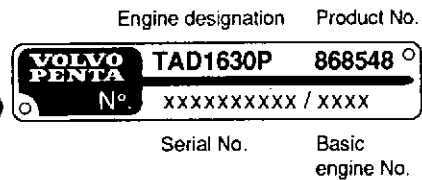
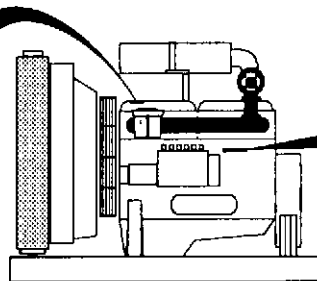


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09-1993

# **Workshop Manual**

## **Technical Data**

### **Diesel Engines TAD1630G/P, TWD1630G/P**



- T - Turbo charged
- A - Air-to-air charge air cooler
- W - Water-to-air charge air cooler
- D - Diesel engine
- 16 - Displacement, litres
- 3 - Generation
- 0 - Version
- P - Stationary engine (Power Pac)
- G - Gen Set engine

## Conversion table

### Length

1 mm = 0.0394"

### Volume

1 litre = 61.024 in<sup>3</sup>  
 1 litre = 0.264 US gal.

### Mass

1 kg = 2.205 lb (pound)

### Force

1 N (Newton) = 0.1 kp (kgf)  
 1 N = 0.225 lb.f

### Torque

1 Nm = 0.1 kpm (kgf m)  
 1 Nm = 8.851 lbf.in  
 1 Nm = 0.738 lbf.ft

### Pressure

1 kPa = 0.01 kp/cm<sup>2</sup>  
 1 kPa = 0.145 psi

### Temperature

°F = °C x 1.8 + 32  
 °C = °F x 0.56 - 18

#### Example:

110 °C = 110 x 1.8 + 32 = 230 °F  
 248 °F = 248 x 0.56 - 18 = 120 °C

# Group 20 General Specifications

## GENERAL

<b>Designation</b> .....	<b>TAD1630G, TAD1630P, TWD1630G, TWD1630P</b>
In line four stroke diesel engine with direct injection	
Turbocharged and air to air intercooled (TAD)	
Turbocharged and water to air intercooled (TWD)	
Numbers of cylinders .....	6
Displacement, total .....	16.2 litres/984 in <sup>3</sup>
Firing order .....	1-5-3-6-2-4
Rotation direction, anti-clockwise viewed towards flywheel	
Bore .....	144.0 mm/5.67 in
Stroke .....	165 mm/6.50 in
Compression ratio .....	15.0:1
Compression pressure, starter speed .....	2760 kPa/27.6 kp/cm <sup>2</sup>
<b>Dry weight</b>	
TAD1630G, engine only .....	1538 kg
TAD1630P, engine only .....	1515 kg
TWD1630G, engine only .....	1428 kg
TWD1630P, engine only .....	1409 kg
<b>Wet weight</b>	
TAD1630G, engine only .....	1650 kg
TAD1630P, engine only .....	1627 kg
TWD1630G, engine only .....	1520 kg
TWD1630P, engine only .....	1501 kg
Idling speed, low (approx.) TAD1630G .....	1300 rpm
TAD1630P .....	600 rpm
TWD1630G .....	1300 rpm
TWD1630P .....	500 rpm

## PERFORMANCE

### TAD1630G/P, TWD1630G/P

Max output: See applicable engine diagram

Max torque: See applicable engine diagram

## ELECTRICAL SYSTEM

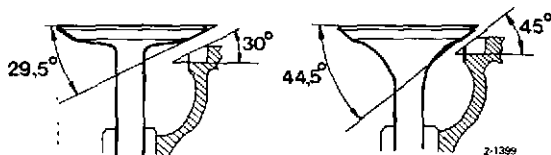
Voltage and type .....	24 V, insulated from earth
<b>Alternator</b>	
output .....	60 Amp
voltage .....	28 V
rating .....	1700W
make .....	Valeo
<b>Starter motor battery capacity</b>	
maximum .....	2 x 176 Ah
minimum at > +5°C .....	2 x 135 Ah
<b>Specific gravity of battery electrolyte at +20°C</b>	
fully charged .....	1.28 g/cm <sup>3</sup>
battery needs recharging at .....	1.23 g/cm <sup>3</sup>
<b>Starter motor</b>	
make/type .....	Bosch, 7.5 kW/24 V
<b>Starting heater</b>	
	24 V



## VALVE MECHANISM

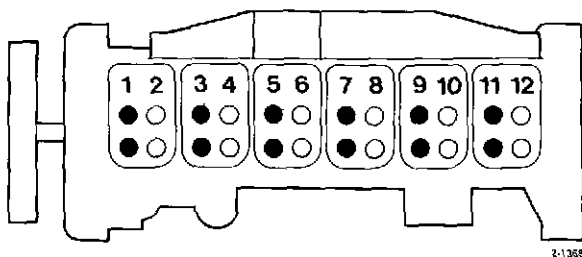
### Valves

Disc diameter	
Inlet .....	47±0.1 mm
Exhaust .....	45±0.1 mm
Stem diameter	
Inlet .....	9.485–9.500 mm
Exhaust .....	9.472–9.487 mm
Valve seat angle	
Inlet .....	29.5°
Exhaust .....	44.5°
Seat angle in cylinder head	
Inlet .....	30°
Exhaust .....	45°



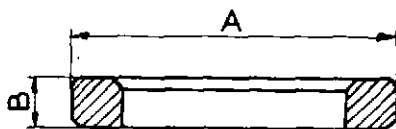
### Valve clearance, cold engine or at operating temp.

Inlet .....	0.30 mm
Exhaust .....	0.60 mm



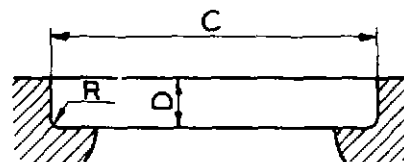
### Valve seats

Outer diameter (meas. A), standard	
Inlet .....	50.070 mm
Exhaust .....	48.062 mm
Oversize	
Inlet .....	50.270 mm
Exhaust .....	48.262 mm
Height (meas. B)	
Inlet .....	7.55 mm
Exhaust .....	12.40 mm



### Valve seat location

Diameter (meas. C), standard	
Inlet .....	50.012 mm
Exhaust .....	48.012 mm
Diameter (meas. C), oversize	
Inlet .....	50.212 mm
Exhaust .....	48.212 mm
Depth (meas. D)	
Inlet .....	9.5 mm
Exhaust .....	14.05 mm
Seat bottom radius (meas. R)	
Inlet .....	0.65 mm
Exhaust .....	0.65 mm
Measurement between valve disc and cylinder head face	
Inlet (0.0-0.4 mm) .....	0.2 mm
Exhaust (0.0-0.4 mm) .....	0.2 mm



### Valve guides

Length	
Inlet .....	87 mm
Exhaust .....	76 mm
Inner diameter	
Inlet .....	9.525–9.540 mm
Exhaust .....	9.525–9.540 mm
Height above cylinder head spring face	
Inlet .....	23.5±0.35 mm
Exhaust .....	25.0±0.35 mm
Clearance valve stem – guide	
Inlet .....	0.04 mm
Exhaust .....	0.052 mm
Rocker arms	
Bearing clearance .....	0.041 mm
Tappets	
Shaft – bushing .....	0.036 mm
Shaft – stem .....	0.026 mm

### Valve springs, exhaust

Outer valve spring	
Length, unladen .....	68.1 mm
With load of 598 N (61 kgf) .....	49.5 mm
With load of 1022 N (104 kgf) .....	36.3 mm
Length, fully loaded .....	33.5 mm

### Valve spring, inlet

Length, unladen .....	61.3 mm
With load of 304 N (31 kgf) .....	48.0 mm
With load of 624 N (63.5 kgf) .....	34.0 mm
Length, fully loaded .....	31.5 mm

### Camshaft

Drive .....	Gear
Number of bearings .....	7
Diameter, front bearing pin .....	68.946—68.965 mm
2nd-7th bearing pins .....	64.940—64.965 mm
Axial clearance .....	0.115 mm
Radial clearance, front .....	0.074 mm
2nd-7th .....	0.078 mm

Check of camshaft setting (cold engine and valve clearance = 0)

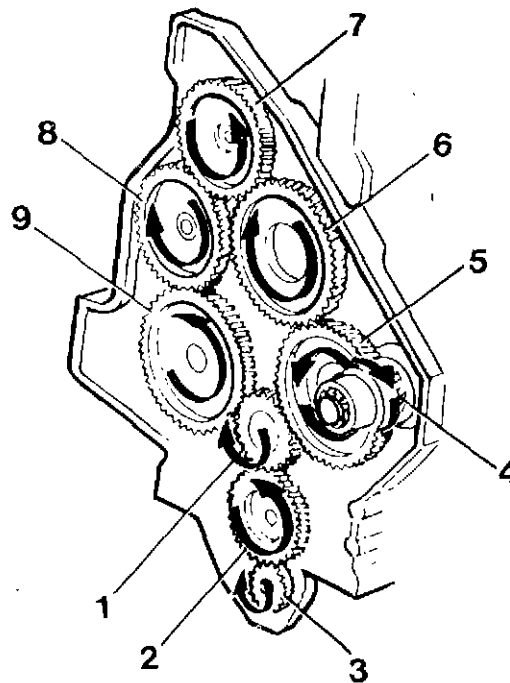
Inlet valve for no. 1 cylinder must with flywheel position 10° A.T.D.C. have opened .....	2.55 mm
Max. valve lift, inlet .....	14.0 mm
exhaust .....	13.2 mm

### Camshaft bearings

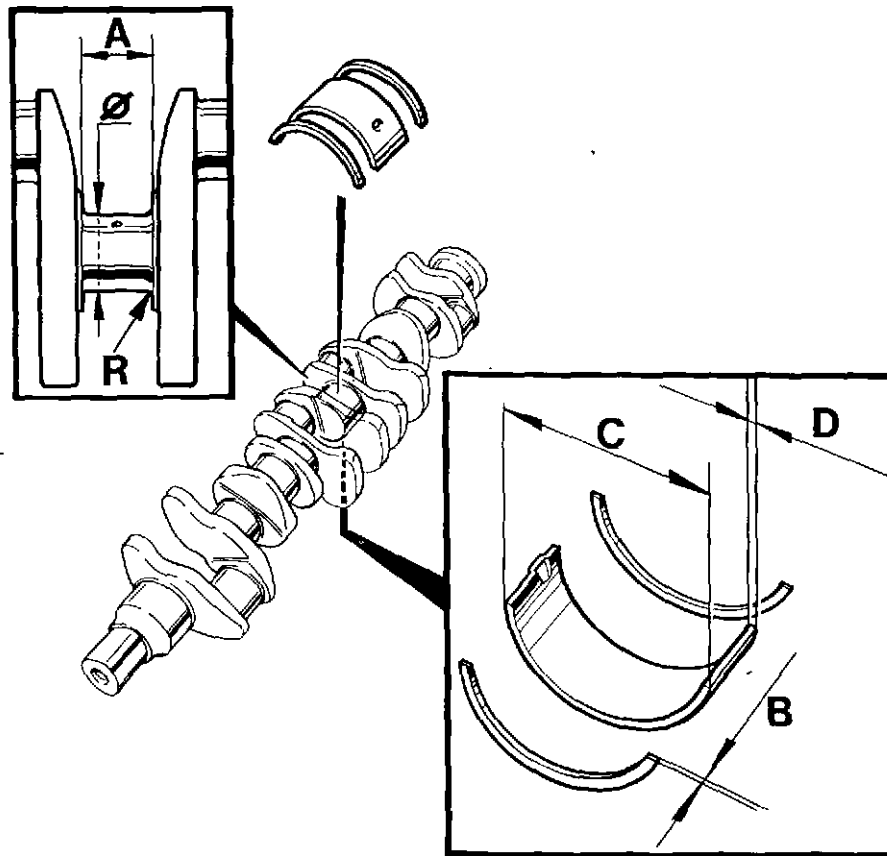
Diameter, front bearing .....	69.030±0.030 mm
2nd-7th bearings .....	65.030±0.030 mm

### TIMING GEARS

- 1 Crankshaft drive
- 2 Idler, oil pump
- 3 Oil pump drive
- 4 Coolant pump drive
- 5 Idler, right
- 6 Idler, upper
- 7 Camshaft drive
- 8 Injector pump drive
- 9 Idler, left



Backlash .....	0.115 mm
Hub for intermediate gear, diameter .....	99.99±0.011 mm
Bushing for intermediate gear, diameter ...	100.04±0.018 mm
Radial clearance for intermediate gear .....	0.054 mm
Axial clearance for intermediate gear .....	0.100 mm



## CRANK MECHANISM

### Crankshaft

Length .....	1323 mm
Crankshaft, axial clearance .....	0.190 mm
Main bearing, radial clearance .....	0.120 mm

### Main bearing pins

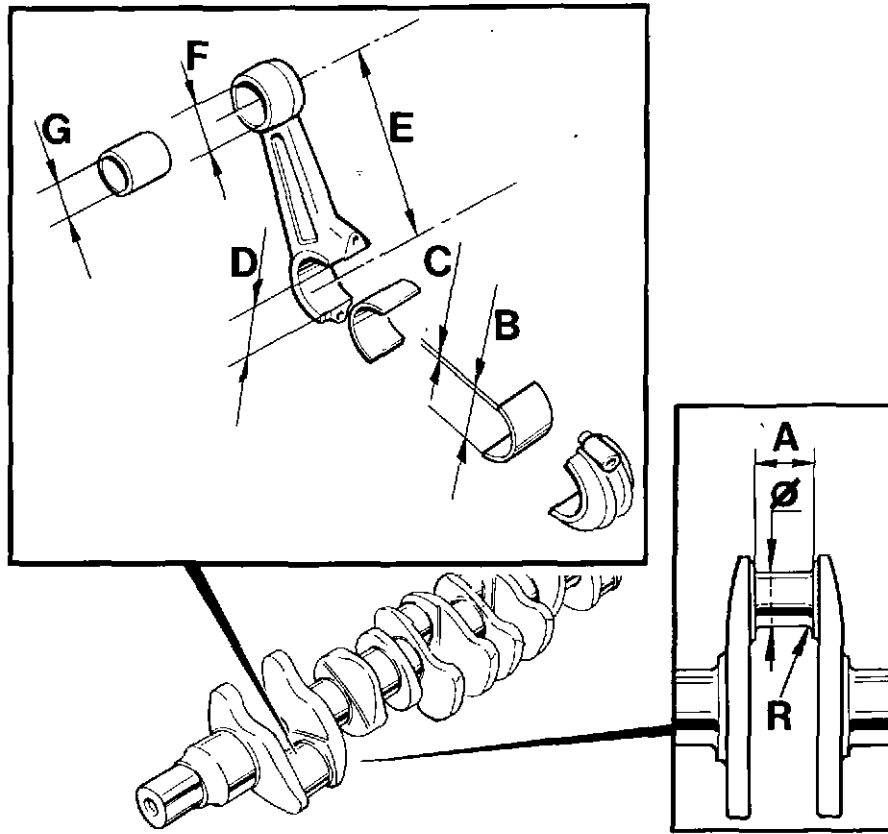
Diameter (Ø), standard .....	117.989±0.011 mm
undersize 0.25 mm .....	117.739±0.011 mm
undersize 0.50 mm .....	117.489±0.011 mm
undersize 0.75 mm .....	117.239±0.011 mm
Width, axial bearing pin (A), standard .....	51.000±0.025 mm
Oversize	
0.2 mm (axial bearing 0.1 mm) .....	51.200±0.025 mm
0.4 mm (axial bearing 0.2 mm) .....	51.400±0.025 mm
0.6 mm (axial bearing 0.3 mm) .....	51.600±0.025 mm
Fillet radius (R) .....	5.380±0.125 mm

### Thrust washers (axial bearing)

Width (B), standard .....	3.175±0.038 mm
oversize 0.1 mm .....	3.275±0.038 mm
0.2 mm .....	3.375±0.038 mm
0.3 mm .....	3.475±0.038 mm

### Main bearing shell

Type .....	Replaceable
Outer diameter (C) .....	123.135 mm
Thickness (D), standard .....	2.506±0.009 mm
oversize 0.25 mm .....	2.632±0.009 mm
0.50 mm .....	2.756 2±0.009 mm
0.75 mm .....	2.882±0.009 mm



**Connecting rod bearing pin**

Diameter (Ø), standard .....	99.992±0.008 mm
undersize 0.25 mm .....	99.742±0.008 mm
undersize 0.50 mm .....	99.492±0.008 mm
undersize 0.75 mm .....	99.242±0.008 mm
Width (A), connecting rod bearing pin .....	59.950±0.05 mm
Fillet radius (R) (5.25–5.5 mm) .....	5.380 mm

**Connecting rod bearing shell**

Outer diameter (B) .....	104.807 mm
Thickness (C), standard .....	2.354±0.008 mm
oversize 0.25 mm .....	2.480±0.008 mm
oversize 0.50 mm .....	2.604±0.008 mm
oversize 0.75 mm .....	2.730±0.008 mm
Diameter, bearing shell bearing seat (D) ...	104.800 mm

**Connecting rods**

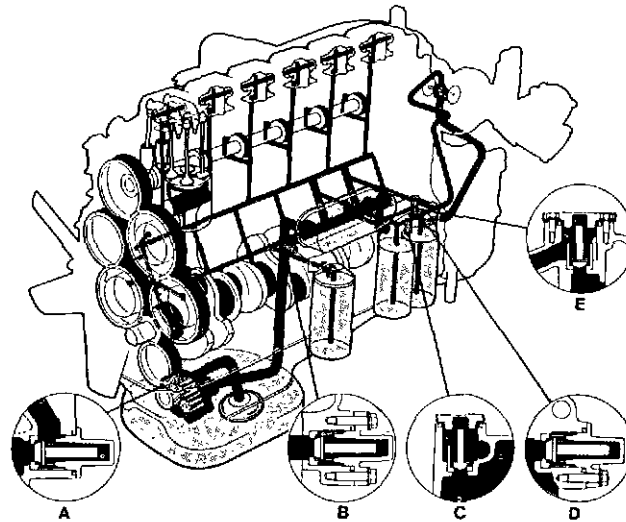
Length, centre-centre (E) .....	286 mm
Marking	
Connecting rod resp. cap .....	1 to 6
"FRONT" on rod turned .....	Forwards
Diameter, connecting rod bushing bearing seat (F) .....	65.323 mm
Connecting rod bushing bore (G) .....	60.026 mm
Axial clearance, connecting rod-crankshaft	0.035 mm
Connecting rod bearing, radial clearance ..	0.128 mm

**Flywheel, installed**

Ring gear on flywheel .....	153 teeth
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**Flywheel casing, installed**

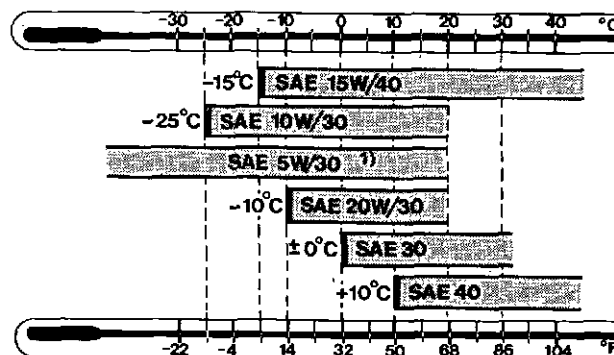
Max. permitted axial throw for contact surface against clutch casing .....	0.20 mm
Max. permitted radial throw for contact surface against clutch casing .....	0.25 mm



### LUBRICATION SYSTEM

Oil grade .....	VDS (Volvo Drain Specification) and MIL-L-2104D, API CD/CE
Oil system capacity including filters .....	64 litres
excl. filters .....	57 litres
Difference in volume between MIN - MAX .....	17 litres
Oil change interval	
CD or CE oil quality .....	200 h
VDS oil quality .....	400 h
Oil pressure	
rated speed .....	300-500 kPa/3-5 kp/m <sup>2</sup>
idling speed (min) .....	150 kPa/1.5 kp/cm <sup>2</sup>
Oil temperature	
normal .....	105 °C/221°F
max .....	120 °C/248°F
Oil filter micron size .....	0.040 mm

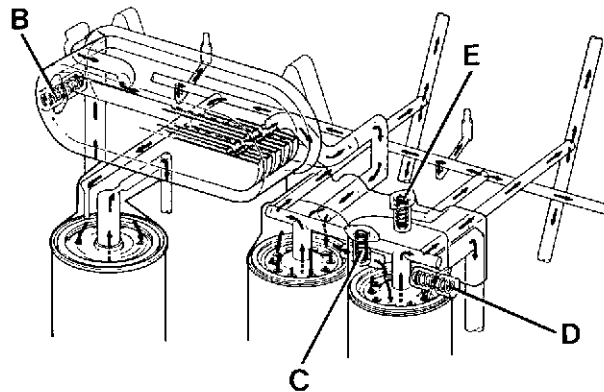
Viscosity is selected according to the following table.  
 Temperatures refer to stable ambient temperature.



<sup>1)</sup> The temperatures refer to stable ambient air temperatures.  
 Concerns synthetic or semi-synthetic oil.  
**NOTE! Only SAE 5W/30 may be used.**

**Lub oil pump**

Type .....	Gear
Number of teeth	
drive gear .....	25
intermediate gear .....	58
Diameter	
bearing sleeve, intermediate gear .....	99.99 mm±0.011
intermediate gear, bushing .....	100.044 mm±0.018
Axial clearance	
pump gear .....	0.095 mm
intermediate gear .....	0.100 mm
Backlash .....	0.15-0.30 mm



**Oil filter**

By-pass .....	1
Full-flow .....	2
Micron size .....	0.04 mm

**Oil valves**

**A. Safety valve**

Spring length	
off-load .....	121.6 mm
with load of 178-200 N (18-20,4 kp) .....	59.6 mm
with load of 215 N (22 kp) .....	51.0 mm

**B. By-pass valve, oil cooler**

Spring length	
off-load .....	91.2 mm
with load of 41.4-47.4 N (4.2-4.8 kp) .....	59.6 mm
with load of 56.5 N (5.6 kp) .....	51.0 mm

**C. By-pass valve, filter**

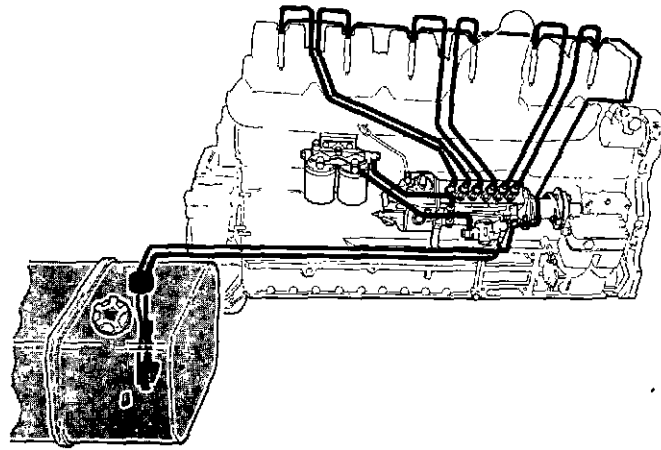
Spring length	
off-load .....	68.8 mm
fully loaded .....	30.0 mm

**D. Reduction valve**

Spring length	
off-load .....	93.0 mm
with load of 96-108 N (9.8-11.0 kp) .....	59.6 mm
with load of 128.3 N (13.1 kp) .....	51.0 mm

**E. Piston cooling valve**

Spring length	
off-load .....	58.4 mm
with load of 18.6-20.6 N (1.9-2.1 kp) .....	40.5 mm
with load of 28.9 N (2.9 kp) .....	32.0 mm



## FUEL SYSTEM

### Fuel

Standard, DIN 51601 SIS 155432 or ASTM-D 975-No 2

### Feed pump

Type .....	FP/KG 24 P307
Feed pump pressure .....	100-150 kPa
Feed pump max suction head .....	2.0 m

### Overflow valve

Designation .....	Bosch PVE 53S 5Z
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### Injection pump

Pump type	
TAD1630G .....	Bosch PE6P 130A 700 RS7272
TAD1630P .....	Bosch PE6P 130A 720 RS7273
TWD1630G .....	Bosch PE6P 130A 720 RS
TWD1630P .....	Bosch PE6P 130A 720 RS
Governor type	
TAD1630G .....	electronic, GAC/ACB275D
TAD1630P .....	mechanical RQV, Bosch
TWD1630G .....	mechanical RQ, Bosch
TWD1630P .....	mechanical RQV, Bosch
Pump element diameter .....	13 mm
Setting	
TAD1630G/1500rpm .....	19° ± 0.5 B.T.D.C.
TAD1630G/1800rpm .....	21° ± 0.5 B.T.D.C.
TAD 1630P .....	21° ± 0.5 B.T.D.C.
TWD1630G/1500 rpm .....	21° ± 0.5 B.T.D.C.
TWD1630G/1800 rpm .....	25° ± 0.5 B.T.D.C.
TWD1630P .....	25° ± 0.5 B.T.D.C.
Lift from basic circle (stroke position)	
TAD1630G .....	4.5 (+0.1) mm
TAD1630P .....	4.5 (+0.1) mm
TWD1630G .....	3.6 (+0.1) mm
TWD1630P .....	3.6 (+0.1) mm

### Injectors

Designation	
nozzle holder .....	KBAL 116 S75
nozzle .....	DLLA 148 S1263
Marking, complete injector .....	531
Opening pressure .....	26 (+0.8) MPa (265 (+8) kp/cm <sup>2</sup> )
Adjustment pressure, new spring .....	26.5 MPa (+0.8) (270 kp/cm <sup>2</sup> +8)
Bore .....	7 x 0.31 mm

**COOLING SYSTEM**

Type .....	Pressurized
Pressure valve opens at .....	70 kPa (0.7 kp/m <sup>2</sup> )
Recommended coolant, Volvo ethylen glycol or Volvo anticorrosion additive together with clean fresh water	
Radiator cooling system type .....	Closed circuit
Coolant capacity, TAD1630G/P engine .....	35 litres
engine incl. std radiator with hoses .....	60 litres
Coolant capacity, TWD1630G/P engine .....	38 litres
engine incl. std radiator with hoses .....	67 litres
Thermostat, TAD1630G/P marked .....	Red
starts to open .....	82 °C
fully open .....	95 °C
Thermostat, TWD1630G/P marked .....	Blue
starts to open .....	76 °C
fully open .....	88 °C

**INTAKE AND EXHAUST SYSTEM****Turbo compressor**

Designation	
TAD1630G .....	Schwitzer S4T/122,61BE/1,30L1
TAD1630P .....	Schwitzer S4T/122,58/EE1,30L1
TWD1630G/P .....	Holset H3B 0980AR-B36S1
Lube system .....	Pressure lubrication
Air filter type .....	Single stage paper cartridge

**Boost pressure TAD1630G**

	<b>1500 rpm</b>	<b>1800 rpm</b>
Prime power	201 kPa	216 kPa

**Boost pressure TAD1630P**

	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1600 rpm</b>	<b>1800 rpm</b>
Continuous power	151 kPa	180 kPa	187 kPa	195 kPa

**Boost pressure TWD1630G**

	<b>1500 rpm</b>	<b>1800 rpm</b>
Prime power	170 kPa	175 kPa

**Boost pressure TWD1630P**

	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1600 rpm</b>	<b>1800 rpm</b>
Continuous power	136 kPa	158 kPa	161 kPa	163 kPa

**Exhaust system**

	<b>TAD1630G</b>		<b>TAD1630P</b>	
	<b>1500 rpm</b>	<b>1800 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>
Exhaust gas temperature after turbine (°C/°F)				
prime power without fan	490/915	455/850		
standby power without fan	510/950	490/915		
continuous power			547/1015	476/890
Max allowable back-pressure in exhaust line (kPa/inwc)	5.0/20.1	7.0/28.1	8.3/33.3	12.0/48.2
	<b>TWD1630G</b>		<b>TWD1630P</b>	
	<b>1500 rpm</b>	<b>1800 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>
Exhaust gas temperature after turbine (°C/°F)				
prime power without fan	522/972	526/979		
standby power without fan	542/1008	605/1125		
continuous power			505/940	500/930
Max allowable back-pressure in exhaust line (kPa/inwc)	5.0/20.1	7.0/28.1	5.0/20.1	7.0/28.1
	<b>TAD1630G</b>			
	<b>1500rpm</b>	<b>1800rpm</b>		
Max combustion pressure (MPa/psi)				
prime power			15.0/2180	15.5/2250
	<b>TAD1630P</b>			
	<b>1500rpm</b>	<b>1800rpm</b>		
Max combustion pressure (MPa/psi)				
continuous power			16.3/2364	15.4/2233
	<b>TWD1630G</b>			
	<b>1500 rpm</b>	<b>1800 rpm</b>		
Max combustion pressure (MPa/psi)				
prime power			13.6/1968	12.5/1809
	<b>TWD1610P</b>			
	<b>1200 rpm</b>	<b>1500 rpm</b>	<b>1800 rpm</b>	
Max combustion pressure (MPa/psi)				
continuous power	15.2/2200	15.1/2190	14.5/2100	

## WEAR TOLERANCES

### Cylinder head

Height, min. .... 134.6 mm

### Cylinder liner

Cylinder liner (pistons and piston rings) should be replaced with wear of 0.45–0.50 mm or if oil consumption is abnormally high.

### Cylinder block

Height above block face — crankshaft centre ..... min. 479.8 mm

### Crankshaft

Max. permitted out-of-round on main and connecting rod bearing pins ..... 0.08 mm  
 Max. permitted taper on main and connecting rod bearing pins ..... 0.05 mm  
 Max. axial clearance on crankshaft ..... 0.40 mm

### Valves

Valve stem, max. permitted wear ..... 0.02 mm  
 Max. permitted clearance between valve stem and valve guide  
   Inlet ..... 0.30 mm  
   Exhaust ..... 0.45 mm  
 Valve disc edge should be min.  
   Inlet ..... 1.40 mm  
   Exhaust ..... 1.55 mm  
 Valve seat may be ground down so far that distance from valve disc (new valve) to cylinder head face is max.  
   Inlet ..... 1.0 mm  
   Exhaust ..... 1.0 mm

### Camshaft

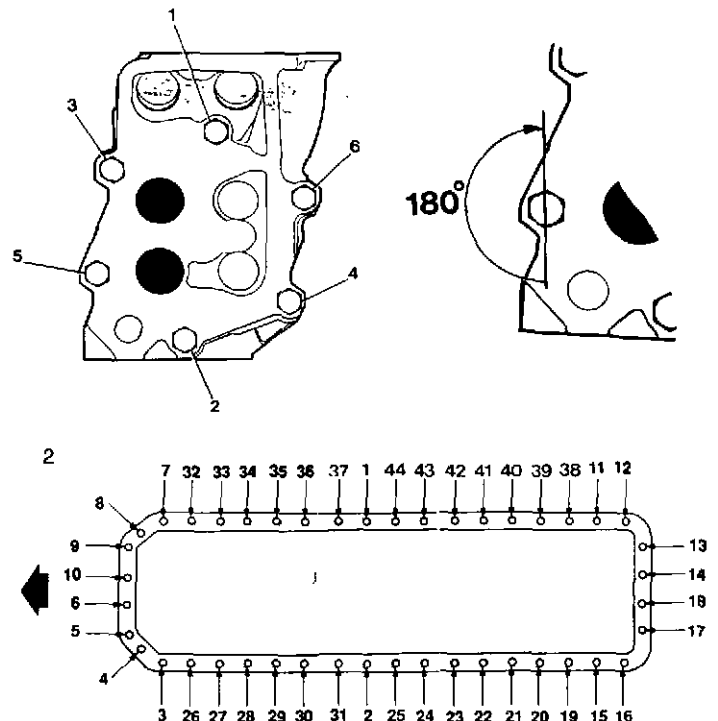
Max. permitted out-of-round (with new bearings) ..... 0.05 mm  
 Bearings, max. permitted wear ..... 0.05 mm  
 Tappet height, min.  
   Inlet ..... 7.800 mm  
   Exhaust ..... 7.350 mm

## TIGHTENING TORQUES

	Nm	Kgf m
Cylinder head <sup>1</sup>		
Main bearings	440	44.8
Main bearing plates, cylinder block	85±7	8.5±0.7
Connecting rod bearings	240	24.5
Axial bearing, camshaft	24	2.4
Timing gear cover M8	24±3	2.4±0.3
M10	48±5	4.8±0.5
M14	140±10	14.8±1.0
Timing gear casing	35±5	3.5±0.5
Gear, camshaft	58±6	5.8±0.6
Gear, injection pump drive	58	5.9

Intermediate gear journal, left and right also upper intermediate gear	65	6.6
Bearing bracket, rocker arm shaft	65	6.5
Oil sump (tighten in a specified order, see below <sup>2</sup> )	16	1.6
Drain plug, oil sump	80	8.2
Bracket, oil pump	48	4.9
Intermediate gear, oil pump	48	4.9
Flywheel	258	26.2
Flywheel casing	140	14.3
Centre bolt, crankshaft	642	65.4
Delivery valve holder, injection pump	115	11.7
Nut for retainers, injectors	50	5.1
Stud for retainers, injectors	65	6.6
Clamp bolt, injection pump coupling	85	8.7
Centre bolt, hub, coolant pump shaft	60	6.1
Valve cover	20±5	2.0±0.5
Engine mount, front, in cylinder block	200±20	20.0±2.0
Exhaust manifold	48±5	4.8±0.5
Centre bolt for fan hub	65±7	6.5±0.7
Vibration damper	48	4.8
Nut, piston cooling nozzle	24±5	2.4±0.5
Stud, piston cooling nozzle	23	2.3
Plug diameter in cylinder block		
1 3/4"	60	6.1
1/2"	80	8.2
Plug diameter in cylinder head		
M30	60	6.1
3/4"	80	8.2

<sup>1</sup> Tighten cylinder head bolts in 4 stages.  
 First tightening 50 Nm (5.1 kgf m).  
 Second tightening 125 Nm (12.7 kgf m).  
 Third tightening 200 Nm (20.4 kgf m).  
 Fourth tightening, angle tightening 180°.



**VOLVO**