Technical Data

T

Engine

Design	4-cycle, internal-combustion engine in unit with clutch, transmission and differential in rear of car
Number of cylinders	4
Arrangement of cylinders	Two pairs horizontally opposed
Bore	75 mm (2.953″)
Stroke	64 mm (2.520″)
Capacity	1131 c. c. (69.014 cu. ins.)
Compression ratio	5.8
Total weight, dry	Approx. 90 kg (198 lbs.)
Cylinders	Single cylinders of special grey cast iron
Cylinder head	One for two cylinders, light alloy
Crankshaft	Forged, 4 bearings
Main bearings, 1, 3 and 4	Precision-insert bushings
Main bearing 2 (center)	Precision-insert shells
Connecting rod bearings	Lead-bronze, steel-backed
Piston pin bearing	Pressed-in bronze bushing
Piston	Light metal with steel reinforcement
Piston rings	2 compression rings 1 oil ring
Valve actuating mechanism	1 camshaft situated below crankshaft, valves operated via push rods and rocker arms
Camshaft	Cast, 3 bearings machined in crankcase
Camshaft drive	Helical gears
Valve arrangement	Overhead
Valve clearance, intake	0.10 mm (.004″) } in cold condition of engine
exhaust	0.10 mm (.004″) } in cold condition of engine
Valve timing (with a valve clearance of 1 mm / .04″)	
Intake opens	2°30′ before T. D. C.
Intake closes	37°30′ after B. D. C.
Exhaust opens	37°30′ before B. D. C.
Exhaust closes	2°30′ after T. D. C.
Cooling system	Air cooling by fan on generator shaft
Fan drive	From crankshaft through V-belt
Cooling air intake	Thermostat-controlled
Amount of cooling air	18 cubic feet per second at 3300 engine r. p. m.
Lubrication	Pressure feed lubrication by gear pump
Oil cooling	Oil cooler situated in air stream
Oil pressure control	By warning light
Ignition	Battery ignition
Ignition coil	Bosch TE 6 A 3
Ignition distributor	Bosch VE 4 BRS 383
Spark timing	5° before T. D. C.
Firing order	1—4—3—2
Spark advance	by centrifugal mechanism
Breaker point gap	0.4 mm (.016″)
Spark plugs	14 mm thread, heat range 175 Bosch W 175 T 1 Beru 175/14 u 2 Lodge H 14 Champion L 10 AC 44
Spark plug gap	0.6—0.7 mm (.024″ to .028″)

Clutch

Design	Single disc, dry
Pedal free play	10 to 20 mm (.4″ to .8″)

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Fuel System

Carburetor	Downdraught, SOLEX 28 PCI, with accelerator pump
Venturi	20 mm
Main jet	105
Pilot jet	50
Pilot jet air bleed	0.8 mm
Air correction jet	190
Emulsion tube	10
Float needle valve	1.5
Float, weight	12.5 g (.44 oz.)
Pump jet	50
Pump air correction jet	2.0
Air cleaner	Felt cone type, oil-bath type in dusty areas
Fuel pump	SOLEX diaphragm type
Feeding pressure	0.09 to 0.13 atm. (1.28 to 1.85 lbs./sq. in.)
Fuel delivery via float needle valve	min. 10 l/h. (approx. 2.5 gals.) at 3000 engine r. p. m.
Fuel filter	Strainer and water excluder at fuel tap

Electrical System

Electrical system	6 V with voltage regulator
Battery	6 V 70 ampere hours
Generator	Bosch RED 130/6—2600 AL 16
Regulator	Bosch RS/G 130/6/11 on generator
Ratio, cranksh. — Generator shaft	Approx. 1 : 2
Generator commences to charge	At approx. 1800 r. p. m. of the generator
Starter motor	Bosch EED 0.4/6 L 4

Transmission Final and Drive

Transmission	4 speeds forward, 1 reverse
De Luxe	2nd, 3rd and 4th gears helically-cut and silent, provided with cone-type synchro-devices
Gear ratios	First 3.60 : 1
	Second 1.88 : 1
	Third 1.22 : 1
	Fourth 0.79 : 1
	Reverse 4.63 : 1
Standard	3rd and 4th gear helically-cut and silent
Gear ratios	First 3.60 : 1
	Second 2.07 : 1
	Third 1.25 : 1
	Fourth 0.80 : 1
	Reverse 6.60 : 1
Gear control	Manually through linkage, ball-type shift lever on frame tunnel
Final drive	Helically-cut drive pinion and ring gear, bevel type differential, swinging half axles
Ratio	4.43 : 1 (Klingelnberg)
	4.37 : 1 (Gleason)

Chassis

Frame	Central tubular backbone with large head for mounting the front axle, forked at the rear to accommodate the power unit
Wheel suspension: front	Independent, two longitudinal torsion arms on either side
rear	Independent, swinging half axles, one longitudinal spring plate on either side
Spring: front	Two square torsion bar springs of 6 steel bands each
rear	One round torsion bar on each side
Adjustment of rear torsion bars, unloaded	13° ± 30′ inclination of the spring plate
Shock absorbers: front and rear	Double acting, telescopic
Steering	Worm and sector gear with divided tie rod
Total ratio	14.15
Turns of steering wheel, lock to lock	2.4
Smallest turning circle	About 11 m (36 ft.)
Toe-in (car unladen)	1—3 mm (0.04″ to 0.12″)
Camber	0°40′ ± 30′
King pin inclination	4°20′
Caster (front axle tubes)	2°30′ ± 30′
Wheels	Disc wheels with drop-center rims 4 J x 15
Tires	5.60—15
Tire pressures	
1—2 Occupants	Front 1.1 atm. (16 lbs./sq. in.)
	Rear 1.4 atm. (20 lbs./sq. in.)
3—4 Occupants	Front 1.2 atm. (17 lbs./sq. in.)
	Rear 1.6 atm. (23 lbs./sq. in.)
Brakes	
De Luxe: foot brake	Hydraulic (Ate), acting on all wheels
hand brake	Mechanical, acting on rear wheels
Standard: foot brake	Mechanical, acting on all wheels
hand brake	Mechanical, acting on all wheels
Braking area: front	260 sq. cm (40.3 sq. ins.)
rear	260 sq. cm (40.3 sq. ins.)
Lubrication system	Single lubrication points

Dimensions and Weights

Wheel base	2400 mm (7 ft. 10.5 ins.)
Track: front	1290 mm (4 ft. 3 ins.)
rear	1250 mm (4 ft. 1.2 in.)
Length	4070 mm (13 ft. 4 ins.)
Width	1540 mm (5 ft. 1/2 in.)
Height	1500 mm (4 ft. 11 ins.)
Smallest ground clearance with the car fully laden	172 mm (6.8 ins.)
Angle of approach	25°
Angle of departure	13°30′

		Sedan	Sedan with sunshine roof	Convertible 4-seater
Net weight	kg	710	710	780
Weight, ready for use	kg	730	730	800
Maximum load	kg	380	380	360
Total weight	kg	1110	1110	1160
Max. load on front axle	kg	450	450	480
Max. load on rear axle	kg	660	660	680
Weight of chassis	kg	435	435	435

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Capacity

Fuel tank	40 liters, including 5 liters reserve (10.5 U. S. Gals.; 8.8 Imp. Gals.)
Crankcase	2.5 liters (5.3 U. S. pints; 4.4 Imp. pints)
Transmission case	2.5 liters (5.3 U. S. pints; 4.4 Imp. pints) Refilling quantity: 2 liters (4.2 U. S. pints; 3.5 Imp. pints)
Steering	0.125 liter (0.26 U. S. pint; 0.22 Imp. pint)
Brake	0.25 liter (0.5 U. S. pint; 0.4 Imp. pint)
Oil bath air cleaner	0.25 liter (0.5 U. S. pint; 0.4 Imp. pint)

Performance

Performance	25 BHP at 3300 r. p. m.
Max. torque	7 mkg (51 ft. lbs.) at 2000 r. p. m.
Average piston speed	6.42 meters per second (1263 ft.) at 3000 r. p. m.
Maximum and cruising speed	100 km p. h. (62 miles) at 3000 r. p. m.

Speeds at 3000 r. p. m.

	De Luxe	Standard
1st speed	approx. 22 km. p. h. (14 miles)	22 km. p. h. (14 miles)
2nd speed	approx. 42 km. p. h. (26 miles)	38 km. p. h. (24 miles)
3rd speed	approx. 65 km. p. h. (40 miles)	63 km. p. h. (39 miles)
4th speed	approx. 100 km. p. h. (62 miles)	100 km. p. h. (62 miles)
Reverse	approx. 16 km. p. h. (10 miles)	12 km. p. h. (7 miles)

Hill climbing ability (car laden with two persons, on normal road)

	De Luxe	Standard
1st speed	approx. 33 % (18.5°)	33 % (18.5°)
2nd speed	approx. 16 % (9°)	18 % (10°)
3rd speed	approx. 9.5 % (5.5°)	9.5 % (5.5°)
4th speed	approx. 5 % (3°)	5 % (3°)

Fuel Consumption

Average fuel consumption on normal roads	metric: 7.5 liters per 100 km. (U. S.: 32 miles per gallon; Imp: 38 miles per gallon)
Fuel	74 Octane (Res. F 1)
Oil consumption	Between 0.03 and 0.1 liter per 100 km

Technical Data

(From January 1954)

T

Engine

Design	4-cycle, internal-combustion engine in unit with clutch, transmission and differential in rear of car
Number of cylinders	4
Arrangement of cylinders	Two pairs horizontally opposed (flat four)
Bore	77 mm (3.031″)
Stroke	64 mm (2.520″)
Capayity	1192 c. c. (72.74 cu. ins.)
Compression ratio	6.1
Total weight, dry	Approx, 90 kg (198 lbs.)
Cylinders	Single cylinders of special grey cast iron
Cylinder head	One for two cylinders, light alloy
Crankshaft	Forged, 4 bearings
Main bearings, 1, 3 and 4	Precision-insert bushings
Main bearing 2 (center)	Precision-insert shells
Connecting rod bearings	Lead-bronze, steel-backed
Piston pin bearing	Pressed-in bronze bushing
Piston	Light metal with steel reinforcement
Piston rings	2 compression rings 1 oil ring
Valve actuating mechanism	1 camshaft situated below crankshaft, valves operated via push rods and rocker arms
Camshaft	Cast, 3 bearings machined in crankcase
Camshaft drive	Helical gears
Valve arrangement	Overhead
Valve clearance, intake	0.10 mm (.004″) } in cold condition of engine
exhaust	0.10 mm (.004″) } in cold condition of engine
Valve timing (with a valve clearance of 1 mm/.04″)	
Intake opens	2° 30′ before T. D. C.
Intake closes	37° 30′ after B. D. C.
Exhaust opens	37° 30′ before B. D. C.
Exhaust closes	2° 30′ after T. D. C.
Cooling system	Air cooling by fan on generator shaft
Fan drive	From crankshaft through V-belt
Cooling air intake	Thermostat-controlled
Amount of cooling air	18 cubic feet per second at 3300 engine r. p. m.
Lubrication	Pressure feed lubrication by gear pump
Oil cooling	Oil cooler situated in air stream
Oil pressure control	By warning light
Ignition	Battery ignition
Ignition coil	Bosch TE 6 A 3
Ignition distributor	Bosch VJU 4 BR 3 mk (or TmK*) with vacuum advance
Spark timing	7° 30′ before T. D. C.
Firing order	1—4—3—2
Spark advance	By centrifugal and vacuum mechanism
Breaker point gap	0.4 mm (.016″)
Spark plugs	14 mm thread, heat range 175 Bosch W 175 T 1 and T 1 A Beru K 175/14 u 2 Lodge HD 14 Champion L 10 AC 44
Spark plug gap	0.6—0.7 mm (.024″ to .028″)

* equipped with special dust protection

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Clutch

Design	Single disc, dry, K 10 (Fichtel and Sachs)
Pedal free play	10 to 20 mm (.4″ to .8″)
Total lining area	268 sq. cm (41.8 sq. ins.)

Fuel System

Carburetor	Downdraught, SOLEX 28 PCI, with accelerator pump
Main jet	122.5
Pilot jet	50
Pilot jet air bleed	0.8 mm diam.
Air correction jet	200
Pump jet	50
Pump air correction jet	2.0
Emulsion tube	29
Venturi	21.5 mm diam.
Float needle valve	1.5
Float weight	12.5 grams
Pump feed	0.40—0.55 c. c. per stroke
Air cleaner	Oil-bath type
Fuel pump	SOLEX diaphragm type
Feeding pressure	0.09 to 0.13 atm. (1.28 to 1.85 lbs./sq.in.)
Fuel delivery via float needle valve	min. 10 l/h. (approx. 2.5 gals.) at 3000 engine r. p. m.
Fuel filter	Strainer and water excluder at fuel tap

Electrical System

Electrical system	6 V with voltage regulator
Battery	6 V 70 ampere hours
Generator	Bosch LJ/REF 160/6—2500 L 4
Regulator	Bosch RS/TA 160/6/A 1 on generator
Ratio, cranksh. — Generator shaft	Approx. 1 : 2
Generator commences to charge	At approx. 1800 r. p. m. of the generator
Starter motor	Bosch EED 0.4/6 L 4
Lighting System:	
Two headlights	Adjustable, with built-in parking lights
Headlight bulbs	35 watts
Parking light bulbs	1.5 watts
Two combined stop and tail lights	On rear fenders
Stop light bulbs	15 watts
Tail light bulbs	5 watts
One license plate light	On engine hood (bonnet)
License plate light bulb	5 watts
Interior light	In left-hand roof side member with built-in switch
Interior light bulb	10 watts
All control light bulbs	1.2 watts
Speedometer light	Indirect and adjustable
Speedometer light bulbs	Two, 1.2 watts
Direction indicator lamps	3 watts

Transmission and Final Drive

Transmission	4 speeds forward, 1 reverse
De Luxe	2nd, 3rd and 4th gears helically-cut and silent, provided with cone-type synchro-devices
Gear ratios	First 3.60 : 1
	Second 1.88 : 1
	Third 1.23 : 1
	Fourth 0.82 : 1
	Reverse 4.63 : 1
Standard	3rd and 4th gears helically-cut and silent
Gear ratios	First 3.60 : 1
	Second 2.07 : 1
	Third 1.25 : 1
	Fourth 0.80 : 1
	Reverse 6.60 : 1
Gear control	Manually through linkage, ball-type shift lever on frame tunnel
Final drive	Helically-cut drive pinion and ring gear, bevel type differential, swinging half axles
Ratio	4.4 : 1

Chassis

Frame	Central tubular backbone with large head for mounting the front axle, forked at the rear to accommodate the power unit
Wheel suspension: front	Independent, two longitudinal torsion arms on either side
rear	Independent, swinging half axles, one longitudinal spring plate on either side
Spring: front	Two square torsion bar springs og 8 steel bands each
rear	One round torsion bar on each side
Adjustment of rear torsion bars, unloaded	13° ± 30′ inclination of the spring plate
Shock absorbers: front and rear	Double acting, telescopic
Steering	Worm and sector gear with divided tie rod
Total ratio	14.15
Turns of steering wheel, lock to lock	2.4
Wheel alignment with car fully laden:	
Track on ground	1290 mm (4 ft. 3 ins.)
Camber	0°40′ ± 30′
King pin inclination	4°20′
Caster (front axle tubes)	2°30′ ± 30′
Toe-in (car unladen)	1—3 mm (0.04″ to 0.12″)
Wheels	Disc wheels with drop-center rims 4 J x 15
Tires	5.60—15
Tire pressures	
1—2 Occupants	Front 1.1 atm. (16 lbs./sq. in.)
	Rear 1.4 atm. (20 lbs./sq. ni.)
Fully occupied	Front 1.2 atm. (17 lbs./sq. in.)
	Rear 1.6 atm. (23 lbs./sq. in.)
Brakes	
De Luxe: foot brake	Hydraulic (Ate), acting on all wheels
hand brake	Mechanical, acting on rear wheels
Standard: foot brake	Mechanical, acting on all wheels
hand brake	Mechanical, acting on all wheels
Braking area: front	260 sq. cm (40.3 sq. ins.)
rear	260 sq. cm (40.3 sq. ins.)
Lubrication system	Single lubrication points

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Body

Design	Two-door, all-steel body with curved sloping front hood and stepless, evenly sloping rear end, bolted to the platform-type frame
Fenders and sill panels	Bolted in position, replaceable

Doors:

Width	905 mm (37.4″)
Angle through which door can be opened	Approx. 70°

Windows:

Windshield	One-piece, flat
Door windows	Vent wings with check-stays, vertically sliding glass panels
Rear quarter windows	Fixed in position
Rear window	One-piece, curved
Glass	Safety type
Windshield wipers	Electric, with 2 wiper arms

Seats:

Number	4—5
Front	Adjustable seats with forward-folding backs
Rear	Seat bench with forward-folding back

Instrument panel:

Central instrument	Combining speedometer with mileage recorder and speedometer light, built-in warning lights for direction indicators, generator charge, headlights and oil pressure
Direction indicator control	Operating lever at steering column below the steering wheel
Ignition switch	Combined ignition and starting switch (ignition key starting)
Glove compartment	Equipped with lid on passenger side

Interior trim:

Floor	Covered with rubber mats and trimmed with carpets
Doors and side panels	Trimmed with upholstery cloth
Roof and roof side members	Lined with cloth
Heating	Warm air heating with two ducts in the front compartment and two defroster vents at the windshield
Heating control	Fine adjustment by means of a rotary knob
Luggage compartments	Dust-proof behind the rear seat back and under the theft-proof front bonnet

Miscellaneous:

Bumpers	At front and rear, each equipped with two overriders
Spare wheel	Theft-proof under front hood
Fuel tank	Under front hood
Tools and accessories	Under front hood

Dimensions and Weights

Wheel base	2400 mm (7 ft. 10.5 ins.)
Track: front	1290 mm (4 ft. 3 ins.)
rear	1250 mm (4 ft. 1.2 in.)
Length	4070 mm (13 ft. 4 ins.)
Width	1540 mm (5 ft. 1/2 in.)
Height	1500 mm (4 ft. 11 inst.)
Smallest ground clearance with the car fully laden	172 mm (6.8 ins.)
Angle of approach	25°
Angle of departure	13°30′
Smallest turning circle	11 m (36 ft.)

		Sedan*)	Convertible 4-seater
Net weight	kg	710	780
Weight, ready for use	kg	730	800
Maximum load	kg	380	360
Total weight	kg	1110	1160
Max. load on front axle	kg	450	480
Max. load on rear axle	kg	660	680
Weight of chassis	kg	435	435

*) Weights apply to Standard, De Luxe, and Sliding Roof Models

Refill Requirements

Fuel tank	40 liters, including 5 liters reserve (10.5 U. S. Gals.; 8.8 Imp. Gals.)
Crankcase	2.5 liters (5.3 U. S. pints; 4.4 Imp. pints)
Transmission case: Standard	2.5 liters (5.3 U. S. pints; 4.4 Imp. pints) Refilling quantity: 2 liters (4.2 U. S. pints; 3.5 Imp. pints)
De Luxe	2.5 liters (5.3 U. S. pints; 4.4 Imp. pints) Refilling quantity: 2 liters (4.2 U. S. pints; 3.5 Imp. pints)
Steering	0.125 liter (0.26 U. S. pint; 0.22 Imp. pint)
Brake	0.25 liter (0.5 U. S. pint; 0.4 Imp. pint)
Oil bath air cleaner	0.25 liter (0.5 U. S. pint; 0.4 Imp. pint)

Performance

SAE Rating	36 BHP at 3700 r. p. m. (= 30 BHP at 3400 r. p. m.)
Max. torque	7.7 mkg (56 ft. lbs.) at 2000 r. p. m.
Maximum and cruising speed	110 km. p. h. (68 m. p. h.)
Engine r. p. m. at 110 km. p. h. (68 m. p. h.)	
De Luxe	3400 r. p. m.
Standard	3345 r. p. m.
Mean piston speed at 110 km. p. h. (68 m. p. h.)	
De Luxe	approx. 7.25 meters/sec (23.8 ft.)
Standard	approx. 7.15 meters/sec (23.5 ft.)

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Speeds at 3400 engine r. p. m.

	De Luxe	Standard
1st speed ..... approx.	25 km. p. h. (16 m. p. h.)	25 km. p. h. (16 m. p. h.)
2nd speed..... approx.	47 km. p. h. (29 m. p. h.)	43 km. p. h. (27 m. p. h.)
3rd speed ..... approx.	73 km. p. h. (45 m. p. h.)	72 km. p. h. (45 m. p. h.)
4th speed ..... approx.	110 km. p. h. (68 m. p. h.)	112 km. p. h. (69.6 m. p. h.)
Reverse ..... approx.	19 km. p. h. (12 m. p. h.)	13.5 km. p. h. (8.4 m. p. h.)

Hill climbing ability (car laden with two persons, on normal roads)

	De Luxe	Standard
Hill climbing 1st gear	37 % (20.5°)	37 % (20.5°)
2nd gear	18.5 % (10.5°)	20.5 % (11.5°)
3rd gear	11 % (6.5°)	11 % (6.5°)
Top gear	6 % (3.5°)	6 % (3.5°)

Fuel Consumption

Average fuel consumption on normal roads	Metric: 7.5 liters per 100 km. (U. S.: 32 miles per gallon; Imp: 38 miles per gallon)
Fuel	74 Octane (Res. F 1)
Oil consumption	Between 0.03 and 0.1 liter per 100 km

SERVICE

Technical Data

(From August 1955)

T

Engine

Design	4-cycle, air-cooled, internal-combustion engine in unit with clutch, transmission and differential in rear of car
Number of cylinders	4
Arrangement of cylinders	Two pairs horizontally opposed (flat four)
Bore	77 mm (3.031″)
Stroke	64 mm (2.520″)
Piston displacement	1192 c. c. (72.74 cu. ins.)
Compression ratio	6.6
Total weight, dry	Approx. 90 kg (198 lbs.)
Crankcase	The magnesium casting alloy crankcase is built in two halves, the joint passing vertically through the centre lines of both the main bearings and the camshaft bearings
Cylinders	Separately cast and interchangeable, finned for air cooling; made of special grey cast iron
Cylinders heads	Cast in pairs, of aluminum alloy, finned for air cooling
Valve seat inserts	Shrunk in position, made of sintered steel alloy
Valve guides	Shrunk in position, made of bronze
Spark plugs inserts	Screwed in, made of steel
Crankshaft	High quality steel stamping, four plain bearings
Main bearings 1, 3, and 4	Sleeve-type bearings of aluminum alloy
Main bearing 2 (center)	Sleeve-type half bearing (split) of aluminum alloy
Flywheel	Steel stamping, with integral starter gear ring
Connecting rods	H section steel stampings
Connecting rod bearings	Lead-bronze, steel-backed
Piston pin bearing	Pressed-in bronze bushing
Pistons	Of aluminum alloy with steel-reinforcement
Piston pins	Fully floating, held in position by retaining rings (circlips)
Piston rings	2 compression rings 1 oil ring
Valve actuating mechanism	1 camshaft situated below crankshaft, valves operated via push rods and rocker arms
Camshaft	Of grey cast iron, runs in three bearings machined direct in crankcase
Camshaft drive	By helical gears from the crankshaft
Valves	1 intake valve and 1 exhaust valve for each cylinder
Exhaust valve	Nickel-chrome plated seating face
Arrangement	Overhead
Clearance: Intake	0.10 mm (0.004″) } in cold condition of engine
Exhaust	0.10 mm (0.004″) } in cold condition of engine
Valve springs	1 spring per valve
Valve timing with a valve clearance of 1 mm (0.04″)	
Intake opens	2.5° before T. D. C.
Intake closes	37.5° after B. D. C.
Exhaust opens	37.5° before B. D. C.
Exhaust closes	2.5° after T. D. C.
Cooling system	Air cooling by fan on generator armature shaft
Fan drive	From crankshaft through V-belt
Cooling air intake	Thermostat-controlled
Amount of cooling air	18 cubic feet per second at 3300 engine r. p. m.
Lubrication	Pressure feed lubrication by gear pump
Oil cooling	Oil cooler situated in cooling air stream
Oil pressure control	By warning light
Ignition	Battery ignition
Ignition coil	Bosch TE 6 A 3
Ignition distributor	Bosch VJU 4 BR 8 mk with vacuum advance
Spark timing	7.5° before T. D. C.
Firing order	1—4—3—2

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Spark advance	By combined centrifugal and vacuum advance mechanisms
Breaker point gap	0.4 mm (.016″)
Spark plugs	14 mm thread, heat range 225
	Bosch W 225 T 1
	Beru 225/14 u 2
	Lodge H 14 or HN
	Champion L 10 S
	AC F 10
	KLG F 70
	Auto-Lite AE 6 or AER 6
Spark plug gap	0.6—0.7 mm (.024″ to .028″)

Clutch

Design	Single disc, dry, K 10 (Fichtel and Sachs)
Pedal free play	10 to 20 mm (0.4″ to 0.8″)
Total lining area	268 sq. cm (41.8 sq. ins.)

Fuel System

Carburetor	Downdraught, SOLEX 28 PCI, with accelerator pump
Main jet	117.5
Pilot jet	50
Pilot jet air bleed	0.8 mm dia.
Air correction jet	195
Pump jet	50
Pump air correction jet	2.0
Emulsion tube	29
Venturi	21.5 mm dia.
Float needle valve	1.5
Float weight	5.7 grams (0.20 oz.), plastic material
Pump feed	0.40—0.60 c. c. per stroke
Air cleaner	Oil-bath type
Fuel pump	SOLEX diaphragm type, mechanically operated
Feeding pressure	max. 0.13 atm. (1.85 lbs./sq. in.) at 3000 engine r. p. m.
Fuel delivery via float needle valve 1.5	min. 16 l/h. (U. S. 2.5 gals.) at 500—600 engine r. p. m.
Fuel tap	Three-way tap with fuel reserve position
Fuel filter	Gauze strainer in tank

Electrical System

Electrical system	6 volts, with voltage regulator
Battery	6 volts, 66 ampere hours
Generator	Bosch LJ/REF 160/6/2500 L 17
Regulator	Bosch RS/TAA 160/6/1, mounted on generator
Ratio, cranksh. — Generator shaft	Approx. 1 : 2
Generator commences to charge	At approx. 1560 r. p. m. of the generator armature shaft
Starter motor	Bosch EED 0.4/6 L 4
Lighting System:	
Two headlamps	Adjustable, combined with parking lamps
Rim inner diameter	180 mm (7.09″)
Headlamp bulbs	35/35 watts
Parking lamp bulbs	2 watts
Two stop/tail lamps with two-filament bulbs	Bezel-type, on rear fenders
Stop lamp bulbs	20 watts
Tail lamp bulbs	5 watts

One license plate lamp	In center of engine hood (bonnet), also serving as underhood light
One tubular bulb	5 watts
One interior light	In left-hand roof side member with built-in switch
Interior light bulb	10 watts
Direction indicators	Semaphore-type, mounted in body center pillars
Tubular bulbs	3 watts
All warning light bulbs	1.2 watts
Instrument light	Rheostat-controlled
Two bulbs	1.2 watts
Fuses:	
For headlamps	Fuse box (two fuses) under front hood at left-hand wheel arch
For all other electrical equipment	Fuse box (four fuses) under front hood on instrument panel

Transmission and Final Drive

Construction	Four speeds, apart from the gears, the transmission case also houses the rear axle differential
Transmission	Four speeds forward, 1 reverse
De Luxe	2nd, 3rd and 4th gears helically-cut, provided with cone-type synchro-devices
Gear ratios	First 3.60 : 1
	Second 1.88 : 1
	Third 1.23 : 1
	Fourth 0.82 : 1
	Reverse 4.63 : 1
Standard	3rd and 4th gears helically-cut
Gear ratios	First 3.60 : 1
	Second 2.07 : 1
	Third 1.25 : 1
	Fourth 0.80 : 1
	Reverse 6.60 : 1
Gear control	Manually through linkage, central ball-type shift lever on frame tunnel
Final drive	Spiral bevel drive, swinging half axles
Ratio	4.4 : 1

Chassis

Frame	Flat platform reinforced by central tubular backbone with large head for mounting the front axle and forked at the rear to accommodate the power unit
Wheel suspension: front	Independent, two longitudinal torsion arms on either side
rear	Independent, swinging half axles, one longitudinal spring plate on either side
Springs: front	Two square torsion bar springs of 8 steel bands each, passing through front axle beams
rear	One round torsion bar on each side
Adjustment of rear torsion bars, unloaded	12° ± 30′ inclination of the spring plate
Shock absorbers: front and rear	Double acting, telescopic
Steering	Worm and sector gear with divided tie rod
Overall ratio	14.15
Turns of steering wheel, lock to lock	2.4
Angle of wheels at full steering lock:	
inner wheel	32°
outer wheel	26°
Torque-arm radius	16 mm (0.63″)

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Wheel alignment with car fully laden:	
Track on ground	1290 mm (4 ft. 3 ins.)
Camber	0°40′ ± 30′
King pin inclination	4°20′
Caster (front axle tubes)	2°30′ ± 30′
Toe-in (car unladen)	1—3 mm (0.04″ to 0.12″)
Wheels	Steel disc wheels with drop-center rims 4 J x 15
Tires	5.60—15
Rolling radius	307 mm (12.09″)
Tire pressures	
1—2 Occupants	Front 1.1 atm. (16 lbs./sq. in.)
	Rear 1.4 atm. (20 lbs./sq. in.)
3—5 Occupants	Front 1.2 atm. (17 lbs./sq. in.)
	Rear 1.6 atm. (23 lbs./sq. in.)
High speed driving for longer periods	Front 1.4 atm. (20 lbs./sq. in.)
	Rear 1.6 atm. (23 lbs./sq. in.)
Brakes	
De Luxe: foot brake	Hydraulic, acting on all wheels
hand brake	Mechanical, acting on rear wheels
Standard: foot brake	Mechanical, acting on all wheels
hand brake	Mechanical, acting on all wheels
Hand brake lever	Centrally mounted between front seats
Braking area: front	260 sq. cm (40.3 sq. ins.)
rear	260 sq. cm (40.3 sq. ins.)
Lubrication system	Single lubrication points

Body

Design	Two-door, all-steel body with dropping front hood and stepless, evenly sloping rear end, bolted to the platform-type frame
Fenders and sill panels	Bolted in position, replaceable
Doors:	
Width	905 mm (37.4″)
Angle through which door can be opened	Approx. 70°
Windows:	
Windshield	One-piece, flat
Door windows	Vent wings with check-stays, vertically sliding glass panels
Rear quarter windows	Fixed in position
Rear window	One-piece, curved
Glass	Heat-treated safety plate, windshield provided with clear vision area
Windshield wipers	Electric, with 2 wiper arms
Hoods:	
Front	Rear-hinged, with automatically engaging collapsible prop
Rear	Top-hinged, unlocked manually by means of T-handle
Seats:	
Number	4—5
Front	Adjustable seats with forward-folding backs
Rear	Seat bench with forward-folding back
Instrument panel:	
Central instrument	Combining speedometer with mileage recorder and speedometer light, built-in warning lights for direction indicators, generator charge, headlights, and oil pressure
Direction indicator control	Operating lever on steering column below the steering wheel
Ignition switch	Combined ignition and starting switch (ignition key starting)
Glove compartment	Equipped with lid on passenger side

Interior trim:

Floor	Covered with rubber mats
Frame tunnel	Rubber-covered
Front panel, front side panels, lower body side members	Covered with haircord carpet
Doors and side panels	Covered with upholstery cloth
Roof	Cloth-lined

Miscellaneous:

Bumpers	At front and rear, each equipped with two overriders
Spare wheel	Theft-proof under front hood
Fuel tank	Under front hood
Tools and accessories	Under front hood

Sliding roof:

Make	Golde
Roof opening:	
Clear length	690 mm (27.2″)
Clear width	730 mm (28.7″)

Dimensions and Weights

Wheel base	2400 mm (7 ft. 10.5 ins.)
Track: front	1290 mm (4 ft. 3 ins.)
rear	1250 mm (4 ft. 1.2 ins.)
Length	4070 mm (13 ft. 4 ins.)
Width	1540 mm (5 ft. 1/2 in.)
Height (unladen)	1500 mm (4 ft. 11 ins.)
Smallest ground clearance with the car fully laden	172 mm (6.8 ins.)
Angle of approach	25°
Angle of departure	16°
Smallest turning circle	11 m (36 ft.)

		Sedan*)	Convertible 4-seater
Weight, dry	kg	710	780
Weight, ready for use	kg	730	800
Maximum load	kg	380	360
Permissible total weight	kg	1110	1160
Max. load on front axle	kg	450	480
Max. load on rear axle	kg	660	680
Weight of chassis	kg	435	435

*) Weights apply to Standard, De Luxe, and Sliding Roof Models

Capacities and Refills

Fuel tank	40 liters, including 5 liters reserve (10.5 U. S. Gals.; 8.8 Imp. Gals.)
Crankcase	2.5 liters (5.3 U. S. pints; 4.4 Imp. pints)
Transmission case: Standard	2.5 liters (5.3 U. S. pints; 4.4 Imp. pints)
	Refilling quantity: 2 liters (4.2 U. S. pints; 3.5 Imp. pints)
De Luxe	2.5 liters (5.3 U. S. pints; 4.4 Imp. pints)
	Refilling quantity: 2 liters (4.2 U. S. pints; 3.5 Imp. pints)
Steering	0.125 liter (0.26 U. S. pint; 0.22 Imp. pint)
Brake	0.25 liter (0.5 U. S. pint; 0.4 Imp. pint)
Oil bath air cleaner	0.25 liter (0.5 U. S. pint; 0.4 Imp. pint)

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Performance

Performance	30 BHP at 3400 r. p. m. (SAE rating: 36 HP at 3700 r. p. m.)
Max. torque	7.7 mkg (56 ft. lbs.) at 2000 r. p. m.
Maximum and cruising speed	110 km p. h. (68 m. p. h.)
Engine r. p. m. at 110 km p. h. (68 m. p. h.)	
De Luxe	3400 r. p. m.
Standard	3345 r. p. m.
Mean piston speed at 110 km p. h. (68 m. p. h.)	
De Luxe	approx. 7.25 meters/sec. (23.8 ft.)
Standard	approx. 7.15 meters/sec. (23.5 ft.)

Speeds at 3400 engine r. p. m.

	Standard	De Luxe
1st speed approx.	25 km p. h. (16 m. p. h.)	25 km p. h. (16 m. p. h.)
2nd speed approx.	42 km p. h. (26 m. p. h.)	47 km p. h. (29 m. p. h.)
3rd speed approx.	72 km p. h. (45 m. p. h.)	73 km p. h. (45 m. p. h.)
4th speed approx.	112 km p. h. (69.6 m. p. h.)	110 km p. h. (68 m. p. h.)
Reverse approx.	13.5 km p. h. (8.4 m. p. h.)	19 km p. h. (12 m. p. h.)

Hill climbing ability (car occupied by two persons, on normal roads)

	Standard	De Luxe
Hill climbing 1st gear	37 % (20.5°)	37 % (20.5°)
2nd gear	20.5 % (11.5°)	18.5 % (10.5°)
3rd gear	11 % (6.5°)	11 % (6.5°)
Fourth gear	6 % (3.5°)	6 % (3.5°)

Acceleration from rest to 80 km p. h. (50 m. p. h.) through gears, with car fully laden	22 sec.

Fuel Consumption

Average fuel consumption on normal roads	Metric: 7.5 liters per 100 km (U. S.: 32 miles per gallon; Imp: 38 miles per gallon)
Fuel	74 Octane (Res. F 1)
Oil consumption	Between 0.03 and 0.1 liter per 100 km

Technical Data

(Karmann-Ghia Coupé)

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As VW Sedan except for the following:

Fuel System

Carburetor	Downdraught, SOLEX 28 PCI with accelerator pump
uVenturi	21.5 mm dia.
uMain jet	117.5
Air correction jet	180
Pilot jet	50
Pilot jet air bleed	0.8 mm dia.
Pmp jet	50
Pmp air correction jet	2.0
Emulsion tube	29
Float needle valve	1.5
Float weight	5.7 grams (0.20 oz.) plastic material
Pump feed	0.40—0.60 c. c. per stroke

Electrical System

Lighting:

Two headlamps	Adjustable, combined with parking lamps
Rim inner diameter	170 mm (6.7″)
Headlamp bulbs	35/35 watts
Parking lamp bulbs	2 watts
Two stop/tail/direction indicator lamps with reflex reflectors	Flush fitting in rear fenders
Tail light bulbs	5 watts
Stop/direction indicator lamp bulbs	15 watts
One license plate lamp	In center of engine compartment hood
Two bulbs	5 watts
One interior lamp	Placed centrally above the wingshield, with built-in switch
Bulb	5 watts
Direction indicators	Bezel type lamps below headlamps
Bulbs	15 watts
At rear	Combined with stop lamps

Chassis

Front axle	With stabilizer shaft attached to lower torsion arms

Tire pressures:

1 or 2 occupants	Front 1.1 kg/cm², (16 lbs./sq. in.),	rear 1.4 kg/cm² (20 lbs./sq. in.)
Fully occupied	Front 1.2 kg/cm², (17 lbs./sq. in.),	rear 1.6 kg/cm² (23 lbs./sq. in.)
High speed driving for longer periods	Front 1.2 kg/cm², (17 lbs./sq. in.),	rear 1.6 kg/cm² (23 lbs./sq. in.)

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Dimensions and Weights

Length	4,140 mm (163″)
Width	1,630 mm (64.2″)
Height (empty)	1,325 mm (52.2″)
Angle of approach	24°
Angle of departure	16°
Smallest turning circle	approx. 11 m (36 ft.)
Net weight	790 kg (1,742 lbs.)
Weight, incl. spare wheel and tools	810 kg (1,786 lbs.)
Carrying capacity	300 kg (661 lbs.)
Max. permissible total weight	1,110 kg (2,447 lbs.)
Max. load on front axle	450 kg (992 lbs.)
Max. load on rear axle	660 kg (1455 lbs.)

Performance

Top and cruising speed	115 km. p. h. (72 m. p. h.) at 3,600 r. p. m.
Mean piston speed at 115 km. p. h. (72 m. p. h.)	7.7 meters/sec. (25.3 ft.(

Hill climbing ability (car occupied by two persons, on normal roads)

1st gear	34 % (18.5°)
2nd gear	17 % (9.5°)
3rd gear	10.5 % (6°)
4th gear	5.5 % (3°)

List of Tolerances and Wear Limits

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The term WEAR LIMIT means that parts which approach, or have already reached, the limit given should not be re-used when carrying out an overhaul. When deciding the wear limit of pistons and cylinders, due consideration should also be given to the oil consumption of the respective engine.

		Tolerance Limits (new parts)	Wear Limits
Engine			
1 - Cylinder seating depth in cylinder head		13.00—12.90 mm (.512″—.507″)	14.50 mm (.571″)
2 - Cylinder	out of round		0.01 mm (.0001″)
3 - Piston / cylinder	clearance	0.035—0.055 mm (.0014″—.0022″)	0.20 mm (.008″)
4 - Upper and lower compression ring	side clearance	0.035—0.062 mm (.0014″—.0024″)	0.10 mm (.004″)
5 - Oil scraper ring	side clearance	0.025—0.052 mm (.001″—.002″)	0.10 mm (.004″)
6 - All piston rings	gap	0.30—0.45 mm (.012″—.018″)	0.95 mm (.037″)
7 - Weight tolerance of pistons in one engine ..		max. 10 g (.35 oz)	
8 - Weight tolerance of con. rods in one engine		max. 11 g (.38 oz)	
9 - Piston pin / con. rod bush	clearance	0.005—0.026 mm (.0002″—.001″)	0.05 mm (.002″)
10 - Connecting rod bearing	clearance	0.019—0.074 mm (.0007″—.003″)	0.15 mm (.006″)
	end play	0.170—0.395 mm (.007″—.0155″)	0.70 mm (.03″)
11 - Crankshaft main bearing (Consideration being paid to the preload of 0.02 mm/0.0008″ by the crankcase)			
a) Bearings 1 to 3	clearance	0.052—0.115 mm (.002″—.0045″)	0.19 mm (.007″)
b) Bearing 4	clearance	0.036—0.096 mm (.0014″—.0038″)	0.17 mm (.006″)
12 - Crankshaft at 2nd and 4th main bearing journals (1st and 3rd bearing journals on V-blocks)	run-out		0.03 mm (.0012″)
13 - Crankshaft / main bearing 1 (fitted with 3 different shims)	end play	0.070—0.120 mm (.003″—.005″)	0.15 mm (.006″)
14 - Main bearing journal	out of round		0.03 mm (.0012″)
15 - Crank pin	out of round		0.03 mm (.0012″)
16 - Crankcase bore for crankshaft			
a) Bearings 1 to 3	diameter	60.000—60.019 mm (2.3622″—2.3630″)	
b) Bearing 4	diameter	50.000—50.025 mm (1.9685″—1.9695″)	
17 - Fan pulley	radial run-out	max. 1.0 mm (.04″)	
	lateral run-out	max. 1.0 mm (.04″)	
18 - Crankcase bore for camshaft	diameter	24.020—24.041 mm (.9457″—.9465″)	24.070 mm (.9476″)

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		Tolerance Limits (new parts)	Wear Limits
19 - Camshaft	clearance	0.020—0.054 mm (.0008″—.0021″)	0.12 mm (.005″)
	end play	0.020—0.074 mm (.0008″—.0029″)	0.10 mm (.004″)
(between two points)	run-out	0.02 mm (.0008″)	0.04 mm (.0016″)
20 - Camshaft timing gear	radial run-out	0.03 mm (.0012″)	
	lateral run-out	0.10 mm (.004″)	
	backlash	0.010—0.035 mm (.0004″—.0014″)	
21 - Flywheel	lateral run-out	max. 0.30 mm (.012″)	
	radial run-out	max. 0.40 mm (.016″)	
	out of balance	max. 5 cmg	
Flange	outer diameter	59.90—60.10 mm ⌀ (2.3583″—2.3661″)	59.70 mm (2.3504″)
Crankshaft seating depth in flywheel flange		3.22—3.25 mm (.1268″—.1279″)	
Thickness of shoulder in flywheel flange		6.5—0.2 mm (.2559″—.008″)	min. 4.8 mm (.1890″)
Flange height		min. 12.5 mm (.4921″)	
Remachining flywheel wall around flange	diameter		110.0 mm ⌀ (.433″)
Remachining width of teeth			max. 2 mm (.08″)
22 - Valve stem: intake	diameter	6.965—6.955 mm ⌀ (.2742″—.2738″)	6.920 mm (.2724″)
exhaust	diameter	6.955—6.945 mm ⌀ (.2738″—.2734″)	6.920 mm (.2724″)
	out of round	0.01 mm (.004″)	
23 - Valve guide / valve stem:			
a) Valve guide	inner diameter	7.000—7.015 mm ⌀ (.275″—.2762″)	7.070 mm (.2783″)
b) intake	clearance	0.035—0.060 mm (.0014″—.0024″)	0.15 mm (.006″)
exhaust	clearance	0.045—0.070 mm (.0018″—.0027″)	0.15 mm (.006″)
24 - Valve seat:			
a) intake	width	1.3—1.6 mm (.051″—.063″)	
b) exhaust	width	1.7—2.0 mm (.067″—.079″)	
c) Valve face	run-out	0.01 mm (.0004″)	
25 - Valve springs free length 43 mm (1.7″) loaded length 28 mm (1.1″)	load	33.4 kg ± 5% (73.6 lbs.)	30 kg (66 lbs.)

		Tolerance Limits (new parts)	Wear Limits
26 - Valve clearance (with engine cold) intake and exhaust	adjustment	0.10 mm (.004″)	
27 - a) Rocker arm (after hardening)	inner diameter	15.99—16.018 mm ⌀ (.6295″—.6306″)	16.035 mm ⌀ (.6313″)
b) Rocker arm shaft	diameter	15.984—15.966 mm ⌀ (.6293″—.6285″)	15.955 mm ⌀ (.6281″)
c) Rocker arm / rocker arm shaft	clearance	0.016—0.052 mm (.0006″—.0020″)	0.080 mm (.0031″)
28 - a) Crankcase bore for valve push rod ...	diameter	15.000—15.018 mm ⌀ (.5905″—.5912″)	15.060 mm ⌀ (.5932″)
b) Valve push rod	diameter	14.984—14.966 mm ⌀ (.5899″—.5892″)	14.955 mm ⌀ (.5888″)
c) Crankcase bore / valve push rod	clearance	0.016—0.052 mm (.0006″—.0020″)	0.120 mm (.0047″)
29 - Valve push rod / guide plate	clearance	The valve push rod should glide through the guide by its own weight at the lowest possible clearance	0.02 mm (.0008″)
30 - Compression ..... (To be checked with the throttle open and the engine having attained operating temperature, all spark plugs removed, pressure gauge in spark plug seat and the engine turned over by the starter motor)		6.0—7.5 atm. (85—107 lbs./sq. in.)	4.0 atm. 57 lbs./sq. in.)
31 - Oil pump: end play of gears with cover removed and gasket in situation		0.066—0.138 mm (.0026″—.0054″)	0.20 mm (.008″)
End play of gears with cover and gasket removed			0.10 mm (.004″)
Oil pump gears	backlash	0.03—0.08 mm (.0012″—.0031″)	
32 - Oil pressure: a) with engine having attained operating temperature (at idling speed)		min. 0.5 atm. (7 lbs./sq. in.)	
b) with engine having attained operating temperature (at 2500 r. p. m.)		min. 2.5 atm. (35 lbs./sq. in.)	
33 - Spring for oil pressure relief valve	free length	52—53 mm (2.05″—2.09″)	
34 - Oil pressure contact opens	pressure	0.3—0.6 atm. (4.3—8.5 lbs./sq. in.)	
35 - Distance from fan housing to upper edge of throttle ring	adjustment	20 mm (.8″)	
36 - Thermostat: after a water bath of 75 to 80 °C (170 to 180 °F)	length	min. 46 mm (1.81″)	

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		Tolerance Limits (new parts)	Wear Limits
Clutch			
1 - Clutch driven plate	lateral run-out	max. 0.5 mm (.02″)	
2 - Clutch thrust spring loaded length 29.4 mm (1.16″)	load	57.5 ± 2.5 kg (127 ± 5.5 lbs.)	49 kg (108 lbs.)
3 - Clutch pedal free play		10—20 mm (.4″—.8″)	
4 - Clutch pressure plate	run-out		0.10 mm (.004″)
5 - Clutch release plate	run-out		0.30 mm (.012″)
6 - Clutch assy	out of balance	max. 15 cmg	
Front Axle			
1 - Torsion arm	twist	max. 0.2 mm (.008″)	
2 - Torsion arm / fiber bush (the upper limit should be approached, fiber will swell)	clearance	0.20—0.27 mm (.008″—.010″)	0.30 mm (.012″)
3 - Torsion arm link pin / sinterised iron bush	clearance	0.042—0.087 mm (.0017″—.0034″)	0.20 mm (.008″)
4 - Torsion arm link pin	diameter	17.913—17.940 mm ⌀ (.7052″—.7063″)	17.800 mm ⌀ (.7008″)
5 - King pin / bush	clearance	0.027—0.034 mm (.0010″—.0013″)	0.08 mm (.003″)
	end play	(None)	
6 - Front axle tubes	departure from parallelism	max. 0.2 mm (.008″)	
7 - Castor (chassis on level surface)		2°30′ ± 30′	
8 - Camber (chassis on level surface)		0°40′ ± 30′	
9 - Toe-in (car standing on the wheels in unladen condition)		1—3 mm (.04″—.12″)	
10 - King pin inclination		4° 20′	
11 - Steering gear			
a) Sector shaft	end play	0.25 mm (.0098″)	
b) Sector shaft spring	free length	23.4 ± 0.4 mm (.921″—.016″)	
	loaded length	20.3 mm (.8″)	
Tension of loaded spring		60—75 kg (130—165 lbs.)	
c) Sector shaft thrust pin	length	19.9—20.1 mm (.7835″—.7913″)	

		Tolerance Limits (new parts)	Wear Limits
12 - Steering drop arm / steering gear case .... end play		0.4—1.0 mm (.016″—.04″)	

Rear Axle and Transmission

1 - Main drive shaft / pilot bush	clearance	0.05—0.15 mm (.002″—.006″)	0.25 mm (.0098″)
2 - Main drive shaft a) at intermediate ball bearing (between two points)	run-out	0.02 mm (.0008″)	mas. 0.05 mm (.002″)
b) at pilot end (with main drive shaft installed)	run-out	0.10 mm (.004″)	max. 0.20 mm (.008″)
3 - Preload of gear shift housing		0.02—0.11 mm (.0008″—.0043″)	
4 - Bushes for transmission shift rod	diameter	15.025—15.060 mm ⌀ (.5915″—.5925″)	15.250 mm ⌀ (.6004″)
5 - Transmission shift rod	diameter	14.957—15.000 mm ⌀ (.5888″—.590″)	14.750 mm ⌀ (.5807″)
6 - Selector shaft detent spring loaded length 21.5 mm (.85″)	load	6.2 kg (13.7 lbs.)	
7 - Pre-load of transmission case halves on the two differential ball bearings		0.10—0.18 mm (.004″—.007″)	
8 - Rear axle shaft a) Flat end / fulcrum plates / differential side gear (4 parts)	clearance	0.05—0.023 mm (.002″—.0009″)	0.30 mm (.012″)
b) Flat end / differential side gear (measured across the convex sides)	clearance	0.03—0.10 mm (.0012″—.004″)	0.15 mm (.006″)
9 - Transmission case / rear axle tube / tube retainer	clearance	0.40—0.60 mm (.016″—.024″)	0.70 mm (.027″)
10 - Rear wheel oil seal	seating depth	4.7—5.0 mm (.185″—.197″)	
11 - Starter shaft bush	inner diameter	12.545—12.570 mm ⌀ (.4939″—.4949″)	12.65 mm ⌀ (.4980″)
12 - Starter shaft / bush	clearance	0.11—0.16 mm (.0043″—.0063″)	

De Luxe Model Only

13 - Gear for 2nd speed	end play	0.10—0.25 mm (.004″—.0098″)
14 - Gear for 3rd speed	end play	0.10—0.25 mm (.004″—.0098″)
15 - Gear for 4th speed	end play	0.10—0.25 mm (.004″—.0098″)

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		Tolerance Limits (new parts)	Wear Limits
16 - Selector fork / 1st speed gear	end play	0.5—0.7 mm (.02″—.03″)	
17 - Selector shaft / 3rd-and-4th speed operating sleeve	end play	0.2—0.4 mm (.008″—.016″)	
18 - Synchronizer stop rings / gears clearance between clutch teeth faces		min. 1.0 mm (.044″)	0.3 mm (.012″)
19 - Bush for reverse sliding gear	inner diameter	16.050—16.077 mm (.6319″—.6330″)	
Standard Model Only			
20 - Gear for 3rd speed	end play	0.20—0.75 mm (.008″—.030″)	
21 - Gear for 4th speed	end play	0.25—0.40 mm (.0098″—.016″)	0.50 mm (.02″)
22 - Selector fork / selector ring	clearance	0.23—0.53 mm (.009″—.021″)	
23 - Bush for reverse sliding gear	inner diameter	16.050—16.093 mm (.6319″—.6336″)	
Brakes, Wheels			
1 - Brake master cylinder	diameter	19.05 mm (.750″)	
Piston push rod measured from ball-shaped end up to nut	length	52—53 mm (2.05″—2.09″)	
2 - Brake wheel cylinder: front	diameter	19.05 mm (.750″)	
rear	diameter	17.45 mm (.690″)	
3 - Stop light switch, contacts close at	pressure	3.5—0.8 atm. (50—114 lbs./sq. in.)	
4 - Brake drum	lateral run-out	max. 0.25 mm (.0098″)	0.35 mm (.0138″)
	radial run-out	max. 0.25 mm (.0098″)	0.25 mm (.0098″)
	thickness of wall	4.90—5.25 mm (.193″—.206″)	4.0 mm (.16″)
	inner diameter	230.0+0.2 mm (9.05″+.008″)	231.5 mm (9.11″)
	taper	max. 0.1 mm (.004″)	
5 - Brake lining	thickness	3.8—4.0 mm (.15″—.16″)	2.7 mm (.106″)
Oversize	thickness	4.3—4.5 mm (.17″—.18″)	3.2 mm (.126″)
6 - Wheel	radial run-out	max. 1.5 mm (.06″)	
	lateral run-out	max. 1.5 mm (.06″)	
7 - Rear wheels — toe-out ..... (Car laden, spring plates horizontal)		0—4 mm (0″—.16″)	
8 - Spring plates, unloaded	adjustment	13° ±30′	

List of Tolerances and Wear Limits

(From January 1954)

The term WEAR LIMIT means that parts which approach, or have already reached, the limit given should not be re-used when carrying out an overhaul. When deciding the wear limit of pistons and cylinders, due consideration should also be given to the oil consumption of the respective engine.

		Tolerance Limits (new parts)	Wear Limits
Engine (1192 cc)			
1 - Cylinder seating depth in cylinder head		12.90—13.00 mm (.507″—.512″)	14.50 mm (.571″)
2 - Cylinder	out of round		0.01 mm (.0001″)
3 - Piston/cylinder	clearance	0.036—0.054 mm (.0014″—.0021″)	0.20 mm (.008″)
4 - Upper and lower compression rin	side clearance	0.035—0.062 mm (.0014″—.0024″)	0.10 mm (.004″)
5 - Oil scraper ring	side clearance	0.025—0.052 mm (.001″—.002″)	0.10 mm (.004″)
6 - All piston rings	gap	0.30—0.45 mm (.012″—.018″)	0.95 mm (.037″)
7 - Weight tolerance of pistons in one engine ..		max. 10 g (.35 oz)	
8 - Weight tolerance of con. rods in one engine		max. 11 g (.38 oz)	
9 - Piston pin/con. rod bush	clearance	0.005—0.026 mm (.0002″—.001″)	0.05 mm (.002″)
10 - Connecting rod bearing	clearance	0.019—0.074 mm (.0007″—.003″)	0.15 mm (.006″)
	end play	0.170—0.395 mm (.007″—.0155″)	0.70 mm (.03″)
11 - Crankshaft main bearing (Consideration being paid to the preload of 0.025 mm/0.001″ by the crankcase)			
a) Bearings 1 to 3	clearance	0.047—0.110 mm (.0019″—.004″)	0.19 mm (.007″)
b) Bearing 4	clearance	0.031—0.091 mm (.0012″—.0036″)	0.17 mm (.006″)
12 - Crankshaft at 2nd and 4th main bearing journals (1st and 3rd bearing journals on V-blocks)	run-out		0.03 mm (.0012″)
13 - Crankshaft/main bearing 1 (fitted with different shims)	end play	0.070—0.120 mm (.003″—.005″)	0.15 mm (.006″)
14 - Main bearing journal	out of round		0.03 mm (.0012″)
15 - Crank pin	out of round		0.03 mm (.0012″)
16 - Crankcase bore for crankshaft			
a) Bearings 1 to 3	diameter	60.000—60.019 mm (2.3622″—2.3630″)	
b) Bearing 4	diameter	50.000—50.025 mm (1.9685″—1.9695″)	
17 - Fan pulley	radial run-out	max. 0.8 mm (.031″)	
	lateral run-out	max. 0.3 mm (.012″)	
18 - Crankcase bore for camshaft	diameter	24.020—24.041 mm (.9457″—.9465″)	24.070 mm (.9476″)

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		Tolerance Limits (new parts)	Wear Limits
19 - Camshaft	clearance	0.020—0.054 mm (.0008″—.0021″)	0.12 mm (.005″)
	end play	0.020—0.074 mm (.0008″—.0029″)	0.10 mm (.004″)
(between two points)	run-out	0.02 mm (.0008″)	0.04 mm (.0016″)
20 - Camshaft timing gear	radial run-out	0.03 mm (.0012″)	
	lateral run-out	0.10 mm (.004″)	
	backlash	0.010—0.035 mm (.0004″—.0014″)	
21 - Flywheel	lateral run-out	max. 0.30 mm (.012″)	
	radial run-out	max. 0.40 mm (.016″)	
	out of balance	max. 5 cmg	
Flange	outer diameter	60.10—59.90 mm (2.3661″—2.3583″)	59.70 mm (2.3504″)
Crankshaft seating depth in flywheel flange		3.22—3.25 mm (.1268″—.1279″)	
Thickness of shoulder in flywheel flange		6.5 $-^{-0.2}$ mm (.2165″—−.008″)	min. 4.8 mm (.1890″)
Flange height		min. 12.5 mm (.4921″)	
Remachining flywheel wall around flange	diameter		110.0 mm (4.33″)
Remachining width of teeth			max. 2 mm (.08″)
22 - Valve stem: intake	diameter	6.965—6.955 mm (.2742″—.2738″)	6.920 mm (.2724″)
exhaust	diameter	6.955—6.945 mm (.2738″—.2734″)	6.920 mm (.2724″)
	out of round	0.01 mm (.004″)	
23 - Valve guides: intake	inner diam.	7.008—7.023 mm (.2759″—.2765″)	7.070 mm (.2783″)
exhaust	inner diam.	7.023—7.038 mm (.2765″—.2767″)	7.080 mm (.2787″)
24 - Valve guide/valve stem: intake	clearance	0.043—0.068 mm (.0017″—.0027″)	0.15 mm (.006″)
exhaust	clearance	0.068—0.093 mm (.0027″—.0037″)	0.16 mm (.0063″)
25 - Valve seat:			
a) intake	width	1.3—1.6 mm (.051″—.063″)	
b) exhaust	width	1.7—2.0 mm (.067″—.079″)	
c) valve face	run-out	0.01 mm (.0004″)	
26 - Valve springs free length 43 mm (1.7″) loaded length 28 mm (1.1″)	load	33.4 ± 5% (73.6 lbs.)	30 kg (66 lbs.)

List of Tolerances and Wear Limits

(From April 1956)

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General

The term Wear Limit means that parts which approach, or have already reached, the limit given should not be re-used when carrying out an overhaul. When deciding the wear limit of pistons and cylinders, due consideration should also be given to the oil consumption of the respective engine.

Engine (1192 ccm – 30 HP)

		Tolerance Limits (new parts)	Wear Limits
1 - Cylinder seating depth in cylinder head		12.90—13.00 mm (.507″—.512″)	14.50 mm (.571″)
2 - Cylinder	out of round		0.01 mm (.0001″)
3 - Piston/cylinder	clearance	0.036—0.055 mm (.0014″—.0022″)	0.20 mm (.008″)
4 - Upper and lower compression ring	side clearance	0.045—0.072 mm (.0018″—.0028″)	0.10 mm (.004″)
5 - Oil scraper ring	side clearance	0.025—0.052 mm (.001″—.002″)	0.10 mm (.004″)
6 - Both compression rings	gap	0.30—0.45 mm (.012″—.018″)	0 95 mm (.037″)
Oil scraper ring	gap	0 25—0.40 mm (.0098″—.016″)	0.95 mm (.037″)
7 - Weight tolerance of pistons in one engine ..		max. 5 grams (.18 oz)	
8 - Weight tolerance of con. rods in one engine		max. 5 grams (.18 oz)	
9 - Piston pin/con. rod bush	clearance	0.005—0.026 mm (.0002″—.001″)	0.05 mm (.002″)
10 - Connection rod bearing	clearance	0.019—0.074 mm (.0007″—.003″)	0.15 mm (.006″)
	end play	0.170—0.395 mm (.007″—.0155″)	0.70 mm (.03″)
11 - Crankshaft main bearing (consideration being paid to the preload of 0.025 mm/.001″ by the crankcase)			
a - Bearings 1 to 3	clearance	0.047—0.102 mm (.0019″—.05″)	0.19 mm (.007″)
b - Bearing 4	clearance	0.031—0.083 mm (.0012″—.0033″)	0.17 mm (.006″)
12 - Crankshaft at 2nd and 4th main bearing journals (1st and 3rd bearing journals on V-blocks)	run-out		0.03 mm (.0012″)
13 - Crankshaft/main bearing 1 (fitted with different shims)	end play	0.070—0.120 mm (.003″—.005″)	0.15 mm (.006″)
14 - Crankshaft	out of balance	max. 8 cmg	
15 - Main bearing journal	out of round		0.03 mm (.0012″)
16 - Crank pin	out of round		0.03 mm (.0012″)
17 - Crankcase bore for cranskhaft			
a - Bearings 1 to 3	diameter	60.000—60.019 mm ⌀ (2.3622″—2.3630″)	
b - Bearing 4	diameter	50.000—50.025 mm ⌀ (1.9685″—1.9695″)	

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		Tolerance Limits (new parts)	Wear Limits
18 - Fan pulley	radial run-out	max. 0.8 mm (.031″)	
	lateral run-out	max. 0.3 mm (.012″)	
19 - Crankcase bore for camshaft	diameter	24.020—24.041 mm ⌀ (.9457″—.9465″)	24.070 mm ⌀ (.9476″)
20 - Camshaft	clearance	0.020—0.054 mm (.0008″—.0021″)	0.12 mm (.005″)
Guide bearing	end play	0.020—0.074 mm (.0008″—.0029″)	0.10 mm (.004″)
(between two points)	run-out	0.02 mm (.0008″)	0.04 mm (.0016″)
21 - Camshaft timing gear	radial run-out	0.03 mm (.0012″)	
	lateral run-out	0.10 mm (.004″)	
	backlash	0.010—0.035 mm (.0004″—0.014″)	
22 - Flywheel	lateral run-out	max. 0.30 mm (.012″)	
(at gear ring)	radial run-out	max. 0.40 mm (.016″)	
	unbalance	max. 5 cmg	
Flange	outer diameter	59.90—60.10 mm ⌀ (2.3583″—2.3661″)	59.70 mm ⌀ (2.3504″)
	height	min. 12.5 mm (.4921″)	
	crankshaft seating depth	3.25—3.33 mm (.1279″—.0131″)	
	thickness of collar in flange	6.3—6.7 mm (.25″—.26″)	min. 4.8 mm (.1890″)
Providing flywheel face with recess of 110 mm (4.33″) around flange	wall thickness		min. 4.4 mm (.1732″)
Removing metal from gear ring			max. 2.0 mm (.08″)
23 - Valve stem: intake	diameter	6.965—6.955 mm ⌀ (.2742″—.2738″)	6.920 mm ⌀ (.2724″)
exhaust	diameter	6.955—6.945 mm ⌀ (.2738″—.2734″)	6.920 mm ⌀ (.2724″)
	out of round	0.01mm (.004″)	
24 - Valve guides: intake	inside diameter	7.008—7.023 mm ⌀ (.2759″—.2765″)	7.070 mm ⌀ (.2783″)
exhaust	inside diameter	7.023—7.038 mm ⌀ (.2765″—.2767″)	7.080 mm ⌀ (.2787″)
25 - Valve guide/valve stem: intake	clearance	0.043—0.068 mm (.0017″—.0027″)	0.15 mm (.006″)
exhaust	clearance	0.068—0.093 mm (.0027″—.0037″)	0.16 mm (.0063″)
26 - Valve seat: intake	width	1.3—1.6 mm (.051″—.063″)	
exhaust	width	1.7—2.0 mm (.067″—0.79″)	
valve seating face	run-out	0.01 mm (.0004″)	

		Tolerance Limits (new parts)	Wear Limits
27 - Valve springs: free length 43 mm (1.7″) loaded length 28 mm (1.1″) ..	load	33.4 kg ± 5% (73.6 lbs.)	30 kg (66 lbs.)
28 - Valve clearance (with engine cold) intake and exhaust	adjustment	0.10 mm (.004″)	
29 - a - Rocker arm	inside diameter	15.990—16.018 mm ⌀ (.6295″—.6306″)	16.035 mm ⌀ (.6313″)
b - Rocker arm shaft	diameter	15.984—15.966 mm ⌀ (.6293″—.6285″)	15.955 mm ⌀ (.6281″)
c - Rocker arm/rocker arm shaft	clearance	0.006—0.052 mm (.0002″—.0020″)	0.080 mm (.0031″)
30 - a - Crankcase bore for valve push rod	diameter	15.000—15.018 mm ⌀ (.5905″—.5912″)	15.060 mm ⌀ (.5932″)
b - Valve push rod	diameter	14.984—14.966 mm ⌀ (.5899″—.5892″)	14.955 mm ⌀ (.5888″)
c - Crankcase bore/valve push rod	clearance	0.016—0.052 mm (.0006″—.0020″)	0.120 mm (.0047″)
31 - Valve push rod/guide plate	clearance	The valve push rod should gilde through the guide by its own weight at the lowest possible clearance	0.02 mm (.0008″)
32 - Compression (To be checked with the throttle open and the engine having attained operating temperature, all spark plugs removed, pressure gauge in spark plug seat and the engine turned over by the starter motor)	pressure	7.0—8.5 atm. (100—121 lbs./sq. in.)	4.5 atm. (64 lbs./sq.in.)
33 - Oil pump: end play of gears with cover removed and gasket in situation	end play	0.066—0.183 mm (.0026″—.0072″)	0.20 mm (.008″)
end play of gears with cover and gasket removed	end play		0.10 mm (.004″)
Oil pump gears	backlash	0.03—0.08 mm (.0012″—.0031″)	
34 - Oil pressure (only for SAE 20 oil): a - with engine having attained operating temperature (at idling speed)		min. 0.5 atm. (7 lbs./sq. in.)	
b - at oil temperature of 70° C (158° F) and 2500 engine r. p. m.		min. 2.0 atm. (28 lbs./sq. in.)	
35 - Spring for oil pressure relief valve	free length	52—53 mm (2.05″—2.09″)	
36 - Oil pressure contact opens	pressure	0.3—0.6 atm. (4.3—8.5 lbs./sq. in.)	
37 - Distance from fan housing to upper edge of throttle ring	adjustment	20 mm (.8″)	
38 - Thermostat: after a water bath of 75 to 80° C (170 to 180° F)	length	min. 46 mm (1.81″)	

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		Tolerance Limits (new parts)	Wear Limits
Clutch			
1 - Clutch driven plate	lateral run-out	max. 0.5 mm (.02″)	
2 - Clutch thrust spring:			
Passenger Cars:			
lenght, unloaded 51.7 mm (2.04″)			
loaded 29.4 mm (1.16″)			
Load		55—60 kg (121—132 lbs.)	49 kg (108 lbs.)
3 - Clutch pedal free play		10—20 mm (.4″—.8″)	
4 - Clutch pressure plate	run-out		0.10 mm (.004″)
5 - Clutch release plate	run-out		0.30 mm (.012″)
6 - Clutch assy	unbalance	max. 15 cmg	
Front Axle			
1 - Torsion arm	twist	max. 0.2 mm (.008″)	
2 - Torsion arm/fiber bush (upper limit should be approached, fiber is apt to swell)	clearance	0.20—0.27 mm (.008″—.010″)	0.35 mm (.014″)
3 - Torsion arm link pin/sintered iron bush ...	clearance	0.042—0.087 mm (.0017″—.0034″)	0.20 mm (.008″)
4 - Torsion arm link pin	diameter	17.940—17.913 mm ⌀ (.7063″—.7052″)	17.800 mm ⌀ (.7008″)
5 - King pin/bush	clearance	0.027—0.034 mm (.0010″—.0013″)	0.08 mm (.003″)
	end play	(None)	
6 - Alignment of front axle tubes, departure from parallelism		max. 0.2 mm (.008″)	
7 - Front wheel alignment (chassis on level surface)			
a - with permissible total weight:			
Camber		0° 40′ ± 30′	
King pin inclination		4° 20′	
Caster (Axle tubes)		2° 30′ ± 15′	
b - with car in unladen condition:			
Toe-in (at rim flange)		1—3 mm (.04″—.12″)	
8 - Steering gear			
a - Sector shaft	end play	0.25 mm (.0098″)	
b - Sector shaft spring	free length	23.4 ± 0.4 mm (.921″—.016″)	
	loaded length	20.3 mm (.8″)	
Tension of loaded spring		60—75 kg (130—165 lbs.)	
c - Sector shaft thrust pin	length	19.9—20.1 mm (.7835″—.7913″)	
9 - Steering drop arm/steering gear case	end play	0.4—1.0 mm (.016″—.04″)	

		Tolerance Limits (new parts)	Wear Limits
Rear Axle and Transmission			
1 - Main drive shaft/pilot bush	clearance	0.09—0.147 mm (.004″—.006″)	0.25 mm (.0098″)
2 - Main drive shaft			
a - at intermediate ball bearing (between two points)	run-out	0.02 mm (.0008″)	max. 0.05 mm (.002″)
b - at pilot end (with main drive shaft installed)	run-out		max. 0.20 mm (.002″)
3 - Preload of gear shift housing		0.02—0.11 mm (.0008″—.0043″)	
4 - Bushes for transmission shift rod	inside diameter	min. 15.015 ⌀ (.5911″)	15.250 mm ⌀ (.6004″)
5 - Transmission shift rod	diameter	15.000—14.957 mm ⌀ (.590″—.5888″)	14.570 mm ⌀ (.5807″)
6 - Selector shaft detent spring, loaded length 21.5 mm (.85″)	load	6.2 kg (13.7 lbs.)	
7 - Preload of transmission case halves on the two differential ball bearings		0.10—0.18 mm (.004″—.007″)	
8 - Rear axle shaft			
a - Flat end/fulcrum plates differential side gear (4 parts)	clearance	0.05—0.23 mm (.002″—.009″)	0.30 mm (.012″)
b - Flat end/differential side gear (measured across the convex sides)	clearance	0.03—0.10 mm (.0012″—.004″)	0.15 mm (.006″)
9 - Transmission case/rear axle tube/tube retainer	clearance	0.40—0.60 mm (.016″—.024″)	0.70 mm (.027″)
10 - Rear wheel oil seal	seating depth	4.7—5.0 mm (.185″—.197″)	
11 - Starter shaft bush	inside diameter	12.545—12.570 mm ⌀ (.4939″—.4949″)	12.65 mm ⌀ (.4980″)
12 - Starter shaft/bush	clearance	0.105—0.16 mm (.0043″—.0063″)	
De Luxe Model Only			
13 - Gear for 2nd speed	end play	0.10—0.25 mm (.004″—.0098″)	
	clearance	0.04—0.072 mm (.0016″—.0028″)	
14 - Gear for 3rd speed	end play	0.10—0.25 mm (.004″—.0098″)	
	clearance	0.04—0.068 mm (.0016″—.0027″)	
15 - Gear for 4th speed	end play	0.10—0.25 mm (.004″—.0098″)	
	clearance	0.04—0.074 mm (.0016″—.0029″)	
16 - Selector fork/1st speed gear	end play	0.5—0.7 mm (.02″—.03″)	
17 - Selector shaft/3rd and 4th speed operating sleeve	end play	0.2—0.4 mm (.008″—.016″)	

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		Tolerance Limits (new parts)	Wear Limits
18 - Selector fork/reverse sliding gear	end play	0.2—0.5 mm (.008″—.02″)	
19 - Synchronizer stop rings/gears clearance between clutch teeth faces		min. 0.8 mm (.03″)	0.30 mm (.012″)
20 - Bush for reverse sliding gear	inside diameter	16.050—16.077 mm ⌀ (.6319″—.6330″)	
Standard Model Only			
21 - Gear for 3rd speed	end play	0.20—0.75 mm (.008″—.030″)	
22 - Gear for 4th speed	end play	0.25—0.40 mm (.0098″—.016″)	0.50 mm (.02″)
23 - Selector fork/selector ring	end play	0.23—0.53 mm (.0091″—.0208″)	
24 - Bush for reverse sliding gear	inside diameter	16.050—16.093 mm ⌀ (.6319″—.6336″)	

Brakes and Wheels

1 - Brake master cylinder	diameter	19.05 mm ⌀ (.750″)	
Piston push rod measured from ball-shaped end up to nut	length	52—53 mm (2.05″—2.09″)	
2 - Brake wheel cylinder, front	diameter	19.05 mm ⌀ (.750″)	
rear	diameter	17.45 mm ⌀ (.690″)	
3 - Stop light switch, contacts close at	pressure	3.5—8.0 atm. (50—114 lbs./sq. in.)	
4 - Brake drum	lateral run-out	max. 0.25 mm (.0098″)	0.35 mm (.0138″)
	radial run-out	max. 0.25 mm (.0098″)	0.25 mm (.0098″)
	thickness of wall	5.25—4.90 mm (.206″—.193″)	4.0 mm (.16″)
	inside diameter	230.0+0.2 mm ⌀ (9.05″+.008″)	231.5 mm ⌀ (9.11″)
	taper	max. 0.1 mm (.004″)	
5 - Brake lining	thickness	4.0—3.8 mm (.16″—.15″)	2.7 mm (.106″)
Oversize	thickness	4.5—4.3 mm (.18″—.17″)	3.2 mm (.126″)
	width	30 mm (1.18″)	
6 - Wheel	radial run-out	max. 1.5 mm (.06″)	
	lateral run-out	max. 1.5 mm (.06″)	
7 - Rear Wheels (spring plate adjustment according to instructions and car unladen)		toe-in 1 mm (.04″) to toe-out 2.5 mm (.098″)	
8 - Spring plates, unloaded	adjustment	12° ± 30′	