

**MERCEDES-BENZ**



**Instruction Manual**

**UNIMOG 416**

**M E R C E D E S - B E N Z**



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**Instruction Manual**

Edition June 1976

**UNIMOG 416**

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Technical details of UNIMOG in relation to data and illustrations of the present manual subject to change.

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# 1 General Hints

## Explanation of Contents

In addition to general explanations, this section **1 General Hints** also contains important details with regard to pertinent numbers, keys and equipment of the UNIMOG.

A careful study of section **2 Operating Instructions** in particular prior to initial operation, is one of the prerequisites for troublefree operation of the UNIMOG.

In addition, relevant instructions in section **3 Maintenance Instructions** are intended to guarantee that the UNIMOG remains efficient and constantly available for use.

Use only the types of fuels, lubricants, coolants, etc. described in section **4 Operative Materials** in the quantities specified.

In the following section **5 Trouble Shooting** we are providing remedies and references as to their possible cause, as well as recommendations for their repair.

For fast information, all the significant dimensional data concerning the engine, the chassis and the body are listed in section **6 Technical Data**.

## Type Plate and Numbers

**In all inquiries concerning the UNIMOG, and when ordering spare parts and special equipment, be sure to name the type and model designation, chassis and engine number, as well as any other unit number.**

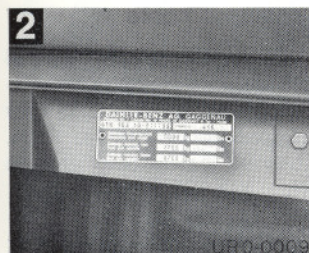
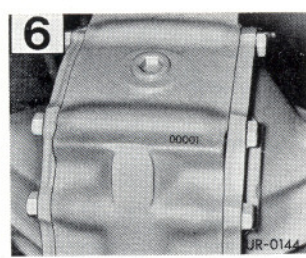
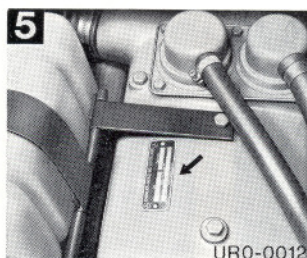
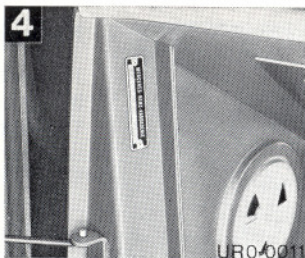
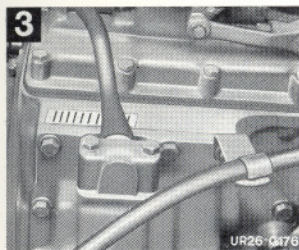
The type plate is located above the right-hand foot compartment underneath the outside hood.

The chassis number is on the type plate and on the frame at the right front in front of the spring bracket.

The engine number plate is located on the right rear next to the oil filter and on the cylinder head cover.

The designations „right-hand“ and „left-hand“ apply as seen in driving direction. The statements 1st, 2nd cylinder, etc. are always as seen from the direction of the radiator.





- 1 Chassis number
- 2 Type plate
- 3 Transmission number
- 4 Cab number
- 5 Engine number
- 6 Axle Number

Fig. 1 Arrangement of type plate and numbers



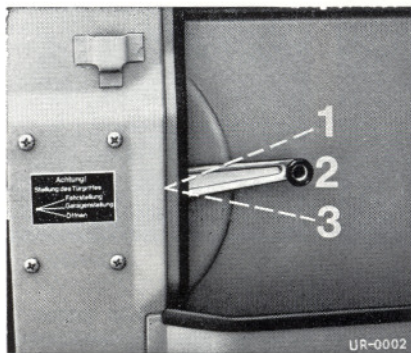


Fig. 2 Door locks

- 1 Driving position (latched)
- 2 Garage position
- 3 Open

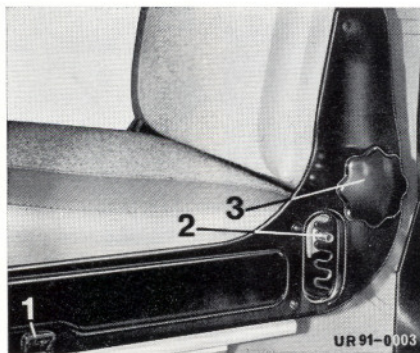


Fig. 4 Seat adjustment

- 1 Longitudinal adjustment
- 2 Tilt of seat cushion
- 3 Tilt of backrest

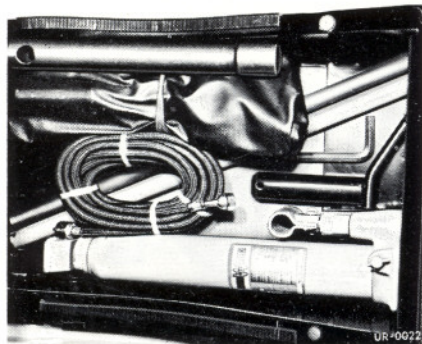


Fig. 3 Vehicle tool box under co-driver's seat

## Keys

The **switch box key** serves for switching the switch box in the instrument panel. The **square drive bonnet key** is in the left-hand door box. It is used for opening the bonnet.

## Doors, Seats and Tools

The door locks of the folding top cab must be latched from inside while driving. In latched condition the inside door latch is positioned at an upward angle. The door can be locked only when in this position.

For seat adjustment refer to Fig. 4.

For tools refer to Fig. 3.

## 2 Operating Instructions

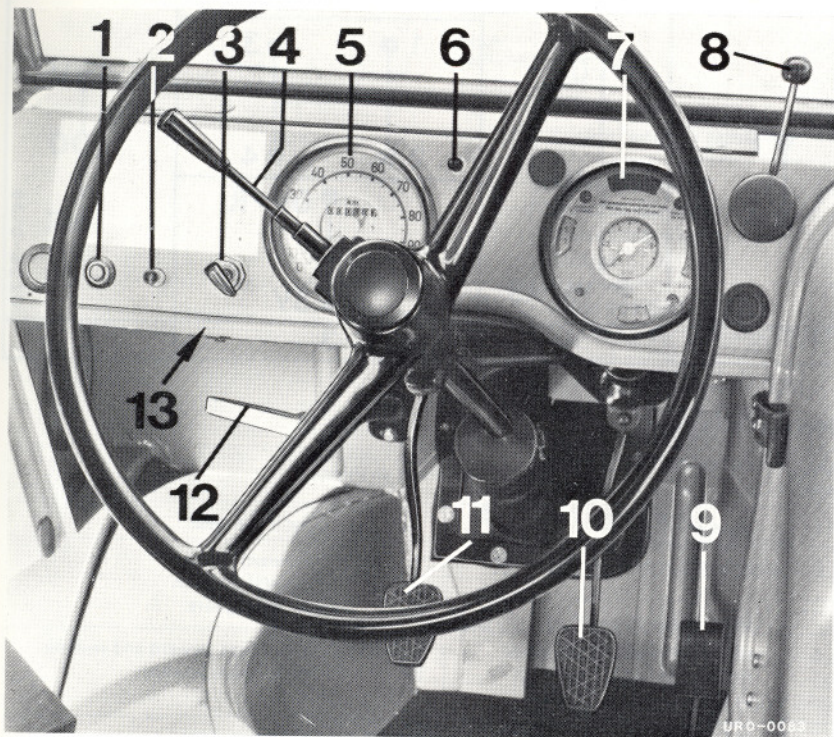


Fig. 5 Arrangement of instruments and controls

- |  |                               |
|--|-------------------------------|
| 1 Starter switch                       | 8 Hand throttle               |
| 2 Windshield wiper switch              | 9 Accelerator pedal           |
| 3 Switch box                           | 10 Brake pedal                |
| 4 Blinker — Horn — Dimmer switch lever | 11 Clutch pedal               |
| 5 Speedometer                          | 12 Parking brake lever        |
| 6 Cut-out switch for blinker           | 13 Socket for emergency light |
| 7 Instrument cluster                   |                               |

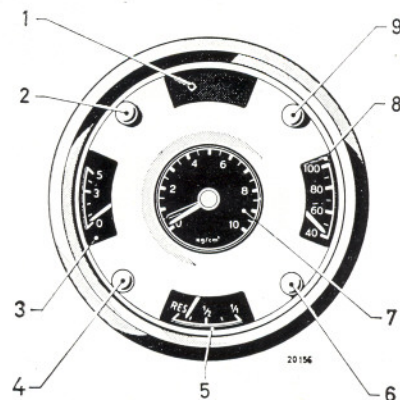


Fig. 6 Instrument cluster

- |   |
|---|
| 1 Brake overpressure warning light (red)        |
| 2 Blinker control light UNIMOG (green)          |
| 3 Oil overpressure indicator                    |
| 4 High beam control light (blue)                |
| 5 Fuel gauge                                    |
| 6 Charging current control light (red)          |
| 7 Dual brake overpressure gauge                 |
| White needle = tank overpressure                |
| Red needle = brake overpressure                 |
| 8 Coolant temperature gauge                     |
| 9 Blinker control light for 2nd trailer (green) |

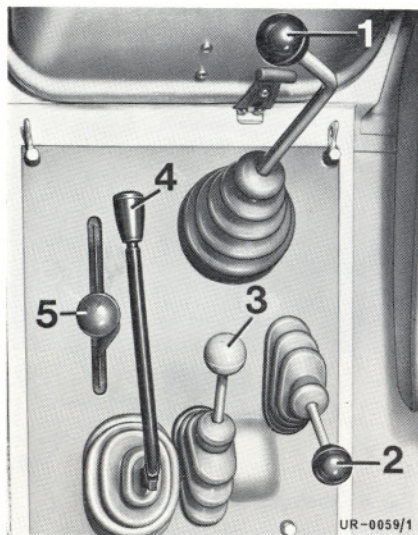


Fig. 7 Shifting levers

- 1 Main shift lever
- 2 Forward-reverse lever
- 3 High-low range lever
- 4 Four wheel drive/differential lock lever
- 5 Pto-shift lever

### Transmission with 2 x 4 gear shifting

		1		
		1 ● 2 ●	3 ● 4 ●	
			GV+R ● SV ●	
				V ● O ○ R ●
				UZ 26 - 0139
5	4	3	2	

### Shifting position 2 x 4

Shifting lever	Shifting position		
1	Main shifting lever	1—4	1st to 4th gear
2	Forward-reverse shifting lever	V O R	Forward gears Neutral position Reverse gears
3	High-low range shifting lever	GV+R SV	Low range forward and reverse High range forward
4	Four-wheel drive-diff. lock shifting lever	O VA VA+AS	Rear axle drive Four-wheel drive Four-wheel drive and diff. lock
5	Pto shifting lever	E A	Engaged Disengaged



## Switch, Explanation

Switch Positions	Consumer
<b>O *</b>	<b>Off</b> Socket, interior light
<b>P</b>	<b>Parking position</b> Parking, Clearance light Instrument cluster light Socket
<b>1</b>	<b>Drive position</b> Charging current control light Starter switch Horn, socket, interior light Blinker-tail-stop light Windshield wiper Instrument indicator
<b>2</b>	<b>to 1, additional</b> Parking, Clearance light Instrument cluster light
<b>3</b>	<b>to 1 and 2, additional</b> Headlight low beam Headlight high beam High beam control light

\* To switching from "O" to "P" and from "3" to "2" push ignition key down.

## Switches

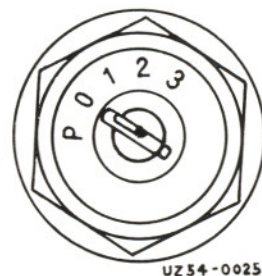


Fig. 8 Switch box

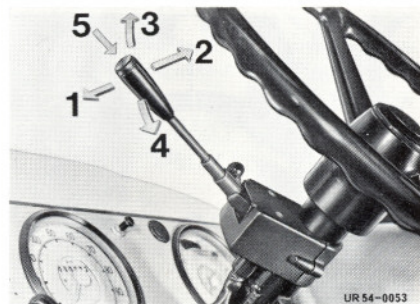


Fig. 9 Blinker-Horn-dimmer switch

- 1 High beam
- 2 Low beam
- 3 Blinker light right
- 4 Blinker light left
- 5 Horn



## Putting UNIMOG into Operation

### Preparations before Starting

Check coolant level in compensation tank. Actuate push button of safety valve prior to opening closing cap to relieve any excess pressure.

The coolant of the cold engine should be up to 30 mm below the upper edge of the filler hole of the compensation tank. Add coolant, if required.

**Be sure** to add 10 cc of anti-corrosive agent for each liter of coolant.

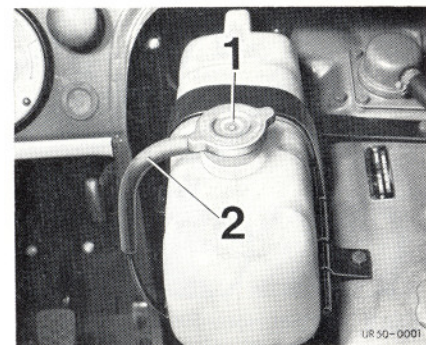


Fig. 10 Coolant compensation tank

- 1 Closing cover with safety valve
- 2 Overflow line

Run engine for 5 minutes at increased idling speed. If required, add coolant with the engine running, until cooling liquid level is reached.

Check **oil level in oil pan** with wiped-off oil dipstick with the UNIMOG on level ground. The oil level should be on the maximum level mark. When checking the oil level of the engine be sure to consider that the oil cooler and various oil passages can be completely drained when the engine has been inoperative for some time. To determine the exact oil level in the oil pan it is necessary **that the check is conducted immediately after shutting off the warm engine or after a short running period** of the previously cold engine.

**Do not fill up beyond the maximum level mark!**

Check contents of **fuel tank**.

Check **tyre pressure**.

Check **lights**.

**Test brakes** after moving off.

### Important

Move vehicle only after red light on instrument cluster is gone off.

### Starting the Engine

Move main shift lever and hand throttle into center position (idling speed).

Insert switch box key into switch box and turn to position 1:

Red charging current control lamp lights up and fuel gauge responds.

Declutch and step on accelerator pedal. Push starter switch and hold for some seconds. Engine will fire. Release starter switch immediately after engine fires since this can otherwise cause damage to the starter.

If the engine does not fire immediately, repeat starting attempt only when the engine and the starter have come to a stop. During repeated starting attempts short recovery periods for cooling the starter and conserving the battery should be imposed.

Watch oil pressure gauge after engine fires.

If no oil pressure is indicated with the engine running, stop engine immediately and look for the cause.

Adjust idling position with hand throttle until the engine runs „smoothly“ at slightly increased idling speed.

## Running-in

It is of decisive importance for the life and the operational safety that the engine and drive train of a new UNIMOG, an exchange engine or reconditioned engine are not fully exploited during the first 1500 km.

Complete the specified service jobs according to schedule once during the running-in time up to 500 km. The regular service jobs according to schedules will then begin. Page 17.

## Stationary Operation

For stationary operation of the pto shaft and low-speed operation the desired engine speed can be fixed by means of the hand throttle control. Tighten round locking disc in clockwise direction.

**While operating the pto drive stationary make sure that the low range/high range lever is in „high range“ to guarantee the oil supply to all rotating parts inside the transmission.**

## Stopping the Engine

Pull hand throttle control toward the rear and turn completely to the right. Engine will stop. Immediately turn hand throttle control back to idle position. At a coolant temperature of 90 to 95° C do

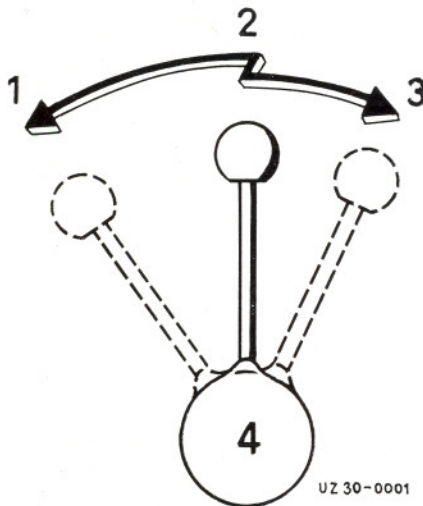


Fig. 11 Hand throttle control

- 1 Full throttle position
- 2 Idle position
- 3 Stop position
- 4 Locking plate

not stop the engine immediately but keep it running at increased idling speed for 1 or 2 minutes, so that the coolant remains in circulation and is not thrown out by the reheating effect of the engine.

## Transmission Shifting

### 2 x 4 Shifting

The manual synchromesh transmission has 4 forward low range gears, 4 forward high range gears and 4 reverse gears.

The 4 forward low range gears have been provided for increased traction. They are shifted with the low range/high range lever (3) after disengaging the clutch. Page 12.

For road operation, the 4 forward high range gears are sufficient, i. e. start the vehicle, depending on trailer weight, with the 1st high range gear engaged.

For reverse operation, declutch and move the short forward/reverse lever to the „reverse“ position, the UNIMOG being stationary.

For repeated forward and reverse operation, keep main shift lever in its position and shift to forward and reverse only with the short forward/reverse lever. See page 12.

### **Special Drive for Pto Shaft**

A special drive for pto shaft of 1/min, 540 can be installed.

The rotation of pto shaft will stop during declutching.

### **Four-Wheel Drive, Differential Locks**

If under difficult ground conditions or with a high total train weight the ground adhesion of the rear wheels is inadequate, engage the four-wheel drive or the four-wheel drive **with** differential locks. This will provide high tractive power for the UNIMOG in spite of its low dead weight. Putting an additional load on the platform may improve ground adhesion still further.

**The four-wheel drive and the differential locks can be engaged while driving without declutching**, but only when the wheels are not spinning, that is, as long as the wheels are rotating in contact with the ground.

If a wheel slips when the four-wheel drive or the differential locks are engaged, declutching is required so that all the wheels are turning at uniform speed or that the UNIMOG comes to a stop.

**The differential locks and the four-wheel drive can also be disengaged while driving without declutching.** Briefly release accelerator pedal when disengaging the four-wheel drive.

Try not to engage the differential locks when driving around a road bend to eliminate additional stresses.

With the differential locks engaged the turning circle increases as a result of the automatically resulting wheel slip.

### **Instruments, Warning Lights**

Check instruments,, warning and control lights occasionally while driving. The most favorable operating temperature of the coolant is at approximately 80° C and is indicated on the coolant temperature gauge. At this temperature the engine wear and the fuel consumption are the lowest. If possible, the operating temperature should not exceed 95° C.

### **Brake System**

Test brakes immediately after moving off. Establish braking action on a dry road affording good grip.

The hand brake system serves as an auxiliary and a parking brake system acting on the rear wheels only.



### 3 Maintenance Instructions

#### Maintenance

##### General

The maintenance jobs specified for the UNIMOG are specified in the Service Booklet.

When driven on roads the maintenance intervals are subdivided according to km.

If, for organizational reasons, the maintenance jobs have to be accomplished by your own personnel we urgently recommend adherence to the required maintenance procedures.

**Thoroughly clean grease nipples, oil filler and drain plugs prior to lubrication jobs.**

#### Maintenance Schedule

Maintenance interval		Job schedule	Job accomplishment	
at	km			
Normal operating conditions	500	* Only once during running-in period of vehicle		
	1000	}	Refer to Maintenance Lubrication Points Survey	
	2000			
	3000			
	4000	}		
	5000			
	6000	}		
	7000			
	8000			
	etc.			

##### \* Lubrication jobs:

Change engine oil  
 Replace bypass oil filter element  
 Change transmission oil  
 Change oil in differential (2)  
 Change oil in wheel hub drive (4)  
 Check oil level in steering  
 Check brake fluid level  
 Lubricate thrust ball (2)  
 Lubricate steering knuckle bearings (4)  
 Lubricate clutch release shaft  
 Lubricate pto shaft universals (2)  
 Lubricate trailer coupling (2)  
 Lubricate intermediate hand brake lever

##### \* Inspection and cleaning jobs:

Clean dry air filter element  
 Retighten cylinder head nuts  
 Check valve clearance, adjust  
 Retighten air intake-manifold and oil pan mounting screws  
 Check V-belt  
 Check clutch play  
 Retighten stabilizer bar/drive units mounting- and connecting screws  
 Check pitman arm for tight seat, steering for correct functioning  
 Check wheel nuts  
 Check brake system



## Maintenance Job Survey

Inspection and cleaning jobs	Pos. Nr.	daily	1st TM	2nd TM
<b>Engine</b>				
Check engine oil	1	—		
Clean air filter element	14		—	—
Check valve clearance, adjust			—	—
Clean fuel pre-filter	15		—	—
Retighten suction-/exhaust- and oilpan mounting screws			—	—
Cooling water		—	—	—
Check V-belt, retighten			—	—
Clean fuel filter felt element, paper filter element must be changed, bleed	12		—	
<b>Chassis</b>				
Check clutch adjustment	8		—	—
Check differential locks for functioning			—	—
Retighten stabilizer, drive train fastening and connecting bolts			—	—
Check shock absorbers for leaks			—	—
Check brake- and clutch fluid	2	—	—	—
Check pitman arm for tight seat steering for free travel, correct	5		—	—
Check toe-in			—	—
Interchange wheels			—	—
Retighten wheel nuts			—	—
Check brakes, adjust			—	—
Check compressed air system for functioning and leaks, drain condensation from compressed air tank and differential lock			—	—
<b>Electrical system</b>				
Check all current consumers, fuses and line connections			—	—
Check battery			—	—
Check head light alignment, correct			—	—
Check all electrical instruments			—	—
<b>Body</b>				
Check bolts of cab and body attachment for tight seat, retighten			—	—

— = work to be performed

Lubrication jobs	Pos. No.	Lub. Points	Oil Grease daily Qty.		1st TM	2nd TM
<b>Engine oil: SAE 20 or SAE 30</b>						
Change oil in engine, change oil filter	1+3	1	10.0	x	v	v
Change oil in air filter	14	1	1.0	x	v	v
Lubricate starter pinion	11	1	5 gr			xx
<b>Transmission oil: SAE 90</b>						
Transmission	9	1	6.0		x	v
Front axle differential	6	1	2.5		x	v
Rear axle differential	6	1	2.5		x	v
Wheel hub drive front	7	2	0.3		x	v
Wheel hub drive rear	7	2	0.3		x	v
<b>Grease: Calcium No. 3</b>						
Thrust ball front and rear axle	4	2	10 gr		xx	xx
Grease clutch shaft	8	1	5 gr		xx	xx
Grease trailer coupling	16	2	10 gr		xx	xx
Grease front winch		1	10 gr		xx	xx
Grease pto shaft universal	13	2	10 gr		xx	xx
Grease joints and nipples on manual and pedal lever assy, door hinges			5 gr		xx	xx
Grease hand brake — intermediate lever	10	1	10 gr		xx	xx
Grease steering knuckles	7	4	10 gr		xx	xx
<b>Hydraulic oil</b>						
Steering *	5	1	2.0	x	x	x
<b>Brake fluid</b>						
Check brake- and clutch fluid level	2	1	1.0	x	x	x

\* Change oil and replace paper oil filter element after the first 52 000 km or once a year.

x = Check  
xx = Lubricate  
v = Change oil

# Lubrication Points Survey

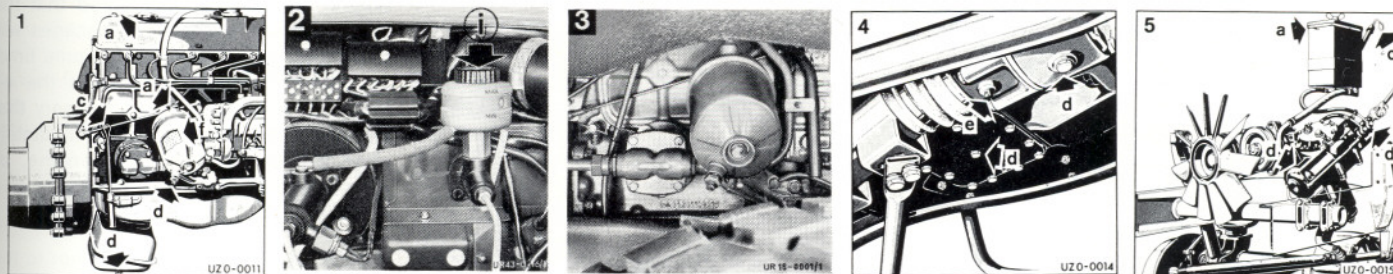
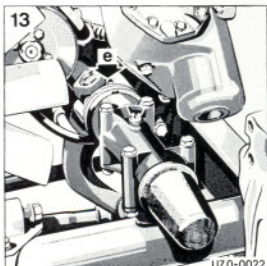
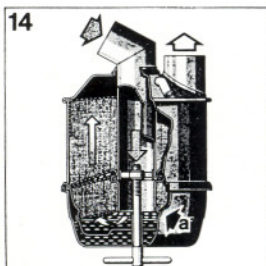
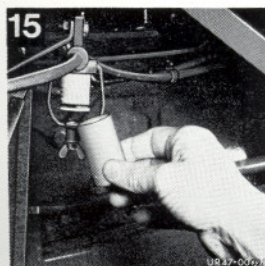
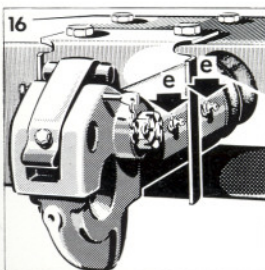
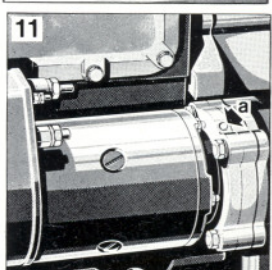
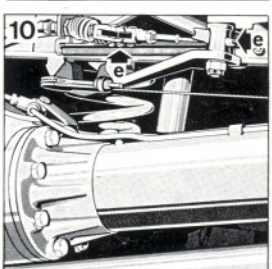
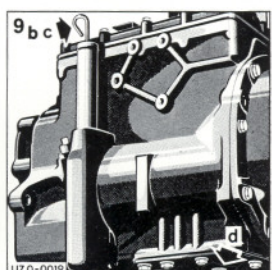
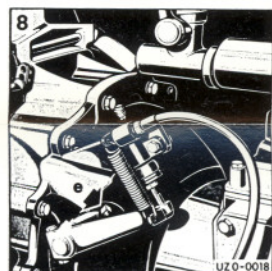
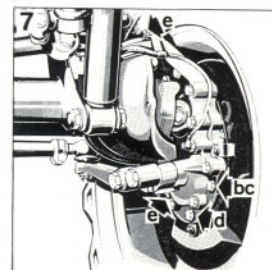
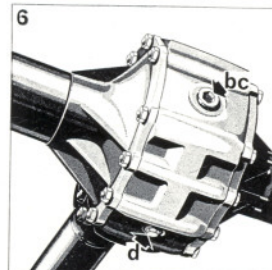
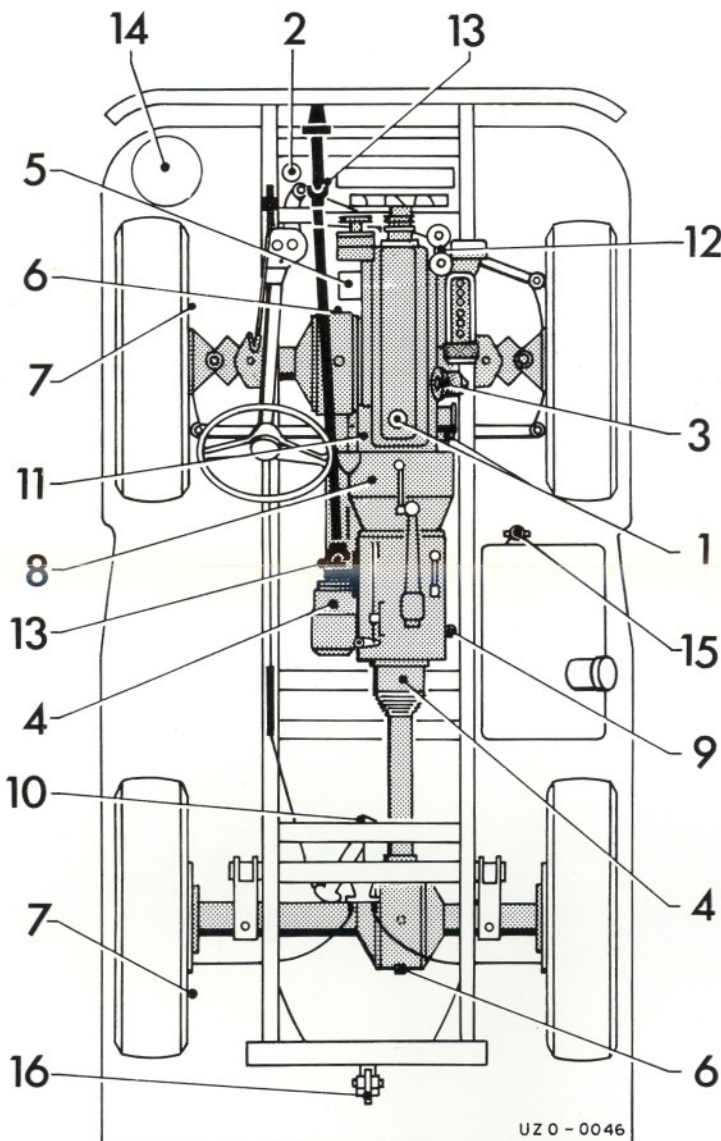


Fig. 12

- a Fill-in engine oil
- b Fill-in transmission oil
- c Check oil level
- d Drain oil
- e Lubricate with grease
- f Replace oil filter element
- i Fill-in and check brake fluid





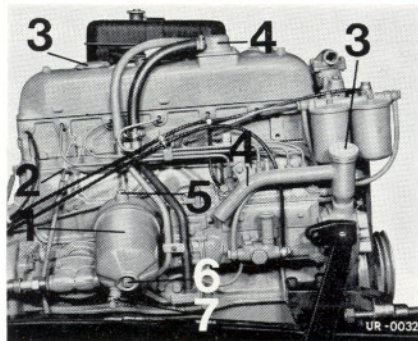


Fig. 13 Engine lubrication

- 1 Oil filter
- 2 Oil dipstick
- 3 Oil filler neck
- 4 Crankcase breather
- 5 Oil filter filler plug
- 6 Mounting bolt
- 7 Oil filter drain plug

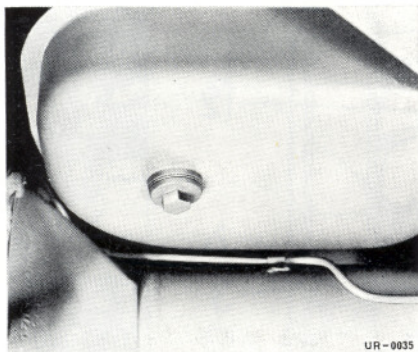


Fig. 14 Oil drain plug

## Engine

### Filling-up Engine Oil

The oil filler neck is located at the rear in the cylinder head cover, accessible from the cab after removal of the inside engine hood. Filling-up may also be accomplished at the breather neck on the timing gear case.

Engines of the new UNIMOG, exchange engines and fully reconditioned engines are filled with running-in oil for the first 500 km.

**After this, only HD (heavy-duty) engine oil grades of the specified viscosity class are permitted.** Refer to page 56.

Change HD engine oil brand if at all possible only during an oil change.

### Oil Level and Oil Change

Check oil level regularly depending on the UNIMOG operating conditions and make adjustments, if required.

Check oil level in oil pan with the UNIMOG on level ground and with the oil dipstick wiped off.

The oil level should be between the minimum and maximum mark.

When checking the oil level of the engine, it must be considered that the **oil cooler** and various oil passages will drain after not being run for some time. In order to exactly determine the oil level in the oil pan, it is necessary **that the check be made either immediately after turning off the warm engine, or after briefly running the previously cold engine.**

If oil must be added already prior to the first oil change and if no running-in oil is available, an HD engine oil of the same viscosity class may be used as an exception.

**Do not add oil beyond the max. level mark!**

Complete oil change according to the maintenance schedule.

Complete oil change only following extended operation of the engine, as long as the engine oil is still **warm and thin**. Change the bypass oil filter element during every oil change. HD engine oil will become dark sooner than unblended engine oil, because the combustion residue entering the oil will not settle in the crankcase and on crank assembly components, but will be kept suspended in the oil. Do not change the HD engine oil too early because of its dark color.

## Cleaning Oil Filter

Clean the combination oil filter with main flow and bypass oil filter element according to maintenance schedule.

Attach approximately 0.6 m of hose to the drain connection of oil filter. Place a collecting vessel underneath, loosen drain plug, unscrew filler plug and drain engine oil.

Loosen mounting bolt of oil filter bowl. Remove filter bowl with filter elements. Close center hole of main flow oil filter element on both sides, rinse with gasoline and then clean with a soft and not too large a brush, so that the filter fabric is not damaged.

Change bypass oil filter element. When assembling, place the main flow oil filter element, the bypass oil filter element and the resilient sealing washer on the oil filter housing.

Replace sealing rings.

To get oil pressure at once during starting procedure, **fill-up oil filter bowl half way.**

Watch out for correct position of drain plug screw on oil filter bowl.

## Oil Overpressure

Under normal operating conditions and when using engine oil of viscosity class SAE 30 at nominal speed the oil overpressure is at least **2.5 bar (kp/cm<sup>2</sup>)**. At idling speed it may drop to **0.6 bar (kp/cm<sup>2</sup>)** without in any way endangering the operational safety of the engine.

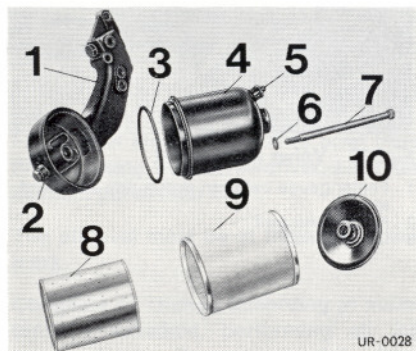


Fig. 15 Oil filter of engine, disassembled

- 1 Oil filter bracket
- 2 Oil filter plug
- 3 Seal ring
- 4 Oil filter housing
- 5 Drain plug
- 6 Seal ring
- 7 Mounting bolt
- 8 Bypass oil filter element
- 9 Main flow oil filter element
- 10 Spring plate

## Retightening Cylinder Head Nuts

**This maintenance job is done only once.**

Clean area around cylinder head cover thoroughly. Remove cylinder head cover and rocker arm shafts. Should it occasionally happen that the cylinder head cover removal is impeded by the lower edge of the instrument panel, loosen the front portion of the cab mounting and lift the cab approximately 20 mm.

**First loosen each individual nut slightly prior to retightening.**

Injection pump side

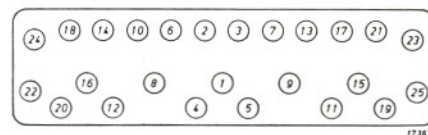


Fig. 16 Tightening pattern of cylinder head nuts

Uniformly retighten cylinder head nuts with the engine cold according to tightening pattern with torque wrench to specified torque of **110 NM (11 kpm)**. Adjust valve clearance Refer to page 67.



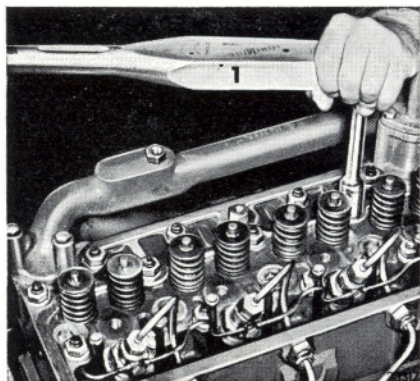


Fig. 17 Retightening cylinder head nuts

1 Torque wrench

### Replacing Cylinder Head Gasket

If a cylinder head gasket leaks combustion gases, replace immediately with a new original gasket.

Indications for a damaged gasket may be among others:

Missing of one or several cylinders, traces of water on oil dipstick, traces of oil in coolant or coolant in compression chamber. Boiling coolant.

To check the cylinder head gasket for leaks, run engine warm and watch in the coolant filler neck whether gas bubbles are rising in the coolant.

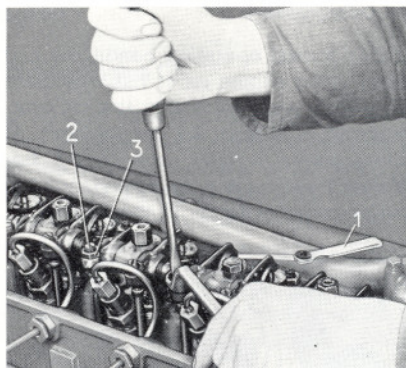


Fig. 18 Valve adjustment

- 1 Feeler gauge between rocker arm and valve stem
- 2 Adjustment bolt
- 3 Counter nut

Drain coolant if cylinder head gasket is damaged. Remove cylinder head cover and gasket. Unscrew rocker arm bearing brackets. Loosen cylinder head nuts with the **engine cold** in reverse to tightening sequence. Unscrew stud bolts and remove cylinder head. Clean contact surfaces of cylinder head gasket and cylinder head. Position new cylinder head gasket and cylinder head. Screw in stud bolts with screwdriver; apply graphite oil to threads of nuts and bolts. Uniformly tighten cylinder head nuts with engine cold according to tightening pattern (Fig. 16) with torque wrench in three steps from **60 Nm (6 kpm)** via **90 Nm (9 kpm)** to the specified torque of **110 (11 kpm)**. Adjust valve clearance. Complete all other jobs in reverse sequence.

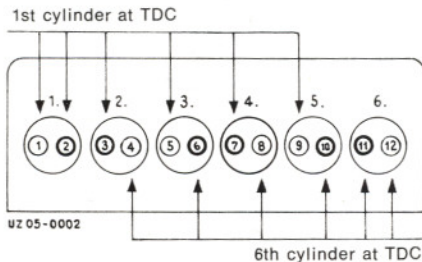


Fig. 19 Valve arrangement

- Exhaust valves
- Intake valves

### Adjusting Valve Clearances

Check valve clearance according to maintenance schedule each time upon removal of cylinder head or when retightening the cylinder head nuts. Measure valve clearance at pressure point between rocker arm and valve stem of intake and exhaust valves with **engine cooled down to below 25° C**.

Rotate crankshaft until the piston of the 1st cylinder is at TDC. Adjust the intake valves 2, 3, 7 and the exhaust valves 1, 5, 9 in the sequence mentioned.

Thereafter position the piston of the 6th cylinder at the TDC and adjust the **intake valves 6, 10, 11** and the **exhaust valves 4, 8, 12** in the sequence mentioned. Fig. 19.

Adjust valve clearance by turning adjustment bolts after loosening their counter nuts with a feeler gauge. Fig. 18. After adjustment tighten the counter nuts again. Check valve clearance again. When the valve clearance is properly adjusted the feeler gauge should pass tightly.

Renew cylinder head cover gasket.

### Checking Compression Overpressures

When the engine output drops, measure compression pressure in each cylinder by means of compression pressure gauge. Measure at starter speed of approximately 150 to 200/min and warmed up engine. Crank engine with starter for at least eight rotations.

If the minimum value is not attained, check valve clearance. If required, remove cylinder head and check valve for leaks, condition of cylinder head gasket, cylinder wear and piston ring contact pattern in cylinder.

Refinish valve seats, if required. Engine must be reconditioned in the event of cylinder or piston ring damage.

### Air Filter

A carefully cleaned air filter is absolutely necessary to protect the pistons and cylinder contact surfaces and in order to avoid damage.

### Oil bath air filter

Change oil according to UNIMOG conditions of operation.

Loosen quick-release lock for removing filter bowl on front folding part of fender. Force filter element and filter bowl from filter housing with screwdriver. Lift filter element out of filter bowl.

The oil level must be at the appropriate mark.

Complete oil change according to maintenance schedule, performing all the specified jobs. Remove oil, clean filter element and filter bowl with benzene and fill up with fresh engine oil.

Dust deposits on the clean air end and in the intake manifold are a sure sign that the oil bath air filter must be cleaned more often than stated in the maintenance schedule.

### Cyclone prefilter

Under extremely dusty operating conditions, we recommend using a cyclone prefilter in **addition** to the oil bath air filter in order to triple the service life of the oil bath air filter.

The cyclone normally requires no maintenance. Remove the cyclone and thoroughly clean according to type of dust accumulation.

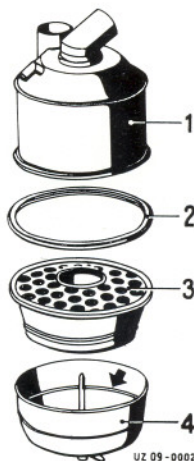


Fig. 20 Oil bath air filter, disassembled

- 1 Filter bowl
- 2 Gasket
- 3 Filter element
- 4 Filter housing w. oil level mark (arrow)



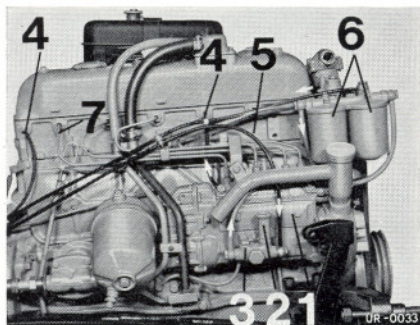


Fig. 21 Fuel system of engine

To Fig. 21

- 1 Injection pump
- 2 Fuel priming pump
- 3 Fuel feed pump
- 4 Fuel return line
- 5 Fuel suction line
- 6 Fuel filter
- 7 Fuel injection line

### Cleaning Fuel Tank

Clean the fuel strainer in the fuel tank regularly.

If installed, remove filler strainer after unscrewing the cap and wash with brush in diesel fuel.

Drain fuel tank completely to clean the fuel tank and intake strainer. Have collecting vessel ready for use, unscrew drain plug and drain remainder of fuel. Pull intake strainer from intake pipe and clean. Fig. 23 and 24.

### Fuel System

#### Filling-up Fuel

When filling fuel into the fuel tank make sure to avoid impurities, that the cap gasket is not damaged and seals tightly. Clean cap regularly.

Dirty fuel will result in early wear of the high-grade and very expensive injection pump elements.

When filling up from barrels or cans the following points should be observed:

Always suck fuel from closely under the fuel level of the barrel, that is, do not simply set suction pump into barrel. Maintain minimum distance between bottom of barrel and end of intake pipe, so that deposits such as dirt, sludge and water will not be sucked in.

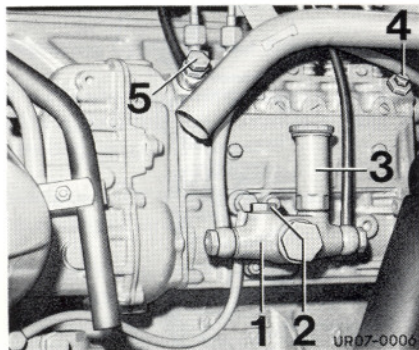


Fig. 22 Injection pump

- 1 Fuel feed pump
- 2 Suction- and pressure valve
- 3 Fuel primer pump
- 4 Bleeding screw
- 5 Pressure valve

#### Cleaning Fuel Prefilter

Clean prefilter according to maintenance schedule. Loosen wing nut, push clip aside and remove bowl. Unscrew strainer body. Carefully wash bowl and strainer in clean gasoline or diesel fuel.

During reinstallation replace worn or hardened gaskets since otherwise air will enter the fuel system. Fig. 25.

## Cleaning Fuel Filter

Clean fuel filter according to maintenance schedule:

Loosen fastening bolts of both filter bowls. Fig. 26. Remove filter bowls and take off felt tube elements. Clean out filter bowls. In no case disassemble felt tube elements for cleaning. Carefully close off both openings of a felt tube element so that no dirt can enter. Shake out felt tube elements in clean diesel fuel.

Immerse heavily dirtied felt tube element in diesel fuel until drawn full of oil and blow out with compressed air or with an air pump through one of the holes from inside. Repeat procedure until the blown out fuel remains clean. During reinsertion pay particular attention to upper and lower felt gasket.

Paper filter elements cannot be washed but should be changed during each 1st TM.

**Trouble-free engine operation requires a carefully cleaned fuel filter.**

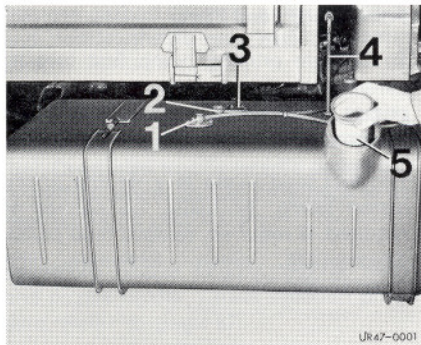


Fig. 23 Fuel tank

- 1 Intake line
- 2 Return line
- 3 Fuel gauge sending unit
- 4 Vent
- 5 Filter strainer

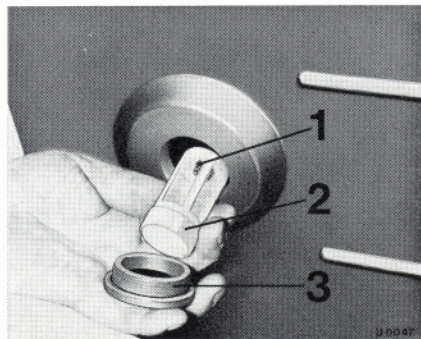


Fig. 24 Intake strainer

- 1 Intake pipe
- 2 Intake strainer
- 3 Drain plug

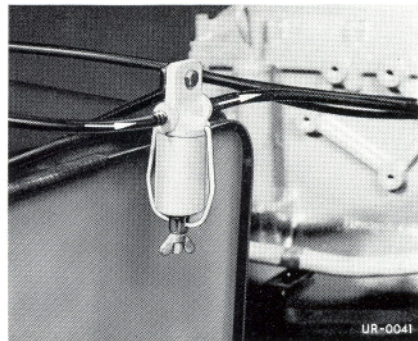


Fig. 25 Fuel prefilter



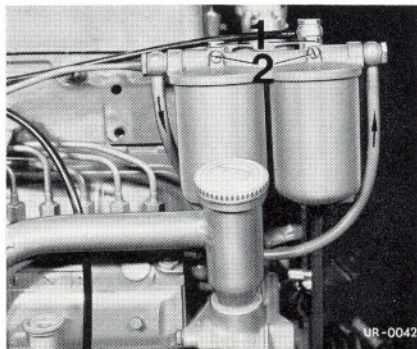


Fig. 26 Fuel filter

- 1 Fastening bolts of filter bowls
- 2 Bleed screws

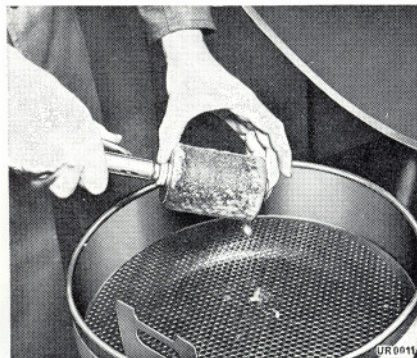


Fig. 27 Cleaning of fuel filter element

### Priming and Feed Pump

To operate priming pump first turn its handle counter-clockwise. After using primer pump screw handle down again by turning clockwise.

The fuel feed pump is a double acting piston pump. Normally, no service is required. If required, remove feed pump, disassemble, clean, assemble and reinstall. Fig. 21.

### Bleeding Fuel Filter

Unscrew both bleeding screws of fuel filter one after the other for 1–2 complete turns and actuate fuel primer pump. Pump until fuel free of bubbles flows out of bore in bleeder screw.

### Bleeding Fuel System

Complete bleeding of the injection pump or the entire fuel system is one of the basic conditions for perfect running of the engine.

If air bubbles collect in any part of the fuel system they are compressed without fuel being ejected out of the injector nozzle. To prevent such trouble in the fuel system never run the fuel tank completely empty.

Bleed entire fuel system prior to initial operation, as well as after each major repair:

When the fuel system has not been run empty completely bleeding of the fuel filter may be sufficient. If thereafter the engine does not fire immediately bleed the injection pump.

Bleed fuel filter.

Loosen bleeder screw on injection pump by a few turns and add fuel with the primer pump until fuel emerges absolutely free of bubbles. Primer pump requires fast actuation.

### Checking and Cleaning Injectors

Trouble on injector nozzles may occur when the fuel system has dirt accumulations whereby the engine will emit black smoke, will knock badly or run erratically.

A stuck nozzle needle may be made operable when the engine is running by actuating the accelerator pedal several times. To find the damaged nozzle, loosen the pressure lines to the nozzle holders of the injector nozzles one after the other, that is, loosen only one pressure line at a time and watch operation, speed and exhaust of engine. If the speed changes not at all or only slightly and the abnormal noise or the black

smoking of the exhaust stop, the damaged injection nozzle has been located.

Replace a damaged injection nozzle or clean on an absolutely clean work bench:

Remove cylinder head cover. Immediately cover the thus unprotected intake ports so that no foreign matter can fall into them. Loosen glands in cylinder head which retain the injection lines. Unscrew pressure and leak fuel lines.

Unscrew union nut. Remove nozzle and watch out for washers under the spring. If damaged, only replace nozzle body and nozzle needle together.

Clean nozzle body and nozzle needle externally. Clean ejection bore and the upper annular surface with a pointed piece of **hardwood** or a soft brush.

Carefully clamp cylindrical pin of nozzle needle between lead jaws and pull nozzle needle out of nozzle body. If required, first soften both parts in diesel fuel.

Clean nozzle body inside with **wooden stick**, gasoline or diesel fuel. Clean nozzle needle with clean rag; hold nozzle needle by pin only to prevent any corrosion of the lapped surface.

Remove carbon deposits on nozzle body and nozzle needle only with hardwood stick.

Prior to reassembly immerse nozzle needle and nozzle body in clean diesel fuel. Drop test: Nozzle needle pulled out by half its length should drop back to its seat under its own weight.

Assemble nozzle needle, nozzle body and nozzle holder. Check ejection pressure. Refer to page 67.

**Insert new copper gasket.**

**Screw in nozzle holder with specified tightening torque since otherwise the nozzles might be subject to distortion.** Refer to page 74.

Connect pressure line and leak fuel line tightly.

## Cooling System

### Filling-up Coolant

Regularly check coolant level in expansion tank. Actuate push button of safety valve prior to opening cap to relieve any excess pressure. Fig. 10.

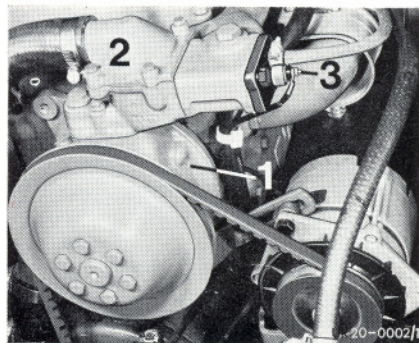


Fig. 28 Engine cooling system

- 1 Coolant pump
- 2 Thermostat
- 3 Sending unit (Temperature)

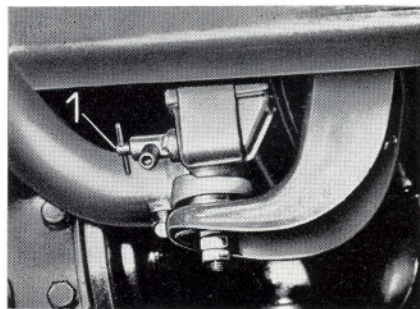


Fig. 29 Radiator drain cock

- 1 Drain cock