SECTION 08-1

Technical Data

ADE 409, 407N/C/T/TI

ENGINE DATA

	409N	407N	407C	407T/TI
Bore	125 mm	125 mm	125 mm	125 mm
Stroke	155 mm	155 mm	155 mm	155 mm
No. of cylinders	5	6	6	6
Cubic capacity	9,510/	11,410/	11,410/	11,410/
Compression ratio	16,5:1	16,5:1	16,0:1	16,0:1
Firing order	12453	153624	153624	153624
Combustion system	Direct Injection	Direct Injection	Direct Injection	Direct Injection
Cycle	4 Stroke	4 Stroke	4 Stroke	4 Stroke

ENGINE TEST DATA

Compression test pressures at 170 r/min and engine at operating temperature	min. 2000 kPa max. 2800 kPa
Idling speed	600 r/min

DETAILS OF RATINGS TO SABS 013-1977

	409N	407N	407C	407T	407TI
Maximum torque N.m-r/min	674 @ 1300	823 @ 1500	975 @ 1200	1177 @ 1200	1350 @ 1200
Output kW-r/min	138 @ 2200	174 @ 2200	175 @ 2200	206 @ 2200	235 @ 2200

ENGINE MASS

Typical dry mass	655 kg	760 kg	780 kg	780 kg
Typical installed mass	690 kg	795 kg	815 kg	815 kg

RECOMMENDED TORQUE TENSIONS

Section 11 — CYLINDER BLOCK AND LINERS

Main bearing cap bolts	Initial torque	300 N.m	Section 14
	Final torque	90° – 100°	Section 14
Blanking plug to compressor drive gear cover		150 N.m	
Blanking plug to compressor drive gear cover/support (407H)		100 N.m	

Section 12 — CYLINDER HEAD

Cylinder head single hexagon bolts	M15 x 2	5 stages	1st: 10 N.m 2nd: 50 N.m 3rd: 100 N.m 4th: 140 – 150 N.m 5th: 90° – 100°
Cylinder head multi hexagon bolts	M15 x 2		1st: 10 N.m 2nd: 60 N.m 3rd: 120 N.m 4th: 180 – 190 N.m 5th: 90° – 100°
Rocker Cover Bolts			25 N.m
Rocker Shaft Pedestal Bolts			75 N.m
Exhaust Manifold Fully Threaded Stretch Bolt	M10		60 N.m + 90°
Exhaust Manifold Shank Stretch Bolt	M10		50 N.m
Inlet Manifold	M8		35 N.m
Turbocharger to manifold			50 N.m
Core Plug to Cylinder Head			100 N.m
Valve Adjusting Locknut			50 N.m
Exhaust Brake Cylinder			25 N.m
Air/fuel ratio control connection to inlet manifold			25 N.m

TECHNICAL DATA — 08-2

Section 13 — PISTONS AND CONNECTING RODS

Connecting rod bolts	Initial torque	100 N.m
	Final torque	90° – 100°

Section 14 — CRANKSHAFT AND MAIN BEARINGS

Counterweight on crankshaft	Initial torque	160 N.m
	Final torque	90° – 100°
Vibration damper on crankshaft		200 N.m
Pulley to vibration damper		25 N.m
Front Crankshaft Oil Seal Cover		25 N.m

Section 15 — CAMSHAFT, TIMING CASE AND DRIVE TIMING

Timing device to camshaft (max. bolt stretch 25,3 mm)		50 N.m
Timing housing to cylinder block	M10	70 N.m
Compressor drive gear to camshaft	M10	65 N.m
Tachometer cable to adaptor		80 N.m

Section 16 — LUBRICATING SYSTEM AND SUMP

Sump bolts		30 N.m
Sump drain plug		80 N.m
Turbocharger oil return plug		120 N.m
Turbocharger oil return connection		50 N.m
Oil pump to crankcase	M8	35 N.m
Oil gallery plugs	M22	50 N.m
	M24 & 26	120 N.m
	M14 & 16	80 N.m
Filler plug in filter housing	M26 × 1,5	60 N.m
Oil spray nozzles for camshaft	M8	35 N.m
Oil pressure relief valve to cylinder block	M8	35 N.m
Suction pipe to oil pump	M8	35 N.m
Suction pipe bracket to crankcase	M8	35 N.m
Oil cooler to housing	M8	25 N.m
Screw plug for by-pass valve	M26 × 1,5	60 N.m
Coolant drain plug on cooler		80 N.m
Oil filler neck to sump		50 N.m
Oil filter bowl to filter head	M10	50 N.m
Oil filter and cooler to crankcase		70 N.m
Piston cooling nozzles	M14 × 1,5	47 N.m
Oil pressure sender unit		50 N.m
Dipstick adaptor to sump		50 N.m
Dipstick tube to adaptor		35 N.m
Oil pump cover	M8	25 N.m

Section 17 — FUEL SYSTEM

Drive gear on injection pump		35 N.m
Injection pump to timing housing		50 N.m
Injector pipe nuts		25 N.m
Injection pump support bracket:		
1. Angle bracket to pump	M10	50 N.m
2. Angle bracket to support	M12	80 N.m
3. Support bracket to block	M12	110 N.m
Injection pump to intermediate flange		65 N.m
Injector securing nuts		70 N.m
Plug on intermediate flange		80 N.m
Injection nozzle to nozzle holder		75 N.m
Governor control shaft to injection pump levers		10 N.m
Governor control shaft brackets to block		50 N.m
Fuel filter bowl to filter head		15 N.m
Fuel filter head mounting bolts to bracket, timing housing		80 N.m
Fuel filter bracket to induction pipe		35 N.m
Fuel lines to lift pump/filter head/injection pipe/return		30 N.m

Section 18 — ANCILLARY EQUIPMENT

Flywheel to crankshaft		
Previous	Initial torque	100 N.m
	Final torque	90° – 100°
New	Initial torque	200 – 220 N.m
	Final torque	90° – 100°

Pulley to alternator	M4 × 1,5	55 N.m
Starter to flywheel housing		80 N.m
Engine mounting to timing cover	M12	80 N.m
Engine mounting to cylinder block	M16	140 N.m
Engine mounting front	M16	110 N.m
Lifting bracket bolt		150 N.m
Alternator bracket to crankcase		110 N.m
Alternator to bracket		65 N.m
Adjusting bracket to alternator		80 N.m
Compressor drive gear cover (engine support ADE 407H)		70 N.m
Cylinder barrel to compressor housing	M8	30 N.m
Cylinder head bolts (compressor)	M8	35 N.m
Driven gear to compressor crankshaft	M18 x 1,5	360 N.m
Compressor to cylinder block	M8	30 N.m
Connecting rod bearing cap bolts	M8	30 N.m
Steering pump to compressor	M10	60 N.m
Valve plate holder	M6	14 N.m
Plugs to compressor head	M26 x 1,5	80 N.m
Coolant adaptors to compressor barrel/cylinder block	M14 x 1,5	50 N.m
Coolant pipes to adaptors	M 16 × 1,5	35 N.m
Coolant adaptor to compressor head	M22 x 1,5	80 N.m
Air suction pressure adaptors to head	M26 x 1,5	80 N.m
Valve plate to cylinder head	M6	15 N.m
Intermediate plate to cylinder head	M8	30 N.m
Front blanking cover	M8	25 N.m
Rear blanking cover	M8	25 N.m
Exhaust brake bracket to housing	M8	25 N.m
Exhaust brake lever to shaft	M6	14 N.m

Power Take-off

Bearing flange to housing	M8	25 N.m
Output flange to shaft	M24 x 1,5	300 N.m
Gear to shaft	M33 x 1,5	300 N.m
Lubrication oil nozzle	M12 x 1,5	60 N.m
Unit to timing housing and block	M10	60 N.m

Section 19 — COOLING SYSTEM

Water pump bolts	M8	25 N.m
Pulley to water pump	M8	25 N.m
Temperature sender unit		80 N.m
Coolant outlet to water pump	M8	25 N.m
Coolant inlet to water pump	M10	50 N.m

Stretch Bolt Limits

Main bearing bolts		156 mm
Counterweight bolts		71,2 mm
Connecting rod bolts		68,5 mm
Flywheel bolts	Bolt length 74 mm max.	75 mm
	80 mm max.	81 mm
	85 mm max.	86 mm
Cylinder head bolts	short	111 mm
	medium	146 mm
	long	170 mm

Fan retaining bolts (Din 933) — Tightening torque

BOLT DIA.	QUALITY	TORQUE
M8	8,8	23 N.m
M8	10,9	30 N.m
M10	8,8	42 N.m
M10	10.9	58 N.m

TECHNICAL DATA — 08-4

SPECIFICATIONS

CYLINDER LINERS

	409/407N/C/T/TI
Bore diameter of new liner when identified on flange with "B"	124,990 – 124,995 mm
"C"	124,995 – 125,000 mm
"D"	125,00 – 125,005 mm
"E"	125,005 – 125,010 mm
Outside diameter of liner flange	151,894 – 151,957 mm
Outside diameter of liner upper fit	142,969 – 142,993 mm
Outside diameter of liner lower fit	139,951 – 139,975 mm
Flange thickness	10,05 – 10,07 mm
Max. ovality at lower fit (before installation)	0,06 mm
Max. ovality at lower fit (after installation)	0,04 mm
Liner protrusion above block face	0,05 – 0,09 mm
for repair	0,03 – 0,09 mm
Max. liner wear at upper return point of top ring	0,06 mm
Max. taper of liner bore	0,06 mm
Surface roughness of honed liner	R3z 3 – 5 µm

CYLINDER BLOCK

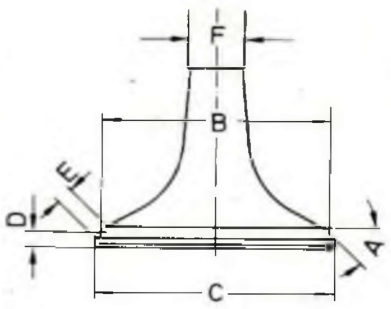
Roughness of upper joint surface	Rz 10 µm – R max. 16 µm
Main bearing bore	111,000 – 111,022 mm
Max. ovality of bore	0,1 mm
Max. taper of bore	0,1 mm
Bearing crush height	0,03 – 0,05 mm
Bore diameter for liner flange	152,100 – 152,350 mm
Bore depth for flange	9,98 – 10,00 mm
Bore diameter for upper fit of liner	143,00 – 143,040 mm
Bore diameter for lower fit of liner	140,000 – 140,040 mm
Pressure test for leakage	50 kPa
Block height (crankshaft centre to top mating surface)	417,95 – 418 mm
Camshaft bearing parent bore: Rear only	76,000 – 76,030 mm
Other	75,000 – 75,030 mm

CYLINDER HEAD

Cylinder head height (new)	113,9 – 114,00 mm
Minimum height	113,4 mm
Machining tolerance maximum	0,5 – 0,6 mm
Maximum distortion: Length	0,015 mm
Width	0,015 mm
Roughness of cylinder head face (Rz)	0 – 16 µm
Maximum deviation between upper and lower parting surfaces	0,1 mm

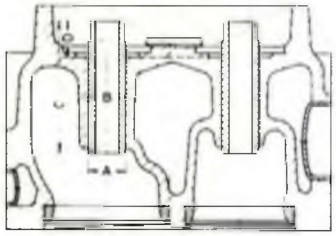
VALVES

Valve	Valve Level*	"A" Seat Angle	"B" Dia Seat Centre	"C" Valve Head Dia	"D" Height New	"D" Height Min	"E" Width New	"E" Width Max	"F" Stem Dia	Stem Hardness
Inlet	Previous	30°	57,01 / 56,99	59,0 / 58,8	3,2 / 3,0	2,7	4,3 / 3,3	7	11,950 / 11,932	60 / 54 HRC
	New*	30°	55,01 / 54,99	59,0 / 58,8	3,8 / 3,6	3,3	5,5 / 4,5	6,5	11,950 / 11,932	60 / 54 HRC
Exhaust	Previous	45°	49,01 / 48,99	51,1 / 50,9	2,7 / 2,5	2,2	4,5 / 3,5	5,5	11,940 / 11,922	60 / 54 HRC
	New*	45°	48,01 / 47,99	51,1 / 50,9	3,2 / 3,0	2,7	5,5 / 4,5	6,5	11,940 / 11,922	60 / 54 HRC



*Breakpoints for new level valves:
ADE 400N/C . . . SA015464 N and up
ADE 400T/TI . . . SA015639 N and up

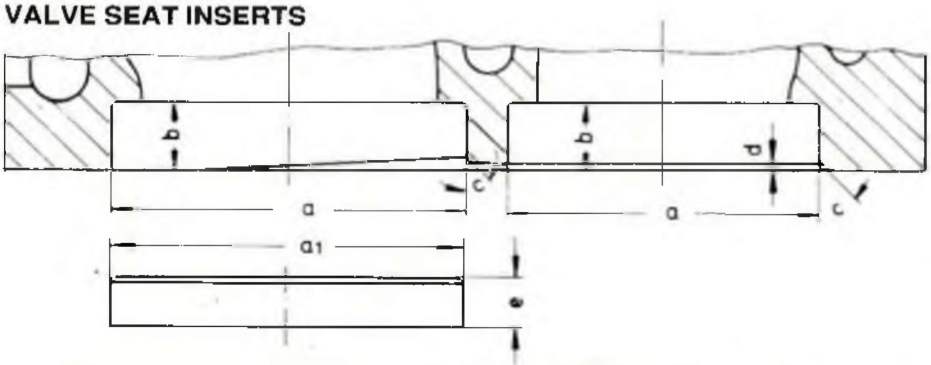
VALVE GUIDES



Repair Sizes	Valve Guide Dia. for Inlet and Exhaust		Length of Valve Guide Dim. "C" for Inlet/Exhaust	Bore in Cylinder Head Dim. "A" for Inlet/Exhaust	Overlap in Cyl. Head for Inlet/ Exhaust	Clearance of Valve Stem in Valve Guide		Valve Guide protrusion for Inlet and Exhaust Dim. "D"
	Outer Dim. "A"	Inner Dim. "B"				Inlet	Exhaust	
Standard	18.046 / 18.028	12.027	67	18.018 / 18.000	0.046 / 0.010	0.095 / 0.050	0,105 / 0,060	17,400 / 17,100
Rep. size 1	18.256 / 18.235	12.000 (Ream after instal-lation)		18.221 / 18.200	0.056 / 0.014			
Rep. size 2	18.456 / 18.435			18.421 / 18.400				

Max.* deviation of valve seat to valve guide centre	0.03
Max. misalignment of valve seat to valve guide measured at 57 mm dia. for inlet, 49 mm dia. for exhaust	0.01

VALVE SEAT INSERTS



	Inlet Valve Seat Insert			Exhaust Valve Seat Insert		
	Standard	Repair 1 (+0,2)	Repair 2 (+0,4)	Standard	Repair 1 (+0,2)	Repair 2 (+0,4)
Basic bore "a" In cylinder head	60.030 / 60.000	60.230 / 60.200	60.430 / 60.400	53.030 / 53.000	53 230 / 53 200	53.430 / 53.400
Valve seat insert outside dia. "a1"	60.11 / 60.10	60.31 / 60.30	60.51 / 60.50	53.11 / 53.10	53.31 / 53.30	53.51 / 53.50
Valve seat insert Interference fit in cyl. head	0.07 – 0.11			0.07 – 0.11		
Bore depth "b" in cylinder head	12.6 / 12.5	12.8 / 12.7	13.0 / 12.9	12.6 / 12.5	12.8 / 12.7	13.0 / 12.9
Valve seat insert height "e" — Previous Level	8.9 / 8.8	9.1 / 9.0	9.3 / 9.2	9.7 / 9.6	9.9 / 9.8	10.1 / 10.0
Valve seat insert height "e" — New Level **	8.4 / 8.3	8.6 / 8.5	8.8 / 8.7	9.2 / 9.1	9.4 / 9.3	9.6 / 9.5

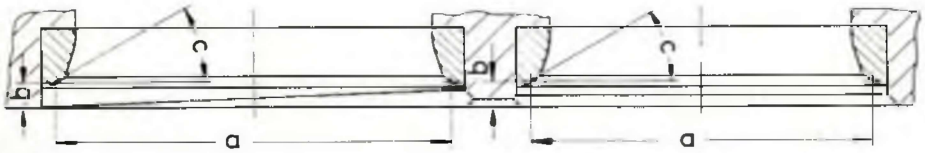
** For new level head with "T" stamp

TECHNICAL DATA — 08-6

VALVE SEATS (cont)

		Inlet Valve Seat Insert	Exhaust Valve Seat Insert
Dimension between cyl. head mating surface and valve seat face.	Previous Level	3.8 / 3.6	3.0 / 2.8
	New Level**	4.3 / 4.1	3.5 / 3.3
Chamfer "c"		45°	45°
Chamfer depth "d"		–	1.8 / 1.6
Max. run-out of valve seat to valve guide		measured at ∅ 57 mm 0.01	measured at ∅ 49 mm 0.01

** For New Level Head with "T" Stamp



		Inlet Valve Seat Insert	Exhaust Valve Seat Insert
Diameter "a"	Previous Level	57.01 / 56.99	49.01 / 48.99
	New Level**	55.01 / 54.99	48.01 / 47.99
Distance "b"	Previous Level	4.05 / 3.90	3.55 / 3.40
	New Level**	4.65 / 4.50	4.05 / 3.90
Valve seat angle "c"		30°	45°
Distance between cylinder head mating surface and valve head face		0.7 ÷ 0.4	0.7 ÷ 0.4
Max. out-of-round of valve seat to valve guide		measured at ∅ 57 mm 0.01	measured at ∅ 49 mm 0.01

**For new level Head with "T" Stamp

VALVE SPRINGS

Engine Model/ Spring Allocation	Spring	Inside Dia.	Wire Dia.	Relaxed Length	Pre-loaded Length	Pre-loaded Load N	Final Loaded Length	Final Loaded Load N
ADE 400N inlet and exhaust valves and ADE 400C/T/TI inlet valves	Outer*	32 ± 0.3	4.7 ± 0.03	64	46.8	345 ± 15	32.8	740 ± 30
		32 ± 0.3	4.8 + 0.05	59	46.8	345 ± 15	33.1	720 ± 50
	Inner	22.8 ± 0.2	3.0 ± 0.025	65.5	46.3	143 ± 12	32.3	280 ± 20
400C/T/TI exhaust valves only	Outer	33 ± 0.3	4.5 ± 0.03	68	46.8	355 ± 15	32.8	670 ± 30
	Inner	22.8 ± 0.2	3.2 ± 0.025	70	46.3	195 ± 12	32.3	350 ± 20

*Optional due to different suppliers

ROCKERSHAFT

Basic bore of rocker arm ..... 28,000 – 28,052 mm
Outer diameter of bush ..... 28,090 – 28,120 mm
Inner diameter of bush ..... 25,000 – 25,021 mm
Diameter of rockershaft ..... 24,967 – 24,980 mm
Bush to shaft clearance ..... 0,020 – 0,054 mm

CRANKSHAFT

Repair Stage	Main journal diameter (mm)	Width for thrust bearing journal (mm)	Big end journal diameter (mm)	Width for crankpin (mm)
Standard	103,98 – 104,00	46,00 – 46,062 (STD)	89,98 – 90,00	46,000 – 46,100
Standard 1 (– 0,10)	103,88 – 103,90		89,88 – 89,90	
Standard 2 (– 0,25)	103,73 – 103,75	46,500 – 46,562 (+ 0,5) or 47,000 – 47,062 (+ 1,0)	89,73 – 89,75	
Rep. Stage 1 (– 0,50)	103,48 – 103,50		89,48 – 89,50	
Rep. Stage 2 (– 0,75)	103,23 – 103,25		89,23 – 89,25	
Rep. Stage 3 (– 1,0)	102,98 – 103,00		88,98 – 89,00	

CRANKSHAFT BEARINGS

Repair Stage	Main Bearing Dia (mm)	Width of fitted thrust bearing (mm)	Big end bearing dia (mm)
Standard	104,060 – 104,106	45,74 – 45,81 (STD)	90,060 – 90,102
Standard 1 (– 0,10)	103,960 – 104,006		89,960 – 90,002
Standard 2 (– 0,25)	103,810 – 103,856	46,24 – 46,31 (+ 0,5) or 46,74 – 46,81 (+ 1,0)	89,810 – 89,852
Rep. Stage 1 (– 0,50)	103,560 – 103,606		89,560 – 89,602
Rep. Stage 2 (– 0,75)	103,310 – 103,356		89,310 – 89,352
Rep. Stage 3 (– 1,0)	103,060 – 103,106		89,060 – 89,102

Main and big end journal finish ..... Ra 0,2 μm – R max. 2 μm
Torque to turn crankshaft with new bearings and seals ..... 12 N.m
Crankshaft hardness ..... 50 – 56 RC
Crankshaft radii ..... 3,5 – 4,0 mm
Width of connecting rod journal ..... 46,0 – 46,1 mm
Diameter of flywheel flange ..... 61,940 – 61,959 mm
Axial play of connecting rod ..... 0,130 – 0,269 mm
Main bearing clearance: Radial ..... 0,064 – 0,124 mm
Axial ..... 0,066 – 0,132 mm
Crankshaft end play ..... 0,190 – 0,322 mm
Crankshaft run-out limit* ..... 0,09 mm
Main bearing oil clearance ..... 0,066 – 0,132 mm
Big end bearing clearance ..... 0,066 – 0,126 mm

*Crankshaft supported at outer bearings and measured at centre bearing.

CONNECTING RODS

Basic bore of big end ..... 95,000 – 95,022 mm
Outer diameter of small end bush ..... 50,665 – 50,695 mm
Inner diameter of small end bush ..... 46,055 – 46,065 mm
Interference fit of bush to con-rod ..... 0,040 – 0,095 mm
Gudgeon pin to bush oil clearance ..... 0,055 – 0,070 mm
Max. bend/100 mm through centre line of bores ..... 0,05 mm
Max. weight variation between con-rods ..... 60 gm
Connecting rod length from centres ..... 255,98 – 256,02

PISTONS

ID Stamps on Piston Crowns		For Use with	Piston/Bore Clearance*	
Nom. Dia.	Grading*	Liner Grades	400N	400C/T/TI
125	Bc BCD CDE DE	B or C B, C or D CD or E D or E	0,195 – 0,205 (New liner/ piston)	0,215mm – 0,225mm (New liner/ piston)

*Capitals denote optimum match, e.g. BCD piston with C liner

Gudgeon pin: diameter ..... 45,995 – 46,000 mm
bore in piston ..... 46,003 – 46,009 mm
clearance in piston ..... 0,003, 0,014 mm
Gudgeon pin/con-rod bush clearance ..... 0,055 – 0,070 mm
Maximum weight variation between pistons ..... 20 gm
Piston protrusion ..... + 0,07 to + 0,43 mm

TECHNICAL DATA — 08-8

PISTON RINGS

	3 Rings	Gap	Clearance
409/407N	Keystone, molybdenum coated	0,25 - 0,40 mm	——
	Stepped outer section, molybdenum coated	0,25 - 0,40 mm	0,060 - 0,095 mm
	Slotted oil control with spring	0,25 - 0,40 mm	0,030 - 0,062 mm
	4 Rings	**Gap**	**Clearance**
407C/T	Keystone, molybdenum coated	0,25 - 0,40 mm	——
	Tapered face	0,25 - 0,40 mm	0,060 - 0,092 mm
	Stepped outer section, molybdenum coated	0,25 - 0,40 mm	0,060 - 0,095 mm
	Slotted oil control with spring	0,25 - 0,40 mm	0,030 -0,062 mm
	3 Rings, Piston with Cooling Channel	**Gap**	**Clearance**
407TI	Keystone, molybdenum coated	0,35 - 0,50 mm	——
	Inner stepped section, tapered face molybdenum coated	0,35 - 0,50 mm	0,060 - 0,095 mm
	Slotted oil control with spring	0,25 - 0,40 mm	0,030 - 0,062 mm

CAMSHAFT

Camshaft play:	Radial	0,062 - 0,12 mm
	Axial	0,20 - 0,90 mm
Hardness of journals and base cam circles		58 - 62 HRC
Hardness of cam lobes		58 - 62 HRC
Max. radial run-out of shaft		0,05 mm
Cam lobe and journal surface finish		Rz 3 µm

CAMSHAFT BEARINGS

P.T.O. Torque	Model	Brg Positions	Parent Bore DIA.	Brg I.D. (mm)	Finished I.D. Brgs. (mm)	Journal O.D. (mm)
Below 100 N.m requirement	407	1 – 7	—	Machine to $\frac{70,030}{70,000}$	$\frac{70,060}{70,000}$ *	$\frac{69,940}{69,910}$
	409	1 – 6				
Above 100 N.m requirement	407	1 – 6	75,030			
	409	1 – 5	75,000			
	407	7	76,030**	No machining $\frac{70,060}{70,000}$ *		
	409	6	76,000			

*Dimension after installation

**Parentbore repair size + 1,0 — 77,000 – 77,030 mm

TIMING GEARS

Backlash between camshaft and compressor gears	0,076 - 0,194 mm
Backlash between camshaft and crankshaft gears	0,118 - 0,242 mm
Backlash between camshaft and injection pump gear	0,102 - 0,338 mm
Maximum permissible run-out of timing gears	0,02 mm

CAMFOLLOWERS

	Outer Shaft Dia.	Bore in Crankcase
Standard	$\frac{19,965}{19,944}$	$\frac{20,021}{20,000}$
Repair 1 (+0,25)	$\frac{20,215}{20,194}$	$\frac{20,271}{20,250}$
Repair 1 (+0,50)	$\frac{20,465}{20,444}$	$\frac{20,521}{20,500}$
Clearance shaft/bore		0,035 – 0,077

CHECKING TIMING WITH VALVE LIFT (See Timing Sequence Page 15-6)

		ADE 409/407N	ADE 407C/T/TI
Valve travel with zero valve play	TDC inlet	0,52 - 0,67 mm	0,40 – 0,60 mm
	TDC exhaust	0,50 - 0,65 mm	0,55 – 0,75 mm

VALVE OPERATION

Timing with specified valve play	Inlet valve opens BTDC	14°	13°
	Inlet valve closes ABDC	52°	27°
	Exhaust valve opens BBDC	51°	55°
	Exhaust valve closes ATDC	13°	13°
Maximum valve lift	Inlet	13,80 mm	11,50 – 11,90 mm
	Exhaust	13,70 mm	13,10 – 13,50 mm
Valve clearance	Inlet	0,25	0,3
	Exhaust	0,35	0,5

LUBRICATING SYSTEM

Oil capacity standard	Depending on application
Pressure relief valve setting	650 kPa*
Minimum operating pressure at 2 500 r/min	280 kPa
at 600 r/min	80 kPa
By-pass valve setting (filter)	250-300 kPa
Filter by-pass valve spring free length	53,6 mm

*As from engine no. SA014151M — 650 kPA valve replaced previous types

FUEL SYSTEM

INJECTOR MAKE		BOSCH	
Injector pressure	New	20,0 – 20,8 mPa	
	Used	17,5 mPa	
Max. pressure variation between injectors		1 MPa	
Nozzle protrusion (controlled by sealing washer, i.e. different sizes 1,00 and 1,5 mm)		1,60 - 2,40 mm	
		409/407N	407C/T/TI
Injection pump timing BTDC		17°	15°
Idle speed		600 r/min	
Max. rated speed		2 200 r/min	

AIR COMPRESSOR

Bore diameter	90,000 – 90,030 mm
Piston diameter	89,910 – 89,950 mm
Stroke	46 mm
Total displacement	292 cc
Delivery capacity with back pressure of 100 kPa	470ℓ/min.
Piston to bore clearance	0,08 – 0,10 mm
Piston below block face	0,10 – 0,90 mm
Crankshaft journal diameter	31,959 – 31,975 mm

TECHNICAL DATA — 08-10

PISTON RINGS

Position	Ring description	Groove width (mm)	Side clearances (mm)	Gap (mm)
1 Top	Tapered face	2,510 - 2,530	0,020 - 0,052	0,25 - 0,40
2	Stepped	2,510 - 2,530	0,020 - 0,052	0,25 - 0,40
3	Stepped	2,510 - 2,530	0,020 - 0,052	0,25 - 0,40
4	Slotted oil control	4,010 - 4,030	0,020 - 0,052	0,25 - 0,40

CONNECTING ROD

Basic bore of big end	36,000 – 36,016 mm
Bearing inner diameter with bearing fitted	31,994 – 32,008 mm
Length of conrod centre to centre	104,950 – 105,000 mm
Width of connecting rod	19,883 – 19,935 mm
Width of small end	20,000 – 20,060 mm
Gudgeon pin diameter	19,996 – 20,000 mm
Gudgeon pin clearance in bush	0,020 – 0,037 mm
Small end bush inner diameter	20,020 – 20,033 mm
Gudgeon pin clearance in piston	0,003 – 0,012 mm

FLYWHEEL

Max. radial run-out	0,1 mm
Max. axial run-out	0,5 mm
Installation temperature for ring gear	250° – 280° C
Max. material removal from clutch face	1,00 mm

COOLING SYSTEM

	Standard	Optional
Thermostat — Wax type		
Start opening temperature	79 ± 2° C	71 ± 2° C
Full open temperature	94° C	85° C
Length of valve stroke	8 mm	8 mm
By-pass valve closed at	91° C	82° C
Max. engine operating temperature	95° C	95° C
Waterpump:		
Clearance between impeller and housing	1,00 – 1,04 mm	
Waterpump shaft diameter at impeller	15,028 – 15,039 mm	
Shaft diameter for hub	25,048 – 25,061 mm	
Bore diameter in hub	25,000 – 25,021 mm	
Bore diameter in impeller	15,000 – 15,018 mm	
Coolant capacity engine only	ADE 409N – 12,5ℓ	
	ADE 407N – 13,5ℓ	
	ADE 407T/TI – 14,0ℓ	