

Table of Contents

	Section	
Introduction	i	█
Engine Identification	E	█
Troubleshooting	T	█
Cooling System Repair	1	█
Lubricating Oil System Repair	2	█
Air Combustion System Repair	3	█
Compressed Air System Repair	4	█
Fuel System Repair	5	█
Electrical System Repair	6	█
Base Engine Components System Repair	7	█
Engine Testing and Run-In	8	█
Engine Removal and Installation	9	█
Specifications and Torque Values	V	█
Component Manufacturers	C	█
Additional Service Literature	L	█
Index	X	█

Symboles

Les symboles suivants sont utilisés dans ce manuel pour aider à communiquer le but des instructions. Quand l'un de ces symboles apparaît, il évoque le sens défini ci-dessous:



AVERTISSEMENT - De graves lésions corporelles ou des dommages matériels considérables peuvent survenir si les instructions données sous les rubriques "Avertissement" ne sont pas suivies.



ATTENTION - De petites lésions corporelles peuvent survenir, ou bien une pièce, un ensemble ou le moteur peuvent être endommagés si les instructions données sous les rubriques "Attention" ne sont pas suivies.



Indique une opération de **DEPOSE**.



Indique une opération de **MONTAGE**.



L'INSPECTION est nécessaire.



NETTOYER la pièce ou l'ensemble.



EFFECTUER une **MESURE** mécanique ou de temps.



GRAISSER la pièce ou l'ensemble.



Indique qu'une **DIMENSION DE CLE** ou **D'OUTIL** sera donnée.



SERRER à un couple spécifique.



EFFECTUER une **MESURE** électrique.



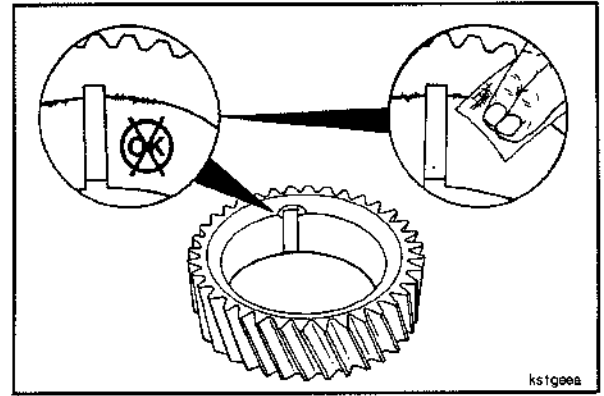
Se reporter à un autre endroit dans ce manuel ou à une autre publication pour obtenir des informations plus complètes.



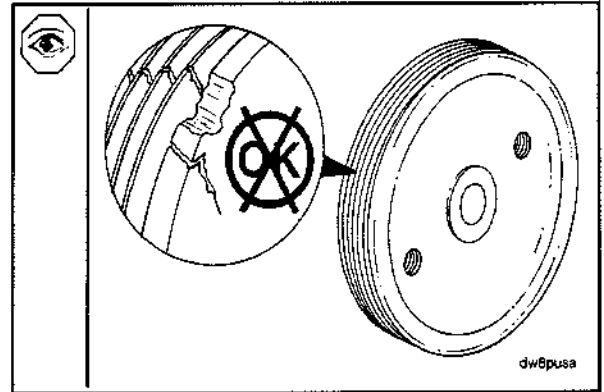
Le composant pèse 23 kg [50 lb] ou davantage. Pour éviter toute blessure, employer un appareil de levage ou demander de l'aide pour le soulever.

Illustrations

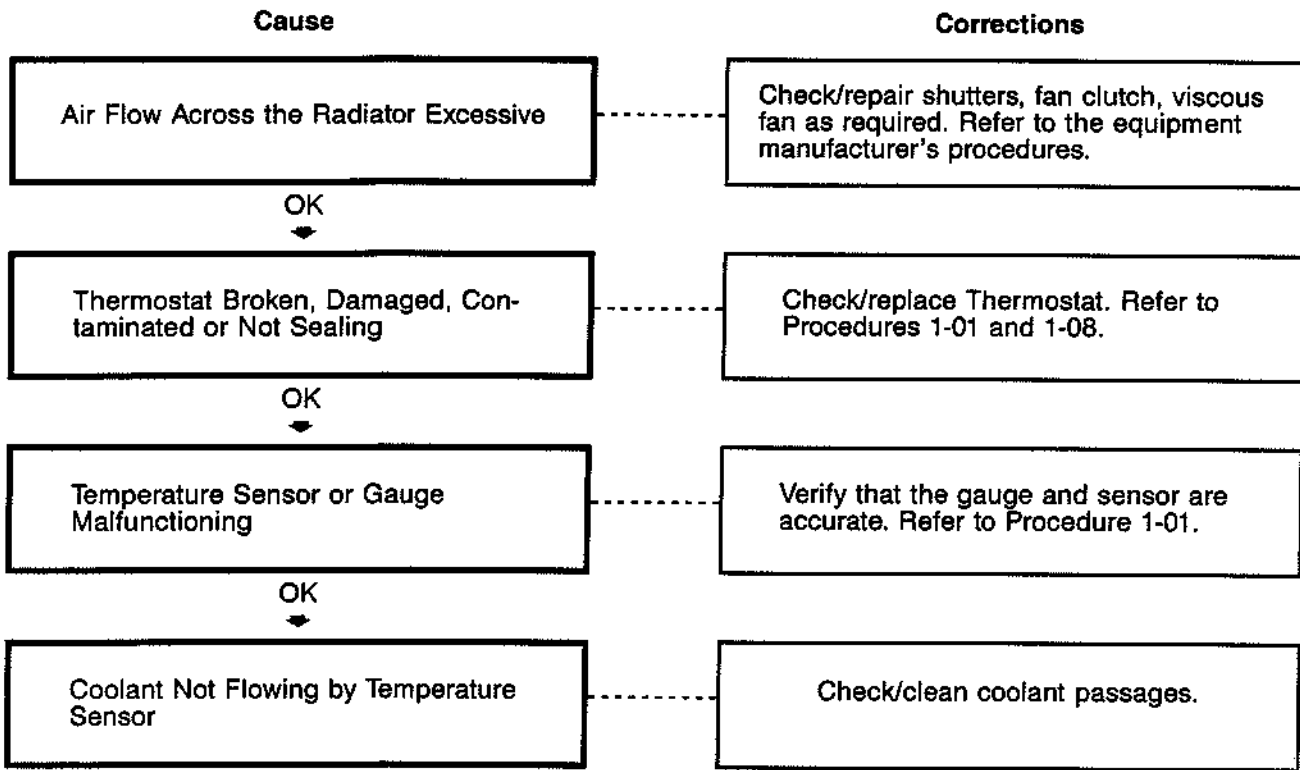
The illustrations used in the "Repair Sections" of this manual are intended to give an example of a problem, and to show what to look for and where the problem can be found. Some of the illustrations are "generic" and will **not** look exactly like the engine or parts used in your application. Some illustrations contain symbols to indicate an action required, and an acceptable or **not** acceptable condition.



The illustrations are intended to show repair or replacement procedures with the engine "in-chassis." The illustration can differ from your application, but the procedure given will be the same.

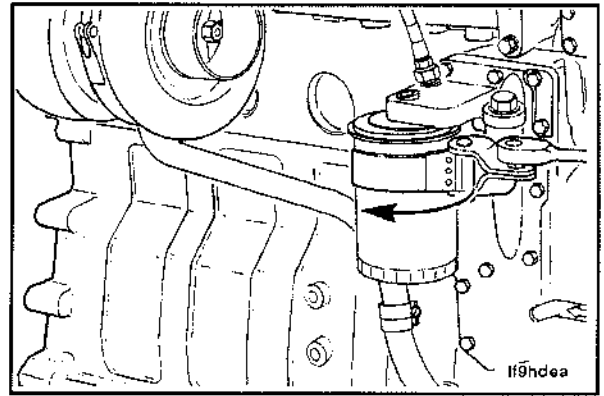


Coolant Temperature Below Normal

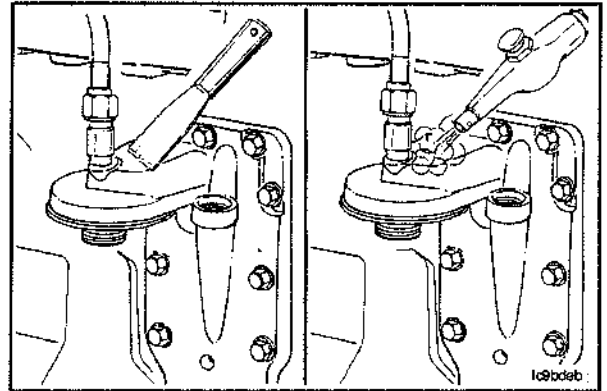


90-95 mm

Remove the lubricating oil filter.

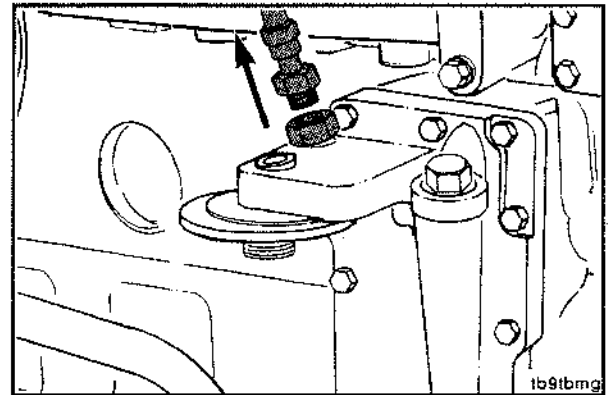


Clean around the lubricating oil cooler cover.



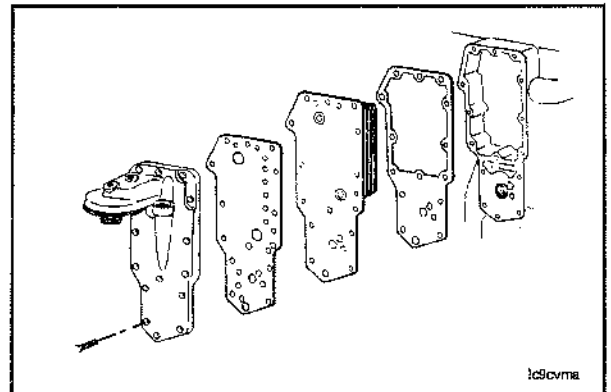
16 mm, 19 mm

Disconnect the turbocharger supply line.



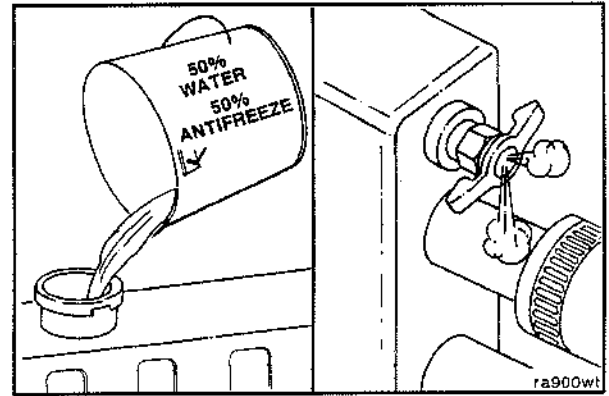
10 mm

Remove the lubricating oil cooler cover, gaskets and cooler element.



Caution: Be sure to vent the engine and aftercooler to prevent entrapment of air as the system is filled.

Fill the coolant system with a premixture of 50 percent water and 50 percent ethylene-glycol type antifreeze.



Turbocharger (3-13)

Replacement

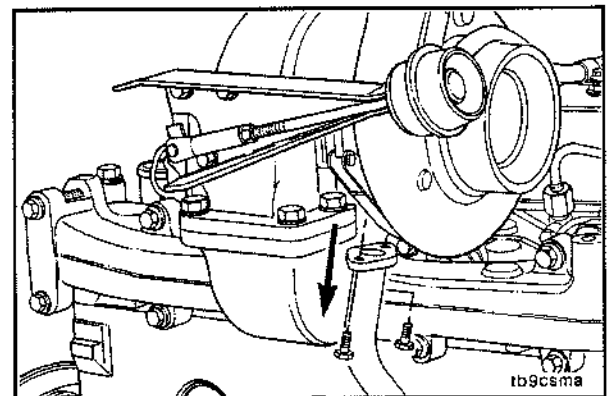
Preparatory Steps:

- Remove the air crossover tube, if used.
- Disconnect the charge air cooler hose.
- Disconnect the boost capsule actuator hose.
- Disconnect the intake and exhaust piping.

Removal

10 mm

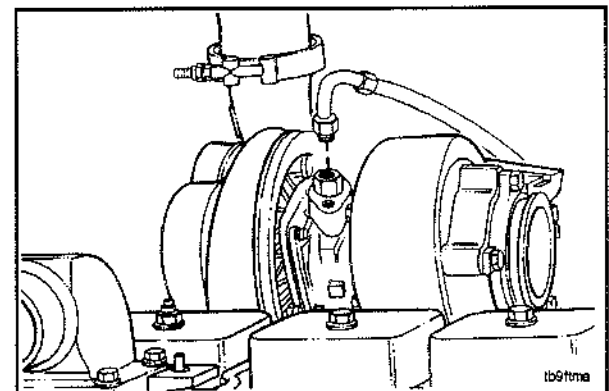
Remove the capscrews from the oil drain tube.



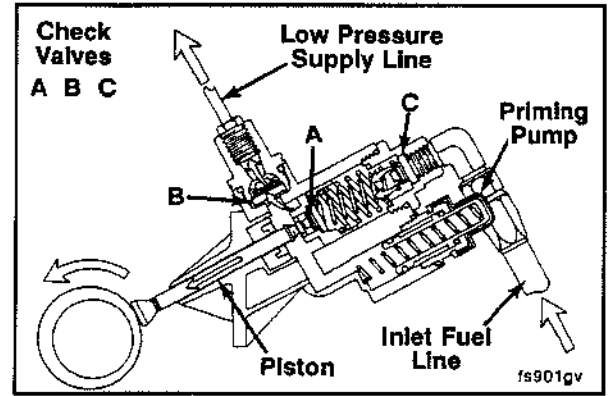
16 mm

Disconnect the oil supply line.

NOTE: Engines built after June 1993 may use a copper washer in both ends of the turbocharger lubricating oil supply line. The washer should be replaced whenever the line is removed.



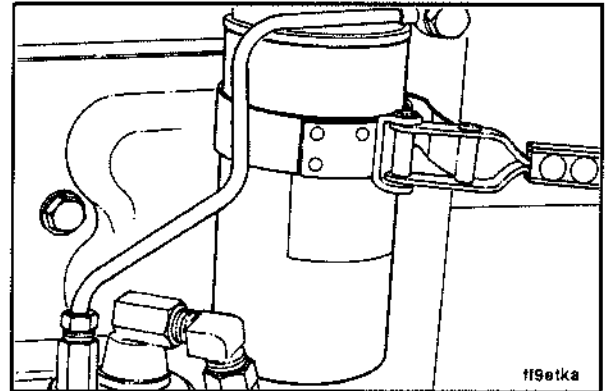
The piston style fuel transfer pump is mechanically driven by a plunger running against a special lobe on the camshaft. The fuel transfer pump contains a pumping piston and check valves to control the flow of fuel, and bleed back during engine shutdown.



Normal pressure drop across the fuel filter is 35 kPa [5 psi], maximum.

The pressure drop will increase as the fuel filter removes contamination from the fuel. Therefore, a worn fuel transfer pump will have reduced capacity to force fuel through a dirty fuel filter. This can cause low engine power.

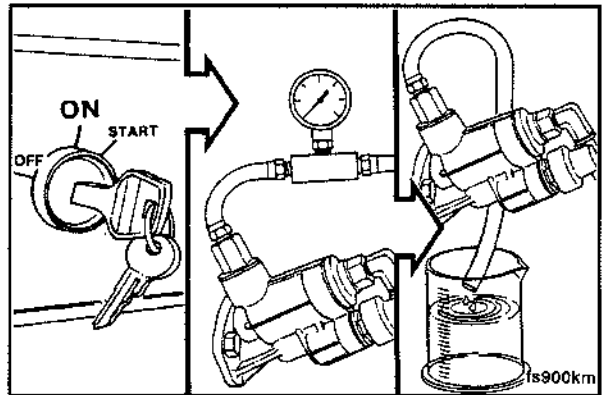
NOTE: Frequent fuel filter replacement to get full power from the engine can indicate a worn transfer pump.



The output of the piston style fuel transfer pump can be checked two ways.

Test 1: Measure the output pressure using an in-line pressure gauge.

Test 2: Measure the flow volume.

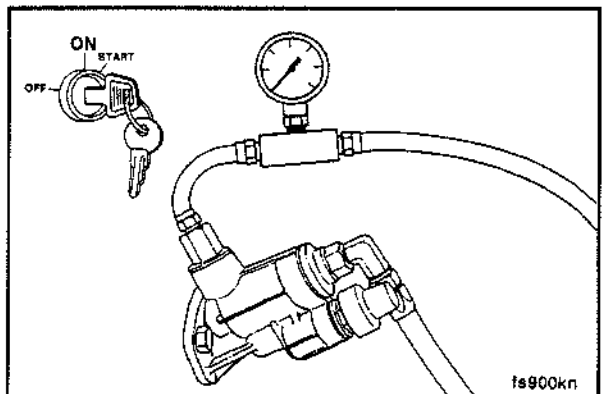


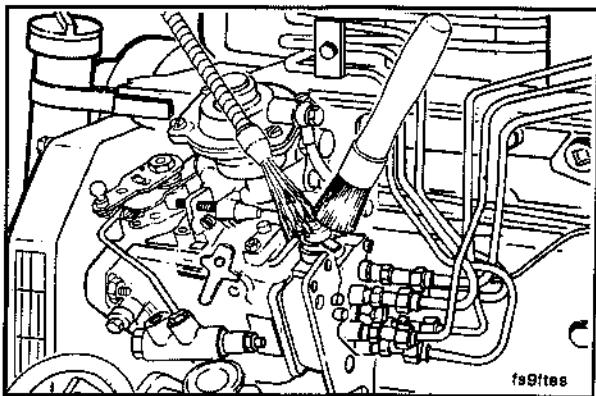
Test 1: Output Pressure Test (Piston Style)

Operate the engine and measure the output pressure of the fuel transfer pump using an in-line pressure gauge.

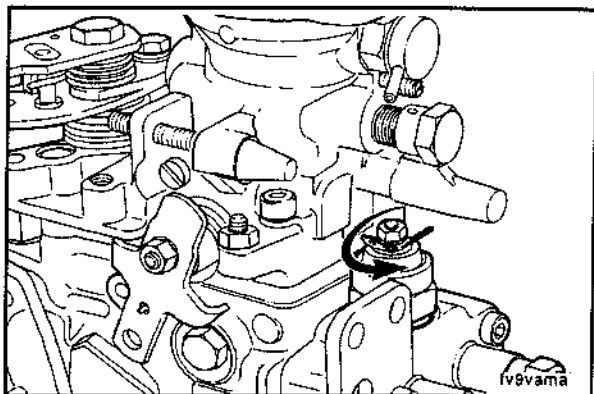
Minimum Pressure @ Rated Speed

172 kPa [25 psi]





Clean around the valve.

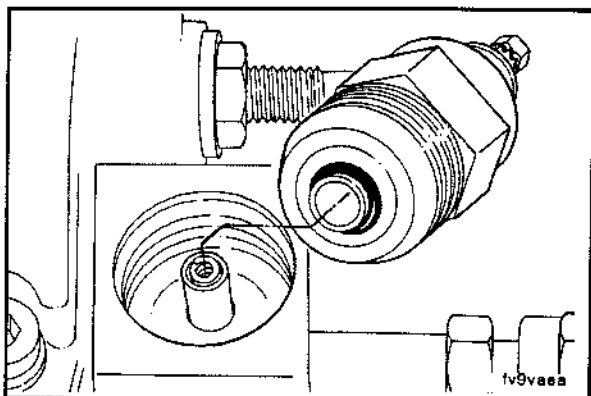


24 mm

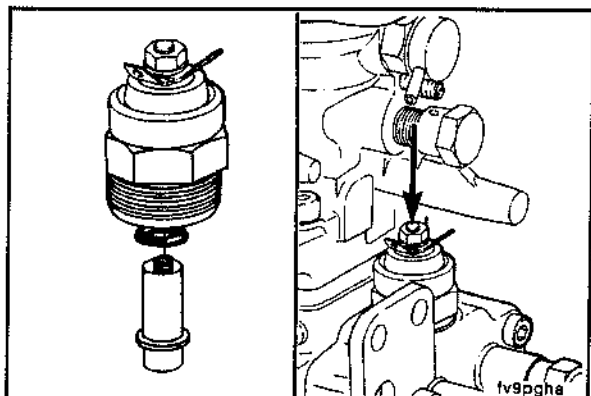
Remove the valve.



NOTE: The Bosch VE valve is shown. The valve for Lucas CAV is located at the bottom of the pump.

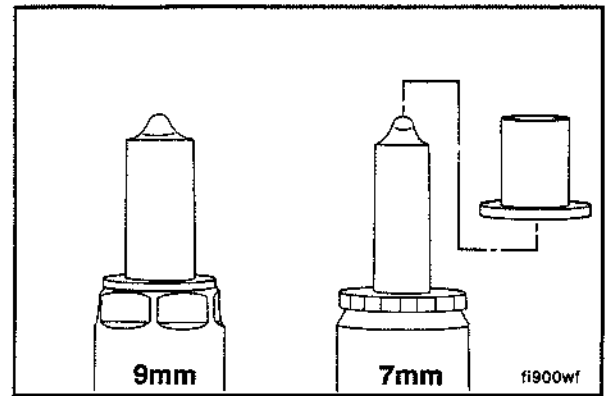


Caution: When removing the valve, be careful not to drop the plunger and spring.

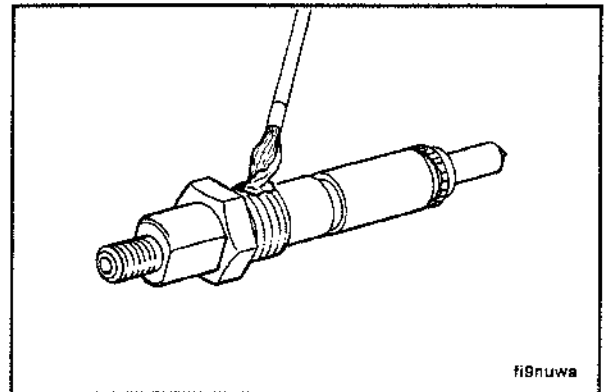


"Package" the solenoid, o-ring, spring and plunger.

7 mm injectors can be used in early model (9 mm) injector holes providing the special adapter sleeve is installed onto the 7 mm injector tip.



Apply a coat of anti-seize compound to the threads of the injector hold down nut and between the top of the nut and injector body.

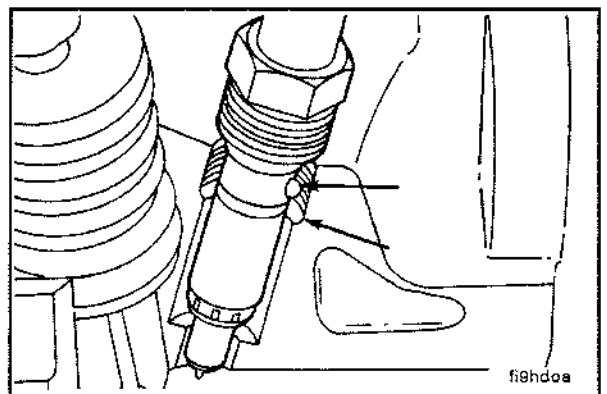


24 mm Deep Well Socket

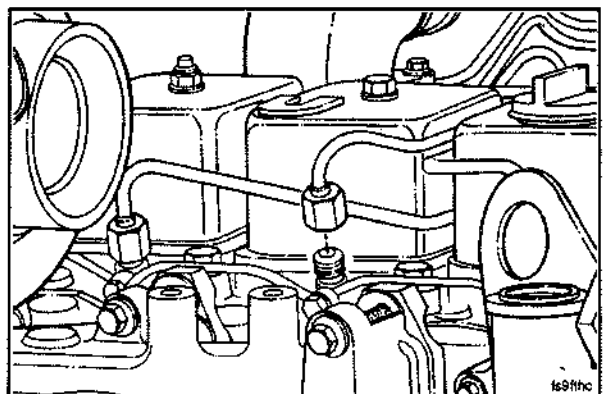
Caution: Align the injector's protrusion with the notch in the bore.

Torque Value: 60 N•m [44ft-lb]

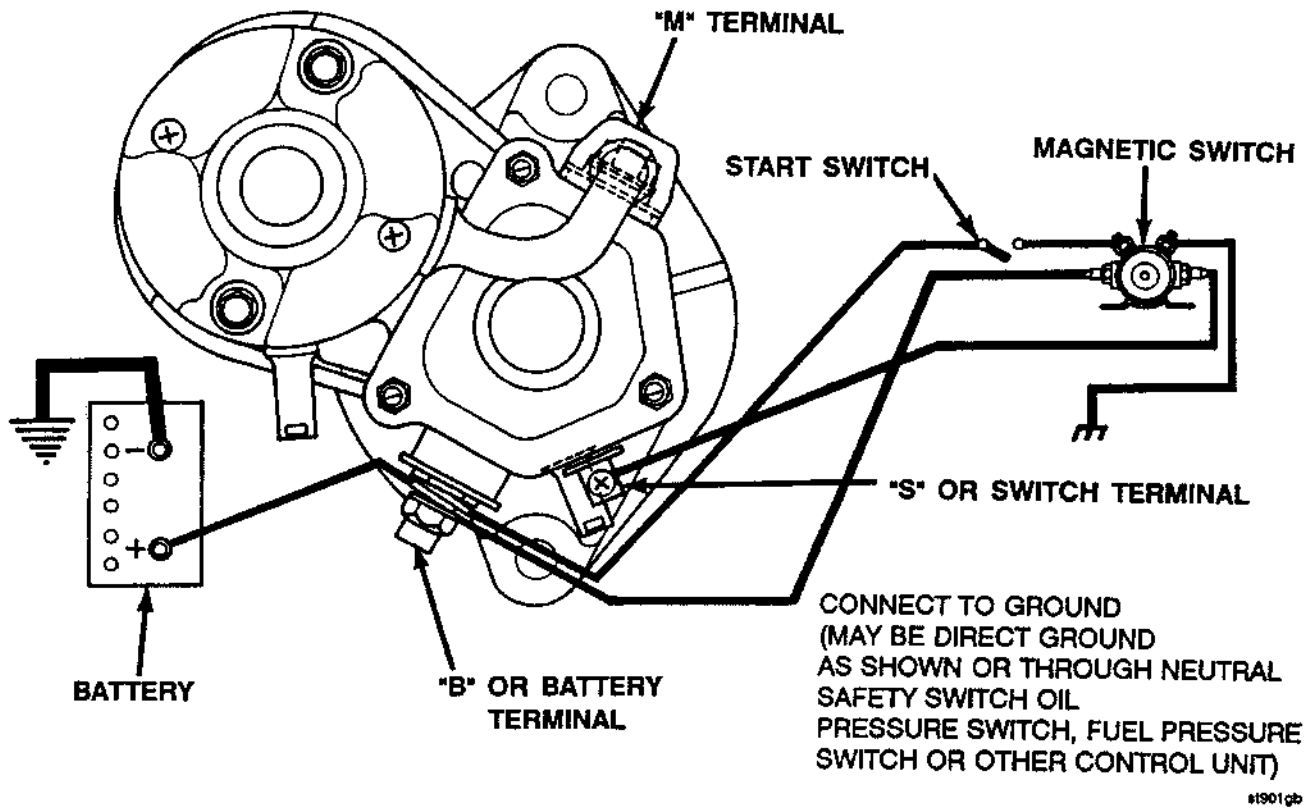
NOTE: The current Bosch injector has an o-ring located above the hold down nut. After tightening the injector be sure to push the o-ring into the groove.



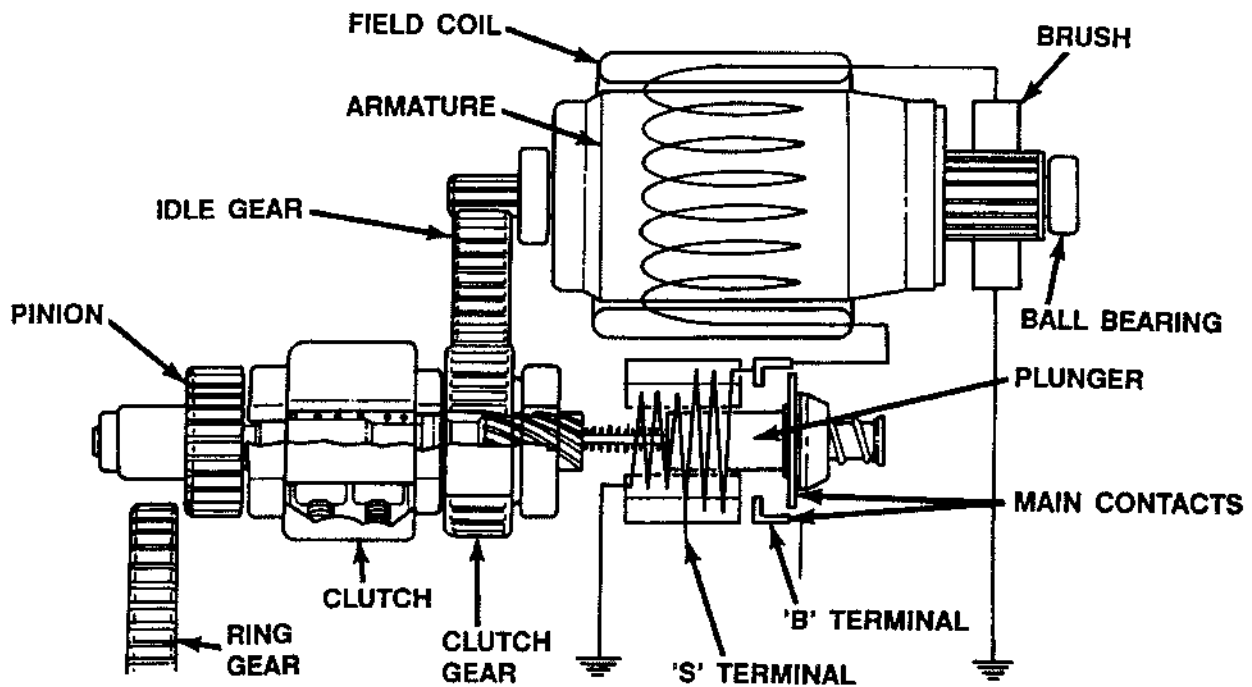
Assemble the fuel drain manifold and high pressure lines. Leave the high pressure fittings loose at the injectors.



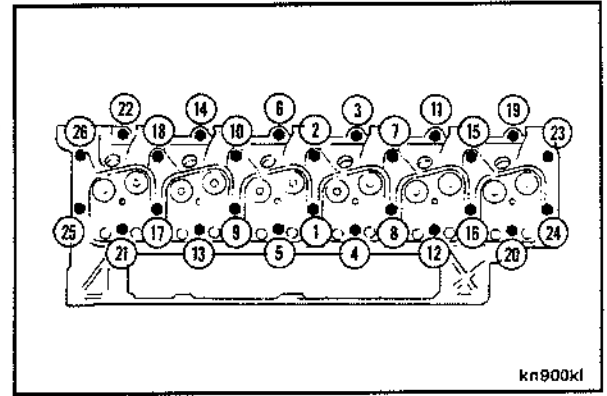
Nippondenso "R" type starting motor



Basic Wiring Circuit (with auxillary magnetic switch)

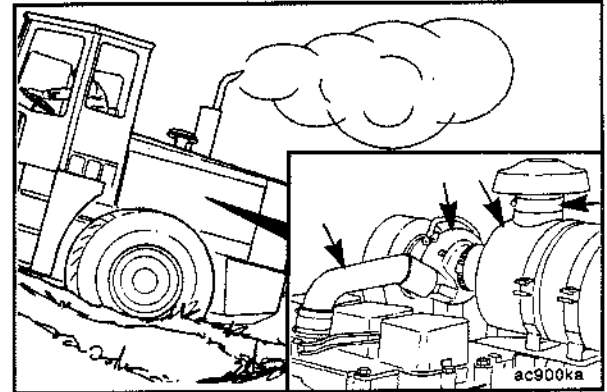


Caution: If one of the individual support pedestals is removed during inspection or repair, all head bolts must be retightened according to the head bolt torque sequence. Refer to Procedure (7-07).



Air and Fuel Systems - Check

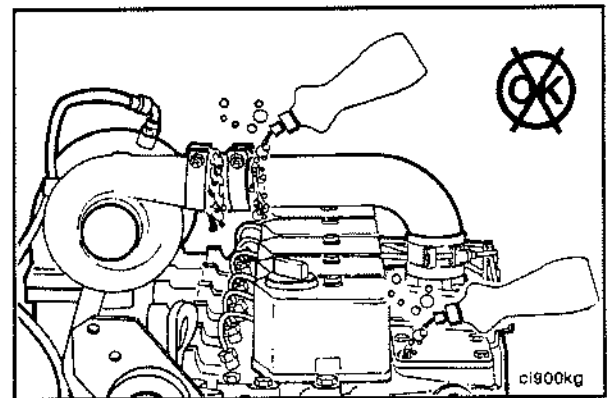
When diagnosing a low power problem, first troubleshoot the air and fuel systems to make sure the engine is receiving adequate intake air and fuel.



Check the intake air system for leaks. Make sure a sealant is used on the through-hole capscrews which secure the manifold cover to the head.

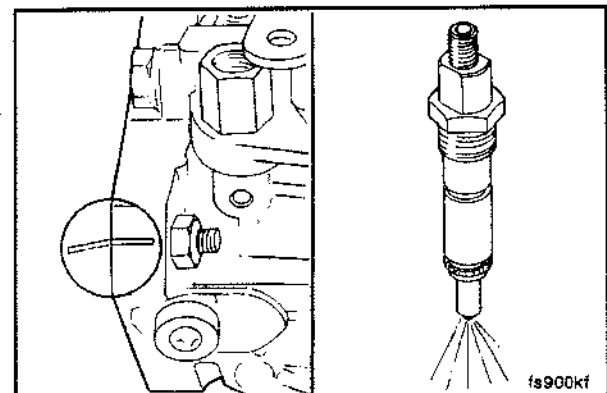
Verify the turbocharger is operating correctly.

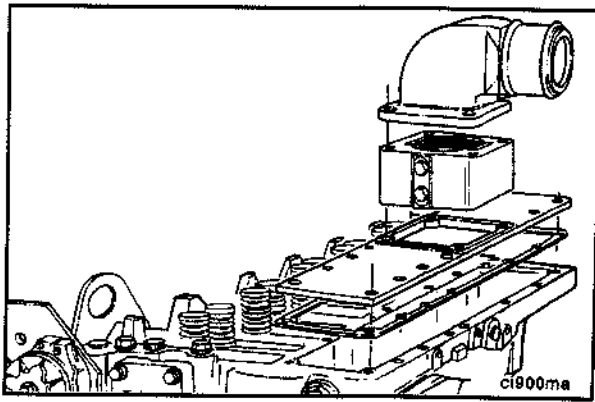
Refer to Section 3 for additional air system checks.



Check the fuel system for correct timing and fuel delivery.

Refer to Section 5 for fuel system malfunction diagnosis.





10 mm

Remove the intake manifold cover and intake heater (if equipped).

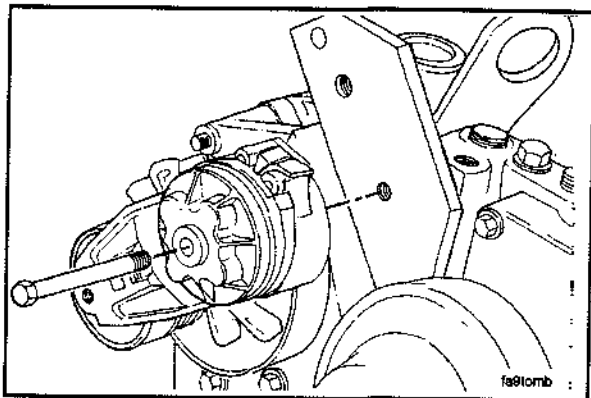


Note the manifold cover orientation for proper direction during installation.



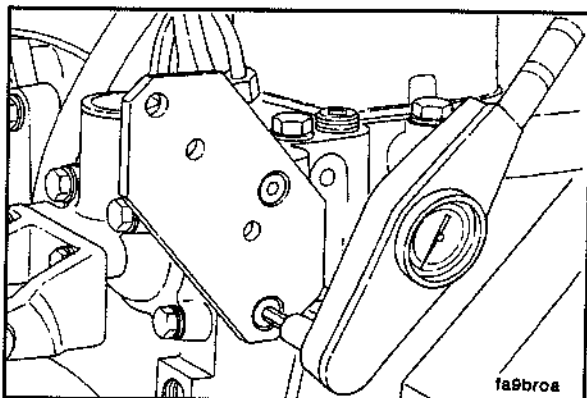
3/8 Inch Square Drive

Remove the drive belt.



13 mm

Remove the belt tensioner.



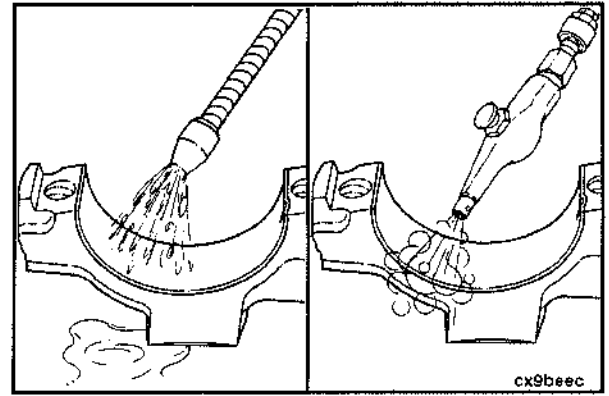
5 mm Allen

Remove the belt tensioner bracket.

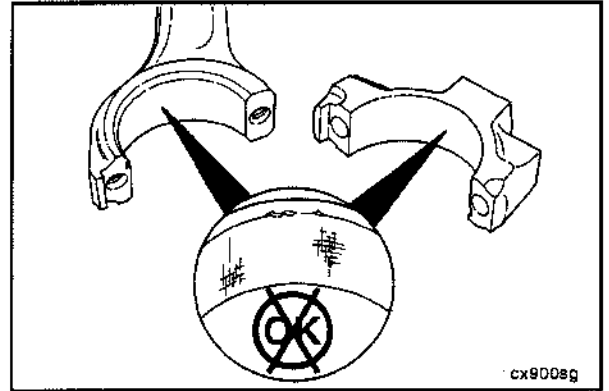


Cleaning and Inspection

Wash the bearing and connecting rod caps. Dry with compressed air.



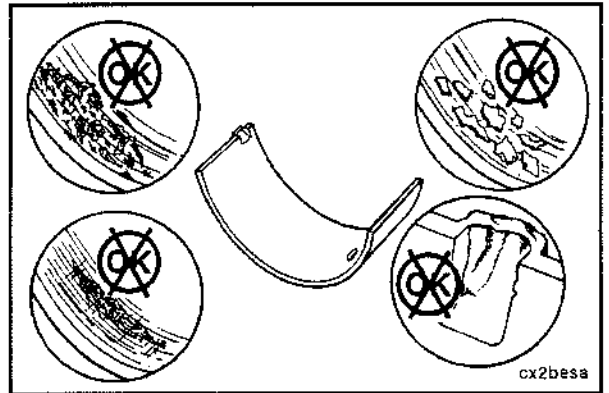
Visually inspect the connecting rod caps, connecting rod bearing saddles, and capscrews for nicks, cracks, burrs, scratches, or fretting.



Visually inspect the bearings for damage.

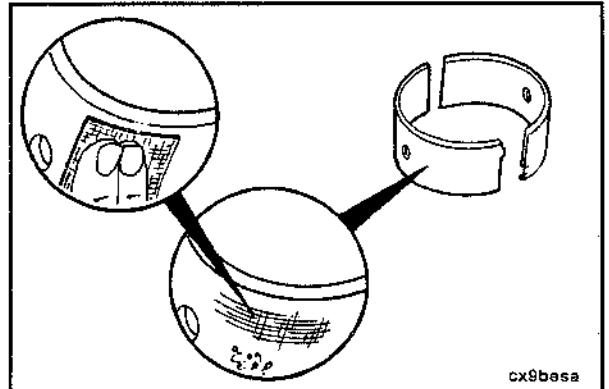
Replace any bearings with the following damage:

- Pitting
- Flaking
- Corrosion
- Lock tang damage
- Scratches

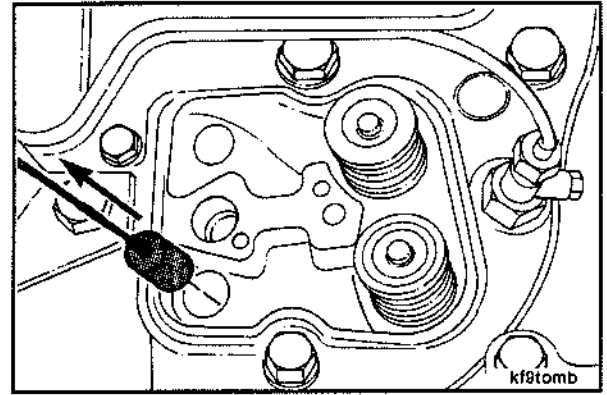


Visually inspect the bearing shell seating surface for nicks or burrs.

If nicks or burrs cannot be removed with Scotch-Brite® 7448 or equivalent, the bearings must be replaced.

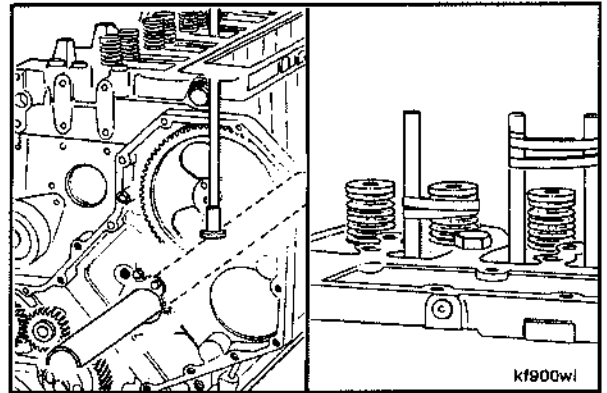


Remove the installation tool from the tappet.



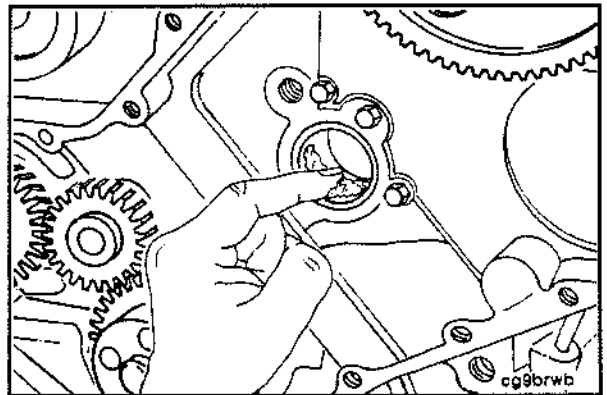
Install a wooden dowel into the top of the tappet. Wrap rubber bands around the wooden dowels to secure the tappets.

Repeat this process until all tappets have been installed.

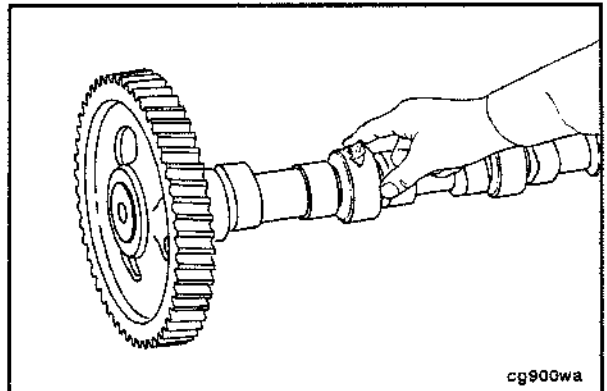


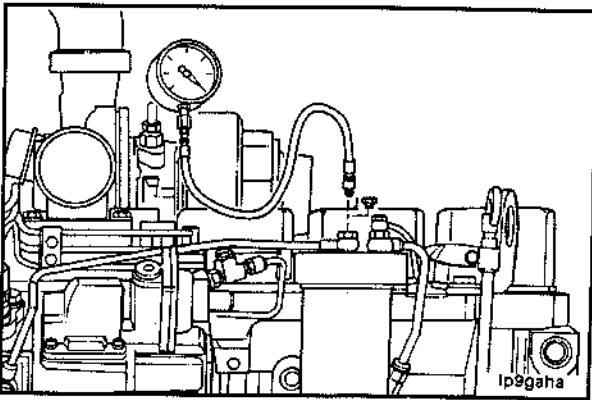
Camshaft Installation

Apply a coat of Lubriplate 105 to the front camshaft bore.



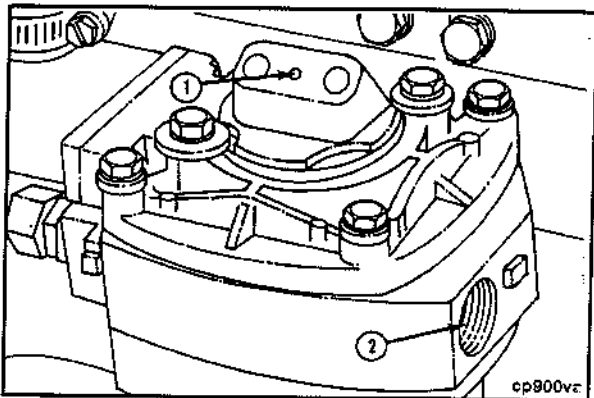
Lubricate the camshaft lobes, journals and thrust washer with Lubriplate™ 105.





To measure fuel filter restriction, connect vacuum gauge, Part No. ST-434, to the injection pump inlet line.

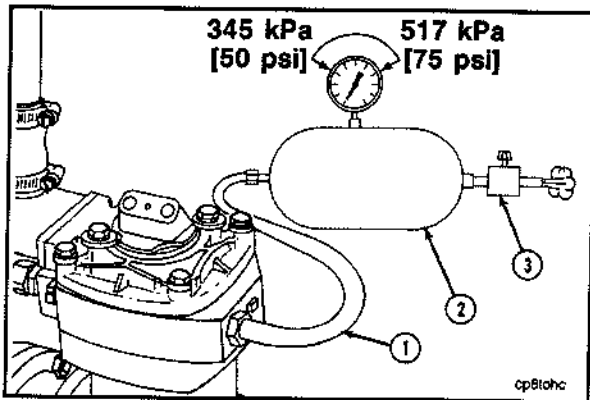
Minimum Gauge Capacity: 760 mm Hg [30 in. Hg]



To be able to unload the compressor, connect a source of compressed air to the unloader (1). This air line **must** contain a valve between the source and the unloader.

NOTE: All air compressors manufactured by Cummins Engine Company, Inc. **must be loaded** during engine run-in. All air compressors **must be unloaded** during the engine performance check.

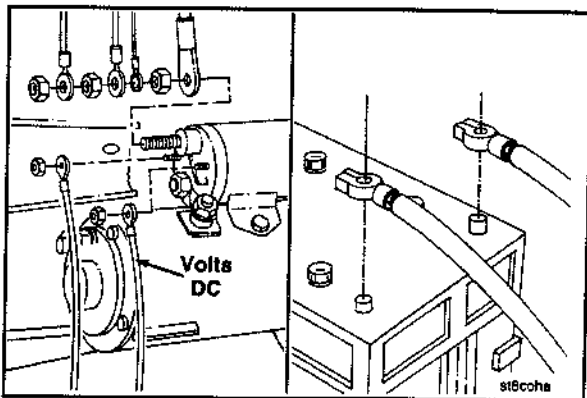
NOTE: The compressed air load in the accompanying illustration **must be attached** to the air compressor outlet (2).



To provide a load on the air compressor, connect an air tank (2) to the compressor outlet, use steel tubing or a high temperature hose (1).

Install an air regulator (3) that can maintain tank air pressure of 345 kPa to 517 kPa [50 psi to 75 psi] at both the minimum and the maximum engine RPM.

Hose Temperature (Minimum): 260° C [500° F]



Inspect the voltage rating on the starting motor before installing the electrical wiring.



Attach electrical wires to the starting motor and the batteries, if used.



NOTE: If another method of starting the engine is used, follow the manufacturer's instructions to make the necessary connections.