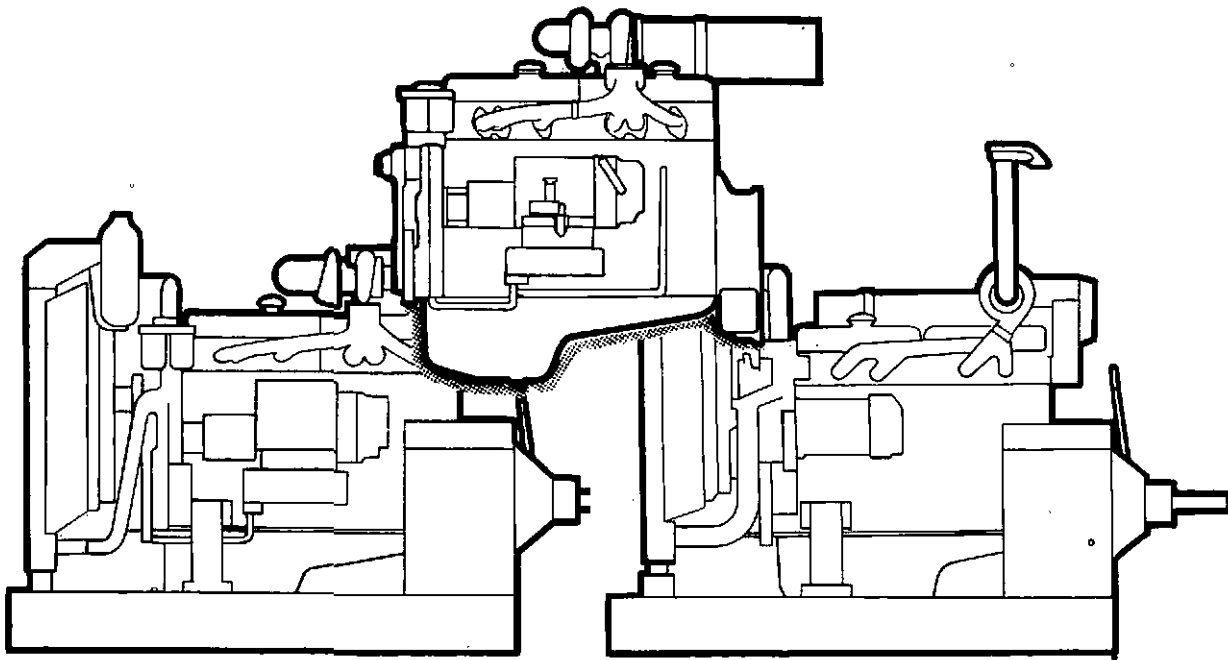


instruction manual

diesel engines



TD60B,-BG,-BPP · TD60D,-DG,-DPP · TID60D,-DG · TD70G,-GG,-GPP
TID70G,-GG,-GPP

Introduction

Before starting the engine, read through the instruction manual. It contains the information that you need in order to run and service your engine. Do not wait until a fault occurs before consulting the instruction manual to see what action to take.

Volvo Penta has built up an extensive service organization in order to provide your engine with the necessary service.

Volvo Penta dealers and service stations are equipped with the special tools required and also have a comprehensive stock of spares, so that genuine spare parts are used for service and repair purposes. Always contact your Volvo Penta representative for service and spares, quoting the type designation and serial number of the engine and its equipment.

A Service and Warranty Book is provided with every engine; this describes the warranty which we give to the Owner in the event of any faults in the product.

The delivery card in the Warranty Book should always be filled in by the selling agent and forwarded to the local Volvo Penta importer.

The servicing instructions in this book must be followed. Volvo Penta reserves the right to introduce modifications to products without previous notice and disclaims any obligation to carry out corresponding modifications to products already sold or manufactured.

The description in this manual does not constitute a valid specification. Each individual engine is equipped in accordance with the agreement which applies to the delivery.

**AB VOLVO PENTA
Technical Publications**

Owner

Name:

Address:

Tel:

Nearest Volvo Penta Service Centre

Name:

Address:

Tel:

Engine data

Type of engine Serial no

Disengageable clutch type/no

Reduction ratio/Rotation

We reserve the right to carry out modifications without previous notice and for this reason the content in this book is not binding.

VOLVO PENTA

INSTRUCTION MANUAL

Diesel Engines

**TD60B,-BG-BPP · TD60D,-DG,-DPP · TID60D,-DG
TD70G,-GG,-GPP · TID70G,-GG,-GPP**

Contents

Presentation

Type designations.....	2
Location of serial numbers	2
Engine description	2

General Information

Lubricating oil	5
Fuel	5
Coolant.....	5
Anti-freeze.....	5
Corrosion inhibitors.....	6
Engine speed	6
Running-in.....	6
Oil change during running-in	6
Electrical system	7
Instruments.....	8

Instructions for operation

Before starting	10
Starting	11
During operation.....	13
Power take-off	13
Stopping	14
Precaution against frost	14
Air compressor	14

Electrical system

Electrical system	7
Wiring diagrams	24-27
Fuses	22

Servicing

Maintenance schedule.....	15
Oil level	16
Coolant level.....	16
Disengageable power-take-off.....	16, 17, 18, 21
Air filter	17
Batteries.....	17, 19
Changing oil, engine	17
V-belts	18
Lubricating oil filter	18
Turbo charger	19, 22
Fuel tank	19
Injectors.....	19
Fuel filters.....	20
Venting the fuel system	20
Crankcase ventilation.....	20
Valve clearance	21
Cooling system	18, 21
Electrical system	22, 24-27
General inspection	22
Inhibiting	23
De-inhibiting.....	23

Technical Data

Engine	28-30
--------------	-------

Index

Alphabetical index	31
--------------------------	----

PRESENTATION

The engines dealt with in this Manual are 6-cylinder, in-line, 4-stroke diesel engines with direct injection and thermostatically controlled water cooling. The engines are lubricated via a pressure lubricating system in which an oil pump supplies lubricating oil to all lubrication points. On TD70G,-GG,-GPP and TID70G,-GG and -GPP the pistons are cooled by the lubricating oil via special nozzles installed in the engine block.

The engines are equipped with wet, replaceable cylinder liners.

All the engines are equipped with an exhaust-driven turbo-charger. The turbo-charger is lubricated and cooled by the engine lubricating oil. The turbo-charger supplies the en-

gine with fresh air under pressure, thus providing the engine with a certain amount of excess air, allowing an increase of the amount of fuel being injected, resulting in an increased engine output.

TID60D,-DG, TID70G,-GG and -GPP are also equipped with a water-cooled charged-air-cooler (inter-cooler), lowering the temperature of the intake-air, thus allowing the engine output to be further increased. At the same time the combustion- and exhaust temperatures are lowered.

Furthermore all the engines are equipped with an electrical starting element in order to facilitate the starting-up and to lower the exhaust smoke when starting-up in cold weather.



Basic engine number Conversion-number Engine designation
Serial number plate, example

Engine	The location of the serial number plate
60-Series	On the right side of the engine block, obliquely above the starter motor.
70-Series	On the left side of the engine block, above the fuel injection pump drive-shaft guard plate.

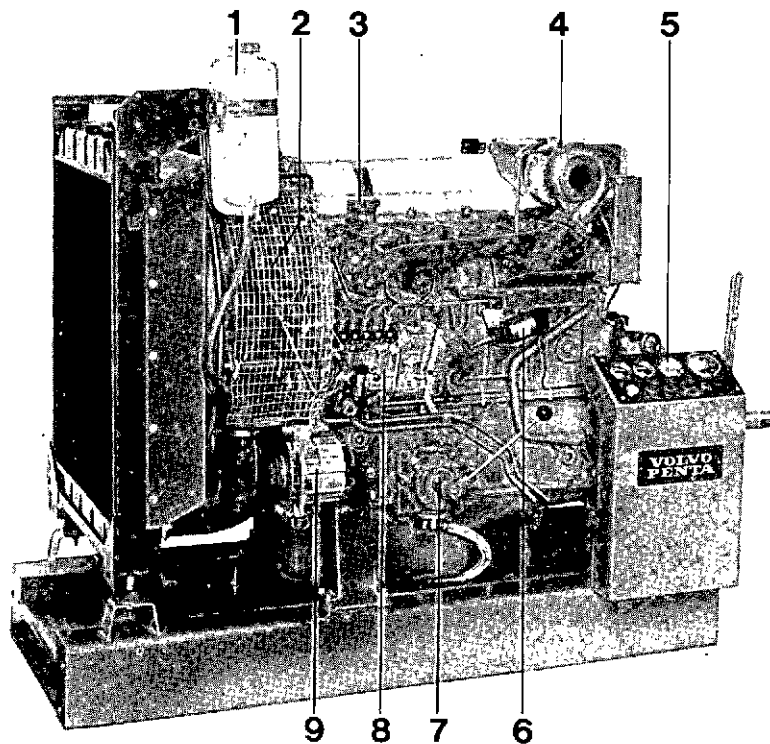


Fig. 1 Engine TD60BPP

- | | |
|----------------------|------------------------|
| 1. Expansion tank | 6. Stop-solenoid |
| 2. Fuel fine-filters | 7. Oil scavenging pump |
| 3. Oil filler cap | 8. Fuel injection pump |
| 4. Turbo-charger | 9. Alternator |
| 5. Instrument panel | |

Fig. 2 Engine TD60BPP

1. Relay, electrical starting element
2. Indicator, pressure-drop
3. Air filter
4. Cooler
5. Oil sump
6. Oil cooler
7. Lubricating oil filter
8. Starter motor
9. Horn

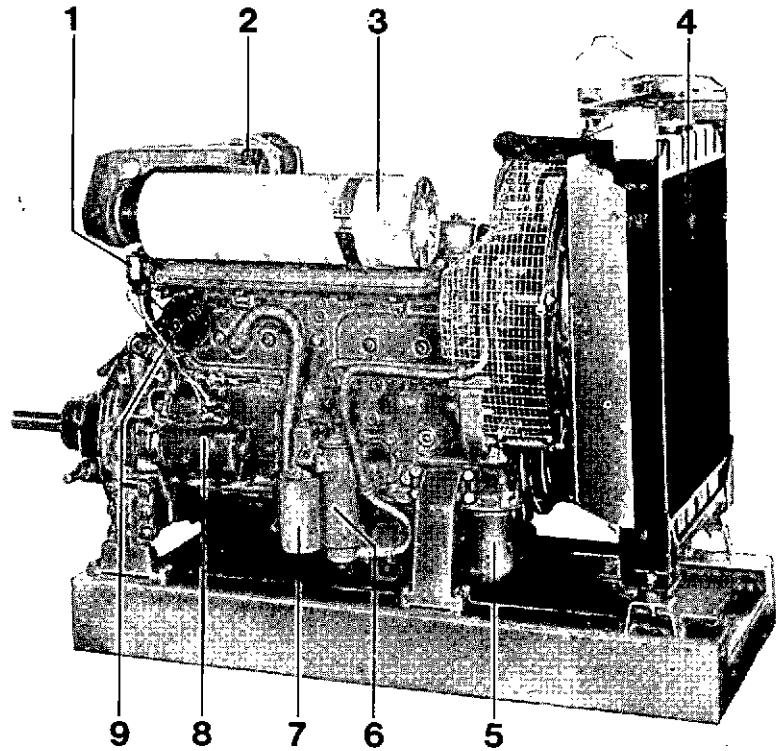
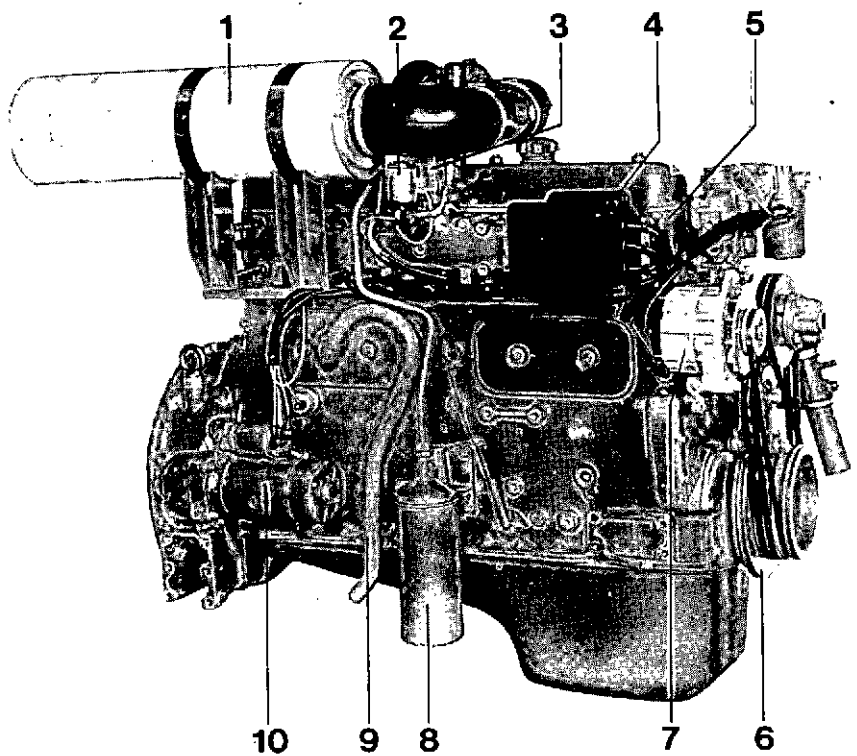


Fig. 3 Engine TD70G

1. Air filter
2. Relay, electrical starting element
3. Starting element
4. Terminal box with fuses
5. Lifting eyelet
6. Vibration damper
7. Alternator
8. Lubricating oil filter
9. Crankcase ventilation
10. Starter motor



PRESENTATION

Fig. 4 Engine TID70G

1. Automatic belt tensioner
2. Fuel fine-filters
3. Oil filler cap
4. Valve cover
5. Turbo charger
6. Heat shield
7. Return oil line from the turbo charger
8. Fuel injection pump
9. Oil cooler
10. Cooling water line to the oil cooler
11. Cooling water pump

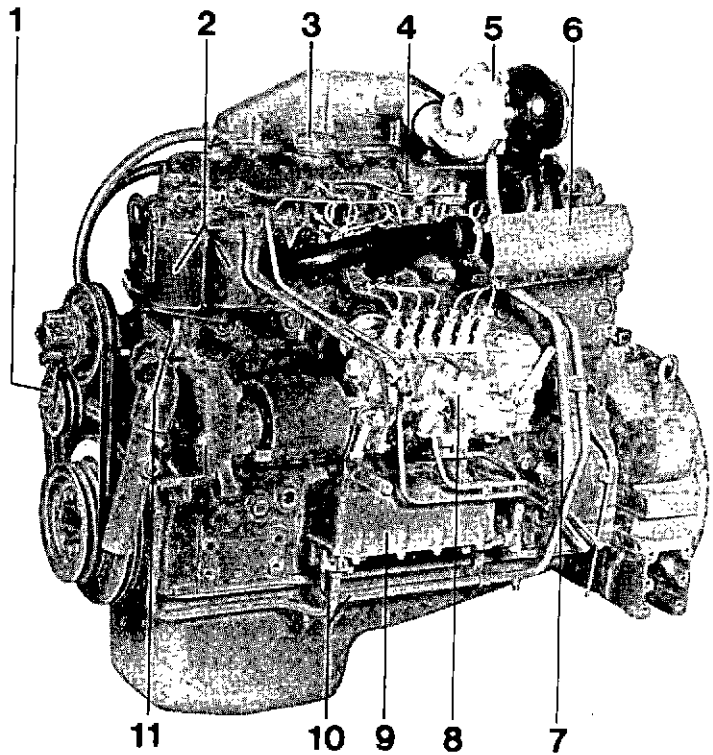
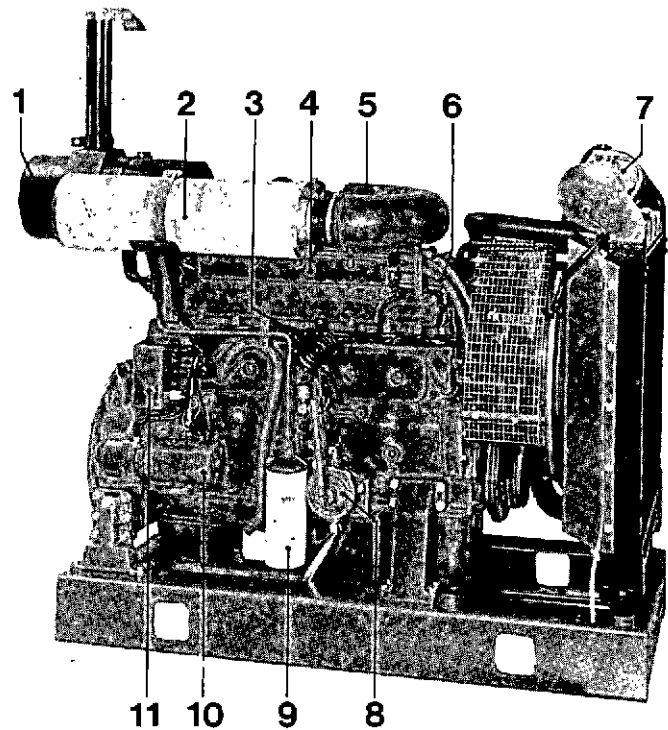


Fig. 5 Engine TID70GPP.

1. Exhaust silencer
2. Air filter
3. Horn
4. Charged air cooler (inter cooler)
5. Pressure drop indicator
6. Cooling water hoses to/from the charged air cooler
7. Expansion tank
8. Oil scavenging pump
9. Lubricating oil filter
10. Starter motor
11. Electrical junction box with automatic fuse



GENERAL INFORMATION

Lubricating oil

Use only oil which satisfies the demands made by the standards referred to in the table below. The Volvo Penta diesel engine oil satisfies these quality demands by a wide margin and can therefore be used to advantage.

NB! The warranty no longer applies, should the engine be operated with the wrong type of lubricating oil.

The viscosity should be appropriate to the air temperature, see "Technical Data".

Designation	Standard
CD MIL-L-2104 C	API (American Petroleum Institute) US Government's Military Spec.

For the (-G) and (-PP)-engines prolonged oil change intervals can be permitted under certain conditions, see page 15. On such occasions a SHPD-oil (Super High Performance Diesel Oil) in accordance with Volvo Drain Specifications and/or CCMC D3* must be used.

* Committee of Common Market Automobile Constructor's D3-oil.

Fuel

The diesel fuel for the operation of the engine must satisfy high quality demands and above all, it must contain a minimum of solid impurities and water. Also the sulphur content should be as low as possible.

If low-grade fuel is used, this will produce abnormal wear, poor functioning and dark exhausts.

The diesel fuel must satisfy the requirements set out in the following standards; DIN 51601, CEC-ERF-D1, ASTM-D975-No. 2-D, SIS 155432 or Volvo Group Standard (Diesel fuel oil 97863-02).

Some of the points contained in the Volvo Group Standard are repeated below:

Ignition value (Cetane-no)	Min. 45
Viscosity at 20°C (+68°F)	2,0-5 cSt
Lowest float. temp, summer grade	-9°C (+16°F)
winter grade*	-24°C (-11°F)
Flash point	40°C min. (104°F)
Solid impurities	None
Sulphur content	Max. 0,5 % by weight

* Alt. filterability at low temperature in accordance with SIS 155122.

Avoid condensation water being formed by always having the fuel tank filled up as much as possible. Methylated spirits must never be added to the diesel fuel as even small quantities may damage the fuel system.

In order to ensure reliable starting and a proper fuel delivery in the winter and under very cold conditions, the special winter grades, sold by the large oil companies, should be used.

These fuel grades are more volatile, thus reducing the risk of wax deposits being formed in the fuel system. Alternatively, about 30 % water-white kerosene (paraffin oil) may be added to the diesel fuel. **Engine- or domestic heating kerosene may not be used, due to its low Cetane-number and subsequent degrading of the ignition quality.**

Coolant

The coolant should consist of a mixture of ethylene glycol and water or if there is no risk of having frost, corrosion inhibitor and water. See below.

Ethylene Glycol

Ethylene glycol in accordance with BS 3151B with copper inhibitor can be used as an anti-freeze. We recommend you to use the **Volvo Genuine Ethylene Glycol***, containing the correct balance of additives for neutralizing corrosive agents in the cooling water. If this red ethylene glycol is used, it will be sufficient to change the coolant once a year, preferably in the autumn.

The anti-freeze has a dual purpose; to protect the cooling system from freezing and to prevent the formation of rust. Therefore always use a mixture containing **at least 40 % ethylene glycol**. Also use this ethylene glycol mixture when topping up the system. This mixture provides a anti-freeze protection down to approx. -25°C (-13°F). For lower temperatures a higher ethylene glycol content is needed, see the table on next page.

The maximum reduction in the freezing point is to -56°C (-69°F) and then with a 60% ethylene glycol content. **Any further increase in the ethylene glycol content reduces the frost protection.**

Mix the ethylene glycol with water in a separate vessel, prior to filling the cooling system.

NB! Ethylene glycol is dangerous (to consume).

Never use untried anti-freeze fluids. Certain defective anti-freeze fluids can initiate corrosion in the engine.

Do not use spirits of any kind, because spirits evaporates quickly. Furthermore, spirits increases the risk of corrosion in the cooling system.

* Part-no 1129616, 1 kilo = 2,2 lbs = approx. 0,9 liter (0.2 Imp.gall. 0.24 US.gall).

Part-no 1129617, 5 kilos = 11 lbs = approx. 4,5 liter (1.0 Imp.gall. 1.2 US.gall).

GENERAL INFORMATION

Volumes

Cooling system capacity litres (Imp./US.gall), with VP standard radiator about:	Amount of glycol in litres (Imp./US.gall) for frost protection down to:			
	-25°C (-13°F)	-30°C (-22°F)	-40°C (-40°F)	-56°C (-69°F)
TD60B, D 22*	9	10	12	13.2
TD60BG, DG (4.8-5.8)	(2.0-2.4)	(2.2-2.6)	(2.6-3.2)	(2.9-3.5)
TD60BPP 28**	11.5	13	15.3	16.8
TD60DPP (6.2-7.4)	(2.5-3.0)	(2.9-3.4)	(3.4-4.0)	(3.7-4.4)
TID60D 23*	9.5	11	13	14
TID60DG (5.1-6.1)	(2.1-2.5)	(2.4-2.9)	(2.9-3.4)	(3.1-3.7)
TID60DGP 29**	12	13.5	16	17.4
(6.4-7.7)	(2.6-3.2)	(3.0-3.6)	(3.5-4.2)	(3.8-4.6)
TD70G 25*	10.1	11.5	13.5	15
TD70GG (5.5-6.6)	(2.2-2.7)	(2.5-3.0)	(3.0-3.6)	(3.3-4.0)
TD70GPP 31**	12.7	14.4	17	18.6
(6.8-8.2)	(2.8-3.4)	(3.2-3.8)	(3.7-4.5)	(4.1-4.9)
TID70G 26*	10.7	12	14.2	15.6
TID70GG (5.7-6.9)	(2.4-2.8)	(2.6-3.2)	(3.1-3.8)	(3.4-4.1)
TID70GPP 32**	13	14.6	17.3	19.2
(7.0-8.5)	(2.9-3.4)	(3.2-3.9)	(3.8-4.6)	(4.2-5.1)

* With expansion tank of plastic.

** With expansion tank of metal.

Corrosion inhibitor

In order to avoid corrosion the most simple thing to do is to use a suitable mixture of Volvo Genuine Ethylene Glycol all the year around (at least a 40 % mixture). Coolant should then be changed each autumn. In case Ethylene Glycol is not being used, a corrosion inhibitor must be added to the cooling water. Preferably use Volvo's corrosion inhibiting additive (part-no 1129709-0), available in 1/2-litre packs. Three packs (=1.5 litre) are required for TD70 and TID70 with expansion tank of metal. For other engines with the Volvo Penta standard cooler two packs (1 litre) are required.

Clean the cooling system carefully prior to filling-up. Run the engine warm as soon as possible after the filling, this in order to give the additive the best possibilities for action.

In order to maintain the corrosion inhibiting properties, the coolant must be **replenished** with half a litre (=1 pack) corrosion inhibiting additive **each 400 hours of operation**.

NB! It is absolutely forbidden to mix Glycol or any other type of anti-freeze fluid with this corrosion inhibitor. **The corrosion inhibitor does not prevent the formation of ice. Therefore it is allowed to use the corrosion inhibitor only if the temperature steadily lies above 0°C.**

Engine speed

Do not operate the engine during longer periods at an engine speed less than **1400 rpm** and under full load.

Should you find the engine particularly weak, a fault in the turbo-charger may be suspected. Then stop the engine and carry out the following checks:

1. Remove the inlet-tube between the air-filter and the turbo-charger.
2. **Make sure that the compressor wheel is at standstill.** Then check with the fingers if the compressor wheel feels sluggish when being rotated. Use a light pressure at first to turn the wheel and then with a light pull axially. **If the wheel feels sluggish, the turbo-charger must either be overhauled soonest or replaced.**

Running-in

When the engine is new, it must be run with a certain amount of caution for the **first 200 hours**. This also applies to an engine, which just has been reconditioned. Read the instruments often and make sure that they produce the correct readings.

Operate at full engine speed only during short intervals during the **first 50 hours** of operation. The use of full power should also be confined to short periods during the first part of the running-in period. It is particularly important not to subject the engine to full load during longer periods of time.

NB! On a new or reconditioned engine, the valve clearance must be checked for the first time after 100-200 hours of operation, then at each 1200 hours.

Oil-change during the running-in

Change the oil and the oil filter for the first time after **100 hours** of operation. This also applies to the oil in the disengageable power-take-off with reduction gear (if installed).

The oil and the filter are then changed at intervals given in the "Maintenance Schedule".

Electrical system

The wiring diagrams are found on pages 24–27.

Important

For engines equipped with alternator, the following is valid:

1. **Never break the circuit between the alternator and the battery while the engine is running. Consequently the main switch must not be disconnected until the engine is at a complete standstill.** Nor should any other wire or lead be disconnected during operation, as this also may damage the charging regulator.
2. The batteries, the battery leads and cable terminals must be inspected regularly. The battery terminals must be kept clean and the cable terminals tightened and well greased in order to avoid interruptions. All leads must be well tightened and no loose leads are allowed.

NB! Under no circumstances must the battery poles, plus and minus, be reversed when installing the battery. Compare the wiring diagram. Check the V-belt tension regularly.

3. **When using an auxiliary battery to start the engine – see under the next section.**
4. Remove the battery leads before starting any type of repair work on the alternator equipment. This also applies should a rapid battery charging equipment be used to charge the batteries.

NB! Make sure to follow the valid safety regulations when charging the batteries.

5. Never use a screwdriver or similar tool against the terminals to check if "it gives off sparks".
6. **Electrical welding**

If electrical welding work is to be carried out on the engine or on its components, the following precautions must be taken:

Remove the battery ground connection and then all leads to the alternator. Insulate the alternator leads and attach the battery ground connection again. Remember to remove the battery ground connection before the leads to the alternator are replaced.

Attach the welding clamp in a way that no current passes through any bearing.

Starting the engine with an auxiliary battery

Warning!

The batteries, and then especially the auxiliary batteries, contain detonating gas, being very explosive. A spark, which might be formed if the auxiliary battery leads are wrongly connected, can be sufficient to explode a battery and cause subsequent damage to personnel and material.

Should the batteries be frozen, they have to be thawed prior to making a first starting attempt with the auxiliary batteries.

1. Make sure that the auxiliary batteries are connected (in series or in parallel) so that the rated voltage coincides with the system voltage of the engine.
2. Attach the red auxiliary starting wire to the plus pole of the auxiliary battery (marked with red paint, P or +). Always check that clamps are tightened to avoid sparks being formed during the starting attempt.
3. Attach the other end of the red auxiliary starting wire (+) to the plus pole of the empty battery, where the plus lead to the starter motor is connected.
4. Attach one end of the black (–) auxiliary starting wire to the minus pole (marked with blue paint, N or –) of the auxiliary battery.
5. Attach the other end of the black (–) auxiliary starting wire to a **position away from the empty batteries**, i.e. at a main switch on the negative lead or the minus connection on the engine.
6. Start the engine. **NB! Don't dislodge or move the lead connections during the starting attempt** (risk of forming sparks) **and don't lean down over any of the batteries.**
7. Remove the wires in a way quite contrary to the way they were attached. **NB! Under not circumstances must the leads to the ordinary batteries be disconnected.**

INSTRUMENTS

Familiarize yourself with controls and instruments very carefully before you begin to operate the engine. Read the instruments off and on during the operation in order to discover abnormal readings in time.

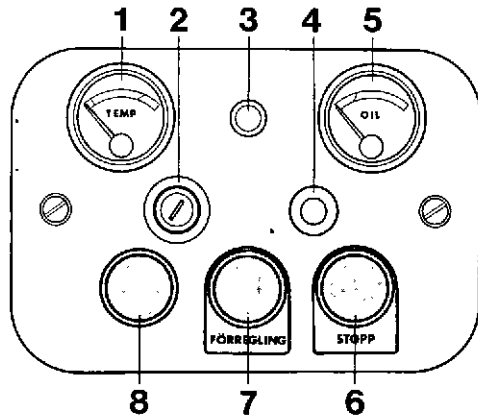


Fig. 6 Instrument panel TD60, TD70

Instruments (early prod.), TD60, TD70

1. Temperature gauge – engine coolant

The pointer during normal operation must point within the green field. Should the pointer during any length of time indicate a too high temperature, red field, then stop the engine and investigate the reason. Nor should the engine be operated on too low temperature, white field, during a longer period of time.

2. Key Switch

When the key is turned clockwise, the current is switched on. The key must remain in the engaged position during operation, otherwise the battery will not be charged. When the engine has come to standstill, the key should be turned off.

The key switch in fig. 6 has four positions:

- Position 0 – the key can be inserted and taken out.
- Position 1 – position during operation.
- Position 2 – glow position (starting element switched on).
- Position 3 – starting position (starter motor engaged).

In order to move the key from the glow position to the starting position, the key has to be depressed.

The key can also be turned depressed one step counter clockwise from the 0-position. This position is not connected at the time of delivery and should not be used.

3. Switch – instrument lighting

With the switch in a pulled-out position the instruments are illuminated indirectly.

4. Charging warning lamp

The charging warning lamp lights up if and when the batteries are discharging. Should the warning lamp light up during normal operational engine speed, there is a fault at hand, which must be remedied.

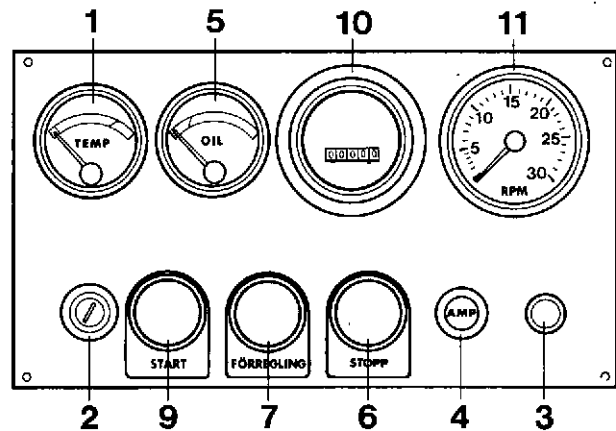


Fig. 7 Instrument panel, installed on a column TD60GPP, TD70GPP.

5. Oil pressure gauge

The pointer during operation must point within the green field. If the oil pressure should drop down to the red field, i.e. below 150 kPa (1,5 kp/cm² = 21 lbf/in²) at higher engine speed than idling, then stop the engine immediately and investigate the reason.

6. Stop button*

Depress the stop button to stop the engine. Should a manual stop control be installed, then pull the stop control instead.

7. Interlock button*

In order to be able to start the engine, the "automatic stop" and the alarm have to be disconnected. These two functions are disconnected by means of the interlock button. Keep the interlock button depressed until the oil pressure is normal. Should the interlock button be released too soon, the automatic stop will cut in and stop the engine, the alarm goes on at the same time.

On engine models TD60BPP and TD70GPP (fig. 7) the starting element is engaged when the interlock button is kept in depressed.

8. Dummy plug

9. Start button*

Engine models TD60BPP and TD70GPP are being started by depressing the starter button.

10. Hour recorder*

Records hours, tenth of an hour of engine operational time.

11. Tachometer*

Displays the engine speed in revolutions per minute. Multiply the display figures by 100.

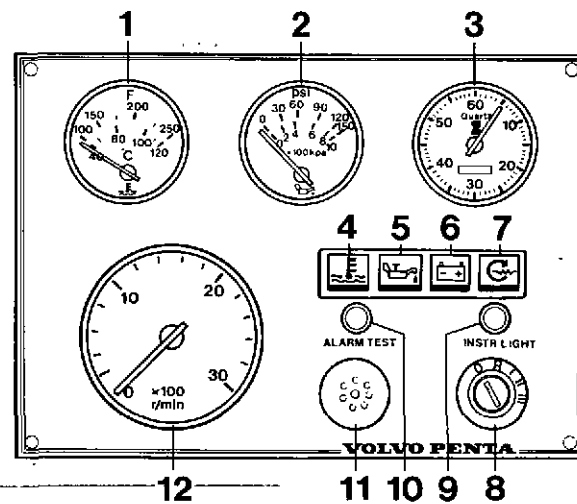


Fig. 8. Instrument panel, TID70

Instruments (late prod.), TD60, TID60, TD70, TID70

1. Temperature gauge, engine coolant

During normal operation, the engine temperature should be between 75–95°C (167–203°F). Should the pointer during any length of time indicate a too high temperature, stop the engine and investigate the reason. Nor should the engine be operated on too low temperature during a longer period of time.

2. Oil pressure gauge

The engine oil pressure during operation should be between 300–500 kPa (43–71 lbf/in²), warm engine. Should the pressure drop below 150 kPa (21 lbf/in²) at a higher engine speed than idling, then the engine must be stopped immediately and the reason investigated.

3. Hour recorder

Records hours and minutes of engine operational time.

4. Warning lamp – high engine coolant temperature or low coolant level*

The warning lamp lights up at a too high engine coolant temperature (above approx. 95°C (203°F) or at a too low coolant level.* The alarm starts sounding at the same time. The warning lamp lights up also should there be a fault in the battery charging (the alarm does not sound).

* Applies to engines with a coolant level switch.

5. Warning lamp – low oil pressure

The warning lamp lights up should the oil pressure become too low (below approx. 150 kPa (21 lbf/in²). The alarm starts sounding at the same time.

6. Warning lamp – battery charging

The warning lamp lights up should the charging current from the alternator be interrupted.

7. Warning lamp – starting element

The warning lamp is alight when the element is connected (approx. 50 seconds). Should the warning lamp light up

while the key stands in position 1, it can depend on the fact that the glow element is out of function. Should the engine be running, then stop the engine immediately and investigate the reason. Parts of the element might otherwise end up in the engine with subsequent severe damages.

8. Key switch

The current is switched on when the key is turned clockwise. The key must be turned on while the engine is in operation. Turn the key to position 0 when the engine has come to a complete standstill.

The key switch is provided with an automatic restarting lock, preventing the engagement of the starter motor while the engine is in operation. The key has to be returned to position R (stop) before it can be turned to the starting position.

Position 0 – the key can be inserted and taken out.

Position R – stop position

Position I – operation position

Position II – glow position (engagement of the starting element)

Position III – start position (engagement of the starter motor).

9. Switch – instrument lighting

The instrument lighting is turned off/on when the switch is operated.

10. Switch – alarm testing

The alarm must sound while the button is being kept in a depressed position.

11. Alarm

The alarm (buzzer) is sounding at too high engine coolant temperature or too low oil pressure or when the alarm test button is being depressed.

12. Tachometer – engine speed

Multiply the display value with 100 to obtain the engine speed in revolutions per minute.

OPERATION

Before starting

1. **Coolant level.** Check to make sure that the coolant level is somewhat above the middle of the expansion tank (not under the MIN.-mark on the plastic tank).

Use the filler opening on the cooler to fill the system until it is full. Install the cooler filler cap and top up the system through the expansion tank until the level is about 5 cm (2") below the sealing surface of the filler cap on the metal tank and between the MIN.- and MAX.-marks on the plastic tank respectively. Run the engine for a while and top up the system if necessary.

Carefully open the filler cap if the engine is warm.

Regarding coolant, see page 5: The topping-up should be made with the same type of coolant as already in the system.

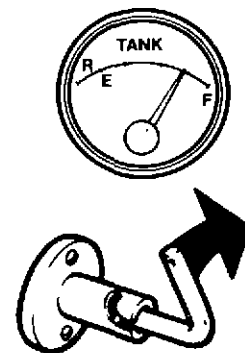
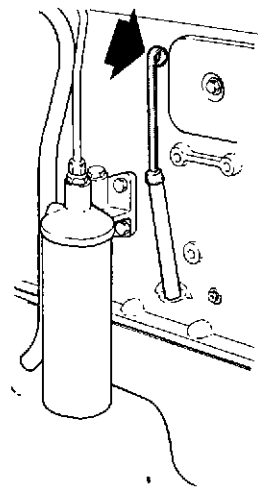
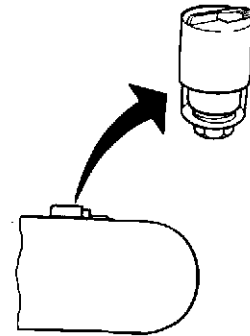
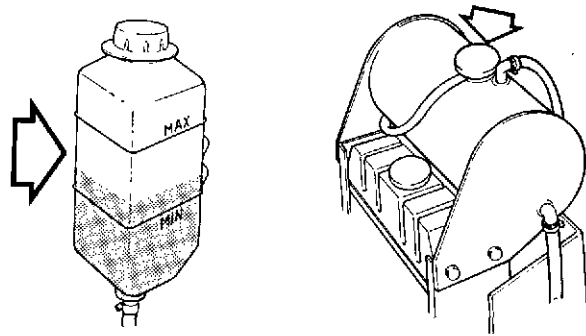
2. **Pressure drop indicator.** Check the air cleaner indicator. Should the indicator show the red field, then replace the air cleaner. See under "Maintenance", point 4.

3. **Lubricating oil level, engine.** Check that the level is between the marks on the oil dipstick (see under "Maintenance", point 1). Never allow the level to drop below the lower mark on the oil dipstick.

4. **Lubricating oil level, reduction gear or gearbox.** Check the oil level in the reduction gear or in the gearbox. Use the available oil dipstick.

5. **Fuel.** Check that there is sufficient fuel in the tank and open the fuel cocks. Should the engine not have been in use for some time, the fuel system must be vented in accordance with the instructions under "Maintenance", point 16.

6. **Main switch.** Switch on the main switch. The main switch must always be switched on while the engine is in operation. NB! Never switch off/on while the engine is in operation, this might damage the voltage regulator.



Starting

The fuel injection pump is equipped with a cold starting device, which is engaged manually on TD60D and TD70G with RQV-governor. On the other engine models, the cold starting device is engaged automatically when the control lever is moved to its "full throttle"-position.

On engine model TD60D with RQV, the cold starting device is located in the centrifugal governor (under the smoke limiting device) at the rear end of the fuel injection pump. Engage by pulling the eyeleted shaft on the side of the regulator after turning the key switch to the operational position, see the picture.

On engine model TD70G with RQV, the cold starting device is located in the smoke limiting device at the front of the fuel injection pump. Engage by pulling the eyeleted shaft on the side of the smoke limiting device, see the picture below after turning the key switch to the operational position.

As soon as the engine starts, the cold starting device cuts out automatically.

The engines are also equipped with an electric starting element, facilitating the starting of the engines and reducing the exhaust smoke when starting with a cold engine.

NB! Never use a starting spray, ether etc to facilitate the starting. The gas can be ignited by the hot starting element and cause an explosion with subsequent damage to the compressor wheel and air intake as well as to personnel.

When in an emergency situation, where the starting element is suspected to be out of function, a starting spray may be used but carefully. However, it is absolutely necessary to **render the starting element harmless by removing the electrical leads and to insulate the same**. Then check with the hand to make sure that the manifold isn't hot where the starting element is located, before starting to use the spray.

Should cold starting in temperatures below -10°C (approx $+14^{\circ}\text{F}$) be a frequent necessity, the employment of an engine heater is recommended.

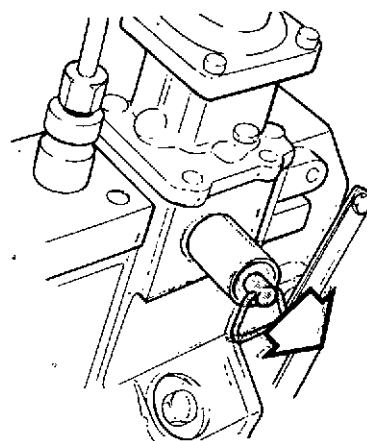
If the engine should not start at the first attempt, then make a short break before the next attempt to allow the batteries and the starter motor time to recover.

Early prod., TD60, TD70

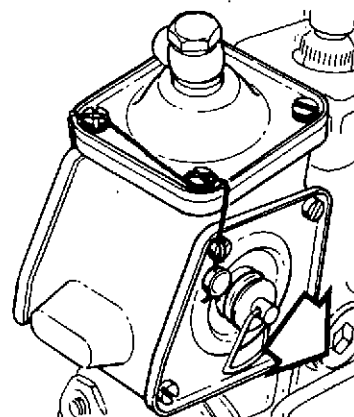
The following is valid for engines, which have been at a standstill during a longer period of time: Turn the engine with the starter motor, holding the stop button depressed, until the oil pressure gauge registers an oil pressure. By doing this, the bearings of the turbo charger are given a good lubrication from the beginning.

Below $+5^{\circ}\text{C}$ (41°F)

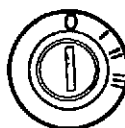
1. Disengage the engine.
2. Move the control lever to the "full throttle"-position. (Should a manual engine stop be installed, start by pushing this in to its neutral position).
3. **TD60D/RQV, TD70G/RQV:** Engage the cold starting device. See the pictures above.
4. **TD60BPP, TD70GPP:** Turn the key switch and check that the charging control lamp is lighting up.



Cold starting device, TD60D/RQV



Cold starting device, TD70G/RQV



- 0 = The key can be inserted and taken out
- 1 = Operational position
- 2 = Glow position, starting element
- 3 = Starting position

5. **TD60BPP, TD70GPP:** Depress the interlock button (the starting element is engaged) and hold it depressed for about 40 seconds (40-60 seconds in temperatures below -20°C (-4°F)). **Never engage the starting element for a period of time longer than 60 seconds before starting.**
6. **TD60BPP, TD70GPP:** Hold the interlock button depressed and depress the starter button. Release the starter button and move the throttle control towards the position for idling as soon as the engine has started. Release the interlock button as soon as normal oil pressure has been obtained.

OPERATION

7. **Remaining engine models:** Turn the key switch over the "Operational position" (1) – (check that the charging control lamp lights up) – to the "Glow position" (2) and hold the key in this position for about 40 seconds (40–60 seconds in temperatures below -20°C (-4°F)). **Never engage the starting element for longer periods of time than 60 seconds before starting.**
8. **Remaining engine models:** Depress the key switch and turn it to the "Starting position" (3). Hold the interlock button depressed until normal oil pressure has been obtained, this only if the engine should be equipped with automatic stop and alarm. Release the key and move the throttle control towards the position for idling as soon as the engine has started.
9. In order to reduce the exhaust smoke during the time the engine is still cold or if the engine is misfiring after having started, the started element can be engaged again for a minute for continued warming up of the intake air.

Repeat the whole procedure should the engine not start or if it stops after the first attempt.

Above $+5^{\circ}\text{C}$ (41°F)

Points 1, 2 and 3 the same as previous.

4. Depress the key and turn it directly to the starting position (3). Hold the interlocking button depressed until normal oil pressure has been built up, this if the engine is equipped with automatic stop. Release the key and move the control lever back towards the idling position as soon as the engine has started.

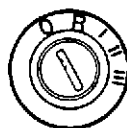
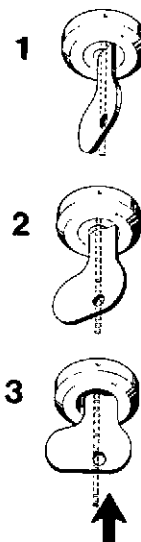
The following applies to engines from which low emission is particularly essential:

Should the engine has been at standstill for more than 10 minutes, the starting element must be used when starting. This applies irrespective of the ambient temperature. See under "Starting below $+5^{\circ}\text{C}$ (41°F)". In temperatures below $+20^{\circ}\text{C}$ (68°F), the starting element should be engaged for about 30 seconds after the start.

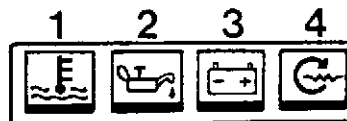
TD60*, TID60, TD70*, TID70

* Late prod.

1. Disengage the engine.
2. Move the control lever to the "full throttle"-position.
3. Turn the key to the operational position (1) and check that the warning lamps for engine coolant temperature (1), for oil pressure (2) and battery charging (3) light up. Engage the cold starting device on TD60 and TD70 with RQV-governor.
4. Depress the button "alarm test" and make sure the alarm sounds. Turn the key to the glow position (2) and check that the warning lamp (4) lights up. Release the key and let it return to position 1. A time relay now keeps the starting element engaged for about 50 seconds. When the light goes out, start the engine by turning the key to position 3. When the key passes position 2, the starting element is engaged again for about 50 seconds.
5. Release the key and move the control lever back towards the neutral position as soon as the engine has started.



- 0 = The key can be inserted and taken out
- R = Stop position
- 1 = Operational position
- 2 = Glow position, starting element
- 3 = Starting position



Warning lamps

- | | |
|------------------------|---------------------|
| 1. Coolant temperature | 3. Battery charging |
| 2. Oil pressure | 4. Starting element |



Alarm

During operation

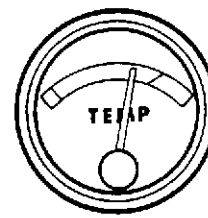
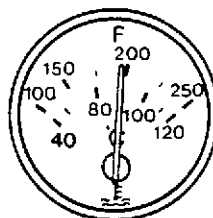
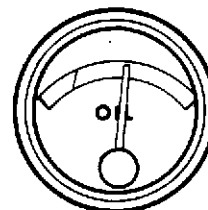
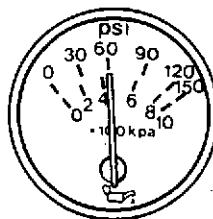
Check during operation that everything is in order by reading the instruments off and on.

Never overspeed the engine when it is cold. Run the engine warm under a low load or at a quick idling.

Engines driving loads such as generators that have a high moment of inertia which cannot be disengaged often have one or more resonance points at low engine speed at which great stresses arise in the transmission. These engine speeds should be avoided if at all possible.

The engine speed during warm-up by a generator unit should therefore not lie under 1400 rpm. Thereby the generator should be run only at low load.

1. Check the oil pressure, which should be 300–500 kPa (43–71 lbf/in²). The pointer must point within the green field of the gauge (early prod.). The warning lamp must be out (late prod.). **The engine must not be run at a too low oil pressure.**
2. Make sure that the charging warning lamp goes out. This indicates that the alternator is charging. Should the lamp be alight, this means that a fault is at hand. On the late prod. instrument panel, also the engine coolant warning lamp lights up, should a fault in the battery charging occur, (the alarm does not sound). If there is a warning lamp for the starting element, this warning lamp must be out.
3. Check to make sure that the engine coolant temperature rises to a normal value, 75–95°C (167–203°F). The pointer must point within the green field of the gauge (early prod.). For late prod. the warning lamp must be out.

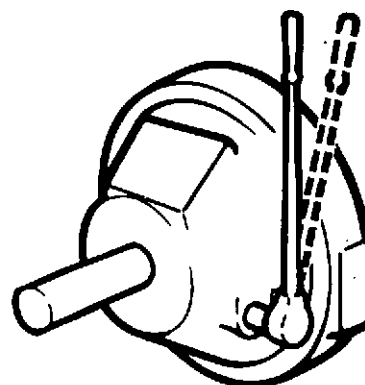


Engagement of Power-take-off

When engaging disconnectable power-take-offs and gears, the engine speed must not exceed 800 rpm. Repeated engagements at higher engine speeds, may cause severe damage.

Disconnectable power-take-off

The power-take-offs have two control lever positions. The lever moved forwards (towards the engine) for engagement – the lever moved towards the rear for neutral.



Stopping

1. **Let the engine run without load for some minutes** to allow the engine temperature to get down. Thus after-boiling and overheating of the turbo-charger is avoided.
2. **Early prod.:** Depress the stop button and hold it there until the engine has come to standstill. Pull the stop control, should the engine be equipped with a manual stop.
3. **Late prod.:** Stop the engine by turning the key switch to position R. Pull the stop control, should the engine be equipped with a manual stop.

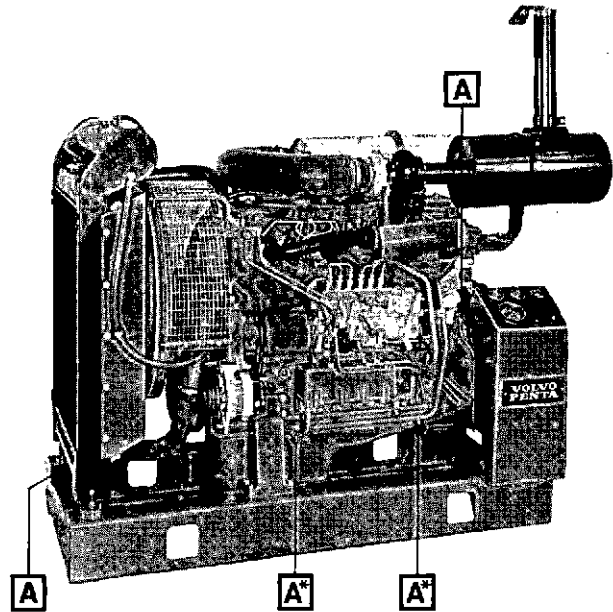
Late prod.: Stop the engine by turning the key switch to position R. Pull the stop control, should the engine be equipped with a manual stop.

3. **Cut out the current** when the engine has come to a complete standstill by turning the key-switch to position 0. Otherwise the batteries will be discharged (the stop solenoid on late prod. engines is in operation with the key switch in position R).

Should the engine be out of use for some time, the main switch must be switched off and the fuel cock closed!

NB! Never switch off the main switch while the engine is running, this will damage the voltage regulator.

Should there be a risk of having frost, the cooling system must be drained or anti-freeze added, see under "Precautions against frost" below.



A = Drainage cock/plug for coolant

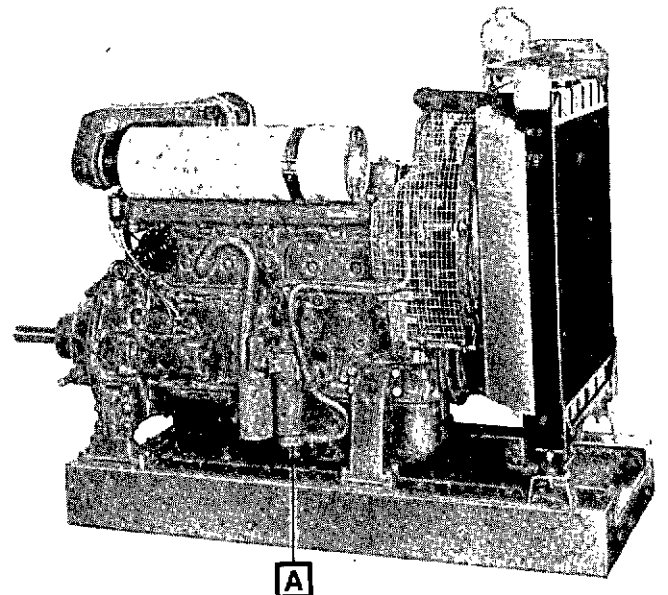
* Only TD70, TID70

Precautions against frost

When the engine is stopped and there is a risk of having frost, the cooling system must be drained or glycol of an approved quality added, see under "Coolant".

Prior to draining, the engine must be stopped and the filler cap removed. Then open the drainage cocks on the engine and the cooler, see the pictures. Do not forget the drainage plug underneath the oil cooler (TD60) and the plugs on the coolant tubes to and from the oil cooler (TD70, TID70).

Should an air compressor be installed, there will be a drainage cock on the compressor as well.



A = Drainage plug for coolant (TD60 only).

Air Compressor (optional equipment)

During the cold period of the year, the anti-freeze container must be filled with 2/3 of isopropyl alcohol to prevent ice from being formed in the compressed air system. At extremely low temperatures, methanol should be used instead (lower temperature of evaporation).

NB! Methanol is poisonous.

Check the level daily and during warmer weather once a week.

MAINTENANCE

During the running-in of the engine, the times as given on page 6, are valid.

The numbering below is referring to the more detailed information on the following pages. Maintenance requiring special skills and tools, are marked with A and should be carried out by authorized service personnel.

Daily

1. Check the oil level in the engine
2. Check the coolant level.
3. Lubricate the throw-out bearing on the disconnectable power-take-off.
4. Check the degree of clogging of the air filter.¹⁾

Every 50 hours

5. Check the electrolyte level of the batteries
6. Lubricate the bearings of the output shaft of the disconnectable power-take-off.

Every 100 hours

7. Change the oil in the engine.²⁾
8. Check and stretch if necessary the V-belts.
9. Lubricate the inner support bearing, the moving parts of the power-take-off mechanism, the bearings of the throw-out shaft in the housing (disconnectable power-take-off).

Every 400 hours

10. Replace the lubricating oil filter.
11. Improve the rust-protection of the cooling system.³⁾
12. Check and make sure that air tubes and oil tubes to the turbo-charger do not leak.

Every 800 hours

13. Check the charging condition of the batteries.
14. Drain the sludge collector in the fuel tank.
15. Check the injectors (A).
16. Replace the fuel fine-filters and vent the fuel system.
17. Replace the crankcase ventilation filter (optional equipment).
18. Check/adjust the disconnectable power-take-off.

Every 1200 hours

19. Check the valve clearance (A)
20. Check and clean the cooling system
21. Check the alternator and the starter motor.

Every 2400 hours or as required

22. Check the turbo-charger (A)
23. A general inspection of the engine and its equipment (A)
24. Inhibiting (if necessary)
25. De-inhibiting (if necessary)

All the above maintenance (except points 19, 21, 22, 23, 24 and 25) must be carried out at least once a year even if the operational time, given in the schedule, should not be reached.

¹⁾ Replace the filter when the indicator is showing a completely red field.

²⁾ For generator units (-G) and power packs (-PP) the interval is **200 hours**. The oil changing interval can be prolonged to **400 hours** (for **stand-by units** the oil change must be carried out at least once each second year even if the operational time of 400 hours should not be reached). The prolonged oil changing interval is valid under the following conditions:

- The oil must be a SHPD-oil (Super High Performance Diesel Oil) in accordance with the Volvo Drain Specification and/or CCMC D3.
- The sulphur content of the fuel must not exceed 0,5 % by weight.
- The engine must be in continuous operation.
- Checks and maintenance must be carried out in accordance with the Instruction Manual.

The changing intervals depend very much on fuel quality and operational conditions. Should longer intervals be required, the oil condition must be checked with the manufacturer by frequent lubricating oil tests.

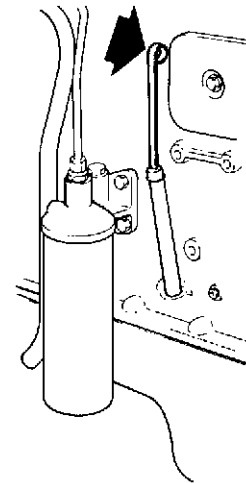
³⁾ This points does not apply when a water/glycol-mixture is used in the cooling system.

MAINTENANCE

1. The oil level of the engine

Check the engine oil level **daily** before starting-up (still-standing engine). Wipe the oil dipstick dry on a clean piece of cloth (not on waste). The oil level must be between the two marks on the oil dipstick, never below the lower mark. Changing the oil, see next page.

The fuel injection pump and the turbo charger are automatically lubricated by the engine lubricating system.



The Engine Lubricating Oil

Oil quality in accordance with the API-system: CD

Viscosity at different outdoor air temperatures, see under "Technical Data", page 29.

Oil capacity, including oil filter and oil cooler, approx.:

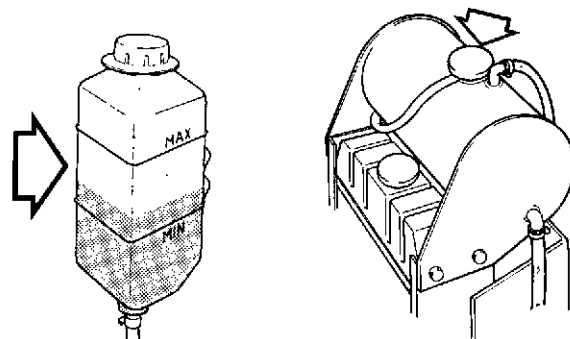
Engine:	Oil capacity in litres (Imp.gall–US.gall)	
	Std. pan	Shallow pan
TD60B, -BG, -BPP TD60D,-DG, DPP TID60D,-DG	11 (2.4–2.9)	min 18 (4.0–4.8) max 20 (4.4–5.3)
TD70G, -GG, -GPP TID70G, -GG, -GPP	15 (3.3–4.0)	min 18 (4.0–4.8) max 20 (4.4–5.3)

2. Coolant level

Check the coolant level **daily** before starting the engine. NB! Open the filler cap carefully should the engine be warm. The coolant level must be somewhat above the middle of the expansion tank (not below the MIN.-mark on the plastic tank). Top up the system through the filler opening of the expansion tank and then with the same type of mixture as the one already in the system. The level must be about 5 cm (2") below the sealing surface of the filler cap on the metal tank and between the MIN.- and Max.-marks on the plastic tank respectively. Top up if necessary.

Use the filler opening on the cooler to fill the system until it is full. Install the cooler filler cap and top up the system through the expansion tank to the correct level, see above.

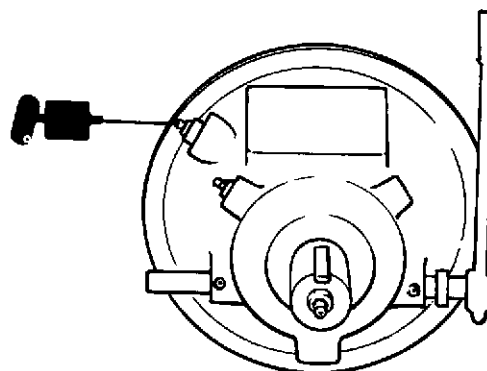
As to the type of coolant, see pages 5 and 6.



3. Power-Take-Off

On a disconnectable power-take-off the throw-out bearing must be lubricated **daily** before starting-up. Use an universal type of grease.

NB! Lubricate sparingly! Excess grease might otherwise enter the friction clutch and cause slipping.



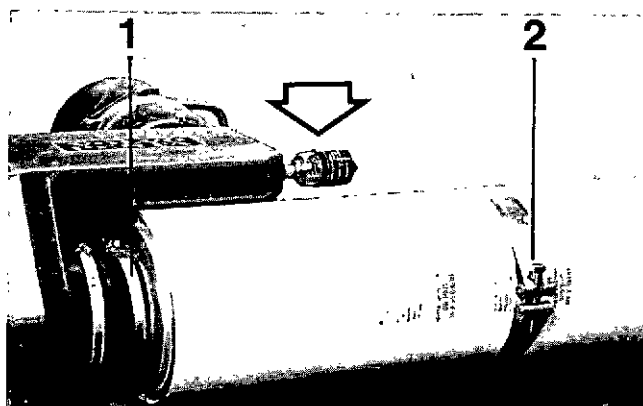
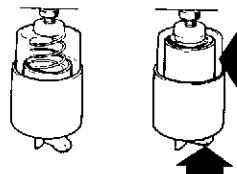
Disconnectable power-take-off

4. Air filter

Check the pressure-drop indicator **daily** before starting-up. Replace the filter as soon as a completely red field can be seen in the "window".

1. Clean the connecting rubber hose at the filter. Ease-off the hose clamp (1) and the attachment-band (2). See the picture.
2. Remove the old filter and discard it.
3. Check and make sure that the connecting rubber hose is without fault. Check and make sure that the new filter is clean and install it.
4. Reset the pressure-drop indicator by pushing in the lever. Start the engine and make sure there are no leakages.

NB! Never allow impurities to enter the engine.



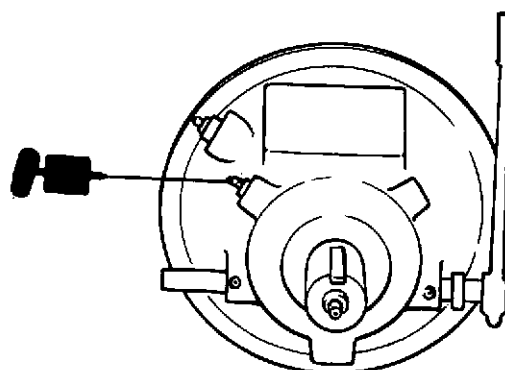
1. Hose clamp 2. Attachment band
(The engine on the picture is a TD60)

5. The electrolyte level in batteries

Check the electrolyte level every **50 hours**. It should be approx 10 mm (0.4 in) above the cell plates. Top-up with distilled water if necessary. Also make sure that the lead terminals are clean, properly tightened and greased.

6. Power-take-off

Grease the output shaft bearing (disconnectable power-take-off) every **50 hours**. Use an universal type of grease.



7. Changing the oil in the engine

Change the oil every **100 hours** of operation. The interval for generator units (-G) and power packs (-PP) is **200 hours**. For these engines the interval, under certain circumstances, can be prolonged to 400 hours.

Change the oil in the engine while the engine is warm.

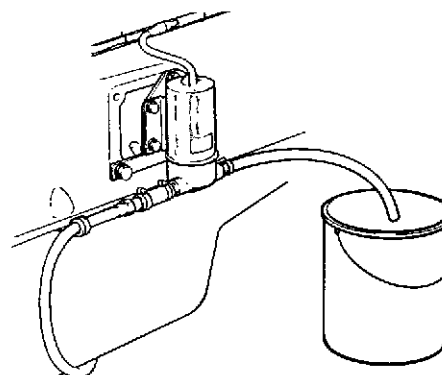
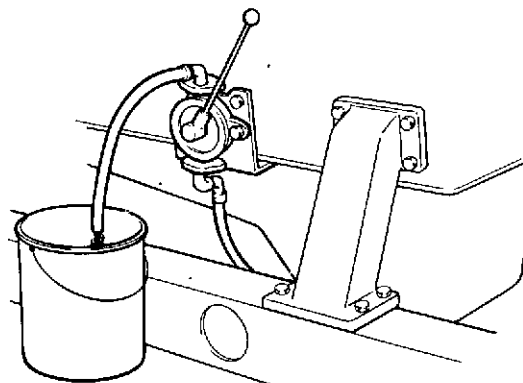
Regarding the oil quality and longer intervals, see pages 5 and 15.

Changing the oil filter, see the next page.

Certain engine models are equipped with a mechanical oil scavenging pump. An electrical oil scavenging pump is available as an optional extra.

Engines with manual scavenging pump: Use the scavenging pump on the side of the engine to drain off the oil and collect the oil in a vessel.

Engines with electrical scavenging pump. Attach the suction hose between the pump and the engine in accordance with the picture. Start the pump and collect the oil in a vessel.



8. Checking the V-belts

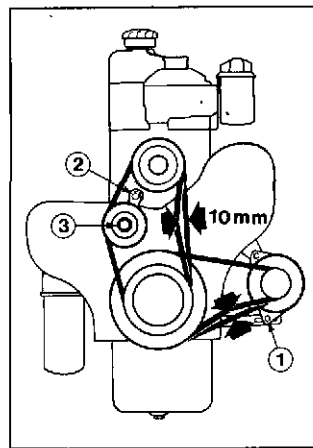
Check the V-belts every **100 hours** for wear and for the correct tension.

The V-belt are correctly stretched if it is possible to depress it approx 10 mm midway between the pulleys. Stretch the alternator V-belt after having eased-off the bolt (1) and the alternator attachment bolt.

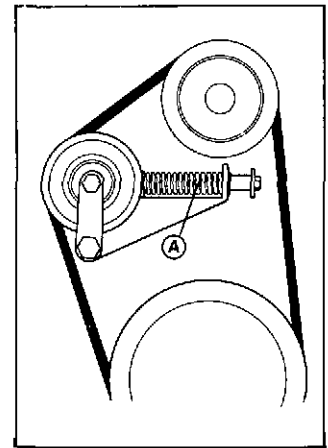
TD60: Ease off the nut (2) and stretch the fan belts. There is an internal square key-hold (3) in the center of the roller-stretcher.

TD70, TID70: The engines are equipped with an automatic stretching device for the fan-belts.

Always change V-belts, operating in pairs, at the same time even if only one V-belt is damaged.



TD60

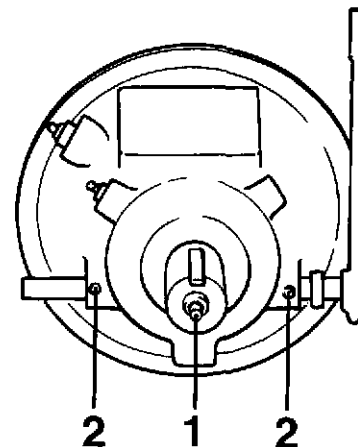


TD70, TID70
A. Spring

9. Power-take-off

Lubricate the inner support bearing (1) and the bearing of the throw-out shaft (2) every **100 hours** (disconnectable power-take-off). Use an universal type of grease.

Remove the inspection cover and lubricate the moving parts of the power-take-off mechanism with thin-bodied engine oil.



10. Changing the lubricating oil filter

Change the oil filter every **400 hours**. During the running-in period for the first time after 100 hours of operation.

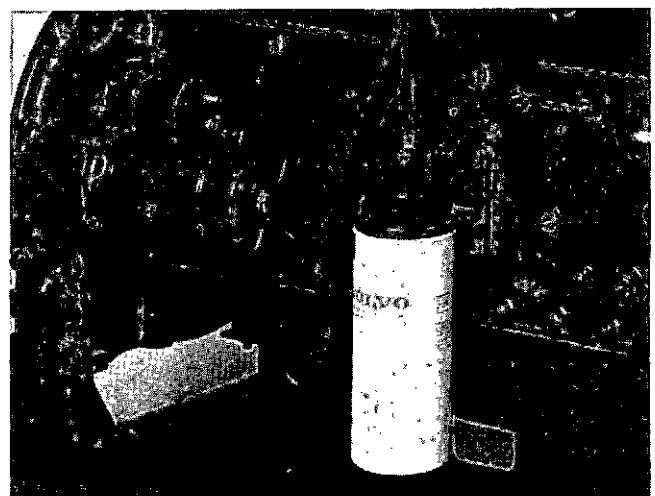
1. Remove the old filter and discard it.
2. Coat the rubber gasket of the new filter with a thin film of oil and check the engine contact surface.
3. Install the filter by hand until the rubber gasket is in close contact with the engine. Then tighten the filter a further half turn.
4. Start the engine and check for leakage.
5. Check the oil level in the engine.

11. Cooling system – rust protection

In case glycol is not being used, an anti-corrosive agent should be added to the engine coolant, see page 6.

Improve the anti-corrosive protection every **400 hours** by adding a further 1/2 litre (=1 pack) of the anti-corrosive agent (part-no 1129709-0) to the cooling system.

NB! Glycol or any other type of anti-freeze fluids are **under no circumstances** allowed to be used together with this anti-corrosive agent.

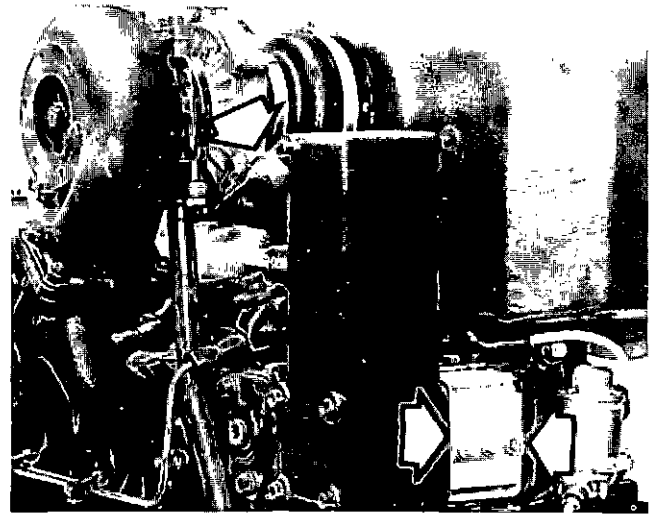


12. Checking the turbo charger for leakages

Check the air line and the oil lines for leakages every **400 hours**.

Check the air line when the engine is running under load. Whistling or hissing sounds are signs of leakages. Paint suspected spots on the pressure side between the turbo charger and the engine with soap water to facilitate the detection of the leakage. Tighten the hose clamps or replace the air line if necessary. An air leakage reduces the engine output and causes dark exhaust gases.

A possible leakage on the lubricating oil line must be remedied immediately in order not to jeopardize the function of the turbo-charger.



13. The charging condition of the batteries

Check the charging condition of the batteries with the use of a hydrometer tester every **800 hours**.

The density of the electrolyte should be $1,28 \text{ g/cm}^3$. Should the density be down to $1,23 \text{ g/cm}^3$, the batteries must be re-charged. NB! The battery electrolyte in a discharged battery is freezing at a temperature of approx. -20°C (-4°F) and thus the battery will be destroyed.

Make sure to install the battery leads correctly when installing the batteries. Compare the electrical wiring diagram.

Also please read the special instructions on page 7.

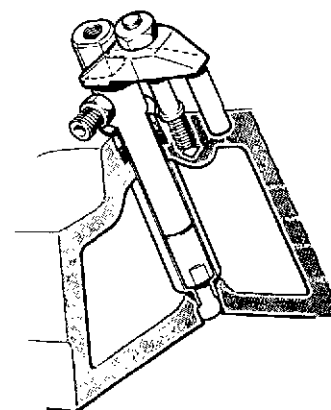
14. Fuel tank – drainage

Remove the bottom plug in the tank every **800 hours** and allow a few liters (pints) of diesel fuel to drain off into a vessel. Impurities and water, having collected at the bottom of the tank, will thereby be separated. Install the plug and tighten it and check for leakages.

15. Injectors – inspection

The injectors should be removed every **800 hours** and handed over to an authorized workshop for cleaning and checking of the opening pressure, spray pattern and for leakages. Regarding injector values, see under "Technical Data".

Clean the engine carefully around the injector openings prior to the removal. Install protective caps on the injectors and in the fuel lines. Make sure that the copper sleeves are clean prior to the installation of the injectors. Tightening torque: 50 Nm ($5,0 \text{ kpm}$) 36 lbf.ft.



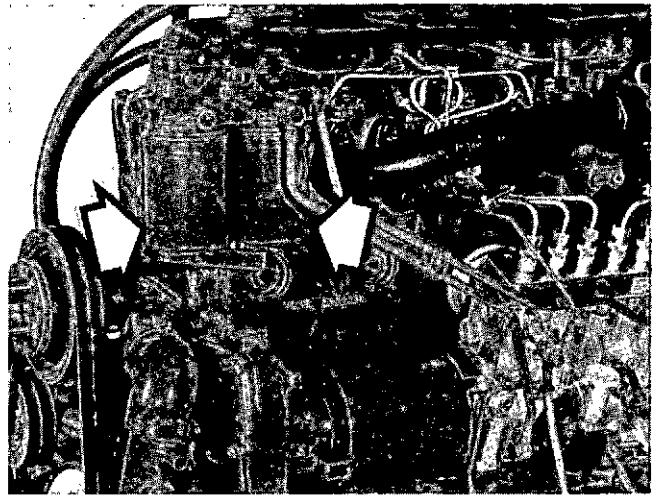
Injector installation

16. Changing fine-filters

The fuel fine-filters should be replaced every 800 hours. On engine models TD70 and TID70 both filters must be replaced.

Please observe the demand for cleanliness when working with the fuel system and its components. Make sure that impurities do not enter the fuel system.

1. Wash the filter head carefully, especially at the downward facing edge. Then remove the two filters and discard them. (TD60 is equipped with only one filter).
2. Make sure that the new filters are absolutely clean and that the gaskets are faultless.
3. Install the new filters by hand until the gasket is in contact with the filter head. Then tighten the filters a further 1/2 turn.
4. Vent the fuel system (see the following text), raise the feeding pressure by pumping, and check for leakages.



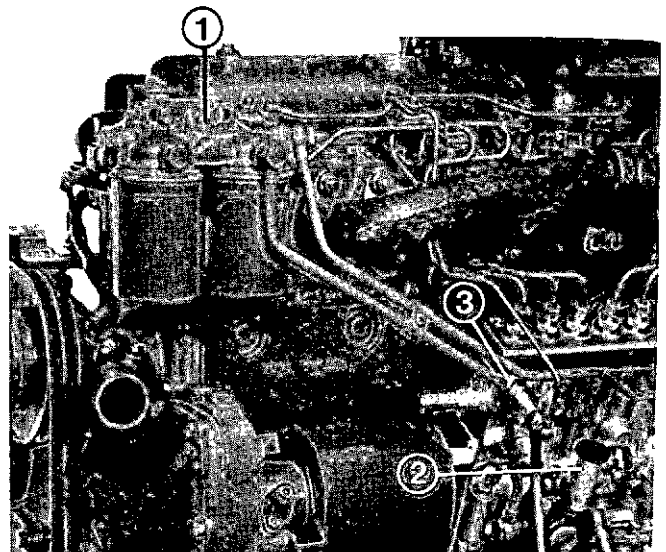
Venting the fuel system

1. Open the venting screw (1) in the filter head.
2. Feed fuel using the hand pump (2) until fuel free of air bubbles is flowing out. Tighten the screw while the fuel is flowing out. (The pump hand lever can be eased off by unscrewing it counter clockwise).
3. Raise the feeding pressure by working the hand pump. Normally a further venting will not be required.

Should it, however, be necessary to vent the fuel injection pump, then remove the connection for the over-flow valve (3) at the pump and continue hand pumping until fuel free of air bubbles is flowing out. Tighten the connection while fuel is flowing out. Raise the feeding pressure by working the hand pump. Check to make sure that the connection is not leaking. Tighten the hand pump lever.

Remark: Do not vent at the pressure equalizer! Due to the location of the pressure equalizer, the sealing washer in the connection against the injection pump might be positioned wrongly when being re-tightened with a subsequent risk of having a leakage.

4. Start the engine. Should the engine not start after a while, ease off the fuel pressure lines at the injectors a few turns. Then run the engine with the starter motor until fuel is pressed out. Tighten the fuel pressure lines and then start the engine.

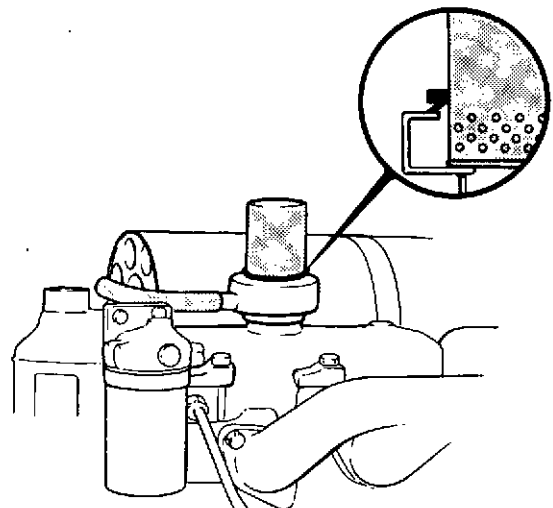


Venting (The engine on the picture is a TD70)

17. Crankcase Ventilation – changing the filter (Optional equipment)

The filter should be replaced every 800 hours or more often if required.

1. Unscrew the old filter counter clockwise. Take care of the sealing ring around the filter (replace it if necessary).
2. Install the new filter by hand. Install the sealing ring.



18. Checking the disconnectable Power-take-off

Check the function of the power-take-off every 800 hours or when you suspect something is the matter with it. Check if the power-take-off is slipping, if it gets warm or if it has a tendency of wanting to disengage.

Adjusting

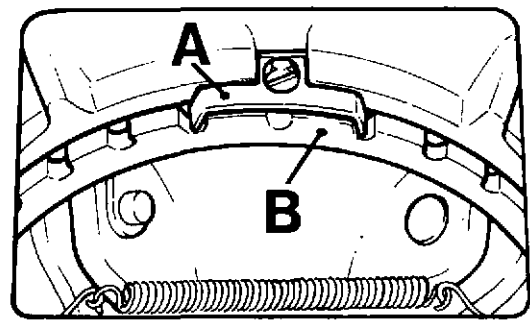
Stop the engine and set the control lever in its neutral position. Remove the inspection cover and turn the clutch plate until the locking device on the adjustment ring becomes accessible. The locking device is somewhat different depending on the make of the power-take-off.

Make: Rockford/Borg Warner

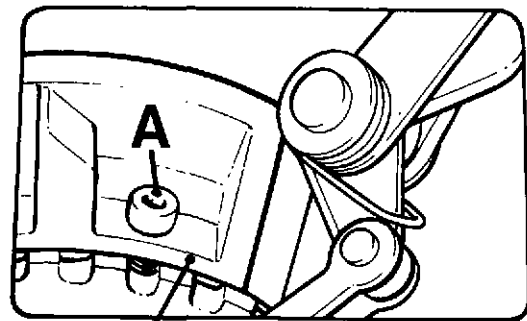
1. Remove the locking plate (A) and turn the adjustment ring (B) as many notches to the left as to allow the build-up of a considerable force, needed to move the control lever to the engagement position.
2. Install the locking plate and the inspection cover.

Make: Automotive Products (AP)

1. Ease off the Allen-head bolt (A) and turn the adjustment ring (B) to the right as far as to allow the build-up of a considerable force, needed to move the control lever to the engagement position.
2. Install the Allen-head bolt and the inspection cover.



Rockford/BW



Automotive Products (AP)

19. Checking the valve clearance

Check the valve clearance every 1200 hours. This job must be done by an authorized Volvo Penta workshop. Clearance, see under "Technical Data".

NB! Never check the valve clearance while the engine is running. The check must be done when the engine is at standstill. The engine can be either cold or at operational temperature.

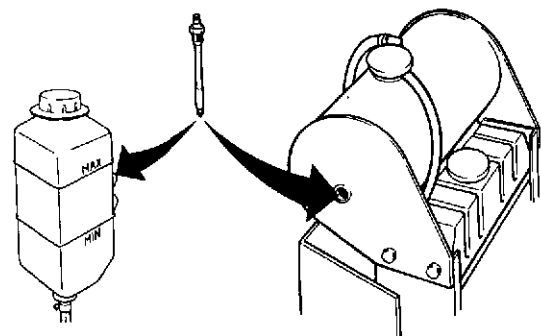
20. Checking the cooling system

Check the cooling system for leakages and clogging every 1200 hours or more frequently if necessary.

Should the coolant temperature reach abnormal high values, the reason for this, except clogged coolant channels, can be too low coolant level, badly stretched V-belts for the water pump and fan or a faulty thermostat or temperature gauge.

Flush the cooling system when changing the anti-freeze fluid every autumn or more frequently if necessary. **NB!** The cooler might also need an external cleaning. Remove also, if necessary, the coolant connections to the oil cooler and flush the cooler with water. This is also valid for the inter-cooler (charged air cooler) on TID60 and TID70. Should water flushing not be sufficient, chemicals can be added to the water, see the "Workshop Manual".

Regarding coolant, see pages 5 and 6.



Coolant level switch

When cleaning the cooling system and changing the coolant, the coolant level switch (if fitted) must be removed and deposits, if any, removed. Deposits might otherwise cause the level switch to indicate the correct level even if the level is too low. Use a soft piece of rag when cleaning the switch.

The sender is located in the expansion tank.

21. Checking the starter motor and the alternator

The inspection must be carried out every **1200** hours and by authorized Volvo Penta workshop personnel.

NB! Remove both battery leads, prior to starting work on the electrical system.

Starter motor: Inspection of brushes and commutator.

Alternator: Inspection of brushes and slip rings.

Fuses

On early prod. engine models TD60BPP and TD70GPP there is a fuse installed behind the instrument column. On early prod. engine models TD60B, TD60D and TD70G the fuses are installed inside the junction box.

When changing a fuse, bend up the lid (1) in the direction of the arrows and replace the burnt fuse with a new one. Check to make sure that the terminal rack (2) is in its correct position and clamp the cover into its position. Make sure that the sealing rings are properly in place.

Late prod. engines are equipped with a reset fuse, which is located in the junction box. Reset the fuse by depressing the button on the outside of the junction box. Furthermore, there is another fuse located inside the junction box. This fuse can be replaced after having removed the lid.

22. The Turbo Charger

Check the turbo charger carefully every **2400** hours for leakages at the lubricating oil lines and air hoses, the bearing clearance as well as the charging pressure and the general condition. If necessary clean the compressor. This work has to be carried out by authorized service personnel.

As to bearing clearance and charging pressure, see "Technical Data".

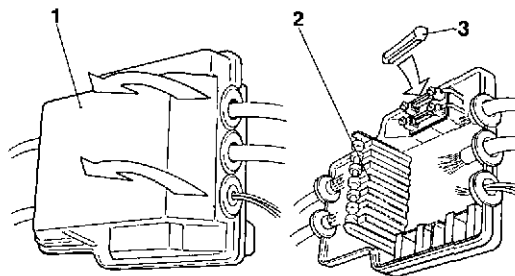
Replace the turbo charger when necessary against a new one or against an overhauled unit.

Always install a new oil filter and change the engine lubricating oil at the same time as changing the turbo charger. Top-up with oil in the bearing housing of the turbo charger prior to connecting the pressure lubricating line.

Start the engine, see under "Operation". Check for leakage.

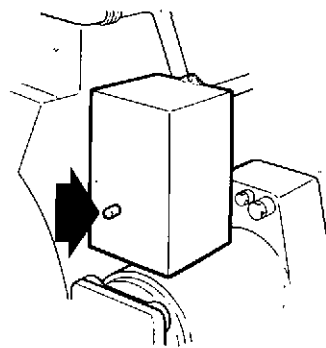
23. General Inspection

To prescribe a certain date for making the engine overhaul is difficult since the operational conditions vary very much. By observing the lubricating oil consumption and by measuring the compression pressure, it is quite possible to estimate when the engine ought to be disassembled and the wear measured. A compression pressure test should be made every **2400** hours. When making this test, it is necessary that the engine has reached operational temperature and that the batteries are well charged.

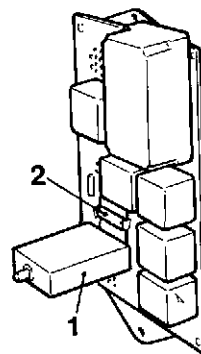


Junction box with fuses.
TD60 and TD70 (early prod.)

1. Lid
2. Terminal rack
3. Fuse (25 Amps)



Resettable fuse,



Junction box, late prod. (the lid is removed)

1. Resettable fuse, 8 Amps.
2. Fuse 35 Amps (bridge connector)

24. Inhibiting when making a break in the operation

Corrosion on the engine components must be prevented. Corrosion will in time completely destroy the engine. Therefore the engine has to be protected against damage, caused by corrosion, as follows:

A. Should the engine be out of operation during a time less than two months, it has to be run warm approximately every 14 days.

Fill up the cooling system with the Volvo Penta ethylene glycol mixture, or its equivalent. The glycol concentration must correspond to the lowest expected temperature. Do not use less than 40 % by volume of glycol. At a low concentration of glycol there is a risk of having corrosion.

See under "Coolant", pages 5 and 6.

B. Should the engine be out of operation during a time in excess of two months, inhibiting must be made as follows:

Should the inhibiting not be made for a period longer than 6-8 months, the Volvo Penta engine lubricating oil can be used and with advantage. Then the engine can be run directly if so desired. Changing the oil and the oil filter must then be made immediately before the stop and the oil does not of course be drained off later on. Run the engine warm after the oil change. **However, should the engine be inhibited for a longer period of time, special inhibiting oil marketed by the oil companies, must be used.**

Remember to make use of the non-operational time to make the periodical inspections, which have to be made anyway.

1. Run the engine warm up to normal operational temperature.
2. Stop the engine and drain off or pump up the lubricating oil from the oil-pan.
3. When the engine is out of operation for a time up to max. 6-8 months, the engine should be filled up with Volvo Penta diesel engine lubricating oil to the normal oil level. For a period of time in excess of 6-8 months, the engine must be filled up to a level slightly above the lower dipstick mark with an inhibiting oil.

The power-take-off or the gear (if installed) must be filled to the upper oil dipstick mark with the oil being recommended. Top-up if necessary.

4. When the engine is out of operation for a time of **maximum 6-8 months**: Run the engine warm!
5. **Should the inhibiting be made for a time of more than 6-8 months**: Remove the fuel line at the fuel feed pump and the return line to the tank. Attach the fuel lines to hoses leading to a vessel filled with 1/3 inhibiting oil and 2/3 diesel fuel. Certain oil companies do have a special oil for this purpose, not needing to be mixed with diesel fuel.

Vent the fuel system and start the engine. See under "Operation". Let the engine run on quick idling until approx. 2 liters (0.4 gall.) have been consumed out of the vessel.

Stop the engine and drain off or pump out the inhibiting oil from the oil pan. Attach the ordinary fuel lines.

6. The engine cooling system has either to be drained off or anti-freeze fluid added, preferably the Volvo Penta ethylene glycol. See page 5.
7. Remove the batteries and have them recharged in accordance with the manufacturers instructions.
8. Protect all external unpainted surfaces with a suitable preservative. The surfaces must be clean and dry before the preservative is applied.

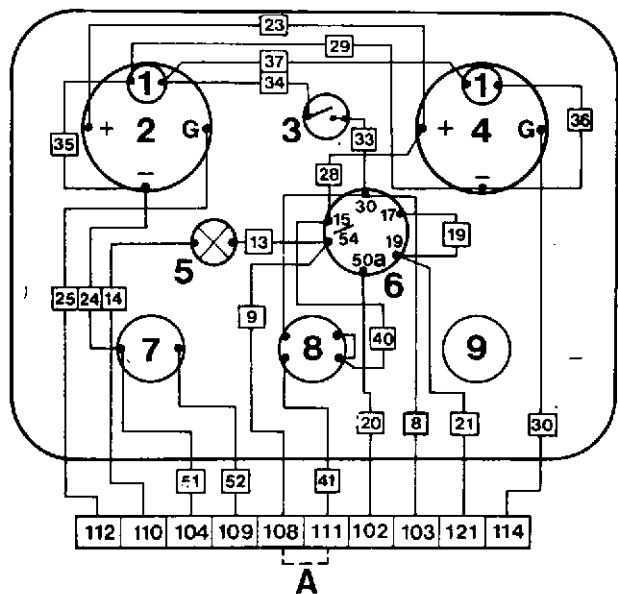
NB! Certain preservatives, for external use, are flammable and therefore have to be treated with care. Certain preservatives are furthermore dangerous to inhale, therefore a breathing mask must be used during the spraying.

9. After the treatment, described above, has been carried out, the engine should not be turned until it is time to put it in operation again. **Attach a label to the engine, stating the date of the inhibiting.** Also note on the label whether the cooling system has been drained or if glycol has been added and if so what temperature will the mixture withstand. Then make a note of whether the lubricating oil has been drained off or if a Volvo Penta diesel lubricating oil has been filled.

25. De-Inhibiting

1. Remove possible protection over the engine, air intake and exhaust manifold.
2. Wash off externally applied preservative with white spirit.
3. Close the drain cocks and fill up the cooling system, should the coolant have been drained off. Regarding the coolant, see pages 5 and 6.
4. Fill up the oil pan with diesel engine lubricating oil if so required. Install a new oil filter, if the oil filter has not been replaced along with the change over the Volvo Penta diesel engine lubricating oil at the time of the inhibiting. Check the oil level in the gearbox or gear if at all installed.
5. Install the batteries and attach them.
6. Install new fuel filters, vent the fuel system and start the engine. See under "Operation". Run the engine warm on quick idling before adding load.
7. Check for oil, fuel or coolant leakages.

Wiring diagrams (early prod.) TD60, TD70



INSTRUMENT PANEL

TD60B,-BG, TD60D, TD70G,-GG

1. Instrument lighting
2. Oil pressure gauge
3. Switch, instrument lighting
4. Temperature gauge
5. Warning lamp, charging
6. Key switch
7. Stop button
8. Interlock button
9. Blind cover

For engines with manual or automatic stop:

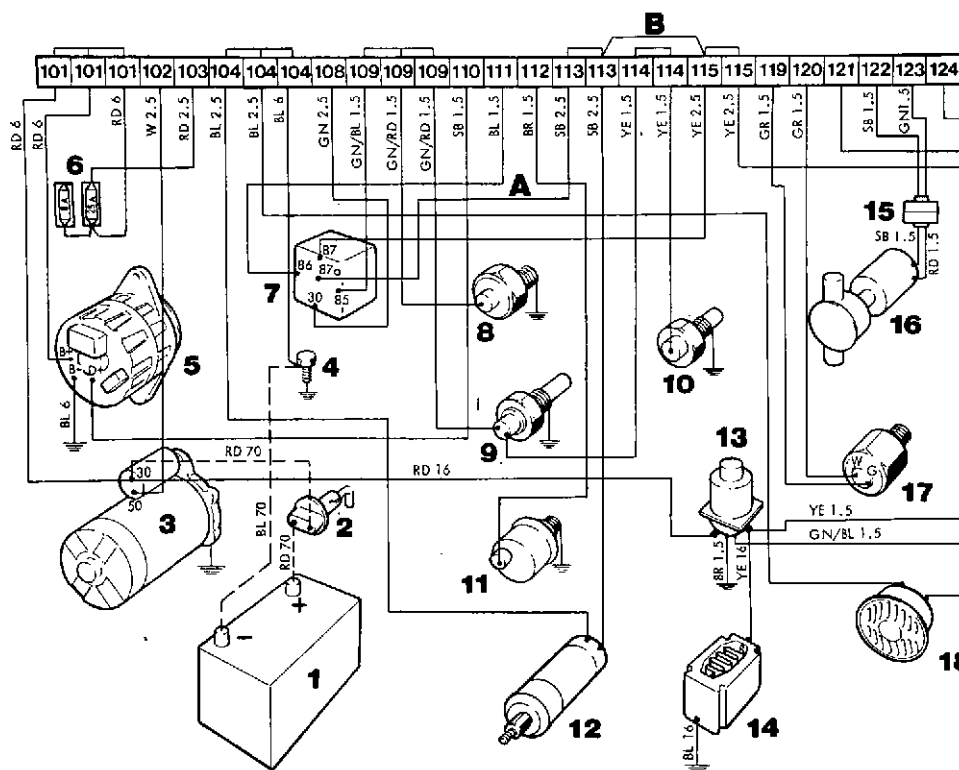
Lead between terminal 108 and 111 is deleted (dotted).

For engines with electrical stop:

Lead between terminal 108 and 111 is added (dotted).

Leads: 8, 9 and 20 = 2,5 mm² (black)

Others = 1,5 mm² (black)



Lead colour

- | | | | |
|----|---------|----|----------|
| BL | = Blue | W | = White |
| BR | = Brown | RD | = Red |
| GN | = Green | SB | = Black |
| GR | = Gray | YE | = Yellow |

Engine

1. Batteries, Capacity – see "Techn. Data"
2. Main switch
3. Starter motor*
4. Ground bolt
5. Alternator
6. Fuses (25 and 8 Amps)**
7. Intermediate relay**
8. Oil pressure switch
9. Temperature sender/switch (alternative to 10)
10. Temperature sender (deleted if 9 is installed)
11. Oil pressure sender
12. Stop solenoid***
13. Relay, starting element
14. Starting element
15. Connector
16. Oil scavenging pump
17. Engine speed sender
18. Horn

Lead areas in mm²

Relationship mm² – AWG¹⁾

mm ²	1.5	2.5	6	16	70
AWG	15 (16)	13	9 (10)	5	2/0

¹⁾ American Wiring Gauge.

* TD60BG and TD70GG are equipped with a 2-pole starter motor. The lead from the battery minus-pole is leading to the starter motor connection 31 and a ground lead (16 mm²) is added between connection 31 and the ground bolt (4).

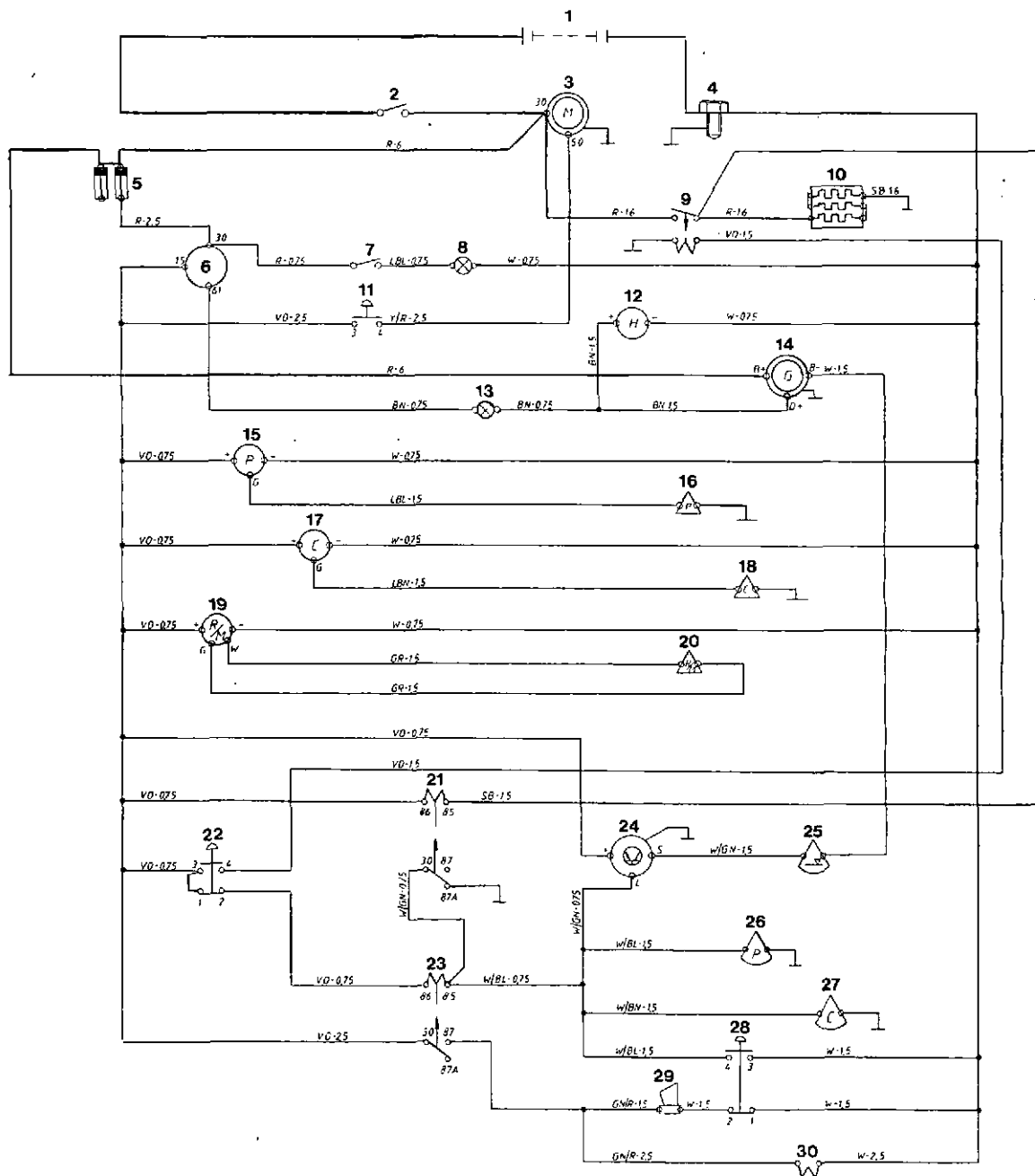
** Located in the junction box.

*** Stop solenoid (Two alternative wirings exist):

A. Holding current during operation (Lead B deleted).

B. Holding current when stopping (Lead A deleted).

Skeleton diagram TD60BPP, TD70GPP (early prod.)



Lead areas in mm²

- | | |
|--|-------------------------------------|
| 1. Batteries. Capacity, see Technical Data | 16. Oil pressure sender |
| 2. Main switch | 17. Coolant temperature gauge |
| 3. Starter motor | 18. Coolant temperature sender |
| 4. Ground bolt | 19. Tachometer |
| 5. Fuse (25 Amps) | 20. Engine speed sender |
| 6. Key switch | 21. Intermediate relay |
| 7. Switch, instrument lighting | 22. Interlock button |
| 8. Instrument lighting | 23. Intermediate relay (stop relay) |
| 9. Relay, starting element | 24. Relay, level switch |
| 10. Starting element | 25. Coolant level switch |
| 11. Starter button | 26. Oil pressure switch |
| 12. Hour recorder | 27. Coolant temperature switch |
| 13. Charging control lamp | 28. Stop button |
| 14. Alternator | 29. Horn |
| 15. Oil pressure gauge | 30. Stop solenoid |

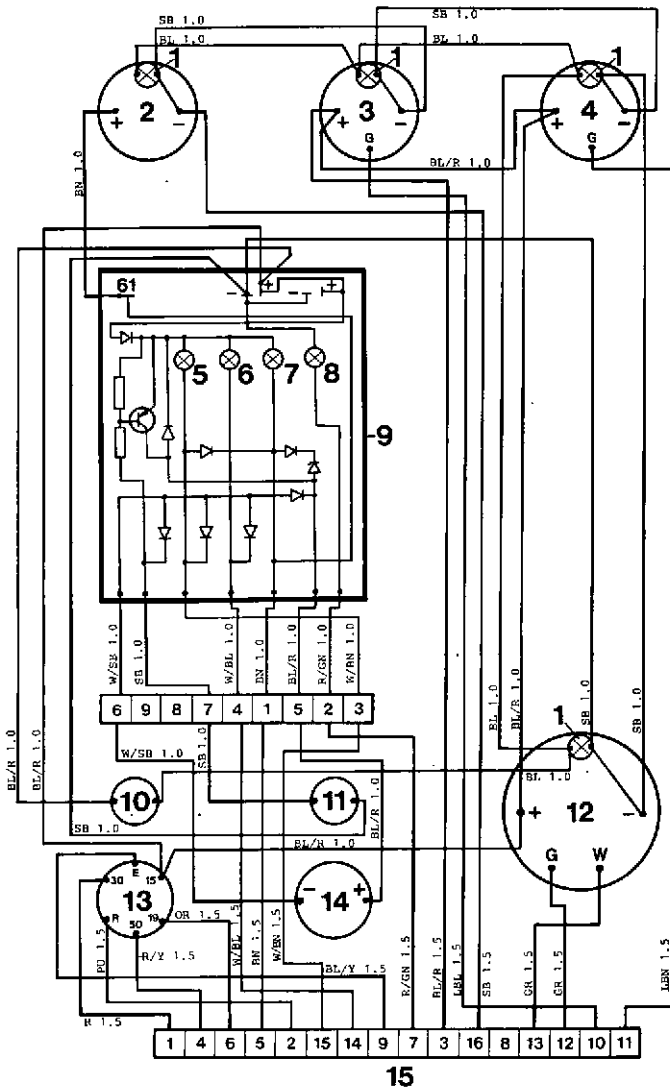
Lead colour

- | | |
|-------------------|----------------------|
| BL = Blue | R = Red |
| BN = Brown | SB = Black |
| GN = Green | VO = Purple (Violet) |
| GR = Gray | W = White |
| LBL = Light blue | Y = Yellow |
| LBN = Light brown | |

Relationship mm² - AWG

mm ²	0.75	1.5	2.5	6	16
AWG	18 (19)	15 (16)	13	9 (10)	5

Wiring Diagram (late prod.) TD60, TID60, TD70, TID70



INSTRUMENT PANEL

1. Instrument lighting
2. Hour recorder
3. Oil pressure gauge
4. Temperature gauge
5. Warning lamp, temperature
6. Warning lamp, oil pressure
7. Warning lamp, charging
8. Indicator lamp, pre-heating
9. Printed circuit card
10. Switch, instrument lighting
11. Switch, alarm testing
12. Tachometer
13. Key Switch
14. Alarm
15. Connector, 16-pole

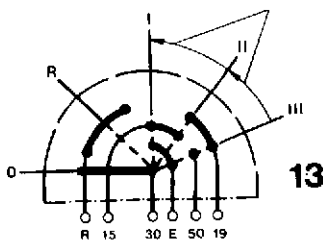
Lead colour

- | | |
|-------------------|------------------|
| GR = Grey | OR = Orange |
| SB = Black | GN = Green |
| BN = Brown | Y = Yellow |
| LBN = Light brown | W = White |
| R = Red | BL = Blue |
| PU = Purple | LBL = Light blue |

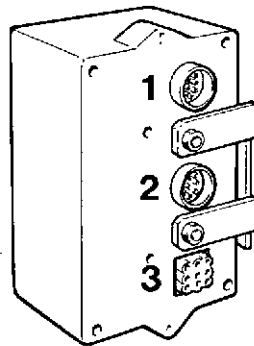
Lead areas in mm²

Relationship mm² – AWG

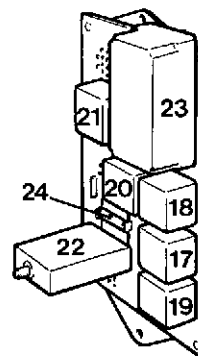
mm ²	1.0	1.5
AWG	16 (17)	15 (16)



Junction Box



1. Connector, 16-pole, for engine harness (senders, sensors etc.)
2. Connector, 16-pole, for instrument panel harness
3. Connector, 9-pole, for engine harness (starter, motor, stop solenoid, horn)

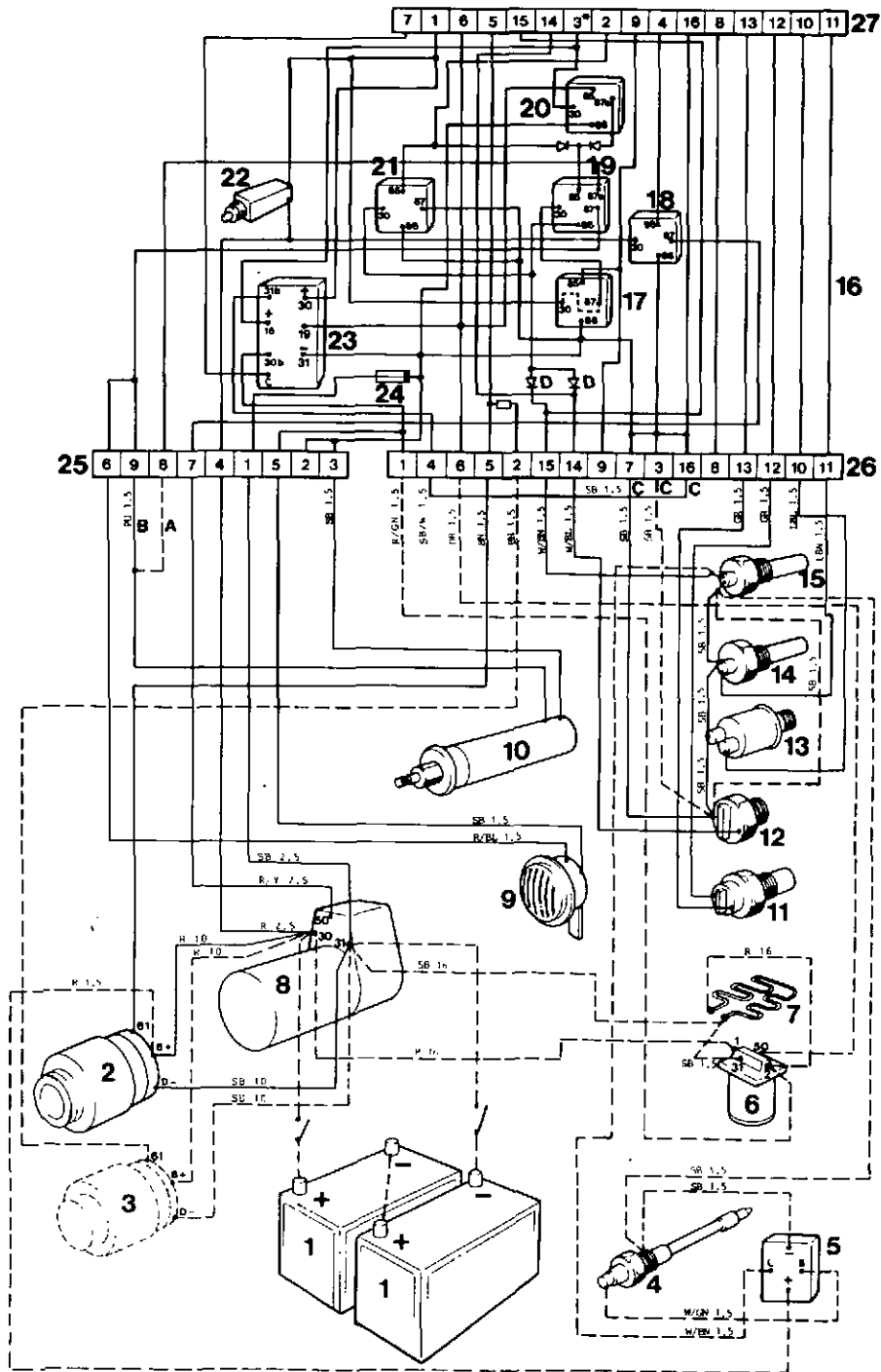


Junction Box

- 17* Stop relay (stop solenoid holding current when in operation)
18. Starting relay
19. Stop relay
20. Interlocking relay (-PP engines)
21. Ground relay
22. Resettable fuse 8 Amps
23. Time relay
24. Fuse 35 Amps (bridge connection)

* Same position-number in the wiring diagram next page.

Wiring diagram (late prod.)
TD60, TID60, TD70, TID70



ENGINE

1. Battery
2. Alternator
3. Optional alternator
4. Level switch, coolant
5. Relay
6. Relay, starting element
7. Starting element
8. Starter motor**
9. Horn
10. Stop solenoid
11. Engine speed sender
12. Oil pressure switch
13. Oil pressure sender
14. Temperature sender
15. Temperature switch
16. Printed circuit card
17. Stop relay*** (installed only when the stop solenoid must hold current during operation. When holding current during stop, a bridge connection is made between 30 and 87 - dotted line)
18. Starting relay***
19. Stop relay***
20. Interlocking relay (-PP engines)***
21. Ground relay***
22. Resettable fuse, 8 Amps***
23. Time relay***
24. Fuse, 35 Amps***
25. Connector, 9-pole***
26. Connector, 16-pole***
27. Connector, 16-pole*** (for instrument panel harness)

* Shall be dead during start.
 ** Standard- and -PP-engines are equipped with a 1-pole starter motor. The starter motor connection 31 is deleted and the leads to this connection are instead going to a separate ground bolt.
 *** Located in the junction box.

Lead colour

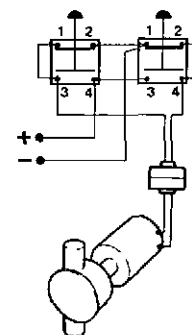
- | | |
|-------------------|------------------|
| GR = Gray | BL = Blue |
| SB = Black | LBL = Light blue |
| BN = Brown | OR = Orange |
| LBN = Light brown | |
| R = Red | |
| PU = Purple | |
| GN = Green | |
| Y = Yellow | |
| W = White | |

Lead areas in mm²

Relationship mm² - AWG

mm ²	1.5	2.5	10	16
AWG	15 (16)	13	7	5

- A. Connected when the stop solenoid is holding the current while in operation.
- B. Connection when the stop solenoid is holding the current during stop.
- C. Ground connection.
- D. Only for engines with automatic stop.



Suggested wiring of the oil scavenging pump (scavenging and filling). Lead area 1,5 mm².

TECHNICAL DATA

General

Type designation	TD60, TID60	TD70, TID70
Number of cylinders	6	6
Cylinder diameter	98.43 (3.88)	104.77 (4.13)
Stroke	120 (4.72)	130 (5.12)
Swept volume	5.48 (334)	6.73 (410)
Output and torque	See the valid product info leaflet	
Firing order (No 6 cylinder closest to the flywheel)	1-5-3-6-2-4	
Direction of rotation (seen from the front end)	Clockwise	
Type of cylinder liners	Wet, exchangeable	
Valve system	Overhead valves	
Valve clearance (engine at stillstand, cold or at working temp.):		
Inlet	0.40 (0.016)	0.40 (0.016)
Outlet	0.45 (0.018)	0.55 (0.022)
Weight, engine less power-take-off	605/1334 (TD60)	705/1554 (TD70)
	615/1356 (TID60)	720/1587 (TID70)

Fuel system

	TD60B	TD60D, TID60D
Pump setting, TD60B, -BG, -BPP, TD60DG	21-22° B.T.D.C.	
TD60D, -DPP	-	22° B.T.D.C.
TID60D	-	24°±0.5° B.T.D.C.
TID60DG	-	18°±0.5° B.T.D.C.
Feed pump working pressure	100-150 (1.0-1.5)	14-21
Injectors compl., part no. (TD60)	466513-9	
(TID60)	844459-8	
Nozzles, part no. (TD60)	466931-3	
(TID60)	844460-6	
Marking (TD60)	870	
(TID60)	865	
Opening pressure (TD60)	27 (275) 3911	
(TID60)	24 (245) 3485	
Setting pressure (new spring), (TD60)	27.5-28.3 (280-289) 3983-4111	
(TID60)	24.5-25.3 (250-258) 3556-3670	
Hole diameter (TD60)	4x0.32 (0.0126)	
(TID60)	4x0.34 (0.0134)	
Pump setting (TD70)	20-21° B.T.D.C.	-
(TD70/RQV, TID70)		20°±0.5° B.T.D.C.
Feed pump working pressure	100-150 (1.0-1.5)	14-21
Injectors compl., part no.	1544090-2	
Nozzles, part no.	1544091-0	
Marking	854	
Opening pressure	27 (275) 3911	
Setting pressure (new spring)	27.5-28.3 (280-289) 3983-4111	
Hole diameter	4x0.355 (0.0140)	

Turbo charger

Make
 Type (TD60B, -BG, -BPP, TID60D) resp. TD70G, -GG, -GPP)
 Type (TD60D, -DG, -DPP) resp. (TID70G, -GG, -GPP)
 Type (TID60DG).....
 Lubricating
 Axial clearance mm/in
 Radial clearance mm/in

TD60, TID60

Garrett/AiResearch
 T-04B/S-3/1.0E T-04B/S-3/1.0F
 T-04B/S-3/0.84E T-04B/T-5/1.0F
 TA3106/50/0.82/57

TD70, TID70

Pressure lubricated by the engine system
 0.03-0.10/0.0012-0.004
 0.08-0.18/0.0032-0.0071

Charging pressure

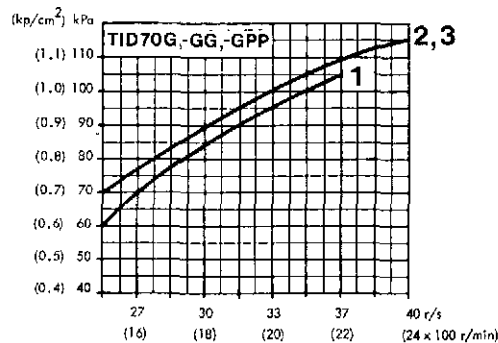
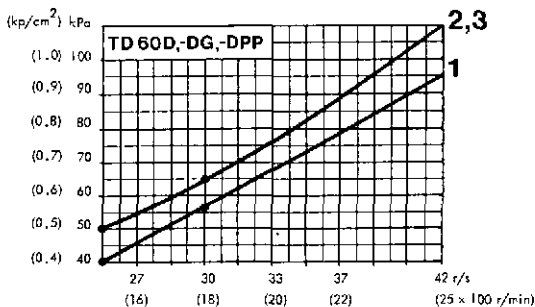
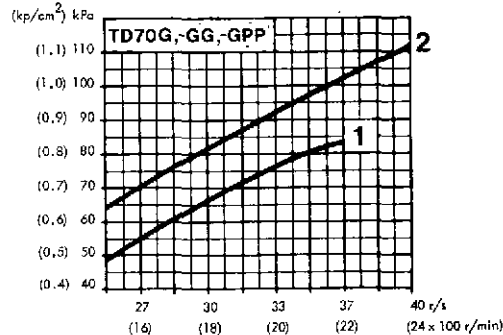
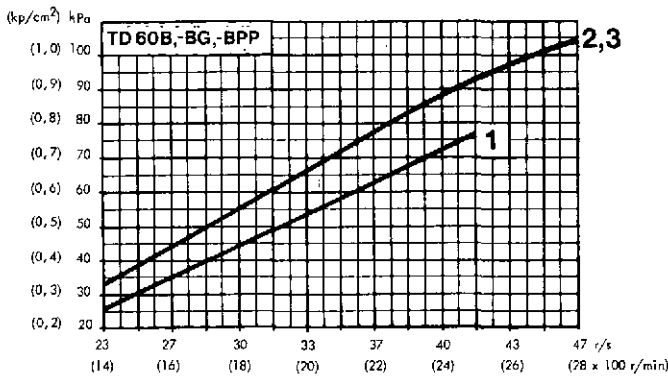
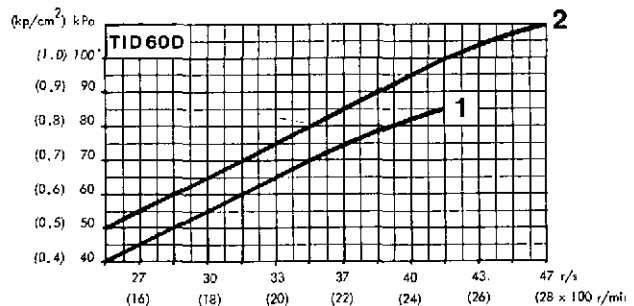
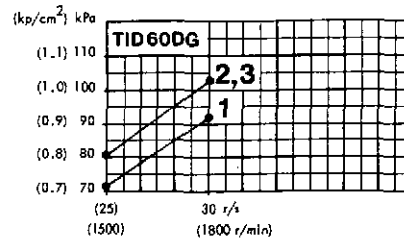
Charging pressures, minimum values, (measured in the engine inlet manifold) at 100 % load and at full throttle and at an air temperature of +20°C (+68°F). Should the measurement be made at any other air temperature, the resulting charging pressures must be corrected – use the Workshop Manual.

Should the engine not be fully loaded, the pressure will come out considerably lower.

Curve 1: Is valid for outputs in accordance with curve No 4 in the engine diagram or point 1 on the speed-drop curve.

Curve 2: Is valid for outputs in accordance with curve No 2 in the engine diagram or point 2 on the speed-drop curve.

Curve 3: Is valid for outputs in accordance with point 3 on the speed-drop curve.



Power-take-offs

Disconnectable power-take-offs (over center type):

Type designation alternative 1
 Diameter, pressure plate mm (in.)
 Weight, approx. Kilos/lbs
 Type designation alternative 2
 Diameter, pressure plate mm (in.)
 Weight, approx. Kilos/lbs

Rockford/BW PTA-21119, single plate
 288 (11 1/2)
 70/154
 Automotive Products (AP), single plate
 288 (11 1/2)
 70/154

Index, alphabetical

- | A | page |
|------------------------------------|------------------------|
| Air compressor..... | 14 |
| Air filter..... | 17 |
| Anti-freeze fluid..... | 5 |
| B | |
| Batteries..... | 7, 17, 19, 29 |
| Installation (wiring diagram)..... | 25, 27 |
| C | |
| Capacity, cooling system..... | 6, 29 |
| lubric. system..... | 16, 29 |
| Changing, engine oil..... | 17 |
| fuel filter..... | 20 |
| oil filter..... | 18 |
| Charging, warning lamp..... | 8, 9 |
| Checking, air filter..... | 17 |
| alternator..... | 22 |
| batteries..... | 17, 19 |
| coolant..... | 10, 16 |
| injectors..... | 19 |
| oil level..... | 16 |
| starter motor..... | 22 |
| valve clearance..... | 21 |
| V-belts..... | 18 |
| Cleaning, cooling system..... | 21 |
| Cold starting..... | 11 |
| Coolant..... | 5 |
| Crankcase ventilation..... | 20 |
| D | |
| De-inhibiting..... | 23 |
| Disengageable power-take-offs..... | 13, 16, 17, 18, 21, 30 |
| E | |
| Electrical system..... | 7, 22, 29 |
| Engine speed..... | 6, 13 |
| Ethylene Glycol..... | 5 |
| F | |
| Fan belts..... | 18 |
| Feeding pressure..... | 28 |
| Filling - oil..... | 10 |
| coolant..... | 10, 16 |
| Freezing, steps to be taken..... | 14 |
| Fuel system venting..... | 20 |
| tank..... | 19 |
| quality..... | 5 |
| Fuses..... | 22 |
| G | |
| Glycol, ethylene..... | 5 |
| I | |
| Indicator, pressure drop..... | 17 |
| Inhibiting..... | 23 |
| Injection pump..... | 28 |
| Injectors..... | 19, 28 |
| Instrument lighting..... | 8, 9 |
| Instruments..... | 8, 9 |
| M | |
| Main switch..... | 7 |
| Maintenance..... | 15 |
| O | |
| Oil, capacities..... | 16, 29 |
| pressure..... | 8, 9, 29 |
| quality/viscosity..... | 5, 29 |
| Operation..... | 10 |
| P | |
| Power-take-offs..... | 13, 16, 17, 18, 21, 30 |
| Precautions against frost..... | 14 |
| Pressure drop indicator..... | 17 |
| R | |
| Running-in..... | 6 |
| Running (Operation)..... | 10 |
| Rust prevention..... | 5, 6, 18, 23 |
| S | |
| Serial numbers..... | 2 |
| Servicing..... | See Mainten. |
| Specifications..... | See Techn. Data |
| Starting..... | 11 |
| T | |
| Technical Data..... | 28-30 |
| Thermostats..... | 29 |
| Turbo charger..... | 19, 22, 30 |
| V | |
| Valve clearance..... | 21, 28 |
| Venting, fuel system..... | 20 |
| V-belts..... | 18 |
| Viscosity..... | 5, 29 |
| W | |
| Warming-up (during operation)..... | 13 |
| Warning lamp, charging..... | 8, 9 |
| Warranty book..... | See under Introduction |
| Wiring diagrams..... | 24-27 |

Publ. No. 5127 Eng.
5-1984

VOLVO PENTA