GROUP 6 — CLUTCH

SECTION 0 — INDEX

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
CLUTCH CHATTER	(a) Worn or damaged disc assembly.	(a) Replace disc assembly.
	(b) Grease or oil on disc facings.	(b) Replace disc assembly and correct cause of contamination.
	(c) Improperly adjusted cover assembly.	(c) Replace cover assembly.
	(d) Broken or loose engine mounts.	(d) Replace or tighten mounts.
	(e) Misaligned clutch housing.	(e) Align clutch housing.
	(f) Loose bell housing bolts.	(f) Re-tension bell housing bolts.
CLUTCH SLIPPING	(a) Insufficient pedal free play.	(a) Adjust cable.
	(b) Burned, worn, or oil soaked facings.	(b) Replace disc assembly and correct cause of contamination.
	(c) Weak or broken pressure springs.	(c) Replace cover assembly.
DIFFICULT GEAR SHIFTING	(a) Excessive pedal free play.	(a) Adjust clutch cable.
	(b) Worn or damaged disc assembly.	(b) Replace disc assembly.
	(c) Improperly adjusted cover assembly.	(c) Replace cover assembly.
	(d) Clutch disc splines sticking.	(d) Remove disc assembly and free up splines or replace disc.
	(e) Worn pilot bearing.	(e) Replace bearing.
	(f) Sticky clutch cable.	(f) Lubricate or replace cable.
CLUTCH NOISY	(a) Worn release bearing.	(a) Replace release bearing.
	(b) Worn disc assembly.	(b) Replace disc assembly.
	(c) Worn release levers.	(c) Replace cover assembly.
	(d) Worn pilot bearing.	(d) Replace bearing.
	(e) Dry contact-pressure plate lugs in cover.	(e) Lubricate very lightly.

SECTION 2 — CLUTCH

SPECIFICATIONS

CLUTCH			
Engine Model Application	1,6 ℓ Imported Clutch	1,85ℓ and 2,0ℓ Imported Clutch	1,85 ℓ and 2,0 ℓ Local Clutch
Type	Single Dry Disc	<———	<———
Clutch Fork Free Play	1,6 mm (0.06")	<———	<———
CLUTCH DISC			
Facing Type	Moulded Woven Asbestos	<———	<———
Outside Diameter	200 mm (7.870")	215 mm (8.460")	<———
Thickness (each facing)	3,5 mm (0.138")	3,2 mm (0.125")	7,5-8,1 mm* (0.295-0.319")
Disc Springs	4	<———	<———
Total Effective Facing Area	320 cm² (49.6 in.²)	373 cm² (57.8 in.²)	<———
* Total driven plate thickness measured under 375 kg (830 lb.) load.			
CLUTCH COVER ASSEMBLY			
Pressure Spring	1 Diaphragm	<———	<———
Clutch Clamping Pressure	3532N (794 lbs.) Minimum	3923N (882 lbs.) Minimum	4005N (900 lbs.) Minimum
No. of diaphragm fingers	18	<———	<———
Height from face of flywheel (New Disc)	37 mm (1.45")	32-34 mm (1.26"-1.34")	35-39 mm (1.38-1.54")
Force on fingers to free clutch (New Disc installed)	1125N (253 lbs.)	1070N (240 lbs.)	1059N (238 lbs.)
Force on fork to free clutch (New Disc inst.)	365N (82 lbs.)	340N (77 lbs.)	<———
Total effective facing areas	320 cm² (49.6 in.²)	373 cm² (57.8 in.²)	<———
RELEASE BEARING			
Type	Ball bearing thrust	<———	<———
Travel (maximum)	5,65 mm (0.223")	<———	<———
CLUTCH CABLE			
Adjustment Gap	5,0 to 6,0 mm (0.20" to 0.24")	3,5 to 4,5 mm (0.14" to 0.18")	<———
CLUTCH PEDAL			
Side Play	3,0 mm (0.120")	<———	<———

SPECIAL TOOLS

E6M15 (imported clutch plate)	Clutch Plate Aligning Tool
E6M16 (local clutch plate)	Clutch Plate Aligning Tool

TORQUE SPECIFICATIONS

	Nm	lb./ft.	lb./in.
Clutch Cable Bracket Bolts	11	8	96
Clutch Cover to Flywheel Bolts	20	15	180
Clutch Housing to Engine Bolts	41	30	
Flywheel to Crankshaft Bolts	137	101	
Pedal Support to Brake Booster	8-12	6-9	72-108
Starter Motor Mounting Bolt	28	21	

GENERAL INFORMATION

The clutch used on all models is a single, dry disc type, with no adjustment for wear being provided in the clutch itself. The clutch pedal cable is provided with an adjustment nut or circlip to maintain a specified free play between the clutch cover fingers and release bearings.

The pressure plate is of the diaphragm type, finger height is preset at manufacture.

CLUTCH

Improper operation or excessive wear may impair the clutch function to a point which may necessitate its removal and overhaul. The transmission must be removed prior to clutch removal, refer Group 21 Transmission.

Removal

(1) Remove the transmission.

(2) Mark the clutch cover and flywheel (see fig. 1) to ensure that the cover and flywheel will be correctly matched in assembly.

(3) Loosen the clutch cover retaining bolts diagonally one by one and then remove the cover and clutch disc assembly.

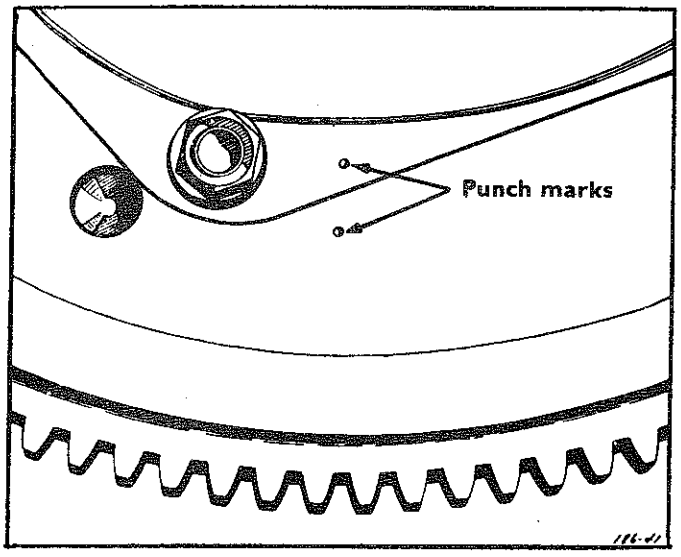

Fig. 1—Punch marks on clutch cover and flywheel

(4) Remove the release bearing return clips and remove the bearing from the transmission.

(5) Using a 5 mm (3/16") parallel punch remove the shift arm roll pins.

(6) Remove the control lever shaft assembly, clutch shift arm, felt and return springs.

Installation

(1) Install the control lever, return springs, felt packing and shift arm to the transmission. Lubricate the felt prior to installation.

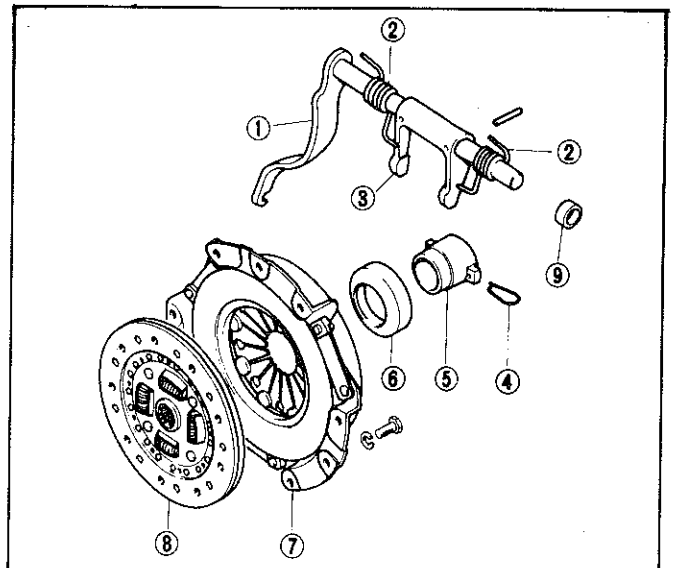

Fig. 2—Clutch assembly

(2) Secure the shift arm to the shaft with new roll pins. The open ends of the roll pins should align with the shaft centre line.

(3) Fill the release bearing carrier inner groove with grease and install the bearing and retaining clips to the transmission.

(4) Clean the surface of the flywheel and pressure plate thoroughly.

(5) Using Tool No. E6M15 or E6M16 install the clutch disc to the flywheel. (If this tool is not available, a spare transmission input shaft may be used).

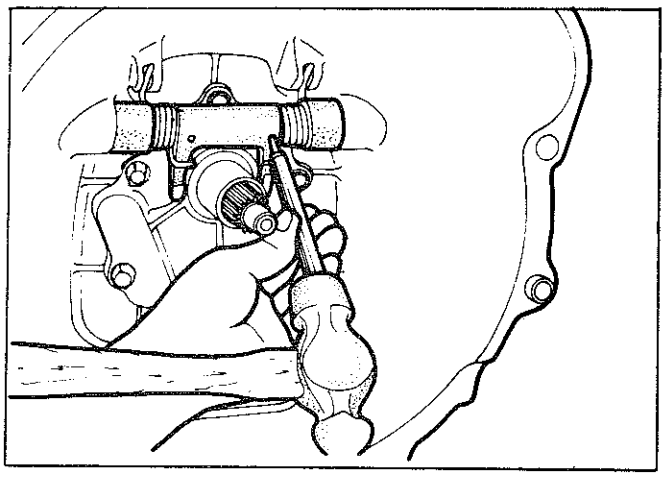

Fig. 3—Removing roll pins

(6) Position the clutch cover and align punch marks. Insert the attaching bolts but do not tighten.

(7) To avoid distortion of the clutch cover, the bolts should be tightened a few turns at a time (alternately) until they are tightened to specifications. Remove the aligning tool.

(8) Install the transmission as described in Group 21 Transmissions.

(9) Adjust the clutch cable so that the specified gap exists between the outer cable and cable support at the dash panel. Adjustment can be altered by rotating the adjusting wheel on the cable or moving the circlip.

SERVICING THE CLUTCH

It is very important that when replacing or installing a clutch on a car, the correct clutch disc, pressure plate assembly be installed. Serious vibration, noise or grabbing, chattery clutch will result, if incorrect parts are used.

This clutch pressure plate assembly is serviced only by replacement.

INPUT SHAFT PILOT BEARING

The flywheel is fitted with a roller bearing to support the forward end of the input shaft. If the bearing is noisy or rough when rotated by hand it should be replaced otherwise transmission bearings may be damaged. Remove the bearing by using a suitable slide hammer.

REPLACING THE RELEASE BEARING

(Transmission Removed)

(1) Support the release bearing in a vice or press, and carefully press out the release bearing sleeve.

(2) Position new bearing on end of sleeve, and using old bearing against the face of the new bearing, carefully press on the bearing. Make certain bearing is seated on flange of release bearing sleeve.

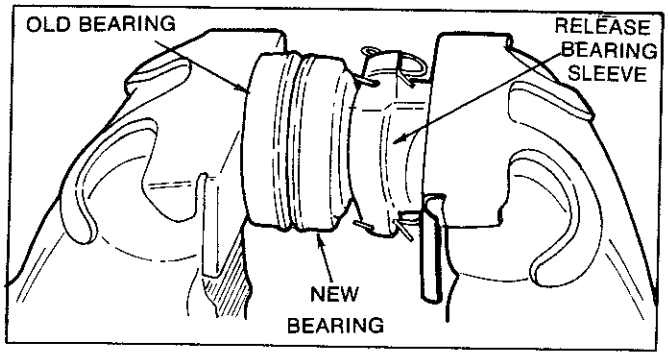

Fig. 4—Installing clutch release bearing (typical)

Exercise care to avoid damaging the bearing race. Never drive the bearing on the sleeve with a hammer. Place the bearings and sleeve in a vice, and press the new bearing on the sleeve (refer Fig. 4). Turn the bearings as they are pressed together. The new bearings must be flush with the shoulder of the release bearing sleeve.

(3) Fill the cavity of the bearing sleeve with short fibre grease prior to installation in vehicle.

STEAM CLEANING PRECAUTIONS

Since the clutch housing has provisions for ventilation, condensation from steam vapours tend to accumulate on the internal clutch mechanism when the vehicle is steam cleaned. The facings of the disc will absorb moisture, and the force exerted by the pressure plate will bond the facings to flywheel and/or, pressure plate, if car is allowed to stand for some time before use. If this condition occurs it will necessitate replacement of the disc assembly, flywheel and/or clutch assembly. **Immediately after cleaning operation, start engine and "slip clutch" in order to dry off disc assembly, pressure plate, and/or flywheel.**

CLUTCH CABLE

Removal

(1) Loosen the cable adjusting nut inside the engine compartment or remove the circlip.

(2) Disconnect the cable from the clutch pedal.

(3) Disconnect the cable from the clutch shift lever and remove the cable.

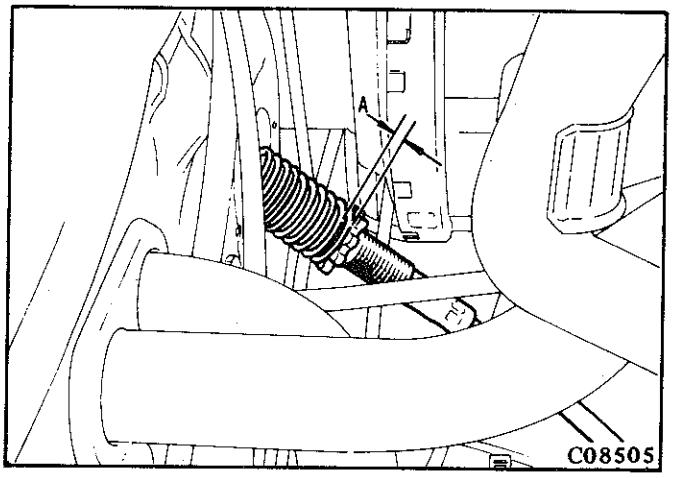

Fig. 5—Adjusting the clutch cable

Installation

Install by reversing removal procedure and observe the following:

(1) Check the cable for breakage and damage.

(2) Lubricate the cable prior to installation.

(3) Route the cable so there are no sharp bends.

(4) Adjust the gap (A in fig. 5) between the adjusting nut or circlip and the cable dash panel support to specification.

CLUTCH PEDAL

Removal

(1) Disconnect the brake master cylinder operating rod from the brake pedal and remove the pedal support to brake booster bolts.

(2) Remove the clutch pedal shaft snap ring.

(3) Disconnect the clutch cable from the clutch pedal.

(4) Remove the clutch pedal from the support.

Installation

Prior to installation check the clutch pedal for bend and distortion and the shaft bushing for wear.

Install by reversing removal procedure noting the following:

(1) Prior to installing the pedal, lubricate the pedal shaft and clutch cable connection at the end of the pedal arm with long fibre grease.

(2) Check that the pedal side play, measured at the depressing pad, does not exceed the specified limit.

(3) Adjust the brake pedal as specified in Group 5 Brakes.

(4) Adjust the clutch pedal travel and cable gap.

Adjustment

By means of the clutch pedal adjusting bolt, adjust the pedal travel and height from dash panel to the dimensions shown in Fig. 7.

NOTE: Insufficient pedal travel results in insufficient clutch release, which may cause clutch or transmission damage.

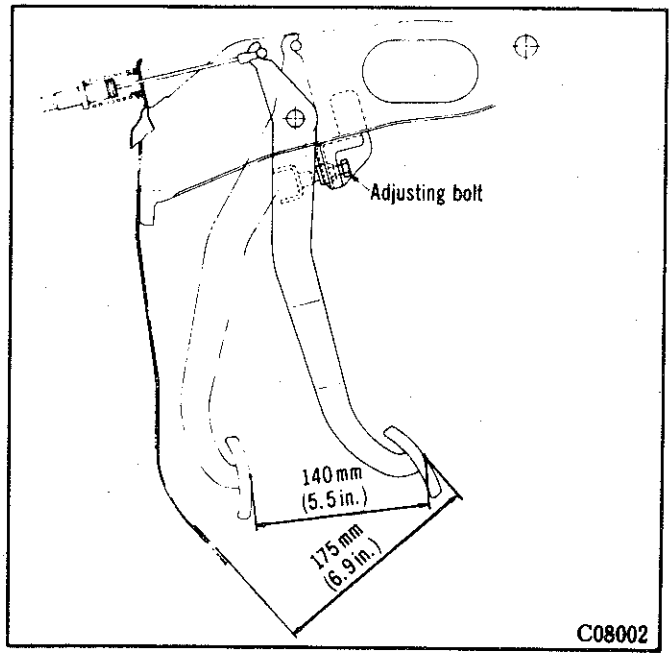

Fig. 7—Clutch pedal adjustment

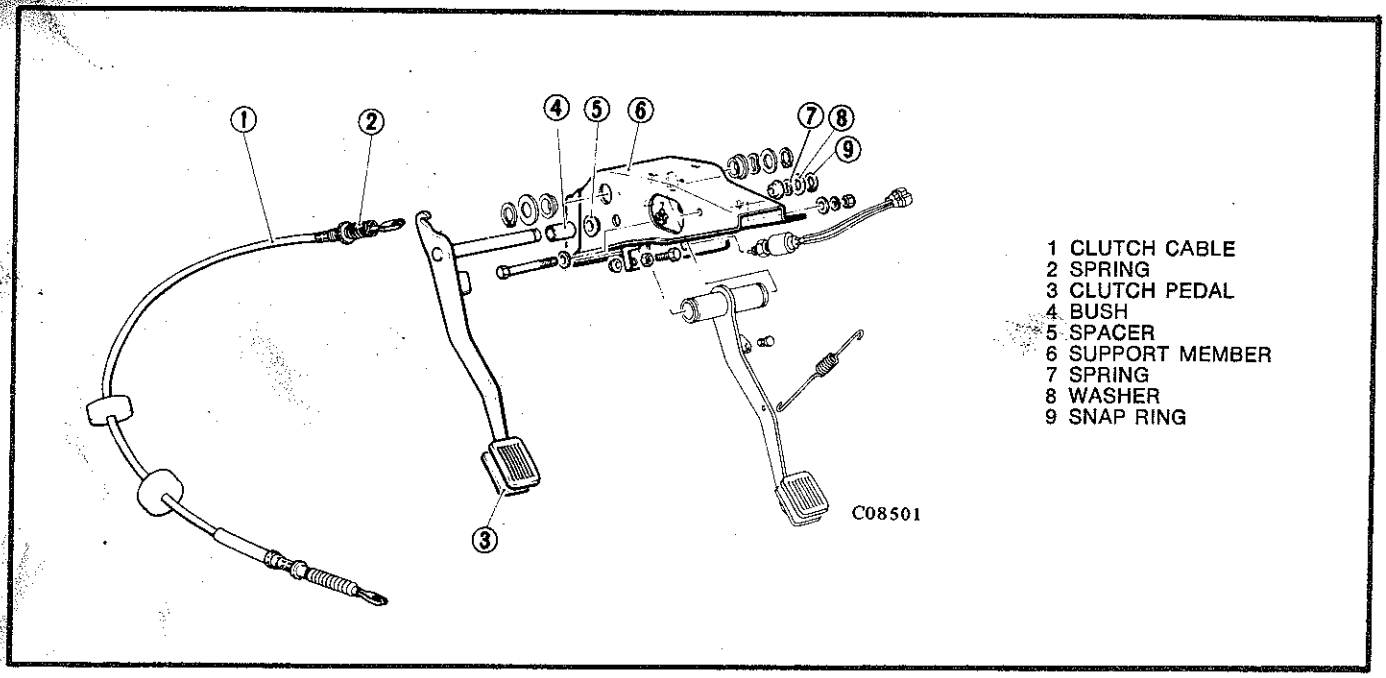

Fig. 6—Clutch pedal components (exploded view)

GROUP 7 — COOLING SYSTEM

SECTION 0 — INDEX

SERVICE BULLETIN REFERENCE

DATE	NUMBER	SUBJECT	CHANGES

SECTION 1 — SERVICE DIAGNOSIS

Condition	Possible Cause	Correction
EXTERNAL LEAKAGE	(a) Loose hose clamp.	(a) Replace the hose clamp.
	(b) Hose leaking.	(b) Replace the hose.
	(c) Leaking radiator.	(c) Repair or replace the radiator as necessary.
	(d) Worn or damaged water pump seal.	(d) Replace the water pump seal and impeller.
	(e) Loose core hole plug.	(e) Install new core hole plug.
	(f) Damaged gasket, or dry gasket, if engine has been stored.	(f) Replace gaskets as necessary.
	(g) Cylinder head bolts loose, or tightened unevenly.	(g) Replace the cylinder head gasket and torque head in correct sequence.
	(h) Leak at heater connection.	(h) Clean the heater connections and replace the hoses and clamps if necessary.
	(i) Leak at water temperature sending unit.	(i) Tighten the water temperature sending unit.
	(j) Leak at water pump attaching bolts.	(j) Tighten the water pump attaching bolts to specifications.
	(k) Leak at exhaust manifold stud.	(k) Seal and re-drive the stud.
	(l) Crushed thermostat housing.	(l) Replace the thermostat housing.
	(m) Dented radiator inlet or outlet tube.	(m) Straighten the radiator inlet or outlet tube as necessary.
	(n) Leaking heater core.	(n) Repair or replace the heater core.
	(o) Cracked or porous water pump housing.	(o) Replace the water pump assembly.
	(p) Warped or cracked cylinder head.	(p) Replace the cylinder head.
	(q) Cracked cylinder block.	(q) Replace the cylinder block.
	(r) Sand holes or porous condition in block or head.	(r) Replace the cylinder block or cylinder head as necessary.
INTERNAL LEAKAGE	(a) Faulty head gasket.	(a) Install a new gasket.
	(b) Refer to causes (f) to (j) listed under External Leakage.	(b) Refer to corrections (f) to (j) listed under External Leakage.
	(c) Cylinder head cracked into valve compartment.	(c) Pressure test cooling system, replace the cylinder head.
	(d) Cracked valve port.	(d) Pressure test cooling system, replace the cylinder head.
	(e) Cracked cylinder wall.	(e) Pressure test cooling system, replace the cylinder block.
POOR CIRCULATION	(a) Low coolant level.	(a) Fill radiator to correct level.
	(b) Collapsed radiator hose. (A faulty bottom hose may collapse only at high engine speeds).	(b) Replace the hose.
	(c) Fan belt glazed, oil soaked, or loose.	(c) Tighten or replace the fan belt as necessary.
	(d) Air leak through loose or faulty bottom hose.	(d) Replace the hose.
	(e) Faulty thermostat.	(e) Replace the thermostat.
	(f) Water pump impeller broken or loose on shaft.	(f) Replace the water pump internal parts.
	(g) Fan drive unit faulty.	(g) Replace fan drive unit.
	(h) Restricted radiator core water passages.	(h) Flush the radiator thoroughly.
	(i) Restricted engine water jacket.	(i) Flush the engine cooling system thoroughly.

Condition	Possible Cause	Correction
OVERHEATING OR APPARENT OVERHEATING (Refer to Causes Listed under "Poor Circulation")	(a) Low coolant level.	(a) Fill radiator to proper level.
	(b) Blocked radiator air passages.	(b) Blow out the radiator passages.
	(c) Incorrect ignition timing.	(c) Time the engine ignition system.
	(d) Low engine oil level.	(d) Add engine oil to the correct level.
	(e) Incorrect valve timing.	(e) Correct the engine valve timing.
	(f) Inaccurate temperature gauge.	(f) Replace the temperature gauge.
	(g) Restricted overflow tube.	(g) Remove restriction from the overflow tube.
	(h) Faulty radiator pressure cap or seat.	(h) Replace the radiator cap and/or seat.
	(i) Dragging brakes.	(i) Adjust the brakes.
	(j) Excessive engine idling	(j) Stop engine or increase R.P.M.
	(k) Frozen coolant.	(k) Thaw out cooling system, add anti-freeze as required.
OVER FLOW LOSS	(a) Refer to causes listed under "Poor Circulation and Overheating."	(a) Refer to corrections under "Poor Circulation and Overheating."
	(b) Overfilling.	(b) Adjust coolant to the correct level.
	(c) Coolant foaming due to insufficient corrosion inhibitor.	(c) Flush the radiator and add anti-freeze or rust inhibitor as required.
CORROSION	(a) Leak at lower radiator hose.	(a) Repair or replace corroded outlet fittings or corroded clamps.
	(b) Use of water containing large concentration of lime and minerals.	(b) Use only clean soft water.
	(c) Insufficient corrosion inhibitor.	(c) Use anti-freeze or rust inhibitor as required.
	(d) Use of anti-freeze for extended length of time.	(d) Drain cooling system and replace with new anti-freeze.
TEMPERATURE TOO LOW — SLOW ENGINE WARM UP	(a) Faulty thermostat.	(a) Replace the thermostat.
	(b) Inaccurate temperature gauge.	(b) Replace the temperature gauge.
WATER PUMP NOISY	(a) Noisy seal.	(a) Add Water Pump Lube.
	(b) Bearing rusted.	(b) Replace bearing seal and impeller.
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	(a) Belt too loose.	(a) Adjust belt tension.
	(b) Belt excessively glazed or worn.	(b) Replace and tighten as specified.
BELT SQUEAL WHEN ACCELERATING ENGINE	(a) Belts too loose.	(a) Adjust belt tension.
	(b) Belts glazed.	(b) Replace belts.

SECTION 2 — COOLING SYSTEM, SATURN 4 CYLINDER

SPECIFICATIONS

Engine Type	Saturn
Cooling System Capacity — with heater	6,5 litres (11.5 pts.)
Radiator Type	Vertical Flow
Core Size	484 mm x 32 mm x 280 mm (19" x 1.25" x 11")
Fin Spacing	10 F per 25 mm (1")
Auto Transmission Oil Cooler — Type	Concentric Tube
— Location	Radiator Bottom Tank
Radiator Pressure Cap — Type	Pressure Vent
— Setting — Nominal	110 kPa (16 p.s.i.)
— Tolerance	98 to 117 kPa (14 to 17 p.s.i.)
Engine Coolant pH level	8 — 9
Fan Belt Deflection — at longest run	7,0 to 10,0 mm (0.28" to 0.40")
Water Pump — Chain Drive Camshaft Engine	Centrifugal Impeller Type (Serviceable)
— Belt Drive Camshaft Engine	Centrifugal Impeller Type (Non-serviceable)
Thermostat — Type	Wax Type
— Opening Temperature	81° to 84°C (178° to 183°F)
— Full Opening Temperature	95°C (203°F)
Fan Drive Unit	Fixed
Fan — No. of Blades	5
— Diameter	320 mm (12.6")
— Pitch	38 mm (1.5")

SPECIAL TOOLS

E7C15	Pressure Tester
E7C20	Pressure Flushing Gun

TORQUE SPECIFICATIONS

	Nm	lb./ft.	lb./in.
Alternator adjusting strap bolts	15-22	11-16	
Water pump attaching bolts	9-12	7-9	84-108
Fan to water pump	8-9	6-7	72-84
Thermostat housing	9-12	7-9	84-108
Temperature sending unit	28-39	21-29	
Camshaft drive belt cover	15-18	11-13	
Crankshaft pulley bolts (belt drive engine)	9-12	7-9	84-108

GENERAL INFORMATION

The engine is water cooled using a vertical flow fin and tube radiator, a belt driven centrifugal water pump, a thermostat and a fixed fan drive unit.

Water is circulated by the pump through the cylinder block, the head and then through the top hose to the top tank of the radiator. Water passing down through the radiator is cooled by air flow through the radiator fins.

Heated water is drawn from the cylinder head to the inlet manifold, the automatic choke and to the heater/demister.

NOTE: The alloy content of this engine makes it essential that an effective level of corrosion inhibitor be maintained in the cooling system.

A pH between 8 and 9 indicates the correct amount of corrosion inhibitor. Check using pH indicator paper.

RADIATOR

Removal

(1) Drain the cooling system and remove the top and bottom radiator hoses and the transmission cooler pipes (if equipped).

(2) Remove the radiator attaching nuts and remove the radiator.

NOTE: During removal, care should be taken to avoid damaging the radiator cooling fins and tubes.

Installation

(1) Slide the radiator down into position being careful not to damage the cooling fins and tubes. Install the radiator retaining nuts.

(2) Install the radiator hoses and clamps ensuring they are securely retained. Connect the transmission cooler lines (if equipped).

(3) Fill the cooling system to 25 mm (1") below the filler neck with rain water or "demineralized" water adding corrosion inhibitor (or antifreeze where required).

(4) On vehicles equipped with automatic transmission, measure the transmission fluid after warm up and add fluid if required.

PRESSURE TESTING THE COOLING SYSTEM

(1) For testing purposes only, fill radiator to within 13 mm (½") of filler neck.

(2) Wipe filler neck sealing surface clean.

(3) Attach tool E7C15 to filler neck and apply recommended pressure as listed in specifications.

(4) If pressure gauge holds steady, the system is satisfactory. If pressure drops, continue as follows.

(5) Check all points for external leaks, if none are evident after the dial gauge shows drop in pressure, continue test.

(6) Remove tester and run engine until normal operating temperature is reached, re-attach tool, apply recommended pressure and increase engine speed to half throttle.

(7) If needle on dial fluctuates, it indicates a combustion leak, generally the head gasket.

(8) If needle on dial did not fluctuate in step (6), sharply accelerate the engine several times. If an abnormal amount of water emits from the tail pipe it indicates a head gasket leak, cracked block or head.

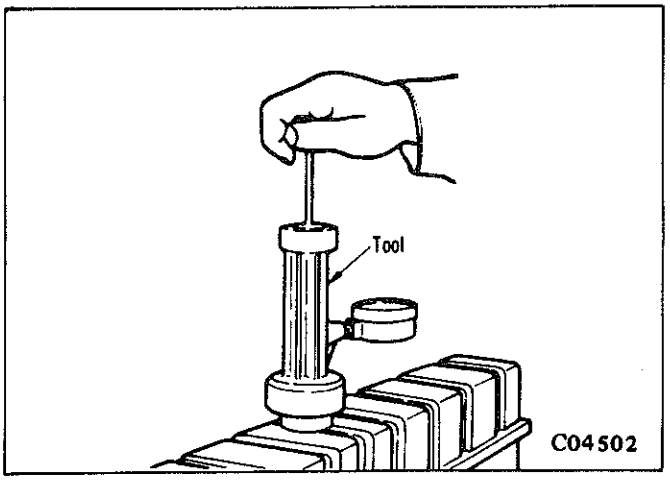

Fig. 1—Pressure testing the cooling system

RADIATOR CAP

This cap is a pressure sealing type, its purpose is to hold the cooling system under slight pressure, increasing the boiling point of the cooling solution and preventing loss of solution due to evaporation and overflow.

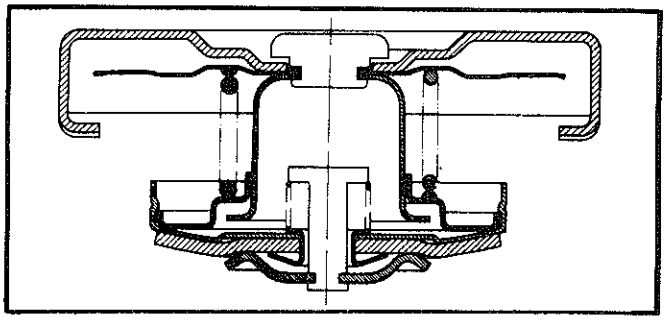

Fig. 2—Radiator cap

The cap has a spring loaded valve, the seat of which is below the overflow pipe, this prevents escape of air or liquid while the cap is in position.

When the cooling system pressure reaches a pre-determined point, the cap valve opens and will again close when the pressure drops below the pre-determined point.

CAUTION: To avoid scalding with steam or hot water the following procedure should be used when removing a radiator cap.

(1) Cover the cap with several layers of cloth and loosen the cap to the first notch. This will release pressure through the overflow pipe.

(2) When the pressure has been released, turn the cap to the fully released position and remove.

NOTE: Do not add cold water to an engine that has overheated. Allow the engine to cool then refill the cooling system slowly while running the engine to provide circulation of the coolant. This will avoid cracking of the cylinder head or block.

PRESSURE TESTING THE RADIATOR CAP

(1) Attach neoprene seal and adaptor to tester E7C15 (See Fig. 3).

(2) Dip the pressure cap in water and apply cap to tester adaptor.

(3) Apply specified pressure to cap. If cap fails to hold pessure, replace the cap.

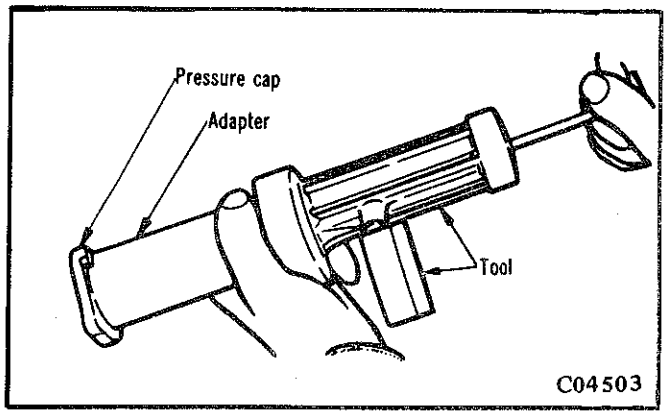

Fig. 3—Testing the pressure cap (Tool E7C15)

PRESSURE FLUSHING THE COOLING SYSTEM

(1) Clean the system, using a cooling system cleaner according to the directions on the label.

(2) Drain the radiator and remove both radiator hoses.

(3) Remove the thermostat and re-install the housing.

(4) Connect flushing gun, Tool E7C20, to the engine thermostat housing, using a length of rubber hose.

(5) Install a drain hose in the water pump inlet.

(6) Connect a flushing gun to sources of water and air pressure.

(7) Fill the block with water by restricting the drain hose. Leave the water valve open.

(8) Open and close the air valve to agitate and force away any foreign material. Continue the operation until the water runs clear.

(9) For final block flushing, fill the block with water and remove the drain plug. Use air pressure until the water from the block drains runs clear.

(10) To pressure flush the radiator, disconnect the two hoses from the engine and attach them to the radiator. Attach the flushing gun hose to the lower radiator tank and drain hose to the top tank.

(11) Fill the radiator with water, leave the water valve open, then open and close the air valve until the water runs clear.

(12) For final radiator flushing, attach flushing gun to top hose and repeat flushing operation.

(13) Test the thermostat. If satisfactory install with pellet toward engine, using new gasket (refer Fig. 6).

(14) Install hoses and refill cooling system as previously described.

(15) Run engine until normal operating temperature is reached and continue an additional five minutes to release any air trapped in system. Check coolant level and top up if necessary.

DRIVE BELTS

To correctly adjust the alternator drive belt, the following procedure should be adhered to:

(1) Loosen the alternator adjusting strap and mounting bolts.

(2) With the aid of a suitable lever, tension the drive belt being careful not to damage components.

(3) Tighten the adjusting strap bolt.

(4) Apply a 98 N (22 lbf.) to the centre of the longest run of the belt using a spring scale. The belt deflection at the point of load should be as shown in Specifications.

(5) When the correct belt deflection is achieved, tighten the adjusting and mounting bolts securely.

NOTE: Any belt that has been replaced must be checked and re-adjusted after stretching. A belt that has been operated for a minimum of half an hour is considered used.

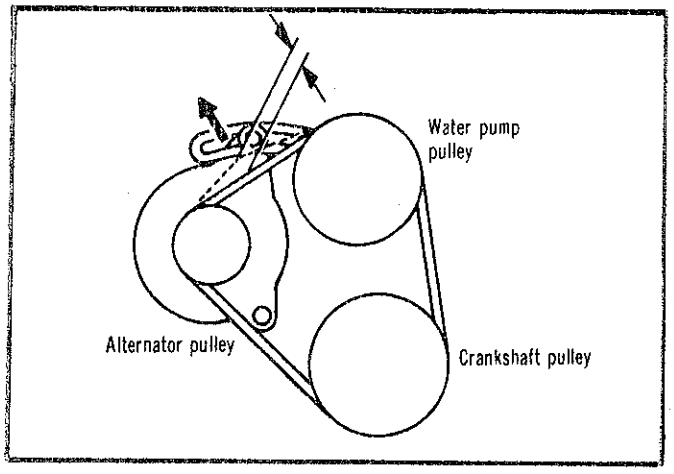

Fig. 4—Drive belt deflection

RADIATOR AND ENGINE HOSES

All hoses are retained by worm drive hose clips. A hardened, cracked, or swollen hose should be replaced.

WATER PUMP

Chain Drive Camshaft Engine

The water pump is a centrifugal impeller type and is mounted to the timing chain case. The pump can be disassembled for service.

Removal

(1) Remove the radiator as previously described.
(2) Loosen the alternator mounting bolts and remove the fan belt.
(3) Remove the fan and drive pulley.
(4) Remove the water pump mounting bolts and remove the water pump.

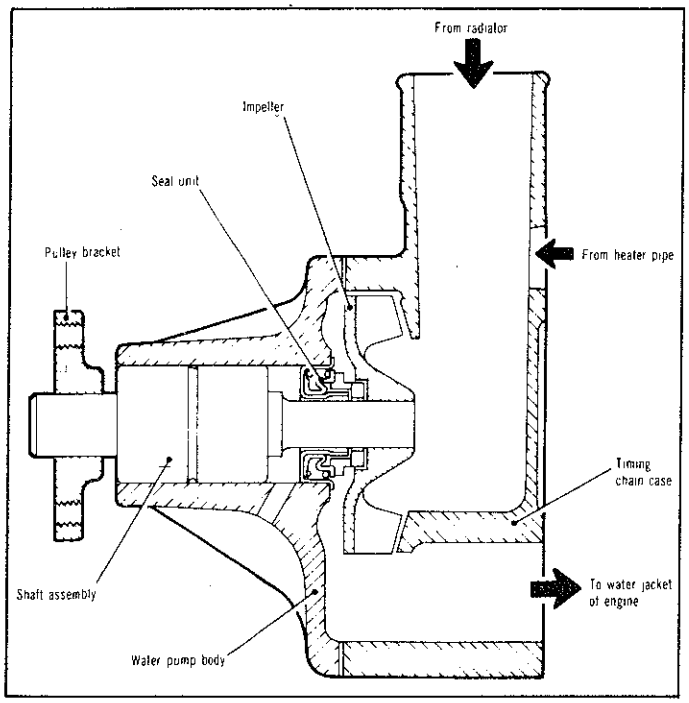

Fig. 5—Water pump assembly (chain drive camshaft engine)

Installation

Install the water pump by reversing the removal procedure and noting the following:
(1) Apply sealant to the water pump gasket.
(2) Adjust the drive belt tension as previously described.
(3) Fill the cooling system with rain or demineralized water adding corrosion inhibitor (or anti-freeze as required).

Disassembly

(1) Remove the impeller using a suitable puller.
(2) Remove the pump shaft seal.
(3) Remove the pulley bracket using a suitable puller.
(4) Heat the water pump body to 100°C (212°F) and remove the shaft assembly using a press.

Inspection

(1) Check the pump body for cracks, damage or wear, replace any faulty components.
(2) Check the bearing for damage, noise and tightness, replace if necessary.
(3) Ensure a new shaft seal is fitted.

Assembly

(1) Heat the pump body to 100°C (212°F) and press in the shaft assembly until the face of the bearing is flush with the front of the pump body.
(2) Install the new pump shaft seal.
(3) Press the impeller onto the shaft, with the vanes facing out, until the impeller face is flush with the shaft face. Ensure that the distance between the body end face and the shaft end face is as shown in Fig. 6.
(4) Install the pulley bracket to the shaft and in the position shown in Fig. 6.

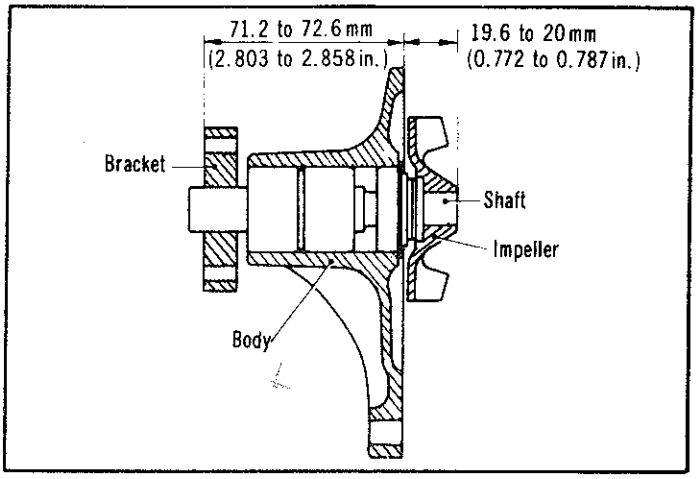

Fig. 6—Impeller and pulley bracket position

Belt Drive Camshaft Engine

The water pump is a centrifugal impeller type and is mounted to the cylinder block. The pump is non-serviceable and if faulty must be replaced.

Removal

(1) Remove the radiator as previously described.
(2) Loosen the alternator mounting bolts and remove the fan belt.
(3) Remove the fan and drive pulley.
(4) Position No. 1 piston on TDC on compression stroke.

NOTE: DO NOT rotate engine anti-clockwise.

(5) Remove the crankshaft pulley bolts and remove the pulley.
(6) Remove the timing belt covers and timing belt as described in Group 9 Engine.
(7) Remove the water pump mounting bolts and remove the pump.

Inspection

Check the pump housing for cracks and leaks, the bearing and seal for noise and the impeller for smooth, light rotation. If the pump is defective in any way, it must be replaced as an assembly.

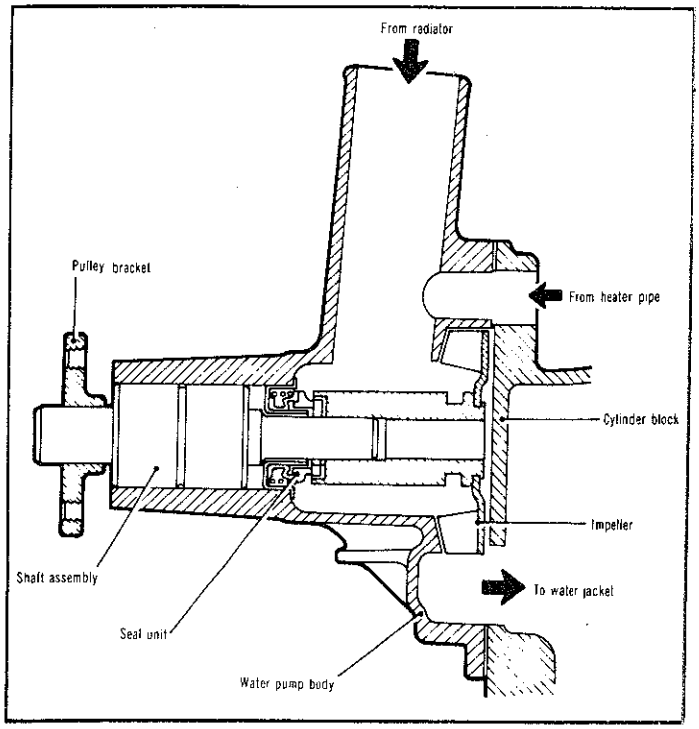

Fig. 7—Water pump assembly (belt drive camshaft engine)

Installation

Install the water pump by reversing the removal procedure and noting the following:

(1) Apply sealant to the water pump gasket.

(2) Adjust the camshaft drive belt as described in Group 9 Engine.

(3) Ensure the crankshaft pulley is correctly positioned on the locating lug.

(4) Adjust the fan drive belt as previously described.

(5) Fill the cooling system with rain or demineralized water adding corrosion inhibitor (or anti-freeze as required).

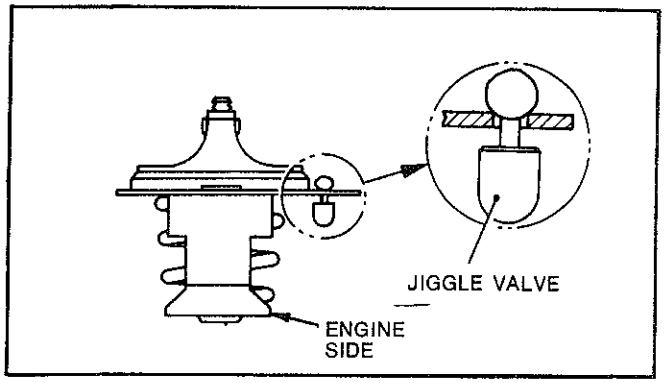

Fig. 8—Thermostat (imported type)

THERMOSTAT

The thermostat is a wax type which opens and closes at a predetermined water temperature. A jiggle valve is fitted to the air bleed hole in the flange of imported thermostats. This valve prevents leakage through the bleed hole thus minimising warm up time.

Removal

(1) Drain the coolant below the level of the thermostat housing.

(2) Remove the top hose from the thermostat housing.

(3) Remove the thermostat housing and withdraw the thermostat.

Inspection

(1) Immerse the thermostat in a container of water, raise the temperature of the water while stirring to ensure even heat distribution.

(2) Measure the thermostat opening temperature with a thermometer and check that it conforms to specification.

(3) Replace the thermostat if the test result is not satisfactory.

Installation

Install by reversing removal procedure making sure sealant is applied to both sides of the thermostat housing gasket. Top up the cooling system.

WATER TEMPERATURE GAUGE UNIT

The temperature sender unit is a thermister type and is attached to the bottom of the thermostat housing. The resistance of the unit varies with water temperature.

NOTE: Early model vehicles equipped with an imported sender unit with a "blade" type terminal, later model vehicles have a local sender unit with a "button" shaped terminal. Imported senders must be matched to imported instruments and local senders to local clusters.

Testing Sender Unit

Place the bottom part of the unit in water and heat the water. Measure the resistance of the unit with an ohmmeter as shown in Fig. 9.

Resistance of the imported unit at 80°C (176°F) should be 68,4 to 82,4 ohms. On local instruments, the reading should be 55,8 to 77,4 ohms at 100°C (212°F).

If the unit does not conform to specification it must be replaced.

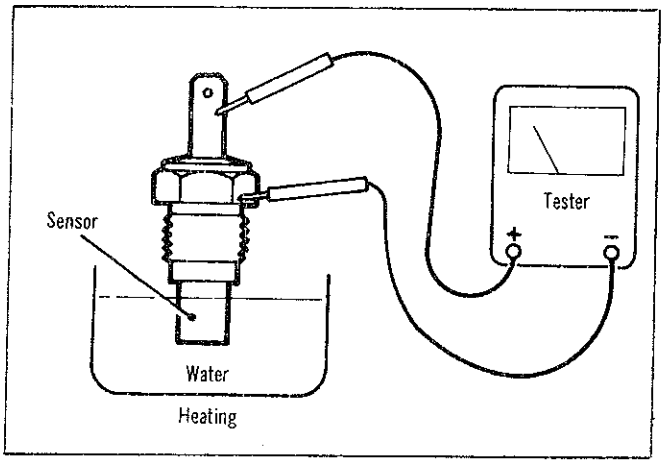

Fig. 9—Testing temperature sending unit

SECTION 2A — COOLING SYSTEM, ASTRON ENGINE

SPECIFICATIONS

Engine Type	Astron
Radiator	
Type	Vertical Flow
Capacity (with heater)	
Sedan and Wagon — early 1,85 and 2,0 litre	7,7 litres (12.4 pts.)
— late 2,0 and 2,6 litre	9,2 litres (16.2 pts.)
Two Door	7,7 litres (12.4 pts.)
Core Size	
— Sedan and Wagon (early 1,85 and 2,0 litre)	484 mm x 32 mm x 350 mm (19" x 1.25" x 13.8")
— Sedan and Wagon (late 2,0 and 2,6 litre)	484 mm x 32 mm x 392 mm (19" x 1.25" x 15.5")
— Two Door (2,0 litre)	490 mm x 32 mm x 350 mm (19.3" x 1.25" x 13.8")
Fin Spacing	
— Sedan and Wagon (early 1,85 and 2,0 litre)	12 F per 25 mm (1")
— Sedan and Wagon (late 2,0 and 2,6 litre)	14 F per 25 mm (1")
— Two Door (2,0 litre)	10 F per 25 mm (1")
Automatic Transmission Oil Cooler — Type	Concentric Tube
— Location	Radiator Bottom Tank
Pressure Cap — Type	Pressure Vent
— Pressure Setting — Nominal	110 kPa (16 p.s.i.)
— Tolerance	98 to 117 kPa (14 to 17 p.s.i.)
Engine Coolant pH level	8 — 9
Fan	
Drive Unit	Torque Drive Clutch
No. of Blades	6
Diameter	380 mm (15.0")
Pitch	38 mm (1.5")
Belt Deflection (at longest run)	7,0 to 9,0 mm (0.28" to 0.35")
Water Pump	Centrifugal Impeller Type
Thermostat — Type	Wax Type
— Opening Temperature	81° to 84°C (178° to 183°F)
— Full Open Temperature	95°C (203°F)

SPECIAL TOOLS

E7C15	Pressure Tester
E7C20	Pressure Flushing Gun

TORQUE SPECIFICATIONS

	Nm	lb./ft.	lb./in.
Alternator adjusting strap bolts	15-22	11-16	
Water pump to timing cover	9-12		84-108
Fan drive unit to water pump	8-9		72-84
Fan to drive unit	8-9		72-84
Thermostat housing	9-12		84-108
Temperature sender unit	30-42	22-30	
Oil Cooler Connections	11-14		97-124

GENERAL INFORMATION

The engine is water cooled using a vertical flow fin and tube radiator, a belt driven centrifugal water pump, a thermostat and a torque type clutch fan drive unit.

Water is circulated by the pump through the cylinder block, the head and then through the top hose to the top tank of the radiator. Water passing down through the radiator is cooled by air flow through the radiator fins.

Heated water is drawn from the cylinder head to the inlet manifold, the automatic choke and to the heater/demister.

NOTE: The alloy content of this engine makes it essential that an effective level of corrosion inhibitor be maintained in the cooling system.

A pH between 8 and 9 indicates the correct amount of corrosion inhibitor. Check using pH indicator paper.

COOLANT RECOVERY SYSTEM (2.6 litre only)

The coolant recovery system has a translucent plastic reservoir with a connecting tube to the radiator filler neck and a special pressure cap. The plastic reservoir has a filler opening with a plastic flip top type cap. With this system the radiator is normally completely full. When heated, coolant in the engine expands and is forced out of the radiator and overflows into the reservoir. When the engine cools down the coolant contracts and vacuum draws coolant from the reservoir back into the radiator thus keeping it full.

RADIATOR

Removal

(1) Drain the cooling system and remove the top and bottom radiator hoses and the transmission cooler pipes (if equipped).

(2) Remove the radiator fan shroud attaching nuts and bolts and remove the shroud in sections. (if equipped).

(3) Remove the radiator attaching nuts and remove the radiator.

NOTE: During removal, care should be taken to avoid damaging the radiator cooling fins and tubes.

Installation

(1) Slide the radiator down into position being careful not to damage the cooling fins and tubes. Install the radiator retaining nuts.

(2) Install the radiator hoses and clamps ensuring they are securely retained. Connect the transmission cooler lines (if equipped).

(3) Fill the cooling system to 25 mm (1") below the filler neck with rain water or "demineralized" water adding corrosion inhibitor (or antifreeze where required).

(4) On vehicles equipped with automatic transmission, measure the transmission fluid after warm up and add fluid if required.

PRESSURE TESTING THE COOLING SYSTEM

(1) For testing purposes only, fill radiator to within 13 mm (½") of filler neck.

(2) Wipe filler neck sealing surface clean.

(3) Attach tool E7C15 to filler neck and apply recommended pressure as listed in specifications.

(4) If pressure gauge holds steady, the system is satisfactory. If pressure drops, continue as follows:

(5) Check all points for external leaks, if none are evident after the dial gauge shows drop in pressure, continue test.

(6) Remove tester and run engine until normal operating temperature is reached, re-attach tool, apply recommended pressure and increase engine speed to half throttle.

(7) If needle on dial fluctuates, it indicates a combustion leak, generally the head gasket.

(8) If needle on dial did not fluctuate in step (6), sharply accelerate the engine several times. If an abnormal amount of water emits from the tail pipe it indicates a head gasket leak, cracked block or head.

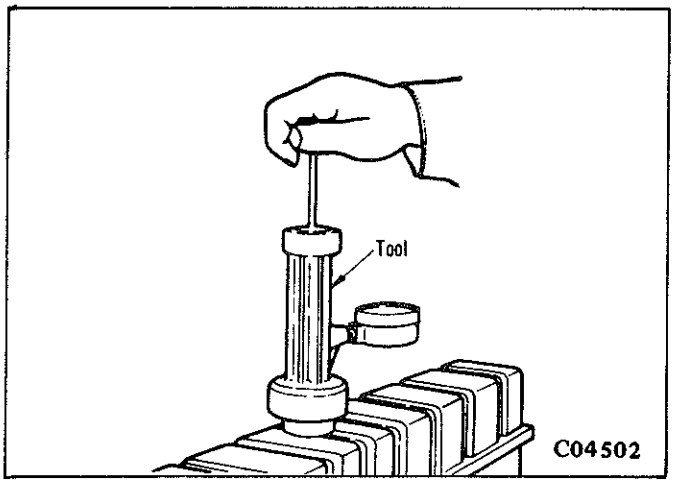

Fig. 1—Pressure testing the cooling system

RADIATOR CAP

This cap is a pressure sealing type, its purpose is to hold the cooling system under slight pressure, increasing the boiling point of the cooling solution and preventing loss of solution due to evaporation and overflow.

The cap has a spring loaded valve, the seat of which is below the overflow pipe, this prevents escape of air or liquid while the cap is in position.

When the cooling system pressure reaches a pre-determined point, the cap valve opens and will again close when the pressure drops below the pre-determined point.

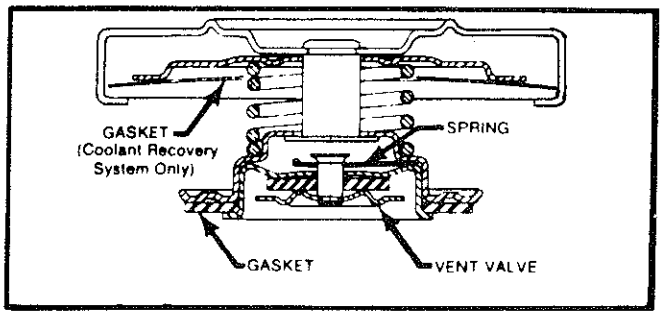

Fig. 2—Radiator cap

CAUTION: To avoid scalding with steam or hot water the following procedure should be used when removing a radiator cap.
(1) Cover the cap with several layers of cloth and loosen the cap to the first notch. This will release pressure through the overflow pipe.
(2) When the pressure has been released, turn the cap to the fully released position and remove.

NOTE: Do not add cold water to an engine that has overheated. Allow the engine to cool then refill the cooling system slowly while running the engine to provide circulation of the coolant. This will avoid cracking of the cylinder head or block.

PRESSURE TESTING THE RADIATOR CAP

(1) Attach neoprene seal and adaptor to tester E7C15 (See Fig. 3).
(2) Dip the pressure cap in water and apply cap to tester adaptor.
(3) Apply specified pressure to cap. If cap fails to hold pressure, replace the cap.

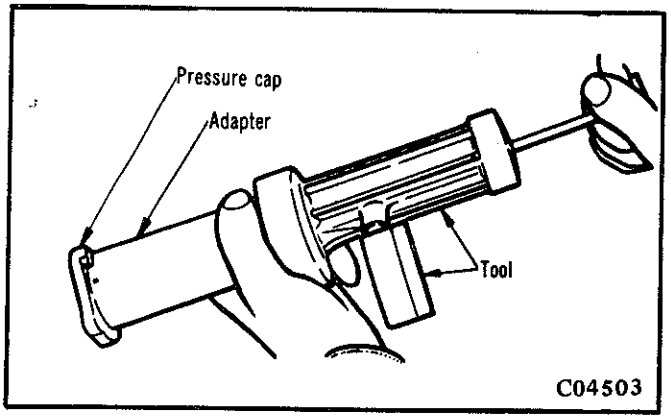

Fig. 3—Testing the pressure cap (Tool E7C15)

Testing Coolant Recovery System

With coolant in the reservoir at the proper level and the radiator cap installed, remove the engine drain plug. Coolant should be drawn from the reservoir into the radiator. **Do not** leave the drain plug out too long as this could allow air to enter the system. If test does not draw coolant from the reservoir, check for leaks at the radiator filler and overflow nipple, radiator cap and reservoir tube.

It may be necessary to pressure test the radiator cap and cooling system to locate a leak.

PRESSURE FLUSHING THE COOLING SYSTEM

(1) Clean the system, using a cooling system cleaner according to the directions on the label.
(2) Drain the radiator and remove both radiator hoses.
(3) Remove the thermostat and re-install the housing.
(4) Connect flushing gun, Tool E7C20, to the engine thermostat housing, using a length of rubber hose.
(5) Install a drain hose in the water pump inlet.
(6) Connect a flushing gun to sources of water and air pressure.
(7) Fill the block with water by restricting the drain hose. Leave the water valve open.
(8) Open and close the air valve to agitate and force away any foreign material. Continue the operation until the water runs clear.
(9) For final block flushing, fill the block with water and remove the drain plug. Use air pressure until the water from the block drains runs clear.
(10) To pressure flush the radiator, disconnect the two hoses from the engine and attach them to the radiator. Attach the flushing gun hose to the lower radiator tank and drain hose to the top tank.
(11) Fill the radiator with water, leave the water valve open, then open and close the air valve until the water runs clear.
(12) For final radiator flushing, attach flushing gun to top hose and repeat flushing operation.
(13) Test the thermostat. If satisfactory install with pellet toward engine, using new gasket (refer Fig. 6).
(14) Install hoses and refill cooling system as previously described.
(15) Run engine until normal operating temperature is reached and continue an additional five minutes to release any air trapped in system. Check coolant level and top up if necessary.

DRIVE BELTS

To correctly adjust the alternator drive belt, the following procedure should be adhered to:
(1) Loosen the alternator adjusting strap and mounting bolts.
(2) With the aid of a suitable lever, tension the drive belt being careful not to damage components.
(3) Tighten the adjusting strap bolt.
(4) Apply a 98 N (22 lb. ft.) to the centre of the longest run of the belt using a spring scale. The belt deflection at the point of load should be as shown in Specification.
(5) When the correct belt deflection is achieved, tighten the adjusting and mounting bolts securely.

NOTE: Any belt that has been replaced must be checked and re-adjusted after stretching. A belt that has been operated for a minimum of half an hour is considered used.

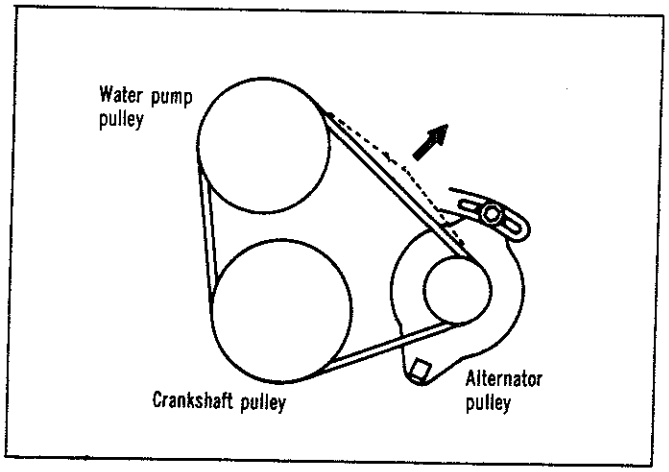

Fig. 4—Drive belt deflection

RADIATOR AND ENGINE HOSES

All hoses are retained by worm drive hose clips. A hardened, cracked or swollen hose should be replaced.

WATER PUMP

The water pump is of the centrifugal impeller type and is mounted to the timing chain case. It is a non-serviceable unit and must be replaced if faulty.

Removal

(1) Remove the radiator as previously described.
(2) Loosen the alternator mounting bolts and remove the fan belt.
(3) Remove the fan drive unit mounting bolts and remove the fan.
(4) Remove the fan drive unit.
(5) Remove the water pump mounting bolts and remove the water pump.

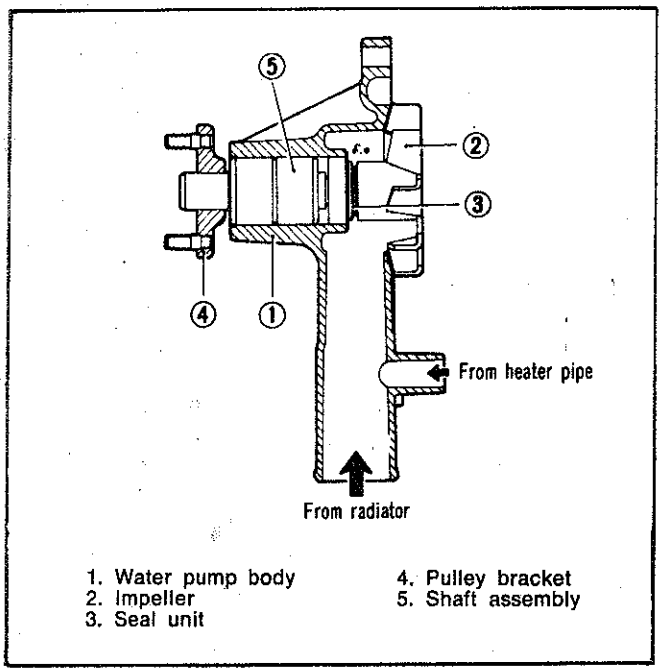

Fig. 5—Water pump construction

Inspection

Check the pump housing for cracks and leaks, the bearing and seal for noise and the impeller for smooth, light rotation. If the pump is defective in any way it must be replaced as an assembly.

Installation

Install the water pump by reversing the removal procedure and noting the following:
(1) Apply sealant to the water pump gasket.
(2) Adjust the drive belt tension as previously described.
(3) Fill the cooling system with rain or "demineralized" water adding corrosion inhibitor (or anti-freeze as required).

THERMOSTAT

The thermostat is a wax type which opens and closes at a predetermined water temperature. A jiggle valve is fitted to the air bleed hole in the flange of imported thermostats. This valve prevents leakage through the bleed hole thus minimising warm up time.

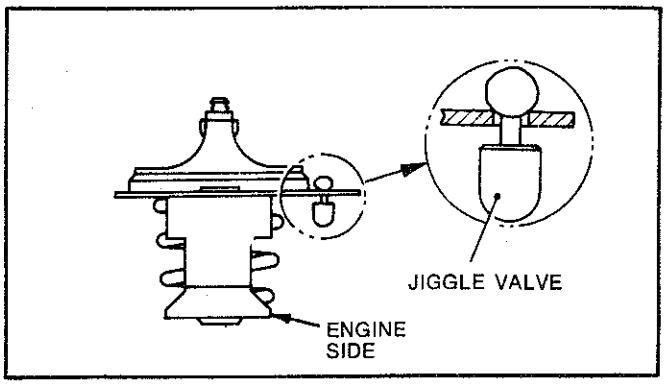

Fig. 6—Thermostat (imported type)

Removal

(1) Drain the coolant below the level of the thermostat housing.
(2) Remove the top hose from the thermostat housing.
(3) Remove the thermostat housing and withdraw the thermostat.

Inspection

(1) Immerse the thermostat in a container of water, raise the temperature of the water while stirring to ensure even heat distribution.
(2) Measure the thermostat opening temperature with a thermometer and check that it conforms to specification.
(3) Replace the thermostat if the test result is not satisfactory.

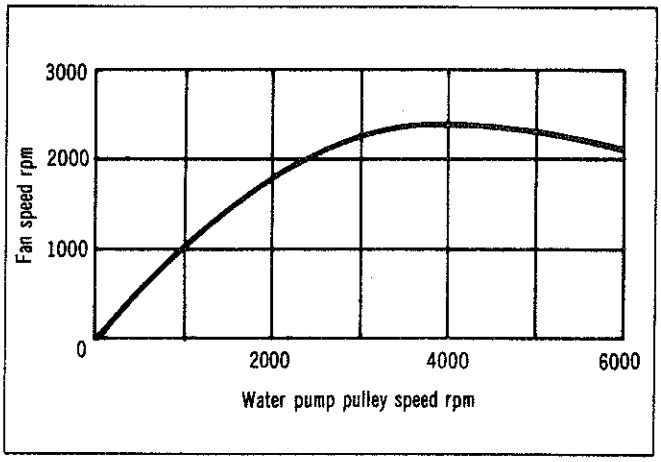

Fig. 7—Fan drive unit characteristics

Installation

Install by reversing removal procedure making sure sealant is applied to both sides of the thermostat housing gasket. Top up the cooling system.

FAN DRIVE UNIT

The fan drive unit torque type clutch varies the fan speed in respect to the water pump pulley speed. This reduction in fan speed minimizes fan noise and engine power loss at high speed.

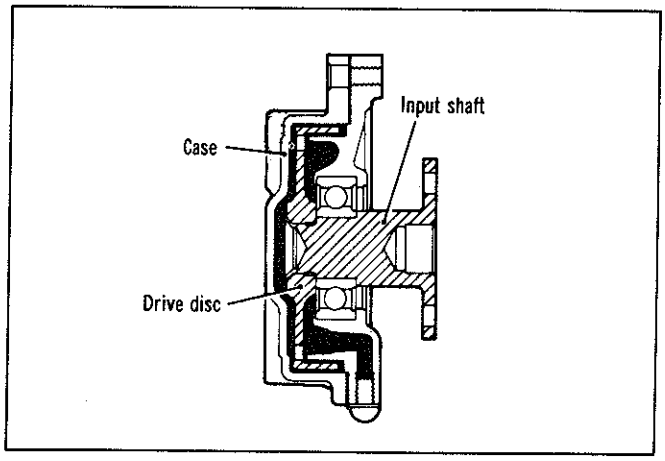

Fig. 8—Sectioned view of fan drive unit

In case of engine overheating and the fan drive unit is suspected, replace the unit with a known good one and retest the vehicle under the same overheating conditions. If the overheating is corrected, replace the original fan drive unit.

WATER TEMPERATURE GAUGE UNIT

The temperature sender unit is a thermister type and is attached to the bottom of the thermostat housing. The resistance of the unit varies with water temperature.

NOTE: Early model vehicles equipped with an imported sender unit with a "blade" type terminal, later model vehicles have a local sender unit with a "button" shaped terminal. Imported senders must be matched to imported instruments and local senders to local clusters.

Testing Sender Unit

Place the bottom part of the unit in water and heat the water. Measure the resistance of the unit with an ohmmeter as shown in Fig. 9.

Resistance of the imported unit at 80°C (176°F) should be 68,4 to 82,4 ohms. On local senders, the reading should be 55,8 to 77,4 ohms at 100°C (212°F).

If the unit does not conform to specification it must be replaced.

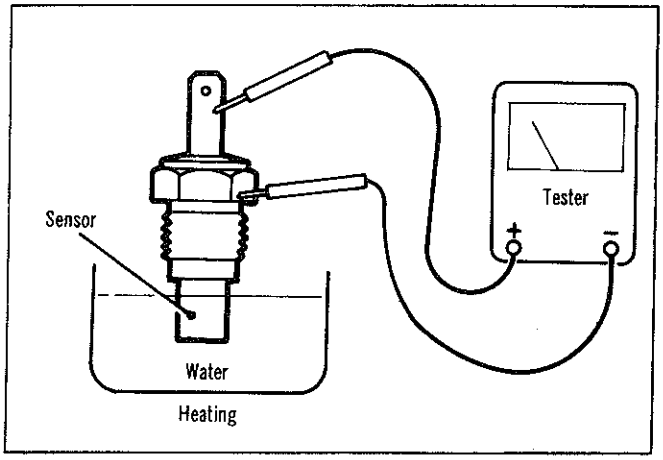

Fig. 9—Testing temperature sending unit.