SPECIFICATIONS: 160-90 Turbo and 180-90 Turbo with late model engine

The engine equipping the **160-90 Turbo** (from frame 317820 for mechanical transmission tractors and from frame 317825 for POWER-SHIFT transmission tractors) and the **180-90 Turbo** (from frame 265251 for mechanical transmission tractors and from frame 265250 for POWER SHIFT transmission tractors) was subjected to modifications some of which are dealt with below.

	160-90 Turbo and 160-90 Turbo DT	180-90 Turbo and 180-90 Turbo DT
Make and design	FIAT turbo-charged	FIAT turbo-charged
Identifications code - Mechanical transmission tractors	8365.25.513 (FIAT pump)	8365.25.512 (FIAT pump)
Identifications code - POWER SHIFT transmission tractors	8365.25.515 (BOSCH pump)	8365.25.514 (BOSCH pump)
ENGINE		
Compression ratio	15.8 to 1	
Valve gear		
Inlet opens B.T.D.C.	11°	
Inlet closes A.B.D.C.	27°	
Exhaust opens B.B.D.C.	55°	
Exhaust closes A.T.D.C.	17°	
Valve clearance (cold) for timing checks	0,44 mm (0.0173 in)	
Injection pump	PES 6A 90D 410 RF 309 - 4834322	PES 6MW 100 - 4843739

Note - Late model 160-90 Turbo engines are fitted with piston cooling oil spray nozzles (standard equipment on the 180-90 Turbo engines).
Consequently, the lubrication system schematics given on page 3, Sect. 16, applies only to the early model 160-90 Turbo engines.
For the late model 160-90 Turbo engine (with piston cooling oil spray nozzles) refer to the schematics on page 4, Sect. 16.

Important - On late model engines the oil sump sealing is ensured by an O-ring plus jointing compound; on early model engines, sealing was obtained by jointing compound only.
On reassembly of late model engine sumps, proceed as follows:
— Clean and degrease the mating surfaces accurately.
— Apply SILASTIC 7091 bonding agent in the seat provided around sump then fit the O-ring.
— Apply LOCTITE 510 sealant on mating surfaces avoiding the sump-to-engine fastener threaded holes.
— Wet front/rear cover, rear cushion mount and sump to engine screws with oil to prevent "bonding" of screws.
— Finally, assemble the parts involved and tighten the screws provided to the specifired torques.

MODEL 160-90 Turbo - CALIBRATION DATA - W ALTECNA INJECTION PUMP TYPE PES6A90D 410 RF 309-483422 (from frame no. 317820)

Assembly data

Pump rotation (drive end) ..... clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off ..... 2.75 to 2.85 mm (0.108 to 0.112 in)
Pump timing, cylinder no. 1 in compression stroke ..... 23° ± 0.5° B.T.D.C.

Test plan

Test bench as per ISO 4008/1 and /2
Injectors as per ISO 7440 A11 - 1688901019 - u/pad 1680103098
Test fluid: ISO 4113 at 40° ± 2° C
Gaduate drain time: 30"
Fuel pressure: 1.5 to 1.8 bar (kg/cm^2) or 22 to 26 PSI
Release pressure: 172 to 175 bar (175 to 178 kg/cm^2 or 2485 to 2527 PSI)
Pipes: 6 × 2 × 600 mm as per ISO 4093.2

PUMP CALIBRATION DATA

Speed rpm	Rack stroke mm	Delivery per injector	Spread	Notes
		cm^3/100 shots		
1100 300	11.35 to 11.45 8.0 to 8.2	8.15 to 8.25 0.70 to 1.30	0.3 (0.45) 0.2 (0.40)	

SPEED GOVERNOR CALIBRATION DATA

Maximum		Idle		Notes
Speed rpm	Rack stroke mm	Speed rpm	Rack stroke mm	
1115 to 1135 1240 to 1280 1310	10.4 4 0 to 1.0	100 200 300 300 to 400	10.4 9.5 8.1 ([1]) 2 ([2])	[1] Actuating the control lever from idle to max (LDA pressure = 0.7 bar or psi). [2] Actuating the control lever from idle to max with solenoid energized.

CALIBRATION DATA - PUMP WITH GOVERNOR

Max. delivery		Speed limitation rpm	Intermediate delivery		Starting delivery		Max. fuel stroke	
Speed rpm	Delivery per injector cm^3/1000 shots		Speed rpm	Delivery per injector cm^3/1000 shots	Speed rpm	Delivery per injector cm^3/1000 shots	Speed rpm	Rack stroke mm
1100	81.5 to 82.5 (79.5 to 84.5)	1115 to 1135 (*)			100	140 to 160	1100	11.3 to 11.4
							900	11.4 to 11.5
700	86 to 88 (84 to 90)						700	12.0 to 12.1
							500	12.1 to 12.2
500	78 to 80 (76 to 82)							

Note: Test values in brackets; (*) Rack stroke 1 mm less than above.

ENGINE BLOCK - CYLINDER HEAD

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Engine Block				
Cylinder bore diameter in engine block	106.850 to 106.900	4.2066 to 4.2086	122.000 to 122.030	4.303 to 4.8043
Liner O.D.	107.020 to 107.050	4.2127 to 4.2145	121.920 to 121.970	4.799 to 4.8019
Liner fit in block				
— 115-90, 130-90 Turbo, 140-90 Turbo (interference)	.120 to .200	.0047 to .0079	—	—
— 160-90 Turbo, 180-90 Turbo (clearance)	—	—	.030 to .110	.0012 to .0043
Liner O.D. oversize	.2	.008	—	—
Liner bore diameter	104.000 to 104.024	4.0945 to 4.0945	115.000 to 115.022	4.527 to 4.528
Maximum ovality and taper due to wear (1)	.12	.0047	.15	.006
Liner bore undersize	.4-.8	.016-.032	.6	.024
Liner protrusion	—	—	.13 to .17	.005 to .006
Maximum liner misalignment	—	—	.04	.0015
Liner protrusion shim thickness	—	—	3.09-3.11-3.13-3.15 3.17-3.19-3.21-3.23 3.25-3.27-3.29-3.31 3.33-3.35-3.37- 3.39-3.41-3.43- 3.45-3.47-3.49	.1216-.1224-.1232- .1240-.1248-.1256- .1264-.1272-.1288- .1296-.1304-.1312- .1320-.1328-.1336- .1344-.1352-.1360- .1368-.1376-.1384
Housing bore diameter				
— Camshaft bushes (115-90, 130-90 Turbo and 140-90 Turbo)				
– Front	55.280 to 55.305	2.176 to 2.177	—	—
– Front intermediate	54.780 to 54.805	2.1567 to 2.1577	—	—
– Rear intermediate	54.280 to 54.305	2.1370 to 2.1380	—	—
– Rear	53.780 to 53.805	2.1173 to 2.1183	—	—
— Camshaft bushes (160-90 Turbo and 180-90 Turbo)	—	—	52.000 to 52.025	2.040 to 2.048
Tappet housing bore diameter	15.000 to 15.018	.5905 to .5912	27.000 to 27.033	1.0630 to 1.0643
Tappet oversize	.1-.2-.3	.004-.008-.012	.2-.4	.008-.016
Main bearing housing bore diameter	84.200 to 84.230	3.3149 to 3.3161	84.206 to 84.226	3.3151 to 3.159
Cylinder Head				
Valve guide housing bore diameter in head	13.950 to 13.983	.5492 to .5505	13.995 to 14.018	0.5510 to .5519
Valve guide oversize	.2	.008	.04-.2-.4	.0016-.008-.016
Valve seat dimensions	See page 3, Section 12			
Valve stand-in				
— Inlet valve	.7 to 1.0	.028 to .0394	.1 to .5	.004 to .020
— Maximum stand-in	1.3	.0512	.7	.028
— Exhaust valve	.7 to 1.0	.028 to .0394	.4 to .8	.016 to .031
— Maximum stand-in	1.3	.0512	1	.039

(follows)

ENGINE BLOCK - CYLINDER HEAD

(continued)

	115-90, 130-90 Turbo, 190-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Injector stand-out (115-90, 130-90 Turbo and 140-90 Turbo)	.05 to .7	.0020 to 0.0275	—	—
— Maximum stand-out	1.0	0.0394	—	—
Injector stand-out (160-90 Turbo and 130-90 Turbo):				
— W ALTECNA EPPZ 10FV4-4750415 injector	—	—	2.7 to 3.5	.11 to .14
— Maximum stand-out	—	—	3.8	.15
— BOSCH EPPZ 50FV6-4750504 injector	—	—	2.2 to 3	.09 to .12
— Maximum stand-out	—	—	3.3	.13
Cylinder head height	92	3.62	99.78 to 100.00	3.93 to 3.94
Maximum head dressing allowance	.5	.02	.5	.02

CRANK GEAR

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Crankshaft - Bearings				
Main journal diameter	76.791 to 79.810(1)	3.1414 to 3.1421(1)	79.777 to 79.800(1)	3.1408 to 3.1417(1)
Main journal undersize	.254-.508-.762-1.016 mm (.010-.020-.030-.040 in)			
Main bearing wall thickness	2.168 to 2.178	.0853 to .0857	2.168 to 2.178	.0853 to .0857
Main bearing undersize	.254-.508-.762-1.016 mm (.010-.020-.030-.040 in)			
Main journal clearance in bearings	.034 to .103	.0013 to .0040	.050 to .113	.0020 to .0044
— maximum wear clearance	.180 mm (.0071 in)			
Crankpin diameter	63.725 to 63.744(1)	2.5088 to 2.5096(1)	72.477 to 72.500(1)	2.8534 to 2.8543(1)
Crankpin undersize	.254-.508-.762-1.016 mm (.010-.020-.030-.040 in)			
Big end bearing wall thickness	1.805 to 1.815	.0710 to .0714	2.061 to 2.070	.0811 to .0815
Big end bearing undersize	.254-.508-.762-1.016 mm (.010-.020-.030-.040 in)			
Crankpin clearance in big end bearing	.033 to .087	.0013 to .0034	.058 to .119	.0023 to .0047
— maximum wear clearance	.180 mm (.0071 in)			
Crankshaft thrust washer thickness	3.378 to 3.429	.1330 to .1350	3.378 to 3.429	.1330 to .1350
Thrust washer oversize	.127-.254-.381-.508 mm (.005-.009-.0149-.0199 in)			
Width of main bearing housing over thrust washers	31.766 to 31.918	1.2506 to 1.2566	49.756 to 49.932	1.9589 to 1.9657
Length of corresponding main journal	32.000 to 32.100	1.2598 to 1.2638	50.000 to 50.050	1.9685 to 1.9704
Crankshaft end float	.082 to .334	.0032 to .0131	.068 to .294	.003 to .0116
— maximum wear end float	.40 mm (.016 in)			

(follows)

(1) .1 mm undersize crankpin and main journal crankshafts may be fitted in production coupled to corresponding undersize bearings.

CRANK GEAR

(continued)

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Maximum main journal and crankpin ovality or taper after grinding	.01	.0004	.01	.0004
Maximum main journal and crankpin ovality or taper due to wear	.05	.0020	.05	.0020
Maximum main journal misalignment with crankshaft resting on end journals	.10	.0040	.05	.0020
Maximum crankpin misalignment relative to main journals (in either direction)	.25	.0100	.25	.0100
Maximum tolerance on distance from outer crankpin edge to crankshaft centreline	±.10	±.0040	±.10	±.0040
Maximum crankshaft flange run-out with stylus in A, page 2, section 14, over:				
— 115-90, 130-90 Turbo and 140-90 Turbo = 108 mm (4.25 in) diameter T.I.R.	.025	.0010	—	—
— 160-90 Turbo and 180-90 Turbo = 119 mm (4.68 in) diameter, T.I.R.	—	—	.025	.0010
Maximum flywheel seat eccentricity relative to main journals (see B, page 2, section 14), T.I.R.	.04	.0016	.04	.0016
Connecting Rods				
Small end bore diameter	41.846 to 41.884	1.6475 to 1.6490	45.946 to 45.971	1.8089 to 1.8099
Small end bushing ID	41.979 to 42.017	1.6527 to 1.6542	46.069 to 46.120	1.8137 to 1.8157
Bushing interference fit in small end	.095 to .171	.0037 to .0067	.098 to .174	.0038 to .0068
Small end bushing fitted ID	38.004 to 38.014	1.4962 to 1.4966	42.025 to 42.035	1.6545 to 1.6549
Big end bore diameter	67.407 to 67.422	2.6538 to 2.6544	76.698 to 76.713	3.0196 to 3.0202
Maximum connecting rod axis misalignment at 125 mm (5 in)	±.07	±.0027	±.05	±.0020
Maximum connecting rod weight difference over a complete set of the same engine	25 grams (1 oz)		20 grams (⅔ oz)	
Pistons				
Piston diameter: 130-90 Turbo and 140-90 Turbo 57 mm (2 ½ in) from base of skirt, at right angles to pin; 160-90 Turbo and 180-90 Turbo 35 mm (1 ⅜ in) from base of skirt, at right angles to pin				
— modd. 115-90	103.812 to 103.826	4.0871 to 4.0876	—	—
— 130-80 Turbo and 140-90 Turbo	103.814 to 103.828	4.0871 to 4.0877	—	—
— 160-90 Turbo and 180-90 Turbo	—	—	114.813 to 114.827	4.5202 to 4.5207

(follows)

CRANK GEAR

(continued)

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Piston clearance in liner				
— 115-90	.174 to .212	.00685 to .00834	—	—
— 130-90 Turbo and 140-90 Turbo	.172 to .210	.0068 to .0083	—	—
— 160-90 Turbo and 180-90 Turbo	—	—	.173 to .209	.007 to .008
Max wear clearance	.30	.012	.30	.012
Piston oversize range	.4-.8	.008.016-.032	.6	.024
Piston position with respect to head at T.O.C.	.355 to .761 (stand out)	.0140 to .02100	−.24 (stand in) to +.71 (stand out)	−.0094 to +.0279
Piston pin diameter	37.983 to 37.990	1.4954 to 1.4957	42.000 to 42.006	1.6535 to 1.6538
Piston pin housing bore in piston	37.993 to 38.000	1.4958 to 1.4961	42.013 to 42.019	1.6540 to 1.6538
Piston pin clearance in piston	.003 to .017	.0061 to .0007	.007 to .019	0.0027 to 0.00075
Piston pin oversize	—	—	.2	.008
Piston pin clearance in small end bushing	.014 to .031	.00055 to .0012	.019 to .035	.0007 to .0014
— maximum wear clearance	.06	.0024	.10	.004
Maximum weight difference over a complete set of pistons	20 grams (⅔ oz)		30 grams (1 oz)	
Piston ring clearance in groove				
— Top: 115-90	.090 to .122	.003 to .005	—	—
— Top: 130-90 Turbo and 140-90 Turbo	.105 to .155	.004 to .006	—	—
— Top: 160-90 Turbo and 180-90 Turbo	—	—	.062 to .112	.002 to .004
— 2nd	.060 to .092	.002 to .004	.060 to .092	.002 to .004
— 3rd: 115-90	.040 to .075	.001 to .003		
— 3rd: 130-90 Turbo and 140-90 Turbo and 160-90 Turbo and 180-90 Turbo	.040 to .072	.001 to .003	.040 to .072	.001 to .003
Maximum wear clearance:				
— Top	.50	.02	.40	0.016
— 2nd	.20	.008	.20	.008
— 3rd	.20	.008	.20	.008
Piston ring gap				
— Top	.40 to .65	.016 to .025	.40 to .65	.016 to .025
— 2nd	.30 to .55	.012 to .020	.40 to .60	.016 to .024
— 3rd: 115-90	.30 to .60	.012 to .024	—	—
— 3rd: 130-90 Turbo, 140-90 Turbo, 160-90 Turbo and 180-90 Turbo	.30 to .45	.012 to .018	.30 to .45	.012 to .018
Maximum wear gap	1.20	.047	1.20	.047

VALVE GEAR

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Valve Timing Gears				
Timing gear backlash	.160	.006	.08	.0031
Idler gear jack shaft diameter	36.975 to 37.000	1.456 to 1.457	49.975 to 50.000	1.9675 to 1.9685
Idler gear bushing fitted I.D. after reaming	37.050 to 37.075	1.459 to 1.460	50.050 to 50.075	1.9705 to 1.9714
Jack shaft journal clearance in bushing	.050 to .100	.0020 to .0040	.050 to .100	.0020 to .0040
— maximum wear clearance	.15	.0060	.15	.0060
Bushing interference fit in idler gear	.063 to .140	.0025 to .0055	.066 to .142	.002 to .006
Steering and lift pump gear shaft diameter	36.975 to 37.000 mm (1.4557 to 1.4567 in)			
Bushing fitted I.D. after reaming	37.050 to 37.075 mm (1.4586 to 1.4596 in)			
Shaft clearance in bushings	.050 to .100 mm (.0020 to .0040 in)			
Bushing interference fit in housing	.063 to .140 mm (.0025 to .0055 in)			
Camshaft				
Camshaft bushing O.D. 115-90, 130-90 Turbo and 140-90 Turbo				
— Front	55.375 to 55.430	2.180 to 2.182	—	—
— Front intermediate	54.875 to 54.930	2.1604 to 2.1626	—	—
— Rear intermediate	54.375 to 54.430	2.1407 to 2.1429	—	—
— Rear	53.875 to 53.930	2.1211 to 2.1232	—	—
160-90 Turbo and 180-90 Turbo	—	—	52.098 to 52.136	2.0511 to 2.0526
Bushing interference fit in housing	.070 to .150	.0027 to .0060	.073 to .136	.003 to .005
Camshaft bushing fitted I.D. after reaming 115-90, 130-90 Turbo and 140-90 Turbo				
— Front	51.580 to 51.630	2.030 to 2.032	—	—
— Front intermediate	51.080 to 51.130	2.6110 to 2.0130	—	—
— Rear intermediate	50.580 to 50.630	1.9913 to 1.9933	—	—
— Rear	50.080 to 50.130	1.9716 to 1.9736	—	—
160-90 Turbo and 180-90 Turbo	—	—	49.055 to 49.090	1.9313 to 1.9327
Camshaft journal diameter 115-90, 130-90 Turbo and 140-90 Turbo				
— Front	51.470 to 51.500	2.0264 to 2.0275	—	—
— Front intermediate	50.970 to 51.000	2.0067 to 2.0079	—	—
— Rear intermediate	50.470 to 50.500	1.9870 to 1.9882	—	—
— Rear	49.970 to 50.000	1.9673 to 1.9685	—	—
160-90 Turbo and 180-90 Turbo	—	—	48.950 to 48.975	1.9272 to 1.9281
Camshaft journal clearance in bushing	.080 to .160	.0030 to .0063	.080 to .140	.003 to .005
Maximum wear clearance	.20	.008	.20	.008
Camshaft end float (thrust plate to associated seat in camshaft)	.070 to .220	.0027 to .0087	.060 to .110	.002 to .004

(follows)

VALVE GEAR

(continued)

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Tappets				
Tappet O.D.	14.950 to 14.970	.5886 to .5894	26.939 to 26.960	1.0606 to 1.0614
Tappet clearance in housing on engine block	.030 to .068	.0012 to .0027	.040 to .094	.0016 to .0037
— maximum wear clearance	.15	.006	.15	.006
Tappet oversize	.1-.2-.3	.004-.008-.012	.3-.4-.5	.012-.016-.020
Rockers				
Rocker bushing O.D.	21.006 to 21.031	.8270 to .8280	—	—
Rocker bore diameter	20.939 to 20.972	.8244 to .7902	—	—
Bushing interference fit in rocker	.034 to .092	.0013 to .0036	—	—
Rocker bracket bore diameter	18.016 to 18.034 (1)	.7093 to .7100 (1)	21.050 to 21.080	.8287 to .8299
Rocker shaft diameter	17.982 to 18.000	.7079 to .7087	21.015 to 21.036	.8273 to .8281
Rocker shaft clearance in bracket	.016 to .052	.0006 to .0020	.014 to .065	.0005 to .0026
— maximum wear clearance	.15	.006	.15	.006
Rocker spacer spring length				
— free	59.5	2.3425	96	3.7795
— under				
– 46 to 52 N, 4.7 to 5.3 kg (10.4 to 11.7 lb)	44	1.72323	—	—
– 25 N, 2.5 kg (5.5 lb)	—	—	62	2.4409
Valves, guides and springs				
Valve head diameter				
— Inlet	45.300 to 45.500	1.783 to 1.791	48.200 to 48.500	1.898 to 1.909
— Exhaust	37.500 to 37.750	1.476 to 1.486	40.700 to 41.000	1.6023 to 1.6141
Valve stem diameter	7.985 to 8.000	.3144 to .3149	7.945 to 7.960	.3128 to .3134
Valve face angle				
— 115-90, 130-90 Turbo and 140-90 Turbo — Inlet	60°30′ ± 7′		—	
— 115-90, 130-90 Turbo and 140-90 Turbo — Exhaust	45°30′ ± 7′		—	
— 160-90 Turbo and 180-90 Turbo	—		45°15′ to 45°20′	
Valve clearance				
— Timing check	.45	.0177	.41	.0161
— Normal (cold or warm)				
— inlet	.25	.0100	.30	.0118
— exhaust	.35	.138	.50	.0197
Useful cam lift				
— inlet	5.250	.2067	7.04	.277
— exhaust	5.677	.223	6.84	.269
Valve lift				
— inlet	9.31	.366	12.46	.490
— exhaust	10.07	.396	12.10	.476

(follows)

(1) Fitted and reamed.

VALVE GEAR

(continued)

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Valve guide O.D.	13.993 to 14.016	.548 to .5518	14.028 to 14.039	.5523 to .5527
Valve guide oversize	.2	.0079	.04-.2-.4	.0016-.008-.016
Valve guide interference fit in housing on cylinder head	.010 to .066	.0004 to .026	.010 to .044	.0004 to .0018
Valve guide protrusion from cylinder head face (160-90 Turbo and 180-90 Turbo)				
— inlet	—	—	2	.0787
— exhaust	—	—	9	.3543
Valve guide fitted I.D. after reaming	8.023 to 8.043	.3158 to .317	7.987 to 8.012	.3144 to .3154
Valve stem clearance in guide	.023 to .058	.0009 to .002	.027 to .067	.0010 to .0026
— maximum wear clearance	.13	.0051	.13	.0051
Maximum valve stem eccentricity over one revolution with stylus on sealing face	.03	.001	.04	.0016
Inlet and exhaust valve spring length 115-90, 130-90 Turbo and 140-90 Turbo				
— free	44.6	1.756	—	—
— under 256 to 284 N, 26.1 to 28.9 kg (58 to 64 lb.)	34	1.338	—	—
— under 502 to 554 N, 51.2 to 56.5 kg (113 to 125 lb.)	23.8	.937	—	—
160-90 Turbo and 180-90 Turbo				
— free	—	—	49.3	1.94
— under 221 to 244 N, 22.5 to 24.9 kg (50 to 55 lb.)	—	—	42	1.65
— under 599 to 662 N, 61.1 to 67.5 kg (135 to 149 lb.)	—	—	29.5	1.16

LUBRICATION SYSTEM

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Oil pump	gear, crankshaft driven		gear, crankshaft driven	
Oil pump drive ratio	1.270 to 1		.906 to 1	
Oil pressure, warm at governed speed				
— 115-90	2.9 to 3.9 bar (3 to 4 kg/cm²)	42 to 57 PSI	—	—
— 130-90 Turbo and 140-90 Turbo	3.9 to 4.9 bar (4 to 5 kg/cm²)	42 to 71 PSI	—	—
— 160-90 Turbo and 180-90 Turbo	—	—	4.7 to 5.1 bar (4.8 to 5.2 kg/cm²)	68 to 74 PSI

(follows)

LUBRICATION SYSTEM

(continued)

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Relief valve crack-off setting				
— 115-90	3.5 bar (3.6 kg/cm²)	51 PSI	—	—
— 130-90 Turbo and 140-90 Turbo	4.5 bar (4.6 kg/cm²)	65 PSI	—	—
— 160-90 Turbo and 180-90 Turbo	—	—	4.9 bar (5 kg/cm²)	71 PSI
Drive gear shaft diameter	17.989 to 18.000	.7082 to .7087	19.987 to 20.000	.7869 to .7874
Shaft bushing fitted I.D. after reaming	18.016 to 18.059 (1)	.709 to .711 (1)	—	—
Shaft clearance in support	.016 to .070	.0006 to .0027	.020 to .054	.0008 to .0021
Bushing interference fit in housing	.034 to .092	.0013 to .036	—	—
Driven gear shaft interference fit in cover	.012 to .050	.0005 to .0020	.020 to .054	.0008 to .0021
Driven gear shaft diameter	14.989 to 15.000	.5001 to .5905	19.900 to 19.913	.7835 to .7847
Bushing fitted I.D. after reaming	15.016 to 15.043	.5912 to .5922	—	—
Driven gear shaft clearance in support	.016 to .054	.0006 to .0021	.000 to .034	.0000 to .0013
Bushing interference fit in housing	.051 to .073	.0020 to .0029	—	—
Gear end float	.016 to .107	.0006 to .0042	.040 to .125	.0016 to .0050
Relief valve spring length — free				
– 115-90	45	1.75	—	—
– 130-90 Turbo and 140-90 Turbo	53	2	—	—
– 160-90 Turbo and 180-90 Turbo	—	—	70.5	2.75
— under 88 to 94 N, 9 to 9.6 kg (20 to 21 lb) (115-90)	30.5	1.2	—	—
— under 82 to 91 N, 8.35 to 9.25 kg (184.34 to 204.57 lb) (130-90 Turbo and 140-90 Turbo)	30.5	1.2	—	—
— under 108 N, 11 kg (24 lb.) (160-90 Turbo and 180-90 Turbo)	—	—	48.5	1.90
Oil filters	gauze on suction and main cartridge on delivery			
Oil cooler	oil to water			
Type	four-row steel tube core		six-row steel tube core	

(1) Fitted and reamed

COOLING SYSTEM

	115-90, 130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Water pump	centrifugal, blade			
Water pump drive ratio	1.409 to 1		1.435 to 1	
Shaft interference fit in impeller	.017 to .060	.0007 to .0024	.029 to .060	.0011 to .0024
Shaft interference fit in fan hub	.024 to .058	.0009 to .0023	.025 to .061	.0010 to .0024
Thermostat				
Type	wax		wax	
Opening temperature	79 ± 2°C		79 ± 2°C	
Fully open at	94°C		94°C	
Valve travel when fully open	7.5	.295	7.5	.295
Radiator	vertical tube, 4-deep (115-90 and 130-90 Turbo) and 5-deep (140-90 Turbo)		vertical tube 5-deep	
Expansion tank	translucent plastic			
Fan	suction, steel, 4-bladed (115-90), or 6-bladed (130-90 Turbo and 140-90 Turbo)		suction, steel, 6-bladed	
Water temperature gauge	three coloured sectors			
Temperature range				
— white sector	30° to 65°C			
— green sector	65° to 105°C			
— red sector	105° to 115°C			

FUEL SYSTEM

	130-90 Turbo, 140-90 Turbo		160-90 Turbo, 180-90 Turbo	
	mm	in	mm	in
Turbocharger				
— make	GARRETT		GARRETT or HOLSET	
Shaft end float				
— GARRETT	.025 to .100		.025 to .100	
— HOLSET	—		.100 to .150	
Shaft radial play				
— GARRETT	.075 to .180		.075 to .180	
— HOLSET	—		.53 max	

(follows)

FUEL SYSTEM

(Continued)

	115-90	130-90 Turbo	140-90 Turbo	160-90 Turbo	180-90 Turbo
Injection pump	in-line, integral governor				
— W ALTECNA	PES 6A 80 D 410 RF 312-4791120	PES 6A 90 D 410 RF 313-4791389	PES 6A 90 D 410 RF 313-4791388	PES 6A 90 D 410 RF 309-4776891	—
— BOSCH	—	—	—	—	PES 6MW 100-4754679
Direction of rotation	clockwise				
Firing order	1-5-3-6-2-4				
Fuel injectors					
— Type W ALTECNA	4802394			EPPZ 10 FV4 - 4750415	
— Type BOSCH	4800029			EPPZ 50 FV6 - 4750504	
— Type OMAP	4800031			—	
— W ALTECNA nozzle holder	KBEL 83 S 1 W 200 - 4802392			KB 88 S 50 F20 - 4750417	
— W ALTECNA spray nozzle	DLL 136 S 501 W - 4802395			DLL 145 S 73 F - 4750416	
— BOSCH nozzle holder	KBEL 83 S 35 - 4791124			KBL 88 S 203/4 - 771404	
— BOSCH spray nozzle	DLLA 136 S 1000 - 4800030			DLLA 145 S 847 - 4750505	
— OMAP nozzle holder	OKLL 83 S 3392 - 4796644			—	
— OMAP spray nozzle	OLL 136 S 9119 - 4776715			—	
Number of spray orifices	3			4	
Spray orifice diameter	0.35 mm (.014 in)			0.34 mm (.013 in)	
Release pressure	230 to 238 bar (235 to 243 kg/cm^2) (3335 to 3452 PSI)			200 to 208 (204 to 212 kg/cm^2) (2900 to 3016 PSI)	
Delivery pipes					
— type	4791125			PRR 11 F 21Z-769652	PRR 2022 FV1-4750418 and PRR 2022 FV2-4750419
— size mm	1,5 × 6 × 320/340/340/420/490/565			2 × 6 × 600	2 × 6 × 600 or 2 × 6 × 620

MODEL 115-90 - CALIBRATION DATA - W ALTECNA INJECTION PUMP TYPE PES6A80D 410 RF 312 - 4791120

Pump components

Pumping elements: 774768, 8 mm dia.
Check valve 773344, valve spring 773252. Valve fitting 773218.

Governor: RQV 300 - 1250 AF012.

Feed pump FP/KS22A D6/2 - 774698, supply pressure: 1.3 to 1.8 bar (kg/cm^2) (19 to 26 psi).

Drive coupling: 4769595 - 4794237 - 4794238.

Assembly data

Pump rotation (drive end) ..... clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off ..... 2.8 ± 0.5 mm (.110 ± .002 in)
Pump timing, cylinder no. 1 in compression stroke ..... 25° ± 1° B.T.D.C.
Max. fuel device stroke ..... 1 to 1.1 mm (0.039 to 0.043 in)

Test plan

Test machine as per ISO 4008
Injectors as per ISO 4010: 0681343009
Test fluid: ISO 4113 at 40° ± 2° C
Graduate drain time: 30"
Fuel pressure: 1.5 to 1.8 bar (kg/cm^2) or 22 to 26 PSI
Release pressure: 175 to 178 bar (178 to 181 kg/cm^2 or 2538 to 2582 PSI)
Pipes: 6 × 2 × 600 mm as per ISO 4093.2

PUMP CALIBRATION DATA

Speed rpm	Rack stroke mm	Delivery per injector cm^3/100 shots	Spread	Notes
1250	11.7 to 11.8	6.0 to 6.1	0.3 (0.45)	
300	9.0 to 9.2	0.8 to 1.4	0.2 (0.40)	

PUMP CALIBRATION DATA

Maximum		Idle		Notes
Speed rpm	Rack stroke mm	Speed rpm	Rack stroke mm	
1280 to 1290 1410 to 1440 1500	10.7 4 0 to 1	300 100 300 to 200	9.0 to 9.2 > 11.5 2	

CALIBRATION DATA - PUMP WITH GOVERNOR

Max. delivery		Speed limitation rpm	Intermediate delivery		Starting delivery		Max. fuel stroke	
Speed rpm	Delivery per injector cm^3/1000 shots		Speed rpm	Delivery per injector cm^3/1000 shots	Speed rpm	Delivery per injector cm^3/1000 shots	Speed rpm	Rack stroke mm
1250	60 to 61 (58 to 63)	1280 to 1290 (•)			200	100 to 120	1200 1000	11.9 to 12 12.3 to 12.4
700	59 to 60 (57 to 62)						800 700	12.6 to 12.7 12.7 to 12.8

Note: Test values in brackets; (•) Rack stroke 1 mm less than above.

MODEL 130-90 Turbo - CALIBRATION DATA - W ALTECNA INJECTION PUMP TYPE PES6A90D 410 RF 313 - 4791389

Pump components

Pumping elements: 774774, 9 mm dia.
Check valve 773344, valve spring 773252. Valve fitting 773218.

Governor: RQV 300 - 1250 AF014.

Feed pump FP/KS22A D6/2 - 774698, supply pressure: 1.3 to 1.8 bar (kg/cm^2) (19 to 26 psi).

Drive coupling: 4769595 - 4794237 - 4794238.

Assembly data

Pump rotation (drive end) ..... clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off ..... 2.8 ± .05 mm (.110 ± .002 in)
Pump timing, cylinder no. 1 in compression stroke 25° ± 1° B.T.D.C.
Max. fuel device stroke ..... 1 to 1.1 mm (.039 to .043 in)

Test plan

Test machine as per ISO 4008
Injectors as per ISO 4010: 0681343009
Test fluid: ISO 4113 at 40° ± 2° C
Graduate drain time: 30″
Fuel pressure: 1.5 to 1.8 bar (kg/cm^2) or 22 to 26 PSI
Release pressure: 175 bar (178 kg/cm^2 or 2538 PSI)
Pipes: 6 × 2 × 600 mm as per ISO 4093.2

PUMP CALIBRATION DATA

Speed rpm	Rack stroke mm	Delivery per injector cm^3/100 shots	Spread	Notes
1250	10.8 to 10.9	6.7 to 6.8	0.5 (0.9)	
300	8.4 to 8.6	0.8 to 1.4	0.8 (1.2)	

PUMP CALIBRATION DATA

Maximum		Idle		Notes
Speed rpm	Rack stroke mm	Speed rpm	Rack stroke mm	
1330 to 1340 1415 to 1445 1510	9.8 4 0 to 1	325 100 325 to 250	8.4 to 8.6 > 11.7 2	

CALIBRATION DATA - PUMP WITH GOVERNOR

Max. delivery		Speed limitation rpm	Intermediate delivery		Starting delivery		Max. fuel stroke	
Speed rpm	Delivery per injector cm^3/1000 shots		Speed rpm	Delivery per injector cm^3/1000 shots	Speed rpm	Delivery per injector cm^3/1000 shots	Speed rpm	Rack stroke mm
1250	67 to 68 (65 to 70)	1330 to 1340 (•)			200	100 to 120	1000 900 800 700 600	10.8 to 10.9 11.1 to 11.2 11.3 to 11.4 11.5 to 11.6 11.7 to 11.8
700	64 to 65 (62 to 67)							

Note: Test values in brackets; (•) Rack stroke 1 mm less than above.

MODEL 140-90 Turbo - CALIBRATION DATA - W ALTECNA INJECTION PUMP TYPE PES6A90D 410 RF 313 - 4791388

Pump components

Pumping element: 774774, 9 mm dia.
Check valve 773344, valve spring 773252. Valve fitting 773218.
Governor: RQV 300 - 1250 AF013.
Feed pump FP/KS22A D6/2 - 774098, supply pressure: 1.3 to 1.8 bar (kg/cm^2) (19 to 26 psi).
Drive coupling: 4769595 - 4794237 - 4794238.

Assembly data

Pump rotation (drive end) ..... clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off ..... 3 ± .05 mm (.118 ± .002 in)
Pump timing, cylinder no. 1 in compression stroke 25° ± 1° B.T.D.C.
Max. fuel device stroke ..... 1 to 1.1 mm (.039 to .043 in)

Test plan

Test machine as per ISO 4008
Injectors as per ISO 4010: 0681343009
Test fluid: ISO 4113 at 40° ± 2° C
Graduate drain time: 30"
Fuel pressure: 1.5 to 1.8 bar (kg/cm^2) or 22 to 26 PSI
Release pressure: 175 bar (178 kg/cm^2 or 2538 PSI)
Pipes: 2 × 6 × 600 mm as per ISO 4093.2

PUMP CALIBRATION DATA

Speed rpm	Rack stroke mm	Delivery per injector cm^3/100 shots	Spread	Notes
1250	11.8 to 11.9	7.4 to 7.5	0.3 (0.45)	
300	9.1 to 9.3	0.8 to 1.4	0.2 (0.40)	

PUMP CALIBRATION DATA

Maximum		Idle		Notes
Speed rpm	Rack stroke mm	Speed rpm	Rack stroke mm	
1300 to 1310	10.8	300	9.1 to 9.3	
1390 to 1420	4	100	> 11.5	
1450	0 to 1	300 to 250	2	

CALIBRATION DATA - PUMP WITH GOVERNOR

Max. delivery		Speed limitation rpm	Intermediate delivery		Starting delivery		Max. fuel stroke	
Speed rpm	Delivery per injector cm^3/1000 shots		Speed rpm	Delivery per injector cm^3/1000 shots	Speed rpm	Delivery per injector cm^3/1000 shots	Speed rpm	Rack stroke mm
LDA	0.7 bar		LDA	0 bar	200	100 to 120		
1250	74 to 75 (72 to 77)	1300 to 1310 (•)	500	53.5 to 55.5 (51.5 to 57.5)			1100	12.0 to 12.1
							1000	12.3 to 12.4
700	77 to 78 (75 to 80)						800	12.8 to 12.9
							700	12.9 to 13.0

ANEROID TEST DATA (LDA)

Adjustment pressure	Test pressure	Rack stroke mm	Notes
0.7 bar (kg/cm^2) or 10 PSI		11.8 to 11.9	
	0.33 bar (kg/cm^2) or 5 PSI	12.6 to 12.7	
	0.28 bar (kg/cm^2) or 4 PSI	11.9 to 12.0	
0 bar (kg/cm^2) or 0 PSI		11.7 to 11.8	

Note: Test values in brackets;-(•) Rack stroke 1 mm less than above.

MODEL 160-90 Turbo - CALIBRATION DATA - W ALTECNA INJECTION PUMP TYPE PES6A90D 410 RF 309 - 4776891

Pump components

Pumping element: 774156, 9 mm dia. — Check valve 773344, valve spring 773252. Valve fitting 773218.

GOVERNOR: RQV 300 1100 A F007.

AUTOMATIC ADVANCE DEVICE: A 5.5/3 - 10 AD - 4764728.

FEED PUMP: 773630 - Supply pressure: 1.3 to 1.8 bar (kg/cm^2) (19 to 26 psi).

DRIVE COUPLING: 4708206 - 4777060 - 4708205.

Assembly data

Pump rotation (drive end) ..... clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off ..... 2.8 ± .05 mm (.110 ± .002 in)
Pump timing, cylinder no. 1 on compression stroke 22°30′ ± 30′ B.T.D.C.
Max. fuel device stroke .... 0.8 ± 0.9 mm (.031 ± .035 in)

Test plan

Procedure A

BOSCH test machine with WSF 2044/4 X injector springs and EFEP 182 spray nozzles.

RABOTTI test machine with FIAT **656829** injector springs and EFEP 182 spray nozzles.
Release pressure ..... 175 bar, 178 kg/cm^2 (2538 psi)
Pipes ..... 2 × 6 × 600 mm

Procedure B

Test machine incorporating same injector bodies and nozzles as fitted to engine.

Release pressure ..... 200 to 208 bar, (204 to 212 kg/cm^2) (2901 to 3017 psi)
Pipes ..... 2 × 6 × 600 mm
Test oil ..... FIAT CFB at 40 ± 3° C
Graduate drain time ..... 30″.

Lever position	Speed	Rack stroke	PROCEDURE A		PROCEDURE B	
			Delivery			
			injector	pump*	injector	pump*
	rpm	mm	cm^3/1000 shots		cm^3/1000 shots	
Idle	300^{+0}_{-10}	8 ± .5	10 ± 1	—	10 ± 1	—
Maximum	•1100^{+0}_{-10}	11.6 ± .1	80 ± 1.5	480 ± 3	82 ± 1.5	492 ± 3
Maximum (1)	700 ± 5	—	—	528 ± 3	—	546 ± 3
	≤1270	—	0	—	0	—
Maximum (2)	200	—	160 to 180	—	160 to 180	—

• Governor cut-in speed 1100 to 1110 rpm
* Governor stop adjustment
(1) Max. fuel device (rack stop)
(2) Excess fuel.

MODEL 180-90 Turbo - CALIBRATION DATA - BOSCH INJECTION PUMP TYPE PES6MW100 - 4754679

Pump components

Pumping element: 9959472, 10 mm dia. — Check valve: 9959473, valve spring: 9923070. — Valve fitting: 9959458.

GOVERNOR RQV 300... 1100 MW19 - 9959384.

AUTOMATIC ADVANCE DEVICE: A 5.5/3 - 10 AD - 4764728.

FEED PUMP: FP/K22MW10: 9959385. Supply pressure: 1.2 to 1.8 bar (kg/cm^2) (17 to 26 psi).

DRIVE COUPLING: 4733802 - 4744146 - 4744148.

Assembly data

Pump rotation (drive end) ..... clockwise
Firing order 1-5-3-6-2-4
Plunger lift to spill cut-off ..... 2.95 ± .05 mm (.116 ± .002 in)
Pump timing (cylinder no. 1 on compression stroke) ..... 15° ± 30′ BTDC

Test plan

Procedure A

BOSCH test machine with WSF 2044/4 X injector springs and EFEP 182 spray nozzles.

RABOTTI test machine with FIAT **656829** injector springs and EFEP 182 spray nozzles.
Release pressure ..... 175 bar, 178 kg/cm^2 (2538 psi)
Pipes ..... 2 × 6 × 600 mm

Procedure B

Test machine incorporating same injector bodies and nozzles as fitted to engine.

Release pressure ..... 200 to 208 bar, (204 to 212 kg/cm^2) (2901 to 3017 psi)
Pipes ..... 2 × 6 × 600 mm
Test oil ..... FIAT CFB at 40 ± 3° C
Graduate drain time ..... 30″.

Lever position	Speed	Rack stroke	PROCEDURE A		PROCEDURE B		Aneroid air pressure bar
			Delivery				
			injector	pump*	injector	pump*	
	rpm	mm	cm^3/1000 shots		cm^3/1000 shots		(kg/cm^2)
Idle	300	6.5 ± .5	18 ± 1	—	18 ± 1	—	—
Maximum	•1100	11.6 ± 5 (*)	100 ± 1.5 (*)	600 ± 3 (*)	97 ± 1.5 (*)	582 ± 3 (*)	⩾ .50
		11.1 ± .1	94 ± 1.5	564 ± 3	91.5 ± 1.5	549 ± 3	—
Maximum (1)	700	—	—	642 ± 3 (*)	—	624 ± 3 (*)	⩾ .50
		—	—	528 ± 3	—	531 ± 3	—
Maximum	600	—	—	—	—	—	.08 to .18 (3)
		—	—	—	—	—	.26 to .36 (4)
Maximum (2)	100	—	160 to 180	—	160 to 180	—	—

• Governor cut-in speed 1100 to 1110 rpm.
* Governor stop adjustment.
(1) Max. fuel device (rack check).
(2) Excess fuel.
(3) Aneroid cut-in.
(4) Aneroid cut-off.
(*) Aneroid in.

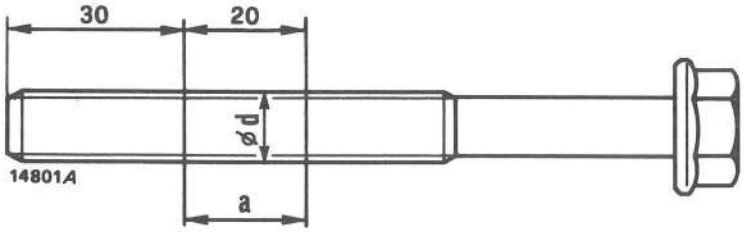
TORQUE DATA

DESCRIPTION	Thread size	Torque		
		Nm	kgm	ft.lb
Engine block and cylinder head - valve gear - crank gear - Section 10				
Capscrew, cylinder head, (115-90, 130-90 Turbo and 140-90 Turbo, C_1, pages 19 and 20)	See tables below and on page 6, section 12			
Nut, cylinder head (160-90 Turbo and 180-90 Turbo, C_1, pages 21 and 22)	M16 × 1.5	226	23	166
Capscrew, main bearing cap (115-90, 130-90 Turbo and 140-90 Turbo, C_2)	See table below			
Capscrew, main bearing cap (160-90 Turbo and 180-90 Turbo, C_2)	M16 × 1.25	235	24	173
Capscrew, connecting rod cap (115-90, 130-90 Turbo and 140-90 Turbo, C_3)	See table below			
Capscrew, connecting rod cap (160-90 Turbo and 180-90 Turbo, C_3)	M14 × 1.5	118	12	87
Capscrew, flywheel (all models, C_4)	See table below			
Capscrew, rocker shaft brackets: — 115-90, 130-90 Turbo and 140-90 Turbo (C_5) — 160-90 Turbo and 180-90 Turbo (C_5)	 M8 × 1.25 M10 × 1.25	 24 49	 2.5 5	 18 36
Nut, crankshaft pulley hub (115-90, 130-90 Turbo and 140-90 Turbo, C_6)	M30 × 1.5	294	30	217
Capscrew, crankshaft pulley hub (160-90 Turbo and 180-90 Turbo, C_6)	M22 × 1.5	559	57	412
Fuel system - Section 15				
Capscrew, rear cover to GARRETT turbocharger (15, page 3)	—	10	1	7
Nut, GARRETT turbocharger turbine shaft (3)	—	see text		
Capscrew, GARRETT turbocharger compressor housing (13) to turbine housing (14)	—	15	1.5	11
Nut, HOLSET turbocharger turbine shaft (13)	—	18	1.8	13

ANGULAR TIGHTENING TORQUE DATA

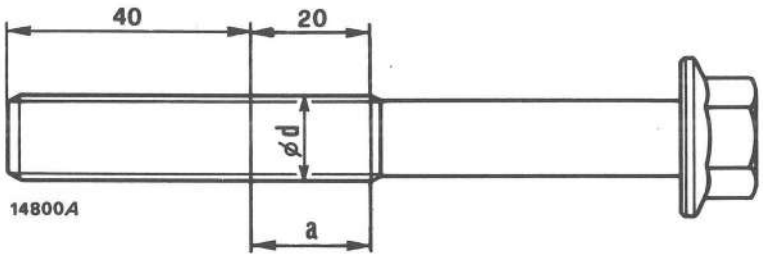
DESCRIPTION	Thread size	Torque			Angle
		Nm	kgm	ft.lb	
Capscrew, cylinder head (115-90, 130-90 Turbo and 140-90 Turbo)	M12 × 1.25	60	6.1	44	90° + 90°
Capscrew, main bearing cap (115-90, 130-90 Turbo and 140-90 Turbo)	M14 × 1.5	80	8.2	59	90°
Capscrew, connecting rod cap (115-90, 130-90 Turbo and 140-90 Turbo)	M11 × 1.5	40	4.1	29.6	60°
Capscrew flywheel: — 115-90, 130-90 Turbo and 140-90 Turbo — 160-90 Turbo and 180-90 Turbo	 M12 × 1.25 M16 × 1.5	 40 100	 4.1 10.2	 29.6 73.7	 60° 60°

Checks to be carried out on cylinder head, main bearing caps, connecting rod caps and flywheel (dim. in mm).



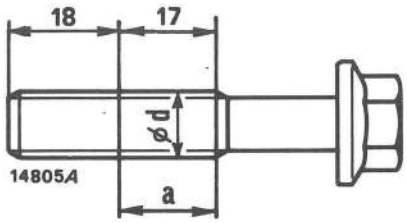
Cylinder head capscrew (C_1, pages 19 and 20, 115-90, 130-90 Turbo and 140-90 Turbo)

Before re-using screws, check that diameter **d** (measured as shown above, area a) exceeds 11.5 mm or 0.4527 in. If not, scrap screw.



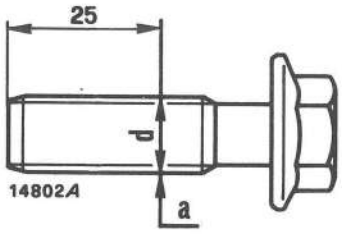
Main bearing cap capscrew (C_2 pages 19 and 20, 115-90 Turbo, 130-90 Turbo and 140-90 Turbo)

Before re-using screws, check that diameter **d** (measured as shown above, area a) exceeds 13.5 mm or 0.5315 in. If not, scrap screw.



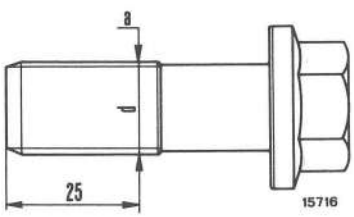
Connecting rod cap capscrew (C_3 pages 19 and 20, 115-90, 130-90 Turbo and 140-90 Turbo)

Before re-using screws, check that diameter **d** (measured as shown above, area a) exceeds 10.5 mm or 0.4134 in. If not, scrap screw.



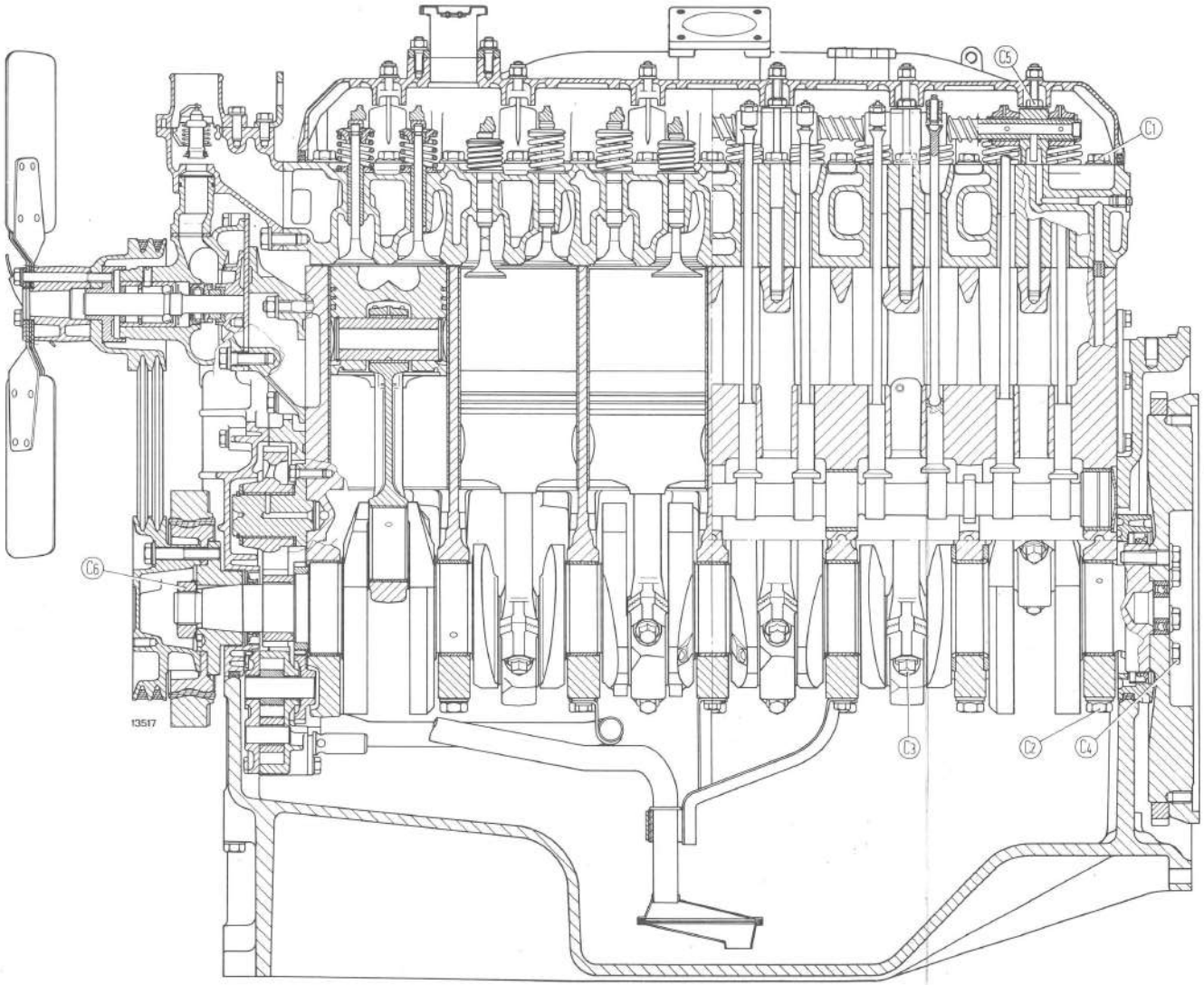
Flywheel capscrew (C_4, pages 19 and 20, 115-90, 130-90 Turbo and 140-90 Turbo)

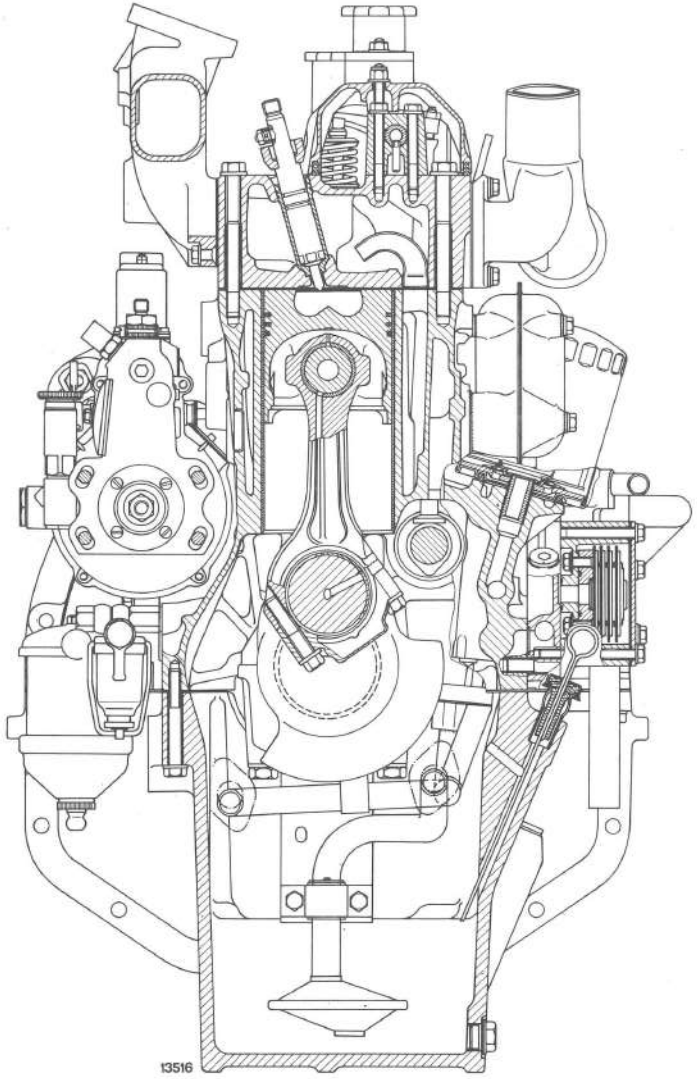
Before re-using screws, check that diameter **d** (measured as shown above, area a) exceeds 11.5 mm or 0.4527 in. If not, scrap screw.



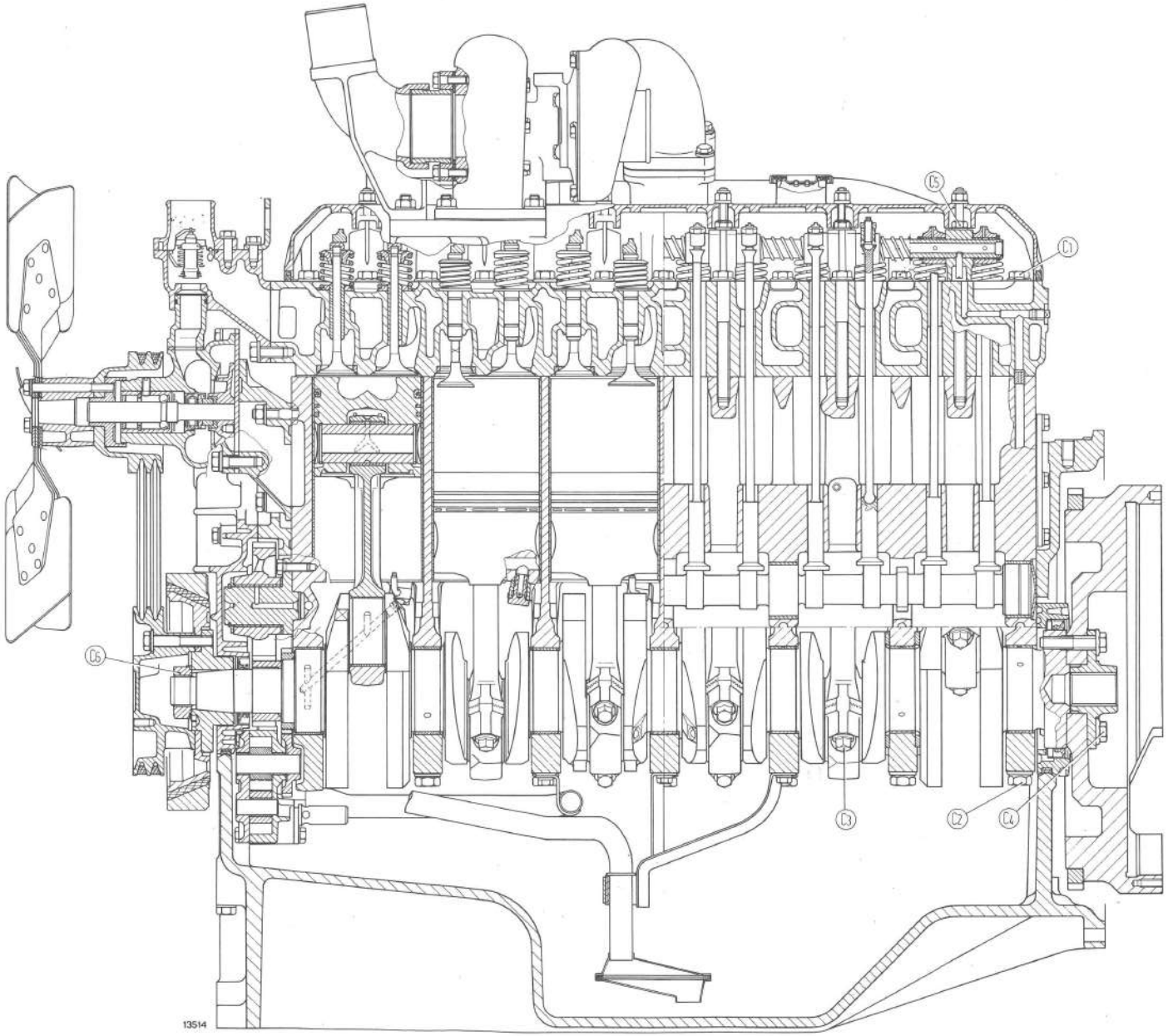
Flywheel capscrew (C_4, pages 21 and 22, 160-90 Turbo and 180-90 Turbo)

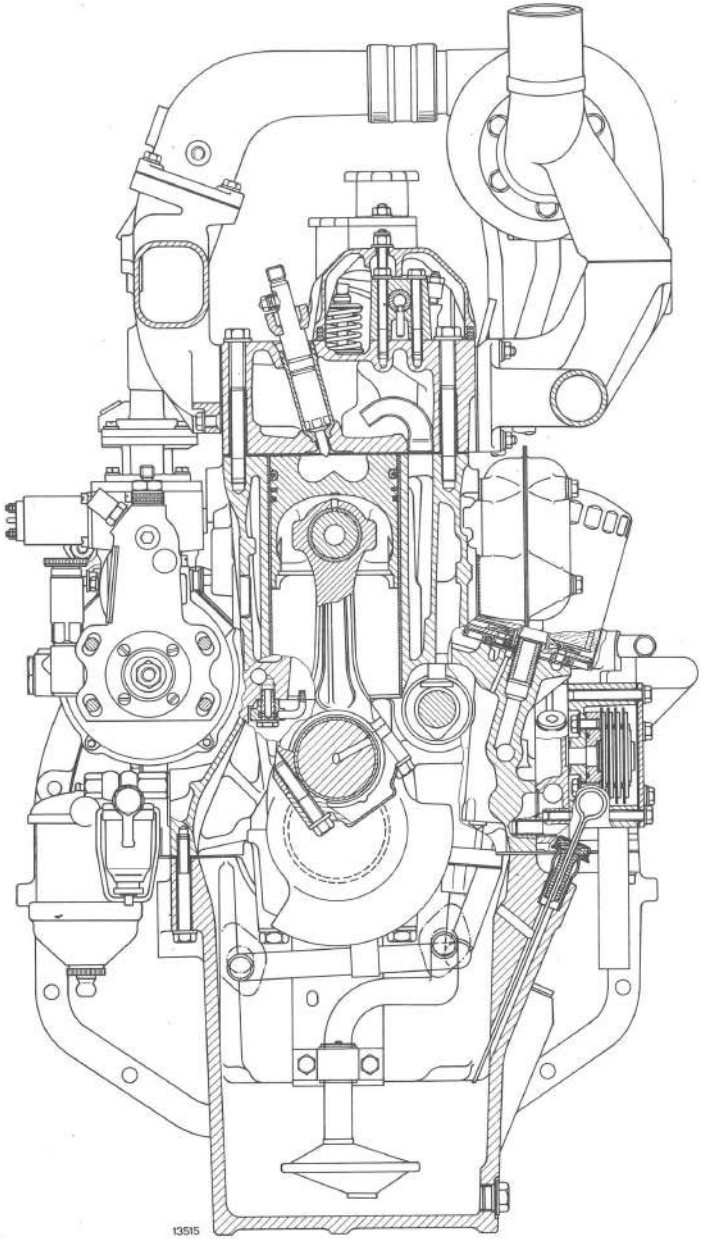
Before re-using screws, check that diameter **d** (measured as shown above, area a) exceeds 15.5 mm or 0.61 in. If not, scrap screw.





Longitudinal and cross sections through engine - 115-90 tractors.





Longitudinal and cross sections through engine - 130-90 Turbo and 140-90 Turbo.

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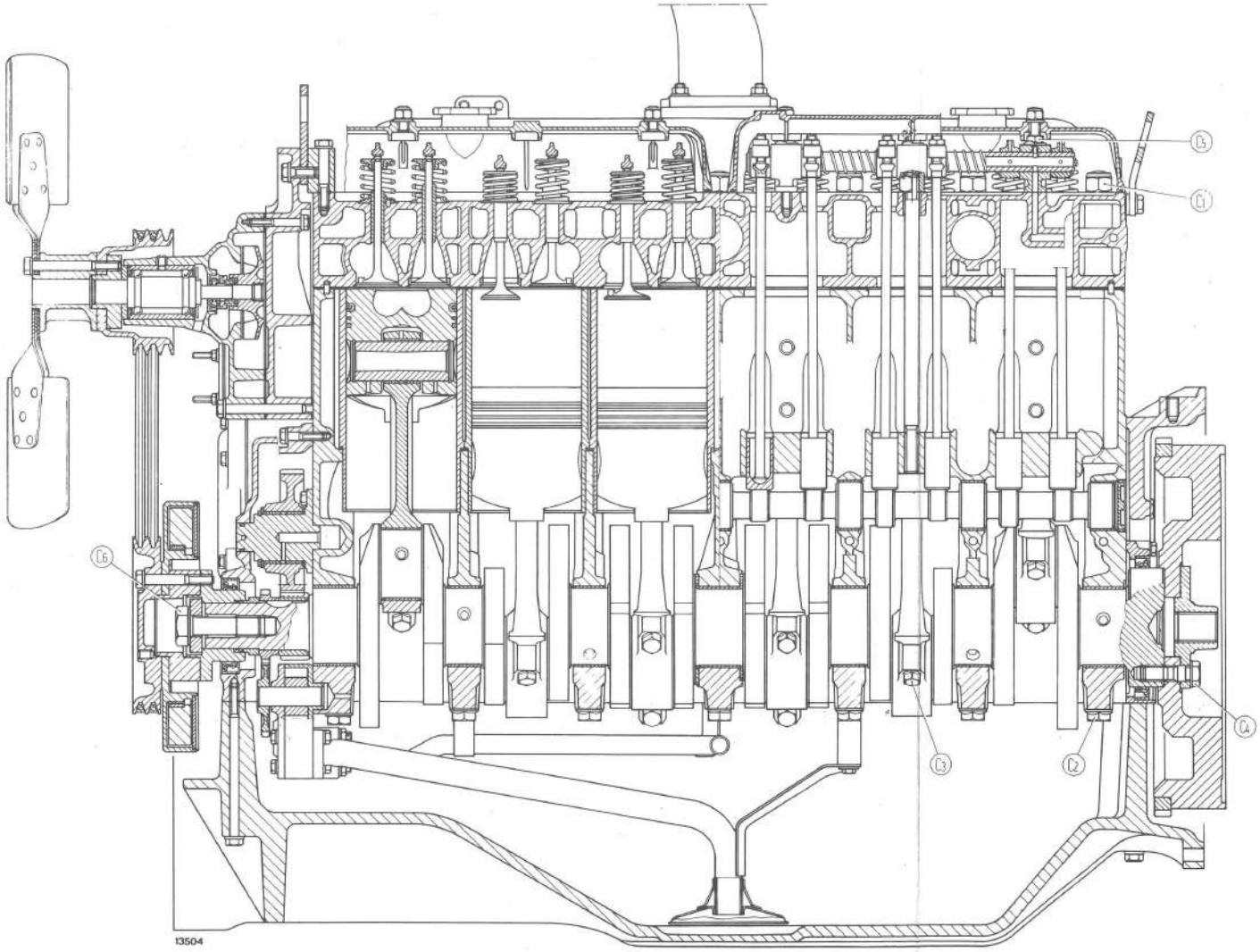
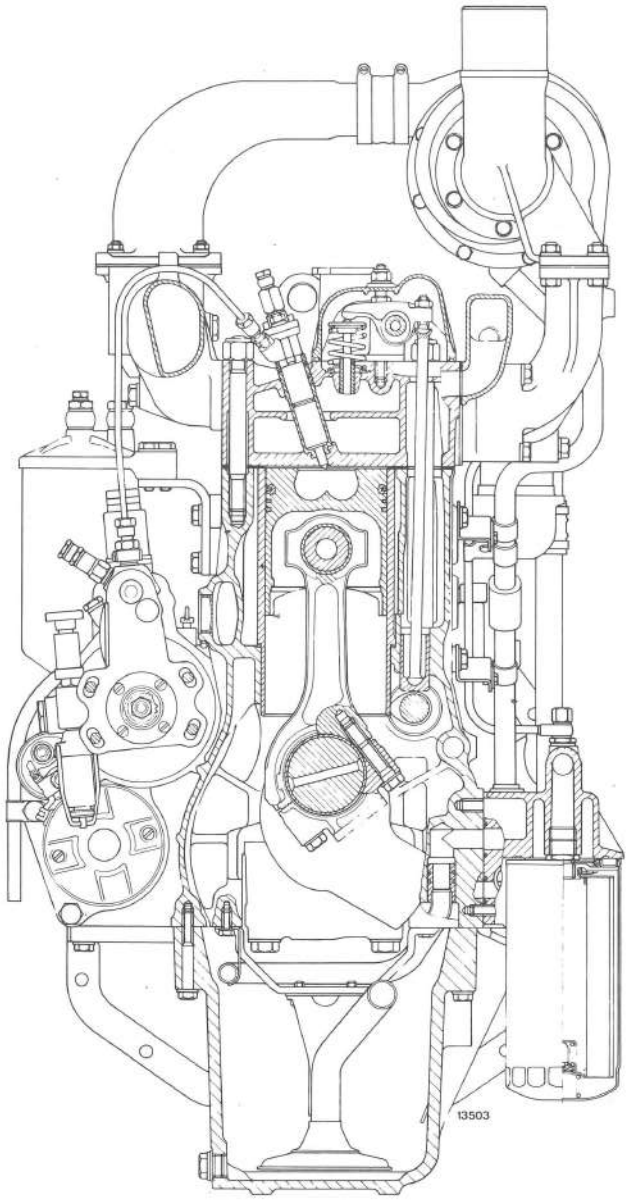
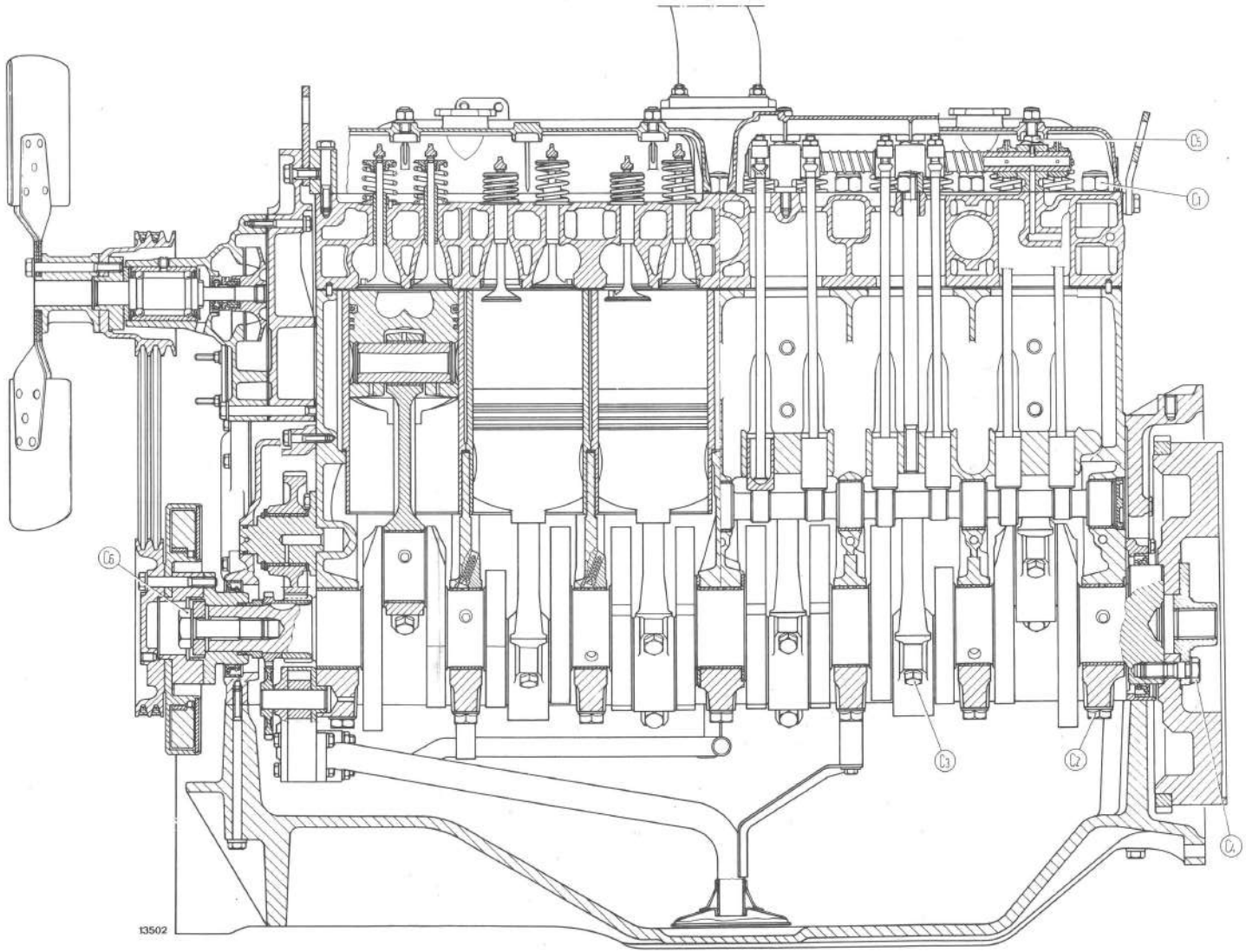
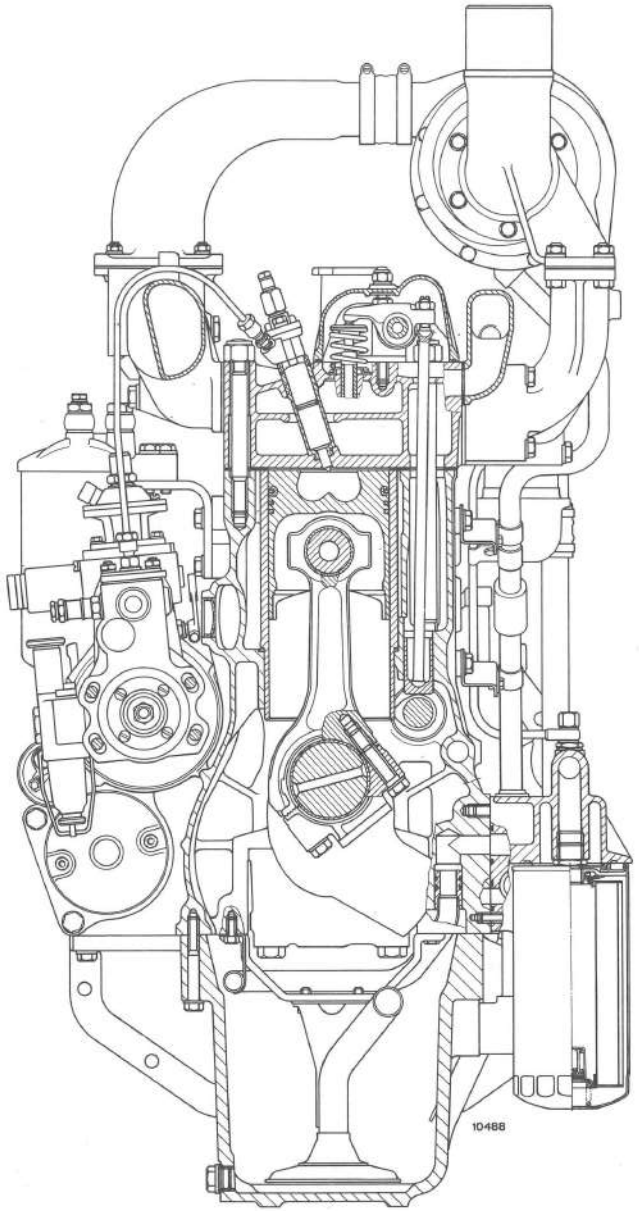




Longitudinal and cross sections through engine - 160-90 Turbo.





Longitudinal and cross sections through engine - 180-90 Turbo.

DESCRIPTION

FIAT engines fitted to 115-90, 130-90 Turbo, 140-90 Turbo, 160-90 Turbo and 180-90 Turbo tractors are high-speed, four stroke, in-line Diesel units.

Engine block: single iron casting, wet liners on 160-90 Turbo and 180-90 Turbo engines and dry liners on 115-90, 130-90 Turbo and 140-90 Turbo engines, incorporating crankshaft and camshaft housings and valve tappet bores.

Cylinder head: integral valve seats.

Valve gear: helical train, pushrod operated, overhead valves.

Crank gear: crankshaft running on 7 bearings, 3 ring light alloy pistons.

Air intake: through dry air cleaner, naturally aspirated for 115-90, turbocharged for 130-90 Turbo, 140-90 Turbo, 160-90 Turbo and 180-90 Turbo.

Fuel system: in-line injection pump.

Lubrication system: forced feed, gear pump, full-flow oil filter (2 for 115-90, 2 double filtration for 130-90 Turbo and 140-90 Turbo, and 1 for 160-90 Turbo and 180-90 Turbo) with by-pass valve. Oil cooler.

Cooling system: water, centrifugal pump, wax thermostat.

Engine starting: 12 V, electromagnetically operated starter and thermostarter (where fitted).

ENGINE PERFORMANCE DATA

Test conditions

Engine with fan, air cleaner and exhaust silencer removed.
Barometric pressure 740 ± 5 mm Hg at 239 metres (785 ft.) above sea level.
Ambient temperature 20 ± 3°C.
Relative humidity 70% ± 5.
Fuel density 830 ± 10 g/litre.

Pump timing B.T.D.C., cylinder no. 1 in compression stroke:

— 115-90 ..... 25° ± 1°
— 130-90 Turbo ..... 25° ± 1°
— 140-90 Turbo ..... 25° ± 1°
— 160-90 Turbo ..... 22°30′ ± 30′
— 180-90 Turbo ..... 15° ± 30′

MODEL 115-90

Throttle	Engine load	Engine rpm	kW		Fuel consumption kg/h
			Production run-in	50-hour run-in	
Full	Full load	2500	83,8 (114 HP) min	86 (117 HP) min	20.2 to 20.8
Full	Full torque	1500	58.4 (79.5 HP) min	60.3 (82 HP) min	13.3 to 14
Full	No load	2760 to 2800	—	—	—
Idle	No load	625 to 675	—	—	—

MODEL 130-90 TURBO

Throttle	Engine load	Engine rpm	kW		Fuel consumption kg/h
			Production run-in	50-hour run-in	
Full	Full load	2500	(+) 94.9 (129 HP) min (*)	(+) 97 (132 HP) min	21.7 to 22.3
Full	Full load	1500	(○) 67.7 (92 HP) min (*)	(○) 69.5 (94.5 HP) min	14.2 to 14.8
Full	No load	2760 to 2800	—	—	—
Idle	No load	625 to 675	—	—	—

(*) Predicted values.
(+) Intake air pressure: .65 to .74 bar (9.24 to 10.52 psi).
(○) Intake air pressure: .37 to .46 bar (5.26 to 6.54 psi).

ENGINE: Performance data - Compression test

MODEL 140-90 TURBO

Throttle	Engine load	Engine rpm	kW		Fuel consumption kg/h
			Production run-in	50-hour run-in	
Full	Full load	2500	(+)104 (141,5 HP) min	(+)106.6 (145 HP) min	23.8 to 24.5
Full	Part load	1100	—	39 (53 HP) min	8.6 to 9.0
Full	Full torque	1500	(○)78 (106 HP) min	(○)80.1 (109 HP) min	16.8 to 17.4
Full	No load	2760 to 2800	—	—	—
Idle	No load	625 to 675	—	—	—

(+) Intake air pressure: .79 to .88 bar (11.23 to 12.5 psi)

(○) Intake air pressure: .39 to .62 bar (5.54 to 8.8 psi)

MODEL 160-90 TURBO

Throttle	Engine load	Engine rpm	kW		Fuel comsumption kg/h
			2-hour run-in	50-hour run-in	
Full	Full load	2200	(●)113.3 (154 HP) min	(●)114 (155 HP) min	25.98 to 26.63
Full	Full torque	1400	(○)83 (113 HP) min	(○)83.8 (114 HP) min	18.08 to 18.79
Full	No load	2440 to 2480	—	—	—
Idle	No load	575 to 625	—	—	—

(●) Intake air pressure: .47 to .60 bar (6.68 to 8.53 psi)

(○) Intake air pressure: .31 to .39 bar (4.4 to 5.54 psi).

MODEL 180-90 TURBO

Throttle	Engine load	Engine rpm	kW		Time to burn 500 cm^3 of fuel (seconds)
			2-hour run-in	50-hour run-in	
Full	Full load	2200	128 (174 HP) min	128.7 (175 HP) min	49 to 50.6
			122.1 (166 HP) min (°)	122.9 (167 HP) min (°)	52.2 (°) min
Full	Full torque	1400	94.9 (129 HP) min	94.9 (129 HP) min	66.4 to 70.6
			83.1 (113 HP) min (°)	83.1 (113 HP) min (°)	82.5 min (°)
Full	No load	2425 ± 10	—	—	—
Idle	No load	650	—	—	—

(°) Aneroid out.

Turbocharged engine performance test for 130-90 Turbo, 140-90 Turbo, 160-90 Turbo and 180-90 Turbo.

For dynamometer testing install air cleaner to engine or connect test room filter (if sufficiently large) even though performance data apply to test conditions without filter. This requirement is dictated by the need to protect compressor impeller from the ingress of foreign bodies which, even if small, might be the cause of inefficient operation or damage.
Note that air cleaner installation results in a 1% reduction in power output indicated in the tables.

COMPRESSION TEST

If engine performance is found to be unsatisfactory, check the injection system (nozzle and injection pump overhaul) and the compression in each cylinder.
To check engine compression use tester **291309/1** proceeding as follows:

— remove the fuel injectors;

— fit dummy injector **293862** 115-90, 130-90 Turbo and 140-90 Turbo, or **292635** 160-90 Turbo and 180-90 Turbo in place of the injector of the cylinder under test.

— Hold the injection pump in shuft-off condition and take the readings cranking the engine through the starter.

Compression should be as follows as recorded at 40° C sump oil temperature, 760 mm Hg (sea level) barometric pressure with the engine running at 200 to 280 rpm.

— Min. 26.5 bar (27 kg/cm^2, 384 psi) 115-90.
— Min. 24.5 bar (25 kg/cm^2, 355 psi) 130-90 Turbo.
— Min. 24.5 bar (25 kg/cm^2, 355 psi) 140-90 Turbo.
— Min. 24.5 bar (25 kg/cm^2, 355 psi) 160-90 Turbo.
— Min. 24.5 bar (25 kg/cm^2, 355 psi) 180-90 Turbo.

The minimum acceptable compression is:

— 21.5 bar (22 kg/cm^2, 313 psi) 115-90.
— 19.5 bar (20 kg/cm^2, 284 psi) 130-90 Turbo.
— 19.5 bar (20 kg/cm^2, 284 psi) 140-90 Turbo.
— 22.5 bar (23 kg/cm^2, 326 psi) 160-90 Turbo.
— 22.5 bar (23 kg/cm^2, 326 psi) 180-90 Turbo.

Maximum compression differential between cylinders is not to exceed 3 bar, kg/cm^2 (42.7 psi).
In this connection, it should be noted that every 100 metres (328 ft.) altitude increase from sea level results in approximately 1% decrease in compression.
Insufficient compression may be due to faulty valves and seats, pistons and associated rings, cylinder liners or cylinder head gaskets.

Note: The purpose of the compression test is merely to assess the consistency of compression in the cylinders and obtain an indication of the degree of wear affecting the parts which help to seal the combustion chambers, and the results should not be taken as an absolute indication of engine efficiency.

REMOVAL

— Apply parking brake, chock rear wheels and remove front ballast weights.

— Drain the cooling system and remove front and rear side panels, exhaust silencer and top center engine cover.

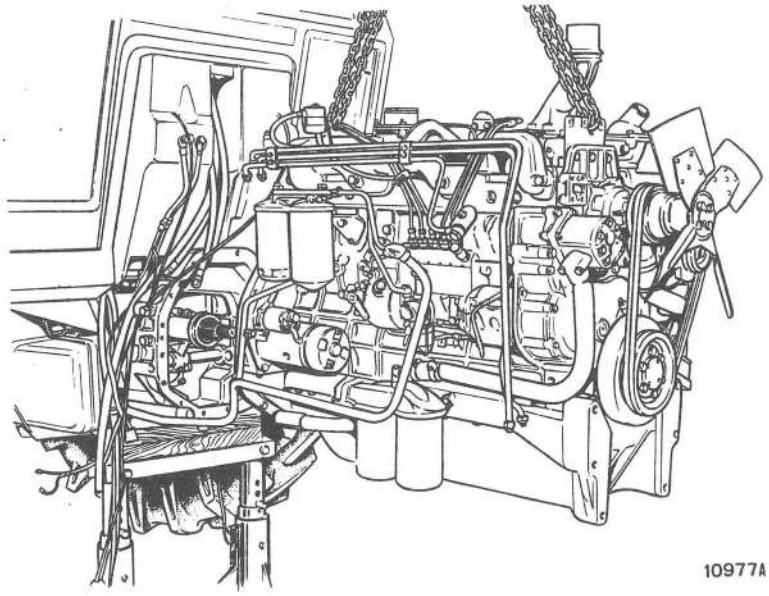
— Disconnect battery, starter, front light and horn leads.

— Remove grill and front engine cover and lift off the battery.

— Remove battery support and side members.

— Disconnect radiator rubber hose, remove air cleaner with hoses and support.

— Disconnect hose from hydrostatic steering pipe both on power steering cylinder and platform, and rubber hose upstream of filter from steering suction line. For 160-90 Turbo and 180-90 Turbo, remove lines connecting oil cooler and transmission housing.



Removing (installing) engine using lift hook 290740/1.

— Drain rear drive housing.

— Disconnect accelerator link, engine shut-off cable from injection pump and tractormeter angle drive, fuel delivery and leak-back lines and lift inlet and outlet lines.

— Wherever possible, remove radiator.

— On DT versions, remove drive shaft with guard and front differential lock delivery line.

— For 160-90 Turbo and 180-90 Turbo, remove lines connecting transmission housing with oil cooler. On heated cab versions, disconnect water inlet and outlet lines to cab. On air conditioned versions disconnect lines from connectors with valves.

— Position stand under engine oil pan, placing two wooden wedges between front axle and support.

— Using two slings **293769**, hoist front axle support, remove six screws and separate front axle from engine, acting on front wheels.

— Hoist the engine using lift hook **290740/1** as shown on page 3, remove screws and bolts retaining engine to transmission and separate engine from transmission.

INSTALLATION

Reverse the removal procedure noting the following points:

— When assembling engine and transmission, slide transmission clutch and P.T.O. clutch shafts smoothly into associated driven splined hubs (115-90) or into transmission clutch driven plate hub and flywheel mounted P.T.O. splined hub (115-90 H, 130-90 Turbo, 140-90 Turbo, 160-90 Turbo and 180-90 Turbo).

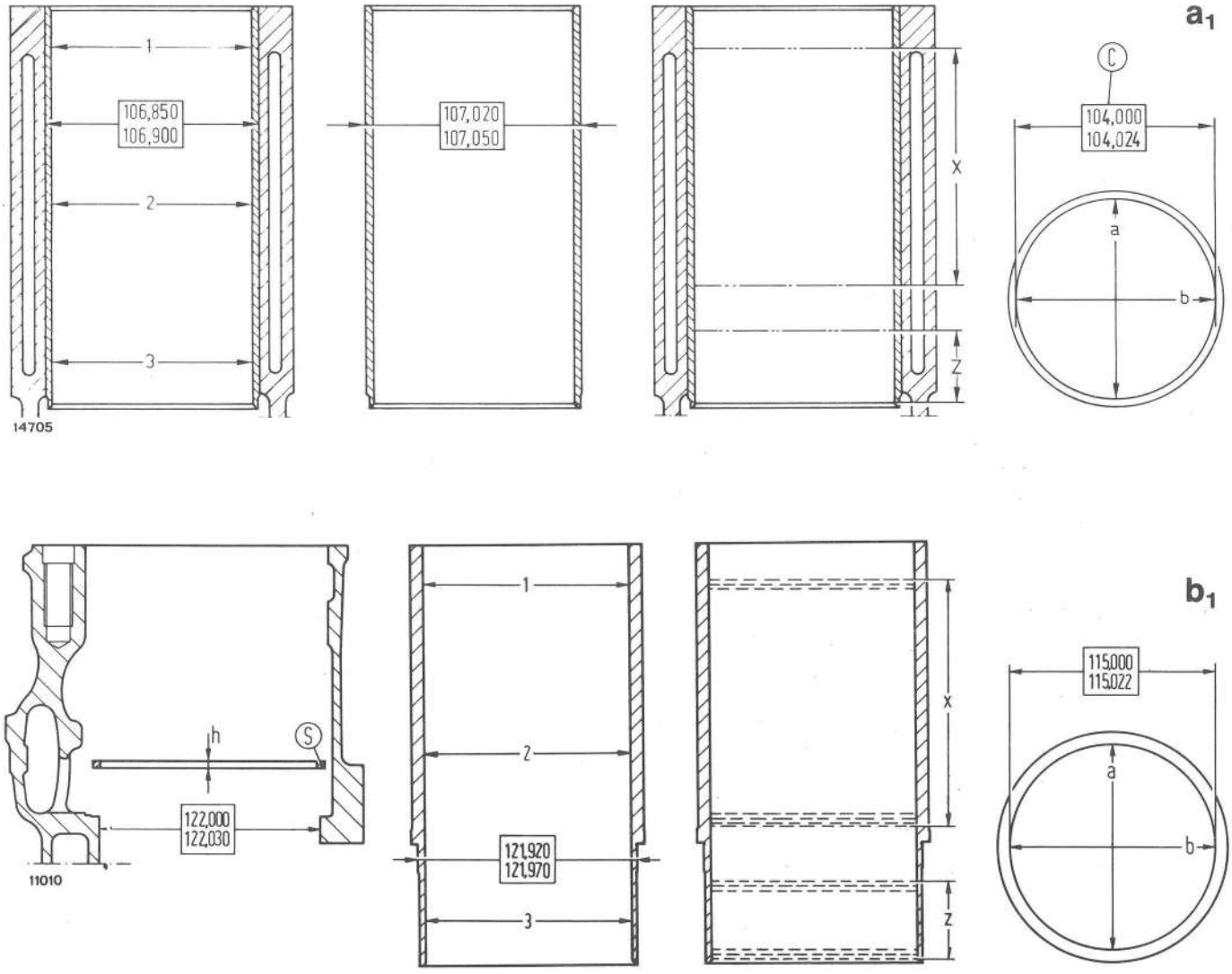
— Strictly adhere to the torque data specified in the table.

CYLINDER SLEEVES

To inspect for wear proceed as follows:
— Measure the sleeve bore diameter over the swept area (X).
— The diameter reading should be taken in both the upper and lower part of the swept area in plane (a) parallel to the crankshaft and in plane (b) at right angles to it.
— Compare the readings to establish the amount of sleeve ovality and taper.

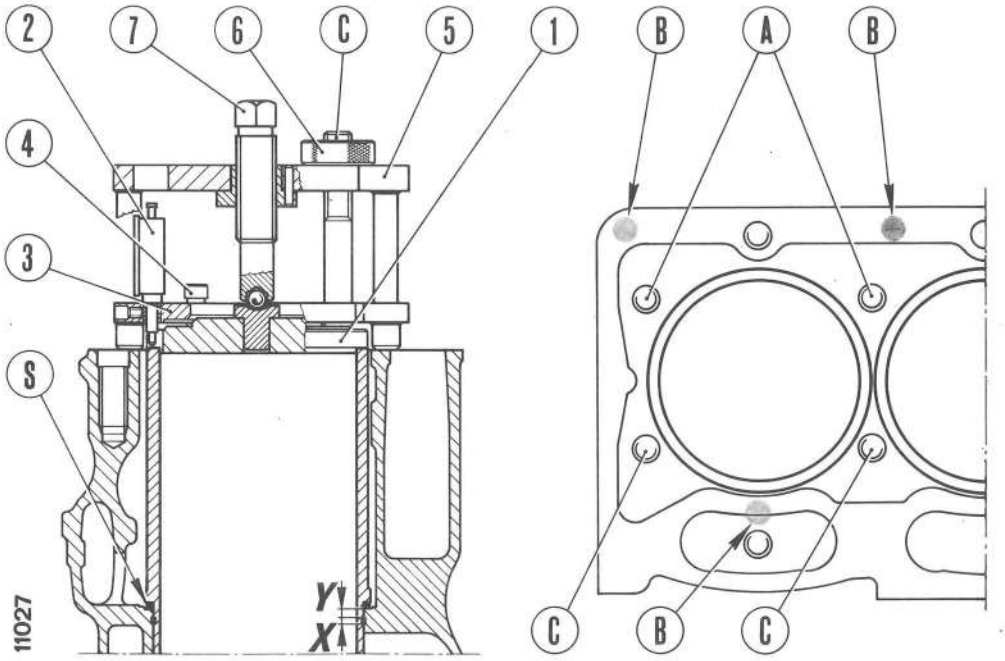
To check the piston working clearance measure the sleeve bore diameter over (Z) in plane (b) only.

If ovality or taper in excess of .12 mm (.0048 in), 115-90, 130-90 Turbo and 140-90 Turbo, or .15 mm (.0060 in), 160-90 Turbo and 180-90 Turbo, or piston working clearance in excess of .3 mm (.012 in) is detected, rebore (or renew) the sleeves to the oversize values envisaged (see page 1, section 10). After machining, check the size by taking 2 dial gauge readings at right angles (a and b) and at 3 depths (1,2 and 3).
Subsequently, fit replacement pistons of suitable size and weight (see page 4, section 10).



Sleeve and block inspection data

a.b. Sleeve bore measurements at right angles - a_1. Models 115-90, 130-90 Turbo and 140-90 Turbo - b_1. Models 160-90 Turbo and 180-90 Turbo - C. Sleeve fitted bore diameter - h. Protrusion shim thickness (for values see section 10, page 1) - S. Protrusion shims - Z. Sleeve wear inspection length for assessment of piston fit (on plane b at right angles to crankshaft) - X. Sleeve wear inspection length (swept area) for assessment of ovality and taper on planes a and b - 1, 2, 3. New or re-bored sleeve bore measuring depth on planes a and b.



Checking cylinder sleeve protrusion using gauge 293821 (Iveco 360445) for 160-90 Turbo and 180-90 Turbo tractor models.

A. Cylinder head studs for installing plate (3) and top plate (5) - B. Points of contact on base of plate (3) - C. Cylinder head studs for installing top plate (5) - S. Sleeve protrusion shim - X = 3 to 4 mm (.118 to .157 in) jointing compound depth - Y ≅ 4 mm (.157 in) width of land from sleeve protrusion shim to jointing compound groove - 1. Compressor plate - 2. Dial gauges - 3. Dial gauge carrier plate - 4. Capscrews - 5. Upper plate - 6. Knurled lock rings - 7. Screw.

When fitting new or reconditioned sleeves to 160-90 Turbo and 180-90 Turbo engines, check and, if necessary, adjust sleeve alignment and protrusion as follows:

— remove sleeves and shims (S) applying a reference mark to each sleeve, shim and engine block to facilitate correct repositioning on assembly;

— throughly clean sleeves and engine block using a suitable solvent to remove all traces of dry jointing compound;

— insert one sleeve with associated shim (S) and install compression plate (1) of tool **293821** (**IVECO 360445**) on cylinder sleeves;

— rest plate (3) together with four gauges (2) on a surface plate and zero the gauges;

— position plate (3) on engine block over two cylinder head studs (A) and make sure gauge styluses pass through the elongated holes in plate (1);

— connect plate (1) to plate (3) through screws (4);

— install upper plate (5) with screws (7) on 4 cylinder head studs (A and C) and fasten to block through 4 knurled lock rings (6);

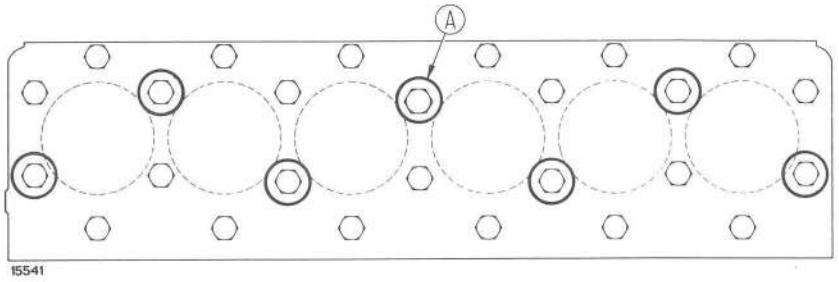
— tighten screw (7) to 108 Nm, 11 kgm (80 ft.lb.) and check on the 4 gauges that sleeve protrusion is .13 to .17 mm (.005 to .007 in). To adjust alter thickness of shim (S) as necessary.

— repeat the above operation on remaining sleeves after removing each preceding sleeve and shim. Ensure that top face misalignment does not exceed .04 mm (.0016 in).

— degrease cylinder sleeve centralization bore in block and apply a **thin** film of "LOCTITE HVX/PIPE SEALANT" No. 576 jointing compound over a width of 3 to 4 mm (.118 to .157 in) (X) ensuring that it does not run.

— reinstall the sleeves and shims, aligning reference marks applied on disassembly.

Since setting of jointing compound takes 24 hours, if crankshaft and pistons are to be rotated during this time, secure sleeves to block using seven retainers **292045** (**IVECO 360722**) (A) installed on cylinder head studs in the order shown on page 3.



Installing sleeve retainers 292045 (IVECO 360722) (A) on head studs.

Note - If sleeve misalignment exceeds .04 mm (.0016 in), dress the sleeve bore in the block using tool **291816 (IVECO 394102)** with cutter **291818 (IVECO 394107)**, bushing **291820 (IVECO 394133)** and taper **291822 (IVECO 394134)**.

For removal and installation of sleeves on 115-90, 130-90 TURBO and 140-90 TURBO tractors, proceed as follows, with cold sleeves, using a suitable press:

— remove worn sleeve operating with press from bottom of block using plate **293864**;

— check block bore for ovality and, if necessary, rebore to .2 mm (.008 in) oversize;

— press replacement sleeve (if necessary, a .2 mm - .008 in - oversize sleeve) from the top of the block using plate **291501**;

— bore the sleeve to restore specified fitted bore diameter.

CYLINDER HEAD

The cylinder head top may be skimmed, if necessary, removing not more than .5 mm (.020 in).
After skimming, check that fuel injector protrusion is as specified.
If necessary, replace injector sleeve proceeding as follows:

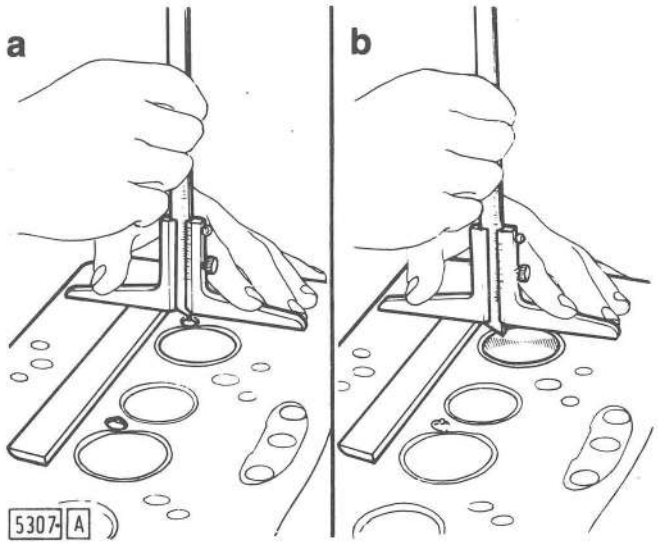
— using lock ring (3, page 4), set dimension (A) on tool (5) **292240 (IVECO 390425)** to approximately 8.5 mm or 0.33 in for 115-90, 130-90 Turbo and 140-90 Turbo tractors, or to approximately 7.5 mm or 0.29 in for 160-90 Turbo and 180-90 Turbo tractors. Secure lock ring through set screw (4);

— thread inner seat of old sleeve using M12 × 1.75 tap **292240 (IVECO 390425); thread must not extend past bottom of sleeve**;

— install puller **293784 (IVECO 342137)** (B, detail e, pages 4 and 5) on cylinder head studs through nuts (E);

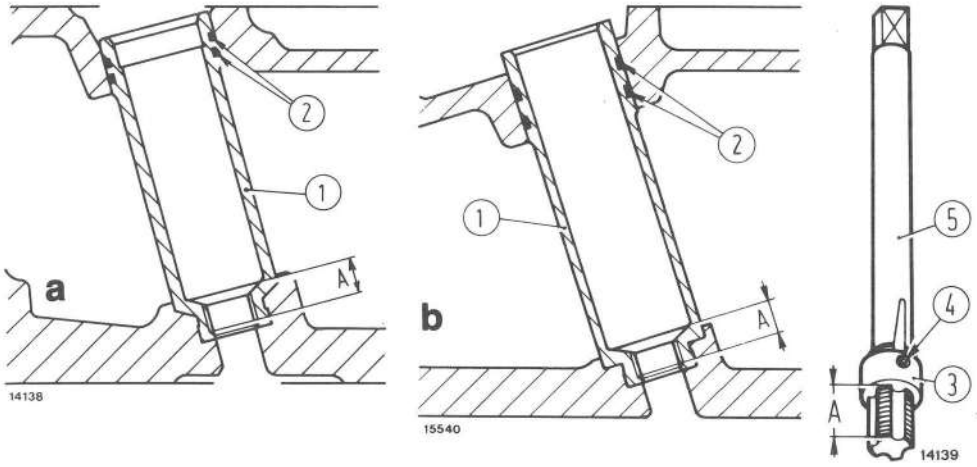
— screw part (C) into threaded seat in sleeve. Turn nut (D) to pull sleeve (1) from cylinder head;

— using cleanup tool (6) **292243 (IVECO 390771)**, remove any traces of copper left by old sleeve inside cylinder head seat as shown in detail f, pages 4 and 5.



Checking fuel injector stand-out and valve stand-in.

a. Injector stand-out: .05 to .7 mm (0.020 to 0.027 in) for 115-90, 130-90 Turbo and 140-90 Turbo (max. stand-out 1 mm or .04 in), 2.7 to 3.5 mm (.106 to .138 in) for 160-90 Turbo and 180-90 Turbo tractors with W ALTECNA injectors (max. stand-out 3.8 mm or .150 in), 2.2 to 3 mm (.087 to .118 in) for 160-90 Turbo and 180-90 Turbo tractors with BOSCH injectors (max. stand-out 3.3 mm or .130 in) - b. Valve stand-in: 0.7 to 1.0 mm (.028 to .043 in) for 115-90, 130-90 Turbo and 140-90 Turbo tractors (max. stand-in: 1.3 mm or 0.051 in); .1 to .5 mm (.04 to .020 in) intake valve models 160-90 Turbo and 180-90 Turbo (max. stand-in .7 mm - .028 in); .4 to .8 mm (.016 to .032 in) for 160-90 Turbo and 180-90 Turbo exhaust valves (max. stand-in 1 mm or .040 in).



Threading injector sleeve using tap (5) 292240 (IVECO 390475).

a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo - A≅8.5 mm, 0.335 in (115-90, 130-90 Turbo and 140-90 Turbo) or ≅7.5 mm, 0.295 in (160-90 Turbo and 180-90 Turbo) depth of threaded hole (M12 × 1.75) - 2.0-ring - 3. Lock ring - 4. Set screw.

— fit O-rings (2, detail g below and page 5) on replacement sleeve. Install sleeve, ensuring that it is fully home in seat. Expand sleeve using burnisher **293861** (F, detail g below) for 115-90, 130-90 Turbo and 140-90 Turbo tractors, or burnisher **293386/1** (F, detail g, page 5) for 160-90 Turbo and 180-90 Turbo tractors;

— insert bushing (G) **293746/1** in new sleeve (1, detail h below and page 5) and turn lock ring (H) clockwise to secure bushing. Insert reamer (I) **293747** in bushing (G) and ream lower part of sleeve;

— remove reamer (I) and back off lock ring (H) by around 10 mm;

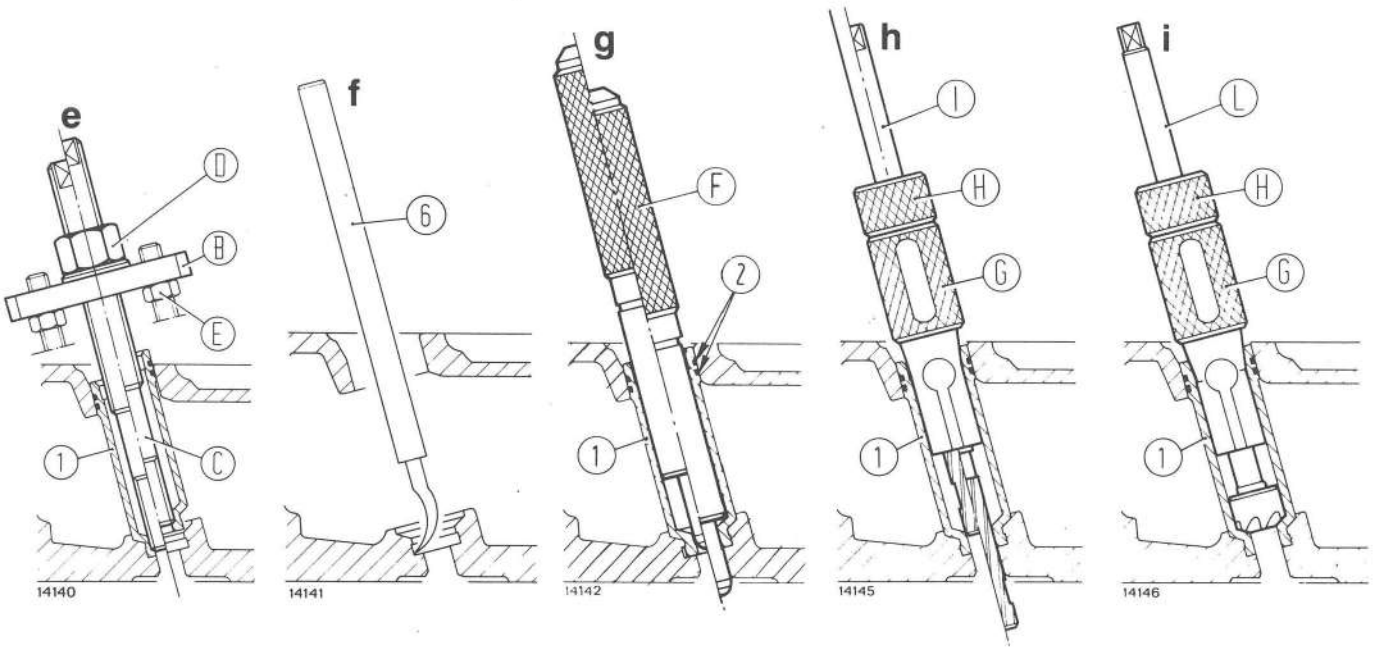
— press lock ring (H) by hand or tap with a soft hammer to release core of bushing (G) **293746/1**;

— remove bushing. Insert cutter **293790/1** (L, detail i below and page 5) in bushing and position bushing/cutter assembly in sleeve (1), securing by turning lock ring (H) clockwise;

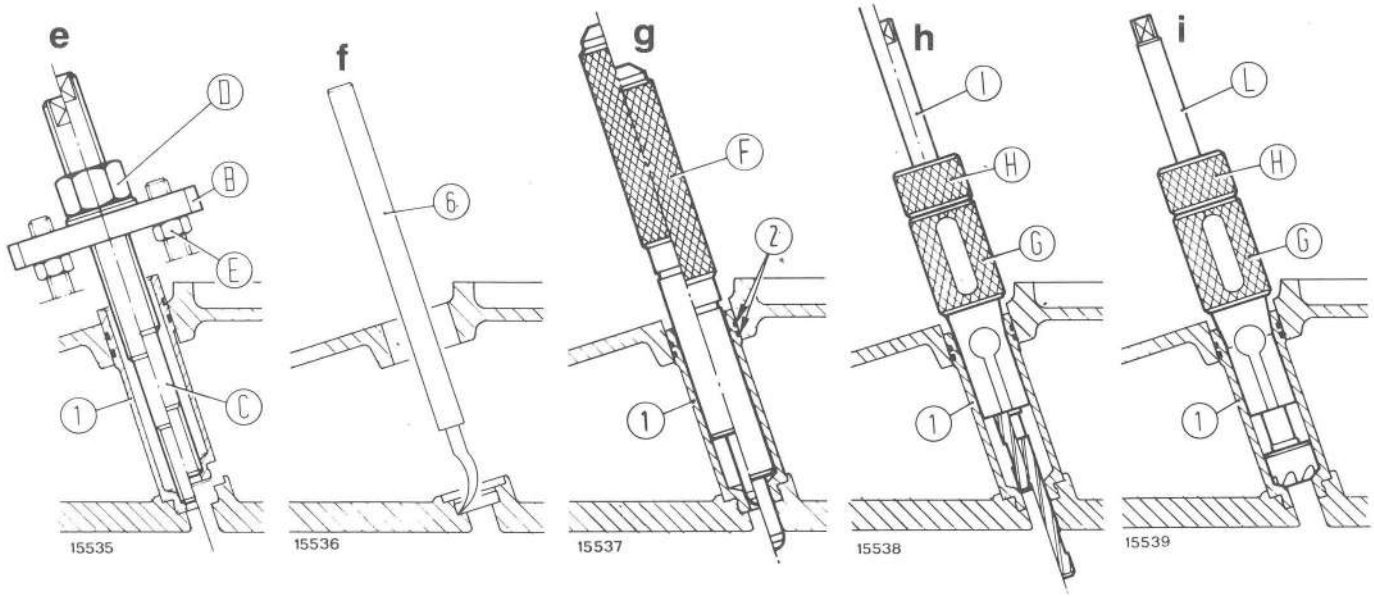
— Cut injector seat until it is perfectly smooth and free from tool marks;

— install injector in sleeve (1) and check that injector stand-out from head face is as indicated in figure a, page 3.

Note - To convert cutter **293790** (of kit **293742/1**) into cutter **293790/1**, grind down width to 20.9 to 21 mm or 0.823 to 0.827 in as shown on page 3 (on cutter **293790**, width was 21.9 to 22 mm or 0.862 to 0.866 in).



Removal (e), dressing (f), assembling (g) and cutting (h,i) injector sleeve on cylinder head using kit **293742/2** (115-90, 130-90 Turbo, 140-90 Turbo) - B,C,D. Puller **293784 (IVECO 342137)** - E. Nuts (M8 × 1.25) - F. Burnisher **293861** - G,H. Guide bushing **293746/1** - I. Reamer **293747** - L. Cutter **293790/1** - 1. Injector sleeve - 2. O-rings - 6. Cleanup tool **292243 (IVECO 390771).**



Removal (e), dressing (f), assembling (g) and cutting (h,i) injector sleeve on cylinder head using kit **293742/2** - 160-90 Turbo and 180-90 Turbo - B,C,D. Puller **293784 (IVECO 342137)** - E. Nuts (M8 × 1.25) - F. Burnisher **293386/1** - G,H. Guide bushing **293746/1** - I. Reamer **293747** - L. Cutter **293790/1** - 1. Injector sleeve - 2. O-rings - 6. Cleanup tool **292243 (IVECO 390771).**

To cut valve seats, use fixture **291113** and hand lathe **292913**. Subsequently, check that valve stand-in does not exceed values on page 3.
When installing the cylinder head, thoroughly clean the mating surfaces and reposition the head gasket on the block with the mark «ALTO» facing towards the cylinder head. Offer up the cylinder head and tighten the capscrews or nuts to the correct torque in the order shown on page 6.

Note - For 115-90, 130-90 Turbo and 140-90 Turbo tractors, cylinder head capscrews are to be tightened in four successive stages as shown in the table on page 6:

— Stage 1 = tighten capscrews to a pre-torque of 60 Nm, 6.1 kgm or 442.56 ft. lb using a torque wrench;

— Stage 2 = check pre-torque using a torque wrench;

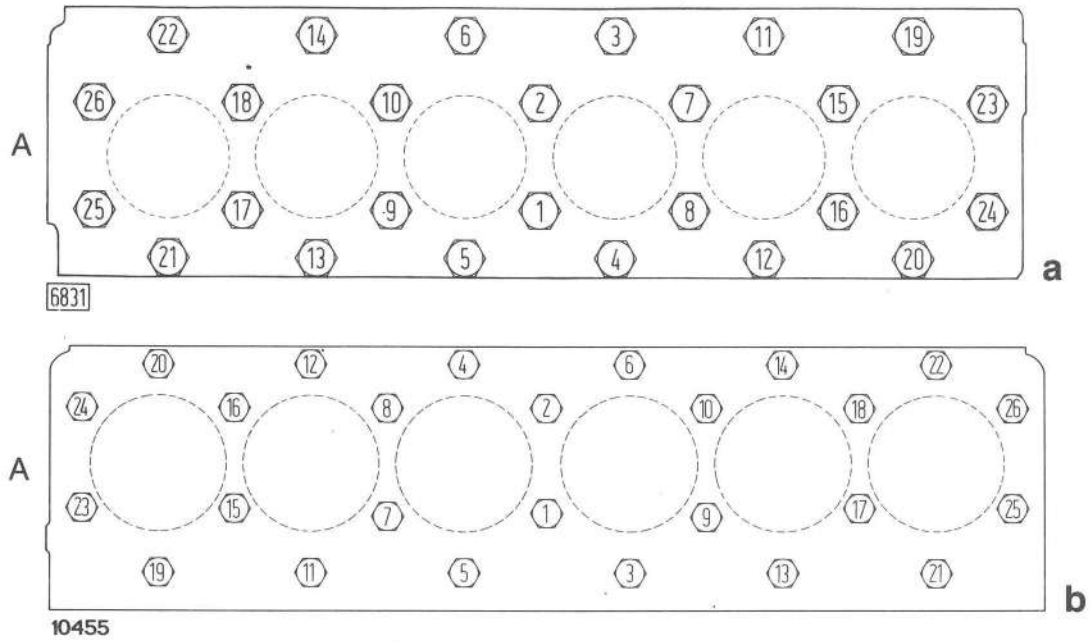
— Stage 3 = tighten capscrews through a further 90° using graduated quadrant **292248**;

— Stage 4 = tighten capscrews through a further 90° using graduated quadrant **292248**.

For 160-90 Turbo and 180-90 Turbo tractors, cylinder head nuts are to be tightened in three successive stages as shown in the table on page 6.

Grinding down cutter 293790 to produce cutter 293790/1.

20.9 to 21 mm or 0.823 to 0.827 in width of cutter **293790/1** (was 21.9 to 22 mm or 0.862 to 0.866 in for cutter **293790**).



Cylinder head tightening diagram.

a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo - A = Fan side.

STAGE	1	2	3	4
Mod.: — 115-90 — 130-90 Turbo — 140-90 Turbo	Pre-torque (use torque wrench)	Pre-torque check (use torque wrench)	Angle tightening (use graduated sector **292248**)	
	60 Nm (6.1 kgm) St. lb. (44.2)	60 Nm (6.1 kgm) St. lb. (44.2)	90°	90°

Cylinder head capscrew tightening stages - 115-90, 130-90 Turbo and 140-90 Turbo.

STAGE	1	2	3
Mod.: — 160-90 Turbo — 180-90 Turbo	118 Nm (12 kgm) St. lb. (87)	167 Nm (17 kgm) St. lb. (123)	226 Nm (23 kgm) St. lb. (166)

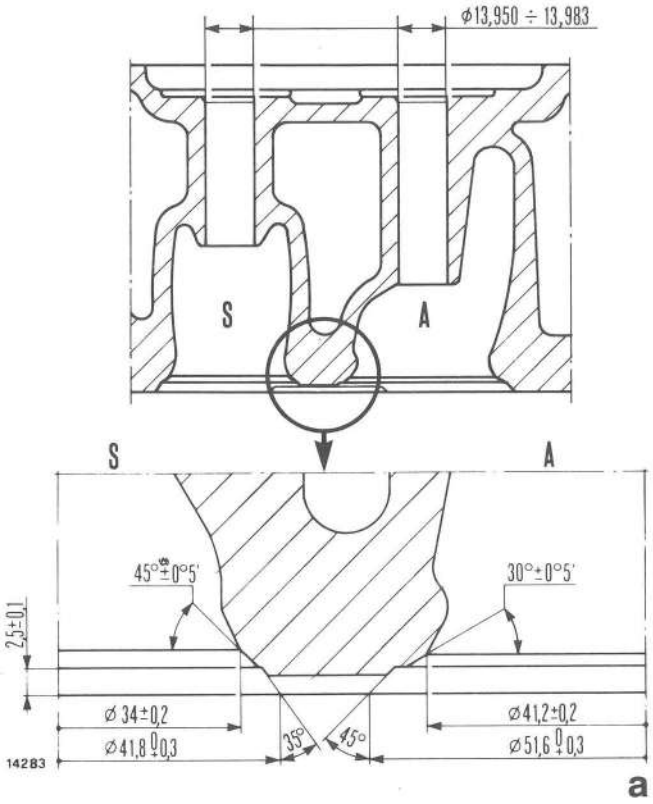
Cylinder head nut tightening stages - 160-90 Turbo and 180-90 Turbo.

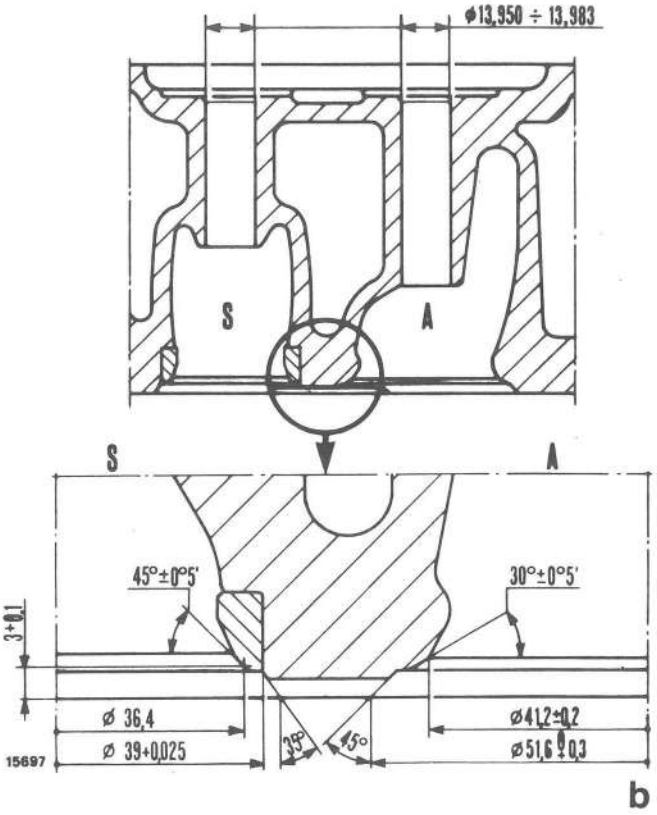
OIL PAN

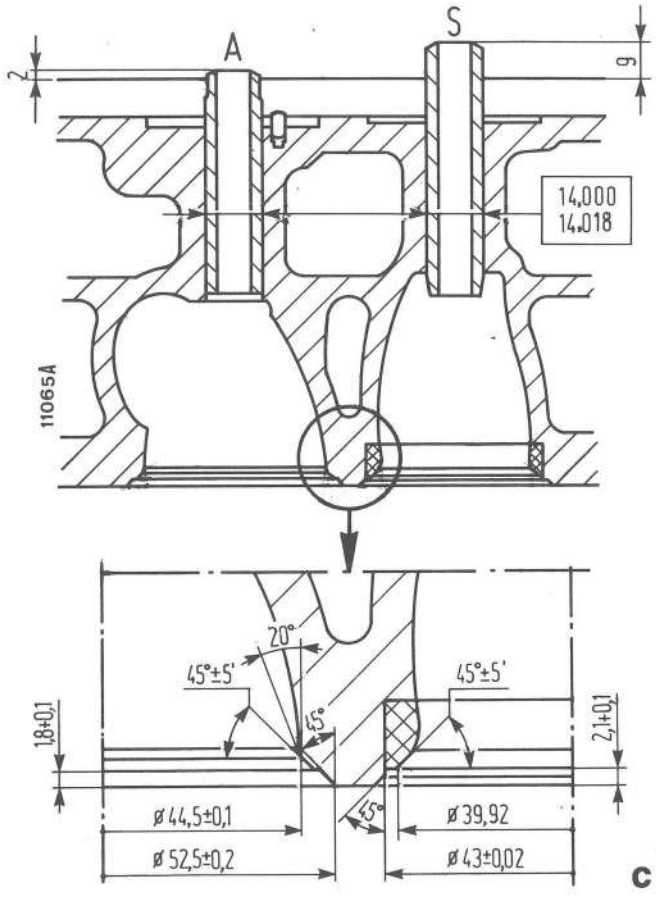
To assemble oil pan on 160-90 Turbo and 180-90 Turbo tractors, proceed as follows:

— clean and degrease contact surfaces of engine block, front timing cover, rear engine mounting and rear seal cover. Apply a light coat of «LOCTITE 510» jointing compound, ensuring that threaded holes for oil pan capscrews are not obstructed;

— clean and degrease oil pan mating surfaces. Position oil pan, wet capscrews with engine oil and tighten.

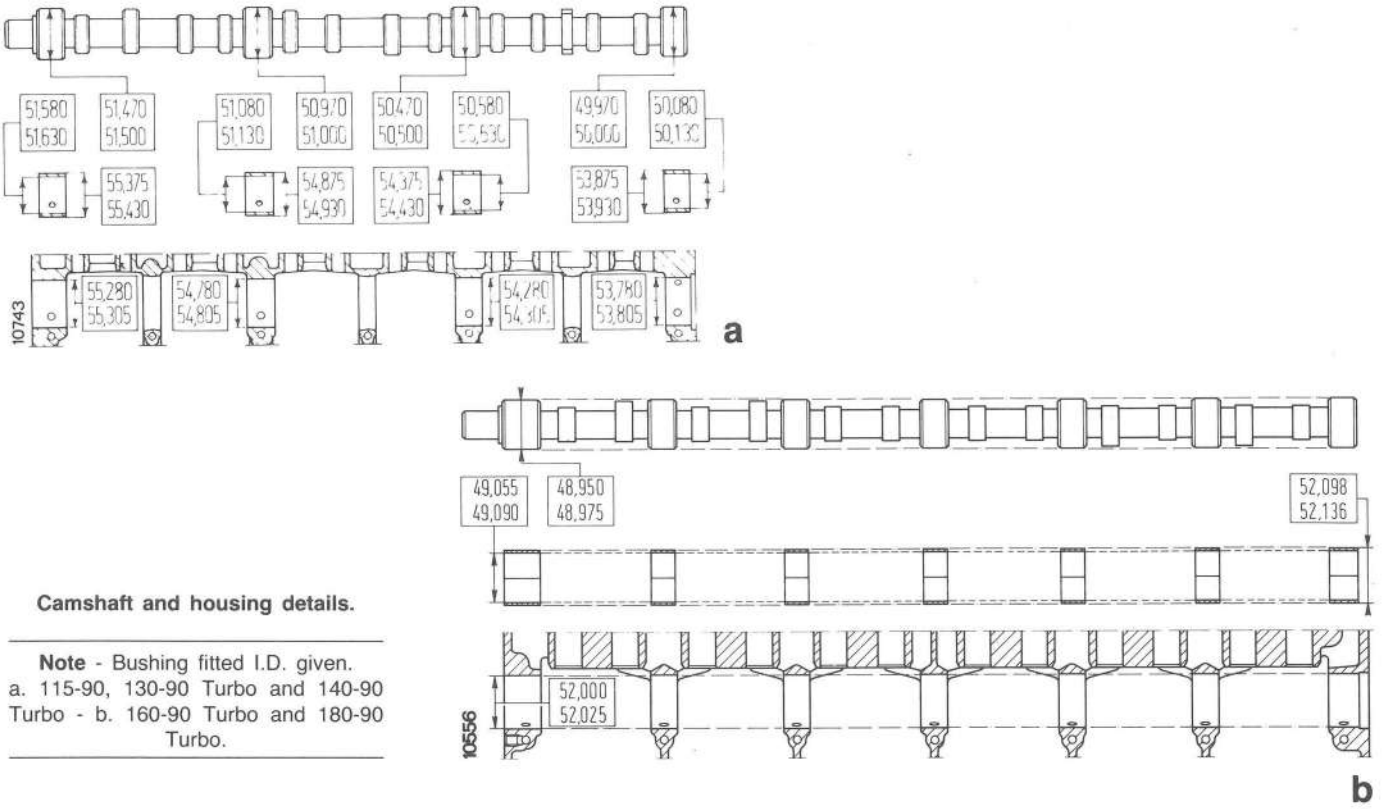






Valve seat and guide details.

a. 115-90 - b. 130-90 Turbo and 140-90 Turbo - c. 160-90 Turbo and 180-90 Turbo - A. Intake - S. Exhaust.



Camshaft and housing details.

Note - Bushing fitted I.D. given.
a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo.

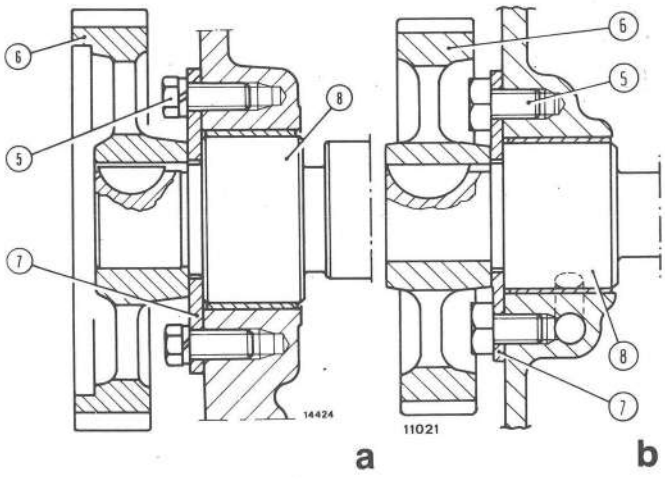
CAMSHAFT

To remove the camshaft take out screws (5) and withdraw thrust plate (7).
To inspect, place the camshaft over V-blocks and check journal eccentricity using a suitable dial gauge. Maximum allowance is .02 mm (.0008 in).
To straighten the camshaft use a press of adequate size for up to .2 mm (.008 in) distortion. If distortion exceeds .2 mm (.008 in), scrap and replace the camshaft without hesitation.
Replace worn bushings using remover/replacer set **292103 (IVECO 360383)** with handle **292208 (IVECO 370008)** for 115-90, 130-90 Turbo and 140-90 Turbo tractors, or remover/replacer **292164 (IVECO 360380)** with handle **292208 (IVECO 370008)** for 160-90 Turbo and 180-90 Turbo tractors.
Open out new bushings to the I.D.'s indicated in figure using reamer **293269 (IVECO 390363)** for 115-90, 130-90 Turbo and 140-90 Turbo tractors, or reamer **292163 (IVECO 390368)** for 160-90 Turbo and 180-90 Turbo tractors.

VALVES, GUIDES AND SPRINGS

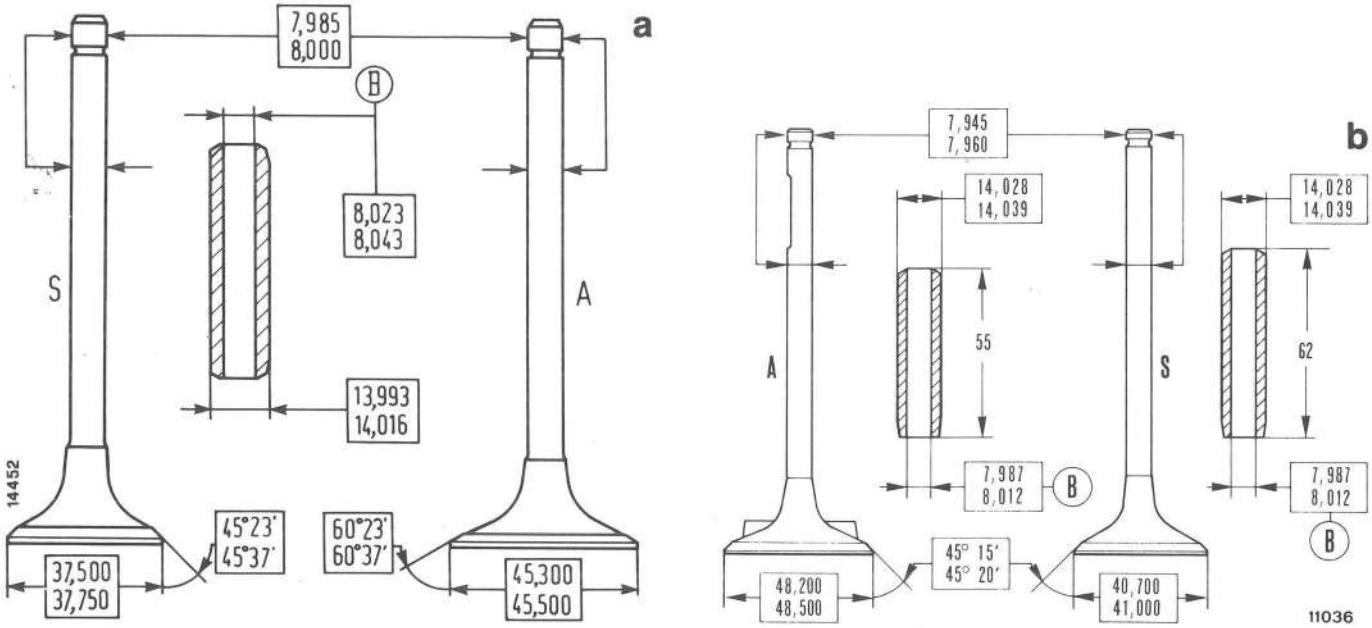
To remove and reinstall the valves use tool **291050.** If defective sealing is detected, grind in together with the seats using air grinder **290064** or hand grinder **290891**. If necessary, re-cut the valve seats as directed and grind the valves (page 2).

After grinding, check that the minimum land below valve head chamfer is not less then .5 mm (.020 in).
To remove the valve guides, use tool **291046/1 (IVECO 360409/1).** To install guides, use the same tool together with bushing **291779 (IVECO 360283)** for exhaust valve guide on 160-90 Turbo and 180-90 Turbo tractors, or together with bushing **291780 (IVECO 360409/3)** for intake valve guides on 160-90 Turbo and 180-90 Turbo tractors and intake and exhaust valve guides on 115-90, 130-90 Turbo and 140-90 Turbo tractors.



Section through camshaft drive.

a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo 5. Plate capscrew - 6. Drive gear - 7. Thrust plate - 8. Camshaft.

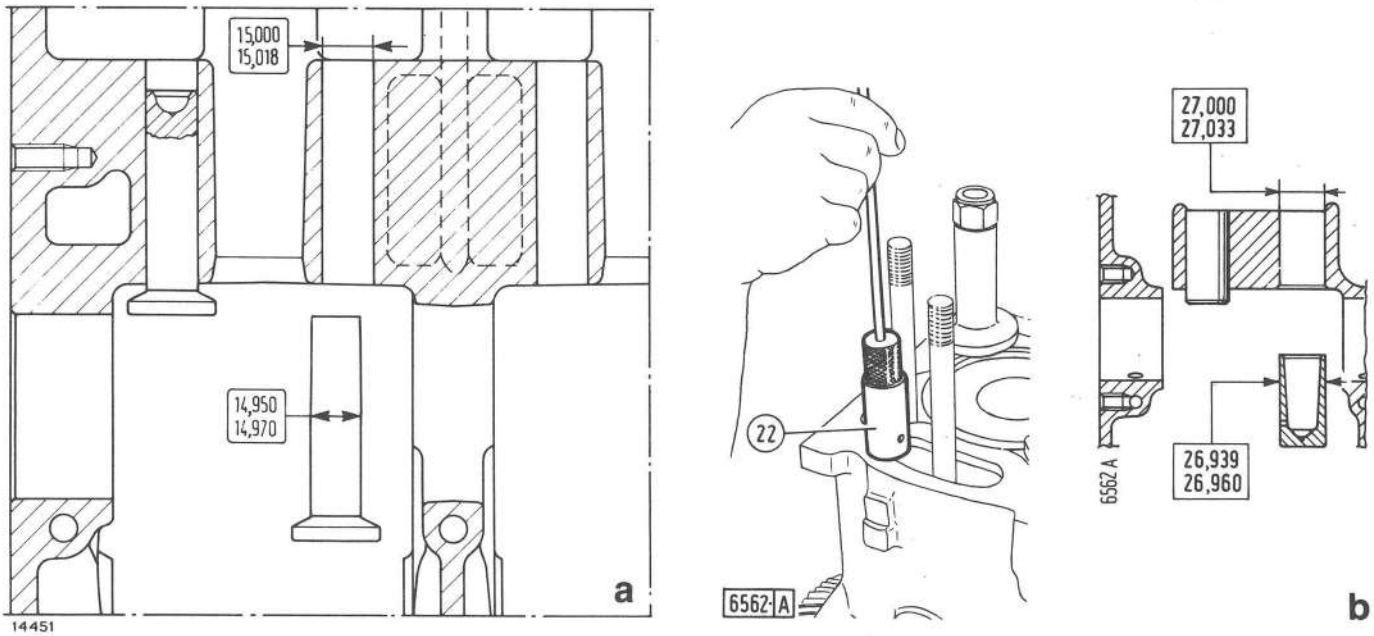


Valve and guide details.

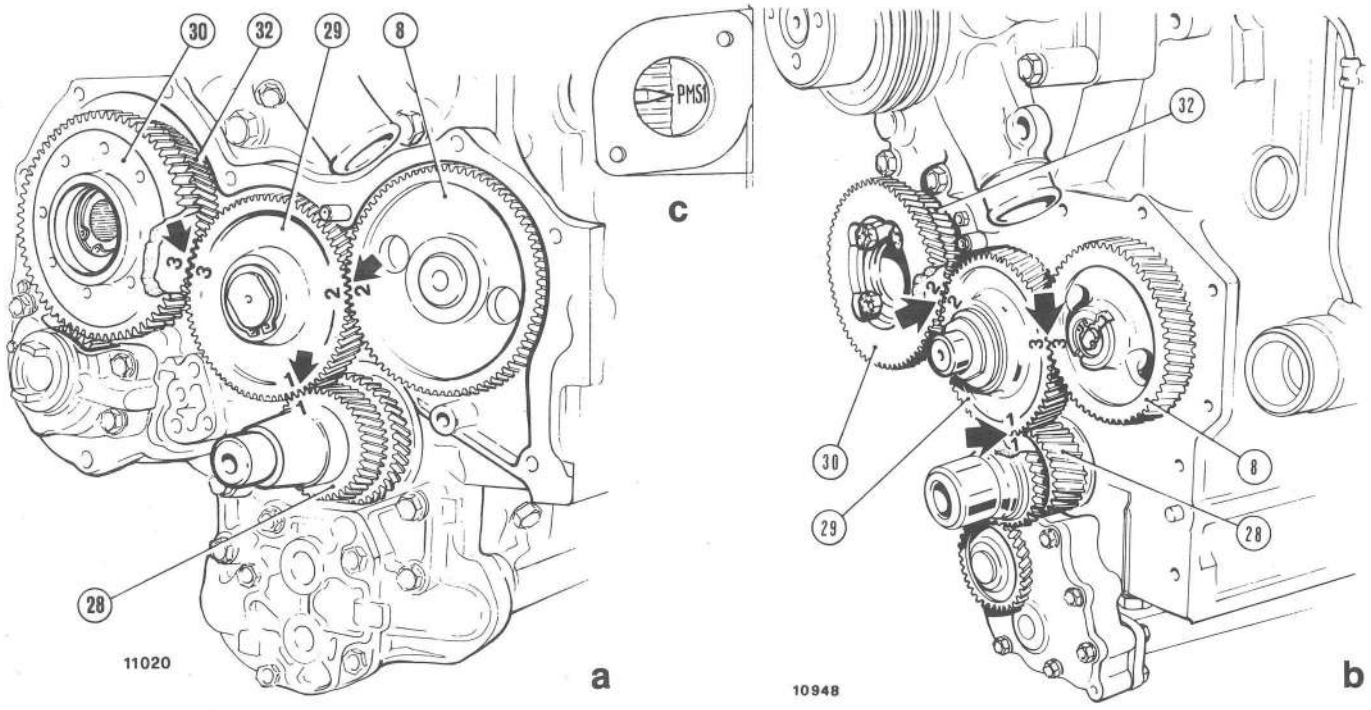
Note - Minimum land below head chamfer is .5 mm or .020 in.
a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo - A. Intake - B. Fitted diameter - S. Exhaust.

On 160-90 Turbo and 180-90 Turbo tractors, guides should protrude from cylinder head as indicated in figure c, page 7, section 12.
Valve guides should be a drive fit in their housing. If loose they should be replaced with oversize guides.

After installation, guides should be reamed with tool **291177 (IVECO 390310)** for 115-90, 130-90 Turbo and 140-90 Turbo tractors, or with tool **290944 (IVECO 394116)** for 160-90 Turbo and 180-90 Turbo tractors.



Removing/installing tappets (160-90 Turbo and 180-90 Turbo) using tool 290947 - Tappet and housing details.
a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo - 22. Tappet.



Valve timing.

Note - Timing marks to line up with piston No. 1 at T.D.C. on compression stroke arrowed (inset c.).
a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo - c. Flywheel timing mark and pointer (P.M.S.1. = Piston No. 1 at T.D.C.) - 8. Camshaft gear - 28. Crankshaft gear - 29. Idler gear - 30. Lift pump and power steering pump gear - 32. Injection pump drive gear.

TAPPETS, PUSHRODS AND ROCKERS

Ensure that the tappets slide smoothly in their housings without excessive clearance.

If excessive clearance is detected, renew using oversize tappets and open out the associated housing bores.
The pushrods should be perfectly straight and the rocker screw seat should not show signs of pick-up or undue wear. Renew as necessary.
Prior to removing the rocker end brackets take off the bracket-to-shaft retaining screw.
Inspect the rocker and screw working surfaces. When dressing becomes necessary, remove as little material as possible.

Valve clearance adjustment

Check the valve clearance using a suitable feeler gauge. For correct clearance see the table on page 6, section 10.
To adjust use wrench **291883 (IVECO 350108)**, working on each cylinder with the valves of the opposite cylinder in a condition of balance (i.e. start of intake stroke). Cylinder matching is 1-6, 2-5 and 3-4.

VALVE GEAR TRAIN

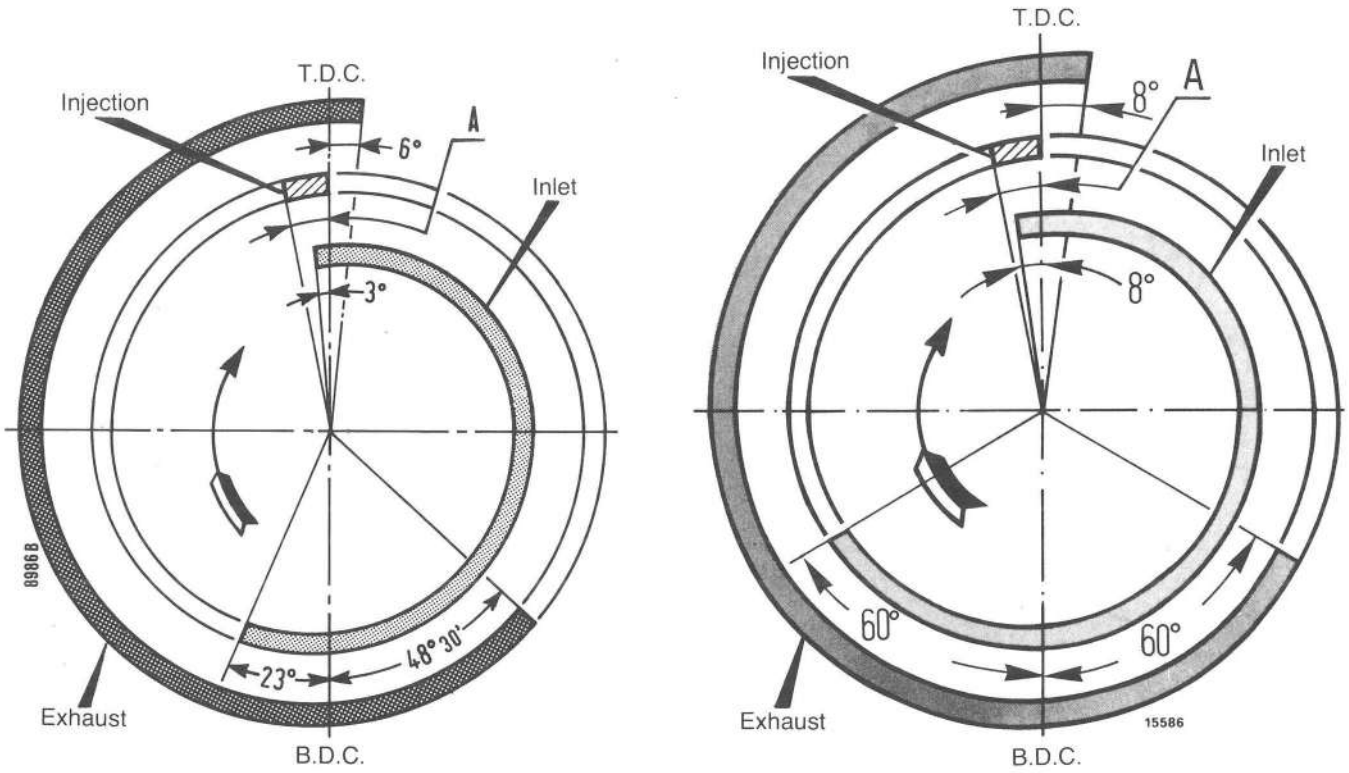
For valve timing, proceed as follows:

— turn the crankshaft to bring piston No. 1 to T.D.C. position on compression stroke;

— install the drive gears and align as shown above.

Note - To check valve timing after overhaul, first adjust valve clearance provisionally to .45 mm (.0177 in) for 115-90, 130-90 Turbo and 140-90 Turbo tractors, or to .41 mm (.0161 in) for 160-90 Turbo and 180-90 Turbo tractors.
Turn crankshaft and, using a protractor, check that valve opening and closing angles are as shown on page 4.
Then adjust valve clearance as indicated on page 5, section 00.

ENGINE: Valve gear



Valve timing diagram.

a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo - A. Fixed advance:

— 115-90 = 25° ± 1°
— 130-90 Turbo = 25° ± 1°
— 140-90 Turbo = 25° ± 1°
— 160-90 Turbo = 22° 30′ ± 30′
— 180-90Turbo = 15° ± 30′

CRANKSHAFT

On 115-90, 130-90 Turbo and 140-90 Turbo tractors, remove the pulley hub using tool **291504**. Carefully inspect the crankshaft.
Remember that even the slightest crack necessitates crankshaft replacement.
Check both main journals and crankpins noting the following points:

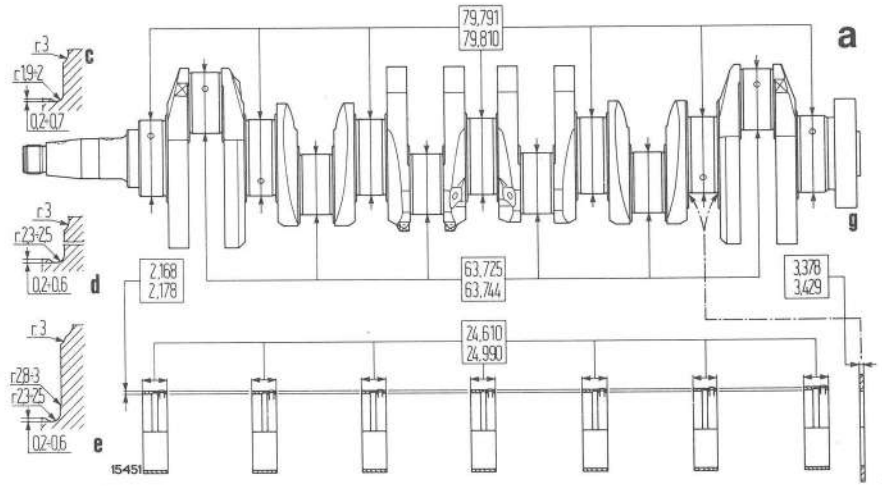
— pick-up and scratch marks may be remedied using zero-grade emery paper;

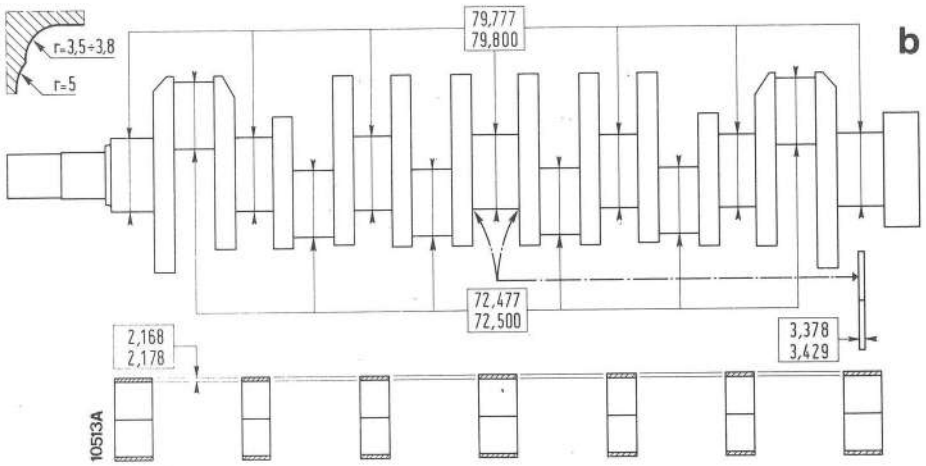
— score marks, ovality and taper in excess of .05 mm (.002 in), necessitate journal regrinding to the nearest undersize dimension (see data table).

After regrinding, blend the journal fillet radii as shown in (a) and (b), and inspect the crankshaft to ensure that:

— journal ovality does not exceed .008 mm (.0003 in);
— journal taper does not exceed .01 mm (.0004 in);
— maximum main journal misalignment with the shaft over V-blocks does not exceed .10 mm or .004 in (D, page 2);
— maximum misalignment of each pair of crankpins with respect to main journals does not exceed ± .25 mm (± .10 in) (a, page 2);
— the distance from top of crankpin to crankshaft centerline does not exceed ± .10 mm (± .004 in);
— run-out and eccentricity, as measured with the dial gauge stylus at (A) and (B) respectively, does not exceed the limits specified in the table of page 3, section 10.

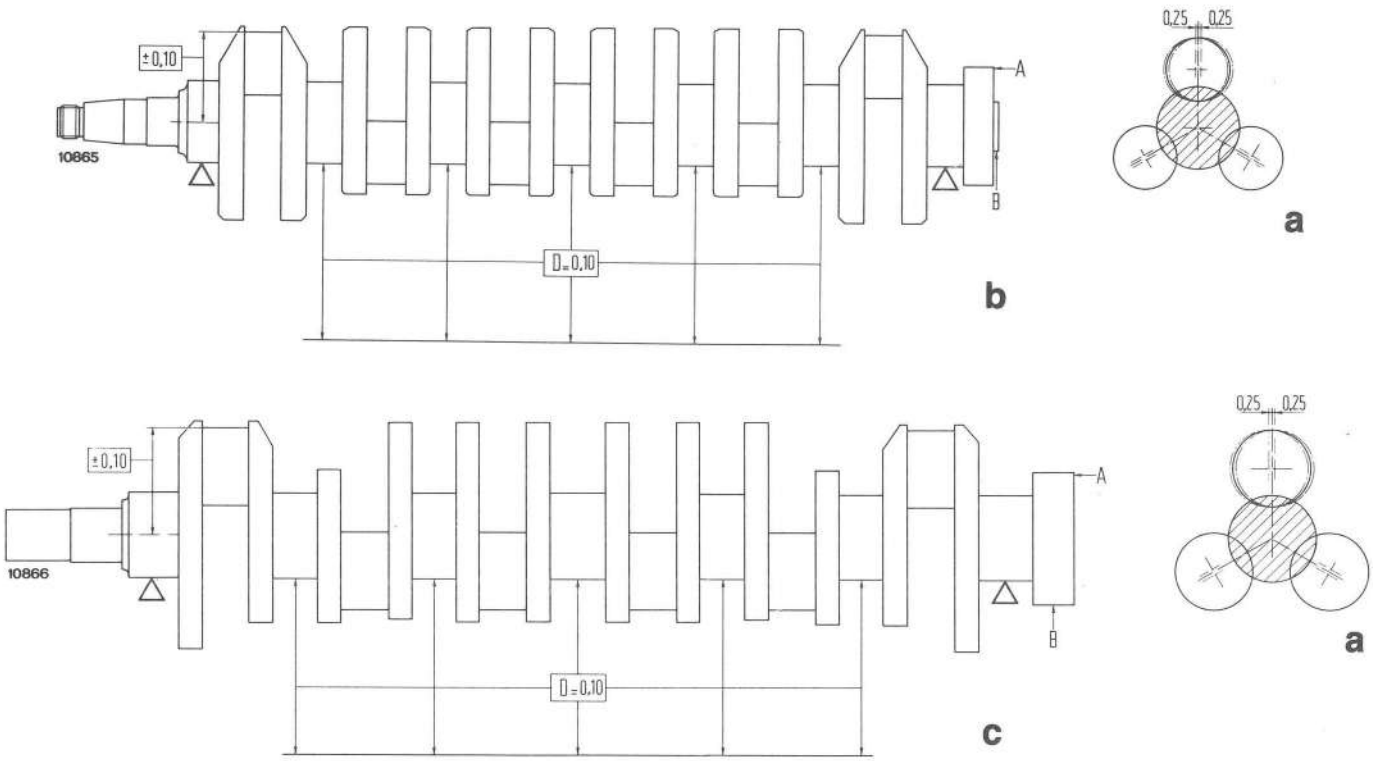
Check the core plugs for leakage with oil at 14.7 bar (15 kg/cm^2, 230 psi). Press fit new core plugs as necessary, peen in position and recheck for leakage.
After refitting the crankshaft and retightening the bearing caps check the end float at the last but one cap (115-90, 130-90 Turbo and 140-90 Turbo) or at the center bearing cap (160-90 Turbo and 180-90 Turbo). If excessive play is detected, install oversize thrust washers (see data table).





Crankshaft, bearing, and thrust washer details.

a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo - c. Crankpin fillet radius details - d. Standard main journal fillet radius details - e. Main journal fillet radius details with thrust washers - f. Crankpin and main journal fillet radius details.

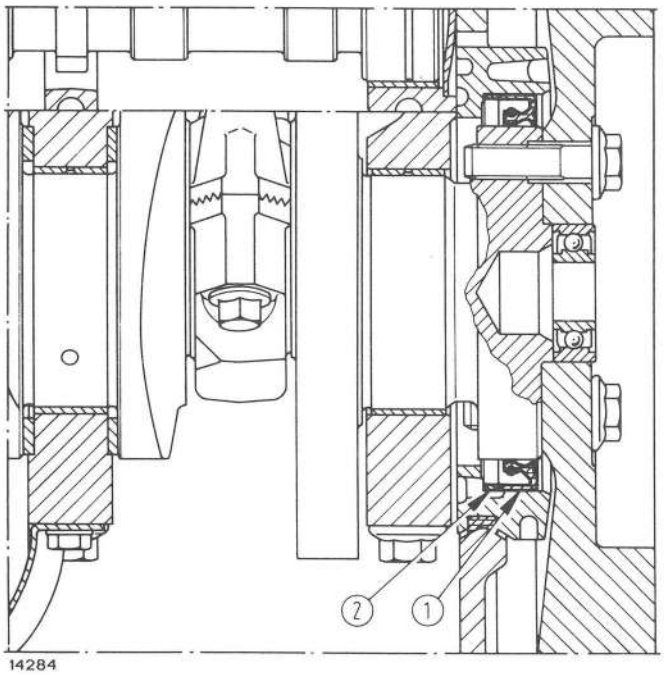


Checking main journal and crankpin alignment.

a. Crankpin to main journal maximum misalignment - b. 115-90, 130-90 Turbo and 140-90 Turbo - c. 160-90 Turbo and 180-90 Turbo - A. Flange run-out stylus position - B. Stylus position for eccentricity check - D. Maximum main journal misalignment.

Crankshaft front and rear seals

Check the metal-caged, double lip spring-loaded rubber seals (pages 19, 20, 21 and 22, section 10).
When replacing the seals note the following points:

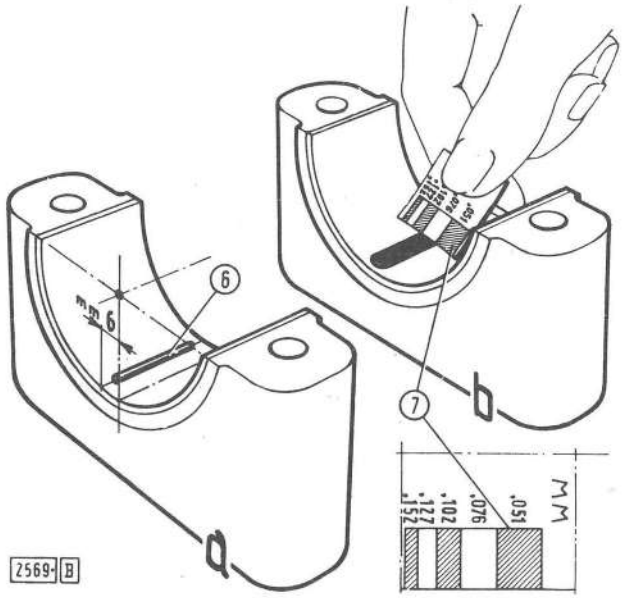


Replacing crankshaft seal - 115-90, 130-90 Turbo and 140-90 Turbo.

1. Seal - 2. Spacer.

— wipe off all traces of oil and dirt. The seal seat should be clean and dry;

— soak the seal in engine oil for 30 minutes and install applying a steady even pressure all round using a suitable drift;



Checking crankshaft journal running clearance.

a. Calibrated wire in position on bearing cap - b. Comparing width of compressed calibrated wire with reference scale - 6. Calibrated wire - 7. Graduated scale printed on wire container.

— smear lips with a film of thick oil and pack the cavity with grease to prevent the seal from running dry when the engine is started for the first time.

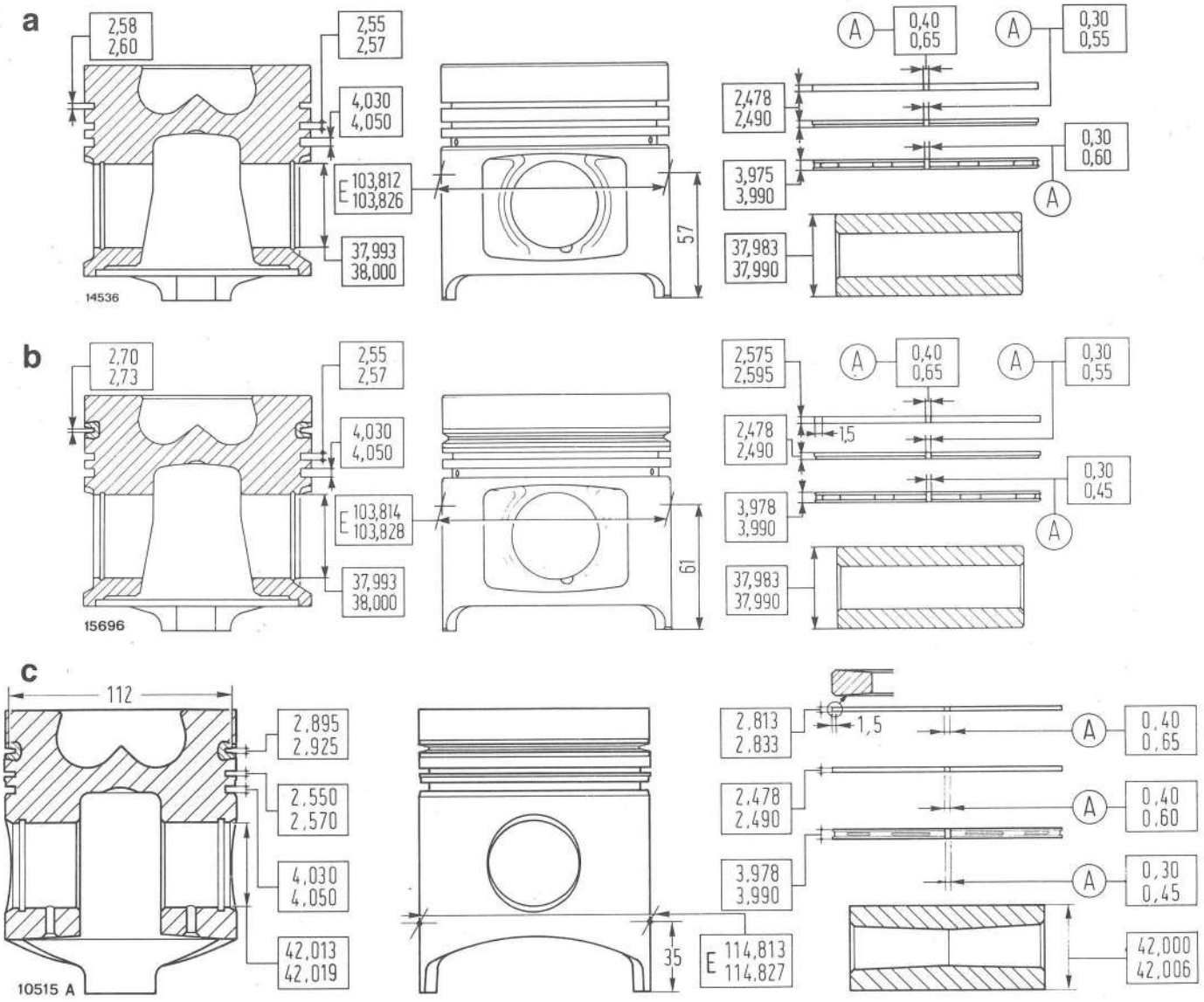
Note - When replacing crankshaft seal (1, page 2), 115-90, 130-90 Turbo and 140-90 Turbo, remove spacer (2) together with old seal.
Install new seal without spacer (2) so as to provide a new sealing face.

MAIN AND BIG END BEARINGS AND CAPS

The bearing caps with attached thin shell bearings are numbered for correct installation.
Accordingly, the cap identification number should tally with that stamped on the engine block.
The crankshaft bearing running clearance may be checked using Perfect Circle Plastigage calibrated wire (page 2).

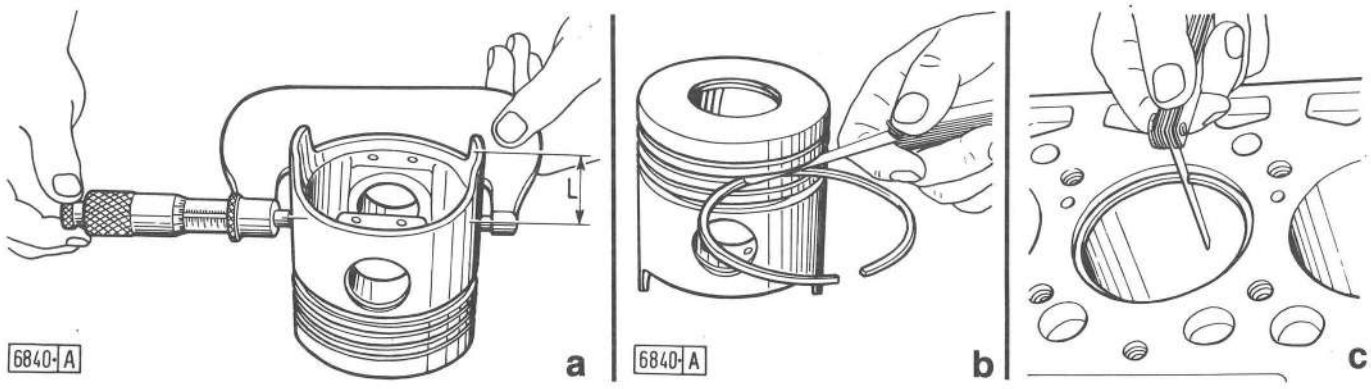
PISTONS AND RINGS

Assess piston and liner wear as directed on page 1, section 12, in the illustration on this page and on page 4.



Piston, pin and ring details.

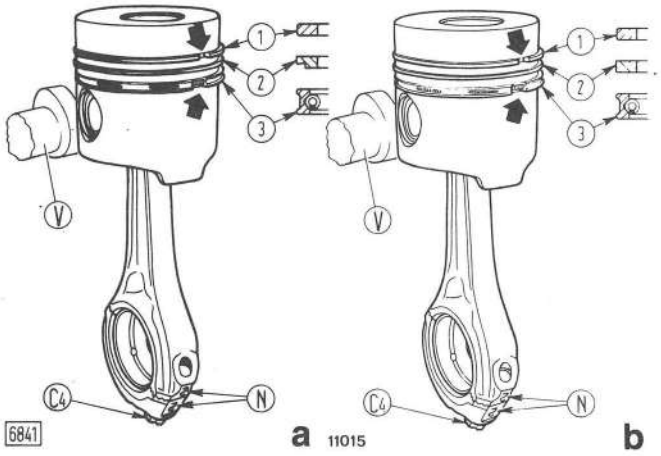
a. 115-90 - b. 130-90 Turbo and 140-90 Turbo - c. 160-90 Turbo and 180-90 Turbo - A. Piston ring fitted gap - E. Piston diameter as measured 57, 61 or 35 mm (2¼, 2½ or 1½ in) from base of skirt.



Inspecting the pistons and rings.

a. Measuring piston diameter at distance (L) from base of skirt - b. Measuring piston ring side clearance - c. Measuring piston ring gap - L. Measuring distance from skirt base, 57 mm (2¼ in), 115-90, 61 mm (2½ in), 130-90 Turbo and 140-90 Turbo or 35 mm (1½ in), 160-90 Turbo and 180-90 Turbo.

If the clearance is found to be in excess of .30 mm (.12 in), rebore the liners and fit oversize pistons and rings (see table).
If the pistons are renewed, note that the weight difference between pistons of the same engine should not exceed 20 grams (⅔ oz.), 115-90, 130-90 Turbo and 140-90 Turbo, or 30 grams (1 oz.) 160-90 Turbo and 180-90 Turbo.
To remove and reinstall the piston rings use tool **291160.**
Check the ring side clearance (b) and the fitted gap (c). If ring gap is found to be less than specified, grind the ring ends as necessary.



Connecting rod/piston assembly in correct fitted position.

Note - Ring gaps arrowed.
a. 115-90, 130-90 Turbo and 140-90 Turbo - b. 160-90 Turbo and 180-90 Turbo - C_4. Cap bolts - N. Cylinder reference - V. Camshaft - 1, 2 and 3. Piston rings.

When reinstalling the rings adhere to the instructions given on page 3.

When inserting the pistons in the cylinder sleeves, ensure that the ring gaps are staggered at 180° from one another.

CONNECTING RODS

Check the small end bushings for looseness and displacement. They should be flush with connecting rod sides.

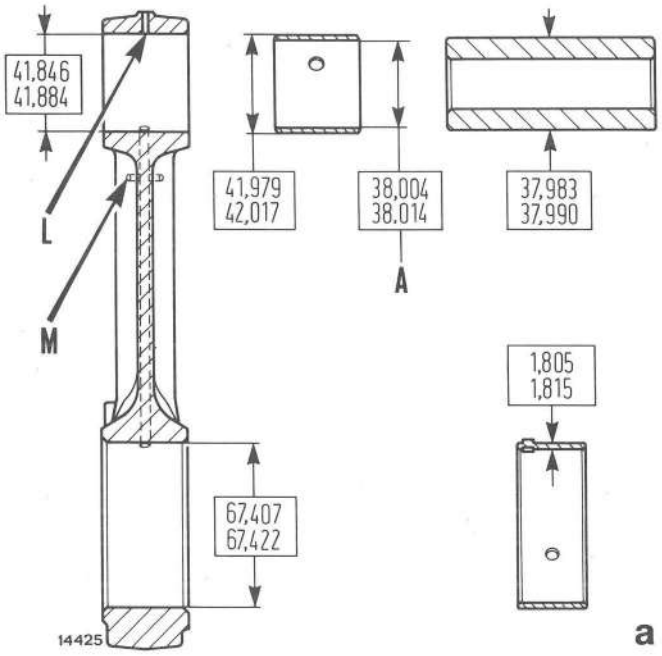
After press fitting, ream the bushings using a suitable expanding blade reamer.

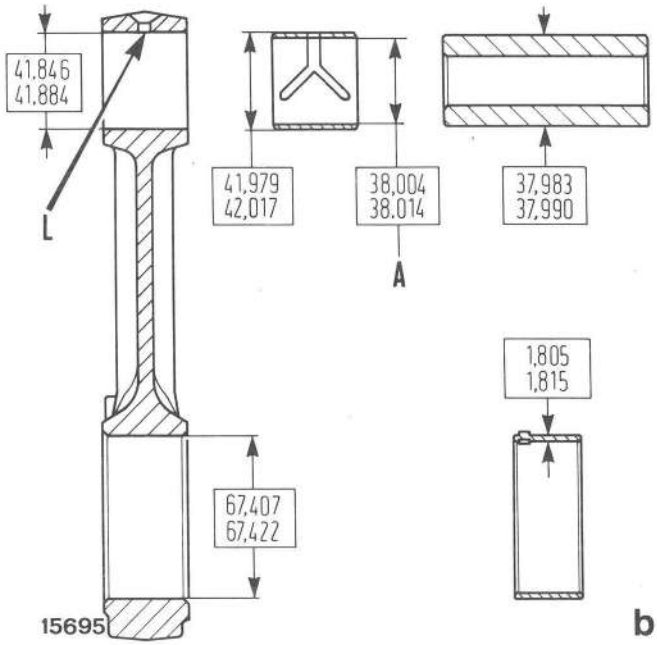
If necessary, bushings for 160-90 Turbo tractors and 180-90 Turbo tractors may be opened out to the specified piston pin oversize (see data table), together with the piston.

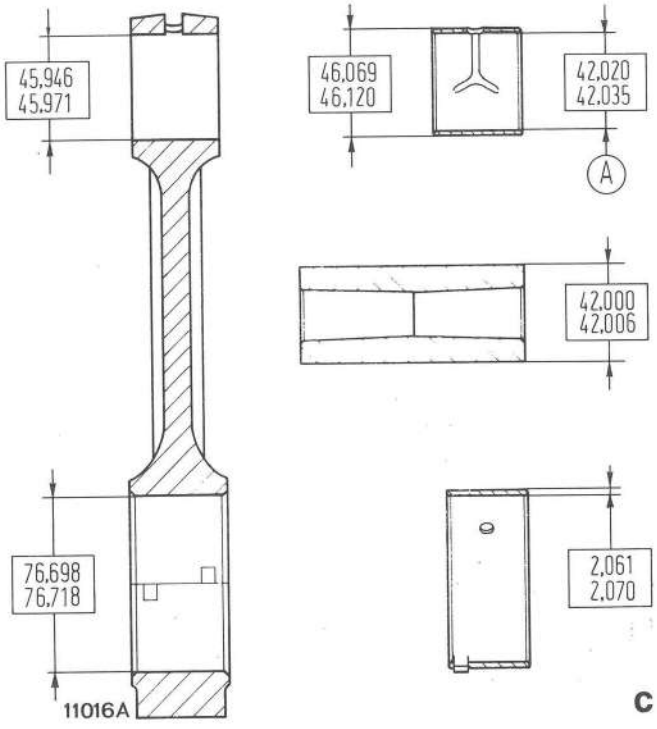
Use gauge **293459** to check connecting rod axis misalignment: big and small end axes at 125 mm (5 in) away from the rod centerline should be as specified in the table. Any slight distortion may be remedied using a suitable press; howewer, if distorsion is serious scrap, and replace the connecting rod without hesitation.

Replacement rods should be stamped with the reference numbers of the cylinders to which they belong. Also ensure that the weight difference between rods of the same engine does not exceed 25 grams (1 oz.), 115-90, 130-90 Turbo and 140-90 Turbo, and 20 grams (⅔ oz.), 160-90 Turbo and 180-90 Turbo.

Ensure that the connecting rod lubricating ways (L and M, page 5) are unobstructed.







Connecting rod, bearing, bushing and pin details.

a. 115-90 - b. 130-90 Turbo and 140-90 Turbo - c. 160-90 Turbo and 180-90 Turbo - A. Fitted dimension after reaming - L. M. Lubricant ways.

Nota - Scrap and replace the cap retaining screws whenever the connecting rods are disassembled.

Connecting rod/piston installation

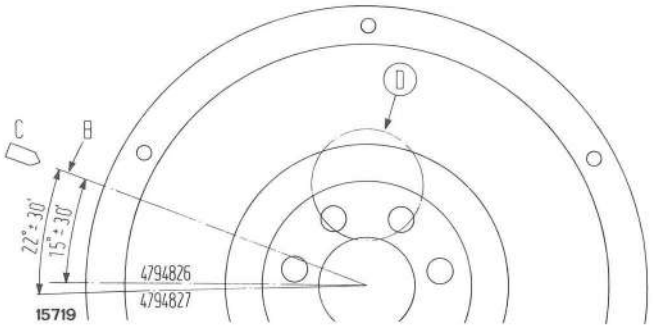
Introduce the pistons with attached rings and connecting rods in the associated liners, preferably using ring compressor **291048**, and position each assembly so that reference (N) on the connecting rods face towards the side opposite the camshaft (V), as indicated in (a) and (b), page 4.

Fitted piston T.D.C. position with respect to engine block should be:

— 115-90, 130-90 Turbo and 140-90 Turbo: .355 to .761 mm (.014 to .030 in) stand-out.

— 160-90 Turbo and 180-90 Turbo: .240 mm (.0010 in) stand-in to .710 mm (.028 in) stand-out.

Note - For 115-90, 130-90 Turbo and 140-90 Turbo tractors, piston crowns may be stamped «LATO PUNTERIE» (tappet side); if so,install pistons accordingly.



Flywheel assembly references (160-90 Turbo and 180-90 Turbo).

A. INIEZ. reference position; marked **4794827** aligned with start of delivery (160-90 Turbo) and **4794826** aligned with start of delivery (180-90 Turbo) - B. T.D.C. 1 reference position - C. Fixed timing pointer - D. No. 1 crankpin position for correct flywheel assembly.

Note - For tractors with POWER-SHIFT transmission, marks are **4799784** aligned with start of delivery (160-90 Turbo) and **4799783** aligned with start of delivery (180-90 Turbo).

FLYWHEEL

When installing the flywheel, 160-90 Turbo and 180-90 Turbo, bring crankpin No. 1 (D) to T.D.C. and check that fixed timing pointer (C) is in register with P.M.S. 1 reference (B).

On 115-90, 130-90 Turbo and 140-90 Turbo, the flywheel assembly position cannot be mistaken as bolt position has been offset for the purpose.

Flywheel dressing

When servicing flywheel for 14″ clutch (fig. a) on 130-90 Turbo and 140-90 Turbo tractors with manual transmission, flywheel face may be dressed, removing a maximum of 1 mm (.039 in) of material.

After dressing, restore 33.8 to 34.2 mm (1.331 to 1.346 in) clearance between clutch contact face on flywheel and bell housing mating face, and 1 mm (.039 in) undercut.

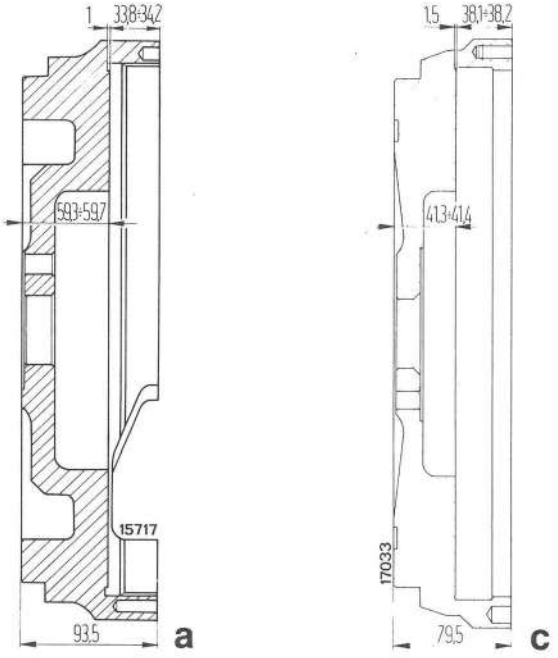
When servicing flywheel for 12″ + 12″ clutch (fig. b) on 160-90 Turbo and 180-90 Turbo tractors, flywheel face may be dressed, removing a maximum of 1 mm (.039 in) of material.

After dressing, restore .5 mm (.197 in) undercut.

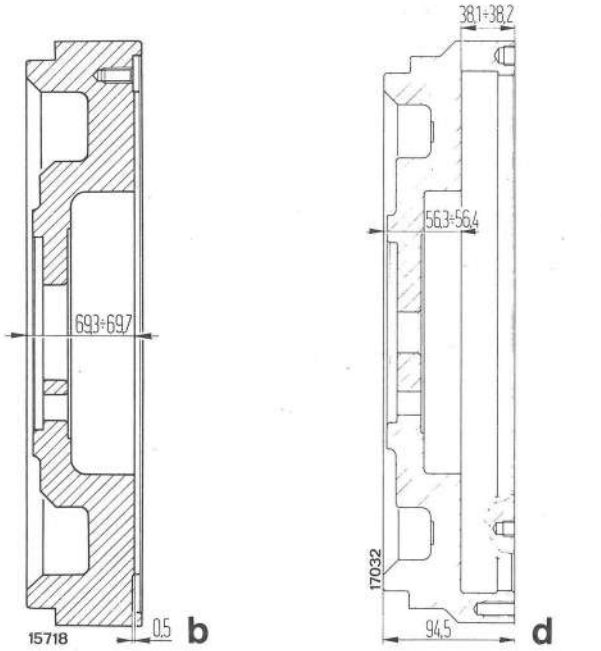
When servicing the 14″ flywheel for tractors equipped with POWER SHIFT transmission (Fig. c for 130-90 Turbo/140-90 Turbo or Fig. d 160-90 Turbo/180-90 Turbo) it is possible to redress the flywheel friction lined face by removing material down to a max thickness of 1 mm (.039 in).

After re-dressing, restore the specified distance of 38.1 to 38.2 mm (1.500 to 1.504 in) between the clutch disc abutment face on flywheel and the drive pinion face on flywheel.

Note - After dressing, check that flywheel face is flat or slightly concave (max .05 mm or .0020 in); flywheel face should under no circumstances be convex.



Original dimensions of flywheel for 14″ clutch - 130-90 Turbo and 140-90 Turbo (fig. a for manual transmission and fig. c for POWER-SHIFT transmission).



Original dimensions of flywheel for 12″ + 12″ clutch - 160-90 Turbo and 180-90 Turbo (fig. b for manual transmission and fig. d for POWER-SHIFT transmission).