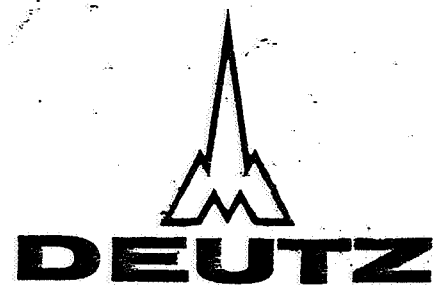


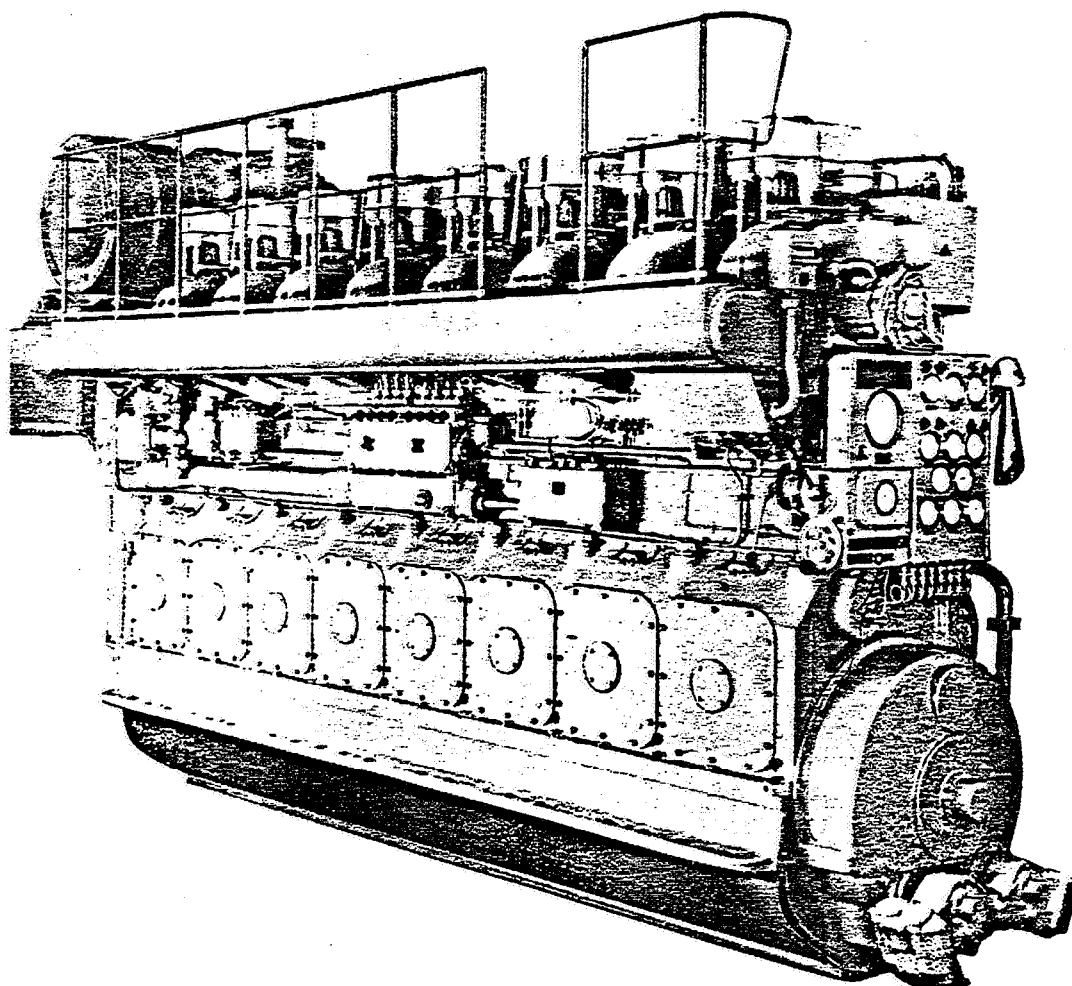
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# INSTRUCTION MANUAL



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## R/S/BV6/8M 358



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### H 0123-1 E

6th Edition  
Volume I



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## 1. GENERAL PARTICULARS



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## 1. Description of Engine

### 1.1 Design

#### 1.1.1 General Layout

The engine is a single-acting, turbocharged, water-cooled, four-stroke, trunk piston type with either six or eight cylinders arranged in-line. The engine can be furnished in a left-hand or right-hand version to suit the prevailing installation conditions. ( When viewing towards the operating side, the flywheel is on the left for a left-hand engine and on the right for a right-hand engine ).

#### 1.1.2 Direction of Rotation

The engine can be furnished for counter-clockwise running, or for clockwise running, or for direct reversing.

A clockwise running engine is one whose flywheel revolves clockwise when the unit is viewed towards the timing case.

The opposite direction of rotation applies in the case of a counter-clockwise running unit.

In the case of reversible engines the nominal direction of rotation is the one which applies while running ahead.

#### 1.1.3 Bedplate and Crankcase

The grey iron bedplate carries the crankshaft bearings and is connected to the crankcase by tie rods extending from the centre of the crankcase to below the main bearings.

The renewable, wet cylinder liners are inserted into the crankcase from the top. Each of the individual grey iron cylinders heads is attached to the crankcase by eight waisted anti-fatigue studs.

#### 1.1.4 Crankshaft and Related Parts

The crankshaft is forged from open hearth steel and is supported in the bedplate by a main bearing adjacent to each throw ; locating bearing rings associated with the second main bearing from the flywheel end provide control of end float. The running surfaces of the main journals and crankpins are hard-chromed. The flangeless split main and big-end bearing shells are surfaced with a thin lead-bronze layer and a running-in layer of tin or lead-tin.

The connecting rods also are forged from open hearth steel . The big-end caps are attached by four anti-fatigue bolts.

#### 1.1.5 Camshaft

The camshaft is carried in a trough cast integral with the top of the crankcase.

On reversible engines the camshaft is shifted endwise hydro-pneumatically.

#### 1.1.6 Timing Gears

In the timing case at the flywheel end is the drive for the camshaft, injection pump, governor and centrifugal cooling water pump.



### 1.1.7 Starting System

The engine is started by compressed air via pneumatically controlled starting valves in the cylinder heads.

### 1.1.8 Injection System

The direct injection principle is employed. The system features a DEUTZ injection pump with helical-control ports, and multi-hole injectors in the cylinder heads. The combustion chamber is designed as a shallow cavity in the piston crown.

### 1.1.9 Governing System

Engine speed is controlled by a variable-speed governor acting on the control rod of the injection pump to control the volume of fuel injected.

### 1.1.10 Lubrication System

Apart from the regular circulatory lubrication system, the engine is equipped with an individual lubricator supplying fresh oil to the cylinders and, depending on the particular model, certain auxiliaries also.

### 1.1.11 Cooling System

Whereas boost air is cooled in an engine-mounted charge air cooler, both lube oil and closed-circuit water are cooled by raw water in separate heat exchangers.



## 1.2 Designation Details

### 1.2.1 Model Designation

The following models of the series 358 engines are available :

BVM - SBVM - RBVM 358

where the letter "B" refers to Büchi ( turbocharging principle ), "V" to Viertakt ( four-stroke , high-rated ), "M" to water-cooled version, "S" to Schiff ( marine, uni-directional ), "R" to reversible ( marine, reversible ), where the figure "3" is the design index and digits 58 indicate a piston stroke of 580 mm. In other words, the BVM is a stationary version and the SBVM and RBVM are marine versions of the 358 engine.

The figure between the letters "V" and "M" ( e.g. RBV6M 538 ) indicates the number of cylinders provided.

### 1.2.2 Definitions of Sides and Ends

Operating side : Engine side mounting governor and injection pump

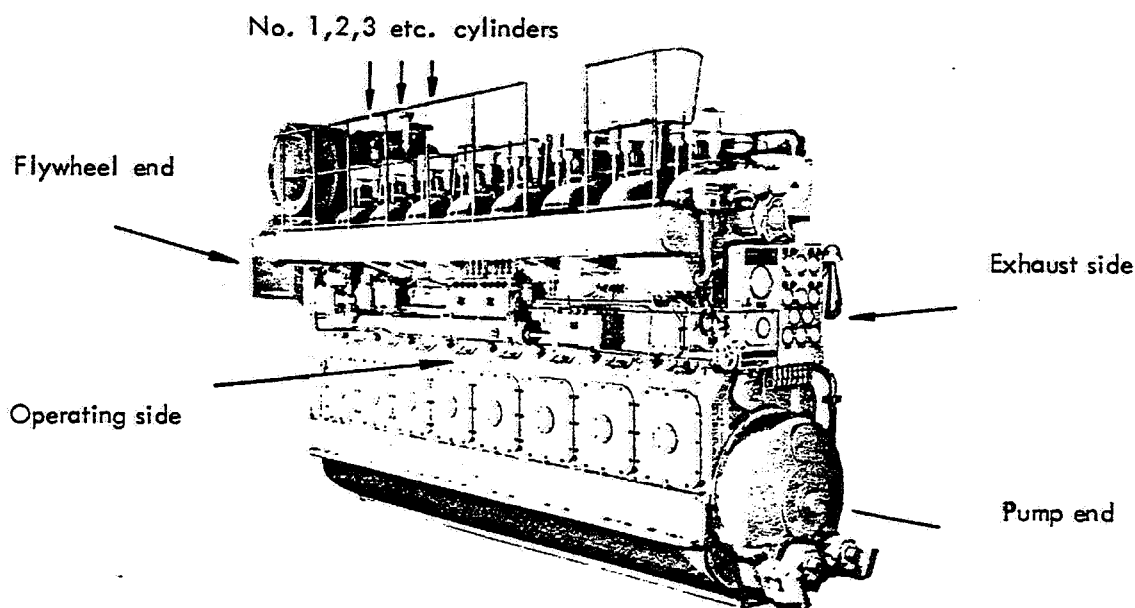
Exhaust side : Engine side mounting exhaust manifold

Flywheel end : Engine end mounting flywheel and timing chest ( gear train )

Pump end : Engine end mounting lube oil pump and vibration damper

### 1.2.3 Numbering of Cylinders

The cylinders are consecutively numbered from the flywheel end.

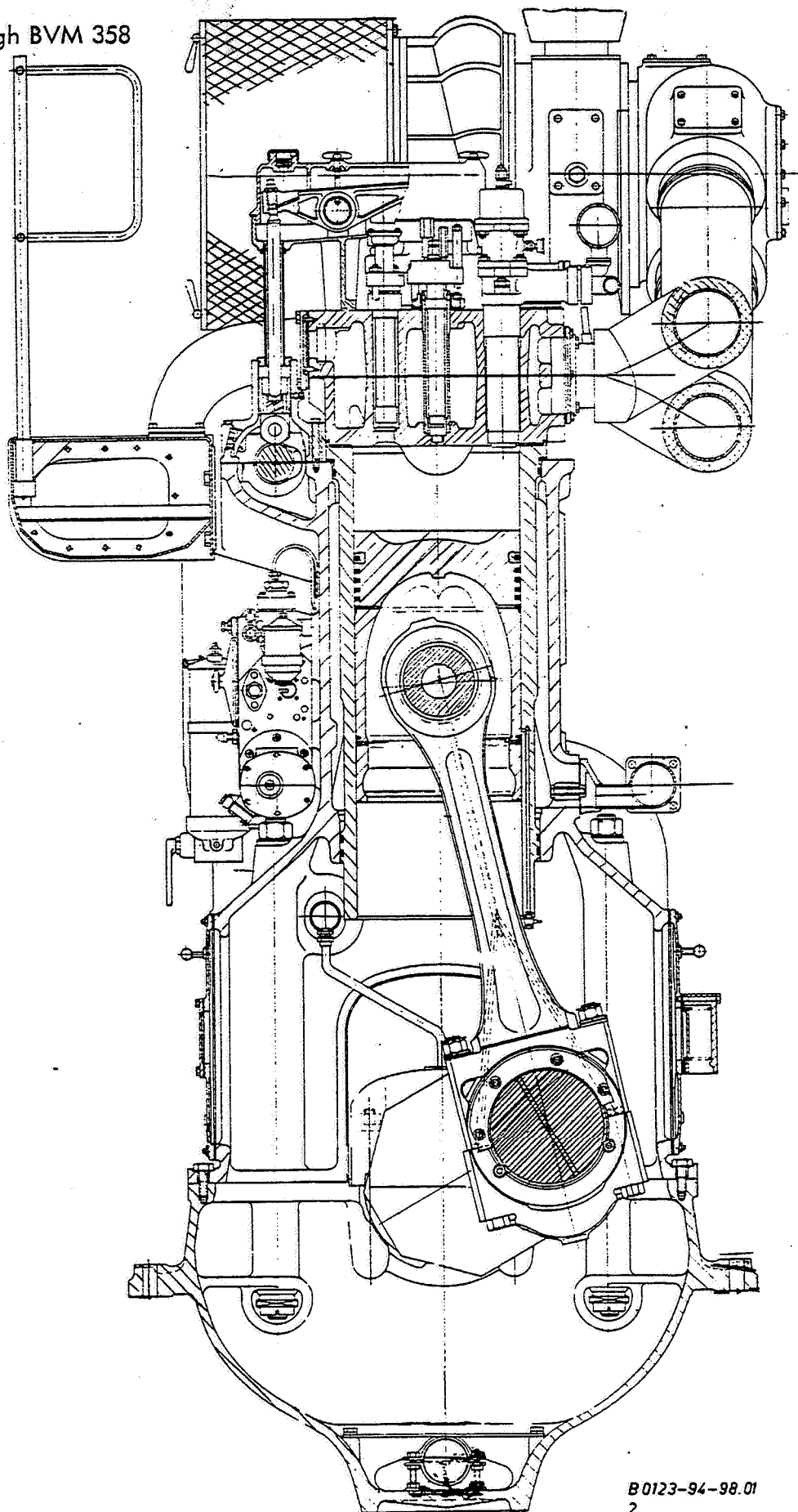




1.2.4 SECTIONS THROUGH ENGINE



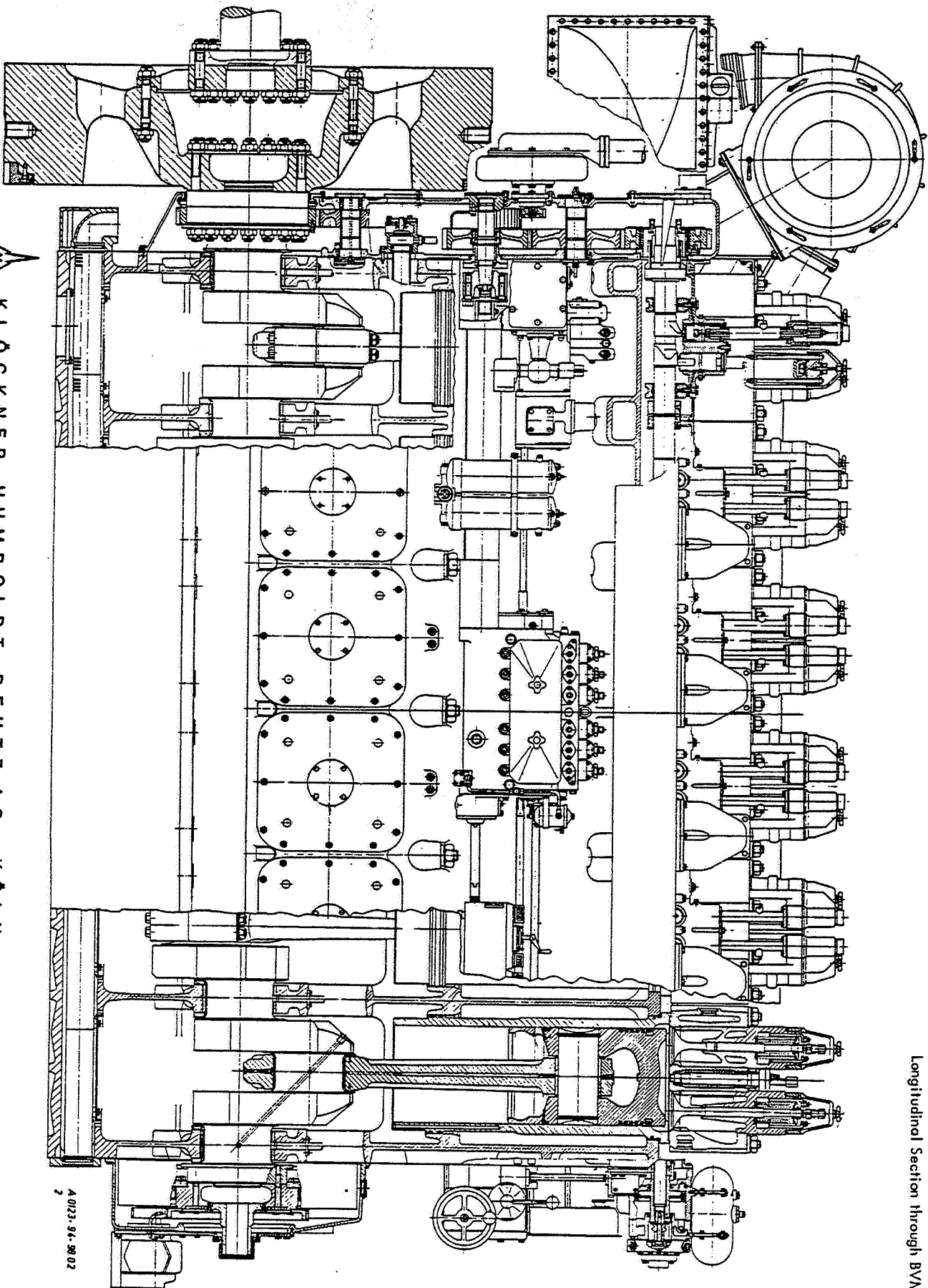
Cross Section through BVM 358



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Longitudinal Section through BVM 358



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1.3 Specification Data1.3.1 Principal Data

Power output and speed ( see Acceptance Certificate )

Bore	400 mm ( 15-3/4 in. )
Stroke	580 mm ( 22-3/4 in. )
Piston displacement per cylinder	72.9 Litres
for 6 cylinders	437.4 Litres
for 8 cylinders	583.2 Litres
Compression ratio	12 : 1

1.3.2 Firing Order

(a) 6-cyl. engine, clockwise running	1-2-4-6-5-3
(b) " " " , counter-clockwise running	1-3-5-6-4-2
(c) 8-cyl. engine, clockwise running	1-3-5-7-8-6-4-2
(d) " " " , counter-clockwise running	1-2-4-6-8-7-5-3

1.3.3 Valve Timing

( in degrees of crank angle )

Exhaust valve opens	b. BDC
Exhaust valve closes	a. TDC
Inlet valve opens	b. TDC
Inlet valve closes	a. BDC

6-cyl.	8-cyl.
45°	45°
55°	75°
80°	75°
40°	40°

1.3.4 Fuel System Data

Opening pressure of injectors  
 Max. fuel viscosity for injection  
 Fuel pressure, before injection pump  
                     before filter

350 kp/cm<sup>2</sup>  
 1.75° E  
 1.8 - 2.5 kp/cm<sup>2</sup>  
 3.5 kp/cm<sup>2</sup>

( connection for separate pumps )

Inlet temperature of injector coolant :

(a) water	60 ± 5° C
(b) gas oil	45 ± 5° C

Admissible deviation from mean value of cylinders

(a) ignition pressures	± 3 kp/cm <sup>2</sup>
(b) exhaust temperatures	± 20° C

Sealing oil pressure in injection pump

3,0 - 5 kp/cm<sup>2</sup>

**1.3.5 Charge Air Cooler Data**

Charge air temperature :

- (a) recommended at engine inlet  
 (b) maximum at cooler outlet ( full load )  
 ( only temporarily )

$45 \pm 5^{\circ} \text{C}$   
 see Acceptance Record

**1.3.6 Injector Data ( see also Groups 0119 and 0149 )**

Tests on the conical-seat injectors with the special testing outfit provided should give the following results :

1. At  $20 \text{ kp/cm}^2$  below opening pressure applied during a period of 1 minute, there should be no dribbling from the nozzle tip.
2. When operating the pump lever in quick strokes there should be even fuel atomization again without dribbling.

**1.3.7 Lube System Data**

Oil pressure :

- (a) behind filter at rated speed ( engine warm )  
 (b) minimum at idling speed, approx.

 $2 - 3 \text{ kp/cm}^2$  $1.0 \text{ kp/cm}^2$ 

Oil temperature at engine inlet

 $10 - 60^{\circ} \text{C}$ **1.3.8 Cylinder Lubricator Setting Data ( see also Group 0114 )**

Delivery per outlet at 20 crank revolutions :

Cylinder

 $4.5 \text{ cm}^3 (0.27 \text{ in}^3)$ 

Injection pump

 $4.5 \text{ cm}^3 (0.27 \text{ in}^3)$ 

The transmission ratio of the lubricator drive should be set with eccentric ( Assembly 0114 ) so as to give the following values :

Engine speed	Drive shaft speed
300 rev/min	$9 \pm 11.7^{+)} \text{ rev/min}$

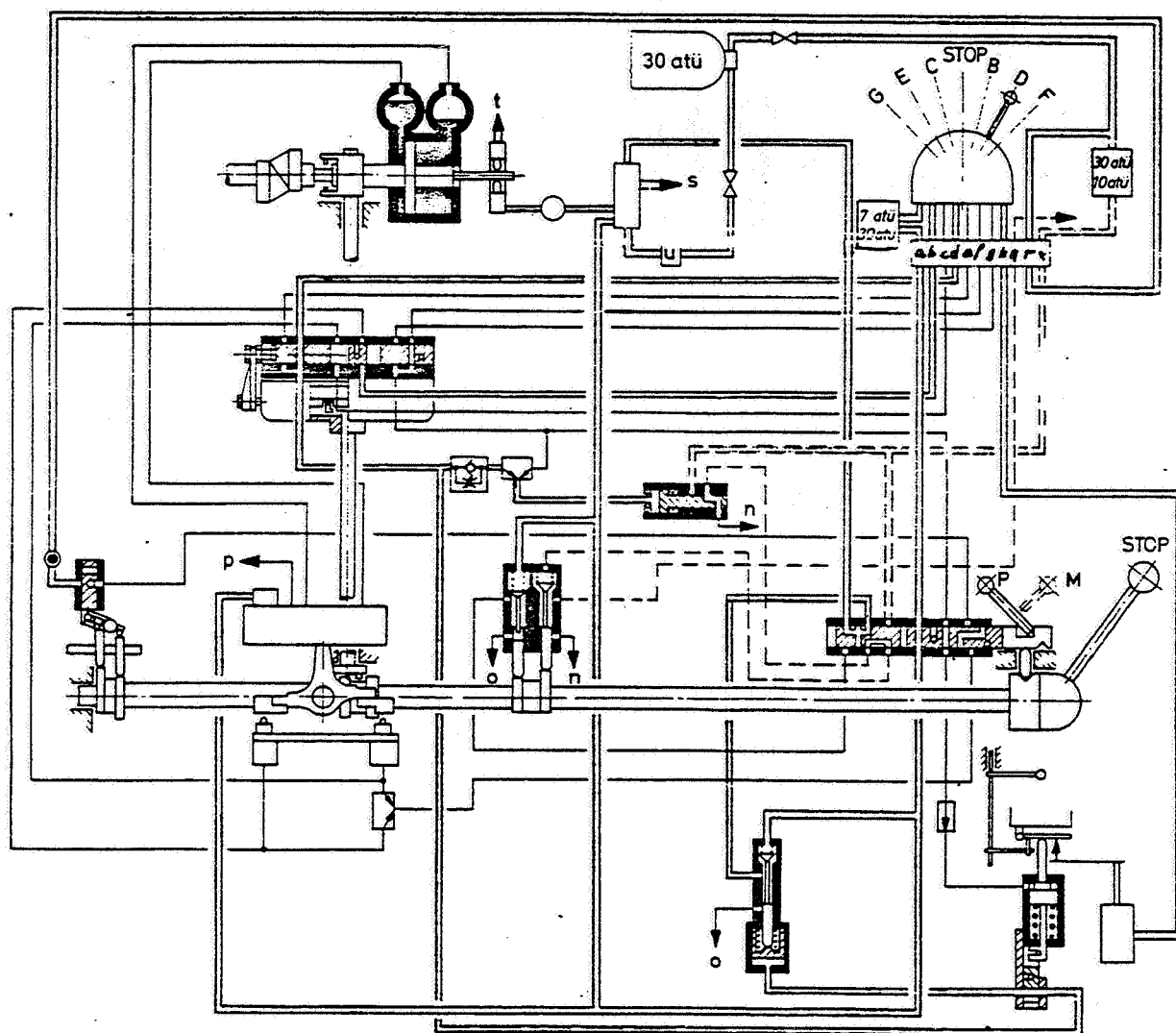
**Fresh Oil Consumption**

in kg/h ( lb/h )

Engine speed	6-cyl.	8-cyl.
300 rev/min	1.45 1.89 <sup>+) )</sup> (3.2 4.2)	1.95 2.54 <sup>+) )</sup> (4.3 5.6)







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### 5.3 Checking the Exhaust Temperature

At constant engine operating conditions as specified under 5.1 the exhaust temperatures of the various cylinders, which are a direct function of the volume of the fuel injected, must not depart from their mean value by the tolerance specified under 1.3.4.

Balancing of the exhaust temperatures was made at the works by setting the individual plunger control pins on the pump control rod. If adjustment is necessary, proceed as follows :

Release hex. bolt 366 of the eccentrically fitted respective control pin 462 by spanner ( 0159-39 ) sufficiently enough for the pin to be turned through the amount required. When adjustment is completed, be sure to retighten the nut.

The adjusting effects are as follows :

LH engine :      clockwise turning increases fuel volume  
                    anti-clockwise turning decreases fuel volume

RH engine :      clockwise turning decreases fuel volume  
                    anti-clockwise turning increases fuel volume

Make sure in particular that the upper tolerance limit is not exceeded.

### 6. Removing and Refitting a Pump Element

When carrying out any work on individual pump elements, be sure to exercise utmost cleanliness.

#### 6.1 Element Removal

Before refitting the element, close its fuel inlet and outlet ports by turning the associated cock 592 clockwise as far as it will go. Disconnect the fuel line. Release 4 hex. nuts 335 by socket spanner ( 0159-3 ), release sealing pack by removing screw 667 and remove element ( see Fig.6 ).

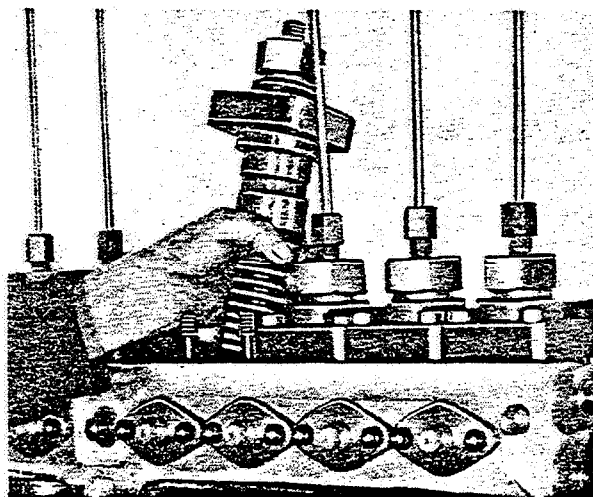


Fig.6 Removed element

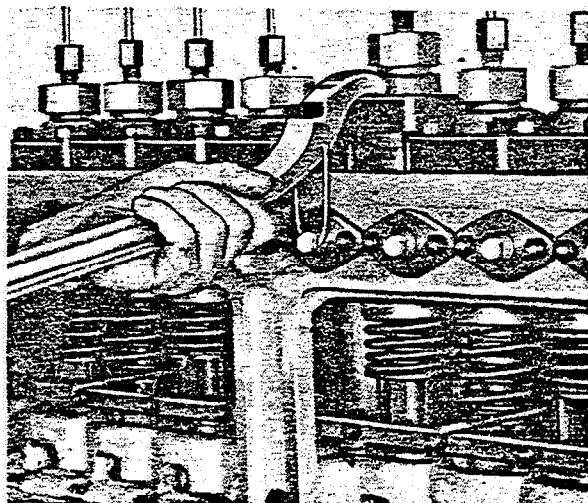


Fig.7 Pressing the element down in position



Refitting the Element Seal1. Measuring Dimensions

- Determine depth "T" of bore in pump top.
- Determine sum of heights h1 to h5.
- Fit shims 6 to ensure that the total height of items 1 to 5 is 0.2 - 0.5 mm smaller than depth "T".

Measuring example :

$$hx = T - (h1 + h2 + h3 + h4 + h5)$$

$$hx = 25.9 - (4 + 4 + 4.5 + 7 + 5)$$

$$hx = 25.9 - 24.5$$

$$hx = 1.4 \text{ mm}$$

After fitting two shims 6, there will be a clearance of  $1.4 - 1.2 = 0.2 \text{ mm}$ , which is within the permissible range of 0.2 - 0.5 mm.

2. Installing the Element Seal

- When fitting the sealing pack, stack the three corrugated washers 3 with corrugations running parallel, which will give an addition of spring forces.
- To install pump element, apply Parker-a-Lube 944 to element sealing surfaces and O-seals.
- Insert element with sealing assembly unloaded and tighten as specified. Tighten screws 667 so clamping pieces 665/666 are seated on the housing.

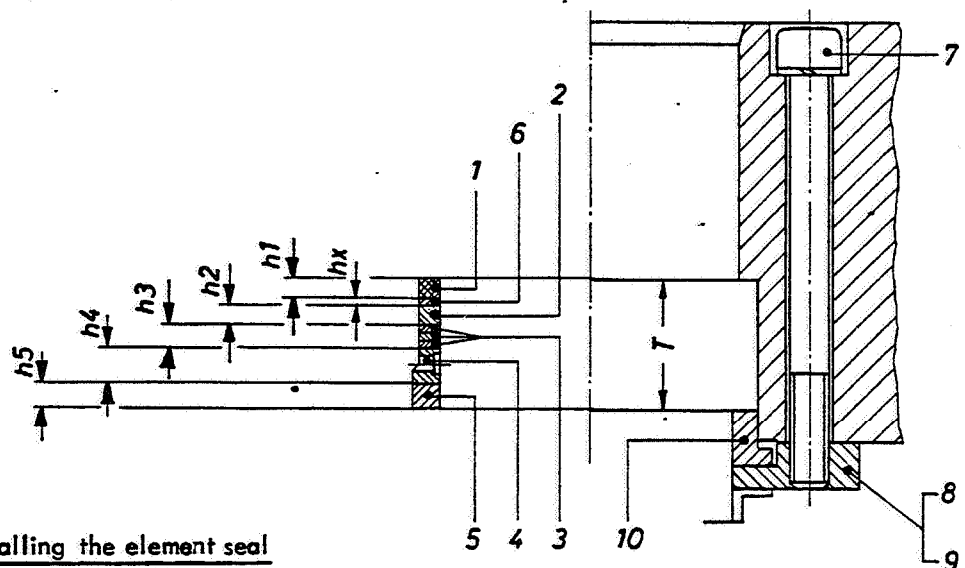


Fig. 8 Installing the element seal

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Following this turn tommy screw ( 0159-29 ) to push pivot pin 328 into the tappet bush until the guide piece abuts in its pilot groove. Make sure that the plug is fitted in the pivot pin ( see Fig. 12 ).

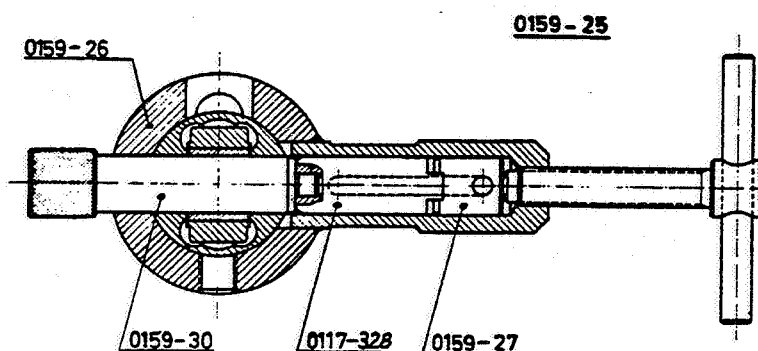


Fig. 12 Refitting the roller pivot pin

#### 9. Removing and Refitting the Camshaft

For removing camshaft, disconnect the pump coupling from its drive shaft and detach the pump from the engine ( see Fig. 13 ).

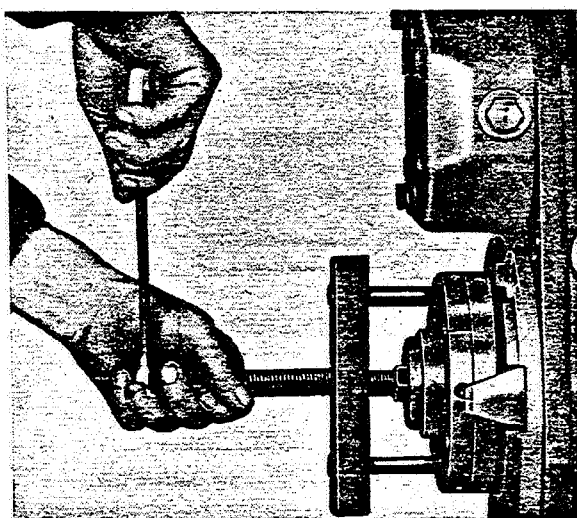


Fig. 14 Pulling off the coupling



In addition, remove lubricating pump 474 and lift off all roller pivot pins 328 with eccentric pins ( 409 ) from the camshaft. Pull off half-coupling from camshaft using device ( 0159-35 ) and remove bearing cap 324 from the injection pump. Finally pull out camshaft toward the injection pump drive side using device ( 0159-17 ) ( see Fig. 14 ).

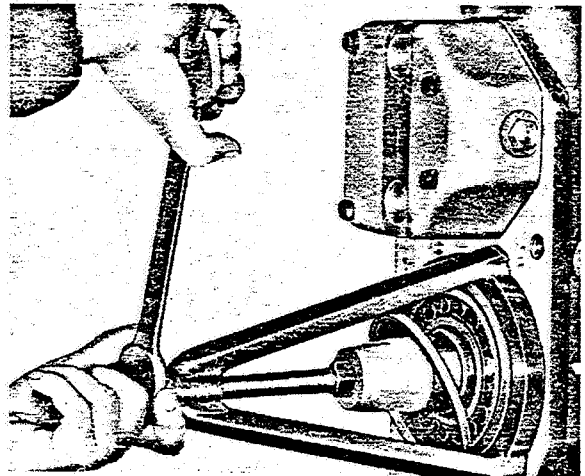


Fig. 15 Removing the camshaft

For refitting the camshaft secure the flange with 4 hex. bolts ( 0159-23 ) to the blunt end of the camshaft and pull the latter into the injection pump housing from the pump drive far end using again device ( 0159-17 ) ( see Fig. 16 ).

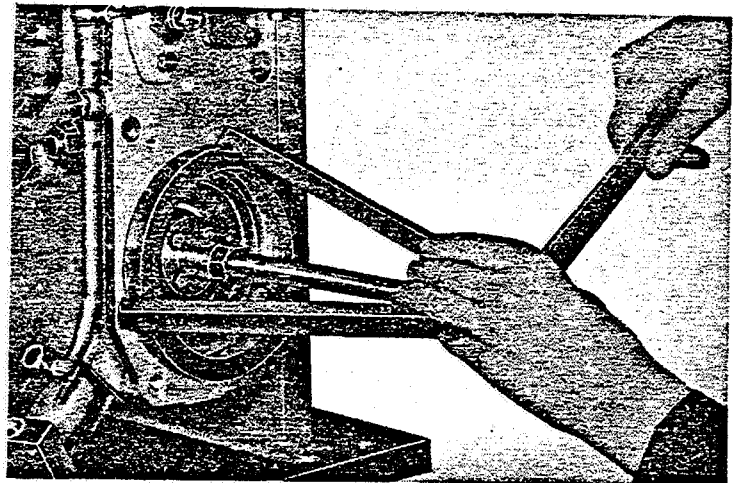


Fig. 16 Refitting the camshaft

Important for engines with separately driven lift pump :

If engines using hydraulic plunger seal in the injection pump are not fitted with a fuel lift pump of the standard engine-mounted type but of a separate type, operation of the latter p r i o r to engine starting is liable to dilute the lube oil with the result that the proper hydraulic seal pressures are not ensured.

Be sure, therefore , to operate such a separate lift pump right before starting the engine.

Note : Orders must quote c o m p l e t e Fig. item Nos. as listed.



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