Users manual: Mitsubishi Delica SpaceGear

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The following data have been collected from various sources, including verbal discussions and opinions of others. The author makes no claim for the accuracy of the data nor accepts any liability in connection with their use. Most of the data are for the 1997 2.8 turbo diesel model.

Credit: http://www.mitsubishi-motors.co.jp/NEWS/recall/h150701/10960.html

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[1] Contact me at rhino@pons.ws to provide feedback, corrections, and any additional information.

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0 Vehicle details

Useful details when you buy spare parts

Year	
Configuration	
Registration number	
Engine type	
Engine number	
Model	
Chassis number	
Transaxle number	
Color int opt	

1 Getting started

This is a quick driving tutorial.

1.1 Driving the Delica

(1) Gearbox must be in park mode (P).
(2) Turn ignition key until instrument lights are illuminated (see Figure 1).
(3) Wait until glow plug light (see Figure 1) is extinguished. This usually happens very fast, or even instantly if the engine is already warm.
(4a) Turn the key further to swing the engine - release when successful.
(4b) If engine struggles to start[2], then turn off ignition, switch on again immediately, wait for glow plug light to go off, wait a further 5 seconds or so until a click is heard from the engine, and then turn the engine [1].
(5) Footbrake must be applied before 'drive' can be engaged.
(6) Ensure drive is in appropriate range. Usually two wheel drive (2H) is fine for town driving. Use ‘Super Select’ gear shift (on floor, see description below) to change as necessary.
(7) Use column mounted gear shift to select reverse (R) or drive (D) as appropriate.
(8) After driving, key can only be removed from ignition if automatic transmission is in park (P).

1.2 Driving a diesel engine

Driving a diesel engine is much the same as a petrol engine. Except that the acceleration is generally slower[3], and the torque at low engine revolutions (revs) is lower. Therefore it is generally better to keep the revs slightly higher than in a petrol engine vehicle, especially if climbing hills. Diesel engines have better thermodynamic efficiency under part load than petrol engines[4].

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[2]For engines that are hard to start or emit copious smoke, there can be several causes and solutions. These include replace batteries (both), clean or replace straps to glow plugs, replace glow plugs, replace or service fuel pump. Search http://www.delicaclub.com and http://www.pocuk.com/ for more clues.

[3]Diesels tend not to accelerate much more when the pedal is floored. A tip that might be useful: "A diesel however won't go much faster and any foot planting results in unburnt fuel going out the tail pipe. When you get to that point where it won't go any faster try taking your foot off slightly and you will find you won't go any slower and save a heap of fuel" [11].

[4]The superior efficiency of a diesel compared to petrol engine is due to the different thermodynamic cycle. Petrol engines throttle the air intake to reduce power, and this is inefficient compared to the diesel method of injecting less fuel.

2 Instruments and gears

This section describes the main driver controls.

2.1 Instrument panel Delica 1997

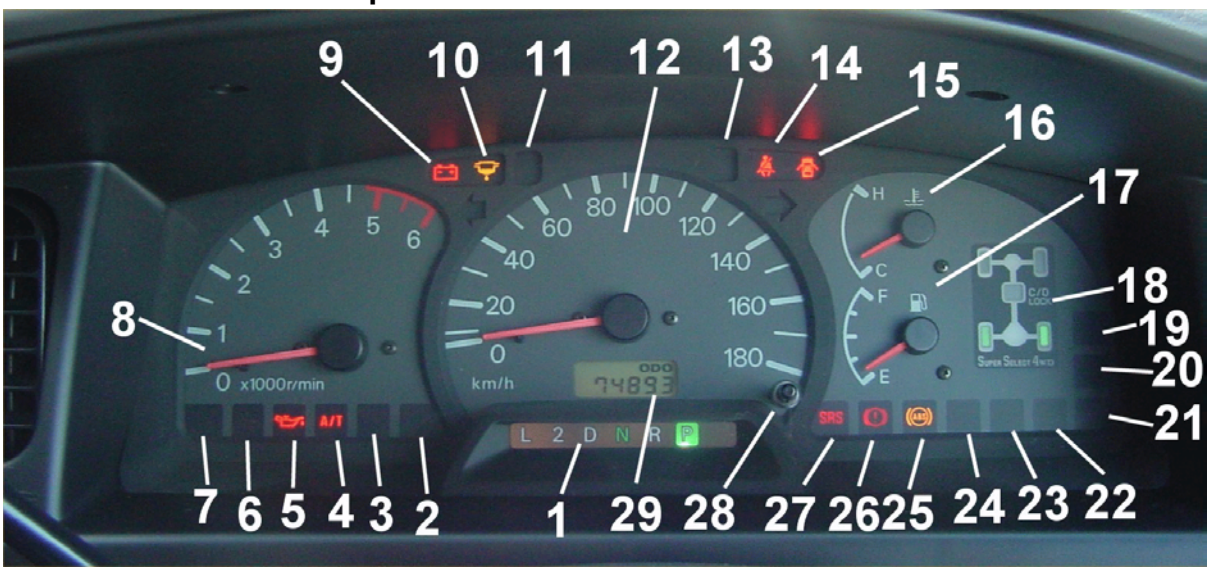

Figure 1 Instrument panel

See Figure 1 for the layout.

1 Gearbox: Shows gear position for **automatic gearbox**. Also an ‘O/D off’ indicator if **overdrive** has been deselected by the driver.

2 ‘HOLD’ - usually off. If on, it shows driver has used the **A/T switch** to force the gearbox to try to start in second rather than first gear (useful on ice or mud to reduce slip).

3 ‘PWR’ - usually off. If on, it shows driver has used the **A/T switch** to force the gearbox to a 'power' mode: faster acceleration by going to higher revs before changing up a gear.

4 ‘**A/T**’ warning - usually off. Indicates over-temperature in gearbox if it comes on while driving. Stop and idle for 5 minutes in park. Check ATF fluid level with engine on and in neutral. Consider switching overdrive OFF.

5 **Oil pressure** warning - usually off. Indicates loss of engine oil pressure if it comes on while driving - may cause major engine damage if driven in this condition. Check oil level in engine.

6 <unknown>

7 **Glow plug** status (coil symbol)- usually on momentarily when ignition is energised. Wait for this light to extinguish before turning the engine.

8 **Engine revolutions per minute** (revs). The information is of no real value if you have an automatic gearbox and mainly use drive (D). But if you are heavily laden, then it's useful to check that the revs are not too low - low revs under high load will generate more heat in the gearbox.

9 **Battery** charge warning - usually off when driving. If on (which it should be at start-up), it shows that the battery is not being charged. If it comes on while driving it means there is an electrical fault, in battery, alternator, or alternator drive belt (the belt could be broken or simply slipping). You might be able to continue driving for some time especially if you can limit the amount of electrical load.

10 **Fuel filter** warning - usually off. If on, there is water that needs to be drained from the base of the fuel filter.

11 High beam (brights)

12 Speed

13 <unknown>

14 **Seat belt** status - strap yourself in.

15 **Door** warning - lights up if a door is open when the ignition is on.

16 **Temperature** gauge - should be well below the 'hot' mark.

17 **Fuel gauge**.

18 **4WD transmission** status - shows what the driver has selected with the 4WD selector. See Figure 2 for detail.

19-20 <unknown>

21 Low fuel indicator (lights when the tank is down to about 9 litres [ref 13]).

22-24 <unknown>

25 Anti-skid braking (**ABS**) - usually off. Performs self-test of ABS system when ignition is turned on, and then light goes off.

26 **Brake** status - lights up if handbrake is on. Might also light up when brake fluid is low or pads are worn?

27 Supplementary restraint system (**SRS**) - usually off. This is the **air bag**

system. The light should come on for a few minutes when the ignition is turned on - this shows that the self-test is being done. When the test is completed successfully then the light is extinguished. If the light stays on then it is a warning that the air-bag will not work.

28 Button for **odometer** - one push toggles the display (29) between odometer and **trip** distance. A sustained push will reset the trip distance to zero.

29 Odometer display. Only on when ignition is on.

2.2 Selecting the right gear

2.2.1 Gear shift

The automatic gearshift is mounted on the steering column. The side of the steering column shows the stepped gear pattern. Note that it is basically a valley with N at the lowest point (furthest away from the driver).

Lift the gear directly towards your chest to move it out of park (P). Thereafter it is away from your chest until it gets to neutral (N). From N to low gear (L) the gear lever needs to again be lifted towards your chest.

2.2.2 Overdrive selection

Overdrive (O/D) is activated/ deactivated by a button at the end of the automatic gearshift. When deactivated then the 'O/D Off' light illuminates (see Figure 1: 1).

Overdrive ON can safely be used for town driving and a lightly loaded vehicle. Overdrive ON permits the automatic transmission control logic to make use of (1) an overdrive clutch and (2) a lock on the torque converter [3]. Consequentially with overdrive on the driver will feel several small gear changes between the three main gears. With overdrive ON the vehicle effectively has another top gear.

Switch overdrive OFF if you need slower speeds with greater torque, e.g. heavily loaded or difficult terrain. With overdrive OFF the gearbox controller is limited to using only the three main gears. If the vehicles is repeatedly making multiple small gear changes when under load, then move overdrive to OFF until conditions change. This will make the vehicle easier to drive. This also has the important benefit of reducing heat generation in the gearbox. Over temperature of gearbox will activate the A/T warning light. (Stop and idle for 5 minutes in park.)

2.2.3 4WD transmission selection

The driver has to manually engage and disengage four wheel drive (4WD) using the "Super Select" selection lever. This is typical of a full 4WD vehicle, and gives the Delica full 4WD capability (the same capability as the Mitsubishi Pajero for

example). By comparison some other vehicles (e.g. Mitsubishi RVR SportsGear) have permanently engaged 4WD over which the driver has no control.

For driving in town and on sealed roads (bitumen or concrete), two wheel drive is adequate.

The 4WD selection lever is floor mounted, see Figure 2.

Figure 2: 4WD transmission selection.

2H Two wheel drive in high range: Rear wheel drive - suitable for driving in conditions where a normal car could go. Ideal for town driving.

4H Four wheel drive in high range: Front and rear wheels drive (4WD) - suitable for slippery or rough or steep conditions - wherever you need better traction or steering. "H" is for high range. You can safely use 4H for normal driving conditions including bitumen and concrete roads. But front tyre wear may be heavier than in 2H.

Driver may shift from 2H to 4H and back while driving, but take your foot off the accelerator pedal when you do, and preferably try to be steering straight ahead (to minimise gear engagement forces).

Transmission may not immediately shift when commanded, but will wait until the torque permits the change - dashboard lights Fig 1: 18 will flash during this period.

4HLc Four wheel drive in high range with locked central differential: For extra traction in low-grip terrain. This is the same as 4H, with the addition that the transfer case (central differential) is locked. With standard 4H there is still the possibility of slipping since all the power could go to one of the axles only. With 4HLc this possibility is prevented: both the front and the rear axle will get torque. Can this gear be engaged and disengaged while driving? Yes, it should be possible [3] (some disagree [6]), but only engage on slippery surface, don't accelerate, and try to be steering straight.

Warning: Use locked centre differential only when surfaces are slippery or have a lot of give for the tyres. Do not use on hard surfaces for extended time as the transmission or tyres may be damaged.

4LLc Four wheel drive in low range with locked central differential: Same as 4HLc,

but with a lower gear range. Vehicle will be slower, but will have increased torque on wheels. **Stop completely before engaging or disengaging this gear**. Same warning applies as for 4HLc, i.e don't use on high-grip surfaces.

The low range 'L' always has locked central differential 'Lc'. You can't have low range on its own with the Mitsubishi design.

2.3 Additional controls

2.3.1 Door controls

Controls located on the driver's door are shown in Figure 3.

Figure 3: Door controls

1 Switch to select left or right external mirror.
2 Switch to fold both mirrors in/out. *Note, if a mirror gets shoved in, do not force it out again manually. Instead, use the motor drive to bring it fully in, and then motor drive it out again.*
3 Joystick pad to adjust mirror as selected by (1).
4 Door lock - locks/unlocks all doors.
5 Window lock - locks/unlocks all electrically driven windows.
6 Driver side window control.
7 Passenger side window control.

2.3.2 Sub-steering wheel controls

The controls under the steering wheel are shown in Figure 4.

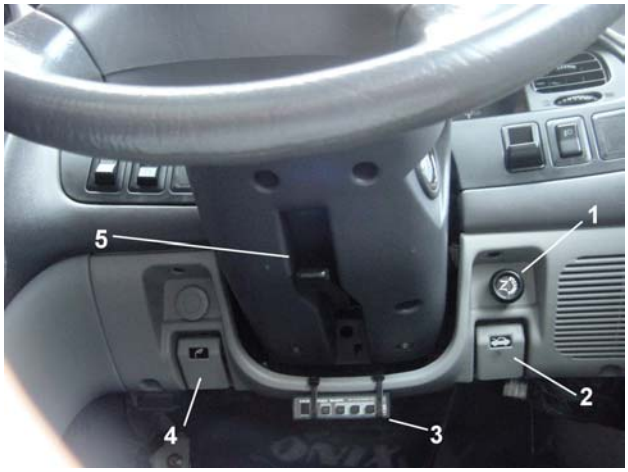

Figure 4: Controls under steering wheel.

1 Idle adjustment.
2 Bonnet catch - pull to release bonnet (engine hood).
3 Turbo timer - after market device, used to keep engine running for a few minutes after power down. This is supposed to cool the turbocharger. Hard to see why this would be necessary in town driving but maybe it has value for hard driving. Mitsubishi designers have not included it as a standard feature.
4 Fuel tank catch - pull to release. The filler cap is between the front passenger and sliding door.
5 Steering wheel angle adjustment - permits wheel to be adjusted for different

driver height.

2.3.3 Windscreen wiper controls

The controls are shown in Figure 5.

Figure 5: Windscreen wiper controls

1 Rear wiper - twist anticlockwise to activate. Water squirt at the end of the range in both directions. Water fill bottle is at left rear of vehicle, see Figure 6.

2 Front wipers - rotate downwards to activate intermittent, then normal wiper speed, then fast wipers.

Pull whole lever towards driver to spray water on front windscreen. Front water fill bottle is under the front bonnet. The rear water bottle is at the back left - open the rear hatch and find it as shown in Figure 6.

Figure 6: Fill location for rear windscreen water spray.

3 Solving simple problems

3.1 Changing a wheel

The spare wheel is underneath at the rear. The tools are inside at the rear right, see Figure 7.

Figure 7: Jack and tools for changing tyre. Extra socket for 12 V power also visible (round black cap) - takes cigarette lighter type fitting.

Remove the tools and use them to unscrew the bolt next to the rear door latch, see Figure 8. The bolt will need to be turned anti-clockwise for many turns, and it may be stiff.

Figure 8: Lowering the spare wheel. Use the socket spanner to turn the bolt head anti-clockwise.

Once the bolt has been unscrewed sufficiently, it lowers the cage holding the spare wheel. The spare wheel can now be removed, see Figure 9.

Figure 9: Releasing the spare wheel. Slide it out backwards.

Remove the plastic wheel cap (if fitted) with the tool provided, or a flat screwdriver, see Figure 10.

Before you jack up the flat wheel, loosen all the screws by a small amount, see Figure 11. The screws may be very tight. Loosening them on the ground is necessary because the wheel will turn if you try to do this when it is raised.

Figure 10: Remove plastic wheel cap, by prising with flat bar or screwdriver.

You don't want the van moving and falling off the jack, so make sure the hand brake is on. If the ground slopes, then put rocks or bricks in front of and behind some of the good wheels. Now use the jack to raise the vehicle. Raise it until the tyre easily clears the ground. Then remove all the wheel screws completely, and take off the flat wheel.

If possible, put some oil or grease on the screw threads and where the head faces the rim. This ensures that your tightening efforts will go into clamping the wheel onto the van, not just overcoming friction. Screws that squeal, or need the spanner the whole way, have too much friction and might be ineffective. Obviously it is sometimes impractical to lubricate the screws if you are changing the wheel at the roadside.

Figure 11: Undoing screws on wheel. Turn anti-clockwise to loosen, i.e. push down from this position.

Offer up the spare wheel to the hub. The wheel is heavy so be careful with your back. The best position is to sit on the ground facing the wheel, with your feet on each side of the tyre. Then you can use your feet to raise the tyre to its position, and

you still have your hands free to insert the screws. If the wheel will not go on properly, check that the vehicle has been raised enough. Tighten the screws as far as you can. Turn them clockwise. You don't want the wheel to be on skew, so tighten each screw a little in turn: don't concentrate all your effort on one screw.

Then lower the jack and remove it. Tighten all the wheel screws as tight as you can. You can exert more force pulling the spanner up than pushing it down, so arrange your position accordingly.

3.2 Roof racks

The vehicle will accept roof racks, but special types are required because of the high roof, and the non-structural trim attached to the gutter.

The following products are candidates (prices at 2004):

(1) Thule roof rack kit 426. This has a special foot with (a) a long tongue and (b) a special shape to the claw. It attaches to the gutter. Part (426) is unique to the Delica, and only for high-top models from 1996 onwards. (A similar part, 425, is for a low top Delica). Available in NZ from Hampco for NZ$430 for a set (4 feet plus two bars). In Australia the price is AU$250.

(2) Prorack pad mount rack SB1000. This is permanently rivetted to the roof[5]. Available in NZ ex Repco for $230. Fitting by a panel beater is additional.

(3) Prorack track system. This has a pair of long tracks (ST14) which are permanently attached to the roof, and then racks (SB3000) which slide into to the track. Available in NZ ex Repco for $160 and $389 respectively. Fitting is extra.

(4) Second hand car dealers may sometimes have racks that they have removed at the time of import. Pajero racks can be modified to fit.

The Delica is already a high vehicle, and adding roof racks may mean that it no longer fits into the garage! You could extend the radio aerial (at front right, high up) as a reminder not to drive into low spaces.

[5]One wonders how much load this type of design can take, since the stresses go into the flat roof rather than the gutter.

3.3 Tow-bar

Tow bars are readily available for the Delica. However, the factory rear chrome bars usually have to be taken off. The standard electrical wiring in Australia and New Zealand is a 7-pin flat plug. The wiring of the pins is shown in Figure 12.

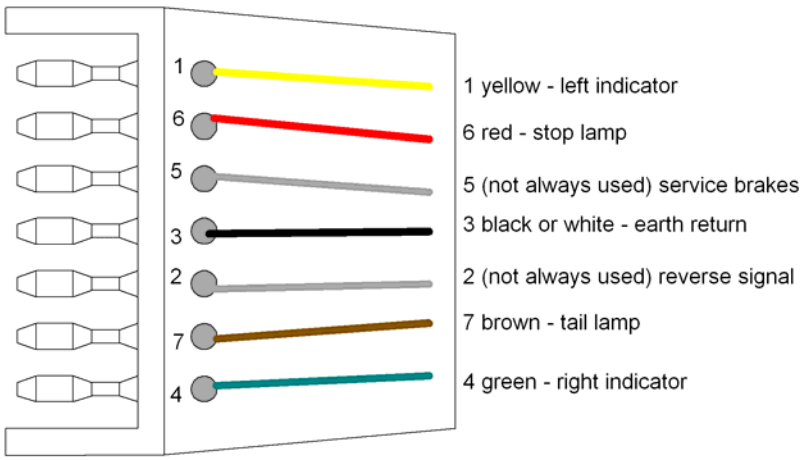

Figure 12: Wiring for trailer 7-pin flat plug.

3.4 Jump starting

The following excellent description was provided by Exide [27] on starting the engine when the battery is flat. The text applies to vehicles in general.

(1) *"STEP 1- WARNING! Jump starting can damage the vehicle electronics. Check the vehicle operating manual. If there are no specific instructions then follow the steps below. If the failed battery is open circuit* do not attempt to jump-start.*
**Open circuit batteries can be detected by:*
a) battery volts reading zero immediately a high rate discharge test is applied.
b) when the battery will not accept charge current.

(2) STEP 2 - Make sure both vehicle ignitions are switched OFF and all electrical equipment is OFF.

(3) STEP 3 - Connect the vehicles in the following EXACT sequence and make sure the jumper leads are clear of any moving parts.
- *a) Take the RED jumper lead and connect to the POSITIVE terminal (marked "+" or POS) of the discharged battery.*
- *b) Connect the other end of the RED jumper lead to the positive terminal of the charged battery.*
- *c) Take the BLACK jumper lead and connect one end to the NEGATIVE terminal (marked "-" or NEG) of the charged battery.*
- *d) Make the final connection to the engine block or chassis of the stalled vehicle. (Negative earth vehicles only).*

(4) STEP 4 - After starting the vehicle with the discharged battery, allow the engine to run at idle for five minutes before disconnecting the jumper leads. This allows the electrical systems of both cars to balance.

(5) STEP 5- Remove the BLACK cable first from the vehicle with the discharged battery then the opposite end from the charged battery. Repeat for the RED cable." [27]

4 Engine compartment

The overall view of the engine bay[6] is shown in Figure 13-16.

Not shown is the oil filter, which is underneath at front right.

Figure 13: Overall view of engine bay. See following figures for details.

Figure 14: Right side of engine bay.

1 Fuse box.

2 Brake fluid reservoir and fill cap.

3 Air cleaner.

4 Dipstick for engine oil (partly hidden by hose).

5 Oil fill cap for engine. Fill engine oil here.

6 Dipstick for automatic transmission (AT). Fill ATF slowly down this pipe.

[6]The Delica is unusual in having the engine at the front, whereas other coaches (e.g. Toyota) tend to have it under the driver seat. The Delica layout is a consequence of the design philosophy that adopts the Pajero layout. As a result, the bonnet for the Delica engine bay is short, and the firewall wraps around the engine.

7 Hose and clamp for compressed air flowing from turbo-charger[7], through inter-cooler, and into engine.

8 Intercooler - cools down hot air ex turbo-charger.

9 Fill cap for power steering.

10 Battery terminal. There are two batteries in parallel in this model. Other models may have only a single battery.

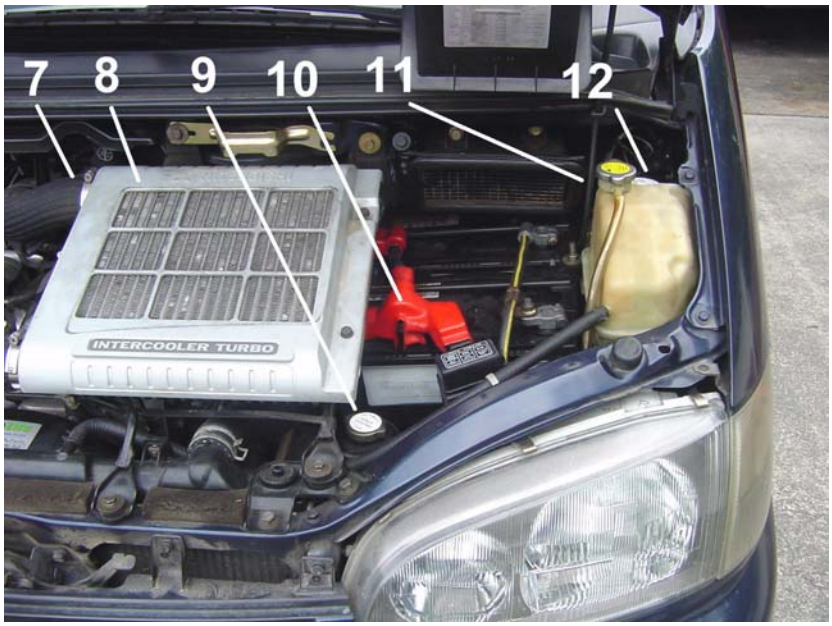

Figure 15: Left side of engine bay.

11 Reservoir and fill cap for radiator. Use anti-freeze and water.

12 Fill cap for front windscreen washer water.

[7]A turbo-charger ('turbo') increases the power of an engine by forcing more air into it. This means more fuel can be burned (because of the increased oxygen) and hence more power produced. A turbo charger does work compressing air and needs energy. It gets this from the hot and slightly pressurised exhaust gases which spin an internal part called a turbine. The turbine drives the compressor (fan). The other way of increasing the power of a given engine size is a super-charger, which is a shaft driven compressor. A turbo-charger is more efficient than a supercharger, but not as responsive at low engine speeds.

5 Driving tips

This section is a basic introduction for new users.

5.1 Delica manoeuvrability

For town driving, the Delica behaves much as a normal sedan. It's light to steer (requires no special physical strength) due to the power steering. The engine is powerful so it accelerates reasonably well.

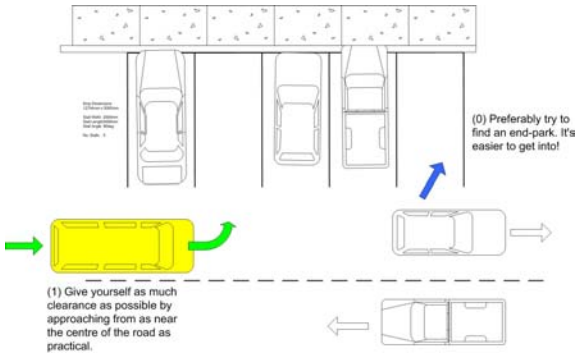

Figure 16: Parking method - initial.

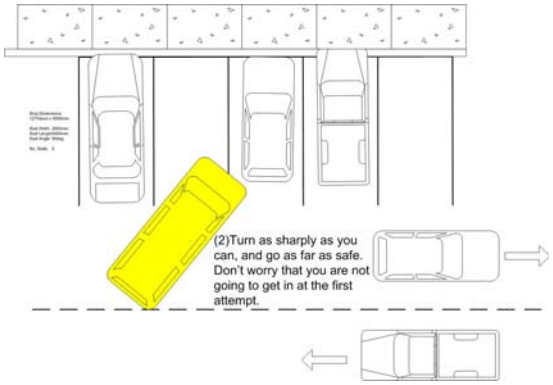

Figure 17: Go in some of the way.

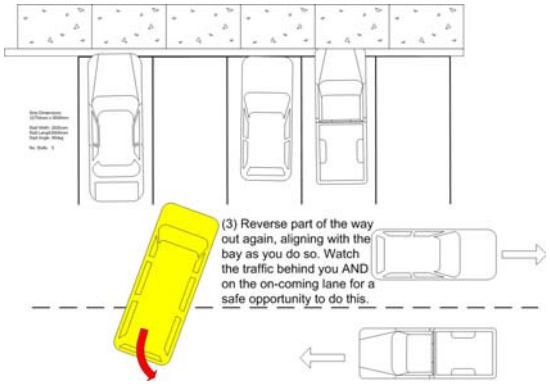

Figure 18: Reverse partly out again.

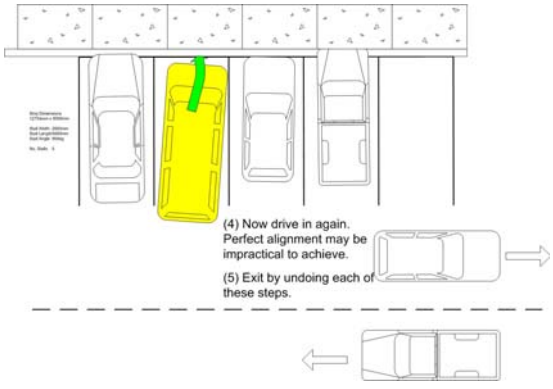

Figure 19: Drive forward again.

The one important difference is manoeuvrability: it is harder to park. This is because it is a long vehicle with a larger turning circle than a sedan. Also, it takes a little while to judge how close the corners of the vehicle are to obstacles. Drivers who are not used to the vehicle would be wise to initially avoid difficult parking situations.

Getting into parallel parking is straightforward, although a longer space is necessary than a sedan.

The difficult parking situation is bays that are at right angles to the road. These you will probably not be able to drive straight into. However, you can still easily get into them by doing it in stages with a small reverse manoeuvre in between. This is shown in Figures 16-19.

5.2 Roll-over Stability

The Delica, like any full 4WD, has a greater risk of rolling sideways than a sedan. This is because the centre of gravity is higher though the width is comparable.

In normal town driving there are few, if any, circumstances where the slope of the land is so steep that the vehicle can roll when stationary. However, it is still easy to roll the vehicle, even on flat ground, simply by driving fast around a sharp corner.

The tyres on the inside of the curve will lift, and the vehicle will roll outwards. Control of the vehicle could be lost even before the tyres lift. When a normal sedan corners too tightly, the tyres tend to lose grip and squeal, preventing the car from rolling. However the Delica, with its higher centre of gravity, might not squeal its tyres under the same conditions - but simply roll over on its side.

Figure 20: Inclination meter.

Slow down in corners. Especially sharp corners.

Driving along the contour of a sufficiently steep slope is the other way of causing a roll. This terrain is encountered in off-road use. Corners and bumps plus a slope can be particularly dangerous.

The inclination meter (Figure 20) on the dashboard measures the combined effect of the slope and the cornering force. It shows the equivalent static slope.

When off-road, try to drive straight up and down slopes. Avoid driving along the contour.

6 Off-road

Many if not most Delica owners are families who expect to do only minor off-road activities. Consequently they are at risk of being under-prepared and inexperienced when they do occasionally venture off-road. This section provides basic guidance to reduce this risk. It is not intended to replace training and experience learned by being with experts.

6.1 Basic rules

Some Basic rules (from [18] and others)

- Use 4WD, i.e. 4H - remember you have to manually engage this gear, it will not automatically engage.
- Slow down.
- Don't change gears when in the middle of mud, sand or a river.
- Be gentle with the brakes.
- If in doubt, go slowly.

6.2 Principles

There are three main issues, steering, traction, stability.

(1) Steering

Slippery surface (gravel, sand, mud, wet grass or ice) decrease the effectiveness of steering - the vehicle tends to skid.

Change to four wheel drive 4H in these conditions. Preferably beforehand, but you can change to 4H even when you are already in difficulty (see above).

(2) Traction

Surfaces that are slippery cause reduced grip for the tyres - the vehicle tends to spin the wheels on the spot. Soft surfaces (mud, sand, snow) are particularly troublesome as the wheels can rapidly dig themselves pits out of which they cannot climb.

The prevention is to use 4H or 4HLc or 4LLc before getting stuck. And keep the revs low at take off (e.g. use A/T HOLD mode, see Figure 1:2) to prevent ripping up the surface.

Also, reduce tyre pressure - this gives a bigger ground footprint, hence lower pressure on the soft surface. A pressure of 140 - 70 kPa (1.4 - 0.7 bar or 20-10 psi) has been reported as fine for Delica in soft sand [7]. Generally inner tubes[8] would be recommended at these low pressures. But drive slowly with deflated tyres, and don't turn too sharply or they may fall off the rim, and don't drive on hard surfaces. Re-inflate tyres when on hard surface. Reinflation may be done with a manual or an electric[9] pump.

(3) Stability: see above.

6.3 Tips for particular conditions

These tips have been collected from various sources and are for 4WD vehicles in general, so they may not specifically apply to the Delica.

STEEP HILLS

(1) The automatic gearbox will select the right gear going up. Maybe set overdrive OFF. For manual gearboxes, 'choose a gear that will allow you to get to the top without having to change gear' [20].
(2) Going down is more problematic than up - force the gearbox to use a lower gear in descent [18]. This will reduce the need to use brakes, thereby reducing the likelihood of skidding. 'If it starts sliding, touch the throttle enough to overcome (out run) the slide, then release the pedal once again letting the engine do its thing' [25].
(3) Use 4LLc on steep hills?
(4) If things start going wrong: 'Should your vehicle stall part way up, don't panic! Quickly hold the brakes, engage reverse (re-start engine if needed) and release all pedals, letting the vehicle back down in gear via engine braking, stay off the brakes! With the engine now above you, and the weight shifted onto the rear axle, your vehicle is quite unstable and can go into roll-over-mode very easy. If... the front end begins to slide to one side, quick use of the throttle will straighten the vehicle out, as soon as its once again straight with the trail, release the throttle, DO NOT touch the brakes, as the front end will try to pass the rear when the weight shifts further' [25].

MUD

(1) Use low range 2nd or 3rd to prevent excessive wheel spin [18, 20].
(2) High speed may help? [18] If the path is clear and there are no obstacles then speed can help [25].
(3) Use normal tyre pressure at the first attempt [20].

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[8] Tyres tend to be tubeless now, which requires a good seal between the tyre bead (the inside edge) and the rim of the metal wheel. Inner tubes prevent the bead dislodging as easily.

[9] One owner [7] reported: "For a compressor I recommend one of the high capacity ones and if it comes with only a cigarette lighter socket connection get a female adapter with battery clips and run direct from the battery. (I burnt out the lighter socket in 5 mins and still havent replaced it....very tricky job) A decent compressor can be had for [AUD] 80-150 bucks that is 4wd and truck suitable."

(4) Snow chains are useful [25].
(5) If slippage develops, slow down to regain traction [21].

SAND

(1) Carry an air pump, at least manual.
(2) There are different opinions about speed: some say slow down [18], others say use high speed [20].
(3) Use 4H
(4) Drive a straight course [18]
(5) In general, deflate the tyres to 140 kPa (20 psi) [20]. For Delica the range seems to be 140 - 70 kPa (1.4 - 0.7 bar or 20-10 psi) [7]
(6) Drive straight up slopes (not along the contour)
(7) Avoid sandy beaches if possible [18]
(8) Driving on beaches: take a tide chart, drive at low tide, park on the dry sand (never the wet sand), front towards the sea [20]. Take off downhill [20] as this reduces the weight on the rear wheels, and allows speed to build up. When driving along the beach the rear of the vehicle may try to slip downwards - the solution is to steer slightly towards rather than away from the sea to build up speed [20].
(9) Avoid undamaged dunes, and areas where there are plants (however small).
(10) Keep speed under 60km/hr on sand on deflated tyres (50km/hr on hard surfaces), reinflate tyres as soon as possible [20]

RIVER CROSSINGS

(1) Get out and check. Forget it if the flow is fast [18] - find an alternative route [20].
(2) Walk through. But not in Australian rivers where there are crocodiles.
(3) Check what the river bottom consists of. Check for holes. Find a shallow route [20].
(4) Be cautious: '*Most 4WD vehicles can only cross about 0.6m depth of water before the risk of damage; drivers should check their owner's manual. Even if the vehicle is capable of a deeper crossing, the strong current can easily wash 4WDs away*!' [19]. Also, '*if the water level is above tyre height or axle deep you should not cross unless you have prepared your vehicle*' [20], since deeper water can result in water in the differentials and the engine stalling. A depth half way up the wheels of the Delica might be a sensible limit.
(5) Open all windows and unlock doors in case you need to escape in a hurry [20].
(6) Look for any markers left by other drivers [18].
(7) Don't drive against the current - go straight across or slightly downstream [25].

(8) Select the gear needed to get up the other side riverbank [18].
(9) Drive slowly.
(10) Keep a constant speed [18].
(11) Don't change gears mid stream.
(12) Don't drive up or down shallow rivers as this destroys the river habitat.
(13) Afterwards, dry out the brakes by driving a short distance with them lightly applied [25].
(14) May have to check air cleaner for water [25].

SNOW

(1) '*The problem isn't the snow, but the ice under it*' [21].
(2) Starting: clear off the accumulated snow. Clear the exhaust pipe [24]. Put sand or cat litter on the road if necessary [24]. Take flashlight, blankets etc.
(3) Use chains on wheels. Some suggest putting them on the front wheels so that steering is better. Leave the tyres at normal pressure [23]. If you are not using 4WD, or driving uphill or towing then the chains should go on the driving wheels, which for Delica are the rear [25]. (For front-wheel drive cars, the chains should always go on the front wheels, as this is where the propulsion and the steering takes place.)
(4) Use 4WD.
(5) Try 4H to start with.
(6) Can change to ALT gearbox mode.
(7) Lights on so others can see you.
(8) Drive slowly.
(9) Don't accelerate around corners [24] or the vehicle will skid.
(10) Test the brakes before you need them [24]. Some Delicas have ABS and this produces a hammering sensation, which is normal.
(11) Coast over particularly slippery looking surfaces [24].
(12) Don't brake when sliding [22]. Turn into the skid if it happens [23].
(13) Don't accelerate harder when slipping uphill [22].
(14) Lightly loaded trailers skid easily [22].
(15) Leave a large following distance [22].
(16) Off-road driving in snow requires additional considerations, e.g. see [23, 25].

6.4 Recovery

Once stuck:

- First try to reverse out [20].
- Deflate tyres further if possible (min 70 kPa or 10 psi),
- Dig ramps in front and behind each wheel and try to drive out.
- Try repeated forwards and backwards [21].
- Dig out a space for the differential (if necessary).
- Add sticks, stones, clothing etc. to provide better traction. Fit snow chain if possible. Steel ladders are useful in sand.
- Jack the vehicle up (not always possible) and fill in the holes under the wheels.
- Remove payload from vehicle [25].

Carry a towing rope/strap as a precaution, so that others can help you out.

- With a conventional rope or wire rope, take up the slack gradually to prevent damage to the mounting points.
- With a semi-elastic strap (see Figure 21) the method is to start moving with a slack strap. This gives a greater pull-out force. Technically, the kinetic energy of the towing vehicle is converted into pull out force. The strap is therefore superior to a rope for recovery.

Towing ropes/straps should be firmly attached, preferably with a shackle. Spectators should stand well aside in case the rope breaks or the mounting points pull out. Do not tow using the factory fitted chrome bars, as these can rip off [12]. Do not tow in reverse [8].

Figure 21: Towing strap and shackle.

The recommended recovery kit from ExplorerOZ [17] includes the following:

(a) Basic capability: long handled shovel, bottle jack, hi-lift jack, jacking plate, snatch strap, tyre levers and mallet, heavy duty air compressor, tyre pressure gauge, tyre valve tool, wheel brace.

(b) For winching capability: winch strap, wire cable, hand winch and or electric or power take-off winch, tree trunk protector, 2 shackles, "D" or "Bow", snatch blocks.

(c) For dragging capability: chain 2.5m and 6m.

7 Service

7.1 Service intervals

Service	*5 000 km*	*20 000 km*	*40 000 km*	*100 000 km*	*Comment*
Change engine oil and oil filter	X[10]				Filter RZ372 and 6.5 litre of oil 15W40 CF/B2-96 or better
Fuel tank - drain 2 litres and check amount of dirt					at change of ownership
Check brake pads		X (10k)			minimum 2 mm lining left
Check Brake fluid and replace if doubtful			Change at two years		Bleeding sequence RR, LF, RF (?)
Lubricate propeller shaft joints		X			
Replace Fuel filter		X			
Drain and refill cooling system			X	X	<Different opinions!>
Replace automatic transmission fluid			X (40-50k)		Dextron II automatic transmission fluid, up to 8.5 litre
Change air filter (‘cleaner element’)			X		
Replace oil in front and rear Differentials			X		80W90, 3.8 litre total
Replace oil in transfer case			X (50k)		75W85 or 75W90 2.5 litre
Replace Engine timing chain				X	

[10]There is some uncertainty about the oil change frequency. It is possible that 5000 km may be conservative, i.e. that longer times between oil change may be acceptable. However, there is no harm in changing oil more frequently, but a lot of potential damage if changed too late.

Purchasers of a used vehicle might consider doing all the items in the 40 000 km column and before, as the previous owner might not have done them.

7.2 Changing engine oil

The best thing you can do to prolong the life of your diesel engine is to replace the engine oil frequently. Since this is required the most frequently of all the many oil changes, it may be worth doing it yourself. The job is actually quite simple, and takes about an hour. Here is how to do it.

Figure 22: Oil filter

You will need:

- ☐ Oil and filter: Filter RZ372 and 6.5 litre of oil 15W40 CF/B2-96 or better. See Figure 22.
- ☐ Tools: socket 14mm, 17mm, and oil filter wrench, see Figure 23.
- ☐ Mat or cardboard under engine to protect floor from inevitable oil spills. Plus some rags.
- ☐ Container to catch oil.


Figure 23: Tools needed.

How to do it:

(1) It is best to replace oil when the engine is warm (the oil flows better), but not when it is hot (difficult to work near it).

(2) Remove 1x steel skid guard from under front of vehicle, see Figure 24. This requires use of a 14mm socket to remove 6 screws.

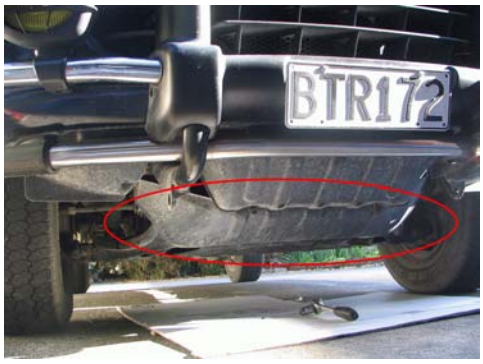


Figure 24: Remove this steel guard.

(3) Oil filter and sump drain plug should now be visible, see Figure 25.
(4) Undo sump drain plug with 17 mm socket and collect oil in container. Replace sump drain plug.
(5) Loosen oil filter, using oil filter wrench if necessary. Place a pan underneath as some oil will spill out. This is the stage at which you are likely to make the most mess. Progressively loosen the filter and eventually remove it altogether.

Figure 25: Oil filter (top left) and drain plug (bottom right).

(6) Check that the new filter matches the old one. Place some used engine oil on the rubber seal of the new filter (touch the filters together).
(7) Clean the part of the engine where the seal will contact.
(8) Screw on the new filter. Use hand force only, not tool. About 3/4 of a turn after the seal touches is usually enough. Do not use a wrench.
(9) Fill engine with oil, through tappet cover. Use a funnel to reduce spills. You can cut a funnel from a plastic bottle. Check oil level with dipstick. See Figure 26.

Figure 26: Oil cap (left) and dip stick (right).

(10) Run engine for a few minutes. Check underneath for oil leaks at sump and filter.
(11) Switch off engine, recheck oil and top up as needed - the oil filter will have taken up some of the oil.
(12) Replace panels underneath.
(13) Dispose of used oil (down the drain is socially unacceptable).
(14) You are done.

7.3 Changing air filter

Replacing the ait filter is an easy task, and takes only five minutes. No tools are needed. The replacement frequency depends on the dustiness of your environment. Unlike oil changes, you may be able to economise on air filter changes if you drive in clean conditions.

You will need:
☐ Air filter: A1312
☐ Tools: none.

Figure 27: Housing for Air filter. Release the four clamps circled.

How to do it:

(1) Open the engine compartment and find the housing for the air filter. Release the four clamps, Figure 27.
(2) Lift out the old air filter. Remove any loose dust, insects, or plant fragments from the housing.
(3) Inspect it. You do not need to automatically replace it. To make a decision, look at the colour difference between inside and outside. If the outside is noticeably darker or dustier than inside, then replace it. Look inside the pleats: if there is noticeable dirt in most of the pleats (as viewed from the outside) then replace it. You must also replace it if it is oily or the paper is cut or the soft seals are damaged.
(4) If you decide to reuse the old filter, then brush off any large pieces of dirt, and reinsert it. Otherwise, insert the new filter.
(5) Close the housing and snap the clips back in place. You are done.

7.4 Remove intercooler

The intercooler is the (silver) radiator at the top of the engine. It often needs to be removed, to give access to other systems below.

You will need:

☐ Socket or spanner 10mm
☐ Screwdriver (star)

How to do it:

(1) Remove 4 hex screws (10mm socket) holding down the intercooler. Two at front, two at rear.
(2) Remove 2 hose clamps from air hoses (screwdriver), and then remove hoses from intercooler (the other sides of the hoses may be left attached).
(3) Take care not to strain the wires and tubes still connected to intercooler.
(4) Unclip 2 electrical connections at rear of intercooler, see Figure 28.
(5) Remove solenoid assemblies at rear of intercooler by undoing 2 hex screws (10mm socket).

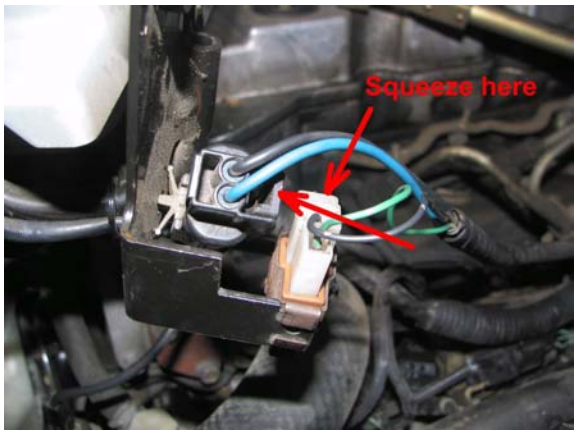


Figure 28: Unclip 2 electrical connections at rear of intercooler

7.5 Replacing fanbelts

The fan belts (two) drive the alternator, water pump, and radiator fan. If the belts fail then you should definitely stop driving. Replacing the belts is a lot of work because of the cramped engine compartment.

You will need:

☐ Socket or spanner 10mm, 12mm, 14mm
☐ Screwdrivers
☐ Gloves (recommended)

And remember this:

☐ only turn the engine crankshaft clockwise, the natural direction of rotation, to prevent any risk of the timing chain tensioner becoming misaligned.

How to do it:

(1) Remove intercooler (see above).

(2) Remove air conditioner belt (if fitted). To do this, remove radiator hose at vehicle left (top front right from mechanic's perspective) (1 big hose clip), and radiator-bottle hose (1 small hose clip). Slacken air con idler (two bolts), -but do not remove- the lower one first, then loosen (anticlockwise) the top one and tap it downwards if necessary to slide the idler, try not to remove it completely as it's difficult to put back). See Figure 29.

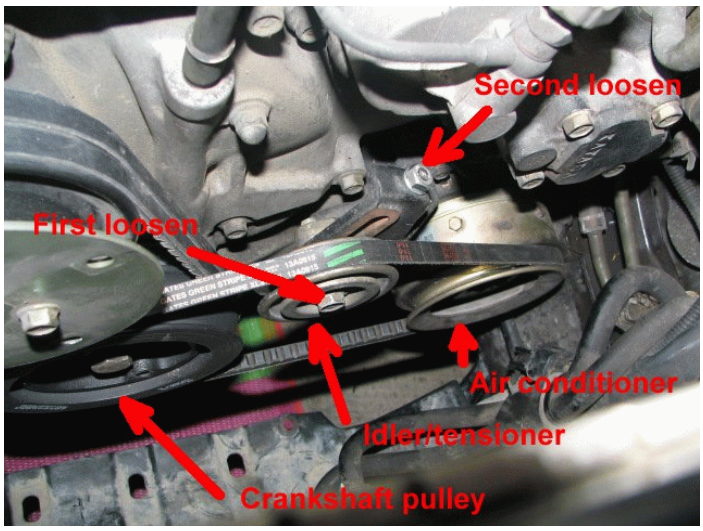


Figure 29: Air conditioner assembly, showing order to loosen hex screws.

(3) Remove lower skid pan (steel, see above for oil change, 6 hex screws).

(4) Remove air con belt (not easy, work from underneath and prise belt off the pulley, turn pulley to remove completely, like taking off a bicycle tyre), get new belt if tapered sides are cut anywhere.

(5) Slacken alternator. To do this, loosen swing arm (two hex screws, first loosen the one to the mechanic's right[11], then the other, do not remove screws completely), use long bar to prise the alternator inwards. It rotates about a hinge at it's base, and it may be necessary to loosen this base hinge if it refuses to shift (try this from below - even then it's not an easy job as the oil filter is in the way). Remove old fan belts.

(6) Check crankshaft pulley - it should not rotate independent of the engine. If it does rotate freely then remove radiator and fix the problem (may need new pulley). See next section.

(7) Fit new fan belts over the three pulleys. Easy said, but takes a while as it's

[11] Driver's left

very cramped in there!

(8) Tension fan belt by prising alternator outwards again, then tighten (clockwise) the hex screws in the reverse order. Tension values in Section 8. See Figure 30.

(9) Replace air conditioner belt, tension at 'second loosen' in Figure 29, then lock into position a 'first loosen'.

(10) Replace other hoses etc.

Figure 30: Tension the alternator belts by tightening (clockwise) this screw. Make sure that the second screw (right) is slack at this time. When the belts are tight enough, then tighten this second screw to lock the mechanism in place.

7.6 Replacing crankshaft pulley

This job typically becomes necessary because the two concentric parts of the pulley have debonded. The crankshaft pulley is made of inner and outer cast-iron parts, held together by rubber, and it is this rubber that tends to debond. You should check the condition of the pulley (check for abnormal movement) when you change the belts. Suspect a pulley failure if the pulley is rubbing against the fan (causes noise and fan wear), abnormal noise from engine, cooling or charging problems.

This is a job that a skilled home mechanic can tackle, but it can be difficult in places without the right tools. In particular, the crankshaft pulley is difficult to take off.

You will need:

- ☐ Socket or spanner 10mm, 12mm, 14mm
- ☐ Heavy duty torque wrench (200 Nm) with half inch drive or better, and 22mm socket to match
- ☐ Screwdrivers
- ☐ Gloves (recommended)
- ☐ Tool to secure crankshaft (see below).

And remember this:

- ☐ Only turn the engine crankshaft clockwise, the

Figure 31: Fan and thermal clutch after removal.

natural direction of rotation, to prevent any risk of the timing chain tensioner becoming misaligned.

☐ Avoid bruising the radiator fins - they are delicate.

How to do it:

(1) Remove intercooler (see above).

(2) Loosen fan rear shroud (cowling) by removing two hoses to top tank of radiator (tie them back) and two bolts on shroud (at top). Shroud is only loosely retained at base.

(3) Loosen fan by removing 4x nuts on the cross (12 mm flat ring spanner required - these can be very tight). See Figure 31 for removed fan.

(4) Remove both shroud and fan by gently lifting upwards.

(5) Remove skid pan under engine. See Oil filter section.

(6) You now should have clear access to the front of the engine. See Figure 32.

(7) Remove the fan belts and air conditioner belts (See previous section).

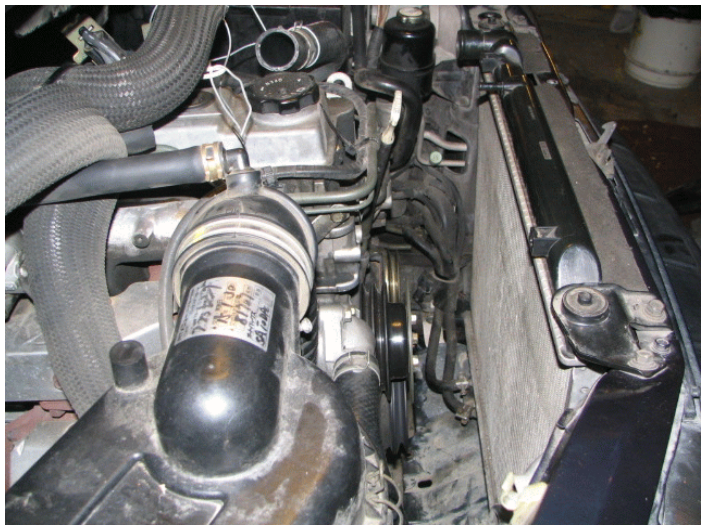


Figure 32: Air conditioner assembly, showing order to loosen hex screws.

(8) Secure the crackshaft pulley against rotation, and undo the hex head screw holding the pulley to the crankshaft. Loosen the screw in the usual anti-clockwise direction. This screw is very tight (e.g. 200 Nm). There are several options for doing this: (a) purchase the special tool from Mitsubishi, (b) make up your own tool with two dowels (or bolts) of D8-D10mm protruding about 20-36mm from a sturdy (steel) bar and spaced at 80mm on their centres, leave clearance in the centre for the 22mmAF socket, which will have an OD of about 30mm, (c) for the brave of heart - place a strong wrench on the hex head and secure the wrench so that it can't rotate clockwise (e.g. strap it underneath at vehicle's left) and give the starter motor a quick half-second burst (do not let the engine start!), (d) secure a strap somewhere convenient and wrap it three

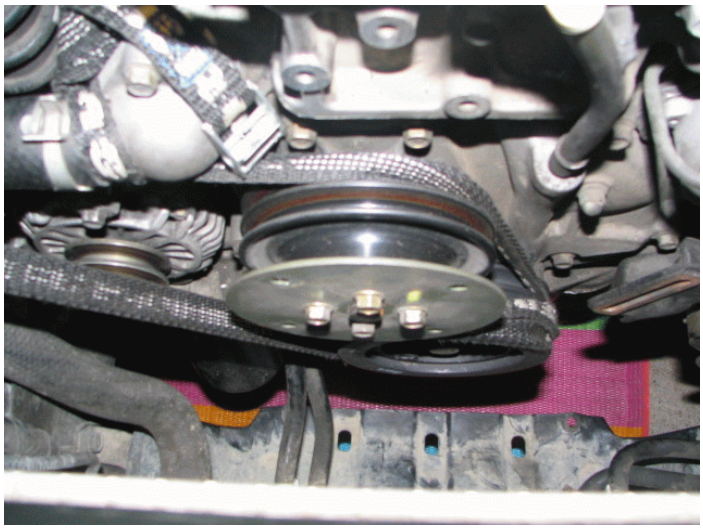


Figure 33: Strap method (d) used to secure crankshaft pulley. Use a strong strap and wrap it several times (e.g. three) round the crankshaft pulley. The free end only needs gentle tension to take up the slack.

or more times around the pulley - it will self lock and grip the pulley, see Figure 33 for application to the tightening stage.

(9) Remove the pulley - it slides off in the forward direction. Check that shaft and keys are still fine.

(10) Fit new pulley - align with key and slide on. Tighten hex head firmly in the clockwise direction <unknown torque, I used 150 Nm as a guess>. To do this you will have to restrain the pulley with either (a), (b) or (d) above.

(11) Reassemble other components in the reverse order.

7.7 Changing cabin lights

To replace an interior light on the roof, use a screwdriver to gently prise off the cover. You must prise on the long edge of the fitting, see Figure 34, not on the short edge. The replacement bulb has pointed ends and is 10W power. The designation is Festoon globe 12V 10W 10x31mm (e.g. Narva part 47269-1). It can go in either way. Then clip the cover back on - it only accepts one orientation.

Figure 34: Replace an interior light by lifting off the cover at the *long edge*.

8 Technical specifications

These data are from various sources: information provided from discussion with those in the trade, feedback from other Delica owners, and comments on the internet. In some cases the various sources differ, and I leave it to the reader to decide which values to use. Much of the numerical data is sourced from trade tables for the Pajero 4M40 engine (shown as [1] or [2]). Data from other sources is also included.

Year and model	1993-onwards 2.8 litre turbo diesel
Engine	This engine and much of the transmission is also used in Pajero models. If you need detailed maintenance information, e.g. internal engine clearance, then suggest that your mechanic look under Pajero if Delica is not listed.
Engine type Capacity Compression ratio	4M40 2.835 litre 21:1 Locate the engine number behind the alternator on the right side (looking forward) of the block [1]
Power (max) Torque (max)	92 kW at 4000 rpm [1] 292 Nm at 2000 rpm [1]
Valve clearances Inlet Exhaust Comment Compression pressure	not running but hot [1] 0.20 mm 0.30 mm Other sources [2] give the same figures for cold. 22.6-28.4 bar [2]
Timing Setting Chain Replacement frequency	 12 deg ATDC [1] every 100 000 km[12]

[12]This is the recommended replacement frequency. It may be a conservative value. Some owners replace the chain less often, or only when it becomes noisy. In doing so, they rely on the tendency for a chain to wear and become slightly elongated (hence the noise). They also rely on their ability to distinguish chain noise above other engine noises. However, this approach is not entirely risk free as a sufficiently worn chain rides high on the sprockets and may jump off them, or may break, in both cases with serious consequences for the engine. Non-expert owners would be better advised to

Engine oil	
Capacity	6.5 litre with filter [1,2] though some report 8.3 litre [4]
Oil grade [2]	Cold climate 10W30, Moderate climate 15W40, Hot climate 20W40
Oil classification	CF/B2-96 [2] or better[13]
Oil change frequency	every 6 months or 5 000 km[14] [1] (up to 10 000 km is OK by some [3])
Oil filter type	RZ 372 (Repco)
Comment	Oil filter is at front right, under engine. Remove front underbody panel (steel).
Oil temperature	80 dec C [2]
Head torque	100 Nm, loosen, tighten to 50 Nm, tighten 90 deg, final another 90 deg [1]
Engine **Air** intake	
Filter type	A1312 (Ryco) - or may use 'Unifilter' (cleanable in turpentine) [3]
Replacement frequency	check and clean 10 000 km, replace every 40 000 km
Comments/Tips	Glow plugs - use the ceramic type as otherwise there can be problems with unstable idling speed [3].
Cooling system	
Drain frequency	40 000 km [1] or 100 000 km [4]
Thermostat open	76.5 deg C [2]

stick to the recommended replacement frequency. By the way, the replacement frequency for *timing belts* (does not apply to this model) should always be followed as belts fail by loss of individual teeth, a process that is silent and inconspicuous.

[13]Oil classification: diesel (compression) engines use oil starting with 'C', and petrol (spark) engines use 'S' oils. The second letter (A, B, C...) gives the performance of the oil, the further into the alphabet the better. *Example: an oil like 'CH-4/SJ' is suitable in a diesel engine like Delica, and is superior to a 'CF' oil. The '4' denotes a high performance oil suitable for clean burning engines that use high compression ratios and exhaust gas re-circulation: these oils have more detergents and additives to cope with the additional combustion by-products that get into the oil. The 'SJ' denotes that this particular oil may be also used in a petrol engine.*

[14]This part of the reference is ambiguous and could alternatively, though less likely, be interpreted as a 10 000 km oil replacement schedule.

Electrical	
Alternator belt tension	6-8 mm new, 5-6 mm used, under 10 kg load [1] or 9-11 mm [2] or 8.0-11.0 mm new or old [4] <which span is this measured at? Uppermost?>
Alternator and water pump/fan belt	Gates 7385 (11A0980) Two off
Battery	negative earth 2 x 12V in parallel[16] 64 Ahr
Starting current	173-211 A
Cold cranking amps (CCA)[15] capacity recommended by Mitsubishi	unknown
Candidate battery	'Exide' N70ZZ or N70EX [30] (see below)
Number of batteries required	One or two. Probably two if used in cold climate[17].
Glow plugs	resistance 0.5 ohms ?
Fuses	For layout of fuse box see http://www.delicaclub.com/load.php?id=39

[15]Batteries are rated by various methods. Perhaps one of the more robust methods is Cold cranking amps (CCA). According to Exide CCA is ' *the discharge load in amperes which a new fully charged battery at -18/C can deliver for 30 seconds and maintain a minimum voltage of 1.2 volts per cell. Therefore, the higher the CCA rating the more powerful it is in producing higher starting voltages to meet the demands placed on it*' [29]. Another method is Reserve capacity in minutes RC(m), which is '*the time in minutes that a new fully charged battery will supply a constant load of 25 amps at 25/C without the voltage falling below 10.5 volts for a 12 volt battery and 5.25 volts for a 6 volt battery. Therefore, the higher the reserve capacity, the more powered time you have to run auxiliary items such as lights, radio, air conditioning, electric windows etc in the event of a charging system failure*' [29].

[16]Use identical batteries: *'If you connect two 12-volt batteries in parallel, and they are identical in type, age and capacity, you can potentially double you original capacity. If you connect two that are not the same type, you will either overcharge the smaller of the two, or you will undercharge the larger of the two*' [28].

[17]Two lighter duty batteries might be a suitable compromise for mild climates, e.g. 2x Exide N50 or 2x Exide NS70 were recommended to me by Exide NZ. If a single battery is used, then it should probably be the heaviest duty type. If the engine is in good order, the battery is new, and the weather warm, then almost any 12V battery will start the engine. If any of those factors change, then additional battery current capability may be necessary.

Candidate ‘Exide’ batteries [30]:

Make/Model	*From - To*	*Heavy Duty*	*Premium*	*Power plus*	*Extra Heavy Duty*	*Extreme*
Delica 1.4, 1.6, 1.8, 2.0 - Petrol	79-95	N310P	-	E360DP		
Delica 2.3, 2.4 diesel	89-95	N50Z	-	GS3478N	NS70	NS70EX
Delica 2.5, 2.8 - Diesel	82-95	-	-	-	N70ZZ	N70EX
Delica Space Gear	95+	-	-	-	N70ZZ	N70EX

Data for particular Exide batteries [31]:

Exide Code	N70ZZ	N70EX
Volts	12V	12 V
CCA	600 A	620 A
Reserve Capacity	130 min	150 min
Assembly	D with standard terminal post	D with standard terminal post
Length	300 mm	300 mm
Width	174 mm	174 mm
Height	220 mm	220 mm

Transmission	
Transmission - automatic Fluid Capacity ATF replacement frequency Comments	 Dextron II automatic transmission fluid [2] up to 8.5 litre 50 000 km [1] or 40 000 km [4] Check level with transmission in neutral [1] and presumably engine on. There is an internal filter [4], which is made of gauze [3] and should be washed down in ATF. This requires removal of the bottom pan of the gearbox [3].
Transmission - manual	75W85W or 75W90 [1] - use the right grade[18]

[18]It has been claimed that "heavier grade oil in the [manual] transmission ... will wear the synchro out [causing] difficult gear change" [10]

Transfer case Oil Grade Capacity Comments	 75W85 or 75W90 grade GL4 [1] 2.5-3.7 litre [1] Remove plug in oil pan to drain [3]. Fill to 'Full' mark on dipstick. No adjustment required.
Front differential Oil Grade Capacity Comments	 80W90 grade GL5 [1] 1.2 litre
Rear differential Oil Grade Capacity Comments	 80W90 grade GL5 [1] for non limited slip diff (plug at rear of diff will usually be black [3]) 2.6 litre
Propeller shaft joints, front suspension, and steering	Lubricate every 20 000 km with lithium grease type NLGI-2 [1]

Fuel	
Fuel filter Replacement frequency Type Dashboard indicator Fuel tank Capacity Comment	Front left of vehicle Replace every 20 000 km Unknown Orange warning symbol when excess water collected in fuel filter 75 litres for 4WD models, 66 litres for 2WD [4] Fuel tank Drain plug under at rear. Recommend drain 2 litres after purchase of used vehicle.

Suspension and brakes	
Brakes	
Type	Discs at front, drum at rear
Replacement	Replace disc pads when only 2 mm lining left [1][19].
Bleeding sequence	RR, LF, RF [1]
Disc thickness - minimum	20.4 mm [1] or 22.4 mm front and 16.4 mm rear [2]
Brake fluid replacement frequency	50 000 km [1] or 24 months [4]
Minimum shoe thickness	4.5 mm (rear shoes) [2]
Minimum drum diameter	198 mm (rear drum) [2]
Power steering	
Fluid type	unknown
Fluid replacement frequency	none specified?

Air conditioner	
Air conditioner belt tension	4.0 - 5.0mm new or 6.5 - 7.5 mm old [4], presumably under 10 kg load?
Air conditioner belt	Gates 9360 (13A0915) one off

[19]Reference [2] gives this value as 0.2 mm, but that must be an error in my opinion.

Tyres	
Check tyre for pressures on the tyre itself. Otherwise these may help [1]:	
Size	205R16T
Inflation Pressure normal	Front 210 kPa, Rear 240 kPa
Inflation Pressure laden	Front 230 kPa, Rear 270 kPa
Lowest permissible pressure (e.g. on sand)	unknown, maybe 70-100 kPa?
Size	265/70R15
Inflation Pressure normal	Front 180 kPa, Rear 200 kPa
Inflation Pressure laden	Front 180 kPa, Rear 200 kPa
Lowest permissible pressure (e.g. on sand)	unknown, maybe 70-100 kPa?
Size	P235/75R15
Inflation Pressure normal	Front 180 kPa, Rear 200 kPa
Inflation Pressure laden	Front 210 kPa, Rear 240 kPa
Lowest permissible pressure (e.g. on sand)	unknown, maybe 70-100 kPa?

Overall dimensions of Delica [16]

Total length (mm)	4685
Full-width (mm)	1695
Total height (mm)	2060 (high roof)
Wheel base (mm)	2800
Tread (mm)	front 1440, rear 1435
Vehicle weight (kg)	up to 2060 depending on configuration
Gross vehicle weight (kg)	up to 2445 depending on configuration
Minimum turning radius	6.0 m
Fuel tank capacity	75 litre
Fuel consumption	15.5 km/litre at 60 km/hr (varies slightly with configuration)

9 Fault diagnosis

Diagnosing Delica vehicle problems can be difficult since the vehicles are imported outside of Mitsubishi dealer networks, and workshop manuals are difficult to obtain. This section provides some basic help.

Starting faults

Will not start
- ☐ battery flat - recharge
- ☐ battery dead - replace both
- ☐ solenoid
- ☐ starter motor
- ☐ glow plugs
- ☐ fuel pump fault
- ☐ electrical fuses

Starts with difficulty
- ☐ glow plugs failed - test resistance
- ☐ corrosion in joints of electrical conductors to glow plugs

Produces excess smoke at start
- ☐ cold ambient temperature
- ☐ quality of diesel
- ☐ glow plugs failed
- ☐ engine rings failed
- ☐ engine valve guides worn
- ☐ fuel injector pump fault

Warning lights

Warning light comes on during driving:
- ☐ see Section 2 for meaning
- ☐ battery and fuel filter lights come on together: loss of electrical power, check for broken fanbelt. Do not continue driving with failed belt as water pump and fan will also be out of action, and you could overheat the engine.

Running faults

Produces excess smoke when running [33]
- ☐ black smoke: fuel injector pump is over fuelling - needs re-calibration
- ☐ black smoke: worn injector nozzles - replace
- ☐ black smoke: dirty air cleaner - replace
- ☐ white smoke: engine rings failed
- ☐ white smoke: injector pump timing needs adjustment, or opening pressure is too low
- ☐ white smoke: value problems
- ☐ black smoke: exhaust gas re-circulation valve failed - replace or blank off

Idles roughly
- ☐ fuel injector pump incorrect setting
- ☐ exhaust gas re-circulation valve failed

Engine cuts out when idling
- ☐ air leak in fuel system
- ☐ fuel injector pump setting
- ☐ exhaust gas re-circulation valve failed

Engine noises
- ☐ fanbelt rattle (intermittent): crankshaft pulley has a rubber adhesive which can fail, eventually causing failure of engine cooling and electrical systems [14]
- ☐ timing chain excessively worn
- ☐ skid pan (stone guard) under engine loose

Thermal faults

Engine overheats
- ☐ radiator effectiveness failed
  - ☐ radiator internal blockage (sludge)
  - ☐ radiator external blockage
    - ☐ Radiator obstructed by foreign matter (oil+dust, grass seeds..)
    - ☐ Radiator core collapsing
- ☐ lack of cooling water
  - ☐ previous overheating episode
  - ☐ thermostat (at radiator top tank) blowing off at low pressure
    - ☐ Thermostat seal faulty (e.g. dirt)
    - ☐ Thermostat faulty (opening at too low a temperature)
  - ☐ loss of water
    - ☐ Rubber hose failed
      - ☐ Rubber hose perished (e.g. by solvent or time)
      - ☐ Rubber hose ruptured
      - ☐ Rubber hose rubbed through (check fan cowl on Delica)
    - ☐ Hose clamp failed or loose
    - ☐ Cylinder head gasket failed (e.g. partially)
- ☐ extreme operating conditions

☐ hot weather
☐ heavy load or steep terrain
☐ handbrake on
☐ Cylinder head gasket failed
☐ engine oil failure
☐ lack of oil
☐ Damaged sump
☐ drain plug absent
☐ oil pump failure

Automatic Gearbox overheats
☐ too high a gear for terrain or load (try switching overdrive off)
☐ lack of automatic transmission fluid

Noises
☐ Engine squeal, only when accelerating: fan belt or air conditioner belt too lose, tightening if necessary

10 EGR Valve

The exhaust gas re-circulation (EGR) valve is an active component in reducing engine emissions, but if it fails then it can cause poor engine performance. Consequently, some people desire to disable the valve. This section discusses the facts about this and shows why this may not be the best solution.

10.1 Purpose

The exhaust gas re-circulation (EGR) valve is primarily there to protect our environment. It does this by introducing inert burnt gas (from the exhaust) to dilute the oxygen concentration thereby lowering the combustion temperature, thereby reducing the formation of nitrous oxides (NOx) and thus reducing smog.

Figure 35: Location of EGR value on Delica (circled). If the valve has to be blanked off, do so by inserting a plate at the arrow point.

10.2 How the EGR valve works

[1] The Engine control unit (ECU) detects accelerator position, Engine speed and other transmission info, decides whether EGR is needed, and sends a signal to the EGR. It should not activate EGR at idling, low load, or full load.

[2] The pulsed electrical signal activates a solenoid, which opens a vacuum line. In the 4M40 engine there are two solenoids. One controls whether the system is on-off, and the other controls the degree to which it is on (duty).

[3] Vacuum has separately been generated by a pump attached to the alternator. (A diesel engine does not have vacuum at inlet manifold as does a petrol engine.) The same vacuum is used for brake booster too.

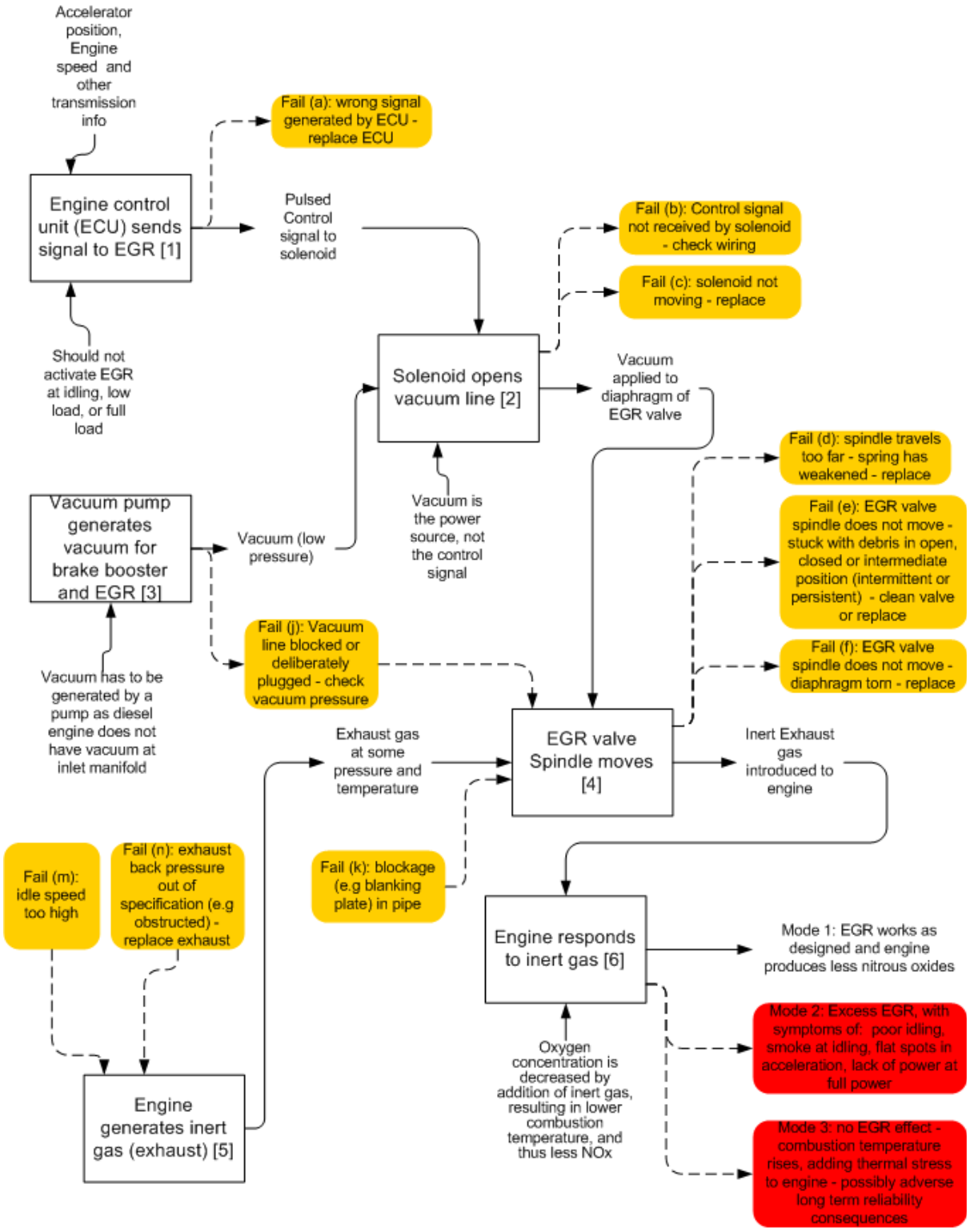
[4] The spindle in the second EGR valve moves when the vacuum is applied. This permits a small amount of inert exhaust gas to be introduced to the

engine.

[5] The inert gas (exhaust) has of course been generated by the engine.

[6] The Engine responds to inert gas. Oxygen concentration is decreased by addition of inert gas, resulting in lower combustion temperature, and thus less NOx.

The accompanying IDEF0 diagram shows how the system works.


Accelerator position, Engine speed and other transmission info
Engine control unit (ECU) sends signal to EGR [1]
Fail (a): wrong signal generated by ECU - replace ECU
Pulsed Control signal to solenoid
Fail (b): Control signal not received by solenoid - check wiring
Fail (c): solenoid not moving - replace
Should not activate EGR at idling, low load, or full load
Solenoid opens vacuum line [2]
Vacuum applied to diaphragm of EGR valve
Vacuum pump generates vacuum for brake booster and EGR [3]
Vacuum (low pressure)
Vacuum is the power source, not the control signal
Fail (d): spindle travels too far - spring has weakened - replace
Fail (e): EGR valve spindle does not move - stuck with debris in open, closed or intermediate position (intermittent or persistent) - clean valve or replace
Fail (f): EGR valve spindle does not move - diaphragm torn - replace
Fail (j): Vacuum line blocked or deliberately plugged - check vacuum pressure
Vacuum has to be generated by a pump as diesel engine does not have vacuum at inlet manifold
Exhaust gas at some pressure and temperature
EGR valve Spindle moves [4]
Inert Exhaust gas introduced to engine
Fail (m): idle speed too high
Fail (n): exhaust back pressure out of specification (e.g obstructed) - replace exhaust
Fail (k): blockage (e.g blanking plate) in pipe
Engine responds to inert gas [6]
Mode 1: EGR works as designed and engine produces less nitrous oxides
Mode 2: Excess EGR, with symptoms of: poor idling, smoke at idling, flat spots in acceleration, lack of power at full power
Mode 3: no EGR effect - combustion temperature rises, adding thermal stress to engine - possibly adverse long term reliability consequences
Oxygen concentration is decreased by addition of inert gas, resulting in lower combustion temperature, and thus less NOx
Engine generates inert gas (exhaust) [5]

10.3 Operating modes for the EGR system

There are three operating modes for the EGR system as a whole. These are listed below with some of the failure causes. If the EGR valve is not working as expected, then the first solution is to try and clean it. The list below gives other possible causes if this does not work.

Mode 1: **EGR works as designed and engine produces less nitrous oxides.**
This is how the designers intended it to work.

Mode 2: **Excess EGR, with symptoms of: poor idling, smoke at idling, flat spots in acceleration, lack of power at full power.**
Failure root causes for this mode include:
Fail (a): wrong signal generated by ECU - replace ECU
Fail (b): Control signal not received by solenoid - check wiring
Fail (c): solenoid not moving - replace
Fail (d): EGR valve spindle travels too far - spring has weakened - replace
Fail (e): EGR valve spindle does not move - stuck with debris in open, closed or intermediate position (intermittent or persistent) - clean valve or replace
Fail (f): EGR valve spindle does not move - diaphragm torn - replace
Fail (m): idle speed too high (creates too much vacuum)
Fail (n): exhaust back pressure out of specification (e.g obstructed) - replace exhaust

Mode 3: **No EGR effect - combustion temperature rises, adding thermal stress to engine - possibly adverse long term reliability consequences. Increased Nox production. Adverse environmental effects.**
Fail (a): wrong signal generated by ECU - replace ECU
Fail (b): Control signal not received by solenoid - check wiring
Fail (c): solenoid not moving - replace
Fail (e): EGR valve spindle does not move - stuck with debris in open, closed or intermediate position (intermittent or persistent) - clean valve or replace
Fail (f): EGR valve spindle does not move - diaphragm torn - replace
Fail (j): Vacuum line blocked or deliberately plugged - check vacuum pressure
Fail (k): blockage (e.g blanking plate) in pipe

10.4 Diagnosis

Overall check on EGR operation
To check operation start the engine and let it warm up to 65 deg C or above. Then race the engine by pressing the accelerator pedal. At this point the diaphragm of the EGR valve should lift. (Perhaps the EGR valve has to be unbolted first?).

Fail a: EGR and glow control unit
A simple set of test of voltage outputs across various terminals will determine whether the control unit is working. However they are not practical to describe here and require the Mitsubishi manual. The EGR control unit senses engine speed, accelerator position, and engine temperature. Therefore a faulty sensor in any of these locations could also affect EGR operation. Some tests follow.

Fail a: Accelerator sensor
Check that the sensor for accelerator lever position is working correctly. With the ignition on (not started) it should read 0.3-1.5 V when idling, and 3.7 - 4.8 when fully open. Special equipment plus a multi-meter is needed for this test, and the accelerator cable must be loosened and the engine at operating temperature. Adjust the sensor position to get within the above range. Turning the sensor clockwise will decrease the voltage.

Fail a: Engine speed sensor
Disconnect the connectors. The resistance between pins 3 and 6 should be 1.3-1.9 k ohm. It is recommended that you obtain the Mitsubishi manual.

Fail a: Engine temperature sensor
Remove sensor. The resistance should be 3.3 kohms at 20 deg C and 0.3 kohms at 80 deg C.

Fail b: Harness continuity
A simple set of resistance tests across various terminals will check for electrical continuity between the control unit and the solenoids.

Fail c: Solenoids holding pressure
A vacuum pump is used to test that each of the two EGR solenoids holds a vacuum whether energised or not.

Fail c: Solenoids electrical behaviour
The solenoid resistance should be 35-44 ohms for each of the two solenoids (at 20 deg C).

Fail e: EGR valve stuck
No official Mitsubishi repair methods known. However, this comment, which applies to EGR problems in general, may be helpful:

> *'If the EGR valve stem is accessible, push it against spring pressure. It should move freely and return fully. If not, remove the valve for cleaning or replacement. With the engine at normal operating temperature, open the throttle enough to reach at least 2,500 rpm while watching the EGR valve*

stem (use a mirror if necessary). It should move, then return. If it doesn't, remove the hose and feel for vacuum as you rev it again. If you find some, the valve's at fault. If you don't, check out the controls (see step #3). Of course, if you're dealing with one of those Ford pressure-operated units, you should feel pressure instead. If you found no vacuum at the valve and there's a thermostatic vacuum switch in the hose, pull off the source line and feel for vacuum above idle. If you find it, but none gets to the valve with the engine warm, the switch is faulty. On all but the positive backpressure and pressure-operated types, you can use a hand-operated vacuum pump to test valve action. The engine should roughen and maybe die off when vacuum is applied at idle. This is especially useful on valves with an enclosed stem. A note on cleaning: GM says never to use a solvent to dissolve deposits in an EGR valve, but Chrysler tells you it's okay providing you're careful not to get any on the diaphragm. With most specimens, you'll be cleaning the pintle and valve seat with a dull scraper or wire brush, and knocking out loose carbon by tapping the pintle. But these parts are expensive, so a more satisfactory means of cleaning them is desirable. Some GM versions, for instance, can be disassembled for this purpose. Just make sure you don't damage the seating surface in the process, and that you scribe marks so you can get it back together in the proper alignment' (Autosite, 2003).

10.5 Modifications

Excess EGR (failure mode 2) can severely reduce the driveability of the vehicle. In this case one work-around is to disable the EGR system entirely, so that it operates in mode 3. It should be noted that this has some negative consequences: hotter combustion temperature and the possibility (presumably small) of reduced engine life. Also, this will be an illegal modification in countries with emission control legislation.

The work-around is achieved by either plugging the vacuum line (j) or blanking the pipe between the exhaust manifold and the EGR valve (k). If the EGR valve is stuck in an open position then plugging the vacuum line will be ineffective and the blanking method is the next option. If blanking is used, then a substantial plate of several mm thickness needs to be used. The temperature of the exhaust gases is probably around 500 deg C if not higher, and this will readily melt aluminium (melting point 300 deg C) and erode through thin sheet steel. It would also seem sensible to place the blanking plate at the EGR valve end of the pipe, not at the exhaust manifold, as this reduces the temperature to which it is exposed. Stainless steel would be the preferred material for a blanking plate and could be quite thin, with mild steel as a second choice (several mm would be necessary). Aluminium, tin can, plastic, silicone or gasket materials would be inappropriate.

Mitsubishi recommend replacing rather than disabling the EGR valve, for both technical and environmental reasons.

10.6 Summary

The EGR system is designed to reduce Nox production. Usually it works fine and there is no need to adjust it. However, if it fails and starts providing excess exhaust gas re-circulation then the engine produces excess smoke and becomes difficult to drive, since idling and power are affected. Several possible causes and solutions have been described. If the EGR system fails in the shut position, or is actively disabled by blanking it off, then near-normal engine performance is restored, although there is the risk, presumably slight, of deceasing engine life. Mitsubishi recommend replacing rather than disabling a faulty EGR valve. In some countries it is illegal to disable the valve.

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