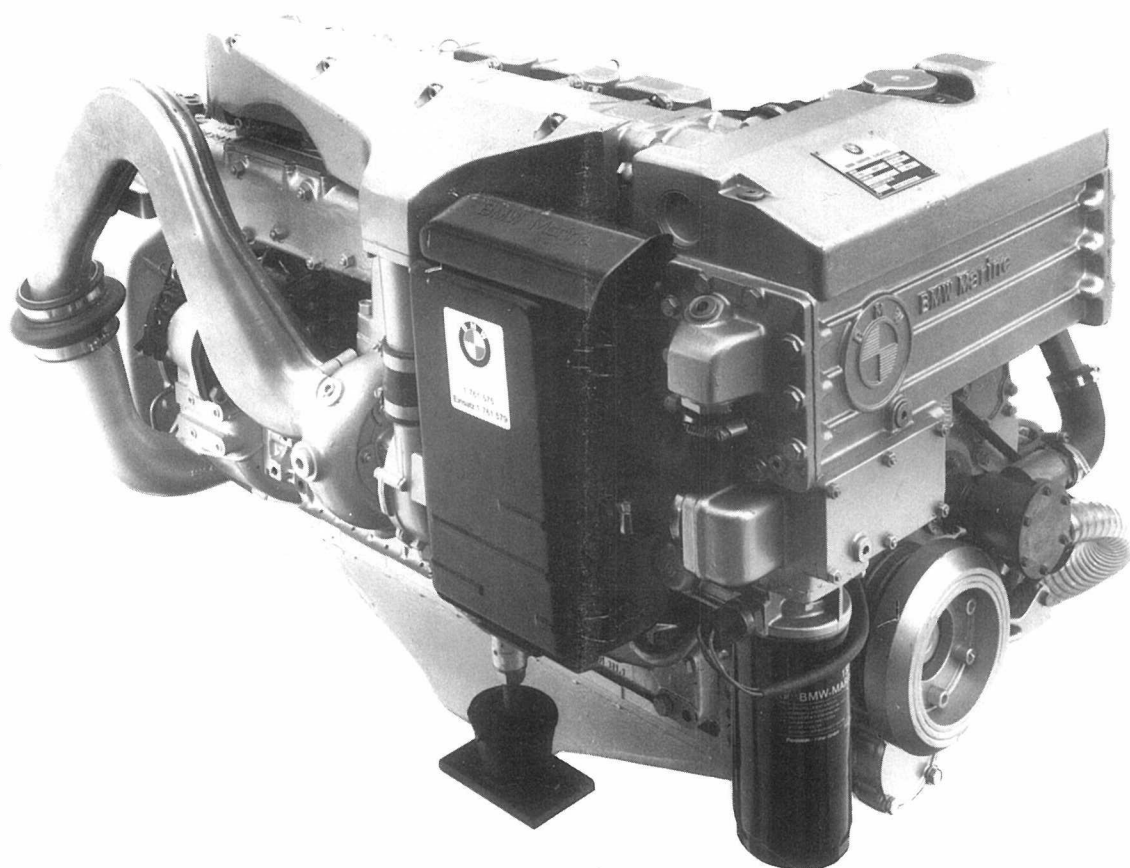


# Workshop Manual

## BMW D 190

### Appendix



**BMW Marine Engines**

**USE OF THE WORKSHOP MANUAL**

This appendix is complementary to the workshop manual for the BMW D150 marine engine, and describes only that work for the D190 and D190 W engines which differs from that for the D150. The following sections are particularly affected:

- Electric box - removing and installing
- Dual-circuit cooling system - removing and installing
- Turbocharger air cooler - removing and installing
- Heat exchanger for air cooler - cleaning
- Fuel filter - removing and installing
- Oil scavenge pump - removing and installing
- Valve covers - removing and installing

All procedures not described in this appendix will be found in the D150 manual.

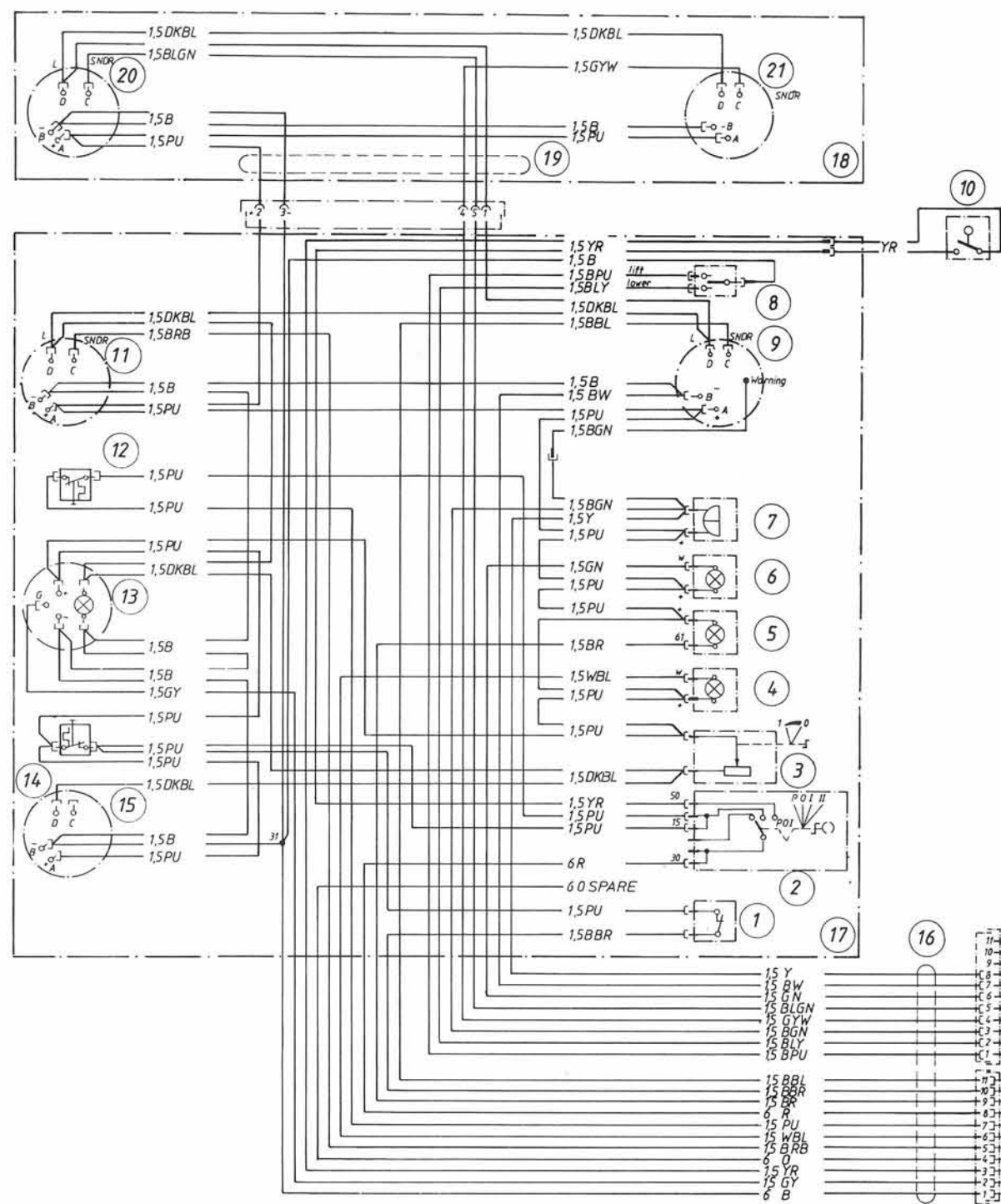
All special tools required are listed on page 95 of the D150 manual.

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## BMW Marine engine D 190

### Key-word index

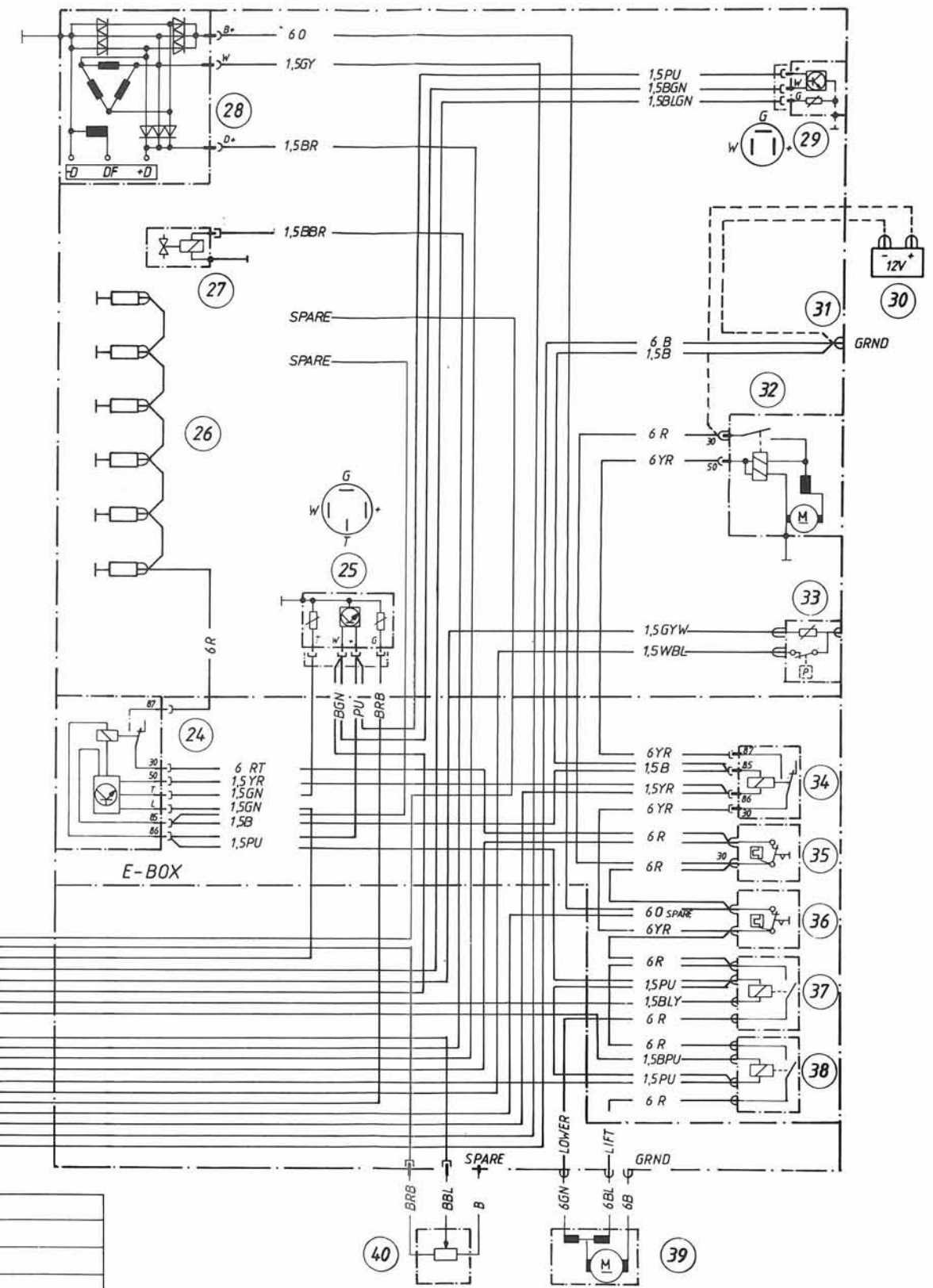
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- Flachsteckhülse receptacle
- Rundsteckhülse pin receptacle
- Lötstelle oder Verbinder
- Schraubanschluß Kabelschuh

A W G	mm <sup>2</sup>
16	15
14	25
12	40
10	60

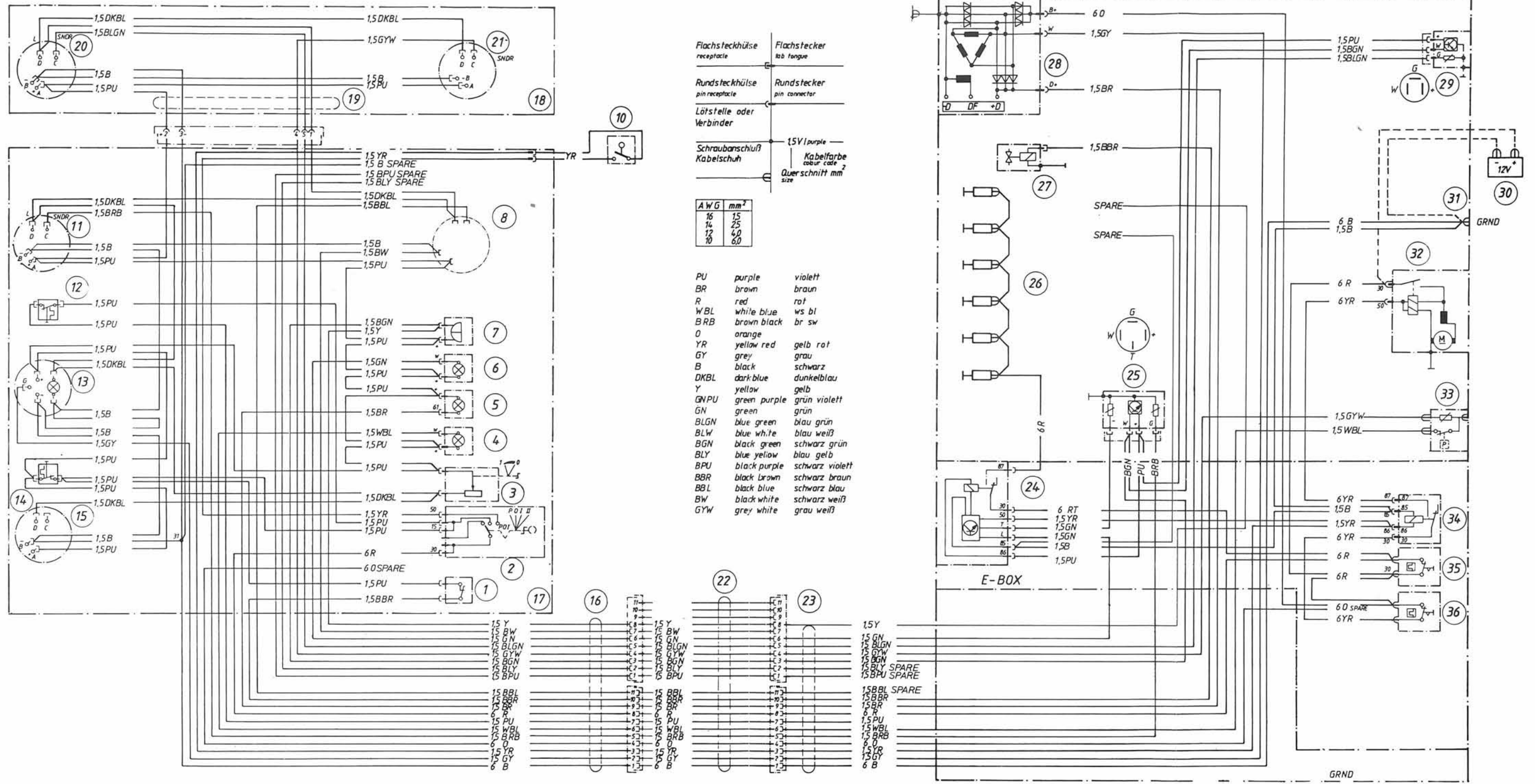
- PU purple violett
- BR brown braun
- R red rot
- WBL whiteblue ws bl
- BRB brown black br sw
- O orange
- YR yellow red gelb rot
- GY grey grau
- B black schwarz
- DKBL darkblue dunkelblau
- Y yellow gelb
- GNPU green purple grün violett
- GN green grün
- BLGN blue green blau grün
- BLW blue white blau weiß
- BGN black green schwarz grün
- BLY blue yellow blau gelb
- BPU black purple schwarz violett
- BBR black brown schwarz braun
- BBL black blue schwarz blau
- BW black white schwarz weiß
- GYW grey white grau weiß



1 Motor Stop Taster push button engine stop	15 Voltmeter voltmeter	29 Öltemperaturkontaktgeber oiltemp sender
2 Anlaßschalter key switch	16 Instrumentenkabelbaum wiring harness additional	30 Startbatterie 12V startbattery
3 Schalter Instr Licht dimmer instr light	17 Instr Tafel instr panel	31 Massenanschluß Motor GRND connection engine
4 Oldruck Kontr Leuchte oil press contr light	18 Tafel für Zusatzinstr. panel for optional instr.	32 Anlasser 12V 2.7kw starter
5 Ladekontr Leuchte charge contr light	19 Kabelbaum Zusatzinstr. wiring harness additional instr.	33 Oldruckgeber oilpress sender
6 Vorglüh Kontr Leuchte glow contr light	20 Ölthermometer oiltemp gauge	34 Starterrelais relay start
7 Summer buzzer	21 Oldruckmesser oilpress gauge	35 Sicherungsautomat circuit breaker 60 A
8 Trimmfaster trim switch	22 Kabelbaum Verlängerung wiring harness extension	36 " " " " 60 A
9 Triminstrument trim gauge	23 Motorkabelbaum engine wiring harness	37 Trimmrelais senken trimrelay lower
10 Leerlauf Sicherheitsschalter neutral safety switch	24 Vorglührelais pre glowrelay	38 " " " " heben
11 Wasserthermometer water temp gauge	25 Wasser Temp Geber water temp sender	39 Hydraulikaggregat power trim
12 Sicherungsautomat circuit breaker instr BA	26 Glühstoffkerzen hearer plug	40 Trimmgeber trim sender
13 Drehmesser mit Betr. St. Zähler tachometer	27 Kraftstoffventil oil valve injector	
14 Sicherungsautomat circuit breaker instr BA	28 Drehstromgenerator alternator	

Wiring diagram  
D 190 Z  
engine and instruments





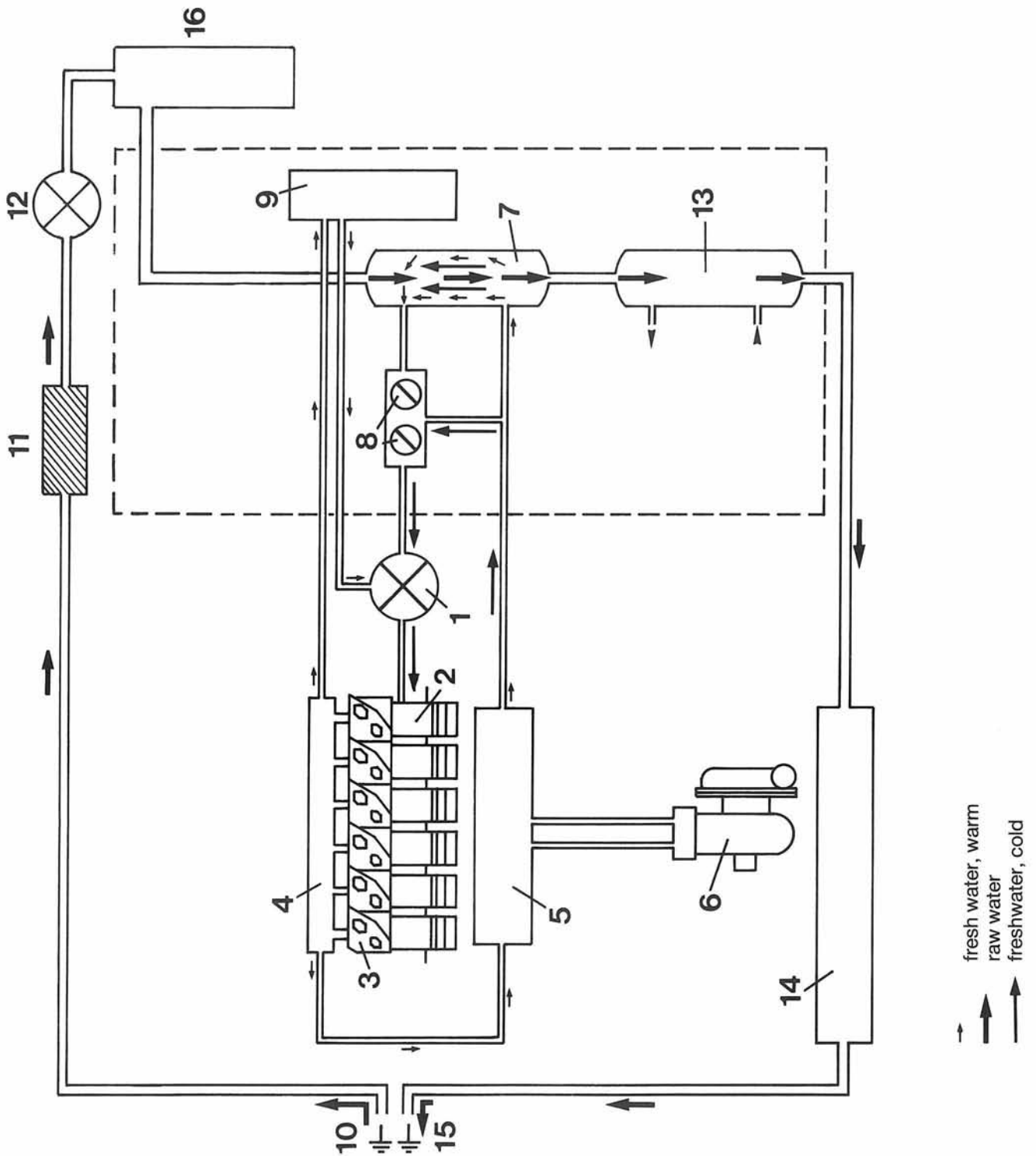
1	Motor Stop Taster Push button engine stop	15	Voltmeter voltmeter	29	Öltemp. Kontaktgeber oiltemp. sender
2	Anlaßschalter key switch	16	Instrumentenkabelbaum wiring harness additional	30	Startbatterie 12V start battery
3	Schalter Instr. Licht dimmer instr. light	17	Instr. Tafel instr. panel	31	Massenanschluß Motor GRND connection engine
4	Öldruck Kontr. Leuchte oil press. contr. light	18	Tafel für Zusatzinstr. panel for optional instr.	32	Anlasser 12V 2,7 kW starter
5	Ladepantr. Leuchte charge contr. light	19	Kabelbaum Zusatzinstr. wiring harness additional instr.	33	Öldruckgeber oil press. SNDR
6	Vorglüh Kontr. Leuchte glow contr. light	20	Ölthermometer oiltemp. gauge	34	Starterrelais relay start
7	Summer buzzer	21	Öldruckmesser c. press. gauge	35	Sicherungsautomat circuit breaker 60 A
8	Blinddeckel blanking plate	22	Kabelbaum Verlängerung wiring harness extension	36	" " 40 A
9		23	Motor-Kabelbaum engine wiring harness		
10	Leerlauf Sicherheitsschalter neutral safety switch	24	Vorglührelais pre glow relay		
11	Wasserthermometer water temp. gauge	25	Wassertemp. Geber water temp. sender SNDR		
12	Sicherungsautomat circuit breaker 1 engine	26	Glühhilfkerzen heater plug		
13	Drehz. Messer mit Betr. St. Zähler tach. w. hourmeter	27	Kraftstoffventil el. valve injector		
14	Sicherungsautomat circuit breaker instr. BA	28	Drehstromgenerator alternator		

Wiring diagram  
D 190 W  
engine and instruments



Cooling System

1. Fresh water pump
2. Engine block (upper part of liners)
3. Cylinder head
4. Water manifold
5. Exhaust manifold
6. Exhaust turbine
7. Heat exchanger water/water
8. Thermostats
9. Expansion tank
10. Raw water inlet
11. Raw water filter
12. Raw water pump
13. Heat exchanger water/oil
14. Exhaust pipe (water sleeve)
15. Raw water outlet
16. Turbocharger air cooler



↑ fresh water, warm  
 ↑ raw water  
 ↑ fresh water, cold



## REMOVING AND INSTALLING ELECTRIC BOX

### Removing the Electric Box

Fig. 4

Disconnect all electrical wires on the engine and run the wiring harness back to the electric box. Unscrew the three hexagon screws (4/1) and take the electric box complete with fixing bracket (4/2) from its location on the crankcase.

4

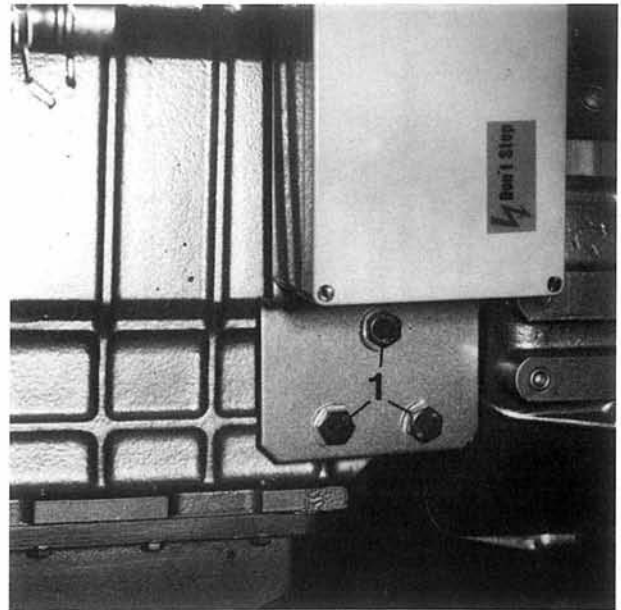


Fig. 5

Unscrew the four nuts (5/1) from the rear of the fixing bracket (5/2) and remove the electric box from the bracket.

5

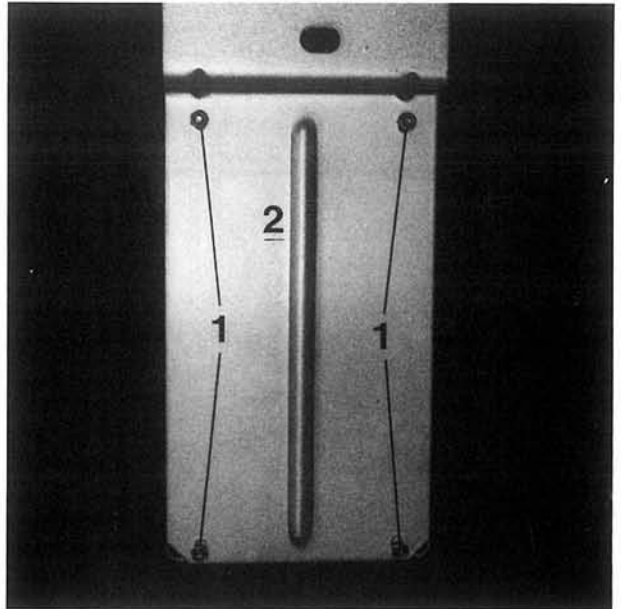


Fig. 6

### Installing the Electric Box

Fasten the fixing bracket to the electric box. Locate the electric box and fixing bracket on the crankcase and fasten with the three hexagon screws (6/1).

6

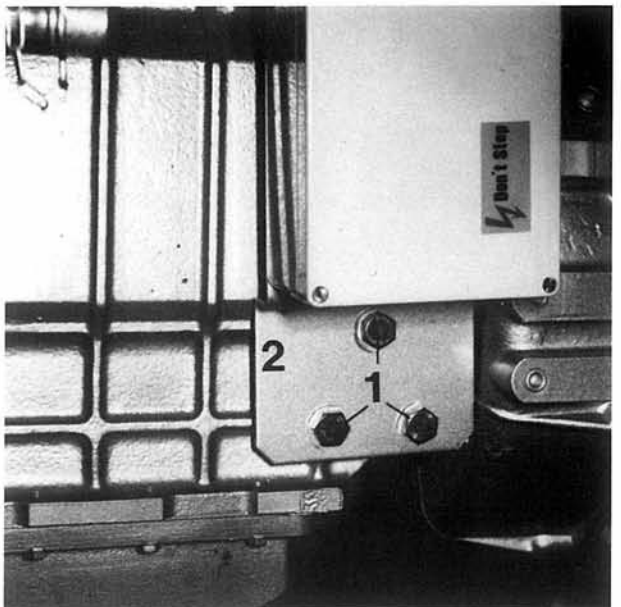
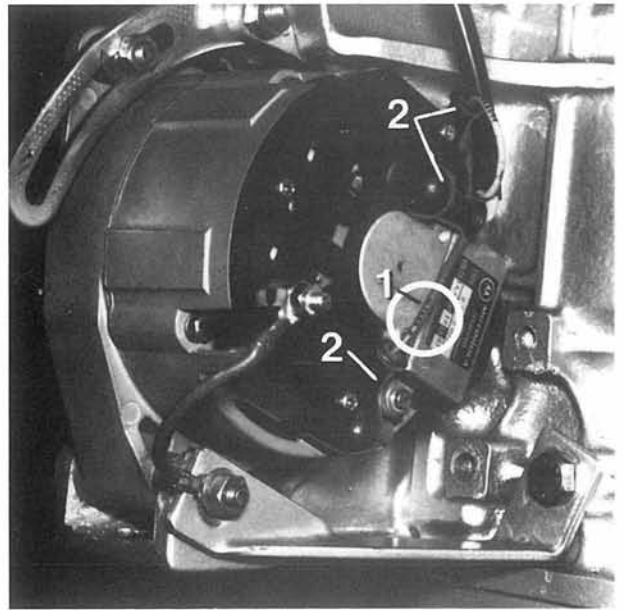


Fig. 7

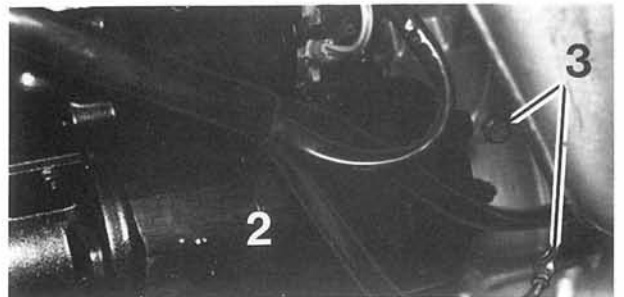
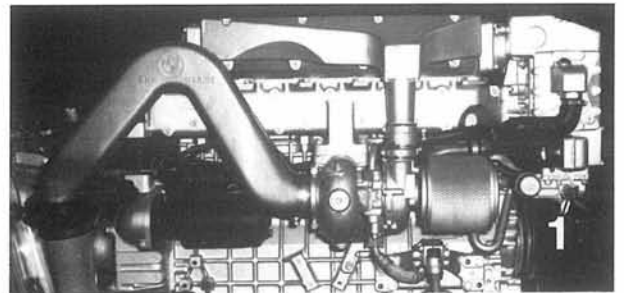
Connect the wires of the alternator and the fuel injection pump solenoid valve.  
Note: Check marks (7/1) on ends of wires. Slide a rubber protection cap (7/2) over each connection.



7

Fig. 8

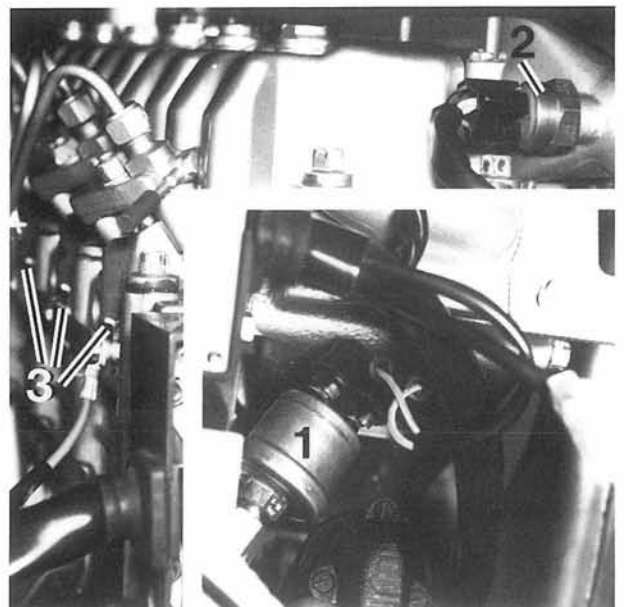
Connect the plug to the oil thermometer (8/1). Connect the starter (8/2), and the earth wire to the engine (8/3). Slide on the rubber protection caps.  
Note: Check the marks on the ends of the starter wires.



8

Fig. 9

Connect the oil pressure sender (9/1), the coolant temperature sender (9/2) and the heater plugs (9/3).

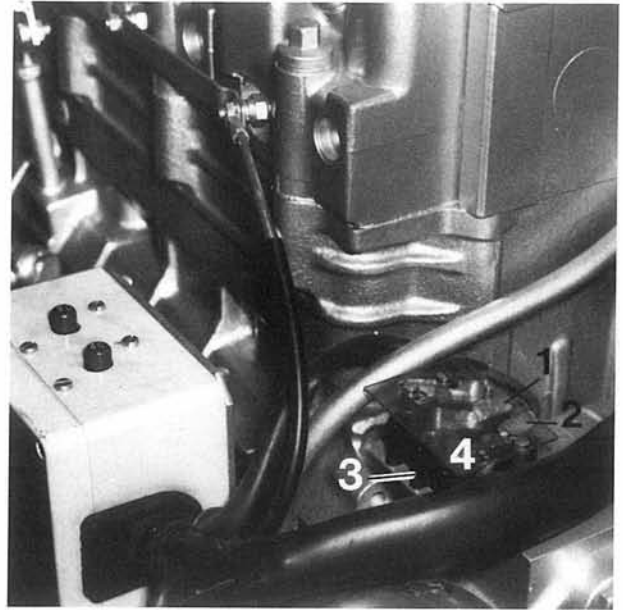


9

Fig. 10

Connect the two leads (10/1,2) to the trim motor adaptor and replace the cover (10/4).

Note: These leads are only to be found on type D 190Z engines.



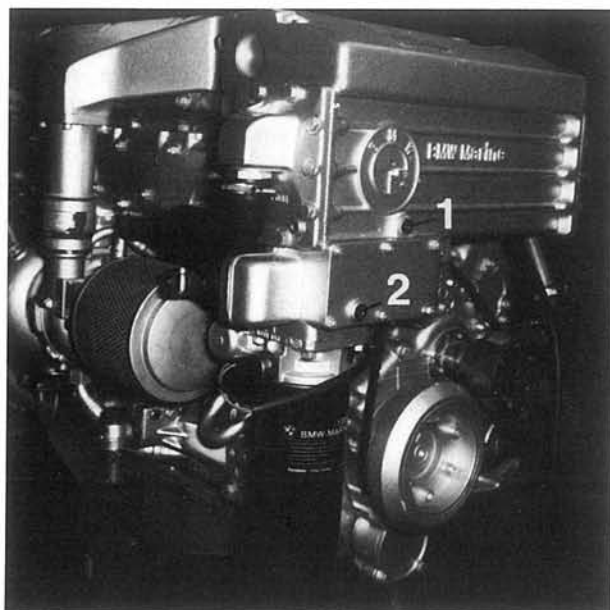
10

## Removing and Installing the Dual-circuit Cooling System

Removing the Dual-circuit Cooling System  
Unplug the connector from the oil thermostat.

Fig. 11

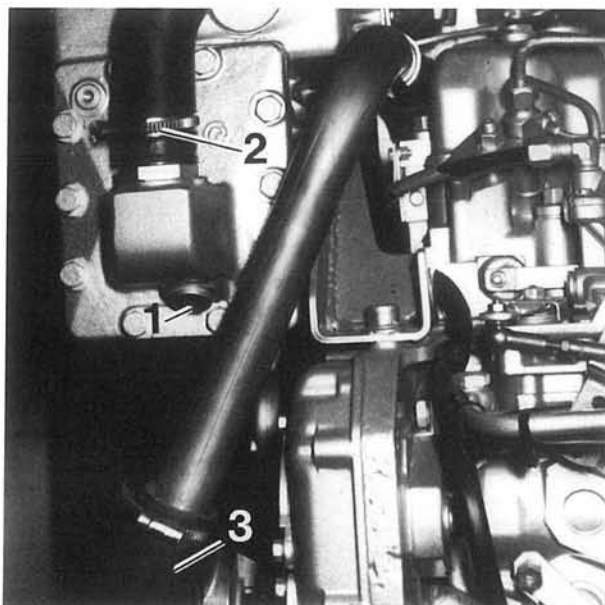
Place a container in position. Unscrew the hexagon socket screw (11/1) and drain oil from the heat exchanger.  
Unscrew the hexagon socket screw (11/2), Take off cap from the expansion tank and drain the fresh water from the cooling system.



11

Fig. 12

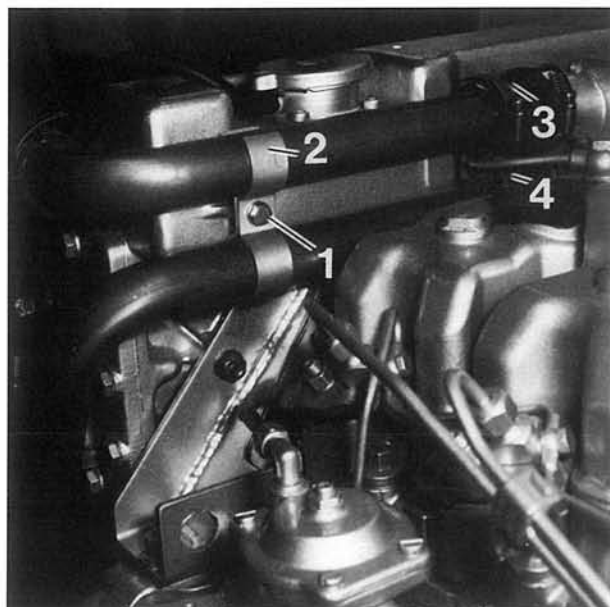
Unscrew the socket screw (12/1) and drain the raw water from the dual-circuit cooling system.  
Unfasten hose clamps (12/2,3) and pull off the raw water hoses to drain the water.  
Note: After draining the raw water fit a new copper sealing ring to the hexagon socket screw (12/1) and re-fit the screw.



12

Fig. 13

Unscrew the hexagon screw (13/1) and take off the pipe clamp (13/2). Unfasten the hose clamps (13/3,4) and take off the raw water hoses from turbocharger air cooler.



13

Fig. 14

Unscrew the two connectors (14/1) and remove the pressure relief line (14/2) between the water manifold and the dual-circuit cooling system.

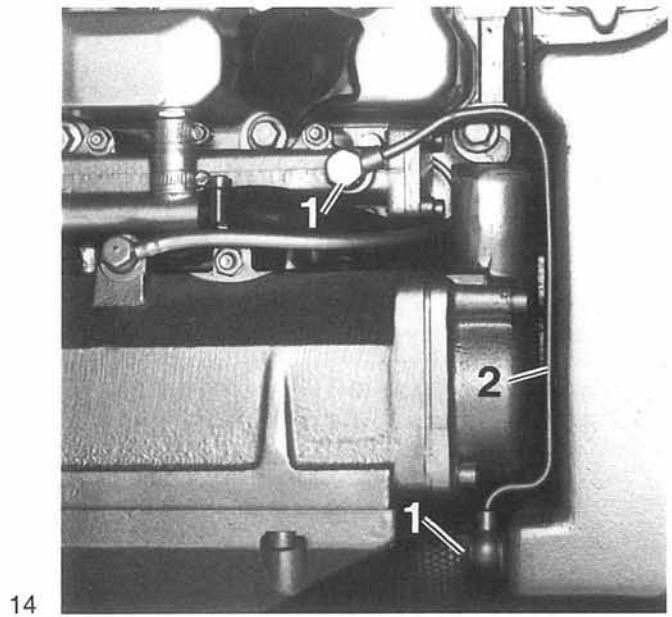


Fig. 15

Unfasten hose clamps (15/1,2).

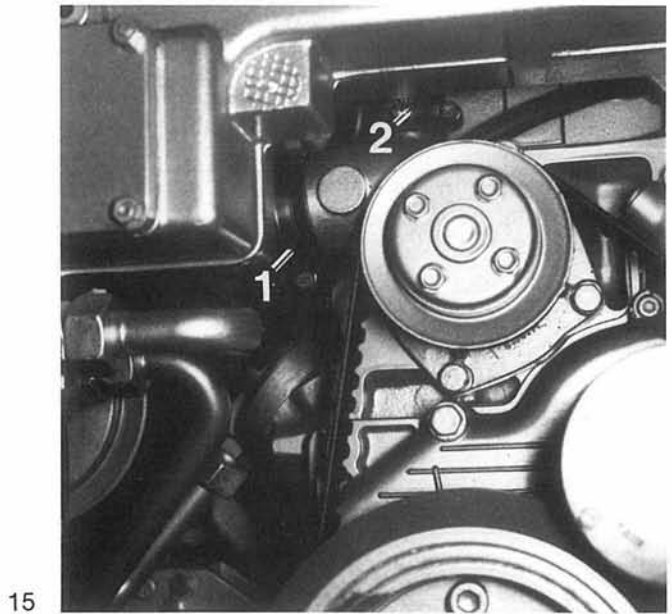
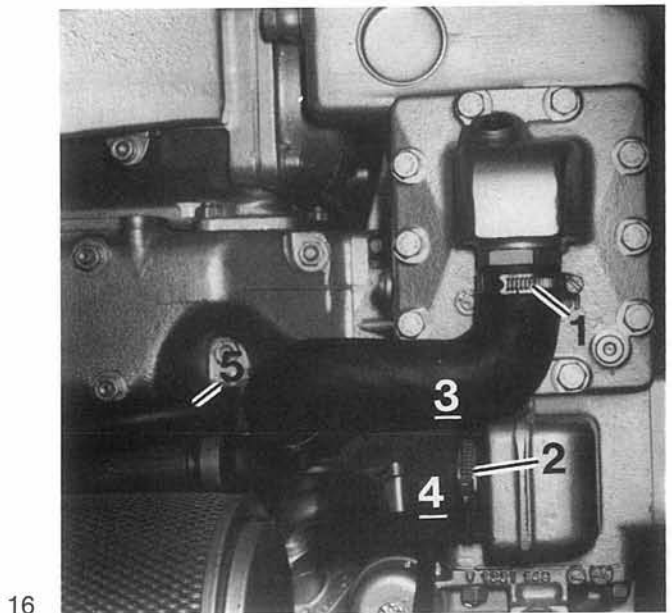


Fig. 16

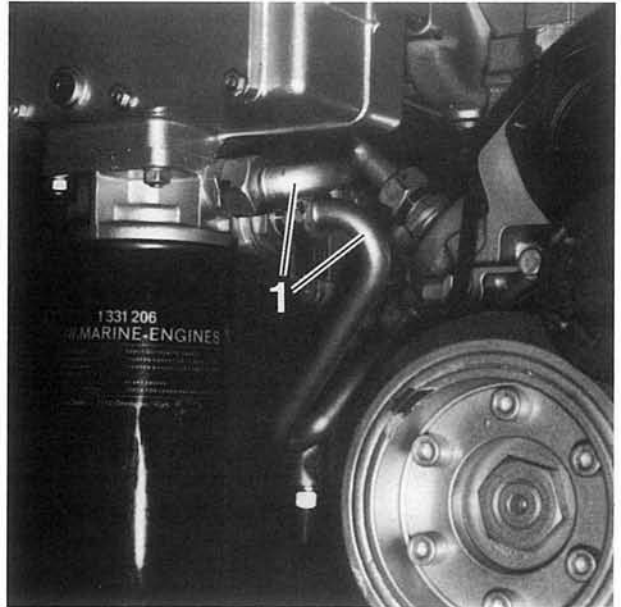
Unfasten the hose clamps (16/1,2) and remove the hoses (16/3,4) from the dual-circuit cooling system. Remove the crankcase breather line (16/5) from the air filter and the manifold on the valve covers.



Remove the air filter

Fig. 17

Unscrew the four coupling nuts (17/1) and remove the two oil lines (17/2) between the dual-circuit cooling system and the central oil supply connection (17/3).

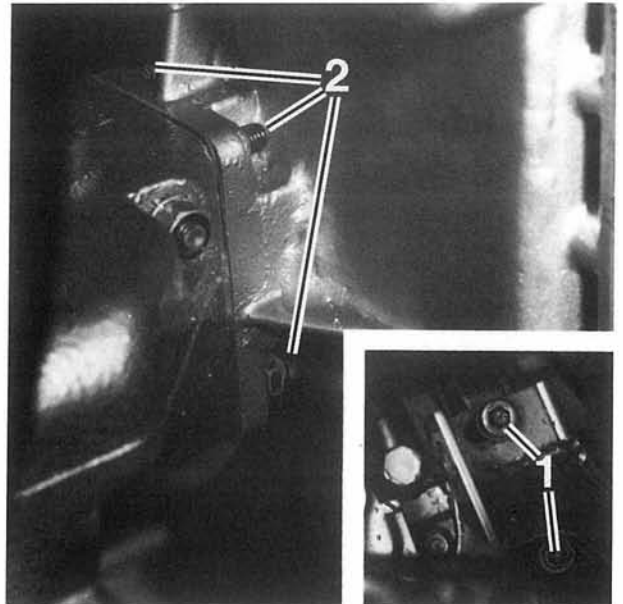


17

Remove the water pump.

Fig. 18

Unscrew the two socket head screws (18/1) from the cooling system support. Unscrew the four mounting nuts from the cooling system flange and take the cooling system from the engine.

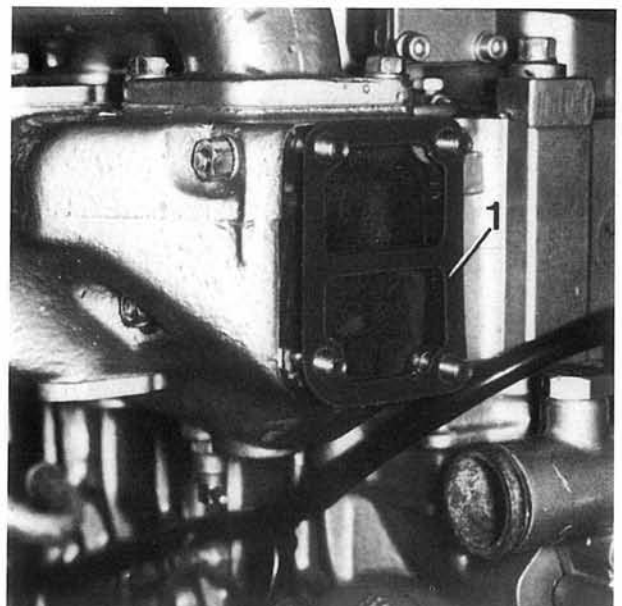


18

Installing the Dual-circuit Cooling System

Fig. 19

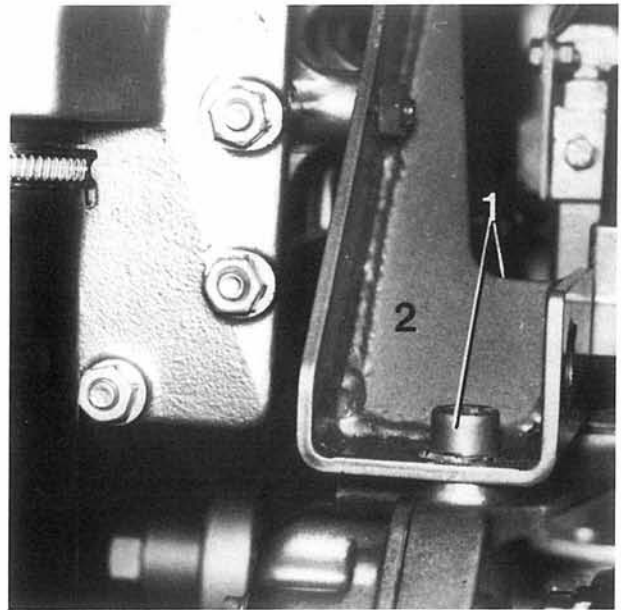
Clean any gasket remnants from the dual-circuit cooling system flange and the exhaust manifold sealing surfaces. Coat new gasket (19/1) with a liquid sealing compound and install on exhaust manifold. Push the dual-circuit cooling system into the threaded bolts and tighten with the four hexagon nuts. Place a spring washer under each nut.



19

Fig. 20

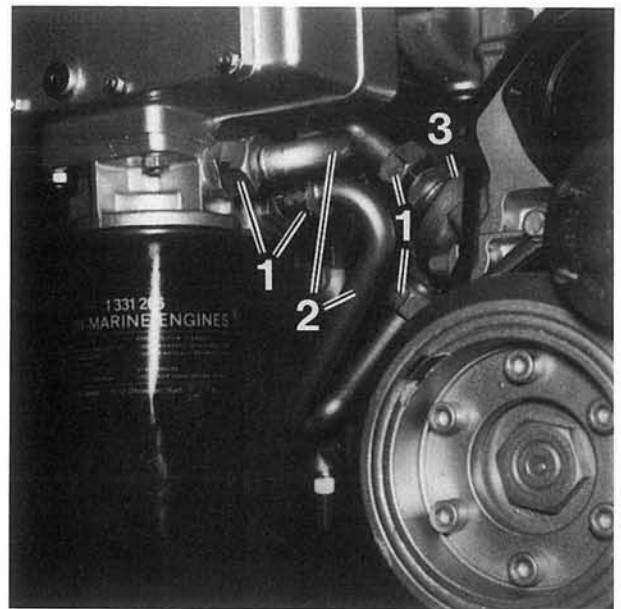
Put an flat and a spring washer into the two socket head screws (20/1) and tighten down the support (20/2).



20

Fig. 21

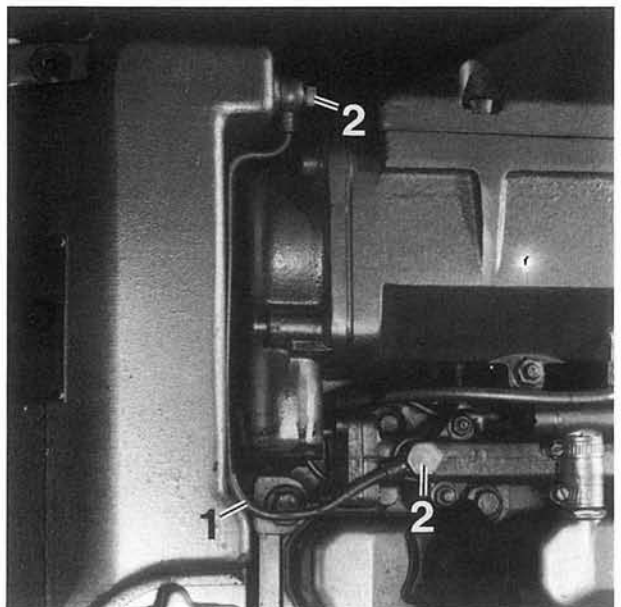
Attach the two oil lines between the oil cooler and the central oil supply. Install the air filter.



21

Fig. 22

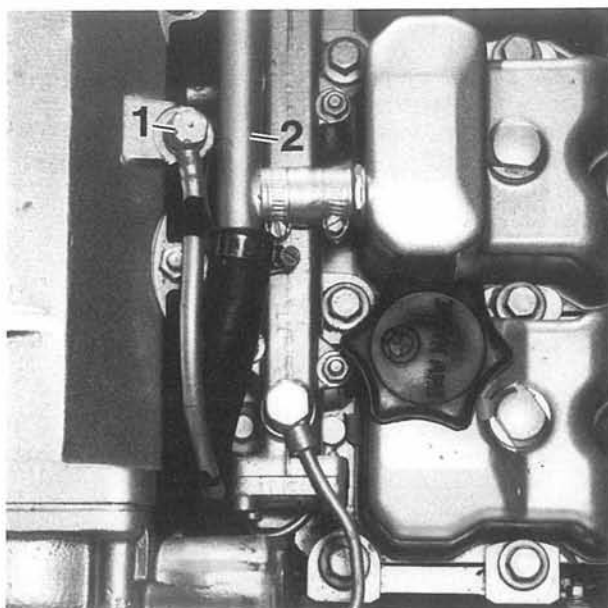
Install the pressure relief line (22/1) between the water manifold and the dual-circuit system.  
Note: Fit a new sealing ring on both sides of connection.



22

Fig. 23

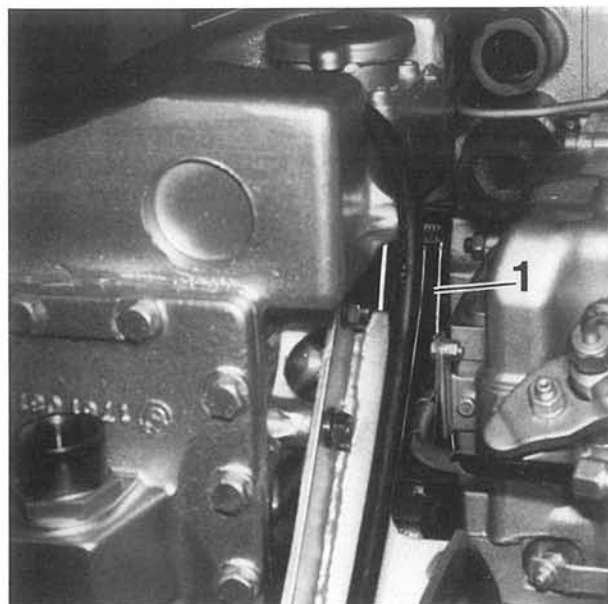
Connect the crankcase breather (23/1) to the air filter and manifold.



23

Fig. 24

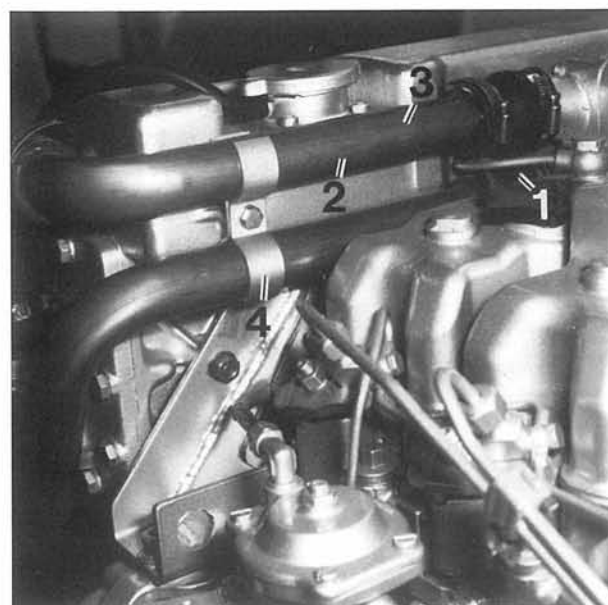
Connect the supply line (24/1) to the dual-circuit cooling system water pump. Install the water pump.



24

Fig. 25

Push the rubber supports (25/1) onto the turbocharger air cooler and connect the line (25/2) between the turbocharger air cooler and the raw water pump. Install the line (25/3) between the turbocharger air cooler and the dual-circuit cooling system. Install the pipe clamps (25/4).



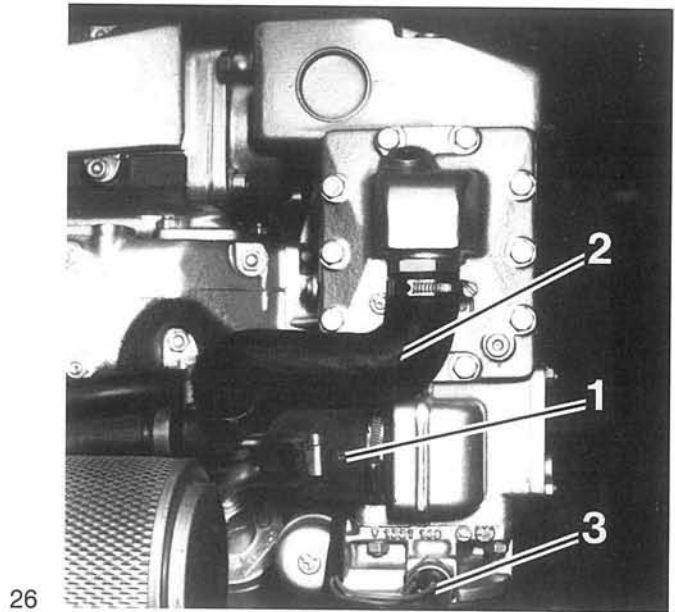
25



Fig. 26

Place two hose clamps onto the hose(26/1)and install the hose between the water pump and the dual-circuit cooling system. Install the hose (26/2) between the dual-circuit cooling system outlet and the exhaust pipe. Plug in the wire to the oil thermometer.

Note: Check once more that all hose clamps are tight.

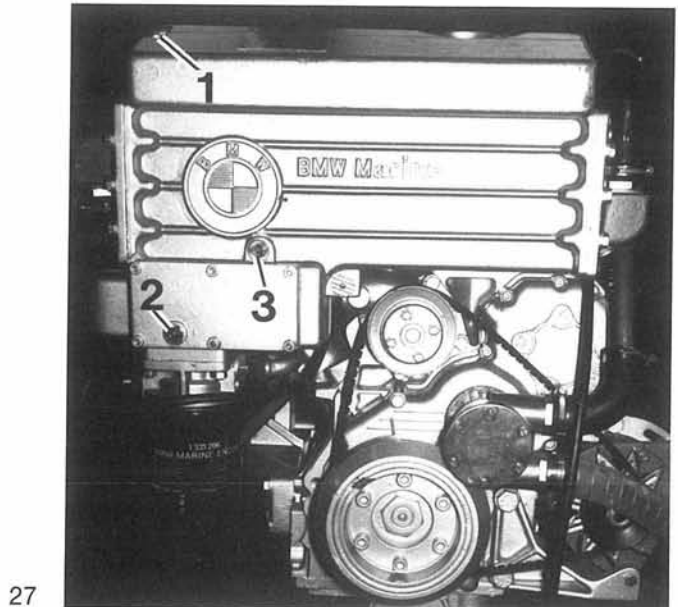


26

Fig. 27

Fill cooling system with coolant. Unscrew socket head screw (27/1), fill oil/water heat exchanger with engine oil and tighten the screw again. Refer to the D 150 technical data for filling capacities.

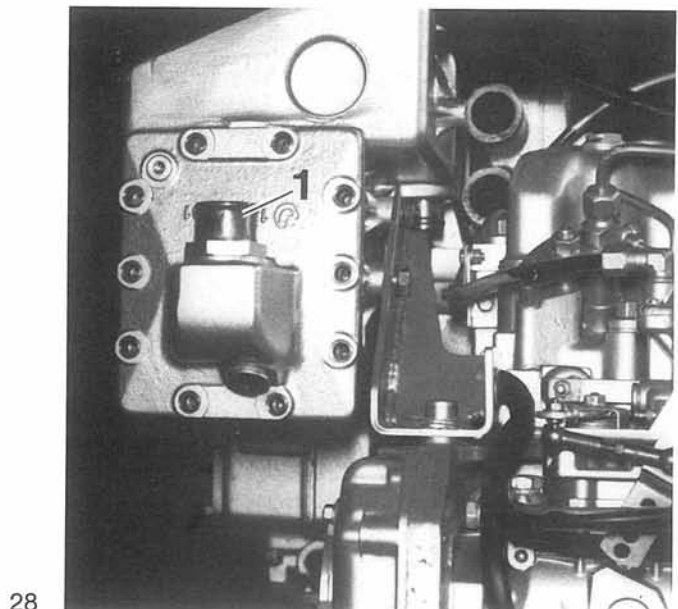
Note: Before filling the cooling system check that both socket head bolts (27/2,3) at the front of the cooling system are tightly installed.



27

Fig. 28

Note: Dismantling and assembling the dual-circuit cooling system is generally the same as for the D 150 engine. Take care when fitting the cover that the heat exchanger inlet standpipe faces upwards (28/1).



28

**REMOVING AND INSTALLING, ASSEMBLING AND DISASSEMBLING THE TURBOCHARGER AIR COOLER**

Removing the turbocharger air cooler

Remove the dual-circuit cooling system

Fig. 29

Unscrew the drain screw (29/1) and drain the raw water from the turbocharger air cooler.

29

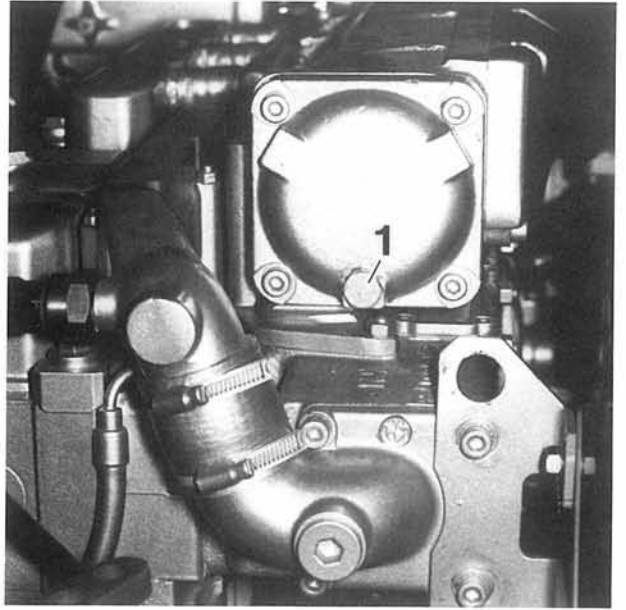


Fig. 30

Unfasten the hose clamps (30/1,2), unscrew the socket head screws (30/3) and withdraw the inlet stand-pipe (30/4) from the turbocharger. Close the turbocharger inlet with clean blanking plug or similar.

30

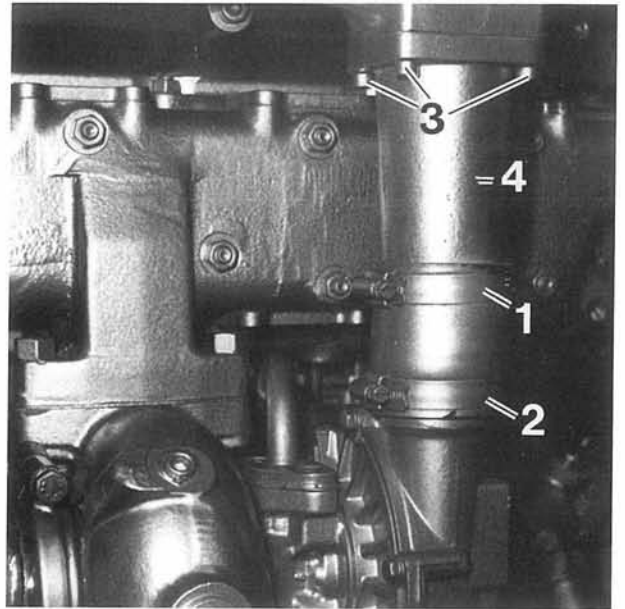


Fig. 31

Unscrew the pressure line (31/1) from the turbocharger air cooler. Unscrew the nuts (31/2) and remove the nuts and washers from the bolts.

31

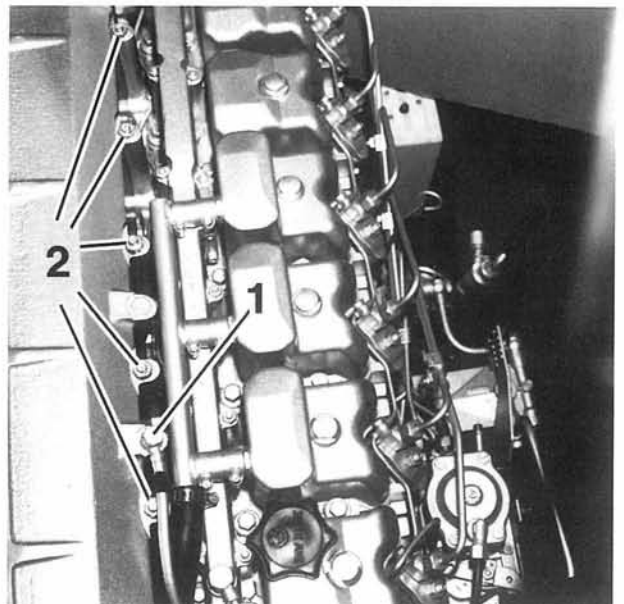
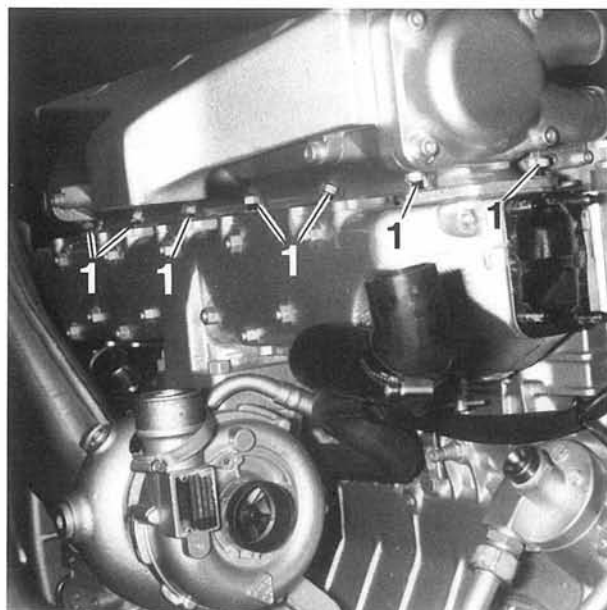


Fig. 32

Unscrew the seven nuts (32/1) on the turbocharger air cooler flange and remove the nuts and washers. Remove the turbocharger air cooler from the exhaust manifold.

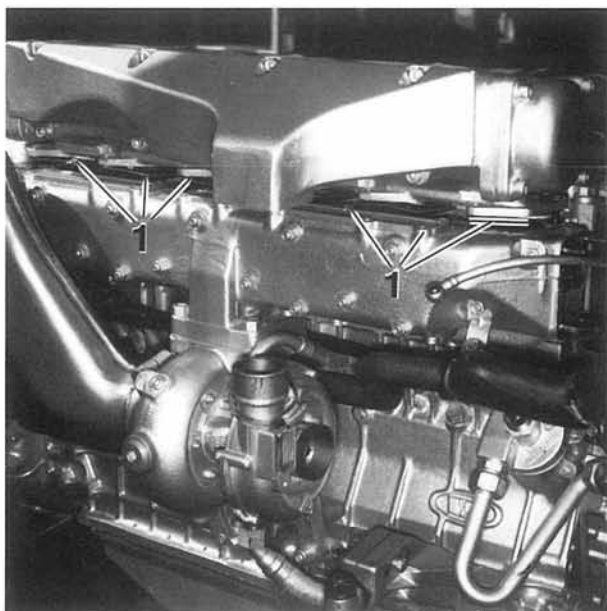


32

Installing the turbocharger air cooler

Fig. 33

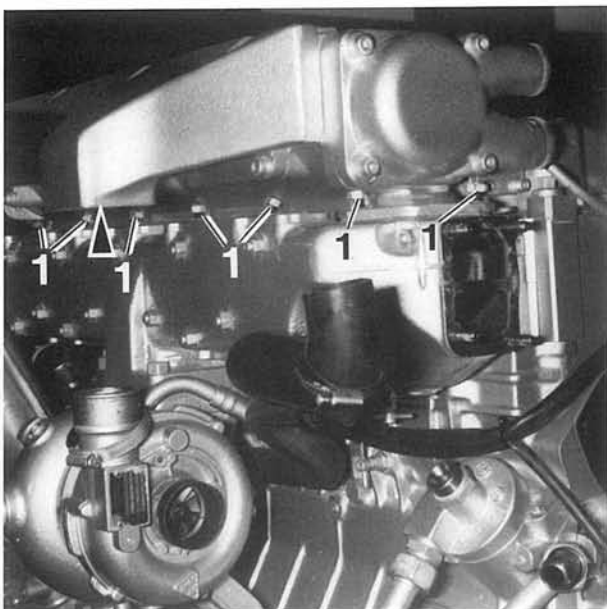
Clean any gasket remnants from the turbocharger air cooler and exhaust manifold sealing surfaces. Place a new gasket (33/1) onto the exhaust manifold and locate the air cooler on the exhaust manifold.



33

Fig. 34

Lift the air cooler a small amount (see arrow), fit the seven nuts (34/1) and spring washers to the bolts and screw on a few turns.



34

Fig. 35

Fit the five nuts (35/1) and spring washers to the bolts. Tightening the nuts (35/1) and (34/1) evenly in pairs, secure the turbocharger air cooler. Connect the pressure line (35/2) to the air cooler.

35

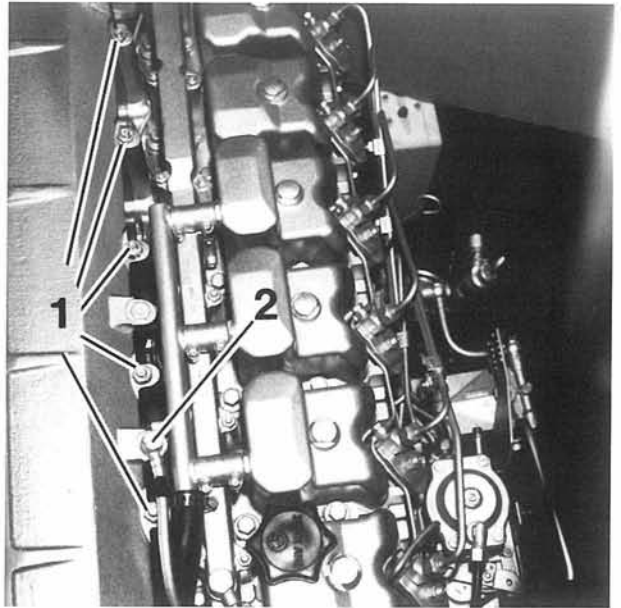


Fig. 36

Remove the blanking plug from the compressor inlet. Hang a hose clamp (36/1) over the compressor inlet and push the inlet standpipe (36/2) rubber connector (36/3) over the inlet. Push the hose clamp (36/1) over the connector and tighten.

36

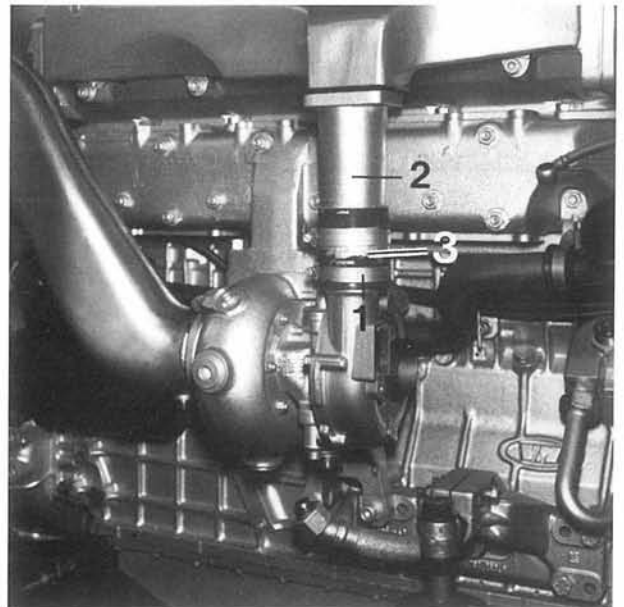
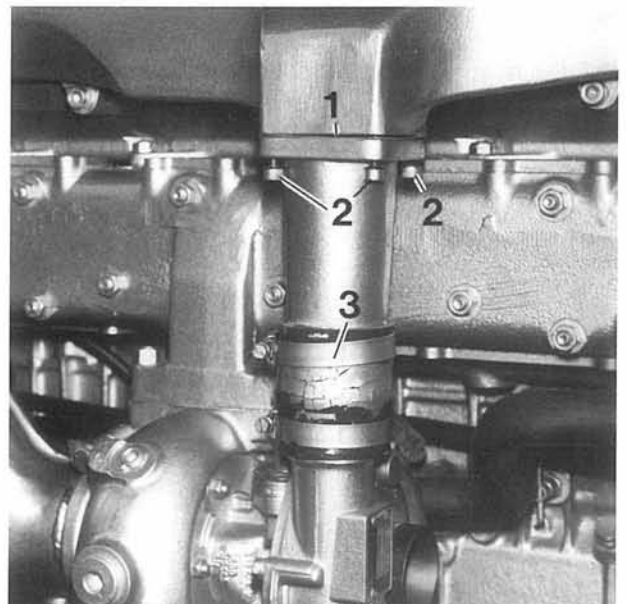


Fig. 37

Place a new gasket (37/1) between the inlet standpipe flange and the inlet manifold. With four socket head screws (37/2) tighten down the inlet standpipe. Use a spring washer for each of the socket screws. Tighten the hose clamp (37/3).

Install the dual-circuit cooling system.

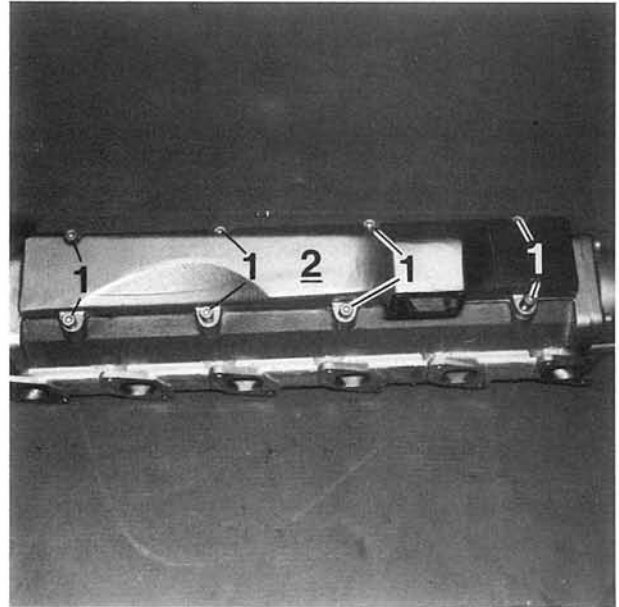
37



Dismantling the turbocharger air cooler

Fig. 38

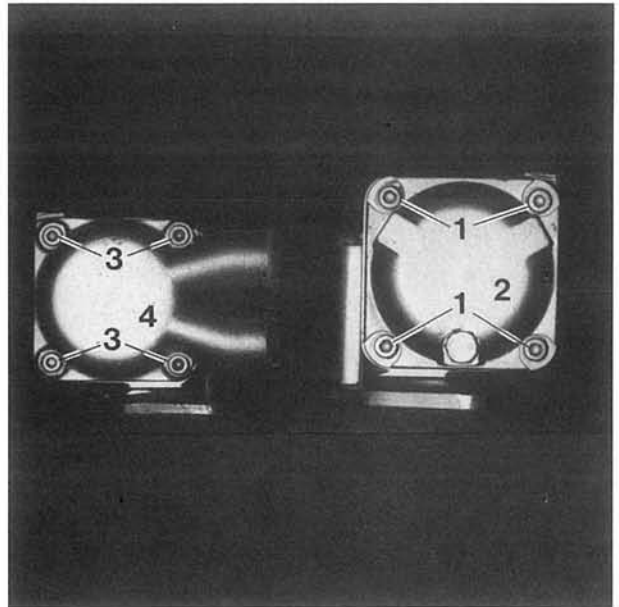
Remove the eight socket head screws (38/1) and remove the inlet manifold (38/2) from the air cooler.  
Note: If necessary loosen the inlet manifold by tapping lightly with a soft hammer.



38

Fig. 39

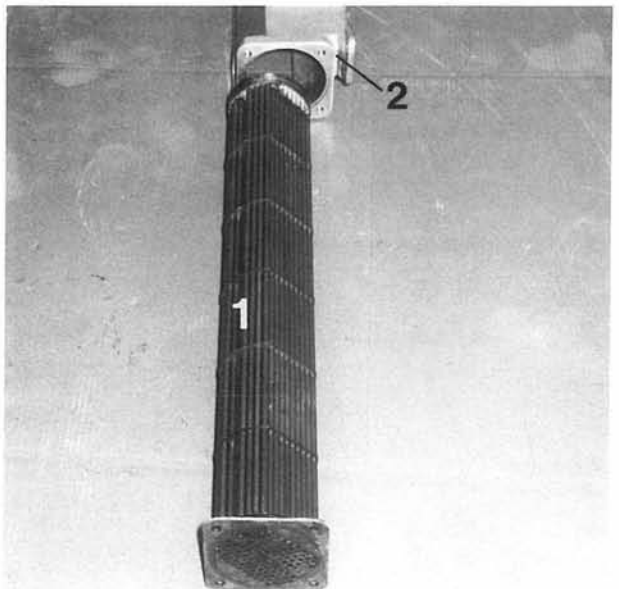
Unscrew the four socket head screws (39/1) and take the rear cover (39/2), distance plate and two O-rings from the air cooler. Unscrew the four socket head screws (39/3) and remove the front cover from the air cooler.



39

Fig. 40

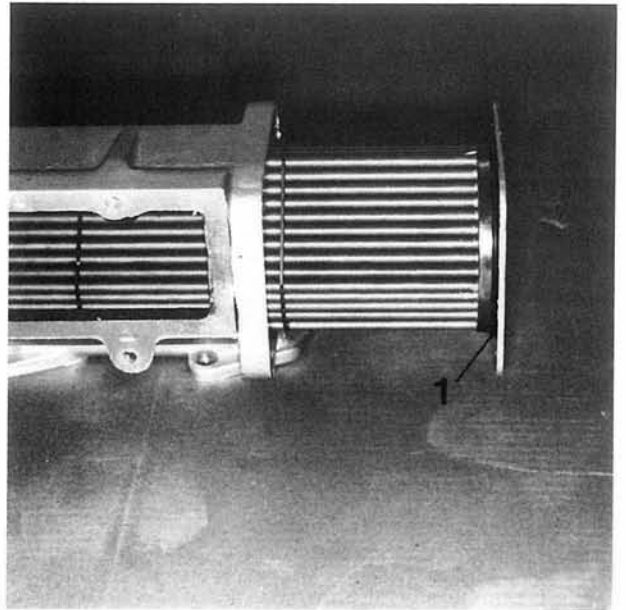
Pull the heat exchanger (40/1) forwards from the air cooler housing (40/2). Carefully clean the heat exchanger and the air cooler housing.  
Assembling the turbocharger air cooler



40

Fig. 41

Push on from the rear new O-ring onto the heat exchanger and push the heat exchanger into the air cooler from the front.

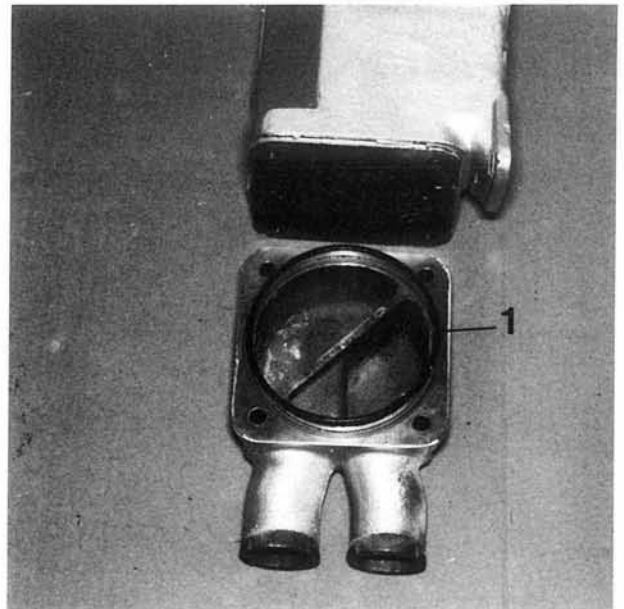


41

Fig. 42

Fit a new O-ring (42/1) to the front cover, coat the sealing surfaces with liquid sealing compound and screw the cover to the air cooler with the four socket head screws.

Note: The water connections must point in the opposite direction to the inlet manifold flange.

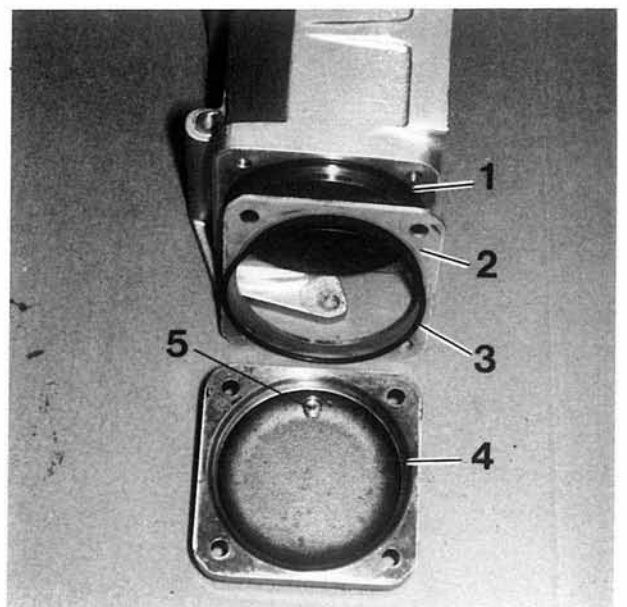


42

Fig. 43

Push a new O-ring (43/1) from the rear onto the heat exchanger, replace the distance plate (43/2), push on the second O-ring (43/3), coat the sealing surfaces with liquid sealing compound and screw the rear cover (43/4) to the air cooler with the four socket head screws.

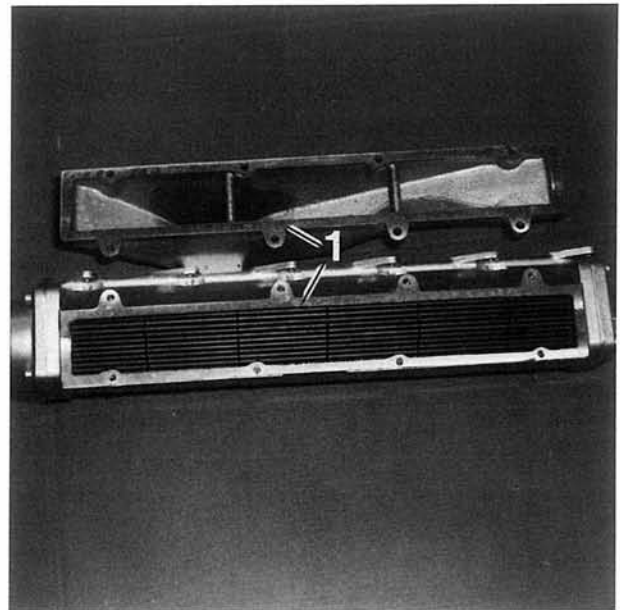
Note: The drain plug must point downwards (43/5).



43

Fig. 44

Clean any gasket remnants from the turbocharger air cooler and inlet manifold sealing surfaces (44/1). Coat the sealing with Loctite 510, place the inlet manifold onto the air cooler and tighten with the eight socket head screws. Each screw should be fitted with a washer.



44

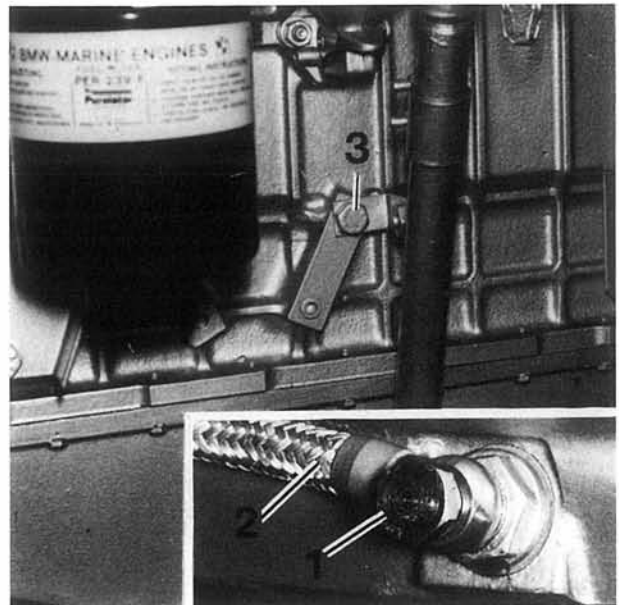
### Removing and installing the oil scavenge pump

Removing the oil scavenge pump

Pump out oil

Fig. 45

Unscrew the connector (45/1) and the flexible line (45/2) from the oil pan and remove. Unscrew the hexagon screw (45/3) and remove the scavenge pump and support from the engine. Installation is carried out in the reverse order. Re-fill with oil.



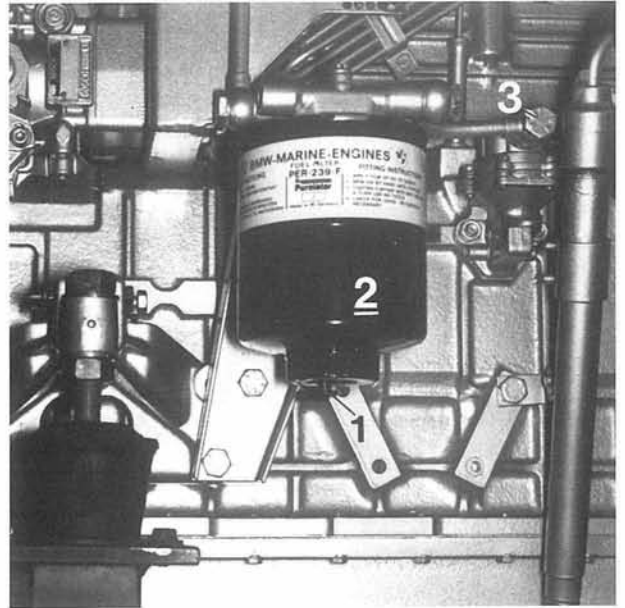
45

Removing and Installing Fuel Filter and Support

Removing the fuel filter and support

Fig. 46

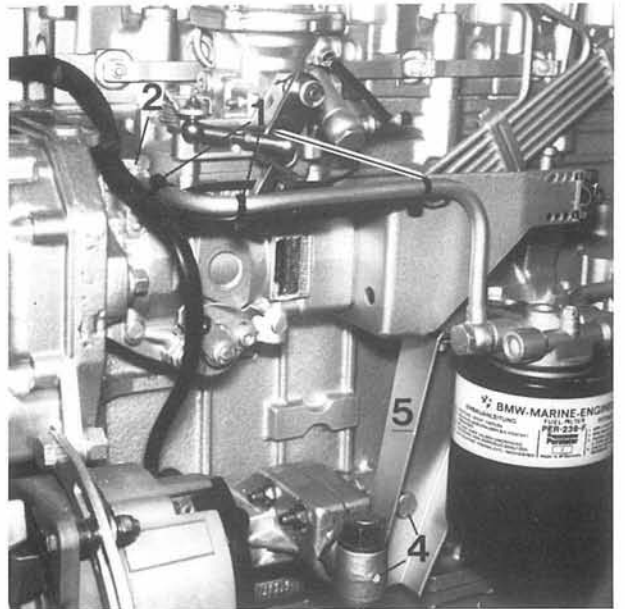
Place a container in position and drain the fuel from the filter (46/2) by pressing the water bleed valve (46/1). Unscrew the connector (46/3) from the fuel pump.



46

Fig. 47

Cut the cable clamps (47/1), unscrew the connector (47/2) on the injection pump, unscrew the two hexagon screws (47/4) and remove the fuel filter complete with support from the engine.



47

Installing the fuel filter

Fig. 48

Place the fuel filter and support onto the engine and loosely hold with the hexagon screws. (48/1)



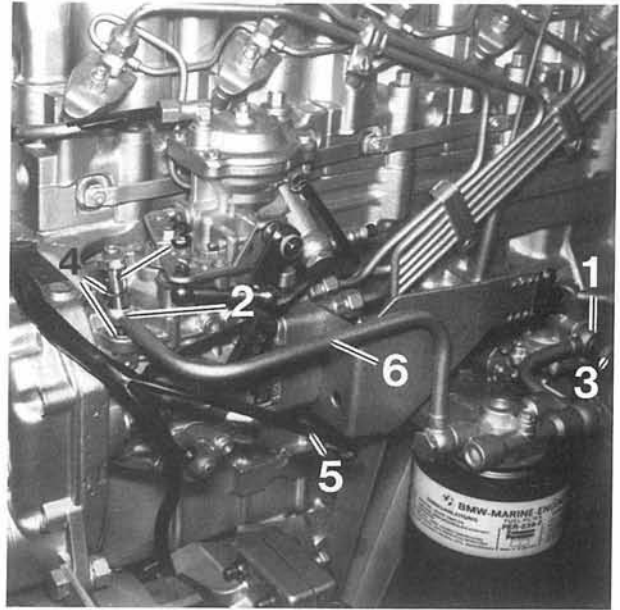
48



Fig. 49

Locate the fuel lines on the fuel pump (49/1) and the injection pump (49/2). Tighten with a connector (49/3). Each connector must be fitted with two sealing rings (49/4) on both sides of the line connection. Tighten the two hexagon screws (49/1) on the support. Attach the electric cables (49/5) with cable clamps to the fuel line (49/6).

Note: Bleed the fuel system after installing the filter and after changing the filter cartridge.



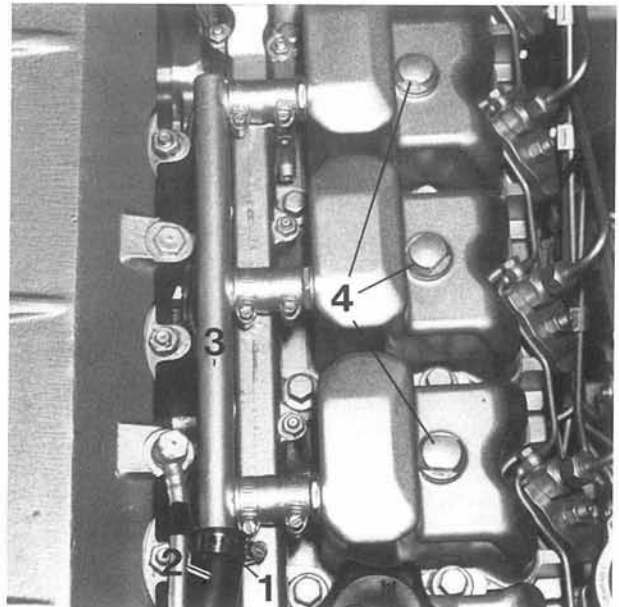
49

## REMOVING AND INSTALLING THE VALVE COVERS

### Removing the valve covers

Fig. 50

Unfasten the hose clamp (50/1) and withdraw the crankcase breather (50/2) from the manifold (50/3). Unfasten the attaching screws (50/4) and remove the valve covers from 2,3 and 4 cylinders together with the manifold.



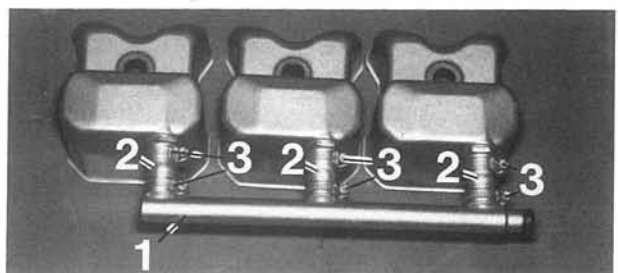
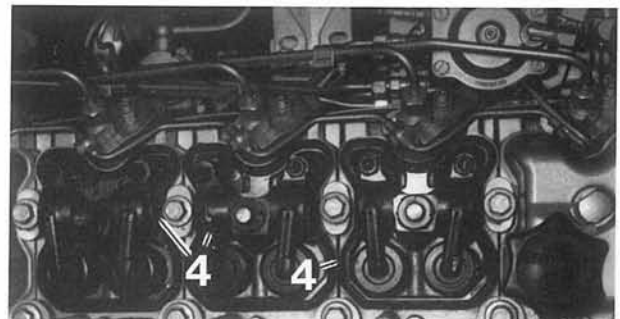
50

### Installing the valve covers

Fig. 51

Push the manifold (51/1) with hose standpipe (51/2) onto the valve cover and tighten the hose clamp (51/3). Put a new gasket (51/4) onto the cylinder head and replace the valve cover.

Note: Take care when installing the manifold that the opening points forward.

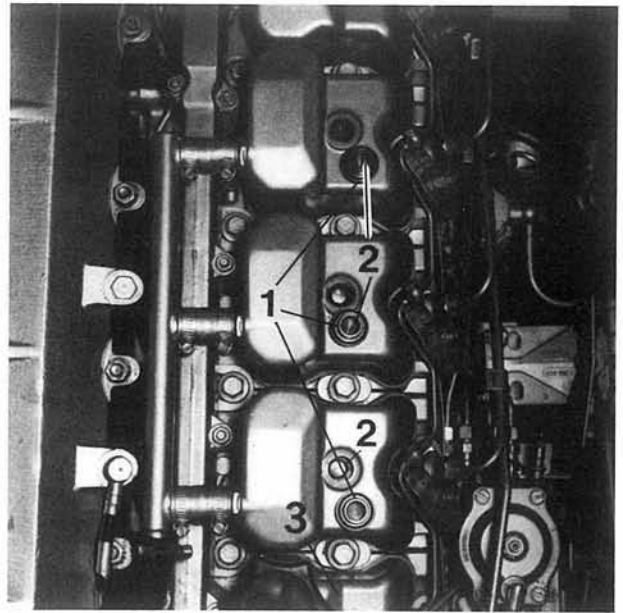


51

Fig. 52

Put a new O-ring onto the attachment screw (52/1) and tighten down the cover. Re-connect the crankcase breather.

Note: The valve cover with the oil filler cap (52/3) must be mounted on cylinder number one. Before installing the covers for 2,3 and 4 cylinders, always install the manifold first.



52

**TECHNICAL DATA****Engine**

Design	In-line, upright
Principle	—
Strokes	4
Operation	Diesel operation with indirect injection and air cooled turbocharging.
No. of cylinders	6
Displacement	3590 cm <sup>3</sup>
Stroke	90 mm
Bore	92 mm
Compression ratio	21:1
Power to DIN 6270B KW/PS	121/165 at 3800 rpm
Max.torque	350 Nm at 2750 rpm
Firing order	1,5,3,6,2,4
Lubrication by:	Gear ring pump
Max. oil temperature	100 °C (176 °F)
Oil temperature briefly	110 °C (230 °F)
Cooling system	Dual circuit, freshwater/sea water pump
Coolant temperature	80 - 85 °C (176 - 185 °F)
Engine weight (dry)	381 kg
Filling capacities	
Oil	
Engine total	10 Liter
Drain oil from oil pan	8 Liter
Drain oil from filter	1 Liter
Drain oil from oil cooler	1 Liter
Coolant (freshwater to antifreeze, 1:1)	12 Liter
Max. axial installation angle	15 °





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