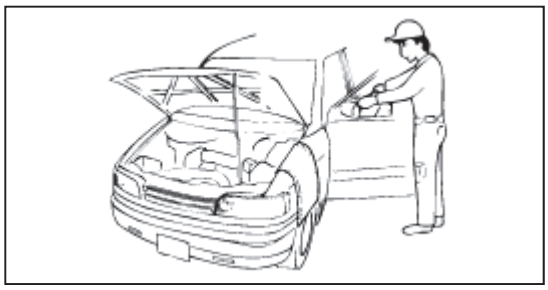
NOTICES, CAUTIONS, AND WARNINGS

As you read through the various procedures, you will encounter Notice, Cautions and Warnings. Each one is there for a specific purpose. Notice give you added information that will assist you in completing a particular procedure. Cautions prevent you from making an error that could damage the vehicle. Warnings remind you to be especially careful in specific areas where carelessness can cause personal injury.

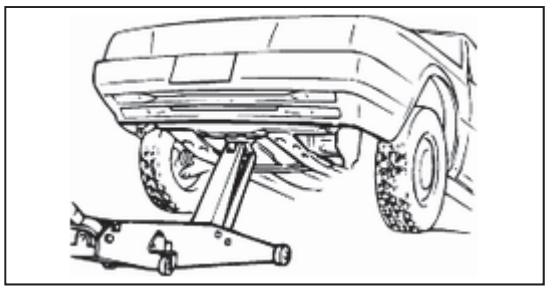
The following items contain general procedures you should always follow when working on a vehicle:

PROTECTION OF THE VEHICLE



- Always cover fenders, seats, and floor areas before starting work.

A WORD ABOUT SAFETY

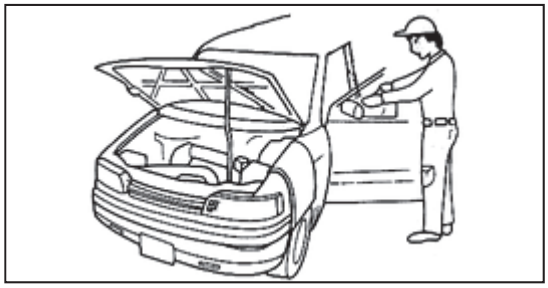


The following precautions must be followed when jacking up the vehicle:

1. Block the wheels.
2. Use only the specified jacking positions.
3. Support the vehicle with safety stands.

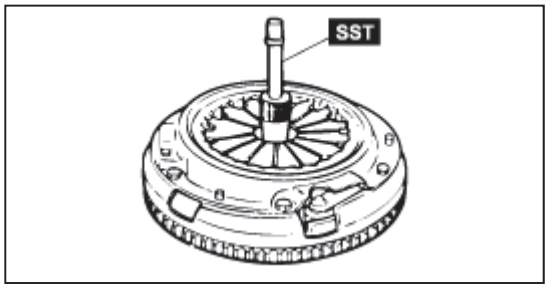
Start the engine only after making certain the engine compartment is clear of tools and people.

PREPARATION OF TOOLS AND MEASURING EQUIPMENT



- Be sure all necessary tools and measuring equipment should be available before starting any work.

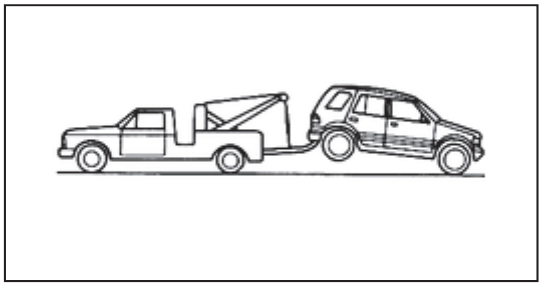
SPECLAL SERVICE TOOLS (SST'S)

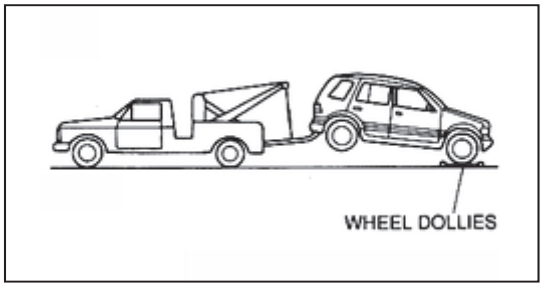


- Use special service tools when they are required.

TOWING

1. Proper towing equipment is necessary to prevent damage to the vehicle.
   Always observe laws and regulations applicable to vehicles in tow. As a general rule, towed vehicles should be pulled with the driving wheels off the ground. If excessive damage or other conditions prevent towing the vehicle with the driving wheels off the ground, use wheel dollies.





2. WITH MANUAL TRANSMISSION

   If the transmission, rear axle, and steering system are not damaged, the vehicle may be towed on all four wheels. If any of these components are damaged, use a towing dolly.

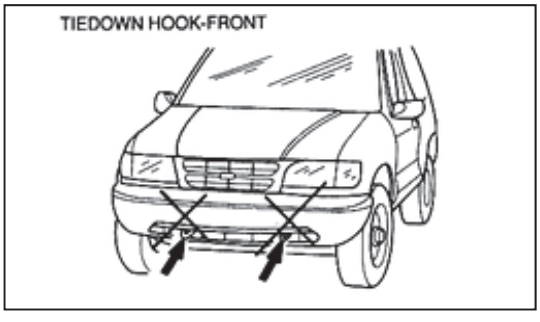
3. WITH AUTOMATIC TRANSMISSION

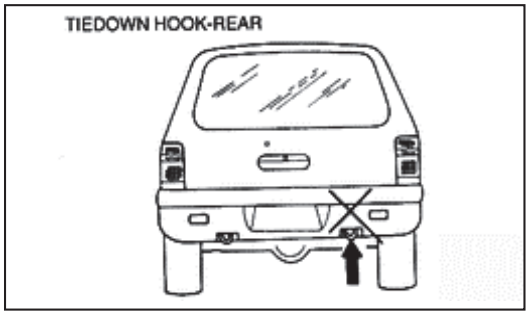
   If excessive damage or other conditions prevent towing the vehicle with the driving wheels off the ground, use a towing dolly. With all wheels on the ground, the vehicle may be towed only forward. In this case, do not exceed 56km/h (35 mph)or a distance of 56 km (35 miles) or transmission damage could result.
   If towing speed will exceed 56 km/h (35 mph), or if towing distance will exceed 56 km (35 miles), use one of these methods :
   (1) Place the rear wheels on a dolly.
   (2) Tow with the rear wheels off the ground.
   (3) Disconnect the rear propeller shaft.

   If the transmission or rear axle is inoperative, tow the vehicle with its rear wheels off the ground or disconnect the rear propeller shaft.

CAUTION

- The power assist for the brakes and steering are inoperable while the engine is off.
- Do not use the hook loops under the front or rear of the vehicle for towing. These hook loops are designed ONLY for transport tie down. If tie down hook loops are used for towing the front or rear skirt and bumper will be damaged.





ABBREVIATIONS

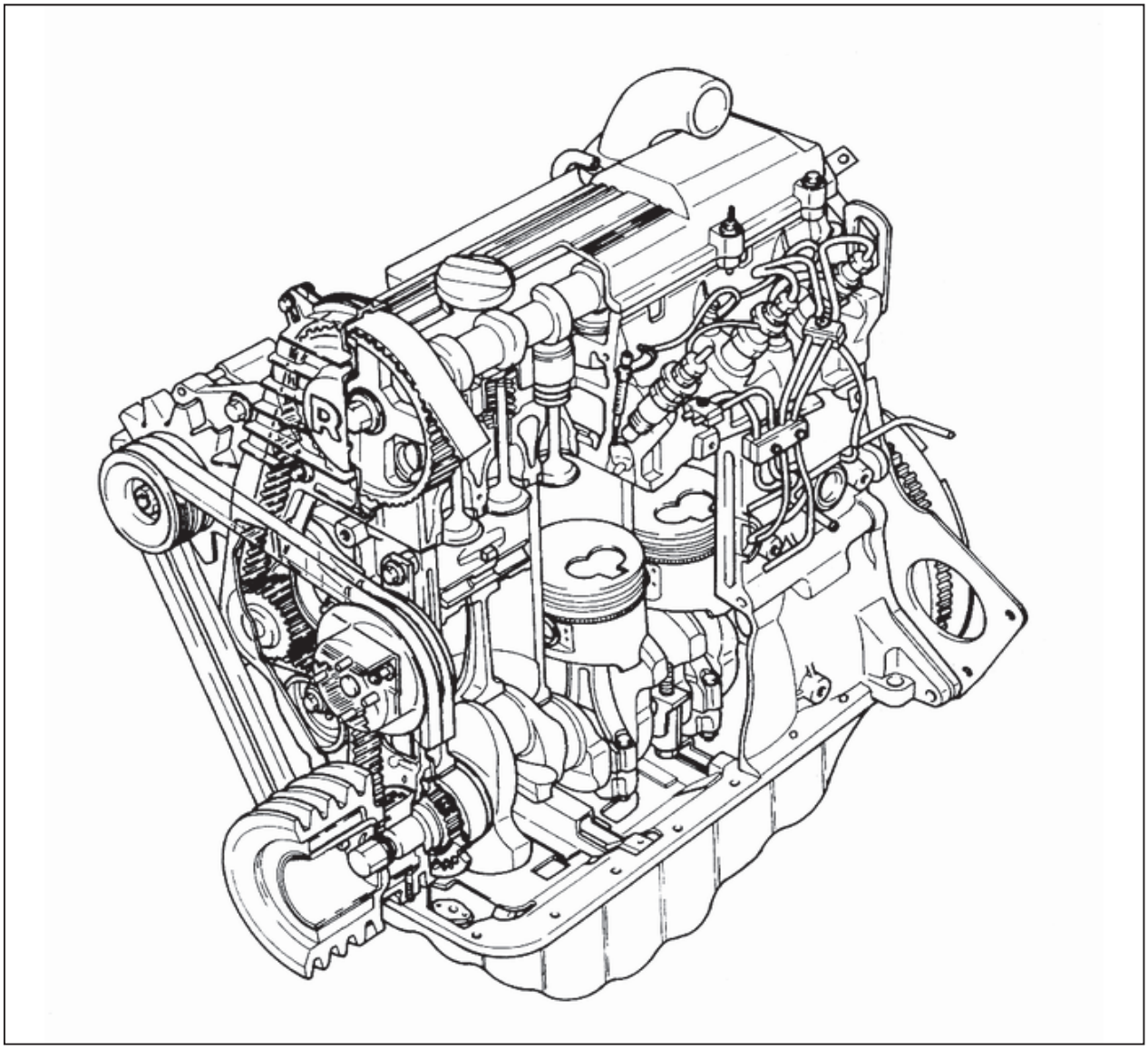
ABDC	After bottom dead center
A/C	Air conditioner
ACC	Accessories
ATX	Automatic transaxle
ATDC	After top dead center
ATF	Automatic transaxle fluid
BAC	Bypass air control
BBDC	Before bottom dead center
BTDC	Before top dead center
CPU	Central processing unit
DRL	Daytime running lights
EC-AT	Electronically-controlled automatic transaxle
ECU	Engine control unit
EGI	Electronic gasoline injection
E/L	Electrical load
EX	Exhaust
GND	Ground
HLA	Hydraulic lash adjuster
IGN	Ignition
IN	Intake
INT	Intermittent
ISC	Idle speed control
LH	Left hand
M	Motor
MIL	Malfunction indicator lamp
M/S	Manual steering
MTX	Manual transaxle
OD	Overdrive

GENERAL INFORMATION

OUTLINE OF CONSTRUCTION

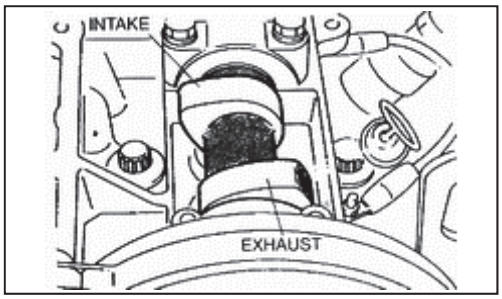
The new magma or R2 diesel engine, by using the latest technological advances, is an excellent balance of output, fuel consumption, durability and quiet operation.

1. Aluminum alloy cylinder head
2. Direct-drive OHC
3. Timing belt
4. New tightening method for cylinder head bolts
5. Oil baffle plate for vibration reduction



ADJUSTMENT OF VALVE CLEARANCE

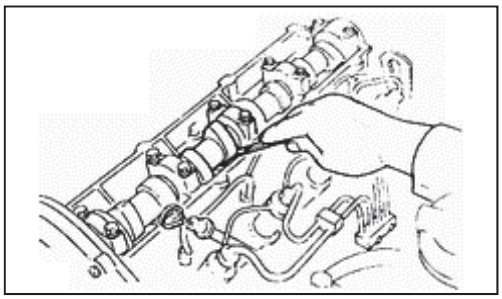
1. Remove the cylinder head cover.
2. Set the No.1 cylinder to compression TDC.



NOTICE

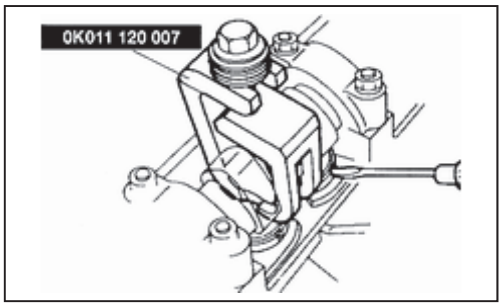
Turn the crankshaft so that the intake and exhaust cam lobes face upward.

3. Measure the valve clearance of No.1 cylinder by using a thickness gauge.

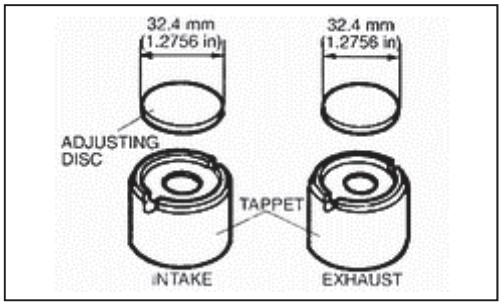


Standard valve clearances (engine cold condition):
- Intake: 0.20~0.30 mm (0.008~0.012.)
- Exhaust: 0.30~0.40 mm (0.012~0.016 in.)

4. Adjust the valve clearances by following the procedures below if they are not within the standard.
   (1) Face the intake cam straight upward.
   (2) Move the tappet so that its notch is at the manifold side, so that access to the adjusting disc is easy.
   (3) Using the tappet holder (0K011 120 007), press the tappet down to the position where the adjusting disc becomes accessible.
   (4) Using a small screw driver or similar tool, take out the adjusting disc.

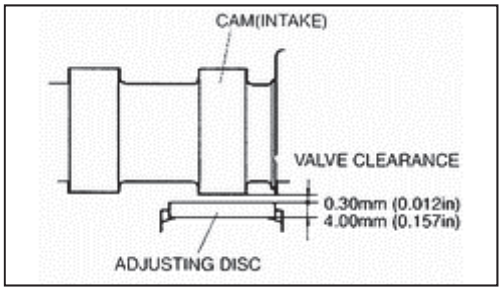


5. Select an appropriate disc depending on the valve clearance measured. Install it and check the clearance again.



Example (Intake valve):

A. Thickness of original adjusting disc + (measured clearance - standard clearance) = thickness of new adjusting disc.
B. 4.00 + (0.30 - 0.25) = 4.05 mm
C. 0.157 + (0.012 - 0.010) = 0.159 in.



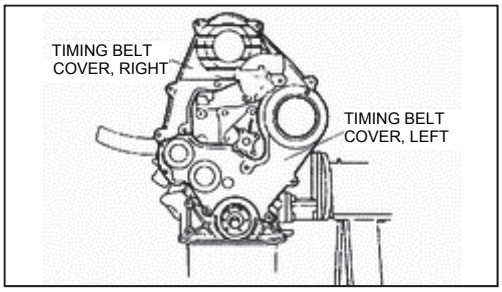
NOTICE

The number marked on the disc indicates its thickness.
Example: 3825 means 3.825 mm (0.1056 in.)
Adjusting discs are available in 37 different thickness within the 3.400-3.650 mm (0.134-0.144 in.), 4.350-4.600 mm (0.171-0.181 in.) range, at intervals of 0.050 mm (0.002 in.) and 3.700-4.275 mm (0.146-0.169 in.) range, at intervals of 0.25 mm (0.00984 in.)

6. Measure and adjust cylinder 2 to 4 in the same way.

8. Install the timing belt cover left with rubber seal.
9. Install the timing belt cover right with rubber seal.

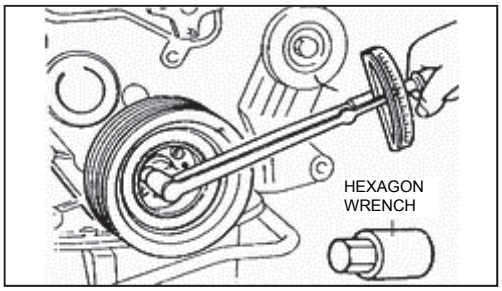
Timing belt covers tightening torque:
7.0~9.81 N·m (0.7~1.0 kg·m, 5~7 lb·ft)



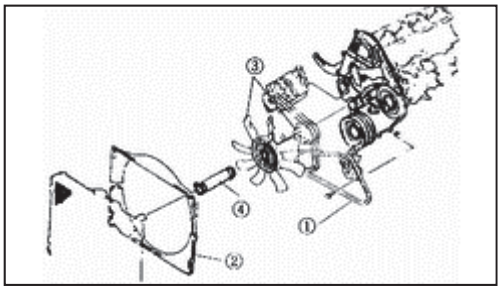
10. Install the crankshaft pulley and the timing belt pulley with the semi circular (wood-ruff) key, then tighten it to the specified torque.

Crankshaft pulley tightening torque:
22.5~32.3 N·m (2.3~3.3 kg·m, 17~24 lb·ft)

CAUTION
Align the torsional damper to the knock pin on the timing belt pulley, when installing.

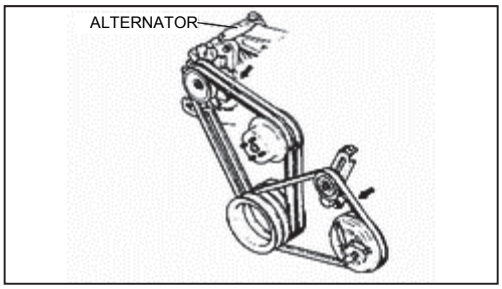


11. Install the following parts.
    (1) Air conditioner drive belt, tensioner and bracket.
    (2) Cooling fan cover.
    (3) Cooling fan pulley and cooling fan.
    (4) Radiator hose, upper.



12 Install the air conditioner drive belt and air conditioner compressor drive belt (if equipped).
13. Adjust each drive belt tension.
To check the belt tension, apply moderate pressure (10 kg, 22 lb) midway between the pulleys. Check the deflection, and adjust it if necessary.

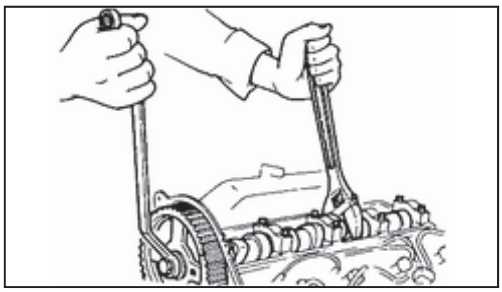
CAUTION
If the drive belt becomes worn, cracked, or frayed, it should be replaced.



Drive belt	Deflection	
	New	Used
1 Alternator	11~12 mm (0.44~0.47 in.)	12~14 mm (0. 47~0.55 in.)
2 Air conditioner compressor	4~5 mm (0.16~0.20 in.)	5~6 mm (0.20~0.24in.)

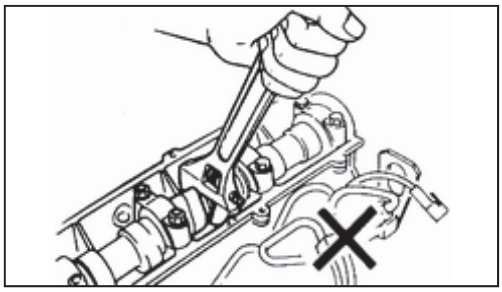
14 Fill the radiator with coolant.

Camshaft pulley



1. Hold the camshaft with a wrench (29 mm, 1.1 in.) and loosen the camshaft pulley lock bolt.

   CAUTIONS
   - Don't damage the edge of the cylinder head with the wrench.
   - If damaged, engine oil may leak.



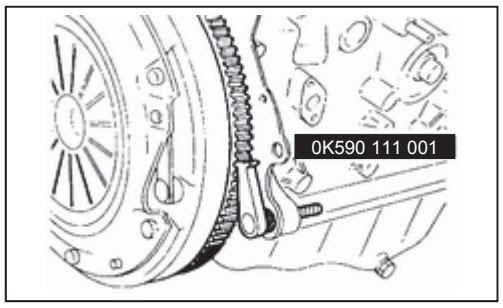
2. Separate the camshaft pulley from the camshaft by referring the procedure of the injection pump pulley described above.

Timing belt pulley

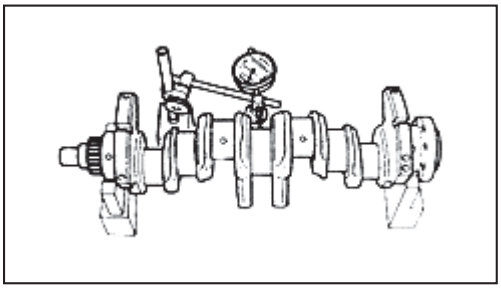
Remove the timing belt pulley.

CAUTION

Set the ring gear brake (0K590 111 001) securely, before loosening the lock bolt.



Crankshaft

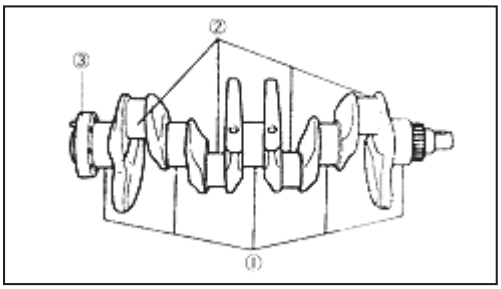


1. Check around the journals and pins for damage, scoring, and oil hole clogging.
2. Check the crankshaft defection and each diameter. Replace if necessary.

Deflection limit : 0.05 mm (0.002 in.)

Standard journal diameters

- Main journal diameter: 59.97~59.96 mm (2.360~2.361 in.)
- Crankshaft pin diameter : 50.94~50.955 mm (2.0055~2.0061 in.)
- Rear housing oil seal sliding surface : 89.95~90.00 mm (3.541~3.543 in.)



Journal wear limit : 0.05 mm (0.002 in.)
Deflection limit : 0.05 mm (0.002 in.)

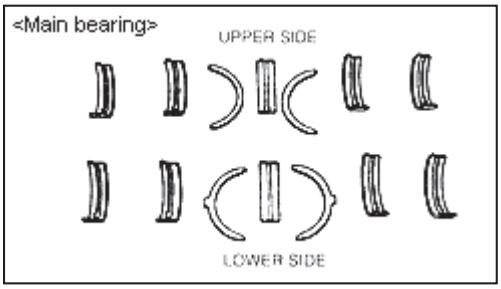
If the wear exceeds the limit, replace or grind the crankshaft to agree with the undersize bearing.

- Undersize bearings : 0.25 mm (0.010 in.), 0.50 mm (0.020 in.), 0.75 mm (0.0295 in.)

CAUTION

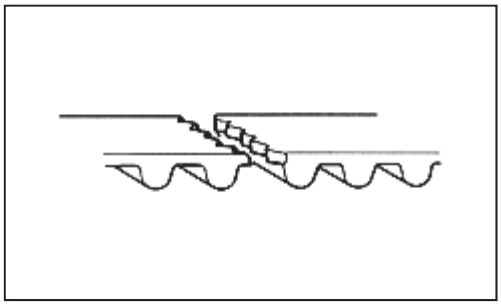
When grinding the journal or pin, pay attention to each Fillet R dimension.

Main and connecting rod bearings



1. Check the main and connecting rod bearings
   (1) Check the bearing inside surfaces for streaking, flaking, pin holes, etc.; replace all bearings as a set if there is a problem.

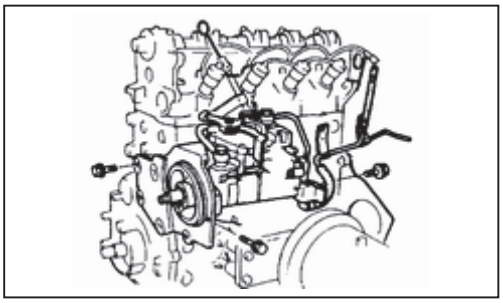
Timing belt



If there are problems, as shown in the figures, check the following points and replace the timing belt if necessary.

1. Premature severance
   (1) Check for proper installation.
   (2) Check timing belt cover gaskets for damage and installation.

Injection pump



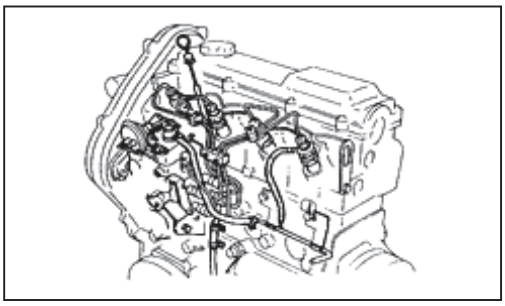
Install the injection pump with the fuel feed pipe and injection pump bracket.

1. Install the oil pressure switch.
2. Install the oil level gauge.

NOTICE

In case the injection pump bracket and the injection pump are separated, injection timing adjustment is necessary after installing the timing belt.

Injection pipe



1. Install the fuel injection pipes.

Fuel injection pipe tightening torque :

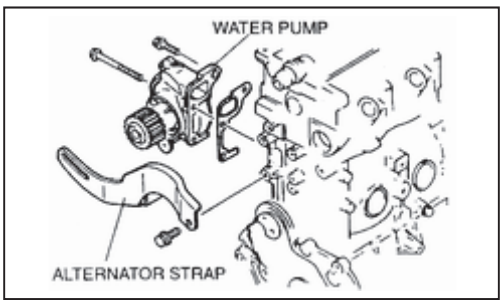
17.6 ~ 22.5 N·m (1.8 ~ 2.3 kg·m, 13 ~ 17 lb·ft)

CAUTION

Check to be sure that no dirt or other foreign material has adhered to the pipe coupling.

2. Tighten the clip channels.

Water pump



1. Install the water pump trough the gasket and alternator strap, and tighten it to specified torque.

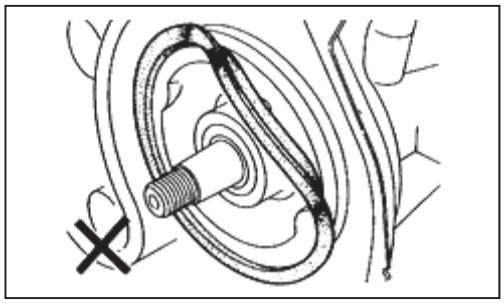
Water pump tightening torque :

31.3 ~ 46.1 N·m (3.2 ~ 4.7 kg·m, 23 ~ 34 lb·ft)

CAUTION

Before installation, remove any dirt from the contact surface. Use a new gasket.

Seal plate



1. Install the seal plate.

Seal plate tightening torque :

8.0 ~ 11.7 N·m (0.8 ~ 1.2 kg·m, 5.75 ~ 8.625 lb·ft)

CAUTION

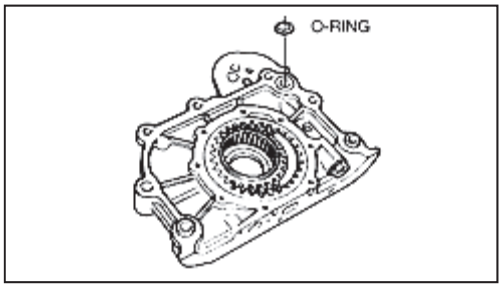
Check to be sure that the seal plate sealing rubbers are installed in position.

INSTALLATION

Oil seal replacement

1. Removal

   Remove the oil seal by using a screwdriver or similar tool to pry it out.

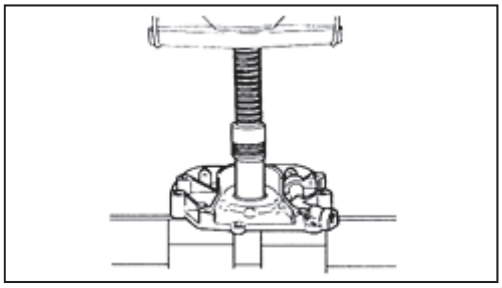


2. Installation

   Press in the oil seal by using a pipe or round rod with an outer diameter of 45 mm (1.77 in).

   CAUTION

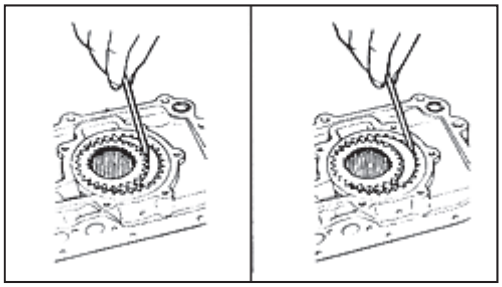
   Press the oil seal in until the front end is aligned with the front end of the pump body.



INSPECTION

Check the following points. Repair or replace if necessary.

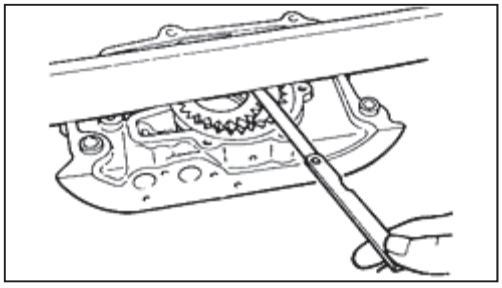
1. Distortion or damage to pump body or cover
2. Worn or damaged plunger
3. Weak or broken plunger spring
4. Measure gear clearances



Outer gear tooth tip and crescent clearance limit : 0.35 mm (0.013 in.) Inner gear tooth tip and crescent clearance limit : 0.35 mm (0.013 in.)

5. Measure the side clearance.

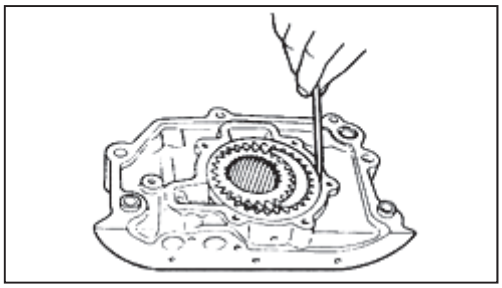
Limit : 0.15 mm (0.006 in.)



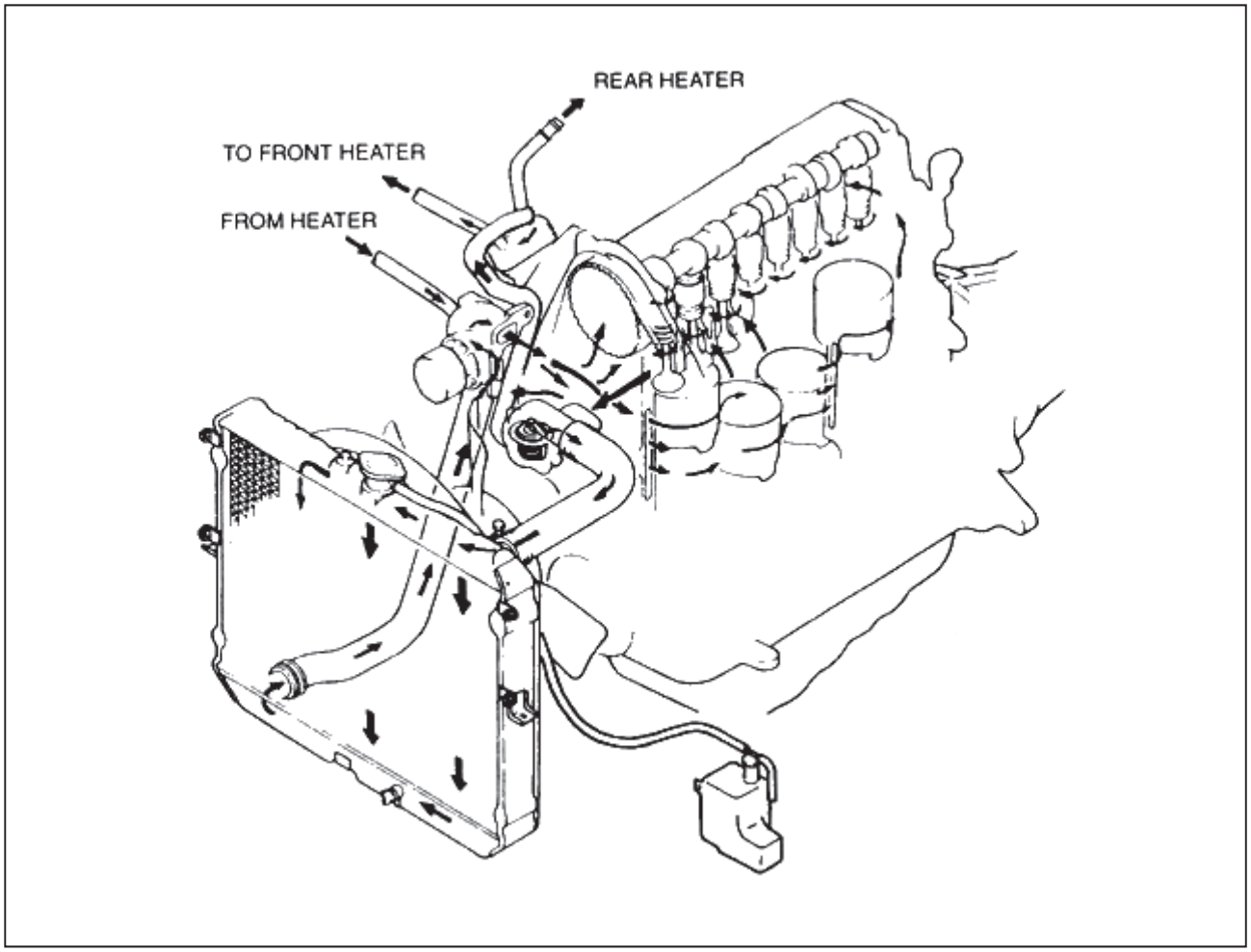
6. Measure the body clearance.

   Outer gear to pump body clearance limit :

   0.20 m (0.008 in.)

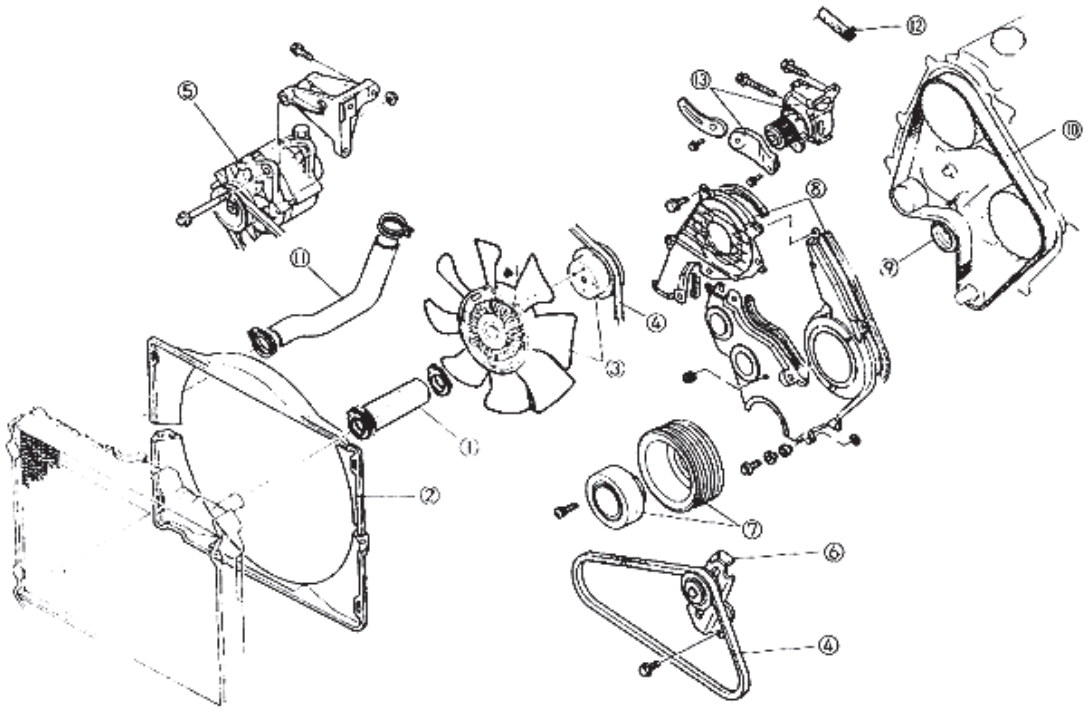


FLOW CHART



Water pump

COMPONENTS



1. Radiator hose, upper
2. Cooling fan shroud
3. Cooling fan and pulley
4. Alternator and air conditioner compressor drive belts
5. Alternator
6. Air conditioner compressor drive belt tensioner
7. Crankshaft pulley
8. Timing belt cover, upper and lower
9. Timing belt tensioner and spring
10. Timing belt
11. Radiator hose, lower
12. Heater hose
13. Water pump and alternator strap

Removal & Installation

1. Turn the crankshaft so that the No. 1 cylinder is at top dead center of compression.

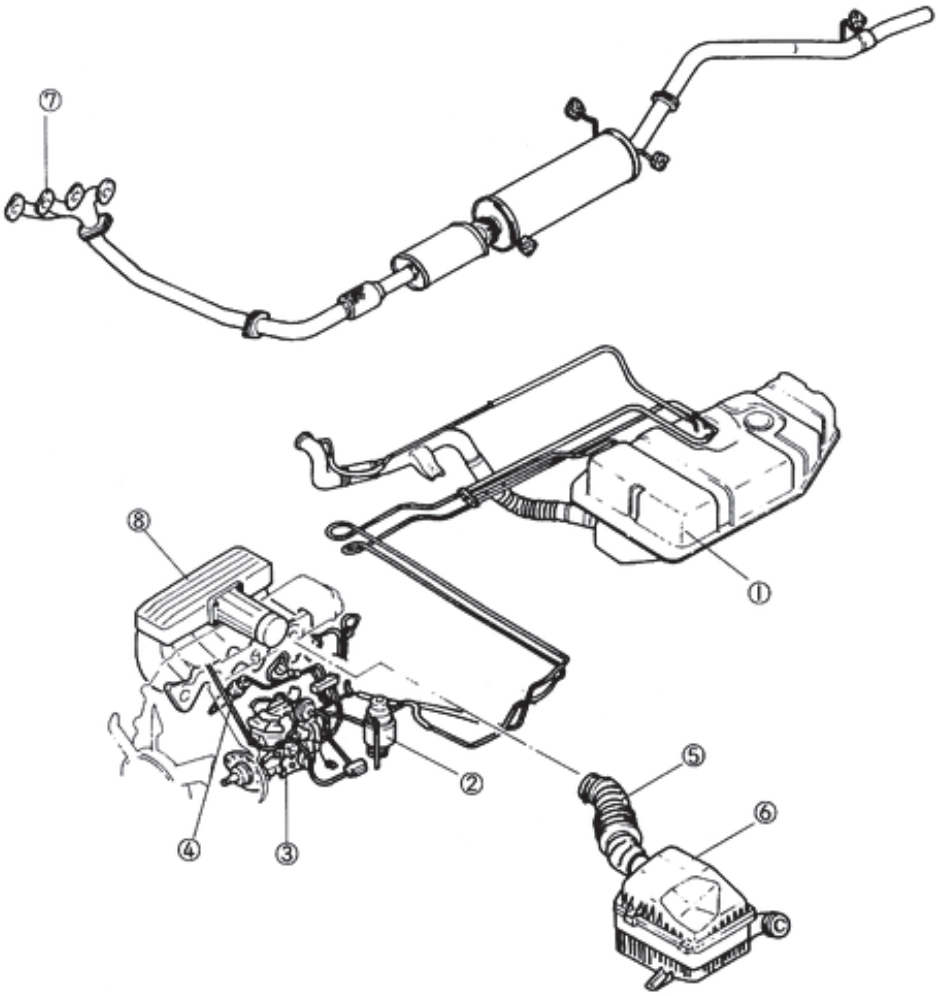
2. Drain engine coolant into a suitable container.

3. Remove each part in the numbered sequence shown in the figure.

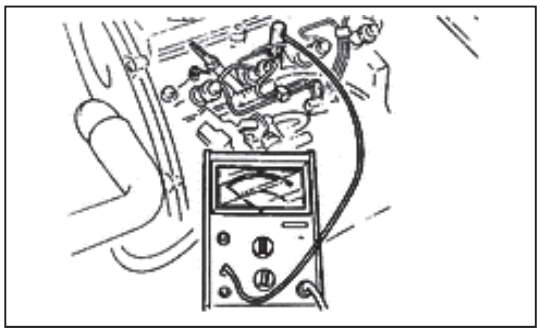
4. Installation is in reverse order of removal.

General Information

DESCRIPTION AND OPERATION



1. Fuel tank
2. Fuel filter
3. Injection pump
4. Injection pipe & nozzle
5. Intake hose
6. Air cleaner
7. Exhaust manifold
8. Intake manifold

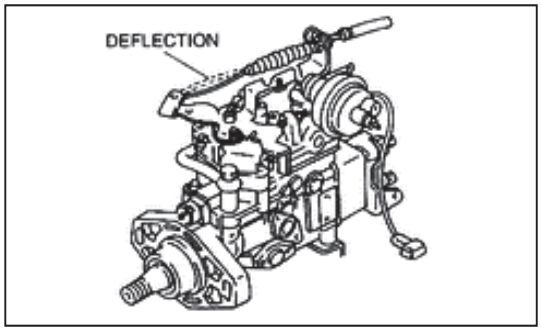


Idling speed checking

1. Warm up the engine to normal operation temperature.
2. Attach a tachometer and check the range speed.

Idling speed : 700~750 rpm

If the idling speed is not within the specified range, adjust the idling speed.

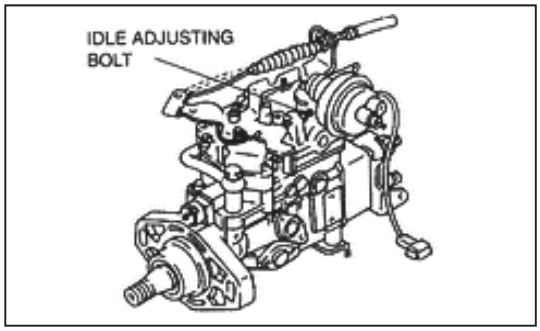


Idling speed adjusting

1. Confirm the accelerator cable deflection.

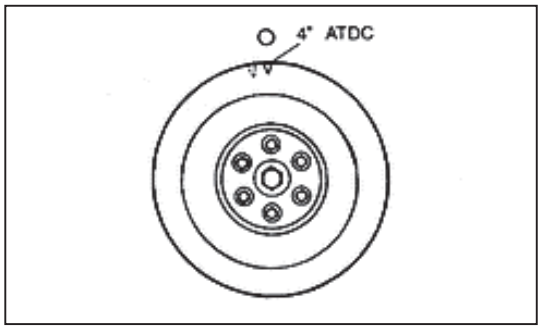
   If the deflection is not within the standard range, adjust it by turning accelerator cable lock nuts.

Standard deflection : 1.0~3.0 mm (0.04~0.12 in)



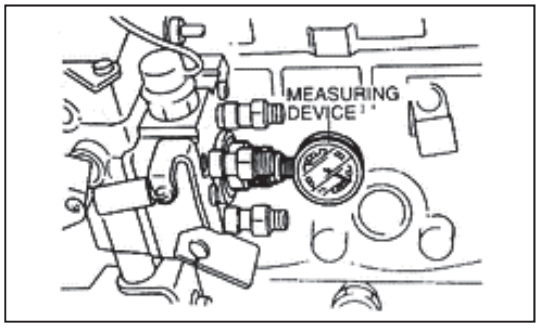
2. Loosen the lock nut of the idle adjusting bolt and adjust the idling speed by turning the idle adjusting bolt.

   NOTICE
   Idle speed will increase when the adjusting bolt is turned clockwise and decrease when turned counter-clockwise.



Injection timing checking

1. Align the timing mark (2° BTDC) on the crankshaft pulley with the indicator pin by turning the crankshaft.
2. Disconnect the injection pipes from the injection pump.



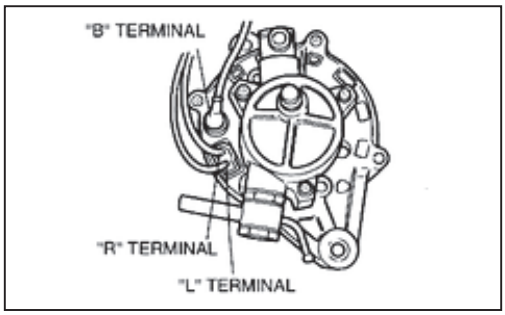
3. Remove the hydraulic head plug on the injection pump.
4. Mount the measuring device into the plug hole on the hydraulic head so the tip of the dial gauge pointer touches the plunger end of the pump and dial gauge indicates approx. 20. mm 90.08 in).

REPAIR PROCEDURES

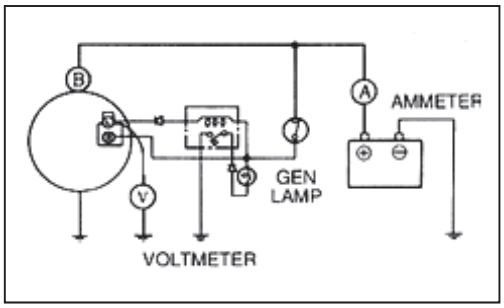
INSPECTION

CAUTIONS

1. Be sure battery connections are not reversed, because this will damage the rectifier.
2. Do not use high-voltage tester, such as a Megger, because they will damage the rectifier.
3. Remember that battery voltage is always applied to the alternator's B terminal.
4. Do not ground the L terminal while the engine is running.
5. Do not start the engine while the coupler is disconnected from the L and R terminals.

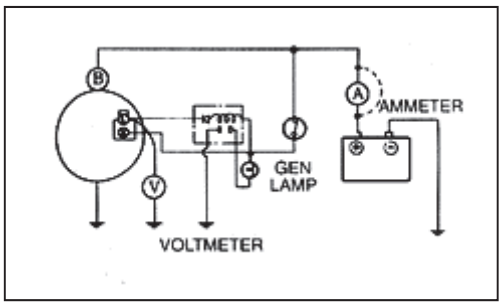


1. Make current and voltage connections as shown in the figure.
2. Turn the ignition switch OFF.
3. Read the voltage between the L terminal and ground. The alternator is bad if the reading is not 0V.
4. Turn the ignition switch ON and read the voltmeter. If the reading is 0V, there is a malfunction of the alternator rear bracket, and then read the voltmeter. If the voltage is near the battery voltage, short circuit the F terminal and the alternator rear bracket, and then read the voltmeter. If the voltage is lower than the battery voltage, there is a malfunction of the IC regulator.



Checking no-load adjustment voltage

1. Check to be sure that the battery is fully charged.
2. Connect an ammeter and voltmeter as shown in the figure.
   Be sure that the voltmeter reading is 0V.
3. Turn the ignition key to ON, and then check to sure that the voltmeter reading is significantly lower than the battery voltage. (1~3V).
   If the voltmeter reading is significantly lower than the battery voltage, there may be a malfunction in the alternator.
4. Short circuit the terminals of the ammeter, and then start the engine. After starting, discontinue the short circuiting.



NOTICE :

Be careful, when starting the motor, that the current of the starter doesn't flow to the ammeter.