg tab. This mounting position corresponds to 10° ± 3° angle from upper arm.



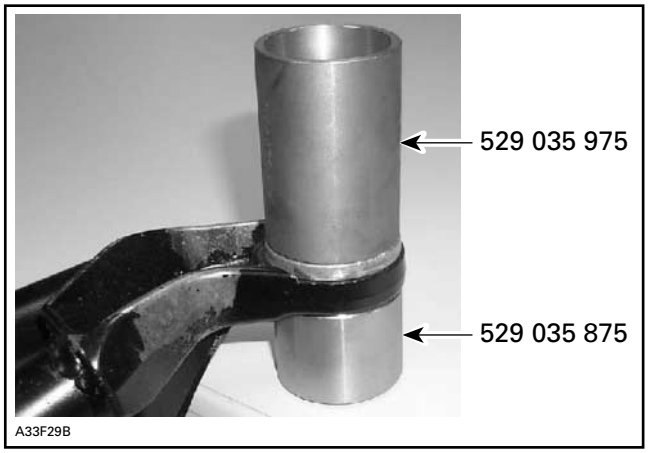
Lower Arm

Position lower arm below anti-sway bar.

Prior to installing ball joint in lower arm, ensure to clean the tapered surfaces with the pulley flange cleaner (P/N 413 711 809). Surface contacts must be clean and free of dirt, oil and grease. Apply the cleaner on a rag then use the rag to clean the surfaces of ball joint and ski leg.

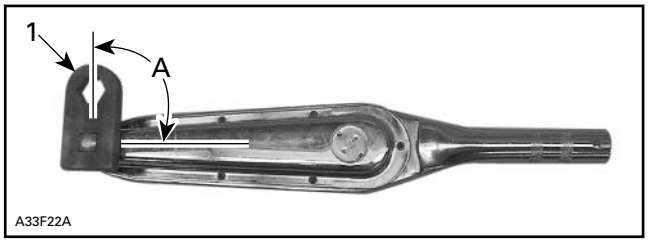
To install ball joint, proceed as follows:

- Install ball joint support (P/N 529 035 875) on top side of lower arm (operating position).
- Position ball joint installer (P/N 529 035 975) on bottom side of lower arm (operating position).
- Press ball joint in.
- Install snap ring **no. 13** with its opening toward front of vehicle.

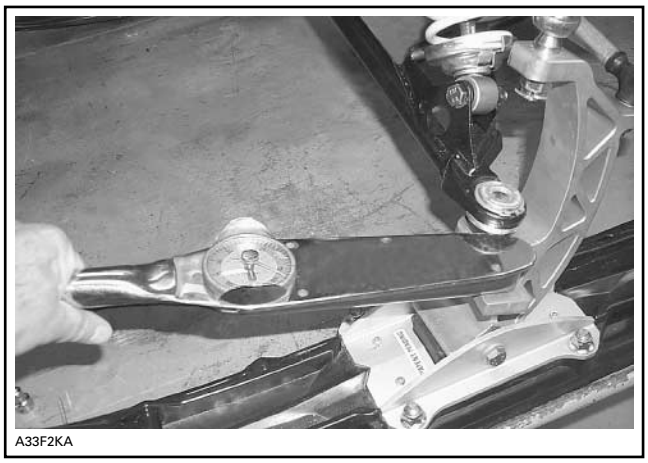


To properly torque ball joint nut, use the A-arm nut wrench (P/N 529 035 876).

Ensure to install the tool perpendicularly (90°) to torque wrench.

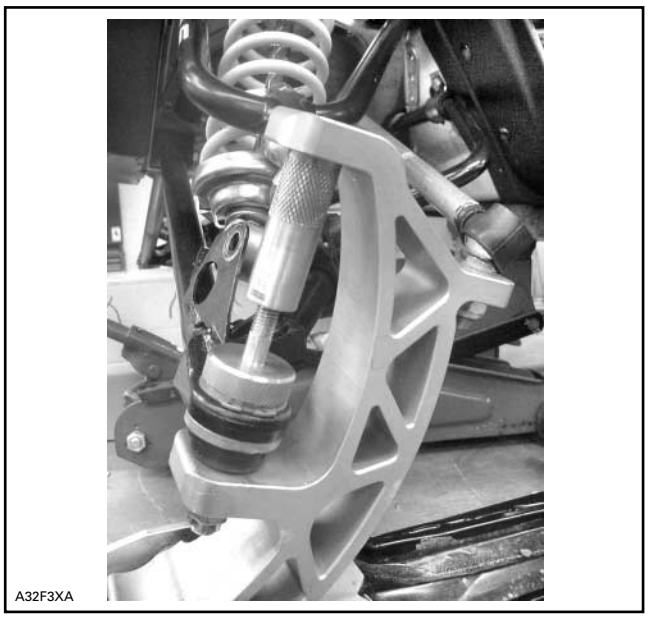


1. Tool perpendicular (90°) to torque wrench
A. 90°



Use ball joint lock tool (P/N 529 035 945) to restrain ball joint during nut tightening.

NOTE: The upper arm ball joint has to be removed in order to use this tool. Also remove the small screw from top of ball joint to allow proper seating of tool.

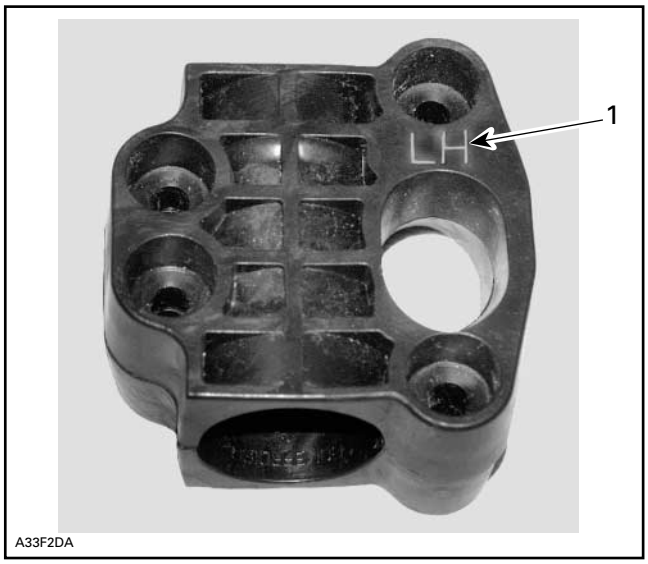


TYPICAL

Anti-Sway Bar

Summit

Notice that LH and RH sliding blocks are different. Look for their molded identification with LH or RH letters.

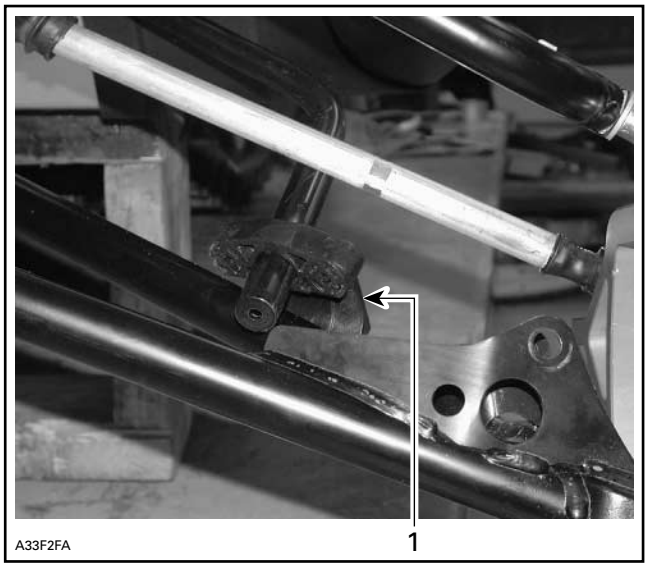


1. Molded identification for proper side installation

To install sliding blocks:

– Temporarily rotate the rear block by 180°.
– Insert on anti-sway bar end and push beyond the lower arm.
– Rotate block back by 180° to its normal position.
– Install the other block half.
– Install screws and nuts.
– Ensure blocks slide easily when compressing and releasing suspension.

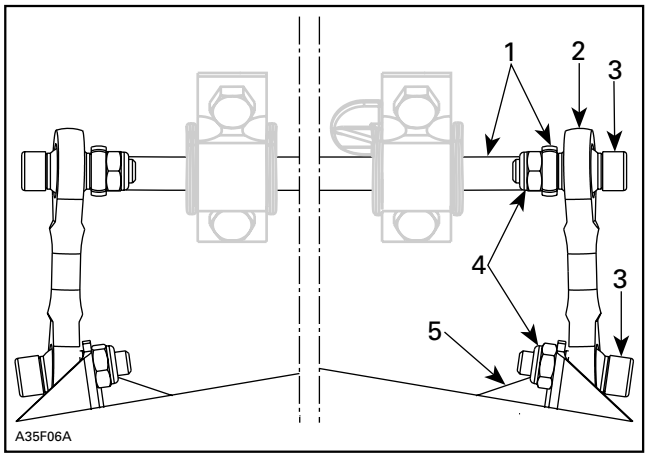
1. Temporarily rotate block by 180° for its insertion



1. Push block on bar end beyond lower arm then rotate back to its normal position

Mach Z

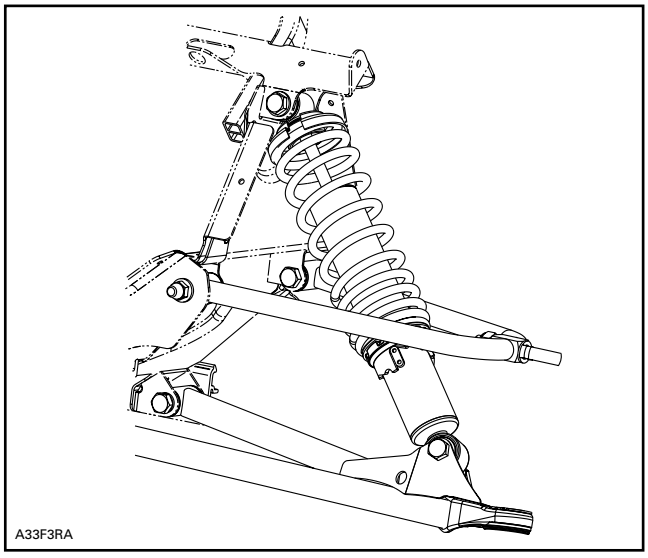
Secure anti-sway bar to link rod as per next illustration.



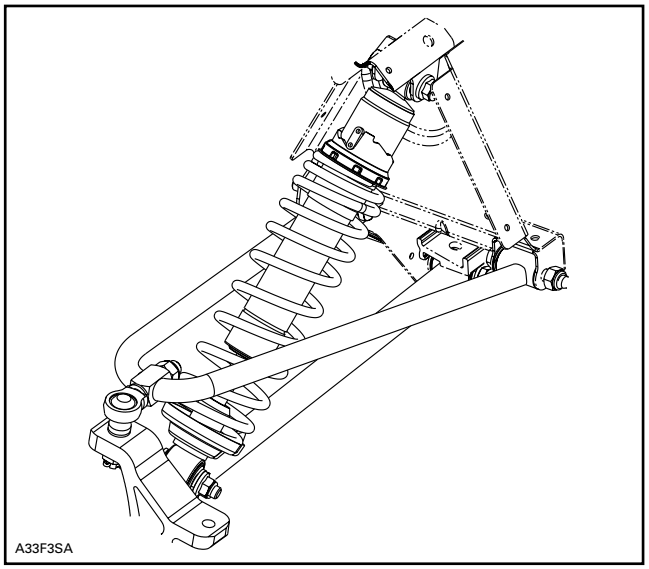
LOOKING FROM THE FRONT OF THE VEHICLE
1. *Anti-sway bar*
2. *Link rod*
3. *Allen screw*
4. *Elastic nut*
5. *Lower A-arm*

Shock Absorber

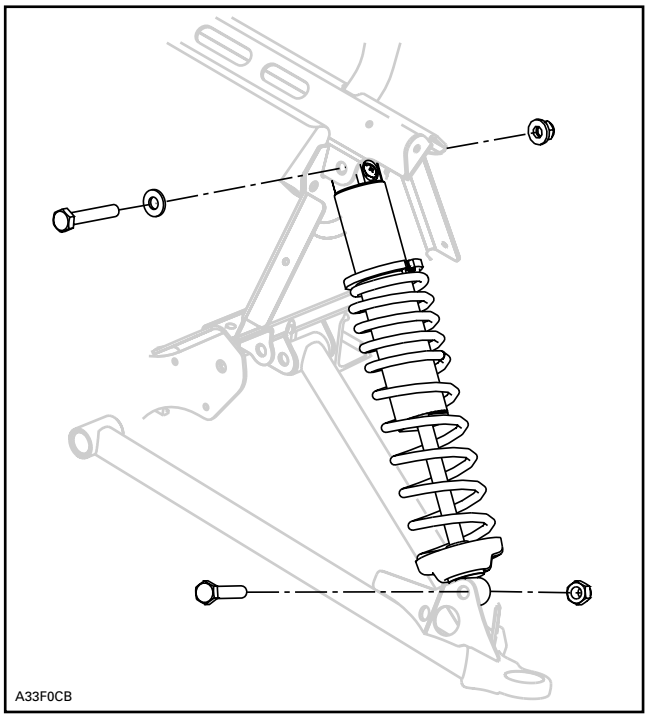
Ensure to reinstall shock absorber in the proper position according to model.



SUMMIT



MACH Z



SUMMIT AND MACH Z (EUROPE MODELS)

Readjust spring preload.

Ski

Apply suspension synthetic grease (P/N 293 550 033) between bushing **no. 28** and spacer **no. 27** and also on inner tube of ski leg.

Summit

Install bushing **no. 29** and spacer **no. 30** inward on each ski leg for the wide ski stance. Install outward for narrow ski stance.

⚠ WARNING

Install skis with proper side facing inward. Refer to warning on ski.

Adjustment

Proceed with ski alignment. Refer to STEERING SYSTEM.

BODY

SERVICE TOOLS

Description	Part Number	Page
adjustment wrench	529 035 891	307
Supertanium™ drill bit	529 031 800	306

DECAL

To remove a decal; heat old decal with a heat gun and peel off slowly.

Using isopropyl alcohol, clean the surface and dry thoroughly.

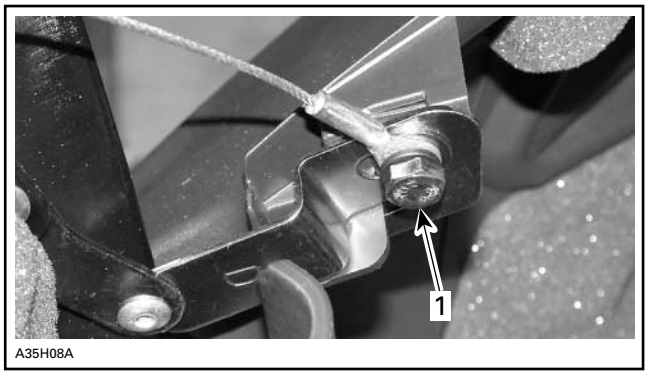
Apply liquid soap to new decal and carefully position the decal. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

CAUTION: Do not apply isopropyl alcohol or solvent directly on decals. Use only in a well ventilated area.

HOOD

Removal

Remove bolts retaining hood hinge to front bumper.



1. Hinge bolt

Remove hood.

Installation

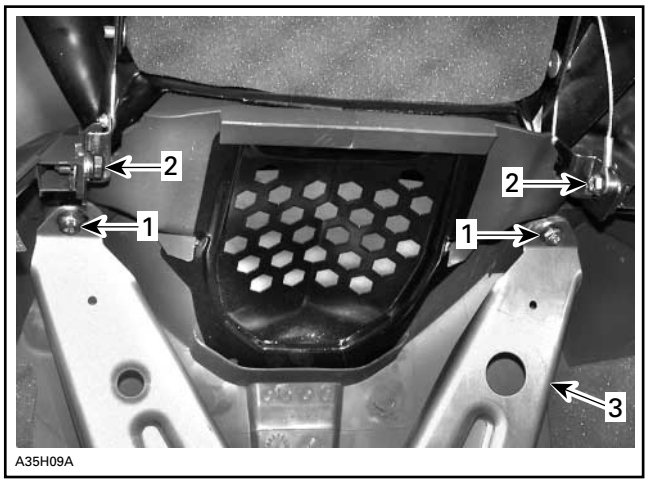
The installation is the reverse of removal procedure.

FRONT BUMPER

Removal

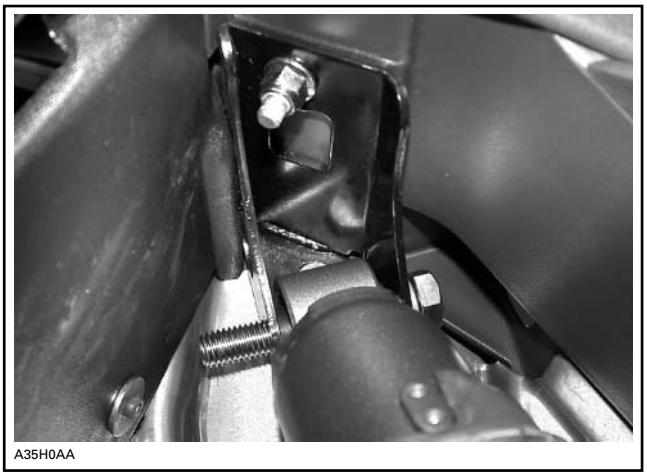
Remove hood.

Unscrew bolts retaining front bumper to frame.



1. Bumper bolts
2. Hinge bolts
3. Frame

Remove bolts near upper shock absorber brackets.


A35H0AA

Remove front bumper.

Installation

The installation is the reverse of removal procedure.

BOTTOM PAN

Removal

Remove front bumper.

Using Supertanium™ drill bit (P/N 529 031 800), drill all rivets retaining bottom pan.

Remove bottom pan.

Installation

The installation is the reverse of removal procedure.

WINDSHIELD

Removal

To remove the windshield, open hood then pull the bottom part of windshield until its pins come out of rubber grommets.

Installation

The installation is the reverse of removal procedure.

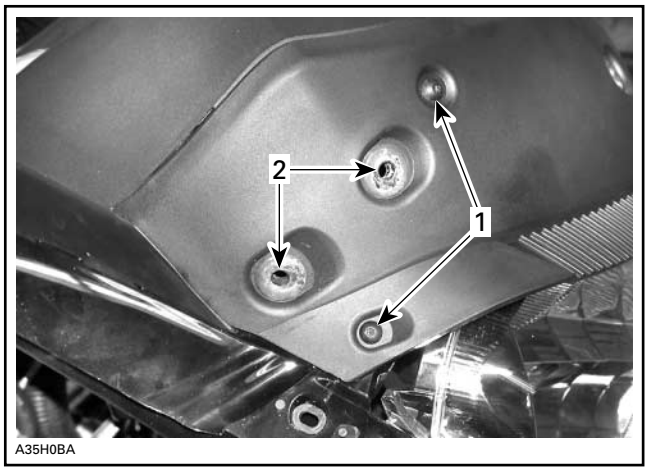
ACCESS PANEL

Removal

Open hood.

Remove windshield.

Remove retaining screws, one on each sides.



A35H0BA

1. Access panel screws
2. Rubber grommet for windshield

Installation

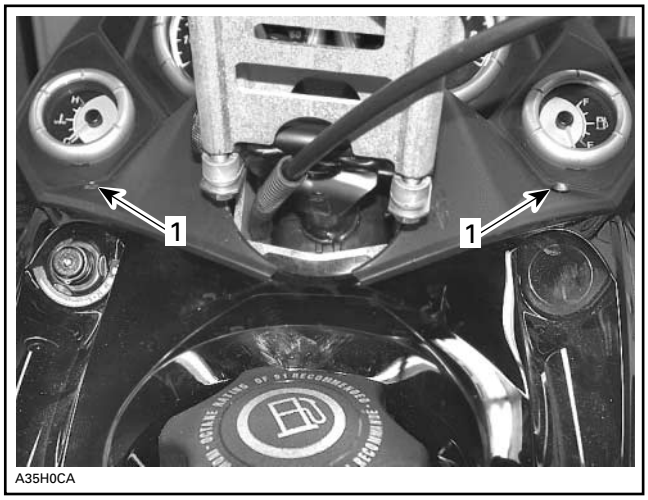
The installation is the reverse of removal procedure.

INDICATOR PANEL

Removal

Open hood and remove the access panel.

Remove the indicator panel screws.



A35H0CA

1. Indicator panel screws

Lift indicator panel and unplug all connectors.

Installation

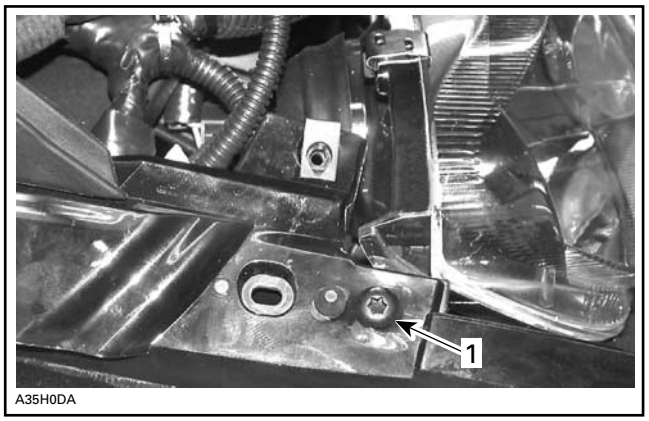
The installation is the reverse of removal procedure.

CONSOLE

Removal

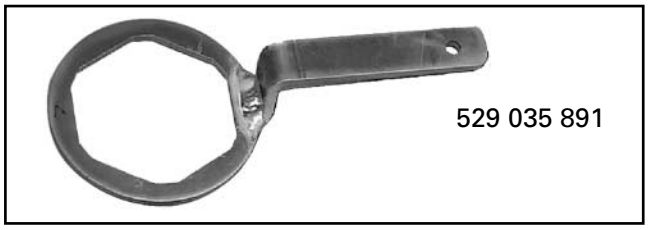
Remove the indicator panel.

Remove the screws near headlamp. One on each side.



1. Console screw

Using the adjustment wrench (P/N 529 035 891), unscrew the fuel tank nut.



Lift up the console and unplug all connectors.

Install fuel tank cap.

Installation

The installation is the reverse of removal procedure.

SEAT

Cleaning

It is recommended to clean the seat with a solution of warm soapy water, using a soft clean cloth.

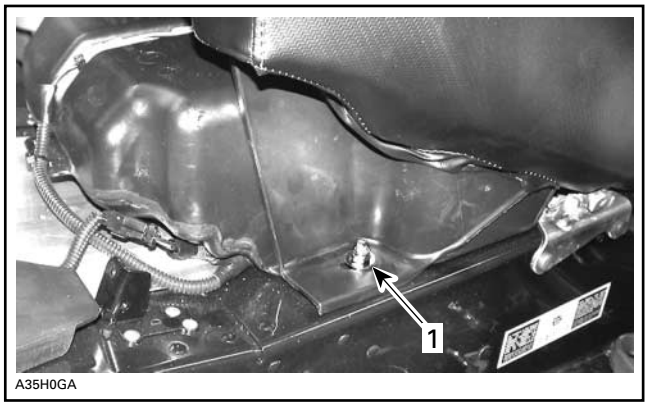
CAUTION: Avoid use of harsh detergents such as strong soaps, degreasing solvents, abrasive cleaners, paint thinners, etc. that may cause damage to the seat cover.

Removal

Loosen fuel tank nut by using the adjustment wrench (P/N 529 035 891).

Remove trunk behind seat.

Remove both nuts retaining seat to frame.



1. Seat nut (one on each side)

Lift the rear of seat then pull the seat backwards.

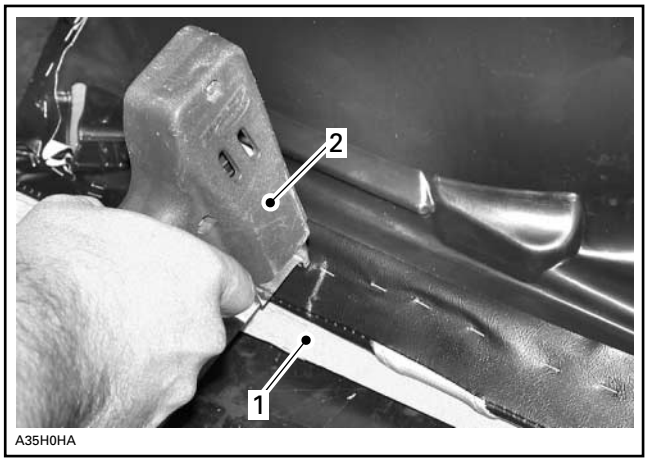
Cover Replacement

Remove the old seat cover. Check the foam and replace it if necessary.

Install staples with an electric tacker such as Arrow tacker ETN-50 or with a manual tacker such as Arrow tacker T-50.

NOTE: For an easier installation, it is highly recommended to use an electric tacker.

Ensure that the seat rest firmly against a hard surface such as a piece of wood. This is done to get the staples completely pushed in place.



TYPICAL
1. Piece of wood
2. Tacker

After seat cover installation, cut all around the excess of material.

Installation

The installation is the reverse of removal procedure.

NOTE: The seat must be inserted under console.

PLASTIC MAINTENANCE AND REPAIR

Maintenance

Clean the vehicle thoroughly, removing all dirt and grease accumulation.

To clean use a soft clean cloth and either soapy water or isopropyl alcohol.

To remove grease, oil or glue use isopropyl alcohol.

CAUTION: Do not apply isopropyl alcohol or acetone directly on decals.

CAUTION: The following products must not be used to clean or wax any of the plastic components used on the vehicles:

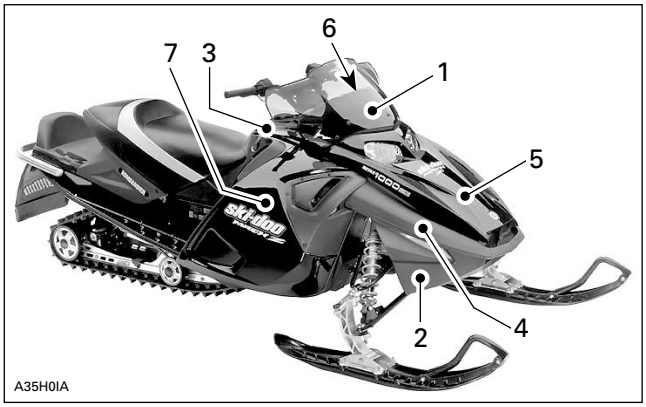
- gasoline
- brake fluid
- kerosene
- diesel fuel
- lighter fluid
- varsol
- naphtha
- acetone
- strong detergents
- abrasive cleaners
- waxes containing an abrasive or a cleaning agent in their formula.

Apply wax on glossy finish only. Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: If for some reason the snowmobile has to be stored outside, it is preferable to cover it with an opaque tarpaulin. This will prevent the sun rays from affecting the plastic components and the vehicle finish.

Repair

The very first step before repairing plastic materials is to find out exactly which type of material is involved.



PLASTIC PARTS		
PARTS		MATERIAL
1	Access panel	Polypropylene
2	Bottom pan	Polypropylene
3	Console	Surlyn
4	Front bumper	Polypropylene
5	Hood	Surlyn
6	Indicator panel	Polypropylene
7	Side panel	Surlyn

CAUTION: Some repair products are not compatible with certain plastics.

⚠ WARNING

Polycarbonate windshields must never be repaired by welding or otherwise.

For hood repair, refer to a specialized shop.

The following company provides a complete line of products to repair plastic materials:

CREST INDUSTRIES, INC.
Trenton, MI 48183
Phone: (734) 479-4141
Toll Free: 1 800 822-4100
Fax: 734-479-4040
E-Mail: info@crestauto.com
www.crestauto.com

FRAME

SERVICE TOOLS

Description	Part Number	Page
Supertanium™ drill bit	529 031 800	311–312

SERVICE PRODUCTS

Description	Part Number	Page
XP-S synthetic chaincase oil	413 803 300	311

FRAME CLEANING

NOTE: For bare aluminum frames use only aluminum cleaner and follow instructions on container. (Dursol cleaner or equivalent).

Clean frame and tunnel with appropriate cleaners and rinse with high pressure hose.

CAUTION: Never direct high-pressure water jet towards decals. They will peel off.

Touch up all metal spots where paint has been scratched off. Spray all bare metal parts of vehicle with metal protector.

FRAME WELDING

Aluminum Frame

– No welds should be done on aluminum frame except if mentioned or required on a BRP bulletin.
– Use ER-5356 rods for MIG or TIG welding.

CAUTION: Before performing electrical welding anywhere on the vehicle, unplug electronic module. On models equipped with a battery, also unplug the negative cable. This will protect the electronic module and battery against damage caused by flowing current when welding.

CAUTION: If welding is to be done near plastic material, it is recommended to either remove the part from the area or to protect it with aluminum foil to prevent damage.

FRAME COMPONENT REPLACEMENT

Drilling Procedure

When drilling self-piercing rivets, use the Supertanium™ drill bit (P/N 529 031 800), available in a 5 mm (3/16 in) size and shipped in packs of 2.

For proper drilling instructions and to prevent premature wear, follow the procedure below.

Always use a variable speed drill.

Partially drill rivet end — not the rivet head.

Maintain a slow to medium speed at all times when drilling. The proper speed is attained when a constant chip is ejected.

NOTE: To increase bit life, use XP-S synthetic chaincase oil (P/N 413 803 300) as a cutting oil.

CAUTION: High speed drilling will cause excessive heat which may destroy the cutting edge of the bit; therefore, avoid using pneumatic drills.

A03H2FA

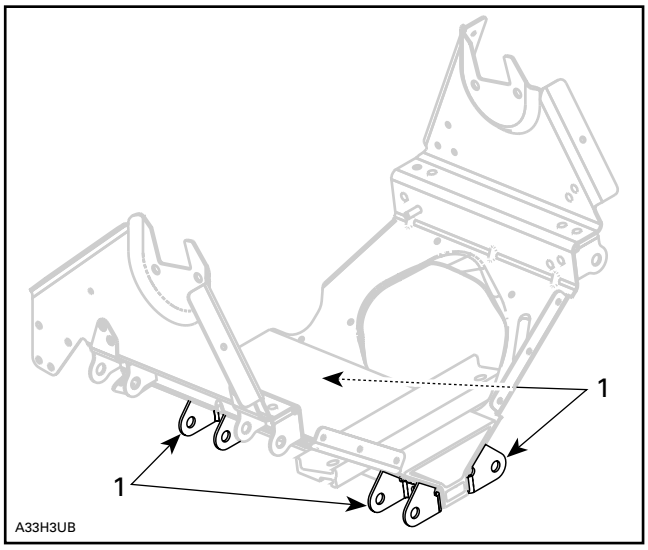
TYPICAL

Cut rivet using a chisel.

Remove riveted part.

Drive out remaining rivet head using a punch.

Lower A-arm Bracket



1. Lower A-arm brackets

To Remove the Lower A-arm Brackets, do the Following:

Remove:

– front shock absorbers
– bolts and nuts retaining lower A-arms to frame
– lower A-arms from their support brackets
– bolts and nuts holding brackets to frame. Discard bolts and nuts.

Using a Supertanium™ drill bit (P/N 529 031 800), drill rivets out.

Remove and discard lower brackets.

For the Installation of Lower A-arm Brackets, do the Following:

Secure the new lower brackets to frame using the following fasteners:

QUANTITY	FASTENERS DESCRIPTION
2	Hexagonal flanged bolt M8 x 55 (P/N 207 685 044)
2	Flanged nut M8 (P/N 233 081 416)

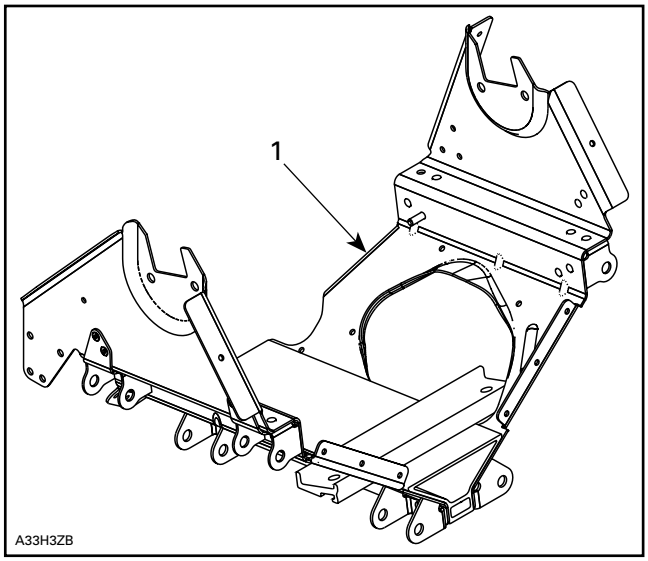
NOTE: Bolt head should be on the RH side of the vehicle.

Secure the lower A-arm with the following fasteners:

QUANTITY	FASTENERS DESCRIPTION
2	Hexagonal flanged bolt M10 x 70 (grade 10.9) (P/N 207 607 046)
2	Elastic nut M10 (P/N 233 201 416)

NOTE: The head of bolts should be towards the front of the vehicle.

Front Cross Member



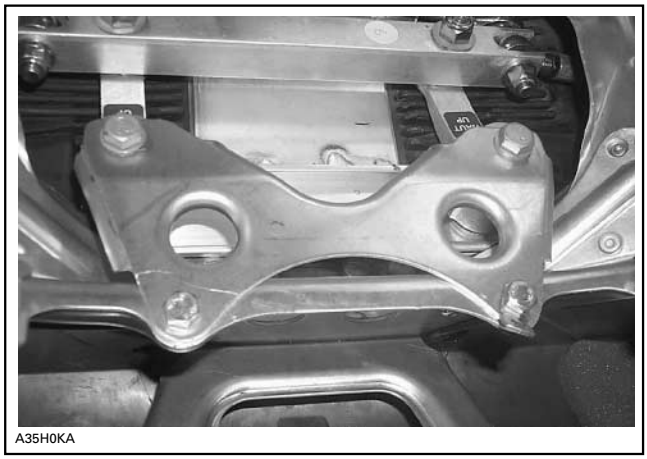
1. Front cross member

To Remove the Front Cross Member, do the Following:

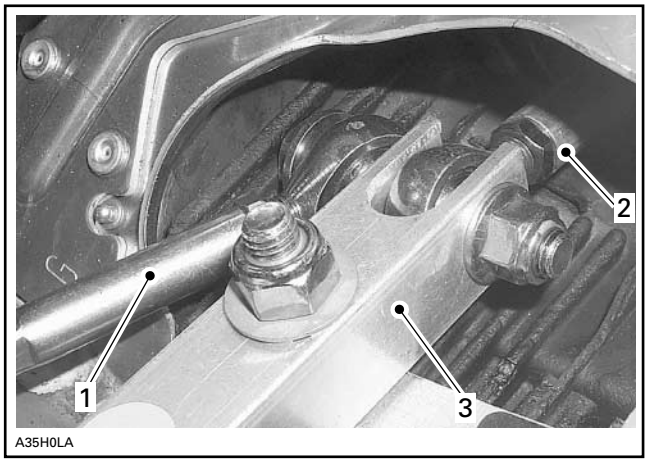
Remove:

– side panels

– hood
– muffler
– tuned pipe
– front bumper brace
– pivot support


A35H0KA

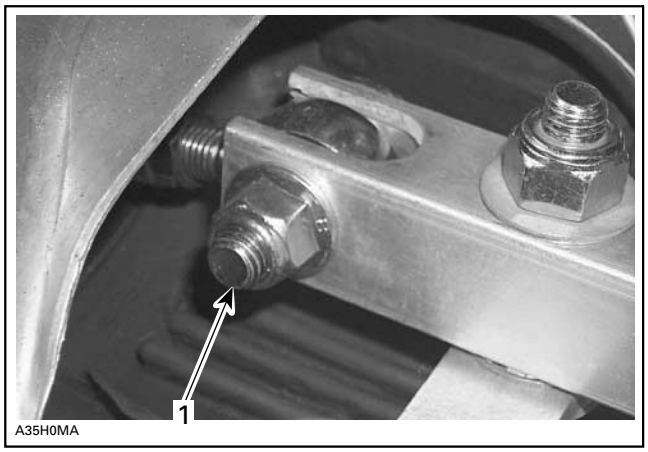
– bolt holding short tie-rod and LH tie-rod to swivel bar



A35H0LA

1. *Short tie-rod*
2. *Tie-rod*
3. *Swivel bar*

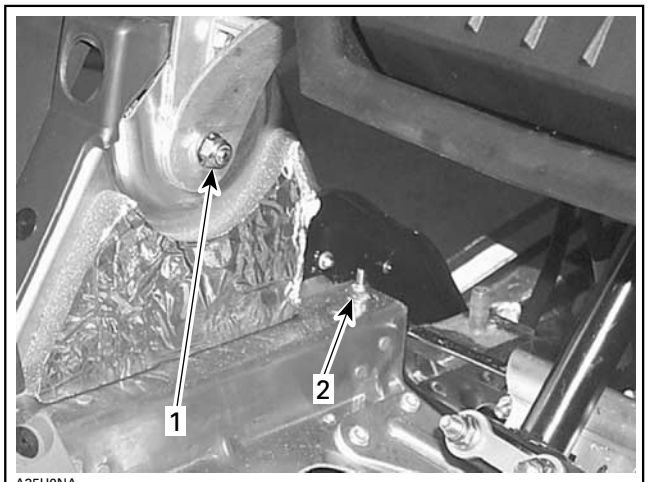
– bolt holding RH tie-rod to swivel bar



A35H0MA

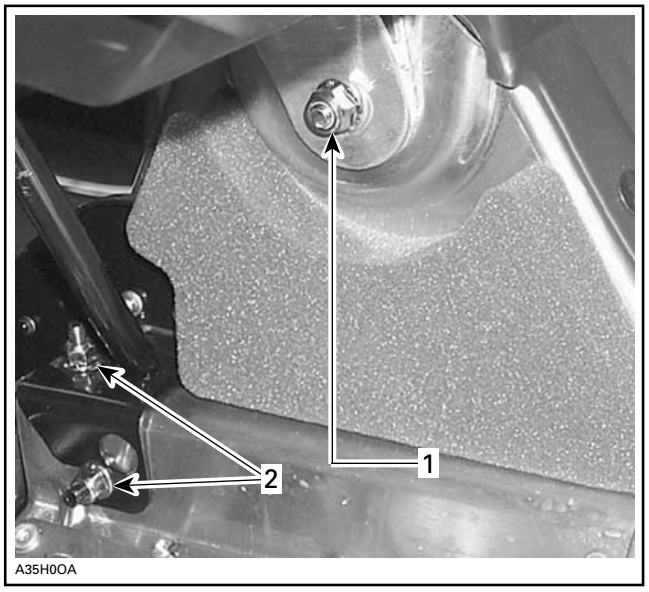
1. *RH tie rod bolt*

– swivel bar with swivel arms
– front shock absorbers
– upper and lower A-arms (with tie-rods and skis)
– bolts and nuts holding rear of lower cross member to frame
– upper cross member nuts (on RH and LH sides)



A35H0NA

RH SIDE OF VEHICLE
1. *Upper cross member nuts*
2. *Lower cross member nuts*



LH SIDE OF VEHICLE
1. Upper cross member nuts
2. Lower cross member nuts

– front bumper
– bottom pan.

Drill all rivets that attach the front cross member to frame.

NOTE: It may be necessary to grind some rivets out.

Remove front cross member.

To Install the Front Cross Member, do the Following:

Install and secure new or existing front plate and the front plate reinforcement to front cross member using:

QUANTITY	FASTENERS DESCRIPTION
6	Hexagonal flanged bolt M5 x 16 (P/N 207 151 644)
6	Elastic flanged nut M5 (P/N 233 251 414)

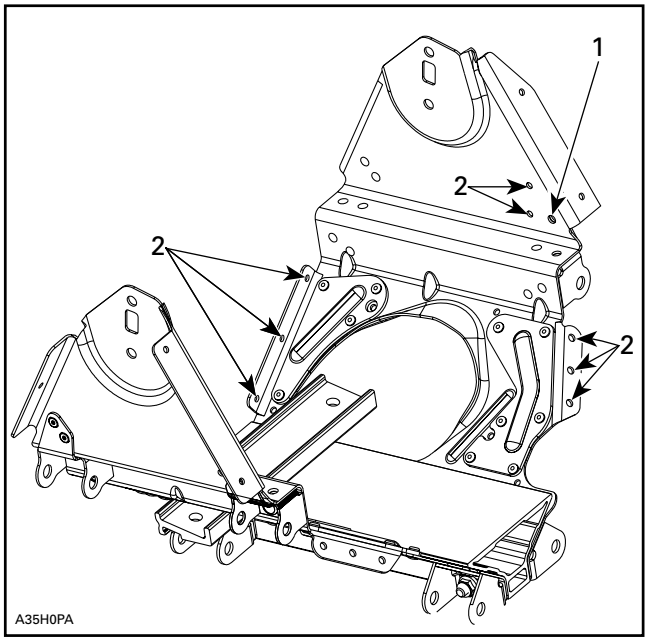
NOTE: Place head of bolts and washer towards the front of the vehicle.

Secure front cross member to frame. First reinstall nuts retaining upper and lower cross member. Do not torque yet.

Install bolts and nuts that attach rear of lower cross member to frame. Do not torque yet.

On each side, install the following fasteners instead of rivets.

QUANTITY	FASTENERS DESCRIPTION
2	Hexagonal flanged bolt M6 x 20 (P/N 207 662 044)
2	Elastic flanged nut M6 (P/N 233 261 414)
4	Hexagonal flanged bolt M5 x 16 (P/N 207 151 644)
4	Elastic flanged nut M5 (P/N 233 251 414)

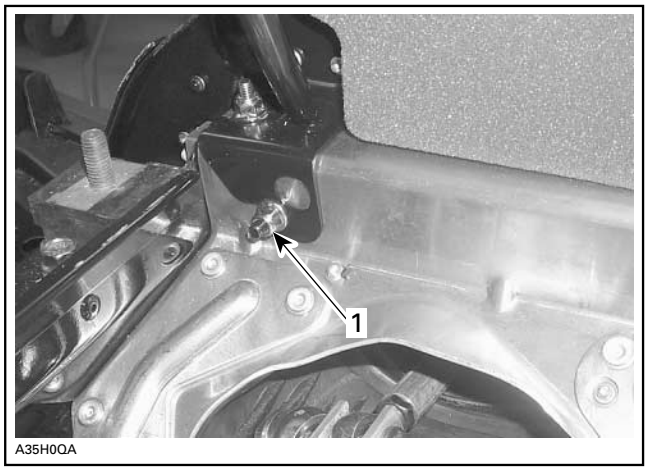


1. M6 bolt
2. M5 bolts

Under front cross member, replace rivets with the following fasteners.

QUANTITY	FASTENERS DESCRIPTION
6	Hexagonal flanged bolt M5 x 16 (P/N 207 151 644)
6	Elastic flanged nut M5 (P/N 233 251 414)

Torque all bolts. Refer at the beginning of this manual for the tightening torque table. Use the standard torque except for one bolt. The lower bolt retaining the upper cross member brace to the frame must be torqued to 7.5 N•m (66 lbf•**in**).



*1. Torque to 7.5 N•m (66 lbf•**in**)*

Install all other removed parts. Refer to specific sections for inspection, installation and adjustment.

Engine Support

LH Support

Unscrew engine and lift it.

Remove the countershaft and its bearing. Refer to CHAINCASE.

Remove the LH handle support.

Drill rivets holding engine support to frame.

Unscrew both engine support bolts. Note bolts's location.

Remove engine support.

To install a new or existing engine support, reverse the removal procedure. However, pay attention to the following.

Install engine support bolts with heads inside.

Replace rivets with the following fasteners:

QUANTITY	FASTENERS DESCRIPTION
4	Hexagonal flanged bolt M6 x 20 (P/N 207 662 044)
4	Elastic flanged nut M6 (P/N 233 261 414)

Install new bolts with their heads outside.

Install all removed parts. Refer to CHAINCASE to install and adjust countershaft properly.

RH Support

Unscrew engine and lift it.

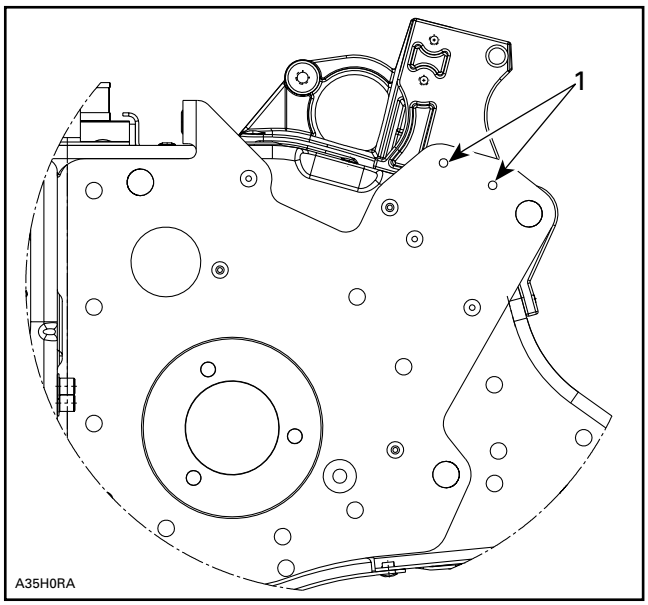
Remove the RH handle support.

Remove chaincase housing. Refer to CHAINCASE.

Drill all rivets holding engine support to frame.

To install a new or existing engine support, reverse the removal procedure. However, pay attention to the following.

Position engine support by installing 2 pop rivets.



1. Pop rivets

Replace all other rivets with the following fasteners:

QUANTITY	FASTENERS DESCRIPTION
3	Hexagonal flanged bolt M6 x 20 (P/N 207 662 044)
3	Elastic flanged nut M6 (P/N 233 261 414)

Install new bolts with the head inside.

Install all removed parts.

MACH Z/SUMMIT 1000 SDI

MODEL			MACH Z	SUMMIT
			1000 SDI	1000 SDI
ENGINE				
Engine			995 SDI	
Number of cylinders			2	
Bore	Standard	mm (in)	88 (3.465)	
Stroke		mm (in)	82 (3.228)	
Displacement		cm^3 (in^3)	997.47 (60.870)	
Compression ratio			12.20 ± 0.5	
Maximum power engine speed (1)		± 100 RPM	7900	
Piston ring type		1st	Semi-trapezoidal	
		2nd	—	
Ring end gap	New	mm (in)	0.55 to 0.70 (.0217 to .0276)	
	Wear limit	mm (in)	1.00 (.0394)	
Ring/piston groove clearance	New	mm (in)	0.45 to 0.090 (.0018 to .0035)	
	Wear limit	mm (in)	0.20 (.0079)	
Piston/cylinder wall clearance	New	mm (in)	0.115 to 0.151 (.0045 to .0059)	
	Wear limit	mm (in)	0.20 (.0079)	
Maximum crankshaft end play (2)	New	mm (in)	0.30 (.0118)	
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.030 (.0012)	
Connecting rod big end axial play	New	mm (in)	0.23 to 0.62 (.0091 to .0244)	
	Wear limit	mm (in)	1.20 (.0472)	
ELECTRICAL				
Magneto generator output		W	480	
Ignition type			Inductive	
Spark plug	Make and type		NGK BR9ECS (6)	NGK BR8ECS
	Gap	mm (in)	0.8 mm (.0315)	
Ignition timing BTDC (3) (7)		mm (in)	7.87 (.3098)	
Trigger coil (4)		Ω	190 to 300	
Generating coil (4)	Low speed	Ω	—	
	High speed	Ω	—	
Lighting coil (4)		Ω	0.145 to 1.185	
High tension coil (4)	Primary		—	
	Secondary		—	
Battery			12 V, 18A•h	
Headlamp		W	60/55 (H4)	
Taillight and stoplight		W	8/27	
Tachometer and speedometer bulbs		W	N.A.	
Fuel and temperature gauge bulbs		W	2 x 3	N.A.

MODEL			MACH Z 1000 SDI	SUMMIT 1000 SDI
Fuse	Starter solenoid	A	30	
	Fuel level sensor	A	0.25	N.A.
FUEL SYSTEM				
Throttle body type			Dell'Orto	
Idle speed		± 200 RPM	1600	
Gas type			Premium unleaded	
Pump octane number	Inside North America	(R+M)/2	91	
	Outside North America	RON	95	
Gas/oil ratio			Injection	
Injection oil			XP-S 2-stroke synthetic blend	
COOLING SYSTEM				
Type			Liquid	
Coolant		Mixture	Ethyl glycol/water mix (50% coolant, 50% distilled water). Use coolant specifically designed for aluminum engines.	
		Premixed	P/N 219 700 362 — 12 x 1 L	
Thermostat opening temperature		°C (°F)	N.A.	
Radiator cap opening pressure		kPa (PSI)	90 (13)	
DRIVE				
Chaincase oil			XP-S Synthetic chaincase oil	
Chain drive ratio			29/49	21/49 EUR: 23/49
Chain	Pitch	in	3/8	
	Type/links qty/plate qty		Silent 82/13	Silent 86/13
Drive pulley type			TRA V	
Drive pulley calibration	Clutch engagement	± 100 RPM	3400	3500 EUR: 3400
	Spring color		Green/Purple	Pink/White EUR: Green/White
	Spring length	mm (in)	130.2 (5.126)	124.5 (4.90) EUR: 110.7 (4.36)
	Pin (with roller (P/N 417 222 762))		Steel solid (P/N 417 004 309)	
	Ramp		434	433 EUR: 600
	Screw position		6	4 EUR: 3
Driven pulley type	Type		HPV Roller	HPV VSA
	Spring preload		0.0	
	Cam angle		44°/33°	44°/30°
Pulley distance	Z	mm (in)	27.5 (1.083)	
Offset	X	mm (in)	37.0 ± 0.5 (1.457 ± 0.2)	
	Y – X	mm (in)	1.23 (.0484)	

MODEL			MACH Z	SUMMIT
			1000 SDI	1000 SDI
Drive belt part number			417 300 189	
Drive belt	Width [10]	mm (in)	38.3 (1.51)	
	Wear limit	mm (in)	35.9 (1.41)	
Drive belt adjustment	Deflection	mm (in)	32 ± 5 (1.260 ± .197)	
	Force [8]	kg (lbf)	11.30 (24.91)	
Track	Width	mm (in)	381 (15)	406 (16)
	Length	mm (in)	3074 (121)	4115 (162)
	Profile height	mm (in)	25.4 (1.0)	58.5 (2.303)
			31.8 (1.25)	
Track adjustment	Adjustment deflection	mm (in)	30 to 35 (1.181 to 1.378)	
	Force [9]	kg (lbf)	7.3 (16)	
Suspension type	Track		SC 4	SC 162 in
	Ski		R.A.S. A-arm	
BRAKE				
Brake fluid reservoir		mL (U.S. oz)	60 (2.0)	
Brake fluid (P/N)			GTLMA (DOT 4) (P/N 293 600 062) Racing brake fluid SRF (DOT 4) (P/N 293 600 063)	
VEHICLE INFORMATIONS				
Mass (dry)	Manual start		236 kg (519 lb)	240 kg (529 lb)
	Electric start		248 kg (546 lb)	
Length		mm (in)	2930 (115.4)	3435 (135.2)
Width		mm (in)	1217 (47.9)	1139 (44.8)
Height		mm (in)	1046 (41.2)	1125 (44.3)
Ski stance (carbide to carbide)		mm (in)	1195 (47.0)	1025 to 1080 (40.35 to 42.52)
Toe-out		mm (in)	0.00	
Camber			0°	
Ground contact area		cm^2 (in^2)	6910.2 (1071.083)	10251.96 (1589.057)
Ground contact pressure	Manual start		3.35 kPa (.486 PSI)	2.30 kPa (.334 PSI)
	Electric start		3.52 kPa (.510 PSI)	
Frame material			Aluminum	
Bottom pan material			Impact resistant copolymer	
Hood material			Surlyn	
CAPACITIES				
Fuel tank		L (U.S. gal)	40 (10.6)	
Chaincase/gearbox		mL (U.S. oz)	250 (8.5)	
Cooling system		L (U.S. oz)	6.4 (216.4)	7.4 (250.2)
Injection oil reservoir		L (U.S. oz)	3.7 (125.112)	

MODEL		MACH Z	SUMMIT
		1000 SDI	1000 SDI
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw		(5)	
Exhaust manifold screws		21.5 N•m (16 lbf•ft)	
Magneto ring nut		130 N•m (96 lbf•ft)	
Crankcase nuts or screws	M6	9 N•m (80 lbf•**in**)	
	M8	29 N•m (21 lbf•ft)	
Crankcase/engine support nuts or screws		35 N•m (26 lbf•ft)	
Cylinder head nuts or screws		55 N•m (41 lbf•ft)	

TECHNICAL DATA LEGEND

BTDC: Before Top Dead Center

CDI: Capacitor Discharge Ignition

MAG: Magneto

N.A.: Not Applicable

P/N: Part Number

PTO: Power Take Off

R.A.S.: Response Angle Suspension

RER: Rotax Electronic Reverse

RPM: Revolution Per Minute

TRA: Total Range Adjustable

VSA: Variable Sheave Angle

W: Watt

(1) The maximum horsepower RPM applicable on the vehicle. It may be different under certain circumstances and BRP reserves the right to modify it without obligation.

(2) Crankshaft end-play is not adjustable on these models. Specification is given for verification purposes only.

(3) At 3500 RPM with headlamp turned on.

(4) All resistance measurements must be performed with parts at room temperature (approx. 20°C (68°F)). Temperature greatly affects resistance measurements.

(5) Drive pulley retaining screw: torque to 100 to 120 N•m (74 to 89 lbf•ft), install drive belt, accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake; repeat 5 times. Retorque screw to 110 to 120 N•m (81 to 89 lbf•ft).

(6) **CAUTION:** Do not attempt to adjust gap on spark plug BR 9 ECS. The specification is given for verification purpose only. If found out of specification, replace with a new one.

(7) 995 SDI: with APS (Air pressure Sensor) disconnected.

(8) Force applied midway between pulleys to obtain specified tension deflection.

(9) Force or downward pull applied to track to obtain specified tension deflection.

(10) Minimum allowable width may not be less than 3.0 mm (1/8 in) of new drive belt.

WIRING DIAGRAMS

SERVICE TOOLS

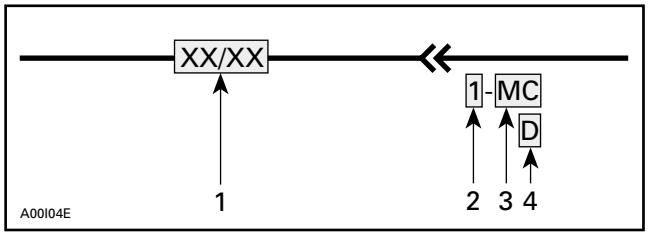
Description	Part Number	Page
connector crimping tool	529 035 909	332
crimper die	529 035 906	332

Wiring diagrams can be found at the end of this subsection.

WIRING DIAGRAM LEGEND

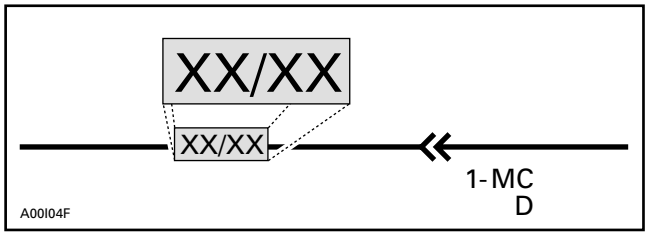
⚠ WARNING

Ensure all terminals are properly crimped on the wires and all connector housings are properly fastened.



1. *Wire colors*
2. *Connector housing area*
3. *Housing code per area*
4. *Wire connector location in housing*

WIRE COLORS



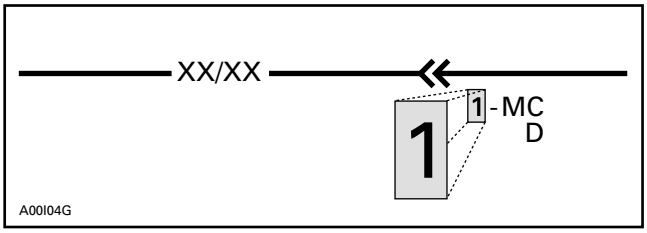
The first color of a wire is the main color, second color is the stripe.

Example: YL / BK is a YELLOW wire with a BLACK stripe.

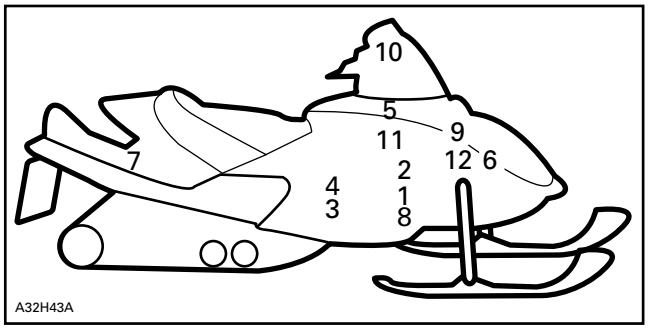
COLOR CODE					
BE	—	BEIGE	OR	—	ORANGE
BK	—	BLACK	RD	—	RED
BU	—	BLUE	VI	—	VIOLET
BR	—	BROWN	WH	—	WHITE
GN	—	GREEN	YL	—	YELLOW
GY	—	GREY			

CONNECTOR HOUSING AREA

The first digit of the connector identification number presents the location of the connector on the vehicle.



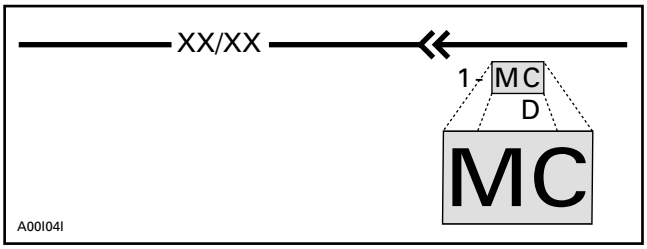
The following illustration shows the snowmobile with number on it. These numbers will correspond with the locations of the connector on the vehicle along with a brief description.

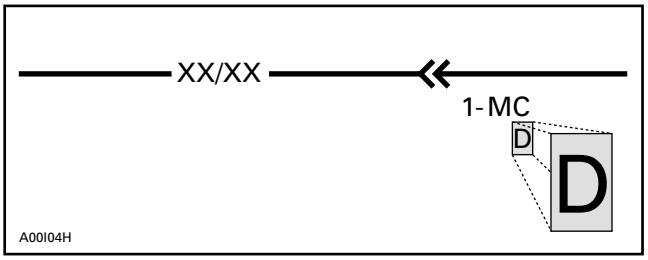


AREA	LOCATION
1	Right hand side of engine
2	Engine
3	Near right hand side footrest
4	Near driven pulley
5	Under console
6	Under hood
7	Near fuel tank
8	Under engine
9	Near steering column or on primary air intake silencer
10	On handlebar
11	Injection oil tank
12	Secondary air intake silencer

HOUSING REFERENCE PER AREA

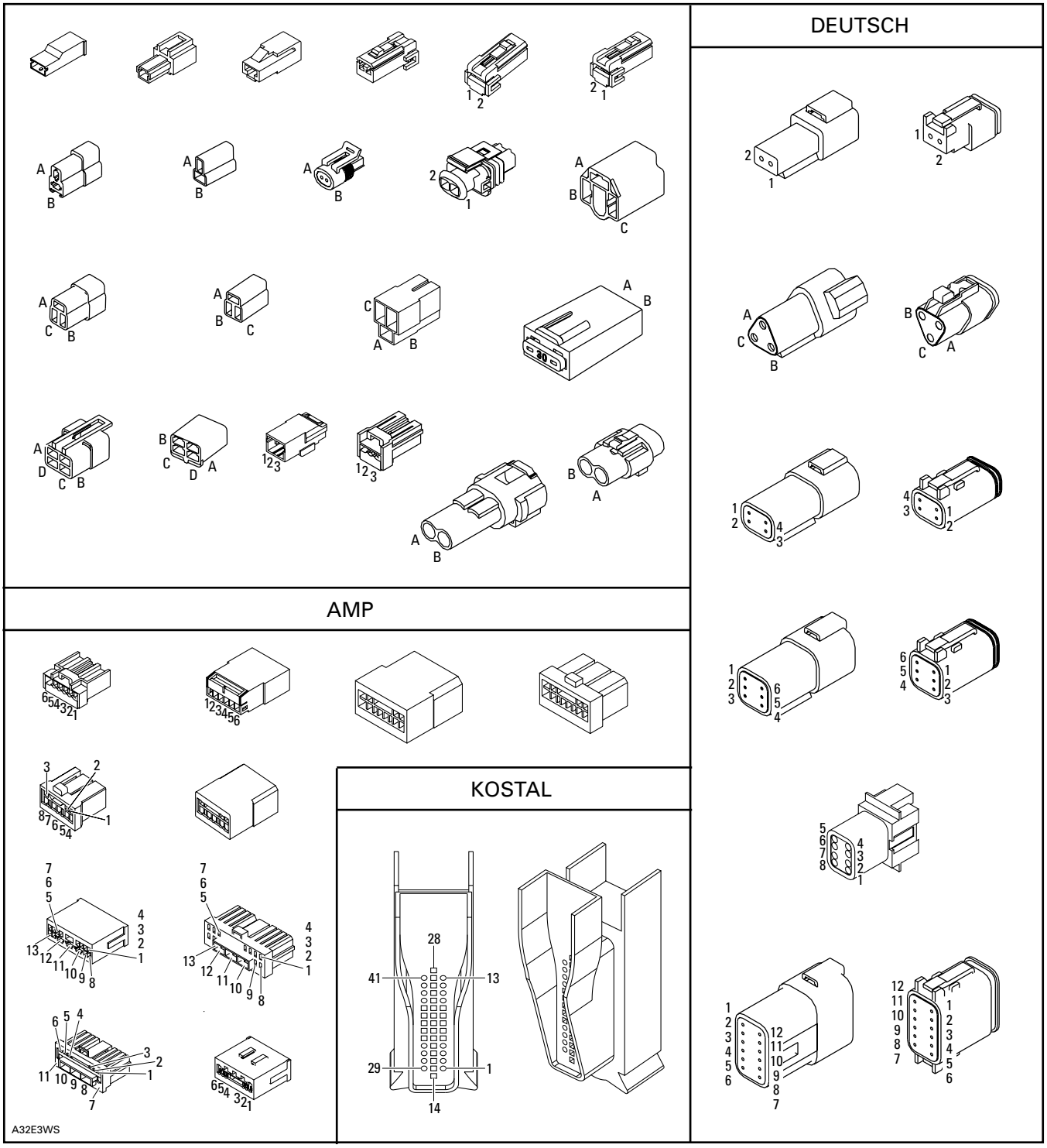
The next two letters of the connector identification number represents a connector reference. If there are many connectors in the same area this helps identify which wire is in which connector.



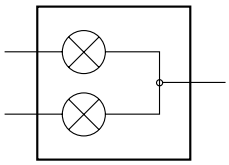
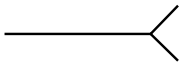
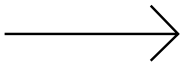
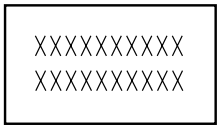
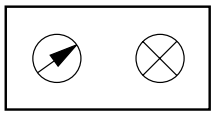
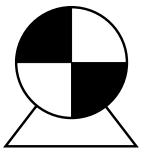
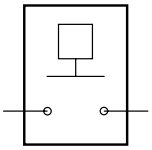
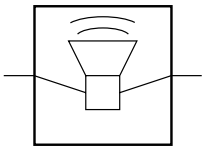
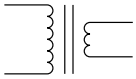
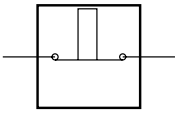
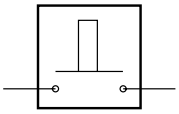
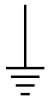
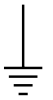
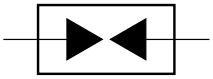
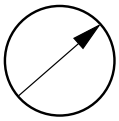
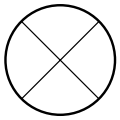
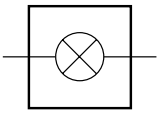
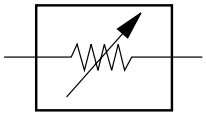
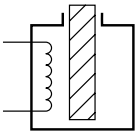
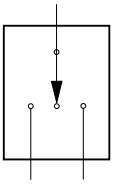
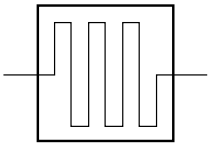
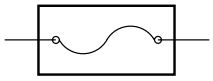
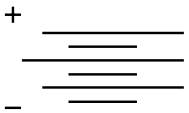
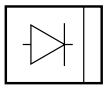
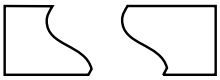


WIRE LOCATION IN CONNECTOR HOUSING

The third portion of the connector identification number represents the location of the wire in the connector housing. This could be identified by either a number such as 1, 2, 3 or by a letter such as A, B, C depending on the type of connector used.


DEUTSCH
AMP
KOSTAL
A32E3WS

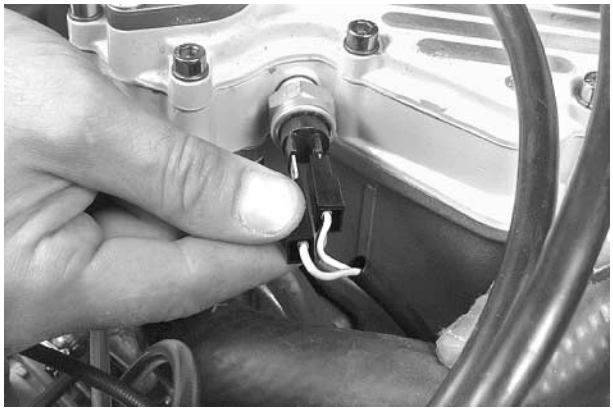
SYMBOLS DESCRIPTION

Beam and tail light 	Female terminal 	Male terminal 	Electronic module 
Meter 	Electric motor 	Low level sensor 	Buzzer 
Ignition coil 	Normally close switch 	Normally open switch 	Male terminal on instrument
Engine ground 	Frame ground  Frame	Spark plug 	Meter movement 
Bulb 	Pilot 	Analog sensor 	Solenoid valve 
Magneto (Delta)	3 position switch 	Heating element 	Fuse 
Trigger coil	Battery 	Diode 	Partially illustrated component 

A00E9PS

UNPLUGGING CONNECTORS

Always unplug connectors by pulling on housing not on wire.

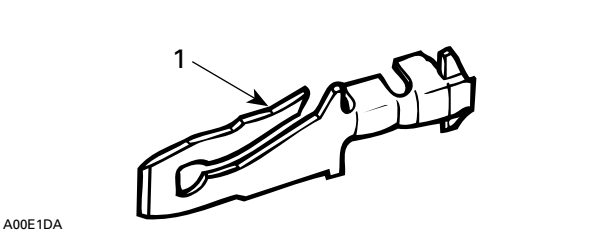

A06E1PA

TYPICAL

TAB AND RECEPTACLE CONNECTORS REMOVAL

Tab Connector

It is locked in its housing by a spring tab on its side. Removal is done by squeezing this tab.

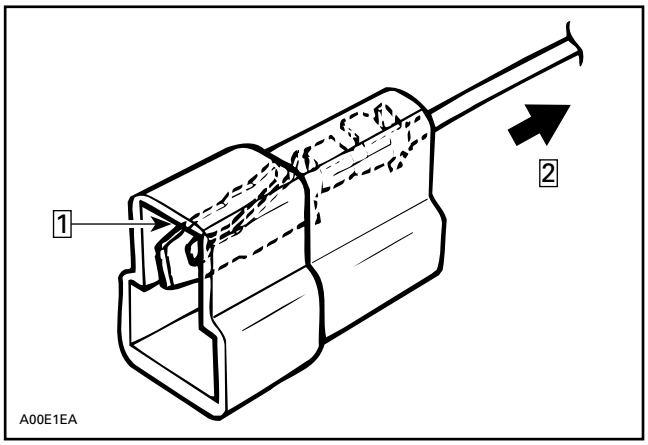


A00E1DA

TAB CONNECTOR
1. Locking tab

To remove:

– Insert a screwdriver or Snap-on TT 600-5 from opposite side of wire and pry locking tab.
– While holding locking tab pried, pull connector toward wire side.



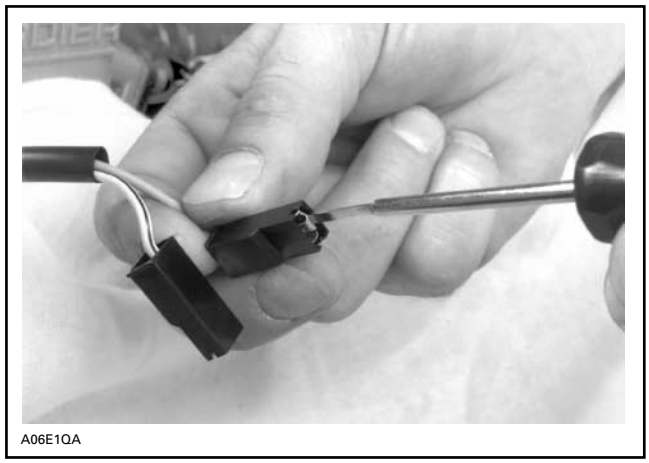
A00E1EA

1. Insert screwdriver here
2. Pull this side

Locking Receptacle Connector

To remove:

– Insert tool Snap-on TT 600-5 in access opening then pull housing toward wire side.

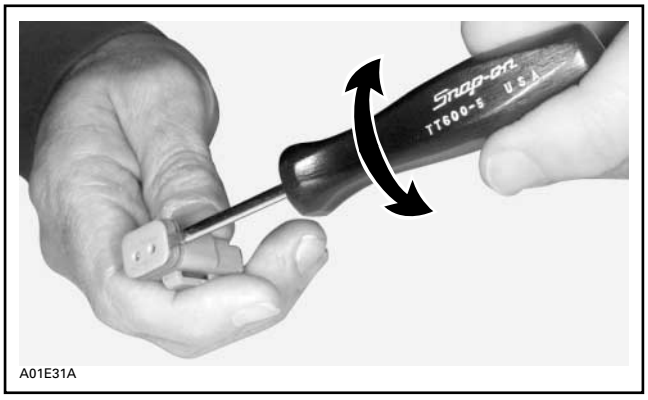

A06E1QA

Waterproof Connector Housing

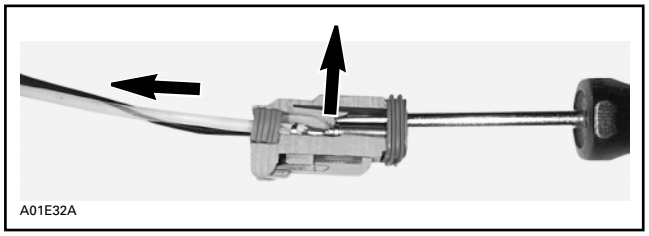
Female Connector Housing

To remove:

– Insert tool Snap-on TT 600-5 under lock and twist to lift it.



– Pry tab to free connector then pull wire out of housing.

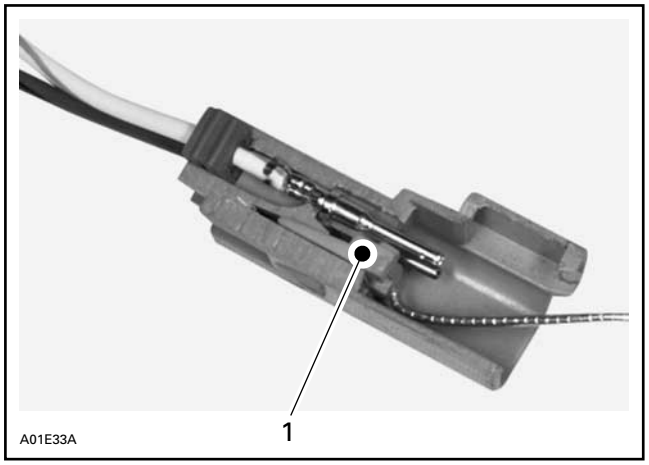


FEMALE CONNECTOR HOUSING — CUT-AWAY

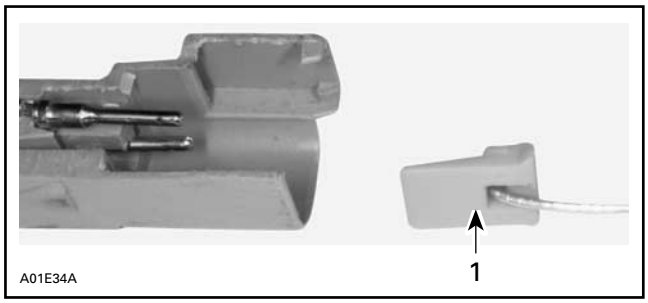
Male Connector Housing

To remove:

– Using a small hook, pull out the lock.

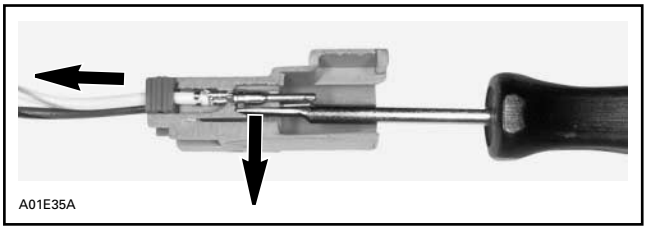


1. Lock



1. Lock

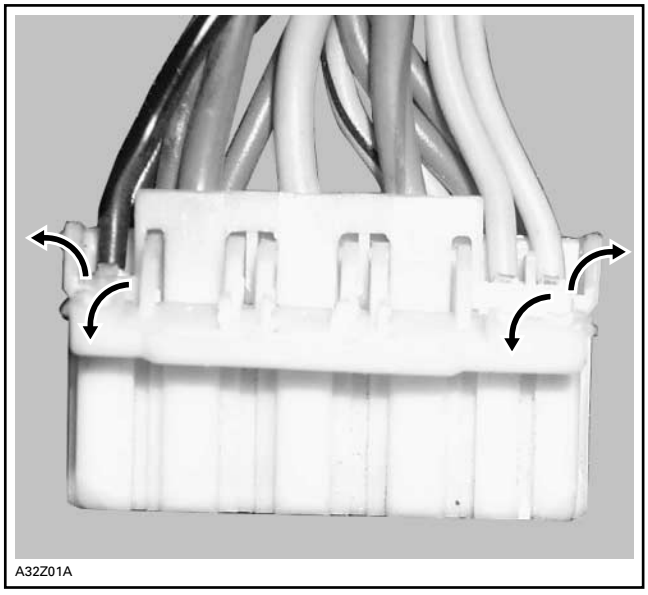
– Pry tab to free connector then pull wire out of housing.



MALE CONNECTOR HOUSING — CUT-AWAY

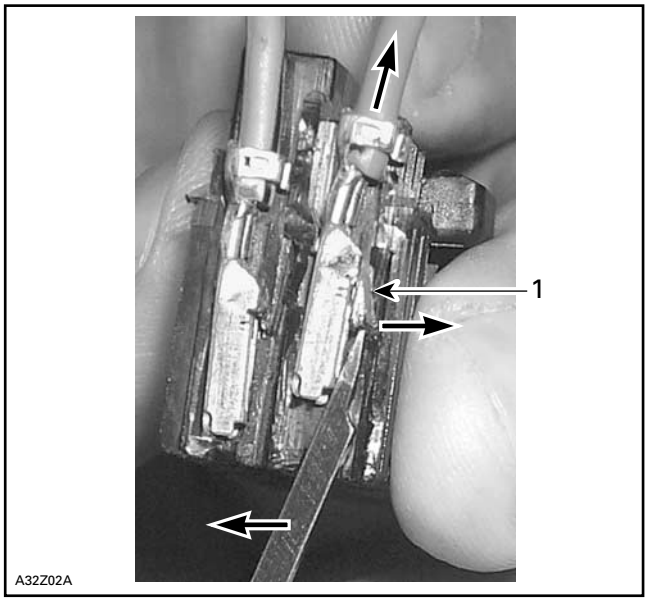
Multilock Connector Housing

Female Connector Housing



To remove:

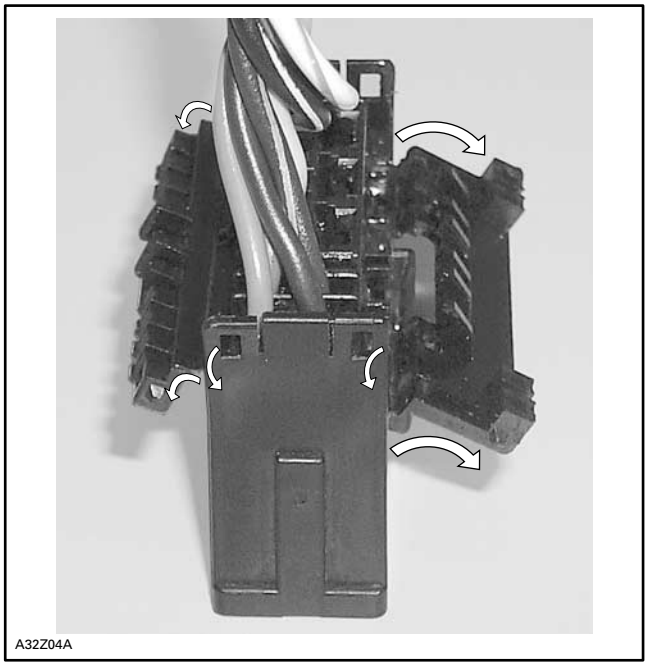
– Insert tool AMP- 755430-2 under lock and twist to lift it.



FEMALE CONNECTOR HOUSING — CUT-AWAY
1. Lock

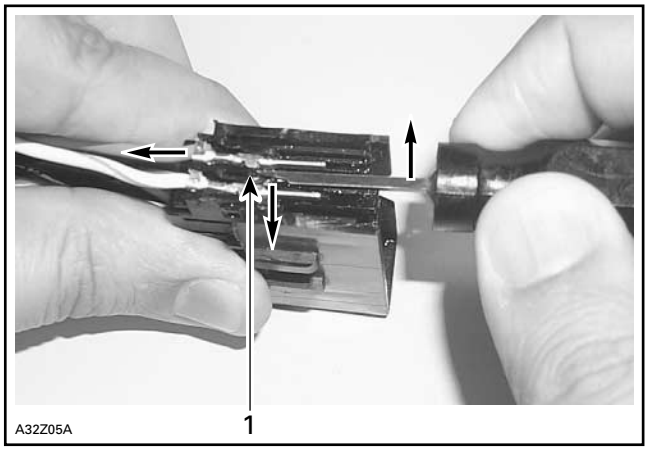
Receptacle connectors can be removed from female housing with sharp head pin.

Male Connector Housing



To remove:

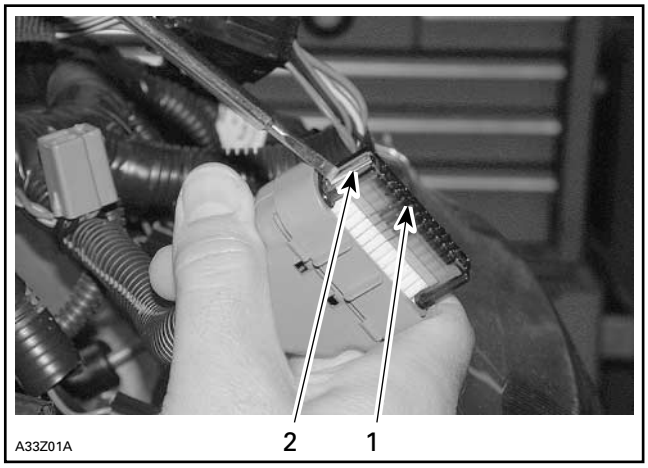
– Insert tool AMP-755430-2 under lock and twist to lift it.



MALE CONNECTOR HOUSING — CUT-AWAY
1. Lock

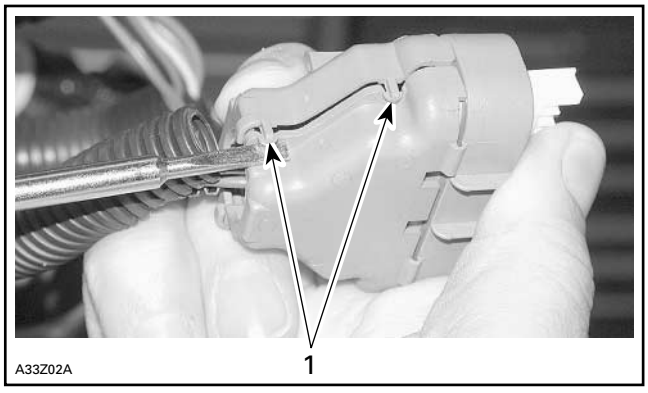
24-Circuit Connector Housing

Push on both tabs to remove retainer.



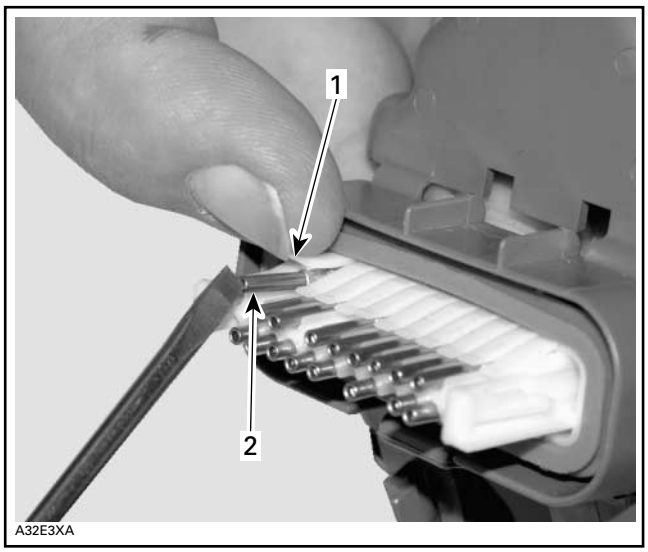
1. Retainer
2. Tab (one on each side)

Open housing by lifting 4 tabs.



1. Tabs (2 on each side)

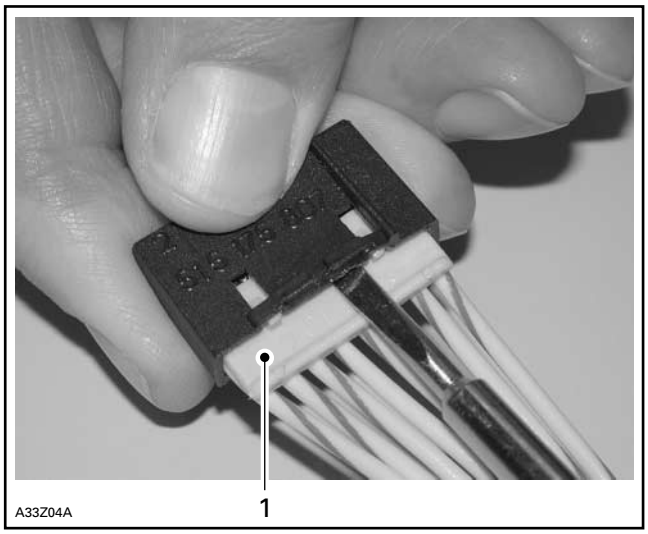
Lift the top plastic lock of the female terminal to be removed and hold in position. Lift the female terminal to unlock from the housing and push out of housing.



1. Lift and hold plastic lock
2. Lift to unlock and push out

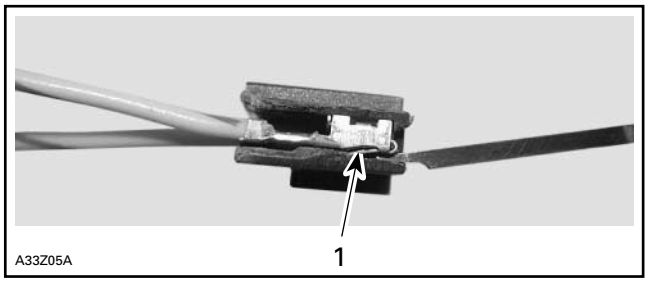
8-Circuit Connector Housing

Pry housing to release lock.



1. Lock

Insert tool AMP-755430-2 under tab and pry it to free connector. Pull on the female terminal wire to remove female terminal from housing.

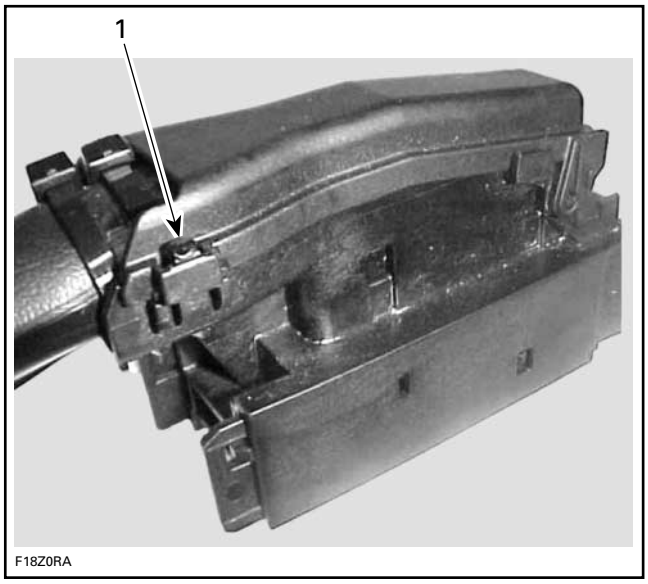


8-CIRCUIT CONNECTOR HOUSING — CUT-AWAY
1. Tab

Connector Housing A and B on ECM

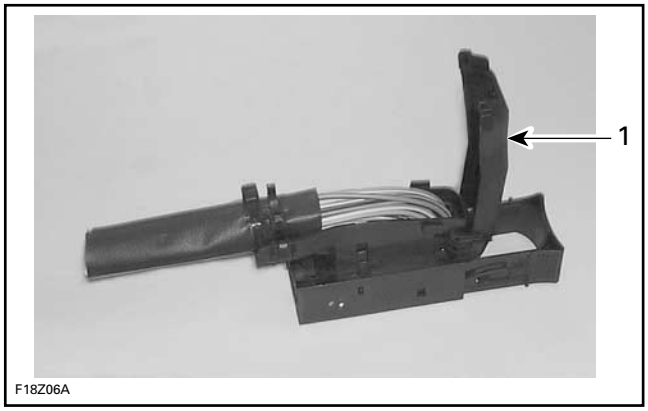
Terminal Removal

Unlock the connector housing cover by pushing in the tabs on top of the housing with a flat screwdriver to be able to flip the top cover up.



1. Push in tab

Lift the cover by pushing it forward.

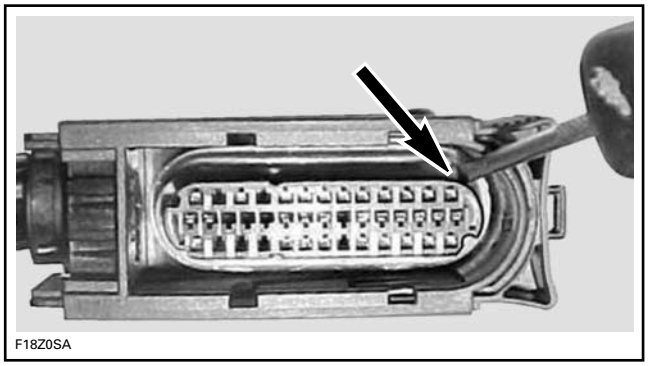


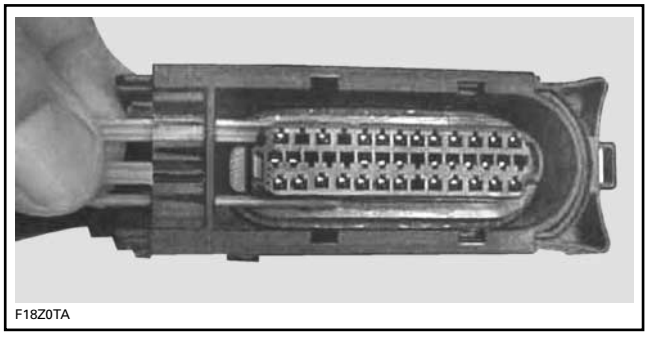
1. Cover

Cut both locking ties that secure the harness to the housing.

1. Locking ties

Turn the housing over and remove the lock by pushing and then pulling toward the wire harness.

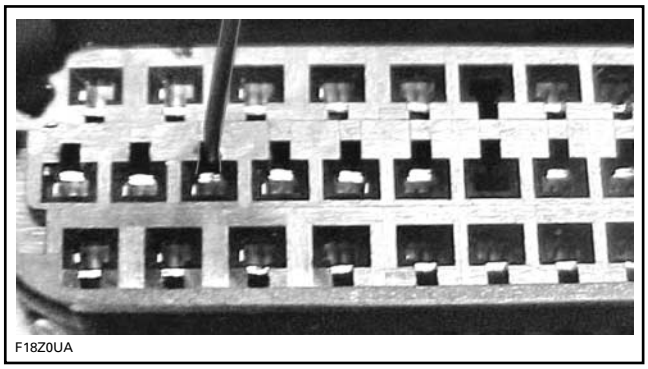


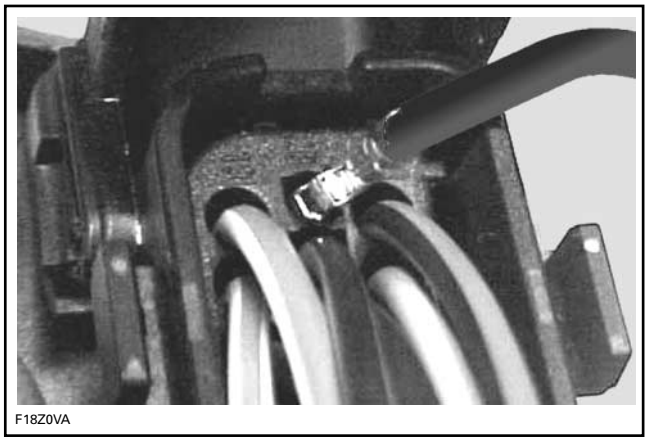


Use a 0.76 mm (.030 in) oxyacetylene torch tip cleaner or a no. 68 drill bit inserted down into the housing to release the locking tab on the connector.

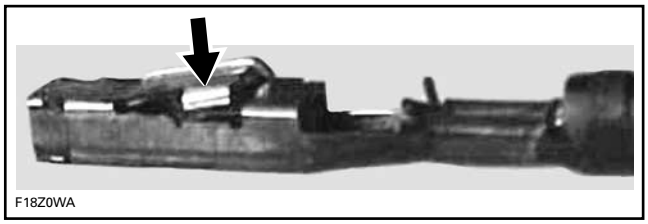
CAUTION: Using a probe larger than 0.76 mm (.030 in) may damage the terminal.

Insert the probe into the housing as shown, and locate the appropriate wire in the back of the housing. You may have to slightly cam the probe against the locking tab to release it, then remove the terminal from the housing.





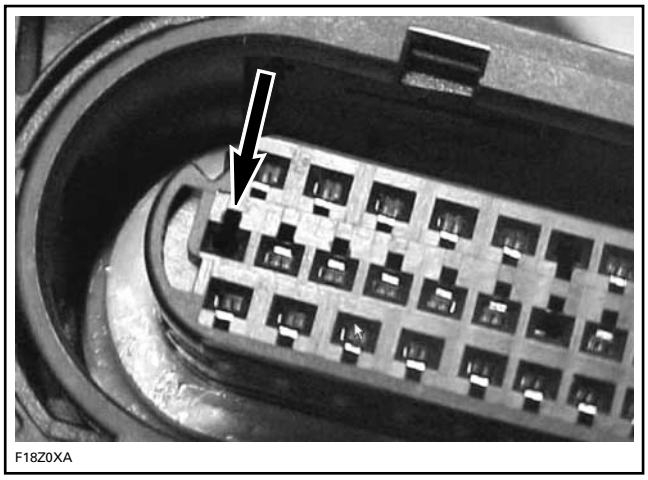
The locking tab on the connector may have to be bent out a little so it will lock in the housing when it is reinserted.



If the wire is in good condition but the terminal is rusted or corroded, remove defective terminal and crimp a new one. If wire and terminal are defective, acquire a new genuine wire and new terminal and crimp them together as explained below.

IMPORTANT: Use genuine wires only. Otherwise wires will not fit properly.

When reinserting the connector, the locking tab must be installed facing the smaller cutout of the connector cavity.


F18Z0XA

Insert the connector, ensuring the locking tab snaps into the housing.

Reinstall the lock, attach the 2 tie raps, and close the housing cover.

Terminal Crimping (Kostal and AMP multilock)

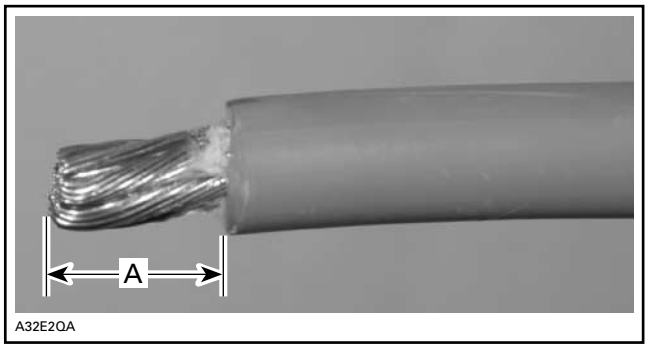
To crimp a new connector terminal, use the connector crimping tool (P/N 529 035 909) and the crimper die (P/N 529 035 906).

F00B0EA

CRIMPING TOOL

To properly crimp the wires, strictly follow this procedure.

Strip the wire to a maximum of 3 mm (1/8 in).

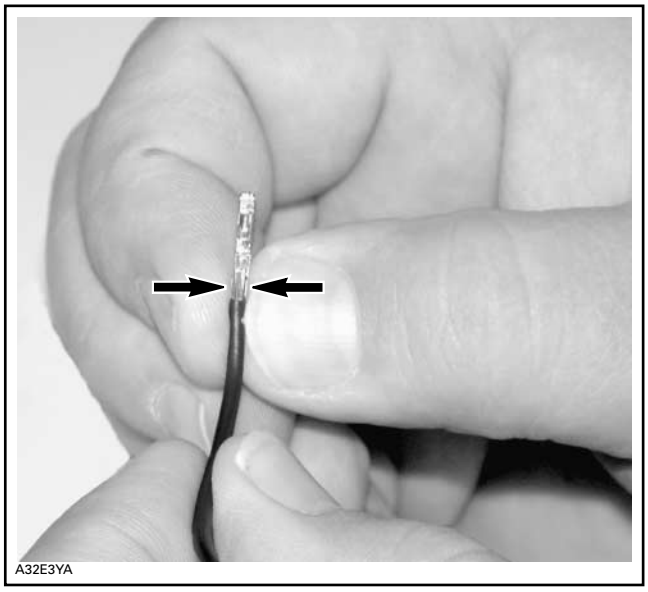


A32E2QA

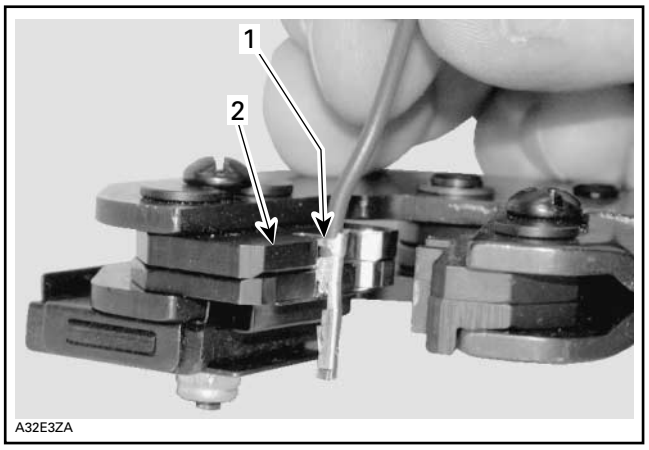
TYPICAL
A. 3 mm (1/8 in) max.

Position wire in terminal.

Squeeze the terminal tabs with your fingers to temporarily retain terminal in place.


A32E3YA

Insert terminal with wire in crimping pliers and position so that top of terminal tabs are flush with pliers edge or a little bit lower as shown.



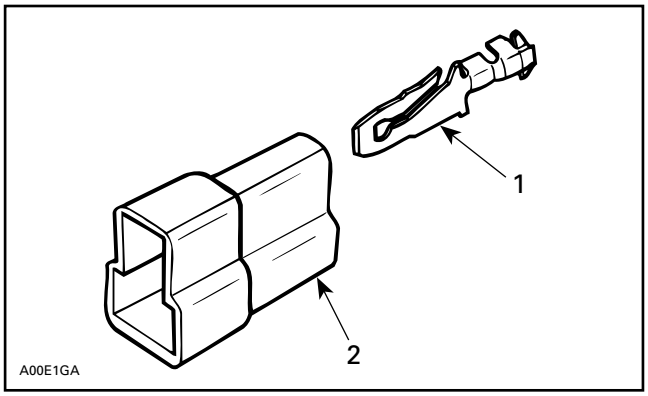
1. Top of terminal tabs
2. Align tabs with pliers edge

Crimp terminal. Ensure no tiny wire goes out of terminal. This might cause strange problems of the electrical system.

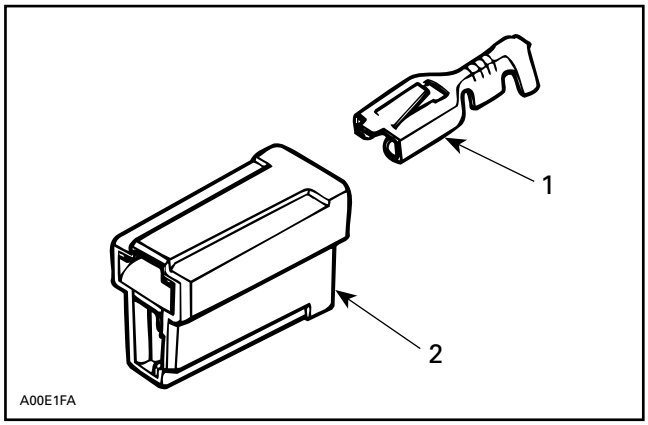
TAB AND RECEPTACLE CONNECTORS INSTALLATION

Prior to installing, make sure locking tab is sufficiently lifted to properly lock.

Insert tab and receptacle connectors in their respective housings as shown in following illustrations. Push sufficiently so that they snap. Try pulling wire to ensure they are properly locked.



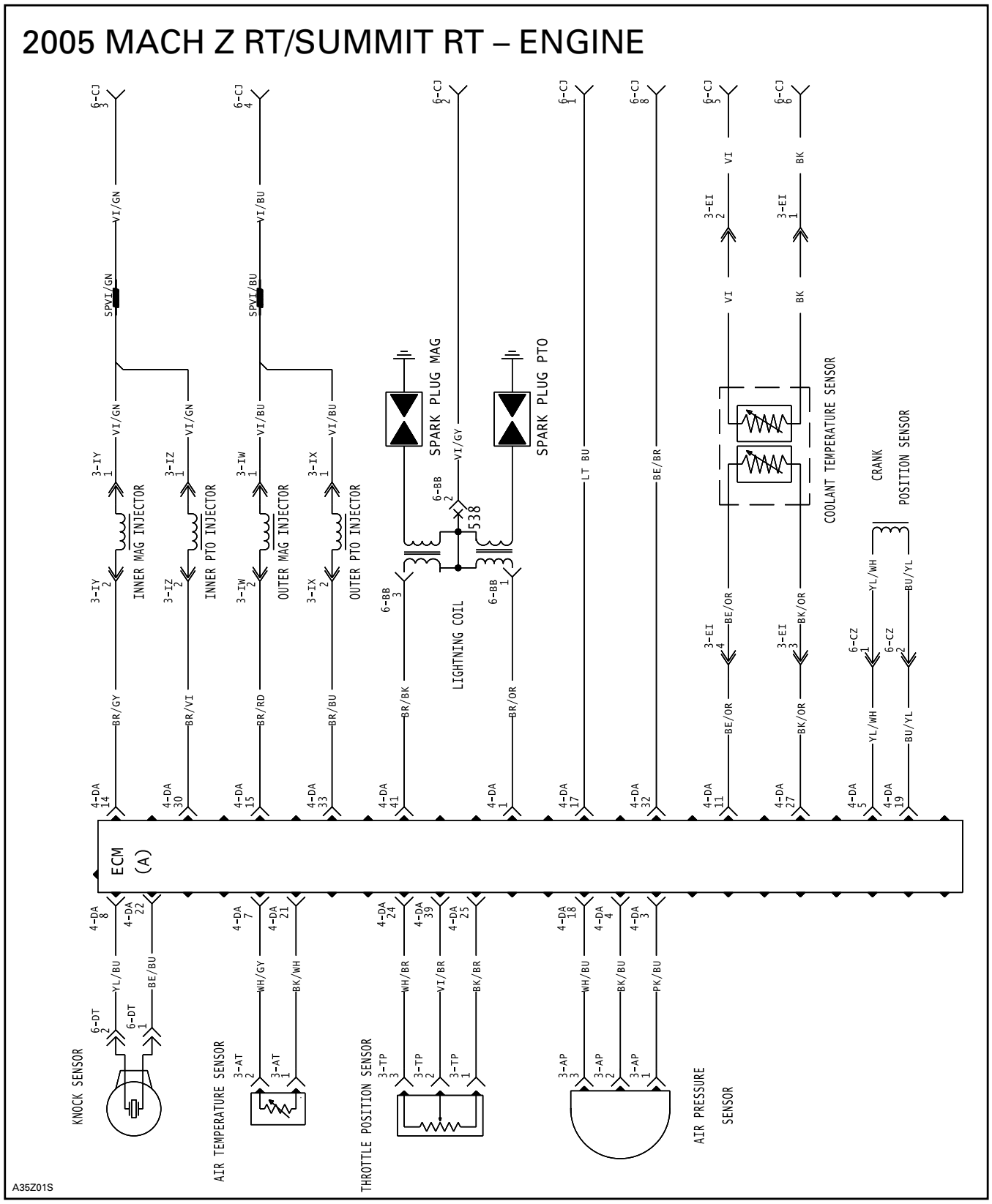
1. Tab
2. Housing



TYPICAL
1. Receptacle
2. Housing

⚠ WARNING

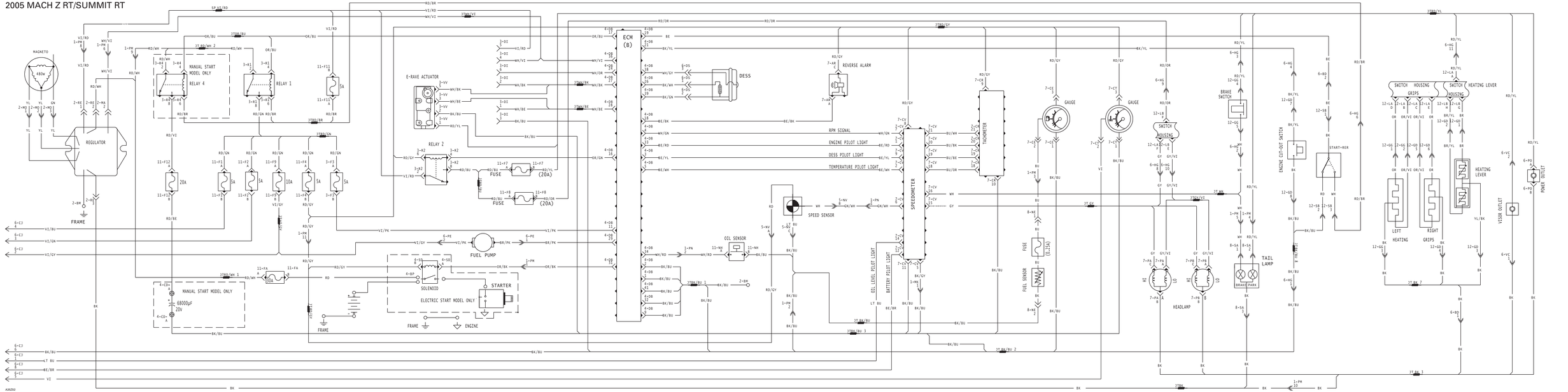
Keep wires away from any rotating, moving, heating, vibrating or sharp edge. Use proper fastening devices as required.


2005 MACH Z RT/SUMMIT RT – ENGINE
ECM (A)
KNOCK SENSOR
AIR TEMPERATURE SENSOR
THROTTLE POSITION SENSOR
AIR PRESSURE SENSOR
SENSOR
SPARK PLUG MAG
SPARK PLUG PTO
LIGHTNING COIL
538
INNER MAG INJECTOR
INNER PTO INJECTOR
OUTER MAG INJECTOR
OUTER PTO INJECTOR
COOLANT TEMPERATURE SENSOR
CRANK
POSITION SENSOR
A35Z01S

NOTES

NOTES

2005 MACH Z RT/SUMMIT RT



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MAN. DE RÉPARATION, SÉRIE RT / ANGLAIS

FAIT AU / MADE IN CANADA U/M:P.C.

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ski-doo®

2005

Shop Manual

Tundra™/ Skandic™ Series / Expedition

484 200 062

2005
Shop Manual

TUNDRA
SKANDIC LT/LT E/WT/SWT/WT LC/SUV 550/SUV 600
EXPEDITION TUV 600 HO SDI/TUV V-1000

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TABLE OF CONTENTS

SAFETY NOTICE XIII

INTRODUCTION XIV
VEHICLE DESCRIPTION DECAL XV
VEHICLE IDENTIFICATION NUMBER (VIN) XVI
ENGINE SERIAL NUMBER XVI
LIST OF ABBREVIATIONS USED IN THIS MANUAL XVII
ARRANGEMENT OF THIS MANUAL XVIII
GENERAL INFORMATION XX
ILLUSTRATIONS AND PROCEDURES XX
SELF-LOCKING FASTENERS PROCEDURE XX
LOCTITE APPLICATION PROCEDURE XXI
THREADLOCKER XXI
STRIPPED THREAD REPAIR XXII
GASKET COMPOUND XXIII
MOUNTING ON SHAFT XXIII
CASE-IN COMPONENTS XXIV
TIGHTENING TORQUE XXV

01 MAINTENANCE
01 – MAINTENANCE CHART 1
02 – STORAGE 3
GENERAL 3
VEHICLE CLEANING 3
ENGINE COMPARTMENT 3
BATTERY 4
FUEL STABILIZER 4
ENGINE LUBRICATION 4
COOLING SYSTEM 5
ENGINE OIL CHANGE AND FILTER 5
COUNTERSHAFT LUBRICATION 5
PULLEY PROTECTION 5
VEHICLE PROTECTION 5
RAGS IN AIR INTAKE AND EXHAUST SYSTEM 5
03 – PRESEASON PREPARATION 7
FUEL FILTER REPLACEMENT 7
THROTTLE BODY CLEANING (ON SO EQUIPPED MODELS) 7
CARBURETOR CLEANING (ON SO EQUIPPED MODELS) 7
AIR FILTER CLEANING 7
RAGS IN AIR INTAKE AND EXHAUST SYSTEM 8
ENGINE LUBRICATION 8
CLEANING OF DRIVE AND DRIVEN PULLEYS 8
CLEANING OF BRAKE DISK 8
DRIVE BELT CONDITION 8
SPARK PLUGS 8

02 TROUBLESHOOTING GUIDE
01 – ENGINE (2-STROKE) 9
02 – ENGINE (4-TEC) 17
COOLING SYSTEM 17
ALTERNATOR 17
LUBRICATION 18

TABLE OF CONTENTS

CYLINDER AND CYLINDER HEAD 19
CRANKSHAFT 19
ELECTRIC STARTER 19
ENGINE GENERAL 21
03 – FUEL AND OIL SYSTEMS (2-STROKE ENGINES) 25
04 – TRANSMISSION AND BRAKE SYSTEMS 29
TRANSMISSION 29
BRAKE SYSTEM 33
MECHANICAL BRAKE 33
HYDRAULIC BRAKE 33
MECHANICAL AND HYDRAULIC BRAKES 34
05 – ELECTRICAL SYSTEM 35
06 – SUSPENSION AND TRACK 43

03 ENGINES (2-STROKE)
01 – 277 ENGINE TYPE 47
ENGINE REMOVAL AND INSTALLATION 48
REMOVAL FROM VEHICLE 49
ENGINE SUPPORT AND MUFFLER DISASSEMBLY AND ASSEMBLY 49
INSTALLATION ON VEHICLE 49
TOP END 50
TROUBLESHOOTING 51
TOP END REMOVAL (WITHOUT REMOVING ENGINE FROM CHASSIS) 51
CLEANING 51
DISASSEMBLY 51
INSPECTION 53
ASSEMBLY 53
BOTTOM END 57
CLEANING 58
DISASSEMBLY 58
INSPECTION 58
ASSEMBLY 58
02 – 443 AND 552 ENGINES 61
ENGINE REMOVAL AND INSTALLATION 62
ENGINE REMOVAL AND INSTALLATION 64
TOP END 65
GENERAL 67
TROUBLESHOOTING 67
CLEANING 67
DISASSEMBLY 67
INSPECTION 69
ASSEMBLY 69
BOTTOM END 75
CLEANING 77
DISASSEMBLY 77
INSPECTION 78
ASSEMBLY 78
BREAK-IN 83
03 – 593 AND 593 HO SDI ENGINES 85
REMOVAL FROM VEHICLE 86
INSTALLATION ON VEHICLE 86
TOP END 87

TABLE OF CONTENTS

GENERAL 89
TROUBLESHOOTING 89
COMPONENT REMOVAL 89
CLEANING 89
RAVE VALVE BASIC OPERATION 89
DISASSEMBLY 90
INSPECTION 94
ASSEMBLY 95
BOTTOM END 100
CLEANING 102
DISASSEMBLY 102
INSPECTION 103
ASSEMBLY 103
BREAK-IN 108
04 – LEAK TEST AND ENGINE DIMENSION MEASUREMENT 109
LEAK TEST 109
PREPARATION 109
PROCEDURE 110
FINALIZING REASSEMBLY 112
ENGINE LEAK VERIFICATION FLOW CHART 113
ENGINE DIMENSION MEASUREMENT 114
CYLINDER HEAD WARPAGE 114
CYLINDER TAPER 114
CYLINDER OUT OF ROUND 114
COMBUSTION CHAMBER VOLUME MEASUREMENT 114
USED PISTON MEASUREMENT 116
CYLINDER/PISTON CLEARANCE 116
RING/PISTON GROOVE CLEARANCE 118
RING END GAP 118
CRANKSHAFT DEFLECTION 118
CONNECTING ROD BIG END AXIAL PLAY 119
CRANKSHAFT END-PLAY 119
CHECKING SURFACE FLATNESS 120
RECTIFYING SURFACES 121
CHECKING CRANKSHAFT ALIGNMENT 121
05 – MAGNETO SYSTEM 123
GENERAL 128
CLEANING 128
DISASSEMBLY 128
ASSEMBLY 129
06 – OIL INJECTION SYSTEM 131
OIL INJECTION PUMP 132
GENERAL 136
OIL TYPE 136
OIL SYSTEM LEAK TEST 136
OIL PUMP IDENTIFICATION 136
CLEANING 137
DISASSEMBLY 137
ASSEMBLY 137
ADJUSTMENT 138
BLEEDING OIL LINES 140
CHECKING OPERATION 140

TABLE OF CONTENTS

07 – AXIAL FAN COOLING SYSTEM 141
REMOVAL 143
CLEANING 143
DISASSEMBLY AND ASSEMBLY 143
INSTALLATION 144
FAN BELT REPLACEMENT AND DEFLECTION ADJUSTMENT 144
08 – LIQUID COOLING SYSTEM 147
COOLING SYSTEM LEAK TEST 149
INSPECTION 149
DRAINING THE SYSTEM 149
DISASSEMBLY AND ASSEMBLY 149
COOLING SYSTEM REFILLING PROCEDURE 151
09 – REWIND STARTER 153
INSPECTION 156
REMOVAL 156
ROPE REPLACEMENT 156
DISASSEMBLY 157
ASSEMBLY 157
INSTALLATION 160
10 – FUEL SYSTEM 161
CARBURETOR 162
IDENTIFICATION 165
REMOVAL 165
CLEANING AND INSPECTION 165
DISASSEMBLY AND ASSEMBLY 165
CARBURETOR ADJUSTMENTS 166
INSTALLATION 168
IDLE SPEED FINAL ADJUSTMENT 170
CHOKE 170
FUEL PUMP 172
REMOVAL 172
PUMP VERIFICATION 172
CLEANING AND INSPECTION 172
INSTALLATION 173
FUEL TANK 173

04 ENGINE (4-TEC)
01 – LEAK TEST 175
VERIFICATION 175
LEAK TEST PROCEDURE 175
PREPARATION AND TEST 175
PREPARATION 175
INSTALLATION 176
02 – REMOVAL AND INSTALLATION 177
ENGINE REMOVAL 178
ENGINE INSTALLATION 180
03 – COOLING SYSTEM 183
COOLING SYSTEM LEAK TEST 186
INSPECTION 186
COOLANT REPLACEMENT 186
COOLANT HOSES 188
WATER PUMP HOUSING/THERMOSTAT 188

WATER PUMP IMPELLER 189
IGNITION COVER 189
WATER PUMP SHAFT 190
PRESSURE CAP 193
RADIATORS 193
04 – LUBRICATION SYSTEM 195
GENERAL 198
OIL LEVEL CHECK 198
ENGINE OIL PRESSURE TEST 198
OIL CHANGE 199
OIL FILTER 199
OIL TANK 200
OIL FILTER HOUSING 201
ENGINE OIL PRESSURE REGULATOR 201
OIL PUMPS 202
PRESSURE OIL PUMP 202
SUCTION OIL PUMP 205
OIL NOZZLE 206
OIL SIEVES 206
REED VALVE 207
05 – CYLINDER AND CYLINDER HEAD 209
CYLINDER/CYLINDER HEAD 1 (FRONT-SIDE) 210
CYLINDER/CYLINDER HEAD 2 (REAR-SIDE) 211
GENERAL 212
SPARK PLUG 212
TEMPERATURE SENSOR 212
VALVE COVER 213
ROCKER ARM 213
CHAIN TENSIONER 216
BREATHER 217
DECOMPRESSOR 218
CAMSHAFT TIMING GEAR 219
TIMING CHAIN 220
CYLINDER HEAD 220
CAMSHAFT 222
VALVE SPRINGS 223
VALVE 225
CYLINDER 227
PISTON 229
06 – CRANKSHAFT/DRIVE GEARS 231
TIMING CHAIN 234
DRIVE GEARS 234
TRIGGER WHEEL 236
CRANKSHAFT 236
CRANKSHAFT LOCKING TOOL 241
PISTON 241
PISTON RINGS 244
07 – CRANKCASE 247
GENERAL 249
PTO COVER 249
CRANKCASE 251

TABLE OF CONTENTS

05 ENGINE MANAGEMENT (2-TEC)

01 – OVERVIEW 257
OPERATING PRINCIPLE 258
AIR INDUCTION 258
FUEL DELIVERY SYSTEM 258
GENERAL 258
COMPONENT DESCRIPTION 258
ENGINE MANAGEMENT SYSTEM (EMS) 259
EMS — GENERAL FUNCTIONS 260
EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS 262
ELECTRONIC FUEL INJECTION 262
IGNITION TIMING 263
ELECTRONICALLY CONTROLLED RAVE 263
KNOCK SENSOR 263
ENGINE MODES OF OPERATION 263
FLOODED ENGINE (DROWNED MODE) 263
MONITORING SYSTEM 263
LIMP HOME MODES 263
DIAGNOSTIC MODE 264
CHARGING SYSTEM 264
IGNITION SYSTEM 264
DOUBLE IGNITION COIL 264
TRIGGER COIL 264

02 – DIAGNOSTIC PROCEDURE 265
GENERAL 265
TROUBLESHOOTING 266
VCK (VEHICLE COMMUNICATION KIT) 266
2-TEC SYSTEM FAULT CODES 267

03 – COMPONENT INSPECTION AND ADJUSTMENT 269
GENERAL 269
FUEL SYSTEM 269
ELECTRICAL SYSTEM 270
RESISTANCE MEASUREMENT 271
ENGINE CONNECTOR PIN-OUTS 273
AIR INDUCTION SYSTEM 274
THROTTLE BODY 274
FUEL DELIVERY 277
FUEL PUMP 278
FUEL RAILS 282
FUEL INJECTORS 283
ELECTRONIC MANAGEMENT 285
ECM REPLACEMENT 285
ENGINE WIRING HARNESS 285
THROTTLE POSITION SENSOR (TPS) 286
CRANKSHAFT POSITION SENSOR (CPS) 288
AIR TEMPERATURE SENSOR (ATS) 289
COOLANT TEMPERATURE SENSOR (CTS) 290
AIR PRESSURE SENSOR (APS) 291
EXHAUST GAS TEMPERATURE SENSOR (EGTS) 291
KNOCK SENSOR (KS) 292
E-RAVE SOLENOID 293
DOUBLE IGNITION COIL 293

IGNITION TIMING 295
ENGINE START/RER BUTTON VERIFICATION 295
DESS SWITCH VERIFICATION 295
SPARK PLUGS 295
CRANKING SYSTEM 296

06 ENGINE MANAGEMENT (4-TEC)

01 – OVERVIEW 297
OPERATING PRINCIPLE OF ENGINE MANAGEMENT 298
AIR INDUCTION 298
FUEL DELIVERY SYSTEM 298
BASIC OPERATION 298
INTAKE MANIFOLD 299
FUEL PUMP MODULE 299
ELECTRONIC MANAGEMENT 300
EMS (ENGINE MANAGEMENT SYSTEM) 300
ECM 300
EMS — GENERAL FUNCTIONS 300
EMS — ENGINE MANAGEMENT FUNCTIONS 302
02 – DIAGNOSTIC PROCEDURE 305
GENERAL 305
MONITORING BEEPER CODED SIGNALS 306
VCK (VEHICLE COMMUNICATION KIT) 306
4-TEC SYSTEM FAULT CODES 307
4-TEC TPS FAULT TABLES 308
03 – COMPONENT INSPECTION AND ADJUSTMENT 311
GENERAL 311
FUEL SYSTEM 311
ELECTRICAL SYSTEM 312
ENGINE CONNECTOR PIN-OUTS 314
CONNECTORS ON ENGINE 314
AIR INDUCTION SYSTEM 315
THROTTLE BODY 315
FUEL DELIVERY 318
FUEL PUMP 319
FUEL RAILS 323
FUEL INJECTORS 324
ELECTRONIC MANAGEMENT 325
ECM REPLACEMENT 325
ENGINE WIRING HARNESS 326
THROTTLE POSITION SENSOR (TPS) 328
IDLE BYPASS VALVE 330
CRANKSHAFT POSITION SENSOR (CPS) 331
CAMSHAFT POSITION SENSOR (CAPS) 332
AIR TEMPERATURE SENSOR (ATS) 334
COOLANT TEMPERATURE SENSOR (CTS) 335
MANIFOLD AIR PRESSURE SENSOR (MAPS) 335
OIL PRESSURE SWITCH (OPS) 336
IGNITION COILS 337
ENGINE START SWITCH VERIFICATION 338
DESS SWITCH VERIFICATION 339
SPARK PLUGS 339

TABLE OF CONTENTS

CRANKING SYSTEM 340

07 TRANSMISSION

01 – DRIVE BELT 341
APPLICATION CHART 341
CHECKING NEUTRAL FUNCTION 341
CLEANING 341
INSPECTION 341
ROTATION DIRECTION 342
DRIVE BELT HEIGHT MEASUREMENT AND ADJUSTMENT 342
DRIVE BELT DEFLECTION MEASUREMENT (REFERENCE ONLY) 343

02 – DRIVE PULLEY 345
BOMBARDIER LITE 346
GENERAL 347
REMOVAL 347
DISASSEMBLY 347
CLEANING 348
INSPECTION 348
ASSEMBLY 348
INSTALLATION 349
COMET® 102C 350
GENERAL 351
MAINTENANCE 351
REMOVAL 351
DISASSEMBLY 352
CLEANING 353
INSPECTION 353
ASSEMBLY 353
INSTALLATION 354
TRA III 355
TRA IV 356
GENERAL 357
REMOVAL 357
DISASSEMBLY 358
CLEANING 359
INSPECTION 360
ASSEMBLY 362
INSTALLATION 366
DRIVE PULLEY ADJUSTMENT 367

03 – DRIVEN PULLEY 369
REMOVAL 371
DISASSEMBLY 371
INSPECTION 372
ASSEMBLY 372
INSTALLATION 373
ADJUSTMENT 373
DISASSEMBLY 375
INSPECTION 375
ASSEMBLY 376
INSTALLATION 376
ADJUSTMENT 377
REMOVAL 379

TABLE OF CONTENTS

DISASSEMBLY 379
CLEANING 379
INSPECTION 379
ASSEMBLY 379
INSTALLATION 379
ADJUSTMENT 379
04 – PULLEY DISTANCE AND ALIGNMENT 381
GENERAL 381
GENERAL PROCEDURE 381
PULLEY ALIGNMENT AND DISTANCE SPECIFICATIONS CHART 383
05 – BRAKE 387
MECHANICAL BRAKE 388
HYDRAULIC BRAKE 390
BRAKE FLUID TYPE 391
BRAKE PADS REPLACEMENT 391
REMOVAL 392
DISASSEMBLY 392
CLEANING 393
INSPECTION 393
ASSEMBLY 393
INSTALLATION 393
ADJUSTMENT 395
BLEEDING 395
06 – CHAINCASE 397
REMOVAL 399
DISASSEMBLY 399
INSPECTION 399
ASSEMBLY 399
INSTALLATION 400
ADJUSTMENT 400
REMOVAL 402
INSPECTION 402
GEAR RATIO MODIFICATION 402
INSTALLATION 402
DRIVE CHAIN ADJUSTMENT 403
ADJUSTMENT 403
07 – GEARBOX 405
3-SPEED GEARBOX 406
REMOVAL 407
DISASSEMBLY 407
INSPECTION 414
ASSEMBLY 414
INSTALLATION 417
OIL LEVEL 417
08 – DRIVE CHAIN 419
GENERAL 419
SILENT CHAIN 419
CHAIN ATTACHMENT 419
CHAIN SEPARATION 419

TABLE OF CONTENTS

08 ELECTRICAL

01 – IGNITION TIMING 421
..... 421
02 – SPARK PLUGS 433
NGK SPARK PLUG 433
NGK SPARK PLUG NUMBERING SYSTEM 433
DESIGN SYMBOLS USED IN NGK SPARK PLUGS 434
DISASSEMBLY 435
HEAT RANGE 435
FOULING 435
SPARK PLUG ANALYSIS 435
SPARK PLUG INSTALLATION 436
SPARK PLUG TIGHTENING TORQUE 436
03 – ALTERNATOR 437
REMOVAL 437
INSPECTION 437
INSTALLATION 437
04 – BATTERY 439
GENERAL 439
REMOVAL 439
CLEANING 440
INSPECTION 440
BATTERY CHARGE TESTING 441
BATTERY STORAGE 442
ACTIVATION OF NEW BATTERY 442
SERVICING 445
BATTERY CHARGING 445
INSTALLATION OF BATTERY 446
CABLE TERMINAL INSTALLATION 447
05 – ELECTRIC STARTER 449
REMOVAL 453
DISASSEMBLY 453
CLEANING AND INSPECTION 456
CLEANING 456
INSPECTION 456
ASSEMBLY 458
INSTALLATION 460
06 – TESTING PROCEDURE 463
GENERAL 467
IGNITION SYSTEM TESTING SEQUENCE 468
LIGHTING SYSTEM TESTING SEQUENCE 468
1. SPARKING 469
2. ELECTRICAL CONNECTOR TESTING 469
3. IGNITION SWITCH, DESS SWITCH OR TETHER CORD CUT-OUT SWITCH AND ENGINE CUT-OUT SWITCH TESTING 469
4. IGNITION GENERATOR COIL TESTING 471
5. TRIGGER COIL TESTING 471
6. MPEM VOLTAGE TESTING 471
7. HIGH VOLTAGE COIL TESTING 472
8. BUZZER TESTING 472
LIGHTING GENERATOR COIL VOLTAGE TESTING 473
CONCLUSION 473

INSPECTION OF AC CIRCUIT ISOLATION 479
INSPECTION 479
INSPECTION OF HEATING ELEMENTS 479

09 REAR SUSPENSION

01 – TORQUE REACTION SUSPENSION 481
COMPONENT REMOVAL 483
SUSPENSION ASS'Y REMOVAL 483
DISASSEMBLY AND ASSEMBLY 483
INSPECTION 484
SUSPENSION ASS'Y INSTALLATION 484
RIDE ADJUSTMENT 485
LUBRICATION 487
02 – ARTICULATING SLIDE SUSPENSION 489
REMOVAL 490
DISASSEMBLY AND ASSEMBLY 490
SHOCK ABSORBER SERVICING 491
INSTALLATION 492
RIDE ADJUSTMENT 492
03 – SUV SUSPENSION 493
REMOVAL 495
DISASSEMBLY AND ASSEMBLY 495
SHOCK ABSORBER INSPECTION 496
INSTALLATION 497
LUBRICATION 498
RIDE ADJUSTMENT 498
04 – DRIVE AXLE 499
REMOVAL 504
DISASSEMBLY 504
ASSEMBLY 505
INSTALLATION 508
LUBRICATION 508
ADJUSTMENT 508
05 – TRACK 511
TRACK TYPE APPLICATION 511
GENERAL 511
INSPECTION 511
REMOVAL 511
INSTALLATION 512

10 STEERING / FRONT SUSPENSION

01 – STEERING SYSTEM 515
INSPECTION 520
DISASSEMBLY AND ASSEMBLY 520
HANDLEBAR POSITION ADJUSTMENT 523
STEERING ADJUSTMENT (SKIS) 524
LUBRICATION 527
02 – SUSPENSION AND SKI SYSTEM 529
ON-VEHICLE COMPONENT REMOVAL 531
DISASSEMBLY 531
INSPECTION 532
INSTALLATION 532

TABLE OF CONTENTS

ON-VEHICLE COMPONENT VERIFICATION 535
DISASSEMBLY 536
INSPECTION 536
INSTALLATION 537
DISASSEMBLY 539
INSPECTION 539
INSTALLATION 540

11 BODY/FRAME

01 – BODY 541
INSTALLATION AND ADJUSTMENT 541
HEADLAMP BEAM AIMING 541
BULB REPLACEMENT 541
DECAL 542
BELT GUARD 542
WIRING HARNESS 543
CABLES 543
TUBING 543
PLASTIC MAINTENANCE AND REPAIR 543
MAINTENANCE 543
REPAIR 543
REPAIR PROCEDURE FOR R.I.M. URETHANE 544
02 – FRAME 547
FRAME CLEANING 547
FRAME WELDING 547

12 TECHNICAL DATA

01 – ENGINES 549
02 – VEHICLES 559
03 – TECHNICAL DATA LEGENDS 567
ENGINE TECHNICAL DATA LEGEND 567
VEHICLE TECHNICAL DATA LEGEND 568

13 WRING DIAGRAMS

01 – WIRING DIAGRAMS 569
WIRE COLORS AND CIRCUIT 569

SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair some 2005 Ski-Doo® snowmobiles. See model list in introduction.

This edition was primarily published to be used by snowmobile mechanic technicians who are already familiar with all service procedures relating to BRP made snowmobiles. Mechanic technicians should attend continuous training courses given by BRP Training Dept.

Please note that the instructions will apply only if proper hand tools and special service tools are used.

This Shop Manual uses technical terms which may be slightly different from the ones used in the Parts Catalog.

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

The content depicts parts and/or procedures applicable to the particular product at time of writing. Service and Warranty Bulletins may be published to update the content of this manual. Make sure to read and understand them.

In addition, the sole purpose of the illustrations throughout the manual, is to assist identification of the general configuration of the parts. They are not to be interpreted as technical drawings or exact replicas of the parts.

The use of BRP parts is most strongly recommended when considering replacement of any component. Dealer and/or distributor assistance should be sought in case of doubt.

The engines and the corresponding components identified in this document should not be utilized on product(s) other than those mentioned in this document.

Torque wrench tightening specifications must be strictly adhered to. Locking devices (ex.: locking tab, self-locking fasteners, etc.) must be installed or replaced with new ones. If the efficiency of a locking device is impaired, it must be renewed.

This manual emphasizes particular information denoted by the wording and symbols:

⚠ WARNING

Identifies an instruction which, if not followed, could cause serious personal injury including possibility of death.

CAUTION: Denotes an instruction which, if not followed, could severely damage vehicle components.

NOTE: Indicates supplementary information needed to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use. Always use common shop safety practice.

Bombardier Recreational Products Inc. (BRP) disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that any services be carried out and/or verified by a highly skilled professional mechanic. It is understood that certain modifications may render use of the vehicle illegal under existing federal, provincial and state regulations.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (ex.: locking tab, self-locking fasteners, etc.) must be installed or replaced with new ones. If the efficiency of a locking device is impaired, it must be renewed. Unless otherwise specified, engine should be turned OFF and cold for all maintenance and repair procedures.

INTRODUCTION

This Shop Manual covers the following BRP made 2005 snowmobiles:

MODEL	ENGINE	COLOR	MARKET	MODEL NUMBER
TUNDRA	280F (R)	YELLOW	CANADA USA	FK5A
TUNDRA	280F (R)	BLACK	CANADA USA	FK5B
SKANDIC LT	440F (R)	YELLOW	CANADA	FH5B
SKANDIC LT	440F (R)	YELLOW	USA	FH5A
SKANDIC LT (E)	440F (R)	YELLOW	CANADA	FH5D
SKANDIC LT (E)	440F (R)	YELLOW	USA	FH5C
SKANDIC WT	550F (R)	YELLOW	CANADA	FG5B
SKANDIC WT	550F (R)	YELLOW	USA	FG5A
SKANDIC SWT	550F (R)	YELLOW	CANADA	FE5B
SKANDIC SWT	550F (R)	YELLOW	USA	FE5A
SKANDIC WT LC	600 (R)	YELLOW	CANADA	FF5B
SKANDIC WT LC	600 (R)	YELLOW	USA	FF5A
SKANDIC SUV	550F (R)	YELLOW	CANADA	FD5B
SKANDIC SUV	550F (R)	YELLOW	USA	FD5A
SKANDIC SUV	600 (R)	YELLOW	CANADA	FC5B
SKANDIC SUV	600 (R)	YELLOW	USA	FC5A
SKANDIC SUV	600 (R)	BLACK	CANADA	FC5D
SKANDIC SUV	600 (R)	BLACK	USA	FC5C
SKANDIC SUV	550F (R)	BLACK	CANADA	FD5C
SKANDIC SUV	550F (R)	BLACK	USA	FD5D
EXPEDITION TUV	600 HO SDI (R)	BLACK	CANADA USA	FB5B
EXPEDITION TUV	600 HO SDI (R)	SEASHORE METALLIC	CANADA USA	FB5A
EXPEDITION TUV	V-1000 (R)	BLACK	CANADA USA	FA5B
EXPEDITION TUV	V-1000 (R)	SEASHORE METALLIC	CANADA USA	FA5A

(E) = Electric start
(R) = Reverse

Tundra

TYPICAL — TUNDRA

Skandic LT
Skandic LT E
Skandic WT
Skandic SWT
Skandic WT LC
Skandic SUV 550
Skandic SUV 600

TYPICAL — SKANDIC SERIES

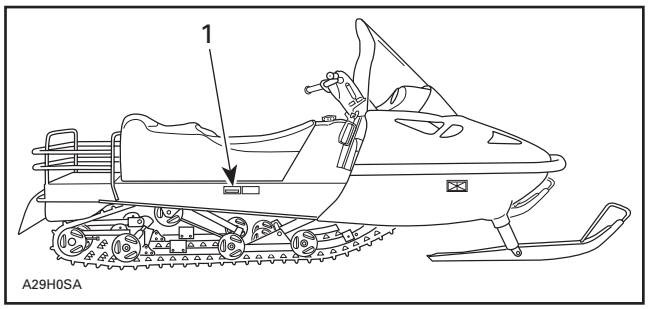
Expedition TUV 600 HO SDI
Expedition TUV V-1000

TYPICAL — EXPEDITION SERIES

VEHICLE DESCRIPTION DECAL

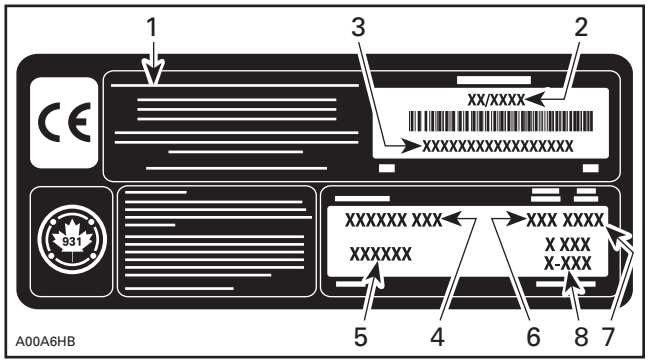
Location

Vehicle description decal is located on right hand side of tunnel.



TYPICAL
1. Vehicle description decal

Description



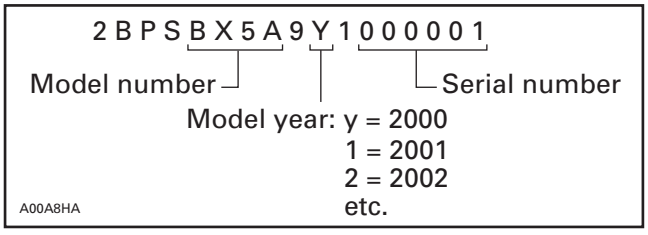
VEHICLE DESCRIPTION DECAL
1. *Manufacturer name and address*
2. *Manufacturing date*
3. *Vehicle identification number (VIN)*
4. *Model name*
5. *Option package*
6. *Engine type*
7. *Model year*
8. *Color codes*

VEHICLE IDENTIFICATION NUMBER (VIN)

Location

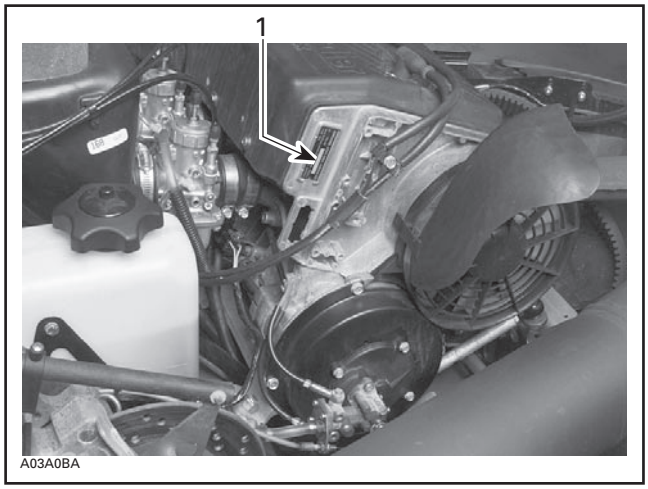
VIN is scribed on vehicle description decal. See above. It is also embossed on tunnel near vehicle description decal.

Description

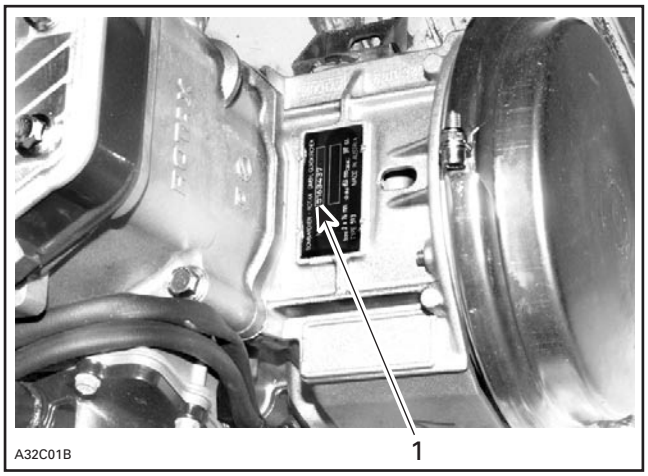


ENGINE SERIAL NUMBER

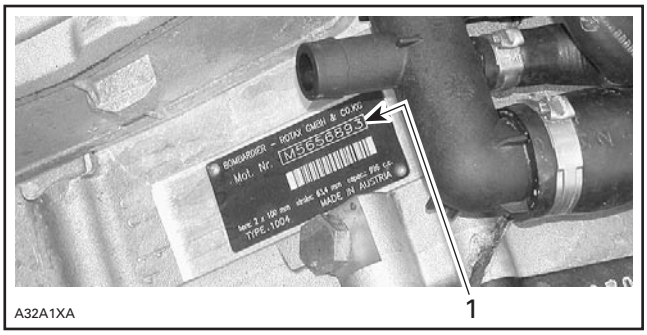
Location



TYPICAL — 2–STROKE FAN-COOLED ENGINES
1. *Engine serial number*



TYPICAL — 2–STROKE LIQUID-COOLED ENGINES
1. *Engine serial number*



4-TEC ENGINE — RH OF ENGINE
1. *Engine serial number*

LIST OF ABBREVIATIONS USED IN THIS MANUAL

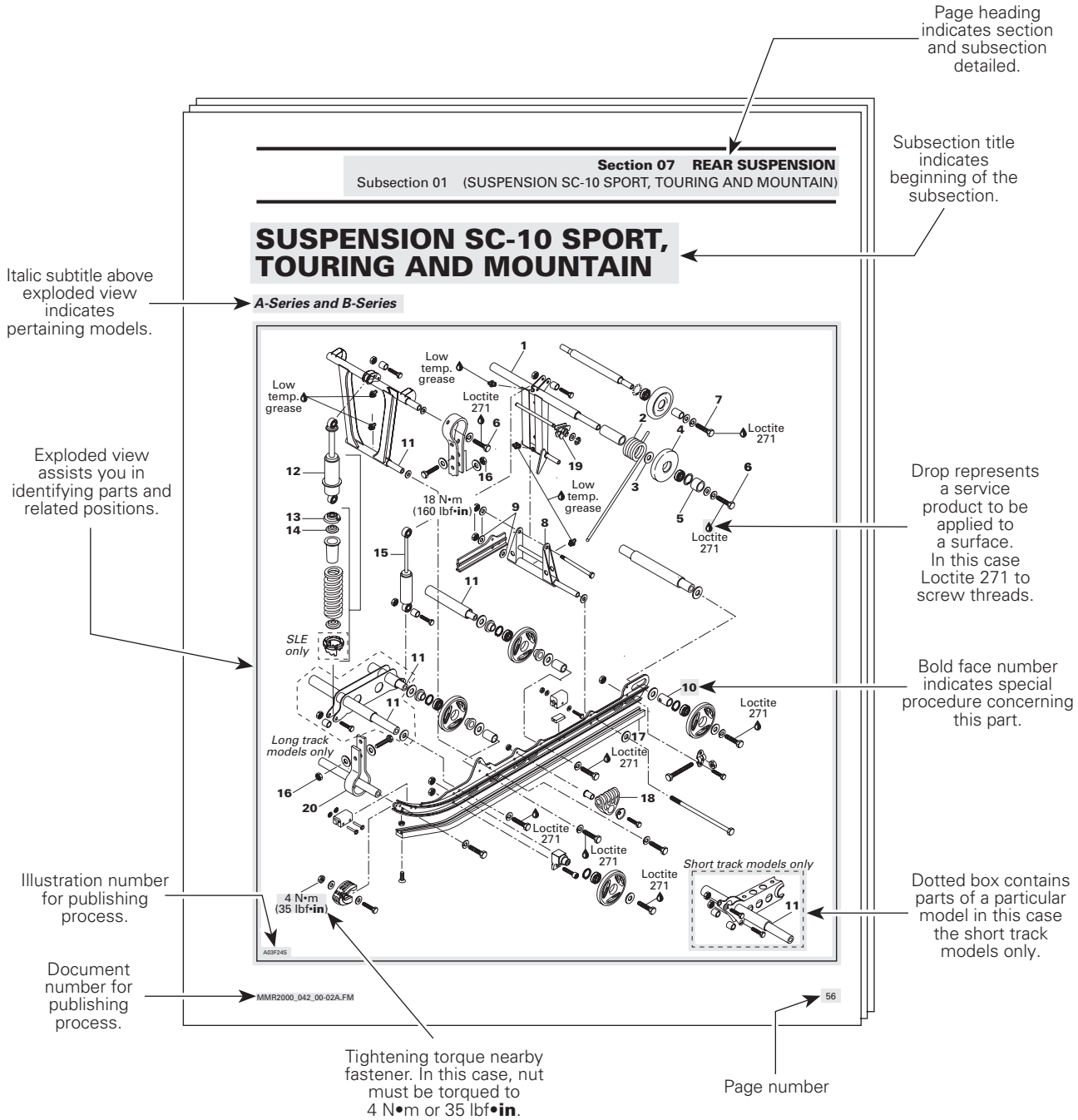
ABREVIATION	MEANING
A	ampere
amp	ampere
A•h	ampere-hour
AC	alternate current
ACM	acceleration and control modulator
ARM	advance ride management
BDC	bottom dead center
BTDC	before top dead center
°C	degree Celsius
cc	cubic centimeter
CDI	capacitor discharge ignition
CTR	center
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
DC	direct current
DPM	digital performance management
DSA	direct shock action
°F	degree Fahrenheit
FC	fan cooled
fl. oz	fluid ounce
ft	foot
GRD	ground
H.A.C.	high altitude compensator
hal.	halogen
HI	high
imp. oz	imperial ounce
in	inch
in^2	square inch
in^3	cubic inch
k	kilo (thousand)
kg	kilogram
km/h	kilometer per hour
kPa	Kilopascal
L	liter
lb	pound
lbf	pound (force)
LH	left hand

ABREVIATION	MEANING
LO	low
LT	long track
m	meter
m.	mile
MAG	magneto
Max.	maximum
Min.	minimum
mL	milliliter
mm	millimeter
MPEM	multipurpose electronic module
MPH	mile per hour
N	newton
N.A.	not applicable
no.	number
00.0	continuity
0.L	overload (open circuit)
O.D.	outside diameter
OPT	optional
oz	ounce
P/N	part number
PSI	pound per square inch
PTO	power take off
R	rectangular
RH	right hand
RAVE	rotax adjustable variable exhaust
RPM	revolution per minute
RMS	root mean square
RRIM	reinforced reaction injection molding
Sp. Gr.	specific gravity
ST	semi-trapezoidal
TDC	top dead center
TRA	total range adjustable
U.S. oz	ounce (United States)
V	volt
Vac	volt (alternative current)

ARRANGEMENT OF THIS MANUAL

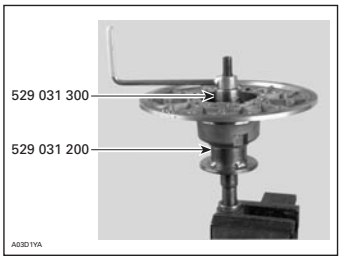
This *Shop Manual* uses technical terms wich may be slightly different from the ones in the parts catalog.

TYPICAL PAGE



TYPICAL PAGE

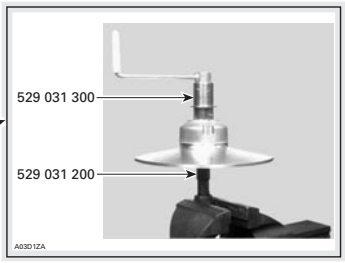
Turn puller handle and sliding half at once to extract the bushing.



IMPORTANT: Large bushing retaining screws and washers must be removed before small bushing installation.

Coat bushing outside diameter with Loctite 609 (P/N 413 703 100).

Install bushing as following photo.



ASSEMBLY

Came Slider Shoe

When replacing slider shoes **no. 4**, always install a new set (3 shoes) to maintain equal pressure on the cam.

Assemble driven pulley components by reversing the disassembly procedure.

Cam

Coat cam **no. 18** interior with anti-seize lubricant.

INSTALLATION

Countershaft

CAUTION: Always apply anti-seize lubricant (P/N 413 701 000) on the countershaft before final pulley installation.

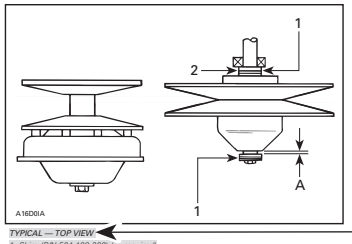
A-Series and B-Series Only

Should installation procedure be required, refer to BRAKE then look for **Brake Disc and Countershaft Bearing Adjustment**.

Reinstall the pulley on the countershaft by reversing the removal procedure.

All Models

Check end play of driven pulley on countershaft by pushing pulley towards outer housing so that the inner shims (P/N 504 108 200) contact it. Measure end play at the mounting screw end between shim(s) and puley. See illustration.



TYPICAL — TOP VIEW

1. Shim (P/N 504 108 200) (as required)
2. Contact
A. 0 to 1 mm (0 to 3/64 in)

Torque retaining screw **no. 13** to 25 N•m (18 lbf•ft).

ADJUSTMENT

Refer to PULLEY DISTANCE AND ALIGNMENT to adjust pulley distance. Adjust drive belt height between pulley halves to obtain specified belt deflection.

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Title indicates main procedure to be carried-out.

Italic bold face type setting indicates a particular procedure concerning a model.

Italic bold face setting in this case indicates that particular procedure for A and B-Series is finished, so from this point, all models are concerned.

"TYPICAL" caption indicates a general view which does not represent full detail. "TOP VIEW" caption helps you in understanding illustration.

Call-outs for above illustration.

Illustration always follows text to which it pertains.

Reference to look up a certain section and subsection. In this case it concerns pulleys adjustment.

Subtitle indicates a particular procedure for the named part.

Bold face number following part name refers to exploded view at beginning of subsection.

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GENERAL INFORMATION

The information and component/system descriptions contained in this manual are correct at time of publication. BRP however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Due to late changes, it may have some differences between the manufactured product and the description and/or specifications in this document.

BRP reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

ILLUSTRATIONS AND PROCEDURES

Illustrations and photos show the typical construction of the different assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts shown. However, they represent parts which have the same or a similar function.

CAUTION: Most components of those vehicles are built with parts dimensioned in the metric system. Most fasteners are metric and must not be replaced by customary fasteners or vice versa. Mismatched or incorrect fasteners could cause damage to the vehicle or possible personal injury.

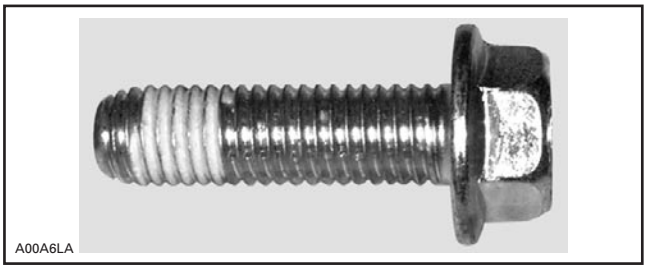
As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or subsection in which the procedure is contained.

A number of procedures throughout the book require the use of special tools. Before commencing any procedure, be sure that you have on hand all the tools required, or approved equivalents.

The use of RIGHT and LEFT indications in the text, always refers to driving position (when sitting on vehicle).

TYPICAL
1. Left
2. Right

SELF-LOCKING FASTENERS PROCEDURE



TYPICAL — SELF-LOCKING FASTENER

The following describes the most common application procedures when working with self-locking fasteners.

Use a metal brush or a screwtap to clean the hole properly then use a solvent (Methyl-Chloride), let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

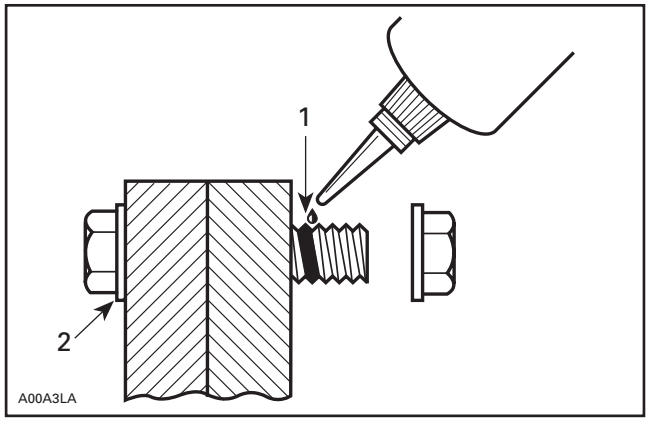
LOCTITE APPLICATION PROCEDURE

The following describes the most common application procedures when working with Loctite products.

NOTE: Always use proper strength Loctite product as recommended in this *Shop Manual*.

THREADLOCKER

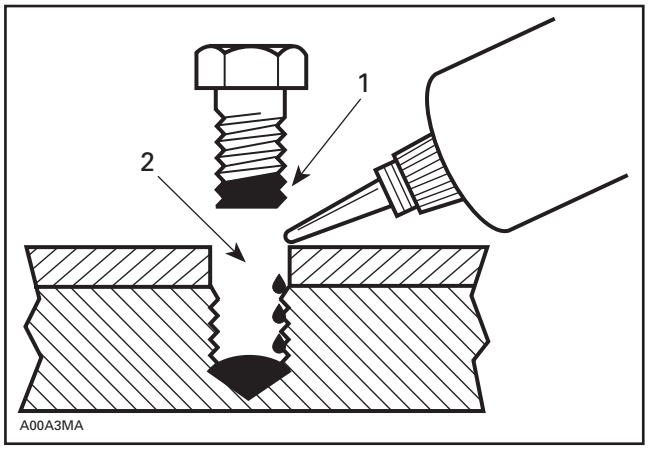
Uncovered Holes (bolts and nuts)



1. Apply here
2. Do not apply

– Clean threads (bolt and nut) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
– Choose proper strength Loctite threadlocker.
– Fit bolt in the hole.
– Apply a few drops of threadlocker at proposed tightened nut engagement area.
– Position nut and tighten as required.

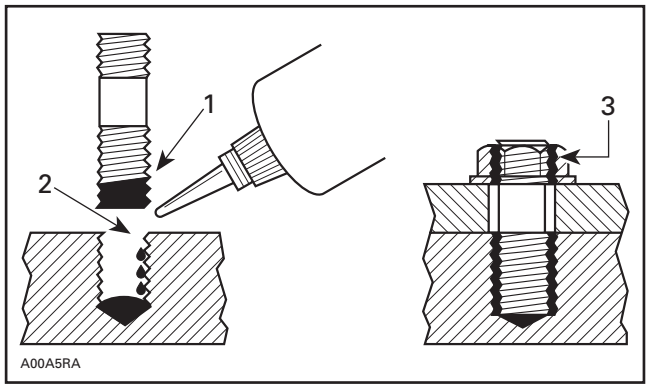
Blind Holes



1. On threads
2. On threads and at the bottom of hole

– Clean threads (bolt and hole) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads (bolt and nut) and allow to dry for 30 seconds.
– Choose proper strength Loctite threadlocker.
– Apply several drops along the threaded hole and at the bottom of the hole.
– Apply several drops on bolt threads.
– Tighten as required.

Stud in Blind Holes

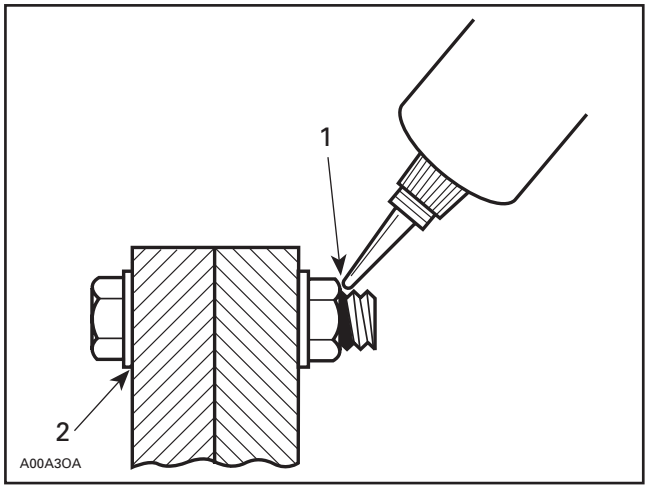


1. On threads
2. On threads and in the hole
3. Onto nut threads

– Clean threads (stud and hole) with solvent.
– Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
– Put several drops of proper strength Loctite threadlocker on female threads and in hole.

– Apply several drops of proper strength Loctite on stud threads.
– Install stud.
– Install cover, etc.
– Apply drops of proper strength Loctite on uncovered threads.
– Tighten nuts as required.

Preassembled Parts

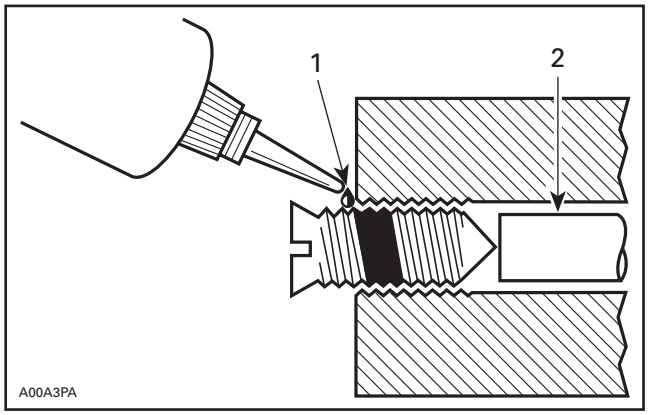


1. Apply here
2. Do not apply

– Clean bolts and nuts with solvent.
– Assemble components.
– Tighten nuts.
– Apply drops of proper strength Loctite on bolt/nut contact surfaces.
– Avoid touching metal with tip of flask.

NOTE: For preventive maintenance on existing equipment, retighten nuts and apply proper strength Loctite on bolt/nut contact surfaces.

Adjusting Screw



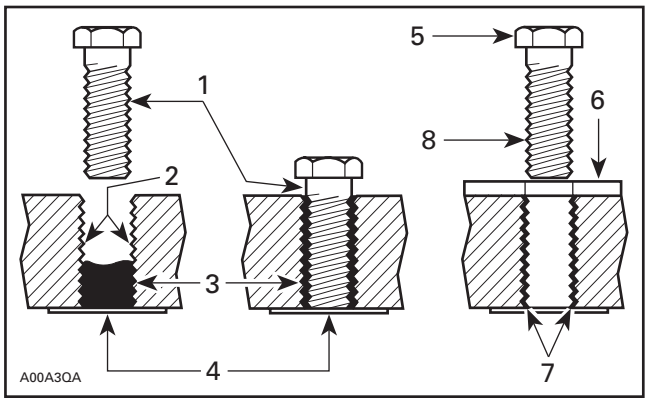
1. Apply here
2. Plunger

– Adjust screw to proper setting.
– Apply drops of proper strength Loctite threadlocker on screw/body contact surfaces.
– Avoid touching metal with tip of flask.

NOTE: If it is difficult to readjust, heat screw with a soldering iron (232°C (450°F)).

STRIPPED THREAD REPAIR

Stripped Threads



1. Release agent
2. Stripped threads
3. Form-A-Thread
4. Tape
5. Cleaned bolt
6. Plate
7. New threads
8. Threadlocker

Standard Thread Repair

– Follow instructions on Loctite FORM-A-THREAD (P/N 413 708 600) package.

– If a plate is used to align bolt:
  – Apply release agent on mating surfaces.
  – Put waxed paper or similar film on the surfaces.
  – Twist bolt when inserting it to improve thread conformation.

NOTE: NOT intended for engine stud repairs.

Repair of Small Holes/Fine Threads

Option 1: Enlarge damaged hole, then follow STANDARD THREAD REPAIR procedure.

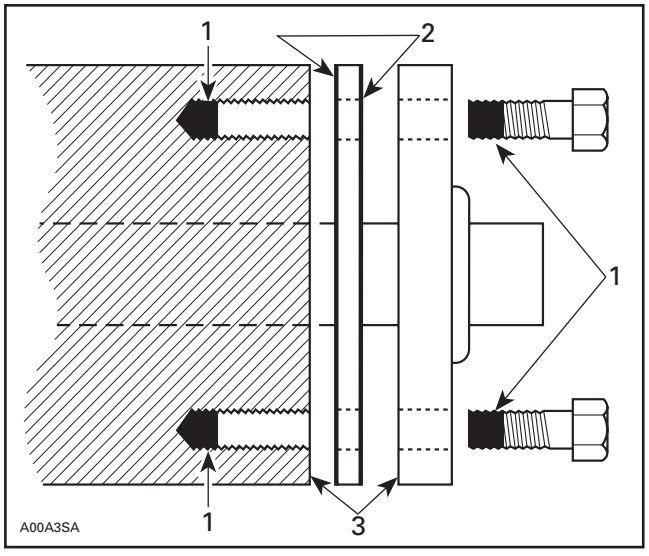
Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

Permanent Stud Installation (light duty)

– Use a stud or thread on desired length.
– DO NOT apply release agent on stud.
– Do a STANDARD THREAD REPAIR.
– Allow to cure for 30 minutes.
– Assemble.

GASKET COMPOUND

All Parts



1. Proper strength Loctite
2. Loctite Primer N (P/N 413 708 10) and Gasket Eliminator 515 (P/N 413 702 700) on both sides of gasket
3. Loctite Primer N only

– Remove old gasket and other contaminants with Loctite Chisel (P/N 413 708 500). Use a mechanical mean if necessary.

NOTE: Avoid grinding.

– Clean both mating surfaces with solvent.
– Spray Loctite Primer N on both mating surfaces and on both sides of gasket. Allow to dry 1 or 2 minutes.
– Apply GASKET ELIMINATOR 515 (P/N 413 702 700) on both sides of gasket, using a clean applicator.
– Place gasket on mating surfaces and assemble immediately.

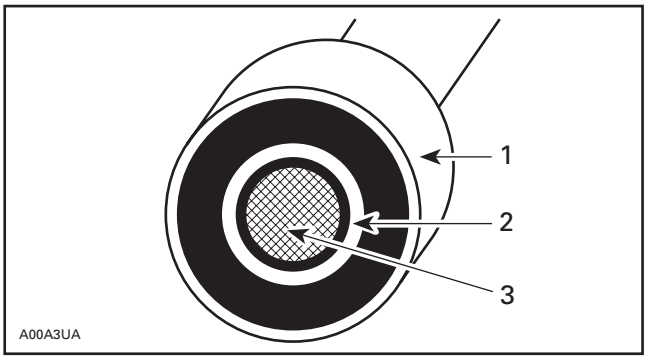
NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

If holes are sunken, apply proper strength Loctite on bolt threads.

– Tighten as usual.

MOUNTING ON SHAFT

Mounting with a Press



1. Bearing
2. Proper strength Loctite
3. Shaft

Standard

– Clean shaft external part and element internal part.
– Apply a strip of proper strength Loctite on shaft circumference at insert or engagement point.

NOTE: Retaining compound is always forced out when applied on shaft.

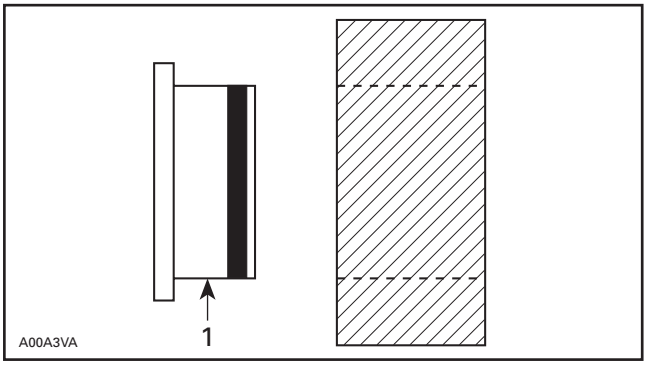
– DO NOT use antiseize Loctite or any similar product.
– No curing period is required.

Mounting in Tandem

– Apply retaining compound on internal element bore.
– Continue to assemble as shown above.

CASE-IN COMPONENTS

Metallic Gaskets



1. Proper strength Loctite

– Clean inner housing diameter and outer gasket diameter.
– Spray housing and gasket with Loctite Primer N (P/N 293 800 041).
– Apply a strip of proper strength Loctite on leading edge of outer metallic gasket diameter.

NOTE: Any Loctite product can be used here. A low strength liquid is recommended as normal strength and gap are required.

– Install according to standard procedure.
– Wipe off surplus.
– Allow it to cure for 30 minutes.

NOTE: Normally used on worn-out housings to prevent leaking or sliding.

It is generally not necessary to remove gasket compound applied on outer gasket diameter.

TIGHTENING TORQUE

Tighten fasteners to torque mentioned in exploded views and/or text, When they are not specified, refer to following table. The table also gives the metric conversion.

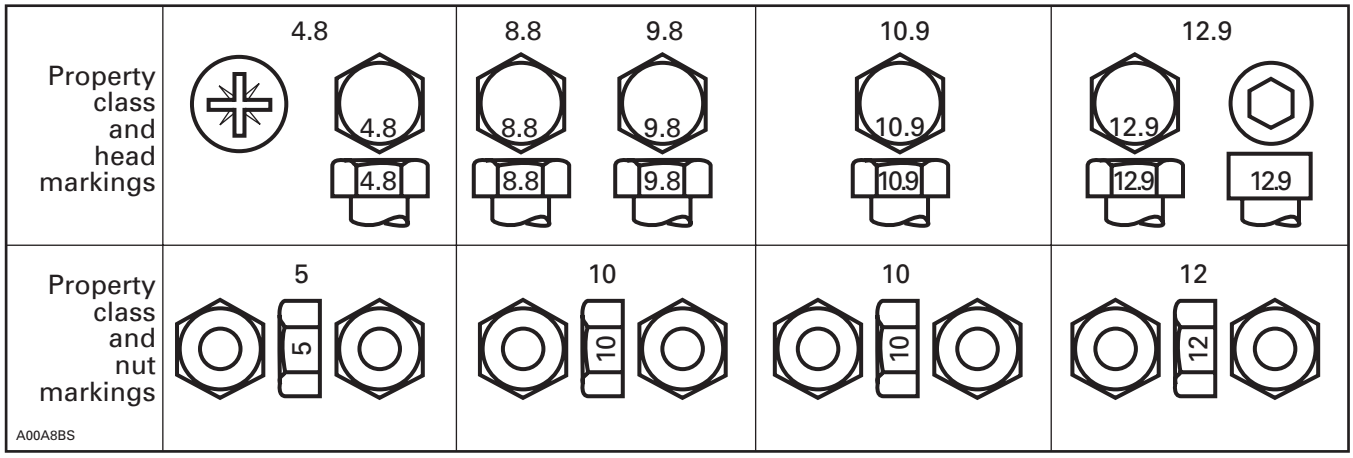
⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to. Locking devices (ex.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones, where specified. If the efficiency of a locking device is impaired, it must be renewed.

In order to avoid a poor assembling, tighten screws, bolts or nuts in accordance with the following procedure:

– Manually screw all screws, bolts and/or nuts.
– Apply the half of the recommended torque value.

CAUTION: Be sure to use proper tightening torque for the proper strength grade.



FASTENER SIZE	FASTENER GRADE/TORQUE			
	5.8 Grade	**8.8** Grade	**10.9** Grade	**12.9** Grade
M4	1.5 – 2 N•m (13 – 18 lbf•**in**)	2.5 – 3 N•m (22 – 27 lbf•**in**)	3.5 – 4 N•m (31 – 35 lbf•**in**)	4 – 5 N•m (35 – 44 lbf•**in**)
M5	3 – 3.5 N•m (27 – 31 lbf•**in**)	4.5 – 5.5 N•m (40 – 47 lbf•**in**)	7 – 8.5 N•m (62 – 75 lbf•**in**)	8 – 10 N•m (71 – 89 lbf•**in**)
M6	6.5 – 8.5 N•m (58 – 75 lbf•**in**)	8 – 12 N•m (71 – 106 lbf•**in**)	10.5 – 15 N•m (93 – 133 lbf•**in**)	16 N•m (142 lbf•**in**)
M8	15 N•m (11 lbf•ft)	24.5 N•m (18 lbf•ft)	31.5 N•m (23 lbf•ft)	40 N•m (30 lbf•ft)
M10	29 N•m (21 lbf•ft)	48 N•m (35 lbf•ft)	61 N•m (45 lbf•ft)	72.5 N•m (53 lbf•ft)
M12	52 N•m (38 lbf•ft)	85 N•m (63 lbf•ft)	105 N•m (77 lbf•ft)	127.5 N•m (94 lbf•ft)
M14	85 N•m (63 lbf•ft)	135 N•m (100 lbf•ft)	170 N•m (125 lbf•ft)	200 N•m (148 lbf•ft)

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MAINTENANCE CHART

A: ADJUST
I: INSPECT (clean, inspect, repair, adjust, lubricate)
L: LUBRICATE
R: REPLACE
C: CLEAN

PART/TASK	10-HOUR OR 500 KM (300 mi) INSPECTION (to be performed by dealer)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	6000 KM (3700 mi)	STORAGE (to be performed by dealer)	PRESEASON PREPARATION (to be performed by dealer)	REFER TO SECTION(S) AND SUBSECTION(S)
ENGINE								
Rewind starter and rope						I,L,C	I	03-09
Engine nuts and screws	I			I		I		Section 03 or 04, see the appropriate subsection
Exhaust system	I		I			I		Section 03 or 04, see the appropriate subsection
Engine lubrication						L		01-02
Cooling system	I			I			I	03-08 or 04-03
Coolant	I					R		03-08 or 04-03
Condition of seals [4]						I	I	03-01, 03-02, 03-03 or 04-02 to 04–07
RAVE valves [4]				C				03-03
LUBRICATION								
Oil and filter replacement (4-TEC)					R			04-04
Injection oil filter			I			R		03-06
Oil injection pump	A			A			A	03-06
FUEL								
Fuel stabilizer						R		01-02
Fuel filter							R	01-03
Fuel lines and connections	I					I	I	03-10, 06-03 or 05-03
Carburetor	A			A			A,C	03-10
Throttle cable	I			I		I	I	03-10
Air filter			C				C	01-03
Fuel injection system (visual inspection)				I				05-03 or 06-03
Throttle body bores and throttle plates [4]							C	05-03 or 06-03
DRIVE								
Drive belt	I	I					I	07-01
Drive and driven pulley	I		I	C		I	C	07-02 and 07-03
Tightening torque of drive pulley screw	I			I			I	07-02
Driven pulley preload	I			I		I		07-03
BRAKE								
Brake fluid	I	I				R	I	07-05
Brake	I	I	A			I,A	I	07-05

A: ADJUST
I: INSPECT (clean, inspect, repair, adjust, lubricate)
L: LUBRICATE
R: REPLACE
C: CLEAN

PART/TASK	10-HOUR OR 500 KM (300 mi) INSPECTION (to be performed by dealer)	WEEKLY OR EVERY 240 KM (150 mi)	MONTHLY OR EVERY 800 KM (500 mi)	ONCE A YEAR OR EVERY 3200 KM (2000 mi)	6000 KM (3700 mi)	STORAGE (to be performed by dealer)	PRESEASON PREPARATION (to be performed by dealer)	REFER TO SECTION(S) AND SUBSECTION(S)
TRANSMISSION								
Drive chain tension	A		A			A		07-06
Chaincase and gearbox oil	R		I	R(3)		R	I	07-06
Drive axle end bearing (2)	L		L			L		09-04
Countershaft	L		L			L		09-04
STEERING/FRONT SUSPENSION								
Steering and front suspension mechanism lubrication (2)	A,I,L		A,I	L		A,I,L		10-01 and 10-02
Wear and condition of skis and runners	I	I				I		10-02
SUSPENSION								
Suspension adjustments	A	AS REQUIRED						09-01, 09-02 or 09-03
Suspension (2)	I		I,L			I,L		
Suspension stopper strap				I		I		09-01, 09-02 or 09-03
Track	I		I			I		09-05
Track tension and alignment	A	AS REQUIRED						09-05
ELECTRICAL								
EMS fault codes (4)	I				I			05-03 or 06-03
Spark plugs (1) (4)	I		I				R	08-02
Battery (if so equipped)	I		I			I	I	08-04
Headlamp beam aiming				A			A	11-01
Wiring harnesses, cables and lines (4)	I		I			I		11-01
Operation of lighting system (HI/LO beam, brake light, etc.) test operation of engine cut-out switch and tether cut-out switch	I	I				I		Operator's Guide
VEHICLE								
Rags in air intake and exhaust system						R	C	01-02 and 01-03
Engine compartment	C		C			C		01-02
Vehicle cleaning and protection	C		C			C		01-02

(1) Before installing new spark plugs at pre-season preparation, it is suggested to burn excess storage oil by starting the engine with the old spark plugs. Only perform this operation in a well-ventilated area.

(2) Lubricate whenever the vehicle is used in wet conditions (wet snow, rain, puddles).

(3) Change oil every 3200 km (2000 mi).

(4) Emission-related

STORAGE

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	5
BOMBARDIER LUBE	293 600 016	3, 5
BOMBARDIER premixed coolant	293 600 038	5
BOMBARDIER Scratch Remover Kit	861 774 800	3
fuel stabilizer (250 mL)	413 408 600	4
Heavy duty cleaner (4 L)	293 110 002	3
Heavy duty cleaner (spray can 400 g)	293 110 001	3
storage oil (Canada)	413 711 600	4
storage oil (United States)	413 711 900	4
Vinyl & Plastic Cleaner (6 x 1 L)	413 711 200	3

GENERAL

Proper snowmobile storage is a necessity during the summer months or when a vehicle is not being used for more than one month.

Refer to storage column from MAINTENANCE CHART jointly with the present storage procedure in order to cover each and every aspect of the snowmobile storage procedure. Any worn, broken or damaged parts should be replaced.

⚠ WARNING

Unless otherwise specified, engine should be turned off for storage procedure.

VEHICLE CLEANING

To facilitate the inspection and ensure adequate lubrication of components, it is recommended to clean the entire vehicle.

Remove any dirt or rust.

To clean the entire vehicle, use only flannel cloths or equivalent.

CAUTION: It is necessary to use flannel cloths or equivalent on windshield and hood to avoid damaging further surfaces to clean.

To clean the entire vehicle, including bottom pan and metallic parts use Heavy duty cleaner (spray can 400 g) (P/N 293 110 001) and Heavy duty cleaner (4 L) (P/N 293 110 002).

CAUTION: Do not use Heavy duty cleaner on decals or vinyl.

For vinyl and plastic parts, use Vinyl & Plastic Cleaner (6 x 1 L) (P/N 413 711 200).

To remove scratches on windshield or hood use BOMBARDIER Scratch Remover Kit (P/N 861 774 800).

CAUTION: Never clean plastic parts or hood with strong detergent, degreasing agent, paint thinner, acetone, products containing chlorine, etc.

Inspect the hood and repair any damage.

Touch up all metal spots with touch-up paint where paint has been scratched off.

Spray all bare metal parts including shock chromed rods with BOMBARDIER LUBE (P/N 293 600 016).

Wax the hood and the painted portion of the frame for better protection.

NOTE: Apply a non-abrasive wax on glossy finish only.

ENGINE COMPARTMENT

Keep clean of grass, twigs, cloth, etc. These are combustible under certain conditions.

BATTERY

Remove battery, clean its tray and its exterior surface. Charge battery as explained in BATTERY section.

FUEL STABILIZER

With the new fuel additives, it is critical to use the fuel stabilizer (250 mL) (P/N 413 408 600) to prevent fuel deterioration, gum formation and fuel system components corrosion. Follow manufacturer's instructions for proper use.

Pour fuel stabilizer in fuel tank prior to starting engine so that stabilizer lubricate all fuel system components. Fill up fuel tank completely. Ensure there is no water inside fuel tank.

CAUTION: Should any water be trapped inside fuel tank, severe internal damage will occur to the fuel injection system (if so equipped).

On so equipped models, after engine starting, use primer several times so that stabilizer flows inside it.

Do not drain fuel system.

CAUTION: Fuel stabilizer should be added prior to engine lubrication to ensure carburetor protection against varnish deposit.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Fuel tank may be pressurized, slowly turn cap when opening. Never use an open flame to check fuel level. When fueling, keep vehicle level. Do not overfill or top off the fuel tank and leave vehicle in the sun. As temperature increases, fuel expands and might overflow. Always wipe off any fuel spillage from the vehicle. Periodically inspect fuel system.

ENGINE LUBRICATION

NOTE: Be sure to add fuel stabilizer before starting the engine.

Engine internal parts must be lubricated to protect them from possible rust formation during the storage period. To protect appropriately the engine use storage oil (Canada) (P/N 413 711 600) or storage oil (United States) (P/N 413 711 900).

Proceed as follows:

Start the engine and allow it to run at idle speed until the engine reaches its operating temperature.

⚠ WARNING

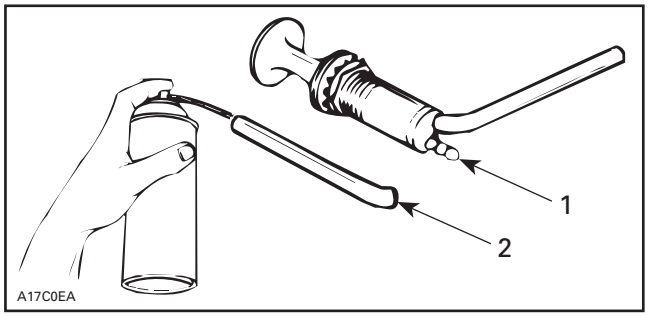
Ensure the track is free of all particles which could be thrown out while it is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the vehicle.

Stop the engine.

Models with a Primer

To prevent fuel from draining, primer button should be pushed all the way in.

Disconnect the outlet primer hose from the primer valve (straight coupling).



1. Straight coupling
2. To intake manifold

Insert storage oil nozzle into primer outlet hose.

Models with a Choke

Remove air silencers to spray storage oil into each carburetor bore.

All Models

Restart engine and run at idle speed.

Inject storage oil until the engine stalls or until a sufficient quantity of oil has entered the engine (approximately half a can).

With the engine stopped, remove the spark plug and spray storage oil into each cylinder.

Crank slowly 2 or 3 revolutions to lubricate cylinders.

Reinstall the spark plugs and the outlet primer hose or air silencers.

⚠ WARNING

This procedure must only be performed in a well-ventilated area. Do not run engine during storage period.

COOLING SYSTEM

4-Stroke Models

Antifreeze should be replaced for the storage period to prevent antifreeze deterioration.

Make sure to perform an antifreeze density test.

Cooling system must be filled with BOMBARDIER premixed coolant (P/N 293 600 038) or with distilled water antifreeze solution (50% distilled water, 50% antifreeze).

CAUTION: Improper antifreeze mixture might allow freezing of the liquid in the cooling system if vehicle is stored in area where freezing point is reached. This would seriously damage the engine. Failure to replace the antifreeze for storage may allow its degradation that could result in poor cooling when engine will be used.

Refer to COOLING SYSTEM section.

ENGINE OIL CHANGE AND FILTER

4-Stroke Models

Change engine oil and filter. Refer to LUBRICATION in ENGINE section.

COUNTERSHAFT LUBRICATION

Driven pulley and brake disc must be floating on the countershaft for efficient operation. Lubricate with anti-seize lubricant (P/N 293 800 070).

CAUTION: Do not lubricate excessively as lubricant could contact and soil brake pads and/or drive belt.

PULLEY PROTECTION

After inspection and interior cleaning of pulleys, spray BOMBARDIER LUBE (P/N 293 600 016) on sheaves. Do not reinstall drive belt.

VEHICLE PROTECTION

Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: The snowmobile has to be stored in a cool and dry place and covered with an opaque but ventilated tarpaulin. This will prevent sun rays and grime from affecting plastic components and vehicle finish.

Lift rear of vehicle until track is clear of the ground. Install on a snowmobile mechanical stand.

NOTE: Do not release track tension.

RAGS IN AIR INTAKE AND EXHAUST SYSTEM

Block air intake hole and exhaust system hole using clean rags.

PRESEASON PREPARATION

Proper vehicle preparation is necessary after the summer months or when a vehicle has not been used for more than one month.

Refer to preseason preparation column from MAINTENANCE CHART jointly with the present preseason preparation procedure in order to cover each and every aspect of the snowmobile preseason preparation procedure.

Any worn, broken or damaged parts found during the storage procedure should have been replaced. If not, proceed with the replacement.

⚠ WARNING

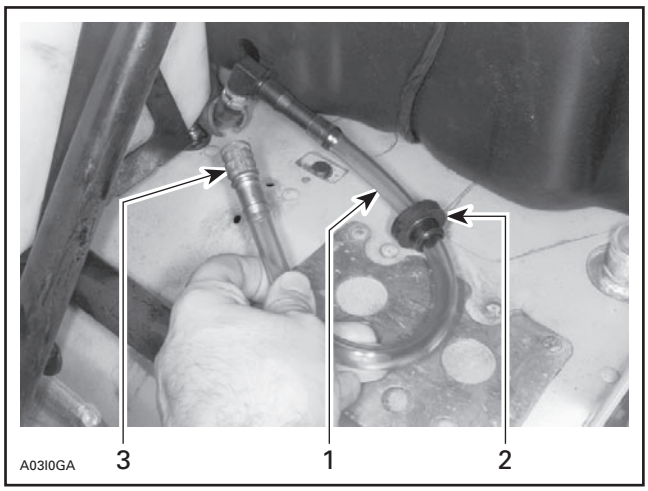
Unless otherwise specified, engine should be turned off for preparation procedure.

FUEL FILTER REPLACEMENT

All Models except V-1000 and 593 SDI Engine Equipped Models

Drain fuel tank.

Remove fuel line grommet from fuel tank and pull out inlet fuel line from tank.



TYPICAL
1. *Inlet fuel line*
2. *Position of grommet when installing*
3. *Fuel filter*

Replace fuel filter. To facilitate the fuel line installation, slide grommet on fuel line about 50 mm (2 in) away from elbow then install grommet on fuel tank and push elbow through grommet.

V-1000 and 593 SDI Engine Equipped Models Only

Fuel filter, inlet and outlet hoses come as an assembly.

The fuel filter is located beside the steering column, next to coolant tank.

Using B.U.D.S. release the fuel pressure. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

Remove console to gain access to top of fuel pump module.

Disconnect both ends of fuel filter line.

Unfasten clip retaining fuel filter line to fuse box support.

Unscrew the fuel filter support nut then remove the filter.

Reverse removal procedure for installation.

THROTTLE BODY CLEANING (ON SO EQUIPPED MODELS)

Remove the throttle body from vehicle.

Using the pulley flange cleaner (P/N 413 711 809), remove the dirt ejected by the drive belt from the throttle plate and from both throttle body bores. After throttle body installation, adjust throttle and injection oil cables.

CARBURETOR CLEANING (ON SO EQUIPPED MODELS)

Disassemble carburetor(s) in order to clean all internal parts. Do not hesitate to replace any jets having gum or varnish on their surfaces.

AIR FILTER CLEANING

Check that inside of air silencer is clean and dry then properly reinstall the filter.

CAUTION: These snowmobiles have been calibrated with the filter installed. Operating the snowmobile without it may cause engine damage.

RAGS IN AIR INTAKE AND EXHAUST SYSTEM

Remove rags that were installed during STORAGE preparation.

ENGINE LUBRICATION

All Models except 4-TEC

Add 500 mL (17 U.S. oz) of recommended injection oil to the first full filled fuel tank.

CLEANING OF DRIVE AND DRIVEN PULLEYS

Clean drive and driven pulleys sheaves with pulley flange cleaner (P/N 413 711 809).

CLEANING OF BRAKE DISK

Remove any rust built-up on braking surfaces. Clean brake disk braking surfaces with pulley flange cleaner (P/N 413 711 809).

DRIVE BELT CONDITION

Inspect belt for cracks, fraying or abnormal wear. Replace if necessary. Make sure to install the proper belt with arrow printed on belt pointing front of vehicle.

SPARK PLUGS

Once preseason preparation is done, start engine with the old spark plug(s) to burn excess storage oil. Then, install new properly gapped spark plug(s).

ENGINE (2-STROKE)

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

Symptom: **ENGINE BACKFIRES.**

1. **Check spark plugs.**
   - *Carbon accumulation caused by defective spark plug(s). Clean carbon accumulation from piston and cylinder head and install dry properly gapped spark plug(s).*
2. **Check ignition timing.**
   - *Timing is too advanced. Set timing according to specifications (refer to TECHNICAL DATA).*
3. **Check for erratic sparks.**
   - *Poor electrical connections. Repair.*
   - *Faulty stator. Replace defective parts.*
4. **Check carburetor.**
   - *Fuel passages obstructed. Clean carburetor and install new filter(s).*
   - *Fuel level too low. Adjust float level according to specifications.*
5. **Check cooling system.**

   Fan-Cooled Engines
   - *Loose fan belt. Adjust or replace fan belt (refer to AXIAL FAN COOLING SYSTEM).*
   - *Dirty cooling fins or blocked air ducts. Clean.*

   Liquid-Cooled Engines
   - *Low antifreeze level. Adjust antifreeze level. Proceed with a leakage test (refer to LIQUID COOLING SYSTEM) and repair as required.*
   - *Defective tank cap. Replace cap.*
   - *Defective thermostat. Replace thermostat.*
   - *Air in system. Bleed system.*

Symptom: **ENGINE SUDDENLY TURNS OFF AT HIGH RPM AND/OR WITH LIGHT LOAD.**

1. **Check that all ground wires are well connected.**

Symptom: **ENGINE SUDDENLY TURNS OFF.**

1. **Perform engine leak test. Check possible piston seizure.**
   - *Damaged gasket and/or seal. Replace defective parts.*
2. **"Four-corner" seizure of piston(s).**
   - *High acceleration when engine is cold. Piston expands faster than cylinder. Replace piston(s). Ask driver to refer to the warm-up procedure in the Operator's Guide.*

Symptom: **ENGINE SUDDENLY TURNS OFF.** (cont'd)

3. Piston(s) seizure on exhaust side (color on piston dome is correct).

- *Kinked fuel tank vent tube. Relocate fuel tank vent tube.*
- *Leaks at fuel line connections or damaged fuel lines. Replace defective lines.*
- *Fuel does not flow through carburetor(s) (foreign particles in needle area and/or varnish formation in carburetor(s)). Clean carburetor(s) and install new filter(s).*
- *Spark plug heat range is too warm. Install spark plugs with appropriate heat range (refer to TECHNICAL DATA).*
- *Improper ignition timing. Adjust according to specifications (refer to TECHNICAL DATA).*
- *Restriction in exhaust system. Replace.*
- *Compression ratio is too high. Install genuine parts.*
- *Too low fuel octane number. Use proper fuel octane number.*
- *Carburetor calibration is too lean. Adjust according to specifications (refer to TECHNICAL DATA).*
- *Improper reed valve adjustment or damage. Adjust according to specifications (refer to appropriate ENGINES TYPES) and/or install BRP's recommended reed valve.*
- *Poor quality oil. Use XP-S injection oil.*
- *Leaks at air intake silencer. Replace air intake silencer grommets.*

4. Melted and/or perforated piston dome; melted section at ring end gap.

- *When piston reaches TDC, mixture is ignited by heated areas in combustion chamber. This is due to an incomplete combustion of a poor quality oil. Clean residue accumulation in combustion chamber and replace piston(s). Use XP-S injection oil.*
- *Spark plug heat range is too high. Install recommended dry properly gapped spark plugs (refer to TECHNICAL DATA).*
- *Ignition timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).*
- *Inadequate fuel quality. Use appropriate fuel.*
- *Carburetion is too lean. Adjust according to specifications (refer to TECHNICAL DATA).*

5. Seized piston all around the circumference (dry surface).

- *Lack of oil, damaged oil line or defective injection pump. Replace defective part(s).*

6. Grooves on intake side of piston only.

- *Oil film eliminated by water (snow infiltration in engine). This can also be caused by running engine on choke for too long. Excessive fuel will remove the oil film on the piston and make marks. Replace piston(s) and check if intake system leaks.*

7. Piston color is dark due to seizure on intake and exhaust sides.

- *Broken or loose fan belt. Replace fan belt and/or adjust its tension (refer to TECHNICAL DATA).*
- *Cooling system leaks and lowers coolant level. Proceed with a leakage test (refer to LIQUID COOLING SYSTEM) and repair as required. Add coolant in cooling system until appropriate level is reached.*
- *Accumulation of foreign particles in needle valve and/or main jet area. Clean carburetor(s).*

8. Cracked or broken piston(s).

- *Cracked or broken piston(s) due to excessive piston/cylinder clearance or engine overreving. Replace piston(s). Check piston/cylinder clearance (refer to TECHNICAL DATA). Adjust drive pulley according to specifications (refer to TECHNICAL DATA) and/or clean pulley sheaves if they are contaminated with greasy particles.*

9. DPM manifold air vent is obstructed.

- *Carburetion is too lean. Ensure proper air vent.*

Symptom: **PISTON RING AND CYLINDER SURFACES ARE SCRATCHED.**

1. **Check oil quality.**
   - *Poor quality oil. Use XP-S injection oil.*
2. **Check injection pump and its hoses.**
   - *Inadequate injection pump adjustment and/or defective hoses. Adjust pump according to specifications (refer to ENGINE) and/or replace hoses.*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.**

1. **Check spark plug condition and gap.**
   - *fouled spark plugs or wrong spark plug gap. Replace or readjust gap.*
2. **Check if there is water in fuel.**
   - *There is water in fuel. Drain fuel system, then fill with appropriate fuel.*
3. **Check proper operation of RAVE valves. (Refer to ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM LOWER).)**
   - *Repair.*
4. **Check items listed in ENGINE RUNS OUT OF FUEL (refer to FUEL AND OIL SYSTEMS subsection).**
5. **Check carburetor adjustments and cleanliness.**
   - *Inadequate carburetor adjustments or dirt accumulation. Adjust according to specifications (refer to TECHNICAL DATA) or clean.*
6. **Check drive belt.**
   - *Worn belt. Replace belt if width is 3 mm (1/8 in) less than nominal dimension (refer to TECHNICAL DATA).*
7. **Check track adjustment.**
   - *Too much tension and/or improper alignment. Align track and adjust its tension to specifications (refer to TECHNICAL DATA).*
8. **Check drive pulley.**
   - *Improper calibration screw adjustments (TRA pulley) and/or worn bushing(s). Adjust according to specifications (refer to TECHNICAL DATA) and/or replace bushing(s).*
9. **Check driven pulley.**
   - *Worn bushing and/or spring tension. Replace spring and/or adjust its tension according to specifications (refer to TECHNICAL DATA).*
10. **Check exhaust system.**
    - *Restriction or exhaust system leakage. Replace or reseal with Ultra Copper.*
11. **Check ignition timing.**
    - *Decrease in power due to delayed ignition. Adjust according to specifications (refer to TECHNICAL DATA).*
12. **Check engine compression.**
    - *Worn piston(s) and ring(s). Replace (refer to TECHNICAL DATA for specifications).*
13. **Check engine cooling system.**
    - *Improper fan belt tension. Adjust fan belt (refer to TECHNICAL DATA).*
    - *Coolant level is low, cap fails to pressurize system or air circulates through lines. Adjust level, replace cap or bleed cooling system.*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.** (cont'd)

14. Check reed valve.

- Improper tightness and/or opening. Replace or adjust. Refer to proper engine subsection.

Symptom: **ENGINE DETONATION AT MAXIMUM RPM.**

1. Check which type of fuel is used.

- Octane number is too low and/or alcohol level is too high. Use recommended fuel type.

2. Check spark plug type.

- Improper spark plug heat range. Install recommended spark plugs (refer to TECHNICAL DATA).

3. Check exhaust system.

- Too much restriction. Replace.

4. Check ignition timing.

- Timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).

5. Check proper operation of RAVE valves. (Refer to ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM LOWER).)

- Repair.

6. Check if engine is overheating. (Refer to HIGH ENGINE OPERATING TEMPERATURE).

7. Check carburetion.

- Fouled and/or improper carburetor components. Clean or replace according to specifications (refer to TECHNICAL DATA).

8. Check compression ratio and combustion chamber volume.

- Compression ratio is too high. Install genuine parts.

Symptom: **ENGINE TURNS OVER BUT FAILS TO START (MANUAL START).**

1. Check switches.

- Ignition switch, emergency cut-out switch or tether switch is OFF. Place all switches in the RUN or ON position. If it still does not work, connect DESS switch BK/GN and BK/WH wires together (harness side).

2. Check fuel valve.

- Fuel valve is OFF or not fully open. Fully open fuel valve.

3. Check fuel level.

- Mixture too lean to start cold engine. Check fuel tank level and use choke or primer.

4. Check spark plug.

- Defective spark plug (no spark) or wrong spark plug gap. Replace spark plugs or readjust gap.

5. Check amount of fuel on spark plug.

- Flooded engine (spark plug wet when removed). Do not overprime or overchoke. Remove wet spark plugs, turn ignition switch to OFF and crank engine several times. Install clean dry properly gapped spark plugs. Start engine following usual starting procedure.

6. Check fuel lines.

- No fuel to the engine (spark plugs dry when removed). Check fuel tank level; turn fuel valve on if applicable; check fuel filter, replace if clogged ; check condition of fuel and impulse lines and their connections.

Symptom: **ENGINE TURNS OVER BUT FAILS TO START (MANUAL START).** (cont'd)

7. **Check engine compression.**
   - *Insufficient engine compression. Replace defective part(s) (ex.: piston(s), ring(s), etc.).*

Symptom: **IRREGULAR ENGINE IDLE (NORMAL USE AFTER ENGINE WARM UP).**

1. **Check choke.**
   - *Choke plunger may be partially opened. Readjust.*
2. **Check carburetor adapter.**
   - *Air enters through a crack. Replace.*
3. **Check air screw position.**
   - *Inadequate fuel/air mixture. Adjust according to specifications (refer to TECHNICAL DATA).*
4. **Check dimension of pilot jet.**
   - *Inadequate fuel/air mixture. Adjust according to specifications (refer to TECHNICAL DATA).*
5. **Check reed valve.**
   - *Improper tightness and/or opening. Replace or adjust. Refer to proper engine subsection.*
6. **Perform engine leak test.**
   - *Leaking gaskets allow air to enter in engine. Replace defective parts.*
7. **DPM manifold air vent is obstructed.**
   - *Carburetion is too lean. Ensure proper air vent.*
8. **Check ignition system trigger coil air gap.**
   - *Air gap is too large. Adjust according to specifications (refer to TECHNNICAL DATA).*

Symptom: **HIGH ENGINE OPERATING TEMPERATURE (FAN COOLED ENGINES).**

1. **Check cooling system.**
   - *Loose fan belt. Adjust or replace fan belt (refer to AXIAL FAN COOLING SYSTEM).*
   - *Dirty cooling fins or blocked air ducts. Clean.*
2. **Check carburetion.**
   - *Improperly adjusted or inadequate carburetor components. Adjust according to specifications (refer to TECHNICAL DATA) or replace inadequate component(s).*
3. **Check cylinder O-rings.**
   - *Worn O-rings. Replace.*
4. **Check ignition timing.**
   - *Ignition timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).*
5. **Check if there are leaks at air intake silencer and/or engine crankcase.**
   - *Leak(s). Repair or replace.*
6. **Check condition and heat range of spark plugs.**
   - *Melted spark plug tip or inadequate heat range. Replace.*

Symptom: **HIGH ENGINE OPERATING TEMPERATURE (LIQUID COOLED ENGINES).**

1. **Check temperature gauge sensor.**
   - *False reading. Check terminal connections. If problem persists, replace sensor.*
2. **Check if heat exchangers are clean.**
   - *Dirty heat exchangers. Clean heat exchangers.*
3. **Check coolant level and check if there is air infiltration in the system or if there are leaks in gasket areas.**
   - *Low coolant level or air in system. Add coolant until recommended level is reached, bleed system and/or tighten clamps.*
4. **Check if coolant flows through system properly.**
   - *Foreign particles and/or broken coolant pump impeller. Clean cooling system and/or replace coolant pump impeller.*
5. **Check thermostat.**
   - *Thermostat reacts slowly or not at all. Replace.*
6. **Check antifreeze concentration.**
   - *Antifreeze concentration is too high. Adjust concentration according to BRP recommendations.*
7. **Check tank cap.**
   - *Cap does not hold pressure. Replace.*
8. **Check carburetion.**
   - *Improperly adjusted or inadequate carburetor components. Adjust according to specifications (refer to TECHNICAL DATA) or replace inadequate component(s).*
9. **Check cylinder head gaskets.**
   - *Worn gaskets. Replace.*
10. **Check ignition timing.**
    - *Ignition timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).*
11. **Check if there are leaks at air intake silencer and/or engine crankcase.**
    - *Leak(s). Repair or replace.*
12. **Check condition and heat range of spark plugs.**
    - *Melted spark plug tip or inadequate heat range. Replace.*

Symptom: **ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM SLOWER).**

1. **Check RAVE valve pistons.**
   - *Valve piston(s) is (are) not screwed to the bottom. Screw valve piston(s) to bottom.*
2. **Check that valve moves freely.**
   - *Valve stuck in closed position. Clean.*
3. **Check RAVE valve stems.**
   - *Bent RAVE valve stem(s). Replace.*
4. **Check RAVE valves.**
   - *Jammed valve(s). Clean.*

Symptom: **ENGINE EQUIPPED WITH RAVE VALVE DOES NOT REACH ITS FULL OPERATING RPM (500 TO 1000 RPM SLOWER).** (cont'd)

5. **Check tension of RAVE springs.**
   - *Inadequate spring tension. Replace.*
6. **Check RAVE pressure holes.**
   - *Clogged holes. Clean.*
7. **Check clamps or sleeves.**
   - *Damaged clamp(s) or sleeve(s). Replace.*
8. **Check exhaust tightness.**
   - *Exhaust system is leaking leading to a too low back pressure. Replaces parts and reseal.*

Symptom: **ENGINE EQUIPPED WITH RAVE. ENGINE HESITATES AT LOW OR MID-SPEED AND REACHES MAXIMUM PERFORMANCE ONLY AFTER A WHILE.**

1. **Check RAVE valve spring(s).**
   - *Spring tension is too low or spring(s) is (are) broken. Replace.*
2. **Check RAVE valve cover red adjustment screws.**
   - *Adjustment screw(s) is (are) too loose. Adjust according to ASSEMBLY PROCEDURE in appropriate engine subsections.*
3. **Check RAVE valve movement (RAVE movement indicator (P/N 861 725 800).**
   - *Valve(s) is (are) stuck in open position. Clean.*

Symptom: **REWIND STARTER ROPE DOES NOT REWIND.**

1. **Check rewind spring.**
   - *Broken spring. Replace spring.*

Symptom: **REWIND STARTER PAWL DOES NOT ENGAGE.**

1. **Check stopper spring.**
   - *Broken stopper spring. Replace.*
2. **Check pawl and pawl lock.**
   - *Pawl and pawl lock have stuck together because of heat. Replace.*
3. **Check pawl and rope sheave.**
   - *Pawl and rope sheave have stuck together because of heat. Replace.*

Symptom: **ENGINE PINGING.**

1. **Check for proper fuel octane number according to engine type.**
   - *Too low fuel octane number. Use appropriate fuel octane number (refer to Operator's Guide).*
2. **Check fuel lines.**
   - *Bent fuel lines (preventing fuel from flowing through). Relocate or replace fuel lines.*
3. **Check if carburetor(s) is (are) clean.**
   - *Dirt prevents fuel from flowing through. Clean.*
4. **Check ignition timing.**
   - *Timing is too advanced. Adjust according to specifications (refer to TECHNICAL DATA).*

Symptom: **ENGINE PINGING.** (cont'd)

5. Check compression ratio.

- *Compression ratio is too high. Replace inadequate part(s) to obtain manufacturer's recommended compression ratio or use a higher grade fuel.*

Symptom: **ENGINE GENERATES A LOT OF VIBRATIONS.**

1. Check engine supports and stopper.

- *Loose and/or broken supports or interference between support(s) and chassis. Retighten to specification (refer to TECHNICAL DATA) or replace.*

2. Check drive pulley (refer to VIBRATIONS ORIGINATING FROM DRIVE PULLEY).

3. Check carburetors synchronization.

- *Throttle slide height is not the same on each carburetor and/or throttle slides opening is unsynchronized. Adjust throttle slide heights and throttle cable.*

4. Check crankshaft and bearings.

- *Loose crankshaft bearings or uneven crankshaft. Replace parts.*

ENGINE (4-TEC)

COOLING SYSTEM

Symptom: **HIGH ENGINE OPERATING TEMPERATURE.**

1. **Check coolant level.**
   - *Coolant level lower than recommended. Check for leakage.*
   - *Coolant leaking from control bore means a damaged water pump rotary seal. Replace rotary seal (refer to COOLING SYSTEM and CRANKCASE).*
   - *Cylinder head and/or cylinder base. Gasket(s) is(are) causing coolant leakage. Replace.*
   - *Gasket on water pump housing leaks. Retighten screws and/or replace gasket.*
   - *Hoses are brittle and/or hard. Replace.*
   - *Hose clamps are loose. Retighten clamps.*
2. **Check temperature sensor for electrical/mechanical failure.**
   - *Temperature sensor defective. Replace.*
3. **Check thermostat (located in the thermostat housing on the alternator side cover).**
   - *Thermostat defective (does not open when engine gets hot). Replace water pump housing (refer to COOLING SYSTEM).*
4. **Check condition of impeller located on the water pump shaft.**
   - *Impeller fins broken and/or impeller threads are damaged. Replace.*

ALTERNATOR

Symptom: **NOT CHARGING AT ALL OR CHARGING VOLTAGE INADEQUATE.**

1. **Check the alternator and measure the charging voltage.**
   - *Defective alternator. Replace the alternator (refer to alternator).*
2. **Inspect the alternator; check if it is turning along during starting.**
   - *Generator gear damaged. Replace the generator gear (refer to CRANKSHAFT/DRIVE GEARS).*
3. **Check wiring harness for cracks or other damages.**
   - *Harness shows electrical failure and/or other damages. Replace wire harness.*
4. **Check the alternator charging light on the dashboard for proper functioning.**
   - *Alternator charging light defective. Replace the alternator charging light.*

LUBRICATION

Symptom: LOW OR NO OIL PRESSURE.

1. **Check oil level and search for leakage on crankcase and/or sealing parts.**
   - *Oil drain plug on engine bottom is loosed and/or gasket ring is missing. Retighten the plug and/or place gasket ring.*
   - *Control bore if oil leaks (beside thermostat housing). Oil leaking from control bore means a damaged oil seal on water pump shaft. Replace oil seal (refer to COOLING SYSTEM).*
   - *Crankcase is leaking due to damage. Rebuild engine with new crankcase and gasket parts. Use recommended oil (refer to TECHNICAL DATA).*
   - *Crankcase is leaking due to loose screws. Retighten screws with recommended torque.*
   - *Sealing rings, O-rings and/or gaskets are brittle and/or hard or damaged. Replace damaged parts.*
   - *Piston rings worn out (blue coloured engine exhaust emission). Replace piston rings (refer to CRANKSHAFT/DRIVE GEARS).*
   - *Piston rings are broken (low compression). Replace piston rings (refer to CRANKSHAFT/DRIVE GEARS).*
   - *Valve stem seal damaged and/or sealing lip is hard and/or brittle. Replace all valve stem seals.*
2. **Check oil pressure switch function.**
   - *Oil pressure switch damaged. Replace oil pressure switch.*
3. **Check oil orifice(s) on the oil pump suction side.**
   - *Oil orifice(s) is(are) clogged. Clean from contamination. Replace oil and oil filter if necessary (refer to MAINTENANCE or LUBRICATION SYSTEM).*
4. **Check oil pump function.**
   - *Oil pump rotor is out of wear limit. Replace oil pump shaft (refer to LUBRICATION SYSTEM).*
   - *Oil pump seized due to oil leakage and/or air inclusion. Replace oil pump (refer to LUBRICATION SYSTEM).*
   - *Gears driving oil pump are broken or otherwise damaged. Replace gears.*
   - *Incorrect oil being used. Use recommend oil (refer to TECHNICAL DATA).*
5. **Check oil pressure regulator valve (spring) function.**
   - *Valve spring damaged (valve always open). Replace spring.*
   - *Valve piston is stuck in oil pump housing. Repair valve piston.*
6. **Check plain bearings in crankcase for heavy wear.**
   - *Plain bearings out of specification (increased clearance). Replace plain bearings.*

Symptom: OIL CONTAMINATION (WHITE APPEARANCE).

1. **Check control bore (beside thermostat housing) if water and oil leaks.**
   - *Leakage of oil/water mixture from bore means damaged water pump seal ring and rotary seal. Replace sealing ring, rotary seal and change oil, oil filter and/or coolant (refer to LUBRICATION SYSTEM, COOLING SYSTEM and CRANKCASE).*
2. **Check cylinder head and/or cylinder base gasket.**
   - *Gasket damaged or leaking. Retighten cylinder head with recommended torque and/or replace gasket.*
3. **Check tightening torque of cylinder head screws.**
   - *Screws not properly tightened. Retighten screws to recommended torque and replace oil.*

Symptom: **OIL CONTAMINATION (WHITE APPEARANCE).** (cont'd)

4. **Check oil for particles (may indicate possible engine internal damages).**
   - *Oil contamination due to metal or plastic particles. Replace possibly damaged part(s) including oil and oil filter. Use recommended oil (refer to TECHNICAL DATA).*

CYLINDER AND CYLINDER HEAD

Symptom: **UNUSUAL ENGINE NOISE AND/OR VIBRATIONS.**

1. **Check noise coming from cylinder head area.**
   - *Faulty chain tensioner. Replace spring and/or mechanism.*
   - *Chain guide worn out. Replace chain guide.*
   - *Stretched chain and/or worn out sprockets. Replace chain and sprockets.*
   - *Sprocket screws got loose. Retighten screws with recommended torque.*
   - *Hydraulic element inside rocker arm(s) is(are) worn out (valve adjustment). Replace rocker arm(s).*
   - *Rocker arm screws not tightened. Replace screws and perform the torque procedure (refer to CYLINDER AND CYLINDER HEAD).*

Symptom: **OIL CONTAMINATION ON CYLINDER AND/OR CYLINDER HEAD.**

1. **Check screws for torque.**
   - *Loose screws. Retighten screws with recommended torque.*
   - *Gaskets are brittle, hard, worn out or otherwise damaged. Replace damaged gaskets, O-rings or the V-ring on breather.*
   - *Contact area between spark plug and stick coils fouled by oil. Clean spark plug area and replace spark plug tube.*

CRANKSHAFT

Symptom: **UNUSUAL ENGINE NOISE AND/OR VIBRATIONS.**

1. **Check noise coming from crankshaft area.**
   - *Crankshaft bushings are damaged. Replace the crankshaft bushings. (refer to CRANKSHAFT/DRIVE GEARS).*
   - *Connecting rod bushings are damaged. Replace the connecting rod bushings. (refer to CRANKSHAFT/DRIVE GEARS).*
2. **Check if drive gears are loosen.**
   - *Crankshaft nut retaining drive gear is loose. Retighten retaining nut with recommended torque.*

ELECTRIC STARTER

Symptom: **STARTER DOES NOT TURN.**

1. **Check the battery voltage.**
   - *Battery discharged. Charge the battery.*
2. **Check wiring harness for cracks or other damages.**
   - *Harness shows electrical failure and/or other damages. Replace wire harness.*

Symptom: **STARTER DOES NOT TURN.** (cont'd)

3. **Check 30 A and 5 A fuses.**
   - *Burnt fuse. Check wiring condition and replace fuse.*
4. **Check continuity of starter switch contact points.**
   - *Poor contact of starter switch contact points. Repair or replace switch.*
5. **Check continuity between starter switch and ECM.**
   - *Open circuit. Repair.*
6. **Check continuity between ECM and solenoid switch.**
   - *Open circuit. Repair.*

Symptom: **STARTER TURNS, BUT ENGINE DOES NOT CRANK.**

1. **Check the starter gear.**
   - *Starter gear and/or intermediate gear is worn or damaged. Replace starter gear and/or intermediate gear (refer to CRANKSHAFT/DRIVE GEARS).*
2. **Check the sprag clutch.**
   - *Sprag clutch is worn or otherwise damaged. Replace sprag clutch (refer to CRANKSHAFT/DRIVE GEARS).*

Symptom: **STARTER TURNS SLOWLY**

1. **Check battery capacity.**
   - *Shorted battery cell(s). Replace.*
2. **Check battery charge.**
   - *Low battery. Recharge battery and check recharge system and wires.*
3. **Check wire connection.**
   - *Inadequate connection (too much resistance). Clean and reconnect.*
4. **Check brushes.**
   - *Poor contact of brushes. Replace starter.*
5. **Check commutator.**
   - *Burnt commutator. Replace starter.*
6. **Check engine.**
   - *Engine seized. Overhaul the engine.*
7. **Check field coil resistance.**
   - *Shorted field coil. Replace starter.*
8. **Check armature resistance.**
   - *Shorted armature. Replace starter.*
9. **Check tension of brush springs.**
   - *Weak brush spring tension. Replace starter.*
10. **Check if bushings are worn.**
    - *Worn bushings. Replace starter.*

ENGINE GENERAL

Symptom: ENGINE BACKFIRES.

1. **Check spark plug.**
   - *Carbon accumulation caused by defective spark plug. Clean carbon accumulation and replace spark plug.*
2. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*
3. **Check leakage on intake manifold.**
   - *Air leak on intake system. Retighten screws and/or replace intake manifold gasket.*
4. **Check exhaust air leaking.**
   - *Exhaust gasket is leaking. Retighten screws and/or replace exhaust gasket.*
5. **Check intake valve(s) for leaking.**
   - *Intake valve(s) is(are) leaking. Repair or replace valve(s).*
6. **Check if fuel supply is sufficient at high RPM.**
   - *Fuel line is contaminated and/or bent (engine gets lean). Clean and/or replace defective part(s).*

Symptom: ENGINE SUDDENLY TURNS OFF.

1. **Check spark plug condition and/or gap.**
   - *Fouled spark plug or wrong spark plug gap. Readjust gap and clean spark plug or replaceplace pistons. Ask driver to refer to warm-up procedure in Operator's Guide.*
2. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*
3. **Check if fuel supply is sufficient at high RPM.**
   - *Fuel line is contaminated and/or bent. Clean and/or replace defective part(s).*
4. **Perform engine leak test. Refer to ENGINE LEAK TEST procedure. Check for possible piston seizure.**
   - *Damaged head gasket and/or seal and/or leaking inlet/exhaust valve(s). Replace and/or repair defective parts.*
5. **Piston seizure.**
   - *Spark plug heat range is too hot. Install spark plug with appropriate heat range (refer to TECHNICAL DATA).*
   - *Compression ratio is too high. Install genuine parts.*
   - *Poor oil quality. Use BRP's XP-S recommended oil.*
   - *Leaks at air intake manifold (engine gets too lean). Retighten screws or replace air intake manifold gasket.*
   - *Snow/water intrusion through intake system into combustion chamber. Clean intake system and replace defective part(s).*

Symptom: **ENGINE SUDDENLY TURNS OFF.** (cont'd)

6. Melted and/or perforated piston dome; melted section at ring end gap.

- *Spark plug heat range is too hot. Install recommended spark plug (refer to TECHNICAL DATA).*
- *Coolant less than recommended level (engine gets too hot). Repair cooling circuit and/or refill with recommended liquid.*
- *Poor quality and/or wrong fuel. Clean from contamination and use appropriate fuel (refer to TECHNICAL DATA).*

7. Piston color is dark due to seizure on intake and exhaust sides.

- *Cooling system leaks and lowers coolant level. Tighten clamps or replace defective parts. Add antifreeze in cooling system until appropriate level is reached. Replace damaged parts.*
- *Oil nozzle is clogged or bent. Clean or replace oil nozzle (refer to LUBRICATION SYSTEM).*

8. Cracked or broken piston.

- *Cracked or broken piston due to excessive piston/cylinder clearance or engine overreving. Replace piston. Check piston/cylinder clearance (refer to CRANKSHAFT/DRIVE GEARS).*

9. Check piston rings and cylinder surface for grooves.

- *Poor oil quality. Use recommended oil.*
- *Contamination through engine intake. Replace defective part(s) and use new air filter.*

10. Check valve springs exhaust/intake.

- *Broken valve spring damages the cylinder head, valve(s), rocker arm(s)/piston/ piston rings and connecting rod. Replace defective part(s).*

11. Check crankshaft, rocker arms movement.

- *Oil pump failure due to leack of oil. Repair and replace defective parts and use recommended oil.*
- *Oil contamination due to clogged oil filter/oil sieve. Replace oil and oil filter at the same time,replace defective part(s) (refer to MAINTENANCE CHART and LUBRICATION SYSTEM).*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.**

1. Check spark plug condition and/or gap.

- *Fouled spark plug or wrong spark plug gap. Readjust gap or replace.*

2. Check spark plug type.

- *Improper spark plug heat range. Install recommended spark plug (refer to TECHNICAL DATA).*

3. Check fault codes in B.U.D.S system.

- *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*

4. Check for water in fuel (wrong fuel).

- *There is water in fuel or wrong fuel. Drain fuel system, search for leakage and refill it with appropriate fuel.*

5. Check engine compression.

- *Worn piston(s) and/or piston ring(s). Replace (refer to CYLINDER AND HEAD).*

6. Check fuel pressure.

- *Low fuel pressure. Perform fuel pressure test (refer to COMPONENT INSPECTION AND ADJUSTMENT).*

Symptom: **ENGINE DOES NOT OFFER MAXIMUM POWER AND/OR DOES NOT REACH MAXIMUM OPERATING RPM.** (cont'd)

7. **Perform engine leak test. Refer to ENGINE LEAK TEST procedure. Check for possible piston seizure.**
   - *Damaged head gasket and/or seal and/or leaking intake/exhaust valve(s). Replace and/or repair defective parts.*

Symptom: **ENGINE CRANKS BUT FAILS TO START.**

1. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*
2. **Check if stick coil fits on spark plug (refer to spark plug).**
3. **Check spark plug.**
   - *Define spark plug (no spark) or wrong spark plug gap. Readjust gap and clean spark plug or replace.*
4. **Check for fuel on spark plug.**
   - *Flooded engine (spark plug wet when removed). Activate engine drowned mode and crank engine with rags over the spark plug holes (refer to OVERVIEW in EMS system).*
5. **Check battery voltage.**
   - *Battery is discharged and starter works not properly. Charge battery.*
6. **Check engine compression.**
   - *Insufficient engine compression. Replace defective part(s) (ex.: piston, ring(s), etc.).*
7. **In cold weathers, check engine decompressor (located on camshaft sprocket/timing gear).**
   - *Centrifugal weight spring is not engaged and/or damaged. Readjust spring or replace centrifugal weight if damaged.*

Symptom: **ENGINE DOES NOT START — NO SPARK AT SPARK PLUG (REFER TO ENGINE MANAGEMENT SYSTEM).**

1. **Check fault codes in B.U.D.S. system.**
   - *Check if electrical actuator(s) is/are defective. Replace defective part(s) (refer to COMPONENT INSPECTION AND ADJUSTMENT).*
2. **Verify spark plug condition.**
   - *Defective, improperly set, worn out, fouled. Identify source of problem and correct. Replace spark plug.*
3. **Check stick coil (refer to COMPONENT INSPECTION AND ADJUSTMENT).**
   - *Defective part. Replace stick coil.*
4. **Check crankshaft position sensor (refer to COMPONENT INSPECTION AND ADJUSTMENT).**
   - *Defective crankshaft position sensor. Corroded connector terminals. Replace crankshaft position sensor. Clean terminals and apply silicone dielectric grease.*
5. **Check condition of wiring harness and connectors.**
   - *Cables and/or connectors are damaged and/or corroded. Replace connectors or complete wiring harness (refer to COMPONENT INSPECTION AND ADJUSTMENT). Clean terminals and apply silicone dielectric grease.*

FUEL AND OIL SYSTEMS (2-STROKE ENGINES)

The following chart is provided to help in diagnosing the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

NOTE: For the SDI fuel and oil systems troubleshooting, also refer to appropriate ENGINE subsection.

Symptom: **HIGH FUEL CONSUMPTION OR RICH MIXTURE.**

1. **Check fuel tank.**
   - *Perforated fuel tank. Replace fuel tank.*
2. **Check fittings on fuel pump, fuel tank and carburetor(s).**
   - *Leaking fittings. Replace defective part.*
3. **Check choke adjustment.**
   - *Fuel flows through choke circuit while engine runs. Readjust choke.*
4. **Check float height in carburetor(s).**
   - *Fuel level is too high in float bowl(s). Adjust according to specifications (refer to TECHNICAL DATA).*
5. **Check needle valve of carburetor(s).**
   - *Foreign particles prevent needle valve(s) from closing and/or worn seating area. Clean or replace needle valve(s), then clean seating area.*

Symptom: **FUEL LEAKS IN ENGINE BASE WHEN ENGINE IS STOPPED.**

1. **Check items 3, 4 and 5 of HIGH FUEL CONSUMPTION.**
2. **Check fuel pump diaphragm.**
   - *Cracked diaphragm. Replace.*

Symptom: **ENGINE LACKS POWER OR STALLS AT HIGH RPM.**

1. **Check fuel tank vent hose.**
   - *Kinked or clogged vent hose. Relocate or replace.*
2. **Check fuel filter.**
   - *Clogged filter. Replace.*
3. **Check fuel lines.**
   - *Kinked or clogged lines. Relocate or replace.*
4. **Check fuel pump flow.**
   - *Leaking impulse hose. Replace.*
   - *Dried diaphragm. Replace.*
5. **Check if carburetor(s) is (are) clean.**
   - *Varnish. Clean.*

Symptom: **HIGH INJECTION OIL CONSUMPTION.**

1. **Check oil injection pump adjustment.**
   - *Oil injection pump adjusted too rich. Adjust.*
2. **Check injection pump identification.**
   - *Wrong pump installed. Replace with the appropriate pump. Refer to OIL INJECTION SYSTEM.*
3. **Check injection oil lines and their fitting.**
   - *Leaking lines. Replace defective part(s).*
4. **Check injection pump cover gasket.**
   - *Worn gasket. Replace.*
5. **Check pump check valve(s).**
   - *Check valve(s) stuck open. Replace.*
6. **Check pump.**
   - *Leaking pump. Replace.*
7. **Check oil pump cable.**
   - *Cable stuck in open position. Replace cable.*
8. **On liquid-cooled models, test pump shaft gear reservoir for leaks.**
   - *Leaking seals. Replace seals.*

Symptom: **ENGINE LACKS FUEL (OR LEAN MIXTURE).**

1. **Check fuel filter ball located in fuel tank. Ball must move freely.**
   - *Corrosion due to oxidation at installation. Replace fuel filter.*
2. **Check if lines are perforated or kinked or if they leak at fittings.**
   - *Lines are too big for their fittings or are improperly routed. Replace or properly relocate lines.*
3. **Check fuel pump outlet flow.**
   - *Dirt clogging fuel pump lines or torn membrane. Clean or replace fuel pump.*
4. **Check needle valve of carburetor(s).**
   - *Dirt (varnish, foreign particle) clogging fuel line inlets. Clean.*
5. **Check main jet.**
   - *Dirt (varnish, foreign particle) accumulation at main jet. Clean.*
6. **Check float height in carburetor bowl(s).**
   - *Running out of fuel at high speed because float height is too low. Adjust float height according to specifications.*

Symptom: **DPM SEEMS TO BE DEFECTIVE.**

1. **Check electrical connections.**
   - *Corroded terminals. Clean or replace.*
2. **Fuel mixture is too rich or too poor.**
   - *Possible damage to DPM. If DPM does not operate properly, unplug compensation solenoid connector while engine is running. The carburetion is now identical to that of carburetors without a DPM, provided that all pipe fittings are tight and that solenoid is in good condition, (it must not be half-open). If problem is resolved with this procedure, DPM is faulty.*

Symptom: **DPM SEEMS TO BE DEFECTIVE.** (cont'd)

3. Check for DPM manifold leaking.

- DPM manifold is leaking. Repair or replace.

TRANSMISSION AND BRAKE SYSTEMS

The following charts are provided to help in diagnosing the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

TRANSMISSION

Symptom: **THE SNOWMOBILE ACCELERATES SLOWLY, ESPECIALLY FROM A STANDING START.**

1. **Check drive belt condition.**
   - *Belt is too narrow (drive belt engagement is higher in drive pulley). Replace belt if width is less than specified in DRIVE BELT.*
2. **Check distance between pulleys and/or drive belt deflection.**
   - *Distance is too small between pulleys or deflection is too high (drive belt engagement is higher in drive pulley). Adjust distance between pulleys and/or drive belt deflection according to specifications (refer to TECHNICAL DATA).*
3. **Check driven pulley sliding half play.**
   - *Jammed sliding half. Replace.*
4. **Check spring tension of driven pulley sliding half.**
   - *Sliding half rotation is accelerated when spring tension is too weak. Adjust according to specifications (refer to TECHNICAL DATA).*
5. **Refer to VIBRATIONS ORIGINATING FROM DRIVE PULLEY and VIBRATIONS ORIGINATING FROM DRIVEN PULLEY and check items listed.**
6. **Check drive pulley spring tension.**
   - *Spring tension is too weak. Replace.*

Symptom: **ENGINE MAXIMUM RPM IS TOO HIGH AND TOP SPEED IS NOT REACHED.**

1. **Check items 1, 2 and 3 of THE SNOWMOBILE ACCELERATES SLOWLY, ESPECIALLY WHEN IT IS STOPPED.**
2. **Check driven pulley spring tension.**
   - *Spring tension is too stiff. Adjust according to specifications (refer to TECHNICAL DATA).*
3. **Check position of the calibration screws (TRA drive pulley).**
   - *Selected numbers are too high. Adjust according to specifications (refer to TECHNICAL DATA).*
4. **Refer to VIBRATIONS ORIGINATING FROM DRIVEN PULLEY and check items listed.**
5. **Check the driven pulley.**
   - *Driven pulley does not open completely. Clean, readjust or replace driven pulley.*
6. **Check if levers of drive pulley move freely.**
   - *Stuck levers. Replace lever bushings.*

Symptom: **LOOSENESS IS FELT IN DRIVE SYSTEM WHEN ACCELERATING/DECELERATING.**

1. **Check drive chain tension.**
   - *Drive chain is too loose. Adjust.*
2. **Check radial play of driven pulley.**
   - *Worn key, keyway or splines. Replace.*

Symptom: **VIBRATIONS ORIGINATING FROM DRIVE PULLEY.**

1. **Check drive belt.**
   - *Belt width is uneven at many places. Replace.*
2. **Check tightening torque of drive pulley screw.**
   - *Moving governor cup. Retighten screw.*
3. **Spring cover screws.**
   - *Spring cover moves and restrains sliding half movement. Retighten screws.*
4. **Check spring cover (TRA TYPE) and/or sliding half bushings.**
   - *Excessive gap between bushings and fixed half shaft, thus restraining sliding half movements. Replace bushing(s).*
5. **Check governor cup splines.**
   - *Excessive radial play. Replace governor cup.*
6. **Check lever assembly.**
   - *Lever assembly is damaged (worn bushing, bent lever, etc.). Replace damaged part.*

Symptom: **VIBRATIONS ORIGINATING FROM DRIVEN PULLEY.**

1. **Check sliding half side play.**
   - *Sliding half bushing worn out. Replace sliding half bushing.*
2. **Check sliding half and fixed half straightness.**
   - *Sliding half/fixed half warped. Replace.*
3. **Check cam slider shoes.**
   - *One or two slider shoes out of three are broken. Replace.*

Symptom: **PULLEYS DO NOT DOWN SHIFT PROPERLY.**

1. **Check driven pulley spring tension.**
   - *Spring tension is too low. Adjust according to specifications (refer to TECHNICAL DATA).*
2. **Refer to VIBRATIONS COMING FROM DRIVEN PULLEY and check items listed.**
3. **Check drive pulley bushings (cleanliness, wear, etc.).**
   - *Bushings stick to fixed half pulley shaft. Clean or replace.*

Symptom: **IN REVERSE ENGINE FAILS AND DRIVEN PULLEY OPENS TOO FAST (DRIVE BELT IS LOW IN DRIVEN PULLEY).**

1. **Check pulley distance and alignment.**
   - *Improper adjustment. Adjust according to specifications (refer to PULLEY DISTANCE AND ALIGNMENT) and make sure that torque rod is resting against engine. Check engine mounts.*
2. **Check for reverse sliding shoes.**
   - *Sliding shoes are worn or missing. Replace sliding shoes.*
3. **Check spring.**
   - *Spring is weak or insufficient tension. Replace spring.*

Symptom: **UNEVEN BELT WEAR ON ONE SIDE ONLY.**

1. **Check tightening torque of engine mount bolts.**
   - *Loose engine mount. Tighten engine mount nuts/bolts equally.*
2. **Check pulley alignment.**
   - *Pulley misalignment. Align pulleys.*
3. **Check drive belt contact area on pulleys.**
   - *Rough or scratched pulley surfaces. Repair or replace pulley half.*
4. **Check driven pulley sliding half play.**
   - *Driven pulley bushing worn. Replace bushing.*

Symptom: **BELT GLAZED EXCESSIVELY OR HAVING BAKED APPEARANCE.**

1. **Check if drive pulley bushings are worn.**
   - *Slipping due to insufficient pressure on belt sides. Replace bushing.*
2. **Check condition of drive pulley fixed half shaft.**
   - *Slipping due to rusted drive or driven pulley shafts. Clean shaft with fine steel wool.*
3. **Check if pulley halves are clean.**
   - *Slipping due to oily pulley surfaces. Clean pulley halves.*
4. **Check pulley calibration.**
   - *Slipping due to improper pulley calibration. Calibrate according to specifications.*

Symptom: **BELT WORN EXCESSIVELY IN TOP WIDTH.**

1. **Check drive pulley.**
   - *Excessive slippage due to jammed of drive pulley. Inspect drive pulley.*
2. **Check drive belt identification number.**
   - *Improper belt angle. (wrong type of belt). Replace belt with an appropriate drive belt.*
3. **Check drive belt width.**
   - *Considerable use. Replace belt if width is less than specified in DRIVE BELT.*

Symptom: **BELT TOO NARROW ON ONE SECTION.**

1. **Check for frozen track.**
   - *Frozen track. Free track from ice.*
2. **Check parking brake.**
   - *Parking brake is engaged. Release parking brake.*
3. **Check track tension/alignment.**
   - *Track too tight. Adjust track tension and alignment.*
4. **Check drive pulley.**
   - *Drive pulley does not operate properly. Repair or replace drive pulley.*
5. **Check idle speed.**
   - *Engine idle speed is too high. Adjust according to specifications.*
6. **Check drive belt length.**
   - *Incorrect belt length. Replace with an appropriate drive belt (refer to TECHNICAL DATA).*
7. **Check distance between pulleys.**
   - *Incorrect pulley distance. Readjust according to specifications.*
8. **Check belt height.**
   - *Belt height is incorrect. Adjust according to specifications.*

Symptom: **BELT SIDES WORN CONCAVE.**

1. **Check pulley half surfaces.**
   - *Rough or scratched pulley half surfaces. Repair or replace.*
2. **Check drive belt identification number.**
   - *Wrong type of belt. Replace belt with an appropriate drive belt (refer to TECHNICAL DATA).*

Symptom: **BELT DISINTEGRATION.**

1. **Check drive belt identification number.**
   - *Excessive belt speed. Wrong type of belt. Replace belt with proper type of belt. (refer to TECHNICAL DATA).*
2. **Check if pulley halves are clean.**
   - *Oil on pulley surfaces. Clean pulley surfaces with fine emery cloth and wipe clean using Parts Cleaner (P/N 413 711 809) and a cloth.*

Symptom: **BELTCORD POPPED OUT.**

1. **Check pulley alignment.**
   - *Pulley misalignment. Align pulley according to specifications (refer to TECHNICAL DATA).*

Symptom: **FATIGUE CRACKS BETWEEN COGS.**

1. **Check drive belt condition.**
   - *Belt considerably worn, worn out. Replace.*
   - *Distortion of natural belt shape due to improper storage. Store properly.*

Symptom: **TOOTH CHUNK OUT.**

1. **Check drive belt rotational direction.**
   - *Improper belt installation. Replace.*
2. **Check if drive belt rubs against components.**
   - *Belt rubs against fixed components. Relocate components.*
3. **Check drive pulley.**
   - *Violent engagement of drive pulley. Check drive pulley engagement speed, drive pulley bushings and components.*

Symptom: **BELT "FLIP-OVER" AT HIGH SPEED.**

1. **Check pulley alignment.**
   - *Pulley misalignment. Align pulley according to specifications (refer to TECHNICAL DATA).*
2. **Check drive belt identification number.**
   - *Wrong type of belt. Replace with an appropriate drive belt.*

BRAKE SYSTEM

MECHANICAL BRAKE

Symptom: **BRAKE DOES NOT ADJUST AUTOMATICALLY.**

1. **Check ratchet wheel spring.**
   - *Broken ratchet wheel spring tab. Replace.*
2. **Check mobile pad stud.**
   - *Stud rotates in pad. Replace.*

Symptom: **BRAKE HANDLE DOES NOT RETURN COMPLETELY.**

1. **Check brake return spring.**
   - *Broken return spring. Replace.*
2. **Check if brake cable moves freely in its housing.**
   - *Brake cable movement is limited due to oxidation or dirt accumulation. Replace.*
3. **Check distance between brake lever and caliper.**
   - *Distance is too wide. Adjust according to specifications (refer to TRANSMISSION).*

HYDRAULIC BRAKE

Symptom: **SPONGY BRAKE CONDITION.**

1. **Contaminated brake fluid.**
   - *Replace brake fluid and bleed system. If the problem persists, replace master cylinder.*
2. **Check for damaged hose, master cylinder and caliper.**
   - *Replace part(s) and check for proper mounting.*

Symptom: **BRAKE FLUID LEAKING.**

1. **Check for loosen hose connectors.**
   - *Replace copper washers and retighten.*

MECHANICAL AND HYDRAULIC BRAKES

Symptom: **BRAKE SYSTEM IS NOISY.**

1. **Check brake pad thickness.**
   - *Pads are worn up to wear warner. Replace.*
2. **Check key/keyway or splines.**
   - *Key/keyway or splines are worn out. Replace parts.*

ELECTRICAL SYSTEM

The following chart is provided to help in diagnosing the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

Symptom: **STARTER DOES NOT TURN.**

1. **Check fuse.**
   - *Burnt fuse. Check wiring condition and replace fuse.*
2. **Check continuity of starter switch contact points.**
   - *Poor contact of starter switch contact points. Repair or replace switch.*
3. **Check continuity between starter switch and solenoid on fan-cooled models or between starter switch and MPEM on liquid-cooled models.**
   - *Open circuit. Repair.*
4. **On liquid-cooled models check continuity between MPEM and solenoid switch.**
   - *Open circuit. Repair.*

Symptom: **STARTER TURNS BUT DOES NOT CRANK THE ENGINE.**

1. **Check engine.**
   - *Engine seized. Rebuild engine.*
2. **Check wire connection.**
   - *Inadequate connection (too much resistance). Clean and reconnect.*
3. **Check battery charge.**
   - *Weak battery. Recharge battery and verify recharge system and wires.*
4. **Check battery capacity.**
   - *Shorted battery cell(s). Replace.*
5. **Check starter relay contact disc.**
   - *Burnt or poor contact of starter relay contact disc. Replace starter relay.*
6. **Check continuity of starter relay pull-in winding.**
   - *Open circuit of starter relay pull-in winding. Replace starter relay.*
7. **Check continuity of starter relay hold-in winding.**
   - *Open circuit of starter relay hold-in winding. Replace starter relay.*
8. **Check brushes.**
   - *Poor contact of brushes or worn. Replace brushes.*
9. **Check commutator.**
   - *Burnt commutator. Turn commutator on a lathe. Respect outer diameter wear limit. Refer to ELECTRIC STARTER.*
10. **Check height of commutator mica.**
    - *Commutator mica too high. Undercut mica.*
11. **Check field coil resistance.**
    - *Shorted field coil. Repair or replace yoke.*
12. **Check armature resistance.**
    - *Shorted armature. Repair or replace armature.*

Symptom: **STARTER TURNS BUT DOES NOT CRANK THE ENGINE.** (cont'd)

13. Check tension of brush springs.

- Weak brush spring tension. Replace springs.

14. Check yoke assembly magnets.

- Weak magnets. Replace yoke assembly.

15. Check if bushings are worn.

- Worn bushings. Replace bushings.

Symptom: **STARTER TURNS, BUT OVERRUNNING CLUTCH PINION DOES NOT MESH WITH RING GEAR.**

1. Check clutch pinion gear and small return spring.

- Worn clutch pinion gear or damaged small return spring. Replace damaged part(s).

2. Check clutch.

- Defective clutch. Replace clutch.

3. Check brackets.

- Worn or broken brackets. Replace brackets.

4. Check movement of clutch on splines.

- Poor movement of clutch on splines. Clean and correct.

5. Check clutch bushing.

- Worn clutch bushing. Replace clutch.

6. Check starter bushings.

- Worn starter bushing(s). Replace bushing(s).

7. Check ring gear.

- Worn ring gear. Replace ring gear.

8. Check for proper starter rotation direction.

- Starter turns in wrong direction, incorrectly installed brushes, wrong polarity or wrong starter. Replace starter or reconnect properly.

Symptom: **ELECTRIC STARTER KEEPS TURNING WHEN ENGINE IS STARTED.**

1. Check clutch.

- Jammed clutch pinion gear. Replace or clean.

2. Check movement of clutch on splines.

- Clutch is stuck on splines. Clean.

3. Check starter brackets.

- Broken bracket(s). Replace bracket(s).

4. Check ignition switch (fan-cooled models).

- Ignition switch does not return to its ON position or is short-circuited. Adjust retaining screw or replace switch.

5. Check starter relay.

- Shorted starter relay winding(s). Replace starter relay.

Symptom: **ELECTRIC STARTER KEEPS TURNING WHEN ENGINE IS STARTED.** (cont'd)

6. **Check starter relay contacts.**
   - *Melted starter relay contacts. Replace starter relay.*
7. **Check starter switch.**
   - *Starter switch returns poorly. Replace ignition switch.*

Symptom: **NOISE OCCURENCE WHEN STARTING ENGINE.**

1. **Check if ring gear is well-mounted to drive pulley fixed half.**
   - *Loose and/or broken bolts. Retighten bolts using threadslocker or replace ring gear and drive pulley fixed half.*

Symptom: **REGULATOR BLACK WIRE IS MELTED (HARNESS SIDE).**

1. **Check that big ground wire at battery is well connected to chassis.**
   - *Corroded and/or loose connection(s). Clean and/or retighten.*

Symptom: **OPTIONAL ELECTRIC STARTER DOES NOT WORK WHEN TURNING IGNITION SWITCH.**

1. **Check connection of BLACK wire (starter relay ground) in 3-wire housing coming from magneto (white housing).**
   - *Corroded and/or loose connection(s). Clean and/or retighten.*

Symptom: **ELECTRIC STARTER SOMETIMES DOES NOT WORK WHEN ACTIVATED.**

1. **Check battery cables and starter wires.**
   - *Corroded and/or loose connection(s). Clean and/or retighten.*
2. **Check fuse(s).**
   - *Oxidized or burnt fuse(s). Clean or replace.*
3. **Check wiring harness connections.**
   - *Oxidized connections. Clean or replace defective terminals.*
4. **Check ignition switch.**
   - *Defective contacts in ignition switch. Replace.*
5. **Check starter relay.**
   - *Shorted starter relay wiring harness or eroded contact washer. Replace.*

Symptom: **ENGINE DOES NOT START — NO SPARK AT SPARK PLUG. (AT ENGINE CRANKING.)**

1. **Verify spark plug condition.**
   - *Defective, improperly set, worn-out, fouled. Identify source of problem and correct. Replace spark plugs.*
2. **Verify spark plug cap resistance with an ohmmeter.**
   - *Defective part. Replace cap.*

Symptom: **ENGINE DOES NOT START — NO SPARK AT SPARK PLUG. (AT ENGINE CRANKING.)** (cont'd)

3. **Verify if problem originated from electrical system wiring harness and/or accessories and/or ignition cut-out switches by unplugging the 3-wire connectors between the magneto/generator and the vehicle wiring harness. Check condition of connectors.**
   - *Heating, rotating or sharp part in contact with harness. Improper harness routing. Defective switch(es). Corroded connector terminals. Replace or repair damaged wires. Reroute where necessary. Replace defective switch(es). Clean terminals and apply silicone dielectric grease.*
4. **Verify trigger coil resistance with an ohmmeter and connector condition.**
   - *Defective coil. Corroded connector terminals. Replace defective coil. Clean terminals and apply silicone dielectric grease.*
5. **Verify condition of ignition coil.**
   - *Mechanically damaged part. Vibration problem. Electrically damaged part. Tighten mounting screws. Replace ignition coil.*
6. **Verify condition of ignition generator coils.**
   - *Mechanically damaged part. Vibration problem. Electrically damaged part. Tighten mounting screws. Replace coils.*
7. **Verify MPEM.**
   - *Mechanically damaged part. Vibration problem. Electrically damaged part. Tighten mounting screws. Replace MPEM, retest and verify ignition timing.*

Symptom: **CDI/MPEM MODULE DOES NOT WORK.**

1. **Check that high tension coil wires do not touch any metal parts.**
   - *Short circuit. Isolate and reroute wires.*

Symptom: **ENGINE STALLS (AT LOW SPEED).**

1. **Verify items 4, 5 and 6 above.**

Symptom: **IRREGULAR ENGINE SPEED (AT HIGH SPEED).**

1. **Verify items 4, 5 and 6 above.**

Symptom: **IRREGULAR ENGINE SPEED (AT LOW SPEED).**

1. **Verify items 4 and 5 above and trigger coil/flywheel protrusion air gap.**
   - *Air gap too large. Readjust air gap.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG. (RIDING ON WET SNOW.)**

1. **Verify if spark plug wires and/or spark plug cap seals are sealing out moisture.**
   - *Defective wires and/or seals. Replace defective part.*
2. **Verify if ignition system wiring harness connectors are in good condition and/or are sealing out moisture.**
   - *Loose connectors, corroded terminals or defective parts. Clean terminals and apply silicone dielectric grease. Replace defective parts.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG (NORMAL USE).**

1. **Verify misfiring by observing flash of stroboscopic timing light; unplug connectors between magneto/generator and vehicle wiring harness to isolate problem. Check condition of connectors.**
   - *Defective spark plug(s) and/or cable(s)/cap(s). Defective electrical system wiring harness and/or accessories and/ignition cut-out switches. Condition of connector terminals. Replace defective parts and/or repair damaged wires. Replace defective switch(es). Clean terminals and apply silicone dielectric grease.*

Symptom: **ENGINE IS MISFIRING — ERRATIC SPARK AT SPARK PLUG. (RIDING IN DEEP AND THICK SNOW.)**

1. **Perform all verifications outlined under ENGINE DOES NOT START — NO SPARK AT SPARK PLUG.**
2. **Verify spark plugs. Proceed with spark plug analysis in order to identify source of problem.**
   - *Defective and/or worn spark plug(s) and/or cable(s) and/or cap(s). Replace defective part(s). Proceed with ignition system testing procedures. Perform engine analysis.*

Symptom: **FOULED (BLACK) SPARK PLUG TIP.**

1. **Check carburetor(s).**
   - *Carburetion is too rich. Adjust according to specifications (refer to TECHNICAL DATA).*
2. **Check injection oil consumption.**
   - *Injection pump flow is too high. Adjust according to specifications or replace.*
3. **Check oil quality.**
   - *Poor quality oil. Use Bombardier injection oil.*
4. **Check engine compression.**
   - *Leaking piston ring(s). Replace.*

Symptom: **SPARK PLUG TIP(S) IS (ARE) LIGHT GREY.**

1. **Refer to ENGINE SLOWS DOWN OR STOPS AT HIGH RPM and check items listed.**
2. **Check spark plug heat range.**
   - *Spark plug heat range is too high. Replace by Bombardier's recommended spark plug (refer to TECHNICAL DATA).*
3. **Check if air intake silencer leaks.**
   - *Air surplus coming from opening(s) located between halves. Seal.*
4. **Check carburetor adapter collars.**
   - *Loose collar(s). Tighten.*
5. **Check carburetor adapter(s).**
   - *Cracked or deformed adapter(s). Replace.*
6. **Check if primary compression leaks.**
   - *Primary compression leaks. Perform leak down test and repair as necessary.*

Symptom: **RER (ROTAX ELECTRONIC REVERSE) DOES NOT WORK.**

1. **Check idle speed.**
   - *Wrong idle speed. Adjust according to specification (refer to TECHNICAL DATA).*
2. **Check spark plug.**
   - *Faulty spark plug. Replace.*
3. **Check drive belt deflection.**
   - *Wrong deflection. Adjust according to specification (refer to TECHNICAL DATA).*
4. **Check carburetor synchronization and air screw adjustment.**
   - *Wrong adjustment. Adjust according to specification (refer to TECHNICAL DATA) and read carburetor subsection.*
5. **Check electrical connections.**
   - *Bad electrical connections or damaged wires. Clean or replace.*
6. **Check MPEM.**
   - *Faulty MPEM. Replace.*

Symptom: **RER (ROTAX ELECTRONIC REVERSE) DOES NOT WORK (AT HIGH ALTITUDE).**

1. **Check high altitude cap continuity.**
   - *Broken jumper inside high altitude cap. Replace high altitude cap.*

Symptom: **HEADLAMP NOT LIGHTING (WHITE BULB).**

1. **Check bulb.**
   - *Gas leak. Replace bulb.*

Symptom: **HEADLAMP NOT LIGHTING (BROKEN ELEMENT).**

1. **Check for loose headlamp housing and bulb socket.**
   - *Vibration problem. Tighten headlamp mounting screws. Lock bulb in socket. Replace bulb.*

Symptom: **HEADLAMP NOT LIGHTING. (MELTED FILAMENT (ENDS OF ELEMENT HOLDER) AND BLACK BULB.)**

1. **Check voltage at headlamp at different speeds. It must not be above 15 Vac. (If quartz halogen bulb is involved, ensure that proper voltage regulator is installed).**
   - *Excessive voltage in lighting circuit. Replace voltage regulator and ensure proper grounding. Retest.*

Symptom: **HEADLAMP DIMING.**

1. **Check voltage at headlamp at different speeds. It must not be below 11 Vac.**
   - *Insufficient voltage in lighting circuit. Replace voltage regulator and retest.*
2. **Visually inspect wiring harness for damaged and/or melted wires and/or bad wire terminal crimping and/or connections.**
   - *Heating, rotating or sharp part in contact with harness. Improper harness routing. Repair/replace damaged wires and/or terminals. Reroute harness where necessary.*
3. **On manual start models: Verify regulator ground.**
   - *Rusted or loose retaining screws. Clean, apply lithium grease (LMZ1) and firmly tighten screws.*

Symptom: **HEADLAMP DIMING.** (cont'd)

4. **Verify if there is an interconnection between AC and DC current (fan-cooled models).**
   - *Faulty installation of optional equipment. Find optional equipment connected directly to DC ground (BK wire or chassis) or to any DC hot wire (RD, RD/BU). Disconnect and reconnect to AC current (YL and YL/BK wires).*
5. **Verify if optional electric accessories are overloading the magneto/generator.**
   - *Excessive electrical load to magneto/generator. Reduce the electrical load by removing excess accessories. Reconnect as recommended by manufacturer.*
6. **Hot Grips brand: Verify if they were connected in parallel by mistake.**
   - *Excessive electrical load to magneto/generator. Reconnect as recommended by manufacturer.*
7. **Bombardier heating grips: Verify if the return wires of the elements were grounded to the chassis by mistake.**
   - *Faulty installation of optional equipment. Reconnect as recommended by manufacturer.*
8. **Verify if heating grips installation overloads the magneto/generator capacity.**
   - *Excessive electrical load to magneto/generator. Reduce the electrical load by removing accessories.*

Symptom: **FALSE FUEL AND/OR TEMPERATURE GAUGE READINGS.**

1. **Verify if gauge was connected on DC current by mistake (in case of optional installation).**
   - *Faulty installation of optional equipment. Find optional wires connected directly to DC ground (BK wire to chassis) or to any DC hot wire (RD, RD/BU). Disconnect and reconnect to AC current (YL and YL/BK wires).*
2. **Verify sender unit for resistance variation when moving float arm.**
   - *Defective or damage part. Replace sender unit.*
3. **Verify sender unit for free movement and/or correct arm position.**
   - *Defective or damaged part. Correct or replace sender unit.*
4. **Verify sender unit/gauge wiring harness condition.**
   - *Heating, rotating or sharp part in contact with harness. Improper harness routing. Replace or repair damaged wires. Reroute where necessary.*

Symptom: **WITH ENGINE IDLING NO ELECTRICAL ACCESSORIES WORK.**

1. **Check idle speed.**
   - *Too low idle speed. Readjust to specifications.*
2. **Verify regulator.**
   - *Faulty regulator. Replace.*

Symptom: **BRAKE LIGHT REMAINS ON.**

1. **Check if bulb is properly installed.**
   - *Bulb is not installed correctly (contact elements are reversed). Install bulb correctly.*
2. **Check brake switch.**
   - *Switch contact remains closed. On mechanical brake if brake switch is in good condition, adjust brake cable or brake switch. On hydraulic brake, replace brake switch.*
3. **Check wiring harness.**
   - *Shorted wiring harness. Replace or repair wiring harness.*

Symptom: **REAR LIGHT BULB FLASHES.**

1. **Check bulb tightness in housing.**
   - *Looseness at bulb contact elements. Install bulb correctly.*
2. **Check if rear light is properly connected.**
   - *Connector housing is partially connected. Install connector housing properly.*
3. **Check continuity of wires.**
   - *Corroded terminals and/or broken wires. Replace terminal(s) or crimp defective wires*

Symptom: **TACHOMETER DOES NOT WORK.**

1. **Check continuity of wires.**
   - *Corroded terminals and/or broken wires. Replace terminal(s) or crimp defective wires.*

Symptom: **HIGH BEAM PILOT LAMP LIGHTS UP WHEN LOW BEAM IS SELECTED.**

1. **Check proper connections.**
   - *YELLOW wire connected to pilot lamp. Mixed-up connections with heating element pilot lamps. Reconnect a yellow/black wire to pilot lamp. yellow wires are connected to heating element pilot lamps.*

SUSPENSION AND TRACK

The following chart is provided to help diagnose the probable source of troubles. It should be used as a guideline. Some causes or corrections may not apply to a specific model.

Symptom: **SUSPENSION IS TOO LOW.**

1. **Check condition of springs.**
   - *Springs are broken. Replace springs.*
2. **Check springs preload.**
   - *Too low spring preload. Increase preload to the recommended position.*
3. **Check springs.**
   - *Installed springs are too soft. Install optional stiffer springs, refer to Service Bulletin SPRING REFERENCE ACCORDING TO LOAD.*

Symptom: **REAR SUSPENSION BOTTOMS OUT.**

1. **Check condition of springs.**
   - *Springs are broken. Replace springs.*
2. **Check springs preload.**
   - *Too low spring preload. Increase preload to the recommended position.*
3. **Check springs.**
   - *Springs installed are too soft. Install optional stiffer springs, refer to Service Bulletin SPRING REFERENCE ACCORDING TO LOAD.*
4. **Check the rear shock motion ratio position.**
   - *It is adjusted in soft position. Adjust rear shock motion ratio to firm position.*

Symptom: **REAR SUSPENSION IS TOO STIFF.**

1. **Check rear spring preload.**
   - *Too much preload. Adjust to a softer position.*
2. **Check springs.**
   - *Springs installed are too stiff. Install optional softer springs, refer to Service Bulletin SPRING REFERENCE ACCORDING TO LOAD.*
3. **Check the rear shock motion ratio position.**
   - *It is adjusted in firm position. Adjust rear shock motion ratio to soft position.*
4. **Check track tension.**
   - *Track is too tight. Adjust.*
5. **Check if axles are properly lubricated.**
   - *Improper lubrication and/or contaminated grease (sticky oil sludge). Clean and/or lubricate.*

Symptom: **WHEN HANDLEBAR IS TURNED, SNOWMOBILE UNDERSTEERS.**

1. **Check ski runner condition.**
   - *Worn ski runners. Replace.*
2. **Check ski spring preload.**
   - *Insufficient ski pressure on the ground. Increase spring preload.*

Symptom: **WHEN HANDLEBAR IS TURNED, SNOWMOBILE UNDERSTEERS.** (cont'd)

3. **Check if front arm stopper strap is too long.**
   - *Insufficient ski pressure on the ground. Shorten stopper strap.*
4. **Check front arm spring preload.**
   - *Insufficient ski pressure on the ground. Loosen spring tension.*

Symptom: **HANDLEBAR IS DIFFICULT TO TURN.**

1. **Check if the handle bar turns freely when skis are off the ground.**
   - *Ball joints corrosion restrains movement. Lubricate or replace the ball joint.*
   - *Component need proper lubrication. Lubricate. Refer to MAINTENANCE.*
   - *Bent parts. Replace parts.*
2. **Check ski spring preload.**
   - *Too much preload. Reduce ski spring preload.*
3. **Check position of stopper strap.**
   - *Too much weight when stopper strap is short. Lengthen front arm stopper strap.*
4. **Check position of front arm spring adjustment cam(s).**
   - *When spring tension is weak, more weight is transferred to the skis. Increase spring preload.*

Symptom: **THE SNOWMOBILE ZIGZAGS.**

1. **Check ski runner condition.**
   - *Worn or bent ski runners. Replace ski runners.*
2. **Check ski alignment.**
   - *Improper ski alignment. Align skis in order to obtain proper toe-out (opening) (to adjust, refer to STEERING SYSTEM).*
3. **Check if bushings are too loose in steering system.**
   - *Bushings are too loose. Replace.*
4. **Check ski pressure.**
   - *Too much pressure on skis. Reduce ski spring preload and/or increase center spring preload.*

Symptom: **SLIDER SHOES WEAR OUT PREMATURELY/OR TRACK CLEATS BECOME BLUE.**

1. **Check track tension.**
   - *Pressure is too great on slider shoes. Adjust according to specifications (refer to TECHNICAL DATA). Replace defective parts.*
2. **Check idler wheel condition.**
   - *Stuck bearing, flat spot on wheel or damaged wheel. Replace defective parts.*
3. **Check snow conditions or lack of snow.**
   - *Lack of lubrication of slider shoes Ask driver to ride in appropriate snow conditions (see Operator's Guide).*
4. **Check slider shoes and/or suspension retaining screws.**
   - *Twisted slider shoes or loose retaining screws. Replace defective parts and/or tighten loose screws.*

Symptom: **DERAILING TRACK.**

1. **Check track tension.**
   - *Track is too loose. Adjust.*
2. **Check if track and slider shoes are properly aligned.**
   - *Improper alignment. Adjust.*

Symptom: **NOISE OR VIBRATION COMING FROM THE TRACK.**

1. **Check slide suspension retaining bolts.**
   - *Missing bolt(s) (some components interfere with track rotation). Replace missing bolt(s).*
2. **Check condition of idler wheel(s).**
   - *Idler wheel rubber is damaged. Replace.*
3. **Check guide cleats.**
   - *Top portion of guide cleat(s) is bent. Replace.*
4. **Check sprockets.**
   - *One or several teeth of drive shaft sprockets are broken. Replace sprocket(s).*
5. **Check track tension.**
   - *Track is too loose. Adjust to recommended tension.*
6. **Check track rods and/or internal traction teeth.**
   - *One or several track rods and/or teeth are broken. Replace track.*

277 ENGINE TYPE

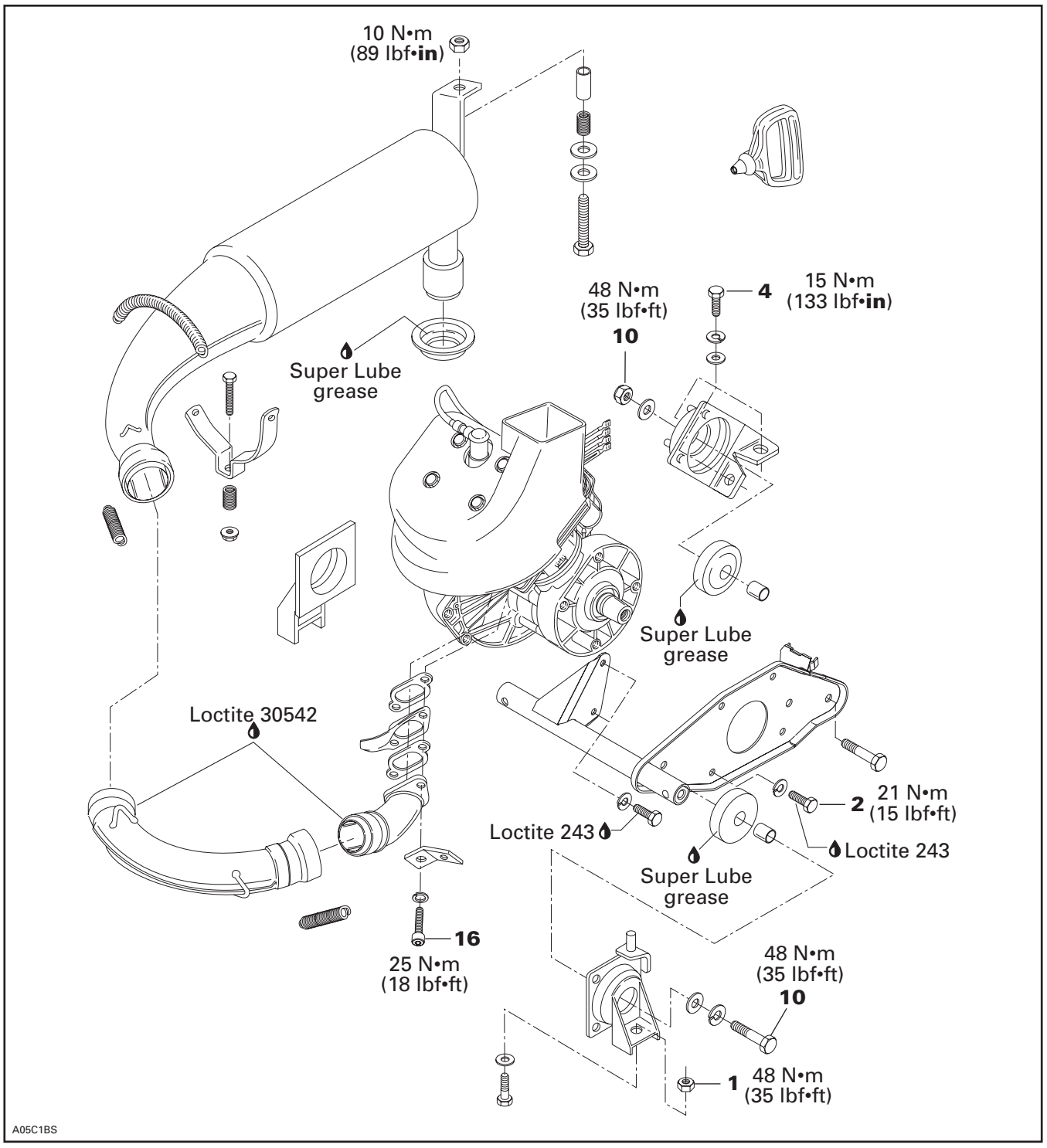
SERVICE TOOLS

Description	Part Number	Page
18 mm sleeve kit	529 035 541	51
locating sleeve	529 023 800	51
piston circlip installer	529 035 561	54
piston pin puller	529 035 503	51
plate	529 024 900	58
puller	420 876 298	58
pusher	420 277 875	59
pusher	420 876 660	59
rubber pad	529 023 400	51

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	58
Loctite 243	293 800 060	49
Loctite 30542	293 800 090	49

ENGINE REMOVAL AND INSTALLATION



REMOVAL FROM VEHICLE

Remove or disconnect the following then lift engine from vehicle:

– guard
– drive belt
– muffler
– carburetor
– oil injection pump cable
– oil injection inlet line
– impulse line
– electrical connectors
– hood retaining cable
– engine mount nuts.

ENGINE SUPPORT AND MUFFLER DISASSEMBLY AND ASSEMBLY

Torque the manifold screws **no. 16** to 25 N•m (18 lbf•ft).

Torque the support screws **no. 4** to 15 N•m (133 lbf•**in**) and nuts **no. 1** to 48 N•m (35 lbf•ft).

Torque the engine support screws and nut **no. 10** to 48 N•m (35 lbf•ft).

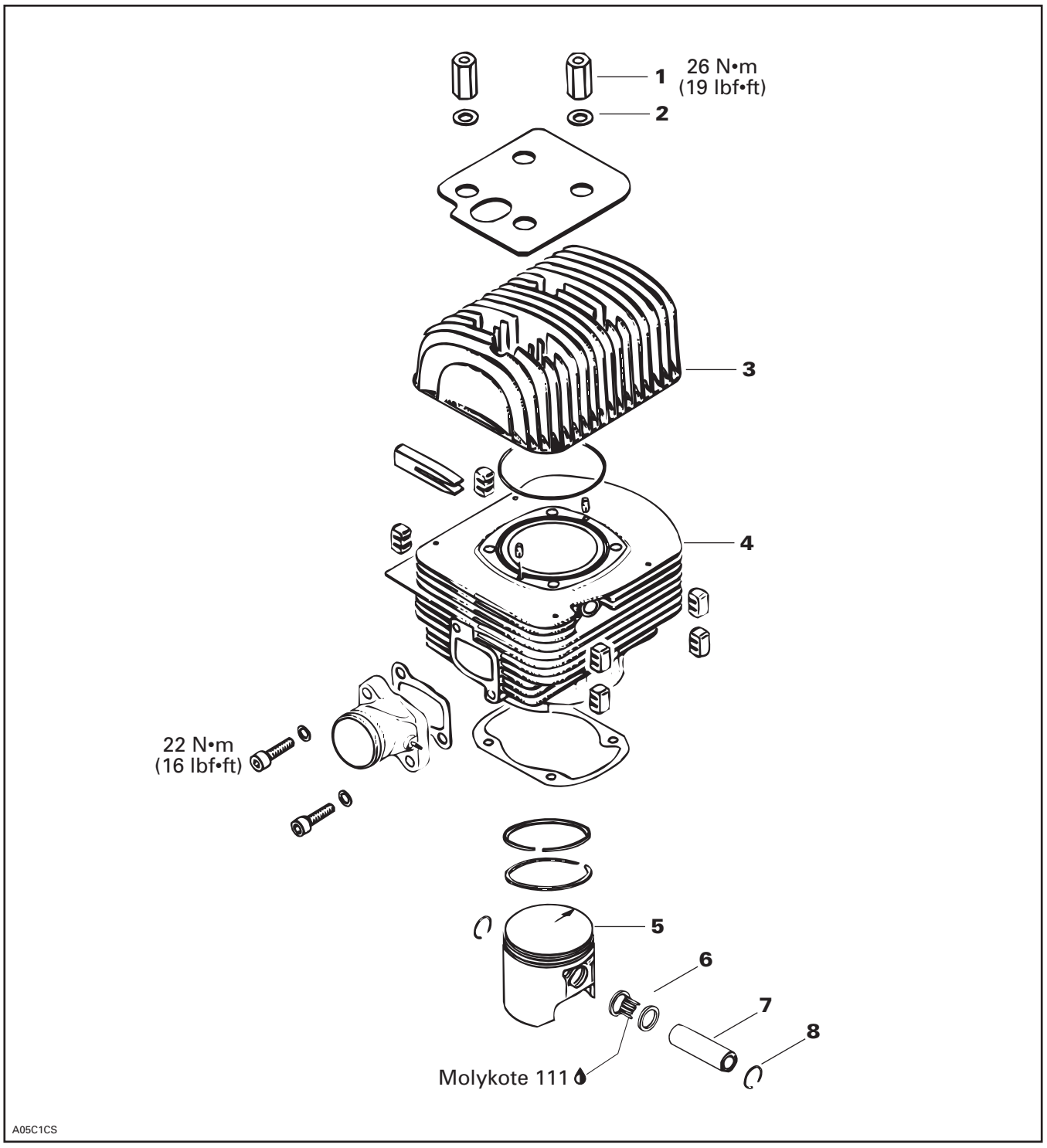
Apply Loctite 243 (P/N 293 800 060) on threads of screw **no. 2**. Torque screws **no. 2** retaining the engine support to engine crankcase to 21 N•m (15 lbf•ft).

INSTALLATION ON VEHICLE

To install engine on vehicle, reverse removal procedure. However, pay attention to the following:

– Check tightness of engine mount nuts, and drive pulley screw.
– After throttle cable installation, check maximum throttle slide opening.
– Check pulley alignment and drive belt tension.
– Seal exhaust ball joints with Loctite 30542 (P/N 293 800 090).

TOP END



TROUBLESHOOTING

Before completely disassembling the engine, check airtightness. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

NOTE: The following procedures can be done without removing the engine from chassis.

TOP END REMOVAL (WITHOUT REMOVING ENGINE FROM CHASSIS)

Remove the following then lift cylinder head **no. 3** and cylinder **no. 4**:

- belt guard
- carburetor
- exhaust system
- spark plug
- oil injection inlet
- fan cowl and hood cable
- cylinder head nuts **no. 1** and washers **no. 2**.

CLEANING

Discard all gaskets.

Clean all metal components in a non-ferrous metal cleaner.

Scrape off carbon formation from cylinder exhaust port, cylinder head and piston dome using a wooden spatula.

NOTE: The letters "AUS" (over an arrow on the piston dome) must be visible after cleaning.

Clean the piston ring grooves with a groove cleaner tool, or with a piece of broken ring.

DISASSEMBLY

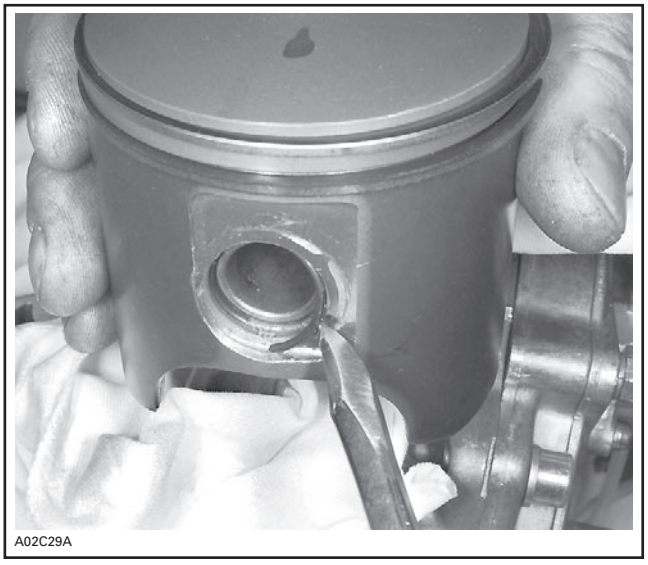
5, Piston

On this engine, piston pin needle bearing **no. 6** is mounted without a cage.

Use piston pin puller (P/N 529 035 503) along with 18 mm sleeve kit (P/N 529 035 541) and locating sleeve (P/N 529 023 800).

NOTE: The locating sleeve is the same that contains new cageless bearing.

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase to prevent circlips **no. 8** from falling into crankcase. Then with a pointed tool inserted in piston notch, remove both circlips from piston **no. 5**.

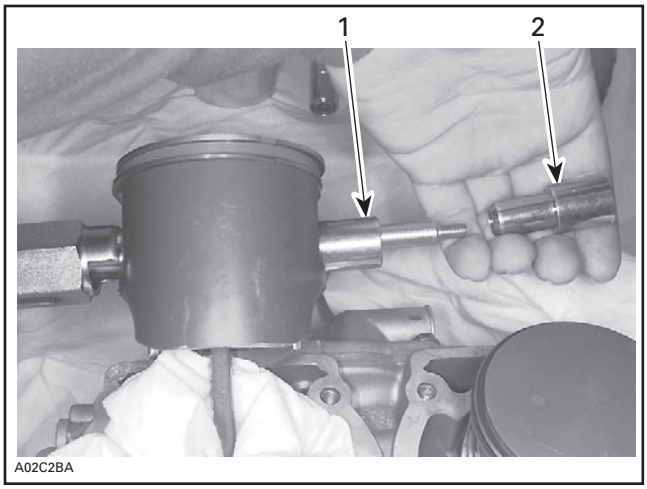


TYPICAL

Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.

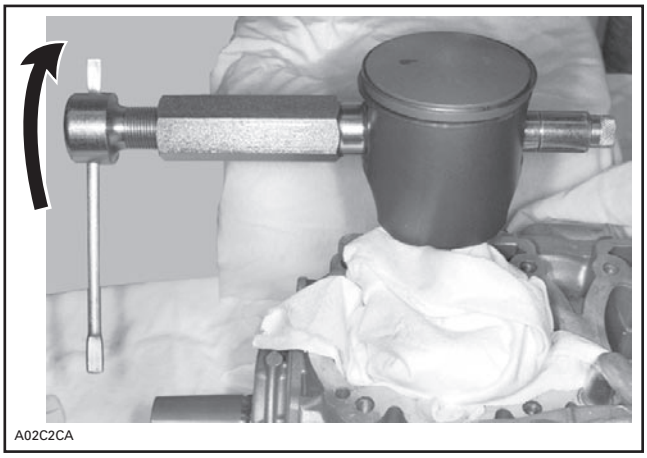
TYPICAL
1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.

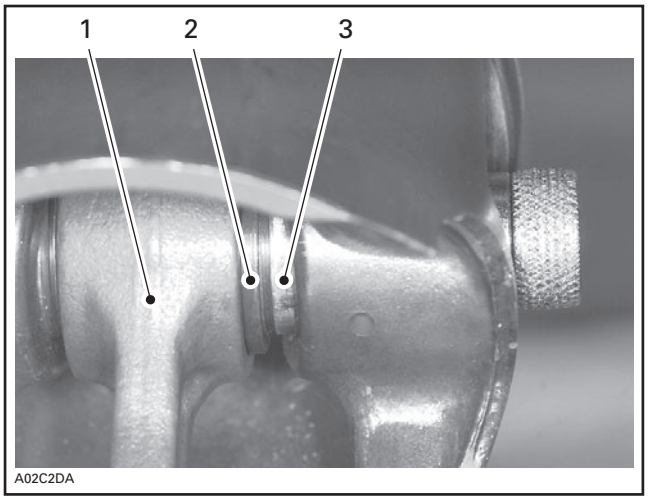


TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Pull out piston pin no. 7 by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

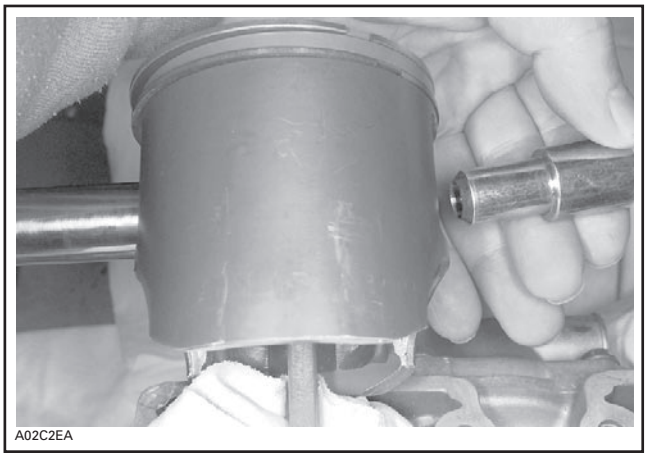


TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

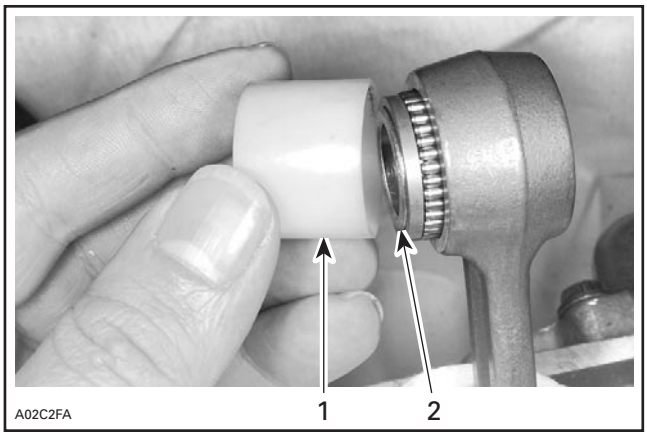
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

NOTE: 0.25 and 0.5 mm oversize pistons and rings are available if necessary.

Use a locking tie to fasten all needles and thrust washers along with locating sleeve.

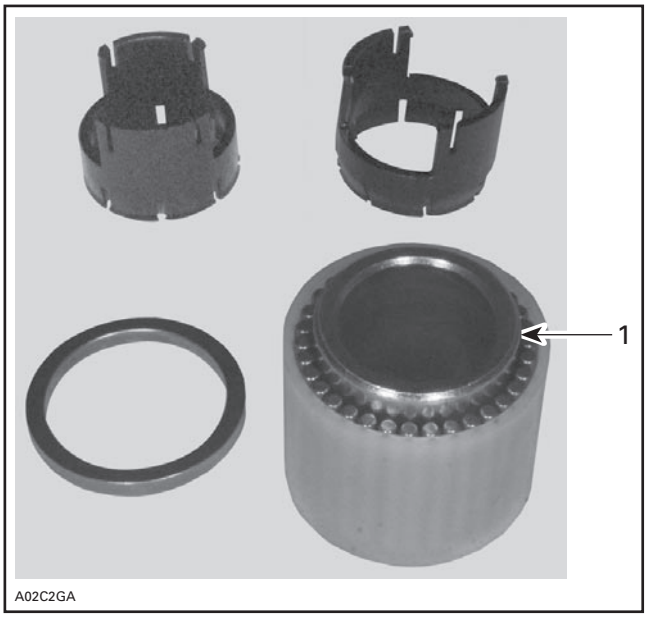
INSPECTION

Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT.

ASSEMBLY

When reinstalling original needle bearings, make sure that 31 needles are inserted between sleeve and locating sleeve.

When installing a new cageless bearing, replace half plastic cages by sleeve.



TYPICAL
1. Sleeve

Grease thrust washers and install them on each end of needles.

Insert cageless bearing into connecting rod.

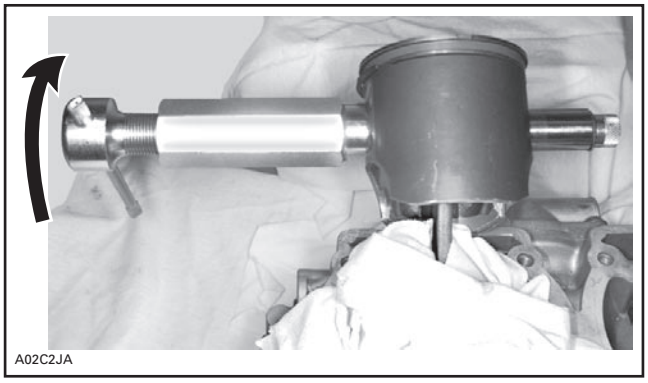
TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Mount piston over connecting rod with the letters "AUS" (over an arrow on the piston dome) facing in the direction of exhaust port.

Install shouldered sleeve.

TYPICAL — SHOULDERED SLEEVE INSTALLATION

Install piston pin puller and turn handle until piston pin is correctly positioned in piston.

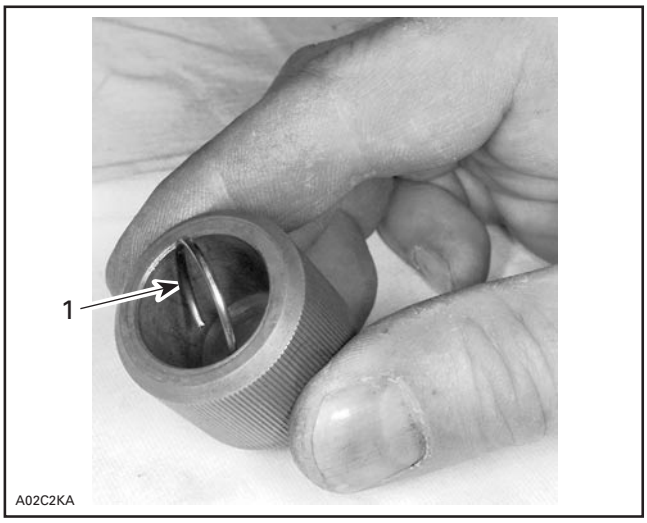


TYPICAL

Remove piston pin puller and sleeve kit.

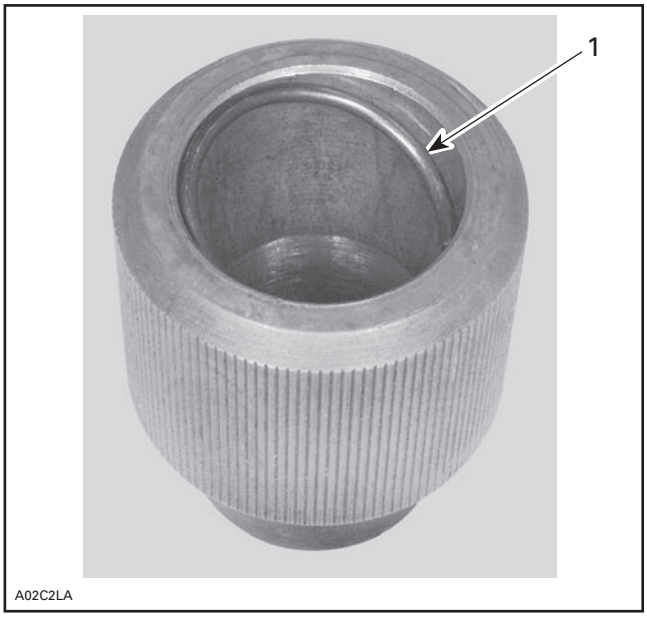
To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use piston circlip installer (P/N 529 035 561).

Insert circlip in tool at an angle.



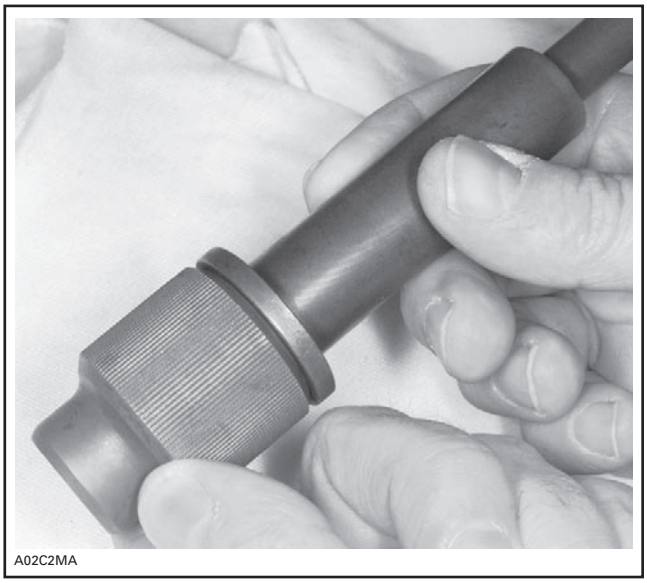
1. Circlip

Square it up using a finger.

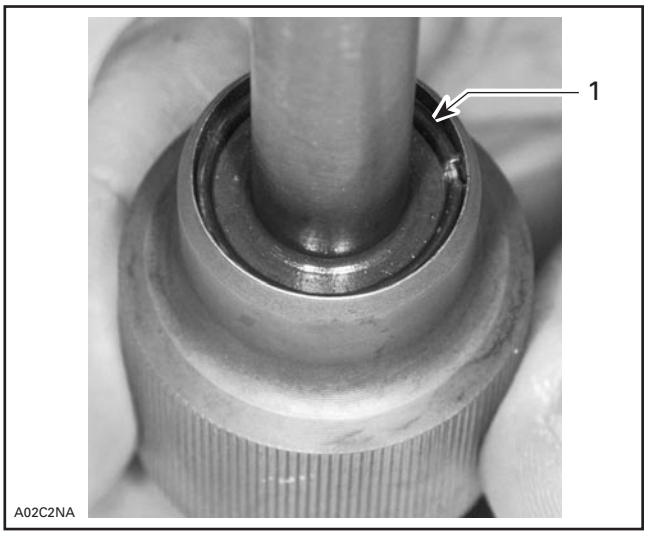


1. Circlip

Continue to square it up using round end of circlip installer.

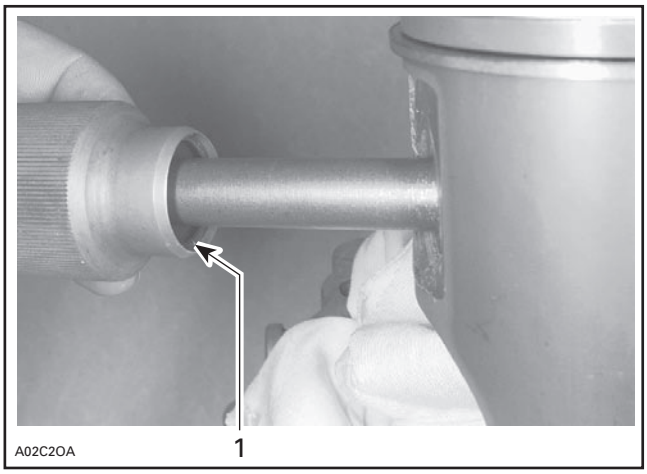


Using square end of tool, push circlip in until it rests in groove.



1. Circlip in groove

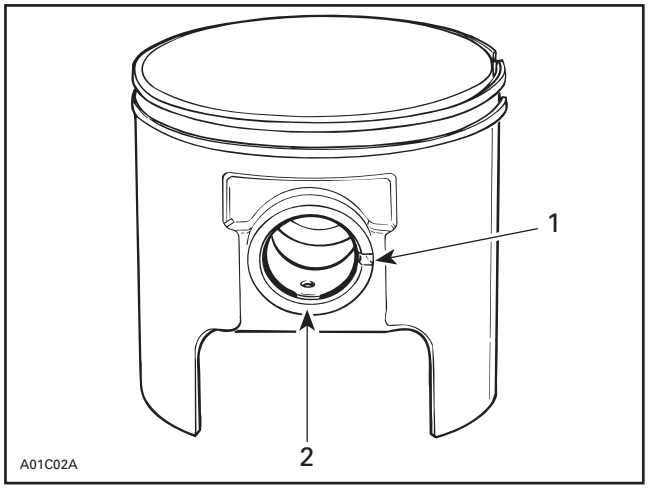
Mount tool in piston making sure that circlip break is facing down.



TYPICAL
1. Circlip break facing down

Hold tool firmly against piston then strike on round end of tool. Circlip will move from tool groove to piston groove.

TYPICAL



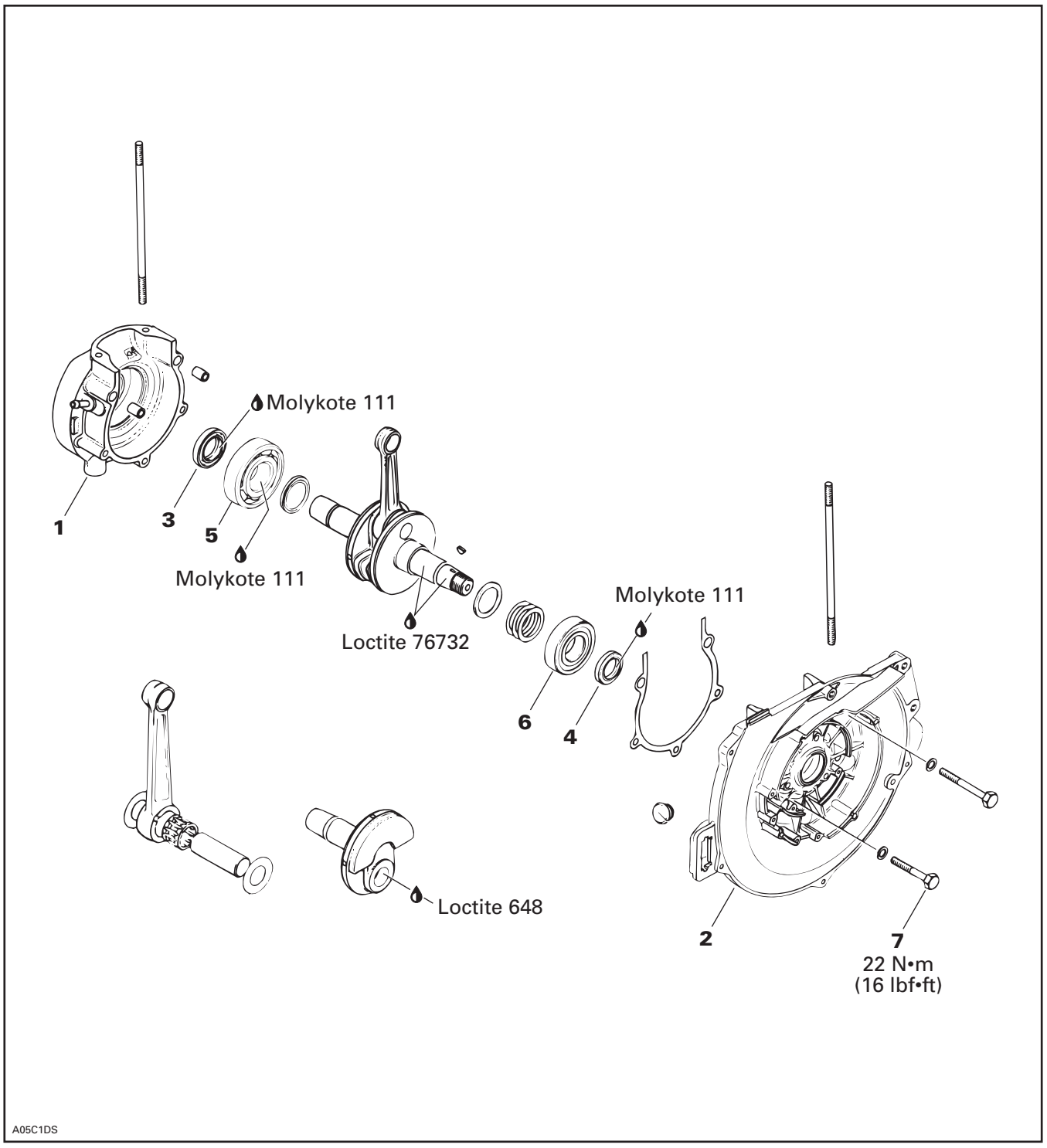
1. Piston notch
2. Circlip break

CAUTION: Circlips must not move freely in the groove after installation. If so, replace them.

Before inserting piston in the cylinder, lubricate the cylinder with new injection oil or equivalent.

Position cylinder head on cylinder with fins in line with crankshaft center line. Cross torque retaining nuts to 26 N•m (19 lbf•ft).

BOTTOM END


Molykote 111
1
3
5
Molykote 111
Loctite 76732
Molykote 111
6
4
Loctite 648
2
7
22 N•m
(16 lbf•ft)
A05C1DS

NOTE: Engine must be removed from chassis to perform the following procedures.

CLEANING

Discard all oil seals and gaskets.

Clean all metal components in a non-ferrous metal cleaner.

DISASSEMBLY

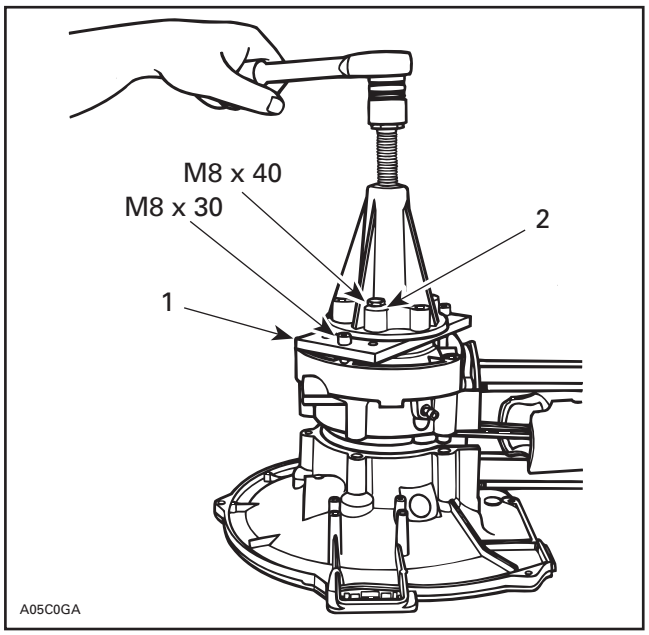
General

To remove drive pulley, refer to DRIVE PULLEY.

To remove magneto, refer to MAGNETO.

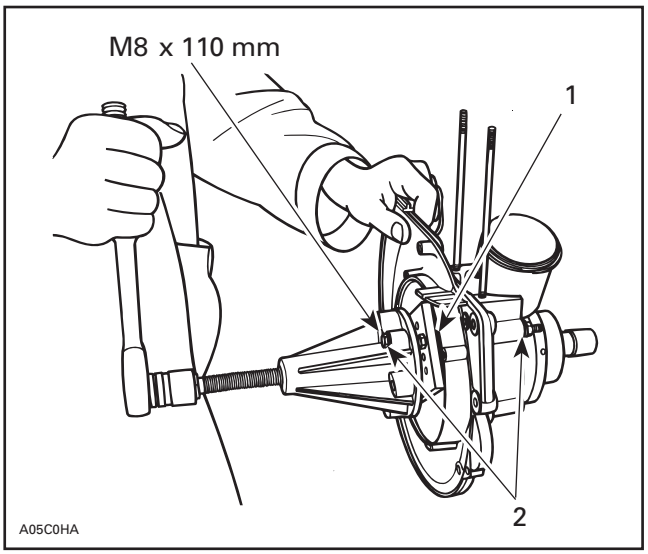
2,6, Crankcase Half

Heat to 110 - 120°C (230 - 248°F) all around bearing seat on PTO side. Install puller (P/N 420 876 298) to plate (P/N 529 024 900) with flat washer under screw heads and extract PTO side crankcase half **no. 1**.



1. Plate
2. Flat washer

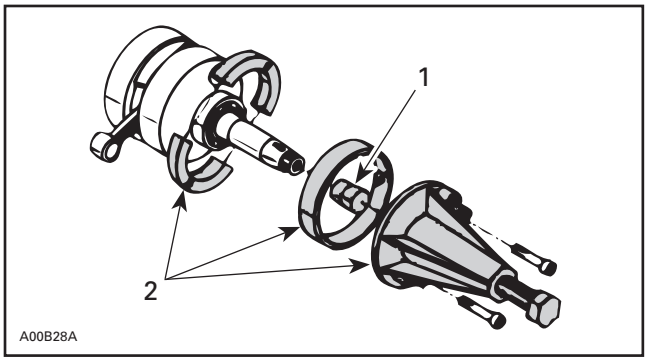
Heat to 110 - 120°C (230 - 248°F) all around bearing seat on MAG side. Install puller with plate, long bolts M8 x 110 mm and flat washers. Extract MAG side crankcase half **no. 2**.



1. Plate
2. Flat washers

To remove seals **no. 3 and 4**, push from outside the crankcase towards the inside.

To remove bearings **no. 5 and 6** from crankshaft use a protective cap and special puller as illustrated.



1. Protective cap
2. Special puller

INSPECTION

Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

ASSEMBLY

Install connecting rod with its lubrication slot on big end facing exhaust side.

Smear anti-seize lubricant (P/N 293 800 070) on part of crankshaft where bearing fits.

Prior to installation, place bearings into an oil container and heat the oil to 75°C (167°F) for 5 to 10 min. This will expand bearings and ease installation.

Install bearings with groove outward.

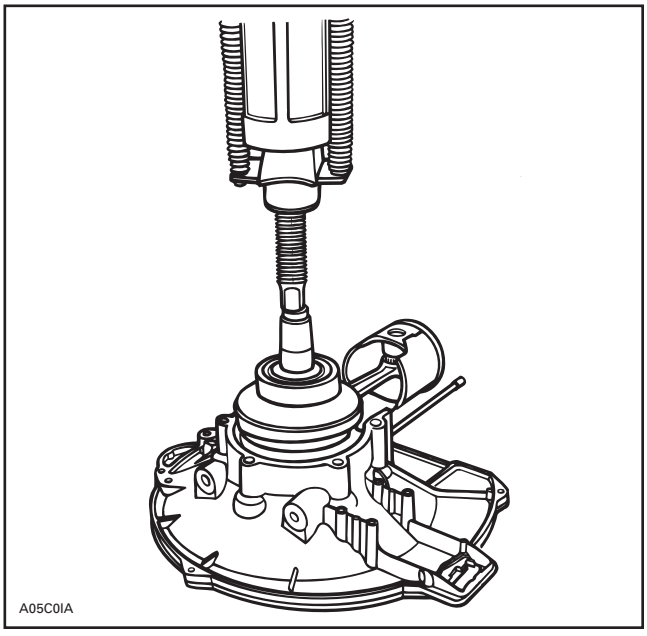
NOTE: Crankshaft end play requires adjustment only when crankshaft and/or crankcase is replaced. Prior to magneto side bearing installation, determine crankshaft end play and install required shim(s) on crankshaft extension. For the crankshaft end play adjustment procedure, refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

Prior to crankcase adjoining, install a protector sleeve on each crankshaft extension to prevent oil seal damage. Apply a light coat of lithium grease on seal lip. Spray some new injection oil on all moving parts of the crankshaft.

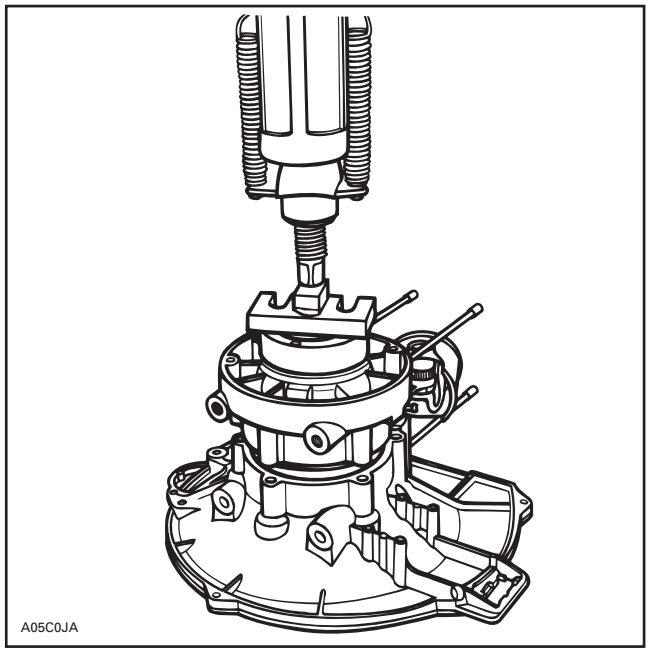
Install crankshaft seals with pusher (P/N 420 277 875) for MAG side seal **no. 4** and pusher (P/N 420 876 660) for PTO side seal **no. 3**.

CAUTION: To ensure appropriate crankshaft bearing lubrication, seal outer surface must be pressed against seal crankcase shoulder.

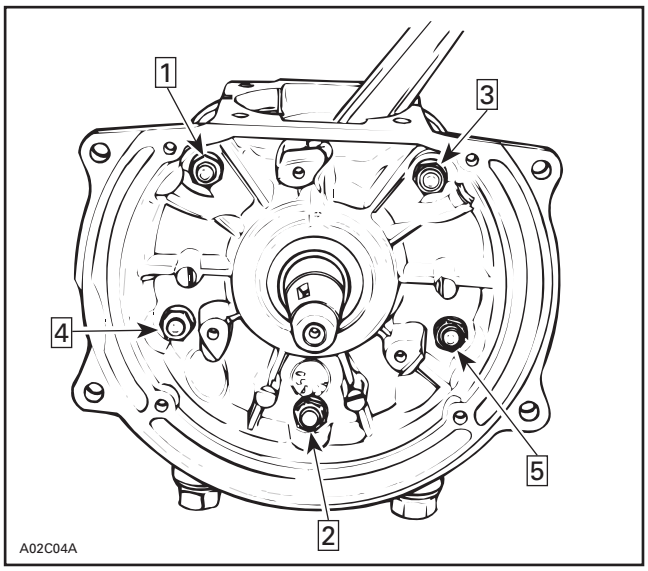
Using a press, install crankshaft into MAG side crankcase half.



Press down PTO side crankcase half onto crankshaft using appropriate spacer(s).



Torque the screws **no. 7** to 22 N•m (16 lbf•ft) following illustrated sequence.



443 AND 552 ENGINES

SERVICE TOOLS

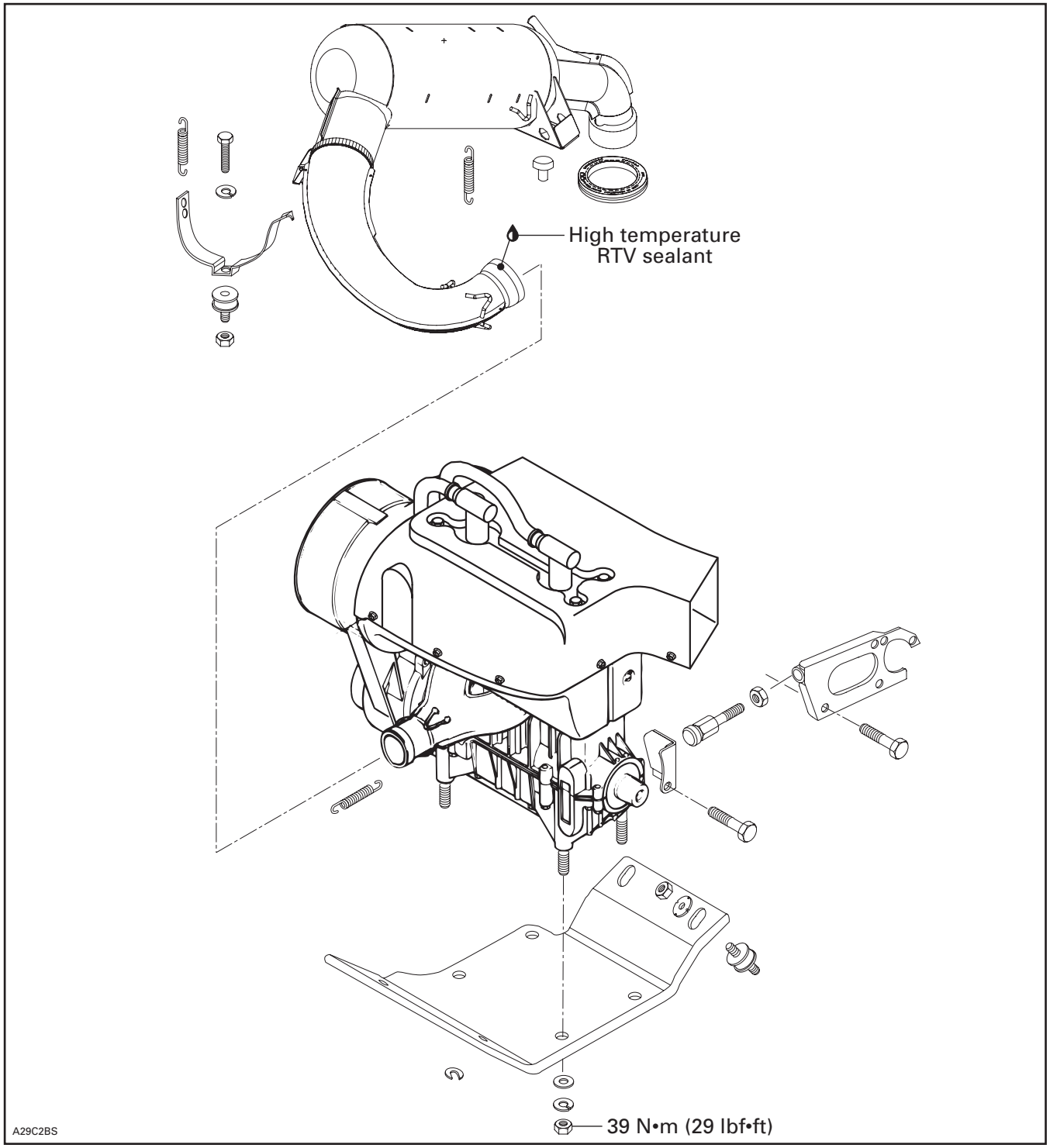
Description	Part Number	Page
bearing heater	529 035 969	70, 79
circlip installer	529 035 686	72
distance gauge	420 876 822	79
distance gauge	529 035 965	80
feeler gauge	420 876 620	79
piston circlip installer	529 035 561	71
piston pin puller	529 035 503	67
protective cap	420 876 552	77
protective cap	420 876 557	78
rubber pad	529 023 400	67
screws	420 840 681	77
support plate	529 035 976	80
temperature indicator stick	529 035 970	79

SERVICE PRODUCTS

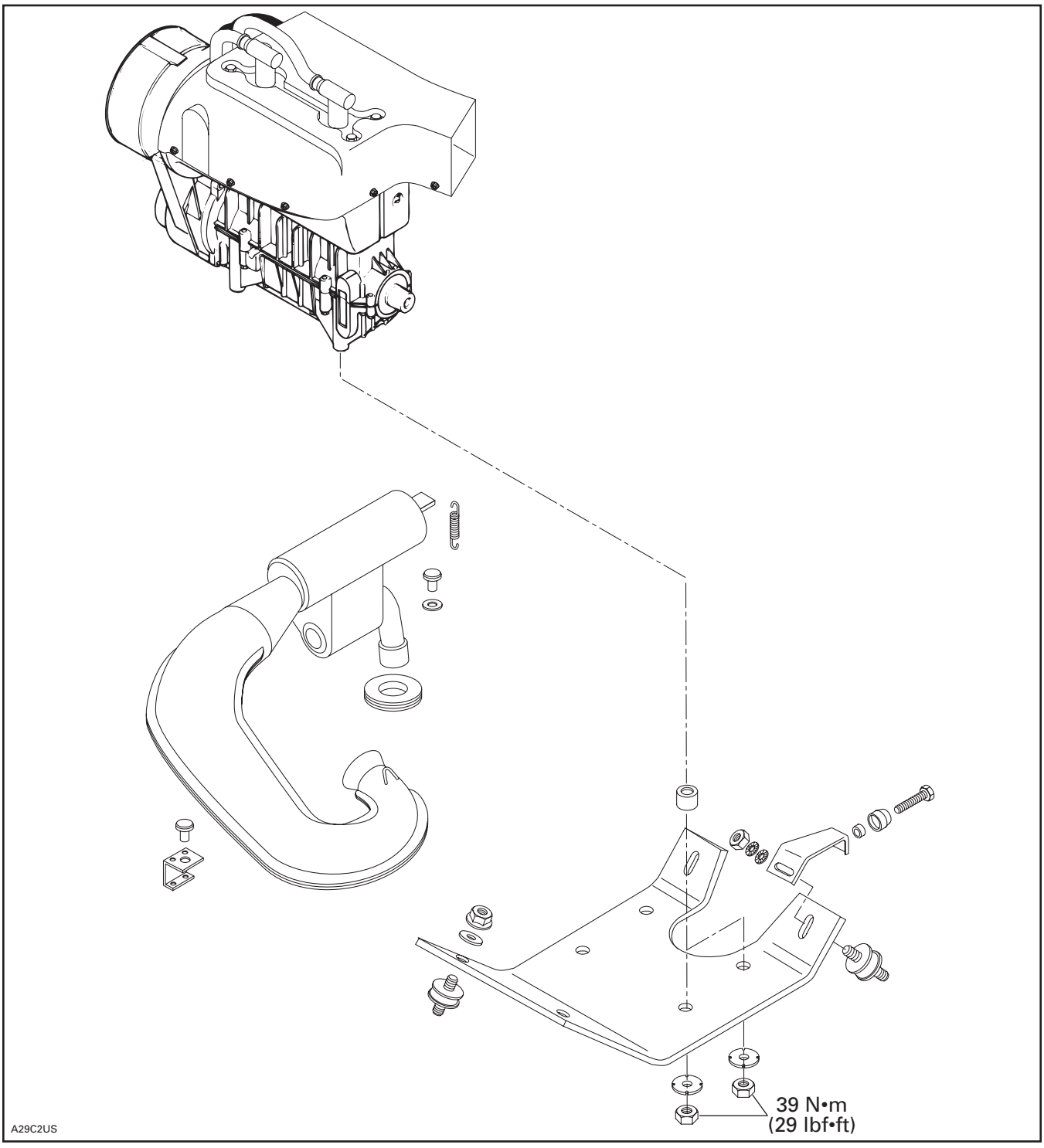
Description	Part Number	Page
anti-seize lubricant	413 701 000	78
Isoflex grease	293 550 021	81
Loctite 518	293 800 038	73
Loctite 5910	293 800 081	82
Loctite Chisel	413 708 500	67, 73, 77
pulley flange cleaner	413 711 809	78
RTV sealant	293 800 090	64
synthetic grease	413 711 500	77

ENGINE REMOVAL AND INSTALLATION

443 Engine



552 Engine



ENGINE REMOVAL AND INSTALLATION

Disconnect or remove the following:

⚠ WARNING

Before disconnecting any electrical wire in starter system always first disconnect the BLACK negative battery cable (on electric starting models).

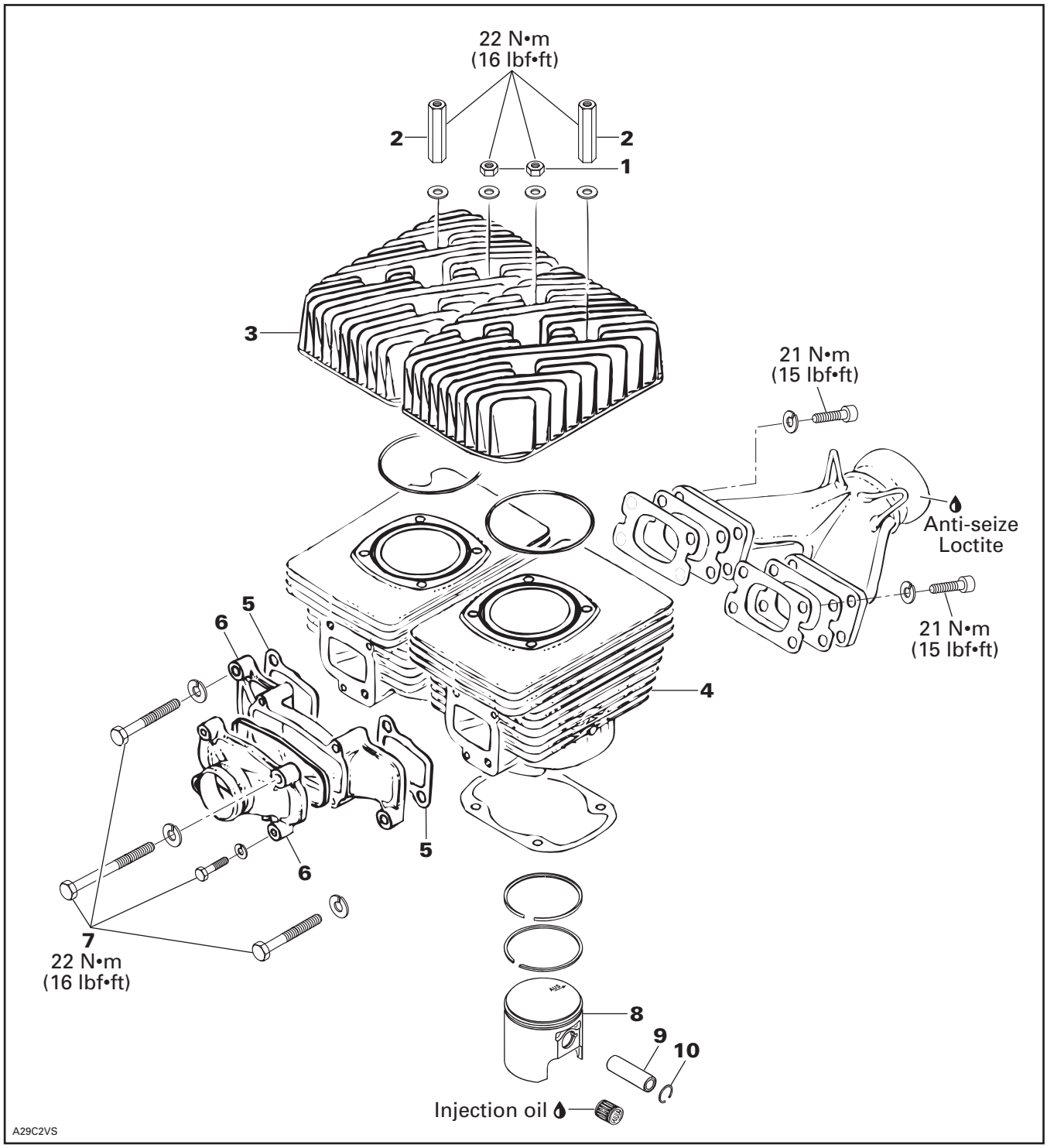
- negative cable from battery (on electric starting models)
- guard
- drive belt
- drive pulley using appropriate puller, refer to DRIVE PULLEY
- air silencer and carburetors
- impulse line from engine crankcase
- electrical connector housings
- exhaust pipe
- oil pump inlet line and plug it
- oil pump cable
- rewind cable: tie a knot near rewind housing and remove starting grip.

Tighten fasteners to recommended torque in appropriate exploded view.

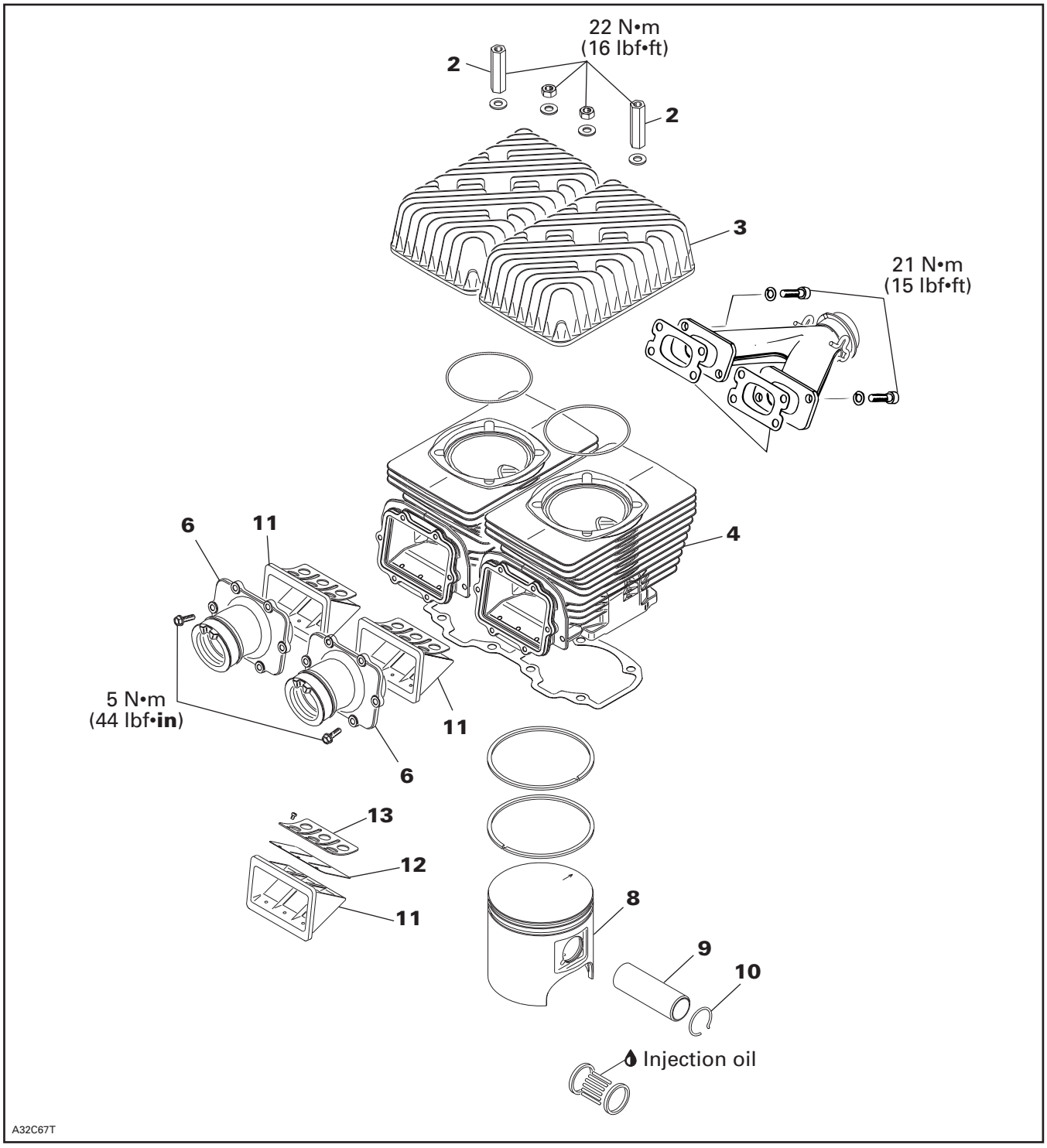
Apply high temperature RTV sealant (P/N 293 800 090) on metal-to-metal exhaust joints.

TOP END

443 Engine



552 Engine


22 N•m
(16 lbf•ft)
2
2
3
21 N•m
(15 lbf•ft)
4
6
11
5 N•m
(44 lbf•in)
11
6
13
12
11
8
9
10
Injection oil
A32C67T

GENERAL

CAUTION: While performing any engine related procedure, always make sure that the working area is clean and free from dust or particles to reduce the risk of damaging the engine.

TROUBLESHOOTING

Before completely disassemble engine, check airtightness. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

NOTE: The following procedures can be done without removing the engine from chassis.

CLEANING

Discard all gaskets. Use Loctite Chisel (P/N 413 708 500) to clean mating surfaces.

Clean all metal components in a non-ferrous metal cleaner.

Scrape off carbon formation from cylinder exhaust port, cylinder head and piston dome using a wooden spatula.

NOTE: The letters "AUS" and arrow on the piston dome must be visible after cleaning. Clean the piston ring grooves with a groove cleaner tool, or with a piece of broken ring.

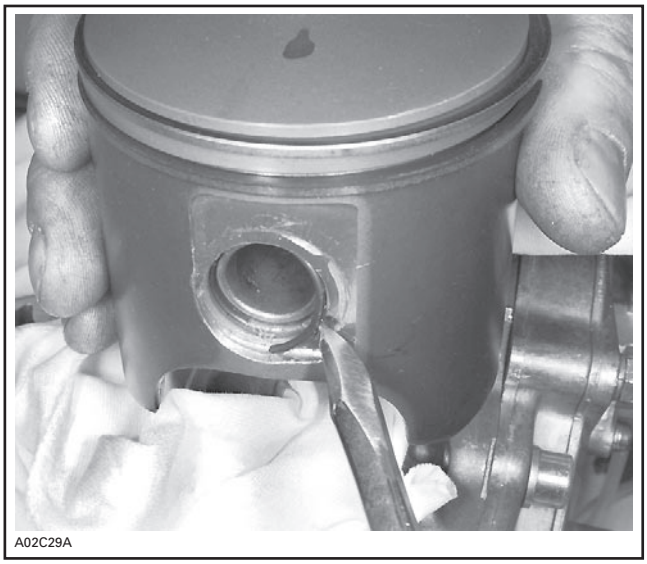
DISASSEMBLY

Remove top fan cowl, intake sockets and lower fan cowl.

Remove cylinder heads.

Remove cylinders.

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase to prevent circlips no. 10 from falling into crankcase. Then with a pointed tool inserted in piston notch, remove both circlips from piston no. 8.


A02C29A

TYPICAL

443 and 552 Engines

On these engines, piston pin needle bearing is mounted without a cage.

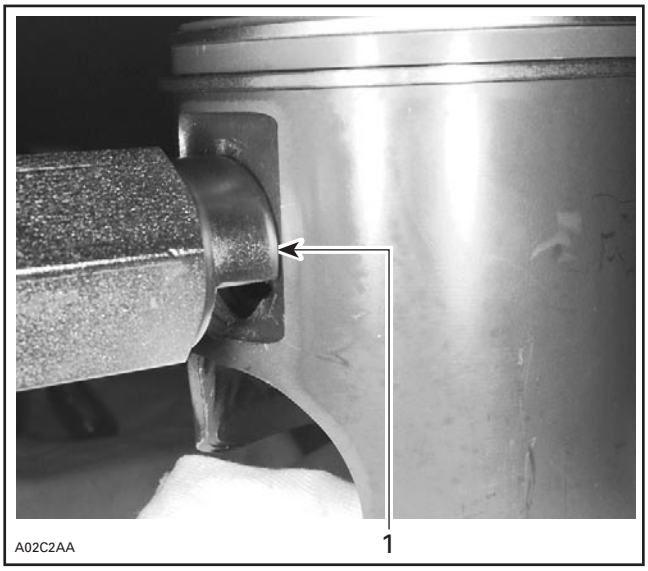
NOTE: The PTO cylinder or fan housing have to be removed to give access to MAG piston pin with the puller.

Use piston pin puller along with sleeve kit and locating sleeve as per following table.

ENGINE	PULLER P/N	SLEEVE KIT P/N	LOCATING SLEEVE P/N
443	529 035 503	529 035 541 (18 mm)	529 023 800
552	529 035 503	529 035 542 (20 mm)	529 023 800

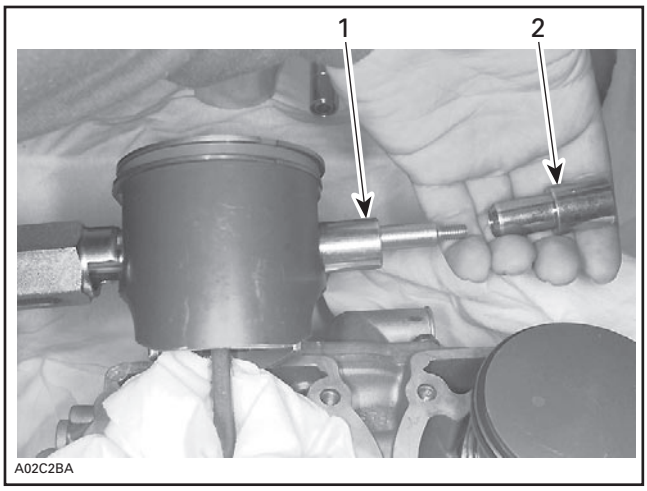
NOTE: The locating sleeve is the same that contains new cageless bearing.

Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.



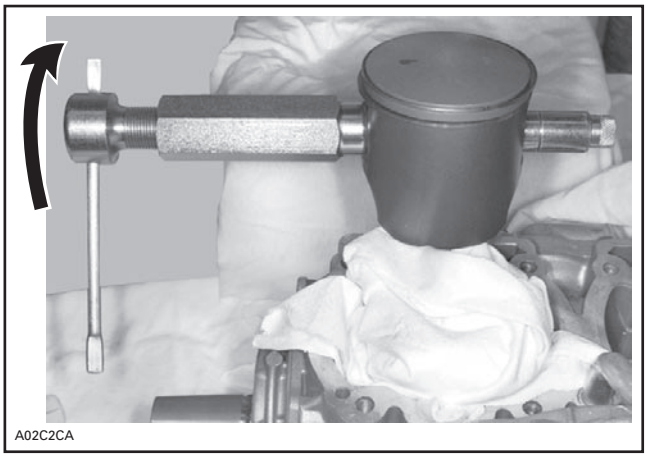
TYPICAL
1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.

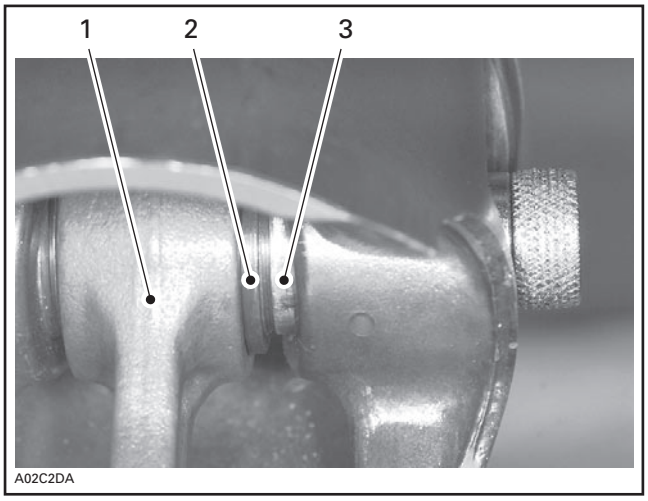


TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Pull out piston pin **no. 10** by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

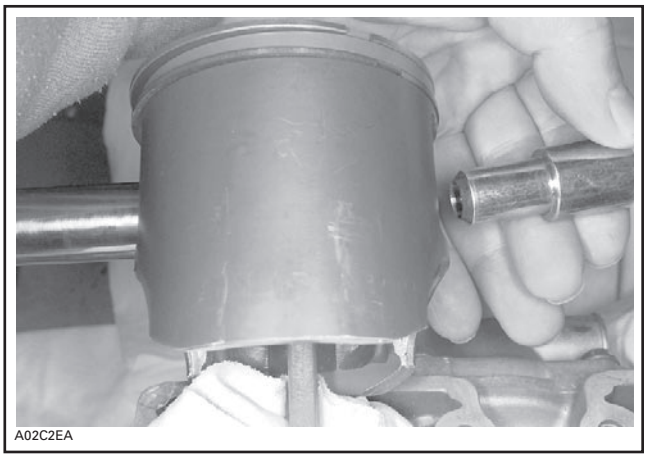


TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

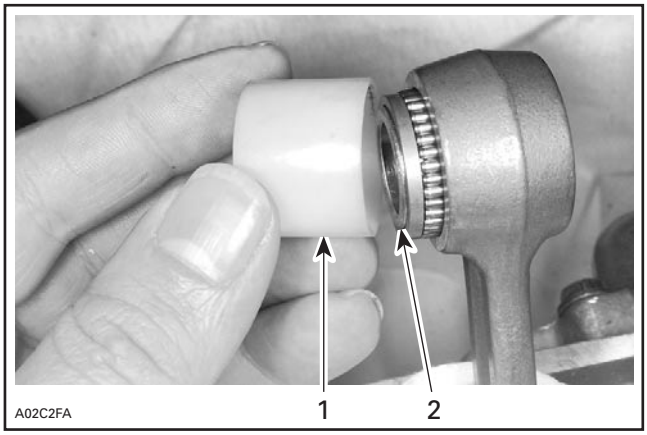
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

NOTE: 0.25 and 0.5 mm oversized piston and rings are available if necessary.

Use a locking tie to fasten all needles and thrust washers along with locating sleeve.

INSPECTION

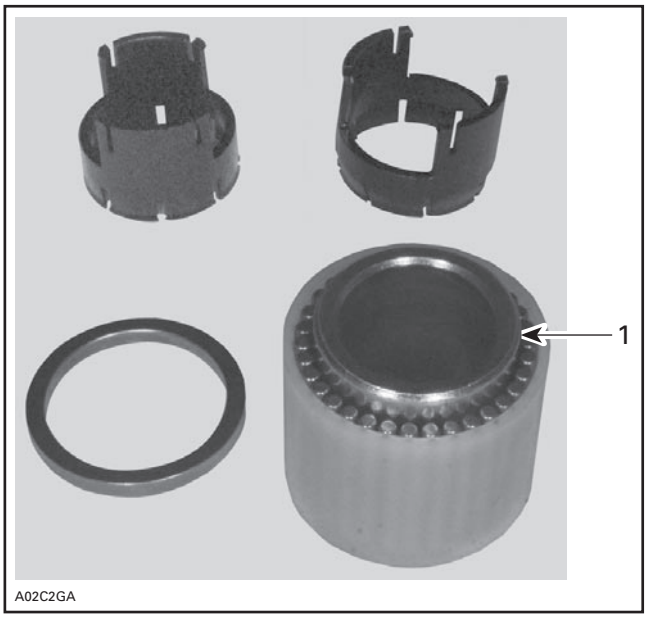
Refer to ENGINE DIMENSION MEASUREMENT.

ASSEMBLY

443 and 552 Engines

When reinstalling original needle bearings, make sure that 31 needles (in case of 443 engine) or 34 (in case of 552 engine) are inserted between sleeve and locating sleeve.

When installing a new cageless bearing, replace half plastic cages by sleeve.



TYPICAL
1. Sleeve

Grease thrust washers and install them on each end of needles.

Insert cageless bearing into connecting rod.

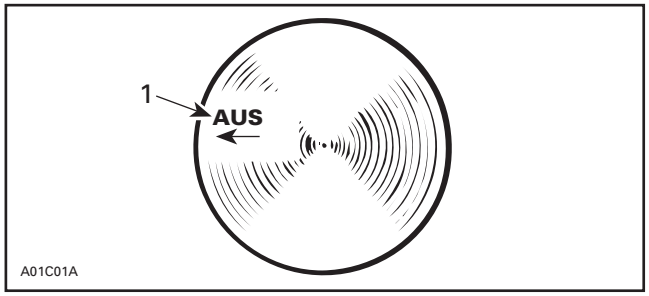
TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Heat piston using bearing heater (P/N 529 035 969).

A32CBHA

CAUTION: Piston temperature must not exceed 46°C (115°F). NEVER USE DIRECT FLAME to heat the piston and never freeze the pin. Inappropriate heating procedure(s) may damage the piston.

Mount piston over connecting rod with the letters "AUS" (over an arrow on the piston dome) facing in the direction of exhaust port.



A01C01A

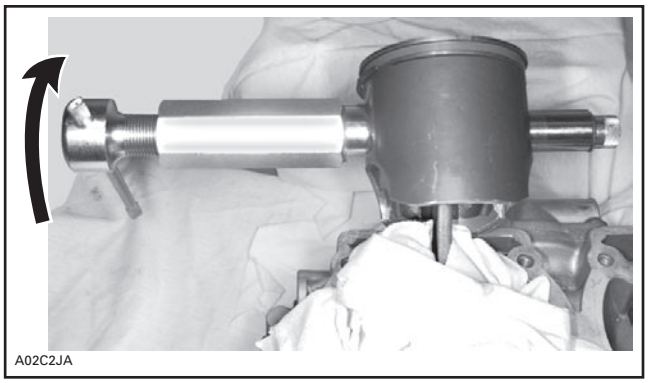
1. Exhaust

Install shouldered sleeve.

A02C2IA

TYPICAL — SHOULDERED SLEEVE INSTALLATION

Install piston pin puller and turn handle until piston pin is correctly positioned in piston.


A02C2JA

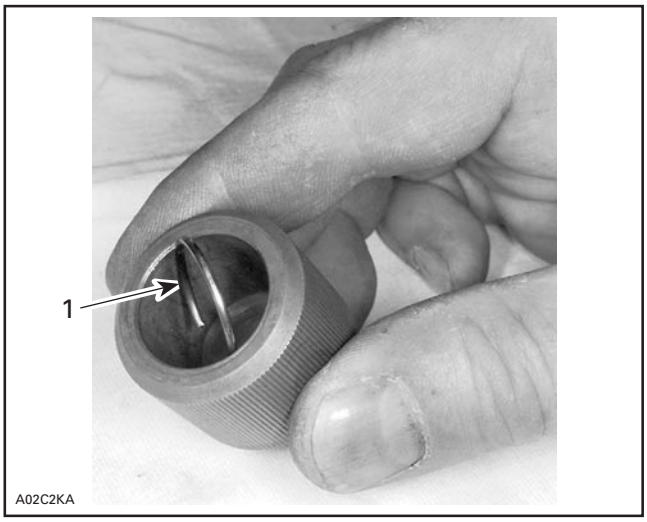
TYPICAL

Remove piston pin puller and sleeve kit.

443 Engine

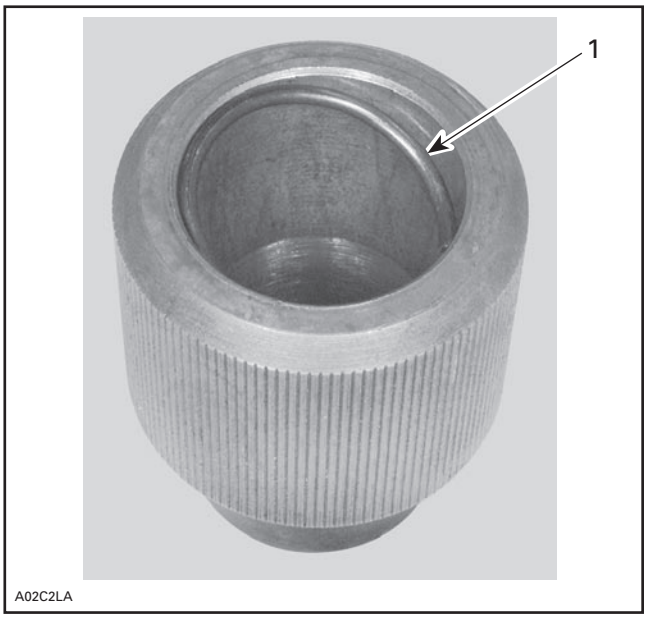
To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use piston circlip installer (P/N 529 035 561).

Insert circlip in tool at an angle.



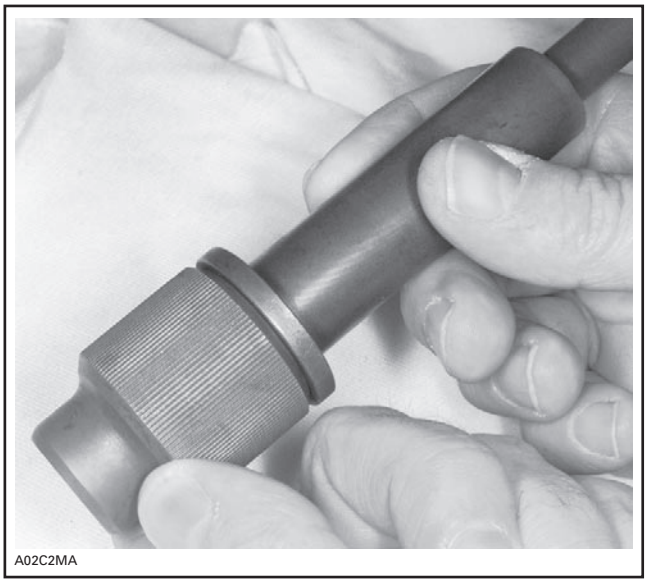
1. Circlip

Square it up using a finger.

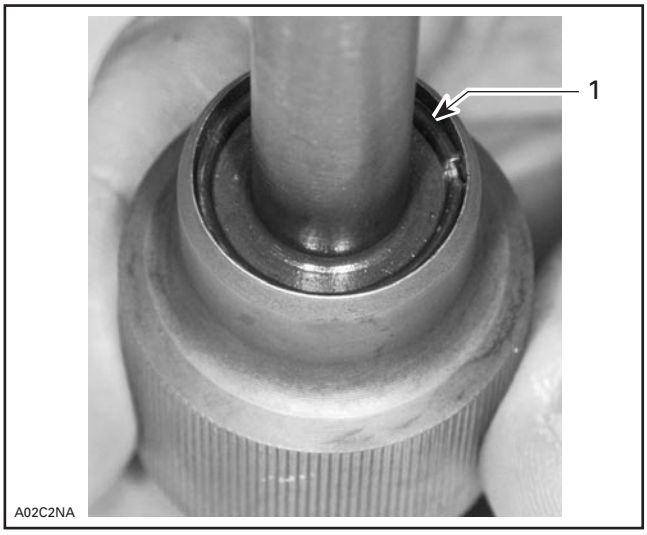


1. Circlip

Continue to square it up using round end of circlip installer.

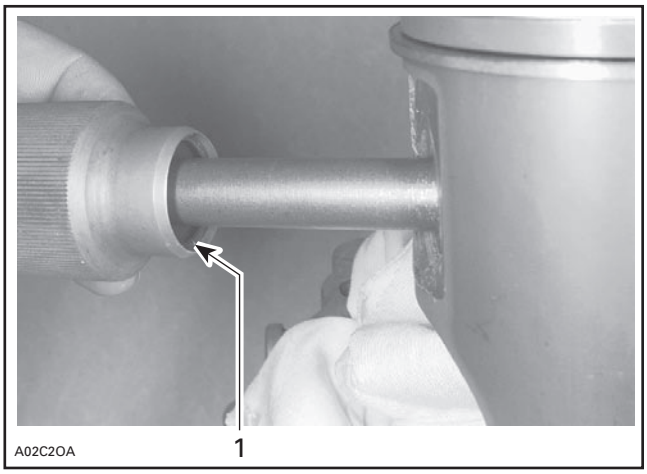


Using square end of tool, push circlip in until it rests in groove.



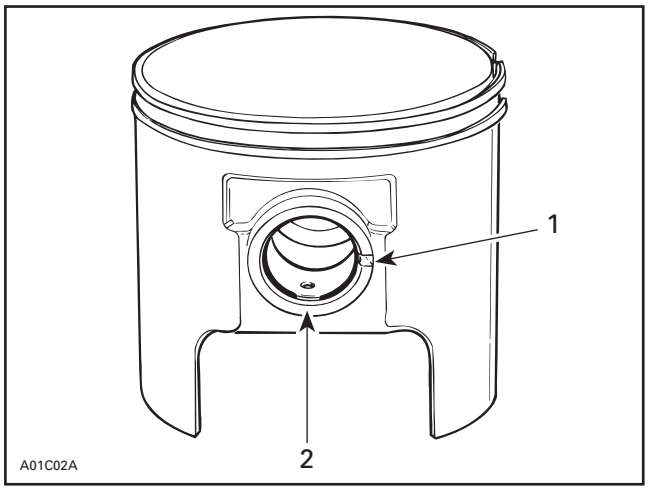
1. Circlip in groove

Mount tool in piston making sure that circlip break is facing down.



TYPICAL
1. Circlip break facing down

Hold tool firmly against piston then strike on round end of tool with a plastic hammer. Circlip will move from tool groove to piston groove.



1. Piston notch
2. Circlip break at 6 o'clock

CAUTION: Circlips must not move freely in the groove after installation. If so, replace them.

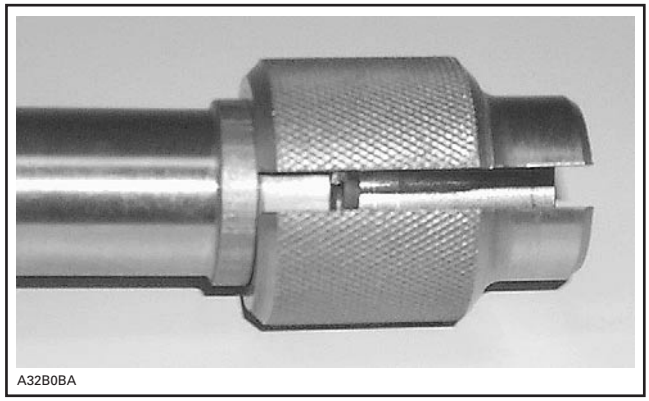
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.

552 Engine

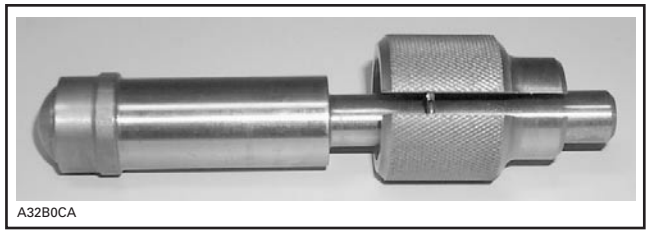
Use circlip installer (P/N 529 035 686) to install new mono-hook circlips no. 10.

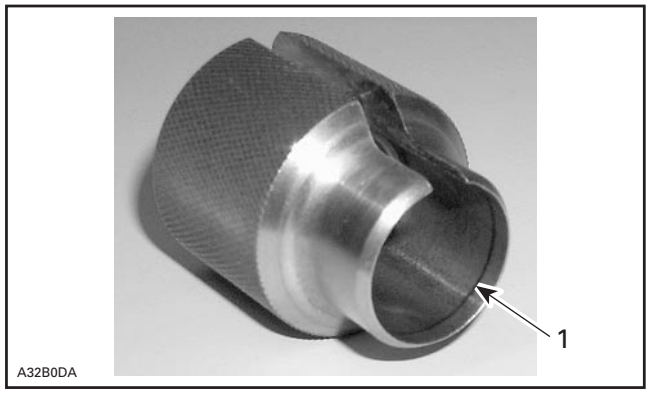
Insert circlip into support in such a way that when installed in piston groove, the tab will face upward.

With round end of pusher, position circlip perpendicular to the support axis.



With the other end of the pusher, push circlip into the support groove.

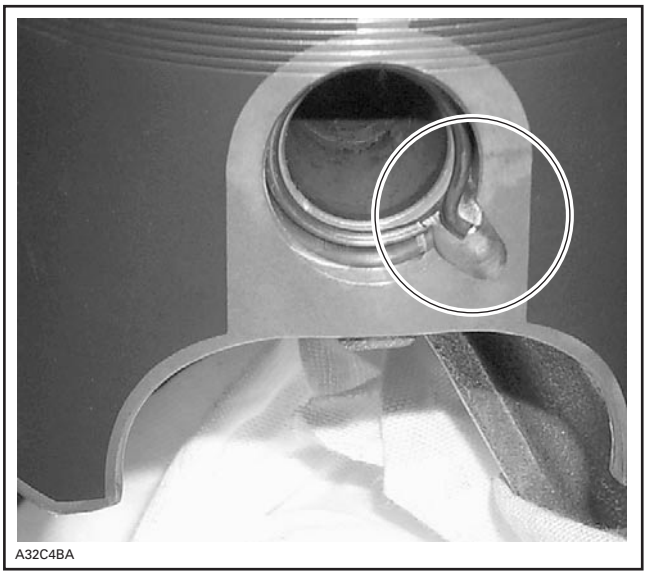




1. Groove

CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to insert circlip in place. Take care to install new circlips with tab toward top as per following photo.



TAB TOWARD TOP

CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one as on a second attempt circlip will lose its normal retaining capabilities.

CAUTION: Circlips must not move freely after installation; if so, replace them.

Clean cylinders and crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

Coat crankcase mating surface with Loctite 518 (P/N 293 800 038). Choose the right gasket thickness according to combustion chamber volume. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT. Install it on crankcase. Coat gasket with Loctite 518.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.

All Engines

Before inserting piston in cylinder **no. 4**, lubricate the cylinder with new injection oil or equivalent.

Install proper ring compressor on piston assembly.

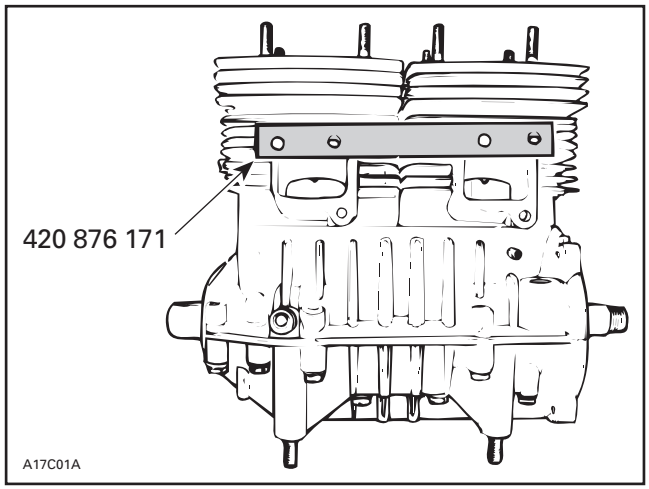
ENGINE	RING COMPRESSOR P/N
443	420 876 090
552	420 876 972

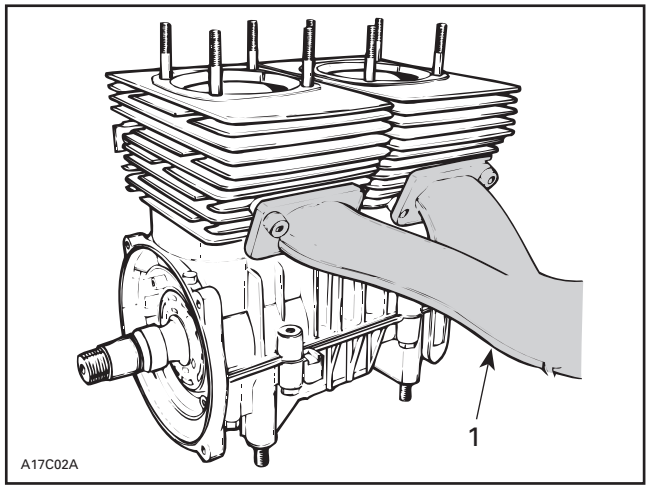
NOTE: The ring compressor will not fit on over size pistons.

Check flatness of intake sockets **no. 6**. Refer to ENGINE DIMENSION MEASUREMENT and look for CHECKING SURFACE FLATNESS.

At cylinder **no. 4** and/or cylinder head **no. 3** installation, use aligning tool or exhaust manifold itself to ensure sealing of intake manifold and exhaust before tightening cylinder head nuts.

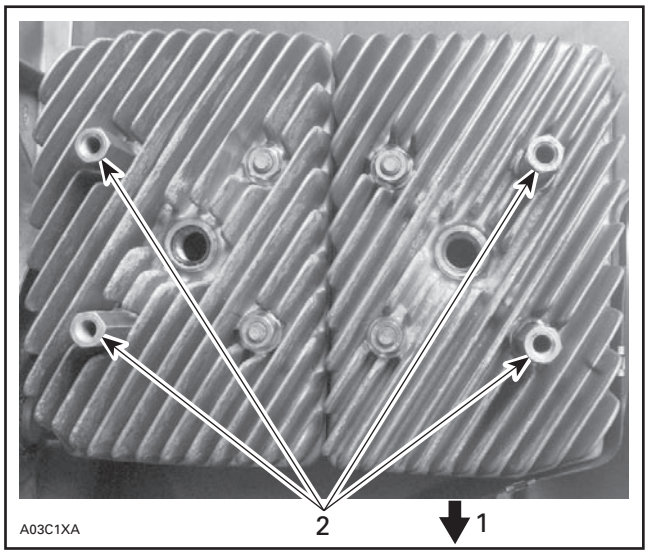
ENGINE	ALIGNING TOOL P/N
443 and 552	420 876 171





1. Or use exhaust manifold to align cylinders

Position distance nuts **no. 2** as shown below.



1. Exhaust
2. Distance nuts

Cross torque cylinder head nuts **no. 1** and **no. 2** to 22 N•m (16 lbf•ft); torque each cylinder head individually.

Install armature plate, fan housing and then air deflector.

Install a gasket on each side of the air deflector.

Torque intake socket bolts to 22 N•m (16 lbf•ft).

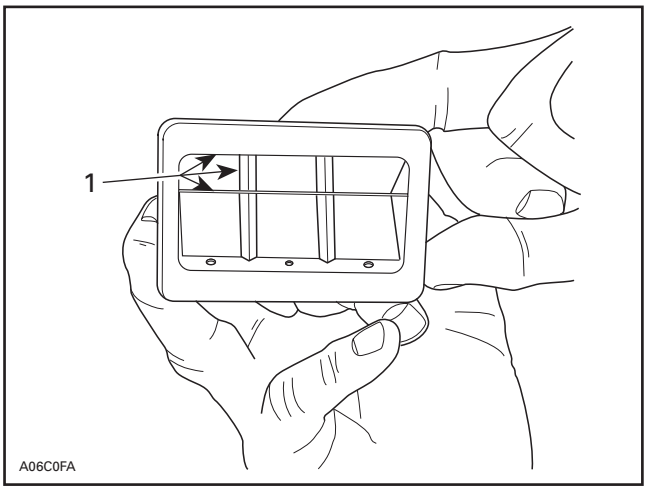
552 Engine

12, Reed Valve

Blades have a curved shape. Install with their curve facing reed block.

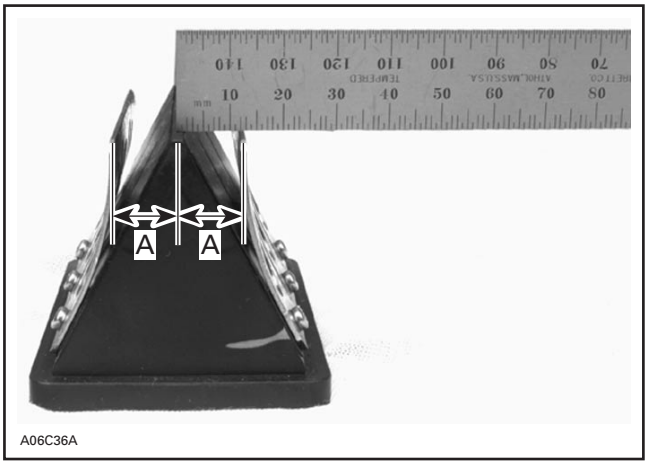
With blade stopper **no. 13** removed, check reed valve for proper tightness. There must be no play between blade and valve body when exerting a finger pressure on blade at blade stopper location.

In case of a play, turn blade upside down and recheck. If there is still a play, replace blade and/or valve body.



1. No play

Check distance from blade stopper inner edge and distance from center of reed valve block.



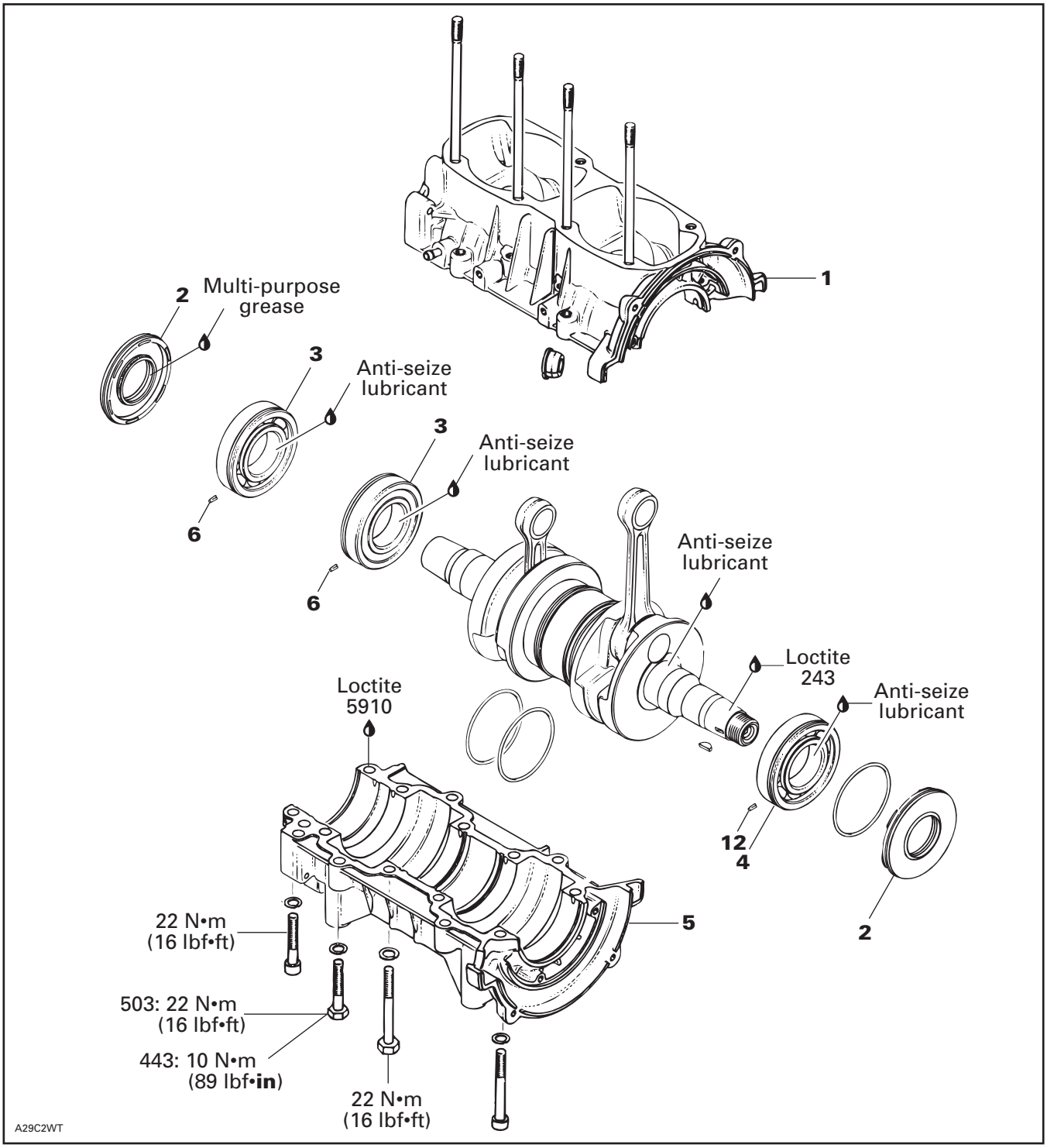
TYPICAL
A. 14.75 - 0, + 0.75 mm (.580 - 0, + .030 in)

Bent blade stopper as required to obtain the proper distance.

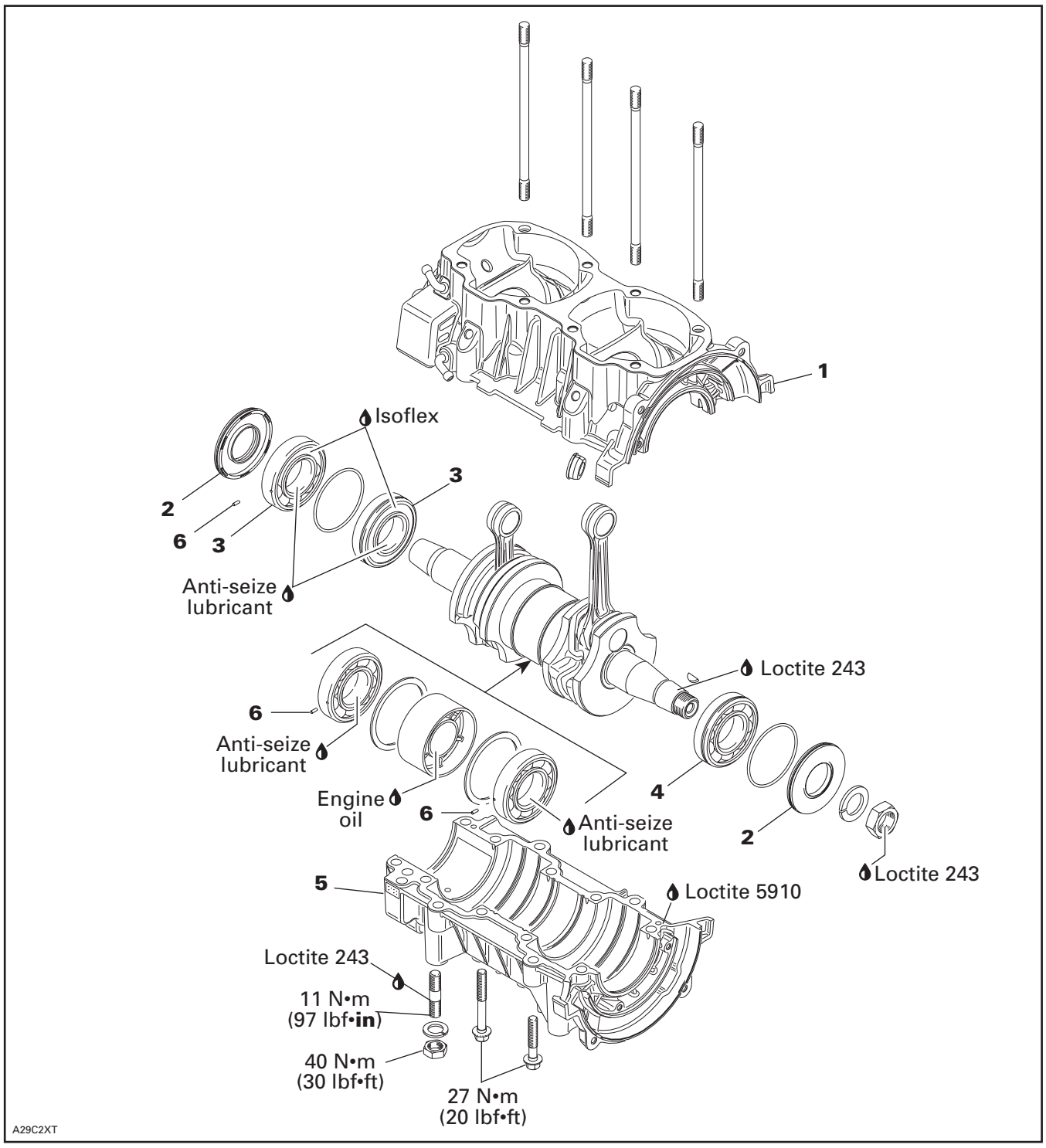
Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

BOTTOM END

443 Engine



552 Engine


1
Isoflex
2
3
6
3
Anti-seize lubricant
Loctite 243
6
Anti-seize lubricant
4
Engine oil
6
Anti-seize lubricant
2
Loctite 243
5
Loctite 5910
Loctite 243
11 N•m (97 lbf•in)
40 N•m (30 lbf•ft)
27 N•m (20 lbf•ft)
A29C2XT

NOTE: Engine must be removed from chassis to perform the following procedures.

Remove engine from chassis.

Remove fan guard, rewind starter, starting pulley, trigger coil wire from 4-connector housing, magneto flywheel then fan housing.

Remove stator plate.

CLEANING

Discard all seals, gaskets and O-rings.

Clean all metal components in a non-ferrous metal cleaner. Use Loctite Chisel (P/N 413 708 500) accordingly.

Remove all trace of Loctite from crankshaft taper.

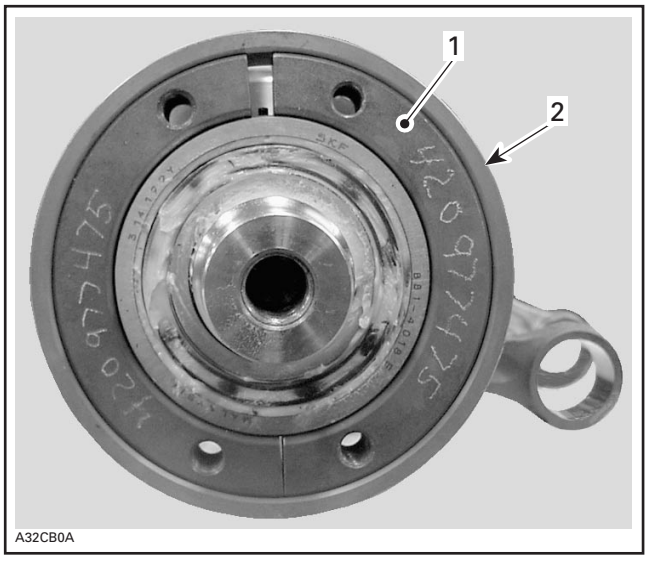
Remove old sealant from crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

DISASSEMBLY

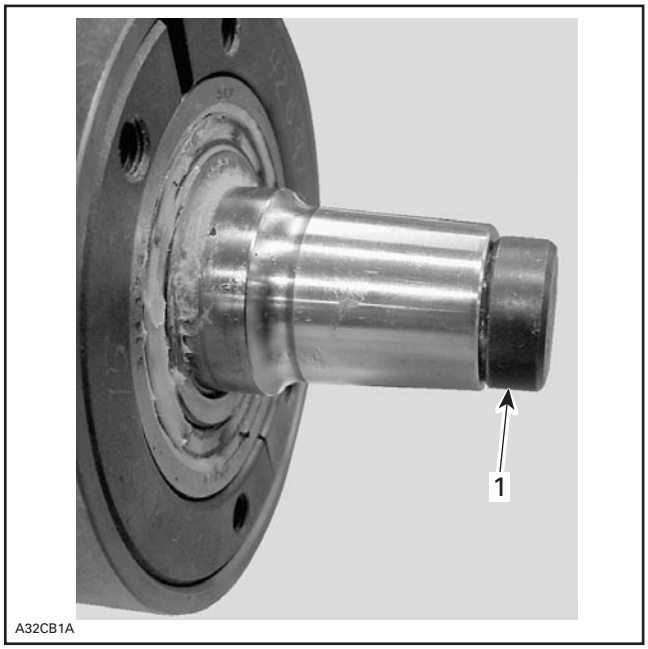
To remove PTO side bearing **no. 3** from crankshaft, install half rings on the bearing.

NOTE: Remove the bearing O-ring prior to installation of half ring.



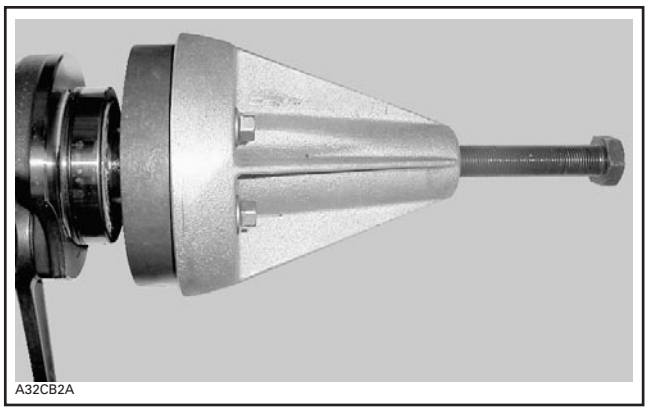
1. Half ring
2. Puller ring

Apply synthetic grease (P/N 413 711 500) on the crankshaft end and install protective cap (P/N 420 876 552).



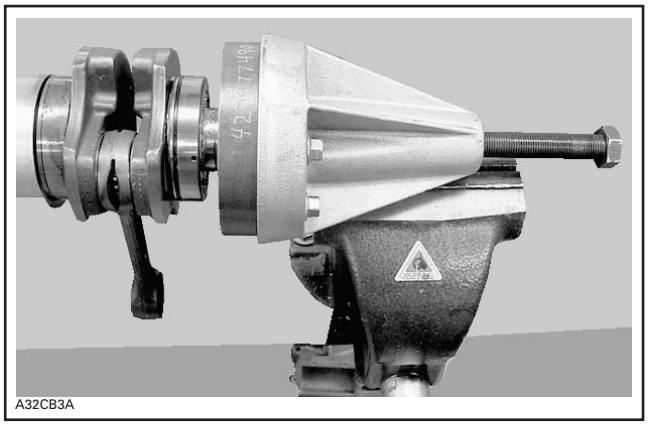
1. Protective cap

Using screws (P/N 420 840 681), install bearing puller on the half rings.



PULLER INSTALLED ON THE HALF RINGS

Secure the bearing puller in a vise by one of its rib.


A32CB3A

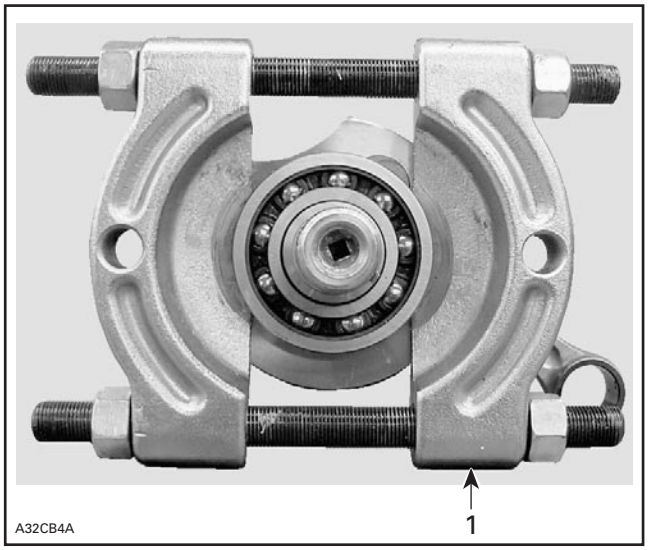
BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool to tighten the puller bolt.

Lubricate the puller bolt and then proceed with tightening the puller bolt until the bearing comes out.

Follow the same procedure for the inner bearing.

NOTE: In the case of damaged bearing or less clearance between crankshaft counterbalance and the bearing, use bearing separator (Snap-On tool (P/N CJ951)) or (SPX/OTC tool (P/N 1124)) to facilitate the removal.



A32CB4A

1. Bearing separator

Procedure for MAG side bearings **no. 4** is same as of PTO side with the exception of protective cap (P/N 420 876 557).

INSPECTION

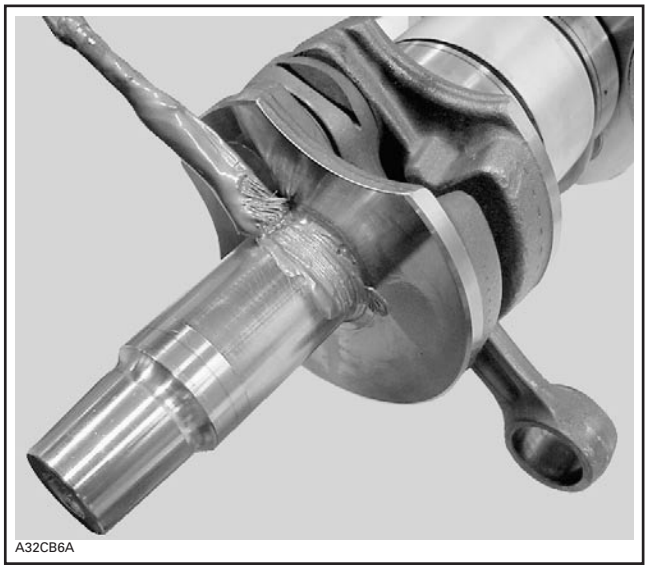
Refer to ENGINE DIMENSIONS MEASUREMENT.

ASSEMBLY

Clean crankshaft end with sand paper no. 180 and remove all residue using pulley flange cleaner (P/N 413 711 809).

A32CB5A

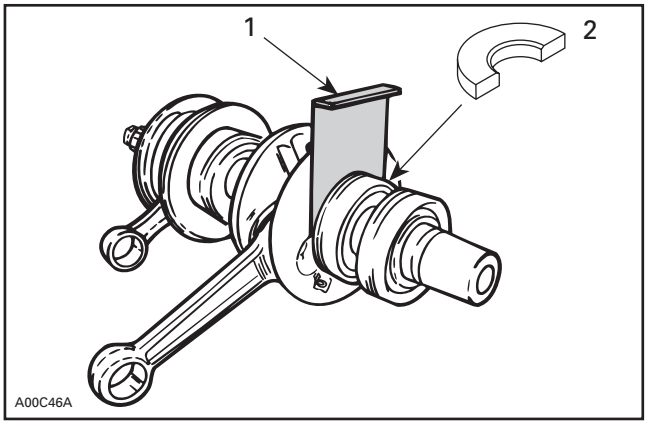
Smear anti-seize lubricant (P/N 413 701 000) on part of crankshaft where bearing fits.


A32CB6A

443 Engine

To check proper clearance between bearing **no. 3** and crankshaft counterbalance, use feeler gauge (P/N 420 876 620).

Mount second bearing with distance gauge (P/N 420 876 822) for 443 for proper positioning.



1. Feeler gauge
2. Distance gauge

Prior to installation, heat the bearing as per the procedure given further in this subsection.

This will expand bearings and ease installation. Install bearings with groove as per exploded view.

552 Engine

Heat up the bearing(s) using bearing heater (P/N 529 035 969). This will expand bearings and ease installation. If required, put a suitable plate or shim to avoid the direct contact between integrated seal and the heating surface.

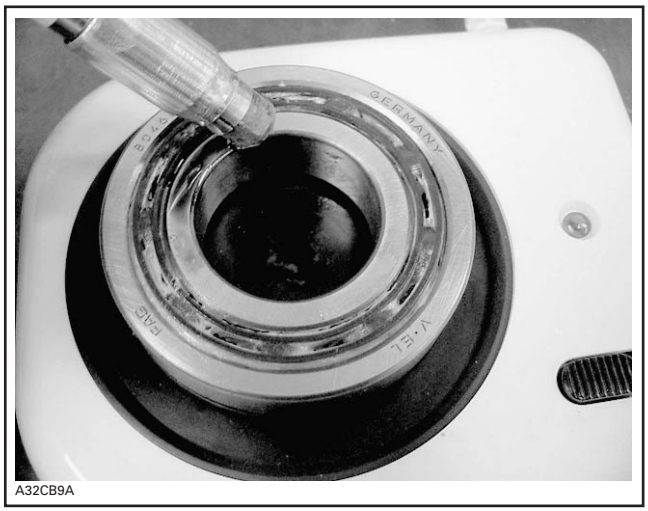
CAUTION: Bearing should not be heated to more than 80°C (176°F). Do not heat bearing with direct flame or heat gun or heated oil. Inappropriate heating procedure(s) may cause inner seal failure.

Turn bearing(s) several times during heating process for heating it/them properly.

NOTE: Normally it takes approximately 10 minutes to heat up a bearing. So in the event of replacing a bearing, it is recommended to start heating it prior to removal. Two bearings can be heated at the same time on one bearing heater.

1. Bearings

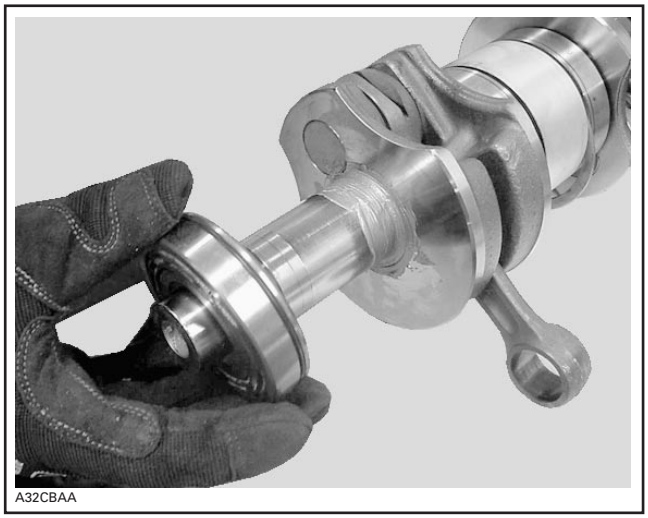
Touch the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reaches the proper temperature.

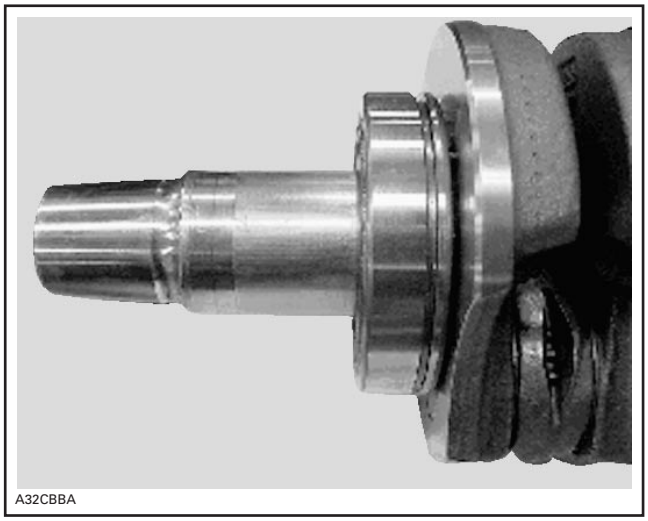


⚠ WARNING

Do not touch heated bearing with bare hands. Wear heat resisting gloves before handling the heated bearing(s).

Slide in the inner PTO bearing with the integrated seal facing crankshaft. Push bearing to end position.

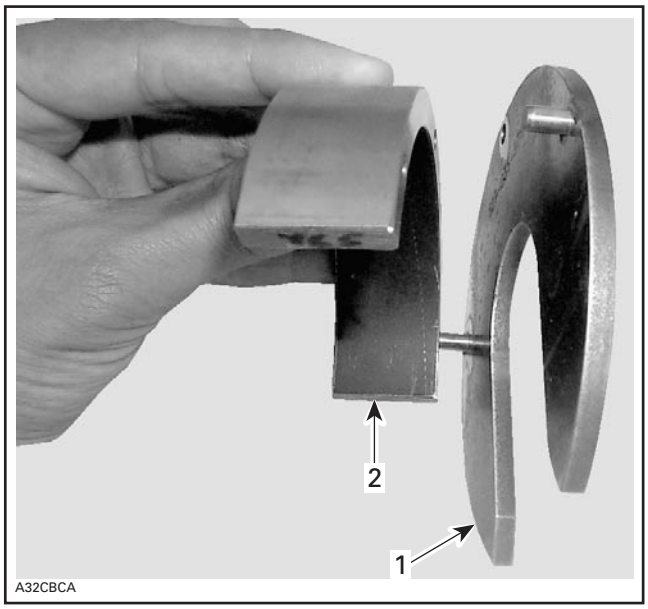

A32CBAA


A32CBBA

BEARING TO END POSITION

Install the O-ring.

Make a bearing locator tool using support plate (P/N 529 035 976) and distance gauge (P/N 529 035 965).



A32CBCA

1. Support plate
2. Distance gauge

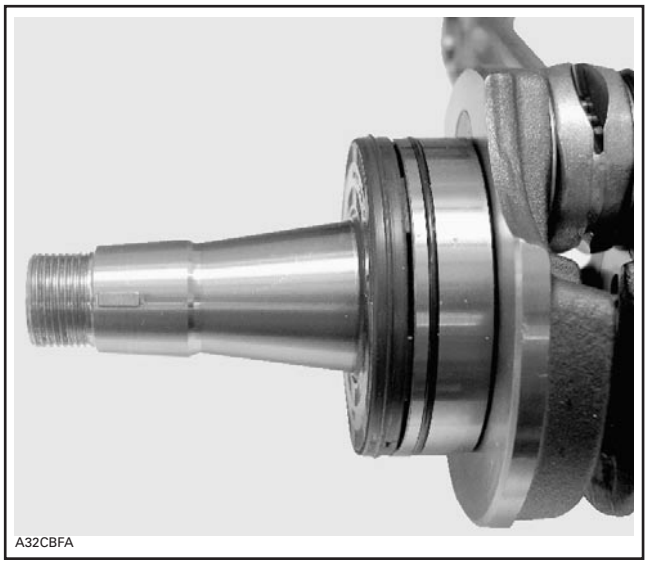
Install bearing locator tool.

A32CBDA

Slide in the heated outer PTO bearing onto the crankshaft.

A32CBEA

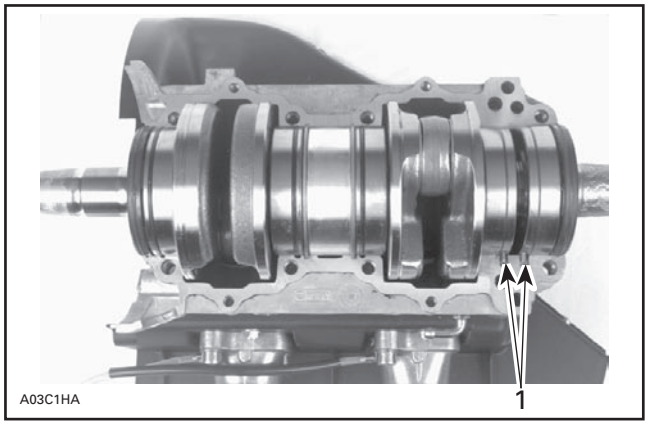
Install the MAG side heated bearing.


A32CBFA

All Engines

Bearings are pressed on crankshaft until they rest against radius. These radius maintain the gap needed for bearings lubrication.

When installing crankshaft, position drive pins **no. 6** as illustrated.



TYPICAL
1. Drive pins

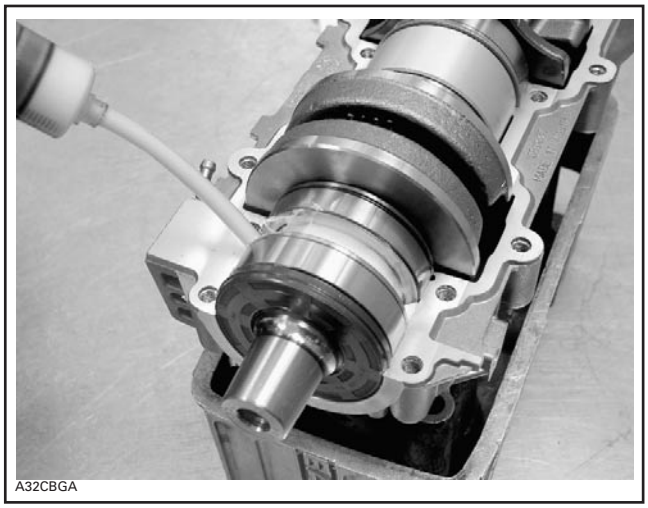
552 Engine

CAUTION: Use only the recommended Isoflex grease (P/N 293 550 021). Make sure not to push Isoflex grease between outside bearing race and half crankcase.

NOTE: The 50 g tube corresponds to 50 cc of grease.

Put 27 to 32 mL of grease in a syringe.

With the syringe, fill the PTO side ball bearings with 27 to 32 mL of Isoflex grease as shown below.

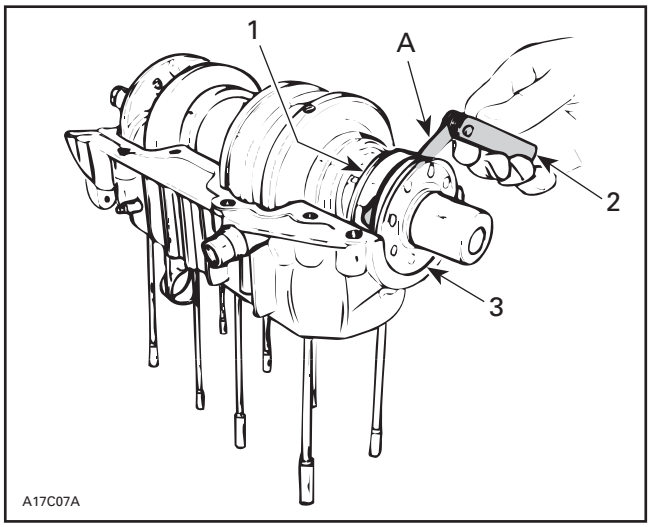

A32CBGA

All Engines

At seal **no. 2** assembly, apply a light coat of lithium grease on seal lip.

For bearing lubrication purpose, a gap of 1.0 mm (.040 in) must be maintained between seals and bearings.

When installing plain oil seals (seal without locating ring or without spacing legs), ensure to maintain 1.0 mm (.040 in) gap.



1. Bearing
2. Feeler gauge
3. Plain oil seal
A. 1 mm (.040 in)

Crankcase halves no. 1 and no. 5 are factory matched and therefore, are not interchangeable as single halves.

Crankcase Assembly

IMPORTANT: The total assembly sequence, including sealing compound spreading, screwing and torquing of bolts according to the proper sequence must be performed within 10 minutes. Do not wait between each bolt torquing. All bolts must be torqued in a row.

Before screwing both parts of crankcase, seal it with a Loctite 5910 (P/N 293 800 081).

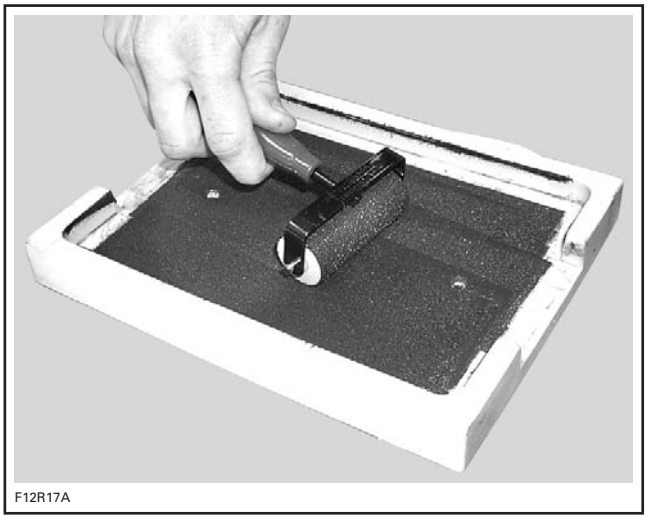
NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant (unlike the Dreibond sealing compound, using a finger will not affect the adhesion).

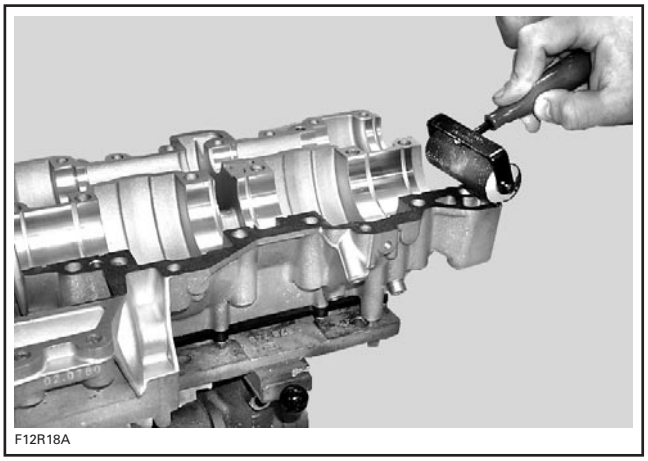
Use the silicone-based Loctite 5910 (P/N 293 800 081) on mating surfaces.

NOTE: The sealant curing time is similar to the Loctite 518 without using the Primer N.

CAUTION: Do not use Loctite 515 or 518 to seal crankcase. Do not use Loctite Primer N with the Loctite 5910. Using these products or non silicone-based sealant over a previously sealed crankcase with Loctite 5910 will lead to poor adhesion and possibly a leaking crankcase. These products are chemically incompatibles. Even after cleaning, the Loctite 5910 would leave incompatible microscopic particles.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.





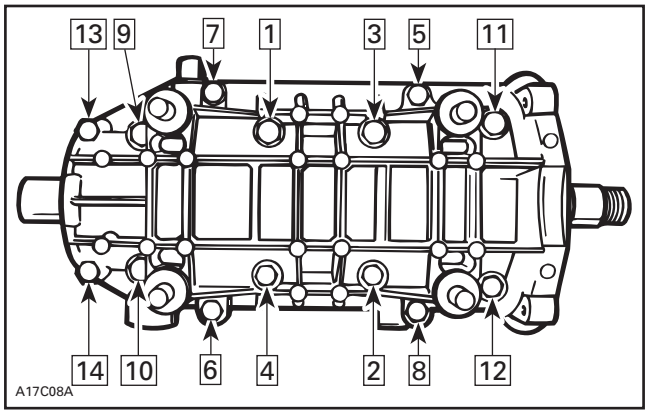
Do not apply in excess as it will spread out inside crankcase.

CAUTION: If sealant spreads out inside air compressor area, it could plug the compressor lubrication nipple and serious compressor damage may occur.

NOTE: Do not use Loctite Primer N with this sealant. The sealant curing time is similar to the Loctite 518 without using the Primer N, which is 4 to 24 hours.

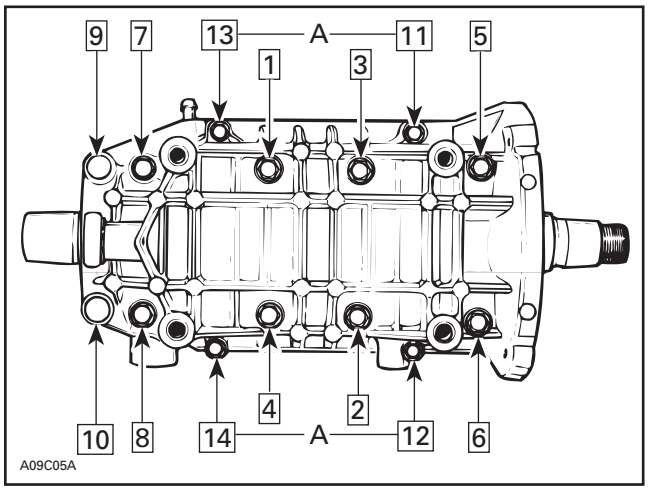
Screw all crankcase bolts in place in the following sequence and to the appropriate torque through a two steps torquing: first, screw bolts up to 60% of the final torque (13 N•m (115 lbf•**in**) for M8 bolts), then, tighten to the required torque (i.e. 22 N•m (16 lbf•ft)).

552 Engine



TIGHTENING SEQUENCE FOR 552 ENGINE TYPE

443 Engine



TIGHTENING SEQUENCE FOR 443 ENGINE TYPE
*A. 10 N•m (89 lbf•**in**). All the other screws are torqued to 22 N•m (16 lbf•ft)*

All Engines

To install magneto, refer to MAGNETO SYSTEM.

BREAK-IN

After rebuilding an engine always observe a break-in period as described in *Operator's Guide*.

593 AND 593 HO SDI ENGINES

SERVICE TOOLS

Description	Part Number	Page
20 mm sleeve kit	529 035 542	93
bearing heater	529 035 969	96, 104
bearing puller	529 036 004	102
circlip installer	529 035 686	97
crankshaft protector	420 876 552	102
crankshaft protector	420 876 557	102–103
half rings	420 977 479	102
piston pin puller	529 035 503	93
puller ring	420 977 494	102
rubber pad	529 023 400	92
screws	420 840 681	102
support plate	529 035 976	105
temperature indicator stick	529 035 970	104
vacuum/pressure pump	529 021 800	90

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	413 701 000	103
BOMBARDIER LUBE	293 600 016	102
Dreibond sealing compound	420 297 906	95
grease	413 711 500	102
Isoflex grease	293 550 021	105–106
Loctite 518	293 800 038	98
Loctite 5910	293 800 081	107
Loctite Chisel	413 708 500	98, 102
Petamo grease	420 899 271	103
pulley flange cleaner	413 711 809	103
Ultra Copper	413 710 300	86

Skandic WT LC/SUV 600/Expedition TUV 600 HO SDI

REMOVAL FROM VEHICLE

Open hood.

Expedition TUV 600 HO SDI

Using B.U.D.S. software, remove the pressure in the fuel system. Refer to ENGINE MANAGEMENT.

All Models

Remove tuned pipe and muffler.

Drain engine coolant.

Remove or unplug the following then lift off engine from engine compartment.

NOTE: Use of a hoist is recommended.

– guard
– air silencer
– drive belt
– rewind starter handle
– drive pulley (not necessary if engine is not disassembled)
– hood
– carburetors/throttle body (as applicable)
– impulse hose and electrical connectors
– oil injection inlet line at oil injection pump, install hose pincher
– oil pump cable
– coolant hoses between cylinder head and radiator
– coolant by-pass hose
– coolant hose at front of coolant reservoir
– engine support screws
– engine stopper (left rear of engine).

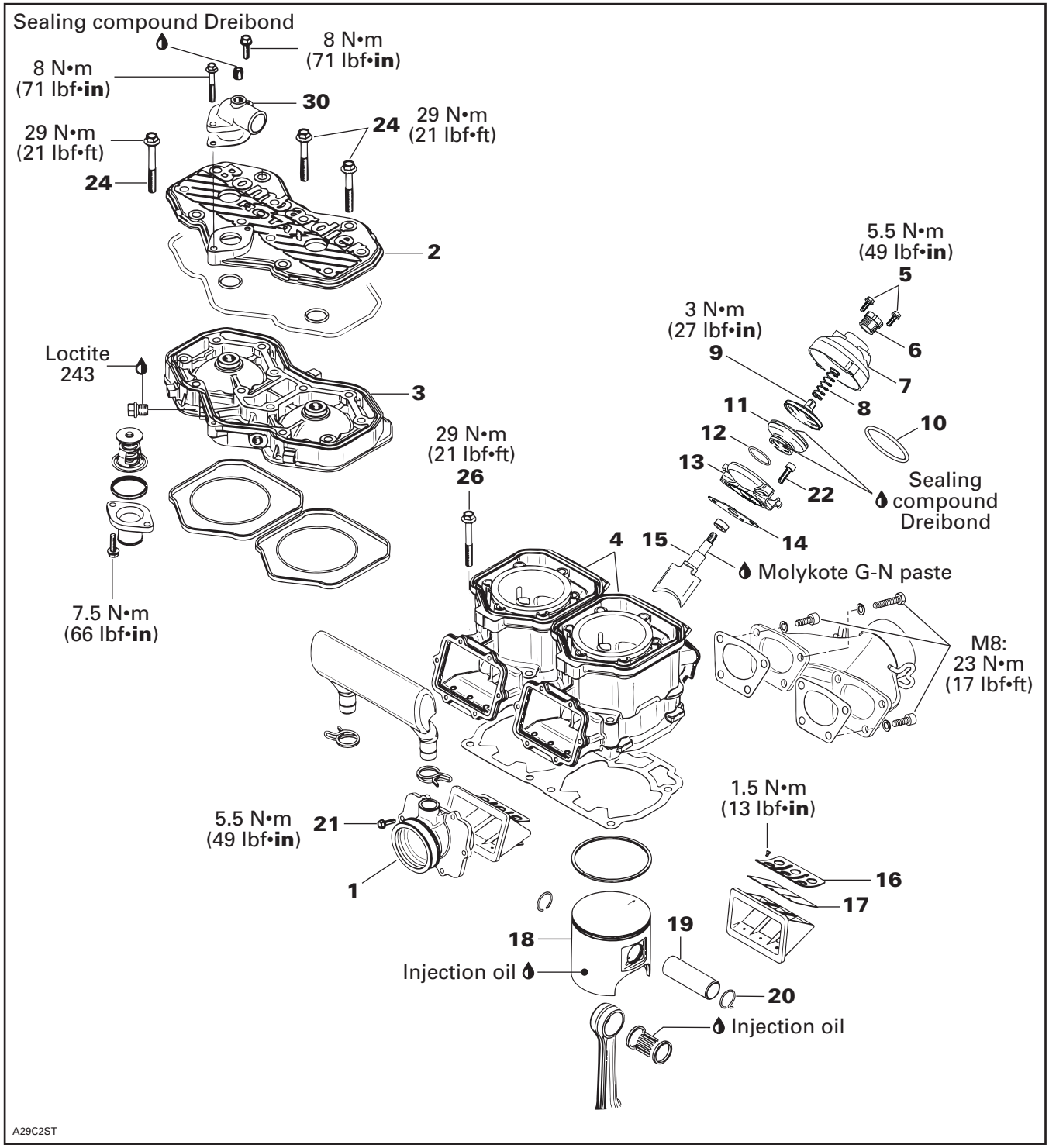
INSTALLATION ON VEHICLE

To install engine on vehicle, reverse removal procedure. However, pay attention, to all appropriate component/system reinstallation procedures described throughout this Shop Manual and to the following:

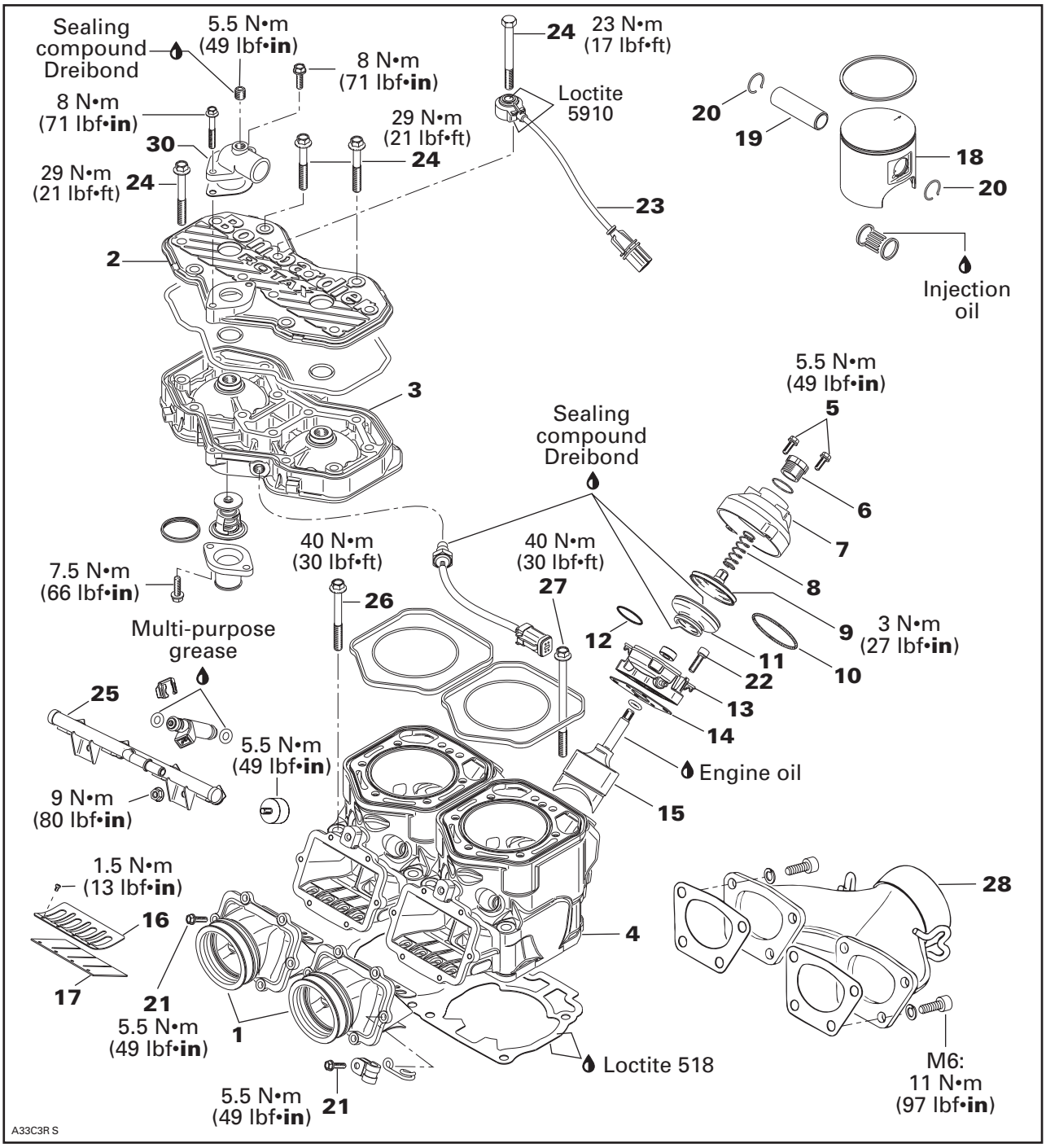
– After throttle cable installation, check carburetor/throttle body maximum throttle opening and oil injection pump adjustment.
– Check pulley alignment and drive belt tension.
– Seal exhaust ball joints with Ultra Copper (P/N 413 710 300).

TOP END

593 Engine



593 HO SDI Engine



GENERAL

CAUTION: While performing any engine related procedure, always make sure that the working area is clean and free from dust or particles to reduce the risk of damaging the engine.

TROUBLESHOOTING

Before completely disassembling the engine, check airtightness. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT.

COMPONENT REMOVAL

Most engine components can be removed with engine in vehicle such as:

– cylinder head
– piston(s)
– cylinder(s)
– rewind starter
– oil pump
– water pump
– magneto flywheel
– RAVE valve(s)
– reed valve(s).

CLEANING

Discard all gaskets and O-rings.

Clean all metal components in a non-ferrous metal cleaner.

Scrape off carbon formation from cylinder exhaust port, cylinder head and piston dome using a wooden spatula.

NOTE: The letters "AUS" (over an arrow on the piston dome) must be visible after cleaning.

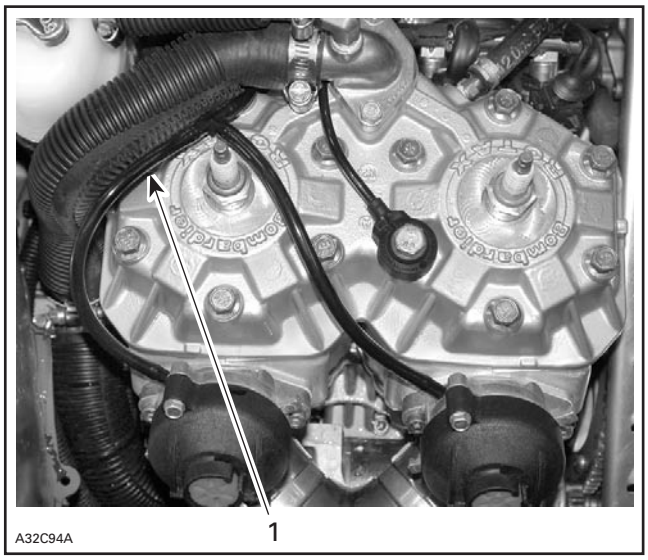
Clean the piston ring groove with a groove cleaner tool or with a piece of broken ring.

RAVE VALVE BASIC OPERATION

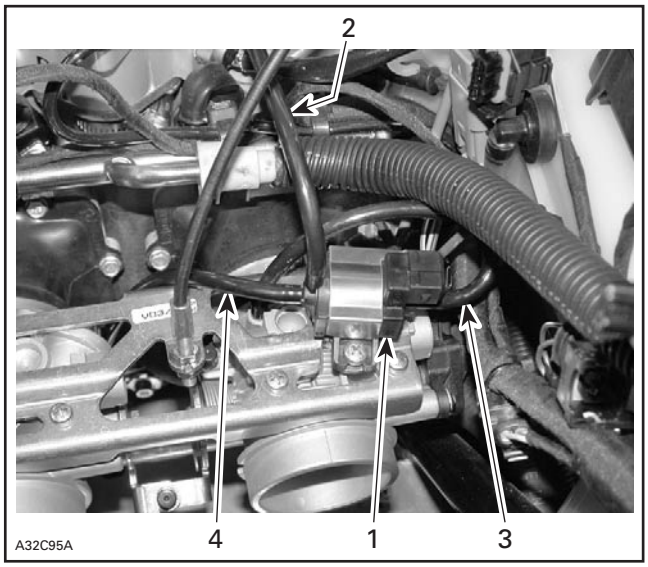
593 HO SDI Engine

The RAVE valves change the height of the exhaust port. The RAVE valve solenoid, which is controlled by the ECM, allows positive crankcase pressure to inflate the bellows and open the RAVE valves.

To open the RAVE valves, the ECM activates a solenoid which directs the pressure to the valves.



1. Pressure from solenoid



1. Solenoid
2. Pressure to RAVE valves
3. Vent to throttle body
4. Pressure with check valve from crankcase

To close the RAVE valves, the ECM deactivates the solenoid. In the closed position, the RAVE valves are vented through the intake manifold.

Maintenance

All Engines

There are no wear parts anywhere in the system and there are no adjustments to be periodically checked. The only possible maintenance required would be cleaning of carbon deposits from the guillotine slide. Cleaning intervals would depend upon the user's riding style and the quality of the oil used.

BRP suggests annual cleaning of the valve. If a customer uses lower quality oil, than recommended, more frequent cleaning may be required.

No special solvents or cleaners are required when cleaning the valve.

On **SDI models**, check if solenoid heating element is still functional once a year, the element should be warm after one minute of riding (measure should be between 0.0 to 0.4 ohms). At the same time, using a vacuum/pressure pump (P/N 529 021 800), check if crankcase check valve is still functional.

NOTE: Make sure hoses are not kinked or damaged.

Boring Precaution

All Engines

In its stock configuration, the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

DISASSEMBLY

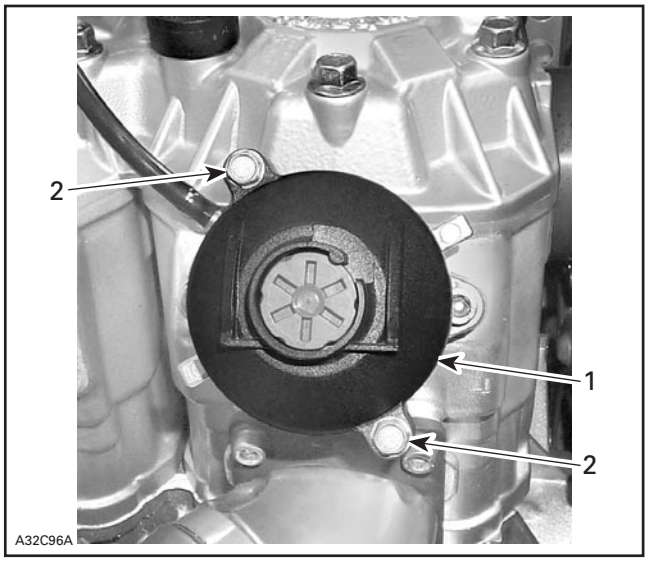
RAVE System

NOTE: RAVE stands for Rotax Adjustable Variable Exhaust.

Remove RAVE valve cover **no. 7** by removing screws **no. 5**.

⚠ WARNING

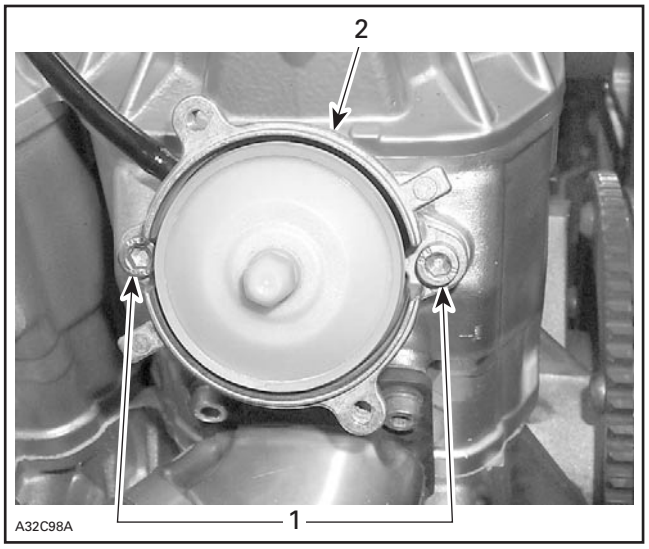
Firmly hold cover to valve base. The compression spring inside the valve is applying pressure against the cover.



TYPICAL
1. RAVE valve cover
2. Screws

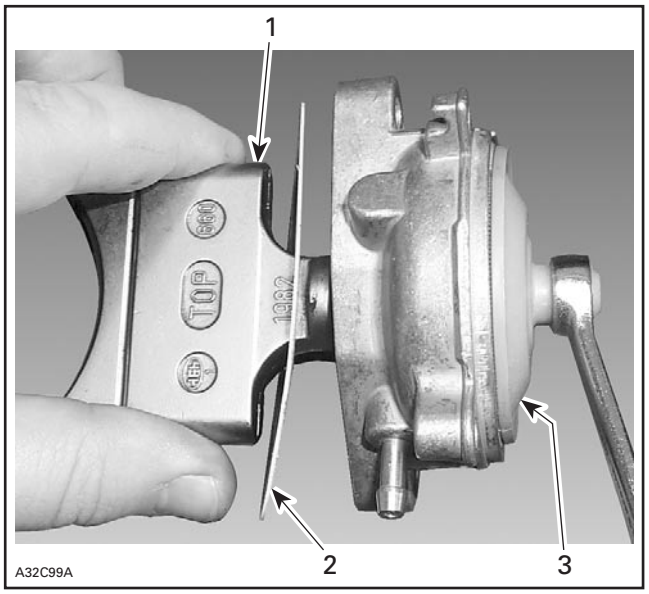
Remove the compression spring **no. 8**.

Unscrew the Allen socket screws **no. 22** then remove the RAVE valve base **no. 13**.



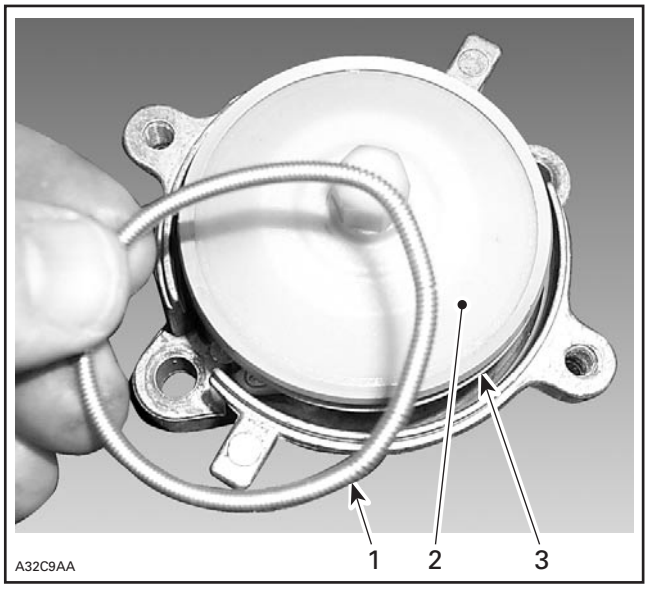
TYPICAL
1. *Allen socket screws*
2. *RAVE valve base*

Unscrew and remove the guillotine **no. 15** from the valve piston **no. 9** than remove the gasket **no. 14**.



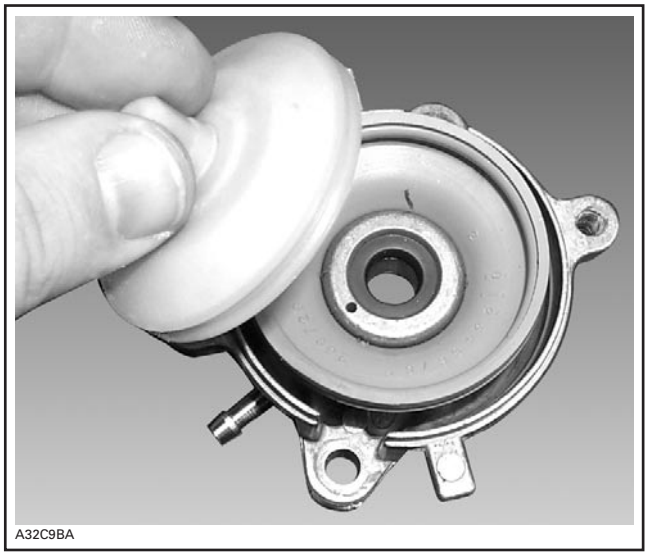
1. *Guillotine*
2. *Gasket*
3. *Valve piston*

Remove spring **no. 10** retaining bellows **no. 11** to valve piston.

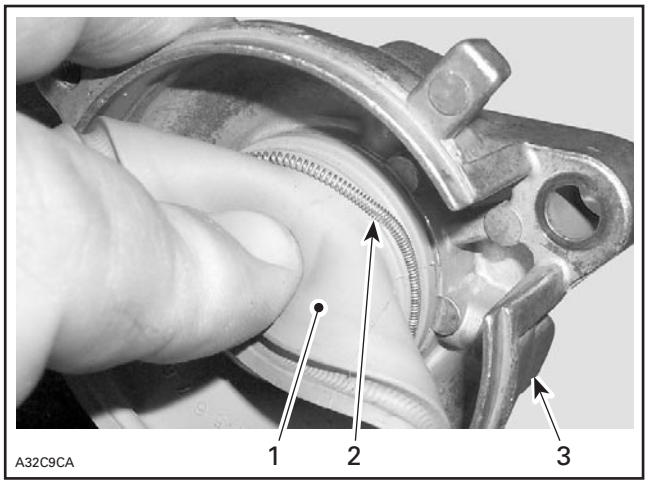


1. *Spring*
2. *Valve piston*
3. *Bellows*

Remove the valve piston.

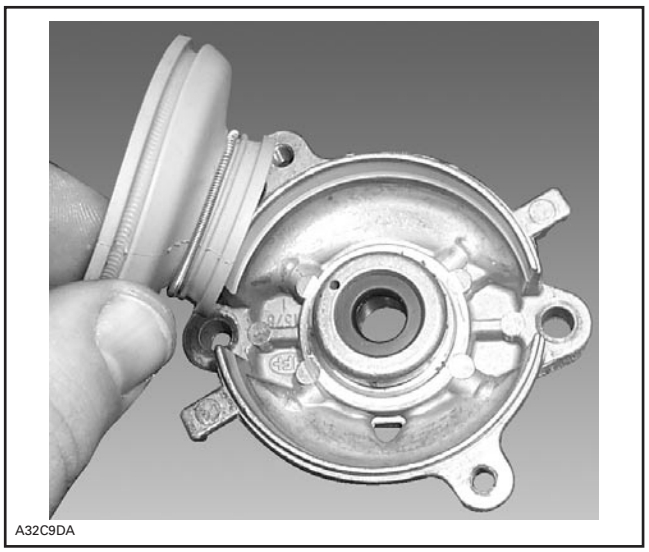


Remove the small spring **no. 12** retaining bellows to valve base.



1. Bellows
2. Small spring
3. Valve base

Remove bellows from valve base.



REED Valve

If applicable, remove intake resonator on top of reed valves **no. 1**.

Unscrew reed valve screws **no. 21** then remove reed valve(s).

Cylinder Head Cover

Unplug spark plug cables.

593 HO SDI Engine

Disconnect the knock sensor **no. 23**.

All Engines

Unplug coolant hose from upper thermostat housing **no. 30**.

Unscrew all cylinder head cover screws **no. 24**.

Cylinder Head

Remove the cylinder head cover **no. 2**.

Disconnect the temperature sensor connector.

Remove the cylinder head **no. 3**.

Cylinder

593 HO SDI Engine

Release the fuel pressure of the system. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

Unplug fuel injector connectors then remove the fuel rail **no. 25**. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

All Engines

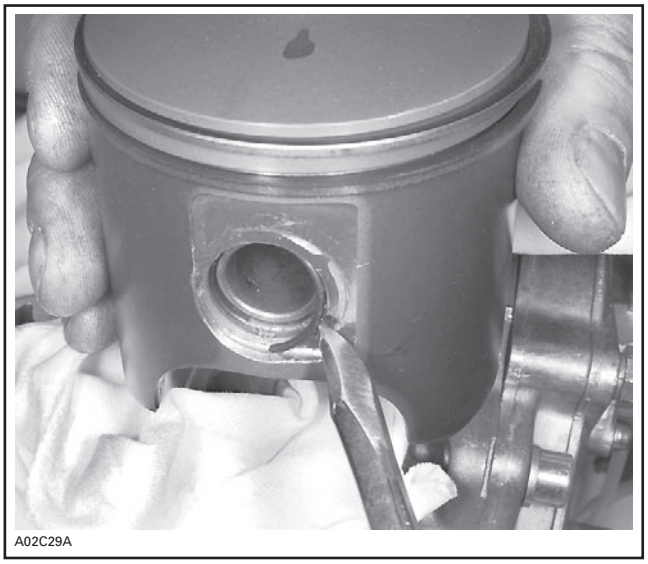
Remove cylinder head **no. 3**.

Remove manifold and RAVE valves.

Unscrew cylinder screws **no. 26** and **no. 27** then remove the cylinder(s) **no. 4**.

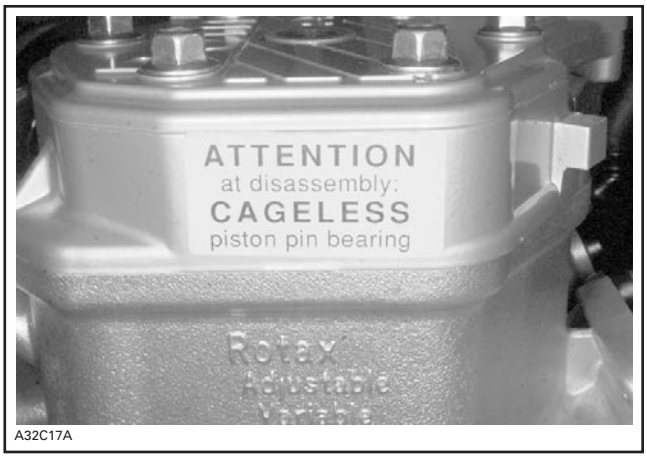
Piston

Place a clean cloth or rubber pad (P/N 529 023 400) over crankcase. Then with a pointed tool inserted in piston notch, remove both circlips **no. 20** from piston **no. 18**.



TYPICAL

This engine is equipped with cageless piston pin bearings.

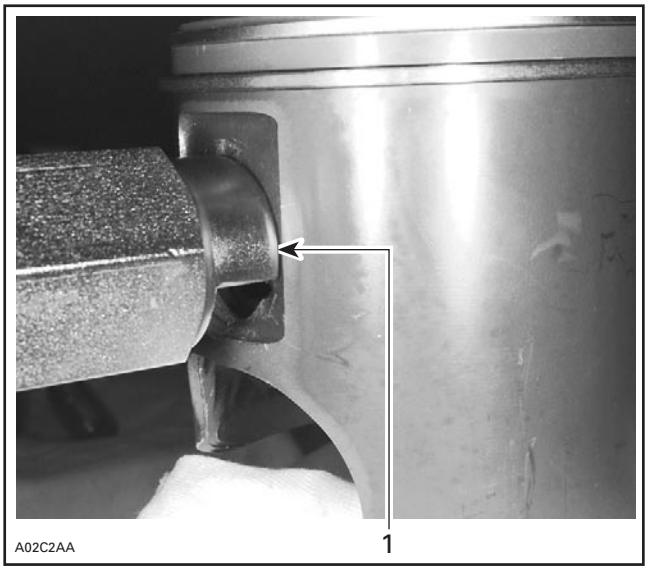


A32C17A

Use piston pin puller (P/N 529 035 503) along with 20 mm sleeve kit (P/N 529 035 542) and locating sleeve.

NOTE: The locating sleeve is the same that contains new cageless bearing.

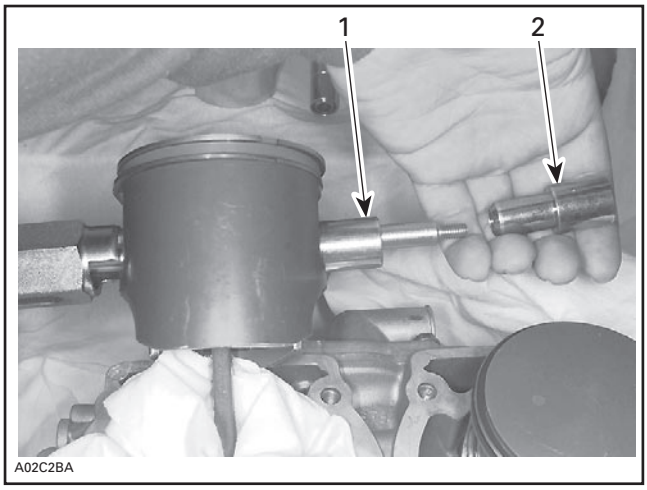
Insert piston pin puller (P/N 529 035 503) making sure it sits squarely against piston.



A02C2AA

TYPICAL
1. Properly seated all around

Install sleeve then shouldered sleeve over puller rod.

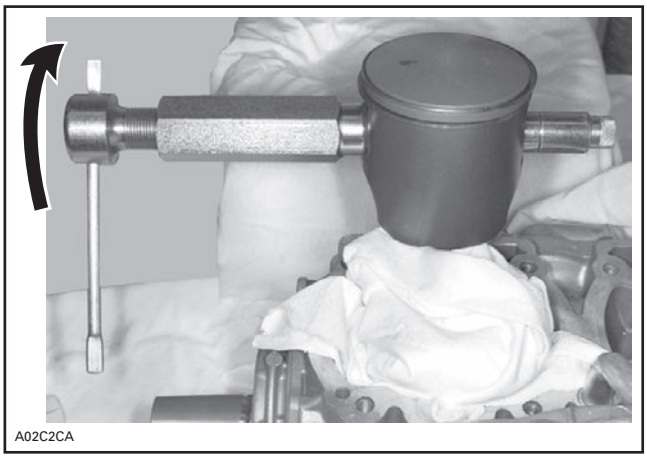


A02C2BA

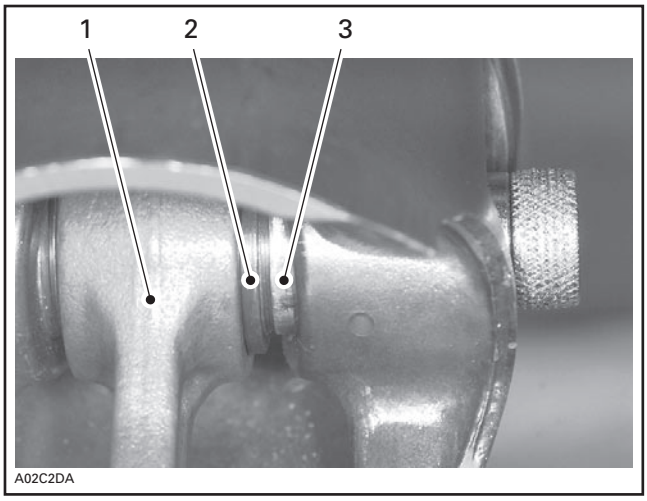
TYPICAL — INSTALLATION OF SLEEVE KIT
1. Sleeve
2. Shouldered sleeve

Screw (LH threads) extracting nut.

Pull out piston pin **no. 19** by unscrewing puller until shouldered sleeve end is flush with thrust washer of piston pin bearing.

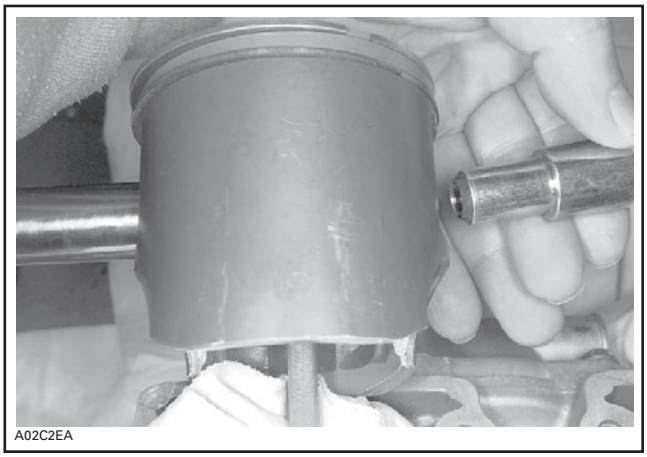

A02C2CA

TYPICAL — PISTON PIN EXTRACTION



TYPICAL
1. Sleeve inside bearing
2. Thrust washer
3. Shouldered sleeve end

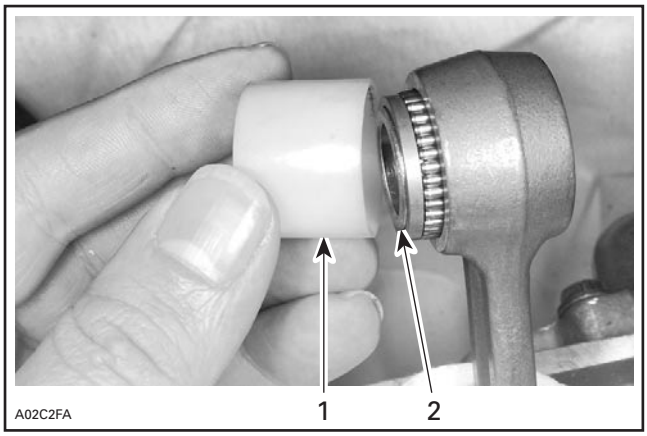
Remove puller. Pull out shouldered sleeve carefully.



TYPICAL

Remove piston from connecting rod.

Install locating sleeve. Then push needle bearings along with thrust washers and sleeve.



TYPICAL
1. Locating sleeve
2. Sleeve

Exhaust Manifold

593 HO SDI Engine

Upon removal of the exhaust manifold **no. 28**, you must heat M6 bolt heads for 30 seconds before loosening.

NOTE: Heat one bolt at a time.

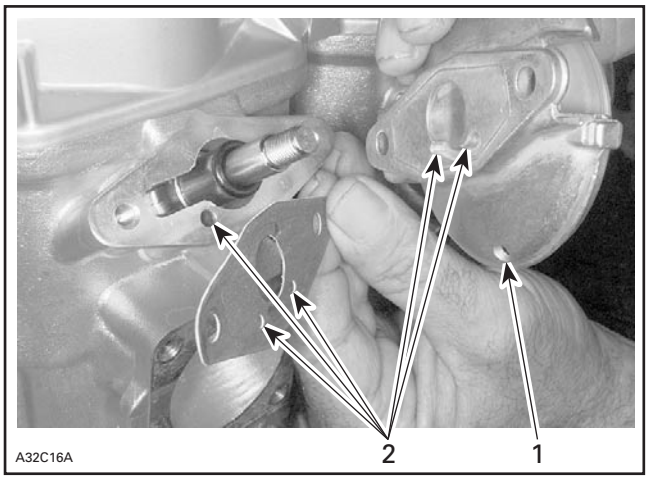
INSPECTION

Cylinder Head Cover, Cylinder Head and Cylinder

NOTE: Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT.

RAVE System

Check valve rod housing and cylinder for clogged passages.



1. Draining hole
2. Passages

NOTE: Oil dripping from draining hole indicates a loosen spring or damaged bellows.

Bellows

Check for cracked, dried or perforated bellows **no. 11**.

Spring

Check if the compression springs **no. 87** are in specifications.

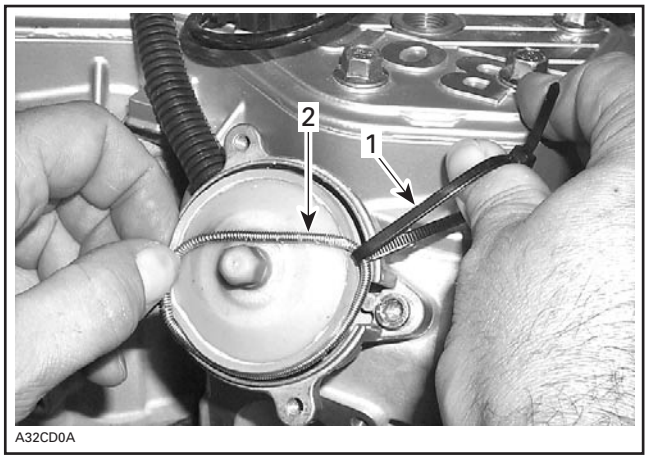
ENGINE	SPRING P/N	COLOR	WIRE DIA. mm (in)	FREE LENGTH mm (in)
593	420 239 948	GREY	1.0 (.039)	38.0 (1.50)
593 HO SDI	420 239 942	BLACK	0.8 (.031)	42.5 (1.67)

ASSEMBLY

RAVE System

Apply Dreibond sealing compound (P/N 420 297 906) in the groove of valve base and in the piston valve groove, then install bellows.

NOTE: To ease the installation of the spring **no. 12** retaining bellows **no. 13** to valve piston, refer to the following photo.



TYPICAL
1. Locking tie
2. Spring

Install RAVE valve with its mention "TOP" as illustrated in the following photo.

RAVE VALVE PARTIALLY INSERTED

Tighten red cap **no. 6** screw to bottom.

Cylinder and Piston

Be sure to restore the chamfer around all cylinder sleeve port openings.

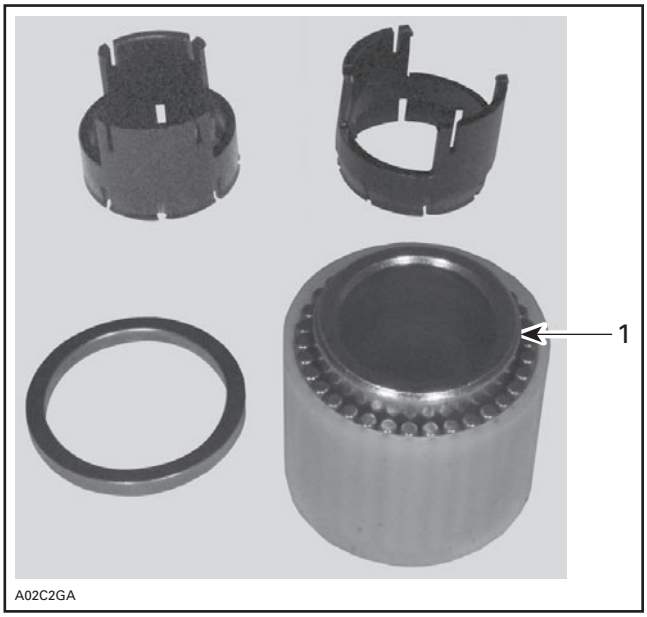
Before inserting piston **no. 18** in cylinder **no. 4**, lubricate the cylinder with new injection oil or equivalent.

Cylinder Head Cover, Cylinder Head and Cylinder

Check flatness of part sealing surfaces. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT and look for CHECKING SURFACE FLATNESS.

When installing a new cageless bearing, replace half plastic cages with sleeve.

NOTE: 593 engine cageless bearings have 28 needles.



TYPICAL
1. Sleeve

Lubricate needle bearings with injection oil. Grease thrust washers and install them on each end of needles.

Insert cageless bearing into connecting rod.

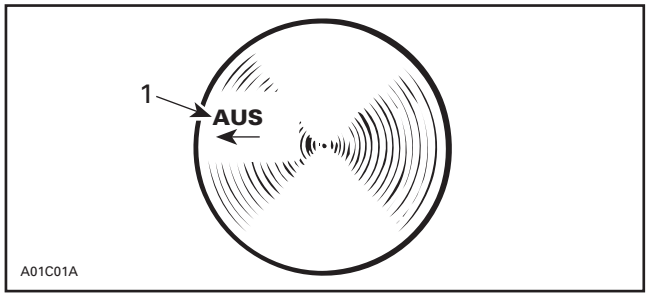
TYPICAL — CAGELESS BEARING AND SLEEVE INSTALLED

Heat piston using bearing heater (P/N 529 035 969).

TYPICAL

CAUTION: Piston temperature must not exceed 46°C (115°F). NEVER USE DIRECT FLAME to heat the piston and never freeze the pin. Inappropriate heating procedure/s may damage the piston.

At assembly, place the pistons over the connecting rods with the letters "AUS" (above the arrow on the piston dome) facing in direction of the exhaust port.



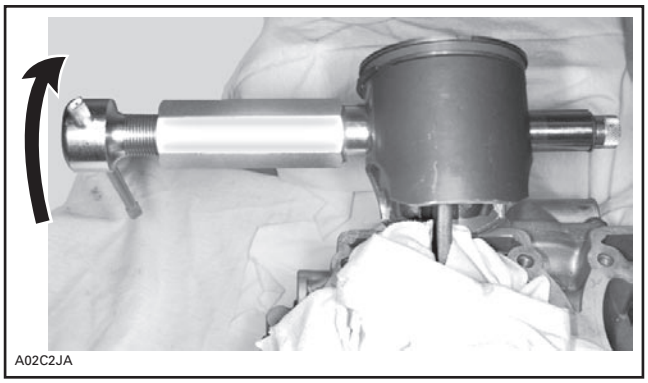
1. Exhaust

Install shouldered sleeve.

A02C2IA

TYPICAL — SHOULDERED SLEEVE INSTALLATION

Install piston pin puller and turn handle until piston pin is correctly positioned in piston.


A02C2JA

TYPICAL

CAUTION: Always install new circlips.

To minimize the effect of acceleration forces on circlip, install each circlip so the circlip break is at 6 o'clock as illustrated. Use appropriate piston circlip installer.

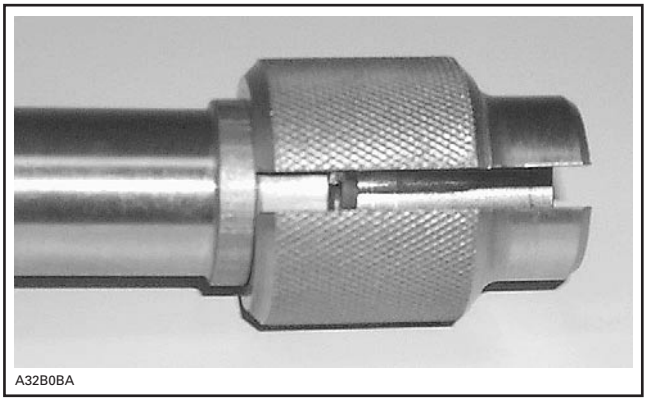
ENGINE	PISTON CIRCLIP INSTALLER (P/N)
593, 593 HO SDI	529 035 686

Use circlip installer (P/N 529 035 686) to install new mono-hook circlips **no. 20**.

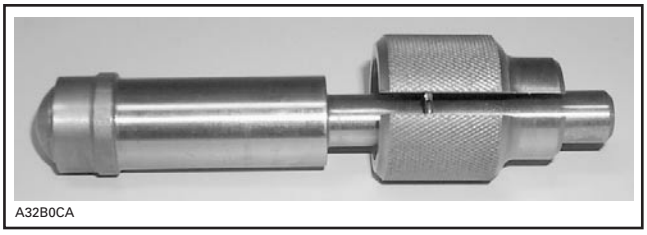
Insert circlip into support in such a way that when installed in piston groove, the tab will face upward.

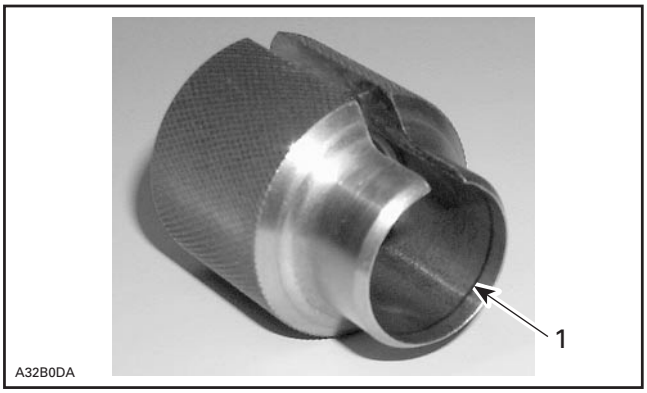
A32B0AA

With round end of pusher, position circlip perpendicular to the support axis.


A32B0BA

With the other end of the pusher, push circlip into the support groove.


A32B0CA



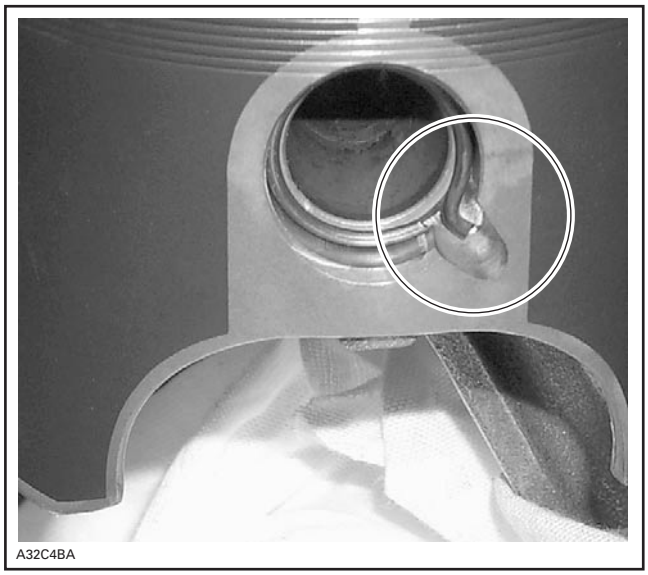
A32B0DA

1. Groove

A32B0EA

CIRCLIP READY TO BE INSTALLED ON PISTON

Using a plastic hammer, tap pusher to insert circlip in place. Take care to install new circlips with tab toward top as per following photo.


A32C4BA

TAB TOWARD TOP

CAUTION: Always install new mono-hook circlips. If circlip installation fails at the first attempt, always retry with a new one as on a second attempt circlip will lose its normal retaining capabilities.

CAUTION: Circlips must not move freely after installation; if so, replace them.

Clean cylinders **no. 4** and crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

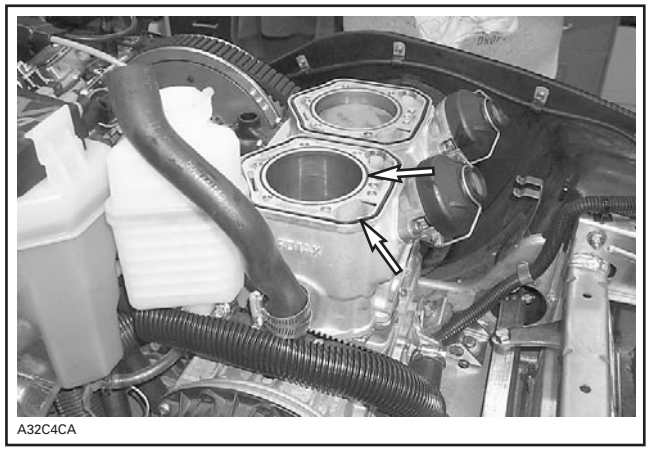
Coat crankcase mating surface with Loctite 518 (P/N 293 800 038). Choose the right gasket thickness according to combustion chamber volume. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT. Install it on crankcase. Coat gasket with Loctite 518.

CAUTION: Always install a gasket of the proper thickness. Failure to do so may cause detonation and severe engine damage.

Before inserting piston **no. 18** in cylinder **no. 4**, lubricate the cylinder with new injection oil or equivalent.

Install cylinders. Do not tighten.

Install new rubber ring and round O-rings on each cylinder.


A32C4CA

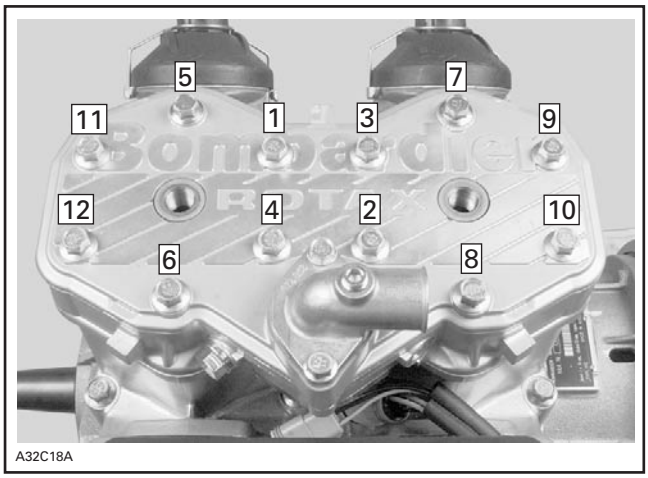
TYPICAL

NOTE: Carefully clean screws before reinstallation, specifically under screw head.

Install exhaust manifold with gaskets. Do not tighten yet.

At assembly, torque cylinder head screws using the following table and as per the following illustrated sequence.

ENGINE	
593	593 HO SDI
29 N•m (21 lbf•ft)	29 N•m (21 lbf•ft)
	Cylinder head screw with knock sensor: 23 N•m (17 lbf•ft)

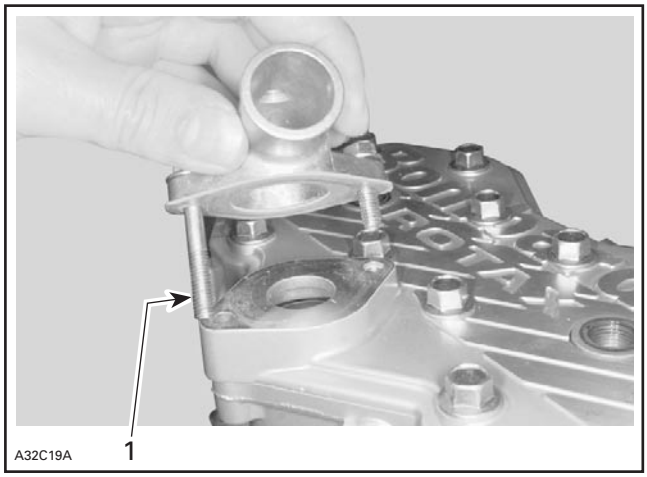


TYPICAL

Tighten exhaust manifold bolts in a criss-cross sequence as per the following table.

ENGINE	
593	593 HO SDI
23 N•m (17 lbf•ft)	11 N•m (97 lbf•**in**)

Install outlet socket and tighten screws to 8 N•m (71 lbf•**in**). Note position of longer screw.



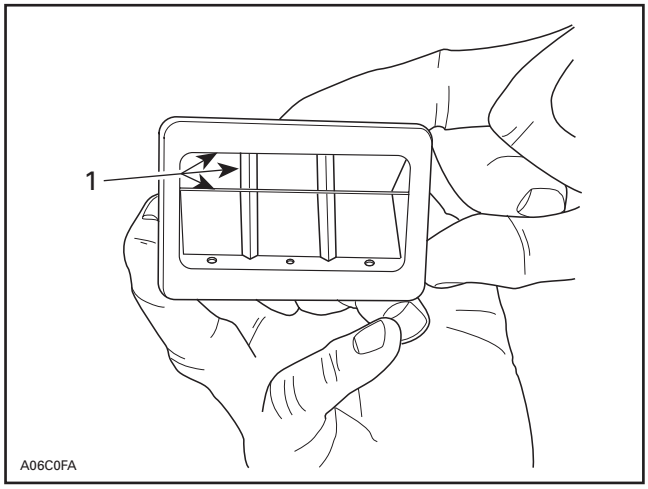
1. Longer screw

Reed Valve

Blades have a curved shape. Install with their curve facing reed block.

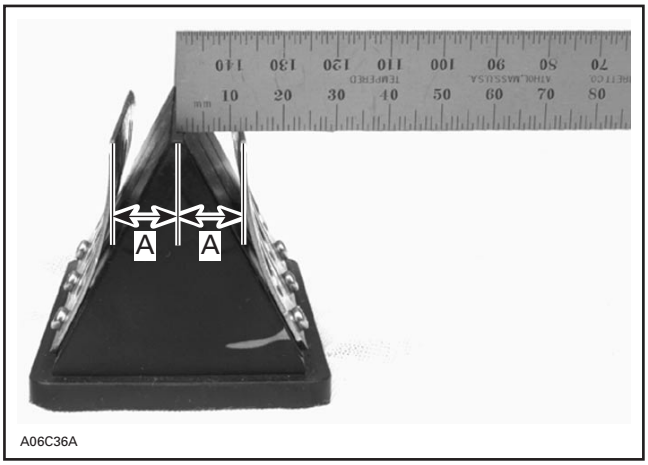
With blade stopper **no. 16** removed, check reed valve for proper tightness. There must be no play between blade and valve body when exerting a finger pressure on blade at blade stopper location.

In case of a play, turn blade upside down and recheck. If there is still a play, replace blade and/or valve body.



1. No play

Check distance from blade stopper inner edge and distance from center of reed valve block.



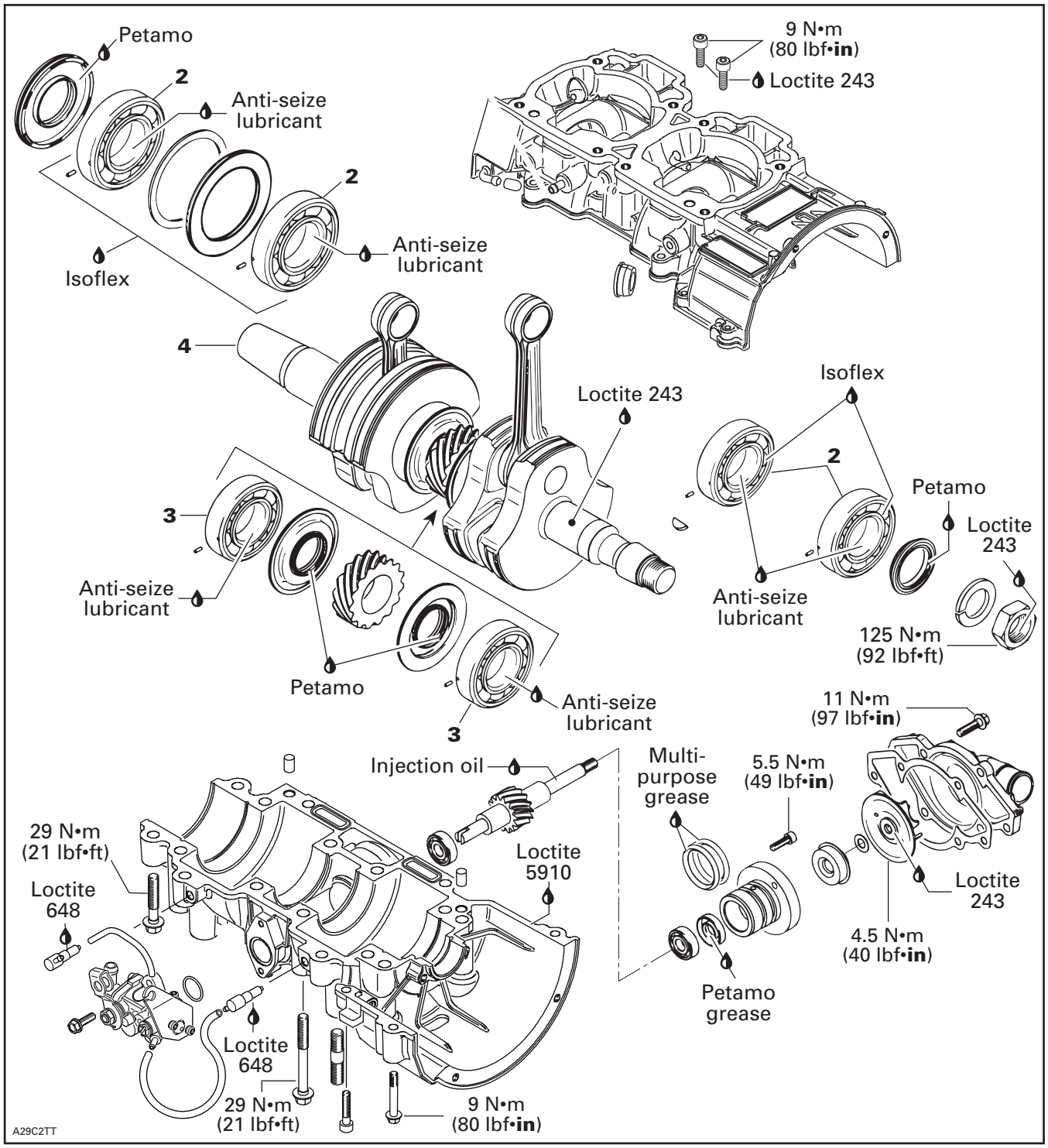
TYPICAL
A. 14.75 - 0, + 0.75 mm (.580 - 0, + .030 in)

Bent blade stopper as required to obtain the proper distance.

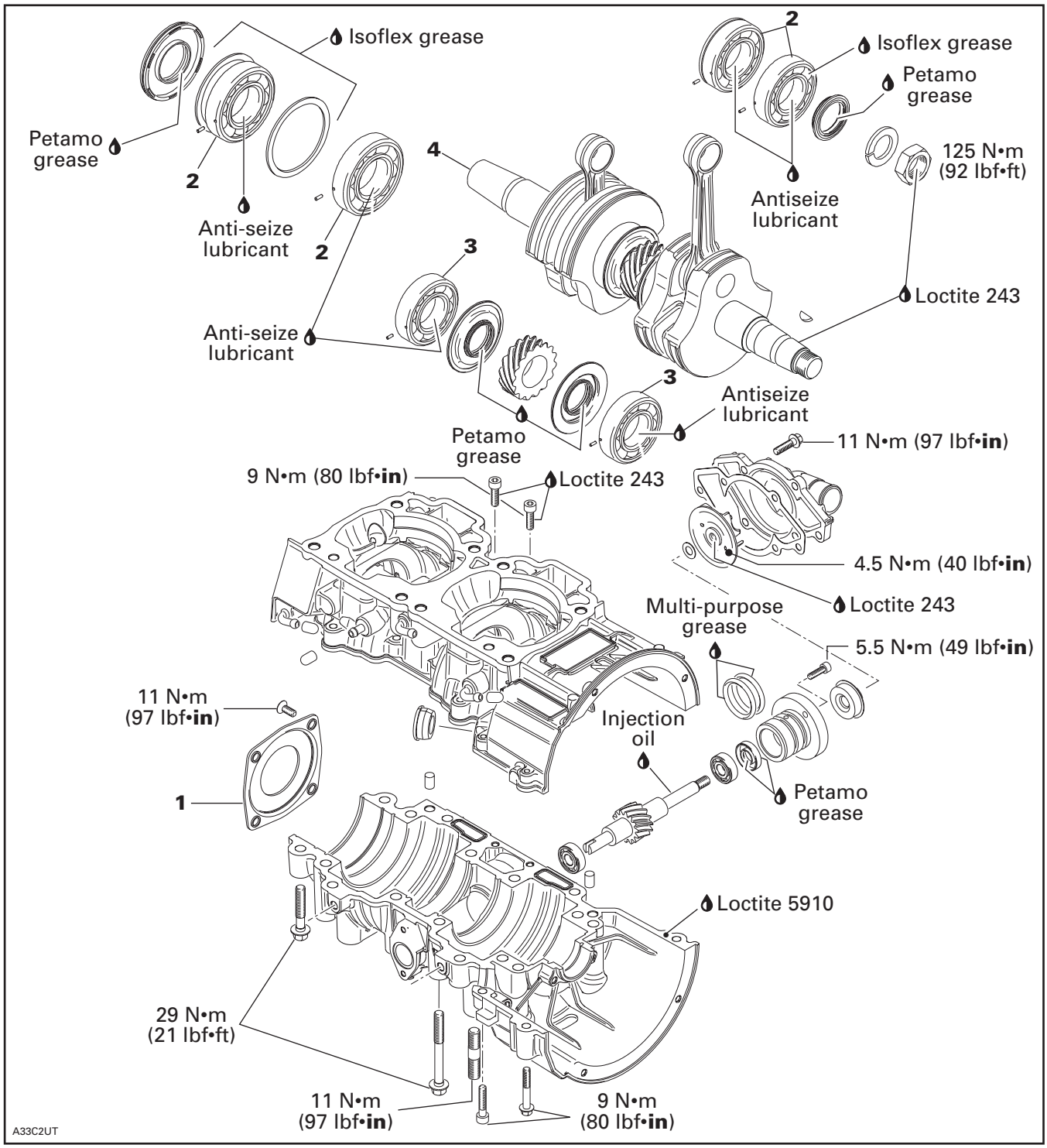
Blade stoppers may slightly interfere with cylinder during installation. Adjusted distance will be reduced automatically upon installation.

BOTTOM END

593 Engine



593 HO SDI Engine



NOTE: Engine must be removed from chassis to perform the following procedures.

CLEANING

Discard all oil seals, gaskets, O-rings and sealing rings.

Clean all metal components in a non-ferrous metal cleaner. Use Loctite Chisel (P/N 413 708 500) accordingly.

Remove old paste gasket from crankcase mating surfaces with Loctite Chisel (P/N 413 708 500).

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

DISASSEMBLY

General

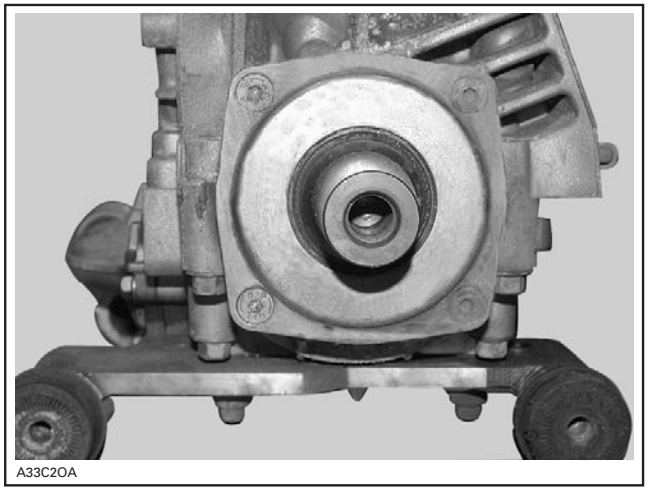
To remove drive pulley, refer to DRIVE PULLEY.

Remove rewind starter.

To remove magneto, refer to MAGNETO SYSTEM.

593 HO SDI Engine

Remove oil seal cover no. 1.

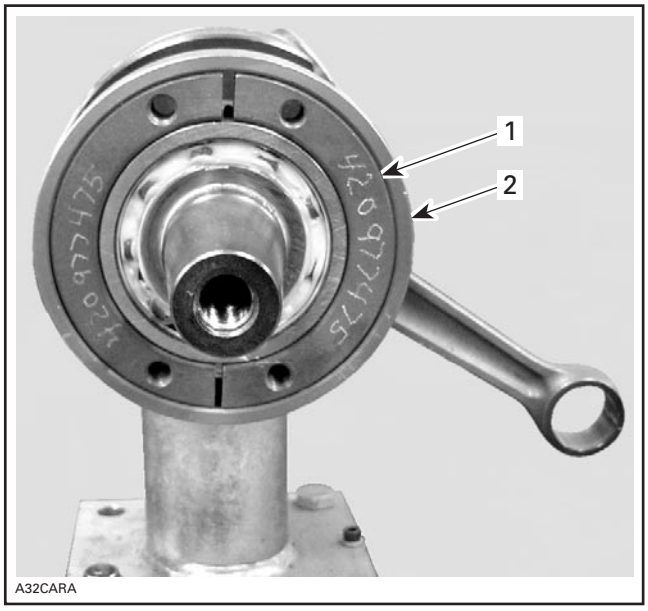

A33C2OA

TYPICAL

Crankshaft Bearing

To remove PTO side bearings no. 2 and no. 3 from crankshaft no. 4, install the following tools on the bearing.

– half rings (P/N 420 977 479)
– puller ring (P/N 420 977 494).



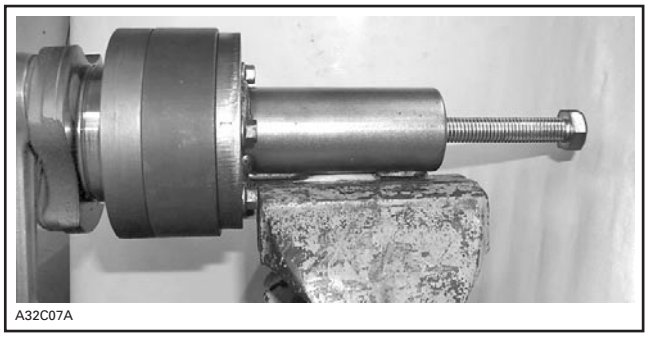
A32CARA

1. Half ring
2. Puller ring

NOTE: Apply grease (P/N 413 711 500) on crankshaft end in order to hold in place the crankshaft protector (P/N 420 876 552) on PTO side and crankshaft protector (P/N 420 876 557) on MAG side.

Using screws (P/N 420 840 681), install bearing puller (P/N 529 036 004) on the half rings.

Secure the bearing puller in a vise by one of its rib.


A32C07A

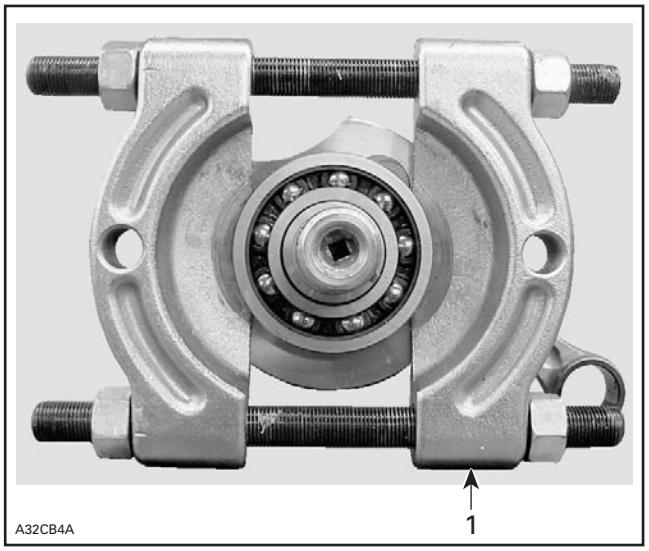
BEARING PULLER SECURED IN THE VISE

CAUTION: Never use any air impact tool for tightening the puller bolt. Lubricate the bolt with BOMBARDIER LUBE (P/N 293 600 016) to avoid damaging the threads.

Lubricate the puller bolt and then proceed with tightening the puller bolt until the bearing comes out.

Follow the same procedure for the inner PTO side bearing.

NOTE: In the case of damaged bearing or less clearance between crankshaft counterbalance and the bearing or on the MAG side bearing, use bearing separator (Snap-On tool (P/N CJ951) or (P/N SPX/OTC) tool (P/N 1124) to facilitate the removal.



1. Bearing separator

Procedure for MAG side bearings **no. 2** and **no. 3** is same as of PTO side with the exception of crankshaft protector (P/N 420 876 557).

INSPECTION

NOTE: Refer to LEAK TEST AND ENGINE DIMENSIONS MEASUREMENT.

ASSEMBLY

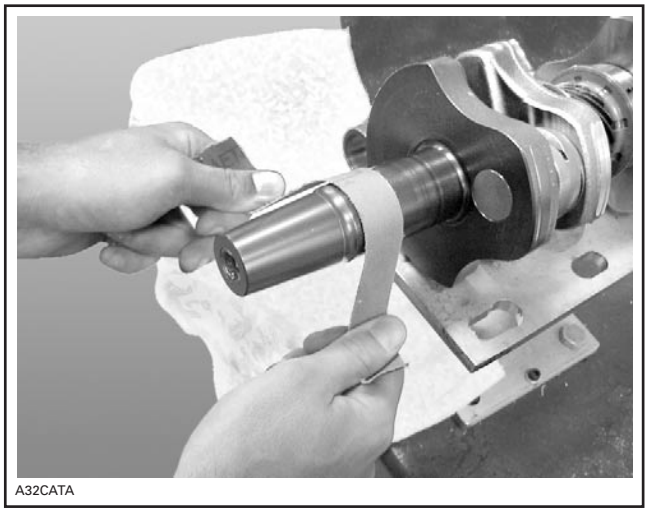
Coat lip of all seals with Petamo grease (P/N 420 899 271).

Crankshaft Bearing

CAUTION: Never reinstall a bearing that has been removed.

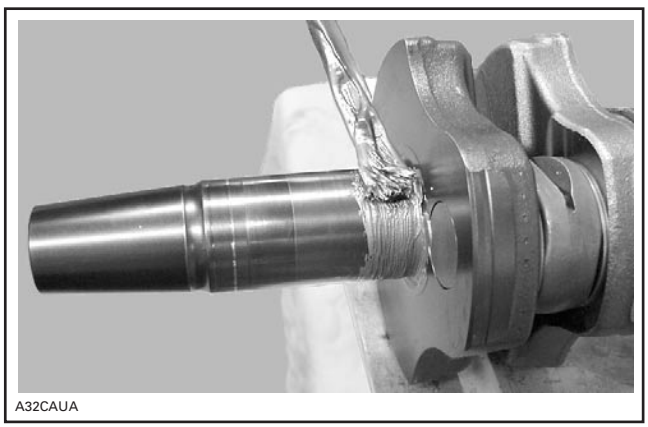
Inspect crankshaft ends for damage.

Clean crankshaft end with sand paper no.180 and remove all residue using pulley flange cleaner (P/N 413 711 809).



Remove all residue using pulley flange cleaner (P/N 413 711 809).

Smear anti-seize lubricant (P/N 413 701 000) on part of crankshaft where bearing fits.



Heat up the bearing(s) using bearing heater (P/N 529 035 969). This will expand bearings and ease installation. If required, put a suitable plate or shim to avoid the direct contact between integrated seal and the heating surface.

A32CB7A

CAUTION: Bearing should not be heated to more than 80°C (176°F). Do not heat bearing with direct flame or heat gun or heated oil. Inappropriate heating procedure(s) may cause inner seal failure.

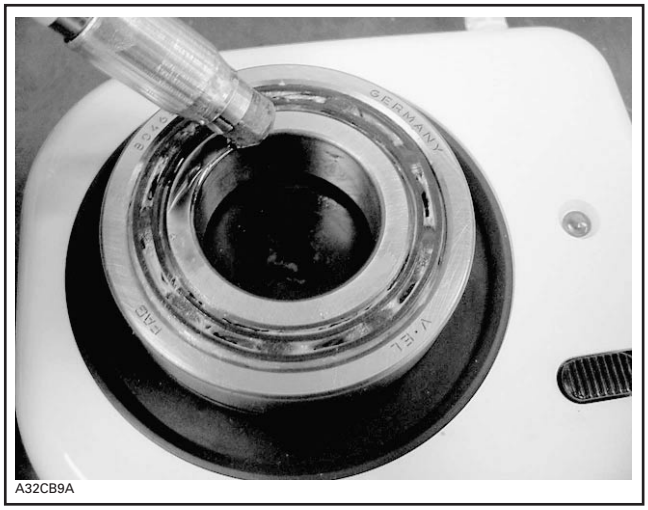
Turn bearing(s) several times during heating process for heating it/them properly.

NOTE: Normally it takes approximately 10 minutes to heat up a bearing. So, in the event of replacing a bearing, it is recommended to start heating it prior to removal. Two bearings can be heated at the same time on one bearing heater.

A32CB8A

1. Bearings

Probe the inner race of the bearing with the temperature indicator stick (P/N 529 035 970). Stick will liquefy when the bearing reach the proper temperature.


A32CB9A

⚠ WARNING

Do not touch heated bearing with bare hands. Wear heat resisting gloves before handling the heated bearing(s).

Slide in the inner PTO bearing with the integrated seal facing crankshaft. Push bearing to end position.

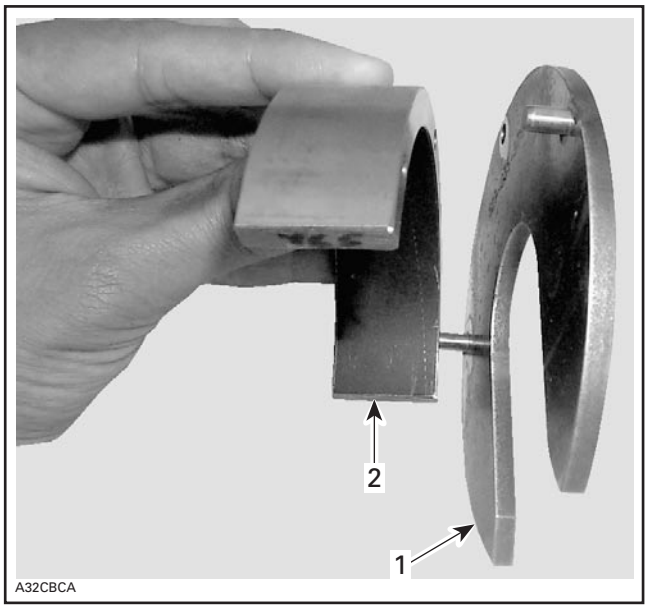
A32CAVA

NOTE: Heated bearings will slide onto the crankshaft. If required, push with a steel tube on the inner ring of the bearing. **Pay special attention to correct positioning of the drive pins and/or retaining discs.**

Install retaining discs.

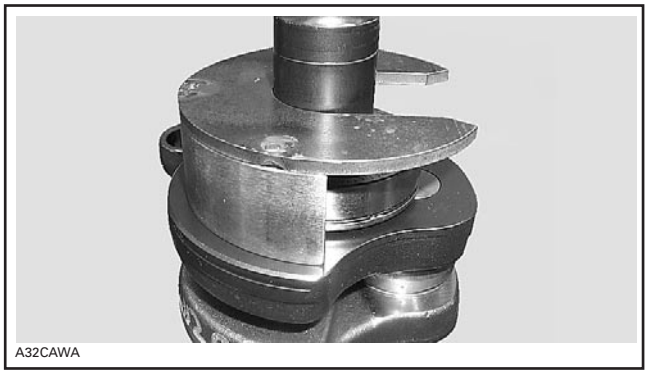
Install support plate (P/N 529 035 976) with appropriate distance gauge; refer to following table.

DISTANCE GAUGE P/N	ENGINE APPLICATION
529 035 966	593
529 035 968	593 HO SDI



1. Support plate
2. Distance gauge

Install bearing locator tool.



Slide in the heated outer PTO bearing onto the crankshaft until it contacts the distance gauge.

Slide-in the first MAG bearing **with the integrated seal facing crankshaft**. Push bearing to the bottom with pusher, using a rubber hammer.

Slide-in the second bearing until it contacts the first one.

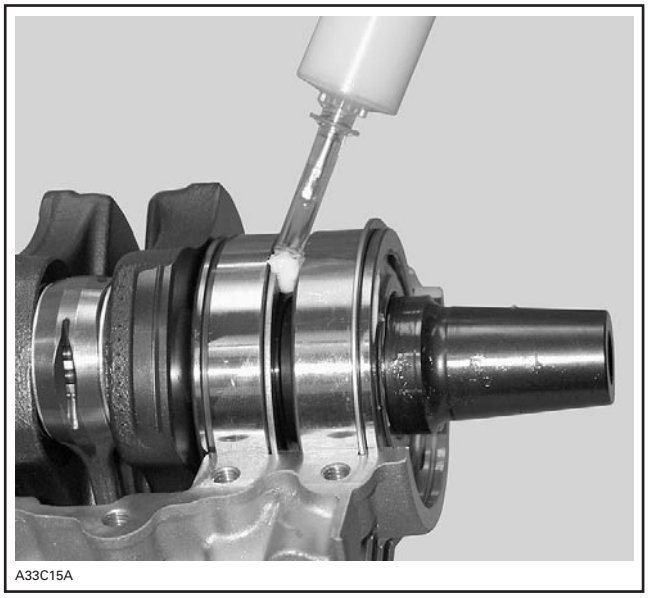
CAUTION: Use only the recommended Isoflex grease (P/N 293 550 021). Make sure not to push Isoflex grease between outside bearing race and half crankcase.

NOTE: The 50 g tube corresponds to 50 cc of grease.

Put 50 to 55 mL of Isoflex grease (P/N 293 550 021) in a syringe.

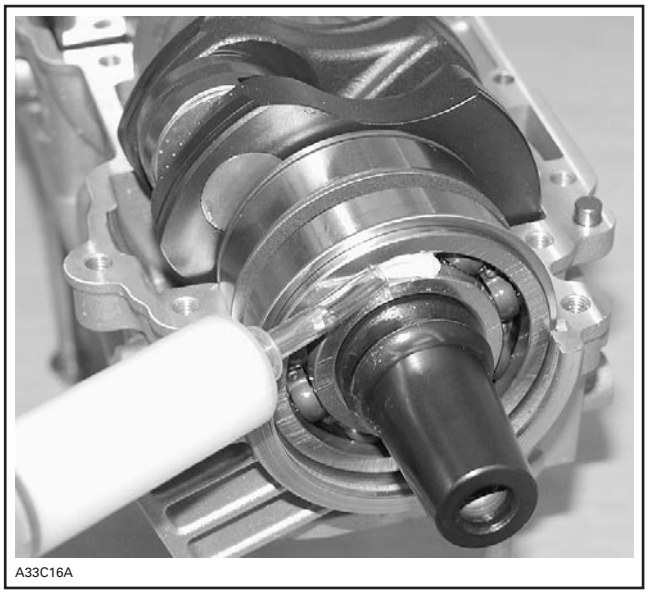
CAUTION: Do not exceed the recommended amount of grease.

Fill inner side of PTO side bearing with Isoflex grease (P/N 293 550 021) (about 10 mL).

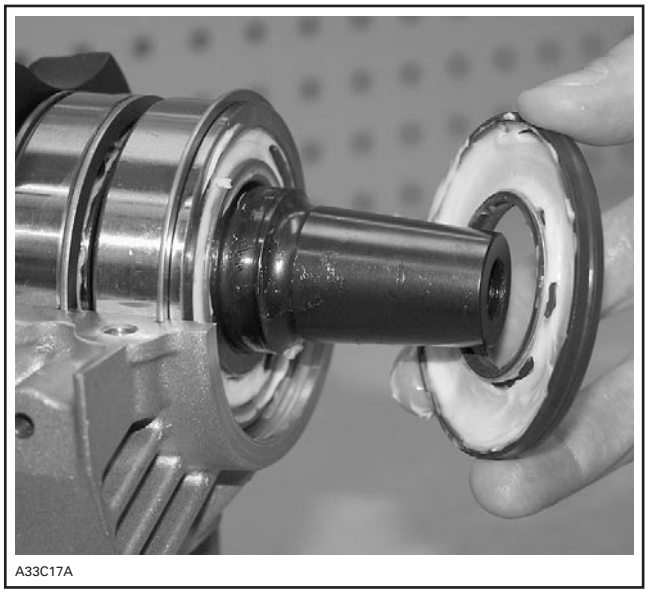

A33C15A

PTO SIDE BEARING FILLED WITH ISOFLEX GREASE

With the syringe, fill the outer ball bearing and inner side of outer seal with 40 to 45 mL of Isoflex grease (P/N 293 550 021).


A33C16A

BALLS COATED WITH A SEAM OF GREASE

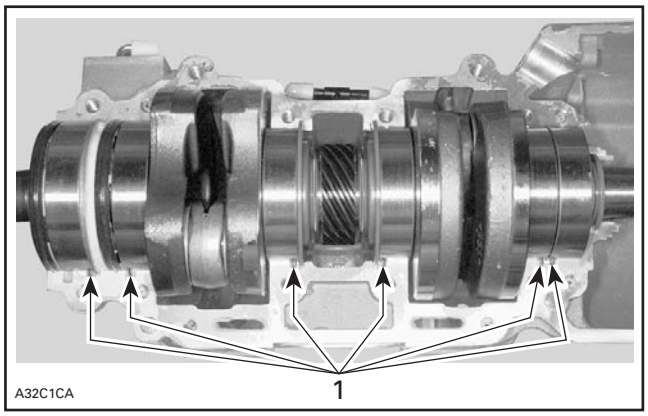

A33C17A

TYPICAL — FILL WITH GREASE AND SET IN PLACE

Apply 6 mL of Isoflex grease (P/N 293 550 021) to MAG side outer bearing.

NOTE: If replaced with new bearing, do not apply grease as new bearings come with grease already applied.

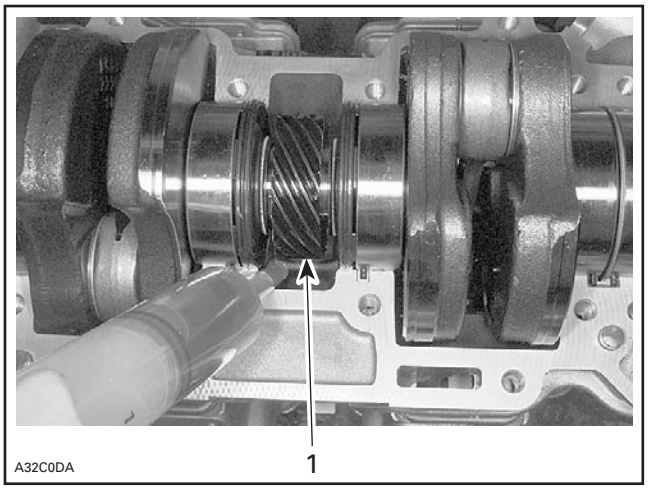
At crankshaft installation, position drive pins as illustrated.



A32C1CA

1. Position pins

Pour 50 mL (2 U.S. oz) of injection oil in the pan under central gear to lubricate pump gearing as per photo.



1. Oil bath

Crankcase Assembly

IMPORTANT: The total assembly sequence, including sealing compound spreading, screwing and torquing of bolts according to the proper sequence must be performed within 10 minutes. Do not wait between each bolt torquing. All bolts must be torqued in a row.

Before screwing both parts of crankcase, seal it with a Loctite 5910 (P/N 293 800 081).

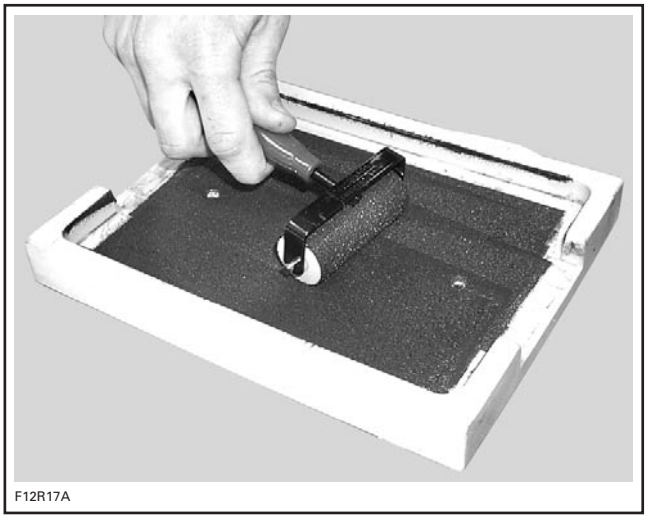
NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps. If you do not use the roller method, you may use your finger to uniformly distribute the sealant (unlike the Dreibond sealing compound, using a finger will not affect the adhesion).

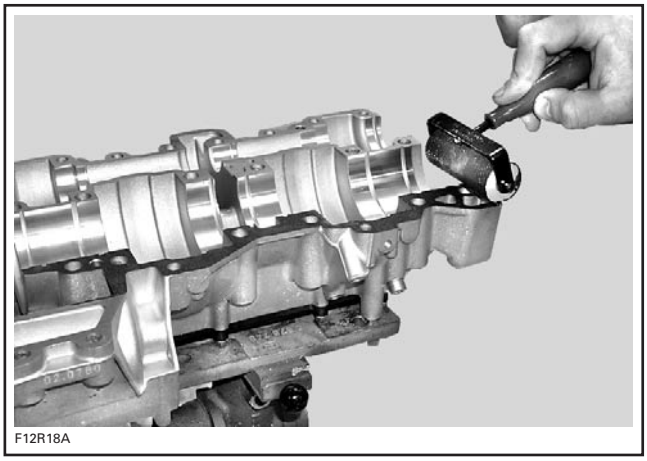
Use the silicone-based Loctite 5910 (P/N 293 800 081) on mating surfaces.

NOTE: The sealant curing time is similar to the Loctite 518 without using the Primer N.

CAUTION: Do not use Loctite 515 or 518 to seal crankcase. Do not use Loctite Primer N with the Loctite 5910. Using these products or non silicone-based sealant over a previously sealed crankcase with Loctite 5910 will lead to poor adhesion and possibly a leaking crankcase. These products are chemically incompatibles. Even after cleaning, the Loctite 5910 would leave incompatible microscopic particles.

Use a plexiglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.



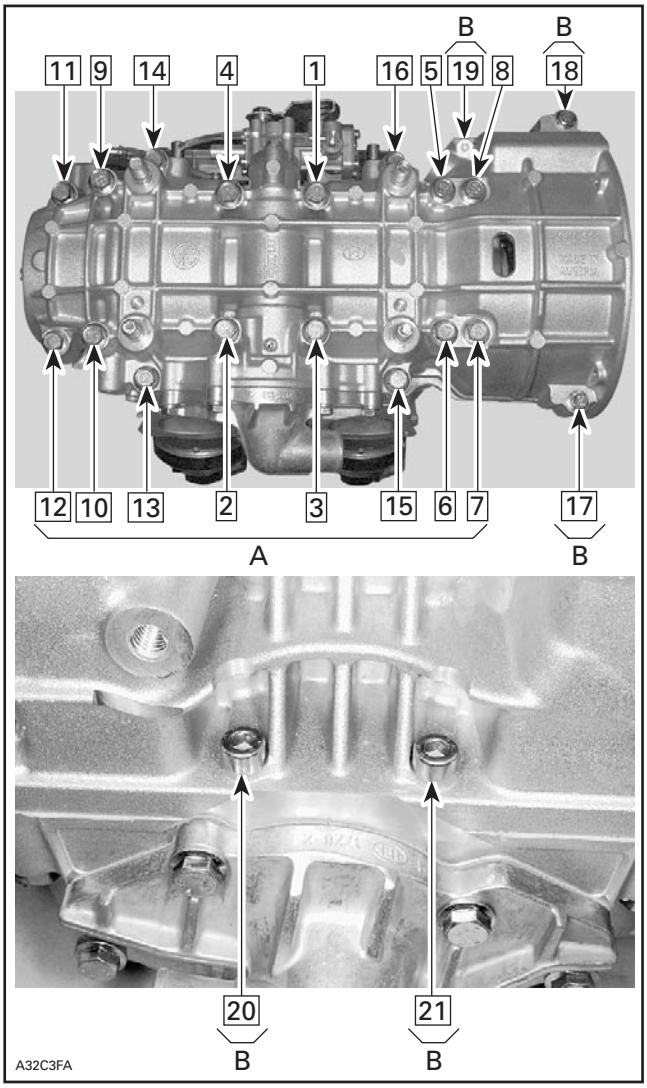


Do not apply in excess as it will spread out inside crankcase.

CAUTION: If sealant spreads out inside air compressor area, it could plug the compressor lubrication nipple and serious compressor damage may occur.

NOTE: Do not use Loctite Primer N with this sealant. The sealant curing time is similar to the Loctite 518 without using the Primer N, which is 4 to 24 hours.

Screw all crankcase bolts in place in the following sequence and to the appropriate torque through a two steps torquing: first, screw bolts up to 60% of the final torque (18 N•m (13.5 lbf•ft) for most of the bolts), then, tighten to the required torque (i.e. 29 N•m (21 lbf•ft)).



1. Torque bolts 1 through 16 to 29 N•m (21 lbf•ft)
*2. Torque bolts 17 through 21 to 9 N•m (80 lbf•**in**)*

593 HO SDI Engine

Install oil seal cover.

BREAK-IN

After rebuilding an engine always observe a break-in period as described in Operator's Guide.

LEAK TEST AND ENGINE DIMENSION MEASUREMENT

SERVICE TOOLS

Description	Part Number	Page
degree wheel	414 352 900	121
dial indicator	414 104 700	118, 121
hose pincher	295 000 076	109
vacuum/pressure pump	529 021 800	110–111

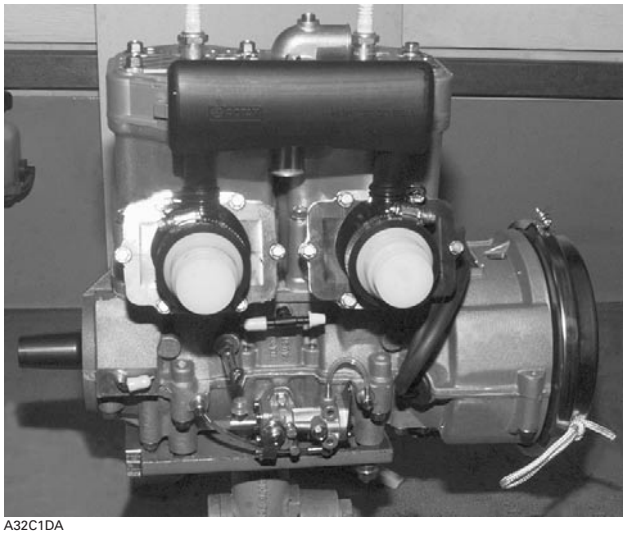
LEAK TEST

The following gives verification procedures for liquid cooled engines though it also applies to fan cooled engines. For FC engines, do not consider information pertaining to coolant system and pump shaft oil gear reservoir.

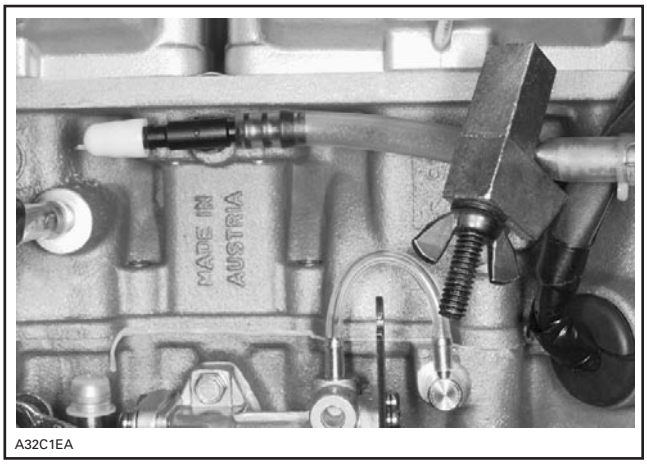
On FC twin-cylinder engines, each cylinder cannot be verified individually due to leakage from one cylinder to the other through labyrinth sleeve in center of crankshaft.

PREPARATION

– Remove tuned pipe.
– Install plug over exhaust manifold.
– Remove carburetors/throttle body assembly (as applicable).
– Insert plugs in intake rubber boots. Tighten with clamps already there.


A32C1DA

– Using a hose pincher (P/N 295 000 076), block impulse hose.
– Using hose pincher (P/N 295 000 076), block pump shaft oil hose and lubrication nipple on PTO side.

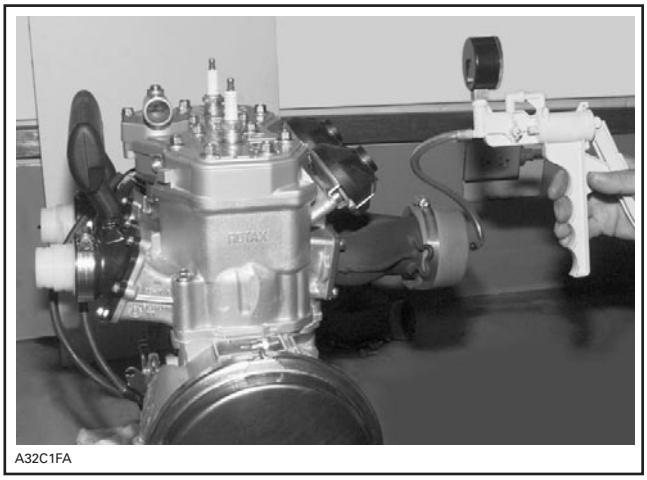


A32C1EA

– Install vacuum/pressure pump (P/N 529 021 800) on exhaust plug.

NOTE: If necessary, lubricate vacuum/pressure pump (P/N 529 021 800) piston with mild soap.

CAUTION: Using hydrocarbon lubricant (such as engine oil) will damage rubber seal of pump piston.


A32C1FA

– Activate pump and pressurize engine to 34 kPa (5 PSI). Do not exceed this pressure.
– Engine must stand this pressure during 3 minutes. If pressure drops before 3 minutes, check tester kit by spraying a soapy solution on pump cylinder, all plugs and fittings.
  • If tester kit is leaking, bubbles will indicate where leak comes from.
  • If tester kit is not leaking, check engine as per following procedure.

PROCEDURE

NOTE: A flow chart has been prepared as a visual reference. See last page of this chapter.

Using flow chart and following text, pressurize area to be tested and spray soapy solution at the indicated location.

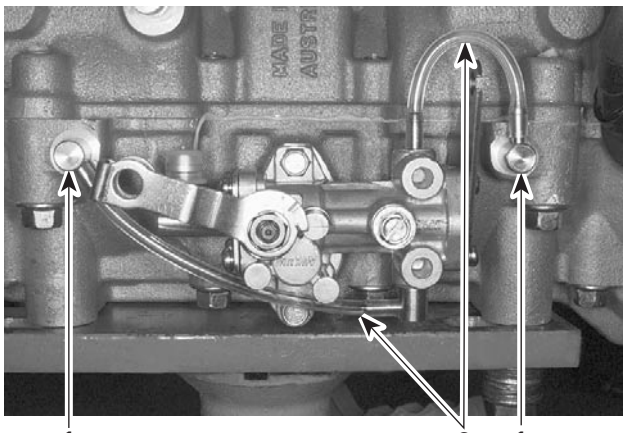
TEST PRESSURE: 34 KPA (5 PSI) FOR 3 MINUTES

– If there is a leak at the tested location, it is recommended to continue testing next items before overhauling engine. There is a possibility of more than one leak.
– If there is no leak at the tested location, continue pumping to maintain pressure and continue with next items until leak is found.

Engine

Check the following:

– All jointed surfaces and screw/stud threads of engine:
  • spark plug base, insulator
  • cylinder head
  • RAVE valve bellows, piston and housing
  • cylinder
  • crankcase halves (joint)
  • oil injection pump mounting flange (O-ring, seal)
  • coolant pump housing
  • bleed screws/plugs
  • crankcase grease reservoir fitting.
– Small injection oil lines coming from pump.



A32C1GA

1. Injection nipples
2. Small injection oil lines

Check for air bubbles or oil column going toward pump. It indicates defective check valve in injection nipples.

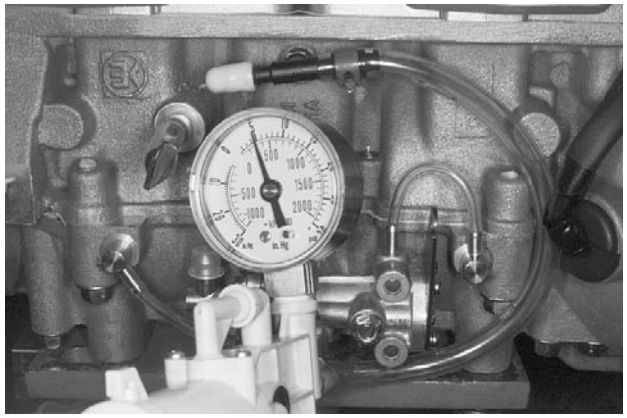
– Remove cooling system cap.

Check for air bubbles in antifreeze. It indicates defective cylinder head O-ring or cylinder base gasket.

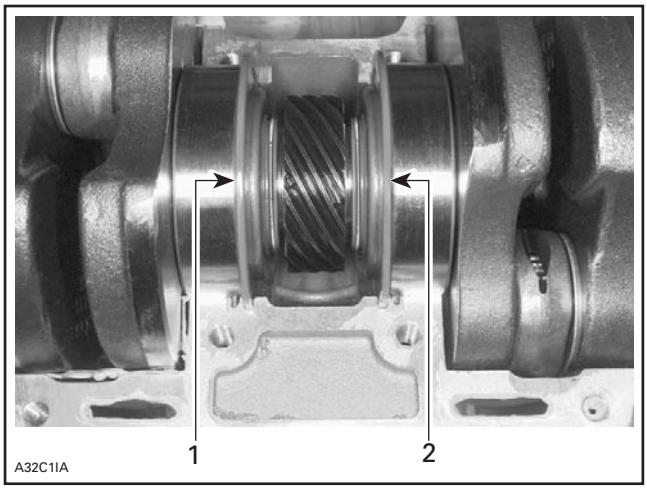
– Remove drive pulley then check crankshaft outer seal.
– Remove rewind starter and magneto system then check crankshaft outer seal.
– Check pump shaft gear oil reservoir.

Pump Shaft Oil Gear Reservoir

Install vacuum/pressure pump (P/N 529 021 800) on adapter and pressurize as before.


A32C1HA

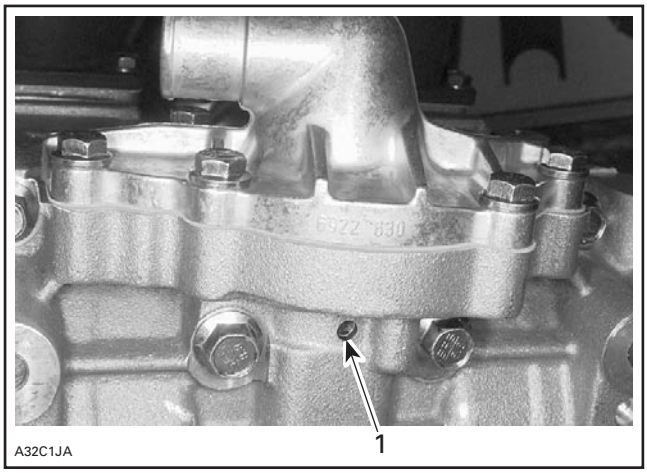
If pressure drops, it indicates a defective crankshaft inner seal.



A32C1IA

CRANKSHAFT INSTALLED IN UPPER HALF CRANKCASE
1. *Crankshaft inner seal on PTO side*
2. *Crankshaft inner seal on MAG side*

– Check weep hole below coolant pump housing with soapy water.

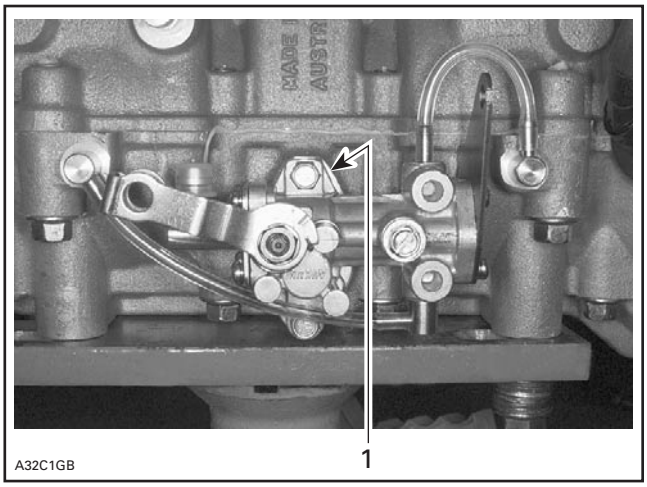


A32C1JA

1. *Weep hole*

If there is a leak, it indicates defective seal of pump shaft (oil seal beside coolant ceramic seal).

– Leaks can be also on oil pump side. Check mounting area for leaks.



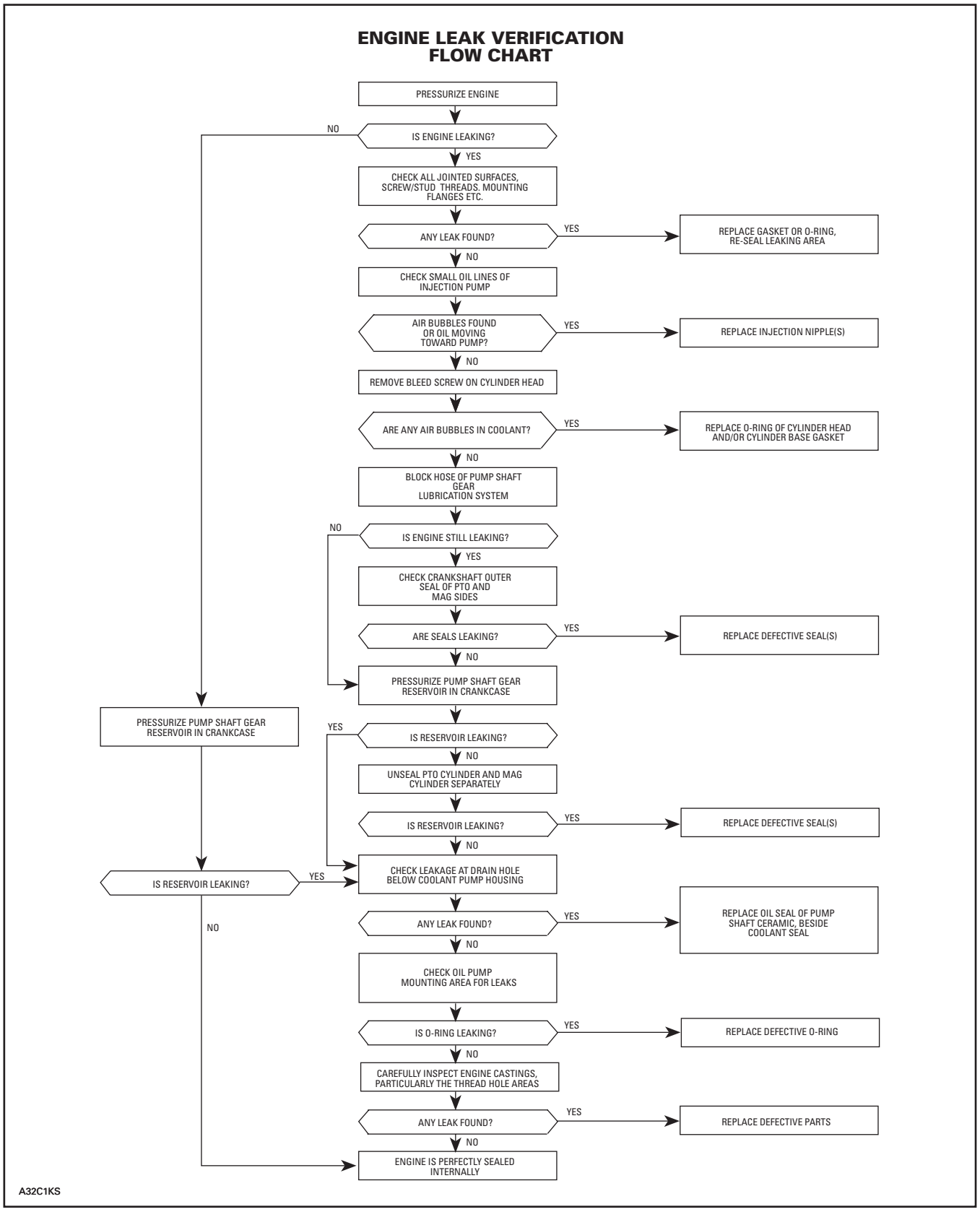
1. Check mounting area

– If leak still persists, it indicates a defective casting somewhere in engine.
– Disassemble engine and carefully check for defects in castings. Pay attention to tapped holes which may go through engine sealed area and thus lead to leakage.

FINALIZING REASSEMBLY

After reassembling engine, always recheck for leakage.

ENGINE LEAK VERIFICATION FLOW CHART



ENGINE DIMENSION MEASUREMENT

This section covers all engine types.

CYLINDER HEAD WARPAGE

ENGINE TYPE	MAXIMUM
All	0.05 mm (.002 in) per 50 mm (2 in) of surface
	0.5 mm (.020 in) for total length of cylinder head

Check gasketed surface of the cylinder head with a straightedge and a feeler gauge.

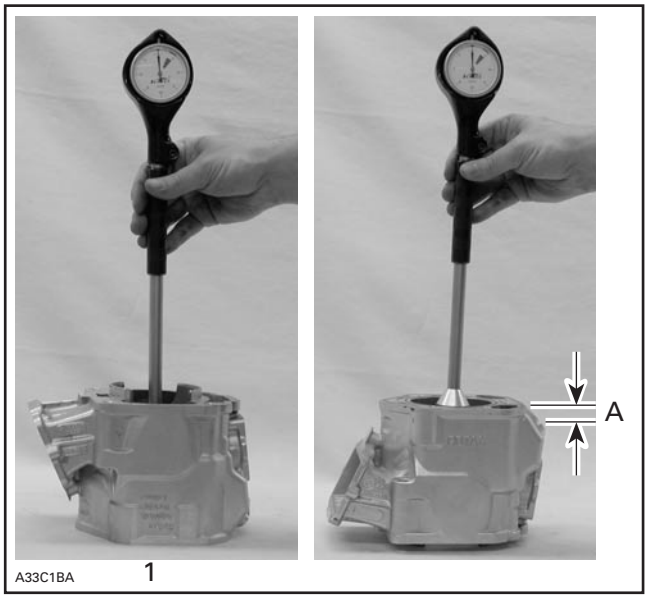
CYLINDER TAPER

ENGINE TYPE	MAXIMUM
All	0.10 mm (.004 in)

Compare cylinder diameter 16 mm (5/8 in) from top of cylinder to just below its intake port area.

If the difference exceeds the specified dimension the cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but can not be rebored.

NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



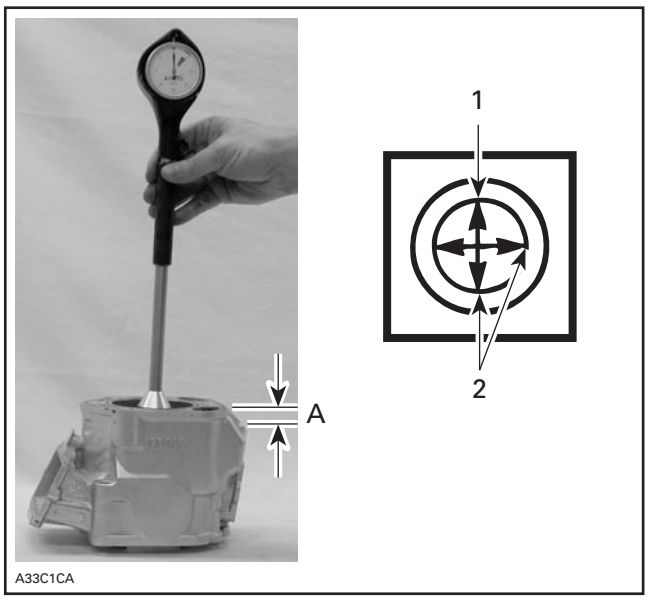
1. Below the intake port
A. 16 mm (5/8 in) from top

CYLINDER OUT OF ROUND

ENGINE TYPE	MAXIMUM
All	0.08 mm (.003 in)

Measuring 16 mm (5/8 in) from top of cylinder with a cylinder gauge, check if the cylinder out of round is more than the specified dimension. If larger, cylinder should be rebored and honed or should be replaced. Nikasil cylinder can be honed using diamond hone but can not be rebored.

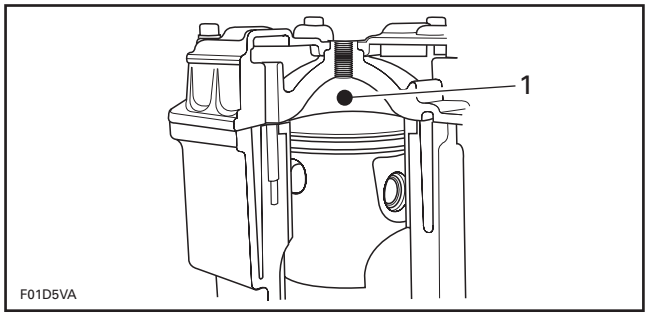
NOTE: Be sure to restore the chamfer around all cylinder sleeve port openings.



1. Piston pin position
2. Measures to be compared
A. 16 mm (5/8 in)

COMBUSTION CHAMBER VOLUME MEASUREMENT

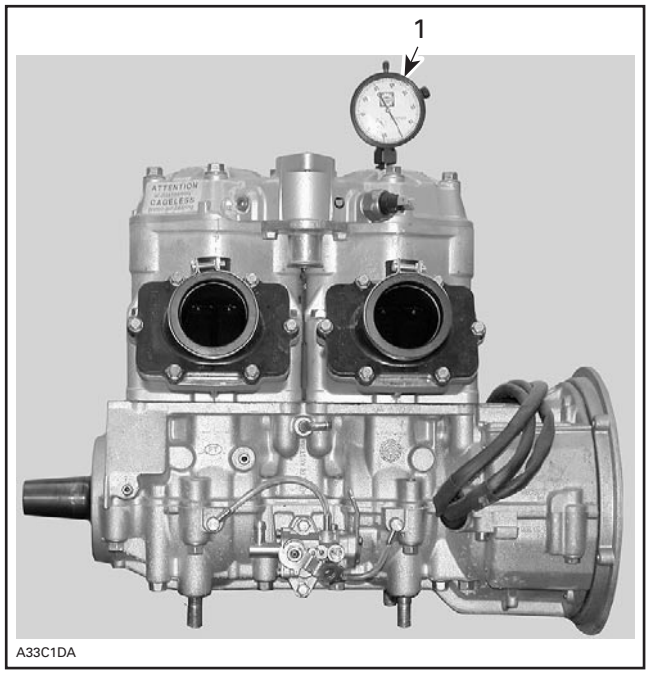
The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center. It is measured with the cylinder head installed on the engine.



1. Combustion chamber

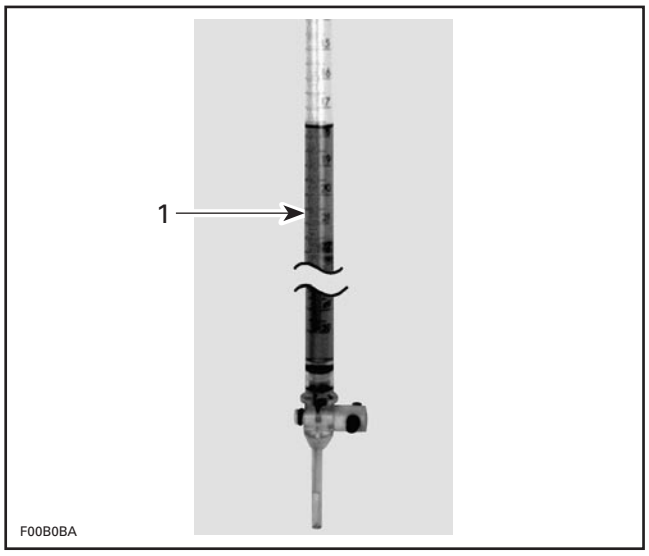
NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposit and cylinder head must be leveled.

– Remove both spark plugs and bring one piston to Top Dead Center a using a TDC gauge.



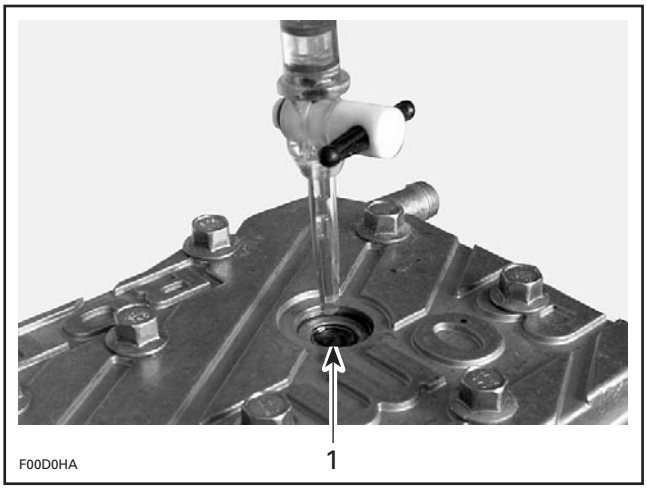
1. Bring piston to TDC

– Obtain a graduated burette (capacity 0-50 cc) and fill with an equal part (50/50) of gasoline and injection oil.



1. Graduated burette (0-50 cc)

– Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.
– Inject the burette content through the spark plug hole until liquid touches the top of the spark plug hole.



1. Top of spark plug hole

NOTE: The liquid level in cylinder must not drop for a few seconds after filling. If so, there is a leak between piston and cylinder. The recorded volume would be false.

– Let burette stand upward for about 10 minutes, until liquid level is stabilized.
– Read the burette scale to obtain the quantity of liquid injected in the combustion chamber.

NOTE: When the combustion chamber is filled to top of spark plug hole, it includes an amount of 2.25 cc corresponding to the spark plug well.

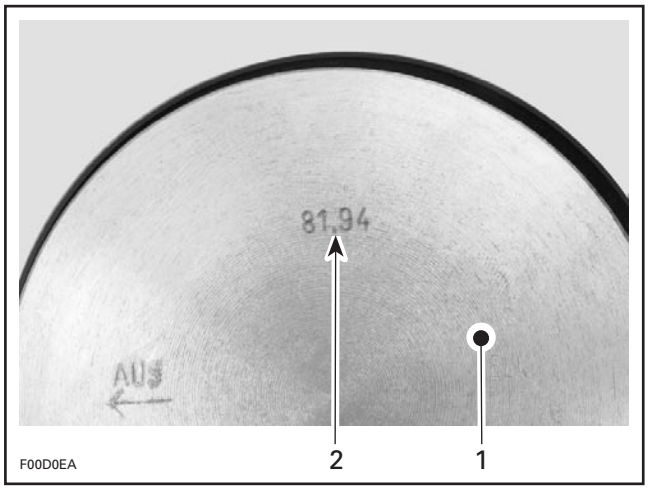
– Repeat the procedure for the other cylinder.

ENGINE TYPE	COMBUSTION CHAMBER VOLUME (cc) (up to top thread of spark plug hole)
443	24.0 ± 1.0
552	34.43 ± 1.2
593	28.97 ± 1.2
593 HO SDI	26.4 ±1.2

Install a thicker or thinner cylinder/crankcase gasket (refer to Parts Catalogs) in order to obtain the specified combustion chamber volume.

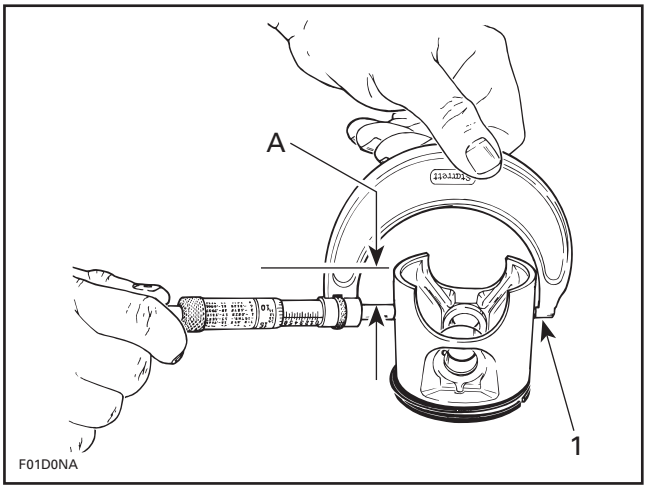
USED PISTON MEASUREMENT

Note the measurement on the piston dome.



1. Piston dome
2. Piston measurement

Using a micrometer, measure piston at A perpendicularly (90°) to piston pin.



1. Measuring perpendicularly (90°) to piston pin axis
A. 15 mm (.590 in)

ENGINE TYPE	MAXIMUM PISTON SKIRT WEAR mm (in)
All	0.15 (.006)

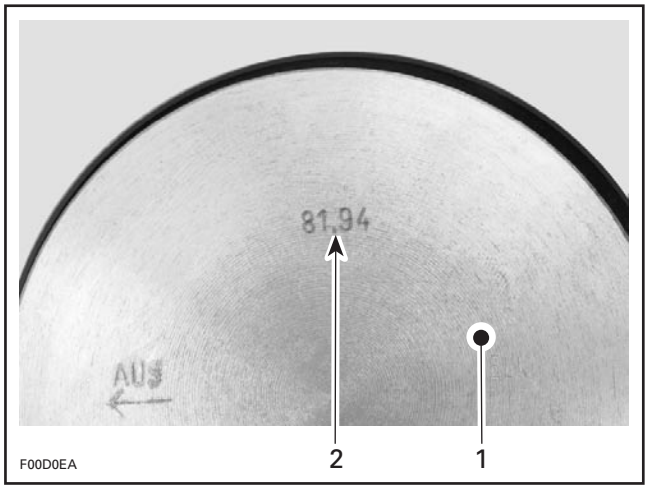
The measured dimension must not be less than 0.15 mm (.006 in) of the one scribed on piston dome. Otherwise, install a new piston.

CYLINDER/PISTON CLEARANCE

Used and New Pistons

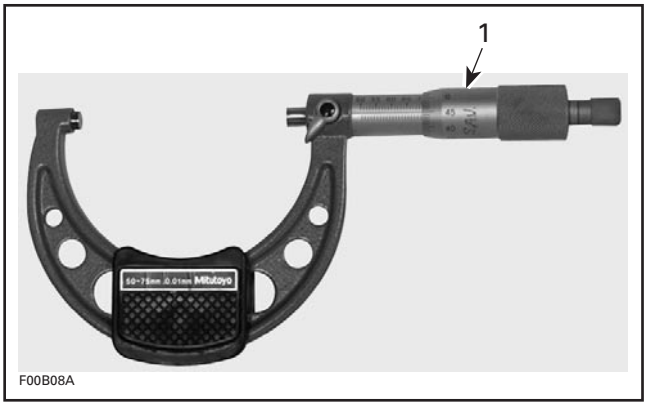
IMPORTANT: Make sure used piston is not worn more than specified. See USED PISTON MEASUREMENT above.

Take the measurement on the piston dome.



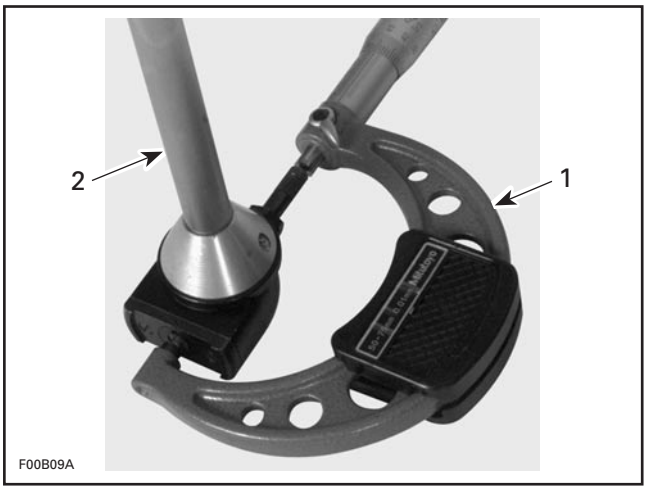
1. Piston dome
2. Piston measurement

Adjust and lock a micrometer to the specified value on the piston dome.

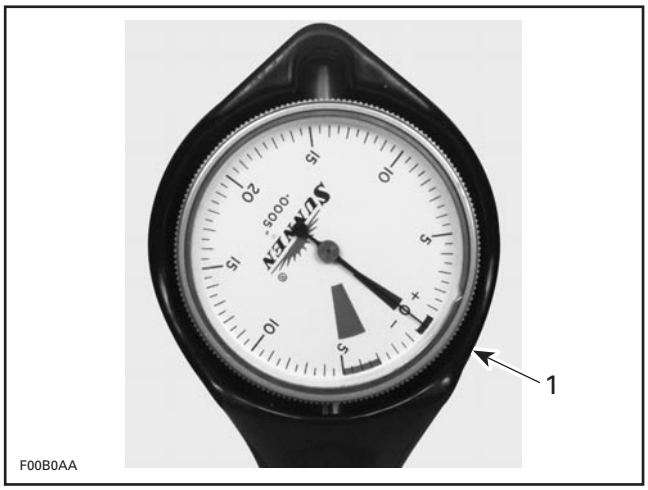


1. Micrometer set to the piston dimension

With the micrometer set to the piston dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0.



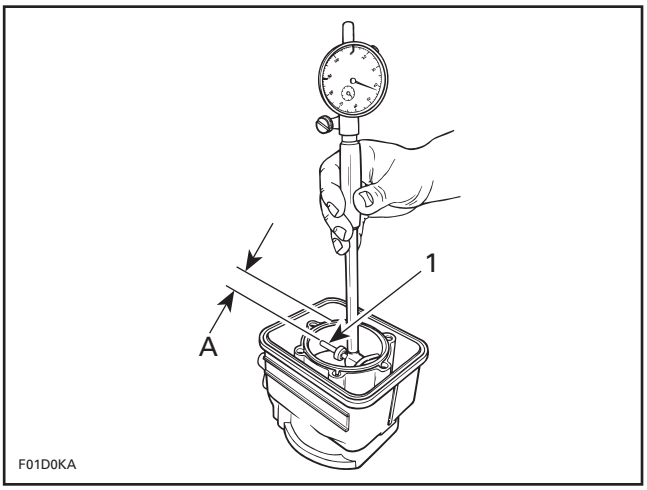
1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



1. Indicator set to 0 (zero)

IMPORTANT: Always remove cylinders from crankcase before measuring.

Position the dial bore gauge at 16 mm (5/8 in) below cylinder top edge.



1. Measuring perpendicularly (90°) to piston pin axis
A. 16 mm (5/8 in)

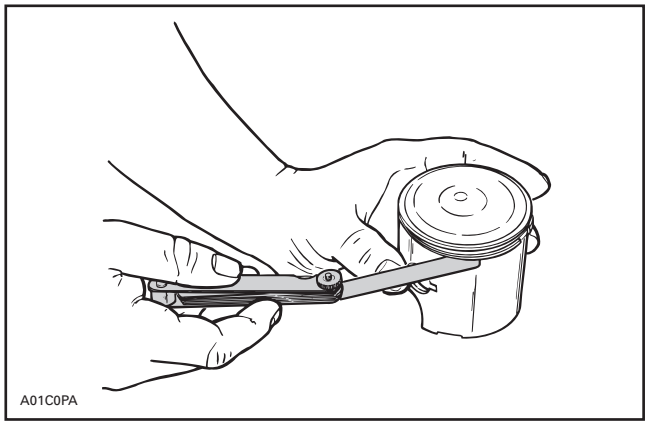
Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance. If clearance exceeds specified tolerance, replace cylinder or rebore. Refer to TECHNICAL DATA.

NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

IMPORTANT: The total piston/cylinder clearance (actual cylinder diameter minus actual piston skirt diameter) should be within 0.30 mm (.012 in).

RING/PISTON GROOVE CLEARANCE

Using a feeler gauge check clearance between upper compression ring and groove. Replace piston if clearance exceeds specified tolerance. Refer to TECHNICAL DATA.

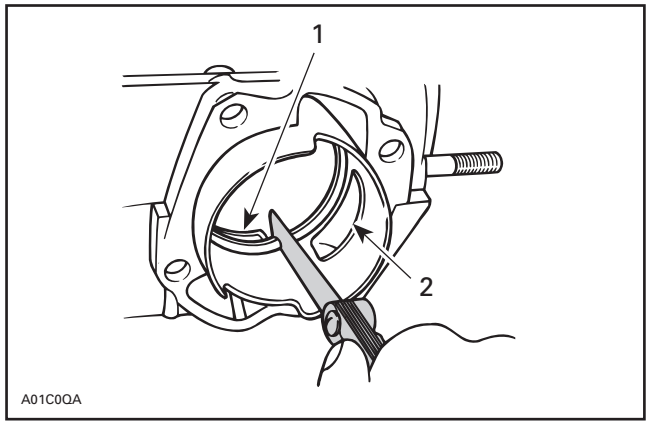


RING END GAP

Position ring halfway between transfer port and intake port.

NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds specified tolerance. Refer to TECHNICAL DATA.



1. Transfer port
2. Intake port

CRANKSHAFT DEFLECTION

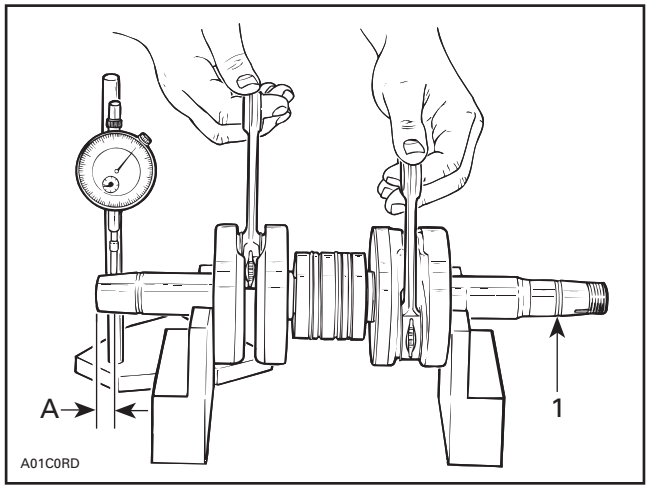
Crankshaft deflection is measured with a dial indicator (P/N 414 104 700).

Measuring (in crankcase)

First, check deflection with crankshaft in engine. If deflection exceeds the specified tolerance, recheck deflection using V-shaped blocks to determine the defective part(s). See below.

Measuring (on bench)

Once engine is disassembled, check crankshaft deflection on V-shaped blocks. If deflection exceeds the specified tolerance, it can be worn bearings or a bent crankshaft. Remove crankshaft bearings and check deflection again on V-shaped blocks to determine the defective part(s). See measurement A in following illustration.



TYPICAL
1. Measure at mid point between the key and the first thread
A. 3 mm (1/8 in)

Crankshaft Deflection on PTO Side

ENGINE TYPE	MAXIMUM ON PTO SIDE mm (in)
All	0.06 (.0024)

Crankshaft Deflection on MAG Side

ENGINE TYPE	MAXIMUM ON MAG SIDE mm (in)
277, 443 and 552	0.03 (.0012)
593/593 HO SDI	0.05 (.0020)

Crankshaft Deflection in Center of Crankshaft

ENGINE TYPE	MAXIMUM IN CENTER OF CRANKSHAFT mm (in)
All	0.08 (.0031)

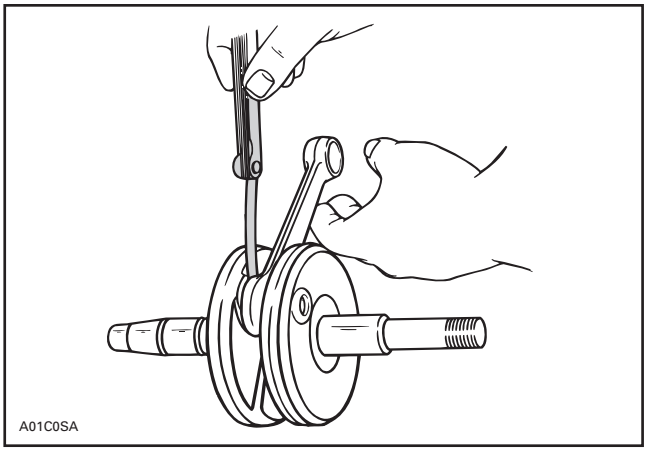
NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

NOTE: If the deflection exceeds the specified tolerance, crankshaft should be repaired or replaced.

CONNECTING ROD BIG END AXIAL PLAY

ENGINE TYPE	NEW PARTS (min. - max.)	WEAR LIMIT
277, 443 and 552	0.20 - 0.53 mm (.008 - .021 in)	1.0 mm (.039 in)
593	0.39 - 0.74 mm (.015 - .029 in)	1.20 mm (.047 in)
593 HO SDI	0.31 - 0.67 mm (.012 - .026 in)	1.20 mm (.047 in)

Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight. If the distance exceeds specified tolerance, repair or replace the crankshaft.



TYPICAL

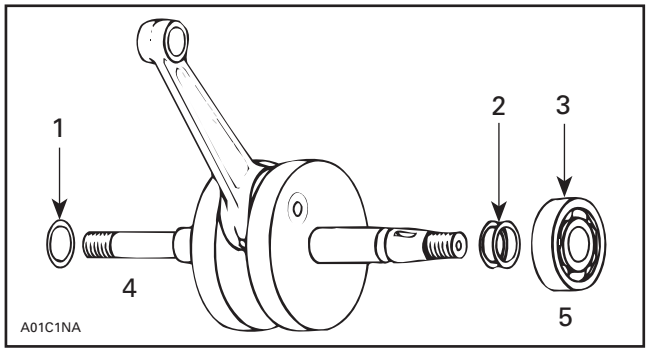
CRANKSHAFT END-PLAY

277 Engine Type

ENGINE TYPE	MINIMUM	MAXIMUM
277	0.10 mm (.004 in)	.030 mm (.012 in)

Adjustment

Crankshaft end-play is adjusted with shims located between crankshaft and magneto side bearing.



1. Distance ring
2. Shim location
3. Bearing
4. PTO
5. MAG

CAUTION: Always install end-play adjustment shims on the magneto side between bearing and crankshaft counterweight.

The following is required for the adjustment procedure:

– adjustment shims (refer to Parts Catalog)

THICKNESSES AVAILABLE
0.10 mm (.004 in)
0.20 mm (.008 in)
0.30 mm (.012 in)
0.50 mm (.020 in)

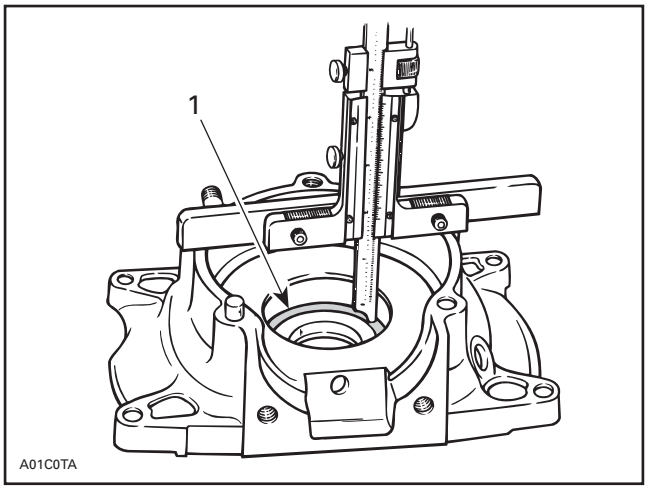
– micrometer

– caliper.

Total shim thickness needed for the end-play adjustment is determined with the following procedure:

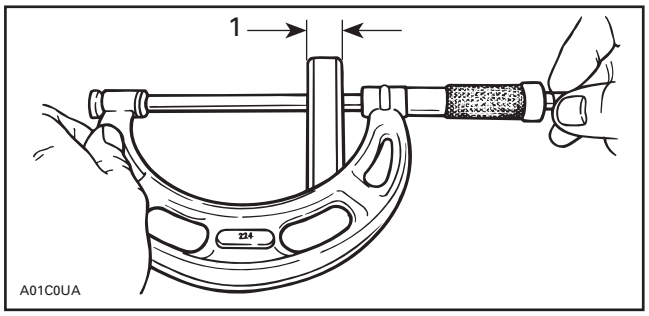
- Measure crankcase halves as illustrated (M_1 and M_2).

A standard compressed crankcase gasket will have a 0.30 mm (.012 in) thickness (M_3). **Add these measurements to obtain dimension A.**



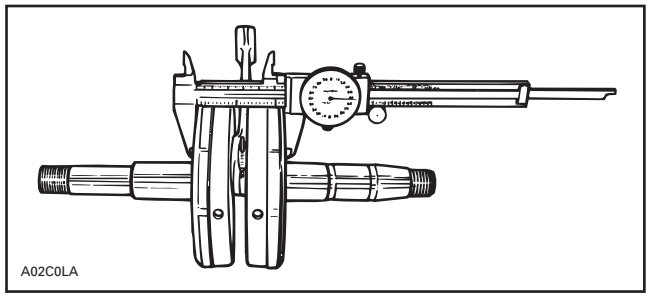
MEASURING M_1 AND M_2
1. Bearing seat

- Measure the thickness of each bearing (M_4 and M_5).



MEASURING M_4 AND M_5
1. Bearing thickness

- Measure distance between bearing shoulders on crankshaft (M_6).



MEASURING M_6

- Measure the distance ring (M_7) and adjustment shims thickness (M_8). **Add these measurements to obtain dimension B.**
- **From dimension A, subtract dimension B.**

The result is the actual crankshaft end-play that must be within specification.

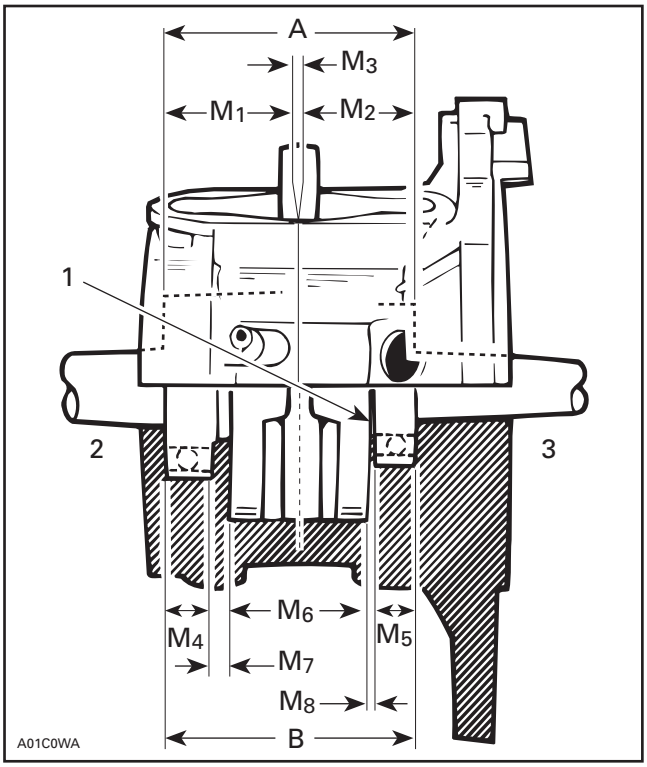
If the result is over specification, add adjustment shim(s) to reach this specification.

If the result is under specification, remove adjustment shim(s) to reach this specification.

To Summarize

A	=	$M_1 + M_2 + M_3$
B	=	$M_4 + M_5 + M_6 + M_7 + M_8$
A - B	=	Actual end-play that must be within specification.

M_8 is the dimension that must be adjusted to obtain the specified crankshaft end-play.



1. End-play is adjusted with shims
2. PTO
3. MAG

443, 552 and 593 Engine Types

End-play is not adjustable but it should be between 0.10 - 0.30 mm (.004 - .012 in).

CHECKING SURFACE FLATNESS

Intake manifold, intake manifold cover can be checked for perfectly mating surfaces.

Lay part on a surface plate (marble, mirror or thick glass plate).

Holding down one end of part, try pushing down the other end.

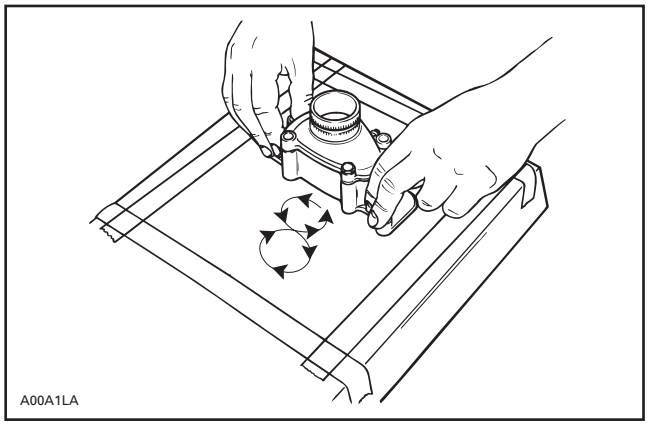
If any play is felt, part must be rectified.

RECTIFYING SURFACES

Stick a fine sand paper sheet on the surface plate then lightly oil the sand paper.

Rub part mating surface on sand paper using 8-figure movements.

Sand until mating surface is perfectly straight.



CHECKING CRANKSHAFT ALIGNMENT

Install a degree wheel (P/N 414 352 900) on crankshaft end.

Remove both spark plugs.

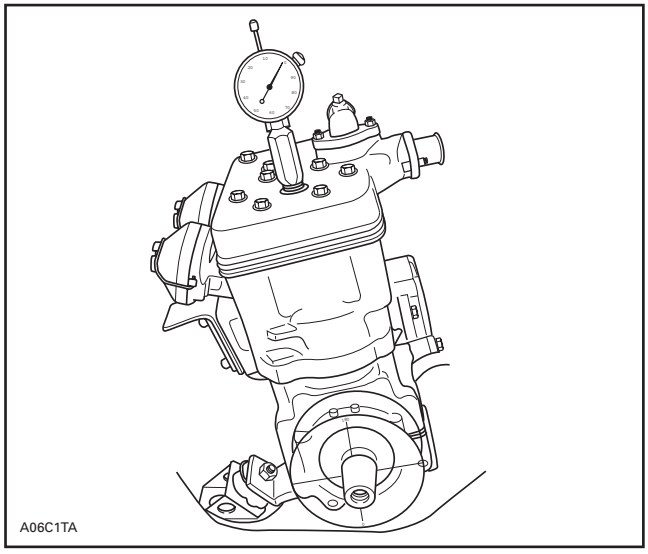
Install a dial indicator (P/N 414 104 700) in spark plug hole on MAG side.

Bring MAG piston at top dead center.

Rotate degree wheel (P/N 414 352 900) (not crankshaft) so that 360° mark aligns with center of crankcase. Scribe a mark on crankcase.

Remove dial indicator (P/N 414 104 700) and install it on PTO side cylinder.

Bring PTO piston to top dead center. degree wheel (P/N 414 352 900) must rotate with crankshaft.



TYPICAL

Interval between cylinders must be 180° ± 0.5.

Any other reading indicates a misaligned (twisted) crankshaft.

MAGNETO SYSTEM

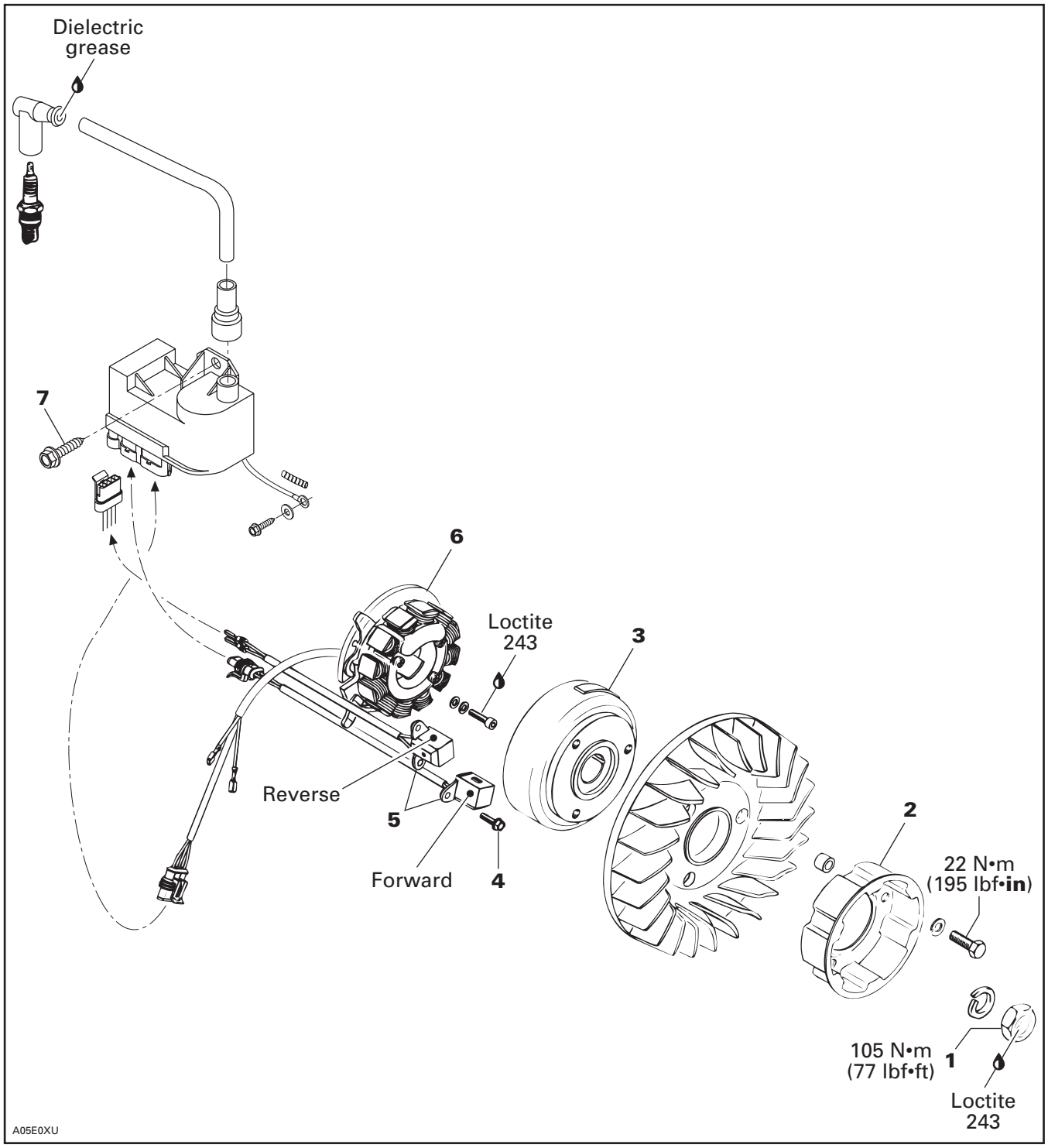
SERVICE TOOLS

Description	Part Number	Page
clutch holder	529 027 600	128
crankshaft protector	420 876 557	129
magneto puller	529 035 547	129
magneto puller ring	420 876 080	128

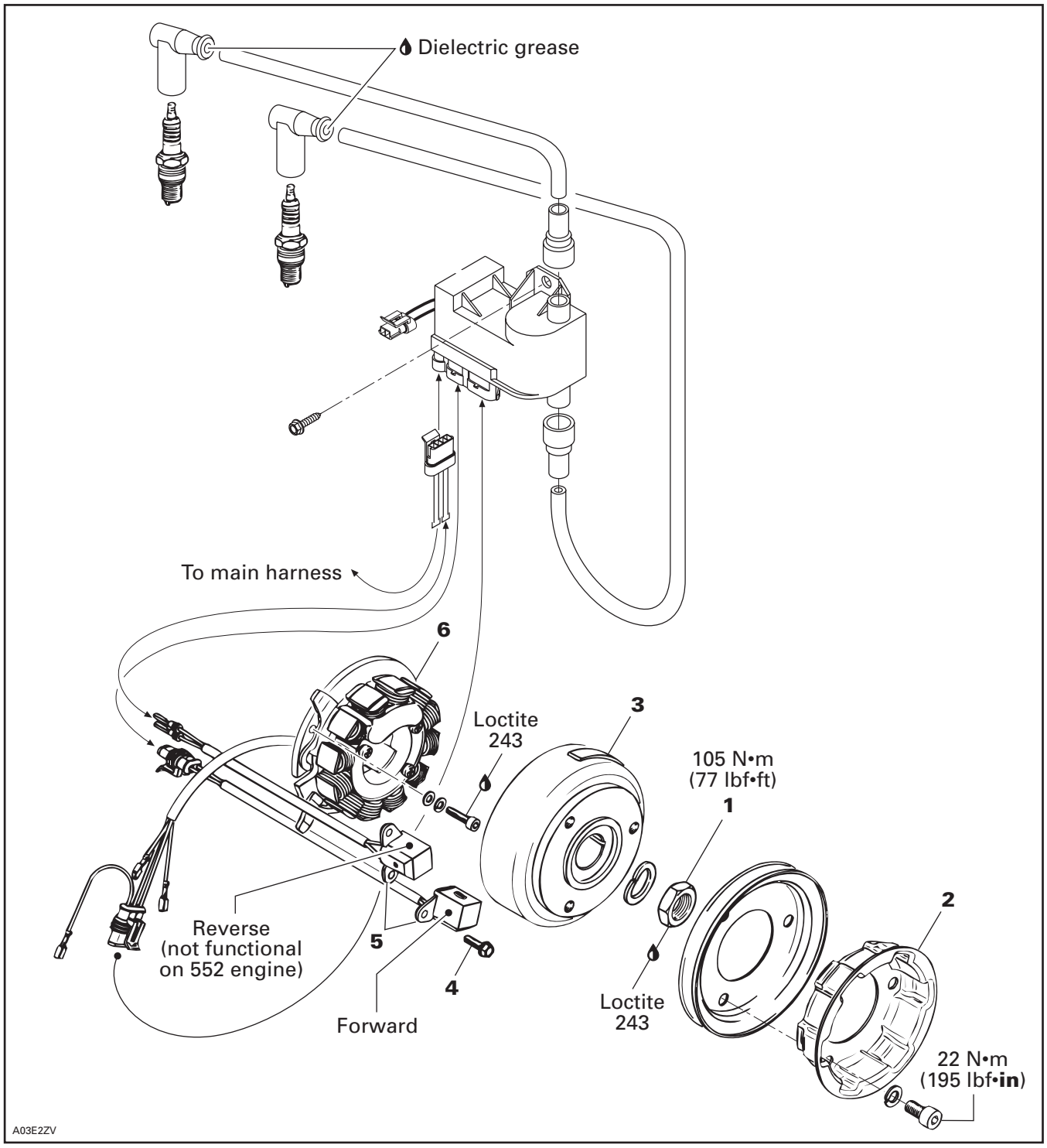
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	129–130
silicone dielectric grease	293 550 004	130

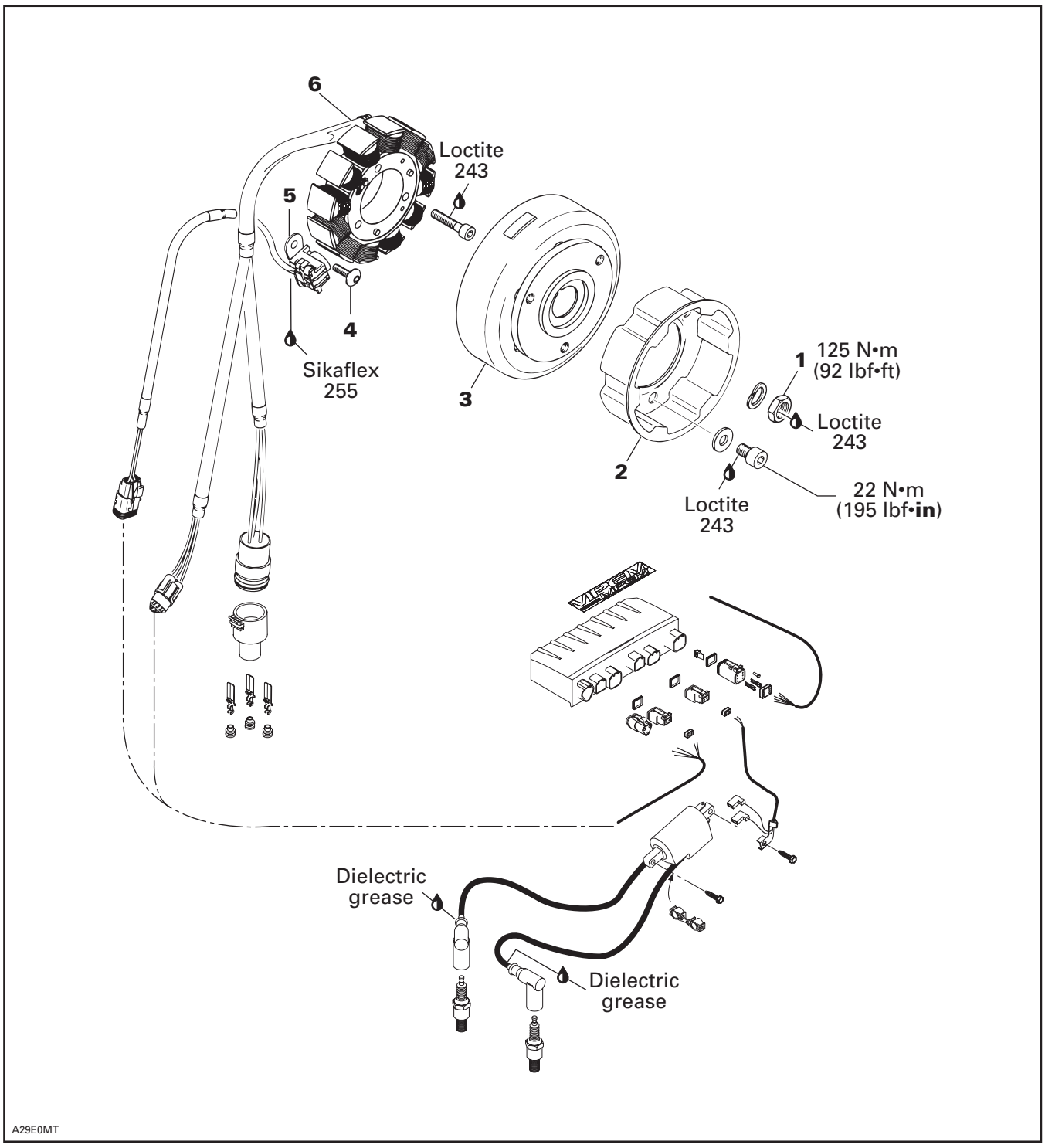
277 Engine


Dielectric grease
7
6
Loctite 243
3
Reverse
5
Forward
4
2
22 N•m (195 lbf•in)
105 N•m (77 lbf•ft)
1
Loctite 243
A05E0XU

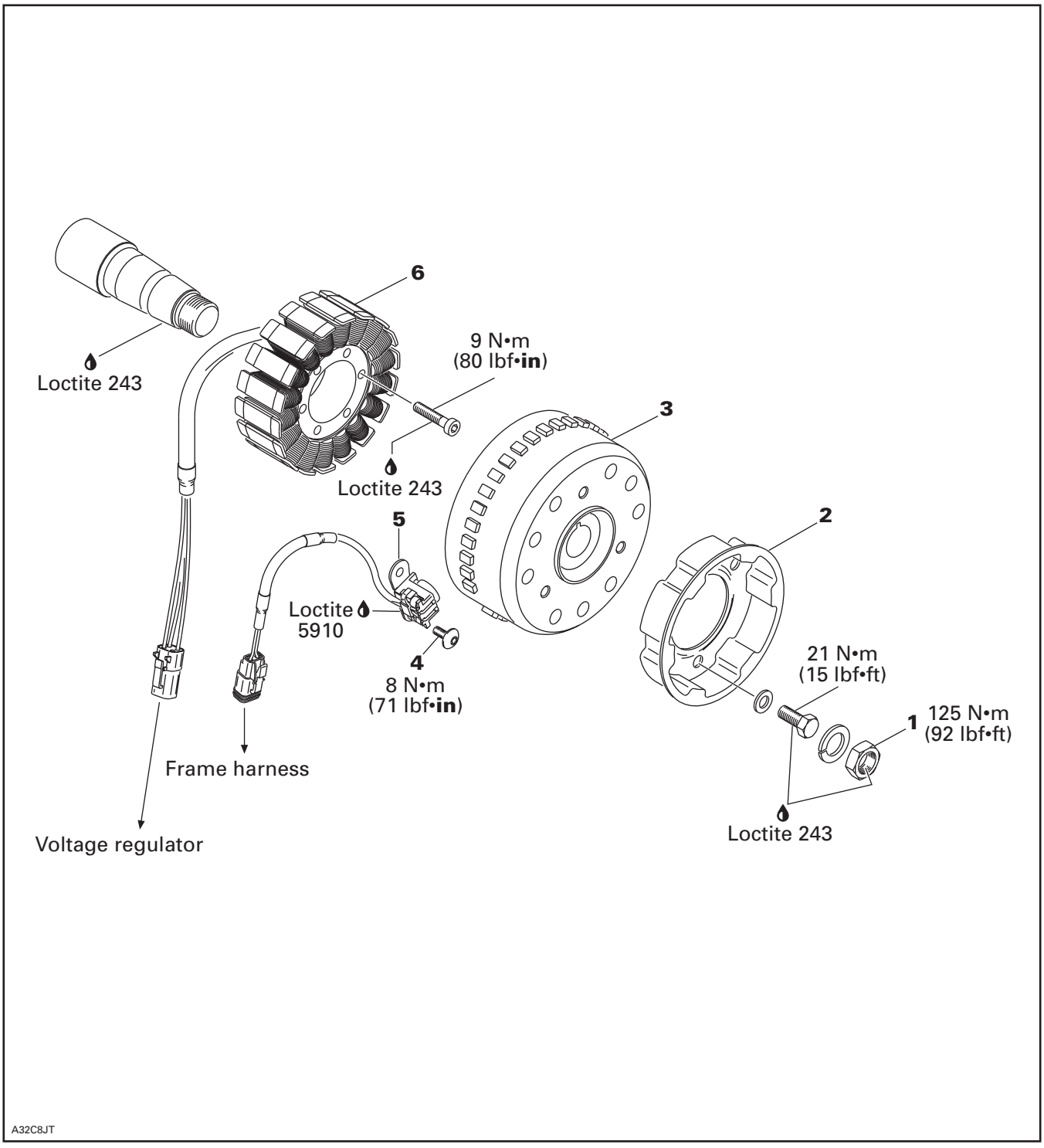
443 and 552 Engines



593 Engine


6
Loctite
243
5
4
Sikaflex
255
3
2
1
125 N•m
(92 lbf•ft)
Loctite
243
Loctite
243
22 N•m
(195 lbf•in)
Dielectric
grease
Dielectric
grease
A29E0MT

593 SDI Engine



GENERAL

NOTE: The following procedures can be done without removing the engine from chassis. To facilitate magneto removal, hold drive pulley with clutch holder (P/N 529 027 600).

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

CLEANING

Clean all metal components in a non-ferrous metal cleaner.

CAUTION: Clean stator and magneto using only a clean cloth.

DISASSEMBLY

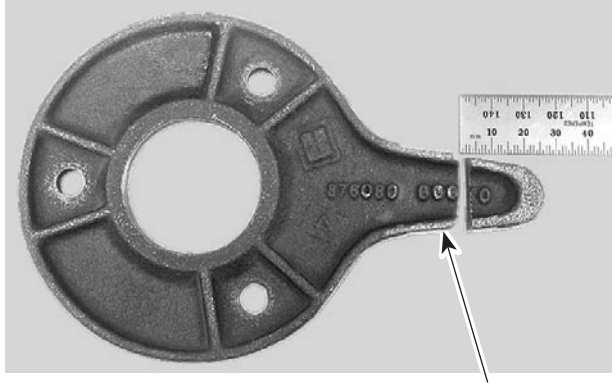
Magneto Flywheel

To gain access to magneto flywheel no. 3 assembly, remove the following parts as needed on different engines:

– tuned pipe and muffler
– rewind starter
– starting pulley no. 2.

To remove magneto flywheel nut no. 1:

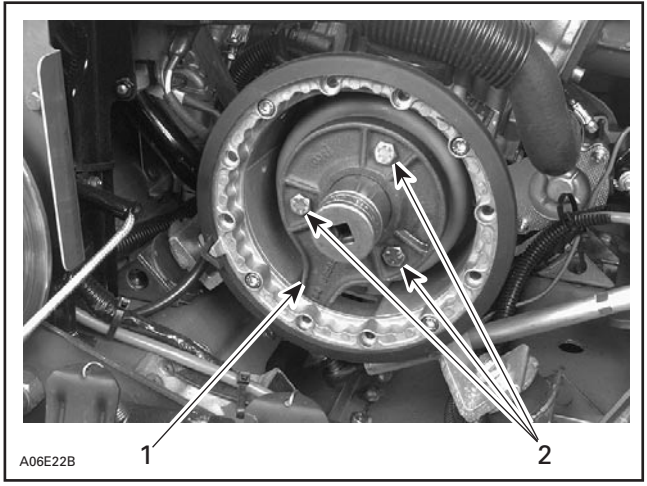
– Use magneto puller ring (P/N 420 876 080). Former puller has to be modified as shown.



1. Cut by 25 mm (1 in)

– Install magneto puller ring (P/N 420 876 080) with its tab in magneto housing opening.

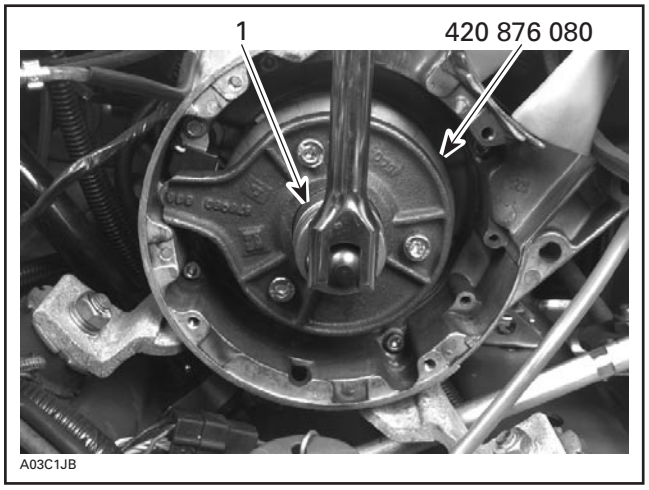
CAUTION: Use only M8 x 20 mm screws to bolt puller to magneto.



TYPICAL
1. Tab in magneto housing opening
2. M8 x 20 mm screws

– Remove magneto flywheel nut, using a 30 mm socket machined to 40 mm (1.580 in) outside diameter by 16 mm (5/8 in) long.

NOTE: To correctly remove a threadlocked fastener, first tap on the fastener to break threadlocker bond. This will avoid thread breakage.



TYPICAL
1. 30 mm socket

To remove magneto flywheel, install crankshaft protector (P/N 420 876 557) on crankshaft end. Screw magneto puller (P/N 529 035 547) into puller ring.

Tighten puller bolt and at the same time, tap on bolt head using a hammer to release magneto flywheel from its taper.

Stator

NOTE: Always check stator **no. 6** before changing it, refer to TESTING PROCEDURE.

Remove:

– magneto flywheel **no. 3**
– all Allen socket screws retaining stator to magneto housing
– grommet from crankcase where trigger coil and stator wires exit magneto housing.

Unplug the trigger coil connectors and pull the wires through the grommet location.

NOTE: To pass the stator connector into the grommet location it is necessary to pass the trigger coil connector first.

Unplug the stator connector and remove the stator.

Trigger Coil

Magneto and stator **no. 6** must be removed before trigger coil removal.

To replace trigger coil **no. 5**:

– Disconnect trigger coil connector housing.
– Remove grommet from crankcase where trigger coil wire exits magneto housing.
– Remove retaining screws **no. 4**.
– Remove trigger coil and carefully pull wires.
– Install new trigger coil and other parts removed.

ASSEMBLY

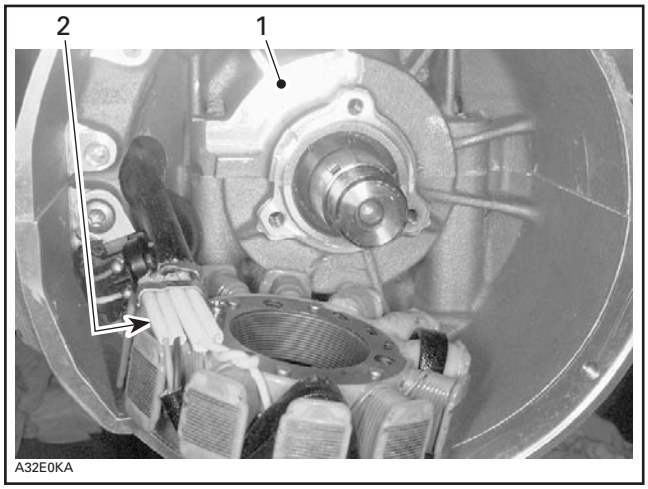
Trigger Coil

For installation, reverse the removal procedure.

NOTE: It is important to remove the old silicon at trigger coil location then apply new silicon. Screw trigger coil then stick the trigger coil wires in the silicon.

Stator

Make sure to position stator **no. 6** in a way that its wire protectors are over recess of crankcase.



1. Crankcase recess
2. Wire protectors

Apply Loctite 243 (P/N 293 800 060) on threads of stator screws then torque them to 9 N•m (80 lbf•**in**).

Reinstall all other removed parts.

Magneto Flywheel

Clean crankshaft extension (taper) and apply Loctite 243 (blue) on taper, then position Woodruff key, magneto flywheel **no. 3** and lock washer on crankshaft.

Clean nut threads and apply Loctite 243 (P/N 293 800 060) then tighten nut to 105 N•m (77 lbf•ft) for fan-cooled engines and to 125 N•m (92 lbf•ft) for liquid-cooled engines.

At reassembly coat all electric connections except Deutsch housings (waterproof gray housing) with silicone dielectric grease (P/N 293 550 004) to prevent corrosion or moisture penetration.

CAUTION: Do not use silicone "sealant", this product will corrode contacts. Do not apply silicone dielectric grease (P/N 293 550 004) on any Deutsch (gray) housing otherwise housing seal will be damaged.

Ignition Timing

Check as described in IGNITION TIMING.

OIL INJECTION SYSTEM

SERVICE TOOLS

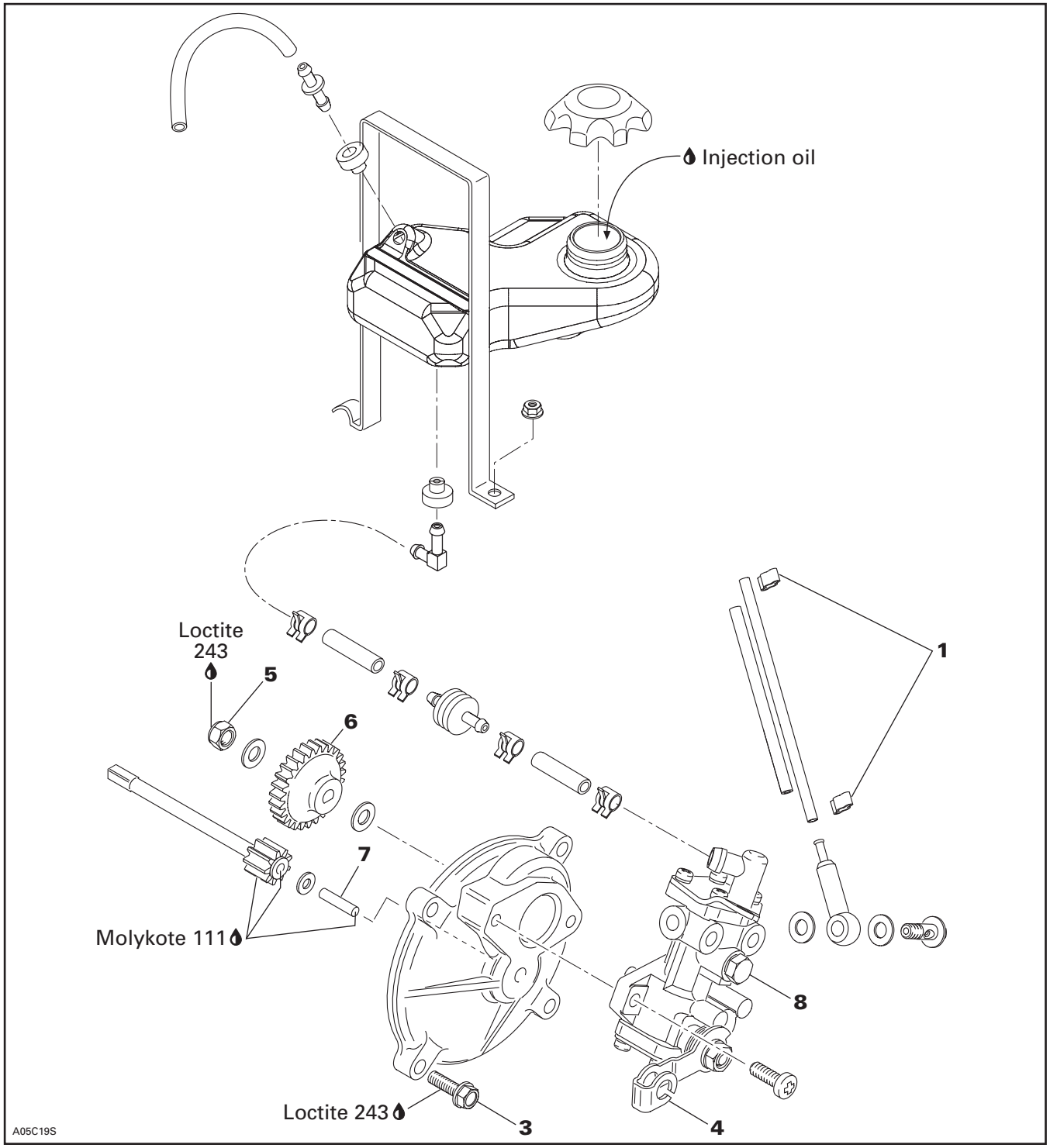
Description	Part Number	Page
gear holder	420 876 695	137
hose pinchers	295 000 076	136
leak testing kit	529 033 100	136

SERVICE PRODUCTS

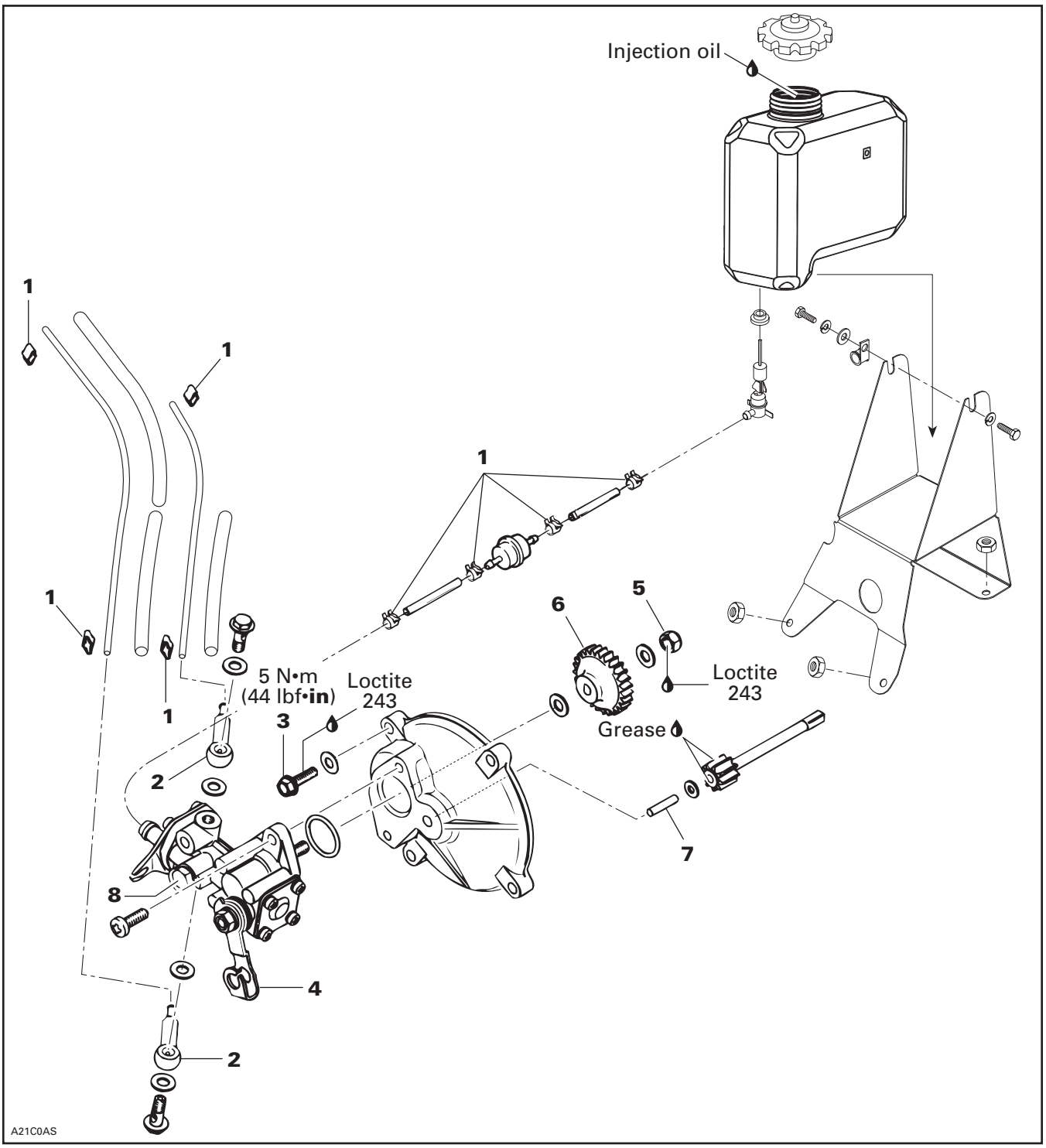
Description	Part Number	Page
Loctite 648 (green)	413 711 400	138
Molykote 111	413 707 000	137
pulley flange cleaner	413 711 809	138

OIL INJECTION PUMP

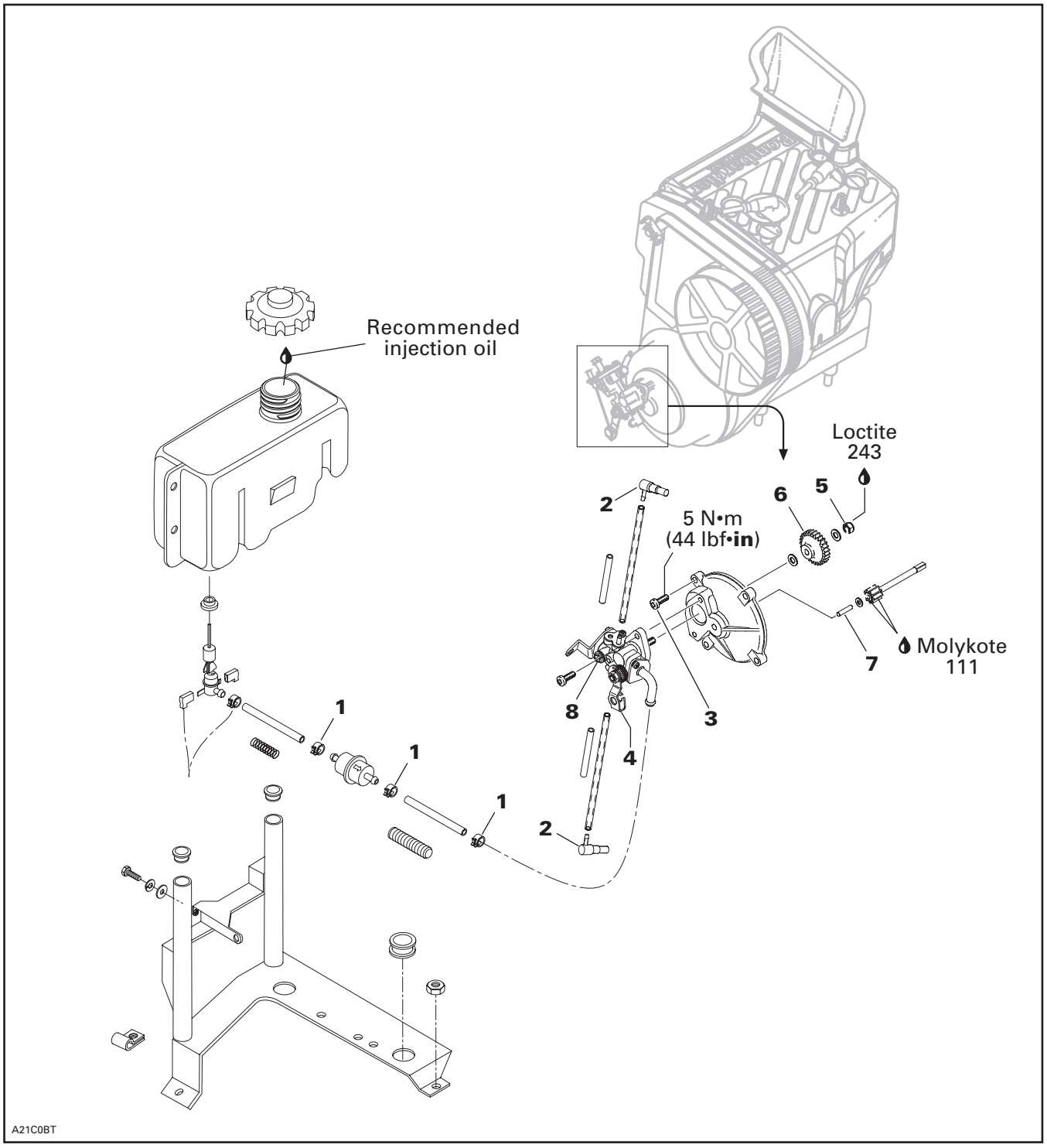
277 Engine



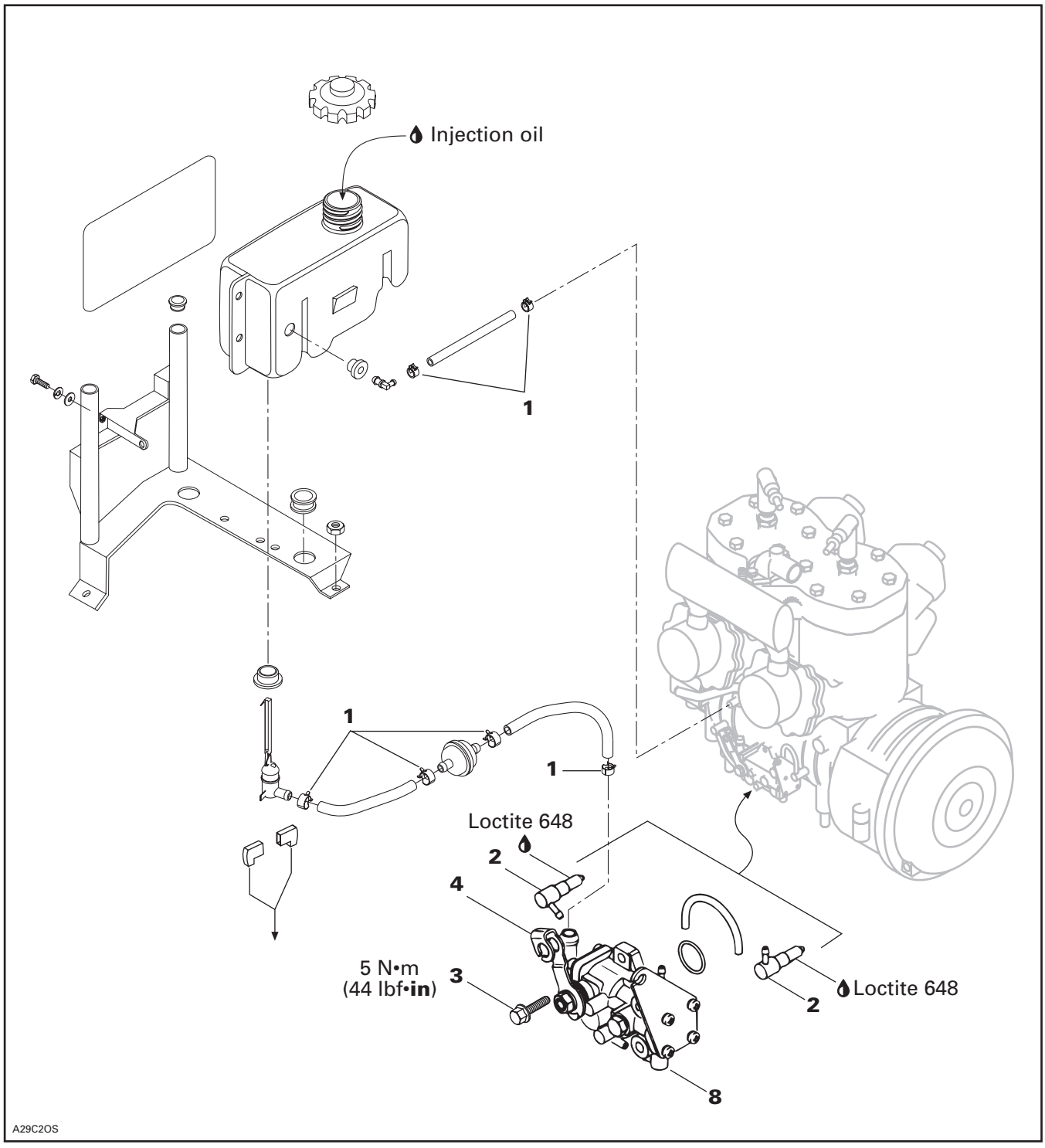
443 Engine


Injection oil
1
1
1
1
1
5 N•m
(44 lbf•in)
Loctite
243
3
2
6
5
Loctite
243
Grease
7
8
4
2
A21C0AS

552 Engine


Recommended
injection oil
Loctite
243
5 N•m
(44 lbf•in)
Molykote
111
1
2
3
4
5
6
7
8
A21C0BT

593 and 593 HO SDI Engines



GENERAL

During assembly/installation, use the torque values and service products as in the exploded views.

Clean threads before applying a threadlocker. Refer to SELF-LOCKING FASTENERS and LOCTITE APPLICATION at the beginning of this manual for complete procedure.

⚠ WARNING

Torque wrench tightening specifications must strictly be adhered to.
Locking devices (e.g.: locking tabs, elastic stop nuts, self-locking fasteners, etc.) must be installed or replaced with new ones where specified. If the efficiency of a locking device is impaired, it must be renewed.

⚠ WARNING

Wipe off any oil spills. Oil is highly flammable.

NOTE: The following procedures can be done without removing the engine from chassis.

OIL TYPE

ENGINE	OIL TYPE
593 HO SDI(1)	XP-S™ synthetic 2-stroke oil or XP-S™ 2-stroke synthetic blend
All others 2-stroke engines	XP-S™ synthetic 2-stroke oil or XP-S™ 2-stroke synthetic blend or XP-S™ mineral injection oil (2) (3)

(1) **CAUTION: XP-S™ synthetic 2-stroke oil and XP-S™ 2-stroke synthetic blend oil are specially formulated and tested for the severe requirement of these engines. Use of any other brand two-stroke oil may void the limited warranty. Use only XP-S™ synthetic 2-stroke oil and XP-S™ 2-stroke synthetic blend. There is no known equivalent on the market for the moment. If a high quality equivalent were available, it could be used.**

(2) If XP-S™ mineral injection oil is not available, API TC high-quality low ash two-stroke injection oil may be used.

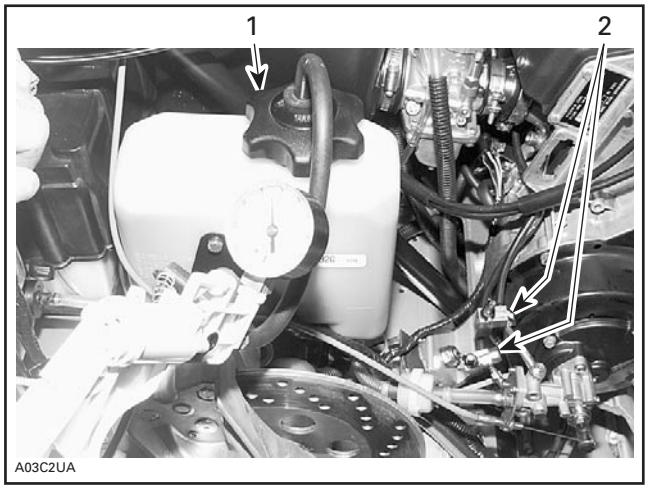
(3) XP-S™ synthetic 2-stroke, XP-S™ 2-stroke synthetic blend and XP-S™ mineral injection oil are compatible, they can be mixed together.

OIL SYSTEM LEAK TEST

The following test will indicate any leak from oil reservoir to the banjo fitting(s).

Install on oil reservoir special cap of leak testing kit (P/N 529 033 100).

Install hose pinchers (P/N 295 000 076) on outlet hoses.



TYPICAL
1. Special cap on reservoir
2. Hose pinchers on outlet hoses

Connect leak testing kit pump to special cap.

Pressurize oil system to 21 kPa (3 PSI). Pressure must not drop during 3 minutes.

If pressure drops, locate leak(s) and repair/replace leaking component(s).

OIL PUMP IDENTIFICATION

4, Pump Lever

Different engines need different pumps. See identification on lever no. 4.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
277	132K
443	E8
552	03
593	L7
593 HO SDI	02

NOTE: The following procedures can be done without removing the engine from chassis.

CLEANING

Clean all metal components in a non-ferrous metal cleaner.

DISASSEMBLY

NOTE: Some oil pump components are not available as single parts.

8, Injection Oil Pump

NOTE: Before removing the injection oil pump no. 8, check its operation. Refer to the end of this section.

443 and 552 Engines

Remove:
– air box
– carburetor
– pump mounting flange screws no. 3

Unplug all hoses connected to oil pump no. 8.

NOTE: Mark hose locations for installation.

Disconnect the oil pump cable.

593, 593 HO SDI Engines

Remove:
– air box
– carburetor or throttle body
– screw no. 3.

Unplug all hoses connected to oil pump no. 8.

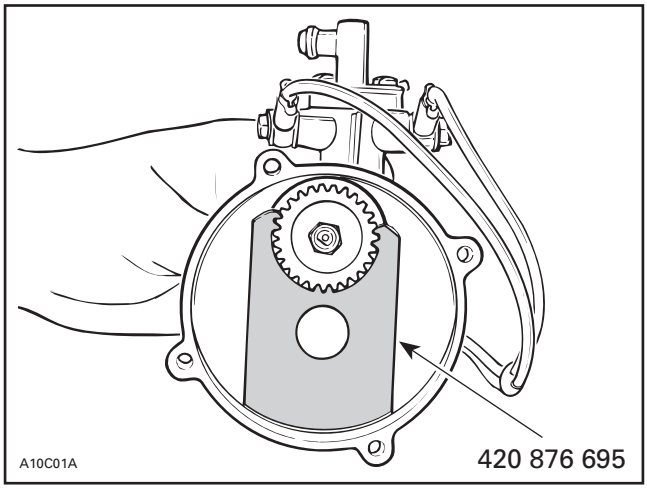
NOTE: Mark hose locations for installation.

Disconnect the oil pump cable.

5,6, Gear Retaining Nut and Oil Pump Gear

277, 443 and 552 Engines

To remove gear retaining nut, first extract the needle roller with pliers then lock gear in place using gear holder (P/N 420 876 695).



ASSEMBLY

1, Spring Clip

Always check for spring clips tightness.

6, Oil Pump Gear

At gear assembly, apply a light coat of Molykote 111 (P/N 413 707 000) on gear teeth.

8, Injection Oil Pump

For installation, reverse the removal procedure. However, pay attention to the following.

Torque the screws no. 3 to 5 N•m (44 lbf•**in**).

Make sure cable barrel is well seated in oil pump lever.

Secure barrel with plastic washer and circlip.

Install cable lock washer on left side of support.

Verify cable and oil pump lever operation then adjust cable.

7, Needle Roller (fan cooled engine only)

The needle roller must be engaged as deep as possible in the pump mounting flange.

3, Screw

Torque to 5 N•m (44 lbf•**in**).

Cable plastic elbow must be fastened and fully inserted.

Make sure cable barrel is well seated in oil pump lever.

Secure barrel with plastic washer and circlip.

Install cable lock washer on lever side.

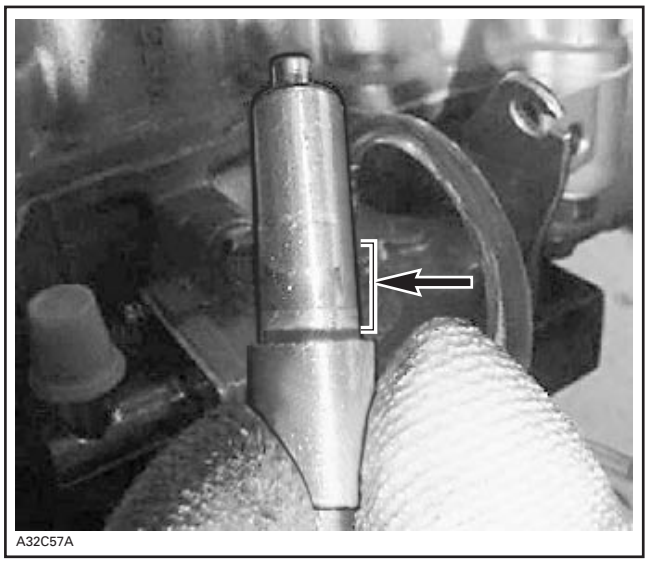
Verify cable and oil pump lever operation.

2, Check Valve

593 and 593 HO SDI Engines

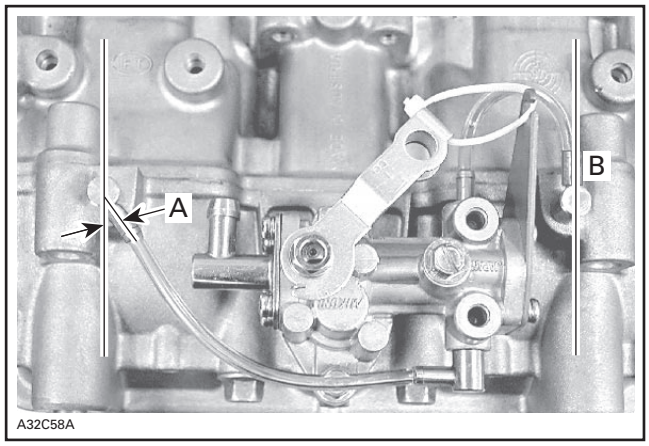
Apply Loctite 648 (green) (P/N 413 711 400) on the outer diameter of the check valve (machined section). Take care that Loctite is ONLY in this area.

NOTE: Prior to coating it with Loctite, make sure check valve body is clean and dry. Clean from dirt or oil, if any, with pulley flange cleaner (P/N 413 711 809).

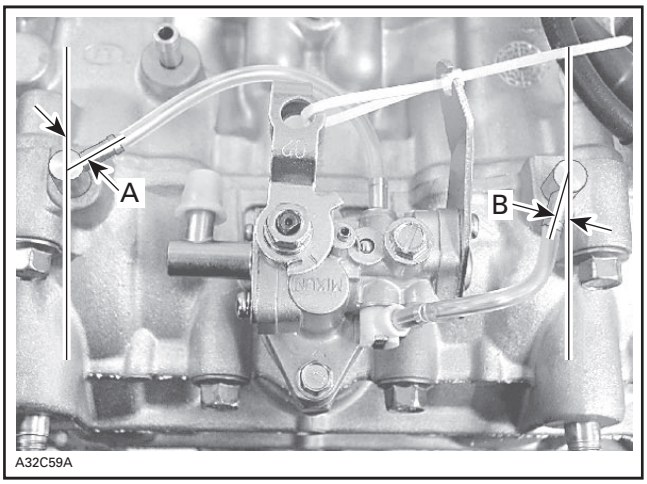


APPLY LOCTITE ON THIS AREA ONLY

Install the check valve in the correct position as described on next photo into the crankcase lower side.



POSITION FOR 593 ENGINE
A. PTO side: 30° ± 10° from cylinder axis to the bottom
B. MAG side: 0° from cylinder axis to the top



TYPICAL — POSITION FOR 593 HO SDI ENGINE
A. PTO side 45° ± 5° from cylinder axis to the top
B. MAG side 20° ± 5° from cylinder axis to the bottom

Punch in the check valve carefully with a plastic hammer.

Clean the crankcase from surplus of Loctite 648 with a rag.

ADJUSTMENT

Prior to adjusting the pump, make sure all carburetor adjustments are completed and engine is stopped.

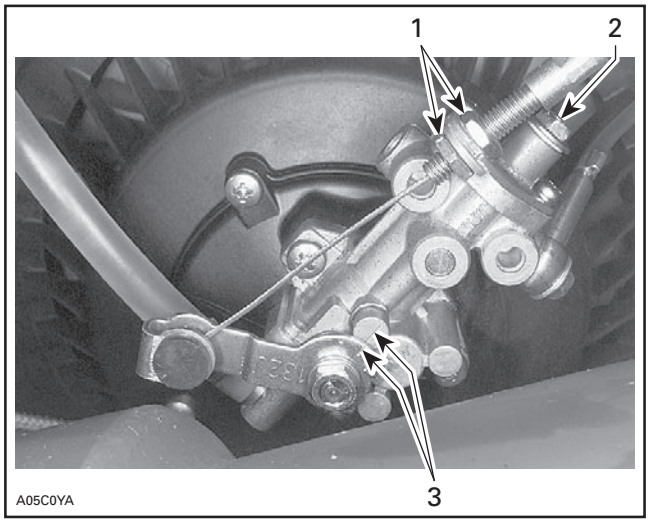
277, 443 and 552 Engines

Eliminate the throttle cable free-play by pressing the throttle lever until a light resistance is felt, then hold in place.

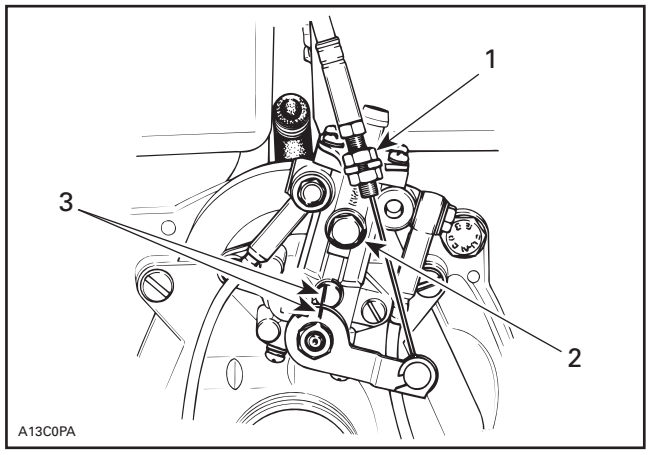
The mark on the pump casting and on the lever must align. Width of lever mark is the tolerance.

Loosen the adjuster nut and adjust accordingly.

Retighten the adjuster nut.



TYPICAL — TUNDRA R
1. *Adjuster nuts*
2. *Bleeder screw*
3. *Marks*



TYPICAL — SKANDIC LT/WT/SWT/SUV 550
1. *Adjuster nut*
2. *Bleeder screw*
3. *Marks*

CAUTION: Proper oil injection pump adjustment is very important. Any delay in the opening of the pump can result in serious engine damage.

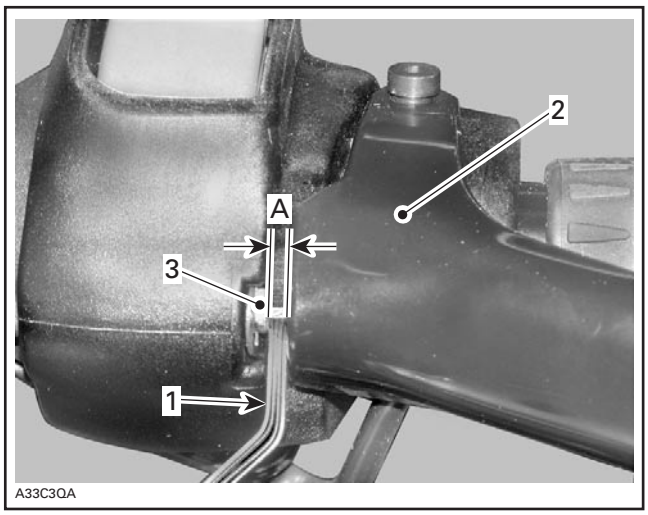
593 and 593 HO SDI Engines

Before proceeding with the oil pump cable adjustment, verify throttle cable adjustment and adjust if needed. Refer to FUEL SYSTEM or COMPONENT INSPECTION AND ADJUSTMENT, noting that the throttle cable free play should be adjusted just prior to the oil pump cable.

Depress the throttle lever lightly until the cable is under tension but carburetors or throttle body are not yet opened.

NOTE: Throttle cable visible distance "A" is measured between the throttle lever and the cable housing end, using a feeler gauge.

Measure the visible distance "A" using the appropriate feeler gauge and note measurement.



TYPICAL
1. *Feeler gauge*
2. *Throttle lever*
3. *Cable housing end*

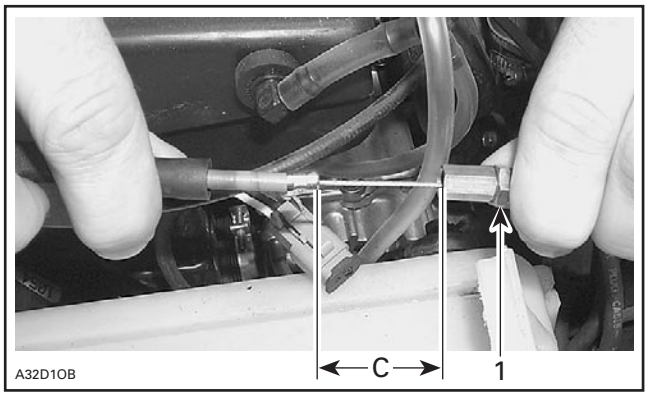
A. Measurement "A"

Next, add to measurement "A" the appropriate specification "B", using the chart below.

OIL PUMP ADJUSTMENT	
Engine Type	Specification "B"
593	16.5 mm (0.650 in)
593 HO SDI	18 mm (0.709 in)

The correct specification for measurement "C" is the sum of "A" plus the specification "B" found in the chart.

Stretch oil pump adjustment cable with a 32 N (7.2 lbf) force and measure the length of its visible distance "C".



TYPICAL
1. Lock nut
C. Oil pump adjustment (sum of "A" plus the specification "B")

If the visible distance is less or more than "A" + "B", adjust cable distance. To do so, loosen lock nut, turn adjusting screw in or out and retighten lock nut.

EXAMPLE: — The 593 HO SDI has a throttle lever measurement "A" of 1.5 mm (0.059 in); by adding the appropriate specification "B" found in the chart (18 mm (0.709 in), you would determine that the correct measurement "C" at the cable would be 19.5 mm (0.768 in) as per equation A + B = C.

BLEEDING OIL LINES

Bleed main oil line (between tank and pump) by loosening the bleeder screw **no. 8** until air has escaped from the line. Add injection oil as required.

Reinstall all parts.

Bleed the small oil lines between pump and engine by running engine at idle while holding the pump lever in fully open position.

NOTE: Make a J hook out of mechanical wire to lift the lever.

⚠ WARNING

Ensure not to operate carburetor throttle mechanism. Secure the rear of the vehicle on a stand.

CHECKING OPERATION

Oil Pump

On Vehicle

NOTE: Main oil line must be full of oil. See bleeding procedure above.

Lift rear of vehicle and support with a mechanical stand. Disconnect small oil lines from pump. Start engine and stop it as soon as it fires.

Check that oil in small oil lines has been sucked up (this will be indicated by a clear section of small oil lines). Repeat the procedure until this condition is attained.

Reconnect small oil lines, start engine and run at idle while holding the pump lever in fully open position. Oil columns must advance into small oil lines.

If not, remove pump assembly and check the pump gear and drive shaft (if applicable) for defects, replace as necessary. Test pump as describes below.

NOTE: Through normal use, oil level must not drop in small oil lines. If oil drops, verify check valve operation in injection nozzle. Replace as necessary.

Test Bench

Connect a hose filled with injection oil to supply line fitting. Insert other hose end in an injection oil container. Using a clockwise rotating drill, rotate pump shaft. Oil must drip from outer fittings while holding lever in a fully open position. If not replace pump.

2, Check Valve

For engine 593, check valve is part (built-in) of injection nozzle.

For engines 277, 443 and 552, check valve is part (built-in) of banjo fitting.

To verify this check valve, proceed the same as for checking pump operation on vehicle. First unplug oil line from injection nozzle. After restarting the engine, check that a clear section in small oil line is present. Reconnect oil line.

Run engine at idle. Oil column must advance. If the check valve is faulty, oil column will go back and forth. Replace if so.

AXIAL FAN COOLING SYSTEM

SERVICE TOOLS

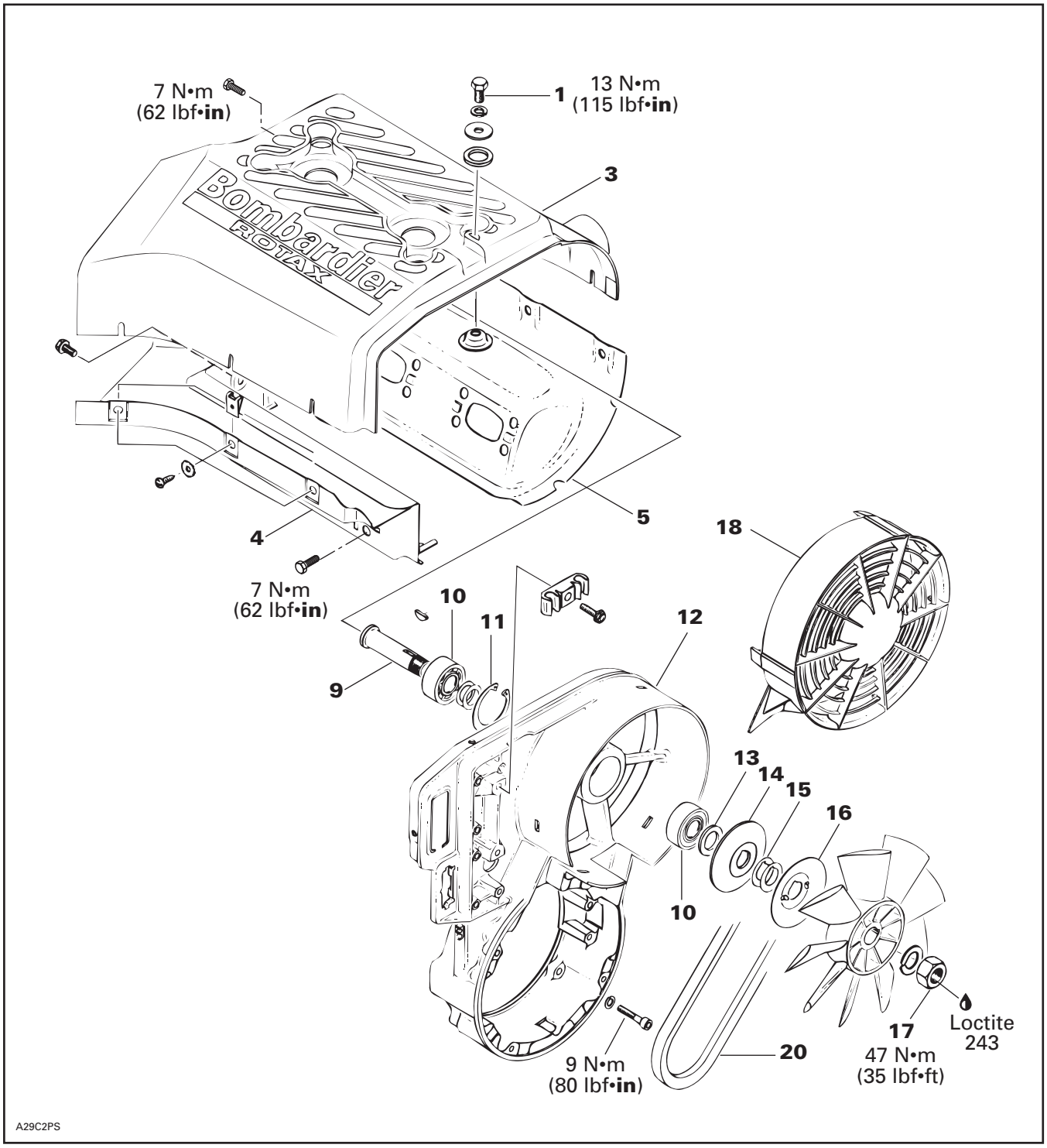
Description	Part Number	Page
holder wrench	420 876 357	144, 146

SERVICE PRODUCTS

Description	Part Number	Page
holder wrench for the 443 engine	420 876 357	143
holder wrench for the 5'52 engine	529 036 006	143
Loctite 243 (blue)	293 800 060	144, 146

443 and 552 Engines

NOTE: For 277 engine radial fan cooling system, refer to CDI SYSTEM.



NOTE: The following procedures can be done without removing engine from chassis.

REMOVAL

NOTE: To facilitate further disassembly, fan nut may be removed before removing fan housing.

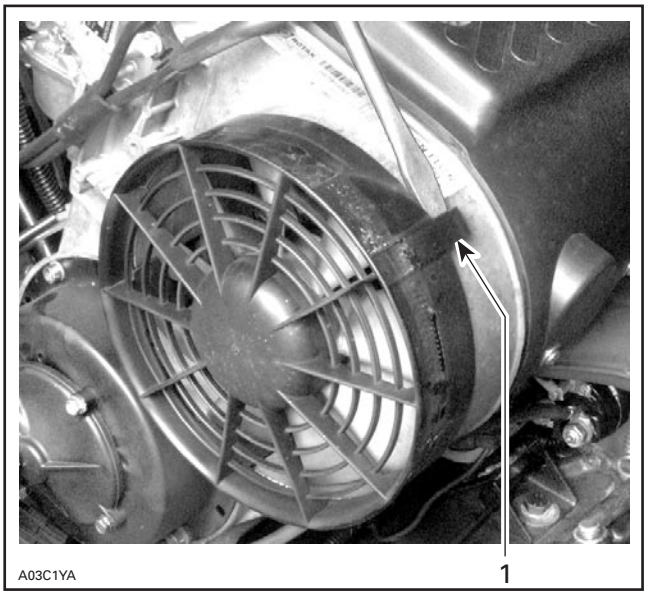
Remove rewind starter, starting pulley, trigger coil wire from 4-connector housing then fan housing ass'y.

CLEANING

Clean all metal components in a non-ferrous metal cleaner.

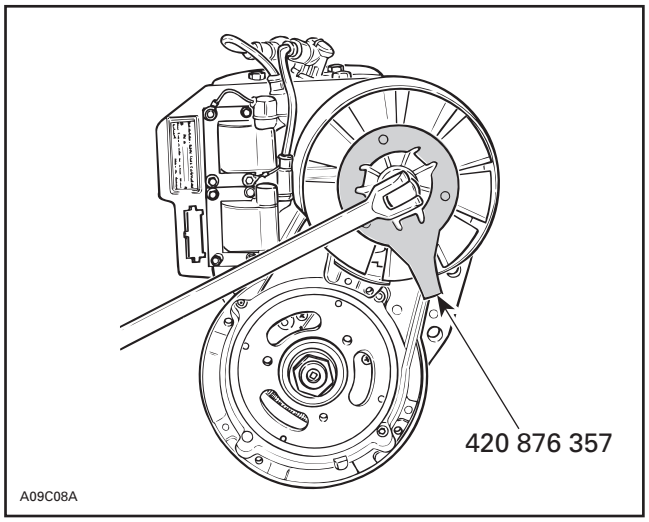
DISASSEMBLY AND ASSEMBLY

Using a flat screwdriver, lift fan protector tabs as shown in the following photo, then remove fan protector.



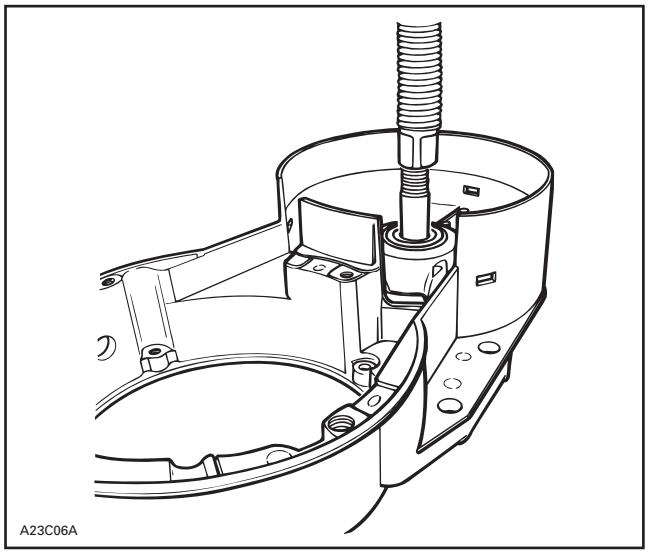
1. Lift tab and remove fan protector

To remove or install fan pulley retaining nut **no. 17**, lock fan pulley with holder wrench for the 443 engine (P/N 420 876 357) and holder wrench for the 552 engine (P/N 529 036 006). At assembly, torque nut to 48 N•m (35 lbf•ft).

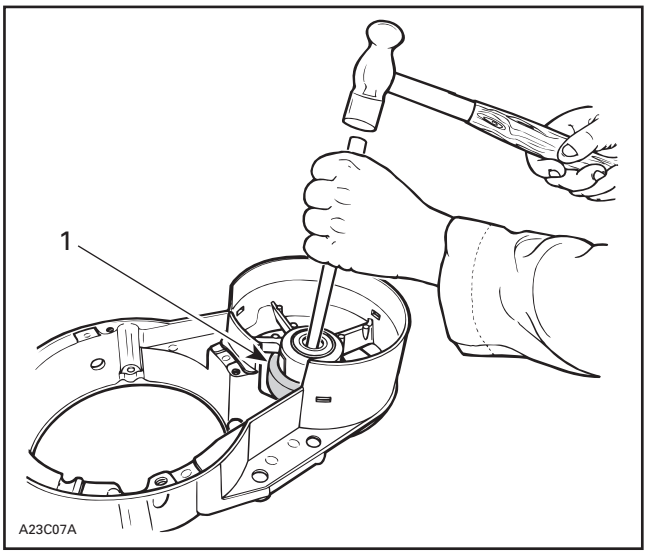


TYPICAL

Using a press, drive the fan shaft **no. 9** out.



Support fan housing **no. 12** with a ring. With a punch, working all around bearing **no. 10** inner race, drive bearing out of fan housing. Keep shims for installation.



1. Ring supporting fan housing

Remove circlip **no. 11** then remaining bearing.

To install, press one bearing in place then install circlip and shims. Press the other bearing from opposite side until it is flush with housing. Press fan shaft from engine side of fan housing. Check for free rolling action.

INSTALLATION

At assembly, apply a light coat of Loctite 243 (blue) (P/N 293 800 060) on screw **no. 1** threads.

A gasket must be placed on both sides (inner and outer) of intake and exhaust holes of cylinder cowl **no. 4 and 5**.

Reinstall fan protector **no. 18** properly.

⚠ WARNING

Always reinstall fan protector after servicing.

FAN BELT REPLACEMENT AND DEFLECTION ADJUSTMENT

Remove muffler, rewind starter and on so equipped models connecting flange. Following procedure described above.

443 Engine

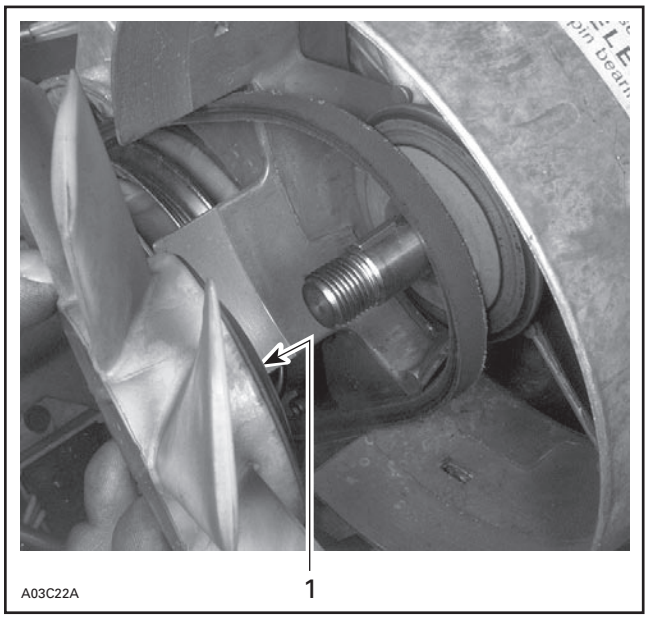
Using holder wrench (P/N 420 876 357), remove fan nut.

552 Engine

Using holder wrench (P/N 529 036 006), remove fan nut.

All Engines

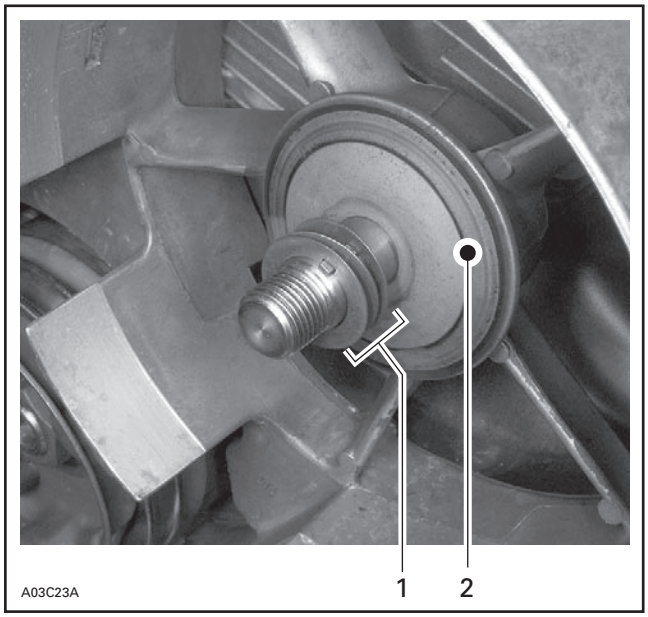
Remove fan with pulley half.



1. Remove fan with pulley half

Remove fan belt.

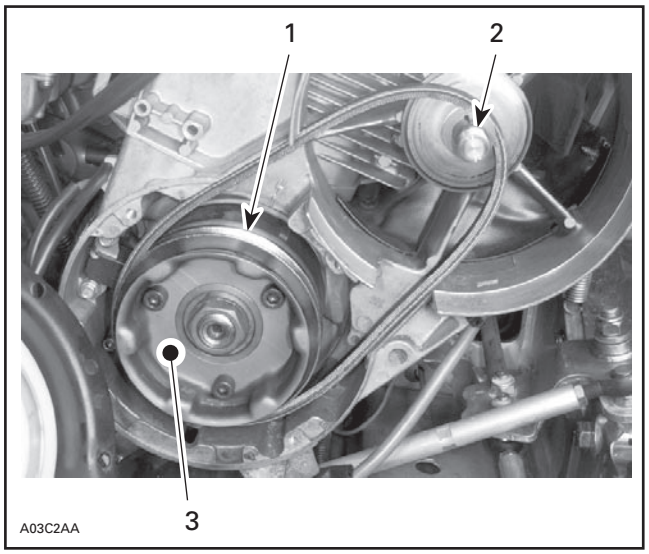
Leave shims and second half pulley in place. Refer to the following photo.



1. Keep shims
2. Leave second half pulley in place

Reassembly

Install fan belt on bottom pulley first then position onto fan shaft, as shown in the next photo.



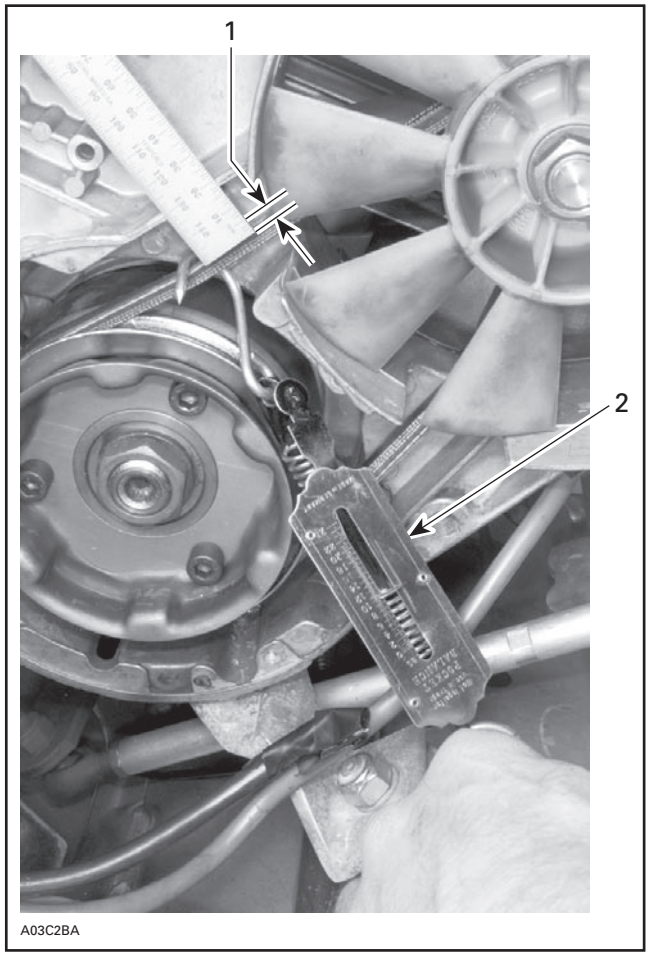
FAN BELT PROPERLY INSTALLED ON BOTTOM PULLEY AND FAN SHAFT
1. *Bottom pulley*
2. *Fan shaft*
3. *Starting pulley*

Reinstall fan assembly on fan shaft. Temporarily tighten fan nut.

CAUTION: When reinstalling fan assembly, ensure that key is properly positioned into fan shaft keyway.

Fan Belt Deflection Adjustment

Check fan belt deflection using a ruler and a fish scale positioned midway between pulleys as per following photo.

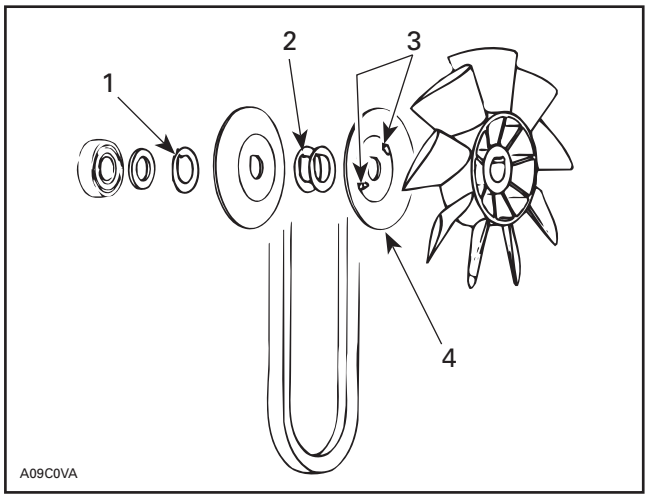


TYPICAL
1. *Measure deflection here*
2. *Fish scale*

Belt deflection must be according to the following specifications:

ENGINE TYPE	BELT DEFLECTION	FORCE APPLIED
443 and 552	9.5 mm (3/8 in)	5 kg (11 lb)

To adjust deflection tension, add or remove shim(s) **no. 15** between pulley halves **no. 14 and 16**. Install excess shim(s) between distance sleeve **no. 13** and pulley half **no. 14** (housing side).



1. Unused shim(s) here
2. Adjust here
3. Positioning noses
4. Some engines only

Select pulley halves so that the one with 2 positioning noses will be on fan side. Ensure to insert these noses into fan notches.

Once fan belt is properly adjusted, torque fan nut to 48 N•m (35 lbf•ft) using holder wrench (P/N 420 876 357), as shown in the following photo.

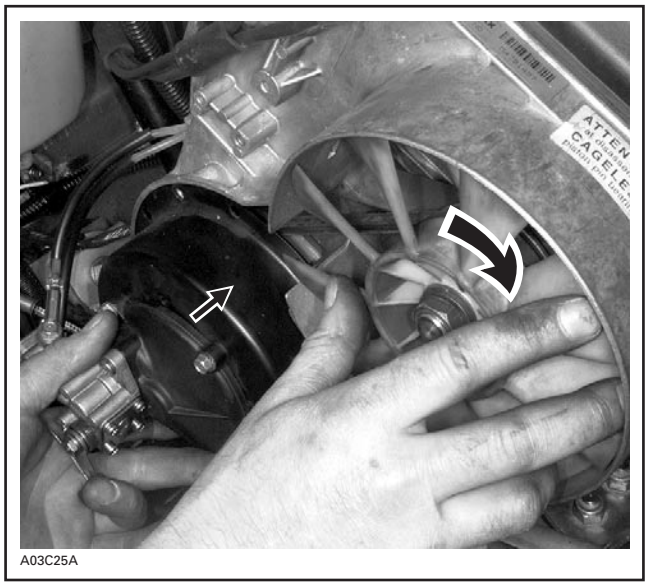
NOTE: Apply Loctite 243 (blue) (P/N 293 800 060) on fan nut threads.

TORQUE FAN NUT USING HOLDER WRENCH

Finalizing Reassembly

Reinstall rewind starter.

CAUTION: When installing rewind starter, ensure that oil pump shaft is properly positioned. Do not force shaft insertion. Turn fan until oil pump shaft slides in place, as shown in the following photo.



TURN FAN TO SLIDE OIL PUMP SHAFT IN PLACE

Secure rewind starter with original screws.

Reinstall fan protector no. 18 properly.

⚠ WARNING

Always reinstall fan protector after servicing.

Reinstall muffler.

LIQUID COOLING SYSTEM

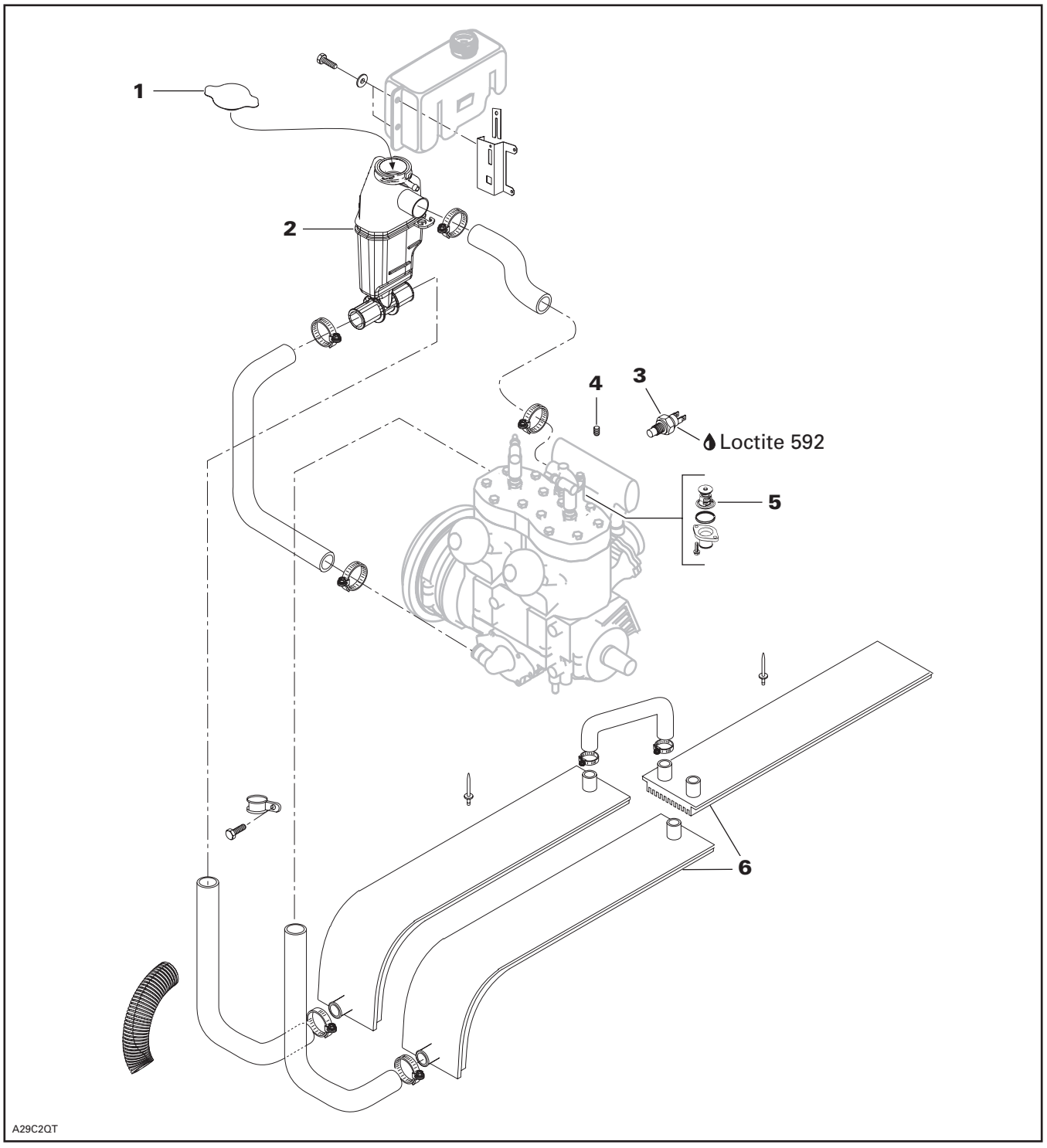
SERVICE TOOLS

Description	Part Number	Page
engine leak tester kit	861 749 100	149
hose pincher	295 000 076	149
siphon tool	529 035 880	149
special radiator cap	529 021 400	149
Supertanium™ bit	529 031 800	149

SERVICE PRODUCTS

Description	Part Number	Page
50/50 PREMIXED COOLANT - 37°C (- 35°F)	293 600 038	151
Loctite 592	293 800 018	149

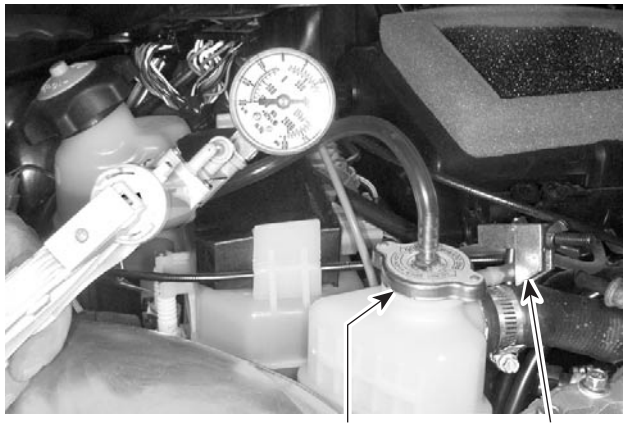
593 Engine



COOLING SYSTEM LEAK TEST

Install special radiator cap (P/N 529 021 400) included in engine leak tester kit (P/N 861 749 100) on coolant tank. Install hose pincher (P/N 295 000 076) on overflow hose. Using pump also included in kit pressurize all system through coolant reservoir to 100 kPa (15 PSI).

Check all hoses and cylinder/base for coolant leaks. Spray a soap/water solution and look for air bubbles.



INSPECTION

Check general condition of hoses and clamp tightness.

DRAINING THE SYSTEM

⚠ WARNING

Never drain or refill the cooling system when engine is hot.

To drain the cooling system, siphon the coolant mixture from the coolant tank **no. 2** using the siphon tool (P/N 529 035 880). Disconnect hose at water pump to drain coolant from engine.

When the coolant level is low enough, lift the rear of vehicle to drain the radiator.

DISASSEMBLY AND ASSEMBLY

Coolant Pump

Refer to BOTTOM END section.

3,4 Sender and Plug or Elbow

Apply Loctite 592 (P/N 293 800 018) thread sealant on sender **no. 3** and plug or elbow **no. 4** to avoid leaks.

1, Pressure Cap

Check if the cap pressurizes the system. If not, install a new 90 kPa (13 PSI) cap (do not exceed this pressure).

2, Coolant Tank

For removal, drain cooling system before removing coolant tank **no. 2**.

Remove all hoses from coolant tank.

Slide down the coolant tank to disengage it from oil tank.

Check if the tank is cracked or melted. Replace if necessary.

For installation, reverse the removal procedure.

NOTE: It may be necessary to move oil tank for an easier installation of coolant tank.

6, Radiators

Remove all debris between radiator fins. A clean radiator is more efficient than a dirty one.

Check if radiator fins are damaged. Replace broken radiator if necessary.

NOTE: A radiator with many broken fins does not work properly.

For disassembly, drain cooling system.

Remove rear suspension (refer to REAR SUSPENSION).

Using Supertanium™ bit (P/N 529 031 800), drill all rivets retaining radiator to the frame or grind the rivets with a grinding disk.

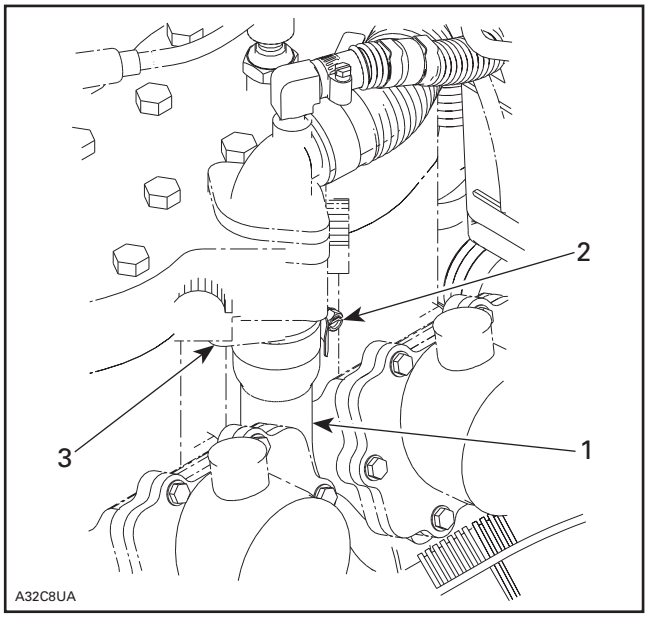
Pull the radiator a little and remove the Oetiker clamps.

For installation, reverse the removal procedure.

5, Thermostat

For disassembly, drain the cooling system (see above).

Unscrew clamp retaining hose to the water outlet socket.



1. *Hose*
2. *Clamp*
3. *Water outlet socket*

Remove:

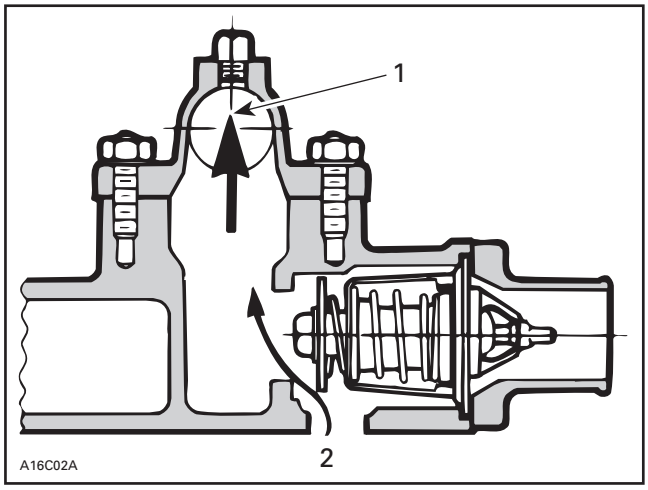
– water outlet
– socket screws
– gasket thermostat.

To check thermostat, put in water and heat water. Thermostat should start to open when water temperature reaches the following degree. It will be almost fully open at 50°C (122°F).

ENGINE	TEMPERATURE
593	42°C (108°F)

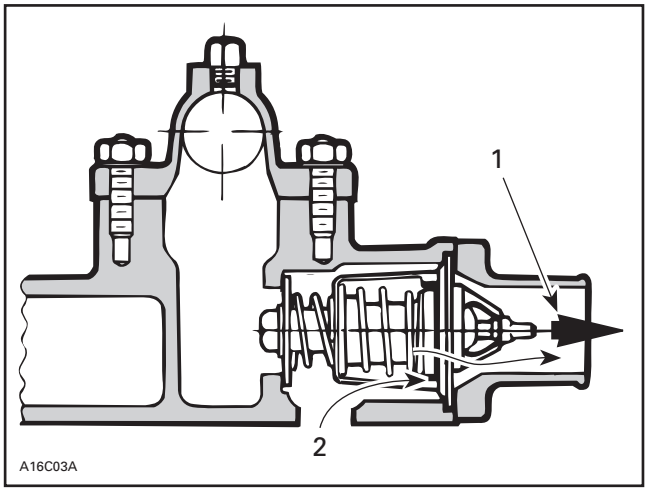
Thermostat is a double action type.

– Its function is to give faster warm up of the engine by controlling a circuit; water pump — engine — coolant tank. This is done by bypassing the radiator circuit.



TYPICAL — CLOSED THERMOSTAT, COLD ENGINE
1. *To reservoir*
2. *From cylinders*

– When the liquid is warmed enough, the thermostat opens progressively the circuit, water pump — engine — radiators — coolant tank to keep the liquid at the desired temperature. (See the diagram of the exploded view).



TYPICAL — OPEN THERMOSTAT, WARM ENGINE
1. *To radiators*
2. *From cylinders*

These 2 functions have the advantage of preventing a massive entry of cold water into the engine.

COOLING SYSTEM REFILLING PROCEDURE

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the Bombardier premixed coolant or with 50% antifreeze and 50% water. Pure antifreeze without water freezes (like slush ice). Always use ethylene glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

System Capacity

Refer to TECHNICAL DATA.

Refilling Procedure

IMPORTANT: USE THE 50/50 PREMIXED COOLANT - 37°C (- 35°F) (P/N 293 600 038).

Do not reinstall pressure cap.

Lift front of vehicle until the tunnel is horizontal. With engine cold, refill coolant tank no. 2 up to cold level line. Wait a few minutes then refill to line. Start engine. Refill up to line while engine is idling until all air bubbles have escaped from system (about 4 to 5 minutes). Install pressure cap.

To make sure coolant flows through radiators, touch them by hand. They must feel warm.

Put back front of vehicle on the ground.

When engine has completely cooled down, recheck coolant level in coolant tank and refill up to line.

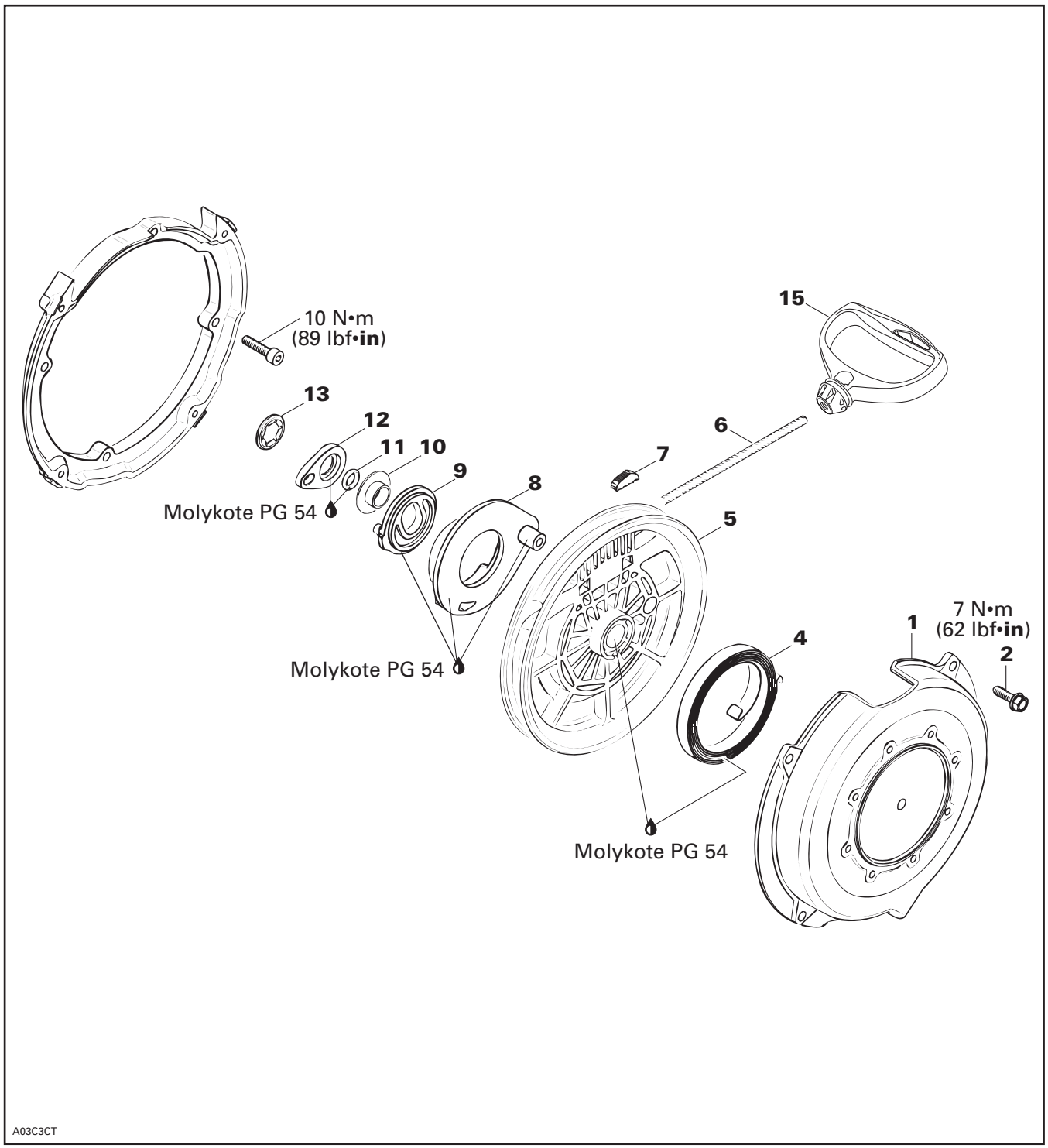
Check coolant concentration (freezing point) with proper tester.

REWIND STARTER

SERVICE PRODUCTS

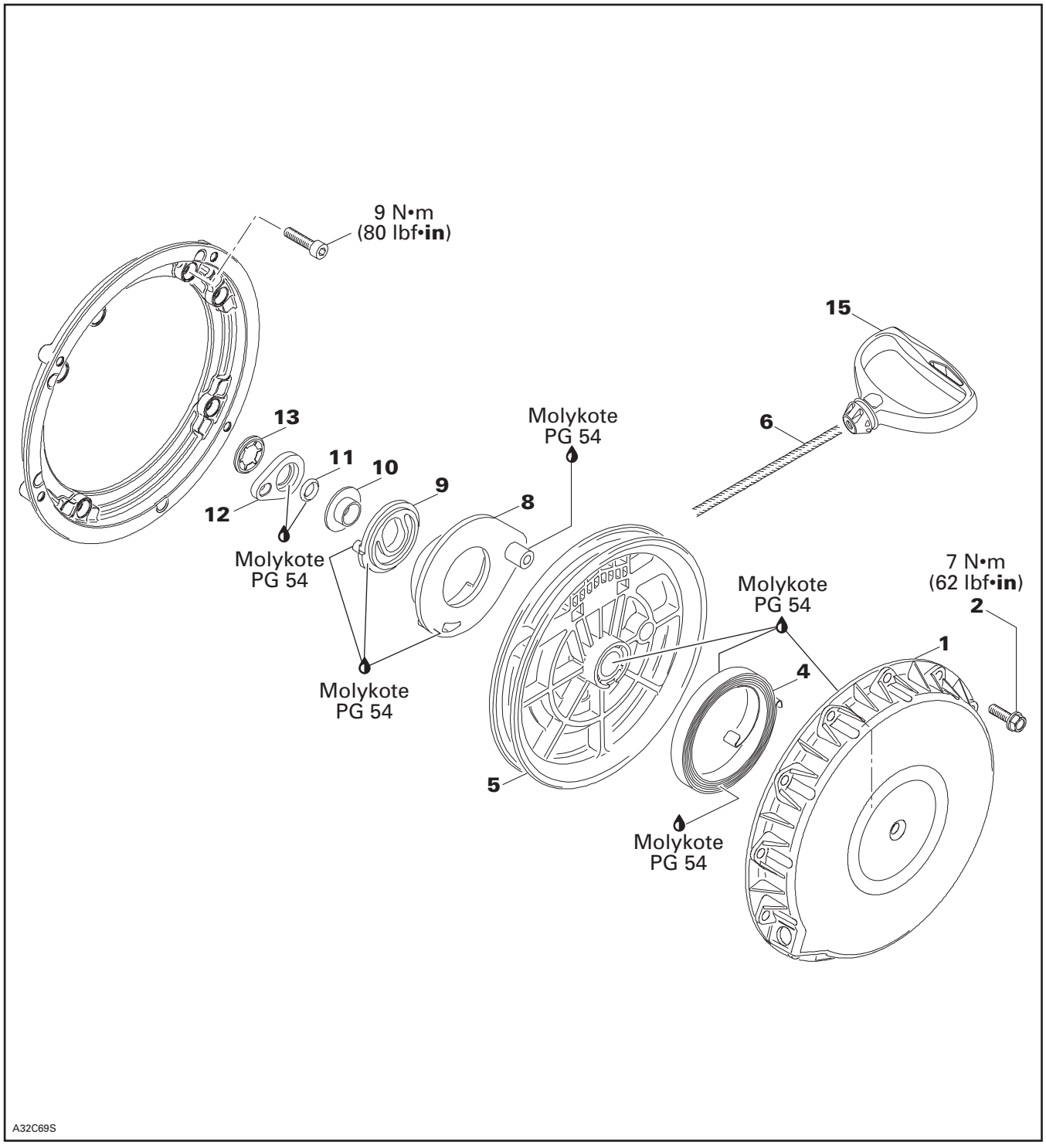
Description	Part Number	Page
Molykote PG 54	420 899 763	157, 159

Rewind Starter on Fan Cooled Models



TYPICAL

Rewind Starter on Liquid Cooled Models



INSPECTION

NOTE: Due to dust accumulation, rewind starter must be periodically cleaned, inspected and relubricated.

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using specific lubricant. Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

Check if rope **no. 6** is fraying, replace if so.

When pulling starter grip, mechanism must engage within 30 cm (1 ft) of rope pulled. If not, disassemble rewind starter, clean and check for damaged plastic parts. Replace as required, lubricate, reassemble and recheck. Always replace O-ring **no. 11** every time rewind starter is disassemble.

When releasing starter grip, it must return to its stopper and stay against it. If not, check for proper spring preload or damages. Readjust or replace as required.

When pulling starter grip 10 times in a row, it must return freely. If not, check for damaged parts or lack of lubrication. Replace parts or lubricate accordingly.

REMOVAL

Using a small screwdriver, extract rope knot from starter grip **no. 15**. Cut rope close to knot. Tie a knot near starter.

Remove screws **no. 2** securing rewind starter **no. 1** to engine then remove rewind starter.

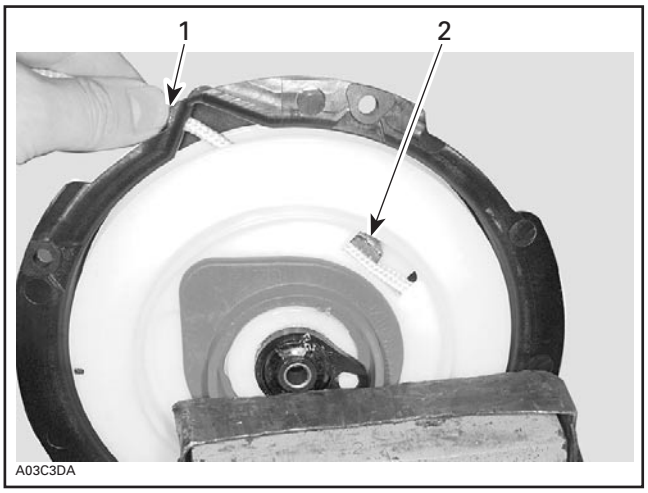
Fan Cooled Models Only

Remove pump from rewind starter cover.

ROPE REPLACEMENT

Fan Cooled Models Only

Completely pull out rope. Hold rewind starter in a vise.



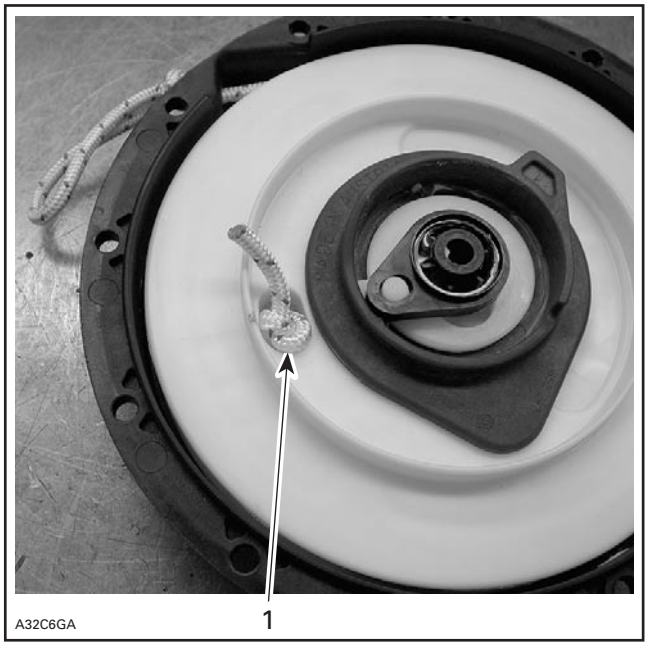
1. Rope exit hole
2. Key to be removed

With a long thin pin punch inserted through rope exit hole, push key **no. 7**. Remove key and rope. Install a new rope and lock it using key **no. 7**.

NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

Liquid Cooled Models Only

Pull out rope. Hold rewind starter in a vise. Slide rope and untie the knot. Pull out the rope completely.



1. Knot to be untied

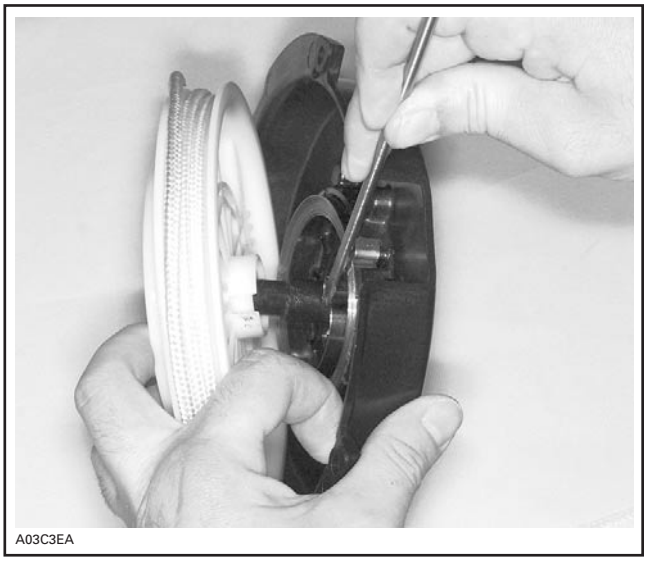
NOTE: When rope is completely pulled out, spring preload is 4-1/2 turns.

DISASSEMBLY

Undo knot previously tied at removal. Let sheave get free to release spring preload.

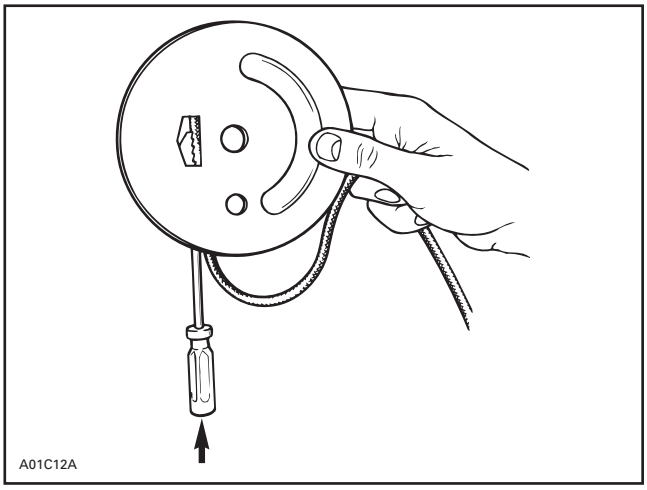
Cut push nut **no. 13** and discard. Remove locking element **no. 12**, O-ring **no. 11**, step collar **no. 10**, pawl lock **no. 9** and pawl **no. 8**.

Remove sheave **no. 5** from starter housing **no. 1**. Hold spring with a screwdriver.


A03C3EA

Fan Cooled Models Only

Disengage key **no. 7** and pull out rope **no. 6**.


A01C12A

GENTLY TAP ON KEY

Liquid Cooled Models Only

Take out the knot and then rope **no. 6**.

ASSEMBLY

At assembly, position spring **no. 4** outer end into spring guide notch then wind the spring counterclockwise into guide.

⚠ WARNING

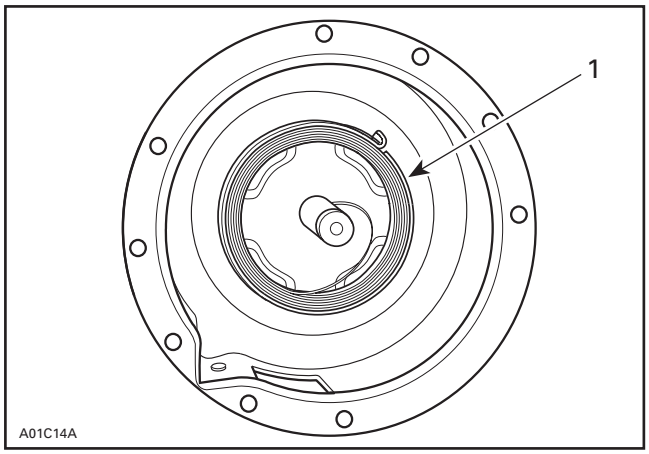
Since the spring is tightly wound inside the guide it may fly out when rewind is handled. Always handle with care.

A03C3FA

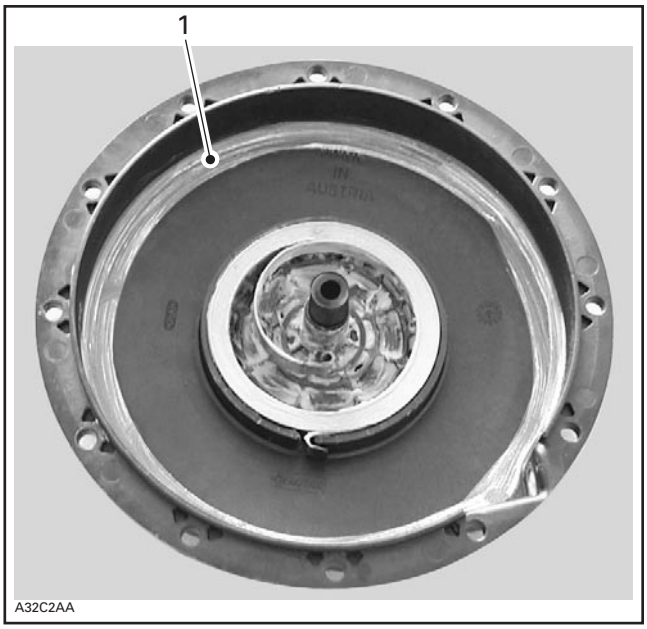
1. Outer end into guide notch

CAUTION: It is of the utmost importance that the rewind starter spring be lubricated periodically using Molykote PG 54 (P/N 420 899 763). Otherwise, rewind starter component life will be shortened and/or rewind starter will not operate properly under very cold temperatures.

Lubricate spring assembly and 1 cm (1/2 in) wide on bottom of housing with Molykote PG 54 (P/N 420 899 763).



TYPICAL
1. Molykote PG 54 inside spring guide

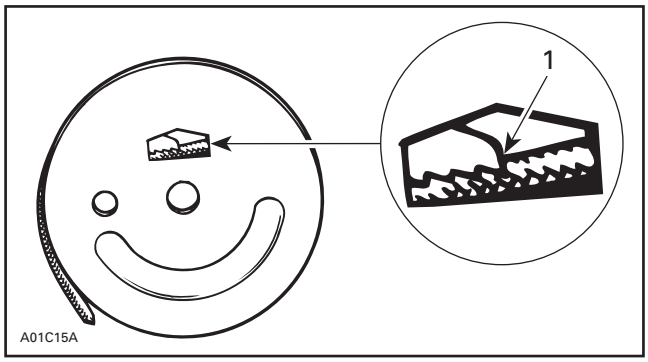


1. Molykote PG 54 applied 1 cm (1/2 in) wide on bottom of housing

CAUTION: The use of standard multipurpose grease could result in rewind starter malfunction.

Fan Cooled Models Only

To install rope no. 6, insert rope into sheave no. 5 orifice and lock it with the key no. 7 as illustrated.

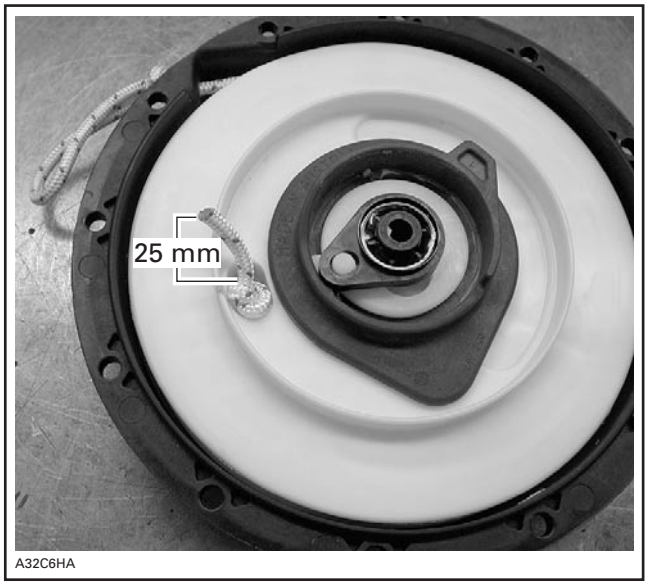


1. Push to lock

Lubricate housing post with silicone compound grease. Install sheave.

Liquid Cooled Models Only

To install rope no. 6, insert rope into sheave no. 5 orifice and lock it by making a knot, leaving behind a free portion of about 25 mm in length. Fuse rope end with a lit match and insert it into sheave.



FREE PORTION

A32C6IA

FREE PORTION INSERTED INTO SHEAVE

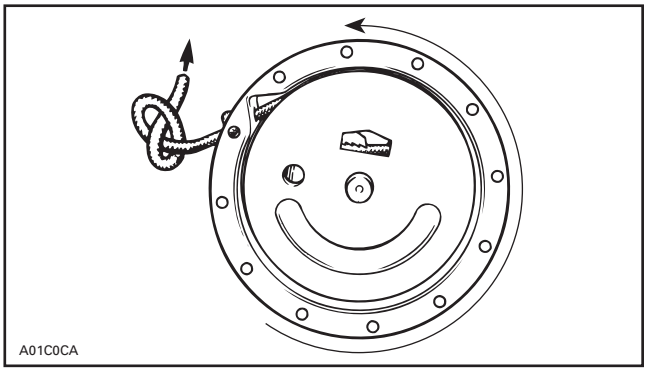
Lubricate housing post with silicone compound grease. Install sheave.

To adjust rope tension:

Wind rope on sheave and place rope sheave into starter housing making sure that the sheave hub notch engages in the rewind spring hook.

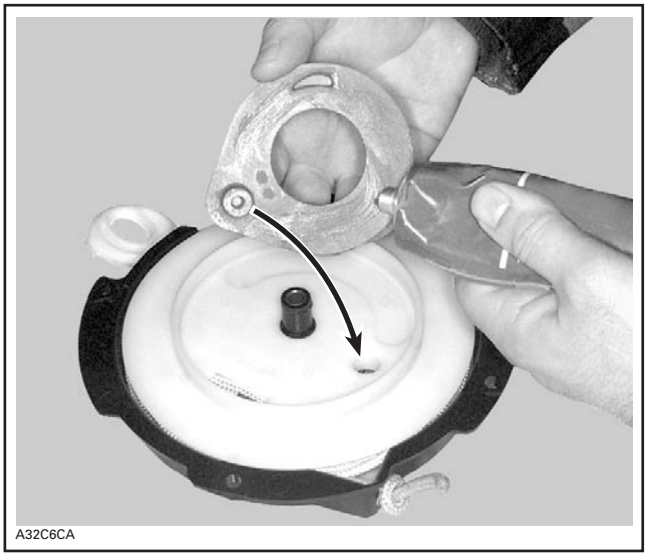
Rotate the sheave counterclockwise until rope end is accessible through rope exit hole. This will give 1/2 turn of preload.

Pull the rope out of the starter housing and temporarily make a knot to hold it.

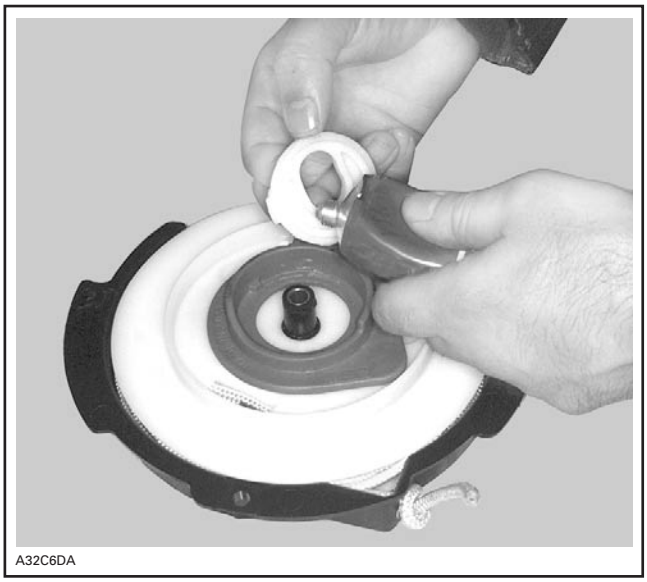

A01C0CA

TYPICAL

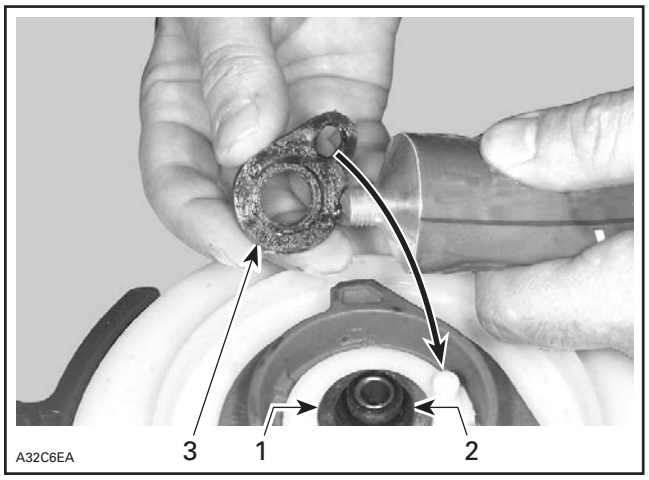
Lubricate pawl **no. 8** with Molykote PG 54 (P/N 420 899 763) then install over rope sheave.


A32C6CA

Lubricate pawl lock **no. 9** with Molykote PG 54 (P/N 420 899 763). Install over pawl.


A32C6DA

Install step collar **no. 10** with its sleeve first. Lubricate a new O-ring **no. 11** and locking element **no. 9** with Molykote PG 54 (P/N 420 899 763). Install over pawl lock.



1. *Step collar*
2. *O-ring*
3. *Locking element*

Position a new push nut no. 13.

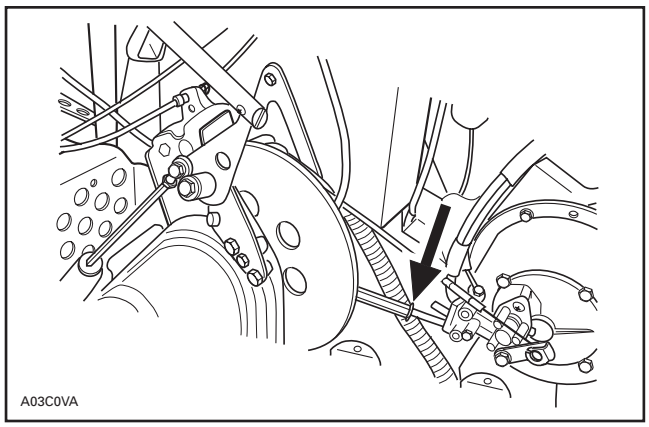
INSTALLATION

Fan Cooled Models Only

Reinstall oil pump on rewind starter assembly.

All Models

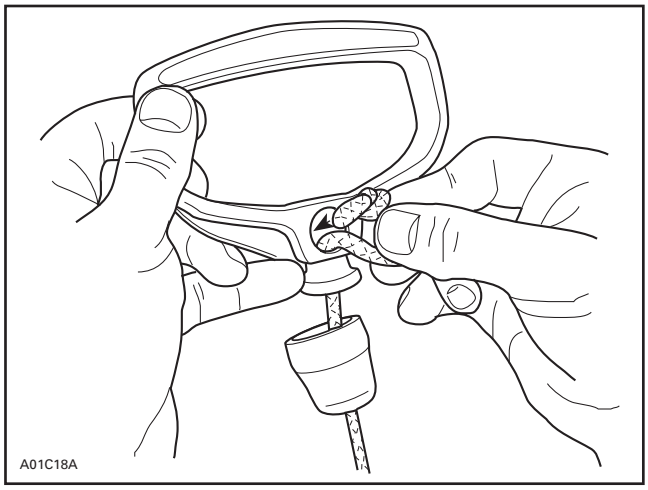
Thread starter rope no. 6 through rope guide when applicable.



TYPICAL

Reinstall rewind starter assembly on engine.

Prior to installing starter grip no. 15 on new rope, it is first necessary to fuse the rope end with a lit match. Pass rope through starter grip and tie a knot in the rope end. Fuse the knot with a lit match then insert rope end down and pull the starter grip over the knot.



TYPICAL

FUEL SYSTEM

SERVICE TOOLS

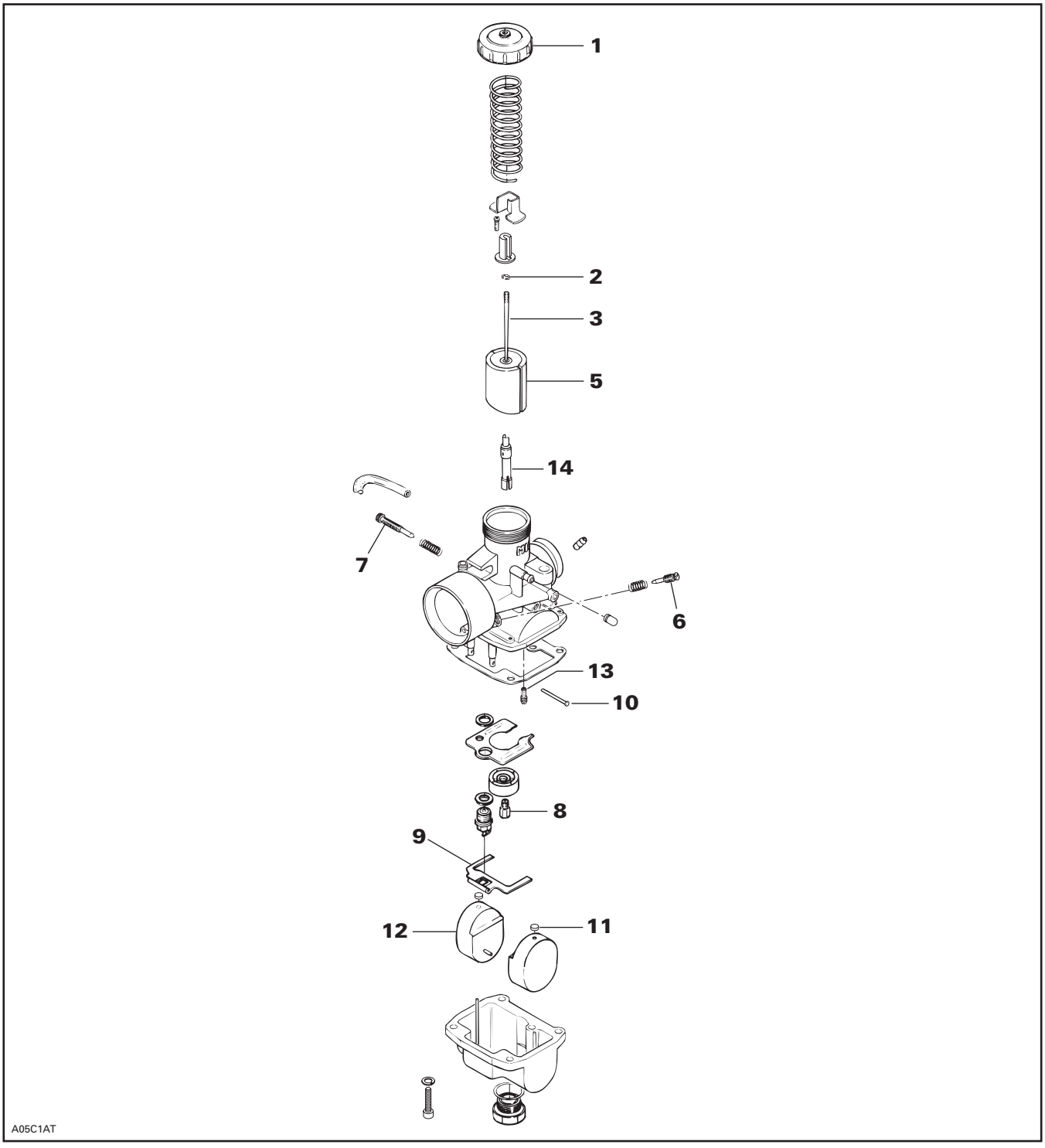
Description	Part Number	Page
carburetor tool kit	404 112 000	165
choke plunger tool	529 032 100	171
float level gauge	529 035 520	167
hose pincher	295 000 076	172–173
vacuum/pressure pump kit	529 021 800	172

SERVICE PRODUCTS

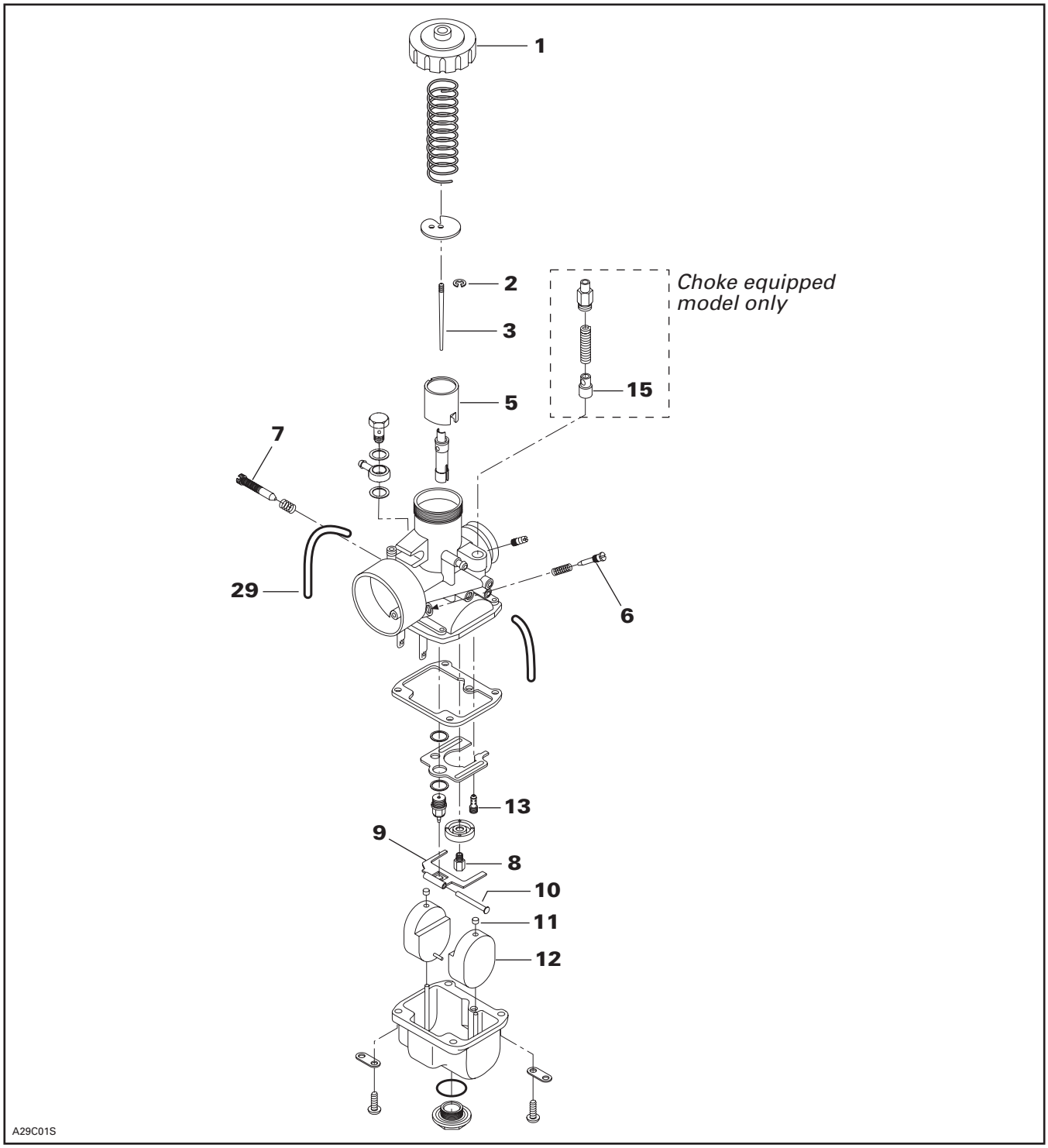
Description	Part Number	Page
silicone grease	293 550 004	169

CARBURETOR

Tundra

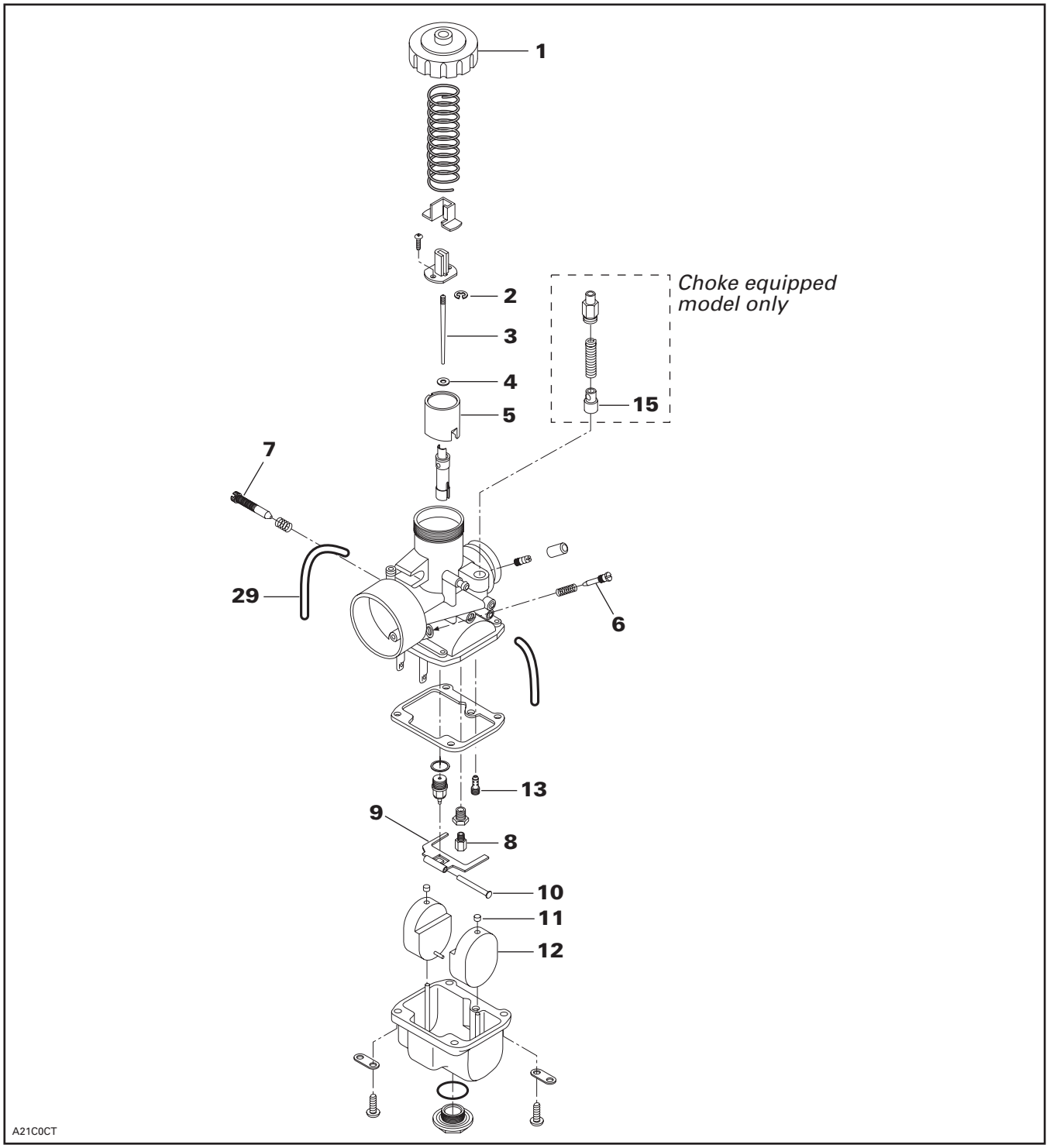


Skandic LT/LT E



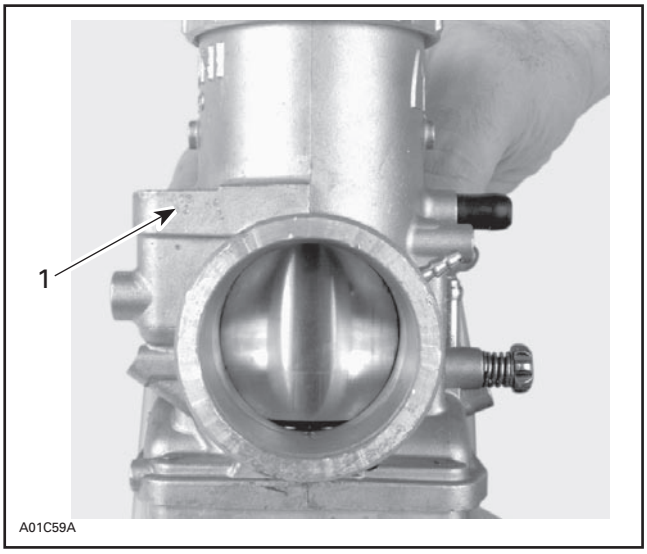
TYPICAL

Skandic WT/SUV/SWT



IDENTIFICATION

All carburetors are identified on their body.



1. Identification: 34-482

REMOVAL

Tundra and Skandic LT/WT/SWT

Remove air silencer.

All Models

Disconnect fuel inlet line.

Disconnect primer line from carburetor on some models.

Disconnect choke cable on some models.

Unscrew carburetor cover **no. 1** then pull out throttle slide **no. 5** from carburetor.

⚠ WARNING

Exercise care when handling throttle slide. Scratches incurred may cause throttle slide to stick open in operation.

Disconnect throttle cable from throttle slide.

Untighten rubber flange clamps then remove carburetor from engine.

CLEANING AND INSPECTION

The entire carburetor should be cleaned with a general solvent and dried with compressed air before disassembly.

CAUTION: Heavy duty carburetor cleaner may be harmful to the float material and to the rubber parts, O-rings, etc. Therefore, it is recommended to remove those parts prior to cleaning.

Carburetor body and jets should be cleaned in a carburetor cleaner following manufacturer's instructions. Replace any jets having gum or varnish on their surfaces.

⚠ WARNING

Solvent with a low flash point such as gasoline, naphtha, benzol, etc., should not be used as they are flammable and explosive.

Check inlet needle tip condition. If worn, the inlet needle and seat must be replaced as a matched set.

NOTE: Install needle valve for snowmobile carburetor only. It is designed to operate with a fuel pump system.

Check throttle slide **no. 5** for wear. Replace as necessary.

Check idle speed screw **no. 7** for straightness. Replace as necessary.

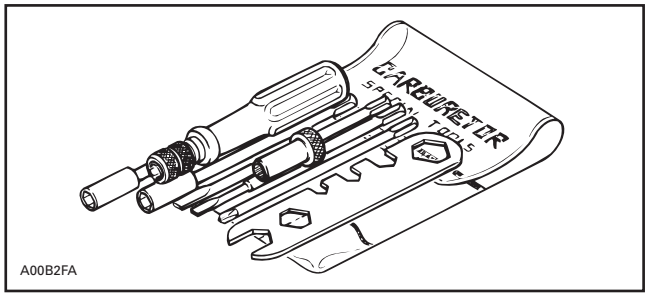
Check for fuel soaked into float **no. 12**; replace as necessary.

Check float **no. 12** for cracks or other damages affecting free movement ; replace as necessary.

Inspect throttle cable and housing for any damages. Replace as necessary.

DISASSEMBLY AND ASSEMBLY

NOTE: To ease the carburetor disassembly and assembly procedures it is recommended to use carburetor tool kit (P/N 404 112 000).

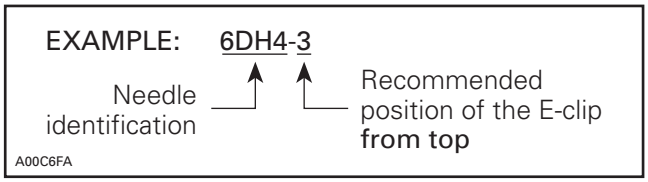


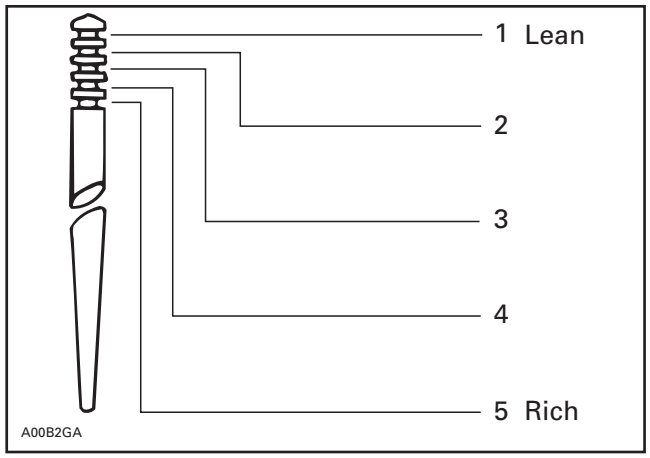
E-Clip and Needle

Remove screws from needle retaining plate to remove the needle **no. 3**.

The position of the needle in the throttle slide is adjustable by means of an E-clip **no. 2** inserted into 1 of 5 grooves located on the upper part of the needle. Position 1 (at top) is the leanest, 5 (at bottom) the richest.

NOTE: The last digit of the needle identification number gives the recommended position of the E-clip from the top of the needle.





CLIP POSITIONS

Main Jet

The main jet **no. 8** installed in the carburetor has been selected for a temperature of - 20°C (0°F) at sea level. Different jetting can be installed to suit temperature and/or altitude changes. A service bulletin will give information about calibration according to altitude and temperature.

CARBURETOR ADJUSTMENTS

NOTE: For high altitude regions, a Service Bulletin will give information about calibration according to altitude and temperature.

Adjustments should be performed following this sequence:

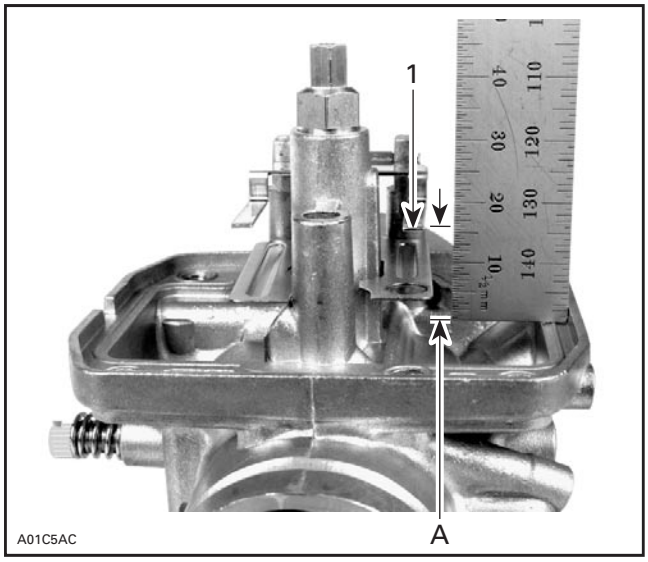
– float arm
– air screw **no. 6** adjustment
– throttle slide **no. 5** height (preliminary idle speed adjustment)
– throttle cable adjustment
– carburetor synchronization (dual carburetor models)
– final idle speed adjustment (engine running)
– oil pump and carburetor synchronization.

Float Arm

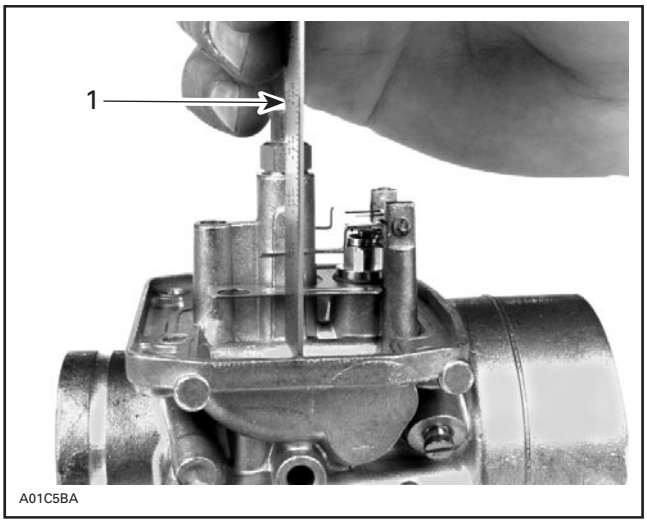
CAUTION: Spark plugs will foul if float is adjusted too low. Engine may be damaged if float is adjusted too high.

Correct fuel level in float chamber is vital toward maximum engine efficiency. To check for correct float level proceed as follows:

– Make sure that float arm **no. 9** is symmetrical — not distorted.
– Remove float bowl and gasket from carburetor.
– With carburetor chamber upside-down on a level surface, measure height A between bowl seat and top edge of float arm. Keep ruler perfectly vertical and in line with main jet hole.

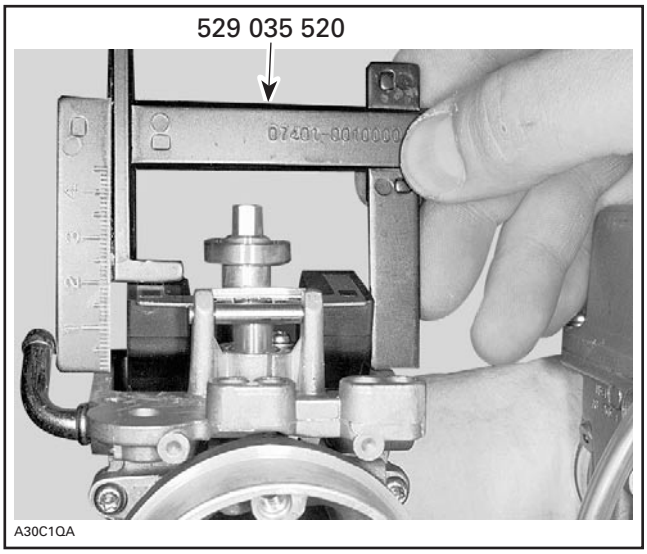


TYPICAL
1. Measure from top of float arm
A. Float height (including float arm thickness)



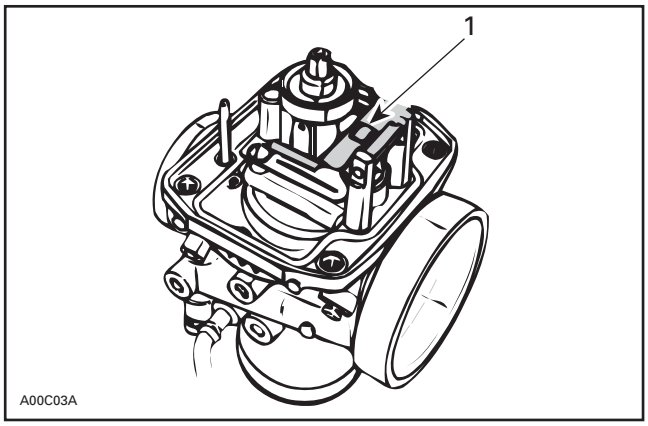
1. Ruler vertical and in line with main jet

Float level height can be checked using float level gauge (P/N 529 035 520). Keep tool in line with main jet as explained above.



MODELS	FLOAT HEIGHT ± 1 mm (± .040 in)
Tundra Skandic 440 LT Skandic 550F WT/SWT/SUV	23.9 (.941)
Skandic 600 WT LC/SUV	18.1 (.713)

– Bend the contact tab of float arm until the specified height is reached.



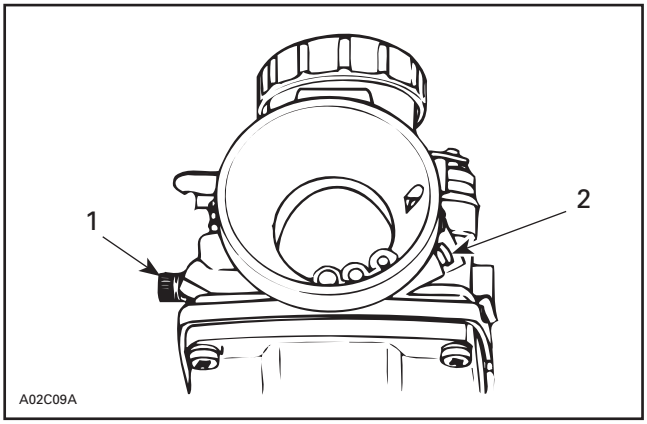
1. Contact tab

Air Screw Adjustment

Completely close the air screw **no. 6** (until a slight seating resistance is felt) then back off as specified.

Turning screw in clockwise enriches mixture and conversely, turning it out counterclockwise leans mixture.

Refer to TECHNICAL DATA for the specifications.



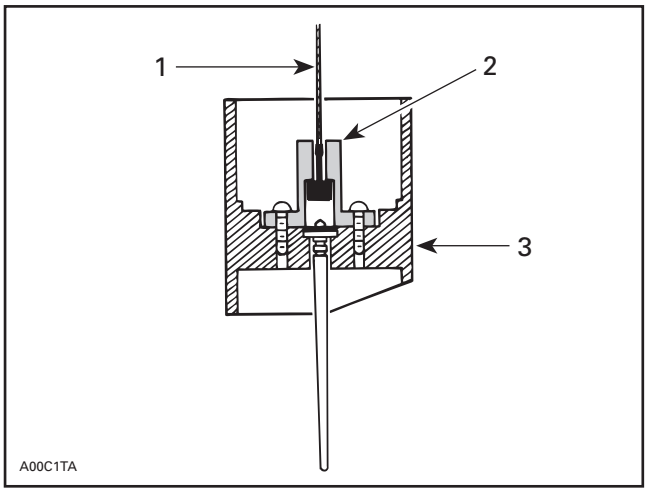
1. Idle speed screw
2. Air screw

Throttle Slide Height

Preliminary Idle Speed Adjustment

Hook throttle cable into the needle retainer plate.

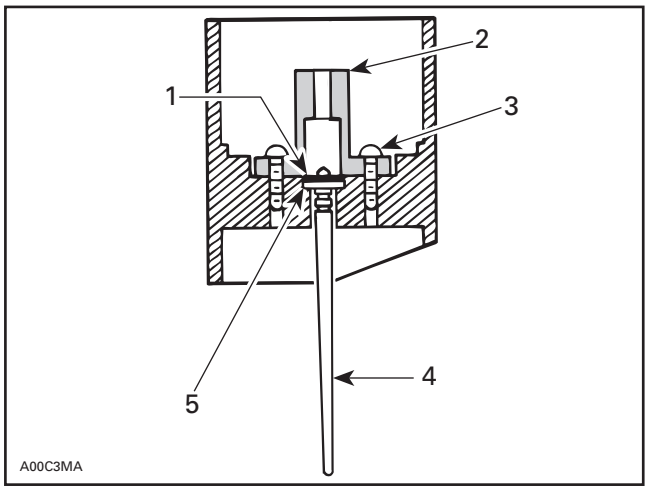
NOTE: Do not obstruct hole in throttle slide when installing needle retaining plate. This is important to let air escape through and thus allow a quick response.



CENTER POST TYPE
1. *Throttle cable*
2. *Needle retaining plate*
3. *Throttle slide*

Make sure the nylon packing no. 4 is installed on all applicable throttle slides.

CAUTION: Serious engine damage can occur if this notice is disregarded.



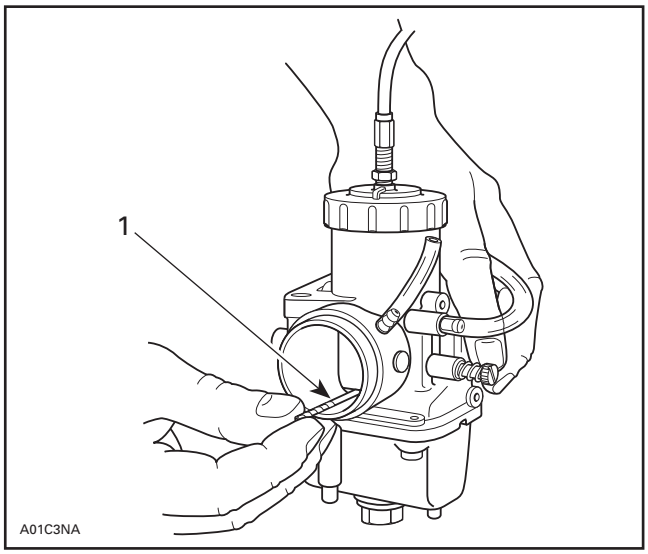
CENTER POST TYPE
1. *E-clip*
2. *Needle retaining plate*
3. *Screw*
4. *Needle*
5. *Nylon packing*

Using a drill bit as a gauge, adjust throttle slide height (see following table) by turning idle speed screw no. 7. Throttle slide height is measured on outlet side of carburetor (engine side).

NOTE: Make sure that throttle cable does not hold throttle slide. Loosen cable adjuster accordingly. Throttle cable adjustment will be done during adjustment of throttle-slide-to-cover free play.

Final idle speed adjustment (engine running at idle speed) should be within 1/2 turn of idle speed screw from preliminary adjustment.

MODELS	THROTTLE SLIDE HEIGHT ± 0.1 mm (± .004 in)
Tundra Skandic WT/ SWT/WT LC/ SUV 550/ SUV 600	1.5 (. 059)
Skandic LT	1.3 (.051)



TYPICAL
1. *Drill bit used as gauge for throttle slide height*

INSTALLATION

CAUTION: Never allow throttle slide(s) to snap shut.

Prior to installing carburetor, adjust air screw and preliminary idle speed as described above.

To install carburetor on engine, inverse removal procedure.

However, pay attention to the following:

On applicable models, make sure to align tab of carburetor and air intake silencer (if applicable) with notch of adaptor(s). On applicable models, install adaptor with up mark facing up.

CAUTION: The rubber flange must be checked for cracks and/or damage. At assembly, the flange must be perfectly matched with the air intake manifold or severe engine damage will occur.

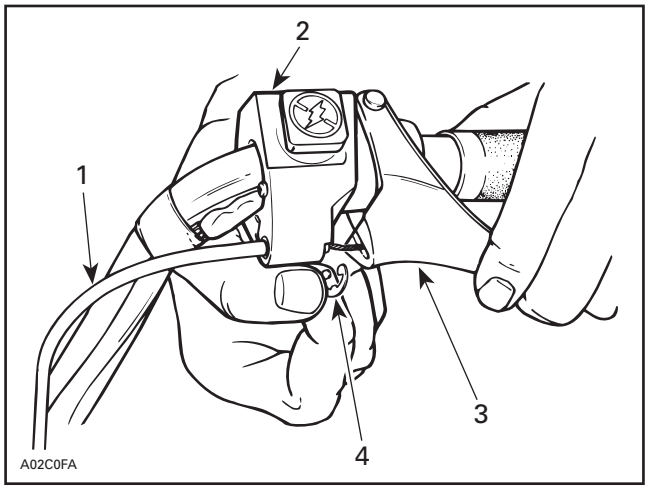
Install clamps in a way that their tightening bolts are staggered — not aligned.

Throttle Cable Circlip at Handlebar

Put silicone grease (P/N 293 550 004) around cable barrel. Locate circlip as per illustration.

⚠ WARNING

If this procedure is disregarded, throttle lever might be half-open at normally closed position and the engine will speed up when starting.



TYPICAL
1. *Throttle cable housing*
2. *Throttle lever housing*
3. *Throttle lever*
4. *Circlip*

Throttle Cable Routing

CAUTION: Check that throttle cable is routed away from sharp edges, hot or vibrating parts. When turning handlebar while engine is running, idle speed must not vary.

Throttle Cable Adjustment

⚠ WARNING

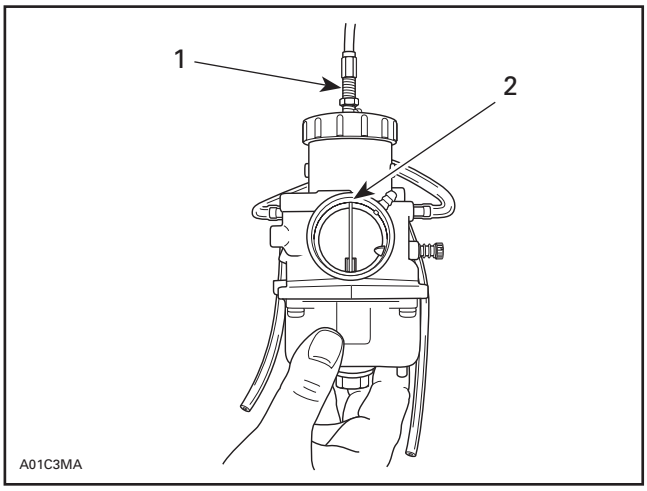
Ensure the engine is turned OFF, prior to performing the throttle cable adjustment.

Carburetors must be installed on engine and throttle cable properly routed.

For maximum performance, correct cable adjustment is critical.

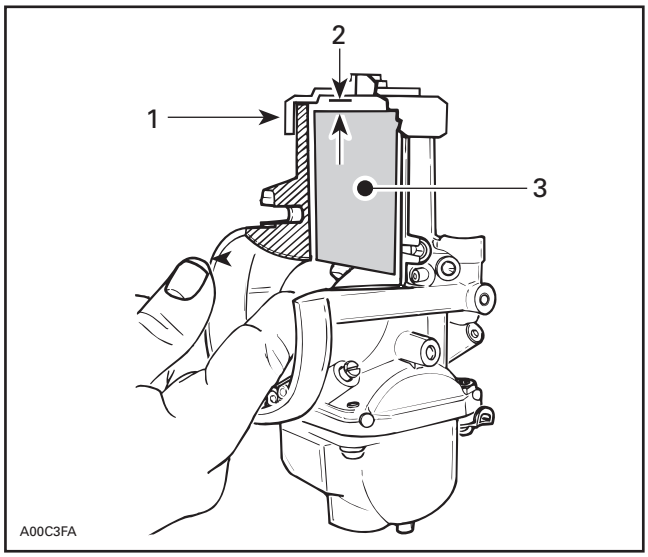
At full opening, throttle slide must be flush or 1.0 mm (.040 in) lower than the top of carburetor outlet bore (engine side). Use a mirror to look through inlet bore.

First loosen adjuster nut then turn throttle cable adjuster accordingly.



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)
1. *Throttle cable adjuster*
2. *Throttle slide flush or 1.0 mm (.040 in) lower than carburetor outlet bore (engine side)*

With the throttle lever fully depressed, check that there is a free play between the carburetor cover and top of throttle slide.



FULL OPENING (THROTTLE LEVER AGAINST HANDLE GRIP)
1. *Cover*
2. *Free play*
3. *Throttle slide*

⚠ WARNING

This gap is very important. If the throttle slide rests against the carburetor cover at full throttle opening, this will create too much strain and may damage the throttle cable or other components in throttle mechanism.

After throttle cable adjustment, synchronized carburetors (refer to CARBURETOR SYNCHRONIZATION) and adjusted oil pump cable (refer to OIL INJECTION PUMP).

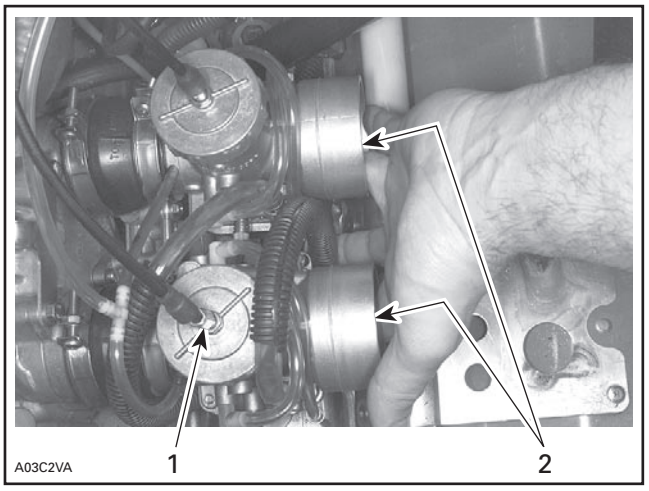
Carburetor Synchronization

Dual Carburetor Models Only

When depressing throttle lever, both carburetor slides must start to open at the same time.

Unlock cable adjustment lock nut on one carburetor.

Screw or unscrew cable adjuster until both carburetor slides start to open at same time. Cable play will be identical on both carburetors. Retighten jam nut.



TYPICAL
1. *Screw or unscrew adjuster*
2. *Check that both slides start to open at the same time*

Check throttle slide position at wide open throttle. Throttle slide must be flush or 1 mm (.040 in) lower than carburetor outlet bore. At that same position, check that throttle slide does not contact carburetor cover. Turn cable adjuster and recheck synchronization.

CAUTION: If the throttle slide rests against the carburetor cover at full throttle opening, this will create too much strain and may damage the throttle cable or other components in throttle mechanism.

CAUTION: On dual carburetor models, make sure both carburetors start to operate simultaneously. Do not interchange carburetors as the jetting may be different on each side. A red dot is printed on one carburetor and on the engine. Match the carburetor and the engine dots when applicable.

CAUTION: The oil injection pump adjustment must be checked each time carburetor is adjusted. Refer to OIL INJECTION SYSTEM.

IDLE SPEED FINAL ADJUSTMENT

Idle Speed Screw

CAUTION: Before starting engine for the final idle adjustment, make sure that oil pump is adjusted. The oil injection pump adjustment must be checked each time carburetor is adjusted. Refer to OIL INJECTION SYSTEM.

Start engine and allow it to warm then adjust idle speed **no. 7** to specifications by turning idle speed screw clockwise to increase engine speed or counterclockwise to decrease it.

NOTE: On twin-carburetor models, turn adjustment screw the same amount to keep carburetors synchronized.

NOTE: Refer to TECHNICAL DATA for the specifications.

CAUTION: Do not attempt to set the idle speed by using the air screw. Severe engine damage can occur.

CHOKE

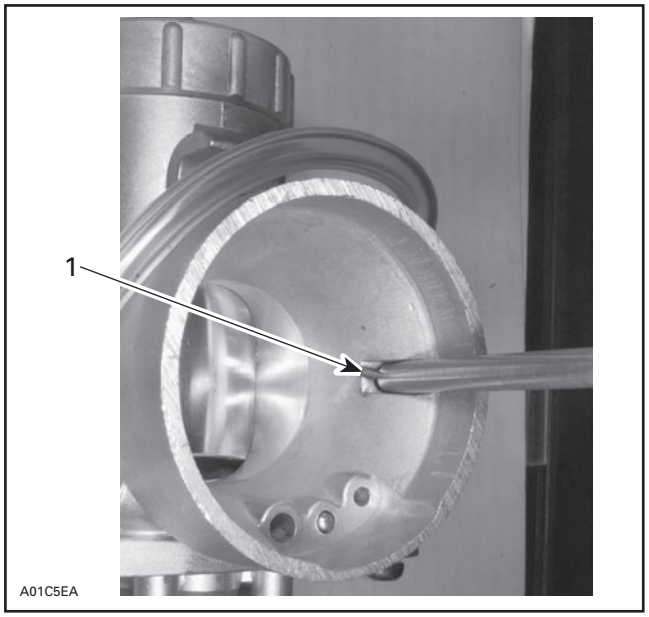
Skandic LT/WT/SWT/WT LC

Choke Plunger Adjustment

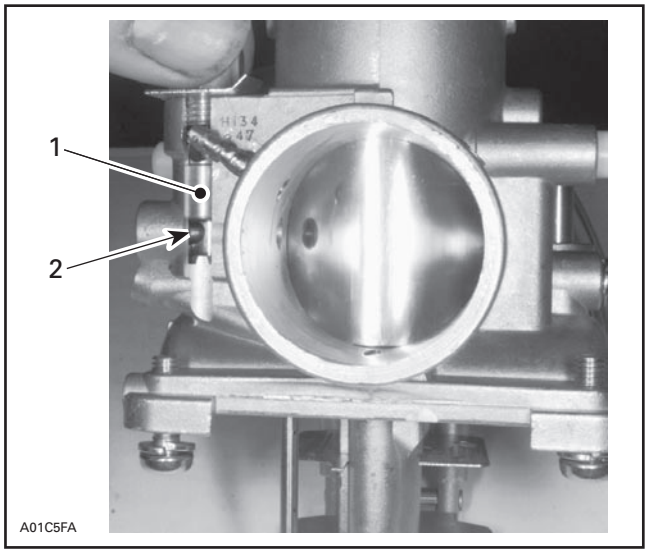
Set choke lever to fully open position.

CHOKE LEVER — FULLY OPEN POSITION

Insert choke plunger tool (P/N 529 032 100) into choke air inlet of each carburetor. Tool stopper may not lean against recess wall. Though it must be within 1 mm (.040 in) of recess wall.



AIR SILENCER SIDE SHOWN
1. *Tool stopper within 1 mm (.040 in) of recess wall*

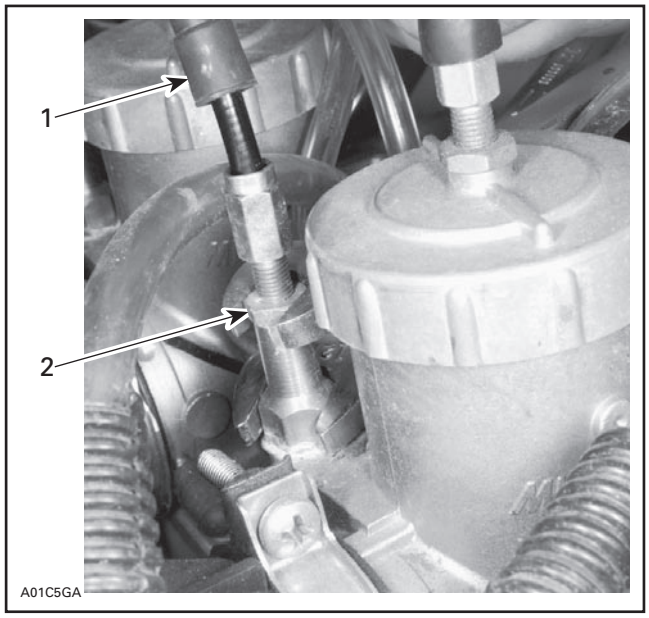


CUT-AWAY (ENGINE SIDE SHOWN)
1. *Choke plunger*
2. *Tool properly seated under choke plunger*

If tool tip does not sit under choke plunger **no. 15**, adjust as follows:

Make sure choke lever is at fully open position.

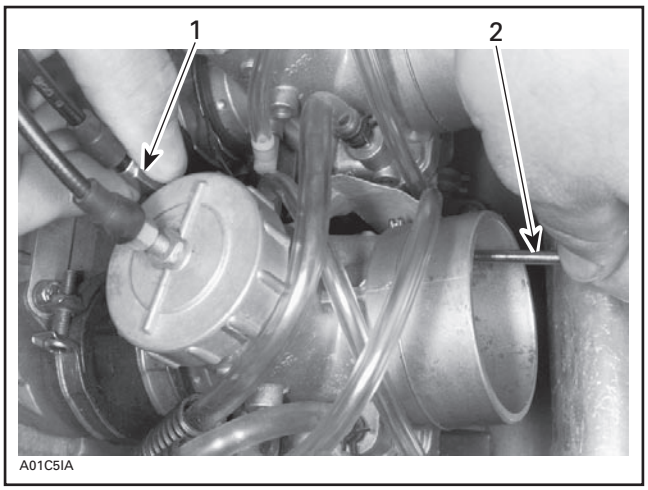
Lift up protector cap and loosen choke cable lock nut, as shown in the next photo.



1. *Lift up protector cap*
2. *Loosen lock nut*

Turn choke cable adjustment nut by hand until tool properly sits under choke plunger.

NOTE: A light pressure is be needed to position tool under plunger.



1. Choke cable adjustment nut
2. Choke plunger tool

Tighten choke cable lock nut and reinstall protector cap.

Set choke lever to close and open positions and ensure that tool properly seats under plunger only when lever is set to fully open position.

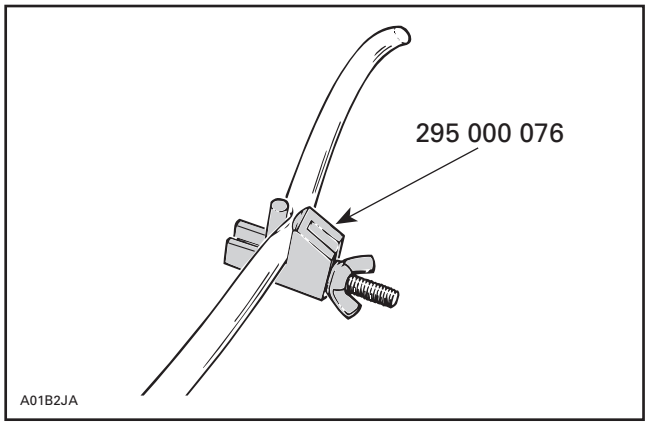
Set choke lever to close position and, by pulling and pushing choke lever, make sure there is no tension on cable (free play).

CHOKE LEVER — CLOSED POSITION

FUEL PUMP

REMOVAL

Install a hose pincher (P/N 295 000 076) on fuel supply line close to pump inlet.



Disconnect fuel outlet line(s).

Disconnect impulse line.

Remove screws securing fuel pump.

PUMP VERIFICATION

Check fuel pump valves operation as follows:

Connect a clean plastic tubing to the inlet nipple and alternately apply pressure and vacuum with pump of leak test kit. The inlet valve should release with pressure and hold under vacuum.

Repeat the same procedure at the outlet nipple. This time the outlet valve should hold with pressure and release under vacuum.

NOTE: On model fitted with 2 outlets, plug 1 outlet with finger while checking outlet valve.

To check impulse diaphragm and gasket on high-supply fuel pump equipped with twin outlets, proceed as follows:

Connect a clean plastic tubing to the impulse nipple and plug vent hole on top cover. Either apply pressure or vacuum using the vacuum/pressure pump kit (P/N 529 021 800). The diaphragm/gasket must not leak.

CLEANING AND INSPECTION

The entire pump should be cleaned with general purpose solvent before disassembly.

Fuel pump components should be cleaned in general purpose solvent and dried with compressed air.

⚠ WARNING

Solvent with a low flash point such as gasoline, naphtha, benzol, etc., should not be used as each is flammable and explosive.

Inspect diaphragm. The pumping area should be free of holes, tears or imperfections. Replace as needed.

High-supply pump with twin outlets: Thoroughly clean filter on top cover. Replace pump if too dirty.

INSTALLATION

To install, inverse removal procedure.

⚠ WARNING

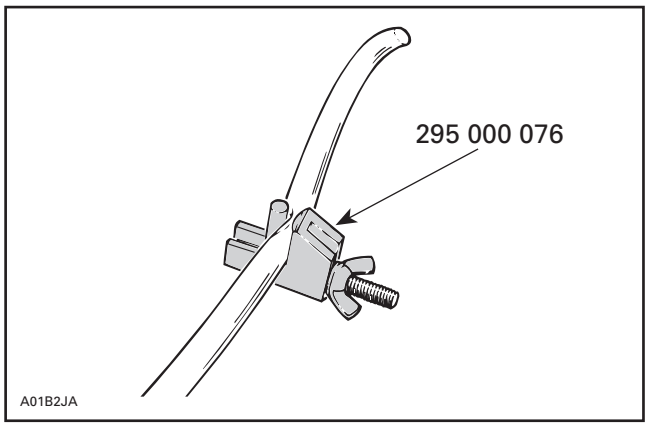
Pressure test to ensure there is no leak in fuel system.

FUEL TANK

Fuel Tank Lines

⚠ WARNING

When draining a fuel tank or whenever a fuel line is disconnected, obstruct line with a hose pincher (P/N 295 000 076) or equivalent device. Fuel is flammable and explosive under certain conditions. Ensure work area is well ventilated. Do not smoke or allow open flames or sparks in the vicinity.



Impulse/Fuel Lines Spring Clips

Always reposition spring clips after any repair to prevent possible leaks.

LEAK TEST

VERIFICATION

Before performing the cylinder leak test, verify the following:

– clamp(s) tightness
– radiator and hoses
– oily contamination on leak indicator hole means a damaged oil seal on water pump shaft
– coolant out of leak indicator hole means a damaged rotary seal on water pump shaft (refer to COOLING SYSTEM)
– coolant escaping from water pump housing means damaged gasket(s) and/or loosened screws (refer to COOLING SYSTEM).

NOTE: For all the checkpoints mentioned above, see the appropriate engine section to diagnose and repair the engine.

LEAK TEST PROCEDURE

NOTE: The following instructions are valid for both cylinders.

PREPARATION AND TEST

NOTE: The following procedures should be done with a cold engine.

PREPARATION

Disconnect battery.

⚠ WARNING

Always respect this order for disassembly; disconnect BLACK (-) cable first. Electrolyte or fuel vapors can be present in engine compartment and a spark may ignite them and possibly cause personal injuries.

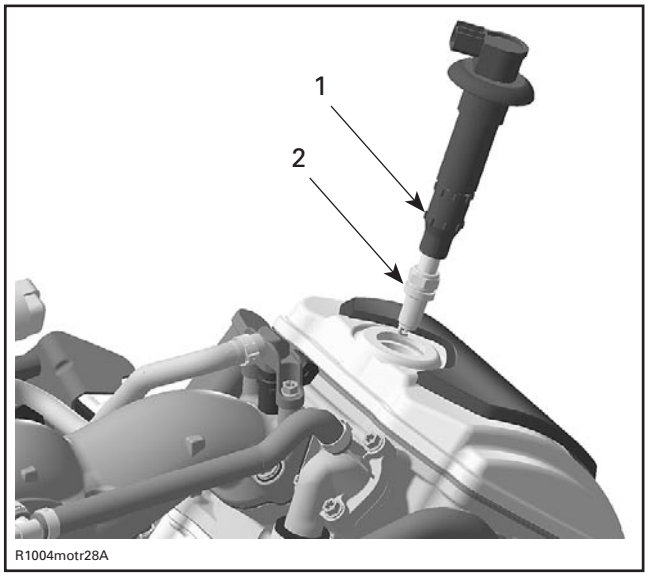
Remove:

– radiator cap.

Unplug and remove ignition coil.

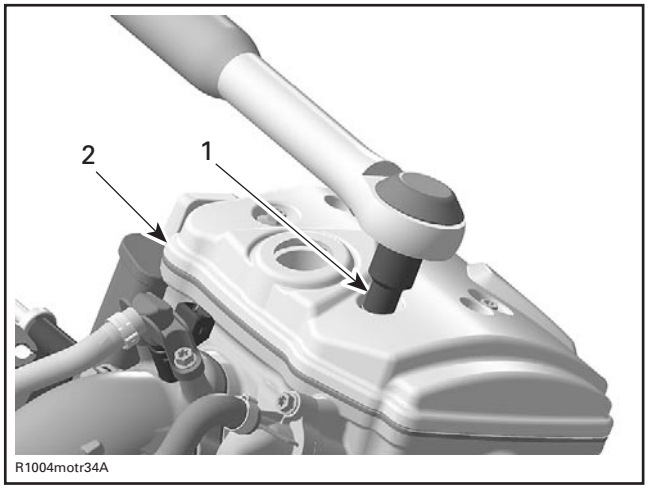
Remove spark plug from cylinder head.

NOTE: Ignition coil can help removing spark plug.



1. Ignition coil
2. Spark plug

Remove valve cover.

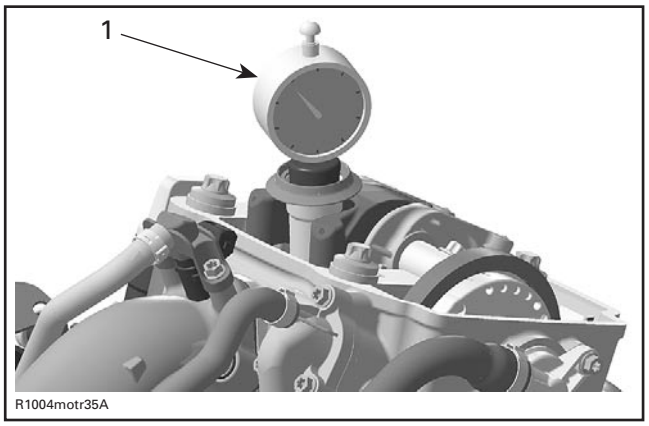


1. Ratchet wrench
2. Valve cover

Preparation

Using a dial gauge set the crankshaft and the piston to precisely ignition TDC. If a dial gauge is not available, use a screwdriver or another similarly suitable tool.

NOTE: The engine must be set to precisely ignition TDC; if this is not ensured the engine will continue to rotate when pressure builds up.



1. Dial gauge

Connect to adequate air supply.

Set needle of measuring gauge to zero.

NOTE: All testers have specific instructions on gauge operation and required pressure.

Install gauge adapter into previously cleaned spark plug hole.

Supply combustion chamber with air pressure.

Note the amount or percentage of leakage (depending on tester).

LEAKAGE PERCENTAGE	ENGINE CONDITION
0% to 7%	Excellent condition
8% to 15%	Fair condition; proceed with tune-up or adjustment
16% to 30%	Poor condition; engine will run but performance might be down in some cases.
30% and higher	Very poor condition, diagnose and repair engine.

Diagnose

Listen for air leaks.

- air escaping on intake port/carburetor means leaking intake valve(s)
- air escaping on exhaust port means leaking exhaust valve(s)
- air bubbles out of radiator means leaking cylinder head gasket
- air/oil escaping from crankcase means damaged gasket and/or loosened screws (refer to CRANKCASE)
- air/coolant escaping from cylinder/head means damaged gasket(s) and/or loosened screws (refer to CYLINDER AND HEAD)
- air escaping into crankcase area means excessively worn cylinder and/or broken piston rings.

NOTE: For all the checkpoints mentioned above see the appropriate engine section to diagnose and repair the engine.

INSTALLATION

NOTE: Within the course of the assembly, always replace the valve cover gasket.

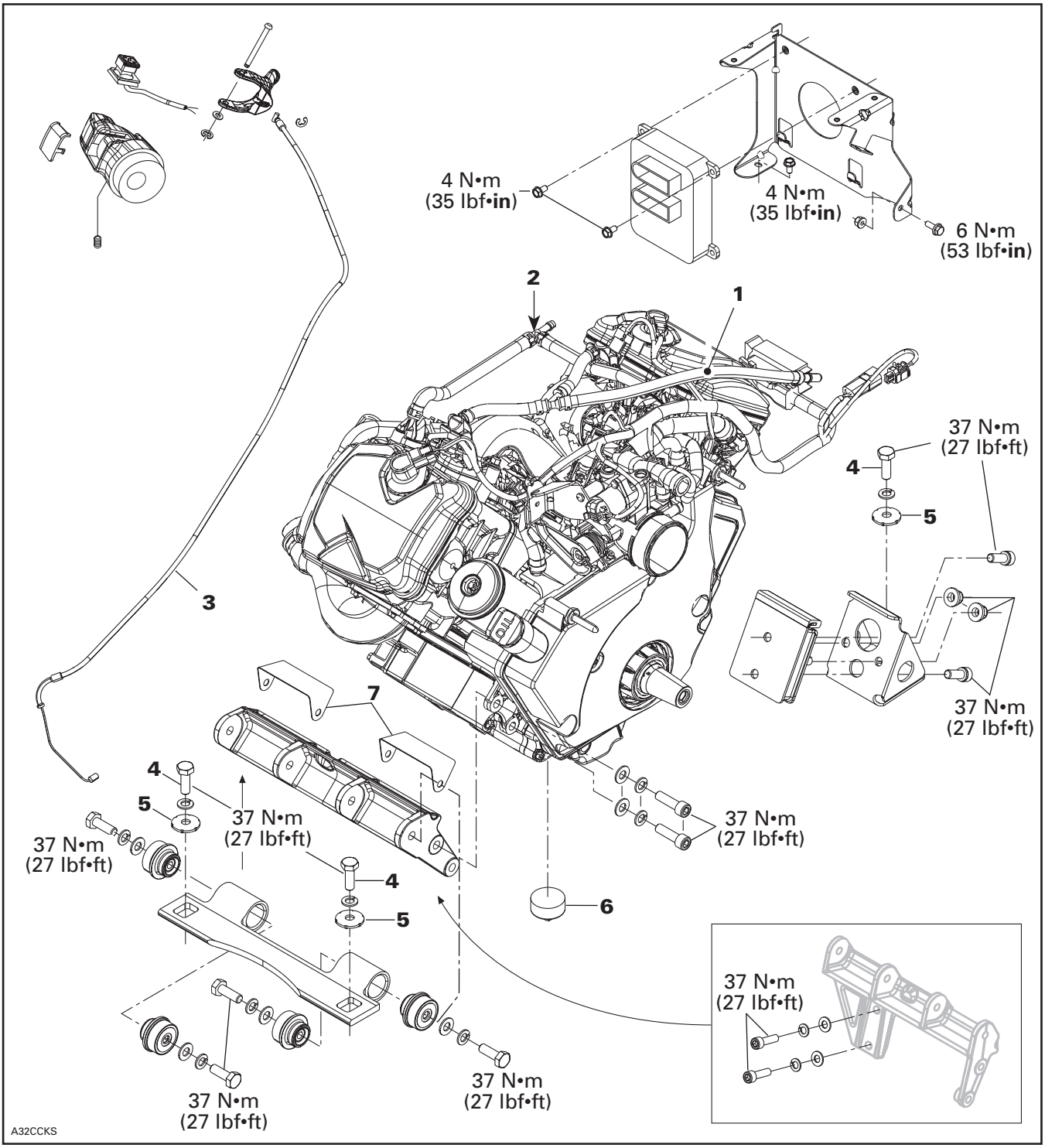
Torque valve cover screws to 9 N•m (80 lbf•**in**).

Torque spark plugs to 17 N•m (150 lbf•**in**).

Slightly oil the bottom outer part of the stick coil. This will simplify installation.

For installation, reverse the preparation procedure.

REMOVAL AND INSTALLATION



ENGINE REMOVAL

Use B.U.D.S. to release fuel pressure. Refer to B.U.D.S. instructions.

Disconnect battery.

⚠ WARNING

Battery BLACK (-) cable must always be disconnected first and connected last.

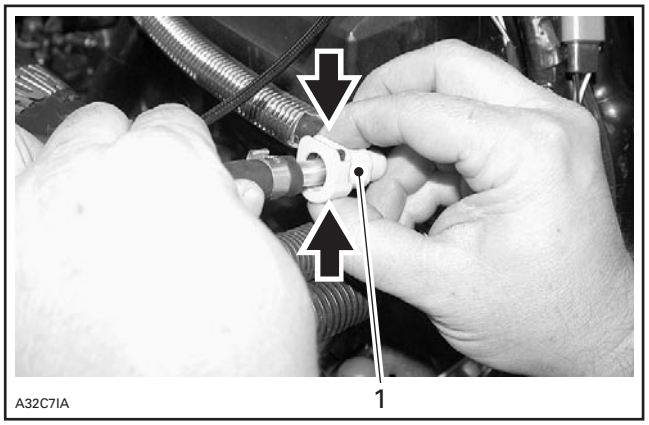
⚠ WARNING

Never charge or boost battery while installed. Battery contains sulfuric acid which is corrosive and poisonous. In case of contact with skin, flush with water and call a physician immediately.

⚠ WARNING

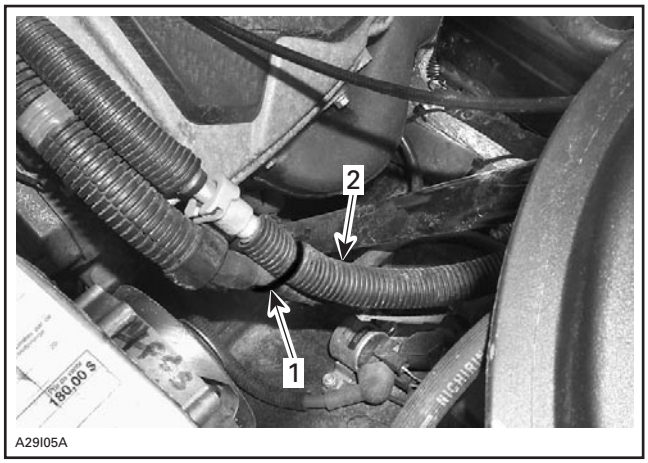
Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Unplug fuel supply line no. 1 by squeezing spring lock of plastic female coupling.



1. Plastic female coupling

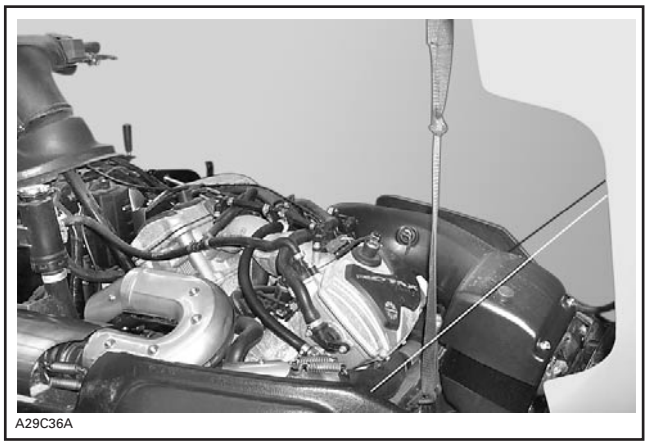
Cut locking tie retaining fuel supply line to engine harness.



1. Locking tie
2. Fuel supply line

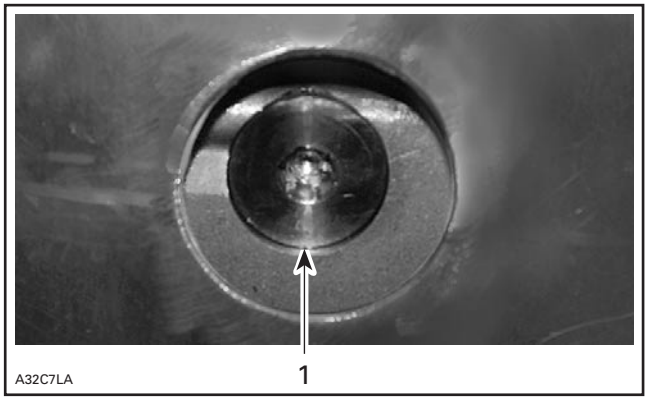
Lift front of vehicle by the front cross member.

CAUTION: Never lift front of 4-TEC models by the front bumper.



NOTE: At this point, drain engine oil only if engine needs repair.

Working underneath bottom pan, remove oil drain plug then lift oil filter cover.



1. Oil drain plug

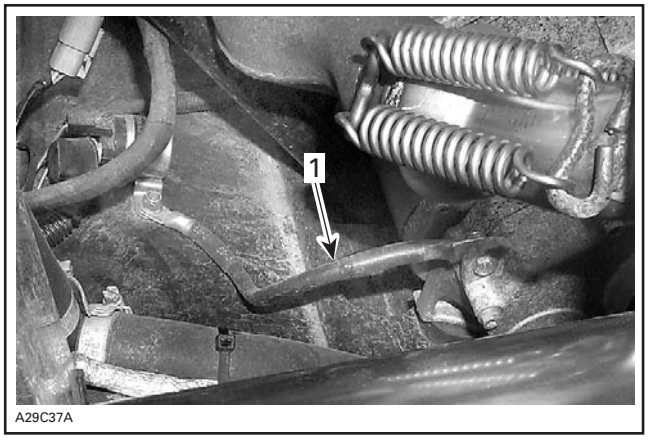
Drain the engine oil.

Put back vehicle on the ground.

Remove muffler and pipes.

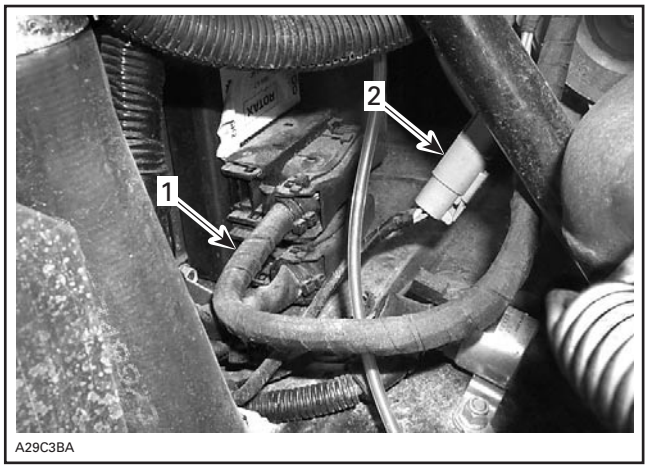
Remove coolant reservoir cap. Siphon as much coolant as possible.

Disconnect the following:
- bottom hose from thermostat housing
- side hose from thermostat housing
- air bleed hose from T-fitting **no. 2**
- alternator
- ground cable from engine.



1. Ground cable

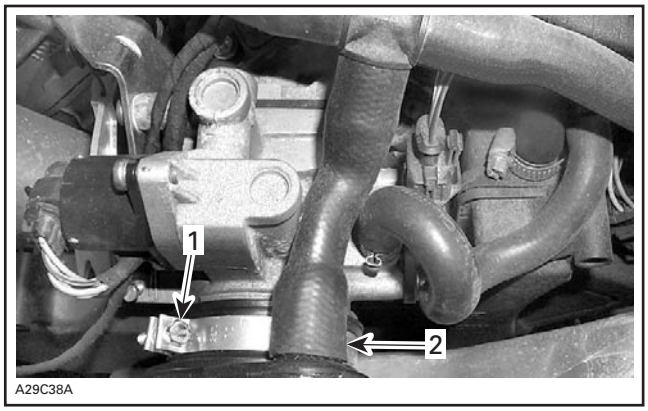
Disconnect engine harness connectors (top one) from ECM (engine control module) and main harness.



1. ECM
2. Main harness

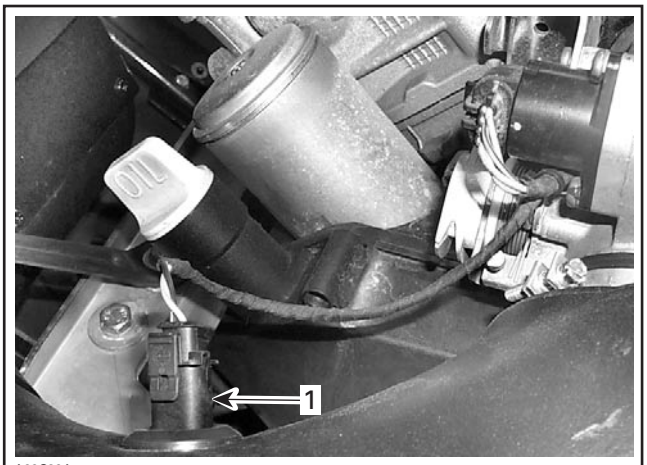
Loosen collar screw on air silencer grommet.

Disconnect blow-by hose from air silencer.



1. Collar screw
2. Blow-by hose

Disconnect air temperature sensor at rear of air silencer.



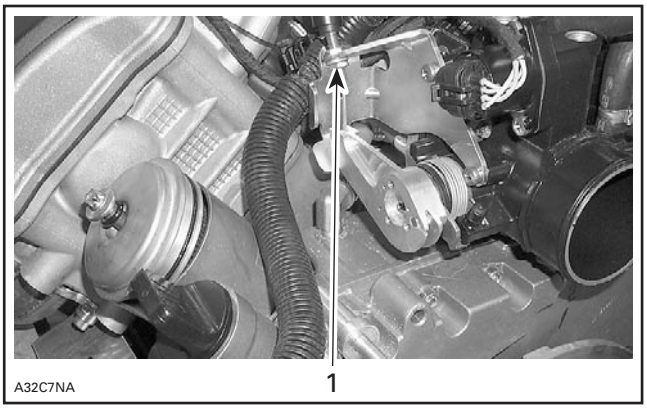
1. Air temperature sensor

Remove air silencer.

Remove guard, drive belt, drive pulley.

Disconnect the starter RED (+) cable from starter.

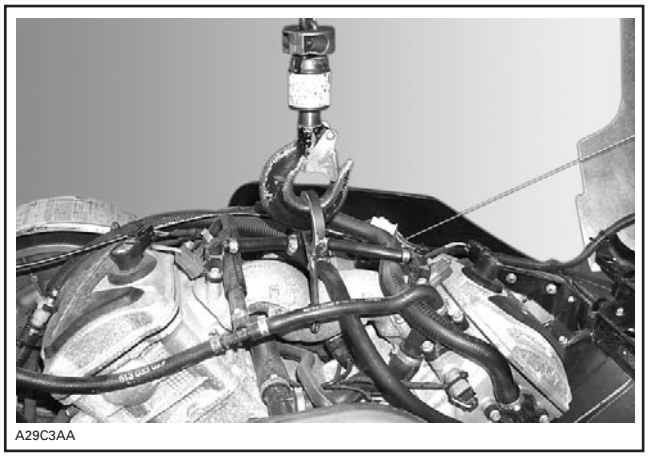
Disconnect throttle cable **no. 3** from throttle body.



1. Throttle cable attachment

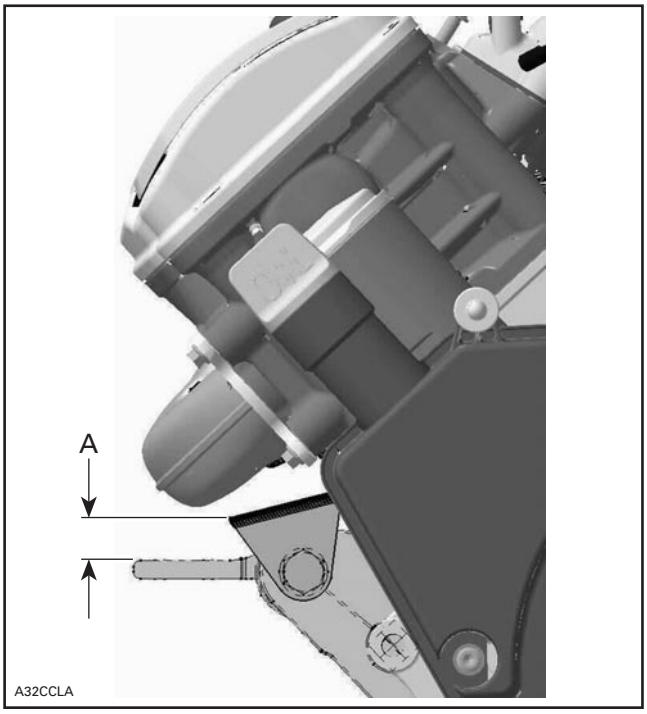
Remove screws **no. 4** of engine supports.

Hook up engine by lifting eye located on intake manifold. Using appropriate lifting device, remove engine from vehicle.



ENGINE INSTALLATION

Before engine installation, make sure that the front deflectors **no. 7** are positioned as per following illustration.



A. 10 ± 1.5 mm (1/2 ± 1/16 in)

Before engine installation make sure a good condition stopper **no. 6** is in place.

To install engine on vehicle, reverse removal procedure. However, pay attention, to all appropriate component/system reinstallation procedures described throughout this *Shop Manual* and to the following:

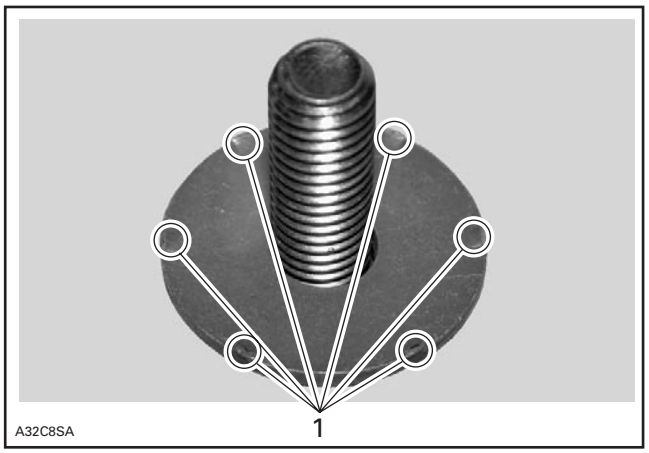
Check pulley alignment and drive belt height.

Install doughnut shaped exhaust gasket with both notches aligned with Y-manifold protrusions.

NOTE: No sealant required on doughnut shaped exhaust gasket.

Torque screws **no. 4** of engine supports to 37 N•m (27 lbf•ft).

NOTE: Install washers **no. 5** with the teeth toward the support.



1. Teeth

Do not forget to connect air temperature sensor to air silencer otherwise a fault code will appear.

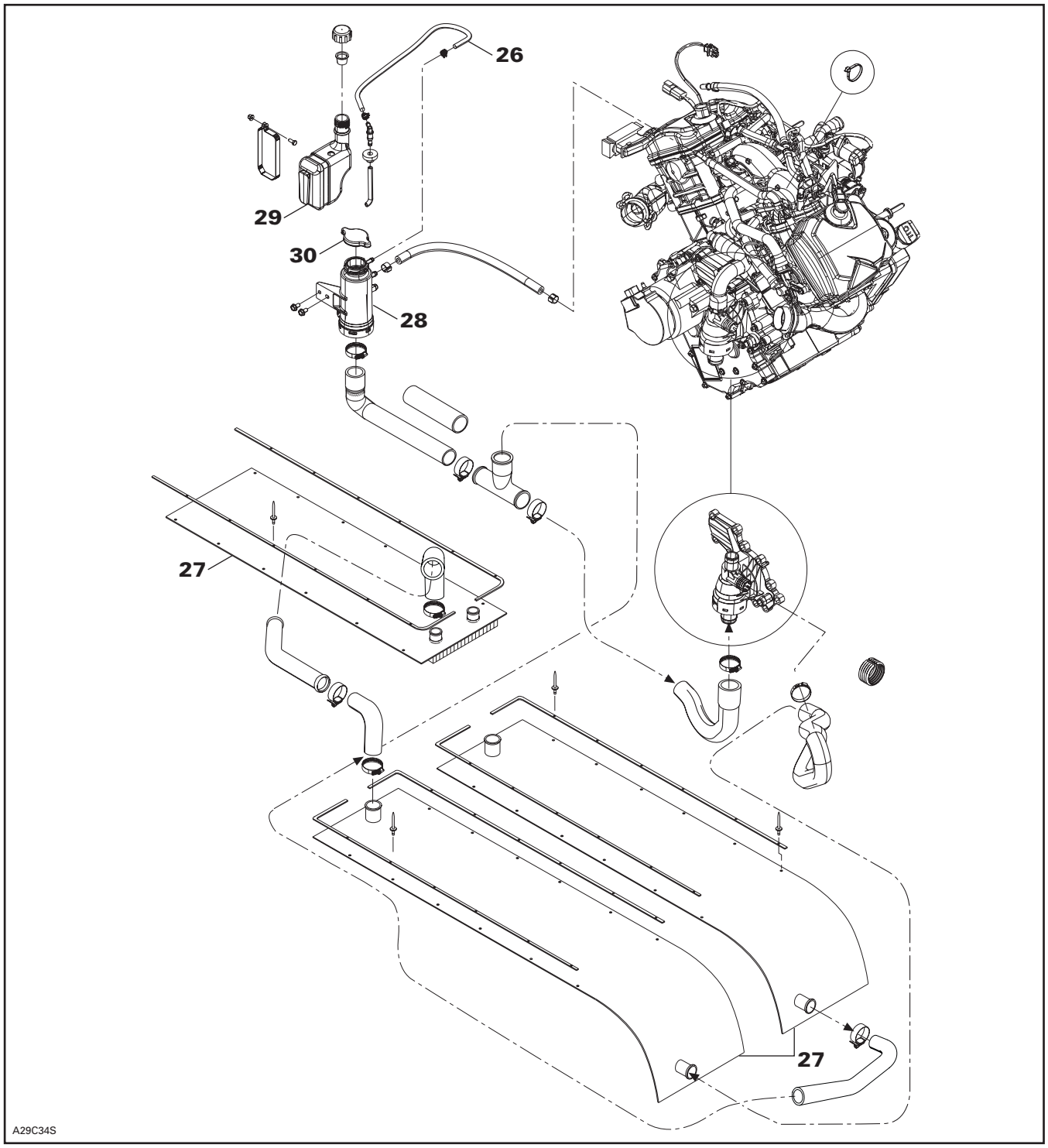
COOLING SYSTEM

SERVICE TOOLS

Description	Part Number	Page
engine leak tester kit	861 749 100	186
hand pump	529 021 800	186
hose pincher	295 000 076	186
oil seal pusher	529 035 757	192
seal installer	529 035 766	192
special radiator cap	529 021 400	186

SERVICE PRODUCTS

Description	Part Number	Page
50/50 PREMIXED COOLANT - 37°C (- 35°F)	293 600 038	186


26
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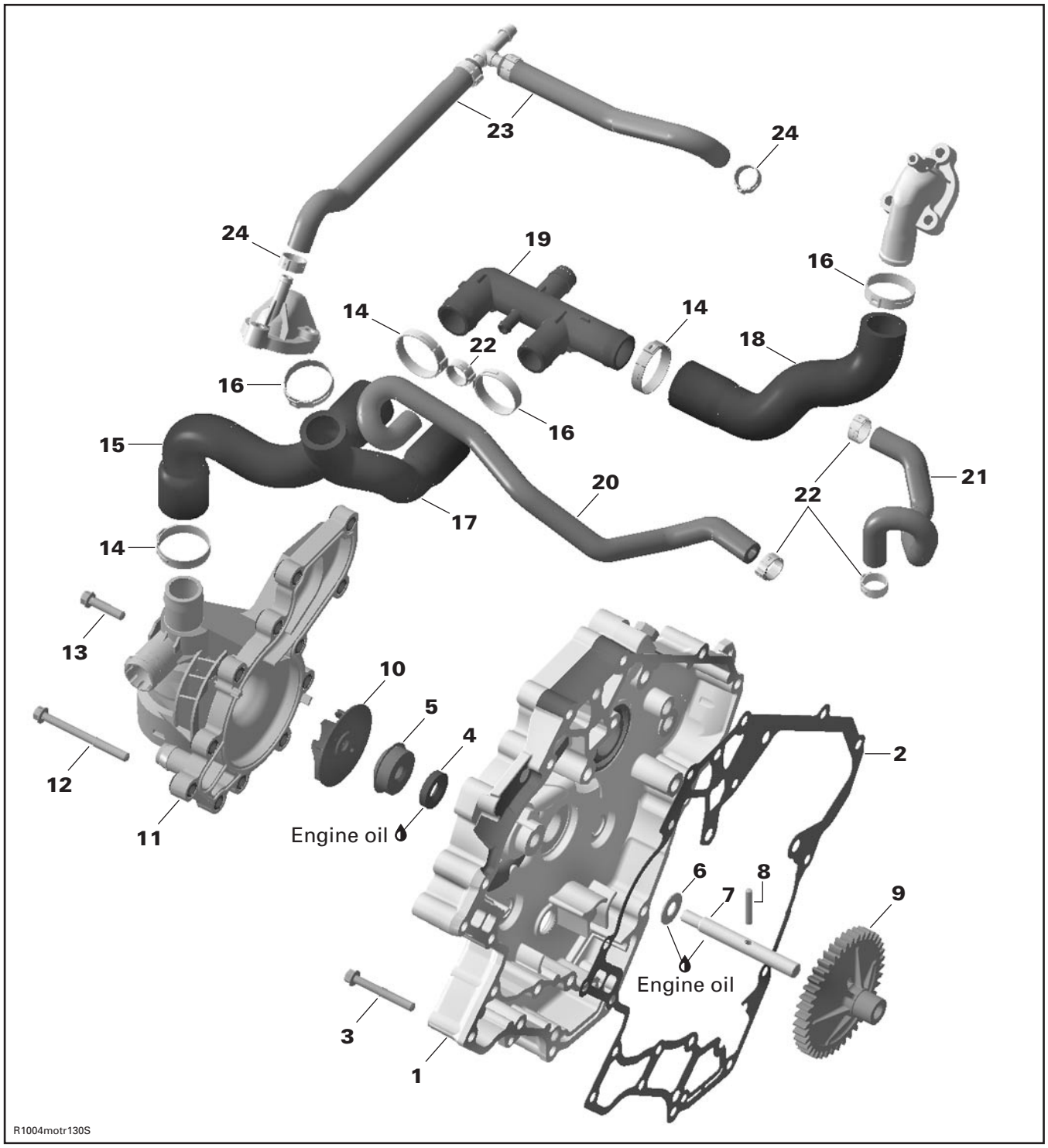
A29C34S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12
11
Engine oil
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6
8
7
9
Engine oil
3
1
R1004motr130S

COOLING SYSTEM LEAK TEST

⚠ WARNING

To prevent burning yourself, do not work on cooling system when the engine is hot.

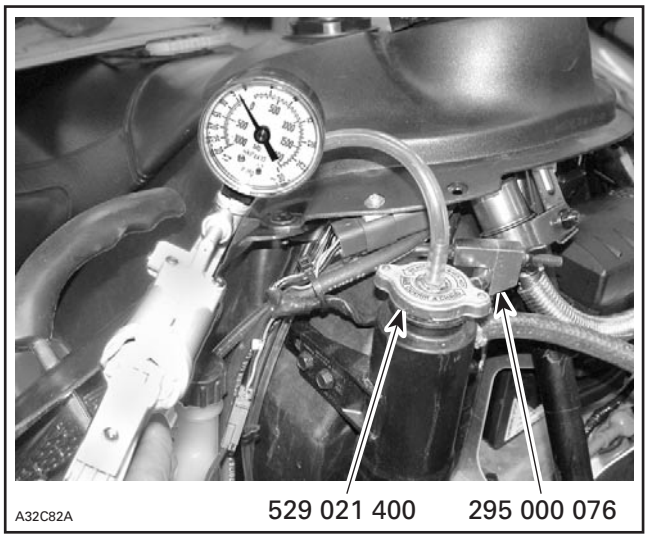
Remove pressure cap **no. 30**.

Install special radiator cap (P/N 529 021 400) included in engine leak tester kit (P/N 861 749 100) on coolant tank **no. 28**.

Install hose pincher (P/N 295 000 076) on overflow hose **no. 26**.

Using the hand pump (P/N 529 021 800) pressurize all system through coolant tank to 120 kPa (17 PSI).

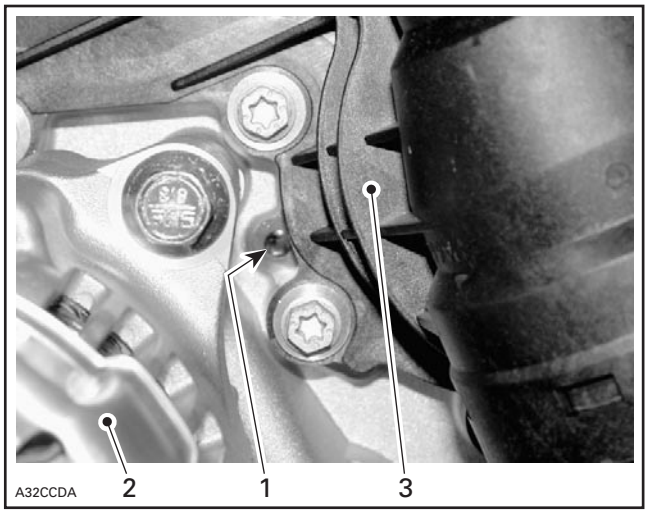
Check all hoses, radiators **no. 27** and cylinder/base for coolant leaks.



INSPECTION

Check general condition of hoses and clamp tightness.

Check leak indicator hole to see if there is oil or coolant.



1. Leak indicator hole
2. Alternator
3. Water pump

NOTE: Flowing coolant indicates a damaged rotary seal **no. 5**. Oil out of the leak indicator hole indicates a defective oil seal **no. 4**.

COOLANT REPLACEMENT

Recommended Coolant

IMPORTANT: USE THE 50/50 PREMIXED COOLANT - 37°C (- 35°F) (P/N 293 600 038).

CAUTION: To prevent rust formation or freezing condition, always replenish the system with the recommended coolant.

System Capacity

Refer to TECHNICAL DATA.

Draining the System

⚠ WARNING

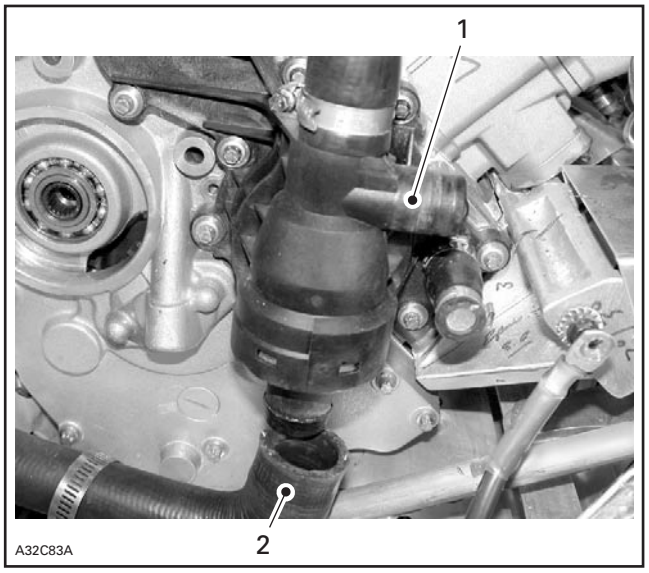
To prevent burning yourself do not work on cooling system when the engine is hot.

Remove pressure cap **no. 30**.

Siphon as much coolant through coolant tank **no. 28**.

Empty the overflow coolant tank **no. 29**.

Disconnect side hose and bottom hose from thermostat housing.

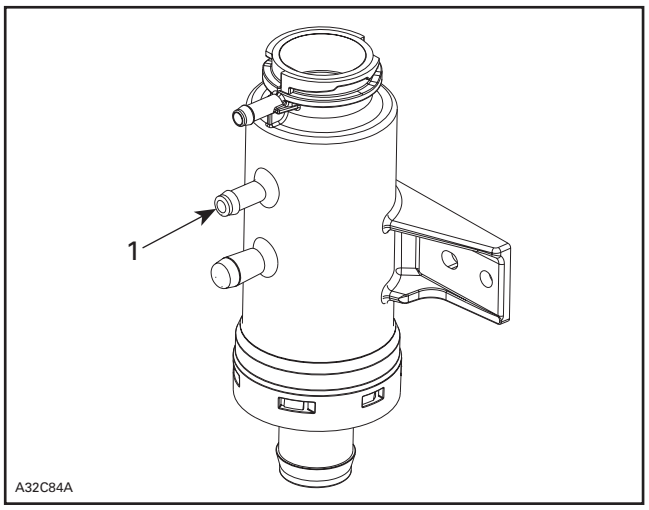


1. Side hose location
2. Bottom hose

Let coolant drain.

Refilling the System

With vehicle on a flat surface, engine cold, slowly half fill coolant tank **no. 28**. Coolant level must not reach bleed hose nipple to allow air to escape from the system.



1. Bleed hose nipple

Coolant level will be stable once coolant tank is half filled.

Do not install the pressure cap **no. 30**.

Start engine. Check level in coolant tank. Refill with coolant to keep coolant tank half filled.

CAUTION: Never allow coolant tank to be empty during the filling procedure.

Let engine idling for about 10 minutes or until radiators are warm — which means that the thermostat is open.

Keep engine idling for an additional 5 minutes maximum or until coolant temperature reaches 100°C (212°F). Always keep coolant tank half filled but the bleed hose free.

CAUTION: Never allow coolant to exceed 100°C (212°F). Put a thermometer in coolant tank to monitor the temperature.

Stop engine. Fill up both coolant tank **no. 28** and overflow coolant tank **no. 29**. Install their respective caps.

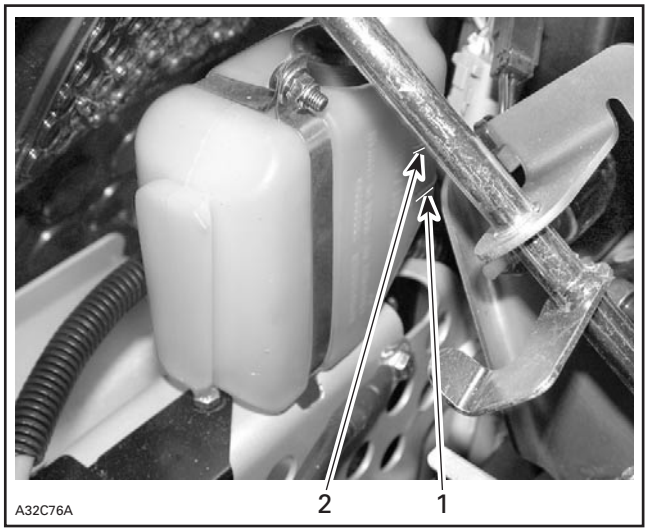
Let vehicle cool down for at least 30 minutes.

Check coolant level in overflow coolant tank **no. 29**. Some coolant should have been sucked through the overflow hose up to the coolant tank. If not repeat refilling procedure.

If some coolant have been siphoned from the overflow coolant tank **no. 29**, remove pressure cap **no. 30** and fill up the coolant tank **no. 28**. Reinstall pressure cap **no. 30**.

Fill overflow coolant tank **no. 29** to maximum level line.

Recheck coolant level after vehicle has completely cooled down. Coolant tank **no. 28** must be full and the level in overflow coolant tank **no. 29** must be between the minimum and maximum marks.



1. Minimum
2. Maximum

After the first few kilometers (miles) of running recheck level.

COOLANT HOSES

Any damaged/leaky or brittle coolant hose or component must be replaced. When replacing a hose, also replace the clamps.

At installation, do not twist or bend the hoses.

WATER PUMP HOUSING/THERMOSTAT

The thermostat is a dual action type.

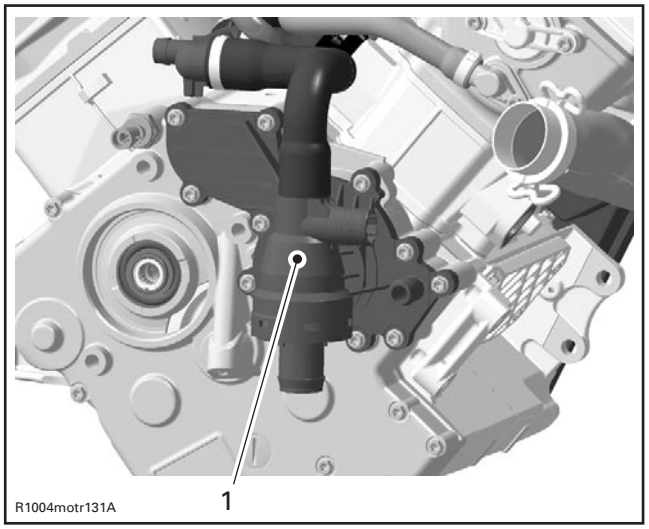
Removal

NOTE: The thermostat is located on the ignition cover. Thermostat and water pump housing form one unit and can only be replaced as one complete component.

Drain cooling system (refer to DRAINING THE SYSTEM above).

Remove:

– water pump housing screws no. 12 and no. 13 and pull water pump housing no. 11.



1. Water pump housing with screws and thermostat inside

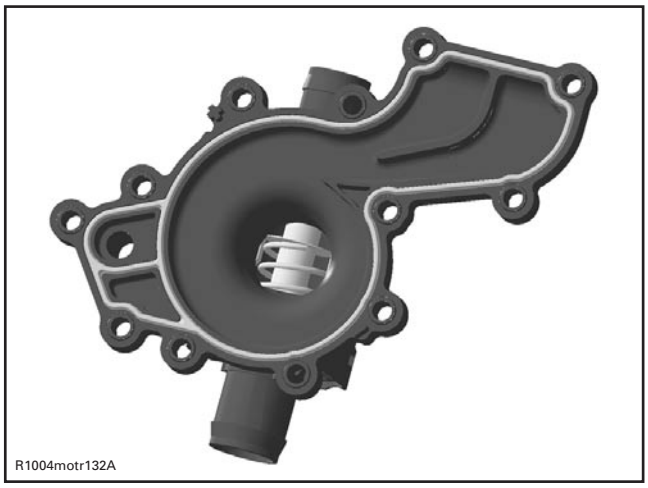
Test

To check thermostat, put in water and heat water. Thermostat should open when water temperature reaches 80°C (176°F).

Inspection

Check the water pump housing for cracks or other damage.

Replace water pump housing if damaged.



WATER PUMP HOUSING WITH GASKET

Installation

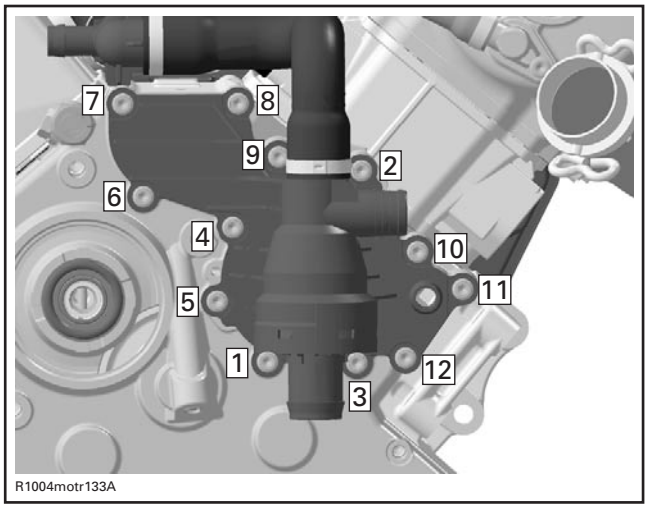
The installation is the opposite of the removal procedure. Pay attention to the following details.

NOTE: At installation, replace the gasket of the water pump housing.

Torque water pump housing screws to 9 N•m (80 lbf•**in**).

CAUTION: To prevent leakage, make sure the gasket is exactly in the groove when the water pump housing is reinstalled.

Tightening sequence for screws on water pump housing is as per following illustration.



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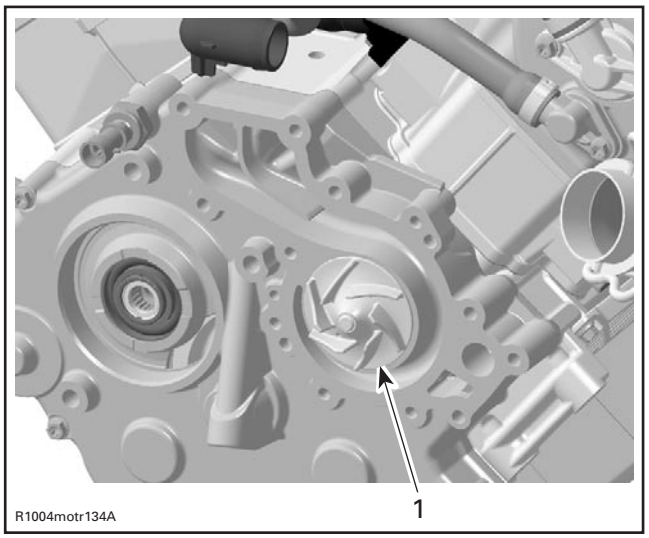
WATER PUMP IMPELLER

Removal

Remove:

– water pump housing **no. 11**
– impeller **no. 10**.

Using pliers, carefully turn the impeller anti-clockwise to remove it from the water pump shaft without any damage. The thread of the water pump shaft is right-hand.



R1004motr134A

1. Impeller

Inspection

Check impeller for cracks or other damage. Replace impeller if damaged.

Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

CAUTION: Be careful not to damage impeller wings during installation. Tighten impeller to 7 N•m (62 lbf•in).

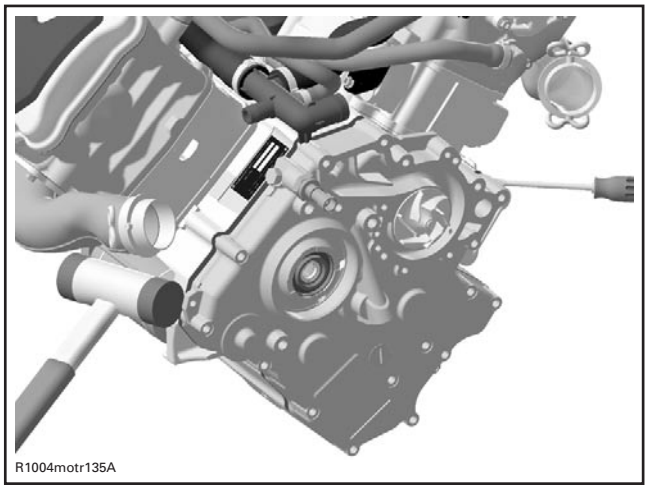
IGNITION COVER

Removal

Remove:

– drain lubrication system (refer to OIL CHANGE)
– alternator (refer to ALTERNATOR)
– water pump housing **no. 11**
– impeller **no. 10**
– screws **no. 3** and pull ignition cover **no. 1**.

Carefully remove the ignition cover using a screwdriver and a plastic hammer.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Ball Bearing Removal Procedure

NOTE: Heat ignition cover up to 100°C (212°F) before removing ball bearings.

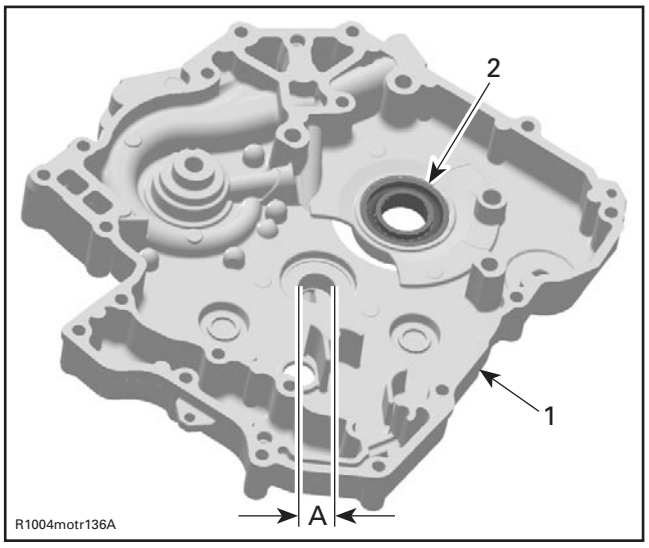
⚠ WARNING

Clean oil, outside and inside ignition cover before heating it.

NOTE: Using a suitable arbor, eject the ball bearing with slight hammer blows towards the inside. The ignition cover has to be supported from below in order to prevent damage of the sealing surface.

Inspection

Check oil supply hole/support bearing for scorings or other damages. There are no plain bearings in the ignition cover.



1. Ignition cover
2. Ball bearing
A. Oil supply hole/support bearing diameter

NOTE: Measure oil supply hole/support bearing diameter. Compare to crankshaft journal diameter on alternator (refer to CRANKSHAFT). Replace the ignition cover if the measurement is out of specification.

DIAMETER OF OIL SUPPLY HOLE/ SUPPORT BEARING	
SERVICE LIMIT	20.040 mm (0.7889 in)

NOTE: Check ball bearing for excessive play and smooth operation. Replace if necessary.

Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

Ball Bearing Installation Procedure

NOTE: Heat ignition cover up to 100°C (212°F) before installing ball bearing.

⚠ WARNING

Clean oil, outside and inside housing before heating it.

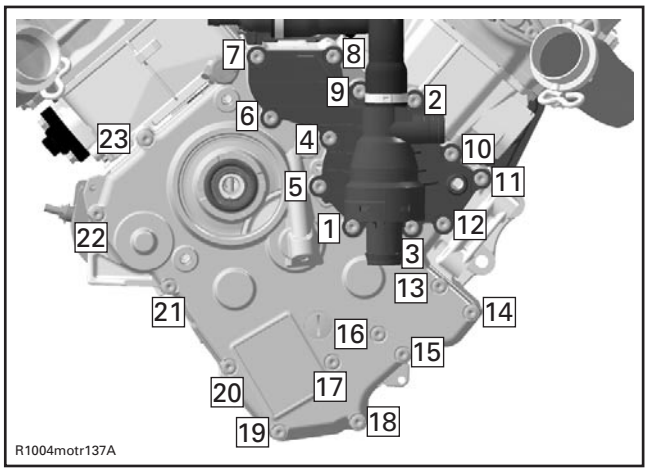
Place new ball bearing in freezer for 10 minutes before installation.

NOTE: Do not use any striking tool to insert the ball bearing. The bearing must be mounted manually with moderate (thumb) pressure into the ignition cover.

Replace gasket **no. 2**.

Torque ignition cover screws to 9 N•m (80 lbf•**in**).

Tighten screws in the following sequence.

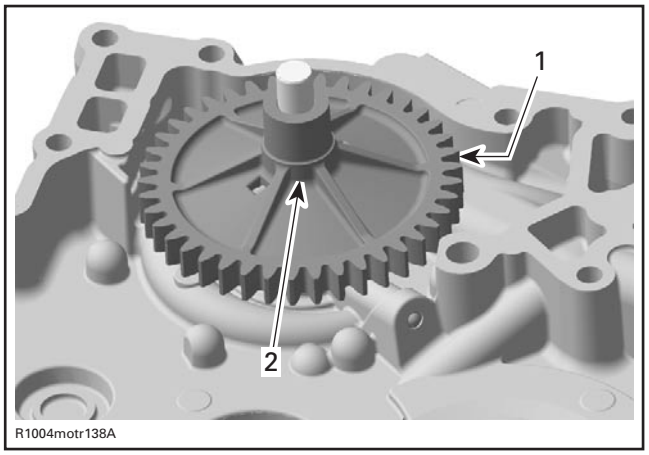


WATER PUMP SHAFT

Removal

Remove:

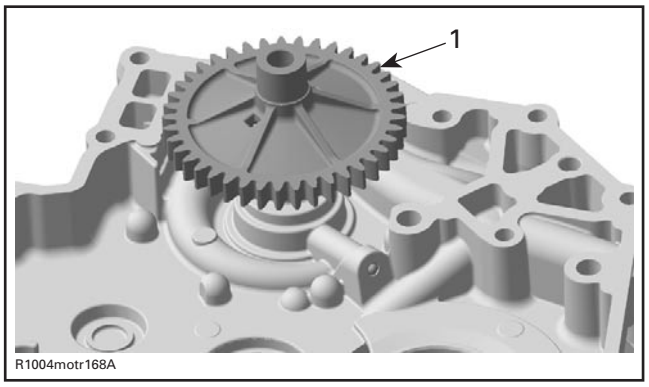
– water pump housing **no. 11**
– impeller **no. 10**
– ignition cover



1. Water pump gear
2. Thrust washer behind water pump gear

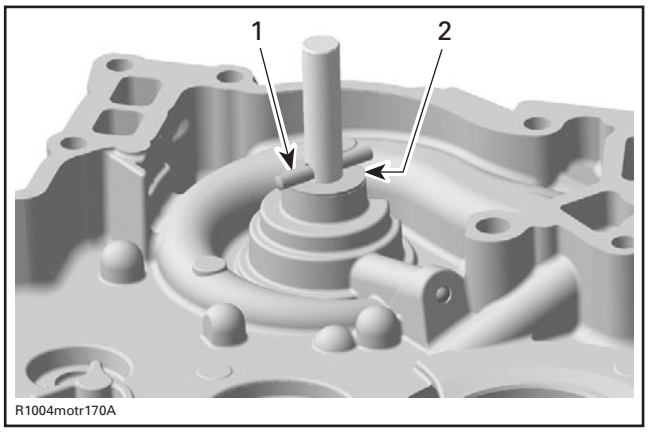
– water pump gear **no. 9**

NOTE: The water pump gear is held by a needle pin on the water pump shaft.



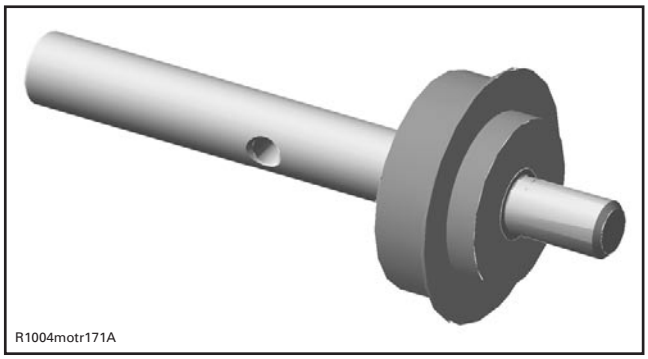
1. Water pump gear

– needle pin **no. 8** and thrust washer **no. 6**.

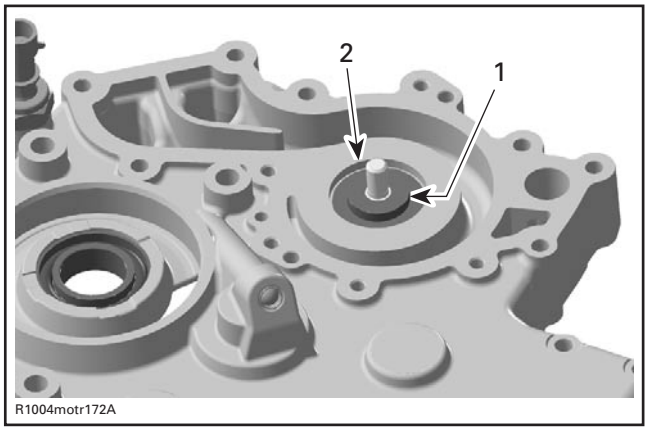


1. Needle pin
2. Thrust washer

CAUTION: When removing water pump shaft, always replace rotary seal with water pump shaft no. **7** and oil seal no. **4** (behind rotary seal).



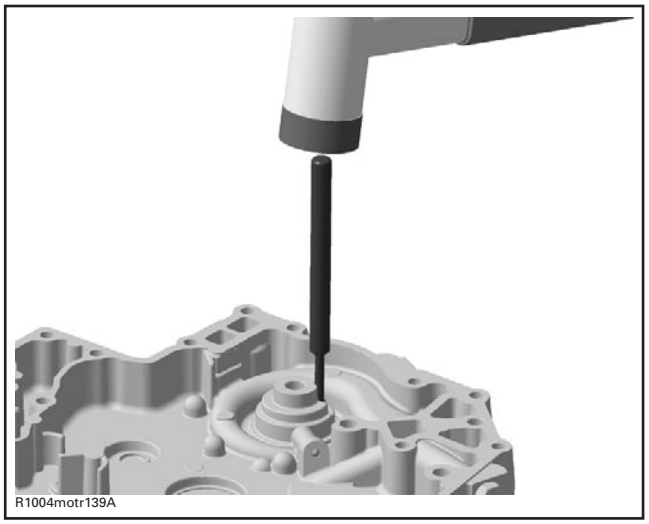
WATER PUMP SHAFT WITH ROTARY SEAL



1. Oil seal behind the rotary seal
2. Rotary seal bore

Extract the water pump shaft with rotary seal **no. 5** together with oil seal **no. 4** from inside ignition cover with a pusher.

CAUTION: Be careful not to damage the surface of the rotary seal bore in ignition cover.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Inspection

Inspect water pump gear for wear and damage on the snap mechanism to the needle pin. Replace if damaged.

Water pump shaft with rotary seal must rotate freely. Otherwise, replace it.

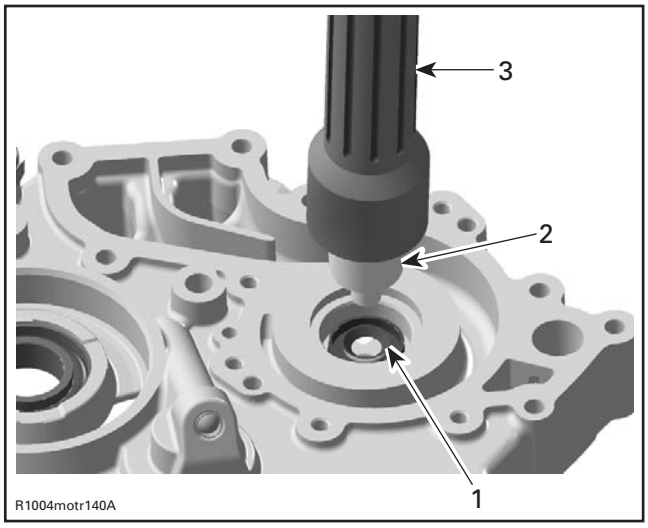
NOTE: When removing water pump shaft, always replace together retaining ring, oil seal, water pump shaft with rotary seal with new parts.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Never use oil in the press fit area of the oil seal and rotary seal.

Push water pump shaft oil seal in place by using the oil seal pusher (P/N 529 035 757).



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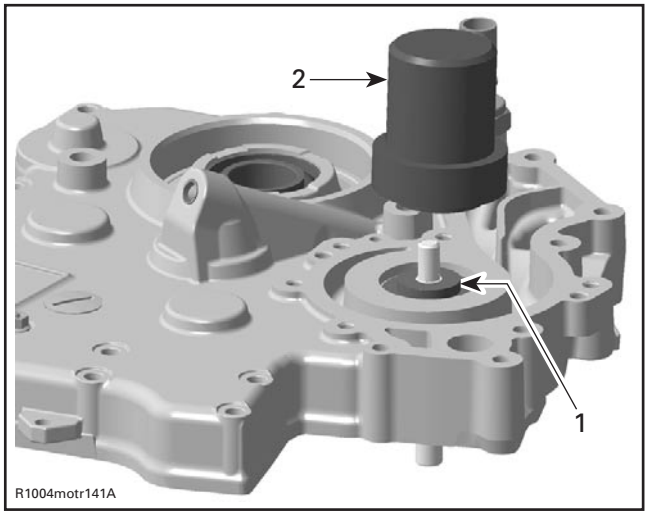
1. Oil seal for the water pump shaft
2. Oil seal pusher (P/N 529 035 757)
3. Handle for insertion jig (P/N 420 877 255)

Install the water pump shaft assembly using the water pump ceramic seal installer (P/N 529 035 766).

CAUTION: Never use a hammer for the rotary seal installation. Only use a press to avoid damaging the ceramic component.



R1004motr141A

1. Water pump shaft with rotary seal
2. Water pump ceramic seal installer (P/N 529 035 766)

Mount thrust washer no. 6 and needle pin no. 8.

NOTE: The water pump shaft must be slightly preloaded by the spring of the rotary seal.

Use multi-purpose grease in water pump shaft bore.

PRESSURE CAP

Check if cap pressurizes the system. If not, install a new 110 kPa (16 PSI) cap (do not exceed this pressure).

RADIATORS

Refer to CHASSIS for radiators no. 27 removal and installation.

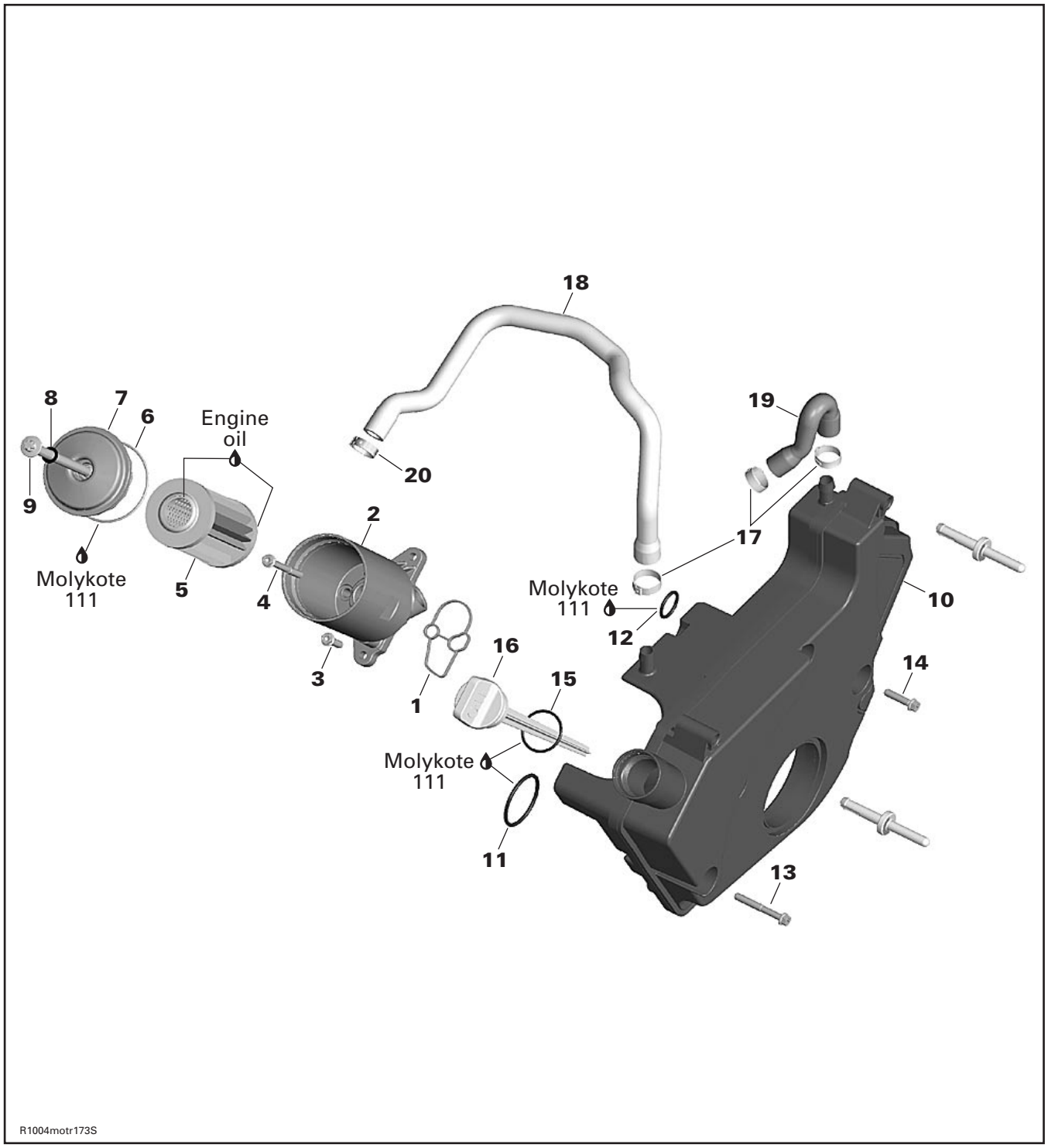
LUBRICATION SYSTEM

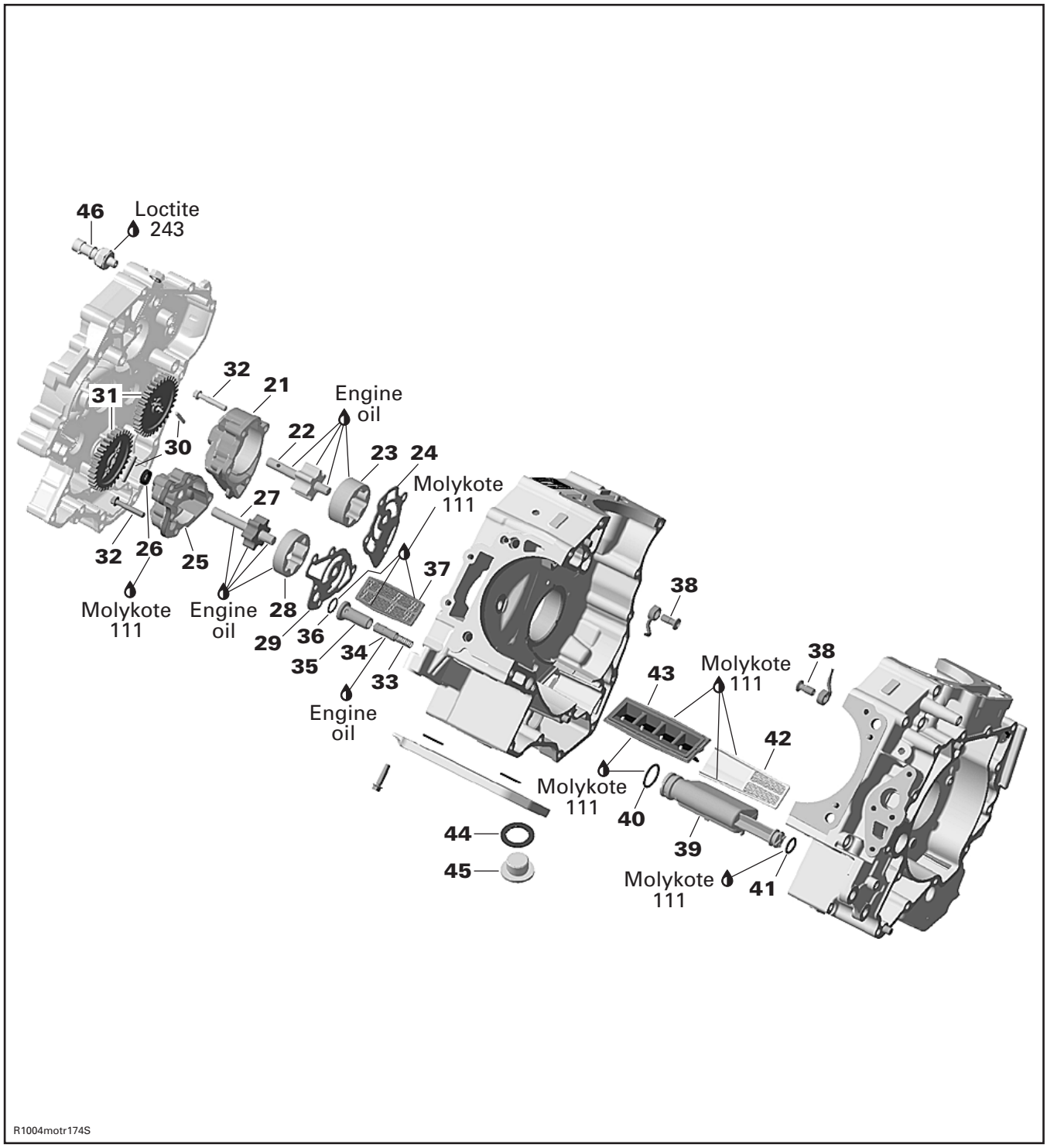
SERVICE TOOLS

Description	Part Number	Page
dial indicator	414 104 700	203
fuel line remover	529 035 714	198
oil pressure adapter	529 035 652	198
oil pressure gauge	529 035 709	198
oil seal pusher	529 035 911	204

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	199
Molykote 111	413 707 000	200, 207
XP-S 0W40 synthetic 4-stroke oil (12 x 1L)	293 600 054	198


18
8
7
6
Engine
oil
19
20
9
2
17
Molykote
111
5
4
Molykote
111
10
12
3
16
14
1
15
Molykote
111
11
13
R1004motr173S


46
Loctite 243
31
32
21
Engine oil
22
23
24
Molykote 111
30
27
32
26
25
37
38
Molykote 111
Engine oil
28
29
36
35
34
33
Engine oil
43
Molykote 111
38
42
Molykote 111
40
39
44
45
Molykote 111
41
R1004motr174S

GENERAL

Prior to changing the oil, ensure vehicle is on a level surface.

Oil and oil filter must be replaced at the same time. Oil change and oil filter replacement should be done with a warm engine.

⚠ WARNING

The engine oil can be very hot. Wait until engine oil is warm.

At installation, use torque values and service products from the exploded view. Clean threads before using Loctite products when installing screws.

Dispose oil and filter as per your local environmental regulations.

OIL LEVEL CHECK

Snowmobile must be on a level surface.

Warm up the engine to 80°C (176°F).

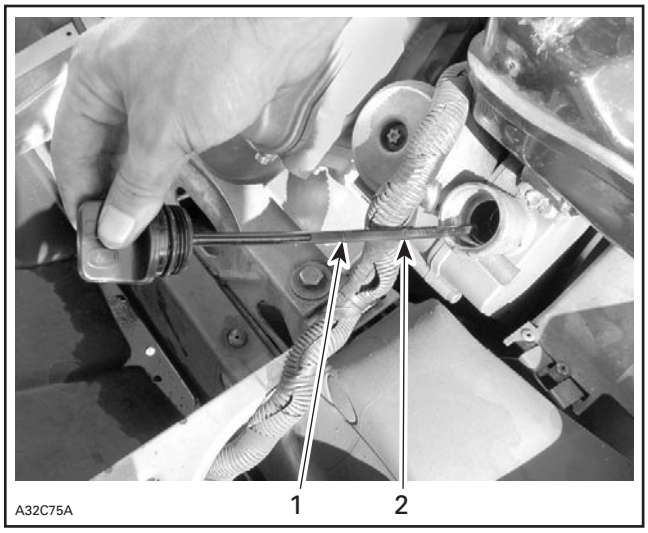
Leave engine running at idle for at least 30 seconds.

Stop engine and wipe the dipstick.

Dipstick must be completely screwed in before checking oil level.

Oil level must be between minimum and maximum marks on dipstick.

There is a capacity of 500 mL (17 U.S. oz) between the two marks.



1. Maximum
2. Minimum

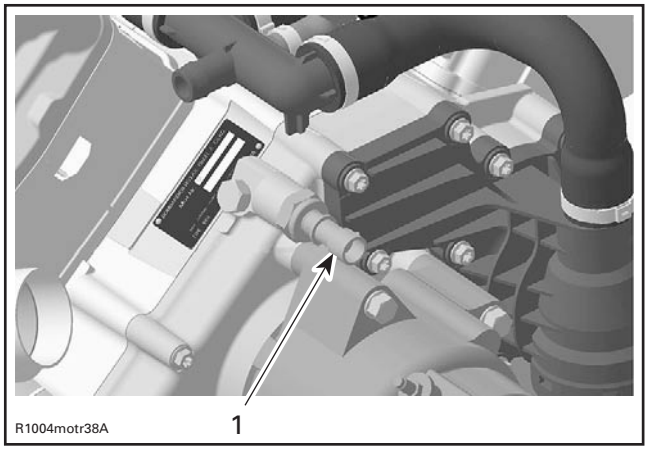
Add XP-S 0W40 synthetic 4-stroke oil (12 x 1L) (P/N 293 600 054)through dipstick hole as required.

Reinstall dipstick.

ENGINE OIL PRESSURE TEST

NOTE: The engine oil pressure test should be done with a **warm engine** 80°C (176°F) and the **recommended oil**.

Remove the oil pressure switch **no. 46** in the area of the cylinder head (intake side), mounted on the ignition cover and install the oil pressure gauge (P/N 529 035 709) and oil pressure adapter (P/N 529 035 652). Use fuel line remover (P/N 529 035 714) to unplug oil pressure adapter from oil pressure gauge.



1. Oil pressure switch

NOTE: Oil pressure switch works between 20 kPa (2.9 PSI) and 40 kPa (5.8 PSI).

The engine oil pressure should be within the following values.

OIL PRESSURE	1300 RPM	7250 RPM
MINIMAL	150 kPa (22 PSI)	400 kPa (58 PSI)
NOMINAL	200 kPa (29 PSI)	450 kPa (65 PSI)
MAXIMAL	250 kPa (36 PSI)	550 KPa (80 PSI)

If the engine oil pressure is out of specifications, check the points described in troubleshooting section.

To install oil pressure switch, reverse the removal procedure.

NOTE: Fit oil pressure switch with Loctite 243 (P/N 293 800 060).

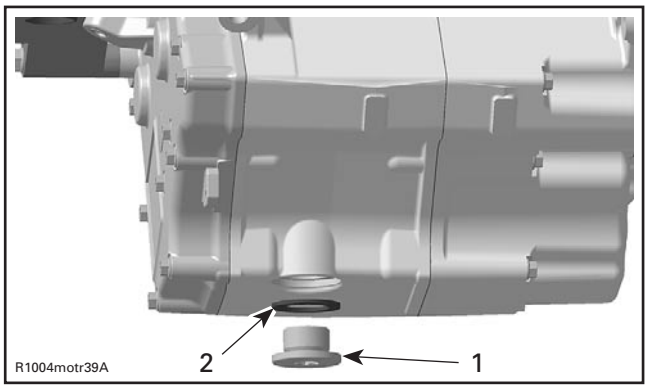
OIL CHANGE

Removal

Place a drain pan under the engine drain plug area.

Clean the drain plug area.

Unscrew drain plug **no. 45** then remove dipstick **no. 16**.



1. Drain plug
2. Gasket ring

– Unscrew retaining screw **no. 9** to drain the oil filter housing.
– Wait a while to allow oil to flow out of oil filter.

Inspection

Oil condition gives information about the engine condition. See TROUBLESHOOTING section.

Installation

The installation is the reverse of removal procedure. Pay attention to the following details.

NOTE: At installation, remember to replace the gasket ring **no. 44** of the drain plug.

Torque drain plug to 55 N•m (40 lbf•ft).

System Capacity

Refer to TECHNICAL DATA.

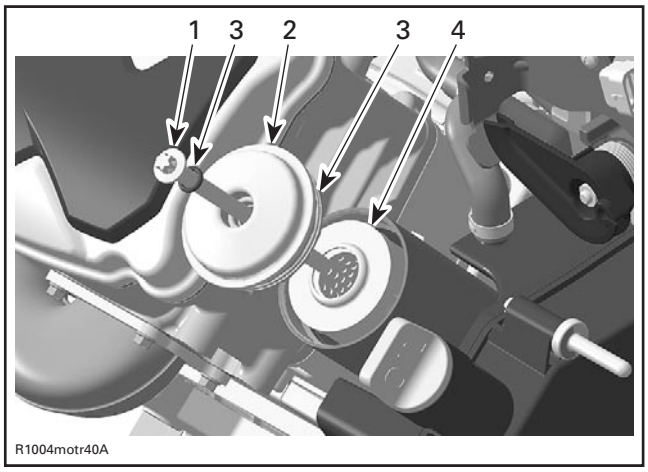
NOTE: After filling, warm up the engine to 80°C (176°F) and check the oil level with the dipstick. Refer to OIL LEVEL CHECK above.

OIL FILTER

Removal

Remove:

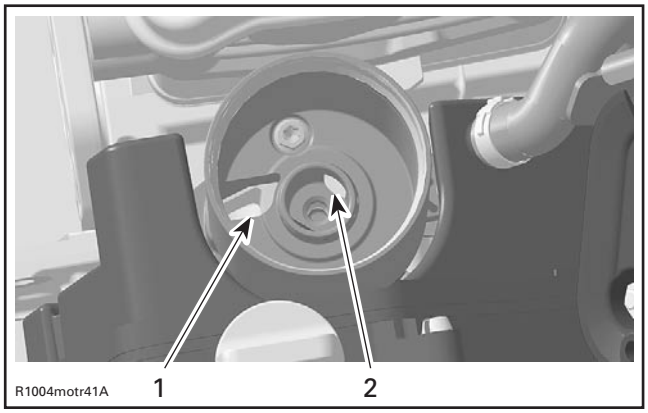
– engine oil (refer to OIL CHANGE)
– oil filter screw **no. 9**
– oil filter cover **no. 7**
– oil filter **no. 5**.



1. Oil filter screw
2. Oil filter cover
3. Gaskets
4. Oil filter

Inspection

Check and clean the oil filter inlet and outlet area for dirt and other contaminations.



1. Inlet bore from the oil pump to the oil filter
2. Outlet bore to the engine oil providing system

Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

NOTE: Slightly oil the two gaskets at the top and bottom sides of the oil filter before assembly. This will ease assembly and prevent displacement of the gasket during installation.

At assembly, remember to replace the two O-rings **no. 6** and **no. 8** of the oil filter screw.

Slightly grease the O-ring **no. 6** of the oil filter cover before assembly using Molykote 111 (P/N 413 707 000). This will ease assembly and prevent displacement of the gasket during installation.

Torque oil filter screw to 9 N•m (80 lbf•**in**).

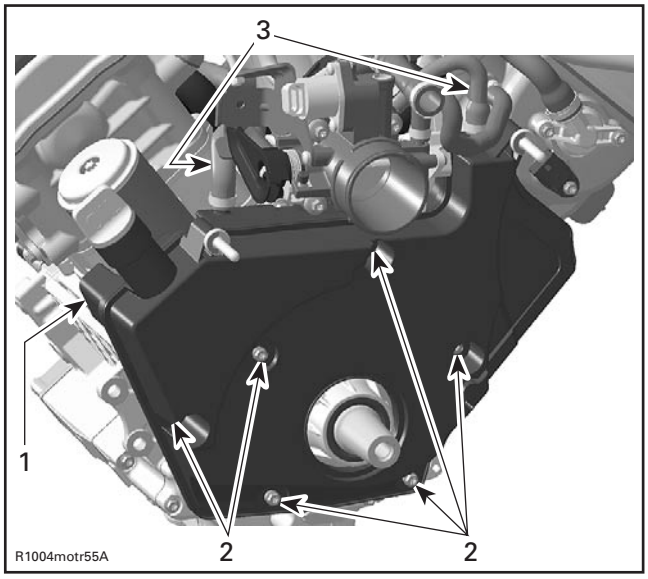
OIL TANK

Removal

First drain the lubrication system (refer to OIL CHANGE).

Remove:

– hose clamps **no. 17** and pull hoses
– oil tank screws **no. 13** and **no. 14** and pull oil tank **no. 10**.



1. Oil tank
2. Six screws
3. Hoses

CAUTION: Make sure that the O-rings no. 11 and no. 12 do not get stuck in the crankcase.

Inspection

Inspect the oil tank for cracks/fractures or other damage/leakage.

NOTE: If necessary, replace the oil tank.

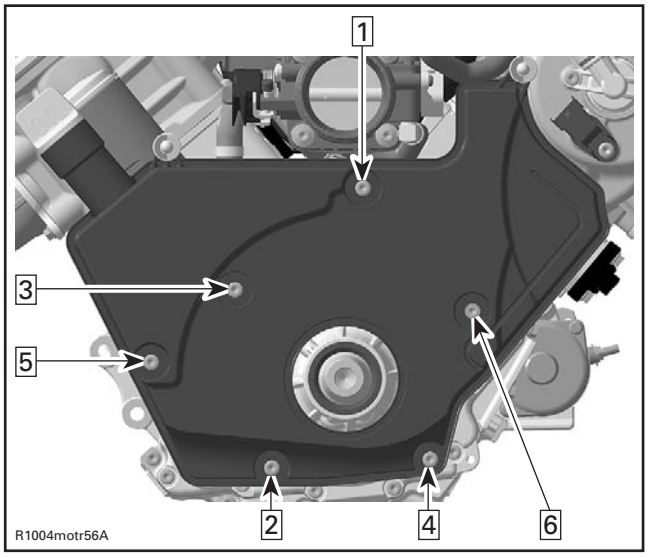
Installation

The installation is the opposite of the removal procedure. Pay attention to the following details.

NOTE: At assembly, replace both O-rings **no. 11** and **no. 12**.

Before assembly, slightly grease the O-rings. This will ease assembly and prevent displacement of the gasket during installation.

Torque oil tank screws to 9 N•m (80 lbf•**in**) as per following sequence.



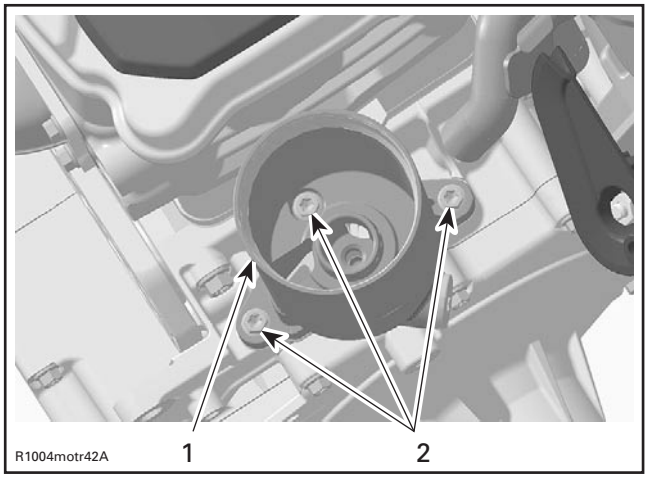
OIL FILTER HOUSING

Removal

First drain the lubrication system (refer to OIL CHANGE).

Remove:

– oil tank (refer to OIL TANK)
– oil filter (refer to OIL FILTER)
– oil filter housing screws **no. 3** and **no. 4** and pull oil filter housing **no. 2**.



1. Oil filter housing
2. Three screws

Inspection

Check the oil filter housing for cracks or other damage.

Replace oil filter housing if damaged.

Installation

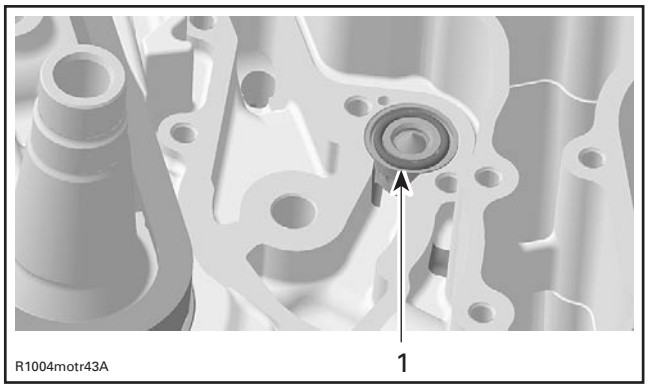
The installation is the opposite of the removal procedure. Pay attention to the following details.

NOTE: Always replace gasket **no. 1**.

Torque oil filter housing screws to 9 N•m (80 lbf•**in**).

ENGINE OIL PRESSURE REGULATOR

The oil pressure regulator is located on the engine alternator side (behind ignition cover/pressure oil pump cover).



1. Engine oil pressure regulator

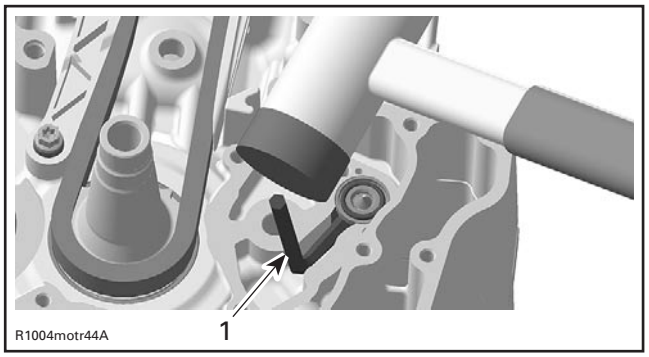
NOTE: The oil pressure regulator system works between 240 kPa (35 PSI) and 430 kPa (62 PSI).

Removal

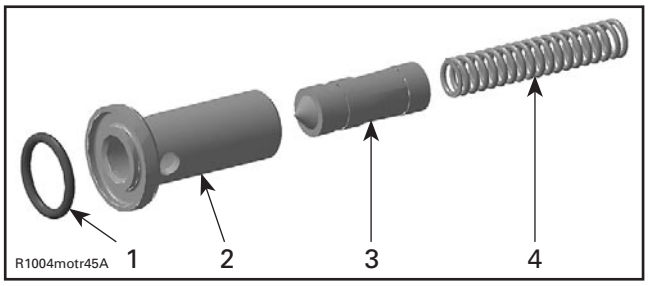
Remove:

– water pump housing (refer to COOLING SYSTEM)
– ignition cover (refer to COOLING SYSTEM)
– oil pump cover **no. 25** (refer to PRESSURE OIL PUMP)
– O-ring **no. 36**, valve seat **no. 35**, pressure regulating piston **no. 34** and spring **no. 33**.

Put a suitable Allen wrench or another 90° angle tool under the engine oil pressure regulator. By slight hammer blows against the Allen wrench carefully drive out the oil pressure regulator.



1. Allen wrench



1. O-ring
2. Valve seat
3. Pressure regulator piston
4. Spring

Inspection

Inspect pressure regulator piston and valve seat for scoring or other damages.

Check spring for free length.

SPRING FREE LENGTH	
NEW NOMINAL	46 mm (1.811 in)
SERVICE LIMIT	45 mm (1.771 in)

NOTE: Replace worn or damaged components. Pressure regulator piston and valve seat may only be replaced together.

Clean bore and threads in the oil pump housing from metal shavings and other contaminations.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Oil the pressure regulator piston before installation.

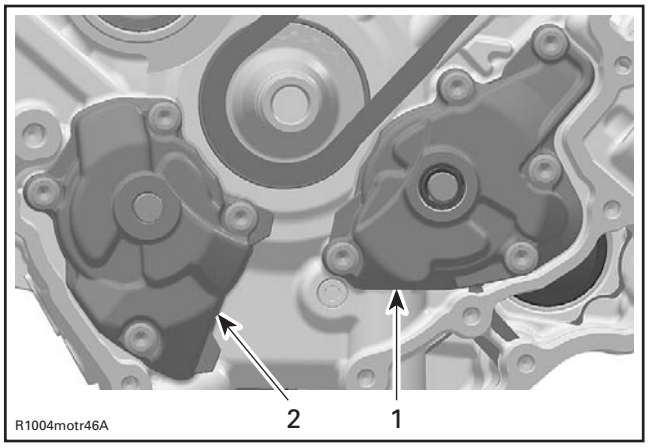
Fit the engine oil pressure regulator by pushing it carefully with an aluminum or brass rod. The engine oil pressure regulator must be flush with the crankcase. Following installation check the pressure regulator piston for easy movement.

NOTE: At installation always replace the O-ring **no. 36**, and fit it with grease.

OIL PUMPS

The oil pumps are located on the engine alternator side (behind ignition cover).

The engine is equipped with two oil pumps, a pressure oil pump and a suction oil pump.



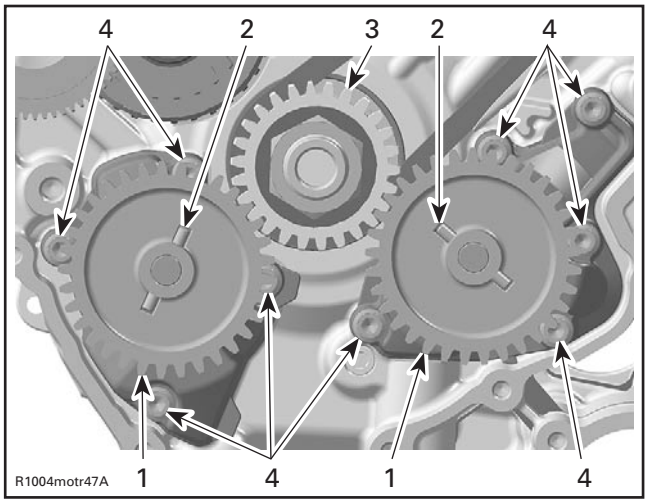
1. Pressure oil pump
2. Suction oil pump

PRESSURE OIL PUMP

Removal

Remove:

– water pump housing (refer to COOLING SYSTEM)
– ignition cover (refer to COOLING SYSTEM)
– oil pump gear **no. 31**
– needle pin **no. 30**
– drive gear of crankshaft (refer to CRANKSHAFT)
– oil pump cover screws **no. 32** and pull oil pump cover **no. 25**
– oil pump shaft with inner rotor **no. 27** and outer rotor **no. 28**
– intermediate plate **no. 29**.

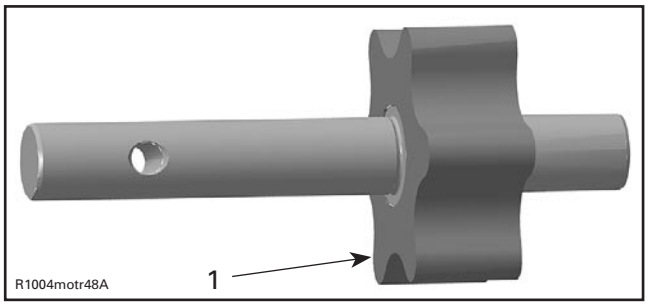


1. *Oil pump gear*
2. *Needle pin*
3. *Drive gear of crankshaft*
4. *Oil pump cover screws*

Inspection

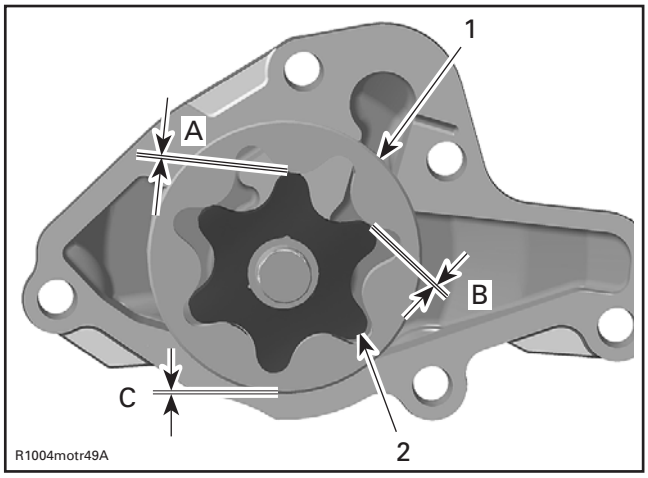
Inspect oil pump shaft assembly and the oil pump cover for marks or other damages.

Check inner rotor for corrosion pin-holes or other damages. If so, replace oil pump shaft assembly. Also check the oil pump cover. If damaged, replace the complete oil pump assembly.



1. *Pittings on the teeth*

Using a feeler gauge, measure the clearance between inner and outer rotors.



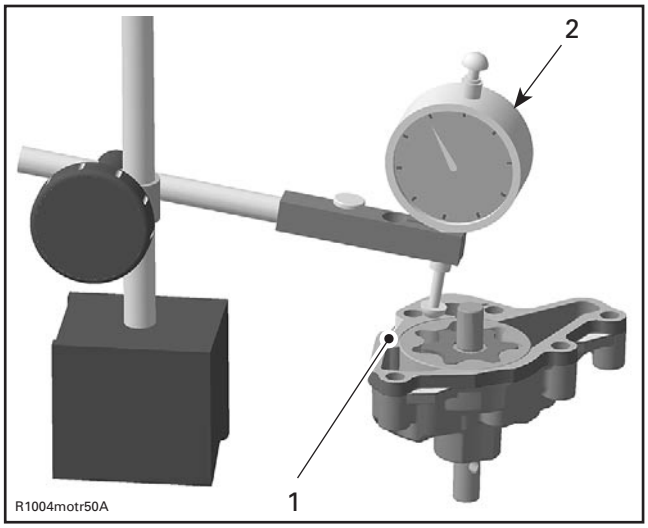
1. *Outer rotor*
2. *Inner rotor*

OUTER AND INNER ROTORS CLEARANCE MM (IN)	
SERVICE LIMIT	
A	0.25 mm (.009 in)
B	
C	

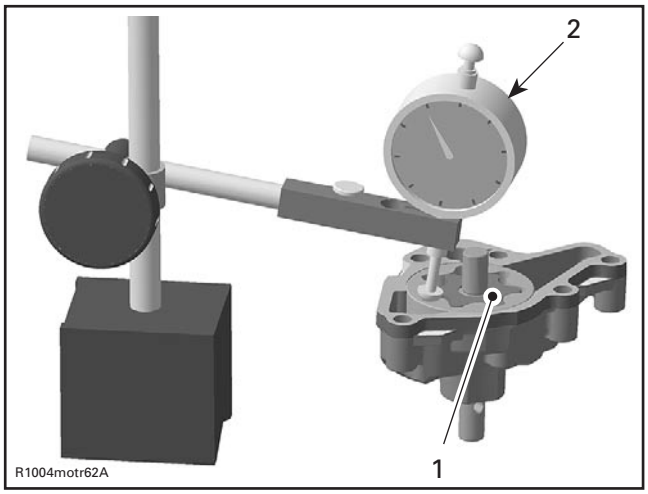
If clearance between inner and outer rotors exceeds the tolerance, replace oil pump shaft assembly. Ensure to also check oil pump cover. If damaged, replace the complete oil pump assembly.

If clearance between outer rotor and its bore in oil pump exceeds the tolerance, replace the complete oil pump assembly.

Using a dial indicator (P/N 414 104 700), measure side wear as shown.



1. Oil pump cover surface
2. Dial indicator



1. Oil pump outer rotor surface
2. Dial indicator

Difference between oil pump cover and outer rotor should not exceed 0.1 mm (.004 in). If so, replace the complete oil pump assembly.

NOTE: When the axial clearance of the oil pump shaft assembly increases, the oil pressure decreases.

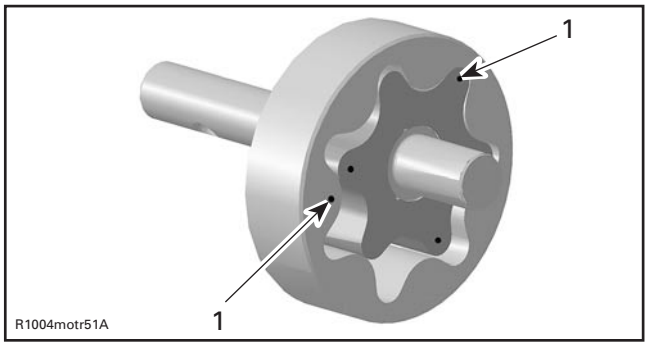
Check the inside of oil pump cover for scoring or other damages. If so, change the complete oil pump assembly.

Installation

For installation, reverse the removal procedure.

Pay attention to the following details.

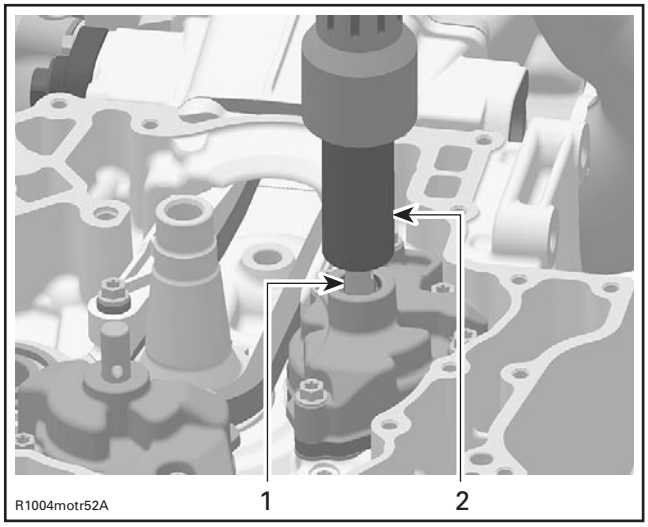
CAUTION: The outer rotor no. 28 and the oil pump shaft with inner rotor no. 27 are marked on the upper side. When installing, make sure that the position of the outer rotor is not reversed.



1. Marking

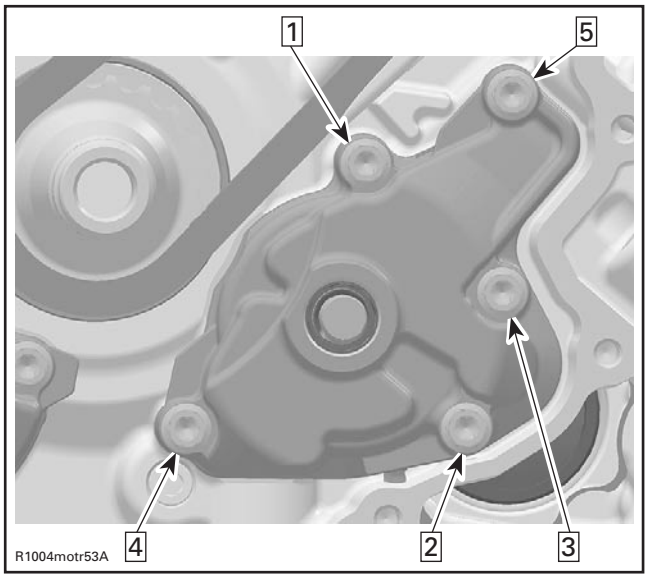
NOTE: At installation always replace the oil seal **no. 26** fitted in the oil pump cover.

Push oil seal in place by using the oil seal pusher (P/N 529 035 911).



1. Oil seal
2. Oil seal pusher (P/N 529 035 911)

Torque oil pump housing screws to 9 N•m (80 lbf•**in**) as per following sequence.



Final Test

After engine is completely reassembled, start engine and make sure oil pressure is within specifications.

SUCTION OIL PUMP

Removal

For information about disassembly of the suction oil pump please refer to PRESSURE OIL PUMP. Disassembly is the same for both pumps.

Inspection

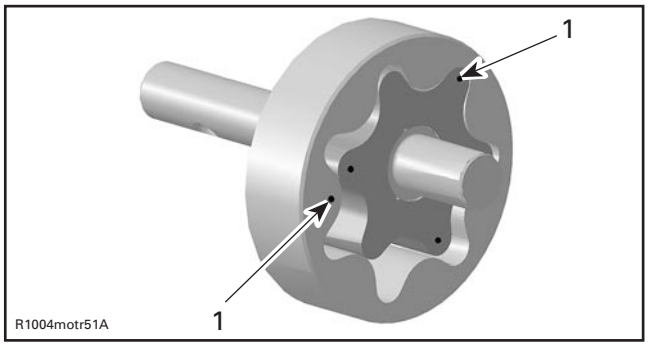
For information about inspection of the suction oil pump please refer to PRESSURE OIL PUMP. Inspection is the same for both pumps.

Installation

For installation, reverse the removal procedure.

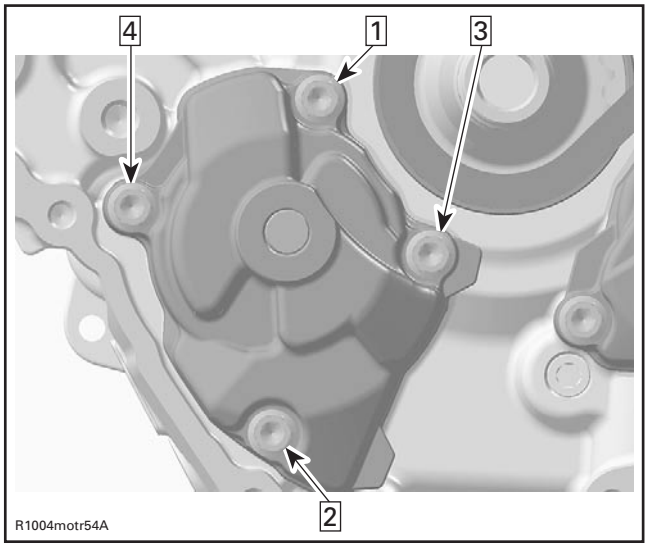
Pay attention to the following details.

CAUTION: The outer rotor no. 23 and the oil pump shaft with inner rotor no. 22 are marked on the upper side. When installing, make sure that the position of the outer rotor is not reversed.



1. Marking

Torque oil pump housing screws to 9 N•m (80 lbf•**in**) as per following sequence.

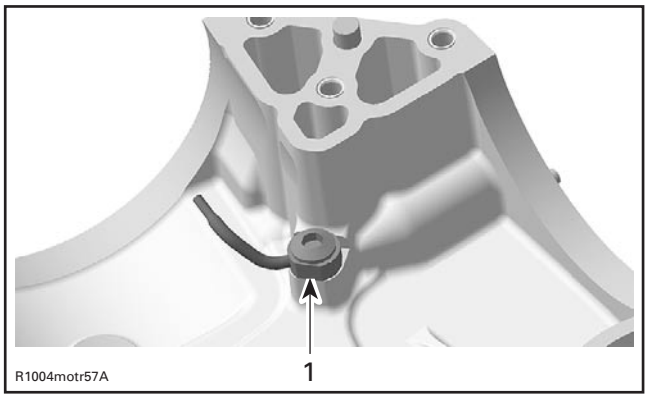


Final Test

After engine is completely reassembled, start engine and make sure oil pressure is within specifications.

OIL NOZZLE

The oil nozzles **no. 38** are located within the crankcase. Each piston is equipped with a separate oil nozzle.



1. Oil nozzle

NOTE: If the engine has to be disassembled within the scope of repair work, take this opportunity to clean the oil nozzles.

Cleaning and Inspection

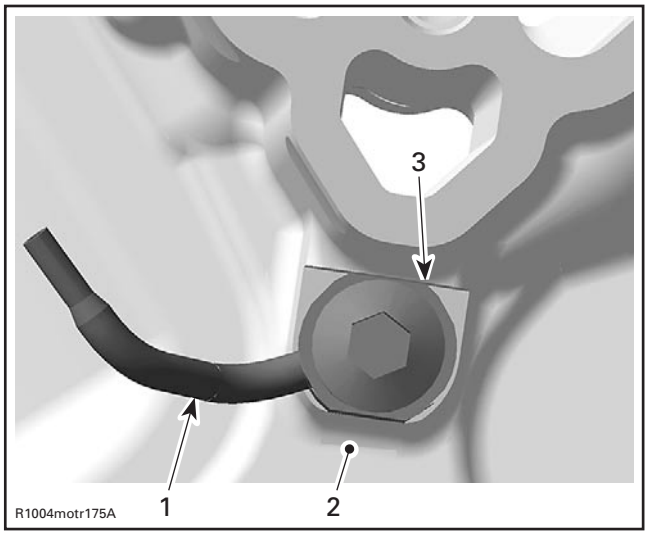
Clean oil nozzle with a part cleaner then use an air gun to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

Installation

CAUTION: At assembly, make sure the contact surfaces of the oil nozzle are well fitted onto the crankcase. If this is not ensured, the spray direction will change, causing potential damage to the engine.



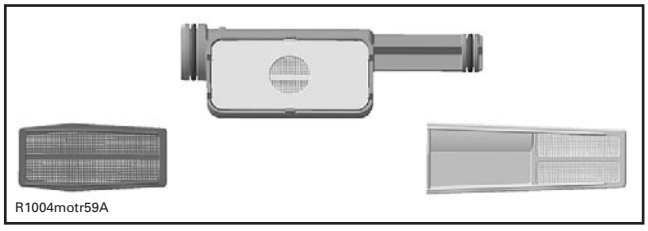
1. Oil nozzle
2. Crankcase
3. Contact surface

NOTE: If the oil nozzles are damaged or bent during installation work in the crankcase, they must be replaced immediately.

Torque oil nozzle screws to 19 N•m (168 lbf•**in**).

OIL SIEVES

The engine is equipped with 3 oil sieves **no. 37**, **no. 39** and **no. 42** for filtering dirt and abraded particles from the oil circuit. The sieves are fitted into the crankcase.



3 OIL SIEVES

NOTE: Cleaning of the oil sieves is only possible if the engine is disassembled. So, if the engine has to be disassembled within the scope of repair work, clean the sieves at the same time.

Cleaning and Inspection

Clean oil sieves with a part cleaner then use an air gun to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

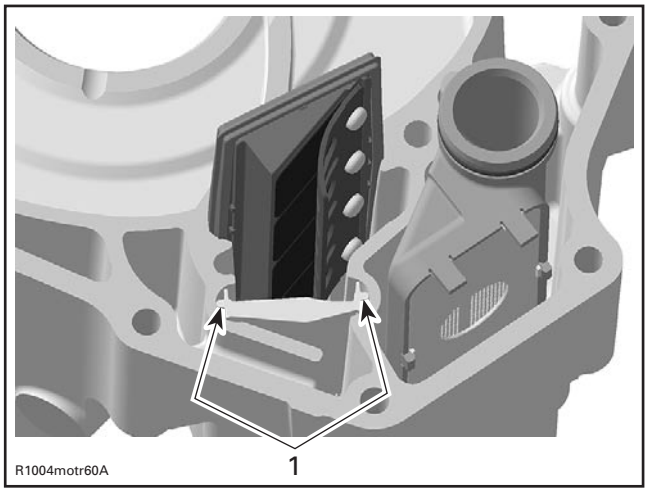
Check sieves for cracks or other damage.

NOTE: Replace sieves if damaged.

Installation

NOTE: During assembly always replace both O-rings no. 40 and no. 41.

CAUTION: Take particular care with oil sieve no. 42 to ensure that it is re-installed in exactly the same position.

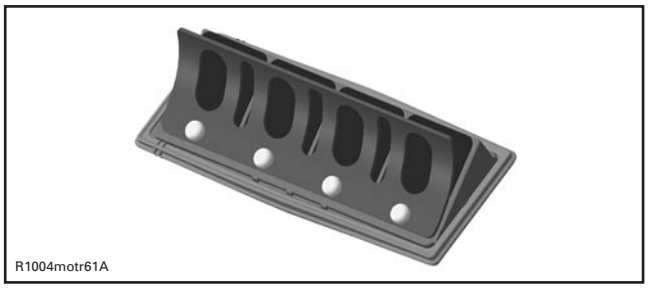


1. Correct installation position of oil sieve

NOTE: Before assembly, slightly oil the O-rings and the sieves at the outside using Molykote 111 (P/N 413 707 000). This will ease assembly and prevent displacement of the gasket during installation.

REED VALVE

The engine is equipped with a reed valve no. 43 which prevents accumulation of larger oil quantities in the crankcase. The reed valve is fitted into the crankcase.



REED VALVE

NOTE: If the engine has to be disassembled within the scope of repair work, take this opportunity to clean the reed valve, using a rag.

Inspection

Check reed valve for cracks or other damage.

NOTE: Replace reed valve if damaged.

Installation

At installation, replace the rubber gasket of the reed valve.

NOTE: Slightly grease the rubber gasket with Molykote 111 (P/N 413 707 000). This will ease assembly and prevent displacement of the gasket during installation.

CYLINDER AND CYLINDER HEAD

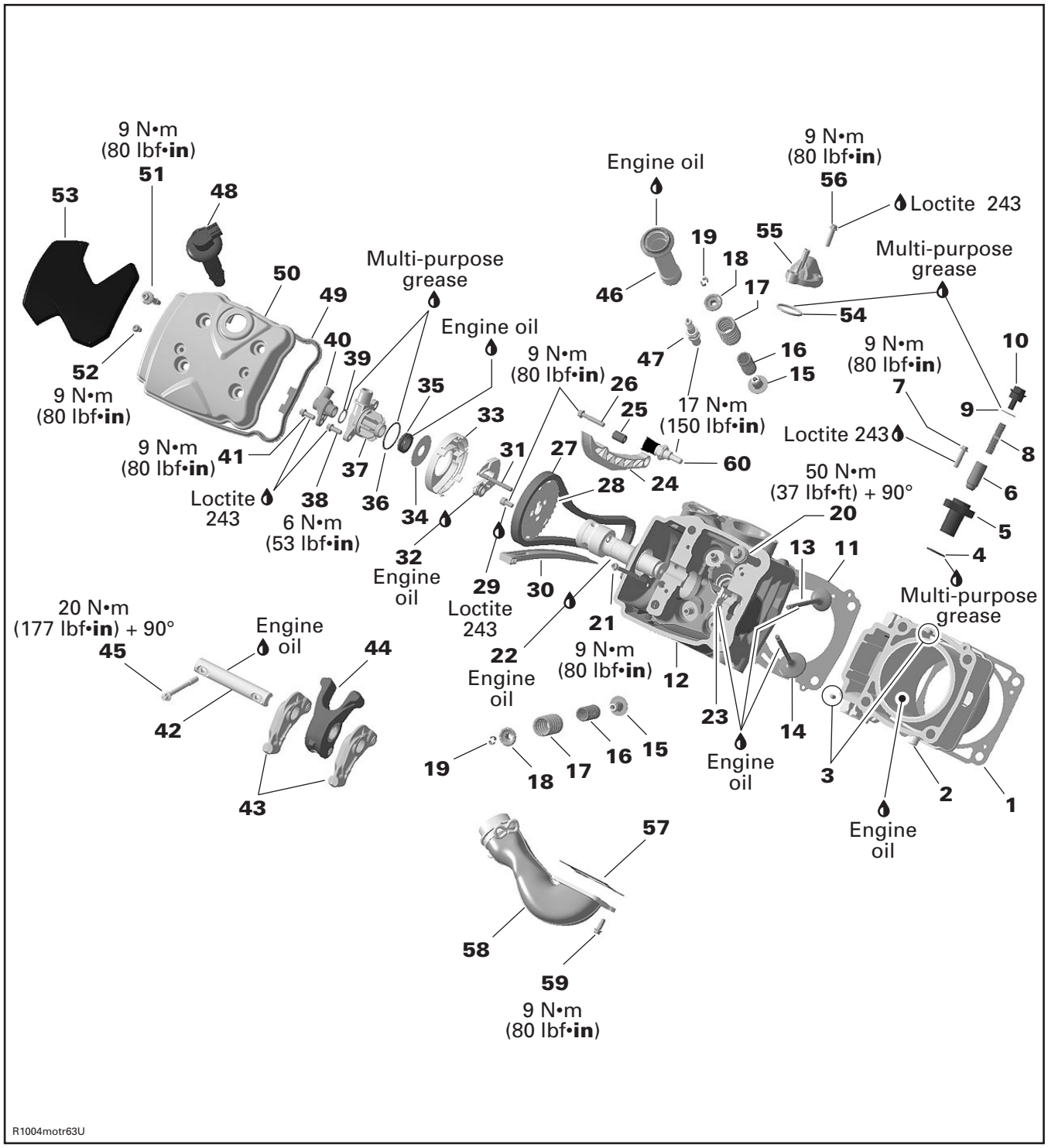
SERVICE TOOLS

Description	Part Number	Page
camshaft locking tool	529 035 839	220
crankshaft locking tool	529 035 900	213–214, 219–220, 222, 227–228
valve spring compressor clamp	529 035 764	223
valve spring compressor cup	529 035 724	223
valve stem seal installer	529 035 687	227

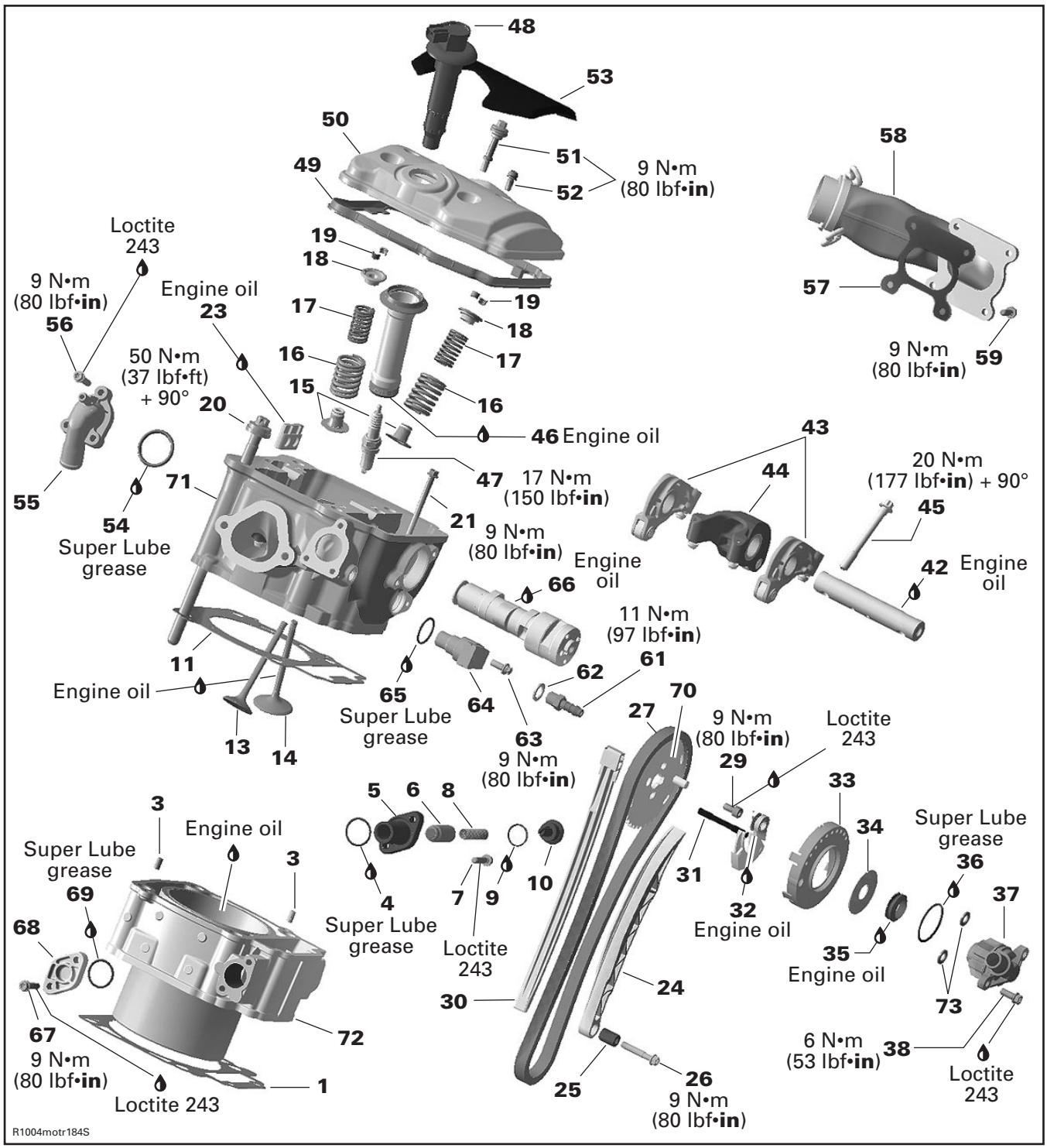
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	217, 220

CYLINDER/CYLINDER HEAD 1 (FRONT-SIDE)



CYLINDER/CYLINDER HEAD 2 (REAR-SIDE)



GENERAL

NOTE: Components which are identical for both cylinders/cylinder heads are identified in the two exploded views by the same number. Components which are different or which are, for instance, present on one of the cylinders/cylinder heads but not on the other, have different numbers. The information given below always relates to both cylinders/cylinder heads as a general rule.

Special reference is made in the text to work instructions which are not the same for cylinder 1 and cylinder 2.

NOTE: For cylinder head, cylinder and piston removal, it is not necessary to remove engine from vehicle.

NOTE: When diagnosing an engine problem, always perform a cylinder leak test. This will help pin-point the problem. Refer to the instructions included with your leak tester and LEAK TEST section for procedures.

Always place the vehicle on a level surface.

NOTE: For a better understanding, the following illustrations are taken with engine out of vehicle. However, it is not necessary to remove engine from vehicle to perform the following instructions.

Always disconnect the negative wire from the battery before working the engine.

Even though many parts do not need to be removed to reach other parts, it is recommended to remove these parts anyway in order to check them.

For installation, use the torque values and service products from exploded views. Clean threads before using Loctite product when installing screws.

When disassembling parts that are duplicated in the engine, (e.g.: valves), it is strongly recommended to note their position (PTO, alternator side) and to keep them as a "group". If you find a defective component, it will be much easier to find the cause of the failure among its group of parts (e.g.: you found a worn valve guide. A bent spring could be the cause. It will be easy to know which one among the springs is defective if you grouped them at disassembly). Besides, since used parts have matched together during the engine operation, they will keep their matched fit when you reassemble them together within their "group".

SPARK PLUG

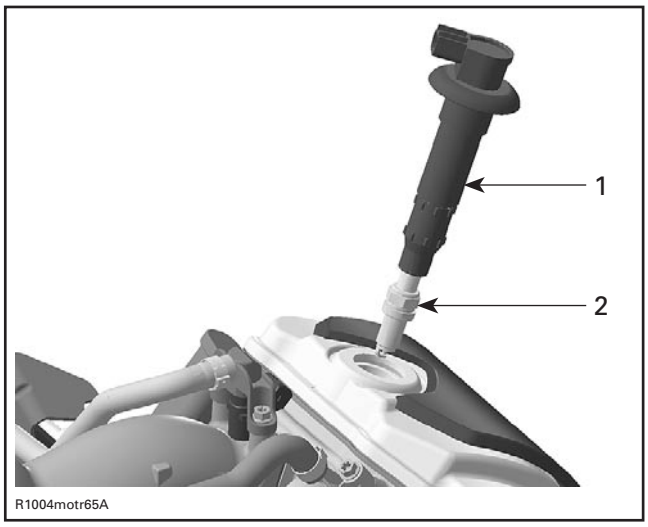
Removal

Unplug the stick coil connector.

Remove the stick coil **no. 48**.

Clean spark plug and stick coil area before disassembly.

Unscrew spark plug **no. 47** then use the stick coil to take spark plug out of spark plug hole.



1. Stick coil
2. Spark plug

Inspection

Check spark plug and stick coil condition (refer to COMPONENT INSPECTION AND ADJUSTMENT).

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Check spark plug gap (refer to TECHNICAL DATA).

Slightly oil the bottom outer part of the stick coil. This will ease installation.

Place spark plug into stick coil, screw spark plug then remove the stick coil. Torque spark plug to 17 N•m (150 lbf•**in**). Reinstall the stick coil.

TEMPERATURE SENSOR

Temperature sensor **no. 60** is located in the cylinder head 1 (front-side).

Inspection

Check the temperature sensor for damage or leakage. For electrical inspection refer to COMPONENT INSPECTION AND ADJUSTMENT.

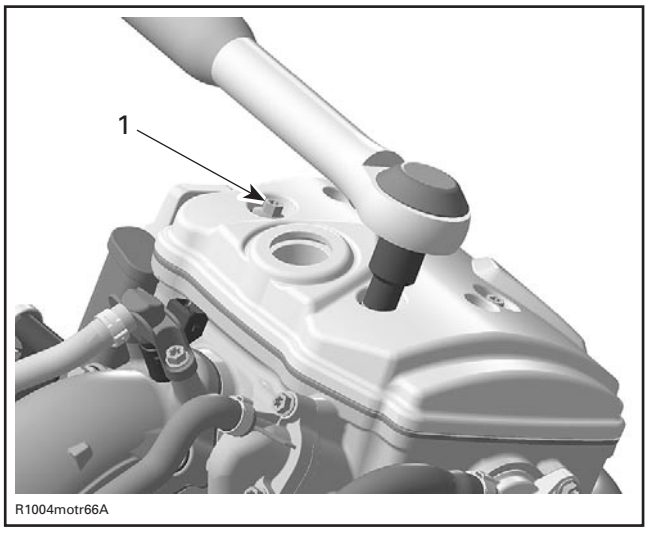
Torque temperature sensor to 17 N•m (150 lbf•**in**).

VALVE COVER

Removal

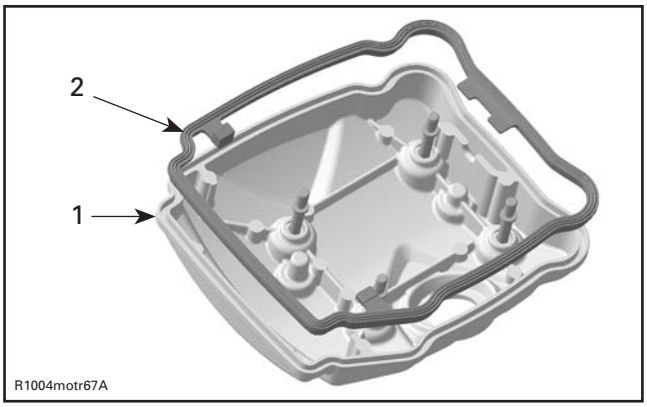
Remove:

– valve cover shield **no. 53**
– valve cover screws **no. 51**



1. Valve cover screws

– valve cover **no. 50** and profile sealing ring **no. 49**.



1. Valve cover
2. Profile sealing ring

Inspection

Check the profile sealing ring on the valve cover and the rubber bushing on the valve cover screws if they are brittle, cracked or hard. If so, replace the profile sealing ring or the valve cover screw accordingly.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: At installation, replace the profile sealing ring **no. 49**.

NOTE: Install the valve cover screws in a criss-cross sequence.

Torque valve cover screws to 9 N•m (80 lbf•**in**).

ROCKER ARM

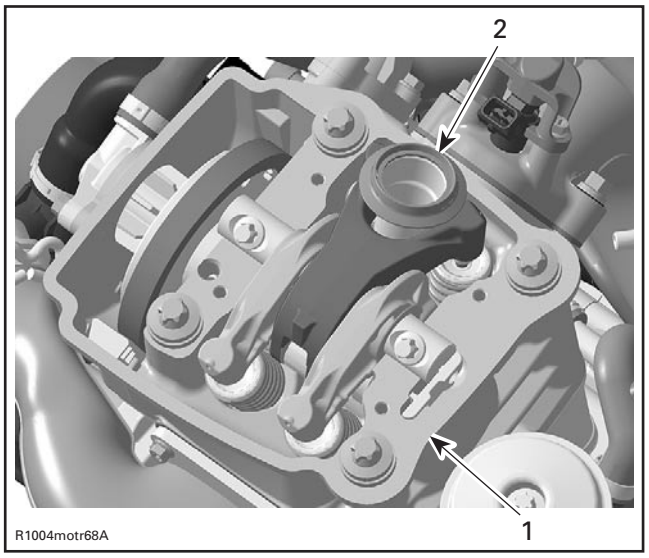
When disassembling the rocker arms, the specified sequence must be followed. Start with cylinder 1, continue with cylinder 2.

Removal Cylinder 1 (front-side)

Lock crankshaft with crankshaft locking tool (P/N 529 035 900), refer to CRANKSHAFT/DRIVE GEARS.

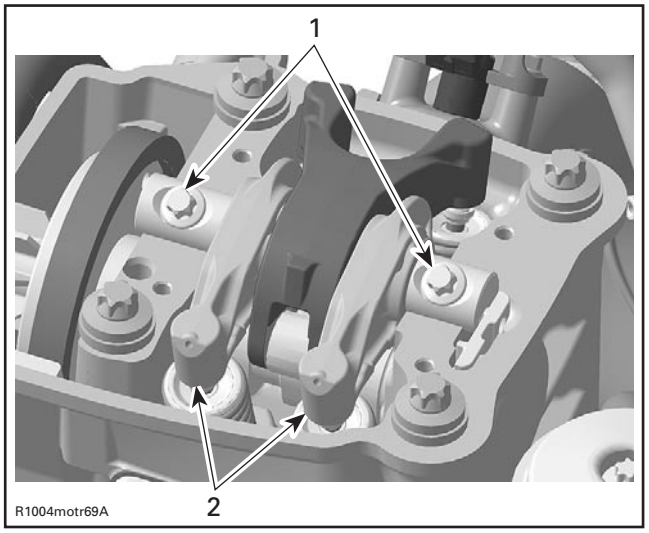
Remove:

– spark plug (refer to SPARK PLUG)
– valve cover (refer to VALVE COVER)
– spark plug tube **no. 46**



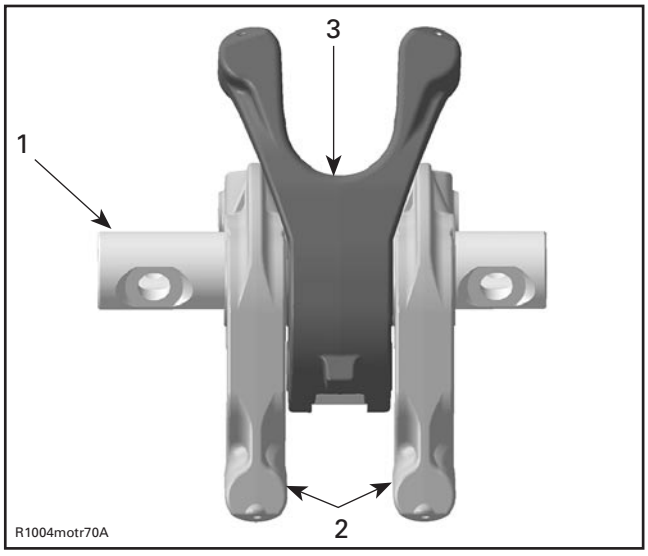
1. Cylinder head
2. Spark plug tube

– rocker arm shaft screws **no. 45** (discard screws)

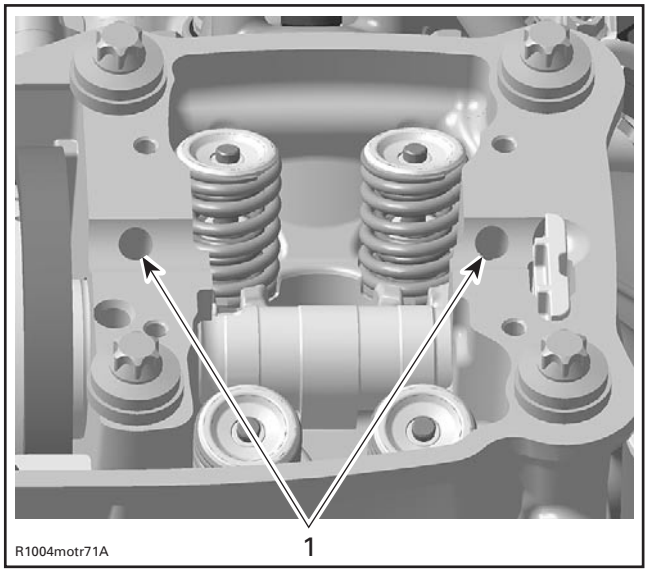


1. Rocker arm shaft screws
2. Rocker arms

– rocker arm shaft **no. 42** with rocker arm assembly (exhaust side **no. 43** and intake side **no. 44**)



1. Rocker arm shaft
2. Rocker arms (exhaust side)
3. Rocker arm (intake side)



1. Oil supply from the camshaft to the rocker arm shaft, then to the rocker arms and finally to the valve adjustment

Removal Cylinder 2 (rear-side)

Remove:

– spark plug (refer to SPARK PLUG)
– valve cover (refer to VALVE COVER)
– spark plug tube **no. 46**

Remove the crankshaft locking tool (P/N 529 035 900).

Crank the engine further until the second cylinder is positioned at ignition TDC.

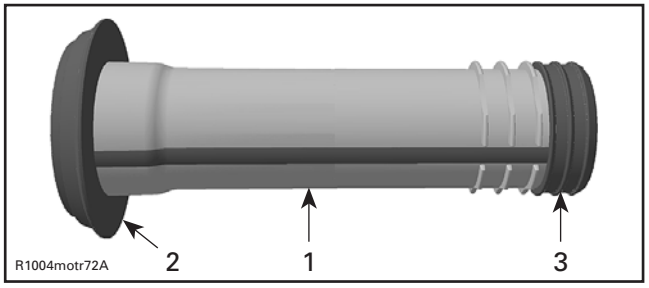
– rocker arm shaft screws **no. 45** (discard screws)

– rocker arm shaft **no. 42** with rocker arm assembly (exhaust side **no. 43** and intake side **no. 44**).

Inspection

Spark Plug Tube

Check seals on spark plug tube. If seals are brittle, cracked or hard, replace spark plug tube.

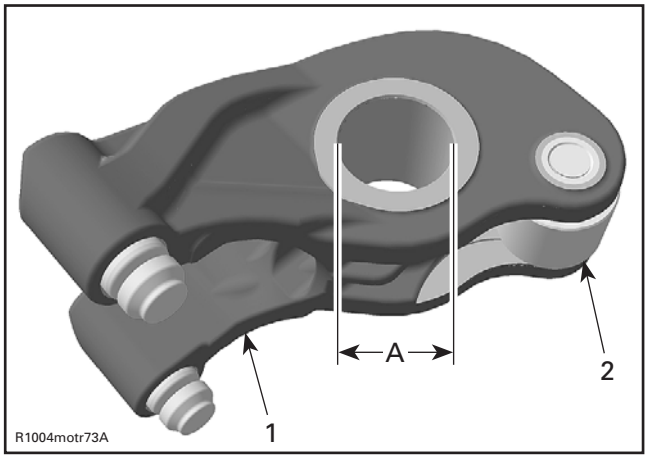


1. *Spark plug tube*
2. *Seal to the valve cover*
3. *Seal to the cylinder head*

Rocker Arm

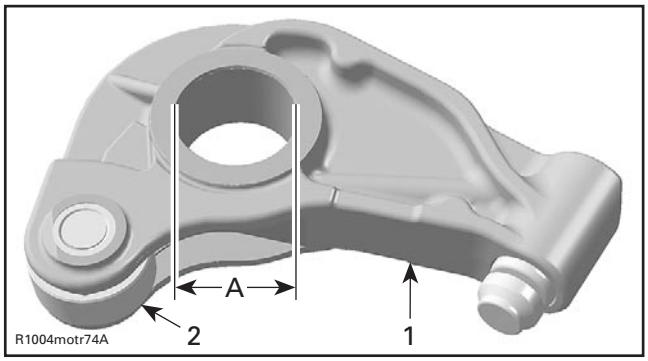
Inspect each rocker arm for cracks and scored friction surfaces. If so, replace rocker arm assembly.

Check the rocker arm rollers for free movement, wear and excessive radial play. Replace rocker arm assembly if necessary.



1. *Rocker arm (intake side)*
2. *Roller*

A. Bore for rocker arm shaft



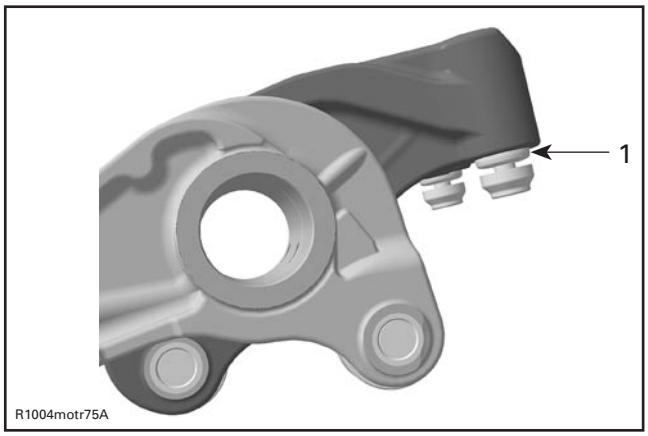
1. *Rocker arm (exhaust side)*
2. *Roller*

A. Bore for rocker arm shaft

Measure rocker arm bore diameter. If diameter is out of specification, change the rocker arm assembly.

ROCKER ARM BORE DIAMETER	
MINIMUM (NEW)	20.007 mm (.7877 in)
MAXIMUM (NEW)	20.020 mm (.7881 in)
SERVICE LIMIT	20.035 mm (.7887 in)

Press the hydraulic lifter with your thumb. If the hydraulic lifter groove disappears inside rocker arm casting, replace rocker arm assembly. Lifter must turn freely in rocker arm bore. Otherwise, replace.



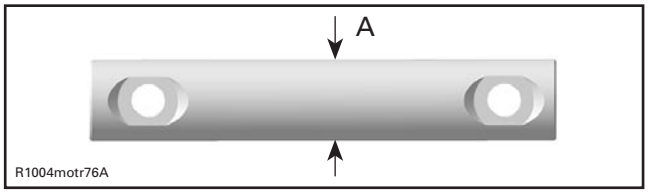
1. *Hydraulic lifter groove*

Rocker Arm Shaft

Check for scored friction surfaces, if so, replace parts.

Measure rocker arm shaft diameter.

ROCKER ARM SHAFT DIAMETER	
MINIMUM (NEW)	19.980 mm (.7866 in)
MAXIMUM (NEW)	19.993 mm (.7871 in)
SERVICE LIMIT	19.965 mm (.7860 in)



A. Measure rocker arm shaft diameter here

Replace any part that shows excessive wear.

Installation

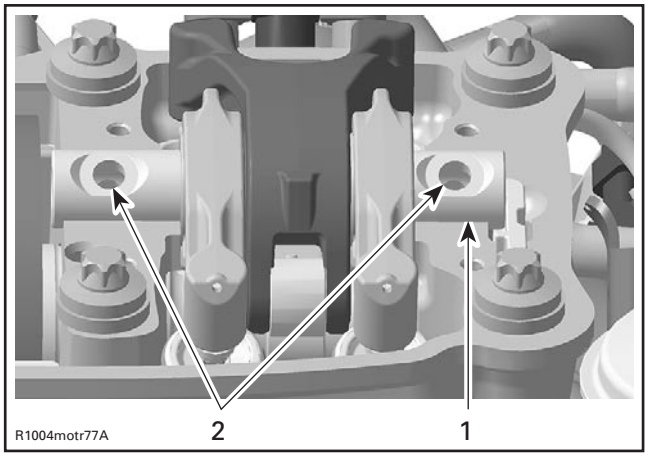
For installation, reverse the removal procedure. Pay attention to the following details.

CAUTION: Make sure to observe the correct matching of rocker arm shaft and rocker arm. When installing the components, make sure they are fitted exactly in their original position on their respective cylinder head. Any inversion of the components may cause damage to the engine.

NOTE: At assembly, position the cylinder to ignition TDC. This will ensure stress-free installation of the rocker arm shaft.

Apply engine oil on rocker arm shaft.

Position the rocker arm shaft with the notches on top.

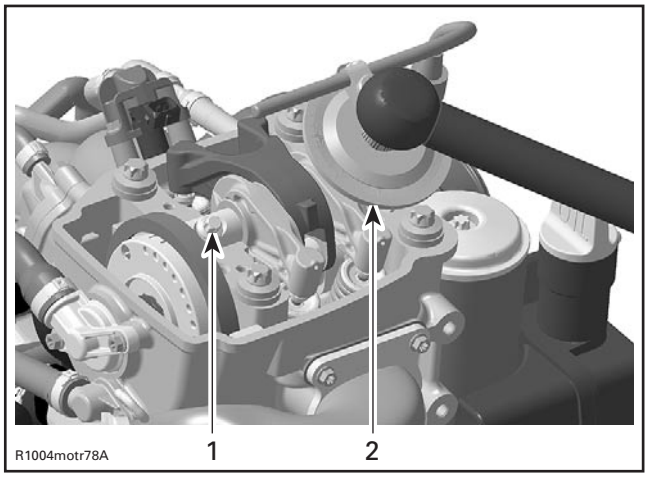


1. Rocker arm shaft
2. Rocker arm shaft notches

Install **NEW** rocker arm shaft screws **no. 45**. Torque as per following procedure:

CAUTION: For this assembly, stretch screws are used. As the screws have been stretched from the previous installation, it is very important to **use new screws at assembly**. Failure to replace screws and to strictly follow the torque procedure may cause screws to loosen and lead to engine damage.

– Torque rocker arm shaft screws to 10 N•m (88 lbf•**in**).
– Torque rocker arm shaft screws to 20 N•m (177 lbf•**in**).
– Finish tightening screws turning an additional **90° rotation** with a torque angle gauge.



1. Rocker arm shaft screw
2. Torque angle gauge

CHAIN TENSIONER

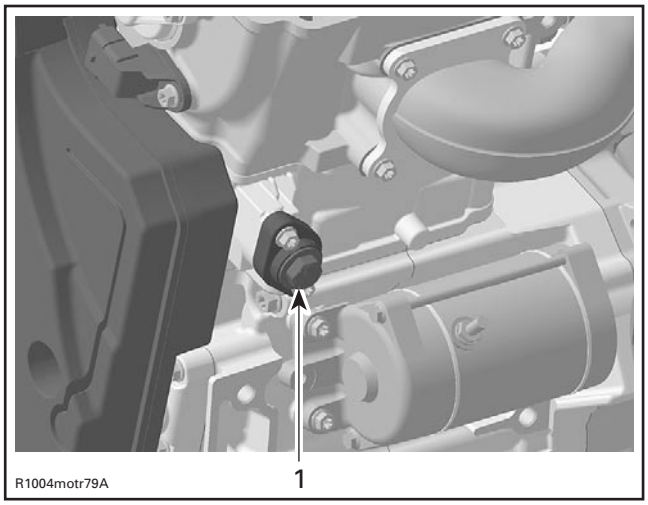
Removal

⚠ WARNING

Chain tensioner is spring loaded. Take that into account when removing chain tensioner plug.

Remove:

– air silencer, guard and driven pulley to gain access to cylinder 2 chain tensioner
– chain tensioner plug **no. 10**

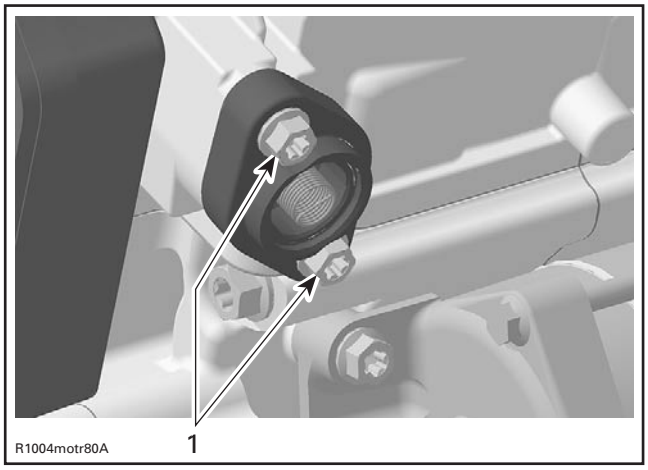


1. Chain tensioner plug

⚠ WARNING

Never perform this operation immediately after the engine has been run because the exhaust system can be very hot. Wait until exhaust system is warm or cold.

– spring **no. 8**
– screws **no. 7**

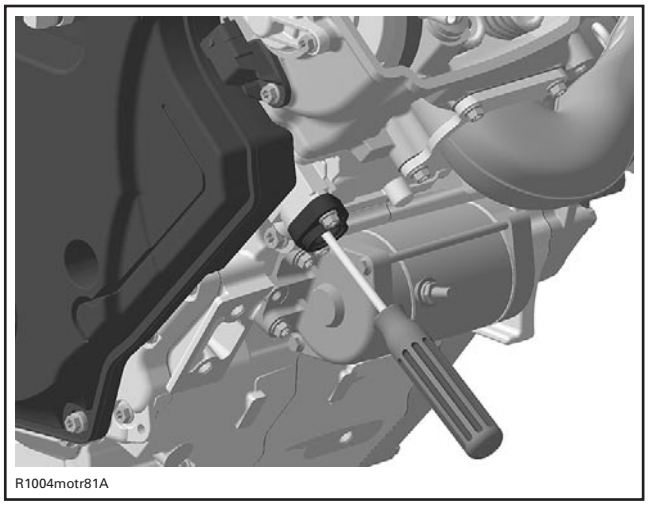


1. Chain tensioner screws

– chain tensioner housing **no. 5**.

Inspection

Using a flat screwdriver, unscrew chain tensioner plunger **no. 6**. Check chain tensioner plunger for free movement in the threads of chain tensioner housing.



Check chain tension guides **no. 24** for wear. Replace as necessary.

Check spring condition. Replace if broken or worn.

Installation

NOTE: At installation, replace the O-rings **no. 4** and **no. 9**. Slightly grease the O-rings before assembly using super lube grease.

For installation, reverse the removal procedure. Pay attention to the following details.

Torque chain tensioner housing screws to 9 N•m (80 lbf•**in**). Apply Loctite 243 (P/N 293 800 060) on threads.

NOTE: Slightly screw the plunger until it touches the chain tension guide. Use only two fingers to hold the screwdriver, in order to recognize the gentle contact with the chain tension guide.

CAUTION: Improper adjustment of the chain tension will lead to severe engine damage.

Install a spring end in plunger groove and the other in the plug screw groove.

Screw in plug screw **no. 10** by hand. There must be no distortion of the spring during installation.

Torque plug screw to 5 N•m (44 lbf•**in**).

BREATHER

Removal

Remove:

– exhaust pipe and muffler

– air silencer then move vehicle harness away from engine
– remove breather hose then unscrew breather screws **no. 38**
– pull out the breather **no. 37** and gasket rings **no. 70**.

NOTE: Pull out the breather with utmost care. Thrust washer **no. 34** may get caught on the breather and drop into the crankcase.

Inspection

Inspect the breather for cracks/fractures or other damage/leakage.

If necessary, replace the breather.

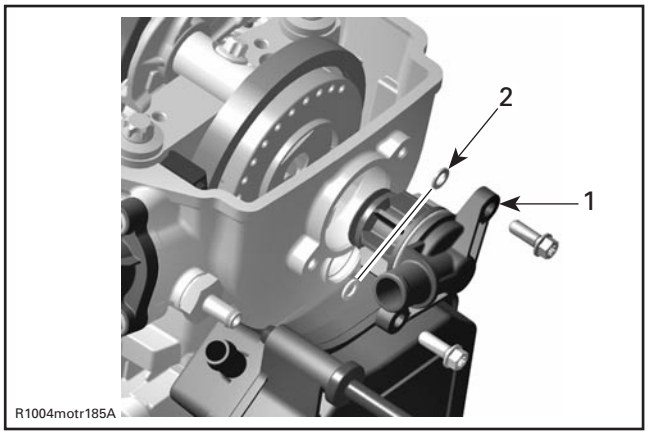
Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: At installation, replace the O-ring **no. 36**, and fit it with grease.

Take care during installation that the flat surface of thrust washer precisely fits in the cover **no. 33.**

NOTE: Make sure to reinstall the two gasket rings **no. 70** between breather and cylinder head surface.



1. Breather
2. Gasket rings

Torque breather screws to 6 N•m (53 lbf•**in**).

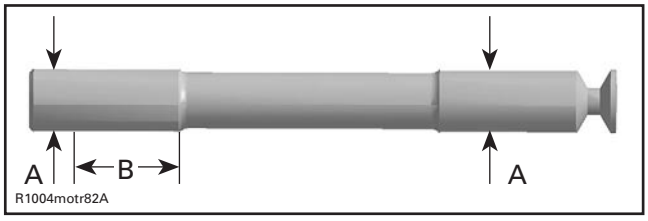
DECOMPRESSOR

Removal

Remove:
– breather (refer to BREATHER)
– valve cover (refer to VALVE COVER)
– thrust washer **no. 34**
– cover **no. 33**
– centrifugal weight **no. 32**
– decompressor shaft **no. 31**.

Inspection

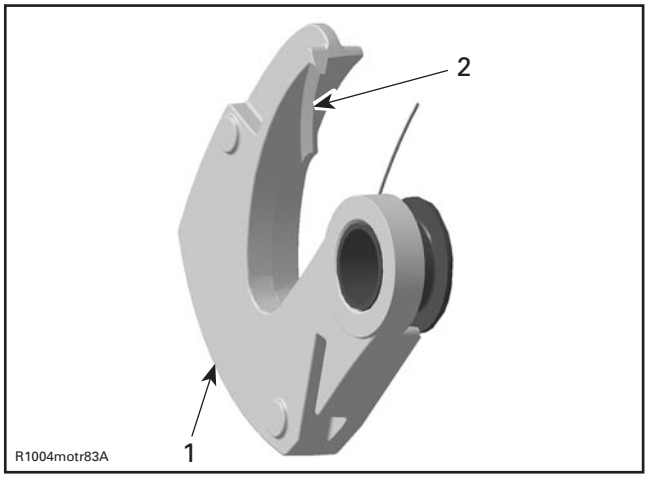
Check decompressor shaft for service limit, replace if it out of specifications.



DECOMPRESSOR SHAFT
A. Measure here
B. Measurement area

DECOMPRESSOR SHAFT MEASUREMENT A	
MINIMUM (NEW)	5.978 mm (.235 in)
MAXIMUM (NEW)	5.990 mm (.236 in)
SERVICE LIMIT	5.850 mm (.230 in)

Check torsion spring and edge of the centrifugal weight for visible wear. If so, replace them together.

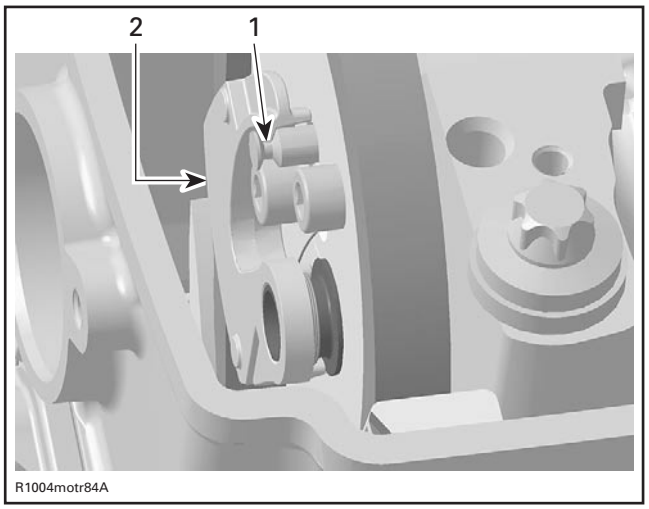


1. Centrifugal weight with torsion spring
2. Edge of centrifugal weight

Installation

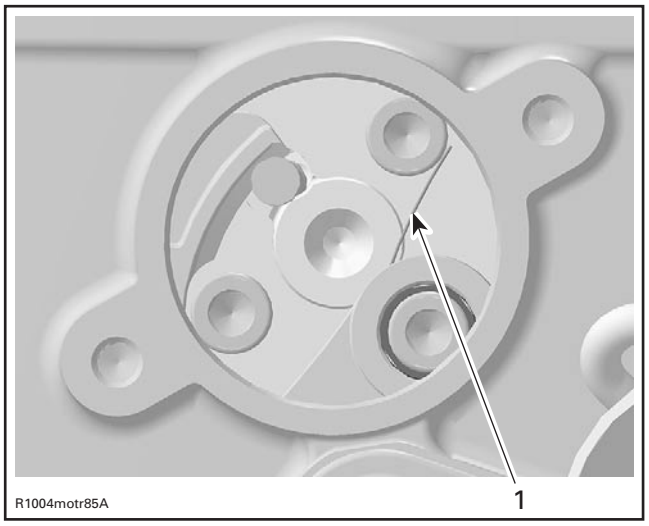
The installation is essentially the reverse of the removal procedure but, pay attention to the following details.

NOTE: Engage the edge of centrifugal weight into the decompressor shaft groove then put the parts in place.



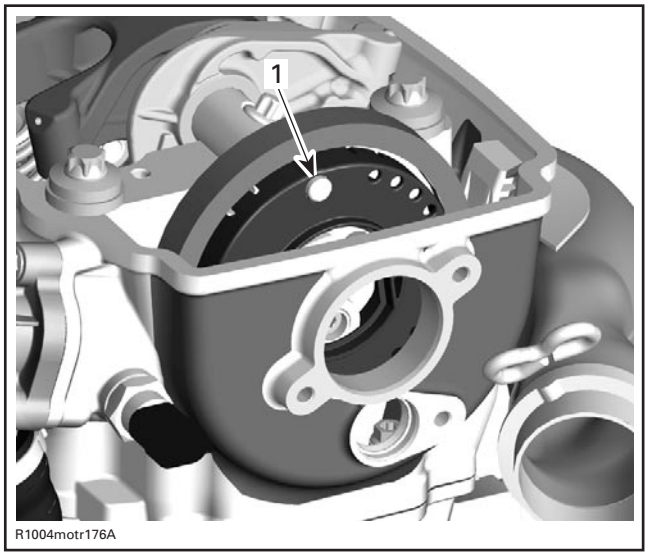
1. *Decompressor shaft groove*
2. *Centrifugal weight*

Place the torsion spring end under socket screw head.



1. *Position of torsion spring end*

Install the cover **no. 33**. Position the cover on the timing gear so that the holes fits to the pin of timing gear.



1. *Hole in cover fits to pin of timing gear*

CAUTION: Before and after cover installation, make sure the centrifugal system works properly.

CAMSHAFT TIMING GEAR

The engine is equipped with two camshaft timing gears **no. 28** and **no. 70**. The timing gear provides the signals for the camshaft position sensor and is located in the cylinder head of the cylinder 2.

NOTE: Although it is not necessary to position crankshaft to TDC for disassembly, it is a good practice to do it, as a troubleshooting step, to know before disassembly if valve timing was appropriate.

Removal

The procedure for disassembly of the two camshaft timing gears **no. 28** and **no. 70**, is the same.

Lock crankshaft with crankshaft locking tool (P/N 529 035 900), refer to CRANKSHAFT AND DRIVE GEARS.

Remove:

- valve cover (refer to VALVE COVER)
- breather (refer to BREATHER)
- chain tensioner (refer to CHAIN TENSIONER)
- decompressor (refer to DECOMPRESSOR)
- chain guide **no. 30**
- screws **no. 29**
- camshaft timing gear **no. 70**.

NOTE: Secure camshaft chain **no. 27** with a retaining wire.

Inspection

Check camshaft timing gear for wear or deterioration.

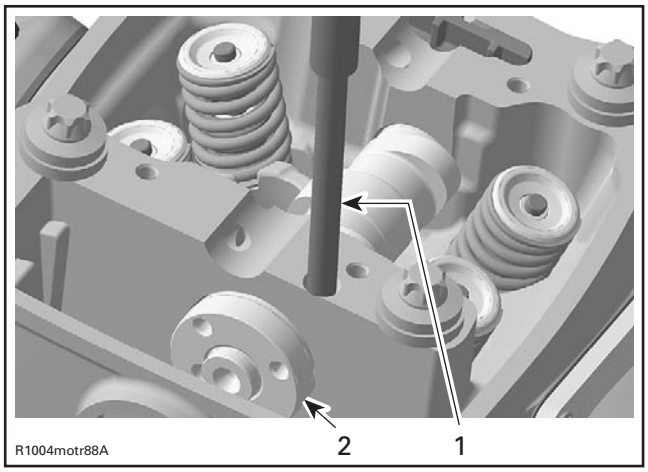
If gear is worn or damaged, replace it as a set (camshaft timing gear and timing chain).

For crankshaft timing gear, refer to CRANKSHAFT AND DRIVE GEARS.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

Using the camshaft locking tool (P/N 529 035 839), lock camshaft on TDC position.



1. Camshaft locking tool
2. Camshaft on TDC position

Install the camshaft timing gear with the writing visible.

IMPORTANT: Make sure that tensioner is in place and properly preloaded before tightening sprocket screws.

Fit the screws with Loctite 243 (P/N 293 800 060).

Torque screws to 9 N•m (80 lbf•**in**).

CAUTION: Crankshaft and camshaft must be locked on ignition TDC position of cylinder 1 (front-side) to place camshaft timing gear and timing chain in the proper position.

TIMING CHAIN

Refer to CRANKSHAFT/DRIVE GEARS.

CYLINDER HEAD

Removal

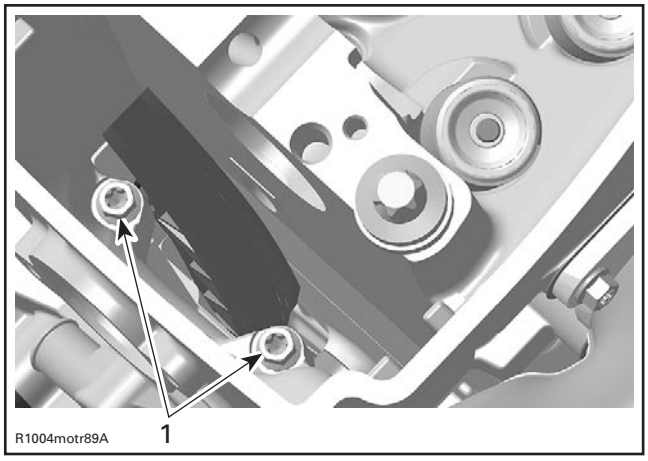
The removal procedure is the same for both cylinder heads **no. 12** and **no. 71**.

Lock crankshaft with crankshaft locking tool (P/N 529 035 900), refer to CRANKSHAFT/DRIVE GEARS.

Drain coolant (refer to COOLING SYSTEM).

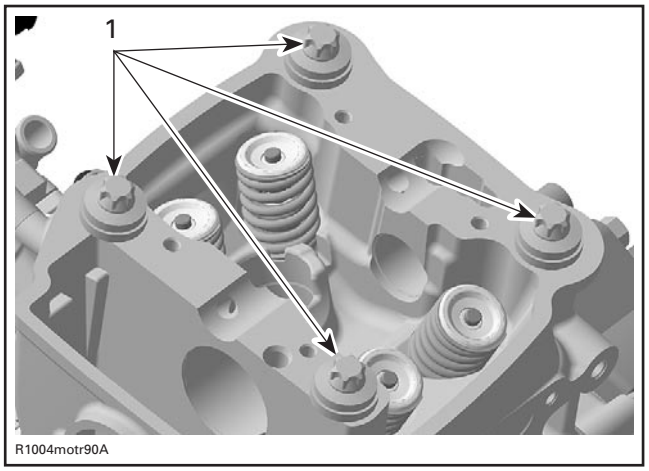
Disconnect temperature sensor and/or camshaft position sensor.

Remove:
- RH side cover
- seat support
- exhaust pipe and upper engine support (refer to REMOVAL AND INSTALLATION)
- engine outlet hose
- air intake manifold (refer to COMPONENT INSPECTION AND ADJUSTMENT)
- chain tensioner (refer to CHAIN TENSIONER)
- valve cover (refer to VALVE COVER)
- valve cover and profile sealing ring (see VALVE COVER above)
- breather (refer to BREATHER)
- decompressor (refer to DECOMPRESSOR)
- camshaft timing gear (refer to CAMSHAFT TIMING GEAR)
- cylinder head screws M6 **no. 21**



1. Cylinder head screws M6

- cylinder head screws M11 **no. 20** retaining cylinder head and cylinder to cylinder base.



1. Cylinder head screws M11

Pull up cylinder head **no. 71**.

Remove gasket **no. 11**.

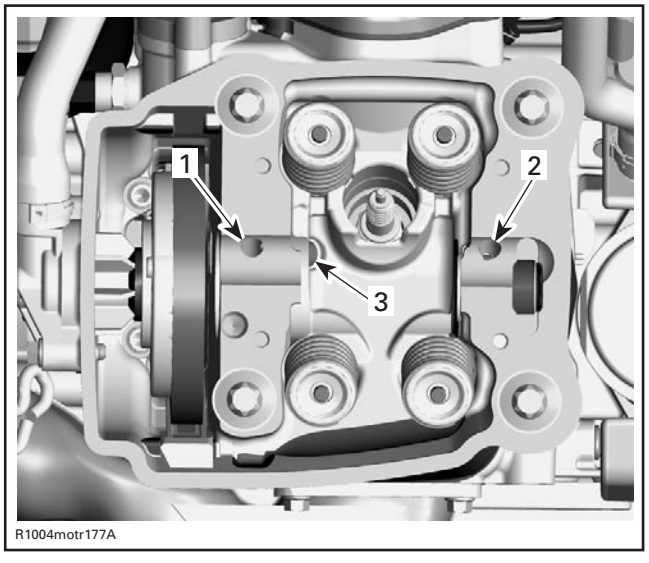
Inspection

Check for cracks between valve seats, if so, replace cylinder head.

Check gasket for cracks or other damages.

Check mating surface between cylinder and cylinder head for contamination. If so, clean both surfaces.

Check oil supply hole in cylinder head for contamination.



1. Oil supply to camshaft bearing journal- big end
2. Oil supply to camshaft bearing journal- small end
3. Oil back flow through chain compartment to engine bottom

Installation

NOTE: The cylinder heads are not identical in design. Do not invert the cylinder heads at assembly.

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: At installation, replace gasket **no. 11**.

Ensure dowel pins are in place.

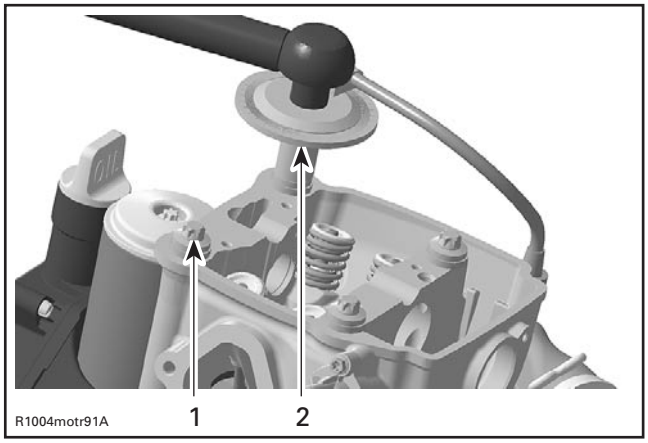
Install cylinder head screws M6 and M11.

Torque screws as per following procedure.

CAUTION: This assembly uses stretch screws. As the screws have been stretched from the previous installation, it is very important to measure each screw at assembly. If screws are out of specification, replace by a new ones. Failure to replace screws and to strictly follow the torque procedure may cause screws to loosen and lead to engine damage.

CYLINDER HEAD SCREW M11	
SERVICE LIMIT	216.5 mm (8.524 in)

– Torque cylinder head screws M11 in criss-cross sequence to 25 N•m (18 lbf•ft).
– Torque cylinder head screws M11 in criss-cross sequence to 50 N•m (37 lbf•ft).
– Finish tightening screws turning an additional 90° rotation with a torque angle gauge then, torque cylinder head screws M6 to 9 N•m (80 lbf•**in**).

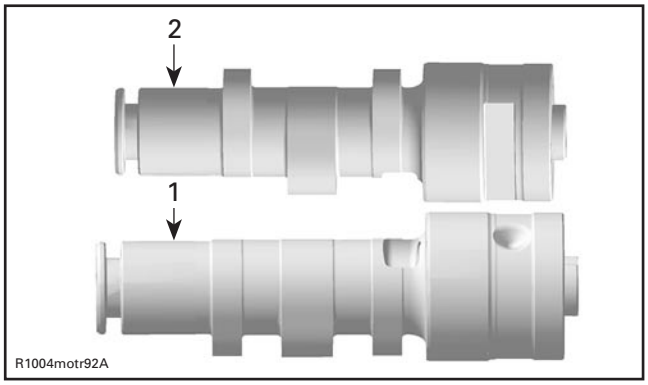


1. Cylinder screws M11
2. Angle torque wrench

Remove crankshaft locking tool (P/N 529 035 900) then install plug with sealing ring.

CAMSHAFT

NOTE: The engine is equipped with two different camshafts **no. 22** and **no. 66**.



1. Camshaft of cylinder 1
2. Camshaft of cylinder 2

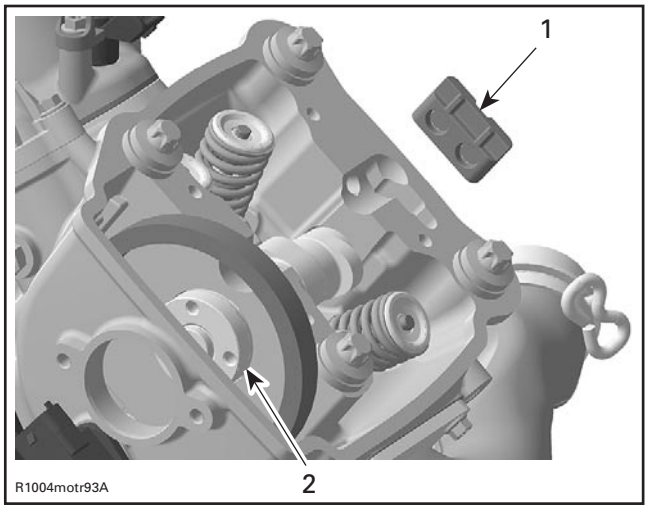
Removal

The removal procedure is the same for both camshafts.

Each camshaft is different in design. Thus, it is important not to mix up any parts of the camshaft assembly with that of the other cylinder. Keep parts as a "group".

Remove:

– valve cover (refer to VALVE COVER)
– chain tensioner (refer to CHAIN TENSIONER)
– breather (refer to BREATHER)
– decompressor (refer to DECOMPRESSOR)
– rocker arms (refer to ROCKER ARMS)
– camshaft timing gear (refer to CAMSHAFT TIMING GEAR)
– camshaft lock **no. 23**
– camshaft **no. 22** and/or **no. 66**.



1. Camshaft lock
2. Camshaft

Cleaning

Remove carbon deposits from combustion chamber, exhaust port and piston top.

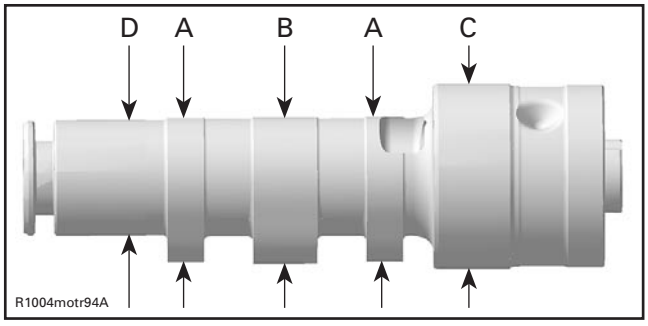
Inspection

Check each lobe and bearing journal of camshaft for scoring, scuffing, cracks or other signs of wear.

Measure camshaft bearing journal diameter and lobe height using a micrometer.

Measure clearance between both ends of camshaft and cylinder head.

NOTE: The data in the following tables are valid for both camshafts.



A. Camshaft lobe (exhaust valves)
B. Camshaft lobe (intake valves)
C. Camshaft bearing journal (big end)
D. Camshaft bearing journal (small end)

CAMSHAFT LOBE - EXHAUST VALVE	
MINIMUM (NEW)	31.435 mm (1.237 in)
MAXIMUM (NEW)	31.635 mm (1.245 in)
SERVICE LIMIT	31.400 mm (1.236 in)
CAMSHAFT LOBE - INTAKE VALVE	
MINIMUM (NEW)	31.654 mm (1.246 in)
MAXIMUM (NEW)	31.854 mm (1.254 in)
SERVICE LIMIT	31.600 mm (1.244 in)
CAMSHAFT BEARING JOURNAL - BIG END	
MINIMUM (NEW)	39.927 mm (1.5719 in)
MAXIMUM (NEW)	39.935 mm (1.5722 in)
SERVICE LIMIT	39.920 mm (1.5716 in)
CAMSHAFT BEARING JOURNAL - SMALL END	
MINIMUM (NEW)	24.967 mm (.9829 in)
MAXIMUM (NEW)	24.980 mm (.9835 in)
SERVICE LIMIT	24.960 mm (.9827 in)
CAMSHAFT BORE - BIG END MEASURED IN DIAMETER	
MINIMUM (NEW)	39.984 mm (1.5742 in)
MAXIMUM (NEW)	40.000 mm (1.5748 in)
SERVICE LIMIT	40.020 mm (1.5756 in)
CAMSHAFT BORE - SMALL END MEASURED IN DIAMETER	
MINIMUM (NEW)	24.987 mm (.9837 in)
MAXIMUM (NEW)	25.000 mm (.9842 in)
SERVICE LIMIT	25.020 mm (.9850 in)

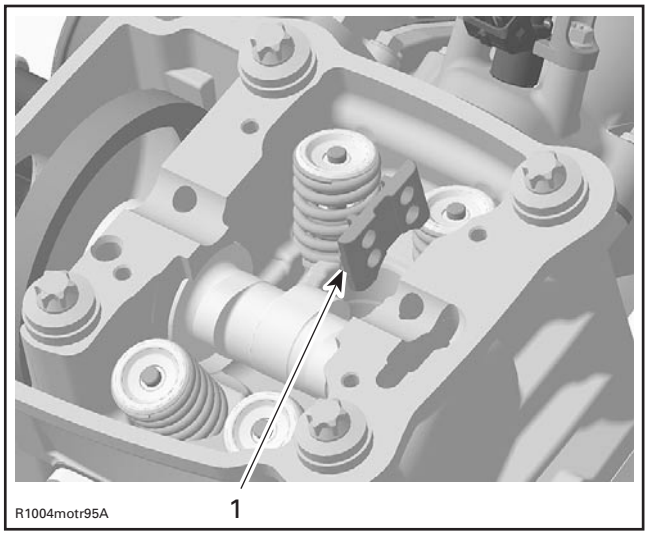
Replace parts that are not within specifications.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

CAUTION: The camshafts are not identical in design. Do not invert the camshafts during assembly. Any mix-up of the components will lead to engine damage.

Install camshaft then place the camshaft lock in the slot.



1. Camshaft lock

For other parts, refer to proper installation procedure.

VALVE SPRINGS

NOTE: The engine is equipped with two different valve springs **no. 16** (inner) and **no. 17** (outer) for every valve.

Removal

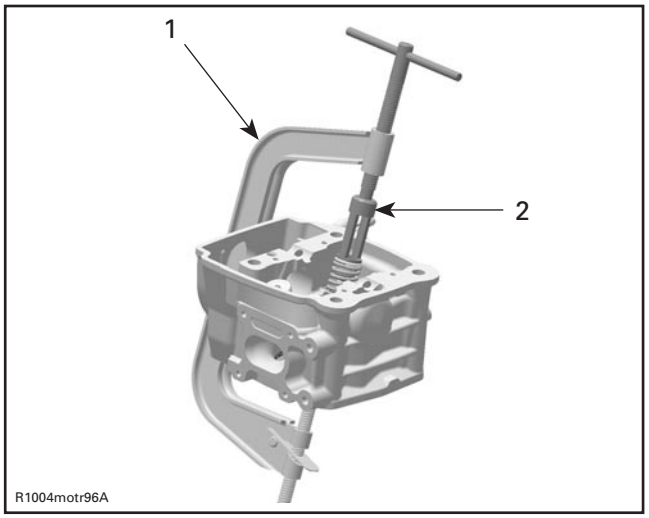
Remove:

– rocker arms (refer to ROCKER ARMS)
– cylinder head (refer to CYLINDER HEAD).

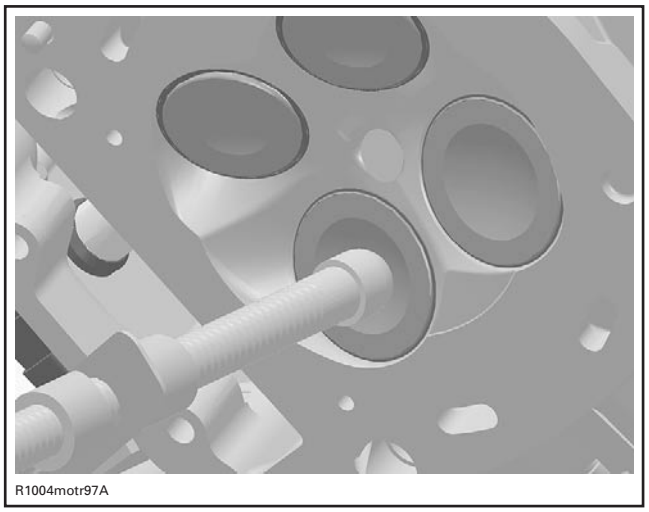
Compress valve springs **no. 16** and **no. 17**, use valve spring compressor clamp (P/N 529 035 764) and valve spring compressor cup (P/N 529 035 724).

⚠ WARNING

Always wear safety glasses when disassembling valve springs. Be careful when unlocking valves. Components could be expelled under pressure from preloaded spring.



1. Valve spring compressor clamp (P/N 529 035 764)
2. Valve spring compressor cup (P/N 529 035 724)



LOCATE VALVE SPRING COMPRESSOR CLAMP IN CENTER OF THE VALVE

Remove valve cotters **no. 19**.

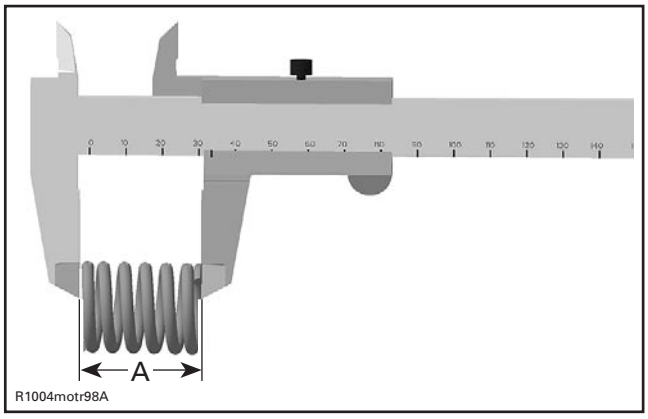
Withdraw valve spring compressor, valve spring retainer **no. 18** and valve springs.

Inspection

Check valve springs for rust, corrosion or other visible damages. If so, replace valve springs.

Check valve springs for free length and straightness.

Replace valve springs if not within specifications.



A. Valve spring length

VALVE SPRING FREE LENGTH	
OUTER VALVE SPRING	
NOMINAL (NEW)	45.45 mm (1.789 in)
SERVICE LIMIT	43 mm (1.693 in)
INNER VALVE SPRING	
NOMINAL (NEW)	41.02 mm (1.615 in)
SERVICE LIMIT	38.80 mm (1.528 in)

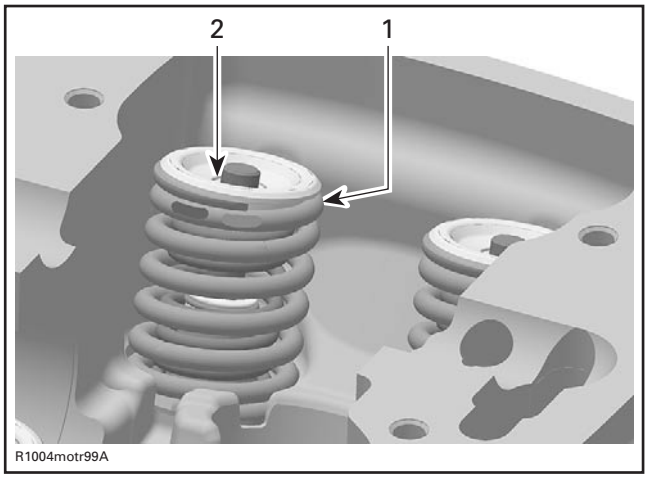
Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Colored area of the valve spring must be placed on top.

If the color cannot be identified any more, orientation is possible, based on the shape of the spring. The spacing of the coils is smaller at one end. At installation, this end must be directed towards the cylinder head.

NOTE: Valve cotters must be properly engaged in valve stem grooves.



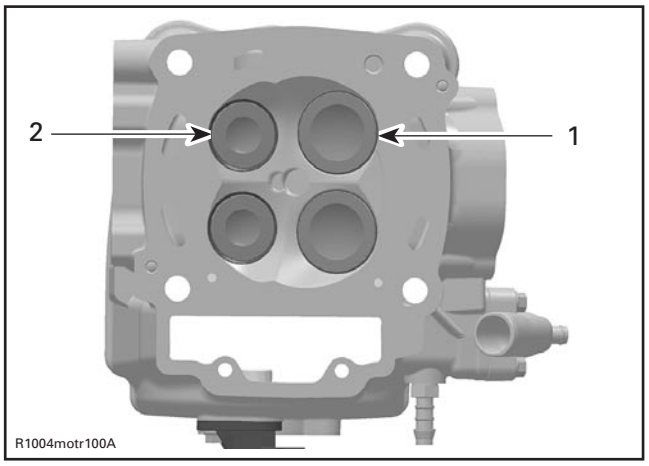
1. Position of the valve spring
2. Valve cotters

VALVE

Removal

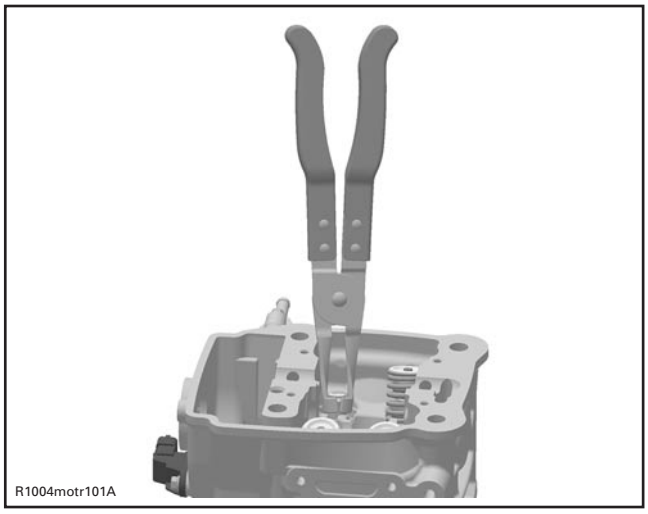
Remove valve springs.

Push valve stem then pull valves **no. 13** and **no. 14** out of valve guide.



1. Intake valve 38 mm
2. Exhaust valve 31 mm

Remove valve stem seal **no. 15** with special pliers such as Snap-ON YA 8230.



Inspection

Valve Stem Seal

NOTE: Inspection of valve stem seals is not needed because new seals should always be installed whenever cylinder head is removed.

Valve

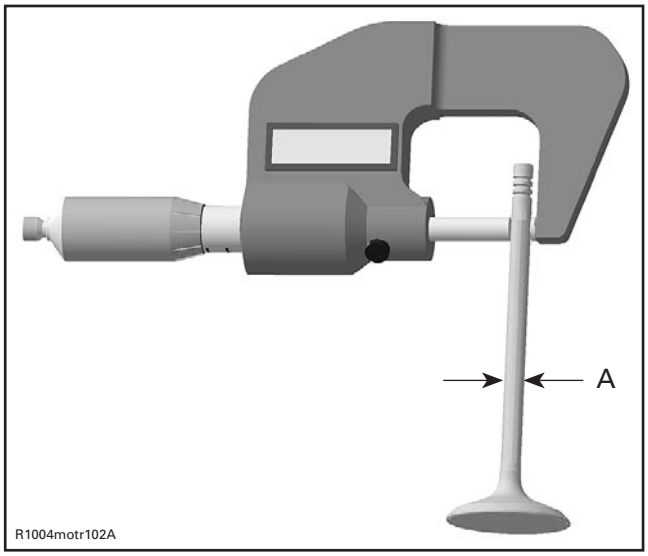
Inspect valve surface, check for abnormal stem wear and bending. If so, replace by a new one.

Valve Stem and Valve Guide Clearance

Measure valve stem and valve guide in three places, using a micrometer and a small bore gauge.

NOTE: Clean valve guide to remove carbon deposits before measuring.

Change valve if valve stem is out of specification or has other damages such as wear or traces of friction.



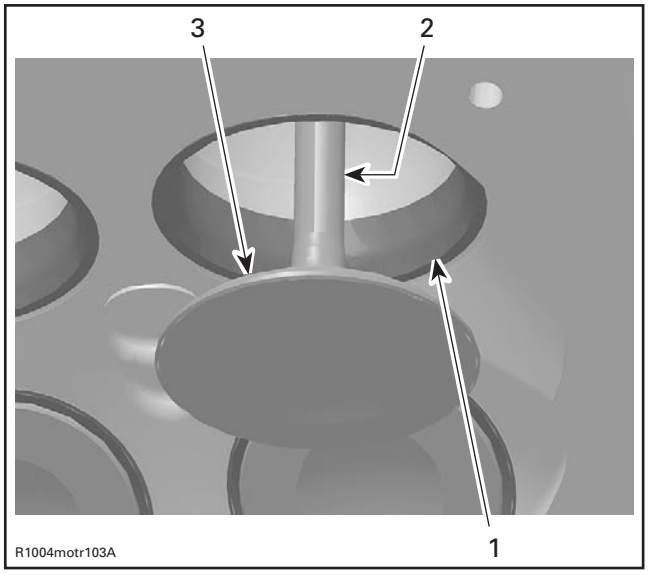
A. Valve stem diameter

VALVE STEM DIAMETER	
MINIMUM (NEW)	
Exhaust	5.946 mm (.2341 in)
Intake	5.961 mm (.2347 in)
MAXIMUM (NEW)	
Exhaust	5.960 mm (.2346 in)
Intake	5.975 mm (.2352 in)
SERVICE LIMIT	
Exhaust	5.93 mm (.233 in)
Intake	

Replace cylinder head if valve guide is out of specification or has other damages such as wear or traces of friction.

VALVE GUIDE DIAMETER	
SERVICE LIMIT	
Exhaust	6.060 mm (.2386 in)
Intake	

Valve Face and Seat



1. Valve seat
2. Exhaust valve contaminated area
3. Valve face (contact surface to valve seat)

Check valve face and seat for burning or pittings and replace valve or cylinder head if there are signs of damage.

Ensure to seat valves properly. Apply some lapping compound to valve face and work valve on its seat with a lapping tool.

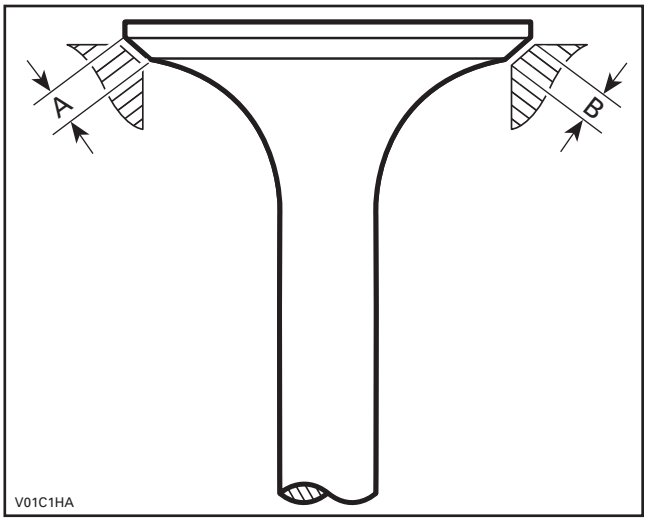
Measure valve face contact width.

NOTE: The location of contact area should be in center of valve seat.

Measure valve seat width, using a caliper.

VALVE SEAT CONTACT WIDTH	
NEW	
Exhaust	1.25 to 1.55 mm (.049 to .061 in)
Intake	1.10 to 1.30 mm (.043 to .051 in)
SERVICE LIMIT	
Exhaust	1.8 mm (.071 in)
Intake	1.6 mm (.063 in)

If valve seat contact width is too wide or has dark spots, replace the cylinder head.

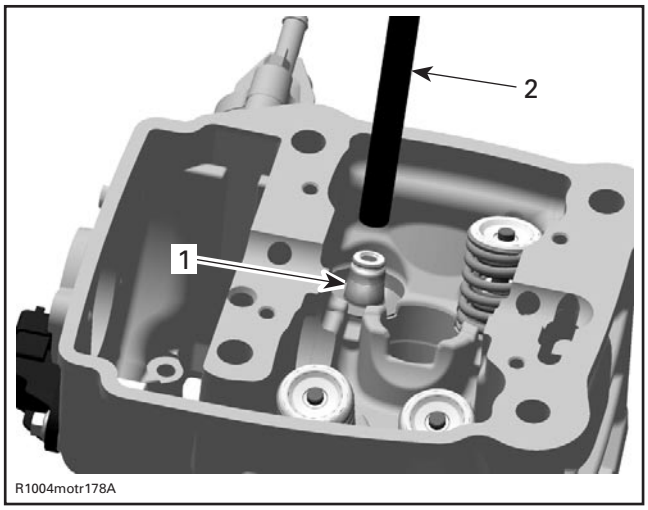


A. Valve face contact width
B. Valve seat contact width

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

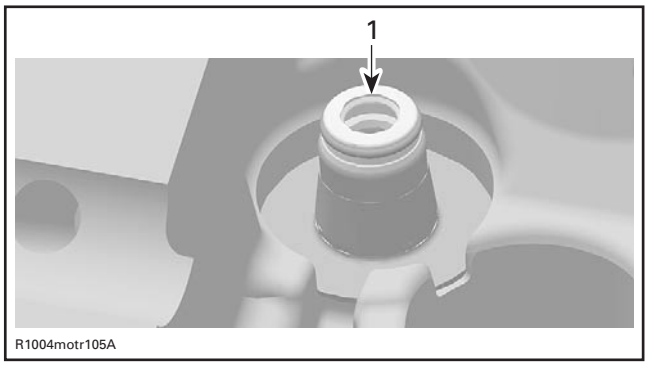
NOTE: At installation, replace the valve stem seal **no. 15**, use valve stem seal installer (P/N 529 035 687).



1. Valve stem seal
2. Valve stem seal installer (P/N 529 035 687)

Apply engine oil on valve stem and install it.

CAUTION: Be careful when valve stem is passed through sealing lips of valve stem seal.



1. Sealing lips of valve stem seal

To ease installation of cotters, apply oil or grease on them so that they remain in place while releasing the spring.

After spring is installed, ensure it is properly locked by tapping on valve stem end with a soft hammer so that valve opens and closes a few times.

CAUTION: An improperly locked valve spring will cause engine damage.

CYLINDER

NOTE: The engine is equipped with two different cylinders **no. 2** and **no. 72**.

Removal

Lock crankshaft with crankshaft locking tool (P/N 529 035 900), refer to CRANKSHAFT/DRIVE GEARS.

Remove:

– cylinder heads (refer to CYLINDER HEAD).

Pull cylinder **no. 2** and **no. 72**.

Discard cylinder gaskets **no. 1**.

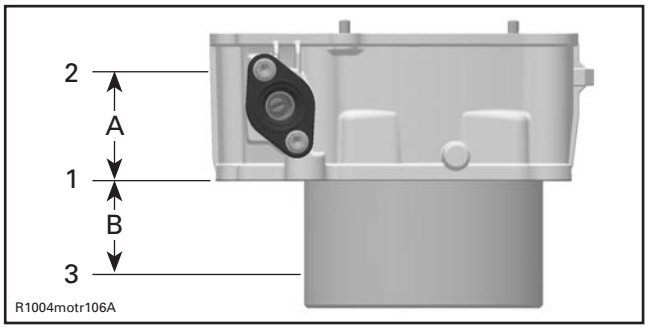
Inspection

Cylinder

Check cylinder for cracks, scoring and wear ridges on the top and bottom of the cylinder. If so, replace cylinder.

Cylinder Taper

Measure cylinder bore at 3 recommended positions. See the following illustration.



1. First measuring diameter in line with cylinder bottom
2. Second measuring diameter
3. Third measuring diameter

A. 60 mm (2.362 in)
B. 50 mm (1.968 in)

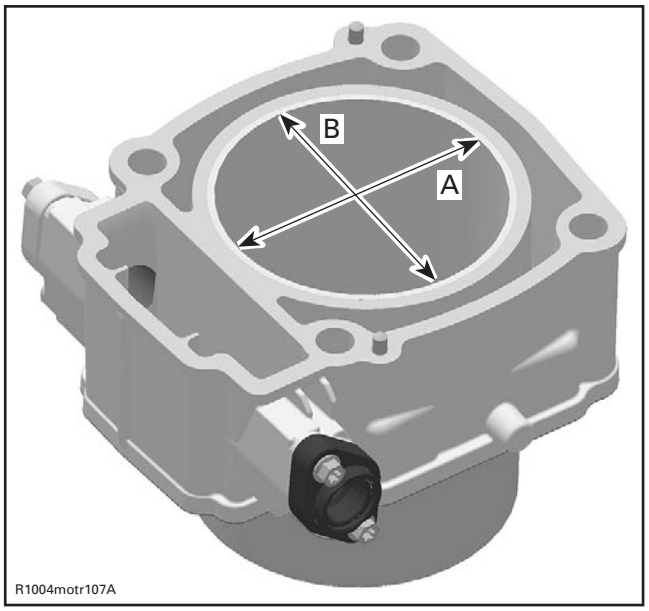
CYLINDER TAPER	
MAXIMUM (NEW)	0.038 mm (.001 in)
SERVICE LIMIT	0.090 mm (.004 in)

Difference between measurements should not exceed the service limit mentioned above.

Cylinder Out of Round

Measure cylinder diameter in piston axis direction from top of cylinder. Take another measurement 90° from first one and compare.

NOTE: Take the same measuring points like described in CYLINDER TAPER above.



A. Parallel to piston axis
B. Perpendicular to piston axis

CYLINDER OUT OF ROUND	
MAXIMUM (NEW)	0.01 mm (.0002 in)
SERVICE LIMIT	0.02 mm (.0008 in)

CAUTION: Always replace gasket no. 1 before installing the cylinder.

Installation

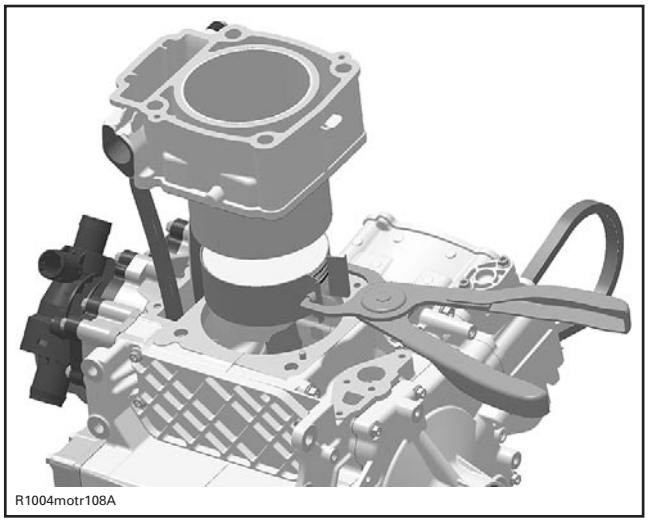
For installation, reverse the removal procedure. Pay attention to the following details.

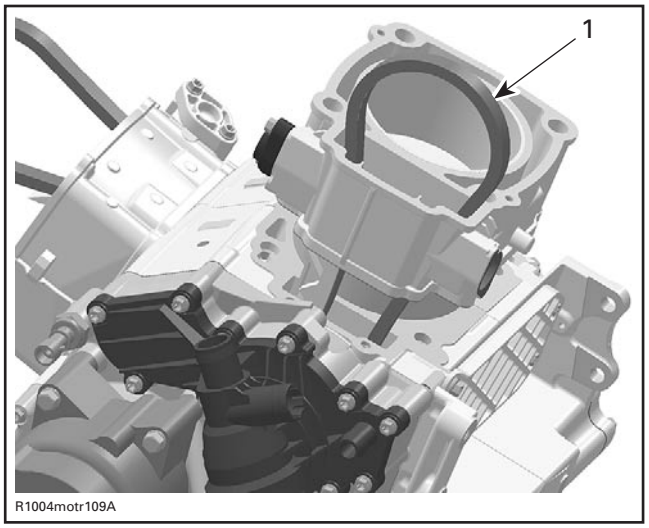
NOTE: The cylinders are not identical in design. Do not invert the cylinders during assembly.

First mount cylinder 1. Then remove the crankshaft locking tool (P/N 529 035 900). Crank the engine further and position piston 2 at TDC. Mount cylinder 2. The cylinder cannot be pushed fully over the piston unless the piston is located at TDC.

Apply engine oil in the bottom area of the cylinder bore and also on the band of the piston ring compressor tool.

Using a piston ring compressor plier, such Snap-On RC-980, slide piston into cylinder.





1. Timing chain

NOTE: Put timing chain through the chain pit then put the cylinder in place.

Install cylinder head and the other parts in accordance with the proper installation procedures.

PISTON

Refer to CRANKSHAFT/DRIVE GEARS.

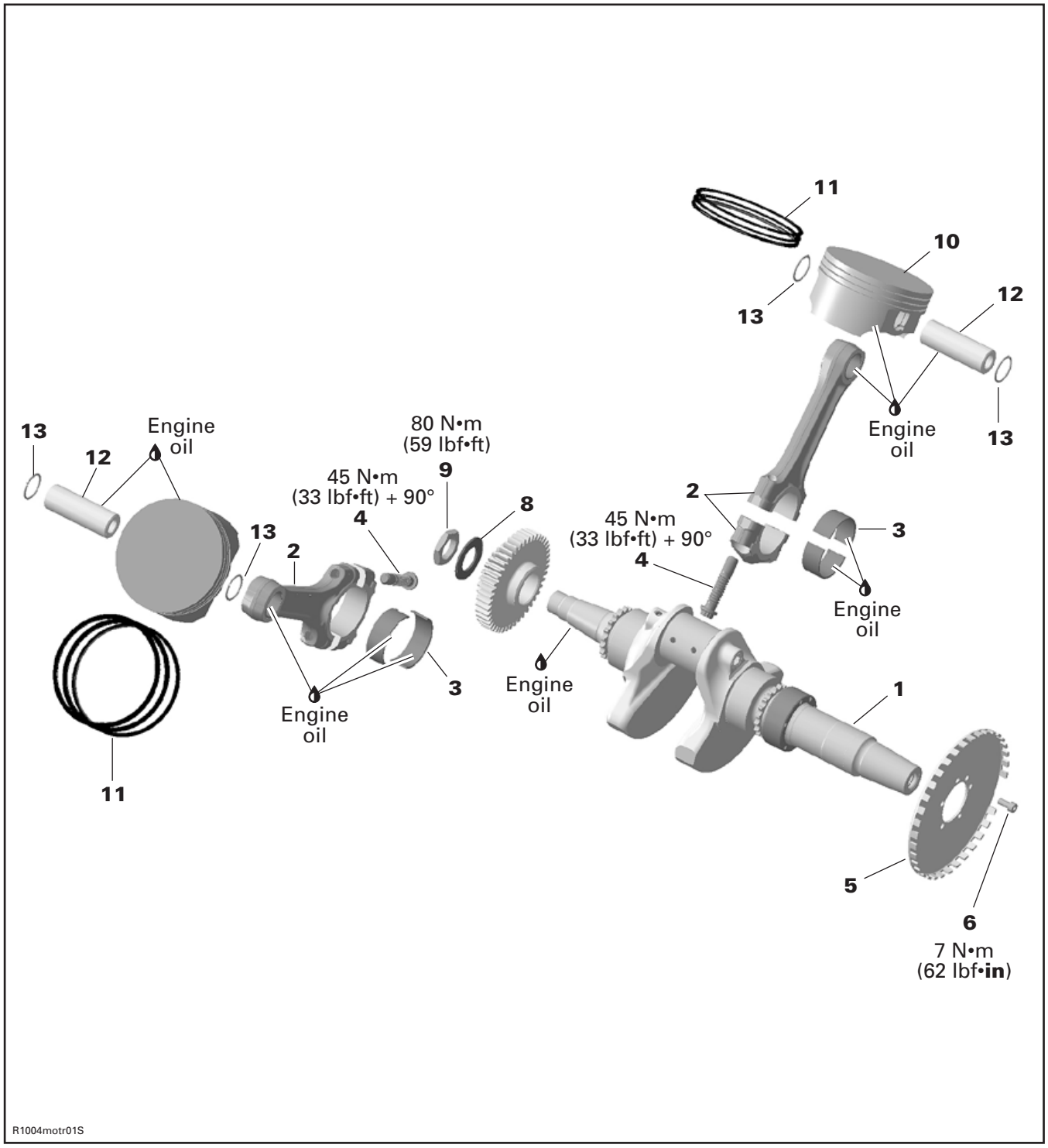
CRANKSHAFT/DRIVE GEARS

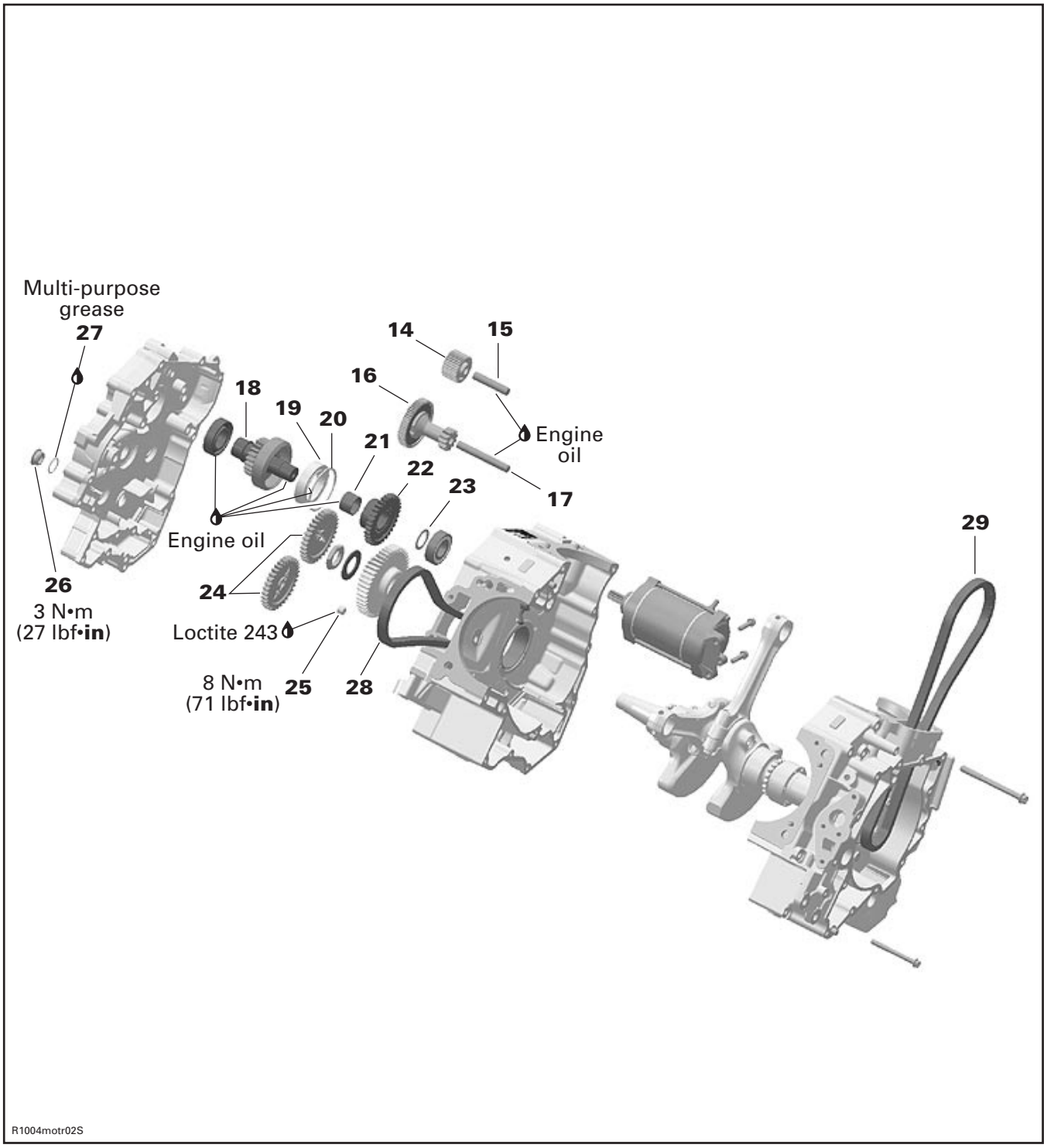
SERVICE TOOLS

Description	Part Number	Page
crankshaft locking tool	529 035 900	235, 241
piston circlip installer	529 035 765	244
protection mushroom	420 876 552	235

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	241
Molykote 111	413 707 000	241


11
10
13
12
13
Engine oil
13
12
Engine oil
80 N•m (59 lbf•ft)
45 N•m (33 lbf•ft) + 90°
9
8
4
2
45 N•m (33 lbf•ft) + 90°
3
4
13
2
Engine oil
Engine oil
3
1
11
5
6
7 N•m (62 lbf•in)
R1004motr01S


Multi-purpose grease
27
26
3 N•m (27 lbf•in)
18
19
20
21
22
23
24
25
8 N•m (71 lbf•in)
Loctite 243
Engine oil
Engine oil
14
15
16
17
28
29
R1004motr02S

TIMING CHAIN

The engine is equipped with two timing chains **no. 28** and **no. 29**. One of the timing chains is located on the engine alternator side behind the ignition cover. The second is located on the PTO side behind the PTO cover.

Removal of Alternator Side Timing Chain

Remove:

– ignition cover (refer to COOLING SYSTEM)
– chain tensioner and chain guide (refer to CYLINDER AND CYLINDER HEAD)
– camshaft sprocket (refer to CYLINDER AND CYLINDER HEAD)
– oil pump gears **no. 24** (refer to LUBRICATION SYSTEM)
– crankshaft drive gear **no. 7** (refer to DRIVE GEARS).

Carefully pull the timing chain sideward and down from the crankcase.

Removal of PTO Side Timing Chain

Remove:

– engine from vehicle (refer to REMOVAL AND INSTALLATION)
– oil tank (refer to LUBRICATION SYSTEM)
– chain tensioner and chain guide (refer to CYLINDER AND CYLINDER HEAD)
– camshaft timing gear (refer to CYLINDER AND CYLINDER HEAD)
– PTO cover (refer to CRANKCASE)
– trigger wheel **no. 6** (refer to TRIGGER WHEEL).

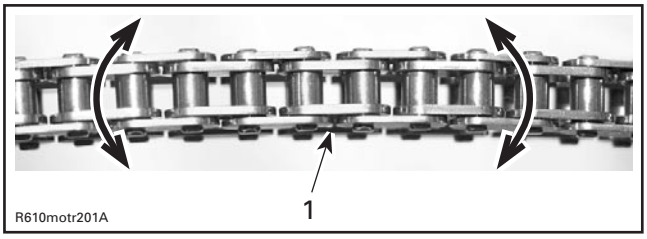
Carefully pull the timing chain sideward and down from the crankcase.

Inspection

Inspection is the same for both timing chains **no. 28** and **no. 29**. Pay attention to the following details.

NOTE: Check timing chain on camshaft sprocket/timing gear for excessive radial play.

Check chain condition for wear and rollers condition.



1. Timing chain

If chain is excessively worn or damaged, replace it as a set (camshaft sprocket/timing gear and timing chain).

Installation

Installation is the same for both timing chains **no. 28** and **no. 29**.

The installation is essentially the reverse of the removal procedure but, pay attention to the following details.

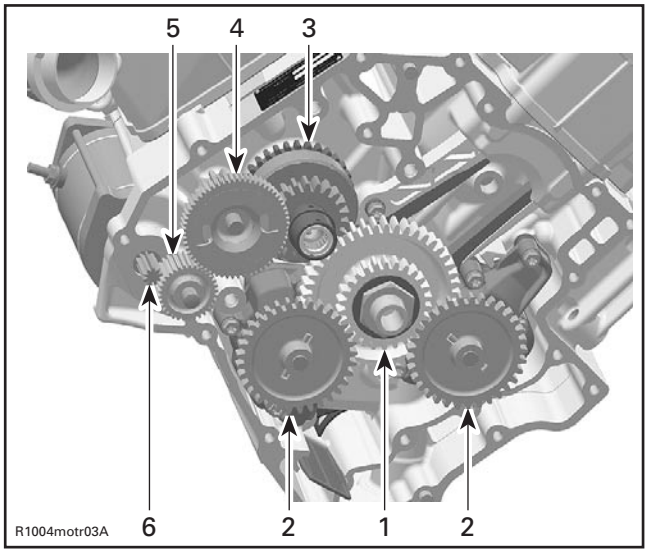
NOTE: Ensure to perform proper valve timing. Lock crankshaft and camshaft at TDC (refer to CYLINDER AND CYLINDER HEAD).

Install chain then, adjust chain tension (refer to CYLINDER AND CYLINDER HEAD).

CAUTION: Improper valve timing will damage engine components.

DRIVE GEARS

The drive gears are located on the engine alternator side behind the ignition cover.



1. *Crankshaft drive gear*
2. *Oil pump gears*
3. *Generator gear*
4. *Double gear*
5. *Intermediate gear*
6. *Starter gear*

Removal

Lock crankshaft with crankshaft locking tool (P/N 529 035 900) (refer to CRANKSHAFT LOCKING TOOL).

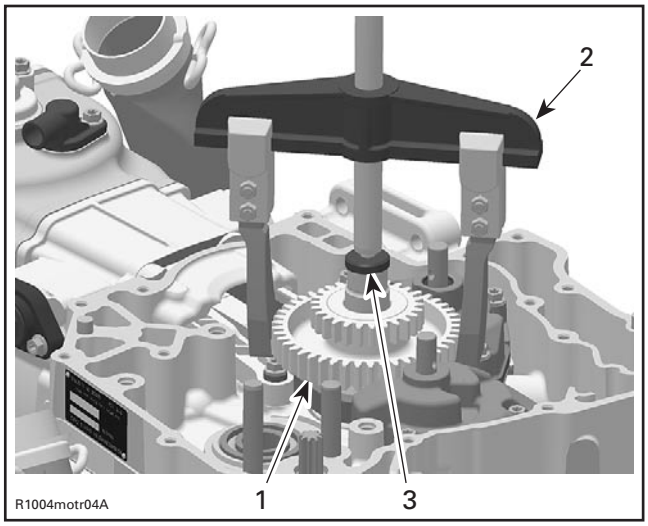
Remove:

– ignition cover (refer to COOLING SYSTEM)
– oil pump gears **no. 24** (refer to LUBRICATION SYSTEM)
– crankshaft nut **no. 9**
– crankshaft drive gear **no. 7**.

Remove crankshaft drive gear with gear puller (aftermarket tool). Also use the protection mushroom (P/N 420 876 552) to avoid damage of the crankshaft.

⚠ WARNING

The gear puller and the crankshaft drive gear are highly tensioned. When the crankshaft drive gear is loosened, the puller may forcefully swing up.



1. *Crankshaft drive gear*
2. *Gear puller*
3. *Protection mushroom (P/N 420 876 552)*

– generator gear **no. 18** and thrust washer **no. 23**
– double gear **no. 16**
– intermediate gear **no. 14**.

Inspection

Double Gear/Intermediate Gear/Crankshaft Drive Gear

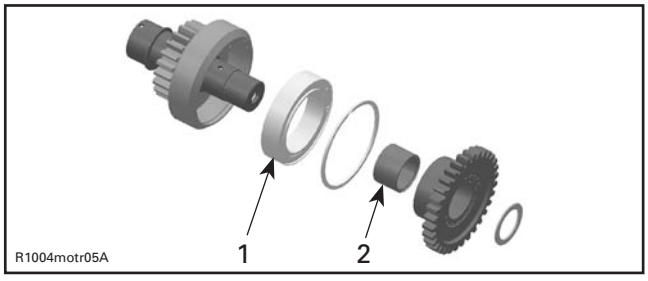
NOTE: Inspect the gears for wear and damage.

Oil Pump Gears

Refer to LUBRICATION SYSTEM.

Generator Gear

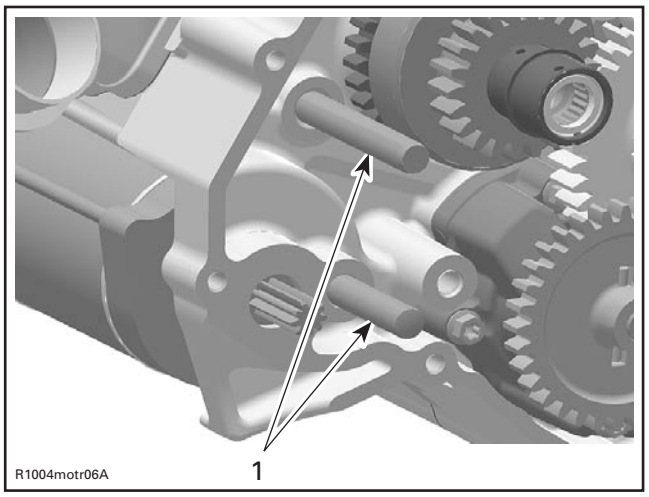
Completely disassemble the generator gear.



1. *Sprag clutch*
2. *Needle bearing*

NOTE: Inspect all components, especially the needle bearing, for wear and damage. Perform a function test of the sprag clutch.

Location Pins



1. Location pins

NOTE: Inspect all pins for wear and damage. The pins are firmly pressed into the crankcase but may work loose during the course of time. If the pins can be rotated, there is no need for repair work.

Installation

The installation is essentially the reverse of the removal procedure, but pay attention to the following details.

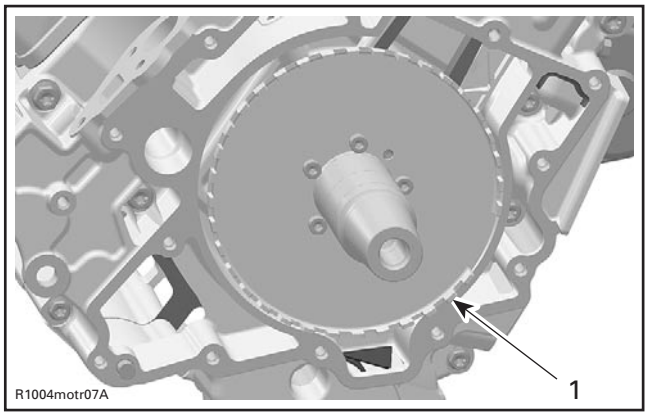
NOTE: Adequately oil all components prior to installation. The oil pump gears and the crankshaft drive gear do not need to be oiled.

The generator gear and the double gear must be installed at the same time on their respective location pin.

Torque crankshaft nut **no. 9** to 80 N•m (59 lbf•ft).

TRIGGER WHEEL

The trigger wheel is located on the engine PTO side behind the PTO cover.



1. Trigger wheel

Removal

Remove:

– oil tank (refer to LUBRICATION SYSTEM)
– PTO cover (refer to CRANKCASE)
– trigger wheel screws **no. 6** and pull trigger wheel **no. 5**.

Inspection

NOTE: Refer to COMPONENT INSPECTION AND ADJUSTMENT in ENGINE MANAGEMENT section.

Installation

For installation, reverse the removal procedure.

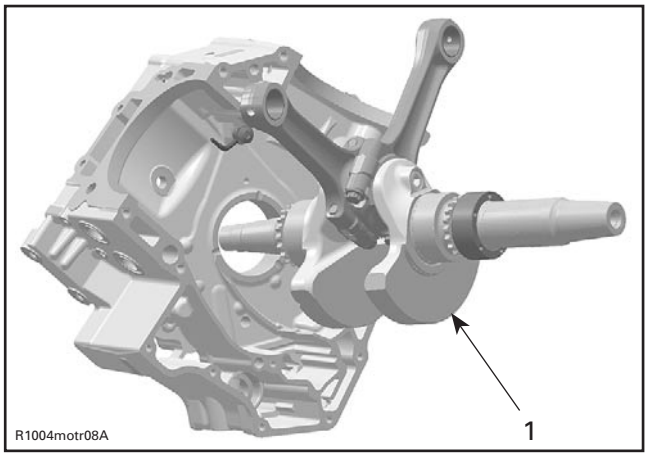
Torque trigger wheel screws to 7 N•m (62 lbf•**in**).

CRANKSHAFT

Removal

Remove:

– drive gears (refer to DRIVE GEARS above)
– crankcase (refer to CRANKCASE)
– crankshaft **no. 1**



1. Crankshaft

– connecting rods **no. 2**.

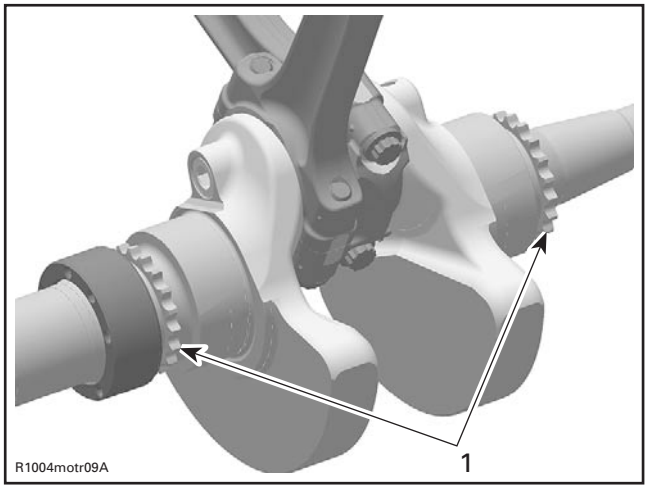
NOTE: Mark the connecting rods prior to dismantling. The connecting rods must be reinstalled in exactly the same position and running direction.

Inspection

NOTE: Check each bearing journal of crankshaft for scoring, scuffing, cracks or other signs of wear.

NOTE: Replace crankshaft if the gears are worn or otherwise damaged.

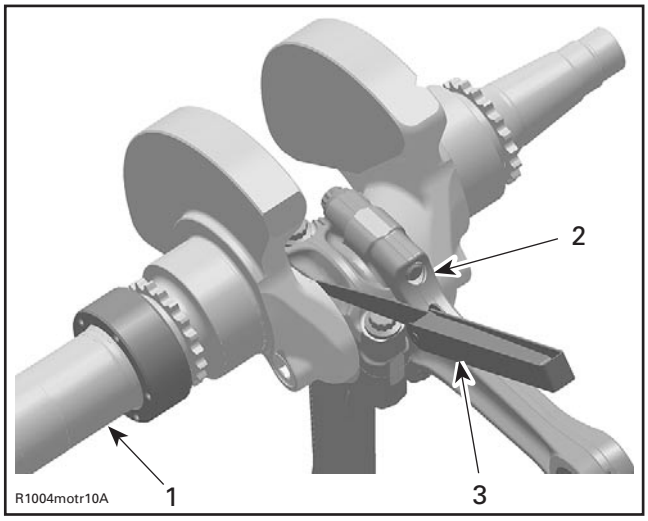
CAUTION: Components with less than the service limit always have to be replaced. If this is not observed, severe damage may be caused to the engine.



1. Crankshaft timing gear

Connecting Rod Big End Axial Play

Using a feeler gauge, measure distance between butting face of connecting rods and crankshaft counterweight. If the distance exceeds specified tolerance, replace the crankshaft.

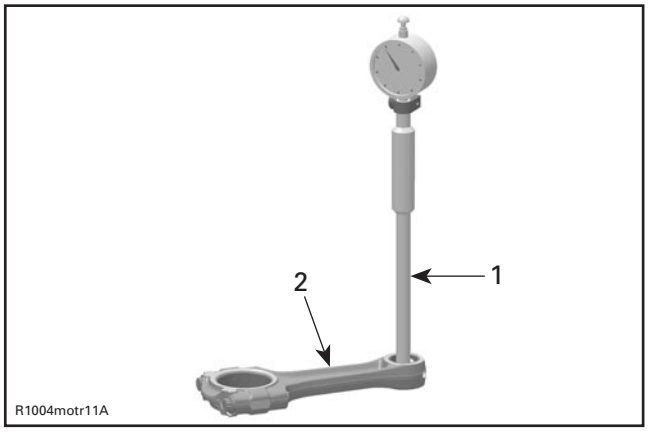


1. Crankshaft
2. Connecting rods
3. Feeler gauge

CONNECTING ROD BIG END	
NEW MINIMUM	0.150 mm (.006 in)
NEW MAXIMUM	0.450 mm (.017 in)
SERVICE LIMIT	0.5 mm (.020 in)

Connecting Rod/Piston Pin Clearance

Measure piston pin. Compare to inside diameter of connecting rod **no. 2**.



1. Bore gauge
2. Connecting rod

A. Piston pin diameter in the area of the bushing

CONNECTING ROD SMALL END DIAMETER	
NEW MINIMUM	23.01 mm (.9059 in)
NEW MAXIMUM	23.02 mm (.9063 in)
SERVICE LIMIT	23.07 mm (.908 in)

PISTON PIN DIAMETER	
NEW MINIMUM	22.996 mm (.9053 in)
NEW MAXIMUM	23.000 mm (.9055 in)
SERVICE LIMIT	22.990 mm (.904 in)

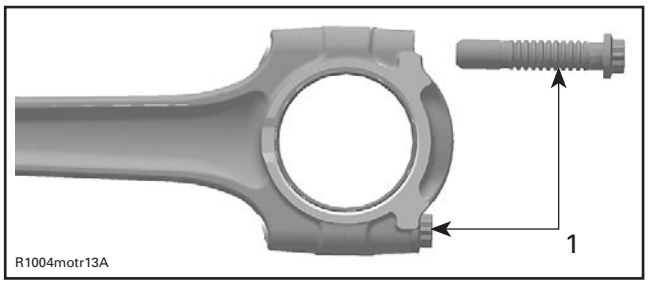
PISTON PIN BORE CLEARANCE	
SERVICE LIMIT	0.080 mm (.0035 in)

NOTE: If the connecting rod small end diameter is out of specification, replace connecting rod.

Connecting Rod Big End Radial Play

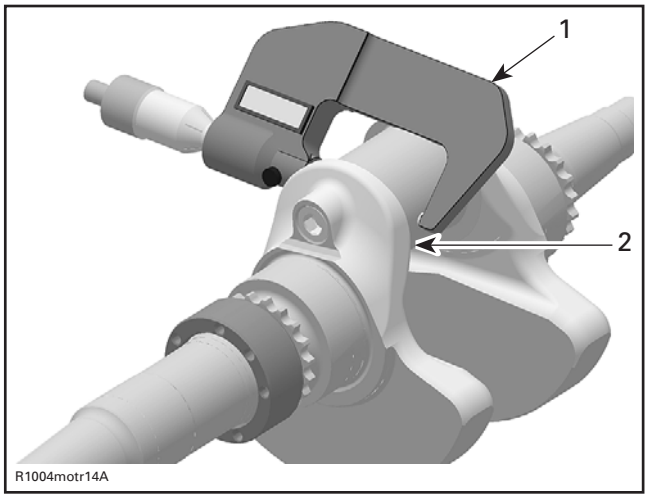
Remove connecting rod **no. 2** from crankshaft **no. 1**.

CAUTION: Always replace connecting rod screws no. 4 if removing the connecting rod. It is recommended to replace bushings no. 3, in case of installing the connecting rod.



1. Connecting rod screw

Measure crankpin. Compare to inside diameter of connecting rod big end.

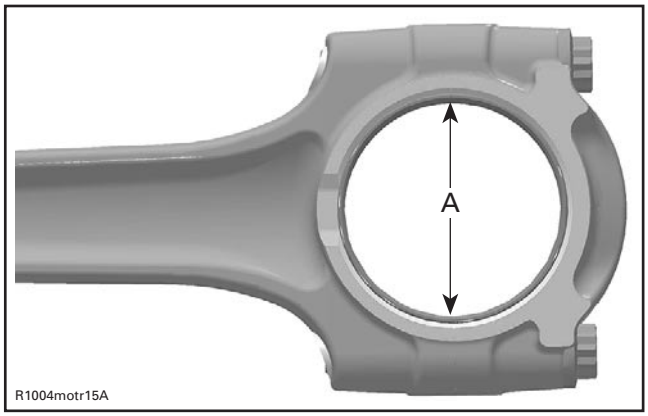


1. Micrometer
2. Crankpin area for bushings

To measure the connecting rod big end diameter, use the OLD screws **no. 4**.

Install the OLD bushings **no. 3** as they were mounted initially.

Do the torque procedure as described further.



A. Connecting rod big end bushing

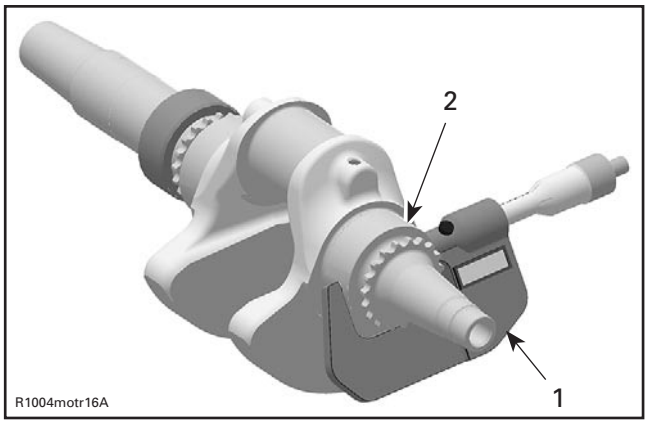
CRANKSHAFT PIN DIAMETER	
NEW MINIMUM	45.017 mm (1.7723 in)
NEW MAXIMUM	45.033 mm (1.7729 in)
SERVICE LIMIT	45.000 mm (1.772 in)

CONNECTING ROD BIG END DIAMETER	
SERVICE LIMIT	45.090 mm (1.775 in)

CONNECTING ROD BIG END CLEARANCE	
SERVICE LIMIT	0.09 mm (.0035 in)

Crankshaft Radial Play Alternator Side

Measure crankshaft on alternator side. Compare to inside diameter of alternator bushing (refer to CRANKCASE).



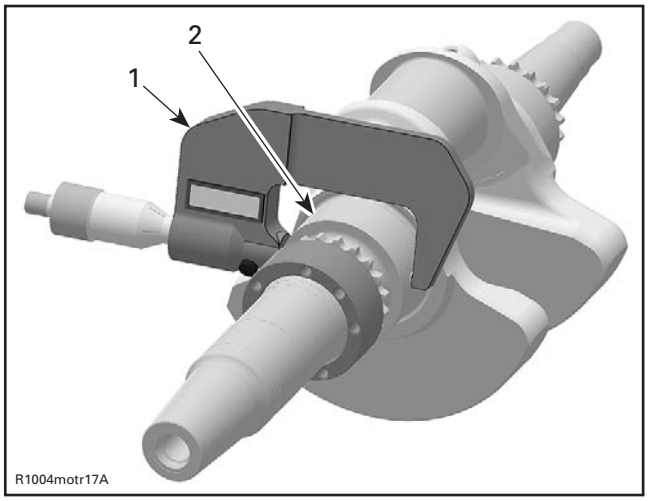
1. Micrometer
2. Crankshaft area for alternator bushing

CRANKSHAFT ALTERNATOR SIDE DIAMETER	
NEW MINIMUM	54.961 mm (2.1638 in)
NEW MAXIMUM	54.980 mm (2.1645 in)
SERVICE LIMIT	54.940 mm (2.1629 in)

CRANKSHAFT ALTERNATOR SIDE RADIAL CLEARANCE	
SERVICE LIMIT	0.08 mm (.0031 in)

Crankshaft Radial Play (PTO side)

Measure crankshaft on PTO side. Compare to inside diameter of PTO bushing (refer to CRANKCASE).



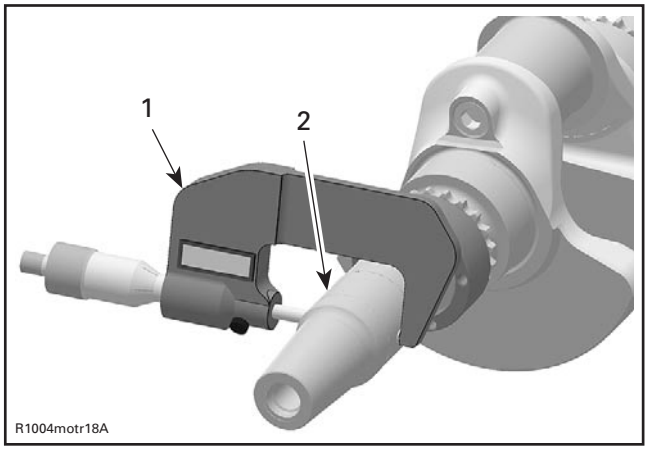
1. Micrometer
2. Crankshaft area for PTO bushing

CRANKSHAFT JOURNAL PTO DIAMETER	
NEW MINIMUM	54.961 mm (2.1638 in)
NEW MAXIMUM	54.980 mm (2.1645 in)
SERVICE LIMIT	54.940 mm (2.1629 in)

CRANKSHAFT ALTERNATOR SIDE RADIAL CLEARANCE	
SERVICE LIMIT	0.08 mm (.0031 in)

Crankshaft Radial Play (PTO side support bearing)

Measure crankshaft on PTO side journal for support bearing. Compare to inside diameter of PTO support bearing (refer to PTO COVER in CRANKCASE section).



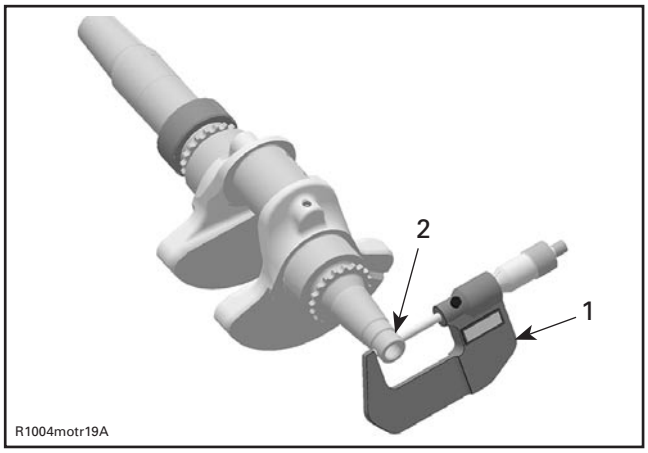
1. Micrometer
2. Crankshaft area (PTO support bearing)

CRANKSHAFT JOURNAL DIAMETER (PTO SUPPORT BEARING)	
NEW MINIMUM	37.984 mm (1.4954 in)
NEW MAXIMUM	38.000 mm (1.4960 in)
SERVICE LIMIT	37.960 mm (1.4945 in)

CRANKSHAFT PTO SUPPORT BEARING RADIAL CLEARANCE	
SERVICE LIMIT	0.08 mm (.0031 in)

Crankshaft Radial Play (alternator side — oil supply hole)

Measure crankshaft on alternator side journal for oil supply hole. Compare to inside diameter of oil supply hole in ignition cover (refer to IGNITION COVER in COOLING SYSTEM).



1. Micrometer
2. Crankshaft area (journal for oil supply hole)

CRANKSHAFT JOURNAL DIAMETER (OIL SUPPLY HOLE)	
NEW MINIMUM	19.987 mm (0.7869 in)
NEW MAXIMUM	20.00 mm (0.7874 in)
SERVICE LIMIT	0.08 mm (.0031 in)

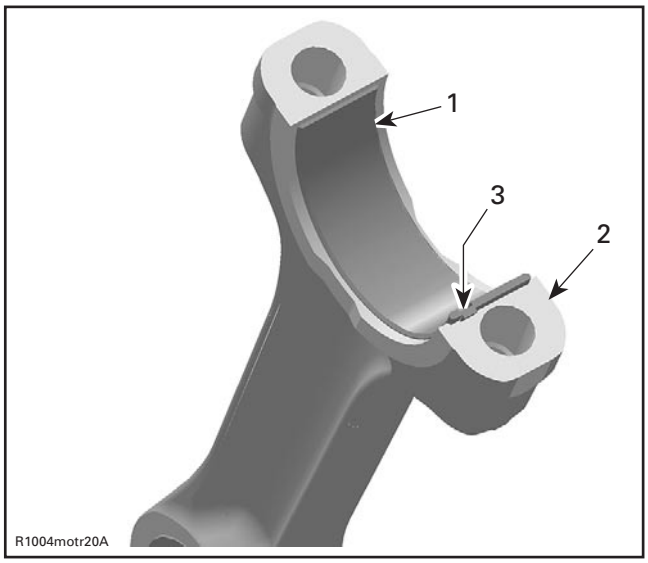
CRANKSHAFT PTO SUPPORT BEARING RADIAL CLEARANCE	
SERVICE LIMIT	0.08 mm (.0031 in)

Installation

For installation, reverse the removal procedure. Pay attention to following details.

NOTE: Use NEW bushings **no. 3**, when connecting rod big end diameter is out of specification.

Put bushings correctly in place and clean the split surface on both sides (cracked area) carefully.



1. Half bushing of connecting rod big end
2. Split surface of the connecting rod
3. Nose of bushing in line with connecting rod groove

NOTE: Oil the plain bearing of the connecting rod before installation.

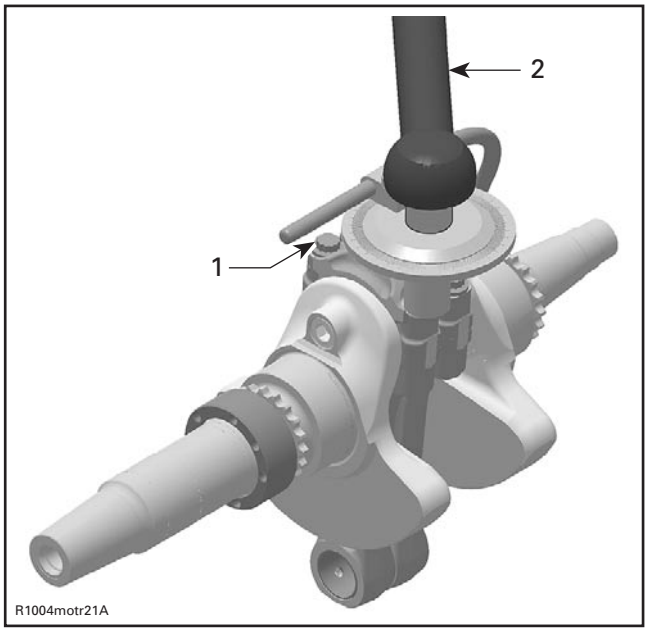
Torque NEW connecting rod screws **no. 4** as per following procedure:

– Torque connecting rod screws to 20 N•m (177 lbf•**in**). Do not apply any thread locker product.
– Torque connecting rod screws to 45 N•m (33 lbf•ft).
– Finish tightening the screws with an additional 90° turn using an angle torque wrench.

CAUTION: Failure to strictly follow this procedure may cause screw to loosen and lead to engine damage. The bushing tapered end must be against the counterweight. Besides, as the "crankpin" screw has been stretched from the previous installation, it is very important to use a new screw at assembly.

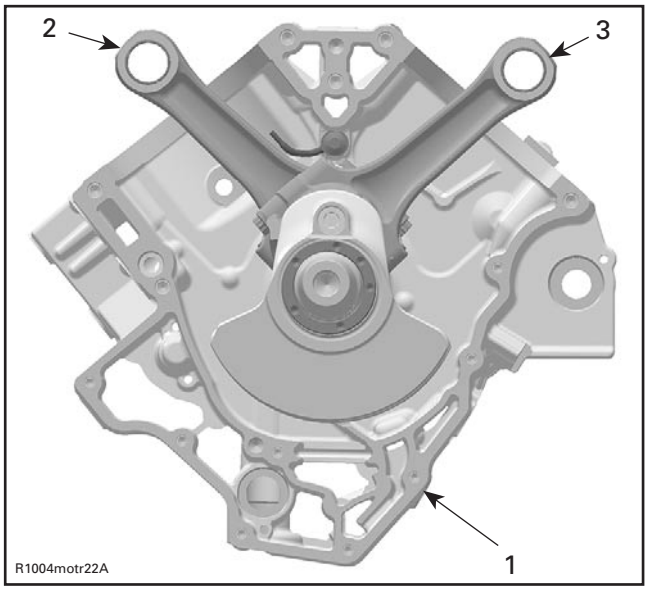
Take care during installation that the connecting rods are not installed with a twist. The running direction of the big end bearings and of the piston pins must not change.

Do not mix up the connecting rods of cylinders 1 and 2 during installation.



1. Connecting rod screws
2. Angle torque wrench

CAUTION: Observe the correct installation position when fitting the crankshaft with the connecting rods. The connecting rod alternator side has to face to cylinder 1.

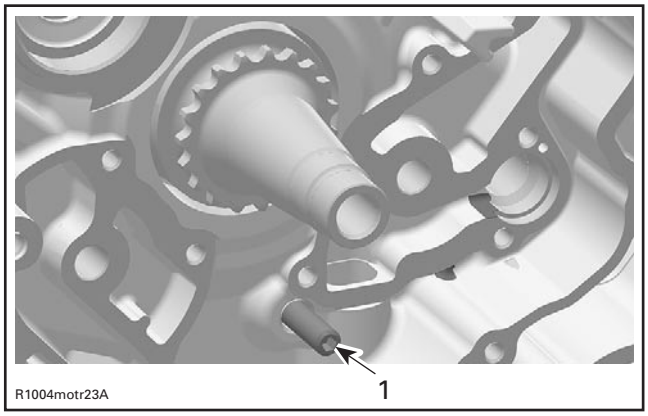


1. Crankcase alternator side
2. Connecting rod cylinder 1
3. Connecting rod cylinder 2

CAUTION: Install crankshaft locking tool (P/N 529 035 900) (refer to CRANKSHAFT LOCKING TOOL) right away to put crankshaft in TDC position before installing the camshaft and rockers (refer to CYLINDER AND CYLINDER HEAD).

CRANKSHAFT LOCKING TOOL

The engine must be locked for removal and installation work on crankshaft and camshaft. The opening for the crankshaft locking tool is located in the ignition cover and in crankcase alternator side.



1. Crankshaft locking tool (P/N 529 035 900)

Removal

Remove:

– plug screw **no. 26**
– plug screw **no. 25**.

CAUTION: Pull out the plug screw with utmost care to prevent it from being dropped into the crankcase during dismantling.

Installation

Fit the plug screw **no. 25** with Loctite 243 (P/N 293 800 060).

Torque plug screw **no. 25** to 8 N•m (71 lbf•**in**).

Replace O-ring **no. 27** during installation and grease it with Molykote 111 (P/N 413 707 000).

Torque plug screw **no. 26** to 3 N•m (26 lbf•**in**).

PISTON

Removal

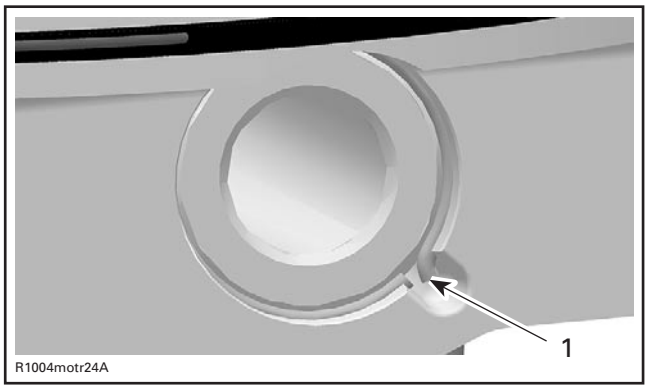
Remove:

– cylinder head (refer to CYLINDER AND CYLINDER HEAD)

– cylinder (refer to CYLINDER AND CYLINDER HEAD).

Place a rag under piston.

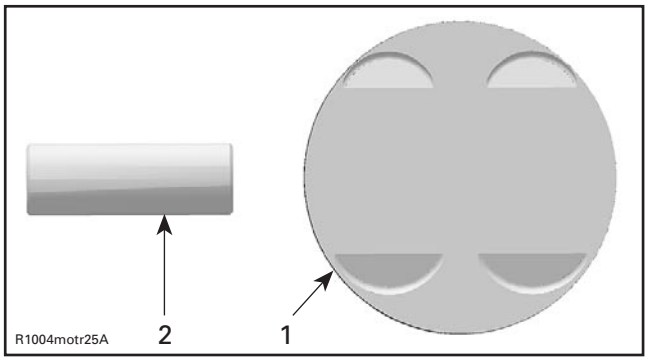
Remove one piston circlip **no. 13** and discard it.



1. Piston circlip

NOTE: The removal of both piston circlips is not necessary to remove piston pin.

Push piston pin **no. 12** out of piston.



1. Piston
2. Piston pin

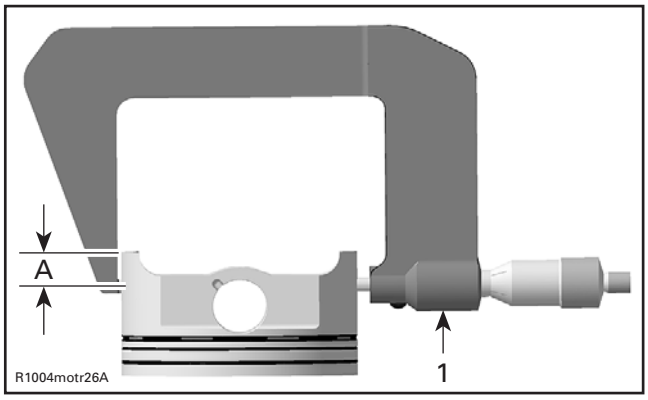
Detach piston **no. 10** from connecting rod.

Inspection

Piston

NOTE: Inspect piston for scoring, cracking or other damages. Replace piston and piston rings if necessary.

Using a micrometer, measure piston at 18 mm (.709 in) perpendicularly (90°) to piston pin.



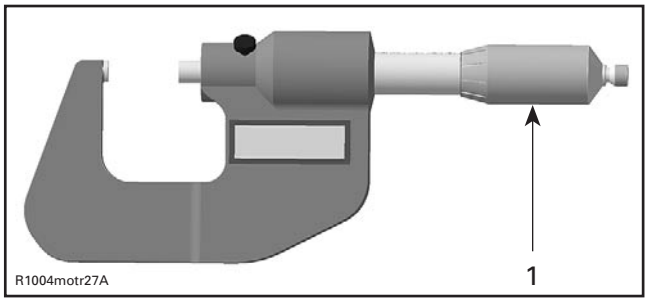
1. Measuring perpendicularly (90°) to piston pin
A. 18 mm (.709 in)

The measurement should be as in the following table. If not, replace piston.

PISTON MEASUREMENT	
NEW NOMINAL	99.951 to 99.969 mm (3.935 to 3.936 in)
SERVICE LIMIT	99.80 mm (3.929 in)

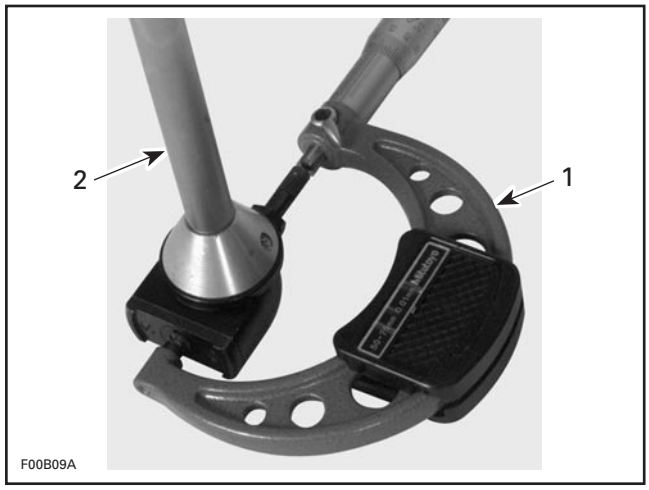
Piston/Cylinder Clearance

Adjust and lock a micrometer to the piston dimension.

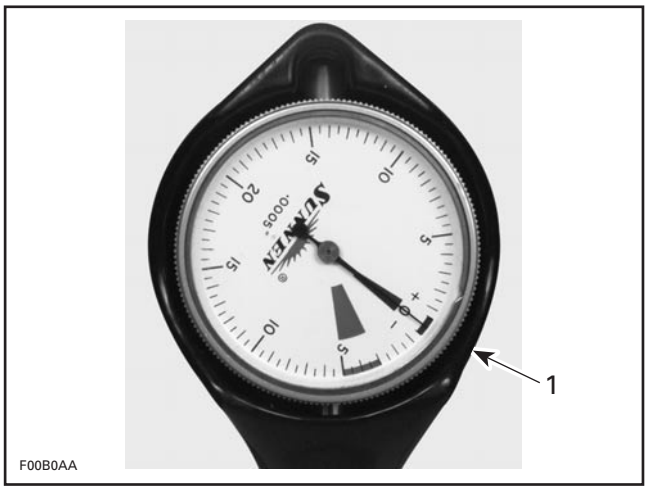


1. Micrometer set to the piston dimension

With the micrometer set to the dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to 0 (zero).



1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



TYPICAL
1. Indicator set to 0 (zero)

Position the dial bore gauge 50 mm (2 in) above cylinder base, measuring perpendicularly (90°) to piston pin axis.

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

PISTON/CYLINDER CLEARANCE	
NEW NOMINAL	0.024 to 0.056 mm (.001 to .002 in)
SERVICE LIMIT	0.090 mm (.004 in)

NOTE: Make sure used piston is not worn. See PISTON MEASUREMENT above.

If clearance exceeds specified tolerance, replace cylinder.

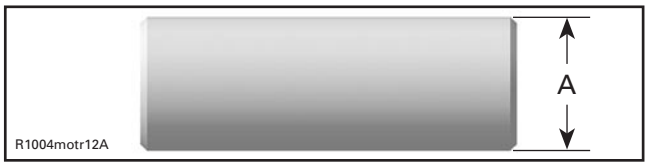
NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

Piston Pin

Using synthetic abrasive woven, clean piston pin from deposits.

Inspect piston pin for scoring, cracking or other damages.

Measure piston pin. See the following illustration for the proper measurement position.



A. Piston pin diameter

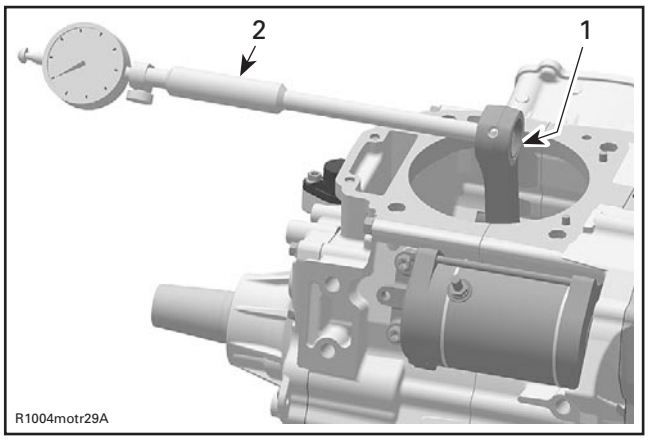
PISTON PIN	
NEW MINIMUM	22.996 mm (.9053 in)
NEW MAXIMUM	23.000 mm (.9055 in)
SERVICE LIMIT	22.990 mm (.9051 in)

NOTE: Replace piston pin if diameter is out of specifications.

Piston Pin/Connecting Rod Bushing Clearance

Measure inside diameter of connecting rod.

CONNECTING ROD SMALL END DIAMETER	
NEW MINIMUM	23.01 mm (.9059 in)
NEW MAXIMUM	23.02 mm (.9063 in)
SERVICE LIMIT	23.07 mm (.908 in)



1. Bushing of the connecting rod
2. Bore gauge

NOTE: Replace connecting rod if diameter of connecting rod small end is out of specifications.

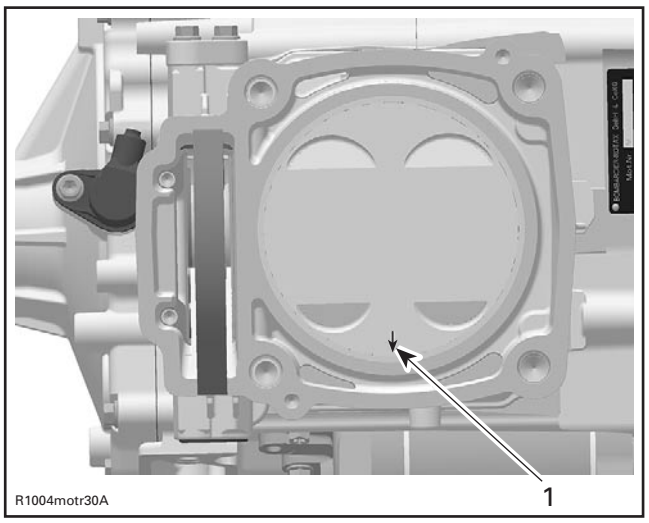
Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Apply engine oil on the piston pin.

Insert piston pin into piston and connecting rod.

CAUTION: Take care that piston will be installed with the punched arrow on piston top to the exhaust side.

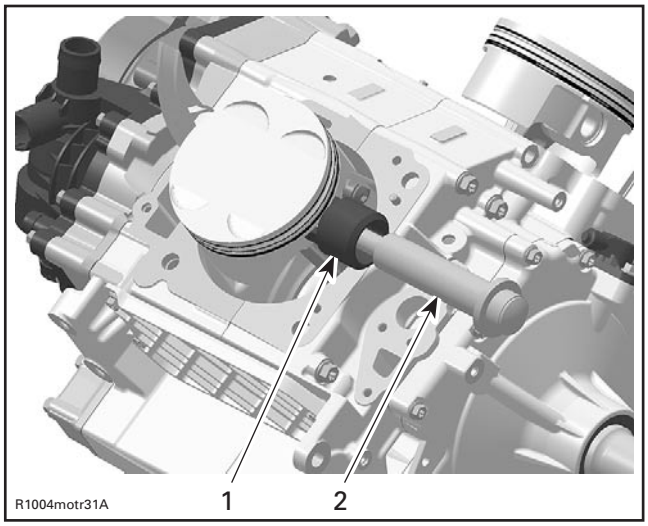


1. Arrow should indicate to the exhaust side

Use the piston circlip installer (P/N 529 035 765) to assemble the piston circlip.

CAUTION: Secure piston pin with new piston circlips.

NOTE: Take care that the hook of the piston circlip is positioned properly.



1. Sleeve with piston circlip inside
2. Assembly jig from piston clip installer

PISTON RINGS

Removal

Remove:

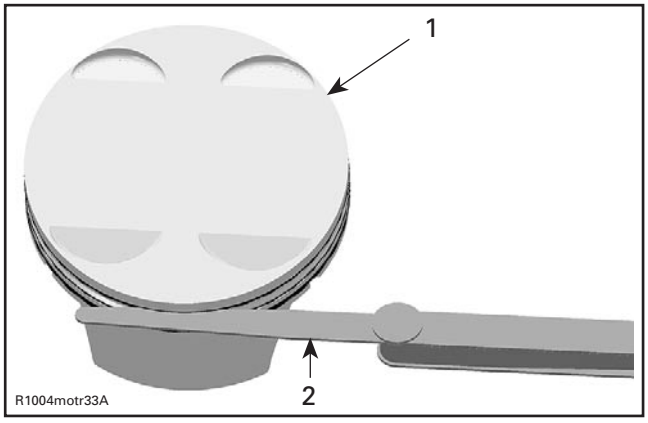
– cylinder head (refer to CYLINDER AND CYLINDER HEAD)
– cylinder (refer to CYLINDER AND CYLINDER HEAD)
– piston pin **no. 12** (refer to PISTON above)
– piston **no. 10**.

Inspection

Ring/Piston Groove Clearance

NOTE: Using a feeler gauge measure each ring/piston groove clearance. If the clearance is too large, the piston and the piston rings should be replaced.

RING/PISTON GROOVE CLEARANCE MM (IN)	
NEW MINIMUM	
UPPER COMPRESSION RING (rectangular)	0.025 mm (.001 in)
LOWER COMPRESSION RING (taper-face)	0.015 mm (.0006 in)
OIL SCRAPER RING	0.020 mm (.0008 in)
NEW MAXIMUM	
UPPER COMPRESSION RING (rectangular)	0.070 mm (.0028 in)
LOWER COMPRESSION RING (taper-face)	0.060 mm (.0024 in)
OIL SCRAPER RING	0.055 mm (.0021 in)
SERVICE LIMIT	
ALL	0.15 mm (.006 in)



1. Piston
2. Feeler gauge

Ring End Gap

RING END GAP	
NEW MINIMUM	
UPPER COMPRESSION RING (rectangular)	0.30 mm (.012 in)
LOWER COMPRESSION RING (taper-face)	0.35 mm (.014 in)
OIL SCRAPER RING	0.35 mm (.014 in)
NEW MAXIMUM	
UPPER COMPRESSION RING (rectangular)	0.50 mm (.020 in)
LOWER COMPRESSION RING (taper-face)	0.55 mm (.022 in)
OIL SCRAPER RING	0.50 mm (.020 in)
SERVICE LIMIT	
ALL	1.5 mm (.059 in)

Measure position for ring end gap in the area of 8 to 16 mm (.315 to .630 in) from top of cylinder.

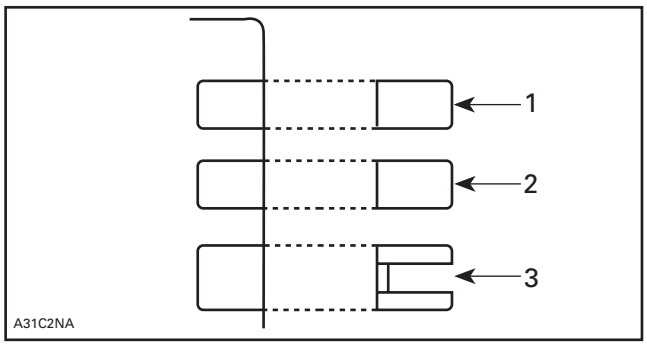
NOTE: In order to correctly position the ring in the cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. Replace ring if gap exceeds above described specified tolerance.

Installation

For installation, reverse the removal procedure. Pay attention to the following details.

NOTE: Install the oil scraper ring first with "O" facing up, then the lower compression (taper-face) ring with the word "TOP" facing up, then the upper compression (rectangular) ring with the word "TOP" facing up.



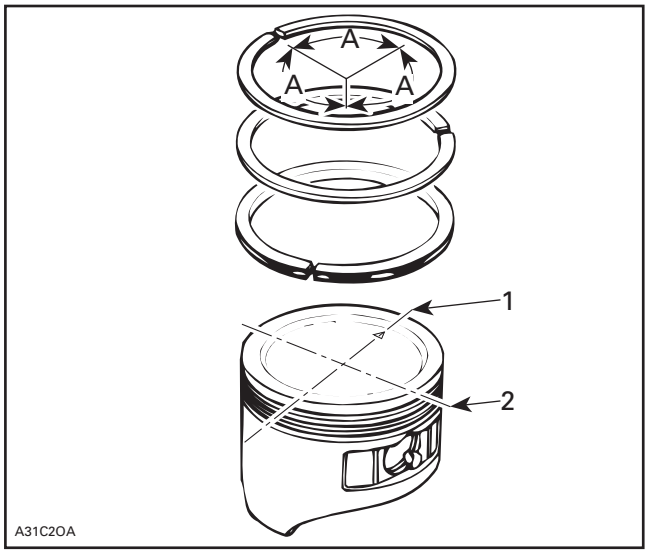
1. Rectangular ring
2. Taper-face ring
3. Oil scraper ring

CAUTION: Ensure that top and second rings are not interchanged.

NOTE: Use a ring expander to prevent breakage during installation. The oil ring must be installed by hand.

Check that rings rotate smoothly after installation.

Space the piston ring end gaps 120° apart and do not align the gaps with the piston pin bore or the thrust side axis.



1. DO NOT align ring gap with piston thrust side axis
2. DO NOT align ring gap with piston pin bore axis
A. 120°

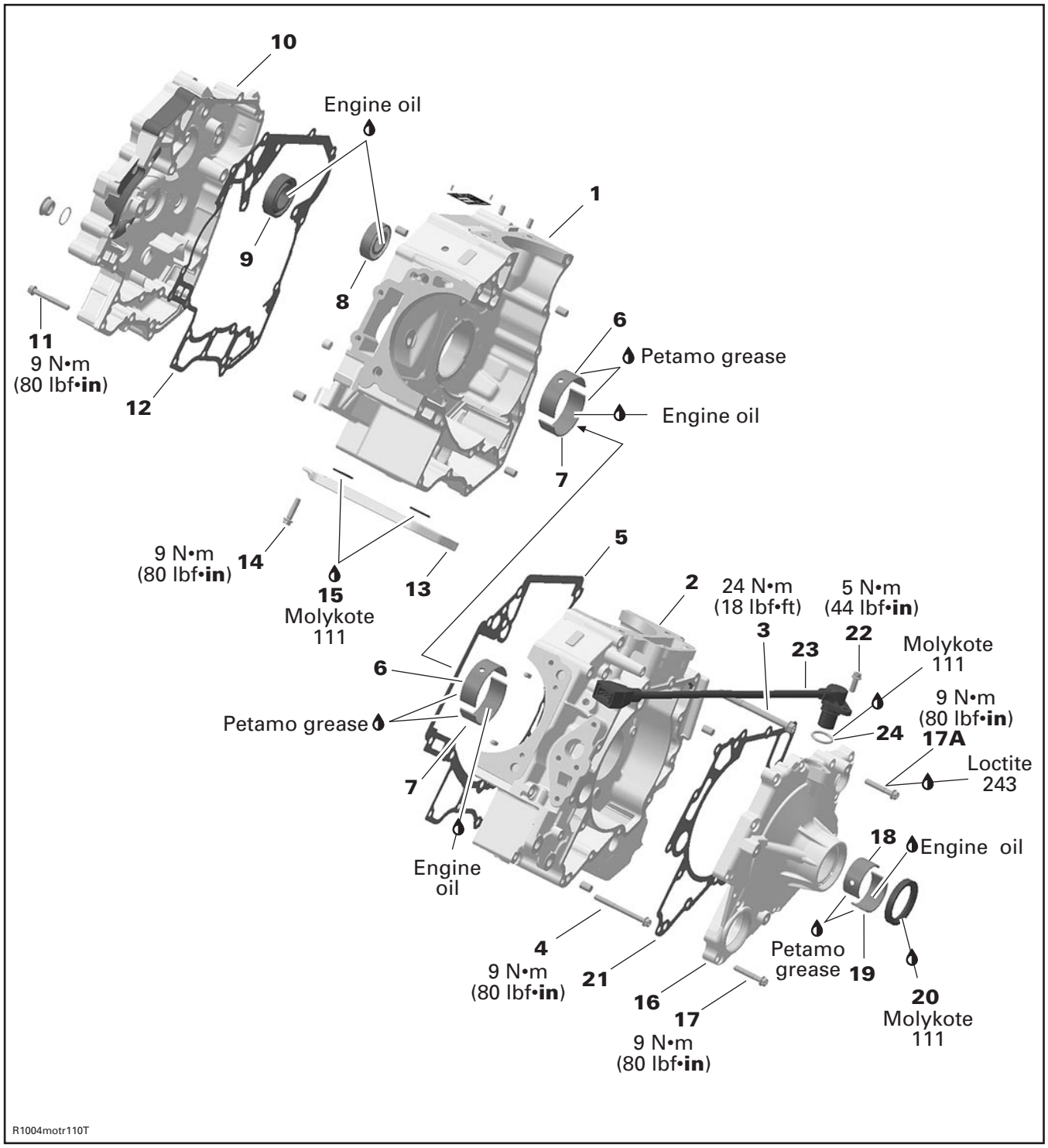
CRANKCASE

SERVICE TOOLS

Description	Part Number	Page
bearing installer/remover	529 035 913	253
bearing installer/remover	529 035 914	250
PTO cover oil seal installer	529 035 910	250
support sleeve	529 035 944	253–254

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 243	293 800 060	251
Molykote 111	413 707 000	255
Petamo grease	420 899 271	250, 253


10
Engine oil
1
9
8
6
Petamo grease
11
9 N•m
(80 lbf•in)
12
Engine oil
7
9 N•m
(80 lbf•in)
14
15
Molykote
111
13
5
2
24 N•m
(18 lbf•ft)
5 N•m
(44 lbf•in)
3
23
22
Molykote
111
6
9 N•m
(80 lbf•in)
Petamo grease
24
17A
Loctite
243
7
18
Engine oil
Engine
oil
4
9 N•m
(80 lbf•in)
21
Petamo
grease
19
16
17
9 N•m
(80 lbf•in)
20
Molykote
111
R1004motr110T

GENERAL

To remove crankcase, the engine removal is necessary.

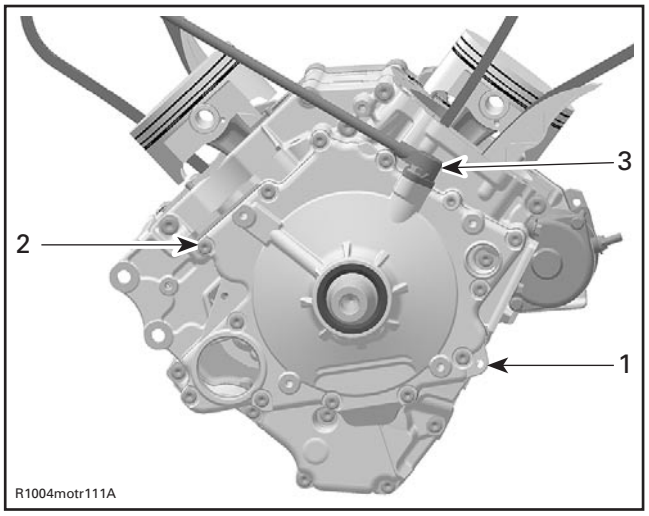
For installation, use the torque values and Loctite products indicated in the exploded view. Clean threads before using Loctite when installing screws.

PTO COVER

Removal

Remove:

– engine from the vehicle (refer to REMOVAL AND INSTALLATION)
– oil tank (refer to LUBRICATION SYSTEM)
– disconnect crankshaft position sensor **no. 23**
– PTO cover screws **no. 17** and **no. 17A** and pull PTO cover **no. 16**.



1. PTO cover
2. PTO cover screws
3. Crankshaft position sensor

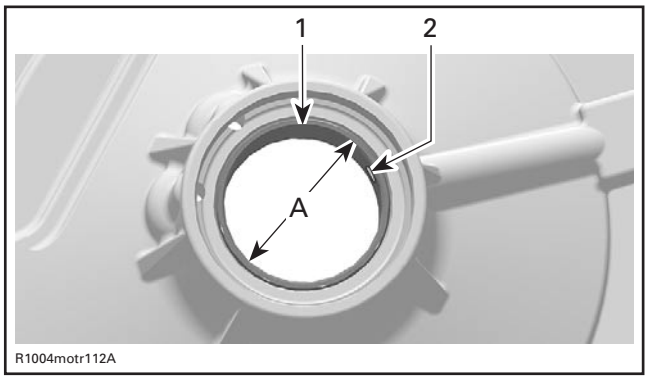
Inspection

Check the PTO cover for cracks or other damage.

Replace PTO cover if damaged.

Check plain bearings **no. 18** and **no. 19** for scorings or other damages.

NOTE: Measure plain bearing inside diameter and compare to crankshaft journal diameter (PTO support bearing). Refer to CRANKSHAFT/DRIVE GEARS. Replace if the measurement is out of specification.



1. Plain bearing
2. Oil bore
A. Plain bearing inside diameter to be measured in area of oil bore

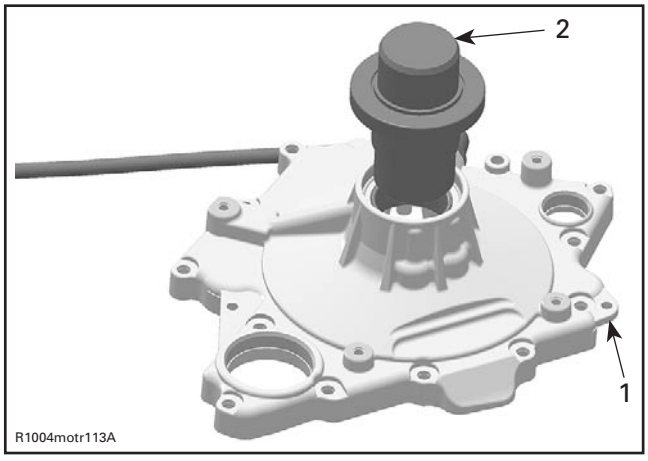
PLAIN BEARING INSIDE DIAMETER (PTO SIDE SUPPORT BEARING)	
Service limit	38.040 mm (1.4976 in)

Bearing Removal Procedure

Carefully remove the oil seal **no. 20** with a screwdriver, without inflicting damage to the PTO cover.

TOOLS P/N TO REMOVE PTO SIDE PLAIN BEARING	
PTO side plain bearing remover	529 035 914

NOTE: Carefully push-out the plain bearings **no. 18** and **no. 19** from the outside towards the inside. The PTO cover has to be supported from below with suitable support with straight surface, in order to prevent damage of the sealing surface.



1. PTO cover
2. Plain bearing remover (P/N 529 035 914)

Bearing Installation Procedure

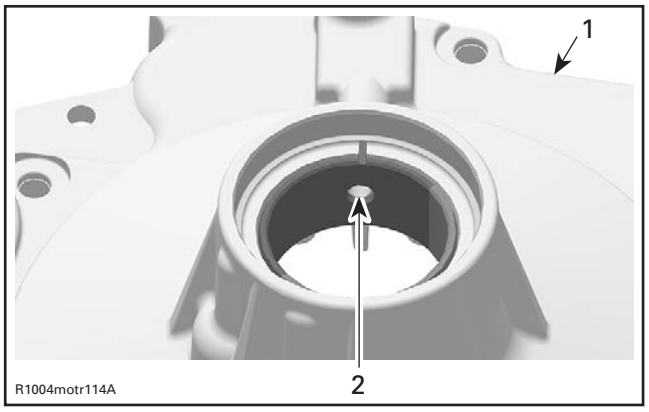
NOTE: Unless otherwise instructed, never use hammer to install plain bearings. Use press machine only.

Install plain bearings with the proper plain bearing installer/remover (P/N 529 035 914).

Fit the plain bearings with Petamo grease (P/N 420 899 271).

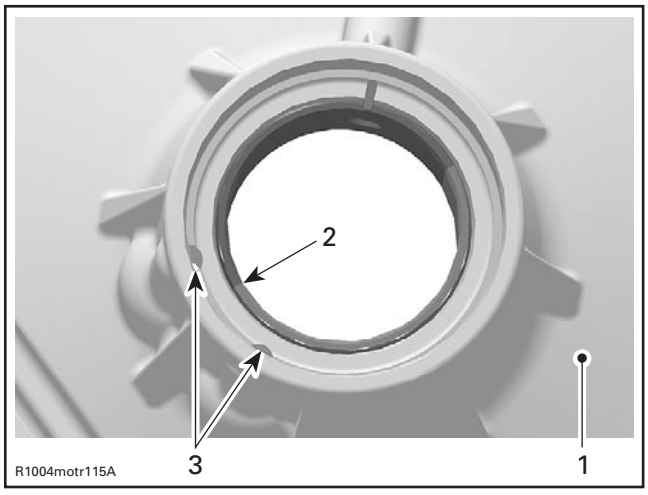
NOTE: Carefully press-in the plain bearings **no. 18** and **no. 19** in the same direction as during disassembly, from the outside towards the inside. Support PTO cover with suitable support with straight surface, in order to prevent damage of the sealing surface.

CAUTION: Mark position of oil bore in plain bearing on crankcase half. Align mark on plain bearing installer/remover with mark on crankcase half. Wrong oil bore position will stop oil supply to plain bearing and will damage the engine.



1. PTO cover
2. Oil bore

CAUTION: The partition of the plain bearings must be positioned between the oil return holes (refer to no. 3 in next illustration) in the PTO cover.

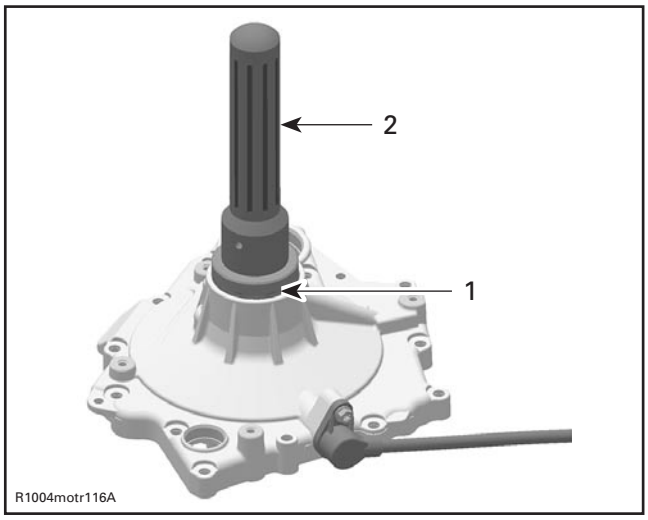


1. PTO cover
2. Partition
3. Oil return holes

Oil Seal Installation Procedure

NOTE: At installation, replace PTO cover oil seal **no. 20**.

Push PTO cover oil seal in place by using the PTO cover oil seal installer (P/N 529 035 910).



1. Oil seal for the PTO cover
2. Oil seal pusher (P/N 529 035 910)

Installation

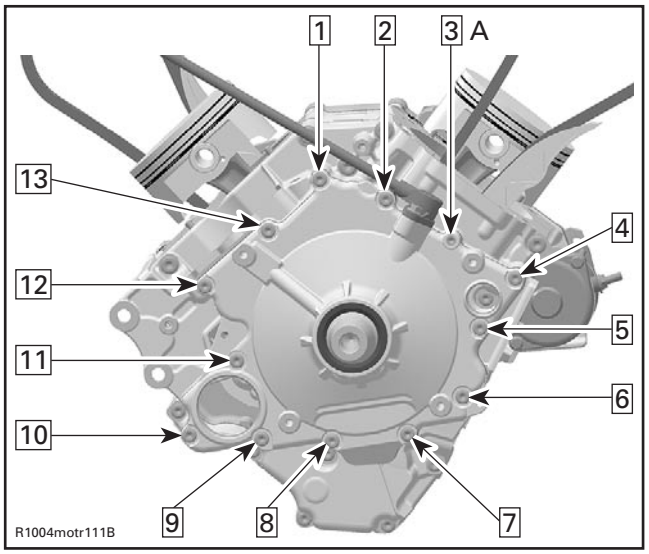
For installation, reverse the removal procedure.

Pay attention to the following details.

NOTE: At installation, replace gasket **no. 21**.

Torque PTO cover screws to 9 N•m (80 lbf•**in**).

Tightening sequence for screws on PTO cover is as per following illustration. Fit the screw **no. 17A** with Loctite 243 (P/N 293 800 060).



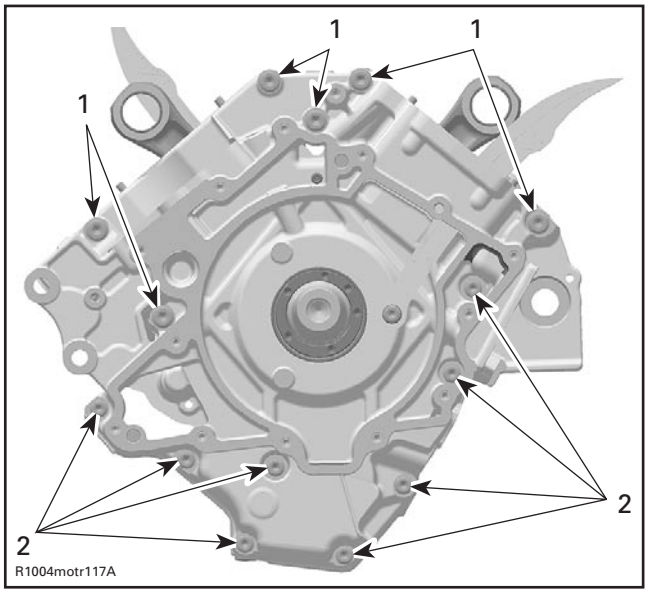
A. Screw 17A with Loctite 243

CRANKCASE

Disassembly

Remove:

– engine from vehicle (refer to REMOVAL AND INSTALLATION)
– oil tank and oil filter housing (refer to LUBRICATION SYSTEM)
– PTO cover (refer to PTO COVER above)
– trigger wheel (refer to CRANKSHAFT/DRIVE GEARS)
– electric starter (refer to ELECTRIC STARTER)
– alternator side cover (refer to COOLING SYSTEM)
– drive gears (refer to CRANKSHAFT/DRIVE GEARS)
– cylinder head and cylinder (refer to CYLINDER AND CYLINDER HEAD)
– timing chains (refer to CRANKSHAFT/DRIVE GEARS)
– cover **no. 13**
– screws **no. 3** and **no. 4** retaining crankcase halves.

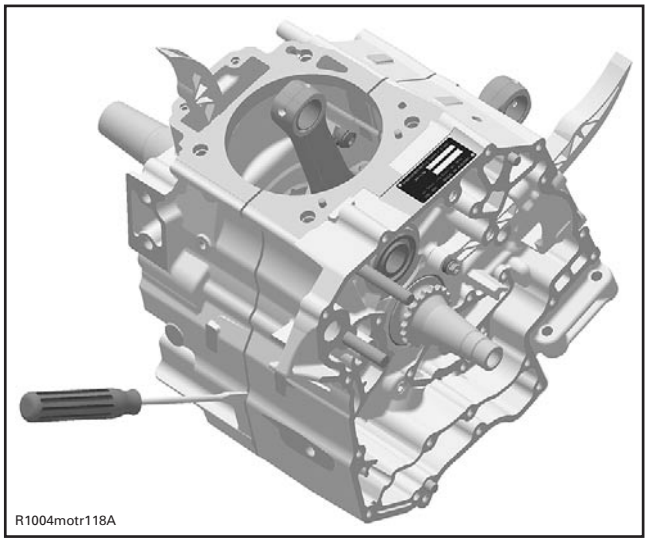


1. Six screws M8 x 90
2. Eight screws M6 x 65

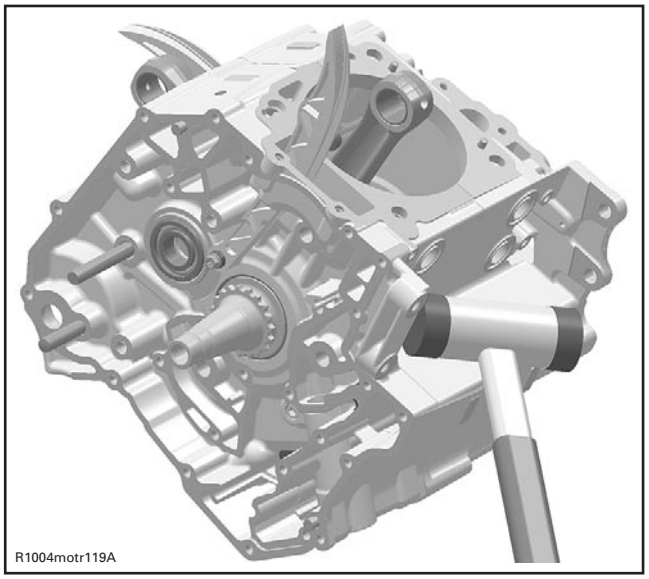
Place the crankcase on a wood stand, PTO side upwards.

Carefully separate crankcase halves by using a screwdriver and a plastic hammer.

NOTE: During disassembly, do not damage the sealing surfaces of the crankcase halves.



POSITION FOR SCREWDRIVER



POSITION FOR PLASTIC HAMMER

Inspection

NOTE: Remove all remaining parts from the crankcase halves; they could get damaged during the repair work.

Clean crankcase halves from contaminations and blow the oil supply lines with compressed air.

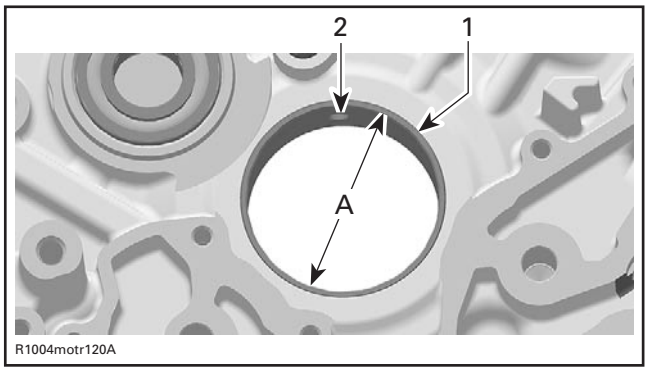
⚠ WARNING

Use safety goggles to avoid eye injuries.

Check bearing **no. 8**, for excessive play and smooth operation. Replace if necessary.

Check plain bearings **no. 6** and **no. 7** for scorings or other damages.

NOTE: Measure plain bearing inside diameter and compare to PTO/alternator side journal diameters (refer to CRANKSHAFT/DRIVE GEARS). Replace if the measurement is out of specification.



1. Plain bearing
2. Oil bore
A. Plain bearing inside diameter to be measured in area of oil bore

PLAIN BEARING INSIDE DIAMETER (ALTERNATOR SIDE)	
Service limit	55.020 mm (2.1661 in)
PLAIN BEARING INSIDE DIAMETER (PTO side)	
Service limit	55.020 mm (2.1661 in)

Bearing Removal Procedure

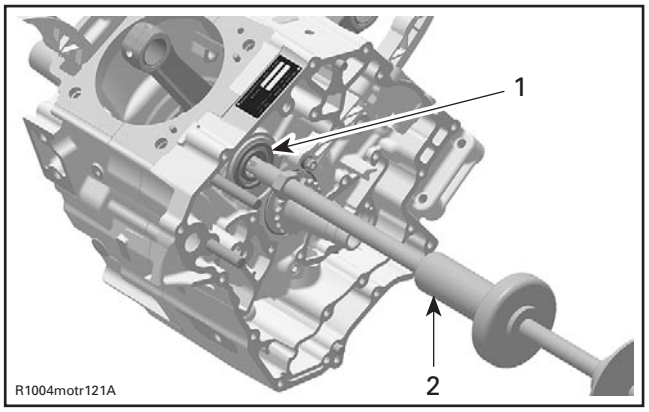
Always heat crankcase half up to 100°C (212°F) before removing ball bearings.

⚠ WARNING

Clean oil, outside and inside of crankcase half before heating it.

CAUTION: Always support crankcase halves properly when ball bearings or plain bearings are removed. Damages to crankcase halves may occur if this procedure is not performed correctly.

The generator gear ball bearing **no. 8** in alternator side crankcase half is removed with a suitable bearing puller (not sold by BRP).



1. Ball bearing
2. Bearing puller

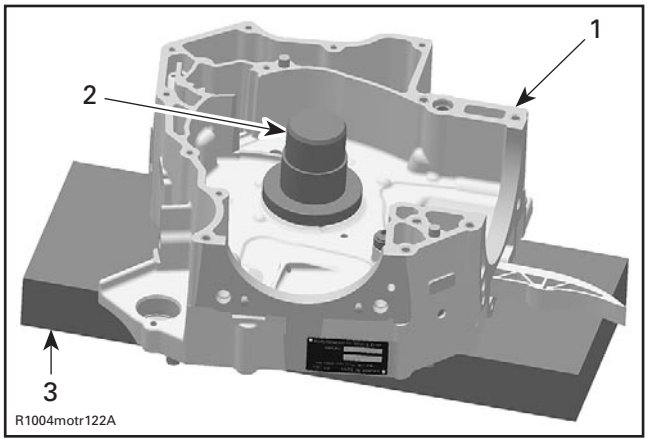
Remove plain bearings **no. 6**, **no. 7**, **no. 18** and **no. 19** with the proper plain bearing installer/remover (P/N 529 035 913).

NOTE: Carefully push the plain bearings out, from the crankcase half inside towards the outside.

NOTE: Place the proper support sleeve (P/N 529 035 944) under PTO crankcase half before removing plain bearings. There is no support sleeve for alternator side crankcase half. To brace the crankcase half, use a suitable wooden block or other support.

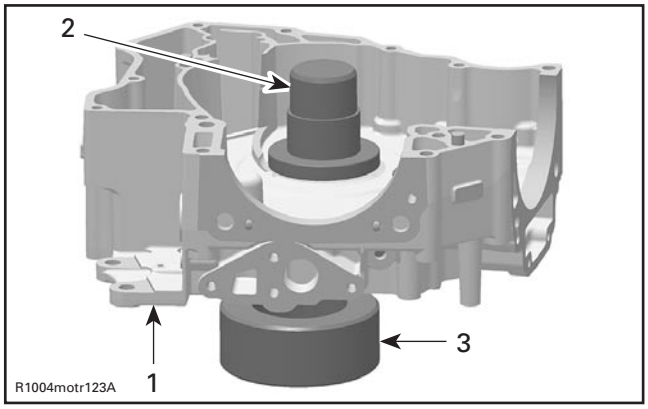
CAUTION: Suitable support sleeve must have straight surface.

During disassembly, make sure not to damage the sealing surfaces of the crankcase halves.



PUSH PLAIN BEARINGS OUTSIDE
1. Crankcase half alternator side
2. Plain bearing remover
3. Wooden block

PLAIN BEARING REMOVER	
Alternator side	529 035 913
PTO side	
SUPPORT SLEEVE	
PTO side	529 035 944



PUSH PLAIN BEARINGS OUTSIDE
1. Crankcase half PTO side
2. Plain bearing remover
3. Support sleeve (P/N 529 035 944)

Bearing Installation Procedure

Unless otherwise instructed, never use hammer to install ball bearings or plain bearings. Use press machine only.

Always heat crankcase half up to 100°C (212°F) before installing ball bearing.

⚠ WARNING

Clean oil, outside and inside of crankcase half before heating it.

NOTE: Place new ball bearing in freezer for 10 minutes before installation.

NOTE: No striking tools are to be used to insert the ball bearing. With moderate (thumb) pressure the bearing has to be mounted manually into the alternator side cover.

Install plain bearings **no. 6**, **no. 7**, **no. 18** and **no. 19** with the proper plain bearing installer/remover (P/N 529 035 913).

Fit the plain bearings with Petamo grease (P/N 420 899 271).

NOTE: Carefully press-in the plain bearings in the same direction as during disassembly, from the case inside towards the outside.

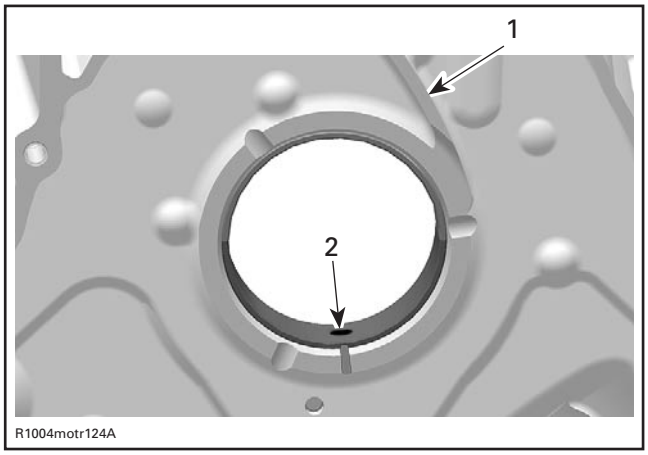
NOTE: Place the proper support sleeve (P/N 529 035 944) under PTO crankcase half before installing the plain bearings. There is no support sleeve for alternator side crankcase half. For bracing of the crankcase half use a suitable wooden block or other support (refer to BEARING REMOVAL PROCEDURE above).

CAUTION: Suitable support sleeve must have straight surface.

During reassembly, make sure not to damage the sealing surfaces of the crankcase halves.

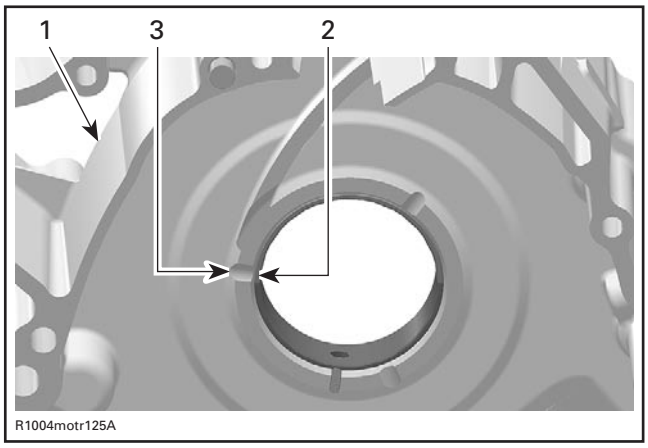
PLAIN BEARING INSTALLER/REMOVER	
Alternator side	529 035 913
PTO side	
SUPPORT SLEEVE	
PTO side	529 035 944

CAUTION: Mark position of oil bore in plain bearing on crankcase half. Align mark on plain bearing installer/remover with mark on crankcase half. Wrong oil bore position will stop oil supply to plain bearing and will damage the engine.



1. Crankcase
2. Oil bore

CAUTION: The partition of the plain bearings must be positioned near the groove (refer to no. 3 in next illustration) of the crankcase.



1. Crankcase
2. Partition
3. Groove

NOTE: Use an O-ring (∅ 55 x 1 to 1.5 mm (.04 to .06 in) thickness) to hold plain bearings in place during installation. The O-ring will disappear in the groove of the plain bearing installer/remover.

Assembly

The assembly of crankcase is essentially the reverse of removal procedure. However, pay attention to the following details.

NOTE: Clean oil passages and make sure they are not clogged.

Clean all metal components in a solvent.

NOTE: At installation, replace gasket **no. 5**.

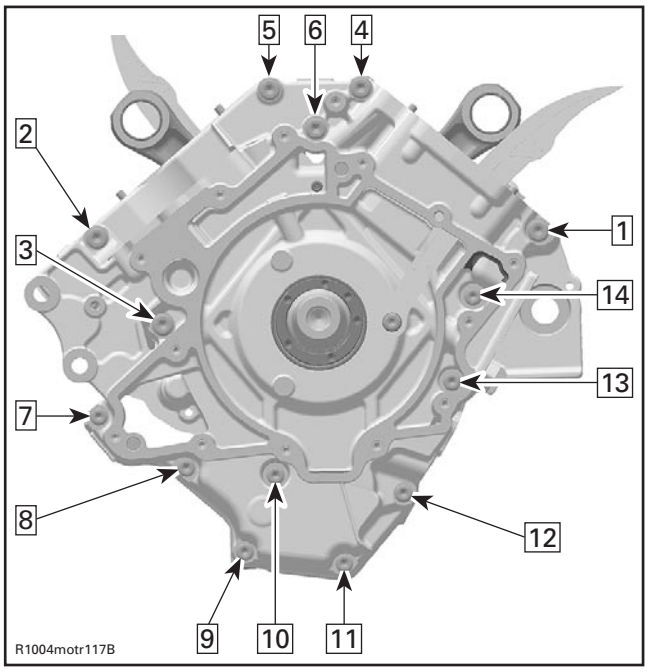
NOTE: Oil the plain bearings before mounting the crankshaft.

Reinstall all other parts (refer to LUBRICATION SYSTEM).

Torque screws **no. 4** M6 x 65 to 9 N•m (80 lbf•**in**).

Torque screws **no. 3** M8 x 90 to 24 N•m (18 lbf•ft).

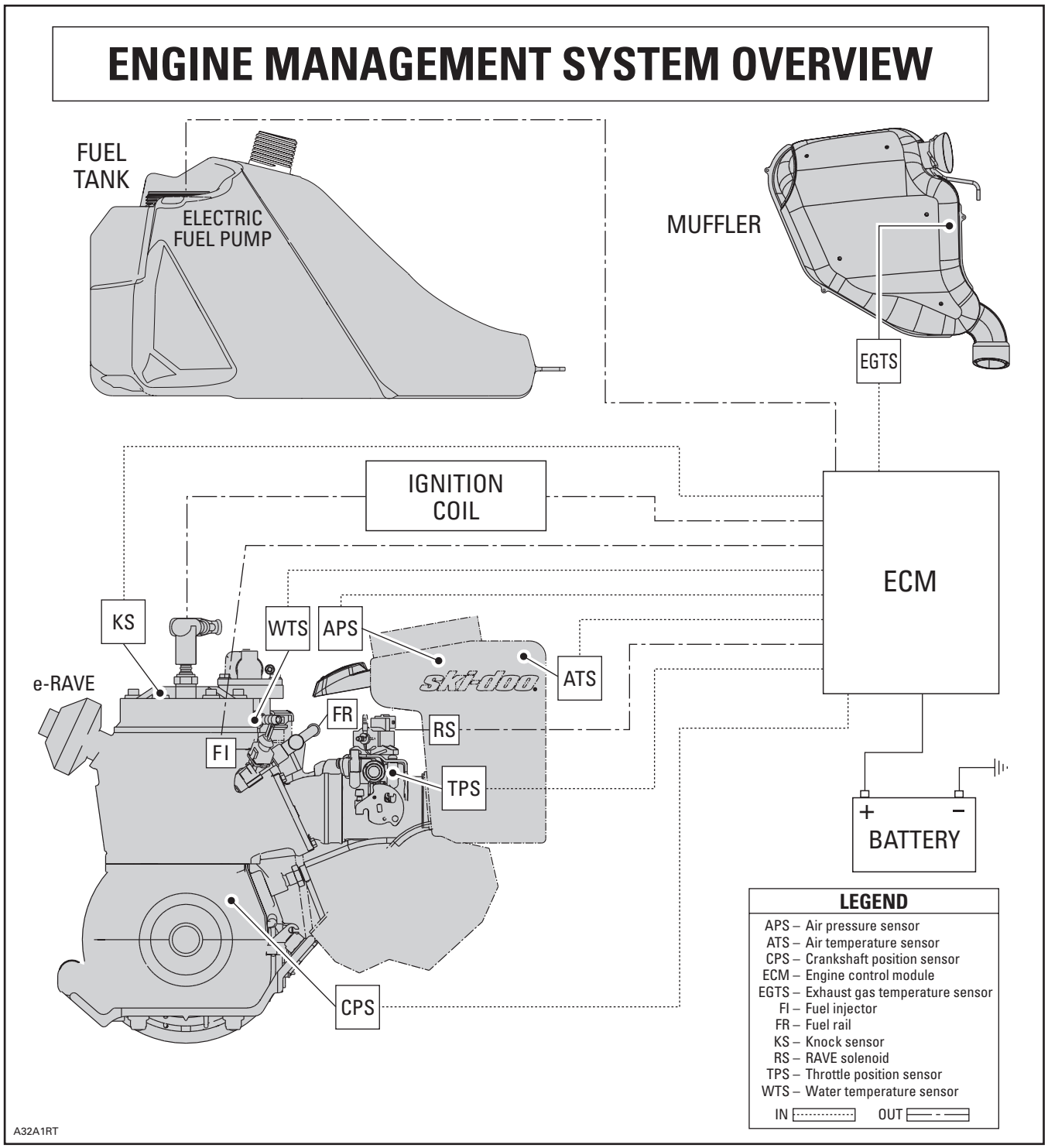
Tightening sequence for screws on crankcase is as per following illustration.



NOTE: At installation, replace gasket rings no. 15.

Slightly grease the gasket rings no. 15 before assembly using Molykote 111 (P/N 413 707 000). Torque cover screws no. 14 to 9 N•m (80 lbf•**in**).

OVERVIEW

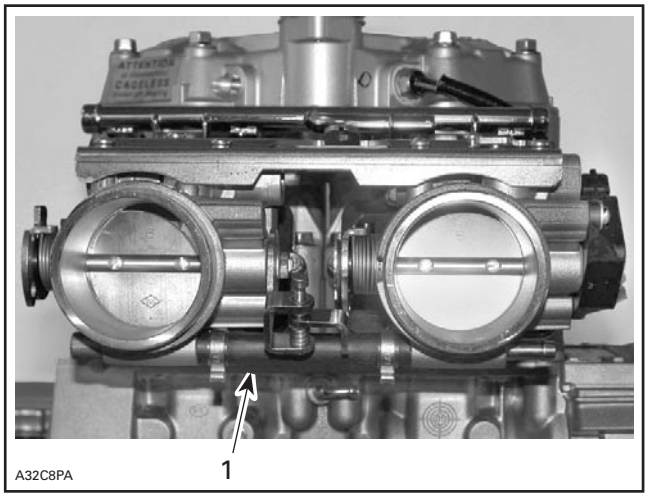

ENGINE MANAGEMENT SYSTEM OVERVIEW
FUEL TANK
ELECTRIC FUEL PUMP
MUFFLER
EGTS
IGNITION COIL
ECM
KS
WTS
APS
ATS
e-RAVE
FR
RS
FI
TPS
CPS
+
–
BATTERY
LEGEND
APS – Air pressure sensor
ATS – Air temperature sensor
CPS – Crankshaft position sensor
ECM – Engine control module
EGTS – Exhaust gas temperature sensor
FI – Fuel injector
FR – Fuel rail
KS – Knock sensor
RS – RAVE solenoid
TPS – Throttle position sensor
WTS – Water temperature sensor
IN
OUT
A32A1RT

OPERATING PRINCIPLE

For this SDI 2-stroke engine, a highly advanced engine management system (EMS) has been used to ensure a high power output combined with cleanest combustion. An ECM (Engine Control Module) calculates the proper air/fuel mixture and ignition timing for each cylinder separately. The fuel is injected into the transfer port of each cylinder.

AIR INDUCTION

Through air filters mounted on dash, air goes into air silencer. The ECM measures at this point air pressure and temperature. Then, air for combustion is drawn through two throttle bodies. The air flow is controlled by two throttle plates. The air continues through the reed valves into the cylinder base then the crankcase.



THROTTLE BODY ASSEMBLY
1. Coolant-heated line

FUEL DELIVERY SYSTEM

GENERAL

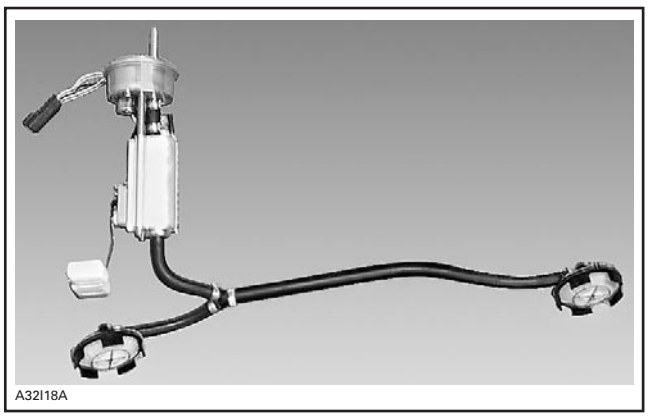
When the piston reaches the correct position, the ECM opens the fuel injectors and fuel is discharged into the transfer ports of cylinders. This air/fuel mixture is then ignited by the spark plug.

COMPONENT DESCRIPTION

Fuel Pump and Fuel Pressure Regulator

They provide fuel pressure and flow rate to the system.

The fuel pump module is located inside the fuel tank. The module includes the fuel pump and the fuel level sensor.



The fuel pressure regulator controls the pressure in the system and allows the excess of fuel to return to the fuel tank. The fuel pressure regulator regulates the fuel pressure at approximately 400 kPa (58 PSI).

Fuel Rail

The fuel rail is a small tube on which the four injectors are mounted. It ensures at all times that enough fuel at the right pressure can be delivered to the fuel injectors. The fuel rail is fed by the fuel pump with a fuel pressure of approximately 400 kPa (58 PSI).

Fuel Injectors

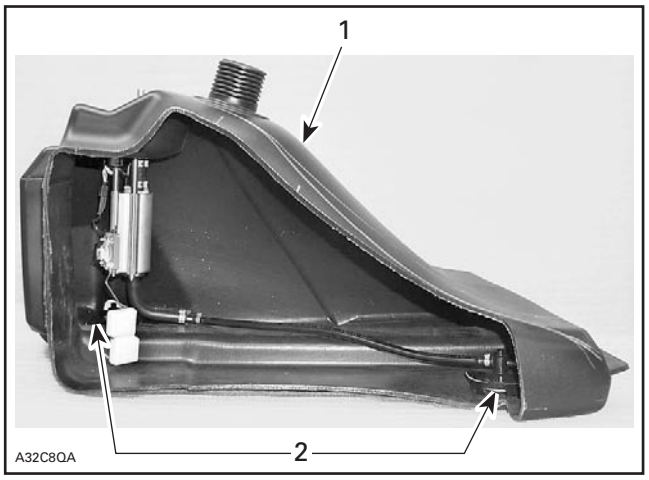
Fuel injectors (two per cylinder) are used to inject fuel into the transfer port of cylinder.

Throttle Body

It is a dual throttle body mounted on the engine intake side. Fitted on this dual throttle body, there is a TPS (Throttle Position Sensor) that sends information to the ECM.

Fuel Pickups

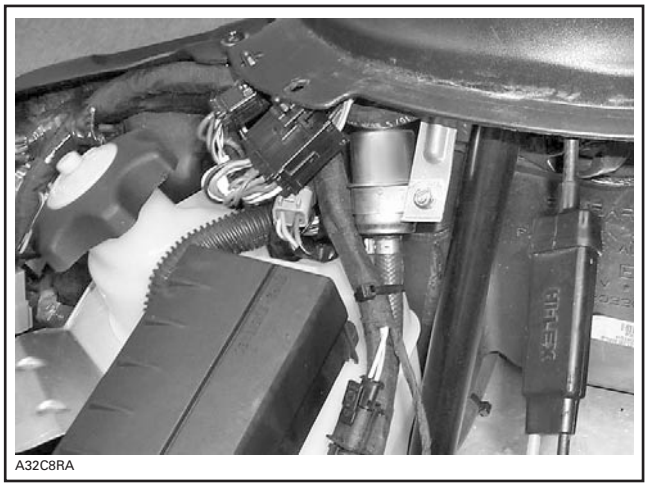
The two fuel pickups come with 70 micron filter. One is located at the front right side of the fuel tank and the other at the rear left side.



1. Fuel tank
2. Fuel pickups

In-Line Fuel Filter

The in-line 10 micron fuel filter is fastened under the steering console. It comes as a complete assembly.



ENGINE MANAGEMENT SYSTEM (EMS)

The EMS (Engine Management System) is equipped with an ECM which controls the ignition system, the vehicle electrical system, the fuel injection system and the electronically controlled RAVE.

TYPICAL — ECM

The ECM is directly powered by the battery. It is responsible for the following engine management/electrical functions:

– interpreting information
– distributing information
– start/stop function
– DESS (Digitally Encoded Security System)
– ignition control
– injection control

NOTE: The ECM applies the proper maps (injection and ignition) for optimum engine operation in all conditions.

– engine RPM limiter
– RER (Rotax Electronic Reverse)
– etc.

The ECM features a permanent memory that will keep the programmed tether cord cap(s) active, fault codes and other vehicle information, even when the battery is removed from the vehicle.

EMS — GENERAL FUNCTIONS

Automatic Power Shut-Down

The ECM is equipped with an automatic power shut-down. This feature prevents the battery from losing its charge if the tether cord cap is left on the post when the engine is not running for more then 30 seconds. The ECM will remain offline until the electric starter or the rewind starter is activated. The ECM will shut down all outputs after 5 seconds when the tether cord cap is removed.

Antidrive Feature

This system allows the engine to reach pulley engagement speed only if a programmed tether cord cap is installed on DESS post. See below for details.

Digitally Encoded Security System (DESS)

The following components are specially designed for this system: ECM, tether cord cap and DESS post.

The tether cord cap contains a magnet and a ROM chip. The magnet actually closes the reed switch inside the post which is the equivalent of a mechanical ON/OFF switch. The chip has a unique digital code.

NOTE: Actually, it is the memory of the ECM which is programmed to recognize the digital code of the tether cord cap. This is achieved with the VCK (Vehicle Communication Kit P/N 529 035 981). Refer to the HELP menu to program a tether cord cap.

The system is quite flexible. Up to 8 tether cord caps may be programmed in the memory of the vehicle ECM. They can also be erased individually.

NOTE: If desired, a tether cord cap can be used on other vehicle equipped with the DESS. It only needs to be programmed for that vehicle.

When waking up the ECM with a tether cord cap on the post, the DESS is activated and will emit audible signals:

– 2 short beeps indicate a working tether cord cap. Engine starting can take place.
– 1 short beep indicates a wrong tether cord cap is being used or that something is defective. Engine starting is not allowed.

The memory of the ECM features two self-diagnostic modes for the DESS operation. Refer to DIAGNOSTIC PROCEDURES section for more information.

The memory of the ECM is permanent. If the battery is disconnected, no information is lost.

Note that the DESS anti-drive circuitry is already activated on all new ECMs.

Gauges Current Supply

The purpose of this function is to allow reading of gauges without the engine running. It will give access to most functions of the information center gauge without starting the engine.

Gauges are supplied with current for 30 seconds when connecting the tether cord cap on its post and pressing the START/RER switch.

NOTE: Each time the tether cord cap is connected to the post, the fuel pump is activated for 2 seconds to build up pressure in the fuel injection system.

Engine Starting

If the ECM recognizes a valid tether cord cap, it allows engine to rev above 3000 RPM.

If the tether cord cap is left on the DESS post for more than 30 seconds after stopping the engine, the ECM will shut down. The current supply to gauges will be stopped as explained in the ANTIDRIVE FEATURE section.

Engine RPM Limiter

The ECM will limit the maximum engine speed.

Low-Oil Level Warning Device

When the oil falls under a certain level, the low oil level LED will be illuminated. The buzzer will also be activated intermittently.

High Coolant Temperature Warning Device

When the coolant temperature is getting to high, the ECM sends out signals to the buzzer, the high temperature LED and to the check engine LED.

High Muffler Temperature Warning Device

When the muffler temperature is getting to high, the ECM will extend the injection period temporarily, until the temperature of the muffler will decrease.

If the temperature still increases, the high temperature LED will be illuminated and further the ECM will limit the engine speed to maximum 5250 RPM.

Power Distribution

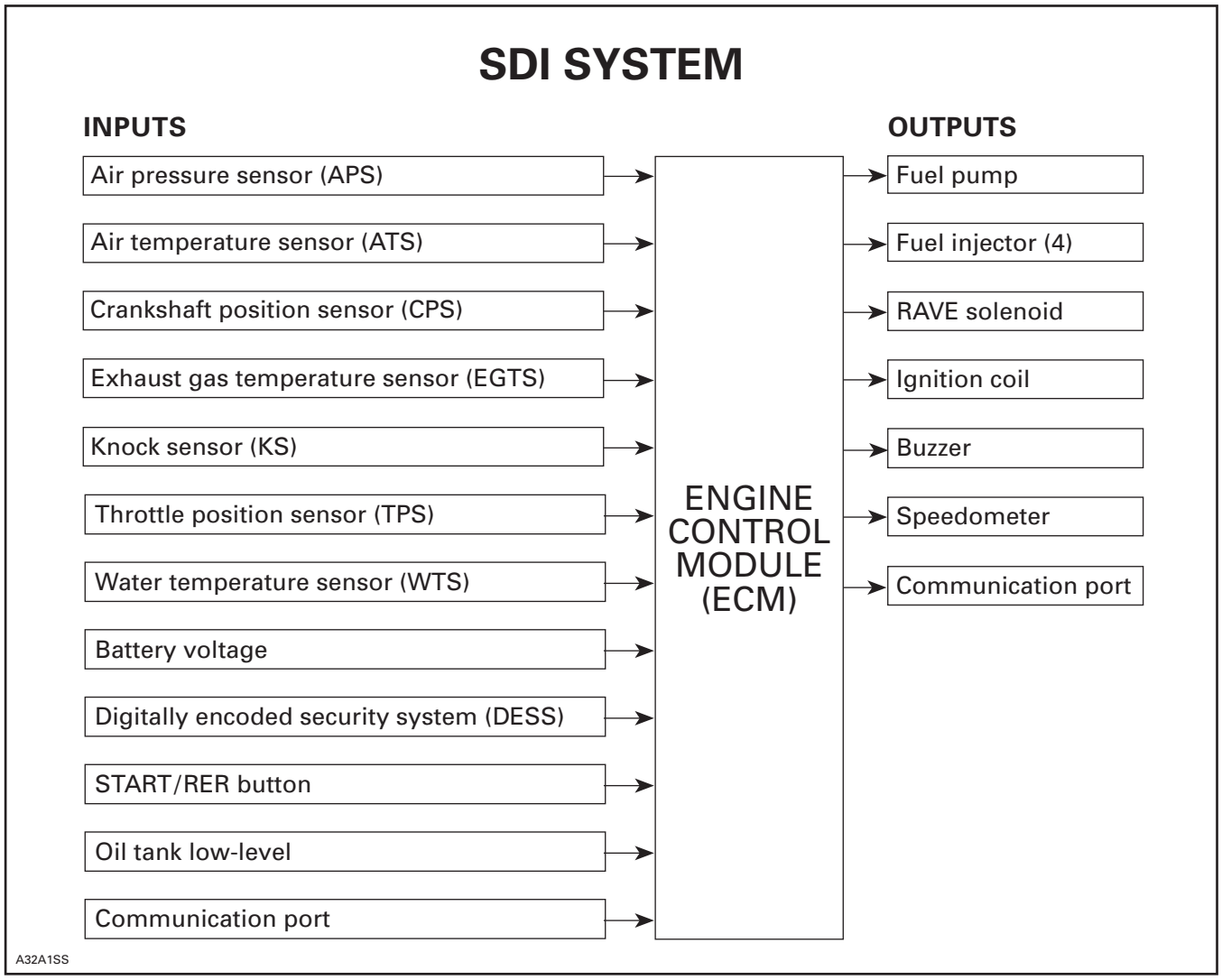
The ECM distributes power from battery to all accessories. Accessories are protected by fuses located in the fuse holder. Fuses are identified besides their holder.

IMPORTANT: The sensors and injectors are continuously powered with the supply from the battery. **The ECM switches the ground to complete the electrical circuits it controls.** Take this into account when troubleshooting the electrical system.

The system uses 3 relays: a main relay, a second for the headlights and a third for the accessories.

If a problem occurs with the magneto system, the ECM will turn off the accessories relay to distribute the remaining voltage to the main systems.

EMS — ENGINE MANAGEMENT SYSTEM FUNCTIONS



This engine management system controls the fuel injection, the ignition timing and the electronically controlled RAVE.

As shown in the ENGINE MANAGEMENT SYSTEM FUNCTIONS illustration, the ECM is the central point of the fuel injection system. It reads the inputs, makes computations, uses pre-determined parameters and sends the proper signals to the outputs for proper engine management.

The ECM also stores the fault codes and general information such as: operating conditions, vehicle hours, serial numbers, customer and maintenance information.

ELECTRONIC FUEL INJECTION

The ECM receives the signals from different sensors which indicate engine operating conditions at milli-second intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS and TPS are the primary sensors used to control the injection and ignition timing. Other sensors are used for secondary input.

IGNITION TIMING

The ECM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the ECM controls the ignition timing for optimum engine operation.

ELECTRONICALLY CONTROLLED RAVE

The electronically controlled RAVE (e-RAVE) offers two performance enhancements to conventional RAVE system.

– The opening of the valve is now activated electronically. A solenoid holds the valve closed. The ECM monitors altitude, engine temperature, throttle position and RPM, and operates the solenoid in optimal conditions.
– The valve is now opened by crankcase pressure, as opposed to exhaust pressure. The greater and more constant pressure from the crankcase opens the valve more crisply.

NOTE: An electric heating element has been added to the RAVE solenoid to ensure proper function in very cold weather.

KNOCK SENSOR

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation. If detonation occurs, the knock sensor detects it and the ECMs retards the ignition advance and extend the injection period temporarily (it goes in a specific mode) until detonation stops.

ENGINE MODES OF OPERATION

The ECM controls different operation modes of the engine to allow proper operation for all possible conditions: Cranking, start up, idle, warm up, normal operation, engine speed limiter, flooded engine and limp home (see below).

FLOODED ENGINE (DROWNED MODE)

If the engine does not start and it is fuel-flooded, this special mode can be activated to prevent fuel injection and ignition while cranking. Proceed as follows:

With tether cord cap on its post while engine is stopped, press completely and HOLD throttle lever.

Press the START/RER button. The mode is now on.

The engine should be cranked for 20 seconds.

NOTE: No spark occurs on drowned mode.

Release START/RER button and throttle lever. Try to start the engine normally.

If the engine does not start, it may be necessary to remove the spark plugs and crank the engine with rags over spark plug holes. Refer to COMPONENT INSPECTION AND ADJUSTMENT.

MONITORING SYSTEM

The ECM monitors the electronic components of the fuel injection system and some components of the electrical system.

When a fault occurs, it sends visual messages through the referring LED and/or audible signals through a buzzer to inform you of a particular condition. Refer to the DIAGNOSTIC PROCEDURES section for the referring LED and the buzzer coded signals chart.

LIMP HOME MODES

Besides the signals as seen above, the ECM may automatically set default parameters to the engine management to ensure the adequate operation of the vehicle if a component of the fuel injection system is not operating properly.

NOTE: Sensor failures will not lead to a limp home mode, warning will follow by the check engine LED and the buzzer.

When minor fault occurs, the fault and message/buzzer will disappear automatically, when the condition disappears.

Depending on the severity of the malfunction, the vehicle speed may be reduced and not allowed to reach its usual top speed.

The engine RPM may be limited if some critical components fail. In this case, releasing throttle and letting the engine returning to idle speed may allow normal operation to come back. If does not work, try removing and reinstalling the tether cord cap on DESS post.

These performance-reduced modes allow the rider to go back home which would not be possible without this advanced system. Refer to the DIAGNOSTIC PROCEDURES for a complete chart.

If a fault occurs and involves a limp home mode operation, the engine management system will reduce engine RPM gradually to the proper level.

DIAGNOSTIC MODE

The malfunctions are recorded in the memory of the ECM. The memory of the ECM can be checked using the VCK (Vehicle Communication Kit) (P/N 529 035 981) to see the fault codes. Refer to the DIAGNOSTIC PROCEDURES section.

The B.U.D.S. software must be used for this system (always use the latest software version).

CHARGING SYSTEM

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

The magneto has a 3 phases, delta wound stator on 18 poles. Capacity is 480 watts.

Unregulated AC current is rectified and regulated between 13.4 and 15 volts for the vehicle electrical system.

Vehicle 12-volt battery supplies the ECM with DC current.

Refer to MAGNETO SYSTEM.

IGNITION SYSTEM

The following type of ignition system is used:

– Digital Inductive System.

DOUBLE IGNITION COIL

Double ignition coil has two separate windings, one for each spark plug.

Ignition coil induces voltage to a high level in the secondary windings to produce a spark at the spark plug.

Two separate windings receive input from the ECM. Each winding provides high voltage to its corresponding spark plug.

This ignition system allows spark plugs to spark independently.

CAUTION: Do not interchange spark plug cables. Match reference (PTO or MAG printed on high tension cable yellow tag) with corresponding cylinder spark plug.

Double ignition coil is located underneath air silencer.

TRIGGER COIL

Trigger coil is used for:

1) Forward engine rotation.
2) Reverse engine rotation.
3) As a crankshaft position sensor (CPS). This information is sent to the ECM.

DIAGNOSTIC PROCEDURE

SERVICE TOOLS

Description	Part Number	Page
GRAY diagnostic key	529 035 896	267
supply cable	529 035 869	267
VCK (Vehicle Communication Kit)	529 035 981	266

GENERAL

Here is the basic order suggested to diagnose a suspected engine management or fuel injection related problem:

- Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.
- Check if the engine management system (EMS) pilot lamp lights up. If so, use the VCK (Vehicle Communication Kit) and look for fault codes to diagnose the trouble.
- Check all fuses.
- Check fuel pressure.
- Check spark plugs condition.
- Check all connections of the wiring harness.

Refer to COMPONENT INSPECTION AND ADJUSTMENT section for procedures.

TROUBLESHOOTING

The following chart is provided to help in diagnosing the probable source of simple troubles.

Monitoring Beeper Coded Signals

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
2 short beeps (when engine is started). DESS/RER pilot lamp also blinks.	Confirms that proper tether cord cap is installed. Engine can rev above clutch engagement.	No problem detected. Good ride.
1 short beep every 1.5 seconds (when engine is started). DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Bad DESS system connection. Defective tether cord cap. Dirt or snow in tether cord cap. Defective DESS post.	Reinstall tether cord cap correctly over post. Use another programmed tether cord cap. Clean tether cord cap. Replace DESS post.
1 long beep per second.	Reverse is selected.	Vehicle can be driven in reverse.
3 short beeps per second. DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Wrong tether cord cap is installed.	Install proper tether cord cap. Program key into ECM.
3 short beeps per second. Engine overheating pilot lamp also blinks.	Engine is overheating.	Stop engine immediately and allow to cool. Check cooling system.
3 short beeps per second.	Low battery voltage.	Check battery and charging system.
4 short beeps every 2 minutes. Oil pilot lamp also lights up.	Low oil level on 2-TEC models.	Check oil level and replenish as soon as possible.
Battery pilot lamp lights up.	No charging.	Check battery and charging system.

Many other codes use the engine pilot lamp and the buzzer to indicate a problem. A complete list of codes is available in B.U.D.S.

VCK (VEHICLE COMMUNICATION KIT)

The VCK (Vehicle Communication Kit) (P/N 529 035 981) is the primary tool to diagnose engine management and fuel injection related problems.

NOTE: The MPEM programmer does not work on **SDI models**.

The **SDI models** require B.U.D.S. version G2.1 or P2.1 or above.

B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow actuators, sensors and electronic equipments inspection, diagnostic options and reset such as the closed throttle and idle actuator.

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

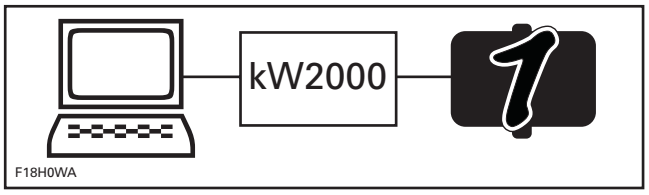
⚠ WARNING

If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

IMPORTANT: When using the software B.U.D.S., with the **SDI engine**, ensure that the protocol "kW2000" is properly selected in **"MPI"** (multi protocol interface) under "CHOOSE PROTOCOL".

When B.U.D.S. is connected to the vehicle, the status bar shows the protocol (kW2000) and the number 1 to the right. To communicate with the ECM, number 1 must be displayed.

Number 1 means that one module is connected.



ONE MODULE IS CONNECTED

If an "X" is shown, this means that no communication between the MPI and the ECM is possible. In this case possible causes are:

- ECM is not powered-up
- wrong protocol is used
- bad connection between MPI and module.

ECM Supply

To power-up the ECM, push the START button shortly while the engine cut-out switch is depressed and the tether cord cap installed on DESS post. If your intention is to program the vehicle key, use GRAY diagnostic key (P/N 529 035 896) on DESS post.

The supply cable (P/N 529 035 869) may also be used. Just the fact to connect it between MPI and vehicle will power-up the ECM.

VCK Supply

The VCK (MPI box) can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

Writing in ECM

When writing in ECM through B.U.D.S., there will be an "EMS Tracking" message that will say "Remove key from vehicle". When this occurs, remove the tether cord cap from its post and wait until the message disappears (it lasts approximately 15 seconds after tether cord cap removal).

2-TEC SYSTEM FAULT CODES

General

The faults registered in the ECM (engine control module) are kept when the battery is disconnected.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. This will properly reset the appropriate counter(s). This will also record that the problem has been fixed in the ECM memory.

Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the code faults (state, count, first, etc.) and report, refer to B.U.D.S. online help.

Supplemental Information

- Electrical noise is picked up by the ECM. Ensure that all connections are in good condition, also grounds (battery, ECM, engine and ignition system), they are clean and well tightened and that all electronic components are genuine — particularly in the ignition system. Installing non-resistive spark plugs may lead to generate fault code.
- Electrical noise might also lead engine to occasional cutout without generating a fault code.
- If everything is in good condition, try a new ECM.

When using the service action suggested in the FAULT section of B.U.D.S., the system circuits are referred to as DA-41, which means connector "A" on the ECM and the circuit D41.

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups TPS faults and adaption faults. These are displayed on the B.U.D.S. system as TPS OUT OF RANGE and TPS ADAPTION FAILURE.

TPS "Out of Range" Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS	Reconnect.
Check if sensor is loose	Tighten sensor and reset **Closed Throttle**.
Inspect sensor for damage or corrosion	Replace sensor and reset **Closed Throttle**.
Inspect wiring (voltage test)	Repair.
Inspect wiring and sensor (resistance test)	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle**.
Test sensor operation (wear test)	Replace sensor and reset **Closed Throttle**.

TPS "Adaptation Failure" Fault

It is caused by the idle position moving out of an acceptable range.

Following failures can be effected by a TPS "Adaption Failure":

- Idle speed is out of range.
- Engine stops, when throttle is released quickly.
- Engine runs inconsistent in low partload or low RPM.

POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
Throttle body has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
EMS has been replaced and TPS closed position not reset	Reset **Closed Throttle**.
Throttle cable too tight	Adjust cable and reset **Closed Throttle**.
Sensor is loose	Tighten sensor and reset **Closed Throttle**.
Throttle bracket is loose	Fix and reset **Closed Throttle**.
Adjustment screw worn or loose	Adjust idle speed screw using B.U.D.S.

COMPONENT INSPECTION AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
Fluke 111	529 035 868	271
fuel pressure gauge	529 035 868	278
supply cable	529 035 869	271
VCK (Vehicle Communication Kit)	529 035 981	269, 279
wrench	529 035 603	279
wrench	529 035 899	279, 281

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	292
dielectric grease	293 550 004	282
Loctite 5910	293 800 081	289, 292
pulley flange cleaner	413 711 809	275

GENERAL

Engine problems are not necessarily related to the electronic fuel injection system.

It is important to ensure that the mechanical integrity of the engine/propulsion system is present:

– good transmission system operation
– good engine compression and properly operating mechanical components, no leaks etc.
– fuel pump connection and fuel lines without leaks.

Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.

When replacing a component, always check its operation after installation.

FUEL SYSTEM

⚠ WARNING

The fuel system of a fuel injection system holds much more pressure than that of a carbureted snowmobile. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here. Pay attention that some hoses may have more than one clamp at their ends. Ensure to reinstall the same quantity of clamps at assembly.

– Use the VCK (Vehicle Communication Kit) (P/N 529 035 981) to release the fuel pressure in the system. Look in the **Activation** section of the software B.U.D.S. (ensure to use the latest version available on BOSSWeb).

529 035 981

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the VCK to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always disconnect battery prior to working on the fuel system. After performing a pressure test, release the pressure.

– Always disconnect battery properly prior to working on the fuel system. Refer to BATTERY section.

When the job is done, ensure that hoses from fuel rail going to fuel pump are properly secured in their supports. Then, pressurize the fuel system. Perform the fuel pressure test as explained in this section.

Properly reconnect the battery.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the tether cord cap on the DESS post. Always perform the high pressure test if any component has been removed. A pressure test must be done before connecting the tether cord cap. The fuel pump is started and pressure quickly builds-up each time the tether cord cap is installed and the START/RER button is depressed (or rewind starter is pulled).

To check fuel rail for leaks, first pressurize the system then spray soapy water on all hose connections, regulators and injectors. Air bubbles will show the leaking area. Check also for leaking fuel or fuel odor.

⚠ WARNING

Never use a hose pincher on injection system high pressure hoses.

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

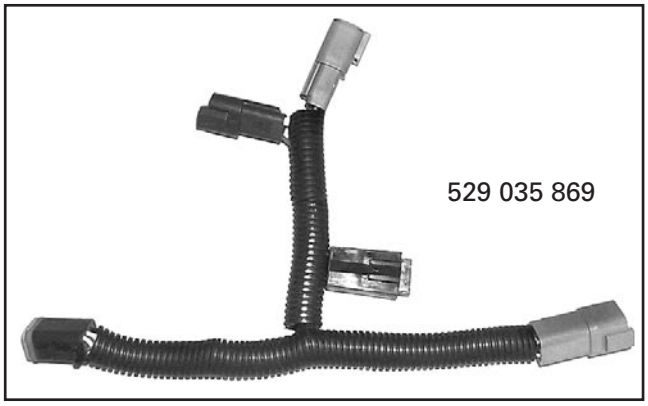
– battery
– fuses
– DESS
– ignition (spark)
– ground connections
– wiring connectors.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

Never use a battery charger to substitute temporarily the battery, as it may cause the ECM (engine control module) to work erratically or not to work at all. Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

⚠ WARNING

All electrical actuators (injectors, fuel pump, ignition coils and starter solenoid) may be suddenly supplied by the battery when the tether cord cap is installed and the start button is depressed or if engine is rotated (manually or with the rewind starter). Even a small movement of the crankshaft or the usage of the supply cable (P/N 529 035 869) will automatically activate the actuators. Always disconnect the tether cord cap and the battery prior to disconnecting any electric or electronic parts.



To perform verifications, a good quality multimeter such as Fluke 111 (P/N 529 035 868) should be used.

Pay particular attention to ensure that pins are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

CAUTION: Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

Before replacing a ECM, always check electrical connections. Make sure that they are very tight and they make good contact and that they are corrosion-free. Check if wiring harness shows any signs of scoring. Particularly check ECM ground connections. Ensure that contacts are good and clean. A "defective module" could possibly be repaired simply by unplugging and replugging the ECM. The voltage and current might be too weak to go through dirty wire pins. Check carefully if pins show signs of moisture, corrosion or if they look dull. Clean pins properly and then coat them with a silicon-based dielectric grease or equivalent.

NOTE: Do not apply dielectric grease or other lubricant on the ECM connectors.

If the newly replaced ECM works, try the old one and recheck if it works.

Ensure that all electronic components are genuine – any modification on the wiring harness may lead to generate fault codes or bad operation.

NOTE: For diagnostics purposes, use Vehicle Communication Kit (VCK). See DIAGNOSTIC PROCEDURES subsection.

After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. Refer to DIAGNOSTIC PROCEDURES subsection.

RESISTANCE MEASUREMENT

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The resistance value of a resistance varies with the temperature. The resistance value for usual resistor or windings (such as injectors) **increases** as the temperature increases. However, some of our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value **decreases** as the temperature increases. Take it into account when measuring at temperatures different from 20°C (68°F). Use this table for resistance variation relative to temperature for **temperature** sensors.

TEMPERATURE SENSOR TABLE					
TEMPERATURE		RESISTANCE (OHMS)			
°C	°F	ATS	EGTS	CTS FOR	
				GAUGE	ECM
- 40	- 40		169.7		72412
- 35	- 31				52637
- 30	- 22	28000			38681
- 25	- 13				28718
- 20	- 4	14500	185.1	733.8	21529
- 15	5			587.7	16288
- 10	14			474	12431
- 5	23			384.8	9565
0	32	5500	200.5	314.3	7418
5	41			258.4	5807
10	50			213.7	4582
15	59			177.7	3644
20	68	2500		148.7	2919
25	77		219.6	125	2355
30	86			105.6	1912
35	95			98.69	1562
40	104	1200		76.5	1284
45	113			65.54	1062
50	122		238.5	56.38	882.6
55	131			48.72	738.9
60	140	600		42.28	622
65	149			36.82	526.3
70	158			32.19	447.5
75	167			28.24	382.3
80	176	320		24.86	328.1
85	185			21.95	282.8
90	194			19.45	244.8
95	203			17.28	212.8
100	212	180	275.9	15.4	185.6
105	221				162.4
110	230				142.7
115	239				125.9

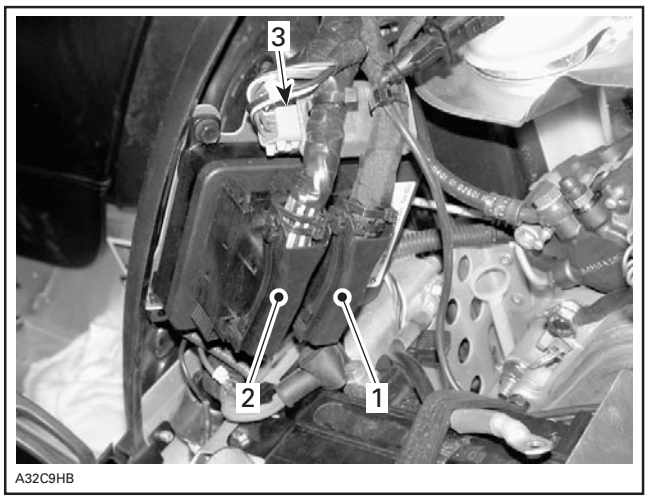
TEMPERATURE SENSOR TABLE					
TEMPERATURE		RESISTANCE (OHMS)			
°C	°F	ATS	EGTS	CTS FOR	
				GAUGE	ECM
120	248				111.5
125	257				99.02
130	266	90			88.26
135	275				78.93
140	284				70.81
145	293				63.71
150	302		312.7		57.49
200	392		349.0		
250	482		384.6		
300	572		419.7		
350	662		454.2		
400	752		488.1		
450	842		521.4		
500	932		554.1		
600	1112		617.8		
700	1292		679.2		
800	1472		738.2		
900	1652		794.9		
1000	1832		849.2		

The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine/air silencer and heated with a heat gun while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

ENGINE CONNECTOR PIN-OUTS

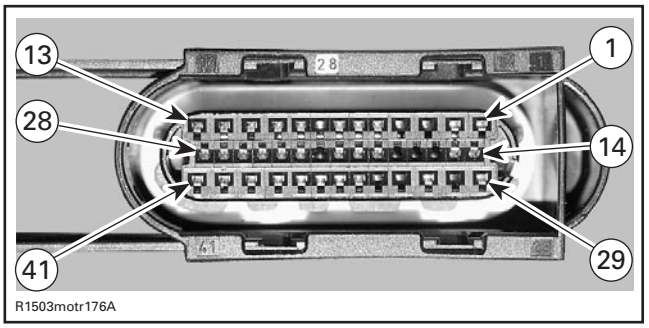
Connector Position



1. *ECM connectorA*
2. *ECM connector B*
3. *Engine connector*

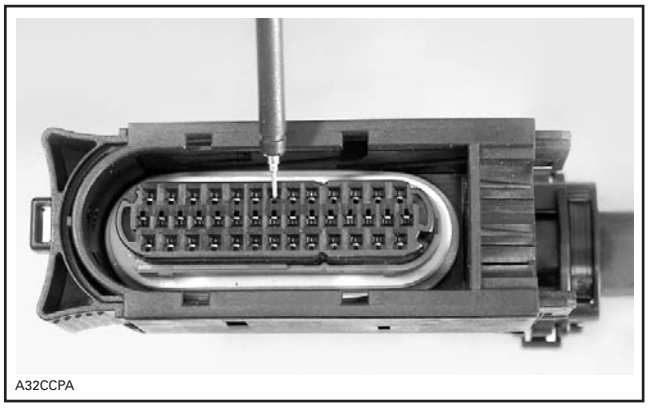
ECM Connector

Use this diagram to locate the pin numbers on the ECM connector of the wiring harness when performing tests.



ECM CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

CAUTION: Probe on top of terminal only. Do not try to probe inside terminal or to use a paper clip to probe inside terminal, it will damage the square-shaped terminal and this could lead to improper function of the engine management system.

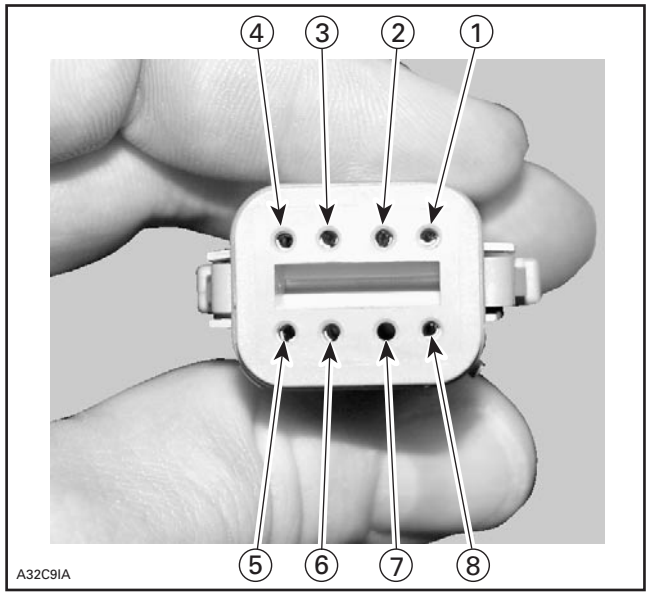


PROBE ONLY ON THE PIN NOZZLE OF FEMALE CONNECTOR

CAUTION: Do not disconnect the ECM connector needlessly. They are not designed to be disconnected/reconnected repeatedly.

Engine Connector

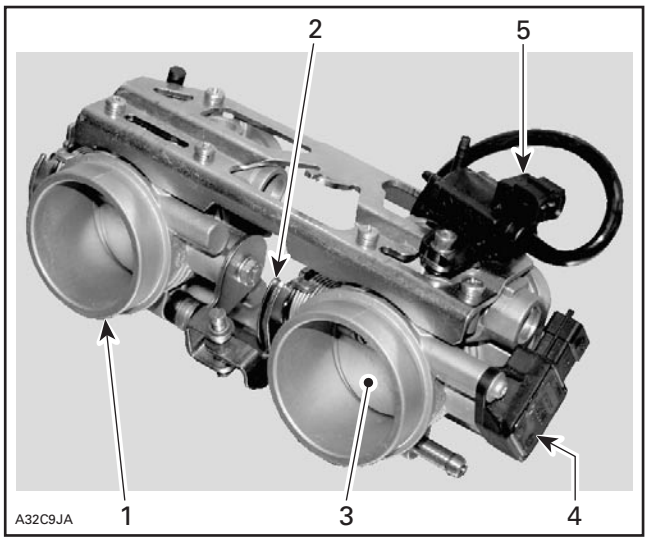
Use this illustration to locate the pin numbers on the engine connector of the wiring harness when performing tests.



ENGINE CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

AIR INDUCTION SYSTEM

THROTTLE BODY



1. Throttle body
2. Throttle cable attachment
3. Throttle plate
4. TPS
5. E-RAVE solenoid

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever. Take this opportunity to lubricate the throttle cable.

IMPORTANT: The throttle body is designed to be tamper proof. Changing the zero position stop screw or synchronization screw or modifying them in any way will not increase performance but may cause poor startability and erratic idling.

Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is not running.

– Throttle cable adjustment too tight. Not returning fully to idle stop.
– Throttle body idle set screw is loose or worn.
– Throttle linkage between the two throttles has moved.
– TPS is loose.
– Corroded or damaged wiring or connectors.
– Throttle body has been replaced and the **Closed Throttle** reset has not been performed.
– ECM has been replaced and the **Closed Throttle** reset has not been performed.

Electrical Inspection

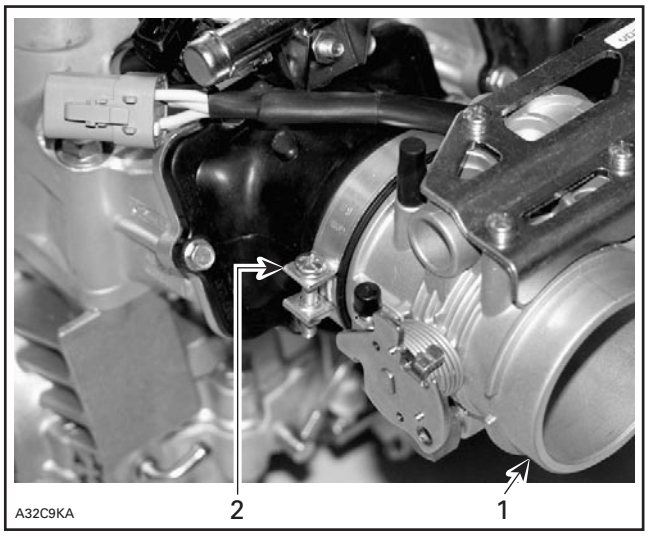
Refer to THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

Replacement

Removal

To remove the throttle body from engine, proceed as follows:

– Disconnect connectors from ATS (Air Temperature Sensor) and APS (Air Pressure Sensor).
– Disconnect air intake silencer from throttle body. Move boot away.
– Drain cooling system.
– Remove clamps and hoses for throttle body heating from nipples.
– Disconnect connectors and hoses from E-RAVE solenoid and TPS.
– Disconnect throttle cable.
– Unscrew retaining clamps of throttle body.



1. Throttle body
2. Clamp

– Slightly pull throttle body out.

Installation

Installation of the new throttle body is the reverse of the removal procedure. Pay attention to the following details.

Refill and bleed the cooling system, refer to LIQUID COOLING SYSTEM.

For TPS and E-RAVE solenoid replacement procedures, refer to the respective paragraph in ELECTRONIC MANAGEMENT below.

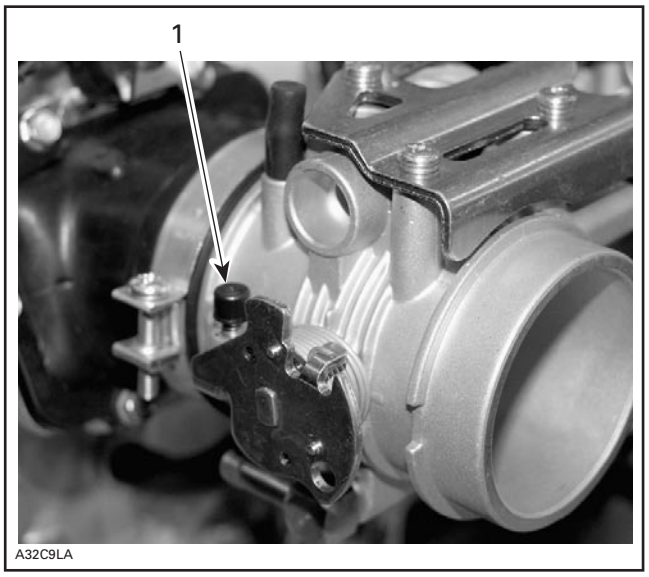
Adjustment

Throttle Body Synchronization

CAUTION: It is not allowed to perform any change on the synchronization screw.

Before installation, clean throttle plates and bores with pulley flange cleaner (P/N 413 711 809).

NOTE: The throttle body is designed as a single part for both cylinders. No synchronization is required as it has already been done at the factory. However, proceed with throttle cable and closed TPS adjustments as described below.

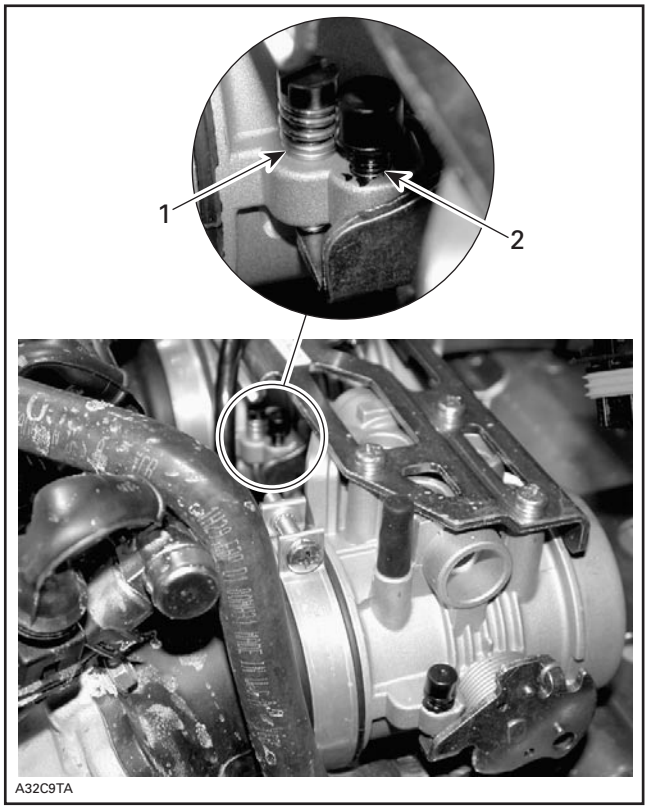


THROTTLE BODY
1. Zero position stopper screw

CAUTION: It is not allowed to perform any change on the zero position stopper screw.

The adjustment of the zero position stopper screw is optimized by the throttle body manufacturer and locked to prevent any modification.

CAUTION: Never attempt to adjust the zero position stopper screw (the capped one) or the idle speed adjustment would be impaired. Besides, no adjustment could be performed by the dealer nor the factory to correct the zero position stopper screw. The throttle body would need to be replaced.



1. Idle speed screw
2. Zero position stopper screw

CAUTION: Do not alter or tamper with throttle cable adjustment or routing. It may cause poor startability and erratic idling.

The only screw that has to be adjusted is the idle speed screw and it has to be adjusted only with the closed throttle reset procedure or for high altitude application. This has to be done only if the ECM or throttle body are replaced or if screw has been tampered with by mistake. Refer to THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

Throttle Cable Adjustment

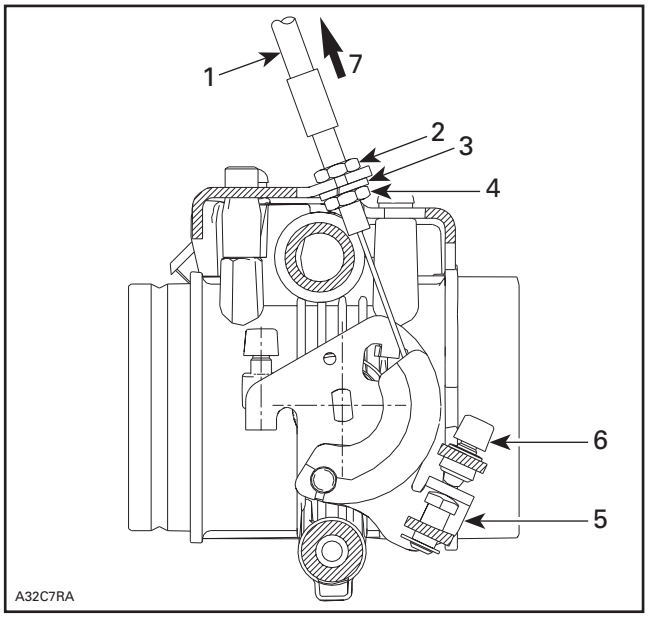
If closed throttle reset is required, then do it before throttle cable adjustment.

Mechanically adjust the throttle cable.

Handlebar and throttle cable must be at their normal position.

Adjust top nut to have a small free play at idle position.

Tighten bottom nut to 4.5 N•m (40 lbf•**in**).



1. Cable sheath
2. Upper nut
3. Lock washer
4. Lower nut
5. Throttle lever
6. Adjusting screw
7. Pull in this direction

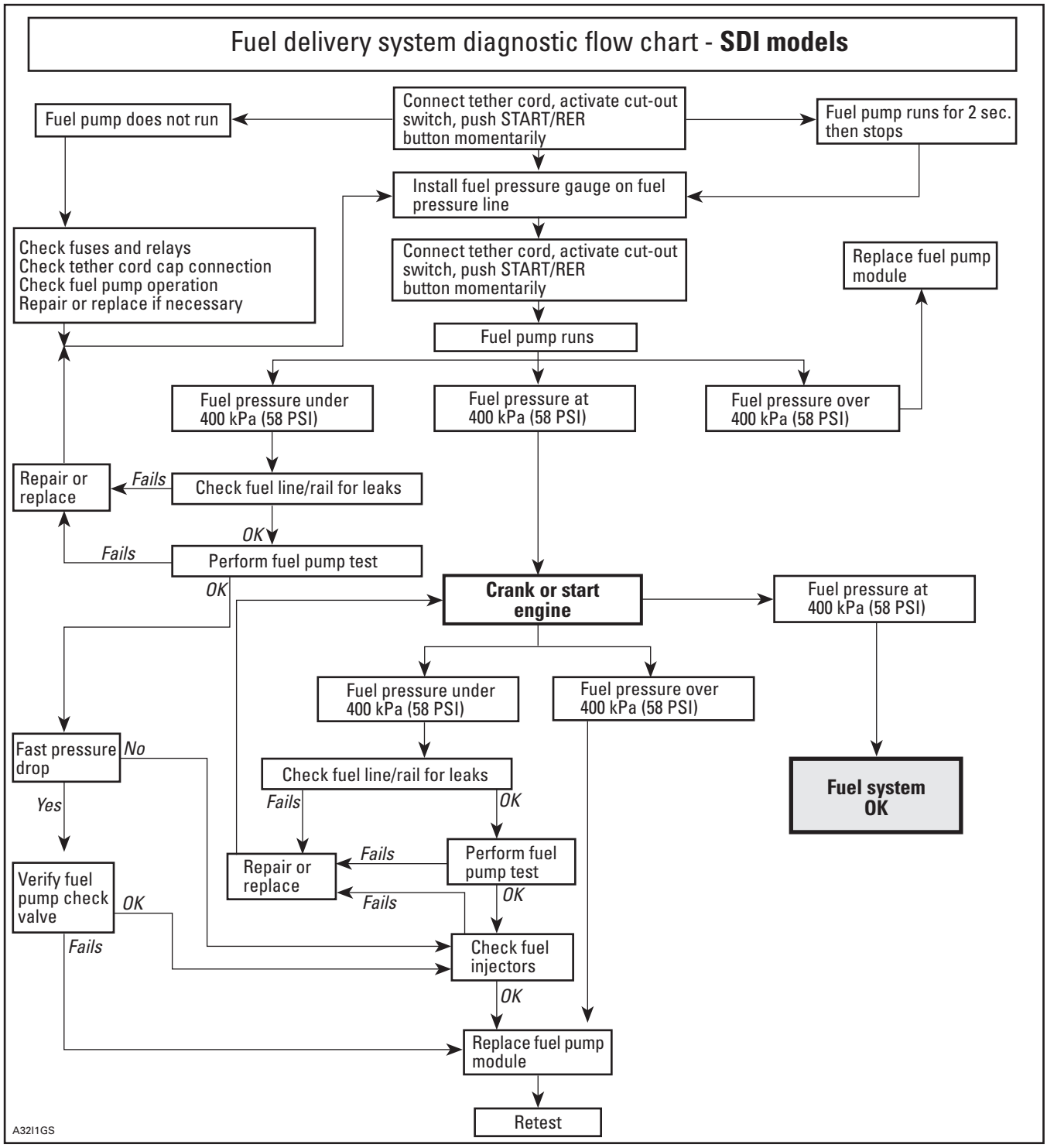
Activate the throttle lever a few times. Make sure throttle cam of throttle body rests against idle speed screw without any tension on the cable.

Using the VCK with B.U.D.S., perform the wide open verification. In monitoring tab check if throttle opening is within 82° to 86° when in wide open position on throttle lever.

Closed Throttle Reset

Perform the **Closed Throttle** reset as described in THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

FUEL DELIVERY



FUEL PUMP

Fuel Pressure Test

Before proceeding to the pressure test, ensure the battery is fully charged. Battery voltage must be over 12 volts.

Release the fuel pressure in the system using B.U.D.S. Refer to the **Activation** tab.

⚠ WARNING

The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside engine compartment.

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.

Ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Disconnect outlet hose from fuel pump.

Install fuel pressure gauge (P/N 529 035 591) between disconnected hose (inline installation).

Remove tether cord cap. Depress START/RER button and observe fuel pressure. **Do not crank engine.** Repeat twice. Release pressure using B.U.D.S. between tests so that the gauge is "reset" to zero (0).

FUEL PRESSURE (WHEN DEPRESSING START BUTTON)
400 kPa (58 PSI)

Crank or start engine and observe fuel pressure. The fuel pressure should be the same as above.

If pressure is within limits, fuel pump and pressure regulator are working adequately.

A rapid pressure drop indicates leakage either from the fuel rail or from the fuel pump check valve. Check fuel rail for leaks. If it is not leaking then replace fuel pump.

A slow pressure drop indicates leakage either from the fuel injector or from the fuel pump check valve. Check fuel injector for leaks (see below). If it is not leaking then replace fuel pump module.

Release fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Remove pressure gauge and plastic clip from inlet hose. Reinstall fuel hose.

⚠ WARNING

Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Reinstall removed parts.

Electrical Test

When depressing the START/RER button, the fuel pump should run for 2 seconds to build up the pressure in the system.

If the pump does not work, disconnect the plug connector from the fuel pump.

Install a temporary connector to the fuel pump connector. Apply 12 V (+ on PINK wire and – on PINK/BLACK wire) to this test harness.

If pump does not run, replace the fuel pump module.

Otherwise, probe PINK wire and battery ground of fuel pump connector on vehicle harness side. When depressing the START/RER button, you should read battery voltage for approximately 2 seconds (then, the voltage will drop). If battery voltage does not appear, the problem can be infuse, relay, harness or in fuel pump connector. Repair or replace appropriate part (fuel pump may be blown).

Check continuity between PINK/BLACK wire of the fuel pump connector on the vehicle harness side and terminal 29 of the ECM connector B. If there is no continuity the problem is in the harness. Otherwise, try a new ECM.

Fuel Pump Module Replacement

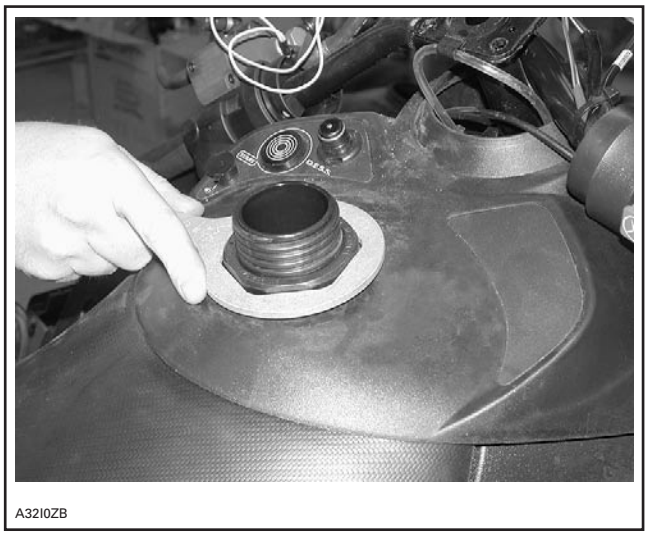
Removal

Open hood. Connect VCK (Vehicle Communication Kit) (P/N 529 035 981). Use B.U.D.S. to release fuel pressure.

Drain fuel tank as much as possible.

Remove steering pad. Unbolt handlebar and move it forward.

Unscrew fuel tank nut using wrench (P/N 529 035 603).

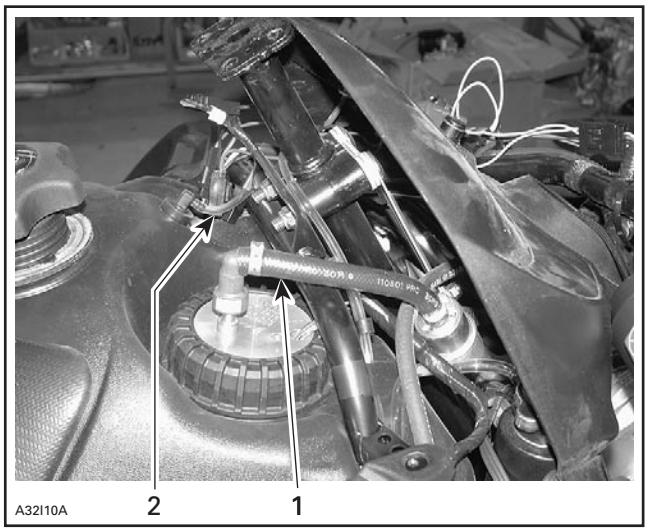


TYPICAL

Unbolt console, then move it forward.

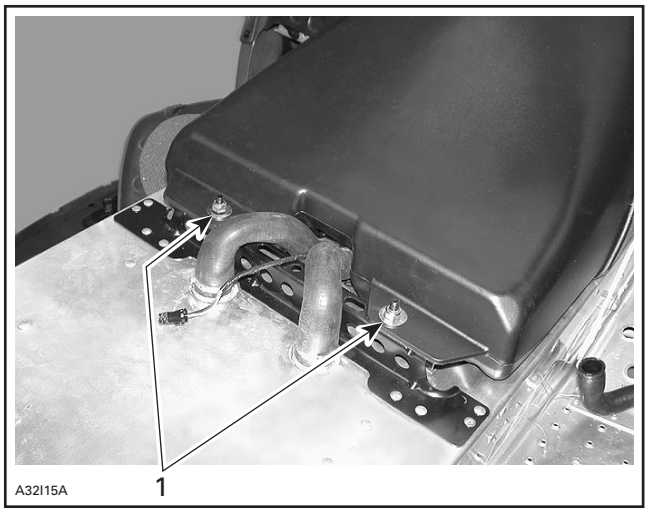
Disconnect fuel supply hose from fuel pump module.

Disconnect vent tube from vent elbow.



1. *Fuel supply hose*
2. *Vent tube*

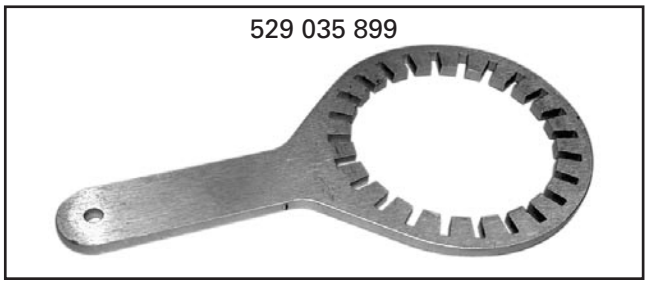
Remove seat. Unbolt fuel tank.



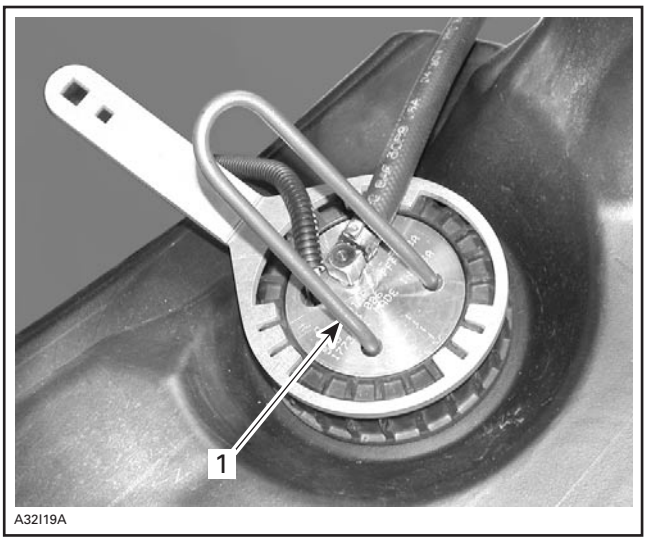
1. *Fuel tank retaining screws*

Move fuel tank rearward, then unplug the fuel pump module electric connector.

With two screwdrivers or a bent rod holding the flange, unscrew fuel pump nut using fuel pump nut wrench (P/N 529 035 899).



A32I11A



A32I19A

1. Bent rod

Pull fuel pump module out of fuel tank to expose sensor body.

Remove fuel pump module. Guide fuel pickups when pulling out fuel pickup hoses.

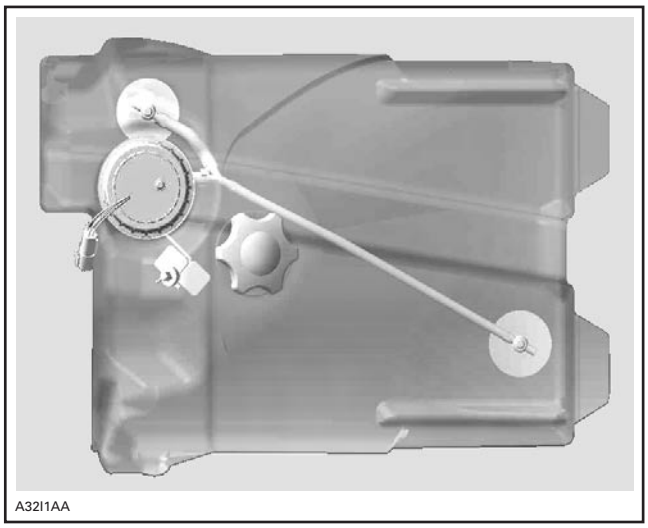
A32I13A

Installation

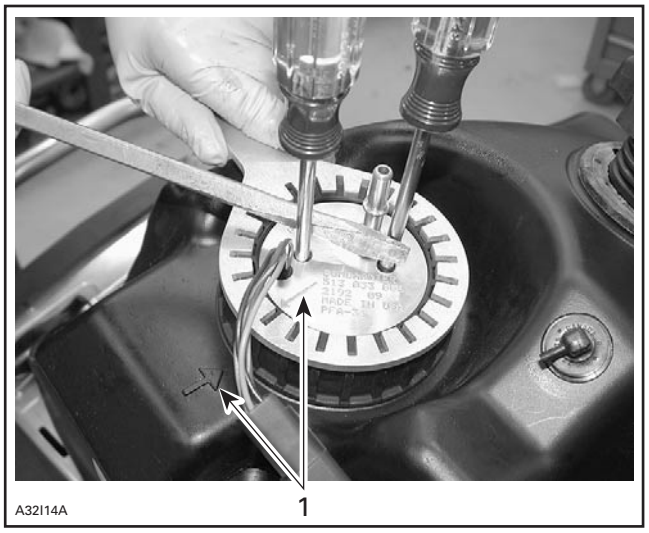
For installation, reverse the removal process but pay attention to the following.

Install a new gasket.

Make sure that rear pickup hose is positioned as following illustration.

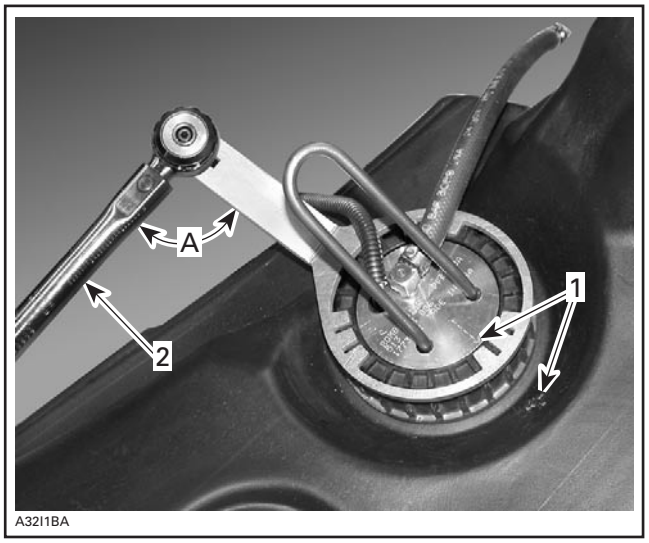

A32I1AA

Align the arrow on fuel pump module with the one on fuel tank. Keep arrows aligned during fuel pump module nut tightening.



1. Arrows

Install a torque wrench perpendicularly (90°) to fuel pump nut wrench (P/N 529 035 899). Torque fuel pump nut to 30 N•m (22 lbf•ft).



1. Arrows
2. Torque wrench
A. 90°

Bleed the fuel system as following procedure.

Fuel Bleeding Procedure

The rear fuel pickup hose has to be bled.

Pour 12 L (3.17 U.S. gal.) of recommended fuel in the fuel tank.

Apply parking brake. Start the engine. Let it run at idle speed.

Lift the front of vehicle at a 45° angle.

Put the vehicle back on the ground.

Do the above procedure three times.

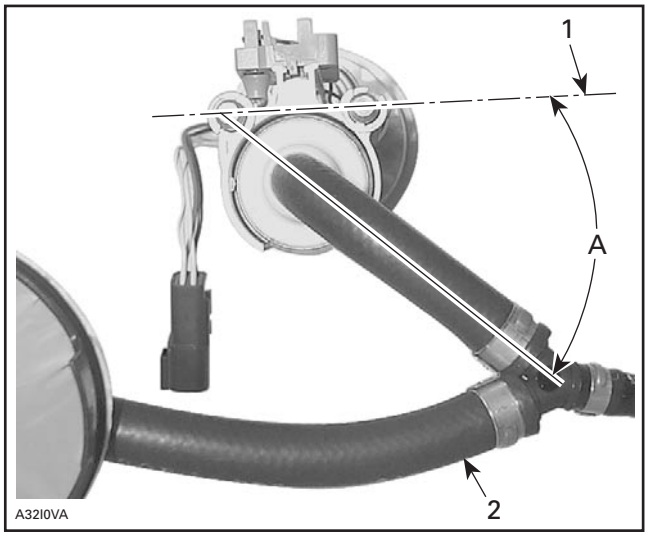
Stop the engine. The rear fuel pickup hose is now bled.

Fuel Hose Kit

Remove fuel pump module as explained above.

Unfasten blue hose clamp retaining old fuel hose ass'y to pump inlet nipple. Remove old fuel hose ass'y.

Install fuel hose ass'y to pump at an angle of 46 ± 3° from retaining rods axis.



1. Retaining rods axis
2. Fuel hose ass'y
A. 30° ± 3

Install a new blue hose clamp on fuel hose ass'y.

Install a new gasket, then reinstall fuel pump module as explained above.

Pump Ass'y Kit

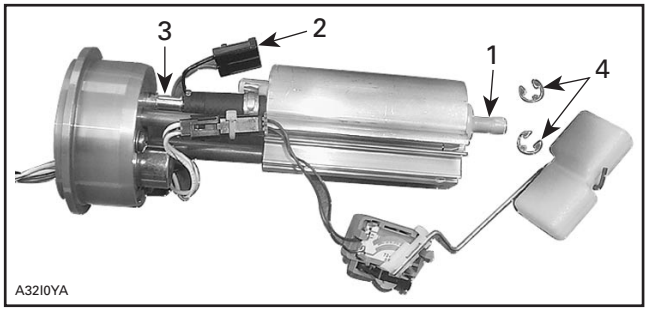
Remove fuel pump module as explained above.

Disconnect fuel hose from pump inlet nipple.

Disconnect pump electric connector.

Disconnect pump outlet hose from pump module flange nipple.

Remove E-clips. Slide pump ass'y out of retaining rods.



TYPICAL
1. *Pump inlet nipple*
2. *Pump electric connector*
3. *Pump module flange nipple*
4. *E-clips*

Reverse removal procedure for installation.

Install a new gasket, then reinstall fuel pump module as explained above.

Regulator Kit

Remove fuel pump module as explained above.

Remove 2 screws retaining regulator to pump module flange.

Replace O-rings with new ones. Install them in pump module flange bore.

CAUTION: Regulator O-rings must be installed in pump module flange bore.

Reverse removal procedure for installation.

Install a new gasket, then reinstall fuel pump module as explained above.

FUEL RAILS

Pressure at fuel rails is supplied and controlled by the fuel pump module. Refer to FUEL PUMP for pressure test.

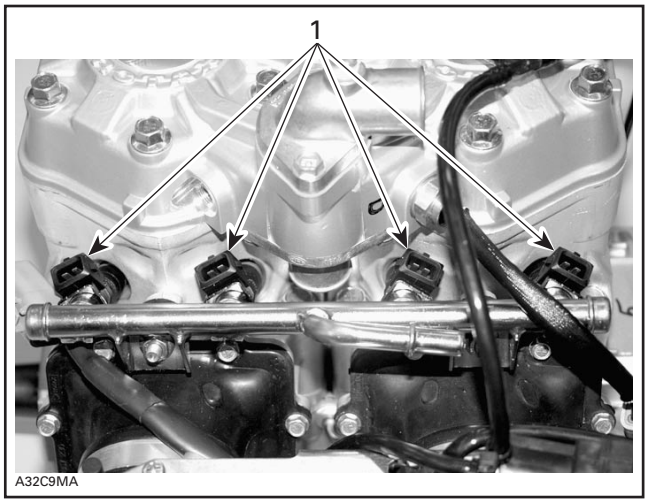
Fuel Rail Replacement

Removal

Release the fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Disconnect fuel hose at the connector.

Wrap a rag around the hose end to prevent rail draining.



1. Fuel injectors

Disconnect wiring harness from the four fuel injectors.

Cut tie raps and remove the wiring harness from the fuel rail.

Unscrew rail retaining nuts.

Gently pull rail up by hand, working each side slightly at a time.

Pull rail out with fuel injectors.

If necessary remove fuel injectors as described below.

Installation

For installation, reverse the removal process but pay attention to the following.

Replace O-rings with new ones.

A thin film of injection oil should be applied to O-rings of fuel injectors to ease installation in cylinder.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

Make sure that injector clips are well in place.

Add dielectric grease (P/N 293 550 004) to injector electrical connector.

When installing fuel line connector to the fuel rail, put some oil on the O-ring to ease installation.

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

FUEL INJECTORS

Leakage Test

To perform a leakage test, the injectors and fuel rail have to be removed from the engine. Refer to REMOVAL in FUEL RAIL REPLACEMENT for the procedure.

NOTE: Do not detach injectors from the fuel rail.

Reconnect the fuel line and the wiring harness.

Place each injector in a clean bowl.

Install the tether cord cap on the DESS post and press the engine START/RER button to activate the fuel pump.

Check for fuel leakage from the injector nozzle. There should be less than 1 drop per minute. Perform the test for 2 minutes.

If not within specification, replace the fuel injector(s).

The leakage test is validated when performing the FUEL DELIVERY SYSTEM DIAGNOSTIC FLOW CHART elsewhere in this section.

Electrical Test

Voltage Test

Tether cord cap must be on DESS post.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the fuel injector from the **Activation** section.

If the injector does not work, disconnect the plug connector from the injector.

Install a temporary connector to the injector with wires long enough to make the connection outside the engine compartment and apply voltage (12 V) to this test harness.

This will validate the injector mechanical and electrical operation.

If it does not work, replace it. If it works, continue procedure.

Wake up ECM using START button and measure voltage between pin 1 (of injector on harness side) and battery ground.

- If 12 V is read, disconnect connector A from the ECM and check continuity of circuit as per following table. If it is good, try a new ECM.

CIRCUIT NUMBER (ECM CONNECTOR «A»)	INJECTOR NUMBER
A-15	1/1 (MAG external)
A-33	2/1 (PTO external)
A-14	1/2 (MAG internal)
A-30	2/2 (PTO internal)

– If it does not read 12 V, check the corresponding fuse(s), relay and continuity of circuit. If continuity is faulty, repair wiring harness.

Resistance Test

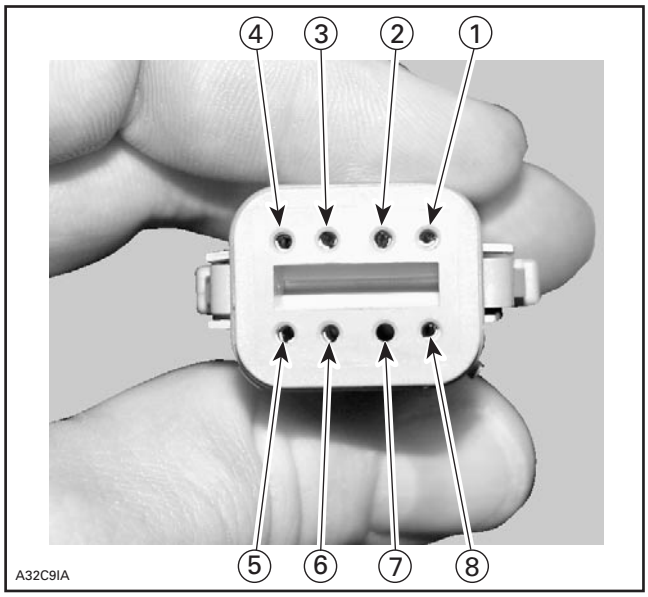
Disconnect the injector from the wiring harness and check the resistance of the injector itself.

The resistance should be around 14.5 Ω.

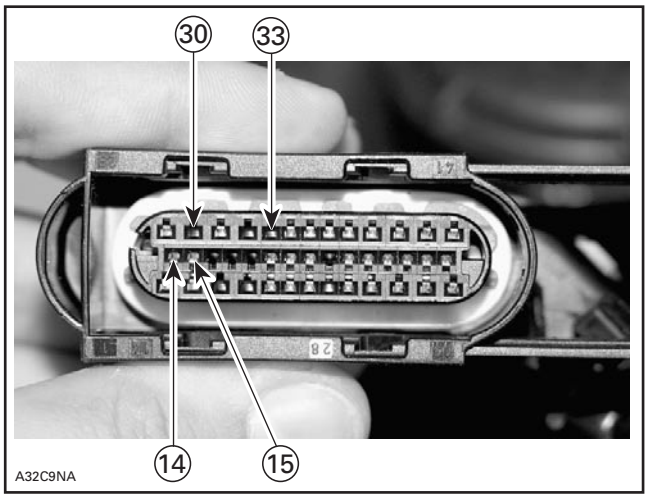
If resistance value is incorrect, replace the injector.

Reconnect the injector and disconnect the connector A from the ECM as well as the engine connector.

Using a multimeter, check resistance value between terminals as shown in the table below.



ENGINE CONNECTOR



ECM CONNECTOR

COMPONENT	CONTACT LOCATION
Cylinder 1 fuel injector 1	4 (Engine Connector) and A-15 (ECM connector)
Cylinder 1 fuel injector 2	3 (Engine Connector) and A-14 (ECM connector)
Cylinderr 2 fuel injector 1	4 (Engine Connector) and A-33 (ECM connector)
Cylinder 2 fuel injector 2	3 (Engine Connector) and A-30 (ECM connector)

The resistance should be around 14.5 Ω.

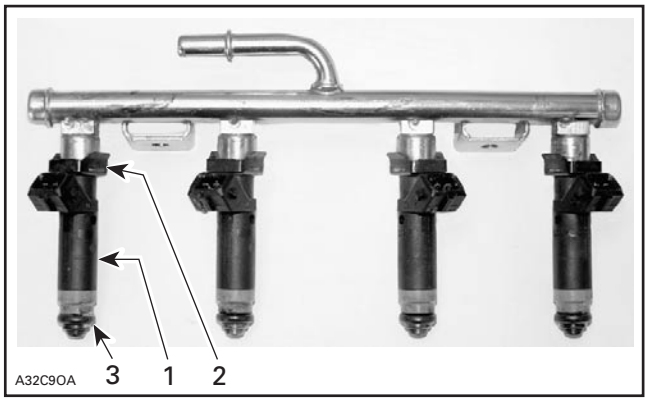
If resistance value is correct, check wiring of corresponding relay. If good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors or replace the wiring harness between ECM connector and fuel injector .

Fuel Injector Replacement

Removal

Before removing the injectors, the fuel rail has to be removed from the engine. Refer to REMOVAL in FUEL RAIL REPLACEMENT for the procedure.



FUEL RAIL ASS'Y
1. *Fuel injector*
2. *Injector clip*
3. *O-ring*

Then remove the injector clip. Now the fuel injector can be easily pulled out of the fuel rail.

Installation

For the installation, reverse the removal procedure. Pay attention to the following details.

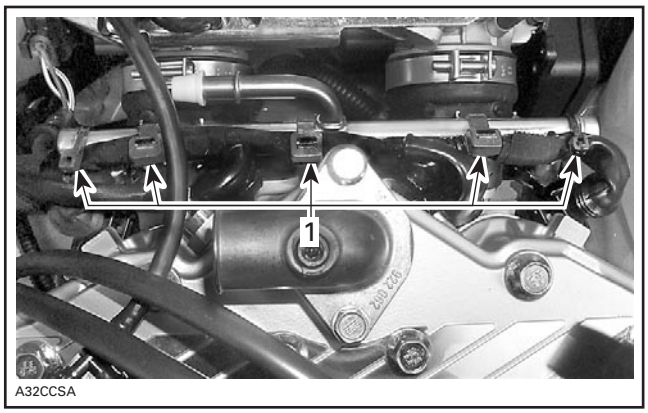
Insert injectors with your hand. Do not use any tool. Ensure clip and injector are properly installed.

Replace O-rings with new ones.

NOTE: A thin film of engine oil should be applied to O-rings to ease insertion in rail.

Torque rail retaining nuts to 10 N•m (89 lbf•**in**).

Attach injector wires with locking ties as shown in following photo.



1. Locking ties

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

ELECTRONIC MANAGEMENT

ECM REPLACEMENT

General

Prior to replacing a suspected ECM, ensure that all the recommendations in the general introduction of this section have been followed.

IMPORTANT: When the ECM is replaced, the tether cord cap(s) and the **Closed Throttle** must be reprogrammed/reset. Refer to their specific section for adjustment.

To allow transferring the previous recorded information from the old ECM to the new one, use the vehicle communication kit (VCK) with the B.U.D.S. software. Use **Replace ECM** in the **ECM** menu. Follow instructions provided by the help system.

NOTE: If the old ECM can still communicate, it must be read inside B.U.D.S. prior to removing it from the vehicle to carry vehicle information and history to the new ECM.

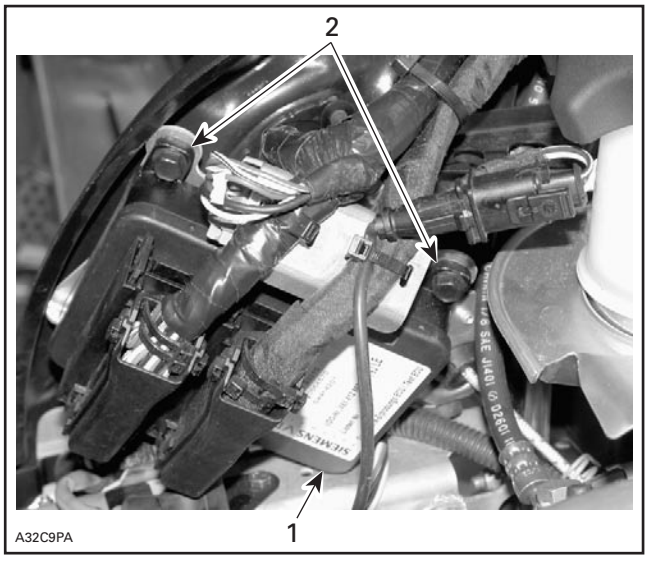
ECM Replacement

Disconnect battery cables.

⚠ WARNING

Battery BLACK (-) cable must always be disconnected first and connected last.

Disconnect both connectors from ECM.



1. ECM
2. Retaining screws

Unscrew all retaining screws and remove the engine ECM from its support.

Install the new ECM to the support.

Reconnect ECM connectors to ECM, and then battery cables.

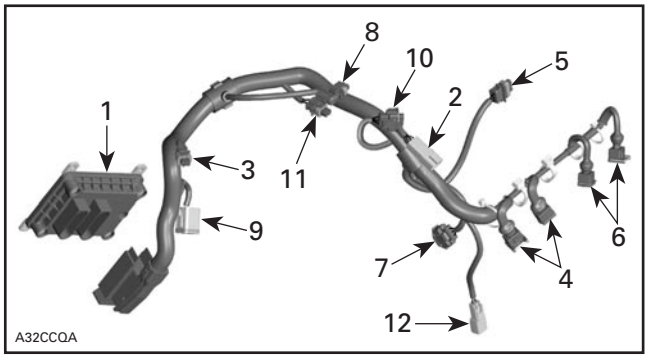
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

NOTE: If data cannot be transferred, manually enter information in **Vehicle** tab.

After performing the required resets, ensure to clear all faults from the newly replaced ECM.

Start the engine and increase engine speed above 5000 RPM to be sure no fault appears.

ENGINE WIRING HARNESS



1. ECM
2. CTS connector
3. EGTS connector
4. Fuel injector connector (cylinder MAG side)
5. Ignition coil connector
6. Fuel injector connector (cylinder PTO side)
7. TPS connector
8. ATS connector
9. Engine connector
10. APS connector
11. KS connector
12. CPS connector

Resistance Test

Check continuity of the circuits according to the wiring diagram in the WIRING DIAGRAMS section of this manual.

If wiring harness is good, check the respective sensor/actuator as described in this section.

Otherwise, repair the connectors, replace the wiring harness or the ECM as diagnosed.

Removal

Remove air intake silencer.

Disconnect the wiring harness from all sensors/actuators.

Disconnect the connector from the ECM.

Cut all locking tie which are holding the wiring harness in position.

Remove complete wiring harness.

Installation

First connect the connector A to the ECM and the engine connector to the vehicle wiring harness.

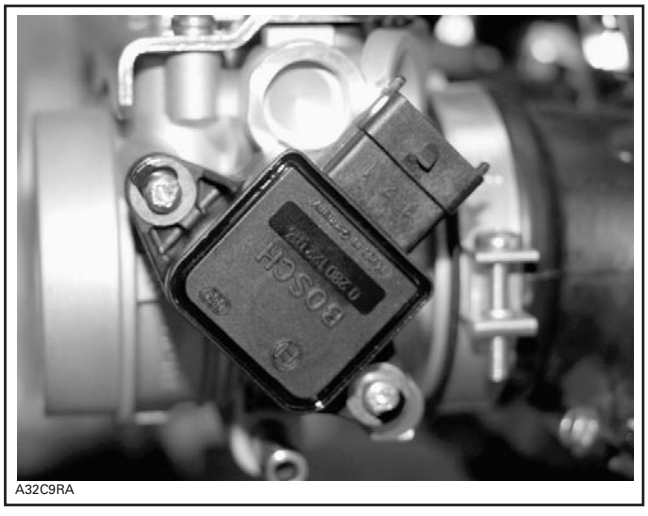
Reconnect the wiring harness to all sensors/actuators and reinstall all locking tie that have been removed.

Install all remaining parts, which have been removed.

THROTTLE POSITION SENSOR (TPS)

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle shaft angle.



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THROTTLE POSITION SENSOR (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to THROTTLE BODY in AIR INDUCTION SYSTEM above.

The ECM may generate several fault codes pertaining to the TPS. Refer to SYSTEM FAULT CODES in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

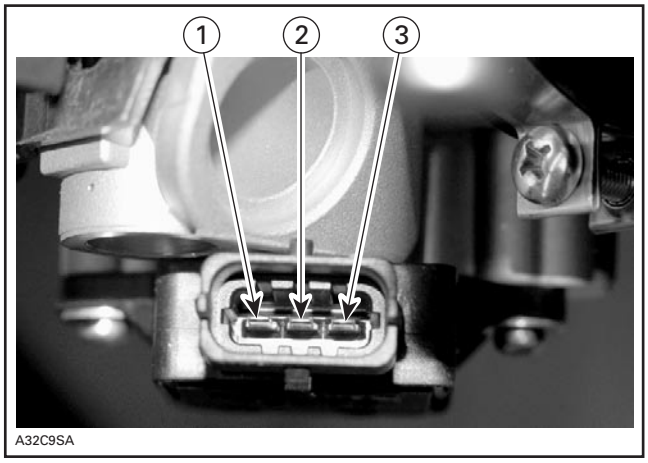
While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, use the **Throttle Opening** display under **Monitoring**.

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle "sticks", bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

Voltage Test

Check the voltage output from ECM to the desired throttle position sensor.



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TPS

Disconnect plug connector from throttle position sensor. To unlock connector, insert a small screwdriver between the folded tab. To see the connector pin-out and its pin numbers, temporarily remove the connector shield joining the harness.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Connect a voltmeter between pin 1 and 2 in the wiring harness.

Voltage should be 5 V.

Check the continuity between pin 3 on wiring harness TPS connector and pin 24 on wiring harness ECM connector.

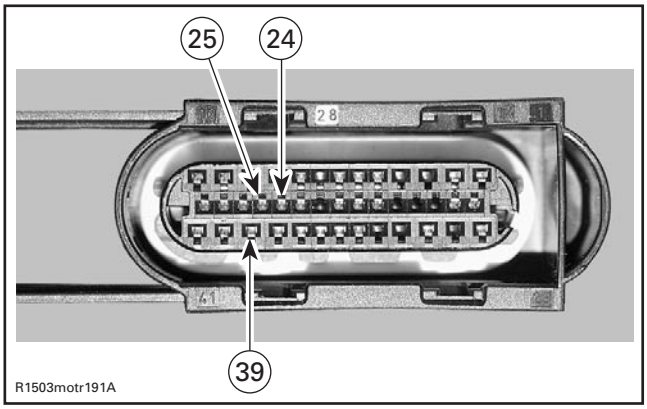
If tests are good, replace the TPS.

If voltage tests are not good, continue to check the resistance of the rest of the TPS circuit.

Resistance Test

Reconnect the TPS.

Disconnect the connector A from the ECM.



Using a multimeter, check resistance value between terminal A-25 and A-39.

The resistance should be 1600 - 2400 Ω in any throttle position.

Check the resistance between terminal A-24 and terminal A-39 with the throttle plate in **idle** position.

The resistance should be approximately 1000 Ω.

Check the resistance between terminal A-24 and terminal A-39 with the throttle plate in **wide open** position.

The resistance should be 2500 Ω.

Check the resistance between terminal A-24 and A-25 with throttle plate in **idle** position.

The resistance should be 2500 Ω.

Now check the resistance with the throttle plate in **wide open** position.

The resistance should be approximately 1000 Ω.

NOTE: When measuring between pins A-24 and A-39, resistance **value increases** while depressing throttle lever. When measuring between pins A-24 and A-25, resistance **value decreases** while depressing throttle lever. The resistance value should change smoothly and proportionally to the throttle movement. Otherwise, replace TPS.

If resistance values are correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

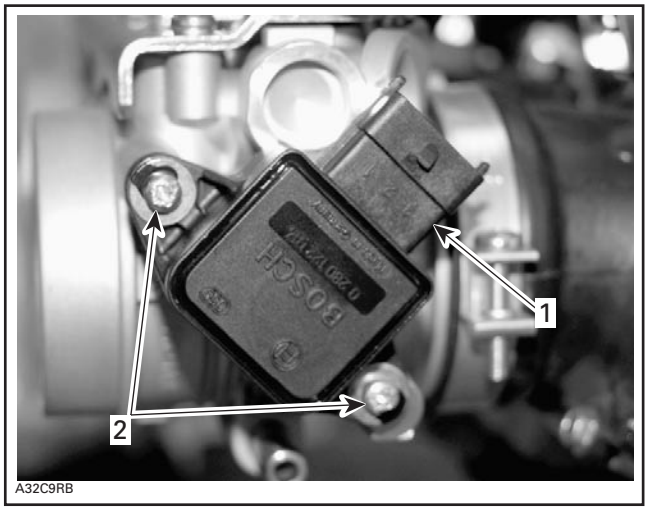
If resistance values are incorrect, repair connector or replace the wiring harness between ECM connector and the TPS.

Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



THROTTLE BODY
1. *Throttle position sensor (TPS)*
2. *Screws*

Install the new TPS.

Apply Loctite 243 on the TPS retaining screws, then torque to 3 N•m (27 lbf•**in**).

Reinstall remaining removed parts.

Proceed with the **Closed Throttle Reset**. See below.

Closed Throttle Reset

NOTE: This operation performs a reset of the values in the ECM.

This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations in idle speed control of the engine.

NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened or removed or throttle body or ECM is replaced.

CAUTION: An improperly set TPS may lead to poor engine performance.

Use the vehicle communication kit (VCK) with the B.U.D.S. software to perform this adjustment.

Unscrew idle speed screw until the throttle body plate stop lever rest against its zero position stopper screw (capped screw). If necessary, loosen the throttle cable. Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate.

Push the **Reset** button in the **Setting** section of B.U.D.S.

The following message will be displayed:

Make sure the idle screw is not in contact with the throttle stopper. Click OK to continue.

Follow instructions and click OK.

Another message will appear to ask you to perform a ECU tracking shut down to save the changes into the ECU permanent memory.

Remove the tether cord cap from the DESS post and wait until the message disappears before reinserting the tether cord cap.

Re-power up the ECM by pushing the START/RER button momentarily.

The throttle opening displayed in B.U.D.S. should be 0.00 (0.1 maximum).

If TPS is not within the allowed range while resetting the **Closed Throttle**, the ECM will generate a fault code and will not accept the setting.

Now, the idle speed screw has to be adjusted. To do this, screw in the idle speed screw until B.U.D.S. throttle opening displays value as per following table.

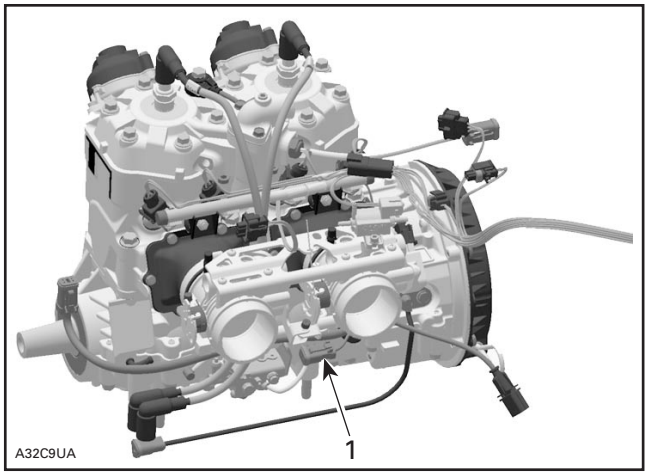
ENGINE TYPE	VALUE	
	AT SEA LEVEL	ABOVE 1800 m (6000 ft)
593 SDI	3.9° ±0.1	4.9° ±0.1

If throttle cable has been loosen during the procedure, adjust a throttle cable.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to SYSTEM FAULT CODES in the DIAGNOSTIC PROCEDURES section for more information.

CRANKSHAFT POSITION SENSOR (CPS)

NOTE: The CPS is the trigger coil used for forward and reverse.



1. CPS connector

NOTE: Take into account that a CPS fault can be triggered by missing encoder wheel teeth. First check fault codes then check the teeth condition if necessary. See below.

Disconnect CPS wiring harness connector. Probe terminals coming from CPS while cranking engine. Voltage should be within 1-2 Vac. Otherwise, inspect wiring and replace CPS if wiring is good.

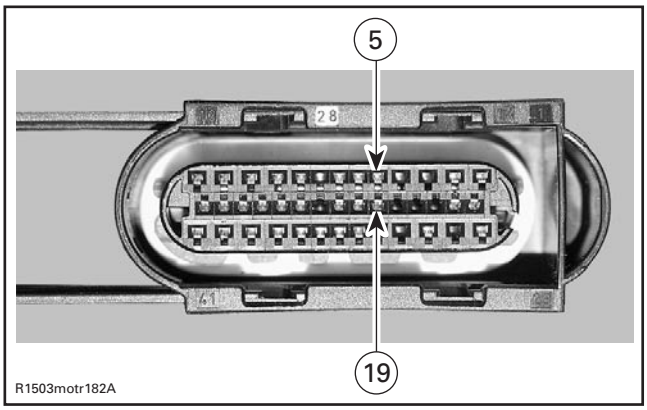
Resistance Test

Disconnect the CPS plug connector from the wiring harness and check the resistance of the sensor itself.

The resistance should be between 190 Ω and 300 Ω.

Otherwise, replace the CPS.

If resistance tests good, **reconnect** the CPS and disconnect the connector A on the ECM.



Using a multimeter, recheck resistance value between terminals 5 and 19.

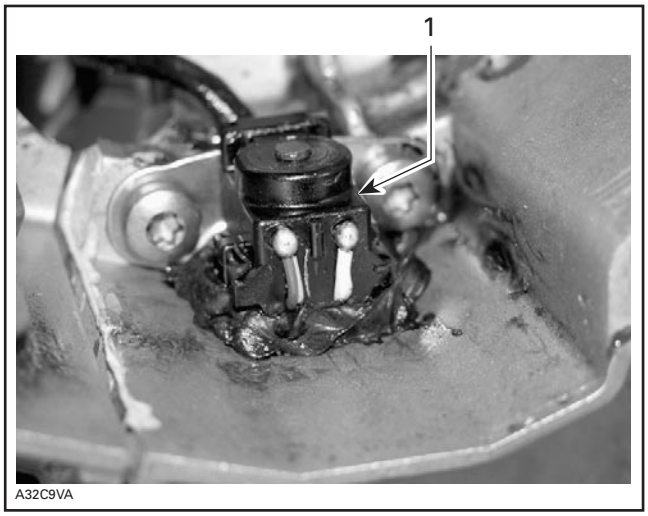
If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

Replacement

Disconnect connectors and remove the rewind starter, then the magneto flywheel. Refer to MAGNETO SYSTEM.

Remove CPS.



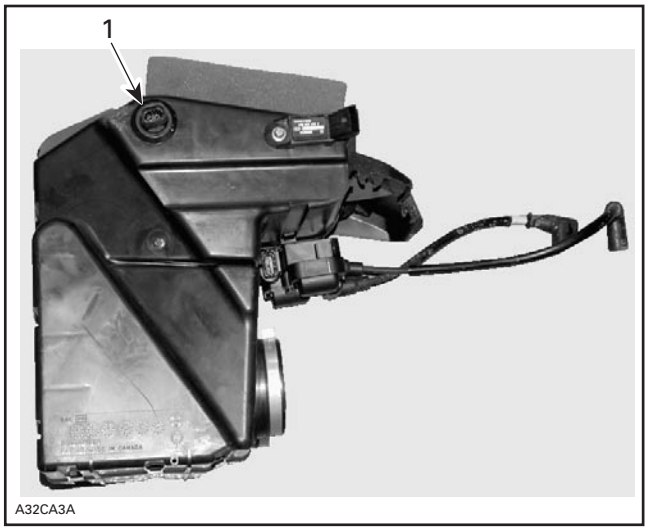
1. CPS inside crankcase

When installing new CPS apply Loctite 5910 (P/N 293 800 081) between CPS and crankcase.

Torque to 8 N•m (71 lbf•**in**).

Reinstall remaining removed parts.

AIR TEMPERATURE SENSOR (ATS)



1. Air temperature sensor (ATS)

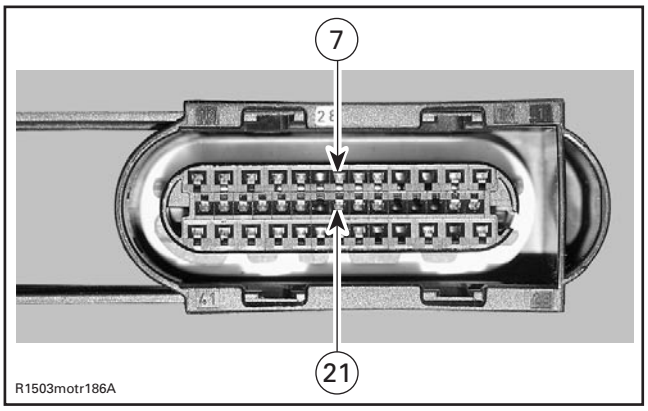
Resistance Test

Disconnect the plug connector from the ATS and check the resistance of the sensor itself.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the ATS and disconnect the connector A on the ECM.



Using a multimeter, recheck resistance value between terminals 7 and 21.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the ATS.

Replacement

Disconnect the connector of the ATS.

Pull the ATS out of the air intake silencer.

Follow this procedure to install the ATS.

First, install the ATS rubber ring.

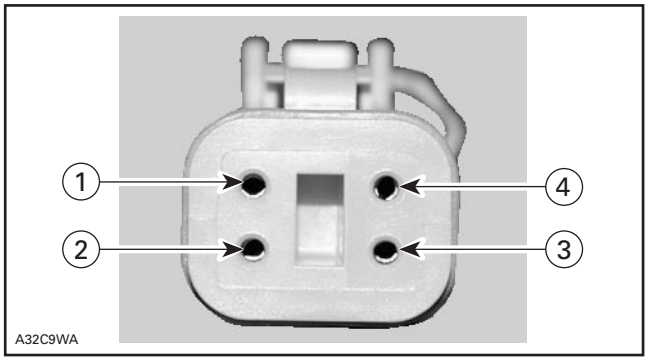
NOTE: If the rubber ring is installed on ATS sensor, remove it before ATS installing.

Spray soapy water on ring. Install ring on air intake silencer then push the sensor in place. Reconnect it.

COOLANT TEMPERATURE SENSOR (CTS)

Resistance Test

Disconnect the plug connector from the CTS and check the resistance of the sensor itself.



The resistance between pin 1 and 2 is used for temperature gauge.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

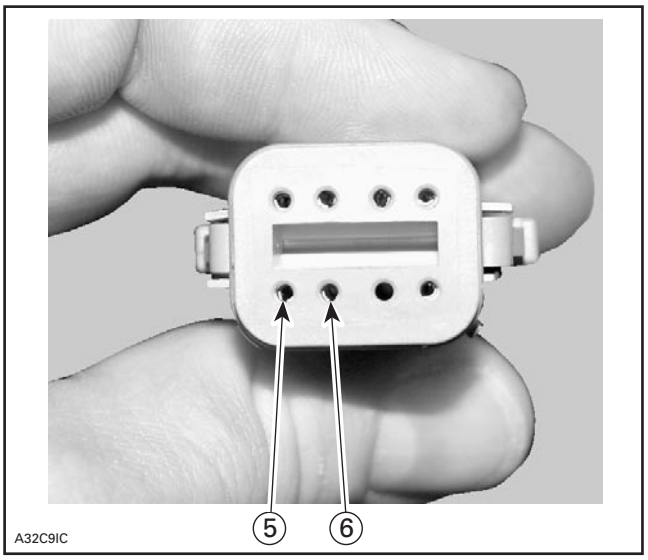
If out of specification, replace the sensor.

The resistance between pin 3 and 4 is used for ECM.

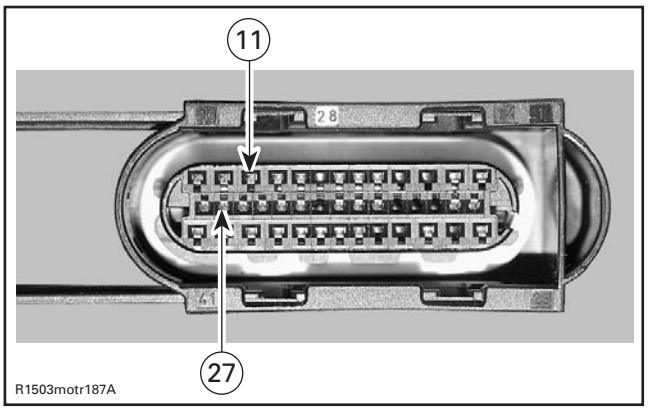
Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the CTS and disconnect the connector A on the ECM as well as the engine connector.



ENGINE CONNECTOR



ECM CONNECTOR A

Using a multimeter, recheck resistance value between terminals 5 and 6 on engine connector. This resistance is used for temperature gauge.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

Recheck also resistance value between terminals 11 and 27 on ECM connector A. This resistance is used for ECM.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

Replacement

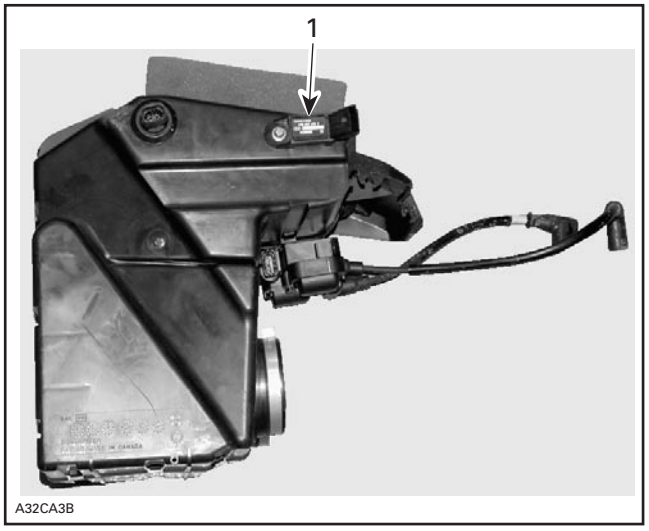
Drain cooling system.

Disconnect CTS connector and remove CTS. Install the new CTS and torque to 12 N•m (106 lbf•**in**).

Reinstall remaining removed parts.

Refill engine coolant and bleed cooling system. Refer to LIQUID COOLING SYSTEM section.

AIR PRESSURE SENSOR (APS)



1. Air pressure sensor (APS)

Ensure sensor is correctly installed on air intake silencer. Otherwise, the APS could generate a fault code. Remove sensor and check for oil or dirt on its end and if problem persists, check the wiring harness. Perform the following tests.

Voltage Test

Check the voltage output from ECM to the APS.

Install the tether cord cap, turn OFF engine cut-out switch and push START/RER button momentarily to activate the ECM.

Disconnect plug connector from APS and connect a voltmeter between pin 1 and 2 of wiring harness.

Voltage should be 5 V.

Check the continuity between pin 3 on APS connector and pin 18 on ECM connector.

If tests are good, replace the APS.

If tests are not good, continue to check the continuity of the rest of the APS circuit on the harness.

Disconnect the connector A from the ECM.

Using a multimeter, check continuity of circuits as per following table.

CIRCUIT NUMBER (ECM CONNECTOR A)	APS CONNECTOR
A-3	PIN 1
A-4	PIN 2
A-18	PIN 3

If wiring harness is good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

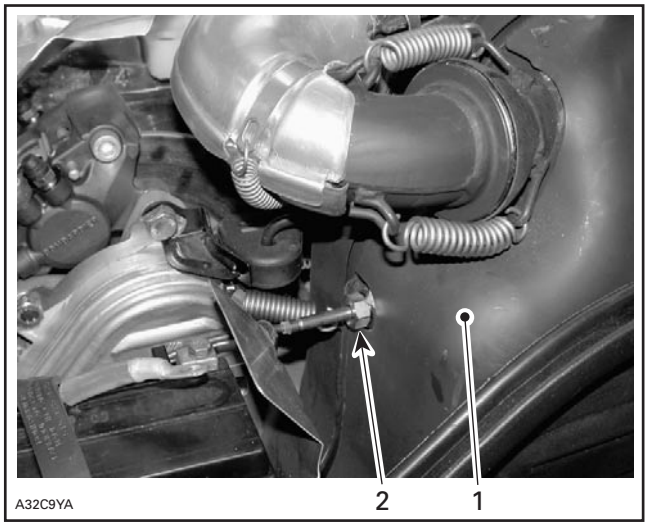
Otherwise, repair the connectors or replace the wiring harness between ECM connector and the APS.

Replacement

Disconnect APS connector and remove the APS. The ATS is retained with a screw.

Install the new APS.

EXHAUST GAS TEMPERATURE SENSOR (EGTS)



1. Muffler
2. Exhaust gas temperature sensor (EGTS)

Resistance Test

Disconnect the plug connector from the EGTS and check sensor resistance.

Refer to TEMPERATURE SENSOR TABLE at the beginning of this section to find the corresponding resistance value for this sensor temperature.

If out of specification, replace the sensor.

If resistance tests good, **reconnect** the EGTS and disconnect the connector A on the ECM.

Using a multimeter, recheck resistance value between terminals 10 and 26.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connector or replace the wiring harness between ECM connector and the EGTS.

Replacement

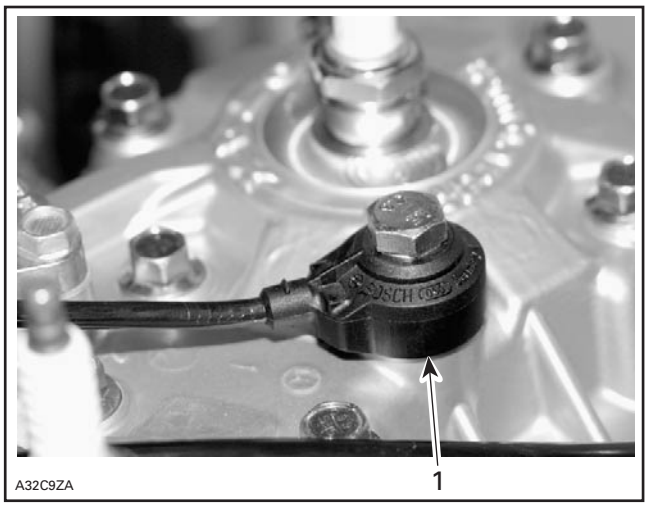
Disconnect EGTS connector and remove EGTS.

Apply anti-seize lubricant (P/N 293 800 070) over EGTS threads to prevent possible seizure.

Torque the new EGTS to 45 N•m (33 lbf•ft).

Replug connector.

KNOCK SENSOR (KS)



1. Knock sensor (KS)

Dynamic Test

Lift rear of vehicle off the ground and support it with a wide-base mechanical stand.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, monitor the knock sensor using the Faults section.

Start the engine and bring engine RPM above 6000 RPM. If no fault code occurs, the knock sensor is good.

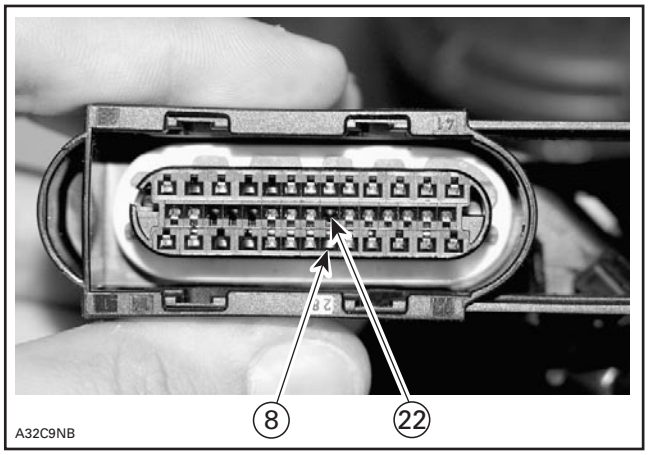
Otherwise, do the following.

Ensure sensor and head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.

Check the knock sensor circuit on wiring harness.

Disconnect the connector from knock sensor harness.

Disconnect connector A from the ECM and check continuity of circuit as per following table.



CIRCUIT NUMBER (ECM CONNECTOR A)	KS CONNECTOR
A-22	PIN 1
A-8	PIN 2

If test is not good, repair the connector or replace the wiring harness between ECM connector and knock sensor.

Replacement

Unscrew and remove knock sensor from cylinder head.

Clean contact surface, apply Loctite 5910 (P/N 293 800 081) on both contact surfaces on the knock sensor then install the new sensor.

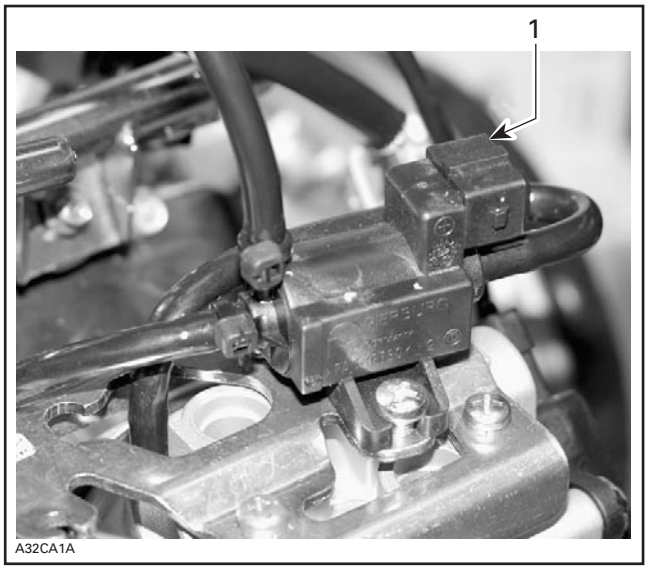
CAUTION: Install screw and torque it within 10 minutes to prevent the sealant to dry before torquing. A dried sealant before torquing would impair the knock sensor operation.

Torque screw to 24 N•m (18 lbf•ft).

CAUTION: Improper torque might prevent sensor to work properly and lead engine to severe damage of internal components.

Replug connector.

E-RAVE SOLENOID



1. E-RAVE solenoid

Resistance Test

Disconnect the solenoid connector.

Check resistance value between both terminals of the solenoid.

The resistance value should be approximately 30 Ω.

Voltage Test

Install the tether cord cap and push the START/RER button momentarily to activate ECM.

Battery voltage should be present on WHITE/GREEN wire. If test fail, fuse or relay may be faulty.

Continuity Test

WHITE/BROWN wire must show continuity between solenoid connector and pin 15 on ECM connector.

If test fail, repair connector or replace wiring harness between ECM connector and solenoid.

Replacement

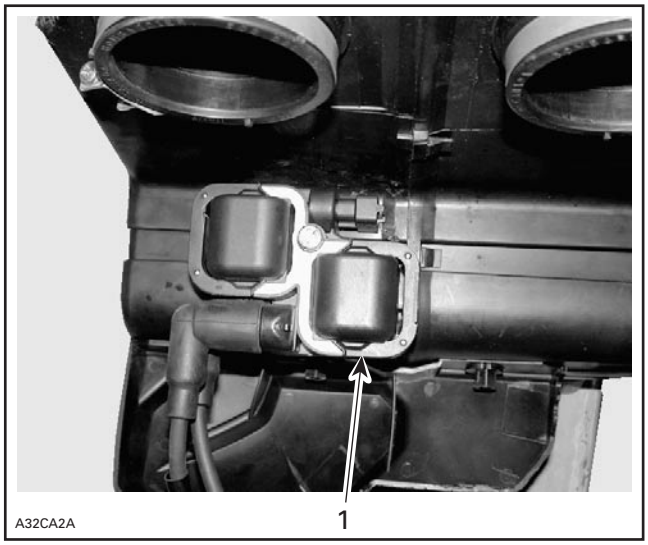
Remove the air intake silencer. Unplug the solenoid connector and all hoses.

NOTE: Mark hose locations for installation.

Remove solenoid screws then the solenoid.

For installation, reverse the removal procedure.

DOUBLE IGNITION COIL



1. Ignition coil

NOTE: The ECM energizes the primary side of each ignition coil individually. It can detect if the double ignition coil is connected otherwise a trouble code will appear upon starting..

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the ignition coil from the **Activation** section.

You should hear the spark occurring. In doubt, use an inductive spark tester or a sealed tester – available from after-market tool/equipment suppliers – to prevent spark occurring in the engine compartment. Otherwise, perform the following checks.

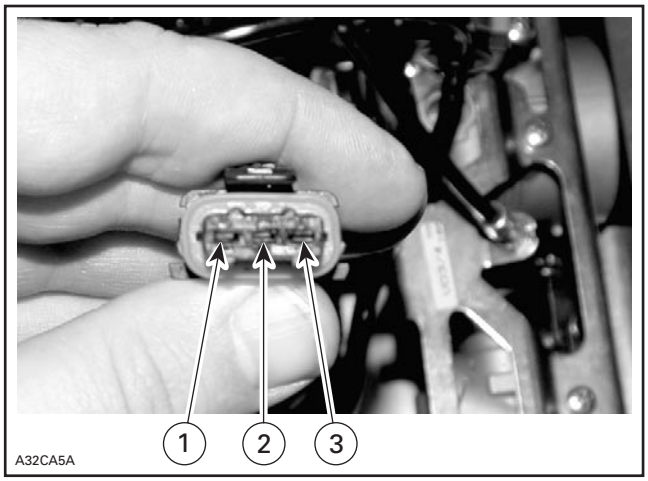
An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

Voltage Test

⚠ WARNING

When disconnecting coil from spark plug, always disconnect coil from main harness first. Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as spark may cause fuel vapor to ignite.

Disconnect the plug connector from the ignition coil and check the voltage supplied by the battery.



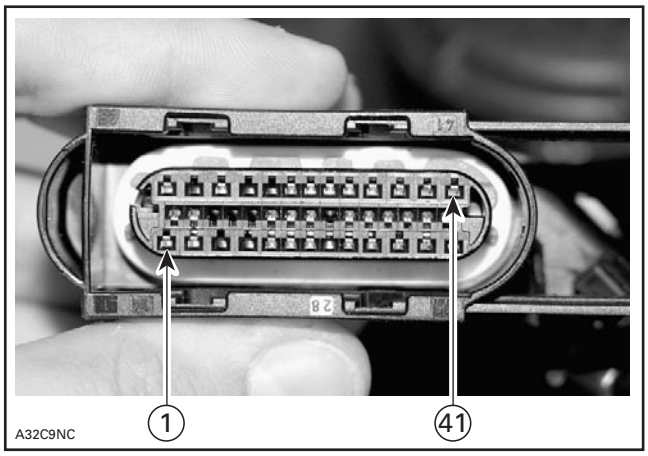
Install **tether cord cap** on the DESS post and push the START/RER button momentarily to activate the ECM.

Check voltage between terminal 2 of ignition coil connector on the wiring harness and battery ground.

Battery voltage should be present (approx. 12 V).

If 12 V is NOT read, check continuity between terminal 2 of ignition coil and the corresponding fuse. Otherwise repair wiring harness.

If 12 V is read, disconnect the connector A from the ECM and check the continuity of appropriate circuit 41 (cylinder 1) or 1 (cylinder 2) and of ignition coil connector, pin 3 and pin 1 respectively.



ECM CONNECTOR

If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

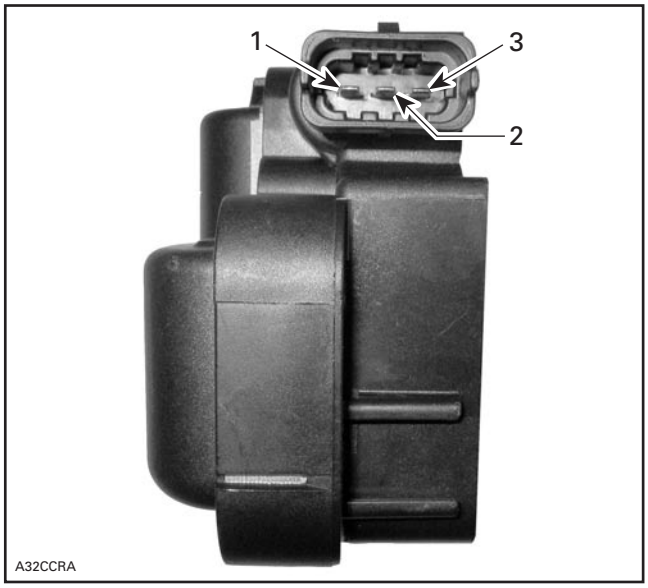
If wiring harness is good, test resistance of primary winding of ignition coil.

Resistance Test

Remove spark plug cables from ignition coil.

Using a multimeter, check the resistance of primary winding.

NOTE: The secondary winding can not be measured with an ohmmeter. Try a new double ignition coil if necessary.



1. *Terminal 1a*
2. *Terminal 15*
3. *Terminal 1b*

For primary winding, check the resistance between terminal 15 and terminal 1a (cylinder 1) of the ignition coil and between terminal 15 and terminal 1b (cylinder 2) respectively.

The resistance should be between 0.40 and 1.15 Ω at 20°C (68°F).

If the resistance of one of both windings is not good, replace the ignition coil.

If the windings test good, check corresponding fuse, relay and wiring. If good, try a new ECM.

⚠ WARNING

Always reconnect ignition coil cables at the same spark plugs where they come from. Otherwise, severe backfire may occur with possible damage to exhaust system components.

IGNITION TIMING

Refer to IGNITION TIMING section.

ENGINE START/RER BUTTON VERIFICATION

A quick operation test can be done using the vehicle communication kit (VCK) with the B.U.D.S. software, using the **Monitoring** section. Press the START/RER button and look at the START/RER button LED. It should turn on, indicating the starting system is working on the input side of the starting system (START/RER button, ECM and wiring). If so, you know now the problem is on the output side of the starting system (ECM output signal to starting solenoid, wiring harness going to the solenoid and starter motor. Otherwise, check the input side as follows.

Disconnect the connector of the steering harness.

Measure the resistance of the GREEN/RED and LIGHT BROWN wires for 0Ω. Depress start button and the reading should change from 0Ω to infinitely high.

Release the start button and measure the resistor between LIGHT BROWN and BLACK wires. It should be 50Ω.

Test continuity of circuit B-19. If it is good, try a new ECM. Otherwise, repair harness/connectors.

DESS SWITCH VERIFICATION

If 2 short beeps are not heard when starting the engine, refer to DIAGNOSTIC PROCEDURES.

The following continuity tests can also be performed using an ohmmeter.

Disconnect switch wires.

Tether Cord Cap Removed

Connect test probes to switch GREY/GREEN and WHITE/BLACK wires. Measure resistance, there should be NO continuity (open circuit).

Connect one test probe to the WHITE/GREY wire and the other test probe to the switch top terminal. Measure resistance, it must be close to 0 ohm.

Connect one test probe to the GREY/GREEN wire and the other test probe to the switch ring. Measure resistance, it must be close to 0 ohm.

Tether Cord Cap on DESS Post

Connect test probes to switch GREY/GREEN and WHITE/BLACK wires. Measure resistance, it must be close to 0 ohm.

SPARK PLUGS

Disassembly

Disconnect the spark plug cable from the spark plug.

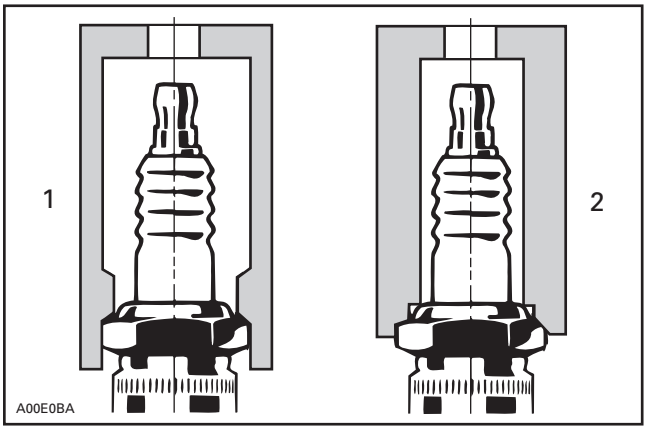
First unscrew the spark plug one turn.

Clean the spark plug and cylinder head with pressurize air then completely unscrew.

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

1) Using a wire feeler gauge, set electrode gap according to the following chart.
2) Apply anti-seize lubricant over the spark plug threads to prevent possible seizure.
3) Hand screw spark plug into cylinder head. Then, tighten the spark plug clockwise an additional 1/4 turn with a proper socket.



1. Proper socket
2. Improper socket

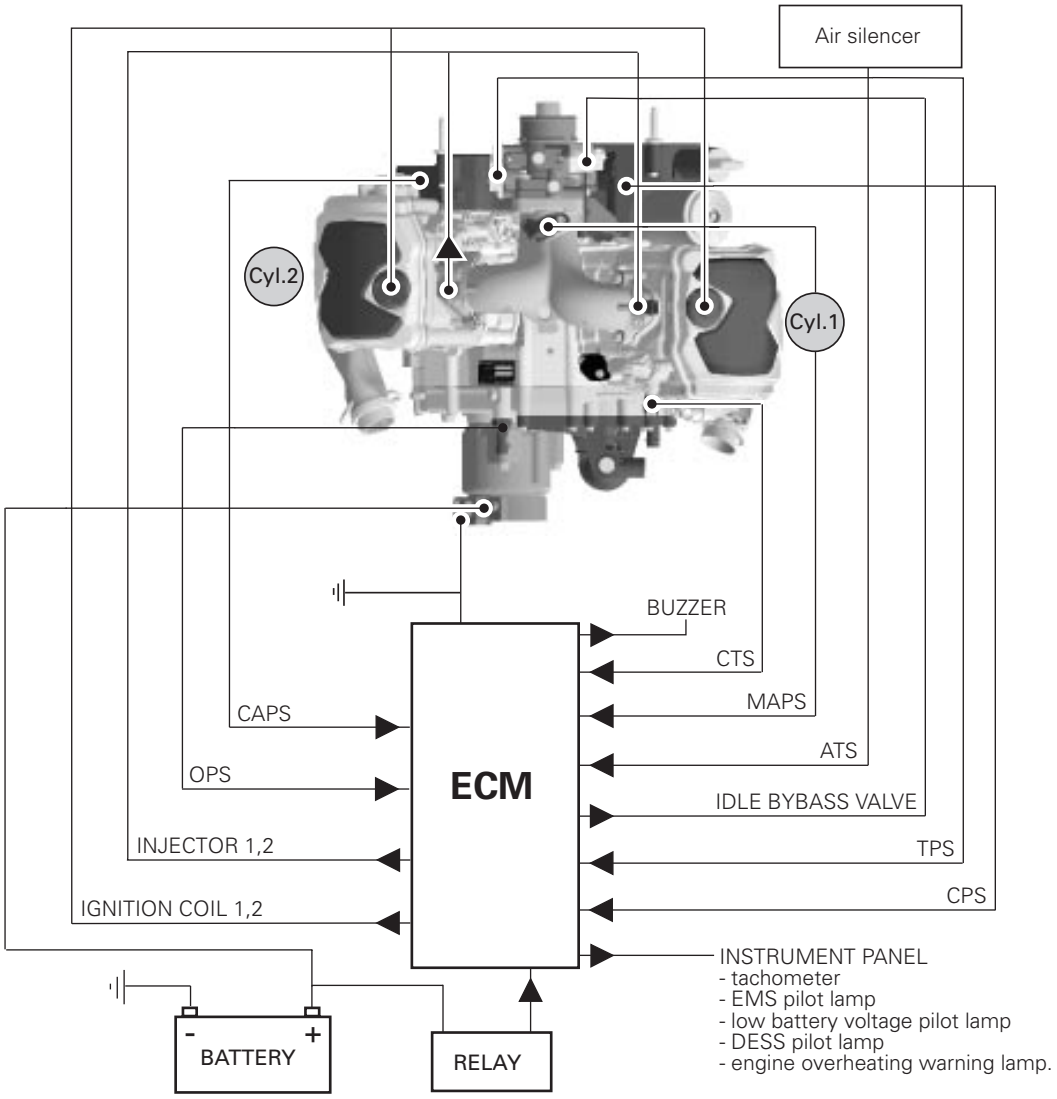
ENGINE	SPARK PLUG	TORQUE	GAP mm (in)
593 SDI	NGK BR 9 ECS	Hand tighten + 1/4 turn with a socket	0.8 (.031)

CRANKING SYSTEM

See above for start/stop switch and the DESS post testing.

OVERVIEW

ENGINE MANAGEMENT SYSTEM - OVERVIEW
ROTAX 4-TEC 1004



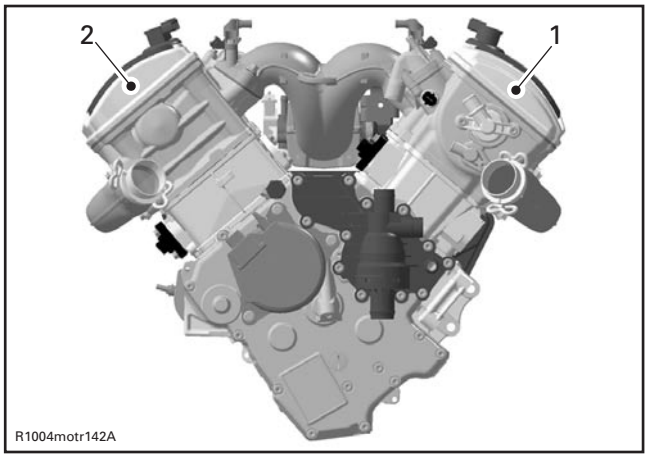
CPS	Crankshaft Position Sensor
TPS	Throttle Position Sensor
ATS	Air Temperature Sensor
CTS	Coolant Temperature Sensor
OPS	Oil Pression Switch
CAPS	Camshaft Position Sensor
MAPS	Manifold Air Pression Sensor
EMS	Engine Management System
ECM	Engine Control Module

A32I0LS

OPERATING PRINCIPLE OF ENGINE MANAGEMENT

A highly advanced engine management system (EMS) has been used to ensure a high power output with cleaner combustion. The EMS calculates the proper air/fuel mixture and ignition timing for each cylinder separately. The fuel is injected into the intake port of each cylinder.

NOTE: On the 1004, the cylinders are referenced as 1 (front) and 2 (rear) instead of PTO and MAG.

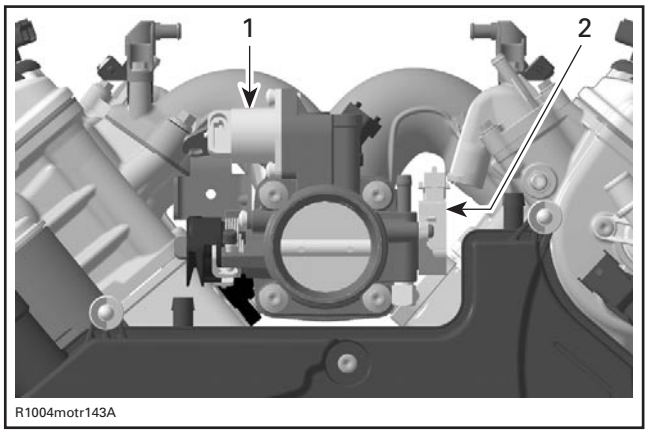


1. Cylinder 1
2. Cylinder 2

NOTE: "EMS" stands for engine management system. "EMS" includes an ECM (engine control module), sensors and injectors.

AIR INDUCTION

Through air filters, air goes into the air silencer. ECM measures at this point air temperature. Air pressure is measured directly in the intake manifold. Then, air for combustion is drawn through one 52 mm throttle body. The air flow is controlled by a throttle plate and an idle bypass valve respectively. The air continues through the intake manifold and goes into the cylinder head.



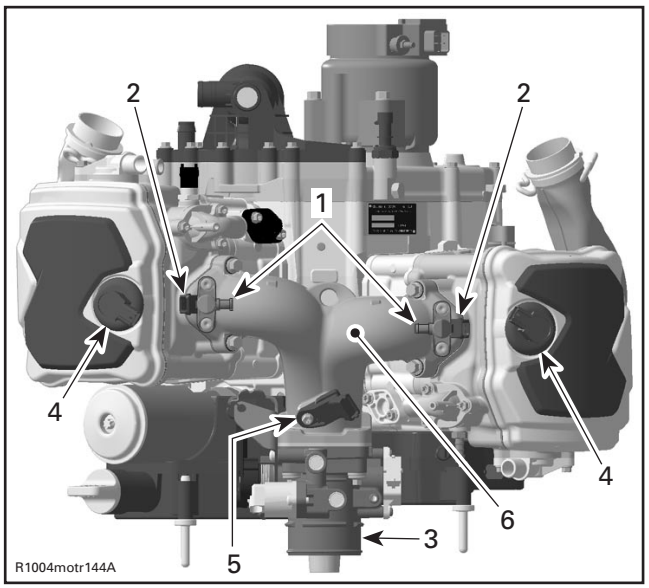
52 MM THROTTLE BODY
1. Idle bypass valve
2. Throttle position sensor (TPS)

FUEL DELIVERY SYSTEM

BASIC OPERATION

When the intake valve reaches the correct position, the ECM (engine control module) opens the fuel injector and fuel is discharged into the intake port at the air intake manifold by the high fuel pressure inside the fuel rail. The air/fuel mixture enters then the combustion chamber through the open intake valve. This mixture is then ignited by the spark plug.

INTAKE MANIFOLD



INTAKE MANIFOLD
1. *Fuel rail*
2. *Injector*
3. *Throttle body*
4. *Ignition coil*
5. *Manifold air pressure sensor (MAPS)*
6. *Intake manifold*

The intake manifold is mounted on the top of the engine on both cylinder heads. It provides support for the fuel injectors, the fuel rails, MAPS (manifold air pressure sensor) and the throttle body. The air intake manifold is a resonator between the throttle body and the air intake at the cylinder heads.

Fuel Rail

Two fuel rails, one for each injector, are mounted on the intake manifold. The fuel rails ensure all the time, that enough fuel at the right pressure can be delivered to the fuel injectors. The fuel rails are fed by the fuel pump with a fuel pressure of approximately 400 kPa (58 PSI).

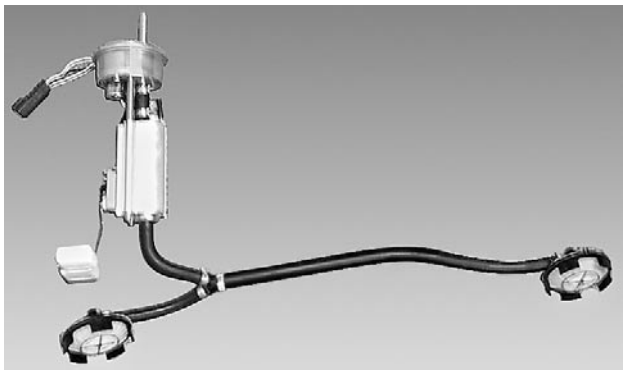
Fuel Injector

Two fuel injectors (one per cylinder) are used to inject fuel into the intake port of the cylinder head.

Throttle Body

It is a 52 mm heated throttle body mounted on intake manifold. Fitted on the throttle body, there is the TPS and the idle bypass valve which allows the ECM to control the RPM while the throttle plate is closed.

FUEL PUMP MODULE



The fuel pump module is located inside the fuel tank. The module includes fuel pump, fuel pressure regulator and fuel level sensor.

Fuel Pump

It provides fuel pressure and flow rate to the system.

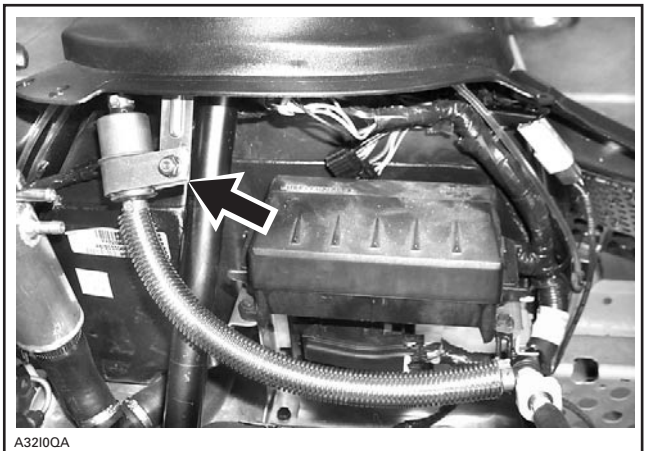
Fuel Pressure Regulator

A fuel pressure regulator controls the pressure in the system and allows excess fuel to return to the fuel tank. The fuel pressure regulator regulates the fuel pressure at approximately 400 kPa (58 PSI).

Fuel Pickups

Two fuel pickups come with 70 micron filter. One is located at the front right side of the fuel tank and the other at the rear left side.

In-Line Fuel Filter

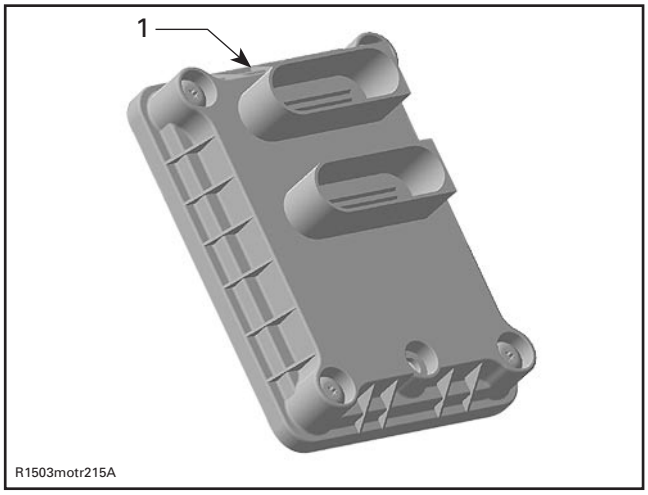


The in-line fuel filter is fastened under the steering console. It comes as a complete assembly.

ELECTRONIC MANAGEMENT

EMS (ENGINE MANAGEMENT SYSTEM)

The engine management system is controlled by the ECM.

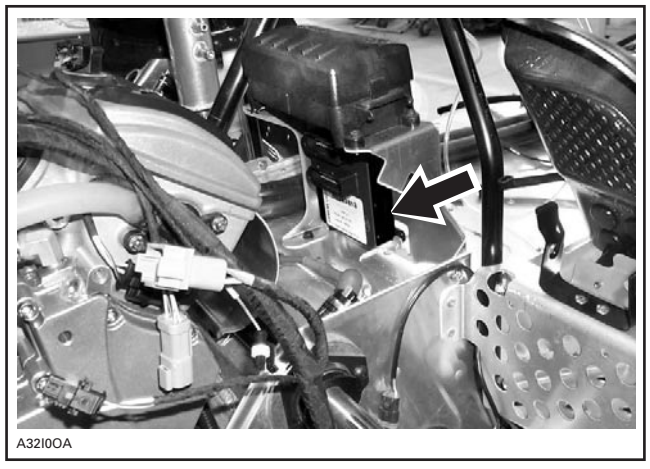


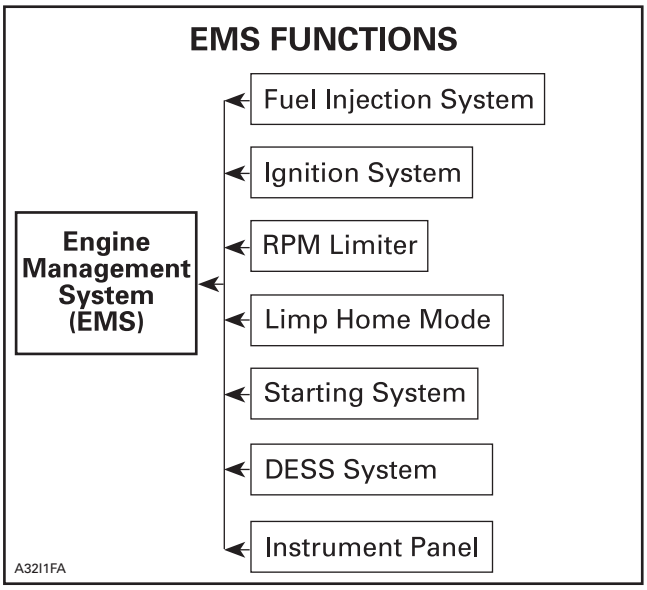
TYPICAL
1. ECM

ECM

The ECM is located between the engine and the fuel tank, under the fuse box.

It controls all engine management functions, by processing the information given by various sensors.





The ECM (engine control module) is directly powered by the battery. It is responsible for the following engine management/electrical functions:

- analysis of information
- distribution of information
- start/stop function
- timer
- DESS (Digitally Encoded Security System)
- ignition timing control
- injection control
- proper mapping (injection and ignition) for optimum engine operation in all conditions.
- engine RPM limiter
- etc.

The ECM features a permanent memory that will keep the programmed tether cord cap (s) active, fault codes and other engine information, even when the battery is removed from the vehicle.

EMS — GENERAL FUNCTIONS

Anti-Drive Feature

This system allows the engine to reach pulley engagement speed only if a programmed tether cord cap is installed on DESS post. See below for details.

Digitally Encoded Security System (DESS)

The ECM is designed to work with the DESS.

The tether cord cap contains a magnet and a ROM chip. The magnet actually closes the reed switch inside the post which is the equivalent of a mechanical ON/OFF switch. The chip has a unique digital code.

NOTE: Actually, it is the memory of the ECM which is programmed to recognize the digital code of the tether cord cap. This is achieved with the VCK (Vehicle Communication Kit) (P/N 529 035 981). Refer to B.U.D.S. help system to program a tether cord cap.

529 035 981

The system is quite flexible. Up to 8 tether cord caps may be programmed in the memory of the vehicle ECM. They can also be erased individually.

NOTE: If desired, a tether cord cap can be used on other vehicles equipped with the DESS. It only needs to be programmed for that vehicle.

The memory of the ECM features a self-diagnostic mode for the DESS operation. Refer to DIAGNOSTIC PROCEDURES section for more information.

The memory of the ECM is permanent. If the battery is disconnected, no information is lost.

Note that the DESS anti-drive circuitry is already activated on all new ECM.

Engine RPM Limiter

The ECM will limit the maximum engine speed.

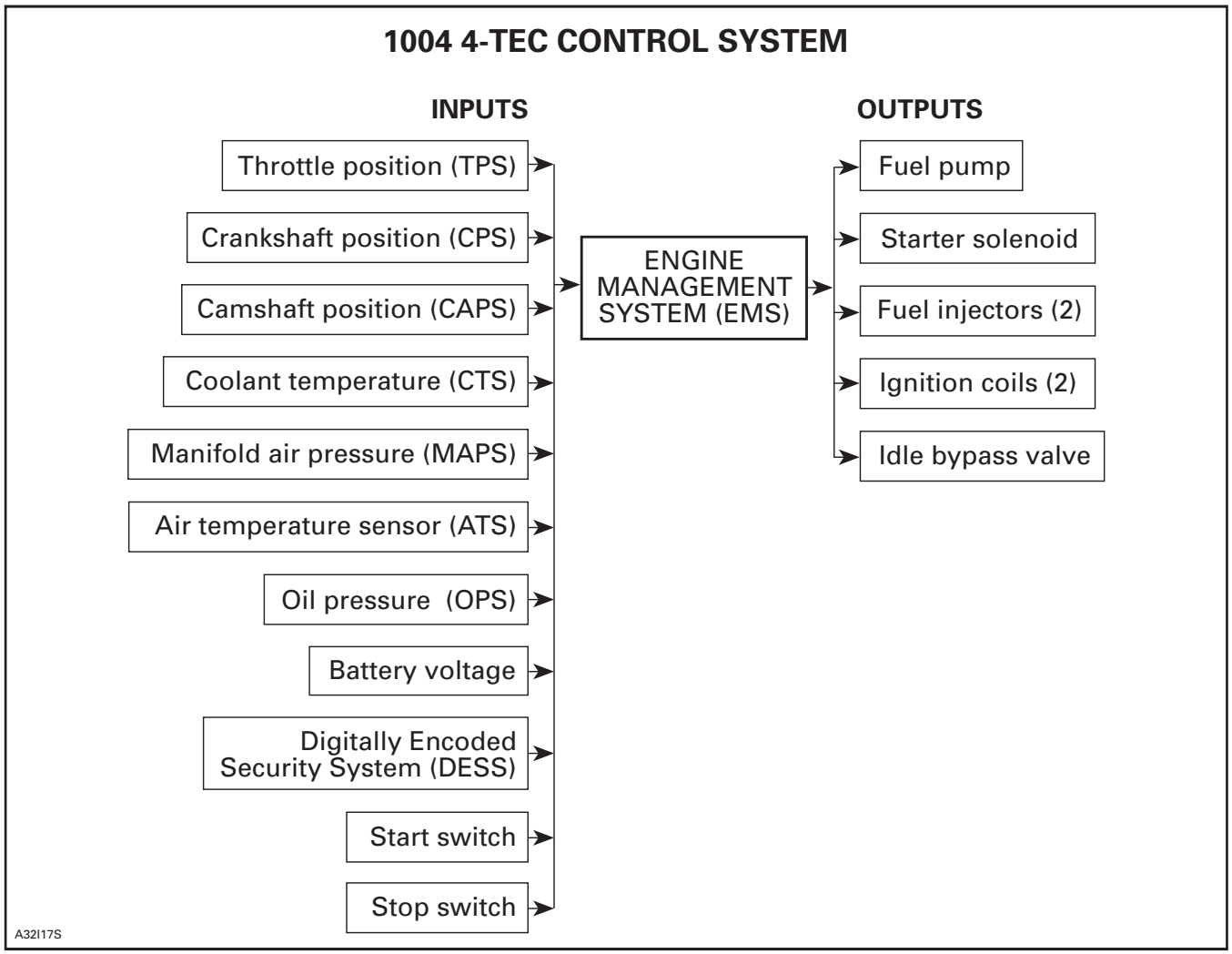
Low Oil Pressure Warning Device

When the oil pressure falls under a certain level, the ECM sends out signals to the buzzer, the low oil pressure warning lamp and to the EMS pilot lamp.

High Coolant Temperature Warning Device

When the coolant temperature is getting to high, the ECM sends out signals to the buzzer, the engine overheating warning lamp and to the EMS pilot lamp.

EMS — ENGINE MANAGEMENT FUNCTIONS



This engine management system controls both the fuel injection and the ignition timing.

As shown in the 1004 4-TEC CONTROL SYSTEM illustration, the ECM is the central point of the fuel injection system. It reads the inputs, makes computations, uses pre-determined parameters and sends the proper signals to the outputs for proper engine management.

The ECM also stores the fault codes and general information such as: operating conditions, vehicle hours, serial numbers, customer and maintenance information.

Electronic Fuel Injection

The ECM reads the signals from different sensors which indicate engine operating conditions at millisecond intervals.

Signals from sensors are used by the ECM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS, the ATS, the MAPS and the TPS are the primary sensors used to control the injection and ignition timing. Other sensors (like temperature sensors, etc.) are used for secondary input.

Ignition System

The ignition system is fully managed by the ECM which controls the ignition system parameters, such as spark timing, duration and firing order to achieve the proper engine requirements.

Ignition Coils

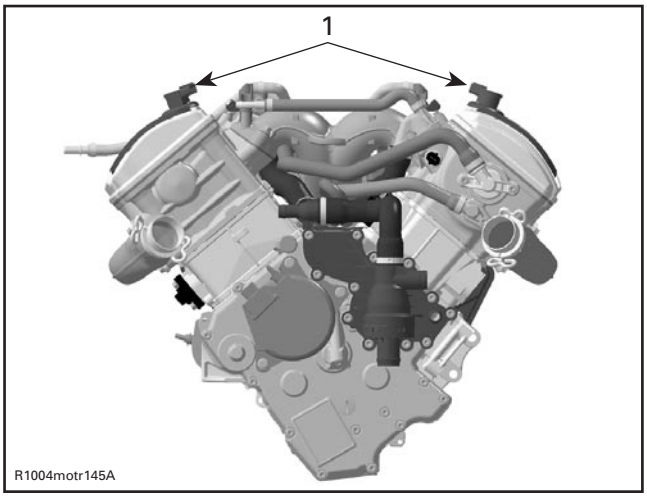
Two separate ignition coils induce voltage to a high level in the secondary windings to produce a spark at the spark plug.

The ignition coils receive input from the ECM. Each coil provides high voltage to its corresponding spark plug.

This ignition system allows spark plugs to spark independently.

NOTE: Ignition coil wires are not interchangeable due to different lengths of the wiring harness.

Both ignition coils are located on the cylinder heads directly on the spark plugs.



1. Ignition coils

Ignition Timing

The ECM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the ECM controls the ignition timing for optimum engine operation.There is no mechanical adjustment to perform.

Engine Modes of Operation

The ECM controls different operation modes of the engine to allow proper operation for all possible conditions: Cranking, start-up, idle, warm up, part load, full load, engine speed limiter, drowned engine and limp home (see below).

Flooded Engine (drowned mode)

If engine is fuel-flooded and does not start, this special mode can be activated to prevent fuel injection and ignition while cranking. Proceed as follows to activate it.

With tether cord cap on its post while engine is stopped, press and HOLD throttle lever at WOT position.

Press the start button. The mode is now on.

Releasing throttle lever will bring back the normal mode.

If engine does not start, it may be necessary to remove spark plugs and crank engine with rags over spark plug holes. Refer to COMPONENT INSPECTION AND ADJUSTMENT subsection.

⚠ WARNING

When disconnecting coil from spark plug, always disconnect coil from main harness first. Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as spark may cause fuel vapor to ignite.

Limp Home Mode

Besides the signals as seen above, the ECM may automatically set default parameters to the engine management to ensure the adequate operation of the vehicle if a component of the fuel injection system is not operating properly.

Sensor failures will not lead to a limp home mode, warning will follow through the EMS pilot lamp and the buzzer.

When minor fault occurs, the fault and message/buzzer disappear automatically when the condition no longer exists.

Releasing throttle and letting the engine returning at idle speed may allow normal operation to come back. If it does not work, try removing and reinstalling the tether cord cap on its post.

These performance-reduced modes allow the rider to go back home which would not be possible without this advanced system. Refer to the DIAGNOSTIC PROCEDURES for a complete chart.

Shutdown Mode

ECM will shut down all outputs 5 seconds after the tether cord cap is removed.

If the tether cord cap is still on DESS post but the engine is turned off using engine cut-out switch, the ECM will shut down all outputs after 15 seconds.

Diagnostic Mode

The malfunctions are recorded in the memory of the ECM. The memory of the ECM can be checked using the VCK (Vehicle Communication Kit) (P/N 529 035 981) to see the fault codes.

The ECM and the VCK are able to communicate through a connector on the vehicle. Refer to the DIAGNOSTIC PROCEDURES section. B.U.D.S. Version G2.10 or P2.10 and up must be used for this system.

Monitoring System

The ECM monitors the electronic components of the fuel injection system and also the electrical system. When a fault occurs, it sends visual messages through the referring LED and/or audible signals through a buzzer to inform you of a particular condition. Refer to the DIAGNOSTIC PROCEDURES section for the LED and the buzzer coded signals chart.

DIAGNOSTIC PROCEDURE

SERVICE TOOLS

Description	Part Number	Page
gray key	529 035 896	307
supply cable	529 035 869	307
VCK (Vehicle Communication Kit)	529 035 981	306

GENERAL

Here is the basic order suggested to diagnose a suspected engine management or fuel injection related problem:

- Check the chart in the TROUBLESHOOTING section to have an overview of problems and suggested solutions.
- Check if the engine management system (EMS) pilot lamp lights up. If so, use the VCK (Vehicle Communication Kit) and look for fault codes to diagnose the trouble.
- Check all fuses.
- Check fuel pressure.
- Check spark plugs condition.
- Check all connections of the wiring harness.
- Refer to COMPONENT INSPECTION AND ADJUSTMENT section for procedures.

Terminology

Some documents or softwares use technical terms that may be different from the one used in this manual. The following table will help to find the equivalence.

TERMS USED IN THIS MANUAL	TERMS USED IN OTHER DOCUMENTS OR SOFTWARES
Camshaft	Cam
Crankshaft	Crank
ECM	– ECU – Module
Idle bypass valve	– DLA (Digital Linear Actuator) – Idle actuator – Idle valve – Idle control air valve
MAPS (Manifold Air Pressure Sensor)	APS (Air Pressure Sensor) or (Atmospheric Pressure Sensor)
DESS tether cord	– DESS key – key

MONITORING BEEPER CODED SIGNALS

CODED SIGNALS	POSSIBLE CAUSE	REMEDY
2 short beeps (when engine is started). DESS/RER pilot lamp also blinks.	Confirms that proper tether cord cap is installed. Engine can rev above pulley engagement.	Normal condition.
1 short beep every 1.5 seconds (when engine is started). DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Bad DESS system connection.	Reinstall tether cord cap correctly over post.
	Defective tether cord cap.	Use another programmed tether cord cap.
	Dirt or snow in tether cord cap.	Clean tether cord cap.
	Defective DESS post.	Replace DESS post.
1 long beep per second.	Reverse is selected.	Vehicle can be driven in reverse.
3 short beeps per second. DESS/RER pilot lamp also blinks. Engine cannot reach pulley engagement speed. Vehicle cannot be driven.	Wrong tether cord cap is installed.	Install proper tether cord cap. Program key into electronic module.
3 short beeps per second. Engine overheating pilot lamp also blinks.	Engine is overheating.	Stop engine immediately and allow to cool. Check cooling system.
3 short beeps per second. Oil pilot lamp also lights up.	Low oil pressure on 4-TEC models.	Stop engine immediately and check oil level and top it. Check lubrication system.
3 short beeps per second. Battery pilot lamps lights up.	Low battery voltage. No charging.	Check battery and charging system.
4 short beeps every 2 minutes. Oil pilot lamp also lights up.	Low oil level on 2-TEC models.	Check oil level and replenish as soon as possible.

VCK (VEHICLE COMMUNICATION KIT)

The VCK (Vehicle Communication Kit) (P/N 529 035 981) is the primary tool to diagnose engine management and fuel injection related problems.

529 035 981

NOTE: The MPEM programmer does not work on 4-TEC models.

Ensure to use the latest B.U.D.S. version available on BOSSWeb.

B.U.D.S. (Bombardier Utility and Diagnostic Software) is designed to allow actuators, sensors and electronic equipments inspection, diagnostic options and reset such as the closed throttle and idle actuator.

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

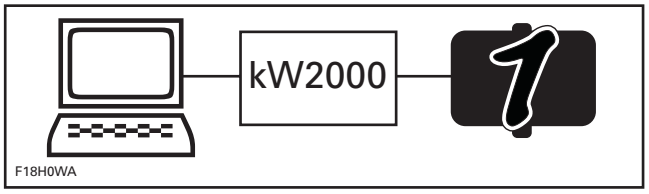
⚠ WARNING

If the computer you are using is connected to the power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

IMPORTANT: When using the software B.U.D.S., with the 4-TEC engine, ensure that the protocol "kW2000" is properly selected in **"MPI"** (multi-protocol interface) under **"Choose protocol"**.

When B.U.D.S. is connected to the vehicle, the status bar shows the protocol (kW2000) and the number 1 to the right. To communicate with the ECM (Engine Control Module), number 1 must be displayed.

Number 1 means that one module is connected.



ONE MODULE IS CONNECTED

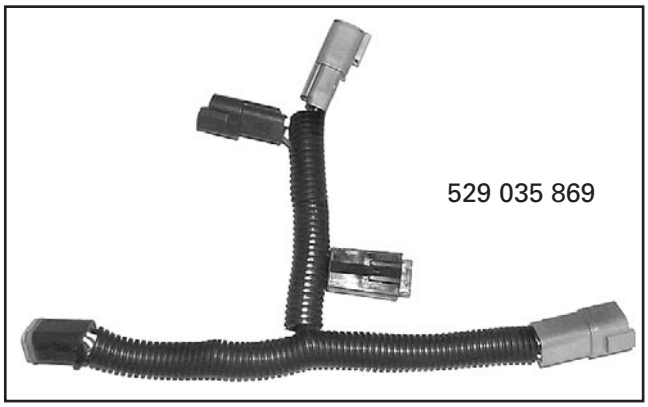
If an "X" is shown, this means that no communication between the MPI and the ECM is possible. Possible causes are:

– ECM is not powered-up
– wrong protocol is used
– bad connection between MPI and module.

ECM Supply

To power-up the ECM, push the START button shortly while the engine cut-out switch is OFF and the tether cord cap installed on DESS post. If your intent is to program the vehicle key, use gray key (P/N 529 035 896) on DESS post.

The supply cable (P/N 529 035 869) may also be used. Connecting it between MPI and vehicle will power-up the ECM.



VCK Supply

The VCK (MPI box) can use the vehicle power for its supply. Four AA batteries or an AC/DC power supply can also be used. Make sure to respect MPI specification if a power supply is used.

Writing in ECM

When writing in ECM through B.U.D.S., there will be an "EMS Tracking" message that will say "Remove key from vehicle". When this occurs, remove the tether cord cap from its post and wait until the message disappears (approximately 15 seconds after tether cord cap removal).

4-TEC SYSTEM FAULT CODES

General

The faults saved in the ECM (Engine Control Module) are kept even if the battery is disconnected.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. This will properly reset the appropriate counter(s) and will also record that the problem has been fixed in the ECM memory.

Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the code faults (state, count, first, etc.) and report, refer to B.U.D.S. online help.

Supplemental Information

– Electrical noise is picked up by the ECM. Ensure that all connections are in good condition, also grounds (battery, ECM, engine and ignition system), they are clean and well tightened and that all electronic components are genuine — particularly in the ignition system. Installing non-resistive spark plugs may lead to generate fault code.
– Electrical noise might also lead engine to occasional cutout without generating a fault code when engine is restarted.
– If everything is in good condition, try a new ECM.

When using the service action suggested in the Fault section of B.U.D.S., the system circuits are referred to as DA-41, which means connector "DA" on the ECM and the circuit 41.

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups TPS faults and adaption faults. These are displayed on the B.U.D.S. system as TPS OUT OF RANGE and TPS ADAPTION FAILURE.

4-TEC TPS FAULT TABLES

TPS "OUT OF RANGE" Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also reveal a fault that is intermittent.

POSSIBLE CAUSES	ACTION
Check if connector is disconnected from TPS	Fix.
Check if sensor is loose	Fix and reset **Closed Throttle and Idle Actuator**.
Inspect sensor for damage or corrosion	Replace and reset **Closed Throttle and Idle Actuator**.
Inspect wiring (voltage test)	Repair.
Inspect wiring and sensor (resistance test)	If bad wiring, repair. If bad TPS, replace and reset **Closed Throttle and Idle Actuator**.
Test sensor operation (wear test)	Replace and reset **Closed Throttle and Idle Actuator**.

TPS "ADAPTATION FAILURE" Fault

It is caused by the idle position moving out of an acceptable range.

Following problems can be caused by a TPS "Adaption Failure":

– Idle speed is out of range.
– Engine stops, when throttle is released quickly.
– Engine runs inconsistent in low partload or low RPM.

POSSIBLE CAUSES	ACTION
Sensor has been replaced and TPS closed position not reset	Reset **Closed Throttle and Idle Actuator**.
Throttle body has been replaced and TPS closed position not reset	Reset **Closed Throttle and Idle Actuator**.
ECM has been replaced and TPS closed position not reset	Reset **Closed Throttle and Idle Actuator**.
Throttle cable too tight	Fix and reset **Closed Throttle and Idle Actuator**.
Sensor is loose	Fix and reset **Closed Throttle and Idle Actuator**.
Throttle bracket is loose	Fix and reset **Closed Throttle and Idle Actuator**.
Adjustment screw worn or loose	Change throttle body.
Idle bypass valve replaced but not reset	Reset **Closed Throttle and Idle Actuator** using B.U.D.S.

COMPONENT INSPECTION AND ADJUSTMENT

SERVICE TOOLS

Description	Part Number	Page
Fluke 111	529 035 868	313
fuel pump wrench	529 035 899	321–322
pressure gauge	529 035 591	319
supply cable	529 035 869	338
tachometer	529 014 500	315
VCK (vehicle communication Kit)	529 035 981	311, 320
wrench	529 035 603	320

SERVICE PRODUCTS

Description	Part Number	Page
silicone lubricant	293 600 041	338

GENERAL

Engine problems are not necessarily related to the electronic fuel injection system.

It is important to ensure that the mechanical integrity of the engine/propulsion system is present:

– good transmission system operation
– good engine compression and properly operating mechanical components, no leaks etc.
– fuel pump connection and fuel lines without leaks.

Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.

When replacing a component, always check its operation after installation.

FUEL SYSTEM

⚠ WARNING

The fuel system of a fuel injection system holds much more pressure than on a carbureted snowmobile. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here. Pay attention that some hoses may have more than one clamp at their ends. Ensure to reinstall the same quantity of clamps at assembly.

– Use the VCK (vehicle communication Kit) (P/N 529 035 981) to release the fuel pressure in the system. Look in the **Activation** section of the software B.U.D.S.

529 035 981

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing pressure test equipment or disconnecting fuel line connections. Use the VCK (Vehicle Communication Kit) to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always disconnect battery prior to working on the fuel system. After performing a pressure test, use the valve on the fuel pressure gauge to release the pressure (if so equipped).

– Always disconnect battery properly prior to working on the fuel system. Refer to BATTERY section.

When the job is done, ensure that hoses from fuel rail going to fuel pump are properly secured in their supports. Then, pressurize the fuel system. Perform the pressure test as explained in this section and pressurize the fuel tank and fuel lines as explained in FUEL SYSTEM section.

Properly reconnect the battery.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the tether cord cap on the DESS post. Always perform the pressure test if any component has been removed. A pressure test must be done before connecting the tether cord cap. The fuel pump is started each time the tether cord cap is installed and it builds pressure very quickly.

To check fuel rails for leaks, first pressurize the system then spray soapy water on all hose connections, regulators and injectors. Air bubbles will show the leaking area. Check also for leaking fuel or fuel odor.

⚠ WARNING

Never use a hose pincher on injection system high pressure hoses.

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

– battery
– fuses
– DESS
– ignition (spark)
– ground connections
– wiring connectors.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

Never use a battery charger to substitute temporarily the battery, as it may cause the ECM (engine control module) to work erratically or not to work at all. Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

⚠ WARNING

All electrical actuators (idle bypass valve, injectors, fuel pump, ignition coils and starter solenoid) are permanently supplied by the battery when the VCK (Vehicle Communication Kit) is connected to the diagnostic connector of the engine wiring harness and the tether cord cap is installed. Always disconnect the battery prior to disconnecting any electric or electronic parts.

To perform verifications, a good quality multimeter such as Fluke 111 (P/N 529 035 868) should be used.

529 035 868

Pay particular attention to ensure that pins are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

⚠ WARNING

Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

Before replacing an ECM, always check electrical connections. Make sure connectors are properly crimped on wires and fastened in housing, and that they are free of corrosion. Check if wiring harness shows any signs of scoring. Ensure proper electrical connection. Particularly check ECM ground connections. Ensure that contacts are good and clean. A «defective module» could possibly be repaired simply by unplugging and replugging the ECM. The voltage and current might be too weak to go through dirty wire pins. Check carefully if pins show signs of moisture, corrosion or if they look dull. Clean pins properly and then coat them prior to assembling with a silicon-based dielectric grease.

NOTE: Do not apply an other lubricant on the ECM connectors.

Ensure that all electronic components are genuine — any modification on the wiring harness may lead to generate fault codes or bad operation.

NOTE: For diagnostics purposes, use Vehicle Communication Kit (VCK). See DIAGNOSTIC PROCEDURES subsection.

After a problem has been solved, ensure to clear the fault(s) in the ECM using the VCK. Refer to DIAGNOSTIC PROCEDURES subsection.

Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (68°F). The resistance value of a resistance varies with the temperature. The resistance value for usual resistor or windings (such as injectors) **increases** as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value **decreases** as the temperature increases. Take it into account when measuring at temperatures different from 20°C (68°F). Use this table for resistance variation relative to temperature for **temperature** sensors.

TEMPERATURE SENSOR TABLE			
TEMPERATURE		**RESISTANCE (ohms)**	
°C	°F	ATS	CTS
- 40	- 40	—	45000
- 30	- 22	28000	28000
- 20	- 4	14500	15000
0	32	5500	5750
20	68	2500	2600
40	104	1200	1200
60	140	600	600
80	176	320	320
100	212	180	180
130	266	90	90

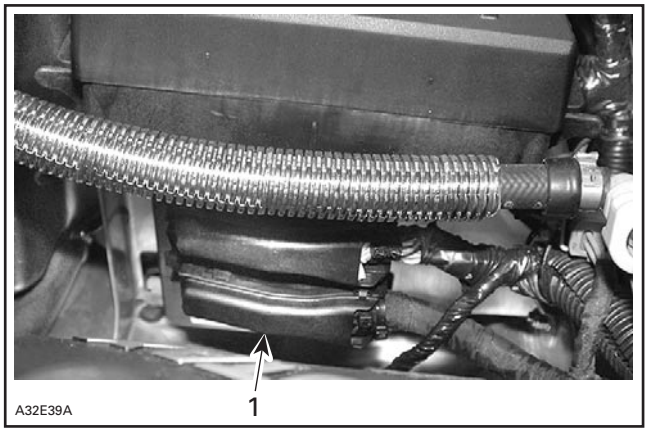
CONVERSION CHART FOR TEMPERATURE SENSORS

The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at room temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine and heated with a heat gun while it is still connected to the harness to see if the ECM will detect the high temperature condition and generate a fault code.

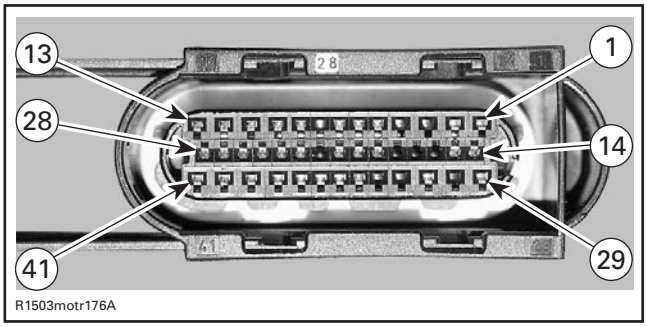
ENGINE CONNECTOR PIN-OUTS

Connector Position



1. ECM connector A

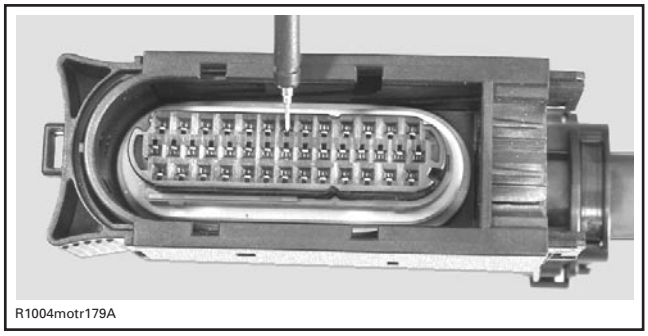
Use this diagram to locate the pin numbers on the ECM connector A of the wiring harness when performing tests.



ECM CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

ECM Connector

CAUTION: Probe on top of terminal only. Do not try to probe inside terminal or to use a paper clip to probe inside terminal, it will damage the square-shaped terminal and this may lead to improper function of the engine management system.

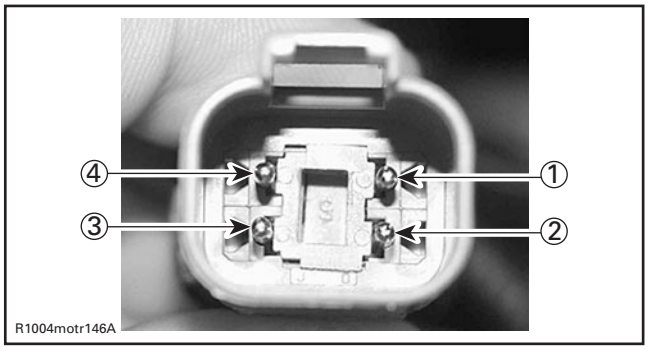


PROBE ONLY ON THE PIN NOZZLE OF FEMALE CONNECTOR

CAUTION: Do not disconnect the ECM connector needlessly. They are not designed to be disconnected/reconnected repeatedly.

Engine Connector

Use this diagram to locate the pin numbers on the Engine connector of the wiring harness when performing tests.

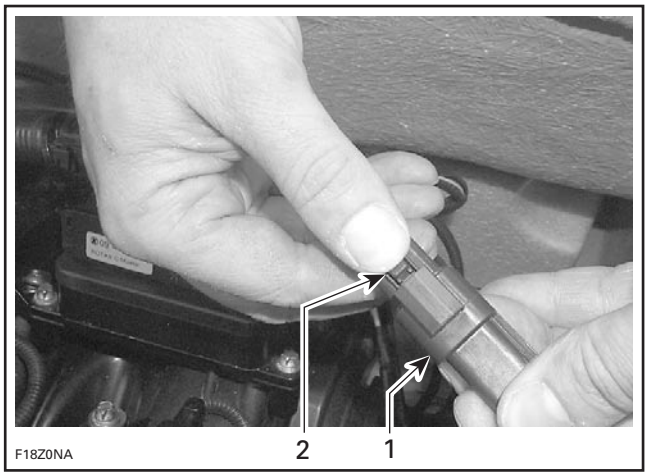


ENGINE CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

CONNECTORS ON ENGINE

Removal

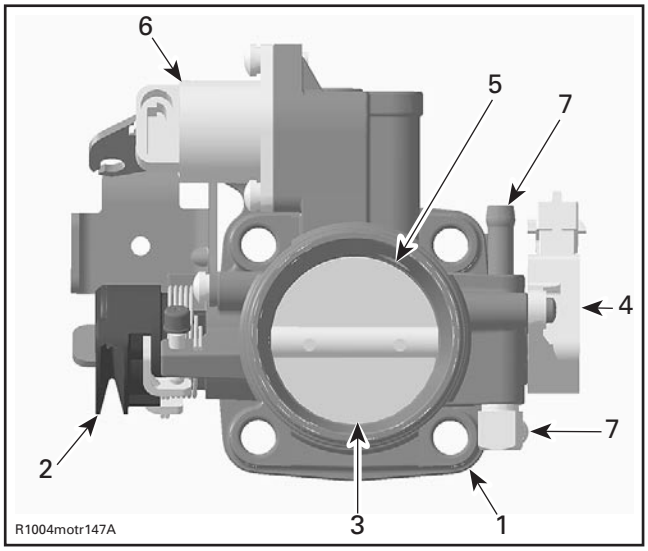
To disengage both connectors, press the release button and disconnect them.



TYPICAL
1. *Connector*
2. *Press release button*

AIR INDUCTION SYSTEM

THROTTLE BODY



1. *Throttle body*
2. *Throttle cable attachment*
3. *Throttle plate*
4. *TPS*
5. *Idle bypass channel*
6. *Idle bypass valve*
7. *Nipples for throttle body heating*

Mechanical Inspection

Check that the throttle plate moves freely and smoothly when depressing throttle lever.

IMPORTANT: The throttle body is designed to be tamper proof. Changing the idle stop or modifying it in any way will not increase performance or change the idle speed but may cause poor startability and erratic idling.

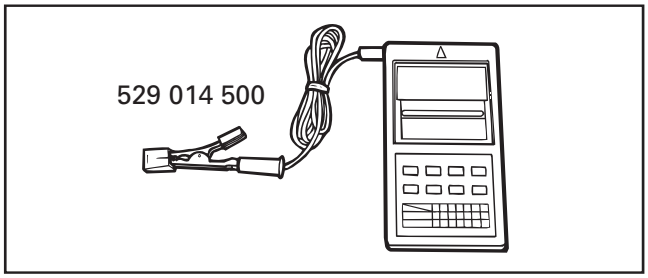
Before replacing any part, check the following as these could be causing the fault. Perform the test while the engine is off.

- Throttle cable adjustment too tight. Not returning fully to idle stop.
- Throttle body idle set screw is loose or worn.
- TPS is loose.
- Idle bypass valve is loose.
- Corroded or damaged wiring or connectors.
- Throttle body has been replaced and the **Closed Throttle and Idle Actuator** reset has not been performed.
- ECM has been replaced and the **Closed Throttle and Idle Actuator** reset has not been performed.

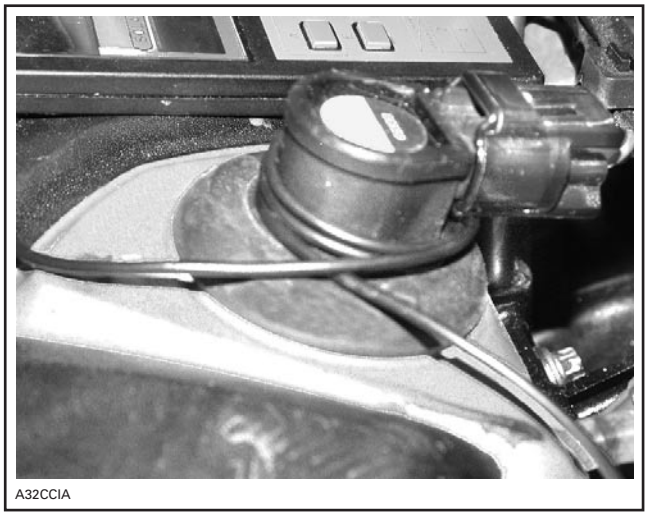
Electrical Inspection

Refer to THROTTLE POSITION SENSOR (TPS) and IDLE BYPASS VALVE in ELECTRONIC MANAGEMENT below.

To verify the engine RPM with the tachometer (P/N 529 014 500), use the following procedure.



The inductive tachometer works on these ignition coils (stick coils) as well as on regular high tension coil. Simply wrap the tachometer's wire a few turns around the protruding part of ignition coil.



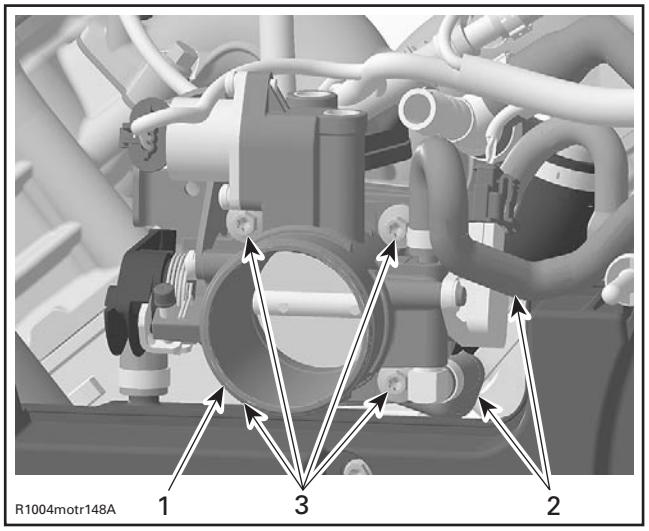
TYPICAL

Replacement

Removal

To remove the throttle body from engine, proceed as follows:

– Disconnect air intake silencer from throttle body.
– Drain cooling system.
– Remove clamps and hoses for throttle body heating from nipples.
– Remove retaining screws of throttle body.



1. *Throttle body*
2. *Hoses*
3. *Screws*

– Slightly pull throttle body out.
– Disconnect connectors from idle bypass valve, and TPS.
– Disconnect throttle cable.

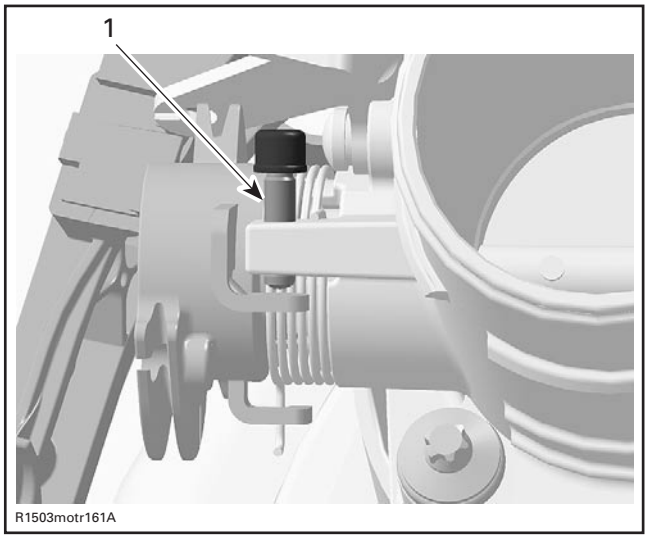
Installation

Installation of the new throttle body is the reverse of the removal procedure. Pay attention for the following details.

Refill and bleed the cooling system, refer to COOLING SYSTEM subsection.

For TPS and idle bypass valve replacement procedures, refer to the respective paragraph in ELECTRONIC MANAGEMENT below.

Adjustment



THROTTLE BODY
1. Idle stop screw

CAUTION: It is not allowed to perform any change on the idle stop screw.

The adjustment of the idle stop screw is optimized by the throttle body manufacturer and locked to prevent any modification.

CAUTION: Never attempt to adjust the idle speed through the throttle body tamper proof screw. If so, it would impair the idle speed stability. Besides, no adjustment could be performed by the dealer nor the factory to correct the idle speed. The throttle body would need to be replaced.

CAUTION: Do not alter or tamper with throttle cable adjustment or routing. It may cause poor startability and erratic idling.

The only thing that has to be performed when the throttle body has been replaced is the **Closed Throttle and Idle Actuator** reset. Refer to THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

Throttle Cable Adjustment

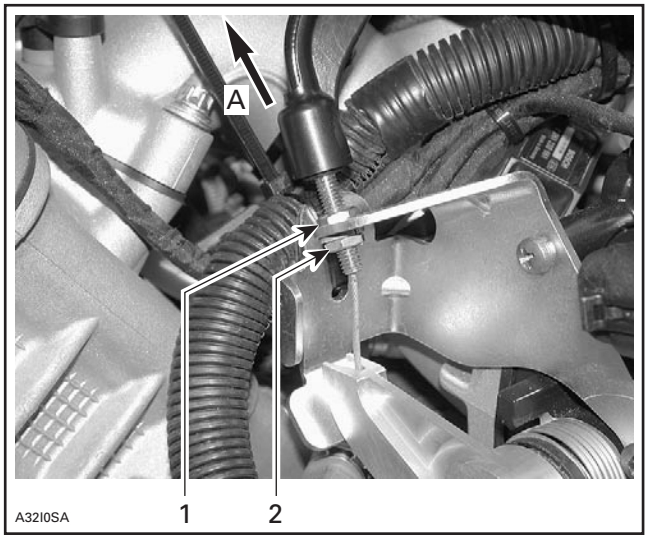
Mechanically adjust the throttle cable.

Handlebar and throttle cable must be at their normal position.

Apply full throttle.

Pull on throttle cable housing with a force of 50 N (11 lbf). Tighten top nut to 1 N•m (9 lbf•**in**).

Tighten bottom nut to 4.5 N•m (40 lbf•**in**).



WIDE OPEN THROTTLE POSITION
1. *Top nut torqued to 1 N•m (9 lbf•**in**)*
2. *Bottom nut torqued to 4.5 N•m (40 lbf•**in**)*

A. 50 N (11 lbf)

Activate throttle lever a few times. Make sure throttle cam of throttle body rests against idle speed screw without any tension in the cable.

CAUTION: If there is no free-play at idle position, it may cause poor idling and startability. Improper cable adjustment will cause strain on cable and/or damage cable bracket or throttle lever at handlebar.

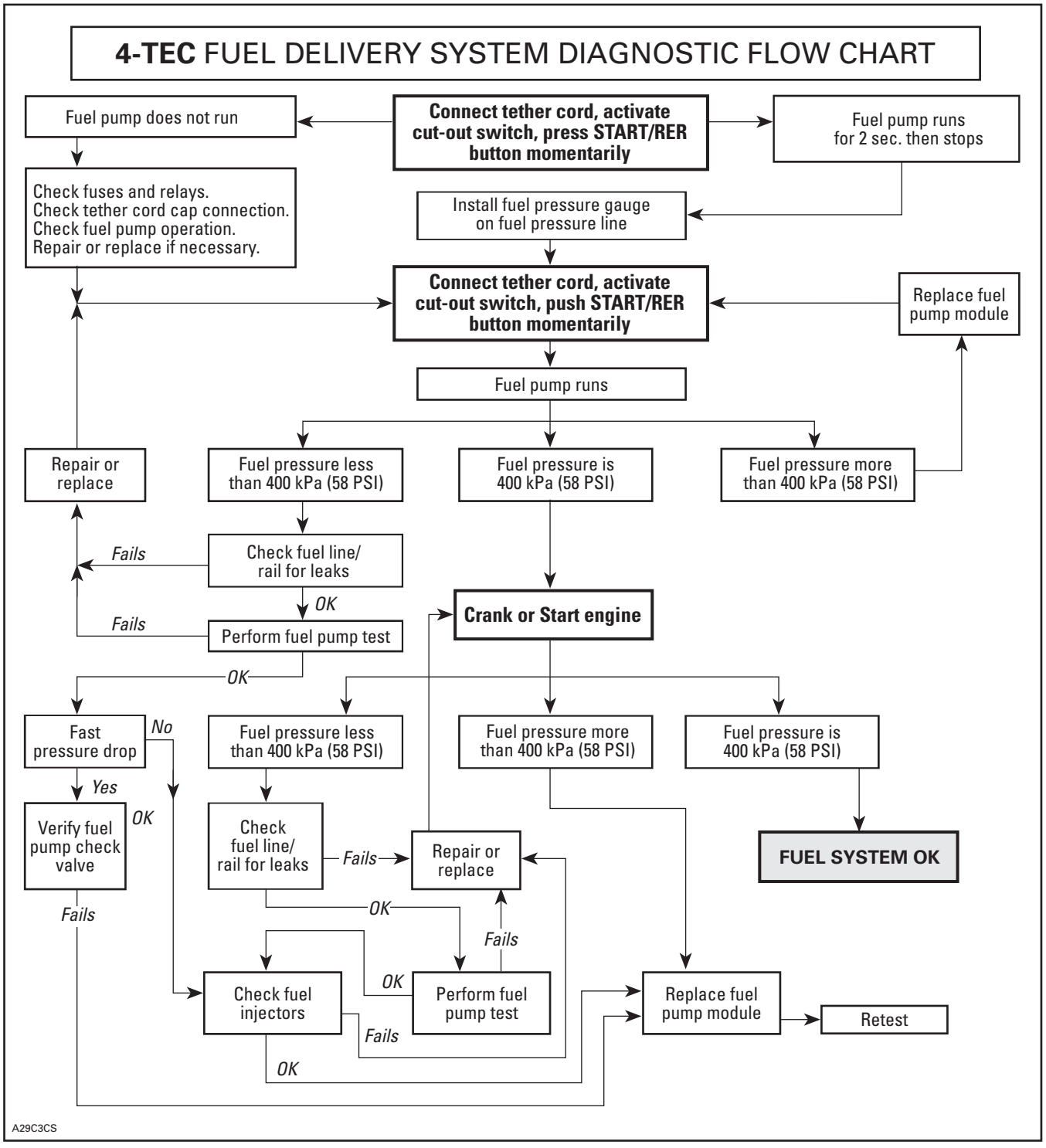
⚠ WARNING

Make sure idle speed stopper contacts throttle cam when throttle lever is fully released at handlebar.

Closed Throttle and Idle Actuator Reset

Perform the **Closed Throttle and Idle Actuator** reset as described in THROTTLE POSITION SENSOR (TPS) in ELECTRONIC MANAGEMENT below.

FUEL DELIVERY



FUEL PUMP

Fuel Pressure Test

Before proceeding to the pressure test ensure the battery is fully charged. Battery voltage must be over 12 volts.

Release the fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

⚠ WARNING

The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside engine compartment.

The pressure test will show the available pressure at the fuel pump outlet. It validates the pressure regulator, the fuel pump and leaks in the system.

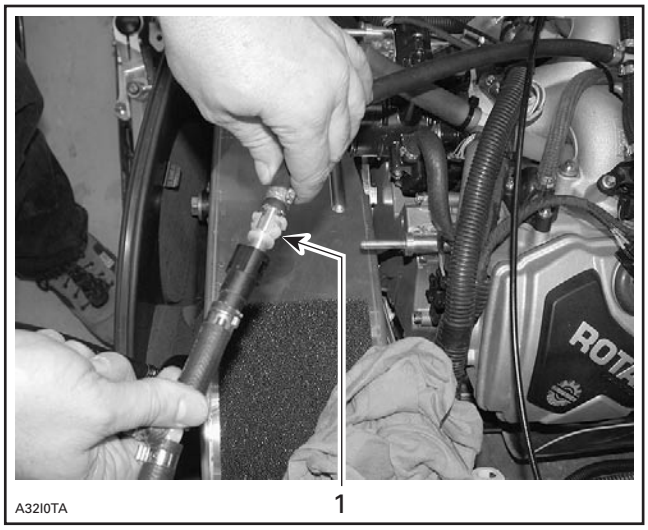
Ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Disconnect outlet hose.

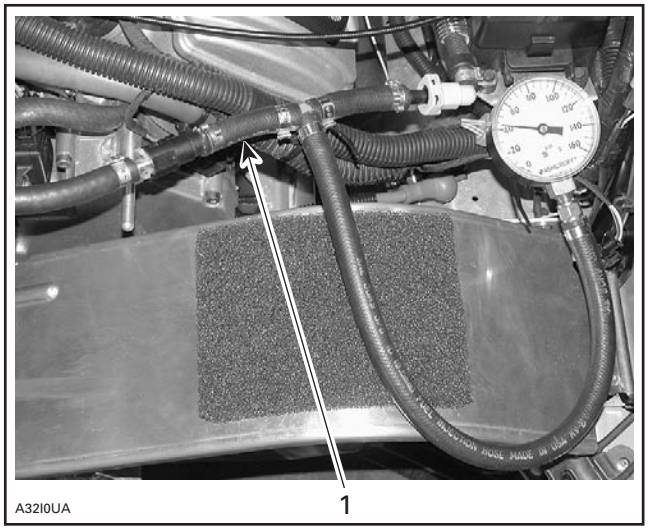
Remove plastic clip (P/N 275 500 429) from male fitting of pressure gauge (P/N 529 035 591).

Install the clip on male fitting of fuel rail inlet hose.



1. Clip installed on male fitting of fuel rail inlet hose

Install fuel pressure gauge (P/N 529 035 591) between disconnected hoses (in-line installation).



1. In-line installation of fuel pressure gauge

Install the tether cord cap. Activate the cut-out switch so the engine will not crank. Depress start button and observe fuel pressure. Release pressure using B.U.D.S. so that the gauge is «reset» to zero (0). Remove the tether cord cap and install it again. Repeat the test.

FUEL PRESSURE (when depressing start button)
400 kPa (58 PSI)

Crank or start engine and observe fuel pressure. The fuel pressure should be the same as above.

If pressure is within limits, fuel pump and pressure regulator are working adequately.

A rapid pressure drop indicates leakage either from the fuel rail or from the fuel pump check valve. Check fuel rail for leaks. If it is not leaking then replace fuel pump.

A slow pressure drop indicates leakage either from the fuel injector or from the fuel pressure regulator. Check fuel injector for leaks (see below). If it is not leaking then replace fuel pump module.

Release fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Remove pressure gauge and plastic clip from inlet hose. Reconnect inlet hose.

⚠ WARNING

Wipe off any fuel spillage in the engine compartment. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Reinstall removed parts.

Electrical Test

When depressing start button, the fuel pump should run for 2 seconds to build up the pressure in the system.

If the pump does not work, disconnect the plug connector from the fuel pump.

Install a temporary connector to the fuel pump connector. Apply 12 V (+ on PINK wire and – on PINK/BLACK wire) to this test harness.

If pump does not run, replace the fuel pump module.

Otherwise, probe terminalsof fuel pump connector on vehicle harness side. When depressing start button, you should read battery voltage for approximately 2 seconds (then voltage will drop to approximately 11 V). If battery voltage is read, the problem can be in harness or in fuel pump connector. Repair or replace appropriate part.

Fuel Pump Module Replacement

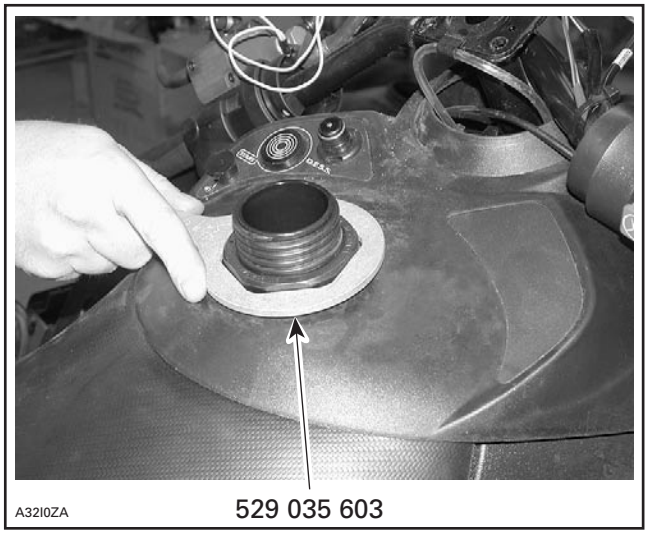
Removal

Open hood. Connect VCK (vehicle communication Kit) (P/N 529 035 981). Use B.U.D.S. to release fuel pressure.

Drain fuel tank as much as possible.

Remove steering pad. Unbolt handlebar and move it forward.

Unscrew fuel tank nut using wrench (P/N 529 035 603).

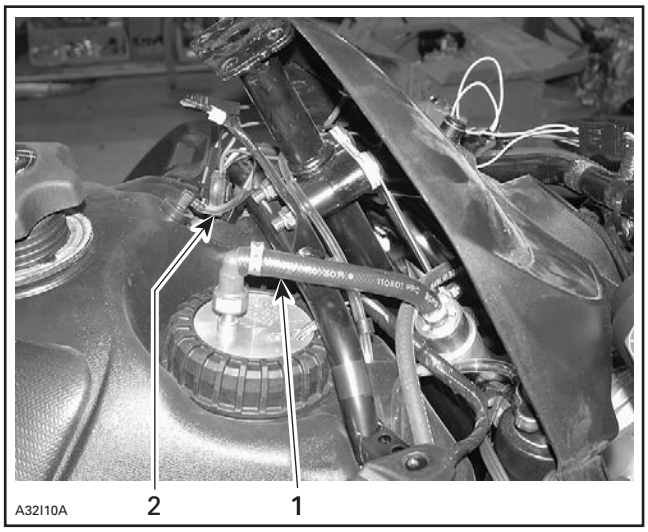


TYPICAL

Unbolt console, then move it forward.

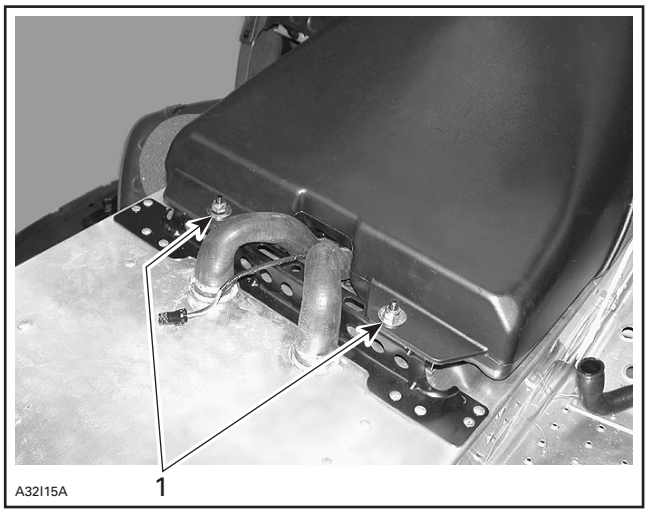
Disconnect fuel supply hose from fuel pump module.

Disconnect vent tube from vent elbow.



TYPICAL
1. Fuel supply hose
2. Vent tube

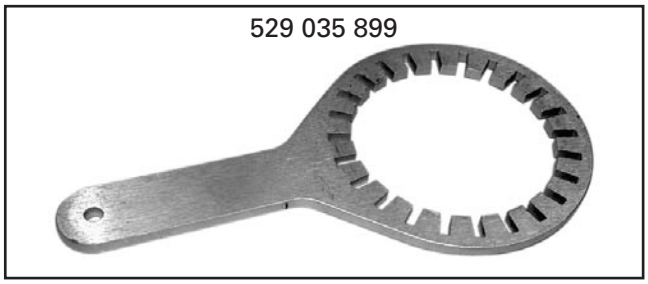
Remove seat. Unbolt fuel tank.



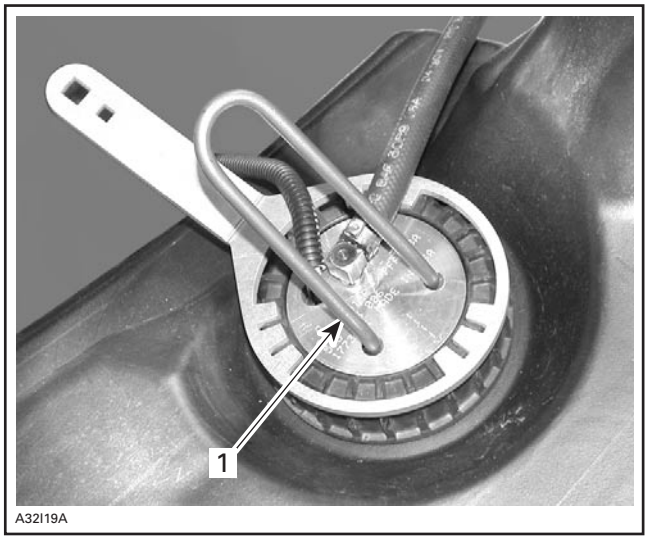
TYPICAL
1. Fuel tank retaining screws

Move fuel tank rearward, then unplug the fuel pump module electric connector.

With two screwdrivers or a bent rod holding the flange, unscrew fuel pump nut using fuel pump nut fuel pump wrench (P/N 529 035 899).



TYPICAL



TYPICAL
1. Bent rod

Pull fuel pump module out of fuel tank to expose sensor body.

Remove fuel pump module. Guide fuel pickups when pulling out fuel pickup hoses.

A32I13A

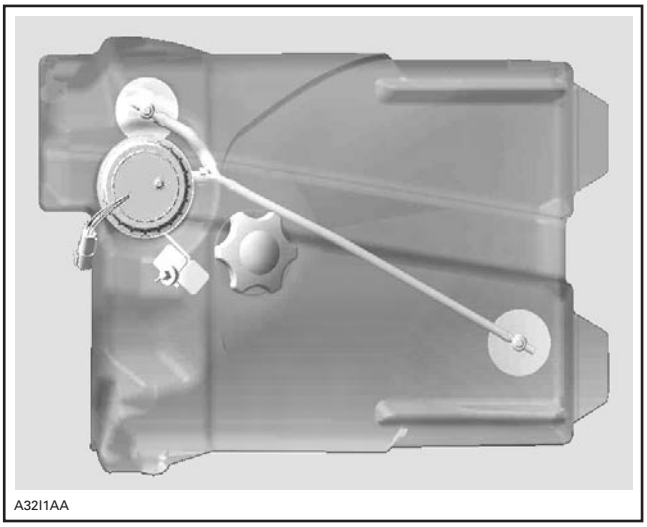
TYPICAL

Installation

For installation, reverse the removal process but pay attention to the following.

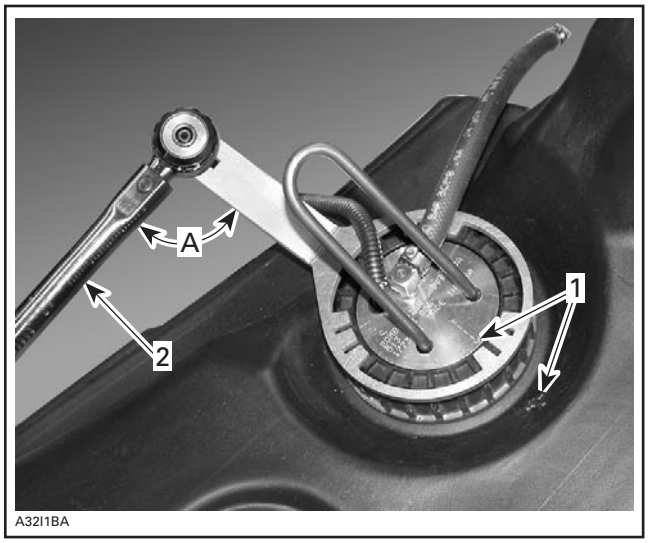
Install a new gasket.

Make sure that rear pickup hose is positioned as following illustration.


A32I1AA

Align the arrow on fuel pump module with the one on fuel tank. Keep arrows aligned during fuel pump module nut tightening.

Install a torque wrench perpendicularly (90°) to fuel pump nut fuel pump wrench (P/N 529 035 899). Torque fuel pump nut to 30 N•m (22 lbf•ft).



A32I1BA

1. Arrows aligned
2. Torque wrench
A. 90°

Bleed the fuel system as per following procedure.

Fuel Bleeding Procedure

The rear fuel pickup hose has to be bled.

Pour 12 L (3.17 U.S. gal.) of recommended fuel in the fuel tank.

Apply parking brake. Start the engine. Let it run at idle speed.

Lift the front of vehicle at a 45° angle.

Put the vehicle back on the ground.

Repeat the operation twice.

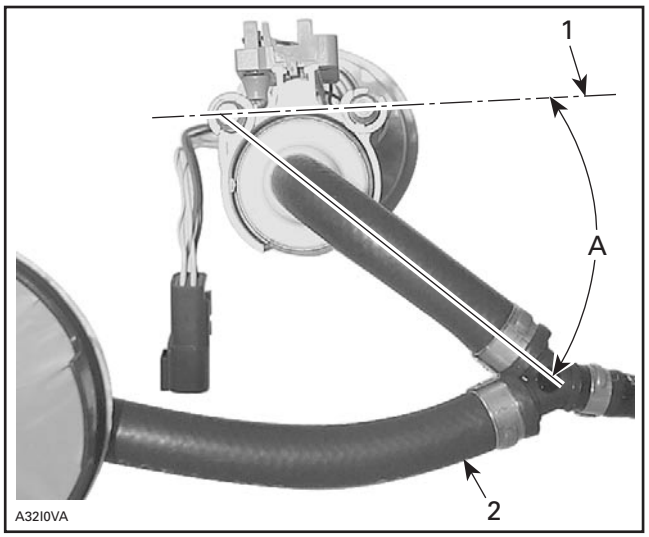
Stop the engine. The rear fuel pickup hose is now bled.

Fuel Hose Kit

Remove fuel pump module as explained above.

Unfasten blue hose clamp retaining old fuel hose ass'y to pump inlet nipple. Remove old fuel hose ass'y.

Install fuel hose ass'y to pump at an angle of 30 ± 3° from retaining rods axis.



1. Retaining rods axis
2. Fuel hose ass'y
A. 30 ± 3°

Install a new blue hose clamp on fuel hose ass'y.

Install a new gasket, then reinstall fuel pump module as explained above.

Pump Ass'y Kit

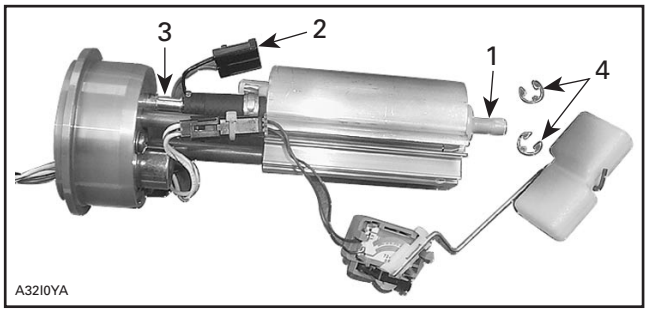
Remove fuel pump module as explained above.

Disconnect fuel hose from pump inlet nipple.

Disconnect pump electric connector.

Disconnect pump outlet hose from pump module flange nipple.

Remove circlips. Slide pump ass'y out of retaining rods.



TYPICAL

1. Pump inlet nipple
2. Pump electric connector
3. Pump module flange nipple
4. Circlips

Reverse removal procedure for installation.

Install a new gasket, then reinstall fuel pump module as explained above.

Regulator Kit

Remove fuel pump module as explained above.

Remove 2 screws retaining regulator to pump module flange.

Remove regulator from pump module flange.

Replace O-rings with new ones. Install them in pump module flange bore.

CAUTION: Regulator O-rings must be installed in pump module flange bore.

Reverse removal procedure for installation.

Install a new gasket, then reinstall fuel pump module as explained above.

FUEL RAILS

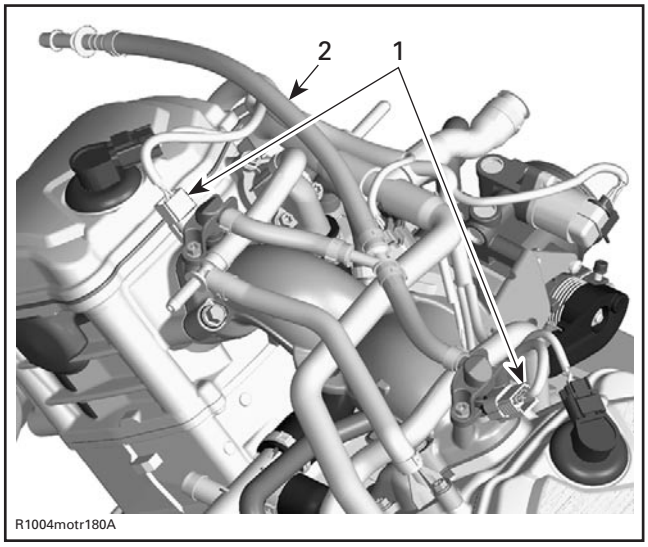
Pressure at fuel rails is supplied and controlled by the fuel pump module. Refer to FUEL PUMP for pressure test.

Fuel Rail Replacement

Removal

Release the fuel pressure in the system using B.U.D.S. Look in the **Activation** tab.

Wrap a rag around the hose end to prevent rail draining.



1. Fuel injector connectors
2. Fuel hose

Remove clamps and fuel hose from the fuel rails.

Disconnect wiring harness from the two fuel injectors.

Unscrew rail retaining screws.

Gently pull rail up by hand.

Pull rail out with fuel injector.

If necessary remove fuel injector as described below.

Installation

For installation, reverse the removal process but pay attention to the following.

A thin film of injection oil should be applied to O-rings of fuel injectors to ease installation in intake manifold.

Tightening torque of the rail retaining screws is 10 N•m (89 lbf•**in**).

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

FUEL INJECTORS

Leakage Test

To perform a leakage test, the injectors and fuel rails have to be removed from the engine.

NOTE: Do not detach injectors and fuel rails from the intake manifold. Remove complete intake manifold with installed fuel rails and injectors to perform this test.

Reconnect the fuel line and the wiring harness.

Place each injector in a clean bowl.

Install the tether cord cap on the DESS post and push start button, without cranking the engine, to activate the fuel pump.

Check for fuel leakage from the injector nozzle. There should be less than 1 drop per minute. Perform the test for 2 minutes.

If not within specification, replace the fuel injector(s).

The leakage test is validated when performing the FUEL DELIVERY SYSTEM DIAGNOSTIC FLOW CHART elsewhere in this section.

Electrical Test

Voltage Test

Tether cord cap must be on DESS post.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the fuel injector from the **Activation** section.

If the injector does not work, disconnect the plug connector from the injector.

Install a temporary connector to the injector with wires long enough to make the connection outside the engine compartment and apply voltage (12 V) to this test harness.

This will validate the injector mechanical and electrical operation.

If it does not work, replace it. If it works, continue procedure.

Using B.U.D.S., activate injector while probing pin corresponding to the power (VIOLET/BLUE for injector 1 and VIOLET/GREEN for injector 2) and battery ground.

– If 12 V is read, check continuity of circuit as per following table. If it is good, try a new ECM.

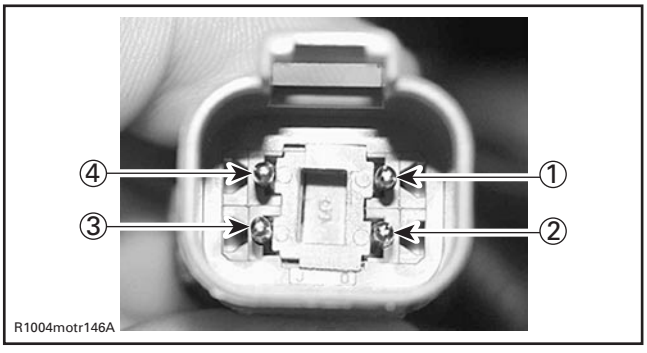
CIRCUIT NUMBER (ECM connector "A")	INJECTOR NUMBER
A-15	1
A-33	2

– If it does not read 12 V, check the corresponding fuse(s), relay and continuity of circuit. If continuity is faulty, repair wiring harness.

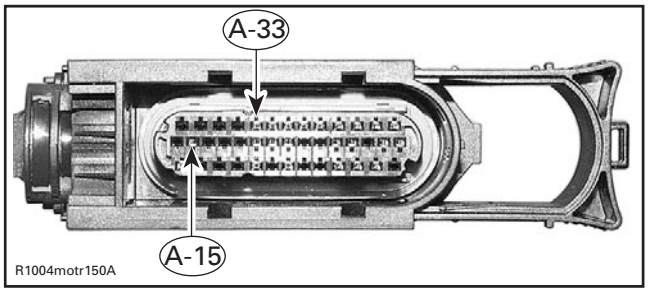
Resistance Test

Reconnect the injector and disconnect the connector A from the ECM.

Using a multimeter, check resistance value between terminals as follows.



ENGINE CONNECTOR



ECM CONNECTOR

COMPONENT	CONTACT LOCATION
Fuel injector cylinder 1	1 (engine connector) and A-15 (ECM connector)
Fuel injector cylinder 2	2 (engine connector) and A-33 (ECM connector)

The resistance should be between 13.8 and 15.2 Ω.

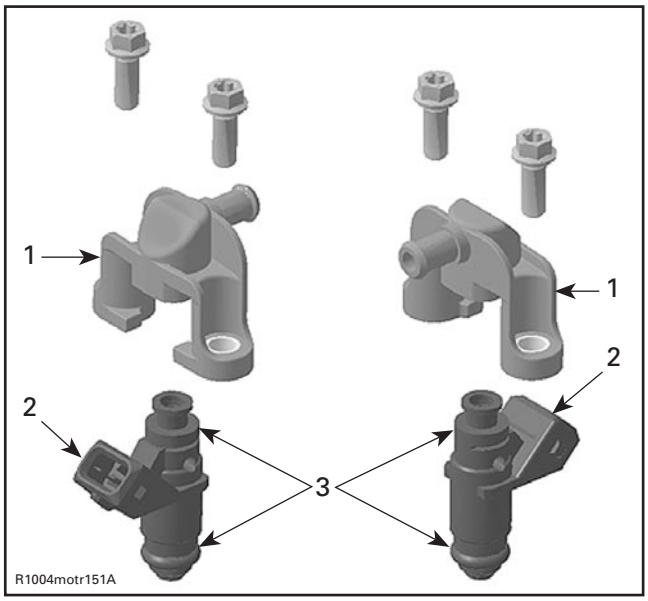
If resistance value is correct, check wiring of corresponding relay. If good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors or replace the wiring harness between ECM plug connector and fuel injector.

Fuel Injector Replacement

Removal

Before removing the injector, the fuel rail has to be removed from the engine. Refer to REMOVAL in FUEL RAIL REPLACEMENT for the procedure.



FUEL RAIL ASS'Y
1. *Fuel rail*
2. *Fuel injector*
3. *O-ring*

The fuel injector can be easily pulled out of the fuel rail.

Installation

For the installation, reverse the removal procedure. Pay attention to the following details.

Install new O-rings, if you reinstall a used injector then insert the fuel injector in place with your hand. Do not use any tool.

NOTE: A thin film of engine oil should be applied to O-rings to ease insertion in rail.

Tightening torque of the rail retaining screws is 10 N•m (89 lbf•**in**).

⚠ WARNING

Perform a fuel pressure test and ensure that there is no leak. Refer to FUEL PUMP above. Run engine and check for leaks.

ELECTRONIC MANAGEMENT

ECM REPLACEMENT

General

Prior to replacing a possibly faulty ECM, ensure that all the recommendations in the general introduction of this section have been carried out.

IMPORTANT: When the ECM is replaced, the tether cord cap(s) and the **Closed Throttle and Idle Actuator** must be reprogrammed/reset. Refer to their specific section for adjustment.

To allow transferring the previous recorded information from the old ECM to the new one, use the vehicle communication kit (VCK) with the B.U.D.S. software. Use **Replace** ECM in the ECM menu. Follow instructions in its help system.

NOTE: If the old ECM still works, its information must be read by B.U.D.S. before being removed from the vehicle in order to transfer vehicle information and history to the new ECM.

ECM Replacement

Disconnect battery cables.

⚠ WARNING

Battery BLACK negative cable must always be disconnected first and connected last.

Disconnect both connectors from ECM.

Unscrew all retaining screws and remove the ECM from vehicle.

Install the new ECM to the vehicle.

Reconnect connectors to ECM, and then battery cables.

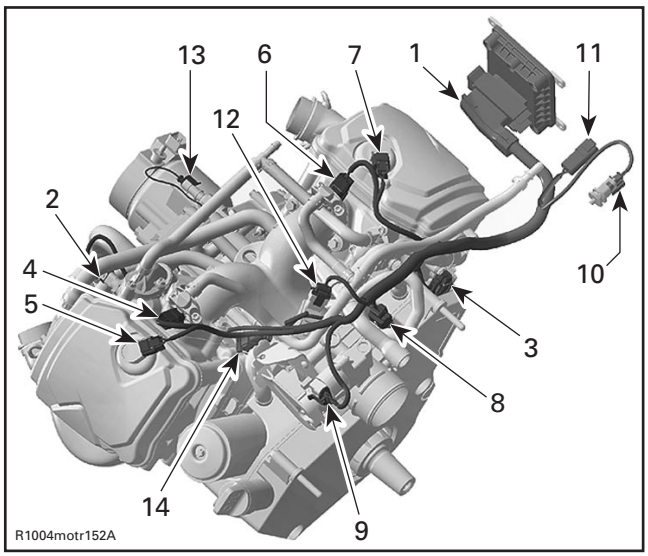
Transfer the data from the previous ECM to the new one using B.U.D.S. then proceed with the required resets and reprogram tether cord cap(s), if you were unable to transfer the data.

NOTE: If data cannot be transferred, manually enter information in **Vehicle** tab.

After performing the required resets, ensure to clear all faults from the newly replaced ECM.

Start the engine and increase engine speed above 5000 RPM to be sure no fault appears.

ENGINE WIRING HARNESS



1. ECM connector A
2. CTS connector
3. CAPS connector
4. Fuel injector connector (cylinder 1)
5. Ignition coil connector (cylinder 1)
6. Fuel injector connector (cylinder 2)
7. Ignition coil connector (cylinder 2)
8. TPS connector
9. Idle bypass valve connector
10. ATS connector
11. Engine connector
12. MAPS connector
13. OPS connector
14. CPS connector

Resistance Test

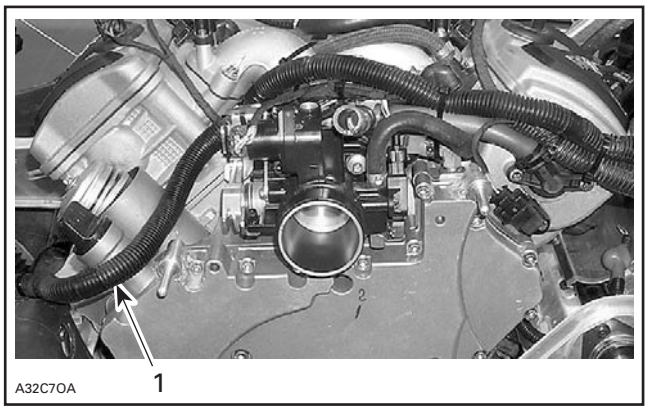
Check continuity of the circuits according to the wiring diagram in the WIRING DIAGRAMS section of this manual.

If wiring harness is good, check the respective sensor/actuator as described in this section.

Otherwise, repair the connectors, replace the wiring harness or the ECM as diagnosed.

Removal

Cut the locking ties retaining vehicle harness to engine. Move the vehicle harness away from engine.

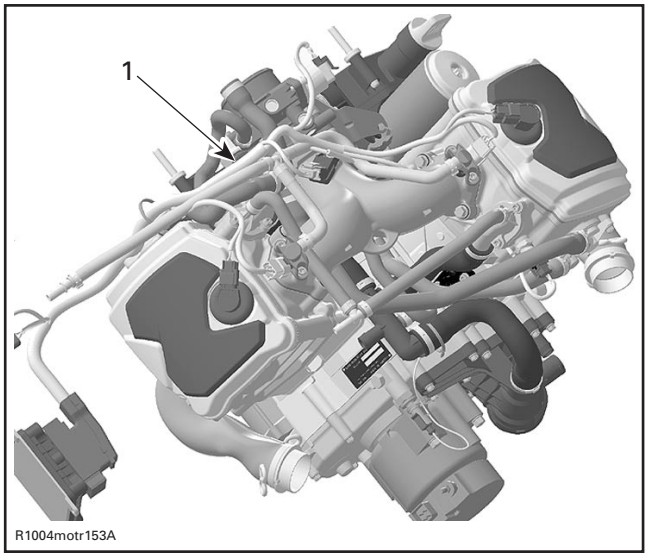


1. Vehicle harness

Disconnect the wiring harness from all sensors/ actuators.

Disconnect the connector A from the ECM.

Cut all locking ties which are holding the wiring harness in position.



1. Wiring harness

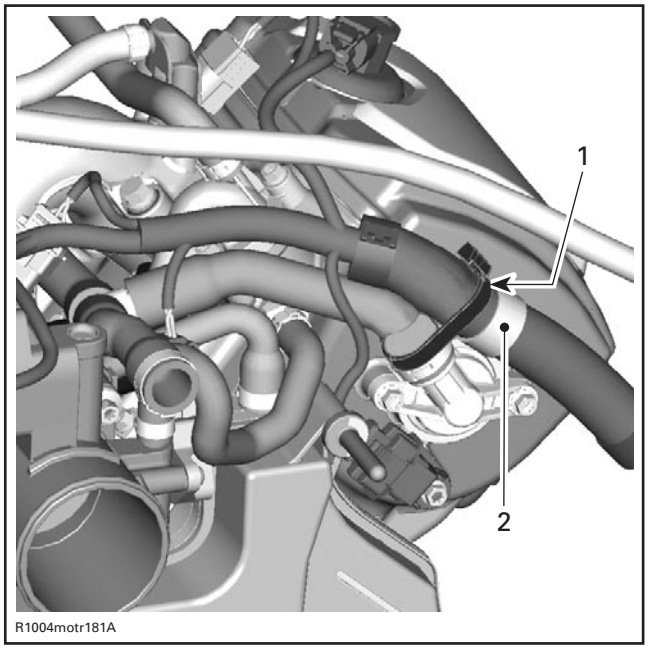
Remove complete wiring harness.

Installation

First connect the connector A to the ECM and the engine connector to the vehicle wiring harness.

Now attach the engine wiring harness with a locking tie to the breather hose.

NOTE: Wiring harness is marked with a green tape, where locking tie has to be installed.



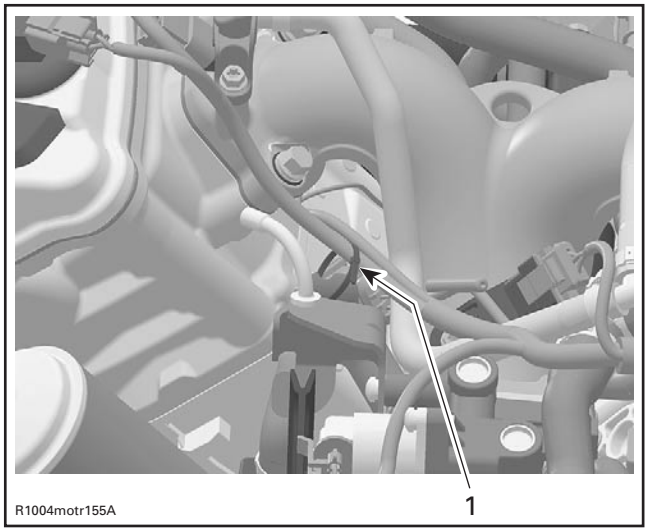
1. Position of locking tie
2. Green mark (tape) on wiring harness

Then connect CAPS. Ensure the cable is above the breather hose, then fasten it with a locking tie.

Connect injector and ignition coil of cylinder 2 to the wiring harness. Ensure that cables are underneath the fuel line.

Also connect the TPS, MAPS (grey connector) and the idle bypass valve to the wiring harness.

Then connect injector and ignition coil of cylinder 1 to the wiring harness. Attach the cable with locking tie on the throttle cable bracket.

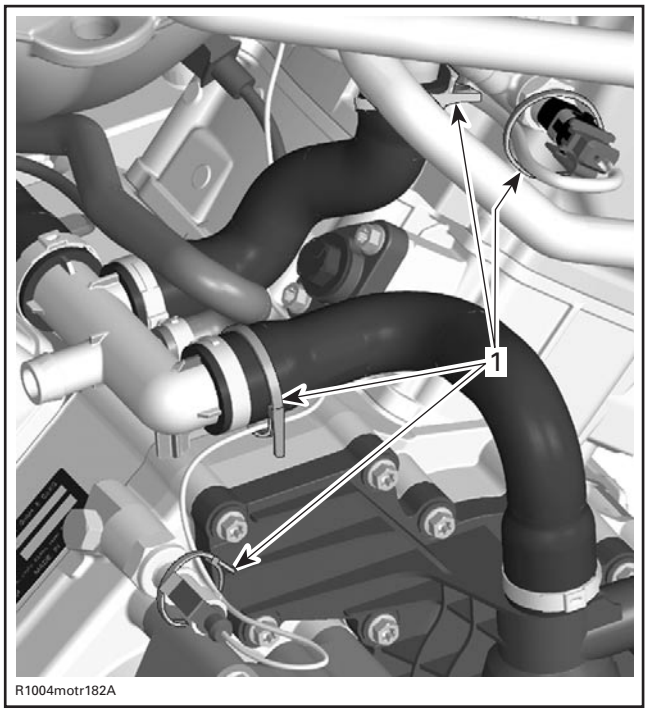


1. Locking tie

Connect the CPS, CTS and OPS to the wiring harness.

NOTE: Routing of the harness for CAPS, CTS and OPS has to be between the intake manifold and cylinder 1, underneath the water hoses.

Use locking ties to attach the cables for the CTS on the water hose and on the sensor itself then for the OPS on the T-fitting and on the sensor itself.



1. Locking ties

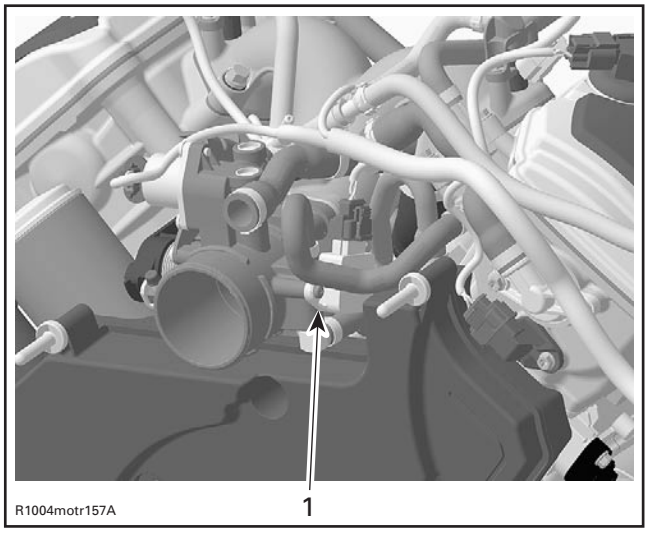
Install all remaining parts, which have been removed.

Do not forget to connect ATS connector to the ATS on the air intake silencer.

THROTTLE POSITION SENSOR (TPS)

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the ECM which is proportional to the throttle shaft angle.



1. Throttle position sensor (TPS)

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to THROTTLE BODY in AIR INDUCTION SYSTEM above.

The EMS may generate several fault codes pertaining to the TPS. Refer to SYSTEM FAULT CODES in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

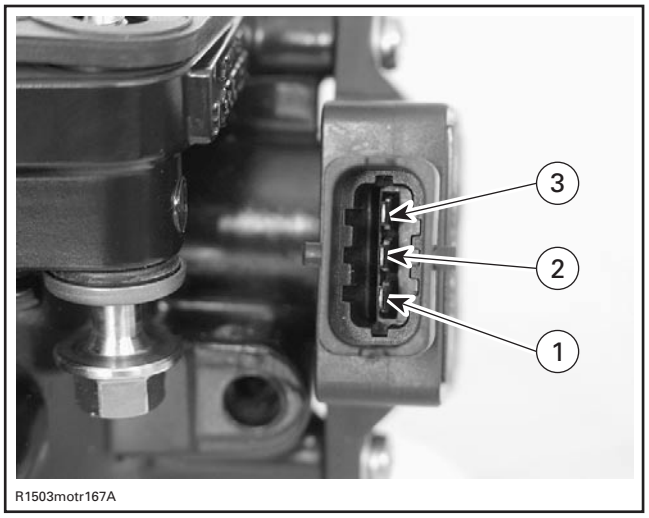
While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, use the **Throttle Opening** display under **Monitoring**.

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle «sticks», bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates that the TPS needs to be replaced.

Voltage Test

Check the voltage output from ECM to the desired throttle position sensor.



TPS

Disconnect plug connector from throttle position sensor. To unlock connector, press the release tab. To see the connector pin-out, temporarily remove the connector shield joining the harness, to expose the pin numbers. Connect a voltmeter between pin 1 and 3 and also between pin 1 and 2 in the wiring harness.

Install the tether cord cap, then depress the cut-out switch and push start button momentarily to activate the ECM.

Check the voltage readings as follows.

CONNECTION	VOLTAGE
Pin 1 with engine ground	0 V
Pin 2 with engine ground	5 V
Pin 3 with engine ground	4.75 - 5 V

NOTE: Make sure the engine is properly grounded.

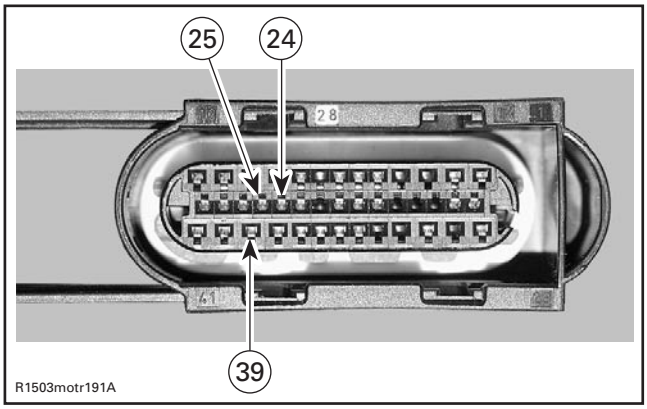
If voltage test is good, replace the TPS.

If voltage test is not good, check the resistance of the TPS circuit.

Resistance Test

Reconnect the TPS.

Disconnect the connector A from the ECM.



Using a multimeter, check resistance value between terminal A-25 and A-39.

The resistance should be 1600 - 2400 Ω.

Check the resistance between terminal A-24 and terminal A-39 with the throttle plate in **idle** position.

The resistance should be approximately 2500 Ω.

Check the resistance between terminal A-24 and terminal A-39 with the throttle plate in **wide open** position.

The resistance should be 1000 - 1100 Ω.

Check the resistance between terminal A-24 and A-25 with throttle plate in **idle** position.

The resistance should be 1000 - 1100 Ω.

Now check the resistance with the throttle plate in **wide open** position.

The resistance should be 2600 - 2700 Ω.

NOTE: When measuring between pins A-24 and A-39, resistance **value decreases** while depressing throttle lever. when measuring between pins A-24 and A-25, resistance **value increases** while depressing throttle lever. The resistance value should change smoothly and proportionally to throttle movement. Otherwise, replace TPS.

If resistance values are correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

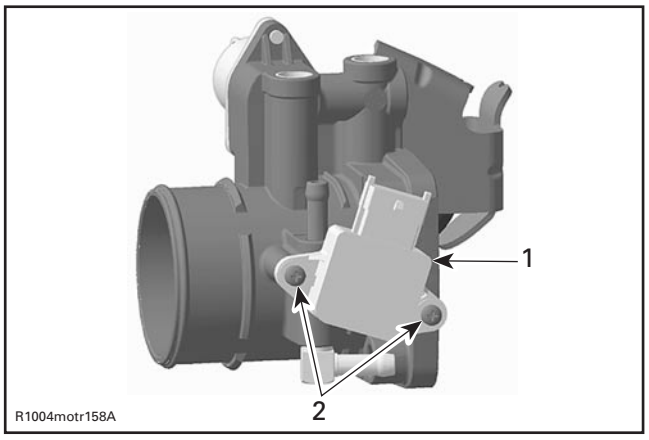
If resistance values are incorrect, repair connector or replace the wiring harness between ECM connector and the TPS.

Replacement

Remove the throttle body as described above.

Loosen two screws retaining the TPS.

Remove TPS.



THROTTLE BODY
1. *Throttle position sensor (TPS)*
2. *Screws*

Install the new TPS.

Apply Loctite 243 on the TPS retaining screws, then torque to 3 N•m (27 lbf•**in**).

Reinstall remaining removed parts.

Proceed with the CLOSED THROTTLE AND IDLE ACTUATOR RESET. See below.

Closed Throttle and Idle Actuator Reset

NOTE: This operation performs a reset of the values in the ECM.

This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several ECM calculations and the setting of the idle bypass valve will determine the basic parameters for the idle speed control of the engine.

NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened or removed or throttle body is replaced or ECM is replaced.

CAUTION: An improperly set TPS or idle bypass valve may lead to poor engine performance.

Use the vehicle communication kit (VCK) with the B.U.D.S. software to perform this adjustment.

Ensure the throttle body plate stop lever rest against its stopper. Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate. If stopper does not rest against its stop lever, perform throttle cable adjustment. Refer to THROTTLE BODY in AIR INDUCTION SYSTEM above.

Click on the **Reset** button in the **Setting** section of B.U.D.S.

NOTE: No message will be displayed if operation is successful. If operation is wrong, an error message will be displayed.

NOTE: There is no idle speed adjustment to perform. The ECM takes care of that. If TPS is not within the allowed range while resetting the **Closed Throttle and Idle Actuator**, the ECM will generate a fault code and will not accept the setting.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to SYSTEM FAULT CODES in the DIAGNOSTIC PROCEDURES section for more information.

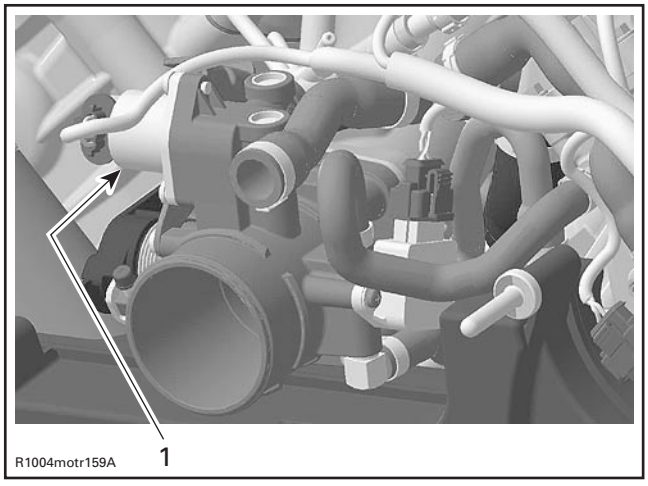
IDLE BYPASS VALVE

An idle bypass valve with good resistance measurement can still be faulty. It is also possible that a mechanical failure occurs which is not detectable without measuring the air flow. Replacing the idle bypass valve may be necessary as a test.

Resistance Test

Disconnect idle bypass valve from the wiring harness.

Using a multimeter, check the resistance in both windings.



1. Idle bypass valve

Check the resistance between pin 1 and pin 4 and also between pin 3 and pin 2 of the idle bypass valve.

The resistance in each winding should be approximately 50 Ω at 23°C (73°F).

If the resistance of one or both windings is not good, replace the idle bypass valve.

If resistance test of valve windings is good, check continuity of circuits A-35, A-36, A-37, A-38.

Visual Inspection

NOTE: Make sure the tether cord cap is removed during the following procedure.

Remove idle bypass valve from throttle body.

Check the piston and bypass channel for dirt/deposits which can cause a sticking piston.

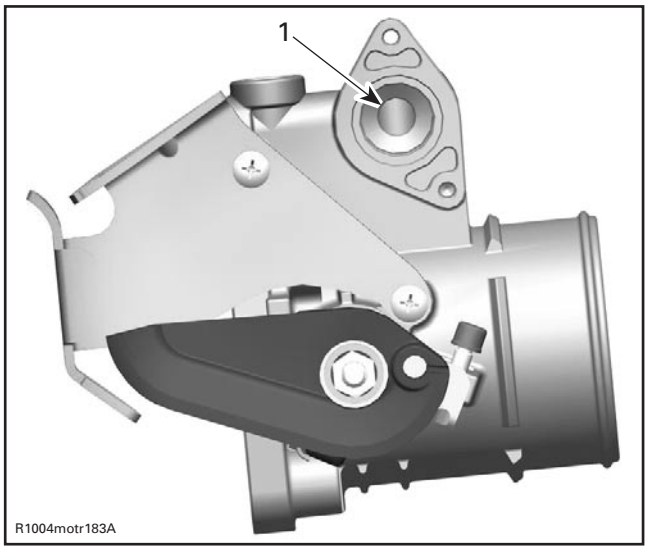
CAUTION: Always keep the tether cord cap disconnected, while the idle bypass valve is removed.

CAUTION: Do not try to operate the piston of the idle bypass valve when it is dismounted. Also do not move the piston by hand. The drive screw is very sensitive and may be destroyed.

Using a part cleaner, clean idle bypass in throttle body from contamination then use an air gun to dry it.

⚠ WARNING

Always wear eye protector. Chemicals can cause a rash break out and injure your eyes.

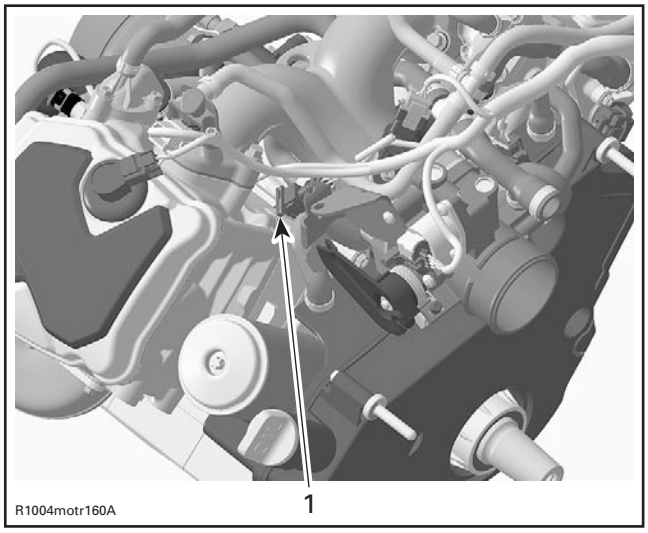


1. Clean bore from contamination

Clean all remaining parts and install the idle bypass valve on the throttle body.

Proceed with the CLOSED THROTTLE AND IDLE ACTUATOR RESET. See above.

CRANKSHAFT POSITION SENSOR (CPS)



1. CPS connector

NOTE: Take into account that a CPS fault can be triggered by bent or missing encoder wheel teeth. First check fault codes then check the teeth condition if necessary. See below.

Disconnect CPS wiring harness connector. Probe terminals 1 and 2 coming from CPS while cranking engine. Voltage should be within 1-2 Vac. Otherwise, inspect wiring and replace CPS if wiring is good.

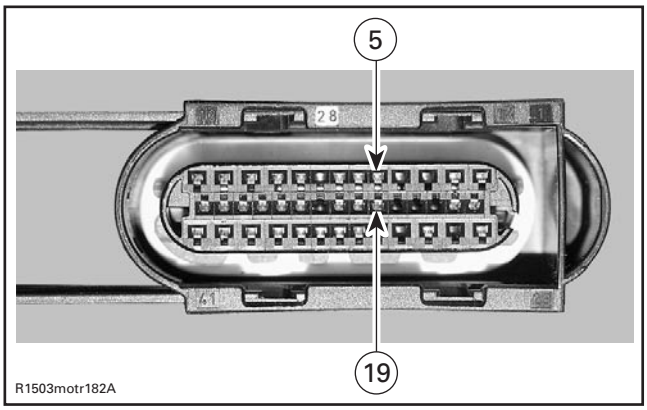
Resistance Test

Disconnect the CPS plug connector from the wiring harness and check the resistance of the sensor itself.

The resistance should be between 0.7 kΩ and 1.1 kΩ.

Otherwise, replace the CPS.

If resistance tests good, **reconnect** the CPS and disconnect the connector A on the ECM.



Using a multimeter, recheck resistance value between terminals 5 and 19.

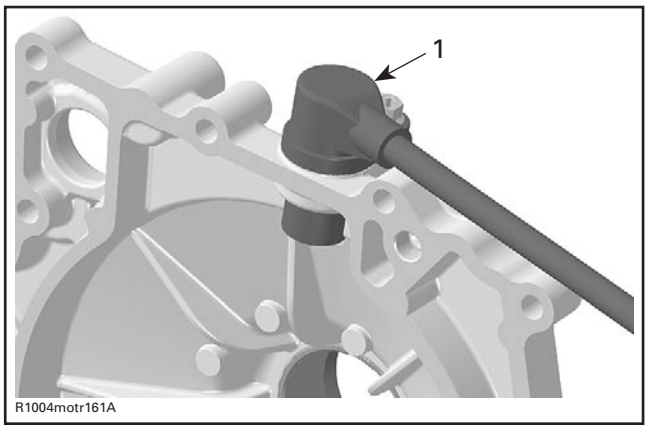
If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CPS.

Replacement

Disconnect CPS connector and remove the PTO cover. Refer to CRANKCASE subsection in ENGINE section.

Remove CPS.



1. CPS inside PTO cover

Install new CPS.

Tightening torque of the CPS retaining screws is 6 N•m (53 lbf•**in**).

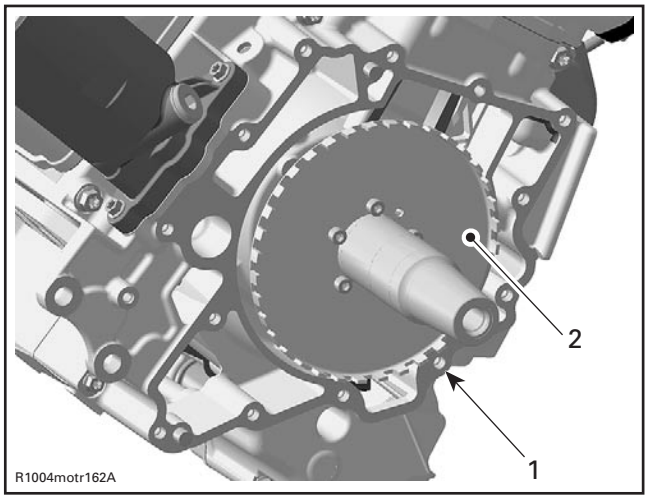
Reinstall remaining removed parts.

Trigger Wheel Inspection

Remove PTO cover. Refer to CRANKCASE subsection in ENGINE section.

Remove trigger wheel.

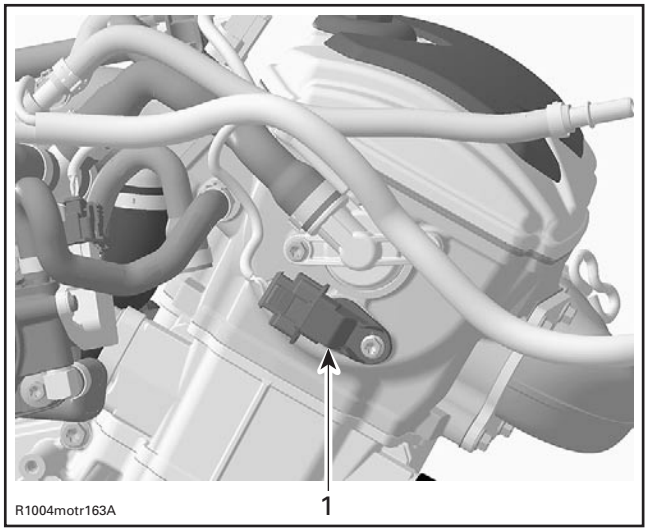
Perform visual inspection of the trigger wheel for bent teeth and also check the mating surface for straightness. If necessary, straighten the teeth or replace the trigger wheel.



1. Trigger wheel
2. Mating surface

Properly reinstall trigger wheel and cover.

CAMSHAFT POSITION SENSOR (CAPS)



1. CAPS

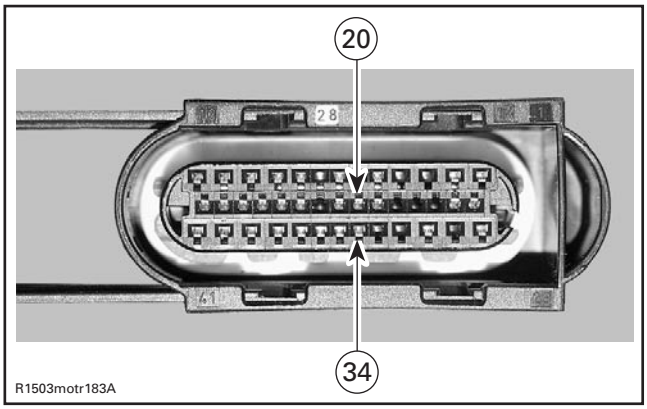
Voltage Test (harness)

Disconnect the connector from the CAPS.

Install the tether cord cap, then depress the cut-out switch and push start button momentarily to activate the ECM.

Probe pin 3 of CAPS connector (wiring harness side) and battery ground.

– If 12 V is read, check continuity of circuits A-20 and A-34. If test is good, perform the CAPS voltage test as explained below. If CAPS tests good, try a new ECM.

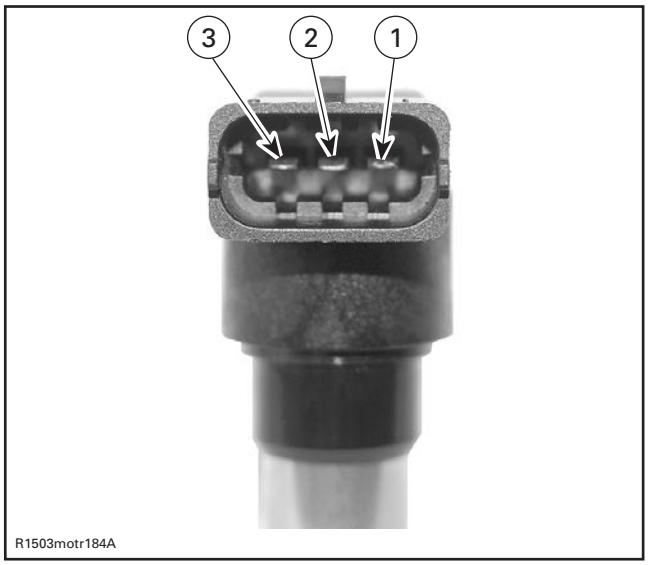


ECM CONNECTOR

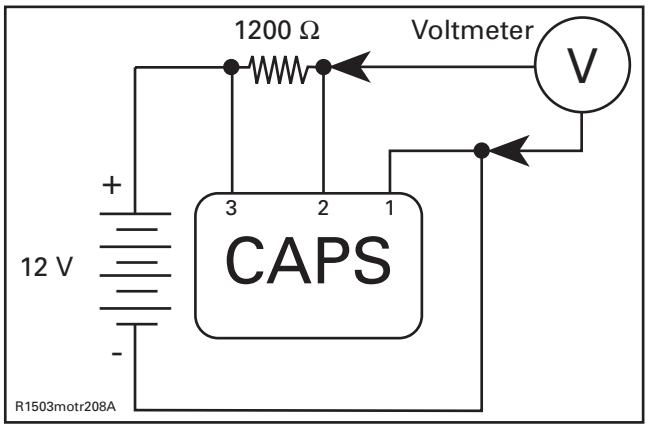
– If 12 V is not read, check continuity of circuit between pin 3 of CAPS connector and the corresponding fuse. Otherwise, repair wiring harness.

Remove the CAPS from the cylinder head.

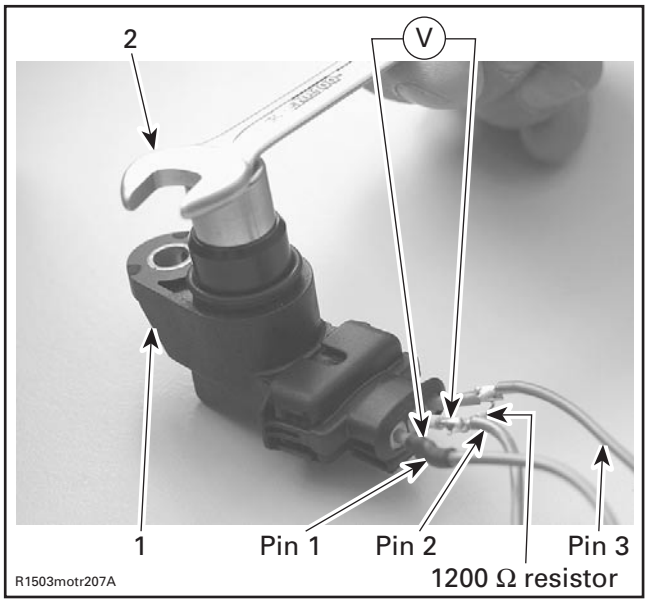
Set up the following electric circuit to perform the voltage test.



CAPS PIN-OUT



Touch the CAPS with a conductor (ex.: screwdriver) and look if the voltage at the multimeter switches from 12 V to less than 1 V.



1. CAPS
2. Conductor

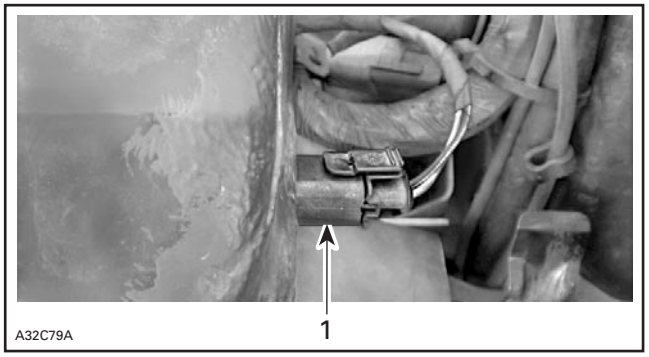
If the voltage is not good, replace the CAPS.

Replacement

Unscrew the retaining screw and replace the CAPS. Ensure to reinstall O-ring.

Apply Loctite 243 (blue) on thread and torque to 6 N•m (53 lbf•**in**).

AIR TEMPERATURE SENSOR (ATS)



AIR SILENCER
1. Air temperature sensor (ATS)

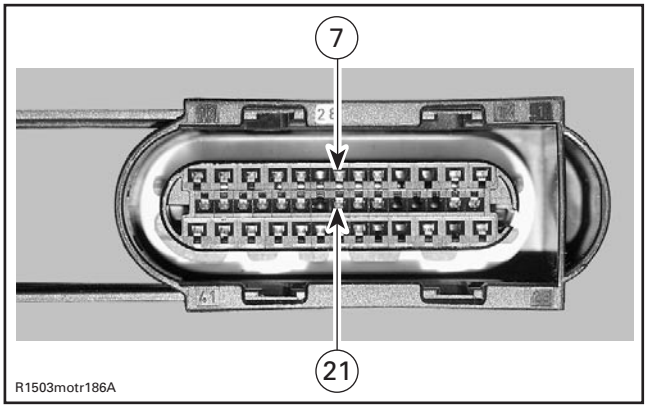
Resistance Test

Disconnect the plug connector from the ATS and check the resistance of the sensor itself.

The resistance should be between 2280 Ω and 2740 Ω at 20°C (68°F).

Otherwise, replace the ATS.

If resistance tests good, **reconnect** the ATS and disconnect the connector A from the ECM.



Using a multimeter, recheck resistance value between terminals 7 and 21.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

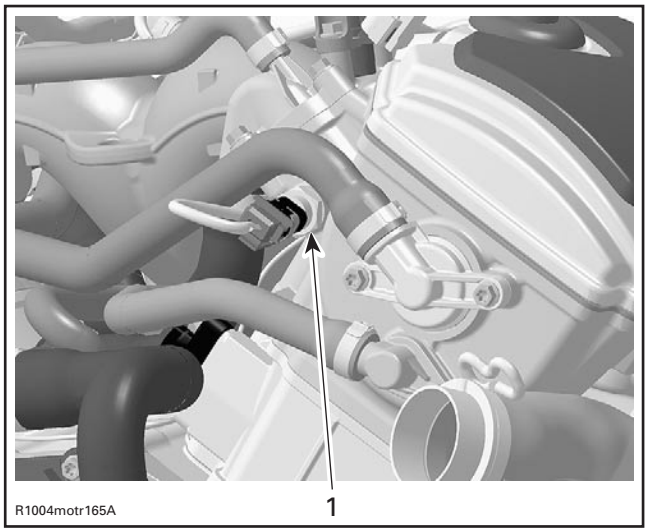
If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the ATS.

Replacement

Disconnect the connector of the ATS.

Pull ATS out and install the new one.

COOLANT TEMPERATURE SENSOR (CTS)



1. Coolant temperature sensor (CTS)

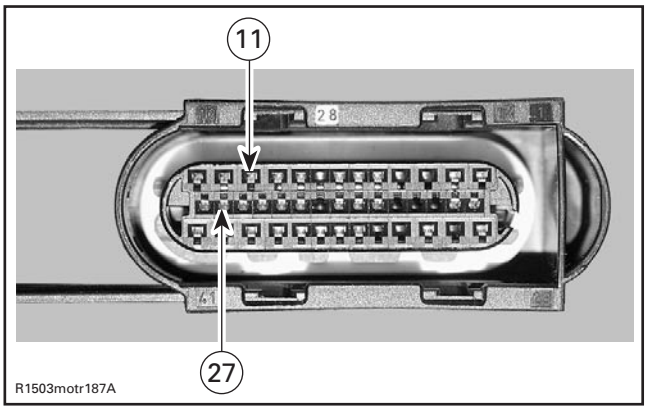
Resistance Test

Disconnect the plug connector from the CTS and check the resistance of the sensor itself.

The resistance should be between 2280 Ω and 2740 Ω at 20°C (68°F).

Otherwise, replace the CTS.

If resistance tests good,**reconnect** the CTS and disconnect the ECM connector A from the ECM.



Using a multimeter, recheck resistance value between terminals 11 and 27.

If resistance value is correct, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

If resistance value is incorrect, repair the connectors or replace the wiring harness between ECM connector and the CTS.

Replacement

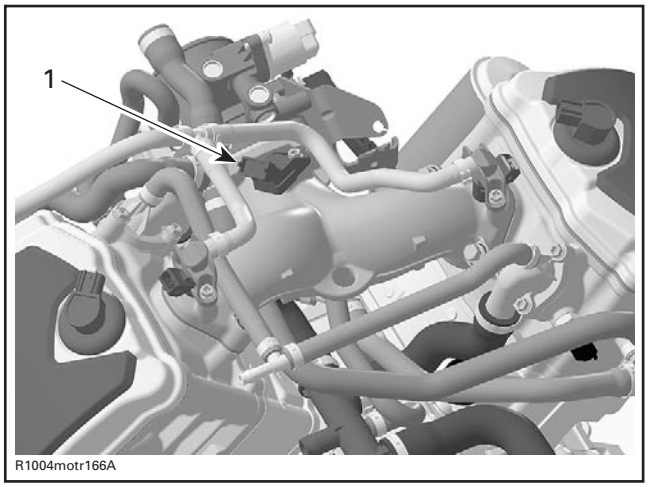
Disconnect CTS connector and remove CTS.

Install the new CTS and torque to 18 N•m (159 lbf•**in**).

Reinstall remaining removed parts.

Refill and bleed the cooling system, refer to COOLING SYSTEM subsection.

MANIFOLD AIR PRESSURE SENSOR (MAPS)



1. Manifold air pressure sensor (MAPS)

NOTE: This sensor is a dual function device. When engine is started and it runs at idle speed, the sensor takes the atmospheric pressure and stores it in the ECM. Thereafter, it takes the manifold air pressure at operating RPMs.

Ensure sensor is correctly installed on intake manifold. Otherwise, the MAPS could generate a fault code for an unexpected sensor range at idle when it reads the atmospheric pressure. Remove sensor and check for oil or dirt on its end and if problem persists, check throttle plate condition/position and the wiring harness. Perform the following tests.

Voltage Test

Check the voltage output from ECM to the manifold air pressure sensor (MAPS).

Disconnect plug connector from MAPS and connect a voltmeter between pin 1 and 2.

Install the tether cord cap, then depress the cut-out switch and push start button momentarily to activate the ECM. The measure should be 5 Vdc on the voltmeter.

If voltage test is good, replace the MAPS.

If voltage test is not good, check the continuity of the MAPS circuit.

Resistance Test

Disconnect the connector A from the ECM.

Using a multimeter, check continuity of circuits 12, 28 and 40.

If wiring harness is good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

Otherwise, repair the connectors or replace the wiring harness between ECM connector and the MAPS.

Verification Test

Using VCK, energize the MAPS from the MONITORING section and read out the proper pressure value while engine is stopped.

Perform the same test with a new MAPS and compare both readings.

Values have to be within ± 3.4 kPa (0.5 PSI).

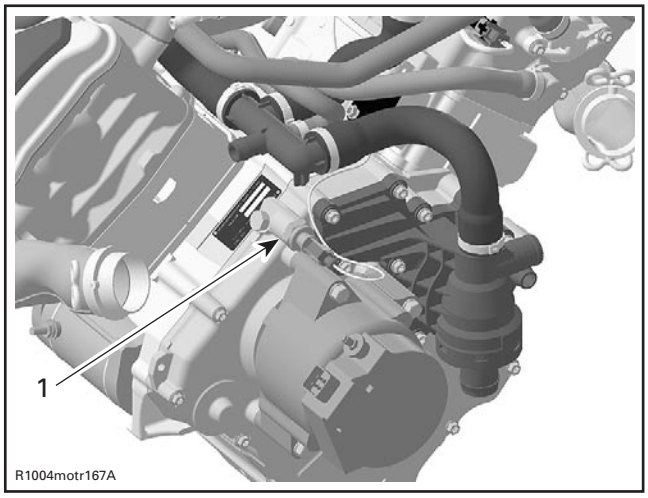
If old MAPS's value is out of this range, replace it.

Replacement

Disconnect MAPS connector and remove the MAPS.

Install the new MAPS paying attention to index its tab into the adaptor notch. Apply Loctite 243 (blue) on screw then torque to 6 N•m (53 lbf•**in**).

OIL PRESSURE SWITCH (OPS)



1. OPS

Oil Pressure Test

To check the function of the oil pressure switch, an oil pressure test has to be performed. Refer to OIL PRESSURE TEST in LUBRICATION SYSTEM section.

If the engine oil pressure is out of specifications, check the points described in troubleshooting section.

If the engine oil pressure is good, check the resistance of the OPS while engine is off and while engine is running.

Resistance Test

Disconnect the plug connector from the OPS and use a multimeter to check the resistance between OPS pin and engine ground while engine is stopped (without oil pressure) and while engine is running (with oil pressure).

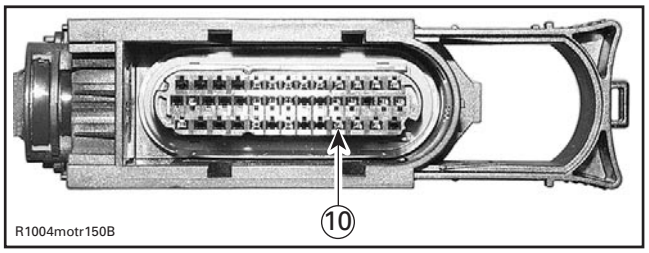
When engine is stopped the resistance is close to 0_{Ω} (normally close switch).

When engine is running and the oil pressure reaches 20 - 40 kPa (2.9 - 5.8 PSI), the resistance of the OPS is infinitely high.

If resistance values are incorrect, replace OPS.

If the values are correct, check the continuity of the wiring harness.

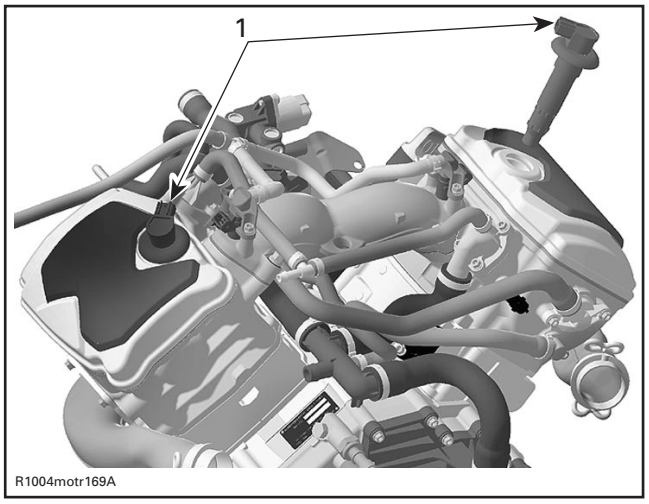
Disconnect the connector A from the ECM and check continuity of circuit 10.



If wiring harness is good, try a new ECM. Refer to ECM REPLACEMENT procedures elsewhere in this section.

Otherwise, repair the connector or replace the wiring harness between ECM connector and OPS.

IGNITION COILS



1. Ignition coil

NOTE: The ECM energizes the primary side of each ignition coil individually. A trouble code will appear if the ECM can not energize the ignition coils.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the ignition coil from the **Activation** section.

You should hear the spark occurring. In doubt, use an inductive spark tester or a sealed tester - available from after-market tool/equipment suppliers - to prevent spark occurring in the engine compartment. Otherwise, perform the following checks.

An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter. Replacing the ignition coil may be necessary as a test.

⚠ WARNING

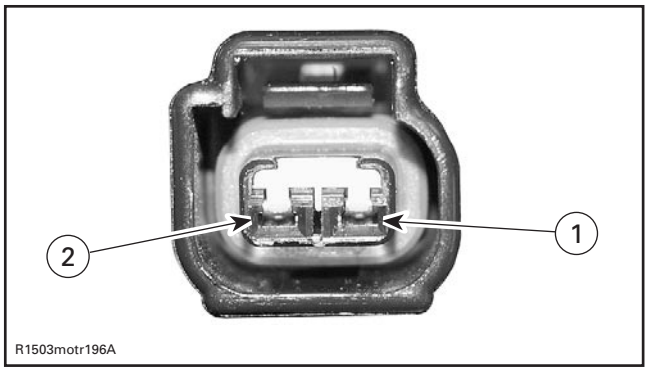
Never make a spark test with spark plug removed. Flammable vapors may be present in the engine compartment and ignited which could cause an explosion.

Voltage Test

⚠ WARNING

When disconnecting coil from spark plug, always disconnect coil from main harness first. Never check for engine ignition spark from an open coil and/or spark plug in the engine compartment as spark may cause fuel vapor to ignite.

Disconnect the plug connector from the ignition coil and check the voltage supplied by the battery.



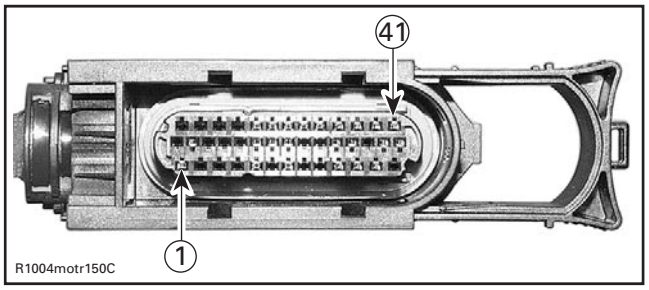
Install tether cord cap and connect the VCK (Vehicle Communication Kit) to activate the system.

Check voltage between terminal 2 of ignition coil connector on the wiring harness and battery ground.

The voltage should be 12 V.

If 12 V is NOT read, check continuity between terminal 2 of ignition coil and the corresponding fuse. Otherwise, repair wiring harness.

If 12 V is read, disconnect the connector A from the ECM and check the continuity of appropriate circuit 41 (cylinder 1) or 1 (cylinder 2).



ECM CONNECTOR

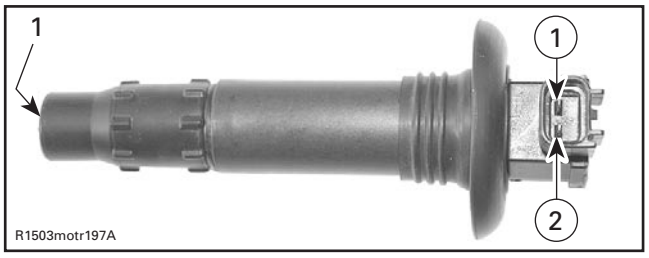
If wiring harness is defective, repair the connector or replace the wiring harness between ECM connector and the ignition coil.

If wiring harness is good, test resistance of primary and secondary winding of ignition coil.

Resistance Test

CAUTION: Do not remove the ignition coil before disconnecting the connector, or the wires may be damaged. To avoid damage, do not pry up ignition coil with a screwdriver.

Remove ignition coil from spark plug.



1. Spark plug terminal

Using a multimeter, check the resistance in both primary and secondary windings.

For primary winding check the resistance between pin 1 and pin 2 of the ignition coil.

The resistance should be between 0.85 and 1.15 Ω at 20°C (68°F).

For secondary winding check the resistance between pin 1 and spark plug terminal.

The resistance should be between 9.2 and 13.8 kΩ at 20°C (68°F).

If the resistance of one of both windings is not good, replace the defective ignition coil.

If the windings test good, check corresponding fuse, relay and wiring. If good, try a new engine ECM.

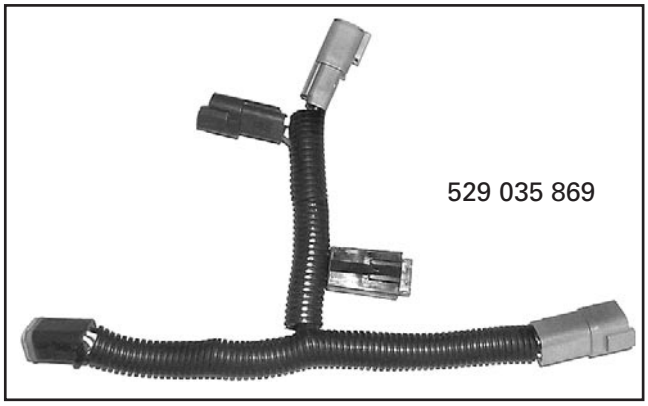
NOTE: Prior to inserting the ignition coil to its location, apply some silicone lubricant (P/N 293 600 041) around the seal area that touches the spark plug hole. After installation, ensure the seal seats properly with engine top surface.

⚠ WARNING

Always reconnect ignition coil cables at the same spark plugs where they come from. Otherwise, severe backfire may occur with possible damage to exhaust system components. The genuine wiring harness is designed to prevent mixing up the cables since they are different in length.

ENGINE START SWITCH VERIFICATION

If the ECM fails to wake-up or engine fails to start while depressing start button check battery voltage and fuses F1 and F8. Connect supply cable (P/N 529 035 869) to wake-up the ECM.



NOTE: Make sure the engine cut-out switch is not in operation.

A quick operation test can be done using the vehicle communication kit (VCK) with the B.U.D.S. software, using the **Monitoring** section. Press the start button and look at the start button LED. It should turn on, indicating the starting system is working on the input side of the starting system (start button, ECM and wiring). If so, you know now the problem is on the output side of the starting system (ECM output signal to starting solenoid, wiring harness going to the solenoid and starter motor. Refer to STARTING SYSTEM for testing procedures). Otherwise, check the input side as follows.

Test corresponding fuse, relay and wiring.

Disconnect the connector of the steering harness.

Measure the resistance of the BLUE/RED and LIGHT BROWN wires for 0 Ω. Depress start button and the reading should change from 0 Ω to infinitely high.

Release the start button and measure the resistor between LIGHT BROWN and BLACK wires. It should be 50 Ω.

Test continuity of circuit B-17. If it is good, try a new ECM. Otherwise, repair harness/connectors.

Test continuity of circuit B-19. If it is good, try a new ECM. Otherwise, repair harness/connectors.

DESS SWITCH VERIFICATION

If 2 short beeps are not heard when engine is started, refer to DIAGNOSTIC PROCEDURES.

The following continuity tests can also be performed using an ohmmeter.

Disconnect DESS post wires.

Tether Cord Cap Removed

Connect test probes to DESS post GREY/GREEN and WHITE/BLACK wires. Measure resistance, there should be NO continuity (open circuit).

Connect one test probe to the WHITE/GRAY wire and the other test probe to the DESS post top terminal. Measure resistance, it must be close to 0 ohm.

Connect one test probe to the GREY/GREEN wire and the other test probe to the DESS post ring. Measure resistance, it must be close to 0 ohm.

Tether Cord Cap on DESS Post

Connect test probes to DESS post GREY/GREEN and WHITE/BLACK wires. Measure resistance, it must be close to 0 ohm.

SPARK PLUGS

Disassembly

⚠ WARNING

Never remove ignition coil from the spark plug without disconnecting it from the wiring harness. Flammable vapors may be present in the engine compartment and ignited by a spark which could cause an explosion.

Disconnect the wiring harness from the ignition coil.

Remove the ignition coil.

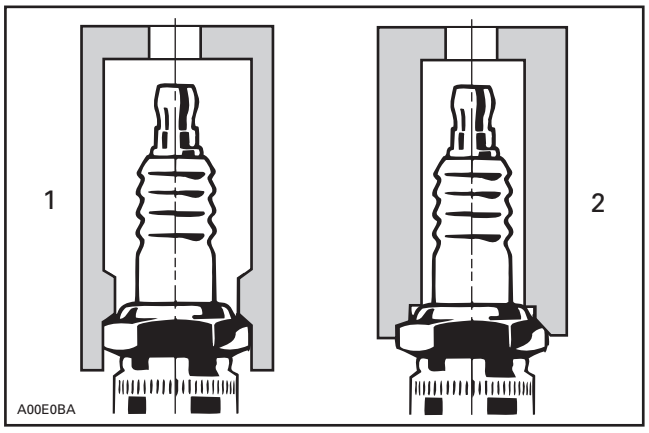
First unscrew the spark plug one turn.

Clean the spark plug and cylinder head with pressurize air then completely unscrew.

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

– Using a wire feeler gauge, set electrode gap according to the following chart.
– Apply anti-seize lubricant over the spark plug threads to prevent possible seizure.
– Hand screw spark plug into cylinder head. Then, tighten the spark plug clockwise an additional 1/4 turn with a proper socket.



TYPICAL
1. *Proper socket*
2. *Improper socket*

ENGINE	SPARK PLUG	TORQUE	GAP ± 0.05 mm (± .002 in)
1004 4-TEC	NGK DCPR8-E	Hand tighten + 1/4 turn with a socket	0.75 (.030)

CRANKING SYSTEM

See above for start switch and the DESS post testing.

DRIVE BELT

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	344
drive belt tension adjuster	529 008 700	343

SERVICE PRODUCTS

Description	Part Number	Page
Pulley flange cleaner	413 711 809	341

APPLICATION CHART

MODEL	PART NUMBER	MINIMUM WIDTH (wear limit)
Tundra	414 827 600	30.0 mm (1.181 in)
Skandic LT/LT E/WT/SWT/SUV 550	414 633 800	32.0 mm (1.260 in)
Skandic WT LC/SUV 600	414 300 155	34.7 mm (1.366 in)
Expedition TUV 600 HO SDI	605 348 425	34.7 mm (1.366 in)
Expedition TUV V-1000	605 348 425	34.7 mm (1.366 in)

CHECKING NEUTRAL FUNCTION

⚠ WARNING

Always check neutral function when servicing.

Apply parking brake. Vehicle must be on the ground and on a plane level surface. No one should be in front of vehicle.

Attach vehicle tether cord to your clothing. Stand aside of vehicle then, start engine.

⚠ WARNING

Do not sit on vehicle.

Release parking brake. Vehicle must not creep when engine is idling. Otherwise, make sure that:

– idle speed is as specified
– proper belt is installed
– pulley center-to-center is as specified
– belt deflection is as specified.

CLEANING

Before drive belt installation, clean drive and driven pulley sheaves with Pulley flange cleaner (P/N 413 711 809).

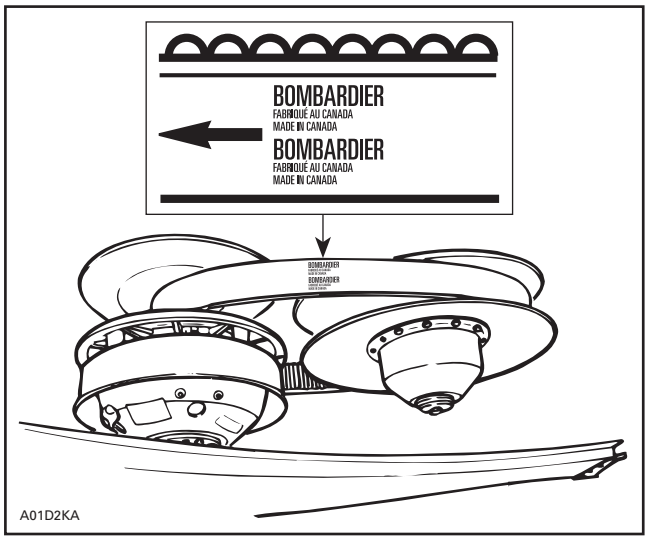
INSPECTION

Inspect belt for cracks, fraying or abnormal wear (uneven wear, wear on one side, missing cogs, cracked fabric). If abnormal wear is noted, probable cause could be pulley misalignment, excessive RPM with frozen track, fast starts without warm-up period, burred or rusty sheave, oil on belt or distorted spare belt.

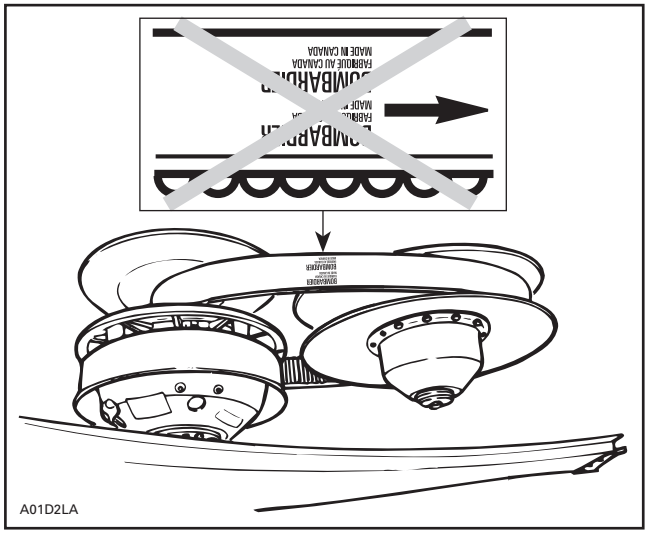
Check the drive belt width. Replace the drive belt if width is less than the minimum width recommended (see table above).

ROTATION DIRECTION

The maximum drive belt life span is obtained when the drive belt is installed as shown. This will ensure that correct direction of rotation is respected.



CORRECT



INCORRECT

NOTE: For used drive belt, mark and reinstall in the same position.

DRIVE BELT HEIGHT MEASUREMENT AND ADJUSTMENT

NOTE: The drive belt height measurement and adjustment must be performed each time a new drive belt is installed.

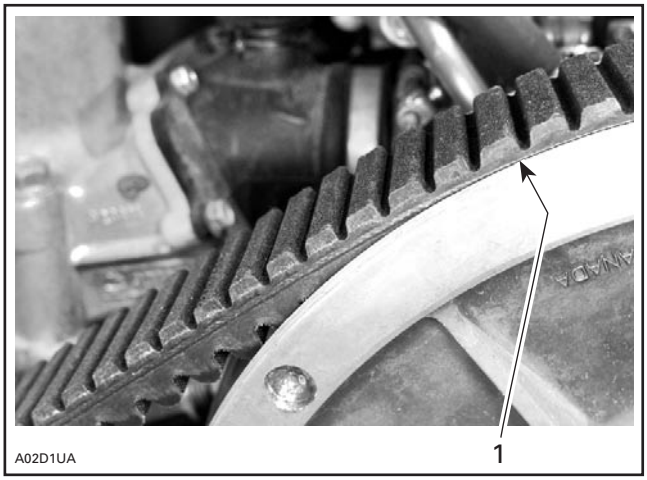
Measurement

Before checking the belt height, ensure that a good-condition proper belt (refer to the APPLICATION CHART) is installed.

Adjust pulley distance and alignment. Refer to PULLEY DISTANCE AND ALIGNMENT.

To obtain maximum vehicle performance, the belt height must be adjusted according to specifications shown in the accompanying chart.

MODEL	BELT HEIGHT mm (in)
All models	Top edge of drive belt cord should be flush with driven pulley edge



1. Flush

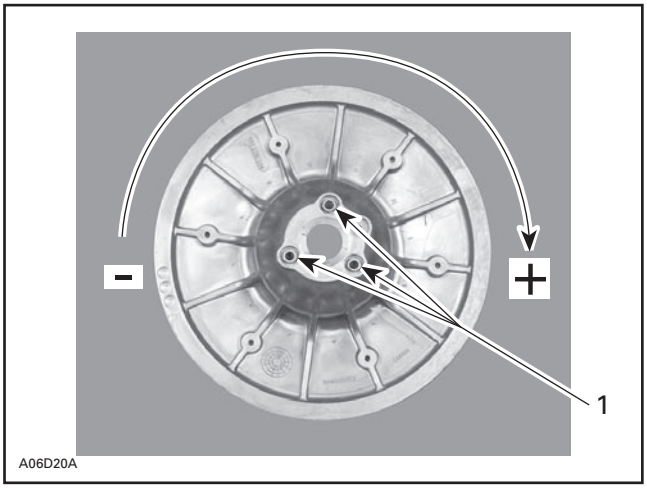
Models Equipped with Formula VSA Type Driven Pulley

Adjust drive belt height using Allen screws, as shown.

To lower belt in driven pulley: turn Allen screws clockwise.

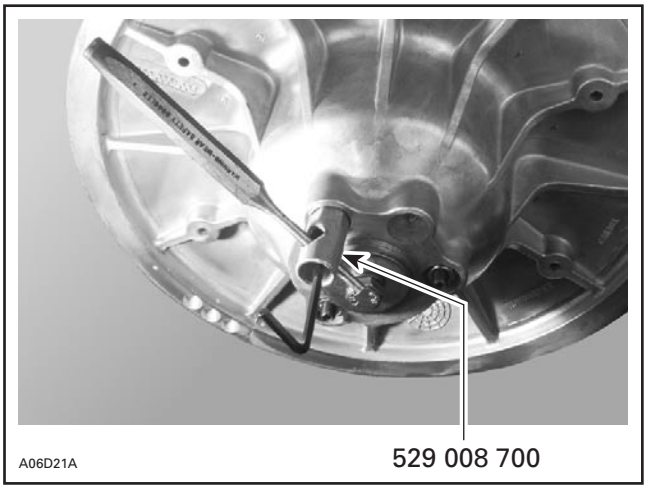
To raise belt in driven pulley: turn Allen screws counterclockwise.

NOTE: Turn Allen screws 1/4 turn at a time, then rotate driven pulley to allow drive belt to settle in pulley. Check height, repeat as required.



TYPICAL
1. Allen screws with jam nuts

Allen screws must be restrained while tightening jam nut to prevent throwing adjustment out. Use drive belt tension adjuster (P/N 529 008 700).



TYPICAL

All Models

Vary pulley distance — within tolerances — to obtain proper drive belt height.

DRIVE BELT DEFLECTION MEASUREMENT (REFERENCE ONLY)

IMPORTANT: The drive belt deflection will be automatically set after performing the pulley distance and belt height adjustments. The following procedure will confirm proper pulley distance and belt height adjustment.

NOTE: To obtain an accurate drive belt deflection measurement, it is suggested to allow a break-in period of 50 km (30 mi).

Before checking the belt deflection, ensure that a good-condition proper belt (Refer to the APPLICATION CHART) is installed.

Adjust pulley distance and alignment. Refer to PULLEY DISTANCE AND ALIGNMENT.

To obtain maximum vehicle performance, the belt tension must be adjusted according to specifications shown in the accompanying chart.

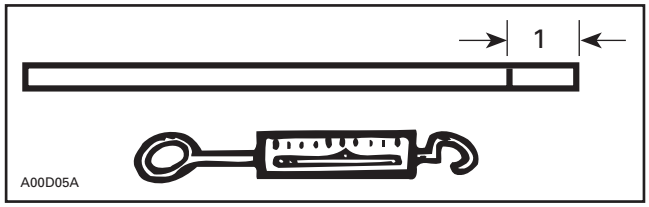
MODEL	DEFLECTION† mm (in)	FORCE kg (lb)
Tundra	32 ± 5 (1.260 ± .197)	6.8 (15)
All models (except Tundra)	32 ± 5 (1.260 ± .197)	11.5 (25)

† FOR REFERENCE ONLY

To Check Tension

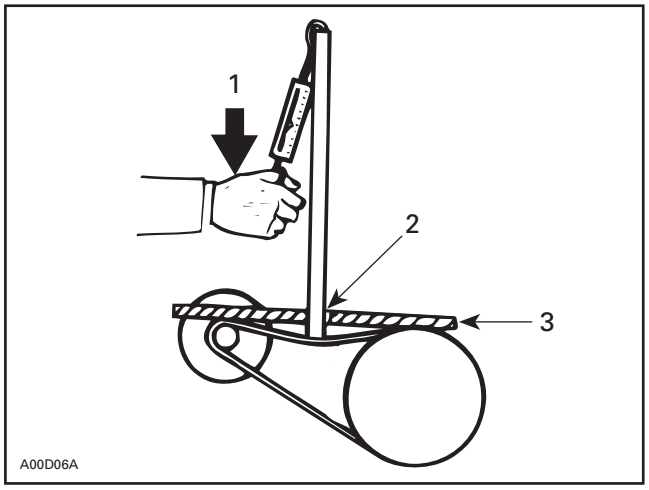
Position a reference rule on drive belt.

Wooden Stick and Spring Scale Method



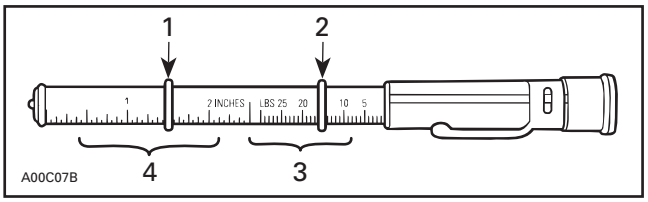
1. Mark specified deflection

Using spring scale and stick, apply specified force on drive belt halfway between pulleys as shown.



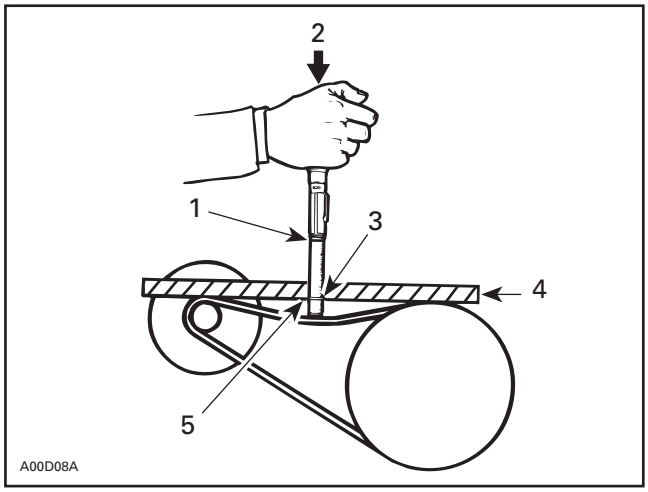
1. Force
2. Read deflection here
3. Reference rule

Or use the belt tension tester (P/N 414 348 200).



1. Lower O-ring
2. Upper O-ring
3. Force (read down)
4. Deflection (read up)

1) Slide lower O-ring of tester to specified deflection.
2) Slide upper O-ring of tester until reaching mark 0 (zero).
3) Apply pressure until lower O-ring is flush with edge of rule and read force on the upper scale at top edge of O-ring.



1. Upper O-ring — force
2. Force applied
3. Lower O-ring — deflection
4. Reference rule
5. Deflection

DRIVE PULLEY

SERVICE TOOLS

Description	Part Number	Page
COMET drive pulley puller	529 025 000	351, 354
drive pulley retainer	529 035 674	357
driven pulley opening tool	529 017 200	351
fork	529 005 500	359, 364
governor cup extractor	529 035 894	358
holder	529 006 400	351
holder	529 027 600	347
large bushing extractor tool	529 035 931	360–361
pulley spring compressor	529 035 524	359–361, 364
short dial indicator	295 000 143	365
spider tool	529 025 200	352
spider wrench	529 025 400	353
spring cover tool	529 027 300	348
tapered tool	529 035 826	352
TRA drive pulley puller	529 022 400	347–348, 357
TRA IV drive pulley support tool	529 035 942	365
vise mount tool	529 031 200	360

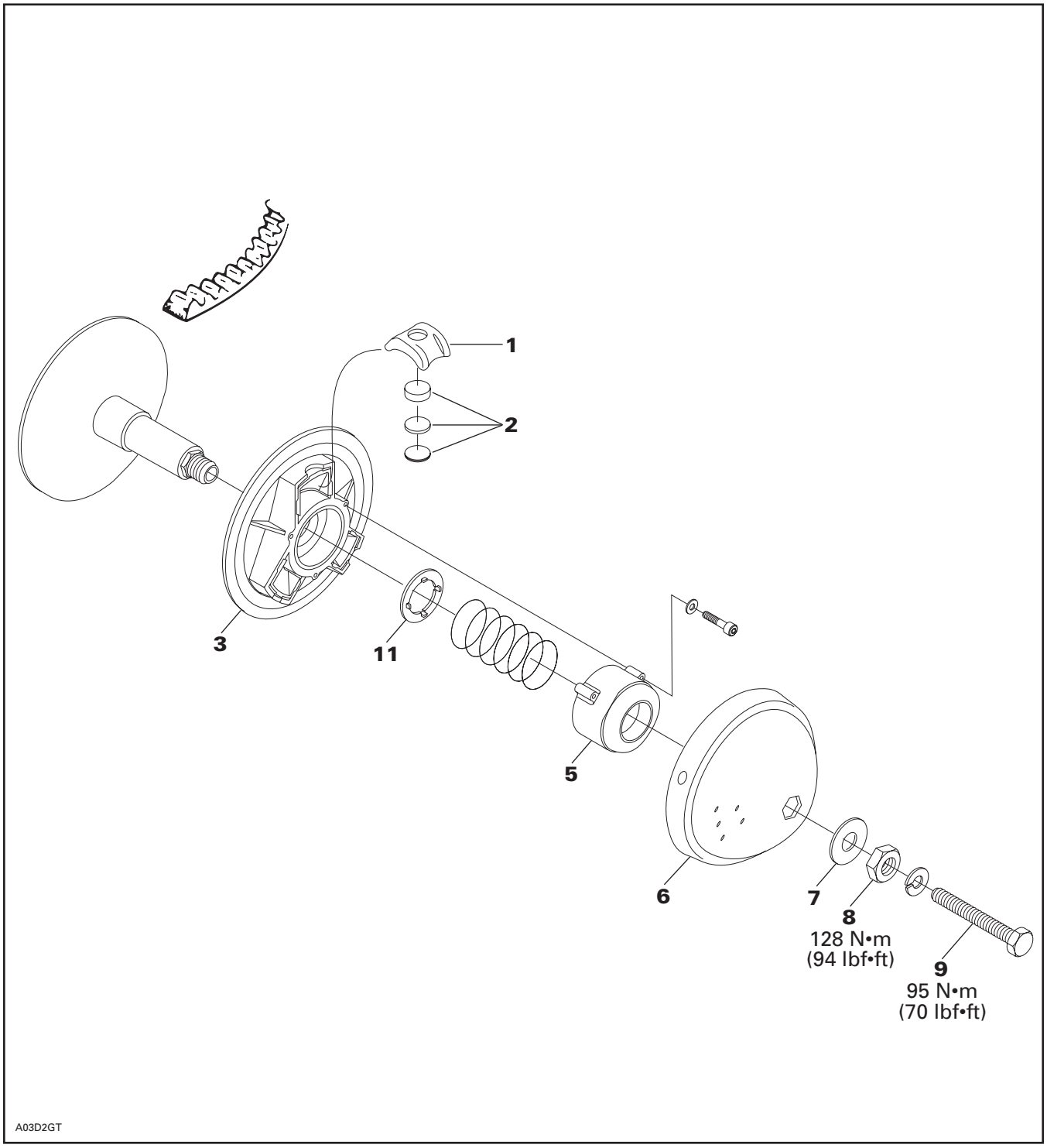
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271	293 800 005	353–354, 362
Primer N	293 800 041	353
pulley flange cleaner	413 711 809	359, 361

BOMBARDIER LITE

NOTE: This is a lubrication free drive pulley.

Tundra/Skandic WT 550/SWT/SUV 550



GENERAL

Some drive pulley components (return spring, calibration disk) can be changed to improve vehicle performance in high altitude regions. A Service Bulletin will give information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

REMOVAL

NOTE: If disassembling drive pulley, first straighten tab washer no. 7 then untighten nut no. 8.

⚠ WARNING

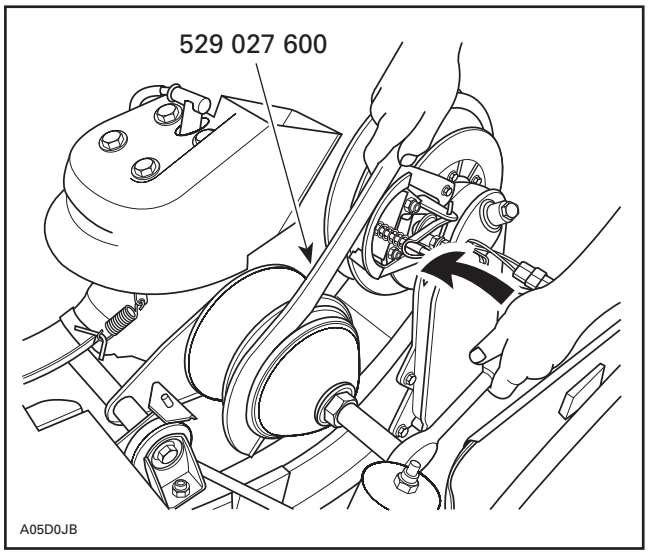
Never use an impact wrench to remove or install the drive pulley.

⚠ WARNING

The drive pulley assembly is a precisely balanced unit. Never replace parts with used parts from another drive pulley assembly.

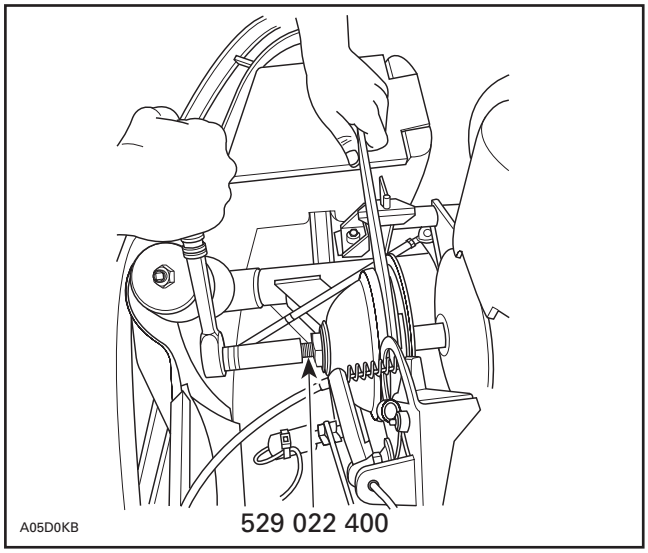
Use holder (P/N 529 027 600).

Remove retaining screw no. 9.



TYPICAL

Insert TRA drive pulley puller (P/N 529 022 400) then remove drive pulley.

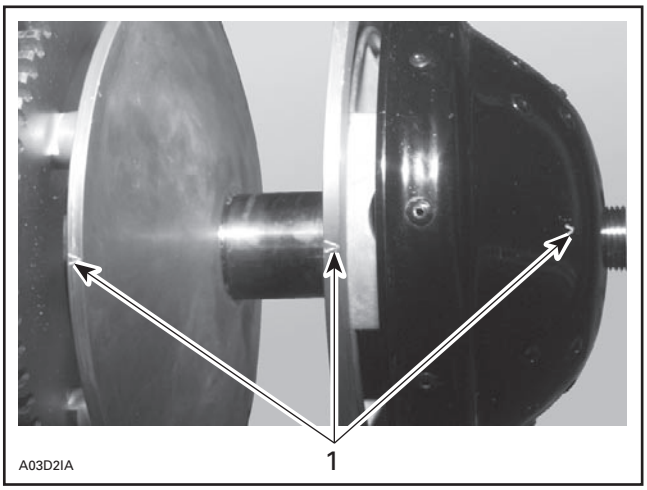


TYPICAL

DISASSEMBLY

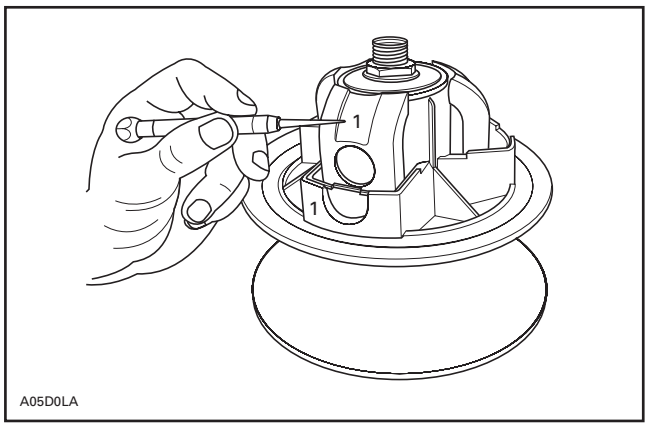
Unscrew nut. Remove tab washer.

Check for alignment marks for proper indexing at reassembly.



1. Alignment marks

Identify blocks **no. 1** and their respective positive positions for reassembly.

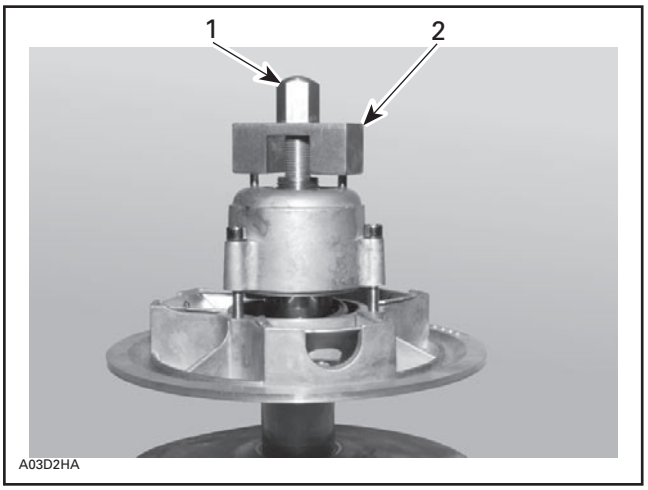


1. Identify

2, Cap, Washer and Disk

These are calibration parts. Refer to TECHNICAL DATA.

Install spring cover tool (P/N 529 027 300) with TRA drive pulley puller (P/N 529 022 400) on spring cover.



1. Puller tool
2. Spring cover tool

Screw puller (hand tight) to hold spring cover and remove screws holding spring cover.

Slowly unscrew puller to release spring pressure.

Remove spring cover **no. 5**, spring and spring seat **no. 11**.

CLEANING

Clean pulley faces and shaft with fine steel wool and clean dry cloth. Clean sliding half bushing with clean dry cloth.

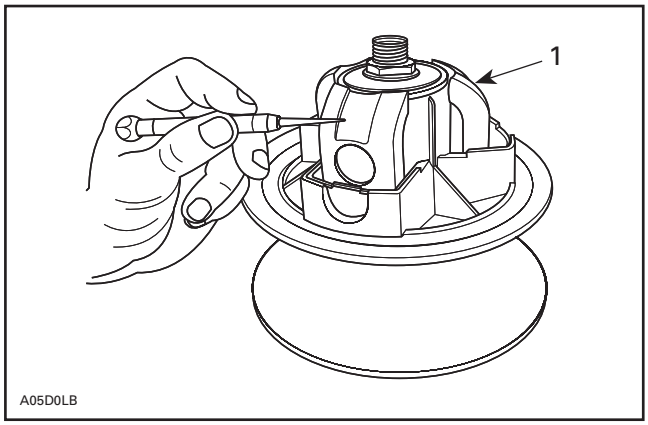
INSPECTION

Check sliding half for excessive lateral play and fixed half shaft for scratches. Replace as required.

ASSEMBLY

Install spring seat **no. 11** then the spring and its cover **no. 5**.

Make sure to install blocks in their original position and with their curved end toward governor cup. See following illustration.



1. Curved end

Tighten nut **no. 8** to 128 N•m (94 lbf•ft).

INSTALLATION

Torque screw to 80 to 100 N•m (59 to 74 lbf•ft).

Install drive belt and belt guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Make sure the track is free of particles that could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

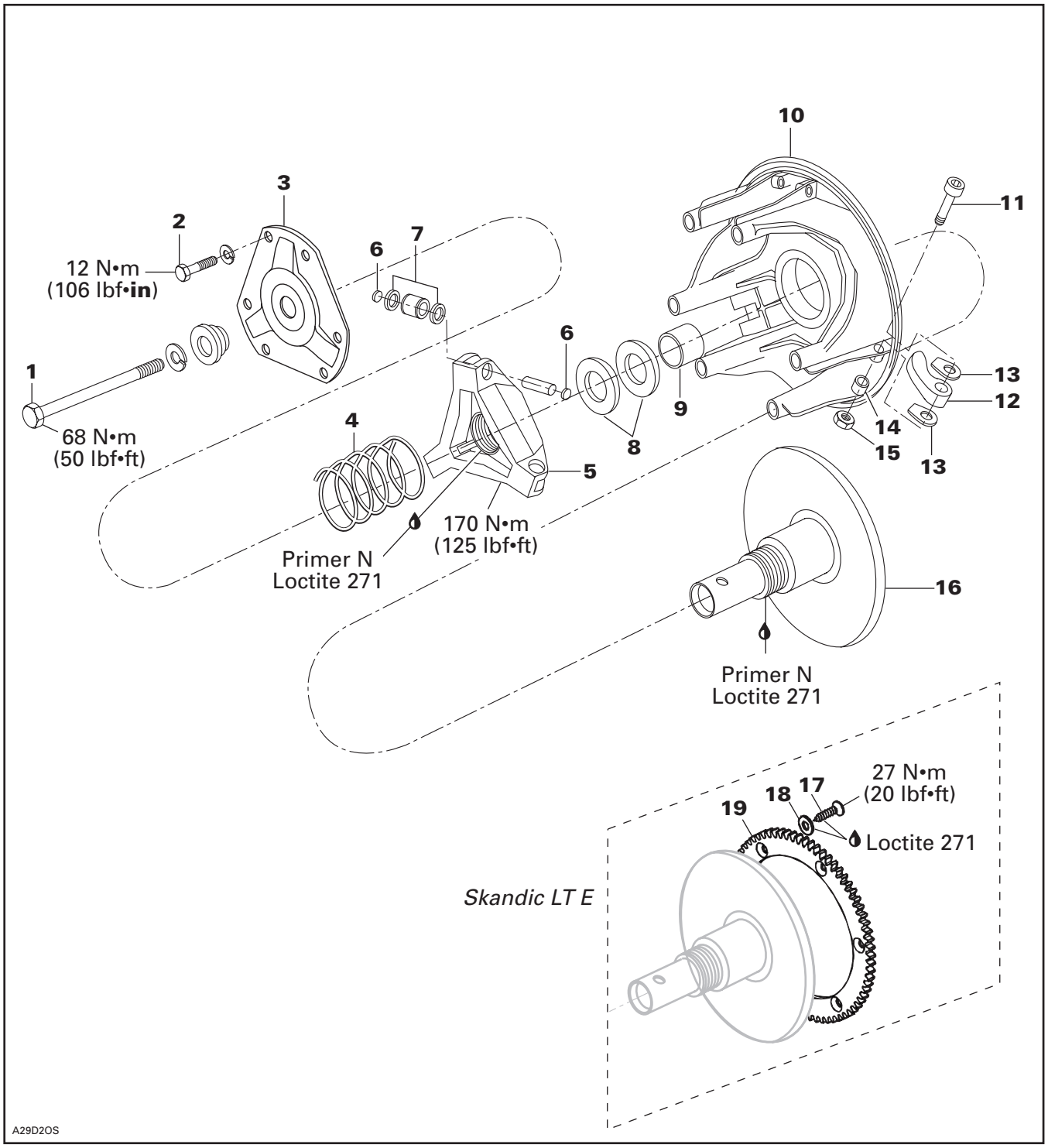
Re-torque screw to 90 to 100 N•m (66 to 74 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

COMET® 102C

Skandic LT/LT E



GENERAL

Some drive pulley components can be changed to improve vehicle performance in high altitude regions. A Service Bulletin will give information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experience mechanics since they can greatly affect vehicle performance.

⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Subcomponent installation and assembly tolerances require strict adherence to procedures detailed.

MAINTENANCE

Cam Arm Pivot Nut

At first 10-hour (500 km) cam arm pivot nuts **no. 15** have to be retighten.

To do so, loosen one turn all cover screws **no. 2**.

Retighten to 5.6 N•m (50 lbf•**in**) maximum all three pivot nuts **no. 15**. Make sure cam arms **no. 12** can still move on their pivot bolts **no. 11**.

Retighten cover screws 2 to 12 N•m (106 lbf•**in**). Proceed with one screw per tower in a criss-cross sequence then, remaining three screws.

Cam Arm Bushing

Cam arm bushings **no. 14** have to be replaced every 3000 km (2000 mi).

With drive pulley still installed on crankshaft, remove one cam arm **no. 12** at a time. Install parts included in Cam Arm Kit. Proceed with remaining cam arms.

Loosen one turn all cover screws **no. 2**.

Retighten to 5.6 N•m (50 lbf•**in**) maximum all three pivot nuts **no. 15**. Make sure cam arms **no. 12** can still move on their pivot bolts **no. 11**.

Retighten cover screws 2 to 12 N•m (106 lbf•**in**). Proceed with one screw per tower in a criss-cross sequence then, remaining three screws.

REMOVAL

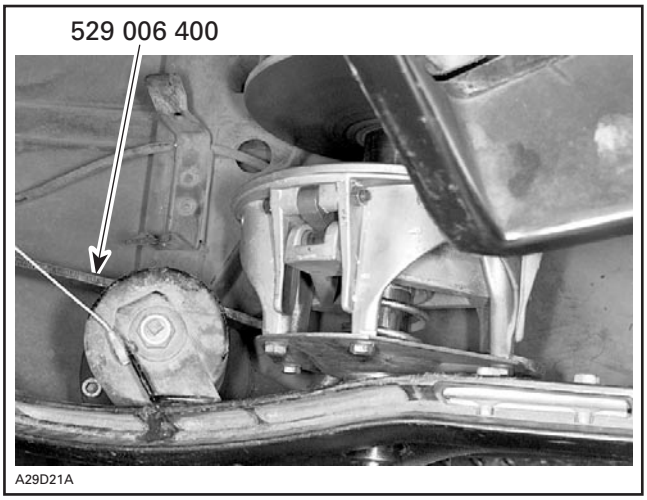
⚠ WARNING

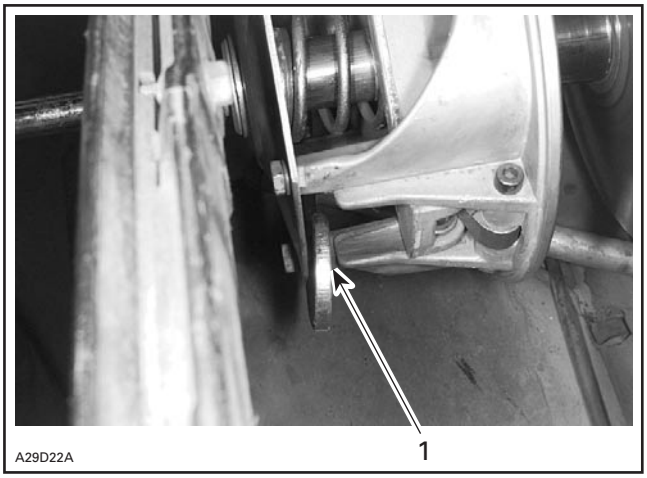
Never use an impact wrench to remove or install the drive pulley.

Unfasten center and rear bottom pan attachments on left hand side. Remove belt guard.

Open driven pulley using driven pulley opening tool (P/N 529 017 200). Remove drive belt.

Use holder (P/N 529 006 400). Make sure holder hook is positioned on top of tower.



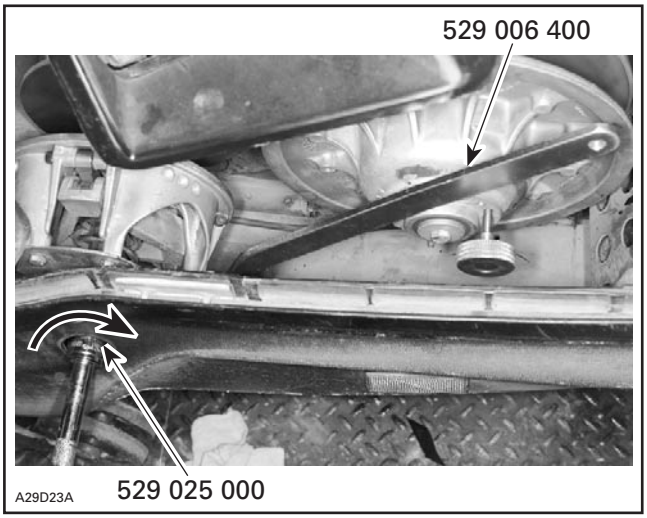


1. Holder hook on top of tower

Remove retaining screw **no. 1**.

Install holder (P/N 529 006 400) in a way to limit pulley clockwise rotation.

Insert COMET drive pulley puller (P/N 529 025 000) then turn puller clockwise to free drive pulley from crankshaft taper.



Remove driven pulley to make room for drive pulley removal.

Remove drive pulley.

DISASSEMBLY

Skandic LT E Only

Remove retaining screws **no. 17** and washers **no. 18** from ring gear **no. 19**.

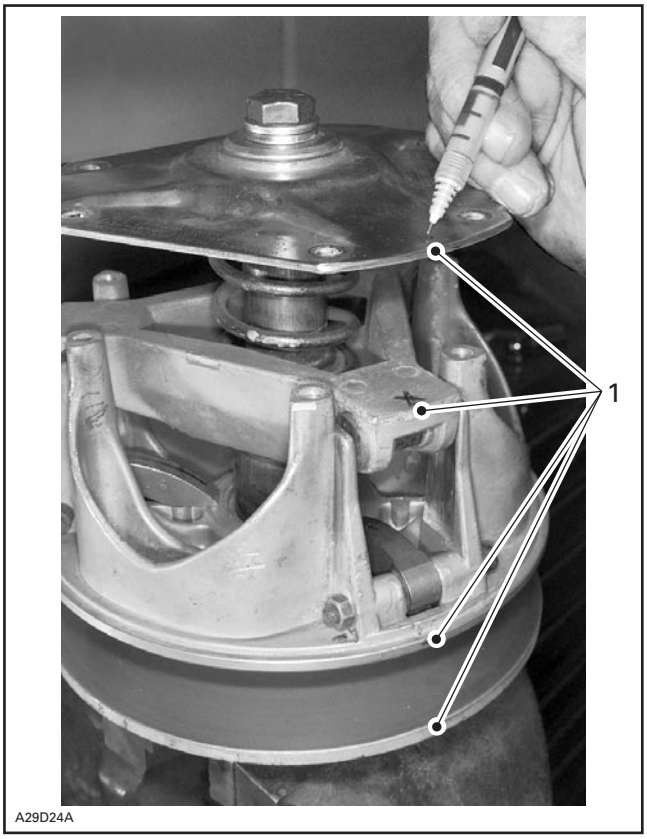
CAUTION: Retaining screws must be heated before disassembly. Heating temperature must not exceed 150°C (300°F).

Skandic LT and Skandic LT E

Mount tapered tool (P/N 529 035 826) in a vise.

Install drive pulley over retainer then, fasten retaining screw **no. 1** and torque to 68 N•m (50 lbf•ft). Now drive pulley is locked on retainer.

Scribe pen marks on fixed half **no. 16**, sliding half **no. 10**, spider **no. 5** and cover **no. 3** for proper indexing at reassembly.



1. Scribe marks

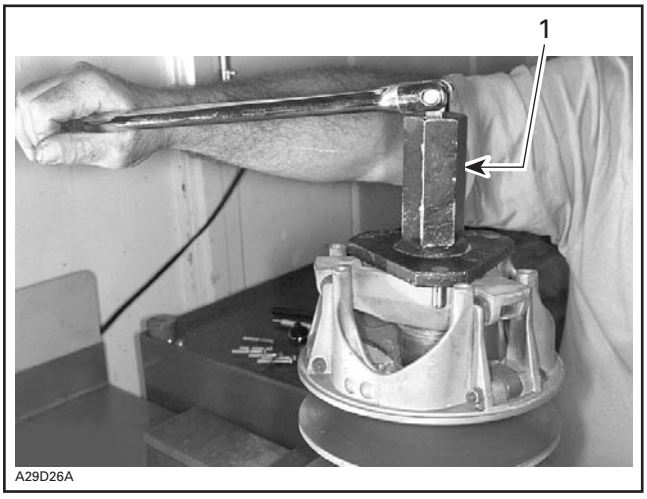
Remove cover screws **no. 2**.

Hold cover **no. 3** by hand then, unscrew retaining screw **no. 1**.

Remove cover **no. 3**.

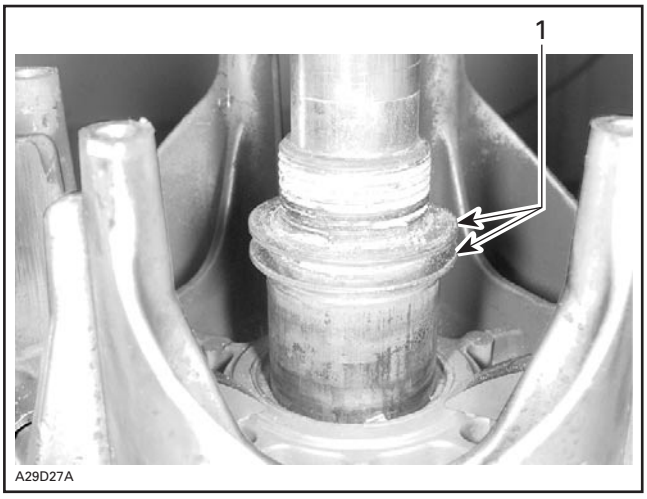
Heat spider **no. 5** to melt threadlocker.

Install spider tool (P/N 529 025 200) then, unscrew spider **no. 5**.



1. Spider wrench

Note shim **no. 8** quantity.



1. Shims

Remove cam arms **no. 12**.

CLEANING

Clean pulley faces and shaft with fine steel wool and clean dry cloth. Clean sliding half bushing **no. 9** and cover bushing with clean dry cloth.

Thoroughly clean spider threads and fixed half post threads.

INSPECTION

Check sliding half for excessive lateral play and fixed half post for scratches. Replace as required.

Check cover bushing interior. Replace cover if bushing is completely bronze instead of the original teflon coating.

Check spider thrust buttons **no. 6** for proper sliding action. Replace as required.

Check rollers **no. 7** for free action. Replace as required.

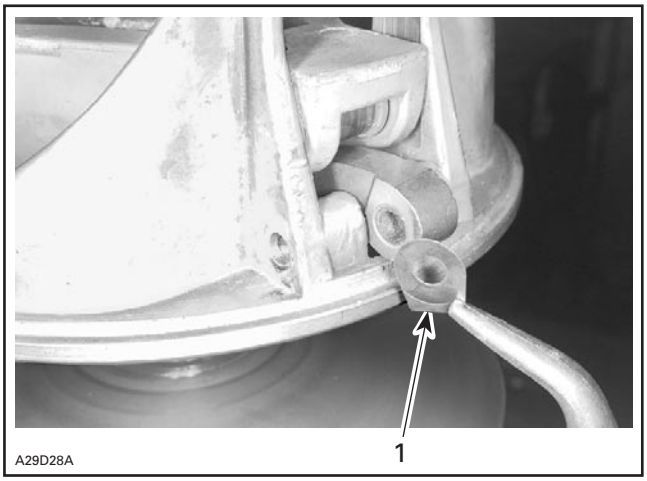
ASSEMBLY

Install shims **no. 8** on fixed half post.

Apply Primer N (P/N 293 800 041) to both post and spider threads, allow to dry for 10 minutes. Apply Loctite 271 (P/N 293 800 005) to threads.

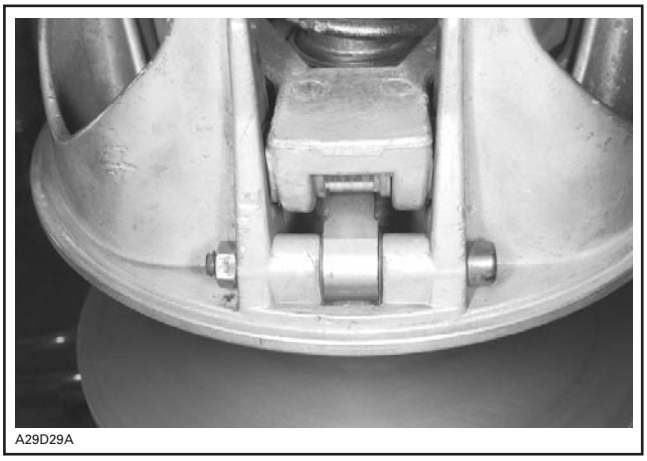
Using spider wrench (P/N 529 025 400) from tool kit, torque spider to 5 to 170 N•m (125 lbf•ft).

With square end facing sliding half, install a washer **no. 13** on each side of cam arm **no. 12**.



1. Square end facing sliding half

Tighten to 5.6 N•m (50 lbf•**in**) maximum all three pivot nuts **no. 15**. Make sure cam arms **no. 12** can still move on their pivot bolts **no. 11**.


A29D29A

Install spring **no. 4**, cover **no. 3**.

Tighten cover screws **no. 2** to 12 N•m (106 lbf•**in**). Proceed with one screw per tower in a criss-cross sequence then, remaining three screws.

Use COMET drive pulley puller (P/N 529 025 000) to unlock drive pulley from retainer.

A29D2AA

Skandic LT E Only

Secure ring gear **no. 19** on inner fixed half using self-tapping screws **no. 17** and thick M8 flat washers **no. 18**. Apply Loctite 271 (P/N 293 800 005) on screw threads and between screw heads and thick flat washers.

NOTE: It is of the utmost importance to use thick flat washers **no. 18** with self-tapping screws **no. 17** in order not to pierce inner fixed half with the screws.

CAUTION: Loctite 271 (P/N 293 800 005) must be applied to safely assemble ring gear.

Torque screws in a criss-cross sequence to 27 N•m (20 lbf•ft).

INSTALLATION

Install drive pulley on crankshaft.

Install a new lock washer.

Torque retaining screw to 68 N•m (50 lbf•ft).

Reinstall driven pulley, drive belt and belt guard. Refasten bottom pan center and rear attachments on left hand side.

Raise the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

Recheck the torque of 68 N•m (50 lbf•ft).

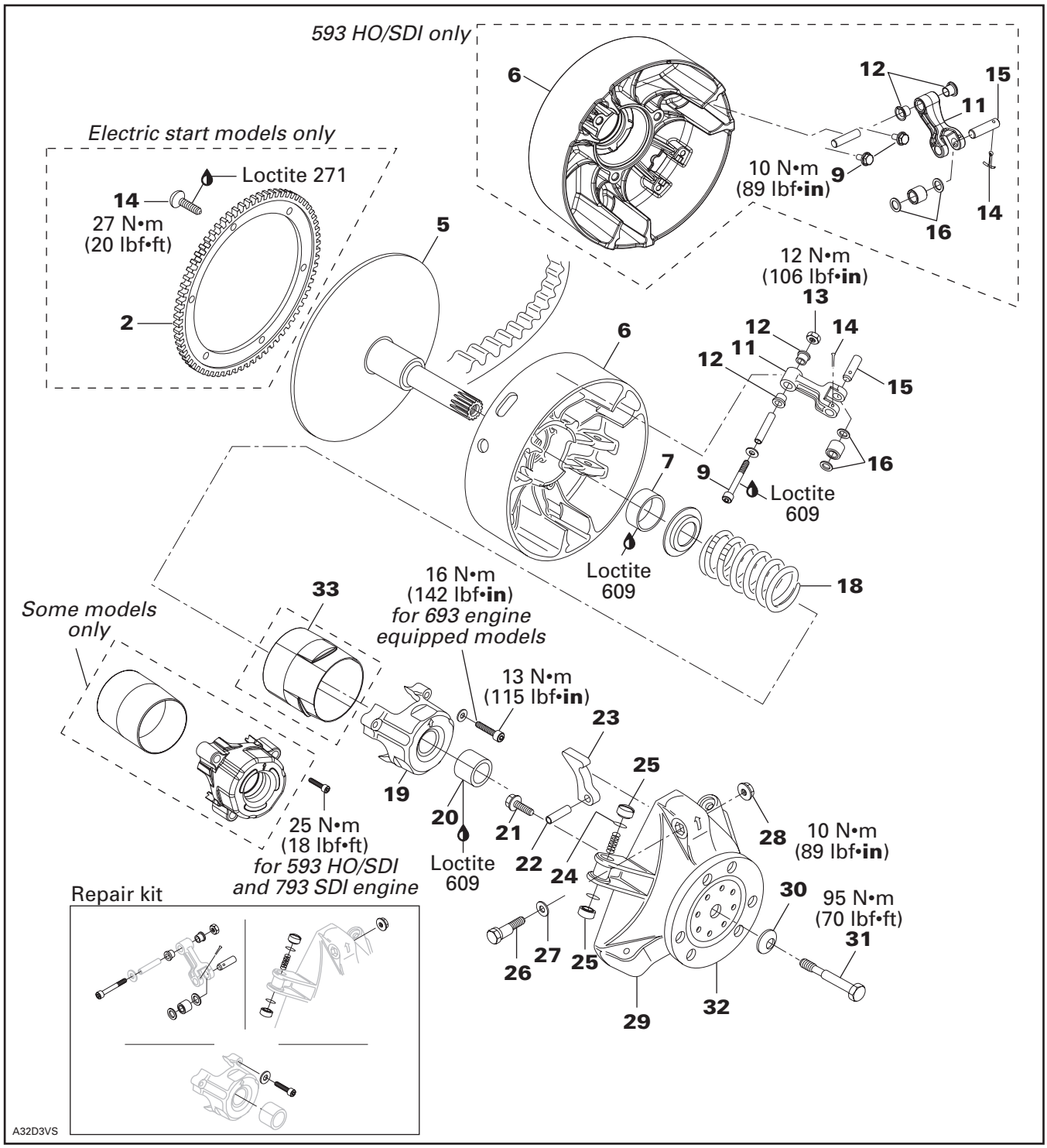
⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

TRA III

All Liquid Cooled Models except 4-TEC Models

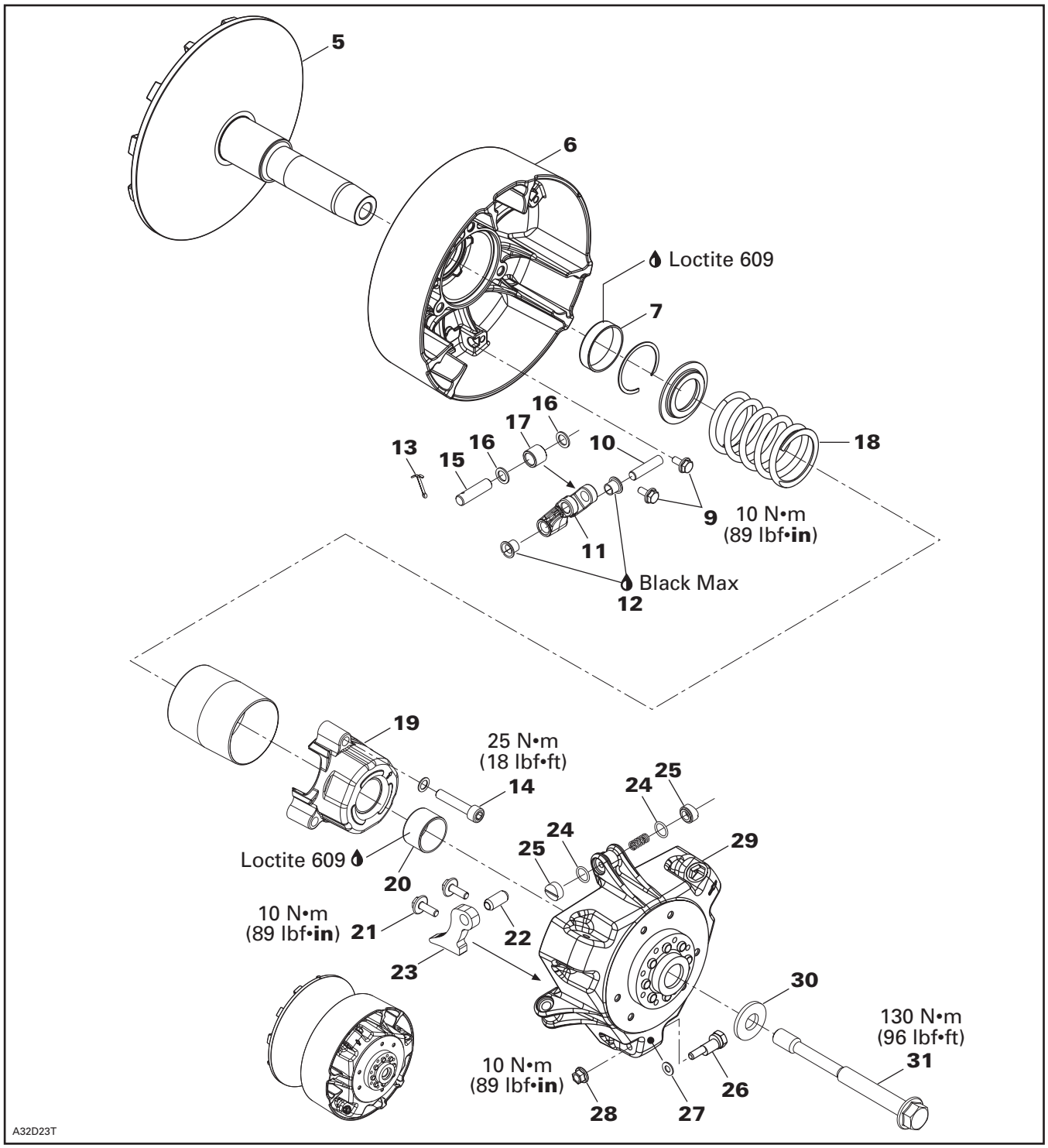
NOTE: These are lubrication free drive pulleys. Always refer to appropriate parts catalog for replacement part. Most parts of TRA III are not interchangeable with those of the TRA.



TRA IV

4-TEC Models

NOTE: This is a lubrication free drive pulleys. Always refer to appropriate parts catalog for replacement part. Most parts of TRA IV are not interchangeable with those of the TRA/TRA III.



GENERAL

Some drive pulley components (return spring, ramp) can be changed to improve vehicle performance in high altitude regions. A service bulletin will give information about calibration according to altitude.

CAUTION: Such modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance. Verify spring specifications before installation. Do not only refer to the spring color code.

NOTE: TRA drive pulley stands for Total Range Adjustable drive pulley.

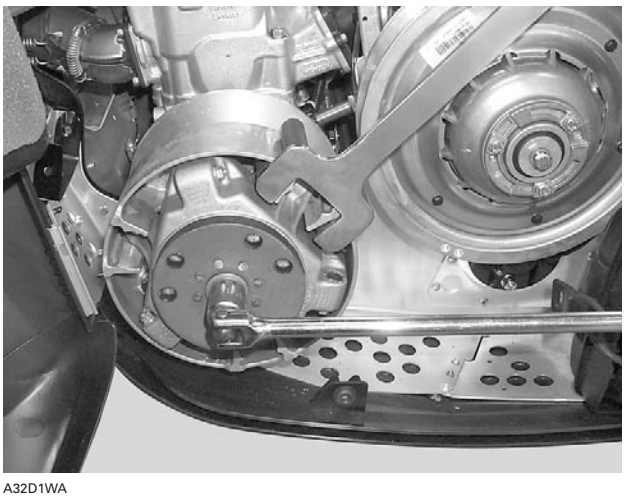
⚠ WARNING

Any drive pulley repairs must be performed by an authorized BRP snowmobile dealer. Sub-component installation and assembly tolerances require strict adherence to procedures detailed.

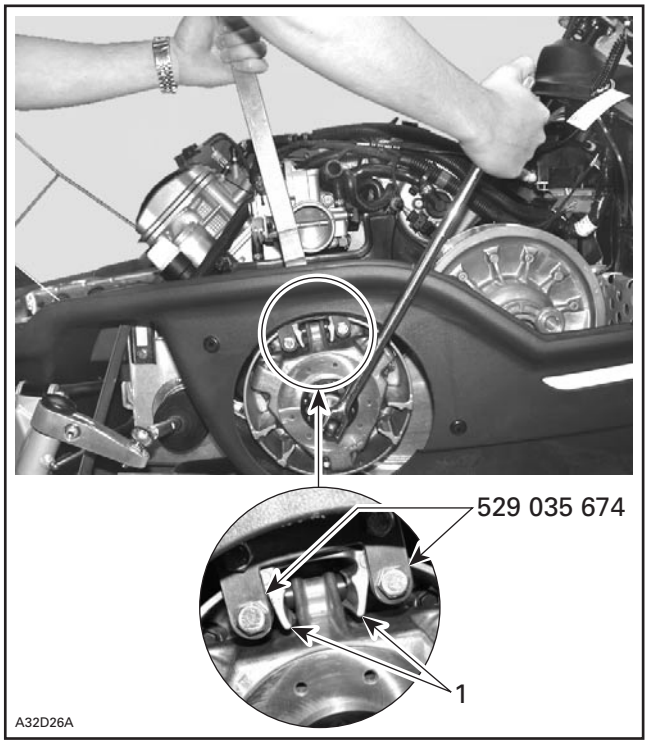
REMOVAL

30,31, Conical Spring Washer and Screw

Secure drive pulley retainer (P/N 529 035 674) over a sliding half tower.



TRA III — INSERT THE TOOL IN SLIDING FLANGE TOWER



1. TRA IV — Sliding half tower

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

Remove retaining screw.

To remove drive pulley ass'y and/or fixed half from engine, use TRA drive pulley puller (P/N 529 022 400).

CAUTION: These pulleys have metric threads. Do not use imperial threads puller. Always tighten puller by hand to ensure that the drive pulley has the same type of threads (metric vs imperial) prior to fully tightening.

To Remove Drive Pulley Ass'y:

Retain drive pulley with drive pulley retainer (P/N 529 035 674).

Install puller in pulley shaft then tighten.

DISASSEMBLY

Models with TRA III

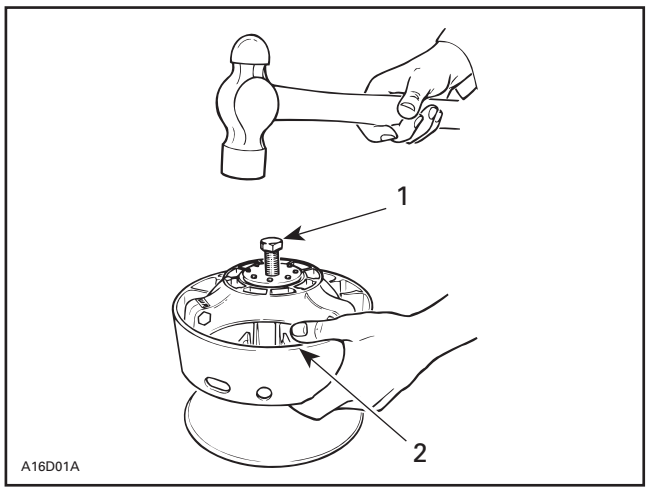
1,2, Screw and Ring Gear

CAUTION: Retaining screws must be heated before disassembly. Do not exceed 150°C (300°F).

5,6, Fixed and Sliding Halves

CAUTION: Do not tap on governor cup.

Screw puller into fixed half shaft about 13 mm (1/2 in). Raise drive pulley and hold it by the sliding half while knocking on puller head to disengage fixed half.



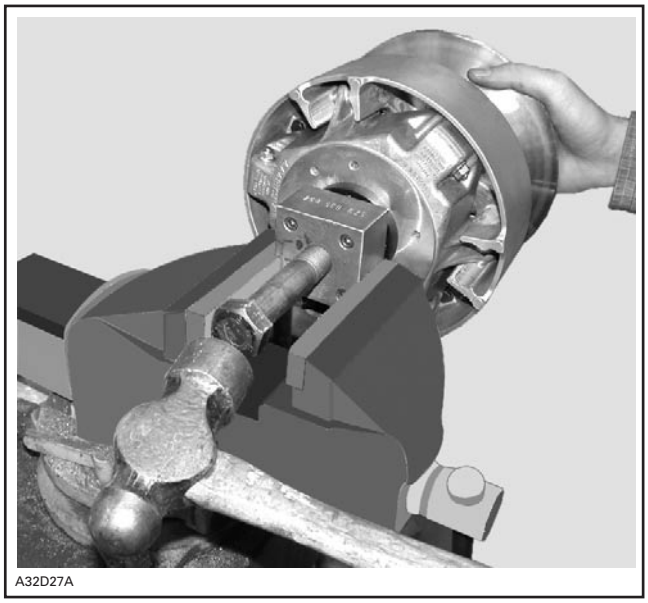
TYPICAL
1. *Puller*
2. *Holding sliding half*

Models with TRA IV

Install governor cup extractor (P/N 529 035 894) on governor cup. Tighten Allen screws in a criss-cross sequence.

Mount governor cup extractor in a vise.

Tighten extractor screw. Hold fixed half and slighty hammer on extractor screw head. Fixed half will come off.



All Models

NOTE: No components marking is required before disassembling this drive pulley since it has factory mark and arrows as indexing reference.

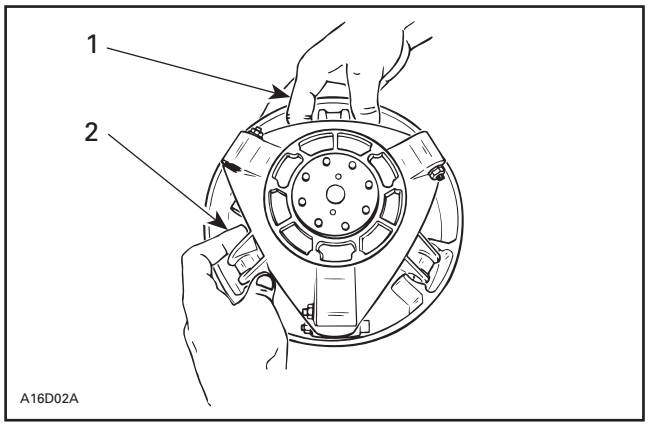
32, Cushion Drive

CAUTION: Do not disassemble cushion drive. Governor cup and cushion drive are factory balanced as an assembly.

25,29, Slider Shoe and Governor Cup

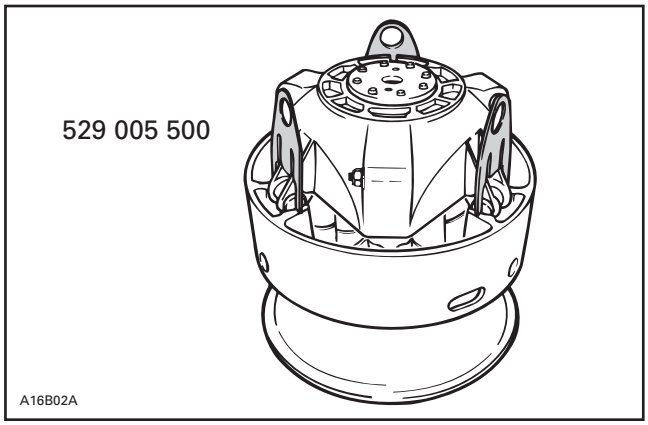
Carefully lift governor cup until slider shoes come at their highest position into guides.

Hold a slider shoe set then carefully lift its housing and remove slider shoes. Proceed the same way for other housings lifting one at a time.



1. *Hold slider shoes*
2. *Lift one housing at a time*

NOTE: To ease disassembly, fork (P/N 529 005 500) should be used to hold slider shoes prior to removing governor cup.



19, Spring Cover Ass'y

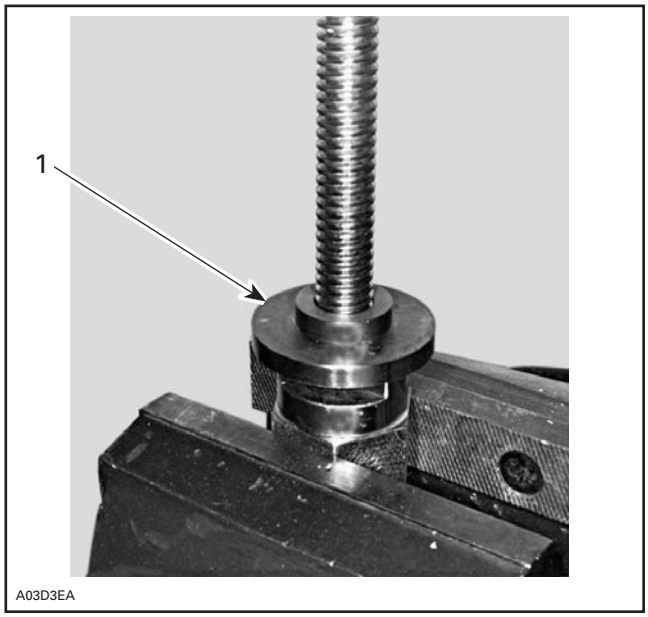
It is pushed by clutch spring pressure.

⚠ WARNING

Clutch spring is very strong. Never attempt to remove spring cover without the recommended tools.

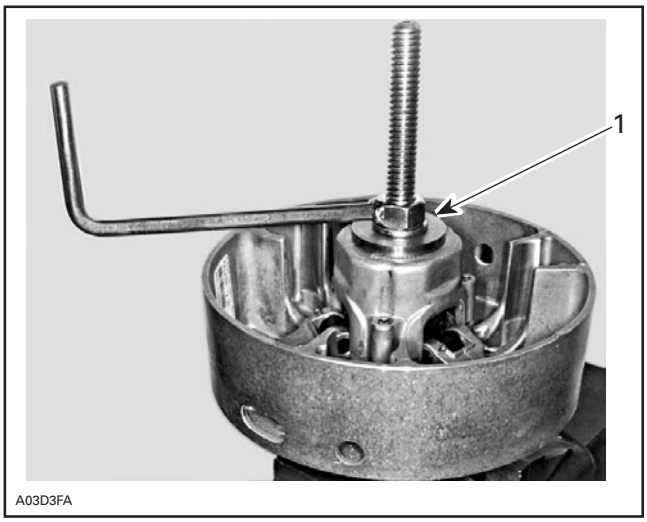
Use pulley spring compressor (P/N 529 035 524).

Install support guide.



1. Support guide

Install sliding half then a second support guide. These support guides will prevent bushing damages.



1. Support guide

Remove 3 Allen screws retaining spring cover then unscrew compressor.

CLEANING

5,6, Fixed and Sliding Halves

Clean pulley halves and shaft with fine steel wool and dry cloth.

5,29, Fixed Half/Crankshaft End and Governor Cup/Fixed Half Post

Parts must be at room temperature before cleaning.

Using a paper towel with pulley flange cleaner (P/N 413 711 809), clean crankshaft tapered end and the taper inside the fixed half of the drive pulley, crankshaft threads and retaining screw threads.

Before installation of drive pulley, clean also crankshaft threads and retaining screw threads.

⚠ WARNING

This procedure must be performed in a well-ventilated area.

CAUTION: Avoid contact between cleaner and crankshaft seal because damage may occur.

Remove all hardened oil deposits that have baked on crankshaft and pulley tapered surfaces with coarse or medium steel wool and/or sand paper no. 600.

CAUTION: Do not use any other type of abrasive.

Reclean mounting surfaces with paper towel and cleaning solvent.

Wipe off the mounting surfaces with a clean, dry paper towel.

CAUTION: Mounting surfaces must be free of any oil, cleaner or towel residue.

7,20, Bushing

Only use petrol base cleaner when cleaning bushings.

CAUTION: Do not use acetone to clean bushing.

INSPECTION

Drive pulley should be inspected annually.

16,17, Thrust Washer and Roller

Check roller for roundness of external diameter. Check thrust washer for thickness wear. Replace as required.

CAUTION: Ensure rollers are in good condition. Replace as required.

9,12, Fitting Bolt Ass'y and Flanged Bushing

Check for wear, replace as required.

24,25, O-Ring and Slider Shoe

Check if O-rings are cracked, cut or crushed. Replace as required.

Check slider shoes for wear. Replace if groove is not apparent on top.

5,29, Fixed Half and Governor Cup

Inspect splines and free play between both parts. Maximum free play is 0.5 mm (.020 in) measured at calibration screw radius. Replace if required.

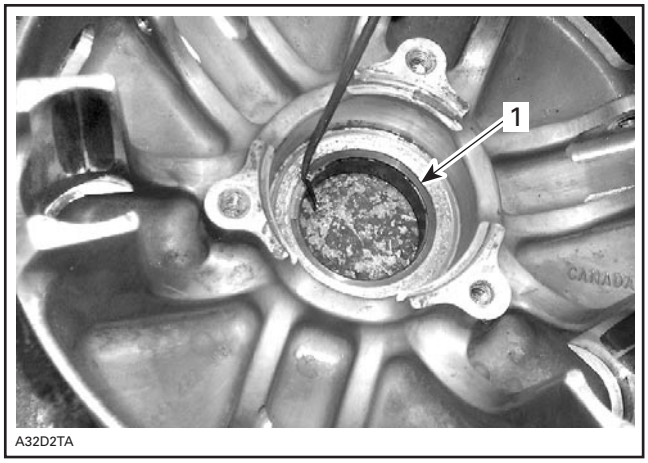
7,20, Sliding Half and Spring Cover Bushing

Visually inspect coating. Replace if worn.

Sliding Half Bushing Replacement

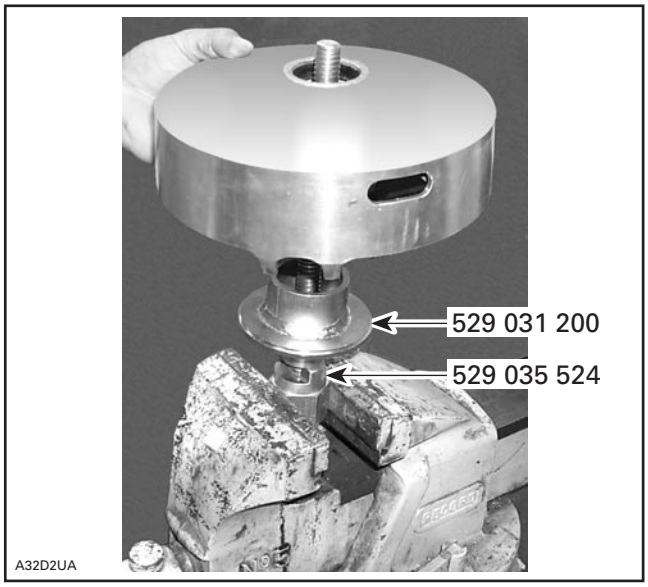
NOTE: In case of worn out bushing, it is advisable to replace whole sliding half ass'y as replacing just the bushing may reduce the drive pulley performance.

Remove circlip from the sliding half.



1. Circlip

Secure the pulley spring compressor (P/N 529 035 524) in a vise mount tool (P/N 529 031 200) and the sliding half ass'y on it.

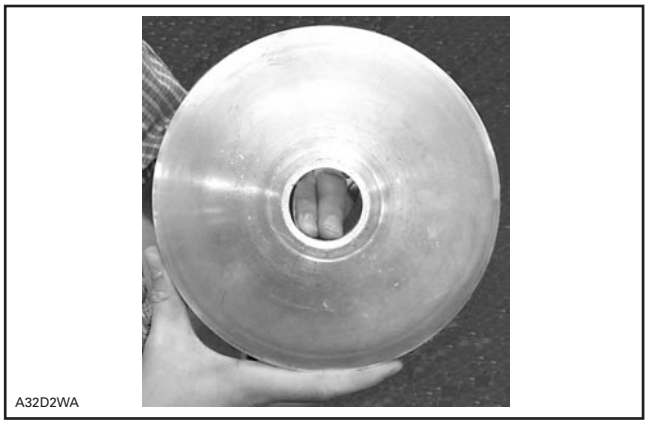


Use the large bushing extractor tool (P/N 529 035 931) to press out old bushing.

NOTE: Make sure to use the large bushing extractor tool (P/N 529 035 931) as marked; to remove the bushing press using the side marked "OUT", as shown below in the picture.

A32D2VA

Use a soft sand paper to clean sliding half bushing mounting surface.


A32D2WA

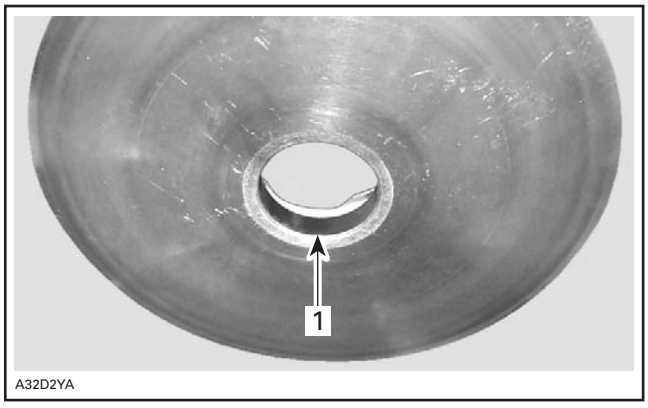
Clean sliding half bushing mounting surface with pulley flange cleaner (P/N 413 711 809).

To install a new bushing, secure the pulley spring compressor (P/N 529 035 524) in a vise and mount the sliding half ass'y. Insert the bushing from inner side of sliding half ass'y.

Mount the large bushing extractor tool (P/N 529 035 931) with side marked "IN" to press in a new bushing.

A32D2XA

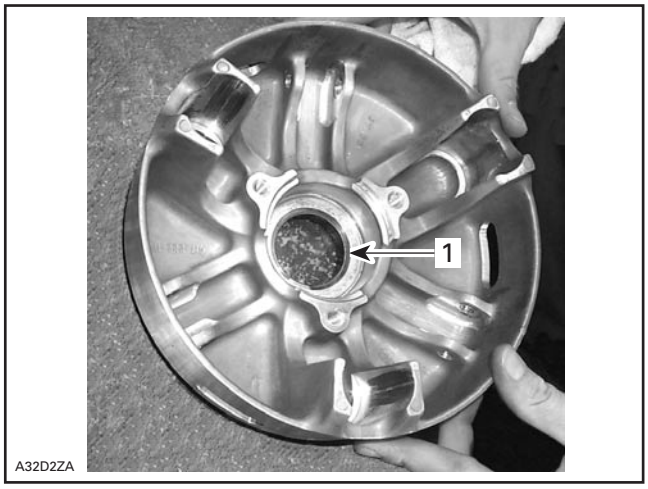
NOTE: Make sure that the bushing is well seated on the sliding half ass'y.



A32D2YA

1. Bushing

Install the circlip.



A32D2ZA

1. Circlip

Spring Cover Bushing Replacement

Under normal use there is no need to replace this bushing.

In case of replacement, it's recommended to replace spring cover ass'y.

ASSEMBLY

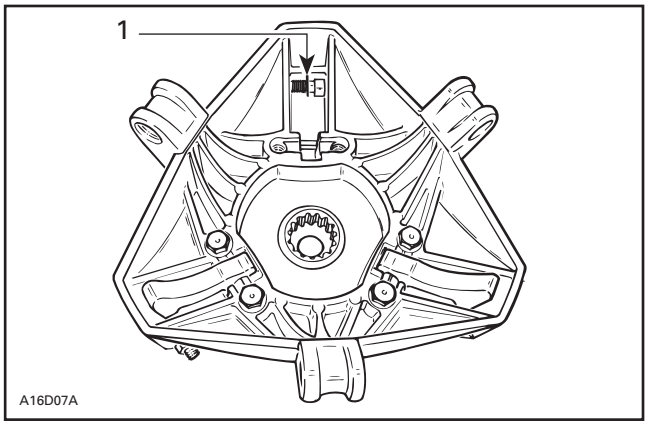
NOTE: This drive pulley is lubrication free. Do not lubricate any component.

1,2,3, Screw, Ring Gear and Loctite 271

Apply Loctite 271 (P/N 293 800 005) on threads and then torque to 27 N•m (20 lbf•ft).

26,27,28, Calibration Screw, Washer and Locking Nut

When installing calibration screw, make sure to install washer as shown.



TYPICAL
1. Washer

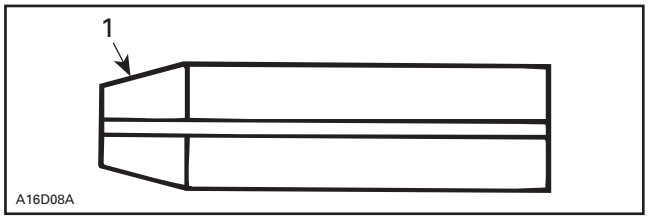
Torque locking nut to 10 N•m (89 lbf•**in**).

15, Pin

Always use the same type of pin as originally installed when servicing. Different types have different weights for calibration purpose. Refer to TECHNICAL DATA.

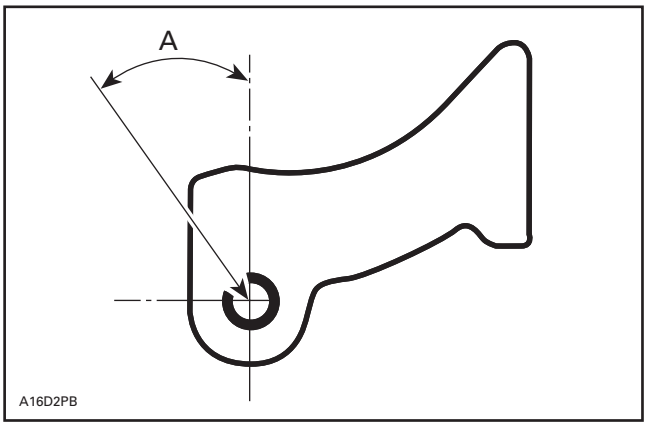
21,22,23, Screw, Dowel Tube and Ramp

Insert dowel tube from chamfered side. Make sure ramp is centered on dowel tube.

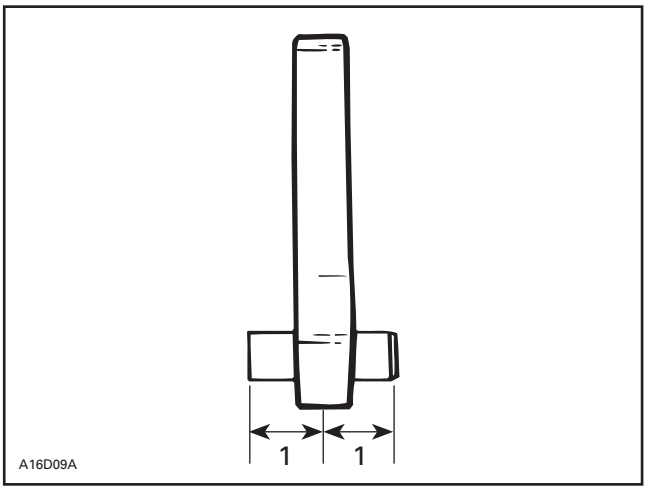


1. Chamfered side

Position dowel tube split at the angle A.



MODEL	ANGLE (A)
With TRA	30 ± 5°
With TRA III and IV	45 ± 3°



1. Equal distance

Torque screws to 10 N•m (89 lbf•**in**).

9,11,13,14, Screw, Lever Ass'y, Nut and Cotter Pin

TRA III and IV

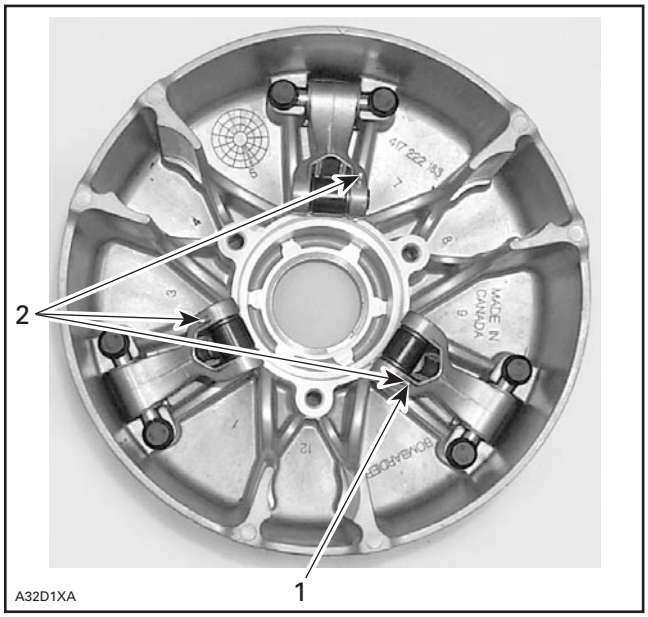
NOTE: While installing lever assemblies make sure that the curved sides of the levers are outwards as shown.

All Models

Always install lever assemblies so that cotter pins are on the shown side. Besides install cotter pin head on top when lever is sat at bottom of sliding half. Bend cotter pin ends to sit perfectly against lever.

⚠ WARNING

Whenever replacing centrifugal levers, always replace all 3 at the same time. Otherwise, drive pulley misbalancing will occur because of levers difference.



1. Head on top
2. All on the same side

CAUTION: Lever assemblies must be installed so that cotter pins are on the same side.

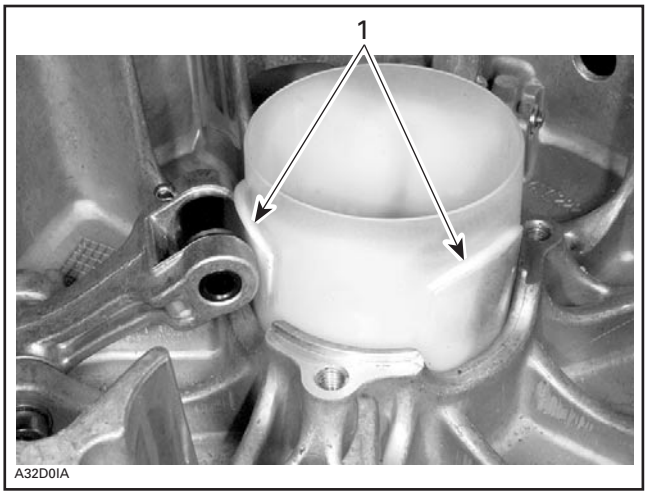
Torque nuts **no. 9** as per the exploded view.

CAUTION: Lever ass'y and rollers must move easily after installation.

33, Guard

Some Models Only

Install guard with its reinforcements in line with levers.



1. Reinforcements

5,6,18,19, Fixed Half, Sliding Half, Spring, Spring Cover and Screw

To install spring cover, use pulley spring compressor (P/N 529 035 524).

Assemble fixed and sliding halves. Note that fixed halves have different cone angle. Match cone angle with crankshaft.

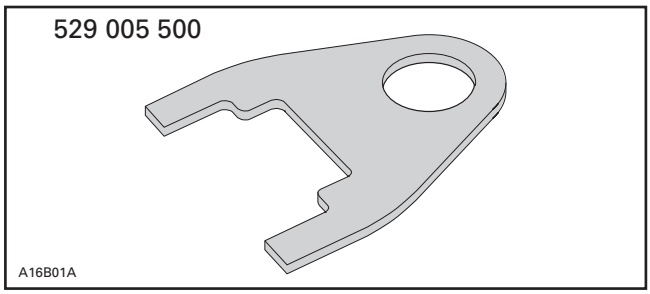
Lift sliding half against spring cover and align spring cover arrow with sliding half mark.

1. Align

Tighten screws to proper torque as mentioned in exploded view.

6,25,29, Sliding Half, Slider Shoe and Governor Cup

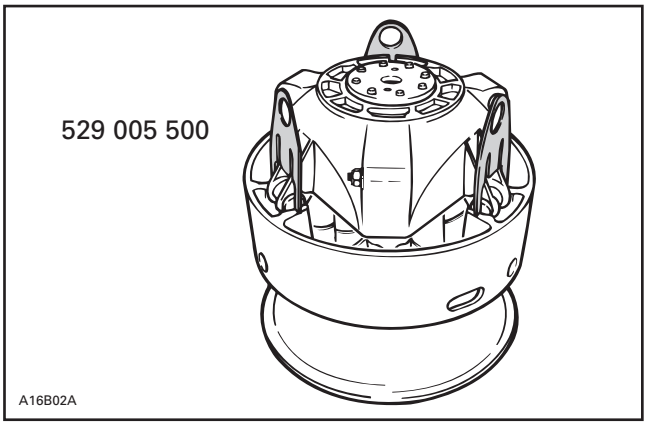
To install governor cup, use following tool:



Insert spring and slider shoes into governor cup so that groove in each slider shoe is vertical to properly slide in guides.

CAUTION: Make sure O-rings are installed on slider shoes and that grooves are positioned vertically.

Install fork (P/N 529 005 500) into slider shoe grooves to maintain them for governor cup installation. Proceed on 3 set of slider shoes.

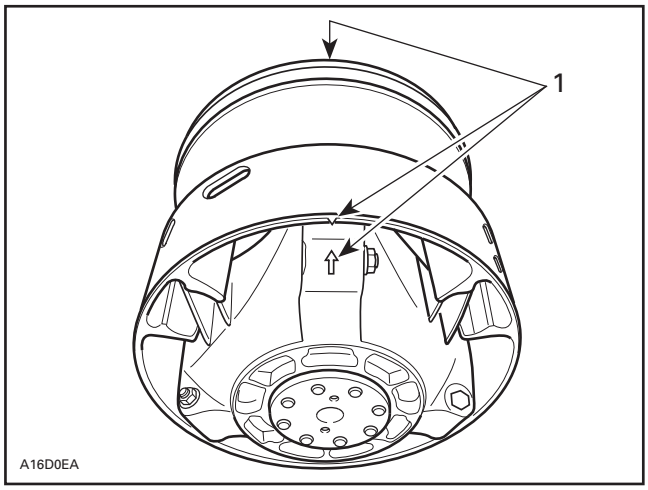


TYPICAL

Make sure to align governor cup arrow with sliding half and fixed half mark.

TRA III

NOTE: If fixed half has no mark, align governor cup mark with segment **no. 1** of inner half. Segments are identified on engine side.



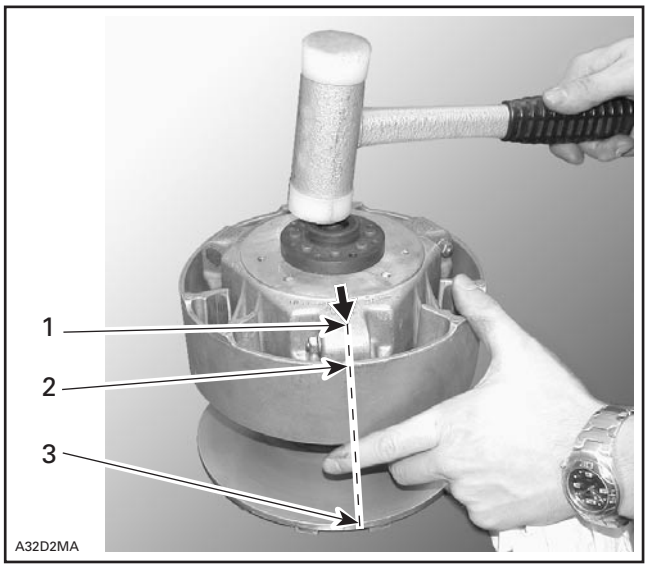
TYPICAL
1. Align

Carefully slide governor cup into sliding half. Align mark of governor cup with mark of fixed half.

Remove forks and push governor cup so that its splines engage with fixed half shaft splines.

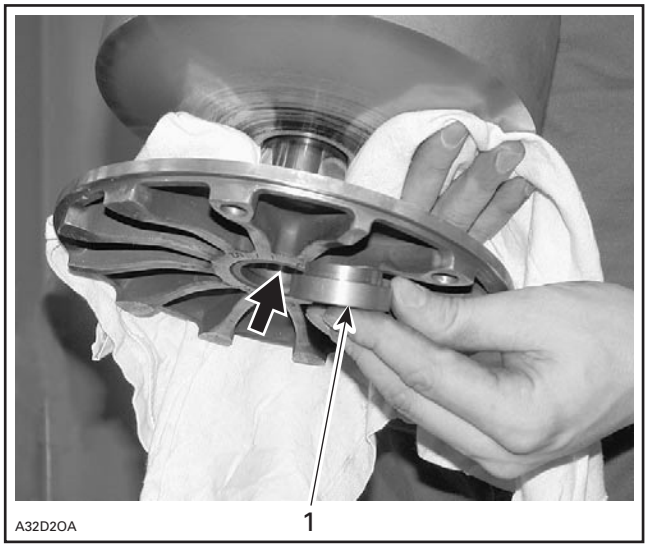
TRA IV

Using a plastic hammer, strike hub firmly 2 or 3 times to ensure proper seating of cones.



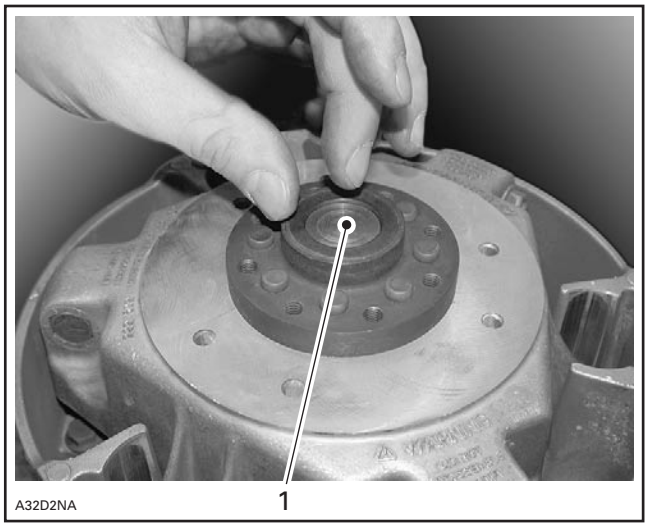
STRIKING HUB
1. *Alignment mark (arrow)*
2. *Sliding flange alignment mark*
3. *Fixed flange alignment mark (reported from underneath)*

Position TRA IV drive pulley support tool (P/N 529 035 942) in hole and align assembly on press, with press shaft.



POSITIONING TRA IV DRIVE PULLEY SUPPORT
1. *TRA IV drive pulley support*

Position dial support tool in hub and make sure it is well seated on fixed flange shaft.

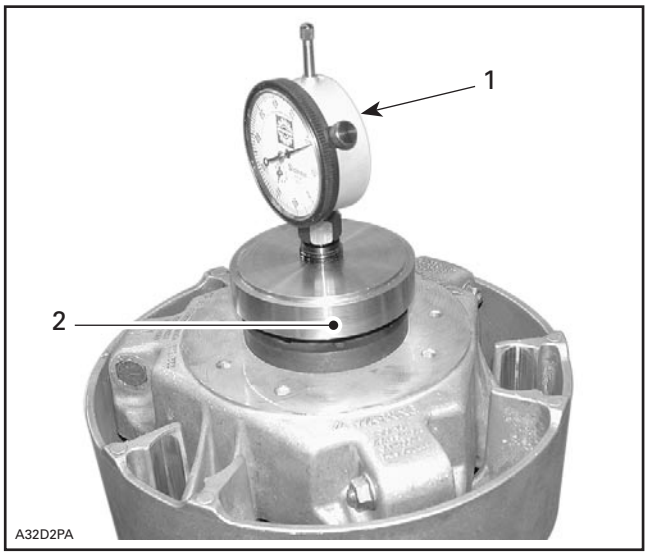


1. *Dial support in hub*

CAUTION: For following procedure, make sure to take off the wheel from the extremity of the dial indicator.

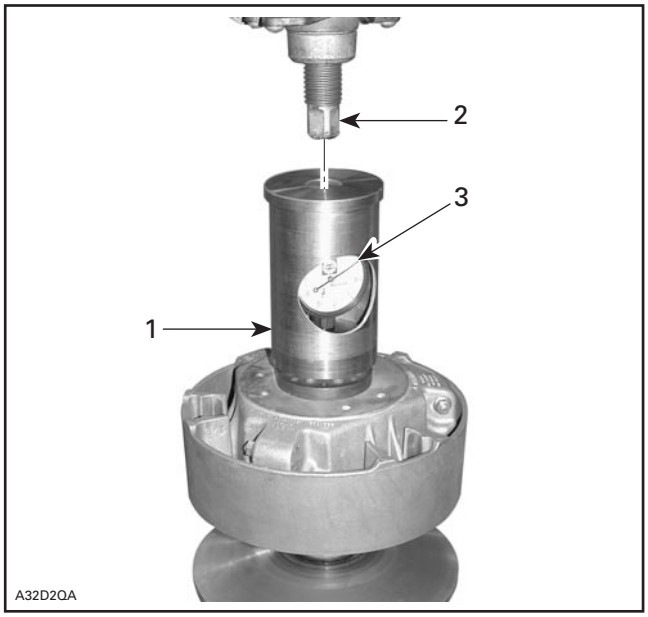
SHOWS WHEEL REMOVED

Completely screw short dial indicator (P/N 295 000 143) in housing support tool and install it on pulley assembly; set dial indicator to “0”. Make sure the set-up is well mounted and the dial constantly reads “0”.



1. Indicator
2. Housing support

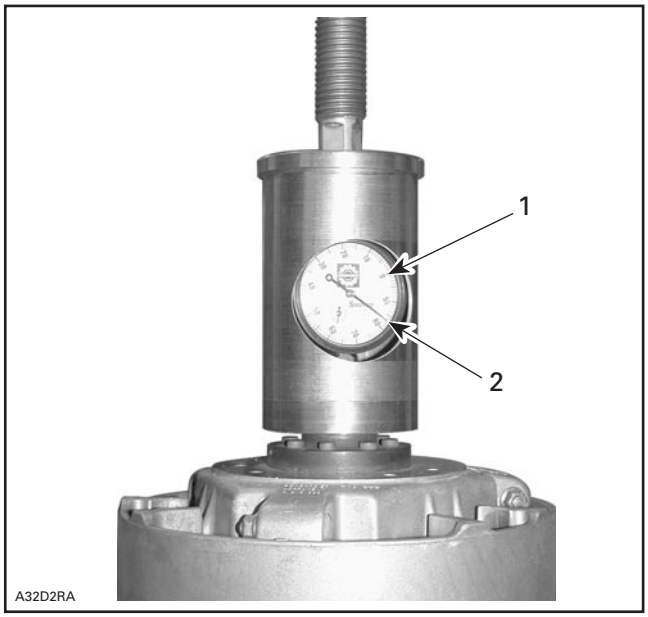
Cover indicator with dial housing tool.



1. Dial housing
2. Press shaft (aligned)
3. Needle at absolute "0"

Align press shaft just over and without touching the very middle of dial housing; do not apply pressure yet.

Ensure indicator needle is still set at absolute "0" and then start activating press until needle reads a displacement of .017 ± .0005 in.



1. Absolute "0"
2. .017 in displacement

CAUTION: Make sure to respect given specification to ensure adequate reassembly of drive pulley. Failure to do so could cause damage to drive pulley assembly.

CAUTION: Make sure splines of both parts are fully engaged.

INSTALLATION

⚠ WARNING

Do not apply anti-seize or any lubricant on crankshaft and drive pulley tapers.

⚠ WARNING

Never use any type of impact wrench at drive pulley removal and installation.

Clean mounting surfaces as described in CLEANING above.

Drive Pulley Ass'y

The following installation procedure must be strictly adhered.

Install drive pulley on crankshaft extension.

Install a new conical spring washer with its concave side towards drive pulley then install screw.

⚠ WARNING

Never substitute conical spring washer and/or screw with jobber ones. Always use BRP genuine parts for this particular case.

Use holder. See removal procedure.

TRA III

Torque screw to 80 to 100 N•m (59 to 74 lbf•ft).

TRA IV

Torque screw to 125 to 135 N•m (92 to 100 lbf•ft).

All Models

Install drive belt and guard.

Raise and block the rear of the vehicle and support it with a mechanical stand.

⚠ WARNING

Ensure that the track is free of particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure nobody is standing near the vehicle.

Accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake, repeat 5 times.

TRA III

Retorque screw to 90 to 100 N•m (66 to 74 lbf•ft).

TRA IV

Retorque screw to 125 to 135 N•m (92 to 100 lbf•ft).

⚠ WARNING

After 10 hours of operation the transmission system of the vehicle must be inspected to ensure the retaining screw is properly torqued.

DRIVE PULLEY ADJUSTMENT

TRA III

The drive pulley is factory calibrated to transmit maximum engine power at a predefined RPM. Factors such as ambient temperature, altitude or surface condition may vary this critical engine RPM thus affecting snowmobile efficiency.

This adjustable drive pulley allows setting maximum engine RPM in the vehicle to maintain maximum power.

Calibration screws should be adjusted so that actual maximum engine RPM in vehicle matches the maximum horsepower RPM given in TECHNICAL DATA.

NOTE: Use precision digital tachometer for engine RPM adjustment.

NOTE: The adjustment has an effect on high RPM only.

To adjust, modify ramp end position by turning calibration screws.

TRA IV

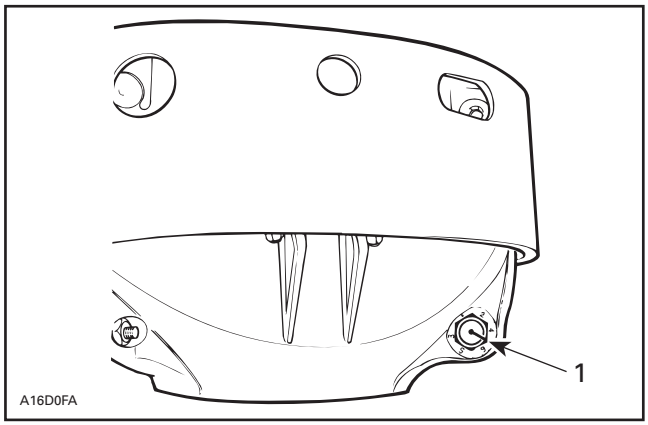
From factory TRA drive pulley adjustment screws are set to position 3. This position allows the best compromise between acceleration, top speed and fuel economy.

Position 1 or 2 would provide the best fuel economy. Top speed would be reduced.

Position 4 would give the best acceleration. Fuel economy would be reduced.

26,28,29, Calibration Screw, Locking Nut and Governor Cup

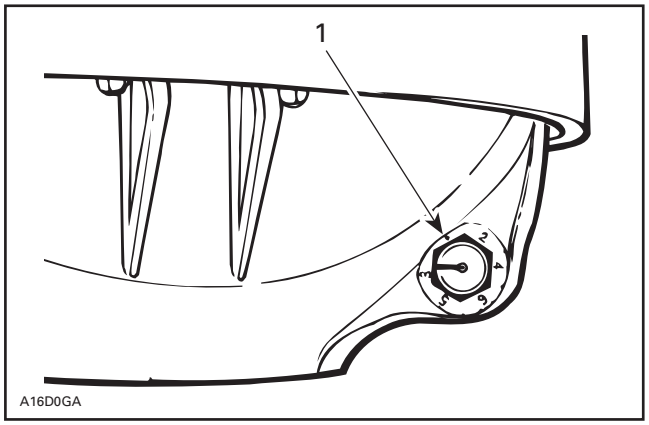
Calibration screw has a notch on top of its head.



1. Notch

Governor cup has 6 positions numbered 2 to 6. Note that in position 1 there is no stamped number (due to its location on casting).

See TECHNICAL DATA for original setting.



1. Position 1 (not numbered)

Each number modifies maximum engine RPM by about 200 RPM.

Lower numbers decrease engine RPM in steps of 200 RPM and higher numbers increase it in steps of 200 RPM.

Example:

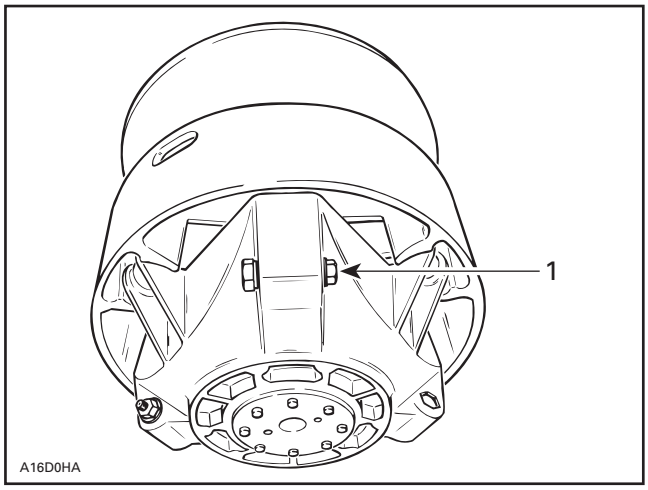
Calibration screw is set at position 3 and is changed to position 5. So maximum engine RPM is increased by about 400 RPM.

To Adjust:

Just loosen locking nut enough to pull calibration screw **partially** out and adjust to desired position. Do not completely remove the locking nut. Torque locking nuts to 10 N•m (89 lbf•**in**).

CAUTION: Do not completely remove calibration screw otherwise its inside washer will fall off.

CAUTION: Always adjust all 3 calibration screws and make sure they are all set at the same number.



TYPICAL
1. Loosen just enough to permit rotating of calibration screw

DRIVEN PULLEY

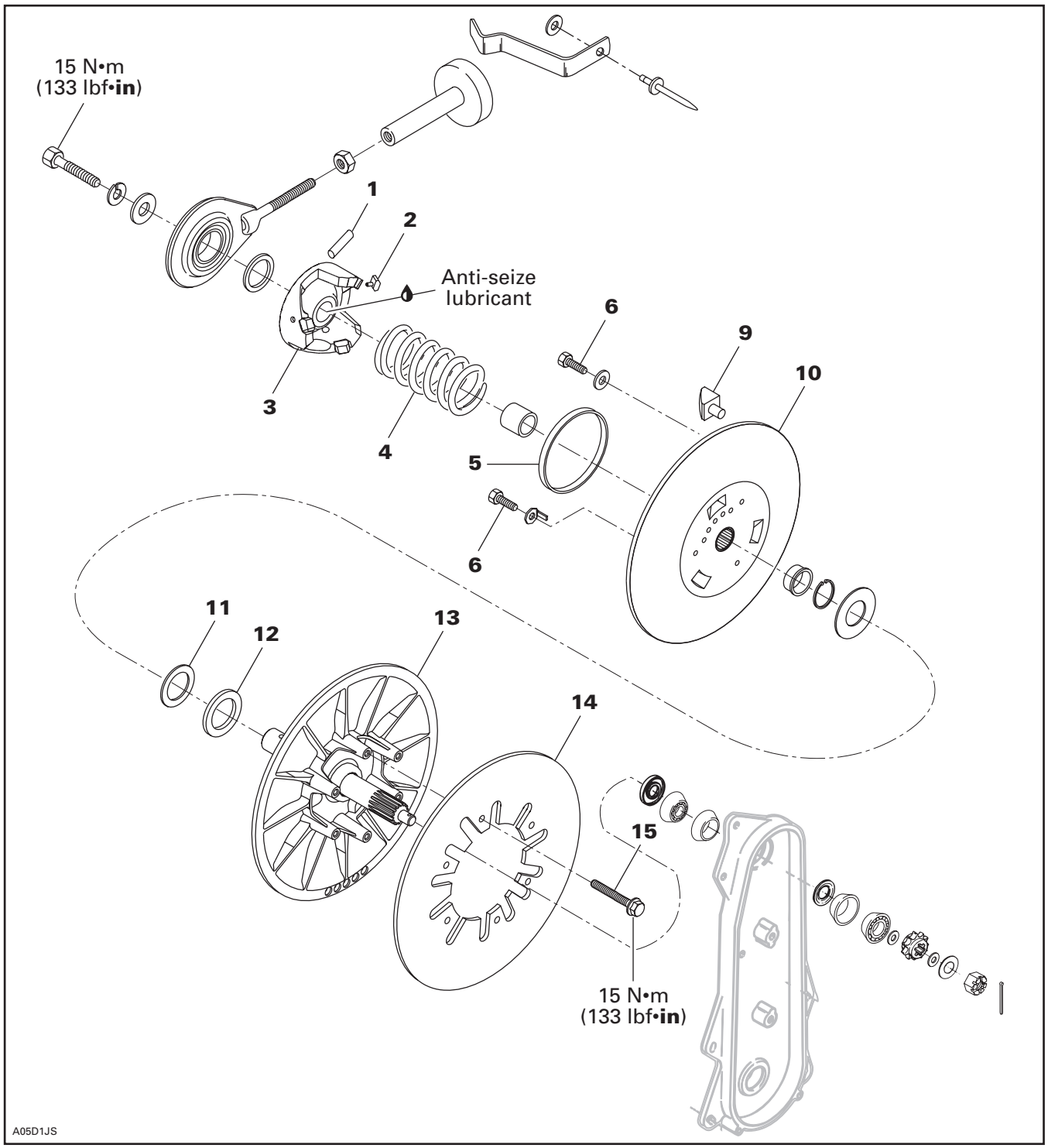
SERVICE TOOLS

Description	Part Number	Page
driven pulley spring compressor	529 035 300	371, 373
extractor	529 035 575	375
pulley spring compressor	529 035 524	375
pulley spring compressor	529 035 524	375–376, 379
spring scale hook	529 006 500	379
support plate	529 031 100	375

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	413 701 000	373, 376, 379
Loctite 609	413 703 100	375
pulley flange cleaner	413 711 809	379

Tundra


15 N•m
(133 lbf•in)
1
2
Anti-seize
lubricant
3
4
5
6
6
9
10
11
12
13
14
15
15 N•m
(133 lbf•in)
A05D1JS

NOTE: Driven pulley components (support, cam, shoes, etc.) can be serviced without removing the whole driven pulley from chaincase. Refer to the following procedures but neither remove brake caliper nor open chaincase for those cases.

REMOVAL

To remove driven pulley from chaincase, follow this procedure.

Remove guard and drive belt from vehicle.

Remove brake support from chaincase with brake ass'y.

Free countershaft support from support clamp.

Chaincase

Open chaincase and drain oil. Unlock and remove upper sprocket.

The following is required to have enough space to remove driven pulley from chaincase:

Loosen steering column upper retaining screws.

Disconnect carburetor boots from intake manifold and air intake silencer.

Disconnect impulse hose from engine.

Disconnect oil injection supply line at injection pump and plug line to prevent draining.

Remove screws retaining rear engine support to chassis.

Tip engine forward just enough to allow driven pulley removal from chaincase. Block in this position.

NOTE: In some cases, chaincase retaining screws might have to be loosened to allow pivoting of chaincase. In this case, note position of alignment shims. In addition, air intake silencer and oil injection reservoir might have to be slightly moved to get enough space to pull driven pulley.

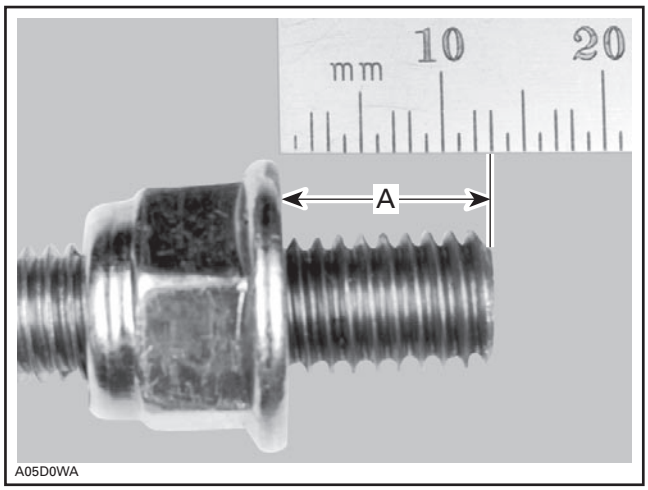
Remove bearing cone.

Knock driven pulley shaft with a plastic hammer and pull driven pulley out.

DISASSEMBLY

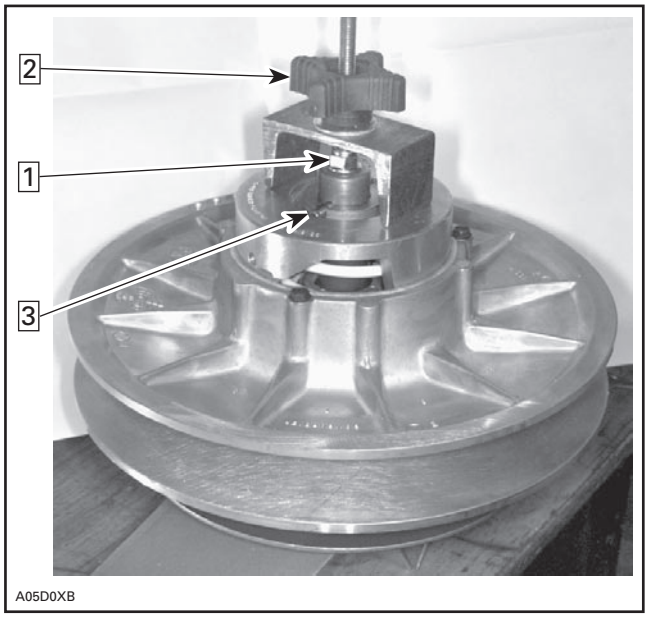
To disassemble driven pulley, driven pulley spring compressor (P/N 529 035 300)) must be used. See following procedure.

Position stop nut 13 mm (1/2 in) from threaded rod end, as shown in the next photo.



1. 13 mm (1/2 in)

Install driven pulley spring compressor (P/N 529 035 300). Fully tighten the 13 mm (1/2 in) exposed threads in driven pulley. Tighten stop nut. Tighten tool knob to compress spring then remove roll pin no. 2.

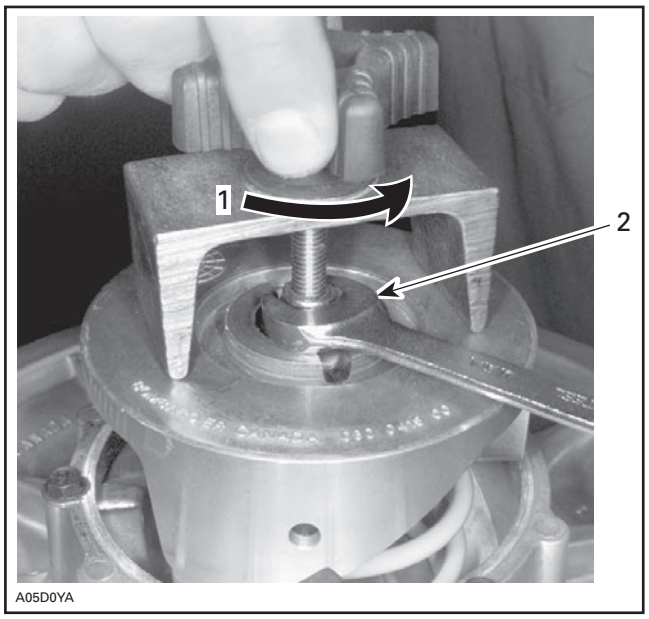


Step 1: Tighten stop nut
Step 2: Tighten knob to compress spring
Step 3: Remove roll pin

Once roll pin has been removed, loosen knob until spring pressure is completely released.

⚠ WARNING

To avoid injuries always hold stop nut with a key when loosening knob, as shown in the next photo.



1. When loosening knob
2. Hold stop nut with a key

Remove tool and cam **no. 3**. Remove spring **no. 4** and sliding half **no. 10**.

5, Large Bushing

Remove 3 screws **no. 6** with washers and pry bushing **no. 5** out.

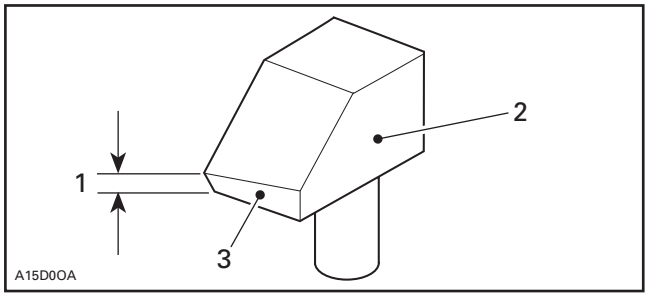
INSPECTION

2,9, Slider Shoe

Black slider shoe = forward

Red slider shoe = reverse

Check cam slider shoes for wear. Replace when inside edge thickness of cam slider shoe slope base is 1 mm (.039 in) or less.



1. Measure thickness of slope base here
2. Sliding pulley side
3. Slop base

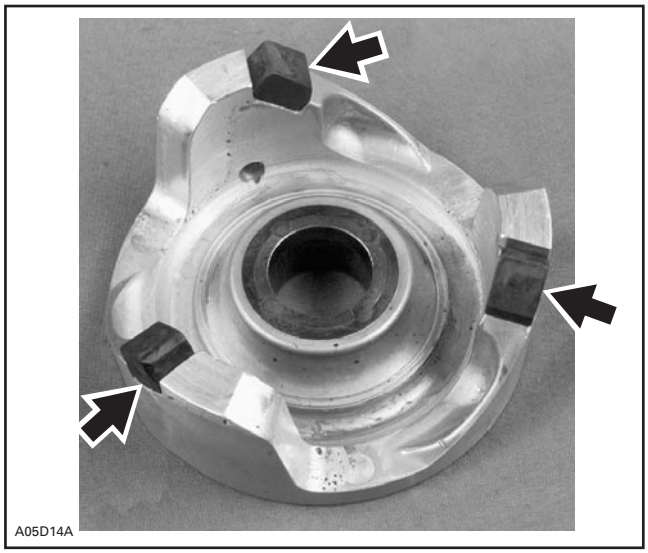
ASSEMBLY

Assemble driven pulley components by reversing the disassembly procedure except for the following.

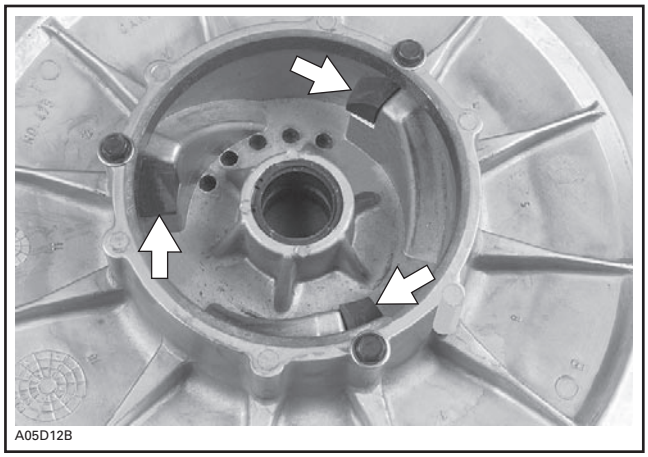
2,9, Slider Shoe

When replacing slider shoes, always install a new set (3 shoes) to maintain equal pressure on the cam.

Install slider shoes as per following photo. Red slider shoes are being used for reverse and black ones for forward.



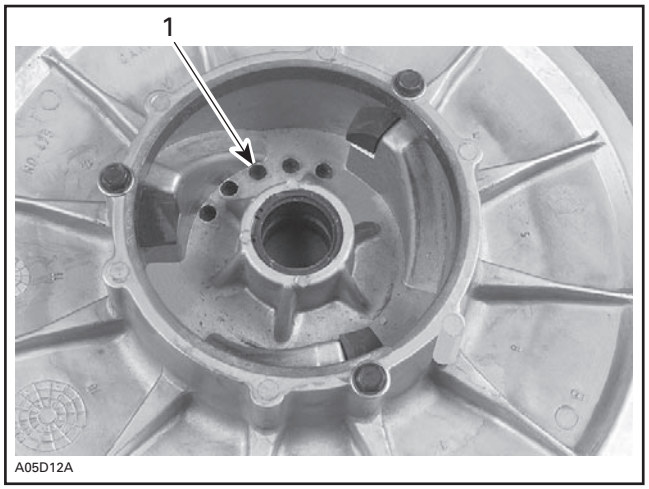
BLACK SLIDER SHOES ON CAM



RED SLIDER SHOES ON PULLEY HALF

2,4,5, Roller Pin, Outer Cam and Spring

Insert spring in adjusting hole **no. 3** into sliding half, as illustrated.



1. Adjusting hole

Insert other spring end in cam. Mount driven pulley spring compressor (P/N 529 035 300) as in DISASSEMBLY procedure.

Push cam all the way in then install roll pin coated with anti-seize lubricant (P/N 413 701 000).

13,14,15, Fixed Pulley Half, Brake Disc and Screw

Install brake disc on fixed pulley half and torque screws to 15 N•m (133 lbf•**in**).

INSTALLATION

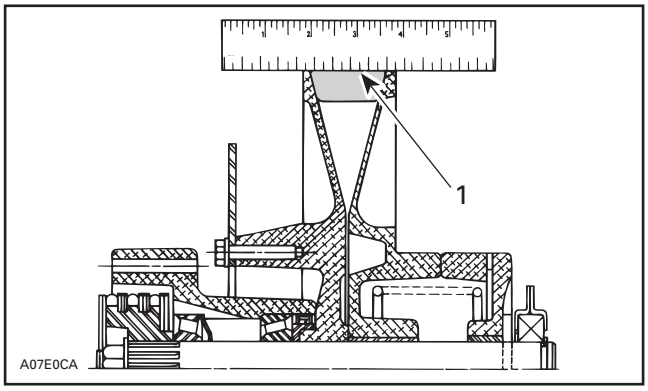
Follow INSTALLATION procedure for Tundra driven pulley at beginning of this subsection.

ADJUSTMENT

11,12, Shim

NOTE: The following adjustment must be performed with a new drive belt.

For best performance, particularly at starting, top of drive belt should be flush with top of driven pulley halves.



TYPICAL
1. Belt flush with the top of the pulley halves

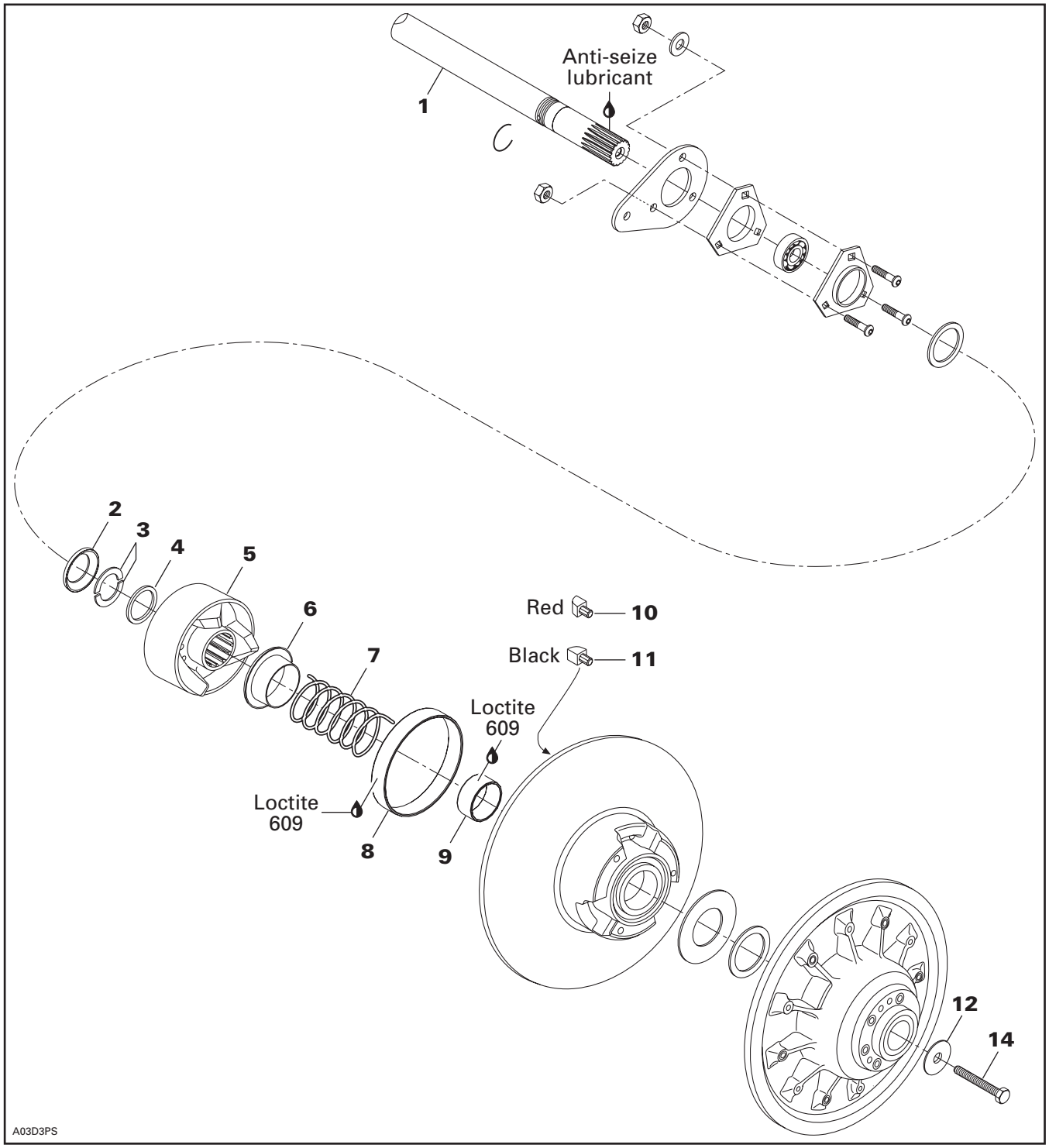
Shim(s) no. 11 and no. 12 provide belt height adjustment between pulley halves. Adding shims will lower the belt in driven pulley, while removing shims will raise the belt. Adjust properly.

Pulley Alignment and Drive Belt Deflection

Refer to PULLEY DISTANCE AND ALIGNMENT and DRIVE BELT to perform adjustments.

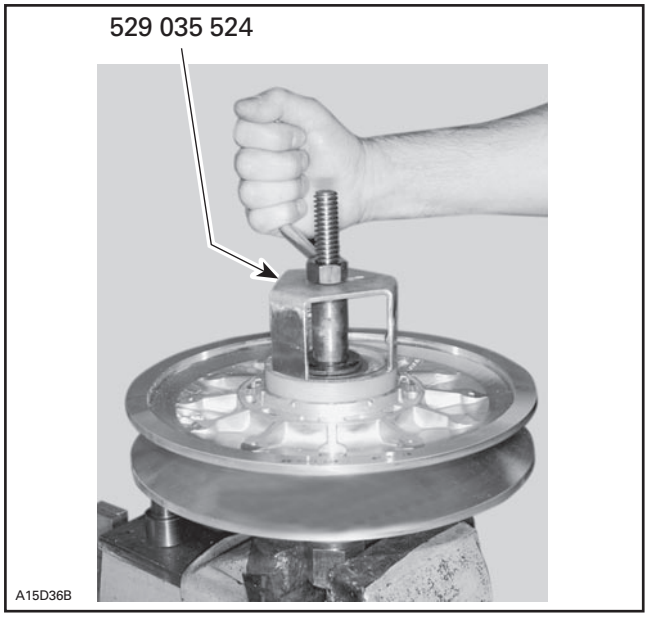
CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

Skandic LT/LT E



DISASSEMBLY

Use pulley spring compressor (P/N 529 035 524).



TYPICAL

Remove half keys **no. 3** and spacer **no. 4** to disassemble the outer cam and the 2 pulley halves.

⚠ WARNING

Driven pulley cam is spring loaded, use above mentioned tool.

INSPECTION

Replace bushing(s) if worn more than specified.

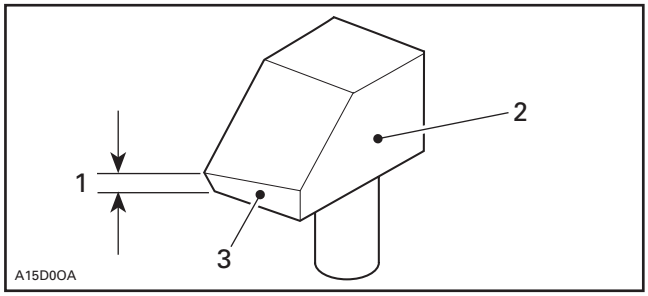
DRIVEN PULLEY BUSHING WEAR LIMIT mm (in)	
Small bushing	38.30 (1.508)
Large bushing	108.2 (4.260)

10,11, Slider Shoe

Black slider shoe = forward

Red slider shoe = reverse

Check cam slider shoes for wear. Replace when inside edge thickness of cam slider shoe slope base is 1 mm (.039 in) or less.



1. Measure thickness of slope base here
2. Sliding pulley side
3. Slope base

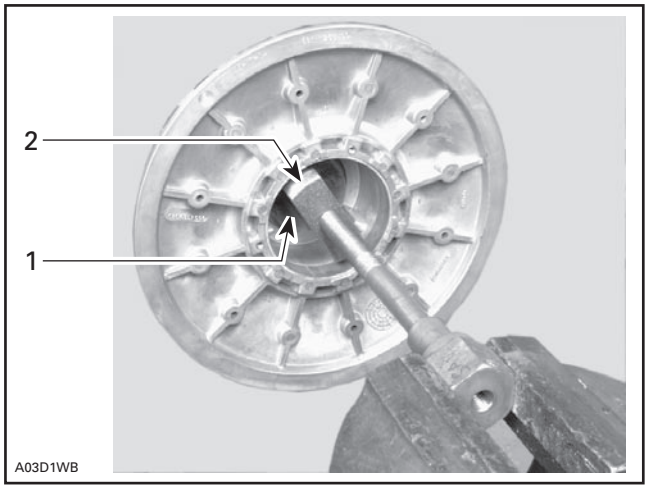
Bushing Replacement

Large Bushing

Remove Allen screws if applicable. Heat to break Loctite bond.

Install support plate (P/N 529 031 100) (included in tool) inside sliding half.

Place extractor (P/N 529 035 575) below bushing.



TYPICAL
1. Support plate
2. Extractor

Mount screw head of pulley spring compressor (P/N 529 035 524) in a vise.

Turn pulley half by hand to extract old bushing.

Before bushing installation, file sliding half bore to remove burrs from crimping areas.

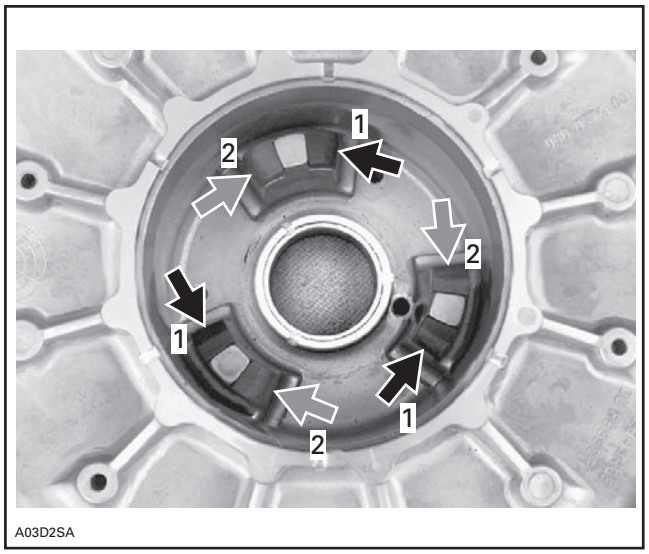
Coat bushing outside diameter with Loctite 609 (P/N 413 703 100). Place new bushing on sliding half and slightly tap to engage squarely the bushing in the sliding.

ASSEMBLY

10,11, Cam Slider Shoe

When replacing slider shoes, always install a new set (3 shoes) to maintain equal pressure on the cam.

Install slider shoes as per following photo. Red slider shoes are being used for reverse and black ones for forward.



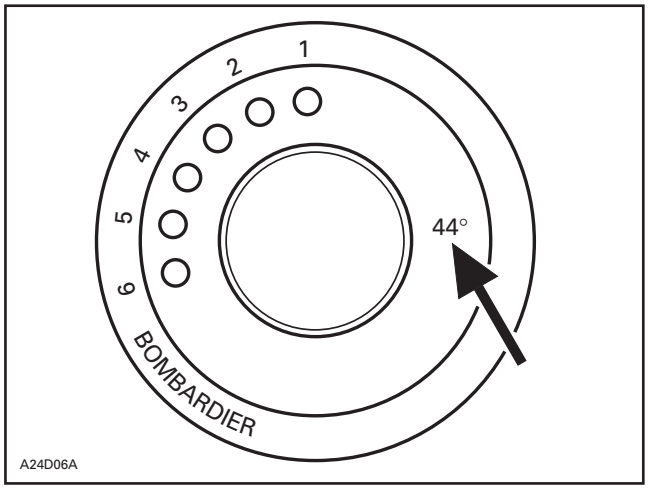
1. BLACK slider shoe
2. RED slider shoe

Assemble driven pulley components by reversing the disassembly procedure.

5,6,7, Cam, Guard and Spring

Make sure to install proper cam. Refer to TECHNICAL DATA.

Cam angle is identified on cam.

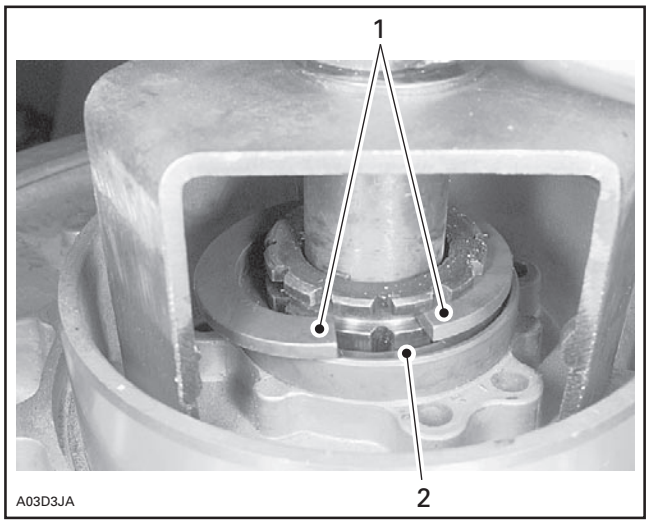


Position guard **no. 6** in cam **no. 5** then insert spring in adjusting hole **no. 3** (mid-hole) into outer cam.

Compress outer cam using pulley spring compressor (P/N 529 035 524).

Install spacer **no. 4** then secure outer cam with half keys **no. 3**, as shown in the next photo.

CAUTION: Ensure that half keys are properly inserted into shaft groove and that spacer recess is facing half keys.



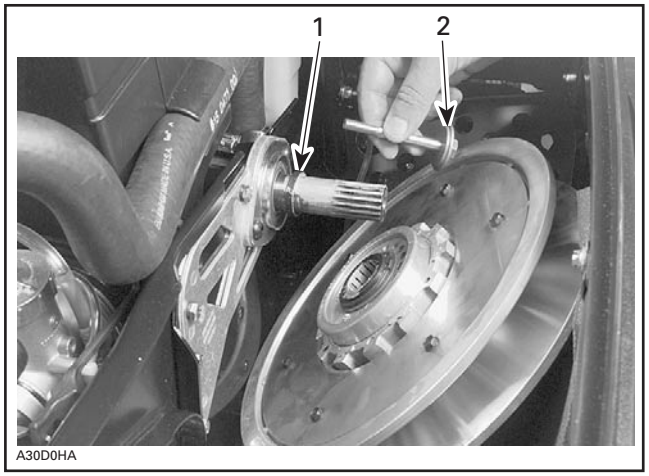
1. Half keys inserted into shaft groove
2. Spacer recess facing half keys

INSTALLATION

1, Countershaft

CAUTION: Always apply anti-seize lubricant (P/N 413 701 000) on the countershaft before final pulley installation.

Make sure that spacer **no. 2** is on countershaft before installing driven pulley. Note also that washer shoulder is facing driven pulley.



TYPICAL
1. Spacer
2. Shoulder on this side

Should installation procedure be required, refer to BRAKE then look for BRAKE DISC and COUNTERSHAFT BEARING ADJUSTMENT.

Reinstall the pulley on the countershaft by reversing the removal procedure.

14, Pulley Retaining Screw

Torque to 25 N•m (18 lbf•ft).

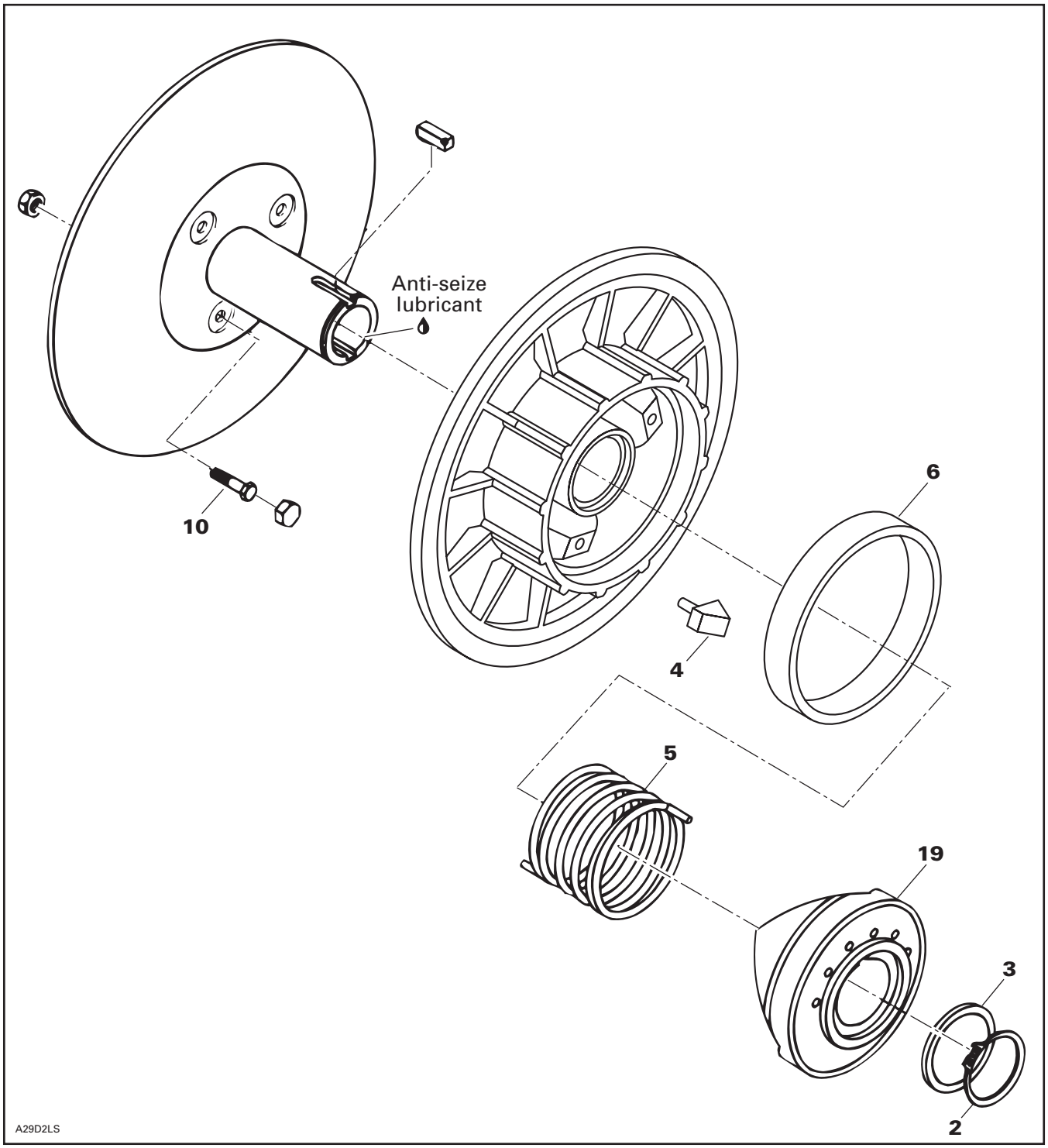
ADJUSTMENT

Pulley Alignment and Drive Belt Deflection

Refer to PULLEY DISTANCE AND ALIGNMENT and DRIVE BELT to perform adjustments.

CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

Skandic WT/WT LC/SWT/SUV/Expedition TUV



REMOVAL

Remove guard and drive belt from vehicle.

Remove the screw, and washer then pull the driven pulley from the shaft.

DISASSEMBLY

Use pulley spring compressor (P/N 529 035 524).

Remove snap ring **no. 2** and washer **no. 3** to disassemble the outer cam and the 2 pulley halves.

⚠ WARNING

Driven pulley cam is spring loaded, use above-mentioned tool.

CLEANING

6, Bushing

During break-in period (about 10 hours of use), teflon from bushing moves to cam or shaft surface. A teflon over teflon running condition occurs, leading to low friction. So it is normal to see gray teflon deposit on cam or shaft. Do not remove that deposit, it is not dust.

When a dust deposit has to be removed from the cam or the shaft, use dry cloth to avoid removing transferred teflon.

Pulley Half Cleaning

Use pulley flange cleaner (P/N 413 711 809).

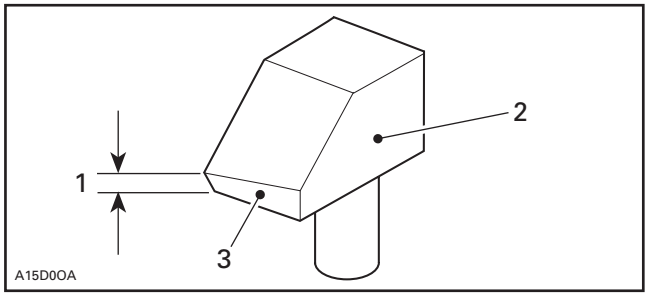
INSPECTION

6, Bushing

Check for cracks, scratch and for free movement when assembled to fixed half.

4, Slider Shoe

Check cam slider shoes for wear. Replace when inside edge of cam slider shoe slope base is worn to 1 mm (.039 in) or less.



1. Measure thickness of slope base here
2. Sliding pulley side
3. Slope base

ASSEMBLY

4, Cam Slider Shoe

When replacing slider shoes, always install a new set (3 shoes) to maintain equal pressure on the cam.

Assemble driven pulley components by reversing the disassembly procedure.

19, Cam

Coat cam interior with anti-seize lubricant.

INSTALLATION

CAUTION: Always apply anti-seize lubricant (P/N 413 701 000) on the shaft before final pulley installation.

ADJUSTMENT

Refer to PULLEY DISTANCE AND ALIGNMENT to adjust pulley distance. Adjust drive belt height in driven pulley. Turn screws **no. 10** equally accordingly.

5, Spring

General

It is usual to experience spring setting during breaking period of a new spring. The factory spring preload is slightly higher (about 1 kg (2 lb)) to compensate for spring setting. Specifications in TECHNICAL DATA are applicable after break-in period (about 10 hours of use).

Spring Torsional Pre-Load

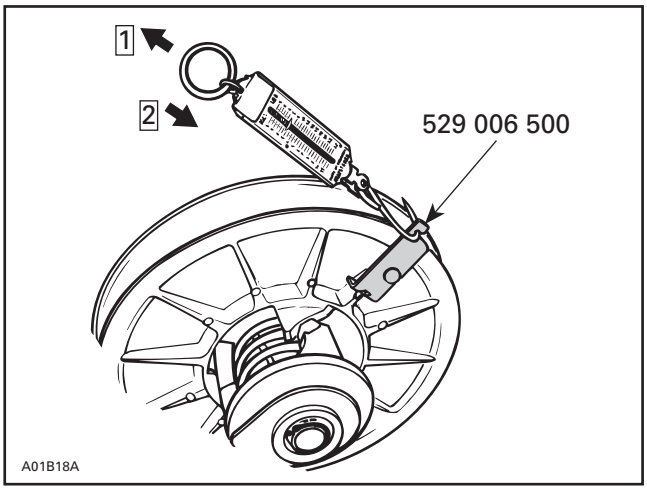
To check spring preload adjustment, use spring scale hook (P/N 529 006 500) and a spring scale.

Remove drive belt.

Install the hook on the sliding half. Preventing fixed half from turning, pull sliding half with the spring scale perpendicularly with pulley axle.

Take 1st measurement when sliding half begins to turn. Rotate sliding half to 10 mm (3/8 in) of rotation. Hold fish scale at this position. Slowly release tension from fish scale and take 2nd measurement when sliding half begins to return. Spring preload is the average measurement between these 2.

	1ST MEASUREMENT (when opening)	+ 2ND MEASUREMENT (when closing)	=	SPRING PRELOAD
	2			
EXAMPLE:	3.8 KG (8.4 LB) (when opening)	+ 3.4 KG (7.5 LB) (when closing)	=	3.6 KG (8 LB) ACTUAL SPRING PRELOAD
	2			



TYPICAL
Step 1: 1st measurement
Step 2: 2nd measurement

To adjust spring preload, relocate spring end in cam, moving it clockwise to increase the preload and counterclockwise to decrease it. Refer to TECHNICAL DATA.

NOTE: Always recheck torsional preload after adjusting.

Pulley Alignment and Drive Belt Deflection

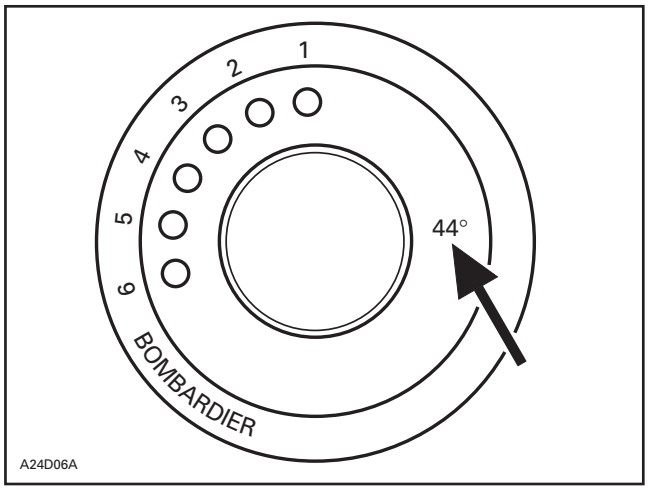
Refer to PULLEY DISTANCE AND ALIGNMENT and DRIVE BELT to perform adjustments.

CAUTION: Drive belt and pulley adjustments must always be checked whenever pulleys have been removed, replaced or disassembled.

19, Cam

Make sure to install proper cam. Refer to TECHNICAL DATA.

Cam angle is identified on cam.



NOTE: For high altitude regions, a service bulletin will give information about calibration according to altitude.

PULLEY DISTANCE AND ALIGNMENT

SERVICE TOOLS

Description	Part Number	Page
driven pulley opening tool	529 034 200	381
driven pulley opening tool	529 035 501	381

GENERAL

The pulley distance we will refer to in this section, is the space separating the drive and driven pulley outside diameters (Z measurement).

This basic distance is provided as an assembly guide and indicates the dimensions between which satisfactory belt deflection will be obtained.

Both pulley distance adjustment and pulley alignment must be carried out to ensure the highest efficiency of the transmission system. Furthermore, optimum drive belt operation and minimal wear will be obtained only with proper pulley alignment.

CAUTION: Before checking pulley adjustment, the rear suspension must be mounted on the vehicle and track tension/alignment must be done. Always check pulley adjustment after suspension is adjusted.

⚠ WARNING

Failure to correctly perform pulley alignment may cause the vehicle to creep forward at idle.

All pulley alignment specifications refer to:

X = Distance between straight bar and drive pulley fixed half edge, measured between pulleys.

Y = Distance between straight bar and drive pulley fixed half edge, measured at the end of straight bar.

Z = Distance between outside diameter of pulleys.

GENERAL PROCEDURE

Remove guard.

Tundra

Use driven pulley opening tool (P/N 529 034 200).

Skandic LT/LT E

Use driven pulley opening tool (P/N 529 035 501).

All Models

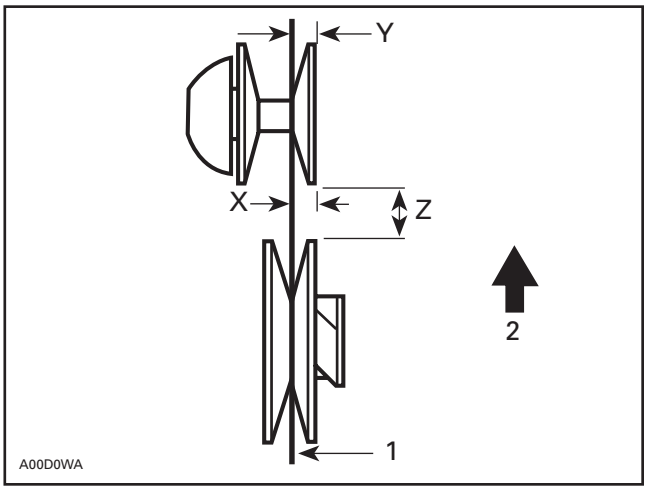
Remove drive belt.

Insert a straight bar 9.5 mm (.375 in) square, 48 cm (19 in) long or the proper alignment bar into the opened driven pulley.

Measuring Procedure

Using Straight Bar

Always measure distances X and Y from the farther straight bar side (including its thickness to the fixed half edge).



1. Straight bar
2. Front of vehicle

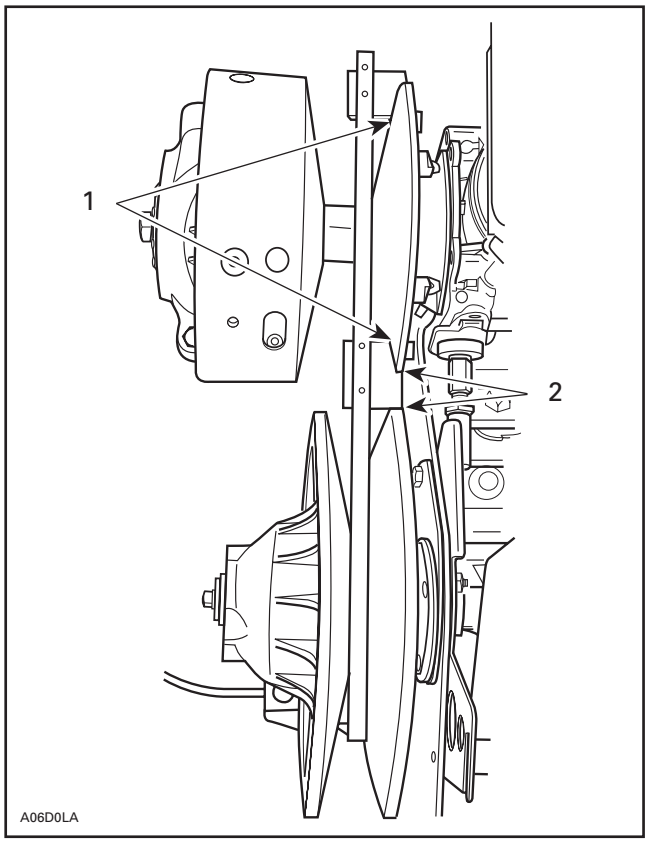
The distance Y must exceed distance X to compensate for the twist due to the engine torque.

Mean Value Procedure and Quick Alignment and Distance Check

Alignment bar tabs must fully contact fixed half of drive pulley.

Pulley distance is correct when tab contacts both pulley halves.

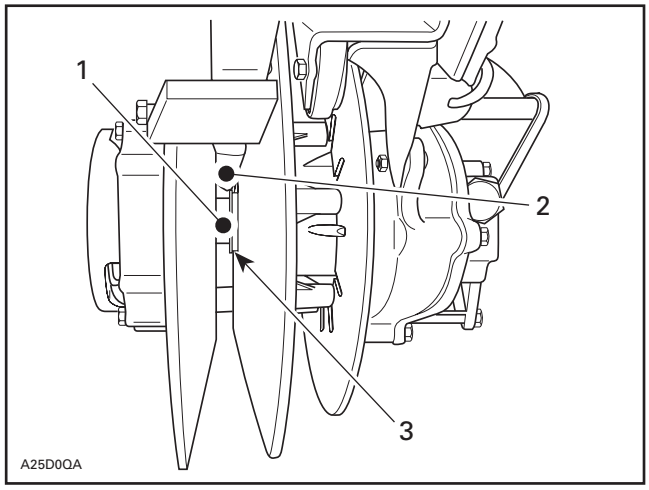
Refer to chart on next page for proper alignment bar.



TYPICAL
1. Contact (alignment)
2. Contact (distance)

Tundra

Bottom of alignment bar must not seat on shaft nor fixed half shoulder and shim(s).



TYPICAL
1. Shaft
2. Alignment bar
3. Fixed half shoulder and shim(s)

Drive Belt Height

NOTE: When pulley distance and alignment are adjusted to specifications, refer to DRIVE BELT to adjust drive belt height.

CAUTION: This section deals mainly with adjustment procedures. For complete assembly requirements, refer to the proper ENGINE or TRANSMISSION installation section.

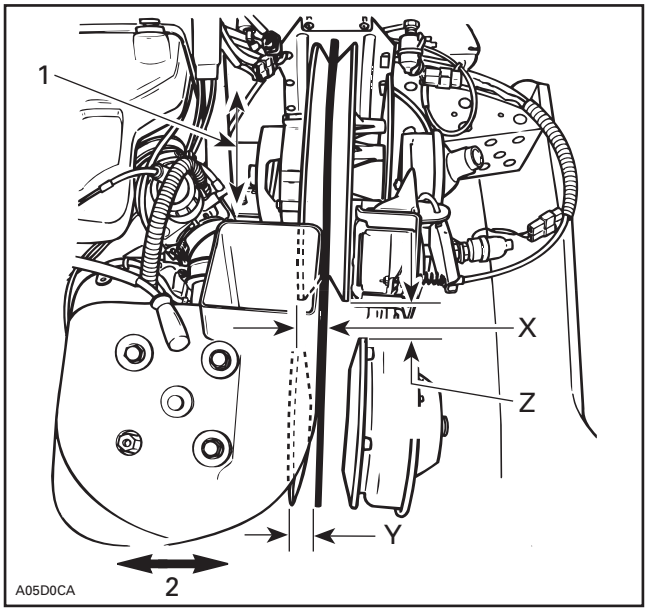
PULLEY ALIGNMENT AND DISTANCE SPECIFICATIONS CHART

MODELS	PULLEY DISTANCE	OFFSET		ALIGNMENT BAR ① P/N
	Z	X	Y-X	
Tundra	37.0 + 0 - 1.5 mm (1.457 + 0 - 0.3 in)	36.0 ± 1.0 mm (1.417 ± .040 in)	0 to 1.5 mm (0 to .060 in)	529 026 900
Skandic LT/LT E	39.0 + 0 - 1.0 mm (1.535 + 0 - .039 in)	37.0 ± 0.75 mm (1.457 ± .030 in)	0.75 to 1.5 mm (.030 to .060 in)	529 035 808
Skandic WT/SWT/SUV 550	41.8 + 0 - 1.0 mm (1.645 + 0 - .039 in)	35.0 ± 0.75 mm (1.380 ± .030 in)	0.75 to 2.25 mm (.030 to .086 in)	529 035 974
Skandic WT LC/SUV 600	35.5 + 0 - 1.0 mm (1.400 + 0 - .039 in)	37.0 ± 0.50 mm (1.456 ± .020 in)	0.75 to 2.25 mm (.030 to .086 in)	529 035 545
Expedition TUV 600 HO SDI	61 + 0 - 1.0 mm	37.0 ± 0.50 mm (1.456 ± .020 in)	0.75 to 2.25 mm (.030 to .086 in)	(Universal) 529 035 831
Expedition TUV V-1000	61 + 0 - 1.0 mm	37.0 ± 0.50 mm (1.456 ± .020 in)	0.75 to 2.25 mm (.030 to .086 in)	

① Alignment bars have been made according to pulley alignment mean values. However, they do not take into account allowed tolerances for alignment specifications. They are used as GO/NOGO gauges for quick alignment and pulley distance check and as reference to reach alignment nominal values.

Pulley Distance Adjustment Method

Tundra

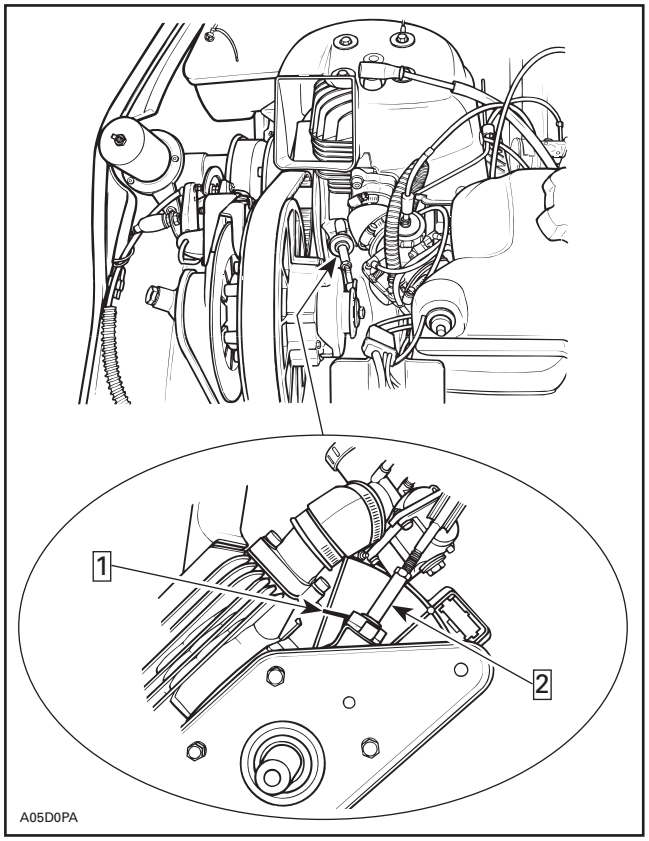


1. Driven pulley movement
2. Engine movement

CAUTION: The rear suspension must be mounted on the vehicle and track tension and alignment must be done to provide the right frame width.

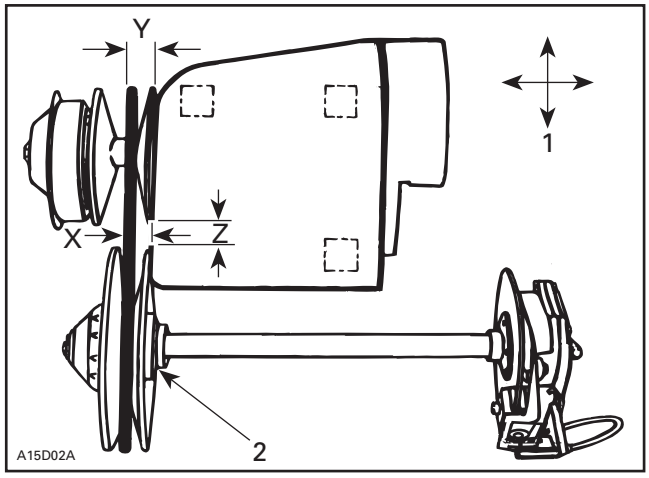
Loosen the 4 chaincase retaining bolts, unlock and raise pulley support.

Move chaincase to obtain specific adjustment and adjust driven pulley support length accordingly (light contact).



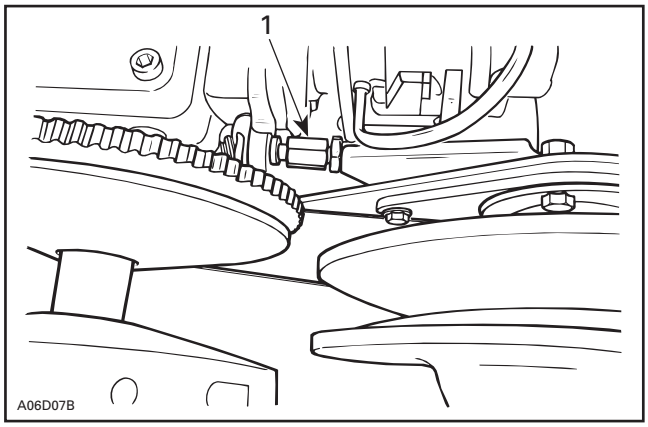
Step 1: Push and hold
Step 2: Raise support

Skandic LT/LT E



TYPICAL
1. Engine movement
2. Contact

NOTE: Prior to performing pulley adjustment, loosen torque rod nut to allow engine movement. Engine supports have tendency to stick to frame, work engine loose prior to aligning.



1. Loosen

Engine Movement

The engine support has slotted mounting holes. Move engine to obtain specified distance between pulleys.

Skandic WT/SWT/WT LC/SUV/Expedition TUV

Driven Pulley Movement

Loosen gearbox retaining screws and move gearbox accordingly.

Retighten screws.

Pulley Alignment Method

Tundra

Engine Movement

Loosen the support retaining bolts.

Move the engine to obtain specified pulley alignment, torque engine support bolts to 55 N•m (41 lbf•ft) and remove engine support positioner.

Driven Pulley Movement

Shims can be mounted between chaincase and frame. Use shim (P/N 504 039 800), 0.53 mm (.021 in) thick.

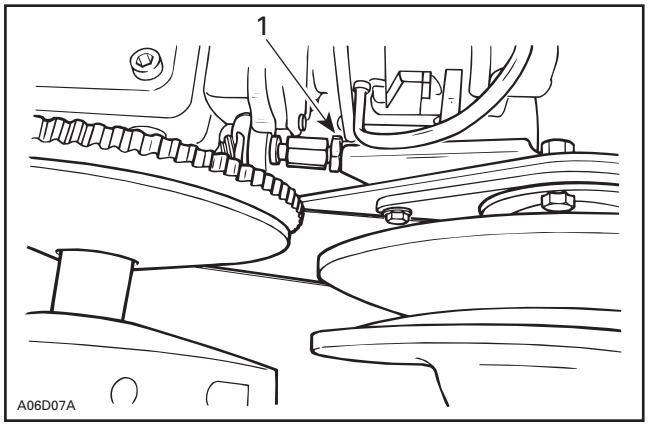
Skandic LT/LT E

When engine slotted mounting holes do not allow to set proper pulley offset X, adjust with shims (P/N 504 108 200) between pulley and countershaft bearing support (pulley pushed toward brake disc).

Engine Movement

Loosen the 4 bolts retaining engine support to the frame. Position engine to obtain the specified alignment.

NOTE: After alignment, adjust torque rod so it slightly contacts stopper plate. Do not over tighten, it will disalign pulleys.



1. Retighten

Skandic WT/SWT/WT LC/SUV/Expedition TUV

Driven Pulley Movement

Loosen gearbox retaining screws.

Install or remove shims accordingly.

Retighten screws.

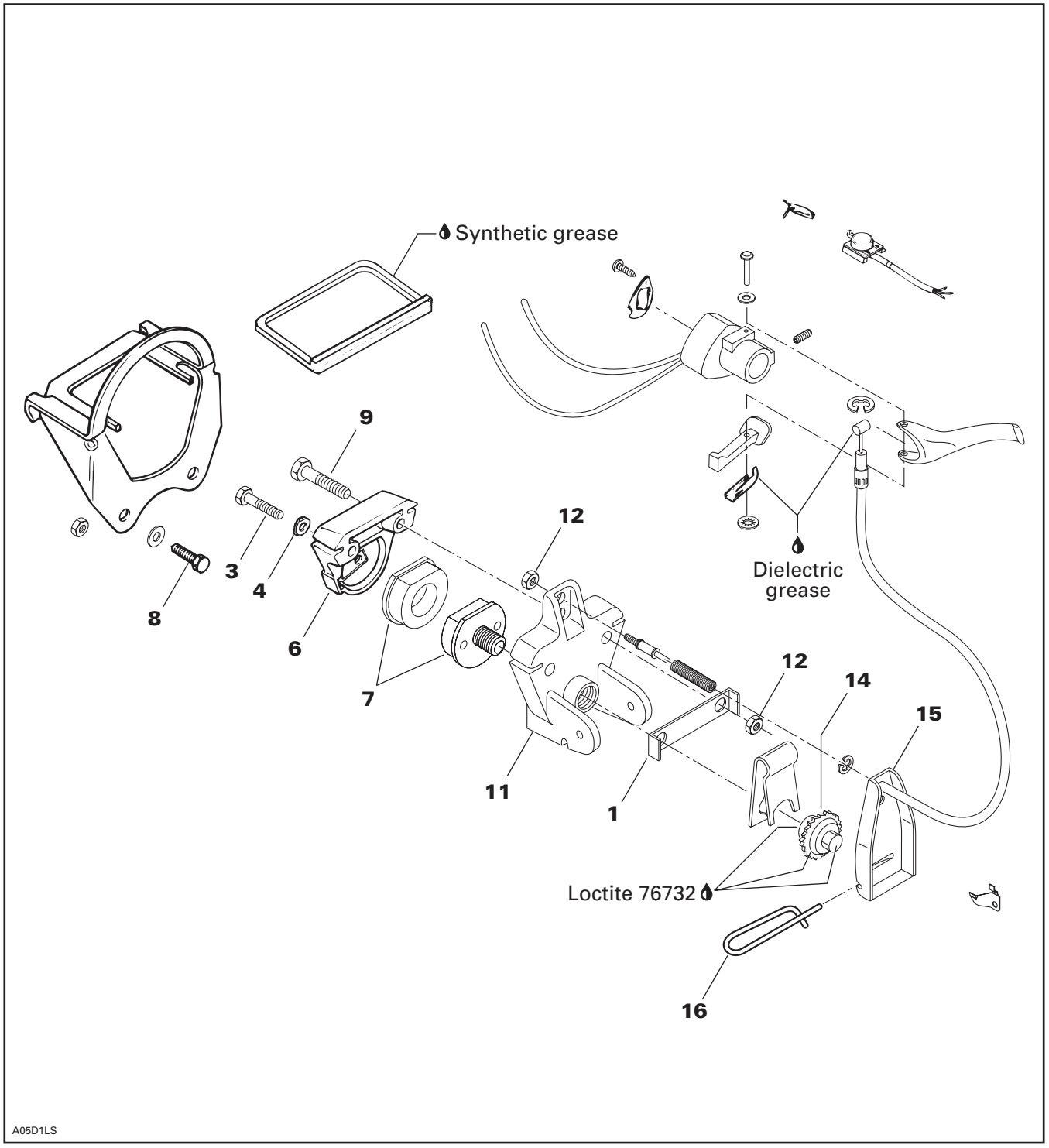
BRAKE

SERVICE PRODUCTS

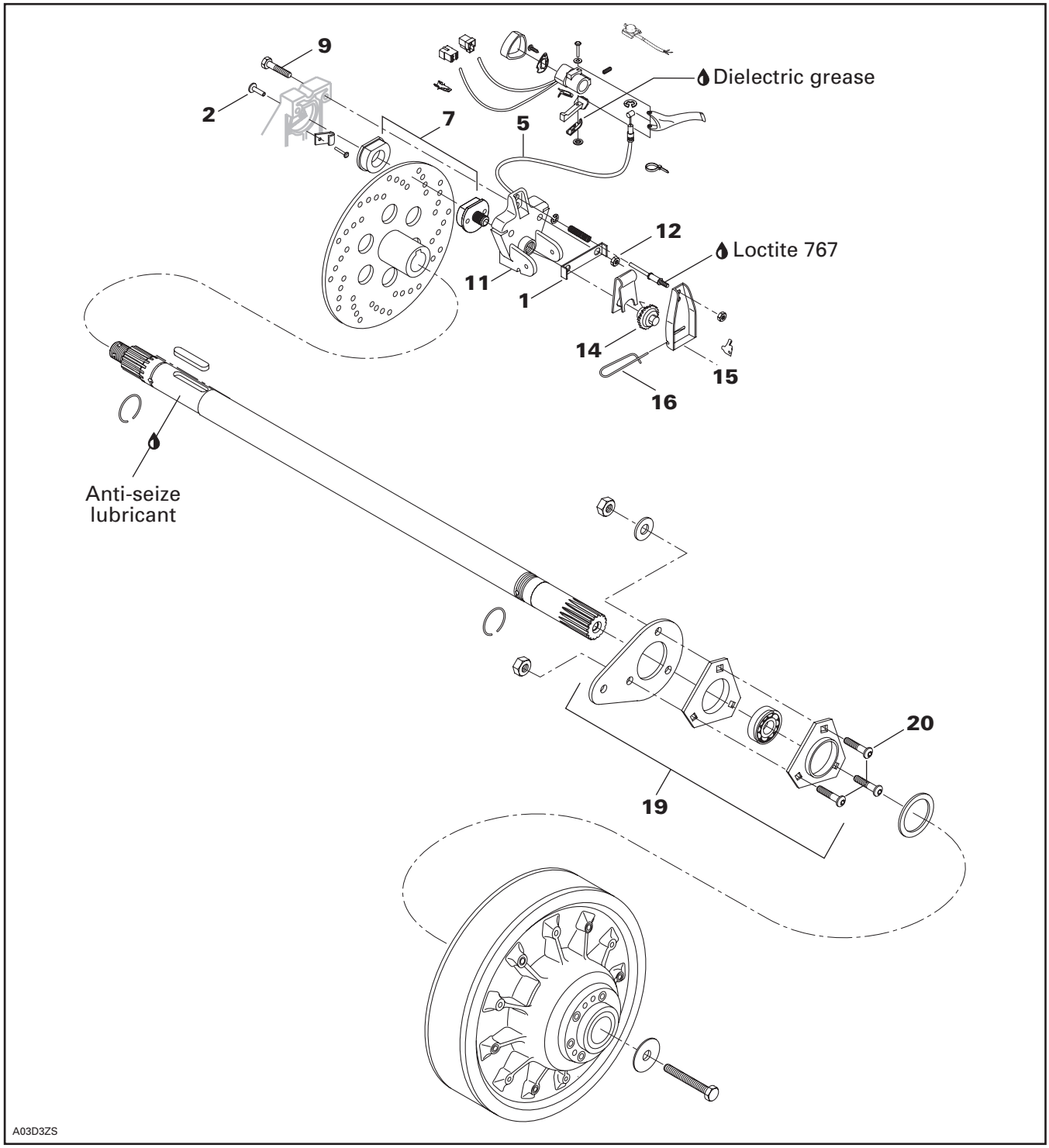
Description	Part Number	Page
anti-seize lubricant	413 701 000	393
brake fluid GTLMA (DOT 4)	293 600 062	391, 395
brake fluid SRF (DOT 4)	293 600 063	391, 395
synthetic grease	413 711 500	393

MECHANICAL BRAKE

Tundra

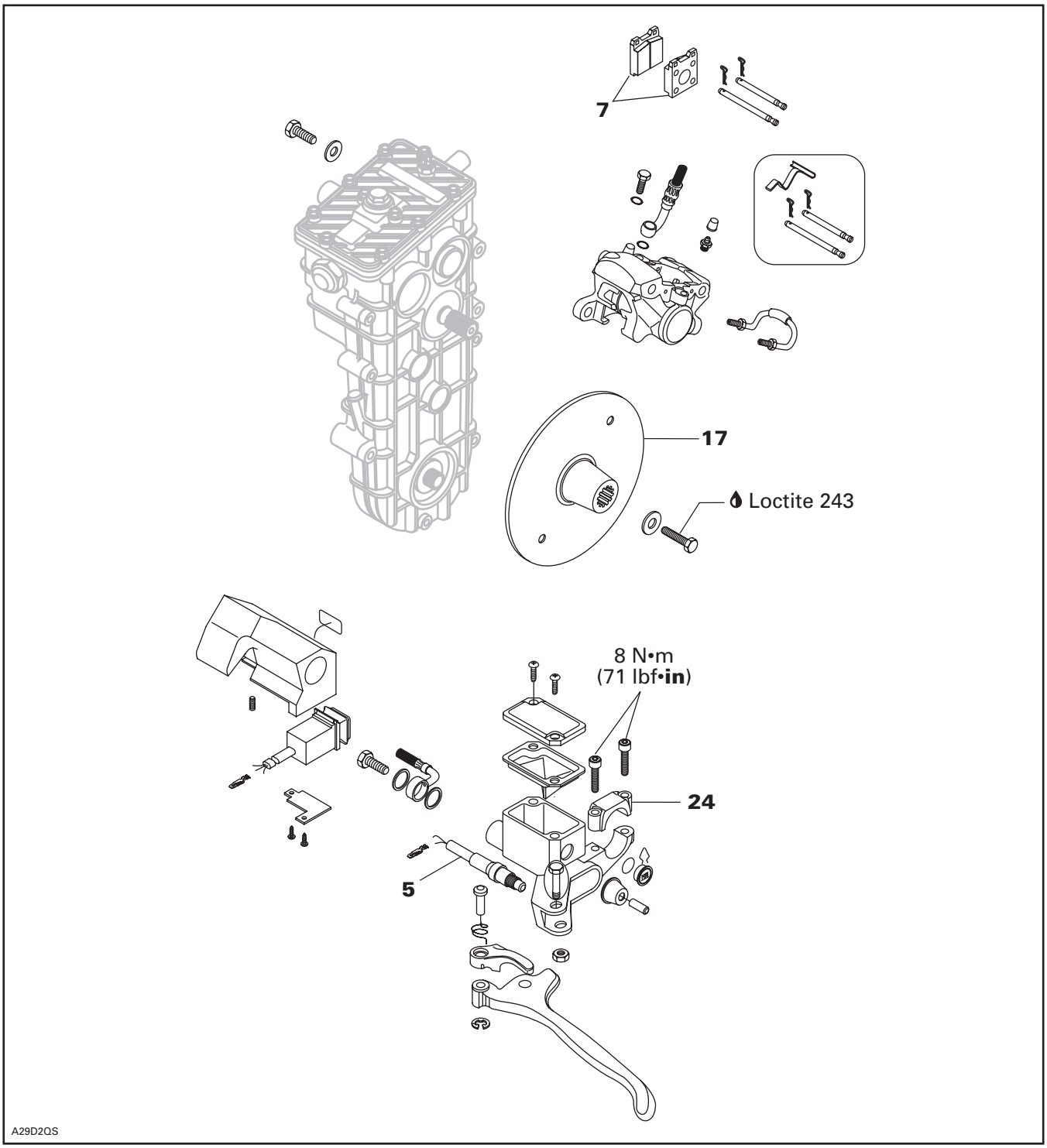


Skandic LT


9
2
7
5
Dielectric grease
12
Loctite 767
11
1
14
15
16
Anti-seize
lubricant
20
19
A03D3ZS

HYDRAULIC BRAKE

Skandic WT/SWT/WT LC/SUV/Expedition TUV



BRAKE FLUID TYPE

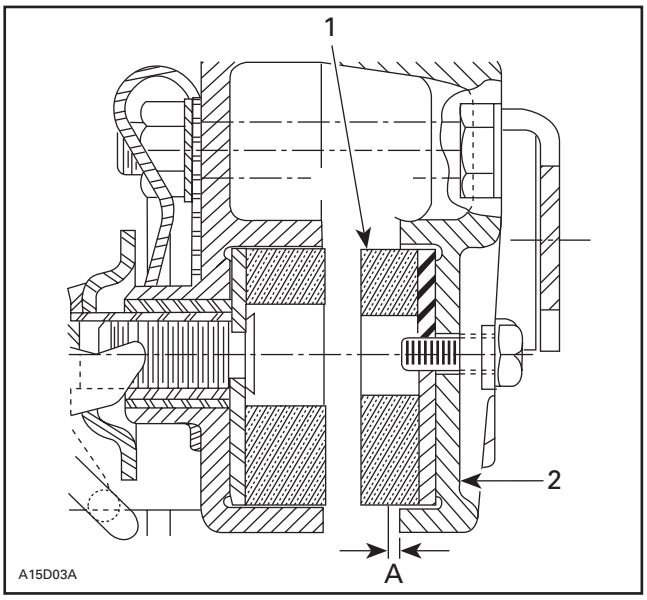
Use recommended brake fluid SRF (DOT 4) (P/N 293 600 063) or brake fluid GTLMA (DOT 4) (P/N 293 600 062).

BRAKE PADS REPLACEMENT

Models with Mechanical Brake

Brake pads must be replaced when fixed pad projects only 1 mm (1/32 in) from caliper.

CAUTION: Brake pads must always be replaced in pairs.



TYPICAL
1. *Fixed pad*
2. *Inner caliper*

A. 1 mm (1/32 in) minimum

Removal

Pull pin **no. 16** out of caliper and remove lever **no. 15**.

Fixed pad is riveted to chaincase on these models. Caliper must be split to remove moving pad. To remove fixed pad, drill out its rivet **no. 2** then pry disc in order to free fixed pad.

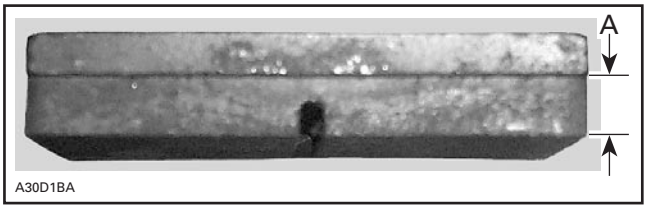
Installation

Reverse removal procedure.

All Models with Hydraulic Brake

Brake pads must be replaced when lining is 1 mm (1/32 in) thick or less.

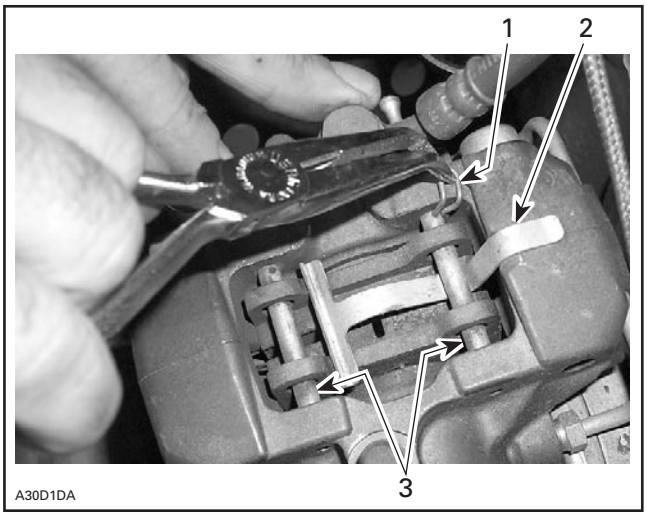
CAUTION: Brake pads must always be replaced in pairs.



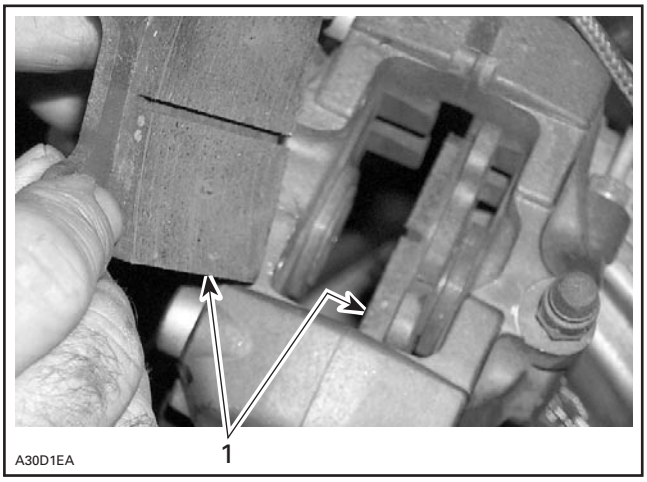
A. 1 mm (1/32 in) minimum

Removal

Brake pads removal procedure is as follows:
- Remove 2 retainers from the pins.
- Pull out 2 pins which releases the spring.
- Remove the brake pads.



TYPICAL
1. *Retainer*
2. *Spring*
3. *Pin*



TYPICAL
1. Brake pad

Installation

– Install new brake pads.
– Install spring and push 2 pins to lock the brake pads.
– Install 2 retainers in the pin holes.

⚠ WARNING

Avoid getting oil on brake pads.

Press the brake lever until both new pads are touching the brake disc.

REMOVAL

Brake Disc Removal

Tundra R

The split caliper type brake should be removed from chaincase as an assembly. Proceed as follows:

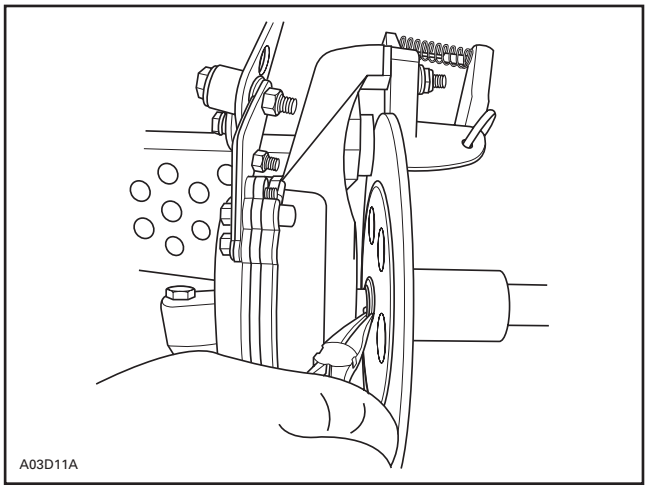
– Remove guard.
– Disconnect brake cable.
– Remove bolts **no. 8** securing brake support to chaincase.
– Slide brake caliper ass'y out of brake support.
– To remove brake disc, driven pulley has to be removed first. Refer to DRIVEN PULLEY.

Skandic WT/SWT/WT LC/SUV/Expedition TUV

– Remove caliper by unscrewing M10 Allen screws.
– Unbolt disc.

Skandic LT

– Remove caliper.
– Remove guard, belt and driven pulley.
– Remove air silencer.
– Unbolt bearing support **no. 19** from chassis.
– Open chaincase and remove upper sprocket.
– Pull countershaft assembly toward driven pulley side to gain access to clip **no. 25**.
– Remove clip **no. 25** on countershaft.



– Pull countershaft toward driven pulley side to free from chaincase and disc.
– Remove disc.

DISASSEMBLY

7,15,16,23, Brake Pad, Brake Lever, Pin and Screw

All Models with Mechanical Brake

Pull pin **no. 16** out of caliper and remove lever **no. 15**.

Fixed pad is riveted to chaincase on these models. Caliper must be split to remove moving pad. To removed fixed pad, drill out its rivet **no. 2** then pry disc in order to free fixed pad.

All Models with Hydraulic Brake

Only brake pads are available as spare parts. If caliper or master cylinder are damaged, replace each of them as an assembly.

CLEANING

Clean all metal components in a general purpose solvent. Thoroughly dry all components before assembling.

CAUTION: Do not clean brake pads in solvent. Soiled brake pads must be replaced by new ones.

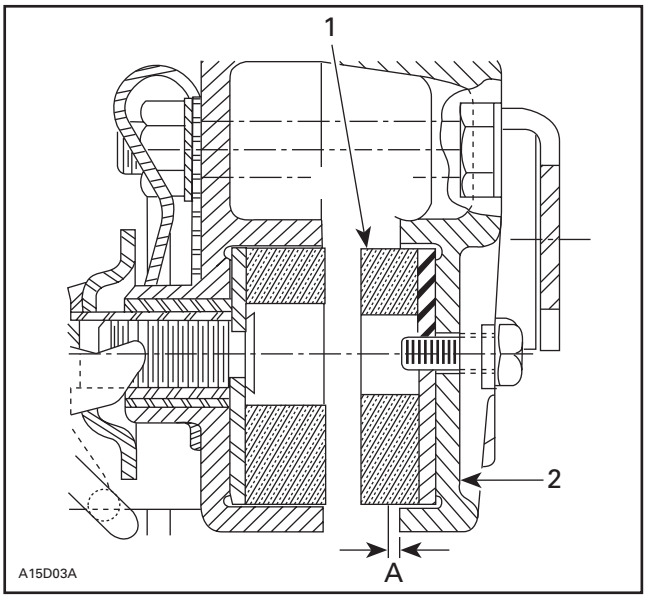
INSPECTION

7, Brake Pad

Models with Mechanical Brake

Brake pads must be replaced when fixed pad projects only 1 mm (1/32 in) from caliper.

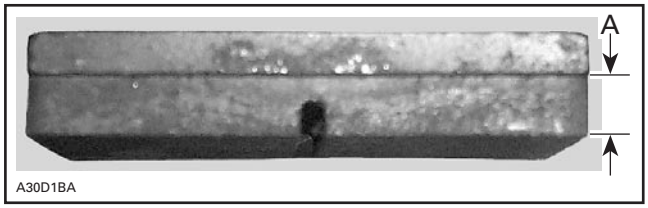
CAUTION: Brake pads must always be replaced in pairs.



TYPICAL
1. Fixed pad
2. Inner caliper
A. 1 mm (1/32 in) minimum

Models with Hydraulic Brake

Brake pads must be replaced when lining is 1 mm (1/32 in) thick.



A. 1 mm (1/32 in) minimum

CAUTION: Brake pads must always be replaced in pairs.

Brake Disc

All Models

Check for scoring, cracking or heat discoloration, replace as required.

CAUTION: Brake disc should never be machined.

ASSEMBLY

14, Ratchet Wheel

Apply synthetic grease (P/N 413 711 500) on threads and spring seat prior to installing. Fully tighten then back off one turn.

16, Pin

Install so that it can only be removed upward. Lock it in the caliper casting notch.

INSTALLATION

To install brake, reverse removal procedure paying attention to the following.

⚠ WARNING

Avoid getting oil on brake pads. Do not lubricate or apply antirust or antifreeze solution in brake cable.

17, Brake Disc

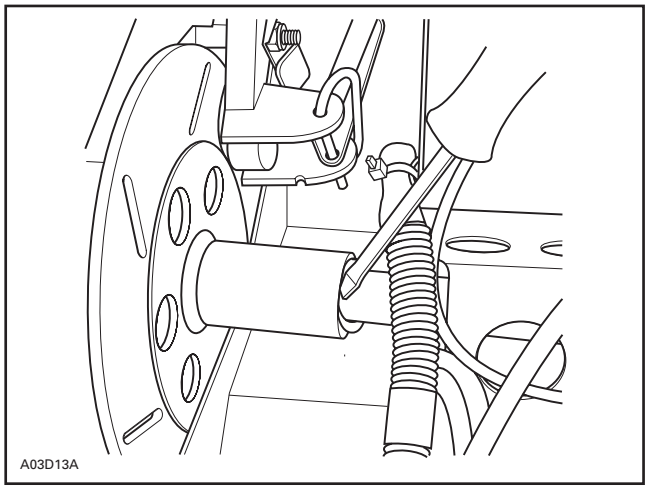
Skandic LT

The brake disc must be floating on countershaft for efficient operation of brake.

Apply anti-seize lubricant (P/N 413 701 000) on shaft and check that disc slides freely.

The disc hub exceeds the disc more from one side than from the other. Install disc with the longer exceeding portion toward driven pulley.

Push O-rings inside disc hub.

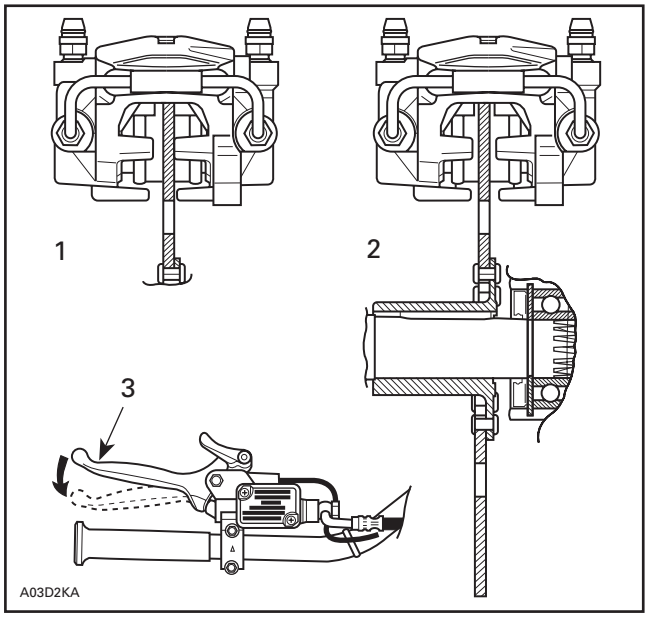


7, Brake Pad

Models with Hydraulic Brake

After brake pads installation, brake disc must be centered in caliper. Apply brake then check for proper brake disc positioning.

Push on appropriate caliper piston in order to move pad inward allowing proper brake disc positioning.



1. Brake disc not centered
2. Brake disc centered
3. Apply brake before checking

Apply brake then recheck.

1,11,12, Locking Tab, Outer Caliper and Nut

Skandic LT

Install caliper retaining bolts.

Assemble outer caliper. Install locking tab then nuts. Torque nuts to 24 N•m (18 lbf•ft). Bend locking tab over a flat of each nut.

5,12, Brake Cable and Nut

Insert brake cable into upper hole in brake lever and caliper. Install nut and tighten until a few threads exceed.

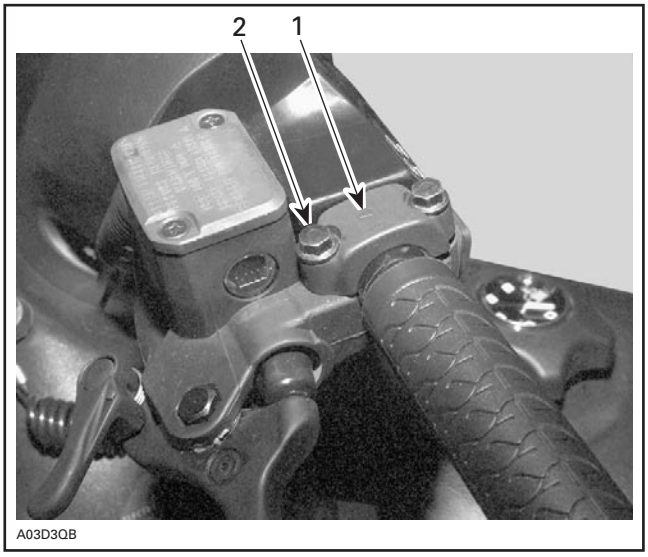
⚠ WARNING

At least 3 threads must exceed the elastic stop nut.

24, Upper Clamp

Models with Hydraulic Brake

Install upper clamp with its arrow pointing at front of vehicle. Tighten to 8 N•m (71 lbf•**in**) front screw before rear one.



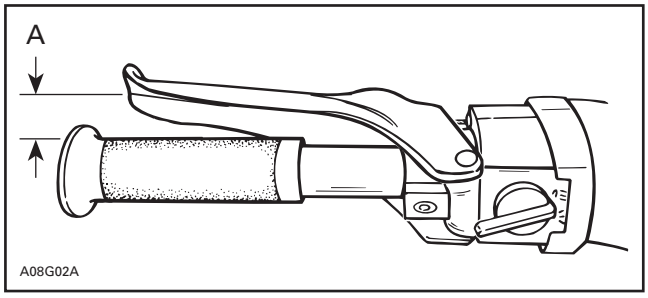
TYPICAL
1. Arrow on upper clamp pointing at front of vehicle
2. Tighten front screw first

ADJUSTMENT

Brake

Models with Mechanical Brake

Fully depress brake handle several times to obtain 13 mm (1/2 in) between brake handle and handlebar grip when brake is fully applied.



A. 13 mm (1/2 in)

Should this adjustment be unattainable, retighten nut no. 12 as needed.

Models with Hydraulic Brake

There is no adjustment on these models.

Change brake fluid once a year.

If brake handle feels spongy or if hydraulic system has been opened, the system must be bled, refer to BLEEDING PROCEDURE.

Brake Light

Skandic LT and Tundra Models Only

Brake light should light up before brake pads touch brake disc. To adjust, unscrew nut no. 12 until brake light goes on.

⚠ WARNING

At least one full thread must exceed the elastic stop nut.

Check brake adjustment as described above.

NOTE: If brake light adjustment is unattainable while respecting brake adjustment, ratchet wheel may be too far out. If so, tighten ratchet wheel.

Models with Hydraulic Brake

There is no adjustment on these models. Check that switch is securely installed.

BLEEDING

Change brake fluid once a year.

Bleed brake system as follows:

Keep sufficient brake fluid SRF (DOT 4) (P/N 293 600 063) or brake fluid GTLMA (DOT 4) (P/N 293 600 062) 4 brake fluid in reservoir at all times.

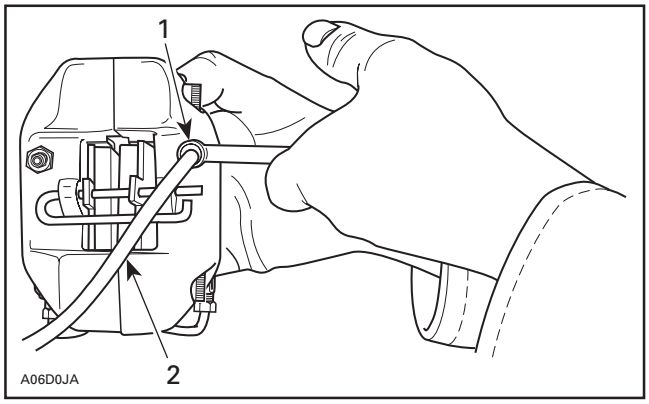
CAUTION: Use only SRF (DOT 4) (P/N 293 600 063) or GTLMA (DOT 4) (P/N 293 600 062) brake fluid.

Install a clear hose on left side bleeder. Route this hose to a container. Open bleeder.

Pump brake lever until no air escapes from hose.

Close bleeder.

Proceed the same way with the right side bleeder.



TYPICAL
1. Open bleeder
2. Clear hose to catch used brake fluid

⚠ WARNING

Avoid getting oil on brake pads. Do not lubricate or apply antirust or antifreeze solution in brake cable.

CHAINCASE

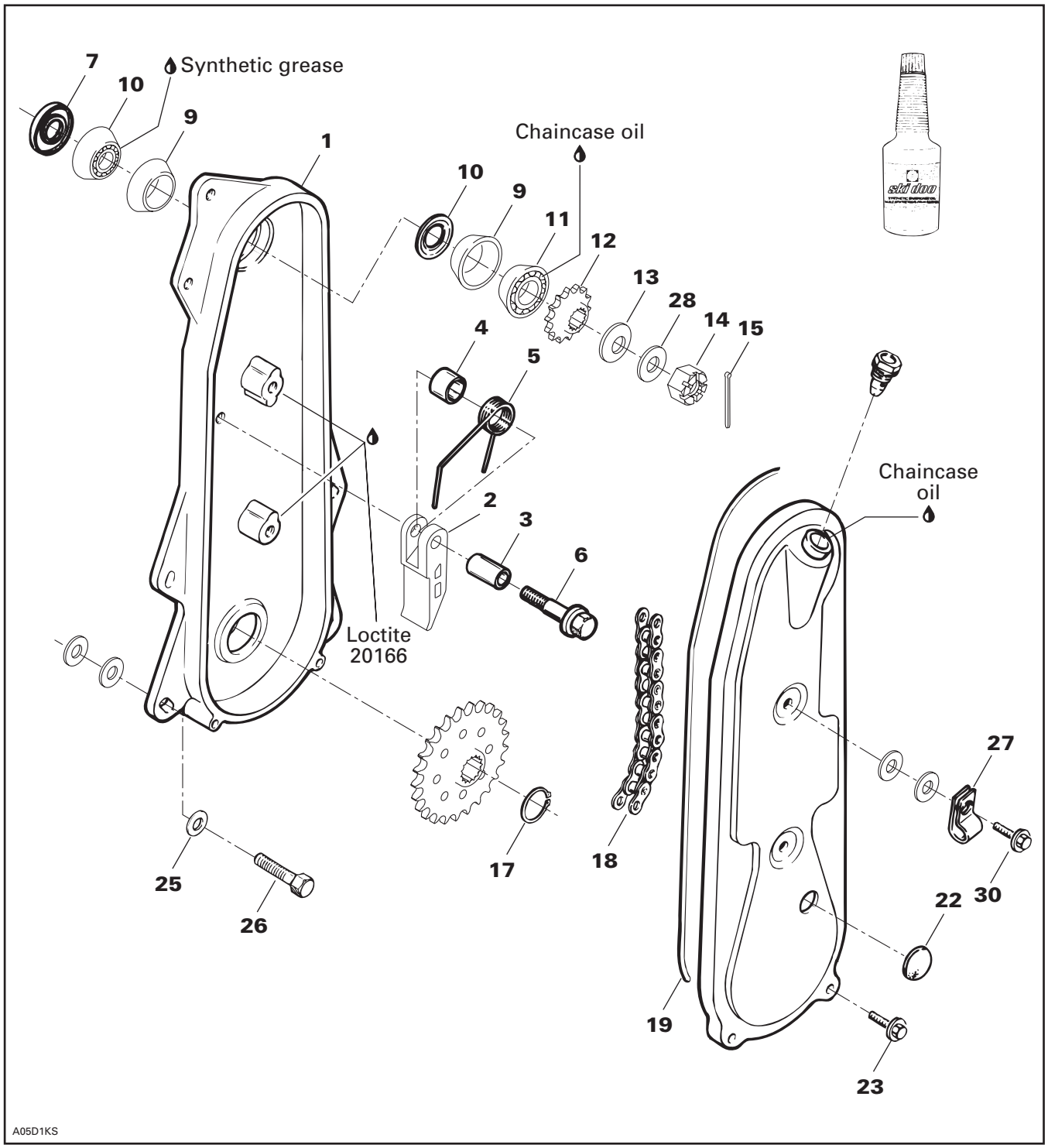
SERVICE TOOLS

Description	Part Number	Page
drive axle holder	529 007 200	399, 402
pusher	529 035 584	402

SERVICE PRODUCTS

Description	Part Number	Page
Loctite 20166	293 800 066	400
Loctite 609	413 703 100	402
XP-S mineral chaincase oil	413 801 900	400
XP-S synthetic chaincase oil	413 803 300	403

Tundra

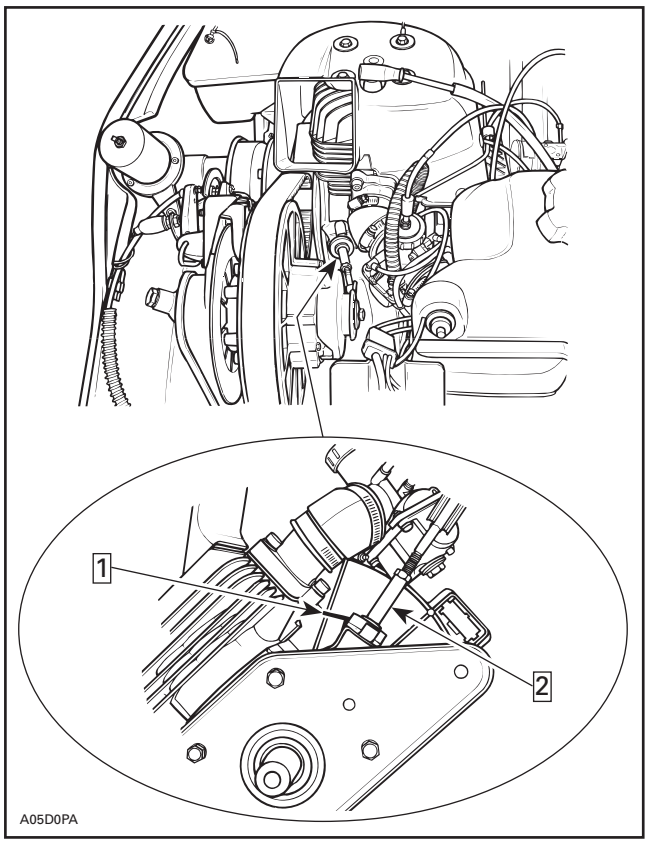

7
10
Synthetic grease
9
1
Chaincase oil
10
9
11
12
13
28
14
15
4
5
2
3
6
Loctite
20166
Chaincase
oil
27
25
26
17
18
22
30
19
23
A05D1KS

REMOVAL

Chaincase and driven pulley can be removed from the vehicle as an assembly.

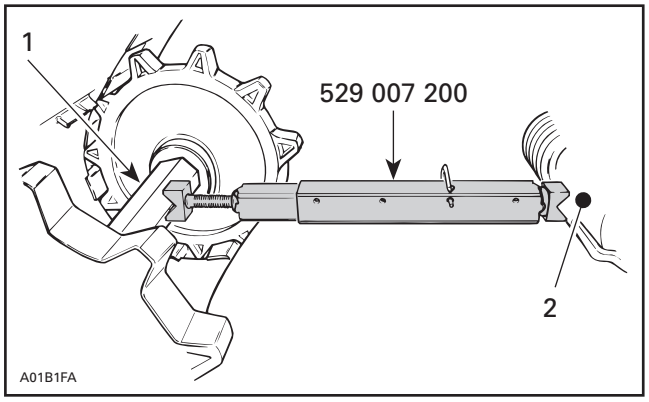
Remove guard and drive belt.

Unlock and raise driven pulley support.



Step 1: Push and hold
Step 2: Raise support

Release track tension. Install drive axle holder (P/N 529 007 200).



1. Drive axle
2. Suspension cross shaft

Remove chaincase cover **no. 20** and drain oil.

Remove right side drive axle bearing cover.

Remove circlip **no. 17**.

Move drive axle and track together to the right side as far as possible.

Unscrew the nut **no. 14** on the upper sprocket **no. 12**. Remove chain tensioner assembly **no. 2 to 6**, then simultaneously remove chain **no. 18** and both sprockets.

Remove the 4 cap screws **no. 26** securing chaincase to frame.

Chaincase and Driven Pulley Assembly

Using 2 large prybars inserted between chaincase and frame, pry complete assembly from vehicle.

DISASSEMBLY

Disassemble driven pulley from chaincase. Refer to DRIVEN PULLEY.

INSPECTION

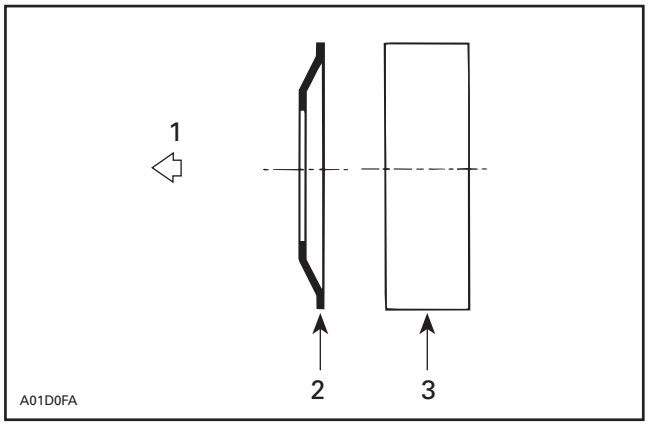
Visually inspect the chain for cracked, damaged or missing link rollers. Check for defective bearings, sprockets and worn chain tensioner components.

⚠ WARNING

If chain deflection is greater than 38 mm (1.5 in) (without chain tensioner), replace chain and check condition of sprockets.

ASSEMBLY

Position oil deflector ring **no. 10** then sit bearing in chaincase aperture. Install spacer then the other bearing.



1. Toward chaincase
2. Oil deflector
3. Bearing

1, Oil Seal

Using an appropriate pusher, press new oil seal **no. 7** into chaincase hub. Oil seal must sit flush with case hub edge.

INSTALLATION

Reverse removal procedure. Pay particular attention to the following:

Torque castellated nut 14 to 14 N•m (124 lbf•**in**), loosen then retorque to 0.5 - 2.5 N•m (5 - 22 lbf•**in**).

Apply Loctite 20166 (P/N 293 800 066) around both threaded holes of cover screws.

Grease new gasket **no. 19** with petroleum jelly, or other suitable product, and install it making sure it does not shift from its correct position. Tighten bolts evenly.

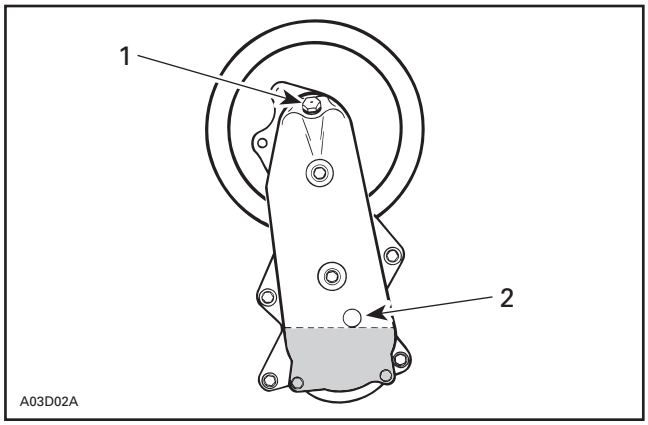
NOTE: Bottom pan has an emboss below chaincase housing to ease installation.

Chaincase Oil

Remove filler cap and pour 250 mL (8.5 fl. oz) of XP-S mineral chaincase oil (P/N 413 801 900) into chaincase.

NOTE: Chaincase oil capacity is 250 mL (8.5 fl. oz).

Check the oil level by removing the chaincase oil level plug.



1. Filler cap
2. Oil level plug

The oil should be leveled with the bottom of the oil level orifice.

Reinstall battery and connect cables on electric starting models.

CAUTION: Always connect positive RED cable first to prevent sparks.

ADJUSTMENT

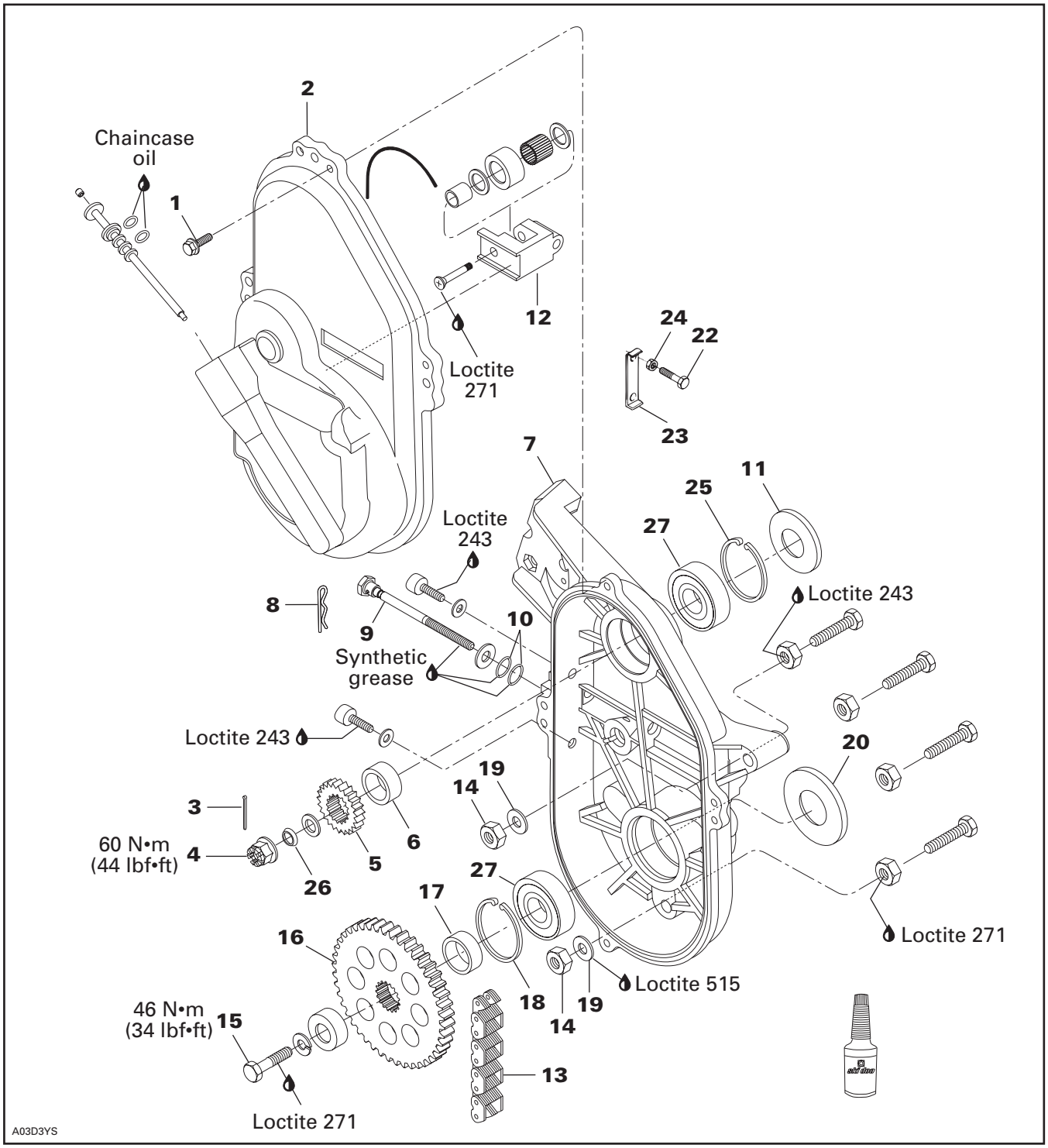
Pulley Alignment

Refer to PULLEY DISTANCE AND ALIGNMENT.

Track Tension and Alignment

Refer to TRACK.

Skandic LT


Chaincase oil
Loctite 271
Loctite 243
Synthetic grease
Loctite 243
Loctite 243
60 N•m (44 lbf•ft)
Loctite 515
46 N•m (34 lbf•ft)
Loctite 271
A03D3YS

REMOVAL

To remove chaincase proceed as follows.

Remove tuned pipe and muffler.

⚠ WARNING

Never remove exhaust components when engine is hot.

Remove hair pin **no. 8**. Release drive chain tension by unscrewing tensioner adjustment screw.

Drain oil by removing chaincase cover **no. 2**.

Apply brakes.

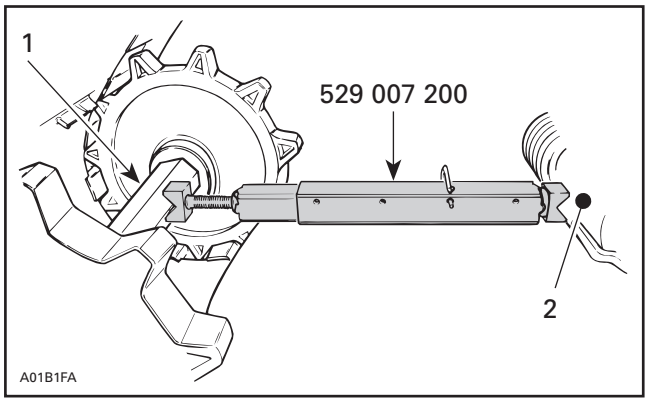
Remove cotter pin **no. 3**, nut **no. 4**, washer **no. 26** retaining upper sprocket **no. 5** and screw **no. 15** retaining lower sprocket **no. 16**. Pull sprockets and drive chain simultaneously. Remove shims **no. 6** and **no. 17**.

NOTE: Should countershaft removal be required, refer to BRAKE then look for BRAKE DISC.

Remove 5 nuts **no. 14**. Three nuts are behind the lower sprocket.

Unfold locking tab **no. 23**, then remove caliper retaining screws **no. 22**.

Release track tension, use drive axle holder (P/N 529 007 200).



TYPICAL
1. Drive axle
2. Suspension cross shaft

Pry out drive axle oil seal **no. 20** from chaincase.

Pull chaincase from drive axle and countershaft.

Using 2 prybars inserted between chaincase **no. 7** and frame, pry complete assembly from vehicle.

INSPECTION

Visually inspect the chain for cracked, damaged or missing links. Check for worn or defective bearings, sprockets and chain tensioner components.

⚠ WARNING

If chain deflection is greater than 38 mm (1.5 in) (without chain tensioner), replace chain and check condition of sprockets.

GEAR RATIO MODIFICATION

For particular applications, the number of teeth of the sprockets can be increased or decreased on lower and upper sprockets.

Refer to TECHNICAL DATA for gear ratios.

CAUTION: Gear ratio modifications should only be performed by experienced mechanics since they can greatly affect vehicle performance.

NOTE: For high altitude regions, a Service Bulletin will give information about calibration according to altitude.

INSTALLATION

Reverse removal procedure and pay attention to the following. Replace oil seals, gaskets and O-rings.

Sealed side of bearing **no. 27** must face chaincase cover.

11, Oil Seal

Clean chaincase bore with cleaning solvent then apply Loctite 609 (P/N 413 703 100) to oil seal mounting surface (outside).

Using pusher (P/N 529 035 584), press the oil seal into chaincase hub. Oil seal must fit flush with the chaincase edge.

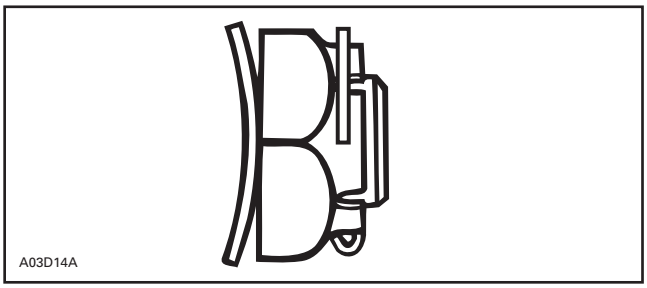
NOTE: Should installation procedure for countershaft be required, refer to BRAKE then look for BRAKE DISC AND COUNTERSHAFT BEARING ADJUSTMENT.

5,16, Sprockets

Position the sprockets with the writing facing the chaincase cover.

26, Conical Spring Washer

Install washer with its concave side towards sprocket.



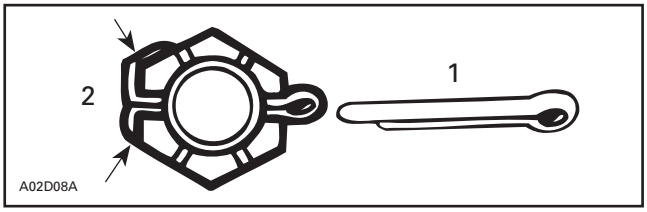
4, Upper Sprocket Castellated Nut

Torque to 60 N•m (44 lbf•ft).

Install new cotter pin in the position shown.

CAUTION: When removing a cotter pin always replace with a new one.

CAUTION: Cotter pin will rub on chaincase cover if installed otherwise.



1. New
2. Fold cotter pin over castellated nut flats only

18, Circlip

CAUTION: It is of the utmost importance to install the circlip otherwise damage to the chaincase components may occur.

DRIVE CHAIN ADJUSTMENT

NOTE: Brake disc key must be in good condition before checking chain free play.

10, O-Ring

Replace both O-rings **no. 10** on tensioner adjustment screw. Fully tighten tensioner adjustment screw by hand, then back off only far enough for hair pin to engage in locking hole.

This initial adjustment should provide 3 - 5 mm (1/8 - 13/64 in) free-play when measured at the outer circumference of the brake disc.

CAUTION: Free-play must not exceed 5 mm (13/64 in), readjust if necessary.

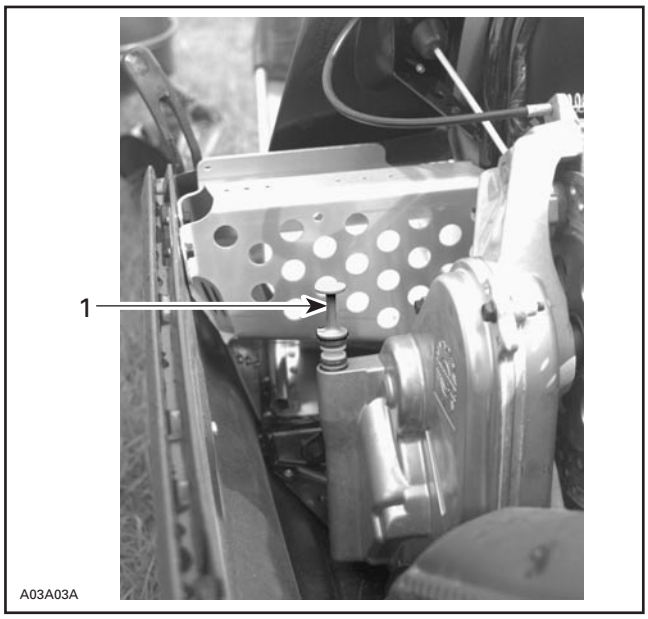
⚠ WARNING

If the specified free-play is not reached with the tensioner screw fully tightened, replace chain and check the condition of sprockets.

21, Chaincase Oil

Pour 250 mL (8.5 fl. oz) of XP-S synthetic chaincase oil (P/N 413 803 300) into chaincase.

Check oil level with the dipstick then add if required. Remove metal particles from magnet.



TYPICAL
1. Dipstick

NOTE: Chaincase must be in its proper position when checking oil level.

ADJUSTMENT

Pulley Alignment

Refer to PULLEY DISTANCE AND ALIGNMENT.

Track Tension and Alignment

Refer to TRACK.

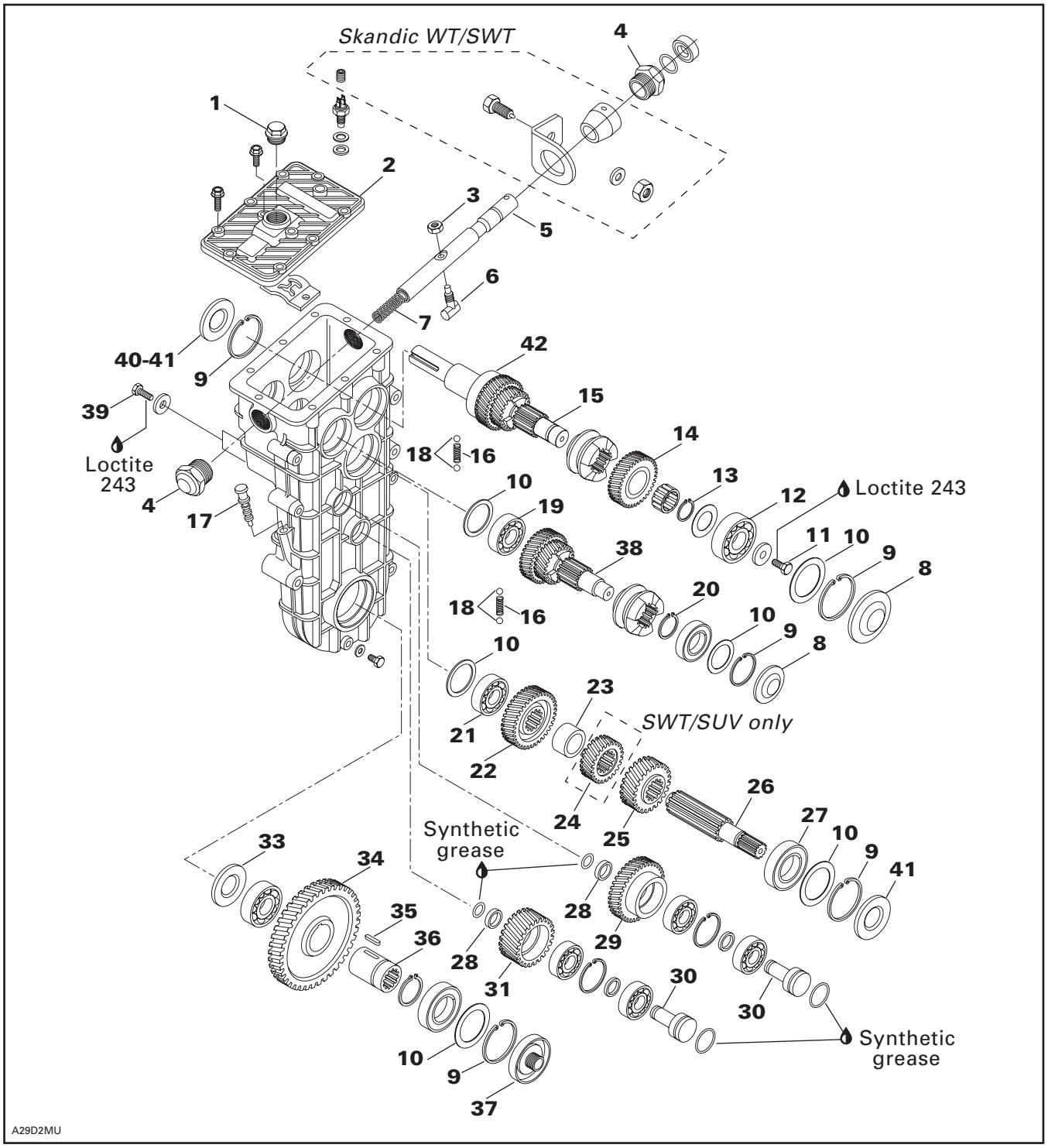
GEARBOX

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	413 711 500	415
XP-S synthetic chaincase oil	413 802 800	418

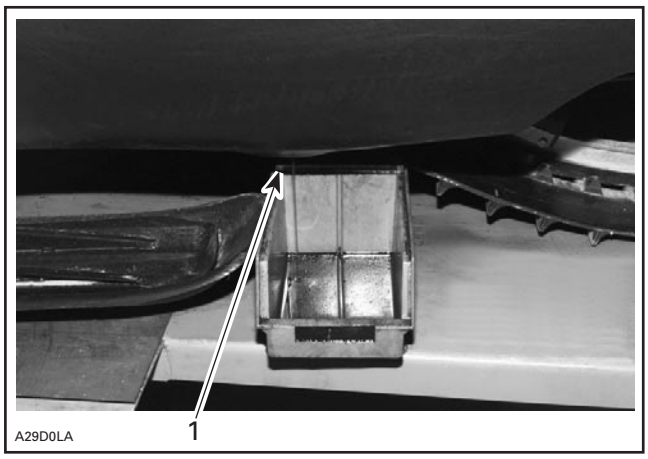
3-SPEED GEARBOX

Skandic WT/SWT/WT LC/SUV/Expedition TUV



REMOVAL

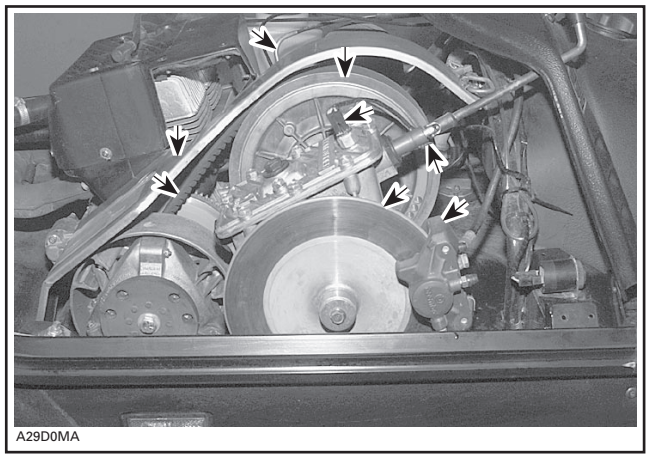
Drain gearbox oil.



1. Bottom pan drain hole nearby gearbox drain plug

Remove belt guard, drive belt. Remove air silencer and carburetor(s); then remove driven pulley.

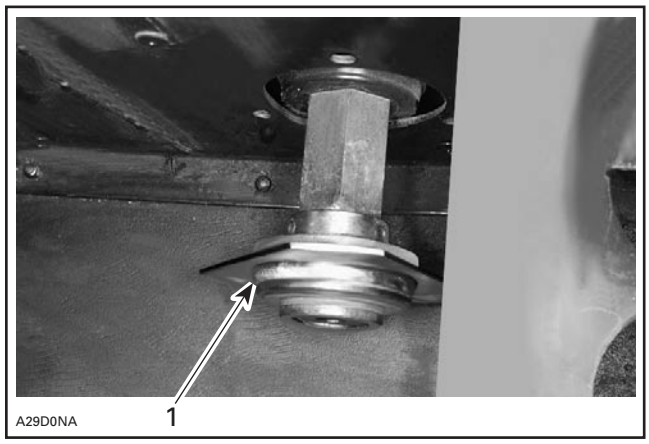
Remove brake caliper, brake disc. Unfasten shifting rod and unplug reverse switch.



Remove rear suspension.

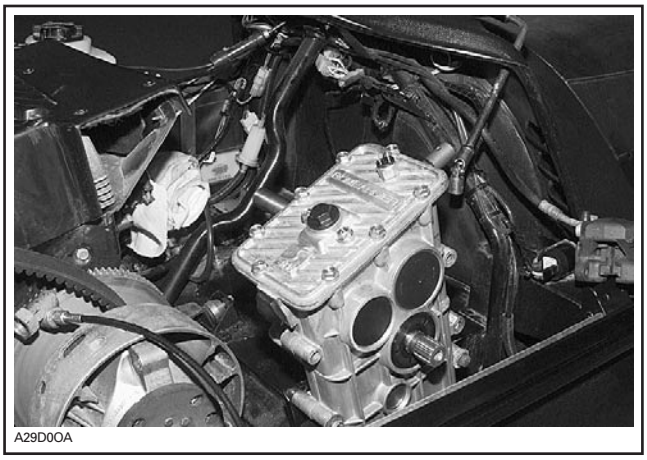
Remove angle drive and square pin from bottom of gearbox.

Remove muffler. Unbolt RH end bearing then pull drive axle toward right side.



1. RH end bearing

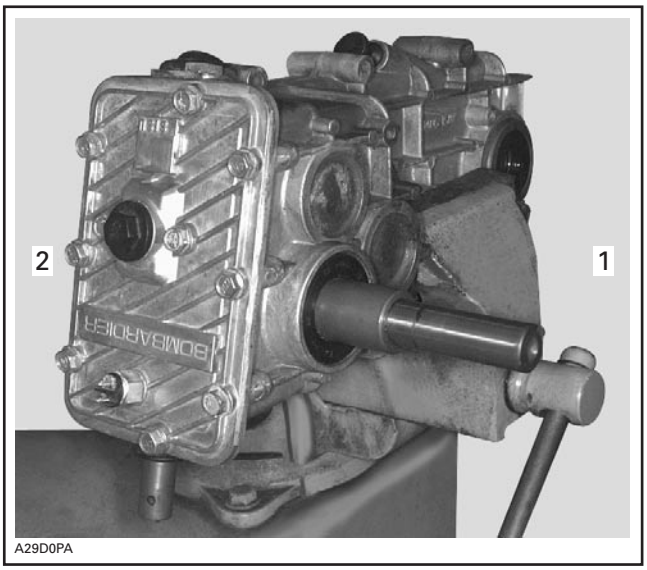
Unbolt gearbox from chassis.



DISASSEMBLY

General

For the following procedure, right hand side refers to driven pulley side and left hand side to brake disc side.



1. RH side driven pulley side
2. LH side brake disc side

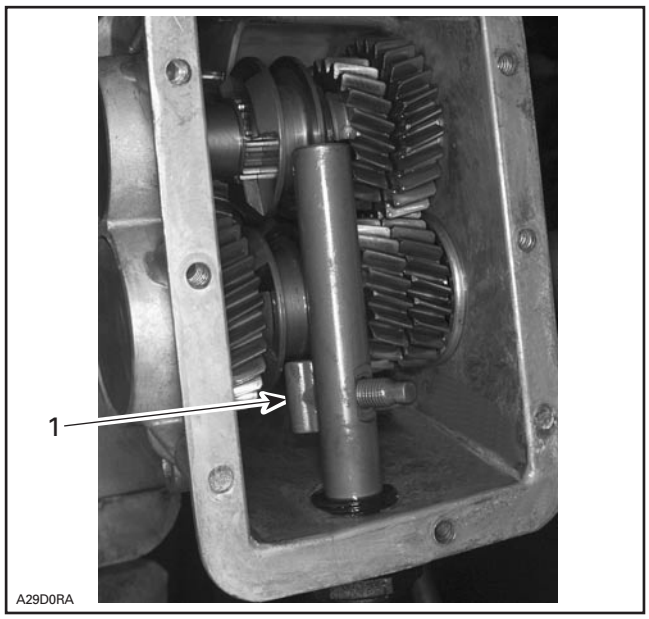
Shaft

Remove dipstick **no. 17**. Unfasten cover **no. 2** from gearbox housing.

Remove nut **no. 3** retaining pin **no. 6**.

1. Cover
2. Nut

Unfasten sleeve nuts **no. 4**, remove spring **no. 7** then, partially pull shaft **no. 5** and remove pin **no. 6**.



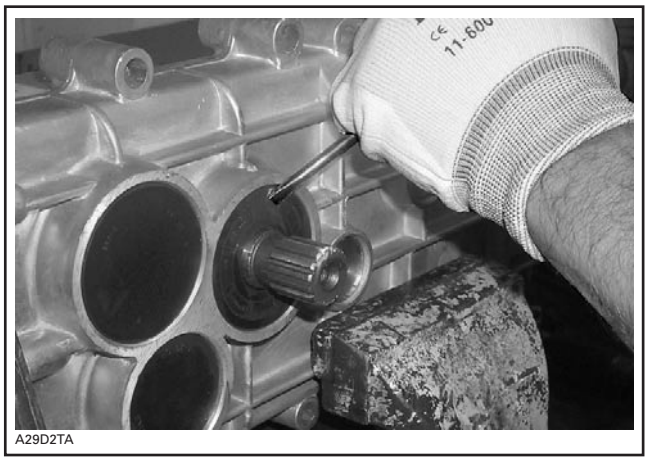
1. Pin

Completely remove shaft **no. 5**.

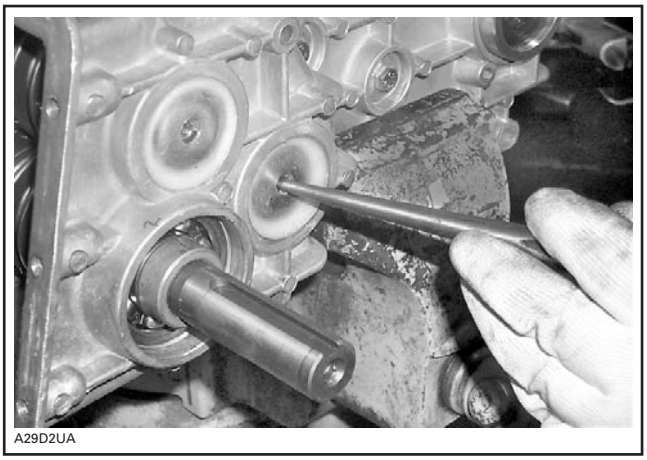
Plug

Remove LH side rubber plugs **no. 8** and oil seal **no. 41**.

Remove RH side oil seal **no. 41**.

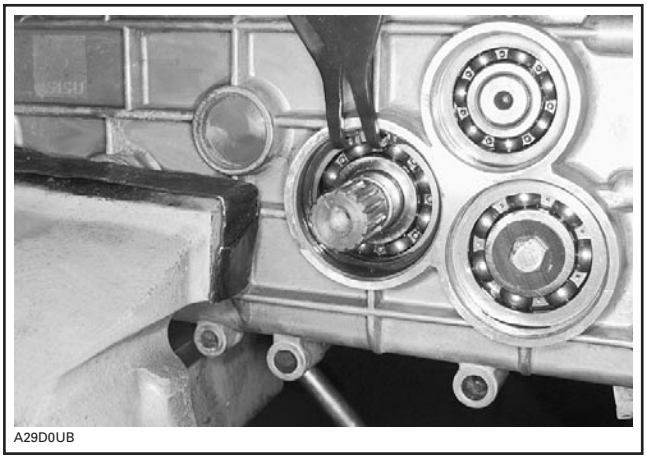


Drill a 10 mm (3/8 in) diameter hole through RH side plugs **no. 40**.


A29D2UA

Brake Shaft

Remove all circlips **no. 9**.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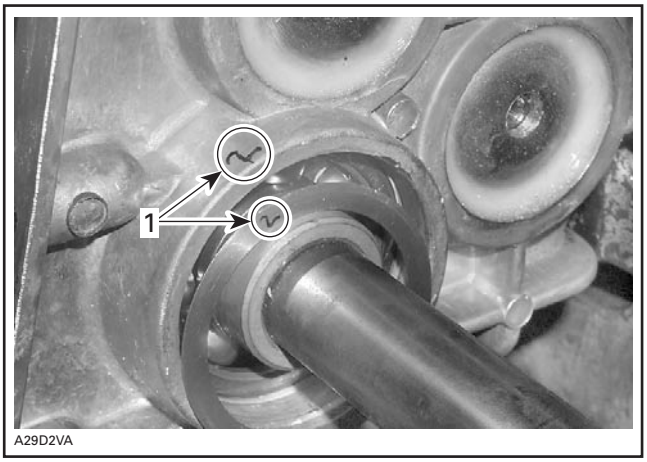
IMPORTANT: Note all shims **no. 10** quantity and location.



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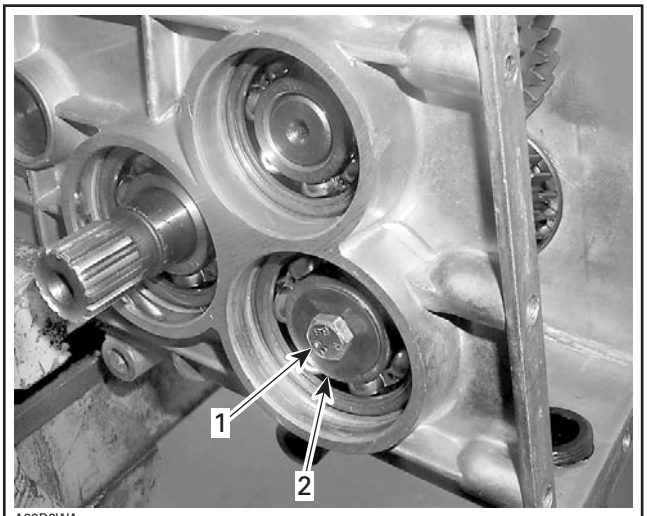
1. Note shims location

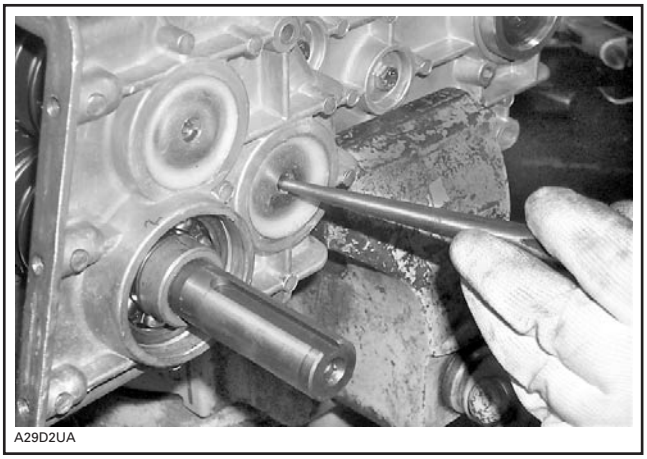
Remove driven shaft bolt **no. 11** and washer.

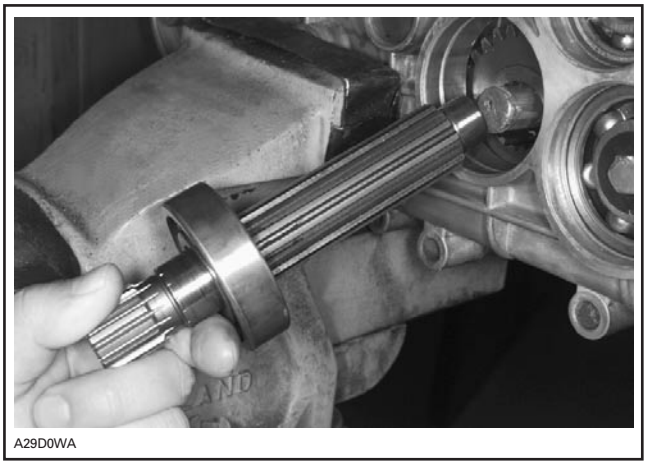


A29D2WA

1. Driven shaft bolt
2. Washer

Proceeding from right side, drive brake shaft **no. 26** out of gearbox housing.


A29D2UA


A29D0WA

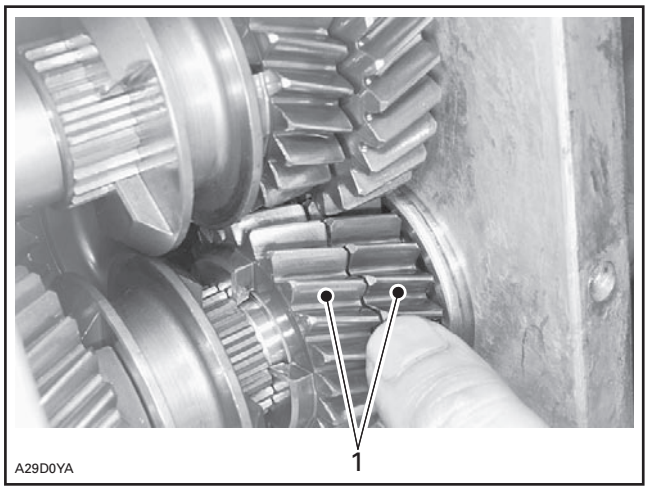
NOTE: Brake shaft gears and sleeve remain in gearbox housing.

Remove bearing **no. 27** from brake shaft **no. 26** using a press.

A29D0XA

Reverse Shaft

Make sure gears mesh.



A29D0YA

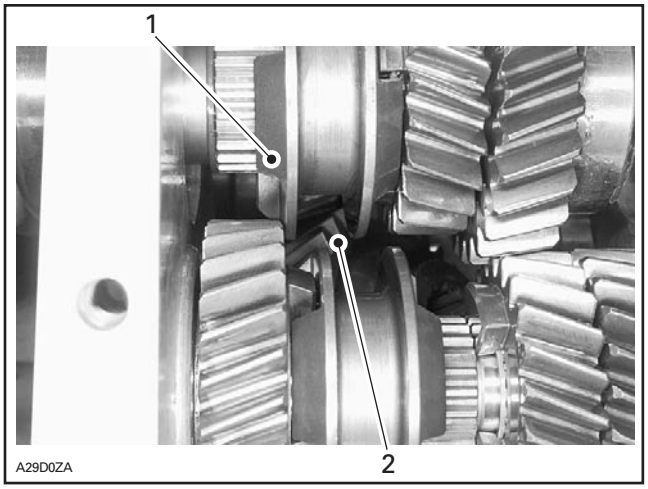
1. These gears must mesh as reverse shaft is driven out

Push sleeve dog against gear to lock it in place (reverse gear).

This will allow the driven pulley shaft to be pushed out enough for bearing removal and sliding sleeve dog will not touch the RH gear of driven pulley shaft **no. 15**.

Drive reverse shaft **no. 38** out until its LH side bearing is free.

CAUTION: Make sure loose gears do not interfere.



A29D0ZA

1. Sleeve dog not touching right gear
2. Brake shaft gears are still in gearbox

Use a puller to extract LH reverse shaft bearing.

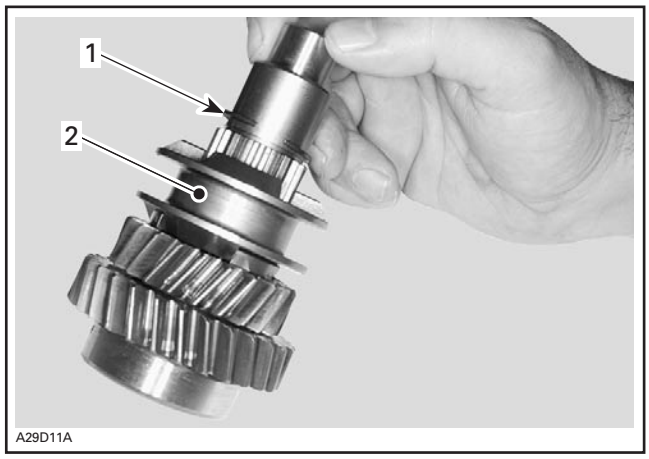
A29D2YA

Remove reverse shaft **no. 38** from gearbox.

Remove loose gears.

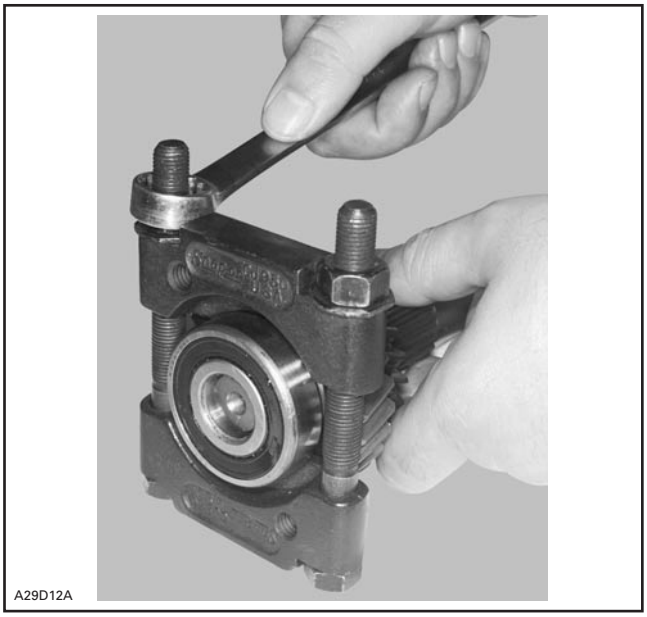
To remove sliding sleeve from reverse shaft, first remove circlip.

NOTE: Take care not to loose balls **no. 18** and spring **no. 16** when removing sliding sleeve.



1. Circlip
2. Sliding sleeve

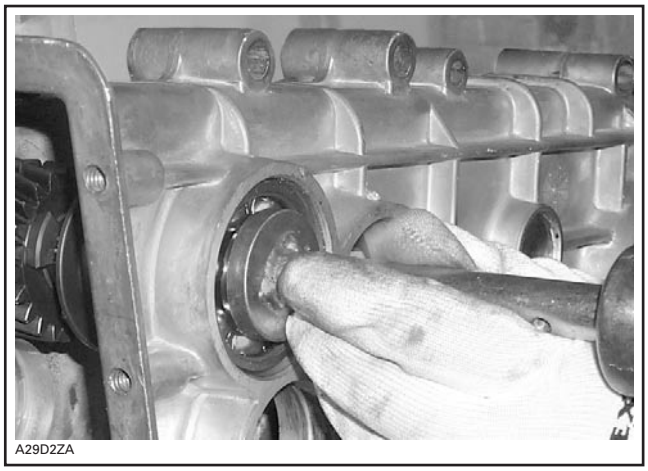
Use a puller to extract bearing **no. 19**.



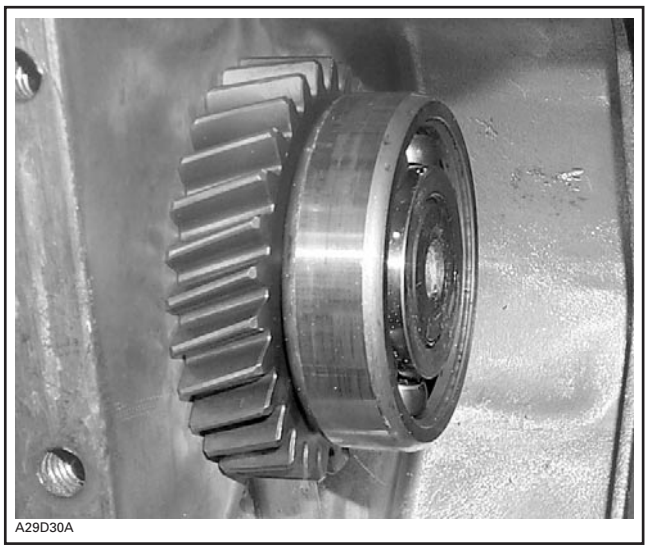
Remove brake shaft gears.

Pulley Shaft

Push driven pulley shaft **no. 15** out of gearbox until its LH gear **no. 14** is against gearbox inner wall.

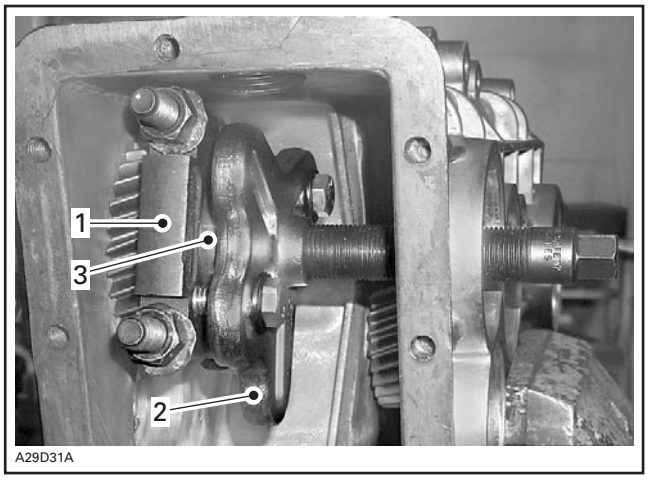


PUSH DRIVEN PULLEY SHAFT OUT



LH GEAR IS AGAINST GEARBOX INNER WALL

Use a puller and a puller retaining plate to extract bearing **no. 12**.

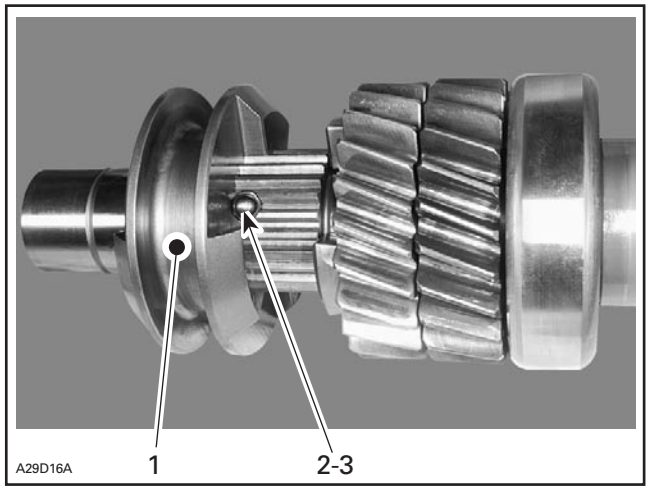


A29D31A

1. *Puller*
2. *Puller retaining plate*
3. *Bearing*

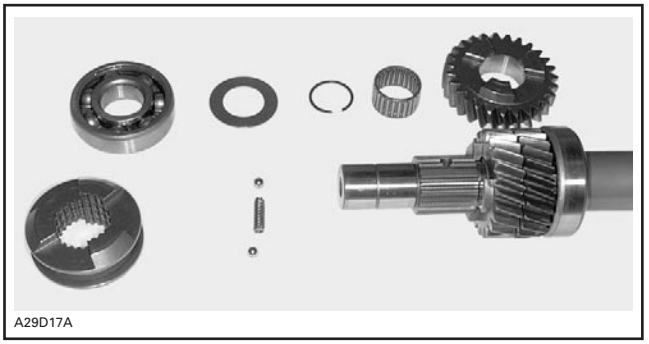
Remove circlip then, gear **no. 14**. Now driven pulley shaft can be pulled out from gearbox.

Remove sliding sleeve taking care not to lose balls **no. 18** and spring **no. 16**.



A29D16A

1. *Sliding sleeve*
2. *Spring*
3. *Balls*


A29D17A

DRIVEN PULLEY SHAFT COMPONENTS

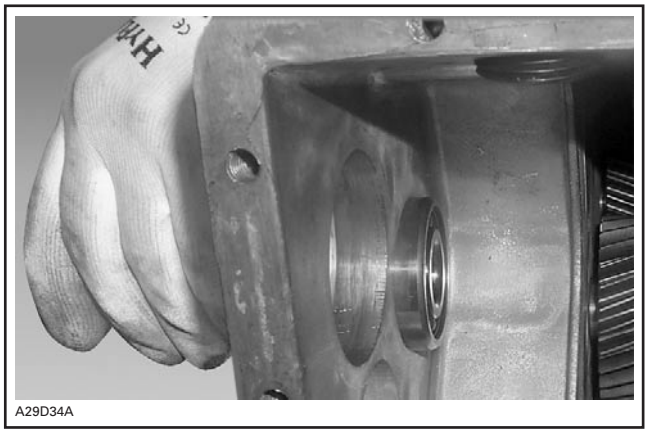
Remove sealant around caps **no. 40**.

A29D32A

Remove caps **no. 40**.

A29D33A

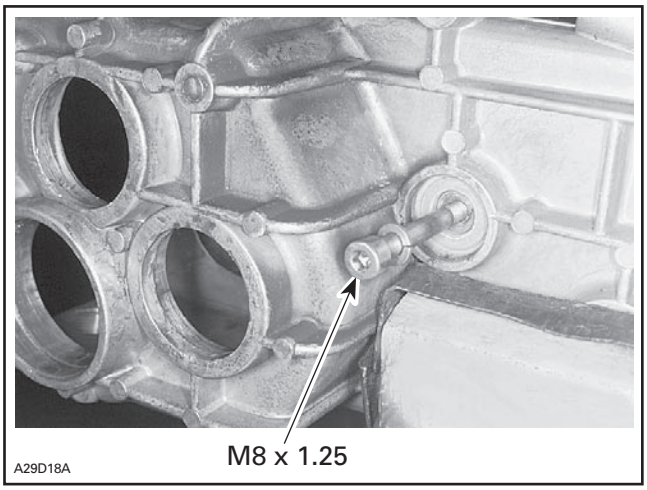
NOTE: Brake shaft bearing and shims will come out with cap **no. 40**.


A29D34A

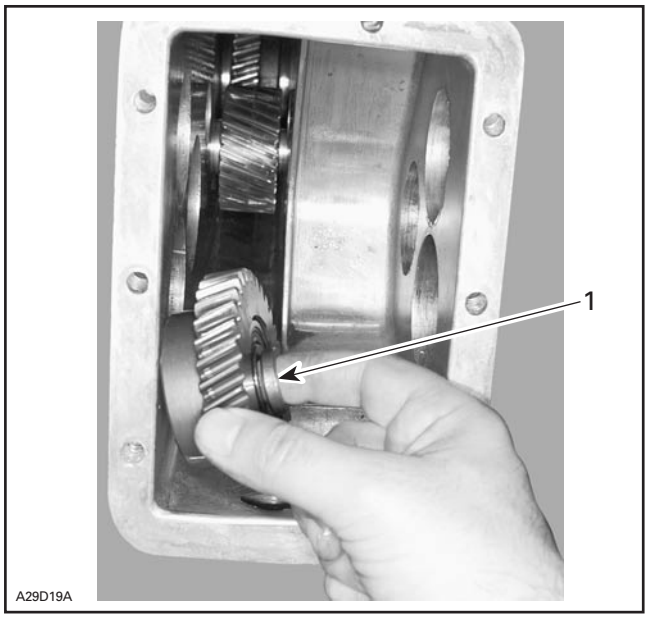
Intermediate Shaft

Remove screws **no. 39** from intermediate shafts **no. 30**.

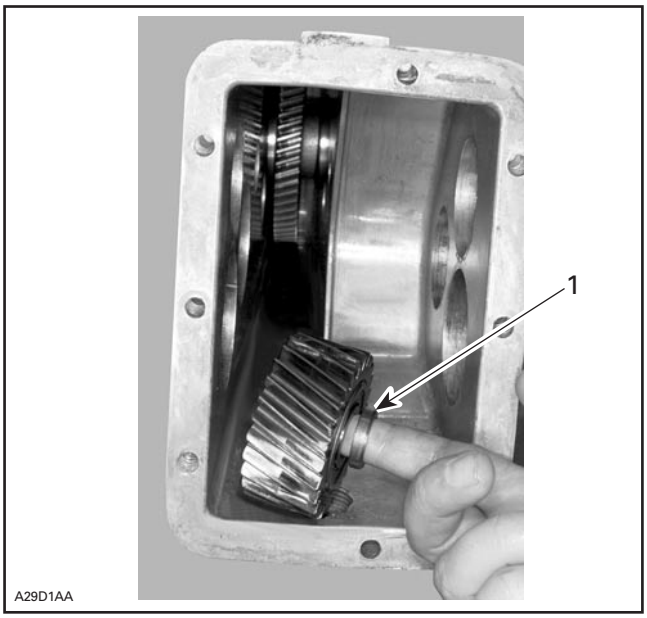
Fasten a long M8 x 1.25 screw in axle end then drive it out, beginning with top one.



Remove intermediate gears and spacers.



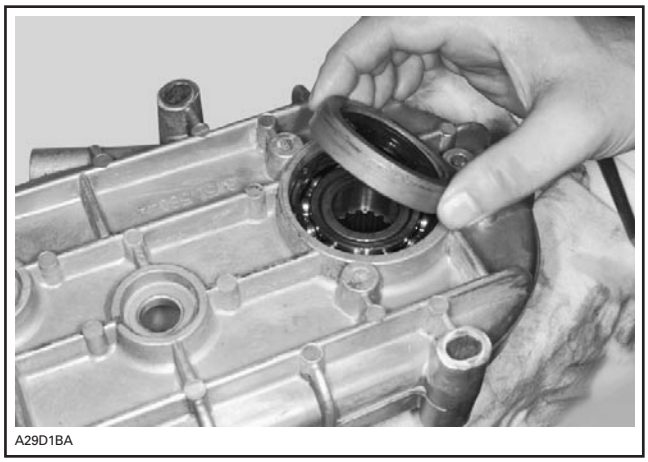
1. Spacer



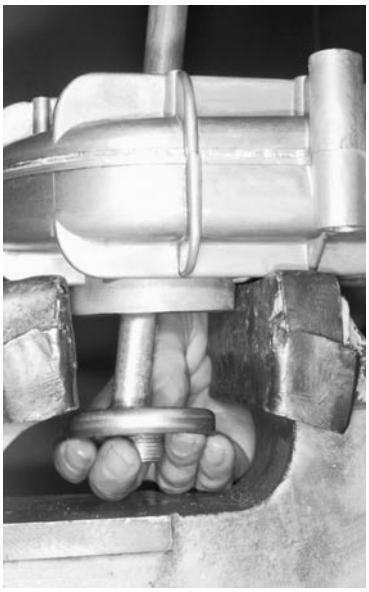
1. Spacer

Do not disassemble bearings of intermediate gears needlessly.

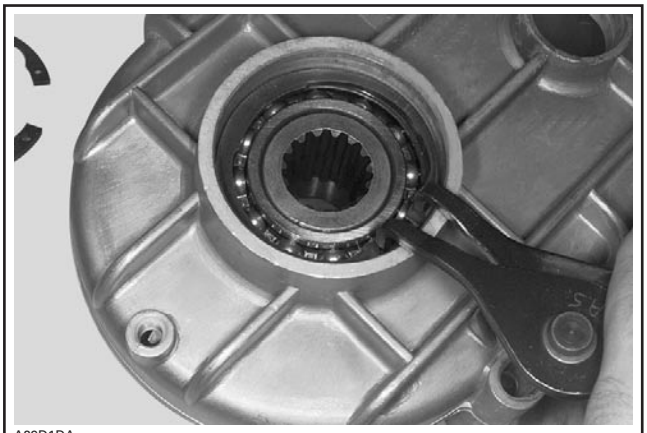
Pry out bottom seal **no. 33** from gearbox housing. Remove circlip **no. 9**.



Drive out plug **no. 37**.

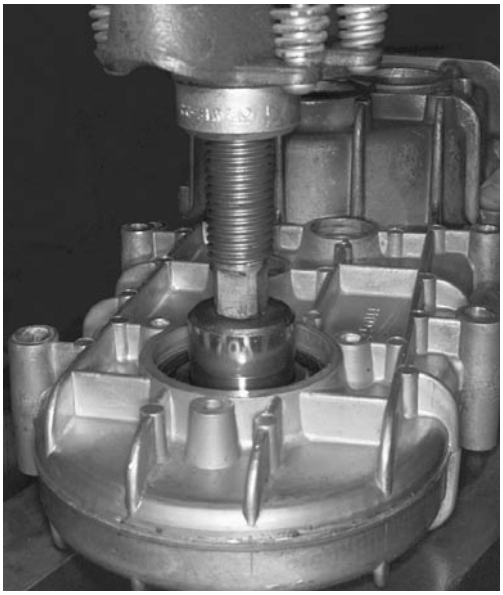

A29D1CA

Remove circlip **no. 9** from LH side.


A29D1DA

Using a press, drive out lower shaft **no. 36** from RH side.

CAUTION: Do not push against inner bearing race.


A29D1EA

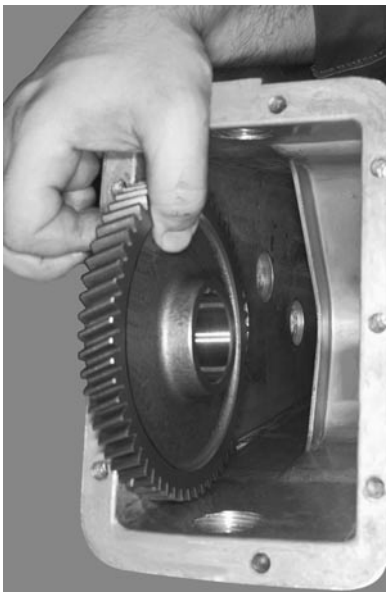
INSPECTION

Check bearing condition. There must be no discoloration, missing rollers or balls, broken cages, etc.

Check sprocket teeth.

ASSEMBLY

Install lower gear **no. 34** with its shoulder facing RH side.


A29D1FA

Install lower shaft **no. 36** with its hollow side (no splines) on RH side. Align key with lower gear **no. 34** keyway.

A29D1GA

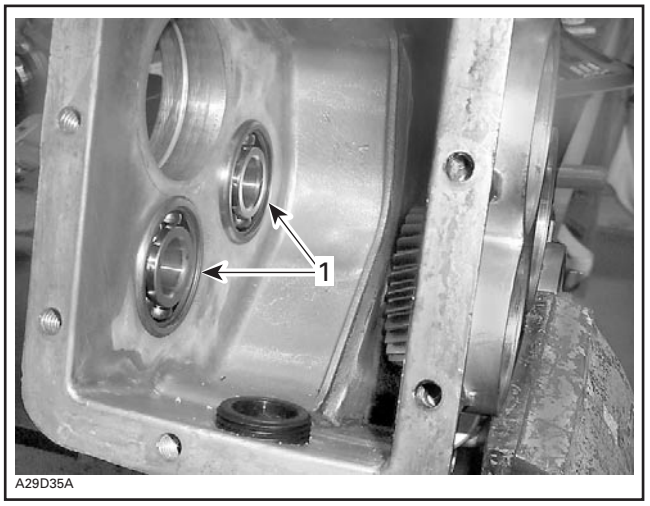
Apply synthetic grease (P/N 413 711 500) on intermediate shaft **no. 30** O-rings.

Install intermediate gears **no. 29** with their shoulder towards LH side. Position spacers **no. 28** as illustrated in removal procedure. Beveled side of spacers goes against gearbox wall.

Install new caps **no. 40**.

Install the appropriate premarked shims **no. 10**.

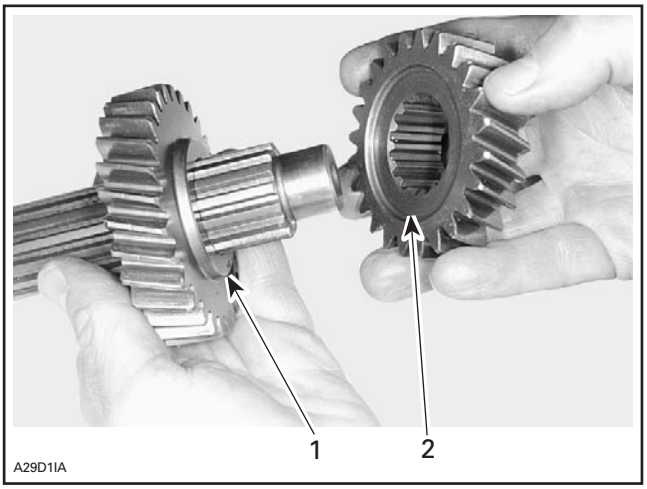
Using a pusher, install RH side bearing of brake and reverse shafts.



A29D35A

1. Bearings installed

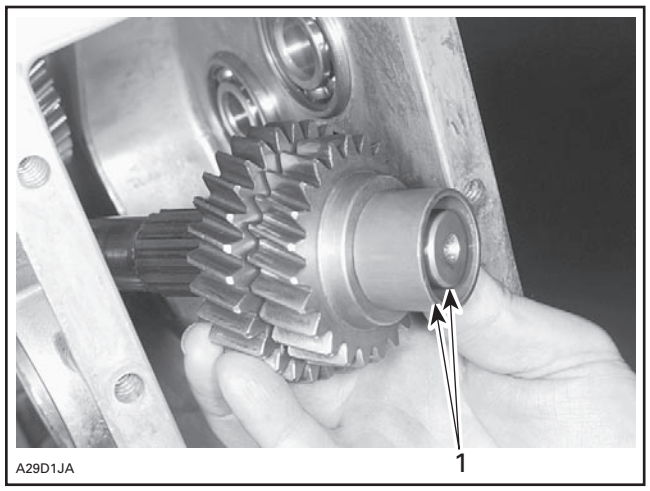
Partially assemble brake shaft gears **no. 24** and **no. 25** with shoulder facing recess.



A29D1IA

1. Shoulder
2. Recess

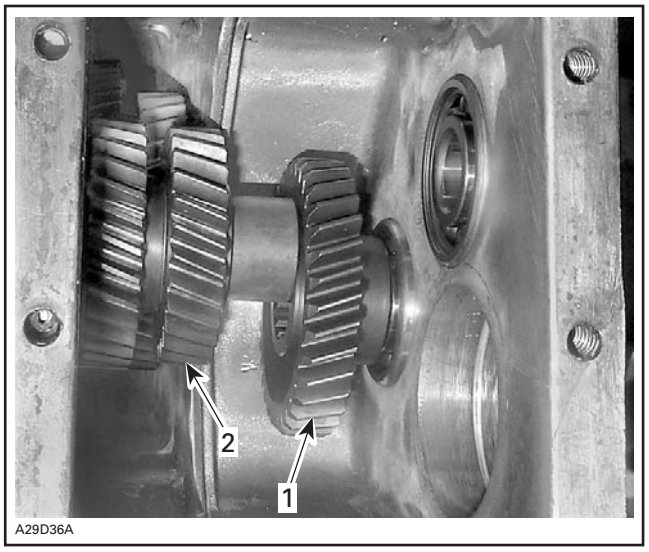
Install sleeve **no. 23** on brake shaft **no. 26** then, slide gears and sleeve until end of sleeve is flush with shaft end.



A29D1JA

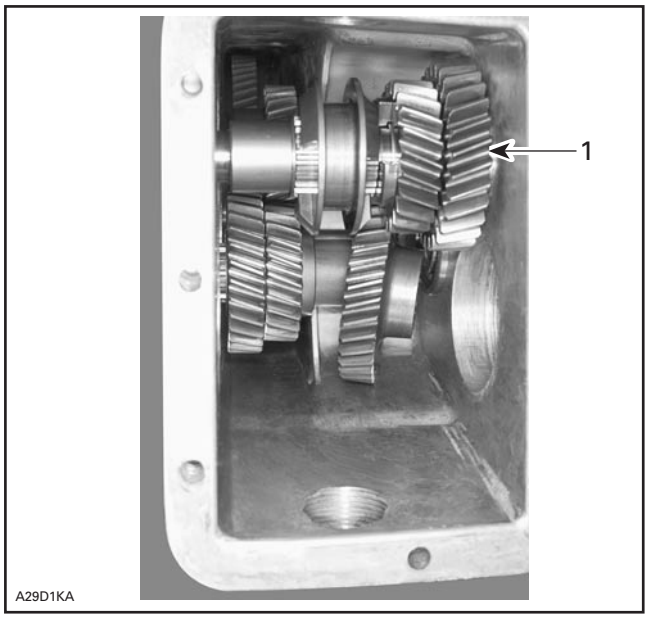
1. Flush

Install brake shaft **no. 26** into gearbox then, loosely install gear **no. 22** with its shoulder facing bearing **no. 21**. Do not push brake shaft into bearing **no. 21** at this time.



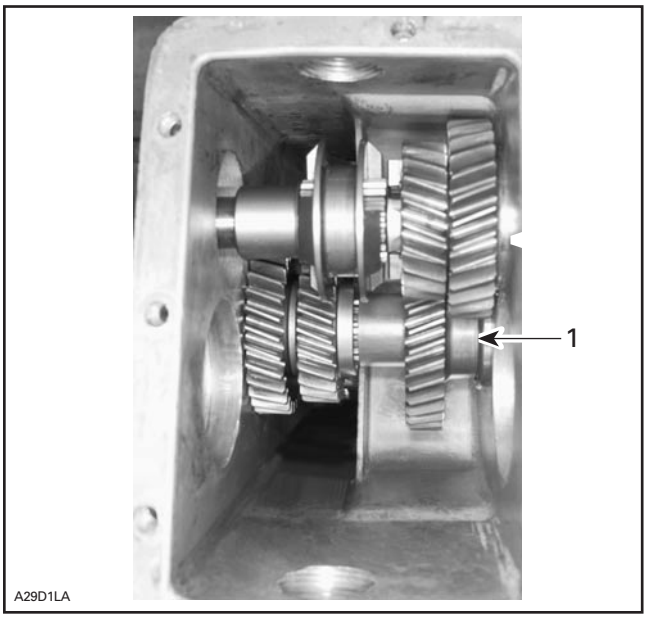
1. Gear loosely installed
2. Brake shaft assembly

Install reverse shaft ass'y **no. 38** into its RH side bearing **no. 19**.



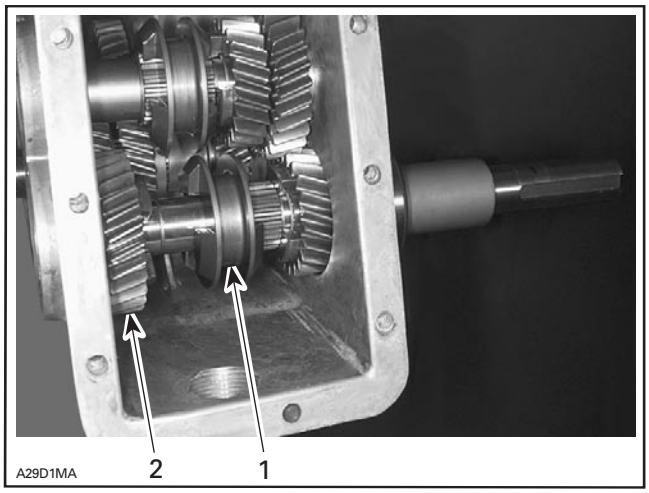
1. Reverse shaft installed in its RH bearing

Position gear **no. 22** against RH side bearing **no. 19** then, finalize brake shaft **no. 26** insertion.



1. Finalizing brake shaft insertion

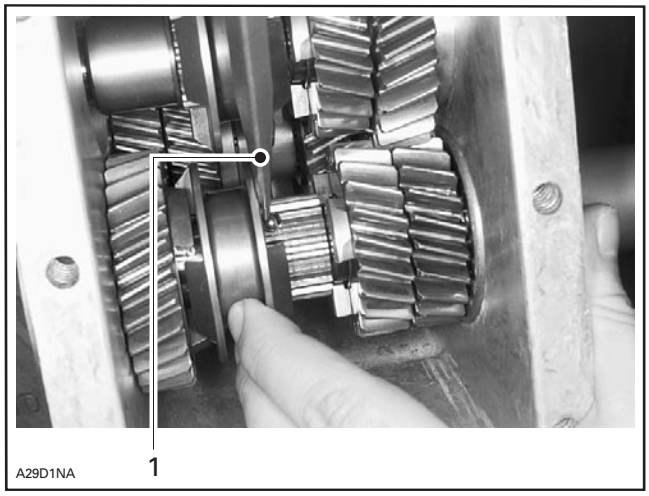
Install driven pulley shaft **no. 15** with the sliding sleeve loosely inserted. Gear **no. 14** must be at its place.



1. Sliding sleeve loosely inserted
2. Gear **no. 14** *in place*

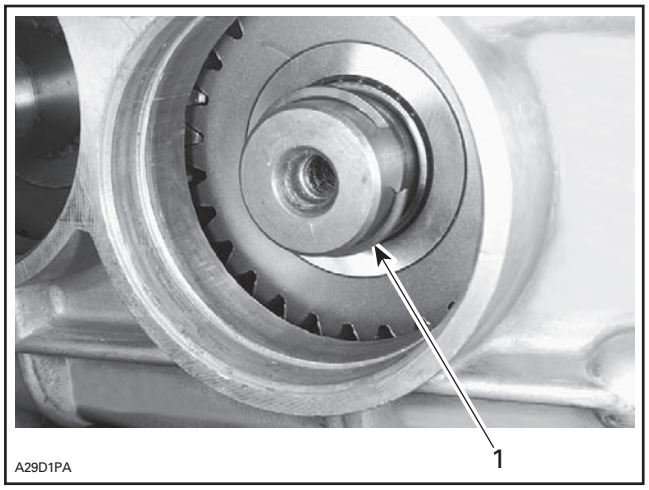
Install balls **no. 18** and spring **no. 16** into driven pulley shaft.

NOTE: If necessary, partly install bearing in gearbox to ease installation of balls and spring.



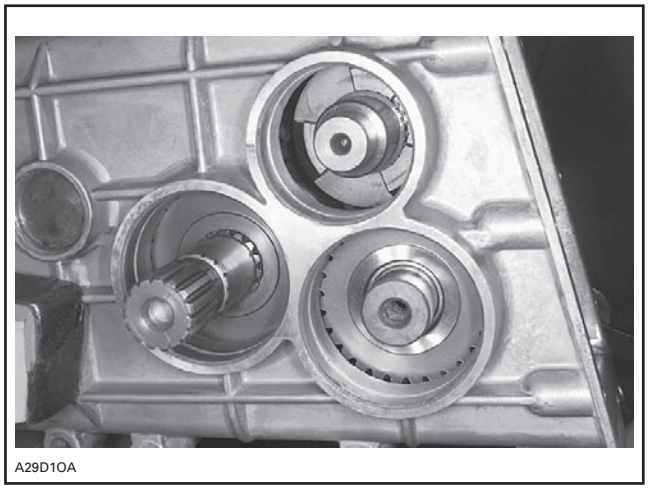
1. Push on ball with a screwdriver then move sliding sleeve to the right

Finalize driven pulley shaft insertion. Make sure that gears mesh during insertion. Install circlip **no. 20**.



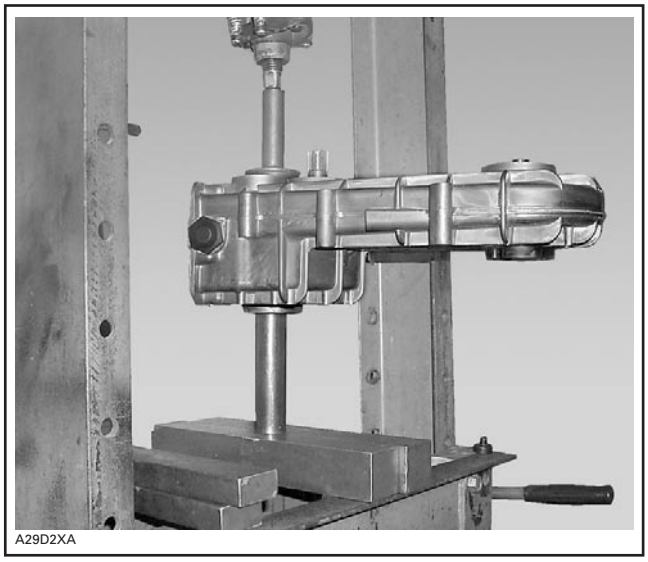
1. Circlip

Install LH side bearings **no. 42, 19 and 21**, shims **no. 10**, circlip **no. 9** then, plugs **no. 40** and oil seal **no. 41**.



READY TO INSTALL BEARINGS, SHIMS, CIRCLIPS AND PLUGS

CAUTION: Make sure that gearbox is well supported before inserting driven pulley shaft bearing, see photo.



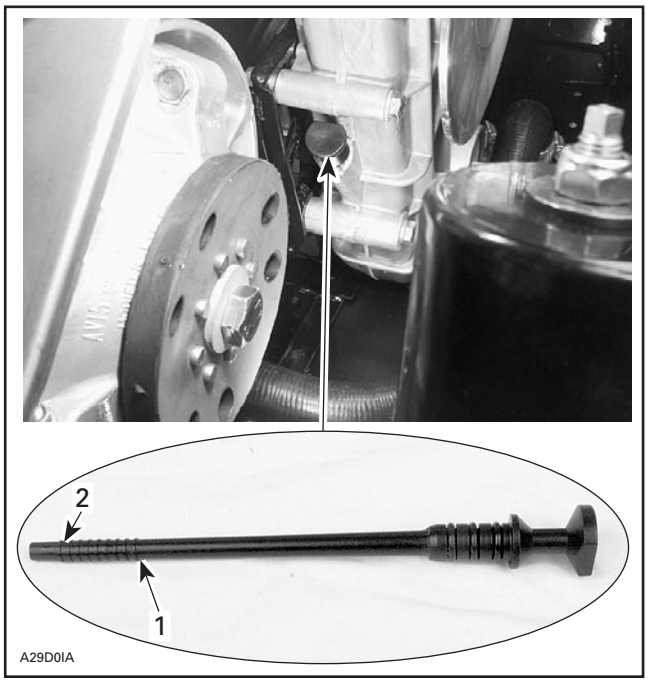
INSTALLATION

Reverse removal procedure. Check pulley alignment.

OIL LEVEL

To check, pull dipstick. Oil should reach level mark.

NOTE: After first outing, oil level will decrease as the upper oil cavity fills with oil. Recheck oil level and refill as required.



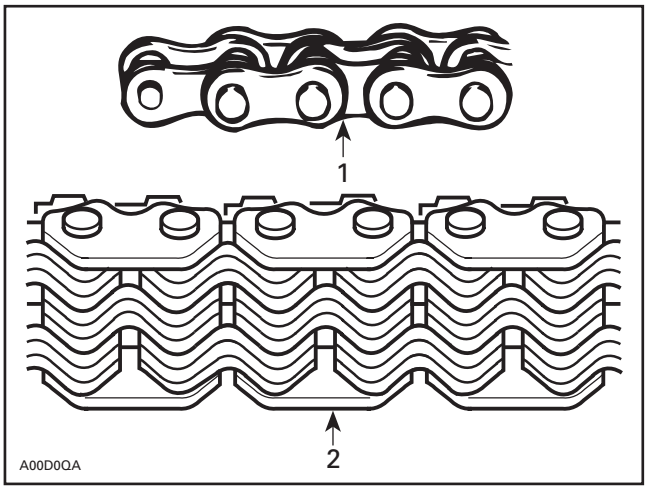
1. Full level mark
2. Lower level mark

To fill, remove filler plug from top of transmission. Refill as required using XP-S synthetic chaincase oil (P/N 413 802 800).

DRIVE CHAIN

GENERAL

Bombardier drive chains exist in 2 types, for proper use refer to TECHNICAL DATA.



1. 1/2 in single
2. 3/8 in silent chain

SILENT CHAIN

There are 2 types of silent chain. One is 11-plates wide and the other is 13-plates wide (stronger). Do not interchange sprockets. Fit chain on sprockets to make sure using right ones according to width. Refer to TECHNICAL DATA.

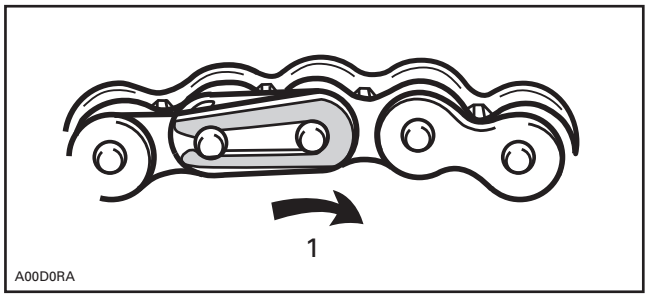
NOTE: No work (separation, lengthening) can be done on the silent chain type.

CHAIN ATTACHMENT

When joining chain ends, the open end of the circlip must be on opposite side of chain rotation. The circlip should also be facing the outer side of chaincase.

⚠ WARNING

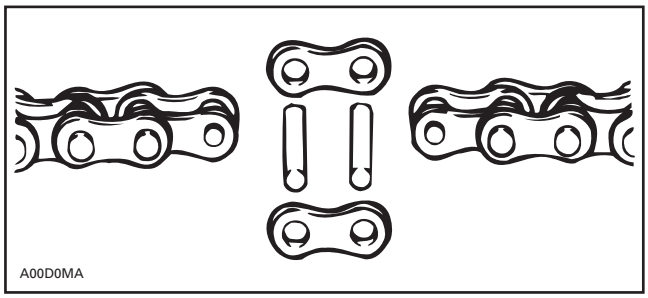
Always ensure that the connecting link circlip is in good condition and is properly secured.



TYPICAL
1. Rotation

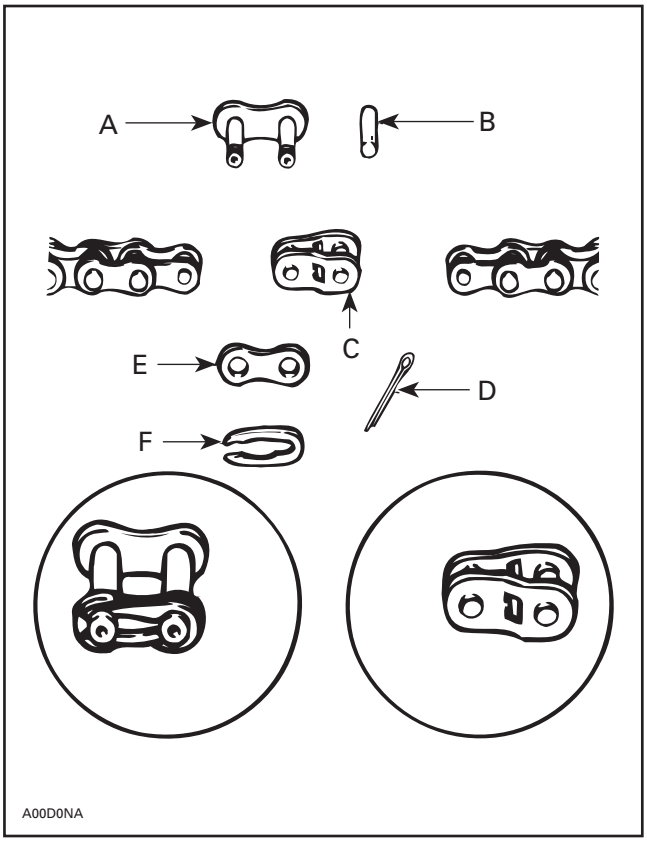
CHAIN SEPARATION

When separating an endless chain, always use a chain bearing pin extractor. Also, make sure to remove one complete link.

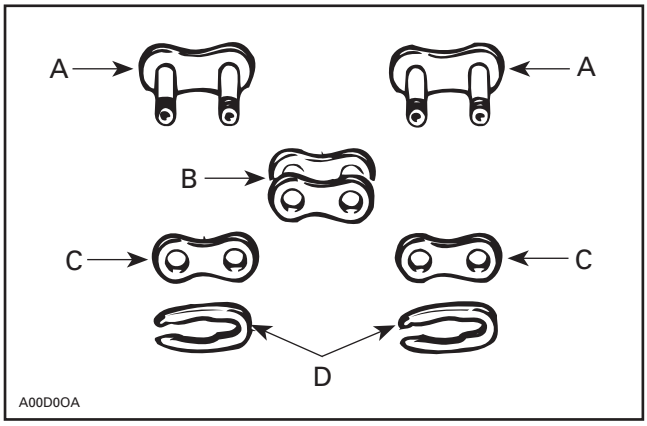


NOTE: Chain connecting link should only be used to lengthen or shorten a chain when changing the sprocket(s) for one(s) with a different number of teeth. A stretched chain must never be shortened because the chain pitch has changed (increased) and will not properly match the sprocket pitch, causing premature wear.

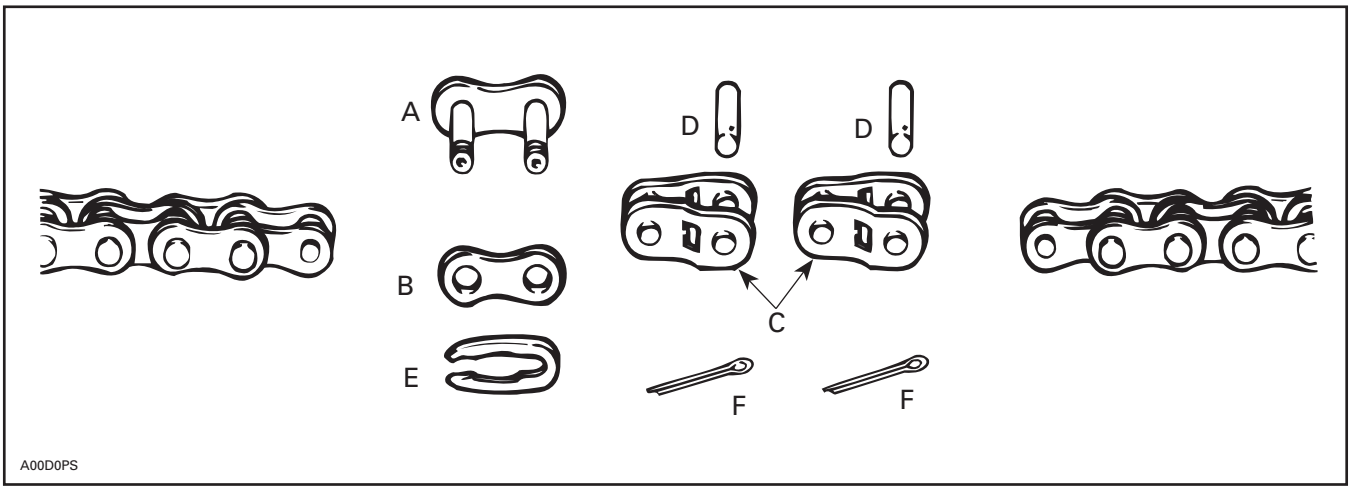
NOTE: Refer to TECHNICAL DATA, for chain length according to gear ratio of each specific vehicle.



LENGTHENING 1/2 LINK
A. Connecting link
B. Link pin
C. Cranked link
D. Cotter pin
E. Outer link
F. Circlip



LENGTHENING 1 LINK
A. Connecting link
B. Inner link
C. Outer link
D. Circlip



LENGTHENING 1-1/2 LINKS
A. Connecting link
B. Outer link
C. Cranked link
D. Link pin
E. Circlip
F. Cotter pin

IGNITION TIMING

SERVICE TOOLS

Description	Part Number	Page
9 volt adapter	529 035 675	428
digital induction type tachometer	529 014 500	422, 424, 427
MPEM programmer	529 035 878	428
supply cable	529 035 869	428
TDC gauge	414 104 700	421, 423, 426
Vehicle Communication Kit (VCK)	529 035 981	428, 431

277 Engine Type

This 277 engine type is equipped with a Rotax Electronic Reverse system (RER). It uses a single coil ignition system and 2 trigger coils. Refer to MAGNETO SYSTEM for more information.

This section is mainly divided in 2 parts, the first one using a Top Dead Center gauge to VERIFY THE MAGNETO FLYWHEEL TIMING MARK POSITION. The second one using a stroboscopic timing light to CHECK IGNITION TIMING.

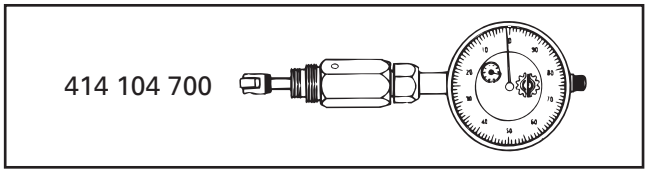
Flywheel timing mark position verification is required to:

– To detect a missing or broken magneto flywheel Woodruff key which change the timing, with eventual break down of the engine.
– To correctly locate and mark a timing mark on a new service magneto flywheel.
– To verify the correct location of the factory timing mark.
– To detect a wrong magneto flywheel corresponding to a different engine type.

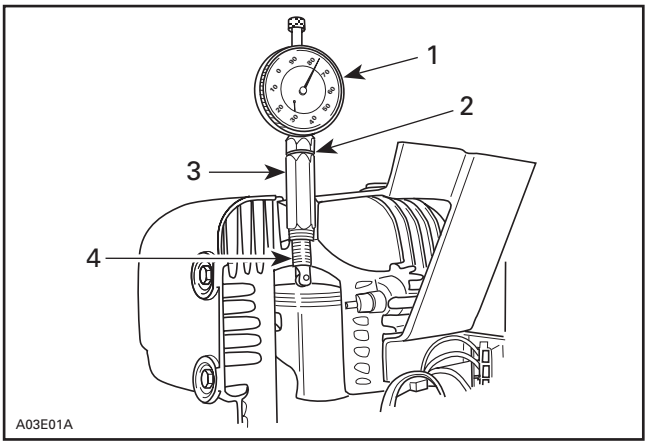
Always verify magneto flywheel timing mark position before checking ignition timing.

Verifying Magneto Flywheel Timing Mark Position

– Disconnect spark plug wire and remove spark plug.
– Install and adjust TDC gauge (P/N 414 104 700) on engine as follows:



- Rotate magneto flywheel clockwise until piston is just Before Top Dead Center.



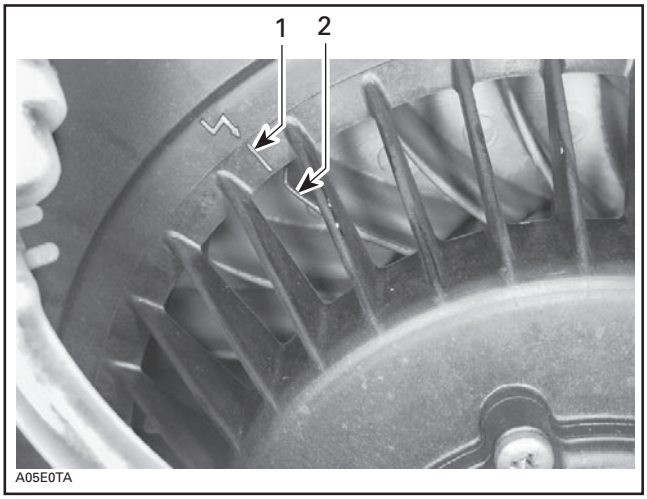
1. Outer ring
2. Adaptor lock nut
3. Roller lock nut
4. Adaptor

- Loosen adaptor lock nut then holding gauge with dial face toward magneto, screw adaptor in spark plug hole.
- Slide gauge far enough into adaptor to obtain a reading then finger tighten adaptor lock nut.
- Rotate magneto flywheel clockwise until piston is at Top Dead Center.
- Unlock outer ring of dial and turn it until "0" (zero) on dial aligns with pointer.

- Lock outer ring in position.

– From this point, rotate magneto flywheel back 1/4 turn then rotate it clockwise to reach the specified position. Refer to TECHNICAL DATA.

Check if red fin aligns with mark on fan cowl.



1. Fan cowl timing mark
2. Red fin

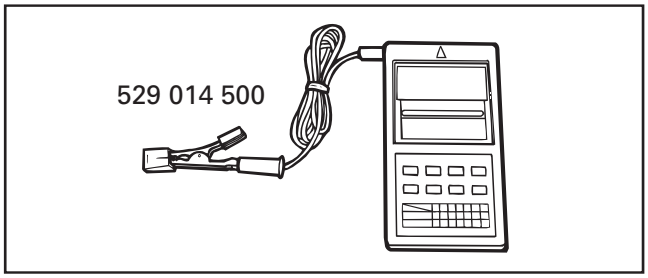
If marks do not align, there is something wrong with fan mounting. Check Woodruff key and fan.

CAUTION: Always check the timing with a stroboscopic timing light at 3500 RPM after the marks have been checked.

Checking Ignition Timing

NOTE: To perform this procedure we strongly recommend a stroboscopic timing light which is able to exceed 3500 RPM.

– Connect timing light pickup to the spark plug lead. Use a digital induction type tachometer (P/N 529 014 500).



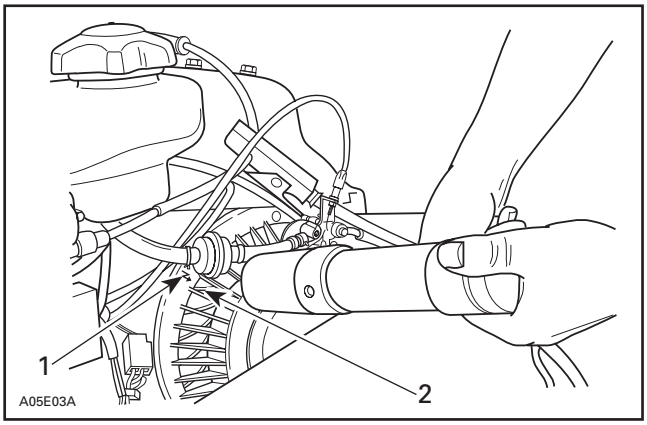
TACHOMETER

Connect tachometer wire to spark plug wire or aim tachometer toward spark plug wire without using any connection wire.

⚠ WARNING

Place ski tips against a wall, raise rear of vehicle on a stand so that track does not contact the ground. Do not allow anyone in front or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

– Start the engine and point timing light straight in line with the fan cowl timing mark. Bring engine to 3500 RPM (3000 to 4000 RPM) for a brief instant.



TYPICAL — TUNDRA
1. Fan cowl timing mark
2. Red fin

– Check if the red fin aligns with the fan cowl timing mark. Tolerance is ± 1°.

If the red fin aligns with the fan cowl timing mark, timing is correct. If not the case, check for proper flywheel, trigger coil position or MPEM.

The RER ignition system is not adjustable. Only trigger coil air gap can be verified. Refer to MAGNETO SYSTEM.

443 and 552 Engine Types

If for any reason, ignition timing accuracy is suspected, it can be verified as follows.

NOTE: Ignition timing can not be adjusted (trigger coil is fixed). If ignition timing is not within specifications, a component is either defective or broken.

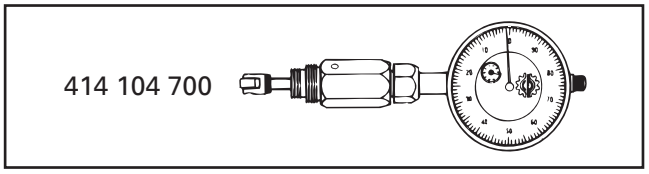
Verifying Magneto Flywheel Timing Mark Position

Prior to checking the timing, it may be necessary to verify the position of the timing mark on the magneto flywheel, for the following reasons:

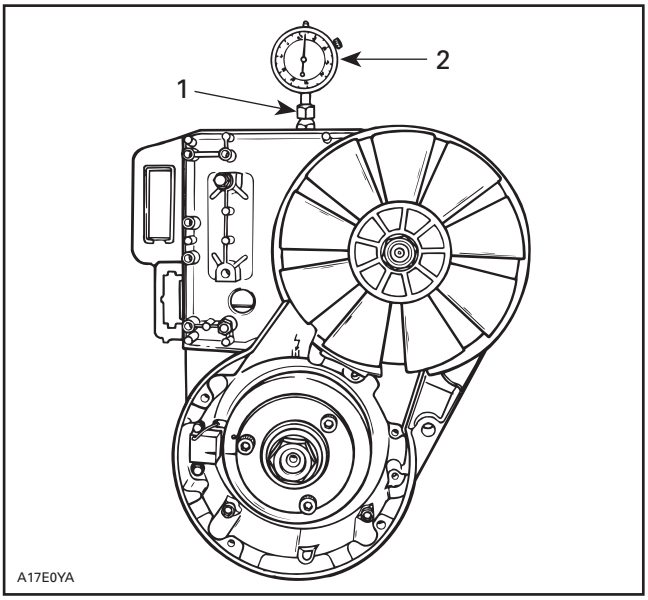
– To detect a missing or broken magneto flywheel Woodruff key which would allow a change of timing to occur, with eventual break down of the engine.
– To correctly locate and mark a timing mark on a new service magneto flywheel.
– To verify the correct location of the factory timing mark.
– To detect a wrong magneto flywheel corresponding to a different engine type.

To verify the position of the timing mark on the magneto flywheel, proceed as follows:

– Clean the area around the spark plugs, and remove them.
– Remove the rewind starter from the engine.
– Install the TDC gauge (P/N 414 104 700) in the spark plug hole (magneto side) and adjust as follows:



- Position the magneto flywheel at approximately TDC.



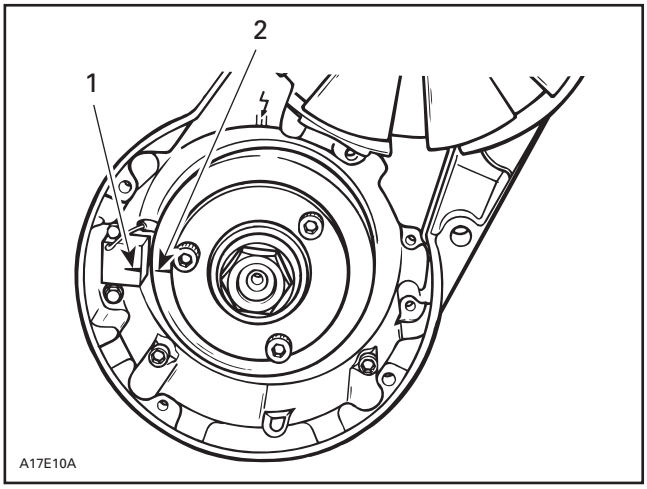
TYPICAL — INSTALLATION OF TDC GAUGE
1. Gauge on MAG side cylinder
2. Adaptor lock nut

- Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.
- Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.
- Position the dial face toward the magneto. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.

– Locate the piston TDC position as follows:
- Slowly rotate the magneto flywheel back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston changes direction.
- Rotate the dial face so that “0” is in line with the needle when it stops moving.
- Again, slowly rotate the magneto flywheel back and forth across TDC and adjust the dial face to “0”, until the needle always stops exactly at “0” before changing direction.
- “0” now indicates exact TDC.
- Verify the position of the timing mark on the magneto flywheel as follows:

NOTE: When checking timing, certain procedures require that the magneto flywheel be turned in a clockwise direction, viewed facing the magneto. If it is necessary to turn back (counterclockwise) for any reason, rotate the magneto flywheel at least one-quarter turn counterclockwise, and then rotate it clockwise. The last magneto flywheel movement when making a critical check must always be in a clockwise direction, to ensure that the slack in engine moving parts is taken-up.

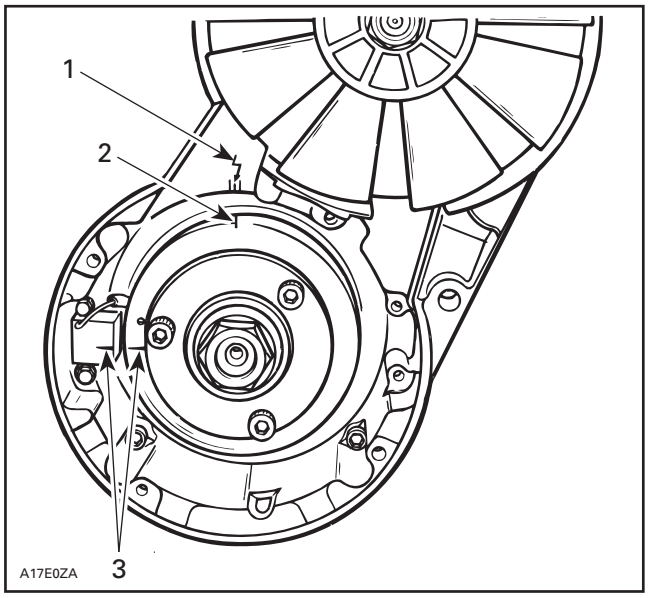
a. Rotate the magneto flywheel counterclockwise, one-quarter turn then carefully rotate it clockwise until the needle indicates the specified measurement. Refer to TECHNICAL DATA.
b. Verify that the magneto flywheel mark perfectly aligns with the mark on the trigger coil, refer to illustration.
c. If the marks do not align, check magneto flywheel and trigger coil part numbers and check Woodruff key condition. If all parts are the appropriate ones and if Woodruff key is in good condition, continue the procedure.



TYPICAL
1. Trigger coil mark
2. Magneto flywheel mark

NOTE: These marks cannot be used to check dynamic (with engine running) ignition timing with a timing light: a new mark must be scribed on magneto flywheel for this purpose.

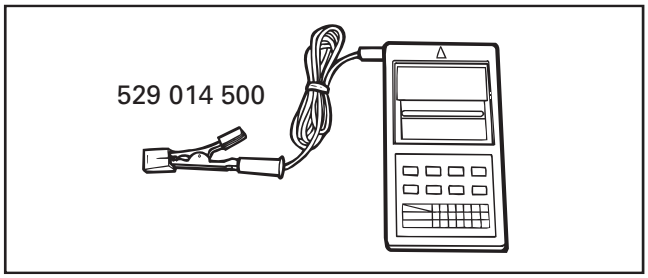
– Scribe a new mark on magneto flywheel as follows.
  - Remove the fan cover from the engine.
  - Maintain magneto flywheel so that previous marks remain aligned.
  - Scribe or punch a mark on magneto flywheel so that it perfectly aligns with the arrow on crankcase, refer to illustration. This new timing mark should be used for future timing checks (dynamic timing).
  - Reinstall rewind starter.
  - Check the timing with a timing light.



TYPICAL
1. Crankcase arrow
2. Scribe a mark here
3. Maintain verified timing marks aligned (static timing)

Checking Ignition Timing

Use a timing light and digital induction type tachometer (P/N 529 014 500).



TACHOMETER

To check the ignition timing, refer to illustration and proceed as follows:

⚠ WARNING

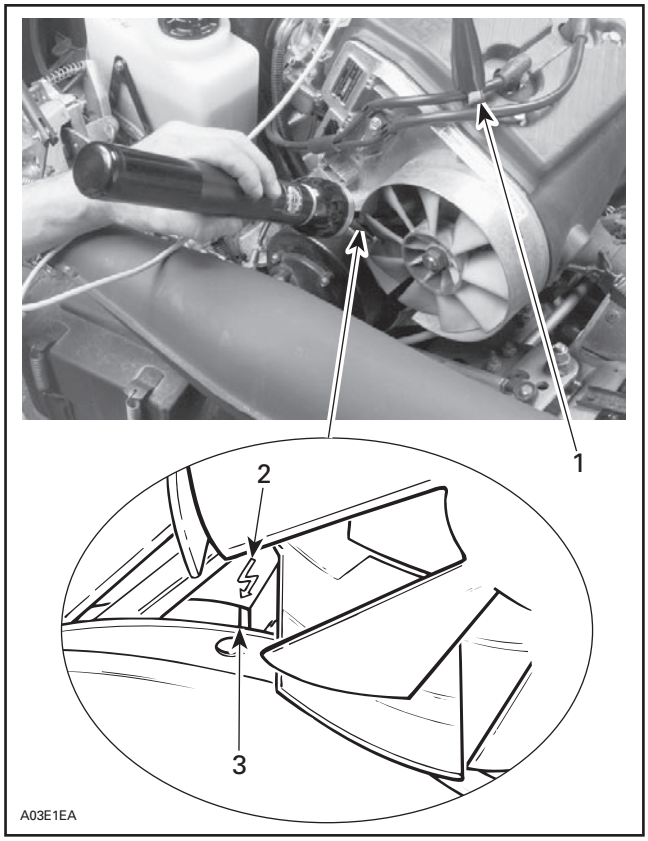
Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

– Connect the timing light pickup to a spark plug cable.

NOTE: To avoid an incorrect reading due to parallax, view the magneto flywheel and the crankcase timing marks in a straight line.

– Connect tachometer wire to spark plug wire or aim tachometer toward spark plug wire without using any connection wire.
– Start the engine and raise the engine speed to 3500 RPM while observing the timing marks, refer to illustration.

NOTE: Ignition timing may be verified when engine speed is anywhere within 3000 - 4000 RPM.



1. Timing light pickup on MAG side
2. Crankcase arrow
3. Magneto flywheel mark

– The magneto flywheel mark scribed previously and the crankcase arrow should be perfectly aligned. If the marks do not align, a faulty trigger coil (check proper grounding of coil), a faulty flywheel, a faulty Woodruff key, a misaligned (twisted) crankshaft or a faulty CDI module could be the cause: substitute one part at a time and recheck timing marks (check connectors condition prior to substituting any part).
– Install parts which were removed.

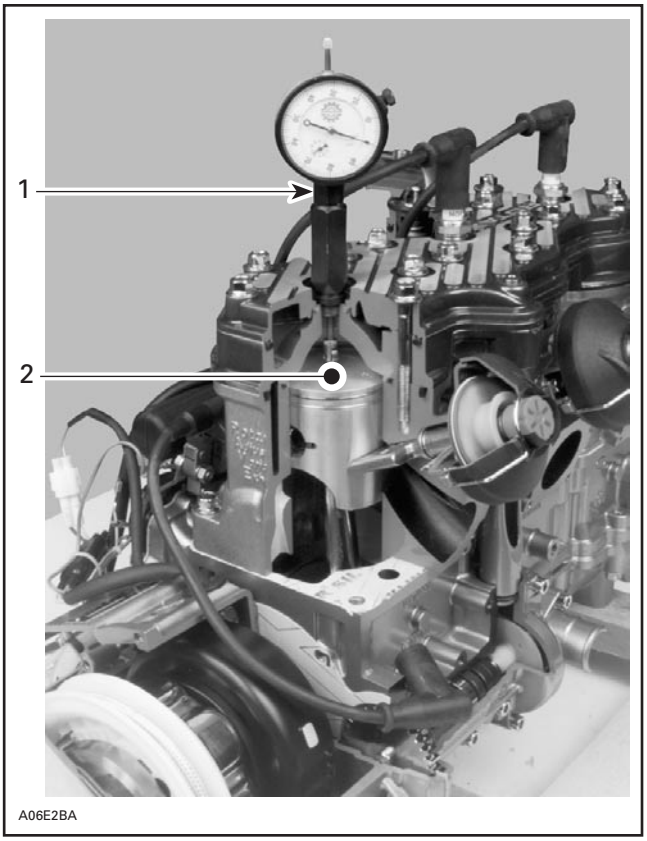
593 and 593 HO SDI Engine Types

Normally ignition timing adjustment should not be required. It has been set at factory and it should remain correctly adjusted since every part is fixed and not adjustable. The only time the ignition timing might have to be changed would be when removing and reinstalling the magneto housing, replacing the crankshaft, the magneto flywheel, the trigger coil or the MPEM. If the ignition timing is found incorrect, first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft. Refer to LEAK TEST AND ENGINE DIMENSION MEASUREMENT. The ignition timing can be checked with either the engine hot or cold. Also, the ignition timing is to be checked at 3500 RPM with a timing light.

NOTE: Between 3000 and 4000 RPM, the spark advance does not change. So when checking ignition timing at 3500 RPM, a change in engine speed within ± 500 RPM will not affect the timing mark when checked with the timing light.

Scribing a Timing Mark

– Clean the area around the MAG spark plug, and remove it.
– Install the TDC gauge (P/N 414 104 700) in the spark plug hole, (magneto side) and adjust as follows:
  • Position the MAG piston at approximately TDC.

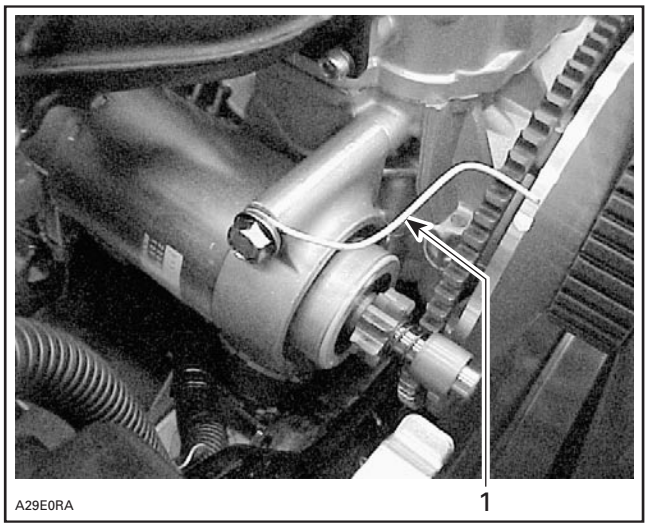


TYPICAL
1. TDC gauge on MAG side
2. MAG side piston at TDC

  • Assemble the gauge to the adaptor and tighten the roller lock nut. Do not tighten the adaptor lock nut.
  • Screw the adaptor into the spark plug hole and tighten to prevent movement in the plug hole.
  • Position the dial face toward the PTO. Move the gauge down until the needle just begins to move, then move down a further 5 or 6 mm (approximately 1/4 in). Tighten adaptor lock nut by hand.
– Locate the piston TDC position as follows:
  • Slowly rotate the drive pulley back and forth across TDC while observing the needle. Note that the needle stops moving only as the piston is changing direction.
  • Rotate the dial face so that "0" is in line with the needle when it stops moving.
  • Again, slowly rotate the drive pulley back and forth across TDC and adjust the dial face to "0", until the needle always stops exactly at "0" before changing direction.

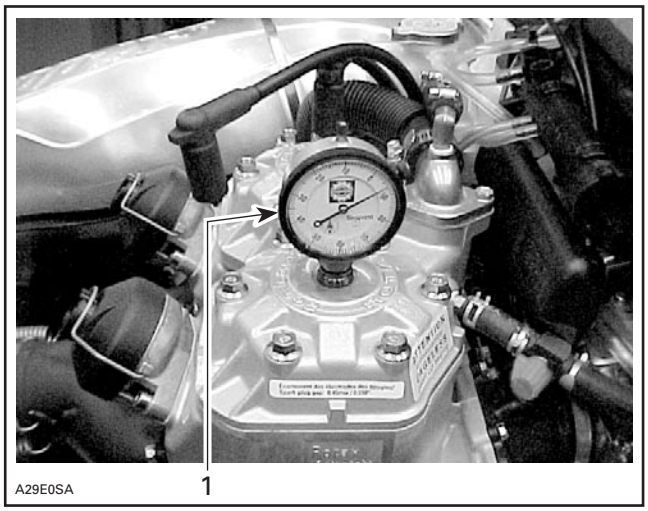
- "0" now indicates exact TDC.

– Rotate the drive pulley clockwise, one-quarter turn then carefully rotate it counterclockwise until the needle indicates the specified measurement, indicated in TECHNICAL DATA.
– Twist a wire as shown and use it as a pointer. Install the wire on upper starter bolt.

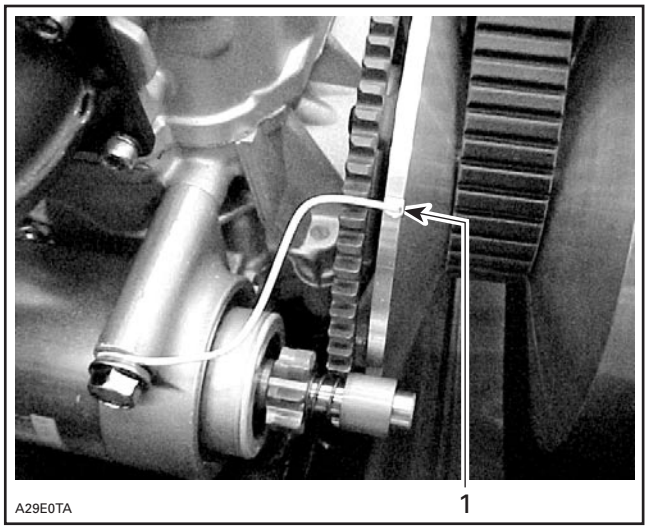


TYPICAL
1. Pointer

– With the TDC gauge indicating specified timing, scribe a mark on drive pulley fixed half in line with pointer end.



TYPICAL
1. TDC gauge indicating specified timing



TYPICAL
1. Timing mark in line with pointer end

Checking Ignition Timing

Use a timing light.

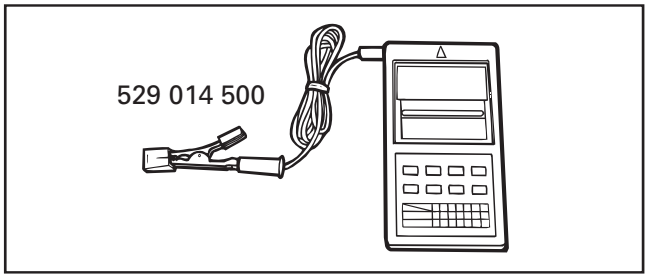
To check the ignition timing, refer to illustration and proceed as follows:

⚠ WARNING

Place ski tips against a wall, raise rear of vehicle on a stand, so that track does not contact the ground. Do not allow anyone in front of or behind the vehicle while engine is running. Keep clear of track and do not wear loose clothing which can get caught in moving parts.

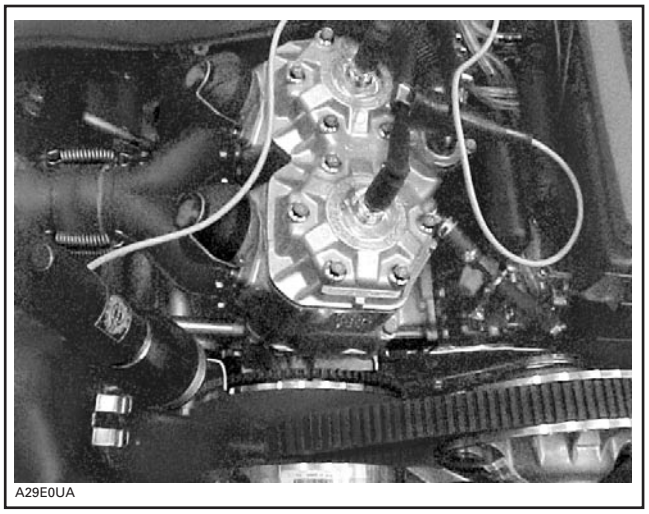
– Connect the timing light pickup to a spark plug cable.

Connect a digital induction type tachometer (P/N 529 014 500).

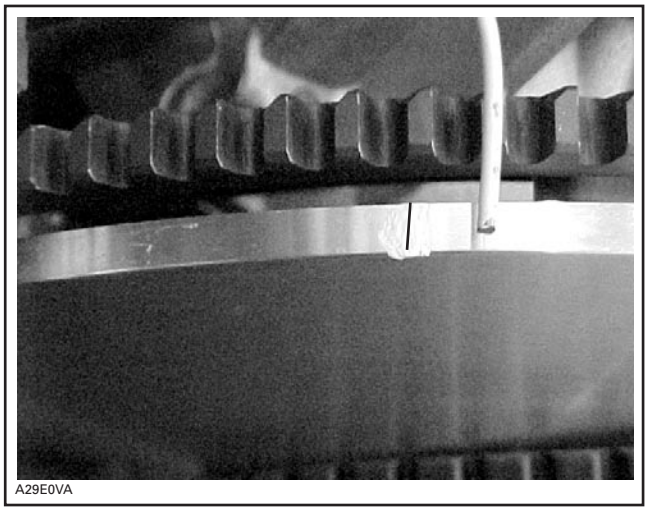


TACHOMETER

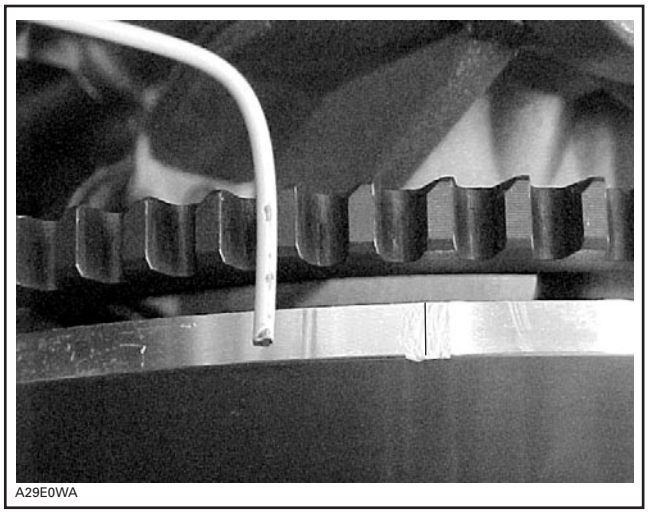
– Start the engine and point timing light on timing mark. Bring engine to 3500 RPM.


A29E0UA

The timing mark must be aligned with pointer end. If such is not the case, note if timing is retarded or advanced. Tolerance is ± 1°.


A29E0VA

TIMING RETARDED BY ABOUT 2°


A29E0WA

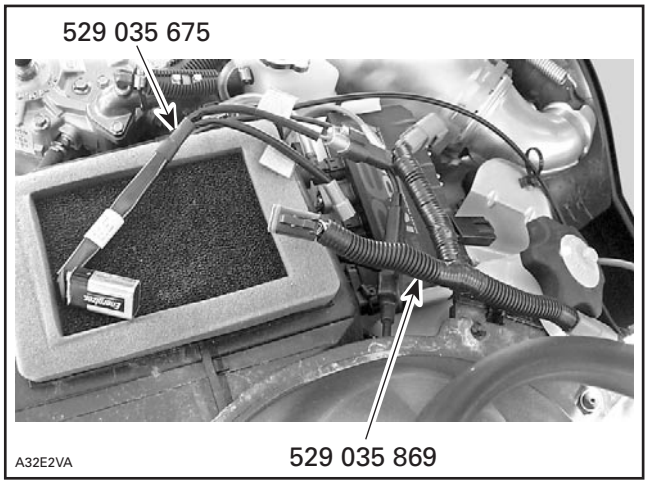
TIMING ADVANCED BY ABOUT 2°

Changing Ignition Timing

593 Engine

Timing can be changed using the MPEM programmer (P/N 529 035 878) or using the Vehicle Communication Kit (VCK) (P/N 529 035 981). See 593 HO SDI engine for more information on the VCK kit or follow the procedure below when using the MPEM programmer.

Connect the 9 volt adapter (P/N 529 035 675) to supply cable (P/N 529 035 869) and supply cable to diagnostic connector.

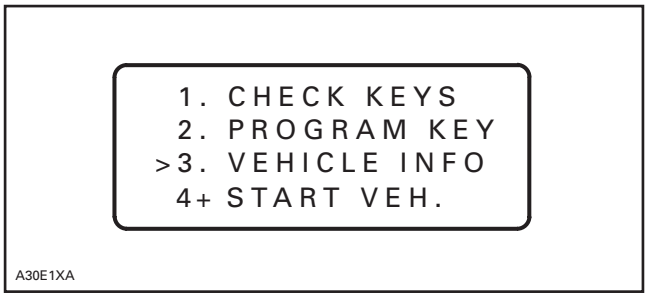


A32E2VA

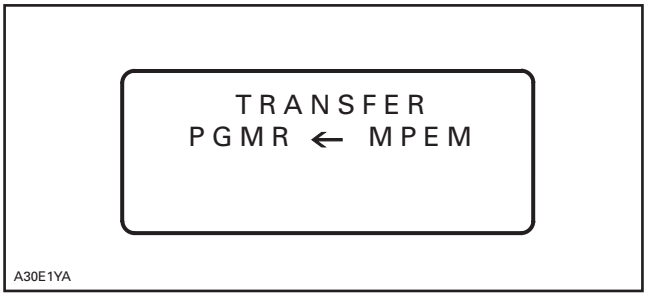
Connect MPEM programmer to DESS post.

Turn on programmer then enter password.

From main menu select no. 3 INFO VEHICLE.



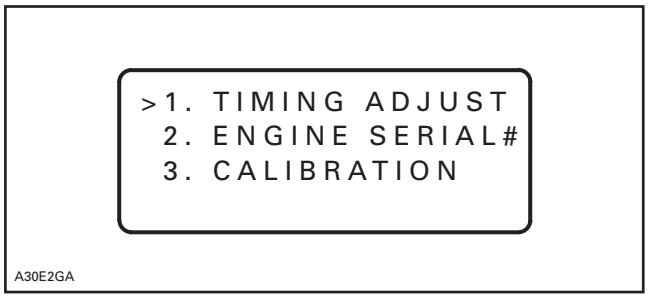
Vehicle information is transferred from MPEM to programmer.



NOTE: In fact the programmer takes a copy of all vehicle parameters scribed in MPEM. This copy will be modified within the programmer then transferred to the MPEM.

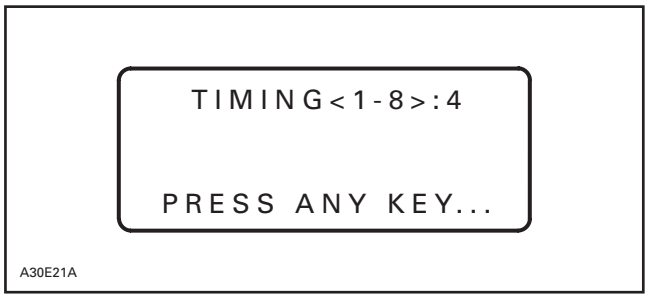
Select no. 4 ENGINE PARAMETER.

Select no. 1 TIMING ADJUSTMENT.



Press ENTER.

Now the display shows the engine timing correction factor that is programmed in the MPEM. In the following example timing correction factor is no. 4.

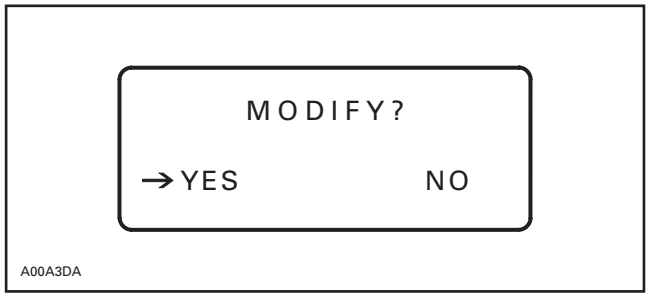


Press any key.

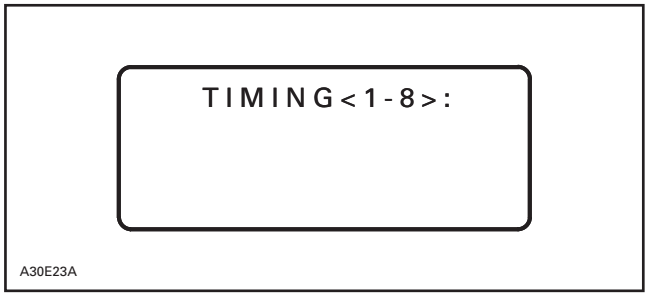
Select YES using the key

←

←



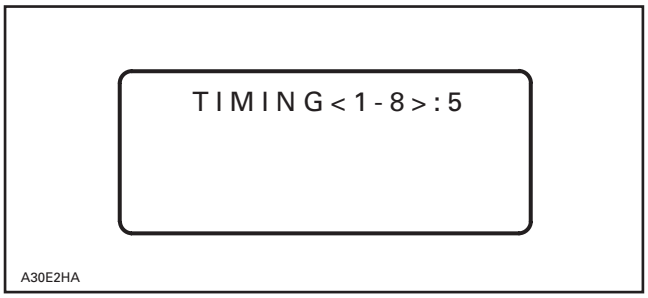
Press ENTER.



Select a timing correction factor corresponding to correction needed.

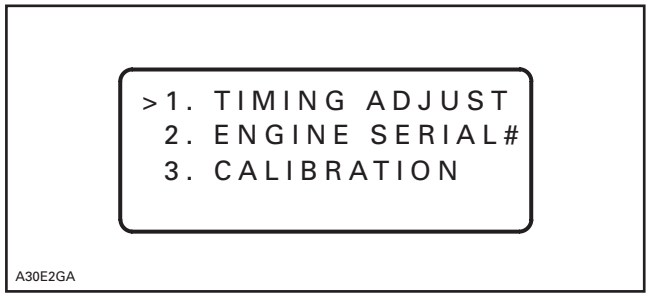
Example: Timing mark as verified with a timing light at 3500 RPM was too early by 2°. The correction factor programmed is no. 4.

Select correction factor no. 5. This will retard the timing by 2° because the difference between correction factor no. 4 and no. 5 is - 2° (passing from 1° to - 1°).

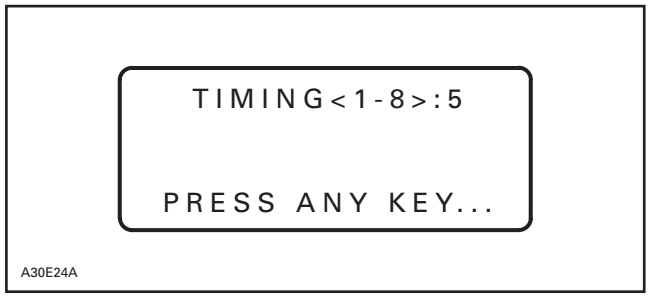


IGNITION CORRECTION FACTOR	
CORRECTION FACTOR PROGRAMMED IN MPEM	IGNITION TIMING CORRECTION
2	3°
3	2°
4	1°
1	0°
5	- 1°
6	- 2°
7	- 3°
8	- 4°

Press ENTER.

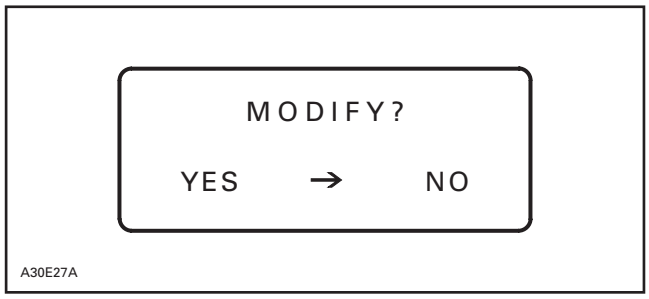


Press ENTER.

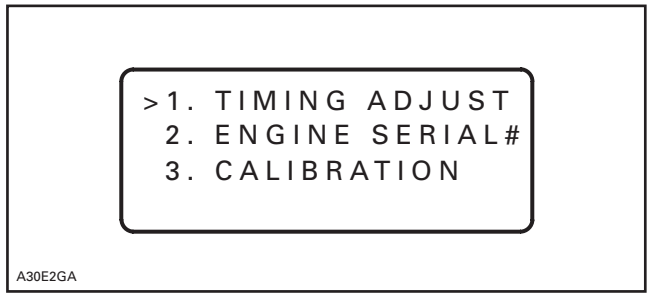


The display confirms that correction factor has been changed to no. 5.

Press any key.

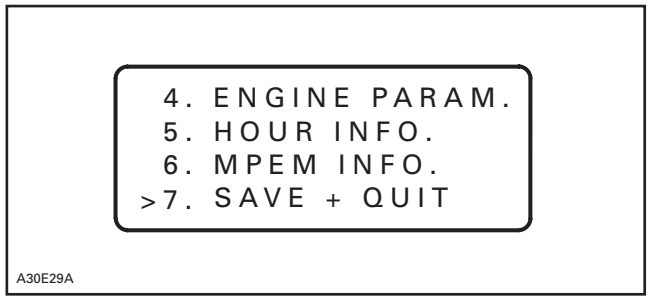


If the new correction factor selected above is the good one select NO and press ENTER. Otherwise select YES to choose an other correction factor.

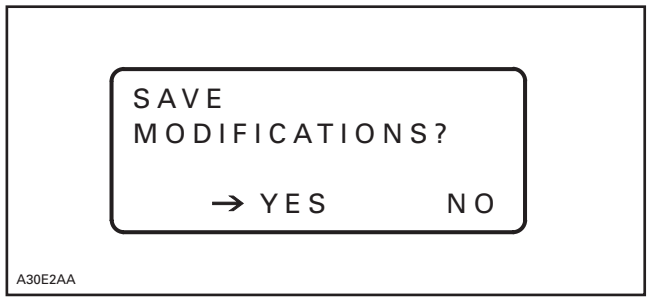


Press MENU.

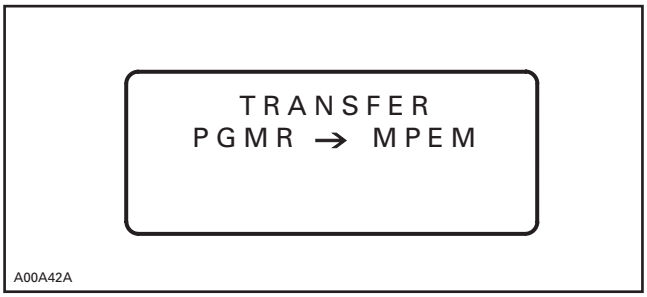
Scroll to no. 7 SAVE AND QUIT.



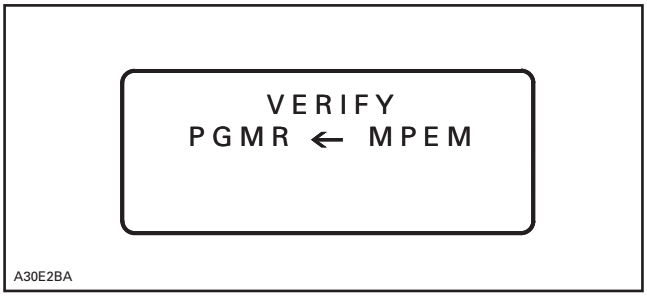
Press ENTER.



Press ENTER.

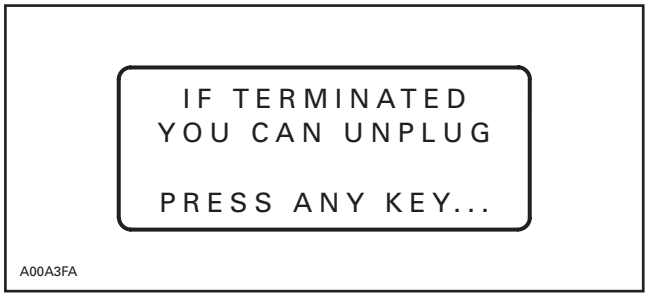


During a very short period of time the following message will appear.

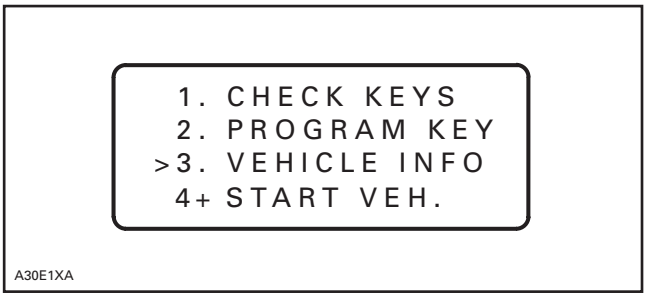


After the programmer has verified, following message will appear.

Press any key.



Press any key.

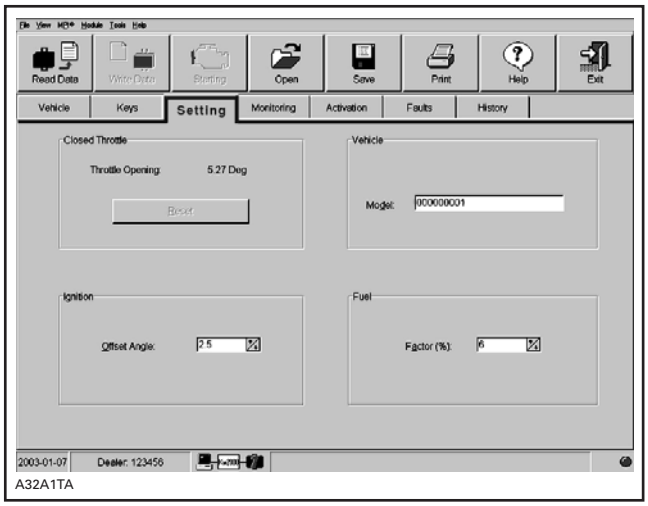


Unplug supply cable and 9-volt adaptor.

593 HO SDI Engine

To change the ignition timing on the 593 HO SDI, the Vehicle Communication Kit (VCK) (P/N 529 035 981) is mandatory. The MPEM programmer can not be used.

Look under the Setting tab of the BUDS software to change the ignition timing.



Detailed information about the BUDS software and its usage is available under the HELP tab.

SPARK PLUGS

SERVICE PRODUCTS

Description	Part Number	Page
anti-seize lubricant	293 800 070	436

NGK SPARK PLUG

All Models

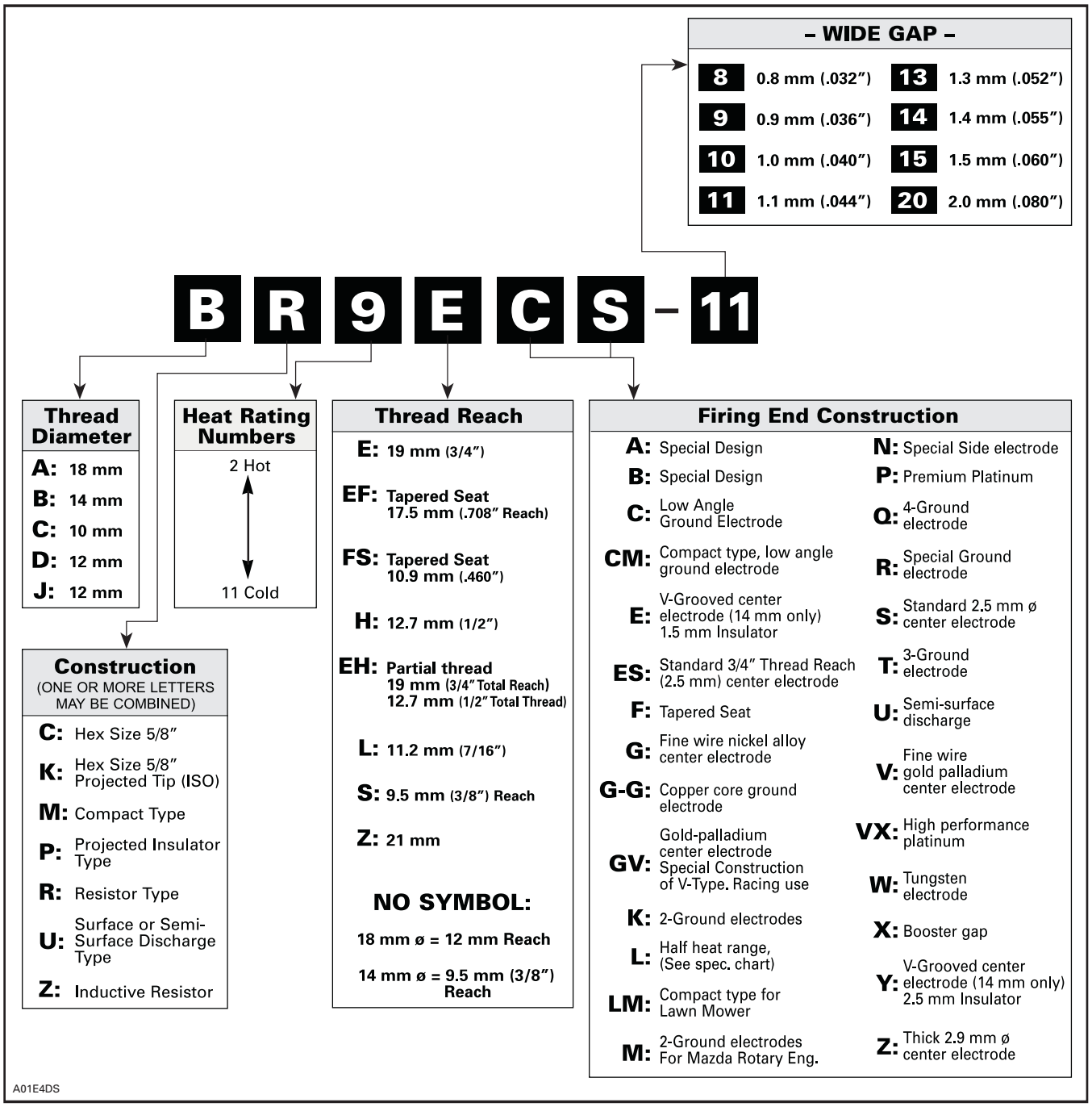
NGK SPARK PLUG NUMBERING SYSTEM

BRP uses NGK brand spark plugs on all its snowmobile models.

The heat range identification system is:

Low number	→	hot plug
High number	→	cold plug

DESIGN SYMBOLS USED IN NGK SPARK PLUGS



DISASSEMBLY

First unscrew the spark plug 1 turn.

Clean the spark plug and cylinder head with pressurized air, then completely unscrew.

⚠ WARNING

Whenever using compressed air, always wear protective eye wear.

HEAT RANGE

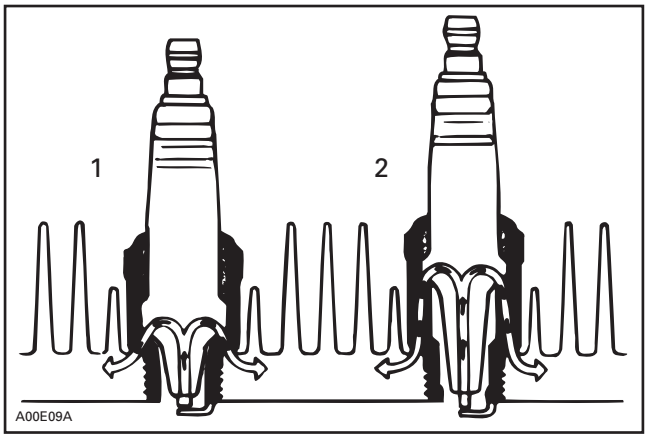
The proper operating temperature or heat range of the spark plugs is determined by the spark plug ability to dissipate the heat generated by combustion.

The longer the heat path between the electrode tip to the plug shell, the hotter the spark plug operating temperature will be — and inversely, the shorter the heat path, the colder the operating temperature will be.

A cold type plug has a relatively short insulator nose and transfers heat very rapidly into the cylinder head.

Such a plug is used in heavy duty or continuous high speed operation to avoid overheating.

The hot type plug has a longer insulator nose and transfers heat more slowly away from its firing end. It runs hotter and burns off combustion deposits which might tend to foul the plug during prolonged idle or low speed operation.



1. Cold
2. Hot

CAUTION: Severe engine damage might occur if a wrong heat range plug is used.

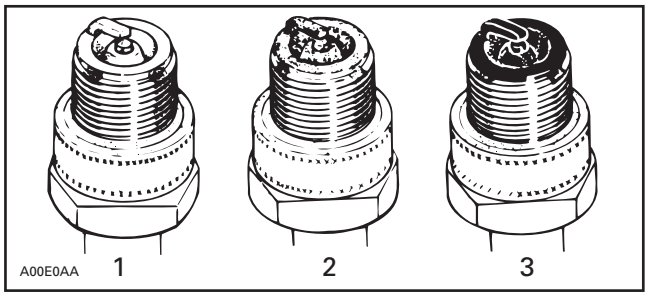
A too hot plug will result in overheating and pre-ignition, etc.

A too cold plug will result in fouling (shorting the spark plug) or may create carbon build up which can heat up red-hot and cause pre-ignition or detonation.

FOULING

Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is due to a loss of compression. Other possible causes are: prolonged idling, or running on a too rich mixture due to a faulty carburetor adjustment or incorrect fuel and/or fuel mixing. The plug face of a fouled spark plug has either a dry coating of soot or an oily, glossy coating given by an excess either of oil or of oil with soot. Such coatings form a conductive connection between the center electrode and ground.

SPARK PLUG ANALYSIS



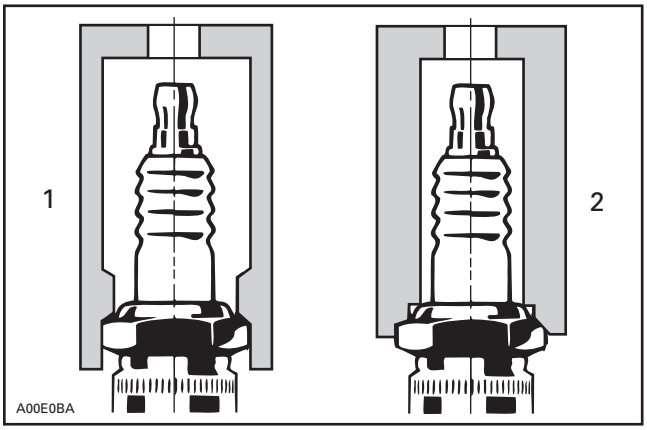
1. Overheated (light grey)
2. Normal (brownish)
3. Fouled (black)

The plug electrode and piston dome reveal the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at regular intervals, examining the plug electrode and the piston dome.

SPARK PLUG INSTALLATION

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

1) Using a wire feeler gauge, set electrode gap according to TECHNICAL DATA.
2) Apply anti-seize lubricant (P/N 293 800 070) over the spark plug threads to prevent possible seizure.
3) Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



1. Proper socket
2. Improper socket

SPARK PLUG TIGHTENING TORQUE

MODELS	SPARK PLUGS	TORQUE N•m (lbf•ft)
All models	NGK	27 (20)

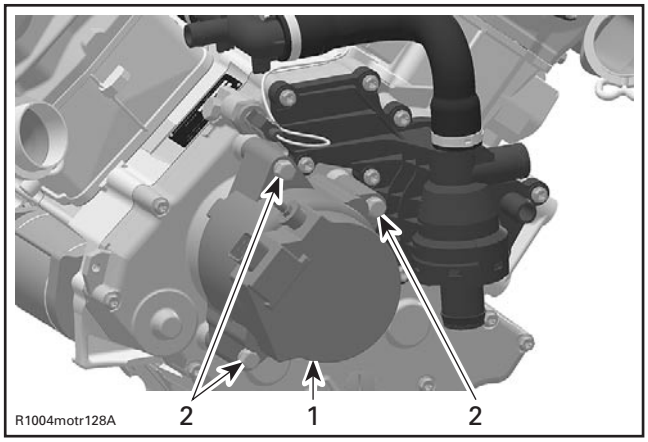
ALTERNATOR

The alternator is located on the ignition cover on the engine right hand side (alternator side).

REMOVAL

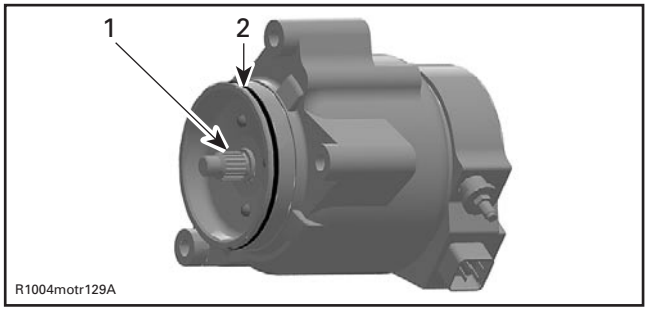
Remove:

– alternator cable
– alternator plug
– alternator screws and pull alternator.



1. *Alternator*
2. *Three screws*

INSPECTION



1. *Drive gear splines*
2. *O-ring*

NOTE: The alternator does not require any maintenance and must not be opened for repair work.

Inspect the housing, O-ring and the alternator drive gear splines for damage or wear. In case of damage, the alternator must be replaced. The alternator can only be replaced as a complete assembly.

INSTALLATION

The installation is the reverse of removal procedure. Pay attention to the following details.

NOTE: At assembly replace the O-ring of the alternator. Grease the drive gear splines and the O-ring before assembly using multi purpose grease. This will ease assembly and prevent displacement of the gasket during installation.

If it is not possible to move the alternator into the guide, this is due to the position of the drive gear. Pull the alternator out once more, slightly rotate the drive gear and try again.

Torque alternator screws to 23 N•m (17 lbf•ft).

BATTERY

SERVICE TOOLS

Description	Part Number	Page
crimp pliers	529 035 730	447

SERVICE PRODUCTS

Description	Part Number	Page
protective heat shrink rubber tube	278 001 692	448
silicone dielectric grease	293 550 004	442, 447

GENERAL

All Models Except Skandic LT E

Sealed valve regulated lead acid (VRLA) battery are used. They are non-spillable and maintenance reduced — no electrolyte level to be checked and readjusted. No ventilation tube is attached to the battery.

MODEL	SUPPLIER P/N	BRP P/N
2-stroke	YTX20L-BS	410 301 203
4-stroke	YTX24HL-BS	410 922 962

REMOVAL

⚠ WARNING

Battery BLACK negative cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Expedition TUV

NOTE: Battery is located under the seat.

Unhook battery cover strap from its support.

Open battery cover.

Remove battery.

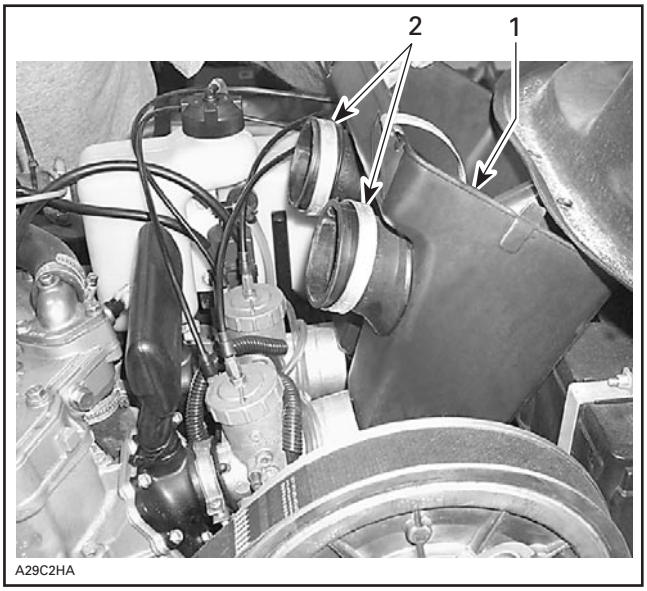
All Models Except Expedition TUV

Before removing battery, remove air silencer to get access to the battery.

Unlock the spring lock and remove intake cover and tube plate from the air silencer.

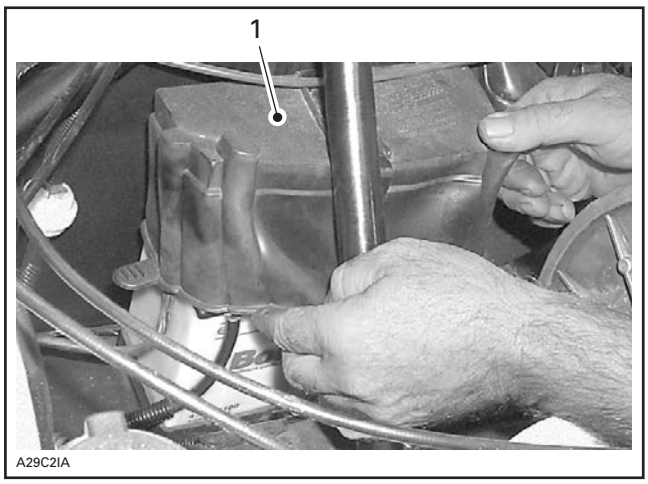
Remove pulley guard to get access to air intake adaptor collars clamps of air silencer.

Loose clamps and remove air silencer.



TYPICAL
1. *Air silencer (cover and tube plate removed)*
2. *Collars loosened*

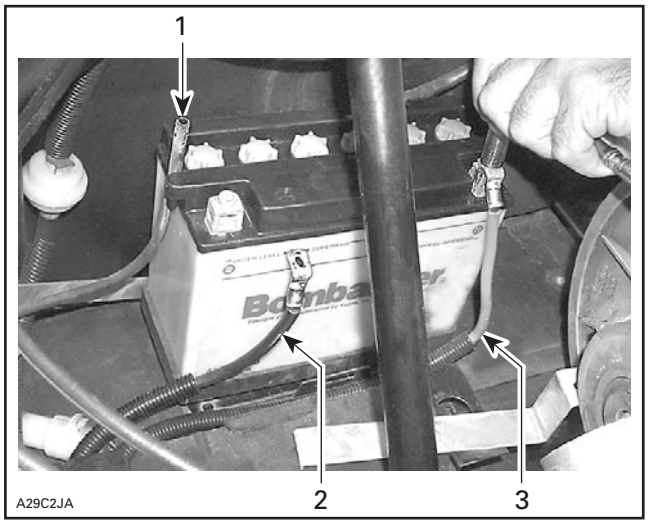
Unbolt battery cover steel strip and remove battery cover.



TYPICAL
1. Battery cover

Unplug vent tube (if applicable) from battery vent nipple.

Disconnect the black negative cable first followed by red cable and remove battery.



TYPICAL
1. Vent tube (if applicable)
2. Black negative cable
3. Red cable

Remove battery from vehicle.

NOTE: On some models, be careful not to lean the battery so that electrolyte flows out of vent tube.

CAUTION: Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water to prevent damage to vehicle components.

CLEANING

Clean the battery, battery casing, vent tube, caps, cables and battery posts using a solution of baking soda and water.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Battery top should be cleaned by soft brush and any grease-cutting soap or baking soda solution.

Skandic LT E

CAUTION: Do not allow cleaning solution to enter battery interior since it will destroy the electrolyte.

INSPECTION

All Models

Visually inspect battery casing for cracks or other possible damage. Discoloration, warping or raised top, indicates that battery has overheated or been overcharged. If casting is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

⚠ WARNING

Should the battery casing be damaged, wear a suitable pair of non-absorbent gloves when removing the battery by hand.

Inspect battery posts for security of mounting.

Inspect for cracked or damaged battery caps, replace defective caps.

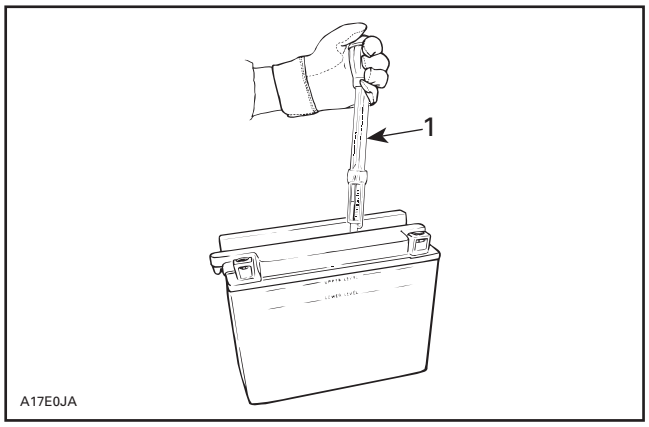
⚠ WARNING

Battery caps do not have vent holes. Make sure that vent tube is not obstructed.

BATTERY CHARGE TESTING

Skandic LT E

Hydrometer Test



1. Specific gravity 1.265

A hydrometer measures the charge of a battery in terms of specific gravity of the electrolyte. Most hydrometers give a true reading at 25°C (77°F).

In order to obtain correct readings, adjust the initial reading by adding .001 to the hydrometer readings for each 2°C (3°F) above 25°C (77°F) and by subtracting .001 for every 2°C (3°F) below 25°C (77°F).

This chart will be useful to find the correct reading.

ELECTROLYTE TEMPERATURE		OPERATION TO PERFORM		
°C	°F			
38	100	ADD	.008	TO THE READING
32	90		.003	
25	**77**	**correct reading**		
21	70	subtract	.002	from the reading
16	60		005	
10	50		009	
4	40		012	
- 1	30		016	
- 7	20		019	
- 12	10		022	
- 18	0		026	
- 23	- 10		029	
- 29	- 20		032	
- 34	- 30		036	
- 40	- 40		039	

EXAMPLE **no. 1** Temperature below 25°C (77°F): Hydrometer Reading: 1.250 Electrolyte temperature: - 7°C (20°F) Subtract .019 Sp. Gr. Corrected Sp. Gr. is 1.231

EXAMPLE **no. 2** Temperature above 25°C (77°F): Hydrometer Reading: 1.235 Electrolyte temperature: 38°C (100°F) Add .008 Sp. Gr. Corrected Sp. Gr. is 1.243

TEMPERATURE CORRECTED SPECIFIC GRAVITY	BATTERY CHARGE
1.265	Fully charged
1.215	3/4 charged
1.165	1/2 charged
1.125	1/4 charged
1.110	Discharged

CAUTION: Do not install a partially charged battery on a snowmobile since the casing might crack at freezing temperature. The following chart shows the freezing point of the electrolyte in relation to the temperature corrected specific gravity.

TEMPERATURE CORRECTED SPECIFIC GRAVITY	FREEZING POINT OF ELECTROLYTE	
1.265	- 59°C	(- 75°F)
1.225	- 37°C	(- 35°F)
1.200	- 27°C	(- 17°F)
1.150	- 15°C	(+ 5°F)
1.110	- 3°C	(+ 27°F)

Voltmeter Test

Skandic WT/SWT/SUV/Expedition TUV

NOTE: To determine the battery state of charge, these sealed batteries have to be tested with a voltmeter. They also need to be tested when their voltage is stabilized. Disconnect battery to have open connectors and wait 1-2 hours prior to reading the voltage. The same condition is required after a battery has been charged.

Batteries with a voltage above 12.8 V do not need to be charged.

Batteries with a voltage of 12.8 V and below need to be charged. Refer to BATTERY CHARGING below.

BATTERY STORAGE

Skandic LT E

Disconnect and remove battery from the vehicle.

Check electrolyte level in each cell, add distilled water up to upper level line.

CAUTION: Do not overfill.

The battery must always be stored in fully charged condition. If required, charge until specific gravity of 1.265 is obtained.

CAUTION: Battery electrolyte temperature must not exceed 50°C (122°F). The casing should not feel hot.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of silicone dielectric grease (P/N 293 550 004) or petroleum jelly on terminals.

Clean battery casing and caps using a solution of baking soda and water. Do not allow cleaning solution to enter battery, otherwise it will destroy the electrolyte. Rinse battery with clear water and dry well using a clean cloth.

Store battery in a cool dry place. Such conditions reduce self-discharging and keep fluid evaporation to a minimum.

During the storage period, recheck electrolyte level and specific gravity readings at least every 40 days. As necessary, keep the battery at its upper level line and near full charge as possible (trickle charge).

Skandic WT/SWT/SUV/Expedition TUV

CAUTION: A discharged battery will freeze and it may damage its casing. A damaged casing will allow electrolyte spillage that may damage surrounding parts.

Disconnect and remove battery from the vehicle.

The battery must always be stored in fully charged condition.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of silicone dielectric grease (P/N 293 550 004) or petroleum jelly on terminals.

Clean battery casing using a solution of baking soda and water. Rinse battery with clear water and dry well using a clean cloth.

Charge the battery every month if stored at a temperature below 15°C (60°F).

Charge the battery every two weeks if stored at a temperature above 15°C (60°F).

ACTIVATION OF NEW BATTERY

Skandic WT/SWT/SUV/Expedition TUV

Refer to the instructions provided with the battery.

Skandic LT E

⚠ WARNING

Never charge or boost battery while installed on vehicle.

CAUTION: Prior to charging the battery, always remove it from the vehicle to prevent electrolyte spillage.

A new battery is factory fresh dry charged. For storage purposes, it is fitted with a temporary sealing tube.

Do not remove the sealing tube or loosen battery caps unless activation is desired.

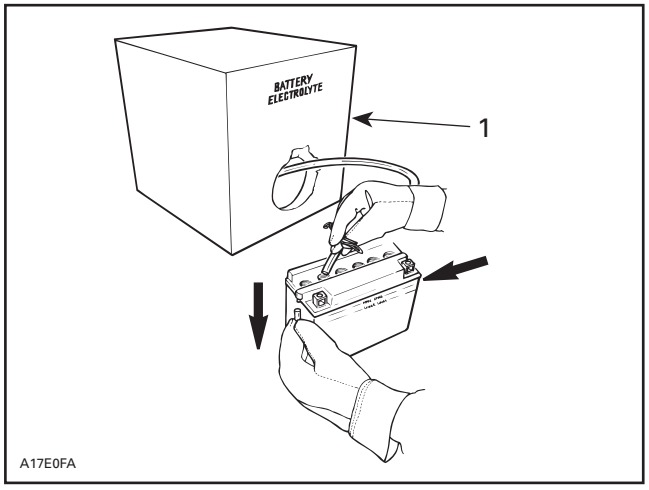
In case of accidental premature removal of caps or sealing tube, battery should be given a full charge.

Perform the following operations anytime a new battery is to be installed.

– Remove the sealing tube from the vent elbow. Install vent tube, included in the battery kit, to battery elbow.

⚠ WARNING

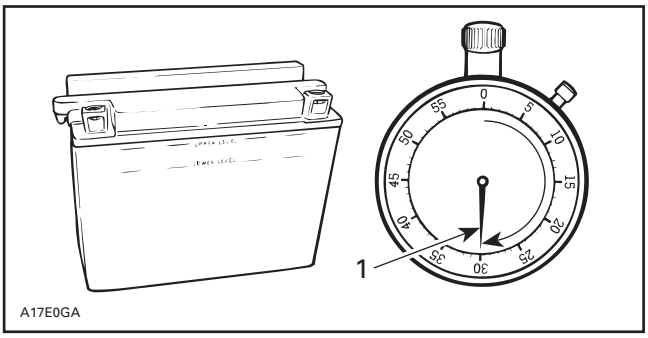
Failure to remove the sealing tube could result in an explosion.



1. Battery electrolyte

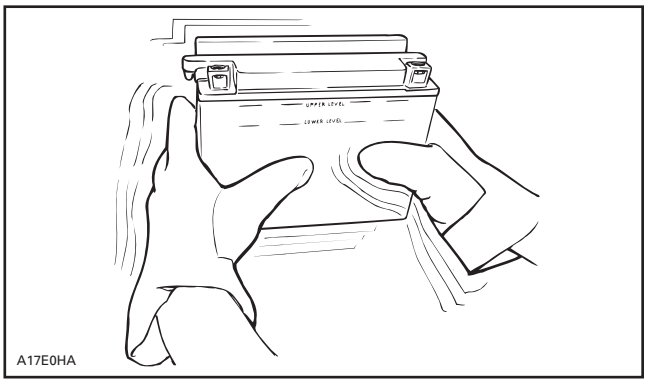
– Remove caps and fill battery to UPPER LEVEL line with electrolyte (specific gravity : 1.265 at 20°C (68°F)).

– Allow the battery to stand for 30 minutes MINIMUM (1 hour MAXIMUM) so that electrolyte soaks through battery cells.

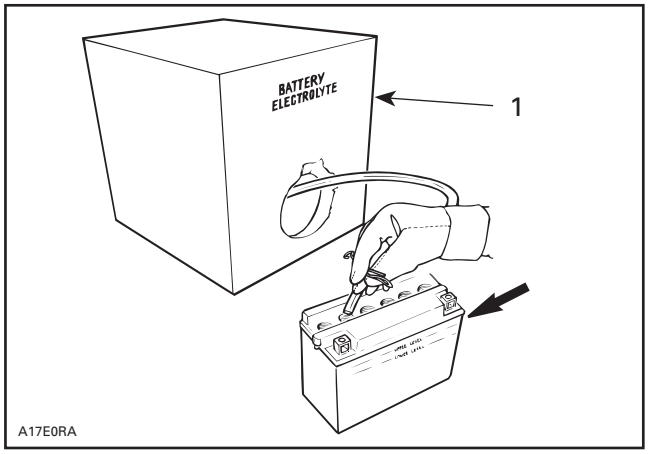


1. 30 minutes

– Allow gas bubbles to escape by lightly shaking battery by hand.

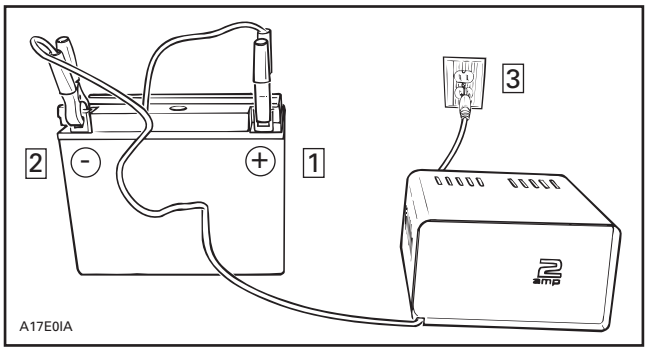


– Readjust the electrolyte level to the UPPER LEVEL line.



1. Battery electrolyte

– Connect a 2 A battery charger for 10 to 20 hours.

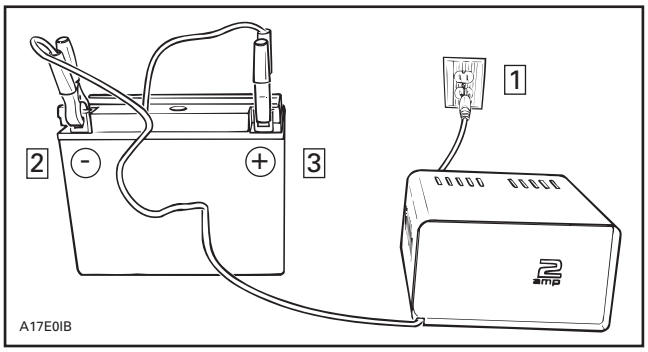


CAUTION: If charging rate raises higher than 2.4 A reduce it immediately. If cell temperature rises higher than 50°C (122°F) (if the casing feels hot) discontinue charging temporarily or reduce the charging rate.

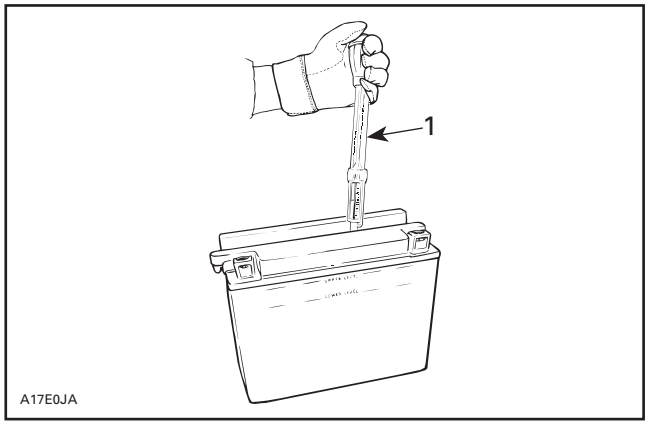
⚠ WARNING

Gases given off by a battery being charged are highly explosive. Always charge in a well ventilated area. Keep battery away from cigarettes or open flames. Always turn battery charger off prior to disconnecting cables. Otherwise a spark will occur and battery might explode.

– Disconnect battery charger.

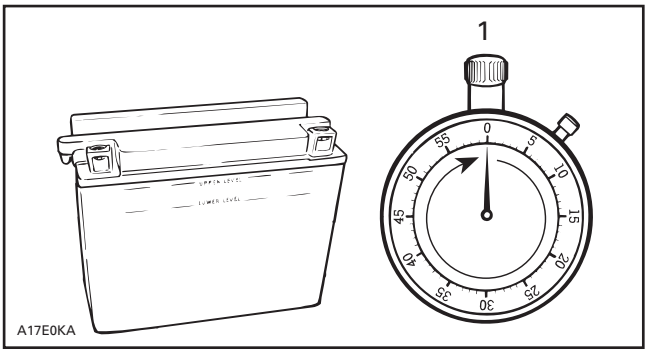


– Test battery state of charge. Use a hydrometer.



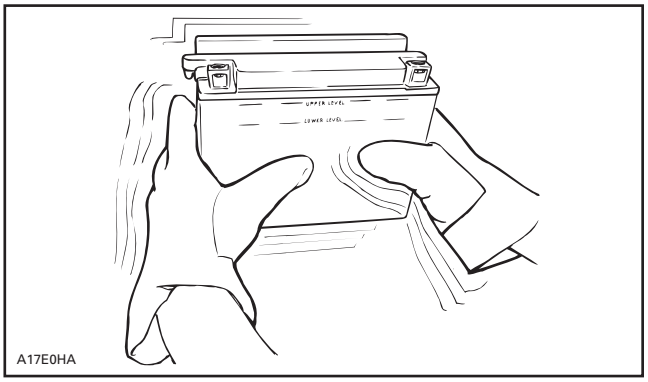
1. Specific gravity 1.265

– Let battery settle for 1 hour.

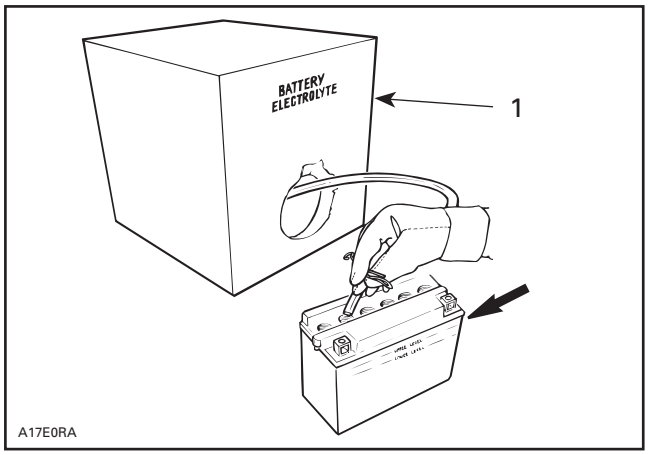


1. 60 minutes

– Allow gas bubbles to escape by lightly shake battery.

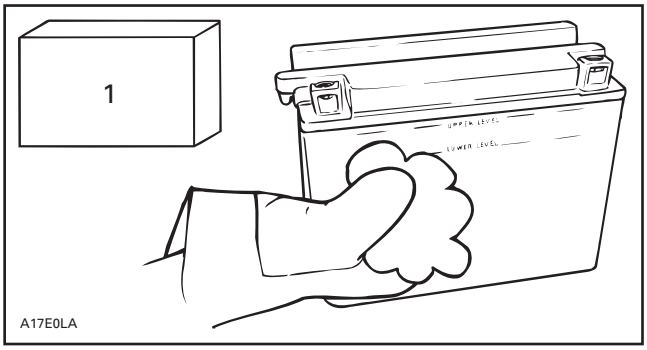


– Readjust electrolyte level.



1. Battery electrolyte

– Reinstall caps and clean any electrolyte spillage using a solution of baking soda and water.



1. Baking soda

CAUTION: Do not allow cleaning solution to enter battery interior since it will destroy the electrolyte.

NOTE: It is recommended to verify the battery charge once a month. If necessary, fully charge battery.

SERVICING

Electrolyte Level

Skandic LT E

Since a battery has been activated (see above), add distilled water to top up electrolyte.

BATTERY CHARGING

Tips for Charging a Used Battery

Skandic LT E

CAUTION: Prior to charging the battery, always remove it from the vehicle to prevent electrolyte spillage.

For best results, battery should be charged when the electrolyte and the plates are at room temperature. A battery that is cold may not accept current for several hours after charging begun.

Do not charge frozen battery. If the battery charge is very low, the battery may freeze. If it is suspected to be frozen, keep it in a heated area for about 2 hours before charging.

⚠ WARNING

Do not place battery near open flame.

Time required to charge a battery will vary depending some factors such as:

– Battery temperature: Charging time is increased as the temperature goes down. The current accepted by a cold battery will remain low. As the battery warms up, it will accept a higher rate of charge.
– State of charge: Because the electrolyte is nearly pure water in a completely discharged battery, it cannot accept current as well as electrolyte. This is the reason the battery will not accept current when the charging cycle first begins. As the battery remains on the charger, the current from the charger causes the electrolytic acid content to rise which makes the electrolyte a better conductor and then, the battery will accept a higher charging rate.
– Type of charger: Battery chargers vary in the amount of voltage and current that they can supply. Therefore, time required for the battery to begin accepting measurable current will also vary.

Charging a Very Flat or Completely Discharged Battery

Skandic LT E

Unless this procedure is properly followed, a good battery may be needlessly replaced.

– Measure the voltage at the battery posts with an accurate voltmeter. If it is below 10 volts, the battery will accept current at very low rate, in term of milliamperes, because electrolyte is nearly pure water as explained above. It could be some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will seem not to accept any charge.
– Only for this particular case, set the charger to a high rate.

NOTE: Some chargers have a polarity protection feature which prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. This will make it appear that the battery will not accept a charge. Follow the charger manufacturer's instruction telling how to bypass or override this circuitry so that the charger will turn on and charge a low-voltage battery.

– Since the battery chargers vary in the amount of voltage and current they provide, the time required for the battery to accept measurable charger current might be up to approximately 10 hours or more.
– If the charging current is not up to a measurable amount at the end of about 10 hours, the battery should be replaced.
– If the charging current is measurable before the end or at the end of about 10 hours, the battery is good and charging should be completed in the normal manner as specified in Activation of a new battery.
– It is recommended that any battery recharged by this procedure be load tested prior to returning it to service.

All Except Skandic LT E

⚠ WARNING

Always wear safety glasses and charge in a ventilated area. Never charge or boost battery while installed on vehicle. Do not open the sealed caps during charging. Do not place battery near open flame.

CAUTION: If battery becomes hot, stop charging and allow it to cool before continuing.

NOTE: Sealed VRLA batteries have an internal safety valve. If battery pressure increases due to overcharging, the valve opens to release excess pressure, preventing battery damage.

Perform BATTERY CHARGE TESTING above then proceed as described here.

An automatic charger is the fastest and most convenient way for error-proof charging.

NOTE: If battery cannot be recharged using the following charging chart, replace battery.

When using a constant current charger, charge battery according to the chart below.

Battery Voltage Below 12.8 V

STANDARD CHARGING (RECOMMENDED)		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	4 – 9 hours	2 A
YTX24HL-BS	5 – 10 hours	

QUICK CHARGING		
BATTERY TYPE	TIME	CHARGE
YTX20L-BS	50 minutes	10 A
YTX24HL-BS	1 hour	

INSTALLATION OF BATTERY

Skandic LT E

Ensure vent tube is properly installed on battery elbow.

Connect vent tube to vehicle fitting on front frame.

All Except Skandic LT E

Route RED positive cable behind retaining strip and connect it to positive battery terminal. Connect RED wire (coming from ignition switch).

Connect BLACK negative cable LAST.

⚠ WARNING

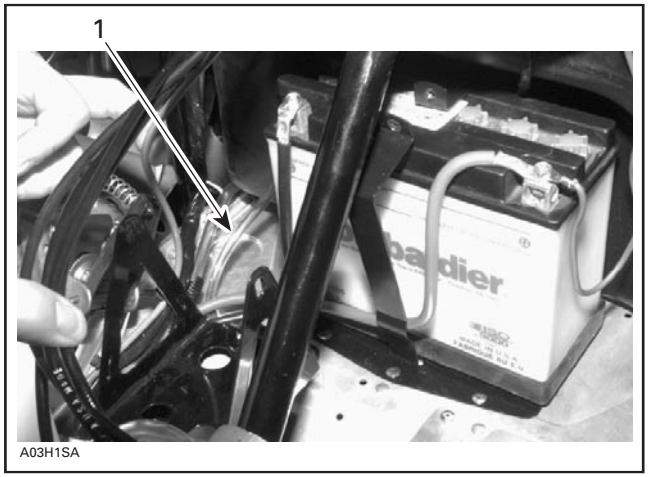
Battery BLACK negative cable must always be disconnected first and connected last.

⚠ WARNING

Never charge or boost battery while installed on vehicle.

Apply silicone dielectric grease (P/N 293 550 004) on battery posts and connectors.

All Models Except Expedition TUV



TYPICAL — BATTERY CONNECTION
1. Vent tube on fitting (if applicable)

Ensure that vent tube is not kinked or blocked then install battery cover over battery (if applicable).

Close and fasten retaining strips.

Reinstall air silencer and pulley guard.

Expedition TUV

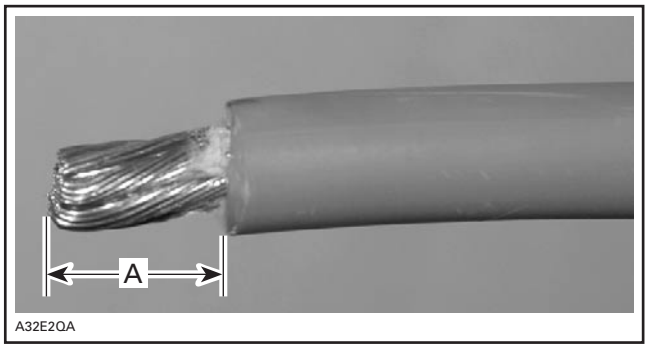
Properly position the battery on its rack.

Close battery cover.

Secure cover with rubber strap.

CABLE TERMINAL INSTALLATION

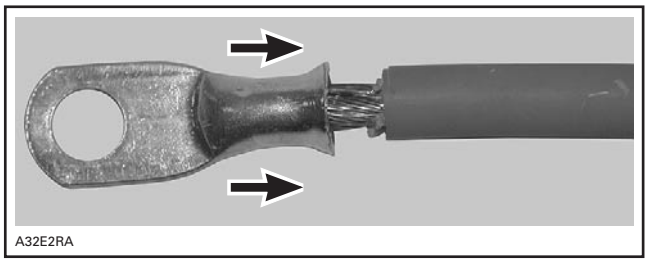
Carefully strip the wire approximately to 10 mm (1/2 in) in length, using a wire stripping tool or sharp blade/knife.



A. 10 mm (1/2 in)

NOTE: Make sure not to cut wire strands while stripping the wire.

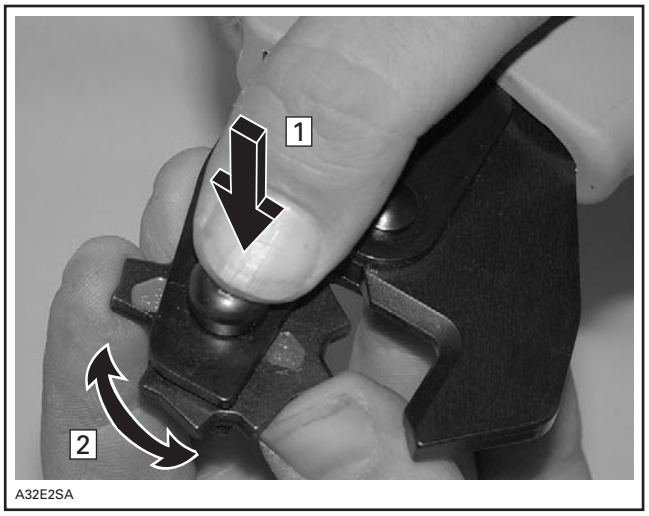
Install the appropriate terminal on the wire according to the requirement. Refer to appropriate parts catalog.



INSTALLATION OF TERMINAL

Follow the instructions provided with the crimp pliers (P/N 529 035 730) to select the proper position of the tool.

NOTE: Different wires require different crimp pliers settings, so make sure to follow the instruction supplied with the tool.



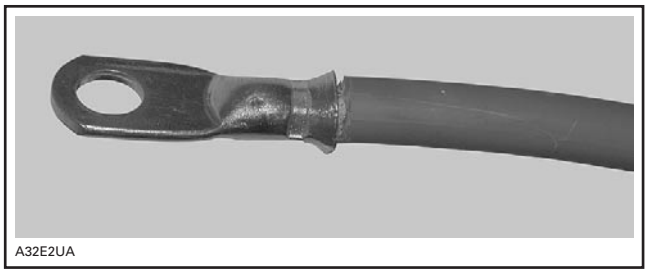
A32E2SA

POSITIONING THE CRIMP PLIERS
Step 1 : Press
Step 2 : Rotate

After positioning the crimp pliers, crimp the terminal already installed on wire.

A32E2TA

CRIMPING OF WIRE


A32E2UA

PROPERLY CRIMPED WIRE

To verify, if the wire is properly crimped, apply some pulling force on wire and the terminal at the same time from both directions.

CAUTION: Never weld the wire to the terminal. Welding can change the property of the wire and it can become brittle and break.

Install the protective heat shrink rubber tube (P/N 278 001 692) on the terminal. Heat the shrink rubber tube using a heat gun so that it grasps the wire and the terminal.

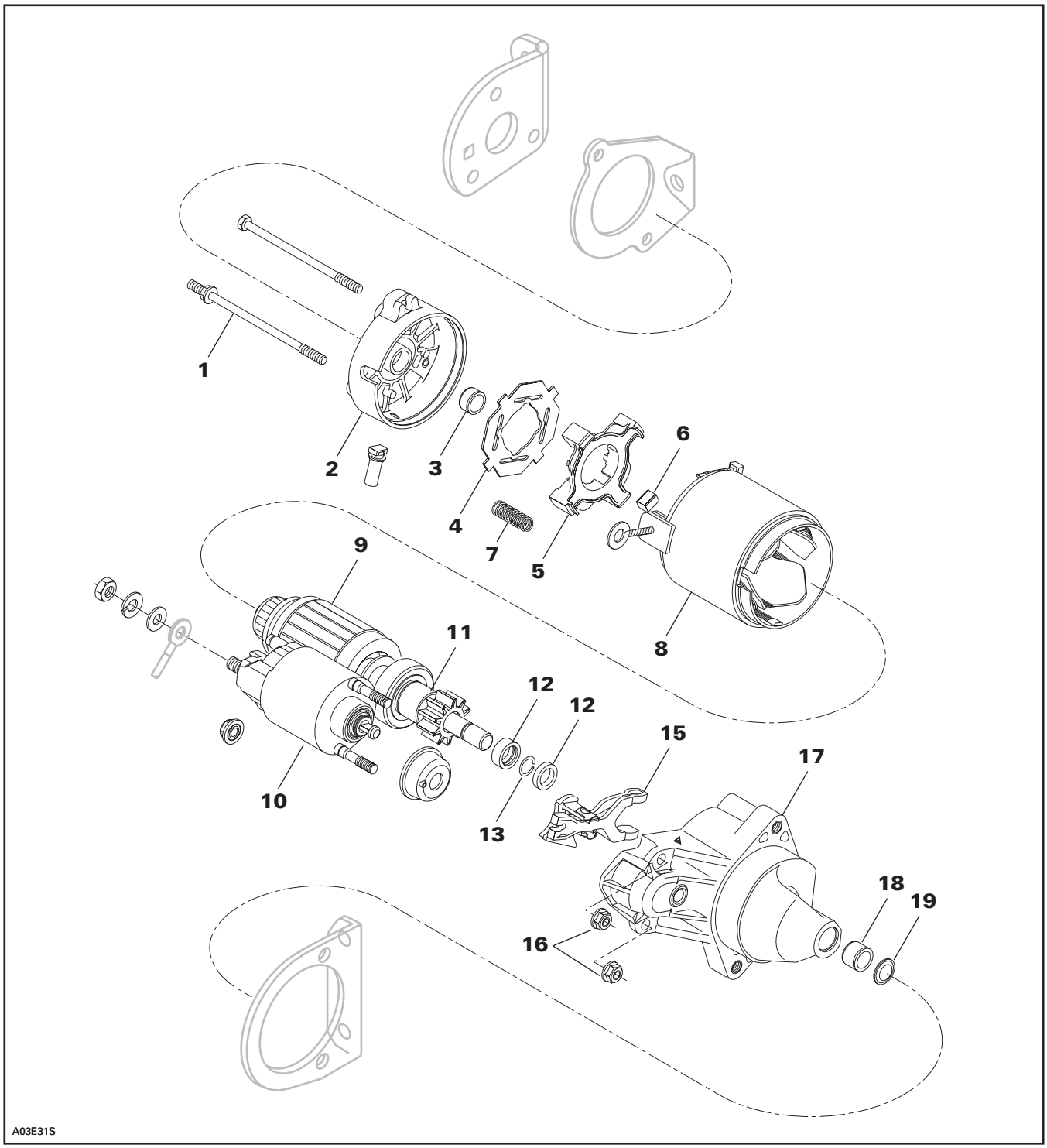
CAUTION: Make sure that the protective heat shrink rubber tube has been properly installed and no part of wire is exposed.

ELECTRIC STARTER

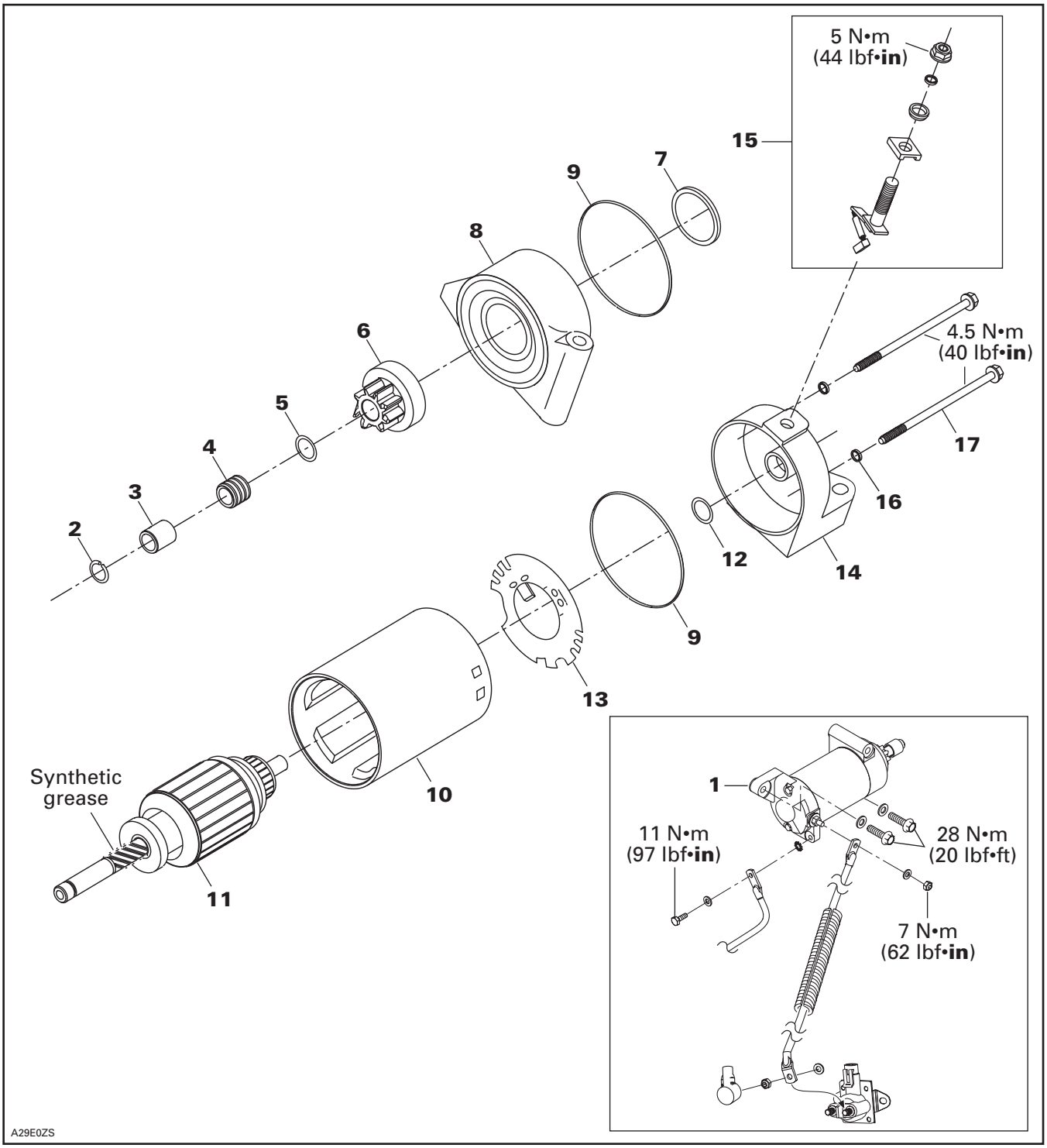
SERVICE PRODUCTS

Description	Part Number	Page
Loctite 271	293 800 005	460
Super Lube grease	293 550 030	461
synthetic grease	413 711 500	458–459

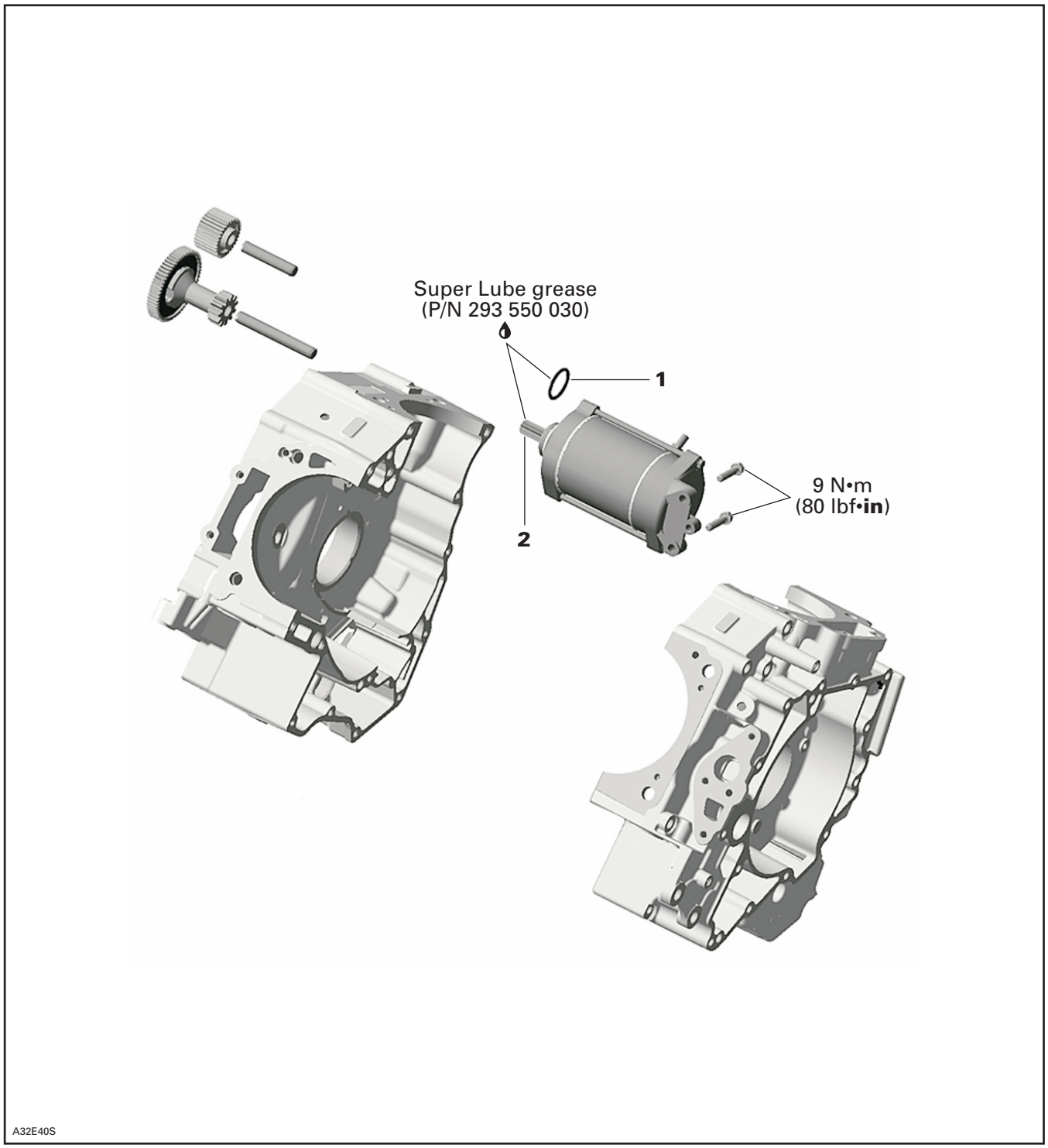
443 and 552 Engines



593 and 593 HO SDI Engines



V-1000 Engine



REMOVAL

443 and 552 Engines

– Disconnect BLACK ground cable from battery.
– Disconnect RED positive cable from battery.

⚠ WARNING

Always disconnect ground cable first and connect last.

– Disconnect RED cable and RED/GREEN wire from starter relay.
– Unbolt starter from PTO side bracket.
– Unbolt MAG side bracket from engine.
– Remove starter from engine.

593 and 593 HO SDI Engines

– Disconnect BLACK ground cable from battery.
– Disconnect RED positive cable from battery.

⚠ WARNING

Always disconnect ground cable first and connect last.

– Remove tuned pipe.
– Disconnect RED cable from starter.
– Disconnect ground cable from starter.
– Unbolt and remove starter from engine.

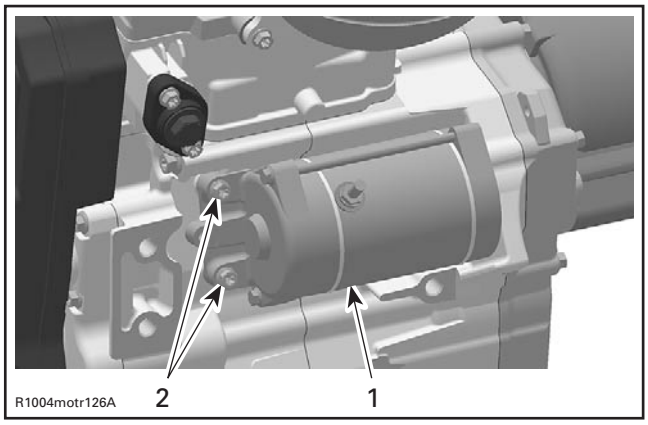
V-1000 Engine

Disconnect BLACK (-) cable from battery.

⚠ WARNING

Always disconnect BLACK (-) cable first and connect last.

The starter is located below the second cylinder in the crankcase.



1. Electric starter
2. Screws

Remove:
– starter cable
– starter screws.

Remove starter.

DISASSEMBLY

443 and 552 Engines

Disconnect bare wire linking starter and relay.

Remove nuts **no. 16** then relay **no. 10** by lifting and pulling to disengage from drive lever **no. 15**.

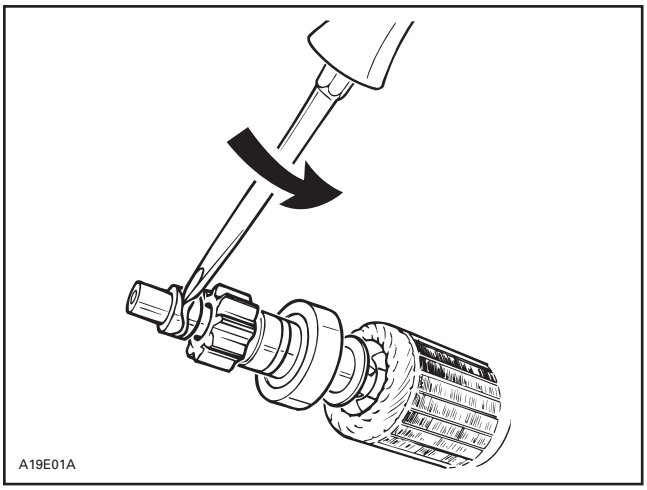
Unscrew starter screws (long) **no. 1** then pull yoke **no. 8** with end frame **no. 2** to separate from drive housing **no. 17**.

Pull armature **no. 9** with drive lever **no. 15**.

Remove insulator **no. 4** then brush springs **no. 7** being careful not to lose them since they will be projected out.

Pull brush holder **no. 5** from yoke **no. 8**.

Insert blade of a small screwdriver between stop collars.



Twist screwdriver to separate stop collars **no. 12** thus giving access to circlip **no. 13**.

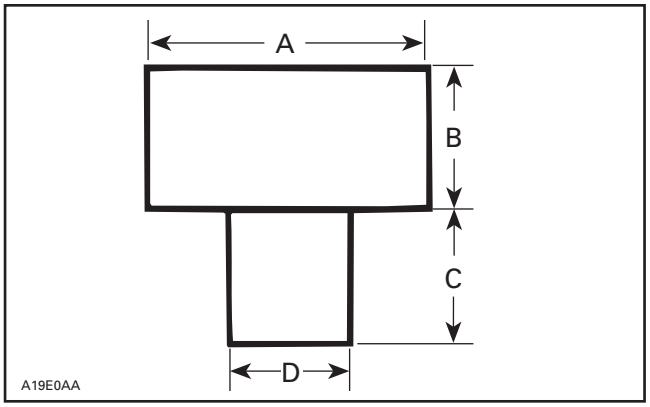
Remove outer collar, circlip then inner collar.

Remove overrunning clutch **no. 11**.

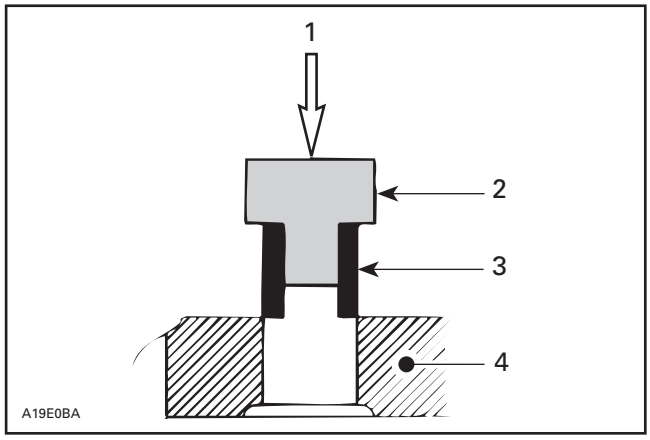
Check the wear on bushing **no. 18** by measuring the amount of radial play between the armature shaft and the bushing.

The radial play should not exceed 0.20 mm (.008 in). If greater, replace the bushing. To replace, press out the old one toward bushing cover and press in a new one with a bushing pusher. The correct size of the bushing pusher to use is given on next illustration.

CAUTION: Support drive housing adequately to prevent damage when pressing bushing.

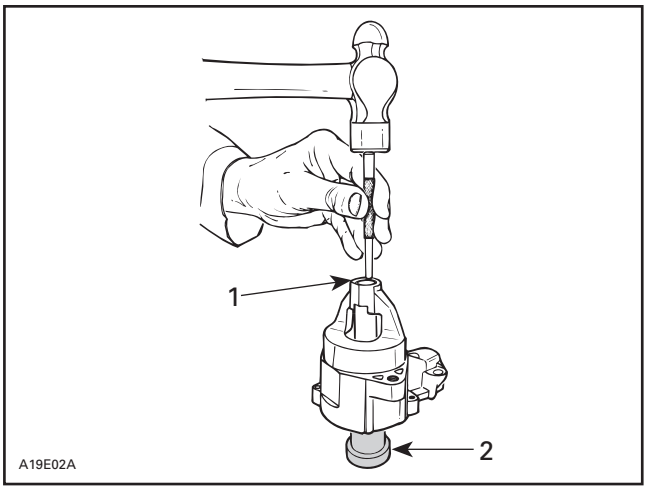


BUSHING PUSHER
A. 16 mm (5/8 in) diameter
B. 13 mm (1/2 in)
C. 11 mm (7/16 in)
D. 11.0 mm (.433 in)



1. Press-in
2. Bushing pusher
3. Bushing
4. Drive housing

Install bushing cover **no. 19** then, using a punch, stake bushing cover in place.



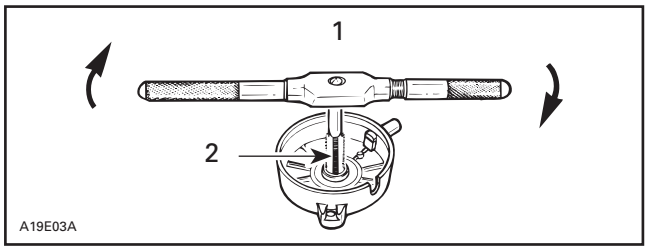
1. Stake bushing cover
2. Support

3, Bushing (end frame)

Check the wear on bushing **no. 3** by measuring the amount of radial play between the armature shaft and the bushing.

The radial play should not exceed 0.20 mm (.008 in). If greater, replace bushing as follows:

Using a 12 mm tap, cut threads into bushing so that the tap contacts the end frame. Continue to rotate tap until the bushing comes free.



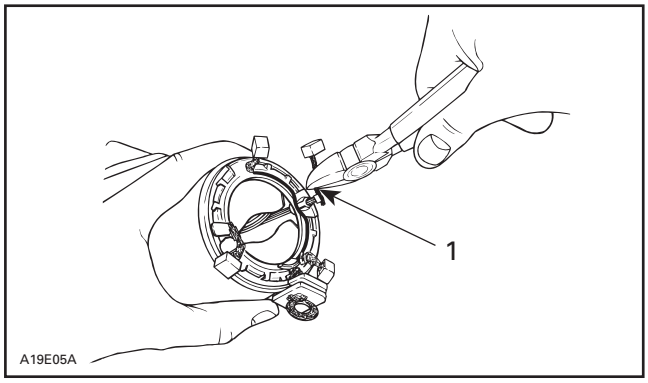
1. Turn until bushing goes out
2. 12 mm tap

To install new bushing, use the same bushing pusher as for drive housing bushing installation.

6, Brush

To replace brush **no. 6**, proceed as follows:

Cut brush wire close to connector at the welded portion.



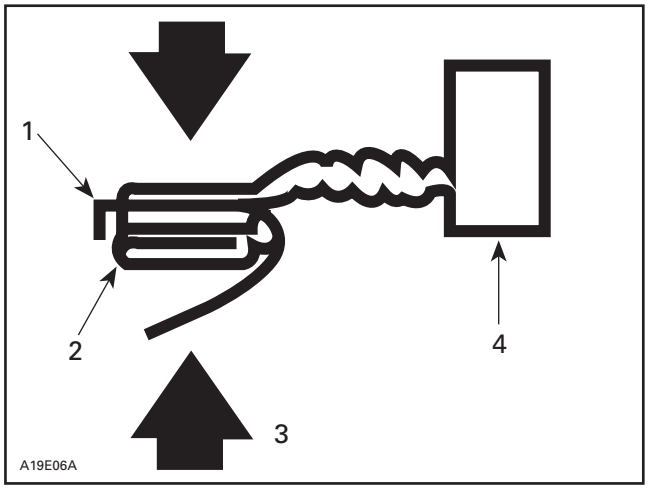
1. Cut close to connector

Remove burrs with a file on the remaining welded portion.

CAUTION: Be careful not to damage plastic portion of starter housing.

Place spare brush plate edge against housing connector edge (welded portion).

Crimp plate over housing connector with a pair of pliers.



1. Plate edge
2. Housing connector
3. Crimp
4. Spare brush

Solder the crimped portion.

CAUTION: Do not overheat and quickly perform soldering to prevent solder from flowing to the brush through the wire. Preferably use a heat sink.

593 and 593 HO SDI Engines

Before disassembling, trace index marks on starter housing **no. 10** and starter housing assembly **no. 8** to ease later assembly.

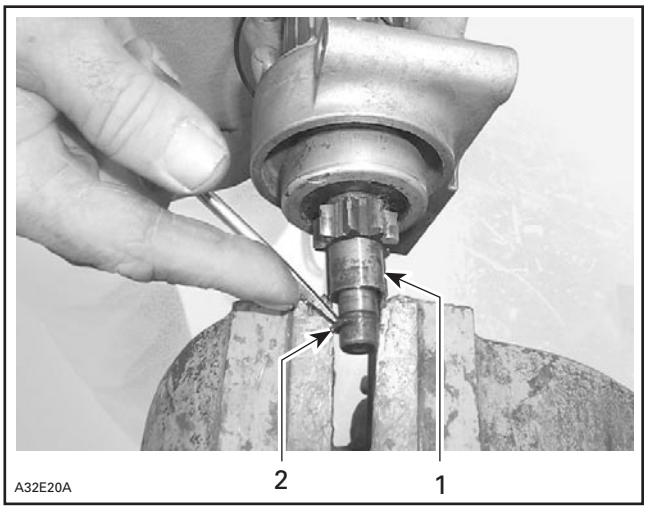
Remove starter through bolts **no. 17**. Separate end frame housing **no. 14** from starter housing **no. 10**. Withdraw starter housing from armature **no. 11**.

Brush holder **no. 13** can be removed from end frame housing **no. 14** by disconnecting the end frame attached brush from brush holder **no. 13**.

Check the radial play between the armature shaft and end frame bearing. Replace the end frame bearing or replace starter. If parts are in good condition then coat with synthetic grease (P/N 413 711 500) before reinstalling them.

Push back the collar **no. 3** using a screwdriver.

Remove snap ring **no. 2**. Remove collar **no. 3** and spring **no. 4**.



1. *Collar*
2. *Snap ring*

Turn starter clutch no. 6 clockwise to remove it from armature assembly no. 11.

Pull housing from armature.

V-1000 Engine

The starter is not serviceable. If defective, replace with a new one.

CLEANING AND INSPECTION

CLEANING

CAUTION: Armature starter yoke ass'y and drive unit assembly must not be immersed in cleaning solvent.

Clean brushes and holder with a clean cloth soaked in solvent. Brushes must be dried thoroughly with a clean cloth.

Blow brush holder clean using compressed air.

⚠ WARNING

Always wear safety goggles when using compressed air.

Remove dirt, oil or grease from commutator using a clean cloth soaked in suitable solvent. Dry well using a clean and dry cloth.

Clean engine ring gear teeth and drive unit (clutch).

NOTE: Bushings must not be cleaned with grease dissolving agents.

Immerse all metal components in cleaning solution. Dry using a clean and dry cloth.

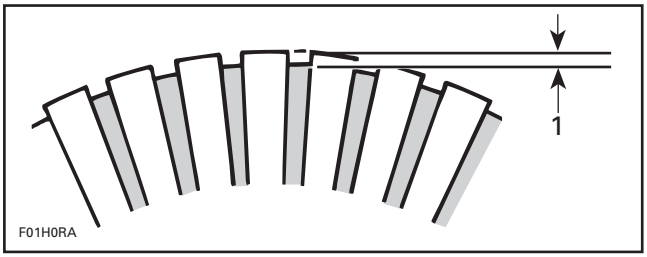
INSPECTION

Armature

NOTE: An ohmmeter may be used for the following testing procedures, except for the one concerning the shorted windings in the armature.

Check the commutator for roughness, burnt or scored surface. If necessary, turn the commutator on a lathe, enough to remove grime only.

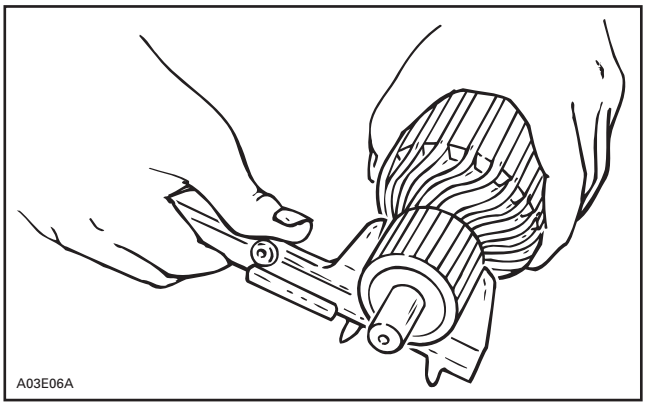
Check the commutator for mica depth. If the depth is less than 0.20 mm (.008 in), undercut the mica. Be sure that no burrs are left and no copper dust remains between the segments after the undercutting operation is completed.



1. *Commutator undercut 0.20 mm (.008 in)*

Check the commutator out-of-round condition with V Blocks and an indicator. If the commutator out-of-round is more than 0.40 mm (.016 in), the commutator should be turned on a lathe.

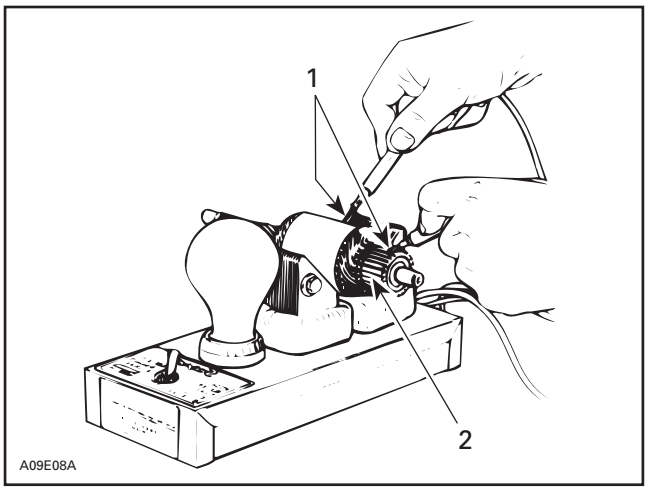
Check commutator outer diameter. If less than specified value, replace.



MODEL	WEAR LIMIT
All	27 mm (1.063 in)

Test for Ground Circuit in the Armature

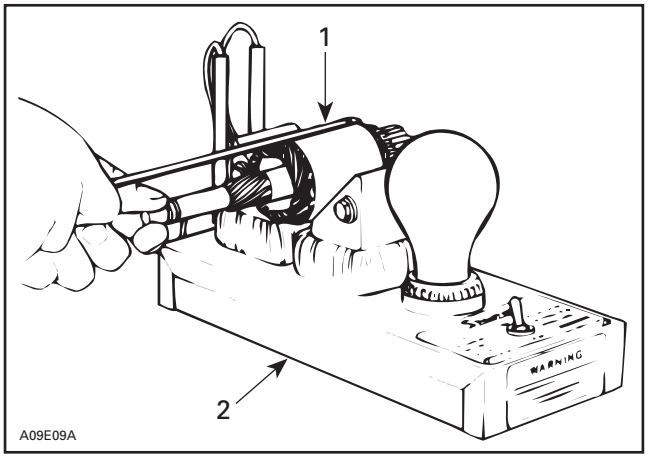
Use growler test probes. Check between armature core and the commutator bars. If growler lamp turns on, bars are grounded. If so, replace armature.



1. Test probes
2. Commutator bars

Test Armature for Shorted Winding

When the armature is rotated in the growler with a steel strip (hacksaw blade) held above it, the strip will vibrate over that area of the armature which has short circuit. Replace armature if so.



1. Steel strip (hack-saw blade)
2. Growler

Test the Armature for Open Circuit

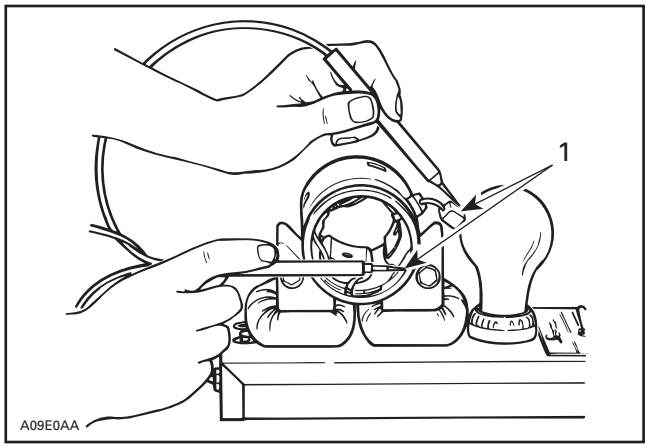
Use growler test probes. Place one test probe on a commutator bar and the other test probe on the neighboring bar. Repeat this operation for all bars, moving one test probe at a time. If the growler lamp does not turn on, the armature circuit between these 2 bars is opened. The armature should be replaced or repaired; open circuits most often occur at the commutator riser where coils are soldered. (Burnt commutator bars are usually an indication of an open-circuit armature coil.)

Field Windings and Brushes

443 and 552 Engines

Test the Field Winding for Open Circuit

Use growler test probes. Place one test probe on the negative brush and the other test probe on the yoke. If growler lamp does not turn on, the field winding has an open-circuit. The yoke has to be repaired or replaced.



1. Test probes

Check the dynamic brake winding for open circuit by placing one test probe on the positive brush and the other probe on the negative brush.

If growler lamp does not turn on, the winding circuit is open-circuit and the starter housing has to be repaired or replaced.

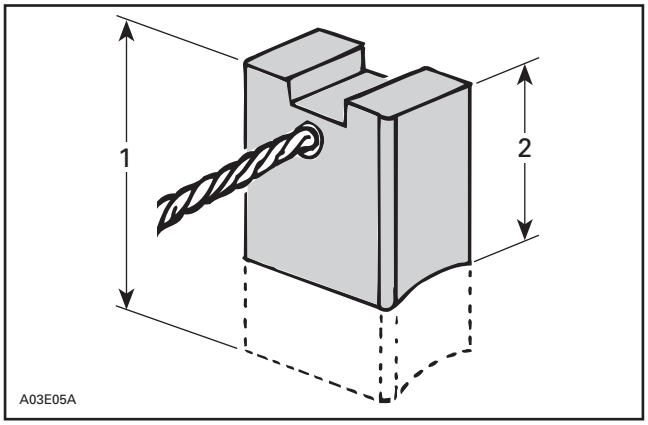
Brush Holder

Check the brush holder for insulation using growler test probes. Place one test probe on the insulated brush holder and the other test probe on the brush holder plate. If the growler lamp turns on, the brush holder has to be repaired or replaced.

Brush Length

Measure brush length. If less than the specified value, replace them.

MODEL	LENGTH	
	NEW	WEAR LIMIT
All	10 mm (.400 in)	6 mm (.236 in)

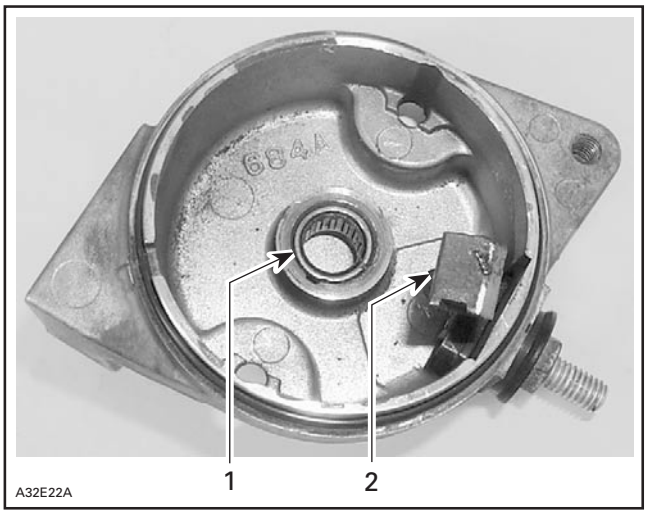


TYPICAL
1. New
2. Wear limit

End Housing

593 and 593 HO SDI Engines

Check the mica insulation of the positive brush and also the roller bearing condition. Replace, if required.



1. Roller bearing
2. Positive brush

Overrunning Clutch

The pinion of the overrunning clutch should turn smoothly in a clockwise direction, and should not slip in a counterclockwise direction. If defective, replace.

Check the pinion teeth for wear and damage. If defective, replace.

Starter Relay

Inspect connections and clean as necessary. Relay condition can be checked with an ohmmeter. Install test probes on large connectors of relay when it is activated ((+) on RED/GREEN wire and (-) on relay body for the fan cooled models and (-) on the BLACK wire for liquid cooled models).

IMPORTANT: No current must be present on large cables when using ohmmeter, otherwise meter could be damaged.

ASSEMBLY

443 and 552 Engines

Prior to assembling, coat sliding surfaces and moving parts on armature shaft splines, overrunning clutch, relay plunger, drive lever and bushings with synthetic grease (P/N 413 711 500).

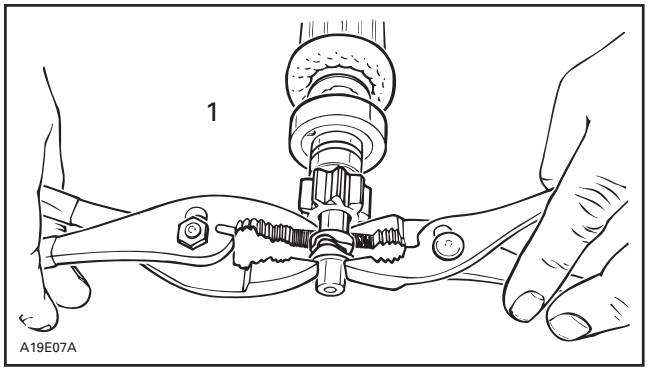
Proceed as follows for assembly.

Install overrunning clutch onto armature shaft. Insert inner collar onto shaft. Install a new circlip.

CAUTION: Always install a new circlip when servicing.

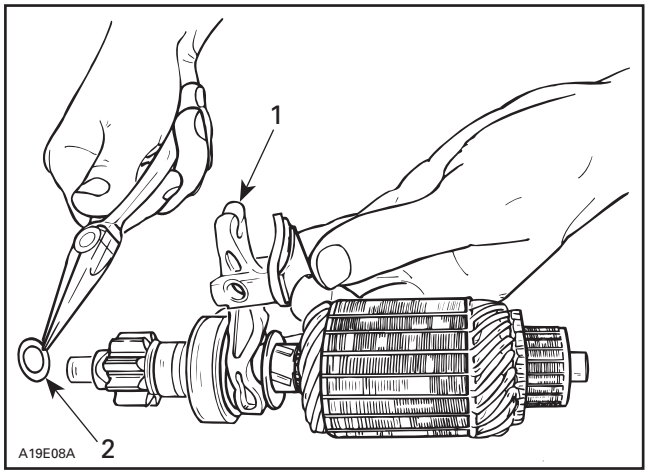
Insert outer collar being careful to match protrusions with notches of collars.

Using a pair of pliers on each side of stop collars, squeeze evenly until collars sit over circlip.



1. Squeeze evenly

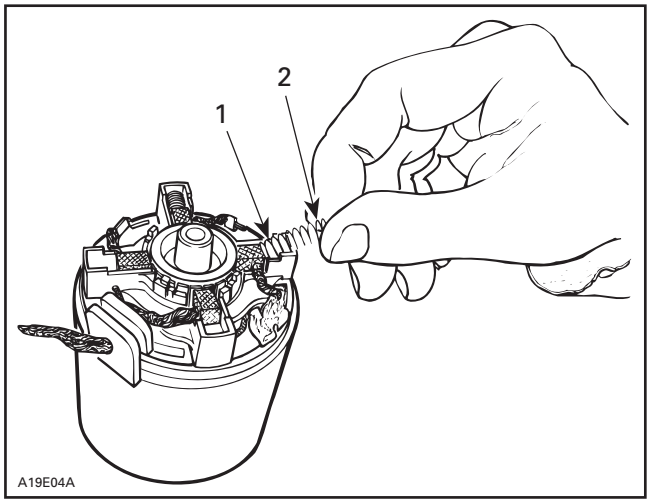
Install thrust washer against outer stop collar. Place drive lever onto overrunning clutch then insert into drive housing.



1. Install on overrunning clutch
2. Install thrust washer

Slide starter housing over armature.

Install brush holder then brushes in their housings. Insert springs as follows: place one end of spring against brush, compress, then push the other end of spring onto its housing. Repeat for remaining springs.



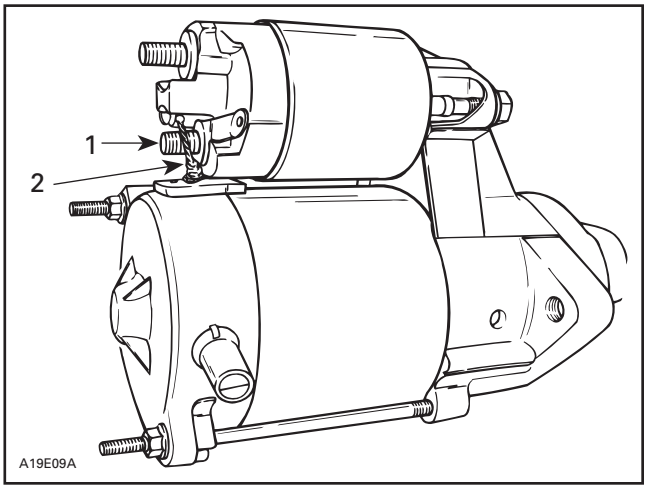
1. This end first
2. Push this end to complete

Secure insulator over brushes and springs. Properly install end frame and tighten screws.

Insert relay plunger inside of drive lever fork and secure to drive housing.

Connect starter bare wire to relay.

NOTE: Connect this wire on the shorter relay stud.



1. Shorter stud
2. Bare wire

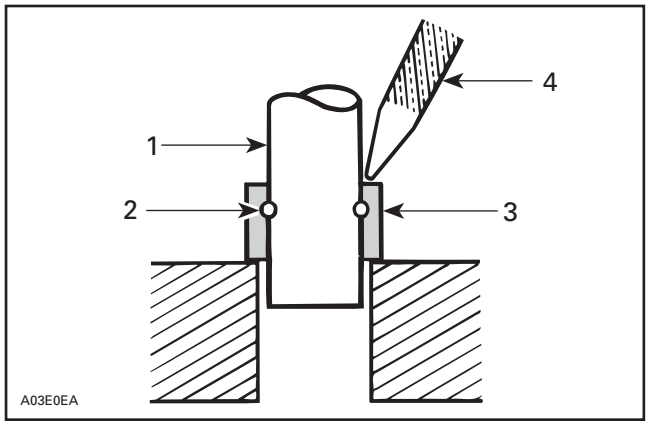
593 and 593 HO SDI Engines

Reverse the order of disassembly to reassemble starter. However, attention should be paid to the following operations.

Prior to assembling, coat sliding surfaces on armature shaft splines, overrunning clutch, bushing and roller bearing with synthetic grease (P/N 413 711 500).

After placing collar **no. 3** on armature shaft **no. 11**, fit new snap ring **no. 2** on armature shaft, then make sure that it is properly secured.

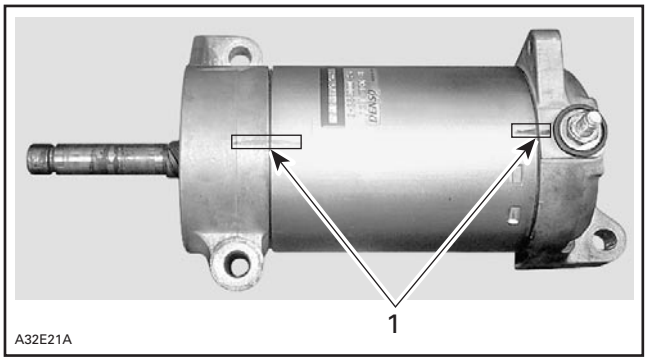
Slide collar **no. 3** over snap ring **no. 2** and secure in place by punching it at two or three places.



1. *Armature shaft*
2. *Snap ring*
3. *Collar*
4. *Punch*

Starter Housing Assembly and Starter Housing

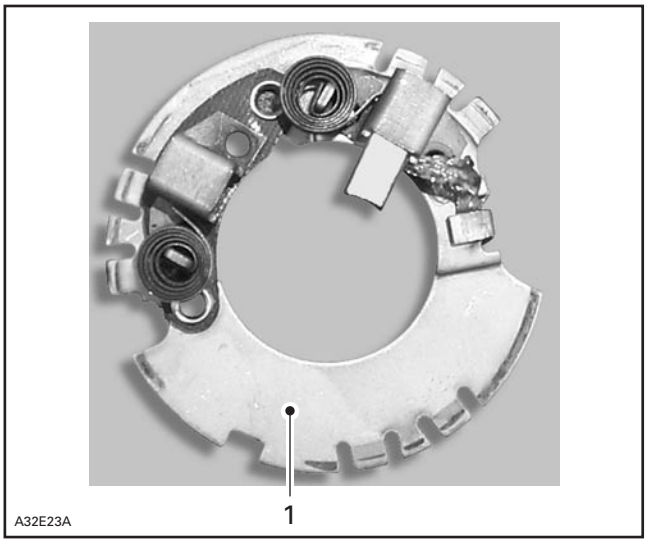
Align previously traced indexing marks.



TYPICAL
1. *Aligned indexing marks*

Open brushes and slide over commutator.

Align end frame locating notch with yoke locating protrusion and properly sit brush holder **no. 13** into housing **no. 14**.



1. *Brush holder*

To ease end frame installation, retain brush holder with a small screwdriver while installing armature assembly.

CAUTION: Make sure to place two end housings on a flat surface before tightening the through bolts.

CAUTION: Make sure end frame fits perfectly on yoke.

INSTALLATION

443 and 552 Engines

Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.

CAUTION: Make sure that both starter brackets are well seated against engine crankcase and starter before torquing all retaining bolts.

Torque all M8 bolts to 24 ± 4 N•m (18 ± 3 lbf•ft).

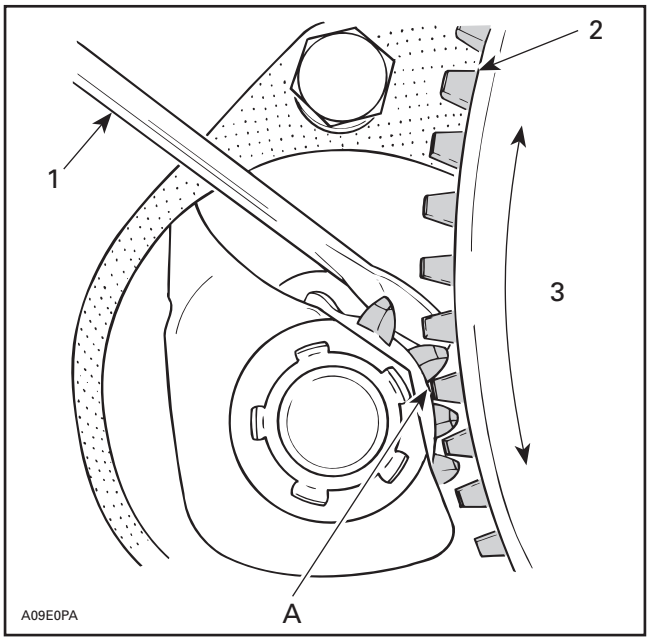
Torque all M5 bolts to 5 ± 0.5 N•m (44 ± 5 lbf•**in**).

CAUTION: Before checking engaging depth of starter pinon teeth, make sure that battery cables are disconnected.

Install starter.

NOTE: Check proper engaging depth of starter pinion teeth to ring gear teeth (see illustration). Install hardened washers (P/N 503 007 900) between engine and starter supports accordingly.

CAUTION: All starter bracket fasteners must be secured with Loctite 271 (P/N 293 800 005).



1. Screwdriver pulling starter pinion
2. Ring gear
3. No excessive backlash
A. 0.5 to 1.5 mm (.020 to .060 in)

Connect the RED battery cable and the RED wire to the large terminal of the relay. Connect RED/GREEN wire to small terminal of relay.

Connect BLACK cable to battery.

⚠ WARNING

Always disconnect ground cable first and connect last.

593 and 593 HO SDI Engines

– Use new teflon washers on the 3 bolts retaining starter to engine.
– Torque the bolts to 28 ± 1 N•m (21 ± 1 lbf•ft).
– Make sure that starter and engine mating surfaces are free of grime. Serious trouble may arise if starter is not properly aligned.
– Connect the RED battery cable and the RED wire to the large terminal of the starter.
– Torque large terminal nut to 7 N•m (62 lbf•**in**).

⚠ WARNING

Always disconnect ground cable first and connect last.

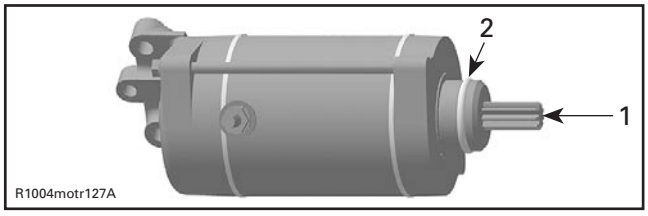
– Connect ground cable to the starter with star washer in between.
– Torque ground cable connecting bolt to 11 N•m (97 lbf•**in**).

V-1000 Engine

The installation is the reverse of removal procedure. Pay attention to the following details.

NOTE: During assembly replace the O-ring **no. 1**of the starter. Grease the drive gear and the O-ring before assembly using Super Lube grease (P/N 293 550 030). This will simplify assembly and prevent displacement of the O-ring during installation.

If it is not possible to move the starter into the guide, this is due to the position of the drive gear**no. 2**. Pull the starter out once more, slightly rotate the drive gear and try again.

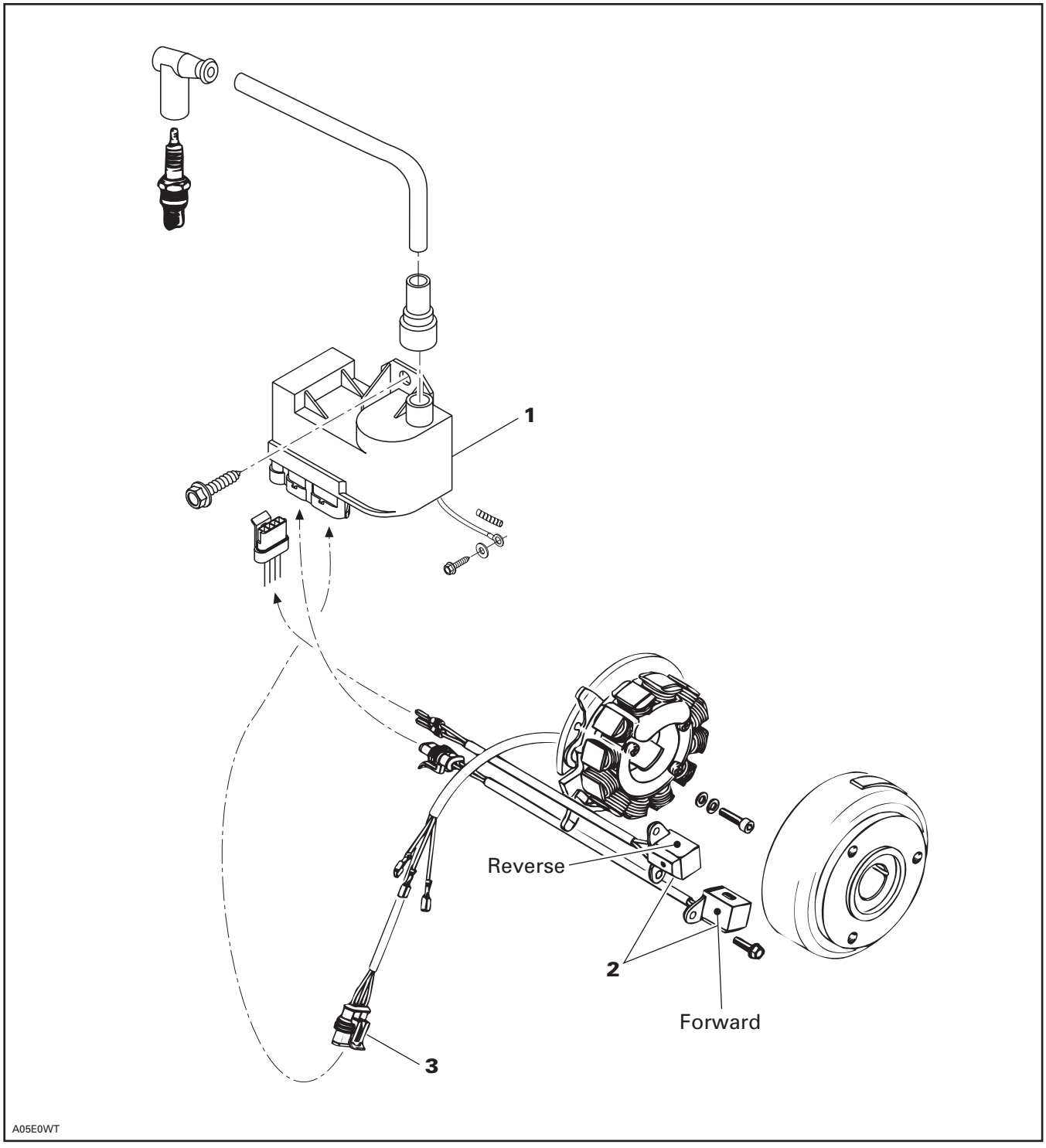


1. Drive gear
2. O-ring

Torque starter screws to 9 N•m (80 lbf•**in**).

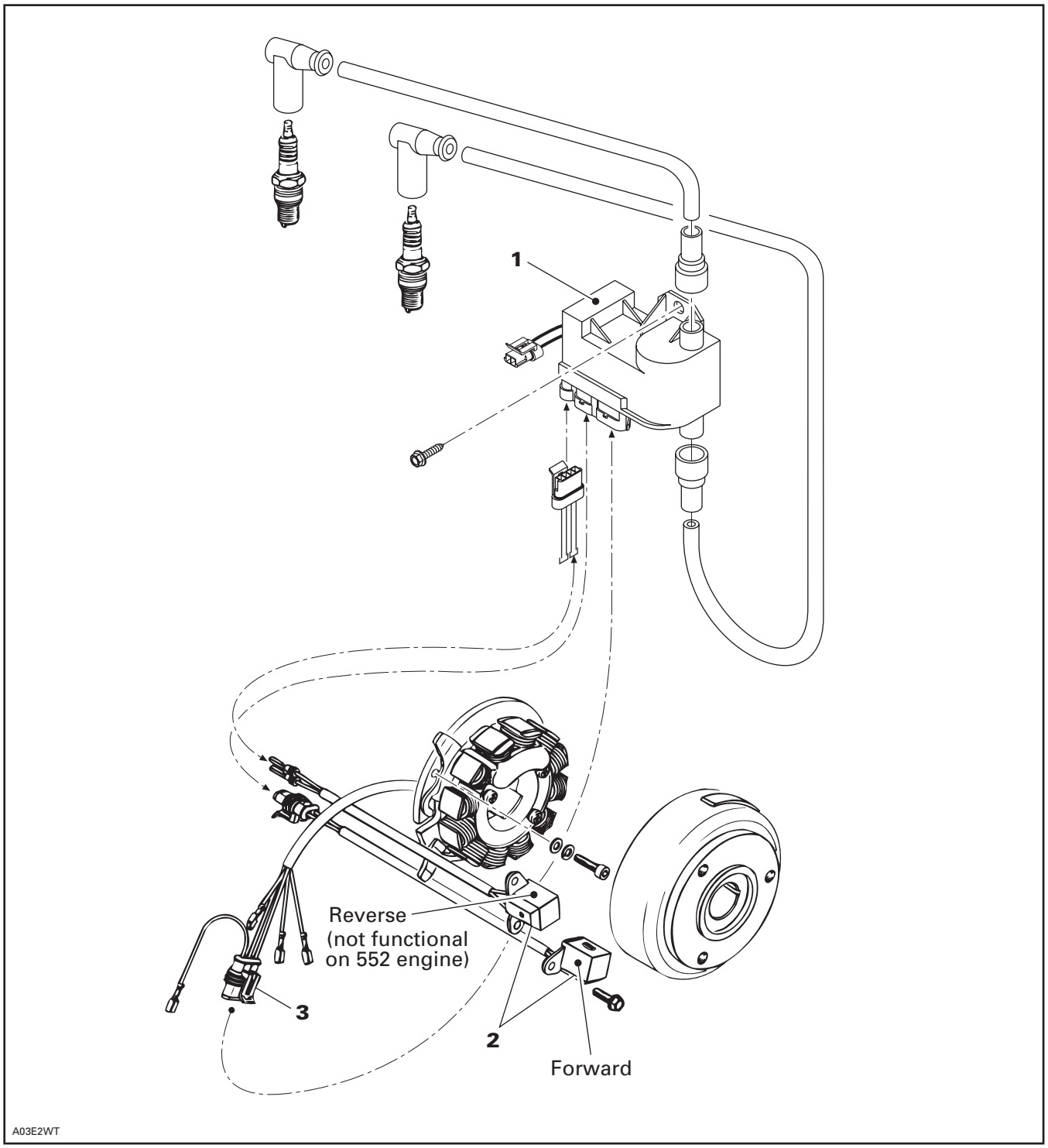
TESTING PROCEDURE

277 Engine



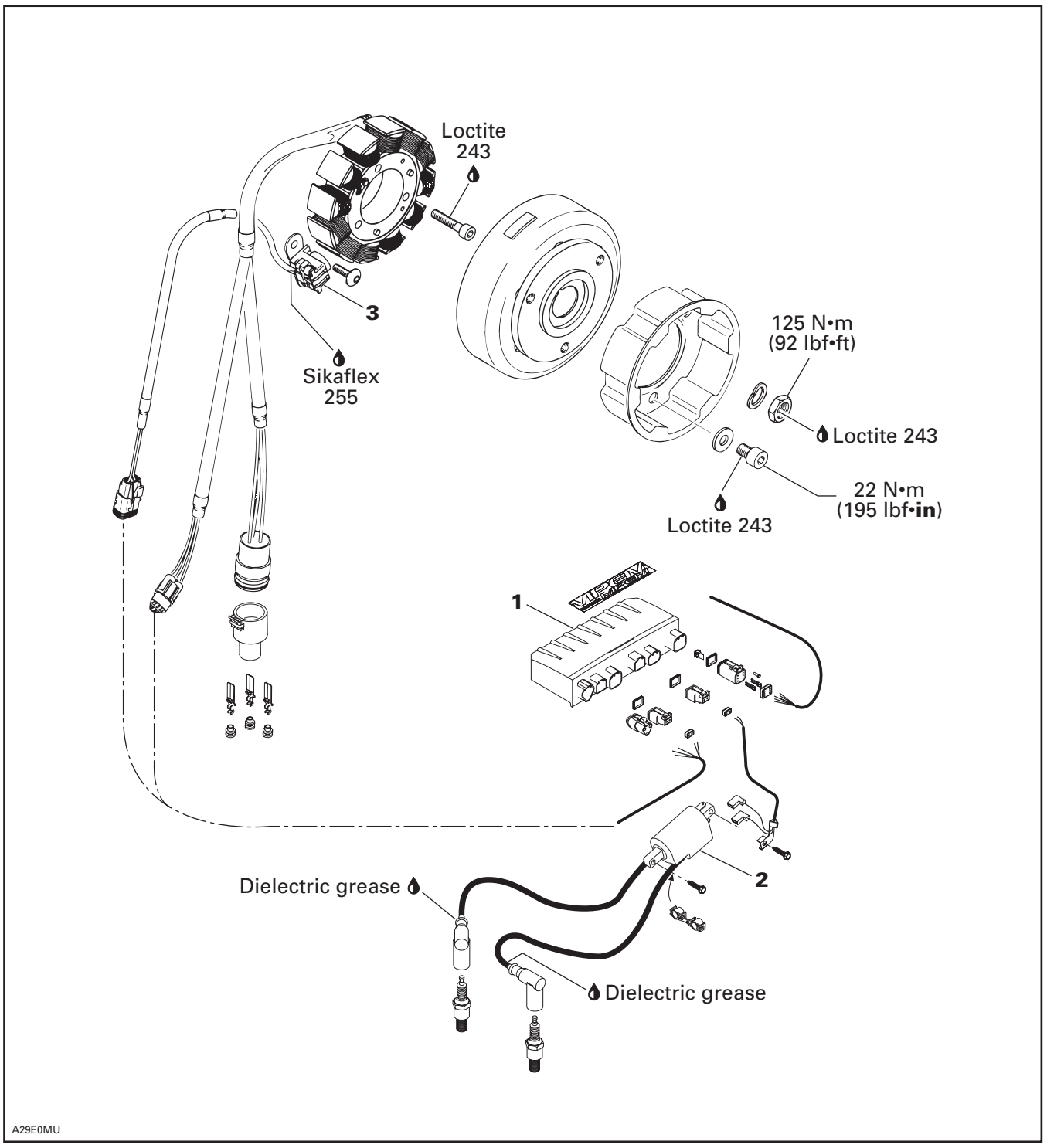
1. MPEM
2. Trigger coils
3. 4-DB housing (BLACK and RED wires)

443 and 552 Engines



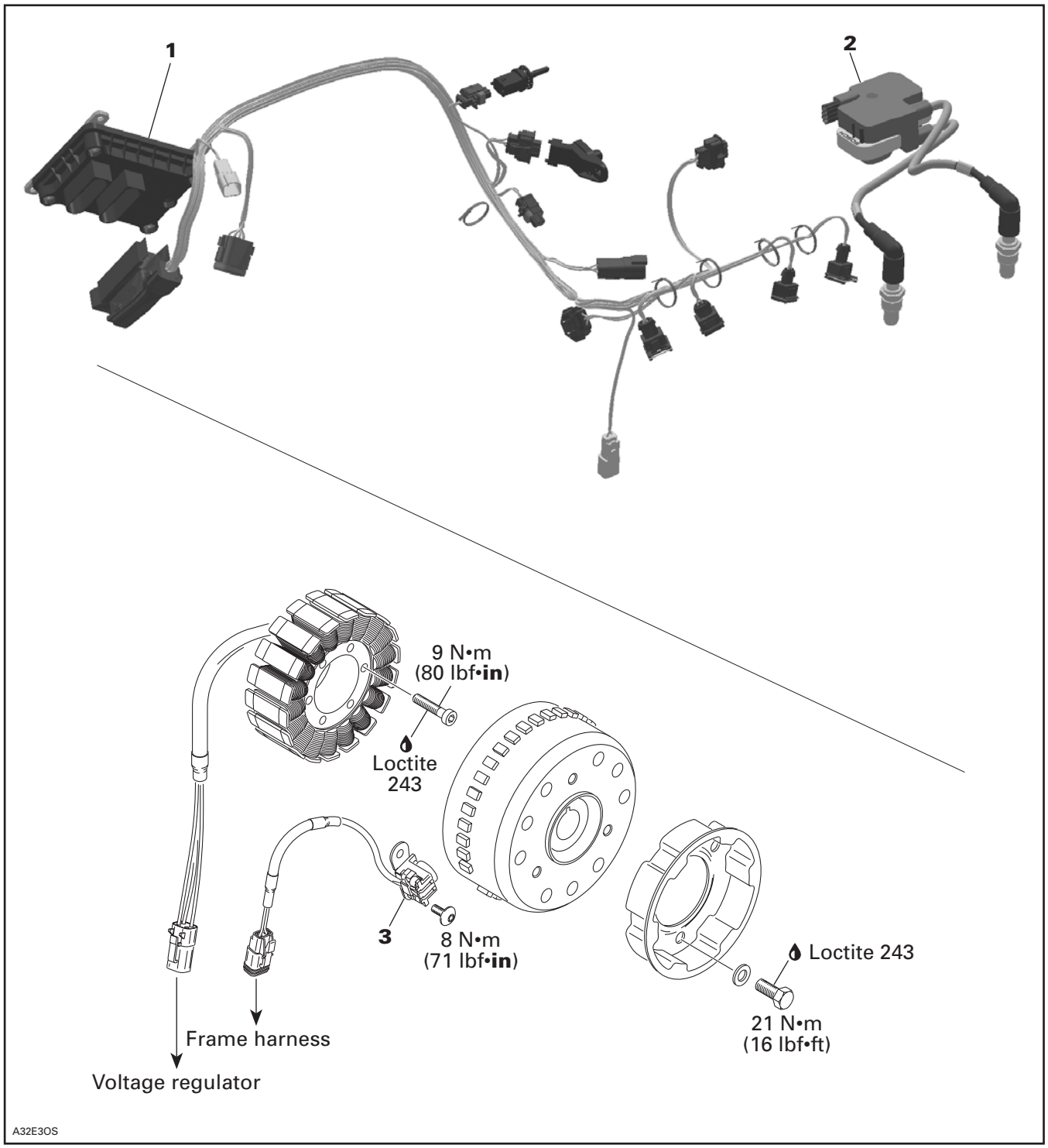
1. MPEM
2. Trigger coils
3. 3-connnector housing (BLACK and RED wires)

593 Engine



1. *MPEM*
2. *Ignition coil*
3. *Trigger coils*

593 HO SDI Engine



1. *ECM*
2. *Ignition coil*
3. *Trigger coil*

GENERAL

NOTE: The 4-TEC engines are equipped with an alternator, not with a magneto. Refer to ALTERNATOR subsection for the checking procedure.

277 and 443 Engines

The RER dual trigger coil CDI system has an ignition coil integrated to the MPEM.

MPEM is connected to a single ignition generator coil via a 3-connector housing (BLACK and RED wires).

MPEM is programmed to recognize a signal sent by the switch located on snowmobile console.

When switch is activated, MPEM cuts off ignition and engine rev drops at approximately:

ENGINE	RPM
277	700
443	450

MPEM fires a spark at a great advance creating a thrust which reverses engine rotation.

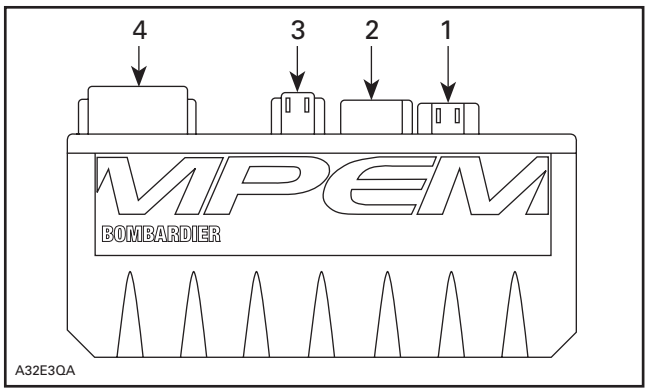
Second trigger coil located on crankcase takes over to produce spark in reverse rotation.

A safety device is incorporated to MPEM preventing it from reading any signal coming from reverse switch at following engine revs:

ENGINE	NO REVERSE SIGNAL	
	BELOW	ABOVE
277	800 RPM	3500 RPM
443	1000 RPM	3500 RPM

Multi-Purpose Electronic Module (MPEM) Connections

593 Engine



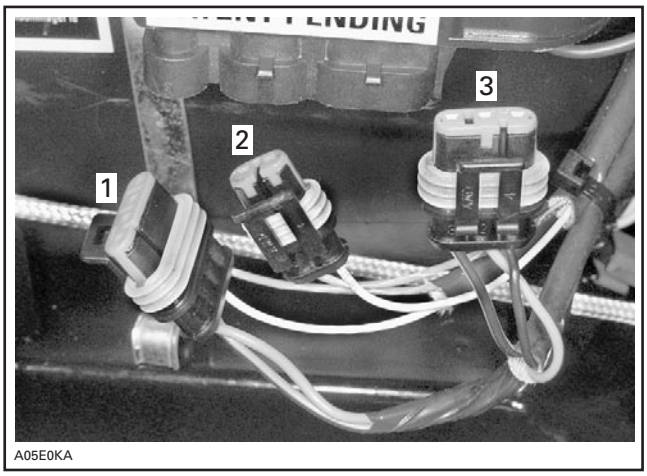
1. *Trigger coil*
2. *Cooling temperature sensor*
3. *High tension coil*
4. *DESS, ignition and engine stop switches, DESS pilot lamp*

593 HO SDI Engine

For more informations concerning the Engine Control Module (ECM) refer to OVERVIEW in ENGINE MANAGEMENT (2-TEC) section.

TYPICAL — ECM

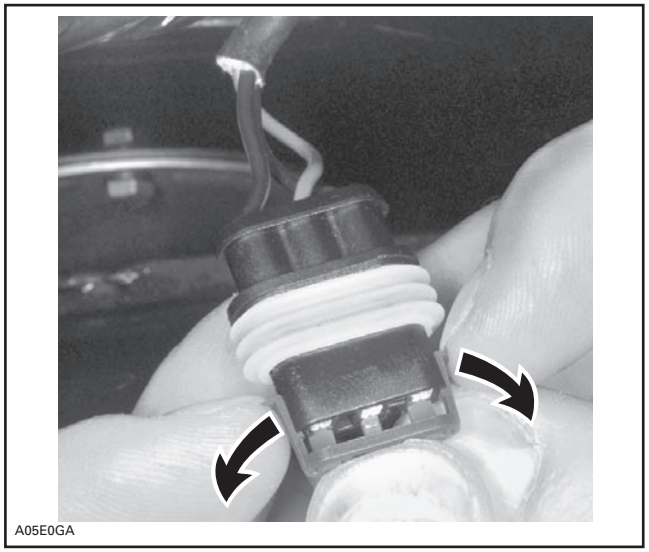
277, 443 and 552 Engines



MPEM
1. *Reverse switch, reverse indicator and trigger coil*
2. *Trigger coil*
3. *Generator output and cut-off switches*

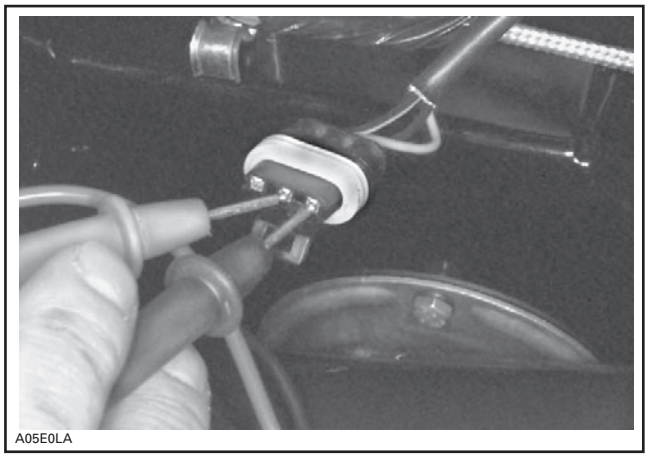
To ease electrical readings on MPEM connectors, connector cap must be removed.

Hold connector in hands then lift both tabs to remove connector cap.



LIFT TABS TO REMOVE CAP

Insert multimeter probes into connector.



TEST USING MULTIMETER PROBES

IGNITION SYSTEM TESTING SEQUENCE

All Models

In case of ignition problems, check the following in the prescribed order until the problem can be solved.

1) Sparking/spark plug condition.
2) Electrical connectors.
3) Ignition switch, DESS switch or tether cut-out switch and engine cut-out switch.
4) Ignition generator coil.
5) Trigger coil.
6) MPEM voltage (liquid cooled engines only).
7) High voltage coil (liquid cooled engines only).
8) Buzzer testing.

LIGHTING SYSTEM TESTING SEQUENCE

1) Electrical connectors.
2) Magneto output (lighting generator coil).

Testing Conditions

Voltage measurements are always taken upon starting the vehicle. Readings taken when the engine is running will be higher than indicated range.

Part temperature must be approximately 21°C (70°F) (room temperature), otherwise readings could be distorted.

Analysis of Readings

Voltage Readings

When testing the different magneto components, it is important to take into consideration that readings vary according to the force applied onto the manual starter. It is therefore important to employ enough force upon each trial.

Doing 3 trials, the readings must each time be within or above the range indicated in the corresponding table. If the reading is too low, the part is considered to be defective and it must be replaced.

Resistance Readings

Place multimeter selector switch to Ω in order to measure resistance. Readings must be within the indicated range. Otherwise, the part is considered to be defective and must be replaced.

CAUTION: When taking measurements, it is useless to try to start the vehicle since readings would then be distorted.

Intermittent Ignition Problems

It is difficult to make a diagnostic in the case of intermittent ignition problems. Thus, problems occurring only when the engine operating temperature is normal must be checked in similar conditions.

In most cases when problems are caused by temperature or vibrations, these can only be solved by replacing parts. Most problems cannot be detected when the engine is stopped.

Multiple Problems

As a matter of fact, more than one component can be defective. As a result, if the problem remains although a part was replaced, start over the whole verification from the beginning in order to identify the other defective component.

1. SPARKING

During this operation, it is important to use the snowmobile spark plug and not a new one. Bring the plug in contact with the engine. If no spark is produced, replace the spark plug with a new one and do the test again.

2. ELECTRICAL CONNECTOR TESTING

Make sure that none of the connectors are disconnected.

3. IGNITION SWITCH, DESS SWITCH OR TETHER CORD CUT-OUT SWITCH AND ENGINE CUT-OUT SWITCH TESTING

Disconnect connector housing and check resistance as indicated in IGNITION table.

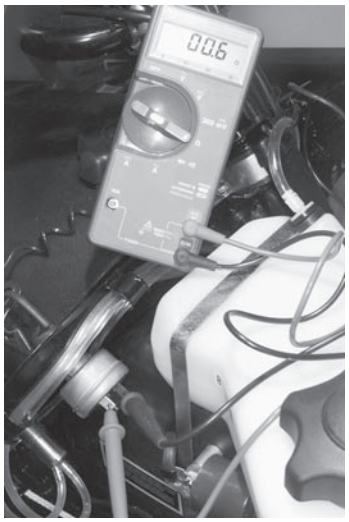
A03E1IA

If readings are acceptable, go on to next step.

If readings are inadequate, individually check each switch as follows.

Ignition Switch (key, if equipped)

Disconnect switch housing. Using a multimeter, check between **MAG** and **GRD** terminals if the circuit is open (0.L MΩ) in operating position and if the circuit is closed (0 Ω) in off position.


A05E07A

TYPICAL

If readings do not correspond to the above-mentioned indications, replace switch.

If readings are acceptable, check other switches.

Liquid Cooled Models Only

Check using a multimeter by connecting probes to BLACK/GREEN and BLACK/WHITE wires. The multimeter should indicate a closed circuit (0 Ω) in operating position and a open circuit (0.L MΩ) in off position.

If readings do not correspond to the above mentioned indications, replace switch.

If none of these verifications are conclusive, the problem finds its source in the main wiring harness. Proceed as follows:

Engine Cut-Out Switch

All Models

Unplug switch block connected to main wiring harness. Check using a multimeter. Connect probes to terminals. The multimeter should indicate an open circuit (0.L MΩ) in operating position and a closed circuit (0 Ω) in off position.

A05E08A

TYPICAL

If readings do not correspond to the above-mentioned indications, replace switch.

If readings are acceptable, check other switches.

Tether Cord Switch

Fan Cooled Engines

Unplug switch block connected to main wiring harness. Check using a multimeter by connecting probes to wires. Refer to corresponding IGNITION and ELECTRICAL SYSTEM TESTING table in this subsection. The multimeter should indicate an open circuit (0.L MΩ) in operating position and a closed circuit (0 Ω) in off position.

A05E09A

TYPICAL

If readings do not correspond to the above-mentioned indications, replace switch.

If readings are acceptable, check other switches.

If none of these verifications are conclusive, the problem finds its source in the main wiring harness. Proceed as follows:

NOTE: For this next step, no stop switch must be connected to the main wiring harness.

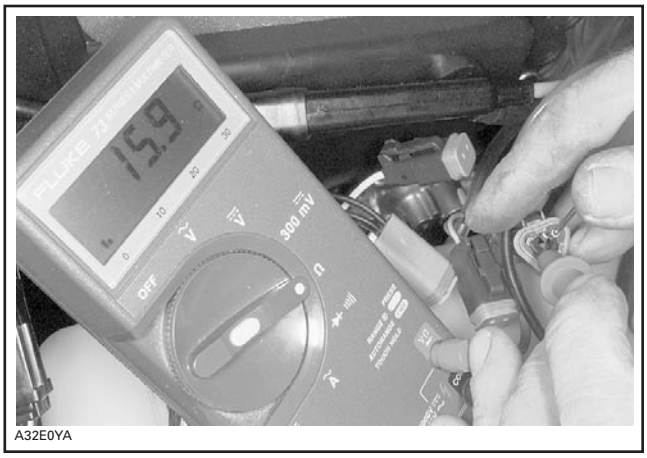
Disconnect all stop switches from the main wiring harness and check the continuity of each wire by connecting probes to the end of wires of the same color. Repeat with all other wires. It is important to mention that all wires of the same color within a given harness are connected together. These wires should therefore have a closed circuit. On the other hand, BLACK and BLACK/YELLOW wires must have an open circuit (0.L MΩ).

Repair or replace if necessary.

4. IGNITION GENERATOR COIL TESTING

Resistance Testing

– Disconnect housing between the magneto and the MPEM.
– Connect multimeter probes to appropriate wires and measure resistance. Refer to corresponding IGNITION and ELECTRICAL SYSTEM TESTING table in this subsection.



A32E0YA

– Compare readings with those appearing in the IGNITION table.

Voltage Testing

When manually starting the engine while the spark plug is installed, the engine will tend to accelerate beyond the compression point. This will result in higher magneto output power.

– Disconnect housing between the MPEM and the magneto.
– Connect multimeter probes to RED and BLACK wires (female end), then bring selector to Vac and scale to 00.0.
– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.
– Compare readings with those appearing in the IGNITION table.

5. TRIGGER COIL TESTING

Resistance Testing

– Connect probes to appropriate wires from trigger coil housing. Refer to corresponding IGNITION and ELECTRICAL SYSTEM TESTING table in this subsection.

A32E10A

– Compare readings with those appearing in the IGNITION table.

Voltage Testing

– Connect probes to appropriate wires from trigger coil housing. Refer to corresponding IGNITION and ELECTRICAL SYSTEM TESTING table in this subsection.
– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.
– Compare readings with those appearing in the IGNITION table.

6. MPEM VOLTAGE TESTING

Liquid Cooled Engines

– Disconnect the housing between module and high voltage coil.

– Connect multimeter probes to WHITE/BLUE and BLACK wires coming out from module. Place the selector switch to Vac and the scale to 00.0.

A32E0ZA

TYPICAL

– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.
– Compare readings with those appearing in the IGNITION table.

7. HIGH VOLTAGE COIL TESTING

Liquid Cooled Engines

Resistance Testing

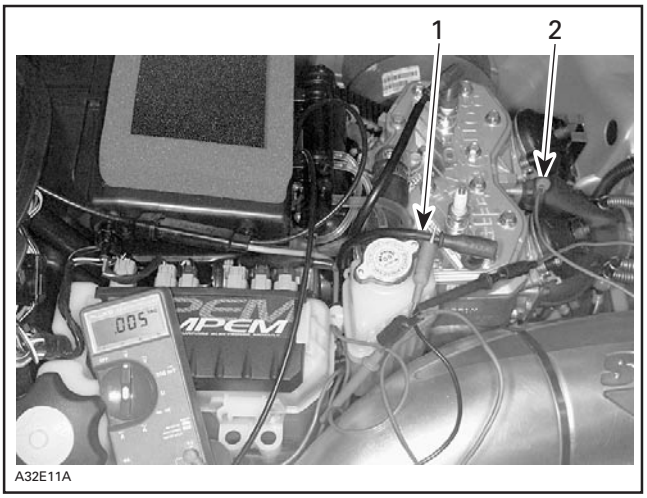
– Unplug housing between high tension coil and MPEM.
– Connect multimeter probes to WHITE/BLUE and BLACK wires and measure resistance.

A32E12A

– Compare readings with those appearing in the IGNITION table.

Voltage Testing

– Disconnect spark plug cap from spark plug.
– Fasten alligator clip to spark plug cable, near the spark plug.
– Connect other multimeter wire to engine (ground), then place selector switch to Vac and scale to 0.00.



A32E11A

1. *MAG side spark plug cable*
2. *Connected to ground*

– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.
– Compare readings with those appearing in the IGNITION table.

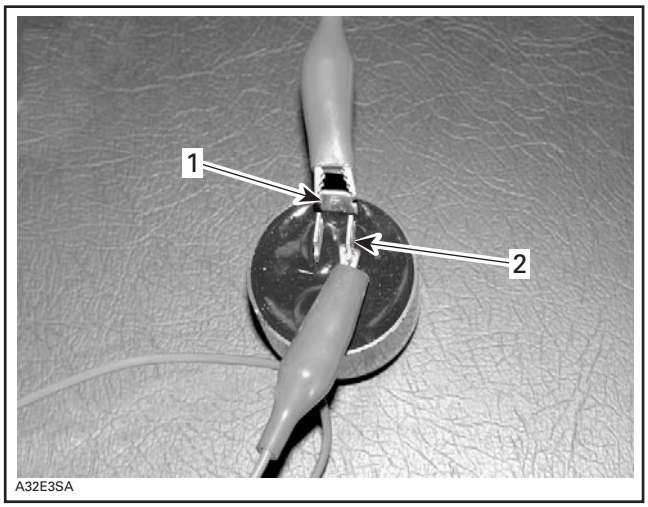
8. BUZZER TESTING

2-Stroke Engines

Using jumper wires, connect battery positive post to buzzer positive tab.

Connect battery negative post to buzzer negative tab.

CAUTION: To avoid buzzer damage, ensure that polarity is respected.



TYPICAL — 12-VOLT BATTERY PLUGGED TO BUZZER
1. Buzzer positive tab
2. Buzzer negative tab

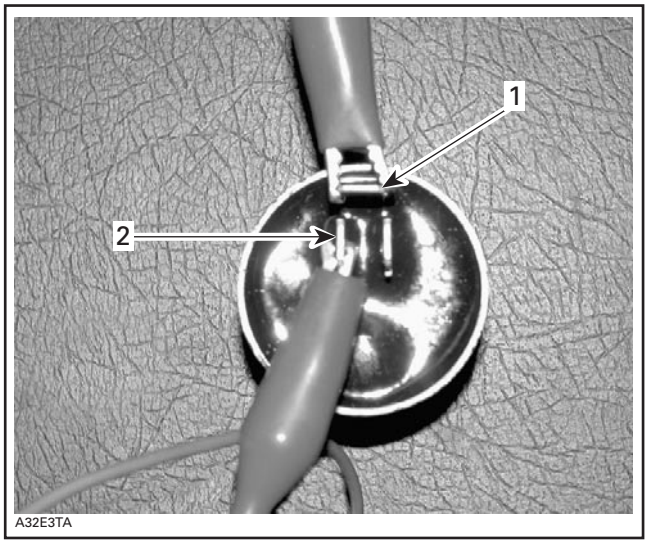
A continuous sound should be heard. if not, replace the buzzer with a new one.

4-Stroke Engines

Using jumper wires, connect battery positive post to buzzer positive tab.

Connect battery negative post to buzzer negative tab. See next photo.

CAUTION: To avoid buzzer damage, ensure that polarity is respected.

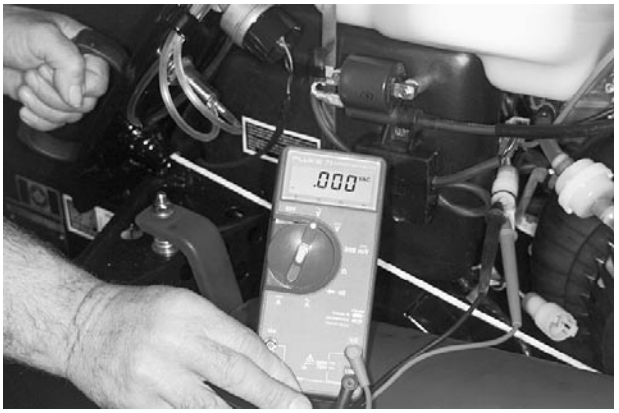


TYPICAL — 12-VOLT BATTERY PLUGGED TO BUZZER
1. Buzzer positive tab
2. Buzzer negative tab

An intermittent sound should be heard. If not, replace the buzzer with a new one.

LIGHTING GENERATOR COIL VOLTAGE TESTING

– Disconnect housing from engine (YELLOW wires).
– Connect multimeter probes to YELLOW wires, then place selector switch to Vac and scale to 0.00.
– Activate the manual starter and check values indicated by the multimeter.
– Repeat operation 3 times.



TYPICAL

– Compare readings with those appearing in the LIGHTING table.

CONCLUSION

If none of the above testing operations produced valid results, it is strongly recommended to keep on testing according to the list appearing in the RESISTANCE column of IGNITION or LIGHTING table.

When using the tables, make sure to follow these guidelines:

NOTE: Stop switches include the ignition switch, the tether cord switch and the engine cut-out switch.

It is important to take note that voltage measurements must be taken while starting the vehicle using the manual starter.

Voltages obtained upon starting are proportional to the force applied onto the manual starter. A low voltage is therefore normal under a low cranking force.

Perform testing in the prescribed order and replace any parts not performing according to specifications.

It is important to resume all tests when replacing a component.

If not specified, the probe connecting sequence is not important.

Set the multimeter as indicated.

IGNITION SYSTEM TESTING — 277 ENGINE								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE V		NOTE
				VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Stop switch	Running insulation	BK BK/YL	4-MOC-M 4-MOA-M	0.L	00.0 MΩ	—	—	No stop switch must be operational.
	Continuity in STOP position	BK BK/YL	4-MOC-M 4-MOA-M	00.0 - 00.5	00.0 Ω	—	—	Only one stop switch must be operational. Test them one after the other.
Ignition generator coil	Output	RD BK	4-DB-1-F 4-DB-2-F	4.5 - 6.5	00.0 Ω	7.0 - 15.0	00.0VAC	—
	Ground continuity	BK engine	4-DB-2-F engine	00.0 - 00.5	00.0 Ω	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
Trigger coil	Forward	WH/YL BU/YL	4-DC-2-F 4-DC-1-F	160 -180	00.0 Ω	.100 - .300	.000VAC	—
	Reverse	WH/YL BU/YL	4-DA-4-F 4-DA-3-F	160 -180	00.0 Ω	.100 - .300	.000VAC	—
MPEM and high voltage coil	Secondary winding resistance with caps	Spark plug cap engine	In spark plug cap and on the engine	4.90 K - 7.10 K	0.00 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding resistance without caps	BK engine	Inside spark plug cable and on the engine	0.90 K - 1.10 K	0.00 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding voltage	BK engine	On spark plug cable housing and on the engine	—	—	.150 - .350	.000VAC	The measurement must be taken on the spark plug cable (without the spark plug).
Spark plug cap	Cap resistance	—	Spark plug side and cable side	4.0 K - 6.0 K	00.0 KΩ	—	—	—

LIGHTING SYSTEM TESTING — 277 ENGINE								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE V		NOTE
				VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Lighting generator coil	Power	YL YL	4-MOB-F 4-MOA-F	00.0 - 00.6	00.0 Ω	3.0 - 7.0	00.0VAC	—
	Insulation	YL engine	4-MO (A,B)-F engine	0.L	00.0 MΩ	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
	Ground continuity	BK engine	4-MOC-F engine	00.0 - 00.5	00.0 Ω	—	—	—

IGNITION SYSTEM TESTING — 443 AND 552 ENGINES							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Stop switch	Running insulation	BK BK/YL	0.L	00.0 MΩ	—	—	All switches must be in run position.
	Continuity in STOP position	BK BK/YL	00.0 - 00.5	00.0 Ω	—	—	Only one stop switch must be in stop position. Test them one after the other.
Ignition generator coil	Output	RD BK	4.5 - 6.5	00.0 Ω	7.0 - 15.0	00.0VAC	—
	Ground continuity	BK engine	00.0 - 00.5	00.0 Ω	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
Front trigger coil	Resistance and output	WH/YL BL/YL	160 -180	00.0 Ω	.150 - .350	.000VAC	—
Rear trigger coil	Resistance and output	WH/YL BL/YL	160 -180	00.0 Ω	.150 - .350	.000VAC	—
MPEM and high voltage coil	Secondary winding resistance with caps	Spark plug cap Spark plug cap	8.90 K - 13.1 K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding resistance without caps	BK BK	0.90 K - 1.10 K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding voltage	BK engine	—	—	.100 - .250	0.00VAC	The measurement must be taken on the spark plug cable (without the spark plug).
Spark plug cap	Cap resistance	—	4.0 K - 6.0 K	00.0 KΩ	—	—	—

LIGHTING SYSTEM TESTING — 443 AND 552 ENGINES							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Lighting generator coil	Power	YL YL/BK	00.0 - 00.6	00.0 Ω	3.0 - 7.0	00.0VAC	—
	Insulation	YL engine	0.L	00.0 MΩ	—	—	The term "engine" refers to the engine metal parts con nected to the magneto housing.
	Ground continuity	BK engine	00.0 - 00.5	00.0 Ω	—	—	

IGNITION SYSTEM TESTING — 593 ENGINE							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Stop switches	Running insulation	BK and BK/YL	0.L	00.0 MΩ	—	—	All switches must be in run position.
	Continuity in stop position	BK and BK/YL	00.0 - 00.5	00.0 Ω	—	—	Only one stop switch must be in stop position. Test one at a time.
	Insulation in stop position	BK/GN and BK/WH	0.L	00.0 Ω	—	—	Tether cord cap must be off.
	Running continuity	BK/GN and BK/WH	00.0 - 00.5	00.0 Ω	—	—	Tether cord cap must be in place.
Ignition generator coil	Output	RD and BK/RD	11.6 - 21.6	00.0 Ω	15.0 - 30.0	00.0VAC	—
	Coil insulation	RD and BK	0.L	00.0 MΩ	—	—	—
	Ground continuity	BK and engine	00.0 - 00.5	00.0 Ω	—	—	The term "engine" refers to the engine metal parts con nected to the magneto housing.
Trigger coil	Resistance and output	WH/YL and BL/YL	190 - 300	00.0 Ω	.200 - .350	.000VAC	—
MPEM	Output voltage	WH/BL and BK	—	—	25.0 - 100.0	00.0VAC	All switches must be in run position.
High voltage coil	Primary winding resistance	WH/BL and BK	00.0 - 00.9	00.0 Ω	—	—	—
	Secondary winding resistance (spark plug cap included)	Spark plug cap and Spark plug cap	19.5 K - 26.5K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding resistance (without spark plug cap)	BK and BK	9.6 K - 14.4K	00.0 KΩ	**CAUTION:** Do not measure high voltage coil output voltage.		
	Secondary winding voltage	BK and engine	—	—	0.1 - 1.4	0.00VAC	The measurement must be taken on the spark plug wire (without the spark plug).
	Insulation	Spark plug cap and BK	0.L	00.0 MΩ	—	—	—
Spark plug cap	Cap resistance	—	4.0 K - 6.0 K	00.0 KΩ	—	—	—

LIGHTING SYSTEM TESTING — 593 ENGINE							
PART	TEST TO BE PERFORMED	WIRE COLOR	RESISTANCE Ω		VOLTAGE V		NOTE
			VALUE (ohms)	MULTIMETER SCALE	VALUE (volts)	MULTIMETER SCALE	
Lighting generator coil	Output	YL and YL	00.1 - 00.4	00.0 Ω	0.5 - 2.0	00.0VAC	—
	Coil insulation	YL and engine	0.L	00.0 MΩ	—	—	The term "engine" refers to the engine metal parts connected to the magneto housing.
	Ground continuity	BK and engine	00.0 - 00.5	00.0 Ω	—	—	

IGNITION SYSTEM TESTING — 593 HO SDI ENGINE								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE V		NOTE
				MULTIMETER SCALE	VALUE (ohms)	MULTIMETER SCALE	VALUE (volt)	
Engine stop switch	Running insulation	YL/BK and BK	B-21 ground	00.0 Ω or auto range	0.L	—	—	Engine cut-out switches must be in run position.
	Continuity in STOP position	YL/BK and BK	B-21 ground	00.0 Ω or auto range	00.0 - 00.5	—	—	Engine cut-out switches must be in stop position.
DESS switch	Insulation with DESS removed	WH/GR and WH/BK	B-38 B-26	00.0 Ω or auto range	0.L	—	—	DESS key removed.
	Continuity with DESS in run position	WH/GR and WH/BK	B-38 B-26	00.0 Ω or auto range	00.0 - 00.5	—	—	DESS key must be in place.
ECM	Ground connection	BK and negative battery terminal or body	B-1, B-2, B-9, B-32 and B-41	00.0 Ω or auto range	00.0 - 00.5	—	—	—
ECM power (with battery)	Power from battery	PK	B-11 ground	—	—	00.0 VDC	Same as battery voltage	Voltage always present.
	Power from regulator	GN/BL	B-36 and ground	—	—	00.0 VDC	1 to 2 volts	While cranking engine.
CPS	Resistance and output	BU/YL and WH/YL	A-5 A-19	00.0 Ω or auto range	190 - 290	00.0 VAC	2.0	While cranking engine.
High voltage coil	Primary winding resistance	—	Pin 1-2 Pin 2-3	00.0 Ω or auto range	0.3 to 0.6	—	—	Disconnect the ignition coil from the ECM
	Secondary winding resistance	—	—	—	—	—	—	No test possible.
Start switch	Start signal at ECM	OR/BK and LBN	11–DA-7–F 11–DA-3–F	—	—	00.0 VDC	Battery voltage	When start/RER switch is activated in all conditions.

LIGHTING SYSTEM TESTING — 593 HO SDI ENGINE								
PART	TEST TO BE PERFORMED	WIRE COLOR	MULTIMETER PROBE CONNECTION	RESISTANCE Ω		VOLTAGE V		NOTE
				MULTIMETER SCALE	VALUE (ohms)	MULTIMETER SCALE	VALUE (volt)	
Charging voltage	Refer to B.U.D.S.	—	—	—	—	—	—	—
Lighting generator coil	Output	YL and YL and GN	Pin 1, 2, 3	00.0 Ω or autorange	.145 to .185 3 times	00.0 VAC	3.5 to 5.5 3 times	Do the test between 1 and 2, 1 and 3 and 2 and 3 using manual starter.
	Coil insulation	YL, GN and engine	Pin 1, 2, 3 and engine	00.0 Ω or autorange	0.L	—	—	The term engine refers to the metal parts connected to the magneto housing.

INSPECTION OF AC CIRCUIT ISOLATION

All Electric Start Models

If AC circuit is not isolated from frame, headlamp beam will weaken.

INSPECTION

Disconnect regulator/rectifier.

On models with hydraulic brake, pull off the rubber boot from brake light microswitch assembly.

Connect one digital ohmmeter probe (needle ohmmeter will not offer enough precision) to frame and other probe to one of 2 YELLOW magneto wires.

Measured resistance must be infinite. If such is not the case, it means there is a connection between AC circuit and DC circuit.

Disconnect one accessory at the time to identify the faulty circuit.

INSPECTION OF HEATING ELEMENTS

All Skandic Models

All measurements must be performed at 21°C (70°F).

Throttle Lever Heating Element

Current Measurement

HIGH INTENSITY	BROWN wire	0.23 A minimum
LOW INTENSITY	BROWN/YELLOW wire	0.13 A minimum

Handlebar Grip Heating Element

Resistance Measurement

LOW INTENSITY	YELLOW/BLACK wire ORANGE/VIOLET wire	17.7 to 20.7 ohms
HIGH INTENSITY	YELLOW/BLACK wire ORANGE wire	8.73 to 10.67 ohms

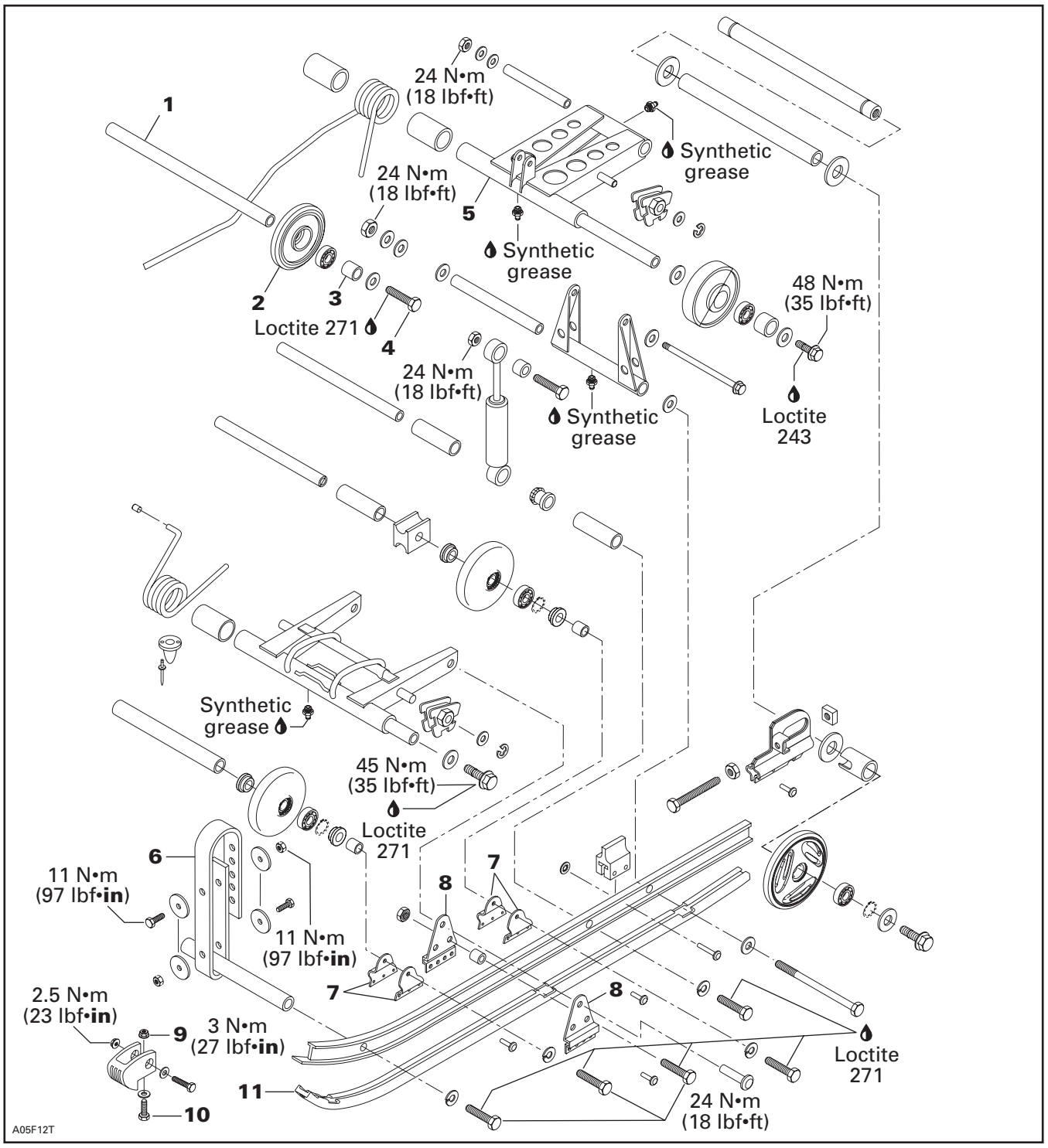
When measuring resistance at terminals the actual value will be half the measurement in table. The reason for that is the elements are connected in parallel. Therefore the total resistance is half the resistance of one element.

TORQUE REACTION SUSPENSION

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	293 550 033	487

Tundra


24 N•m
(18 lbf•ft)
1
Synthetic
grease
24 N•m
(18 lbf•ft)
5
Synthetic
grease
48 N•m
(35 lbf•ft)
2
3
Loctite 271
4
24 N•m
(18 lbf•ft)
Synthetic
grease
Loctite
243
Synthetic
grease
45 N•m
(35 lbf•ft)
Loctite
271
6
11 N•m
(97 lbf•in)
11 N•m
(97 lbf•in)
7
8
7
8
2.5 N•m
(23 lbf•in)
9
3 N•m
(27 lbf•in)
10
11
Loctite
271
24 N•m
(18 lbf•ft)
A05F12T

COMPONENT REMOVAL

Lift rear of vehicle and support it off the ground.

5, Rear Arm

Release track tension.

Release spring tension. Unfasten shock from rear arm. Remove 3 screws retaining rear arm.

SUSPENSION ASS'Y REMOVAL

Release track tension.

NOTE: To prevent cross shaft from turning when unscrewing screws assembled with threadlocker, proceed as follows:

– Loosen one screw then retighten.
– Remove the other screw.
– Remove the first one.

1,2,3,4, Cross Shaft, Idler Wheel, Spacer and Screw

Remove idler wheel ass'y.

Suspension Ass'y

Lift rear of vehicle and support it off the ground.

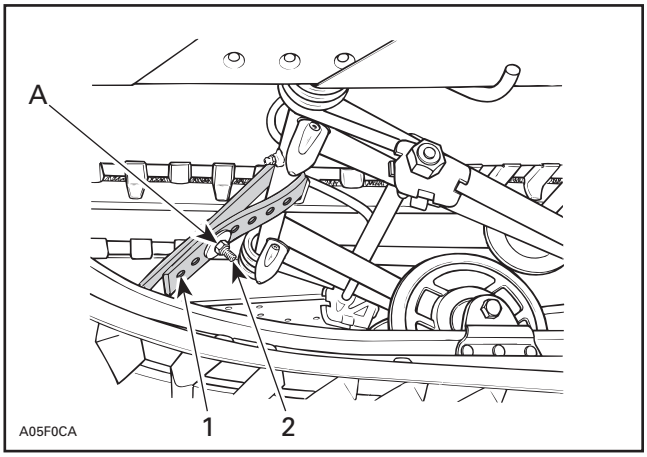
Unscrew 4 screws retaining front arm and rear arm to frame.

Remove suspension.

DISASSEMBLY AND ASSEMBLY

6, Stopper Strap

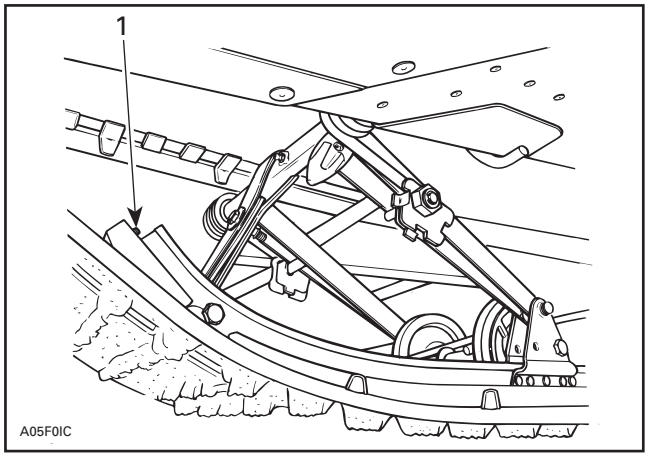
When assembling make sure it is attached through the 3rd hole from the end. Torque nut to 11 N•m (97 lbf•**in**).



1. 1st hole
2. 3rd hole
*A. 11 N•m (97 lbf•**in**)*

9,10,11, Nut, Slotted Screw and Slider Shoe

To replace a worn shoe, remove the front screw and stop nut, then slide the shoe rearward out of the runner.



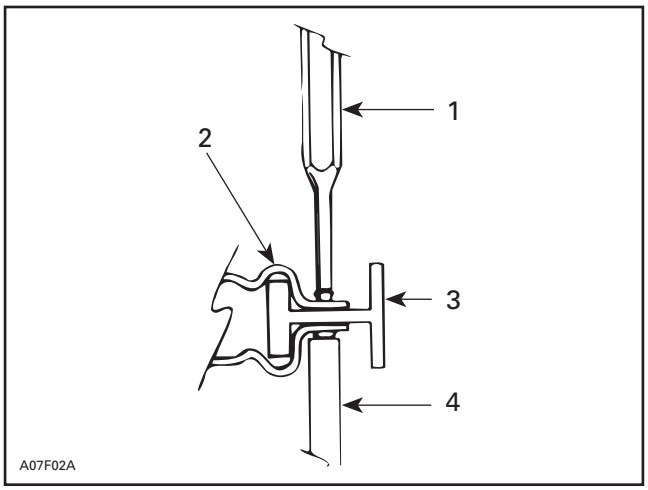
1. Front screw and nut

CAUTION: Slider shoes must always be replaced in pairs.

7,8, Support and Front Arm Support

To remove rivets securing the supports, cut rivet heads off using a cold chisel.

At assembly, position the rivet head toward the outside of the assembly. Support the rivet head against a metal block, as shown, and use a flat head punch to secure the rivet in place.



1. Flat head punch
2. Support
3. Runner
4. Metal block

NOTE: Rivets can be substituted with 3/16 in x 3/4 in long screws and flanged elastic stop nuts. Always position screw head outside the assembly.

INSPECTION

6, Stopper Strap

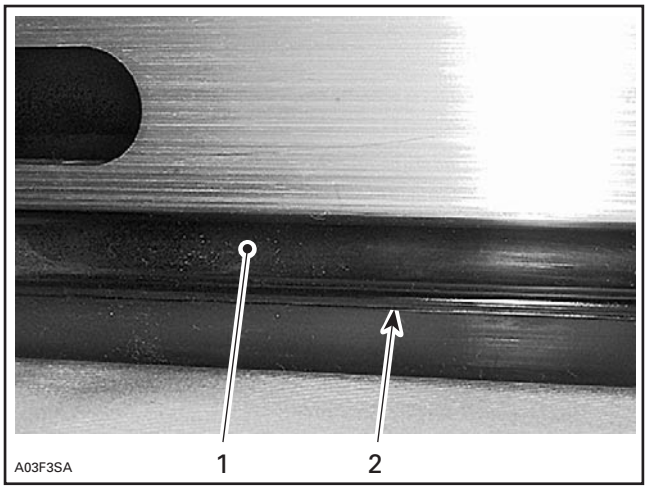
Inspect strap for wear or cracks, bolt and nut for tightness. If loose, inspect hole for deformation. Replace as required.

Shock Absorber

Refer to SUSPENSION AND SKI SYSTEM for shock inspection.

11, Slider Shoe

Molding line is the wear limit indicator.



TYPICAL
1. Slider shoe
2. Molding line (wear limit indicator)

Replace slider shoes when wear limit is reached.

CAUTION: Slider shoes must always be replaced in pairs.

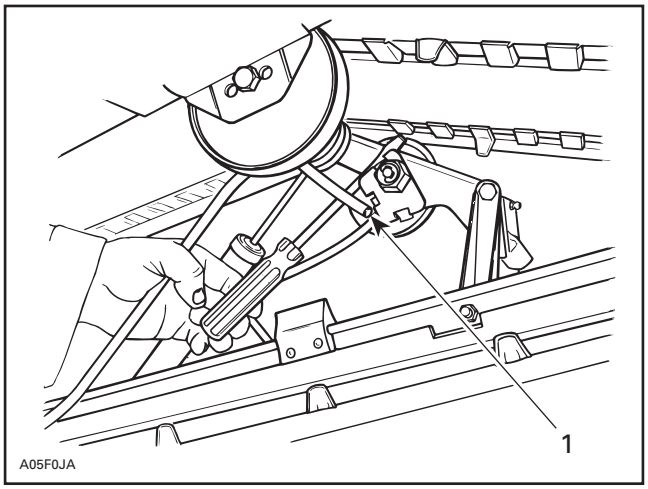
SUSPENSION ASS'Y INSTALLATION

Release rear spring tension then install assembled suspension into track with front portion first.

Insert rear portion of suspension into track.

Bolt suspension to tunnel.

Pry rear spring end onto cam.



1. Spring end

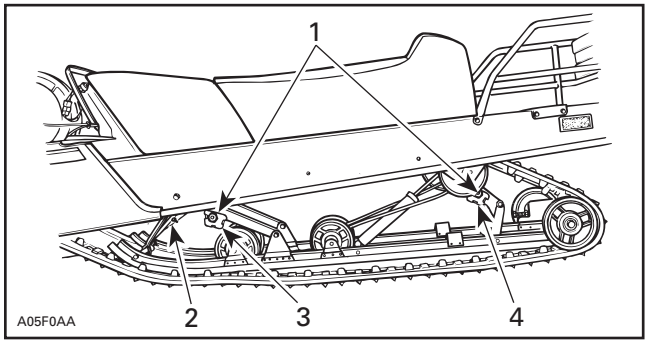
Adjust track tension/alignment. Refer to TRACK.

RIDE ADJUSTMENT

The front portion of rear suspension is adjustable for surface condition and steering effects.

The stopper strap is adjustable for vehicle weight transfer control.

The rear portion of rear suspension is adjustable for driver's weight.



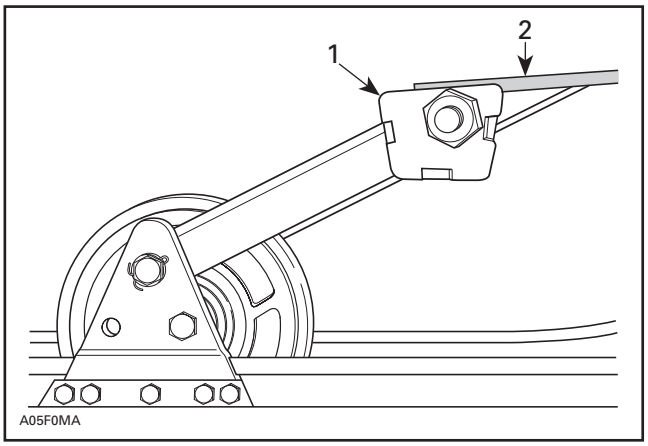
1. Driver's weight
2. Stopper strap for weight transfer
3. Steering effect/surface condition
4. Adjustment cams

Choice of suspension adjustments depends on carrying load, driver's weight, personal preference, riding speed and field condition.

Slight suspension bottoming occurring under the worst riding conditions indicates a good choice of spring preload.

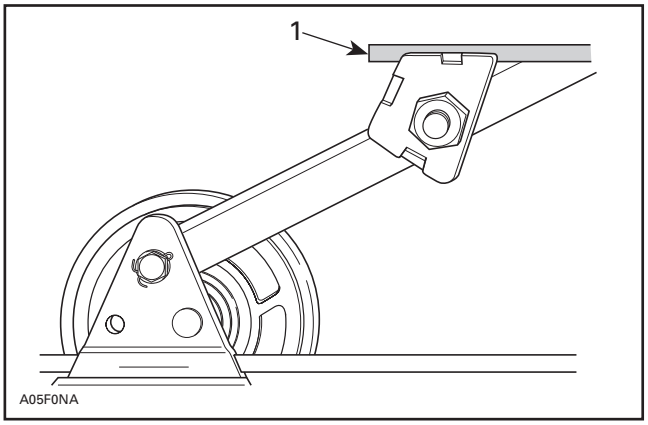
To adjust rear suspension with the adjustment cams, use special key supplied in vehicle tool box.

Turning adjustment cam moves edges of cam supporting spring rod. The softest adjustment is reached when the supporting edge of cam is the closest to hexagonal portion of cam.



SOFTEST ADJUSTMENT
1. Supporting edge closest to hexagonal
2. Spring

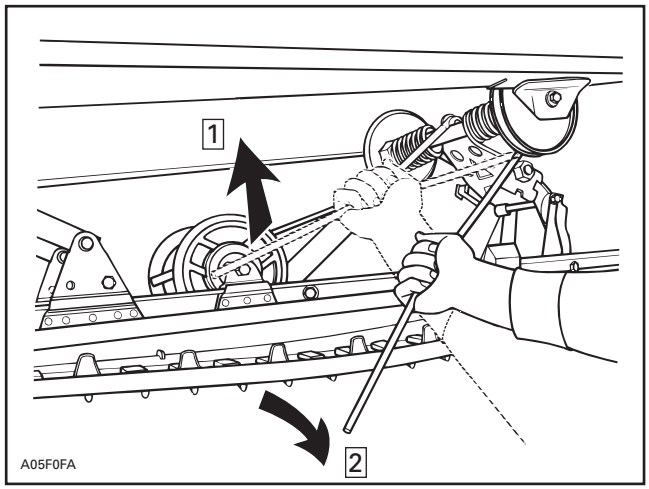
The stiffest adjustment is reached when the supporting edge of cam is the farthest to hexagonal portion of cam.



STIFFEST ADJUSTMENT
1. Supporting edge farthest to hexagonal

NOTE: To quickly change rear cam position without using any tool:

– Lay vehicle on its side.
– Unhook rear spring by hand from lower idler wheel.



– Turn adjustment cam by hand to the desired position.
– Reinstall spring on its support making sure that it sits in the groove of support.

Stopper Strap

The function of the stopper strap is to control the transfer of vehicle weight during acceleration and to control track lead angle.

The longer the belt, the more the weight will be transferred to the track to provide a better traction. The shorter the belt, the lesser the weight transferred to the track, thus maintaining a more positive steering.

The longer the belt, the greater will be the track lead angle. A shorter belt will reduce track lead angle which may help when negotiating a particular snow condition.

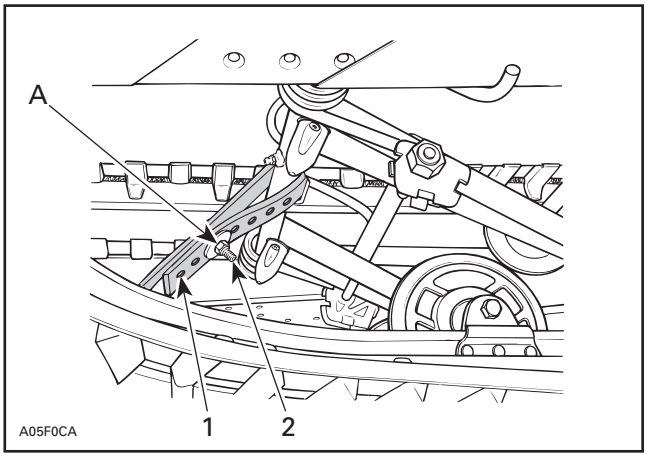
Adjusting holes on the stopper strap allow to adjust it according to driver's requirements, field and/or snow conditions.

CAUTION: Whenever stopper strap length is changed, track tension must be readjusted to prevent any possibility of operating vehicle with a too loose or too tight track tension.

For normal use, locate bolt through 3rd hole from strap end.

⚠ WARNING

Always torque the nut to 11 N•m (97 lbf•in). Replace strap if worn or torn.



1. 1st hole
2. 3rd hole
A. 11 N•m (97 lbf•in)

NOTE: When towing a load, it is suggested to adjust stopper strap to its shortest length, soften front springs of rear suspension and stiffen rear springs. These adjustment will improve steering ability.

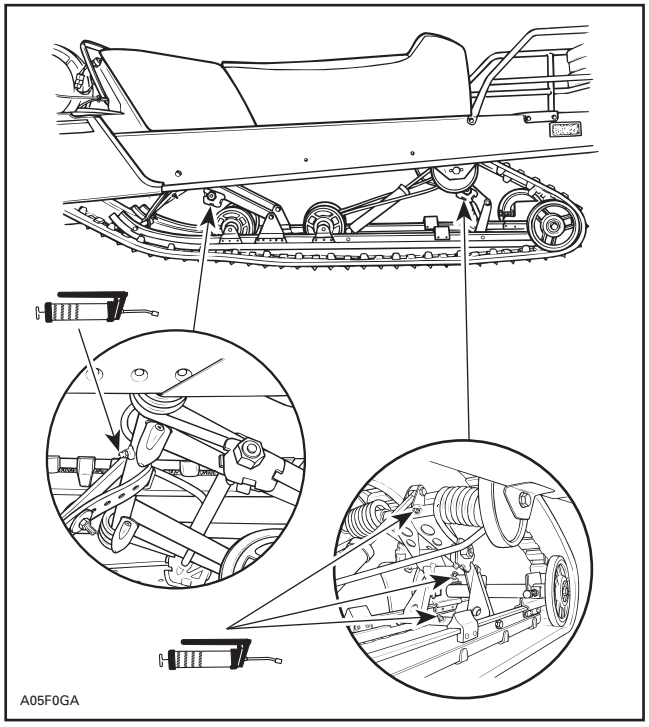
Deep Snow Operation

When operating the vehicle in deep snow, it may be necessary to change position of adjustment cams, stopper strap and/or driver's riding position, to change the angle at which the track rides on the snow. Operator's familiarly with the various adjustments as well as snow conditions will dictate the most efficient combination.

LUBRICATION

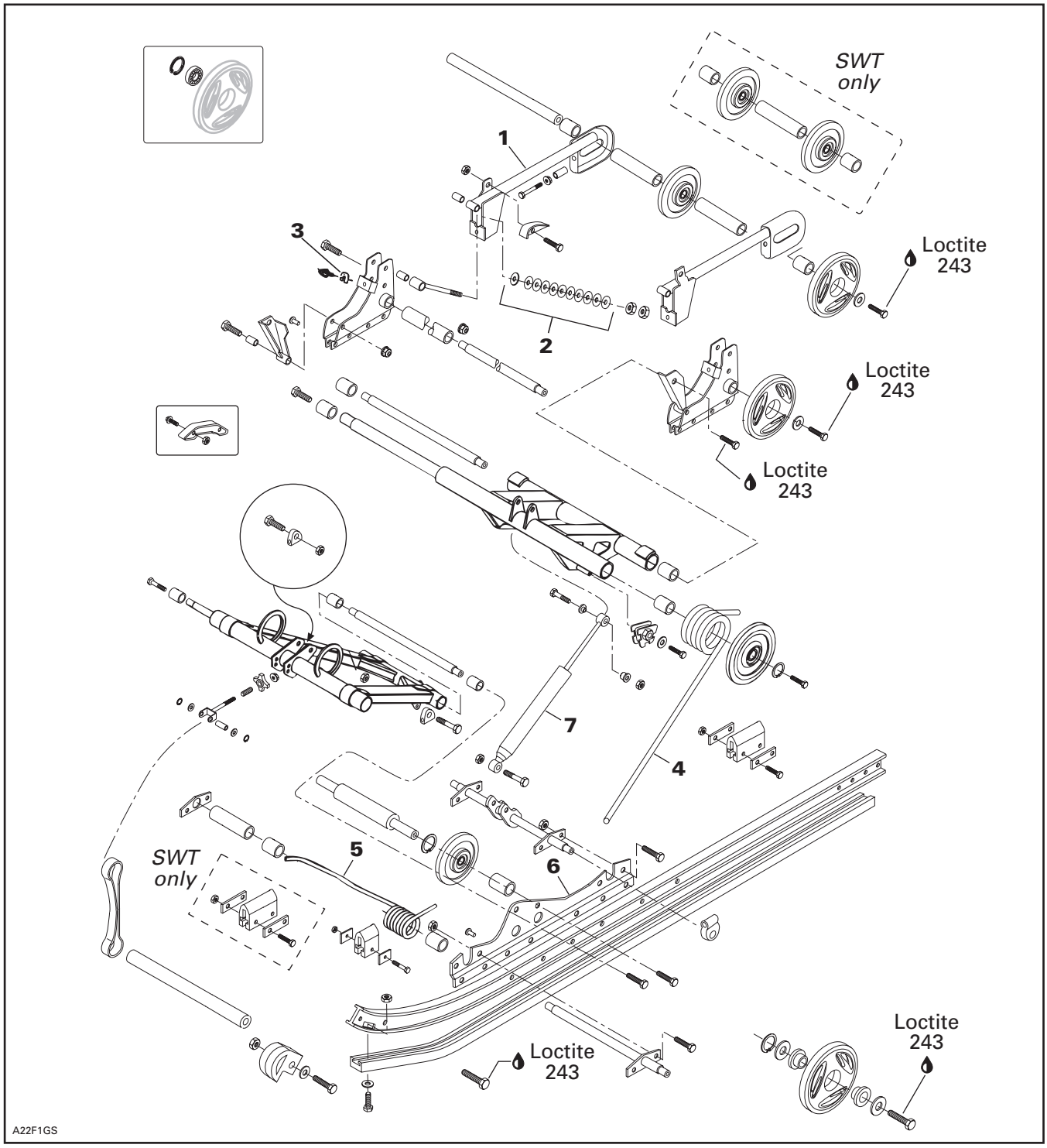
Lubricate front and rear arms at grease fittings using suspension synthetic grease (P/N 293 550 033).

NOTE: There are 4 grease fittings.



ARTICULATING SLIDE SUSPENSION

Skandic LT/WT/SWT/WT LC



TYPICAL

REMOVAL

Release track tension.

Lift rear of vehicle and support it off the ground.

Unbolt front arm then rear arm.

Self-Locking Screws

CAUTION: These self-locking screws must always be replaced by new ones every time they are removed.

NOTE: To prevent axle from turning when unscrewing self-locking screws, proceed as follows:

– Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
– Remove the opposite self-locking screw.
– Remove the temporary installed non-self-locking screw.
– If it doesn't work, heat bolt head to melt threadlocker.

Remove suspension assembly.

DISASSEMBLY AND ASSEMBLY

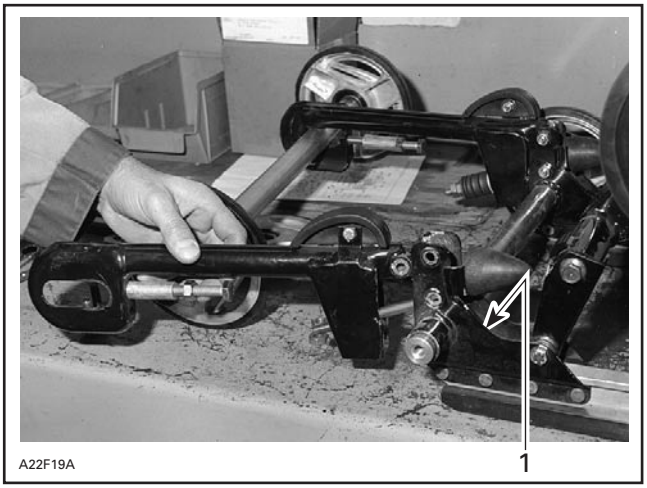
1, Extension

Remove nuts and conical washers from the eye bolt adjuster. Remove bolt retaining eye bolt adjuster to support.

Remove rear idler wheel on appropriate side.

Remove idler wheel from support.

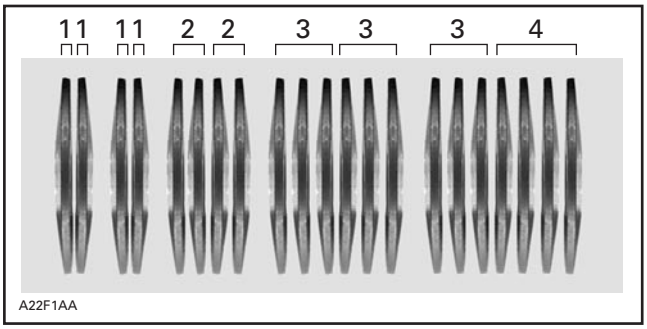
Unbolt extension from its support.



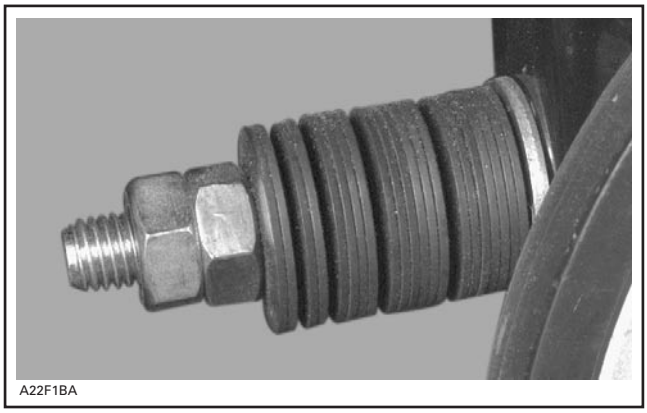
1. Support

2, Conical Washer

At installation, position conical washers as shown.



WASHER QUANTITY AND MOUNTING POSITION



Tighten nut 3/4 turn after contacting washers for better deep snow performance. Maximum preload is 3 turns after nut touching washers. This last adjustment is for trail riding with or without a load and for pulling a load.

4, Rear Spring

Remove top idler wheels.

Unscrew one end of shock.

Remove spring.

5, Front Spring

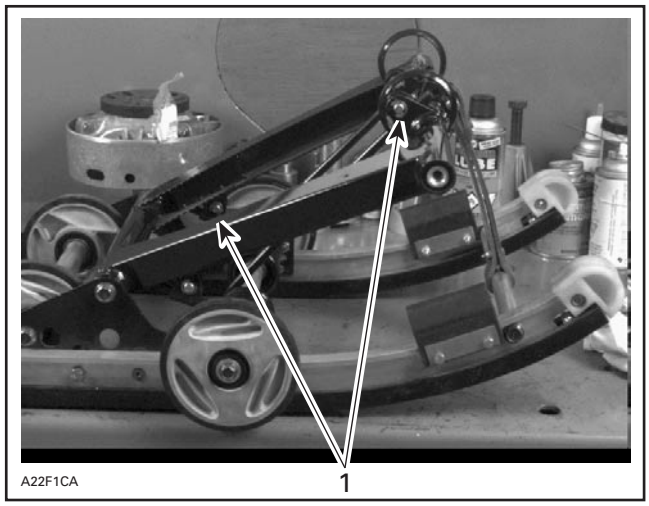
Remove circlips retaining spring support to top and bottom of front arm.

Holding spring end, remove lock pin of top spring support then bottom support lock pin.

Unbolt front idler wheel axle.

Remove idler wheel on side where axle retaining plate is not welded.

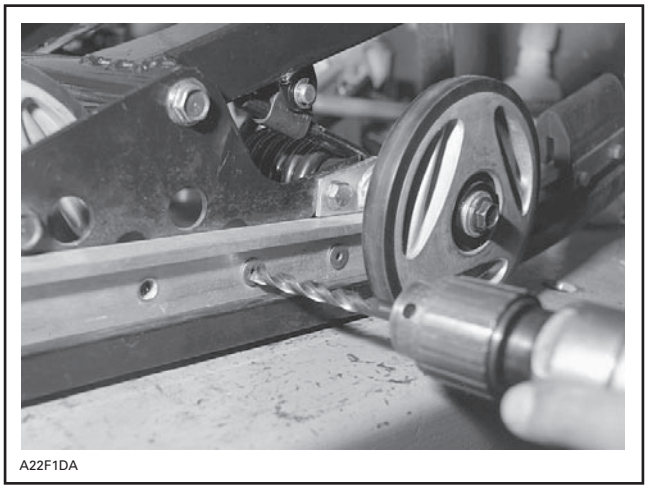
Remove springs.



1. Circlips

6, Support Plate

Drill rivets to remove support plate. Use a 8 mm (21/64 in) drill bit.



Rivets can be substituted by M8 x 20 bolts and nuts.

3, Horse-Shoe Washer

For deep snow riding, do not install washer.

For trail riding with passenger and/or weight, install 1 washer under each rubber stoppers.

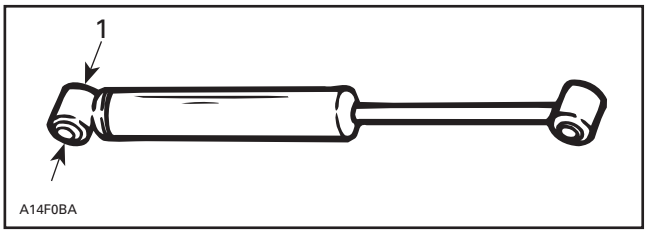
For trail riding with heavy load and/or pulling a load, use 2 washers under each rubber stoppers.

7, Shock

Install shock with its rod upward.

SHOCK ABSORBER SERVICING

Secure the shock body end in a vise.



TYPICAL
1. Clamp

CAUTION: Do not clamp directly on shock body.

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke then check that it moves smoothly and with uniform resistance.

Pay attention to the following conditions that will denote a faulty shock:

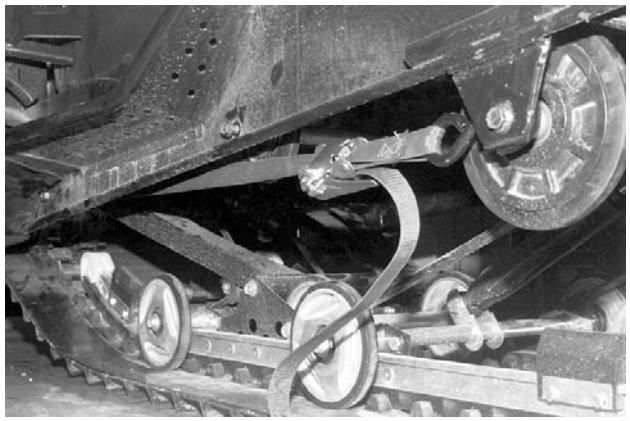
– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme ends of stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any fault is present.

INSTALLATION

Threaded holes must be cleaned before a self-locking screw is installed. Use a metal brush or a screwtap to clean the hole properly then use a solvent (Methyl-Chloride), let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

Use a tie-down between front arm and spring axle to ease installation of front arm screws.



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RIDE ADJUSTMENT

Refer to *Operator's Guide*.

SUV SUSPENSION

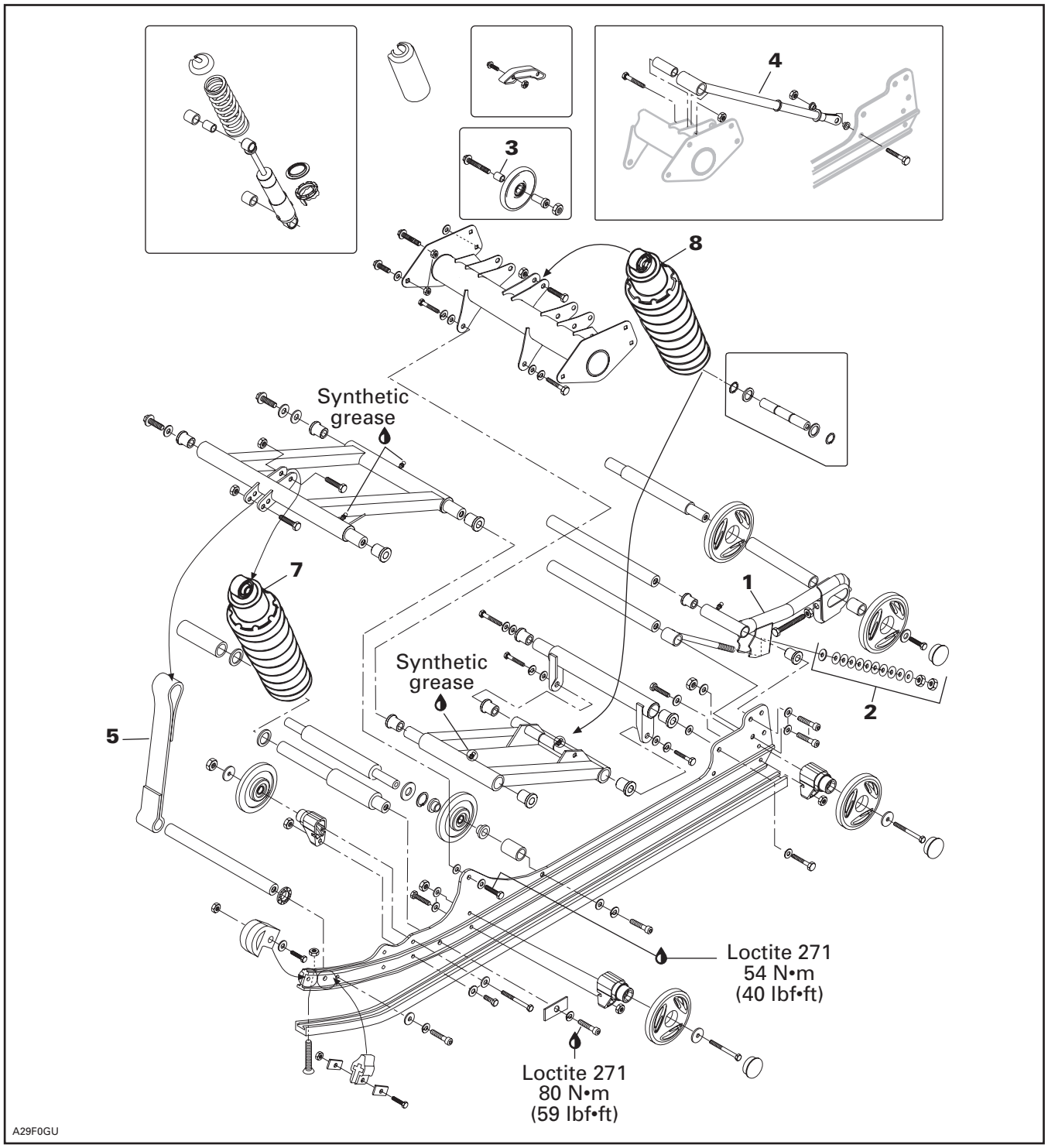
SERVICE TOOLS

Description	Part Number	Page
shock spring removal kit	529 035 504	496

SERVICE PRODUCTS

Description	Part Number	Page
synthetic grease	413 711 500	498

Skandic SUV/Expedition TUV



TYPICAL

REMOVAL

Release track tension.

Lift rear of vehicle and support it off the ground.

Unbolt front arm then rear arm.

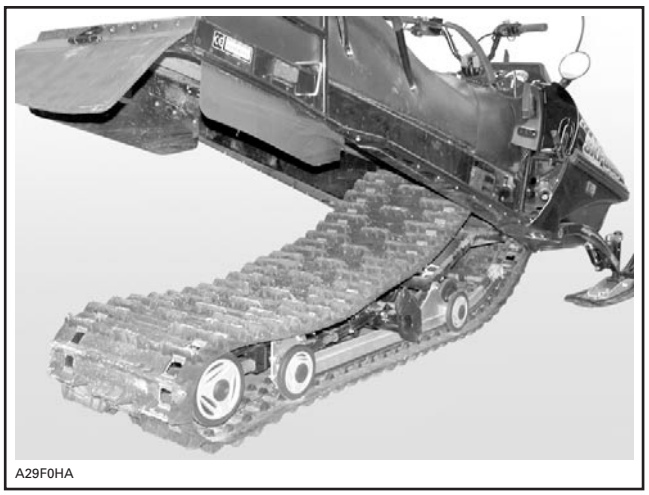
Self-Locking Screws

CAUTION: These self-locking screws must always be replaced by new ones every time they are removed.

NOTE: To prevent axle from turning when unscrewing self-locking screws, proceed as follows:

– Remove one self-locking screw then install a 10 mm shorter non-self-locking one in place. Torque as specified in exploded view.
– Remove the opposite self-locking screw.
– Remove the temporary installed non-self-locking screw.
– If it doesn't work, heat bolt head to melt threadlocker.

Remove suspension assembly.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DISASSEMBLY AND ASSEMBLY

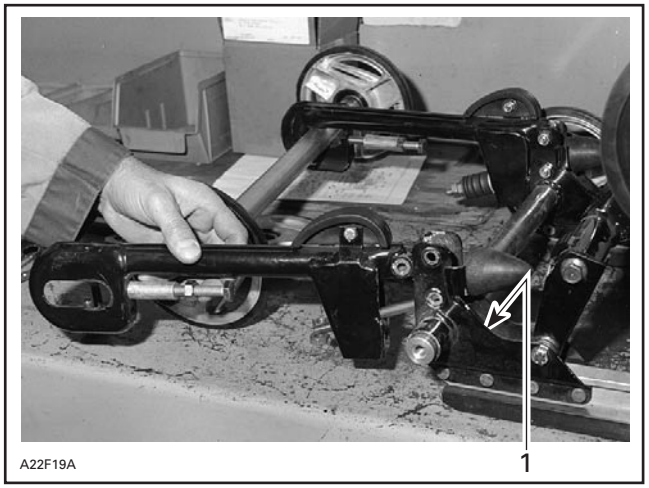
1, Extension

Remove nuts and conical washers from the eye bolt adjuster. Remove bolt retaining eye bolt adjuster to support.

Remove rear idler wheel on appropriate side.

Remove idler wheel from support.

Unbolt extension from its support.



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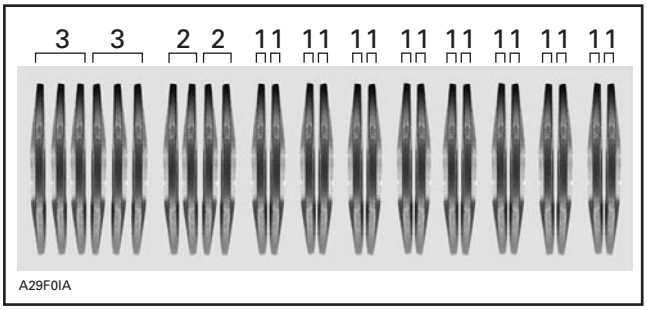
TYPICAL
1. Support

2, Conical Washer

At installation, position conical washers as shown.



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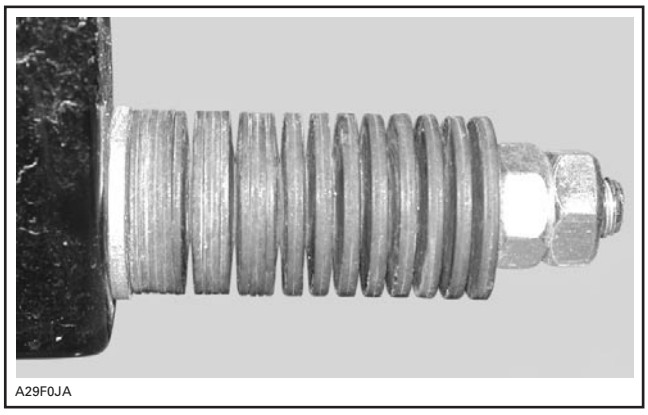
WASHER QUANTITY AND MOUNTING POSITION


A29F0JA

Tighten nut 3/4 turn after contacting washers for better deep snow performance. Maximum preload is 3 turns after nut touching washers. This last adjustment is for trail riding with or without a load and for pulling a load.

8, Rear Spring

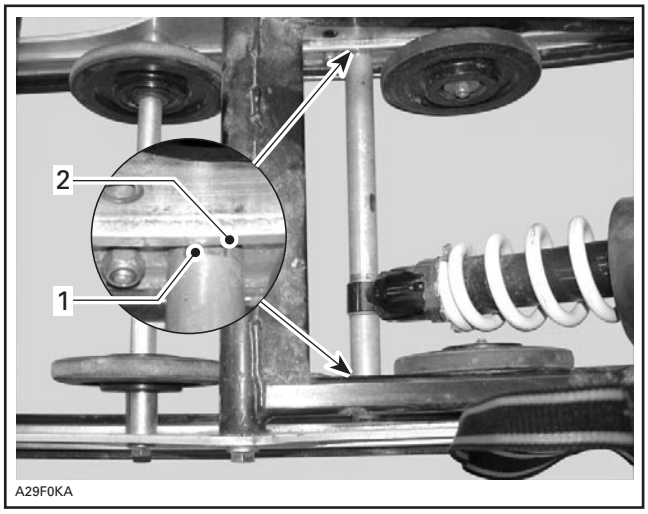
Unbolt top and bottom ends of shock.

7, Front Spring

Unbolt top end of shock.

Unbolt axle retaining bottom end of shock.

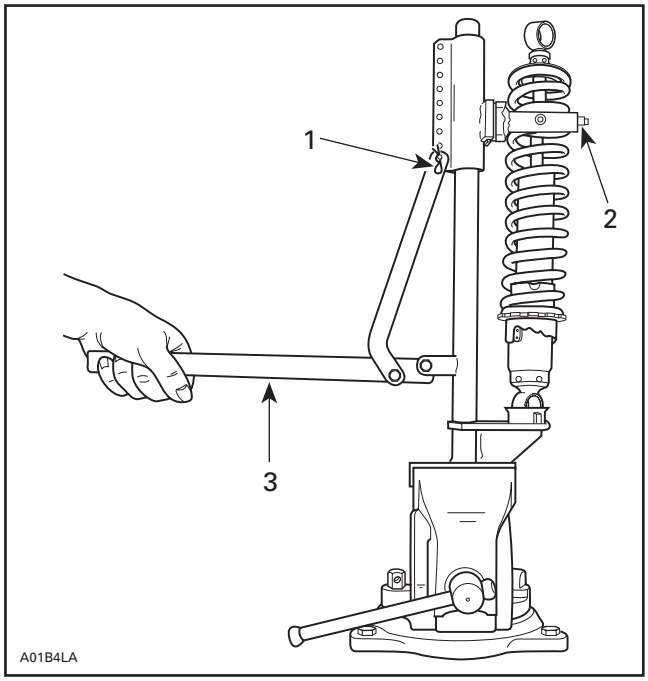
At assembly, make sure that notch on both axle sleeves match rail rib.



1. Notch
2. Rail rib

For shock spring disassembly use shock spring removal kit (P/N 529 035 504) in a vise. Mount shock in it and turn shock so that spring coils rests against spring compressor jaw.

Close and lock the bar. Place handle horizontally by changing the position of the clevis pin.

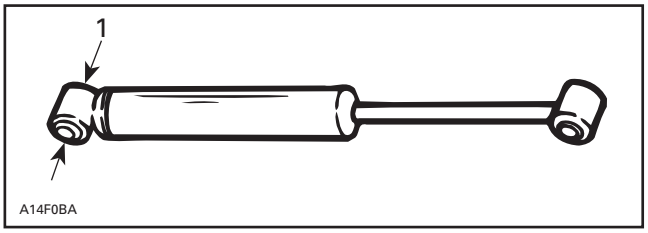


1. Clevis pin
2. Bar
3. Handle horizontal

Push down on the handle until it locks. Remove spring stopper then release handle.

SHOCK ABSORBER INSPECTION

Secure the shock body end in a vise.



TYPICAL
1. Clamp

CAUTION: Do not clamp directly on shock body.

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke then check that it moves smoothly and with uniform resistance.

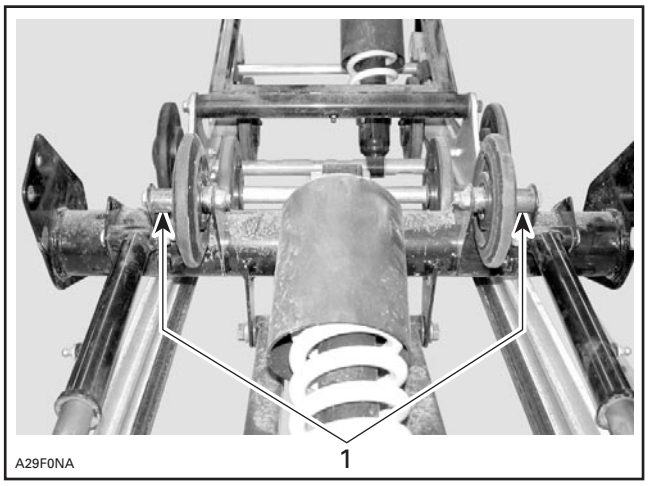
Pay attention to the following conditions that will denote a faulty shock:

– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme ends of stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any fault is present.

3, Spacer

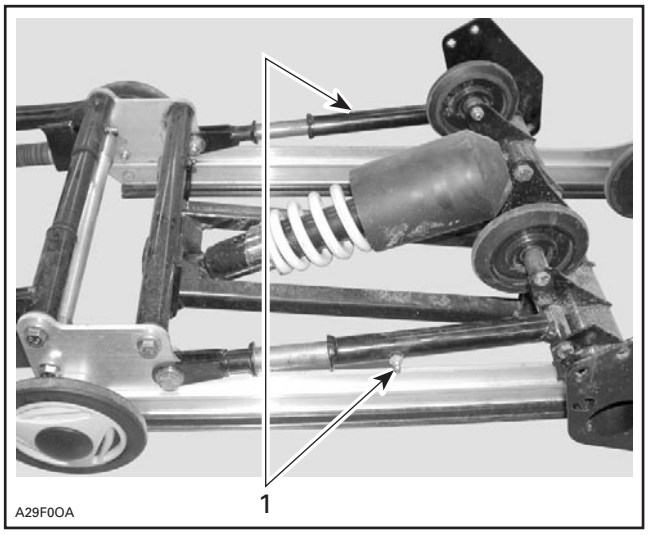
At assembly, install spacer on outer side of top idler wheel.



1. Spacers

4, Coupling Tube

At assembly, install coupling tube with its grease fitting facing outward.



1. Grease fitting facing outward

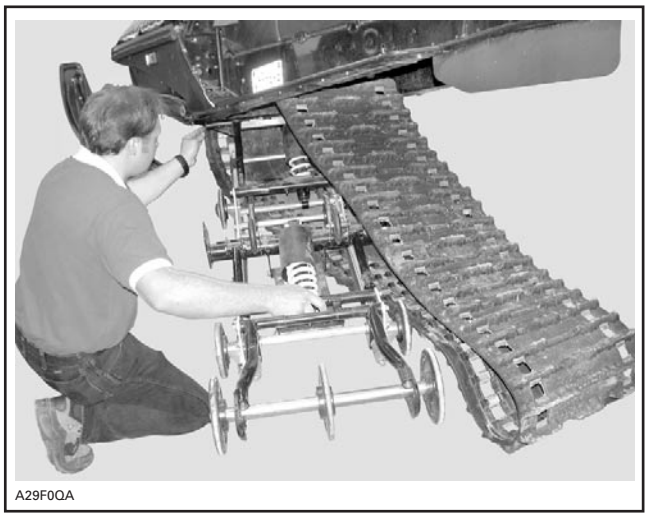
5, Stopper Strap

Fasten stopper strap to lower bracket hole.

INSTALLATION

Threaded holes must be cleaned before a self-locking screw is installed. Use a metal brush or a screwtap to clean the hole properly then use a solvent (Methyl-Chloride), let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

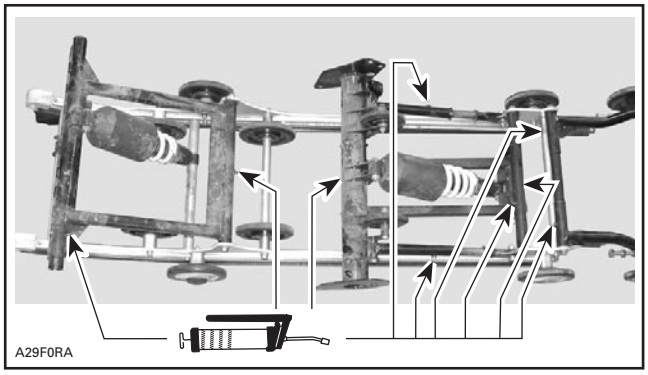
Install front portion of suspension first.



LUBRICATION

Lubricate front and rear arms at grease fittings using synthetic grease (P/N 413 711 500).

NOTE: There is 9 grease fittings.



RIDE ADJUSTMENT

Refer to *Operator's Guide*.

DRIVE AXLE

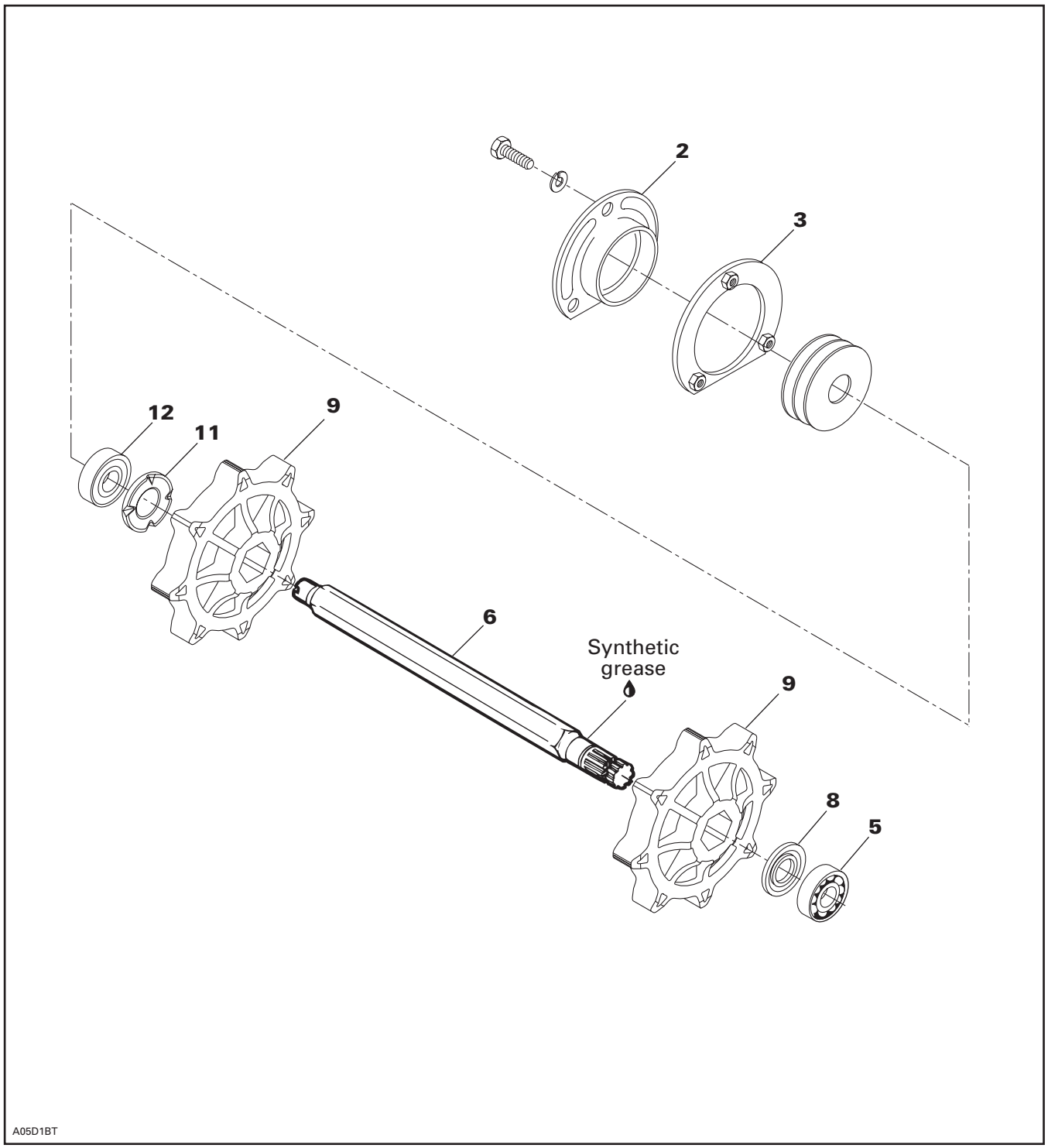
SERVICE TOOLS

Description	Part Number	Page
drive axle sprocket adjuster kit	861 725 700	509

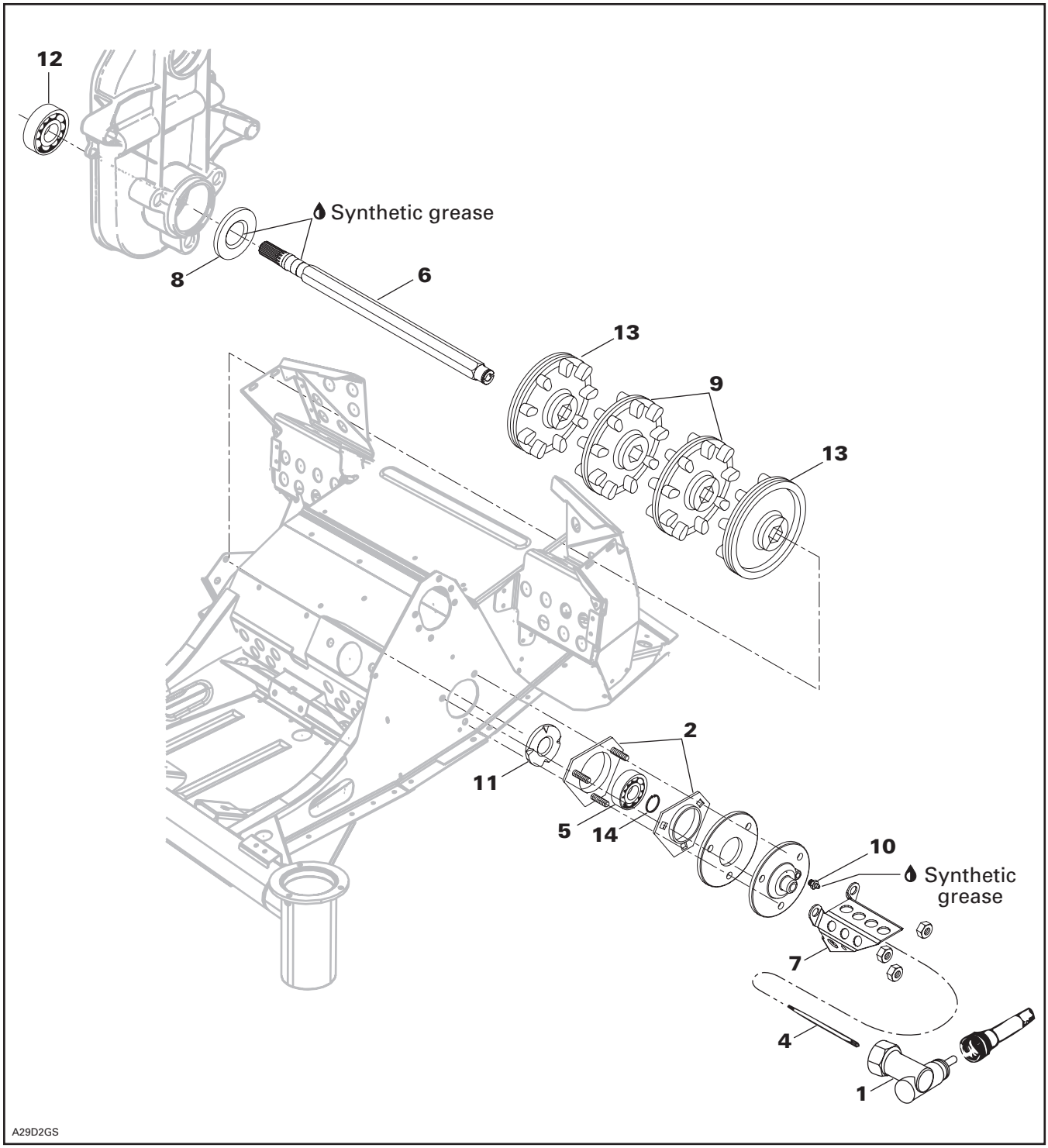
SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	508

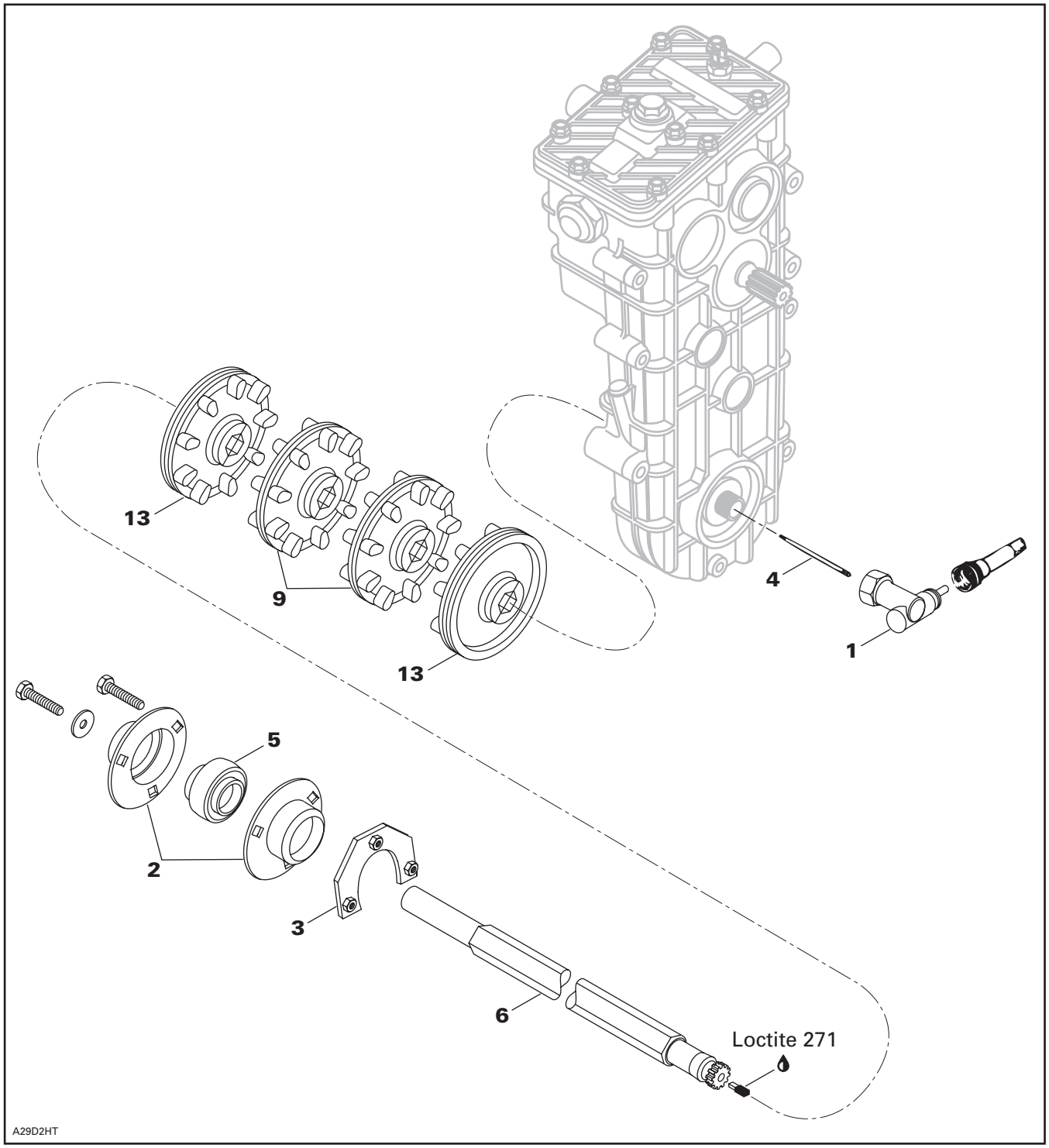
Tundra



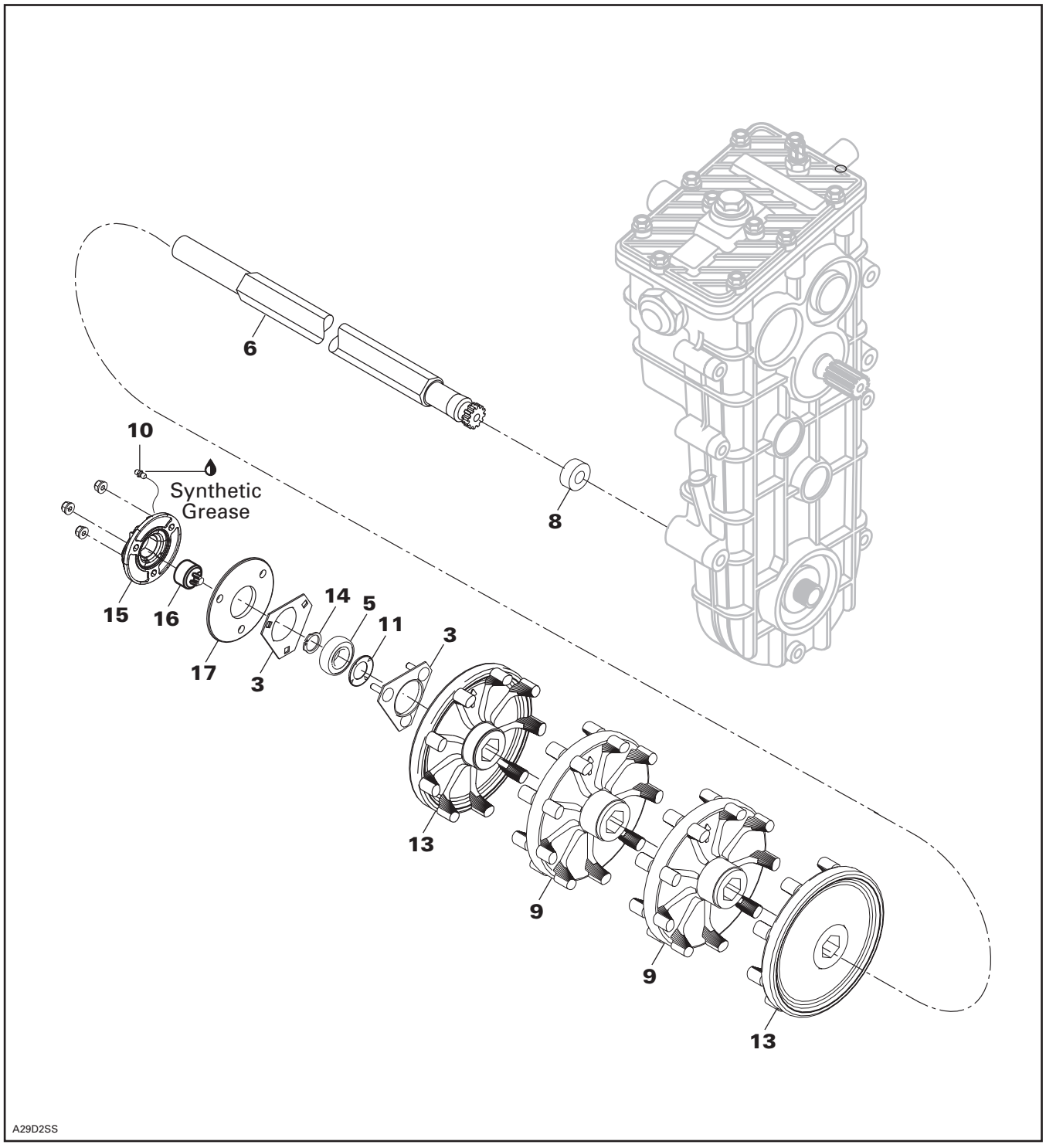
Skandic LT/LT E



Skandic WT/SWT/WT LC/SUV



Expedition TUV



REMOVAL

Tundra R and Skandic LT/LT E

Drain oil from chaincase. Release drive chain tension. Remove chaincase cover.

Raise and block rear of vehicle off the ground.

Remove suspension. Refer to SUSPENSION.

2,8, End Bearing Housing and Seal

Remove cable protector **no. 7**, and plastic bearing cover. Remove circlip **no. 14** from drive axle.

Remove chain and sprocket then circlip and bearing **no. 12** from drive axle.

Pry oil seals from chaincase and end bearing housing.

6,9,13, Drive Axle and Sprocket

Release drive axle sprocket from track and at the same time, pulling the drive axle towards the end bearing housing side.

Remove drive axle from vehicle.

Skandic WT/SWT/WT LC/SUV

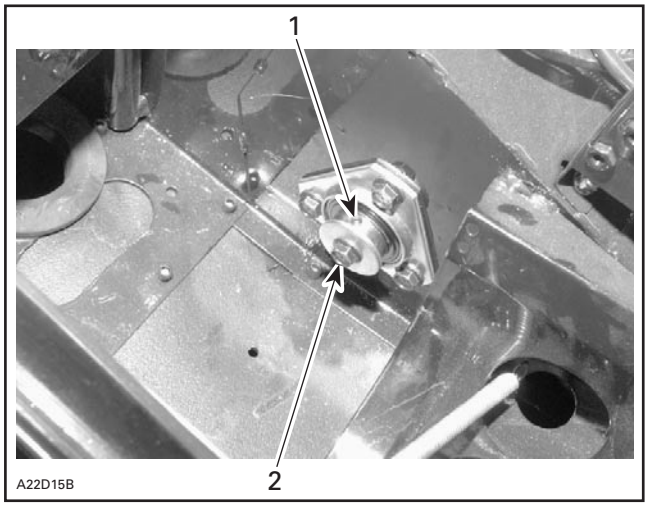
Drain gearbox.

Remove angle drive **no. 1** and square pin **no. 4**.

Raise and block rear of vehicle off the ground.

Remove suspension. Refer to ARTICULATING SLIDE SUSPENSION.

Remove muffler. Unfasten screw from drive axle end. Loosen Allen screw on bearing race.



1. Allen screw
2. Screw

Remove 3 screws retaining ball bearing housing then, remove inner plate **no. 3**.

Remove drive axle.

Expedition TUV

Drain gearbox.

Remove the following parts:
- speedometer flange **no. 15**
- magnetic adaptor **no. 16**
- washer **no. 17**
- bearing housing cover **no. 3**.

Raise and block rear of vehicle off the ground.

Remove suspension. Refer to ARTICULATING SLIDE SUSPENSION.

Release drive axle sprocket from track and at the same time, pulling the drive axle towards the end bearing housing side.

Remove drive axle.

DISASSEMBLY

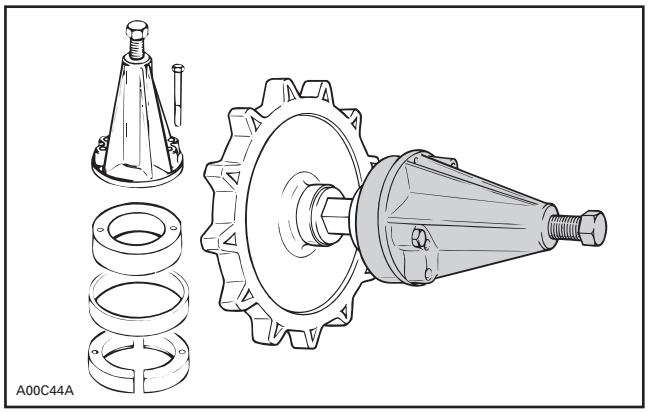
4, Speedometer Drive Insert

Remove speedometer drive insert.

5,12, Bearing

Tundra Only

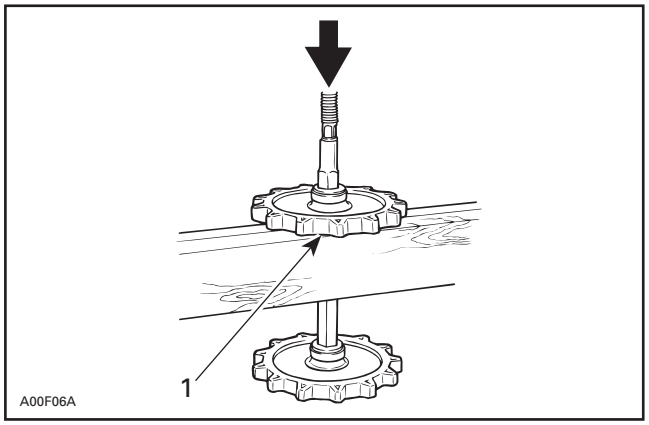
To remove bearings, use puller assembly, ring and half rings as illustrated.



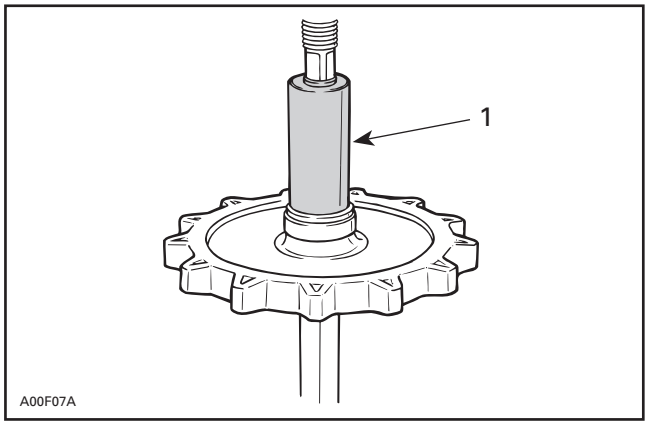
9,13, Sprocket and Half-Sprocket

All Models

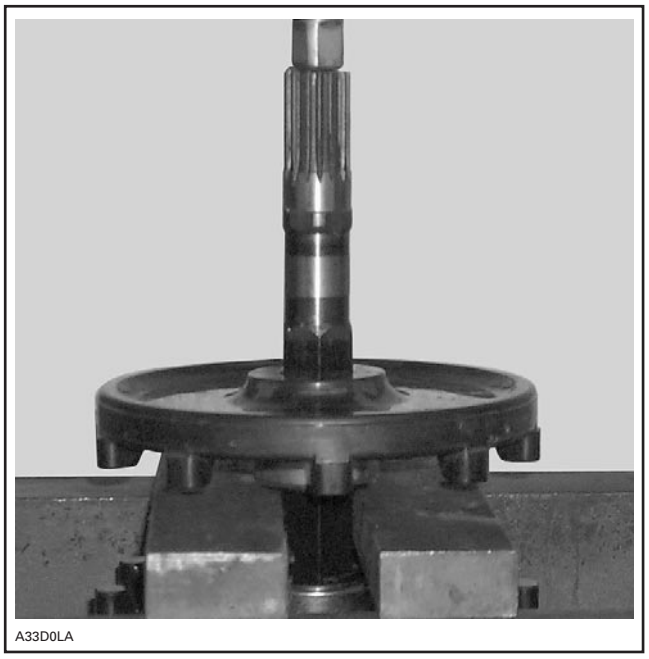
To remove press fit sprockets, use a press and a suitable support as illustrated.



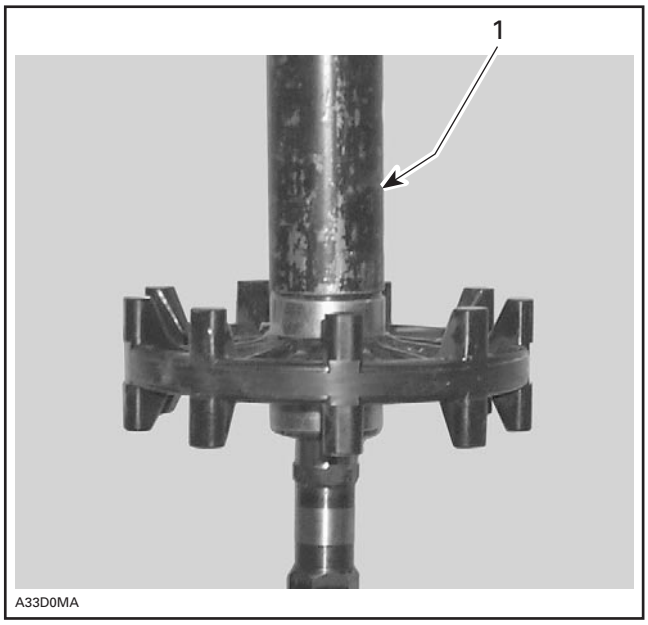
TYPICAL — TUNDRA
1. Support sprocket near hub



TYPICAL — TUNDRA
1. Pipe



TYPICAL — ALL MODELS EXCEPT TUNDRA



TYPICAL — ALL MODELS EXCEPT TUNDRA
1. Pipe

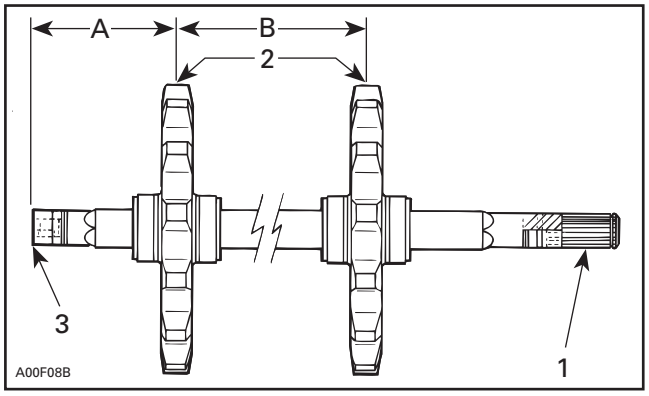
NOTE: Two different types of sprocket press fit can be found. Ensure to replace ring reinforced sprockets with the same type.

ASSEMBLY

6,9,13, Drive Axle and Sprocket

To assemble press fit sprockets, use a press and a suitable pipe as illustrated. Sprockets must be assembled according to the following dimensions.

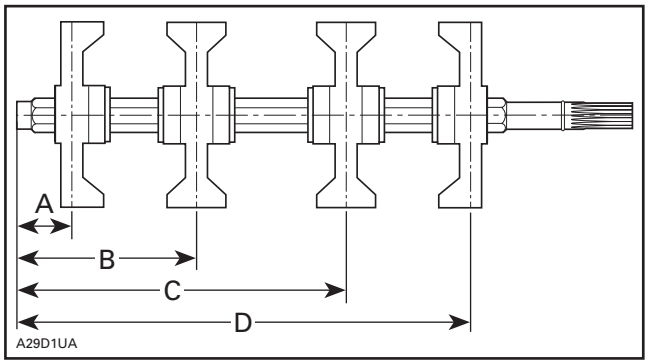
Tundra



TYPICAL
1. Chaincase side
2. Center line of sprocket
3. Drive axle end

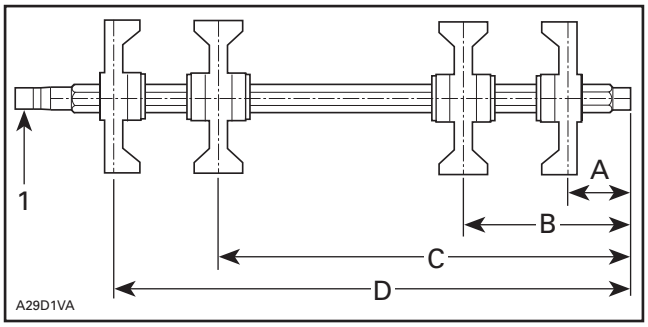
A. 83.0 mm (3-17/64 in)
B. 237 mm (9-21/64 in)

Skandic LT/LT E



A. 47.0 mm (1.850 in)
B. 148.0 mm (5.827 in)
C. 271.0 mm (10.669 in)
D. 372.0 mm (14.646 in)

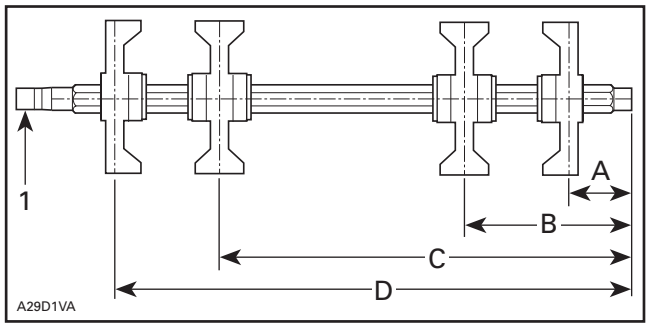
Skandic WT/WT LC/SUV



1. Gearbox side

A. 55.0 mm (2.165 in)
B. 157.0 mm (6.181 in)
C. 399.0 mm (15.709 in)
D. 501.0 mm (19.724 in)

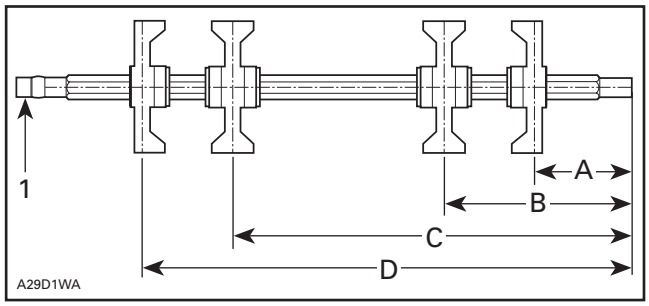
Expedition TUV



1. Gearbox side

A. 46.0 mm (1.811 in)
B. 148.0 mm (5.827 in)
C. 390.0 mm (15.354 in)
D. 492.0 mm (19.370 in)

Skandic SWT

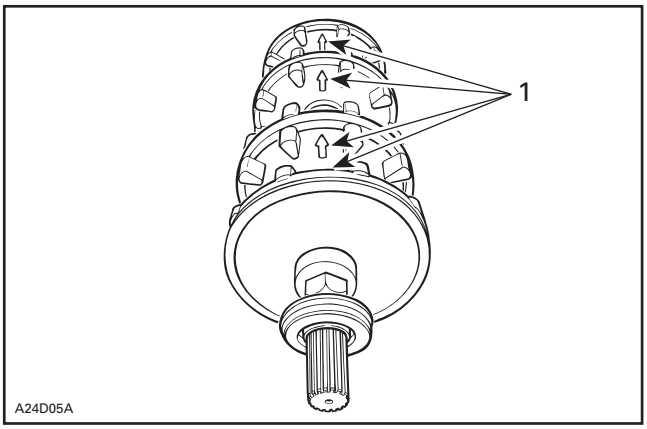


1. Gearbox side

A. 105.0 mm (4.016 in)
B. 207.0 mm (8.150 in)
C. 449.0 mm (17.677 in)
D. 551.0 mm (21.693 in)

All Models

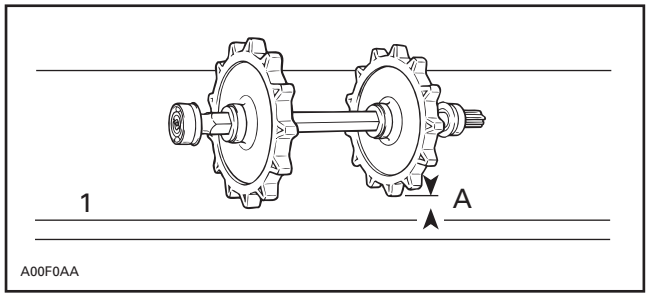
Ensure to align indexing marks of each sprocket when assembling.



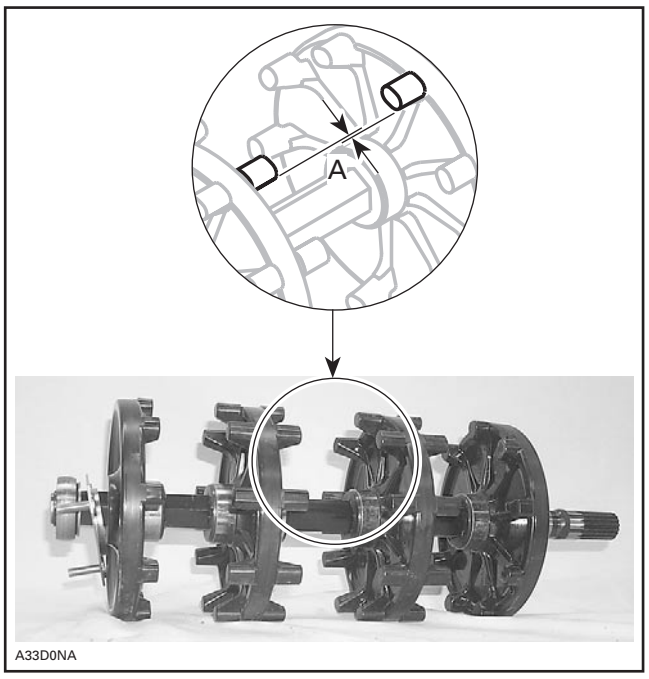
TYPICAL
1. Indexing marks aligned

The maximum de-synchronization for the sprockets is 1.5 mm (1/16 in).

To check this tolerance, place axle assembly on a plane surface and measure the gap between sprocket tooth and surface.



TYPICAL — TUNDRA
1. Plane surface
A. 1.5 mm (1/16 in) MAXIMUM

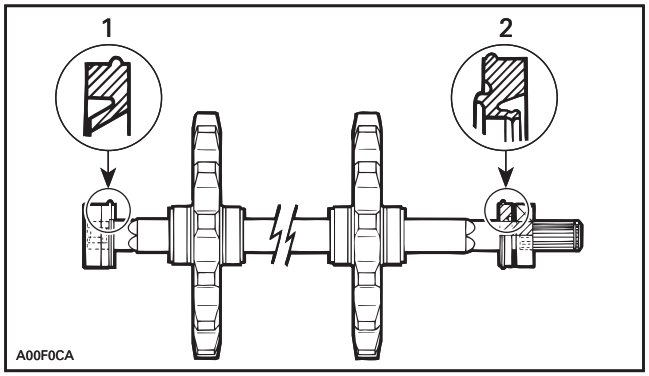


TYPICAL — ALL MODELS EXCEPT TUNDRA
A. 1.5 mm (1/16 in) MAXIMUM

CAUTION: The same sprocket must not be pressed twice on the axle. If synchronization is found to be defective, use a new sprocket.

6,8, Drive Axle and Seal

When assembling drive axle, always position a new seal on each end of drive axle (if applicable). Locate seal lip as illustrated.



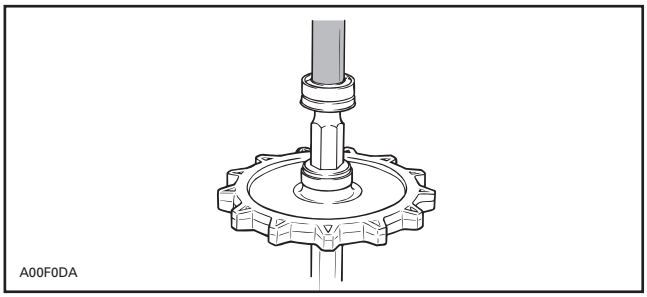
1. Grease seal type
2. Oil seal type

11, Bearing Protector

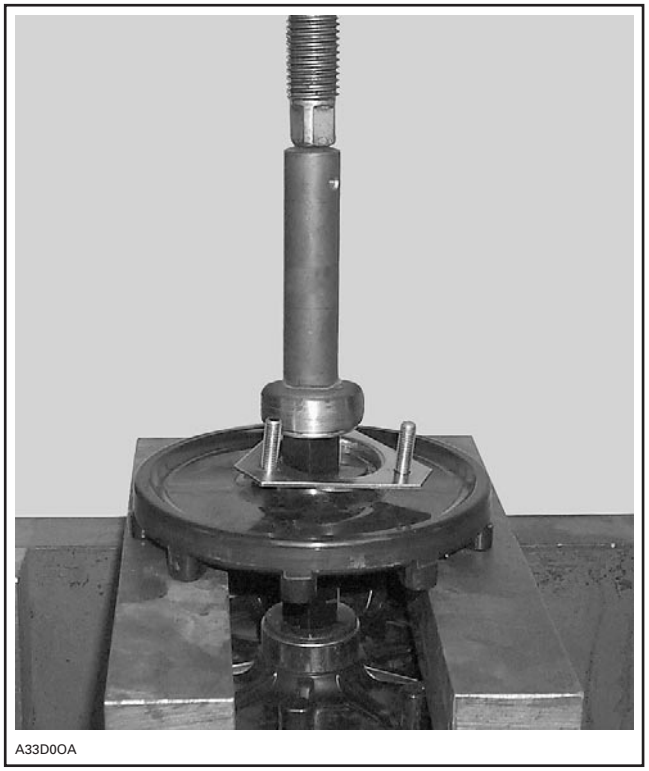
At assembly, flat side of bearing protector must be against bearing.

5,12, Bearing

Always push bearing by inner race.

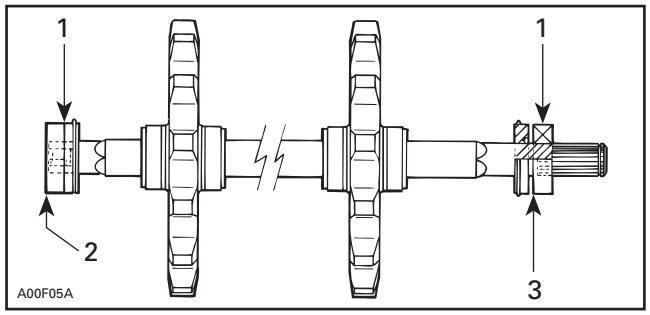


TYPICAL — TUNDRA



TYPICAL — ALL MODELS EXCEPT TUNDRA

The bearing on the splined side of axle must be pushed until it is seated on shaft shoulder. The end bearing housing bearing must be flush with end of drive axle. Each bearing must have its shield facing the sprocket.

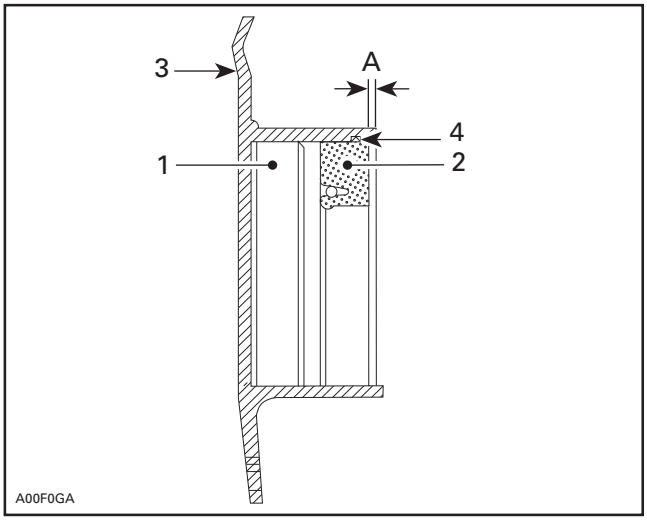


1. Bearing shield on this side
2. Flush with drive axle
3. Seated on shaft shoulder

INSTALLATION

Position drive axle assembly into location. Install end bearing housing. Install spacer (if applicable) between bearing and lower chaincase sprocket.

Install chaincase and position seals (if applicable), making sure that a gap of approximately 2 mm (1/16 in) exists between end of bearing housing and each seal.



SIDE VIEW
1. Bearing
2. Seal
3. Housing
4. Seal lip

A. 2 mm (.080 in) approximately

3, Retainer Ring

Make sure that welded nuts are toward inside of tunnel.

Lock drive axle sprocket with a circlip.

Reinstall the chaincase cover.

Refill with chaincase oil. Refer to TECHNICAL DATA.

Install the suspension. Refer to TRACK and adjust track tension and carry out track alignment procedure.

LUBRICATION

10, Grease Fitting

Lubricate end housing bearing with suspension synthetic grease (P/N 293 550 033).

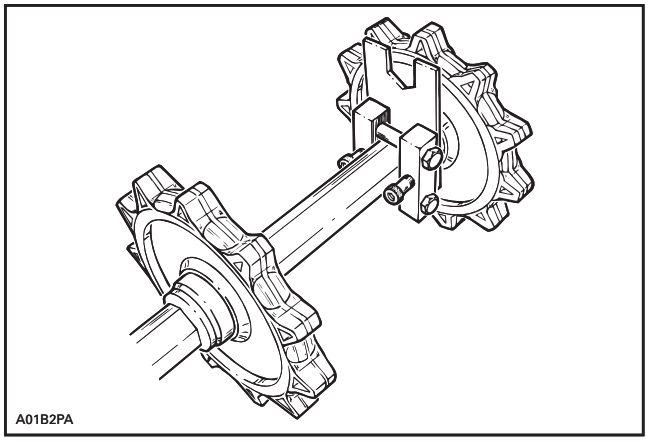
ADJUSTMENT

Sprocket/Track Alignment

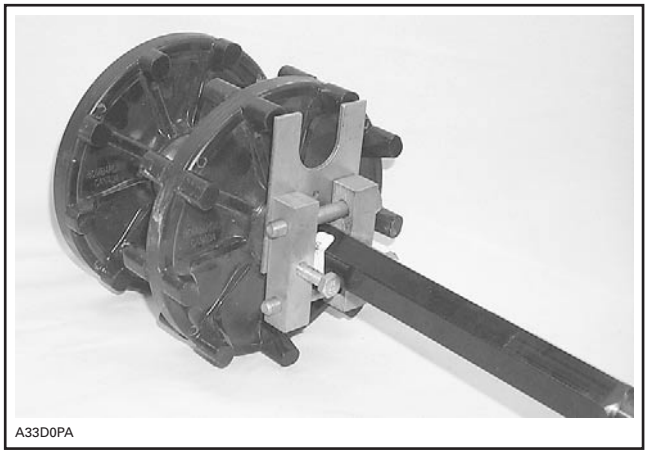
CAUTION: Do not tamper with sprocket/track alignment if frame or suspension is damaged.

Sprockets might be repositioned to fit lugs without removing drive axle.

Use drive axle sprocket adjuster kit (P/N 861 725 700).



TYPICAL — TUNDRA



TYPICAL — ALL MODELS EXCEPT TUNDRA

TRACK

SERVICE TOOLS

Description	Part Number	Page
belt tension tester	414 348 200	512
narrow track cleat installer	529 008 500	511
narrow track cleat installer	529 028 800	514
snowmobile mechanical stand	529 020 000	512
track cleat remover	529 028 700	511, 514

TRACK TYPE APPLICATION

Refer to TECHNICAL DATA section.

GENERAL

This section gives guidelines for track removal. Some components require more detailed disassembly procedures. In these particular cases, refer to the pertaining section in this manual.

INSPECTION

Visually inspect track for:
- cuts and abnormal wear
- broken rods
- broken or missing track cleats.

If track is damaged or rods are broken, replace track. For damaged or missing cleats, replace by new ones, using track cleat remover (P/N 529 028 700). Use narrow track cleat installer (P/N 529 008 500).

⚠ WARNING

Do not operate a snowmobile with a cut, torn or damaged track.

REMOVAL

Tundra

Remove the following items:
- chaincase cover, sprockets, chain
- muffler
- upper center idler ass'y
- suspension
- end bearing housing
- drive axle seal
- drive axle (outwards from end bearing housing)
- track.

Skandic LT/LT E

Remove the following parts:
- speedometer cable
- muffler
- chaincase cover
- suspension
- drive axle seal
- end bearing housing
- sprockets and chain
- drive axle (toward end bearing housing)
- track.

Skandic WT/SWT/WT LC/SUV/Expedition TUV

Remove the following parts:
- rear suspension
- muffler.

Drain gearbox.

Remove drive axle then track.

INSTALLATION

All Models

Reverse the removal procedure.

NOTE: When installing the track, respect rotation direction indicated by an arrow on track thread.

Check sprocket/track alignment as described in DRIVE AXLE.

Track Tension and Alignment

Track tension and alignment are inter-related. Do not adjust one without checking the other. Track tension procedure must be carried out prior to track alignment.

Tension

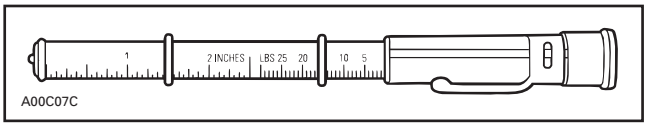
NOTE: Ride the snowmobile in snow about 15 to 20 minutes prior to adjusting track tension.

Remove the tether cord cap.

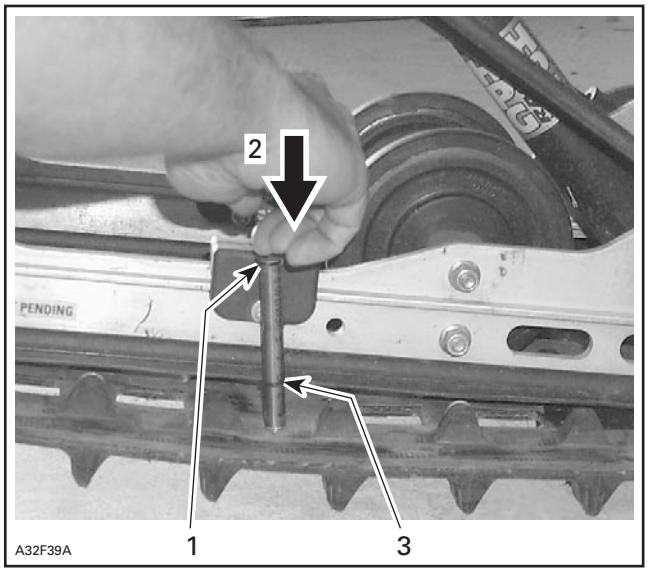
Lift rear of snowmobile and support it with a wide-base snowmobile mechanical stand (P/N 529 020 000).

Allow the suspension to extend normally and check gap halfway between front and rear idler wheels. Measure between slider shoe bottom and inside of track. The gap should be as given in SPECIFICATIONS at the end of this guide. If the track tension is too loose, track will have a tendency to thump.

NOTE: A belt tension tester (P/N 414 348 200) may be used to measure deflection as well as force applied.



BELT TENSION TESTER

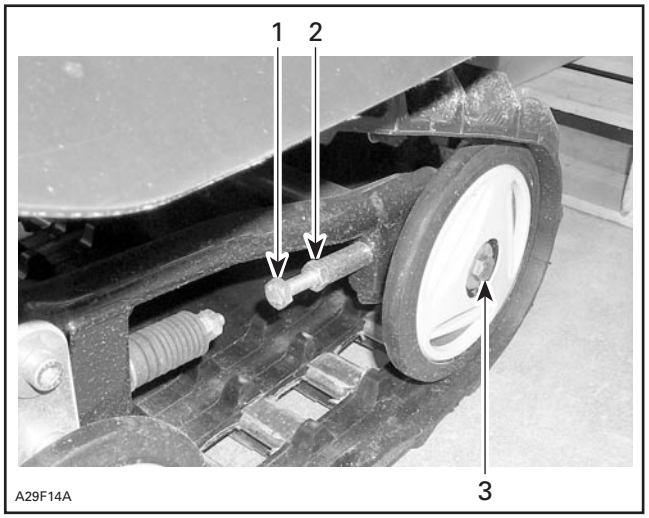


TYPICAL
1. *Top tool O-ring positioned at 7.3 kg (16 lb)*
2. *Push on top portion of tool until it contacts the top O-ring*
3. *Measured track deflection*

CAUTION: Too much tension will result in power loss and excessive stresses on suspension components.

To adjust track tension:

– Remove the tether cord cap.
– Loosen the rear idler wheel retaining screws.
– Loosen the lock nuts (on so equipped models) then turn adjustment screws to adjust.



TYPICAL
1. *Adjustment screw*
2. *Loosen lock nut (on so equipped models)*
3. *Loosen screw*

– Retighten retaining screws and lock nuts (on so equipped models).
– Check track alignment as described below.

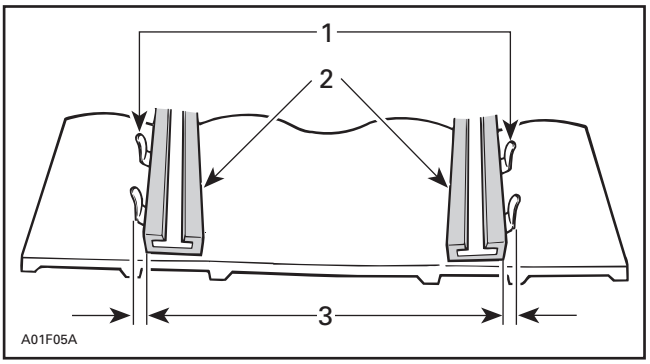
Alignment

⚠ WARNING

Before checking track alignment, ensure that the track is free of all particles which could be thrown out while track is rotating. Keep hands, tools, feet and clothing clear of track. Ensure no one is standing in close proximity to the snowmobile. Never rotate track at high speed.

Start the engine and accelerate slightly so that track barely turns. This must be done in a short period of time (15 to 20 seconds).

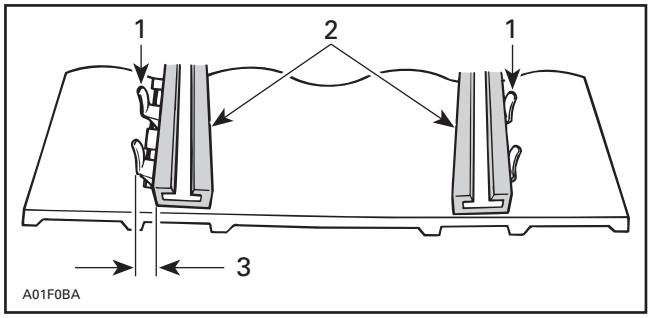
Check that the track is well centered; equal distance on both sides between edges of track guides and slider shoes.



1. *Guides*
2. *Slider shoes*
3. *Equal distance*

To adjust track alignment:

– Remove the tether cord cap.
– Loosen rear idler wheel retaining screws.
– Loosen the lock nuts (on so equipped models).
– Tighten the adjustment screw on side where the slider shoe is the farthest from the track insert guides.

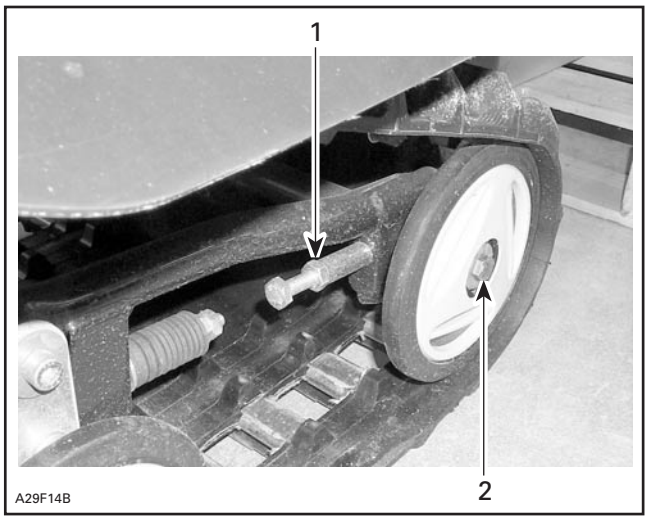


1. *Guides*
2. *Slider shoes*
3. *Tighten on this side*

Tighten lock nuts (some models only) and retaining screws.

⚠ WARNING

If lock nuts are not tightened properly, the adjusting screws could loosen causing the track to become extremely loose and, under some operating conditions, allow the idler wheels to climb over the track lugs forcing the track against the tunnel causing the track to "lock". Properly tighten wheel retaining screws, otherwise wheel may come off and cause track to "lock".



TYPICAL
1. *Retighten (so equipped models)*
2. *Retighten to 48 N•m (35 lbf•ft)*

Restart engine and rotate track slowly to recheck alignment.

Reposition snowmobile on ground.

Track Cleat

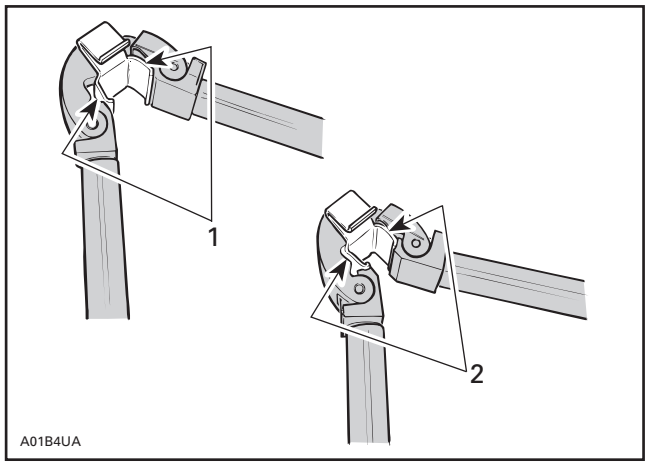
Removal

– Raise rear of vehicle off the ground and lift snow guard then rotate track to expose a cleat to be replaced.
– Using track cleat remover (P/N 529 028 700) for all models.

Installation

NOTE: Keep the same pitch between guide cleats.

– Place new cleat in position and using narrow track cleat installer (P/N 529 028 800) bend cleat then push tabs into rubber.



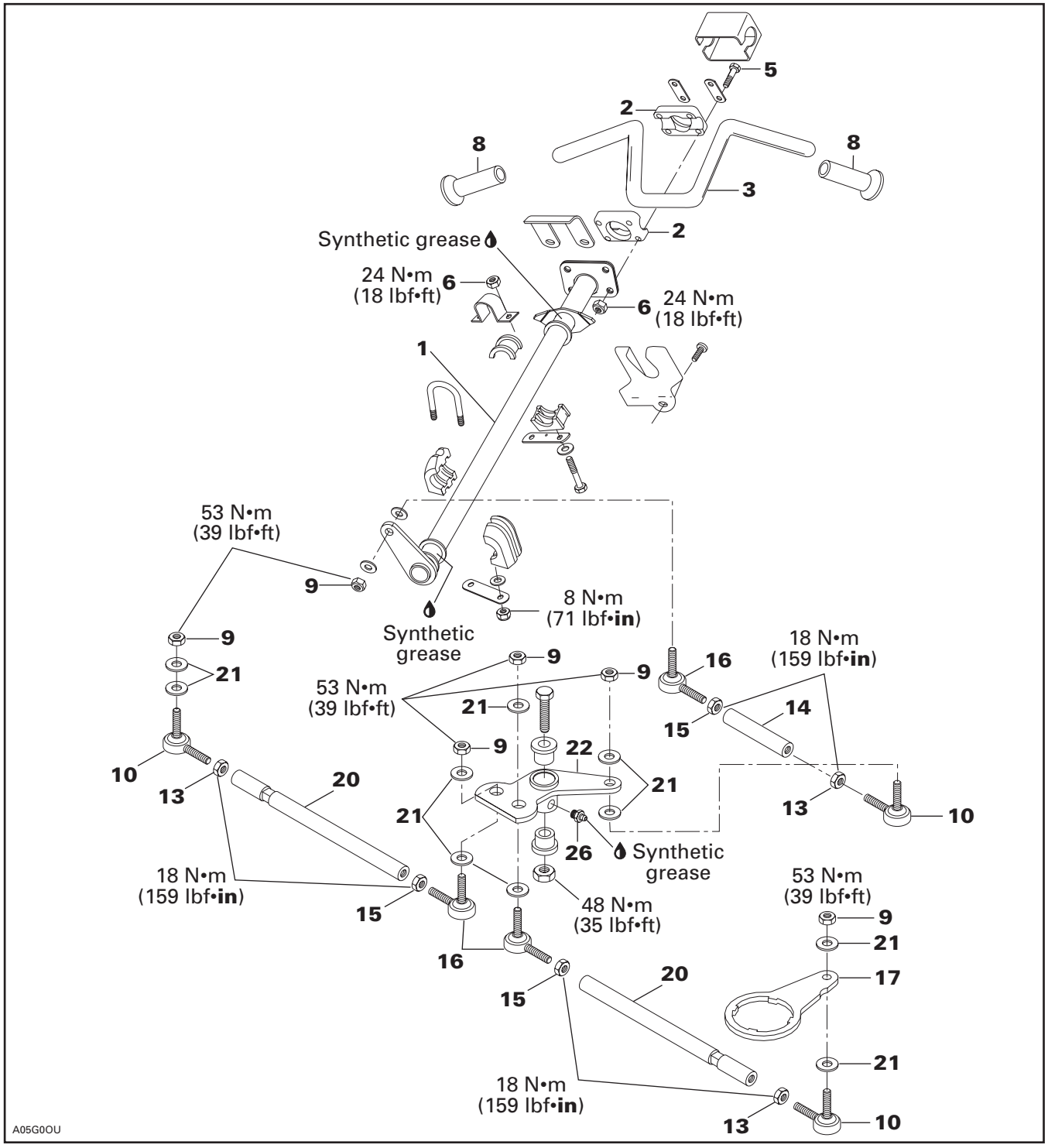
TYPICAL
1. *First step*
2. *Second step (to push tabs into rubber)*

STEERING SYSTEM

SERVICE PRODUCTS

Description	Part Number	Page
Bombardier Lube	293 600 016	527–528
suspension synthetic grease	293 550 033	527
synthetic grease	413 711 500	528

Tundra


5
2
8
8
3
2
Synthetic grease
24 N•m
(18 lbf•ft)
6
6
24 N•m
(18 lbf•ft)
1
53 N•m
(39 lbf•ft)
9
8 N•m
(71 lbf•in)
Synthetic
grease
9
21
9
9
16
18 N•m
(159 lbf•in)
53 N•m
(39 lbf•ft)
21
14
15
9
22
10
13
20
21
21
13
10
26
Synthetic
grease
18 N•m
(159 lbf•in)
48 N•m
(35 lbf•ft)
53 N•m
(39 lbf•ft)
15
9
21
16
17
15
20
21
18 N•m
(159 lbf•in)
13
10
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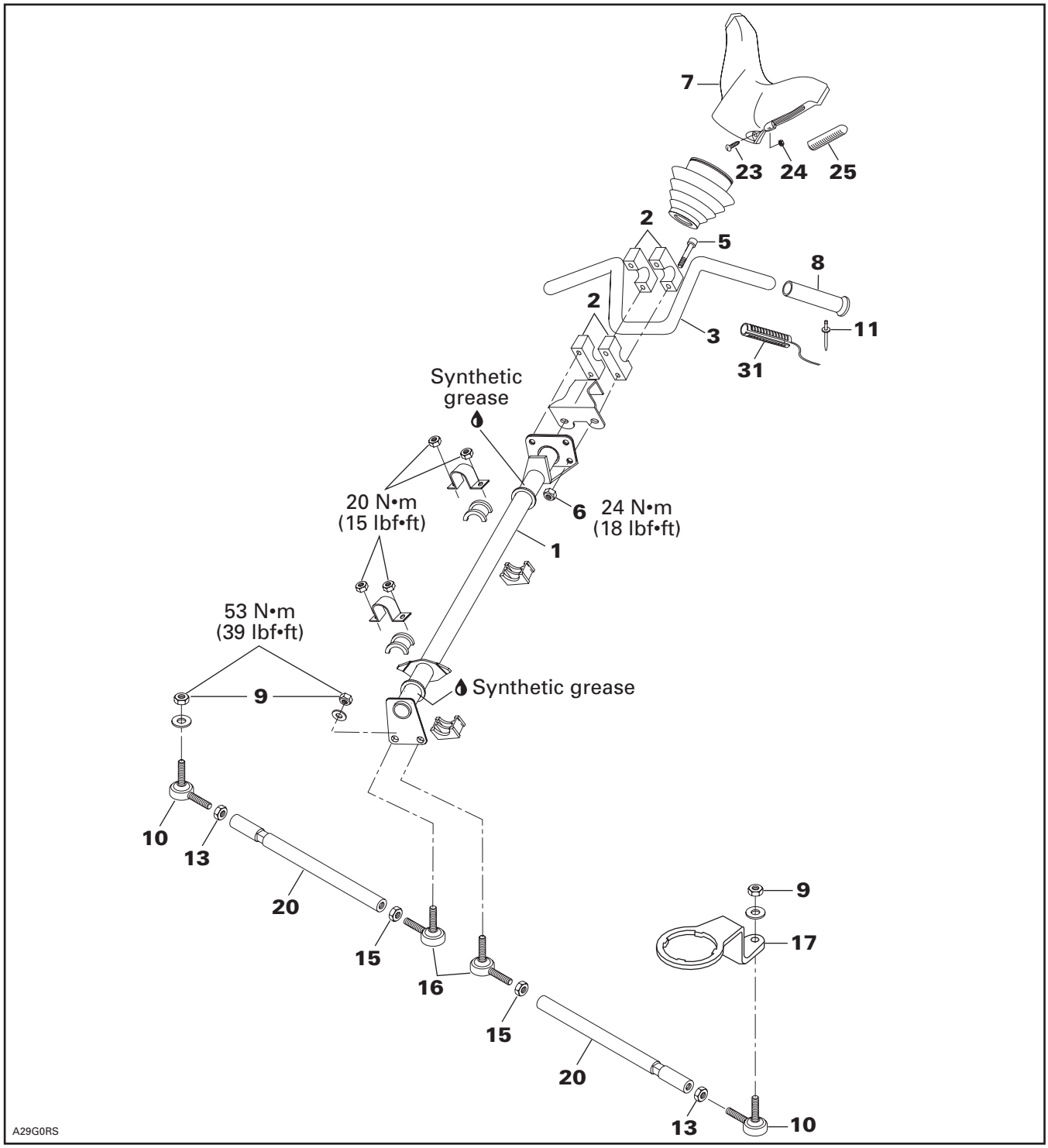
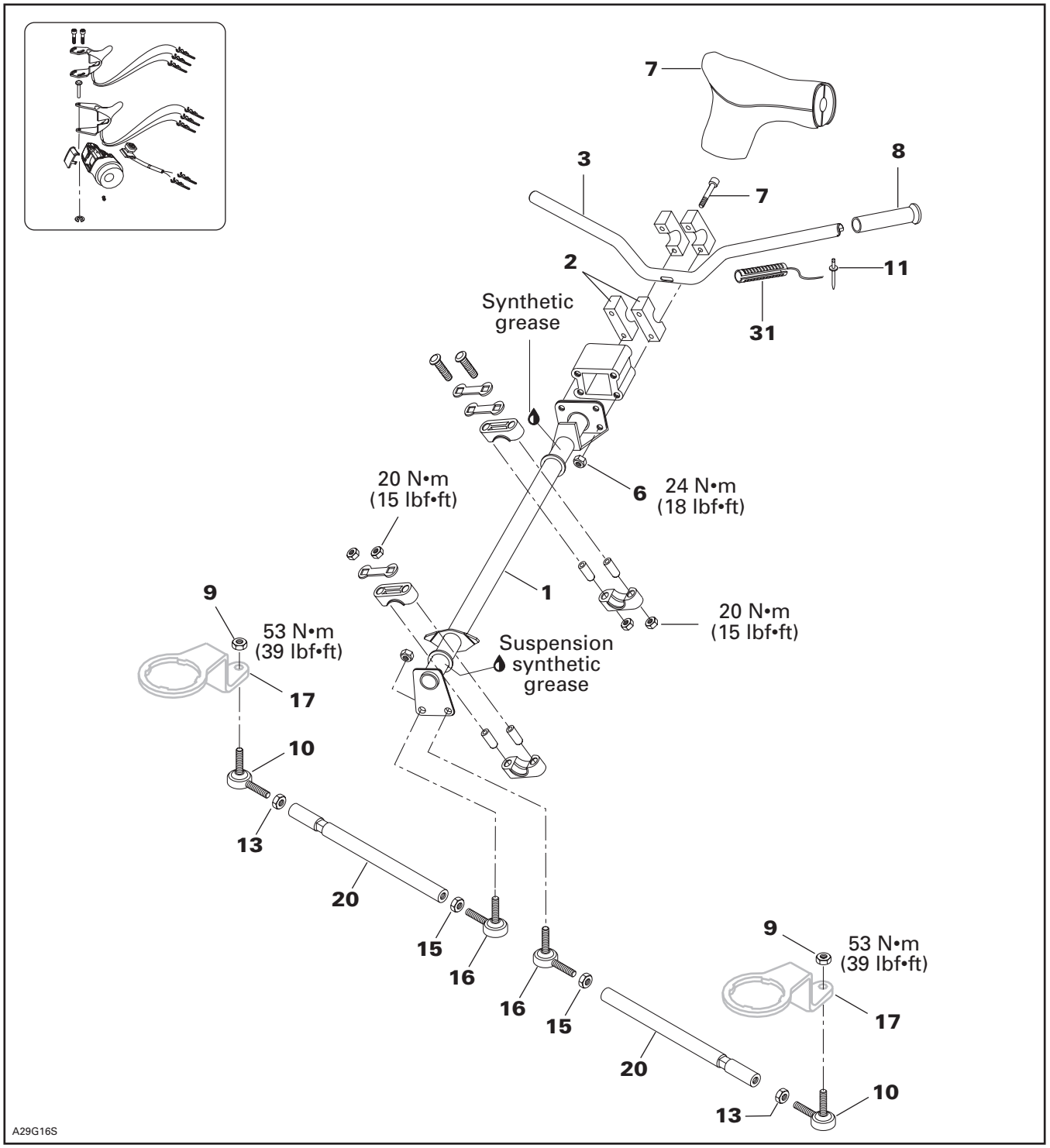
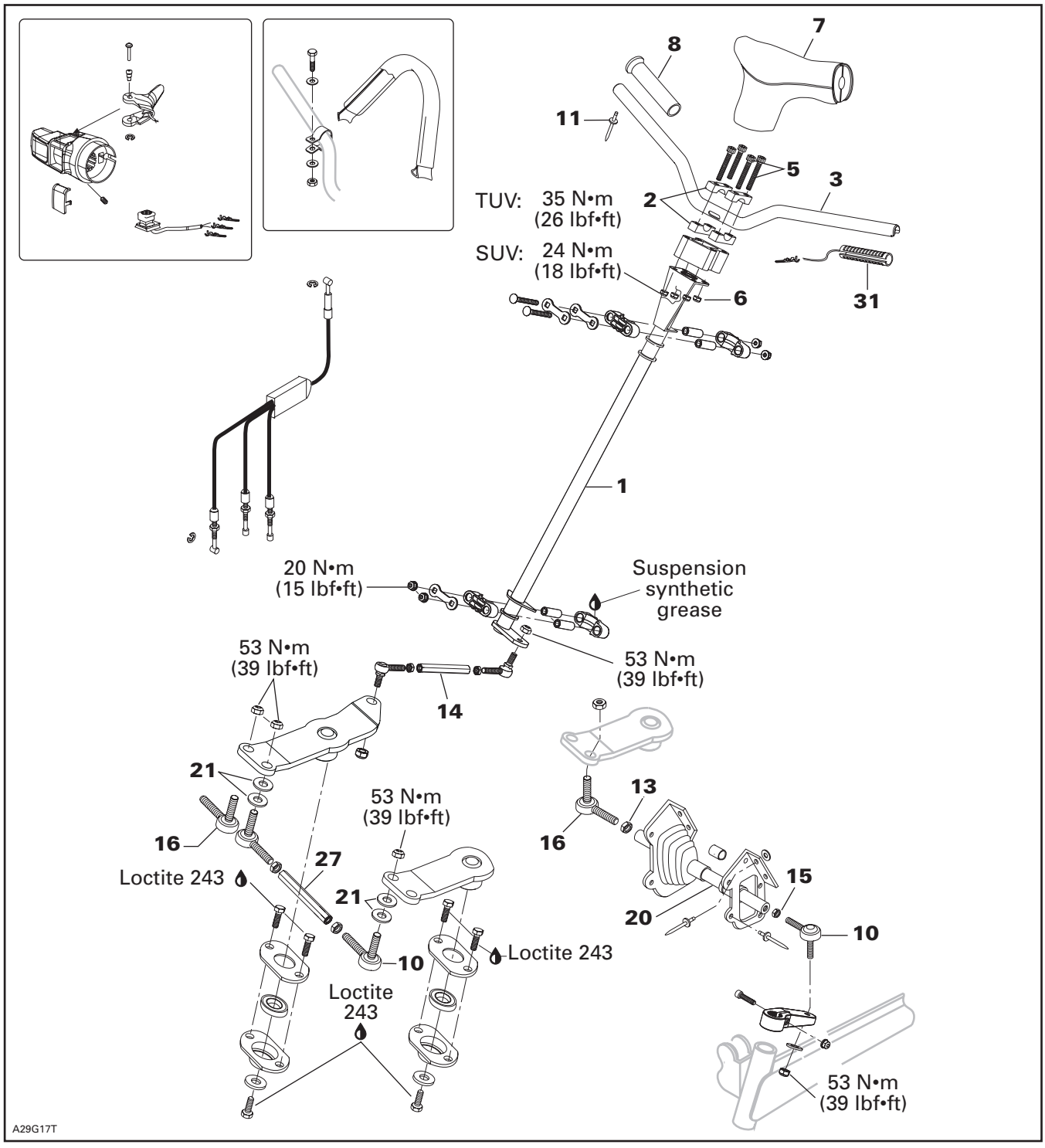
Skandic LT/LT E



Skandic WT/SWT/WT LC



Skandic SUV/Expedition TUV



INSPECTION

Check skis and ski runner for wear, replace as necessary. Refer to STEERING SYSTEM.

17, Steering Arm and Ski Leg

Make sure steering arm and ski leg splines interlock without excessive play.

⚠ WARNING

Any parts having worn splines have to be replaced with new ones.

Check steering system components for wear. Replace if necessary.

31, Heating Grip Element

To test heating elements, refer to TESTING PROCEDURE.

10,16, Ball Joint (left hand and right hand threads)

Inspect ball joint ends for wear or looseness, if excessive, replace them.

DISASSEMBLY AND ASSEMBLY

8, Grip

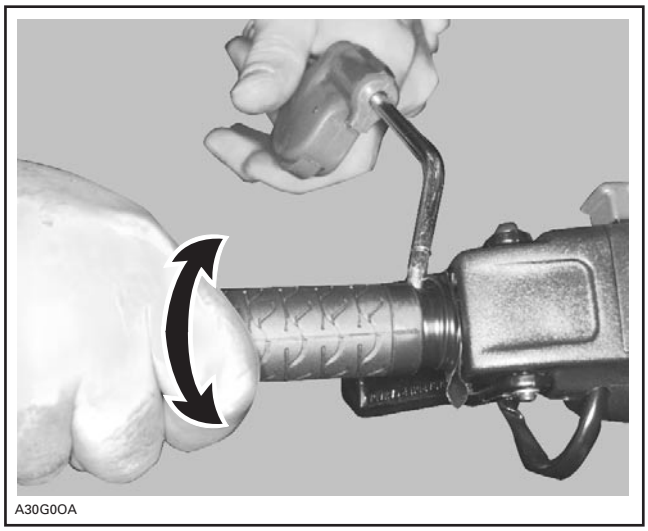
Grips must be carefully removed to prevent damaging the heating elements.

Remove rivet **no. 11** if applicable.

Heat grip with a heat gun.

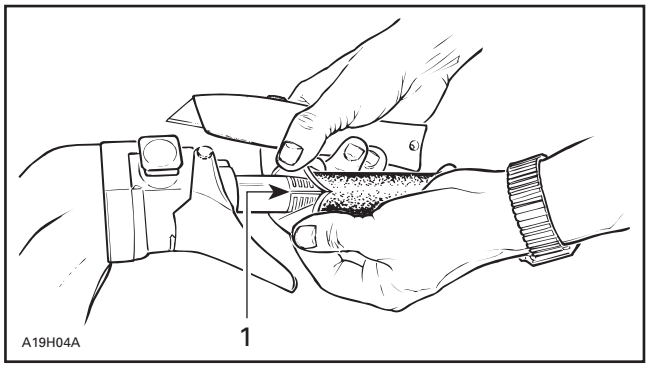
Apply tape to handlebar near the grip to protect paint.

Inject compressed air into the handlebar and twist grip while pulling it out.



The grips might not be removable as explained above; in this case, carefully proceed as follows to prevent damaging the heating elements.

Start cutting and immediately peel it open to locate the gap in the heating element, as shown.



TYPICAL
1. Gap in the heating element opposite the wires

Continue cutting along the gap and remove the grip.

If required, slowly peel heating element **no. 31** from handlebar and remove it.

To install, stick the heating element to the handlebar making sure the wires do not interfere with operation of the accelerator or brake handle.

⚠ WARNING

Never use lubricants (e.g. oil, grease, etc.) to install the handlebar grip. Only use a mix of soap and water. Mix 40 parts of water with one part of dish washing soap (recommended: Ultra Joy, Sunlight or Palmolive).

Heat the grip with a heater gun or a spot light to ease installation. Insert new grip with compressed air.

A30G0NA

Install rivet no. 11 if applicable.

1, Steering Column

Remove steering pad then handlebar ass'y.

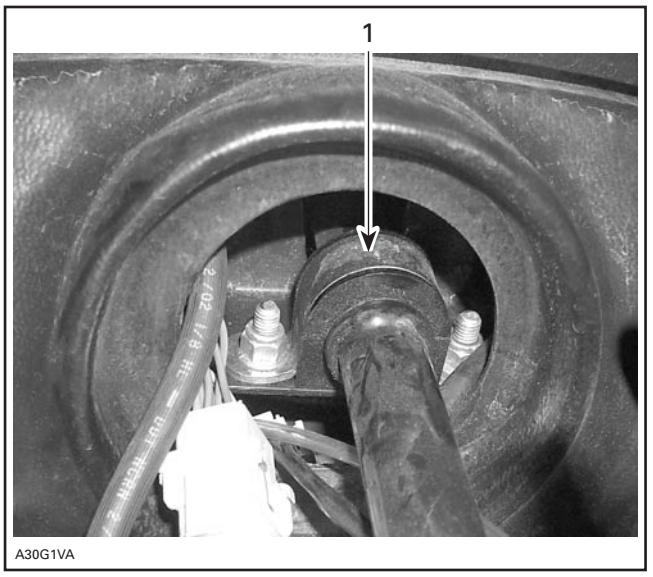
Detach tie rod(s) from the steering column.

Remove U-clamps or half bushings (as applicable) holding steering column.

NOTE: It may be necessary to remove part(s) to gain access to lower U-clamp or half bushing (as applicable).

Remove steering column.

NOTE: To remove steering column on Skandic models only, loosen rear engine fastening screws.

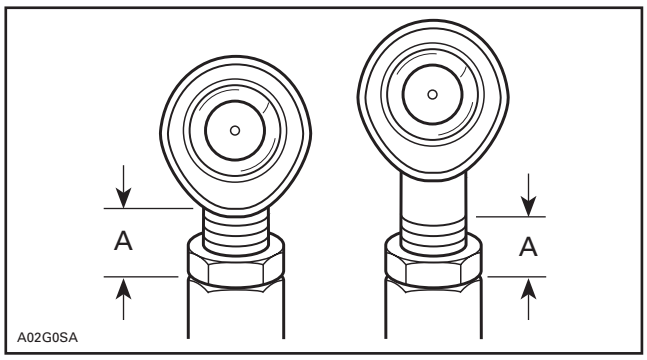


A30G1VA

TYPICAL
1. U-clamp

10,16, Ball Joint (left hand and right hand threads)

Screw threaded end of the ball joint into the tie rod. The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).



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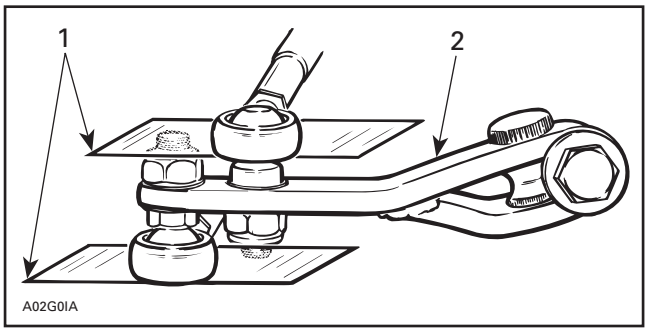
TYPICAL
A. 20 mm (25/32 in) maximum

The ball joint should be restrained when tightening the tie rod end lock nut. Align it so the tie rod end is parallel to the steering arm when assembled on the vehicle, refer to the following illustration.

For proper torque specifications refer to the specific exploded view for the vehicle being serviced.



TYPICAL
1. Parallel with steering arm
2. Steering arm

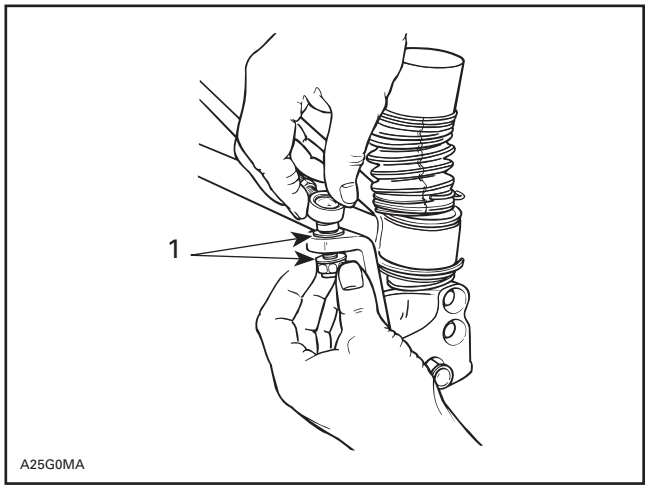
⚠ WARNING

The cut off section of the ball joint must run parallel with the steering arm. When tightening lock nuts, restrain ball joint with appropriate size wrench. The maximum external threaded length not engaged in the tie rod must not exceed 20 mm (25/32 in).

21, Hardened Washer on Ball Joint Stud

Tundra and Skandic SUV

Install a hardened washer on each side of the arm.

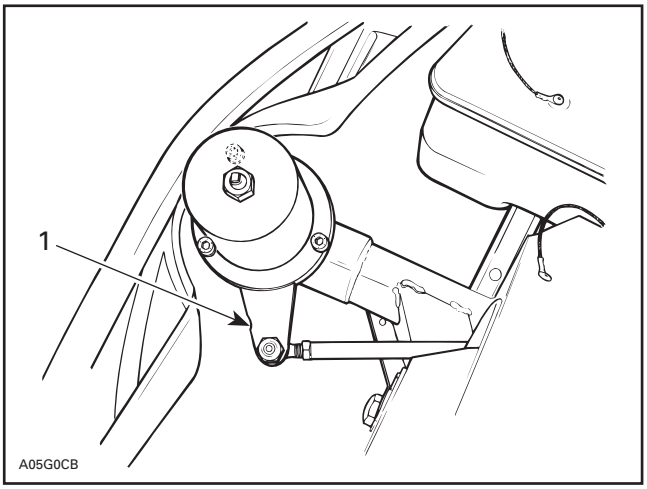


TYPICAL
1. Hardened washers

17, Steering Arm

Tundra

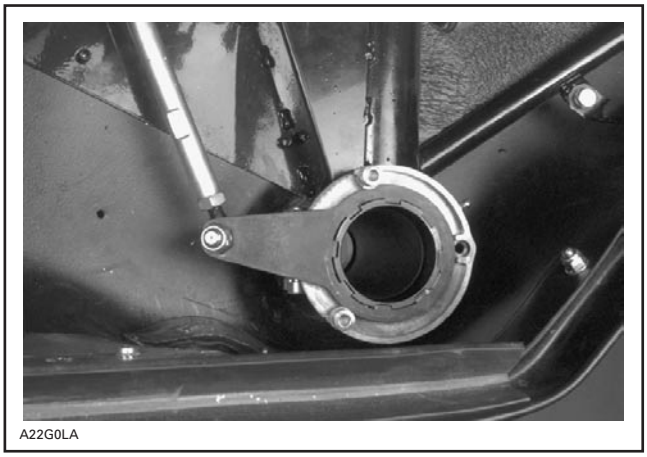
Steering arm notch must face outside of vehicle.



1. Notch facing outside

Skandic LT/LT E/WT/SWT/WT LC

Install steering arm at mid-travel position when handlebar and skis are facing straight ahead.



TYPICAL

Skandic SUV/Expedition TUV

Steering arm must be installed parallel to ski.

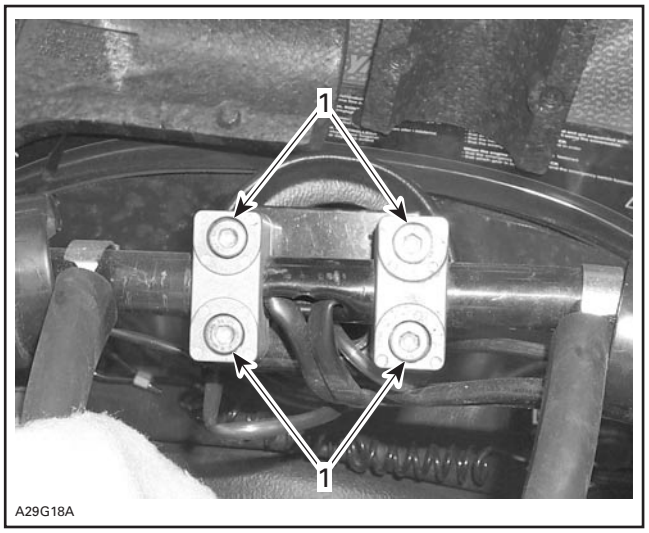
9,13,15, Ball Joint Nut and Jam Nut

Tighten ball joint nuts and jam nuts to specified torque (see exploded view).

HANDLEBAR POSITION ADJUSTMENT

All Models

Remove steering cover and paddings. Loosen 4 nuts on steering clamps **no. 2**.

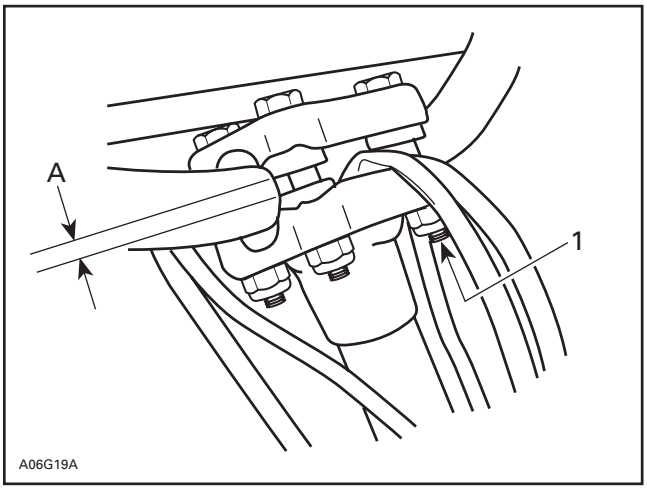


1. Nuts to be removed

Adjust the steering handlebar to the desired position.

Lock the handlebar in place by tightening the 4 nuts as specified in the illustrations.

CAUTION: Tighten the nuts equally in a criss-cross sequence and ensure there is an equal gap on each side of the clamps no. **2**.



TYPICAL
1. Torque to 24 N•m (18 lbf•ft)
A. Equal gap all around

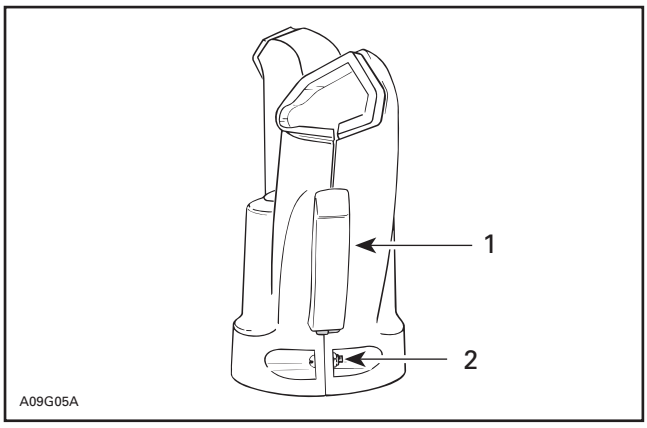
⚠ WARNING

Avoid contact between the brake handle and the windshield by NOT adjusting the handlebar too high.

Properly fit the steering pad to the handlebar. Assemble using the 2 rubber attachments, nuts and bolts where applicable.

⚠ WARNING

Make sure that the steering pad and all controls are properly fixed to their normal location on the handlebar.



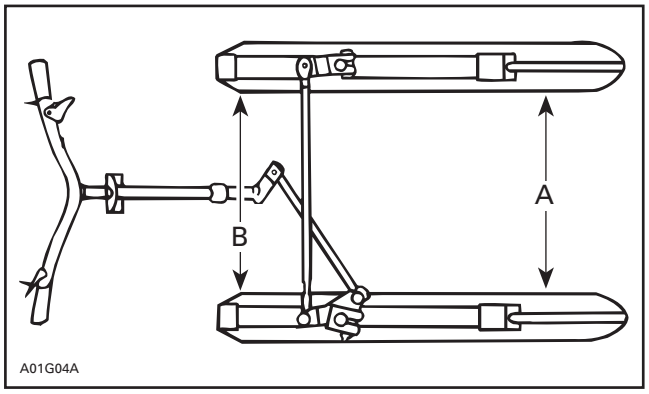
TYPICAL
1. Rubber attachment
2. Nut and bolt (where applicable)

STEERING ADJUSTMENT (SKIS)

Definitions

TOE-OUT:

A difference measured between the front edge of the skis A and rear edge B as viewed from the top. It is adjustable.



CAMBER:

A specific inward or outward tilt angle of ski leg compared to a vertical line when viewing the vehicle from front. This angle is not adjustable on any models.

Adjustments

Tundra

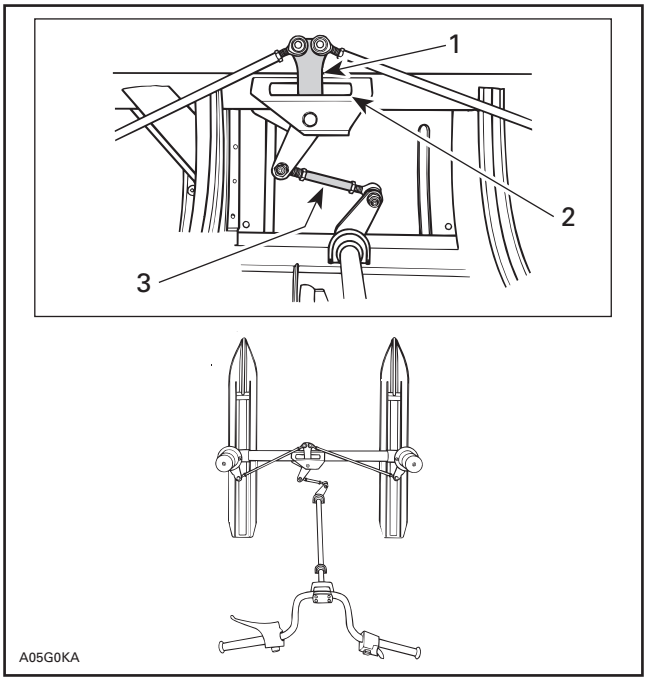
Adjustments should be performed following this sequence:

– Handlebar/pivot arm centering.
– Set toe-out adjustment.

HANDLEBAR/PIVOT ARM CENTERING

Turn handlebar until pivot arm is well centered in slot of its bracket.

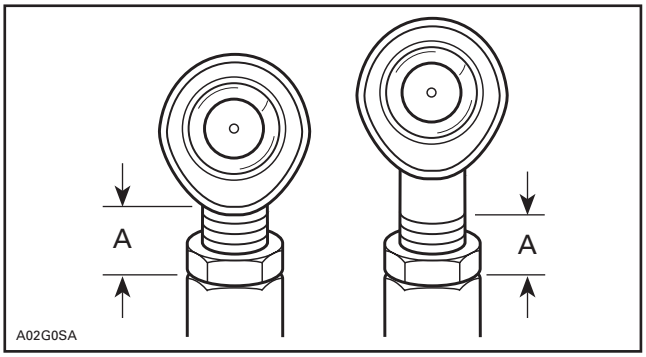
Check if handlebar is horizontal. To adjust, loosen lock nuts of short tie rod and turn it accordingly.



1. Pivot arm centered in slot
2. Slot
3. Turn to adjust

⚠ WARNING

Maximum ball joint external threaded length not engaged in the tie rod end must not exceed 20 mm (25/32 in). Torque lock nut to 18 N•m (159 lbf•in).



1. 20 mm (25/32 in) maximum

Restrain short tie rod while torquing nuts so that ball joint sockets run parallel with steering arm and pivot arm.

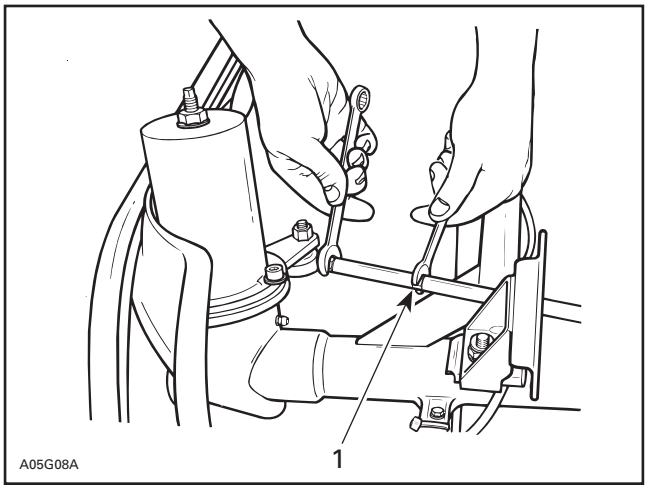
Ensure that pivot arm is still centered and check ski toe-out.

TOE-OUT ADJUSTMENT

Raise front of vehicle so that skis are off the ground.

Loosen lock nuts of long tie rods and turn each tie rod so that skis are in a straight ahead position. To adjust toe-out, slightly turn both tie rods exactly the same amount.

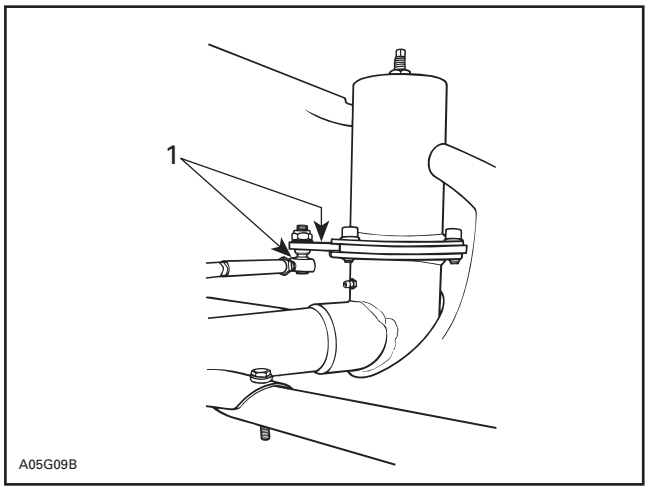
Make sure external threaded length not engaged is not too long and torque nuts as specified above.



LONG TIE ROD SHOWN
1. Restrain tie rod to tighten lock nuts

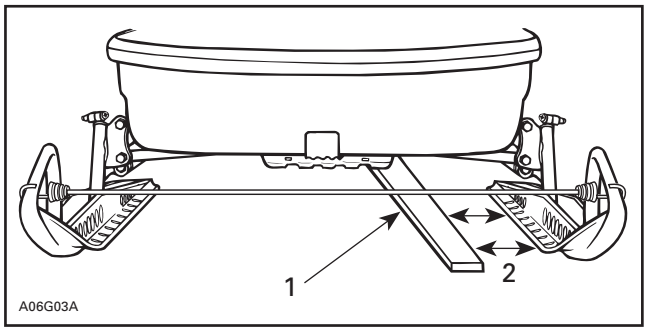
⚠ WARNING

Ball joint sockets must run parallel with steering arm and pivot arm. Tie rod must be restrained when tightening lock nuts.

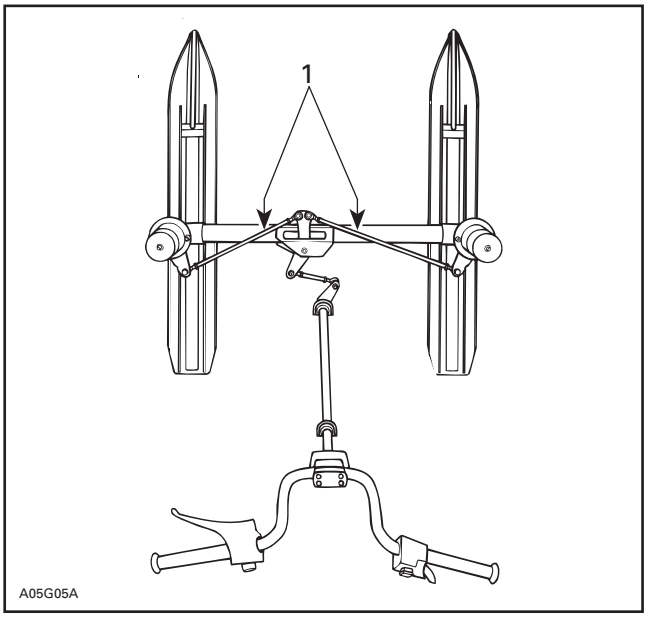


LONG TIE ROD SHOWN
1. Ball joint parallel with arm

NOTE: To make sure skis are in straight-ahead position, place a straight edge against pre-adjusted track and measure distance between front and rear of skis and straight edge. Measurements are taken 200 mm (8 in) at rear and front of ski pivot bolt. Distances should be equal. After ski toe-out adjustment, distance at front of ski must be 3.0 mm (1/8 in) more than at rear on both sides for a total toe-out of 6 mm (1/4 in).



TYPICAL
1. Straight edge
2. 3.0 mm (1/8 in) more at front than at rear



1. Turn to adjust

⚠ WARNING

Do not attempt to adjust skis straight-ahead position by turning ball joint on tie rod no. **14**.

Skandic SUV/Expedition TUV

Adjustments should be performed following this sequence:

– Handlebar/pivot arm positioning.
– Idler arm positioning.
– Set toe-out adjustment.

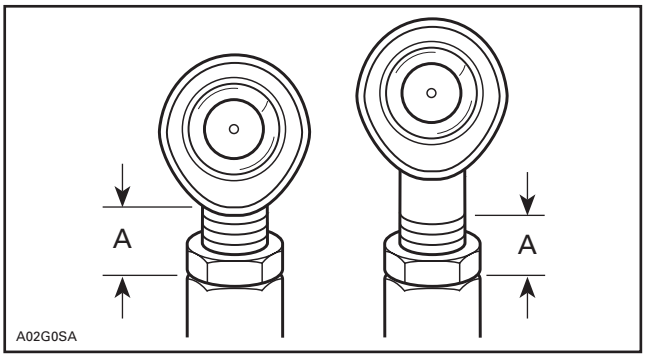
HANDLEBAR/PIVOT ARM POSITIONING

Turn handlebar until pivot arm is pointing straight forward.

Check if handlebar is horizontal. To adjust, loosen lock nuts of short tie rod and turn it accordingly.

⚠ WARNING

Maximum ball joint external threaded length not engaged in the tie rod end must not exceed 20 mm (25/32 in). Torque lock nut to 18 N•m (159 lbf•in).



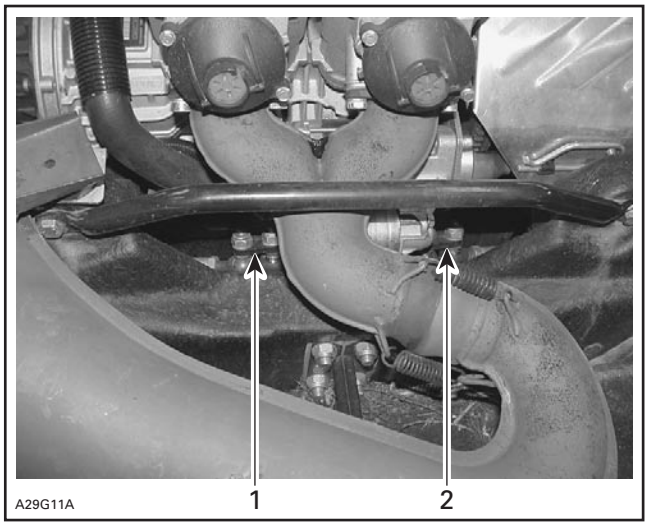
A. 20 mm (25/32 in) maximum

Restrain short tie rod while torquing nuts so that ball joint sockets run parallel with steering arm and pivot arm.

Ensure that pivot arm is still pointing straight forward and check ski toe-out.

IDLER ARM POSITIONING

With the pivot arm pointing straight forward, loosen lock nuts of idler arm tie rod and turn tie rod until idler arm is pointing straight forward too. With this adjustment properly done, turning radius will be the same on both sides.



TYPICAL
1. Pivot arm pointing straight forward
2. Idler arm pointing straight forward too

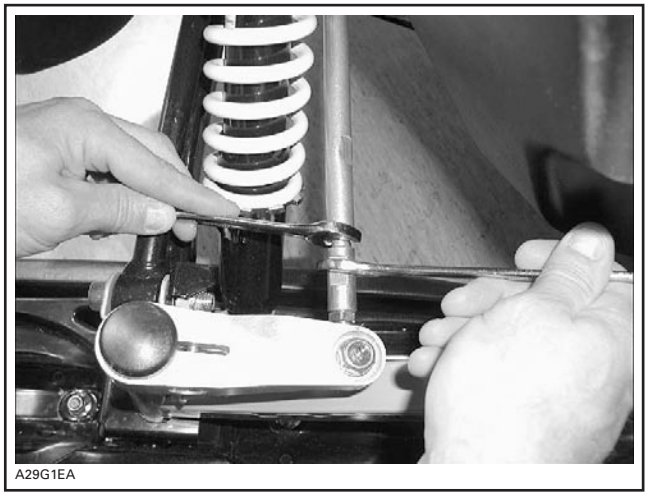
TOE-OUT ADJUSTMENT

With the handlebar in straight ahead position, turn left and right tie rods **no. 20** or tie rods adjuster to obtain specified toe-out.

Procedure:

– Loosen jam nuts **no. 13** and **no. 15** of both tie rods **no. 20**.

NOTE: On models with tie rod adjuster, only loosen adjuster jam nut.



MODELS WITH TIE ROD ADJUSTER

⚠ WARNING

Never lengthen tie rod making threaded portion of ball joint exceed 20 mm (25/32 in).

– Close front of skis manually to take all free-play from steering mechanism.

NOTE: A rubber cord must be hooked in front of skis to keep them closed.

Skis should have a toe-out of 5 mm (3/16 in) when they are in a straight-ahead position and the vehicle is resting on the ground.

Measurements are taken 250 mm (10 in) at front and rear of ski pivot bolt.

NOTE: To make sure skis are in a straight-ahead position, place a straight edge against pre-adjusted track and measure the distance between front and rear of skis and straight edge. Distances should be equal. After the ski toe-out adjustment, distance at front of ski must be 2.5 mm (3/32 in) more than at rear on both sides for a total toe-out of 5 mm (3/16 in).

Skandic LT/LT E/WT/SWT/WT LC

Toe-out adjustment is performed by adjusting length of left and right tie rods **no. 20**. Handlebar centering is done at same time by turning tie rods accordingly.

Procedure:

– Loosen jam nuts **no. 13** and **no. 15** of both tie rods **no. 20**.
– Close front of skis manually to take all free-play from steering mechanism.

⚠ WARNING

Never lengthen tie rod making threaded portion of ball joint exceed 20 mm (25/32 in).

NOTE: A rubber cord must be hooked in front of skis to keep them closed.

Skis should have a toe-out of 5 mm (3/16 in) when they are in a straight-ahead position and the vehicle is resting on the ground.

Measurements are taken 250 mm (10 in) at front and rear of ski pivot bolt.

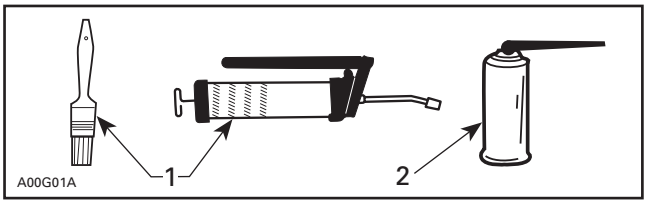
NOTE: To make sure skis are in a straight-ahead position, place a straight edge against pre-adjusted track and measure the distance between front and rear of skis and straight edge. Distances should be equal. After the ski toe-out adjustment, distance at front of ski must be 2.5 mm (3/32 in) more than at rear on both sides for a total toe-out of 5 mm (3/16 in).

LUBRICATION

⚠ WARNING

Do not lubricate throttle and/or brake cable nor their housing.

The following symbols will be used to show what type of lubricant should be used at the suitable locations.



1. Synthetic grease (P/N 413 711 500)
2. Penetrating lubricant (P/N 293 600 016)

Tundra

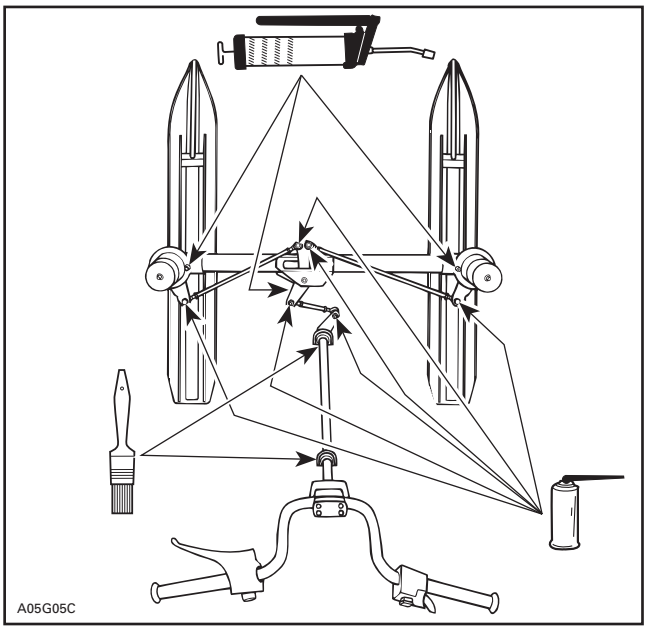
Lubricate front suspension posts and pivot arm at grease fittings. Pump five strokes of grease gun on each post. Use suspension synthetic grease (P/N 293 550 033).

NOTE: There are 3 grease fittings.

Apply Bombardier Lube (P/N 293 600 016) to ball joints.

NOTE: There are 6 lubrication points.

Apply suspension synthetic grease (P/N 293 550 033) to both steering column bushings.



TUNDRA

Skandic LT/LT E/WT/SWT/WT LC

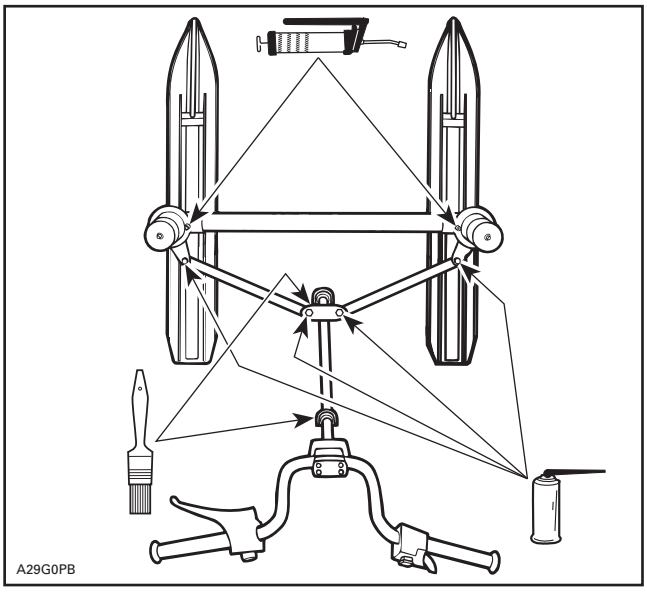
Lubricate front suspension posts. Pump five strokes of grease gun on each post. Use synthetic grease (P/N 413 711 500).

NOTE: There are 2 grease fittings.

Apply Bombardier Lube (P/N 293 600 016) to ball joints.

NOTE: There are 4 lubrication points.

Apply synthetic grease (P/N 413 711 500) to both steering column bushings.



SKANDIC LT/LT E/WT/SWT/WT LC

Skandic SUV

Lubricate ski legs. Pump five strokes of grease gun on each ski leg. Use synthetic grease (P/N 413 711 500).

NOTE: There are 2 grease fittings.

Apply Bombardier Lube (P/N 293 600 016) to all ball joints.

Apply synthetic grease (P/N 413 711 500) to both steering column bushings.

SUSPENSION AND SKI SYSTEM

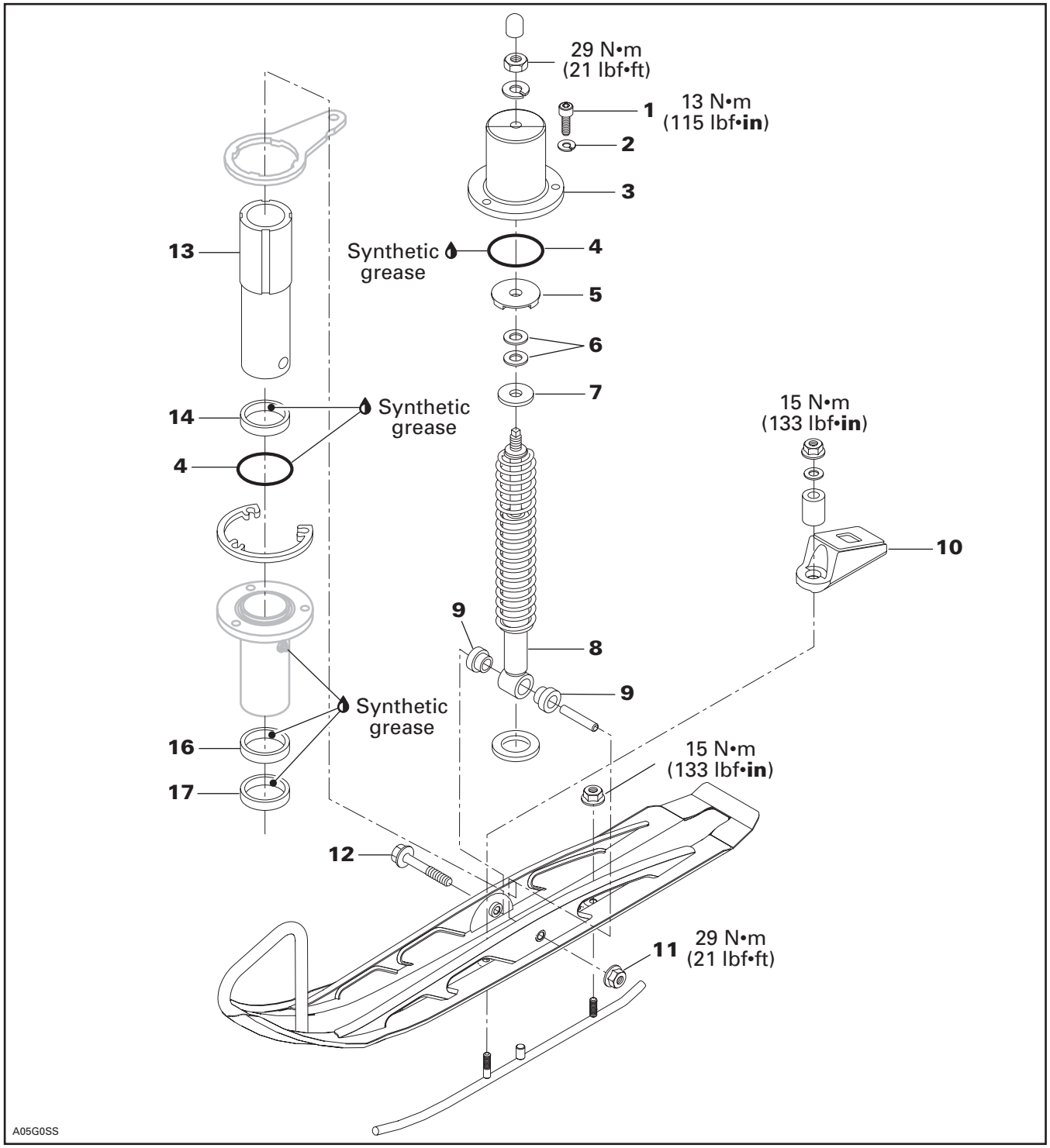
SERVICE TOOLS

Description	Part Number	Page
shock spring removal kit	529 035 504	539

SERVICE PRODUCTS

Description	Part Number	Page
suspension synthetic grease	293 550 033	532, 537, 540

Tundra


29 N•m
(21 lbf•ft)
1
13 N•m
(115 lbf•in)
2
3
13
Synthetic
grease
4
5
6
7
14
Synthetic
grease
4
15 N•m
(133 lbf•in)
10
9
8
9
Synthetic
grease
16
17
15 N•m
(133 lbf•in)
12
11
29 N•m
(21 lbf•ft)
A05G0SS

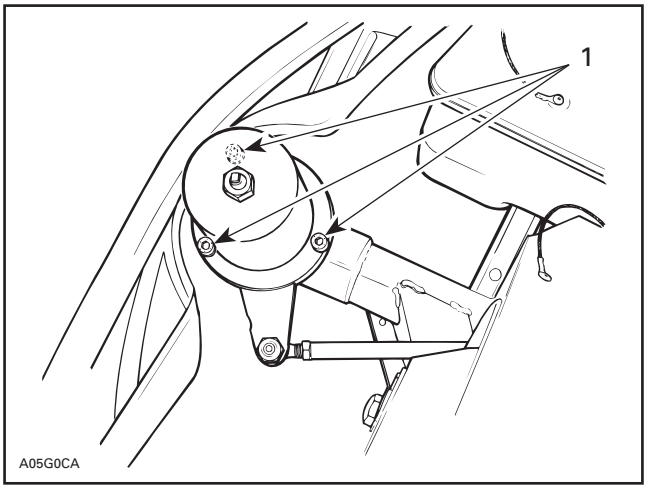
ON-VEHICLE COMPONENT REMOVAL

8, Shock

Lift front of vehicle and support off the ground.

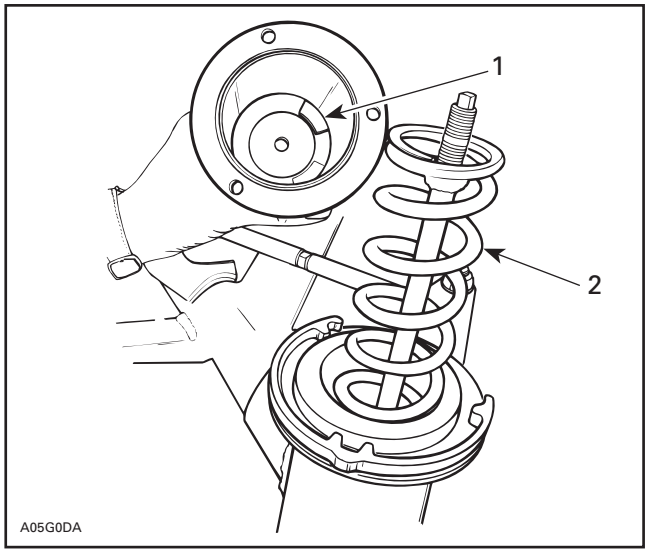
Remove ski.

Unscrew shock rod piston pin nut then remove washer. Unscrew 3 Allen screws retaining cover **no. 3**, then remove stopper **no. 5**, washers **no. 6**, washer **no. 7**.



1. Allen screws

NOTE: These washers and stopper can be wedged in cover.



1. Washers and stopper wedged in cover
2. Spring

Pull out spring then check shock as described below in INSPECTION.

DISASSEMBLY

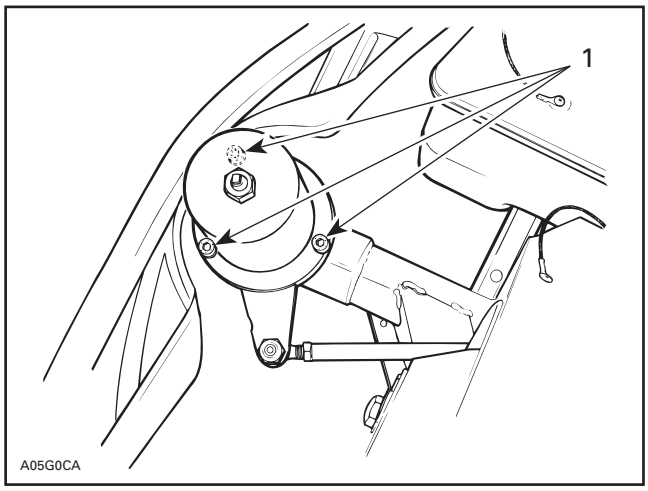
Lift front of vehicle and support off the ground.

1,2,3,5,6,7,9,11,12, Bolt, Lock Washer, Cover, Stopper, Bushing, Cushion and Nut

Remove ski bolt, nut, bushings and ski.

Unscrew shock rod nut then remove washer. Shock will fall off the ski leg.

Unscrew 3 Allen screws retaining cover, then remove stopper and washers.

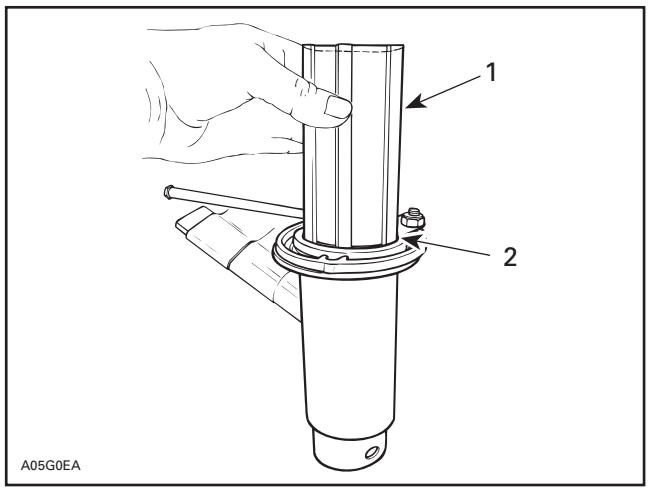


1. Allen screws

NOTE: These washers **no. 6** and **no. 7** and stopper **no. 5** can be wedged in cover.

4,13,14,16,17, O-Ring, Ski Leg, Upper Cushion, Lower Cushion and Seal

Pull up ski leg. Steering arm will not interfere.



1. Pull up ski leg
2. Steering arm in place

Remove seal and O-rings. Drive out upper and lower cushions if worn out.

INSPECTION

Suspension Free Operation

Remove cover and check for free movement of ski leg by lifting end of ski.

13, Ski Leg

Check straightness of ski leg. Check for scored or scratched surface. Replace as required. Check that splines on ski leg and steering arm interlock properly without excessive free play. Replace as necessary.

5, Stopper

Check condition of stopper. Replace it when deteriorated.

Grease Fitting

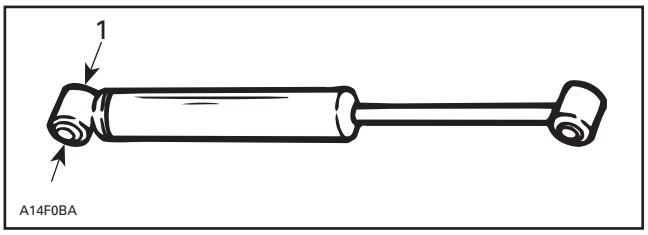
Ensure that grease fittings are not clogged.

10, Stopper

Check stopper for crack or deterioration. Replace as required.

8, Shock Absorber

Secure the shock body end in a vise with its rod upward.



1. Clamp

CAUTION: Do not clamp directly on shock body.

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke checking that it moves smoothly and with uniform resistance.

Pay attention to the following conditions that will denote a defective shock:

– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme end of either stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any faults are present.

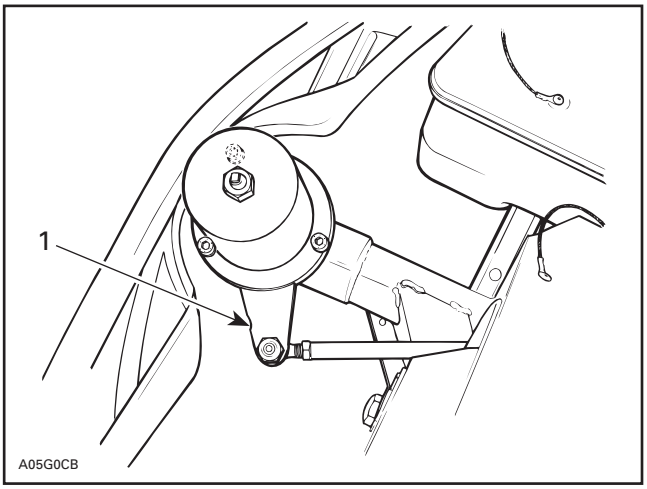
INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Apply suspension synthetic grease (P/N 293 550 033) as illustrated in exploded view above.

Tighten nuts and screws to proper torque as mentioned in exploded view.

Steering arm notch must face outside of vehicle.

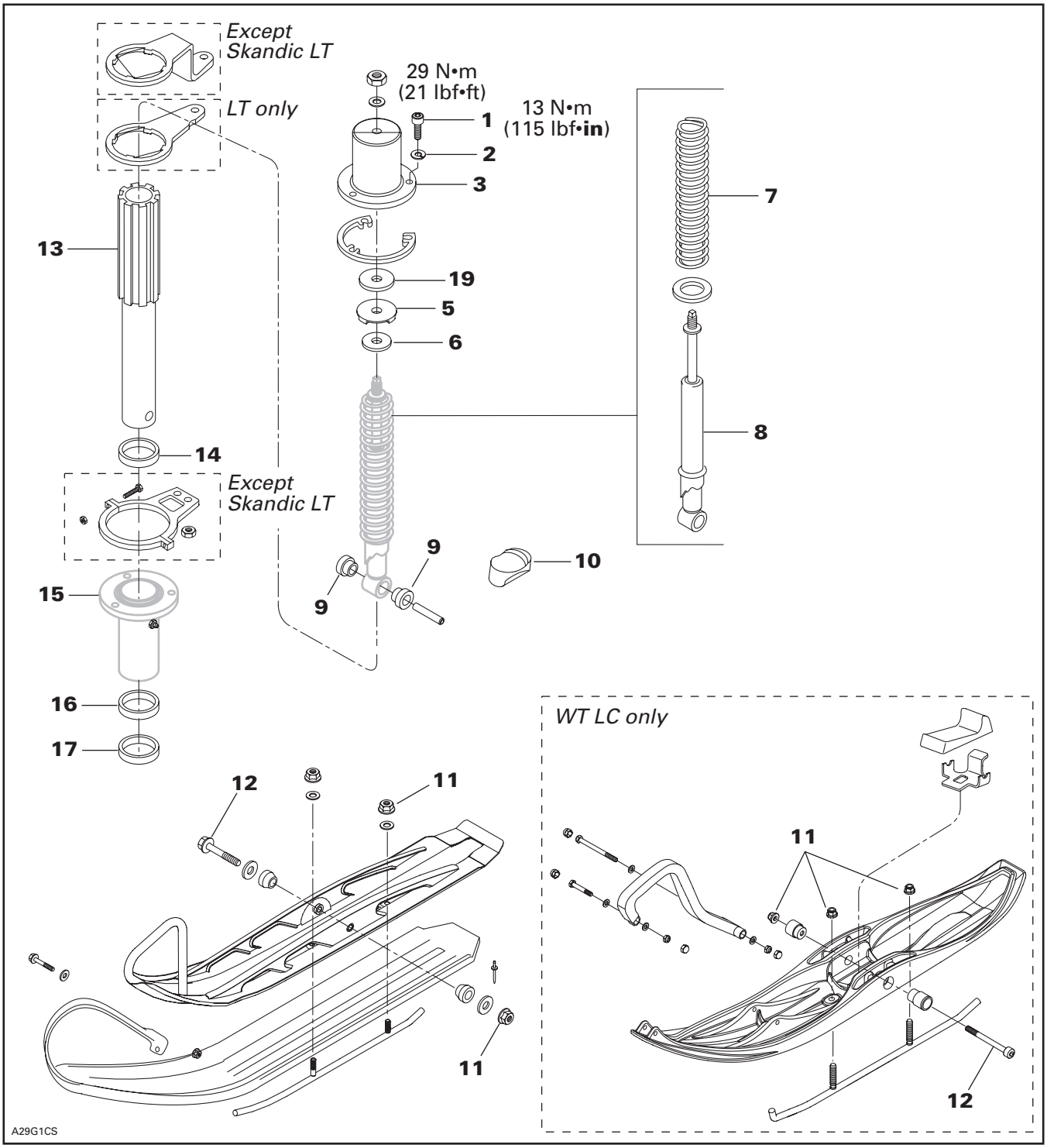


1. Recess facing outside

16,17, Seal

Install seal before reinstalling ski leg.

Skandic LT/LT E/WT/SWT/WT LC



TYPICAL

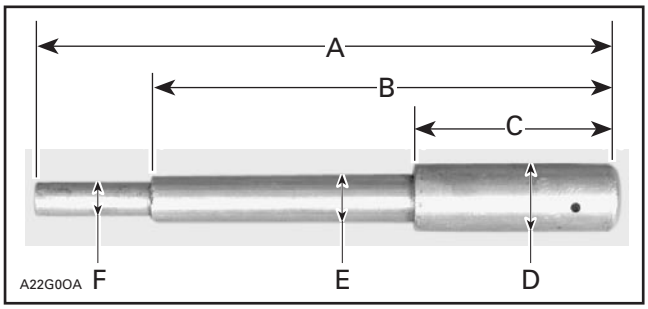
ON-VEHICLE COMPONENT VERIFICATION

8, Shock

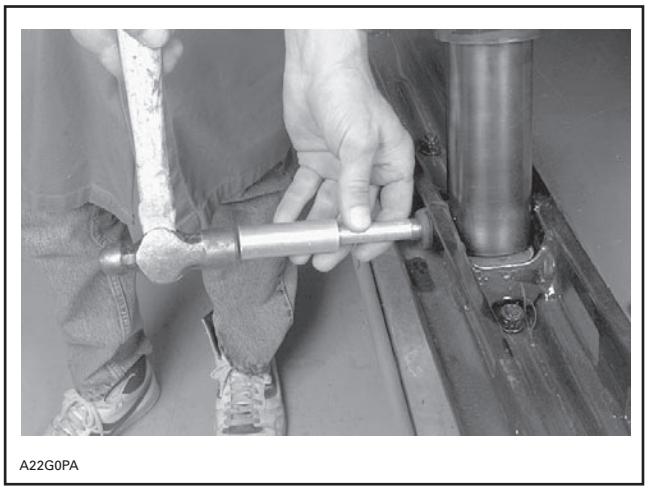
Lift front of vehicle and support off the ground.

Remove ski bolt and nut.

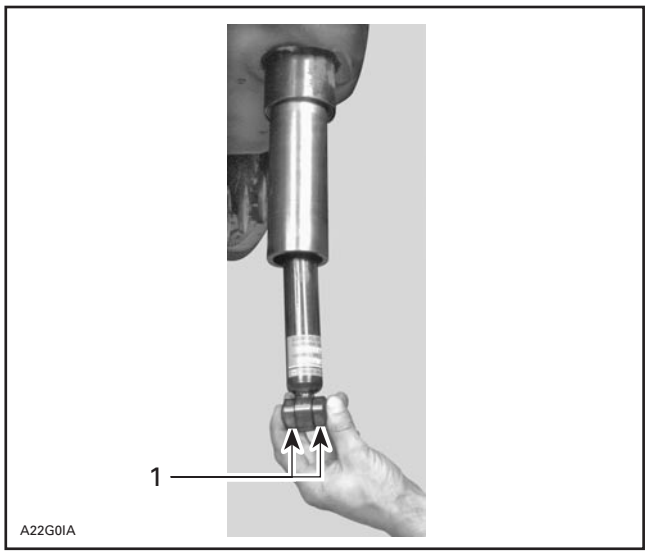
Remove steel bushing from ski using a pusher. See pusher dimensions below.



A. 220 mm (8.66 in)
B. 180 mm (7.09 in)
C. 70 mm (2.75 in)
D. 25 mm (1.0 in)
E. 15 mm (0.59 in)
F. 9 mm (0.35 in)



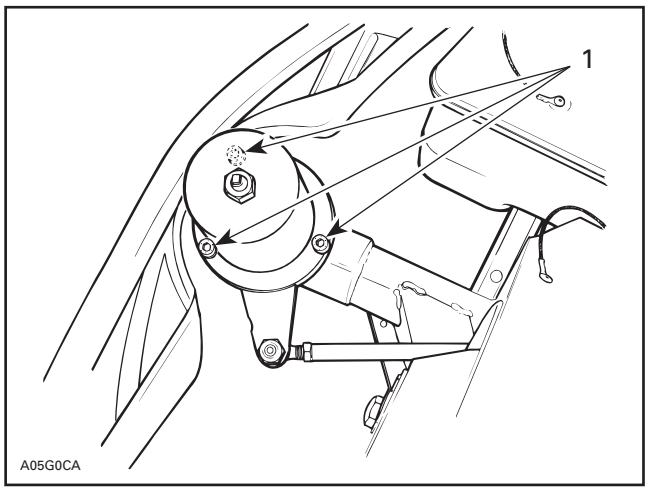
Unfasten rod nut then pull out shock from bottom. Check shock as described below in INSPECTION. At installation, make sure bushings are in place.



1. Bushings

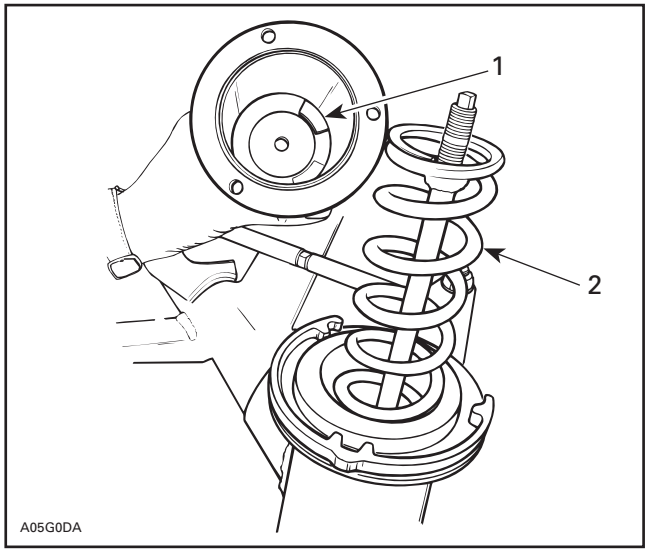
7, Spring

Unscrew shock rod nut then remove washer. Unscrew 3 Allen screws retaining cover **no. 3**, then remove stopper **no. 5**, washers **no. 6**, washer **no. 19**.



1. Allen screws

NOTE: These washers and stopper can be wedged in cover.



1. Washers and stopper wedged in cover
2. Spring

Pull out spring.

DISASSEMBLY

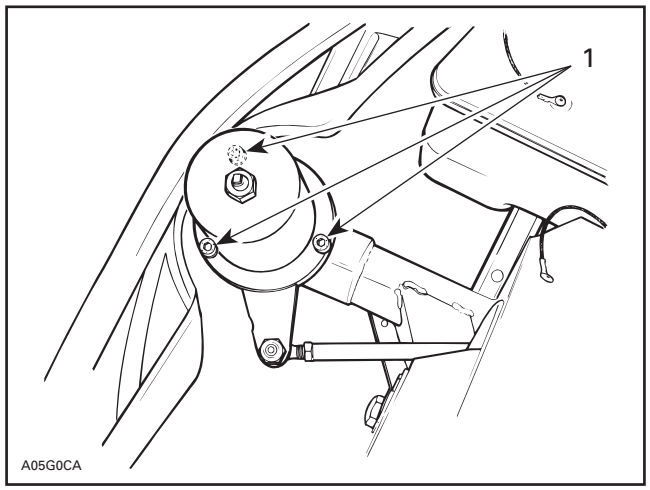
Lift front of vehicle and support off the ground.

1,2,3,5,6,9,11,12, Bolt, Lock Washer, Cover, Stopper, Bushing and Nut

Remove ski bolt, nut, bushings and ski.

Unscrew shock rod nut then remove washer. Shock will fall off the ski leg.

Unscrew 3 Allen screws retaining cover, then remove stopper and washers.

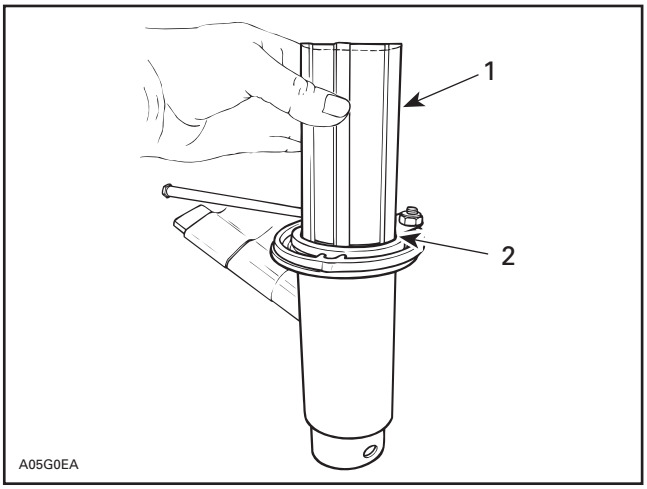


1. Allen screws

NOTE: These washers and stopper can be wedged in cap.

13,14,16,17, Ski Leg, Bushing and Seal

Pull up ski leg. Steering arm will not interfere.



1. Pull up ski leg
2. Steering arm in place

Remove seal. Drive out bushing if worn out.

INSPECTION

All Models

Suspension Free Operation

Remove cover and check for free movement of ski leg by lifting end of ski.

13, Ski Leg

Check straightness of ski leg. Check for scored or scratched surface. Replace as required.

Check that splines on ski leg and steering arm interlock properly with no excessive free play. Renew as necessary.

5, Stopper

Check condition of stopper. Replace it when deteriorated.

Grease Fitting

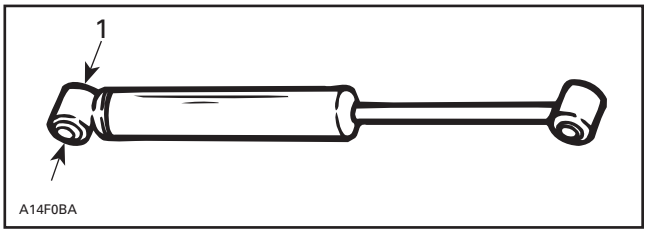
Ensure that grease fittings are not clogged.

10, Ski Stopper

Check stopper for crack or deterioration. Replace as required.

8, Shock Absorber

Secure the shock body end in a vise with its rod upward.



1. Clamp

CAUTION: Do not clamp directly on shock body.

Examine each shock for leaks. Extend and compress the piston several times over its entire stroke checking that it moves smoothly and with uniform resistance.

Pay attention to the following conditions that will denote a defective shock:

– A skip or a hang back when reversing stroke at mid travel.
– Seizing or binding condition except at extreme end of either stroke.
– Oil leakage.
– A gurgling noise, after completing one full compression and extension stroke.

Renew if any faults are present.

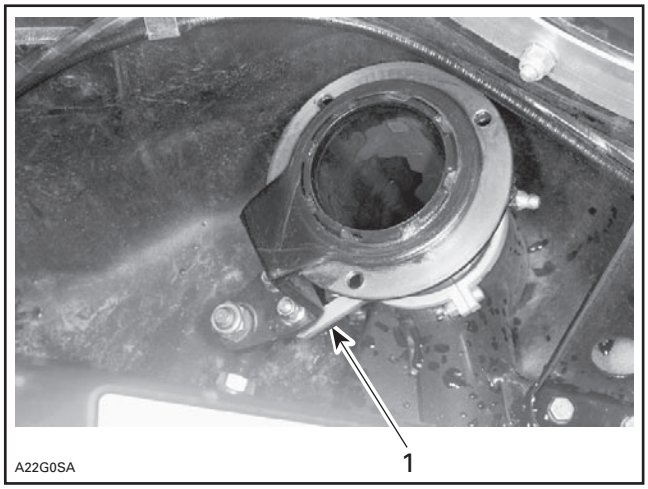
INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Apply suspension synthetic grease (P/N 293 550 033) as illustrated in exploded view above.

Tighten nuts and screws to proper torque as mentioned in exploded view.

Reinstall steering arm reinforcement when removed.

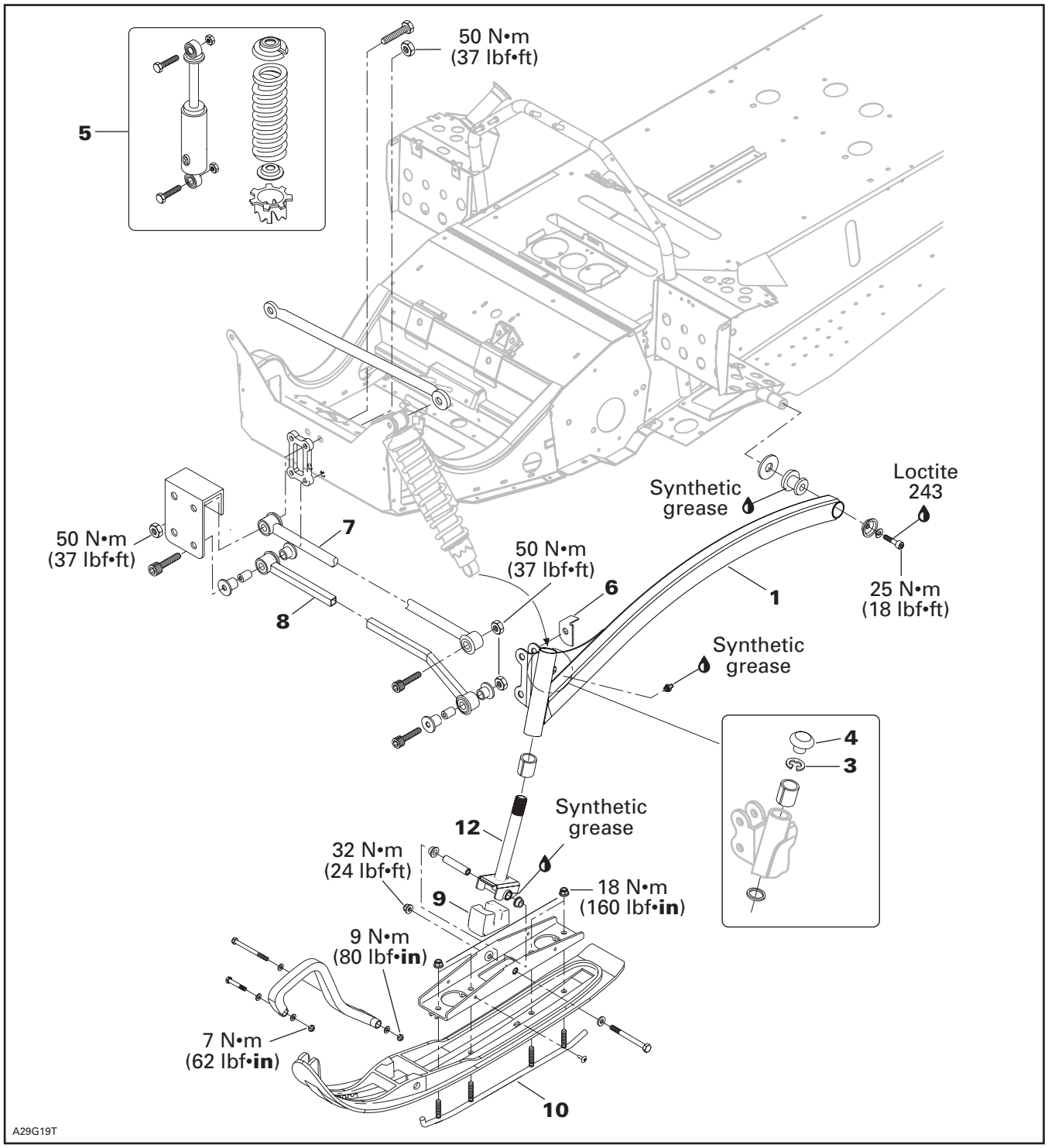


1. Reinforcement

16,17, Seal

Install seal before reinstalling ski leg.

Skandic SUV/Expedition TUV



TYPICAL

DISASSEMBLY

5, Shock

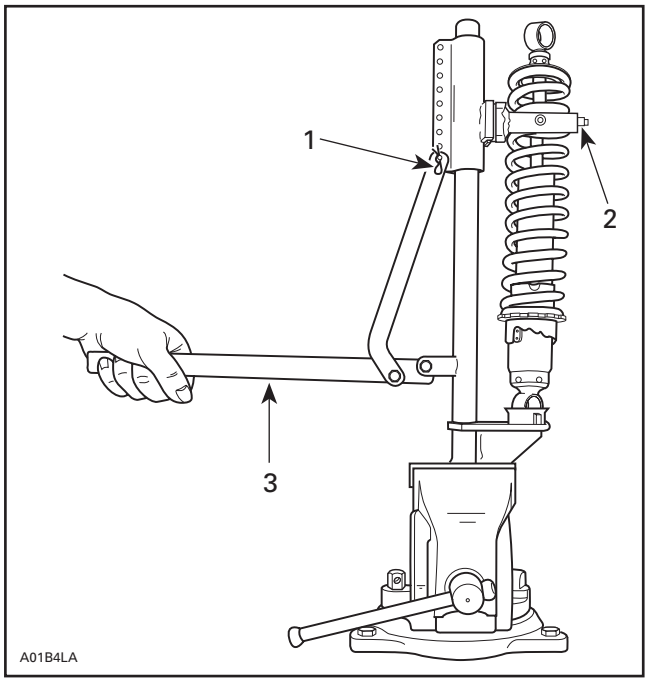
Lift front of vehicle and support it off the ground.

Reduce spring preload by turning adjusting ring accordingly.

Remove lower bolt then upper bolt of shock.

For shock spring disassembly use shock spring removal kit (P/N 529 035 504) in a vise. Mount shock in it and turn shock so that spring coils matched spring compressor.

Close and lock the bar. Adjust the handle at horizontal position by changing the position of the clevis pin.



1. Clevis pin
2. Bar
3. Handle horizontal

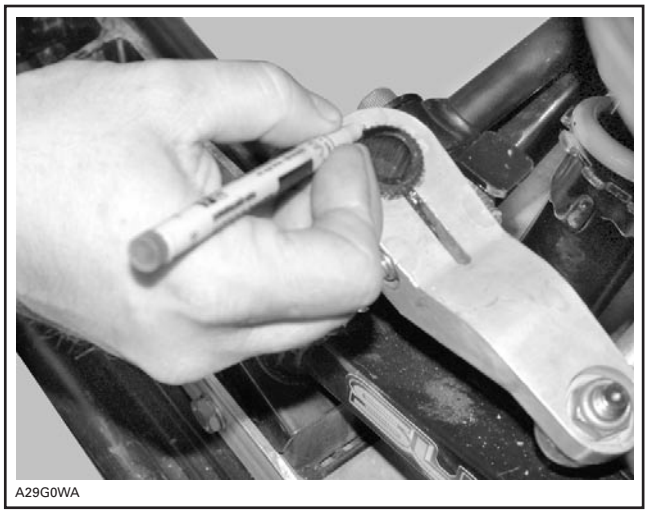
Push down on the handle until it locks. Remove spring stopper then release handle.

1, Swing Arm

Lift front of vehicle and support it off the ground.

Remove cap **no. 4**, circlip **no. 3**.

Scribe mark the steering arm and ski leg before disassembly.



Then loosen steering arm bolt and pull up steering arm. Ski leg may fall off from swing arm.

Unbolt lower end of shock from swing arm.

Unbolt upper and lower arms.

Unbolt rear of swing arm from frame.

Pull swing arm off the vehicle.

INSPECTION

Check all rubber cushions for crack and wear. Replace as required.

Check straightness of ski leg **no. 12** and make sure that splines are properly interlocking with steering arm. Replace as required.

Check for straightness of swing arm. Replace as required.

Check for clogged grease fittings. Clean or replace as required.

Check skis and runners **no. 10** for wear, replace as necessary.

Check condition of ski stopper **no. 9**. Replace it when deteriorated.

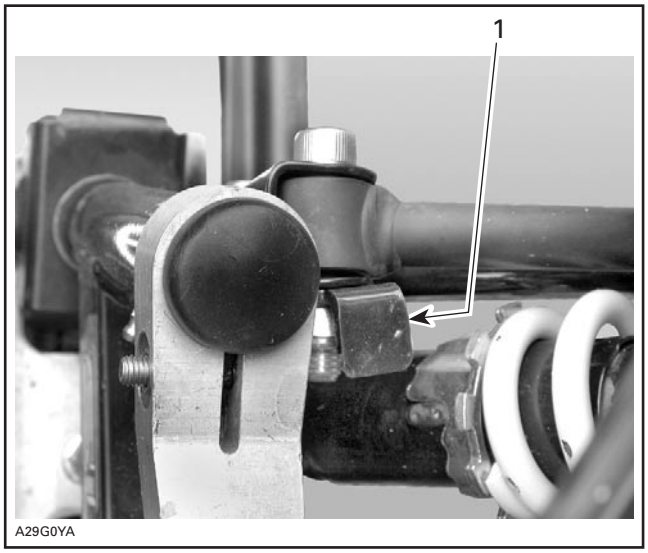
To check condition of shock, refer to SHOCK ABSORBER in INSPECTION CHAPTER.

INSTALLATION

For assembly, reverse the disassembly procedure. However, pay attention to the following.

Apply suspension synthetic grease (P/N 293 550 033) to ski leg components.

Install steering stopper **no. 6** as per following photo.



TYPICAL
1. Steering stopper

Longer bolts for shock and swing arm go on upper attachments.

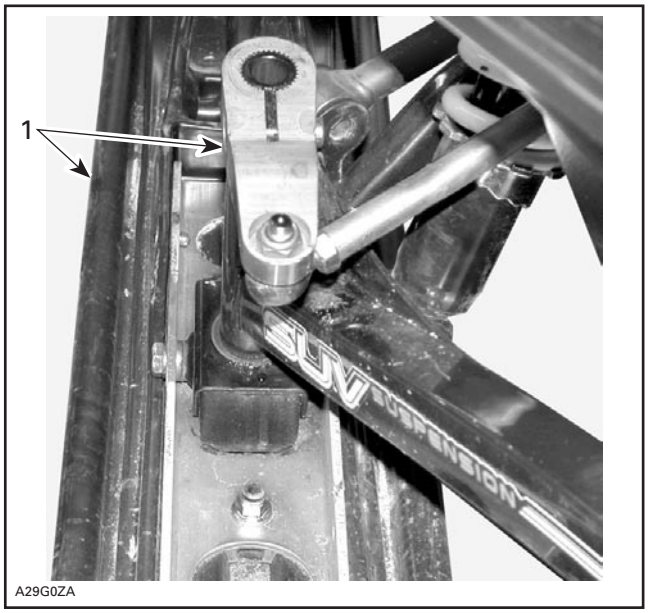
Tighten nuts and screws to proper torque as mentioned in exploded view.

7,8, Upper and Lower Arms

Position arms and tie rods horizontally before tightening nuts.

Bent portion of lower arm **no. 6** must face down.

Steering arm must be installed parallel to ski.



1. Parallel

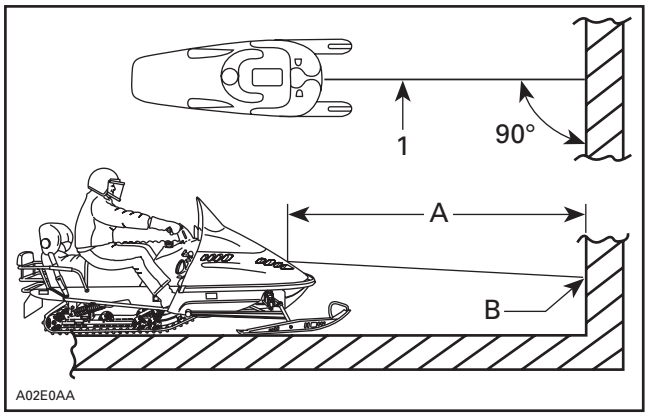
BODY

INSTALLATION AND ADJUSTMENT

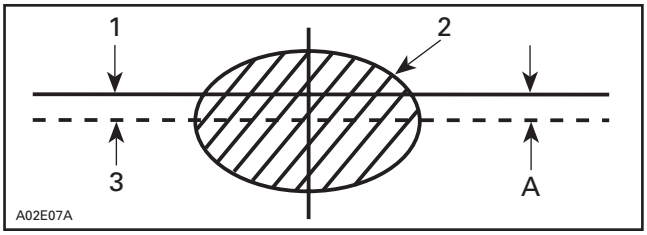
HEADLAMP BEAM AIMING

Beam aiming is correct when center of high beam is 25 mm (1 in) below the headlamp horizontal center line, scribed on a test surface, 381 cm (12 ft 6 in) away.

Measure headlamp center distance from ground. Scribe a line at this height on test surface (wall or screen). Light beam center should be 25 mm (1 in) below scribed line.



1. Headlamp center line
A. 381 cm (12 ft 6 in)
B. 25 mm (1 in) below center line



1. Headlamp horizontal
2. Light beam (high beam) (projected on the wall)
3. Light beam center
A. 25 mm (1 in)

Required Conditions

Place the vehicle on a flat surface perpendicular to test surface (wall or screen) and 381 cm (12 ft 6 in) away from it.

Rider or equivalent weight must be on the vehicle.

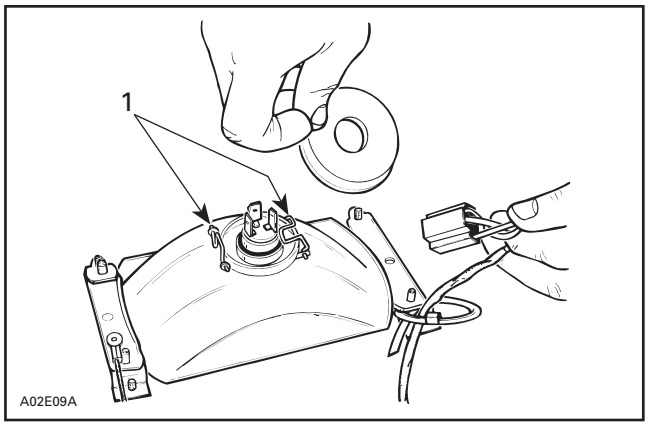
Select high beam.

BULB REPLACEMENT

Headlamp

Tundra

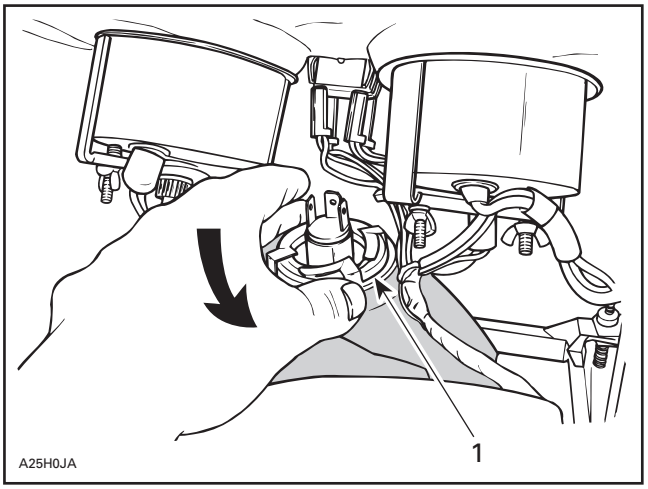
If headlamp is burnt, tilt hood. Unplug connector from headlamp. Remove protector cap and unfasten bulb retainer clips. Detach bulb and replace.



TYPICAL
1. Retainers clips

Skandic LT/LT E

If headlamp bulb is burnt, tilt cab and unplug the connector from the headlamp. Remove the rubber boot and unfasten the bulb retainer ring. Detach the bulb and replace it with a new one. Properly reinstall parts.

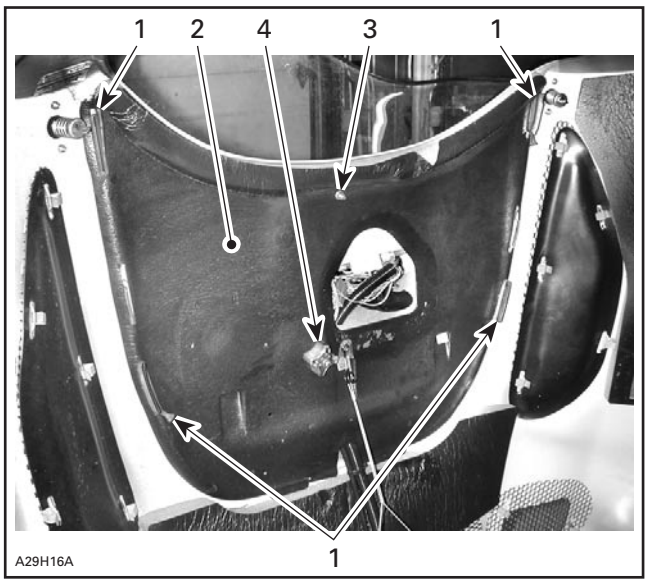


TYPICAL
1. Locking ring

Skandic LT/SWT/WT LC/SUV

If headlamp bulb is burnt, tilt hood.

Remove latches retaining plastic cover. Temporary reinstall the top two latches to retain windshield during bulb replacement.



SKANDIC LT/SWT/WT LC/SUV
1. *Latches*
2. *Plastic cover*
3. *Retaining nut and screw*
4. *Headlamp height adjustment knob*

Expedition TUV

To replace a burnt headlamp bulb, remove the following:

– windshield assembly
– air intake dashboard cover.

Replace bulb.

EXPEDITION TUV

All Models

CAUTION: Never touch glass portion of an halogen bulb with bare fingers, as it shortens its operating life. If by mistake glass is touched, clean it with isopropyl alcohol which will not leave a film on the bulb.

Taillight

If the taillight bulb is burnt, expose the bulb by removing red plastic lens. To remove, unscrew the 2 retaining screws. Verify all lights after replacement.

DECAL

To remove a decal; heat old decal with a heat gun and peel off slowly.

Using isopropyl alcohol, clean the surface and dry thoroughly.

Apply liquid soap to new decal and carefully position the decal. Using a sponge or a squeegee, remove the air bubbles and surplus water working from the center toward the edges. Allow to air dry.

CAUTION: Do not apply isopropyl alcohol or solvent directly on decals.

BELT GUARD

Disassembly and Assembly

NOTE: For additional information (ex.: exploded view) refer to the corresponding *Parts Catalog*.

⚠ WARNING

Engine should be running only with belt guard well-secured in place.

Inspection

All Models

Check belt guard mounting bosses, clips and retainers for wear.

WIRING HARNESS

⚠ WARNING

Ensure all terminals are properly crimped on the wires and that all connector housings are properly fastened. Keep wires away from any rotating, moving, heating and vibrating parts. Use proper fastening devices as required.

CABLES

⚠ WARNING

Before installation, ensure that all cables are in perfect condition. Properly install the cable ends and secure them in place. Pay attention to route them properly, away from any rotating, moving, heating, or vibrating parts.

TUBING

⚠ WARNING

Always ensure that the fuel, vent, primer, impulse, injection oil and rotary valve oil lines are properly fixed to their connectors, that they are not perforated or kinked and that they are properly routed away from any rotating, moving, heating or vibrating parts. Also check for leaks. Replace if required.

NOTE: Refer to proper *Parts Catalog* to find suitable clip part numbers.

PLASTIC MAINTENANCE AND REPAIR

MAINTENANCE

Clean the vehicle thoroughly, removing all dirt and grease accumulation.

To clean use a soft clean cloth and either soapy water or isopropyl alcohol.

To remove grease, oil or glue use isopropyl alcohol.

CAUTION: Do not apply isopropyl alcohol or acetone directly on decals.

CAUTION: The following products must not be used to clean or wax any of the plastic components used on the vehicles:

- gasoline
- brake fluid
- kerosene
- diesel fuel
- lighter fluid
- varsol
- naphtha
- acetone
- strong detergents
- abrasive cleaners
- waxes containing an abrasive or a cleaning agent in their formula.

Apply wax on glossy finish only. Protect the vehicle with a cover to prevent dust accumulation during storage.

CAUTION: If for some reason the snowmobile has to be stored outside it is preferable to cover it with an opaque tarpaulin. This will prevent the sun rays from affecting the plastic components and the vehicle finish.

REPAIR

The very first step before repairing plastic materials is to find out exactly which type of material is involved. Refer to following chart.

CAUTION: Consult chart and repair kit instructions carefully, some repair products are not compatible with certain plastics.

⚠ WARNING

Polycarbonate windshields must never be repaired by welding or otherwise.

		IRRE-PAIRABLE	RE-PAIRABLE
PART	MODEL	High density polyethylene	R.I.M. urethane
HOOD	Tundra		
	Skandic LT/ WT/SWT/ WT LC/ SUV/ Expedition TUV		
BOTTOM PAN	Tundra		
	Skandic LT/ WT/SWT/ WT LC/ SUV/ Expedition TUV		

REPAIR PROCEDURE FOR R.I.M. URETHANE

R.I.M. urethane is light colored (tan) on the inside with a smooth surface.

⚠ WARNING

Material should be repaired and repainted in a well-ventilated area only.

CAUTION: **Clean R.I.M. with isopropyl alcohol or Crest Hi-Solv product. Never use cleaners or products that contain chlorine.**

CAUTION: **R.I.M. should never be exposed to temperatures exceeding 93°C (200°F).**

NOTE: When working on a R.I.M. surface, never use a grinder or a high revolution tool such as an air or electric buffer. Use of such tools could overheat material and liberate agents in it thus causing a bad adhesion.

Small Scratches

– Sand and scuff area.
– Feather out edges.
– Paint with a matching acrylic auto touch-up paint.

Deep Scratches

– Sand and scuff area.
– Make a V groove using a knife or a rough round file.
– Clean surface with isopropyl alcohol or Crest Hi-Solv stock no. AH-S product.
– Cover with TP-E epoxy mixed in equal quantities.
– Heat the surface with a heater lamp placed at 38 cm (15 in) for a period of 15 minutes.
– Sand the surface using a smooth dry sand paper.
– Use the same product if a final finish is required.
– Clean surface with Crest Hi-Solv product.
– Apply a flexible primer such as Crest Prima Flex stock no. AP-F.
– Wait 10 minutes.
– Repaint (air dry during 72 hours (approximately)).

Large Crack

– Sand and scuff outside and inside area by exceeding it 31.7 mm (1-1/4 in) on each side and 12.7 mm (1/2 in) at each end.
– Make a V groove (appr. 90°) on both sides of hood using a knife or a rough round file.
– Enlarge the crack to 2.4 mm (3/32 in) – 3.2 mm (1/8 in) using a sharp knife.
– Clean outside and inside surface with isopropyl alcohol or Crest Hi-Solv product.
– Repair inside surface first.
– Cover inside area with Crest TP-E epoxy.
– Apply a 50 mm x 30 mm (2 in x 1-1/4 in) patch. If no room for the patch, use tape.
– Cover exterior surface with same product. Damaged area should be slightly higher.
– Heat surface with a heater lamp placed at 38 mm (15 in) for a period of 15 minutes.
– Sand outside surface using a smooth dry sand paper.
– Use same product if a final finish is required.
– Apply a flexible primer.
– Wait 10 minutes.
– Repaint (air dry during 72 hours approximately).

NOTE: R.I.M. materials are high static plastics, painting must be done in a dust free area such as a paint booth.

Crest products used in R.I.M. repair procedure are available from following locations:

CREST MAIN OFFICE AND MANUFACTURING PLANT	
CREST INDUSTRIES INC. 1337 King Road Trenton, Michigan, U.S.A. 48183	Phone: 734-479-4141 Toll free: 1 800 822-4100 Fax: 734-479-4040 E-Mail: info@crestauto.com www.crestauto.com

FRAME

FRAME CLEANING

NOTE: For bare aluminum frames use only aluminum cleaner and follow instructions on container. (Dursol cleaner or equivalent).

Clean frame and tunnel with appropriate cleaners and rinse with high pressure hose.

CAUTION: Never direct high-pressure water jet towards decals. They would peel off.

Touch up all metal spots where paint has been scratched off. Spray all bare metal parts of vehicle with metal protector.

Seat Cleaning

For all models, it is recommended to clean the seat with a solution of warm soapy water, using a soft clean cloth.

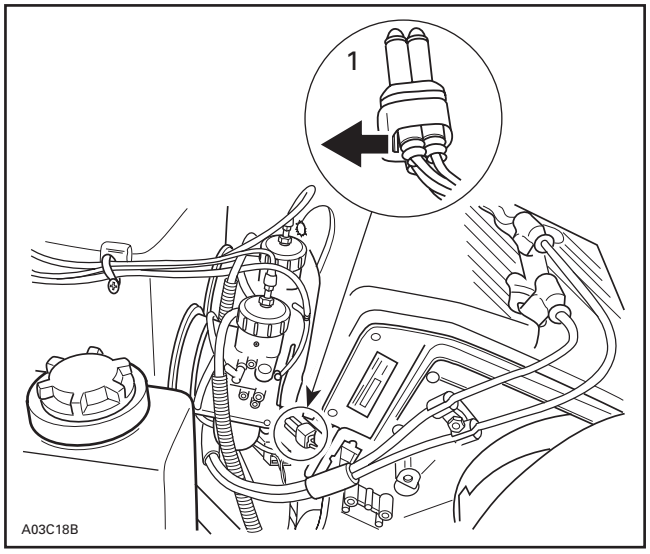
CAUTION: Avoid use of harsh detergents such as strong soaps, degreasing solvents, abrasive cleaners, paint thinners, etc. that may cause damage to the seat cover.

FRAME WELDING

Steel Frame:

– electric welding
– amperage: 70-110 A
– voltage: 20-24 V
– electrode: E-7014 (3/32 in).

CAUTION: Before performing electrical welding anywhere on the vehicle, unplug the multiple connector at the electronic box. On models equipped with a battery, also unplug the negative cable. This will protect the electronic box and battery against damage caused by flowing current when welding.



TYPICAL — FAN COOLED MODELS
1. Unplug before electrical welding

TYPICAL — LIQUID COOLED MODELS MPEM UNPLUGGED

CAUTION: If welding is to be done near plastic material, it is recommended to either remove the part from the area or to protect it with aluminum foil to prevent damage.

ENGINES

TUNDRA			
ENGINE TYPE			**277**
ENGINE			
Number of cylinder			1
Bore	Standard	mm (in)	72.00 (2.835)
Stroke		mm (in)	66.00 (2.598)
Displacement		cm^3 (in^3)	268.7 (16.40)
Compression ratio (corrected)			11.2
Maximum power engine speed (1)		± 100 RPM	6900
Piston ring type	1st		ST
	2nd		R
Ring end gap	New	mm (in)	ST ring 0.25 (.010) R ring 0.20 (.008)
	Wear limit	mm (in)	1.0 (.039)
Ring/piston groove clearance	New	mm (in)	0.025 (.001)
	Wear limit	mm (in)	0.2 (.008)
Piston/cylinder wall clearance	New	mm (in)	0.080 (.0031)
	Wear limit	mm (in)	0.2 (.008)
Maximum crankshaft end play (2)	New	mm (in)	0.3 (.012)
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.06 (.00241)
Connecting rod big end axial play	New	mm (in)	0.20 (.0079)
	Wear limit	mm (in)	1.2 (.0472)
ELECTRICAL			
Magneto generator output		W	240
Ignition type			CDI
Spark plug	Make and type		NGK BR9ES
	Gap	mm (in)	0.45 (.018)
Ignition timing BTDC (3)		mm (in)	3.61 (.142)
Trigger coil (4)		Ω	160 - 180
Generating coil (4)	Low speed	Ω	N.A.
	High speed	Ω	5.1 - 6.2
Lighting coil (4)		Ω	.17 - .21
High tension coil (4)	Primary	Ω	N.A.
	Secondary	kΩ	.9 - 1.1

TUNDRA			
ENGINE TYPE			**277**
FUEL SYSTEM			
Carburetor type	PTO/MAG		1 x VM 34-585
Main jet	PTO/MAG		200
Needle jet			159 O-8
Pilot jet			40
Needle identification — clip position	PTO/MAG		6DH4-3
Slide cut-away			2.5
Float adjustment		mm (in)	23.9 (.94) ± 1 (.040)
Air or pilot screw adjustment	± 1/16 turn		1
Idle speed	± 200 RPM		1650
Gas	Type		Regular unleaded gasoline
	Octane number		North America: 87 (R+M)/2 Elsewhere: 91 RON
Gas/oil ratio			Injection
COOLING SYSTEM			
Type			Radial Fan
Axial fan belt adjustment	Deflection	mm (in)	N.A.
	Force	kg (lbf)	N.A.
Coolant			N.A.
Thermostat opening temperature		°C (°F)	N.A.
Radiator cap opening pressure		kPa (PSI)	N.A.
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw		N•m (lbf•ft)	(5)
Exhaust manifold nuts or bolts		N•m (lbf•ft)	25 (18)
Magneto ring nut		N•m (lbf•ft)	95 (70)
Crankcase nuts or screws	M6	N•m (lbf•**in**)	N.A.
	M8	N•m (lbf•ft)	22 (16)
Crankcase/engine support nuts or screws		N•m (lbf•ft)	21 (15)
Cylinder head screws or nuts		N•m (lbf•ft)	27 (20)
Crankcase/cylinder nuts or screws		N•m (lbf•ft)	N.A.
Axial fan shaft nut		N•m (lbf•ft)	N.A.

SKANDIC			LT	WT/SWT/SUV	SUV/WT LC
ENGINE TYPE			443	552	593
ENGINE					
Number of cylinder			2	2	2
Bore	Standard	mm (in)	67.5 (2.6575)	76.00 (2.992)	76.00 (2.992)
Stroke		mm (in)	61.0 (2.402)	61.0 (2.402)	65.8 (2.591)
Displacement		cm^3 (in^3)	436.6 (26.64)	553.4 (33.78)	597.0 (36.43)
Compression ratio (corrected)			9.6	9.6	12.0
Maximum power engine speed (1)		± 100 RPM	6900	6900	7000
Piston ring type	1st		ST	ST	ST
	2nd		R	R	N.A.
Ring end gap	New	mm (in)	0.2 (.008)	0.4 (.0157)	0.4 (.0157)
	Wear limit	mm (in)	1.0 (.039)	1.0 (.0394)	1.0 (.0394)
Ring/piston groove clearance	New	mm (in)	0.04 (.0016)	0.037 (.0015)	0.04 (.0016)
	Wear limit	mm (in)	0.2 (.0079)	0.2 (.0079)	0.2 (.0079)
Piston/cylinder wall clearance	New	mm (in)	0.070 (.0031)	0.147 (.0058)	0.12 (.0047)
	Wear limit	mm (in)	0.2 (.008)	0.2 (.0079)	0.2 (.0079)
Maximum crankshaft end play (2)	New	mm (in)	0.3 (.012)	0.3 (.012)	0.3 (.012)
Maximum crankshaft deflection at PTO	Wear limit	mm (in)	0.06 (.0024)	0.06 (.0024)	0.06 (.0024)
Connecting rod big end axial play	New	mm (in)	0.20 (.0079)	0.2 (.0079)	0.39 (.0154)
	Wear limit	mm (in)	1.2 (.0472)	1.2 (.0472)	1.2 (.0472)
ELECTRICAL					
Magneto generator output		W	240	340	290
Ignition type			CDI	CDI	CDI
Spark plug	Make and type		NGK BR9ES	NGK BR9ES	NGK BR9ECS (7)
	Gap	mm (in)	0.45 (.018)	0.45 (.018)	0.45 (.018)
Ignition timing BTDC (3)		mm (in)	2.79 (.110)	2.77 (.109)	3.00 (.118)
Trigger coil (4)		Ω	160 - 180	160 - 180	190 - 300
Generating coil (4)	Low speed	Ω	N.A.	N.A.	17.5 - 42.5
	High speed	Ω	5.1 - 6.2	6.3 - 7.7	2.4 - 5.8
Lighting coil (4)		Ω	.17 - .21	.145 - .175	.10 - .40
High tension coil (4)	Primary	Ω	N.A.	N.A.	.3 - .7
	Secondary	kΩ	.9 - 1.1	.9 - 1.1	8 - 16

SKANDIC			LT	WT/SWT/SUV	SUV/WT LC
ENGINE TYPE			443	552	593
FUEL SYSTEM					
Carburetor type	PTO/MAG		1 x VM 32-306	2 x VM 34-614	2 x VM 38-449
Main jet	PTO/MAG		180	190	330
Needle jet			159 O-0	159 P-0	480 P-9
Pilot jet			50	40	40
Needle identification — clip position	PTO/MAG		6DGY12-3	6DH4-2	6DGL24-3
Slide cut-away			3	2.5	2.5
Float adjustment		mm (in)	23.9 (.941) ± 1 (.040)	23.9 (.941) ± 1 (.040)	18.1 (.710) ± 1 (.040)
Air or pilot screw adjustment	± 1/16 turn		1	1-1/2	2
Idle speed	± 200 RPM		1800	1650	1900
Gas	Type		Regular unleaded	Regular unleaded	Regular unleaded
	Octane number		North America: 87 (R+M)/2 Elsewhere: 91 RON	North America: 87 (R+M)/2 Elsewhere: 91 RON	North America: 87 (R+M)/2 Elsewhere: 91 RON
Gas/oil ratio			Injection	Injection	Injection
COOLING SYSTEM					
Type			Axial Fan	Axial fan	Liquid
Axial fan belt adjustment	Deflection	mm (in)	9 - 10 (.35 - .39)	9 - 10 (.35 - .39)	N.A.
	Force	kg (lbf)	5 (11)	5 (11)	N.A.
Coolant			N.A.	N.A.	(8)
Thermostat opening temperature		°C (°F)	N.A.	N.A.	42 (108)
Radiator cap opening pressure		kPa (PSI)	N.A.	N.A.	100 (14.5)
TIGHTENING TORQUE (engine cold)					
Drive pulley retaining screw		N•m (lbf•ft)	(5)	(5)	(5)
Exhaust manifold nuts or bolts		N•m (lbf•ft)	22 (16)	22 (16)	23 (17)
Magneto ring nut		N•m (lbf•ft)	105 (77)	105 (77)	125 (92)
Crankcase nuts or screws	M6	N•m (lbf•**in**)	9 (6.5)	N.A.	9 (6.5)
	M8	N•m (lbf•ft)	22 (16)	27 (20)	29 (21)
Crankcase/engine support nuts or screws		N•m (lbf•ft)	39 (29)	40 (30)	35 (26)
Cylinder head screws or nuts		N•m (lbf•ft)	22 (16)	22 (16)	29 (21)
Crankcase/cylinder nuts or screws		N•m (lbf•ft)	N.A.	N.A.	29 (21)
Axial fan shaft nut		N•m (lbf•ft)	48 (35)	48 (35)	N.A.

SKANDIC EXPEDITION TUV				600 HO SDI
ENGINE TYPE				593
ENGINE				
Number of cylinder				2
Bore		Standard	mm (in)	72 (2.835)
Stroke			mm (in)	73.00 (2.874)
Displacement			cm^3 (in^3)	594.40 (36.273)
Compression ratio (corrected)				12.25
Maximum power engine speed (1)			± 100 RPM	8000
Piston ring type		1st		ST
		2nd		N.A.
Ring end gap		New	mm (in)	0.40 - 0.55 (.016 - .022)
		Wear limit	mm (in)	1.0 (.039)
Ring/piston groove clearance		New	mm (in)	0.05 - 0.10 (.0020 - .0039)
		Wear limit	mm (in)	0.2 (.0079)
Piston/cylinder wall clearance		New	mm (in)	0.105 ± 0.013 (.0041 ± .0009)
		Wear limit	mm (in)	0.18 (.0071)
Maximum crankshaft end play (2)		New	mm (in)	0.3 (.012)
Maximum crankshaft deflection at PTO		Wear limit	mm (in)	0.06 (.0024)
Connecting rod big end axial play		New	mm (in)	0.310 - 0.677 (.0122 - .0267)
		Wear limit	mm (in)	1.2 (.0472)
ELECTRICAL				
Magneto generator output			W	480
Ignition type				Inductive
Spark plug	Make and type			NGK BR9ECS
	Gap		mm (in)	0.75 - 0.85 (.030 -.033) (7)
Ignition timing BTDC (3)			mm (in)	5.390 (.2122)
Trigger coil (4)			Ω	190 -300
Generating coil (4)	Low speed		Ω	N.A.
	High speed		Ω	N.A.
Lighting coil (4)			Ω	.175 - .180
High tension coil (4)	Primary		Ω	N.A.
	Secondary		kΩ	N.A.

SKANDIC EXPEDITION TUV			600 HO SDI
ENGINE TYPE			593
FUEL SYSTEM			
Fuel injection type			SDI with Dell'Orto 46 mm throttle body (no IACV)
Fuel pressure		kPa (PSI)	400 (58)
Idle speed		RPM	1600 ± 200
Throttle Position Sensor (TPS) (4)		kΩ	1.6 - 2.4
Crankshaft Position Sensor (CPS) (4)		Ω	190 - 300
Air Pressure Sensor (APS) (4)		V	5
Air Temperature Sensor (ATS) (4)		kΩ	2.28 - 2.74
Coolant Temperature Sensor (CTS) (4)		kΩ	2.6 - 3.2
Fuel injector		Ω	13.8 - 15.2
Gas	Type		Regular unleaded
	Octane number		North America: 87 (R+M)/2 Elsewhere: 91 RON
Gas/oil ratio			Injection
COOLING SYSTEM			
Type			Liquid
Axial fan belt adjustment	Deflection	mm (in)	N.A.
	Force	kg (lbf)	N.A.
Coolant			N.A.
Thermostat opening temperature		°C(°F)	42 (108)
Radiator cap opening pressure		kPa (PSI)	90 (13)
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw		N•m (lbf•ft)	(5)
Exhaust manifold nuts or bolts		N•m (lbf•**in**)	11 (97)
Magneto ring nut		N•m (lbf•ft)	125 (92)
Crankcase nuts or screws	M6	N•m (lbf•**in**)	9 (80)
	M8	N•m (lbf•ft)	29 (21)
Crankcase/engine support nuts or screws		N•m (lbf•ft)	35 (26)
Cylinder head screws or nuts		N•m (lbf•ft)	29 (21)
Crankcase/cylinder nuts or screws		N•m (lbf•ft)	40 (29)
Axial fan shaft nut		N•m (lbf•ft)	N.A.

SKANDIC EXPEDITION TUV				V-1000
ENGINE TYPE				**1004**
ENGINE				
Engine type				BOMBARDIER-ROTAX 1004 4-TEC, 4-stroke, Over Head Camshaft (OHC), liquid cooled
Cylinder arrangement and quantity				V2
Valves per cylinder				4 valves with hydraulic lifters (no adjustment)
Bore		Standard	mm (in)	100 (3.937)
Stroke			mm (in)	63.4 (2.496)
Displacement			cm^3 (in^3)	995.90 (60.774)
Compression ratio				10.3
Decompressor type				Automatic
Maximum power engine speed (1)			RPM	7250 RPM
Lubrication				Dry sump with replaceable oil filter
Intake valve opening			BTDC	10°
Intake valve closing			ATDC	45°
Exhaust valve opening			BTDC	50°
Exhaust valve closing			ATDC	5°
Starting system				Electric start
Valve stem diameter	Intake	New	mm (in)	5.961 - 5.975 (.2347 - .2352)
		Wear limit	mm (in)	5.930 (.2330)
	Exhaust	New	mm (in)	5.946 - 5.960 (.2341 - .2346)
		Wear limit	mm (in)	5.930 (.2330)
Valve guide diameter		Wear limit	mm (in)	6.060 (.2386)
Valve spring free length	Inner	New	mm (in)	41.02 (1.615)
		Wear limit	mm (in)	38.8 (1.499)
	Outer	New	mm (in)	45.45 (1.789)
		Wear limit	mm (in)	43 (1.693)
Valve seat contact width	Intake	New	mm (in)	1.1 - 1.3 (.043 - .051)
		Wear limit	mm (in)	1.6 (.063)
	Exhaust	New	mm (in)	1.25 - 1.55 (.049 - 061)
		Wear limit	mm (in)	1.8 (.071)
Rocker arm bore diameter		New	mm (in)	20.007 - 20.020 (.7876 - .7881)
		Wear limit	mm (in)	20.035 (.7887)
Rocker arm shaft diameter		New	mm (in)	19.980 - 19.993 (.7866 - 7871)
		Wear limit	mm (in)	19.965 (.7860)
Cylinder head screw length		Service limit	mm (in)	216.5 (8.524)

SKANDIC EXPEDITION TUV					V-1000
ENGINE TYPE					1004
ENGINE (cont'd)					
Piston ring type		1st			Rectangular
		2nd			Taper-face
		3rd			Oil scraper ring
Ring end gap	1st	New		mm (in)	0.30 - 0.50 (.012 - .020)
	2nd			mm (in)	0.35 - 0.55 (.014 - .022)
	3rd			mm (in)	0.15 - 0.3 (.006 - .012)
	All	Wear limit		mm (in)	1.5 (.059)
Ring/piston groove clearance	1st	New		mm (in)	0.025 - 0.07 (.001 - .0028)
	2nd			mm (in)	0.015 - 0.06 (.0006 - .0024)
	3rd			mm (in)	0.02 - 0.055 (.0008 - .0021)
	All	Wear limit		mm (in)	0.15 (.006)
Piston/cylinder wall clearance		New		mm (in)	0.024 - 0.056 (.001 - .0022)
		Wear limit		mm (in)	0.09 (.0035)
Cylinder taper (maximum)		New (maximum)		mm (in)	0.038 (.0015)
		Wear limit		mm (in)	0.09 (.0035)
Cylinder out of round		New (maximum)		mm (in)	0.01 (.0004)
		Wear limit		mm (in)	0.02 (.0008)
Camshaft bearing journal	PTO side	New		mm (in)	24.967 - 24.980 (.9830 - .9835)
		Wear limit		mm (in)	24.960 (.9827)
	Alternator side	New		mm (in)	39.927 - 39.935 (1.5719 - 1.5722)
		Wear limit		mm (in)	39.920 (1.5716)
Camshaft bore	PTO side	New		mm (in)	25.000 - 25.013 (.9842 - .9848)
		Wear limit		mm (in)	25.020 (.9850)
	Alternator side	New		mm (in)	40.000 - 40.016 (1.5748 - 1.5754)
		Wear limit		mm (in)	40.020 (1.5756)
Cam lobe	Intake	New		mm (in)	31.654 - 31.854 (1.2462 - 1.2541)
		Wear limit		mm (in)	31.600 (1.2441)
	Exhaust	New		mm (in)	31.435 - 31.635 (1.2376 - 1.2455)
		Wear limit		mm (in)	31.400 (1.2362)
Crankshaft axial clearance		New		mm (in)	0.100 - 0.45 (.0039 - .0177)
Crankshaft journal diameter		New		mm (in)	54.961 - 54.980 (2.1638 - 2.1646)
		Wear limit		mm (in)	54.940 (2.1630)
Crankshaft deflection		Wear limit		mm (in)	0.050 (.002)
Crankshaft radial clearance		Wear limit		mm (in)	0.080 (.0031)

SKANDIC EXPEDITION TUV			V-1000
ENGINE TYPE			**1004**
ENGINE (cont'd)			
Connecting rod big end diameter	Wear limit	mm (in)	45.090 (1.7752)
Connecting rod big end clearance	Wear limit	mm (in)	0.09 (.0035)
Connecting rod big end axial play	New	mm (in)	0.150 - 0.450 (.0059 - .0177)
	Wear limit	mm (in)	0.500 (.0197)
Connecting rod small end diameter	New	mm (in)	23.010 - 23.020 (.9059 - 9063)
	Wear limit	mm (in)	23.070 (.9080)
Piston pin diameter	New	mm (in)	22.996 - 23.000 (.9053 - .9055)
	Wear limit	mm (in)	22.990 (.9051)
Piston pin bore clearance	Wear limit	mm (in)	0.080 (.0031)
ELECTRICAL			
Alternator output		V, A	12, 40
Ignition system type			DI (Digital Induction)
Ignition timing			Not adjustable
Spark plug	Make and type		NGK DCPR8E
	Gap	mm (in)	0.75 (.030)
Ignition coil	Primary	Ω	.85 - 1.15
	Secondary	kΩ	9.2 - 13.8
Engine RPM limiter setting		RPM	8000
FUEL SYSTEM			
Fuel injection type			ROTAX EMS (Engine Management System) Multipoint Fuel Injection, Single throttle body (52 mm)
Fuel pressure		kPa (PSI)	400 (58)
Idle speed		RPM	1400 ± 100
Throttle Position Sensor (TPS) (4)		kΩ	1.6 - 2.4
Crankshaft Position Sensor (CPS) (4)		Ω	.7 - 1.1
Camshaft Position Sensor (CAPS)		V	12
Camshaft Position Sensor (CAPS) (4)		kΩ	1.2
Air Temperature Sensor (ATS) (4)		kΩ	2.28 - 2.74
Coolant Temperature Sensor (CTS) (4)		kΩ	2.28 - 2.74
Manifold Air Pressure Sensor (MAPS)		V	5
Idle bypass valve (4)		Ω	50
Oil Pressure Switch (OPS) (4)		Ω	0 (continuity), if oil pressure is lower than 20 kPa (2.9 PSI)
Fuel injector		Ω	13.8 - 15.2
Fuel	Type		Regular unleaded
	Octane		North America: 87 (R+M)/2 Elsewhere: 91 RON

SKANDIC EXPEDITION TUV			V-1000
ENGINE TYPE			**1004**
COOLING SYSTEM			
Type			Liquid cooled
Coolant			(8)
Thermostat		°C (°F)	80 (176)
TIGHTENING TORQUE (engine cold)			
Drive pulley retaining screw			(6)
Cylinder head screws or nuts	M11	N•m (lbf•ft)	50 (37) + 90° rotation
	M6	N•m (lbf•**in**)	9 (80)
Rocker arm shaft screws		N•m (lbf•ft)	20 (15) + 90° rotation
Crankshaft nut		N•m (lbf•ft)	80 (59)
Connecting rod screws		N•m (lbf•ft)	45 (33) + 90° rotation
Crankcase screws	M6	N•m (lbf•**in**)	9 (80)
	M8	N•m (lbf•ft)	24 (18)
Oil drain plug		N•m (lbf•ft)	55 (41)
Alternator screws		N•m (lbf•ft)	23 (17)
Oil filter cover screw		N•m (lbf•**in**)	9 (80)
Manifold screws		N•m (lbf•ft)	22 (16)

VEHICLES

TUNDRA/SKANDIC LT					277	443
DRIVE						
Chain drive ratio					14/25	17/44
Chain	Pitch			in	1/2	3/8
	Type/links qty/plate qty				Single/62	Silent 70/13
Drive pulley	Type				Bombardier Lite (1)	Comet
	Calibration	Clutch engagement		±100 RPM	3000	3200
		Spring color			Red/Yellow	Silver/Black
		Spring length		± 1.5 mm (± .060 in)	87.9 (3.461)	78.99 (3.110)
		Weight	Screw: 417 120 400 = 21 g Screw: 417 114 400 = 3.4 g		5 x 3.4 g	
		Block			417 114 300	218311C
		Cap			417 114 500	N.A.
		Pin			N.A.	417 003 900
		Ramp			N.A.	N.A.
		Screw position			N.A.	N.A.
Driven pulley	Type				Tundra Reverse	LPV27
	Spring preload			± 0.7 kg (± 1.5 lb)	0, pos. 3	0
	Cam angle			degree	37.8	40
Pulley distance	Z			mm (in)	37.0 +0, -0.75 (1.457 +0, -.030)	39 ± 0.75 (1.535 ± .030
Offset	X			mm (in)	36.0 ± 1.0 (1.417 ± .040)	37 ± 0.75 (1.457 ± .030)
	Y – X	MIN.-MAX.		mm (in)	1.51 (.060)	0.75 - 2.25 (.030 .090)
Drive belt part number (P/N)					414 827 600	414 633 800
Drive belt width		Wear limit		mm (in)	30.3 (1-3/16)	32.0 (1-1/4)
Drive belt adjustment		Deflection		± 5 mm (13/64 in)	32 (1-1/4)	32 (1-1/4)
		Force (2)		kg (lbf)	6.8 (15)	11.3 (25)
Track	Width			mm (in)	381 (15.0)	381 (15.0)
	Length			mm (in)	3540 (139)	3968 (156.2)
	Profile height			mm (in)	18.4 (.724)	25 (1)
	Adjustment	Deflection		mm (in)	35 - 40 (1-3/8 - 1-9/16)	40 - 50 (1-9/16 - 1-31/32)
		Force (3)		kg (lbf)	7.3 (16)	7.3 (16)
Suspension type		Track			Torque Reaction Slide	Skandic WT
		Ski			Telescopic Strut	Telescopic Strut

TUNDRA/SKANDIC LT			277	443
ELECTRICAL				
Battery		V (Ah)	N.A.	N.A.
Headlamp		W	H4 60/55	H4 60/55
Taillight and stoplight		W	8/27	8/27
Tachometer and speedometer bulbs		W	N.A.	3
Fuel and temperature gauge bulbs		W	N.A.	N.A.
Fuse	Starter solenoid	A	N.A.	N.A.
	Fuel level sensor	A	N.A.	N.A.
CAPACITIES				
Fuel tank		L (U.S. gal)	26 (6.9)	40 (10.6)
Chaincase/gearbox		mL (U.S. oz)	250 (8.5)	250 (8.5)
Cooling system (5)		L (U.S. oz)	N.A.	N.A.
Injection oil reservoir		L (U.S. oz)	1.9 (64)	2.5 (84.5)
VEHICLE INFORMATIONS				
Mass (dry)		kg (lb)	173 (380)	210 (462)
Length		mm (in)	2845 (112)	3020 (118.9)
Width		mm (in)	953 (37.5)	960 (37.8)
Height		mm (in)	1120 (44.1)	1295 (51)
Ski stance (carbide to carbide)		mm (in)	813 (32.0)	820 (32.3)
Toe-out		mm (in)	6 (1/4)	5 (3/16)
Camber		mm (in)	N.A.	N.A.
Ground contact area		cm^2 (in^2)	7570 (1173)	8811.3 (1365.8)
Ground contact pressure		kPa (PSI)	2.24 (.325)	2.46 (.357)
Frame material			Steel	Steel
Bottom pan material			Polyethylene High Density	Polyethylene High Density
Hood material			Polyethylene High Density	RRIM

SKANDIC					WT 552	SWT 552	WT LC 593
DRIVE							
Gear ratio				1st	1:2.82	1:3.80	1:2.82
				2nd	1:1.89	1:2.29	1:1.7
				R	1:3.44	1:4.63	1:3.44
Drive pulley	Type				Bombardier Lite (1)	Bombardier Lite (1)	TRA III
	Calibration	Clutch engagement		±100 RPM	2500	2500	2700
		Spring color			Yellow/Green	Yellow/Green	Yellow/Red
		Spring length	± 1.5 mm (± .060 in)		94.61 (3.725)	94.61 (3.725)	128 (5.039)
		Weight	Screw: 417 120 400 = 21 g Screw: 417 114 400 = 3.4 g		417 120 400 4 x 417 114 400	417 120 400 4 x 417 114 400	N.A.
		Block			N.A.	N.A.	N.A.
		Cap	417 114 500 = 1.65 g		417 114 500	417 114 500	N.A.
		Pin			N.A.	N.A.	417 222 594
		Ramp			N.A.	N.A.	600 (4)
		Screw position			N.A.	N.A.	3
Driven pulley	Type				Cvtech	Cvtech	Cvtech VSA
	Spring preload			± 0.7 kg (± 1.5 lb)	7.0 (15.4)	7.0 (15.4)	7.0 (15.4)
	Cam angle			degree	40/35	40/35	35/30
Pulley distance	Z			mm (in)	41.8 ± 0.75 (1.647 ± .030)	41.8 ± 0.75 (1.647 ± .030)	35.5 ± 0.75 (1.398 ± .030)
Offset	X			mm (in)	35 ± 0.75 (1.380 ± .030)	35 ± 0.75 (1.380 ± .030)	37 ± 0.75 (1.457 ± .030)
	Y – X	MIN.-MAX.		mm (in)	0.75 - 2.25 (.030 - .089)	0.75 - 2.25 (.030 - .089	0.75 - 2.25 (.030 - .089
Drive belt part number (P/N)					414 633 800	414 633 800	417 300 155
Drive belt width		Wear limit		mm (in)	32.0 (1-1/4)	32.0 (1-1/4)	34.3 (1-11/32)
Drive belt adjustment		Deflection		mm (in)	32 (1-1/4)	32 (1-1/4)	32 (1-1/4)
		Force (2)		kg (lbf)	11.3 (25)	11.3 (25)	11.3 (25)
Track	Width			mm (in)	500 (19.7)	600 (23.6)	500 (19.7)
	Length			mm (in)	3968 (156.2)	3968 (156.2)	3968 (156.2)
	Profile height			mm (in)	31.8 (1.250)	23.5 (.925)	31.8 (1.250)
	Adjustment	Deflection		mm (in)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)
		Force (3)		kg (lbf)	7.3 (16)	7.3 (16)	7.3 (16)
Suspension type		Track			Skandic WT	Skandic WT	Skandic WT
		Ski			Telescopic Strut	Telescopic Strut	Telescopic Strut

SKANDIC			WT 552	SWT 552	WT LC 593
ELECTRICAL					
Battery		V (Ah)	12 (18)	12 (18)	12 (18)
Headlamp		W	H4 60/55	H4 60/55	H4 60/55
Taillight and stoplight		W	8/27	8/27	8/27
Tachometer and speedometer bulbs		W	3	3	3
Fuel and temperature gauge bulbs		W	N.A.	N.A.	N.A.
Fuse	Starter solenoid	A	20	20	15
	Fuel level sensor	A	N.A.	N.A.	N.A.
CAPACITIES					
Fuel tank		L (U.S. gal)	40 (10.6)	40 (10.6)	40 (10.6)
Chaincase/gearbox		mL (U.S. oz)	400 (13.5)	400 (13.5)	400 (13.5)
Cooling system		L (U.S. oz)	N.A.	N.A.	4.5 (152)
Injection oil reservoir		L (U.S. oz)	2.5 (84.5)	2.5 (84.5)	2.5 (84.5)
VEHICLE INFORMATIONS					
Mass (dry)		kg (lb)	258 (568)	277 (610)	275 (605)
Length		mm (in)	3020 (118.9)	3150 (124.0)	3150 (124.0)
Width		mm (in)	1045 (41.1)	1100 (43.3)	1100 (43.3)
Height		mm (in)	1295 (50.98)	1330 (52.4)	1220 (48)
Ski stance (carbide to carbide)		mm (in)	900 (35.4)	900 (35.4)	900 (35.4)
Toe-out		mm (in)	5 (3/16)	5 (3/16)	5 (3/16)
Camber		mm (in)	N.A.	N.A.	N.A.
Ground contact area		cm^2 (in^2)	10793 (1672.9)	13986 (2167.8)	12335 (1912)
Ground contact pressure		kPa (PSI)	2.46 (.357)	2.04 (.296)	2.33 (.338)
Frame material			Steel	Steel	Steel
Bottom pan material			Polyethylene High Density	Polyethylene High Density	Polyethylene High Density
Hood material			RRIM	RRIM	RRIM

SKANDIC SUV					552	593
DRIVE						
Gear ratio				1st	1:2.82	1:2.82
				2nd	1:1.89	1:1.7
				R	1:3.44	1:3.44
Drive pulley	Type				Bombardier Lite (1)	TRA III
	Calibration	Clutch engagement		±100 RPM	2500	2700
		Spring color			Yellow/Green	Yellow/Red
		Spring length		± 1.5 mm (± .060 in)	94.61 (3.725)	128 (5.039)
		Weight		Screw: 417 120 400 = 21 g Screw: 417 114 400 = 3.4 g	417 120 400 4 x 417 114 400	N.A.
		Block			N.A.	N.A.
		Cap	417 114 500 = 1.65 g		417 114 500	N.A.
		Pin			417 222 594	417 222 594
		Ramp			N.A.	600 (4)
		Screw position			N.A.	3
Driven pulley	Type				Cvtech	Cvtech
	Spring preload			± 0.7 kg (± 1.5 lb)	7.0 (15.4)	7.0 (15.4)
	Cam angle			degree	40/35	35/30
Pulley distance	Z			mm (in)	41.8 ± 0.75 (1.647 ± .030)	35.5 ± 0.75 (1.398 ± .030)
Offset	X			mm (in)	35 ± 0.75 (1.380 ± .030)	37 ± 0.75 (1.457 ± .030)
	Y – X		MIN.-MAX.	mm (in)	0.75 - 2.25 (.030 - .089)	0.75 - 2.25 (.030 - .089)
Drive belt part number (P/N)					414 633 800	417 300 155
Drive belt width			Wear limit	mm (in)	32.0 (1-1/4)	32.0 (1-1/4)
Drive belt adjustment			Deflection	mm (in)	32 (1-1/4)	32 (1-1/4)
			Force (2)	kg (lbf)	11.3 (25)	11.3 (25)
Track	Width			mm (in)	500 (19.7)	500 (19.7)
	Length			mm (in)	3968 (156.2)	3968 (156.2)
	Profile height			mm (in)	31.8 (1.25)	31.8 (1.25)
	Adjustment		Deflection	mm (in)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)
			Force (3)	kg (lbf)	7.3 (16)	7.3 (16)
Suspension type			Track		Skandic SUV	Skandic SUV
			Ski		SUV	SUV

SKANDIC SUV			552	593
ELECTRICAL				
Battery		V (Ah)	12 (18)	12 (20)
Headlamp		W	H4 60/55	H4 60/55
Taillight and stoplight		W	8/27	8/27
Tachometer and speedometer bulbs		W	3	3
Fuel and temperature gauge bulbs		W	N.A.	N.A.
Fuse	Starter solenoid	A	20	15
	Fuel level sensor	A	N.A.	N.A.
CAPACITIES				
Fuel tank		L (U.S. gal)	40 (10.6)	40 (10.6)
Chaincase/gearbox		mL (U.S. oz)	400 (13.5)	400 (13.5)
Cooling system		L (U.S. oz)	N.A.	4.5 (152)
Injection oil reservoir		L (U.S. oz)	2.5 (84.5)	2.5 (84.5)
VEHICLE INFORMATIONS				
Mass (dry)		kg (lb)	274 (603)	291 (640)
Length		mm (in)	3150 (124)	3150 (124)
Width		mm (in)	110 (43.3)	110 (43.3)
Height		mm (in)	1220 (48)	1220 (48)
Ski stance (carbide to carbide)		mm (in)	900 (35.4)	900 (35.4)
Toe-out		mm (in)	5 (3/16)	5 (3/16)
Camber		mm (in)	N.A.	N.A.
Ground contact area		cm^2 (in^2)	12335 (1912)	12335 (1912)
Ground contact pressure		kPa (PSI)	2.25 (.320)	2.36 (.342)
Frame material			Steel	Steel
Bottom pan material			Polyethylene High Density	Polyethylene High Density
Hood material			RRIM	RRIM

SKANDIC EXPEDITION TUV					600 HO SDI	V-1000 4–TEC
DRIVE						
Gear ratio			1st		1: 2.82	1: 2.82
			2nd		1: 1.70	1: 1.89
			R		1: 3.44	1: 3.44
Drive pulley	Type				TRA III	TRA IV
	Calibration	Clutch engagement		±100 RPM	2700	2500
		Spring color			violet/blue	Red/Yellow
		Spring length	± 1.5 mm (± .060 in)		120 (4.724)	87.9 (3.46)
		Weight			N.A.	N.A.
		Block			N.A.	N.A.
		Cap			N.A.	N.A.
		Pin			Solid	417 222 594 (long)
		Ramp			410	607
		Screw position			3	3(5)
Driven pulley	Type				Cvtech VSA	Cvtech VSA
	Spring preload		± 0.7 kg (± 1.5 lb)		7.7	7.5 - 9.0
	Cam angle		degree		35-30	40-30
Pulley distance	Z			mm (in)	61 ± 0.75 (2.402 ± 0.030)	61 ± 0.75 (2.402 ± 0.030)
Offset	X			mm (in)	37 (1.457)	37 (1.457)
	Y – X	MIN.-MAX.		mm (in)	0.75 - 2.25 (.03 - .09)	0.75 - 2.25 (.03 - .09)
Drive belt part number (P/N)					605 348 425	605 348 425
Drive belt width		Wear limit		mm (in)	35.5 (1.398)	35.5 (1.398)
Drive belt adjustment		Deflection		mm (in)	32 (1-1/4)	32 (1-1/4)
		Force (2)		kg (lbf)	11.3 (25)	11.3 (25)
Track	Width			mm (in)	508 (20)	508 (20)
	Length			mm (in)	3960 (156)	3960 (156)
	Profile height			mm (in)	31.8 (1.25)	31.8 (1.25)
	Adjustment	Deflection		mm (in)	40 - 50 (1-9/16 - 1-31/32)	40 - 50 (1-9/16 - 1-31/32)
		Force (3)		kg (lbf)	7.3 (16)	7.3 (16)
Suspension type		Track			SUV	SUV
		Ski			SUV	SUV

SKANDIC EXPEDITION TUV				600 HO SDI	V-1000 4–TEC
ELECTRICAL					
Battery			V (Ah)	12 (18)	12 (18)
Headlamp			W	60/55	60/55
Taillight and stoplight			W	8/27	8/27
Tachometer and speedometer bulbs			W	N.A.	N.A.
Fuel and temperature gauge bulbs			W	N.A.	N.A.
Fuse	Starter solenoid		A	5	5
	Fuel level sensor		A	N.A.	N.A.
CAPACITIES					
Fuel tank			L (U.S. gal)	42 (11)	42 (11)
Chaincase/gearbox			mL (U.S. oz)	400 (13.5)	400 (13.5)
Cooling system			L (U.S. oz)	4.5 (15.2)	4.5 (15.2)
Engine oil		Engine	L (U.S. oz)	N.A.	3.4 (115)
		Reservoir	L (U.S. oz)	2.5 (84.5)	N.A.
VEHICLE INFORMATIONS					
Mass (dry)			kg (lb)	325 (717)	345 (761)
Length			mm (in)	3150 (124)	3060 (120.5)
Width			mm (in)	1185 (46.7)	1185 (46.7)
Height			mm (in)	1320 (52)	1320 (52)
Ski stance (carbide to carbide)			mm (in)	985 (38.8)	985 (38.8)
Toe-out			mm (in)	5 (3/16)	5 (3/16)
Camber			mm (in)	N.A.	N.A.
Frame material				Steel	Steel
Bottom pan material				High density polyethylene	High density polyethylene
Hood material				RRIM	RRIM

TECHNICAL DATA LEGENDS

ENGINE TECHNICAL DATA LEGEND

A: Ampere

ABDC: After Bottom Dead Center

ATDC: After Top Dead Center

BBDC: Before Bottom Dead Center

BTDC: Before Top Dead Center

CDI: Capacitor Discharge Ignition

IACV: Idle Air Control Valve

k: Kilo (X 1000)

MAG: Magneto Side

N.A.: Not Applicable

PSI: Pound per square inch

PTO: Power Take Off Side

R: Rectangular

SDI: Semi-direct injection

ST: Semi-Trapezoidal

V: Volt

W: Watt

(1) The maximum horsepower RPM applicable on the vehicle. It may be different under certain cricumstances and BOMBARDIER reserves the right to modify it without obligation.

(2) Crankshaft end-play is not adjustable on these models. Specification is given for verification purposes only.

(3) At 3500 RPM with headlamp turned on.

(4) All resistance measurements must be performed with parts at room temperature (approx. 20°C (68°F)). Temperature greatly affects resistance measurements.

(5) Drive pulley retaining screw: torque to 80 to 100 N•m (59 to 74 lbf•ft), install drive belt, accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake; repeat 5 times. Retorque screw to 90 to 100 N•m (66 to 74 lbf•ft).

(6) Drive pulley retaining screw: torque to 125 to 135 N•m (92 to 100 lbf•ft), install drive belt, accelerate the vehicle at low speed (maximum 30 km/h (20 MPH)) and apply the brake; repeat 5 times. Retorque screw to 125 to 135 N•m (92 to 100 lbf•ft).

(7) **CAUTION: Do not attempt to adjust gap on spark plug BR9ECS. The specification is given for verification purpose only. If found out of specification, replace with a new one.**

(8) Use Bombardier premixed coolant (P/N 293 600 038) or a solution of ethylene glycol antifreeze for aluminum engines with demineralized water (50% antifreeze, 50% demineralized water).

(9) At 4000 RPM with APS disconnected.

VEHICLE TECHNICAL DATA LEGEND

RRIM: Reinforced Reaction Injection Molding

TRA: Total Range Adjustable drive pulley

N.A.: Not Applicable

(1) For Bombardier Lite drive pulleys:

1157 = Red block, push type 38 g (P/N 417 115 700).

1181 = Black block, screw type 39.6 g (P/N 417 118 100).

1143 = Red block, screw type 41.8 g (P/N 417 114 300)

W = Washer 1.8 g (P/N 417 115 800)

(2) Force applied midway between pulleys to obtain specified deflection.

(3) Force or downward pull applied to track to obtain specified tension deflection.

(4) Lever with roller pin (P/N 417 222 594) (long and solid).

(5) From factory TRA IV drive pulley adjustment screws are set to **position 3**. This position allows the best compromise between acceleration, top speed and fuel economy.
Position 1 or 2 would provide the best fuel economy. Top speed would be reduce.
Position 4 would give the best acceleration. Fuel economy would be reduced.

WIRING DIAGRAMS

Wiring diagrams can be found at the end of this subsection.

WIRE COLORS AND CIRCUIT

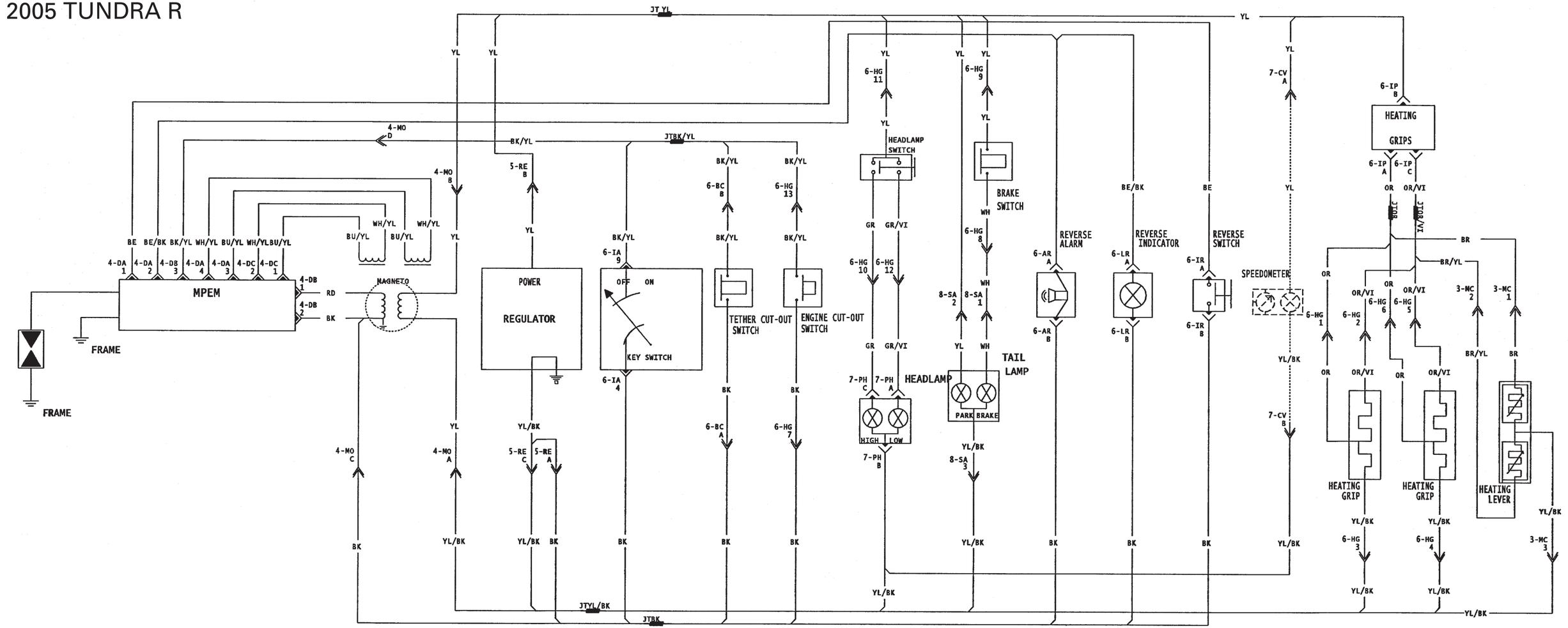
All Models except Expedition TUV 600 HO SDI and V-1000

The first color of a wire is the main color, second color is the stripe.

Example: YL/BK is a YELLOW wire with a BLACK stripe.

COLOR CODE	
BE = BEIGE	OR = ORANGE
BK = BLACK	RD = RED
BL or BU = BLUE	VI or VL = VIOLET
BR = BROWN	WH = WHITE
GN = GREEN	YL= YELLOW
GY or GN = GREY	

2005 TUNDRA R



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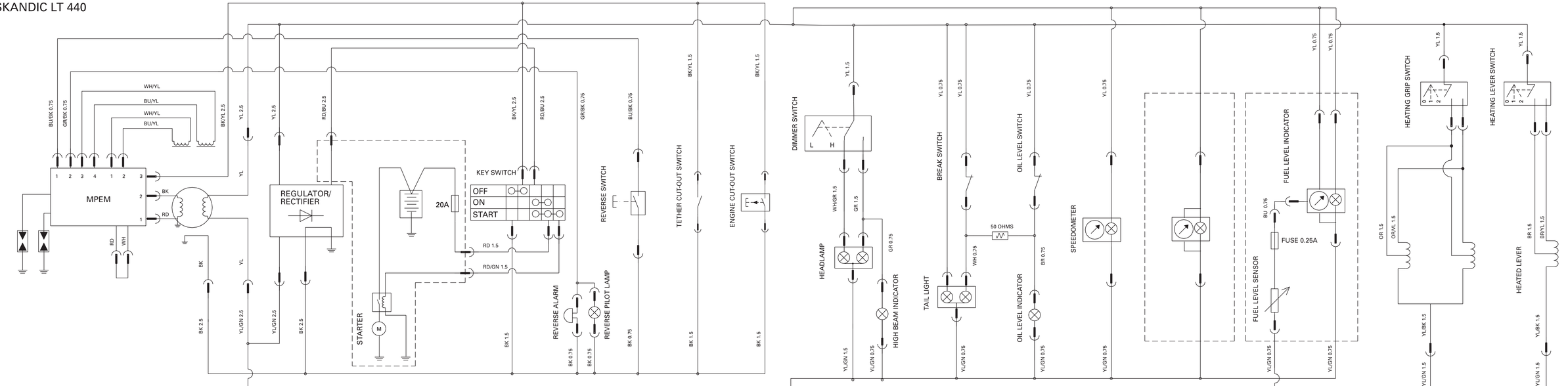
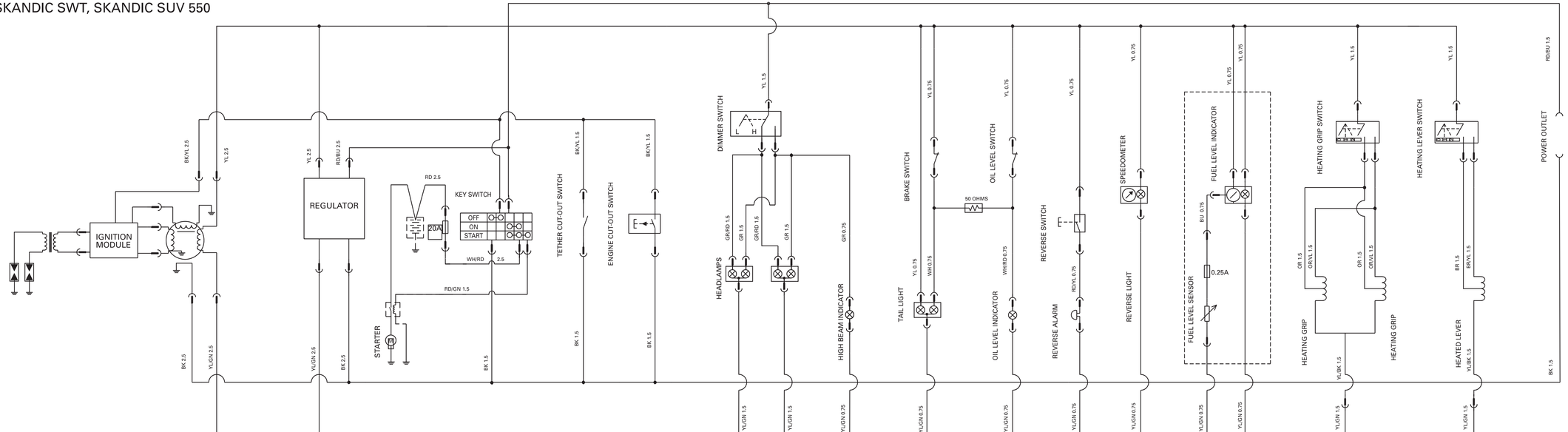
2005 SKANDIC LT 440



IGNITION SYSTEM | POWER SUPPLY | STARTER AND IGNITION SWITCHES | LIGHTING | INSTRUMENTS | HEATING ELEMENTS

A29Z0C8

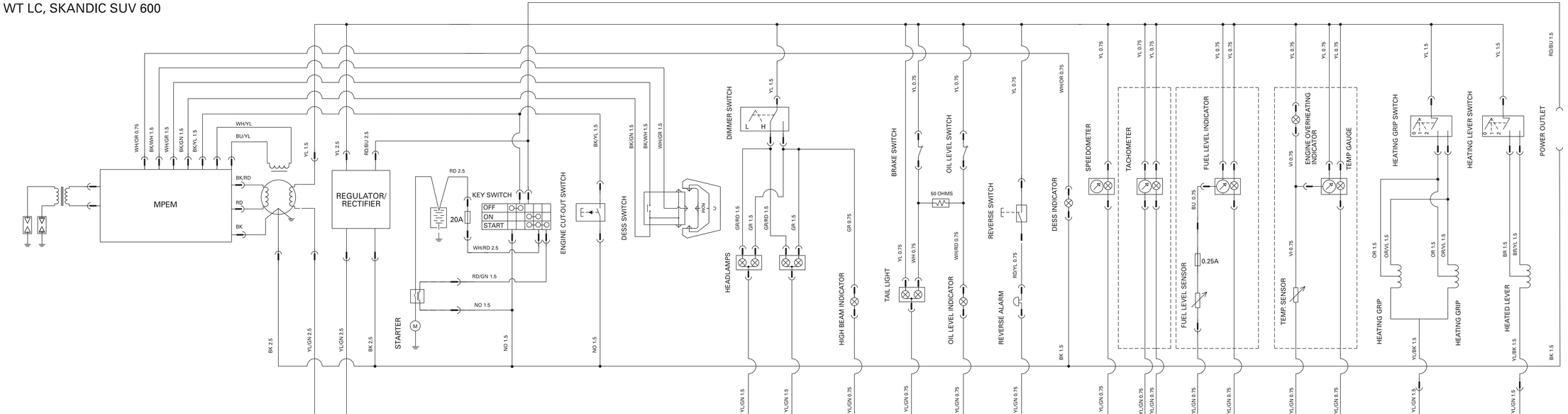
2005 SKANDIC WT, SKANDIC SWT, SKANDIC SUV 550



IGNITION SYSTEM | POWER SUPPLY | STARTER AND IGNITION SWITCHES | LIGHTING | INSTRUMENTS | HEATING ELEMENTS

A29Z0E8

2005 SKANDIC WT LC, SKANDIC SUV 600

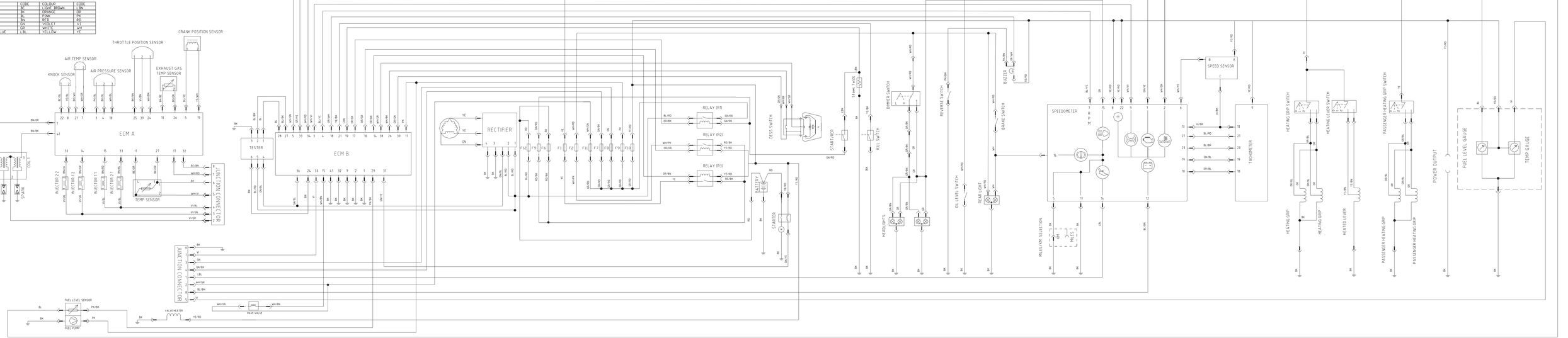


IGNITION SYSTEM | POWER SUPPLY | STARTER AND IGNITION SWITCHES | LIGHTING | INSTRUMENTS | HEATING ELEMENTS

A29Z0D8

2005 EXPEDITION 600 TUV SDI

COLOUR	CODE	COLOUR	CODE
BEIGE	BE	LIGHT BROWN	LBN
BLACK	BK	ORANGE	OR
BLUE	BL	PINK	PK
BROWN	BN	RED	RD
GREEN	GN	VIOLET	VI
GREY	GR	WHITE	WH
LIGHT BLUE	LBL	YELLOW	YE

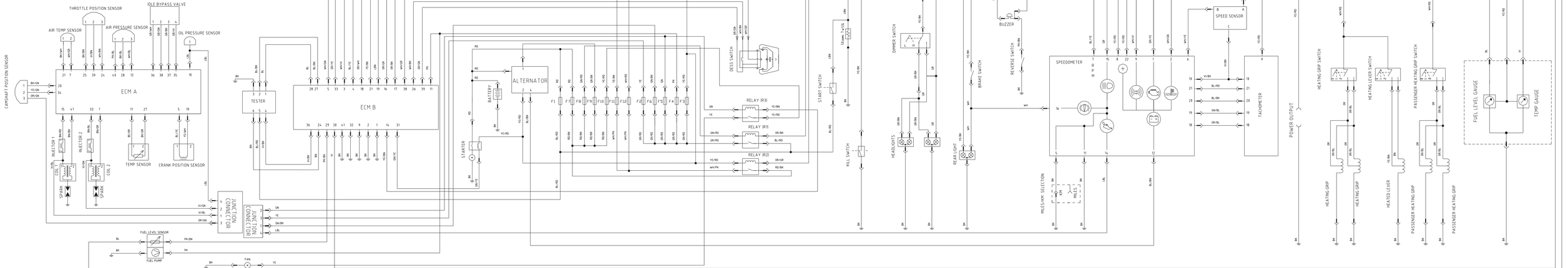


- MOTOR - | - IGNITION SYSTEM - | - POWER SUPPLY - | - STARTER AND IGNITION SWITCHES - | - LIGHTING - | - INSTRUMENTS - | - HEATING ELEMENTS - | - OPTIONAL -

A2920IG

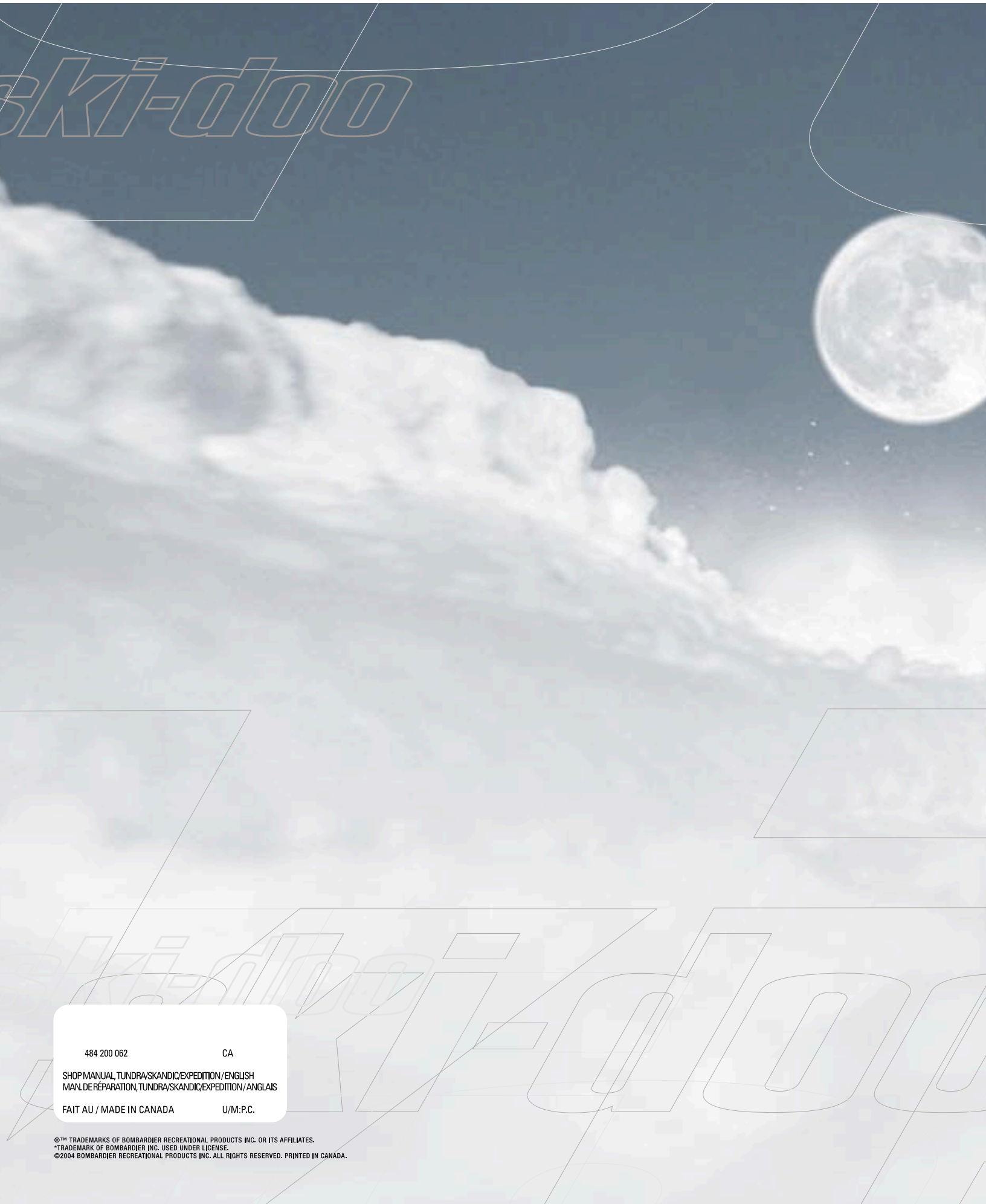
2005 EXPEDITION V-1000 TUV

COLOUR	CODE	COLOUR	CODE
BEIGE	BE	LIGHT BROWN	LBN
BLACK	BK	ORANGE	OR
BLUE	BL	PINK	PK
BROWN	BN	RED	RD
GREEN	GN	VIOLET	VI
GRAY	GR	WHITE	WH
LIGHT BLUE	LBL	YELLOW	YE



- MOTOR - | - IGNITION SYSTEM - | - POWER SUPPLY - | - STARTER AND IGNITION SWITCHES - | - LIGHTING - | - INSTRUMENTS - | - HEATING ELEMENTS - | - OPTIONAL -

A2620F



484 200 062 CA

SHOP MANUAL, TUNDRA/SKANDIC/EXPEDITION / ENGLISH
MAN. DE RÉPARATION, TUNDRA/SKANDIC/EXPEDITION / ANGLAIS

FAIT AU / MADE IN CANADA U/M:P.C.

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