



# SERVICE MANUAL

TRUCKS

**L 385**

*Export Service Department*

AKTIEBOLAGET

**VOLVO**

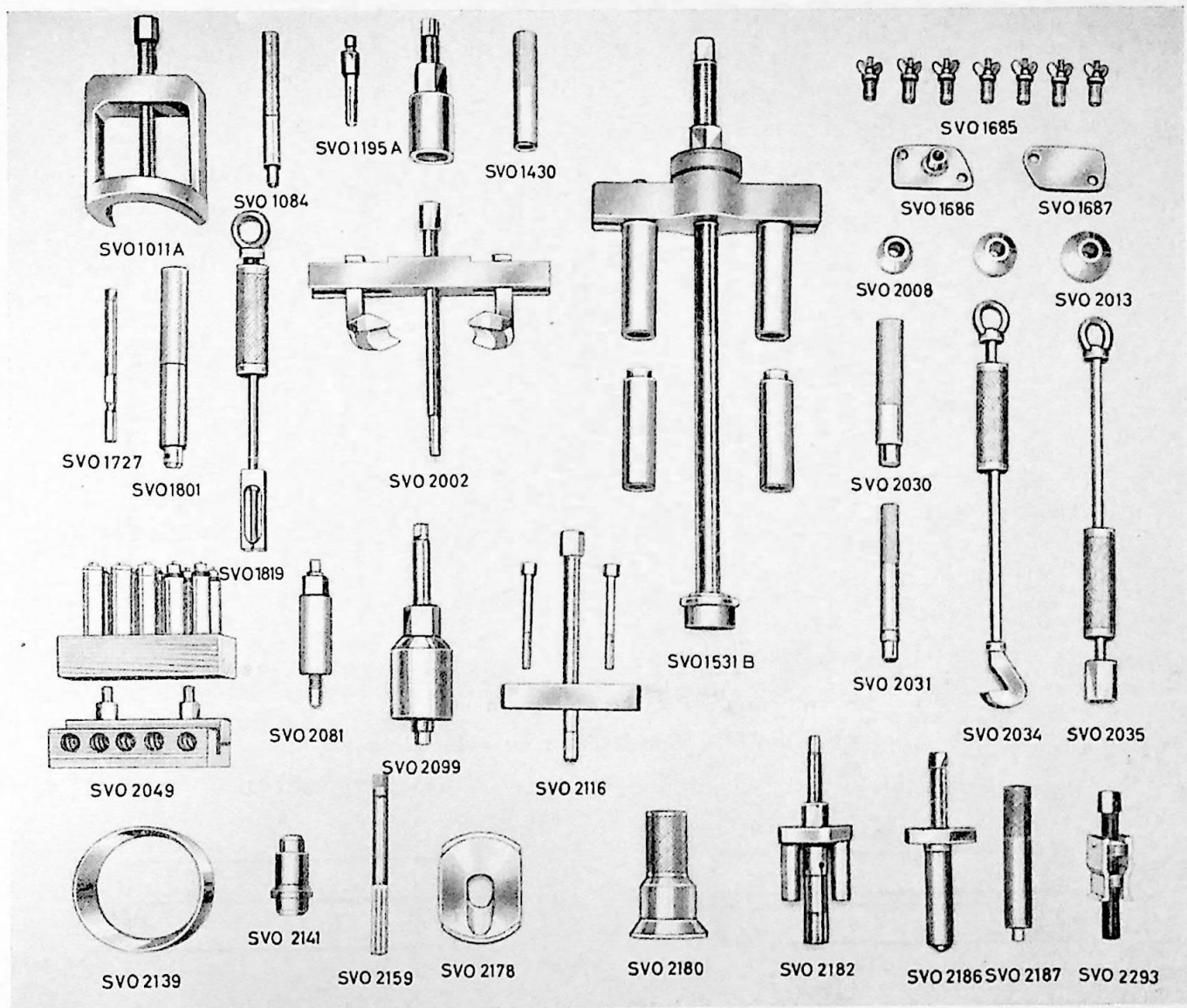
GÖTEBORG, SWEDEN

## TOOLS

The following special tools are required when carrying out repair work on the engine and the water pump. See Figs. 1-144 and 1-145.

### ENGINE

- SVO 1011 A Puller for crankshaft gear.
- SVO 1084 Drift for removing valve guides.
- SVO 1195 A Tool for removing oil relief valve plunger.
- SVO 1356 A Press tool for fitting camshaft gear and fuel injection pump drive gear.
- SVO 1430 Drift for fitting valve guides.
- SVO 1531 B Cylinder liner puller.
- SVO 1685 Expander plugs for pressure testing of cylinder heads.
- SVO 1686 Connector washer for pressure testing of cylinder heads.
- SVO 1687 Seal washer for pressure testing of cylinder heads.
- SVO 1727 Reamer for exhaust valve guides.
- SVO 1801 Standard handle 18 x 200 mm (3/4"x8").
- SVO 1819 Puller for flywheel pilot bearing.
- SVO 2002 Puller for pulley (SVO 1180 can be used).
- SVO 2008 Drift for fitting bushings in connecting rods.
- SVO 2009 Drift for fitting piston pins.
- SVO 2013 Drift for fitting pilot bearing in flywheel.
- SVO 2030 Drift for fitting bushings in rocker arms.
- SVO 2031 Drift for fitting bushing in oil relief valve.
- SVO 2034 Puller for thermostat (SVO 1235 can be used).
- SVO 2035 Puller for injectors.
- SVO 2049 Flanging tools for copper piping; 3/16", 1/4", 5/16", 3/8" and 10 mm.
- SVO 2081 Tool for removing bushing from oil relief valve (SVO 1190 A can be used).
- SVO 2099 Press tool for crankshaft gear and vibration damper.



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Fig. 1-144. Special tools for engine.

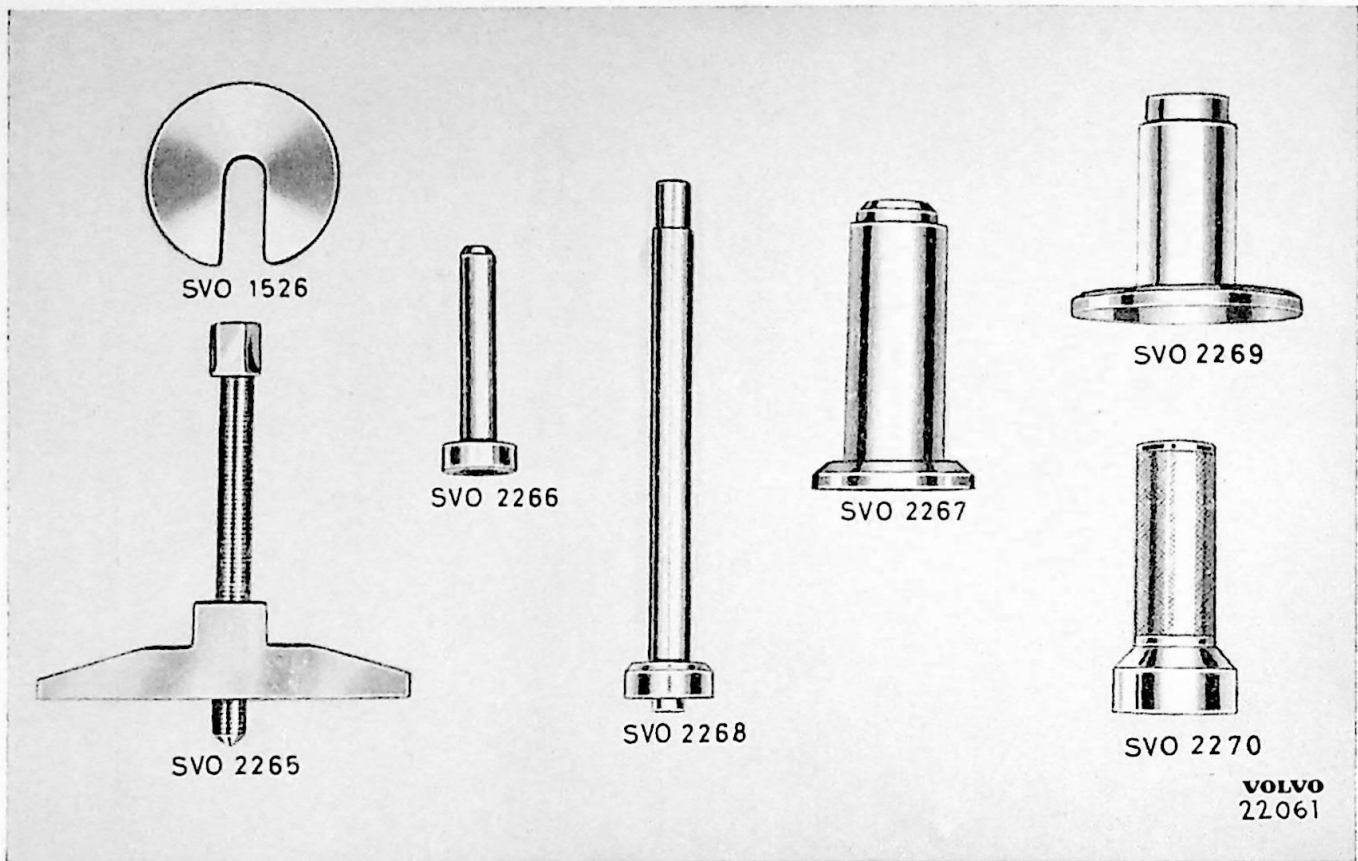
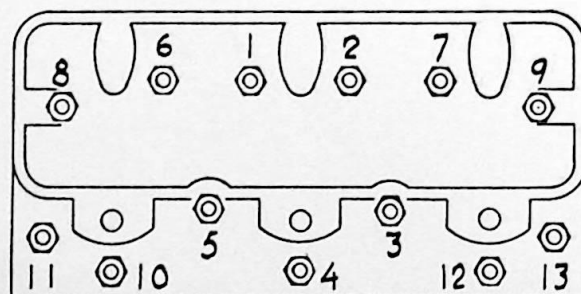


Fig. 1—145. Special tools for water pump.



Fig. 1—146. Sketch showing valve seats and valve seat positions.



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Fig. 1—147. Scheme for lightening of cylinder head nuts.

- SVO 2116 Puller for camshaft gear and fuel injection pump drive gear.
- SVO 2139 Piston fitting tool.
- SVO 2159 Broach for reaming oil relief valve.
- SVO 2178 Puller plate for cylinder liner puller SVO 1531 B.
- SVO 2180 Drift for alignment of auxiliary gear casing and fitting of seal ring.
- SVO 2182 Puller for copper sleeves.
- SVO 2186 Flanging tool for copper sleeves.
- SVO 2187 Drift for copper sleeves.

#### WATER PUMP

- SVO 1526 Press plate, for removing ball bearing.
- SVO 2265 Puller for pulley.
- SVO 2266 Press plate for removing pulley.
- SVO 2267 Drift for removing and fitting ball bearing in pulley.
- SVO 2268 Drift for removing and fitting ball bearing, shaft, seal.
- SVO 2269 Fixture for fitting ball bearing.
- SVO 2270 Drift for fitting seal.

## SPECIFICATIONS

### GENERAL INFORMATION

|   |                                    |
|---|------------------------------------|
| Type designation .....                        | D 67 A                             |
| Output at 2400 r.p.m. ....                    | 115 b.h.p.                         |
| Max. torque at 1200 r.p.m. ....               | 40 kgm (289 lb.ft.)                |
| Numbers of cylinders .....                    | 6                                  |
| Bore .....                                    | 104.77 mm (4.125")                 |
| Stroke .....                                  | 130 mm (5.118")                    |
| Displacement .....                            | 6.73 liters (410 cu.in.)           |
| Compression ratio .....                       | 17:1                               |
| Compression pressure at 200 r.p.m. ....       | 28 kg/cm <sup>2</sup> (398 p.s.i.) |
| Order of firing .....                         | 1-5-3-6-2-4                        |
| Max. engine speed, unloaded engine .....      | 2500 r.p.m.                        |
| Idling speed .....                            | 400-450 r.p.m.                     |
| Weight, complete engine (including oil) ..... | about 650 kg (1433 lb.)            |

### CYLINDER LINERS

Replaceable, wet-type cylinder liners

|                                     |                    |
|-------------------------------------|--------------------|
| Bore (no oversizes available) ..... | 104.77 mm (4.125") |
| Cylinder liner seals (rubber):      |                    |
| Number of rings .....               | 12                 |
| Diameter (inner) .....              | 114.3 mm (4.50")   |
| Thickness .....                     | 4.2 mm (0.165")    |

### PISTONS

|   |                                |
|---|--------------------------------|
| Material .....  | Light-alloy                    |
| Weight, Mahle .....   | 1440 grammes (3.175 lb.)       |
| " Wellworthy .....  | 1432 grammes (3.157 lb.)       |
| Permissible weight difference between pistons of the same engine..... | 28 grammes (1 oz.)             |
| Total height .....  | 141 mm (5.35/64")              |
| Height from piston pin center to top of piston .....                  | 88.40 mm (3.31/64")            |
| Piston clearance, Mahle .....   | 0.11-0.13 mm (0.0043"-0.0051") |
| "       "       Wellworthy .....                                      | 0.10-0.12 mm (0.0039"-0.0047") |

## PISTON RINGS

### Compression rings:

Top ring chromium-plated (no oversizes available)

Height of top ring (chromium-plated) ..... 3/32"

Height of the two remaining compression rings ... 1/8"

### Oil control rings:

Height of the two control oil rings ..... 3/16"

### Piston ring clearance in grooves:

Compression ring No. 1 ..... 0.089-0.127 mm  
(0.00350"-0.0050")

Compression ring No. 2 ..... 0.089-0.127 mm  
(0.00350"-0.0050")

Compression ring No. 3 ..... 0.089-0.127 mm  
(0.00350"-0.0050")

Oil control rings ..... 0.050-0.089 mm  
(0.0020"-0.00350")

Piston ring gap measured at ring opening ..... 0.35-0.65 mm  
(0.014"-0.025")

Piston ring oversize ..... 0.010"

## PISTON PINS

Fully-floating in both piston and connecting rod,  
circlip at both ends.

### Class of fit:

In connecting rod (room temperature 18° C/65° F/) Push fit

Clearance, piston pin - connecting rod bushing ..... 0.014-0.022 mm  
(0.0005"-0.0009")

Clearance, piston pin - piston pin hole (Mahle) ..... max. 0.008 mm  
(0.00031")

Negative clearance, piston pin - piston pin hole  
(Mahle) ..... max. 0.004 mm  
(0.00016")

Clearance, piston pin - piston pin hole (Wellworthy) max. 0.009 mm  
(0.00035")

Negative clearance, piston pin - piston pin hole  
(Wellworthy) ..... max. 0.003 mm  
(0.00012")

Piston pin diam., standard ..... 38.000-38.004 mm  
(1.4960"-1.4962")

Connecting rod bushing int. diam. ..... 38.018-38.022 mm  
(1.4968"-1.4970")

|  |                                       |
|--|---------------------------------------|
| Piston pin hole diam. (Mahle) .....      | 38.000-38.008 mm<br>(1.4960"-1.4963") |
| Piston pin hole diam. (Wellworthy) ..... | 38.001-38.009 mm<br>(1.4961"-1.4964") |

### CYLINDER HEAD

|   |                            |
|---|----------------------------|
| Height measured from cylinder head contact surface to cylinder head nut level ..... | 109 mm (4.19/64")          |
| Tightening torque .....   | 14-16 kgm (100-116 lb.ft.) |

### CRANKSHAFT

(Replaceable main bearing and connecting rod bearing shells)

|   |                                       |
|---|---------------------------------------|
| Crankshaft end play, with flange bearing .....  | 0.150-0.250 mm<br>(0.00590"-0.00984") |
| "    "    "    with separate thrust washers ... | 0.06-0.25 mm<br>(0.0024"-0.0098")     |
| Main bearing radial clearance .....             | 0.066-0.116 mm<br>(0.0026"-0.0046")   |
| Tightening torque for main bearing bolts .....  | 19-22 kgm (140-160 lb.ft.)            |

### MAIN BEARINGS

#### Main Bearing Journals

|                             |                                     |
|-----------------------------|-------------------------------------|
| Diameter, standard .....    | 82.535-82.550 mm<br>(3.249"-3.250") |
| "    undersize 0.010" ..... | 82.281-82.296 mm<br>(3.239"-3.240") |
| "    undersize 0.020" ..... | 82.027-82.042 mm<br>(3.229"-3.230") |
| "    undersize 0.030" ..... | 81.773-81.788 mm<br>(3.219"-3.220") |
| "    undersize 0.040" ..... | 81.519-81.534 mm<br>(3.209"-3.210") |
| "    undersize 0.050" ..... | 81.265-81.280 mm<br>(3.199"-3.200") |

Main bearing journal width for flange bearing shells:

|  |                                     |
|--|-------------------------------------|
| Standard .....                                 | 57.975-58.025 mm<br>(2.282"-2.284") |
| Oversize 0.1 mm (undersize shell 0.010") ..... | 58.075-58.125 mm<br>(2.286"-2.288") |
| "    0.2 mm (    "    "    0.020") .....       | 58.175-58.225 mm<br>(2.290"-2.292") |
| "    0.3 mm (    "    "    0.030") .....       | 58.275-58.325 mm<br>(2.294"-2.296") |

|  |                                     |
|--|-------------------------------------|
| Oversize 0.4 mm (undersize shell 0.040") .....   | 58.375-58.425 mm<br>(2.298"-2.300") |
| Oversize 0.5 mm (undersize shell 0.050") .....   | 58.475-58.525 mm<br>(2.302"-2.304") |
| Width on crankshaft for separate thrust washers: |                                     |
| Standard .....                                   | 57.975-58.025 mm<br>(2.282"-2.284") |
| Oversize 0.2 mm .....                            | 58.175-58.225 mm<br>(2.290"-2.292") |
| "    0.4 mm .....                                | 58.375-58.425 mm<br>(2.298"-2.300") |

### Thrust Washers

|                            |                                     |
|----------------------------|-------------------------------------|
| Thickness, standard .....  | 2.311-2.362 mm<br>(0.0910"-0.0930") |
| "    oversize 0.1 mm ..... | 2.411-2.462 mm<br>(0.0950"-0.0970") |
| "    oversize 0.2 mm ..... | 2.511-2.562 mm<br>(0.0990"-0.1010") |

### Main Bearing Shells

|                             |                                     |
|-----------------------------|-------------------------------------|
| Thickness, standard .....   | 2.927-2.934 mm<br>(0.1152"-0.1155") |
| "    undersize 0.010" ..... | 3.054-3.061 mm<br>(0.1202"-0.1205") |
| "    "    0.020" .....      | 3.181-3.188 mm<br>(0.1252"-0.1255") |
| "    "    0.030" .....      | 3.308-3.315 mm<br>(0.1302"-0.1305") |
| "    "    0.040" .....      | 3.435-3.442 mm<br>(0.1352"-0.1355") |
| "    "    0.050" .....      | 3.562-3.569 mm<br>(0.1402"-0.1405") |

## CONNECTING ROD BEARINGS

### Crankpins

|   |                                       |
|---|---------------------------------------|
| Connecting rod bearing radial clearance ..... | 0.055-0.140 mm<br>(0.002"-0.005")     |
| Crankpin width (early prod.) .....            | 47.900-48.000 mm<br>(1.886"-1.890")   |
| "    "    (late prod.) .....                  | 43.900-44.000 mm<br>(1.728"-1.732")   |
| Diameter, standard .....                      | 69.840-69.850 mm<br>(2.7496"-2.7500") |
| "    undersize 0.010" .....                   | 69.586-69.596 mm<br>(2.7396"-2.7400") |

|                                  |                                       |
|----------------------------------|---------------------------------------|
| Diameter, undersize 0.020" ..... | 69.332-69.342 mm<br>(2.7296"-2.7300") |
| " " 0.030" .....                 | 69.078-69.088 mm<br>(2.7196"-2.7200") |
| " " 0.040" .....                 | 68.824-68.834 mm<br>(2.7096"-2.7100") |
| " " 0.050" .....                 | 68.570-68.580 mm<br>(2.6996"-2.700")  |

Connecting Rod Bearing Shells

|                           |                                     |
|---------------------------|-------------------------------------|
| Thickness, standard ..... | 1.904-1.914 mm<br>(0.0750"-0.0753") |
| " undersize 0.010" .....  | 2.031-2.041 mm<br>(0.0800"-0.0803") |
| " " 0.020" .....          | 2.158-2.168 mm<br>(0.0850"-0.0853") |
| " " 0.030" .....          | 2.285-2.295 mm<br>(0.0900"-0.0903") |
| " " 0.040" .....          | 2.412-2.422 mm<br>(0.0950"-0.0953") |
| " " 0.050" .....          | 2.539-2.549 mm<br>(0.1000"-0.1003") |

CONNECTING RODS

Marked 1-6.

The side marked "FRONT" should be turned to face the front end of engine.

Fitted with replaceable bearing shells.

Side clearance at crankshaft end ..... 0.15-0.35 mm  
(0.00591"-0.0138")

Tightening torque ..... 14-16 kgm (100-116 lb.ft.)

Connecting rods are marked with a letter which specifies the weight classification. Connecting rods of the same classification only should be fitted.

|  |  |
|--|--|
| Weight classification (early production) A ..... | 2850-2950 grammes<br>(6.284-6.504 lb.) |
| " " " " B .....                                  | 2950-3050 grammes<br>(6.504-6.725 lb.) |
| " " " " C .....                                  | 3050-3150 grammes<br>(6.725-6.946 lb.) |
| " " " " D .....                                  | 3150-3250 grammes<br>(6.946-7.166 lb.) |

|   |  |
|---|--|
| Weight classification (late production) A ..... | 2800-2900 grammes<br>(6.174-6.396 lb.) |
| " " " " B .....                                 | 2900-3000 grammes<br>(6.394-6.617 lb.) |
| " " " " C .....                                 | 3000-3100 grammes<br>(6.615-6.837 lb.) |
| " " " " D .....                                 | 3100-3200 grammes<br>(6.835-7.058 lb.) |

#### FLYWHEEL

|  |                              |
|--|------------------------------|
| Permissible axial throw (measured at 150 mm = 6") max. | 0.1 mm (0.0040")             |
| Flywheel ring gear .....                               | 145 teeth                    |
| Tightening torque for nuts .....                       | 8.5 kg-10 kgm (60-72 lb.ft.) |

#### FLYWHEEL HOUSING

|                                     |                  |
|-------------------------------------|------------------|
| Permissible axial throw, max. ....  | 0.2 mm (0.0080") |
| Permissible radial throw, max. .... | 0.2 mm (0.0080") |

#### CAMSHAFT

##### Gear drive

Supported by four bearings

|   |  |
|---|--|
| Forward bearing journal, diameter .....   | 40.068-40.081 mm<br>(1.5774"-1.5780")    |
| 2nd bearing journal, diameter .....   | 61.163-61.189 mm<br>(2.4080"-2.4090")    |
| 3rd bearing journal, diameter .....   | 60.401-60.427 mm<br>2.3780-2.3790")      |
| 4th bearing journal, diameter .....   | 40.068-40.081 mm<br>(1.5775"-1.5780")    |
| Axial clearance .....   | 0.10-0.20 mm (0.004"-<br>0.008")         |
| Radial clearance, 1st and 4th bearing .....   | 0.026-0.077 mm<br>(0.001"-0.003")        |
| Radial clearance, 2nd and 3rd bearing .....   | 0.063-0.102 mm<br>(0.002"-0.004")        |
| Clearance for checking camshaft timing (cold engine):<br>Inlet valve is to open 10° before T.D.C. with check<br>clearance ..... | 1.6 <sup>±</sup> 0.25 mm (0.063-0.0098") |

#### CAMSHAFT BEARINGS

|                                 |                                       |
|---------------------------------|---------------------------------------|
| Forward bearing, diameter ..... | 40.107-40.145 mm<br>(1.5790"-1.5805") |
| 2nd bearing, diameter .....     | 61.252-61.277 mm<br>(2.4115"-2.4125") |
| 3rd bearing, diameter .....     | 60.490-60.515 mm<br>(2.3815"-2.3825") |

4th bearing, diameter ..... 40.107-40.145 mm  
(1.5790"-1.5805")

#### AUXILIARY DRIVE GEARS

Crankshaft gear ..... 30 teeth  
Idler gear ..... 55 teeth  
Camshaft gear ..... 60 teeth  
Fuel injection pump drive gear ..... 60 teeth  
Vacuum pump drive gear ..... 31 teeth  
Tooth flank clearance ..... 0.03-0.07 mm  
(0.0018"-0.0027")  
Idler gear shaft, diameter ..... 31.984-32.000 mm  
(1.2592"-1.2598")  
Idler gear bushing, diameter ..... 32.025-32.050 mm  
(1.2608"-1.2618")  
Radial clearance for idler gear ..... 0.025-0.066 mm  
(0.0010"-0.0026")

#### VALVE SYSTEM

##### Valves

##### Inlet:

Disk diameter ..... 41 mm (1 5/8")  
Stem diameter ..... 10.973-11.000 mm  
(4.3201"-4.3307")  
Valve seat angle ..... 44 1/2°  
Seat width in cylinder head ..... 1.5 mm (1/16")  
Seat angle in cylinder head ..... 45°  
Clearance, warm engine ..... 0.40 mm (0.0160")

##### Exhaust:

Disk diameter ..... 37 mm (1 29/64")  
Stem diameter (early prod.) ..... 10.957-10.984 mm  
(4.3137"-4.3244")  
" " (late prod.) ..... 10.950-10.968 mm  
(4.3110"-4.3181")  
Valve seat angle ..... 44 1/2°  
Seat width in cylinder head ..... 1.5 mm (1/16")  
Seat angle in cylinder head ..... 45°  
Clearance, warm engine ..... 0.45 mm (0.0180")

##### Valve seats

##### Inlet valve seats:

Diameter, standard (measurement A) ..... 44.063-44.089 mm  
(1.7348"-1.7358")

|   |                                       |
|---|---------------------------------------|
| Diameter, oversize 1 .....  | 44.317-44.343 mm<br>(1.7448"-1.7458") |
| Height (measurement B) .....  | 5.9-6.0 mm (0.232"-0.236")            |
| Position for valve seat in cylinder head, inlet valve:                  |                                       |
| Diameter, standard (measurement C) .....                                | 43.987-44.013 mm<br>(1.7318"-1.7328") |
| " oversize 1 .....  | 44.241-44.267 mm<br>(1.7418"-1.7428") |
| Height (measurement D) .....  | 8.5-8.6 mm (0.335"-0.339")            |
| Bottom radius, max. (measurement R) .....                               | 0.8 mm (0.031")                       |
| Exhaust valve seats:  |                                       |
| Diameter, standard (measurement A) .....                                | 44.063-44.089 mm<br>(1.7348"-1.7358") |
| " oversize 1 .....  | 44.317-44.343 mm<br>(1.7448"-1.7458") |
| " oversize 2 .....  | 44.571-44.597 mm<br>(1.7548"-1.7558") |
| " oversize 3 .....  | 44.825-44.851 mm<br>(1.7648"-1.7658") |
| Height (measurement B) .....  | 7.0-7.1 mm (0.276"-0.280")            |
| Position for valve seat in cylinder head, exhaust valves:               |                                       |
| Diameter, standard (measurement C) .....                                | 43.987-44.013 mm<br>(1.7318"-1.7328") |
| " oversize 1 .....  | 44.241-44.267 mm<br>(1.7418"-1.7428") |
| " oversize 2 .....  | 44.495-44.521 mm<br>(1.7518"-1.7528") |
| " oversize 3 .....  | 44.749-44.775 mm<br>(1.7618"-1.7628") |
| Height (measurement D) .....  | 9.65-9.75 mm (0.380"-0.384")          |
| Bottom radius, max. (measurement R) .....                               | 0.8 mm (0.031")                       |
| N.B. Clearance between valve disk and cylinder head level must be ..... | min. 0.5 mm (0.020")                  |

### Valve guides

|  |                                       |
|--|---------------------------------------|
| Length, inlet valve guides .....                     | 84 mm (3 5/16")                       |
| " exhaust valve guides .....                         | 92 mm (3 5/8")                        |
| Inner diameter (inlet and exhaust early prod.) ..... | 11.032-11.059 mm<br>(0.4343"-0.4354") |
| Inner diameter (exhaust, late prod.) .....           | 11.032-11.050 mm<br>(0.4343"-0.4350") |
| Height above cylinder head spring seat level .....   | 31 mm (1 7/32")                       |

### Clearance, valve stem - valve guide:

|                                    |                                     |
|------------------------------------|-------------------------------------|
| Inlet valves .....                 | 0.032-0.086 mm<br>(0.0013"-0.0034") |
| Exhaust valves (early prod.) ..... | 0.048-0.102 mm<br>(0.0019"-0.0040") |
| Exhaust valves (late prod.) .....  | 0.064-0.100 mm<br>(0.0025"-0.0039") |

### Valve springs

Tightly wound at one end. This end is turned downwards.

|   |                        |
|---|------------------------|
| Length, unloaded .....                                | about 72 mm (2 53/64") |
| " loaded with $44^{+2},5$ kg ( $97^{+6}$ lb.) .....   | 57 mm (2 1/4")         |
| " loaded with $85^{+4},5$ kg ( $187^{+10}$ lb.) ..... | 47 mm (1 27/32")       |
| " totally compressed, max. ....                       | 43,5 mm (1 23/32")     |

### LUBRICATING SYSTEM

|   |                                       |
|---|---------------------------------------|
| Oil capacity, including oil cleaner .....                         | about 14 lit. (3 3/4 U.S. gallons)    |
| Oil pressure .....  | 3-4 kg/cm <sup>2</sup> (42-56 p.s.i.) |
| Lubricant .....   | Diesel engine oil (HD oil)            |
| " viscosity, summer .....   | SAE 30                                |
| " " winter .....  | SAE 20                                |
| Oil pump, type .....  | gear pump                             |
| " " number of teeth .....   | 11                                    |
| " " axial clearance, drive gear .....                             | 0.02-0.10 mm<br>(0.001"-0.004")       |
| " " tooth flank clearance .....                                   | 0.15-0.35 mm<br>(0.006"-0.014")       |
| Relief valve in oil pump cover<br>(from engine No. 5390 onwards): |                                       |
| Opening pressure .....  | 8 kg/cm <sup>2</sup> (114 p.s.i.)     |
| Spring length, unloaded .....                                     | 62 mm (2 7/16")                       |
| " " loaded with $6,3+0,2$ kg ( $14+1/2$ lb.) .....                | 38 mm (1 1/2")                        |
| Spring in oil relief valve (in block):                            |                                       |
| Length, unloaded .....  | 53-55 mm (2.1/16-2.5/32")             |
| " loaded with $5+0.3$ kg ( $11+1/2$ lb.) .....                    | 42 mm (1.21/32")                      |

### FUEL SYSTEM

|  |                            |
|--|----------------------------|
| Rotation of injection pump viewed from its coupling side ..... | Clockwise                  |
| Order of injection .....                                       | 1-5-3-6-2-4                |
| Fuel tank capacity .....                                       | 120 lit. (32 U.S. gallons) |

### Injection pump

D 67 A

|  |                 |
|--|-----------------|
| Type designation, early production ..... | CAV NL 6E 75/91 |
|--|-----------------|

|   |   |
|---|---|
| Type designation, late production .....   | CAV NL 6F 75/91   |
| Setting .....   | 30° before T.D.C.   |
| Coupling, early production .....  | CN 1  |
| "    late production .....  | Volvo No. 414760  |
| Plunger diameter .....  | 7.5 mm (0.295")   |
| Pre-filter .....  | CAV BFJSJ1/502  |
| Feed pump .....   | CAV DFP 3/7S  |
| Feed pressure .....   | 0,6-1,0 kg/cm <sup>2</sup><br>(8.5-14.2 p.s.i.)                           |
| Governor .....  | CAV RP 18   |
| <u>Relief valve</u>   |   |
| Type designation .....  | CAV 7019/103  |
| <u>Fuel filters</u>   |   |
| Type designation .....  | CAV F 2/8, CAV F 2/9  |
| Number .....  | 2 (one of each)   |
| <u>Injectors</u>  |   |
| Type designation .....  | CAV BKBL 102 S 617  |
| Nozzle (The holder is marked with a blue point or with A) .....   | BDLL 150 S 6123   |
| Injector opening pressure .....   | 130-140 kg/cm <sup>2</sup><br>(1850-1990 p.s.i.)                          |
| Permissible fall of pressure when testing injector, adjusted to 160-170 kg/cm <sup>2</sup> (2270-2410 p.s.i.) ... | From 150 to 100 kg/cm <sup>2</sup><br>(2160-1410 p.s.i.) in 6-30 seconds. |
| Adjustment: 1/8 of a turn of the adjuster screw alters the pressure .....   | about 6 kg/cm <sup>2</sup> (85 p.s.i.)                                    |
| <b>COOLING SYSTEM</b>   |   |
| Type .....  | Pressure  |
| Radiator pressure valve opens at .....  | 0,23-0,30 kg/cm <sup>2</sup><br>(3,3-4,3 p.s.i.)                          |
| Capacity .....  | about 22 liters (6 U.S. gallons)  |
| Thermostat:   |   |
| Type .....  | Balanced, does not open by water pressure                                 |
| Marked .....  | Early prod.      Late prod.   |
| Starts to open at .....   | 180                      161  |
|   | 82-85° C              69-72° C  |
|   | (180-185°F)        (156-162° F)   |

|  |                   |                          |
|--|-------------------|--------------------------|
|  | Early prod.       | Late prod.               |
| Fully open at .....                            | 97° C<br>(207° F) | 82-85° C<br>(180-185° F) |
| Radiator hose, diameter:                       |                   |                          |
| Water pump-thermostat housing .....            | 1 1/8"            |                          |
| Radiator-thermostat housing .....              | 1 3/8"            |                          |
| Radiator-water pump .....                      | 1 3/8"            |                          |
| Fan belt, outer length, early production ..... | 54" (1372 mm)     |                          |
| " " " " late production .....                  | 53" (1346 mm)     |                          |
| " " width .....                                | 3/4"              |                          |
| " " depth .....                                | 7/16"             |                          |
| Bearing for pump shaft, inner .....            | SKF 6206 Z        |                          |
| " " " " outer .....                            | SKF 6205 NR       |                          |

### WEAR TOLERANCES

#### Cylinder:

Cylinder liners, pistons and piston rings should be replaced when worn 0.35-0.40 mm (0.014-0.016") or an out-of-roundness of 0.08 mm (0.003")

#### Crankshaft:

|   |                    |
|---|--------------------|
| Main bearing journals and crankpins, permissible out-of-roundness, max..... | 0.075 mm (0.0030") |
| Main bearing and crankpins, permissible taper .                             | 0.05 mm (0.0020")  |
| Max, axial crankshaft clearance .....                                       | 0.30 mm (0.0118")  |

#### Valves:

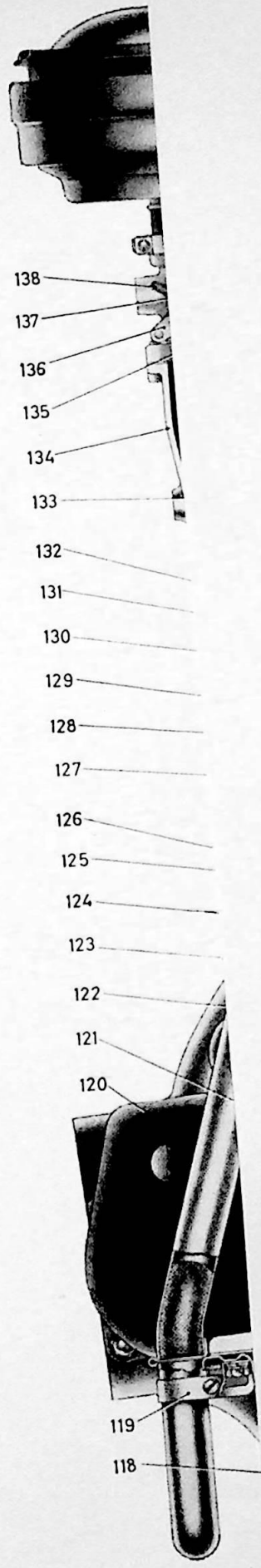
|   |                    |
|---|--------------------|
| Valve stem, permissible wear .....              | 0.02 mm (0.00080") |
| Permissible clearance, valve stem-valve guide:  |                    |
| Inlet valve .....                               | 0.15 mm (0.00591") |
| Exhaust valve .....                             | 0.17 mm (0.00669") |
| Valve plate chamfered edge should be at least . | 1 mm (0.040")      |

#### Camshaft:

|  |                   |
|--|-------------------|
| Permissible out-of-roundness (with new bushings) | 0.07 mm (0.0025") |
| Bearing, permissible wear .....                  | 0.05 mm (0.0020") |

### TIGHTENING TORQUES

|  | kgm     | lb.ft.  |
|--|---------|---------|
| Cylinder head .....                          | 14-16   | 100-116 |
| Main bearings .....                          | 19-22   | 140-160 |
| Connecting rod bearings .....                | 14-16   | 100-116 |
| Flywheel .....                               | 8.5-10  | 60-72   |
| Injection pump pressure valve retainer ..... | 6.4     | 45      |
| Injector bolts .....                         | 2.3-3.0 | 17-22   |



**Illustratio**