ENGINE SPECIFICATIONS

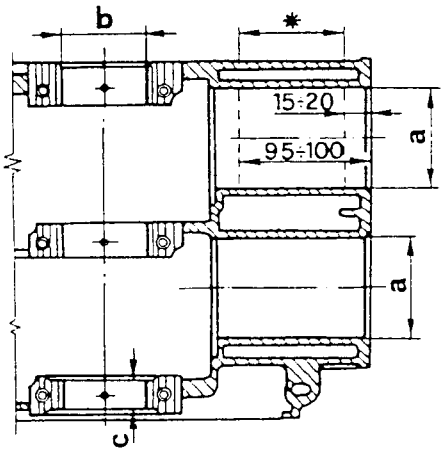
TECHNICAL DATA

Engine type		AR 33501	AR 33201
Cycle		Otto 4-stroke	Otto 4-stroke
Fuel system/ignition		Multi-Point IAW	Multi-Point Motronic MP3.1 (Δ)
Firing order		1 - 3 - 2 - 4	
Displacement	cm^3	1351	1596
Number of cylinders		4 horizontal opposed	4 horizontal opposed
Bore	mm	80	84
Stroke	mm	67.2	72
Maximum power	HP CEE (kW CEE) rpm	90 (66) 6000	103 (76) 6000
Maximum torque	kgm CEE (Nm CEE) rpm	11.7 (115) 4400	13.7 (134) 4500
Compression ratio		9.5 : 1	9.5 : 1
Engine oil pressure (with engine oil at 100°C) - At idle speed - At 4000 rpm	bar	 > 0.8 > 4	 > 0.8 > 4
Idle r.p.m.	rpm	850 ± 50	850 ± 50

(Δ) Multi-Point Rochester for after change version.

COMPLETE CRANKCASE

Crankcase

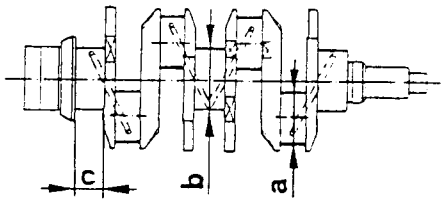


(*) Area for dimensional control

Unit: mm

		AR 33501	AR 33201
Diameter of cylinders "a"	Class A - Blue	80.000 ÷ 80.010	84.000 ÷ 84.010
	Class B - Pink	80.010 ÷ 80.020	84.010 ÷ 84.020
	Class C - Green	80.020 ÷ 80.030	84.020 ÷ 84.030
	Class D - Yellow	80.030 ÷ 80.040	84.030 ÷ 84.040
	Class E - White	80.040 ÷ 80.050	84.040 ÷ 84.050
	Oversize 0.2	80.200 ÷ 80.210	84.200 ÷ 84.210
	Oversize 0.4	80.400 ÷ 80.410	84.400 ÷ 84.410
	Oversize 0.6	80.600 ÷ 80.610	84.600 ÷ 84.610
Diameter of main journals "b"		63.663 ÷ 63.673	63.663 ÷ 63.673
Width of rear main journal shoulder "c"		23.68 ÷ 23.73	23.68 ÷ 23.73

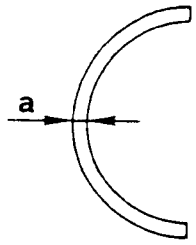
Crankshaft



Unit: mm

		AR 33501	AR 33201
Diameter of connecting rod pins "a"	Class A - Red	49.992 ÷ 50.000	49.992 ÷ 50.000
	Class B - Blue	49.984 ÷ 49.992	49.984 ÷ 49.992
Diameter of main bearing journals "b"	Class A - Red	59.944 ÷ 59.957	59.954 ÷ 59.964
	Class B - Blue		59.944 ÷ 59.954
Length of rear main bearing journal shoulder "c"		28.51 ÷ 28.55	28.51 ÷ 28.55

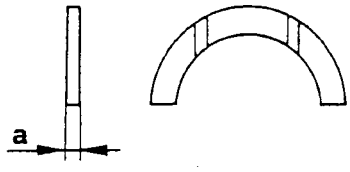
Main half bearings



Unit: mm

		AR 33501	AR 33201
Thickness of main half bearings "a"	Class A - Red	1.833 ÷ 1.839	1.832 ÷ 1.838
	Class B - Blue		1.836 ÷ 1.842
Operating clearance between main journals and half bearings		0.028 ÷ 0.063	0.023 ÷ 0.057

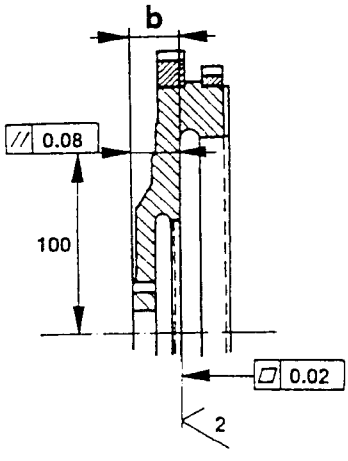
Half thrust rings



Unit: mm

Thickness of half thrust rings "a"	2.310 ÷ 2.360
Crankshaft end float	0.060 ÷ 0.250

Engine flywheel

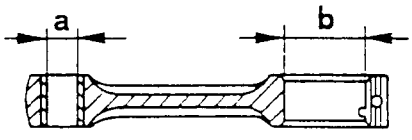


Flywheel grinding dimension "b" (1)	≥ 21.15 mm
Maximum error of parallelism between driven plate rest surface and flywheel rest surface at crankshaft (measured on a radius of 100 mm)	0.08 mm
Maximum error of flatness of driven plate resting surface	0.02 mm
Roughness of driven plate rest surface	2 µm
Heating temperature of ring gears for assembly on engine flywheel	120° ÷ 140°C

(1) The removal of material must be the same on both the driven plate rest surface and on the clutch cover rest surface.

CONNECTING ROD PISTON ASSEMBLY

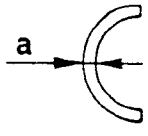
Connecting rod



Unit: mm

Small end bushing bore "a"	21.007 ÷ 21.015
Inside diameter of rod big end "b"	53.696 ÷ 53.708
Clearance between small end bushing and pin	0.007 ÷ 0.019

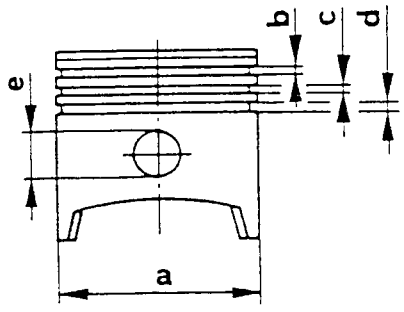
Connecting rod half bearings



Unit: mm

Thickness of rod half bearings "a"	Class A - Red	1.826 ÷ 1.832
	Class B - Blue	1.830 ÷ 1.836
Operating clearance between rod pins and their half bearings		0.032 ÷ 0.064

Piston

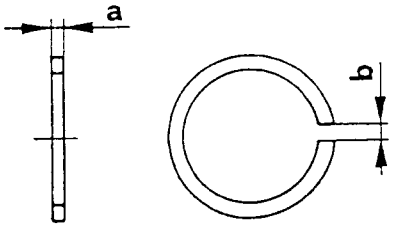


Unit: mm

		AR 33501	AR 33201
Diameter of pistons "a" (1)	Class A - Blue	79.960 ÷ 79.970	83.950 ÷ 83.960
	Class B - Pink	79.970 ÷ 79.980	83.960 ÷ 83.970
	Class C - Green	79.980 ÷ 79.990	83.970 ÷ 83.980
	Class D - Yellow	79.990 ÷ 80.000	83.980 ÷ 83.990
	Class E - White	80.000 ÷ 80.010	83.990 ÷ 84.000
	Oversize 0.2	80.154 ÷ 80.170	- - -
	Oversize 0.4	80.354 ÷ 80.370	84.346 ÷ 84.364
	Oversize 0.6	80554 ÷ 80.570	- - -
Height of first seal ring seat "b"		1.525 ÷ 1.545	1.525 ÷ 1.545
Height of second seal ring seat "c"		1.775 ÷ 1.795	1.510 ÷ 1.530
Height of oil scraper ring seat "d"		4.015 ÷ 4.035	3.510 ÷ 3.530
Diameter of gudgeon pin hole in pistons "e"		21.004 ÷ 21.008	
Clearance between cylinder and piston (not oversized)		0.03 ÷ 0.05	

(1) To be measured perpendicular to the gudgeon pin hole at a distance of 14mm from the lower edge of skirt for "Borgo" pistons and 11.5 mm from the pin axis for "Mondial" pistons.

Piston rings

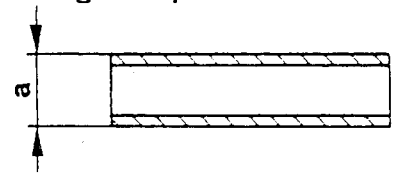


Unit: mm

		AR 33501	AR 33201
Thickness of rings "a"	First ring	1.478 ÷ 1.490	1.478 ÷ 1.490
	Second ring	1.728 ÷ 1.740	1.478 ÷ 1.490
	Oil scraper ring	3.978 ÷ 3.990	3.478 ÷ 3.490
Ring gap "b" (1)	First ring	0.30 ÷ 0.45	0.3 ÷ 0.5
	Second ring	0.30 ÷ 0.45	0.3 ÷ 0.5
	Oil scraper ring	0.25 ÷ 0.40	0.25 ÷ 0.40
Axial play between piston rings and seatings	First ring	0.035 ÷ 0.067	0.035 ÷ 0.067
	Second ring	0.035 ÷ 0.067	0.020 ÷ 0.052
	Oil scraper ring	0.025 ÷ 0.057	0.020 ÷ 0.052

(1) To be measured in the checking ring nut or in the cylinder.

Gudgeon pins

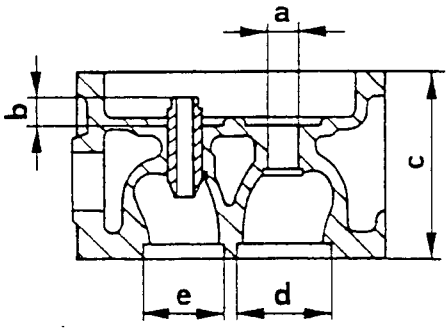


Unit: mm

Outside diameter of gudgeon pins "a"	20.996 ÷ 21.000
Clearance between gudegeon pin and seating on piston	0.004 ÷ 0.012

CYLINDER HEADS

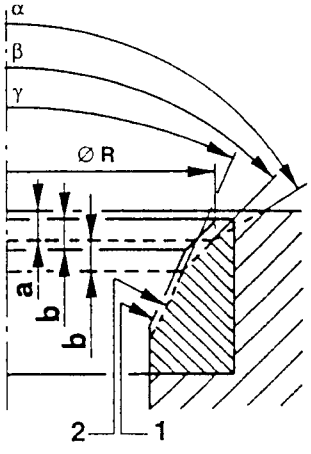
Heads



Unit: mm

Diameter of valve guide seat "a"		13.000 ÷ 13.018
Valve guide protrusion "b"		9.3 ÷ 9.5
Minimum permissible height of head after refacing "c"		77.676 ÷ 77.750
Maximum error of flatness of head lower surface		0.03
Valve seat diameter	Intake "d"	40.000 ÷40.025
	Exhaust "e"	33.000 ÷ 33.025
Cylinder head heating temperature for fitting valve seats		100° ÷ 120°C

Valve seats

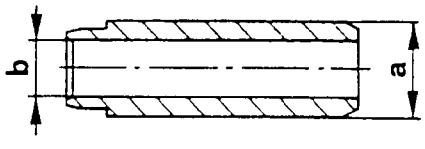


(1) Origin profile
(2) Profile after maximum reconditioning

Unit: mm

Outside diameter of valve seats	Intake	40.075 ÷ 40.100
	Exhaust	33.075 ÷ 33.100
Reference diameter $\varnothing_R$	Intake	39.0
	Exhaust	31.9
Limit for refacing valve seat upper section "a"		2.9
Limit for refacing valve seat contact area "b"	Intake	1.07 ÷ 1.37
	Exhaust	1.26 ÷ 1.56
Upper valve seat taper "α"		120°
Valve seat contact area taper "β"		90° ÷ 90°30'
Valve seat lower section taper "γ"	Intake	70°
	Exhaust	30°

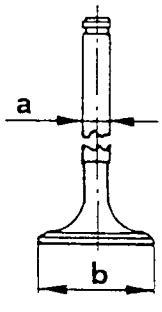
Valve guides



Unit: mm

Outside diameter of valve guides "a"	13.050 ÷ 13.068
Inside diameter of valve guides "b" (bore)	8.013 ÷ 8.031
Interference between valve guides and seats	0.032 ÷ 0.068

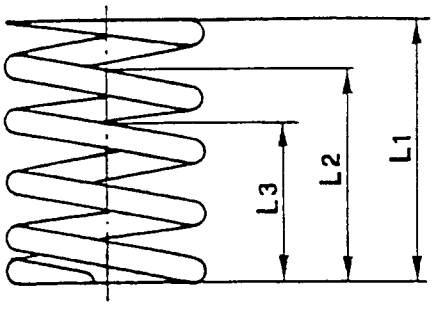
Valves



Unit: mm

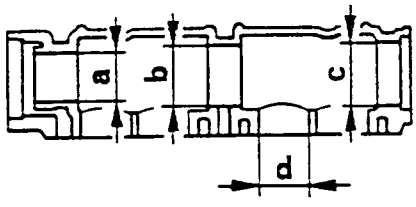
Diameter of valve stem "a"	Intake	7.985 ÷ 8.000
	Exhaust	7.968 ÷ 7.983
Diameter of valve mushrooms "b"	Intake	39.700 ÷ 39.990
	Exhaust	33.000 ÷ 33.200
Radial clearance between valve stem and guide	Intake	0.013 ÷ 0.046
	Exhaust	0.030 ÷ 0.063

Valve springs



	Inner spring	Outer spring
Free length "L1"	~ 45 mm	~ 44 mm
Length with valves closed "L2"	32.25 mm	30.25 mm
Corresponding load at "L2"	23 ÷ 24.4 kg	11.6 ÷ 12.5 kg
Length with valves open at "L3"	23.25 mm	21.25 mm
Load corresponding to length with valves open	43.3 ÷ 46.1 kg	20.4 ÷ 21.8 kg

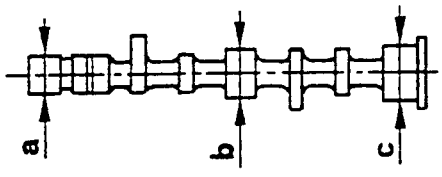
Camshaft bearings



Unit: mm

Diameter of camshaft bearings	Front "a"	35.015 ÷ 35.040
	Centre "b"	48.000 ÷ 48.025
	Rear "c"	49.200 ÷ 49.225
Diameter of valve cup seats "d"		35.000 ÷ 35.025

Camshafts

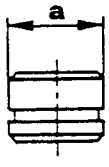


Unit: mm

Diameter of camshaft journals	Front "a"	34.940 ÷ 34.961
	Centre "b"	47.940 ÷ 47.956
	Rear "c"	49.140 ÷ 49.156
Maximum cam lift	Intake	9.80 (*)
	Exhaust	9.00
Clearance between camshaft journals and their housings	Front	0.054 ÷ 0.100
	Centre - rear	0.044 ÷ 0.085

(*) 9.00 for 1351 c.c. engine after change and 1596 c.c. Rochester.

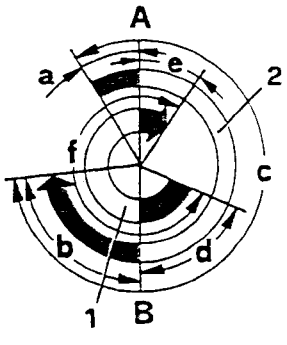
Hydraulic tappets



Unit: mm

Outside diameter of hydraulic tappet "a"	34.959 ÷ 34.975
Clearance between hydraulic tappets & their housings	0.025 ÷ 0.066

ANGLES OF ACTUAL TIMING DIAGRAM



(1) Intake (2) Exhaust
(A) T.D.C. (B) B.D.C.

Intake	Opens (before T.D.C.)	(a)	30°
	Closes (after B.D.C.)	(b)	84° (Δ)
	Intake angle	(c)	294° (❑)
Exhaust	Opens (before B.D.C.)	(d)	68°
	Closes (after T.D.C.)	(e)	34°
	Exhaust angle	(f)	282°

(Δ) 76° (❑) 286°: for 1351 c.c. engines after change and 1596 c.c. Rochester

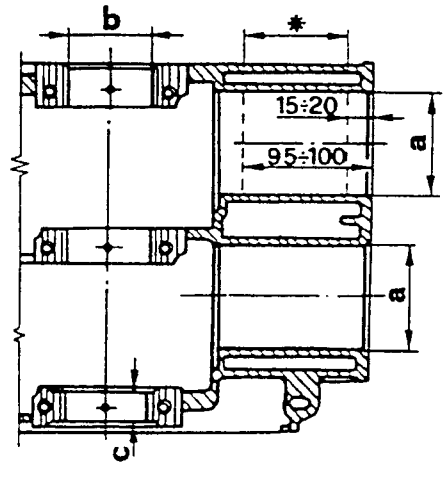
ENGINE SPECIFICATIONS

TECHNICAL DATA

Engine type		AR 33401
Cycle		Otto 4-stroke
Fuel/ignition system		Multi - Point Motronic M 2.10.3
Firing order		1 - 3 - 2 - 4
Displacement	cm^3	1712
Number of cylinders		4 horizontal opposed
Bore	mm	87
Stroke	mm	72
Maximum power	HP CEE (kW CEE) rpm	129 (95) 6500
Maximum torque	kgm CEE (Nm CEE) rpm	15.1 (148) 4300
Compression ratio		10 : 1
Engine oil pressure (with engine oil at 100°C) - At idle speed - At 4000 rpm	bar	 > 0.8 > 4
Idle r.p.m.	rpm	900 ± 50

COMPLETE CRANKCASE

Crankcase

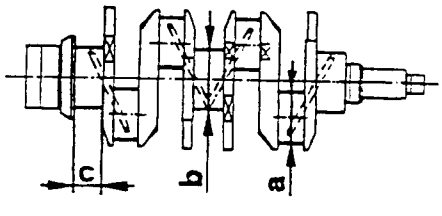


(*) Area for dimensional control

Unit: mm

Cylinder diameter "a"	Class A - Blue	87.000 ÷ 87.010
	Class B - Pink	87.010 ÷ 87.020
	Class C - Green	87.020 ÷ 87.030
	Class D - Yellow	87.030 ÷ 87.040
	Class E - White	87.040 ÷ 87.050
	Oversize 0.2	87.200 ÷ 87.210
	Oversize 0.4	87.400 ÷ 87.410
	Oversize 0.6	87.600 ÷ 87.610
Diameter of main bearings "b"		63.663 ÷ 63.673
Width of rear main bearing shoulder "c"		23.68 ÷ 23.73

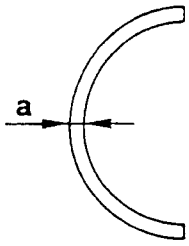
Crankshaft



Unit: mm

Diameter of connecting rod pins "a"	Class A - Red	49.992 ÷ 50.000
	Class B - Blue	49.984 ÷ 49.992
Diameter of main bearing journals "b"	Class A - Red	59.954 ÷ 59.964
	Class B - Blue	59.944 ÷ 59.954
Width of rear main bearing shoulder "c"		28.51 ÷ 28.55

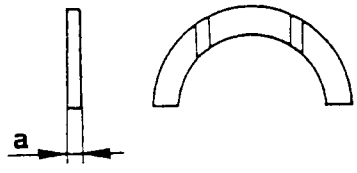
Main half bearings



Unit: mm

Thickness of main half bearings "a"	Class A - Red	1.832 ÷ 1.838
	Class B - Blue	1.836 ÷ 1.842
Operating clearance between main journals and half bearings		0.023 ÷ 0.055

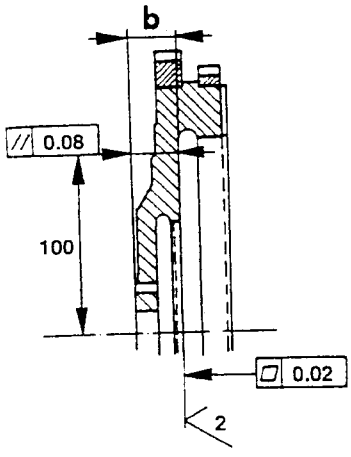
Half thrust rings



Unit: mm

Thickness of half thrust rings "a"	2.310 ÷ 2.360
Crankshaft end float	0.06 ÷ 0.25

Engine flywheel

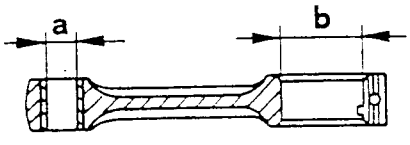


Flywheel grinding dimension "b" (1)	≥ 21.15 mm
Maximum error of parallelism between driven plate rest surface and flywheel rest surface at crankshaft (measured on a radius of 100 mm)	0.08 mm
Maximum error of flatness of driven plate rest surface	0.02 mm
Roughness of driven plate rest surface	2 µm
Heating temperature of ring gears for fitting on flywheel	120° ÷ 140°C

(1) The removal of material must be the same on both the driven plate rest surface and on the clutch cover rest surface.

CONNECTING ROD - PISTON ASSEMBLY

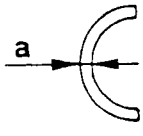
Connecting rods



Unit: mm

Inside diameter of small end bushing "a"	21.007 ÷ 21.015
Inside diameter rod big end "b"	53.696 ÷ 53.708
Clearance between small end bushing and pin	0.007 ÷ 0.019

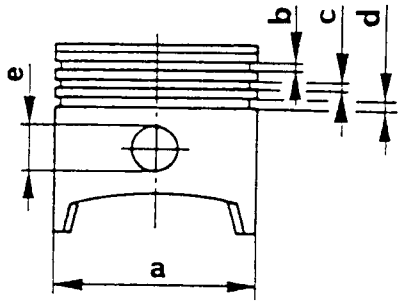
Connecting rod half bearings



Unit: mm

Thickness of connecting rod half bearings "a"	Class A - Red	1.826 ÷ 1.832
	Class B - Blue	1.830 ÷ 1.836
Operating clearance between rod pins and their half bearings		0.032 ÷ 0.064

Piston

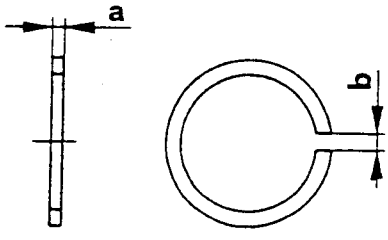


Unit: mm

Diameter of piston "a" (1)	Class A - Blue	86.950 ÷ 86.960
	Class B - Pink	86.960 ÷ 86.970
	Class C - Green	86.970 ÷ 86.980
	Class D - Yellow	86.980 ÷ 86.990
	Class E - White	86.990 ÷ 87.000
	Oversize 0.2	87.144 ÷ 87.160
	Oversize 0.4	87.344 ÷ 87.360
	Oversize 0.6	87.544 ÷ 87.560
Height of first seal ring seats "b"		1.535 ÷ 1.555
Height of second seal ring seats "c"		1.775 ÷ 1.795
Height of oil scraper ring seat "d"		3.015 ÷ 3.035
Diameter of gudgeon pin holes in pistons "e"		21.004 ÷ 21.008
Clearance between cylinders and pistons (not oversized)		004 ÷ 006

(1) To be measured perpendicular to the gudgeon pin hole at a distance of 13.9 mm from the gudgeon pin axis.

Piston rings

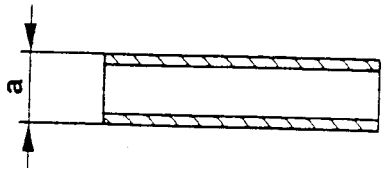


Unit: mm

Thickness of rings "a"	First ring	1.478 ÷ 1.490
	Second ring	1.728 ÷ 1.740
	Oil scraper ring	2.978 ÷ 2.990
Ring gap "b" (1)	First ring	0.30 ÷ 0.50
	Second ring	0.30 ÷ 0.50
	Oil scraper ring	0.25 ÷ 0.50
Axial play between piston rings and housings	First ring	0.045 ÷ 0.077
	Second ring	0.035 ÷ 0.067
	Oil scraper ring	0.025 ÷ 0.057

(1) To be measured in the checking ring nut or in the cylinder.

Gudgeon pins

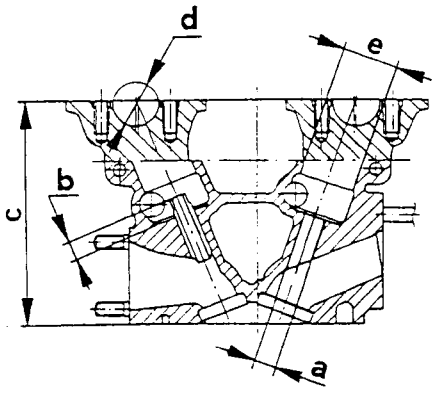


Unit: mm

Outside diameter of gudgeon pins"a"	20.996 ÷ 21.000
Clearance between gudgeon pin and seats on piston	0.004 ÷ 0.012

CYLINDER HEADS

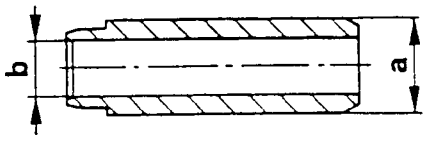
Heads



Unit: mm

Diameter of valve guide seats "a"	12.000 ÷ 12.018
Valve guide protrusion "b"	10.35 ÷ 10.65
Minimum permissible height after refacing "c"	≥ 127.8
Maximum error of flatness of head lower surface	0.03
Diameter of camshaft journals "d"	27.000 ÷ 27.033
Diameter of valve cup seats "e"	33.000 ÷ 33.025
Cylinder head heating temperature for fitting valve seats	100° ÷ 120°C

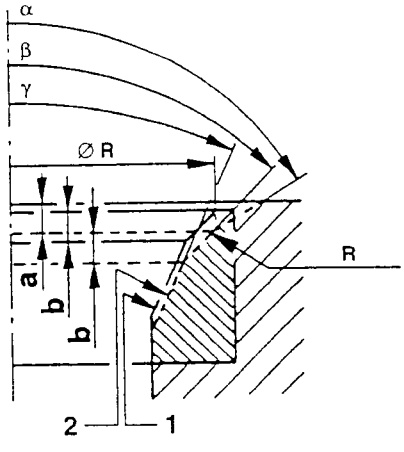
Valve guides



Unit: mm

Outside diameter of valve guides "a"	Intake	12.040 ÷ 12.051
	Oversize 0.2	12.240 ÷ 12.251
	Exhaust	12.050 ÷ 12.068
	Oversize 0.2	12.250 ÷ 12.268
Inside diameter of valve guides "b"		7.000 ÷ 7.015
Interference between valve guides and their seats	Intake	0.022 ÷ 0.051
	Exhaust	0.032 ÷ 0.068

Valve seats

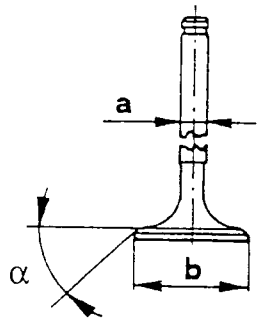


(1) Origin profile
(2) Profile after maximum reconditioning

Unit: mm

Outside diameter of valve seats	Intake	34.100 ÷ 34.116
	Oversize 0.2	34.300 ÷ 34.316
	Exhaust	28.096 ÷ 28.116
	Oversize 0.2	28.296 ÷ 28.316
Reference diameter $Ø_R$	Intake	31.0
	Exhaust	24.5
Limit for refacing valve seat upper section "a"	Intake	0.4
	Exhaust	1.1
Limit for refacing valve seat contact area	Intake "R"	0.9
	Exhaust "b"	1.1
Upper valve seat taper limit "α"	Intake	150°
	Exhaust	120°
Valve seat contact area taper "β"		90° ± 20'
Inner valve seat taper limit "γ"	Intake	75°
	Exhaust	60°

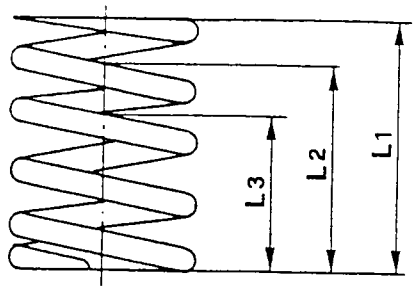
Valves



Unit: mm

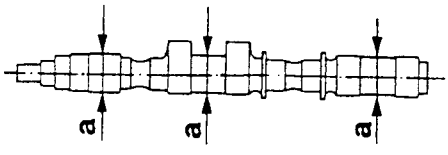
Diameter of valve stems "a"	Intake	6.965 ÷ 6.980
	Exhaust	
Diameter of valve mushrooms "b"	Intake	31.8 ÷ 32.0
	Exhaust	25.8 ÷ 26.0
Valve mushroom angle "α"	Intake	44°25' ÷ 44°35'
	Exhaust	
Radial play between valve stems and valve guides	Intake	0.02 ÷ 0.05
	Exhaust	

Valve springs



	Outer spring	Inner spring
Free length "L_1"	~ 51.8 mm	~ 38 mm
Length with valves closed "L_2"	32.5 mm	30.5 mm
Load corresponding to "L_2"	21.4 ÷ 22.6 kg	13.6 ÷ 14.4 kg
Length with valves open "L_3"	22.9 mm	20.9 mm
Corresponding load at "L_3"	35.52 ÷ 35.72 kg	31.89 ÷ 33.69 kg

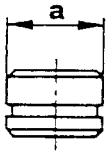
Camshafts



Unit: mm

Diameter of camshaft journals "a"		26.959 ÷ 26.980
Maximum cam lift	Intake	9.50
	Exhaust	9.40
Clearance between camshaft journals and their housings		0.020 ÷ 0.074

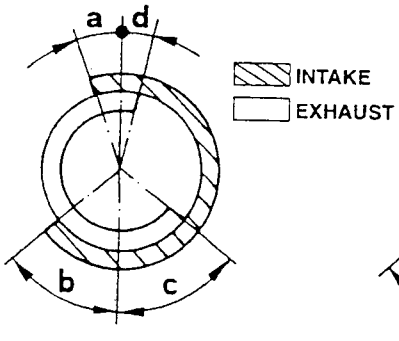
Hydraulic tappets



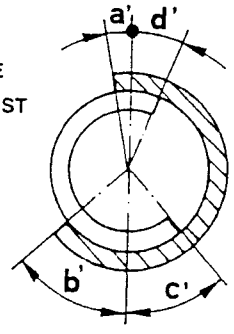
Unit: mm

Outside diameter of hydraulic tappets "a"	32.959 ÷ 32.975
Clearance between cup and housing	0.025 ÷ 30.066

ANGLES OF ACTUAL TIMING DIAGRAM



TIMING OF FIRST PAIR OF VALVES



TIMING OF SECOND PAIR OF VALVES

Intake	Opens (before T.D.C.)	a	20°
		a'	10°
	Closes (after B.D.C.)	b	49°
		b'	49°
Exhaust	Opens (before B.D.C.)	c	52°
		c'	42°
	Closes (after T.D.C.)	d	12°
		d'	22°

TECHNICAL FEATURES OF THE ENGINE

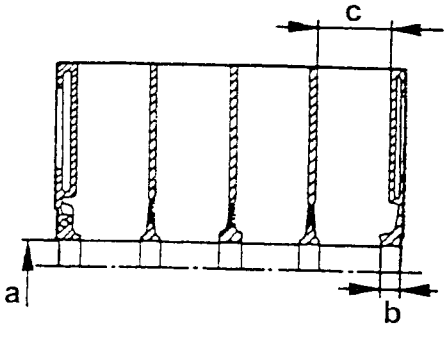
SPECIFIC DATA

Engine		AR 67501 - AR 33601 (▲)
Cycle		four-stroke Diesel engine
Feed		Direct injection with supercharging
Piston displacement	cm^3	1929
Cylinders' number		4 in line
Boring	mm	82.6
Stroke	mm	90
Maximum Power	CV CEE (kW CEE) revs/min	90 (66) 4100 4200 (•)
Pull-in Torque	kgm CEE (Nm CEE) revs/min	19.0 (186) 2400 2500 (•)
Compression ratio		19.2 : 1
Firing order		1 - 3 - 4 - 2
Slow running	revs/min	900 ± 20 900 ± 40 (•)

(▲): Version with catalyst (•): For versions/markets envisaged.

COMPLETE CYLINDER BLOCK

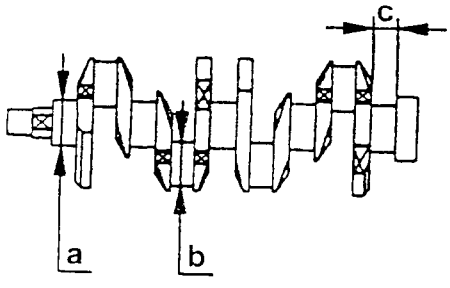
Cylinder block



Unit: mm

Diameter of main bearing "a"		56.717 ÷ 56.735
Shoulder length of rear main bearing "b"		23.12 ÷ 23.20
Diameter of cylinder barrels "c"	Class A	82.600 ÷ 82.610
	Class B	82.610 ÷ 82.620
	Class C	82.620 ÷ 82.630
	Class D	82.630 ÷ 82.640
	Class E	82.640 ÷ 82.650
	Oversize by 0.1	

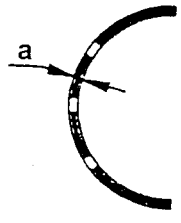
Driving shaft



Unit: mm

Diameter of main journals "a"	Class 1	52.995 ÷ 53.004
	Class 2	52.986 ÷ 52.995
	Undersize by 0.127	
Diameter of rod pins"b"	Class 1	50.796 ÷ 50.805
	Class 2	50.787 ÷ 50.796
	Undersize by 0.127	
Length of rear main journal "c"		27.975 ÷ 28.025

Half bearings



Unit: mm

Thickness of half bearings "a"	Class A (Red)	1.837 ÷ 1.843
	Class B (Blue)	1.843 ÷ 1.849
	Undersize by 0.127	
Radial clearance between pins and main bearings	Class A (Red)	0.027 ÷ 0.066
	Class B (Blue)	0.024 ÷ 0.063

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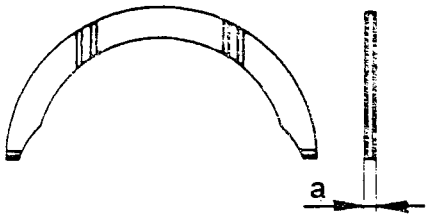
Thrust half rings



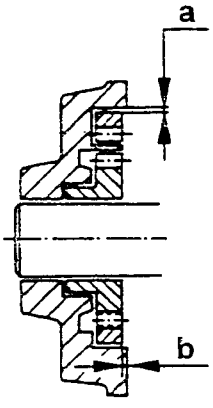
Unit: mm

Thickness of thrust half rings "a"	2.347 ÷ 2.363
	Oversize by 0.127
End play of the driving shaft	0.049 ÷ 0.211

Flywheel

Heating temperature of crown gear for the fitting of engine flywheel	80°C

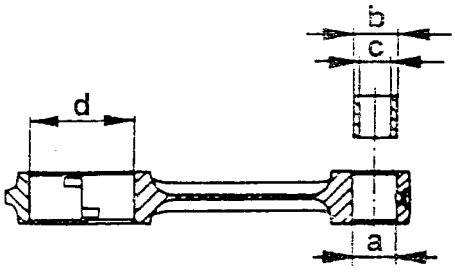
Oil pump



Clearance between pump seat and driven gear "a"		0.080 ÷ 0.186 mm
Clearnce between face of pump cover and gears "b"		0.025 ÷ 0.056 mm
Spring of pressure relief valve	Length	36 mm
	Check load	74 ÷ 82.9 N
Engine oil pressure (with engine oil at 100°C) bar		3.43 ÷ 4.0

CONNECTING ROD - PISTON GROUP

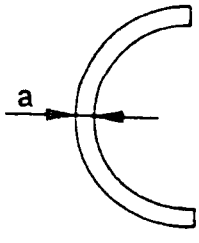
Connecting rods



Unit: mm

Diameter of small end "a"			27.939 ÷ 27.972
External diameter of small end bushings "b"			28.020 ÷ 28.060
Internal diameter of small end bushings (line-boring) "c"	Version before mod.	Class 1	26.004 ÷ 26.007
		Class 2	26.007 ÷ 26.010
	Version after mod.		26.004 ÷ 26.009
Diameter of connecting rod heads "d"			53.897 ÷ 53.913
Weight difference between connecting rods			± 2.5 g
Play among bushings, small ends and piston pins	Version before mod.		0.014 ÷ 0.020
	Version after mod.		0.013 ÷ 0.022
Interference among bushings, small ends and bushings' seats			0.048 ÷ 0.121

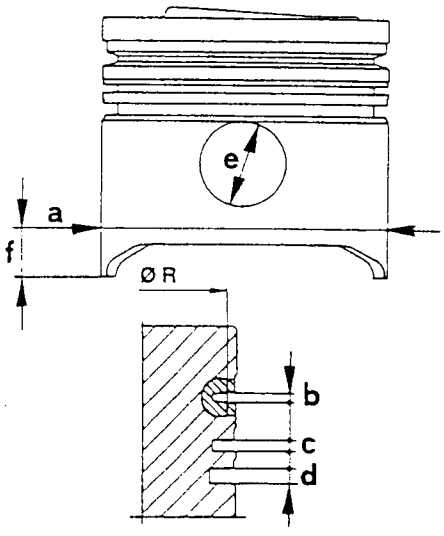
Half bearings



Unit: mm

Thickness of half bearings "a"	Class A (Red)	1.527 ÷ 1.533
	Class B (Blue)	1.533 ÷ 1.539
	Undersize by 0.127	
Radial play between pins and bearings	Class A (Red)	0.026 ÷ 0.063
	Class B (Blue)	0.023 ÷ 0.060

Pistons

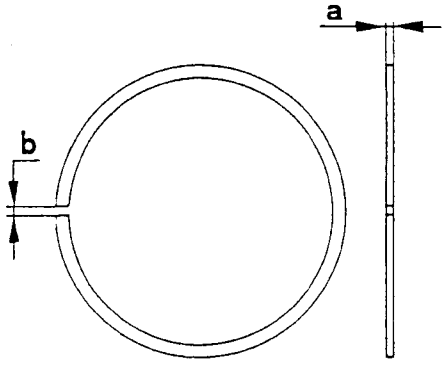


Unit: mm

Diameter of pistons "a" (1)		Class A	82.530 ÷ 82.540
		Class B	82.540 ÷ 82.550
		Class C	82.550 ÷ 82.560
		Class D	82.560 ÷ 82.570
		Class E	82.570 ÷ 82.580
		Oversized by 0.1	
Height of first piston ring seats "b" (at reference diameter Ø R 79.6 mm)			2.675 ÷ 2.705
Height of second piston ring seats "c"			2.010 ÷ 2.030
Height of oil scraper ring seats "d"			3.020 ÷ 3.040
Diameter of gudgeon pin hole in pistons "e"	Version before change	Class 1	25.993 ÷ 25.996
		Class 2	25.996 ÷ 25.999
	Version after change		25.994 ÷ 25.999
Clearance between liners and pistons			0.060 ÷ 0.080
Difference in weight between pistons			± 5 g

(1): To be measured perpendicular to the gudgeon pin hole at a distance of f = 15 mm from lower edge of skirt.

Seal rings

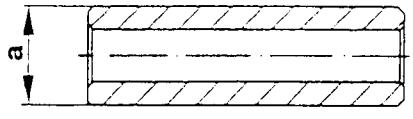


Unit: mm

Thickness of rings "a"	First ring	2.575 ÷ 2.595
	Oversized by 0.1	
	Second ring	1.978 ÷ 1.990
	Oversized by 0.1	
	Oil scraper ring	2.975 ÷ 2.990
	Oversized by 0.1	
Ring gap "b" (1)	First ring	0.20 ÷ 0.35
	Second ring	0.30 ÷ 0.50
	Oil scraper ring	0.25 ÷ 0.50
Axial clearance between seats and seal rings	First ring	0.080 ÷ 0.130
	Second ring	0.020 ÷ 0.052
	Oil scraper ring	0.030 ÷ 0.065

(1) To be measured in the check ring nut or in the cylinder liner.

Gudgeon pins

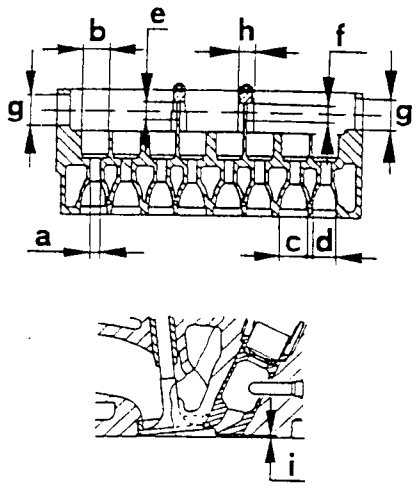


Unit: mm

Outside diameter of gudgeon pins "a"	Version before change	Class 1	25.987 ÷ 25.990
		Class 2	25.990 ÷ 25.993
	Version after change		25.987 ÷ 25.991
	Oversized by 0.2		
Clearance between piston holes and gudgeon pins	Version before change		0.003 ÷ 0.009
	Version after change		0.003 ÷ 0.012

CYLINDER HEAD

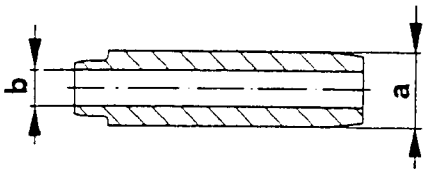
Head



Unit: mm

Diameter of valve guide seats "a"		13.950 ÷ 13.977
Diameter of valve cup seats "b"		37.000 ÷ 37.025
Diameter of valve seat housings	Intake "c"	38.989 ÷ 39.014
	Exhaust "d"	34.989 ÷ 35.014
Diameter of camshaft centre bearings	Second "e"	25.545 ÷ 25.570
	Third "f"	24.045 ÷ 24.070
Diameter of camshaft side bearings "g"		43.020 ÷ 43.040
Width of third camshaft bearing shoulder "h"		18.950 ÷ 19.030
Precombustion chamber protrusion or undercut in relation to the cylinder head surface "i"		- 0.765 ÷ + 0.055

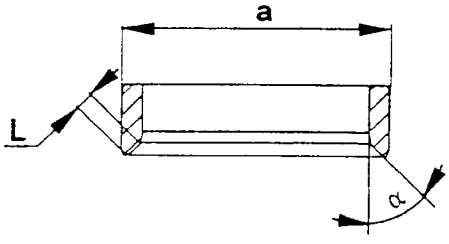
Valve guides



Unit: mm

Outside diameter of valve guides "a"	14.040 ÷ 14.058	
	Oversized by 0.20	
Inside diameter of valve guides (bore) "b"		8.022 ÷ 8.040
Interference between valve guides and seats		0.063 ÷ 0.108

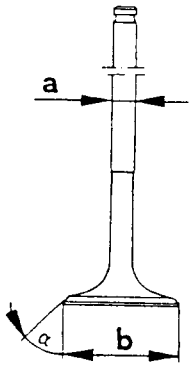
Valve seats



Unit: mm

Outside diameter of valve seats "a"	Intake	39.095 ÷ 39.110
	Exhaust	35.085 ÷ 35.100
Valve seat taper "α"		45° ± 5'
Length "L" of valve seat section with taper at 45°		~ 2.7
Interference between valve seats and housings	Intake	0.081 ÷ 0.121
	Exhaust	0.071 ÷ 0.111
Cylinder head heating temperature for fitting valve seats		80° ÷ 100°C

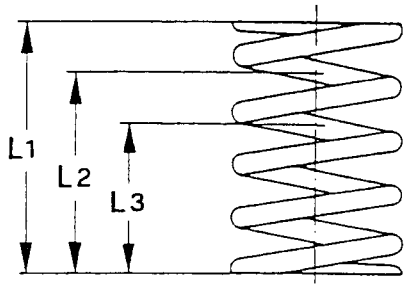
Valves



Unit: mm

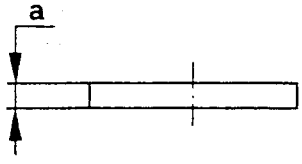
Diameter of valve stems "a"	Intake	7.974 ÷ 7.992
	Exhaust	
Diameter of valve mushrooms "b"	Intake	37.300 ÷ 37.600
	Exhaust	33.300 ÷ 33.600
Valve mushroom angle "α"	Intake	45°30' ± 7'
	Exhaust	
Radial clearance between valve stens and guides	Intake	0.030 ÷ 0.066
	Exhaust	

Valve springs



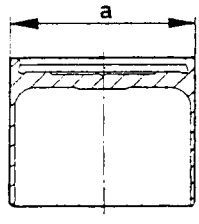
Free length "L_1"	53.9 mm
Spring length with valves closed "L_2"	36 mm
Load corresponding to spring length with valves closed	36.7 ÷ 39.6 daN (37.4 ÷ 40.4 kg)
Length of springs with valves open "L_3"	26.5 mm
Load corresponding to spring length with valves open	55.9 ÷ 60.8 daN (57 ÷ 62 kg)

Plates



Thickness of plates "a"	3.25 ÷ 4.40 mm

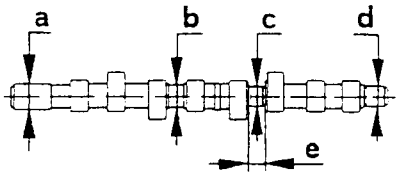
Valve cups



Unit: mm

Diameter of valve cups "a"	36.975 ÷ 36.995
Radial clearance between valve cups and housings	0.005 ÷ 0.050

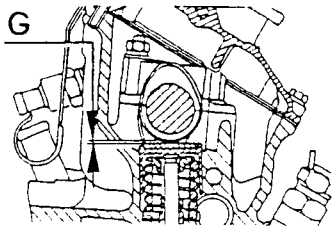
Camshaft



Unit: mm

Diameter of camshaft journals	First "a"	29.945 ÷ 29.960
	Second "b"	25.500 ÷ 25.515
	Third "c"	24.000 ÷ 24.015
	Fourth "d"	23.945 ÷ 23.960
Width of shaft shoulder "e"		19.100 ÷ 19.200
Cam lift (on valve spindle without play)	Intake	8.5
	Exhaust	8.5
Radial clearance between camshaft journals and seats		0.03 ÷ 0.07
Camshaft end float		0.1

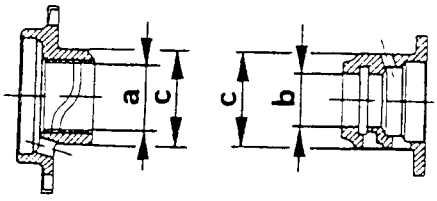
Valve clearance



Unit: mm

Valve clearance for checking timing	Intake	0.50
	Exhaust	0.50
Operating valve clearance (with cold engine) "G"	Intake	0.30 ± 0.05
	Exhaust	0.35 ± 0.05

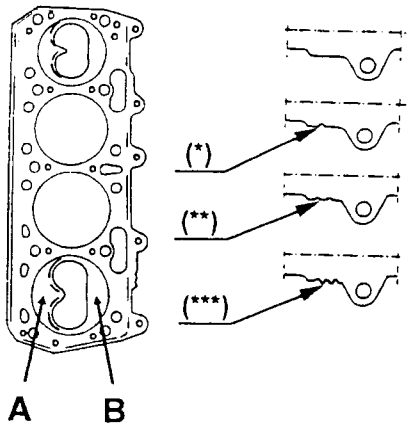
Side camshaft bearings



Unit: mm

Inside diameter of camshaft bearings	front "a"	29.990 ÷ 30.015
	rear "b"	23.990 ÷ 24.015
Outside diameter of camshaft bearings "c"		42.995 ÷ 43.015

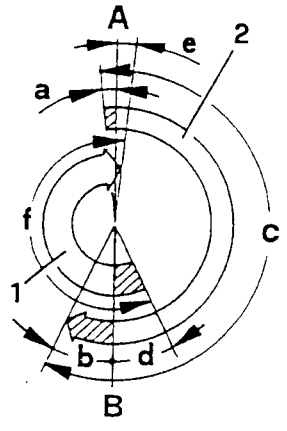
Cylinder head seal



Mean piston protrusion (1)		Thickness of cylinder head seal to be used
from engine no. 1762797	up to engine no. 1762798	
< 0.7 mm	< 1.05 mm	1.67 mm
0.7 ÷ 0.8 mm	1.05 ÷ 1.15 mm	1.75 mm (*)
0.8 ÷ 0.9 mm	1.15 ÷ 1.25 mm	1.85 mm (**)
> 0.9 mm	> 1.25 mm	1.93 mm (***)

(1): To be found by measuring it for each cylinder in points A and B of the piston; calculate the mean between the two values and consider the highest mean between the pistons to define the seal to be used.

ANGULAR VALUES OF ACTUAL TIMING DIAGRAM



Intake	Opens (before T.D.C.)	"a"	6°
	Closes (after B.D.C.)	"b"	26°
	Intake angle	"c"	212°
Exhaust	Opens (before B.D.C.)	"d"	26°
	Closes (after T.D.C.)	"e"	6°
	Exhaust angle	"f"	212°

(1) Exhaust (2) Intake
(A) T.D.C. (B) B.D.C.

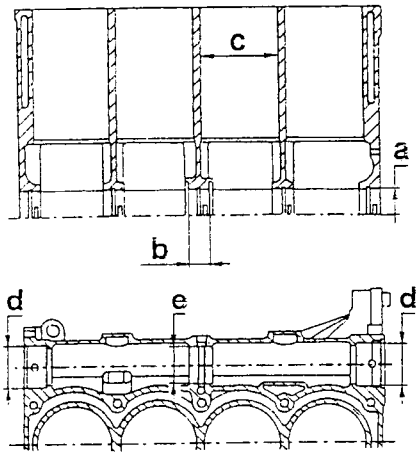
TECHNICAL FEATURES OF THE ENGINE

SPECIFIC DATA

Engine		AR 67204		AR 32301
Cycle		four-stroke Otto		
Feed / Ignition		Multi-Point Motronic M 2.10.3	Multi-Point Motronic M 2.10.4	Multi-Point Motronic M 1.5.5
Firing order		1 - 3 - 4 - 2		
Piston displacement	cm^3	1970		
Cylinders' number		4 in line		
Boring	mm	83		
Stroke	mm	91		
Maximum power	CV CEE (kW CEE) revs/min	150 (110) 6200		155 (114) 6400
Pull-in Torque	kgm CEE (Nm CEE) revs/min	19 (187) 4000		19.1 (187) 3500
Compression ratio		10 : 1		
Pressure of the engine oil - At slow running - At 4000 revs/min	bar	≥ 1.5 ≥ 4.5		
Slow running	revs/min	800 ± 50	840 ± 50	840 ± 50

COMPLETE CYLINDER BLOCK

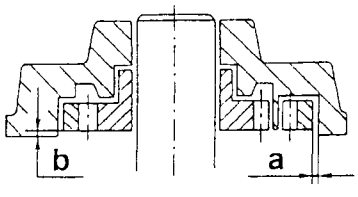
Cylinder block



Unit: mm

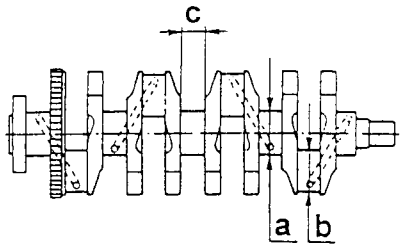
Diameter of main bearings "a"		56.705 ÷ 56.718
Length of shoulders for central main bearing "b"		21.720 ÷ 21.800
Cylinders' diameter "c"	Class A - Blue	83.000 ÷ 83.010
	Class B - Pink	83.010 ÷ 83.020
	Class C - Green	83.020 ÷ 83.030
	Oversize by 0.1	
Diameter of shoulder for counter-rotating shafts	Front and rear "d"	46.975 ÷ 47.000
	Central "e"	39.979 ÷ 40.009

Oil pump



Clearance between pump seat and driven gear "a"		0.080 ÷ 0.186 mm
Clearance between face of the pump cover and upper side of gears "b"		0.025 ÷ 0.070 mm
Spring of pressure relief valve	Check load	6.4 ÷ 7.2 kg
	Spring length	36 mm

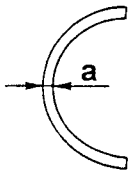
Driving shaft



Unit: mm

Diameter of main journals "a"	Class A - Red	52.994 ÷ 53.000
	Class B - Blue	52.988 ÷ 52.994
	Class C - Yellow	52.982 ÷ 52.988
	Undersize by 0.127	
Diameter of connecting rod pins "b"	Class A - Red	50.799 ÷ 50.805
	Class B - Blue	50.793 ÷ 50.799
	Class C - Yellow	50.787 ÷ 50.793
	Undersize by 0.127	
Length of central main journal "c"		26.575 ÷ 26.625
Maximum taper of main journals and rod pins		0.0045
Maximum concentricity error between main journals and rod pins		0.003

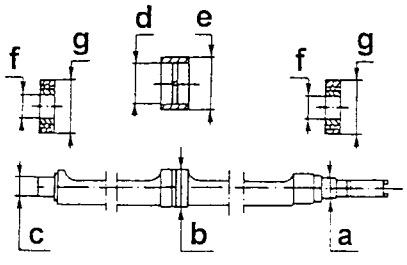
Half bearings



Unit: mm

Thickness of half bearings "a"	Class A - Red	1.836 ÷ 1.840
	Class B - Blue	1.839 ÷ 1.843
	Class C - Yellow	1.842 ÷ 1.846
	Undersize by 0.127	
Functioning play between pins and half bearings		0.025 ÷ 0.052

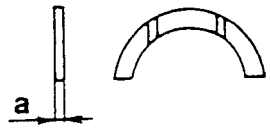
Counter-rotating shafts



Unit: mm

Pins' diameter of counter-rotating shafts	Front "a"	19.980 ÷ 19.993
	Central "b"	36.945 ÷ 36.960
	Rear "c"	19.990 ÷ 20.010
Diameter of central bushings	Internal "d"	37.020 ÷ 37.040
	External "e"	40.065 ÷ 40.090
Diameter of ball bearings	Internal "f"	19.990 ÷ 20.000
	External "g"	46.989 ÷ 47.000
Interference between central bushings and corresponding seats		0.056 ÷ 0.111
Radial play between bushings and central pins		0.060 ÷ 0.095
Play / Interference between ball bearings and corresponding seats on the block		+0.011 ÷ -0.025
Play / Interference between ball bearings and pins of counter-rotating shafts	Front	+0.020 ÷ -0.003
	Rear	+0.010 ÷ -0.020

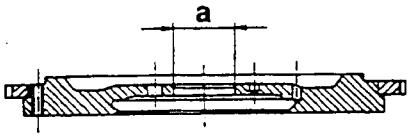
Half thrust rings



Unit: mm

Thickness of half thrust rings "a"	2.342 ÷ 2.358
	Oversize 0.127
Crankshaft end float	0.059 ÷ 0.221

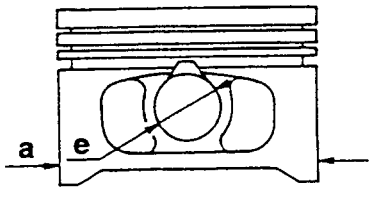
Engine flywheel

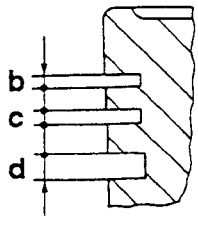


Inside diameter of centre bush (bore) "a"	47.010 ÷ 47.035 mm
Heating temperature of ring gear for assembly on flywheel	80° ÷ 100°C

CONNECTING ROD - PISTON ASSEMBLY

Piston



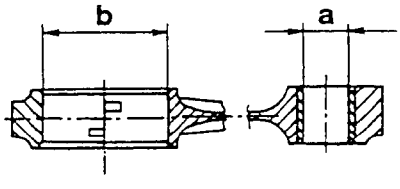


Unit: mm

Diameter of pistons "a" (1)	Class A - Blue	82.952 ÷ 82.962
	Class B - Pink	82.959 ÷ 82.971
	Class C - Green	82.968 ÷ 82.978
Height of first seal ring seats "b"		1.220 ÷ 1.240
Height of second seal ring seats "c"		1.510 ÷ 1.530
Height of oil scraper ring seats "d"		3.010 ÷ 3.030
Diameter of gudgeon pin holes in pistons "e"		20.002 ÷ 20.007
Clearance between cylinders and pistons		0.038 ÷ 0.062
Difference in weight between pistons		± 5 g

(1) To be measured perpendicular to the gudgeon pin hole at a distance of 12.5 mm from lower edge of skirt.

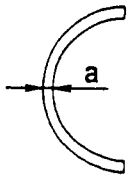
Connecting rods



Unit: mm

Diameter of small end bushing bore "a"	20.006 ÷ 20.012
Inside diameter of rod big ends "b"	53.897 ÷ 53.909
Difference in weight between rods	≤ 5 g
Clearance between small end bushings and pins	0.006 ÷ 0.016
Small end end float	0.25 ÷ 0.6

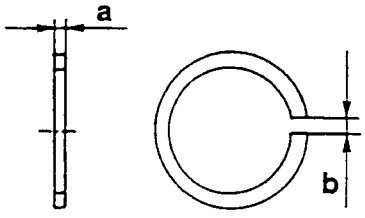
Connecting rod half bearings



Unit: mm

Thickness of connecting rod half bearings "a"	Class A - Red	1.527 ÷ 1.531
	Class B - Blue	1.530 ÷ 1.534
	Class C - Yellow	1.533 ÷ 1.537
	Undersize 0.127	
Operating clearance connecting rod pins and their half bearings	Class A - Red	0.03 ÷ 0.056
	Class B - Blue	
	Class C - Yellow	

Seal rings

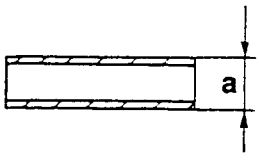


Unit: mm

Thickness of rings "a"	First ring	1.170 ÷ 1.190
		Oversize 0.1
	Second ring	1.475 ÷ 1.490
		Oversize 0.1
	Oil scraper ring	2.975 ÷ 2.990
		Oversize 0.1
Ring gap "b" (1)	First ring	0.25 ÷ 0.50
	Second ring	0.30 ÷ 0.50
	Oil scraper ring	0.25 ÷ 0.45
Axial play between seal rings and seats	First ring	0.030 ÷ 0.070
	Second ring	0.020 ÷ 0.055
	Oil scraper ring	0.020 ÷ 0.055

(1) To be measured in the checking ring nut or in the cylinder

Gudgeon pins

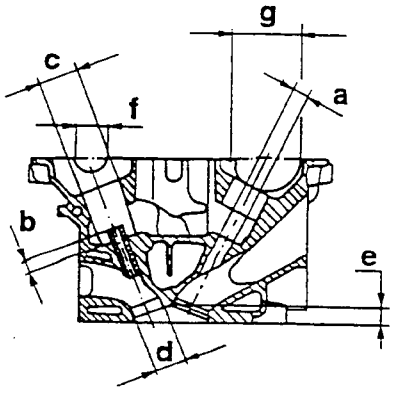


Unit: mm

Outside diameter of gudgeon pins "a"	19.996 ÷ 20.000
Clearance between gudgeon pins and their seats on pistons	0.002 ÷ 0.011

CYLINDER HEAD

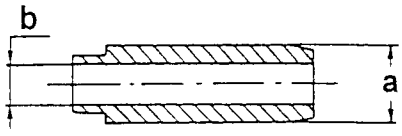
Head



Unit: mm

Diameter of sedi valve guide seats "a"		12.950 ÷ 12.977
Valve guide protrusion "b"		11.25 ÷ 11.75
Diameter of valve cup seats "c"		33.000 ÷ 33.025
Diameter of valve seat housing "d"	Intake	34.989 ÷ 35.014
	Exhaust	28.991 ÷ 29.012
Minimum depth of combustion chamber "e"		13 ± 0.2
Maximum error of flatness of head lower surface		0.1
Diameter of camshaft supports "f"		26.045 ÷ 26.070
Diameter of timing variator support "g"		55.990 ÷ 56.015

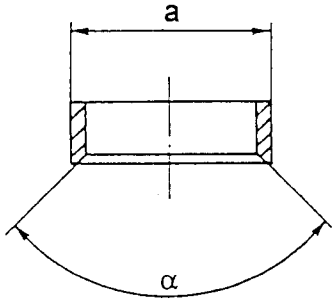
Valve guides



Unit: mm

External diameter of valve guides "a"	13.010 ÷ 13.030
	Oversize by 0.20
Internal diameter of valve guides(line-boring) "b"	7.022 ÷ 7.040
Interference between valve guides and corresponding seats	0.033 ÷ 0.080

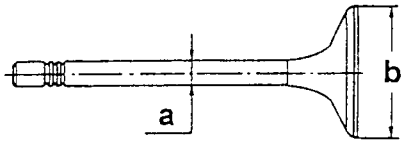
Valve seats



Unit: mm

External diameter of valve seats "a"	Intake	35.135 ÷ 35.150
	Exhaust	29.142 ÷ 29.157
Contact taper with valves "α"		90° ± 10'
Interference between valve seats and respective seats	Intake	0.121 ÷ 0.146
	Exhaust	0.130 ÷ 0.166
Heating temperature of cylinders' head for valve seats fitting		80°C

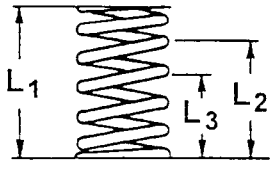
Valves



Unit: mm

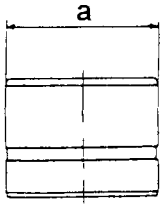
Diameter of valve stems "a"	Intake	6.975 ÷ 6.990
	Exhaust	6.960 ÷ 6.975
Diameter of valve heads "b"	Intake	33.4 ÷ 33.7
	Exhaust	27.9 ÷ 28.2
Radial play between valve stems and valve guides	Intake	0.032 ÷ 0.065
	Exhaust	0.047 ÷ 0.080

Valve springs



	External Spring	Internal Spring
Free length "L_1"	46 mm	39 mm
Length with closed valves "L_2"	34 mm	29.5 mm
Load corresponding to "L_2"	271 ÷ 294 N (27.6 ÷ 30 kg)	96 ÷ 106 N (9.8 ÷ 10.8 kg)
Length with open valves "L_3"	24.5 mm	20 mm
Load corresponding to "L_3"	485 ÷ 524 N (49.4 ÷ 53.4 kg)	201 ÷ 221 N (20.5 ÷ 22.5 kg)

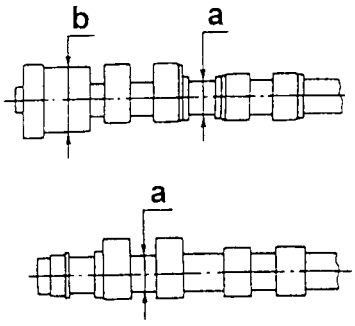
Hydraulic tappets



Unit: mm

External diameter of hydraulic tappets "a"	32.959 ÷ 32.975
Radial play between hydraulic tappets and corresponding seats	0.025 ÷ 0.066

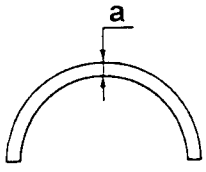
Camshafts



Unit: mm

Diameter of camshafts' pins "a"		26.000 ÷ 26.015
Diameter of phase transformer pin "b"		49.985 ÷ 50.000
Nominal cam lift	Intake	9.50
	Exhaust	9.50
Play between camshafts' pins and corresponding seats		0.03 ÷ 0.07
Camshafts' end play		0.10 ÷ 0.23

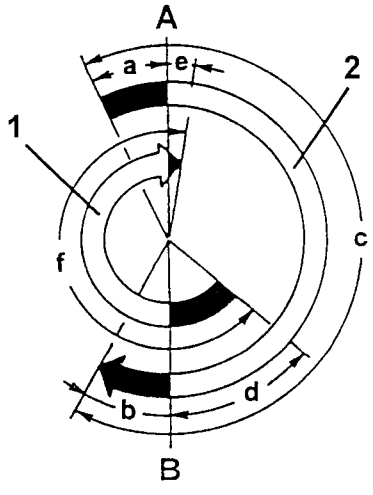
Phase transformer's half bearings



Unit: mm

Thickness of phase transformer half bearings "a"	2.992 ÷ 2.998
Play between phase transformers and corresponding bearings	0.034 ÷ 0.086

ANGULAR VALUES OF THE TRUE DIAGRAM OF THE TIMING SYSTEM (applying a check play of 0.45 mm)



			Engines AR 67204	Engines AR 32301
Intake	Opening (before TDC)	"a"	0° 25°(*)	-3° 22°(*)
	Closing (after BDC)	"b"	55° 30°(*)	51° 26°(*)
	Angular intake value	"c"	235°	228°
Exhaust	Opening (before BDC)	"d"	50°	47°
	Closing (after TDC)	"e"	8°	4°
	Angular exhaust value	"f"	238°	231°

(*): Values obtained with operating phase transformer

(1) Scarico (2) Intake
(A) P.M.S. (B) BDC

TECHNICAL FEATURES OF THE ENGINE

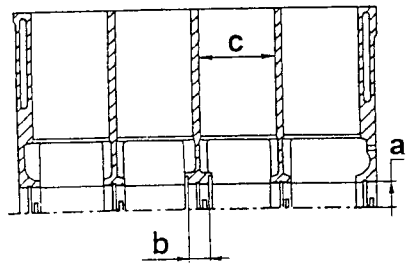
SPECIFIC DATA

Engine		AR 33503	AR 67601	AR 67106	AR 32201
Cycle		Four-stroke Otto			
Feed / Ignition		Motronic M2.10.4 Motronic M1.5.5	Motronic M2.10.4 Motronic M1.5.5	Motronic M2.10.4	Motronic M1.5.5
Firing order		1 - 3 - 4 - 2			
Piston displacement	cm^3	1370	1598	1747	
Cylinders' number		4 in line			
Boring	mm	82	82	82	82
Stroke	mm	64.87	75.65	82.7	
Maximum power	CV CEE (kW CEE) revs/min	103 (76) 6300	120 (88) 6300	140 (103) 6300	144 (106) 6500
Pull-in torque	kgm CEE (Nm CEE) revs/min	12.7 (124) 4600	14.7 (144) 4500	16.8 (165) 4000	17.2 (169) 3500
Compression ratio		10.5 : 1	10.3 : 1	10.3 : 1	10.3 : 1
Pressure of the engine oil - At slow running - At 4000 revs/min	bar	≥ 1.5 ≥ 4.5 (*)	≥ 1.5 ≥ 4.5	≥ 1.5 ≥ 4.5	≥ 1.5 ≥ 4.5
Slow running	revs/min	880 ± 50	840 ± 50	840 ± 50	840 ± 50

(*): For engines of the type AR33503 with injection system - Motronic ignition M1.5.5: > 4.0

COMPLETE CYLINDER BLOCK

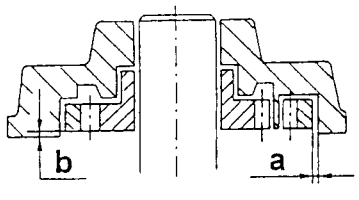
Cylinder block



Unit: mm

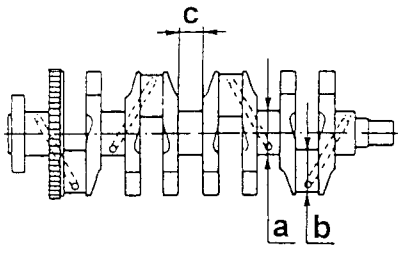
Diameter of main bearing "a"		56.705 ÷ 56.718
Length of shoulder for rear main bearing "b"		21.720 ÷ 21.800
Cylinders' diameter "c"	Class A	82.000 ÷ 82.010
	Class B	82.010 ÷ 82.020
	Class C	82.020 ÷ 82.030
	Oversize by 0.1	

Oil pump



Clearance between pump seat and driven gear "a"		0.080 ÷ 0.186 mm
Clearance between face of pump cover and upper side of gears "b"		0.025 ÷ 0.070 mm
Spring of pressure relief valve	Check load	6.4 ÷ 7.2 kg
	Spring length	36 mm

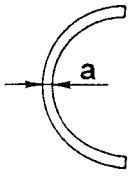
Driving shaft



Unit: mm

		1370	1598	1747
Diameter of main journal "a"	Class A - Red	52.994 ÷ 53.000		
	Class B - Blue	52.988 ÷ 52.994		
	Class C - Yellow	52.982 ÷ 52.988		
	Undersize by 0.127			
Diameter of rod pins "b"	Class A - Red	40.884 ÷ 40.890	48.238 ÷ 48.244	50.799 ÷ 50.805
	Class B - Blue	40.878 ÷ 40.884	48.232 ÷ 48.238	50.793 ÷ 50.799
	Class C - Yellow	40.872 ÷ 40.878	48.226 ÷ 48.232	50.787 ÷ 50.793
	Undersize by 0.127			
Length of middle main journal "c"		26.575 ÷ 26.625		
		Oversize by 0.254		
Maximum taper of main journals and rod pins		0.0045		
Maximum concentricity error between main journals and rod pins		0.03		

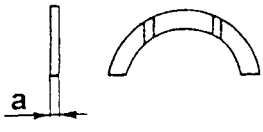
Half bearings



Unit: mm

		1598	1370 1747
Thic of later half b ings "a"	Class A - Red	1.836 ÷ 1.840	1.831 ÷ 1.837
	Class B - Blue	1.839 ÷ 1.843	1.836 ÷ 1.844
	Class C - Yellow	1.842 ÷ 1.846	1.843 ÷ 1.849
	Undersize by 0.127		
Thickness of central half bearings "a"	Class A - Red	1.831 ÷ 1.835	1.826 ÷ 1.832
	Class B - Blue	1.834 ÷ 1.838	1.831 ÷ 1.839
	Class C - Yellow	1.837 ÷ 1.841	1.838 ÷ 1.844
	Undersize by 0.127		
Clearance between pins and half bearings	Lateral	0.025 ÷ 0.052	0.019 ÷ 0.062
	Central	0.035 ÷ 0.062	0.029 ÷ 0.072

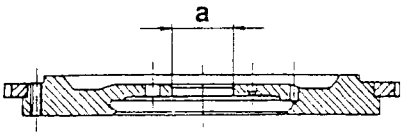
Thrust half rings



Unit: mm

Thickness of thrust half rings "a"	2.342 ÷ 2.358
	Oversize by 0.127
End play of the driving shaft	0.059 ÷ 0.221

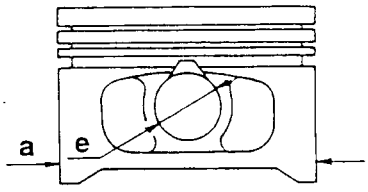
Flywheel

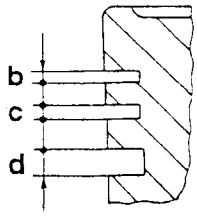


Inside diameter of centre bush (bore) "a"	47.010 ÷ 47.035 mm
Crown wheel heating temperature for assembly on flywheel	80° ÷ 100°C

CONNECTING ROD - PISTON ASSEMBLY

Piston



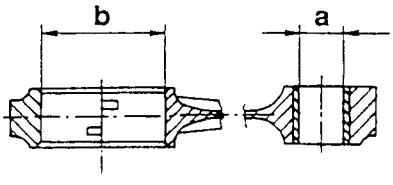


Unit: mm

Piston diameter "a" (1)	Class A - Blue	81.952 ÷ 81.962
	Class B - Pink	81.960 ÷ 81.970
	Class C - Green	81.968 ÷ 81.978
	Oversize 0.1	
Height of seats of first seal ring "b"		1.520 ÷ 1.540
Height of seats of second seal ring "c"		1.510 ÷ 1.530
Height of seats of scraper ring "d"		3.010 ÷ 3.030
Pin hole diameter in pistons "e"		20.002 ÷ 20.007
Clearance between pistons and cylinders		0.038 ÷ 0.062 (*)
Difference in weight between pistons		± 5 g

(1): To be measured at right angles to the pin hole at a distance of 12.5 mm from the lower edge of the skirt. (*): 0.040 ÷ 0.060 for engine AR33503.

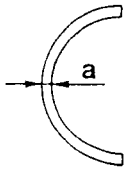
Connecting rods



Unit: mm

	1370	1598	1747
Small end bush hole diameter "a"	20.006 ÷ 20.012		
Inside diameter of big ends "b"	44.000 ÷ 44.012	51.354 ÷ 51.366	53.897 ÷ 53.909
Difference in weight between connecting rods	≤ 5 g		
Clearance between pins and small end bushes	0.006 ÷ 0.016		
Small end end float	0.25 ÷ 0.6		

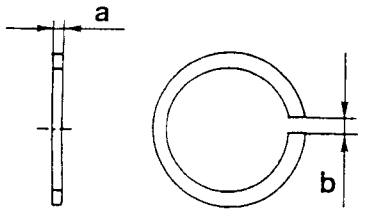
Connecting rod half bearings



Unit: mm

		1370 1598	1747
Thickness of connecting rod half bearings "a"	Class A - Red	1.536 ÷ 1.540	1.527 ÷ 1.531
	Class B - Blue	1.539 ÷ 1.543	1.531 ÷ 1.535
	Class C - Yellow	1.542 ÷ 1.546	1.535 ÷ 1.539
	Undersize 0.127		
Clearance between connecting rod pins and corresponding half bearings	Class A - Red	0.030 ÷ 0.056	0.026 ÷ 0.056
	Class B - Blue		
	Class C - Yellow		

Seal rings

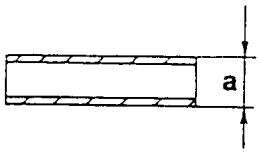


Unit: mm

Ring thickness "a"	First ring	1.470 ÷ 1.490
		Oversize 0.1
	Second ring	1.475 ÷ 1.490
		Oversize 0.1
	Scraper ring	2.975 ÷ 2.990
		Oversize 0.1
Ring gap "b" (1)	First ring	0.25 ÷ 0.50
	Second ring	0.30 ÷ 0.50
	Scraper ring	0.25 ÷ 0.50
End float between rings and their seats	First ring	0.030 ÷ 0.070
	Second ring	0.020 ÷ 0.055
	Scraper ring	0.020 ÷ 0.055

(1) To be measured in the checking nut or in the cylinder

Gudgeon pins

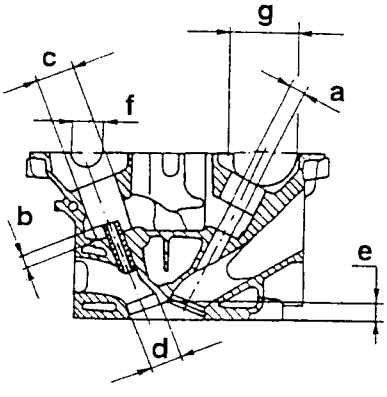


Unit: mm

Outside diameter of gudgeon pins "a"	19.996 ÷ 20.000
Clearance between gudgeon pins and their housings on pistons	0.002 ÷ 0.011

CYLINDER HEADS

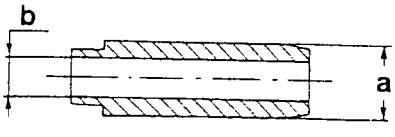
Head



Unit: mm

		1370	1598	1747
Valve guide seat diameter "a"		12.950 ÷ 12.977		
Valve guide protrusion "b"		11.25 ÷ 11.75		
Valve cup seat diameter "c"		33.000 ÷ 33.025		
Valve seat housing diameter "d"	Intake	31.519 ÷ 31.544	35.019 ÷ 35.044	
	Exhaust	27.021 ÷ 27.042	29.021 ÷ 29.042	
Combustion chamber minimum depth "e"		13 ± 0.2		
Maximum flatness error of lower head surface		0.1		
Diameter of camshaft bearings "f"		26.045 ÷ 26.070		
Diameter of timing variator support "g"		55.990 ÷ 56.015		

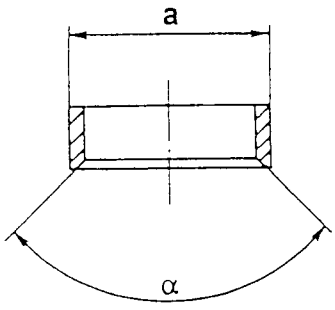
Valve guides



Unit: mm

Outside diameter of valve guides "a"	13.010 ÷ 13.030
	Oversize 0.20
Inside diameter of guide valves (bore) "b"	7.022 ÷ 7.040
Interference between valve guides and their housings	0.033 ÷ 0.080

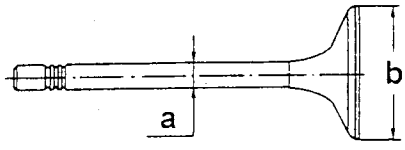
Valve seats



Unit: mm

		1370	1598 1747
External diameter of valve seats "a"	Intake	31.635 ÷ 31.650	35.135 ÷ 35.150
	Exhaust	27.142 ÷ 27.157	29.142 ÷ 29.157
Contact taper with valves "α"		90° ± 10'	
Interference between valve seats and respective seats	Intake	0.124 ÷ 0.131	0.091 ÷ 0.131
	Exhaust	0.100 ÷ 0.136	0.100 ÷ 0.136
Heating temperature of cylinders' head for valve seats fitting		80°C	

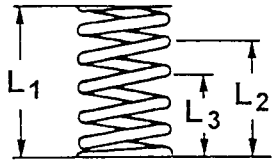
Valves



Unit: mm

		1370	1598 1747
Diameter of valve stems "a"	Intake	6.975 ÷ 6.990	
	Exhaust	6.960 ÷ 6.975	
Diameter of valve heads "b"	Intake	29.9 ÷ 30.2	33.4 ÷ 33.7
	Exhaust	25.9 ÷ 26.2	27.9 ÷ 28.2
Radial clearance between valve stems and valve guides	Intake	0.032 ÷ 0.065	
	Exhaust	0.047 ÷ 0.080	

Valve springs



Unit: mm

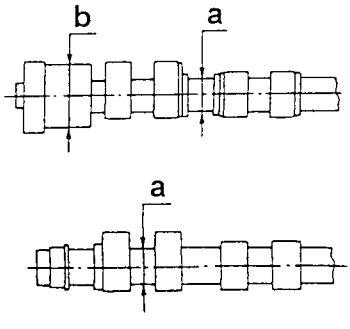
	External spring	Internal spring
Free length "L_1"	46 mm	39 mm
Length with closed valves "L_2"	34 mm	29.5 mm
Load corresponding to "L_2"	271 ÷ 294 N (27.6 ÷ 30 kg)	96 ÷ 106 N (9.8 ÷ 10.8 kg)
Length with open valves "L_3"	24.5 mm	20 mm
Load corresponding to "L_3"	485 ÷ 524 N (49.4 ÷ 53.4 kg)	201 ÷ 221 N (20.5 ÷ 22.5 kg)

Hydraulic tappets

Unit: mm

External diameter of hydraulic tappets "a"	32.959 ÷ 32.975
Radial clearance between hydraulic tappets and corresponding seats	0.025 ÷ 0.066

Camshaft

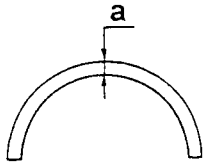


Unit: mm

		1370 1598	1747
Diameter of camshafts pins "a"		26.000 ÷ 26.015	
Diameter of phase transformer pin "b"		49.985 ÷ 50.000	
Nominal cam lift	Intake	8.3 9.0 (*)	9.5
	Exhaust	7.5	9.5
Clearance between camshafts' pins and corresponding seats		0.03 ÷ 0.07	
Camshafts' end play		0.10 ÷ 0.23	

(*): For 98's models with M1.5.5. injection

Phase transformer's half bearings



Unit : mm

Thickness of phase transformer half bearings "a"	2.992 ÷ 2.998
True functioning clearance between phase transformer and corresponding bearings	0.034 ÷ 0.086

ANGULAR VALUES OF THE TRUE DIAGRAM OF THE TIMING SYSTEM (Applying a checking play of 0.45 mm)

1370

Intake	Opening (before TDC)	"a"	-8° 17° (*)
	Closing (after BDC)	"b"	40° 15° (*)
	Angular intake value	"c"	212°
Exhaust	Opening (before BDC)	"d"	26°
	Closing (after TDC)	"e"	1°
	Angular exhaust value	"f"	207°

(*): Values obtained with operating phase transformer

1598

Intake	Opening (before TDC)	"a"	-8° 17° (*)
	Closing (after BDC)	"b"	40° 15° (*) 46° (**) 21° (**)
	Angular intake value	"c"	212°
Exhaust	Opening (before BDC)	"d"	26°
	Closing (after TDC)	"e"	1°
	Angular exhaust value	"f"	207°

(*):Values obtained with operating phase transformer
(**):For 98's models with M1.5.5. injection

1747

Intake	Opening (before TDC)	"a"	-3° 22° (*)
	Closing (after BDC)	"b"	51° 26° (*)
	Angular intake value	"c"	228°
Exhaust	Opening (before BDC)	"d"	47°
	Closing (after TDC)	"e"	4°
	Angular exhaust value	"f"	231°

(*):Values obtained with operating phase transformer

TECHNICAL FEATURES OF THE ENGINE

SPECIFIC DATA

Engine		AR 32302
Cycle		Diesel
Feed		Direct injection BOSCH COMMON RAIL EDC-15C
Cylinder displacement	cm^3	1910
Cylinder number		4 in line
Boring	mm	82
Stroke	mm	90.4
Max Power	CV CEE (kW CEE) revs/min	105 (77) 4000
Max torque	kgm CEE (Nm CEE) revs/min	26 (255) 2000
Compression Ratio		18.45 : 1
Injection order		1 - 3 - 4 - 2
Regime minimo	revs/min	800 ± 30

COMPLETE CYLINDER BLOCK

Cylinder block

Diameter of the main journal seats		63.691 ÷ 63.732 mm
Diameter of the cylinder barrels	Class A	82.000 ÷ 82.010 mm
	Class B	82.010 ÷ 82.020 mm
	Class C	82.020 ÷ 82.030 mm
	Oversize by 0.1 mm	
Cylinder's head face's flatness		< 0.1 mm

Driving shaft

Diameter of main journals	Class A	59.994 ÷ 60.000 mm
	Class B	59.988 ÷ 59.994 mm
	Class C	59.982 ÷ 59.988 mm
	Undersize by 0.127mm	
Diameter of rods' pins	Class A	50.799 ÷ 50.805 mm
	Class B	50.793 ÷ 50.799 mm
	Class C	50.787 ÷ 50.793 mm
	Undersize by 0.127 mm	
End play		0.049 ÷ 0.211 mm

Main bearings

Thickness of the main bearings	Class A	1.836 ÷ 1.840 mm
	Class B	1.839 ÷ 1.843 mm
	Class C	1.842 ÷ 1.846 mm
	Undersize by 0.127 mm	

Oil Pump

Play between pump bay and driven gear		0.080 ÷ 0.186 mm
Play between pump cover face and gears		0.025 ÷ 0.070 mm
Spring of oil pressure relief valve	Height	35 mm
	Check load	11.73 ÷ 12.51 daN
Engine oil pressure	At slow running	0.6 ÷ 0.7 bar
	At 4000 revs/1'	2.5 ÷ 3.0 bar

CONNECTING ROD - PISTON GROUP

Connecting rods

Inner diameter of the connecting rods bushings (line-boring)	26.006 ÷ 26.012 mm
Diameter of the connecting rods heads	53.883 ÷ 53.923 mm
Weight difference between the connecting rods	± 2.5 g

Connecting rods' bearings

Thickness of the connecting rods' bearings	Class A	1.527 ÷ 1.531 mm
	Class B	1.530 ÷ 1.534 mm
	Class C	1.533 ÷ 1.537 mm

Pistons

External diameter of pistons	Class A	81.783 ÷ 81.797 mm
	Class B	81.793 ÷ 81.807 mm
	Class C	81.803 ÷ 81.817 mm
Internal diameter of the bushings in the pistons		25.999 ÷ 26.004 mm
Weight difference among pistons		± 5 g

Gas rings

Rings'port	First ring	0.25 ÷ 0.40 mm
	Second ring	0.25 ÷ 0.50 mm
	Oil scraper ring	0.25 ÷ 0.50 mm
End play between seats and gas rings	First ring	-
	Second ring	0.020 ÷ 0.060 mm
	Oil scraper ring	0.030 ÷ 0.065 mm

Piston pins

External diameter of piston pins	25.982 ÷ 25.988 mm

Cylinders' head

Head

Diameter of transmission tappets seats	37.000 ÷ 37.025 mm
Diameter of transmission shaft supports	26.045 ÷ 26.070 mm
Lower plan's flatness	0.1 mm
Minimum height allowed after flattening	141.00 ± 0.15 mm

Valves' guides

External diameter of valves' guides	Intake	14.010 ÷ 14.030 mm
	Exhaust	
	Oversize by 0.05 - 0.10 - 0.25 mm	
Internal diameter of valves'guides		8.022 ÷ 8.040 mm

Valves' seats

External diameter of valve seat	Intake	36.135 ÷ 36.150 mm
	Exhaust	35.142 ÷ 35.157 mm
Taper of valves'seats		90° ± 20'

Valves

Diameter of the valve stem	Intake	7.974 ÷ 7.992 mm
	Exhaust	
Angle of the valve head		90° ± 20'
Embedding of the valve head		0.1 ÷ 0.5 mm

Valve springs

Loose height	53.9 mm
Height with check load 36.7 ÷ 39.6 N	36 mm
Height with check load 56.0 ÷ 61.0 N	26.5 mm

Transmission tappets

External diameter		36.975 ÷ 36.995 mm
Play with closed valves	Intake	0.25 ÷ 0.35 mm
	Exhaust	0.30 ÷ 0.40 mm

Propeller shaft

Diameter of pins of the propeller shaft		26.000 ÷ 26.015 mm
Nominal cam's lift	Intake	8.5 mm
	Exhaust	8.5 mm
End play of the propeller shaft		0.100 ÷ 0.230 mm

Valves play

Play to check the timing		0.50 mm
Play with closed valves	Intake	0.25 ÷ 0.35 mm
	Exhaust	0.30 ÷ 0.40 mm

Cylinder's head gasket

Average max protrusion of the pistor
0.795 ÷ 0.881 mm
0.881 ÷ 0.967 mm
0.967 ÷ 1.055 mm

	Thickness of the cylinder head gasket to be used
	1.55 ÷ 1.65 mm (no notch)
	1.65 ÷ 1.75 mm (one notch)
	1.75 ÷ 1.85 mm (two notches)

ANGULAR VALUES OF THE TRANSMISSION DIAGRAM (Obtained with a test play of 0.50 mm)

Intake	Opening (before TDC)	0°
	Closing (after BDC)	32°
	Angular intake value	212°
Exhaust	Opening (before BDC)	32°
	Closing (after TDC)	0°
	Angular exhaust value	212°