

# **KOOP DIESEL ENGINE INSTRUCTION BOOK**



**KD292F**

## **A new Diesel engine- working for you**

This engine is intended only for the purpose determined and tested by the manufacturer of the equipment in which it is installed. Using it in any other manner contravenes the intended purpose. For danger and damage due to this, we assume no liability. The risk is with the user only.

Use of this engine in the intended manner presupposes compliance with the maintenance and repair instructions laid down for it. Noncompliance leads to engine breakdown.

Please do not fail to read this operating manual before starting the engine. This will help you to avoid accidents, ensure that you operate the engine correctly.

Heavy-Duty off-road engines to prevent our environment.

Please pass this Instruction Manual on to the next user or to the following engine owner.

Always have service work performed by qualified specialists. To this effect, we recommend that you consult one of the 500 **service stations**. There, your engine is repaired by staff who constantly undergo training and who use both **original spare parts** and **tools**. The world-wide service network is also available to you for consultation and spare parts supply.

The installation of inappropriate spare parts may cause problems. We cannot accept any liability for damage or consequential damage resulting there from.

Thus, we recommend that you use **original spare parts**. These parts are manufactured following the strict specifications and ensure, thanks to their perfect fit and function, maximum operating reliability.

We reserve the right to make modifications in the course of technical progress.

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This symbol identifies important safety precautions.

Please comply with these most carefully in order to avoid any risk of injury to persons or damage to materials.

General legal requirements and safety regulations issued by the competent authorities or industrial accident insurers must also be complied with.

# 1. Important notes on safe operation of the engine



Diesel engines are economical, strongly built and long-lasting. They are therefore frequently chosen for commercially and industrially operated equipment and machinery.

Since the engine forms part of the finished equipment or machine, its manufacturer will take all the applicable safety regulations.

Nevertheless, we give below certain additional comments on operating safety, and would recommend you to note them carefully.

Depend on the manner in which the engine is installed and its intended application, the equipment manufacturer or operator may have to attach additional safety devices and prohibit potentially hazardous aspects of operation, for example:

-Exhaust system components as well as the surface of the engine will naturally be hot and must not be touched while the engine is running or until it has cooled down after being stopped.

-Faulty wiring or incorrect operation of electrical equipment may lead to sparks forming, and must be avoided as a potential fire hazard.

-Rotating parts must be shielded against accidental contact when the engine is installed in other equipment or machinery.

Guards are available from to protect belt drives to coling fans and generators.

-Before attempting to start the engine it is essential to have studied the starting information in the instruction book.

-Mechanical starting devices must not be used by children or persons of insufficient physical strength.

-Before starting the engine,ensure that all the specified protective guards are in place.

-The engine must only be operated, serviced or repaired by persons who have received the appropriate training.

-Keep the ignition key out of reach of unauthorized persons.

-Do not run the engine in closed or badly ventilated rooms.  
Do not breathe in emissions-danger of poisoning!

-Also fuel and lubricants could contain poisonous components. Please follow the instructions of the mineral oil producer (safety data sheets).

# 1. Important notes on safe operation of the engine



-Stop the engine before performing any maintenance, cleaning- or repair work.

-Stop the engine before refueling.

Never add fuel near a naked flame or a source of sparks.

Don't smoke. Don't spill fuel.

-Keep explosive materials as well as flammable materials away from the engine because the exhaust gets very hot during operation.

-Wear close-fitting clothing when working on a running engine.

Please don't wear necklaces, bracelets or any other things which you could get caught with.

-Please pay attention to all advice-and warning stickers placed on the engine and keep them in legible condition. In case a label has come off or is no longer clearly legible, it must be replaced immediately. To this effect, please contact the **service station** in your area.

-Note that any unauthorized modification to the engine absolves its manufacturer from liability for the consequences.

Regular servicing in accordance with the details provided in this Instruction Book is essential to keep the operating reliably and to ensure the exhaust quality of the engine.

In case of doubt, always consult your nearest **service station** before starting the engine.

## 2. Description of the engine

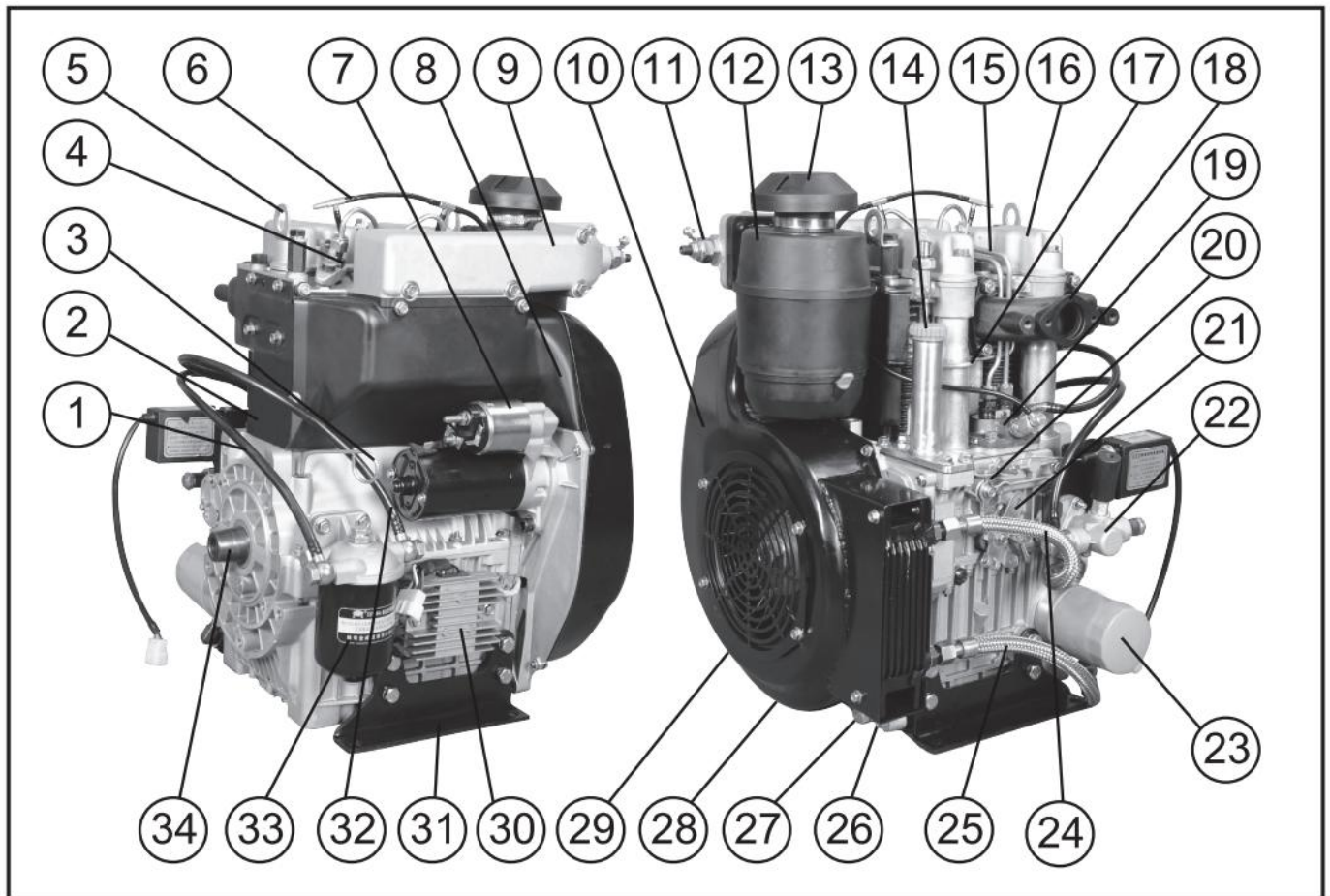


Fig. 1

- |  |                                  |                                       |
|--|----------------------------------|---------------------------------------|
| 1 Fuel line (feed pump<br>fuel filter) | 14 Oil filler cap                | 29 Air guide housing                  |
| 2 Air deflector                        | 15 Fuel pressure pipe            | 30 Voltage regulator                  |
| 3 Oil dipstick                         | 16 Cylinder head cover           | 31 Engine mount                       |
| 4 Injector                             | 17 Engine oil line               | 32 Fuel line<br>(fuel-injection pump) |
| 5 Lifting eyebolt                      | 18 Exhaust manifold              | 33 Fuel filter                        |
| 6 Fuel return line                     | 19 Fuel injection pump           | 34 Crankshaft,<br>power-take-off      |
| 7 Starter motor                        | 20 Stop lever                    |                                       |
| 8 Air guide                            | 21 Speed control lever           |                                       |
| 9 Air intake pipe                      | 22 Fuel feed pump                |                                       |
| 10 Type plate                          | 23 Engine oil filter             |                                       |
| 11 Glow plug<br>(additional equipment) | 24 Oil inlet pipe of oil cooler  |                                       |
| 12 Oil bath air cleaner                | 25 Oil outlet pipe of oil cooler |                                       |
| 13 Rainproof cap                       | 26 Oil cooler                    |                                       |
|  | 27 Oil drain plug                |                                       |
|  | 28 Guard                         |                                       |

## 3. General remarks

### 3.1. Technical data

Type		<b>KD292F</b>
Design		Air-cooled four-stroke Vertical diesel
Combustion system		Direct injection
Number of cylinders		2
Bore/stroke	mm	92/75
Displacement	cm <sup>3</sup>	997
Cont.output	KW/rpm	15.5/3000 16.5/3600
Engine oil capacity max/min.	L	2.75/1.8
Compression		20.5:1
Engine oil pressure	min.	1 bar at 900 rpm. engine speed
Engine oil consumption (after running-in period)	approx.	1% of fuel consumption at full load
Direction of rotation, power take-off end		anti-clockwise
Valve clearances at 10-30°C Inlet/exhaust	mm	0.15
Max.Permissible perm. inclination Angle of inclination in °		Exhaust                  Flywheel low   high                  low   high 30° 17°                  25° 25°
Weight (incl. fuel tank, air-cleaner, exhaust silencer and electric starter)	kg approx	84
Batter capacity	min/max	12V-45/88Ah · 24V-36/55Ah

1) Exceeding these limits causes engine breakdown.

## 3.2. Transport

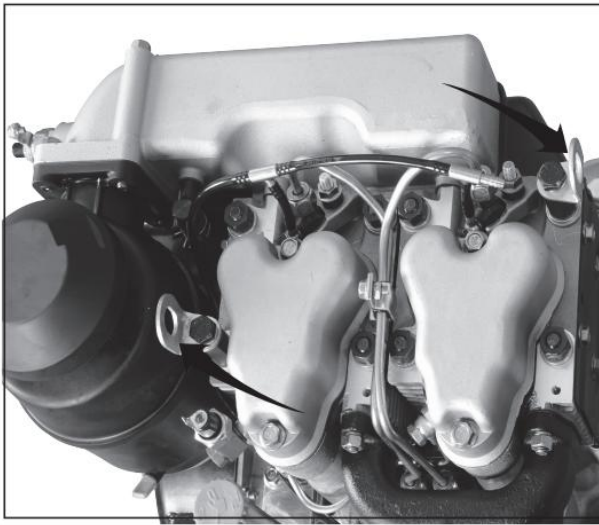


Fig.2



The lifting eyebolt provided as stand and equipment is intended for safe movement of the engine.

It is not intended for lifting complete machinery to which the engine is attached, and this is strictly forbidden.

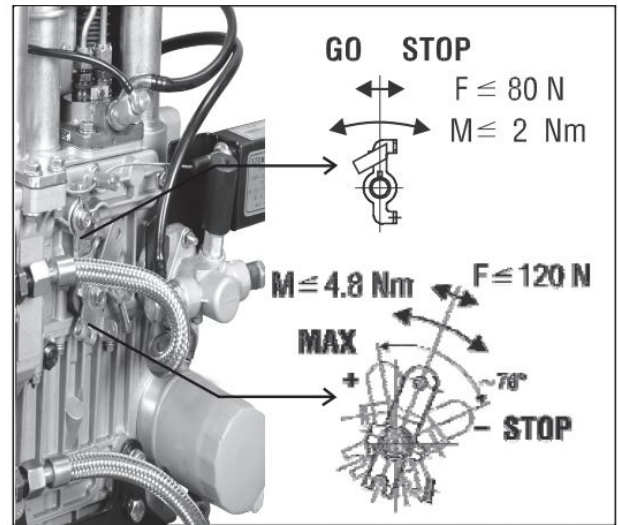


Fig.3



The permitted loads and elements on the speed adjusting lever and the stop lever should be observed as an excess can lead to damage to the contacts and inner governor parts.

## 3.3. Instructions for installation

If you have an engine which is not yet installed in a machine and still has to be installed, make sure that the Assembly Instructions for Diesel Engines are complied with prior to installation. These Assembly Instructions contain important information about safe assembly of the engine and are available from your service center in your area.

**Pending complete installation, the engine must not be started!**

Moreover, we would like to point out that in this case, commissioning of the machine is also prohibited until it has been verified that the machine into which this engine is to be incorporated complies with all the safety precautions.

At the end of these Operating Instructions.



## 4. Operation

### 4.1. Before initial start-up

Engines are normally delivered without fuel and oil.

#### 4.1.1. Engine oil

##### Oil quality

Qualified are all trademark oils which fulfill at least one of the following specifications:

**API-CF / CF-4/ CG-4** or more significant.

If engine oil of a poorer quality is used, reduce oil change intervals to 150 hours of operation.

##### Oil viscosity

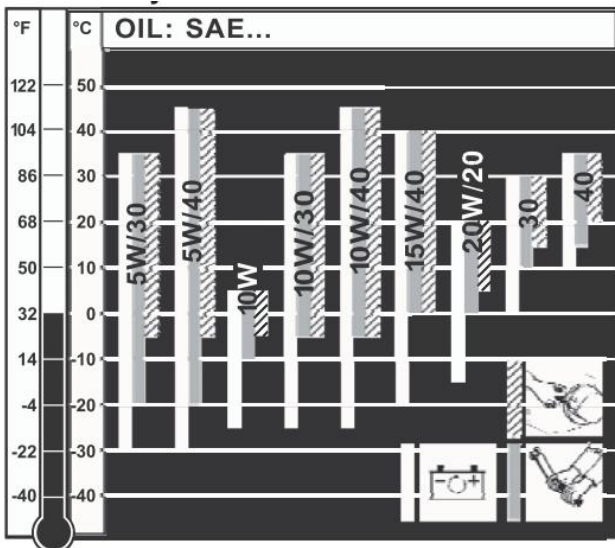


Fig. 4

Please select the recommended viscosity depending on the ambient temperature at which the engine is operated.

**Inappropriate engine oil may shorten the engine's service life significantly.**

When adding oil or checking the level, the engine must be in a horizontal position.

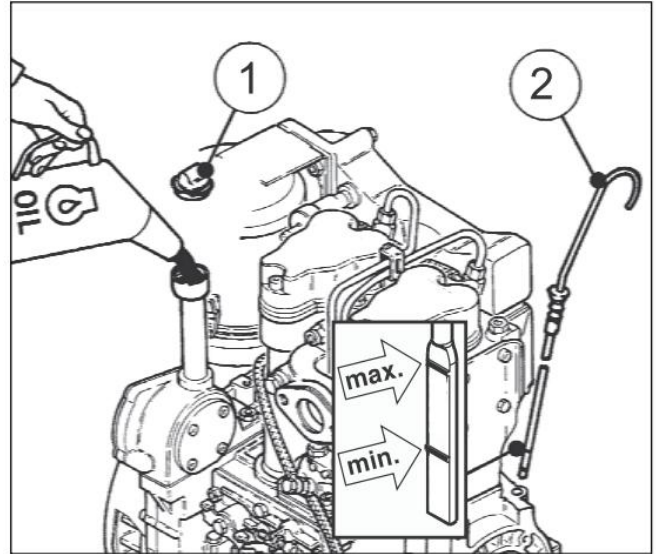


Fig. 5

-Remove oil filler screw "1" and dipstick "2".

-Add engine oil up to the max. mark on the dipstick.

Lubricating oil capacity: see Chapter 3.1.

-Insert the oil filler screw and tighten it (hand-tight only).

##### Attention!

If the engine is operated while the oil level is below the **min.** mark or above the **max.** mark, it can cause damage to the engine.

#### 4.1.2. Oil bath air cleaner

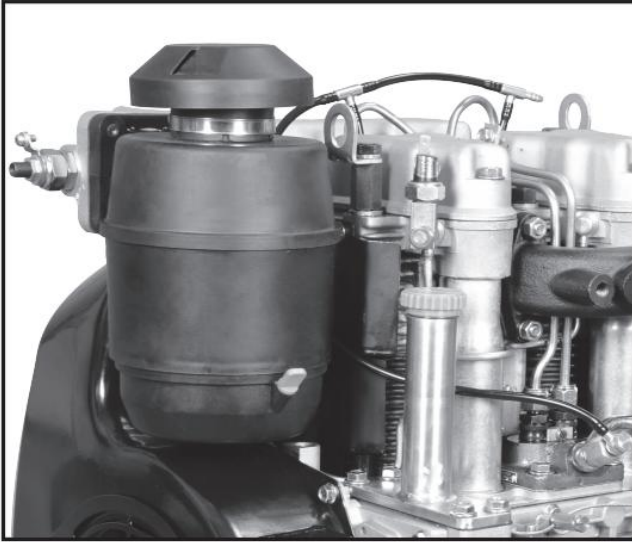


Fig. 6

If a cyclone-type dust trap is fitted, make sure that the dust outlet is pointing in the correct direction.

-Fill the oil tank up to mark with engine oil.

-Attach oil tank, making sure that sealing ring is correctly seated and clips are fastened securely.

#### 4.1.3. Fuel

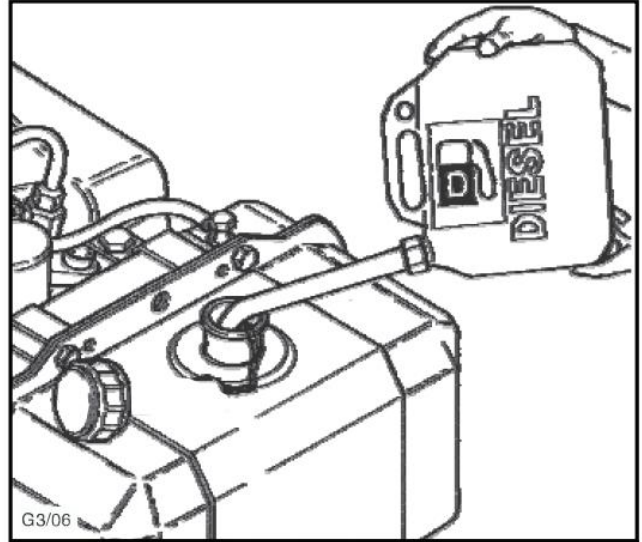


Fig. 7



**Stop the engine before refueling. Never add fuel near a naked flame or a source of sparks. Don't smoke. Use only pure fuel and clean filling equipment. Take care not to spill fuel.**

**Important !**  
**The use of fuels of different specifications requires the prior written consent of the headquarters.**

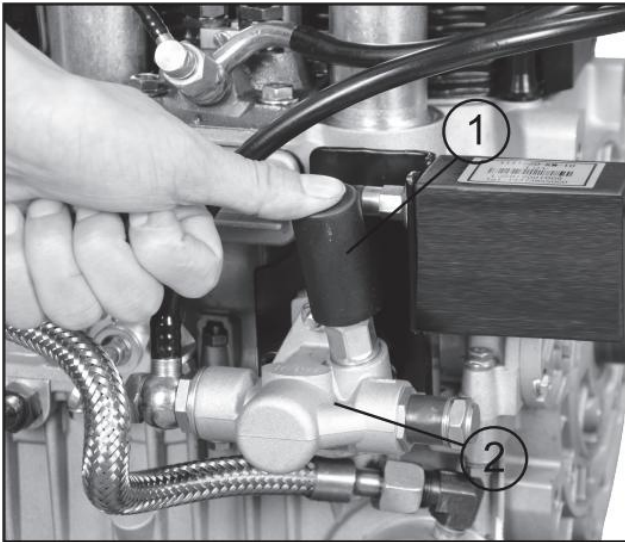


Fig. 8

Before starting for the first time or if the fuel system was run dry, prime it by operating lever “1” on feed pump “2” until fuel is heard to flow back into the fuel tank through the return line.

## 4.2.Starting the engine



**Do not run the engine in closed or badly ventilated rooms- danger of poisoning!**

**Before starting the engine, make sure that no one is within the danger area near the engine or the machinery it is driving, and that all the necessary guards are installed.**

### 4.2.1.Preparations for starting

-If possible, disengage the engine from any driven equipment

The auxiliary equipment should always be placed in neutral.

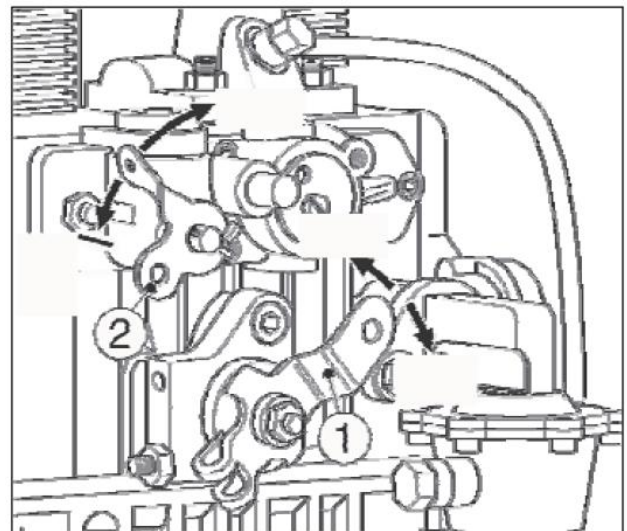


Fig.9

-Depending on operation conditions and requirements, set speed control lever “1” to either the 1/2 START or max.START position.

-Make sure that stop lever “2” is in the off position “START”.



Fig.10

 **Never use starting aids in the form of aerosols or sprays!**

#### 4.2.2. Electric starter

-For starting preparations, see Chapter 4.2.1.

-Insert the start key **to its stop** and turn it to **position**.

- Turn start key to **position**

-As soon as the engine runs, release the start key. It must return to **position** by itself and remain in this position during operation.

-The air cleaner maintenance indicator (additional equipment) only lights up during operation if the air cleaner element needs to be cleaned or renewed.

-Always turn the start key back to **position 0** before re-starting the engine. The repeat lock in the ignition lock prevents the starter motor from engaging and possibly being damaged while the engine is still running.

#### **Important!**

If a starter protection module is fitted, the key must be turned back to **position 0** for at least 8 seconds if the engine fails to start, before a second attempt of starting can be made.

#### **Note:**

Start for max.30 seconds. If the engine does not run after this time, turn starter key back to **position 0** and eliminate the cause.

**Preheating device with automatic heating timer (additional equipment)**

**Automatic shut-down function (additional equipment)**

#### **Important!**

**Even with automatic shutdown monitoring the oil level must be checked every 8-15 operating hours.**

### 4.3. Stopping the engine

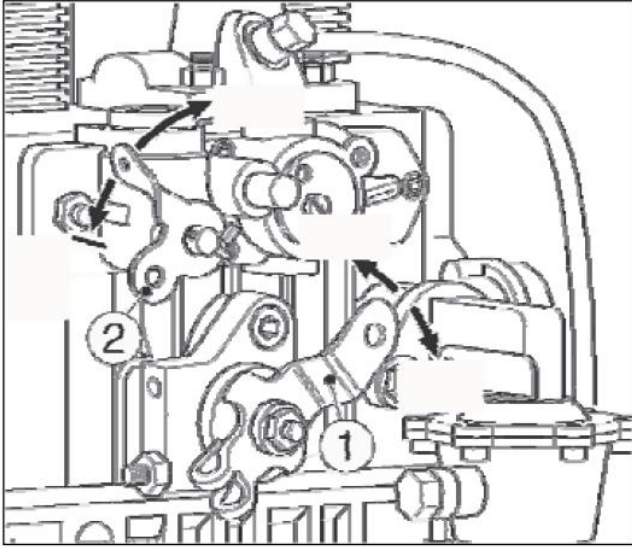


Fig. 11

Move speed control lever "1" back to the "STOP" position.

**Note:**

Engines with an automatic electrical shutdown system can also be stopped by turning the starter key back to position.

**During breaks in operation or at the end of the work session, pull out the starter key and keep in a safe place where it cannot be reached by unauthorized Persons.**

-Move speed control lever "1" back to the "STOP" position.

-On engines with the lower idling speed out of use, move speed control lever "1" back, then move stop lever "2" towards STOP and hold it there until the engine has come to a standstill.

-Once the engine is not running any longer, release the stop lever. The stop lever is returned automatically to its operating position STARTI via a spring.

## 5.Maintenance



The engine must be stopped before any maintenance work is attempted.

Comply with legal requirements when handling and disposing of old oil, filters and cleaning materials.




Keep the engine's starting key and starting handle out of reach of unauthorized persons.

To immobilize engines with an electric starter, disconnect the negative battery terminal.

At the end of the maintenance work, check that all tools have been removed from the engine and all safety guards, covers etc.replaced in their correct positions.

Before starting the engine, make sure that no-one is in the danger area (engine or driven machinery).

### 5.1. Maintenance summary

	Maintenance interval	Maintenance work required	Chap.
	Every 8-15 operating hours or before daily starting	Check oil level. Check area around combustion air input. Check cooling air system. Check that the oil level in the lower part of the oil bath air cleaner is correct and that the oil is not contaminated.	5.2.1. 5.2.2. 5.2.3. 4.1.2. 5.3.1.
	Every 250 operating hours	Maintenance of air filter/oil bath air filter. Replace engine oil and oil filter. Check and adjust valve clearances. Clean cooling air system. Examine screw connections.	5.3.1. 5.3.2. 5.3.3. 5.3.4. 5.3.5.
	Every 500 operation hours	Renew fuel filter. Maintenance of air filter/dry-air filter.	5.4.1.

The above maintenance chart is supplied with every engine. This label should be affixed to the engine or equipment in an easily visible position. The maintenance chart governs the maintenance intervals.

For **new or reconditioned engines**, the following must always be carried out after the **first 25 operating hours**.

- Replace engine oil and oil filter, chap.5.3.2.
- Check tappet clearance, and adjust if necessary, chap.5.3.3.
- Examine screw connections, chap.5.3.5.

**For short operating periods:** replace engine oil and oil filter **after 12 months at the latest**, regardless of the number of operating hours.

## 5.2. Maintenance work every 8-15 operating hours

### 5.2.1. Check engine oil level

When the oil level is checked, the engine must be stopped and in a horizontal position.

-Remove any dirt in the dipstick area.

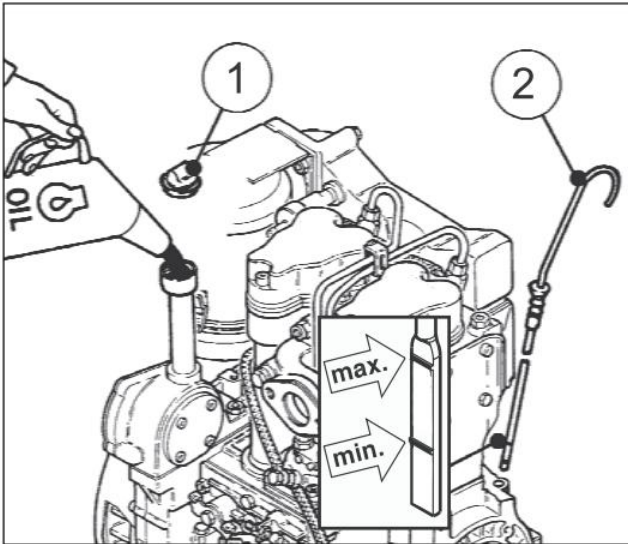


Fig.12

-For oil level inspection, remove the dipstick "2" and wipe it dry using a lint-free, clean piece of cloth; then insert it to its stop and pull it out again.

-Check oil level at the dipstick; top up if necessary as far as the **"max"** mark (see Chapter 4.1.1.).

#### **Attention!**

If the engine is operated while the oil level is below the **min. mark** or above the **max. Mark**, it can cause damage to the engine.

### 5.2.2. Check combustion air intake area

Heavy contamination is an indication that increased dust accumulation necessitates a correspondingly shorter maintenance interval, Chapter 5.3.1.

With oilbath air cleaner:



Fig.13

-Inspect air inlets "1" (depending on version) for severe dirt and dust deposits, and clean if necessary.

-Make sure that dust outlet "2" on the cyclone-type dust trap (depending on version) is not obstructed, and clean if necessary (chap.5.3.1.).

-Inspect air inlets "1" and clean if necessary.

-Check that dust discharge valve "2" is not obstructed; eliminate dust blockage by pressing together as shown.

### 5.2.3. Check the cooling air system

Heavy contamination is an indication that increased dust accumulation necessitates a correspondingly shorter maintenance interval.



Fig.14

-Inspect air inlets and outlets for coarse soiling such as leaves, dust accumulation etc., clean if necessary (chap.5.3.4.).

The temperature indicator, “1” -if installed- will light up as soon as the engine becomes too hot.

**Shut down the engine immediately!**



## 5.3. Maintenance work every 250 operating hours

### 5.3.1. Maintenance work on oil bath air cleaner

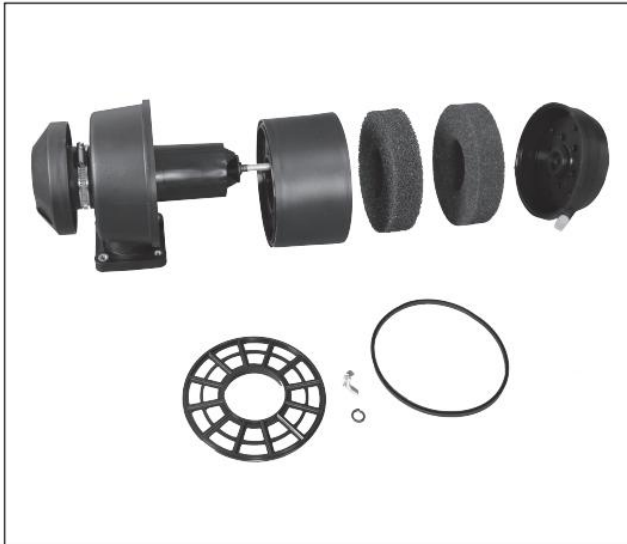


Fig. 15



**Trap the old oil and dispose of it in accordance with local legislation.**

- Take off the oil tank "1".
  - Remove contaminated oil and sludge from the oil tank, and clean it out.
  - Take off rain cap "2" or cyclone-type dust trap "3", and clean.
  - Clean right through intake pipe "4".
  - Check condition of sealing ring "5" and renew if necessary.
  - Add engine oil to the oil tank up to mark "6" and re-assemble the oil bath air cleaner (fig.20, chap.4.1.2.).
- If the filter packing is severely contaminated with dust and dirt, the upper part of the air cleaner must also be cleaned as follows:



Fig.16

- Detach upper part of air cleaner "1" from engine and rinse in diesel fuel.
- Allow the diesel fuel drip off thoroughly, or wipe it off, before re-assembling.
- Install anew filter packing if the sealing surface is uneven, the body of the filter is cracked and/or filter wool is missing.
- Install the upper part of the air cleaner, using a new flange gasket "3".
- Re-assemble the remaining parts of the air cleaner and fill with oil to prepare for further operation (chap.4.1.2.).

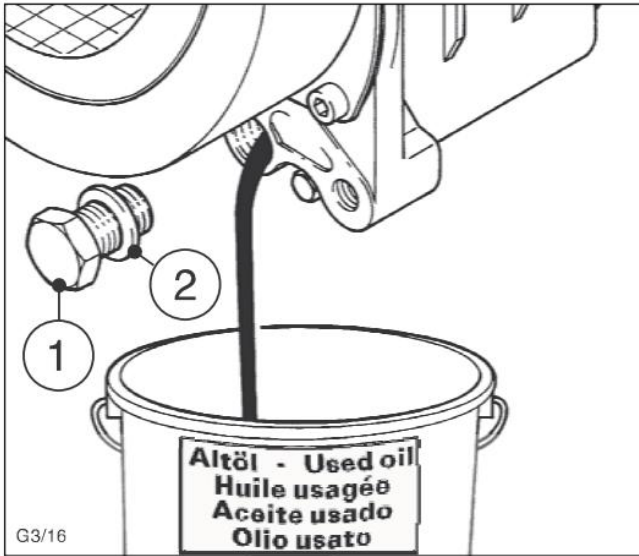
### 5.3.2.Engine oil change and oil filter

#### renewal

The engine must be stopped and in a horizontal position. Drain the engine oil only when the engine is warm.

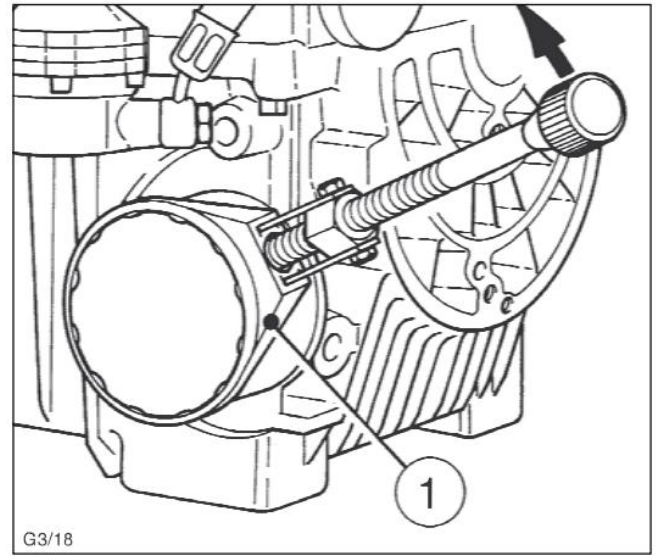


**Danger of scalding from hot oil! Trap the old oil and dispose of it in accordance with local legislation.**



G3/16

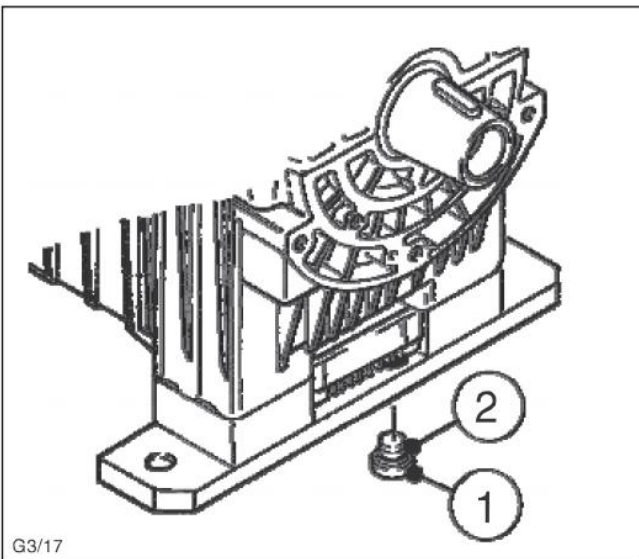
Fig.17



G3/18

Fig.18

-Slacken off and unscrew the throwaway engine oil filter using strap wrench "1", Order No.620 307 01, or a similar tool.



G3/17

Fig.19

-Take out drain plug "1" and allow the oil to drain out completely (fig.22 without oil sump, fig.23 with oil sump).

-Insert oil drain plug "1" with a **new** sealing ring "2" and tighten.

-After cleaning, press the mesh screen back on to the oil pressure relief valve.

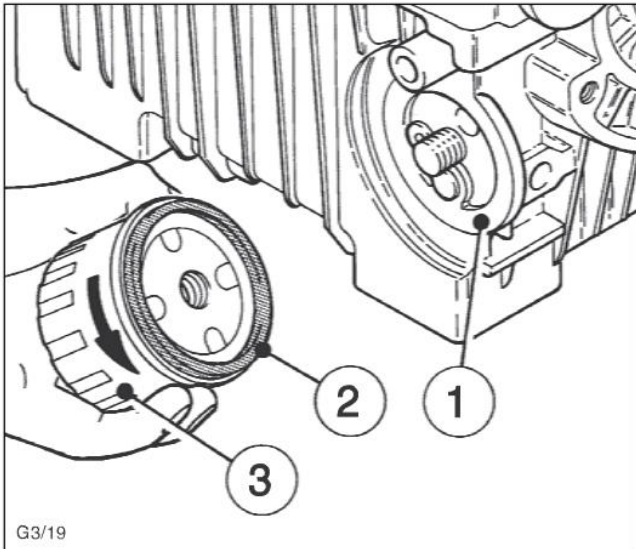


Fig.20

-Clean sealing face "1" thoroughly.

-Never re-use the throwaway filter element. Oil sealing ring "2" on the new filter element lightly.

-Screw in throwaway filter element "3" **hand tight**.

-Add engine oil (chap.4.1.1.).

-Run the engine briefly to check that there are no leaks at the oil filter; take up slack if necessary.

-Check the oil level; add oil if necessary (chap.5.2.1.).

### 5.3.3. Check and adjust valve

#### clearances

-Adjust only when the engine is cold (10-30°C).  
 -Remove any dirt from the area where the cover is attached to the cylinder head.

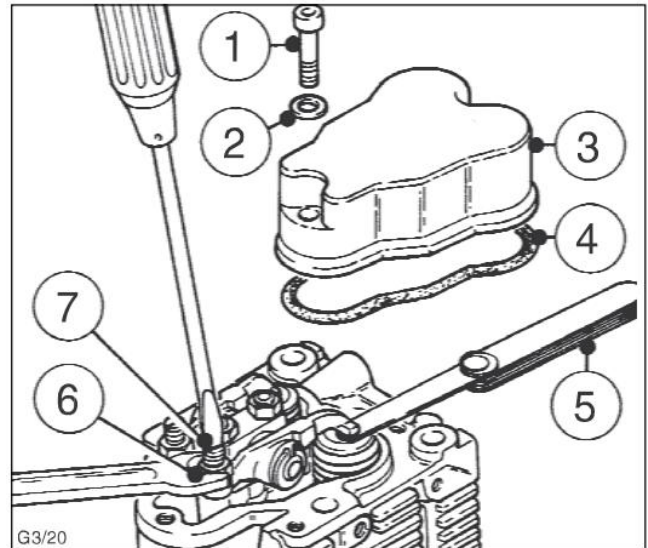


Fig. 21

-Remove screws "1" and take off cover "3" complete with sealing rings "2" and "4". Never re-use these sealing rings.

#### Adjusting procedure:

-Cylinder 1 is at the flywheel end; clockwise rotation.

Cylinder 2 is at the power take-off end; anti-clockwise rotation.

-Turn the engine in its normal direction of rotation until the valves in cylinder 2 are in the overlap position (exhaust valve not yet closed, inlet valve starts to open).

-Turn the crankshaft through 180 degrees in the normal direction of rotation, then check valve clearances for cylinder 1 and adjust if necessary.

-Turn the crankshaft through a further 180 degrees; check valve clearances for cylinder 2 and adjust if necessary.

## Adjusting:

-Measure valve clearance with 0.10 mm feeler Gauge "5" (fig.21, chap.3.1.).

-If adjustment is necessary, slacken off hex nut "6", turn adjusting screw "7" and re-tighten nut "6". It should then be possible to pull feeler gauge "5" through with just perceptible resistance to movement (fig.21).

-Replace the cover in position and tighten it down uniformly.

-Run the engine briefly to check that there are no leaks at the cover.

## 5.3.4.Clean the cooling air system

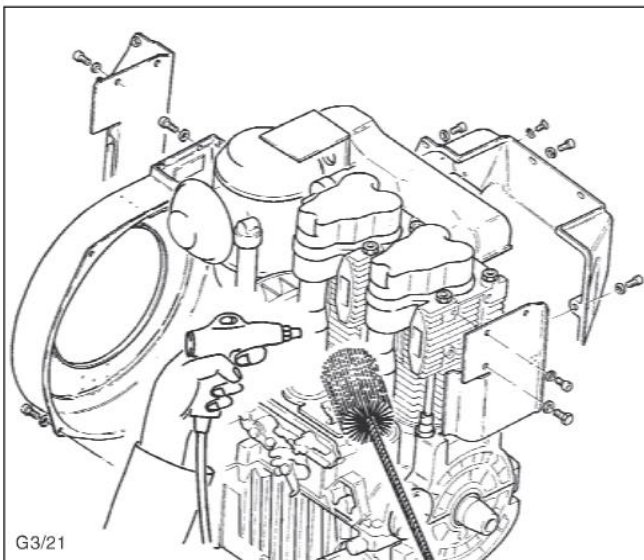


Fig. 22

-Take off I air guides.

### **If dirt deposits are dry:**

-Clean all air guides and the entire cooling air system including cylinder heads, cylinders and flywheel blades without making them wet, and blow them through with compressed air.



**Persons handling compressed air must wear protective goggles. Never direct the jet to animals, persons or yourself!**

## **If dirt deposits are damp or oily:**

-Disconnect the battery.

-Apply a detergent solution (cold cleaner or similar) to the entire system in accordance with the manufacturer's instructions, then spray off with a powerful water jet.

Do not splash electrical device with water jet or pressure jet during engine cleaning.

-Establish the cause of contamination with oil and have any leaks repaired.

Re-attach all air guides.



**The engine must never be run without the air guides.**

-Run the engine immediately after re-assembly unit it is warm; this will prevent rust from forming.

### 5.3.5. Check threaded connections

Check the condition and tightness of all threaded connections, pipes and lines, hose clips and other fastenings on the engine or its mountings which can be reached during maintenance work.

**Do not tighten the cylinder head bolts.**

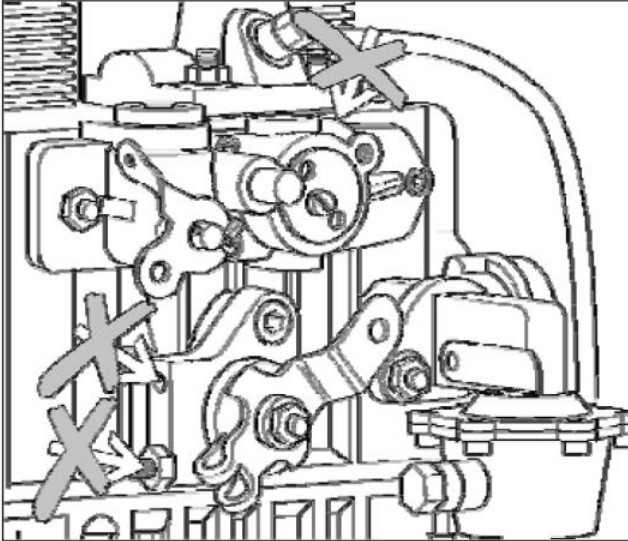




Fig. 23

 **The adjusting screws at the engine governor and on the injection system are sealed with lacquer or with lead and are not to be tightened or adjusted.**

## 5.4. Maintenance work every 500 hours of operation

### 5.4.1. Renew the fuel filter

The maintenance intervals for the fuel filter are dependent upon the purity of the diesel oil being used and, if necessary, may have to be reduced to 250 hours.

 **When working on the fuel system, do not expose it to naked flames; do not smoke.**

**Important!**  
**Keep the entire area clean so that no dirt reaches the fuel. Fuel particles may damage the injection system.**

- Shut off the fuel supply.



Fig. 24

-Pull fuel feed line off fuel filter, at both sides, and insert a new filter. Make sure that the direction of fuel flow is as shown by the arrows.

-Open up the fuel supply again and if necessary operate the priming pump (chap.4.1.3.).

-Run the engine briefly to check that there are no leaks at the fuel filter and fuel lines.

## 6. Malfunctions-causes and remedies

Malfunctions	Possible causes	Remedy	Chap.
The engine does not start or not immediately, can however be turned over with the starter motor.	Speed adjustment lever in the stop or idle position. Stop lever in stop position.	Move the lever in START position.	4.2.1.
	No fuel at the fuel-injection pump.	Fill up with fuel.  Check the complete fuel supply system systematically. If no result, check: -Fuel supply line to the engine. -Fuel filter. -function of the feed pump.	4.1.3.  5.4.1. 4.1.3.
	Insufficient compression: -Wrong valve clearances	Check valve clearances, adjust if necessary.	5.3.3.
	-Worn out cylinders and/or piston rings.  Unserviceable injector jets.	See workshop manual.  See workshop manual.	
At low temperatures.	Below the start-limit temperatures.	Operate glow-plug equipment (additional equipment).	4.2.2.
	Device not disengaged.	Disengage the engine from the device-if possible.	
	Glow-plug equipment defective (additional equipment).	See workshop manual.	
	Fuel flocculent due to inadequate cold stability.	Pull out the return line and check whether clear, unclouded fuel comes out when operating the feed pump.  If the fuel is flocculent, either warm up the engine or drain off the complete fuel supply system. Refill with temperature-resistant fuel mixture.	4.1.3.  4.1.3.

<b>Malfunctions</b>	<b>Possible causes</b>	<b>Remedy</b>	<b>Chap.</b>
At low temperatures.	Starting speed too low: -Oil too viscous.	Replace and fl up with oil.	5.3.2. 4.1.1.
	-Battery inadequately charged.	Check the battery, if necessary contact a service station.	7.
Stater motor does not operate or engine does not tum over.	Discrepancies in the electrical system: -Battery and/or other cable connections wrongly connected. -Loose and/or oxidized cable connections. -Battery defective and/or not charged. -Stater motor defective. -Defective relays, monitoring elements etc.	Check the electrical system and its components or contact service station!	7.
Engine ignites, but stops running as soon as the starter motor is disengaged.	Speed control lever not located far enough in the start direction.	Move the lever to START position.	4.2.1.
	Device not disengaged.	Disengage the engine from the device if possible.	
	Fuel filter blocked.	Replace fuel filter.	5.4.1.
	Fuel supply interrupted.	Check the entire fuel supply systematically.	
In addition, if automatic electrical engine shutdown is installed.	Stop signal from monitoring element for automatic shutdown system (optional extra): -Oil pressure lost	Check oil level.	5.2.1.
	-Cylinder head temperature too high.	Clean cooling air system.	5.3.4.
	-Alternator has failed.	See workshop manual.	

<b>Malfunctions</b>	<b>Possible causes</b>	<b>Remedy</b>	<b>Chap.</b>
Engine shuts down independently during operation.	Fuel supply interrupted: -Tank runs dry -Fuel filter blocked. -Fuel feed pump defective.	Fill up with fuel. Replace fuel filter. Check the entire fuel supply system. Contact a service station.	4.1.3. 5.4.1. 4.1.3.
In addition, if automatic electrical engine shutdown is installed.	Mechanical malfunctions.  Stop signal from monitoring element because of: -oil pressure too low. -cylinder head temperature too high.  -alternator has failed.  Malfunction signal from over-voltage and polarity reversal protection in voltage regulator: -Battery and/or other cable connections incorrectly connected. -Cable connections loose.	Check engine for: Engine oil level Cooling air passages blocked or cooling system otherwise affected.  See workshop manual.  Check electrical equipment and the components thereof.	5.2.1. 5.3.4.
Drop off in performance and speed of the engine.	Fuel supply detrimentally affected: -Tank run dry. -Fuel filter blocked. -Inadequate tank ventilation.  -Line connections leaky.  -The speed control lever does not remain in the required position.	Fill up with fuel. Replace fuel filter. Ensure adequate ventilation of the tank.  Check the line screw-connections for leaks.  Block the speed control.	4.1.3. 5.4.1.



<b>Malfunctions</b>	<b>Possible causes</b>	<b>Remedy</b>	<b>Chap.</b>
Drop off in engine performance and speed, black smoke from the exhaust.	Air filter contaminated.	Clean air filter.	5.3.1.
	Incorrect valve clearances.	Adjust valve clearances.	5.3.3.
	Injector jets unserviceable.	See workshop manual.	
Engine runs very hot, the indicator lamp for cylinder head temperature (additional equipment) comes on.	Too much oil in the engine.	Drain off oil to the upper mark on the dipstick.	5.3.2.
	Inadequate cooling: -Contamination in the entire area for the air guides.	Clean the area of cooling air.	5.3.4.
	-Insufficiently enclosed air guides.	Check that the air guides and shafts are complete and that they are sealed.	

## 7. Work on the electrical system



**Batteries generate explosive gases. Keep them away from naked flame and sparks which could cause them to ignite.**

**Do not smoke.**

**Protect eyes, skin and cloth against the corrosive battery acid. Pour clear water over acid splashes immediately. In case of emergency call doctor.**

**Do not place any tools on top of the battery.**

Always disconnect the negative (-) pole of the battery before working on the electric device.

- The positive (+) and negative (-) battery terminals must not be accidentally interchanged.
- When installing the battery, connect the positive lead first, followed by the negative lead. Negative pole to earth (ground) on engine block.
- When removing the battery, disconnect the negative lead first, followed by the positive lead.
- In all circumstances, avoid short circuits and shorts to earth (ground) at life cables.
- If electrical faults occur, first check for good contact at the cable connections.
- Replace a failed indicator light without delay.
- Do not take the key out while the engine is running.
- Never disconnect the battery while the engine is running. Electric voltage peaks can cause damage to electrical components.

- Do not splash electrical device with water jet or pressure jet during engine cleaning.

- When carrying out welding work on the engine or attached equipment, attach the earth (ground) clip as near as possible to the welding point, and disconnect the battery. If an alternator is fitted, separate the plug connector leading to the voltage regulator.

The relevant circuit diagrams are supplied with engines which have an electrical system. Additional copies of circuit diagrams can be obtained on request.

Circuit diagrams assumes no liability for electrical systems which was not carried out acc.

## 8. Protective treatment

A new engine can normally be stored for up to 12 months in a dry place. If atmospheric humidity is high (or if exposed to sea air), protection is sufficient for about 6 months' storage.

If the engine is to be stored for a longer period, or laid up out of use, please consult

## **UNUSUAL OPERATING CONDITIONS.**

The engine must not be operated at a load factor less than 25% for an extended period as such operation will cause the fuel injector to foul. If such a condition occurs, you should contact the nearest authorized Service Center for necessary repairs.

The engine is designed and adjusted to operate most efficiently at the following conditions:

- Air temperature of 25°C (77°F)
- Atmospheric pressure of 100 KPa (14.5 psi)
- Relative humidity of 30 %

Operation of the engine at conditions other than above will affect performance and exhaust emissions. Normally the equipment manufacturer takes this into account during the design of the machine and your equipment will perform within specifications over a wide range of climatic conditions. However if you must operate your equipment under very unusual climatic conditions, please contact your nearest distributor for advice.

## **YOUR WARRANTY RIGHTS AND OBLIGATIONS.**

Its warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system includes:

- Fuel injection pump
- Injection nozzle( s)
- Extra fuel device
- Crankcase breather valve assembly
- Air cleaner housing
- Intake manifold
- Exhaust manifold
- Oil filler cap
- Intake and exhaust gaskets at head interfaces
- Emission Control Information Labels

Where a warrantable condition exists, we will repair your engine at no cost to you including diagnosis, parts and labor.

## **OWNERS WARRANTY RESPONSIBILITIES:**

- As the engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. We recommend that you retain all receipts covering maintenance on your engine, but we cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

- As the engine owner, you should be aware, however, that we may deny you warranty coverage if your engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

- You are responsible for presenting your engine to our authorized service center as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.