

DIESEL ENGINE TYPE DA 475

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TECHNICAL DATA

GENERAL	
Make of engine Model Specification No. of cylinders Bore Stroke Swept volume	DAF DA 475 Water-cooled diesel engine with direct fuel injection 6 100.62 mm 100 mm 4.769 litres
Run-away speed Governed speed Idling speed Compression ratio Firing order Dry weight, incl. accessories	2780 r.p.m. 2500 r.p.m. 400—500 r.p.m. 16 : 1 1 — 5 — 3 — 6 — 2 — 4 470 kg
CYLINDER HEAD	
Cylinder head Height Max. refacing allowance Valve guide bore dia.	86.31 — 86.41 mm 0.2 mm 14.288—14.300 mm

Valve guides		
Overall length	70.9 — 71.3 mm	
Outside diameter	14.331 — 14.339 mm	
Inside diameter — before pressing in	8.725 — 8.737 mm	
Inside diameter — after pressing in	8.705 — 8.717 mm	
Interference fit in head	0.03 — 0.05 mm	
Projection above cylinder head	22.4 — 23.4 mm	
Valve seats	Inlet	Exhaust
	Angle of valve seat Seat width (new)	30° ± 15' 1.2 mm
* Valve seat inserts	Inlet	Exhaust
	Width Inside diameter Outside diameter	4.394 — 4.572 mm 37.535 — 37.687 mm 48.374 — 48.387 mm
* On new engines the exhaust valve seats are shrunk into the heads; the inlet valve seats are cut direct into the heads. Loose inserts for inlet valves are available for servicing purposes.		
Machined recess in cylinder head	Inlet	Exhaust
	Width Diameter	5.70 — 5.80 mm 48.234 — 48.260 mm
VALVE GEAR		
Valve timing (based on valve clearance of 1 mm)		
Inlet valve opens	3° after T.D.C.	
Inlet valve closes	34° after B.D.C.	
Exhaust valve opens	33° before B.D.C.	
Exhaust valve closes	2° before T.D.C.	
Valves	Inlet	Exhaust
	Angle of valve face Valve face diameter Valve stem diameter Valve stem clearance in guide Valve clearance (cold) Lift	29°30' ± 15' 41.9 — 42.1 mm 8.649 — 8.661 mm 0.044 — 0.068 mm 0.5 mm 9.75 mm



Valve springs	Inner	Outer
Compressed to	40.7 mm	43.2 mm
Spring load	10.4—11.4 kg	21.4—23.4 kg
Compressed to	30.9 mm	33.5 mm
Spring load	18.8—20.8 kg	39.4—43.4 kg
Tappets		
Outside diameter	33.274— 33.287 mm	
Diametral clearance in cylinder block	0.043— 0.081 mm (max. 0.15 mm)	
Push rods		
Overall length	313.3 —313.9 mm	
Max. permissible amount out of straight	0.25 mm	
Rocker shaft		
Outside diameter	22.193— 22.206 mm	
Rocker bush I.D. (reamed)	22.213— 22.234 mm	
Diametral clearance, shaft in bushes	0.007— 0.041 mm (max. 0.09 mm)	
CYLINDER BLOCK		
Cylinder block		
Initial bores for cylinder liners	105.665—105.687 mm	
Initial bores for main bearings	82.880— 82.906 mm	
Initial bores for camshaft bearings 2 and 3	53.330— 53.360 mm	
Initial bores for camshaft bearing bushes 1 and 4	59.680— 59.710 mm	
Initial bores for tappets	33.330— 33.355 mm	
Cylinder liners		
Outside diameter	105.669—105.687 mm	
Inside diameter before pressing in	100.62 —100.64 mm	
Inside diameter after pressing in	100.60 —100.63 mm	
Projection above top face of cylinder block	0.00 — 0.07 mm	
Replace liner when wear exceeds	0.4 mm	
CRANKSHAFT		
Crankshaft		
Maximum run-out between two adjacent bearings	0.08 mm total clock reading	
Maximum run-out on shaft	0.15 mm total clock reading	
Main bearing journals		
Diameter	78.734— 78.754 mm	
Undersize limits	Five regrinds in steps of 0.254 mm (max. 1.27 mm)	
Width No. 1 journal	46.87 — 47.13 mm	
Width Nos. 2, 3, 5 and 6 journals	35.433— 35.687 mm	
Width No. 4 journal	49.53 — 49.58 mm	
Width No. 7 journal	49.46 — 49.66 mm	
Fillet radius	3.55 — 4.05 mm	

<p>Crankpins Diameter Undersize limits Width Fillet radius</p>	<p>60.954— 60.974 mm Five regrinds in steps of 0.254 mm (max. 1.27 mm) 43.182— 43.258 mm 3.55 — 4.05 mm</p>
<p>After every crankshaft regrind chamfer oil hole edges to a radius of 0.5 mm.</p>	
<p>Crankshaft end play End play Oversize thrust washers When using washers regrind no. 4 journal to (The fillet radius must be adhered to)</p>	<p>0.06 — 0.25 mm (max. 0.35 mm) 0.13 mm 49.784— 49.809 mm</p>
<p style="text-align: center;">BEARINGS</p>	
<p>Main bearings Inside diameter Bearing diametral clearance Undersize bearings</p>	<p>78.804— 78.842 mm 0.050— 0.108 mm Five, in steps of 0.254 mm</p>
<p>Big-end bearings Inside diameter Bearing diametral clearance Undersize bearings</p>	<p>61.013— 61.037 mm 0.039— 0.083 mm Five, in steps of 0.254 mm</p>
<p style="text-align: center;">CONNECTING RODS</p>	
<p>Connecting rods Initial bore, big end Initial bore, small end Inside diameter bush (reamed) Diametral clearance, gudgeon pin in small-end bush</p>	<p>64.593— 64.605 mm 36.824— 36.849 mm 33.046— 33.054 mm 0.020— 0.034 mm</p>



PISTONS	
Pistons Material Skirt diameter below scraper ring Piston clearance Width of grooves for compression rings Width of grooves for scraper rings Distance between top of pistons at T.D.C. and top face of engine block Initial bore for small end bush	aluminium alloy 100.457—100.482 mm 0.118— 0.173 mm 2.47 — 2.49 mm 6.39 — 6.41 mm max. —.20 — +.20 33.022— 33.026 mm
Gudgeon pins Diameter Diametral clearance in small end bush Retained by Insert gudgeon pin in piston heated to 60°—80° C	33.020— 33.026 mm 0.020— 0.034 mm circlips push-fit
Piston rings Top compression ring Width of compression rings (3) Width of scraper rings (2) Gap, top compression ring Gap, 2nd. and 3rd. compression rings Gap, scraper rings Clearance, compression rings in grooves Clearance, scraper rings in grooves	chromium plated 2.358— 2.370 mm 6.328— 6.340 mm 0.4 — 0.6 mm 0.35 — 0.55 mm 0.35 — 0.55 mm 0.10 — 0.132 mm 0.05 — 0.082 mm
CAMSHAFT	
Camshaft Journal diameter Initial dimension from nose to back of cam Renew camshaft when this dimension is Camshaft end-play	53.217— 53.230 mm 44.800— 44.900 mm 44.550 mm 0.10 — 0.25 mm (max. 0.3 mm)
Camshaft bearings Outside diameter, bearings 1 and 4 (bushes) Inside diameter, bearings 1 and 4 (bushes) Diameter, bearings 2 and 3 (in block) Interference fit, bearings 1 and 4 in block Diametral clearance, bearings 1 and 4 Diametral clearance, bearings 2 and 3	59.72 — 59.74 mm 53.33 — 53.35 mm 53.33 — 53.36 mm 0.01 — 0.06 mm 0.10 — 0.133 mm (max. 0.25 mm) 0.10 — 0.143 mm (max. 0.25 mm)

TIMING GEARS

Timing gears	
Crankshaft gear	23 teeth
Camshaft gear	46 teeth
Idler gear	49 teeth
Accessory drive gear	46 teeth
Crankshaft gear interference fit	0.019—0.043 mm
Camshaft gear interference fit	0.001—0.028 mm
Crankshaft gear to idler gear backlash	0.045—0.139 mm
Idler gear to camshaft gear backlash	0.035—0.129 mm
Idler gear to accessory drive gear backlash	0.095—0.189 mm
Idler gear spindle clearance in bush	0.03 —0.08 mm
Bush clearance in idler gear	0.035—0.075 mm
Idler gear end-play	0.065—0.25 mm (max. 0.3 mm)

FLYWHEEL

Lateral runout (measured 140 mm from centre)	0.15 mm
Starter ring	126 teeth

LUBRICATION

Lubricating system	
Sump capacity	12 litres
A.P.I. classification	Service DG-DM
Lubricant	Heavy Duty - Suppl. I
Viscosity, below 0° C	SAE 20
0°—30° C	SAE 30
above 30° C	SAE 40
Oil pressure to be measured at	75°—80° C coolant temperature
at idling speed	0.35 kg/cm ²
at 2000 r.p.m.	3.5—4.2 kg/cm ²
Lubricating oil filter	Full-flow filter

Note: Oil pressure may be changed by means of pressure regulating screw located just ahead of oil filter. Pressure at 2000 r.p.m. may not exceed upper limit indicated above.



<p>Oil pump</p> <p>Operation Ratio Diametral clearance, driving spindle in bush Internal diameter, pump housing Depth, pump housing External diameter, pump gears Height, pump gears Backlash between gears Diameter, driving spindle Clearance in housing Diameter, idler spindle Clearance, idler spindle in idler gear Free pump delivery (without counter pressure) at 1000 r.p.m. and 75° C oil temperature</p>	<p>Shaft driven from camshaft 1 : 1 0.050— 0.080 mm { 53.677— 53.703 mm { 44.487— 44.513 mm 34.875— 34.925 mm { 53.55 — 53.60 mm { 44.36 — 44.41 mm 34.887— 34.913 mm 0.55 — 0.65 mm 17.408— 17.418 mm 0.037— 0.067 mm 17.345— 17.355 mm 0.032— 0.054 mm 28 litres/min.</p>																				
<p>COOLING SYSTEM</p>																					
<p>Cooling</p> <p>Coolant circulation Thermostat opening temperature Operating temperature Cooling system capacity Fan diameter</p>	<p>forced by impeller type pump 71°—77° C 75°—80° C 22 litres 500 mm</p>																				
<p>Water pump</p> <p>Pulley interference fit Impeller interference fit</p>	<p>0.002—0.028 mm 0.022—0.050 mm</p>																				
<p>TORQUE LIMITS</p>																					
<p>Required torque for the attachment of:</p> <p>Cyl. head Main bearing caps Con. rod bearing caps Flywheel Injection pump camshaft nut Vacuum pump or compressor shaft nut Delivery valve holders Injector clamp nuts Vibration damper Injector line union nuts</p>	<table border="0"> <tr> <td>180—190 ft.lbs</td> <td>25 —26.4 mkg</td> </tr> <tr> <td>145—155 ft.lbs</td> <td>20 —21.5 mkg</td> </tr> <tr> <td>75— 85 ft.lbs</td> <td>10.2—11.8 mkg</td> </tr> <tr> <td>62— 68 ft.lbs</td> <td>8.5— 9.5 mkg</td> </tr> <tr> <td>45 ft.lbs</td> <td>6.2 mkg</td> </tr> <tr> <td>45 ft.lbs</td> <td>6.2 mkg</td> </tr> <tr> <td>31— 40 ft.lbs</td> <td>4.2— 5.6 mkg</td> </tr> <tr> <td>35 ft.lbs</td> <td>5 mkg</td> </tr> <tr> <td>300 ft.lbs</td> <td>40 mkg</td> </tr> <tr> <td>18— 21 ft.lbs</td> <td>2.5— 3 mkg</td> </tr> </table>	180—190 ft.lbs	25 —26.4 mkg	145—155 ft.lbs	20 —21.5 mkg	75— 85 ft.lbs	10.2—11.8 mkg	62— 68 ft.lbs	8.5— 9.5 mkg	45 ft.lbs	6.2 mkg	45 ft.lbs	6.2 mkg	31— 40 ft.lbs	4.2— 5.6 mkg	35 ft.lbs	5 mkg	300 ft.lbs	40 mkg	18— 21 ft.lbs	2.5— 3 mkg
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REPAIR PROCEDURE

ENGINE REMOVAL

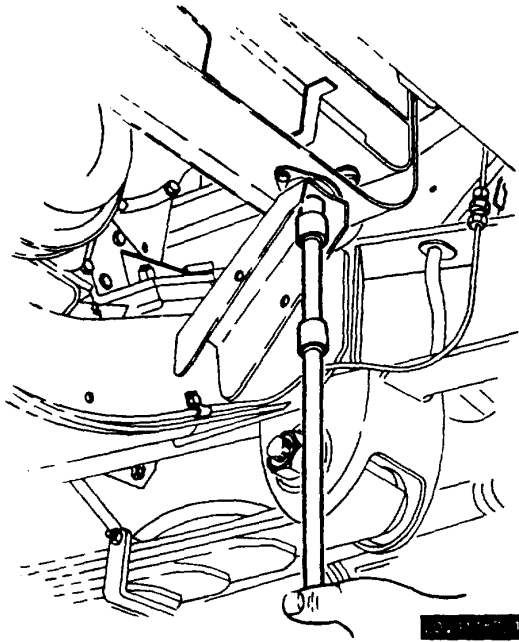


Fig. 3.
Disconnect radiator at bottom brackets.

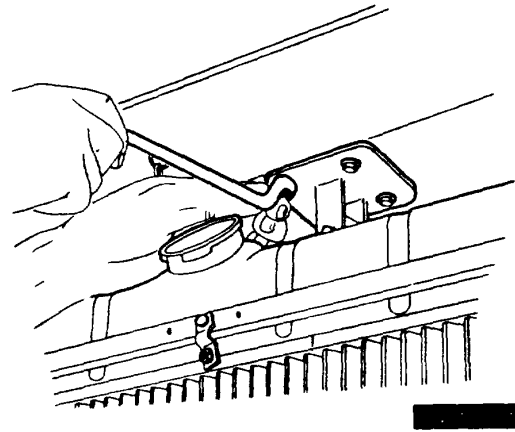


Fig. 4.
Remove upper radiator attaching nuts.

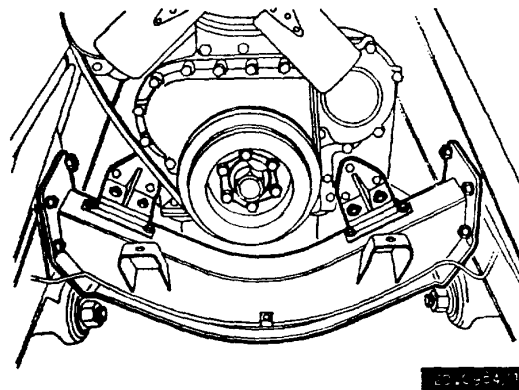


Fig. 5.
Remove front cross-member assy, supporting engine on jacks.

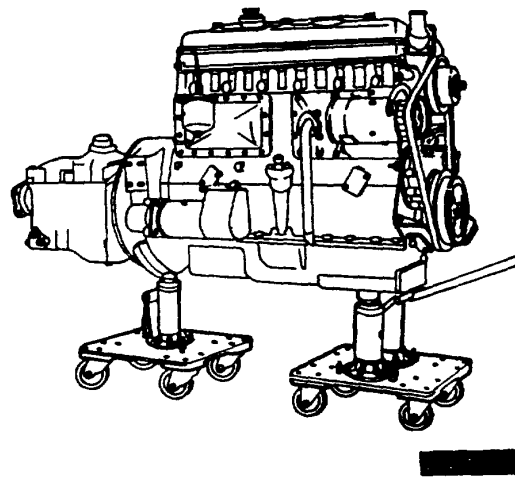
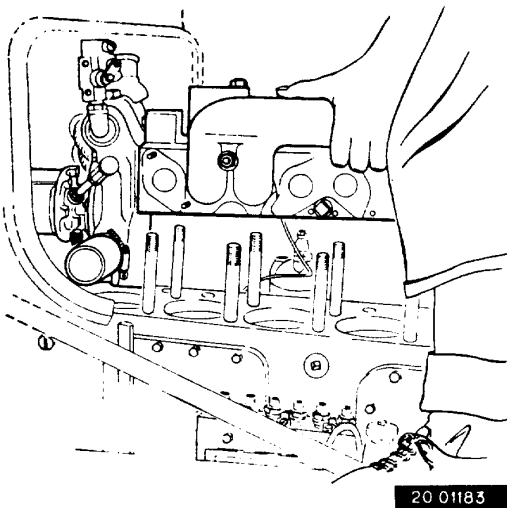


Fig. 6.
Remove engine from chassis with mobile jacks.

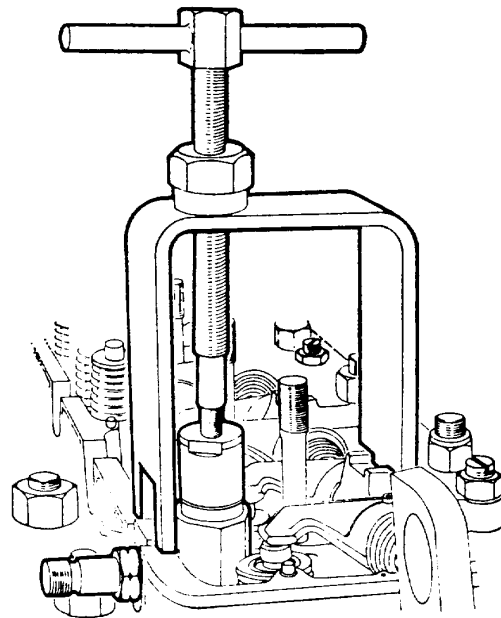
CYLINDER HEAD



20.01183

Fig. 7.

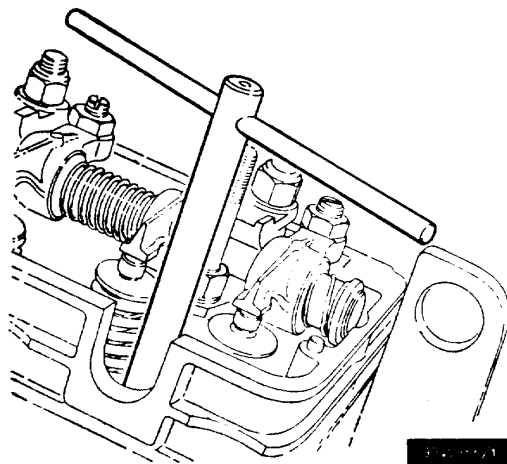
Remove cylinder head complete with inlet manifold and water pump.



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Fig. 8.

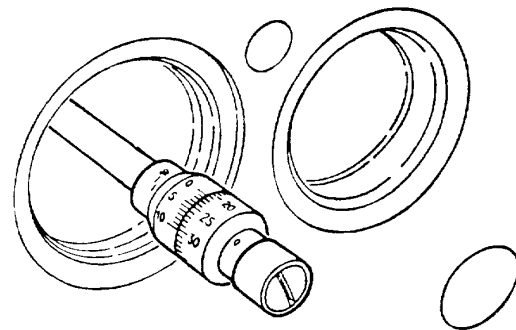
Remove jammed injectors with extractor 4-99-535055.



20.01185

Fig. 9.

True up injector seat in head with cutter 2-99-535058, if necessary.



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Fig. 10.

Check valve guide wear with an inside micrometer.

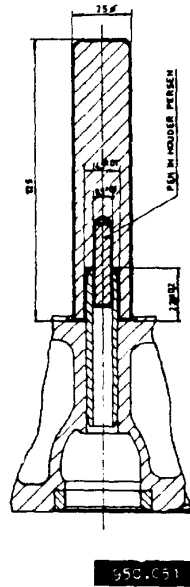


Fig. 11.

Press in valve guides from above with pressing pin 2-99-535073.

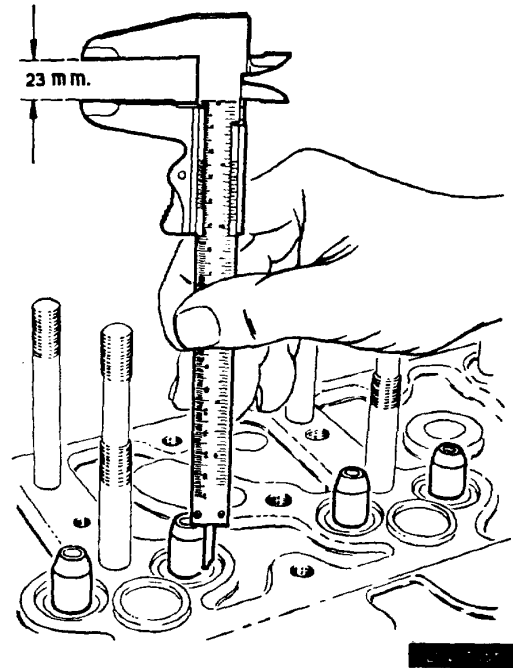


Fig. 12.

Check distance valve guides protrude above cylinder head with a depth gauge or vernier caliper gauge.

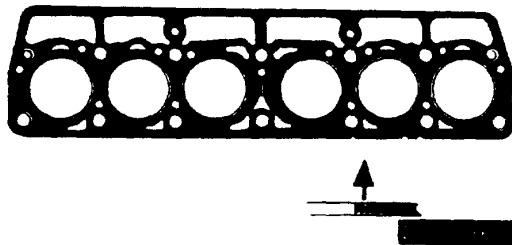


Fig. 13.

Fit head gasket dry with holes aligned with coolant passages in cylinder block. If necessary, head and block should be planed.

Small flange of turnover reinforcement must face cyl. head.

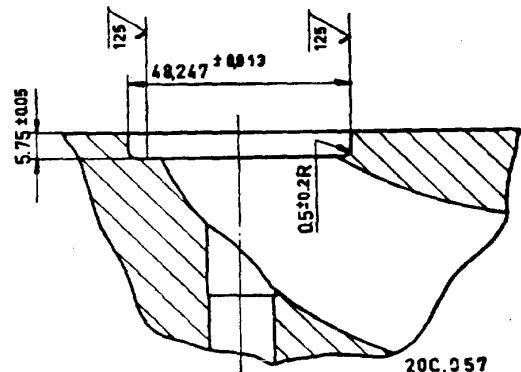


Fig. 14.

Machine recess for inlet valve seat inserts to dimensions shown. The inserts can either be pressed in or shrunk in, e.g. using liquid carbon dioxide.

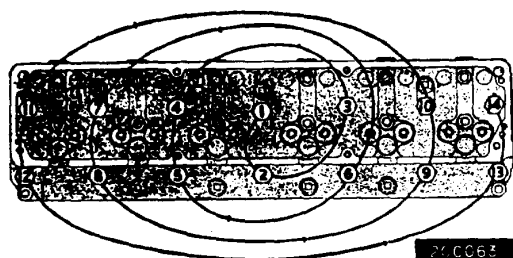


Fig. 15.

Correct sequence of tightening cylinder head nuts.

1. Tighten nuts evenly in correct sequence.
2. Tighten nuts to specified torque in correct sequence.
3. Run engine until it reaches operating temperature.
4. Switch off engine and tighten nuts again as indicated under (2) before the engine has cooled down.
5. After 600 km (25 operating hours) tighten nuts again, preferably with a warm engine.

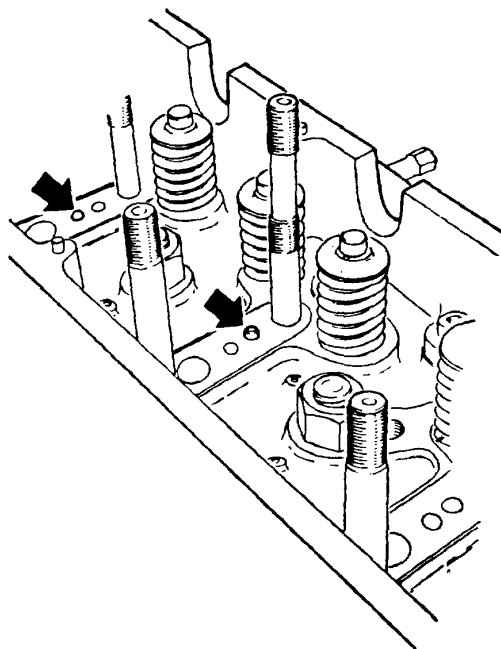


Fig. 16.

Do not omit to fit gasket and dowel pins, under the rocker shaft support brackets.

VALVE GEAR

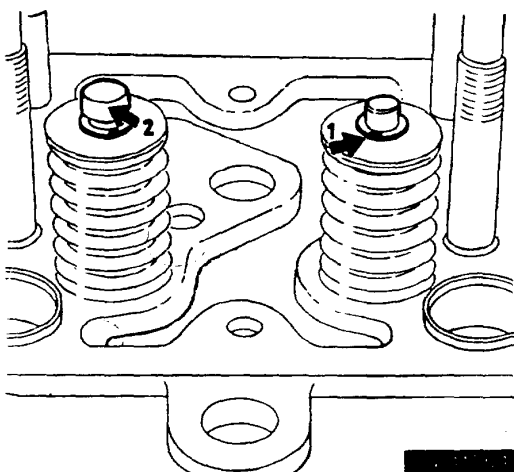


Fig. 17.

Valves installed.

1. Leave a gap between valve collet halves.
2. Fit valve stem caps.

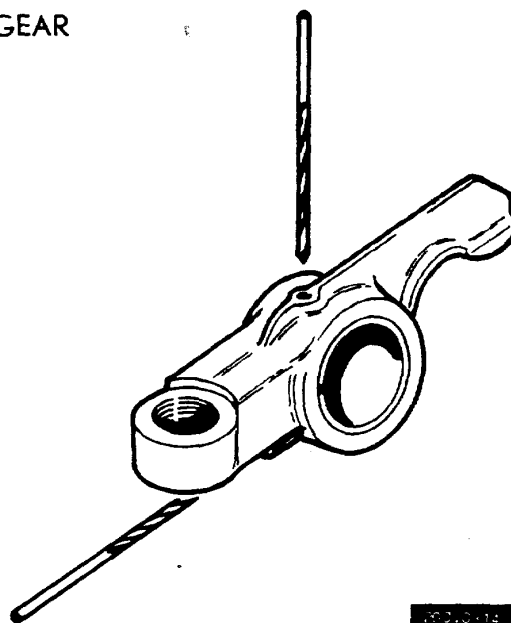


Fig. 18.

Drill two oil holes in bush after it has been pressed in.

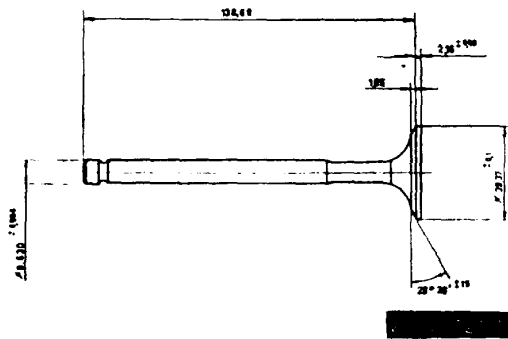


Fig. 19.
Exhaust valve.

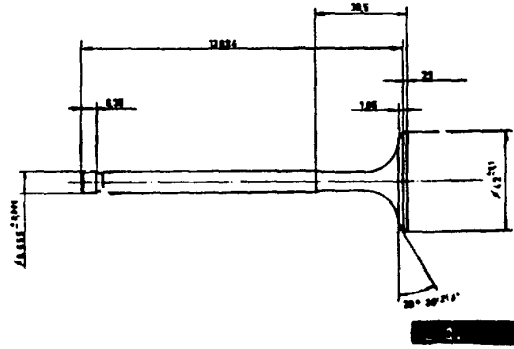


Fig. 20.
Inlet valve.

Valve face to be concentric with valve stem to within
0.1 mm total clock reading.

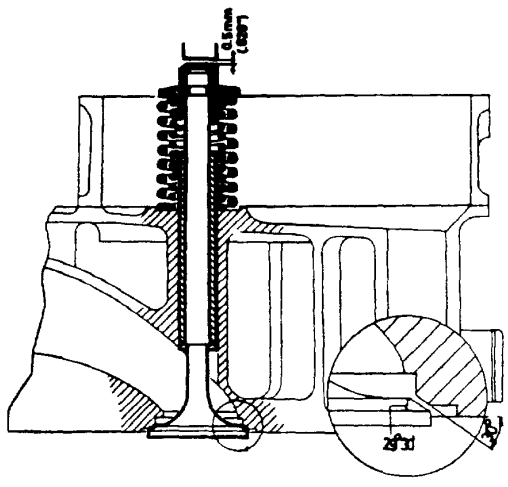


Fig. 21.
Inlet valve in position.

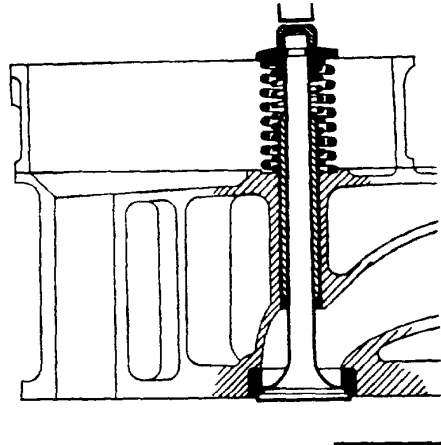


Fig. 22.
Exhaust valve in position.

Check valve clearance with engine cold.

CYLINDER BLOCK

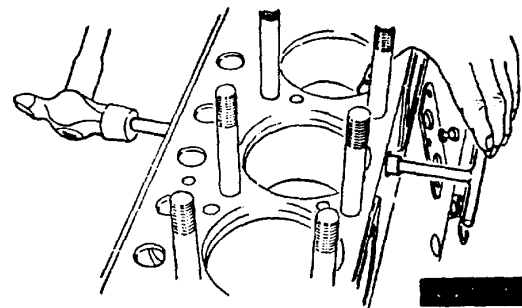


Fig. 23.
Tap out throttle control shaft bushes in manner illustrated
above.

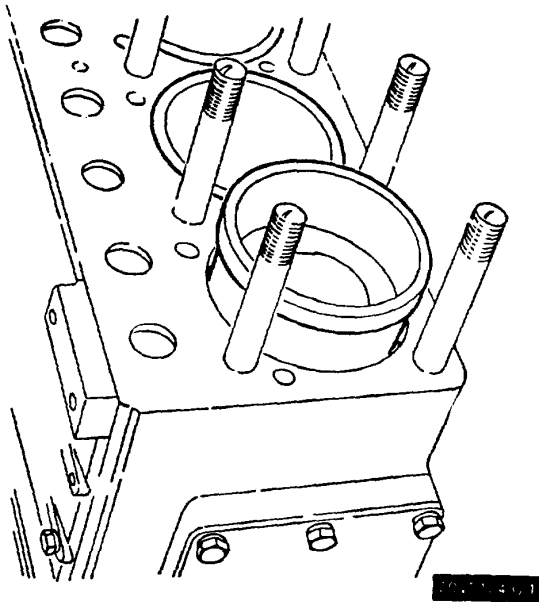


Fig. 24.

The DA 475 diesel engine is fitted with replaceable dry cylinder liners.

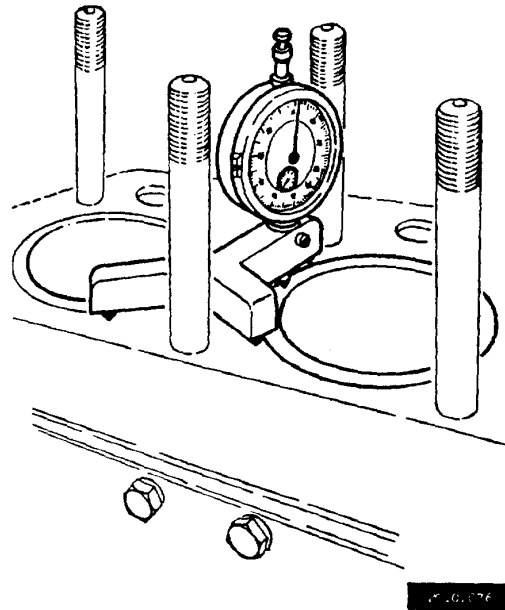


Fig. 25.

Check cylinder liner head clearance with the aid of a dial gauge and if necessary correct by adding or removing shims.

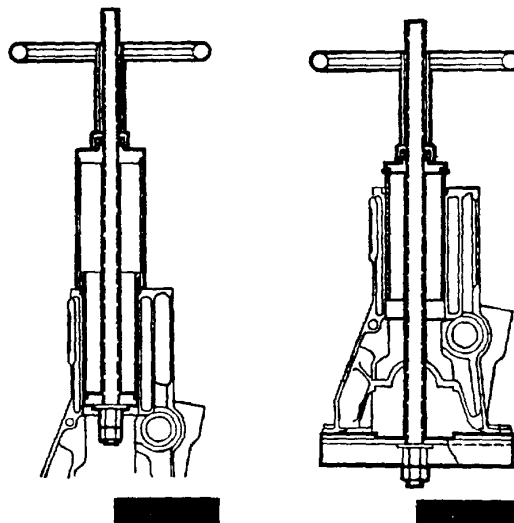


Fig. 26.

Remove and install cylinder liners with extractor tool 2-99-535223. When fitting, coat outside of liners with suitable lubricant. Never use soft soap.

CRANKSHAFT AND BEARINGS

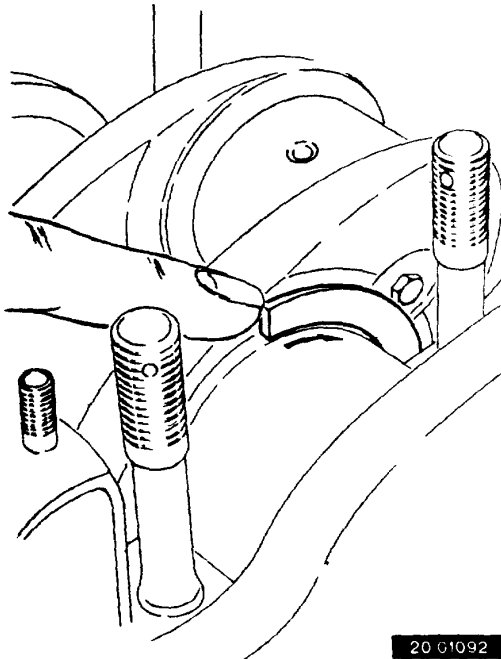


Fig. 27.

Fitting end-play thrust washer halves.

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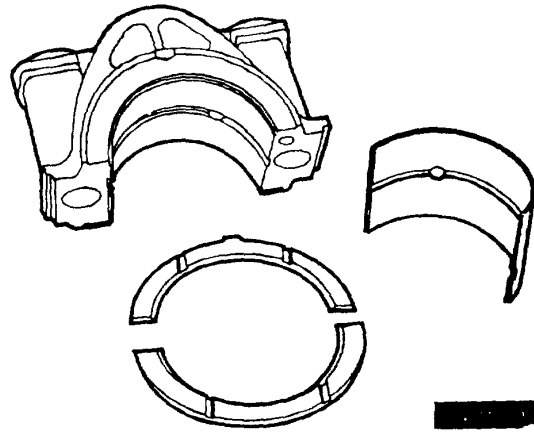


Fig. 28.

Thrust washers are located on either side of centre main bearing journal.

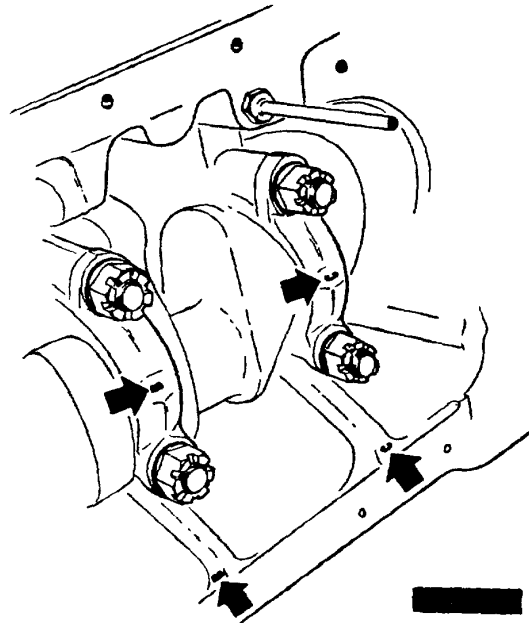


Fig. 29.

Fit the main bearing caps in their correct positions with the aid of the alignment marks.

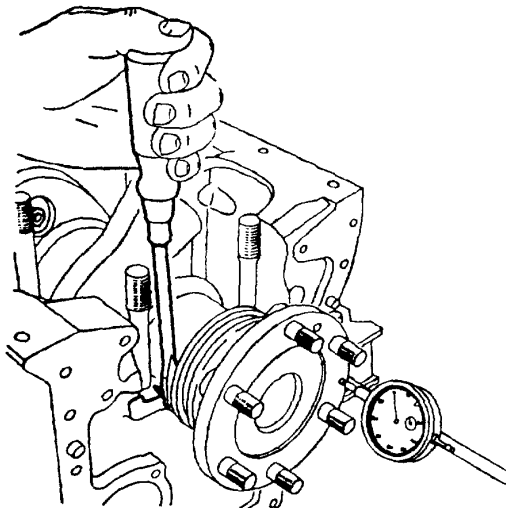


Fig. 30.

Check crankshaft end-play with dial indicator. This must be between 0.06–0.25 mm and may not exceed 0.35 mm. Correct by fitting oversize thrust washers.

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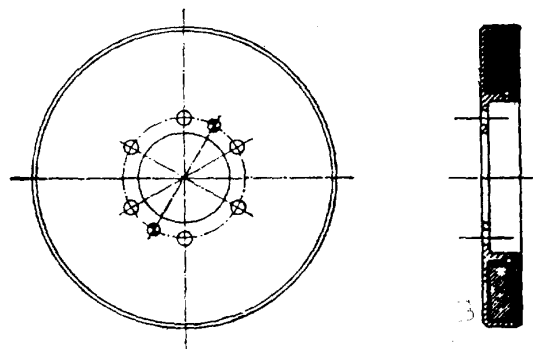


Fig. 31.

Cross-sectional view of crankshaft vibration damper.

PISTONS AND CONNECTING RODS

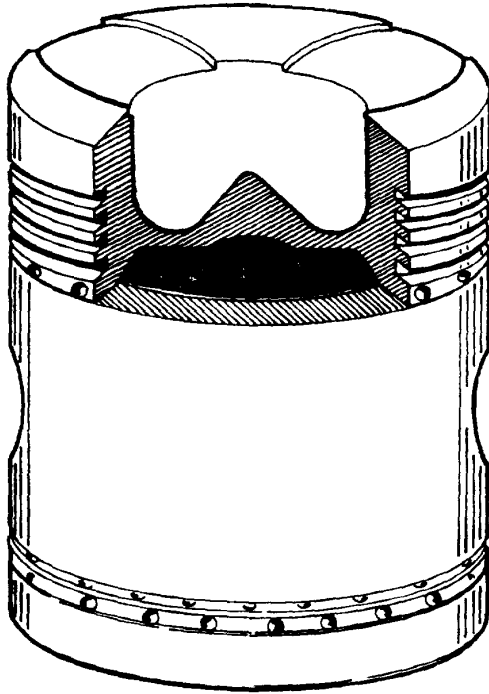


Fig. 34.

Pistons with a toroidal combustion chamber cavity are fitted in DA 475 diesel engines.

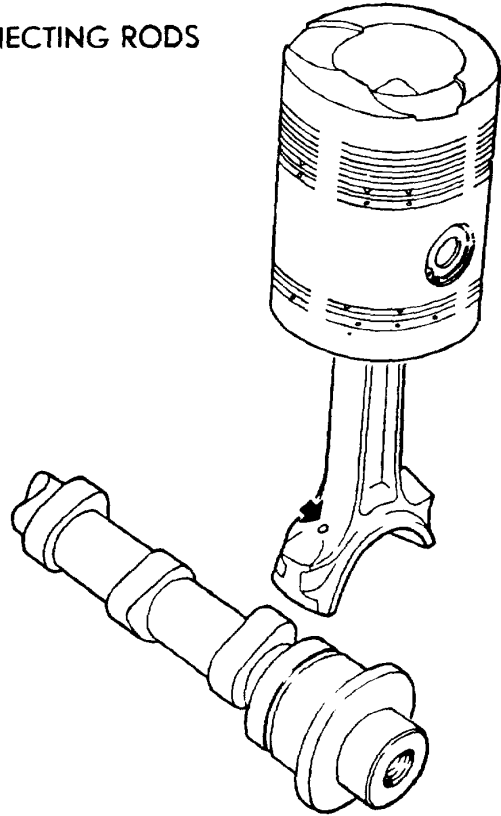


Fig. 35.

When fitting, ensure that piston and connecting rod are correctly positioned in relation to camshaft.

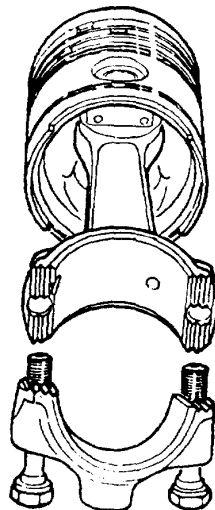


Fig. 36.

Grooved connecting rod and cap.

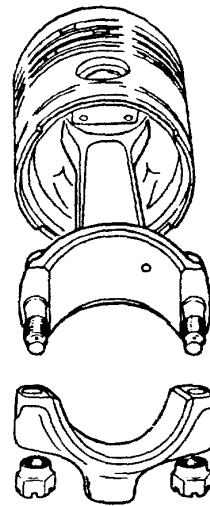


Fig. 37.

Smooth connecting rod and cap.



CAMSHAFT AND TIMING GEAR

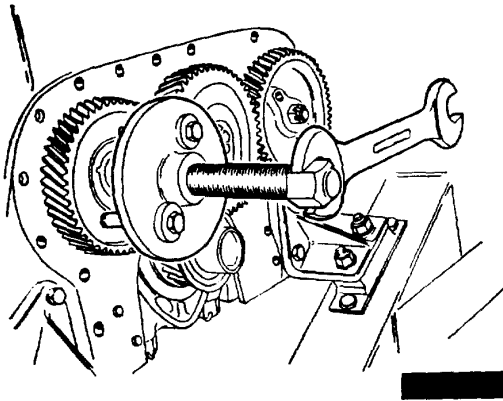


Fig. 38.

Remove camshaft gear with puller 2-99-535144.

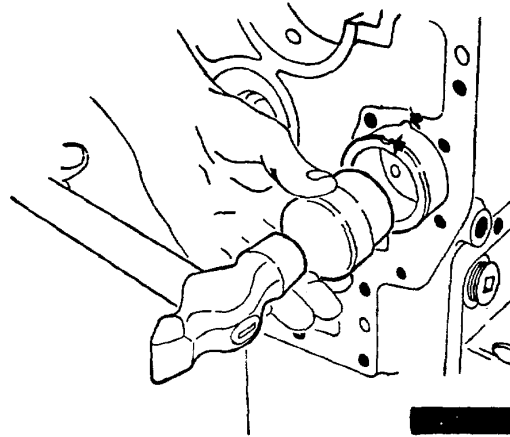


Fig. 39.

Fit front camshaft bearing with punch 2-99-535079. Make sure bearing is correctly positioned.

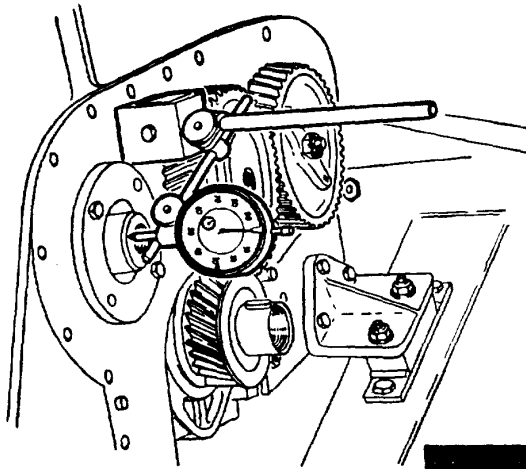


Fig. 40.

Check camshaft end-play as follows: Fit camshaft and thrust plate, tightening cap screws securely. Check end-play and correct, if necessary, by fitting a different thickness shim. Slacken cap screws again, align thrust plate by placing centring sleeve on end of camshaft and retighten and secure cap screws. Check that camshaft rotates freely.

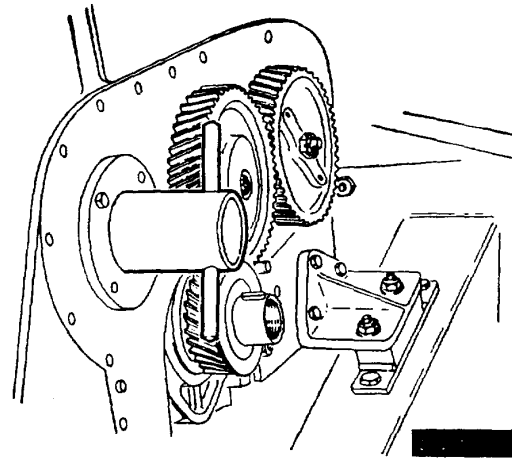


Fig. 41.

Centre thrust plate with sleeve 2-99-535047.

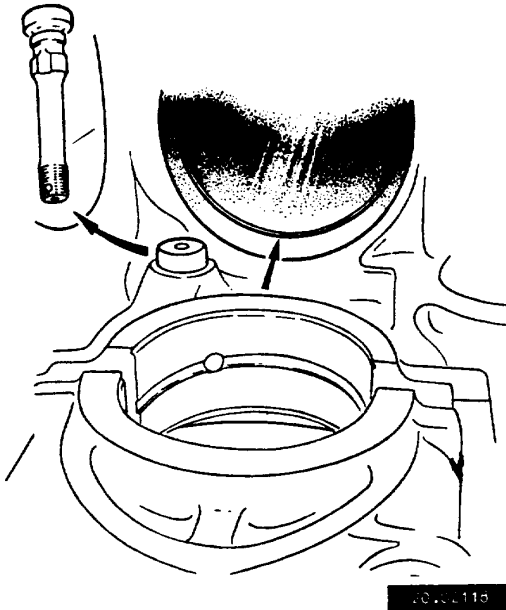


Fig. 42.

Before the idler gear fixing bolt can be removed the cylinder liner of no. 1 cylinder must be pulled up a little.

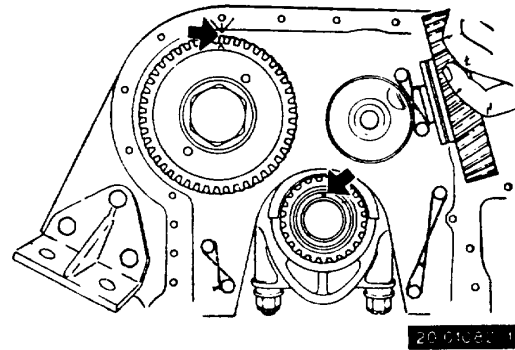


Fig. 43.

Fitting the timing gears. Ensure that the timing marks on the timing gear case and camshaft drive gear are in line and the crankshaft timing gear key is in the vertical position. No. 1 and no. 6 pistons will then be at T.D.C.

FLYWHEEL AND FLYWHEEL HOUSING

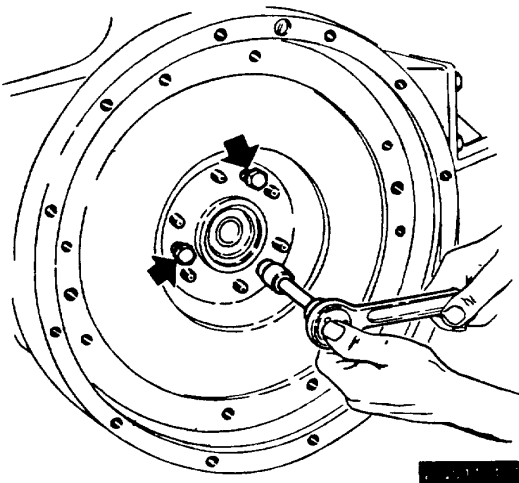


Fig. 44.

Press the flywheel off the crankshaft using the special puller screws.

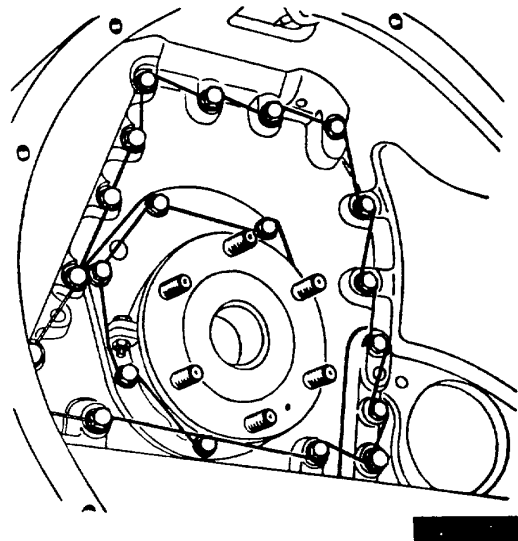


Fig. 45.

The lock wire must be fitted in such a way that the bolts are not forced in anti-clockwise direction when the wire is tightened.

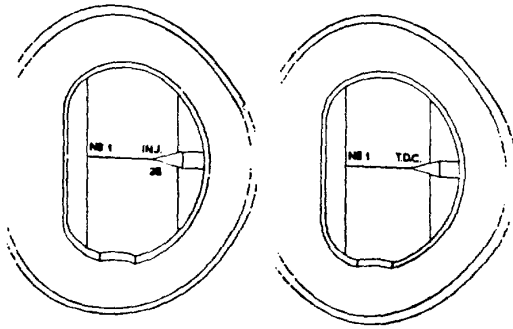


Fig. 46.

Inspection opening in flywheel housing.
Left: injection timing No. 1 cylinder is 28° before T.D.C.
Right: No. 1. piston at T.D.C.

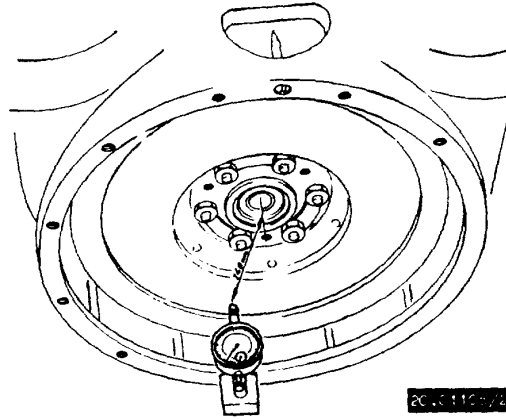


Fig. 47.

Check lateral runout of flywheel on clutch facing contact surface approx. 140 mm from crankshaft centre.

LUBRICATION

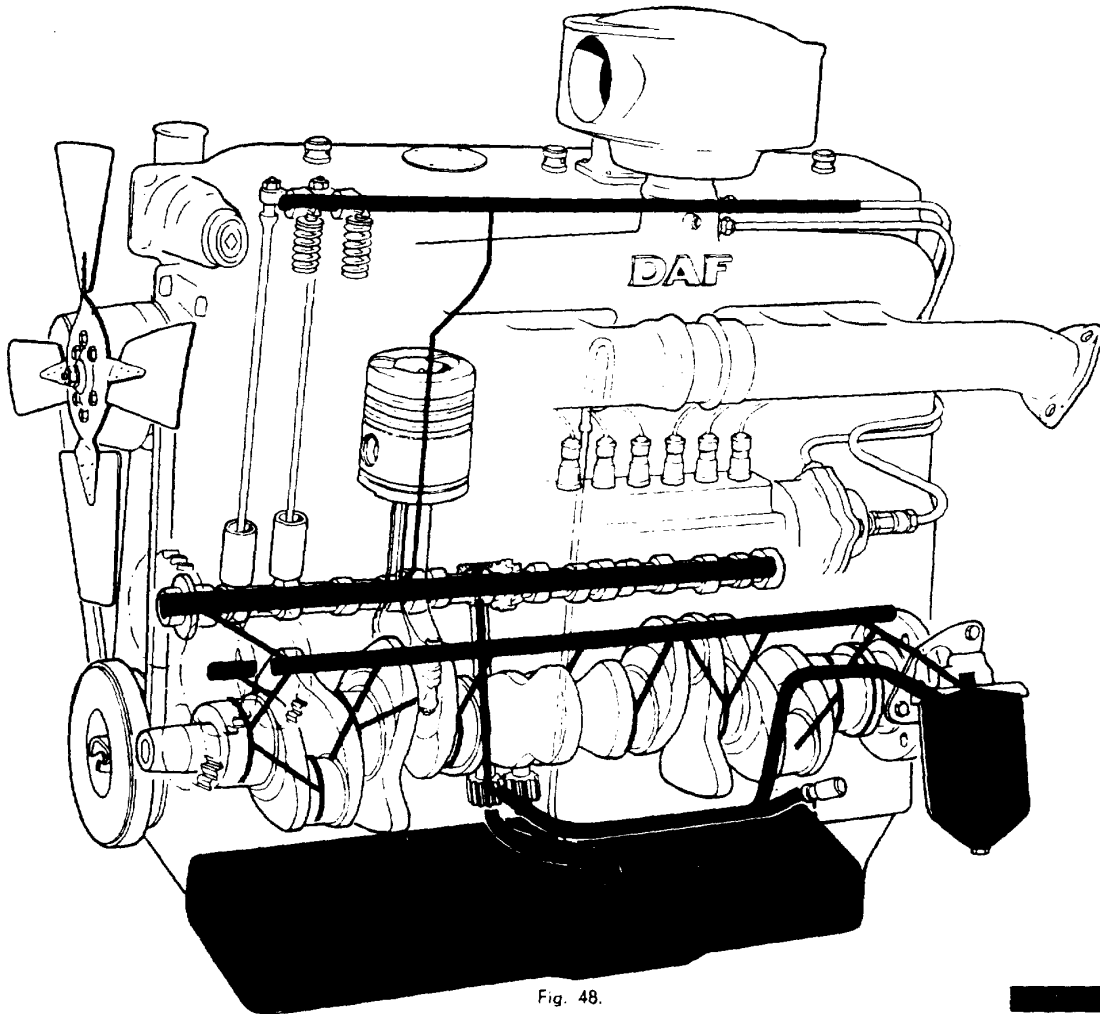


Fig. 48.
Oil flow diagram.

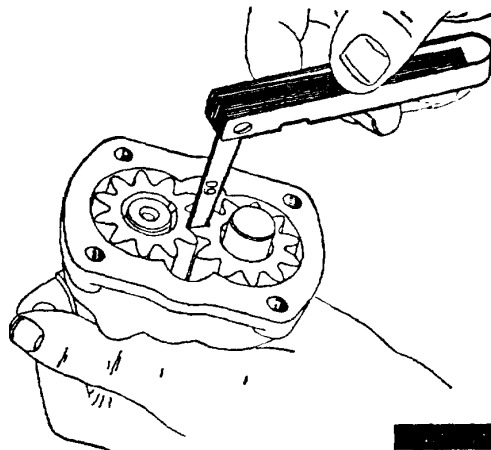


Fig. 49.
Check backlash between oil pump gears.

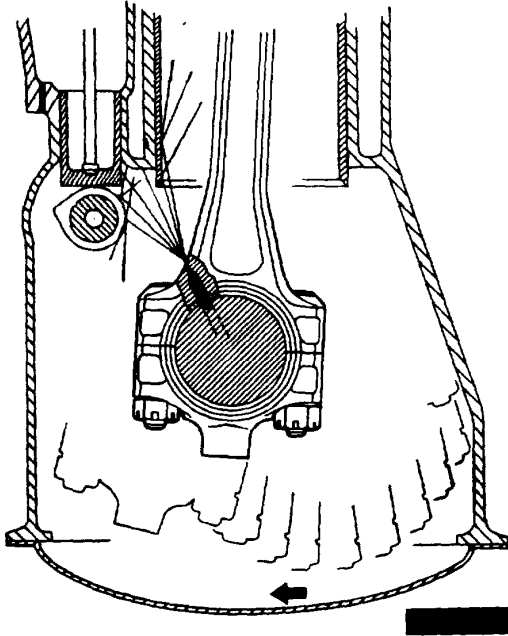


Fig. 50.
Tappet lubrication.

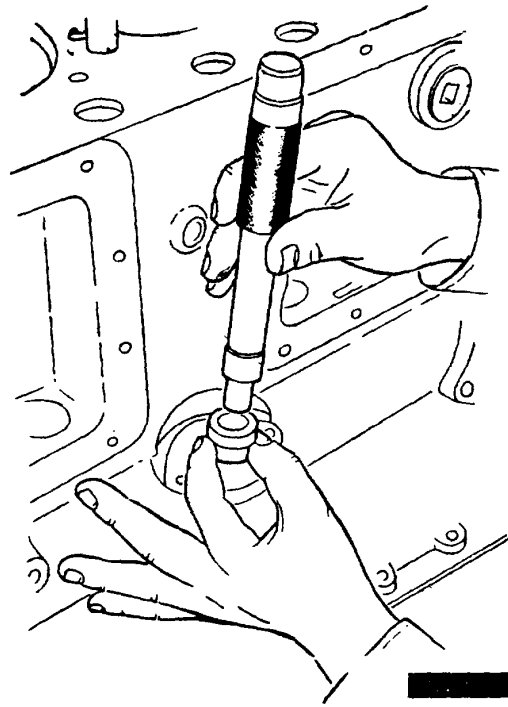


Fig. 51.
Fit oil pump drive gear bush with drift 2-99-535076.

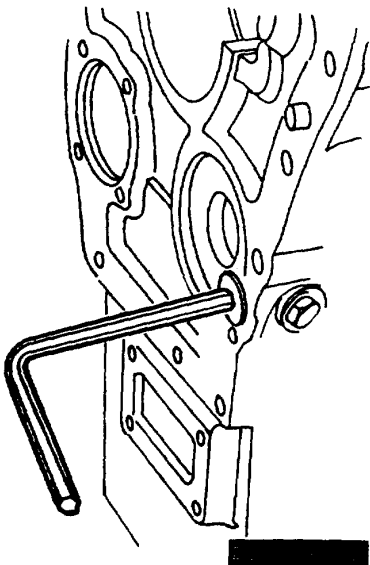


Fig. 52.
Use an Allen key to remove and install oilway plug.

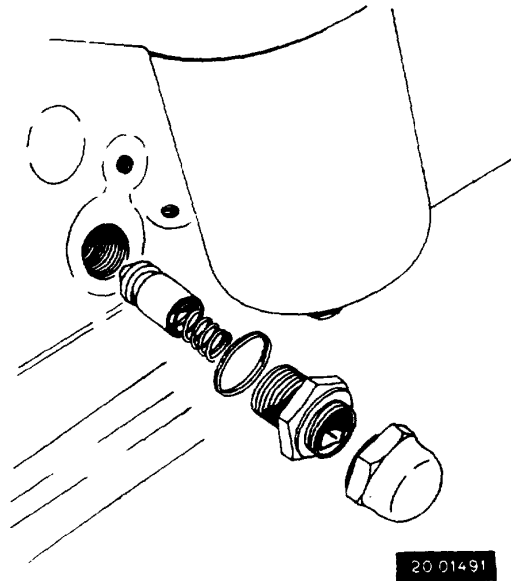


Fig. 53.
Exploded view of oil pressure relief valve.

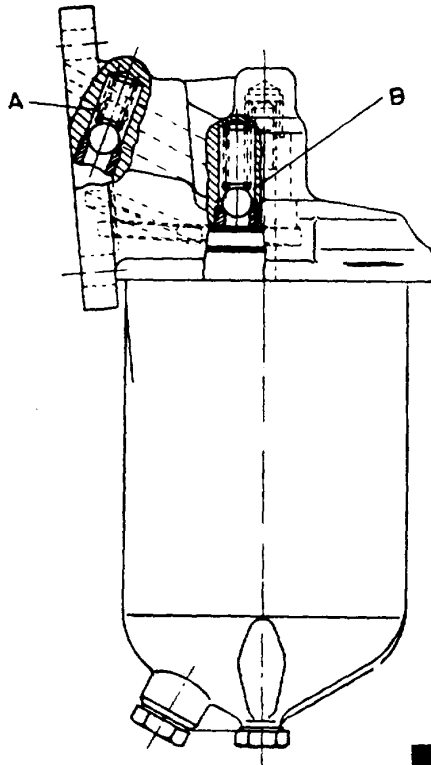


Fig. 54.

- A. By-pass valve for coarse and fine filter; opening pressure 3 kg/cm².
- B. By-pass valve for fine filter; opening pressure 2 kg/cm².

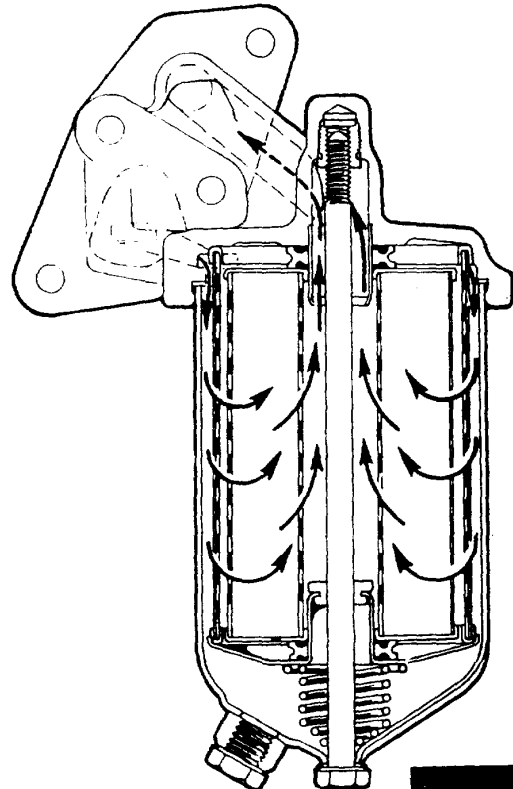
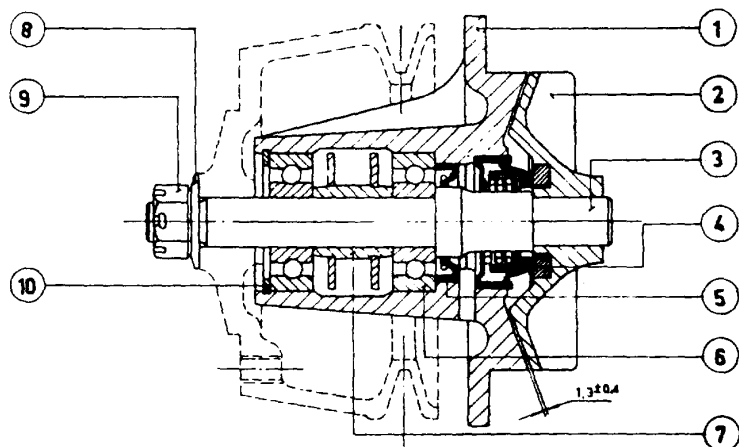


Fig. 55.

Section through oil filter.

WATER PUMP



- 1. Bearing hub
- 2. Impeller
- 3. Impeller shaft
- 4. Waterpump seal
- 5. Grease seal
- 6. Ball bearing (2x)
- 7. Spacer tube
- 8. Lock plate
- 9. Shaft nut
- 10. Circlip

Ball bearings and space between ball bearings must be filled full of preferably a lithium-base grease.

Fig. 56.

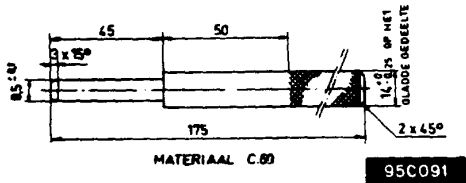
Section through water pump.

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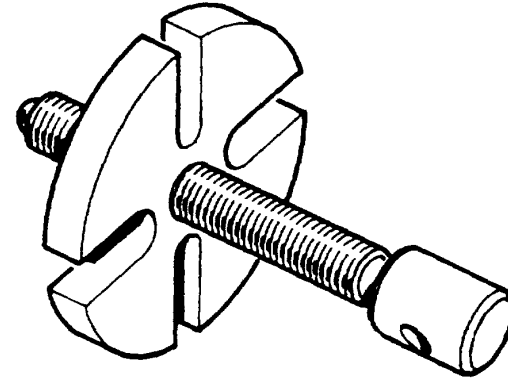


DAF TOOLS

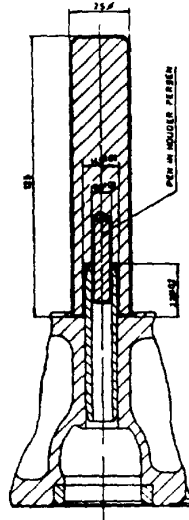
Order numbers are indicated in brackets.



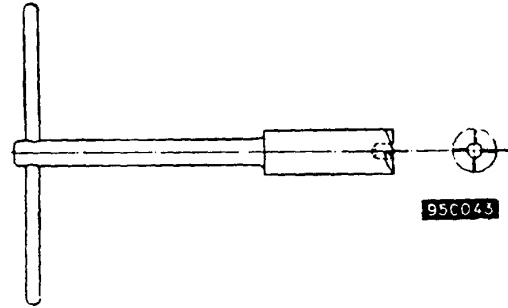
Pressing pin for valve guide removal. (2-99-535074)
 14.50 op het gladde gedeelte = on smooth section



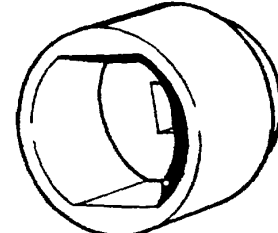
Vibration damper and camshaft gear puller (2-99-535144)



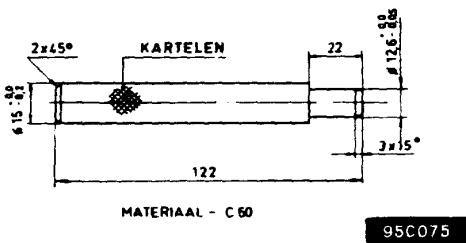
Pressing pin for valve guide installation (2-99-535073)



Injector seat cutter. (2-99-535058)



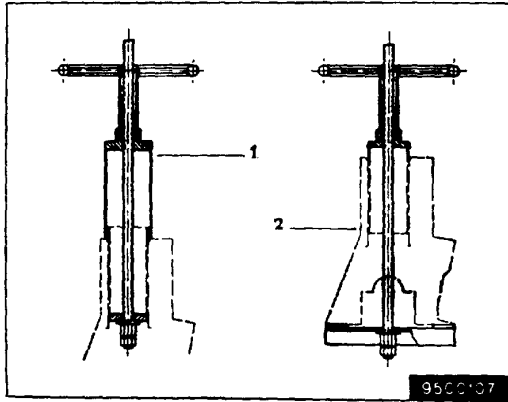
Socket for vibration damper bolt removal and installation. (2-99-535272)



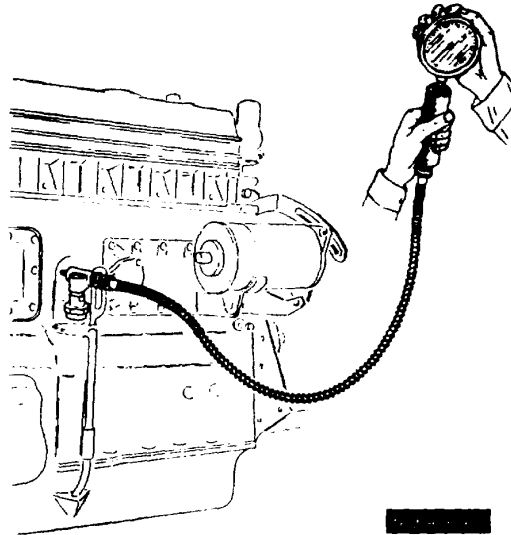
Throttle control shaft bush drift. (2-99-535075)
 Kartelen = Knurl



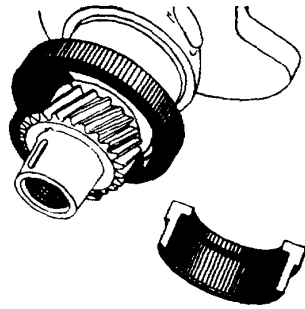
Oil pump drive gear shaft bush drift. (2-99-535076)



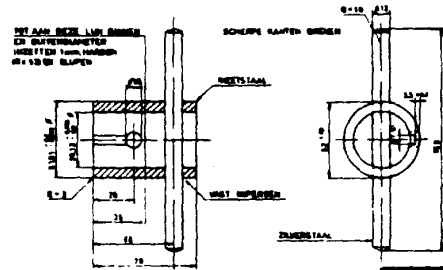
Extractor for cylinder liner removal and installation. (2-99-535223)



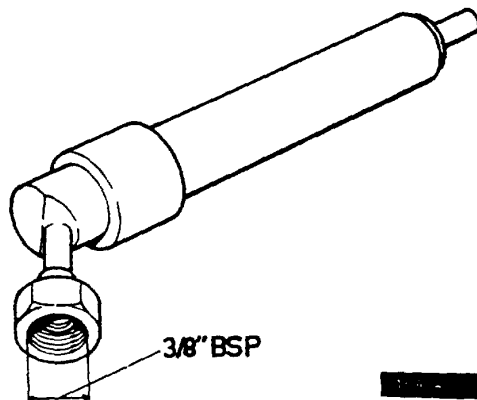
Rev counter flexible drive cable. (2-99-535265)



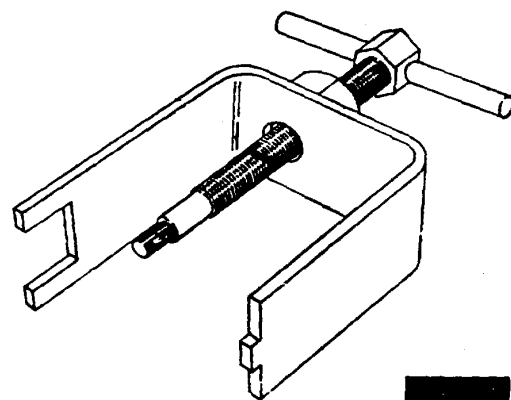
Split collar and ring for crankshaft gear removal. (2-99-535098)



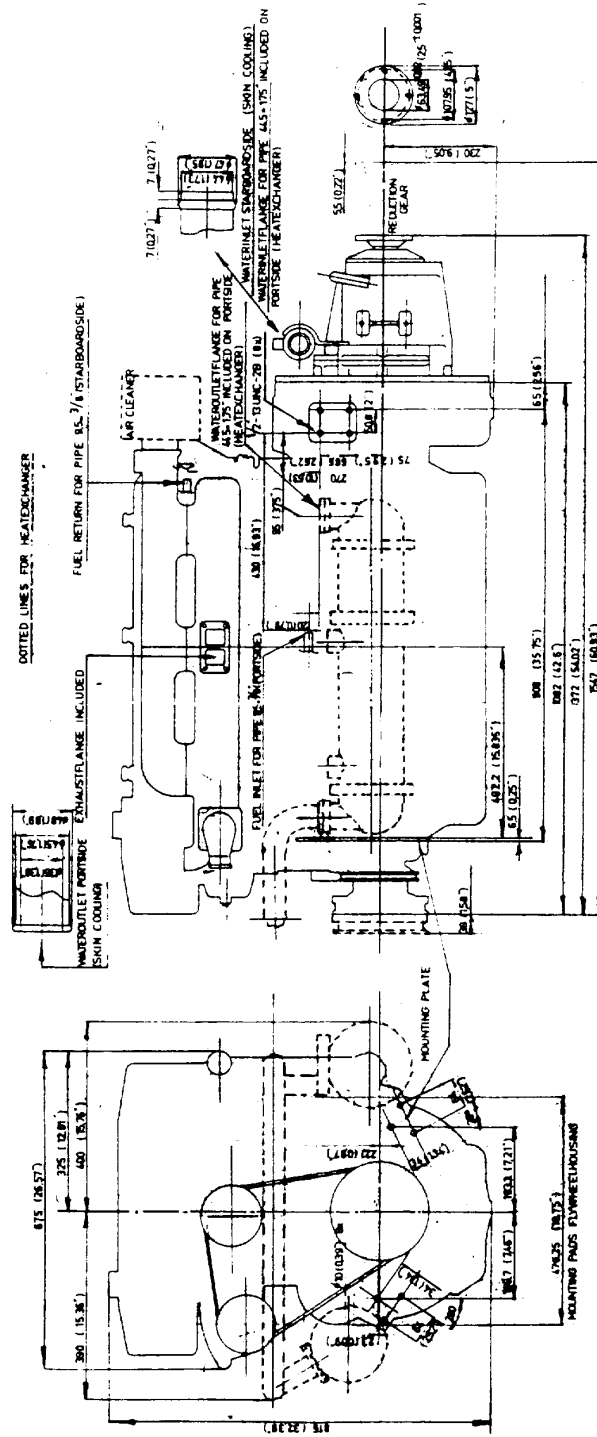
Camshaft thrust plate centring sleeve. (2-99-535047)



Compression gauge extension. (2-99-535264)



Injector extractor. (4-99-535055)



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