All measurements in millimeters unless indicated otherwise
Tightening Torques at the end of each Group

Engine — Group 01-24

A. Crankcase and Cylinder Head

Overhaul Stages of Cylinder Bores

Standard size	Intermediate stage	1st Overhaul stage	2nd Overhaul stage	3rd Overhaul stage
85.000 / 85.022	85.250 / 85.272	85.500 / 85.522	86.000 / 86.022	86.500 / 86.522

Machining Tolerances of Cylinder Bores

Out-of-round tolerance of cylinder bores	0.013
Conicity tolerance of cylinder bores	0.013
Departure of cylinder bores from vertical to crankshaft axis related to cylinder height	0.05
Permissible roughness of cylinder walls	0.005
Permissible undulation of cylinder walls	0.0025

Available Piston Sizes

Standard size	Intermediate	1st Overhaul stage	2nd Overhaul stage	3rd Overhaul stage
84.96	85.21	85.46	85.96	86.46
84.97	85.22	85.47	85.97	86.47
84.98	85.23	85.48	85.98	86.48

Piston Measurements

Piston clearance	0.04
Piston diameter	Cylinder bore less piston clearance
Permissible weight variation of pistons in any one engine	4 g

Machining Tolerances for the Separating Surfaces of Crankcase and Cylinder Head

		Crankcase	Cylinder Head
Height		238.4 — 238.5	84.80 — 85.00
Permissible stock removal		0.3	0.5
Permissible out-of-level	longitudinal	0.03	0.1
	lateral	0	0
Deviation in parallelity between upper and lower separating surface		0.1	0.1
Test pressure (hot water, 70° C.)		2 atm.	2 atm.

Overhaul Stages of Valve Guides and Cylinder Head Bores

Overhaul stage	Color code	Valve guide					Bores in cylinder head	Valve guide force-fit size in cylinder head
		External diameter	Internal diameter		Length			
			Inlet	Exhaust	Inlet	Exhaust		
Standard size	plain	14.013 / 14.007	9.000 / 9.015	10.000 / 10.015	67	68	14.000 / 14.006	+0.007
	red	14.019 / 14.013					14.006 / 14.012	
	white	14.025 / 14.019					14.012 / 14.018	
	yellow	14.031 / 14.025					14.018 / 14.024	
	blue	14.037 / 14.031					14.024 / 14.030	
	brown	14.043 / 14.037					14.030 / 14.036	
1st Overhaul stage	red	14.225 / 14.207					14.200 / 14.218	
2nd Overhaul stage	white	14.425 / 14.407					14.400 / 14.418	

Overhaul Stages of Valve Seat Rings and Bores in Cylinder Head

	Overhaul stage	Milled out well in cylinder head	Diameter of valve seat ring	Height of valve seat ring	Depth in cylinder head t**	Depth in cylinder head t_1 **	Force-fit size of valve seat rings in relation to cylinder head
Inlet	Standard size	48.000 / 48.016	48.160 / 48.150	8.000 / 7.910	10.00 / 10.10	2	+ 0.134 to + 0.160
	1st Overhaul stage	48.500 / 48.516	(49.300)* 48.660 / 48.650	8.000 / 7.910	10.00 / 10.10	2	
Exhaust	Standard size	42.000 / 42.016	42.145 / 42.135	9.500 / 9.410	27.50 / 27.60	17.70 / 18.30	+ 0.119 to + 0.145
	1st Overhaul stage	42.500 / 42.516	(43.300)* 42.645 / 42.635	9.500 / 9.410	27.50 / 27.60	17.70 / 18.30	

* Unfinished size ** see Figures 01 — 5/8 and 01 — 5/9

Valve Seat Machining

Valve seat angle in cylinder head	90° — 30'			
Valve seat width	1.25 — 1.75			
Valve seat backing off	with milling cutter 120° or 150°		with backing-off cutter minimum 0.1	
Permissible deepening of valve seat well	Inlet		1	
	Exhaust		1.3	
Permissible depth of valve disk in relation to cylinder head separating surface	for new valve seats		for reconditioned valve seats	
	Inlet	Exhaust	Inlet	Exhaust
for new valves	0.8	16	1.8	17.3
for reground valves	1.5	16.7	2.5	18

Compression Ratio and Compression Space

Cylinder Head		**Standard compression**	**Optional lower compression** according to SA 10 250
Compression ratio	maximum	7.8 : 1	7.0 : 1
	standard	7.5 : 1	6.8 : 1
	minimum	7.25 : 1	6.6 : 1
Height of compression space		17.7 — 18.3	17.7 — 18.3
Total compression space with cylinder head fitted		69.8 — 75.8 cc.	78.5 — 84.5 cc.
Compression space in cylinder head with valves and spark plugs fitted		62.3 — 63.3 cc.	70.3 — 71.3 cc.

Crankshaft Grinding Table

Overhaul stage	Crankshaft Journals			Crankpins	
	Diameter of Journals	Journal width at locating bearing	Rear journal width	Crankpin diameter	Crankpin width
Standard size	69.96 / 69.94	34.000 / 34.025	34.000 / 34.100	51.96 / 51.94	32.000 / 32.100
1st Overhaul stage	69.71 / 69.69	34.000* / 28.025*		51.71 / 51.69	32.000
2nd Overhaul stage	69.46 / 69.44	to		51.46 / 51.44	to
3rd Overhaul stage	69.21 / 69.19	34.700* / 34.725*		51.21 / 51.19	32.300
4th Overhaul stage	68.96 / 68.94			50.96 / 50.94	

* Graded from 0.1 mm to 0.1 mm according to available thrust washers. (See Crankshaft Bearings, p. 00-2/5)

Machining Tolerances of Crankshaft Journals and Crankpins

Permissible out-of-round tolerance of crankshaft journals and crankpins		0.005
Permissible conicity		0.01
Permissible misalignment of crankpins with regard to crankshaft journals, related to bearing length		0.01
Permissible run-out of center crankshaft journal with crankshaft supported on the outside journals		0.02
Permissible lateral deflection of locating journal		0.015
Permissible radial deflection of flywheel flange related to three crankshaft journals		0.02
Permissible lateral deflection of flywheel flange related to three crankshaft journals		0.01
Fillet radii at crankshaft journals and crankpins		2.5 — 3
Hardness of crankshaft journals and crankpins	Scleroscope hardness	68 — 74
	Rockwell hardness	H Rc 55 — 61
Permissible unbalance of crankshaft The crankshaft is balanced together with the front counter-weight and the flyweel		15cmg

Crankshaft Bearing Play

	Radial play	End play
Crankshaft bearings	0.045 — 0.065	0.040 — 0.096
Connecting-rod bearings	0.045 — 0.065	0.120 — 0.259 repair stage up to 0.5

Crankshaft Bearings

Housing bore							74.500 — 74.519
Out-of-round tolerance of housing bore							0.01
Conicity tolerance of housing bore							0.01
Crush of bearing shell halves							+ 0.01
Diameter of crankshaft bearings with bearing shell halves installed	Standard size	Overhaul stages I	II	III	IV	V	VI
	69.99 / 70.02	69.74 / 69.77	69.49 / 69.52	69.24 / 69.27	68.99 / 69.02	—	—
Thickness of thrust washers	2.030 / 2.023	2.080 / 2.073	2.130 / 2.123	2.180 / 2.173	2.230 / 2.223	2.280 / 2.273	2.330 / 2.323

Dimensions of Connecting Rods

Base bore for connecting rod bearings		55.600 / 55.619
Base bore for piston pin bushing	Standard size	28.000 / 28.021
	Overhaul stage	28.500 / 28.521
Permissible out-of-roundness of base bore		0.01
Permissible conicity of base bore		0.01
Center-to-center distance of bores		153.95 / 154.05
Width of connecting rod		31.880 / 31.841
Permissible difference in weight between connecting rod assemblies in any one engine		5 g
Permissible departure from axial parallelity related to a length of 100 mm		0.03
Permissible longitudinal distortion, related to a length of 100 mm		0.1

Connecting Rod Bearings

Crush of bearing shell halves	+ 0,01				
Diameters of connecting rod bearings with bearing shell halves installed	Overhaul stages				
	Standard size	I	II	III	IV
	51.99 / 52.02	51.74 / 51.77	51.49 / 51.52	51.24 / 51.27	50.99 / 51.02

Piston Pin Bushings

External diameter of piston pin bushings	Standard size		1st Overhaul stage	
	28.048 / 28.035		28.548 / 28.535	
Internal diameter of piston pin bushings	rough-turned	final	rough-turned	final
	24.600 / 24.730	25.007 / 25.013	24.600 / 24.730	25.007 / 25.013
Force-fit dimension of piston pin bushings in connecting rod	minimum + 0.3			
After pressing in the piston pin bushings, the connecting rod should be unstressed for half an hour at 160—180° C.				

Piston Pins

Color code	Diameter of piston pins	Piston pin bushing bore	Clearance	Bore in piston
black	24.997 / 24.994	25.007 / 25.010	0.010 — 0.016	24.994 / 24.997
white	25.000 / 24.997	25.010 / 25.013	0.010 — 0.016	24.997 / 25.000

Connecting Rod Cap Bolts

Shank diameter	plain	10.008 / 10.001
	white	10.016 / 10.009

Pistons

Piston clearance	0.04				
Piston diameter	Cylinder bore less piston clearance				
Pistons available	Standard size	Intermediate stage	1st Overhaul stage	2nd Overhaul stage	3rd Overhaul stage
	84.96 84.97 84.98	85.21 85.22 85.23	85.46 85.47 85.48	85.96 85.97 85.98	86.46 86.47 86.48
Permissible difference in weight between the pistons in any one engine	4 g				

Piston ring clearance and gap		Clearance	Gap
1. Compression ring	10f85 x 77.6 x 2	0.035 — 0.062	0.55 — 0.70
2. Tapered compression ring	11f85 x 77.6 x 2.5		0.45 — 0.60
3. Novi stepped ring	85 x 3T 16 Nova		0.30 — 0.45
4. Novi slotted ring	85 x 5T 17 Nova		0.25 — 0.40

Flywheel

Clearance between clutch face and clutch clamping face	$29^{\pm 0.1}$	
Clearance between clutch face and flywheel attaching flange	new	overhaul
	12.5	up to 11.5
Departure from parallel between clutch face and clamping face for the crankshaft flange	0.05 mm at a diameter of 230 mm	

C. Engine Timing

Valves

	Valve head diameter	Shaft diameter	Length	Height of valve head	Valve seat angle	Hardness at valve shaft end
Inlet	$\frac{44.2}{44.1}$	$\frac{8.97}{8.95}$	128	1.5	90° + 30	HRc 55-61
Exhaust	$\frac{37.2}{37.1}$	$\frac{9.95}{9.93}$	112.75	2.25		

Valve Springs

	External diameter	Wire gage	Length L unloaded	Length L_1 depressed under load P_1		Length L_2 under final load P_2	
	mm	mm	mm	mm	kg	mm	kg
Inner	20.7	2.6	42	34.2	8.9	25.7	18.6^{+2}_{-1}
Outer	30.6	4	47	38.4	23.1	29.9	$45.9^{+4.5}_{-2.2}$

Camshaft and Camshaft Bearings

Overhaul stage	1st Bearing (Timing gear end)		2nd Bearing		3rd Bearing (Flywheel end)	
	Shaft	Bearing	Shaft	Bearing	Shaft	Bearing
Standard size	$\frac{34.975}{34.959}$	$\frac{35.000}{35.016}$	$\frac{44.975}{44.959}$	$\frac{45.000}{45.016}$	$\frac{45.975}{45.959}$	$\frac{46.000}{46.016}$
Intermediate stage	$\frac{34.875}{34.859}$	$\frac{34.900}{34.916}$	$\frac{44.875}{44.859}$	$\frac{44.900}{44.916}$	$\frac{45.875}{45.859}$	$\frac{45.900}{45.916}$
1st Overhaul stage	$\frac{34.725}{34.709}$	$\frac{34.750}{34.766}$	$\frac{44.725}{44.709}$	$\frac{44.750}{44.766}$	$\frac{45.725}{45.709}$	$\frac{45.750}{45.766}$

Camshaft (continued)

Permissible eccentricity of intermediate bearing surface, cam base circles and camshaft timing gear hub, with camshaft supported by the outside bearings	0.025	
Hardness of bearing journals and cam base circles	Brinell hardness HB in kg/mm²	Scleroscope hardness
	217 — 248	36 — 40
Hardness of cam nose incl. lifting flank	minimum 500	minimum 64

Camshaft Bearing Play

Radial play	End play
0.025 - 0.045	0.050 - 0.128

Chain Tensioner Pressure Spring

External diameter mm	Wire gage mm	Length L unloaded mm	Length L_1 depressed under load P_1		Length L_2 under final load P_2	
			mm	kg	mm	kg
15.6	1.1	118	44	1.85	38	$2^{+0.05}_{-0.10}$

Tension Sprocket and Bearing

Diameter of pivot pin in cylinder head	$\frac{9.995}{9.986}$
Bore in tension sprocket bearing	$\frac{10.000}{10.015}$
Diameter of pivot pin in tension sprocket	$\frac{19.980}{19.959}$
Bore in bushing	$\frac{20.000}{20.021}$
Radial play of tension sprocket bearing on pivot pin in cylinder head	0.005 — 0.029
Radial play of tension sprocket	0.020 — 0.062

Rocker Arms and Supports

Base bore in rocker arm	$\frac{12.000}{12.018}$	
External diameter of bushing	$\frac{12.039}{12.028}$	
Internal diameter of bushing	rough-turned	final
	9.6	$\frac{10\,000}{10.015}$
Bore in rocker arm block	$\frac{9.985}{10.000}$	
Diameter of rocker arm shaft	$\frac{9.987}{9.972}$	
Radial play of rocker arm on shaft	0.013 — 0.046	
Permissible departure from parallelity between sliding surface and bore measured over a length of 100 mm	0.01	

Jets and Technical Data

Name of Part	Stage 1	Stage 2
Air horn "K"	23	25
Main jet "Gg"	0125*	0170
Air correction jet "a"	180	200 c (with mixing tube)
Mixing tube "s"	44	—
Mixing tube holder with polyamide ball valve	Res. 5.5	—
Idle fuel jet "g"	g 50	—
Idle air jet "u"	1.0 (previously 1.5)	—
Float chamber vent	1.5 ⌀	—
Accelerator pump Injection amount	Nr. 841 (neutral) 1.0 - 1.2 cc./stroke	—
Pump jet "Gp"	80	—
Injection tube	high 0.5 graded	—
Starter fuel jet "Gs"	110	—
Starter air jet bore in starter slide	3.0 ⌀	—
Float needle valve	2.0	
Weight of float (nylon float)	7.3 g	
Fuel level	19 - 21	
Angle of throttle valve	8°	17°
By-pass bores	1.2 and 1.8 (previously 2 × 1.15)	—
Filling capacity of oil shock absorber — engine oil SAE 10 W		approx. 1.2 cc.

* For countries above 2000 m above sea-level the following optional main jets (SA 10 195) are available for carburetor adjustment:

0125 (standard size)	Part No. 000 071 31 35
0120	Part No. 000 071 32 35
0117.5	Part No. 000 071 56 35
0115	Part No. 000 071 29 35
0112.5	Part No. 000 071 57 35

E. Fuel Feed Pump

Delivery pressure (atm.)	at 700—750 rpm	at 5000 rpm
	0.15—0.20	0.25—0.30
Output at an engine speed of 5000 rpm (camshaft speed 2500 rpm) and feeding through a 2.0 mm float needle valve	35—40 liters per hour	
Performance is checked with a suction head of 900 mm and a delivery head of 400 mm with gasoline as a testing fluid		
Clearance between cam and tappet	0.4—0.5	

F. Intake and Exhaust Manifold

Heater Valve and Heater Valve Shaft

Base bore in exhaust manifold	13.000 / 13.018
External diameter of bushing	13.039 / 13.028
Internal diameter of bushing	10.132 / 10.159
Diameter of shaft	9.995 / 9.986
Radial play of shaft	0.137—0.173
End play of heater valve on each side	0.2—0.3

G. Distributor and Oil Pump Drive

External diameter of idling gear shaft	front: 19.980 / 19.959	rear: 17.960 / 17.940
Bore of front bushing	20.020 / 20.033	
Bore of rear bushing	18.000 / 18.018	
External diameter of helical gear	13.968 / 13.950	
Bore of bushing	14.000 / 14.018	
Radial play of idling gear shaft	front: 0.040—0.074	rear: 0.040—0.078
End play of idling gear shaft	0.05—0.12	
Radial play of helical gear	0.032—0.068	
Backlash	0.05—0.15	
Misaligment of all sprockets, measuring from sprocket on idling gear shaft	0.1	

Oil Pump

Bore in oil pump housing	$\frac{12.000}{12.018}$
Diameter of drive shaft	$\frac{11.984}{11.973}$
Diameter of oil pump spindle	$\frac{11.973}{11.964}$
Radial play of drive shaft	0.016—0.045
Radial play of oil pump spindle	0.027—0.054

Gear play		
Radial play	End play	Backlash
0.025—0.057	0.020—0.062	0.05—0.10
Minimum axial play between housing and cam		0.2

Oil Pump Output

Engine speed rpm	Output kg/min	Vacuum suction side mm Hg	Pressure delivery side atm.	Oil temperature °C	Type of oil
5000	$24.5^{-20\%}$	400	5	100°	Engine oil SAE 10

Oil Relief Valve in Main Oil Flow

Pressure spring						
External diameter	Wire gage	Length L unloaded	Length L_1 depressed under load P_1		Length L_2 under final load P_2	
mm	mm	mm	mm	kg	mm	kg
9.1—9.4	1.4	43.6	39	2.4	25	9.6
Opening pressure of oil relief valve				6 ± 0.5 kg/cm^2		

Oil Relief Valve in Oil Filter

Pressure spring						
External diameter mm	Wire gage mm	Length L unloaded mm	Length L_1 depressed under load P_1 mm	kg	Length L_2 under final load P_2 mm	kg
12.25	1.25	49	32	2.6	24	3.30
Opening pressure of oil relief valve			for metal filter		2 ± 0.2 kg/cm²	
			for paper filter		1.2 ± 0.2 kg/cm²	
The varying opening pressures are the result of varying initial tension of the springs						

I. Engine Cooling

Distance between impeller and water pump flange*	23 ± 0.2
V-belt tension	Depressed with moderate thumb pressure 5—10 mm

*see Figure 20-5/1

K. Rear Engine Suspension

Distance between front axle support and rubber buffer**	5

**see Figure 24-1/1

L. Torque Readings

Crankshaft bearing bolts		8 mkg
Connecting rod bearing bolts	stretch	0.1 mm
	in mkg	3.75 mkg
Cylinder head attaching screws	with engine **cold**	8 mkg
	with engine **warm**	9 mkg
Rocker arm bearing screws		3.75 mkg
Flywheel screws		6 - 6.5 mkg
Spark plugs		4 mkg

Clutch — Group 25

Flywheel

Distance between clutch face and flywheel recess	29 ± 0.1	
Distance between clutch face and flywheel attaching flange	new	overhaul
	12.5	down to 11.5

Clutch Disk

Thickness of clutch disk	released	compressed
	$10.3^{+0.3}$	$9.1^{+0.3}$
Permissible wear of total facing thickness	1	
Permissible run-out of clutch disk	0.5	
Free motion torque of clutch disk	12 mkg	
Stop angle of clutch disk	5° 30'	
Friction torque of clutch disk	0.4 - 0.6 mkg	
Permissible unbalance of clutch disk	5 cmg	

Clutch

Thickness of clutch pressure plate	new	overhaul
	15	down to 14
If more than 0.5 mm is removed, precision-ground steel shims of the thickness of the material removed must be placed between clutch springs and spring cups		
Distance between release levers and cover plate when clutch is installed in vehicle	when clutch disk is new	when clutch disk is worn
	17.8	up to 28.8

Clutch Springs

Color code	Number	External diameter mm	Wire gage mm	Free length mm	Length under final load mm	Length under final load kg
white	9	25.6	3.6	44.5	29.2	45^{+4}

Total spring pressure = contact pressure	410 kg

Permissible unbalance of clutch	max. 20 cmg

Clutch Adjustment Data

Clutch pedal free movement	25
Center clutch actuating lever eye to center pedal shaft	45 ± 4
Clearance between release lever and throw-out bearing	2

Gear Ratio and Number of Teeth

	Gear ratio	Number of teeth
1st gear	1 : 4.05	13/28
2nd gear	1 : 2.38	19/24
3rd gear	1 : 1.53	27/22
4th gear	1 : 1	—
Reverse gear	1 : 3.92	12/17/25
Constant (drive shaft: countershaft)	1 : 1.88	17/32

Backlash

1st gear	0.10 — 0.16
2nd gear	0.10 — 0.16
3rd gear	0.06 — 0.12
Reverse gear	0.10 — 0.20
Constant (drive shaft: countershaft)	0.06 — 0.12

Bearing Surfaces and Clearances of Main Shaft and Gears

	Diameter main shaft		Bore gear		Radial play		End play
1st gear	$\frac{35.000}{34.987}$		$\frac{42.018}{42.033}$		0.030 — 0.045		0.10 — 0.18
2nd gear	$\frac{35.000}{34.987}$		$\frac{42.018}{42.033}$		0.030 — 0.045		0.10 — 0.18
3rd gear	Plain bearing	Roller bearing	Plain bearing	Roller bearing	Plain bearing	Roller bearing	0.10 — 0.18
	$\frac{37.955}{37.946}$	$\frac{35.000}{34.987}$	$\frac{38.000}{38.016}$	$\frac{40.030}{40.005}$	0.045 — 0.070	0.030 — 0.058	

Longitudinal play of key	minimum 0.1

Bearing Surfaces of Countershaft and Counter Gears

	Diameter Countershaft	Bore Counter Gear
for counter gear 3rd speed	$\frac{35.033}{35.017}$	$\frac{35.000}{35.025}$
for counter gear 4th speed	$\frac{35.033}{35.017}$	$\frac{34.994}{35.010}$

Permissible eccentricity	of main shaft and countershaft 0.02

Reverse Gear and Shaft

Bore of bushing	Diameter of reverse gear shaft	Radial play	Force-fit dimension of bushing in gear
$\frac{20.065}{20.098}$	$\frac{20.000}{19.987}$	0.065—0.111	+ 0.01 to + 0.03 Ends expanded at 45° bushing must withstand an axial thrust of 15000 kg

Annular Grooved Bearing and Cylindrical Rollers

Designation	Location	Radial play	End play	Bore inner race	Diameter outer race	Width
Annular grooved bearing 6305 C 3 DIN 625	Countershaft	0.017 — 0.032	0.17—0.32	25	62	17
Annular grooved bearing 6306 N DIN 625	Main shaft *	0.008 — 0.022	0.10—0.20	30	72	19
Annular grooved bearing 6306 ZN DIN 625 (ZN with cover plate)	Drive shaft					
Roller cage 2x18 cylindrical rollers 3.5 × 8 DIN 5402 120 981 03 12	1st speed gear	0.030 — 0.045	minimum 0.10	Shaft diameter 35	Bore speed gear 42	21.4
Split roller cage 2×18 cylindrical rollers 3.5 × 8 DIN 5402 120 981 03 12	2nd speed gear					
2 Roller cages 2×28 cylindrical rollers 2.5×11.8 DIN 617 000 981 28 12	3rd speed gear**	0.030 — 0.058	minimum 0.20	35	40	15.5

* On the main shaft, only bearings marked X may be installed
(X = maximum rounding radius 2 mm)

** In the 1st version, the gear is supported on a plain bearing

Shaft Diameter for Ball Bearing Seat

Drive shaft	Main shaft	Countershaft
$\frac{30.009}{29.996}$	$\frac{29.996}{29.991}$	$\frac{25.000}{24.996}$

Clearance between Annular Grooved Bearings and Front and Rear Transmission Covers

Drive shaft and main shaft	0.00—0.05	Countershaft	only at rear transmission cover 0.15—0.20

Synchronizing Rings

Nose width	1st gear 10 mm	2nd, 3rd, and 4th gear 8.4 mm
Minimum distance between the short teeth of synchronizing ring and of the speed gear		0.5 mm

Sliding Sleeve

Thrust when sliding sleeve is disengaged	7—11 kg
Play of sliding sleeve until contact is established with 1st — 4th speed cone	0.8—1.3

Transmission Cover

Clearance between spacer tube or spacer rings and transmission cover in shift position	0.10—0.15

Spring Testing Table

	External diameter mm	Wire gage mm	Free length mm	Length under load mm	Length under load kg	Load tolerance %
Pressure springs 120 993 14 01	6	0.75	12.4	a) 8.2 b) 7.3	1.65 2.00	± 5
Pressure springs for shift forks, 1st and 2nd gear, 3rd and 4th gear 186 993 13 01	7.6	1.1	20.2	a) 15.5 b) 13.0	3.2 5.0	± 8
Pressure springs for reverse gear shift shoe 136 993 31 01	7.8	1.4	20.25	a) 15.5 b) 13.0	9.8 15.0	± 8

a) installed b) under final load

Shaft Diameters for Sealing Rings

	new	Repair stage	Thread
Drive shaft	29.900 / 29.848	down to 29.700	turn a left-hand thread-pattern after refinishing
Three-way flange on main shaft	38.000 / 37.840	37.340	turn a right-hand thread-pattern after refinishing

Permissible run-out of three-way flange at outside diameter	0.10
The three-way flange can be turned down to a minimum thickness of 8.5 mm	

Torque Readings

Front main shaft grooved nut	12 mkg
Rear main shaft grooved nut for attaching the three-way flange	14—15 mkg

Pedals — Group 29

Clutch Pedal

Free movement of clutch pedal	25
Distance between center of clutch actuating lever eye and center of pedal shaft	$45^{\pm 4}$

Clutch and Brake Pedal Bearings

Bushing oversize	+ 0.02 to + 0.06
Internal diameter of bearing bushings	$\frac{27.040}{27.073}$
External diameter of mounting tube	$\frac{26.980}{26.959}$

Adjustments — Group 30

Adjustment of Accelerator Pedal

See Job No. 30-3

Springs and Shock Absorbers — Group 32

A. Springs

a) Front Springs

Color Code for Front Springs

Color Code	Standard springs Part No. 120 321 14 04	Harder springs for bad roads as an optional extra (SA 10014) Part No. 120321 1904
	Trim dimension measured at P_{normal} in mm	
white	from 213 — 216	from 219.5 — 222
red	above 216 — 219	above 222 — 224.5
blue	above 219 — 222	above 224.5 — 227

In the case of the front springs, the varying trim dimensions are not equalized by spacers. When springs are replaced, only springs with the same color coding should therefore be installed on both sides.

Test Values of Standard Front Springs

Part No.	Maximum front axle load capacity kg	Free length of spring in mm	Trim dimension, i. e. spring length under normal load in mm	Load P norm. kg	Load P max. kg	Spring rate for 100 kg of load in mm	Wire gage in mm	Mean coil diameter in mm	Number of coils
120 321 14 04	770	339	216^{+6}_{-3}	570	819	21.7	15.1	110 ± 1	8.5

Test Values of Front Springs for Bad Roads (optional SA 10 014)

Part-No.	Maximum front axle load capacity kg	Free length of spring in mm	Trim dimension, i. e. spring length under normal load in mm	Load P norm. kg	Load P max. kg	Spring rate for 100 kg of load in mm	Wire gage in mm	Mean coil diameter in mm	Number of coils
120 321 19 04	770	334	$222^{+5}_{-2.5}$	570	844	19.7	15.25	$110^{\pm 1}$	8
Color code as for standard springs, see page 00—2/17									

* This spring is also suitable for the needs of sports enthusiasts.

b) Rear Springs

Color Code for Standard Rear Springs

Color code		Rear spring left Part No. 121 324 20 04 and Part No. 105 324 00 04*	Rear spring right Part-No. 121 324 21 04 and Part-No. 105 324 01 04*
		Trim dimension measured at P_{normal} in mm	
white	1 line	from 170.5 — 172,5	from 171 — 173
	2 lines	above 172.5 — 174.5	above 173 — 175
	3 lines	above 174.5 — 176.5	above 175 — 177
red	1 line	above 176.5 — 178.5	above 177 — 179
	2 lines	above 178.5 — 180.5	above 179 — 181
blue	1 line	above 180.5 — 182.5	above 181 — 183
	2 lines	above 182.5 — 184.5	above 183 — 185
	3 lines	above 184.5 — 186.5	above 185 — 187

* For reasons of standardization, recent models are provided with the same rear springs as Model 219.

Color Code for Rear Springs for Bad Roads and for Export Rear Springs (optional, SA 10 113/1 or 2)

Color Code		Rear spring left		Rear spring right	
		Part No. 121 324 22 04	Part No. 180 324 26 04*	Part No. 121 324 23 04	Part No. 180 324 27 04*
		Trim dimension measured at P_{normal} in mm			
white	1 line	from 182 — 184	from 186.5 — 188.5	from 182.5 — 184.5	from 187 — 189
	2 lines	above 184 — 186	above 188.5 — 190.5	above 184.5 — 186.5	above 189 — 191
	3 lines	above 186 — 188	above 190.5 — 192.5	above 186.5 — 188.5	above 191 — 193
red	1 line	above 188 — 190	above 192.5 — 194.5	above 188.5 — 190.5	above 193 — 195
	2 lines	above 190 — 192	above 194.5 — 196.5	above 190.5 — 192.5	above 195 — 197
blue	1 line	above 192 — 194	above 196.5 — 198.5	above 192.5 — 194.5	above 197 — 199
	2 lines	above 194 — 196	above 198.5 — 200.5	above 194.5 — 196.5	above 199 — 201
	3 lines	above 196 — 198	above 200.5 — 202.5	above 196.5 — 198.5	above 201 — 203

* For reasons of standardization, recent models are provided with the same rear springs as Model 220 S.

Color Code for Rear Springs for Special-Purpose Vehicles (optional, SA 10 154/1 or 2, and SA 10 155)

Color Code		Load Capacity (maximum rear axle load)		
		1100 kg		1250 kg
		SA 10 154/1 or 2		SA 10 155
		Rear spring left Part No. 121 324 12 04	Rear spring right Part No. 121 324 13 04	Rear springs, left and right Part No. 121 324 24 04
white	1 line	from 173.5 — 175.5	from 174 — 176	from 182 — 184
	2 lines	above 175.5 — 177.5	above 176 — 178	above 184 — 186
	3 lines	above 177.5 — 179.5	above 178 — 180	above 186 — 188
red	1 line	above 179.5 — 181.5	above 180 — 182	above 188 — 190
	2 lines	above 181.5 — 183.5	above 182 — 184	above 190 — 192
blue	1 line	above 183.5 — 185.5	above 184 — 186	above 192 — 194
	2 lines	above 185.5 — 187.5	above 186 — 188	above 194 — 196
	3 lines	above 187.5 — 189.5	above 188 — 190	above 196 — 198

Color Code, Corresponding Notch Position and Use of Rubber Compensating Ring

Rear spring Color Code		Corresponding Notch Position	Rubber Compensating Ring
white	1 line	4	yes
	2 lines	3	yes
	3 lines	2	yes
red	1 line	1	yes
	2 lines	4	no
blue	1 line	3	no
	2 lines	2	no
	3 lines	1	no

Test Values of Standard Rear Springs

Part No.	Load capacity (maximum front axle load**) kg	Free length of spring in mm	Trim dimension, i.e. spring length under normal load in mm	Load P norm. kg	Load P max. kg	Spring rate for 100 kg of load in mm	Wire gage in mm	Mean coil diameter in mm	Number of coils
121 324 20 04 left	890	296	178.5 ±8	627	867	18.75	16.2	135	5.25
121 324 21 04 right	890	293.5	179 ±8	645	899	17.75	16.2	135	5.0
105 324 00 04* left	920	299.5	178.5 ±8	644	848	18.75	16.2	135	5.25
105 324 01 04* right	920	296	179 ±8	660	880	17.75	16.2	135	5.0

* For reasons of standardization, recent models are provided with the same rear axle springs as Model 219. When replacing springs, make sure that matched springs are used at the left and at the right.

** Within the limits indicated, the permissible rear axle load depends on the load capacity of the tire (see also Job No. 40 — 0, Section B., Tires, and Job No. 40 — 3, Section C., Wheel Adjustment Data).

Test Values of Rear Springs (optional, SA 10 113/1 or 2, SA 10 154/1 or 2, and SA 10 155)

Part No.	Load capacity (maximum rear axle load**) kg	Free length of spring in mm	Trim dimension, i. e. spring length under normal load in mm	Load P norm. kg	Load P max. kg	Spring rate for 100 kg of load in mm	Wire gage in mm	Mean coil diameter in mm	Number of coils
Harder Rear Springs for Bad Roads and Export Rear Springs (optional, SA 10 113/1 or 2)									
121 324 22 04 left	950	281	190 ±8	697	1065	13.05	17.2	135	4.65
121 324 23 04 right	950	279	190,5 ±8	716	1108	12.38	17.2	135	4.4
180 324 26 04* left	950	294	194.5 ±8	668	970	14.9	17.0	135	5.05
180 324 27 04* right	950	292	195 ±8	686	1005	14.1	17.0	135	4.8

* For reasons of standardization, recent models are provided with the same rear springs as Model 220 S.

Note: If the springs 121 324 22 04/23 04 are installed, the standard shock absorbers must be replaced by shock absorbers of shorter stroke and larger diameter (Part No. 180 326 02 00, or Part No. 121 326 03 00) (see Job No. 32 — 1, Sections B and C).

Harder Rear Springs for Ambulances, Police Radio Cars, and for Special-Purpose Vehicles up to 1100 kg Rear Axle Load (optional, SA 10 154/1 or 2)									
121 324 12 04 left	1100	279	181.5 ±8	840	1168	11.62	18.0	135	5.0
121 324 13 04 right	1100	277	182 ±8	864	1210	11.0	18.0	135	4.7
Harder Rear Springs for Special-Purpose Vehicles such as Light Vans etc. up to 1250 kg Rear Axle Load (optional, SA 10 155)									
121 324 24 04 left and right are identical	1250	264.5	190 ±8	915	1510	8.14	19.2	135	4.5

* Within the limits indicated, the permissible rear axle load depends on the load capacity of the tires (see also Job No. 40 — 0, Section B, Tires, and Job No. 40 — 3, Section C, Wheel Adjustment Data).

Note: If the springs 121 324 12 04/13 04 or 124 324 24 04 are installed, the standard type rubber buffer stops (Part No. 120 320 04 44) must be replaced by stops as per Part No. 120 320 04 44.

B. Shock Absorbers

a) Front Shock Absorbers

Standard Type

Designation Color Make	Part No.	Dimensions of Shock Absorber in mm			Adjustment and Acceptance Values at n = 100 rpm		
		Outside diameter D	Stroke H	Compressed L	Stroke mm	Pull kg	Pressure kg
Front shock Absorber for Control Arm* 120 330 12 08 and 120 330 13 08							
Sov 26 x 130 black Fichtel & Sachs	000 323 60 00 (without reinforcement plate) 121 323 00 00** (with reinforcement plate)	38.4	130	239^{+2}	25 50 100	35 140 310	5 10 30
T 40 x 130 black Stabilus	000 323 56 00 (without reinforcement plate) 121 323 01 00** (with reinforcement plate)	44	130	244.5^{+2}	25 50 100	35 140 310	5 10 30
Front Shock Absorber for Control Arm* 180 330 00 08 and 180 330 01 08							
Sov 26 x 130 black Fichtel & Sachs	120 323 00 00	38.4	130	239^{+2}	25 50 100	35 140 310	5 10 30
T 40 x 130 black Stabilus	120 323 01 00	44	130	244.5^{+2}	25 50 100	35 140 310	5 10 30

* For reasons of standardization, on recent models the lower control arms (Part No. 120 330 12 08 or 13 08) have been replaced by the types used on Model 220 S (Part Nos. 180 330 00 08 and 180 330 01 08). On these control arms, the through-way hole for the shock absorber is larger (58 mm diameter instead of previously 48 mm diameter). For this reason, the shock absorber mounting has had to be changed accordingly. **When ordering, please make sure that the right type of shock absorber is specified.**

** Only shock absorbers with reinforcement plates are supplied as replacements.

Shock Absorber for Bad Roads and Export Shock Absorbers (optional, SA 10 113/1 or 2)

Designation Color Make	Part No.	Dimensions of Shock Absorber in mm			Adjustment and Acceptance Values at n = 100 rpm		
		External diameter D	Stroke H	Compressed L	Stroke mm	Pull kg	Pressure kg
T 50 x 130 black Stabilus	180 323 03 00*	56	130	244.5^{+2}	25 50 100	65 230 330	8 12—15 30

* If these shock absorbers are installed later, control arms with a small through-way hole (48 mm diameter, Part No. 120 330 12 08/13 08) must be replaced by control arms with a larger through-way hole (58 mm diameter, Part No. 180 330 00 08/01 08).

Shock Absorbers for Special-Purpose Vehicles (optional, SA 10 154/1 or 2, and SA 10 155)

Identical with Standard Type

b) Rear Shock Absorbers

Standard Type

Designation Color Make	Part No.	Dimensions of Shock Absorber in mm			Adjustment and Acceptance Values at n = 100 rpm		
		External diameter D	Stroke H	Compressed L	Stroke in mm	Pull kg	Pressure kg
Tov 30 x 140 red Fichtel & Sachs	121 320 03 31 (without reinforcement plate) 121 326 00 00* (with reinforcement plate)	46	140^{+1}_{-3}	251^{+2}	25 50 100	90 200 370 ± 20	20 25 35 ± 5
T 40 x 140 red Stabilus	000 326 41 00 (without reinforcement plate) 121 326 01 00* (with reinforcement plate)	44	140^{+1}_{-3}	254^{+2}	25 50 100	80 220 380	20 30 43
*Only shock absorbers with reinforcement plates are supplied as replacements.							

Shock Absorbers for Bad Roads and Export Shock Absorbers (optional, SA 10 113/1 or 2)

Designation Color Make	Part No.	Dimensions of Shock Absorber in mm			Adjustment and Acceptance Values at n = 100 rpm		
		External diameter D	Stroke H	Compressed L	Stroke mm	Pull kg	Pressure kg
T 50 x 130 red Stabilus	180 326 02 00	55	130	254.5^{+2}	25 50 100	80 220 380^{+20}_{-18}	20 30 43 ± 5

Shock Absorbers for Special-Purpose Vehicles (optional, SA 10 154/1 or 2 and SA 10 155)

Designation Color Make	Part No.	Dimensions of Shock Absorbers in mm			Adjustment and Acceptance Values at n = 100 rpm		
		External diameter D	Stroke H	Compressed L	Stroke mm	Pull kg	Pressure kg
Tov 36 x 130 red Fichtel & Sachs	000 326 45 00 (without reinforcement plate) 121 326 03 00* (with reinforcement plate)	55	130	242^{+2}	25 50 100	80 220 380^{+20}_{-18}	20 30 43 ± 5
* Only shock absorbers with reinforcement plates are supplied as replacements.							

King Pins and King Pin Bushings

King pin diameter	External diameter	Internal diameter rough-turned	Internal diameter final	Base Bore in Steering Knuckle
19.980 / 19.959	24.048 / 24.035	19.700 / 19.750	20.000 / 20.021	24.000 / 24.021

Radial play of king pin	0.02 — 0.052
End play of king pin	0.05 — 0.1

Radial Play	of threaded pin in bottom part of steering knuckle support	0.46
	of threaded bushing in top part of king pin	0.32
	of pivot pins in threaded bushings, top and bottom	0.45

Front Wheel Hub

Taper Roller Bearing Designation	Wheel spindle diameter	Internal diameter Roller bearing	External diameter Roller bearing	Internal diameter Wheel Hub
DIN 720 30 303	16.994 / 16.983	16.992 / 17.000	47.000 / 46.989	46.977 / 46.992
DIN 720 32 206	30.000 / 29.987	29.989 / 30.000	62.000 / 61.987	61.971 / 61.991

End play of wheel hub	0.000 — 0.005

Tie-Rods

Center-to-center distance of ball heads	approx. 457

Torque Readings

Fixing screws for sub-frame	4 mkg
Fixing screws for lower control arm	10—12 mkg

Rear Axle — Group 35

General

Gearing	Number of teeth drive pinion: ring gear	Gear ratio	Backlash
Gleason Hypoid	10 : 41	1 : 4.10	0.16

Bearings

Use	Designation	Internal diameter	External diameter	Radial play	End play
Annular grooved bearing for rear axle shaft*	180 981 00 25 special purpose bearing 6208 C 4 DIN 625	39.988 / 40.000	80.000 / 79.987	0.032-0.050	approx. 0.32-0.50
Angular contact bearing** with split inner race for drive pinion	000 981 04 27 000 981 07 27 (optional)	34.988 / 35.000	80.000 / 79.987	—	approx. 0.01-0.035
Cylindrical roller bearing for drive pinion	000 981 16 01	39.988 / 40.000	80.000 / 79.987	0.018-0.031	—
Taper roller bearing for differential	30 208 DIN 720	39.988 / 40.000	80.000 / 79.987	adjustable	adjustable

* On the rear axle shaft, only bearings with a rounding radius of 2 + 0.7 mm on the inner race may be used.
** A number of rear axles have also been fitted with angular contact bearing 3307 DIN 628 with one-piece inner race.

Rear Axle Shaft

Length left	Length right	Diameter for sealing ring retainer	Internal diameter of sealing ring retainer	Oversize	External diameter of sealing ring retainer	Diameter for outer sealing ring	Diameter at seat for annular grooved bearing
693	676 687*	34.059 / 34.043	34.000 / 34.025	+ 0.018 to + 0.059	37.700 / 37.540	50.000 / 49.840	40.013 / 40.002

Permissible diameter decrease at sealing surfaces	0.5
Brake drum fit	66.954—67.000

Permissible eccentricity	at sealing surfaces and ball bearing seat	at splines
	0.02	0.1
Permissible run-out	0.1	

Thread on outside sealing surface of rear axle shaft	Left shaft	Right shaft
	right thread	left thread

* Rear axle shafts with locking device for the sliding sleeve

Left Axle Tube

Fitting length	Parallel deviation of flange surfaces	Bore for annular grooved bearing	Depth of bore for annular grooved bearing	Bore for taper roller bearing
599.5 ± 1	0.1	79.985 / 80.004	20.00 0.1	79.985 / 79.999

Right Axle Tube

Length from flange to center fork eyes	Parallel deviation between center fork eyes and flange	Bore for annular grooved bearing	Depth of bore for annular grooved bearing	Distance between eyes	Parallelity of eyes	Width of eyes	Permissible decrease at inner face of each eye
$670.5^{\pm 1}$	0.1	$\frac{79.985}{80.004}$	$20.00^{+0.1}$	$115^{+0.2}$	0.05	$\frac{25.960}{25.876}$	0.3

Bore of eyes	External diameter of bushings	Oversize	Bore of bushing	Sleeve on connecting pin	Clearance
$\frac{38.000}{38.025}$	$\frac{38.059}{38.043}$	+ 0.018 to + 0.050	$\frac{33.000}{33.025}$	$\frac{32.975}{32.950}$	0.025 to 0.075

Clearance between axle tube and rear axle housing	max. 0.1

Supporting Tube

Bore in axle tube	External diameter of supporting tube	Oversize
$\frac{26.000}{26.021}$	$\frac{26.048}{26.035}$	+ 0.014 to + 0.048

Rear Axle Housing

		Bore in housing	External diameter of bearing	Force-fit dimension or clearance
For drive pinion	Angular contact bearing with split inner race	$\frac{79.994}{80.013}$	$\frac{80.000}{79.987}$	— 0.026 to + 0.006
	Cylindrical roller bearing	$\frac{79.985}{80.004}$	$\frac{80.000}{79.987}$	— 0.017 to + 0.015
For differential	Taper roller bearing	$\frac{79.985}{79.999}$	$\frac{80.000}{79.987}$	— 0.012 to + 0.015

Distance of contact surfaces for eyes of right axle tube	110.9—111
Permissible decrease each side	0.3
Diameter of bore	27.983—27.996

Connecting Pin and Sleeves

Type	Color code	Connecting pin external diameter	Bore in sleeve	Oversize
I	white	$\frac{28.000}{27.994}$	$\frac{27.983}{27.989}$	+ 0.005 to + 0.017
II	blue	$\frac{27.993}{27.987}$	$\frac{27.976}{27.982}$	

Permissible run-out of connecting pin	0.1

Differential Gear

Drive Pinion

	at ball bearing seat	at splines
Permissible eccentricity	0.005	0.03
Permissible run-out	0.005	

	Bearing seat on shaft	Internal diameter of bearing	Force-fit dimension or clearance
Angular contact bearing	$\frac{35.006}{34.995}$	$\frac{34.988}{35.000}$	— 0.005 to + 0.018
Cylindrical roller bearing	$\frac{40.013}{40.002}$	$\frac{39.988}{40.000}$	+ 0.002 to + 0.025

Universal Joint Flange

Permissible run-out, measured at outside diameter	0.02
When repairs are necessary, the universal joint flange can be turned down to a minimum thickness of 5.70 mm	
Diameter of sealing surface	$\frac{35.000}{34.840}$
When repairing, the sealing surface can be reconditioned; maximum removal of stock 0.5 mm	

Differential

	Type	Color code	Differential pinion shaft	Bore in differential gear housing	Oversize
Differential pinion shaft	I	white	$\frac{17.023}{17.012}$	$\frac{17.000}{17.010}$	+ 0.002 to + 0.003
	II	blue	$\frac{17.034}{17.023}$	$\frac{17.011}{17.021}$	

Bore in differential pinion gear	$\frac{17.07}{17.72}$
Play of differential pinion gears on differential pinion shaft	0.036—0.108
External diameter of bearing surfaces at differential side gears	$\frac{35.475}{35.450}$
Bore in differential gear housing	$\frac{35.500}{35.525}$
Play of differential side gears in differential gear housing	0.025—0.075
Clearance between shim plate and differential gear housing	0.05—0.1

Differential (continued)

Ring gear	Diameter at differential housing		Bore in ring gear	Force-fit dimension
	$\frac{107.035}{107.013}$		$\frac{107.000}{107.013}$	0,000 to + 0,035
	Permissible run-out		Permissible eccentricity	
	0.005		0.01	
Seat and bore of taper roller bearings	Designation of bearing	Inner race of bearing diameter	Bearing seat at differential housing diameter	Force-fit dimension
	Taper roller bearing 30 208 DIN 720	$\frac{39.988}{40.000}$	$\frac{40.030}{40.014}$	+ 0.014 to + 0.042

Sliding Joint

Type	Color code	Needle bearing bushing external diameter	Bore in yokes	Force-fit dimension or clearance	Needle bearing bushing internal diameter	Trunnion diameter	Clearance
I	1 white dot	$\frac{29.502}{29.512}$ $\left(\frac{29.522}{29.515}\right)^*$	$\frac{29.500}{29.510}$	-0.008 to $+0.012$ $\left(\begin{matrix}+0.005\\ \text{to}\\ +0.022\end{matrix}\right)^*$	$\frac{22.641}{22.620}$	$\frac{17.600}{17.589}$	0.02 to 0.05
II	2 white dots	$\frac{29.513}{29.523}$ $\left(\frac{29.528}{29.523}\right)^*$	$\frac{29.511}{29.521}$	-0.008 to $+0.012$ $\left(\begin{matrix}+0.002\\ \text{to}\\ +0.017\end{matrix}\right)^*$			

* Previous dimensions

Torque Readings

Screws attaching ring gear to differential	7—8 mkg
Right threaded ring in rear axle housing	4 mkg
Roller cage in rear axle housing	50—80 cmkg
Grooved nut for drive pinion shaft	14—16 mkg
Adjusting screws for pressure ring at angular contact bearing on drive pinion shaft	2.5 mkg
Hexagon screw to connecting pin	10—12 mkg
Castle nut for torque arm at step bearing	8 mkg

Wheels and Tires, Adjustment of Wheels — Group 40

Wheels

	Rim width	Rim diameter	Rim circumference (measured circumference)	Permissible eccentricity	Permissible run-out	Permissible unbalance
$4^1/_2$ K × 13—B (Standard)	114.3 ±1	328.7	1032.6 ±1	1.5	1.5	750 cmg
$4^1/_2$ K × 15—A optional (SA 10 174/1)	114.3 ±1	379.5	1192.2 ±1.2	1.5	1.5	750 cmg

Tires

Standard	low-pressure tire 6.40 — 13 4-ply
Optional (SA 887/1—120)	low-pressure tire 6.40 — 13 6-ply
Optional (SA 10 215)	low-pressure tire 6.70 — 13 4-ply
Optional (SA 10 135/1)	low-pressure tire 6.70 — 13 6-ply
Optional (SA 10 173)	low-pressure tire 6.70 — 13 6-ply — transport type —
Optional (SA 10 174/1)	low-pressure tire 6.40 — 15 4-ply

Effective dynamic radius		at 60 km/h	at 100 km/h	at 140 km/h
Tire size	6.40 — 13	299 ±3	305 ±3	314 ±3
	6.70 — 13	307 ±3	313 ±3	319 ±3
	6.40 — 15	326 ±3	331 ±3	338 ±3

Permissible Axle Load for various Types of Tire

Type of tire	Permissible axle load kg	Specified tire pressure atm.
6.40 — 13 4-ply	approx. 880	1.9
6.40 — 13 6-ply	approx. 900	2.0
6.70 — 13 4-ply	approx. 950	1.8
6.70 — 13 6-ply	approx. 1000	2.0
6.70 — 13 6-ply — transport type —	approx. 1100	2.25
	approx. 1150	2.50
	approx. 1200	2.75
	approx. 1250	3.00
6.40 — 15 4-ply	approx. 900	1.7

Tire Pressure

	For normal driving			For continuous fast freeway driving	
	Cold tires	Increases after prolonged city driving or limited highway travel to	Increases after fast highway travel to	Cold tires	Increases after fast highway travel to
Front wheels	1.7 atm.	1.8 atm.	1.9 atm.	1.9 atm.	2.1 atm.
Rear wheels and spare wheel	1.8 atm.*	2.0 atm.	2.1 atm.	2.0 atm.	2.3 atm.

* If car is fully loaded (6 persons and luggage), the rear wheel tire pressure must be increased to 1.9 atm. with tires cold.

Wheel Adjustment Data

Load condition	Front axle							Rear axle						Wheel-base: permissible difference mm
	Camber	Toe-in mm	Track angularity differential at 20° lock of inner wheel	Caster	King pin inclination	Pivot point distance mm	Axle positioning distance: permissible difference mm	Camber left	Camber right	Toe-in or toe-out mm	Center position permissible deviation mm	Axle positioning distance: permissible difference mm	Permissible misalignment up to	
Curb Weight	+0° to +1°*	0 — 2	—	2° 50'* to 4°	5° 20' to 5° 40'	34 ± 2	5	approx. +1° 30'	approx. +1° 45'	0 ± 2	2	3	0° 20'	5
Normal load	+0° to +1°*	0 — 2	—2° 30'*	3° 10'* to 4° 10'	5° 20' to 5° 40'	34 ± 2	5	—2° 30'** to —3° 30'	—3°** to —4°	0 ± 2	2	3	0° 20'	5

* The difference between left and right wheel camber should be as small as possible; maximum permissible difference 0° 30'. Preferable front wheel camber + 0° 20' to + 0° 40'.

** The difference in camber of the rear wheels is approx. 0° 30' with the car loaded, approx. 0° 15' in curb condition.

Track	1430	1470
Smallest turning circle diameter		10.7 m
Smallest track circle diameter		10.0 m

Propeller Shaft — Group 41

Shaft Yoke and Needle Bearing Bushings

Type	Marking	External diameter of needle bearing bushing	Bore in shaft yoke	Force-fit dimension	Internal diameter of needle bearing bushing	Trunnion diameter	Clearance
I	1 white dot	$\frac{26.022}{26.015}$	$\frac{26.000}{26.010}$	+ 0.005 to + 0.022	$\frac{20.107}{20.120}$	$\frac{15.100}{15.089}$	0.02 to 0.05
II	2 white dots	$\frac{26.028}{26.023}$	$\frac{26.011}{26.021}$	+ 0.002 to + 0.017			

General

Pressure in hydraulic system	with brake pedal depressed	with brake released (residual pressure)
	60 — 80 atm.	0.4 — 0.8 atm.
Check of brake fluid level	1 — 2 cm below top edge of fluid reservoir	
Capacity of fluid reservoir (ATE blue brake fluid)	0.35 lit.	
Dimensions of brake fluid lines	Bundy steel tube 6 × 1 mm ⌀ and 5 × 0.75 mm ⌀, on recent models 4.75 × 0.72 mm ⌀	

Brake Master Cylinder

Brake master cylinder diameter	1″ = 25.4 mm
Bore	25.400 — 25.502
Brake master cylinder diameter with ATE Power Brake T 50 installed	1 1/16″ = 26.98 mm
Bore	26.980 — 27.082
Permissible out-of-roundness of cylinder bore	0.03
Piston diameter	25.252 — 25.335
Piston diameter with ATE Power Brake T 50 installed	26.832 — 26.915
Piston clearance	0.065 — 0.250

Clearance between piston and push rod	approx. 1
Brake pedal free play	6 — 8

Front Brake Wheel Cylinder

Brake wheel cylinder diameter	1 1/8"
Bore	28.570 — 28.672
Permissible out-of-roundness of cylinder bore	0.03
Piston diameter	28.505 — 28.422
Piston clearance	0.055 — 0.250

Rear Brake Wheel Cylinder

Brake wheel cylinder diameter		1", on recent models 15/16"
Bore for	1" ∅ version	25.400 — 25.502
	15/16" ∅ version	23.810 — 23.912
Permissible out-of-roundness of cylinder bore		0.03
Piston diameter for	1" ∅ version	25.335 — 25.252
	15/16" ∅ version	23.662 — 23.745
Piston clearance		0.065 — 0.250

Brake Shoes

	Anchor pin diameter	Bore in brake shoe	Radial play
Brake shoe suspension	15.968 / 15.941	16.000 / 16.027	0.032 — 0.086

Permissible wear of brake lining	down to 1.5
Permissible departure from vertical of brake shoe	0.5
Brake shoe external diameter 1.5 mm smaller than brake drum internal diameter	
Brake shoe toe slightly chamfered for approx. 15 mm	

Automatic Brake Shoe Adjustment

Brake	Adjusting sleeve		Pin diameter	Clearance between pin and adjusting sleeve
	Internal diameter	Length		
front	$\frac{12.000}{12.058}$	36	$\frac{11.200}{11.173}$	0.800 — 0.885
rear	$\frac{12.000}{12.058}$	30	$\frac{11.000}{10.973}$	1.000 — 1.085

Clearance between pin and adjusting sleeve	front wheel brake	rear wheel brake
measured in the direction of the longitudinal bore	0.8	1
measured in a direction perpendicular to the brake shoe	0.6	0.8
Adjusting force	60 — 90 kg	

Thickness of friction washers	2.5 ± 0.1
Thickness of thrust washers	2.0 ± 0.05

Brake Drum

Internal diameter of brake drum	new	repair stage
	$230 + 0.2$	up to 232
Diameter of center bore	67.00 — 67.03	
Permissible out-of-roundness	0.05	
Permissible eccentricity	0.1	
Permissible taper	0.1	
Permissible run-out above the bores for the wheel bolts	0.1	
Permissible unbalance	200 cmg	

Spring Testing Table

Type of spring		Free length mm	Length under load mm	Length under load kg
Pressure spring for brake master cylinder	on 1" ∅ version	73	57	3.2
	on $1^{1}/_{16}$" ∅ version	72.5	56.5	3.2
Pressure spring for brake wheel cylinder	front wheel	35	20	$1.2^{\pm 10\%}$
	rear wheel	45	30	$1.2^{\pm 10\%}$
Pressure spring for brake shoe suspension of rear wheel brake		54.5	26.5	$23.8^{+10\%}_{-5}$
Return spring for brake shoe	front wheel	85.5	103* 114**	$25^{+10\%*}_{-5}$ $36.6^{+10\%**}_{-5}$
	rear wheel	118.5	130.5* 146.5**	$18^{+10\%*}_{-5}$ $33.5^{+10\%**}_{-5}$
Pressure spring for automatic brake shoe adjustment		16.4	13	120—140
Pressure spring for guide pin for automatic brake shoe adjustment on front wheel		15.7	11.5	$15^{\pm 5\%}$
Return spring for brake lever		57	64* 77**	$7^{+10\%*}_{-5}$ $14.55^{+10\%**}_{-5}$
Return spring for equalizer lever of hand brake		88	128.5* 198.5**	$4.2^{\pm 10\%*}$ $8^{\pm 10\%**}$

* pre-tension
** final tension

Play in Steering Assembly Units

Permissible play, measured at steering wheel circumference	max. 25

Steering Gear Housing, Steering Shaft and Steering Worm

Steering shaft	Upper and lower bearing bushing			Steering gear housing
Bearing diameter	Internal diameter rough-turned	Internal diameter final	External diameter	Base bore diameter
29.993 / 29.980	29.5 / 29.6	30.000 / 30.013	32.059 / 32.043	32.000 / 32.025

Taper roller bearing				Steering worm	Steering gear housing
Part No.	Internal diameter	External diameter	Width	Bearing seating diameter	Base bore diameter
000 981 03 18	19.590 / 19.600	44.475 / 44.450	14.180 / 14.448	19.615 / 19.602	44.470 / 44.495

Pressure Spring

External diameter	Wire gage mm	Free length mm	Length under load	
			mm	kg
$17.5^{-0.1}$	3.5	$23.6^{\pm 0.2}$	18.7	80^{+10}_{-5}

Pressure Sleeve

External diameter	Internal diameter	Length
22.048 / 22.035	17.8 / 18.0	22

Pressure Screw

External diameter	Internal diameter	Tightening of pressure screw in cover
M 28 x 1.5	22.2 / 22.3	Tighten hard, then 3-4 mm back, measured around circumference of pressure screw

Steering Gear Arm

Crank	$39^{\pm 0.3}$

Steering Relay Arm

Trunnion bearing	Bearing bushing			Steering relay arm
Base bore diameter	External diameter	Internal diameter rough-turned	Internal diameter final	Bearing diameter
22.000 / 22.021	22.048 / 22.035	17.7 / 17.8	18.006 / 18.024	17.984 / 17.966
Permissible radial play of steering relay arm			0.022 — 0.058	
Oversize dimension of bearing bushing			0.014 — 0.048	

Radiator

Cooling water temperature		70—95° C
Cap	Pressure	1 atm.
	Vacuum	0.1 atm.
Radiator testing pressure when pressing out		0.5 atm.
Distance between radiator and fan		Top 20 + 2
		Bottom 10 + 2

V-belt tension	Depression with moderate thumb pressure 5—10 mm

Cooling Water Thermostat

Cooling water thermostat	begins to open	78°—79° C
	fully opened	91°—94° C
Stroke of valve head		8—9
Water circulation at a water temperature of 15°—20° C and a water pressure of 1 atm.		50—70 l/h

A. Starter

General

Designation	EED 0.8 / 12 R 30
Adjusting dimension for solenoid switch (see Fig. 15 — 2/2)	a = 32.4 ± 0.1

Test Values

Voltage under load	Current under load	Speed
Volts	amp.	rpm
9.5	160 — 180	1100 — 1250

Note: The test should be made with a well-charged 12 volt battery with a capacity of 135 Amp/h

B. Generator

General

Designation	Generator LJ / GEG 160/12 — 2500 R 8	
	Regulator RS / UA 160/12/15	
Minimum permissible diameter of commutator when reconditioned		31.5
Permissible run-out	of commutator 0.03	of armature core laminations 0.05
Springs for carbon brushes	Brush pressure 450—500 g	

Test Values

Generator LJ/GEG 160/12 — 2500 R 8				Regulator RS/UA 160/12/15	
Regulating voltage Volts	Cut-in speed rpm	Load at rated output watts	Speed at rated output rpm	Starting of regulator at rated output (given battery and load conditions) amp.	Return current amp.
engine idling without battery 13.8 — 14.8	2050	160	2560	17.5 — 20.5 cold 19.5 — 22.5 warm	2.5 — 7.5

Note: When the generator is tested, the brushes must be well run in. At normal operating speeds and rated load there must be no arcing of the commutator

C. Ignition Coil

Designation	TK 12 A 3

Test Values

Spark length	14 mm	Primary current	1.3 amp.

D. Distributor

General

Designation	VJU 4 BR 14 m K
Contact gap	0.40 — 0.50
Angle of closure	48° — 52°
The angle of closure must not change by more than 3° over the whole speed range	
Contact pressure of contact breaker	400 — 500 g
Permissible end play of distributor shaft	0.1 — 0.2

Test Values

Angular distance	90° ± 1°
Movement curve	see Job No. 15 — 23
Leakage test of vacuum control	A vacuum of 600 mm Hg must not fall off by more than 10% within 2 minutes
Continuous run test	15 minutes under standard operating conditions rated voltage 12 volts spark length 7 mm speed n = 500 rpm
Test at maximum speed (distributor speed)	Speed (of distributor) n = 3000 rpm spark length 7 mm
Test of starting output	Battery voltage 8 volts spark length 9 mm test period ½ minute speed (of distributor) n = 100 rpm

E. Spark Plugs

General

Spark plugs without suppressors	Spark plugs with suppressors
Bosch W 175 T 7 "N" Beru 175/14 Lu_3 Champion 730	Bosch W 175 RT 7 "N" Beru E 175/14 Lu_3 Champion X 730
Electrode gap	
0.7 — 0.8	0.9 — 1.0

F. Battery

General

Voltage	12 volts	Capacity	55 Ah
Cell voltage		standard	2 — 2.2 volts
		minimum	1.8 volts
Acid level		10 mm above top edge of separators 15 mm above top edge of plates	
Charging current in amp.	initial charging	3.5 amp.	
	ordinary recharging	5.6 amp.	
	quick charging	40 amp.	
Acid temperature	standard	16 — 32° C	
	maximum	40° C	
	maximum (tropics)	50° C	

Acid Density and Specific Gravity

Acid density according to Beaumé	Specific gravity	Condition
32° Bé	1.285	fully charged
27—25° Bé	1.23—1.21	semi-charged
18—14° Bé	1.14—1.11	discharged

(The density values are given for + 20° C)

Acid Density (Tropics)

Specific gravity at			Condition
20° C	40° C	60° C	
1.23	1.215	1.200	fully charged
1.16	1.148	1.136	semi-charged
1.09	1.080	1.070	discharged

G. Set of Bulbs

Use	Number	Wattage each	Remarks
Upper beam/lower beam	2	35/35	
Fog lights (optional)	2	35	
Parking beam	2	5	
License and trunk compartment lamps	2	5	tubular
Tail lamp	2	5	tubular
Stop lamp	2	15	tubular
Instrument and clock lamps	4	2	
Beam indicator	1	2	
Charge indicator	1	3	tubular
Choke control indicator	1	2	
Signal indicator	1	2	
Flash signal, front	2	15	
Flash signal, rear	2	15	tubular
Reversing lamp	1	15	tubular
Parking lamp right (front)	1	2	
Parking lamp right (rear)	1	2	tubular
Parking lamp left (front)	1	2	
Parking lamp left (rear)	1	2	tubular
Interior lighting	1	5	tubular