6/6 Measuring sparkplug electrode gap.

6/7 Correct connection of sparkplug wires.

6 Once you've checked and cleaned the plug electrodes, or before new plugs are installed, check the electrode gap. It is worth buying a plug gapping tool for this task; these have wire-type feeler gauges and special tools for setting the gap by bending the ground (earth) electrode. Note that you should never attempt to bend the center electrode; if you do, you're likely to break the insulator nose. Set the electrode gap to 1.0-1.1mm/0.040-0.043in.

7 Before installing the new or cleaned plugs, apply a small trace of copper-based, anti-seize compound or molybdenum disulfide grease to the plug threads; this will make removal easier next time, and lessens the risk of a frozen (seized) plug tearing out the plug threads in the cylinder head. **Caution!** Do not overtighten the sparkplugs, the correct torque is 15-22Nm/1.5-2.3kgf m/11-16lbf ft. Reconnect the sparkplug wires (HT leads).

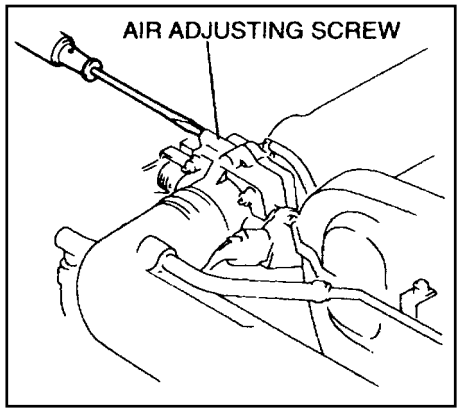
7. IDLE SPEED - CHECKING & ADJUSTMENT

☞ 1/1, 2 & 2/1.

1 The correct idle speed for an engine at normal temperature with the transmission in neutral (manual trans) or **P** (auto trans) is 800-900rpm (MT) or 750-850 (AT). With air conditioning on, idle should increase to 1000rpm (MT only).

2 The onboard rev counter (tachometer) is not very accurate at measuring these sort of engine speeds, so you should assume that the idle speed is OK if the engine does not seem to be running excessively fast at idle, nor so slowly that it stalls at the least provocation.

3 Idle speed can be altered by small adjustments of the air adjusting screw (see diagram). However, as this action may be illegal in some territories, we advise you to leave it to your Mazda dealer to set idle speed using the appropriate SSTs (special service tools). **Do not** attempt to adjust the throttle adjusting screw, which is factory set and should never be disturbed.



D7/3 USING AIR ADJUSTING SCREW TO ADJUST IDLE SPEED.
(See text.)

7/3 Air adjusting screw (see text).

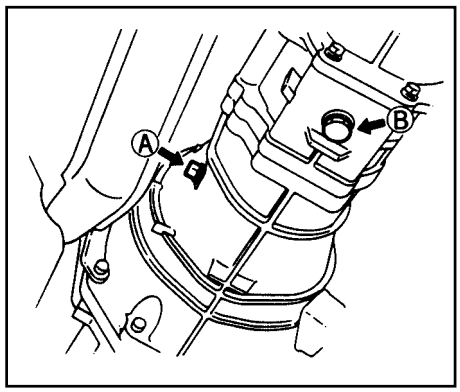
8. TRANSMISSION (MANUAL) OIL - CHECKING LEVEL & CHANGING

☞ 1/1, 2 & 2/1.

1 Checking or changing the transmission oil requires the car to be raised so you can get access to the filler and drain plugs. Place the car on jack (axle) stands, or on fabricated steel wheel ramps. **Caution!** The car must be raised to a ***level*** position to ensure the oil level reading is correct. If you have access to a vehicle lift, or can get the oil changed by a Mazda dealer or service station, we suggest that you do so. Unless you need to do other work under the car, you need to do a lot of preparatory work to gain access. For details of jacking and supporting the car ☞ 1/3.

CHECKING LEVEL

2 With the car safely supported, unscrew and remove the transmission oil level/filler plug **A**, which is situated halfway up the transmission casing on the left-hand side.



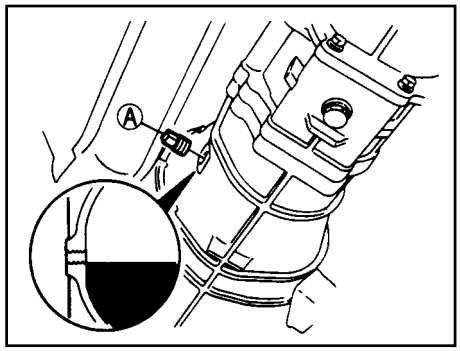
D8/2 LOCATION OF MANUAL TRANSMISSION DRAIN AND LEVEL/FILLER PLUGS.

3 You'll need a syringe, or transmission oil in a pack with a built-in tube. Add fresh oil through the filler/level plug hole until the oil is level with the hole - allow any excess to drain out for at least ten minutes. The correct oil grade, which will be marked on the container, is most commonly API Service GL-4 or GL-5 SAE 75W-90. Where temperatures are constantly above 10 degrees C/50 degrees F, you can use API Service GL-4 or GL-5 SAE 80W-90. These gearboxes respond well to synthetic oils of the appropriate grade, particularly if you feel the gearchange is too notchy.

4 Once the oil level is correct, install the filler/level plug (**A**) and tighten it to 25-39Nm/2.5-4.0kgf m/18-28lbf ft.

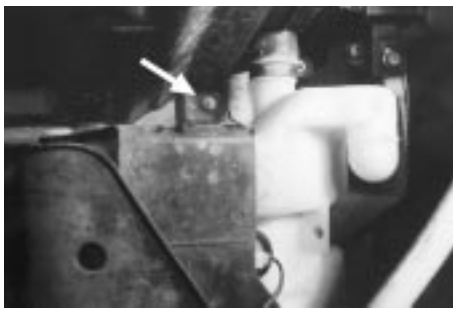
CHANGING TRANSMISSION OIL

5 With the car safely supported, position a drain tray under the transmission drain plug, then remove the filler plug **A** (diagram D8/2), followed by the drain plug **B**. The transmission holds 2.0 liters/2.1 US or 1.8 Imp quarts of oil, so have ready a container of at least this capacity. The transmission



D8/4 CORRECT OIL LEVEL FOR MANUAL TRANSMISSION.
A = Filler/level plug.

4/12 Disconnect washer hose.



4/15c ... some cars have this front left fixing ...

4/15f Lift away undertray.

4/13 Remove four hinge bolts.

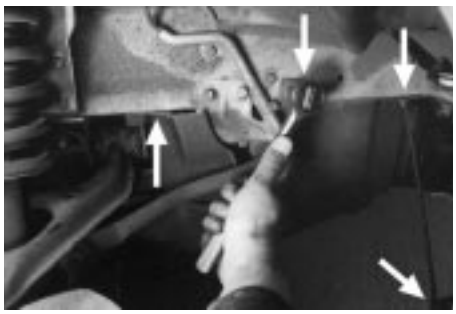
4/15d ... two bolts at rear ...

4/16 Drain coolant into suitable receptacle.

4/14 Remove front wheels.

4/15e ... and three at front secure undertray.

4/17a Remove drain plug and ...



4/15a Three bolts each side ...

where there are three fixings on each side. You'll also have to remove the 10mm nut that holds the stay (or stays) to the lower part of the front wing (or wings). Note that on some right-hand drive cars the windscreen washer reservoir is mounted forward of the left-hand wheelarch, in which case one of the undertray fixings will be a deeply recessed 10mm nut near the reservoir body. Remove the two 10mm bolts at the rear of the undertray and three at the front; then lift the undertray out from beneath the car.

16 The next step is to drain the radiator. Unscrew and remove the crosshead drain screw from the bottom of the radiator, having first placed a suitable receptacle underneath. If you use a clean receptacle you can retain the coolant for re-use.

17 + Place a drainer can under the sump and then, using a 19mm socket, loosen and remove the sump drain plug.

18 + Manual transmission cars only: loosen and remove the 24mm transmission drain plug once a suitable receptacle is in place to catch the oil.

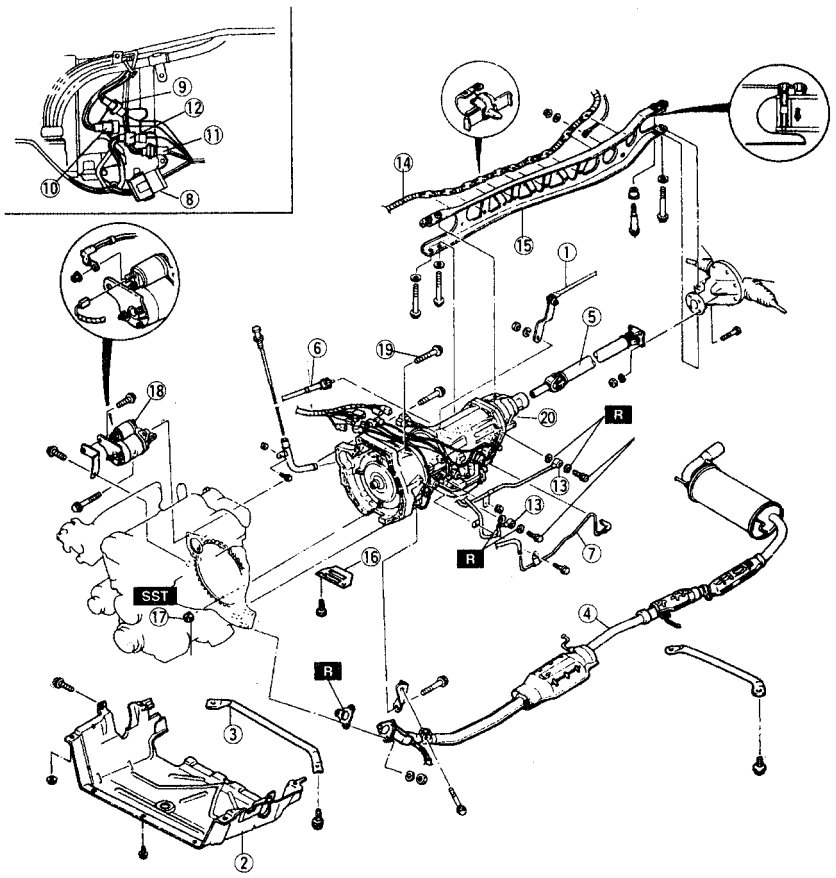
19 Working from above the engine compartment and starting at the right-hand side of the engine proceed as follows -

20 First, disconnect the hose from the

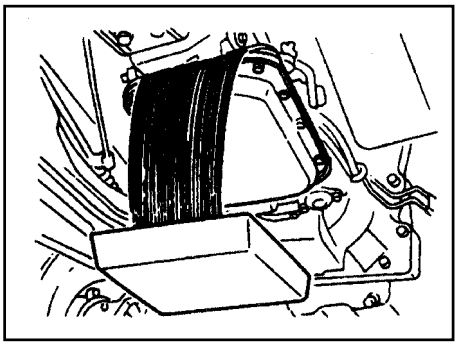
4/17b ... drain the engine oil.

4/15b ... one of which secures stay ...

4/18a Remove drain plug and ...



D3/2 AUTOMATIC TRANSMISSION REMOVAL SEQUENCE
1 Shift rod. 2 Engine undertray. 3 'Performance rod' brace. 4 Exhaust system (except manifold). 5 Driveshaft (propshaft). 6 Speedometer cable. 7 Vacuum pipe/hose. 8 Range switch connector. 9 Input/turbine speed sensor connection. 10 Solenoid connector. 11 ATF temperature sensor. 12 Clutch solenoid connector. 13 Oil cooler pipes. 14 Wiring harness. 15 PPF (power plant frame). 16 Access cover. 17 Torque convertor nuts or bolts (as applicable). 18 Starter motor. 19 Bellhousing bolts. 20 Auto transmission unit. R = Replace.



D3/6 DRAINING ATF.

section of the small bore vacuum pipe (**7**) to the left-hand side of the casing. Pull the rubber section of the pipe from its union stub.

10 Also on the left of the unit you'll see the oil cooler feed and return pipes (**13**). Both are secured to the transmission casing and bellhousing by clips and then at their unions by banjo bolts. Remove the bolts securing the clips and the banjo bolts, then tie the loose pipes out of harm's way.

11 Detach the wiring harness (**14**) and remove PPF (**15**)☞ 4/2/17-23.

12 At the front of the unit on the right-hand side you'll see the transmission dipstick tube. Remove the dipstick, unscrew the nut and bolt securing the tube's support bracket and then pull the tube from the transmission case.

13 Remove the cover (**16**) of the access hole in the bottom of the bellhousing. With a blob of paint or an indelible marker, mark the relative positions of the driveplate and torque convertor so that they can be reattached in the same positions on reassembly.

14 Reach up into the bellhousing and unscrew and remove the four nuts or bolts (**17**), as applicable, fixing the torque convertor to the driveplate. You can lock the driveplate by jamming a large screwdriver into the starter ring gear teeth and simultaneously wedging it against the side of the access hole.

15 Release bellhousing bolts and nuts☞ 4/2/25-27.

16 Lower the transmission as far as it will go until the jack pad just comes free and then jack it back up just 13mm/half-an-inch so that the engine mountings are not too strained.

17 There should now be sufficient room above the transmission to reach and separate the five electrical connector blocks (**8**, **9**, **10**, **11**, **12**). **Caution!** Before disconnecting, check the color coding of the wires each side of each connector: if necessary, tag wires so you know what goes with what on refit. The wiring harness can now be pulled to the side and tied to the brake pipes out of harm's way.

18 Carefully undo and remove the last two bellhousing bolts.

19 Using a wooden packing piece, place a jack under the rear end of the engine oil pan/sump adjacent to the bellhousing and jack upwards until the weight of the transmission is just released from the existing jack. **Caution!** Don't jack the sump any higher than this. The jack which was used to support the transmission should now be removed (unless it's a wheeled jack).

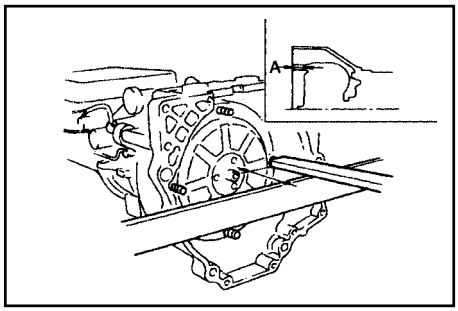
20 With the help of a strong assistant, or by supporting the weight of the transmission on a wheeled jack, pull the transmission backward whilst supporting the weight of the unit - which we think is around 70kg (155lb). **Warning!** If you and your assistant are doing this job without a wheeled jack, neither of you should position yourselves directly beneath the transmission in case it drops. Once the spigots in the bellhousing joint face are clear, the whole transmission unit can be lowered to the ground and then removed from beneath the car. **Caution!** It is essential that the automatic transmission unit is kept the right way up at all times, otherwise sediment and debris from the oil pan (which will still contain fluid) can be dislodged and allowed to contaminate fine drillings and valves.

4. TRANSMISSION (GEARBOX), MANUAL - DISMANTLING & REBUILD GENERAL

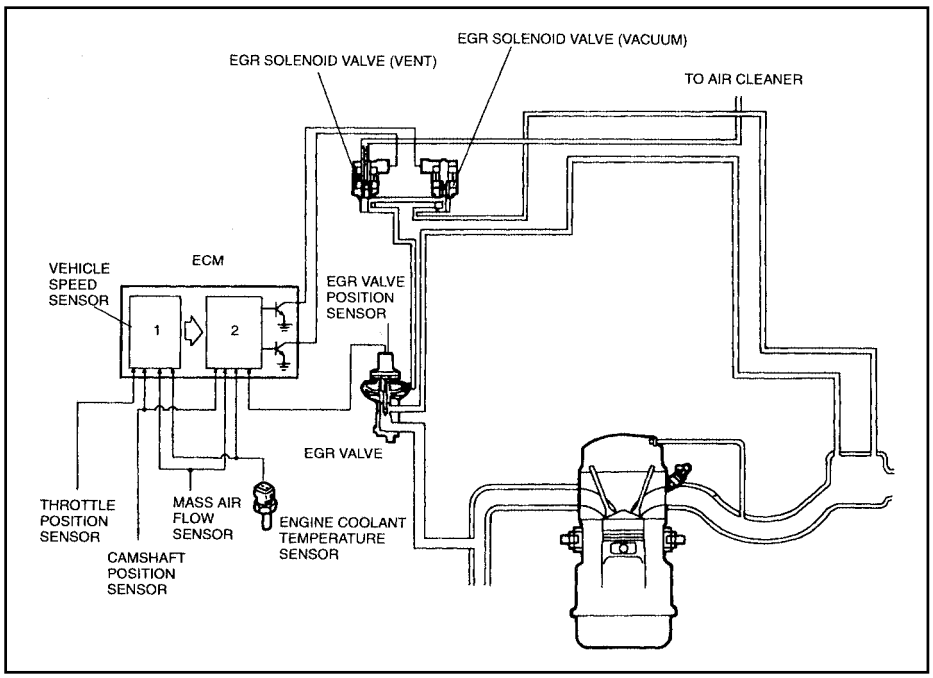
☞ First read 1/1, 2.

1 Read the text on teardown and rebuild before you start the job so that you have a good idea of what's involved☞ 4/5, 6, 7.

2 Most of the work can be undertaken with ordinary tools, but there are a few tasks requiring



D4/1 CHECK THAT TORQUE CONVERTOR PROPERLY ENGAGED WITH OIL PUMP
'A' = 22.5mm/0.89in.



D3/8 OVERVIEW OF THE EXHAUST GAS RECIRCULATION (EGR) SYSTEM.

exhaust manifold and the main muffler/silencer.

13 **Ignition**. The PCM reads the engine operating condition and uses this data to determine the exact point of ignition for each cylinder for optimum efficiency. Once triggered by the PCM, each coil generates a high voltage which fires two sparkplugs simultaneously.

14 **Power train control module (PCM)**. Also known as the ECU or ECM. The main control element in the engine management system - the car's brain. Tucked safely away inside the cockpit, it constantly monitors engine operating conditions through the battery of sensors previously described. It uses a basic pre-programmed set of instructions ('maps') overlaid by the varying conditions it reads from the rest of the vehicle to control engine operation

4. POWERTRAIN CONTROL SYSTEM - TROUBLESHOOTING TIPS

1 DONT PANIC! It's too easy to assume that, because the PCM and its associated components and wiring make a complex system, the slightest stumble from the engine is bound to be caused by the failure of some mysterious little part deep inside the PCM: this is not so.

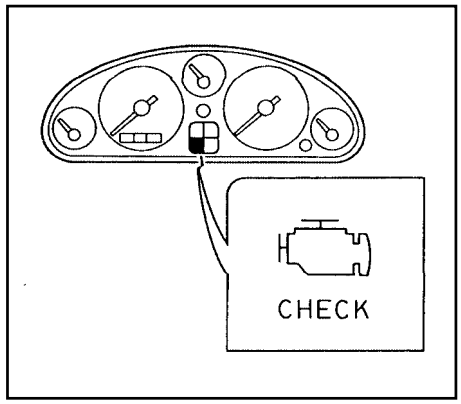
2 The fact is that the PCM and the components to which it is linked are designed to last the life of the car without replacement, and are therefore unlikely to give trouble.

3 What this means is that if the engine stops, it's most likely that you're out of fuel; if it misfires, that the sparkplug wires or sparkplugs are shot or wet; and, if it fails to start, that the battery is flat or the auto transmission's in **D**. Keep it simple: eliminate the most likely problems with a logical process before hunting for extremely obscure and unlikely faults.

4 The "Troubleshooting" chapter will point you in the right direction; meantime those with earlier cars just got lucky and are off to a head start with fault diagnosis -

FAULT CODES

5 The PCM of 1994 and early 1995 models using the original OBD (on board diagnosis) rather than the OBD II system, will report the general nature of a fault by a sequence of flashes of the dashboard mounted 'Check' light. Whenever you turn the ignition key to the **ON** position (this applies to later models, too), the 'Check' light illuminates to indicate that its bulb is working. Once the engine is started it will go out if the PCM has detected no faults in the system. If the light stays on when the engine is started, the PCM is telling you that a fault exists in the PCM circuitry, componentry controlled by/reporting to the PCM or within the PCM itself.



D4/5 THE DASHBOARD MOUNTED ENGINE 'CHECK' LIGHT.

6 For models with the original OBD system, after getting the engine to normal operating temperature, determine the nature of the fault as follows. Switch off the engine. Switch off all accessories (eg: air conditioning, lights, radio, etc.) and put the transmission in neutral. Do not press the accelerator or clutch pedals during the test.

7 Open the data link connector on the left-hand inner fender (wing) and, with a piece of stiff copper wire, or a paperclip, bridge terminals **TEN** (test engine) and **GND** (ground). Turn the ignition switch to **ON** (do not start the engine).

8 If the PCM has stored a fault code the check light will give a series of flashes separated by 4 second pauses. A short flash indicates a single digit, so 3 short flashes repeating every 4 seconds would indicate **fault code 3**. A long flash equates to 10, so 2 long flashes and 3 short flashes repeating every 4 seconds would indicate **fault code 23**. Got it? If you get more than one type of flashing sequence every four seconds, multiple faults are being reported. Take your time to determine the fault codes; the light sequence will continue until you turn the ignition off.

9 Note that once a fault has been rectified, the fault code can be cleared from the PCM (and therefore the check light) by disconnecting the battery negative cable and pressing the brake pedal for at least 20 seconds.

10 The check light system reports just 16 codes, though there are many more which can be picked up by SSTs (Special Service Tools). The codes are as follows -

Code 01: A problem with the ignition system or associated circuitry.
Code 03 and **04**: A problem with the camshaft position sensor or associated circuitry.
Code 08: A problem with the MAF (mass airflow) sensor or associated circuitry.
Code 09: A problem with the engine coolant temperature sensor or associated circuitry.
Code 10: A problem with the air temperature sensor (within MAF unit) or associated circuitry.
Code 12: A problem with the throttle position sensor or associated circuitry.
Code 14: A problem with the barometric pressure sensor (located within PCM) or associated circuitry.
Code 15 and **17**: A problem with the heated oxygen sensor or associated circuitry.
Code 16: A problem with the EGR valve position sensor, associated circuitry or hoses.
Code 25: A problem with the PRC solenoid valve, associated circuitry or hoses.
Code 26: A problem with the purge solenoid valve, associated circuitry or hoses.
Code 28: A problem with the EGR solenoid valve (vacuum), associated circuitry or hoses.
Code 29: A problem with the EGR solenoid valve (vent), associated circuitry or hoses.
Code 34: A problem with the idle air control valve, associated circuitry or hoses.

6

Cooling, heating and air conditioning systems

1. INTRODUCTION

These cars use a conventional cooling system in which the water-based coolant is circulated around the engine by a small centrifugal pump driven by a belt from the crankshaft. Engine heat is transferred to the coolant, which is constantly circulated through the radiator. Air passing though the radiator matrix reduces coolant temperature before it circulates once again through the engine. Hot air is sucked from the engine compartment by the airstream created by the moving car. An electric cooling fan switches on at a predetermined coolant temperature to draw air through the radiator matrix. This ensures adequate cooling in very hot temperatures, or when in slow-moving traffic.

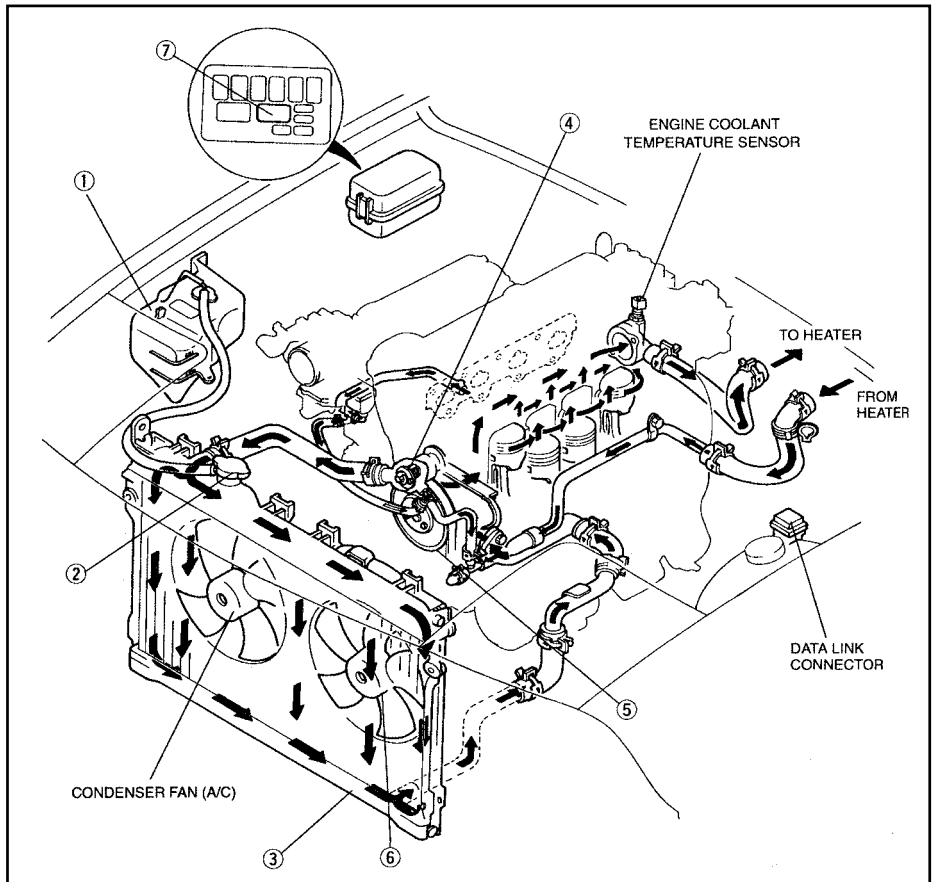
During cold weather, the interior of the car is heated by a system like the engine cooling system running in reverse: hot coolant from the engine is diverted through the heater matrix below the dashboard, and air is passed through the matrix to extract heat to warm the passenger compartment. The heater control allows the occupants to control a combination of recirculated and fresh air, and to boost the incoming airflow with an electric fan.

An optional air conditioning system is available. This works pretty much like a domestic refrigerator. An engine-driven compressor circulates refrigerant through the condenser - effectively another radiator - mounted in the nose of the car. The condenser, backed up by an electric fan, is designed to dump unwanted heat into the passing airstream. Refrigerant is piped to the cooling unit (evaporator) mounted under the dashboard. Hot air from the car's interior is passed through the evaporator, the refigerant absorbing the air's heat and thus reducing its temperature. The warmed refrigerant evaporates into a gas which is pumped back to the condenser, where it cools and liquefies: the cycle is then repeated.

2. ENGINE COOLANT - TOPPING-UP & CHANGING

☞ 1/1, 2 & 6/1.

Warning! If the engine has been run within the last hour or so, the engine coolant will be hot and under pressure. Removing the radiator cap or coolant reservoir cap can result in the coolant suddenly boiling as pressure is released, resulting in scalding steam being ejected. Always allow the engine to cool before removing either cap. Wear eye protection, gloves and overalls for safety. Place rag over the radiator cap, then turn the cap slowly counter-clockwise until it reaches the first stop position.



D1/0 ENGINE COOLING SYSTEM (SHOWING COOLANT FLOW)
1 Reservoir. 2 Radiator cap. 3 Radiator. 4 Thermostat. 5 Water pump. 6 Engine coolant fan. 7 Engine coolant fan relay.