Engine Checking and Fuel Pump Marking Angles, Static Timing

The correct marking angles and static timing can be found by reference to the prefix letters and figures of the setting code adjacent to the word "Set" on the fuel pump identification plate. Engine checking and fuel pump marking angles are for use with timing tool MS67B.

Prefix Letters 6.354 & 6.3542	Engine Checking Angle (Degrees) (with engine at TDC compression)	Fuel Pump Marking Angle (Degrees)	Static Timing (BTDC—Degrees)	Piston Displacement BTDC
A50E AX53)	154	143	22	0.230 in (5.84 mm)

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SECTION F
Pistons and Connecting Rods

NOTE: Special pistons are used with the 6.3542 engine, having a protection insert in the top ring groove.

6.3542 pistons and standard 6.354 pistons are not interchangeable.

To Remove Piston and Connecting Rod Assemblies

1. Remove the cylinder head, page E.1.
2. Drain and remove the sump, page K.2.
3. Remove the nuts from the big end bolts.
4. Remove the big end caps, bearing shells and bolts (Fig. F.1).

   Note: If the bearings removed are serviceable, mark them for refitting in their original positions.
5. Push pistons and connecting rods out of the top of the cylinders (Fig. F.2).

   Note: Keep each piston and connecting rod assembly separate, each to each as marked.

To Remove Pistons from the Connecting Rods

An exploded view of a piston and connecting rod assembly is shown in Fig. F.3.

1. Remove the rings from each piston.
2. Remove the circlips and withdraw the gudgeon pin. If the gudgeon pin is tight in the

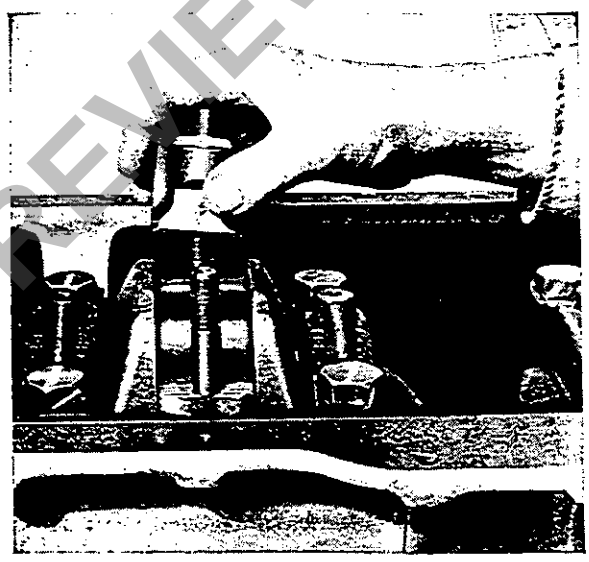


Fig. F.1 Big End Cap Removal.

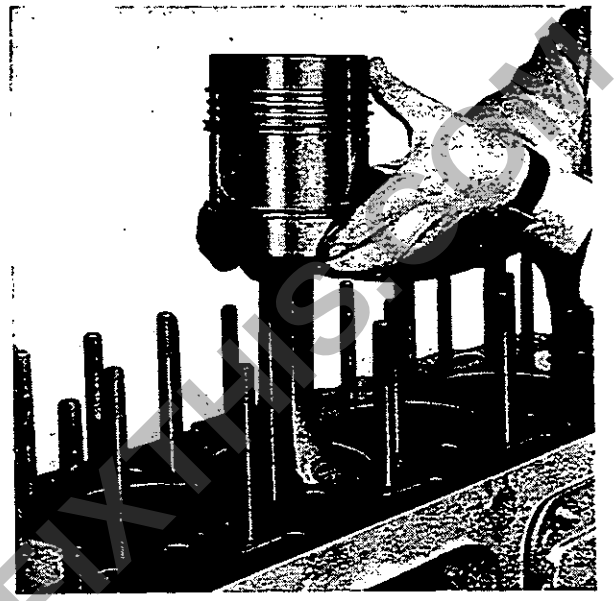


Fig. F.2.

Removing Piston and Connecting Rod Assembly from Cylinder Bore.

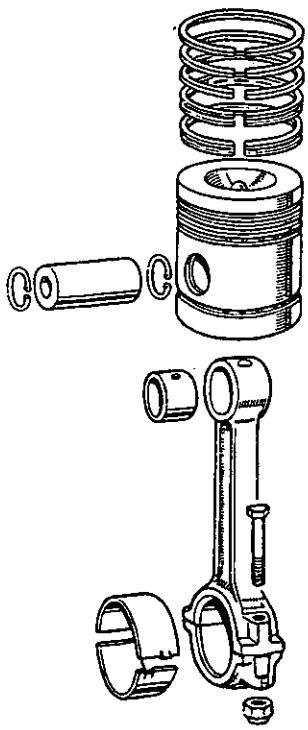


Fig. F.3.

Exploded view of Piston and Connecting Rod Assembly.

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To Assemble and Refit the Relief Valve Assembly

1. Fit the plunger, spring and cap to the relief valve housing and secure with the split pin.
2. If possible, check the pressure setting of the relief valve as quoted above. If not, extreme caution is advised when starting the engine, until it is certain that the pressure relief valve is working properly.
3. Refit the relief valve assembly to the cylinder block. When refitting, the oil seals around the connecting tube should be renewed.
4. Refit the sump.

Oil Pressure

The pressure may vary with individual engines and under different operating conditions, but should be 30 lbf/in² (2,1 kgf cm²) — 207 kN/m² minimum at working temperature and maximum running speed.

If the oil pressure is below normal, check the following in the order given below.

1. Dipstick. Check there is sufficient oil in the sump.
2. Oil Pressure Gauge. Check for accuracy with a master gauge.
3. Lubricating Oil Filter. May be choked, renew element.
4. Sump Strainer. This may be choked, remove, clean and replace.
5. Lubricating Oil Pump. Check that the suction pipe and oil delivery housing joints are tight.
6. Oil Pressure Relief Valve may be stuck open.

LUBRICATING OIL FILTERS

A sump strainer and full flow main oil filter are fitted. For early T6.354 engines a turbocharger filter is fitted in tandem with the engine filter.

The sump strainer consists of a gauze wire container which fits over the suction pipe of the lubricating oil pump. The sump strainer must be thoroughly cleaned each time the sump is removed.

The main oil filter is mounted on the side of the cylinder block. The canister or paper element should be renewed every 5,000 miles (7,500 km) or 200 hours.

To Change the Filter Element (Paper Type)

1. To dismantle the filter, see Figs. K.10 and K.11.
2. Remove the old element (Fig. K.12 and clean out the container.
3. Part fill the container with new oil and fit the new element so that it locates correctly on the spring loaded guide in the base of the container.
4. Fit a new container seal in the filter head.
5. Offer up the container and element assembly to the filter head and secure.

To Refit the Oil Filter to the Engine

1. Secure the filter to the cylinder block. Between the joint and filter bracket, a hard setting jointing compound should be used, as

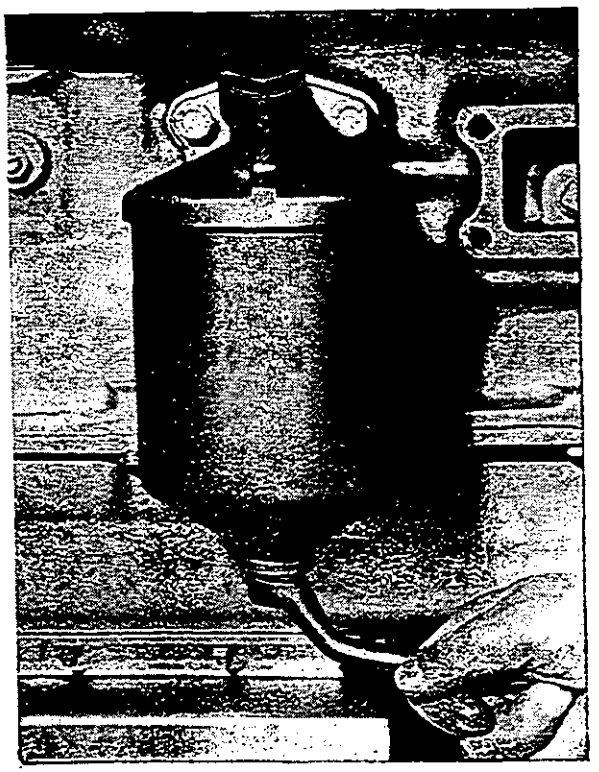


Fig. K.10. Unscrewing Filter Bowl Securing Bolt.

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It is recommended that, where an early type pump requires attention or replacement, it should be exchanged for one of the current type.

Should this not be possible, however, it is possible to fit all later parts to an earlier type pump, but the following must be observed.

1. The sealed bearings must be fitted with the seals towards the outside of the pump.
2. The space between the fitted bearings must be half to two thirds filled with Shell Alvania 2 grease.
3. When fitting the rear seal, the brass portion of the seal and the recess in the pump body should be cleaned and a good quality jointing compound used before pressing the seal home. The contact face of the seal must be kept clean.

NOTE: A new water seal, which has an integral ceramic counter-face, and a new pump shaft have been introduced for spares purposes. Where water pumps have a felt seal, felt seal housing and a bearing retainer, these items have been deleted and a longer distance piece is supplied for between the bearings.

Water Pump Seals

Where ceramic counter-face water pump seals are fitted, if the engine is run without coolant, even for a few seconds, the heat build-up between the carbon seal and ceramic counter-face is very rapid, resulting in the cracking of the ceramic. This often creates the misunderstanding that the cause of leakage is due to the incorrect assembly of the sealing arrangement of the water pump.

THERMOSTAT

A thermostat is incorporated in the cooling system to allow the engine to reach the most efficient working temperature quickly.

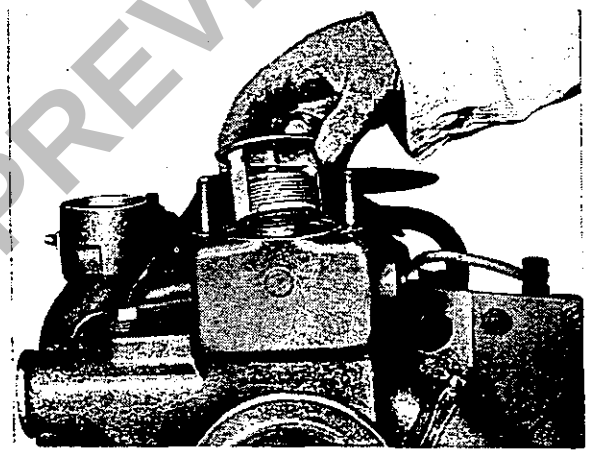


Fig. L.8.
Removing Thermostat (6.354 High Position Type Water Pump).

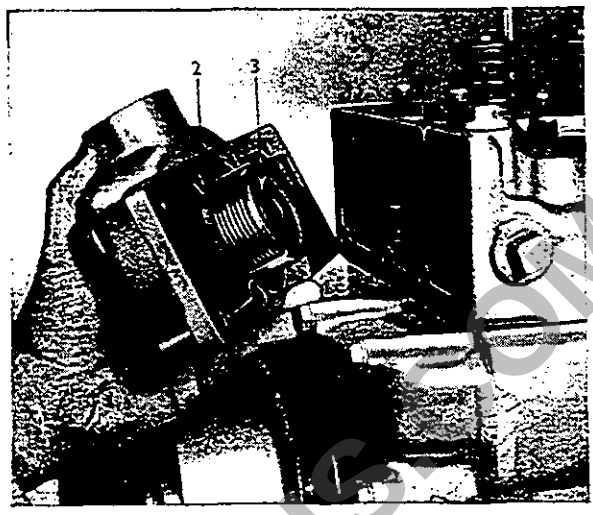


Fig. L.9. Removing Thermostat.
(6.354 Low Position Type Water Pump).
1. Cylinder Head.
2. Water Outlet Plate.
3. Thermostat.

With the high position pump, the thermostat is fitted in the top of the pump (Fig. L.8).

With the low position pump, the thermostat is fitted in the water outlet body situated on the front of the cylinder head (Fig. L.9). It is retained by a circlip (Fig. L.10).

With 6.372 engines, twin by-pass blanking thermostats are fitted in the water outlet body at the front of the cylinder head.

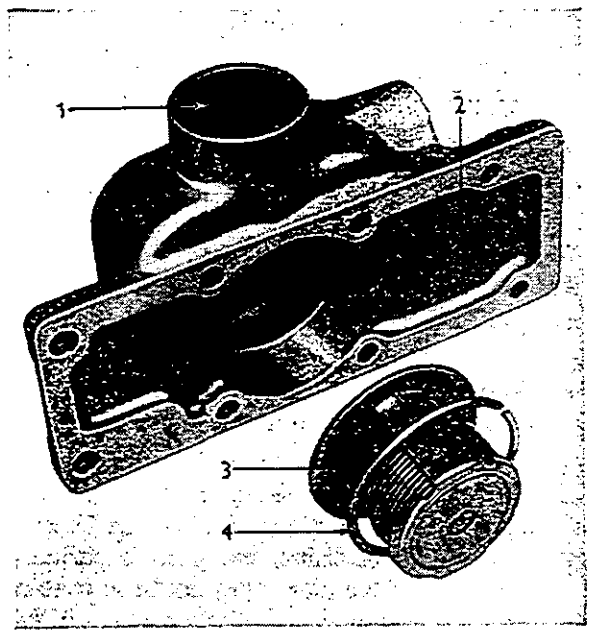


Fig. L.10. Exploded view of Thermostat and Water Outlet Connection
(6.354 Low Position Type Water Pump).
1. Water Outlet Connection.
2. Water Outlet Plate.
3. Thermostat.
4. Circlip.

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Fuel Pump Timing

There are a number of timing marks appertaining to the fuel pump, which when aligned in the correct manner, ensure the fuel pump is timed correctly.

With No. 1 piston at T.D.C. on compression and with the fuel pump removed, the slot in the fuel pump drive hub should be aligned with the slot in the fuel pump adaptor plate, see Fig. M.13. If these slots are not in line, remove the auxiliary drive gear cover plate from the front of the timing case, release the three securing setscrews of the gear and turn the auxiliary drive shaft by means of the hexagon plug in the front end of the shaft.

On the fuel pump rotor, inside the fuel pump, are a number of scribed lines, each one bearing an individual letter. A timing circlip also bearing a scribed line is positioned inside the pump body which has to be set so that when the appropriate scribed line on the fuel pump rotor aligns with the scribed line on the circlip, it denotes commencement of injection (static timing), Fig. M.14.

Note: On later engines the scribed line on the circlip has been deleted. On these engines the scribed line on the rotor should be aligned with the end of the circlip which has a straight edge (Fig. M.15).

To set the timing circlip it is necessary to remove the pump from the engine and fix the position of the circlip by connecting No. 1 cylinder outlet connection on the pump to an atomiser tester and pump up to 30 ats (31 kgf/cm² or 440 lbf/in²). Turn the pump by hand in the normal direction of rotation until it "locks up". The squared end of the circlip should now be adjusted until it lines up with the relative letter on the pump rotor.

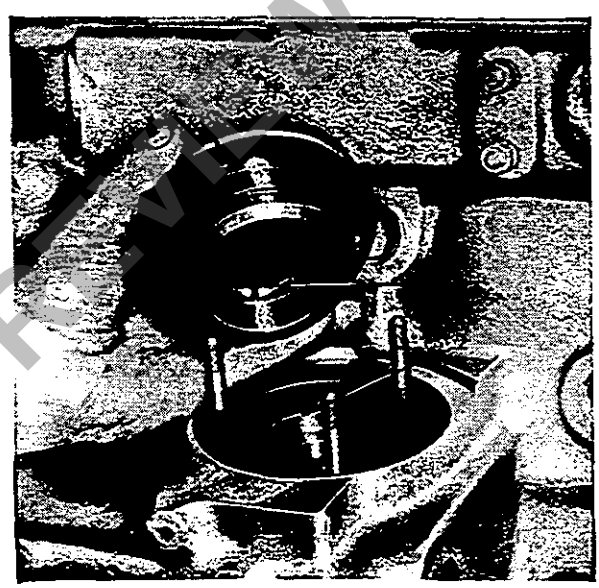


Fig. M.13
1. Timing Slot on Fuel Pump Adaptor Plate.
2. Timing Slot on Fuel Pump Drive Hub.

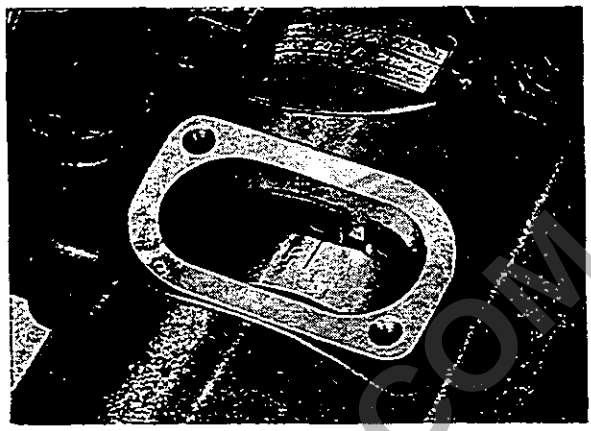


Fig. M.14. Static Timing Mark—Early Fuel Pumps.

A line is scribed on the fuel pump mounting flange and another on the fuel pump adaptor plate. When the fuel pump is fitted to the engine, before tightening the securing nuts, these two scribed lines should be aligned.

Checking Fuel Pump Timing

1. Ensure fuel pump timing circlip is correctly positioned as described previously.
2. Ensure the fuel pump is correctly fitted with the scribed line on the mounting flange aligning with the mark on the fuel pump adaptor plate.
3. Position the crankshaft so that No. 1 piston is at T.D.C. on its compression stroke.
4. Remove the rocker cover.
5. Remove the collets, spring cap and springs from No. 1 inlet valve and allow the valve to rest on top of the piston.

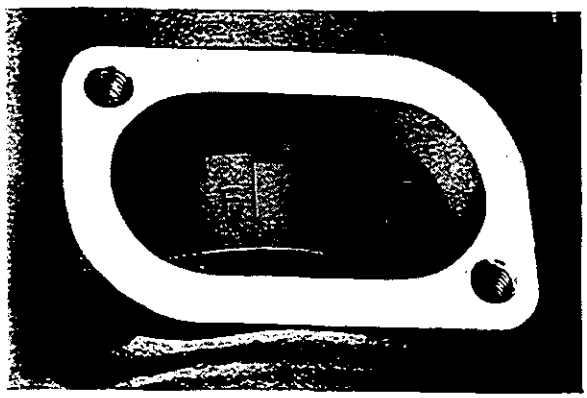


Fig. M.15. Static Timing Mark—Later Fuel Pumps.

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SECTION P
Turbochargers

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These instructions are issued for the general guidance of those concerned with the turbocharged 6.354 diesel engine. Please read carefully BEFORE starting a turbocharged engine.

In all correspondence or communications dealing with a turbocharger of this type, the date and serial number to be found on the body of the unit must be quoted clearly and fully.

In the event of an accident causing damage to the turbocharger, the unit must be removed, carefully packed and returned to the nearest Perkins Industrial Distributor or Overseas Company, where a replacement unit should be obtained. If this is impossible the instructions given in section 9 should be carefully followed.

It is not permissible to fit a Turbocharger unit to a normally aspirated engine.

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SECTION 5

Starting Instructions. From New Installation.

(1) Slacken the lubricating oil feed pipe union at the centre casing of the turbocharger, or the plug in the banjo bolt if fitted. Turn the engine over on the battery with the fuel control off until oil leaks from the union; re-tighten the union and then start the engine.

(2) Start the engine and operate at idling or light load conditions. A minimum oil pressure of 10 lbf/in² (0,7 kgf/cm²) — 69 kN/m² is required during idling conditions and if this pressure does not show on the pressure gauge in 12 to 15 seconds, shut down and check for the cause.
Note : The engine should not be run at more than 1,000 r.p.m. no load speed until the oil pressure has reached 20 lbf/in² (1,4 kgf/cm²) — 138 kN/m².

t3) Operate the engine at a fast idling speed (1,200 rev/min no load), for 10 minutes checking the lubricating oil pressure in the engine system. When normal engine oil pressure has been developed, the oil pressure to the turbocharger must be a minimum of 30 lbf/in². If this is not achieved, shut down and investigate.

(4) The unit should be checked during the 10 minutes of operation to make certain that no oil, water and exhaust gas leaks have developed.

(5) After the above steps have been taken, the turbocharger is ready for continuous operation.

It is advisable NOT to run up to maximum speed and boost during the first 500 miles or 25 hours of running.

NOTE : The power output of the turbocharged engine should never be increased beyond its manufactured rating as this will create an overload condition, increased exhaust temperatures and high turbocharger speed which may lead to failure.

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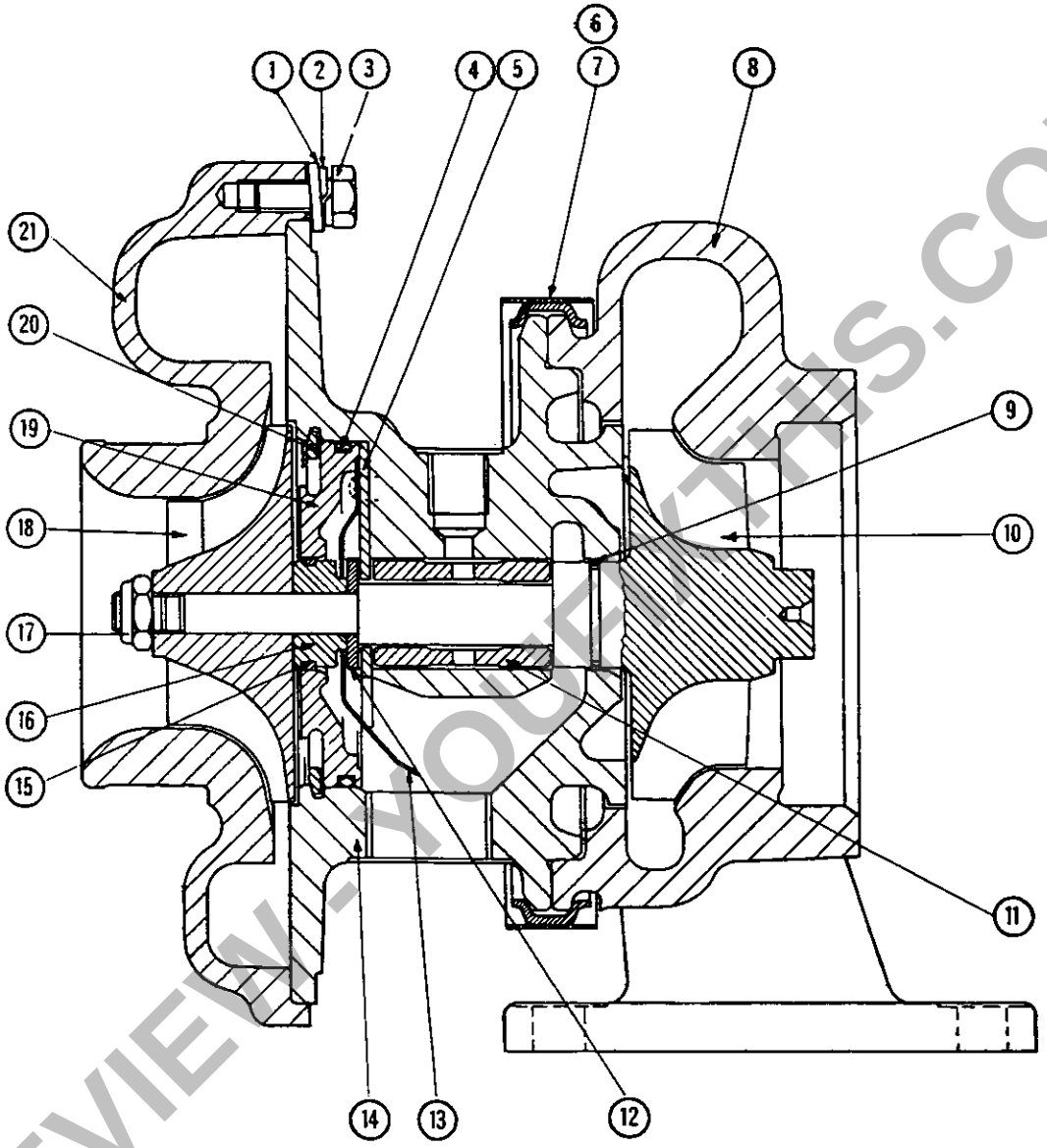


Fig. P.6.

Sectional View of Typical Holset Model 3LD Turbocharger.

1. Washer.
2. Lockwasher.
3. Bolt.
4. 'O' Ring.
5. Thrust Plate.
6. 'V' Clamp Locknut
7. 'V' Clamp.
8. Turbine Housing.
9. Piston Ring.
10. Shaft and Turbine Wheel Assembly.
11. Bearing.
12. Thrust Ring.
13. Oil Deflector.
14. Bearing Housing.
15. Piston Ring.
16. Spacer Sleeve.
17. Compressor Locknut.
18. Compressor Wheel.
19. Compressor Insert
20. Retaining Ring.
21. Compressor Cover.

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SECTION C

Operating and Maintenance

STARTING THE ENGINE

Turn starter switch to position "R" (see Fig. C.1) and ensure that the engine stop control is in the run position (i.e., pushed fully home).

Place engine speed control in maximum speed position.

If the engine or weather is warm, turn starter switch in a clockwise direction to the "HS" position.

As soon as the engine starts release the switch to the "R" position.

Be sure that the starter pinion and engine have stopped rotating before re-engaging the starter motor otherwise damage may result.

If weather is cold, turn starter switch to the "H" position and hold it there for fifteen to twenty seconds.

Then turn the starter switch to the "HS" position, thereby engaging the starter motor.

If the engine does not start after fifteen seconds, return the switch to the "H" position for ten seconds and then re-engage the starter motor by switching to the "HS" position.

As soon as the engine starts, release the switch to the "R" position.

Earlier Heat Start Switch

The cold start switch supplied with earlier engines is shown in Fig. C.2.

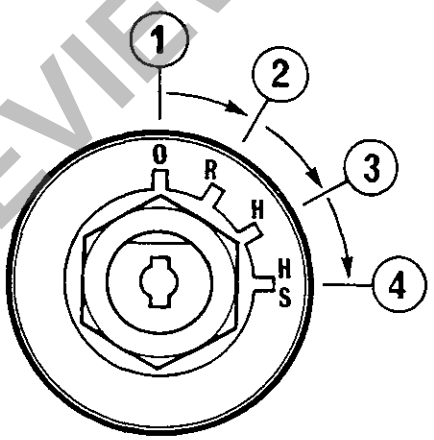


Fig. C.1.

Combined Heat/Start Switch.

1. Off Position.
2. Run Position.
3. Heat Position.
4. Heat and Start Position.

With this switch, starting a warm engine is effected by turning the switch in a clockwise direction to the "S" position.

In cold weather, the switch should be turned to the "H" position for fifteen to twenty seconds and then to the "HS" position in order to engage the starter motor.

As soon as the engine starts, the switch should be returned to the "O" position.

Where this type of switch is used, it was sometimes customary to have a separate switch for the electrical circuits and this should be turned on before starting the engine and turned off after stopping the engine.

Starting the Engine (Alternative Method)

With some engines, a different starter switch may be provided and the cold start aid is operated by means of a separate push button switch.

The cold starting procedure is however the same, i.e.

Switch on by turning the starter switch in a clockwise direction to the first position.

Press the heater button for fifteen to twenty seconds and then, with the heater button still pressed, turn the starter switch in a further clockwise direction to engage the starter motor. As soon as the engine starts, release both starter switch and heater button.

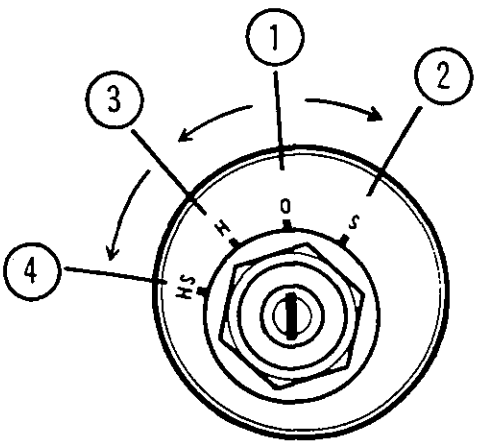


Fig. C.2.

Earlier Combined Heat/Start Switch.

1. Off Position.
2. Start Position.
3. Heat Position.
4. Heat and Start Position.

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SAFETY PRECAUTIONS

THESE SAFETY PRECAUTIONS ARE IMPORTANT. Refer also to the local and government regulations applicable in your jurisdiction.

Do not use these engines in marine applications.

Do not modify the engine.

Do not smoke when refuelling.

Always remove spilt fuel and soaked clothing to a safe place.

Do not refuel whilst the engine is running (unless absolutely necessary).

Never clean, lubricate or adjust the engine whilst it is running (unless qualified to do so, in which case, extreme care should be taken to avoid injury).

Do not attempt any adjustments you do not understand.

Ensure the engine is positioned so as to prevent a build-up of toxic emissions.

Warn persons in the area to keep well clear during engine and equipment or vehicle operation.

Do not wear loose clothing or allow long hair near moving machinery.

Keep well clear of rotating parts or machinery in operation. Note that fans are not clearly visible whilst the engine is running.

Do not run the engine with any safety guards removed.

Do not remove the radiator cap whilst the engine is hot and coolant is under pressure as scalding can result.

On no account should sea water or any other electrolytic or corrosive medium be used in the cooling system.

Keep sparks or flames away from batteries as the gases from the electrolyte (especially whilst the battery is under charge) are highly inflammable. This acid is also dangerous to the skin especially the eyes.

Always disconnect the battery terminals before repairing or interfering with the electrical system.

Only one person should be in control of the engine.

Always operate the engine from the control panel or operators seat.

If your skin comes into contact with high pressure fuel, seek medical attention immediately.

Diesel fuel can cause skin infections to some people. Use protective gloves or hand cream.

Do not move mobile equipment without first ensuring the brakes are in good working order.

Ensure that the transmission drive control is in "Out of Drive" position before starting the engine.

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