CABRIOLETS

1500 Type 118K

1600S Type 118SB

SPECIFICATIONS AND FEATURES

MAIN SERVICING INSTRUCTIONS

FIAT - SERVICE DEPARTMENT - TURIN

CABRIOLETS

1500 Type 118 K

1600 S Type 118 SB

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SERVICE DEPARTMENT - TURIN

PRINTED IN ITALY

FIAT SERVICE DEPARTMENT
Print No. SAT 1930 - Norm. 501.881 - 2000 - II-1966

STAMPERIA ARTISTICA NAZIONALE
TORINO - Corso Siracusa, N. 37

GENERAL INFORMATION

In this publication are outlined the main specifications and features as well as the service procedures of more current use covering 1500 and 1600 S Cabriolets.

All data and repair directions in the following pages are intended to apply to both Models whenever no specific mention of the type is made. Differing parts are dealt with separately and each of them comes with the applicable Model name.

MAIN SPECIFICATIONS - 1500 CABRIOLET

IDENTIFICATION DATA

Chassis type	118 K
Engine type	115 C.005

ENGINE

Arrangement	front
Cycle and strokes	Otto, 4 - stroke
No. of cylinders	four, in - line
Bore	3.03″ (77 mm)
Stroke	3.13″ (79.5 mm)
Displacement	90.37 cu.in (1,481 cm^3)
Compression ratio	9 to 1
Maximum horsepower, SAE standards	83
at	5,400 rpm
Taxable horsepower (Italy)	16
Cooling	water

CLUTCH

Dry, single plate type with spring cushioned hub.
Driven plate lining O. D. . . . . $7\,^{7}/_{8}$″ (200 mm)

TRANSMISSION

Five forward speeds and reverse.
Gear ratios:

First, synchromeshed	3.242 to 1
Second, synchromeshed	1.989 to 1
Third, synchromeshed	1.410 to 1
Fourth, synchromeshed	1 to 1
Fifth (O. D.), synchromeshed	0.864 to 1
Reverse	3.340 to 1

PROPELLER SHAFT

Two-section with center pillow bearing.
A flexible joint and two universal joints.

REAR AXLE

Hypoid final drive gear set.
Gear ratio: . . . . . 4.1 to 1 (10/41)

FRONT SUSPENSION

Independent-wheel type.
Control arms counteracted by coil springs and hydraulic shock absorbers.
Sway eliminator bar.
Toe-in, fully laden . . . . .0394″ to .1181″ (1 to 3 mm)
Camber, fully laden . . . . . $0^{o}\ 30' \pm 20'$
Caster, fully laden . . . . . $2^{o}\ 10' \pm 30'$

REAR SUSPENSION

By semi-elliptic springs and hydraulic shock absorbers.
Sway eliminator bar.

STEERING SYSTEM

Worm and roller steering gear.
Gear ratio . . . . . 16.4 to 1
Turning circle . . . . . $34\,^{1}/_{2}$ ft (10.5 m)
Steering column mounted on two ball bearings and fitted with a pair of end universal joints.
Linkage end joints, of the « for life » type, need not be lubricated.

BRAKES

Front: disc type.
— Disc diameter . . . . . $9\,^{27}/_{32}$″ (250 mm)
— Bore of caliper outer cylinders $1\,^{11}/_{32}$″ (33.985 mm)
— Bore of caliper inner cylinder . $1\,^{15}/_{16}$″ (48.132 mm)

Rear: drum type, with self-centering shoes.
— Drum diameter . . . . . $9\,^{27}/_{32}$″ (250 mm)
— Wheel cylinder bore . . . . . 3/4″
— Master cylinder bore . . . . . 7/8″

Vacuum brake booster acting on four wheels.

WHEELS AND TIRES

Disc wheels with rim, type . . . . $3\,^{1}/_{2}$ J
Tire size . . . . . 145 x 14″
Tire inflation pressure:
— front . . . . . 22.8 psi (1.6 kg/cm^2)
— rear . . . . . 24.2 psi (1.7 kg/cm^2)

ELECTRIC SYSTEM

Voltage 12
Battery capacity (at 20-hour discharge rate) . . . . . 48 Amp/hr
FIAT generator type D 115/12/28/4.
FIAT generator regulator type GN 2/12/28.
FIAT starting motor type E 100-1,5/12 Var. 1.

WEIGHTS

Curb weight (with water, oil, petrol, spare wheel, tool kit and accessories) . . . . . 2,127 lbs (965 kg)
No. of seats . . . . . two
Carrying capacity . . 2 people plus 110 lbs (50 kg)

Laden weight . . . . . 2,546 lbs (1,155 kg)
Distribution of laden weight:
— front axle . . . . . 1,290 lbs (585 kg)
— rear axle . . . . . 1,256 lbs (570 kg)

PERFORMANCE

Speeds, maximum, on flat road (run-in and fully laden):

first gear	31 mph (50 km/h)
second gear	50 mph (80 km/h)
third gear	68 mph (110 km/h)
fourth gear	93 mph (150 km/h)
fifth gear (overdrive)	100 mph (160 km/h)
reverse	31 mph (50 km/h)

Gradients, maximum climbable (run-in and fully laden):

first gear	40 %
second gear	22 %
third gear	14 %
fourth gear	9 %
fifth gear (overdrive)	6.5 %
reverse	40 %

CAPACITIES

UNIT	Quantity				FILL-IN
	lt	kg	Imp. units	U.S. units	
Fuel tank	38	—	8.36 gals	10.04 gals	Gasoline: ON 92 (Research Meth)
Radiator, engine and heating system	6	—	1.32 gals	1.52 gals	Pure water (1)
Oil pan (*)	3.500	3.150	3.1 qts	3.7 qts	FIAT oil (3)
Transmission	1.60	1.50	1.4 qts	1.7 qts	FIAT W 90/M oil (SAE 90 EP)
Rear axle	0.90	0.85	0.79 qts	0.95 qts	
Steering gear	0.16	0.15	0.14 qts	0.17 qts	
Hydraulic brake circuit	0.37	0.37	0.65 pts	0.78 pts	FIAT special blue label fluid
Front shock absorbers, each	0.165	0.15	0.29 pts	0.35 pts	FIAT S.A.I. fluid
Rear shock absorbers, each	0.185	0.165	0.33 pts	0.39 pts	
Windshield washer bag	—	(2)	(2)	(2)	Water and FIAT D.P./1 fluid mixture (concentrated solution)

(*) Total oil capacity of pan, filter and pipings is 3.79 Imp. qts - 4.55 U.S. qts (3.900 kg). Figure specified in table refers to the amount recommended for periodical oil changes.

(1) When temperature is close to 32° F (0° C), replace radiator water by **FIAT special anti-freezing mixture.**

(2) Pure water .66 Imp. qts - .79 U.S. qts (0.75 kg) plus .6 oz - 17 g (Summer) or 1.2 oz - 34 g (Winter) cleaner.

(3) Use the following grades of oil:

TEMPERATURE	**FIAT Unigrade Oil**	**FIAT Multigrade Oil**	TEMPERATURE	**FIAT Unigrade Oil**	**FIAT Multigrade Oil**
	Supplement 1 level oils which fill MS sequence requirements			**Supplement 1** level oils which fill MS sequence requirements	
Below 5° F (—15° C) - minimum	**VS 10 W** (SAE 10 W)	—	Above 32° F (0° C) - minimum	**VS 30** (SAE 30)	**20 W - 40**
Between 32° F (0° C) and 5° F (—15° C) - minimum	**VS 20 W** (SAE 20 W)	**10 W - 30**	Above 86° F (30° C) - average	**VS 40** (SAE 40)	

CAUTION!: These are detergent oils; do not top up with oils of different make or grade; when first using **detergent** oils on engines other than new, carry out an accurate **flushing** of the lubrication system.

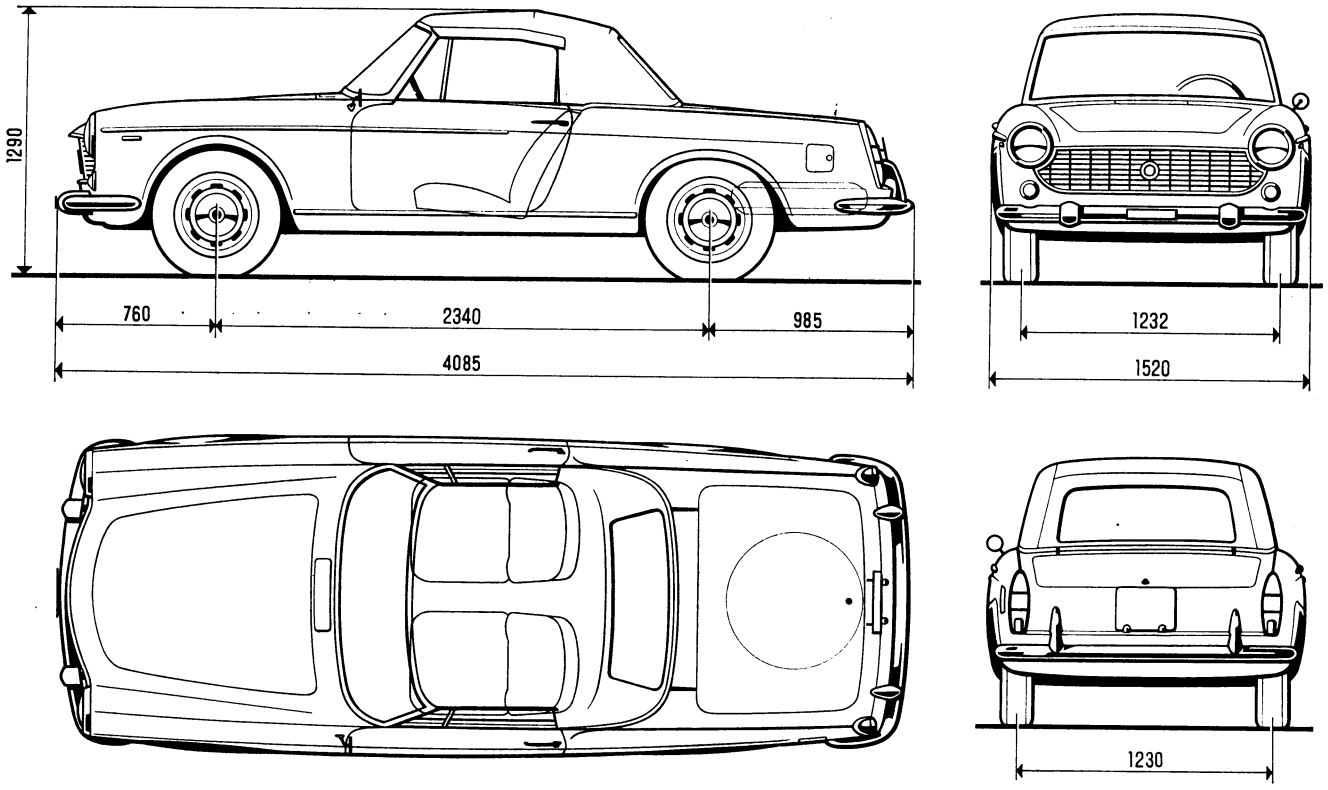
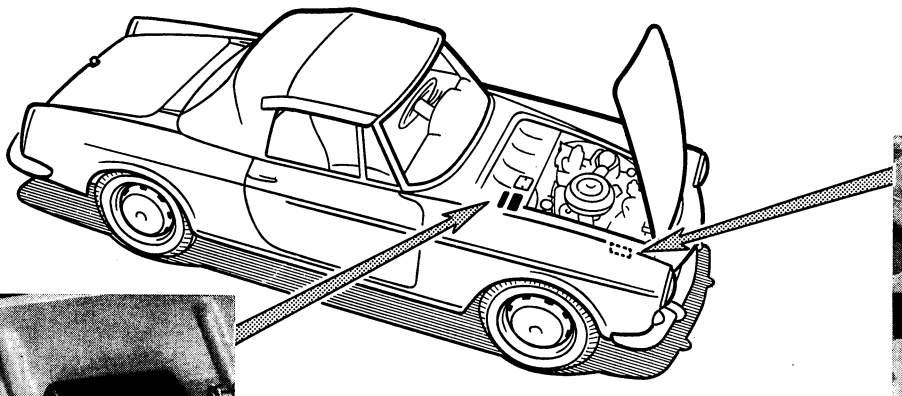


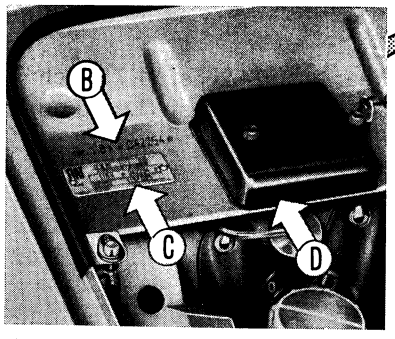
Fig. 1. - Leading dimensions of FIAT 1500 Cabriolet (in mm).

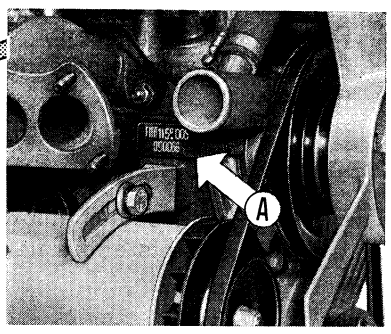
Overall height applies to an unladen vehicle.

UNIT IDENTIFICATION DATA

Fig. 2. - Location of FIAT 1500 Cabriolet identification data.







A. Engine type (115 C.005) and serial number.

B. Chassis type (118 K) and serial number.
C. Unit identification plate.
D. Fuse box.

MAIN SPECIFICATIONS - 1600 S CABRIOLET

IDENTIFICATION DATA

Chassis type	118 SB
Engine type	118 B.000

ENGINE

Arrangement	front
Cycle and strokes	Otto, four - stroke
No. of cylinders	four, in - line
Bore	3.15″ (80 mm)
Stroke	3.07″ (78 mm)
Displacement	95.69 cu.in (1,568 cm^3)
Compression ratio	8.6 to 1
Maximum horsepower, SAE standards	100
at	6,000 rpm
Taxable horsepower (Italy)	17
Cooling	water

CLUTCH

Dry, single-plate type.
Driven plate lining O. D. . . . $8\,1/2$″ (216 mm)
Hydraulic control of clutch.

TRANSMISSION

Five forward speeds and reverse.
Gear ratios:

First, synchromeshed	3.242 to 1
Second, synchromeshed	1.989 to 1
Third, synchromeshed	1.410 to 1
Fourth, synchromeshed	1 to 1
Fifth (O. D.), synchromeshed	0.864 to 1
Reverse	3.340 to 1

PROPELLER SHAFT

Two-section with center pillow bearing.
Two universal joints and a flexible joint.

REAR AXLE

Hypoid final drive gear set.
Gear ratio: . . . . . 4.4 to 1 (9/40)

FRONT SUSPENSION

Independent-wheel type.
Control arms counteracted by coil springs and oleo-pneumatic shock absorbers; sway eliminator bar.

Toe-in, fully laden	.0394″ to .1181″ (1 to 3 mm)
Camber, fully laden	$0^o\,30' \pm 20'$
Caster, fully laden	$1^o \pm 30'$

REAR SUSPENSION

By semi-elliptic springs and oleo-pneumatic shock absorbers; sway eliminator bar.

STEERING SYSTEM

Worm and roller steering gear.

Gear ratio	16.4 to 1
Turning circle	$34\,1/2$ ft (10.5 m)

Steering column mounted on two ball bearings and fitted with a pair of end universal joints.
Linkage end joints, of the « for life » type, need not be lubricated.

BRAKES

Disc type throughout.

Disc diameter	$10\,5/8$″ (270 mm)
Master cylinder bore	7/8″
Bore of front caliper outer cylinders	$1\,1/2$″ (38.195 mm)
Bore of front caliper inner cylinder	$2\,1/8$″ (54 mm)
Bore of rear caliper outer cylinders	$1\,3/16$″ (30.251 mm)
Bore of rear caliper inner cylinder	$1\,11/16$″ (42.874 mm)

Pressure regulator controlling front circuit.
Vacuum brake booster acting on four wheels.

WHEELS AND TIRES

Disc wheels with rim, type	$4\,1/2$ J
Tire size	155 x 15″

Tire inflation pressure:

— low speed, front and rear	24.2 psi (1.7 kg/cm^2)
— high speed, front and rear	27 psi (1.9 kg/cm^2)

ELECTRIC SYSTEM

Voltage	12
Battery capacity (at 20-hour discharge rate)	48 Amp/hr

FIAT generator type D 115/12/28/4 C.
FIAT generator regulator type GN 2/12/28.
FIAT starting motor type E 100-1,5/12 Var. 1.

WEIGHTS

Curb weight (with water, oil, petrol, spare wheel, tool kit and accessories) . . . . . 2,315 lbs (1,050 kg)
No. of seats . . . . . two
Carrying capacity . . . 2 people plus 110 lbs (50 kg)

Laden weight . . . . . 2,734 lbs (1,240 kg)
Distribution of laden weight:
— front axle . . . . . 1,400 lbs (635 kg)
— rear axle . . . . . 1,334 lbs (605 kg)

PERFORMANCE

Speeds, maximum, on flat road (run-in and fully laden):

first gear	31 mph (50 km/h)
second gear	50 mph (80 km/h)
third gear	75 mph (120 km/h)
fourth gear	106 mph (170 km/h)
fifth gear (overdrive)	109 mph (175 km/h)
reverse	31 mph (50 km/h)

Gradients, maximum climbable (run-in and fully laden):

first gear	43 %
second gear	24 %
third gear	14.5 %
fourth gear	10 %
fifth gear (overdrive)	7 %
reverse	43 %

CAPACITIES

UNIT	Quantity				FILL-IN
	lt	kg	Imp. units	U.S. units	
Fuel tank	45	—	10 gals	12 gals	Premium gasoline: ON 98 (Research Method)
Radiator, engine and heating system	6	—	1.32 gals	1.52 gals	Pure water (1)
Oil pan (3)	6	5.4	5.3 qts	6.3 qts	FIAT oil (4)
Transmission	1.6	1.50	1.4 qts	1.7 qts	FIAT W 90/M oil (SAE 90 EP)
Rear axle	0.90	0.85	0.79 qts	0.95 qts	
Steering gear	0.16	0.15	0.14 qts	0.17 qts	
Hydraulic brake circuit	0.42	0.42	0.74 pts	0.88 pts	FIAT special blue label fluid
Hydraulic clutch control circuit	0.17	0.17	0.30 pts	0.36 pts	
Windshield washer bag	—	(2)	(2)	(2)	Water and FIAT D.P./1 fluid mixture (concentrated solution)

(1) When temperature is close to 32° F (0° C), replace radiator water by **FIAT special anti-freezing mixture.**

(2) Pure water .66 Imp. qts - .79 U.S. qts (0.75 kg) plus .6 oz - 17 g (Summer) or 1.2 oz - 34 g (Winter) cleaner.

(3) Total oil capacity of pan, filter and pipings is 5.9 Imp. qts - 7.1 U.S. qts (6.00 kg). Figure specified in table refers to the amount recommended for periodical oil changes.

(4) Use the following grades of oil:

TEMPERATURE	**FIAT Unigrade Oil**	**FIAT Multigrade Oil**	TEMPERATURE	**FIAT Unigrade Oil**	**FIAT Multigrade Oil**
	Supplement 1 level oils which fill MS sequence requirements			**Supplement 1** level oils which fill MS sequence requirements	
Below 5° F (—15° C) - minimum	**VS 10 W** (SAE 10 W)	—	Above 32° F (0° C) - minimum	**VS 30** (SAE 30)	**20 W - 40**
Between 32° F (0° C) and 5° F (—15° C) - minimum	**VS 20 W** (SAE 20 W)	**10 W - 30**	Above 86° F (30° C) - average	**VS 40** (SAE 40)	

CAUTION!: These are detergent oils; do not top up with oils of different make or grade; when first using **detergent** oils on engines other than new, carry out an accurate **flushing** of the lubrication system.

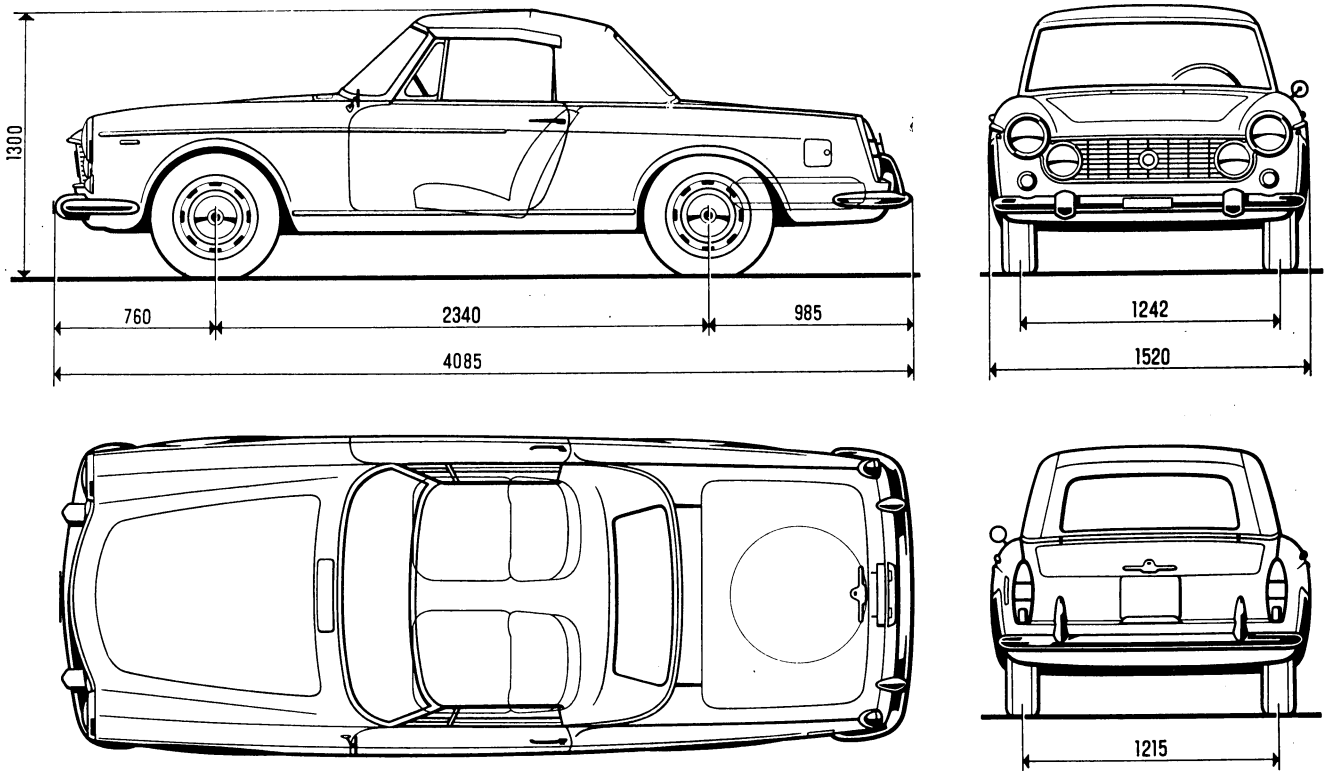
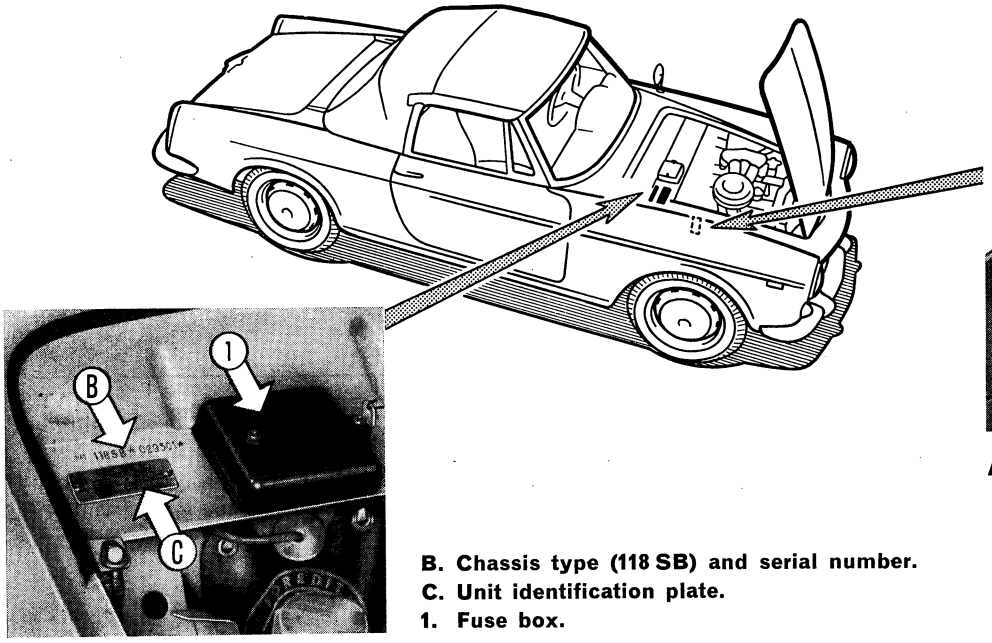
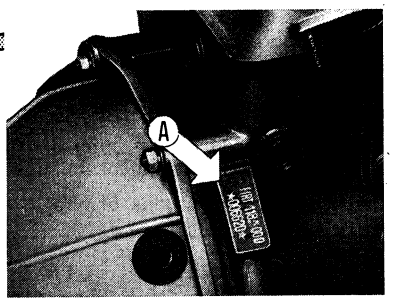


Fig. 3. - Leading dimensions of FIAT 1600 S Cabriolet (in mm).

UNIT IDENTIFICATION DATA

Fig. 4. - Location of FIAT 1600 S Cabriolet identification data.





A. Engine type (118 B.000) and serial number.

B. Chassis type (118 SB) and serial number.
C. Unit identification plate.
1. Fuse box.

MAIN FEATURES

Engine

ENGINE 115 C.005

The four-stroke gasoline engine is arranged at the front of the car.

The principal characteristics of engine 115 C.005 are tabulated on foot of this page.

Cylinder block and crankcase in one iron casting. Aluminum alloy **pistons** of the steel-belted type.

Pistons fitted with three **piston rings**: a compression ring (first), an oil ring (second) and a radial-slotted oil scraper ring (third).

The piston pin hole is .079″ (2 mm) offset.

On assembly, the offset piston should be positioned to the left in respect of cylinder axis, viewing from the valve gear end.

Aluminum **cylinder head** with cast iron valve seat inserts.

Crankshaft working on three supports; babbitt-lined thin-wall type **main bearings**; four half thrust rings fitted on center bearing shoulders.

Connecting rods steel forged with babbitt-lined thin-wall type **bearings**.

VALVE GEAR

Overhead valves operated through tappets, push rods and rockers off the camshaft in crankcase. Camshaft chain-driven by crankshaft.

Valve tappet clearance to check timing		.0177″ (0.45 mm)
Intake	opens	25° B.T.D.C.
	closes	51° A.B.D.C.
Exhaust	opens	64° B.B.D.C.
	closes	12° A.T.D.C.
Valve tappet clearance for engine operation, **cold:**		
— intake		.0079″ (0.20 mm)
— exhaust		.0098″ (0.25 mm)
Valve head diameter	intake	1.378″ (35 mm)
	exhaust	1.240″ (31.5 mm)
Valve face angle		45° 30′ ± 5′
Valve seat angle		45° ± 5′

LUBRICATION

Pressure metered flow system activated by a gear pump.

Centrifugal oil filter and by-pass supplementary filter with pleated paper cartridge.

MAIN SPECIFICATIONS OF ENGINE

Type	115 C.005
Cycle and strokes	Otto, four-stroke
No. of cylinders, lin line	4
Bore	3.03″ (77 mm)
Stroke	3.13″ (79.5 mm)
Displacement	90.37″ cu.in (1.481 cm^3)
Compression ratio	9 to 1
Maximum horsepower (DIN)	75
Maximum horsepower (SAE)	83
at	5,400 rpm
Maximum torque (DIN)	85.35 ft.lbs (11.8 kgm)
Maximum torque (SAE)	88.97 ft.lbs (12.3 kgm)
at	3,200 rpm
Taxable horsepower (Italy)	16
Timing	overhead valves
Dual-barrel carburetor — Weber, type	34 DCHD
Dual-barrel carburetor — Solex, type	C 34 PAIA 2

Pressure relief valve incorporated in oil pump.

Standard oil pressure, at rated speed: 56.9 to 64 psi (4 to 4.5 kg/cm^2).

FUEL SYSTEM

Air cleaner with pleated paper filtering element.

Fuel feed by a camshaft-driven mechanical pump of the diaphragm type, sucking from the tank.

Intake manifold with hot water jackets for heating fuel mixture.

Dual-barrel downdraft carburetor with air control of second throat throttle valve; gradual operation choke and accelerator pump.

Carburetor type: Weber 34 DCHD 4.

Recirculation device of blow-by gases and oil vapours which are drawn into carburetor air intake, hence burned in cylinders.

COOLING SYSTEM

Water is circulated by a centrifugal type pump located in front of cylinder block and V-belt driven off the crankshaft.

Water circulation control by thermostat on engine water outlet duct.

Vertical row tube, single-core type radiator in front of engine.

Automatic in-and-out fan operating through a solenoid controlled by a thermal switch in radiator to contact of coolant.

Temperature gauge sending unit, connected with the temperature gauge on dashboard.

IGNITION

Battery ignition, with distributor driven by a spindle off the camshaft. Combination vacuum and centrifugal weight advance. Manual variator of static advance.

Firing order	1-3-4-2
Static advance	10°
Manual adjustment of static advance	± 5°
Vacuum advance	15° ± 2°
Automatic advance	21° ± 2°
Breaker point gap	.0177″ ± .0012″ (0.45 ± 0.03 mm)

Spark plug types and gap:

— Marelli M 14-19 (CW 240 LP)	.0197″ to .0236″ (0.5 to 0.6 mm)
— Champion M 14-19 (N 9 Y)	.0197″ to .0236″ (0.5 to 0.6 mm)
— AC-Delco M 14-19 (44 XL)	.0197″ to .0236″ (0.5 to 0.6 mm)

STARTING

By electric motor. Drive solenoid actuated from key-type ignition switch adjacent to the steering column.

ENGINE MOUNTINGS

The engine-clutch-transmission unit is mounted at three points on rubber blocks, two of which are located on engine sides and one under transmission extension.

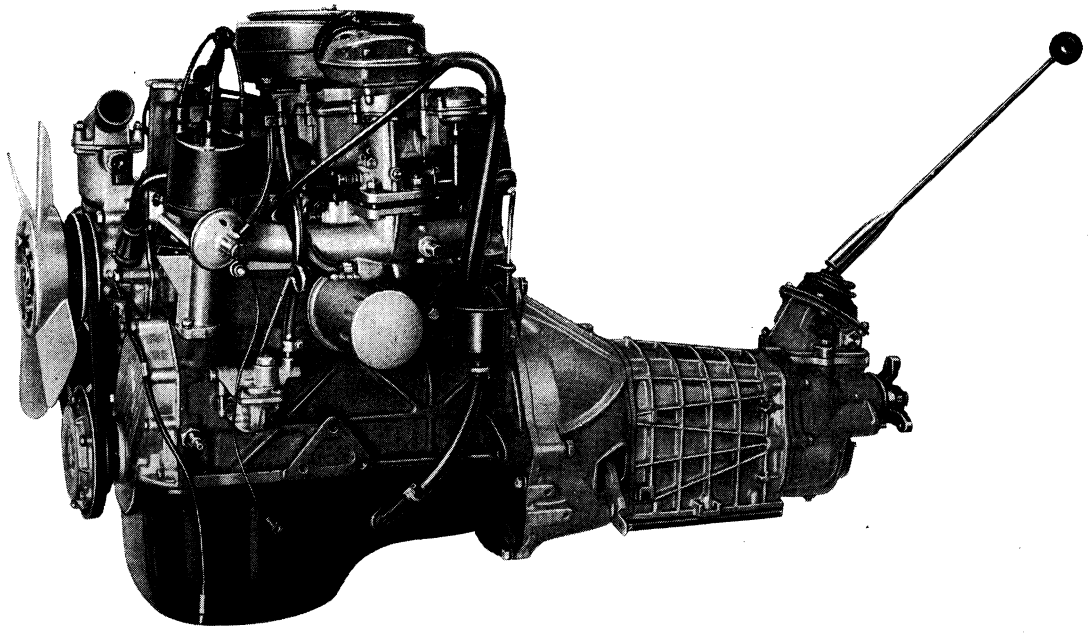


Fig. 5.

Left-hand side view of 1500 Cabriolet power plant.

ENGINE 118 B.000

The four-stroke gasoline engine is arranged at front of the car.

The principal characteristics of engine 118 B.000 are tabulated on foot of this page.

Cylinder block and crankcase in one iron casting.

Aluminum alloy **pistons** fitted with three **piston rings**: a compression ring (first), an oil ring (second) and a slotted oil scraper ring (third).

Aluminum **cylinder head** with cast iron valve seat inserts.

Crankshaft working on five supports; babbitt-lined thin-wall type **main bearings**; four half thrust rings fitted on rear bearing shoulders.

Connecting rods are steel forged with babbitt-lined thin-wall type **bearings**.

VALVE GEAR

Inclined overhead valves operated by two O. H. camshafts.

Twin double-chain drive.

Valve tappet clearance for both timing check and engine operation, **cold:**

— intake . . . . . .0118″ (0.30 mm)

— exhaust . . . . . .0138″ (0.35 mm)

Intake	opens	28° B.T.D.C.
	closes	64° A.B.D.C.
Exhaust	opens	63° B.B.D.C.
	closes	23° A.T.D.C.
Valve head diameter	intake	1.595″ (40.5 mm)
	exhaust	1.437″ (36.5 mm)
Valve face angle		55° 30′ ± 5′
Valve seat angle		55° ± 5′

LUBRICATION

Pressure metered flow system activated by a chain-driven gear pump.

Centrifugal oil filter and by-pass supplementary filter with pleated paper cartridge.

Pressure relief valve in the delivery line.

Standard oil pressure, at rated speed . . . . . 85.3 psi (6 kg/cm²)

MAIN SPECIFICATIONS OF ENGINE

Type	118 B.000
Cycle and strokes	Otto, four-stroke
Number of cylinders, in-line	4
Bore	3.15″ (80 mm)
Stroke	3.07″ (78 mm)
Displacement	95.69 cu.in (1.568 cm³)
Compression ratio	8.6 to 1
Maximum horsepower, DIN standards	85
at	5,800 rpm
Maximum horsepower, SAE standards	100
at	6,000 rpm
Maximum torque, DIN standards	87.52 ft.lbs (12.1 kgm)
at	3,800 rpm
Maximum torque, SAE standards	97.65 ft.lbs (13.5 kgm)
at	4,000 rpm
Taxable horsepower (Italy)	17
Timing	twin O.H. camshaft
Dual-barrel carburetors:	
— Weber type front	34 DCS 2
— Weber type rear	34 DCS 4

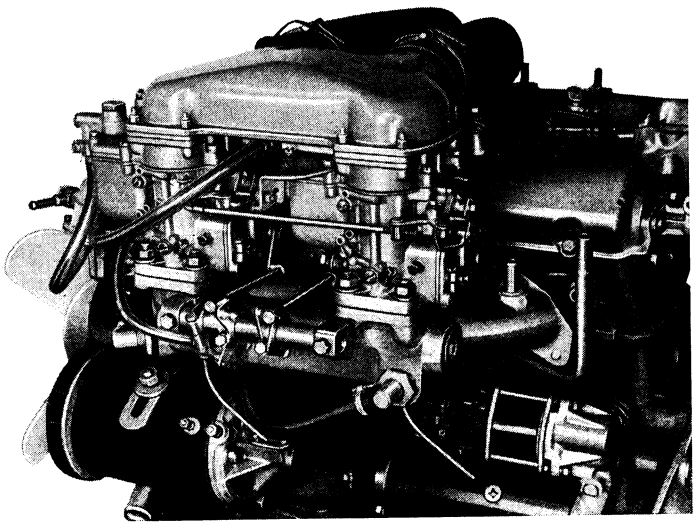


Fig. 6. - Weber carburetors in place on engine 118 B.000.

FUEL SYSTEM

Air cleaner with pleated paper filtering element.

Fuel feed by serially-connected mechanical diaphragm pump and electric pump; the latter operates on engine starting.

Intake manifold with hot water jackets for heating fuel mixture.

Two dual-barrel downdraft carburetors with simultaneous opening of throttle valves. Both carburetors feature an independent ckoke device and power pump.

Carburetor types: Weber 34 DCS 2 and 34 DCS 4.

Recirculation device of blow-by gases and oil vapours which are drawn into carburetor air intake, hence burned in cylinders.

COOLING SYSTEM

Water is circulated by a centrifugal type pump located in front of cylinder block and V-belt driven off the crankshaft.

Water circulation control by thermostat on engine water outlet duct.

Vertical row tube, single-core type radiator in front of engine.

Automatic in-and-out fan operating through a solenoid controlled by a thermal switch in radiator to contact of coolant.

Temperature gauge sending unit, connected with the temperature gauge on dashboard.

IGNITION

Battery ignition, with distributor chain-driven by the crankshaft via a spindle.

Firing order	1-3-4-2
Static advance	$0^{o} \pm 1^{o}$
Automatic advance	$33^{o} \pm 2^{o}$
Breaker point gap	.0165″ to .0189″ (0.42 to 0.48 mm)

Spark plug types and gap:

— Marelli M 14-19 (CW 230 LPS)	.0256″ to .0295″ (0.65 to 0.75 mm)
— Champion M 14-19 (N 9 Y)	.0197″ to .0236″ (0.50 to 0.60 mm)

STARTING

By electric motor. Drive solenoid actuated from key-type ignition switch adjacent to the steering column.

ENGINE MOUNTINGS

Support of engine-clutch-transmission unit is provided by means of two resilient blocks situated on engine sides, and a cross member being attached to the transmission extension, through rubber cushions, and to underbody.

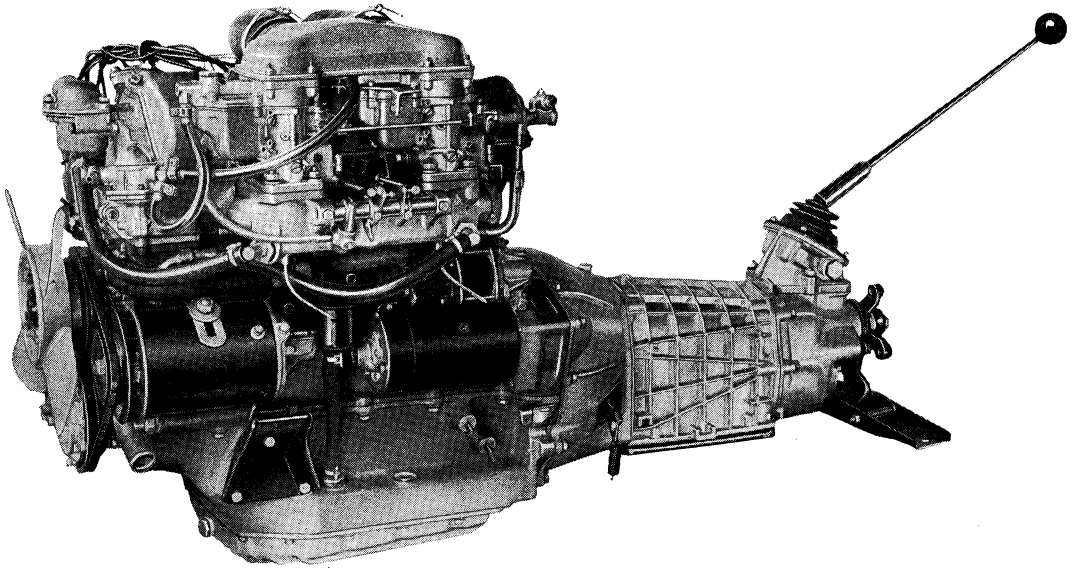


Fig. 7.

Left-hand side view of 1600 S Cabriolet power plant.

Running Gear

CLUTCH

Dry, single plate type with spring-cushioned hub and damper rings. Clutch is actuated mechanically in 1500 Cabriolet and hydraulically in 1600 S Cabriolet.

	1500	1600 S
Driven plate lining O. D.	$7\,^{7}/_{8}''$ (200 mm)	$8\,^{1}/_{2}''$ (216 mm)
Driven plate lining I. D.	$5\,^{19}/_{32}''$ (142 mm)	6″ (152 mm)
Pedal free play	23/32″ to 7/8″ (18 to 22 mm)	23/32″ to 7/8″ (18 to 22 mm)
Master cylinder bore	—	3/4″
Actuating cylinder bore	—	3/4″

TRANSMISSION

Five forward speeds (all synchromeshed) and reverse. Fifth speed is an overdrive.

All forward speeds are constant meshed.

Free-type synchromesh rings for first, second, third and fourth gears.

Fifth gear synchromesh ring of the **spring-type**.

Gearshift control by manual lever mounted on floor tunnel.

Gear ratios:

— first	3.242 to 1
— second	1.989 to 1
— third	1.410 to 1
— fourth	1 to 1
— fifth	0.864 to 1
— reverse	3.340 to 1

PROPELLER SHAFT AND JOINTS

Power is driven to rear wheels by means of two tubular shafts with center pillow block (fig. 131).

The front prop shaft is connected to the transmission through a flexible joint (fig. 131) and fitted with a bearing housing for the pillow block in the vicinity of the rear flange sleeve.

The rear prop shaft is connected to the front one and to rear axle through universal joints. Splined front end allows for sliding trip of « U » joint slip yoke.

REAR AXLE

of the semi-floating type.
Pressed steel sheet axle housing.
Cast-iron differential carrier.

Final drive hypoid gear ratio:

— 1500 Cabriolet	4.1 to 1 (10/41)
— 1600 S Cabriolet	4.4 to 1 (9/40)

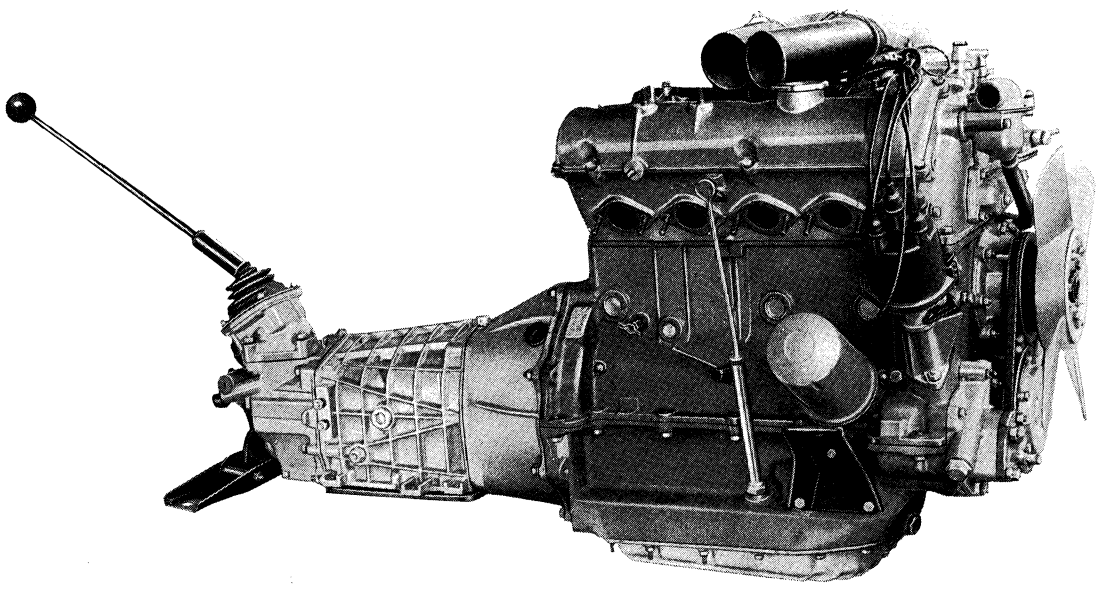


Fig. 8.

Right-hand side view of 1600 S Cabriolet power plant.

FRONT SUSPENSION

Independent-wheel type front suspension consisting of control arms, upper and lower, attached to the sub-frame and wheels and counteracted by coil springs; hydraulic double acting telescope shock absorbers fitted with a gradual action compression valve (1500), and oleo-pneumatic shock absorbers (1600 S).

Sway eliminator bar mounted on lower control arms and sub-frame.

A pair of rubber buffers, mounted on underbody, control up-and-down swings of upper control arm.

Control arms, both upper and lower, are attached to the frame by means of rubber bushings, while arm attachment to knuckle pillars is provided by spiders which, in turn, are tied to control arms through self-threading bushings.

Shock absorbers are secured to underbody on upside and to lower control arms on downside.

	1500	1600 S
Toe-in (*)	.0394″ to .1181″ (1-3 mm)	.0394″ to .1181″ (1-3 mm)
Camber (*)	0° 30′ ± 20′	0° 30′ ± 20′
Caster (*)	2° 10′ ± 30′	1° ± 30′
Kingpin inclination	7°	7°

(*) Check with fully laden car.

REAR SUSPENSION

by semi-elliptic springs and:

— hydraulic double-acting telescope shock absorbers for 1500 Cabriolet;

— oleo-pneumatic shock absorbers for 1600 S Cabriolet;

— cross-mounted sway eliminator bar.

Semi-elliptic springs are pivoted, at the front end, in brackets welded on underbody; a bushing, press-fitted in the front eye of the main leaf, is attached to the underbody bracket by a screw with nut.

At rear, semi-elliptic springs are shackled to a bracket mounted on underbody. Attachment of springs to shackles and of shackles to bracket is assured by a rubber bushed pivot.

The axle housing is connected to the semi-elliptic springs through « U » bolts, whose lower saddle plate is fitted with a pin for lower mounting of shock absorbers.

Shock absorbers are mounted at top on a pin rigidly fastened to the underbody.

Seven rubber buffers, fixed to the body floor, control suspension swings. Arrangement of buffers: two on sides and one at center of each semi-elliptic spring; one at differential carrier.

STEERING SYSTEM

Worm and roller steering gear, ratio 16.4 to 1.

The steering column is mounted on a pair of ball bearings and fitted with two universal joints.

The pitman arm, press fitted on roller shaft, operates an intermediate track rod which is attached, at the opposite end, to an idler arm. Two side tie rods are connected to the idler arm and pivoted to knuckle arms at the opposite end.

The idler arm bracket is secured to the dash bracing in engine compartment interior.

During the whole turning travel, the inner wheel develops a 35° angle, whereas the outer wheel turning angle is 27°.

Turning circle: 34 $^1/_2$ ft (10.50 m).

Both side tie rods are provided with an adjusting sleeve for correct positioning of front wheels.

Steering linkage joints are of the « for life » type and need not be lubricated.

BRAKES

Hydraulic service brakes on four wheels, pedal controlled, and mechanical parking brake on rear wheels, manually operated.

A vacuum brake booster relieves the driver's effort on pedal for brake application.

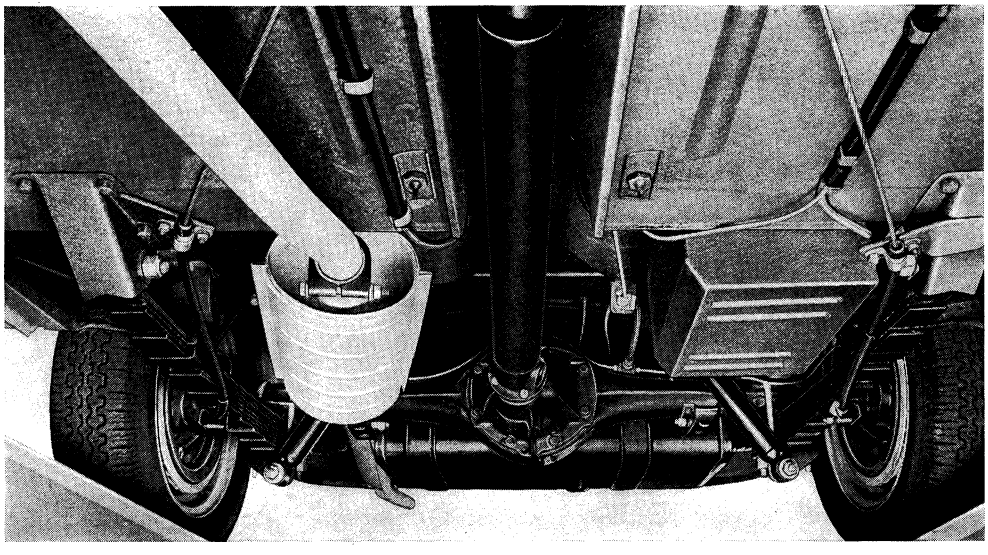
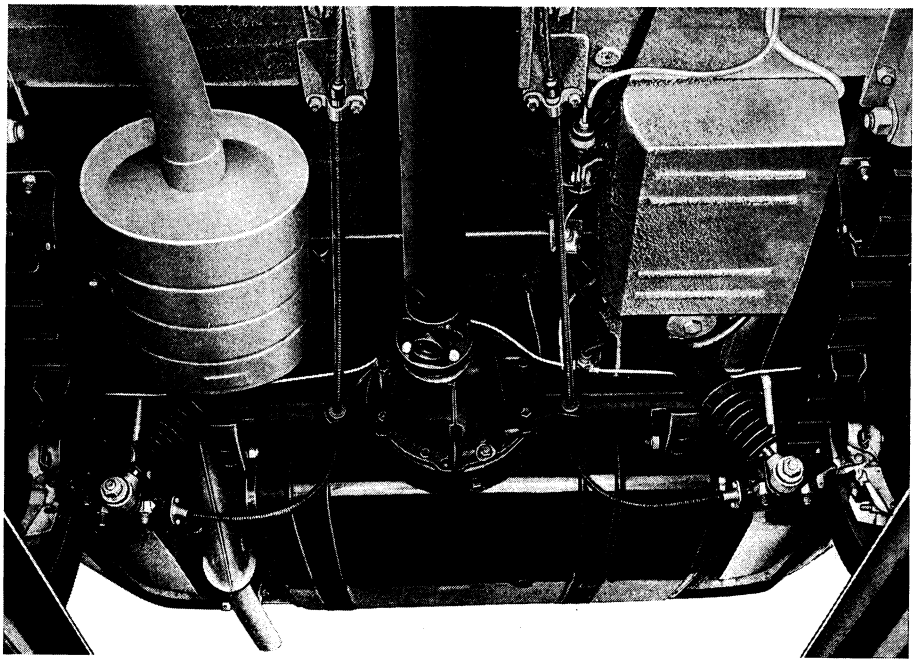


Fig. 9.

Bottom view of 1500 Cabriolet rear axle and suspension.

Fig. 10.

Bottom view of 1600 S Cabriolet rear axle and suspension.



The 1500 Cabriolet features service brakes of the disc type with lining pads at front and of the expanding type with self-centering shoes at rear.

Service brakes of the 1600 S Cabriolet are of the disc type throughout. A special device regulates line pressure on rear wheel brakes.

Disc brakes at each wheel are actuated by three hydraulic cylinders, one inboard and two outboard, working on lining pads.

Expansion brakes are actuated by one dual-piston wheel cylinder.

	1500	1600 S
Front brake disc dia.	9 27/32" (250 mm)	10 5/8" (270 mm)
Rear brake disc dia.	—	10 5/8" (270 mm)
Rear brake drum dia.	9 27/32" (250 mm)	—
Total working area	92.69 sq.in (598 cm²)	57.97 sq.in (374 cm²)
Master cylinder bore	7/8"	7/8"
Bore of front caliper outboard cylinders	1 11/32" (33.985 mm)	1 1/2" (38.195 mm)
Bore of front caliper inboard cylinder	1 15/16" (48.132 mm)	2 1/8" (54 mm)
Bore of rear caliper outboard cylinders	—	1 3/16" (30.251 mm)
Bore of rear caliper inboard cylinder	—	1 11/16" (42.874 mm)
Rear wheel cylinder diameter	3/4"	—

AIR CONDITIONING SYSTEM

Fresh air circulation, heating of passenger compartment and windshield demisting are assured thanks to: an air scoop on cowl, an electro-fan in air distributor assembly, a horizontal row tube radiator in engine cooling circuit, situated in car interior.

Summer Ventilation.

To admit fresh air inside the car (with the canvas top up), the following can be made:

a) lower door glasses;

b) set the lever (C, fig. 11) controlling water flow to heater radiator on « FREDDO » (cool) position and shift air scoop lever (B) to the « INTERNO » (interior) position; so air flows in through deflectors (D) on heater housing.

At low car speed, the amount of incoming air can be increased by turning on the switch (A) operating the front electrofan (the switch is energized only with ignition on).

Mid-Season Ventilation.

In this period, to avoid the misting of the windshield, just let fresh air in by leaving lever (C, fig. 11) in « FREDDO » (cool) position and setting lever (B) on « CRISTALLO » (windshield) position. So air admitted inside is flown exclusively toward the windshield out of six slots on instrument panel upper lining, via air hoses (E).

Winter Heating.

To admit warmed air inside the vehicle for heating purposes, and against the windshield to avoid misting and prevent frost and ice from building up on windshield exterior, arrange control levers as follows:

a) **Windshield.** Set lever (B, fig. 11) on « CRISTALLO » (windshield) position, lever (C) on « CALDO » (warm) position and operate the electrofan through switch (A).

b) **Car Interior.** Set lever (B) on « INTERNO » (interior) position, lever (C) on « CALDO » (warm) position, and operate the electrofan through switch (A).

c) **Windshield and Car Interior.** Set lever (B) midway between « INTERNO » (interior) and « CRISTALLO » (windshield) positions (in a manner to have

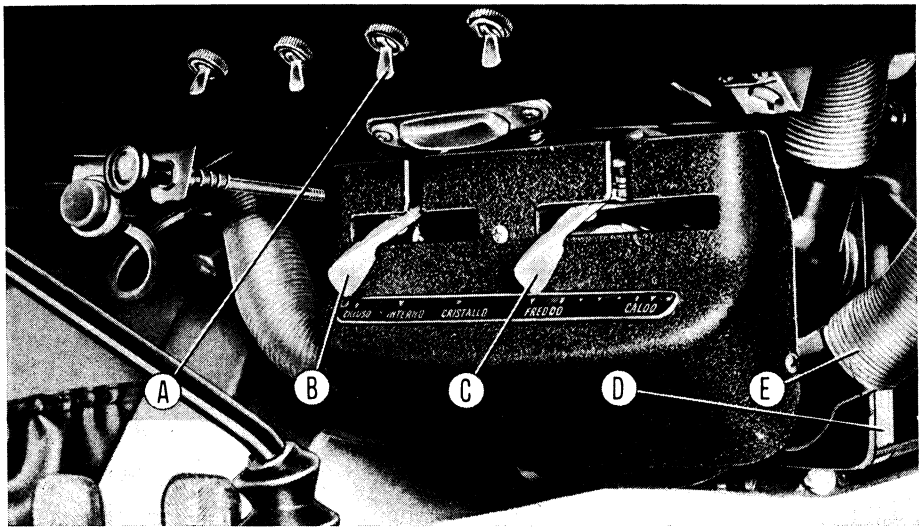


Fig. 11. - Car air conditioner control. A. Electrofan switch - B. Air scoop control lever - C. Engine-to-heater radiator water flow control lever - D. Air inlet deflectors - E. Windshield air delivery hoses.

air flow at the same time inside the vehicle and against the windshield), lever (C) on « CALDO » (warm) position, and operate the electrofan through switch (A).

NOTE - In addition to the extreme « wide open » (« CALDO » - warm) and « off » (« FREDDO - cool) positions, the air conditioner control lever (B) may be set at any intermediate position in the board, so that the desired temperature of incoming air can be obtained.

In winter, should the car be kept inoperative for a certain while without the anti-freeze mixture in the cooling system, in addition to draining the water radiator and engine, take care to let the residual water out also from the heater radiator by loosening the plug on right lower side of the heater housing.

Electric System

1500 Cabriolet

Voltage: 12.

Battery: 48 Amp/hr capacity (at 20 hr discharge rate).

Generator FIAT D 115/12/28/4, belt-driven, 500 W maximum output.

Current and voltage regulator FIAT GN 2/12/28, three-unit type: cut-out relay, voltage regulator, current regulator.

Starting motor FIAT E 100-1,5/12 Var. 1, overrunning clutch type. Solenoid drive controlled from key-type ignition switch with anti-theft device built-in.

Battery **ignition**, via ignition distributor and coil. Ignition distributor operated by a camshaft-driven spindle. Automatic vacuum and centrifugal weight advance. Manual adjustment of static advance.

Lighting Equipment:

— High and low beam headlights, recessed in fenders; asymmetrical low beam.
— Two engine compartment lights.
— Front parking and direction signal lights.
— Side direction signal blinking lights.
— Double license plate light (fitted on bumper).
— Rear tail, direction signal and stop lights with reflector lens.
— Deck light with jam switch.
— Dash light controlled by a toggle switch on instrument panel and a jam switch on door opening contour.
— Fuel gauge and temperature gauge light.
— Clock light.
— Speedometer-odometer light.

External and flashing light control by a switch lever under the steering wheel.

Direction signal light control by a switch lever under the steering wheel returning automatically to « off » position. Flasher unit.

Dual chime horns, with control button on steering wheel and relay switch.

Twin-arm **windshield wiper** with automatic parking-off device.

Fuel gauge tank unit, with reserve supply indicator. The unit incorporates the fuel suction tube and strainer.

Electrofan for interior heating and windshield defrosting.

Trouble light receptacle.

Spark plugs.

Thermal switch (in radiator) for electromagnetic control of cooling fan.

Temperature gauge sending unit (resistor and silicon diode for gauge).

Thermal switch (in cylinder head) for heat indicator.

Low oil pressure indicator sending unit.

Fuse holder, located on bulkhead in engine compartment.

Key-type ignition switch, also energizing warning lights and starting circuit, with anti-theft device built-in, situated on steering column support.

Instrument panel gauges and accessories: windshield washer, instrument light switch; wiper switch; direction signal light indicator (green); parking light indicator (green); master light switch; electro-fan switch; heat indicator.

Speedometer-odometer with high beam indicator (blue). Cluster including: fuel gauge, reserve supply indicator, low oil pressure and no-charge indicators, water temperature gauge.

Electric cigar lighter, ash receiver and electric clock.

1600 S Cabriolet

Voltage: 12.

Battery: 48 Amp/hr capacity (at 20 hr discharge rate).

Generator FIAT D 115/12/28/4 C, belt-driven, 500 W maximum output.

Current and voltage regulator FIAT GN 2/12/28, three-unit type: cut-out relay, voltage regulator, current regulator.

Starting motor FIAT E 100-1,5/12 Var. 1, overrunning clutch type 1.5 KW output. Solenoid drive controlled from key-type ignition switch with anti-theft device built-in.

Battery **ignition**, via ignition distributor and coil. Ignition distributor operated by a spindle chain driven from crankshaft. Automatic advance by centrifugal weights.

Lighting Equipment:

— Twin headlights: asymmetrical low beam by outer lamps, high beam by all lamps.
High beam controlled by outer light switch via a relay.

— Two engine compartment lights with jam switch.

— Front parking and direction signal lights.

— Side direction signal blinking lights.

— Double license plate light (fitted on lower rear panel).

— Rear tail, direction signal and stop lights with reflector lens.

— Deck light with jam switch.

— Dash light controlled by a toggle switch on instrument panel and a jam switch on door opening contour.

— Speedometer-odometer light.

— Clock light.

— Tachometer light.

— Cigar lighter spot light.

External and flashing light control by a switch lever under the steering wheel.

Direction signal light control by a switch lever under the steering wheel returning automatically to « off » position. Flasher unit.

Dual chime horns, with control button on steering wheel and relay switch.

Twin-arm **windshield wiper** with automatic parking-off device.

Fuel gauge tank unit, with reserve supply indicator. The unit incorporates the fuel suction tube and strainer.

Electrofan for interior heating and windshield defrosting.

Trouble light receptacle.

Spark plugs.

Thermal switch (in radiator) for electromagnetic control of cooling fan.

Temperature gauge sending unit (resistor and silicon diode for gauge).

Thermal switch (in cylinder head) for heat indicator.

Low oil pressure indicator sending unit.

Electric fuel pump with relay switch control.

Fuse holder, located on bulkhead in engine compartment.

Key-type ignition switch, also energizing warning lights and starting circuit, with anti-theft device built-in, situated on steering column support.

Instrument panel gauges and accessories: windshield washer, instrument light switch; wiper switch; direction signal light indicator (green); parking light indicator (green); master light switch; electro-fan switch; heat indicator.

Cluster including: speedometer-odometer, fuel gauge reserve supply indicator, high beam indicator (blue) and no-charge indicator.

Tachometer, including also oil pressure gauge and temperature gauge.

Electric cigar lighter, ash receiver and electric clock.

Body

Cabriolet: two-seater, with two doors and side windows. Integral body construction.

Hood: front-hinged, with catch control in car interior.

Windshield: non-adjustable, with curved laminated safety glass.

Doors: front-hinged. Windows with fixed (1500) or swivelling (1600 S) type front pane and adjustable crank-controlled rear pane. Side arm rests on door trim panels.

Canvas top: folding, metal framed, contained in a waterproof fabric case.

Trunk compartment: with front-hinged lid having a push-button key-locked release. Lid hand grip (1600 S only).

Spare wheel: stowed under trunk compartment floor.

Front and rear bumpers: with chromium plated overriders.

Rear license plate: mounted below deck lid.

Front license plate: mounted on bumper blade.

Adjustable bucket seats: with forward tilting and partially reclinable squabs.

Utility recess - arm rest: between seats.

Matting: rubber-and-moquette on passenger compartment floor, rubber on trunk compartment floor.

Air conditioner: under instrument panel, centrally arranged.

Instrument panel:

— 1500 Cabriolet, with chromium plated trim mouldings; plastic padded top and bottom surfaces.

— 1600 S Cabriolet, with imitation wood front trim moulding and chromium plated trim moulding; plastic padded top and bottom surfaces.

Rear view mirrors: internal with non-glare device centrally arranged at top of instrument panel, and external on driver's side fender.

Upholstery: artificial leather.

Door handles: inner and outer, chromium-plated.

Foot rest: tiltable, in front of passenger's seat (1600 S only).

Assist handle: on instrument panel, passenger side.

Tool kit: in trunk compartment.

Provision for safety belt installation (lap and skew types).

Optional: hard top and radio receiver.

Fig. 12. - FIAT 1600 S Cabriolet.

SERVICE PROCEDURES AND FITTING DATA

ENGINE 115 C.005

CYLINDER BLOCK

The cylinder block and crankcase are cast in a single unit of special cast iron.

On the lower face of crankcase letters are stamped at each barrel referring to the value of the bore diameter. In fact, cylinder barrels are graded into three size groups A, B, C, according to the bore size.

Bore sizes corresponding to the various groups are the following:

— Group A . . . 3.0315″ to 3.0319″ (77.000 to 77.010 mm)
— Group B over 3.0319″ to 3.0323″ (77.010 to 77.020 mm)
— Group C » 3.0323″ to 3.0327″ (77.020 to 77.030 mm)

PISTONS

Pistons are of the slipper, domed-crown type with a cavity to allow for intake valve opening.

The slipper type design of the bottom side (fig. 15) is to avoid any interference of the piston with the crankshaft counterweights.

Piston pin hole is .079″ (2 mm) offset.

Pistons are graded into three groups A, B, C, on the ground of their diametrical quotations shown in fig. 15; they are also graded into two groups 1 and 2 according to the boss bore for mating with pins; see paragraph **Connecting Rods**, page 21.

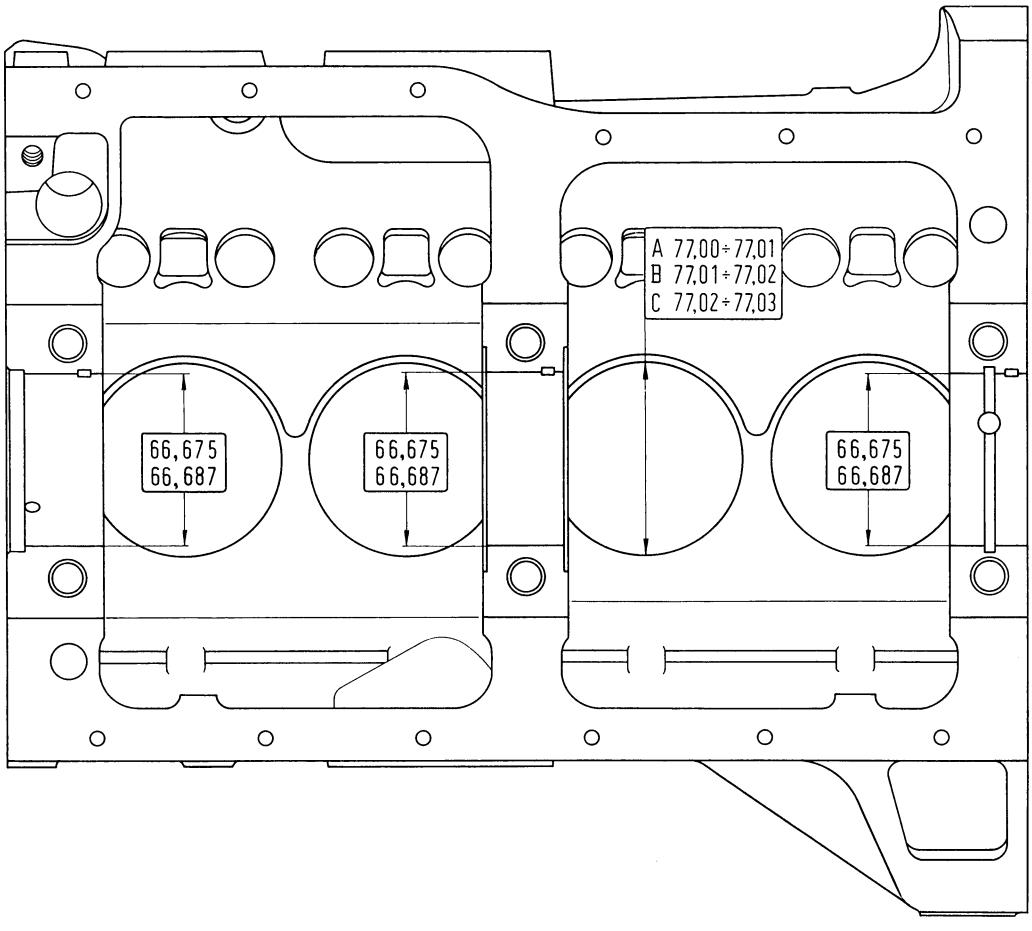


Fig. 13.

Critical dimensions of 115 C.005 engine crankcase (in mm).

Diametrical group sizes of cylinder bores.

Diametrical sizes of three main transverse members.

115C.005 ENGINE ASSEMBLY

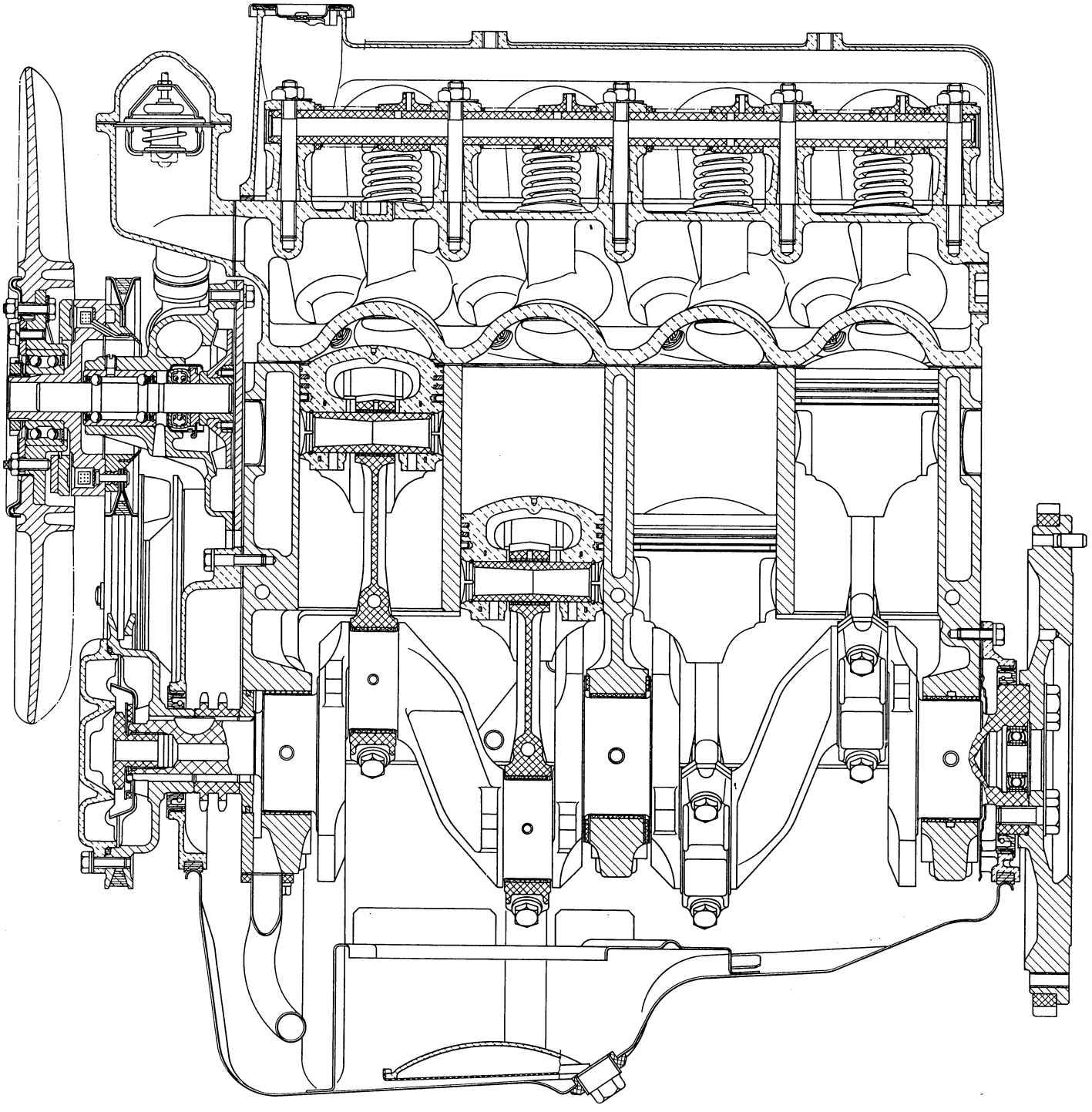


Fig. 14. - Side sectional view of engine 115 C.005 across cylinders.

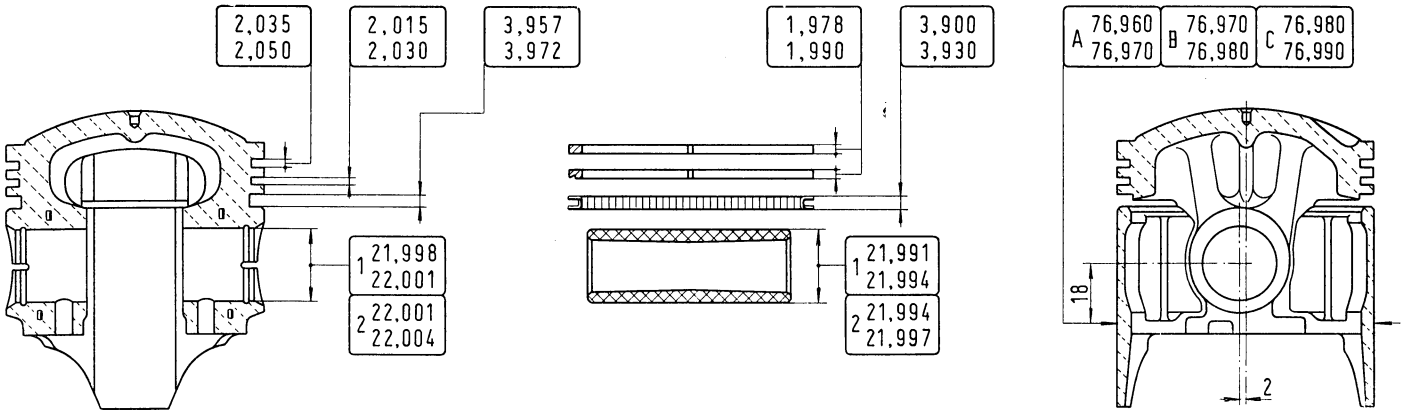


Fig. 15. - Critical dimensions of pistons, piston pins and rings to suit engine 115 C.005 (in mm).

CAUTION - Measurement of piston diameters square to the pin axis should be made 23/32″ (18 mm) apart from pin centerline, as shown in fig. 15.

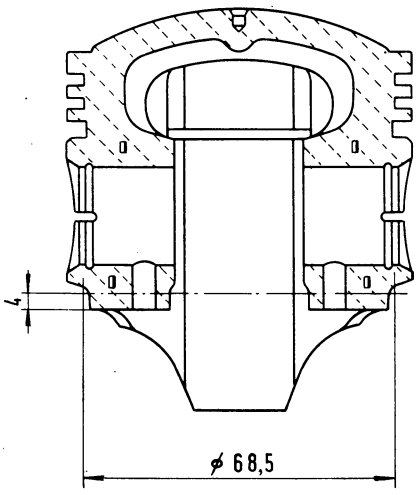


Fig. 16.

Milling diagram to equalize the weight in the same set of four pistons (engine 115 C.005).

4 = 5/32″ - ø 68.5 = diam. 2 11/16″

Cylinder barrel-piston assemblies should be made according to the size group. Every cylinder barrel should be fitted with a piston belonging to the same size group.

Piston size group letter and number are stamped on piston crown on the opposite side to the head cavity (see 1, fig. 19).

Prior to installing pistons, check them for an even weight, maximum weight difference being ± .07 oz (± 2 gr). Should a set of pistons in specified weight range not be available, remove stock by milling at piston boss base as shown in fig. 16. Stock removal should not go over 5/32″ (4 mm) in depth and 2 11/16″ (68.5 mm) in circle diameter.

CONNECTING RODS - ROD BEARINGS

Prior to tying connecting rods with pistons check rod ends for a parallel relationship using fixture **Ap. 5051** at a distance of 4 15/16″ (125 mm) apart from connecting rod vertical centerline. Maximum out-of-true limit ± .0020″ (0.05 mm).

Thin-wall bearing shells cannot be reworked or adapted, lest the babbitt coat is reamed out.

Should deep scratches or signs of wear be evident, renew the bearings.

Connecting rod bearing shells come for replacement in the standard size and undersizes.

Connecting rods, piston pins and pistons are graded into two size groups **1** and **2** as follows:

— **connecting rods:** according to the bore of the small end bushing press-fitted and reamed.
— **piston pins:** according to their O.D.;
— **pistons:** according to pin boss bore.

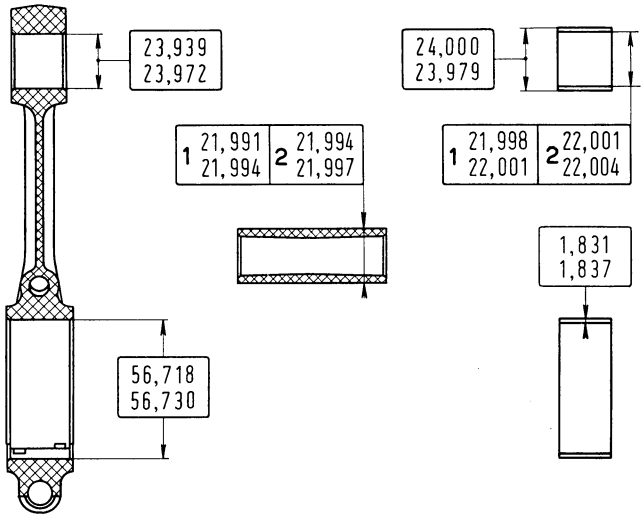


Fig. 17. - Critical dimensions of 115 C.005 engine connecting rods, small end bushings, rod bearings and piston pins (in mm). (Bushing bore specifications in figure apply to a smallend bushing reamed in place).

115C.005 ENGINE ASSEMBLY

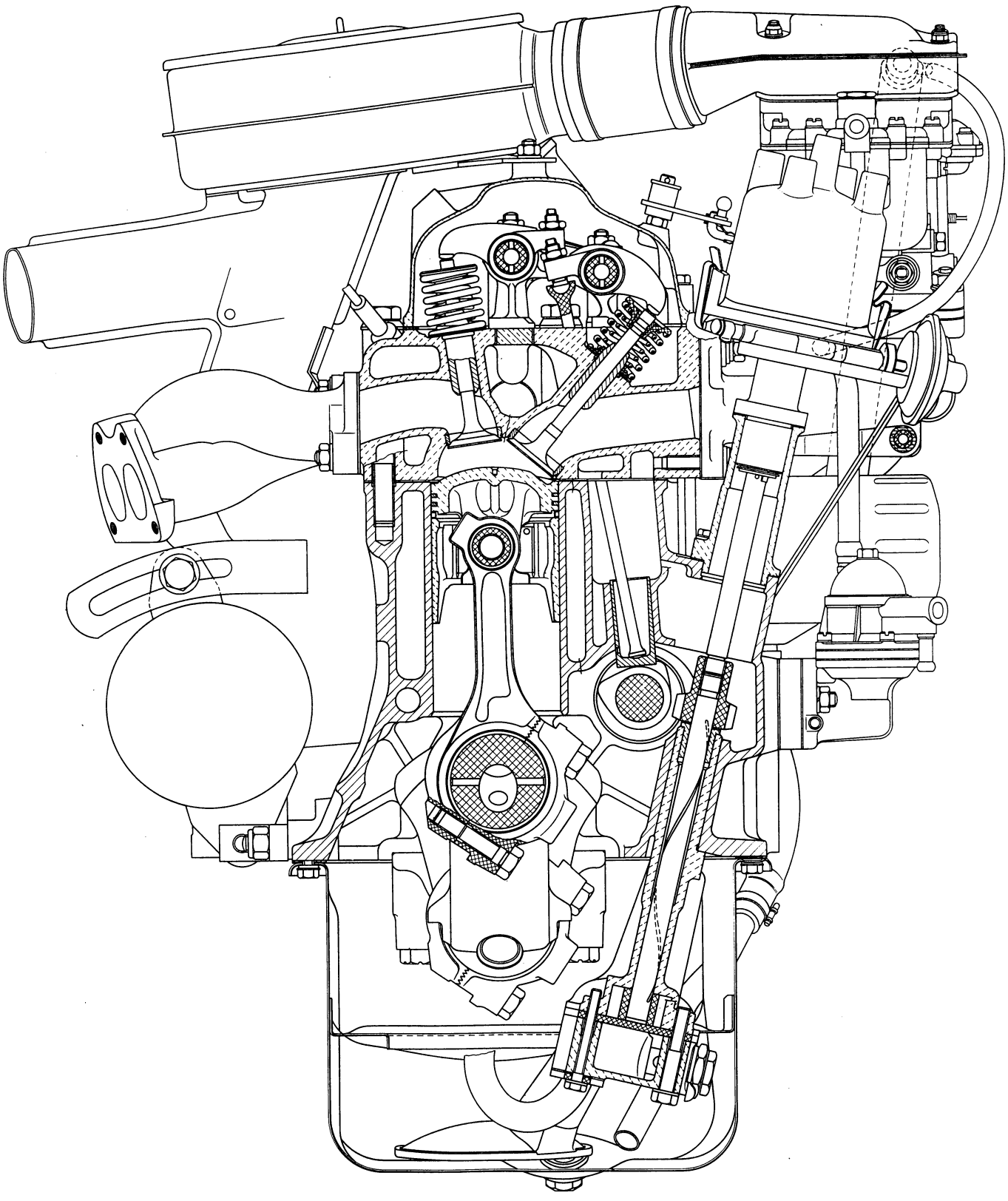


Fig. 18. - End sectional view of engine 115 C.005 across connecting rod, piston, valves, and oil pump and distributor drive mechanism.

Size group numbers are:

— stamped at 4, fig. 19 for connecting rods;

— stamped at 1, fig. 19 for pistons;

— electrically scribed on pin outer face for piston pins.

Connecting rod piston and pin assembly should be made by size group, that is all three items must have the same group number.

Assembly specifications pertaining to pistons, pins and connecting rods are tabulated on pages 43 and 44.

Connecting rod identification number to match with the cylinder bore number should be stamped at 5, fig. 19. Remember to stamp identification number whenever installing new connecting rods.

The connecting rod must be assembled to the piston so that the number stamped on the connecting rod face (5, fig. 19) is on the opposite side to the piston top cavity (2).

When fitting the connecting rod-piston assembly into the cylinder bore, take care that the connecting rod assembly number to the cylinder is facing on the opposite side to the camshaft.

To check the clearance between bearing shells and journals, use the « Plastigage » calibrated wire, type PG 1 or PR 1.

Clearance is indicated by the amount of flattening of the wire, which has been placed between the bearing and the crankshaft journal.

Compare the width of the flattened « Plastigage » with the graduations on the envelope; the value within the graduation on the envelope shows the bearing clearance (fig. 21) which should be, for new parts, .0122″ to .0299″ (0.031 to 0.076 mm).

CRANKSHAFT AND MAIN BEARINGS

The crankshaft is forged with counterweights and rotates on three bearings.

Four shoulder ring halves on center bearing take the end thrusts of the crankshaft.

Grinding Crankshaft Journals.

Crankshaft journals should be ground with the utmost care, otherwise an alteration of crankarm fillet radius may result in respect of the specifications given in fig. 22.

Main bearing halves are supplied for replacement in the standard size and undersizes.

As already outlined under « Connecting Rods-Rod Bearings », precision insert bearings should not be reworked or adapted; in case deep scores or signs of excessive wear are observed, renew main bearings using proper undersizes.

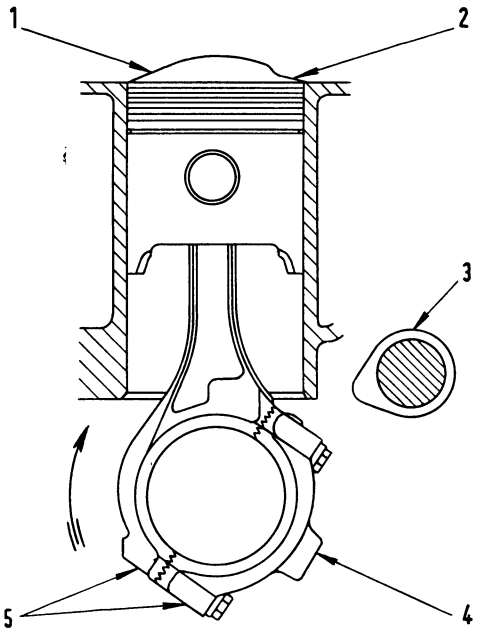


Fig. 19. - Connecting rod-piston assembly installation diagram. Engine 115 C.005.

1. Location of piston-cylinder size group letter and piston-piston pin size group number - 2. Piston top cavity - 3. Camshaft - 4. Location of small end bushing size group number - 5. Location of connecting rod-cylinder pairing number.

Arrow shows turning direction of front viewed engine.

MAIN BEARING JOURNAL DIAMETER SPECIFICATIONS

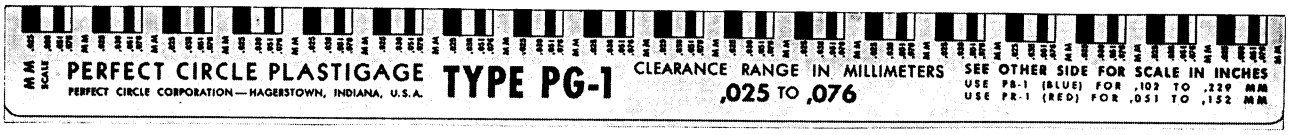
Standard Size	Undersizes			
	.0108″ (0.274 mm)	.0208″ (0.528 mm)	.0308″ (0.782 mm)	.0408″ (1.036 mm)
2.4788″ (62.962 mm) to 2.4796″ (62.982 mm)	2.4680″ (62.688 mm) to 2.4688″ (62.708 mm)	2.4580″ (62.434 mm) to 2.4588″ (62.454 mm)	2.4480″ (62.180 mm) to 2.4488″ (62.200 mm)	2.4380″ (61.926 mm) to 2.4388″ (61.946 mm)

MAIN BEARING SHELL THICKNESS SPECIFICATIONS

Standard Size	Undersizes			
	.0108″ (0.274 mm)	.0208″ (0.528 mm)	.0308″ (0.782 mm)	.0408″ (1.036 mm)
.0716″ (1.818 mm) to .0718″ (1.824 mm)	.0770″ (1.955 mm) to .0772″ (1.961 mm)	.0820″ (2.082 mm) to .0822″ (2.088 mm)	.0870″ (2.209 mm) to .0872″ (2.215 mm)	.0920″ (2.336 mm) to .0922″ (2.342 mm)

CON ROD JOURNAL DIAMETER SPECIFICATIONS

Standard Size	Undersizes			
	.0108″ (0.274 mm)	.0208″ (0.528 mm)	.0308″ (0.782 mm)	.0408″ (1.036 mm)
2.0863″ (52.992 mm) to 2.0871″ (53.013 mm)	2.0755″ (52.718 mm) to 2.0763″ (52.739 mm)	2.0655″ (52.464 mm) to 2.0663″ (52.485 mm)	2.0555″ (52.210 mm) to 2.0563″ (52.231 mm)	2.0455″ (51.956 mm) to 2.0463″ (51.977 mm)



CALIBRATED WIRE

Fig. 20. - « Plastigage » calibrated wire for checking crankshaft bearing shell-to-journal clearance, and envelope with graduation scale.

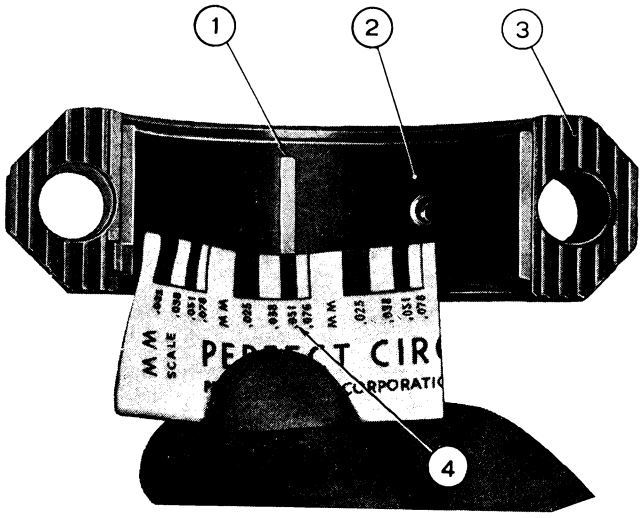


Fig. 21. - Comparing the width of the flattened « Plastigage » with the envelope graduation scale to check connecting rod bearing shell-to-journal clearance.

1. « Plastigage » wire - 2. Bearing shell - 3. Con rod bearing cap - 4. Clearance reading.

ROD BEARING SHELL THICKNESS SPECIFICATIONS

Standard Size	Undersizes			
	.0108″ (0.274 mm)	.0208″ (0.528 mm)	.0308″ (0.782 mm)	.0408″ (1.036 mm)
.0721″ (1.831 mm) to .0723″ (1.837 mm)	.0775″ (1.968 mm) to .0777″ (1.974 mm)	.0825″ (2.095 mm) to .0827″ (2.101 mm)	.0875″ (2.222 mm) to .0877″ (2.228 mm)	.0925″ (2.349 mm) to .0927″ (2.355 mm)

To check clearance (.0018″ to .0035″ - 0.045 to 0.089 mm) between main bearing shells and journals, just follow the procedure outlined for the clearance check of connecting rod bearing shells to journals (page 23).

Next check the side clearance of center main bearing thrust rings at crankshaft shoulder faces: it should be .0024″ to .0102″ (0.06 to 0.26 mm).

Should the shoulder-to-shoulder clearance exceed .0138″ (0.35 mm), replace thrust rings by thicker ones. Thrust rings come in .004″ (0.1 mm) oversize.

Checking Crankshaft.

These inspections are recommended after the crankshaft journals have been ground and the crankshaft balanced.

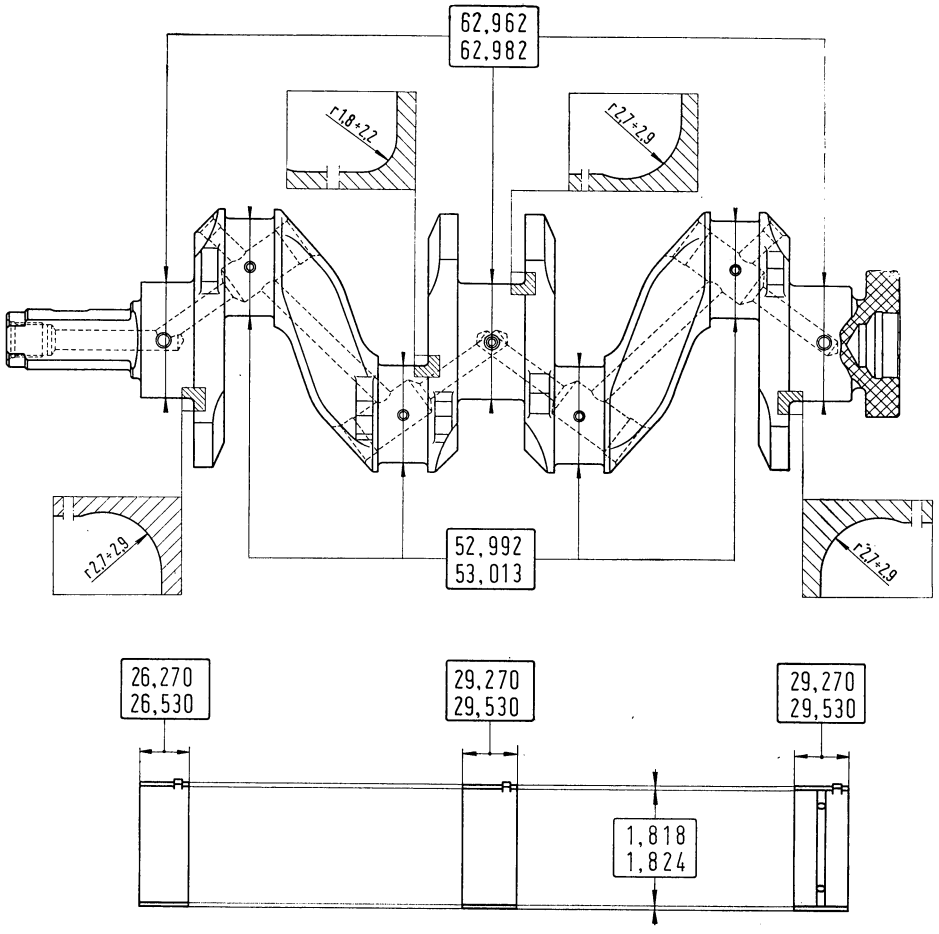


Fig. 22.

Critical dimensions of main bearing and connecting rod journals, and of main bearing shells (in mm). Engine 115 C.005.

Support the crankshaft at ends on V blocks **A. 95731** or between centers and using a dial indicator check for the following conditions:

1) Alignment of main bearing journals: maximum out-of-true limit .002″ (0.05 mm) (total reading of indicator dial).
2) Alignment of connecting rod bearing journals: maximum out-of-true of connecting rod bearing journals to main bearing journals ± .02″ (0.5 mm).
3) Out-of-round of main and connecting rod bearing journals: maximum limit after grinding .0002″ (0.005 mm).
4) Taper of main and connecting rod bearing journals: maximum limit after grinding .0002″ (0.005 mm).
5) Squared condition of flywheel mounting face to crankshaft: with a dial indicator set laterally at a distance of some 1 1/2″ (38 mm) from crankshaft axis, turn the crankshaft and check for no runout in excess of .0010″ (0.025 mm).

CYLINDER HEAD - VALVES - VALVE GUIDES AND SPRINGS

Aluminum cylinder head with cast-iron valve seat inserts. Valve seat angle 45° ± 5′.

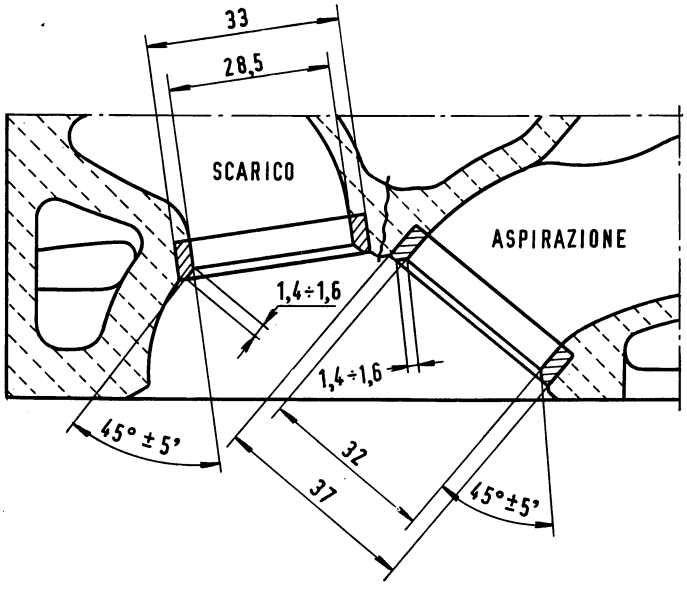


Fig. 23. - Critical dimesions (in mm) and angles of intake and exhaust valve seats. Engine 115 C.005.
SCARICO = EXHAUST - ASPIRAZIONE = INTAKE

To narrow the width of valve seats, both intake and exhaust, use the following cutters: **A. 94031** (20°) and **A. 94003** (75°).

Grind valve seats with taper grinder **A. 94078** (45°).

Both intake and exhaust valves are of the flat-headed type.

Valves are fitted with a double spring the load and deflection data of which are tabulated on page 26.

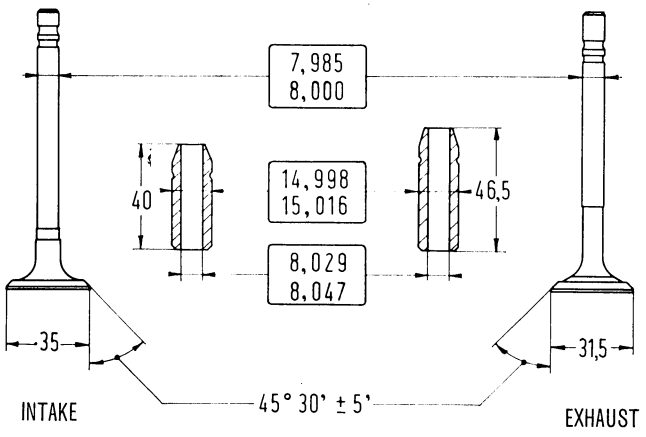


Fig. 24. - Critical dimensions of intake and exhaust valves and valve guides (in mm). Engine 115 C.005.

Cylinder head hold down screws should be tightened using a torque wrench in the sequence shown in fig. 27. Tighten head screws gradually, in no less than two passes:

— 1st pass: up to 21.7 ft.lbs (3 kgm) of torque;
— 2nd pass: draw up with prescribed torque, or 65.1 ft.lbs (9 kgm).

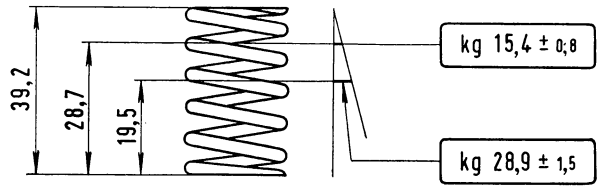


Fig. 25. - 115 C.005 engine inner valve spring testing data.
39,2 = 1.5433″ - 28.7 = 1.1299″ - 19,5 = .7677″
kg 15,4 ± 0,8 = 34 ± 1.8 lbs - kg 28,9 ± 1,5 = 63.7 ± 3.3 lbs

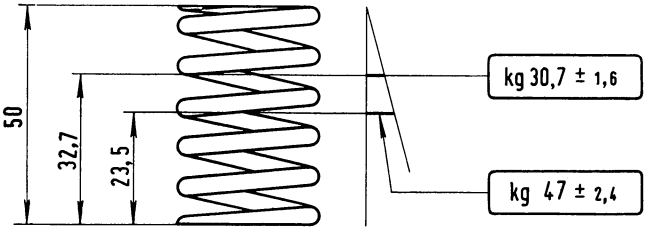


Fig. 26. - 115 C.005 engine outer valve spring testing data.
50 = 1.9685″ - 32,7 = 1.2874″ - 23,5 = .9252″
kg 30,7 ± 1,6 = 67.7 ± 3.5 lbs - kg 47 ± 2,4 = 103.6 ± 5.3 lbs

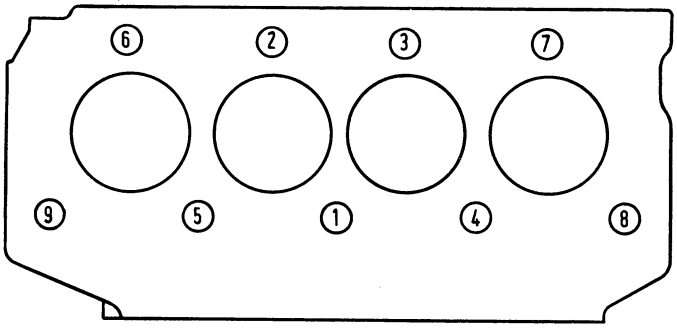


Fig. 27. - 115 C.005 engine head hold-down screw tightening sequence.

VALVE GUIDE - VALVE GUIDE SEAT FITTING SPECIFICATIONS

Valve Guide Seat Diameter	Valve Guide O. D.	Pinch Fit of New Parts
.5886″ to .5897″ (14.950 to 14.977 mm)	.5905″ to .5912″ (14.998 to 15.016 mm)	.0008″ to .0026″ (0.021 to 0.066 mm)

VALVE - VALVE GUIDE FITTING SPECIFICATIONS

Valve Guide I. D.	Valve Stem Diameter	Clearance of New Parts
.3161″ to .3168″ (8.029 to 8.047 mm)	.3144″ to .3150″ (7.985 to 8.000 mm)	.0011″ to .0024″ (0.029 to 0.062 mm)

VALVE SPRING SPECIFICATIONS

DESCRIPTION	Part No.	Working Coils No.	Total Coils No.	Spring I.D.	Wire Dia.	A	B		C		Minimum Load Referred to B
Outer Spring	4118615	4.5	6	1.0039″ (25.5 mm)	.1417″ (3.6 mm)	1.9685″ (50 mm)	1.2874″ (32.7 mm)	67.7 lbs (30.7 kg)	.9252″ (23.5 mm)	103.6 lbs (47 kg)	60.6 lbs (27.5 kg)
Inner Spring	4118614	5	6.5	.6829″ (17.6 mm)	.1063″ (2.7 mm)	1.5433″ (39.2 mm)	1.1299″ (28.7 mm)	34 lbs (15.4 kg)	.7677″ (19.5 mm)	63.7 lbs (28.9 kg)	29.8 lbs (13.5 kg)

A = Length, free spring. B-C = Length and load, spring check.

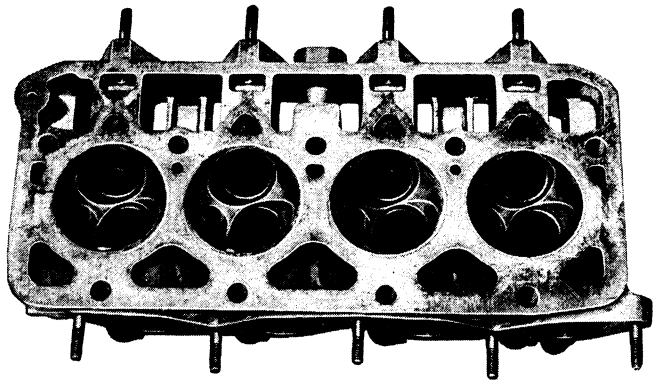


Fig. 28. - 115 C.005 engine head: view of block mating face.

VALVE GEAR

The three-bearing camshaft is situated in the crankcase and driven by the crankshaft, via a link chain.

Valve timing data (using increased tappet clearance of .0177″ - 0.45 mm) are as follows:

Intake:

— opens, B.T.D.C. . . . . 25°

— closes, A.B.D.C. . . . . 51°

Exhaust:

— opens, B.B.D.C. . . . . 64°

— closes, A.T.D.C. . . . . 12°

Tappet clearance, cold:

— intake . . . . . .0079″ (0.20 mm)

— exhaust . . . . . .0098″ (0.25 mm)

The front camshaft bushing is of aluminum and tin alloy, while the center and rear bushings are of babbitt-coated sheet steel.

Valves are controlled by the camshaft via tappets, push rods and rockers.

Rocker arms are working on two separate shafts (fig. 32), one intake valve rocker shaft and one exhaust valve rocker shaft.

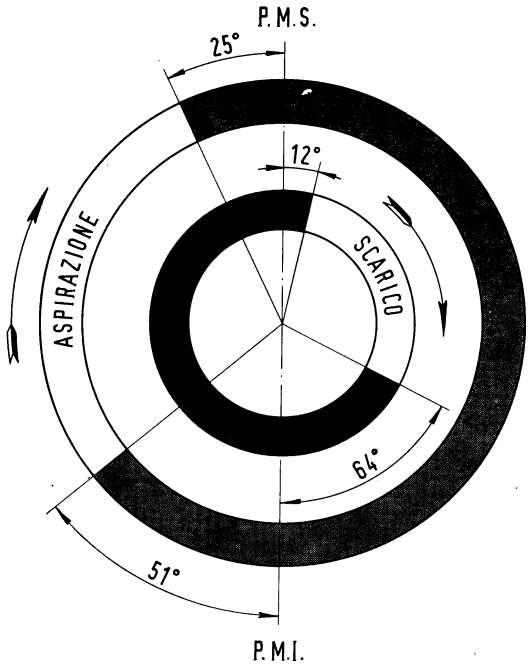


Fig. 29. - Valve timing diagram of engine 115 C.005 at increased tappet clearance of .0177″ (0.45 mm).

ASPIRAZIONE = INTAKE - SCARICO = EXHAUST
P.M.I. = B.D.C. - P.M.S. = T.D.C.

Intake valve rockers are different from exhaust valve rockers.

Push rods are varying in length for either intake or exhaust rockers: the length of intake push rods is lesser than that of exhaust push rods.

Replacing and Reaming Camshaft Bushings.

If camshaft bushings are proved to need replacement, remove them from their bores and install new ones as directed hereafter:

— the front bushing should be fitted loosely into relevant crankcase bore; the inside and outside faces of this bushing are precision-machined; with two screws, secure the bushing to the crankcase; the fact that fixing screws are arranged offset allows for one position of the bushing, which will be correct in any case.

— the center bushing and the rear one should be force driven into seat, because a press fit is specified between the bushings and their crankcase bores as tabulated on page 48. Use care, when driving in the bushings, that the inlet holes are indexing with oil passages on crankcase;

— bore specifications of center and rear bushings fitted into seat are tabulated on page 48;

— the center bushing and the rear one should be finish reamed to the camshaft journal mating bores as tabulated for these bushings in place in crankcase (see fig. 30); this will warrant perfect alignment and squareness of camshaft bearing axes; line ream bushings with reamer **A. 90327** complying with the manufacturer's directions contained in the tool kit.

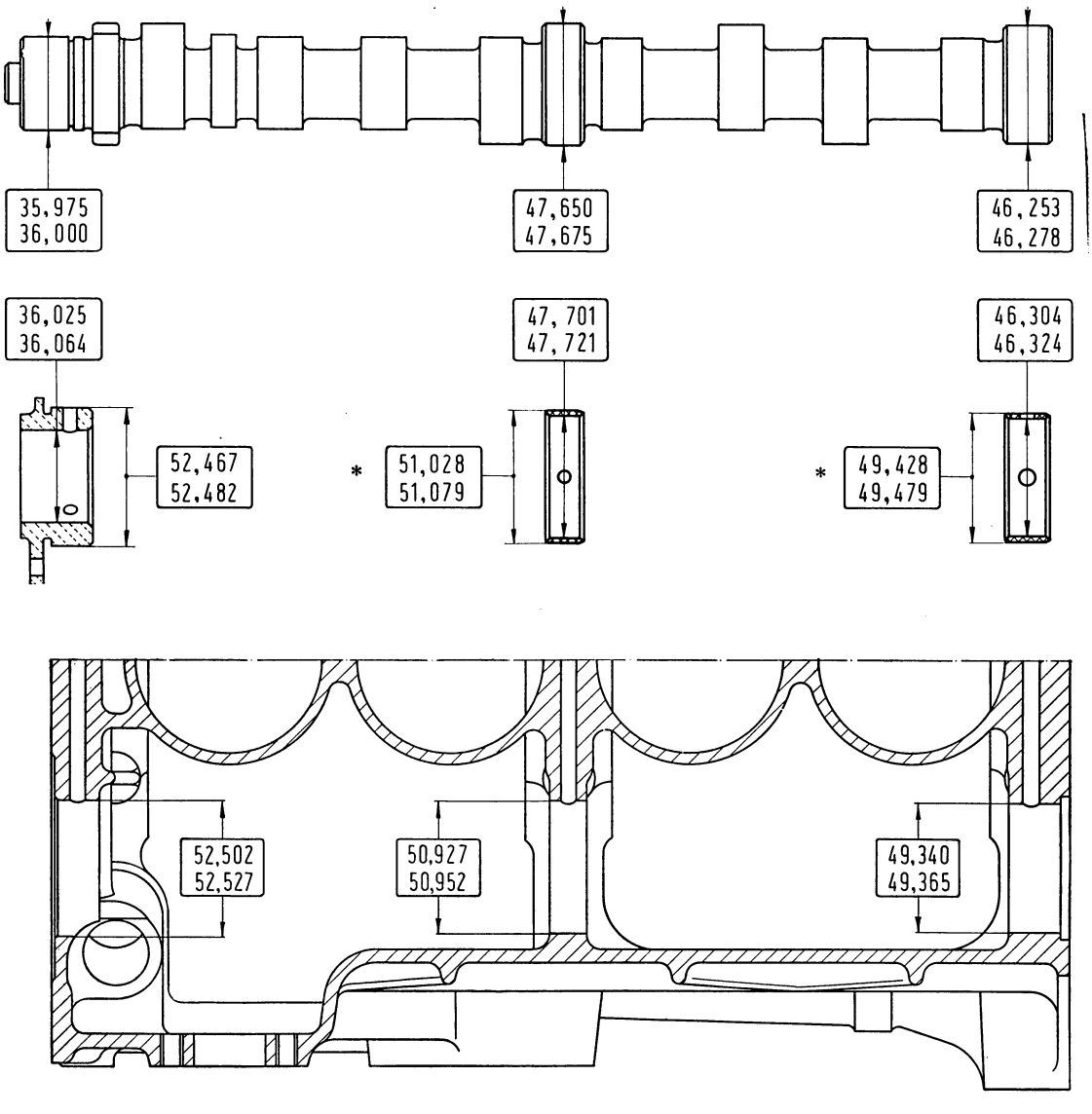


Fig. 30. - Critical dimensions (in mm) of camshaft, bushings and bushing seats.

Center and rear bushing bores apply to bushings seated and reamed.

* Figure refers to ring gauge bore (bushing fitted manually).

115 C.005 ENGINE ASSEMBLY

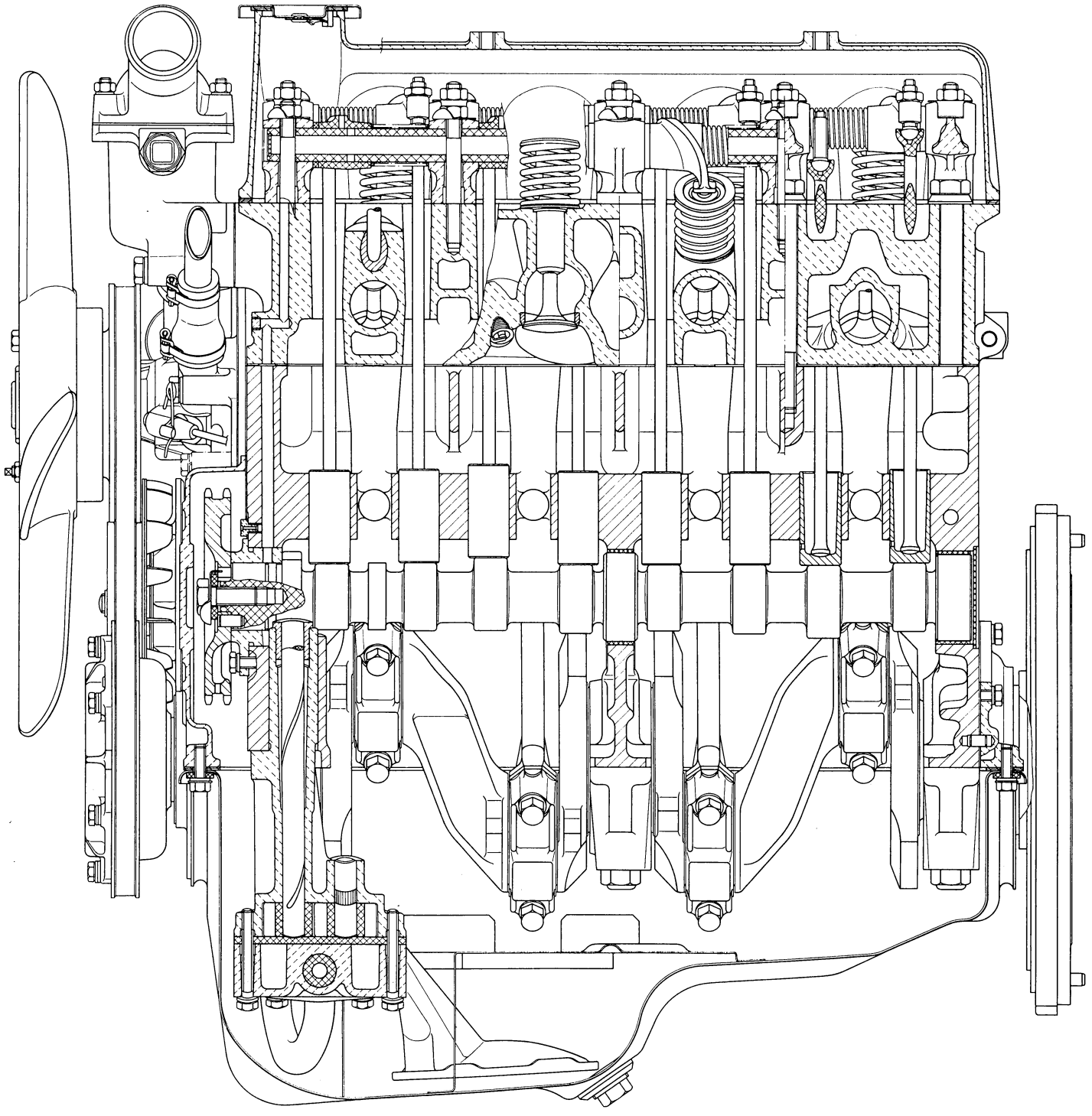


Fig. 31. - Side sectional view of engine 115 C.005 across camshaft, rocker shaft and oil pump.

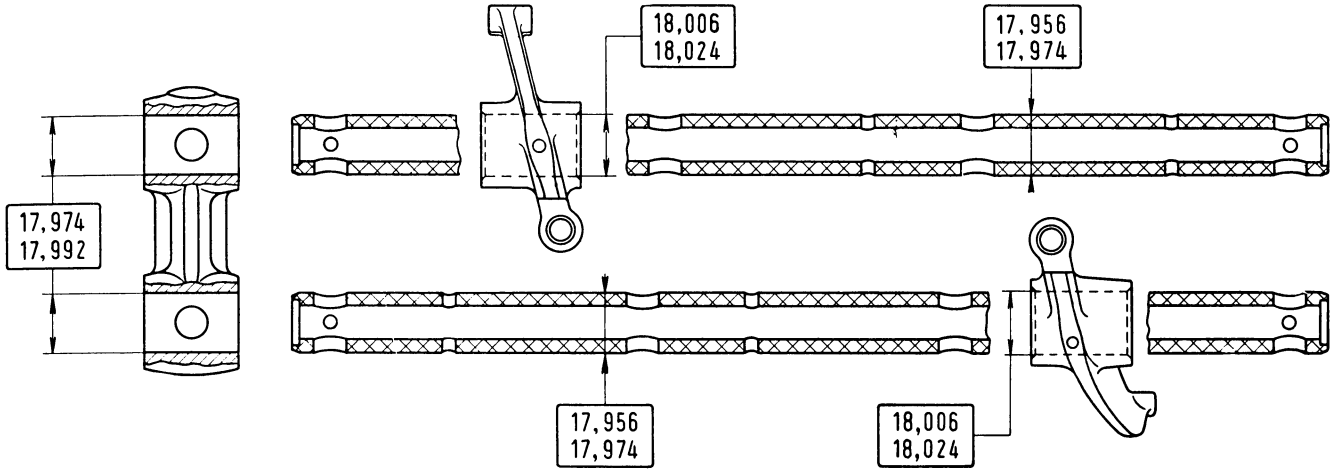


Fig. 32. - Critical dimensions of 115 C.005 engine rocker shafts, supports and rocker arms (in mm).

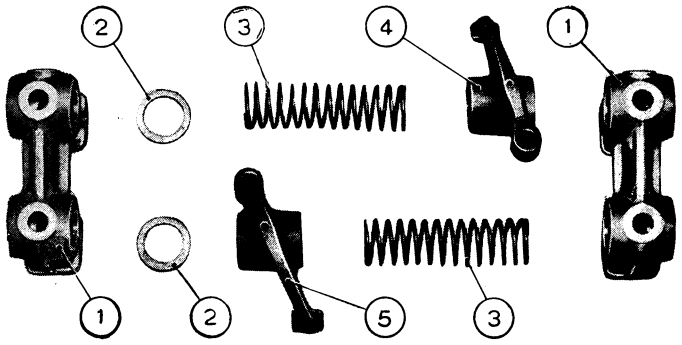


Fig. 33. - Components of a valve rocker assembly (engine 115 C.005).

1. Rocker shaft supports - 2. Spring and rocker arm backing washers - 3. Rocker arm springs - 4. Exhaust valve rocker arm - 5. Intake valve rocker arm.

Adjusting Valve Tappet Clearance.

Tappet clearance should be set at **.0079″ (0.20 mm),** intake, and **.0098″ (0.25 mm)**, exhaust, **with a cold engine**. The adjustment of tappet clearance deserves much care, because if it is other than specified an alteration of the valve timing diagram may result.

As a matter of fact, excessive tappet clearance, in addition to clicking noises, causes a delayed opening and advanced closing of valves, while insufficient tappet clearance reverses the effect. Eventually, should tappet clearance be reduced to nil, valves will stay in part open position all the time, with most harmful consequences on valve and valve seat life.

To adjust tappet clearance, proceed as follows:

— crank the engine until valves of cylinder No. 1 are « on balance », or the intake stroke is about to begin in this cylinder;

— adjust the valve stem-to-rocker arm clearance at cylinder No. 4; in fact this cylinder is at the end of the compression stroke and therefore both valves are closed. Using wrench **A. 50107**, hold the rocker arm setscrew and with a box wrench turn out the lock nut; insert the stock of feeler gauge **A. 95110** (.0079″ - 0.20 mm thick) or **A. 95111** (.0098″ - 0.25 mm thick) between the rocker arm and the valve stem, and by means of wrench **A. 50107** turn in or out the setscrew until the feeler stock slides in with some drag; now, firmly hold the setscrew and lock the nut with the box wrench.

After this procedure has been completed at both valves of cylinder No. 4, adjust the tappet clearance at remaining cylinders, recalling that: with valves of cylinder No. 4 « on balance », clearance must be set at

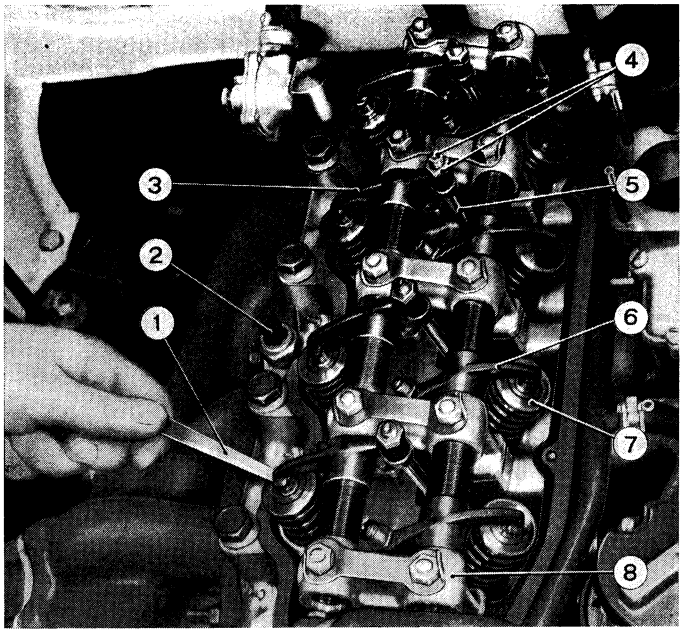


Fig. 34. - Close-up view of cylinder head, showing tappet clearance adjustment (engine 115 C.005).

1. Feeler gauge - 2. Heat indicator sending unit - 3. Exhaust valve rocker arm - 4. Tappet clearance adjusting screw and nut - 5. Push rod - 6. Intake valve rocker arm - 7. Cup - 8. Rocker shaft support.

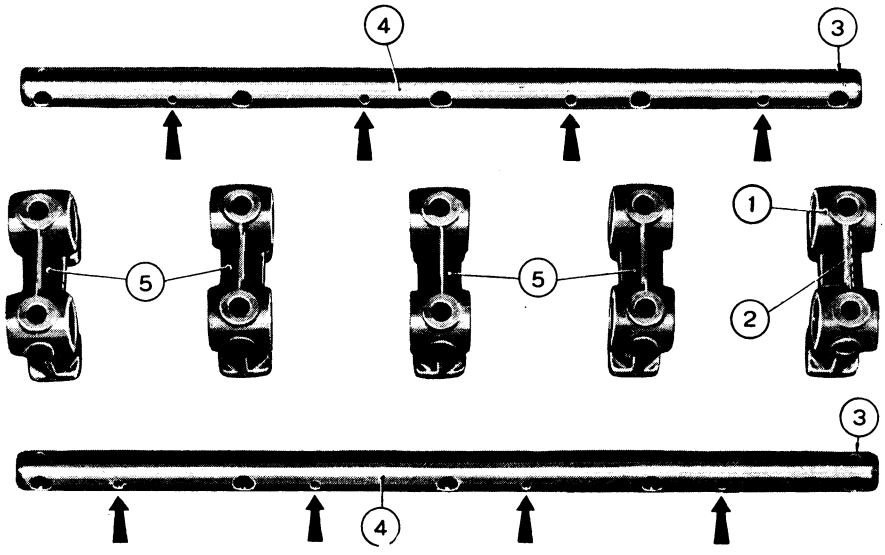


Fig. 35.

Rocker shafts and supports.

1. Front support - 2. Oil delivery passage from intake valve rocker shaft to exhaust valve rocker shaft - 3. Oil inlet holes - 4. Rocker shafts - 5. Intermediate and rear rocker shaft supports.

For satisfactory lubrication of rocker arms, on assembly rocker shafts should be placed with the oil holes, which are evidenced by arrows, in the same position relative to support as shown in figure.

cylinder No. 1, with valves of cylinder No. 3 « on balance », clearance must be set at cylinder No. 2, and vice versa.

Valve Timing.

The correct valve timing is obtained when the timing marks on sprockets are indexing as shown in fig. 36.

To line up the timing marks on sprockets, proceed as follows:

— insert the drive sprocket on the front end of crankshaft;

— install the driven sprocket on camshaft and turn it about until the mark machined on its outskirts is in line with the notch on the drive sprocket;

— without moving the camshaft, **take out the driven sprocket**, and mesh the timing chain with the sprockets; reinstall the driven sprocket and chain, using care that the timing marks are indexing (fig. 36); lock the crankshaft and camshaft by placing tool **A. 60193** on the flywheel; use a torque wrench and draw up the driven sprocket screw with 36.2 ft.lbs (5 kgm) of torque, then bend down the lock plate.

Should the necessity arise to check whether the timing marks are stamped in the right place and consequently the correct valve timing has been obtained, proceed as follows:

— affix the sector scale **A. 95677** on crankcase;

— fit the crank **A. 60186** on the flywheel;

— temporarily set the tappet clearance of cylinder No. 1 at .0177″ (0.45 mm);

— using the crank, turn about the flywheel until the cylinder No. 1 begins the compression stroke, that is the intake valve is just on the way of opening: at this point the flywheel mark (showing T.D.C. of cylinder Nos. 1 and 4) should register 25° before T.D.C.; go on cranking the flywheel until its mark is indexing with the zero sign on sector scale;

— in this position observe the marks on timing sprockets: they should be lined up (fig. 36).

Next to valve timing, crank the flywheel and verify on sector scale that the advance angle at the beginning and the retard angle at the end of the intake stroke as well as the advance angle at the beginning and the retard angle at the end of the exhaust stroke, are as specified in fig. 29.

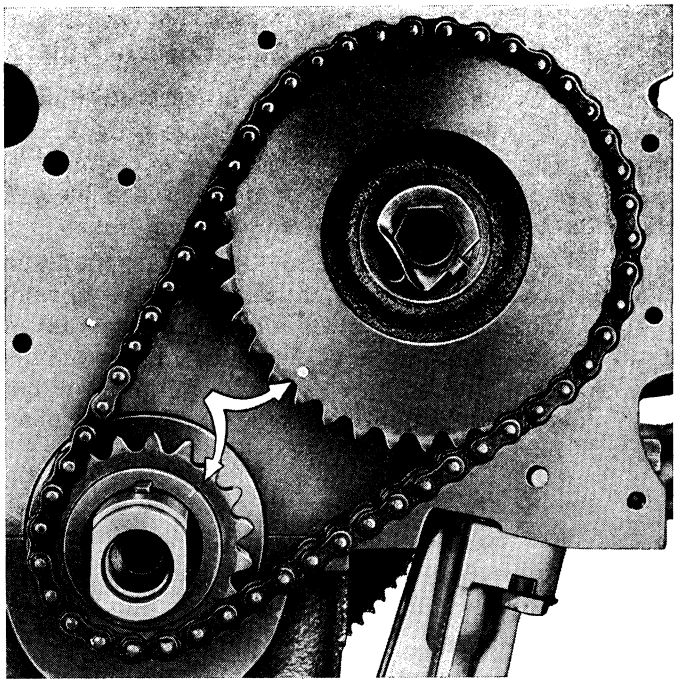


Fig. 36. - Valve timing marks on drive and driven sprocket (engine 115 C.005).

ENGINE 118 B.000

Service procedures not dealt with in the following text must be taken as common to those covering engine 115 C.005 and reference to them should be made.

CYLINDER BLOCK

Standard cylinder barrels are graded into four size groups A-B-C-D according to the bore diameter.

Bore sizes corresponding to the various groups are the following:

Group A . . 3.1496″ to 3.1500″ (80.000 to 80.010 mm)
Group B . . 3.1500″ to 3.1504″ (80.010 to 80.020 mm)
Group C . . 3.1504″ to 3.1508″ (80.020 to 80.030 mm)
Group D . . 3.1508″ to 3.1512″ (80.030 to 80.040 mm)

PISTONS

Standard pistons are graded into four size groups A-B-C-D on the ground of their diametrical quotation as shown in fig. 40; they are also graded into two groups 1 and 2 according to the boss bore for mating with pins.

NOTICE - Piston skirt diameter should be measured at right angle to the pin at two points being 9/32″ (7 mm) and 1 $^{9}/_{16}$″ (40 mm), respectively, apart from skirt top as shown in fig. 40.

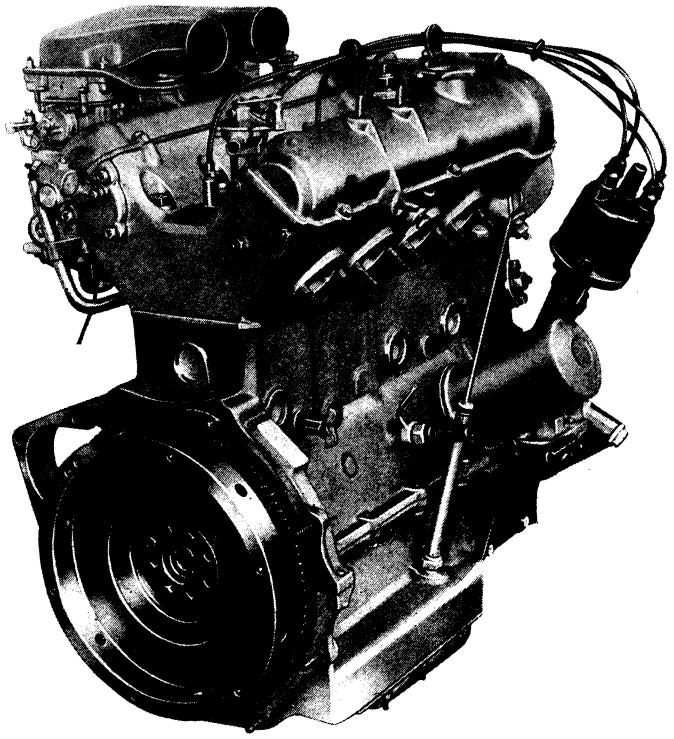


Fig. 37. - Engine 118 B.000 viewed from the right hand side.

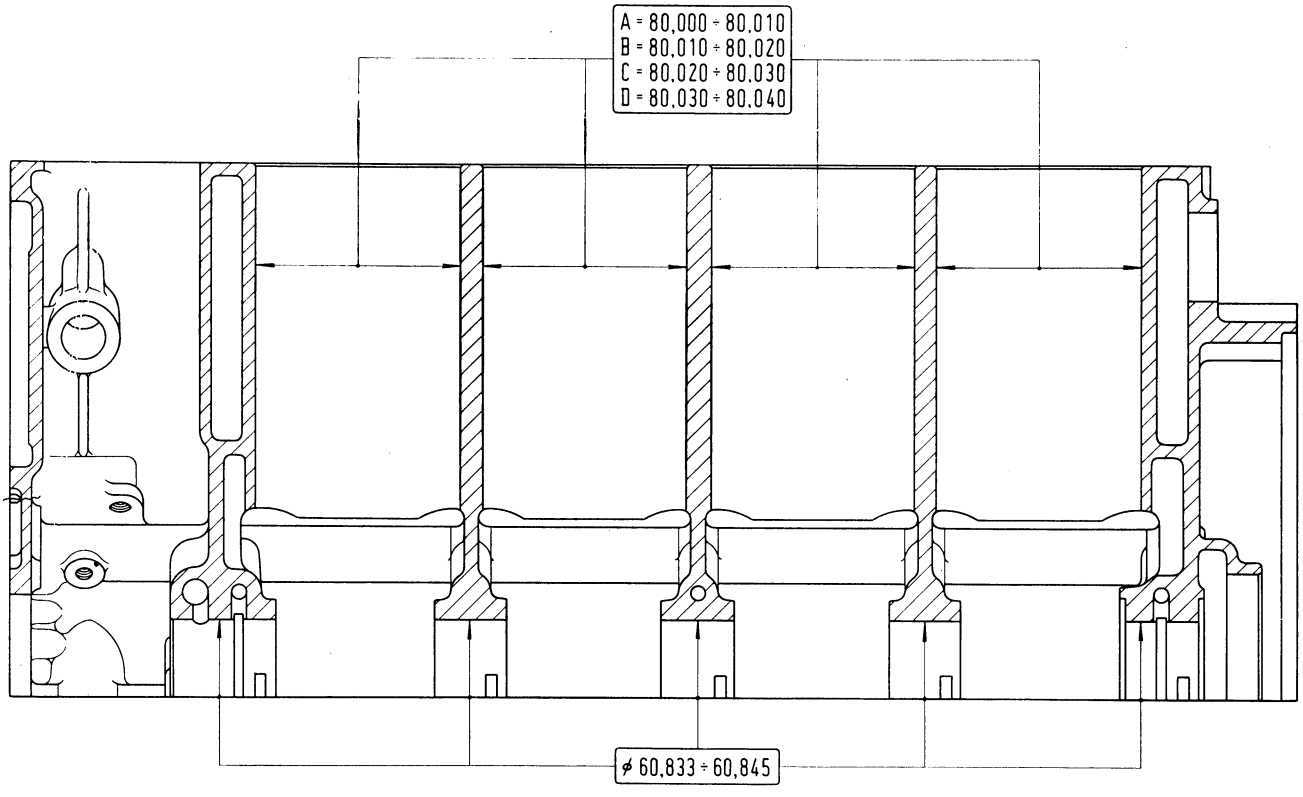


Fig. 38. - Critical dimensions of 118 B.000 engine crankcase (in mm): diametrical sizes of cylinder bore grades and of five main bearing saddles.

118B.000 ENGINE ASSEMBLY

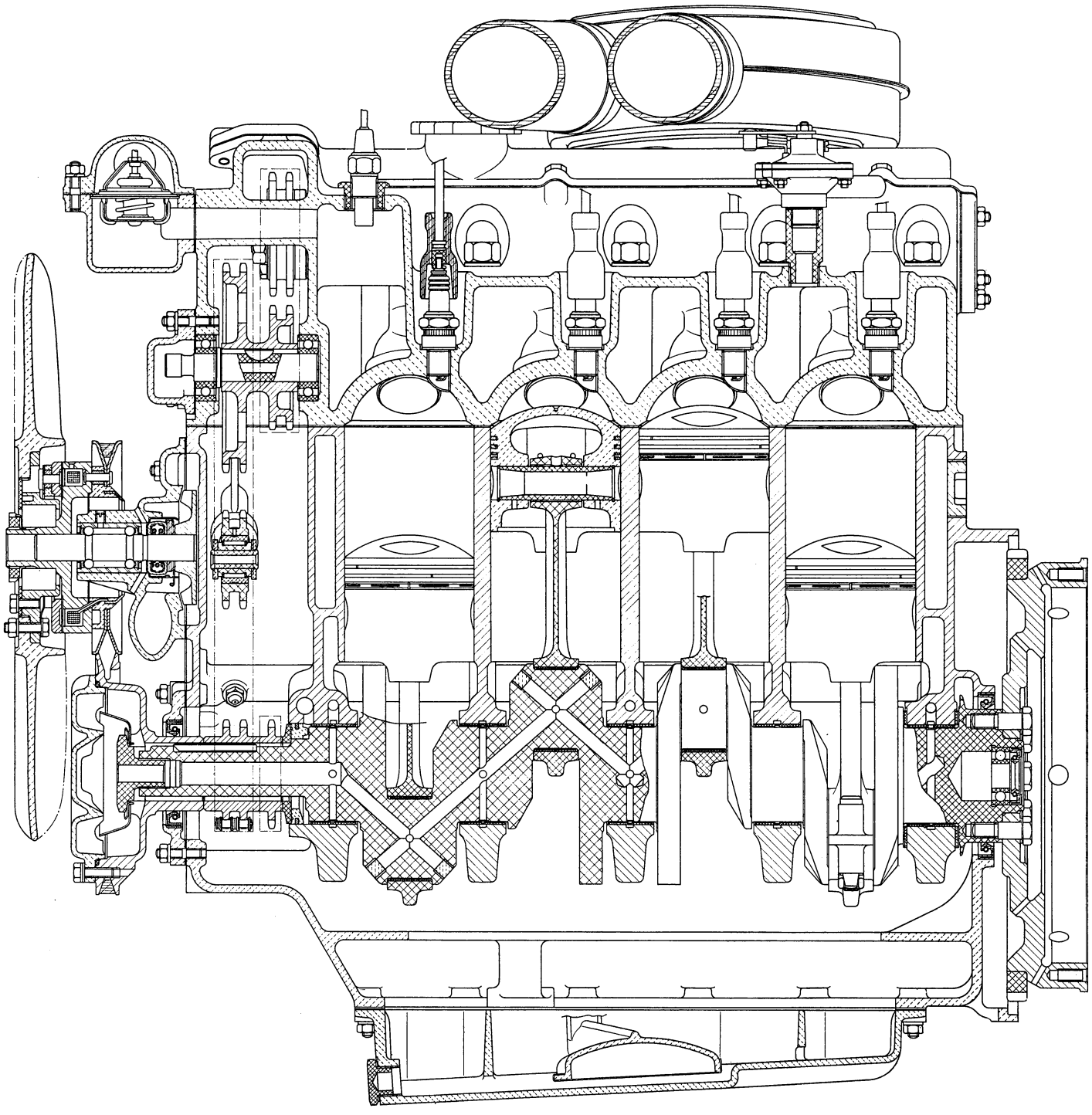


Fig. 39. - Side sectional view of engine 118 B.000 across cylinders.

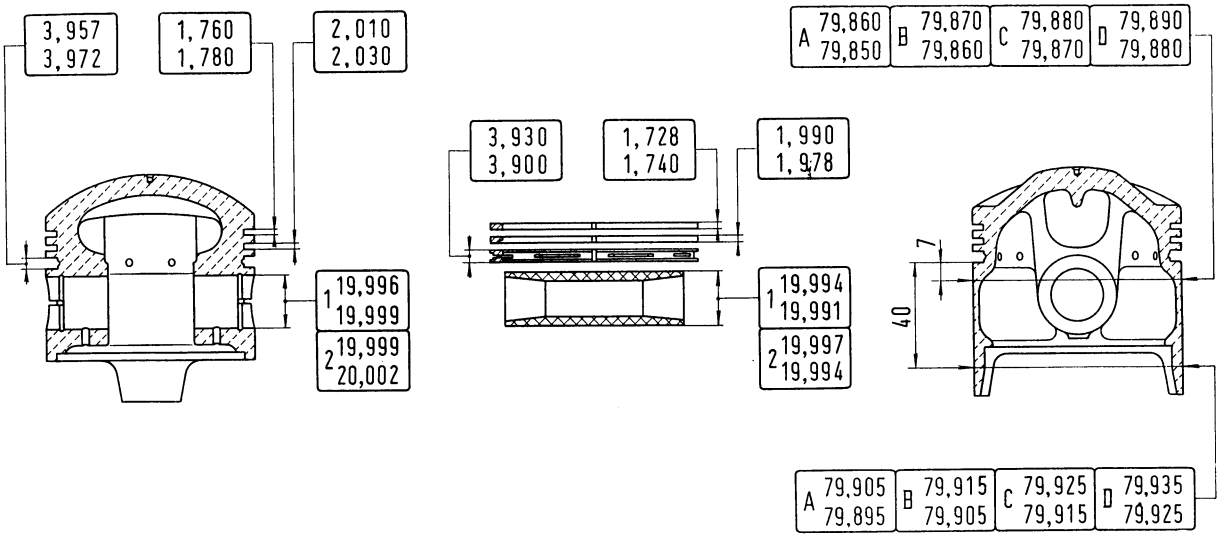


Fig. 40. - Critical dimensions (in mm) of 118 B.000 engine pistons, pins and rings. Piston and pin come for replacement in a matched set.

Pistons come paired with the pin in sets of four ranging in the prescribed weight tolerance.

CONNECTING RODS - ROD BEARINGS

For installation of connecting rod-piston-pin assembly see fig. 41.

Fitting data for assembly of parts are tabulated on page 43.

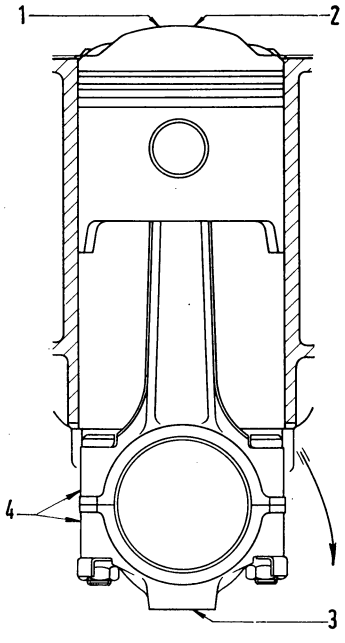


Fig. 41. - Installation diagram of 118 B.000 engine connecting rod-piston-pin assembly.

1. Location of piston-cylinder size group letter - 2. Location of piston -piston pin size group number - 3. Location of connecting rod-piston pin size group number - 4. Location of connecting rod-cylinder pairing number.

Arrow shows turning direction of front-viewed engine.

CRANKSHAFT AND MAIN BEARINGS

The crankshaft is forged with counterweights and rotates on five bearings.

Four half shoulder rings on rear bearing take the end thrusts of the crankshaft.

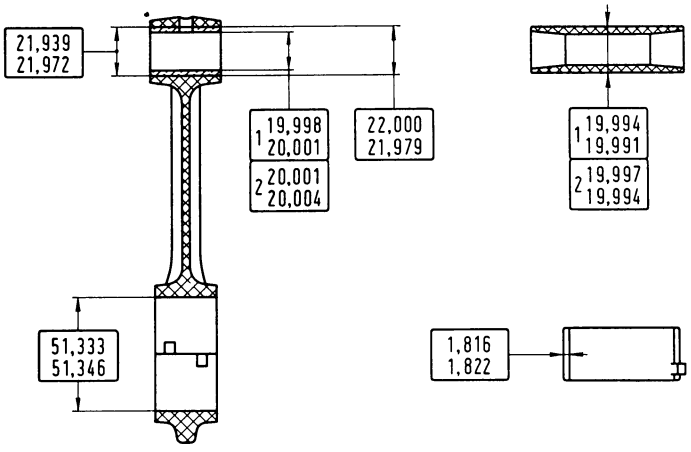


Fig. 42. - Critical dimensions (in mm) of 118 B.000 engine connecting rods, piston pins and small end bushings.

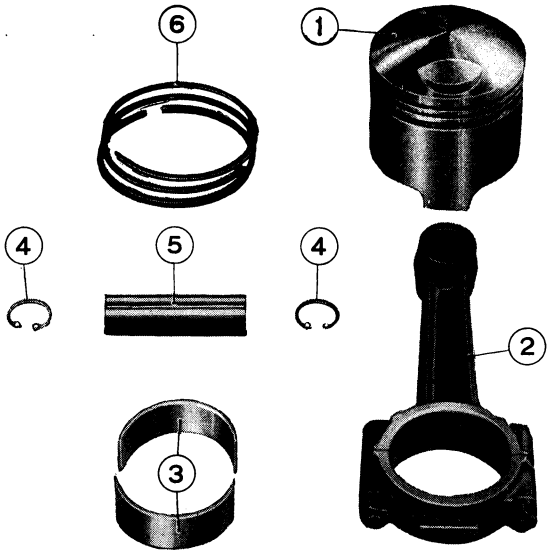


Fig. 43. - Connecting rod-piston assembly components.
1. Piston - 2. Con rod with cap - 3. Bearing shells - 4. Snap rings - 5. Piston pin - 6. Piston rings.

MAIN BEARING JOURNAL DIAMETER SPECIFICATIONS

Standard Size	Undersizes			
	.01″ (0.254 mm)	.02″ (0.508 mm)	.03″ (0.762 mm)	.04″ (1.016 mm)
2.2470″ (57.073 mm) to 2.2474″ (57.086 mm)	2.2370″ (56.819 mm) to 2.2374″ (56.832 mm)	2.2270″ (56.565 mm) to 2.2274″ (56.578 mm)	2.2170″ (56.311 mm) to 2.2174″ (56.324 mm)	2.2070″ (56.057 mm) to 2.2074″ (56.070 mm)

CON ROD JOURNAL DIAMETER SPECIFICATIONS

Standard Size	Undersizes			
	.01″ (0.254 mm)	.02″ (0.508 mm)	.03″ (0.762 mm)	.04″ (1.016 mm)
1.8755″ (47.638 mm) to 1.8763″ (47.658 mm)	2.8655″ (47.384 mm) to 1.8663″ (47.404 mm)	1.8555″ (47.130 mm) to 1.8563″ (47.150 mm)	1.8455″ (46.876 mm) to 1.8463″ (46.896 mm)	1.8355″ (46.622 mm) to 1.8363″ (46.642 mm)

MAIN BEARING SHELL THICKNESS SPECIFICATIONS

Standard Size	Undersizes			
	.005″ (0.127 mm)	.010″ (0.254 mm)	.015″ (0.381 mm)	0.20″ (0.508 mm)
.0727″ (1.845 mm) to .0729″ (1.851 mm)	.0777″ (1.972 mm) to .0779″ (1.978 mm)	.0827″ (2.099 mm) to .0829″ (2.105 mm)	0.877″ (2.226 mm) to .0879″ (2.232 mm)	.0927″ (2.353 mm) to .0929″ (2.359 mm)

ROD BEARING SHELL THICKNESS SPECIFICATIONS

Standard Size	Undersizes			
	.005″ (0.127 mm)	.010″ (0.254 mm)	.015″ (0.381 mm)	.020″ (0.508 mm)
.0716″ (1.816 mm) to .0718″ (1.822 mm)	.0766″ (1.943 mm) to .0768″ (1.949 mm)	.0816″ (2.070 mm) to .0818″ (2.076 mm)	.0866″ (2.197 mm) to .0868″ (2.203 mm)	.0916″ (2.324 mm) to .0918″ (2.330 mm)

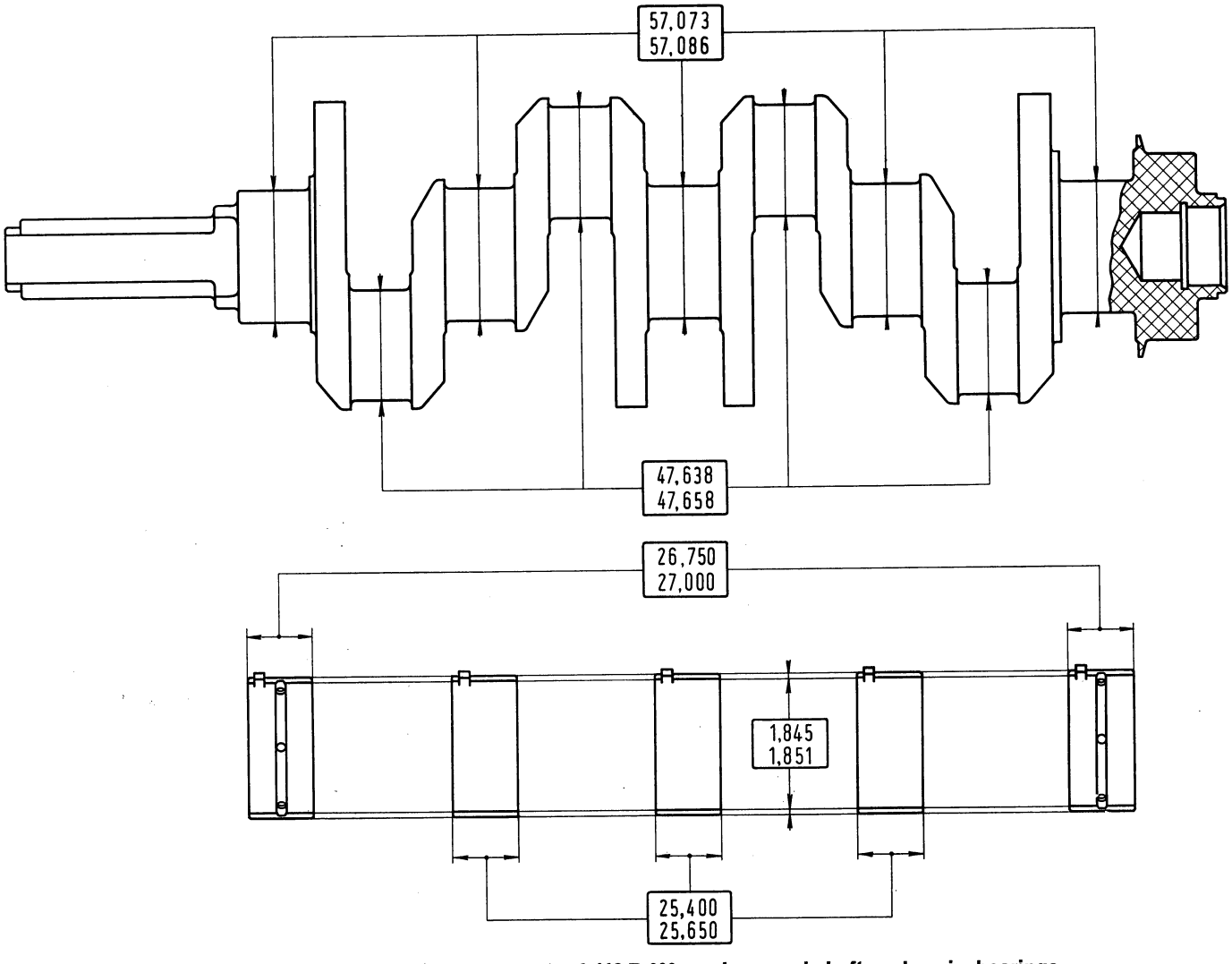
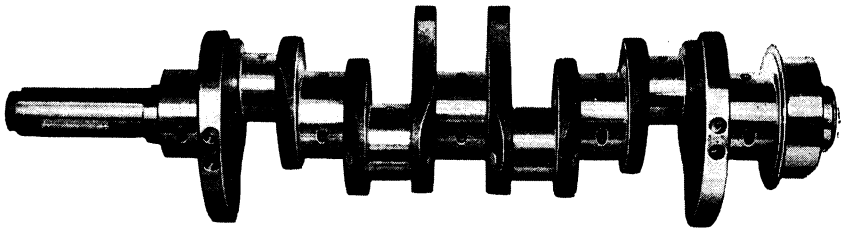


Fig. 44. - Critical dimensions (in mm) of 118 B.000 engine crankshaft and main bearings.

Fig. 45.
118 B.000 engine crankshaft.



Grinding Crankshaft Journals.

As a result of grinding operation, no alteration of crankarm fillet should be observed in respect of the radius specification: r = .0866″ to .0945″ (2.2 to 2.4 mm).

Checking Crankshaft.

Using a dial indicator check as follows:

— Alignment of main bearing journals: maximum out-of-true limit .002″ (0.05 mm) (fig. 47) (total reading of indicator dial).

— Alignment of connecting rod bearing journals: maximum out-of-true of connecting rod bearing journals to main bearing journals ± .01″ (0.25 mm) (fig. 47).

— Out-of-round of main and connecting rod bearing journals: maximum limit after grinding .0002″ (0.005 mm).

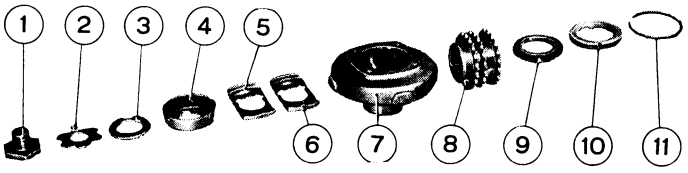


Fig. 46. - Items fitted at front end of crankshaft.
1. Centrifugal oil filter mounting screw - 2. Lock plate - 3. Washer - 4. Oil slinger - 5-6. Baffle plates - 7. Filter thrower - 8. Timing gear drive sprocket - 9. Thrust ring - 10. Oil seal disc - 11. Oil seal ring.

— Taper of main and connecting rod bearing journals: maximum limit after grinding .0002″ (0.005 mm).

— Squared condition of flywheel mounting face to crankshaft: with a dial indicator set laterally (A, fig. 47) at a distance of some 1 1/2″ (38 mm) from crankshaft axis, turn the crankshaft and check for no runout in excess of .0008″ (0.02 mm).

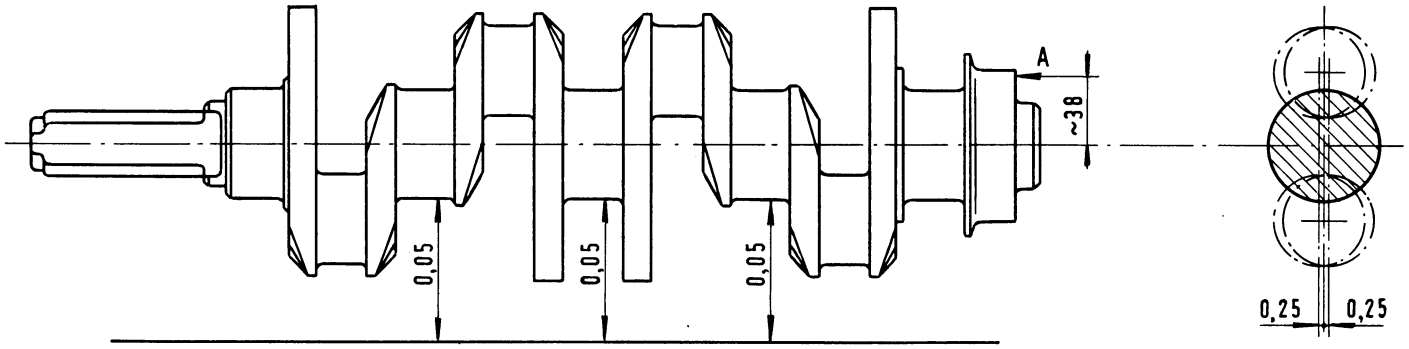


Fig. 47. - Maximum out-of-true allowances on alignment of main bearing journals and of connecting rod journals to main bearing journal axis; quotation for squareness inspection of flywheel resting face to crankshaft centerline (engine 118 B.000).
0,05 = .002″ - 0,25 = .01″ - ~ 38 = 1 1/2″

CYLINDER HEAD - VALVES - VALVE GUIDES AND SPRINGS

Valve seats on cylinder head are angled at 55° ± 5′.

To narrow the width of valve seats, both intake and exhaust, use the following cutters: **A. 94046** (20°) and **A. 94003** (75°).

Grind valve seats with taper grinder **A. 94060** (55°).

The load and deflection data of valve springs are tabulated on page 37.

Cylinder head hold-down screws should be tightened, using a torque wrench, in the sequence shown in fig. 50.

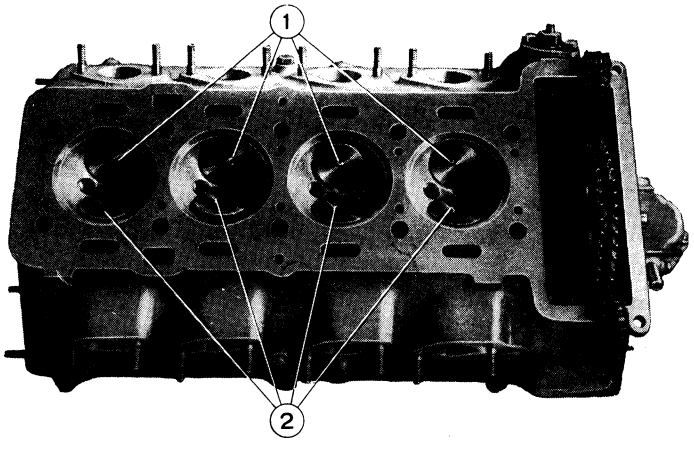


Fig. 48. - Bottom view of 118 B.000 engine head.
1. Intake valves - 2. Exhaust valves.

118 B.000 ENGINE ASSEMBLY

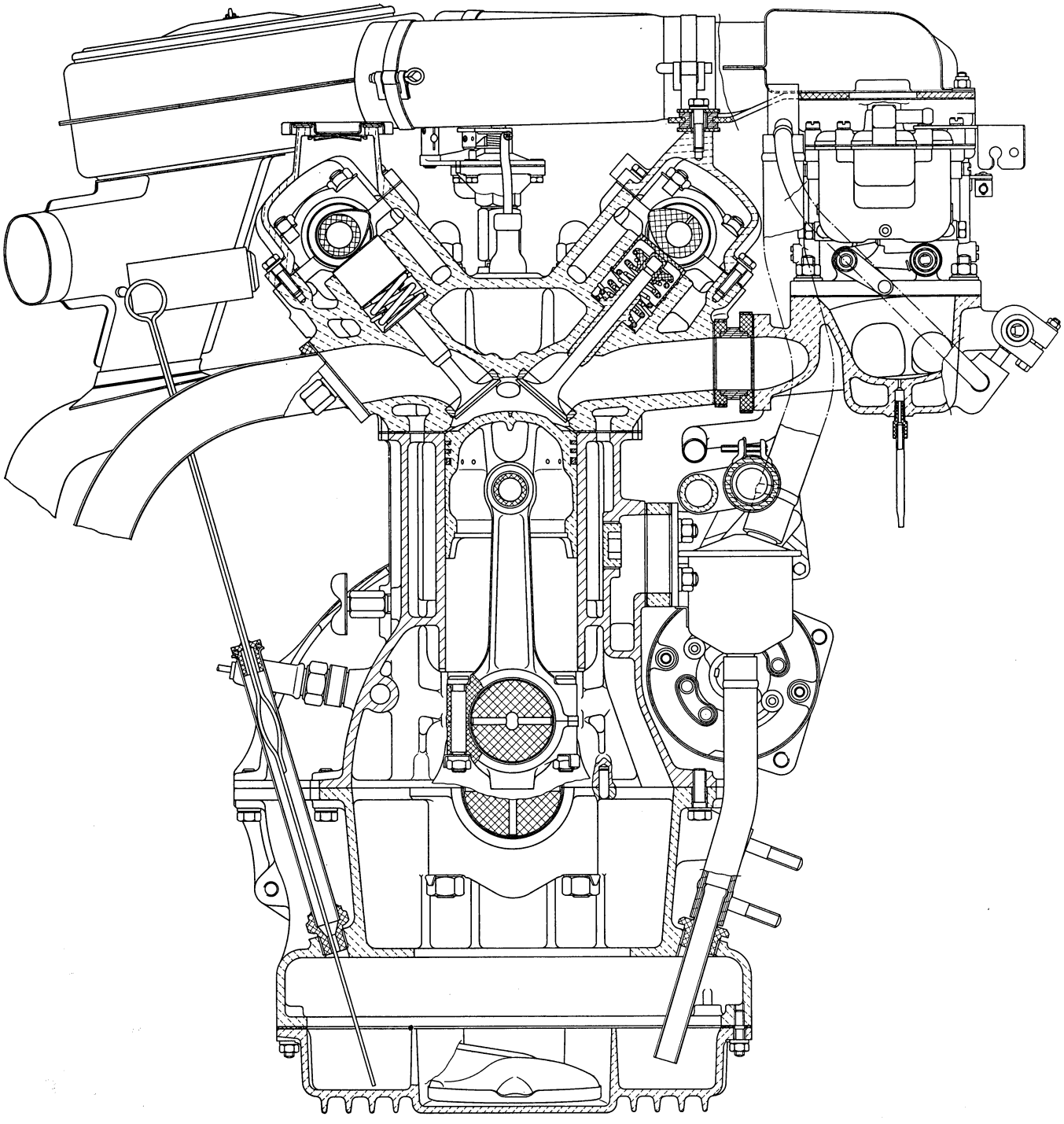


Fig. 49. - End sectional view of engine 118 B.000 across connecting rod, piston and valves.

118 B.000 ENGINE VALVE SPRING SPECIFICATIONS

DESCRIPTION	Part N°	Working Coils No.	Total Coils No.	Spring I.D.	Wire Dia.	A	B		C		Minimum Load Referred to B
Outer Spring	4046108	4.25	5.75	.9449″ (24 mm)	.1378″ (3.50 mm)	1.7126″ (43.5 mm)	1.4173″ (36 mm)	33 lbs (15 kg)	1.0630″ (27 mm)	72.8 lbs (33 kg)	26.5 lbs (12 kg)
Inner Spring	4046107	5.50	7.00	.6693″ (17 mm)	.1083″ (2.75 mm)	1.4370″ (36.5 mm)	1.2205″ (31 mm)	18.6 lbs (8.45 kg)	.8661″ (22 mm)	49.2 lbs (22.3 kg)	15 lbs (6.8 kg)

A = Length, free spring. B-C = Length and load, spring check.

Tighten the head screws gradually, in no less than two passes:

— 1st pass: up to some 18.1 ft.lbs (2.5 kgm) of torque;

— 2nd pass: turn in with the prescribed torque, or 65.1 ft.lbs (9 kgm).

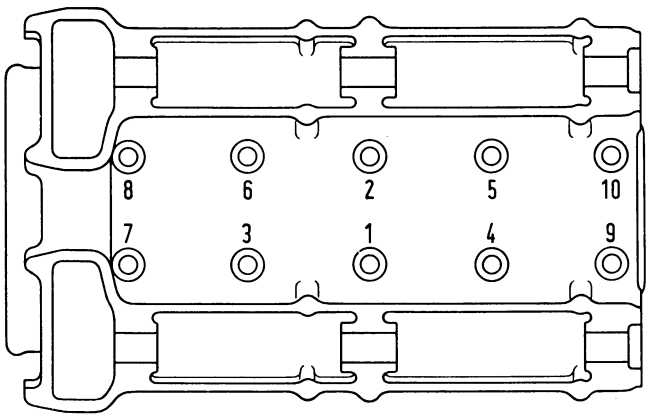


Fig. 50. - 118 B.000 engine head hold-down screw tightening sequence.

VALVE GUIDE-TO-SEAT FITTING SPECIFICATIONS

Valve Guide Seat I. D.	Valve Guide O. D.	Pinch Fit of New Parts
.5118″ to .5125″ (13.000 to 13.018 mm)	.5138″ to .5142″ (13.052 to 13.062 mm)	.0013″ to .0024″ (0.034 to 0.062 mm)

VALVE-TO-VALVE GUIDE FITTING SPECIFICATIONS

Valve Guide I. D.	Valve Stem Dia.	Clearance of New Parts
.3150″ to .3156″ (8.000 to 8.015 mm)	.3139″ to .3146″ (7.975 to 7.990 mm)	.0004″ to .0016″ (0.010 to 0.040 mm)

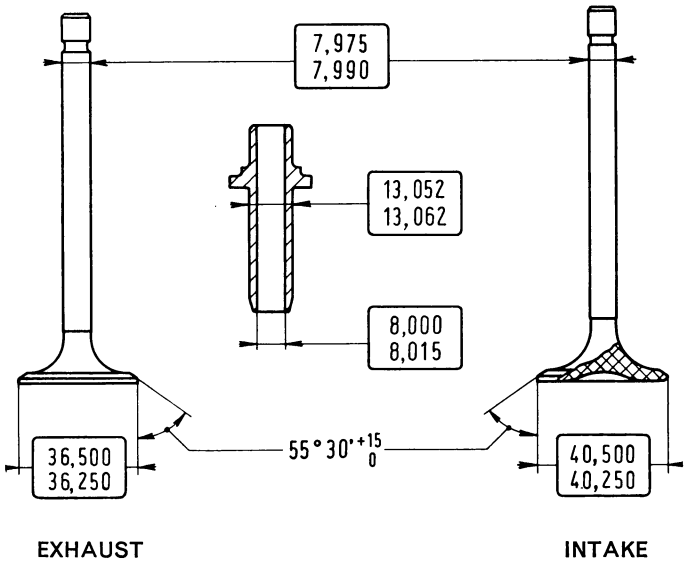


Fig. 51. - Critical dimensions (in mm) and angles of 118 B.000 engine exhaust and intake valves and valve guides.

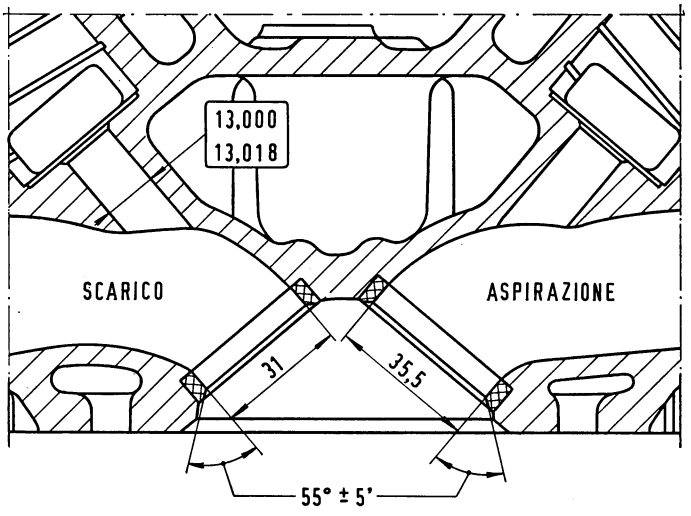


Fig. 52. - Critical dimensions (in mm) and angles of 118 B.000 engine valve seats on head.

SCARICO = EXHAUST - ASPIRAZIONE = INTAKE

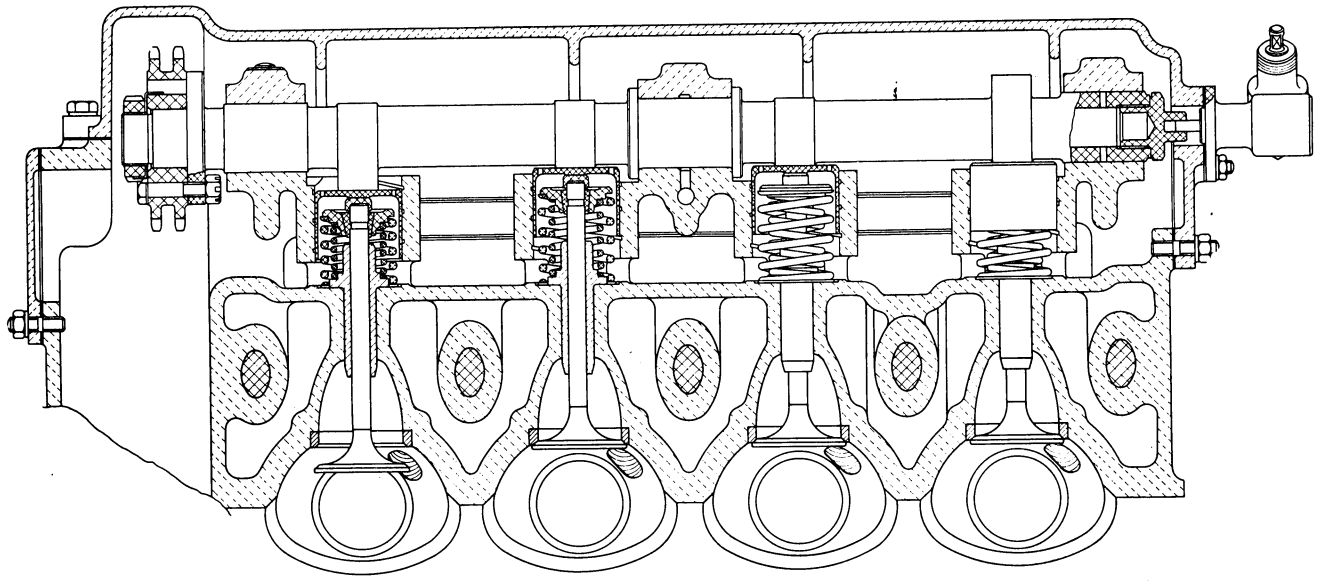


Fig. 53. - Sectional view of 118 B.000 engine head across intake valve camshaft and tachometer drive.

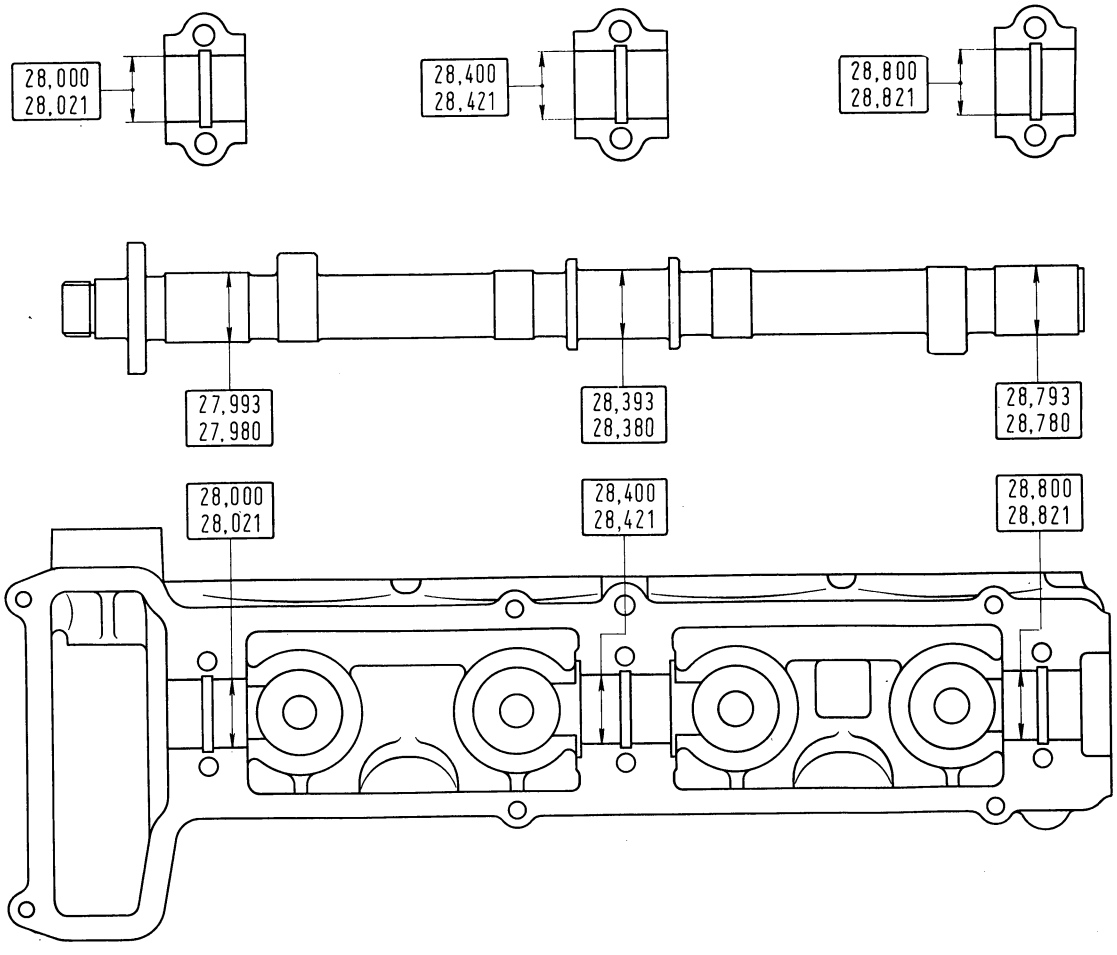


Fig. 54. - Critical dimensions (in mm) of 118 B.000 engine camshaft journals and bearings.

VALVE GEAR

Two overhead camshafts operate intake and exhaust valves, through tappets.

Camshafts are driven by crankshaft off twin double row chains.

Valve timing data (at a tappet clearance of .0118″ - 0.30 mm, intake and .0138″ - 0.35 mm, exhaust):

Intake:

— opens	28° B.T.D.C.
— closes	64° A.B.D.C.

Exhaust:

— opens	63° B.B.D.C.
— closes	23° A.T.D.C.

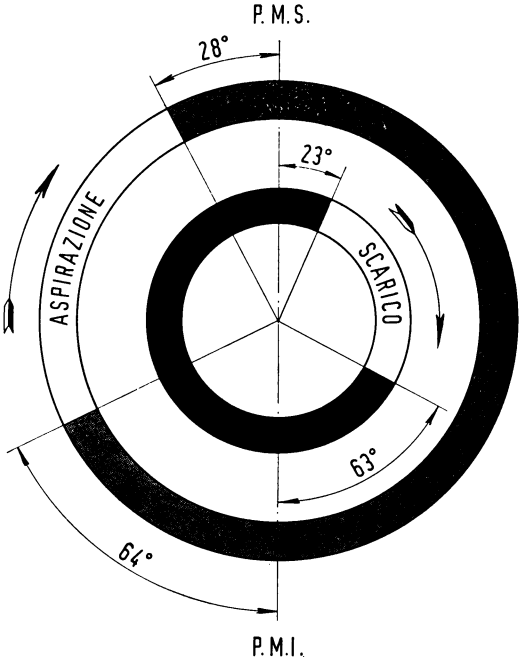


Fig. 55. - 118 B.000 engine valve timing diagram at a tappet clearance of .0118″ (0.30 mm), intake and .0138″ (0.35 mm), exhaust.

ASPIRAZIONE = INTAKE - SCARICO = EXHAUST
P.M.S. = T.D.C. - P.M.I. = B.D.C.

Valve tappet clearance for engine operation, cold:

— intake	.0118″ (0.30 mm)
— exhaust	.0138″ (0.35 mm)

Checking and Adjusting Tappet Clearance (cold engine).

The recommended clearance setting between camshafts and tappets of:

— .0118″ (0.30 mm) intake valves;

— .0138″ (0.35 mm) exhaust valves;

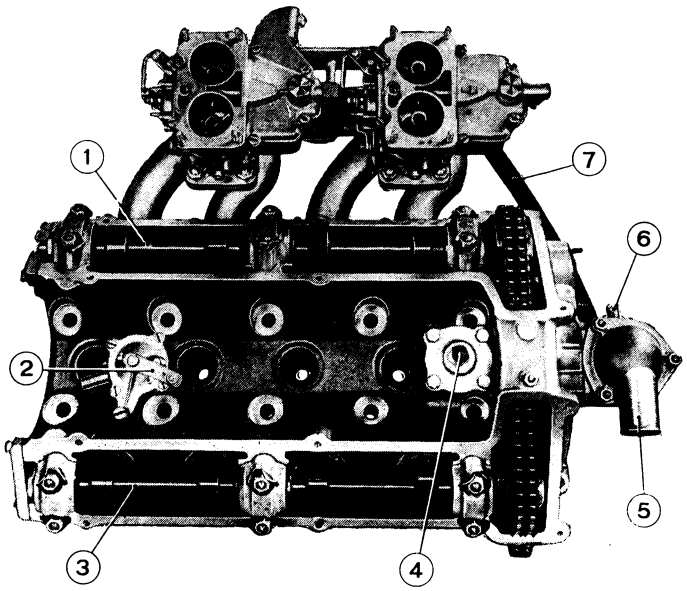


Fig. 56. - 118 B.000 engine head with valve gear covers removed.

1. Intake valves camshaft - 2. Cock, water to car heater - 3. Exhaust valves camshaft - 4. Heat indicator sending unit - 5. Cylinder head water outlet - 6. Water return line from heater - 7. Water delivery line to intake manifolds.

should be kept as constant as possible in order not to alter the correct timing and obtain optimum engine operation. In fact, if clearance is excessive, noises will develop, while if it is much less than specified, valves will keep on staying a bit open with consequent lack of compression, reduced life of valves and seats.

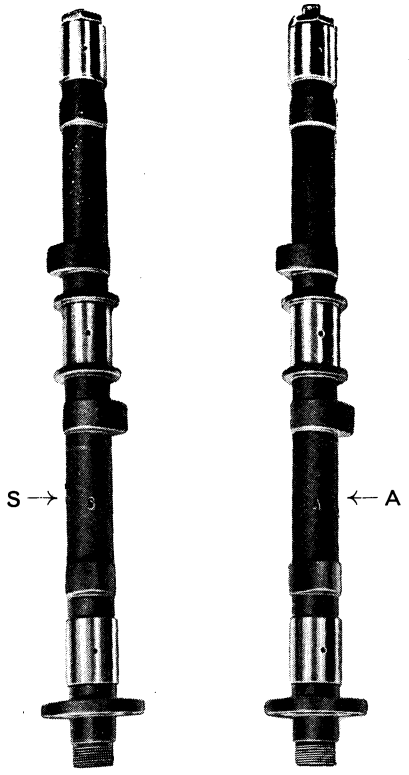


Fig. 57. - Camshafts: exhaust valve camshaft is marked S (left) and intake valve camshaft is marked A (right).

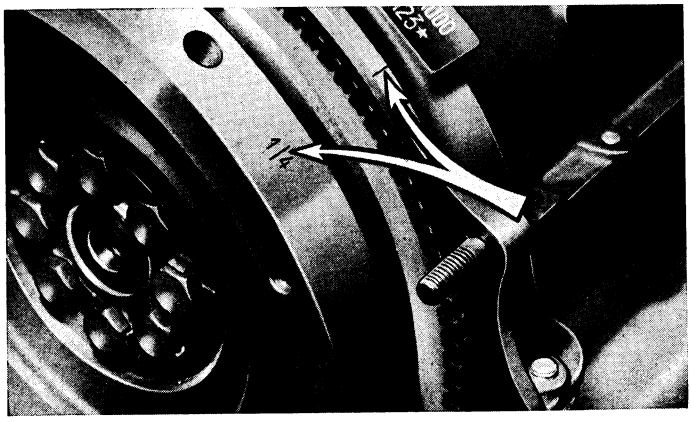


Fig. 58. - Reference marks on flywheel and crankcase for valve gear and ignition timing on engine 118 B.000.

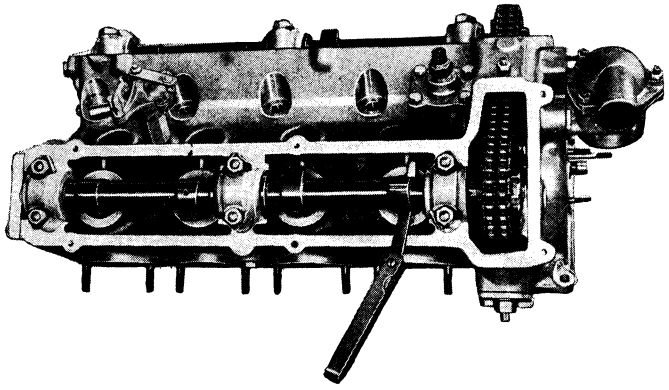


Fig. 61. - Checking tappet clearance on engine 118 B.000 by means of feeler gauge A. 95113.

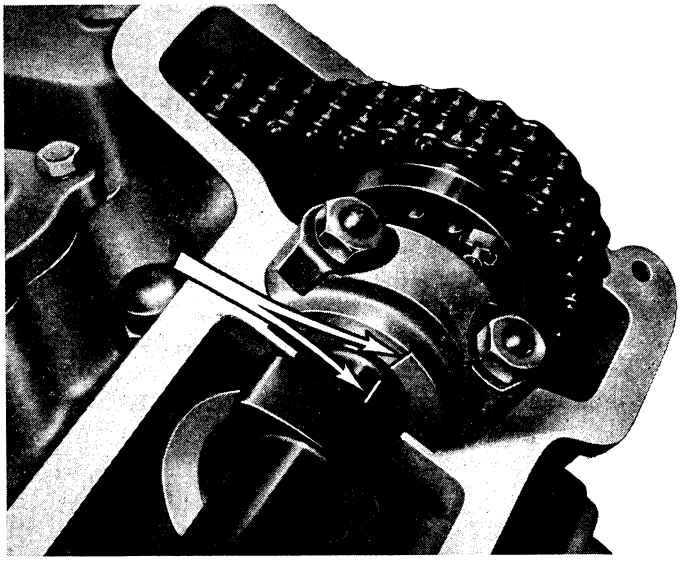


Fig. 59. - Timing marks on camshaft and bearing - engine 118 B.000.

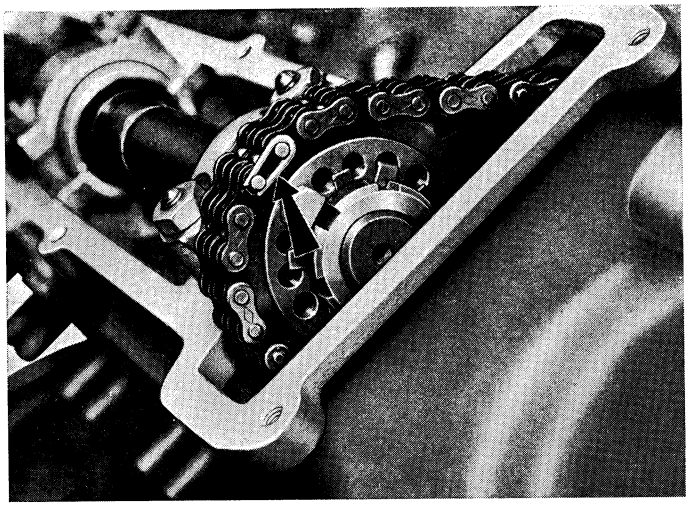


Fig. 60. - Upper timing chain link retainer - engine 118 B.000.

Arrow shows correct position of link retainer.

Before any re-adjustment is undertaken, check with feeler gauge **A. 95113** (fig. 61) the clearance between tappets and camshaft and record each reading.

This procedure makes it possible to know beforehand the thickness of each valve end cap (see fig. 62) for end caps are supplied in thicknesses ranging from .080″ (2 mm) to .126″ (3.20 mm) in progressive .002″ (0.05 mm) oversize increments.

Once the valves needing a clearance re-adjustment are singled out, proceed as follows:

— Turn flywheel until its « 1/4 » reference mark lines up with the mark on crankcase (fig. 58) and the reference marks on camshafts line up with the marks on camshaft bearings (fig. 59).

— See if the timing chain removable link is in a visible and accessible position (fig. 60); if not, turn flywheel until the alignment of reference marks and the correct location of chain removable link are obtained.

— Take off the link retainer, remove the link and secure chain free ends with two pieces of wire (fig. 63) so that chain cannot fall into the timing gear case.

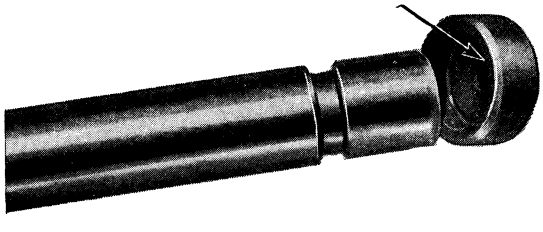


Fig. 62. - Detail of a valve stem and differential thickness cap for tappet clearance adjustment on engine 118 B.000.

Remove camshafts and proceed with the replacement of the end caps between valves and tappets (fig. 62) in accordance with the previously recorded clearances.

Next to adjustment, re-install all parts by reversing the removal operations, making sure that reference marks are indexed correctly.

Carry out a final check to ensure that clearances are all as specified.

NOTE - With chain open, do not vary the position of crankshaft.

On removal of camshaft bearings take care to slacken centre member screws first, then the front and rear ones, working as uniformly as possible to prevent distortion of camshafts from the upward pressure of valve springs.

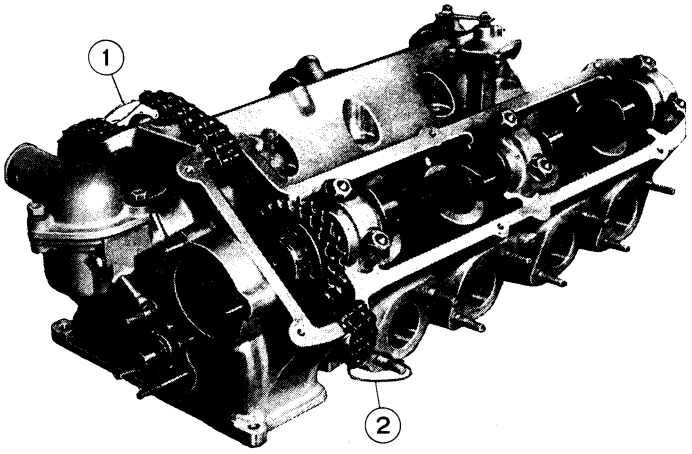


Fig. 63. - Timing chain opened for tappet clearance adjustment (engine 118 B.000).

1-2. Chain ends secured by lock wire.

VALVE TIMING

Proceed as follows:

— Turn flywheel until its « 1/4 » reference mark lines up with the mark on crankcase (fig. 58) and see to it that the reference marks on camshafts line up with the marks on camshaft bearings (fig. 59).

— Install the upper chain, locating the removable link retainer in the position shown in fig. 60, and stretch the chain as instructed on next page. Using a sector scale, and turning the flywheel, check that the advance and retard angles, respectively at opening and closing of intake and exhaust strokes, correspond to those specified on the timing diagram against the .0118″ (0.30 mm) and .0138″ (0.35 mm) clearances, respectively for the intake and exhaust valves.

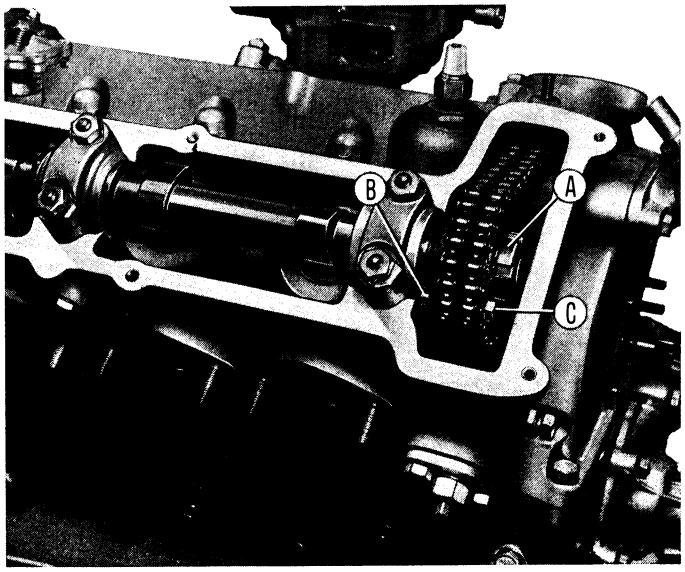


Fig. 64. - Detail of camshaft drive sprocket mounting on engine 118 B.000.

A. Camshaft drive sprocket lock nut - B-C. Camshaft locating screw and nut.

In case a re-adjustment is required, timing may be corrected to the specified values by relocating the holes (14 in all) in the flange of camshafts relative to the holes (15 in all) in sprocket (see fig. 65).

The difference in the number of holes allows a correction of 1° 42′ 51″, plus or minus, by shifting the location

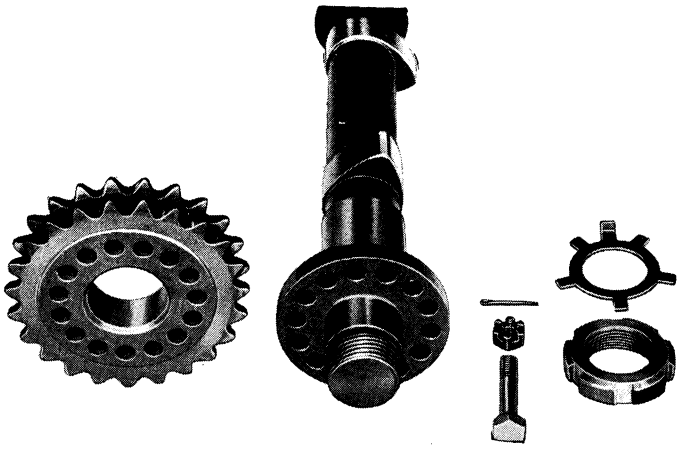


Fig. 65. - Flanged camshaft with sprocket, location screw, nut, cotter pin, adjuster ring and lockplate (engine 118 B.000).

The sprocket has 15 drilled holes, the camshaft flange 14. By varying the mounting position of sprocket on camshaft of 1 hole, an angular displacement of 1° 42′ 51″ — plus or minus depending on the direction of rotation — is obtained, to reset engine timing in conformity with the specified data (see timing diagram).

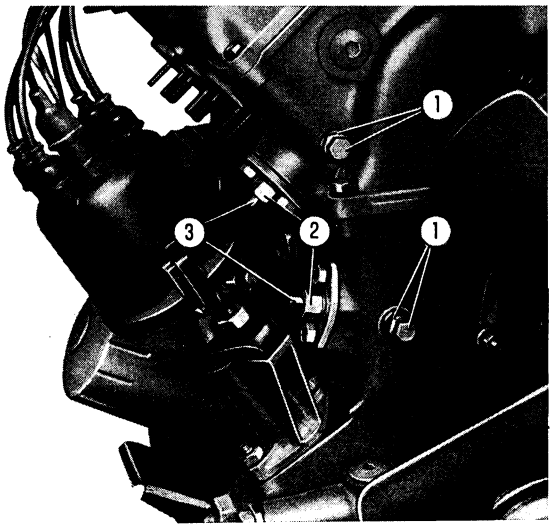


Fig. 66. - Adjusting tension of timing chains on engine 118 B.000. 1. Screws (with nuts) locking the upper double-row chain for camshafts and the double-row chain for dual idler sprocket - 2. Lock nuts - 3. Chain setting screws (loosen to stretch chain).

screw to the hole immediately following or preceding, as required.

For this operation, proceed as follows: back out the adjuster rings, remove sprocket-to-camshaft location screws; while holding fast the sprocket, relocate the camshaft so to obtain the correct setting, re-install the location screws in the newly aligned holes and fully tighten adjuster rings (fig. 64).

Adjusting Tension of Timing Chains.

Timing chains tension is adjusted by means of the stretchers shown in fig. 67.

Chains must not be excessively stretched (sag under hand pressure: .039″ to .079″ (1-2 mm).

Turn stretcher square shank counterclockwise to increase and clockwise to reduce chain tension. Care must be taken that the nuts and bolts fixing the stretcher flanges to cylinder head and crankcase are well taut.

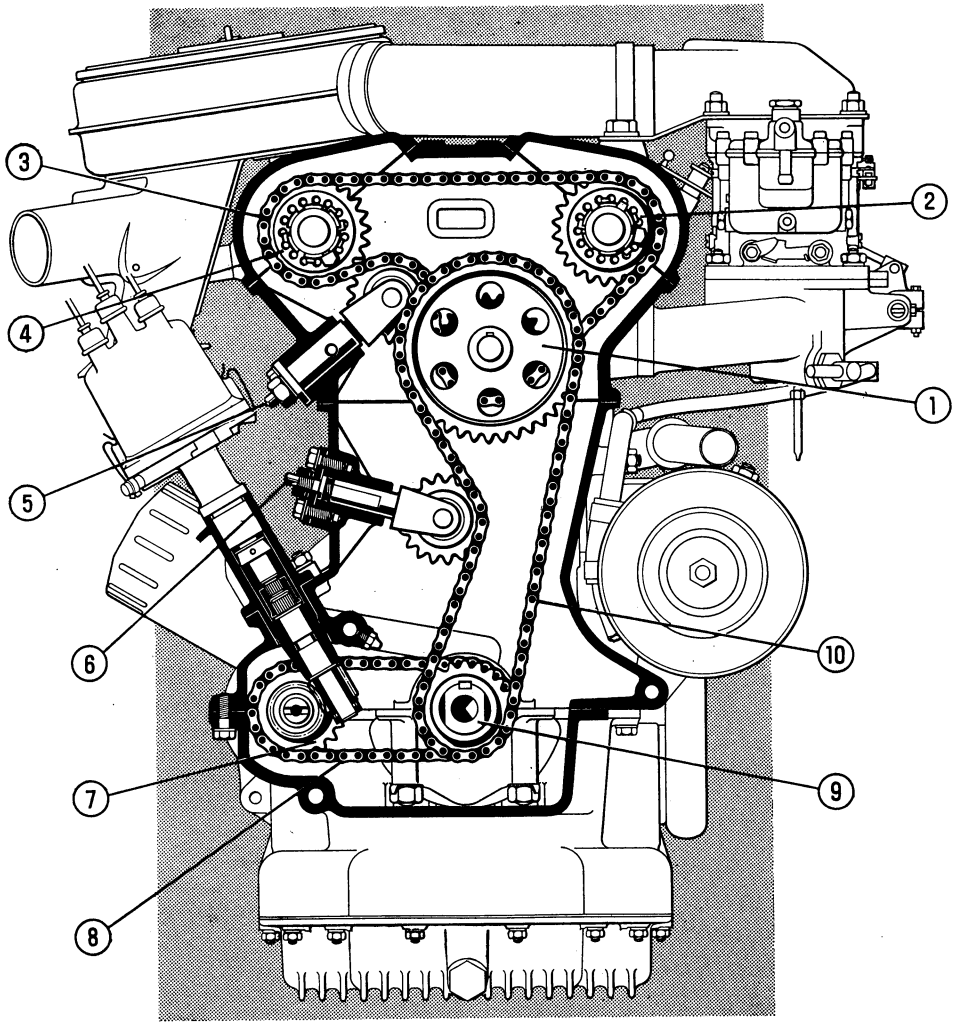


Fig. 67.

Valve drive diagram - engine 118 B.000.

1. Dual idler sprocket - 2. Intake valve camshaft sprocket - 3. Chain, double row, camshaft drive - 4. Exhaust valve camshaft sprocket - 5. Stretcher, chain (3) - 6. Stretcher, chain (10) - 7. Sprocket, ignition distributor and oil pump drive - 8. Chain, single, sprocket (7) drive - 9. Crankshaft - 10. Chain, double row, idler sprocket drive.

SPECIFICATIONS - FITS OF NEW PARTS TIGHTENING REFERENCE

CYLINDER BLOCK AND CRANKCASE

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Cylinder bore diameter	Size group A	3.0315″ to 3.0319″ (77.000 to 77.010 mm)	3.1496″ to 3.1500″ (80.000 to 80.010 mm)
	Size group B	3.0319″ to 3.0323″ (77.010 to 77.020 mm)	3.1500″ to 3.1504″ (80.010 to 80.020 mm)
	Size group C	3.0323″ to 3.0327″ (77.020 to 77.030 mm)	3.1504″ to 3.1508″ (80.020 to 80.030 mm)
	Size group D	—	3.1508″ to 3.1512″ (80.030 to 80.040 mm)
Cylinder bore line diam.		3.1862″ to 3.1870″ (80.93 to 80.95 mm)	— —
Cylinder liner O.D.		3.1890″ to 3.1898″ (81.00 to 81.02 mm)	— —
Cylinder liner I.D.		3.0118″ to 3.0193″ (76.50 to 76.69 mm)	— —
Cylinder bore-to-liner pinch fit		.0019″ to .0035″ (0.05 to 0.09 mm)	— —

CONNECTING RODS - BEARINGS - BUSHINGS

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Connecting rod big end bore		2.2330″ to 2.2334″ (56.718 to 56.730 mm)	2.0210″ to 2.0215″ (51.333 to 51.346 mm)
Connecting rod small end bore		.9425″ to .9438″ (23.939 to 23.972 mm)	.8637″ to .8650″ (21.939 to 21.972 mm)
Standard con rod bearing insert thickness		.0721″ to .0723″ (1.831 to 1.837 mm)	.0715″ to .0717″ (1.816 to 1.822 mm)
Replacement con rod bearing insert undersize range		.0108″ - .0208″ - .0308″ - .0408″ (0.274 - 0.528 - 0.782 - 1.036 mm)	.01″ - .02″ - .03″ - .04″ (0.254 - 0.508 0.762 - 1.016 mm)
Small end bushing O.D.		.9440″ to .9449″ (23.979 to 24.000 mm)	.8653″ to .8661″ (21.979 to 22.000 mm)
Seated bushing ream diameter	Size group 1	.8661″ to .8662″ (21.998 to 22.001 mm)	.7873″ to .7874″ (19.998 to 20.001 mm)
	Size group 2	.8662″ to .8663″ (22.001 to 22.004 mm)	.7874″ to .7875″ (20.001 to 20.004 mm)
Piston pin-to-small end bushing: — clearance of new parts		.0002″ to .0004″ (0.004 to 0.010 mm)	.0002″ to .0004″ (0.004 to 0.010 mm)
Small end bushing-to-bore	pinch fit	.0003″ to .0024″ (0.007 to 0.061 mm)	.0003″ to .0024″ (0.007 to 0.061 mm)
Connecting rod bearing-to-journal: — clearance of new parts		.0012″ to .0030″ (0.031 to 0.076 mm)	.0012″ to .0030″ (0.031 to 0.076 mm)
Maximum misalignment of connecting rod axes: — $4\,^{59}/_{64}$″ (125 mm) apart from rod stem		± .0020″ (± 0.05 mm)	± .0020″ (± 0.05 mm)

PISTONS - PINS - RINGS

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Standard diameter of steel belted unsplit pistons, at right angle to piston pin: — .709″ (18 mm) apart from pin axis (fig. 15)	Size group A	3.0299″ to 3.0303″ (76.960 to 76.970 mm)	—
	Size group B	3.0303″ to 3.0307″ (76.970 to 76.980 mm)	—
	Size group C	3.0307″ to 3.0310″ (76.980 to 76.990 mm)	—
Standard diameter of pistons, at right angle to piston pin: — 9/32″ (7 mm) apart from skirt top (fig. 40)	Size group A	—	3.1437″ to 3.1441″ (79.850 to 79.860 mm)
	Size group B	—	3.1441″ to 3.1445″ (79.860 to 79.870 mm)
	Size group C	—	3.1445″ to 3.1449″ (79.870 to 79.880 mm)
	Size group D	—	3.1449″ to 3.1453″ (79.880 to 79.890 mm)
— $1\ ^{9}/_{16}$″ (40 mm) apart from skirt top (fig. 40)	Size group A	—	3.1455″ to 3.1459″ (79.895 to 79.905 mm)
	Size group B	—	3.1459″ to 3.1463″ (79.905 to 79.915 mm)
	Size group C	—	3.1463″ to 3.1467″ (79.915 to 79.925 mm)
	Size group D	—	3.1467″ to 3.1471″ (79.925 to 79.935 mm)
Replacement piston oversize range		.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)	.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)
Piston pin hole diameter	Size group 1	.8661″ tq .8662″ (21.998 to 22.001 mm)	.7873″ to .7874″ (19.996 to 19.999 mm)
	Size group 2	.8662″ to .8663″ (22.001 to 22.004 mm)	.7874″ to .7875″ (19.999 to 20.002 mm)
Piston ring groove height	Top groove	.0801″ to 0.807″ (2.035 to 2.050 mm)	.0683″ to .0701″ (1.760 to 1.780 mm)
	Second groove	.0793″ to .0799″ (2.015 to 2.030 mm)	.0791″ to .0799″ (2.010 to 2.030 mm)
	Bottom groove	.1558″ to .1564″ (3.957 to 3.972 mm)	.1558″ to .1564″ (3.957 to 3.972 mm)
Standard piston pin diameter	Size group 1	.8658″ to .8659″ (21.991 to 21.994 mm)	.7871″ to .7872″ (*) (19.991 to 19.994 mm)
	Size group 2	.8659″ to .8660″ (21.994 to 21.997 mm)	.7872″ to .7873″ (*) (19.994 to 19.997 mm)
Replacement piston pin oversize range		.0079″ (0.2 mm)	(*)
Piston ring thickness	first compression ring	.0779″ to .0783″ (1.978 to 1.990 mm)	.0680″ to .0685″ (1.728 to 1.740 mm)
	second oil ring	.0779″ to .0783″ (1.978 to 1.990 mm)	.0779″ to .0783″ (1.978 to 1.990 mm)
	third radial-cut oil ring	.1535″ to .1547″ (3.900 to 3.930 mm)	—
	third slotted oil ring	—	.1535″ to .1547″ (3.900 to 3.930 mm)

(*) Piston pin comes in a matched set with the piston.

(Cont.)

Cont.: **PISTONS - PINS - RINGS**

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Piston skirt-to-cylinder barrel, at right angle to piston pin: — .709″ (18 mm) apart from pin axis: clearance of new parts		.0012″ to .0020″ (0.030 to 0.50 mm)	— —
Piston skirt-to-cylinder barrel, at right angle to piston pin: — 9/32″ (7 mm) apart from skirt top		—	.0055″ to .0063″ (0.140 to 0.160 mm)
— $1\ ^{9}/_{16}$″ (40 mm) apart from skirt top		—	.0374″ to .0453″ (0.095 to 0.115 mm)
Piston pin-to-piston hole: clearance of new parts		.0002″ to .0004″ (0.004 to 0.010 mm)	.0001″ to .0003″ (*) (0.002 to 0.008 mm)
Piston ring-to-groove land (vertically)	first compression ring: clearance of new parts	.0018″ to .0028″ (0.045 to 0.072 mm)	.0008″ to .0020″ (0.020 to 0.052 mm)
	second oil ring: clearance of new parts	.0010″ to .0020″ (0.025 to 0.052 mm)	.0008″ to .0020″ (0.020 to 0.052 mm)
	third radial-cut oil ring: clearance of new parts	.0011″ to .0028″ (0.027 to 0.072 mm)	—
	third slotted oil ring: clear. of new parts	—	—
Ring end gap in cylinder bore	first compression ring: clearance of new parts	—	.0011″ to .0028″ (0.027 to 0.072 mm)
	second oil ring: clearance of new parts	.0118″ to .0177″ (0.30 to 0.45 mm)	.0118″ to .0177″ (0.30 to 0.45 mm)
	third radial-cut oil ring (compressed)	.0079″ to .0138″ (0.20 to 0.35 mm)	.0079″ to .0138″ (0.20 to 0.35 mm)
	third slotted oil ring: clear. of new parts	touch fit	—
Replacement piston ring oversize range	compression and oil ring	—	.0098″ to .0138″ (0.25 to 0.35 mm)
	radial-cut oil ring	—	—
	slotted oil ring	.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)	.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)
		.0157″ (0.4 mm)	—
		—	.0079″ - .0157″ - .0236″ (0.2 - 0.4 - 0.6 mm)
		—	

(*) Piston pin comes in a matched set with the piston.

CRANKSHAFT AND MAIN BEARINGS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Main bearing journal standard diameter	2.4788″ to 2.4796″ (62.962 to 62.982 mm)	2.2470″ to 2.2475″ (57.073 to 57.086 mm)
Main bearing bore diameter	2.6250″ to 2.6255″ (66.675 to 66.687 mm)	2.3950″ to 2.3955″ (60.833 to 60.845 mm)
Standard main bearing insert thickness	.0716″ to .0718″ (1.818 to 1.824 mm)	.0726″ to .0728″ (1.845 to 1.851 mm)
Replacement main bearing insert undersize range	.0108″ - .0208″ - .0308″ - .0408″ (0.274 - 0.528 - 0.782 - 1.036 mm)	.01″ - .02″ - .03″ - .04″ (0.254 - 0.508 - 0.762 - 1.016 mm)
Connecting rod journal standard diameter	2.0863″ to 2.0871″ (52.992 to 53.013 mm)	1.8755″ to 1.8763″ (47.638 to 47.658 mm)
Main bearing-to-journal: — clearance of new parts	.0018″ to .0035″ (0.045 to 0.089 mm)	.0022″ to .0032″ (0.057 to 0.082 mm)
Length of intermediate main bearing journal, shoulder-to-shoulder	1.3772″ to 1.3787″ (34.98 to 35.02 mm)	— —

(Cont.)

Cont.: CRANKSHAFT AND MAIN BEARINGS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Width of intermediate main bearing bore and cap, between thrust ring seats	1.1866″ to 1.1890″ (30.14 to 30.20 mm)	— —
Intermediate main bearing thrust ring thickness	.0909″ to .0929″ (2.31 to 2.36 mm)	— —
Oversize thrust ring thickness	.0949″ to .0969″ (2.41 to 2.46 mm)	— —
Length of rear main bearing journal, shoulder-to-shoulder	— —	1.2917″ to 1.2933″ (32.81 to 32.85 mm)
Width of rear main bearing bore and cap, between thrust ring seats	— —	1.1004″ to 1.1024″ (27.95 to 28.00 mm)
Rear main bearing thrust ring thickness	— —	.0909″ to .0929″ (2.31 to 2.36 mm)
Oversize thrust ring thickness	— —	.0949″ to .0969″ (2.41 to 2.46 mm)
Crankshaft end fit, thrust rings installed: — clearance of new parts	.0024″ to .0102″ (0.06 to 0.26 mm)	.0035″ to .0110″ (0.09 to 0.28 mm)
Maximum misalignment of main bearing journals	.0020″ (*) (0.05 mm)	.0020″ (*) (0.05 mm)
Maximum misalignment of crankpins to main bearing journals	± .0197″ (± 0.5 mm)	± .0100″ (± 0.25 mm)
Maximum out-of-round of crankpins and main bearing journals, after grinding	.0002″ (0.005 mm)	.0002″ (0.005 mm)
Maximum taper of crankpins and main bearing journals, after grinding	.0002″ (0.005 mm)	.0002″ (0.005 mm)
Flywheel: — parallel relationship of clutch disk face to crankshaft mounting face: max. out-of-true, not above — squareness of above faces to rotation axis: max. out-of-true, not above	.0039″ (0.1 mm) .0039″ (0.1 mm)	.0039″ (0.1 mm) .0039″ (0.1 mm)
Squareness of flywheel resting face to crankshaft centerline: — max. out-of-true with indicator plunger set laterally some 1 1/2″ (38 mm) apart from crankshaft rotation axis, not above	.0010″ (0.025 mm)	.0008″ (0.020 mm)

(*) Total indicator reading.

CYLINDER HEAD - VALVES - GUIDES - SPRINGS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Valve guide head seat diameter	.5886″ to .5896″ (14.950 to 14.977 mm)	.5118″ to .5125″ (13.000 to 13.018 mm)
Valve guide O. D.	.5905″ to .5912″ (14.998 to 15.016 mm)	.5139″ to .5143″ (13.052 to 13.062 mm)
I.D. of valve guides installed in head	.3161″ to .3168″ (8.029 to 8.047 mm)	.3150″ to .3156″ (8.000 to 8.015 mm)
Valve guide-to-seat: pinch fit of new parts	.0008″ to .0026″ (0.021 to 0.066 mm)	.0013″ to .0024″ (0.034 to 0.062 mm)
Valve stem diameter	.3144″ to .3150″ (7.985 to 8.000 mm)	.3140″ to .3146″ (7.975 to 7.990 mm)

(Cont.)

Cont.: **CYLINDER HEAD - VALVES - GUIDES - SPRINGS**

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Valve stem-to-guide fit: — clearance of new parts	.0011″ to .0024″ (0.029 to 0.062 mm)	.0004″ to .0016″ (0.010 to 0.040 mm)
Valve seat angle	45° ± 5′	55° ± 5′
Valve face angle	45° 30′ ± 5′	55° 30′ $^{+15'}_{0'}$
Valve head diameter — intake	1.3780″ (35 mm)	1.5945″ (40.5 mm)
Valve head diameter — exhaust	1.2402″ (31.5 mm)	1.4370″ (36.5 mm)
Maximum run-out of valve rotating on stem a full turn, with dial plunger set on center of outside face	.0008″ (0.02 mm)	.0008″ (0.02 mm)
Valve seat I. D. — intake	1.2598″ (32 mm)	1.3976″ to 1.4055″ (35.5 to 35.7 mm)
Valve seat I. D. — exhaust	1.1220″ (28.5 mm)	1.2205″ to 1.2283″ (31 to 31.2 mm)
Valve spring I. D. — inner spring	.6829″ (17.6 mm)	.6693″ (17 mm)
Valve spring I. D. — outer spring	1.0039″ (25.5 mm)	.9449″ (24 mm)
Free length — inner spring	1.5433″ (39.2 mm)	1.4370″ (36.5 mm)
Free length — outer spring	1.9685″ (50 mm)	1.7126″ (43.5 mm)
Length and load, spring check: **engine 115 C.005**		
— inner spring under 34 lbs (15.4 kg) of load	1.1299″ (28.7 mm)	—
— inner spring under 63.7 lbs (28.9 kg) of load	.7677″ (19.5 mm)	—
— outer spring under 67.7 lbs (30.7 kg) of load	1.2874″ (32.7 mm)	—
— outer spring under 103.6 lbs (47 kg) of load	.9252″ (23.5 mm)	—
engine 118 B.000		
— inner spring under 18.6 lbs (8.45 kg) of load	—	1.2205″ (31 mm)
— inner spring under 49.2 lbs (22.3 kg) of load	—	.8661″ (22 mm)
— outer spring under 33 lbs (15 kg) of load	—	1.4173″ (36 mm)
— outer spring under 72.8 lbs (33 kg) of load	—	1.0630″ (27 mm)
Minimum permissible load on springs: — inner spring length 1.1299″ (28.7 mm)	29.8 lbs (13 1/2 kg)	—
— inner spring length 1.2205″ (31 mm)	—	15 lbs (6.8 kg)
— outer spring length 1.2874″ (32.7 mm)	60.6 lbs (27 1/2 kg)	—
— outer spring length 1.4173″ (36 mm)	—	26 1/2 lbs (12 kg)
Theoretical valve lift (touch fit) — intake	.3409″ (8.65 mm)	.3409″ (8.65 mm)
Theoretical valve lift (touch fit) — exhaust	.3386″ (8.60 mm)	.3386″ (8.60 mm)

CAMSHAFT AND BUSHINGS

DESCRIPTION		Engine 115 C.005	Engine 118 B.000
Bushing seat bore in crankcase:			
— front		2.0670″ to 2.0680″ (52.502 to 52.527 mm)	
— center		2.0050″ to 2.0060″ (50.927 to 50.952 mm)	—
— rear		1.9425″ to 1.9435″ (49.340 to 49.365 mm)	
Bushing O. D.:			
— front		2.0656″ to 2.0662″ (52.467 to 52.482 mm)	
— center (1)		2.0090″ to 2.0110″ (51.028 to 51.079 mm)	—
— rear (1)		1.9460″ to 1.9480″ (49.428 to 49.479 mm)	
	seated	reamed	—
Bushing bore:			
— front	1.4183″ to 1.4198″ (2) (36.025 to 36.064 mm) (2)	1.4183″ to 1.4198″ (2) (36.025 to 36.064 mm) (2)	
— center	1.8640″ to 1.8680″ (47.346 to 47.447 mm)	1.8780″ to 1.8788″ (47.701 to 47.721 mm)	—
— rear	1.8090″ to 1.8130″ (45.949 to 46.050 mm)	1.8230″ to 1.8238″ (46.304 to 46.324 mm)	
Bushing-to-crankcase bore fit:			
— front: clearance of new parts		.0008″ to .0024″ (0.02 to 0.06 mm)	
— center: pinch fit of new parts		.0030″ to .0060″ (0.076 to 0.152 mm)	—
— rear: pinch fit of new parts		.0025″ to .0055″ (0.063 to 0.139 mm)	
Camshaft journal diameter:			
— front		1.4163″ to 1.4173″ (35.975 to 36.000 mm)	1.1016″ to 1.1021″ (27.980 to 27.993 mm)
— center		1.8760″ to 1.8770″ (47.650 to 47.675 mm)	1.1173″ to 1.1178″ (28.380 to 28.393 mm)
— rear		1.8210″ to 1.8220″ (46.253 to 46.278 mm)	1.1331″ to 1.1336″ (28.780 to 28.793 mm)

(1) Figure refers to the ring gauge bore (hand fitted bushing).

(2) This bushing, which comes precision finished in the bore, is secured by two screws.

(Cont.)

Cont.: **CAMSHAFT AND BUSHINGS**

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Camshaft bearing bore:		
— front		1.1024″ to 1.1032″ (28.000 to 28.021 mm)
— center	—	1.1181″ to 1.1189″ (28.400 to 28.421 mm)
— rear		1.1339″ to 1.1347″ (28.800 to 28.821 mm)
Camshaft bushing-to-journal fit:		
— clearance of new parts — front	.0010″ to .0035″ (0.025 to 0.089 mm)	—
— clearance of new parts — center	.0010″ to .0028″ (0.026 to 0.071 mm)	—
— clearance of new parts — rear	.0010″ to .0028″ (0.026 to 0.071 mm)	—
Camshaft bearing-to-journal fit:		
— clearance of new parts — front		.0003″ to .0016″ (0.007 to 0.041 mm)
— clearance of new parts — center	—	.0003″ to .0016″ (0.007 to 0.041 mm)
— clearance of new parts — rear		.0003″ to .0016″ (0.007 to 0.041 mm)

TAPPETS - ROCKERS - SHAFTS - SUPPORTS

DESCRIPTION	Engine 115 C.005	Engine 118 B.000
Standard tappet seat bore in crankcase	.8663″ to .8670″ (22.003 to 22.021 mm)	1.3779″ to 1.3789″ (35.000 to 35.025 mm)
Standard tappet O. D.	.8653″ to .8660″ (21.978 to 21.996 mm)	1.3773″ to 1.3778″ (34.984 to 34.995 mm)
Replacement tappet oversize range	.0020″ - .0039″ (0.05 - 0.10 mm)	— —
Tappet-to-seat fit:		
— clearance of new parts	.0003″ to .0017″ (0.007 to 0.043 mm)	.0002″ to .0016″ (0.005 to 0.041 mm)
Rocker shaft support bore diam.	.7076″ to .7083″ (17.974 to 17.992 mm)	— —
Rocker shaft diameter	.7069″ to .7076″ (17.956 to 17.974 mm)	— —
Rocker shaft support-to-rocker shaft fit:		
— clearance of new parts	.0000″ to .0014″ (0 to 0.036 mm)	— —
Rocker arm bore diameter	.7089″ to .7096″ (18.006 to 18.024 mm)	— —

(Cont.)

Cont.: **TAPPETS - ROCKERS - SHAFTS - SUPPORTS**

DESCRIPTION	Engine 115 C.005	Engine 115 B.000
Rocker arm-to-shaft fit:		
— clearance of new parts	.0013″ to .0027″ (0.032 to 0.068 mm)	— —
Rocker arm spring:		
— I. D.	.7283″ (18.5 mm)	
— free height	2.7480″ (69.8 mm)	—
— spring height under 5.5 ± .4 lbs (2.5 ± 0.2 kg) of load	1.2205″ (31 mm)	

115 C.005 ENGINE TIGHTENING REFERENCE

ITEMS	Part Number	Thread Diam. and Pitch	Material	Torque
Main bearing cap screw	4025557	M 12 x 1.5	R 100	76 ft.lbs (10.5 kgm)
Con rod bearing cap screw	4119148	M 11 x 1	R 100	47.7 ft.lbs (7 kgm)
Cylinder head hold-down screw	1/59747/30	M 12 x 1.5	R 100	50.6 ft.lbs (9 kgm)
Flywheel-to-crankshaft screw	1/42334/30	M 10 x 1.25	R 100	57.9 ft.lbs (8 kgm)

(Cont.)

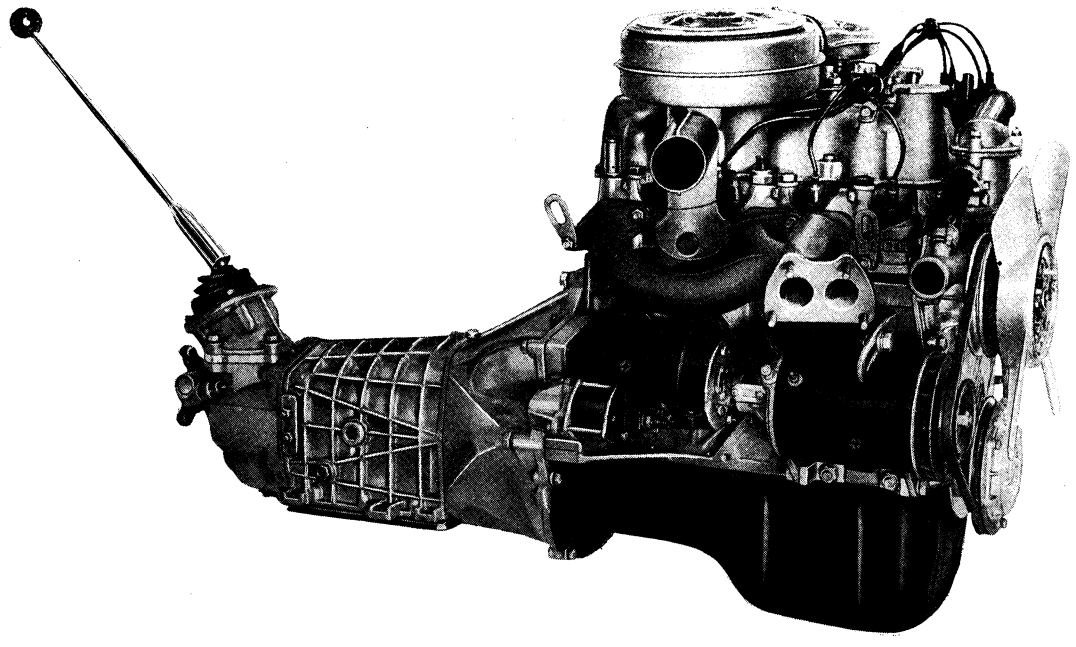


Fig. 68. - Right-hand side view of 1500 Cabriolet power plant.

Cont.: **115 C.005 ENGINE TIGHTENING REFERENCE**

ITEMS	Part Number	Thread Diam. and Pitch	Material	Torque
Driven sprocket-to-camshaft screw	1/59707/20	M 10 x 1.25	R 80	36.2 ft.lbs (5 kgm)
Rocker shaft support-to-cylinder head stud nut	1/61008/11	M 8 x 1.25	R 50 Cdt (stud R 80)	13.7 ft.lbs (1.9 kgm)
Fan and generator drive pulley hub screw . . .	4089697	M 20 x 1	R 100	101.3 ft.lbs (14 kgm)
Spark plug	4079728	M 14 x 1.25	—	18.1 to 21.7 ft.lbs (2.5 to 3 kgm)
Fan solenoid thermal switch	4078479	M 22 x 1.5	OT 58	36.2 to 43.4 ft.lbs (5 to 6 kgm)

118 B.000 ENGINE TIGHTENING REFERENCE

ITEMS	Part Number	Thread Diam. and Pitch	Material	Torque
Flywheel-to-crankshaft screw	4104765	M 9 x 1	R 100	32 1/2 ft.lbs (4.5 kgm)
Connecting rod bearing cap screw self-locking nut	4045971	M 9 x 1	R 80 (screw R 100)	28.9 ft.lbs (4 kgm)
Cylinder head hold-down screw	1/59749/30	M 12 x 1.5	R 100	65.1 ft.lbs (9 kgm)
Main bearing cap screw	4025557	M 12 x 1.5	R 100	76 ft.lbs (10.5 kgm)
Camshaft bearing cap stud	1/61008/21	M 8 x 1.25	R 80 Znt (stud R 100)	18.1 ft.lbs (2.5 kgm)
Centrifugal oil filter housing screw	4104168	M 18 x 1	R 100	101.3 ft.lbs (14 kgm)
Fan solenoid thermal switch	4111819	M 22 x 1.5	OT 58	36.2 to 43.4 ft.lbs (5 to 6 kgm)
Spark plug	4079728	M 14 x 1.25	—	18.1 to 21.7 ft.lbs (2.5 to 3 kgm)

Lubrication

Engine 115 C.005.

Metered pressure, gear-pump controlled engine lubrication.

The lubrication system includes, besides the gear pump:

— a suction intake horn with filter screen;

— a centrifugal delivery oil filter (6, fig. 71);

— a by-pass, supplementary oil filter (17), mounted on engine left side;

— an oil pressure relief valve (10) on pump cover;

— a low pressure indicator sending unit (14).

Standard oil pressure: 57 to 64 p.s.i. (4 to 4.5 kg/cm²).

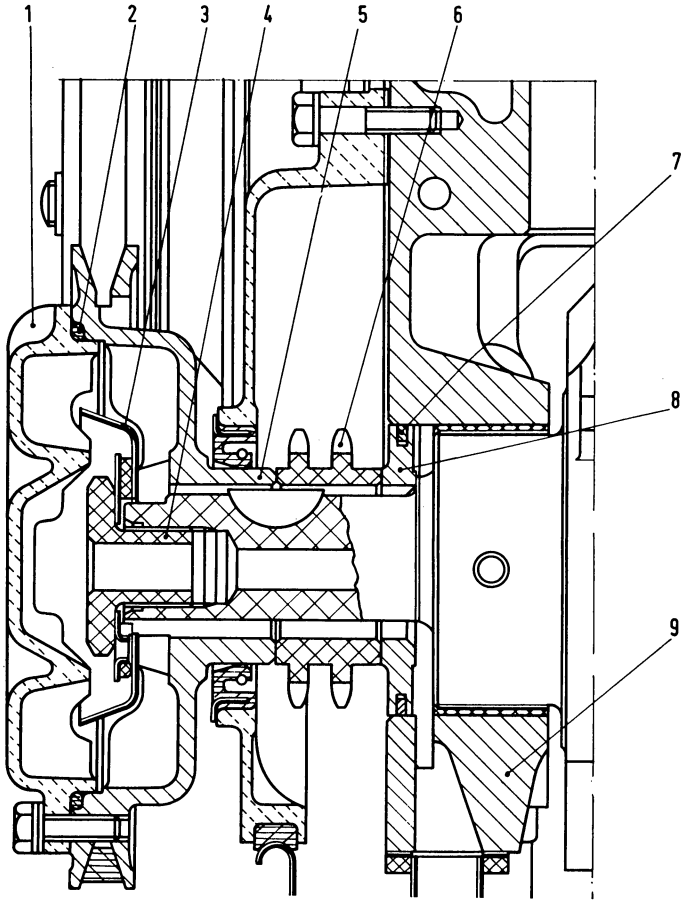


Fig. 69. - Detail of 115 C.005 engine side section view across centrifugal oil filter.

1. Centrifugal filter cover - 2. Seal ring - 3. Baffle ring - 4. Pulley hub-to-crankshaft hollow screw - 5. Centrifugal oil filter pulley hub - 6. Timing gear drive sprocket - 7. Oil shield disk ring - 8. Oil shield disk - 9. Front main bearing cap.

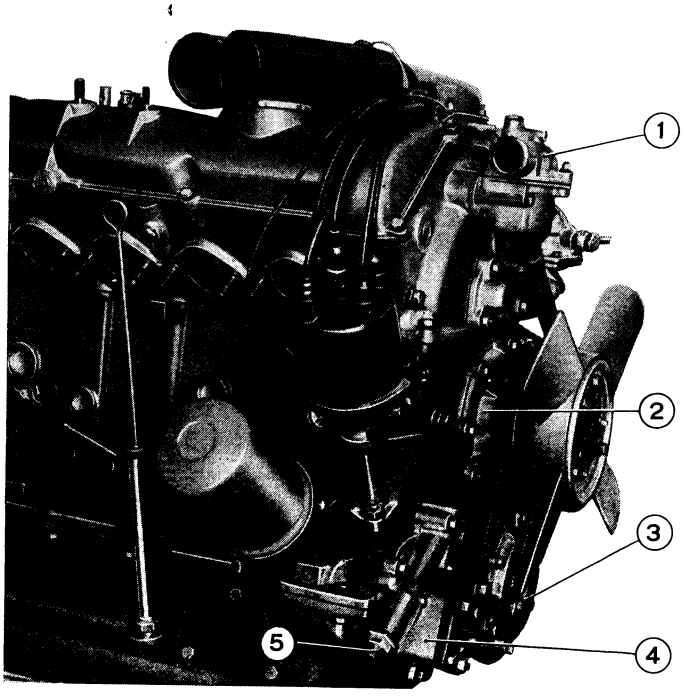


Fig. 70. - Scrap view of engine 118 B.000.

1. Water outlet tube from cylinder head - 2. Water pump - 3. Centrifugal oil filter - 4. Oil pump - 5. Oil pressure relief valve.

Engine 118 B.000.

The lubrication system includes, besides the gear pump:

— an oil suction line (9, fig. 76) from sump;

— a centrifugal delivery oil filter (15);

— a by pass, supplementary oil filter (7), mounted on engine right side;

— an oil pressure relief valve (13) on pump housing;

— an oil delivery line to pressure gauge.

Standard oil pressure: 85.3 p.s.i. (6 kg/cm²).

CENTRIFUGAL OIL FILTER

The centrifugal oil filter consists basically of a cover (1, fig. 69), a pulley hub (5) and a baffle ring (3).

The lower diameter of the baffle ring is lesser than that of the cover and cover hub, because the baffle ring has been designed to create a radial oil strain toward an area where centrifugal force is such as to segregate foreign matter.

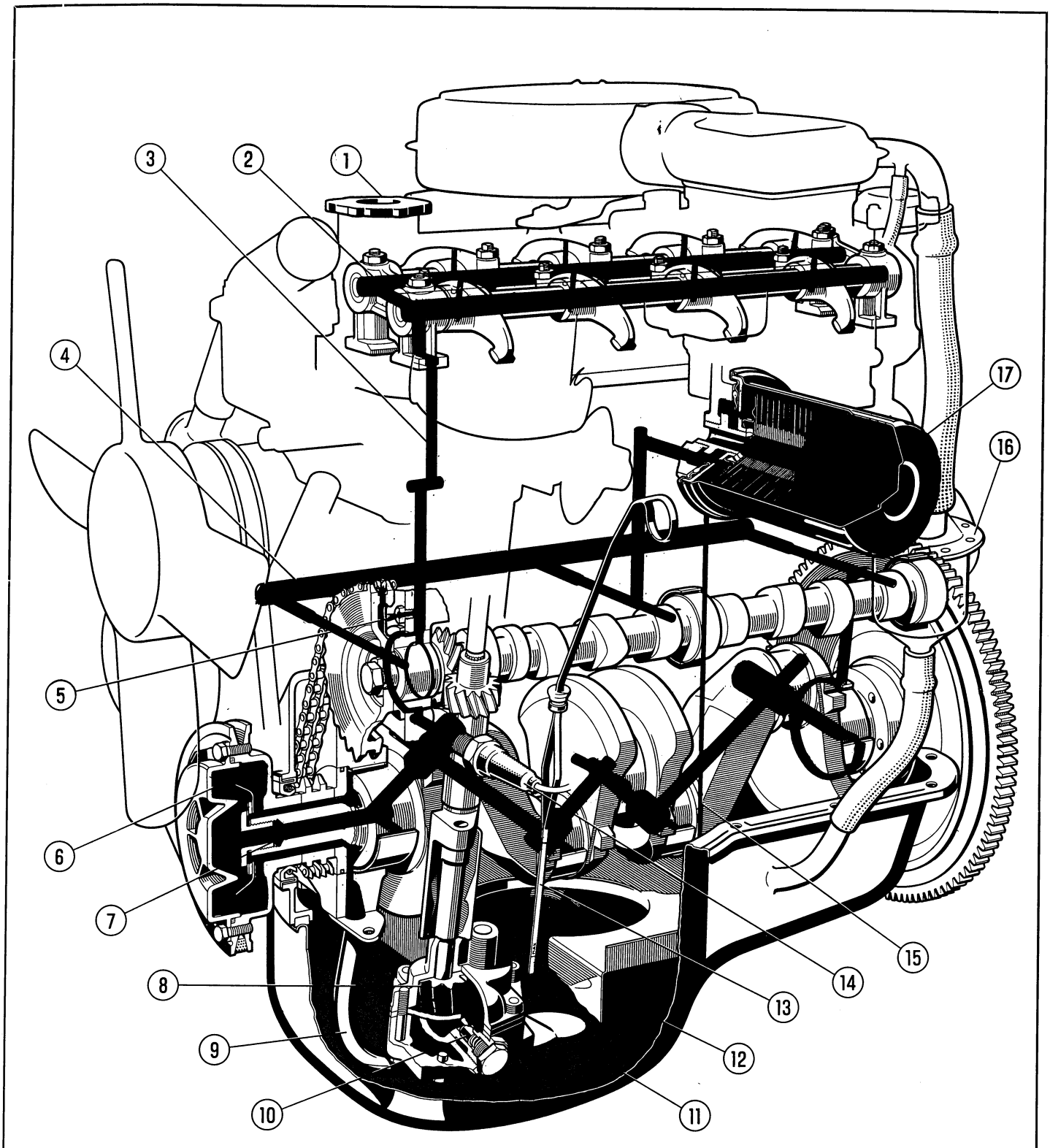


Fig. 71. - Cut-away and phantom view of 115 C.005 engine lubrication system.

1. Oil filler cap - 2. Rocker shafts - 3. Rocker shaft oil delivery passage - 4. Main oil delivery passage - 5. Timing chain oil connection - 6. Centrifugal oil filter - 7. Crankshaft with cut-away of inner oil passage - 8. Gear oil pump - 9. Pump-to-centrifugal filter oil delivery pipe - 10. Oil pressure relief valve - 11. Oil pump suction filter - 12. Oil pan drain plug - 13. Oil dip stick - 14. Low pressure indicator sending unit - 15. Supplementary filter oil return to pan - 16. Blow-by device of gases and oil vapours, circuited with the oil pan and carburetor air intake - 17. By-pass, supplementary oil filter.

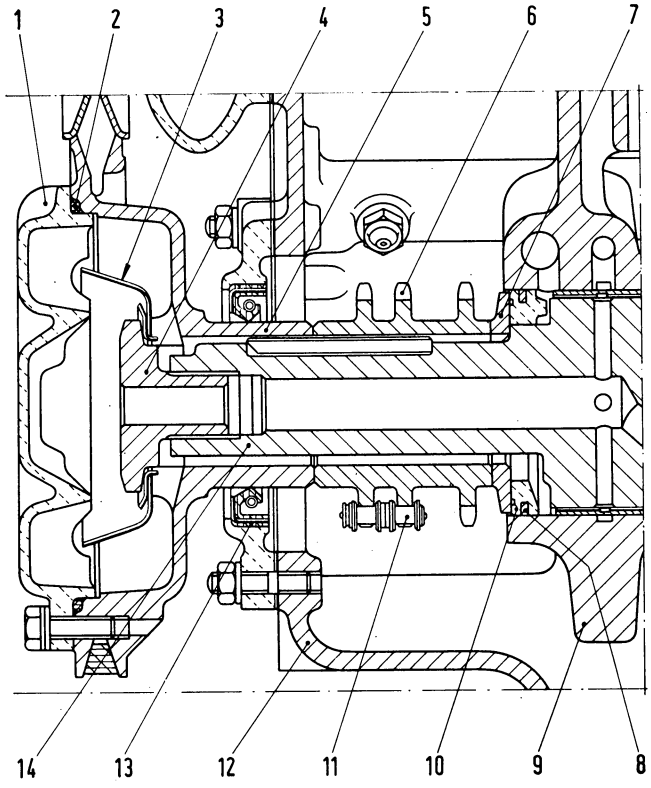


Fig. 72. - Detail of 118 B.000 engine side section view across centrifugal oil filter.

1. Centrifugal filter cover - 2. Seal ring - 3. Baffle ring - 4. Pulley hub-to-crankshaft hollow screw - 5. Centrifugal oil filter pulley hub - 6. Timing gear, oil pump and ignition distributor drive drive sprocket - 7. Thrust ring - 8. Seal ring - 9. Front main bearing cap - 10. Oil shield disk - 11. Timing gear idler sprocket drive chain - 12. Oil pan - 13. Front gasket - 14. Crankshaft.

Radial ribs on pulley inner face are to trap foreign matter and convey oil to center filter.

The oil from both sides of front crankshaft end

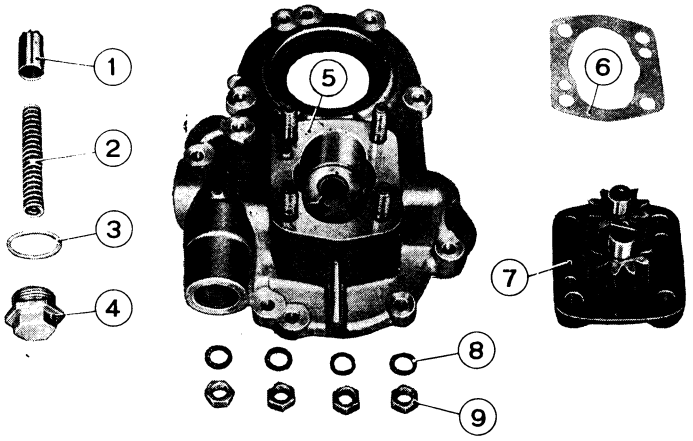


Fig. 74. - 118 B.000 engine oil pump components.

1. Oil pressure relief valve - 2. Relief valve spring - 3. Seal - 4. Relief valve plug - 5. Oil pump housing - 6. Gasket - 7. Drive gears and cover - 8. Spring washers - 9. Pump-to-crankcase mounting nuts.

(which bears two longitudinal machine grooves) is forced to filter outskirts by the baffle ring. Oil is so cleaned and returns to filter center whence it flows inside the crankshaft through a hollow screw (4) securing the hub and the baffle ring to the crankshaft.

The hub edge is grooved to fit a « V » belt which transmits drive to the generator and fan.

The hollow screw securing the hub to the crankshaft should be drawn up with 101.3 ft.lbs (14 kgm) of torque, using a torque wrench.

By-pass Oil Filter.

The by-pass oil filter is a self-contained unit which comes as such for spare.

The routine replacement of this filter is recommended to be effected every 6,000 miles (10,000 km).

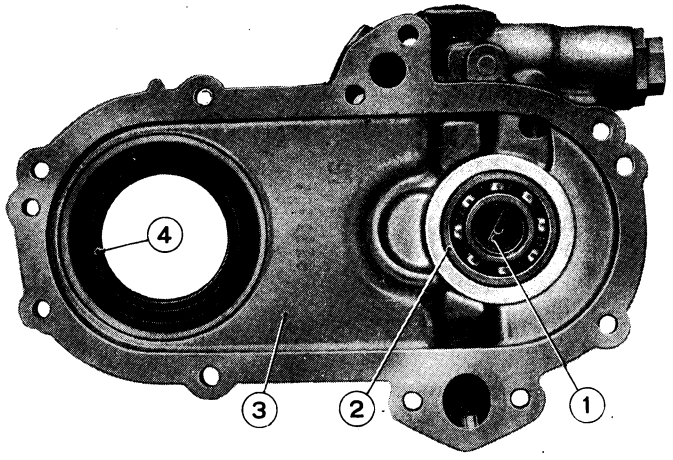


Fig. 73. - 118 B.000 engine oil pump - Interior view.

1. Pump shaft drive tang - 2. Ball bearing - 3. Pump housing - 4. Crankshaft seal.

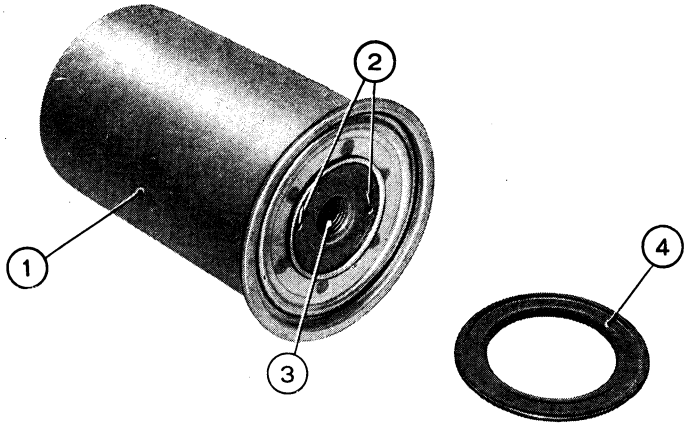


Fig. 75. - By-pass oil filter.

1. Filter element - 2. Oil inlet holes to filter - 3. Oil return hole to pan - 4. Filter-to-crankcase seal.

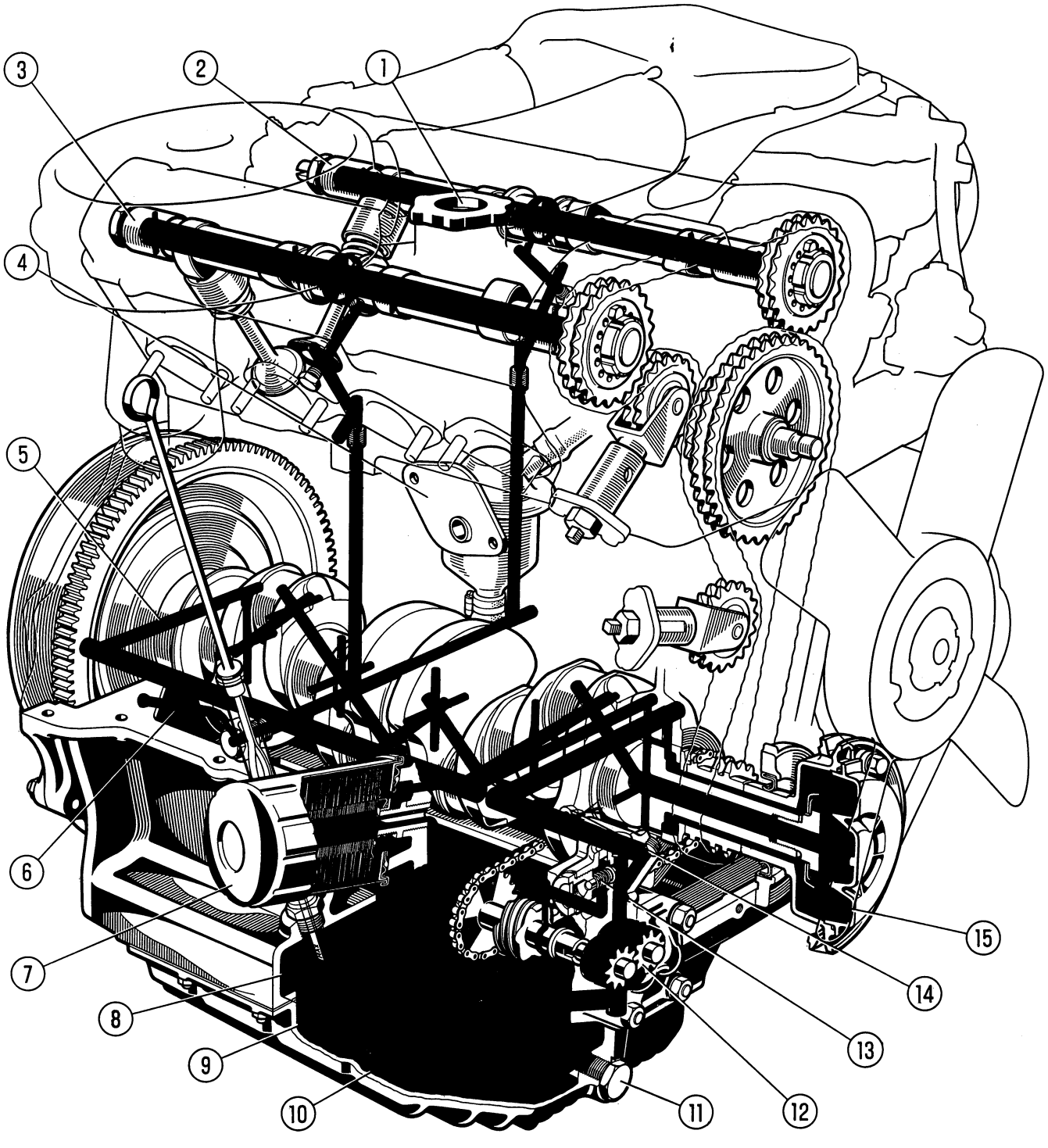


Fig. 76. - Cut-away and phantom view of 118 B.000 engine lubrication system.

1. Oil filler cap - 2. Intake valves camshaft - 3. Exhaust valves camshaft - 4. Crankcase oil vent line, with filter - 5. Duct, oil to pressure gauge, camshafts and by-pass filter - 6. Line, oil to pressure gauge - 7. By-pass oil filter - 8. Oil dipstick - 9. Oil suction line in sump - 10. Oil intake filter - 11. Drain plug - 12. Oil gear pump - 13. Oil pressure relief valve - 14. Connection, ignition distributor and oil pump drive chain lubrication - 15. Centrifugal oil filter.

To replace the filter, proceed as follows:

— Using tool **A. 60260**, unscrew the filter from crankcase connection, check the filter seating and clean it thoroughly. Coat the seating face with a film of oil and install a new filter unit. Again with tool **A. 60260**, tighten the filter home using care that the rubber seal between filter and crankcase seating is positioned correctly.

— Run the engine for some minutes and check for oil leaks or incorrect operation.

Oil Pump Drive Shaft (Engine 118 B.000).

ADJUSTING END PLAY

Oil pump and ignition distributor are driven off the crankshaft via a chain (figs. 76 and 67).

To take up end play, a thrust washer is fitted between the abutment face of ignition distributor/oil pump drive shaft and the oil pump ball bearing in pump housing (see figs. 78 and 79).

Thrust washers are available for service in .0039″ (0.10 mm) oversize thickness increments, from .0669″ (1.70 mm) to .1181″ (3.00 mm).

Adjustment procedure is as follows:

Make sure the shaft ball bearings are tightly fitted, at both crankcase and pump housing ends, and insert the drive shaft into the crankcase bearing.

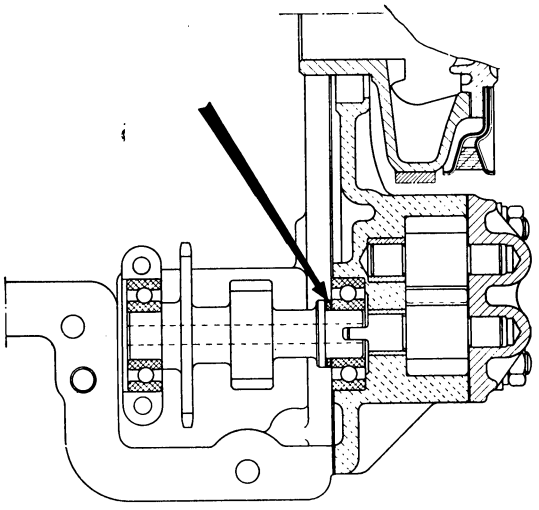


Fig. 78. - Sectional view of 118 B.000 engine oil pump.

Arrow points to the thrust washer which comes for service in different thicknesses.

Holding a straightedge on crankcase machined surface, select a thrust washer having a thickness equivalent to the gap between shaft abutment face and straightedge; make sure that the mounting face of the ball bearing in pump housing is flush with pump housing mounting flange: differences, if any, must be kept in due account to increase or decrease the washer thickness.

On shaft, insert the washer of the proper thickness and fit the oil pump after setting a paper gasket in between. The drive shaft end play is determined by the thickness of this paper gasket.

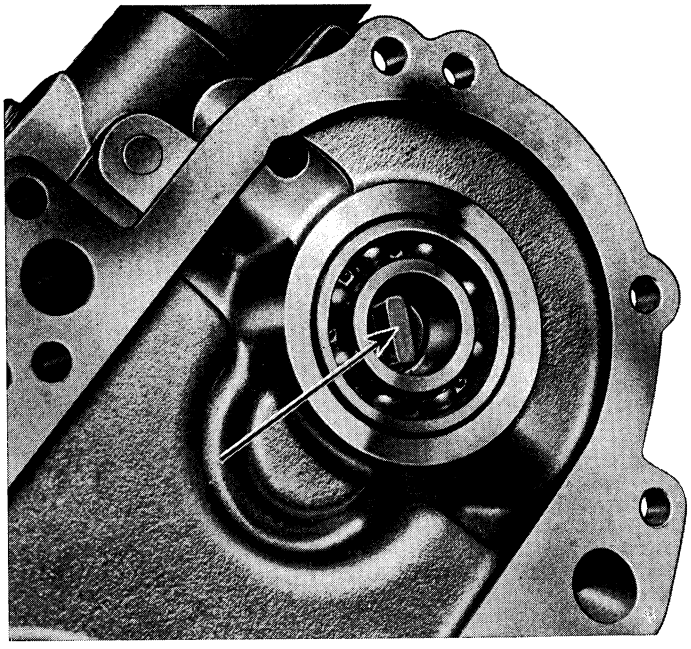


Fig. 77. - Detail of the 118 B.000 engine oil pump housing with bearing. Arrow points to the shaft drive tang.

Fig. 79. - 118 B.000 engine ignition distributor-oil pump drive gear set and shaft, with thrust washer.

Cooling

Engine is cooled through a forced water circulation promoted by a centrifugal pump.

The cooling system includes the following parts:

— a water pump, mounted on the crankcase;

— a vertical-tube radiator for water cooling, in front of engine;

— a thermostat, located in the cylinder head-to-radiator funnel.

Thermostat setting at atmospheric pressure:

— opening begins . . . . . 181° ± 4° F (83° ± 2° C)

— minimum valve trip (at 205° F - 96° C, max) . . . . . .295″ (7.5 mm)

— maximum valve trip . . . . . .433″ (11 mm)

— an automatic in-and-out fan operating through a solenoid controlled by a thermal switch which is located on down side of radiator to contact of coolant;

— a temperature gauge sending unit, wired with the temperature gauge on dashboard.

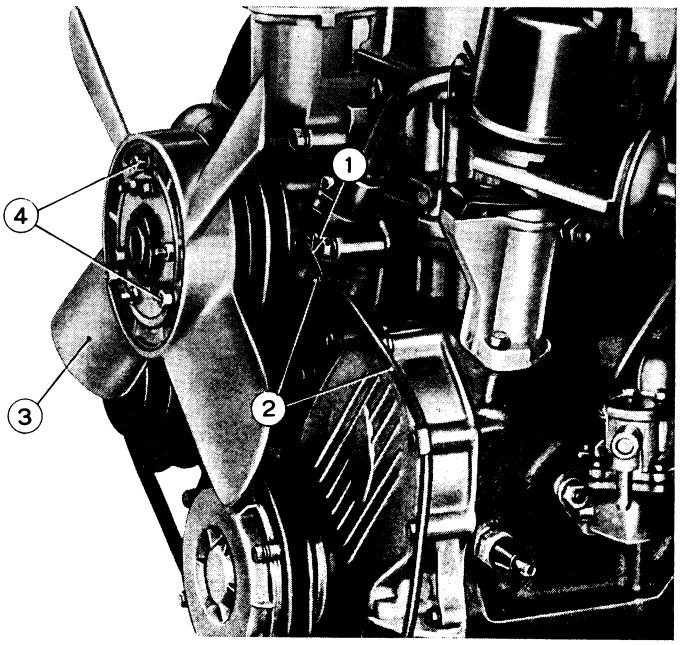


Fig. 80. - Scrap view of engine 115 C.005.
1. Brush holder spring - 2. Brush and lead to temperature gauge sending unit - 3. Fan - 4. Fan-to-hub nuts.

WATER PUMP

The water pump bearing is integral with the impeller shaft and is metal boxed at ends.

The bearing pocket is packed with Jota 3 grease in production and therefore no further lubrication is required during car service. A retaining screw secures the bearing to the pump housing.

If the bearing needs replacement for any reason, the bearing-shaft assembly must be replaced. Recall that the impeller, impeller bushing and fan driven pulley hub are forced on to the shaft using a press (in engine 115 C.005). For removal of the pulley and solenoid assembly, see covering paragraph on page 61.

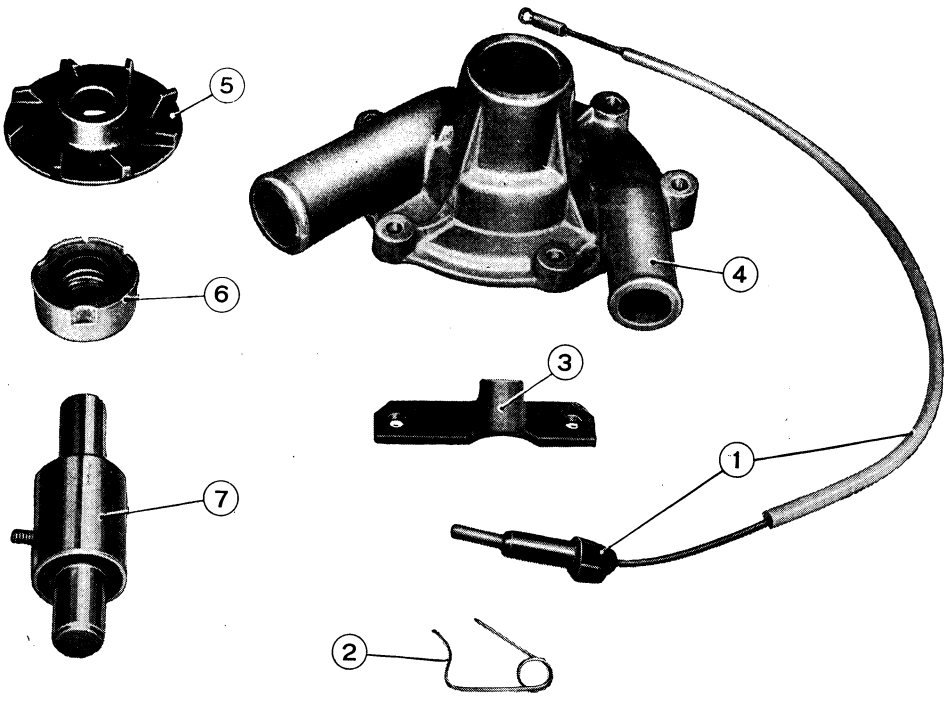


Fig. 81. - Components of water pump and fan wiring - engine 118 B.000.

1. Brush and wire, slip ring to switch - 2. Brush holder spring fastener - 3. Brush holder - 4. Water pump housing - 5. Impeller - 6. Bearing seal - 7. Shaft with bearing and stop screw.

FAN

The automatic, solenoid-controlled in-and-out fan consists basically of two units, namely:

1) **Pulley unit,** including the pulley (1, fig. 84) complete with hub (2) for pulley attachment to the water pump shaft, and with recesses to locate the solenoid winding (3) and the slip ring (6) in the water pump.

   The solenoid housing (3) contains a ring-shaped hollow seat (4) for the winding (5). The brass slip ring (6) is insulated from the pulley.

   An armoured wire (7) passing through a hole drilled in the pulley and the solenoid housing, provides the circuit between slip ring and winding.

   With engine running the pulley unit is driven into rotation by the « V » belt operated off the crankshaft.

2) **Hub-fan unit** including the hub (8, figs. 84 and 86) on which the fan (16) and the solenoid armature (9) are fixed. This unit can rotate freely in respect of the pulley unit thanks to a ball bearing (10) being placed between either unit.

   During engine operation, even though the solenoid is not attracted, the pulley unit is driven by the belt, whereas in this condition the hub-fan unit keeps free, being just apt to undergo a negligible rotational force as a result of bearing friction and air action on fan blades.

   The energizing of the solenoid draws the armature (9) toward the solenoid housing (3) and there is enough friction between these parts to obtain a dragging force stronger than the fan reaction, so that the hub-fan unit will rotate rigidly with the pulley unit.

   The armature (9) is linked resiliently with the hub by means of three lamina springs (11) being arranged as shown in fig. 84, which have been designed to take the armature away from the solenoid housing when current is turned off.

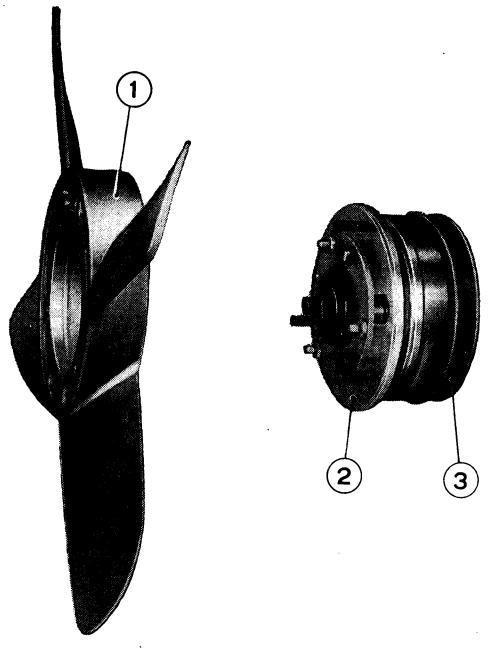


Fig. 82. - Fan and hub - engine 118 B.000.

1. Fan - 2. Electromagnetic hub - 3. Fan pulley with solenoid.

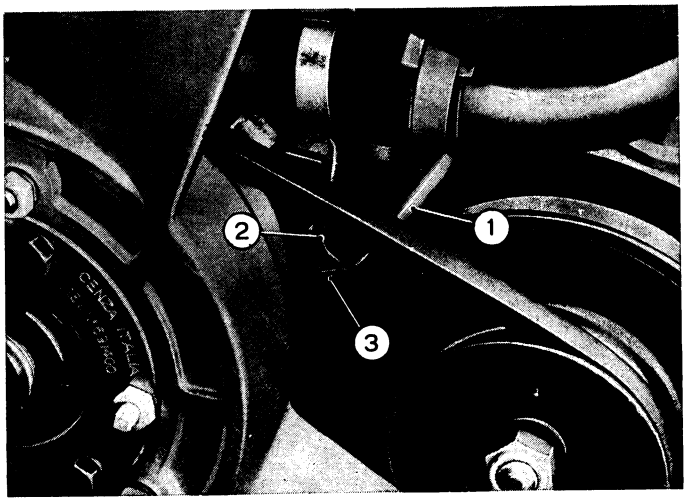


Fig. 83. - Detail of electrical connection between thermal switch, carbon contact and slip ring (engine 118 B.000).

1. Armoured wire - 2. Spring fastener - 3. Carbon contact on slip ring.

For regular solenoid operation, the air gap between the armature (9) and the solenoid housing (3) should be .0098″ to .0138″ (0.25 to 0.35 mm); for any air gap adjustment, use three screws (12) with nuts (13).

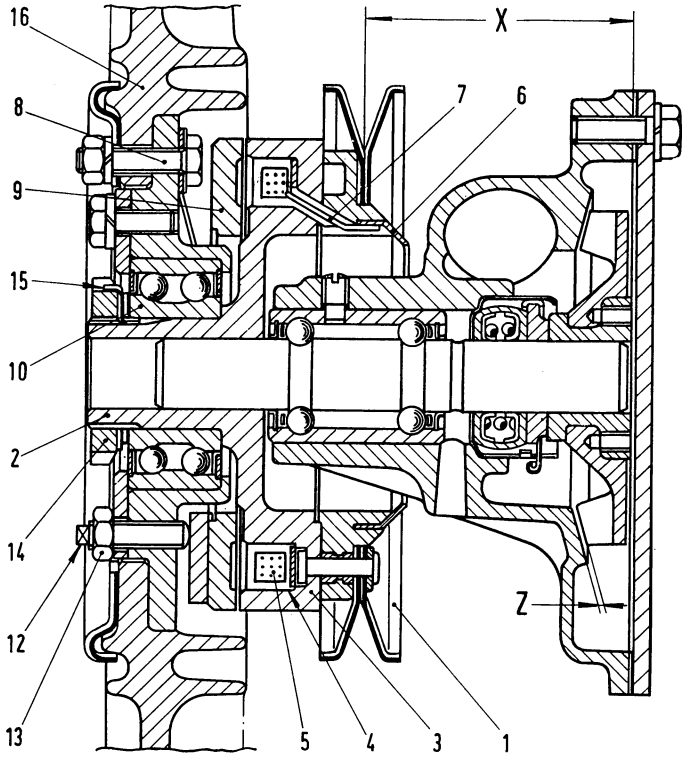
Linear attachment of pulley unit to hub-fan unit is assured by nut (14) with lock washer (15).

Current feed from main circuit to slip ring (6) is given by a sliding carbon brush (17); engagement and disengagement of fan are controlled by a thermal switch on down side of water radiator to contact of coolant (fig. 85).

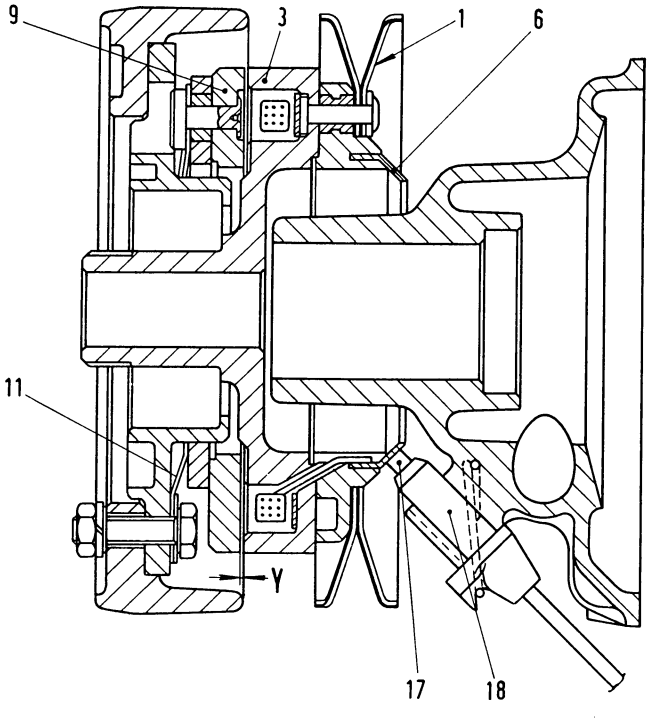
As water temperature reaches 181°±4° F (83°±2° C), the sending unit closes the electric circuit and the solenoid is energized, throwing in the radiator fan.

115C.005 ENGINE WATER PUMP-FAN ASSEMBLY

SECTION A-A



SECTION B-B



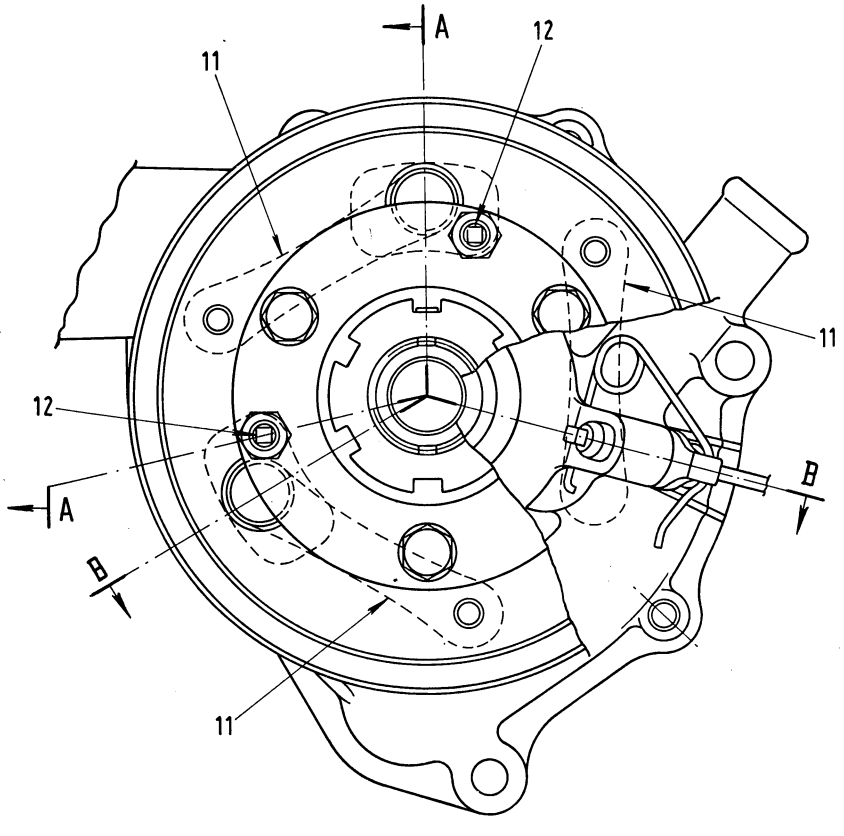


Fig. 84. - Sectional views of water pump and automatic in-and-out fan (engine 115 C.005).

1. Pulley - 2. Pulley hub - 3. Solenoid housing - 4. Solenoid seat - 5. Solenoid winding - 6. Slip ring - 7. Slip ring-to-solenoid wire - 8. Fan hub - 9. Solenoid armature - 10. Fan bearing - 11. Solenoid armature return lamina springs - 12. Solenoid air gap adjusting screws - 13. Screw nut - 14. Bearing retainer nut - 15. Nut lock washer - 16. Fan - 17. Brush - 18. Brush holder.

X = $2\,^3/_8''$ (60.5 mm)

Y = .0098″ to .0138″ (0.25 to 0.35 mm)

Z = .0197″ to .0394″ (0.5 to 1 mm)

When water temperature drops below 154° ± 4° F (68° ± 2° C), the thermal switch cuts out the electric circuit and the radiator fan is disengaged. In out position the fan will go on spinning at reduced speed as a result of ball bearing friction and the air stream activated by the riding vehicle.

Inspection and Adjustment.

After an initial stretch of 900 to 1,200 miles (1,500 to 2,000 km), check the solenoid housing-to-armature air gap for **.0098″ to .0138″ (0.25 to 0.35 mm);** if not so, adjust air gap as follows:

— loosen the lock nuts (1, fig. 85) of adjusting screws (2);

— turn the screws (2) in or out, each time measuring the air gap by means of a feeler gauge at the affected screw;

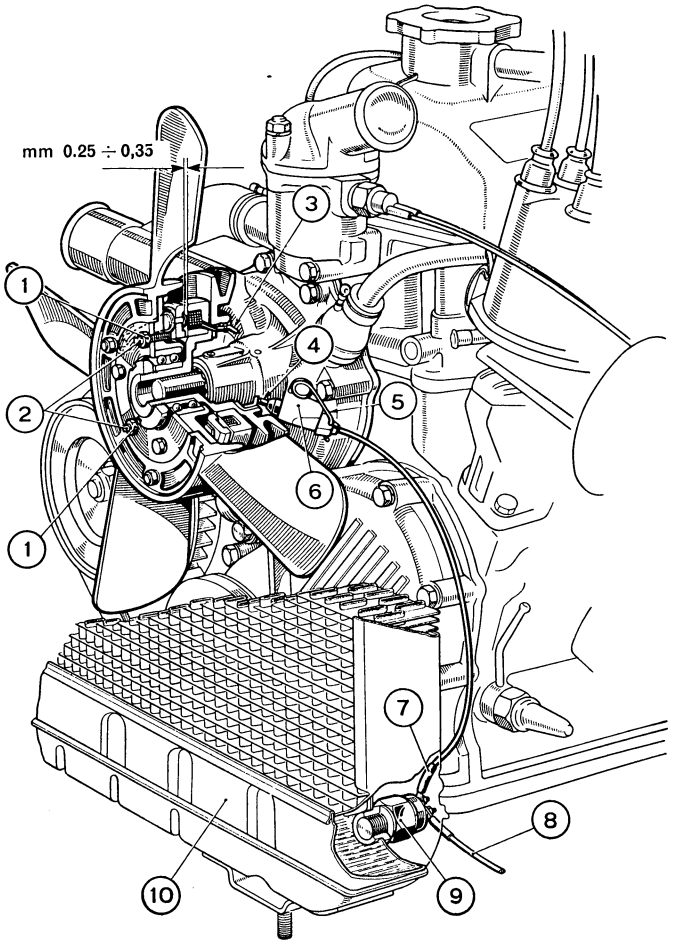


Fig. 85. - Automatic in-and-out fan (engine 115 C.005).

1. Solenoid air gap adjusting screw nuts - 2. Air gap adjusting screws - 3. Slip ring - 4. Brush - 5. Brush holder spring - 6. Brush holder seat - 7. Sending unit-to-brush lead - 8. Feeding line to fan thermal switch - 9. Fan thermal switch - 10. Radiator.

mm 0,25 ÷ 0,35 = .0098″ to .0138″.

NOTE - Pulley, fan hub and solenoid housing shown here are the early type. For the late design of these parts see figures 84 and 86.

— when air gap is correct, lock the screw nuts (1).

Every 12,000 miles (20,000 km):

— thoroughly wipe the slip ring (3, fig. 85) with a dry cloth;

— unfasten the retaining spring (5, fig. 85), slide off the brush holder from its seat (6) and inspect the wear condition and contact ability of the brush (4) and brush pressure spring, making sure that the brush can slide freely in its seat; replace worn parts, if any;

— on reassembly, see that the spring (5) grasps the brush holder firmly.

Trouble Diagnosis and Corrections.

1) **Faulty Thermal Switch.**

If the temperature gauge on dashboard registers water temperature in excess of 185° F (85° C) and the radiator fan fails to throw in, the thermal switch may be at fault. If so, **temporarily** tie wires 7 and 8 (fig. 85) on the same terminal so that the fan will be operating all the time. Replace the thermal switch, as soon as possible.

2) **Open Solenoid Winding** (exceptional occurrence).

If the fan fails to thrown in even though the wires (7-8, fig. 85) have been tied together, which must be traced to an open solenoid winding (5, fig. 84), it will be also possible to have the fan operate all the same, **as a temporary measure**, by the **extended drag** method, as follows:

— loosen the three nuts (1, fig. 85) which secure the air gap adjusting screws (2);

— turn the three adjusting screws (2, fig. 85) **part way in**, so that the armature adheres to the solenoid housing;

— lock the screws with the three nuts (1, fig. 85); in this way the fan will be put into uninterrupted operation. As a definite remedy of trouble, arrange to replace the pulley-solenoid-slip ring assembly.

3) **Open Slip Ring-Solenoid Wire.**

If the fan fails to throw in even though the wires (7-8, fig. 85) have been tied together, this may be due to the commutator-to-solenoid wire (7, fig. 84) being open; if so, to have the fan operate, proceed as outlined at 2), **for temporary correction.**

To remove the trouble, replace the pulley-solenoid-slip ring assembly.

Replacing Pulley and Solenoid Assembly.

To replace the pulley (1, figs. 84 and 86) with solenoid (3) as an assembly, proceed as follows:

— Drain the water radiator and cylinder block.

— Loosen and lift out the fan belt.

— Loosen clamp collars, disconnect water outlet and inlet pipe hoses at water pump.

— Unfasten the brush holder pressure spring and slide off the brush holder (18) from its seat.

— Remove retaining screws and withdraw the water pump and fan assembly.

With the water pump on work bench, proceed as follows:

— Pry up the lock washer (15) and remove the bearing nut (14) using wrench **A. 50099**.

— Slide off the fan (16) assembly, inclusive of hub (8), solenoid armature (9) and bearing (10).

— Use a puller and drive the pulley-solenoid assembly (1, 2 and 3) from the water pump bearing shaft.

To assemble, proceed as follows:

— Remove the water pump cover to gain access to the opposite end of the bearing shaft, which will work as a resting face on subsequent pulley pressing operation.

— Using a press, insert the pulley and solenoid assembly on to the water pump bearing shaft, caring for the perfect alignment between these parts and recalling that there must be a constant pinch fit of **.00047″** to **.00236″ (0.012** to **0.06 mm).** The pressing job should be made so that **the centerline of the pulley is 2 3/8″ (60.5 mm)** (fig. 84) (engine 115 C.005) or **1 7/8″ (47.5 mm)** (fig. 86) (engine 118 B.000) **apart from the water pump cover mounting face.**

— Temporarily fit the brush holder (18, fig. 84) in seat and, whilst turning the pulley, check the brush (17) for a perfect touch all along the outside of slip ring

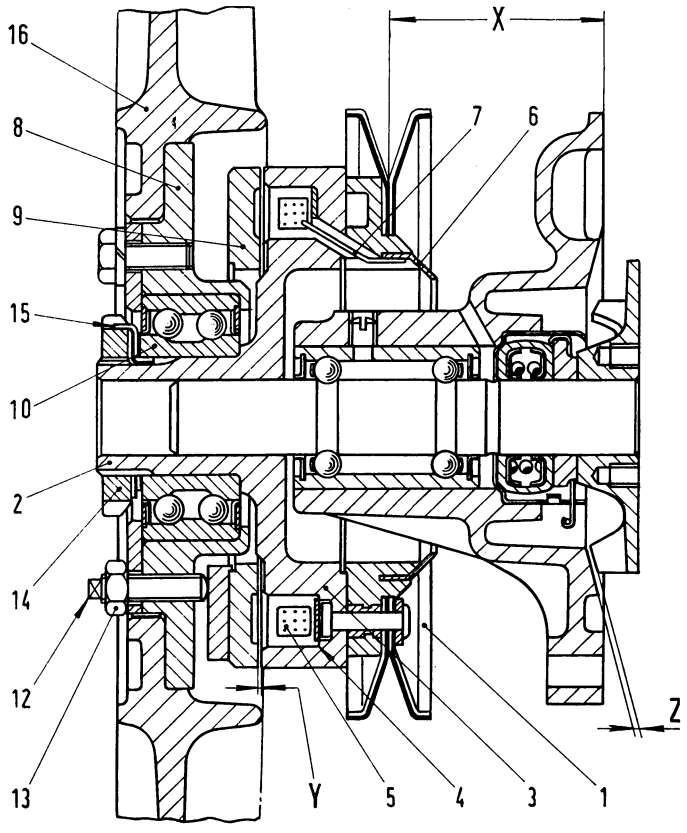


Fig. 86. - Sectional view of water pump and automatic in-and-out fan assembly (engine 118 C.000).

1. Pulley - 2. Pulley hub - 3. Solenoid housing - 4. Solenoid seat - 5. Solenoid winding - 6. Slip ring - 7. Lead, slip ring to winding - 8. Fan hub - 9. Armature - 10. Fan bearing - 12. Air gap adjustment screws - 13. Locknut - 14. Slotted ring, fan mounting - 15. Lock plate for ring - 16. Fan.

X = 1 7/8″ (47.5 mm)

Y = .0098″ to .0138″ (0.25 to 0.35 mm)

Z = .0197″ to .0394″ (0.5 to 1 mm)

(6). Any insulating material dripping between brush and commutator should be thoroughly removed.

— Install, on the pulley hub (2, fig. 86), the fan (16) assembly, inclusive of hub (8), solenoid armature (9) and bearing (10), slide in the lock washer (15) and then lock the bearing with the nut (14) using wrench **A. 50099**; bend down the lock washer.

— Adjust the air gap at **.0098″** to **.0138″ (0.25** to **0.35 mm)** as outlined on page 60.

Next install the water pump and fan assembly on cylinder block, fit the water pump drive belt and adjust belt tension. Thread the brush holder (18, fig. 84) into seat and hook up the brush holder spring fastener.