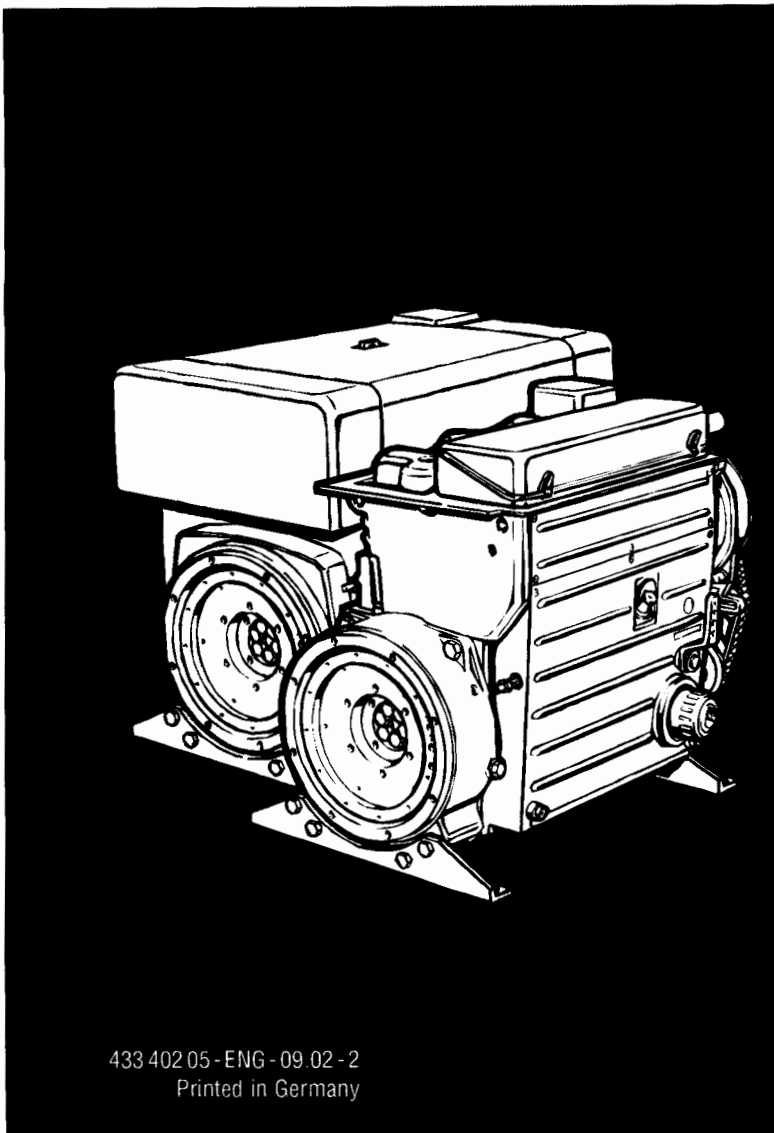


INSTRUCTION BOOK



433 402 05 - ENG - 09.02 - 2
Printed in Germany

2-4L40.

2-4L41.

2-4M40.

2-4M41.

A new HATZ Diesel engine - working for you

This engine is intended only for the purpose determined 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, Motorenfabrik HATZ accepts no warranty. 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.

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 and assist you in complying with the maintenance intervals in order to ensure long-lasting, reliable performance.

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



The worldwide HATZ Service Network is at your disposal to advise you, supply with spare parts and undertake servicing work.

You will find the address of your nearest HATZ service station in the enclosed list.



Original - Ersatzteile

Original-spare parts

Pièces de rechange d'origine

Repuestos originales

Use only original spare parts from HATZ. Only these parts guarantee a perfect dimensional stability and quality. The order numbers can be found in the enclosed spare parts list. Please note the spare part kits shown in Table 1.

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

MOTORENFABRIK HATZ GMBH & CO KG

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This symbol draws attention to important safety precautions.

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

General legal requirements or safety regulations issued by the competent authorities or industrial accident insurers are also applicable.

1. Important notes on safe operation of the engine



HATZ diesel engines are economical, strongly built and long-lasting. They are therefore frequently chosen for commercially and industrially operated equipment and machinery. If the engine forms part of the finished equipment or machine, its manufacturer will take all the applicable safety regulations into account.

Nevertheless, we would like you to note certain additional comments on operating safety which follow. Depending 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 so that they cannot be touched accidentally when the engine is installed in other equipment or machinery.
Guards are available from HATZ to protect belt drives for cooling 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.
- In order to benefit from the advantages of the starting handle with kick-back damping, it must be used precisely as recommended in this Instruction Book.
- 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 starting handle and the 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.

Important notes on safe operation of the engine



- Stop the engine before performing any maintenance, cleaning- and repair work.
- Stop the engine before refuelling.
Never refuel near a naked flame or sparks which could start a fire. 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 the engine while it is running.
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. Contact your next HATZ Servicestation, if a sticker comes off or is illegible and ask for a new one.
- Note that any unauthorized modifications to the engine absolve its manufacturer from liability for the consequences.

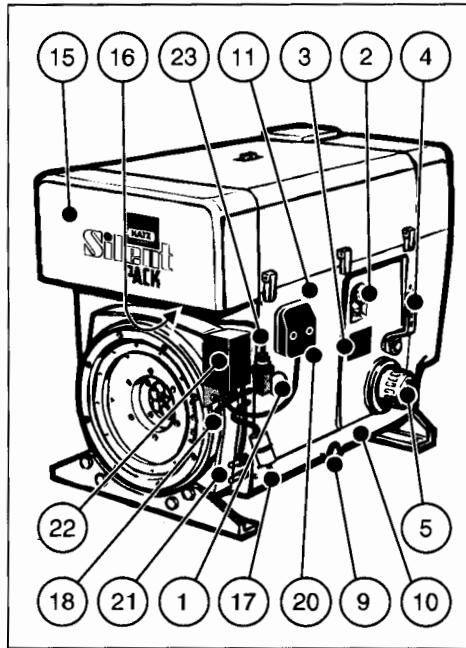
Regular servicing in accordance with the details provided in this Instruction Book is essential to keep the engine operating reliably.

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

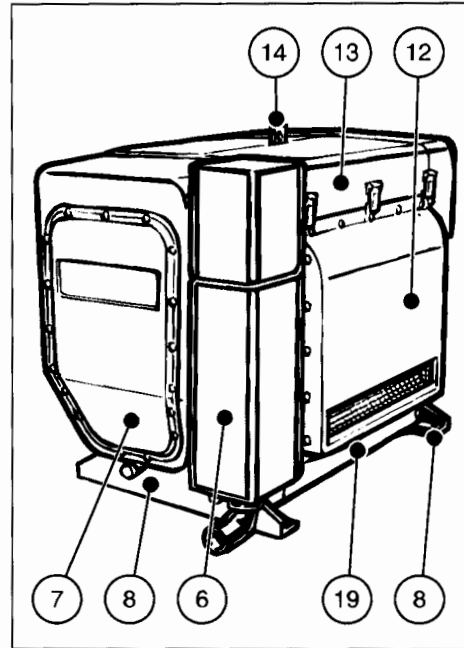
2. Description of engine

Fully encapsulated „Silent Pack“ version

Engine 2... 4L40C, 2... 4L40CH, 2... 4L41C, 4L40K, 4L41K



1



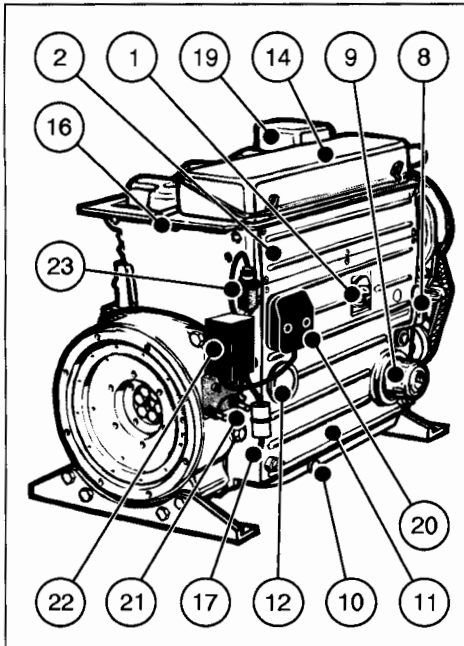
2

- | | |
|---|--|
| 1 Access cover for fuel delivery pump | 12 Air outlet duct |
| 2 Oil filler pipe and dipstick | 13 Capsule hood |
| 3 Type plate | 14 Suspension lug (retractable),
max. load 5000 N |
| 4 Speed control lever | 15 Air intake duct for capsule |
| 5 Replaceable-element oil filter | 16 Combustion air intake aperture |
| 6 Exhaust silencer (in capsule) | 17 Fuel feed line line with fuel pre-filter |
| 7 Cover for air guide housing
(Access to fan drive belt) | 18 Fuel return line |
| 8 Engine support feet | 19 Cover plate, air outlet side |
| 9 Cover plate, control side | 20 Central plug for electrical system |
| 10 Oil drain plug | 21 Battery connections |
| 11 Side panel | 22 Power-Box |
| | 23 Electrical maintenance switch for
air cleaner |

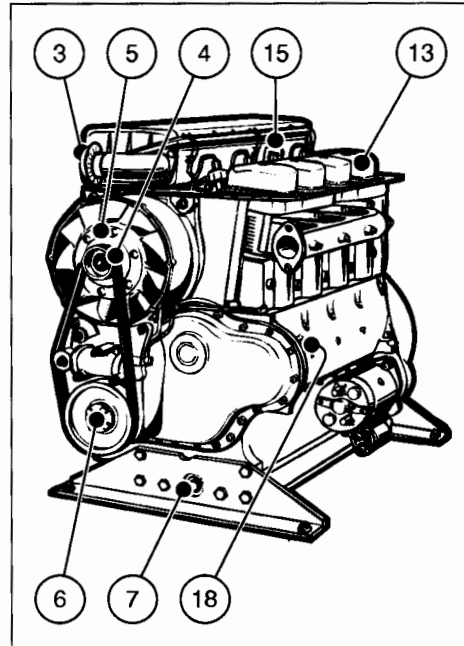
Description of engine

Standard version

Engine 2...4M40H / L / HZ / LZ • 2...4M41 • 2...4M41Z



3



4

- 1 Oil filler pipe and dipstick
- 2 Side panel
- 3 Combustion air intake aperture
- 4 Cooling fan drive belt
- 5 Cooling fan with alternator attached
- 6 1/2-inch intl. hex socket for turning over engine
- 7 Oil drain plug
- 8 Speed control lever
- 9 Replaceable-element oil filter
- 10 Oil drain plug (if sump is fitted)
- 11 Cooling air duct for engine oil cooler
- 12 Access cover for fuel delivery pump

- 13 Cylinder head cover
- 14 Air cleaner cover
- 15 Suspension lug, max. load 5000 N
- 16 Fuel return line
- 17 Fuel feed line with fuel pre-filter
- 18 Type plate
- 19 Exhaust silencer
- 20 Central plug for electrical system
- 21 Battery connections
- 22 Power-Box
- 23 Electrical maintenance switch for air cleaner

3. General information

3.1. Technical data

		2L40. 2L41. 2M40. 2M41.	3L40. 3L41. 3M40. 3M41.	4L40. 4L41. 4M40. 4M41.
Type		Air-cooled, four-stroke diesel engine		
Combustion method		Direct fuel injection		
Number of cylinders		2	3	4
Bore/stroke	mm	102 / 105	102 / 105	102 / 105
Displacement	cm ³	1716	2574	3432
Engine oil pressure Oil temperature 100 ± 20°C		min. 0.6 bar at 850 r.p.m.		
Consumption of lubrication oil after running-in period		max. 1 % of fuel consumption at full-load		
Direction of rotation		Counterclockwise, looking at flywheel		
Valve clearance (at 10 - 30 °C) Inlet/exhaust	mm	0.10		
Net weight				
Version H / L	approx.	223	255	291
Version Z / HZ / LZ	kg	228	262	306
Version C / K		276	331	396 / 386
Max. angle from vertical in any direction (in continuous operation)		with and without	with without	only with
Control side		sump	sump	sump
Air outlet side		30° 1)	30° 1) 25° 1)	25° 1)
Timing gear side		30° 1)	30° 1) 30° 1)	30° 1)
Flywheel side		30° 1)	25° 1) 25° 1)	15° 1)
		30° 1)	22° 1) 25° 1)	18° 1)

1) Exceeding these limits causes engine breakdown.

3.2. Transport



A suspension lug is provided as standard equipment, so that the engine and its auxiliaries can be lifted safely. It is not suitable for lifting complete machines or similar to which the engine has been attached, and this is strictly prohibited. (See Chapter 2.)

3.3. Instructions for installation

The „Manual for Selection and Installation of Engines“ contains all the information you need if your engine has not yet been installed on or in the equipment it is intended to drive, or set up in its correct operating position. You can obtain a copy of this manual from your nearest HATZ service station.

3.4. Load on engine

Operating the engine for a lengthy period off-load or at very low loads can affect its running quality.

We therefore recommend a minimum engine load of 15 %. If operated at such low loads, it is best to operate the engine at a significantly higher load for a short period before switching it off.

3.5. Type plate

The type plate is placed on the crankcase resp. on the capsule (chapt. 2) and includes the following engine information (pict. 5a resp. 5b):

- ① engine type
- ② code (only for special equipment)
- ③ engine number
- ④ max. engine speed

For any offer as well as spare part orders it is necessary to mention these data (also see spare parts list, page 1).

4. Operation

4.1. Before first start-up

Engines are normally delivered without any fuel or oil.

4.1.1. Engine oil

All brand-name engine oils which comply with the minimum requirements of the following specifications are suitable:

**CCMC D4 / D5 / PD2 or
API CD / CE / CF / CG or
SHPD**

If engine oils with low quality standard are being used, the intervals of changing the engine oil have to be reduced from 250 to 150 resp. 500 to 250 hours of operation, see chapter 5.1.

Oil viscosity

Choose a suitable oil viscosity according to the ambient temperature when the engine is started from cold (Figure 6).

Engine oil quantities and dipstick markings

Engine type	Sump	Oil content (liter)	dipstick marking (Figure 7, item 2)
2L40C/CH			
2L41C	Yes	7.5	C
2M40HZ/LZ	No	4.5	A
2M41Z			
2M40H/L	Yes	8.5	C
	No	5.5	A
2M41	Yes	8.5	C
	No	5.5	A
3L40C/CH			
3L41C	Yes	10.5	D
3M40HZ/LZ	No	8.0	A
3M41Z			

Engine type	Sump	Oil content (liter)	dipstick marking (Figure 7, item 2)
3M40 H/L	Yes	11.0	D
	No	8.5	A
3M41	Yes	11.0	D
	No	8.5	A
4L40C/CH			
4L41C	Yes	13.0	D
4M40 HZ/LZ	No	–	–
4M41 Z			
4L40 / 41 K	Yes	14.0	D
4M40 H/L	No	–	–
4M41			

Note:

The **engine oil contents** stated here are to be regarded as **approximate**.

In all cases, the **MAX marking** on the dipstick **should be complied with**.

The engine should be in a horizontal position before adding oil or checking the oil level.

- Pull out dipstick „1“ (fig. 7).
- Add engine oil up to the **MAX** mark on dipstick „1“ (Figures 7 and 8).
- Run the engine for a short time, then check oil level again and correct if necessary.

4.1.2. Fuel



Stop the engine before refilling the fuel tank. Never refuel near a naked flame or sparks which could start a fire. Don't smoke. Use only pure fuel and clean filling equipment. Take care not to spill fuel.

All diesel oils sold as fuel and complying with the following minimum specifications can be used:

EN 590 or
DIN 51601 - DK or
BS 2869 A1 / A2 or
ASTM D 975 - 1D / 2D

- Before the engine is first started, or if the fuel system was run dry, prime the fuel delivery pump at lever „1“ until fuel is heard to flow back through the return line „2“ to the fuel tank (Figure 9).

Important !

Remember to replace the access cover for the fuel delivery pump in the side panel of the engine enclosure after priming the pump (Chap. 2).

At temperatures below 0 °C, winter-grade fuel should be used or paraffin added to the fuel well in advance.

Lowest ambient temperature when starting, in °C	Paraffin content for:	
	Summer fuel	Winter fuel
0 up to -10	20 %	–
-10 up to -15	30 %	–
-15 up to -20	50 %	20 %
-20 up to -30	–	50 %

4.2. Starting



Do not run the engine in closed or badly ventilated rooms – danger of poisoning! Before the engine is started, always make sure that nobody is in the danger area (moving parts on engine or machinery) and that all safety guards are in place. Never use any spray starting aids (Fig. 10)

If possible, disengage the engine from any driven equipment.

The auxiliary equipment should always be placed in neutral.

4.2.1. Starting with the electric starter

– Move the speed control lever to the 1/2 START or max. START position, according to requirements and starting conditions (Figure 11).

Note that a lower speed setting will cause less exhaust smoke when starting.

– Insert start key and turn to **position I** (Fig. 12).

– Battery charge telltale „2“ and oil pressure warning „3“ must light up (Fig. 13).

– Turn start key to **position II** (Fig. 12).

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

The battery charge telltale and oil pressure warning must go out immediately after starting. Indicator light „1“ is on when the engine is in operation.

– The air cleaner maintenance indicator „5“ only lights up during operation if the air cleaner element needs to be cleaned or renewed (Fig. 13, see chapter 5.4.2.).

– The engine temperature display „4“ (additional equipment) lights up if the temperature at the cylinder head becomes too high.

Switch off the engine and trace and eliminate the cause of the problem, see chapter 7.

– 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 installed, the start key has to be returned to **position 0** for at least 8 seconds after the engine has failed to start or after switching it off before a further attempt can be made to start the engine.

Preheating device with automatic heating timer (additional equipment)

The preheating light „6“ lights up additionally at temperatures below 0° Celsius (Fig. 13).

– After the light has gone out, start the engine without delay.

Automatic shut-down function (additional equipment)

Engines with the automatic shut-down function have the preheating display „6“ on the instrument box, see figure 13.

Important!

If the engine cuts out immediately after starting or switches off by itself during operation, a monitoring element in the automatic shutdown system has tripped. The corresponding indicator light (Fig. 13, positions 2 - 5) will come on.

After the engine has stopped, the display continues to glow for about 12 seconds.

The electrical device then switches itself off automatically. The display lights up again after the start key has been turned back to **position 0** and then to position I again.

Trace and eliminate the cause of the operating fault before trying to restart the engine (see chapter 7).

The display light goes out when the engine is next started.

Even with automatic shutdown monitoring the oil level must be checked every 8 – 15 operating hours (Chapter 5.2.1.).

4.2.2. Emergency starting

If the engine has been stopped by the automatic shutdown system because of an electrical fault signal or inadequate oil pressure, an emergency start can be attempted, though in this case the manufacturer will accept no liability for consequential damage.

An emergency start could for example be unavoidable if the engine is used to power a vehicle which has come to a halt in a potentially dangerous area (for example on a rail crossing or road junction).

Proceed as follows:

- Detach the hood of enclosure „13“ (Figure 2) or side panel „2“ (Figure 3).
- Place a suitable tool, for example a screw driver, behind emergency start lever „2“ and pull sharply outwards. This will break the lead seal „3“ between the emergency start lever and the screw on the engine block (Figure 14).
- As soon as the emergency start lever is in the starting position, the engine can be started again.

Important:

If the emergency start lever is used, the automatic shutdown system ceases to operate and the warranty is invalidated. For this reason, run the engine only in a genuine emergency and for a very short time (a few seconds) after operating the emergency start lever. Make sure before re-starting the engine that there is sufficient oil in the engine; if oil pressure is too low, irreparable engine damage may occur very quickly. Immediately after running the engine in an emergency, locate the origin of the fault signal and rectify the fault (see Chapter 7).

If any problems arise, please contact the nearest HATZ service point.

4.2.3. Starting with handle

(on 2-4 M 40. / 2-4 M 41 engines only)

Preparations

- Move the speed control lever to START position (Fig. 11).
- Turn all decompression levers (1 on two-cylinder engines, 3 on three-cylinder engines, 4 on four-cylinder engines) to position 1 (Fig. 15).

Important !

Turn decompression levers only in the direction shown by the arrow.

Exception:

the lever can be moved back directly from position „1“ to „0“.



Never operate the automatic decompression system when the engine is running.

- Check that the starting handle is in correct working order, without a broken tubular handle worn engagement dogs or similar faults.
- Lightly grease the sliding-contact area between the starting handle and the guide sleeve.
- Insert the starting handle, hold it with both hands and stand in the correct position in relation to the engine (Figure 16).
- Turn the engine over until it is felt to move more freely.

2M40./2M41 two-cylinder engines

- Turn the decompression lever to position „2“ (Figure 15).

3M40./3M41 three-cylinder engines

- Turn the decompression levers for cylinders 1 and 3 (counting from the fan end) to position „2“ (Figures 15 and 34).
- Turn the decompression lever for cylinder 2 to position „3“.

4M40./4M41 four-cylinder engines

- Turn the decompression levers for cylinders 1, 3 and 4 (counting from the fan end) to position „2“ (Figures 15 and 34).
- Turn the decompression lever for cylinder 2 to position „3“.

Starting procedure

- Turn the starting handle with both hands at an increasing speed.

The maximum speed of rotation must have been reached by the time the decompression lever has returned to **position „0“**.

- As soon as the engine has started, pull the starting handle out of the guide sleeve.
- If the engine backfires during starting because it was not turned over with sufficient force (the engine could even start to run backwards in certain circumstances), release the starting handle immediately and move the speed control lever to the STOP position (Chapt. 4.3.).



The starting handle could be driven round by the engine and cause injury.

- Wait until the engine has come to a standstill before repeating the preparatory procedure and making another attempt to start it.

4.2.4. Starting with the handle with kick-back damping

- Preparations for starting the engine and the hand starting procedure are precisely the same as with the standard handle. Always hold tubular grip „1“ with both hands (Figures 16 and 17).
- Turn the handle slowly at first, until the pawl engages in the ratchet, then increase turning force to build up speed. The highest speed must have been reached by the time the decompression lever returns to position „0“. As soon as the engine has started, pull the starting handle out of the guide sleeve.



You must hold the tubular grip firmly to maintain contact all the time between the starting handle and the engine. Maintain turning force during the entire hand starting operation.

- If backfiring should occur while hand starting the engine too soft, the brief reversal of movement disengages the pawl between the crankshaft „2“ and the drive dog „3“ (Fig. 17).
- If backfiring occurred and the engine starts running backwards (smoke from airfilter), release crankhandle immediately and move speed control lever into STOP-position, chapt. 4.3.
- To repeat the starting attempt, wait for the engine to cease rotating, reset the automatic decompression device and turn the starting handle in the correct starting direction again.

4.3. Stopping the engine



If the engine is shut down for a short period, or at the end of the working day or shift, keep the key and the starting handel in a safe place, out of reach of unauthorized persons.

Engines with electric starter

- Move the speed control lever to the stop position; the engine will be shut down (Picture 11).
- Turn the key to **position 0** (Picture 12).

Note:

Engines with an automatic shut-down function (they have preheating display „6“ on the instrument box, see fig. 13) can also be switched off by turning the start key back to **position 0**.

Engines with starting handle

- Move the speed control lever to the stop position; the engine will be shut down (Picture 11).



Never stop the engine by moving the decompression lever.

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 out of reach of unauthorized persons.

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 nobody is in the danger area (engine or driven machinery).

5.1. Maintenance summary

	Maintenance intervals	Maintenance work required	Chap.
	Every 8 – 15 hours of operation, or before each daily start-up	Check oil level. Check combustion air intake area. Check the cooling air system	5.2.1. 5.2.2. 5.2.3.
	Every 250 hours of operation	Engine oil change (2 M 40./2 M 41 without sump, 2...4 L 40. / 2...4 L 41 in general). Clean fan, cooling fins and oil cooler. Check tightness of threaded connections. Cleaning of mesh insert in exhaust pipe. Check for contamination of fuel pre -filter, renew if necessary.* Checking operation of air cleaner maintenance indicator. Do not tighten the cylinder head nuts.	5.3.1. 5.3.2. 5.3.3. 5.3.4. 5.4.1. 6.1.
	Every 500 hours of operation	Renew the fuel pre -filter. Air cleaner maintenance. Check and adjust valve clearances. Engine oil change (2 M 40. / 2 M 41 with sump, 3...4 M 40. / 3...4 M 41 in general). Renew the oilfilter.	5.4.1. 5.4.2. 5.4.3. 5.4.4. 5.4.5.
	Every 1000 hours of operation	Renew the fuel filter	5.5.1.

* Fuel **pre**-filter renewal intervals depend on the degree of fuel contamination, the care taken when refuelling and the amount of contamination inside the fuel tank.

HATZ
DIESEL

WARTUNG · MAINTENANCE
ENTRETIEN · MANTENIMIENTO
MANUTENZIONE

8-15 250

STUNDEN · HOURS · HEURES
HORAS · ORE

500 1000

BEI BEDARF
IF NECESSARY
SI NECESSAIRE
EN CASO DE
NECESIDAD
SE NECESSARIO

2M40
2M41

OIL: SAE...
122 100 80 60 40 20 0 -20 -40 -60

2 M 40. and 2 M 41 without oil pan

HATZ
DIESEL

WARTUNG · MAINTENANCE
ENTRETIEN · MANTENIMIENTO
MANUTENZIONE

8-15 250

STUNDEN · HOURS · HEURES
HORAS · ORE

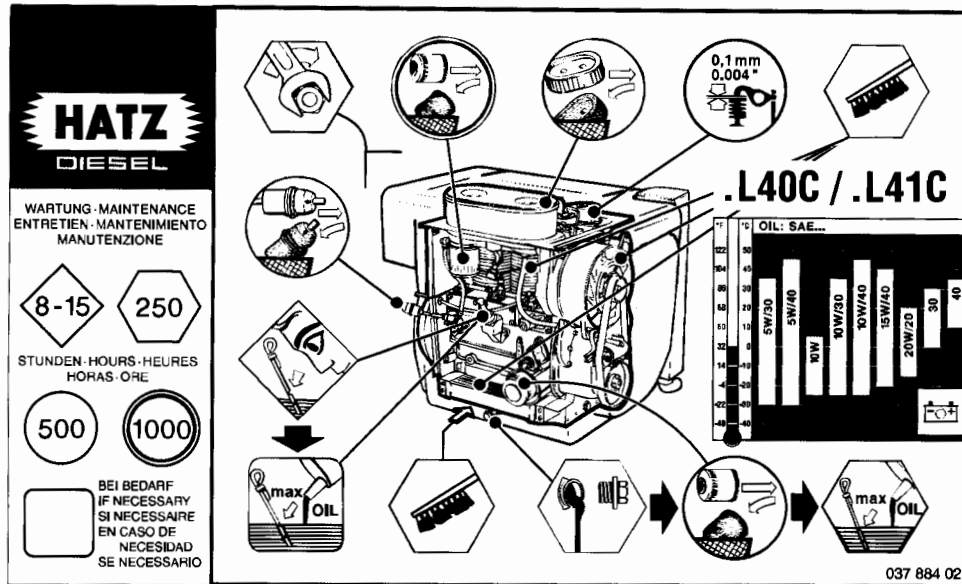
500 1000

BEI BEDARF
IF NECESSARY
SI NECESSAIRE
EN CASO DE
NECESIDAD
SE NECESSARIO

.M40
.M41

OIL: SAE...
122 100 80 60 40 20 0 -20 -40 -60

2 M 40. / 2 M 41 with oil pan; 3 - 4 M 40. / 3 - 4 M 41 in all cases



Depending on engine type and version, one of the three self-adhesive maintenance charts illustrated here and on the previous page will be supplied. It should be attached to the engine or equipment at a point where it is clearly visible. Comply with the maintenance intervals stated in the maintenance summary in this chapter

The following work is essential on **new** or **reconditioned** engines after the **first 25 hours of operation**:

- Change the engine oil and renew the oil filter element (Chapter 5.3.1. and 5.4.5.).
 - Check valve clearances and adjust if necessary (Chapter 5.4.3.).
 - Check tightness of all screw connections (Chapter 5.3.3.).
- Do not take up slack at cylinder head bolts.**

If the engine has **not been operated for long periods at a time**, change the oil and renew the filter element **after a maximum of 12 months**, regardless of how many operating hours have been recorded.

5.2 Maintenance every 8 – 15 hours of operation

5.2.1. Check engine oil level

When checking the oil level, the engine should be standing level, and must not be running.

- Check oil **level** at the dipstick. Add oil up to the **MAX mark** on dipstick „1“ if necessary (Figure 8, Chapter 4.1.1.).

5.2.2. Check combustion air intake area

Severe contamination is a sign that the air contains a high level of dust, and that the maintenance intervals should be shortened accordingly (Chapter 5.4.2.).

- Inspect intake opening „1“ on the rain protection cap or cyclone separator for severe blockage with dirt, for instance leaves, heavy dust deposits etc., and clean if necessary. (Figures 18 and 19).
- Check for free airflow at dust outlet hole „2“ on the underside of the housing, and clean if necessary (Picture 18).
With oily contamination remove cyclone and clean it.
- Run the engine at full speed briefly once a day, shortly after starting it. Check that indicator light „5“ comes on briefly or, depending on version, red zone „1“ is seen in the mechanical maintenance indicator (Figures 13 and 20, Chapter 5.4.2.).

5.2.3. Check the cooling air system

Severe contamination with dirt is a sign that the air contains a high level of dust, and that the maintenance intervals should be shortened accordingly.

- Inspect the air inlet and outlet areas for severe blockage with dirt, for instance leaves, heavy dust deposits etc., and clean if necessary (see Chapter 5.3.2.).

Temperature display „4“ (if fitted) lights up as soon as the engine starts to overheat (Fig.13).

Stop the engine immediately. (Chap. 5.3.2.).

5.3. Maintenance every 250 hours of operation

5.3.1. Engine oil change

(see Chapter 5.1.)

The dipstick mark will indicate whether or not the engine has a sump (see Chapter 4.1.1.).

The engine must be stopped, and should be standing on a flat, level surface.

- Drain the engine oil only when it is warm.



**Risk of scalding from hot oil.
Trap the old oil and dispose of it in an environmentally acceptable manner.**

- Unscrew oil drain plugs „1“ and allow all the oil to drain out (Figure 21).
- Attach a new seal and insert and tighten the oil drain plug.

Important !

When unscrewing and removing drain plug „1“, make sure that drain tube „2“ is not accidentally loosened. If necessary, prevent it from turning with a suitable open-ended wrench (Figure 22).

- Add **lubricating oil** of suitable quality and viscosity up to the **MAX. mark** on the dipstick. (Figure 8, Chapter 4.1.1.).
- Run the engine for a short period, then check the oil level again and top up if necessary.

5.3.2. Cleaning cooling fan, cooling fins and oil cooler



Before cleaning, the engine must be stopped and allowed to cool down.

- On encapsulated engines, unscrew and remove the hood, side panel with speed control lever, cover plate on operating side and air outlet duct and cover plate on air outlet side (see Chapter 2).
- On non-encapsulated engines, take off the side trim and the air duct to the engine oil cooler.
- Unscrew and remove baffle plate „1“ (Fig. 23).

Removing dry dirt

- Clean the cooling fan, cylinder head and cylinders with a suitable brush (Figure 24).

Note:

On the encapsulated engine, also clean the area between the baseplate and the crankcase (Fig. 25).

- Blow out the entire cooling area zone with compressed air.
- Clean the engine oil cooler only by blowing out with compressed air. In this case, do not direct a powerful air jet against the easily damaged cooling fins (Figure 25).

Removing damp or oily dirt

- Disconnect the negative lead at the battery.
- Manually clean alternator and regulator.
- Shield the alternator with attached voltage regulator; do not spray it directly.
- Clean the complete area with a suitable detergent solution in accordance with its manufacturer's instructions, then spray down with a powerful water or steam jet.

Note:

Do not use petrol (gasoline) or acid cleaning agents.

- Dry the engine with a compressed air jet.
- Trace the cause of any contamination with oil and have the leak eliminated by a HATZ service station.
- Install the capsule or air guide elements previously removed.
- Run the engine until warm, to prevent residual moisture from causing rust.



The engine must never be run without all guards and covers in position.

5.3.3. Checking threaded connections

Check the tightness of all threaded connections and take up slack if necessary, provided that these can be reached during maintenance work.

Note:

Do not tighten the cylinder head nuts.



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.

5.3.4. Cleaning of mesh insert in exhaust pipe (additional equipment)



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

- Loosen pipe clip „1“ and remove with exhaust pipe (Figure 26)
- Remove deposits in mesh insert „2“.
- Check mesh insert on chinks or fractures, replace if necessary.

Remark:

Engine operation for a longer period of time without load or with less load can lead to deposits in the mesh insert. Shorten maintenance interval.

5.4. Maintenance every 500 hours of operation

5.4.1. Replace fuel pre-filter



Do not smoke and never bring a naked flame near the fuel system when working on it.

- Place a suitable vessel under the filter to trap escaping fuel.
- Close the fuel supply line.

Note:

Fuel pre-filter maintenance intervals depend on the purity of the fuel used in the engine and should be reduced to 250 hours if necessary.

Replace fuel pre-filter

- Pull fuel supply line „1“ off fuel pre-filter „2“ at both sides (Figure 27).
- Insert the new pre-filter.

Important !

When installing a new filter, note the arrow indicating the correct flow direction (depends on whether the tank is mounted HIGH or LOW). The pre-filter's installed position (direction of flow) should be as vertical as possible.

- Open the fuel supply line.

Note:

To make starting easier, it is best to prime the fuel delivery pump at lever „1“ until fuel is heard to flow back through return line „2“ and into the fuel tank (Figure 9).

- Operate the lever to check for leaks.

5.4.2. Air cleaner maintenance

It is best to clean the filter cartridge (two pcs. on four-cylinder engines) only when the maintenance indicator displays the appropriate signal. Apart from this, the cartridge should be renewed after 500 hours of operation.

Removing the air filter cartridge

(on 2..4 L 40. / 2..4 L 41. engines)

- Take off the capsule hood. chap. 2.
- Remove dirt adhering in the region of the air cleaner housing.
- Slacken of screws „1“ only sufficiently to enable the complete air cleaner housing to be lifted off (Fig. 28).
- Cover the opening in the intake pipe so that nor dirt or other foreign bodies can enter.
- After this, open the air cleaner housing and take out element „3“ (Fig. 29).
With 3-cyl. engines the cover „2“ is additionally fixed with clamp „7“.
- Clean the housing and the cover.

Spacer „5“ is attached to screw „1“ by flexible bushing „6“, so that it cannot drop into the intake pipe during dismantling and assembly work.

- If the spacer is loose, renew bushing „6“

Removing the air filter cartridge

(on 2..4 M 40. / 2..4 M 41 engines)

- Release clips „1“ and take off the cover of air cleaner housing „2“ (Figure 30).
- Remove dirt adhering in the air cleaner area.
- Slacken off screws „3“ only sufficiently to enable cover „4“ with the filter element to be lifted off.
- Blank off the intake pipe opening with cloths so that dirt or other foreign bodies cannot enter.

- Clean filter housing and cover.

Spacer „5“ is attached to screw „3“ by flexible bushing „6“, so that it cannot drop into the intake pipe during dismantling and assembly work.

- If the spacer is loose, renew bushing „6“.

The filter cartridge is either renewed or, depending on the degree of contamination, checked and cleaned as follows:

Cleaning the air filter cartridge

Dry contamination

- Blow through the filter cartridge from the inside outwards with dry compressed air until no more dust emerges (Fig. 31).

Important

Air pressure must not exceed 5 bar, and the compressed air jet must be held approx. 150 mm (6 in) away from the filter cartridge.

Damp or oily contamination

- Renew the filter cartridge

Checking the air filter cartridge

- Examine sealing faces „1“ on the filter cartridge for damage (Fig. 32)
- Hold the air filter cartridge at an angle against the light or shine a lamp through it to detect any cracks or other damage to the paper element.

Important:

If there is the slightest damage in these areas, the filter cartridge should not be re-used.

Installing the air filter cartridge

- Assemble all parts in succession, making sure that they seat firmly and make a reliable seal.

Mechanical contamination indicator

After the air cleaner has been re-assembled, the red zone „1“ visible in the maintenance indicator must be cancelled by pressing reset knob „2“ (Figure 20).

**5.4.3. Checking and adjusting
valve clearances**

- On the encapsulated engine, take off the capsule hood (see Chapter 2).
- Unscrew the hex nuts and take off the cylinder head cover (Figure 4, Item 13).
- Take off the covers for the air guide housing and belt guard (see Chapter 2).
- Insert a ratchet wrench or a 1/2" T-piece with the necessary extension into square hole „1“ (Figure 33).

Important !

Turn the engine over in the normal direction of rotation.

This is counter-clockwise in either case – at the flywheel or timing gear end.

Adjusting method for two-cylinder engines

- The valves in cylinder 1 (at the fan end) must be in the overlap position (exhaust valve not yet closed, inlet valve just starting to open).
- Turn the crankshaft through 180 degrees in the normal direction of rotation, and check valve clearances at cylinder 2.
- Turn the crankshaft a further 180 degrees in the same direction as before, and check the valve clearances at cylinder 1.

Adjusting method for three- and four-cylinder engines (Fig. 34)

Type	Valve No. ... fully open	Check valves at cyl. No.
3-cylinder	1	3
	5	2
	3	1
4-cylinder	1	3
	5	4
	7	2
	3	1

- Check valve clearances with a feeler gauge.
- Valve clearances (inlet and exhaust valves) = 0.10 mm **with engine cold**.
- If valve clearance is incorrect, slacken off hex nut „1“. Turn adjusting screw „2“ until feeler gauge „3“ can just be pulled through between the rocker and the valve stem, with slight resistance to its movement, after nut „1“ has been retightened (Figure 35).

Important !

Repeat the procedure for all valves, noting the adjusting method described above.

- Attach the cover to the cylinder head again; always use new sealing rings.
- Do not use the nuts securing the cover to the cylinder head more than twice before renewing them.
Tightening torque: 10 Nm.
- Run the engine briefly and check that the cover is not leaking at the cylinder head.

5.4.4. Engine oil change

(see Chapters 5.3.1. and 5.1.)

5.4.5. Renewing oil filter



**Risk of scalding from hot oil.
Trap the old oil and dispose of it in an environmentally acceptable manner.**

- Using a strap wrench, unscrew the engine oil filter with replaceable element and pull it out (Figure 36).
Order number for strap wrench: 620 307 01.
- Wipe escaping oil out of the oil trap plate.
- Oil the sealing lip of the new filter element lightly. Insert the **filter element** and **screw up handtight**.
- Add **engine** oil of a suitable specification and viscosity up to the **MAX mark** on the dipstick (See Chapter 4.1.1.).
- After running the engine for a short time, check the oil level again and correct it if necessary.
- Check the filter element for leaks and tighten by hand.

5.5. Maintenance every 1000 hours of operation

5.5.1. Renewing the fuel filter



Do not smoke and never bring a naked flame near the fuel system when working on it.

- On the encapsulated engine, take off the capsule hood (see Chapter 2).
- On non-encapsulated engines, take off the side trim.
- Place an absorbent cloth or wadding under the filter to trap escaping fuel.
- Close the fuel supply line.

Note:

Fuel filter maintenance intervals depend on the purity of the fuel used in the engine and should be reduced to 500 hours if necessary.

Renewing the fuel filter

- Push on strap wrench „1“ and unscrew the replaceable filter element by turning to the left (Figure 37).
Order number for strap wrench: 620 307 01.
- Oil the sealing lip of the new filter element lightly.
- Install the **filter element** and **screw up handtight**.
- Open the fuel supply line again.

Note:

To make starting easier, it is best to prime the fuel delivery pump at lever „1“ until fuel is heard to flow back through return line „2“ and into the fuel tank (Figure 9).

- Operate the lever to check for leaks.
- Install the enclosure and air guide elements again.

6. Operating checks and repair work

6.1. Checking operation of air cleaner maintenance indicator

Every 250 hours of operation, perform a routine check on the maintenance indicator or maintenance switch and the display light.

- Detach the capsule hood or side trim (see Chapter 2).

Electric maintenance switch

- Turn switch key to **position I** (Figure 12).
- Pull hose „2“ off air intake pipe and build up a strong vacuum at the open end (Figure 37). Indicator light „5“ will come on (Figure 13).

If this response is not obtained, check the following points:

- electrical section: cable connections etc.
- Indicator light
- function of maintenance switch.

Mechanical maintenance indicator

- Pull hose „2“ off air intake pipe and build up a strong vacuum at the open end (Figure 37). Red zone „1“ will appear and engage in position (Fig. 20).
- After the functional check, release red zone „1“ by pressing reset knob „2“.

Renew any defective components without delay.

6.2. Renewing fan drive belt, checking operation of belt monitor

- Remove one machine screw at belt pulley „1“ (Figure 38).
- Press back tensioning pulley „2“ and lock it with the machine screw provided.
- Unscrew and remove the belt pulley.
- Take off the Poly-V belt.

Note:

If any grooves on the belt pulley have broken off or are bent, always renew the pulley.

Checking operation of belt monitor

Always check operation of the shutdown device when the belt is renewed.

- Remove the machine screw to release the piston with tensioning pulley „1“ (Figure 39).
- Spring pressure will force the piston with tensioning pulley out of the housing.
- Angled lever „2“ rotates downwards and releases shutdown pin „3“.

Important !

Shutdown pin must be forced out by spring loading or else automatic shutdown will not take place if the belt breaks.

Installing the fan drive belt

- Push in shutdown pin „1“ (Figure 40).
- Push piston with tensioning pulley „2“ into housing „3“ and lock with the machine screw.
- Place the Poly-V belt centrally on the fan pulley and install the tensioning pulley and the lower belt pulley (Figure 41).
- Retain the belt pulley with one machine screw „1“ without pushing it fully on to the centering hub (Figure 42).

- Insert a large screwdriver between the hydraulic belt tensioner and the belt pulley and press it down until the pulley slides on to the centering hub (Figure 43).
- Insert and tighten the remaining machine screws „1“.

Types of belt

Since the belt pulleys on the **fan side** differ in diameter on various engine types and versions, Poly-V belts of differing lengths are fitted.

Type and engine version	Ident. No.	Belt length (mm)	Fan pulley diameter (mm)
2L 40 C/CH 2L 41 C	502 031 00	920	72
All other types and versions	501 415 00	910	64

Note:

In order to be sure of avoiding mistakes concerning the length of Poly-V belts when ordering them, it is best to measure the diameter of the belt pulley at the fan end and refer to the above table, using this figure as a starting point.

7. Malfunctions – causes and remedies

Kind of trouble	Possibly caused by	Remedy	Chapt.	
Engine will not start or is reluctant to start although it can be turned over with the starter.	Speed control lever is in stop or idle position.	Move lever to 1/2 START or max. START position according to operating conditions. Lever must remain fixed in this position.	4.2.1.	
	No fuel reaching injection pump.	Add fuel. Prime the delivery pump until fuel is heard to flow back through the return line to the fuel tank.	4.1.2.	
		Check through the entire fuel supply system systematically. If there is no improvement, check	- feed line to engine	5.4.1.
			- fuel pre-filter	5.5.1.
	If the engine is difficult to start after having been out of use for a lengthy period, but the problem can be solved by priming the delivery pump for some time: check that the fuel system is correctly laid out.		3.3.	
	Compression too low:			
	- incorrect valve clearances.	Check valve clearances and adjust if necessary.	5.4.3.	
	- valves worn	See workshop manual.		
	- cylinder or piston ring wear	See workshop manual.		
	- fault in automatic decompression device	See workshop manual.		
	Injectors not working correctly.	See workshop manual.		
	Fan drive belt broken.	Renew the Poly-V belt.	6.2.	

Kind of trouble	Possibly caused by	Remedy	Chapt.
At low temperatures.	Pre-heat system (optional extra) has a fault.	See workshop manual.	
	Fuel has separated (inadequate low-temperature resistance).	Pull off fuel return line and check that clear (not turbid) fuel emerges. If fuel has separated, heat up the engine or drain the entire fuel supply system. Refill with a fuel mixture that is resistant to low temperatures.	4.1.2.
	Starting speed too low: - oil viscosity is too high.	Change engine oil; use correct viscosity grade.	4.1.1.
	- insufficient battery charge. - engine not declutched from machinery.	Check battery; Contact specialist workshop if necessary. If possible, declutch or otherwise disconnect the engine from the machinery it is used to drive.	8.
Starter motor is not energized, or does not turn the engine over.	Fault in electrical system: - battery and / or other cable connections are not correct. - loose and / or corroded cable connections. - battery defective and / or flat. - starter motor defective. - defective relays, monitoring elements etc.	Check electrical system and its components or contact a HATZ service point.	8.
Engine fires but does not run after the starter motor is switched off.	Speed control lever not moved far enough in the start direction.	Move lever farther towards „START“.	4.2.1.
	Engine not decoupled from machinery.	If possible, declutch or otherwise separate engine from the machinery it drives.	
	Fuel pre-filter or main fuel filter blocked.	Renew the filter.	5.4.1. 5.5.1.
	Fuel supply is interrupted.	Check through complete fuel supply system systematically.	

Kind of trouble	Possibly caused by	Remedy	Chapt.
Engine fires but does not run after the starter motor is switched off.	Stop signal from monitoring element for automatic shutdown system (optional extra):		
	- oil pressure lost - air cleaner blocked.	Check oil level. Check the amount of dirt adhering to the air filter; clean or if necessary renew.	5.2.1. 5.4.2.
	- alternator has failed.	See workshop manual.	
Engine shuts down during operation.	Fuel tank is empty.	Add fuel.	4.1.2.
	Fuel pre-filter or main fuel filter blocked.	Renew filter.	5.4.1. 5.5.1
	Fan drive belt is broken. Mechanical defect.	Renew the Poly-V belt. Contact a HATZ service point.	6.2
In addition, if automatic engine shutdown is installed.	Stop signal from monitoring element because of:	Check engine for:	
	- oil pressure too low.	Engine oil level.	5.2.1.
	- cylinder head temperature too high.	Cooling air passages blocked or cooling system otherwise affected.	5.3.2.
	- blocked air cleaner.	Check degree of air cleaner contamination and renew filter element if necessary.	5.4.2.
	Faults in electrical system, for instance:		
	- poor contact at cable connections. - defective alternator. - defective relay.	Check electrical system and its components, or contact a HATZ service point.	8.
Engine power and speed drop.	Poor fuel supply:		
	- tank is running dry.	Add more fuel.	4.1.2.
	- fuel pre-filter or main fuel filter blocked.	Renew the filter.	5.4.1. 5.5.1.
	- inadequate fuel tank venting.	Ensure that tank is properly vented.	
	- leaks at fuel line connections. - speed control lever does not remain in the selected position.	Check threaded unions for leaks. Tighten the speed control so that it cannot move accidentally.	

Kind of trouble	Possibly caused by	Remedy	Chapt.
Engine power and speed drop, black smoke from exhaust.	Air cleaner is blocked.	Check degree of air cleaner contamination and renew filter element if necessary.	5.4.2
	Valve clearances incorrect.	Adjust valve clearances.	5.4.3.
	Injectors not operating correctly.	See workshop manual.	
Engine runs very hot. Warning light for cylinder head overheating (optional extra) comes on.	Engine oil level is too high.	Drain off engine oil until level is at upper dipstick mark.	5.3.1.
	Inadequate cooling: - contamination at some point in cooling air supply.	Clean the cooling air path.	5.3.2.
	- missing or loose air guide plates or sections of capsule.	Check that all air guide plates and capsule sections are fitted and not leaking.	

8. 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.

- 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 live 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.
- When cleaning the engine, do not spray electrical components with water. If this is unavoidable, first disconnect the battery. Dry all components carefully with compressed air before reconnecting them.
- 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.

No warranty is provided in respect of electrical systems not carried out in accordance with HATZ circuit diagrams.

9. Protective treatment

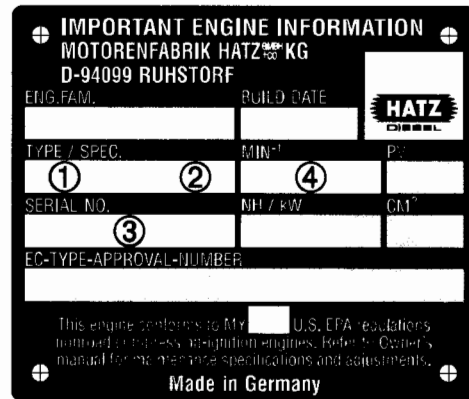
A new engine can normally be stored for up to 12 months in a dry place.

If atmospheric humidity is high (or if exposed to sea air), protection is sufficient for about 6 months' storage.

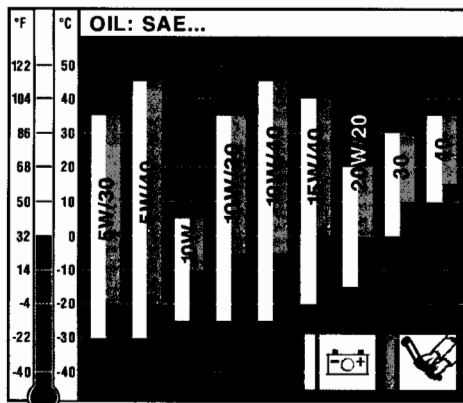
If the engine is to be stored for a longer period, or laid up out of use, please consult the nearest HATZ service point.



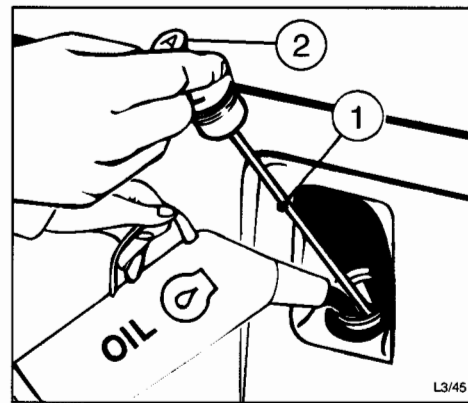
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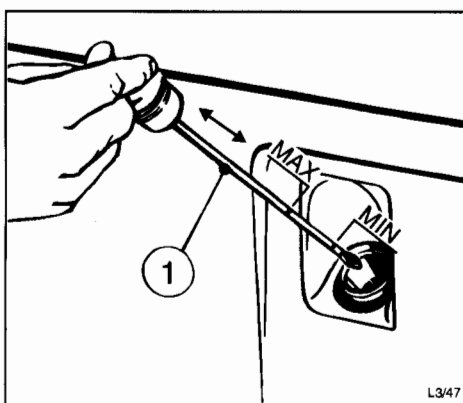
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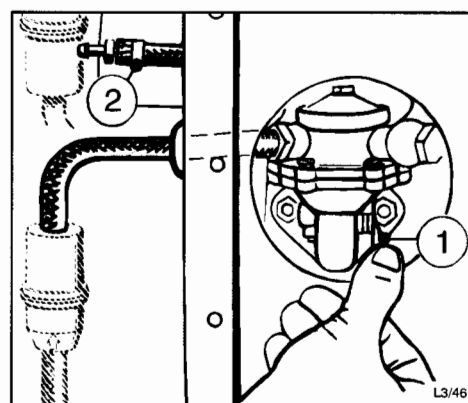
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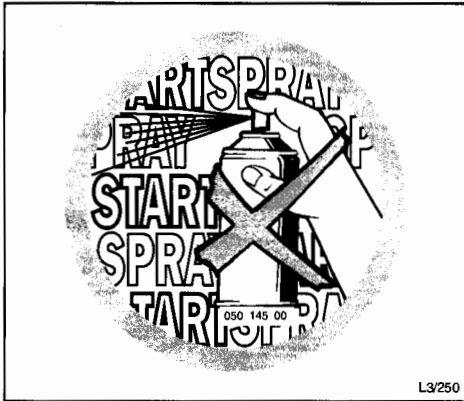
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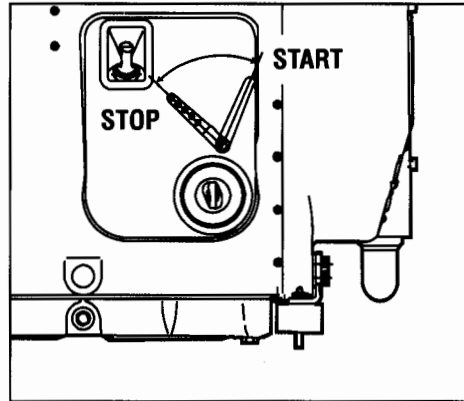
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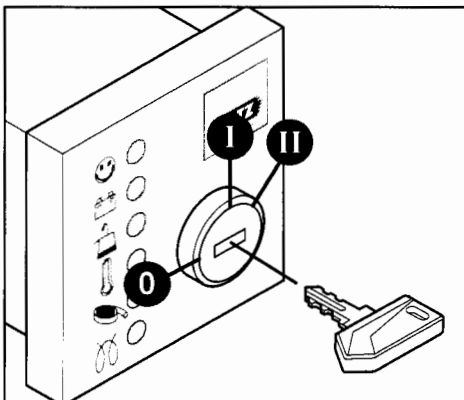
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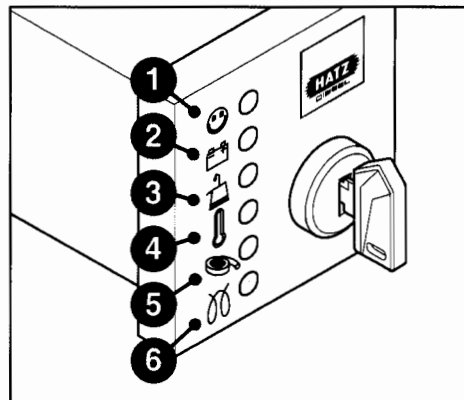
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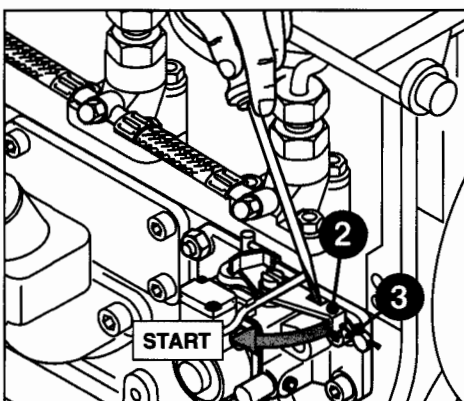
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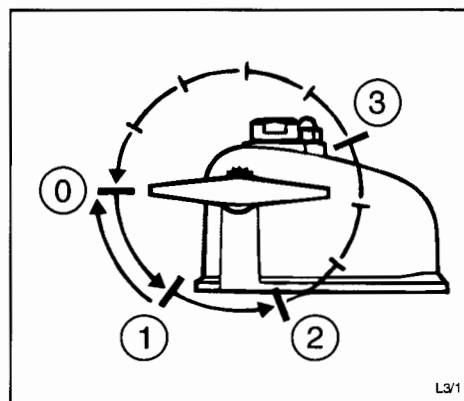
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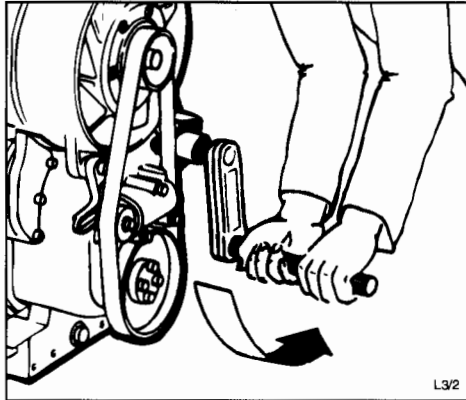
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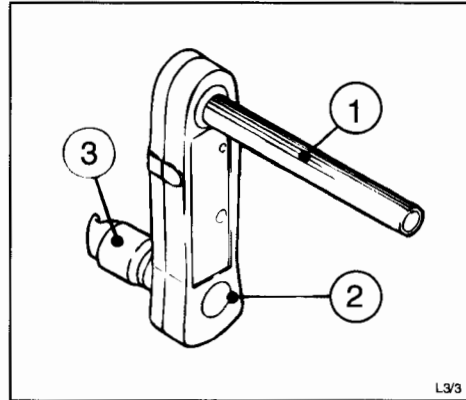


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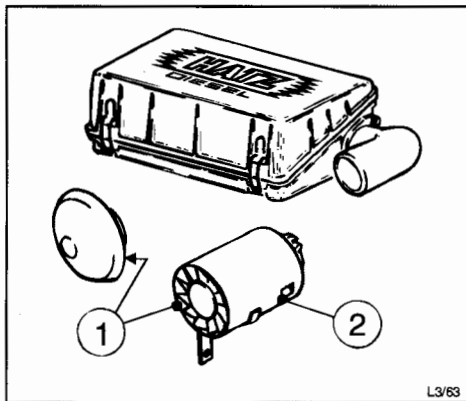
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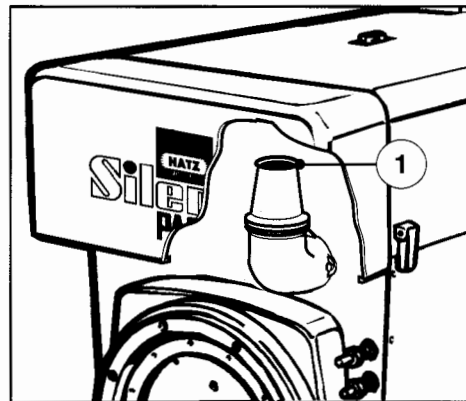
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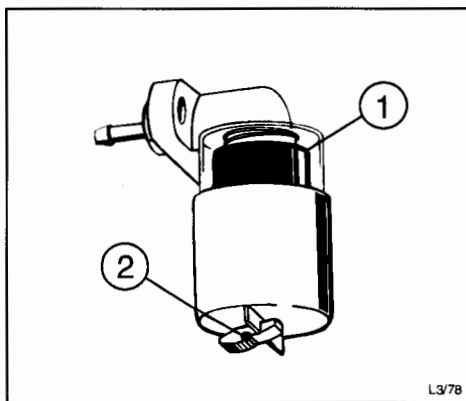


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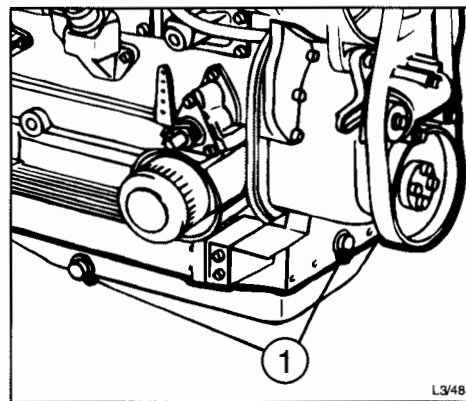


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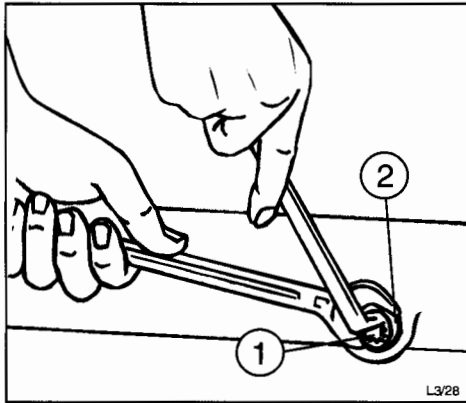
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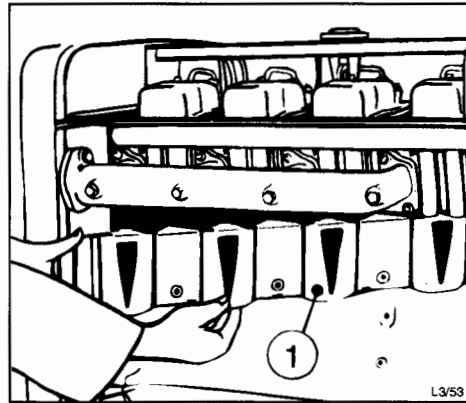


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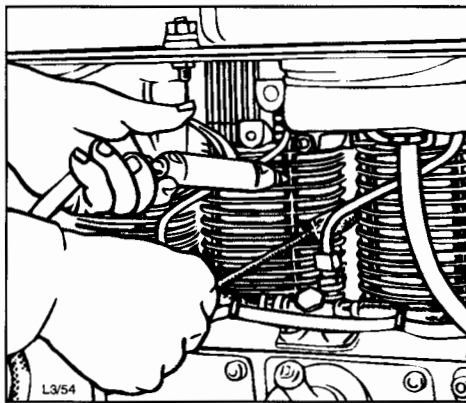
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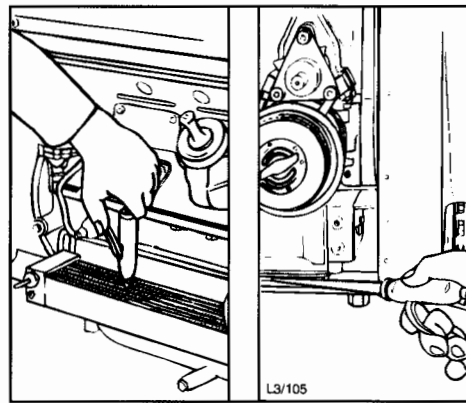
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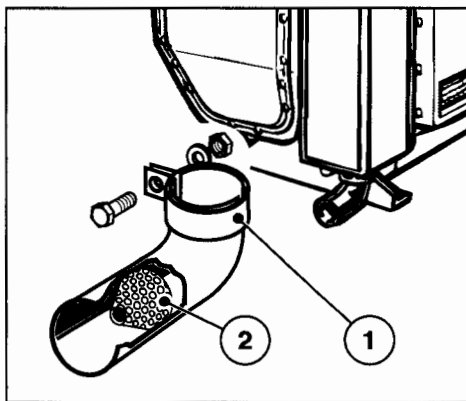
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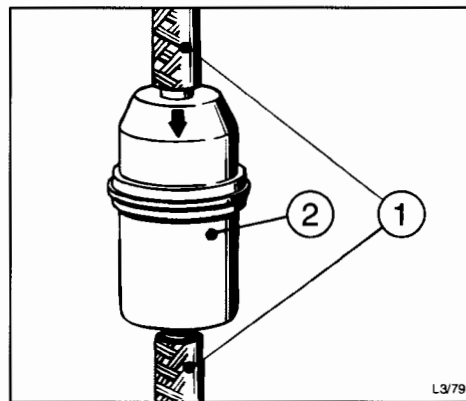
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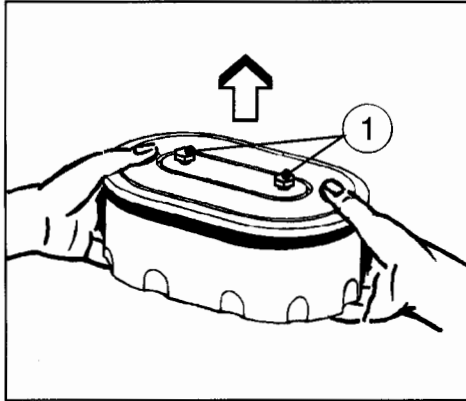
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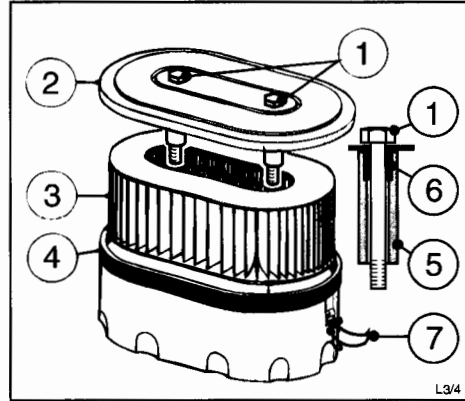
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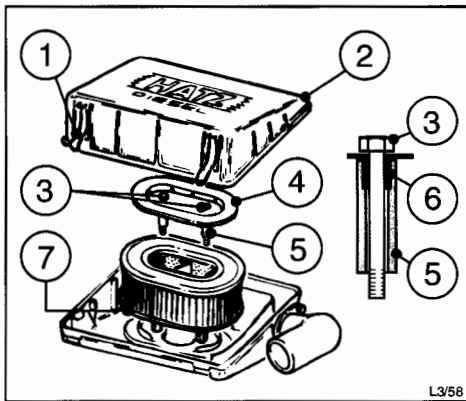
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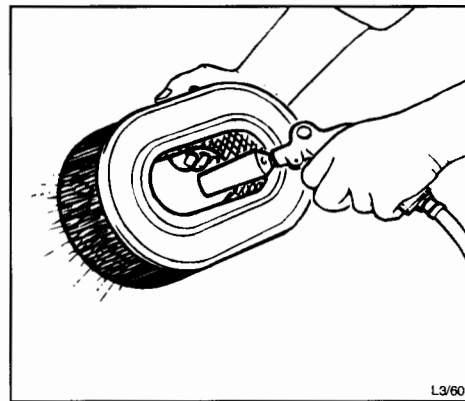
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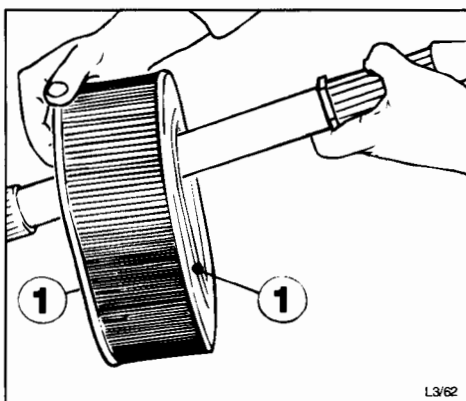
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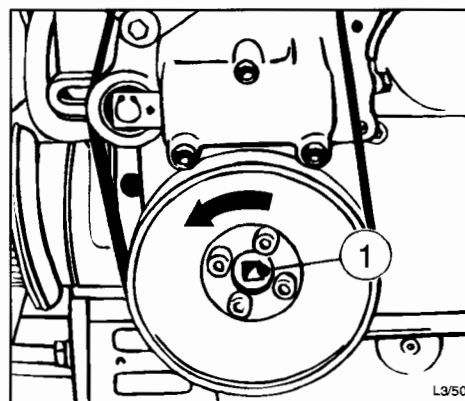
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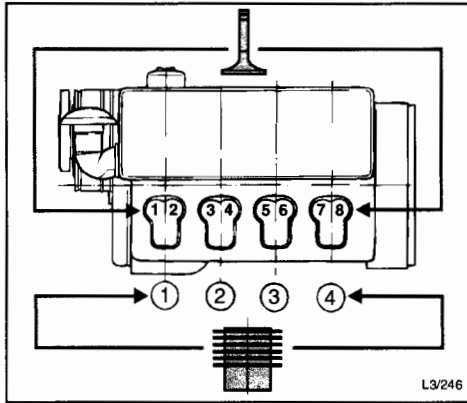
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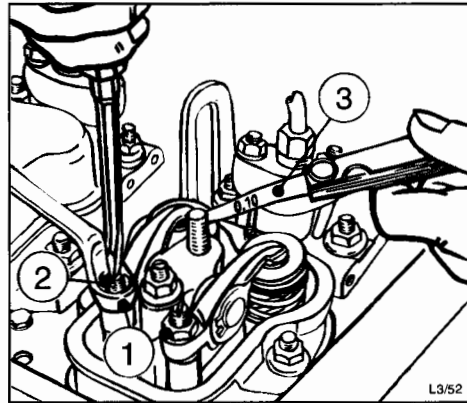
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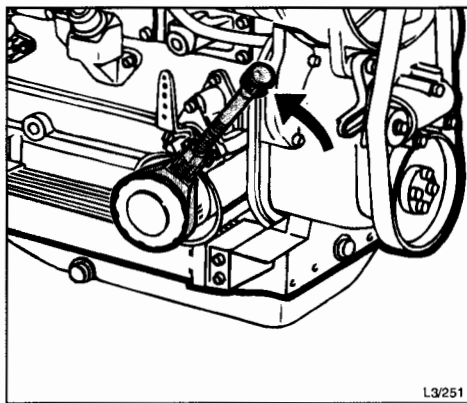
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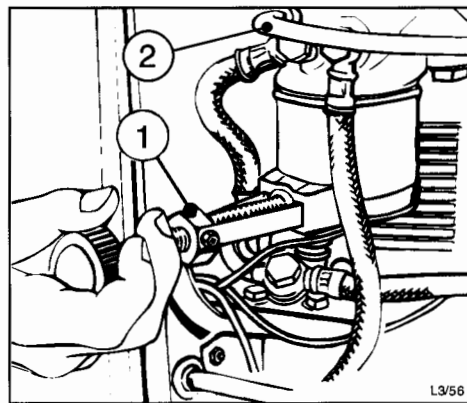
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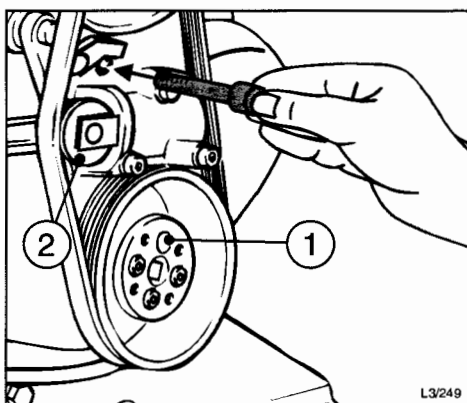
35



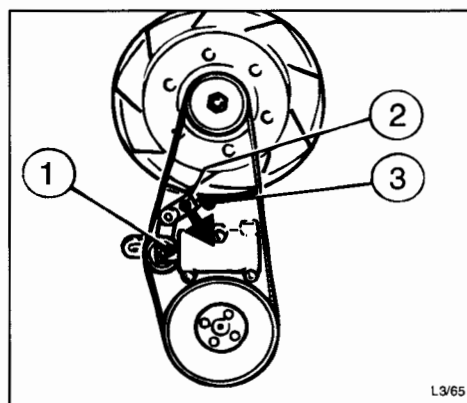
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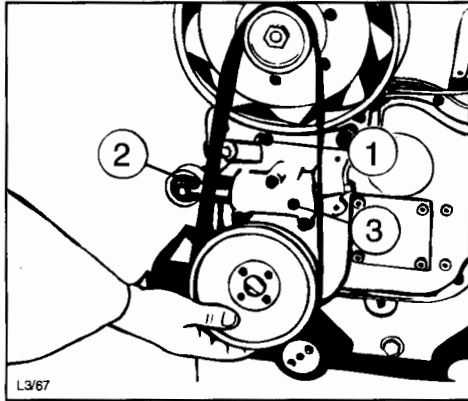
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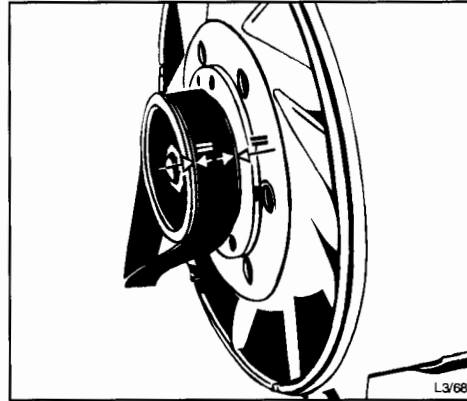
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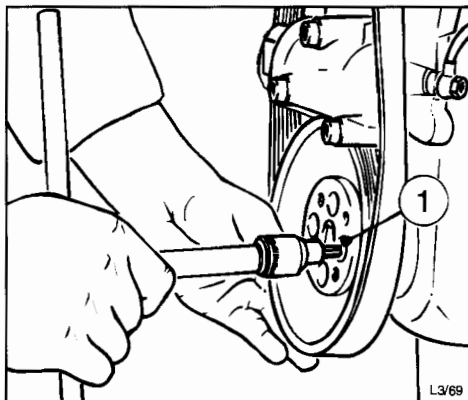
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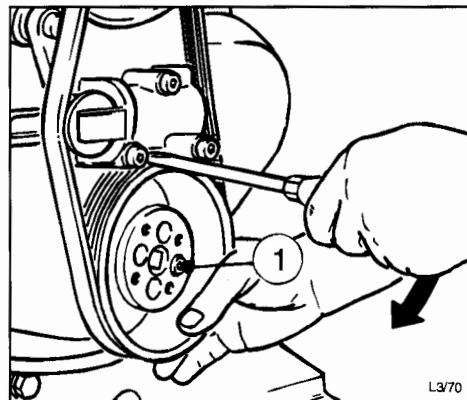
40



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CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.