

INTRODUCTION

Purpose of this manual is to give the necessary instructions for overhauling and carrying out repairs in a rational way.

All data herein contained are meant to give a general knowledge on the main checking operations to be made when overhauling the different groups.

To this end, the manual contains many illustrations, drawings, diagrams and tables to assist in the stripping, checking and assembling operations.

This manual will also be a guidance to anybody who wishes to familiarize with the manufacturing characteristics of the various component parts of the models examined. The knowledge of these will be an essential factor for performing a good job.

NOTE - The terms «right» and «left» used in this text are to be considered as seen by the rider astride the machine; all measurements are in millimeters.

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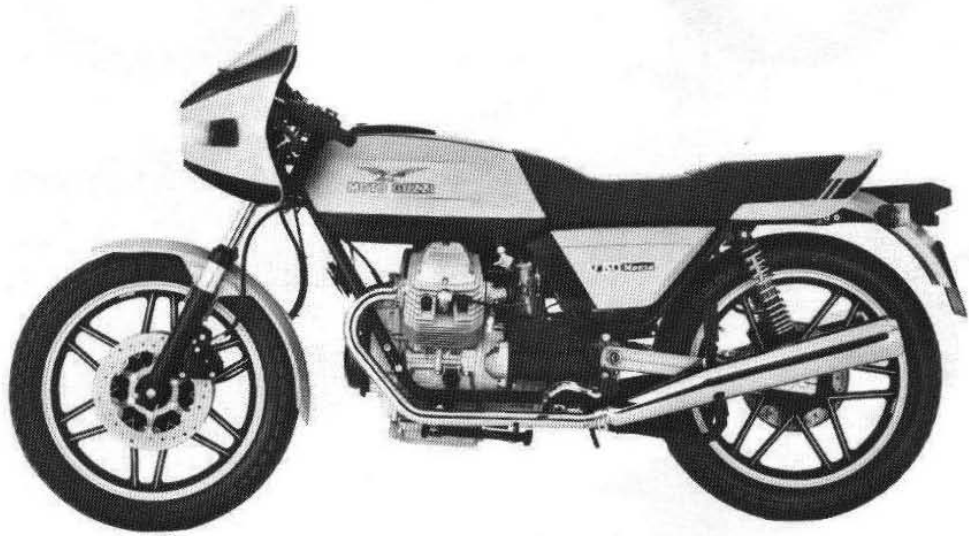
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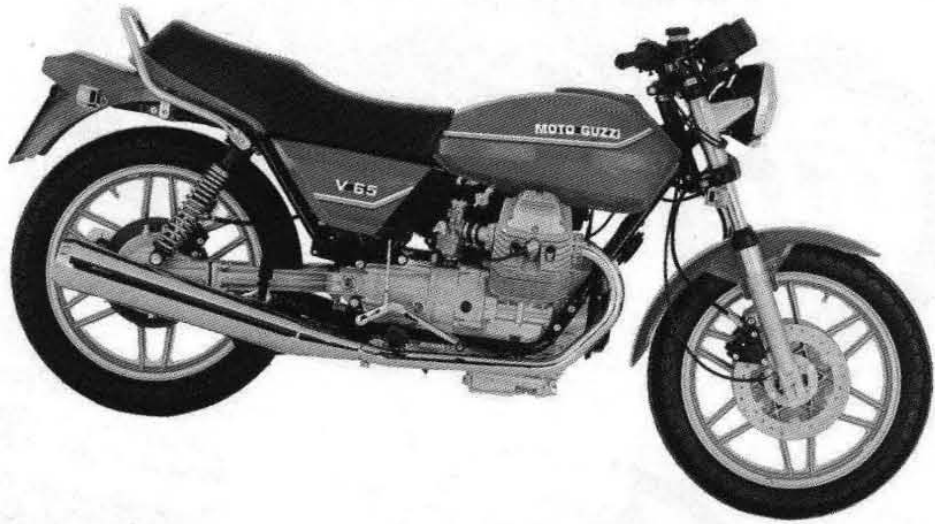
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1 MAIN FEATURES

1.1 V35 II - V50 III

	V 35 II	V 50 III
ENGINE	cycle 4-stroke	cycle 4-stroke
– number of cylinder	2	2
– cylinder disposition	V type, 90°	V type, 90°
– bore	66 mm	74 mm
– stroke	50.6 mm	57 mm
– displacement	cc 346.22	cc 490.29
– compression ratio	10.5 to 1	10.4 to 1
– max output	35 HP at 8100 rpm	47 HP at 7500 rpm
– nominal power	6 HP	8 HP
VALVE TIMING	OHV, push rod operated	OHV, push rod operated
– inlet	opens 18° before TDC closes 50° after BDC	opens 18° before TDC closes 50° after BDC
– exhaust	opens 53° before BDC closes 15° after TDC	opens 53° before BDC closes 15° after TDC
– rocker clearance for valve timing	1 mm	1 mm
– normal rocker clearance:		
– inlet	0.15 mm *	0.15 mm *
– exhaust	0.20 mm *	0.20 mm *
LUBRICATION	pressure, lobe type pump oil tank in crankcase	pressure, lobe type pump oil tank in crankcase
– warning light for insufficient oil pressure	on panel board	on panel board
– oil filters	wire gauze and cartridge type	wire gauze and cartridge type
IGNITION	coil ignition with double contact breaker and automatic advance with centrifugal masses	coil ignition with double contact breaker and automatic advance with centrifugal masses
– ignition advance (fixed)	10°	10°
– automatic advance	25° ± 2°	25° ± 2°
– full advance (fixed + autom.)	35° ± 2°	35° ± 2°
– contact breaker gap	0.35-0.45 mm	0.35-0.45 mm

* Updating previous publications.

	V 35 II	V 50 III
– spark plugs	two with long thread dia. 14 x 1,25 Bosch W 5 D Bosch W 5 DC Lodge 3 HLN Y Marelli F8 LCR plugs point gap 0.6 mm	two with long thread dia. 14 x 1,25 Marelli F8 LCR Bosch W 5 DC Lodge 3 HLN Y plugs point gap 0.6 mm
– ignition coils	two	two
CARBURATION		
– carburettors	2 Dell'Orto carburettors Dell'Orto type VHB 26 FD (right) VHB 26 FS (left)	2 Dell'Orto carburettors Dell'Orto type PHBH 28 BD (right) PHBH 28 BS (left)
COOLING		
	by air	by air
EXHAUST SYSTEM		
	dual exhaust pipes and silencers, interconnected	dual exhaust pipes and silencers, interconnected
GENERATOR-ALTERNATOR		
	fitted on front end of crankshaft (14V-20A)	fitted on front end of crankshaft (14V-20A)
STARTING		
	electric starter	electric starter
TRANSMISSIONS		
– clutch	dry-type single plate with diaphragm spring controlled by lever on left side of handlebar	dry-type single plate with diaphragm spring controlled by lever on left side of handlebar
primary drive	helical gears. Ratios: 1 to 1.846 (Z = 13/24)	helical gears. Ratios: 1 to 1.642 (Z = 14/23)
– speed change	5 speeds, costant mesh gears frontal engagement, foot controlled on left side of machine	5 speeds, costand mesh gears, frontal engagement, foot controlled on left side of machine
side of machine		
– internal gear ratios:		
low gear	1 to 2.727 (Z = 11/30)	1 to 2.727 (Z = 11/30)
2nd gear	1 to 1.733 (Z = 15/26)	1 to 1.733 (Z = 15/26)
3rd gear	1 to 1.277 (Z = 18/23)	1 to 1.277 (Z = 18/23)
4th gear	1 to 1.045 (Z = 22/23)	1 to 1.045 (Z = 22/23)
high gear	1 to 0.909 (Z = 22/20)	1 to 0.909 (Z = 22/20)
– secondary drive	cardan shaft with bevel gears	cardan shaft with bevel gears
– ratios	1 to 3.875 (Z = 8/31)	1 to 3.875 (Z = 8/31)

	V 35 II	V 50 III
overall gear ratios:		
low gear	1 to 19.506	1 to 17.362
2nd gear	1 to 12.396	1 to 11.034
3rd gear	1 to 9.134	1 to 8.134
4th gear	1 to 7.475	1 to 6.655
high gear	1 to 6.502	1 to 5.787
FRAME	tubular structure, craddle type	tubular structure, craddle type
SUSPENSIONS		
– front	telescopic front fork with hydraulic dampers	telescopic front fork with oilpneumatic dampers
– rear	rear swinging arm with externally adjustable springs concentric to hydraulic dampers	rear swinging arm with externally adjustable springs concentric to oilpneumatic dampers
WHEELS		
– front	light alloy casting WM 2/1.85 x 18"	light alloy casting WM 2/1.85 x 18"
– rear	WM 3/2.15 x 18"	WM 3/2.15 x 18"
TYRES		
– front	3.00 - 18" R	3.00 S 18" or 90/90 S 18"
– rear	3.25 - 18" R	3.50 S 18" or 100/90 S 18"
BRAKES		
– front	disc type with 2 cylinders with fixed caliper operated by hand lever on right side handlebar disc dia. 260 mm cylinder dia. 32 mm master cylinder dia. 12.7 mm	disc type with 2 cylinders with fixed caliper operated by hand lever on right side handlebar disc dia. 260 mm cylinder dia. 32 mm master cylinder dia. 12.7 mm
– rear	disc type with double cylinder fixed caliper, pedal operated from the right hand side of the machine disc dia 235 mm cylinder dia. 32 mm master cylinder dia 15.875 mm The rear brake connection is by hydraulic transmission in common with a second front brake of same sizes as the hand lever operated right front brake	disc type with double cylinder fixed caliper, pedal operated from the right hand side of the machine disc dia. 235 mm cylinder dia. 32 mm master cylinder dia. 15.875 mm the rear brake connection is by hydraulic transmission in common with a second front brake of same sizes as the hand lever operated right front brake
OVERALL DIMENSIONS AND WEIGHTS		
– wheel base (fully loaded)	1.420 m	1.420 m
– length	2.090 m	2.120 m
– width	0.750 m	0.750 m
– height	1.060 m	1.100 m
– weight (dry)	154 kg	158 kg

	V 35 II	V 50 III
PERFORMANCES		
– max speed solo rider	over 150 km/h	abt 170 km/h
– fuel consumption (100 km)	3.5 l	4 l
FUEL AND OIL CAPACITIES		
– fuel tank	16 l petrol (97 NO-RM min.) (2 l abt reserve)	16 l petrol (97 NO-RM min.) (2 l abt reserve)
– sump	2 l oil Agip SINT 2000 SAE 10 W/50	2 l oil Agip SINT 2000 SAE 10 W/50
– gear box	0.900 l oil Agip F. 1 Rotra MP SAE 80 W/90	0.900 l oil Agip F. 1 Rotra MP SAE 80 W/90
– rear drive box	0.170 l of which: 0.160 oil Agip Rotra MP SAE 85/W/140 and 0.010 l oil Agip Rocol ASO/R or Molyctote type «A»	0.170 l of which: 0.160 oil Agip Rotra MP SAE 85/W/140 and 0.010 l oil Agip Rocol ASO/R or Molyctote type «A»
– front fork (each leg)	0.070 l liquid Agip F. 1 ATF Dexron	0.070 l liquid Agip F. 1 ATF Dexron
– front and rear braking circuits	fluid Agip F. 1 Brake fluid SAE J 1703 B	fluid Agip F. 1 Brake fluid SAE J 1703 B

1.2 V35 IMOLA - V50 MONZA

	V 35 IMOLA	V 50 MONZA
ENGINE	cycle 4-stroke	cycle 4-stroke
– number of cylinder	2	2
– cylinder disposition	V type, 90°	V type, 90°
– bore	66 mm	74 mm
– stroke	50.6 mm	57 mm
– displacement	cc 346.22	cc 490.29
– compression ratio	10.5 to 1	10.4 to 1
– max output	36 HP at 8200 rpm	48 HP at 7600 rpm
– nominal power	6 HP	8 HP
VALVE TIMING	OHV, push rod operated	OHV, push rod operated
– inlet	opens 18° before TDC closes 50° after BDC	opens 18° before TDC closes 50° after BDC
– exhaust	opens 53° before BDC closes 15° after TDC	opens 53° before BDC closes 15° after TDC
– rocker clearance for valve timing	1 mm	1 mm
– normal rocker clearance:		
– inlet	0.15 mm*	0.15 mm*
– exhaust	0.20 mm*	0.20 mm*
LUBRICATION	pressure, lobe type pump oil tank in crankcase	pressure, lobe type pump oil tank in crankcase
– warning light for insufficient oil pressure	on panel board	on panel board
– oil filters	wire gauze and cartridge type	wire gauze and cartridge type
IGNITION	coil ignition with double contact breaker and automatic advance with centrifugal masses	coil ignition with double contact breaker and automatic advance with centrifugal masses
– ignition advance (fixed)	10°	10°
– automatic advance	25° ± 2°	25° ± 2°
– full advance (fixed + autom.)	35° ± 2°	35° ± 2°
– contact breaker gap	0.35-0.45 mm	0.35-0.45 mm

* Updating previous publications.

	V 35 IMOLA	V 50 MONZA
– spark plugs	two with long thread dia. 14 x 1.25 Bosch W 5 D Bosch W 5 DC Lodge 3 HLN Y Marelli F8 LCR plugs point gap 0.6 mm	two with long thread dia. 14 x 1.25 Marelli F8 LCR Bosch W 5 DC Lodge 3 HLN Y plugs point gap 0.6 mm
– ignition coils	two	two
CARBURATION		
– carburettors	2 Dell'Orto carburettors Dell'Orto type VHB 26 FD (right) VHB 26 FS (left)	2 Dell'Orto carburettors Dell'Orto type PHBH 28 BD (right) PHBH 28 BS (left)
COOLING	by air	by air
EXHAUST SYSTEM	dual exhaust pipes and silencers, interconnected	dual exhaust pipes and silencers, interconnected
GENERATOR-ALTERNATOR	fitted on front end of crankshaft (14V-20A)	fitted on front end of crankshaft (14V-20A)
STARTING	electric starter	electric starter
TRANSMISSIONS		
– clutch	dry-type single plate with diaphragm spring controlled by lever on left side of handlebar	dry-type single plate with diaphragm spring controlled by lever on left side of handlebar
– primary drive	helical gears. Ratios: 1 to 1.846 (Z = 13/24)	helical gears. Ratios: 1 to 1.666 (Z = 15/22)
– speed change	5 speeds, constant mesh gears frontal engagement, foot controlled on left side of machine	5 speeds, constant mesh gears, frontal engagement, foot controlled on left side of machine
– internal gear ratios:		
low gear	1 to 2.727 (Z = 11/30)	1 to 2.727 (Z = 11/30)
2nd gear	1 to 1.733 (Z = 15/26)	1 to 1.733 (Z = 15/26)
3rd gear	1 to 1.277 (Z = 18/23)	1 to 1.277 (Z = 18/23)
4th gear	1 to 1.045 (Z = 22/23)	1 to 1.045 (Z = 22/23)
high gear	1 to 0.909 (Z = 22/20)	1 to 0.909 (Z = 22/20)
– secondary drive	cardan shaft with bevel gears	cardan shaft with bevel gears
– ratios	1 to 3.875 (Z = 8/31)	1 to 3.875 (Z = 8/31)

	V 35 IMOLA	V 50 MONZA
overall gear ratios:		
low gear	1 to 19.506	1 to 15.499
2nd gear	1 to 12.396	1 to 9.850
3rd gear	1 to 9.134	1 to 7.261
4th gear	1 to 7.475	1 to 5.941
high gear	1 to 6.502	1 to 5.166
FRAME	tubular structure, cradle type	tubular structure, cradle type
SUSPENSIONS		
– front	telescopic front fork with hydraulic dampers	telescopic front fork with oilpneumatic dampers
– rear	rear swinging arm with externally adjustable springs concentric to hydraulic dampers	rear swinging arm with externally adjustable springs concentric to oilpneumatic dampers
WHEELS	light alloy casting	light alloy casting
– front	WM 2/1.85 x 18"	WM 2/1.85 x 18"
– rear	WM 3/2.15 x 18"	WM 3/2.15 x 18"
TYRES		
– front	3.25 S 18" or 90/90 S 18"	3.25 S 18" or 90/90 S 18"
– rear	3.50 S 18" or 100/90 S 18"	3.50 S 18" or 100/90 S 18"
BRAKES		
– front	disc type with 2 cylinders with fixed caliper operated by hand lever on right side handlebar disc dia. 260 mm cylinder dia. 32 mm master cylinder dia. 12.7 mm	disc type with 2 cylinders with fixed caliper operated by hand lever on right side handlebar disc dia. 260 mm cylinder dia. 32 mm master cylinder dia. 12.7 mm
– rear	disc type with double cylinder fixed caliper, pedal operated from the right hand side of the machine disc dia 235 mm cylinder dia. 32 mm master cylinder dia. 15.875 mm The rear brake connection is by hydraulic transmission in common with a second front brake of same sizes as the hand lever operated right front brake	disc type with double cylinder fixed caliper, pedal operated from the right hand side of the machine disc dia. 235 mm cylinder dia. 32 mm master cylinder dia. 15.875 mm The rear brake connection is by hydraulic transmission in common with a second front brake of same sizes as the hand lever operated right front brake

	V 35 IMOLA	V 50 MONZA
OVERALL DIMENSIONS AND WEIGHTS		
– wheel base (fully loaded)	1.420 m	1.420 m
– length	2.090 m	2.090 m
– width	0.700 m	0.700 m
– height	1.150 m	1.150 m
– weight (dry)	158 kg	160 kg
PERFORMANCES		
– max speed solo rider	160 km/h	abt 175 km/h
– fuel consumption (100 km)	3.7 l	4.2 l
FUEL AND OIL CAPACITIES		
– fuel tank	16 l petrol (97 NO-RM min.) (2 l abt reserve)	16 l petrol (97 NO-RM min.) (2 l abt reserve)
– sump	2 l oil Agip SINT 2000 SAE 10 W/50	2 l oil Agip SINT 2000 SAE 10 W/50
– gear box	0.900 l oil Agip F. 1 Rotra MP SAE 80 W/90	0.900 l oil Agip F. 1 Rotra MP SAE 80 W/90
– rear drive box	0.170 l of which: 0.160 oil Agip Rotra MP SAE 85/W/140 and 0.010 l oil Agip Rocol ASO/R or Molyctote type «A»	0.170 l of which: 0.160 oil Agip Rotra MP SAE 85/W/140 and 0.010 l oil Agip Rocol ASO/R or Molyctote type «A»
– front fork (each leg)	0.070 l liquid Agip F. 1 ATF Dexron	0.070 l liquid Agip F. 1 ATF Dexron
– front and rear braking circuits	fluid Agip F. 1 Brake fluid SAE J 1703 B	fluid Agip F. 1 Brake fluid SAE J 1703 B

1.3 V35 C - V50 C

	V 35 C	V 50 C
ENGINE	cycle 4-stroke	cycle 4-stroke
– number of cylinder	2	2
– cylinder disposition	V type, 90°	V type, 90°
– bore	66 mm	74 mm
– stroke	50.6 mm	57 mm
– displacement	cc 346.22	cc 490.29
– compression ratio	10.5 to 1	10.4 to 1
– max output	35 HP at 8100 rpm	47 HP at 7500 rpm
– nominal power	6 HP	8 HP
VALVE TIMING	OHV, push rod operated	OHV, push rod operated
– inlet	opens 18° before TDC closes 50° after BDC	opens 18° before TDC closes 50° after BDC
– exhaust	opens 53° before BDC closes 15° after TDC	opens 53° before BDC closes 15° after TDC
– rocker clearance for valve timing	1 mm	1 mm
– normal rocker clearance:		
– inlet	0.15 mm*	0.15 mm*
– exhaust	0.20 mm*	0.20 mm*
LUBRICATION	pressure, lobe type pump oil tank in crankcase	pressure, lobe type pump oil tank in crankcase
– warning light for insufficient oil pressure	on panel board	on panel board
– oil filters	wire gauze and cartridge type	wire gauze and cartridge type
IGNITION	coil ignition with double contact breaker and automatic advance with centrifugal masses	coil ignition with double contact breaker and automatic advance with centrifugal masses
– ignition advance (fixed)	10°	10°
– automatic advance	25° ± 2°	25° ± 2°
– full advance (fixed + autom.)	35° ± 2°	35° ± 2°
– contact breaker gap	0.35-0.45 mm	0.35-0.45 mm

* Updating previous publications.

	V 35 C	V 50 C
– spark plugs	two with long thread dia. 14 x 1.25 Bosch W 5 D Bosch W 5 DC Lodge 3 HLN Y Marelli F8 LCR plugs point gap 0.6 mm	two with long thread dia. 14 x 1.25 Marelli F8 LCR Bosch W 5 DC Lodge 3 HLN Y plugs point gap 0.6 mm
– ignition coils	two	two
CARBURATION		
– carburettors	2 Dell'Orto carburettors Dell'Orto type VHB 26 FD (right) VHB 26 FS (left)	2 Dell'Orto carburettors Dell'Orto type PHBH 28 BD (right) PHBH 28 BS (left)
COOLING		
	by air	by air
EXHAUST SYSTEM		
	dual exhaust pipes and silencers, interconnected	dual exhaust pipes and silencers, interconnected
GENERATOR-ALTERNATOR		
	fitted on front end of crankshaft (14V-20A)	fitted on front end of crankshaft (14V-20A)
STARTING		
	electric starter	electric starter
TRANSMISSIONS		
– clutch	dry-type single plate with diaphragm spring controlled by lever on left side of handlebar	dry-type single plate with diaphragm spring controlled by lever on left side of handlebar
– primary drive	helical gears. Ratios: 1 to 1.846 (Z = 13/24)	helical gears. Ratios: 1 to 1.642 (Z = 14/23)
– speed change	5 speeds, constant mesh gears frontal engagement, foot controlled on left side of machine	5 speeds, constant mesh gears, frontal engagement, foot controlled on left side of machine
– internal gear ratios:		
low gear	1 to 2.727 (Z = 11/30)	1 to 2.727 (Z = 11/30)
2nd gear	1 to 1.733 (Z = 15/26)	1 to 1.733 (Z = 15/26)
3rd gear	1 to 1.277 (Z = 18/23)	1 to 1.277 (Z = 18/23)
4th gear	1 to 1.045 (Z = 22/23)	1 to 1.045 (Z = 22/23)
high gear	1 to 0.909 (Z = 22/20)	1 to 0.909 (Z = 22/20)
– secondary drive	cardan shaft with bevel gears	cardan shaft with bevel gears
– ratios	1 to 3.875 (Z = 8/31)	1 to 3.875 (Z = 8/31)

	V 35 C	V 50 C
– overall gear ratios:		
low gear	1 to 19.506	1 to 17.362
2nd gear	1 to 12.396	1 to 11.034
3rd gear	1 to 9.134	1 to 8.134
4th gear	1 to 7.475	1 to 6.655
high gear	1 to 6.502	1 to 5.787
FRAME	tubular structure, cradle type	tubular structure, cradle type
SUSPENSIONS		
– front	telescopic front fork with oil pneumatic dampers	telescopic front fork with oil pneumatic dampers
– rear	rear swinging arm with externally adjustable springs concentric to oil pneumatic dampers	rear swinging arm with externally adjustable springs concentric to oil pneumatic dampers
WHEELS	light alloy casting	light alloy casting
– front	WM 3/2.15 x 18"	WM 3/2.15 x 18"
– rear	WM 3/2.5 x 16"	WM 3/2.5 x 16"
TYRES		
– front	100/90 - 18"	100/90 - 18"
– rear	130/90 - 16" or 5.10 - V 16"	130/90 - 16" or 5.10 - V 16"
BRAKES		
– front	disc type with 2 cylinders with fixed caliper operated by hand lever on right side handlebar disc dia. 260 mm cylinder dia. 32 mm master cylinder dia. 12.7 mm	disc type with 2 cylinders with fixed caliper operated by hand lever on right side handlebar disc dia. 260 mm cylinder dia. 32 mm master cylinder dia. 12.7 mm
– rear	disc type with double cylinder fixed caliper, pedal operated from the right hand side of the machine disc dia 235 mm cylinder dia. 32 mm master cylinder dia. 15.875 mm The rear brake connection is by hydraulic transmission in common with a second front brake of same sizes as the hand lever operated right front brake	disc type with double cylinder fixed caliper, pedal operated from the right hand side of the machine disc dia. 235 mm cylinder dia. 32 mm master cylinder dia. 15.875 mm The rear brake connection is by hydraulic transmission in common with a second front brake of same sizes as the hand lever operated right front brake

	V 35 C	V 50 C
OVERALL DIMENSIONS AND WEIGHTS		
– wheel base (fully loaded)	1.460 m	1.460 m
– length	2.200 m	2.200 m
– width	0.960 m	0.960 m
– height	1.175 m	1.175 m
– weight (dry)	165 kg	165 kg
PERFORMANCES		
– max speed solo rider	over 150 km/h	abt 165 km/h
– fuel consumption (100 km)	4.3 l	5 l
FUEL AND OIL CAPACITIES		
– fuel tank	16 l petrol (97 NO-RM min.) (2 l abt reserve)	16 l petrol (97 NO-RM min.) (2 l abt reserve)
– sump	2 l oil Agip SINT 2000 SAE 10 W/50	2 l oil Agip SINT 2000 SAE 10 W/50
– gear box	0.900 l oil Agip F. 1 Rotra MP SAE 80 W/90	0.900 l oil Agip F. 1 Rotra MP SAE 80 W/90
– rear drive box	0.170 l of which: 0.160 oil Agip Rotra MP SAE 85/W/140 and 0.010 l oil Agip Rocol ASO/R or Molyctote type «A»	0.170 l of which: 0.160 oil Agip Rotra MP SAE 85/W/140 and 0.010 l oil Agip Rocol ASO/R or Molyctote type «A»
– front fork (each leg)	0.070 l liquid Agip F. 1 ATF Dexron	0.070 l liquid Agip F. 1 ATF Dexron
– front and rear braking circuits	fluid Agip F. 1 Brake fluid SAE J 1703 B	fluid Agip F. 1 Brake fluid SAE J 1703 B

1.4 V65 - V65 SP

	V 65	V 65 SP
ENGINE	cycle 4-stroke	cycle 4-stroke
– number of cylinder	2	2
– cylinder disposition	V type, 90°	V type, 90°
– bore	80 mm	80 mm
– stroke	64 mm	64 mm
– displacement	cc 643.4	cc 643.4
– compression ratio	10 to 1	10 to 1
– max output	52 HP at 7050 rpm	52 HP at 7050 rpm
– nominal power	10 HP	10 HP
VALVE TIMING	OHV, push rod operated	OHV, push rod operated
– inlet	opens 18° before TDC closes 50° after BDC	opens 18° before TDC closes 50° after BDC
– exhaust	opens 53° before BDC closes 15° after TDC	opens 53° before BDC closes 15° after TDC
– rocker clearance for valve timing	1 mm	1 mm
– normal rocker clearance:		
– inlet	0.15 mm*	0.15 mm*
– exhaust	0.20 mm*	0.20 mm*
LUBRICATION	pressure, lobe type pump oil tank in crankcase	pressure, lobe type pump oil tank in crankcase
– warning light for insufficient oil pressure	on panel board	on panel board
– oil filters	wire gauze and cartridge type	wire gauze and cartridge type
IGNITION	coil ignition with double contact breaker and automatic advance with centrifugal masses	coil ignition with double contact breaker and automatic advance with centrifugal masses
– ignition advance (fixed)	7°	7°
– automatic advance	26°	26°
– full advance (fixed + autom.)	33° ± 3°	33° ± 3°
– contact breaker gap	0.35-0.45 mm	0.35-0.45 mm

* Updating previous publications.

	V 65	V 65 SP
– spark plugs	two with long thread dia. 14 x 1.25 Lodge 2 HL Marelli F8 LCR plugs point gap 0.6 mm	two with long thread dia. 14 x 1.25 Lodge 2 HL Marelli F8 LCR plugs point gap 0.6 mm
– ignition coils	two	two
CARBURATION		
– carburettors	2 Dell'Orto carburettors Dell'Orto type PHBH 30 BD (right) PHBH 30 BS (left)	2 Dell'Orto carburettors Dell'Orto type PHBH 30 BD (right) PHBH 30 BS (left)
COOLING	by air	by air
EXHAUST SYSTEM	dual exhaust pipes and silencers, interconnected	dual exhaust pipes and silencers, interconnected
GENERATOR-ALTERNATOR	fitted on front end of crankshaft (14V-20A)	fitted on front end of crankshaft (14V-20A)
STARTING	electric starter	electric starter
TRANSMISSIONS		
– clutch	dry-type single plate with diaphragm spring controlled by lever on left side of handlebar	dry-type single plate with diaphragm spring controlled by lever on left side of handlebar
– primary drive	helical gears. Ratios: 1 to 1.466 (Z = 15/22)	helical gears. Ratios: 1 to 1.466 (Z = 15/22)
– speed change	5 speeds, costant mesh gears frontal engagement, foot controlled on left side of machine	5 speeds, costand mesh gears, frontal engagement, foot controlled on left side of machine
– internal gear ratios:		
low gear	1 to 2.3636 (Z = 11/26)	1 to 2.3636 (Z = 11/26)
2nd gear	1 to 1.6428 (Z = 14/23)	1 to 1.6428 (Z = 14/23)
3rd gear	1 to 1.2777 (Z = 18/23)	1 to 1.2777 (Z = 18/23)
4th gear	1 to 1.0555 (Z = 18/19)	1 to 1.0555 (Z = 18/19)
high gear	1 to 0.9000 (Z = 20/18)	1 to 0.9000 (Z = 20/18)
– secondary drive	cardan shaft with bevel gears	cardan shaft with bevel gears
– ratios	1 to 3.875 (Z = 8/31)	1 to 3.875 (Z = 8/31)

	V 65	V 65 SP
– overall gear ratios:		
low gear	1 to 13.433	1 to 13.433
2nd gear	1 to 9.336	1 to 9.336
3rd gear	1 to 7.262	1 to 7.262
4th gear	1 to 5.999	1 to 5.999
high gear	1 to 5.115	1 to 5.115
FRAME	tubular structure, cradle type	tubular structure, cradle type
SUSPENSIONS		
– front	telescopic front fork with oil pneumatic dampers	telescopic front fork with oil pneumatic dampers
– rear	rear swinging arm with externally adjustable springs concentric to oil pneumatic dampers	rear swinging arm with externally adjustable springs concentric to oil pneumatic dampers
WHEELS	light alloy casting	light alloy casting
– front	WM 2/1.85 x 18"	WM 2/1.85 x 18"
– rear	WM 3/2.15 x 18"	WM 3/2.15 x 18"
TYRES		
– front	100/90 - H 18"	100/90 - 18"
– rear	110/90 - H 18"	110/90 - H 18"
BRAKES		
– front	disc type with 2 cylinders with fixed caliper operated by hand lever on right side handlebar disc dia. 260 mm cylinder dia. 32 mm master cylinder dia. 12.7 mm	disc type with 2 cylinders with fixed caliper operated by hand lever on right side handlebar disc dia. 260 mm cylinder dia. 32 mm master cylinder dia. 12.7 mm
– rear	disc type with double cylinder fixed caliper, pedal operated from the right hand side of the machine disc dia 235 mm cylinder dia. 32 mm master cylinder dia. 15.875 mm The rear brake connection is by hydraulic transmission in common with a second front brake of same sizes as the hand lever operated right front brake	disc type with double cylinder fixed caliper, pedal operated from the right hand side of the machine disc dia. 235 mm cylinder dia. 32 mm master cylinder dia. 15.875 mm The rear brake connection is by hydraulic transmission in common with a second front brake of same sizes as the hand lever operated right front brake

	V 65	V 65 SP
OVERALL DIMENSIONS AND WEIGHTS		
– wheel base (fully loaded)	1.440 m	1.440 m
– length	2.120 m	2.120 m
– width	0.730 m	0.730 m
– height	1.100 m	1.255 m
– weight (dry)	165 kg	170 kg
PERFORMANCES		
– max speed solo rider	abt 185 km/h	abt 185 km/h
– fuel consumption (100 km)	5.5 l	5.5 l
FUEL AND OIL CAPACITIES		
– fuel tank	16 l petrol (97 NO-RM min.) (2 l abt reserve)	16 l petrol (97 NO-RM min.) (2 l abt reserve)
– sump	2 l oil Agip SINT 2000 SAE 10 W/50	2 l oil Agip SINT 2000 SAE 10 W/50
– gear box	0.900 l oil Agip F. 1 Rotra MP SAE 80 W/90	0.900 l oil Agip F. 1 Rotra MP SAE 80 W/90
– rear drive box	0.170 l of which: 0.160 oil Agip Rotra MP SAE 85/W/140 and 0.010 l oil Agip Rocol ASO/R or Molyctote type «A»	0.170 l of which: 0.160 oil Agip Rotra MP SAE 85/W/140 and 0.010 l oil Agip Rocol ASO/R or Molyctote type «A»
– front fork (each leg)	0.070 l liquid Agip F. 1 ATF Dexron	0.070 l liquid Agip F. 1 ATF Dexron
– front and rear braking circuits	fluid Agip F. 1 Brake fluid SAE J 1703 B	fluid Agip F. 1 Brake fluid SAE J 1703 B

2 MAINTENANCE OPERATIONS

The efficiency and conservation of the various engine and frame components are largely dependant on an accurate and periodical maintenance.

The indicated periods and mileages for the various operations apply to a vehicle used normally. If the motorcycle is used on dusty or unspahalted roads or at continuous high speed on motorways more frequent controls are necessary. Each vehicle is supplied with a suitable set of tools for emergency operations.

2.1 ENGINE LUBRICATION (fig. 1)

Oil level check

Every 500 km check the oil level in the crankcase.

The oil should just skim the top mark on dipstick «A», if not, top up with oil of same brand and specification.

This check should be carried out when the engine has run a short while and with the filler cap «A» fully screwed in.

Oil change

Every 500-1500 km and then every 3000 km change the oil in the crankcase.

Do this on a warm engine and allow all the old oil drain completely from the drain plug.

«A» oil filler cap;

«B» front oil drain cap;

«C» rear oil drain cap.

Quantity required: 2 l of «Agip Sint 2000 SAE 10 W/50» oil.

2.2 REPLACING THE OIL CARTRIDGE IN THE SUMP (fig. 2)

After the first 500-1500 km (first oil change) and then every 6000 km replace the cartridge in the oil sump operating as follows:

■ undo drain caps «A» and «B» from the sump «C» and filler cap («A» of fig. 1);

■ allow all the old oil to drain from the sump;

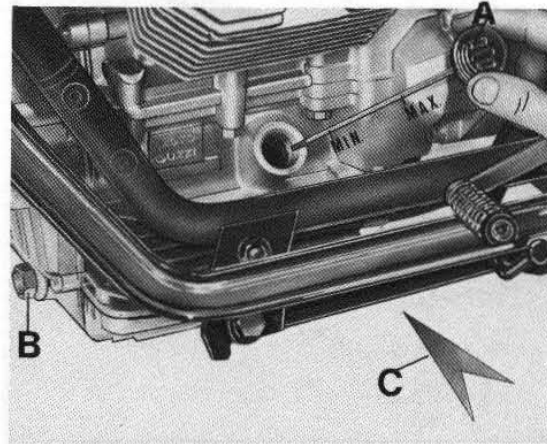
■ undo the screw and washer securing cartridge «D» and withdraw the cartridge assembly complete with cover «E», gasket «F», spring «G» and cartridge «H»;

■ replace cartridge «H» and if necessary seal on cover.

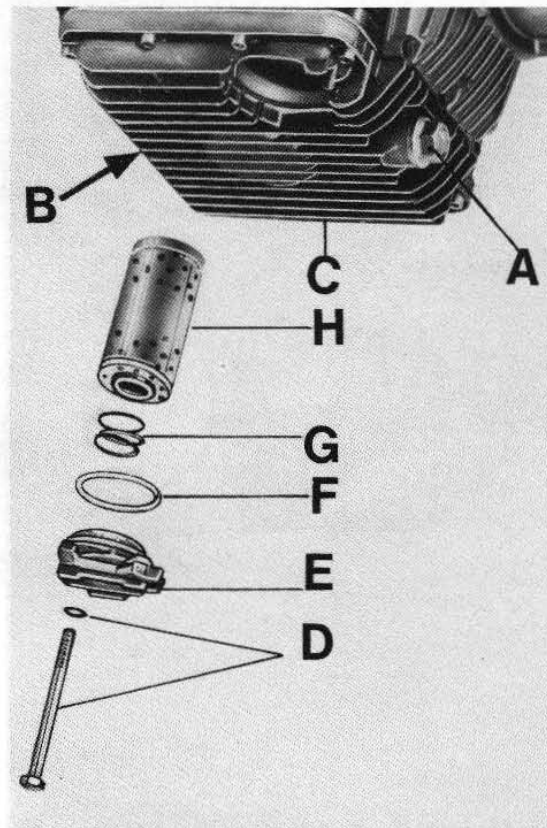
Reassemble the complete unit reversing the dismantling sequence and introduce the specified quantity of oil.

2.3 CLEANING THE WIRE GAUZE FILTER AND THE SUMP (fig. 64)

After the first 500-1500 km (i.e. after the first oil and cartridge change) and then every 15000 km

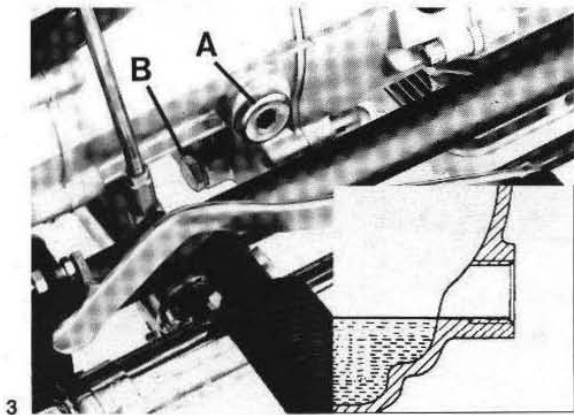


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it is a good rule to dismantle the oil sump from the crankcase, take out the wire gauze and thoroughly clean everything in a petrol bath. Then dry off the filter and oil-ways in the sump with compressed air. In re-assembly the sump do not forget to replace its gasket.



3

2.4 LUBRICATION OF THE GEAR BOX (fig. 3)

Checking the oil level

Every 3000 km make sure that the oil level skims filler cap as shown in the picture. If not top up with oil of same quality and density.

Oil change

Every 9000 km or so the gearbox oil has to be replaced.

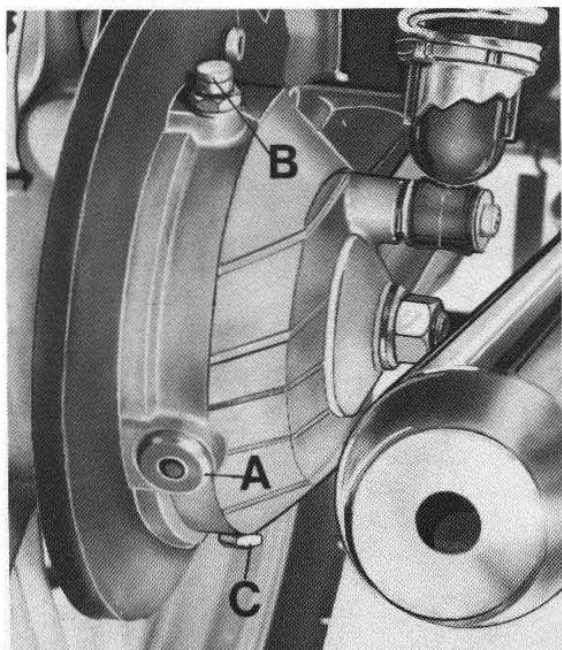
This operation should be done when the gearbox is warm as in this condition the oil is fluid and more easily drained.

Allow all the old oil to drain completely before introducing new oil.

«A» oil filler plug;

«B» drain plug.

Quantity: 0.900 l of «Agip F. 1 Rotra MP 80 W/90» oil.



4

2.5 LUBRICATION OF REAR DRIVE BOX (fig. 4)

Checking the oil level

Every 3000 km ensure that the oil skims filler and level plug «A».

If lower, top up with oil of same quality and density.

Oil change

Every 9000 km replace the oil in the box. This operation is best carried out with the box warm as in this condition the oil is fluid and more easily drained.

Before introducing any fresh oil, ensure the old one has completely drained.

«A» filler and level plug;

«B» vent plug;

«C» drain plug.

Quantity: 0.160 l of «Agip Rotra MP SAE 85 W/140» oil and 0.010 l of «Agip Rocol ASO/R» oil or «Molykote A type» oil.

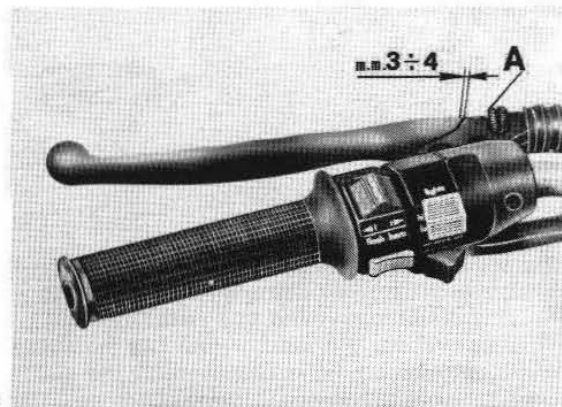
2.6 SUNDRY LUBRICATIONS

Lubricate periodically:

- steering cups and balls;
- swinging arm bearings;
- control cable terminals;
- articulations of prop stands;
- speedo drive.

2.7 ADJUSTING THE CLUTCH CONTROL LEVER (fig. 5)

Adjust the play between lever and handlebar; if the play is more or less than 3-4 mm operate on adjuster «A» to obtain the correct distance.

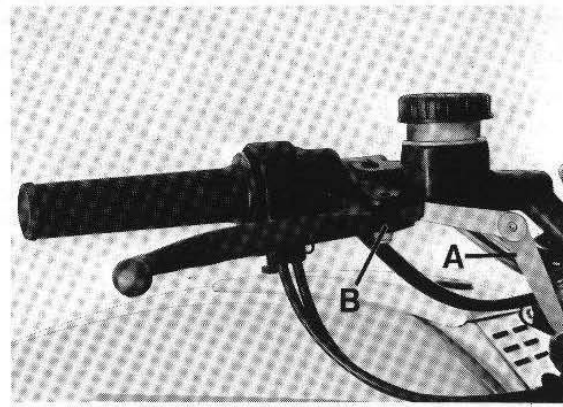


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2.8 ADJUSTING THE RIGHT FRONT BRAKE LEVER (fig. 6)

For this adjustment operate as follows:

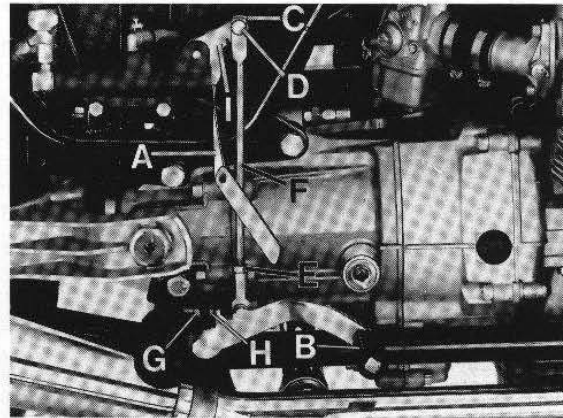
- put between master cylinder floater and lever-end feeler gauge «A» then act on screw «B»;
- correct play 0.05 to 0.15 mm.



2.9 ADJUSTING THE LEFT FRONT BRAKE AND THE REAR BRAKE PEDAL (fig. 7)

Check the play between master cylinder control linkage and control lever «I» as follows:

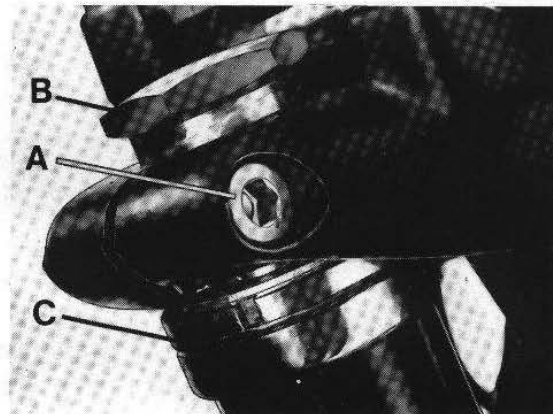
- set up a feeler gauge «A» between linkage and lever end;
- admissible play: 0.05 to 0.15 mm;
- if the play is not within these limits it is necessary to remove cotter pin «C», withdraw pin «D», loosen counternut «E» and screw in or out fork «F» until the ideal position for pedal «B» is found. Re-fit pin retaining rod «D» and cotter pin «C». Finally loosen counternut «G» and adjust lever «H» return spring.



2.10 ADJUSTING THE STEERING (fig. 8)

For safe riding the steering should be adjusted as to allow free movement to the handlebar but without excessive play:

- loosen steering head fixing bolt «A»;
- undo steering head securing nut «B»;
- screw in or out adjuster «C» by means of a center punch until the correct play is obtained. After this has been done, lock nut «B» and steering head fixing bolt «A».



2.11 SERVICE SCHEDULE

ITEMS ▼	MILEAGE COVERED ►	900 mi	1800 mi	3700 mi	5600 mi	7500 mi	9400 mi	11.300 mi	13.200 mi	15.100 mi	17.000 mi	18.900 mi
Engine oil		R	R	R	R	R	R	R	R	R	R	R
Oil filter cartridge		R		R		R		R		R		R
Wire gauze oil filter		C					C					C
Air filter				C	R		C	R		C	R	
Ignition timing		A	A	A	A	A	A	A	A	A	A	A
Spark plugs		A	A	A	R	A	A	R	A	A	R	A
Rocker clearance		A	A	A	A	A	A	A	A	A	A	A
Carburetion		A	A	A	A	A	A	A	A	A	A	A
Nuts and bolts		A					A					A
Fuel tank, filters and pipes					C			C			C	
Gearbox oil		A	A	A	R	A	A	R	A	A	R	A
Rear drive box oil		A	A	A	R	A	A	R	A	A	R	A
Wheel and steering bearings									A			
Fork legs oil									R			
Starter motor and generator									A			
Brake systems fluid		A	A	A	A	A	R	A	A	A	A	R
Brake pads		A	A	A	A	A	A	A	A	A	A	A

A = Inspections - Adjustments - Possible replacing - Servicing. / **C** = Cleanings. / **R** = Replacements.
Occasionally, check the electrolyte level in battery; every 300 miles check the engine oil level.
In any case, renew this oil at least once a year.;

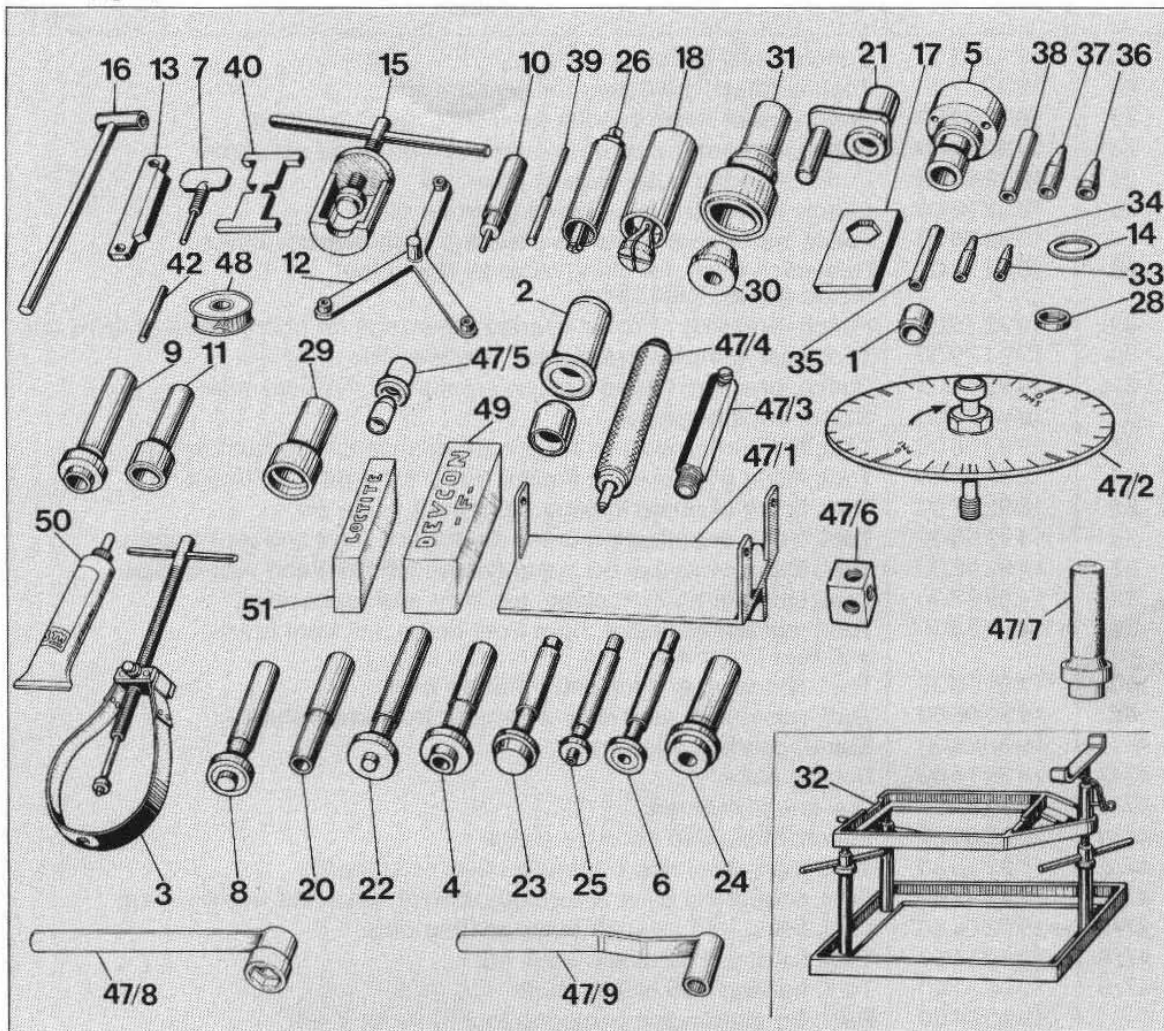
3 TORQUE LOADINGS

DESCRIPTION	TORQUE LOADINGS Kgm
Cylinder heads	
Screws, rocker box cover	1
Spark plugs	2+3
Crankcase and covers	
Nut cylinder head to crankcase (M 10)	4+4.2
Nut cylinder head to crankcase (M 8)	2.8+3
Nuts, crankcase joining	2.2+2.5
Nuts, crankcase joining	3.8+4
Screws, timing cover	1
Screw, oil sump	1
Connecting rod	
Selflocking nut big end	3+3.2 V65 2.2+2.5 V35 - V50
Bolt, flywheel	4
Bolt, crown wheel	1
Valve timing	
Screw, camshaft flange	3
Nut, camshaft gear	2.5+2.7
Starter motor	
Screws, starter motor securing	3
Fuel feed	
Screws, intake pipe	1
Lubrication	
Screws, oil sump	1
Screws, oil cartridge cover	2.5
Ignition	
Screw stator securing	0.5
Screw rotor securing	3.2+3.5
Clutch	
Nut, clutch shaft	10
Gearbox	
Nuts, mainshaft	10
Screws securing gearbox cover	1
Screws securing gearbox to flywheel housing	1
Engine to machine	
Nut, front stud	4.5
Nut, short and long screw	4.5
Screws, gearbox to clutch housing cover	2.5+3

DESCRIPTION	TORQUE LOADINGS Kgm
Rear drive	
Nut, bevel gear to housing	10
Screws, crown wheel to hollow spindle	4+4.2
Screws, cover to drive box	2.5
Screws, brake disc to hollow spindle	2.2+2.4
Frame	
Screws, cradle to frame	8
Screws, center stand	3.5
Front suspension	
Screws, front fork plate (top)	4.5
Screws, front fork bottom plate	4.5
Screws, damper securing	1.8
Screws, fork leg to wheel spindle	4.5
Rear suspension	
Screws, top and bottom securing	3
Front wheel and brake disc	
Nut, wheel spindle	9
Screws, brake disc to hub	2.2+2.4
Rear wheel	
Nut, wheel spindle	9
Screw, wheel spindle to swinging arm	3
Steering	
Bush, steering lock	5+6

4 SPECIFIC WORKSHOP TOOLS

(fig. 9)



POS.	PART. N.	DESCRIPTION
1	1992 7300	Bush, seal fitting on layshaft
2	1992 7220	Bush, seal mounting on timing cover (crankshaft)
3	1990 7800	Puller, gudgeon pin
4	1992 6100	Punch, bevel set seal
5	1992 8800	Tool, alignment of bevel set
6	1992 8700	Punch, pressing in seal on gear selector spindle
7	1990 2800	Tool, positioning of sector for pedal starting
8	1992 9400	Tool, clutch shaft bearing (in clutch housing)
9	1992 6000	Punch, pressing of seal in drive box
10	1990 5900	Punch, fitting of seal on clutch shaft
11	1992 7200	Punch, fitting of seal in timing cover
12	1990 6500	Tool, clutch assembling and centering
13	1991 1800	Tool, holdfast, flywheel
14	1992 7202	Spacer, fitting seal on layshaft
15	1990 7000	Puller, seal inside bevel set
16	1990 7100	Tool, holdfast clutch shaft, layshaft, and bevel pinion
17	1990 5400	Tool, main shaft and clutch shaft locking nuts
18	1992 7500	Puller, roller bearing outer race in drive box

POS.	PART N.	DESCRIPTION
20	1992 62 00	Punch, bevel pinion bearing
21	1992 77 00	Tool, holdfast, drive gear for gearbox stripping
22	1992 63 00	Punch, taper roller bearing for main shaft in gearbox
23	1992 64 00	Punch, taper roller bearing outer race on bevel set carrier
24	1992 65 00	Punch, bearing outer race in drive box
25	1992 66 00	Punch, swing arm bearing on gearbox cover
26	1992 76 00	Puller, removal of swing arm bearing from gearbox cover
28	1992 78 00	Reduction bush, for fitting valve stripping tool (listed as No. 1090 72 00)
29	1992 79 00	Punch, pressing of roller bearing inner race on hollow shaft in drive box
30	1291 20 00	Tool, seal fitting on crankshaft, flywheel side
31	1992 71 00	Punch, pressing flange seal on crankshaft, flywheel side
32	1891 24 50	Stand, engine support
33	1892 66 00	Tool, fitting of gasket on floater, brake pump, right front brake
34	1892 65 00	Tool, fitting of gasket on floater, pump for right front brake
35	1892 67 00	Tool, fitting of pump locking, right front brake pump
36	1492 66 00	Tool, fitting of gasket on pump floater, left front and rear brakes
37	1492 65 00	Tool, fitting of gasket on pump floater, left front and rear brakes
38	1492 67 00	Tool, fitting of pump locking, left front and rear brakes
39	1492 64 00	Tool, removal of floater, right front brake, left front brake, and rear brakes
40	1492 69 00	Tool, checking of carburettor floater level
42	1490 66 00	Tool, removal of generator-alternator from crankshaft
47/1	1990 25 00	Stand, gearbox support
47/2	1492 74 00	Degree plate
47/3	1794 82 60	Dial gauge support
47/4	1992 60 20	Punch, fitting cap on valve guide
47/5	1992 73 20	Tool, fitting seal ring on timing cover (camshaft)
47/6	1794 97 60	Tool, controlling oil pressure adjustment valve and warning plug
47/7	1992 64 60	Tool, fitting V65 layshaft outer bearing ring
47/8	1990 54 60	Tool, holding V65 clutch shaft nut
47/9	1990 71 60	Tool, holding V65 clutch shaft
—	1990 64 00	Bush for clutch disc centering tool (only for V 65)
SPECIAL PRODUCTS		
48	0001 00 00	Teflon (923.499.909) - Sealing tape
49	0001 02 00	Devcon «F» - Filling paste for blowholes
50	0001 03 00	ER 847 3M - Sealing compound for crankcase cover
51	0001 04 00	Loctite 601 (804.585.601) - Nut and bolts

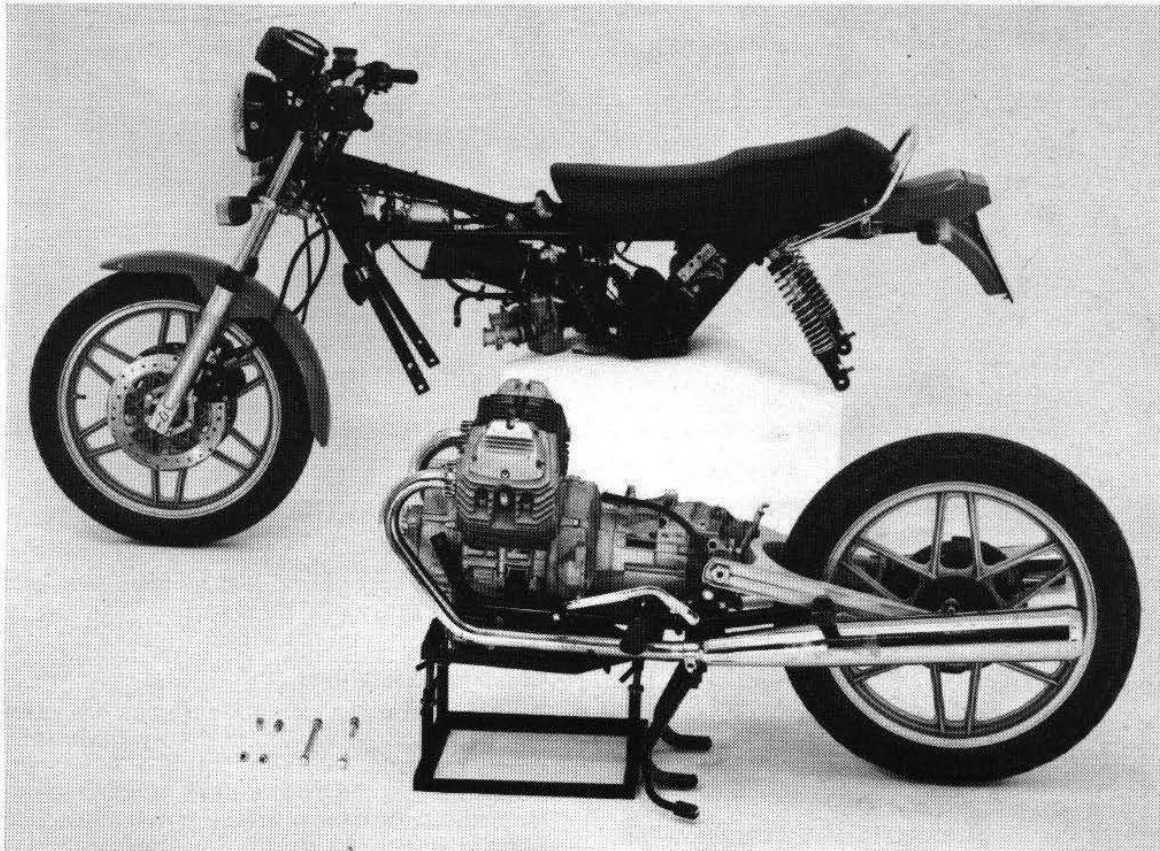
5 ENGINE UNIT

5.1 REMOVAL OF ENGINE-GEARBOX FROM THE FRAME

For the disassembly operate as follows:

- using the proper tool unlock and lift the saddle;
- remove the battery side cover and disconnect battery cables;
- remove battery from its seat;
- close fuel taps, loosen clamps and detach pipes from tank;
- unhook elastic band and remove fuel tank from supports;
- disconnect electrics from clamps, from generator and starter device;
- disconnect cables from oil pressure switch, idle warning device and cable from starter motor switch;
- remove spark plug cables and place them suitably;
- disconnect intake pipes from cylinder heads and move them just to easily lift the frame;
- loosen clamps and disconnect oil recovery pipes from breather pipes on cylinder heads;
- remove clutch control cable from lever on gearbox cover;

- unscrew rev counter cable from driving gear paying attention to the holding conic bush;
- remove rear brake caliper complete with pipes and place it in the battery seat;
- place under the engine the special support in such a way that this holds the engine;
- detach rear brake master cylinder control rod after having removed split pin and pin;
- undo screw and withdraw from pins on box the transmission and from the swinging arm the rear suspensions;
- undo the four allen screws (two per side) fixing front frame arm to the engine cradle;
- undo completely the two upper screws (one per side) fixing the frame to the gearbox cover;
- undo and withdraw the rod fixing frame to the gearbox;
- lift the frame from the rear side and push it forward.

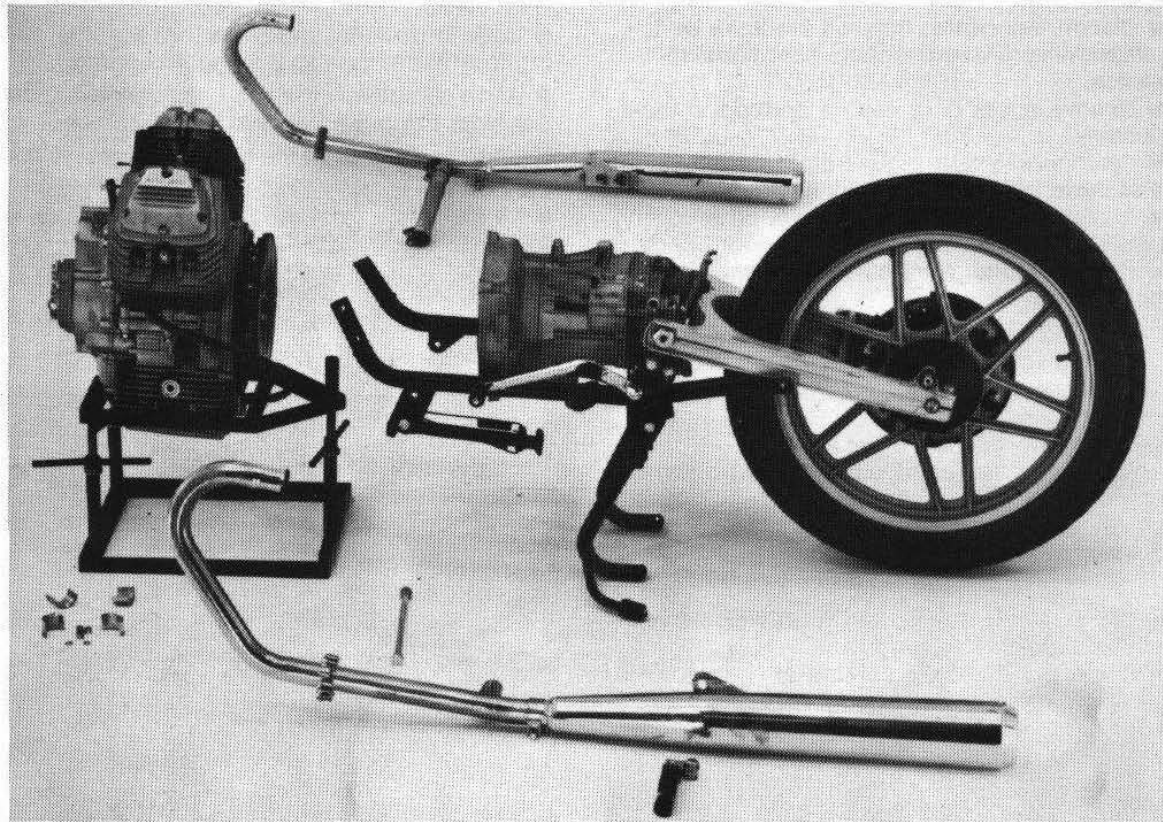


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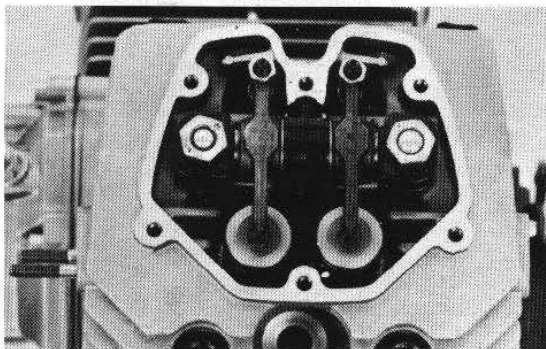
5.2 REMOVAL OF ENGINE-FROM GEARBOX AND FRAME

For this operation proceed as follows:

- undo the bolts fixing the exhaust pipes to the cylinder heads, withdraw the flanges and spacers;
- slacken the screw of the clamp fixing compensator, undo the screws fixing foot-rest and mufflers to the frame then remove the mufflers complete with exhaust pipes;
- undo the engine-gearbox joining screws, actuate the clutch operating arm so as to separate the engine from the gearbox; place oil recovery pipe from breather, slightly open frame arm and then withdraw the engine.



11



12

5.3 REMOVING THE ROCKER BOX COVERS

- Undo the screws and remove the covers and gaskets.

Checking operations

- Ensure that the contact surfaces are quite smooth. If scored, smoothen them with very fine emery paper;
- Ensure that the covers have no casting defects and in the case of any blow holes fill in with Devcon «F».

Re-assembly

■ When re-fitting the rocker box cover do not forget to change the gasket and to tighten the hold down nut in a diagonal sequence, completing the operation with a torque wrench loaded to 1 kgm.

5.4 DISMANTLING THE TIMING GROUP

(figs 13-14-15)

■ Undo the screw fixing the stator to the timing cover, withdraw the stator paying attention not to damage the brushes.

■ Undo the central screw «A» fixing the rotor to the crankshaft; introduce tool «B» and screw on until you hear the rotor snap away from the crankshaft.

■ Undo screws «C» fixing contact plate and screw «D» fixing the automatic advance control; remove the plate complete with the advance control paying attention to the dowel on the camshaft.

■ Undo the screws and remove the cover «F» with its gasket.

■ Remove chain tensioner «G».

■ Undo screws «H» fixing the timing gear to the camshaft.

■ Remove the nut with washer «I» fixing the gear to the oil pump.

■ Withdraw from the shafts gears «L» complete with the chain on the oil pump shaft.

NB – If dismantling the automatic advance control the cam comes out its seat, when re-assembling pay attention to place the claw for the articulation of the centrifugal masses in the proper groove on the cam; the cam has to be fitted in such a way that the front mark on the cam same is diametrically opposite the arrow on the plate (fig. 17).

■ Withdraw nuts «D», remove rocker support «B» and spacers «C» (fig. 18).

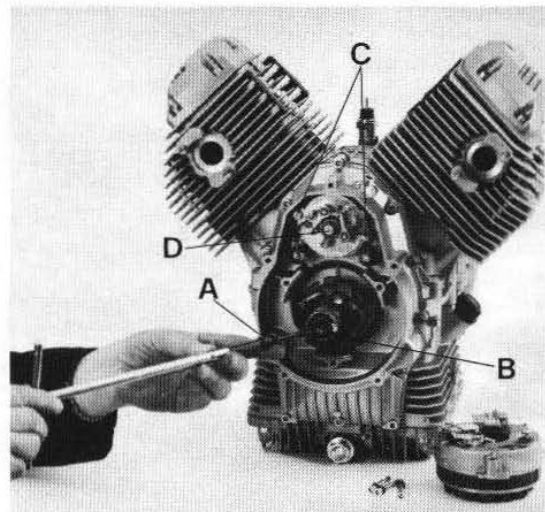
■ Remove the rocker spindle after removing circlip «A», rockers «E». Tappets «M» shall be removed from their housing after the crankcases have been separated and after removing the camshaft (fig. 18).

Ensure that:

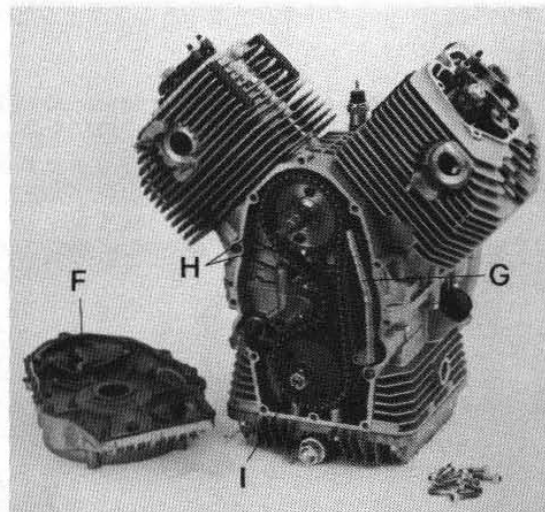
■ The tappet contact surface is quite smooth, if scored or in any way damaged, replace;

■ The camshaft ends and the cam lobes are not excessively worn or scored. If so, replace the camshaft;

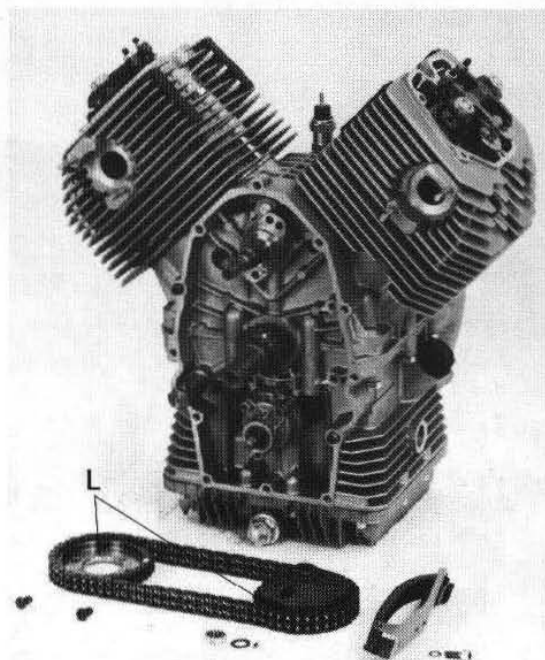
■ The push rods are straight and their ball ends perfectly smooth. If bent or scored, replace.



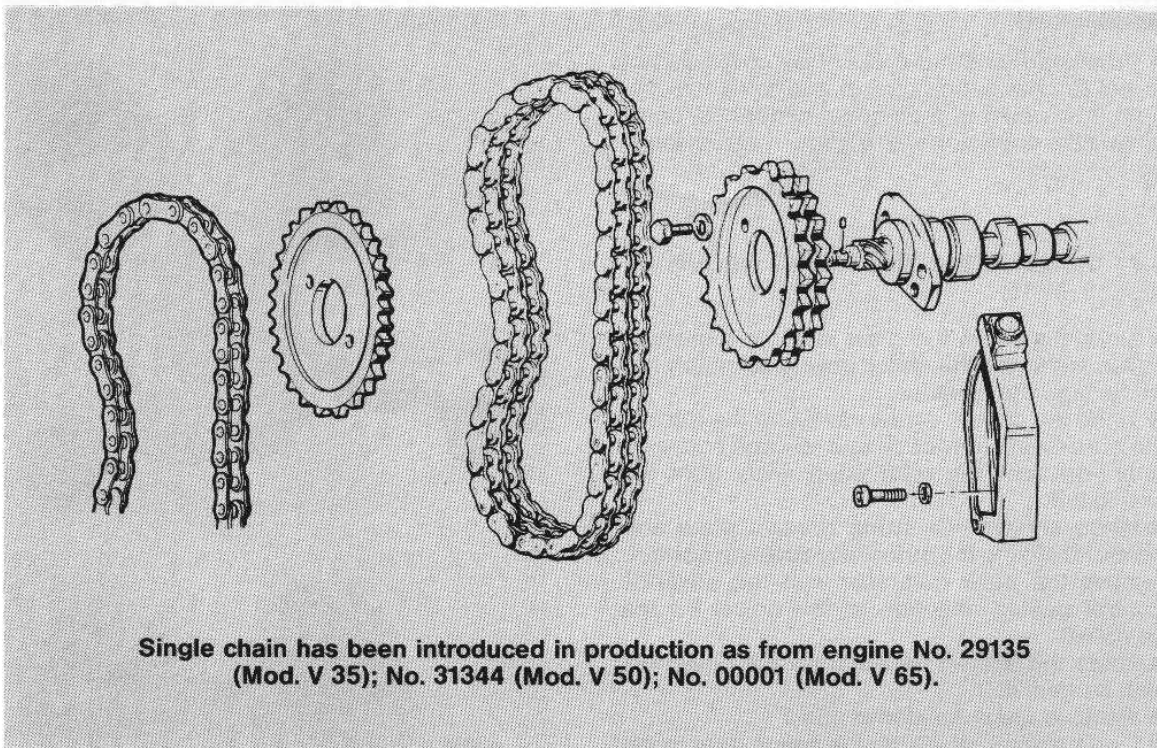
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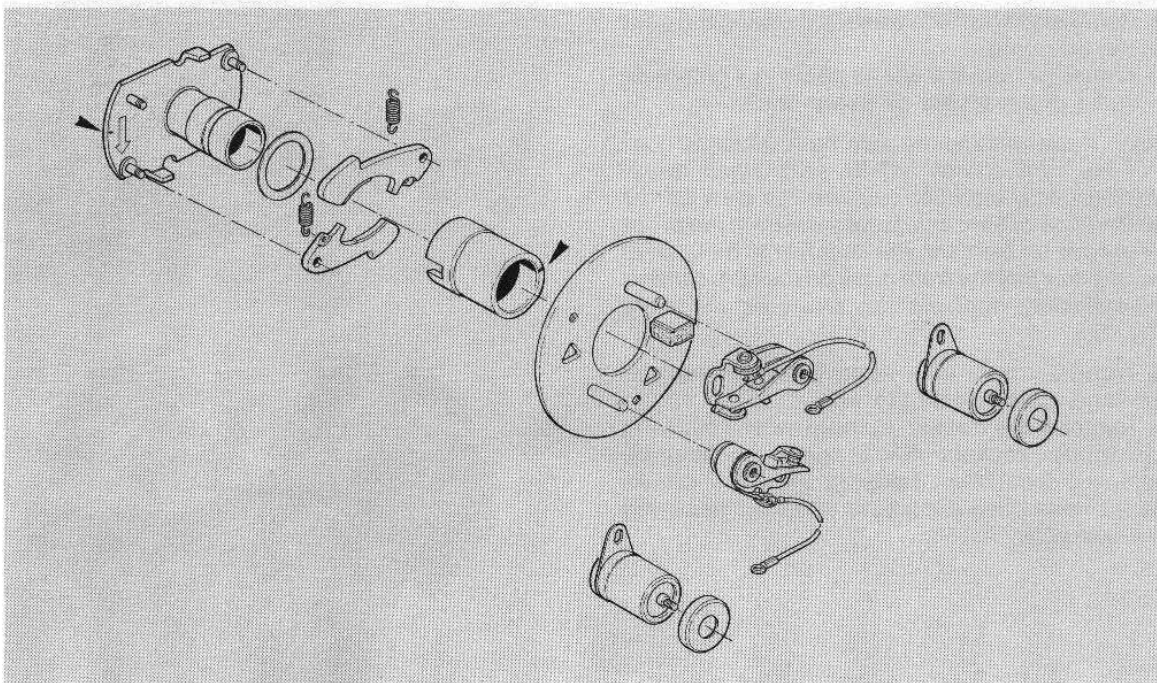
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17

To check the straightness of the push rods operate as follows:

- put them up on a surface face and roll them ensuring their adherence to it all along their length;
- ensure that there is no play at the ball ends. This can be detected by letting them drop on a surface plate from a small height. If on impact there is a high pitched metallic sound, this means the contact ends have no play;

- the spheric side of the adjusting screws is perfectly smoothed;
- ensure that the rocker spindle has been fitted correctly that is with the grinded side placed on the lower spacers;
- ensure that the longitudinal milling is placed towards the oil delivery and that connects the circular groove delivering oil to the rockers;
- ensure also that the spindle does not show excessive wear on the surface contacting the rockers.

Re-fitting

Reverse the dismantling sequence except that:

- 1 When re-fitting connection «O» locking the camshaft to the crankcase, ensure that the end of this connections is correctly placed in the housing hole in half-sector «R»; this in order to avoid an abnormal hardening in the camshaft rotation (fig. 18).

- 2 When re-fitting the chain gear set pay attention to the reference marks as indicated in paragraph 5.5 «Valve timing».

5.5 VALVE TIMING

Ensure that the mark on camshaft gear «A» is in line with the mark on the crankshaft «B»; dowel «C» has to be on the upper part, as indicated in fig. 20 and fig. 21.

In this condition the engine is timed.

However, if it is desired to check the valve timing proceed as follows:

- 1 Adjust rocker clearance to 1 mm.
- 2 Set the left cylinder n. 1 at T.D.C., compression stroke.
- 3 Fit control index («D» of fig. 22).
- 4 On the crankshaft fit the generator rotor and degree plate No. 14 92 74 00 («E» of fig. 22) paying attention to keep mark «PMS» towards control index arrow.
- 5 Set up a dial gauge in the plug hole of the left cylinder so its probe contacts the piston crown.
- 6 Turn slowly the crankshaft in a clockwise direction and then anticlockwise in order to determine exactly the TDC position by looking at the gauge.

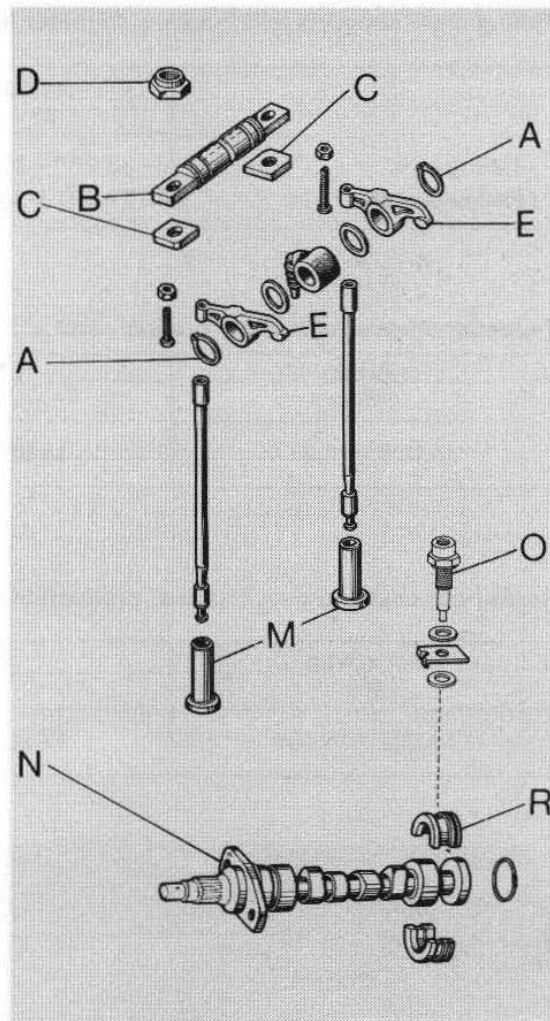
Then if necessary move the arrow so as to read the exact TDC position «0°» on the gauge.

- 7 Turn the shaft clockwise and by finger touch check when the ball end of the exhaust valve push rod starts to get hard.

This indicates that the valve is starting to open. At this stage check that the degree shown by the arrow on the degree plate (see fig. 22) are as specified in the timing table (see fig. 23).

Then, keeping to the data in the timing table it is possible to check the closing of the inlet valve.

- 8 Remove the dial gauge from the plug hole and refit the plug.



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Remove the index, the degree plate and the rotor.

- 9 Adjust the clearance between rockers and valves operating on the proper adjusters.

Normal clearance:

- inlet 0.15 mm;
- exhaust 0.20 mm.

Timing shaft supports and housing diameter in top crankcase cover

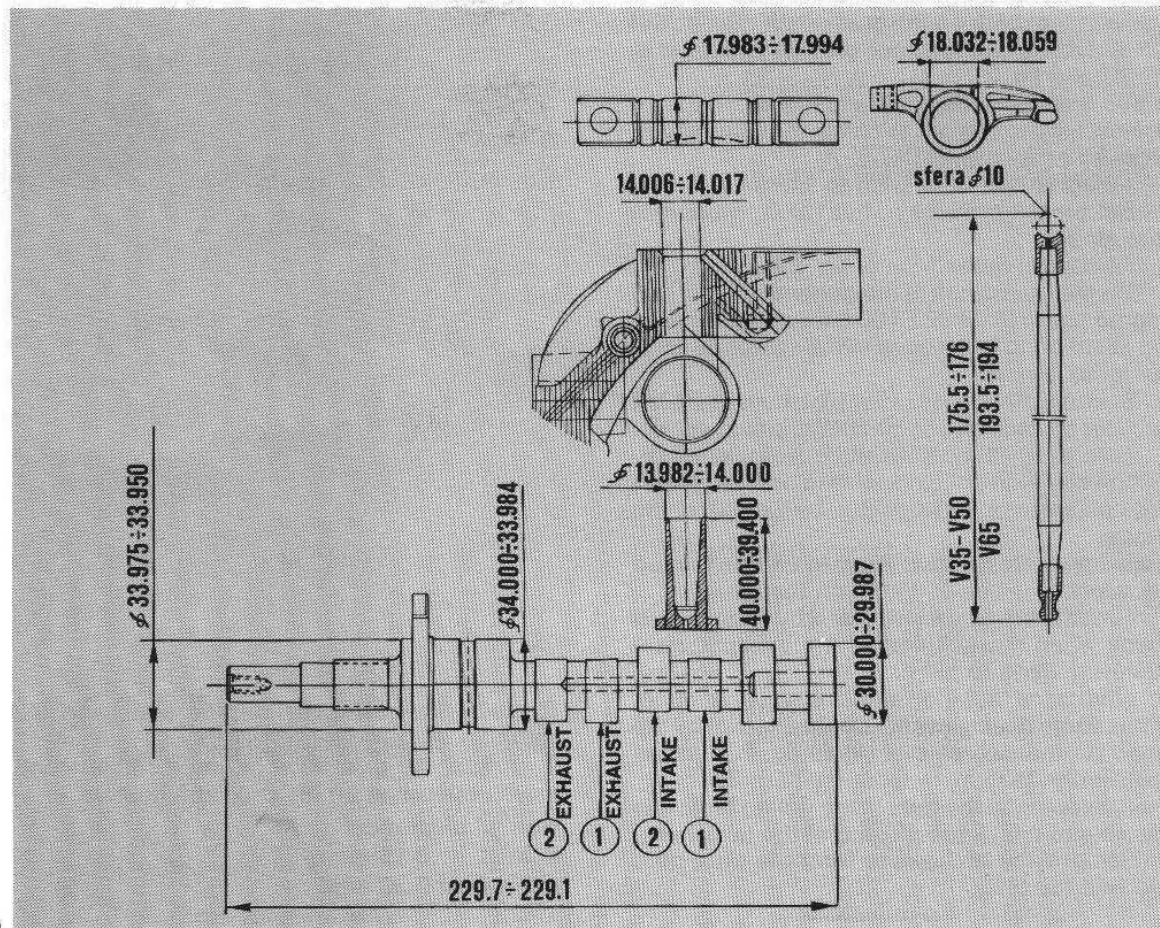
	SHAFT-JOURNAL DIA. mm	HOUSING DIA. IN CRANKCASE mm	ORIGINAL CLEARANCE mm
Timing side	33.950 ± 33.975	34.025 ± 24.050	0.050 ± 0.100
Flywheel side	29.987 ± 30.000	30.020 ± 30.041	0.020 ± 0.054

Tappet-crankcase seat data (original production)

SEAT I/D mm	TAPPET O/D mm	ORIGINAL ASSEMBLY CLEARANCE mm
14.006 ± 14.017	13.982 ± 14.000	0.006 ± 0.035

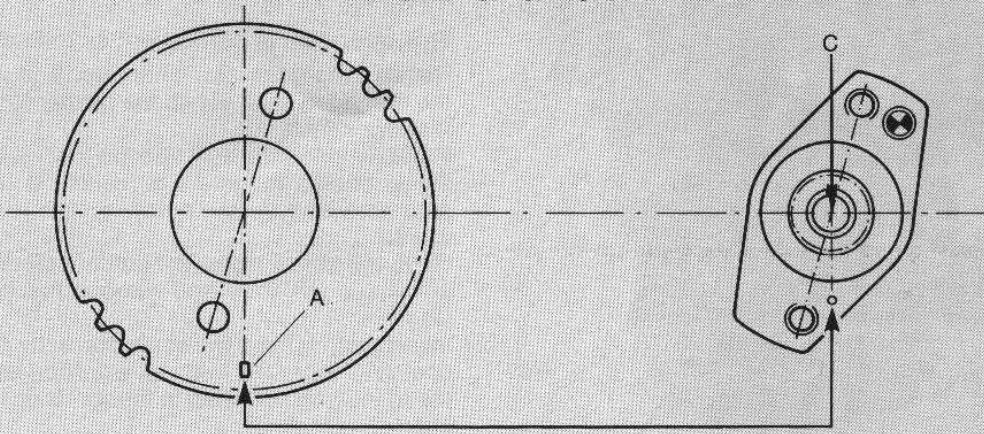
Rocker-pin coupling data (original production)

ROCKER I/D mm	PIN DIA. mm	ORIGINAL ASSEMBLY CLEARANCE mm
18.032 ± 18.059	17.983 ± 17.934	0.034 ± 0.076

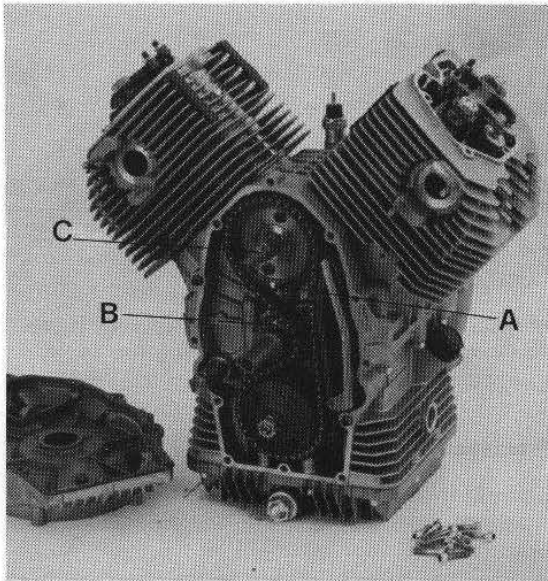


19

TIMING REFERENCES TO ASSEMBLE
THE GEAR ON CAMSHAFT



20



21

Timing data (figs. 23-24)

Inlet

- opens 18° before TDC;
- closes 50° after BDC.

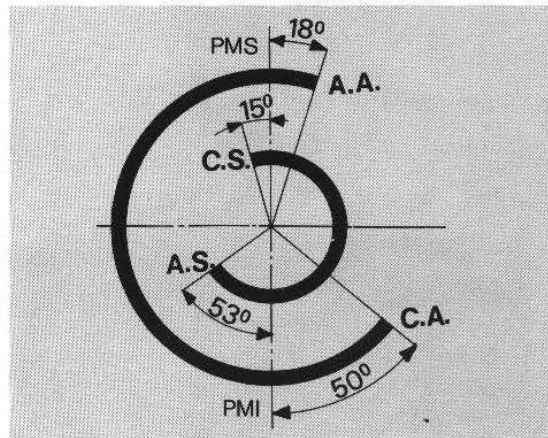
Exhaust

- opens 53° before BDC;
- closes 15° after TDC.

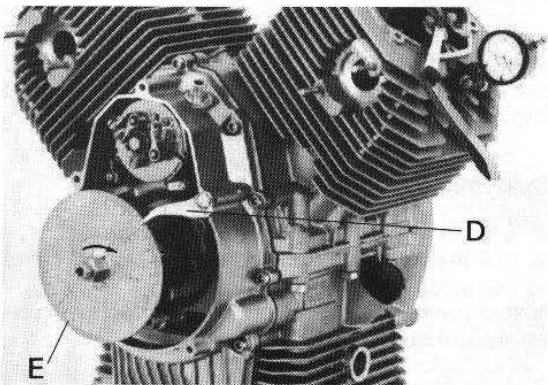
Valve clearance for valve timing 1 mm.

Normal rocker clearance:

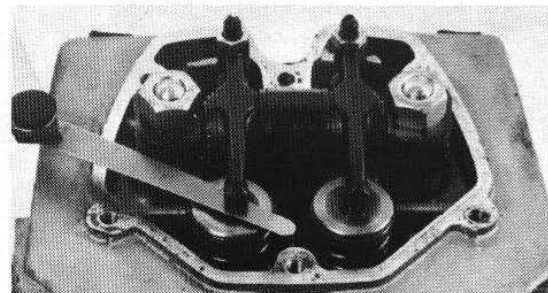
- inlet 0.15 mm
- exhaust 0.20 mm.



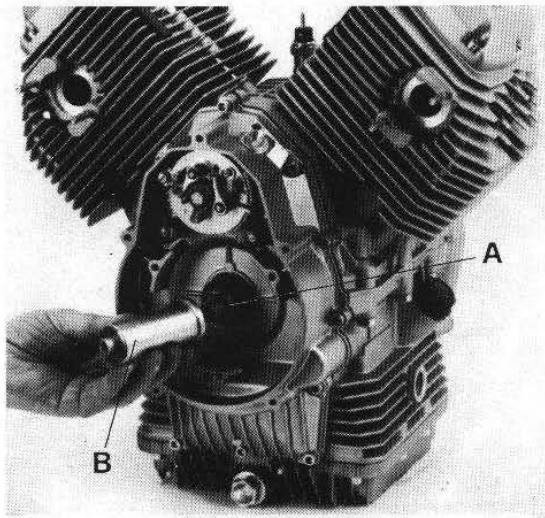
23



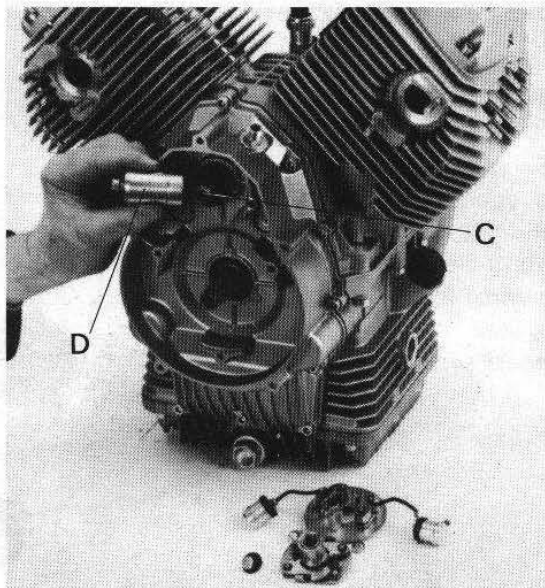
22



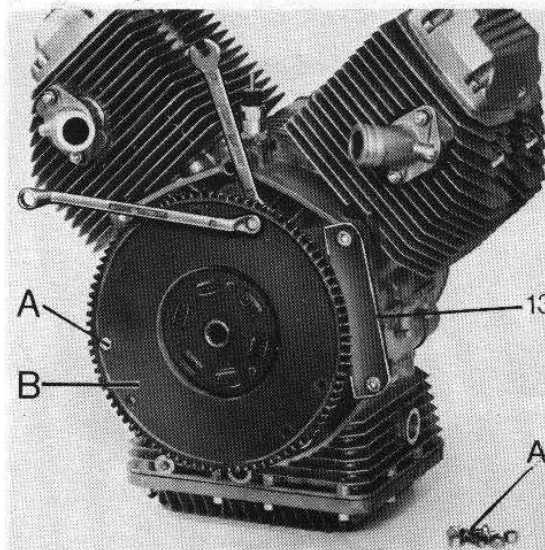
24



25



26



27

5.6 REPLACING THE SEAL IN TIMING COVER (ENGINE MOUNTED) (figs 25-26)

This operation is carried out as follows:

Remove the generator-alternator and withdraw the damaged seal, set up the proper tool «A» on the crankshaft.

Properly insert the seal and the tool «B»; using a screw of an adequate size insert the seal in its seat screwing on the screw on the crankshaft thread.

Undo the screw fixing the contact plate and the automatic advance and remove the damaged ring.

Insert bush «C» on the shaft, correctly place the seal and tool «D»; with an appropriate screw, insert the ring screwing in the screw on the camshaft.

5.7 CLUTCH

Removal (fig. 27)

- Set up flywheel holding tool «13»;
- Undo screws «A» of starting ring gear «B» and remove the gear.

Inspection

- Ensure that the plate is not scored. If worn down to less than 6.5 mm replace the plate. Original size 8 mm.

Re-assembly

To refit the clutch group and ring gear on the flywheel, reverse the dismantling sequence but ensure that:

- mark «A» on the crankshaft is in line with mark «C» on the flywheel and with mark «B» on the ring gear in TDC position (fig. 28);
- to center the clutch group it is necessary to fit tool 12 and tool 13 (fig. 29).

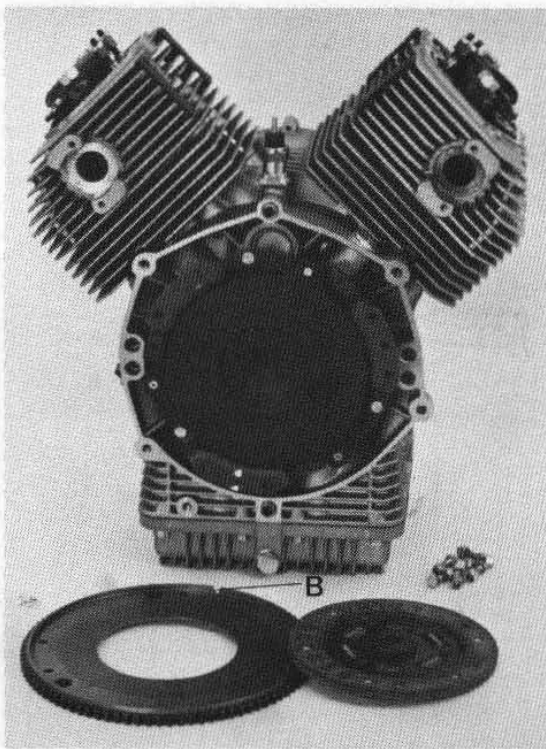
5.8 REMOVING THE FLYWHEEL

Undo the screws fixing the flywheel to the crankshaft, then withdraw it (fig. 30).

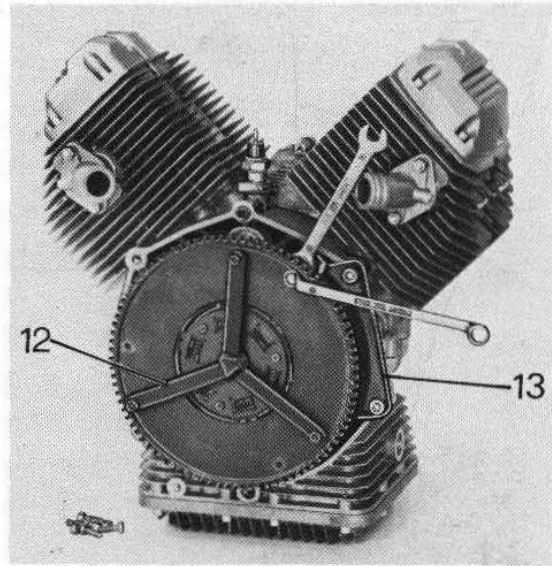
For the clutch type A.P. it is necessary to remove the lock ring and the central cup.

Inspection

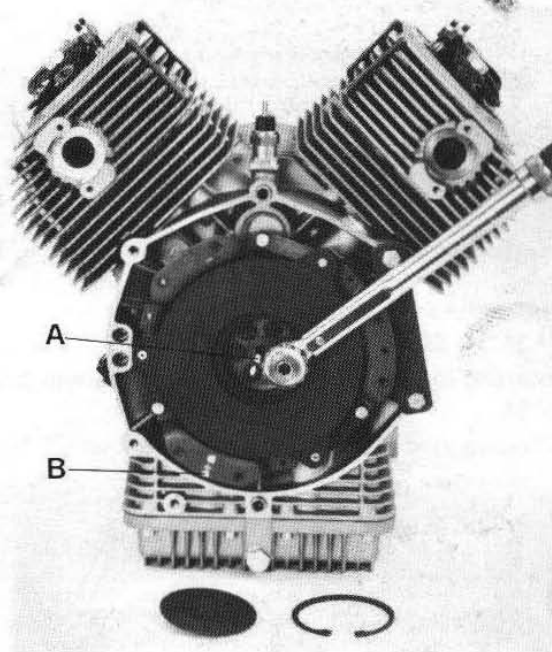
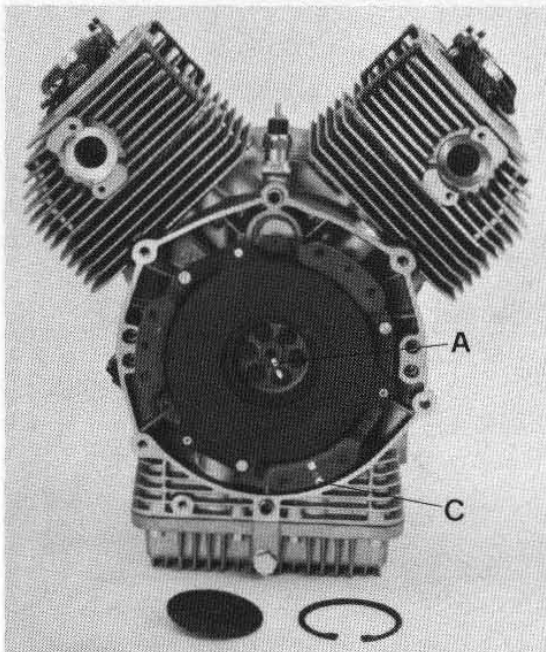
- Ensure that the flywheel is not cracked;
- that the assembly hole is not deformed so as to compromise the centering;
- that the facing side to the crankshaft is not deformed, if so replace the flywheel.



28



29

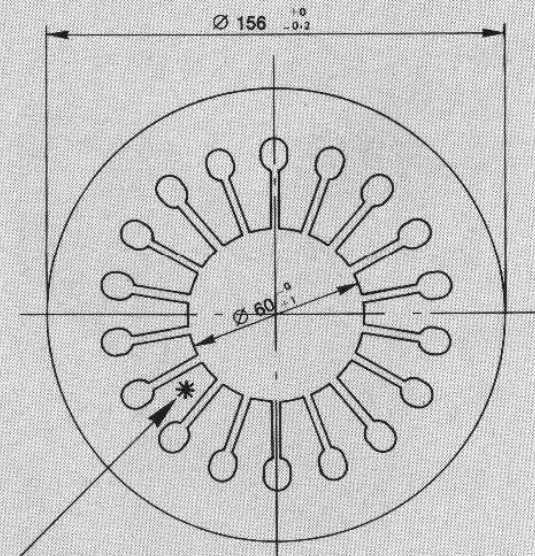


30

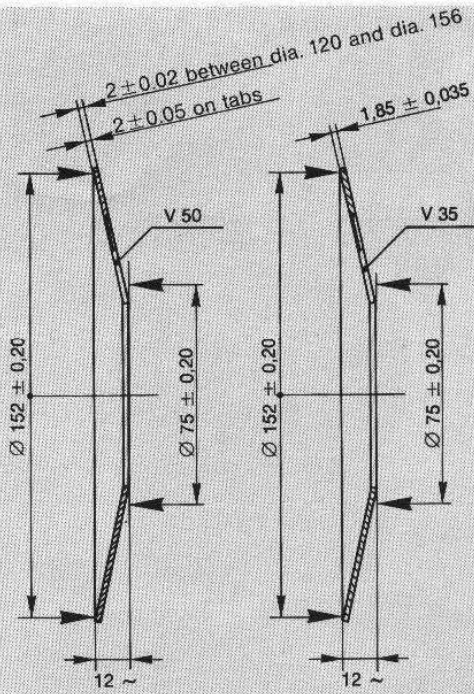
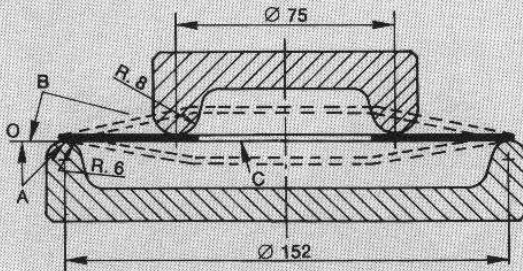
Re-fitting

When re-fitting the flywheel on the crankshaft make sure that mark «A» on the shaft is in line with mark «B» on the flywheel (see fig. 30). Tighten the securing bolt in a diagonal sequence using a torque wrench set at 4 kgm. It is advisable to replace the bolts tightening the flywheel to the crankshaft.

«PITTERY & VIOLINI» CLUTCH



V 35 reference red mark



V 35
Starting load 130 ± 10 kg
V 50
Starting load 160 ± 20 kg

V 35 - V 50

31

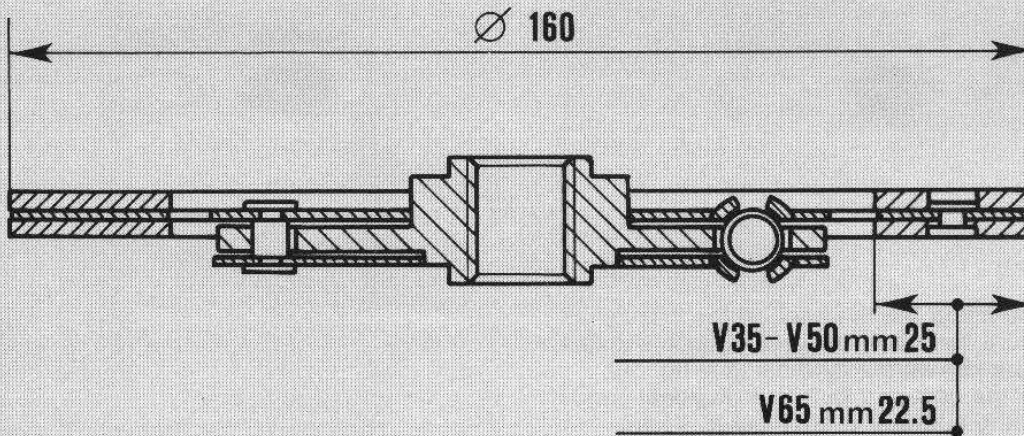
«AP» clutch - Clutch mechanism

V 35 - V 50

Starting load 150 ± 10 - identification: green paint dot

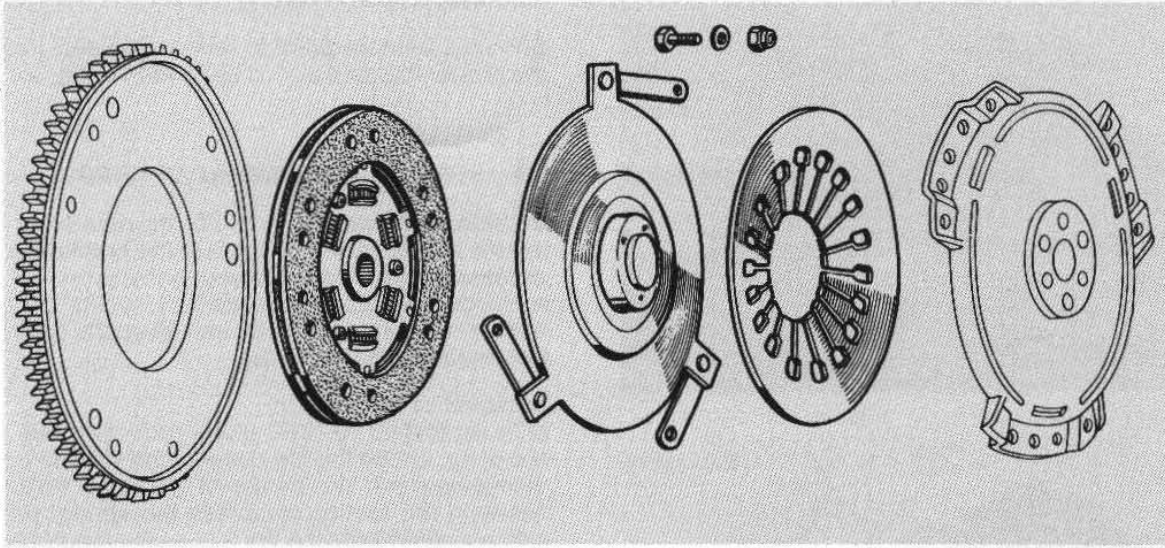
V 65

Starting load 170 $\pm \begin{matrix} 5 \\ -10 \end{matrix}$ - identification: white paint dot



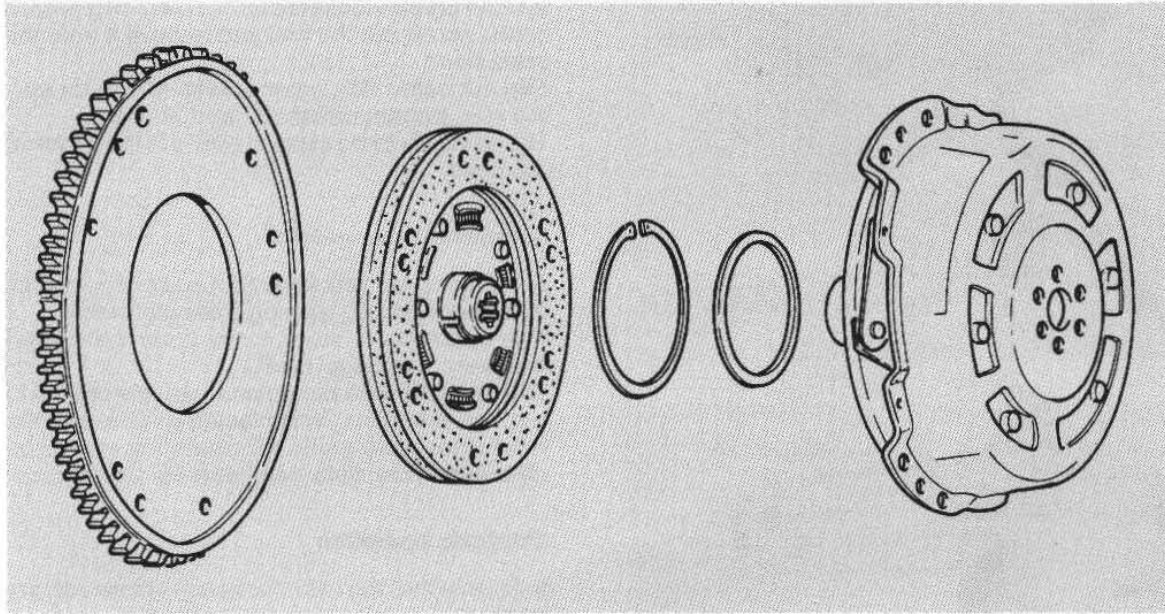
32

«PITTERY & VIOLINI» CLUTCH

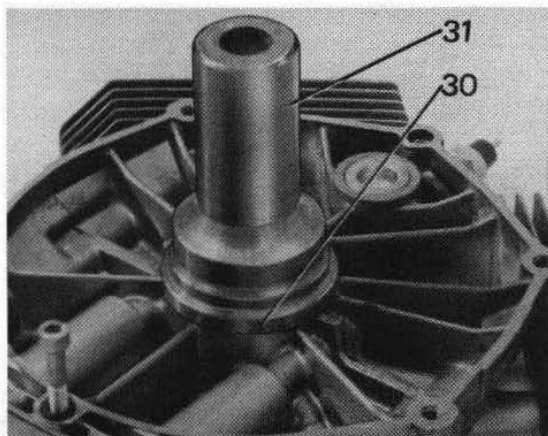


33

«AP» CLUTCH



34



35

Assembling the seal on the crankshaft flywheel side with engine fitted.

Should it be necessary to remove the seal use the proper tool and punch (30 and 31 of fig. 35).

5.9 STRIPPING THE CYLINDER HEADS

- Undo the rocker pin nuts, also the nuts securing the heads and the barrels to the crankcase, proceeding in a diagonal sequence;
- remove the top rocker spacers, rocker pins, bottom spacers, push rods and lift up the cylinder heads from the studs.

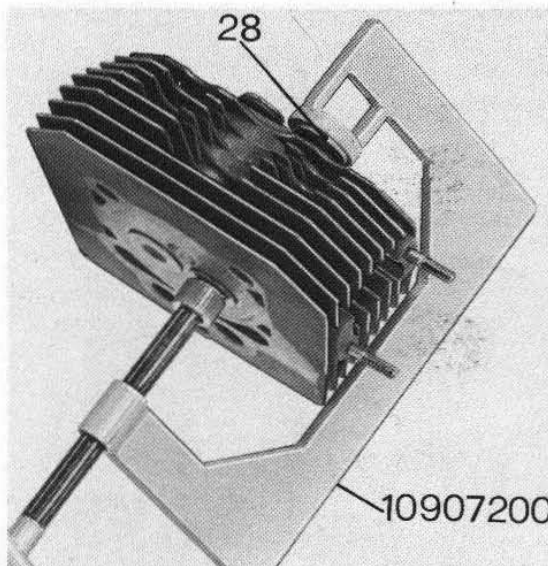
Removal of valves:

- fit up tool 10907200 using reduction bush (28 of fig. 26) on the top collar of the valve to be dismantled and the center of the valve head; screw in the tool to compress the spring and with a mallet lightly tap the tool on the top collar to detach both collets «A» from top collar «B» (see fig. 37).

When both collets «A» are loosened, screw in the tool until the collets can be taken off the valve seats; screw out the tool and remove it from the valve head.

Slip out collar «B», inner spring «C», outer spring «D», bottom collar «E» and shims.

The valve «F» to be slipped out from the inside of the head.



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Removing valve guides

The guides are removed by means of a special drift and a mallet, tapping from the inside.

This operation is more easily done if the head has been heated to 50-60°.

The valves have to be replaced when worn out to such an extent that by replacing a valve only, the valve stem-valve guide I/D clearance cannot be eliminated (see data table and fig. 38-40).

Checking operation

- Ensure that the cylinder head – cover joining surfaces are not dented or scored.

If so smoothen out the faces;

- check tightness of valves in their seats.

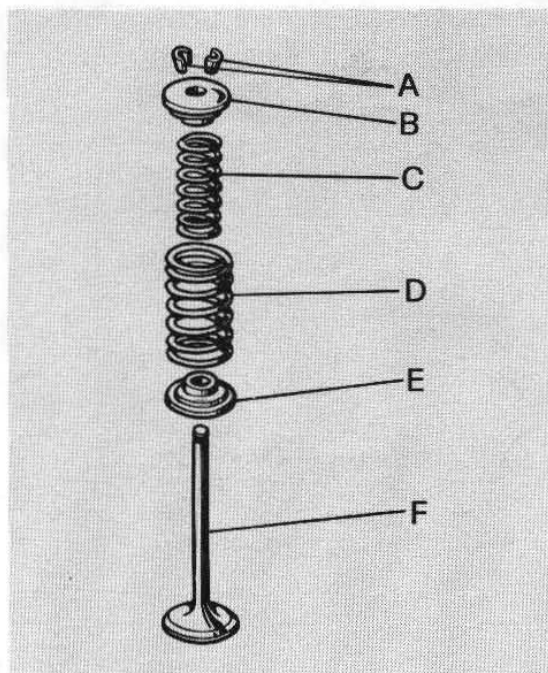
Pour some petrol in the head and if any seeps through, the valves have to be ground in.

If after this operation the valves are not perfectly tight, then it will be necessary to mill off the seats, and to regrind the valves or replace the valve.

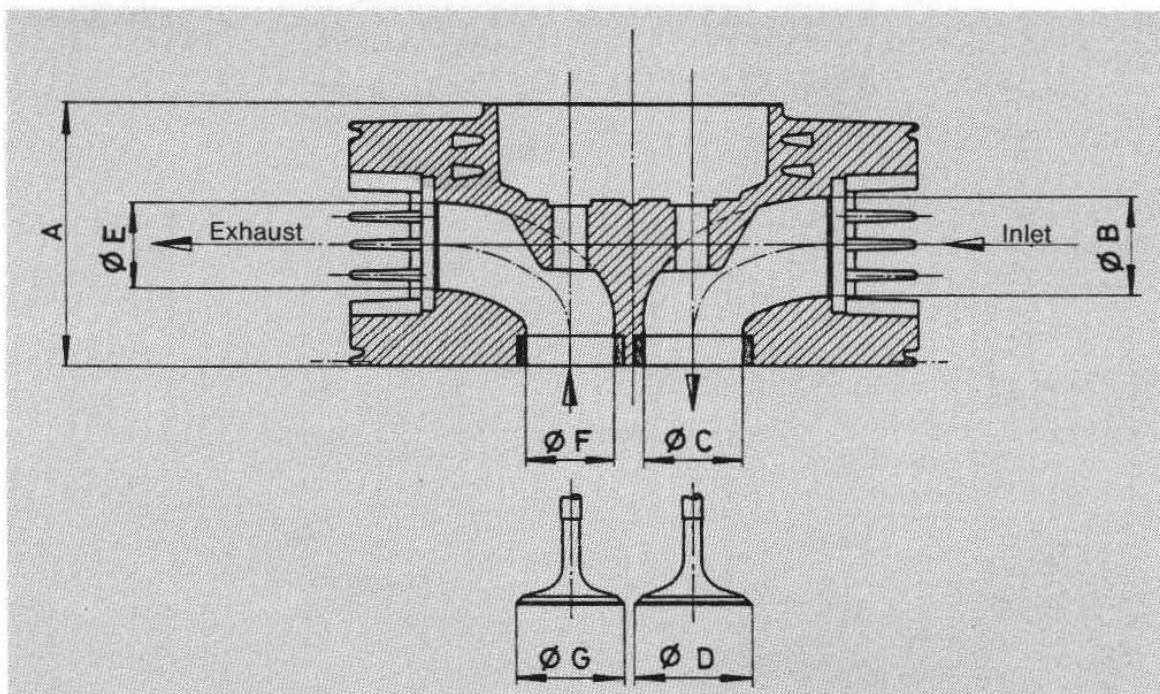
Ensure that the rubber seal caps are not cracked, if so replace them.

Inclination angle of the valve heads is 90° to 90°30' (see fig. 40); inclination angle of the seat is 88°30' to 89° (see figs 41-42);

- ensure that the play between stem and guide is as specified (see table and drawing fig. 40).



37

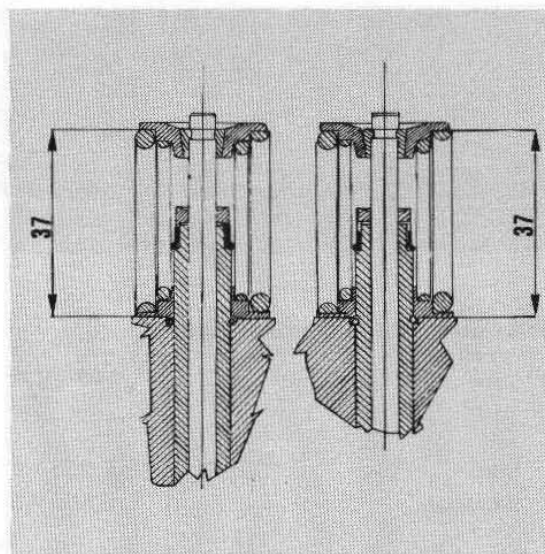


Model	A	B	C	D	E	F	G
V 35	80.1	22.5	26	30.6	25.5	22.5	27.6
V 50	80.1	30	29	34.6	27	26	30.6
V 65	80.1	30	29	34.6	27	26	30.6

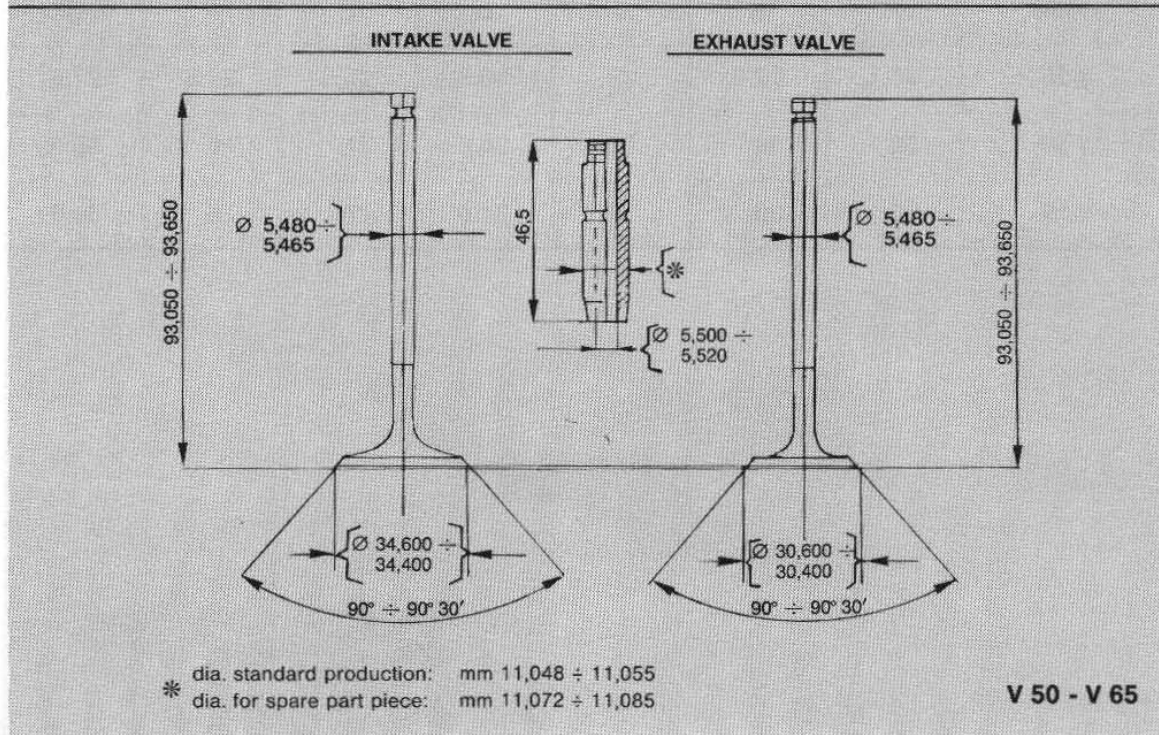
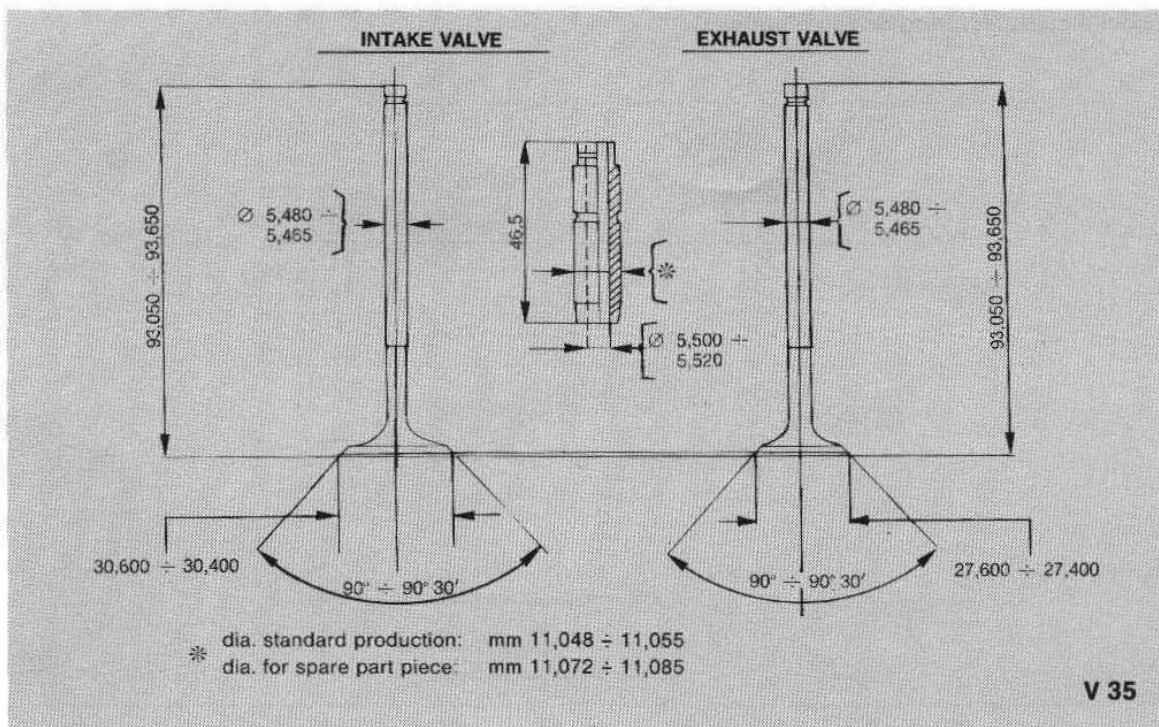
38

Inspection of valve springs

■ On valves fully assembled (collars, springs, collets and valves) the outer spring should be compressed to 37 mm (see dwg. fig. 39). It should not be forgotten that a fully open valve should still have 1 mm travel before the inner spring compresses completely. Add or remove shims until this measurement is obtained.



39

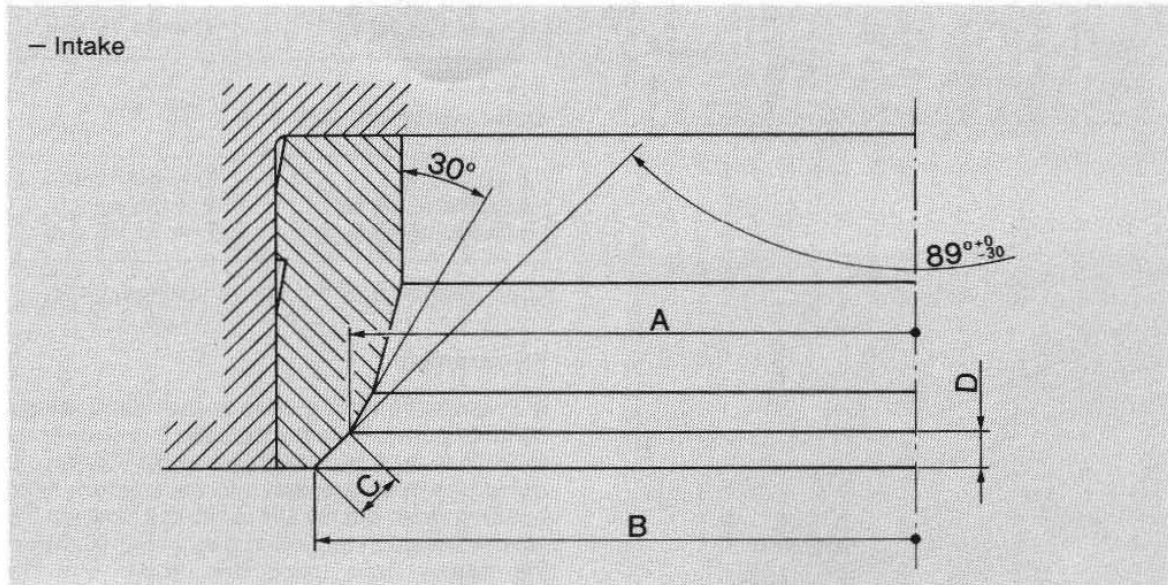


40

Valve-valve guide coupling data

	I/D OF VALVE GUIDE mm	VALVE STEM DIA. mm	CLEARANCE ON ASSEMBLY mm
Inlet	5.500 + 5.520	5.480 + 5.465	0.020 + 0.055
Exhaust	5.500 + 5.520	5.480 + 5.465	

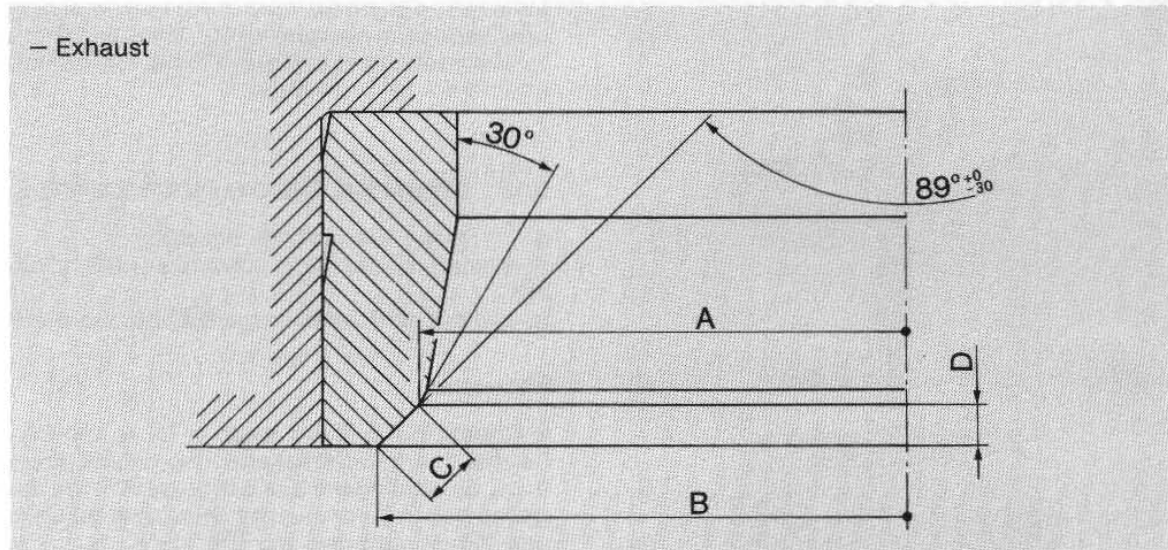
Special manufacturing of valve housing



	A ϕ	B (theoretic) ϕ	C (theoretic)	D
V 35	28.1+28.3	30	1.27	0.9
V 50	32.0+32.25	34	1.42	1
V 65	32.0+32.25	34	1.42	1

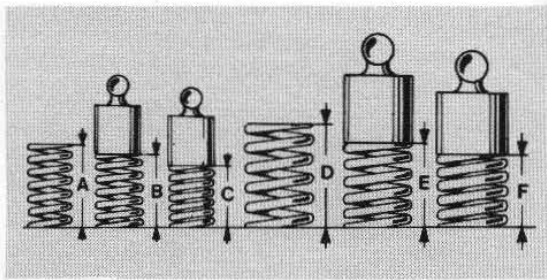
41

Data of these tables correspond to production standard.
In case the necessary tooling is not available, use a frontal milling at 90° for the valve counterboring.



	A ϕ	B (theoretic) ϕ	C (theoretic)	D
V 35	25.0 +25.2	27	1.42	1
V 50	27.72+27.97	30	1.6	1.14
V 65	27.72+27.97	30	1.6	1.14

42



43

Inner spring (fig. 43)

Free length	A = 36 mm
Loaded at 8 kg	B = 31.5 mm
Loaded at 20 kg	C = 24.45 mm

Outer spring (fig. 43)

Free length	D = 40.5 mm
Loaded at 18 kg	E = 36 mm
Loaded at 43.5 kg	F = 28.95 mm

Load tolerance of the above springs $\pm 4\%$.

Re-assembly

■ Press in the valve guides on the heads using a suitable punch from the outside; it is necessary to first pre-heat the head to about 60 °C; after the guide has been pressed into the cylinder head housing ream out the I/D to bring it down to the size indicated in table and dwg of fig. 40; insert the rubber caps using the proper tool No. 1992 60 20.

Hole size in head: 11.00 to 11.018 mm.

O/D of valve guide:

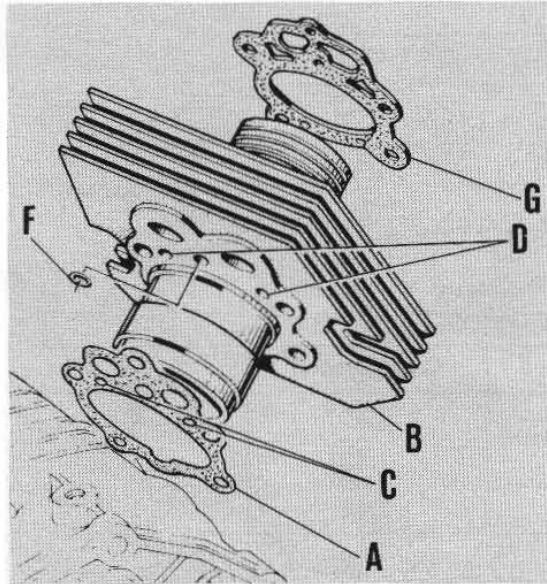
11.042 to 11.045 mm.

Guide-head interference fit: 0.037 to 0.042 mm.

■ Now re-fit the valve assembly consisting of valve, collars, spring and collets with any necessary shims.

Do so using the special tool No. 1090 72 00 plus the special reduction bush No. 1927 78 00 (28 of fig. 36) reversing the dismantling sequence.

■ To prevent deformation of the cylinder head, be sure to tighten the hold down nuts in a diagonal sequence completing the operation with a torque wrench set to 2.5 to 2.8 kg, for M8 nuts and 4 kgm for M 10 nuts.



44



45

5.10 REMOVING THE CYLINDER BARRELS

- Lift up the barrels from the studs
- remove OR seal from crankcase and cylinders;
- take out cylinder base gasket from the studs.

Inspection

■ Check the cylinder wear at three different heights in a transversal and longitudinal directions, by rotating the dial gauge by 90°; the dial gauge has to be previously set to zero on a slip ring (fig. 45 and dwg fig. 46).

If the plated surface at the cylinder top is worn down to more than 0.10 mm or if any scoring or ovalization is detected, the cylinder should be replaced.

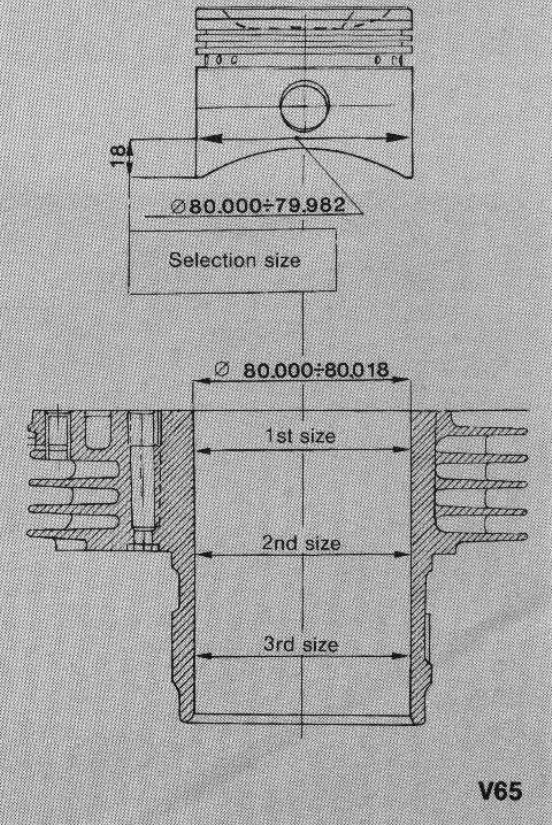
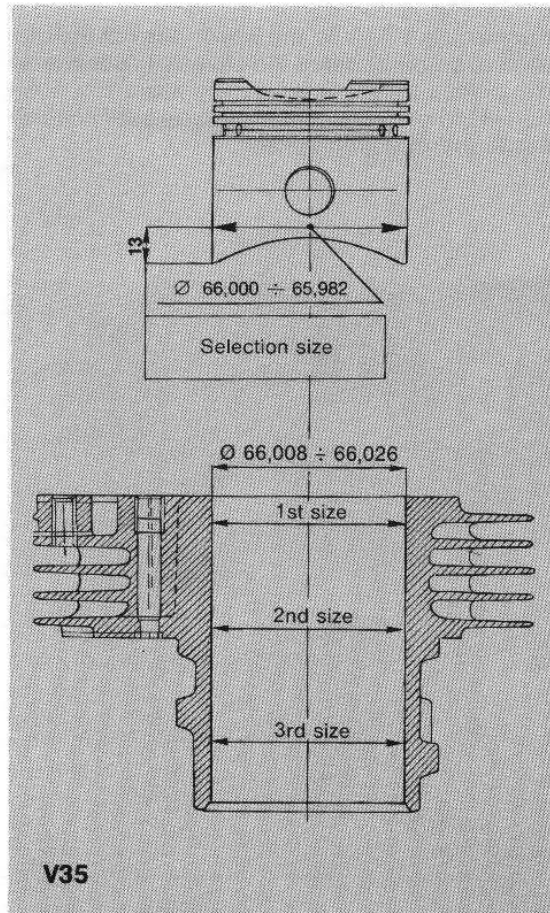
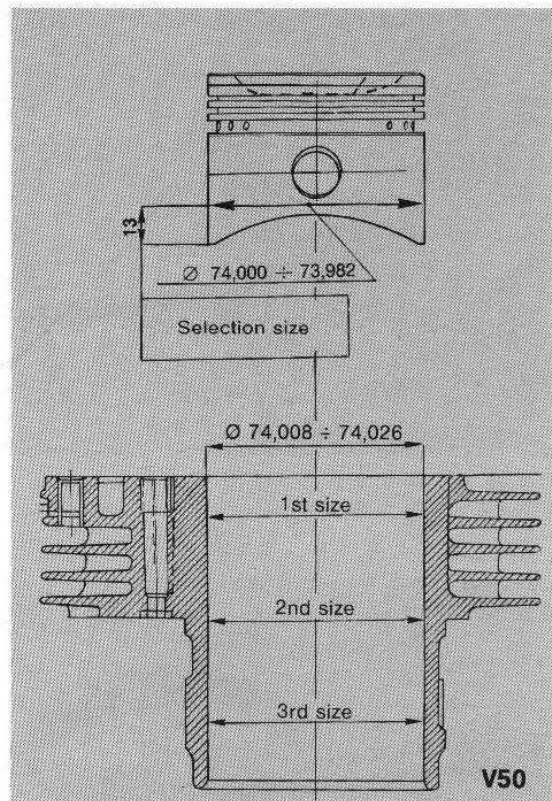
Re-fitting (fig. 40)

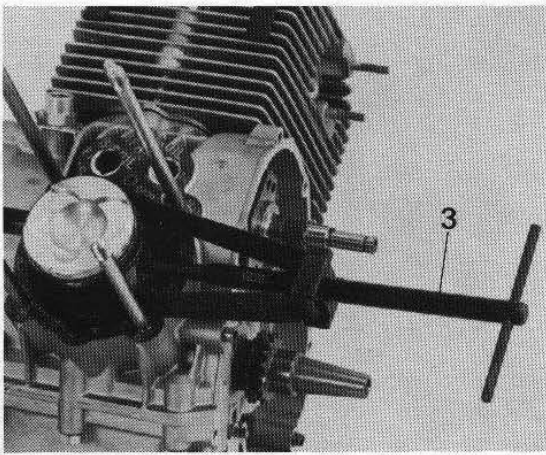
Fit the new gasket «A» and insert ring «F» in its housing in the crankcase, lubricate the cylinder inner wall and piston surface.
In order to avoid piston and cylinder scoring use a suitable piston wrench available on the market.

Selection of cylinder diameter

	CLASS «A»	CLASS «B»	CLASS «C»
V 35	66.008÷66.014	66.014÷66.020	66.020÷66.026
V 50	74.008÷74.014	74.014÷74.020	74.020÷74.026
V 65	80.000÷80.006	80.006÷80.012	80.012÷80.018

Cylinders of class A-B-C have always to be matched with pistons of the same class A-B-C. Assembling tolerances between pistons and cylinders 0.012 to 0.024 mm.





47

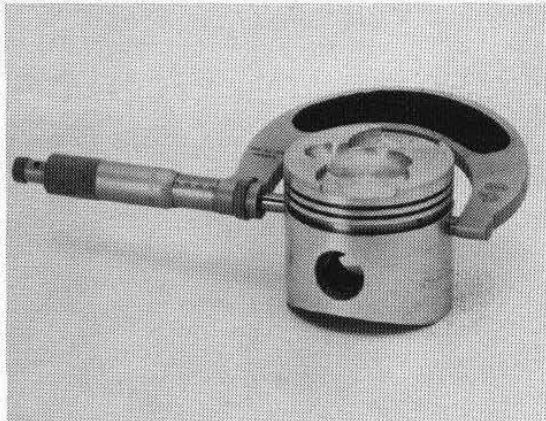
5.11 REMOVAL OF PISTONS

To remove the pistons from the small end it is necessary to push out the gudgeon pin after removing its retaining circlip using tool 19 90 78 00 (3 in fig. 47).

When overhauling always remove all carbon deposits from the piston crown and slots.

Checking operations

- Ensure the piston-barrel clearance is as specified 0.012 to 0.024 mm.
- Check piston weights. Max permissible difference: 1.5 grams.
- Make sure the piston is marked with its selection letters «A-B-C» and the word «alto» (top).
- The selection measurements indicated in the table have to be taken at 13 mm from the piston base in an orthogonal sense to the piston pin axis (see fig. 48 and dwg of fig. 46).

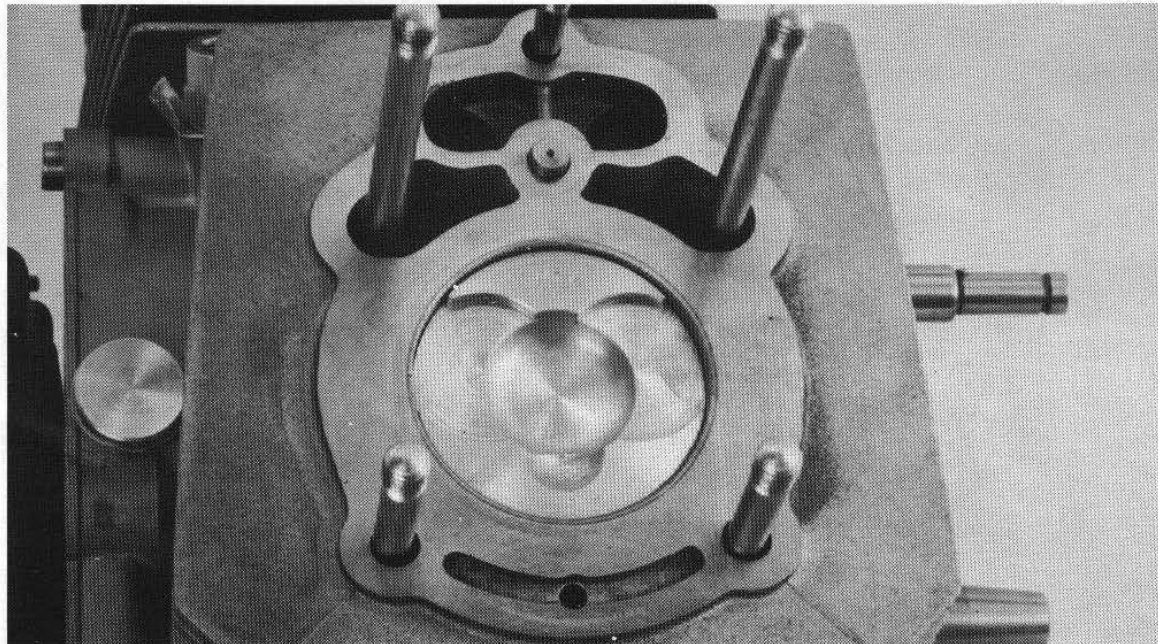


48

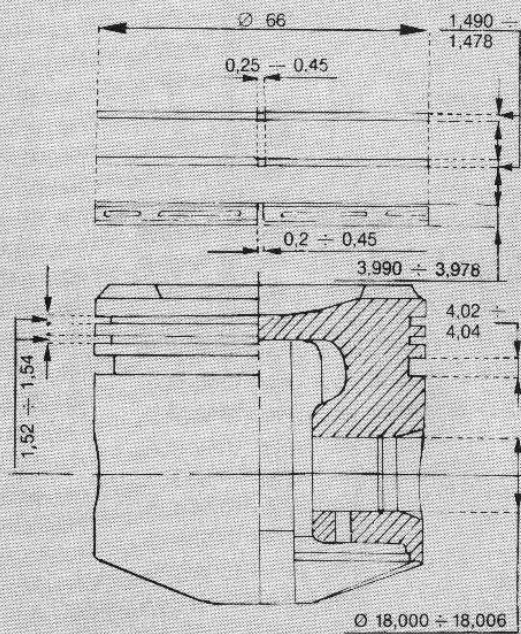
Re-fitting

To re-fit the piston on small end with the piston pin it is necessary to warm the piston in an oil bath to a temperature of 60 °C, in order to allow the piston to expand sufficiently for the pin to be pushed in.

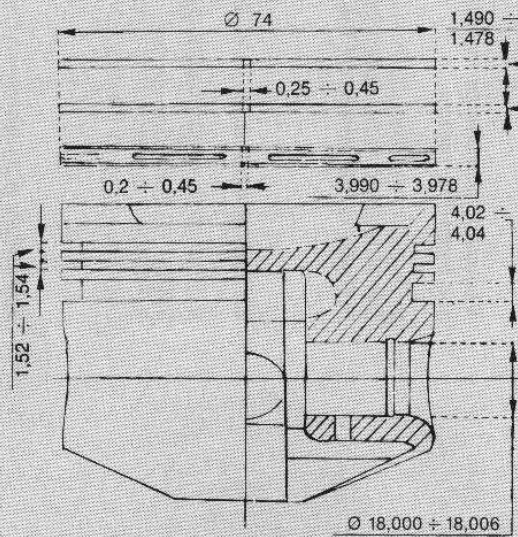
For models V35/V50 the word «alto» in the piston crown determines the assembly position of the piston; for models V65 the assembly position is indicated by an arrow to be kept according to the direction sense.



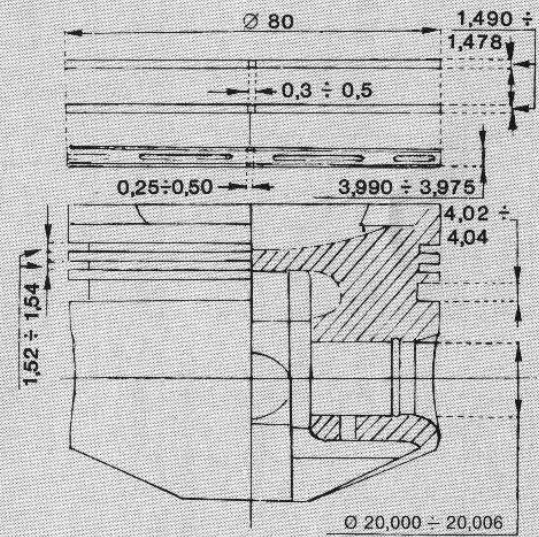
49



V35



V50



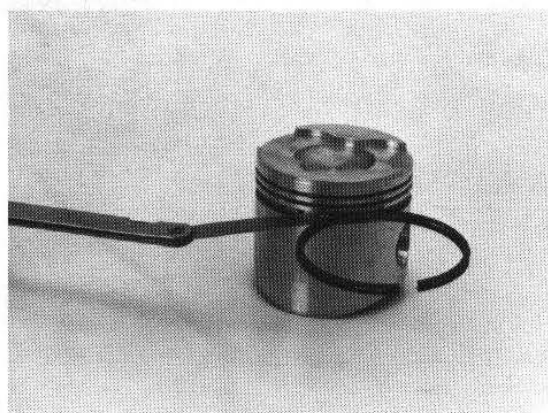
V65

Selection of pistons diameter

	CLASS «A»	CLASS «B»	CLASS «C»
V 35	65.982 ÷ 65.988	65.988 ÷ 65.994	65.994 ÷ 66.000
V 50	73.982 ÷ 73.988	73.988 ÷ 73.994	73.994 ÷ 74.000
V 65	79.982 ÷ 79.988	79.988 ÷ 79.994	79.994 ÷ 80.000

Matching data - Gudgeon pin-piston hole clearance

O/D OF PIN mm	PISTON HOLE DIA. mm	NEGATIVE ALLOWANCE mm
V 35/V 50 17.994 ÷ 17.998 V 65 19.994 ÷ 19.998	18.000 ÷ 18.006 20.000 ÷ 20.006	0.002 ÷ 0.012



51

Removing the compression rings and oil scrapers from the piston

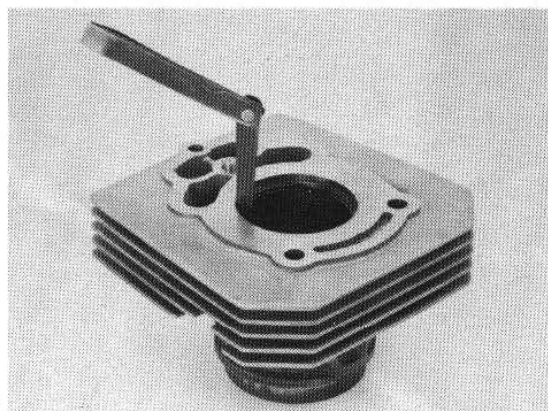
- These rings should be removed from the piston with great care; widen the ring ends just sufficiently to slip them off the piston.

Checking operation

- Ensure the piston slots clearance is as specified;
- Check the piston ring gap with a feeler gauge with the rings in the barrel.

Assembly play between piston-ring thickness and grooves on piston (fig. 51)

- Top compression ring
0.030 to 0.062 mm;
- central compression ring
0.030 to 0.062 mm;
- oil scraper ring
0.030 to 0.062 mm.



52

Piston rings gaps (fig. 52)

- Compression ring top and middle:
0.25 to 0.45 mm;
- oil scraper: 0.20 to 0.45 mm.

Re-assembly

When re-fitting the piston rings pay attention to the end gaps which have to be out of line with each other.

5.12 SEPARATING THE CRANKCASE COVERS

- Drain the oil from the sump, undo the bolt fixing oil cartridge filter and remove it together with cup and cartridge;
- undo bolt fixing sump, remove it paying attention to the gasket and its correct position; an incorrect re-assembly of the gasket may cause an abnormal oil circulation;
- undo the four nuts from the inside of the crankcase and the six bolts;
- insert a rod in the engine-frame fixing rod hole, then with a mallet lightly tap the rod to separate the two half crankcases;
- from the top crankcase undo camshaft retainer and then slip out the shaft same;
- remove crankshaft complete with con rods;
- remove from their housing the four tappets.

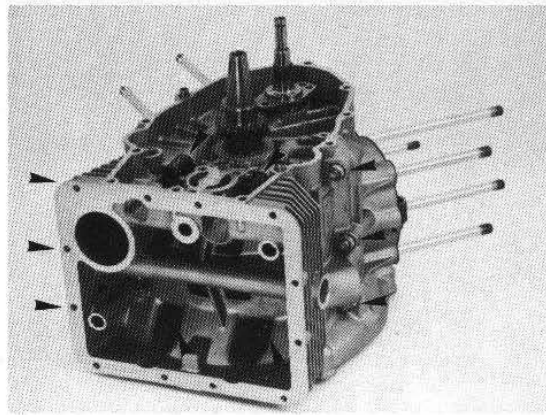
Checks

- Ensure the cover joining faces are unscored or nicked.
Remove gasket liquid residuals using trichloroethylene.
- Check the threaded portion of the studs.
If damaged or stripped, replace the stud or studs.
- Blow out all oilways in the covers with compressed air.

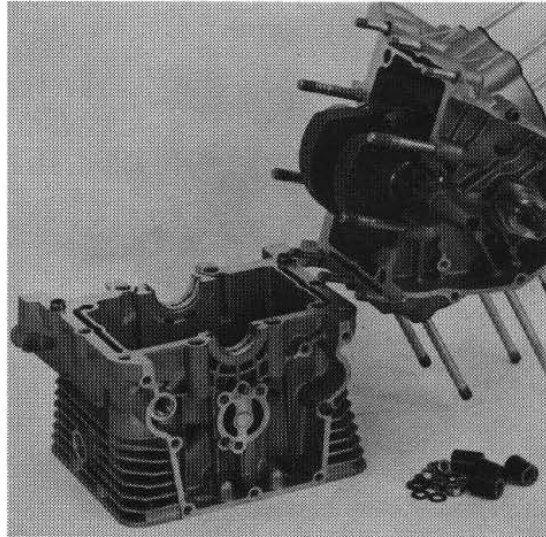
Re-fitting

- Introduce the camshaft in its housing on top cover after ensuring that both sectors with circlip are properly mounted.
Fit connector «A» paying attention that its end enters into the hole shown by arrow «B» (see fig. 55).
- Fit half bearings in their housing in the upper crankcase, set up the crankshaft complete with con rods and then fit the halfbearings in the bottom crankcase.
- Smear the union faces with sealing compound No. 00010300, position the bottom crankcase on the top cover studs.
Tighten the nuts and complete the operation with a torque wrench set to 2.2 to 2.5 kgm for the outer nuts (M8) and 2.7 to 3.1 (V65 3.8 to 4) kgm for the four central studs (M10) in the shown sequence.

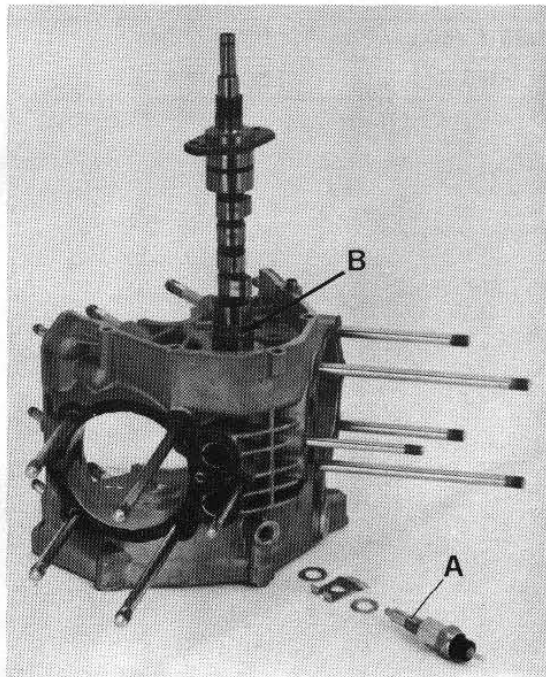
9 ○	1 ○	□	○ 3	○ 7
6 ○				○ 5
8 ○	4 ○	□	○ 2	○ 10



53



54



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5.13 DISMANTLING THE CON-RODS (figs. 56-57)

- After removing the complete crankshaft-connecting rod assembly from the top crankcase cover, undo self-locking nuts «H» and remove the con-rod caps «I»;
- from con-rod and from con-rod caps remove bearings «M»;
- if worn out push out the small end bush by the aid of a suitable punch;
- ensure also that the small end bushes are not seized or deeply scored.
Replace as necessary;
- check the parallelism of axis i.e. before fitting the con-rods make sure the small end and the big end holes are «square» that is parallel to each other.
Possible deformation can be rectified by means of a fork lever set-up on the con-rods.
Maximum offset permissible for the small and big end axis is ± 0.10 mm as measured at a distance of 200 mm;
- the weight of the con-rod complete with bolts, nuts and upper bush, but without half-bearings is 310 gr ± 4 for mod. V35/V50 and 417 gr ± 4 for mod. V65.

V 35 - V 50

Housing diameter 38.103 to 38.115 mm
Shaft diameter 34.987 to 34.999 mm.

- Bearing-shaft clearance at 90° from joining surfaces: min. 0.018 mm, max 0.054 mm.

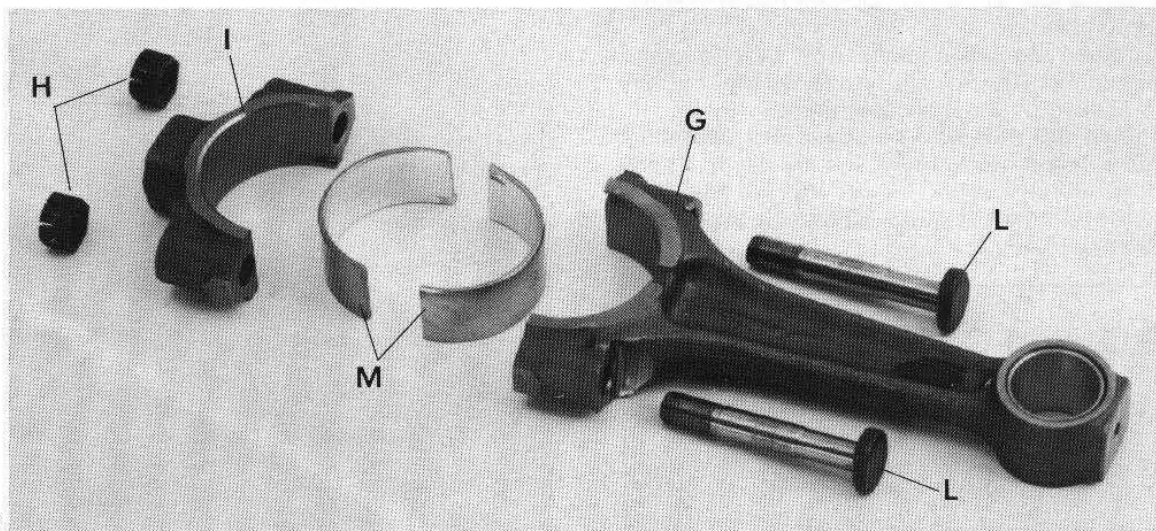
V 65

Housing diameter 43.657 to 43.670 mm
Shaft diameter 39.995 to 40.011 mm.

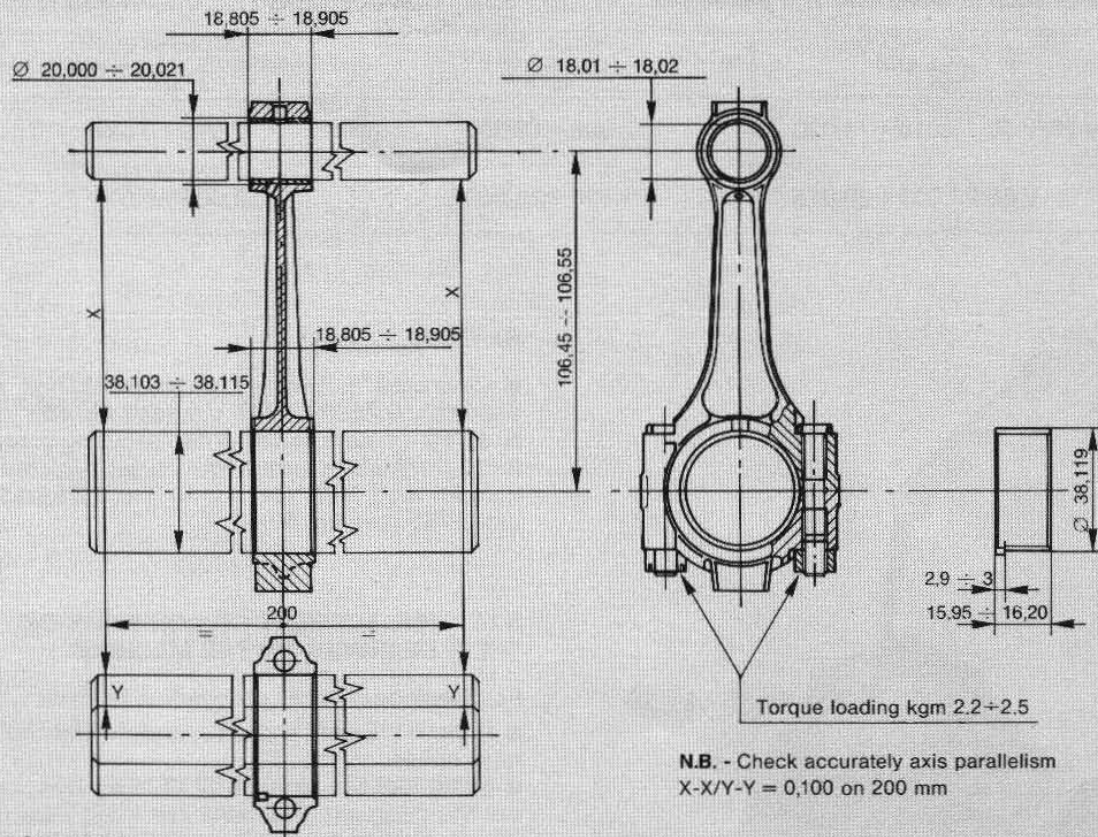
- Bearing-shaft clearance at 90° from joining surfaces: min. 0.020 mm, max. 0.061 mm.

Thickness of con-rod bearings

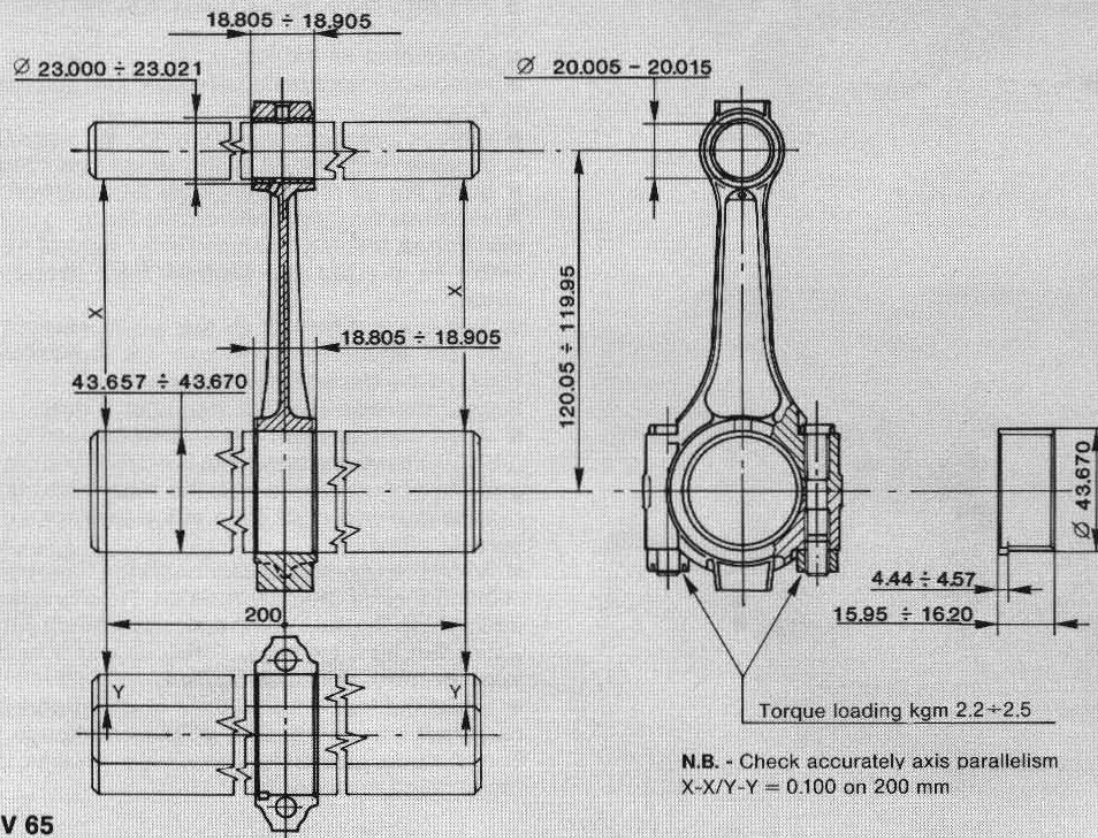
	NORMAL (production)
	At 90° in relation to the coupling plane
V35 / V50	1.537 ÷ 1.543
V65	1.807 ÷ 1.813



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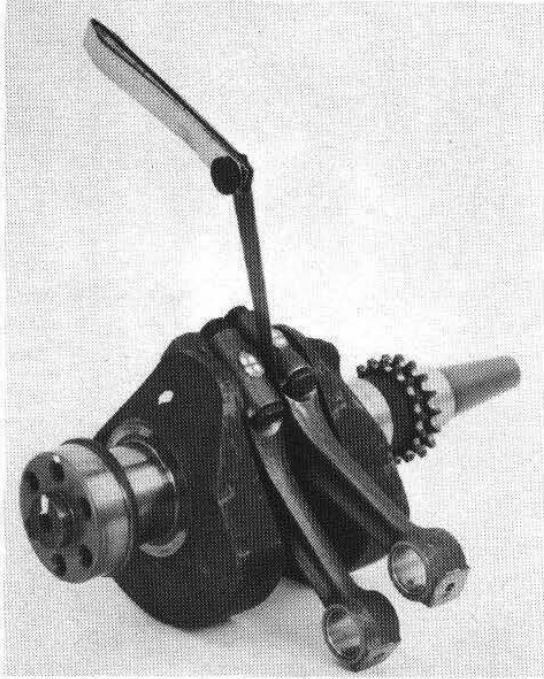
V 35 - V 50



V 65

Size of bush in small end and piston pin

I/D OF BUSH PRESSED IN SMALL END mm	PISTON PIN DIAMETER mm	PISTON PIN-BUSH ASSEMBLY CLEARANCE mm
V 35/V 50 18.010 + 18.020	17.996 + 18.000	0.010 + 0.024
V 65 20.005 + 20.015	19.996 + 20.000	0.005 + 0.019



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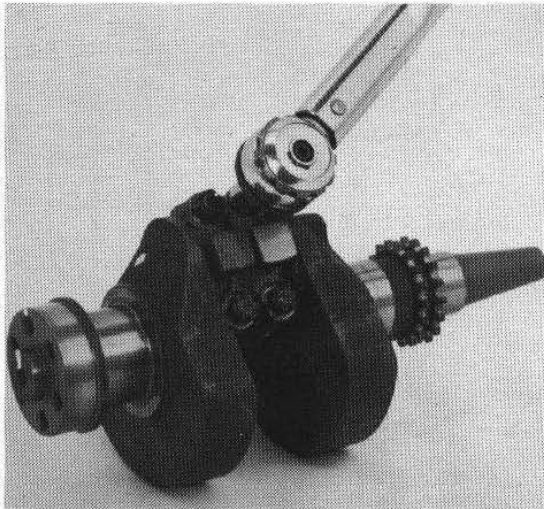
Re-fitting

- Clearance between conrod-crankshaft on assembly 0.265 to 0.515 mm (see fig. 58);
- screw on the nuts on the cap securing screws and tighten with a torque wrench set to 2.2 to 2.5 kgm for mod. V35/V50 and to 3 to 3.2 kgm for mod. V65 (see fig. 59).

5.14 REPLACEMENT OF CON-RODS OR THEIR BEARINGS ON THE MACHINE

For these operations proceed as follows:

- remove the right and left cylinder head-barrel assemblies;
- using tool No. 19907800 (3 of fig. 47) push out the gudgeon pins (after removing their retaining circlip), then remove pistons from con-rods;
- remove the generator cover and the generator;
- disconnect all cables;
- remove contact plate complete with automatic advance;
- remove timing cover and timing gear assembly together with the oil pump gears and chain;
- undo the oil pressure gauge and support;
- withdraw the camshaft from the housing in the crankcase, placing one hand in the bore of a cylinder to prevent the tappets from dropping down;
- turn the crankshaft to the point where the con-rod securing nuts can be unscrewed through the bore of one cylinder. Repeat the operation for the other 2 nuts;
- when the cap retaining nuts have been unscrewed, insert one hand into the cylinder bore to grip the con-rods and with the other hand take out the con-rod caps (one at the time) or vice-versa;
- when the con-rod and/or bearings have been replaced; re-fit the con-rods on the crankshaft and tighten the nuts using a torque wrench set to 2.2 to 2.5 kgm for mod. V35/V50 and 3 to 3.2 kgm for mod. V65 (see fig. 59);
- insert the tappets into their housing and the camshaft into its housing on the crankcase. For all other assembly operations, reverse the dismantling sequence.



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5.15 DISMANTLING THE CRANKSHAFT

After removing the crankshaft from the top crankcase cover, undo the oil pressure gauge plug and carefully clean all oilways to the con-rods and to the crankcase pins.

Inspection

NB – The crankshaft is nitrided and therefore cannot be regrinded; therefore in case of ovalization or deep scorings this has to be replaced.

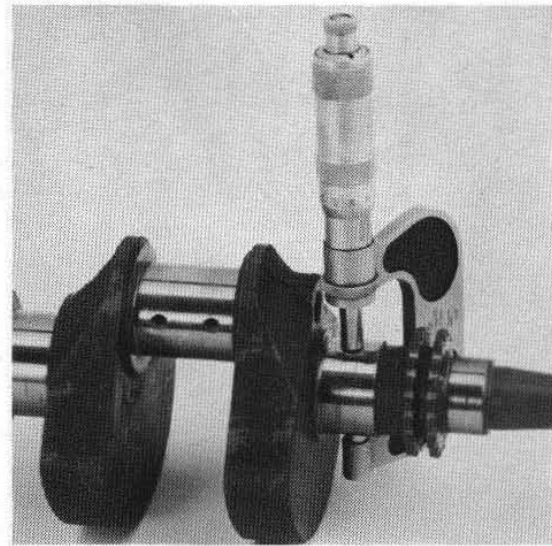
■ Smear the plug with Loctite before tightening. The shaft is statically balanced by applying the following weights:

0.883 to 0.913 kg for **V35** mod.;

0.943 to 0.973 kg for **V50** mod.;

1.159 to 1.189 kg for **V65** mod.;

■ ensure that on the crankshaft, flywheel side there is a reference mark in correspondence with the flywheel screw fixing hole in the vertical of the con-rod bottom center.



Mainshaft diameter, timing side (fig. 60)

ORIGINAL (production) mm
34.995 +35.012 V35 / V50
40.004 +40.020 V65

Bearing housing diameter, timing side

ORIGINAL (production) mm
38.103 +38.119 V35 / V50
43.657 +43.670 V65

Overall thickness of bearings, timing side

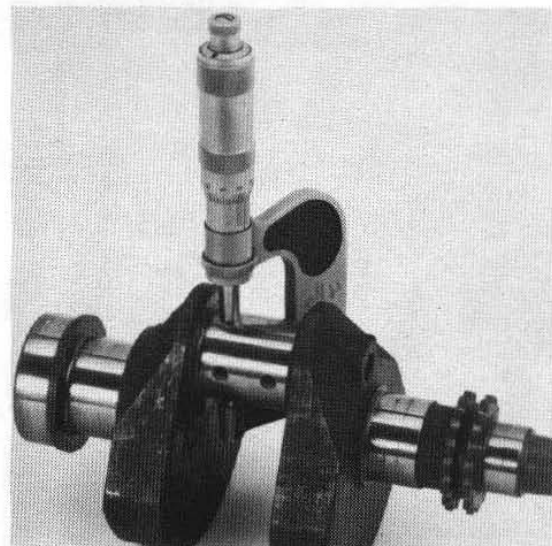
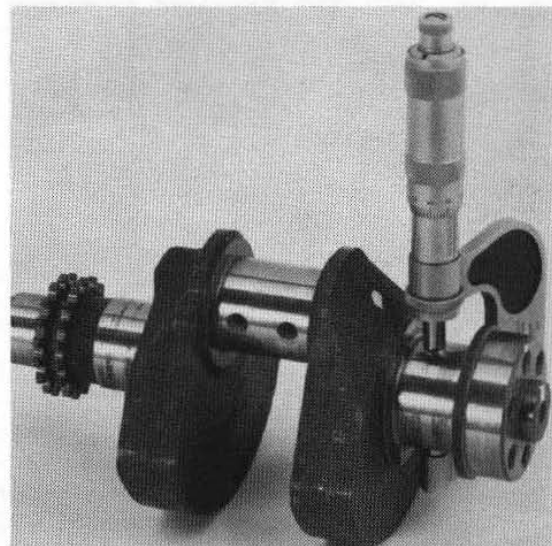
ORIGINAL (production) mm
1.537 +1.543 V35 / V50
1.809 +1.815 V65

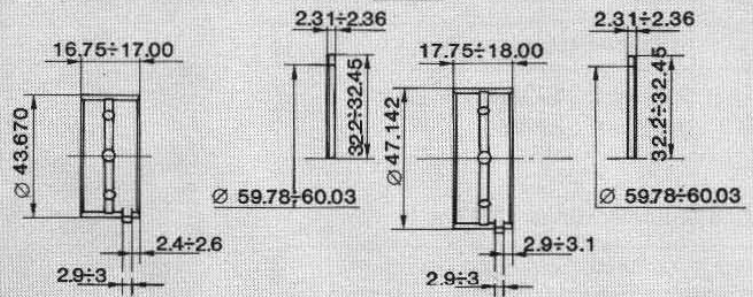
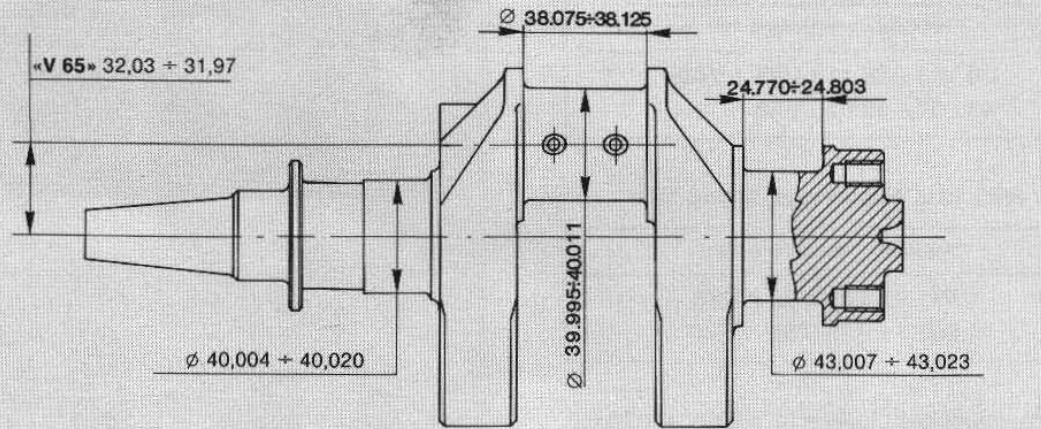
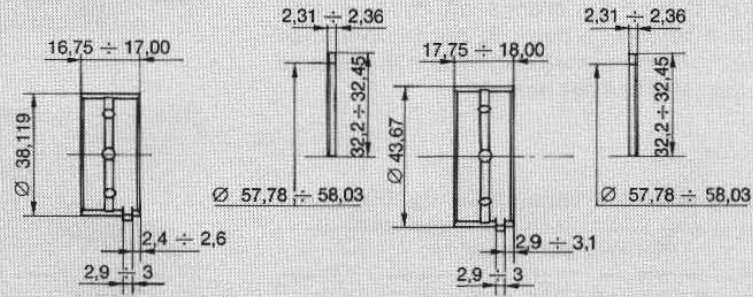
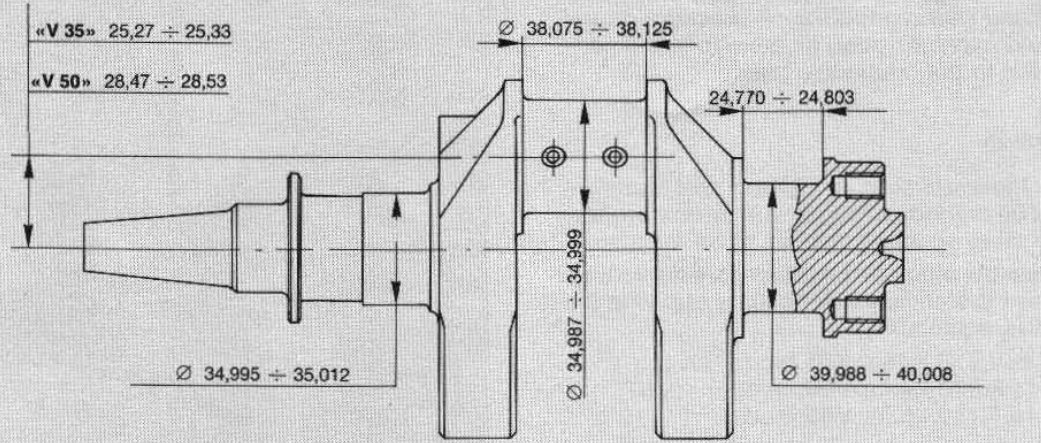
Bearing-mainshaft clearance, timing side (cold)

ORIGINAL (production) mm
0.005 +0.050 V35 / V50
0.007 +0.048 V65

Mainshaft diameter, drive side

ORIGINAL (production) mm
40.008 +39.988 V35 / V50
43.023 +43.007 V65





Bearing housing diameter, drive side

ORIGINAL (production) mm
43.657 + 43.670 V35 / V50 47.130 + 47.142 V65 V

Overall thickness of bearings, drive side

ORIGINAL (production) mm
1.807 + 1.816 V35 / V50 2.044 + 2.050 V65

Bearing-mainshaft clearance, drive side

ORIGINAL (production) mm
0.017 + 0.068 V35 / V50 0.007 + 0.047 V65

Selection of big end pin (fig. 62)

ORIGINAL (production) mm
34.987 + 34.999 V35 / V50 39.995 + 40.011 V65

Thickness of half collar on main shaft, drive side

ORIGINAL (production) mm
2.310 + 2.360

Side play, drive side

ORIGINAL (production) mm
0.35 + 0.40

- Max admissible offset of the two crankshaft axis (con-rod pin, drive, and timing side pins) should not exceed 0.02 mm at a distance of 40 mm.

NB – The illustrations show the crankshaft with double chain.

The single chain has been fitted as from engine No. 29135 (V35); No. 31344 (V50); No. 00001 (V65).

6 LUBRICATION

6.1 REMOVING THE OIL SUMP (fig. 64)

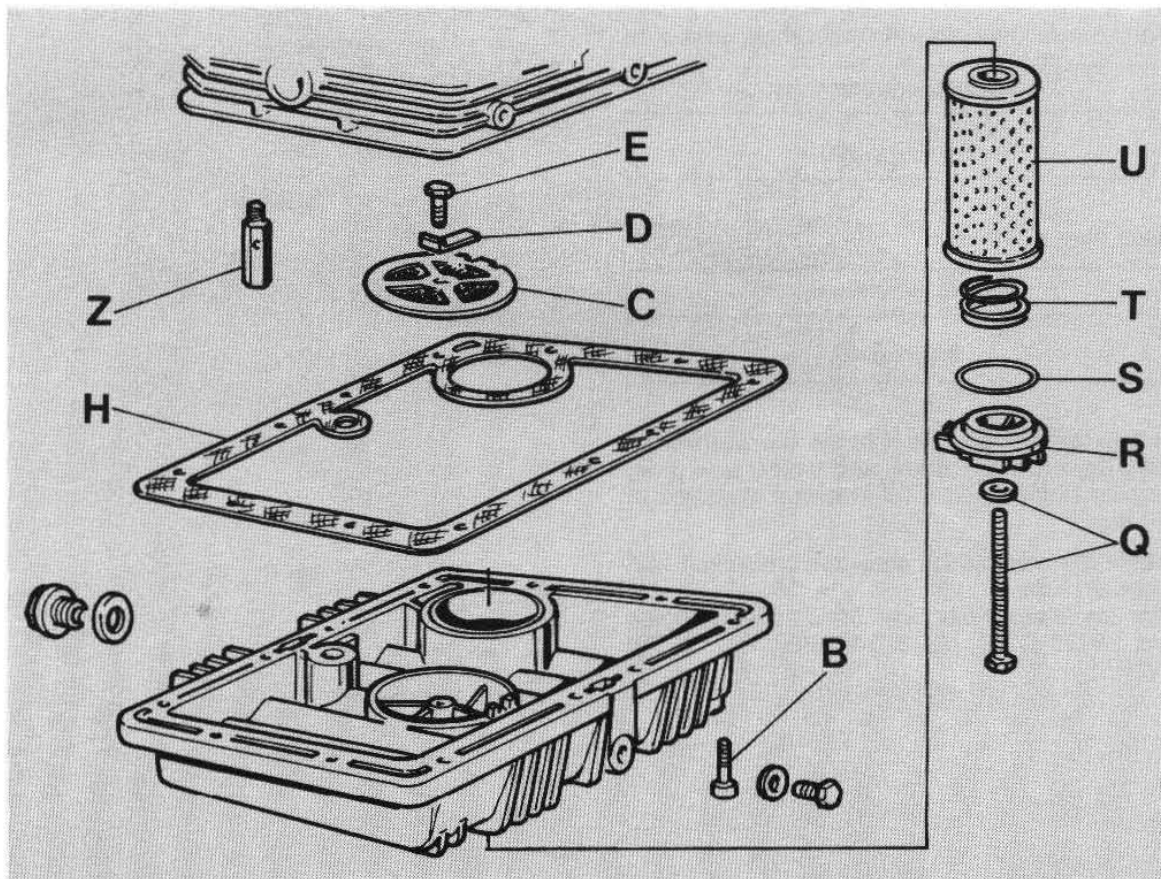
- drain the oil from the sump;
- undo screw «Q», remove plug «R», gasket «S», spring «T» and filtering cartridge «U»;
- undo screws «B» remove sump from the crankcase together with gasket «H»; from the sump remove screw «E», wire gauze «C» after straightening lock plate «D».

Checks

- If the wire gauze filter is dirty, clean it in a petrol bath and dry it off with compressed air;
- ensure the oilways are free;
- ensure the joining surfaces are not damaged.

Re-fitting

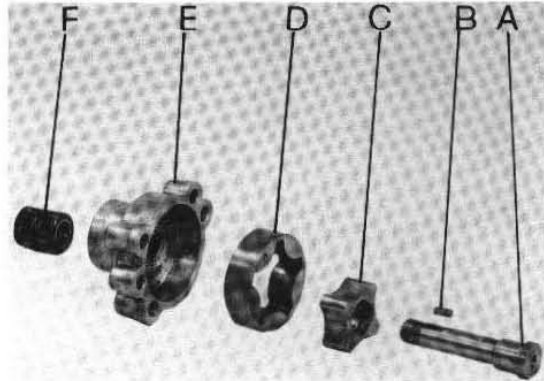
- After these controls and/or any replacements, refit the components reversing the dismantling sequence but do not forget to always replace the sump-crankcase gasket «H». An incorrect assembly of the gasket may cause troubles to the oil circulation.



Tighten the sump securing screws in a diagonal sequence, using a torque wrench set to 1 kgm. The cartridge securing screw have to be tightened with the wrench set to 2.5 kgm. After re-fitting the drain plugs with gasket introduce new oil. Quantity 2 l of Agip Sint 2000 SAE 10W/50. Finally screw on filler cap («A» of fig. 1).

6.2 DISMANTLING THE OIL PUMP

- Dismantle valve gearings as described in section 5.4;
 - from the crankcase remove oil pump after undoing allen screw.
- To strip the oil pump operate as follows (fig. 65):
- take out pump spindle «A»;
 - take out bearing «F» from pump body «E»;
 - take out inner rotor «C»;
 - take out outer rotor «D».



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Inspection

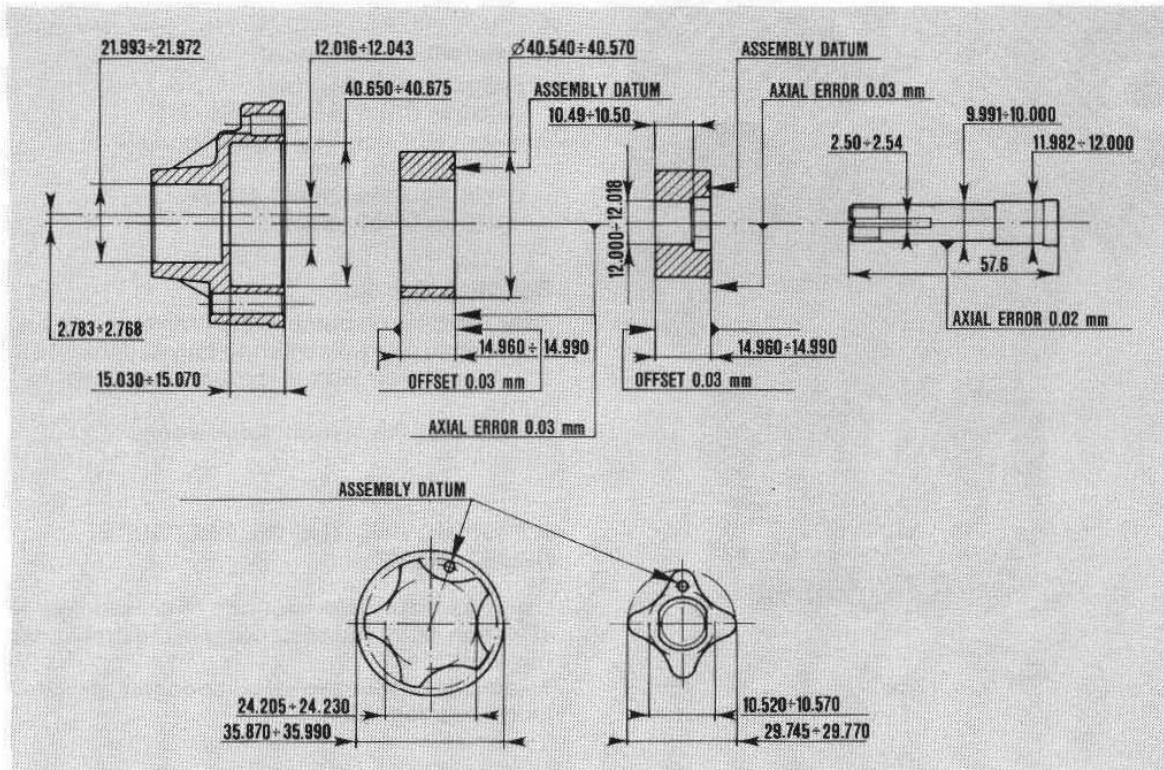
(for dimensions see dwg fig. 66)

■ Pump body («E» of fig. 65)

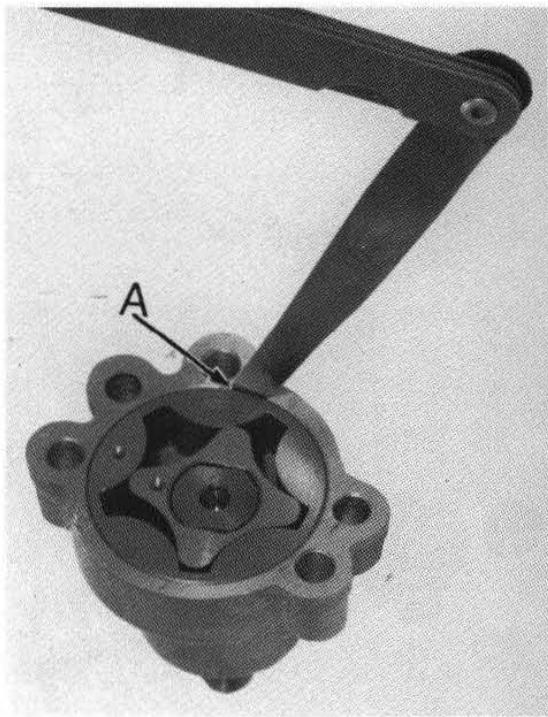
Ensure the outer and inner faces are not scored or nicked.

Pump body data:

- outer rotor housing dia. 40.650 to 40.675 mm;
- dia. of pump spindle hole 12.016 to 12.043 mm;
- dia. of roller bearing housing 21.972 to 21.993 mm;
- housing thickness for outer rotor 15.030 to 15.070 mm.



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■ **Outer rotor** («D» of fig. 65)

Check all the inner and outer surfaces.
If scored in any way, damaged, change both rotors.

Data of outer rotor:

- O/D 40.540 to 40.570 mm;
- I/D 24.205 to 24.230 mm;
- thickness 14.960 to 14.990 mm.

■ **Inner rotor** («C» of fig. 65)

Check smoothness of the inner and outer surface.

If scored or nicked, replace both rotors.

- O/D 29.745 to 29.770 mm;
- I/D of pump spindle housing
12.000 to 12.018 mm;
- thickness 14.960 to 14.990 mm.

■ **Roller bearing** («F» of fig. 65)

Check if roller bearings are in good state.
If damaged replace them.

■ **Oil pump spindle** («A» of fig. 65)

Check the condition, the thread not stripped, the key in the slot not burred, and the contact surface of the inner rotor is undamaged.
If necessary replace the spindle.

Splinde data:

- pump body-housing dia.
11.982 to 12.000 mm;
- roller bearing housing dia.
9.991 to 10.000 mm.

■ **Assembly clearances:**

- pump body-outer rotor
0.080 to 0.135 mm (see fig. 67)
- inner rotor housing-pump spindle
0.016 to 0.061 mm;
- pump housing- pump spindle
0.016 to 0.061 mm.

Re-fitting (fig. 68)

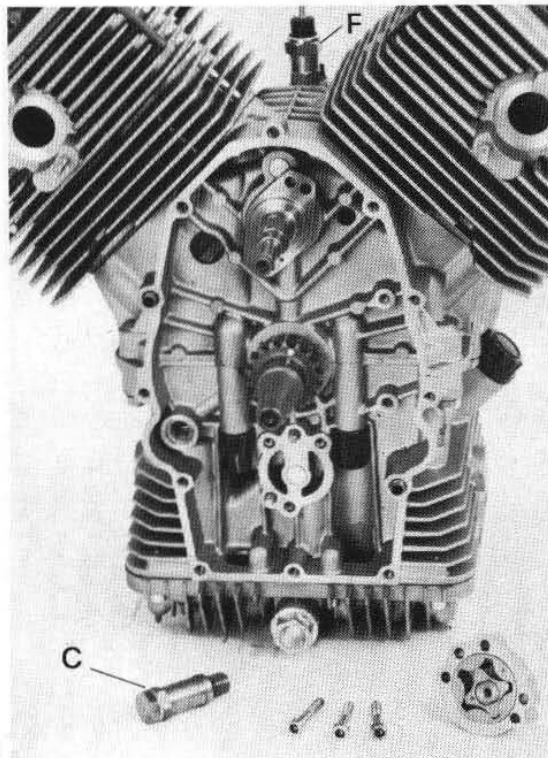
After re-fitting oil pump in the crankcase paying attention to the two centering dowel, tighten with the Allen screw with a torque wrench set to 1 kgm.

Ensure that the spindle turns freely.

6.3 REMOVING THE OIL PRESSURE RELIEF VALVE

Using a suitable wrench, undo oil pressure valve «C» from its threaded housing in the crankcase (fig. 68).

To strip the various valve components, proceed as follows (fig. 69):



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- undo plug «A»;
- remove gasket «B» from the plug;
- remove pressure adjusting disc «C»;
- remove spring «D»;
- remove plunger «E»;
- valve «F» is now completely bare.

Inspection

- Check the efficiency of the pump, ensuring that the plunger slides up and down freely in the valve body.

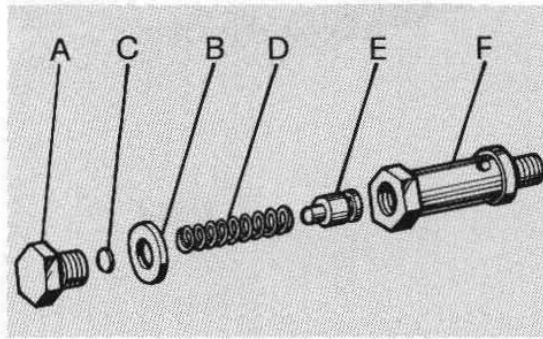
If necessary replace it;

- be sure that the threaded portion of the pump body and plug is in good state;
- ensure spring «D» when compressed to 19.5 mm gives a load of 4.675 to 4.825 kg. Free length of spring is 29.650 mm to 29.350. The dia. is 7 mm and the spire number effective is 15.

To check the load of the spring use the proper tool No. 17949760 with connected a pressure gauge; ascertain that the indicated pressure is as prescribed otherwise operate on cap «C» preloading the spring or on adjusting disc «B» to obtain a different value.

The valve is calibrated for an operating pressure of 3.8 to 4.2 kg/sqcm for models V35-V50; for model V65 a different plug «A» is fitted; the calibrating value is 2.6 to 2.9 kg/sqcm.

To check the calibration see fig. 70.



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6.4 OIL PRESSURE LIGHT SWITCH («F» of figs 68 and 71)

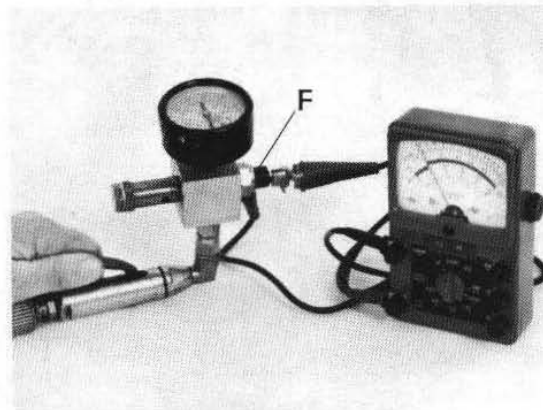
The switch is fitted in the crankcase and is cable connected to a red warning light on the panel board.

If the operating pressure is too low, the lamp does not go out and warns something is wrong with the engine.

In such an event, the engine should be immediately stopped and the cause of the pressure drop looked for.

When the pressure is correct, the light goes out as soon as the engine has reached a certain number of revolutions.

The oil pressure switch opens an electric circuit at a value of about 0.15 to 0.55 kg/sqcm.



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7 CARBURATION

7.1 CARBURETTORS

V 35 II - V 35 Imola - V 35 C

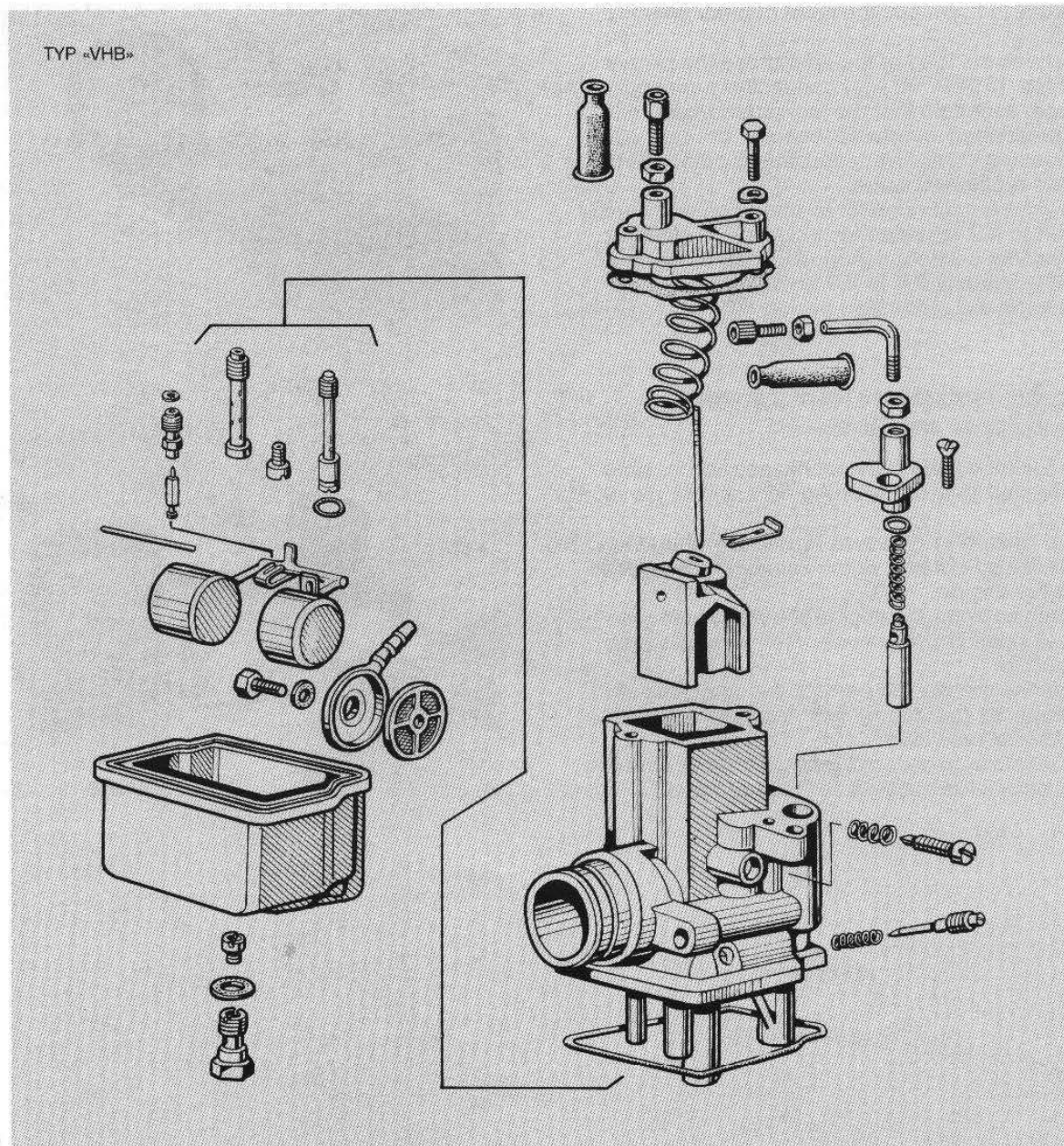
No. 2 Dell'Orto type VHB 26 FD (right); VHB 26 FS (left).

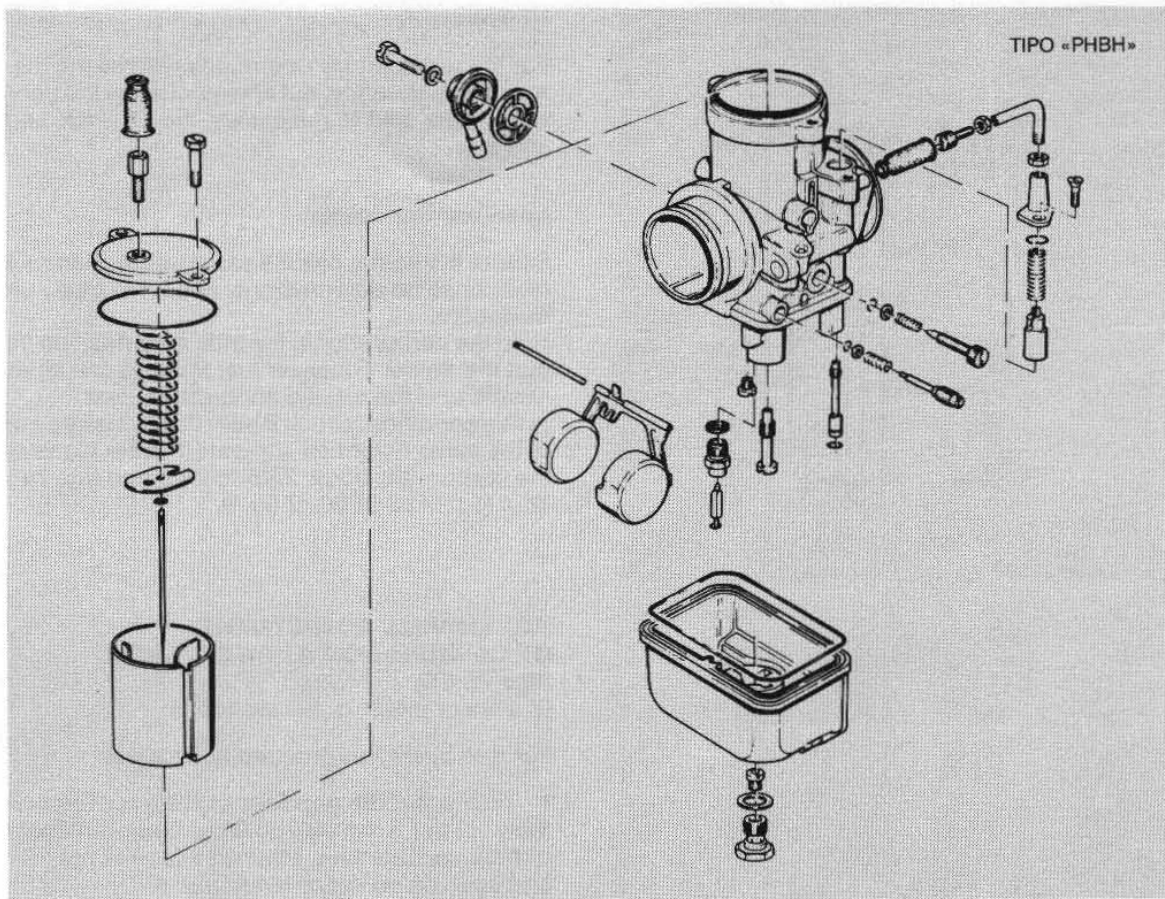
V 50 III - V 50 Monza - V 50 C

No. 2 Dell'Orto type PHBH 28 BD (right); PHBH 28 BS (left).

V 65 - V 65 SP

No. 2 Dell'Orto type PHBH 30 BD (right); PHBH 30 BS (left).





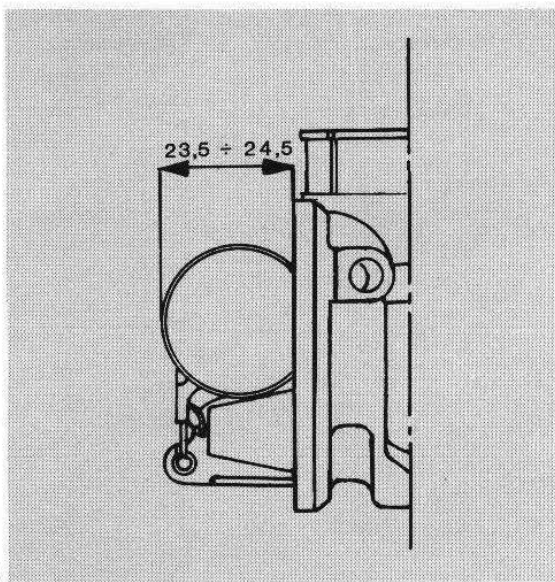
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Carburettor setting

	V 35	V 50	V 65
Choke	∅ 26 mm	∅ 28 mm	∅ 30 mm
Throttle valve	40	50	40
Atomizer	260 AH	268 T	268 T
Main jet	108	118	105
Idling jet	40	50	40
Starter jet	60	60	60
Needle	E 27 (2nd notch)	X 6 (3rd notch)	X 8 (2nd notch)
Floater	14 gr	11 gr	11 gr
Idling adjusting screw	1½ turns	1½ turns	1½ turns

Inspection

Check wear of seats and taper needle.
 Ensure the throttle valve is in good conditions, there are non holes or bumps in the floater, also all gaskets and seals are still efficient otherwise replace them.
 Avoid using steel wires or needles to clean the jet orifices as this might upset carburations.
 Clean with nylon thread or brass wire.



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Re-assembly

For the re-assembly operations reverse the dismantling sequence, but always change the paper gaskets and if necessary the O rings and seals.

Levelling the floater

Ensure the floater has the same weight stamped on it, it has no deformations, and turns freely on its needle.

Hold the carburettor in the indicated position so that the floater equalizer just touches the taper needle and the needle contacts its seat.

In this condition, check if both floater halves are at the same height as compared to the plane of the carburettor body: 23.5 to 24.5 mm (fig. 74). Tool No. 14 92 69 00 of fig. 9.

7.2 MANUAL ADJUSTMENT OF CARBURATION AT IDLING SPEED

(figs 75-76)

(if a vacuummeter is not available)

For this operation proceed as follows:

1 With a throttle grip fully closed, ensure that there is 1 to 1.5 mm play between cable terminals of both carburettors, otherwise loosen nut «G» and operate on cable tensioner «F».

At the end of this operation lock nut «G» and check that both starter cables have about 3 mm idle run at tensioners «E» entry in running position.

Run up the engine to its normal operating temperature.

2 Screw idling screws «C» fully home and then undo them 1½ turns.

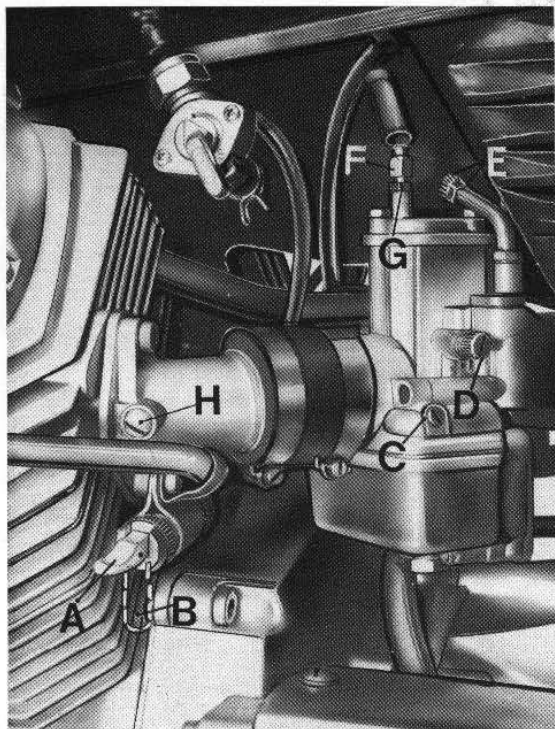
3 Using both hands at the same time, check if the pressure at both exhaust pipe ends is uniform.

In case is different, operate on screw «D» of one carburettor till the pressures are equal (since the idling speed has to be kept at about 1000 to 1200 rpm, it might be necessary to screw in the carburettor screw of the cylinder giving a lower pressure, or to screw out the screw of the cylinder giving a higher pressure).

4 Operating on screw «C» adjust each cylinder to the point where the carburation is best (this is perceived by a slight increase of the engine revs) and then reset the idling speed as described at point «3».

5 Disconnect one plug lead at a time and check that in each instance the engine stops after firing the same number of strokes.

If not undo screw «D» of the carburettors for the cylinder firing too much or screw in the carburettor screw of the cylinder firing less.



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6 Check if the throttle slides open simultaneously, as follows: with the assistance of a second person, slowly and gradually turn the twist grip and with both hands check if the pressure increase at each exhaust pipe end is synchronous.

If not, adjust the carburation of the cylinder in advance (as compared to the other) by gradually screwing in cable adjuster «F», after loosening counternut «G» until the pressure is the same for both exhaust pipes.

7.3 CHECKING THE CARBURATION WITH A VACUUMETER (fig. 76)

For this operation proceed as follows:

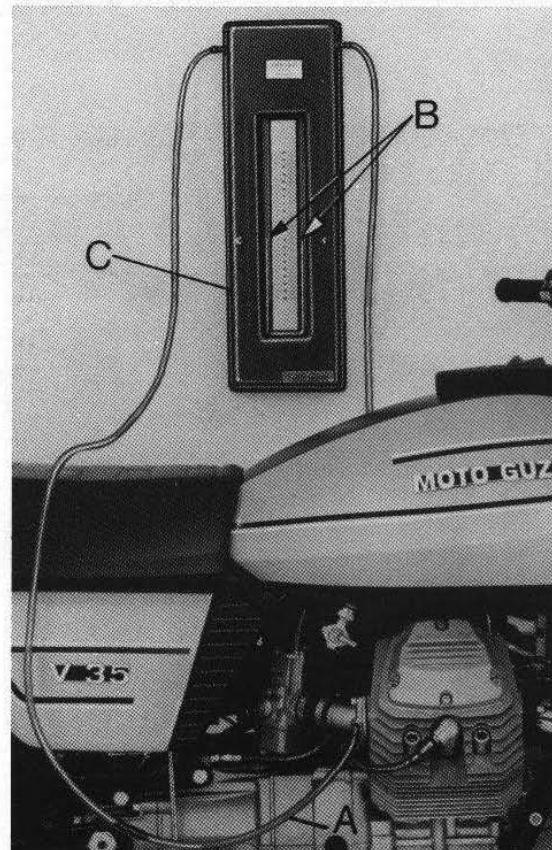
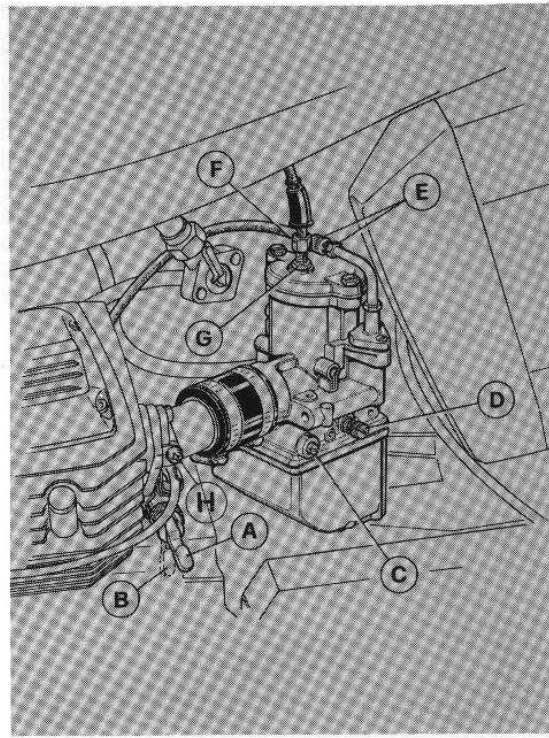
- 1 Set up the byke on the center stand.
- 2 Remove plugs and washers on intake pipe «H» (fig. 75).
- 3 Screw in the vacuumeter pipe connectors «A» in the intake pipe holes.
- 4 Screw in fully screw «C» (fig. 75) and then undo it 1½ turns on both carburettors; check that the two cables have a play between 1 to 1.5 mm at their terminals «F» (fig. 75). Check also that both starter cables have about 3 mm idle run at tensioner «E» (fig. 75) in running position «B» (fig. 75).
- 5 With the engine at idling speed and its operating temperature, adjust screw «D» until both mercury columns «B» are at the same height on the vacuumeter dial «C».
- 6 Adjust position of idling screw «C» (fig. 75) to obtain the highest possible idling revolutions and then recheck the position of the mercury columns «B» on the vacuumeter dial «C» and if necessary repeat operation of point «5».
- 7 After adjusting idling speed (1000 to 1200 rpm) synchronize both carburettors as follows:

■ start the engine and gradually open the twist grip observing on the vacuumeter dial «C» if both mercury columns «B» are lined up.

If not operate on the throttle cables «F» (fig. 75) after loosening nut «G» (fig. 75) till both columns are aligned.

Ensure also that both terminals of the starter control cables at the adjuster «F» (fig. 75) have still an idle run.

Finally unscrew the vacuumeter line connectors «A» on intake pipes and refit the plugs with their washers.



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7.4 AIR FILTER AND BREATHER UNITS WITH LINES (fig. 77-77/A)

Inspections

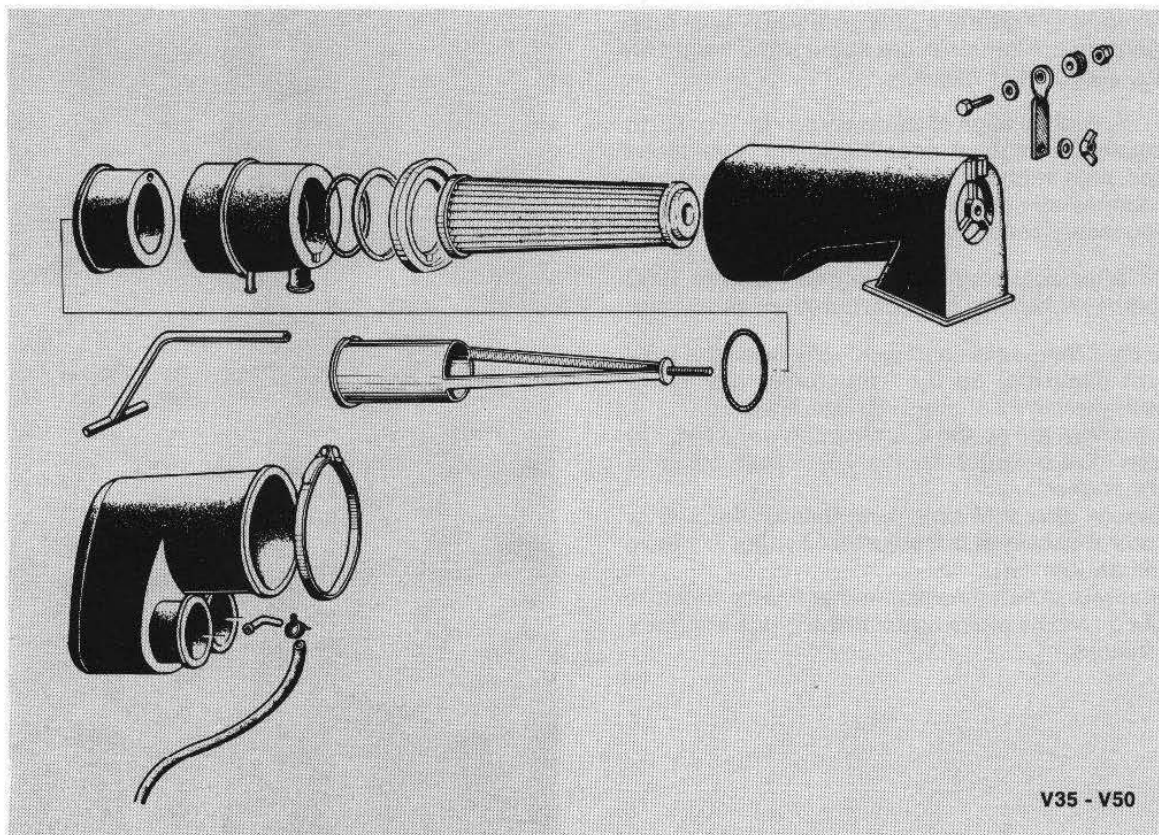
If the filter is very dirty, replace it with an original one otherwise blow it through with low pressure compressed air.

Normally the air filter should be replaced every 10.000 km or more frequently when riding on very dusty roads.

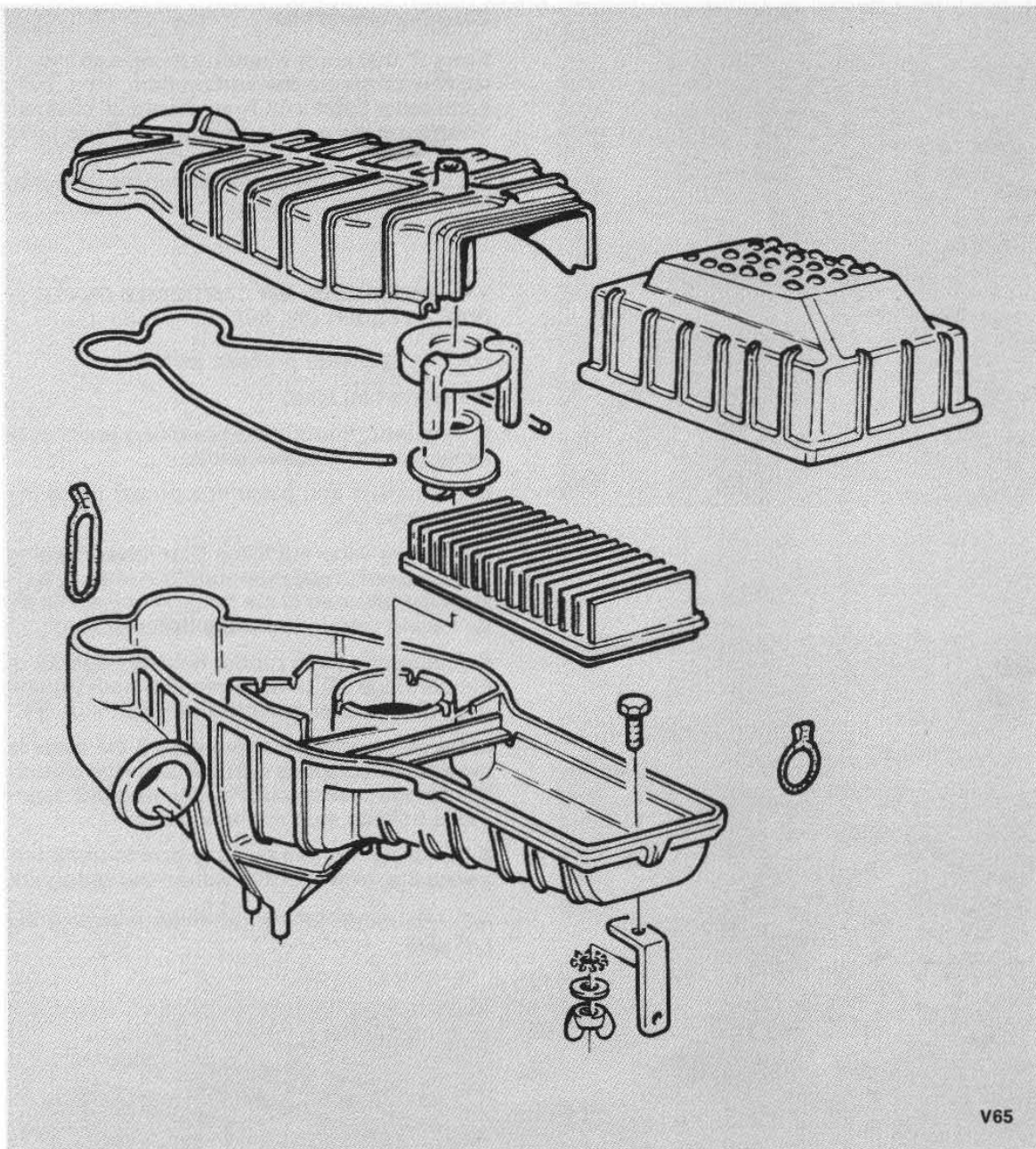
Check cleanliness of the breather and wash all parts in petrol, drying off with compressed air. Ensure also the cylinder head-breather and breather-engine lines are in good state, with no cracks or holes.

Otherwise replace them.

Check also that the ball in the front breather element (mod. V35-V50) moves freely and that all breather ducts are not deformed or obstructed.



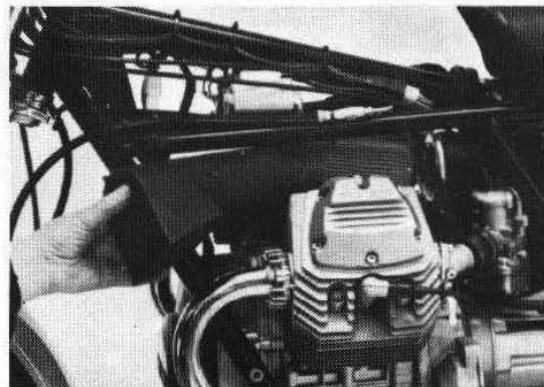
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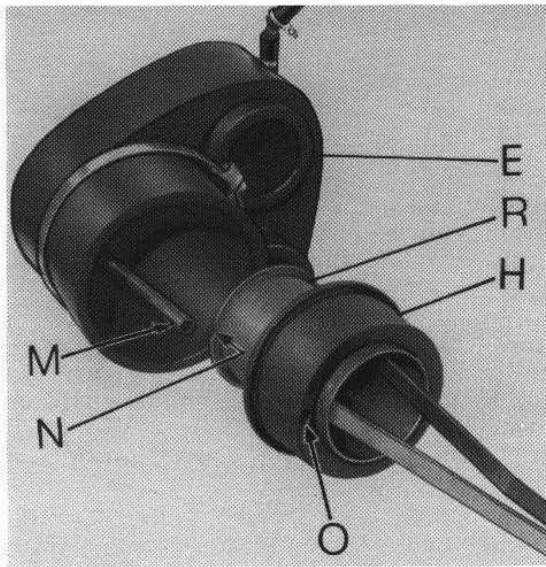


**7.5 REMOVING THE FILTER CARTRIDGE
(V35 - V50) (fig. 78)**

Lift the seat and remove the fuel tank.
Unscrew wing nut fixing the filter components,
remove the washer support plate and rotate it
slightly on the screw fixing it to the frame, sleep
out between cylinder and frame the filter car-
tridge and its housing.

*NB – In order to facilitate the re-assembly mark
on all components a reference in correspon-
dence of hole «O» on sleeve «H» of flaring «N»
on filter housing «R».
This to easily introduce pipe «M» in sleeve «E»
(fig. 79).*





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Cleaning operations

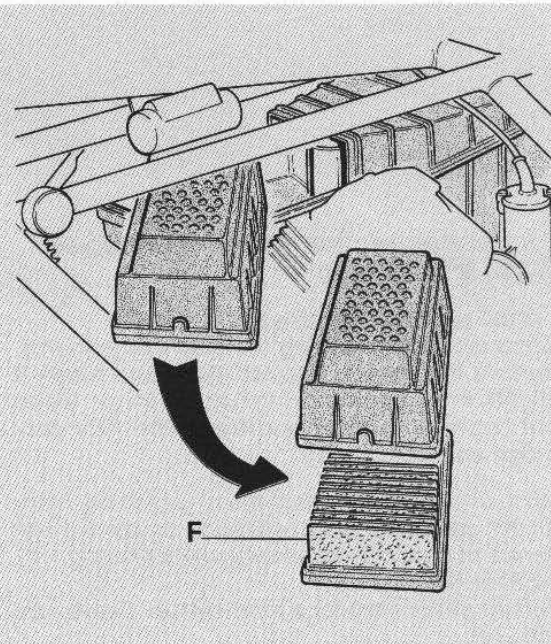
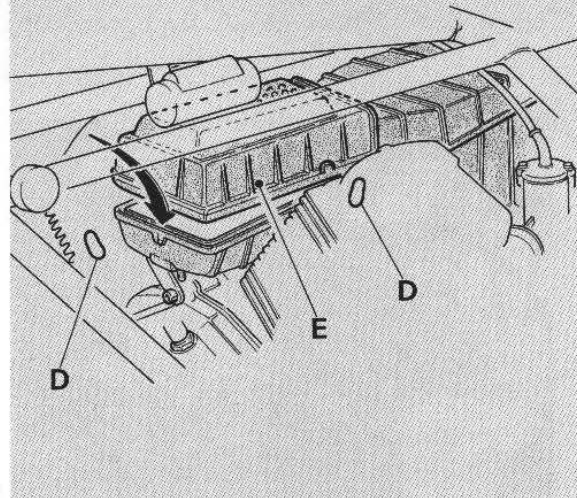
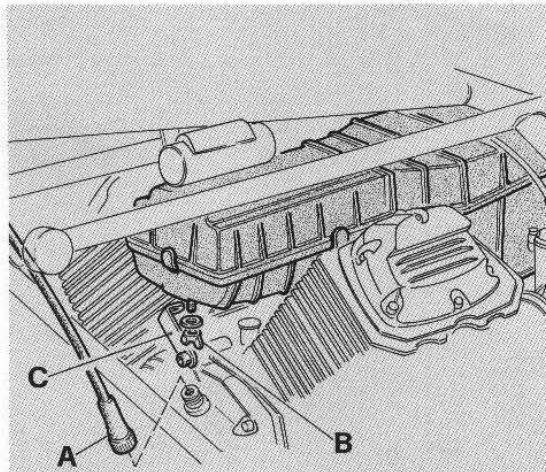
Every 10.000 km or whenever there is an irregular flow of fuel to the carburetors, taps, tank, carburettor filters and lines should be cleaned. Wash them in a petrol bath and dry off with compressed air. It is also advisable to blow through the tap ducts, filters and lines.

7.6 REPLACING AIR CARTRIDGE FILTER (V65 - V65 SP) (fig. 80)

For this operation proceed as follows:

- remove fuel tank;
- from the cylinder head-cover connections remove both oil breather ducts;
- disconnect and place in a proper place the rev counter (A);
- unscrew wing nut fixing filter lower housing to the support; rotate support (C) in order to facilitate the lowering of the housing same, this after having unscrewed fixing allen screw;
- remove the three rubber holding rings (D) of the cartridge (E) cover; lower the housing and remove the cover complete with cartridge (F);
- the re-assembly is more easy if the cover is assembled complete with the cartridge already fitted in the cover same. Pay attention to the cartridge holding stud in the housing;
- complete the re-assembly operation by following the reverse of the dismantling sequence.

NB – For model SP it is necessary to remove the L/H side.



80

70

8.1 REMOVING THE GEARBOX FROM THE FRAME AND FROM THE SWINGING FORK (fig. 81)

Undo the screws of the dust protection holding clamp and bend the protection edge sufficiently to slip out the rear fork complete with rear wheel «N» and cardan joint «L».

Unscrew nut «B» from the pin «C» of swinging fork; undo the pin and slip out the rear swinging fork complete with wheel and cardan joint from the gearbox.

Pay attention to the line-up washer fitted on the right side of the pin.

Undo the screws fixing selector lever «I» and slip out the lever complete with rod.

Remove screws «A» fixing gearbox «D» to cradle «E» and then remove the gearbox same from the arms.

Remove the central stand «F»; the side stand «G»; the foot-rest «M».

The left hand front brake and rear brake control lever «H» complete with rod.

Inspection

Ensure that the central stand «F» is not deformed, that the pin holes are not ovalized, that the pins are in good conditions and that the return springs are not elongated so as to loose their load.

At 10 mm elongation the spring should give a load of $3.0 \pm 5\%$ kg;

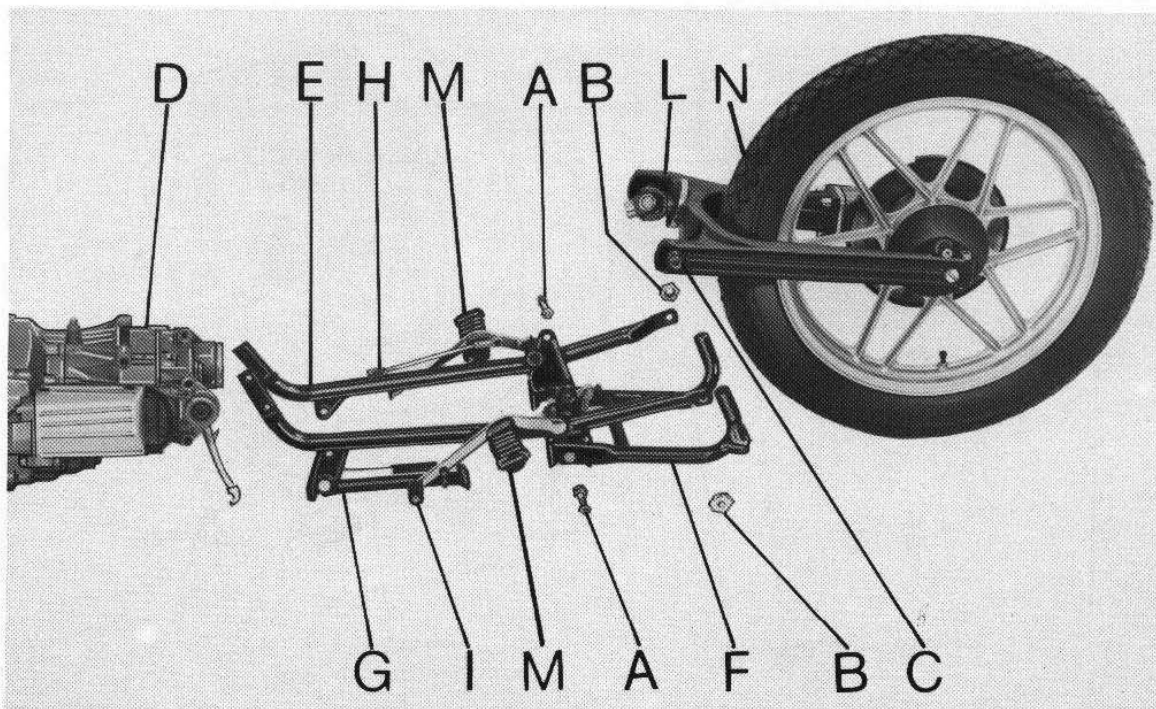
■ check that the side stand «G» is not deformed and that the return spring has not loosed its load.

A 10 mm elongation spring should give a load of $4.2 \pm 5\%$ kg;

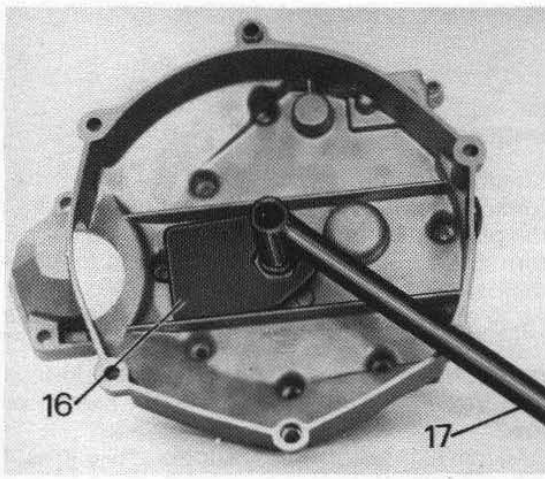
■ ensure that the foot-rest, the rear brake and left front brake control lever are not deformed;

■ check threaded portion of the spindles connecting the swinging fork to the gearbox. If stripped replace them;

■ ensure that the nylon bushes of the brakes and gearbox levers are not deformed. Otherwise replace them.



81



82

8.2 CLUTCH HOUSING

Removal (figs. 82-83)

After having removed the gearbox from the frame to remove the clutch housing proceed as follows:

- drain the oil from the gearbox;
- undo the Allen screw «F» of fig. 83 fixing the clutch housing to the gearbox;
- tap lightly the clutch housing with a mallet to separate it from the gearbox.

Remove the housing complete with the clutch shaft;

- set up the nut holdfast tool part No. 19907100 (16 in fig. 82) and using tool 19905400 (17 in fig. 82) turn the shaft slowly to undo the nut itself. For model V65 use for the clutch shaft tool No. 19907160 and for the nut shaft tool No. 19905460.

- remove shaft «I» from bearing «D» on clutch housing «H»;

- remove seal ring «L» from shaft;

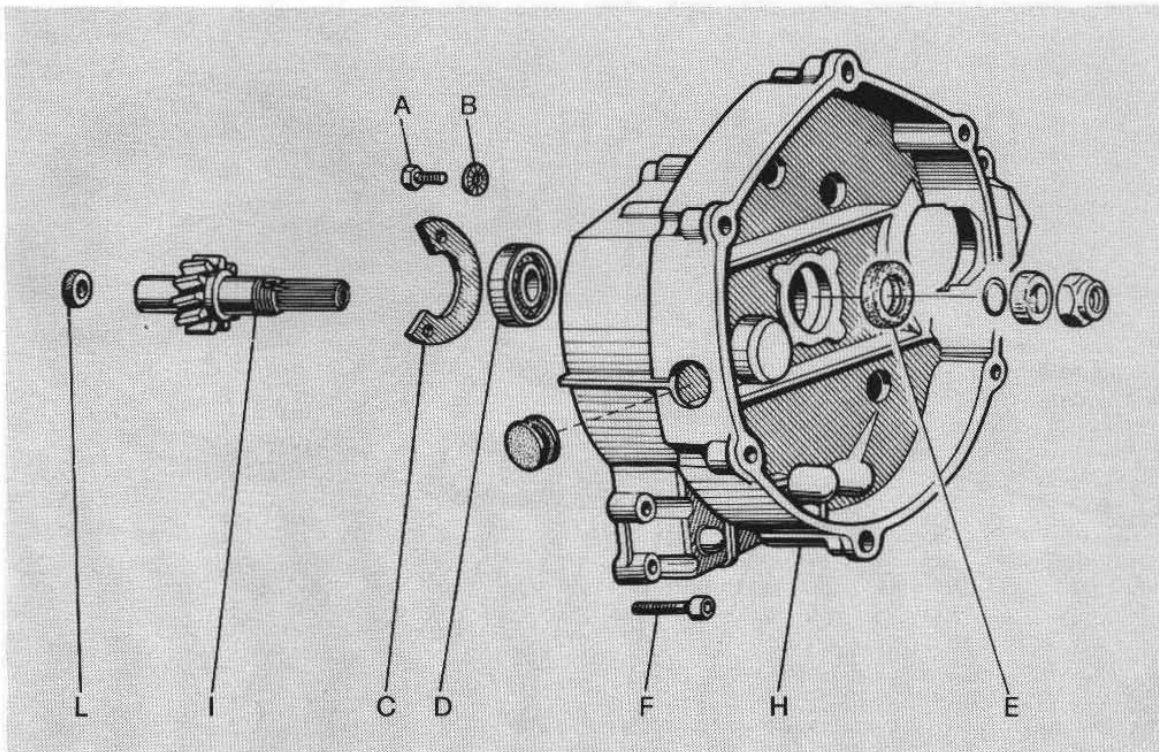
- undo the three screws «A» complete with washers «B» and remove plate «C» retaining bearing «D»;

- using a suitable punch tap lightly from the inside to remove bearing «D» from its seat;

- by the aid of a suitable punch take out seal «E» from the outside.

Inspection

- check that the bearing is not damaged and operates freely;

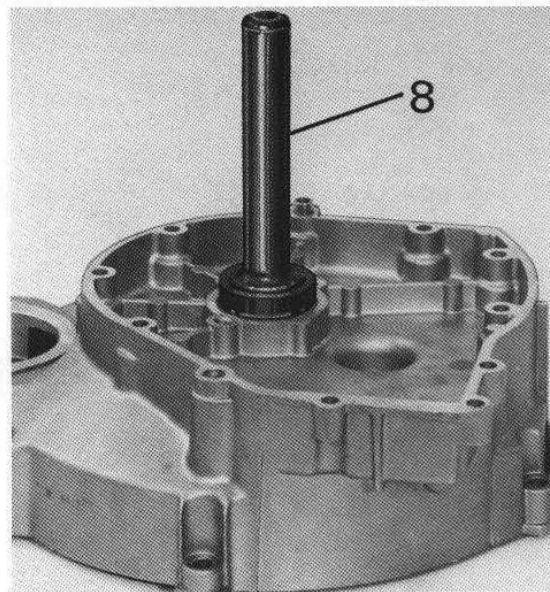


83

- check teeth wear of the clutch shaft, also smoothness of its splines;
- check condition of the gear and cover seals.

Re-assembly

- Using punch 19929400 (8 in fig. 84) press in the bearing after having lubricated its inner and outer surfaces with a Loctite coat;
- fit bearing retainer with washer on the cover and tighten screw;
- fit the seal on the clutch shaft using punch 19905900 (10 in fig. 85);
- insert the splined end of the clutch gear in the previously mounted bearing and tap it with a mallet in its housing;
- re-fit the seal using punch 19926700 (27 in fig. 86) and bushing 19927300 (1 in fig. 86). Tighten the nut on the threaded end of the clutch shaft using tool 19907100 (16 in fig. 82) and tool 19905400 (17 in fig. 82).



84

8.3 CLUTCH

Removal (see fig. 87)

For this operation remove:

- lever return spring from its housing «F»;
- split pin «G» withdrawing dowel «H» and clutch operating rod on gearbox cover «I» complete with adjusting screw «L» and nut «M».

Press on the clutch operating rod to take off the cover:

- remove the outer body «A» from the seal «B»;
- remove thrust bearing «C»;
- remove the inner body «D» and then control rod «E».

Inspection

- Ensure the surface of the outer body contacting the boss on the cover is not scored or damaged.

If so replace the outer body;

- ensure that the thrust bearing has not damaged the cover otherwise replace the cover;
- ensure the seal is not crumpled or hardened. In any case it is a good rule to always replace this;

- check the condition of the thrust bearing and its rollers.

If damaged replace it;

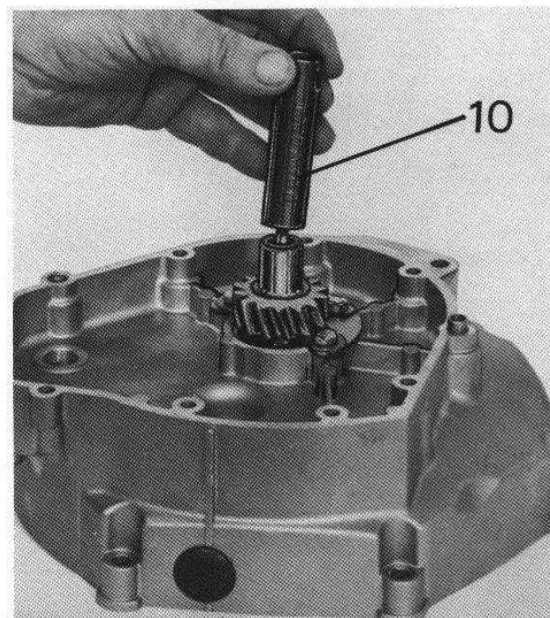
- ensure the end section of the inner body is not unduly worn.

If so, replace both the inner and outer body;

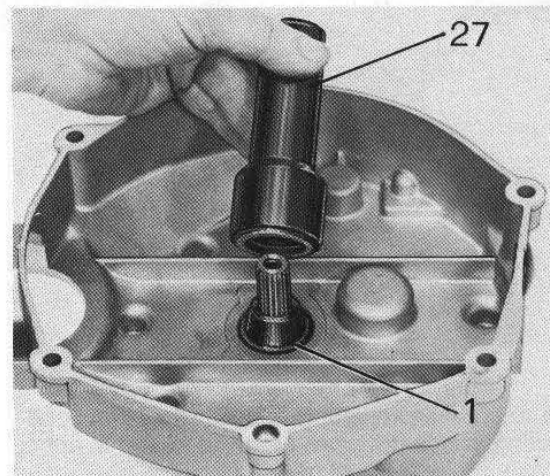
- check the straightness of the control rod. Do so by rolling it on a flat surface in which it should contact all along its length.

If bent, straighten or replace it;

- check the efficiency of the lever return spring. If deformed or has lost its efficiency, replace it;

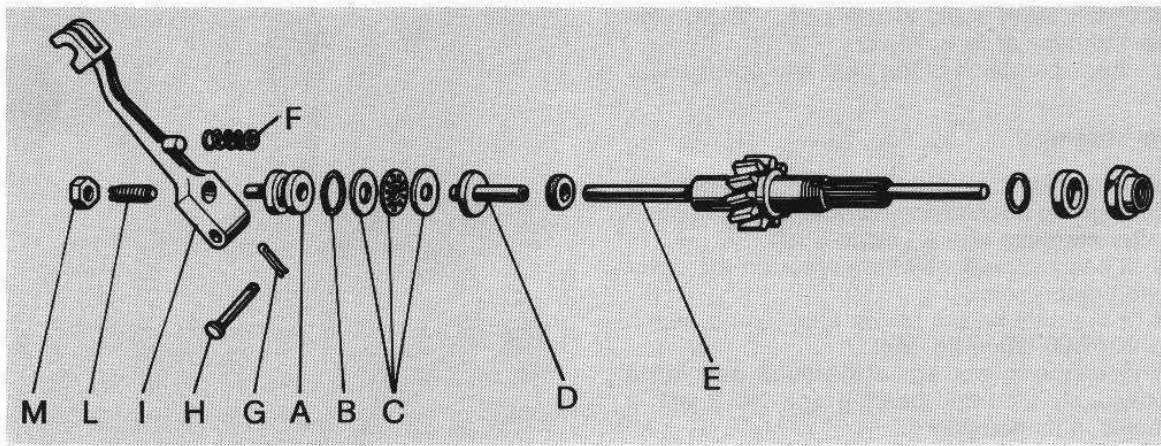


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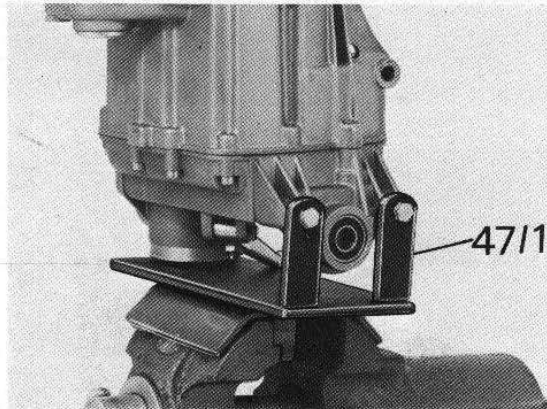
87



Re-assembly (fig. 87)

To re-assemble the clutch, reverse the dismantling operations but ensure that spring «F» is properly seated in its housing on the cover and that lever «I» is secured with a rubber band to vent plug.

88

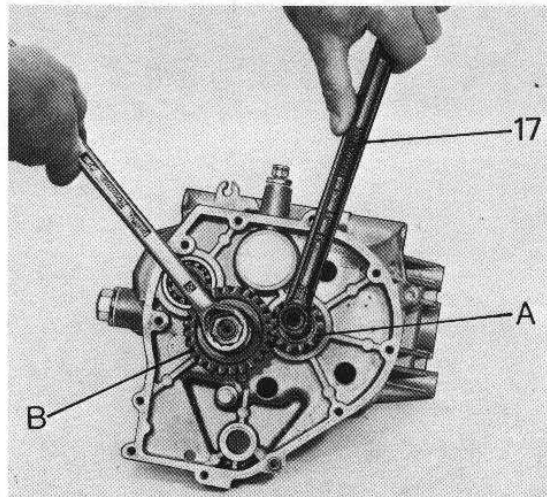


8.4 GEARBOX

Dismantling

- Set up the casing on its supporting plate part No. 19902500 (47/1 of fig. 88) previously gripped in a vice;
- set up clutch shaft («A» in fig. 89) in gearbox casing «C» so that its gear engages main shaft gear («B» of fig. 89);
- on the shaft splines fit holdfast tool No. 19905400 (17 of fig. 89) for models V35-V50 and tool No. 19907160 with tool No. 19905460 for model V65;
- undo the clutch gear securing nut, remove shim, take off bushing and the gear;
- undo vent plug with gasket «A» from the box, remove spring «B» and dowel «C» (fig. 90);
- undo the Allen screws «D» (fig. 90) fixing the cover and remove the box from the cover complete with gears and shafts (fig. 90/1).

89



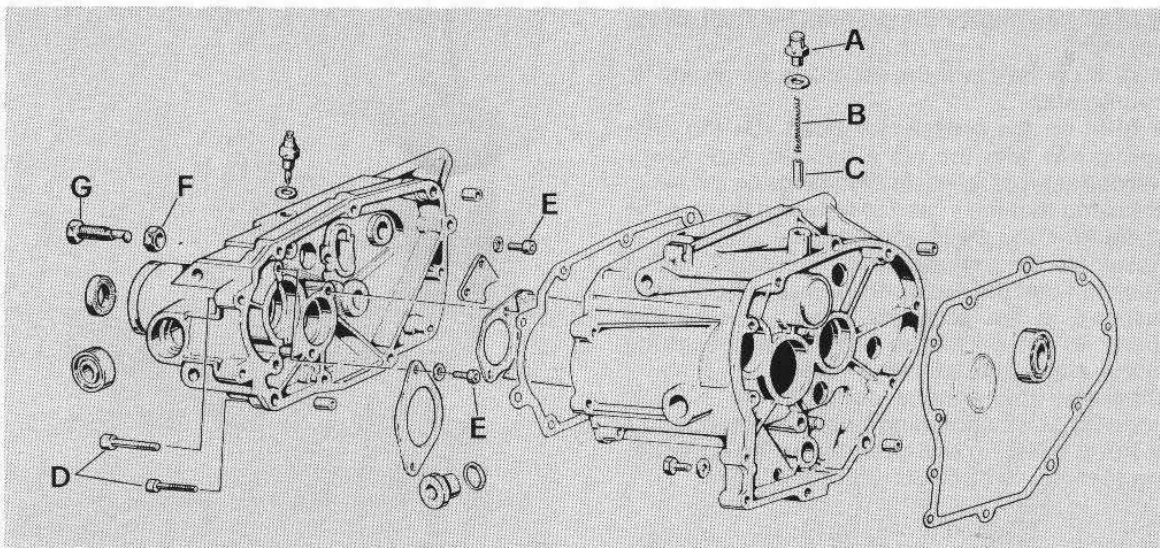
Inspection

- Check that the joining faces are not scored or nicked;
- check the conditions of the bearing and if necessary replace it.

Re-assembly

- Re-fit the clutch shaft bearing by the aid of tool No. 19929400 (8 of fig. 91);
- re-fit main shaft bearing using tool No. 14929200 (22 of fig. 92) only for model V65;

- ensure the adjusting screw on the clutch operating arm is not worn or stripped and in either case, replace the screw.



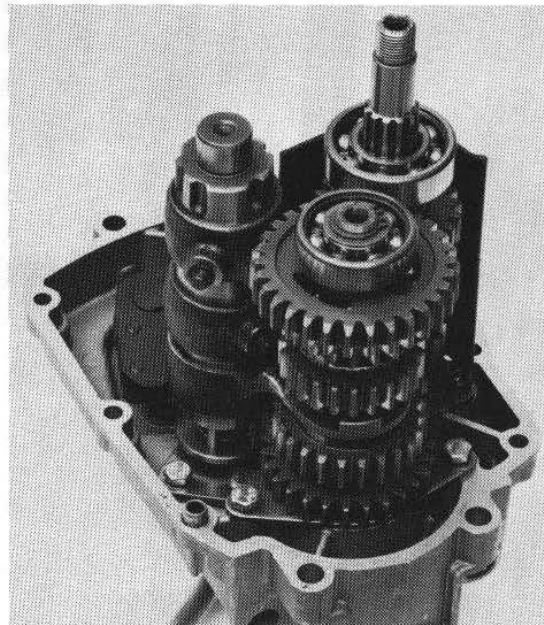
90

- insert tapered race on layshaft using tool No. 1992 64 60 (fig. 92/1) only for model V65;
- for the other components reverse the dismantling sequence.

8.5 GEARBOX COVER

Removal

- Undo the neutral indicator switch «B» (fig. 93);
- undo screws «E» (fig. 90) fixing plate bearings and shaft on the cover and slip out the group complete with gears, shafts and sliding forks;
- undo counternut «F» and unscrew eccentric screw positioning preselector «G» (fig. 90);
- remove preselector from its seat;
- using puller No. 1992 76 00 (26 of fig. 93) remove swinging arm spindle bearings if required.



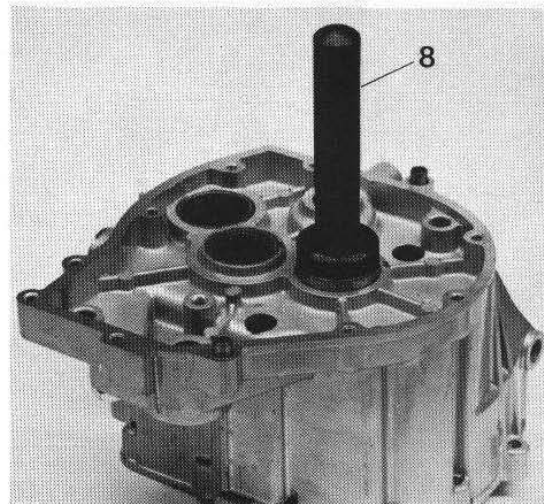
90/1

Inspection

- ensure that the seals have not become hard or crumpled;
- ensure preselector spring «A» of fig. 96 is not deformed or has lost its elasticity. If so, replace it;
- check conditions of bearings. If necessary replace them;
- ensure cover joining face is not scored or nicked;
- ensure neutral indicator is still efficient. If not, replace it.

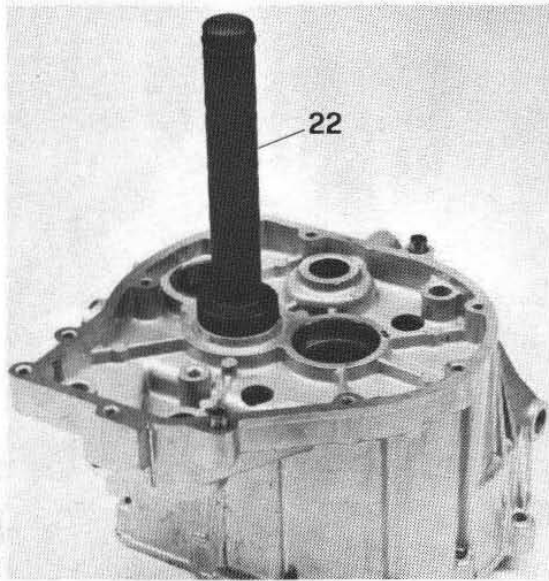
Re-assembly

- by the aid of punch No. 1492 72 00 (11 of fig. 94) re-fit layshaft seal ring;

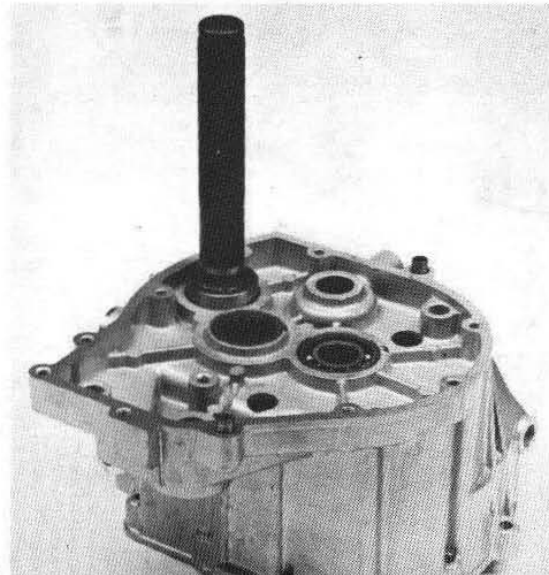


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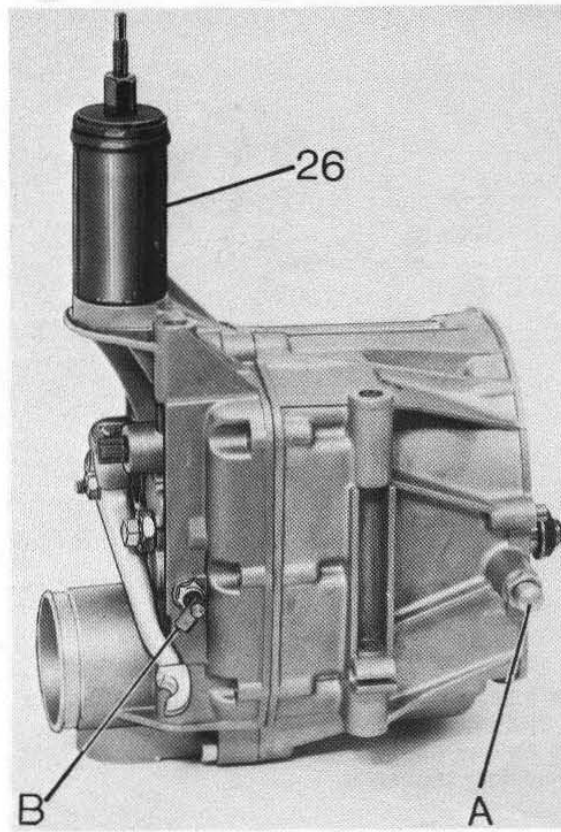
- re-fit seal ring for the preselector shaft on the cover;
 - re-fit on the cover the eccentric screw and its counternut;
 - re-fit on the preselector bush «B» (fig. 96), spring «A» with the more bended part downwards; insert parallelly the two tangs on the stake checking that the distance between them is the same from the stake and from the tangs.
- Assemble the preselector on the cover paying attention that the two spring tangs are correctly inserted in the eccentric screw; ensure that there is not excessive play between spring tangs, stake and adjusting screw.
- Otherwise this can be corrected by suitably bending or straightening one of the two tangs.
- Re-fit swinging arm bearings on the cover using tool No. 19926600 (25 of fig. 95):



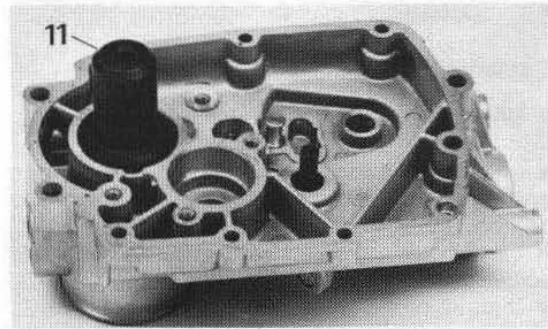
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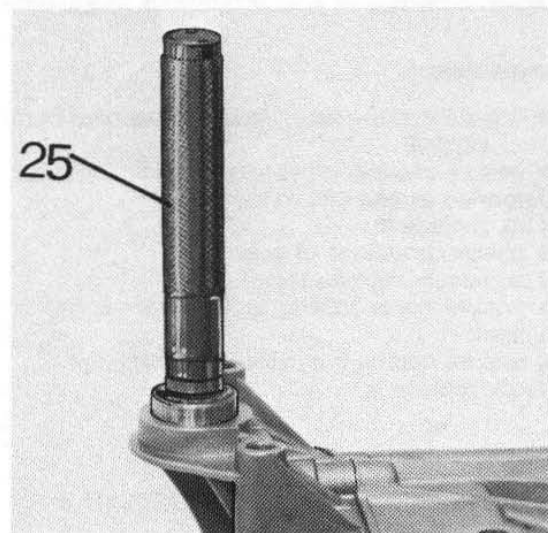
92/1



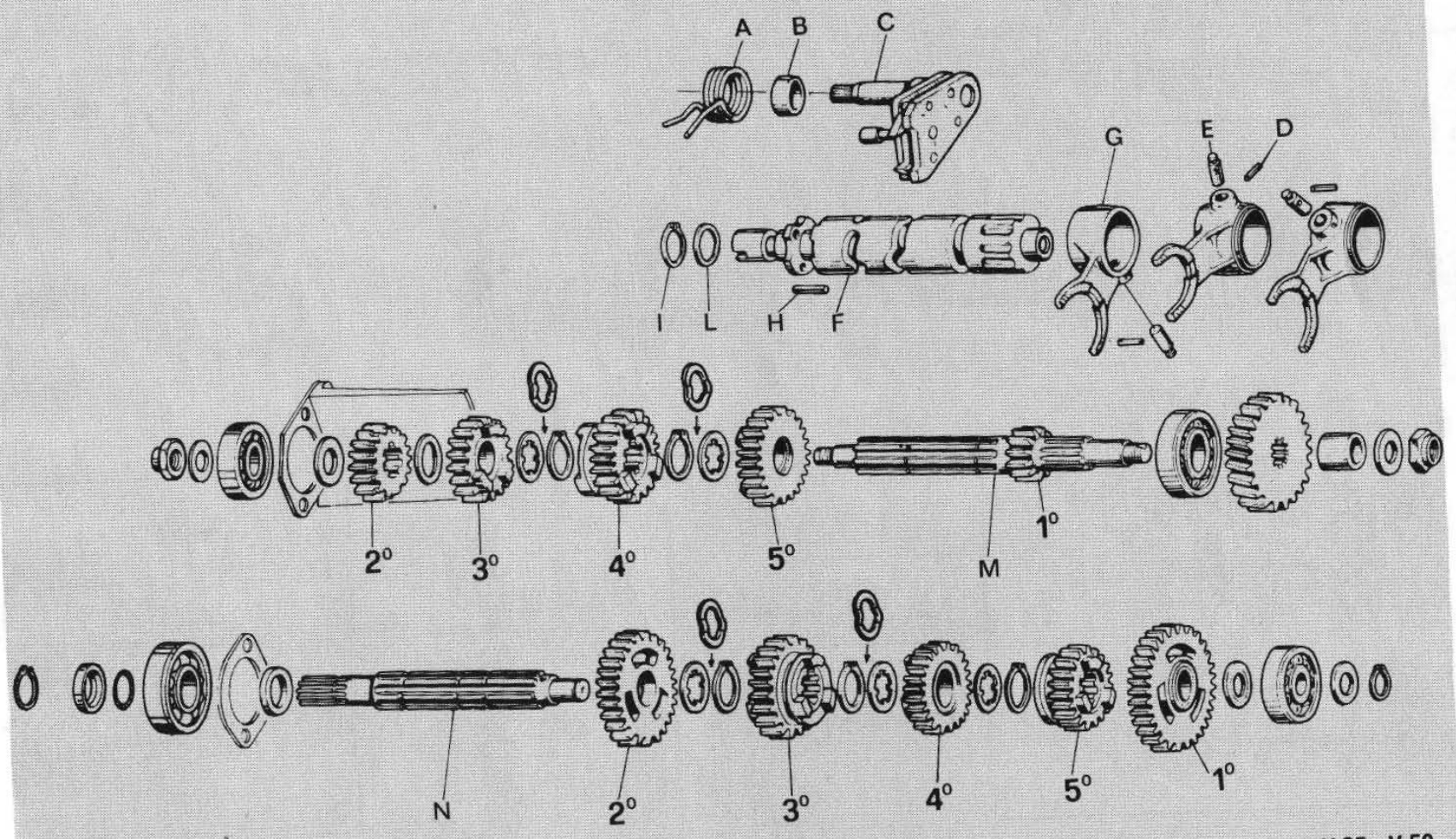
93



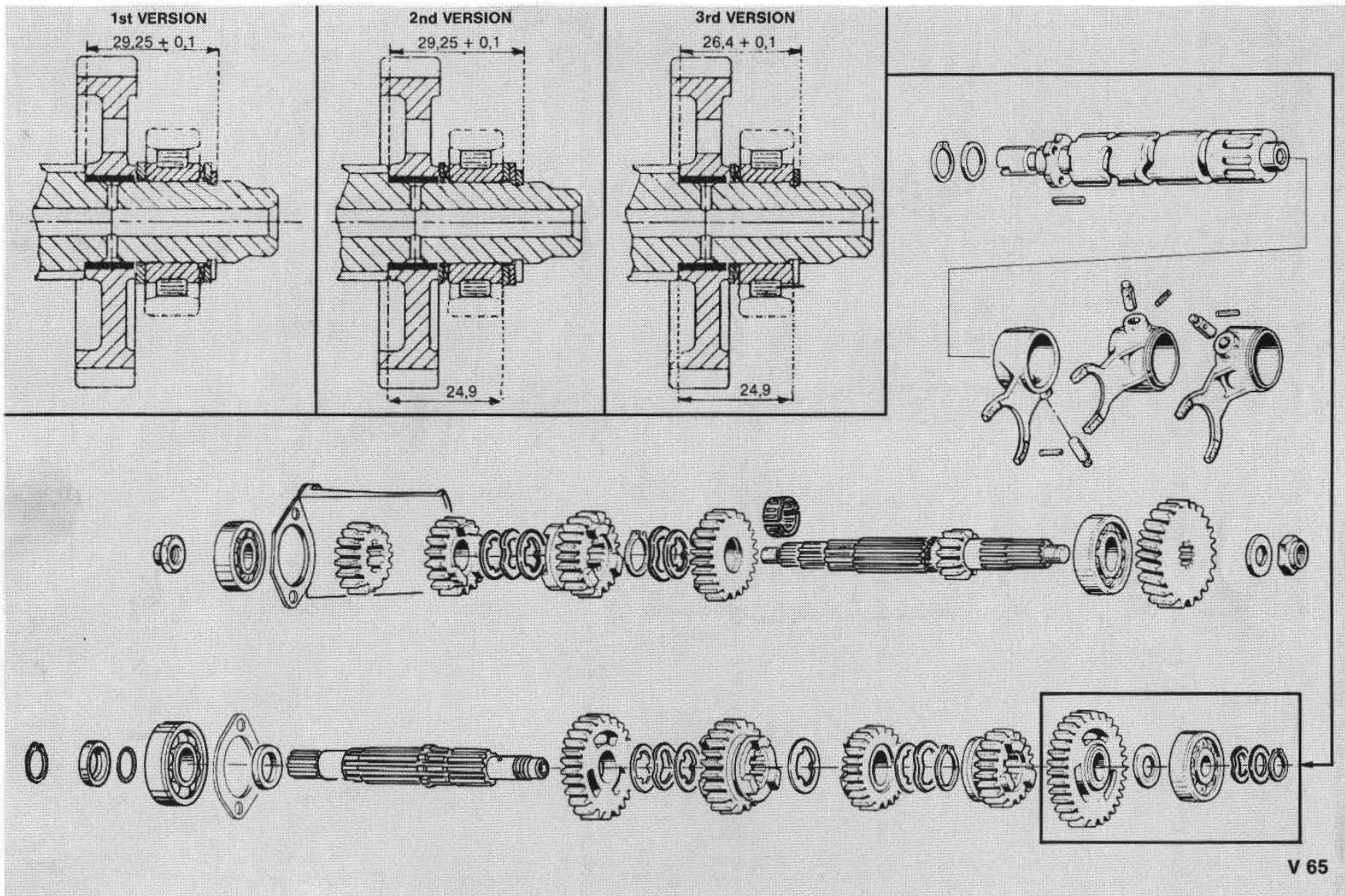
94



95



V 35 - V 50



Dismantling (see fig. 96)

- remove split pin «D» and remove pins «E» from the forks;
- withdraw desmodromic shaft «F», forks «G» and pins «H» contacting preselector lugs «C»; after having removed seal ring «I» and washer «L»;
- from the mainshaft «M» and from the layshaft «N» disassemble the components as indicated in the drawing.

Inspection

- check wear of teeth and grooves on the shaft mounted gears.
If worn or nicked, replace the damaged part or parts;
- ensure the splines and the teeth of the gear machined on main shaft are in good state.
If worn out or damaged, replace the main shaft;
- check splines on the layshaft.
If scored or damaged, replace the shaft;
- make sure the circlips have not lost their elasticity otherwise replace them;
- check the tab washers are still in good state or else replace them;
- check condition of the low gear bush on layshaft.
If excessively worn replace it, bearing in mind these data:
 - I/D of the bush pressed into the gear: 17.045 to 17.064 mm;
 - assembly play of layshaft - 1st gear bush: 0.016 to 0.043 mm;
- check wear of the desmodromic shaft splines contacting the pawl and the selector fork pins.
If wear is excessive, change the shaft.

Check also wear where the selector stop pawl operates.
Ensure also that these turn freely.

Re-assembly

Reverse the dismantling sequence.

8.7 GEAR SELECTOR

Dismantling (fig. 98)

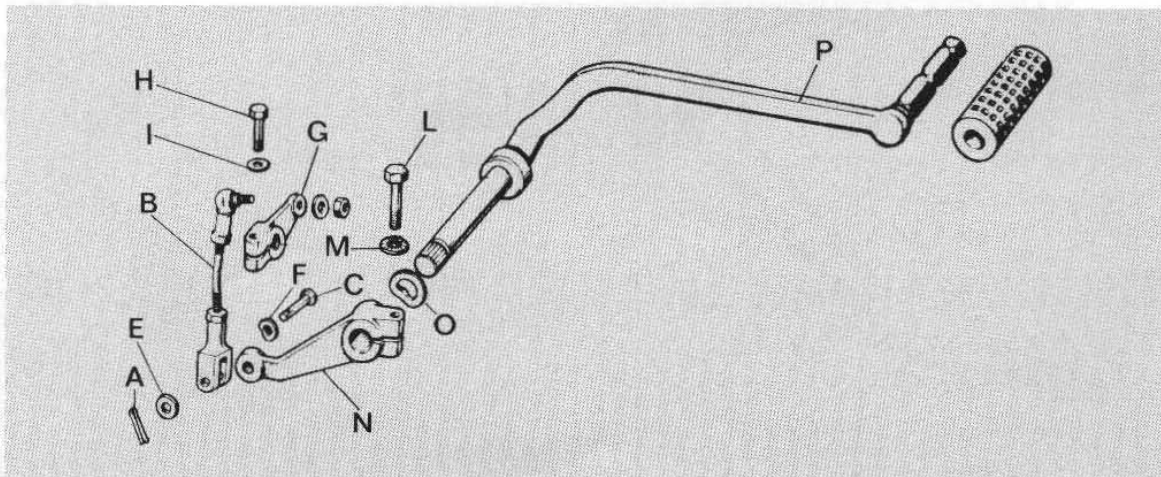
- remove split pins «A» from spindle «C»;
- take out spindle «C» from the rod complete with selector fork «B» and lever «N» and then washers «E» and «F»;
- undo gear lever securing bolt «H» with washer «I» and remove gear operating lever «G»;
- undo bolt «L» with washer «M» and remove lever «N» with washer «O» from the control pedal «P».

Inspection

- ensure the grooves and threaded portions of the levers and spindles are not stripped or damaged.
- check thread of all lever securing bolts, and check if stripped or damaged;
- check elasticity of both shakeproof and crinkled washers.

Re-assembly

Reverse the dismantling operations and replace the split pins.



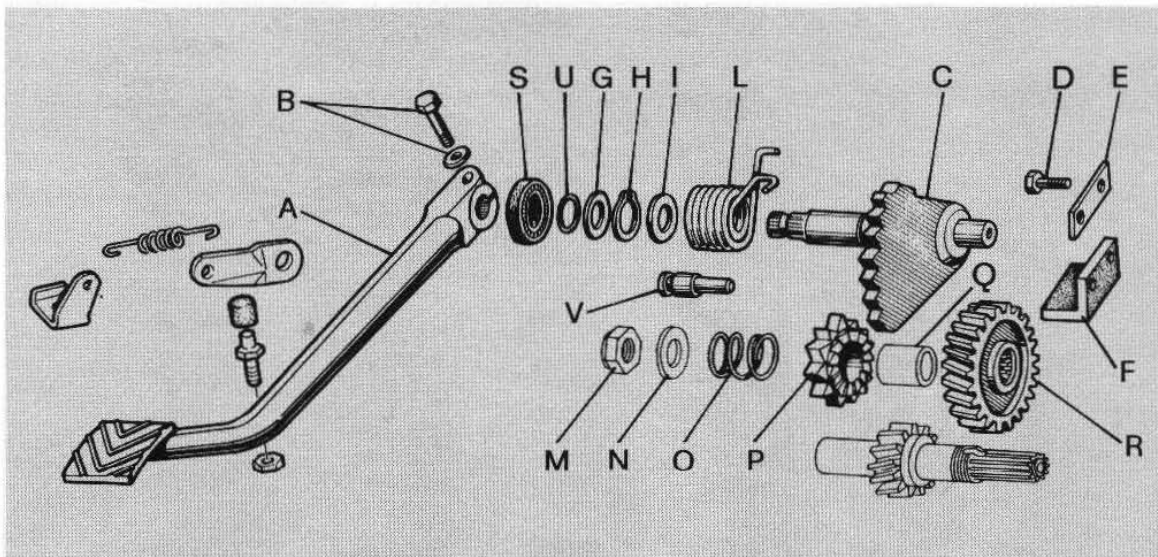
98

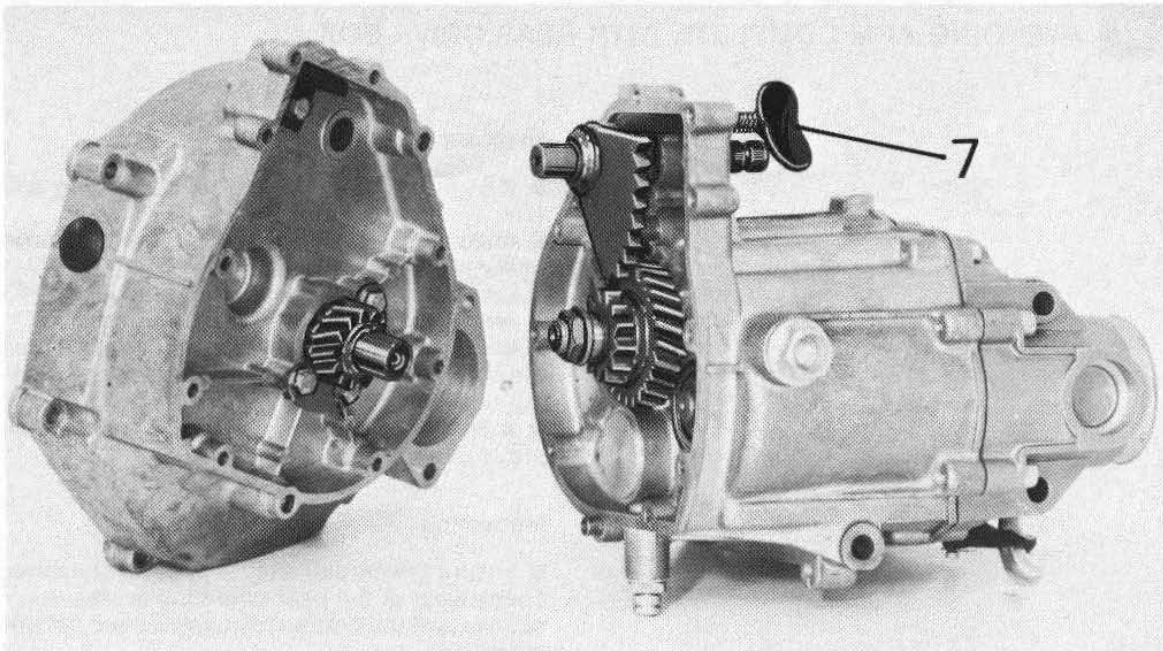
Dismantling (see fig. 99)

- undo retaining bolt «B» from quadrant «C» and remove kickstarter lever «A»;
 - remove the clutch housing from the gearbox, the quadrant stop assembly consisting of: Screws «D», plate «E», rubberised plate «F»;
 - using a mallet, tap on quadrant spindle «C», unhook spring «L» from the lug on the gearbox, and withdraw the quadrant;
 - from the quadrant shank «C» take off:
 - thrust ring «G»;
 - circlip «H» using a suitable pair of pincers;
 - washer «I»;
 - return spring «L»;
 - undo nut «M» with washer «N» using holdfast tool part No. 19905400 (17 in fig. 82).
- From the main shaft remove:
- spring «O»;
 - gear «P»;
 - bush «Q»;
 - gear «R».

Inspection

- ensure seal «S» is not crumbled or damaged or deformed.
If so, replace it;
- ensure circlip «H» is still in good state or else replace it;
- ensure the splines on the shaft and quadrant gear are undamaged or excessively worn.
If so, replace the quadrant complete with spindle;
- ensure the rubberised plate «F» on the clutch housing is not damaged or worn.
If so, replace it;





100

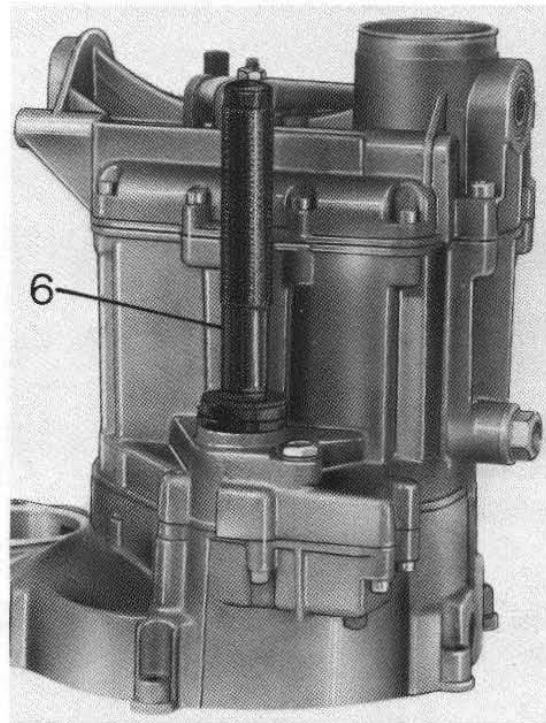
- ensure gears «P» and «R» retaining spring «O» is still efficient. If deformed or has lost its elasticity, replace it. However, before doing so check its load: when compressed to 9.5 mm the load should be $0.95 \pm 5\%$ kg;
- ensure the outer tothing and front dogs of gears «P» and «R» are not damaged, chipped or scored.

Re-assembly

Reverse the dismantling operations but remember that in fitting the clutch housing on the gearbox casing it is necessary to introduce spring tensioning tool No. 19902800 (7 in fig. 100) in the oil drain hole.

When the complete gearbox is assembled on the clutch housing, remove the above tool and re-fit the oil drain plug with its gasket.

Now assemble the seal by the aid of tool 19928700 (6 in fig. 101).



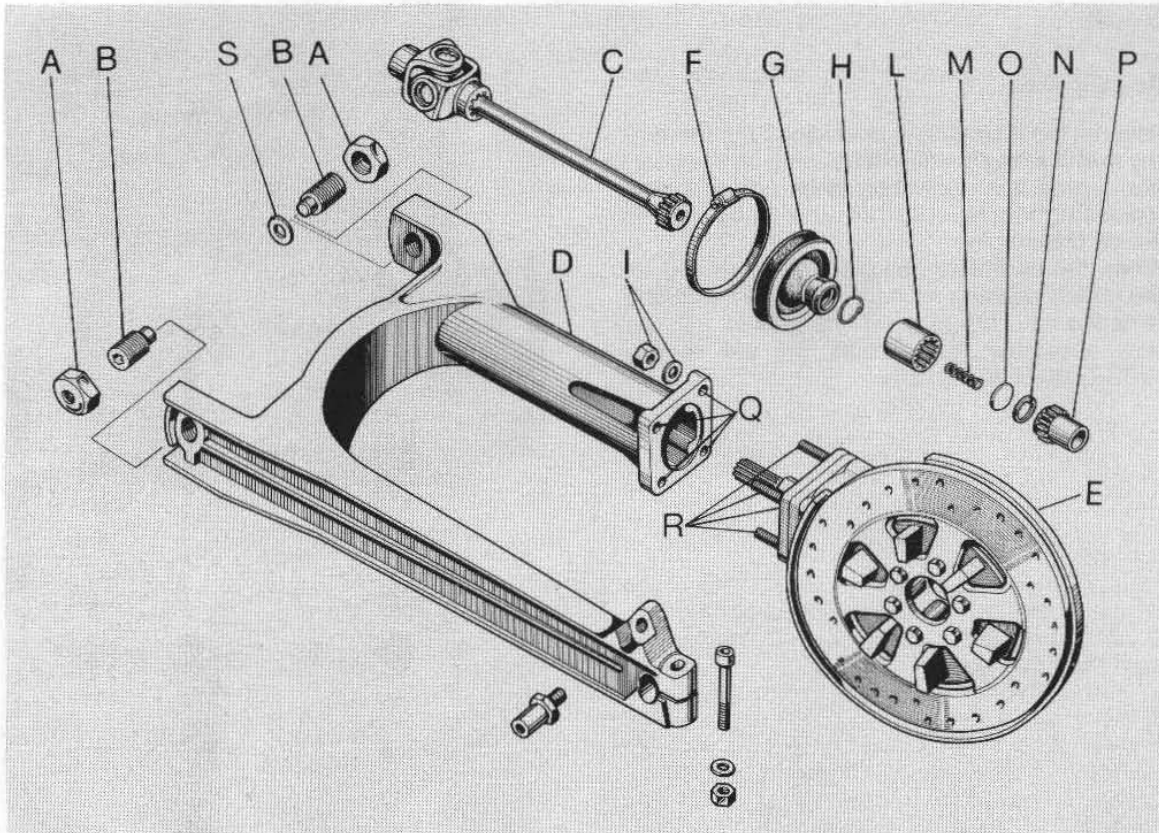
101

Removal (see fig. 102)

- take out the cardan joint «C» swinging arm «D»;
- undo clip retaining screw «F» and remove gaiter «G»;
- undo nuts «A» and threaded pins «B»;
- remove shim «S» from the R/H side;
- undo the 4 nuts and washers «I» and lift out the complete rear drive box «E» from the swinging arm «D»;
- withdraw sleeve «L», spring «M», circlip «N», metal retainer «O», and gear «P».

Inspection

- ensure the cardan shaft is in good condition, check wear of the gear operating in sleeve «L» splines and the cardan joint splines are not damaged.
- If so, replace the cardan joint;
- ensure the rubber gaiter is not cracked or broken.
- If so, replace it;
- ensure the threaded portion of the securing spindles and nuts are not damaged or stripped.
- Replace, as necessary.



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- check the efficiency of the spring.
If deformed or flat change it.
- When compressed to 9 mm the spring «M» should give a load of 3.8 to 4 kg;
- check the elasticity and shape of the circlip.
Replace if necessary;
- ensure the toothed section and the splines of pinion «P» are in good state.
If excessively worn or damaged, change the pinion.

Re-assembly

In sleeve «L» fit seal ring «N»; re-fit on the bevel pinion shang «E» sleeve «P», sleeve «L» retainer «O».

Insert studs «R» located on box in swinging arm «D» holes «Q».

Do this correctly, screw in nuts but do not tighten fully.

Insert spacer and wheel spindle; at this stage tighten in a crossed way as indicated in fig. 103. Insert in the front part of the swinging arm the dust protection «G» together with seal ring «H» and clamp «F».

Place in the cardan joint «C» hole spring «M» smeared with some grease then insert the cardan joint complete with spring in the rear fork through the dust protection.

Pay attention during this operation that the spring does not fall when inserting it in the sleeve «I».

Re-fit the swinging arm operating as follows:

- screw in spindle «B» from the right side till this protrudes from the swinging arm sufficiently to hold washer «S»;
- insert swinging arm on the gearbox cover and then fully screw in pin «B» from the left side till washer «S» on the right side contacts the bearings fitted on the gearbox cover;
- screw in fully pin «B» from the right side but to not tighten it;
- ascertain that the swinging arm oscillates freely without any play;
- screw in counternut «A» on pins «B» and then tighten them fully.

10.1 DRIVE BOX

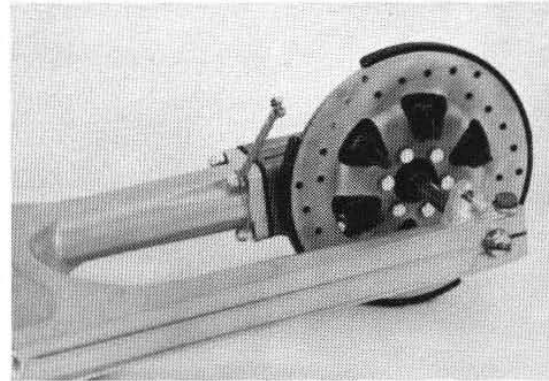
Removing the bevel pinion housing

After removing the complete drive box from the right arm of the rear fork, proceed as follows:

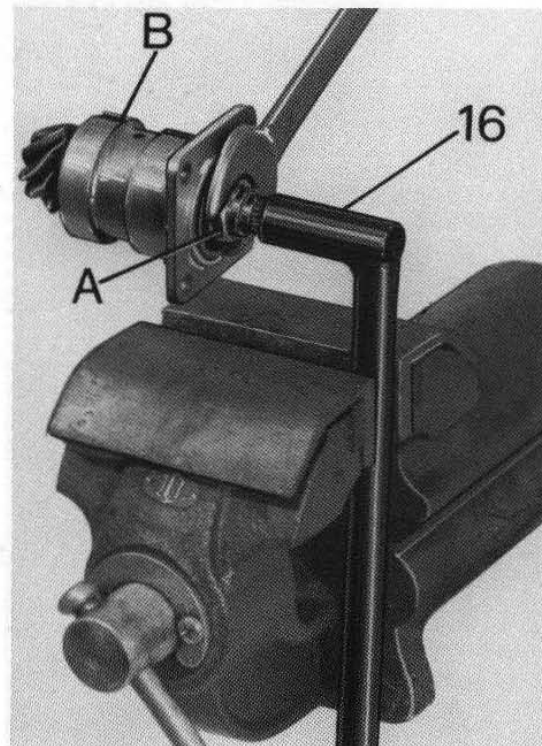
- withdraw complete housing «B» of fig. 104 from the drive box;

- grip holdfast tool part No. 19907100 (16 of fig. 104);

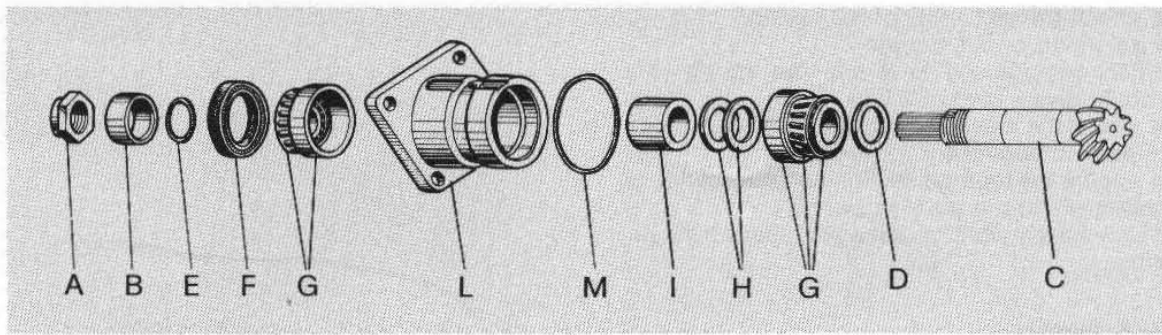
- insert the splined end of the pinion in the tool and by the aid of a suitable spanner undo nut «A» and remove the components as indicated in fig. 105.



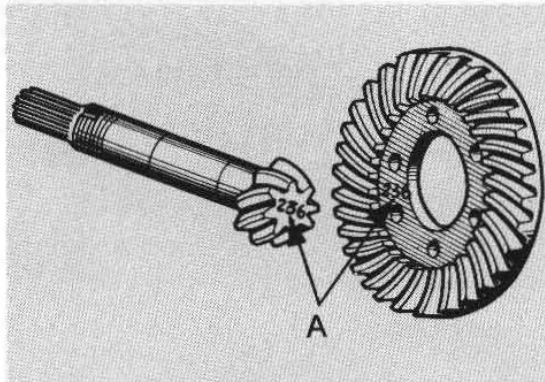
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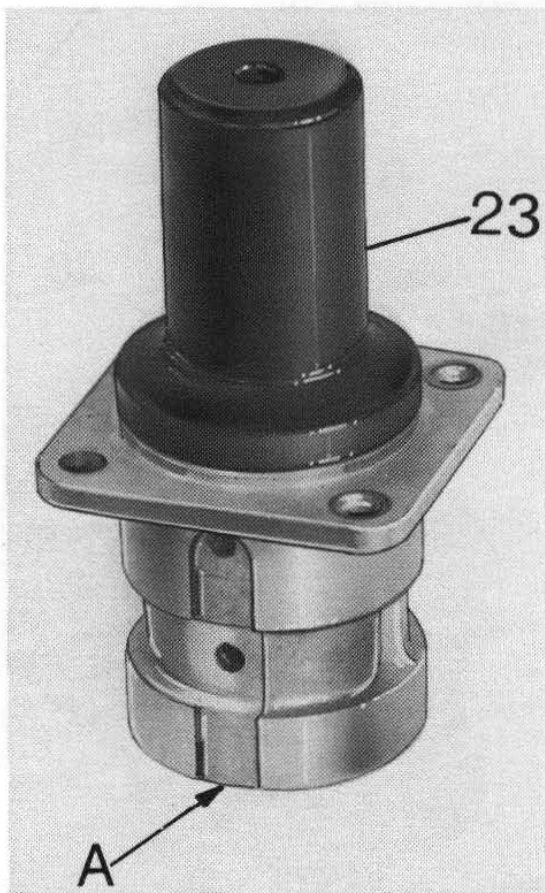
- A = Nut
- B = Spacer
- C = Pinion
- D = Shim
- E = O ring
- F = Seal
- G = Taper roller
- H = Shim
- I = Spacer
- L = Housing
- M = O ring

Inspection

- check pinion teeth wear. If excessively worn or chipped, change the bevel gear set;
- ensure both taper roller bearings are in good condition and the rollers not worn. If so, replace the bearing;
- ensure the shims are not deformed. Replace them if bent;
- check efficiency of the seals. If damaged or crumbled, replace..

Re-assembly

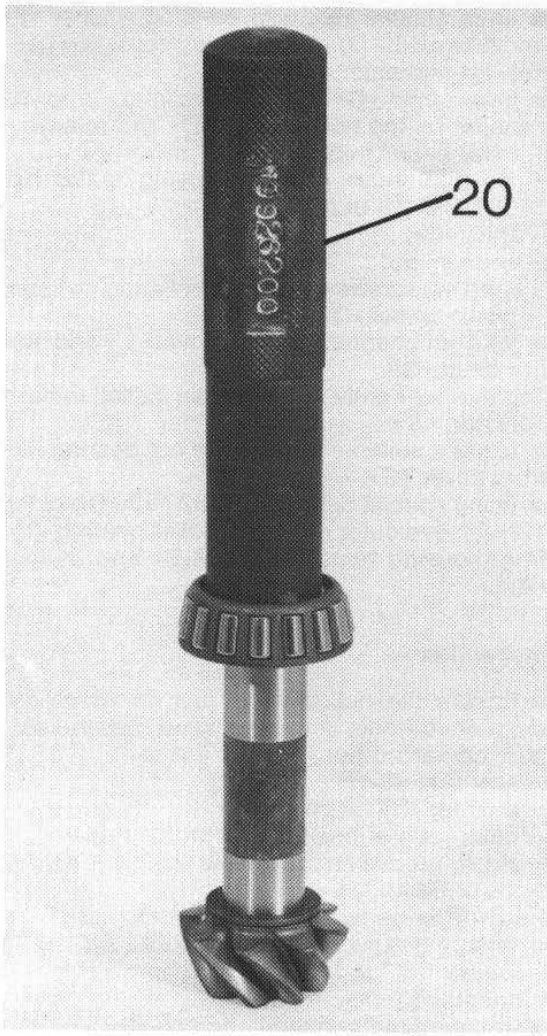
- If the bevel pinion is changed, it is necessary to change the crown wheel as well. Be sure in such case that both gears bear the same number (see «A» in fig. 106).
- To re-assemble the other components, reverse the dismantling sequence bearing in mind that:
- the outer race of the taper bearings in the pinion housing are fitted using punch 19 92 64 00 (23 in fig. 107);
 - the bearing on the bevel pinion is fitted with punch No. 19 92 62 00 (20 of fig. 108);
 - to fit the seal ring use punch No. 19 92 61 00 (4 of fig. 109).



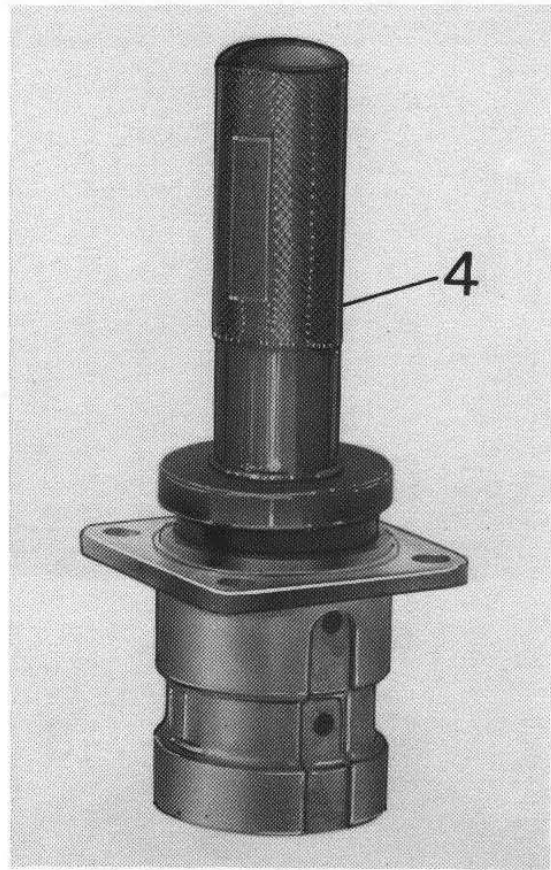
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Dismantling the rear drive transmission box (fig. 110)

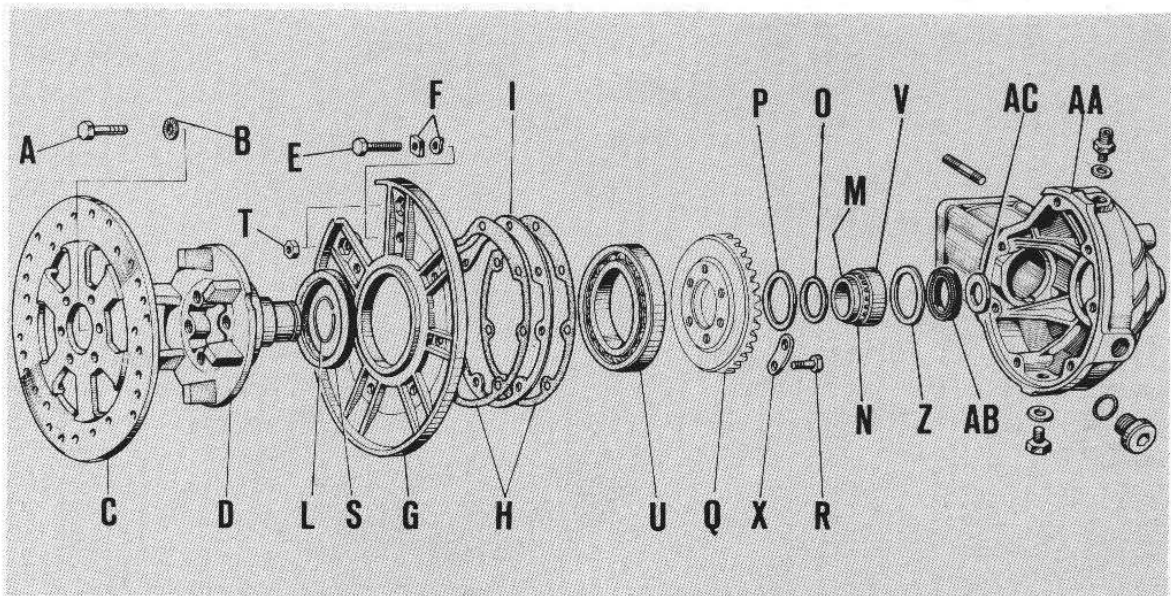
- undo screws «A» with washers «B» and remove the hollow shaft with brake disc «C»;



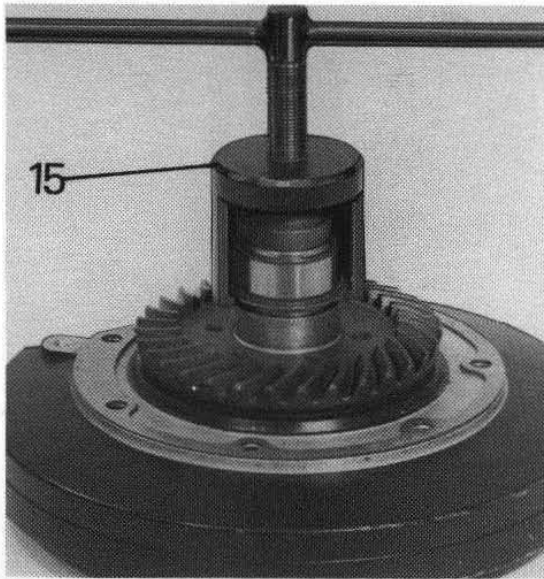
108



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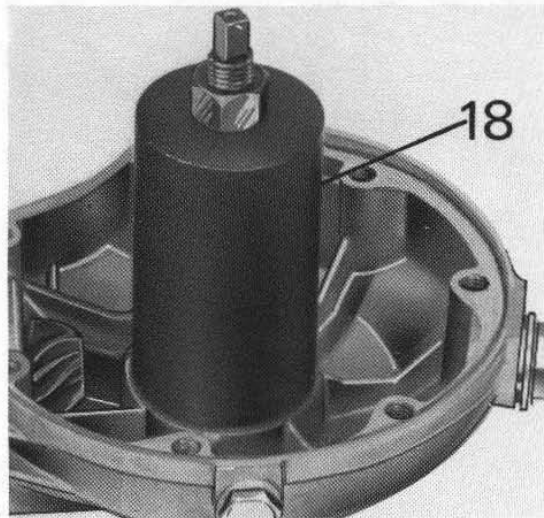


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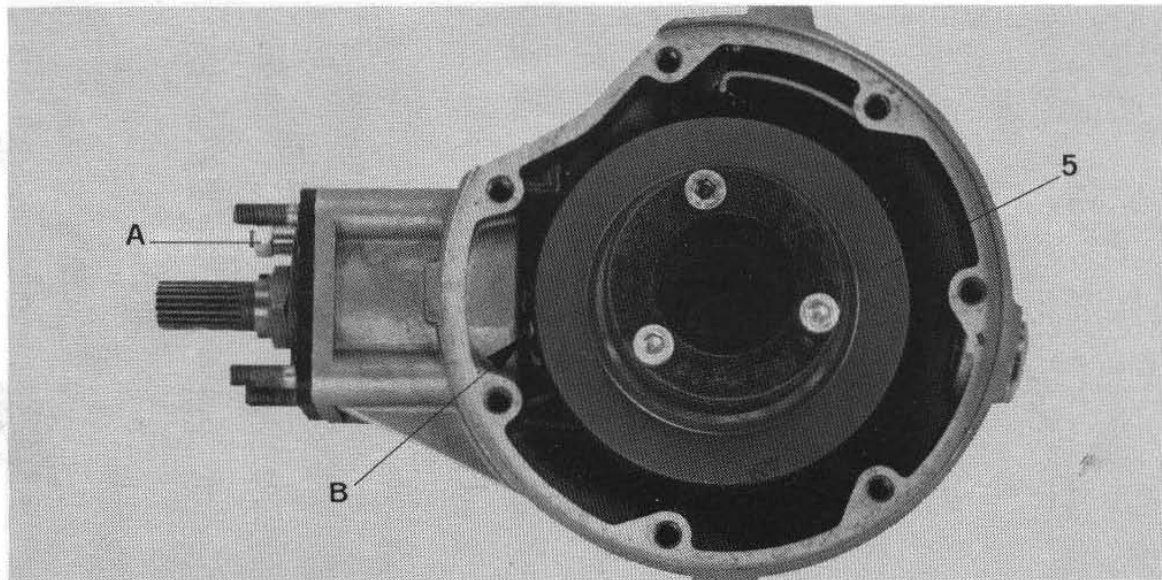
- undo screws «E», with crinkled washer «F» and take off the complete casing cover «G» gasket «H» and shim «I»;
 - from cover «G» take off circlip «L» from its housing on the hollow shaft «D» and remove:
 - roller bearing «N»;
 - bearing inner race «M» using puller No. 19907000 (15 of fig. 111);
 - shim «O»;
 - washer «P»;
 - undo the screws «R» with their flattening flaps;
 - crown wheel «Q»;
 - take out bearing «U» from cover «G» and hollow shaft «G».
- Tap this out lightly with a plastic mallet; remove seal ring «S»;
- using a suitable punch take out bearing «U» from cover «G»;
 - using special puller No. 19927500 (18 of fig. 112) remove outer race from roller bearing «V»;
- from housing remove seal «A-B» and washer «A-C».



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Inspection

- Ensure the hollow shaft just on which the cush drive works is not damaged; that the surface contacted by:
 - seal ring «S»;
 - bearing «U» on cover «G»;
 - outer race of bearing «V» on the housing;
 - circlip groove on the hollow shaft «L», are not worn or damaged.
- Replace as necessary;
- ensure that rubber seal «A-B» has not lost its elasticity.
- If crumbled replace;
- ensure that the bearing on box «N» have not their rollers used or damaged.
- If necessary replace;
- ensure the union faces are death smooth and not scored or nicked.



113

10.2 PINION-WHEEL COUPLING

(bevel set)

Pinion-crown wheel clearance is adjusted as follows:

- using 2 nuts «A» and washers, provisionally fit up the complete pinion housing on the casing (fig. 113);
- set up tool 1992 88 00 on the crown wheel (5 in fig. 113);
- insert the tool into the cage of the bearing in the casing;
- check pinion-crown alignment («A» in fig. 114 and arrow «B» in fig. 113).

If offset, place suitable shims between pinion and taper bearing.

It is also necessary to check the contact area of the pinion-crown wheel teeth proceeding as follows:

- 1 smear the pinion teeth with a suitable coloured compound easily found on the market;
- 2 provisionally fit up the crown wheel-hollow shaft assembly and the cover on the casing;
- 3 set up a universal type puller on the hollow shaft to keep the crown wheel lightly pressed at the brake disc side using suitable centre spacers (fig. 115);
- 4 rotate pinion in its normal running direction keeping a fast hold on crown wheel so that rotation occurs under a certain load, thus leaving a distinct contact mark on the pinion teeth:

– if the contact is correct, the pinion teeth mark will appear as shown at «1» fig. 116 (pinion seen from the driving shaft side);

– if the contact mark is as shown at «2» (fig. 116), the crown wheel is too near the rotational axis of the pinion.

Move the crown away reducing the pressure on spacer «I» (fig. 110);

– if the contact is as shown at «3» (fig. 116) the pinion is too near the rotational axis of the crown wheel.

Move away the pinion reducing thickness of shims «D» in fig. 105;

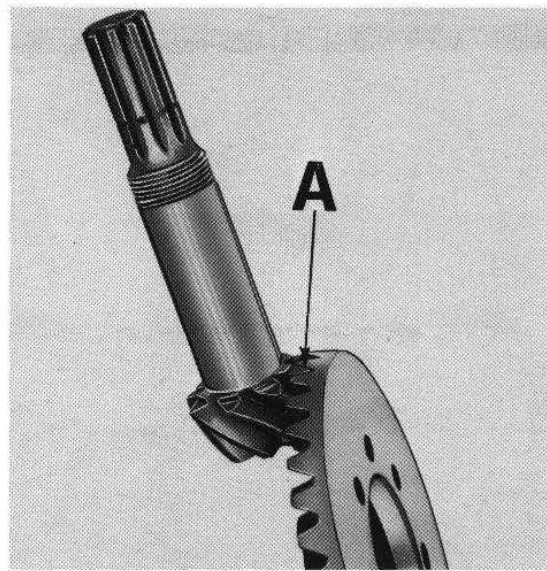
– if the contact is as shown at «4» (fig. 116), the pinion is too far from the crown wheel rotational axis.

Move the pinion nearer increasing the thickness of shim «D» in fig. 105;

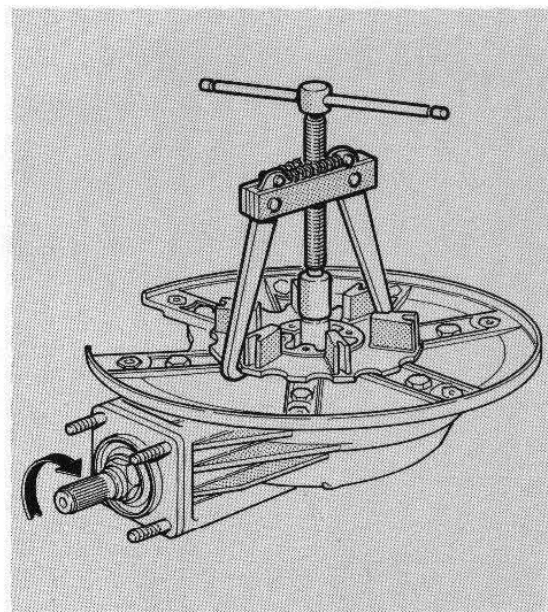
– if the contact is as shown at «5» (fig. 116) the crown wheel is too far away from the rotational axis of the pinion.

Move the crown wheel nearer by reducing the size of shim «I» (fig. 110);

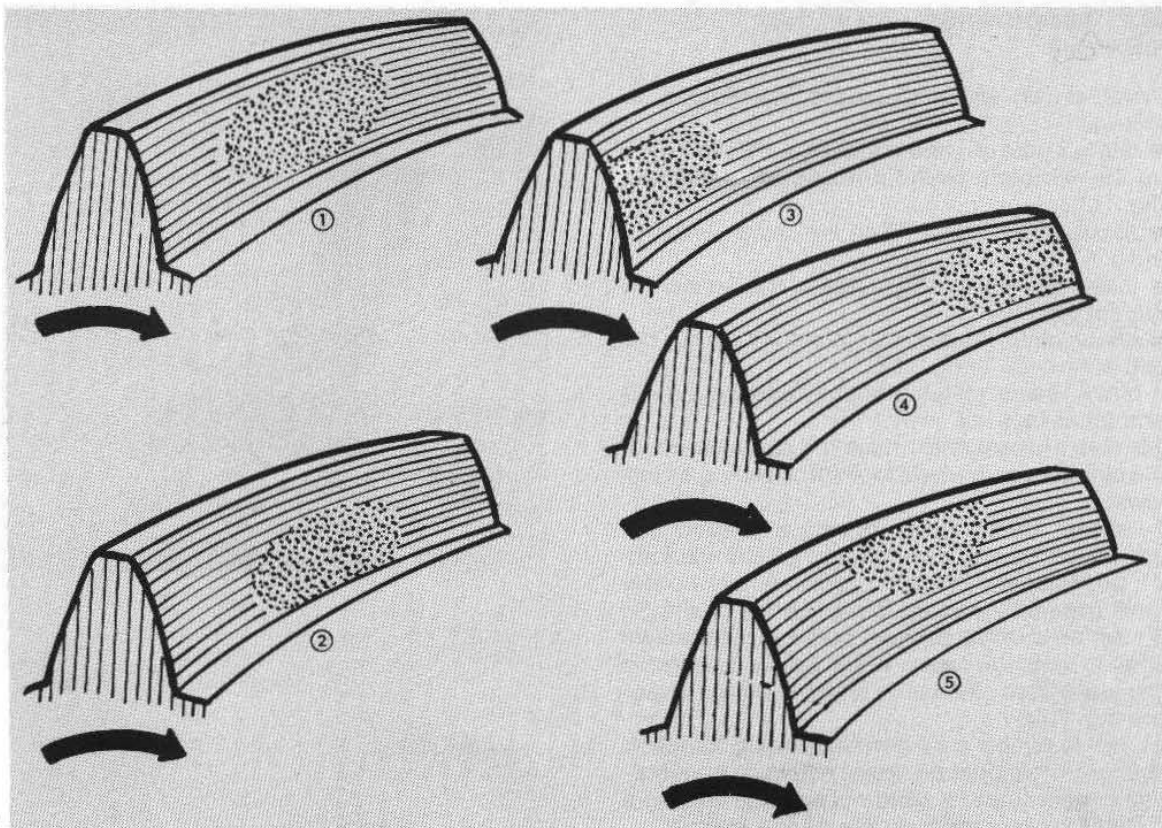
– properly assembled bevel set should have a teeth clearance of 0.10 ± 0.15 mm.



114



115

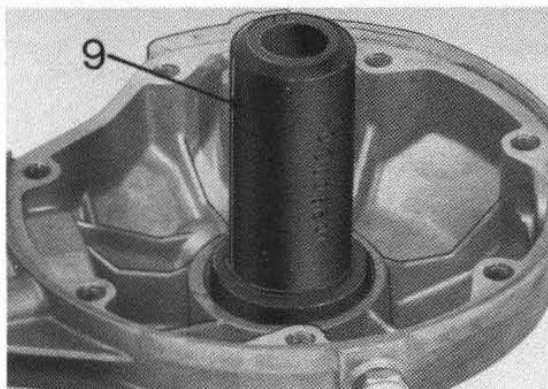


116

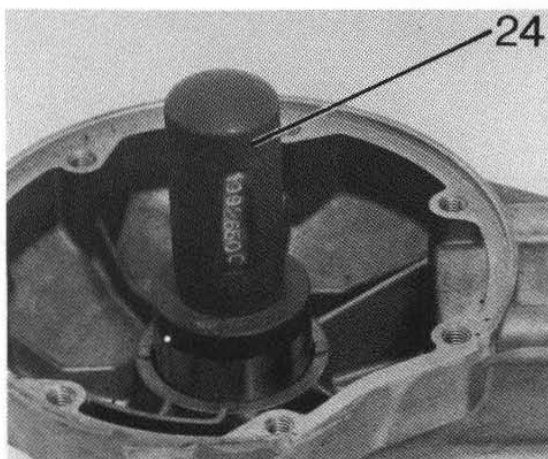
Re-assembly

Reverse the dismantling operations but keep in mind that:

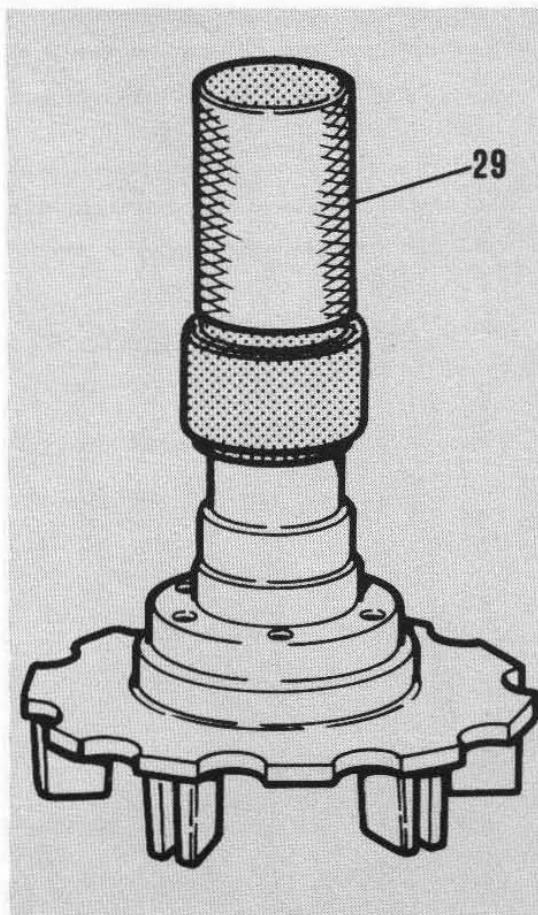
- the seal on casing is fitted by the aid of punch 1992 60 00 (9 in fig. 117);
- the outer race of the roller bearing in the casing is fitted by the aid of punch 1992 65 00 (24 in fig. 118);
- the inner race of roller bearing on the hollow shaft is fitted with punch 1992 79 00 (29 in fig. 119);
- the brake disc is assembled on the hollow shaft as follows:
 - tighten the disc securing screws with a torque wrench set at 2.2 to 2.4 kg;
 - check side play of disc which should not exceed 0.2 mm;
- in refitting the bevel pinion housing on the drive box ensure the oilways «A» are fitted in vertical direction (looking at the oilways one has to be upwards and one downwards) (fig. 107).



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10.3 SWINGING ARM

Removal (see fig. 102)

- remove rear wheel.
- remove the complete rear drive box «E» after undoing nuts with washers «I» and withdrawing the cardan joint from the R/H arm of the rear fork «D»;
- undo nuts «A» and loosen pins «B» so as to withdraw the rear fork off the gearbox;
- remove shims «S» between R/H arm of the fork and the gearbox.

Inspection

Ensure the arms of the rear fork are not cracked or bent.

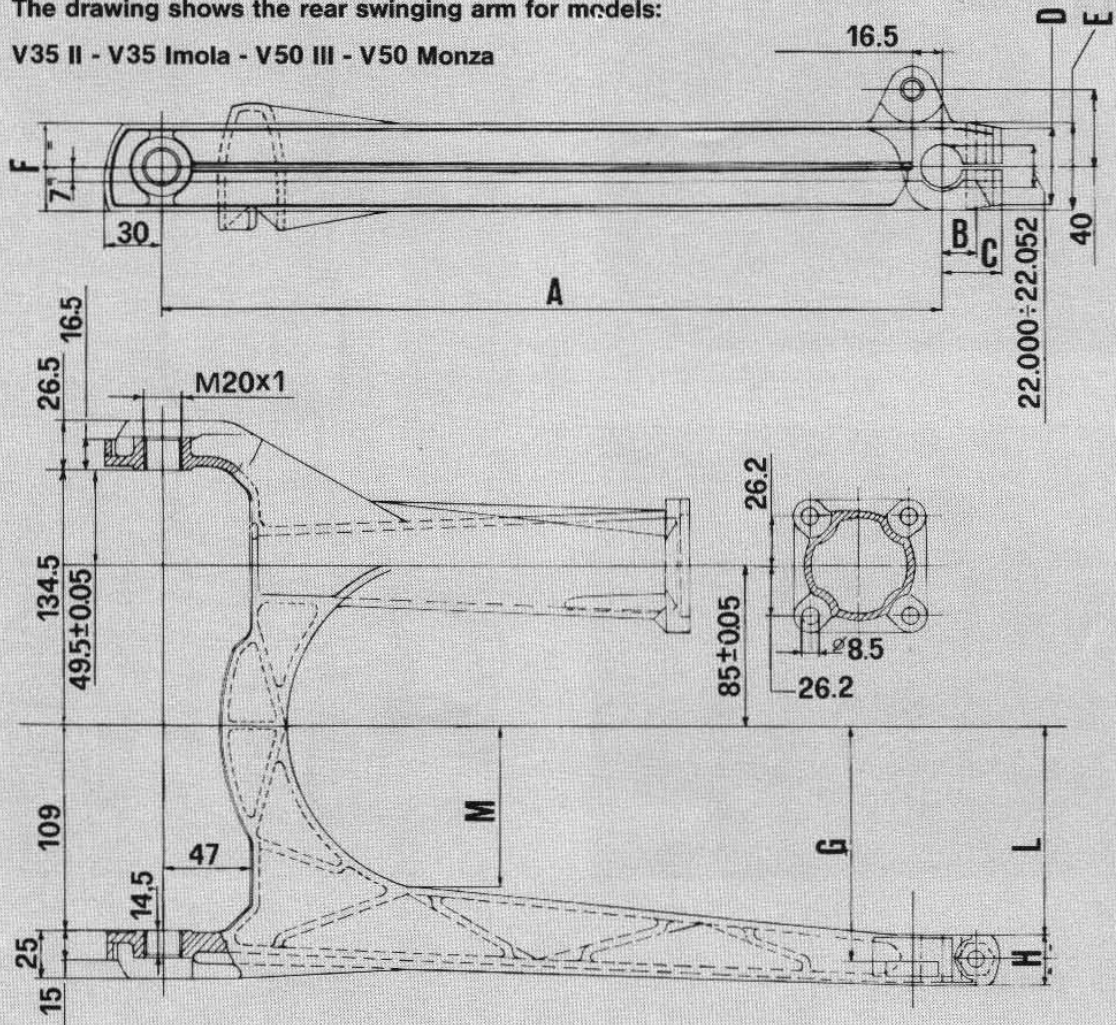
If possible, straighten keeping to the sizes and dimensions in dwg fig. 120.

Re-assembly

Is a reversal of the dismantling operations.
To adjust the rear fork see page. 82 (fig. 102, chpt. 10).

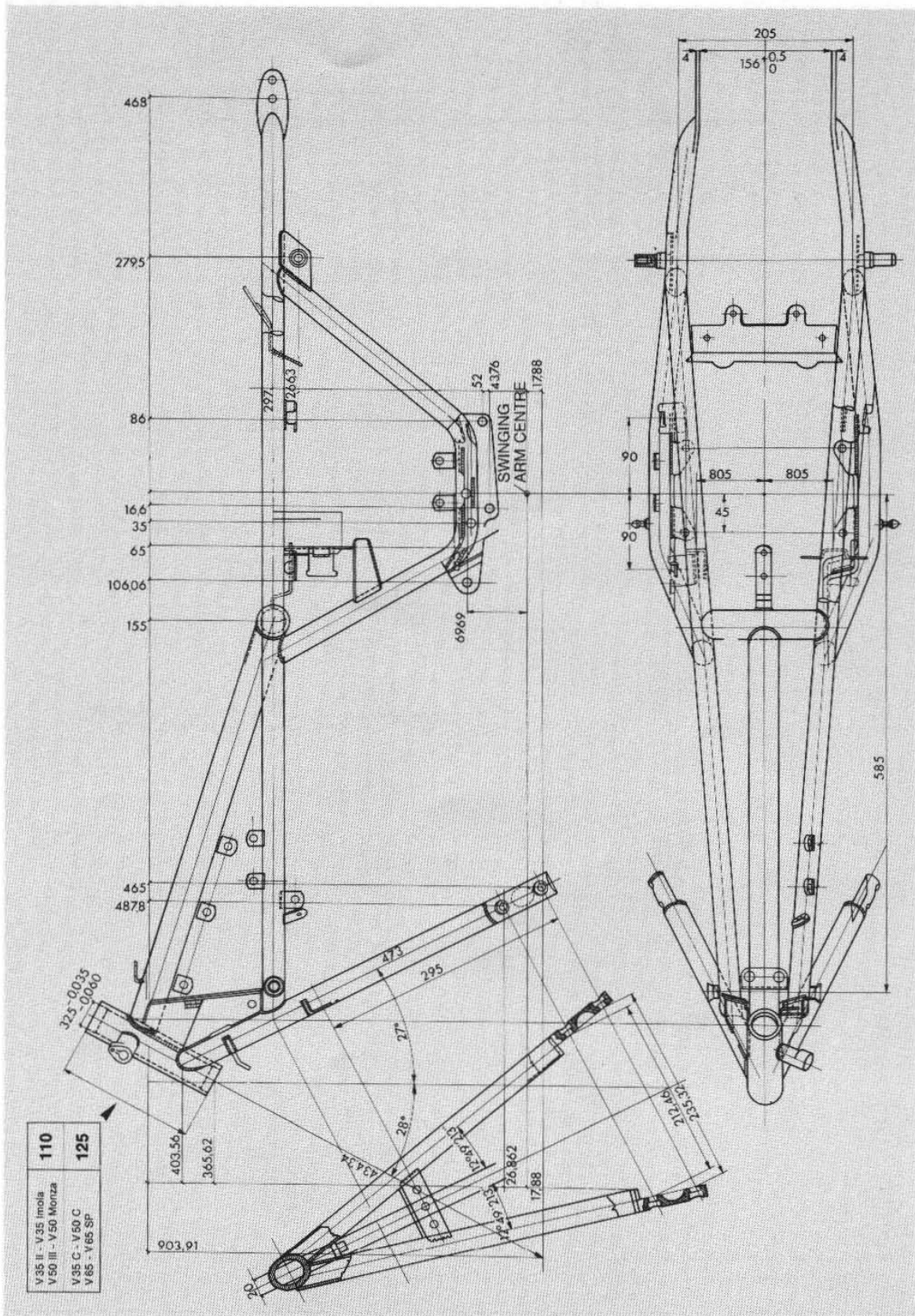
The drawing shows the rear swinging arm for models:

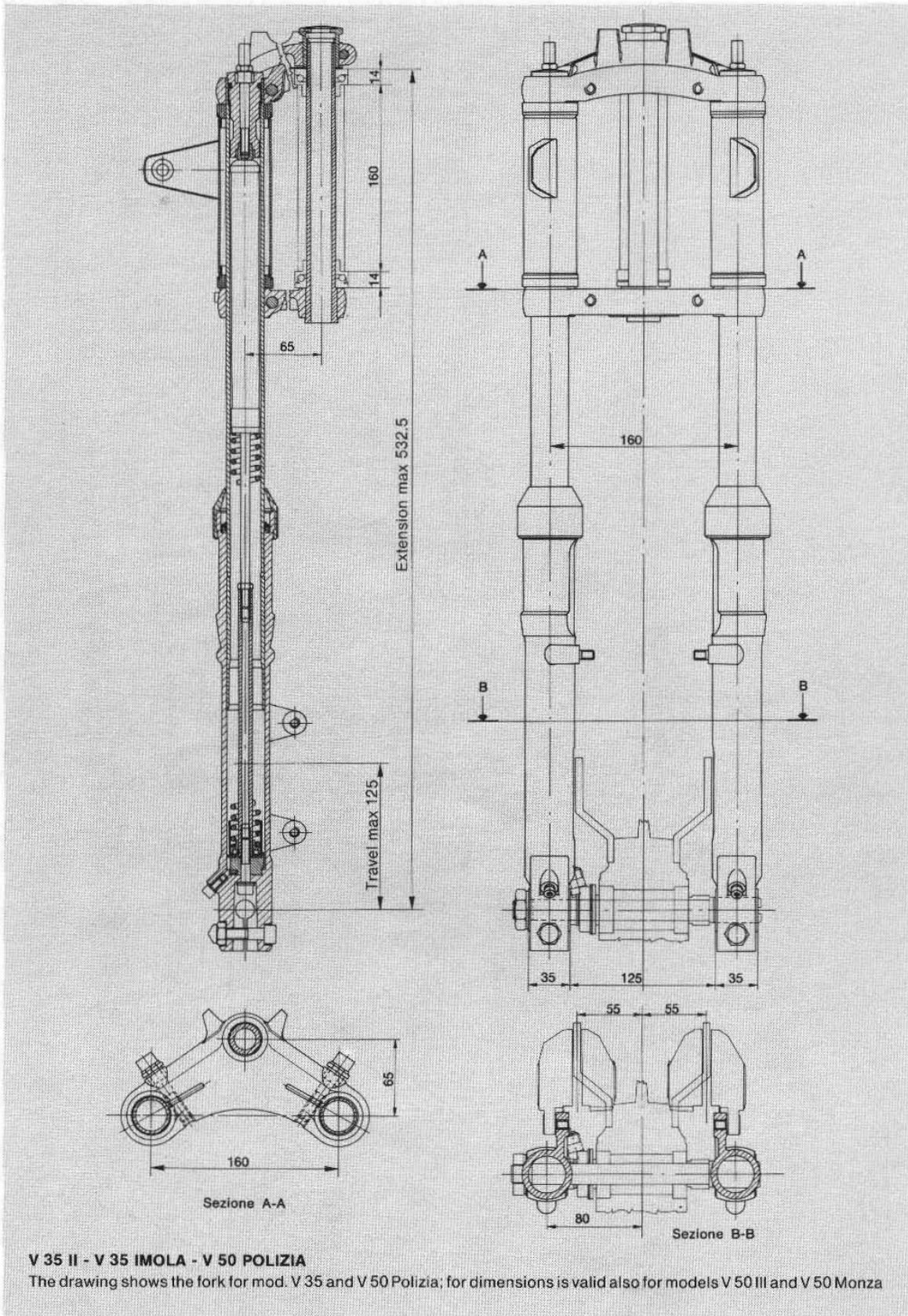
V35 II - V35 Imola - V50 III - V50 Monza



120

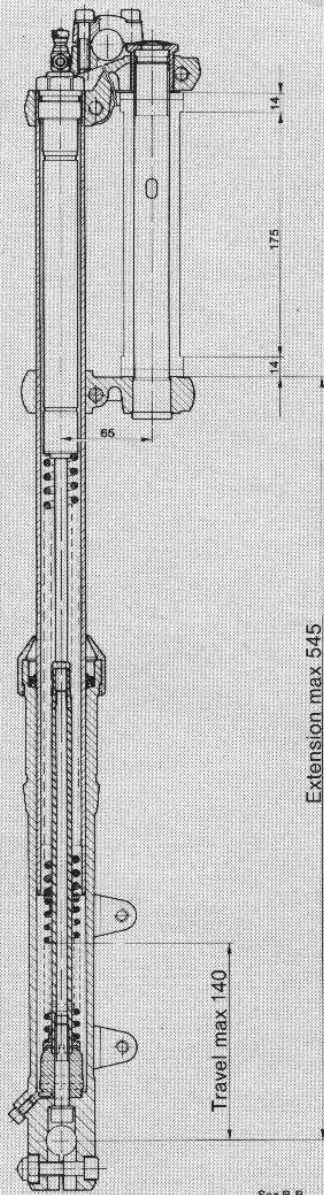
mm	V35 II - V50 III V35 Imola - V50 Monza	V35 C - V50 C	V65 - V65 SP
A	409 ÷ 411	457,9 ÷ 458,1	435,4 ÷ 435,6
B	18	20	20
C	33	35	35
D	40	42	40
E	46	47	46
F	46	46	46
G	124	—	131
H	25	30	27
L	110	137	116



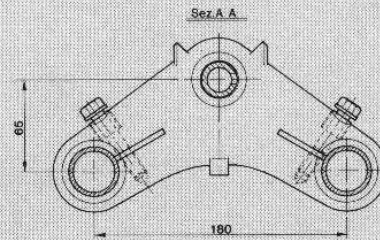
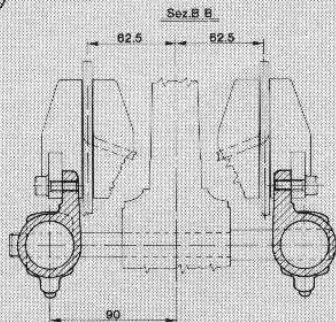
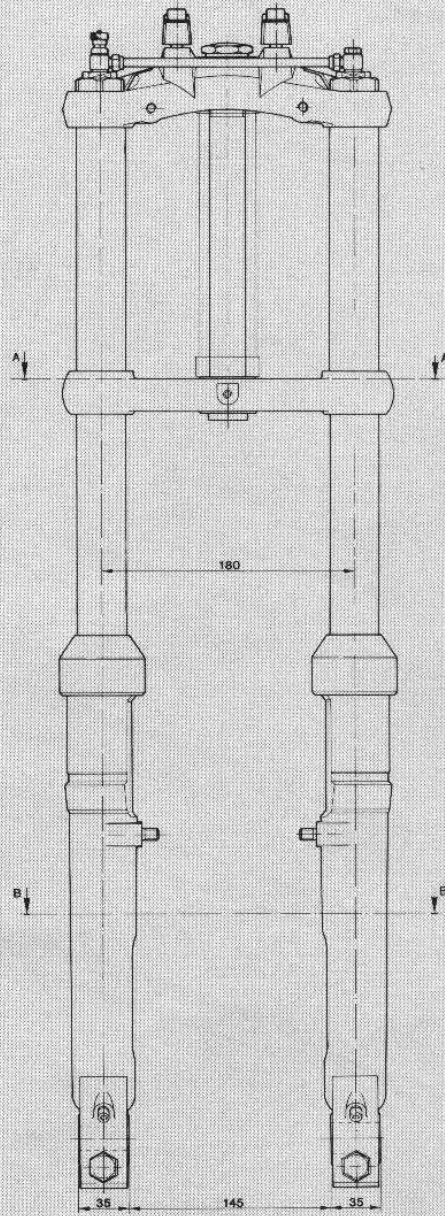


V 35 II - V 35 IMOLA - V 50 POLIZIA

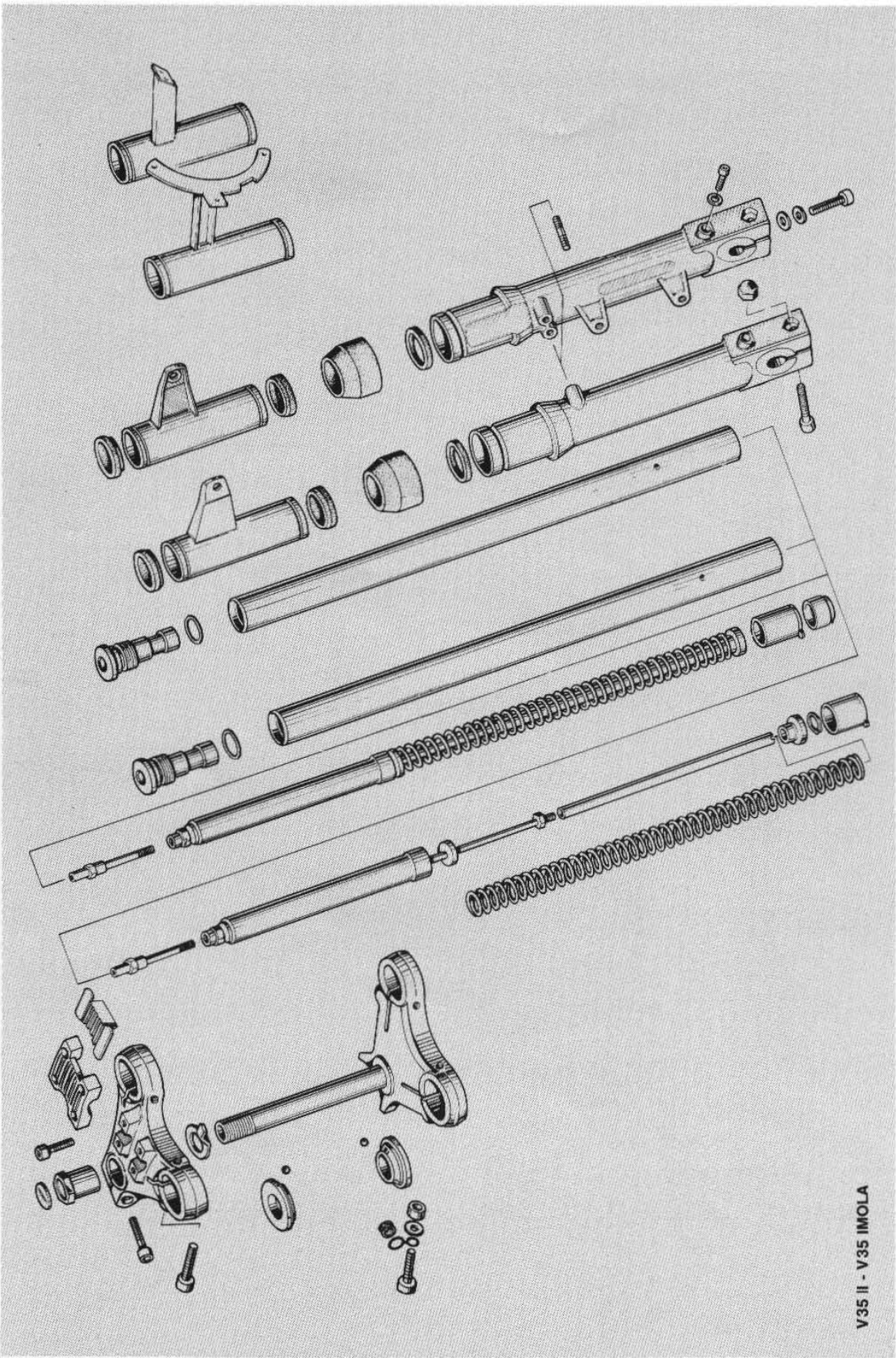
The drawing shows the fork for mod. V 35 and V 50 Polizia; for dimensions is valid also for models V 50 III and V 50 Monza

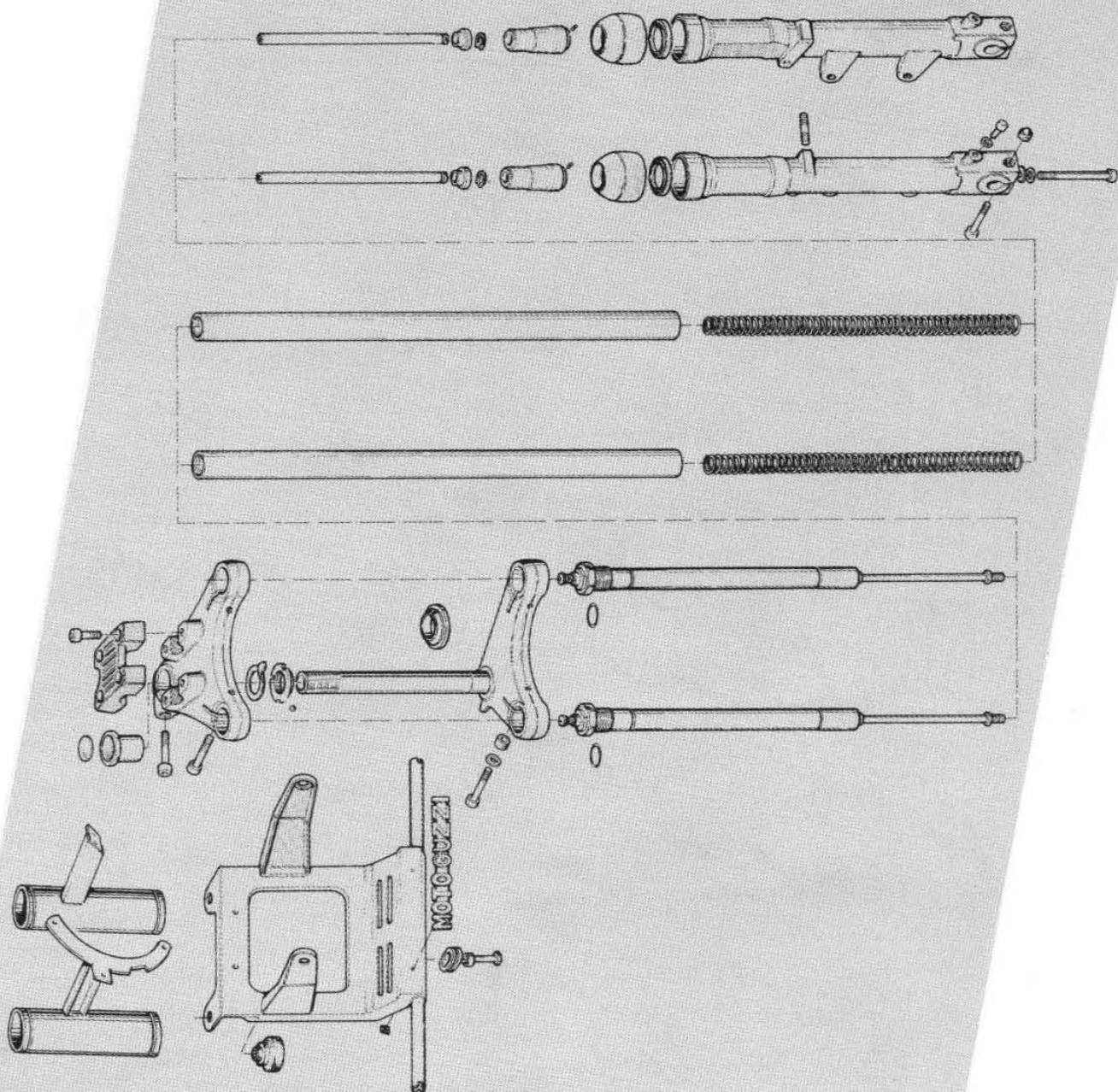


Extension max 545

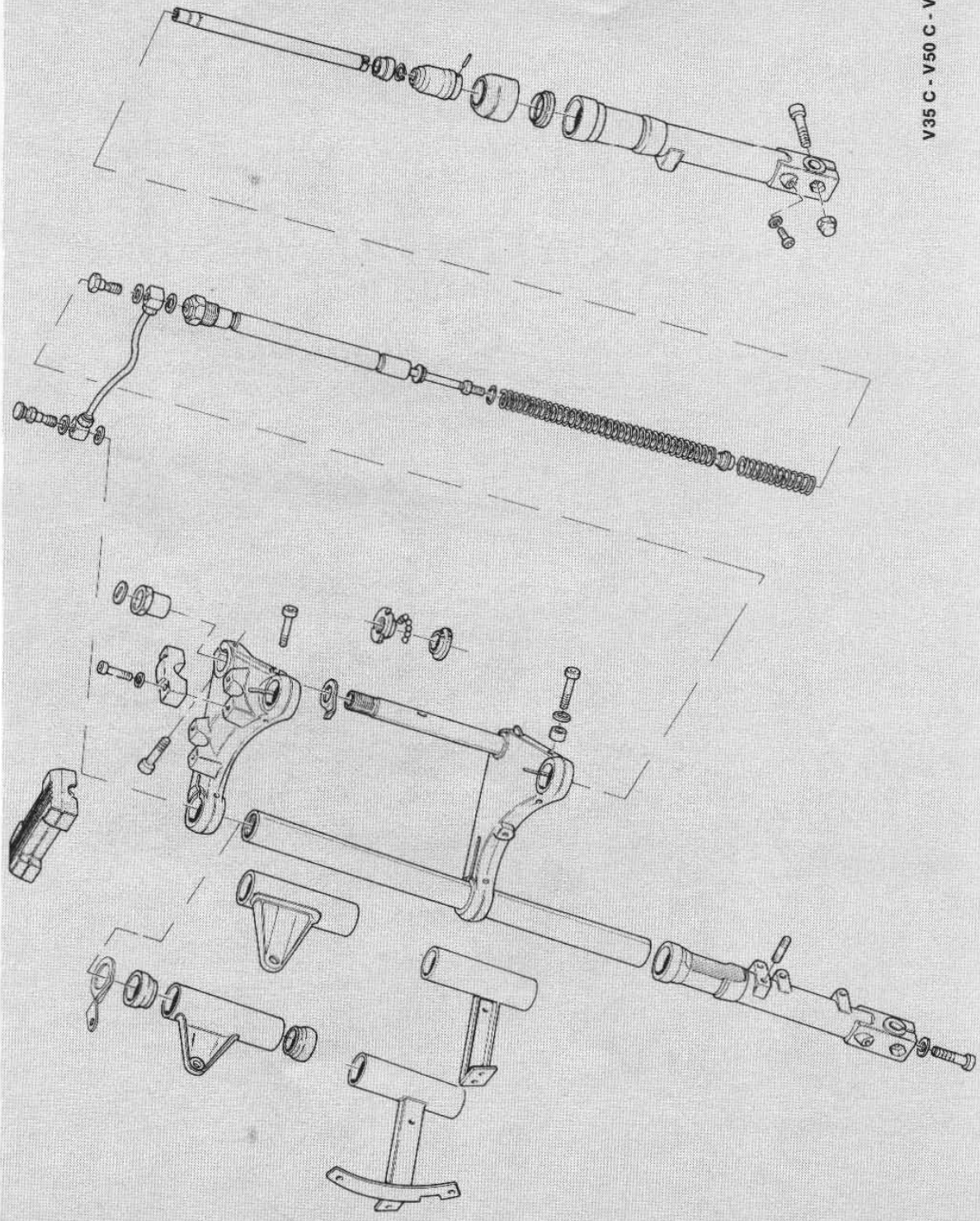


V35 C - V50 C - V65





V50 III - V50 MONZA

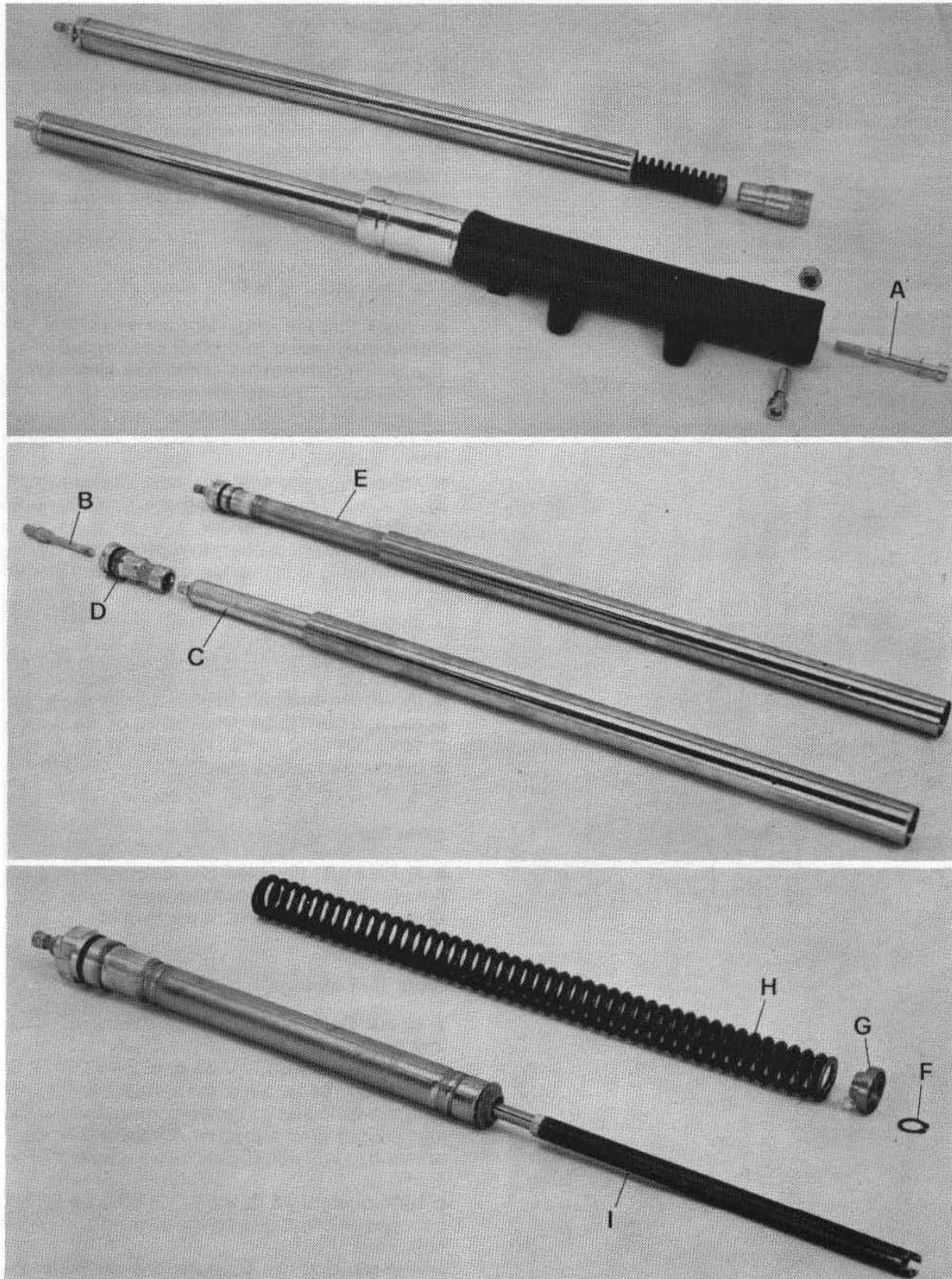


12.1 FRONT FORK BREAKDOWN (fig. 127)

- Remove lower plugs and drain oil.
- Undo lower screw «A» fixing shock absorbers of the fork sleeve and remove these paying attention to the seals.

■ Remove lower cap in case is still inside the sleeve.

- To disassemble the hydraulic absorbers undo screw «B» and take out absorber «C»; plug «D» can then be removed from the fork sleeve.



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■ To dismantle the oil pneumatic shock absorbers «E» undo upper plug making a whole piece with the dampers.

■ Slowly press the spring to disengage lower seal «F»; take out cup «G», spring «H». Remove rod «I».

Inspection

■ ensure the steering cap grooves containing the balls are undamaged and that there is no play in their frame housing;

■ make sure all balls show up bright;

■ if the fork has undergone severe impacts because of falls or crashes, straighten observing the dimensions indicated in dwg of fig. 122 or fig. 123.

The fork slider is in light alloy

■ check that the inner surface where the fork sleeve operates is in perfect conditions.

The inside dimensions of the fork slider are:
31.750 to 31.790 mm for models V35 II - V35 Imola - V50 III - V50 Monza;

34.750 to 34.790 mm for models V35 C - V50 C - V65 - V65 SP;

■ ensure that the seal ring has not lost elasticity, that is not cracked and that is perfectly sealing sleeve and fork slider;

■ should it be necessary to replace the seal ring it is advisable to fit the new one by using a proper tool.

Fork dampers

■ the above dampers have in no way to be tampered and have to be checked in couple in order to have both the same characteristics;

■ otherwise replace them.

Slide bar

■ ensure that the slide bar is straight and that the circlip groove is not damaged.
Check also conditions of the thread.

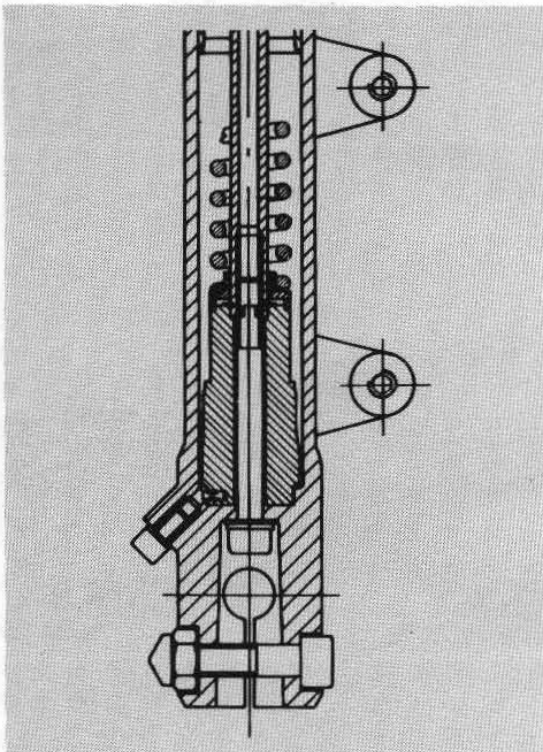
Front fork springs

■ check that the spring is not deformed or has lost its elasticity;

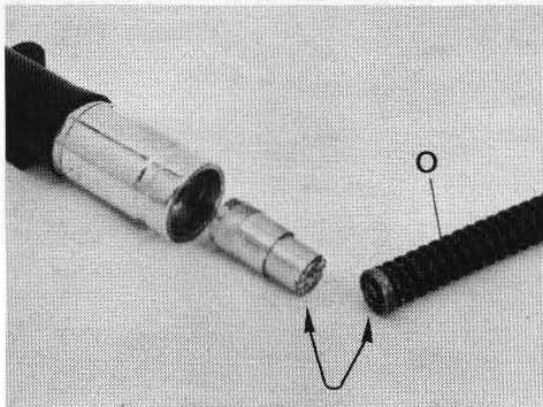
■ for models V 35 II, V 35 Imola, V 50 III, V 50 Monza the free length of the spring is 362 to 365 mm; the spring length when compressed to 357 mm should give a load of $4.8 \text{ kg} \pm 3\%$; compressed to 232 mm should give a load of $97.5 \text{ kg} \pm 3\%$;

■ for models V 35 C, V 50 C, V 65, V65 SP two springs are fitted: one on the top and one on the bottom.

Of the top one two versions are available: the



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first one with a 4.5 mm dia. wire, the free length is of 336 mm \pm 1.5, compressed to 327.5 mm should give a load of 8 kg \pm 3%; compressed to 239 mm should give a load of 90.7 kg \pm 3%; the second one with a 4.2 mm dia. wire has a free length of 336 mm \pm 1.5; compressed to 327.5 mm should give a load of 6.7 kg \pm 3%; compressed to 239 mm should give a load of 76.53 kg \pm 3%.

The bottom spring, free, has a length of 95 mm \pm 1.5; compressed to 91.5 mm should give a load of 9.3 kg \pm 3%; compressed to 60.9 mm should give a load of 90.7 kg \pm 3%;

■ the spring that does not fall within the above values has to be replaced.

Fork cover

- ensure that the chromed part is free from scoring;
 - the fork cover is straight in all its length;
 - the thread is not nicked or stripped.
- If so replace the fork cover;
- the diameter of the fork cover is:
- 34.690 to 34.715 mm for models V 35 C, V 50 C, V 65, V 65 SP.

Re-assembly

Is a reversal of the dismantling operations except that:

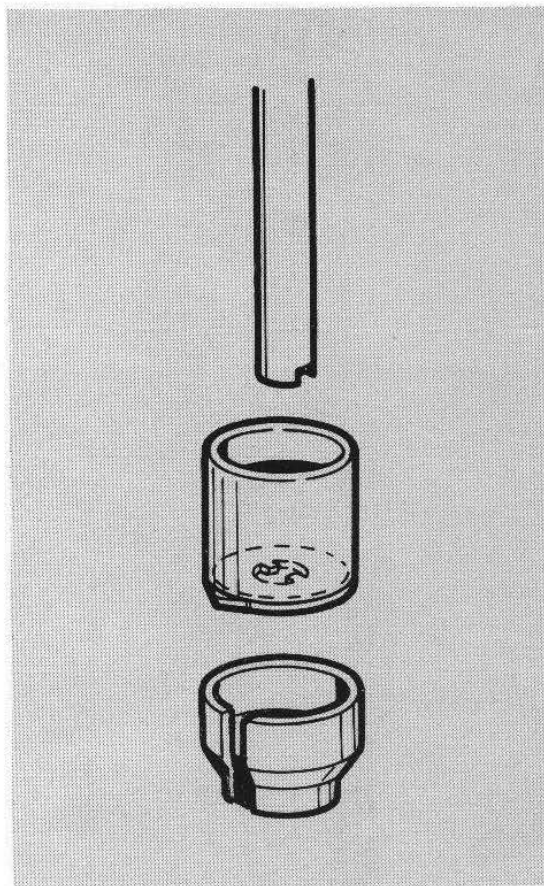
- in re-fitting the spring assembly «O» on slider it is necessary to ensure that notches fit tightly in lower cap, and that lower cap notch fits correctly in bottom fork slider;
- for forks of models V 35 II, V 35 Imola and V 50 Polizia the lower components have to be assembled as shown in fig. 132;
- when fitting the group pay attention not to damage the seal ring edges;
- tighten the screws complete with aluminium washer and washer;
- introduce in the hydraulic dampers 0.70 cc of «Agip F. 1 ATF Dexron»;
- and 0.60 cc in oil pneumatic dampers;
- and 0.90 cc in oil pneumatic dampers of mod. V 35 C, V 50 C, V 65 and V 65 SP.

12.2 LUBRICATION OF FRONT FORK (with hydraulic dampers) (fig. 133)

For this operation proceed as follows:

- undo drain plug «A» with its gasket;
 - remove panel board and unscrew stud bolt «B»;
 - before introducing fresh liquid, allow all the old oil to drain.
- «A» drain plug with gasket;
«B» filling plug.

Quantity: 0.070 l each leg of «Agip F. 1 ATF Dexron» fluid.



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12.3 FRONT FORK LUBRICATION

To replace the oil in the front fork legs, proceed as follows:

a undo drain plug «A». With the bike on the central stand, loose side screw «C» locking the steering head to the fork arm and completely unscrew the exagonal screw plug fitting the pressure control valve.

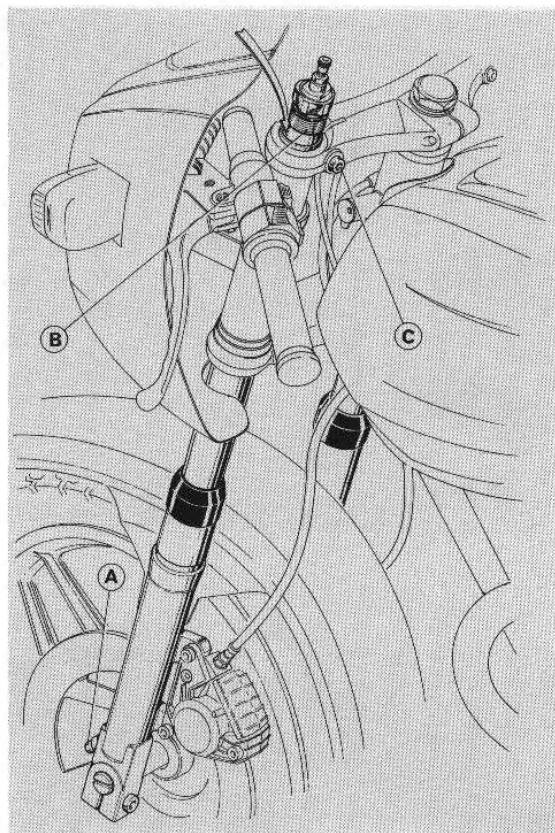
b Slightly press the front part of the bike to force out the plug «B» which is solidal to the shock absorber.

c Refit plug «A» and introduce the quantity of fluid necessary (0.060 l «Agip F. 1 ATF Dexron» for mod. V 50 III and V 50 Monza; 0.090 l «Agip F. 1 ATF Dexron» for mod. V 35 C, V 50 C, V 65, V 65 SP, through the space existing between the inner diameter of the fork arm and the shock absorber body.

d Release the front part of the bike, refit plug «B» and lock the side screw.

The same operations to be repeated for the other fork leg.

NB – For the bikes fitting pressure compensating pipe, disconnect the pipe.



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12.4 OIL PNEUMATIC SHOCK ABSORBERS

The operating load pressure of these shock absorbers are the following:

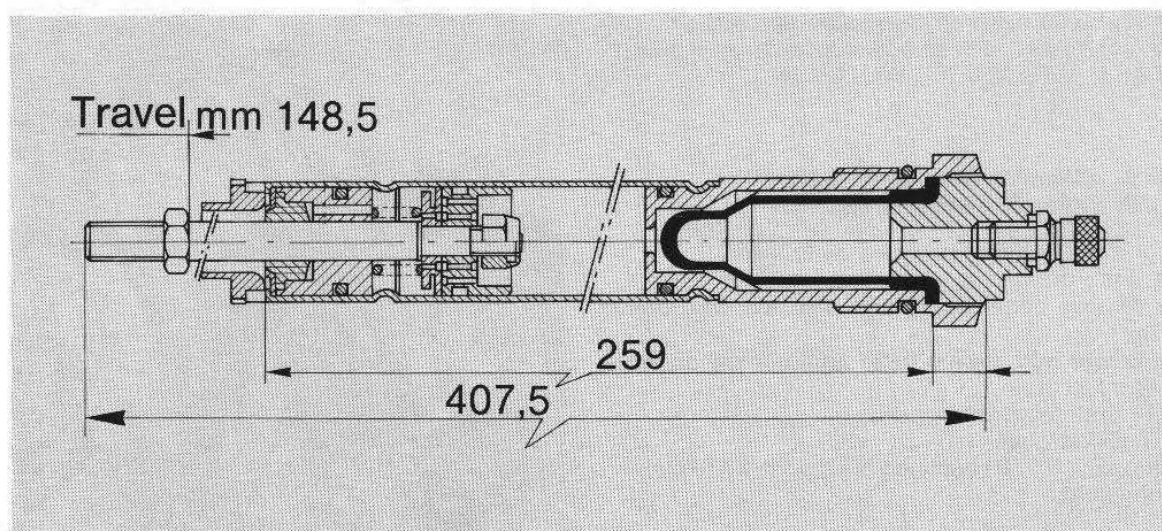
■ front 3 kg/sqcm \pm 1;

■ rear 4 kg/sqcm \pm 1.

The given tolerances are to be considered valid only for the set of each group; that is both shock absorbers can have a pressure from 2 to 4 kg/sqcm, but in any case the R/H front shock absorber must have the same pressure of the L/H front shock absorber; the same applies for the rear group.

For models V 65, V 65 SP, the operating load pressures are:

– front 1 kg/sqcm and rear 2 kg/sqcm.



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13 REAR SUSPENSION

Dismantling from the frame

■ Unscrew the nuts securing it to the frame and remove the shock absorbers from the bosses on the frame, rear fork, and drive box.

Inspection (see figs. 136-137)

■ check conditions of springs «A» and both shock absorbers «B» at the same time to ensure they have the same load and so prevent offsetting the swinging arm and the rear drive box. In case of inefficient shock absorbers, replace either the springs or the complete shock absorber;

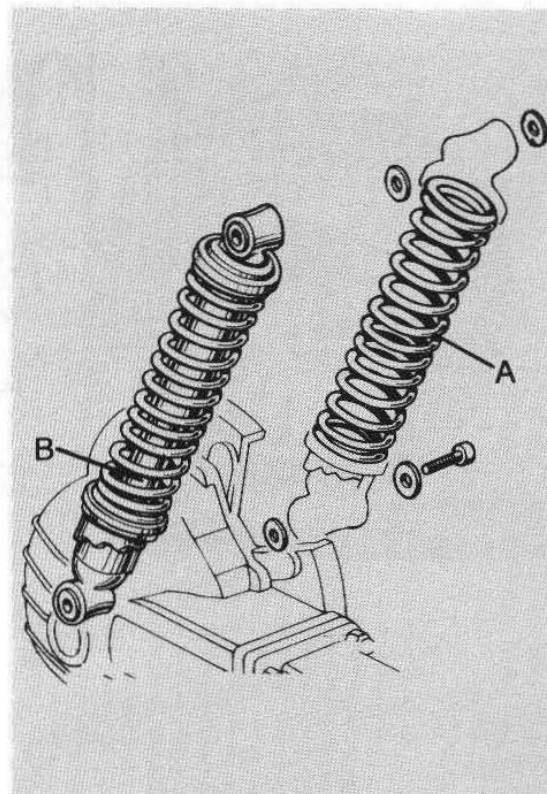
■ Ensure rubber bushings «C» are not crumbled or hardened, if so, replace them.

In case of inefficient damper operation, it is better to replace the complete units.

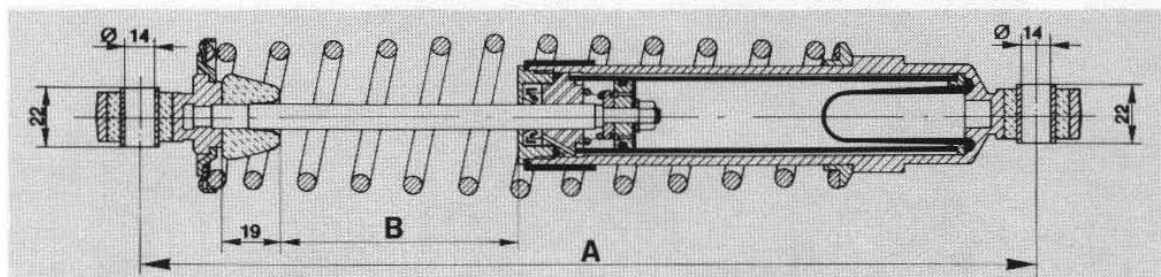
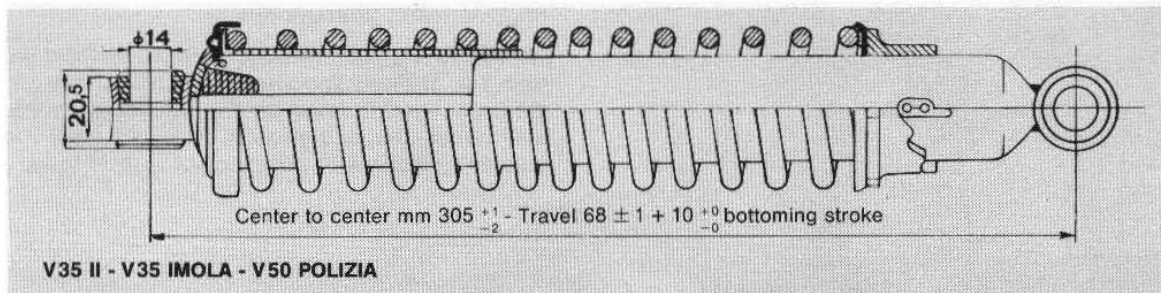
WARNING – Do not forget that good stability is mostly dependent on the springs being adjusted to the same position and load.

Re-assembly

Reverse the dismantling operations.



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Model	Travel in mm B	Center to center in mm A
V50 III - V50 Monza	65 + 5 bottoming stroke	$310 \begin{smallmatrix} +2 \\ -0 \end{smallmatrix}$
V35 C - V50 C	75 + 5 bottoming stroke	$330 \begin{smallmatrix} +2 \\ -0 \end{smallmatrix}$
V65 - V65 SP	70 + 5 bottoming stroke	$320 \begin{smallmatrix} +2 \\ -0 \end{smallmatrix}$

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14.1 FRONT WHEEL

Removal from front fork
(fig. 138)

For this operation proceed as follows:

- set up the motorcycle on the center stand and place supporting stand (32 in fig. 9) under the sump with a suitable wooden board to keep the wheel off the ground;
- undo the caliper securing screws «A» from the left fork slider and disconnect the slider from caliper with its pipe;
- undo wheel spindle fixing nut and washer «B» on the L/H side; loosen the bottom cover screws to the wheel splinde «C»;
- withdraw wheel spindle «D» from the hub, observing the mounting position of washer «E» and spacer «F».

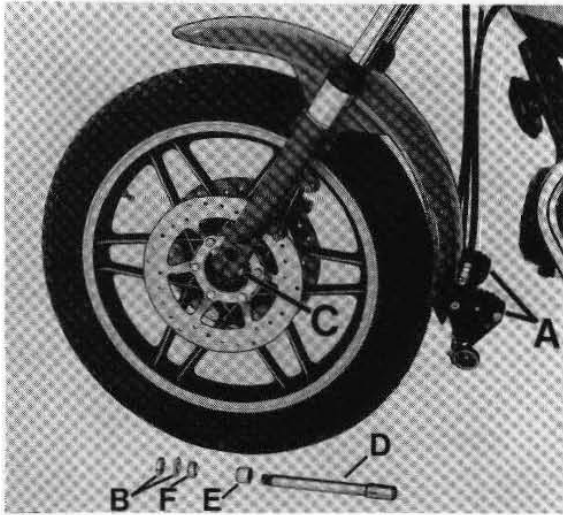
Pay attention to any speed driving gear shims.

Removing the front wheel hub (see fig. 139)

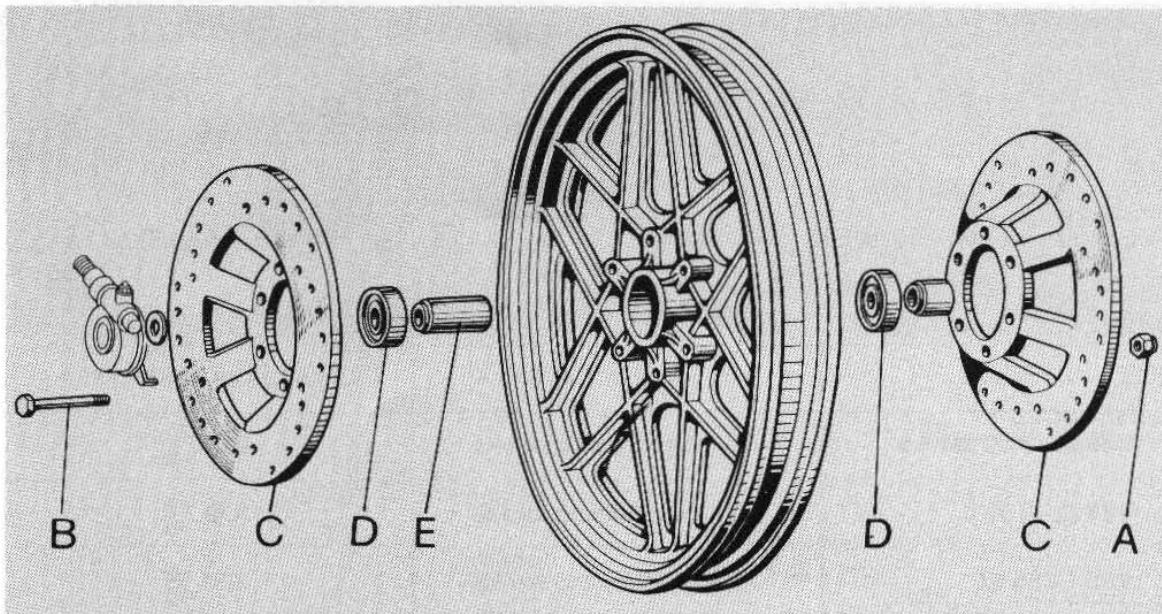
After removing the wheel, the hub on it is removed as follows:

- undo six self-locking nuts «A», take out their screws «B», and remove both discs «C»;
- using the special punch, remove both bearings «D» and spacers «E».

IMPORTANT – After removing the wheel from the fork it is strongly recommended not to actuate the brake control lever on the handlebar as this may cause the plungers to drop out from the master cylinder with consequent loss of fluid.



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If this should happen, push the plungers up again in their housings and top up the reservoir. Proceed now to bleed the air from the circuit. To check end and side play, see drawing fig. 140.

14.2 REAR WHEEL

Removal of rear wheel from swinging arm and drive box (fig. 141)

Proceed as follows:

- set up the bike on the center stand;
- undo nut «A» with washer «B» from the spindle on the drive box side;
- loosen screw «C» securing spindle «D» to the rear fork arm;
- withdraw spindle «D» from the box, hub, and swinging fork arm;
- remove shim «E»;
- lean the bike to the right so as to allow the wheel to be taken off the swinging fork arm and rear drive box.

To refit the wheel, reverse the dismantling operations.

Removing the rear wheel hub (fig. 142)

Proceed as follows:

- remove cushioning springs «A» from the wheel hub;
- using a suitable punch, remove both bearings «B» with their spacer «C».

Re-assemble reversing the dismantling operations.

Check end and side play against drawing No. 143.

14.3 TYRES

Tyres are included in the components that have always to be kept under control as the vehicle stability, riding, comfort, and even the rider's safety are dependant on them.

Accordingly, it is strongly recommended to never use tyres with less than 2 mm tread.

An incorrect tyre pressure may also affect the vehicle stability and cause the tyres to rapidly wear out.

Recommended tyre pressures:

Front wheel

Solo or with pillion: kg/cmq 2.

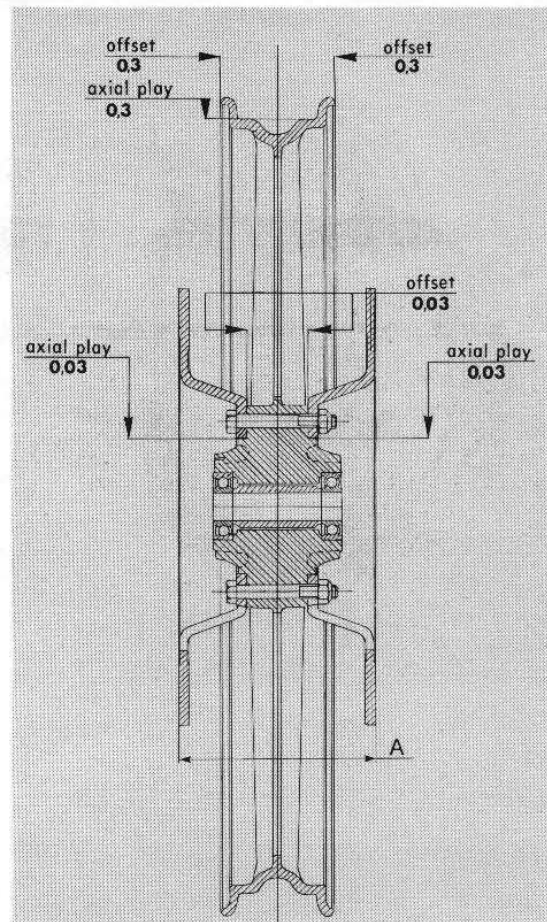
Rear wheel

Solo: kg/cmq 2.2

With pillion: kg/cmq 2.4

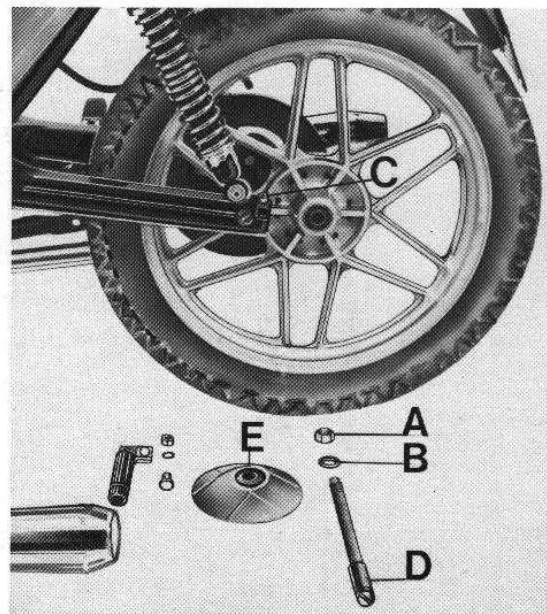
The above figures apply for normal riding (cruising).

If using the motorcycle at constant high speed or on highways, it is recommended, to increase pressure by 0.2 kg/cmq.

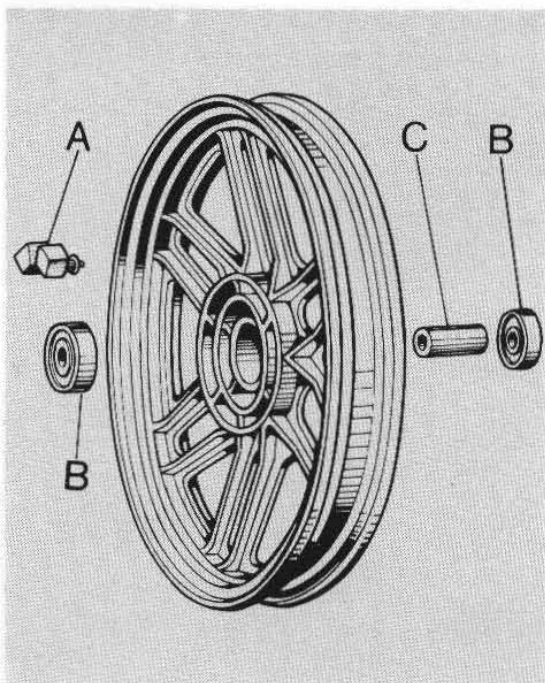


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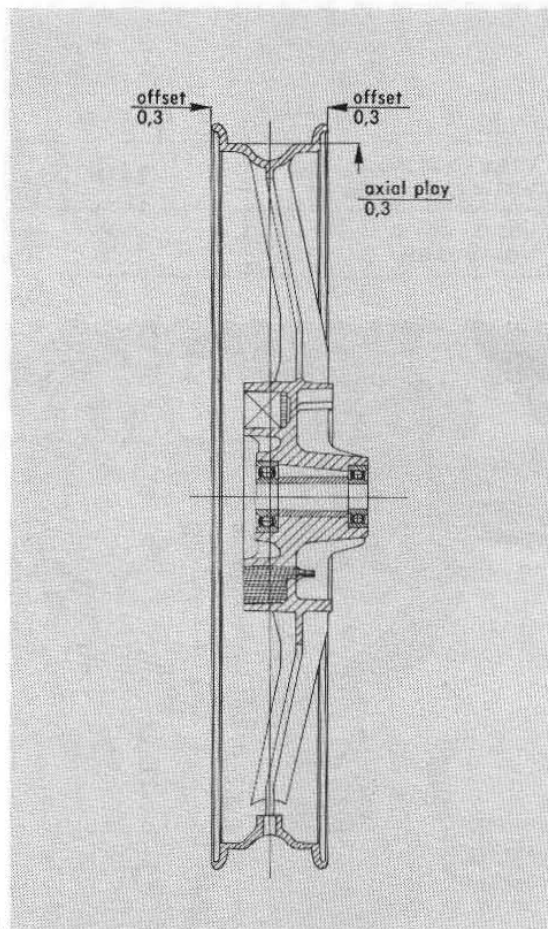
	A (in mm)
V35 II - V35 Imola V50 III - V50 Monza	110
V35 C - V50 C V65 - V65 SP	125



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14.4 WHEEL BALANCING

To improve stability and decrease vibrations at high speeds, the wheels have to be kept well balanced.

If a balancing machine is not available, a wheel can be balanced as follows:

- remove the wheel and suspend it on a fork;
- lightly spin the wheel several times and see if it always stops in different positions, thus indicating a correct balance;
- if one point of the wheel always stops at the bottom, put a balance weight on a spoke opposite this point;
- repeat this operation until the wheel is correctly balanced.

14.5 REMOVING AND RE-FITTING THE TYRES

These models fit light alloy rims which do in effect offer considerable mechanical resistance but can easily suffer damage if inappropriate tools are used for removing or re-assembling the tyres.

Accordingly, for these operations it is strongly recommended to use tools without ribbings or sharp edges where they contact the wheel rim. The contact surface should be quite wide, very smooth, and with all edges suitably rounded off. The use of any of the special lubricants available on the market, will make the fitting and bedding down of the tyres on the rim a much easier job and also prevent excessive stress on the tools. Do not forget that the tyre beads should always be a perfect fit in the central rim channel.

When fitting a tyre, and if this has an arrow stamped on its side, make sure to assemble it as follows:

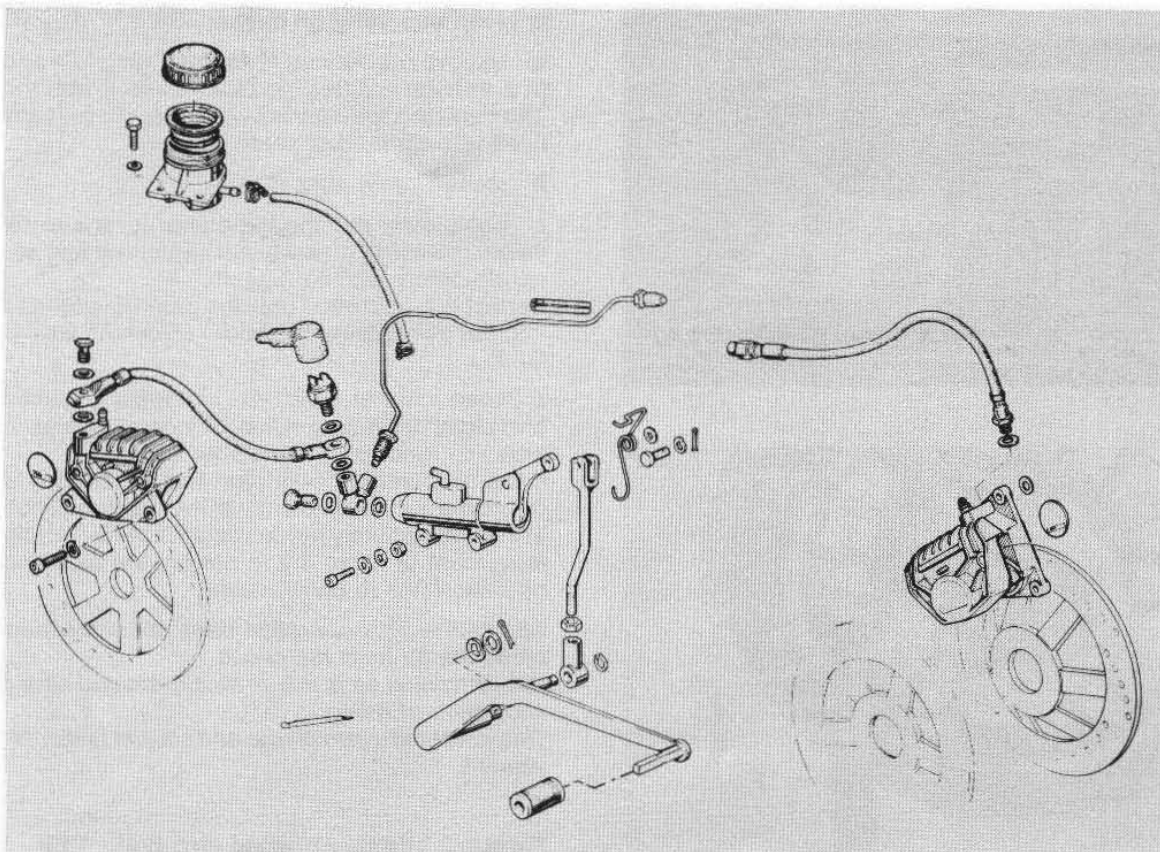
- front wheel, with arrow turned against riding direction;
- rear wheel, with arrow turned in riding direction.

14.6 HOW TO CHECK AND OVERHAUL THE BRAKING CIRCUITS FOR THE RIGHT FRONT AND REAR BRAKES

General maintenance

For a good working of the brakes the following directions have to be strictly followed.

- periodically check the level of the fluid in the reservoir for the front and rear master cylinders. It should never be below the top of the reservoir separator.
- every 3000 km, top up the fluid reservoir with fluid from an original container to be opened just before topping;
- every 15,000 km or at most every year, the braking circuits fluid should be completely renewed.



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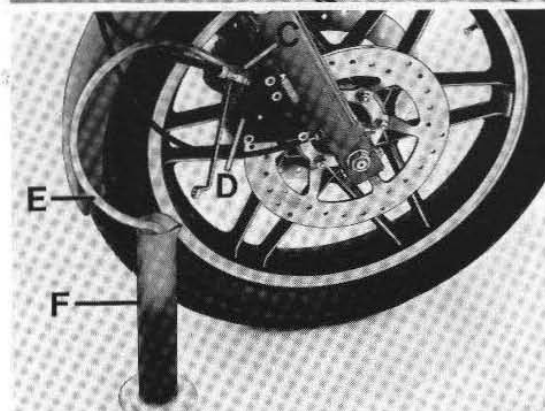
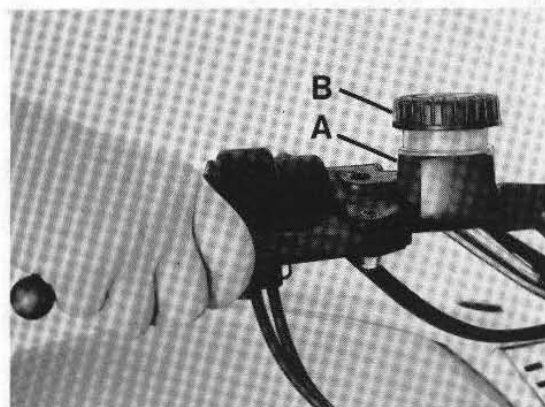
■ for good braking efficiency be sure the fluid pipes are always full of fluid without air bubbles. The presence of air is evidenced by a long and elastic movement of the control lever. To clean out the braking circuit, use only fresh fluid of recommended type. Never use alcohol to clean or compressed air to dry. Recommended fluid: Agip F. 1 Brake Fluid (SAE J 1703).

Air bleeding

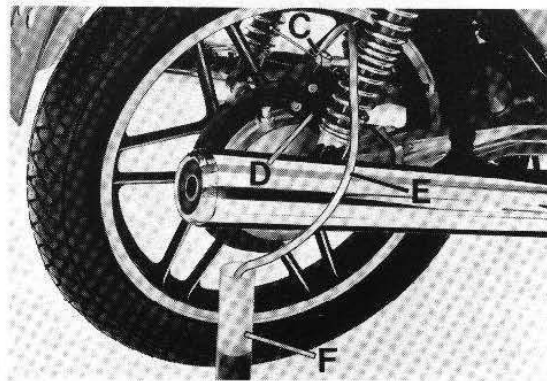
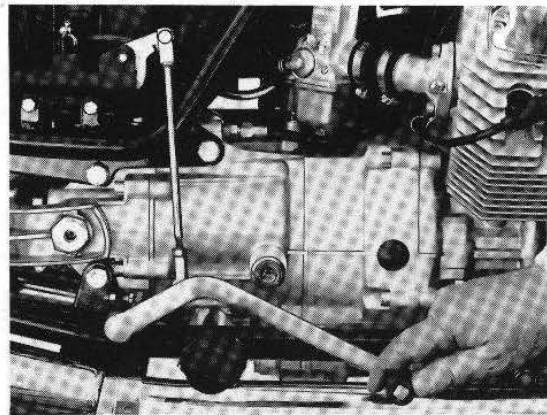
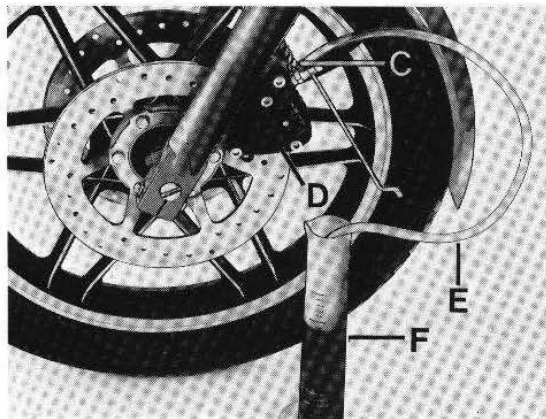
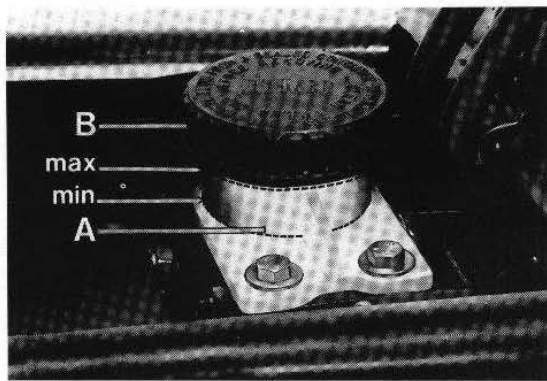
This operation is needed every time the movement of the control lever or pedal is long and elastic due to the presence of air bubbles in the braking circuit.

Front right braking circuit (fig. 145)

- set up the byke on the center stand;
- If necessary, fill up fluid reservoir «A» (always ensure that during the bleeding operation the fluid level never drops below the top of the plate separator);



145



■ bleed operating on caliper «D»:

a remove rubber cap from drain plug «C» and fit a transparent flexible pipe «E» in it with the other end in a transparent container «F» partially filled up with fluid of same type;

b loosen drain plug «C»;

c completely pull the handlebar lever several times, releasing it slowly and waiting a few seconds before pulling it again. Repeat this operation until the pipe «E» plunged into the transparent container «F» emits airless fluid;

d keep control lever «B» completely pulled and close drain plug «C» tightly; remove plastic tube «E», and re-fit the rubber cap. If the air bleeding operation has been carried out correctly, the efficiency of the braking action will be immediately perceived after the initial idle movement of lever. If it is not so, the bleeding operation has to be repeated.

REMARK – This operation does not completely bleed the air from the circuit. The remaining air is automatically emitted after a short time of riding. This will entail a less elastic and shorter lever movement.

Front left and rear braking circuit (fig. 146)

■ proceed similarly as done for the «Front right braking circuit» except for points «C» and «D»:

- «C», fully operate on control pedal, etc.;
- «D» keep the control pedal fully drawn, etc.

Checking the level in reservoir and replacing the fluid

For a good working of the brakes the following directions have to be observed:

- frequently check the fluid level in reservoir «A» of figs 145-146. This level must never fall below the minimum;
- periodically or whenever necessary top up fluid reservoir.

To top up always use fluid taken from a container opened just before pouring in.

General procedure for dismantling components from the braking circuit

Before any part is removed, clean it thoroughly on the outside.

Carefully plug up all pipe ends to prevent the entrance of foreign matter.

After the parts have been removed, clean them thoroughly in trichloroethylene (metal parts) and the rubber parts with the specified liquid.

Ensure the rubber gaskets and seals do not get in contact with trichloroethylene.
 Handle all delicate components with care.
 After cleaning, dry all parts with clean rags and moisten the cylinder walls and plungers with brake fluid to prevent oxidation.

14.7 MASTER CYLINDER FOR RIGHT FRONT BRAKE

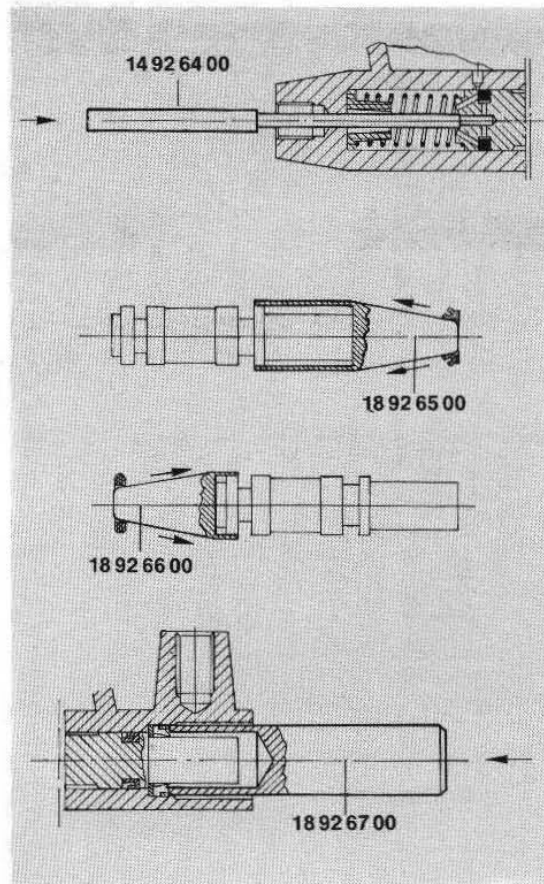
The master cylinder for right front brake is bolted on the R/H side of the handlebar.
 Check floater-lever end clearance which should be 0.05 to 0.15 mm.
 Periodically grease the scraper and floater shank with the fluid indicated.

Overhauling and replacement of master cylinder components and tools to be used (figs. 147 and 148)

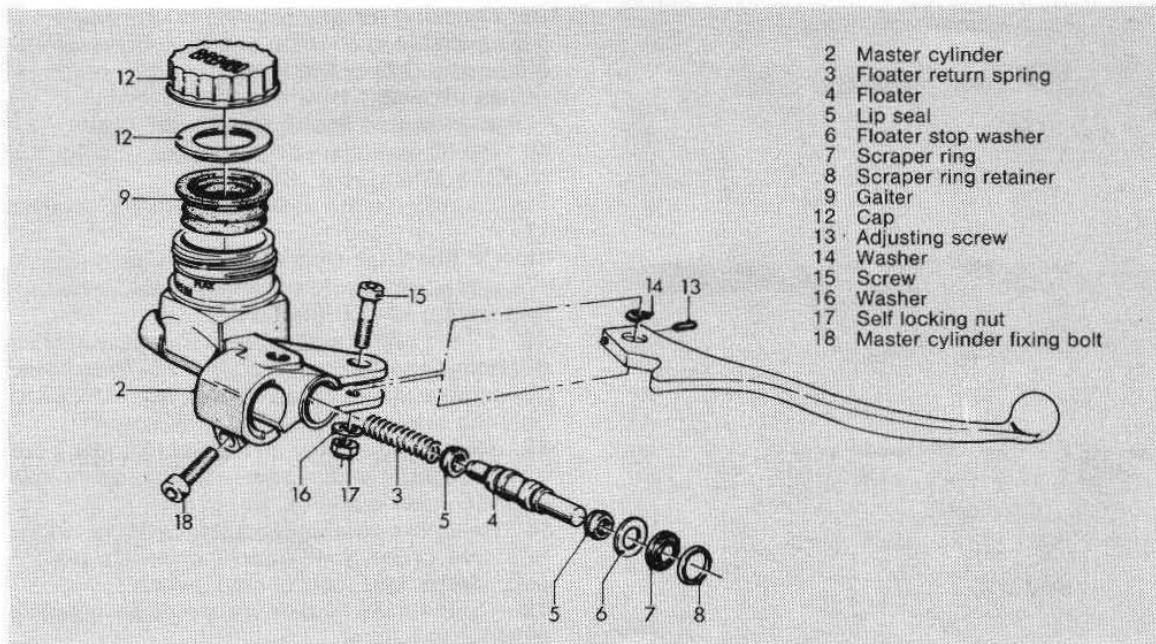
If the master cylinder operation is incorrect where the control lever operates (decreased braking ability), it is necessary to replace seal gaskets.

To carry out this operation proceed as follows:

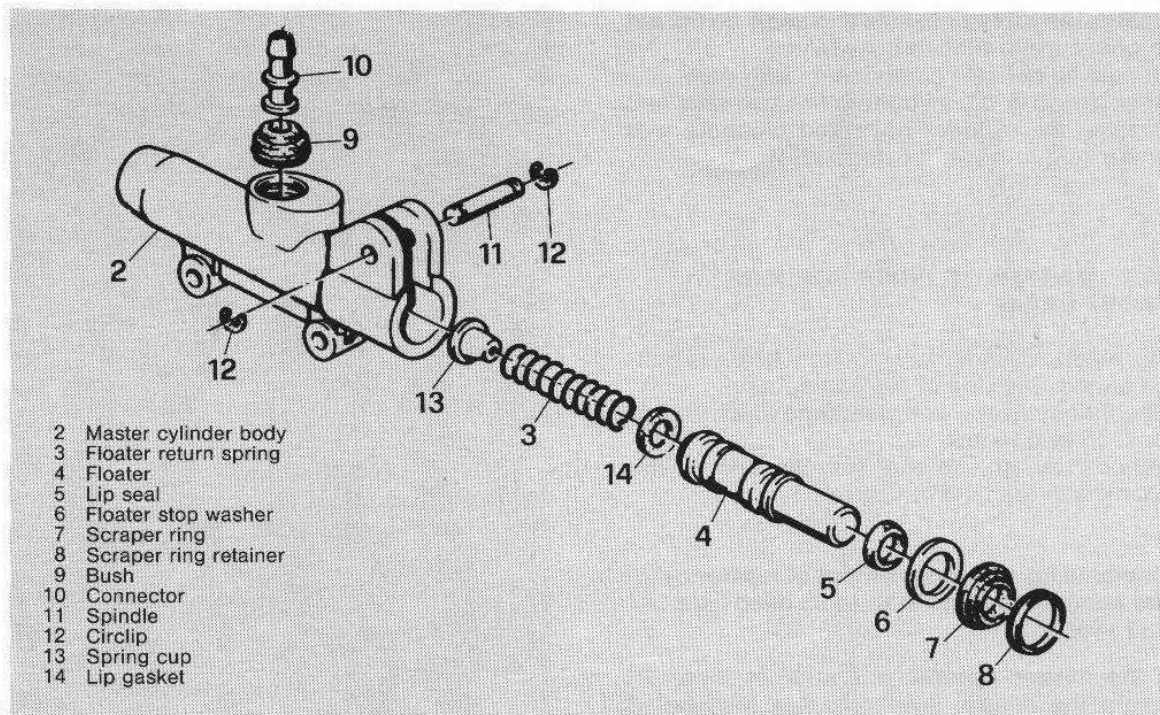
- 1 Disconnect the fluid delivery pipe to the master cylinder.
- 2 Remove cap and gaiter.
- 3 Drain fluid from the reservoir.
- 4 Remove master cylinder from handle bar after having disassembled throttle control grip starter and stop engine switch.



147

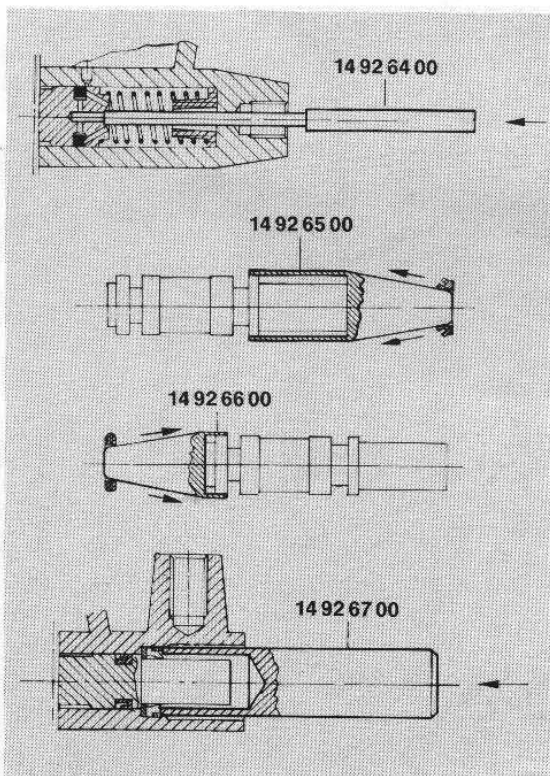


148



- 2 Master cylinder body
- 3 Floater return spring
- 4 Floater
- 5 Lip seal
- 6 Floater stop washer
- 7 Scraper ring
- 8 Scraper ring retainer
- 9 Bush
- 10 Connector
- 11 Spindle
- 12 Circlip
- 13 Spring cup
- 14 Lip gasket

149



150

Undo nut «17» with washers «16» and «14» and screw «15» then remove lever from master cylinder body «2».

6 Fit tool 14926400 into the fluid passage hole and push out floater «4» by lightly tapping with a mallet, taking care not to score or scratch the hole walls or the outer surface of the floater.

7 From floater remove scraper ring «17» locking «6» and lip gasket «5».

8 From the pump body remove return spring «3».

9 Clean accurately floater and master cylinder checking for any scoring or damages.

It is advisable to check also the I/D of master cylinder and O/D of the floater:

- max allowable hole dia. 12.843 mm
- min allowable floater dia. 12.657 mm.

10 Re-fit gaskets «5» on floater, using tool 18926500 and tool 18926600.

Pay attention to the assembly sense of gaskets «5».

11 On floater fit stop washer «6» scraper ring «7» and scraper ring retainer «8» and insert return spring «3» on the floater.

12 Fit the entire assembly in the master cylinder hole, fit scraper ring retainer «8» in its housing using a mallet to tap on tool No. 18926700 until the retainer is head to click home.

13 Refit control lever on master cylinder body «2» securing it with screws «15», washers «14» and «16» and nut «17».

14 Re-fit the complete master cylinder on the R/H side of the handlebar, the throttle control grip, starter and stop engine switch.

15 Connect the fluid delivery pipe from master cylinder to caliper.

16 Re-check the clearance between floater and control lever on the master cylinder of the R/H front brake.

17 Fill up the reservoir with fluid to reach the correct level and then carry out the air bleeding operation.

18 Re-fit gaiter «9» and screw in plug «12».

NB - Before mounting lightly moisten the rubber and metal parts with the fluid indicated or proper grease. Under no circumstances use mineral oils or grease.

14.8 MASTER CYLINDER FOR FRONT LEFT AND REAR BRAKES (fig. 149)

It is centrally located on the R/H side of the vehicle.

To get access to it remove the R/H side cover. Ensure that there is a clearance of 0.05 to 0.15 mm between floater and lever end on the master cylinder; if not adjust the correct clearance.

Overhauling and replacing components and tools to be used (figs. 149 and 150)

If the master cylinder operation is incorrect (fluid leakage at lever side, decreased braking ability etc.) it is necessary to replace the sealing gaskets.

For this operation proceed as follows:

1 Disconnect the rod connecting master cylinder with control pedal.

2 Disconnect fluid delivery pipe from reservoir to master cylinder.

3 Disconnect pipes from master cylinder.

4 Plug up these pipes.

5 Remove master cylinder from frame.

6 Remove control lever from pump body «2» after removing circlip «12» and withdrawing pin «11».

7 Insert tool 1492 64 00 in the fluid duct and tapping lightly with a plastic mallet push out the floater «4», paying attention not to score the hole walls and the outer surface of the floater.

8 From floater remove lock ring «80», scraper ring «7», stop washer «6», lip gasket «5» and gasket «14».

9 From master cylinder remove return spring «3» and guide bush «13».

10 If necessary remove connector «10» and bush «9».

11 Carefully clean floater and pump body and check if damaged.

It is advisable to check I/D of master cylinder and O/D of floater:

— max allowed hole dia. 15.918 mm

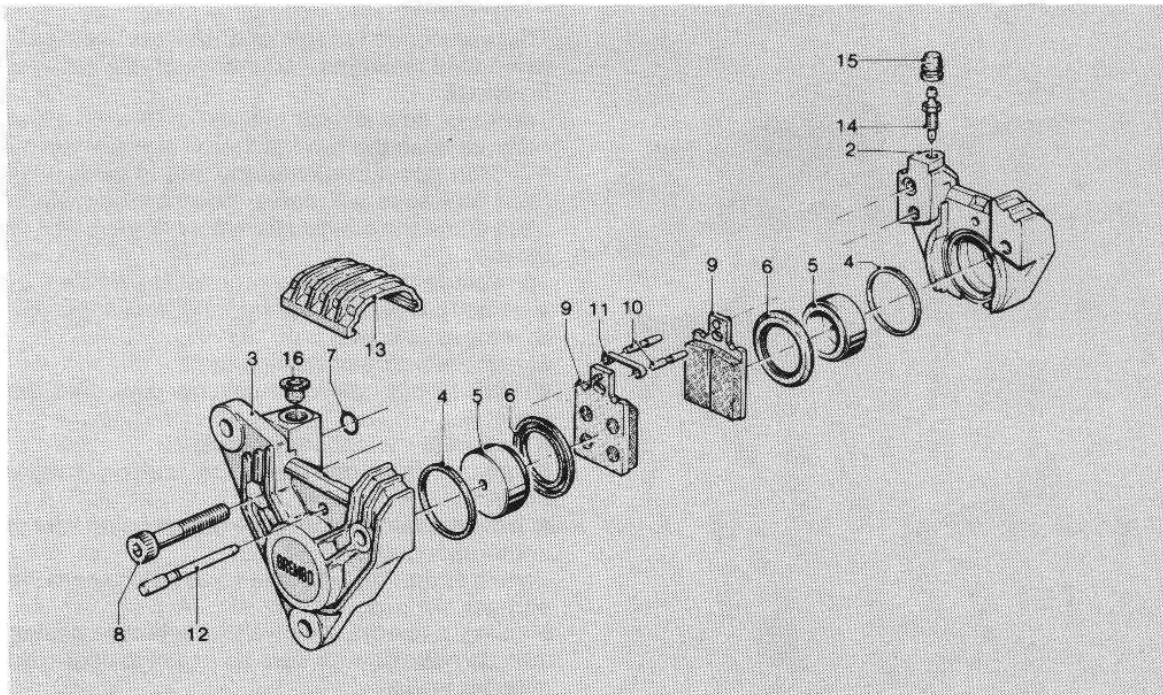
— min allowed floater dia. 15.832 mm.

12 Fit on floater «4» gasket «5» using tool 1492 65 00 and gasket «14» using tool 1492 66 00.

Attention to the assembly sense of gasket «5».

13 On floater fit washer «6», scraper ring «7», scraper lock ring «8» and insert return spring «3» on the floater.

14 Fit the hole assembly in the master cylinder hole «2», fit lock ring «8» using tool No. 1492 67 00 and lightly tap with a mallet to drive stop washer «6» fully home.



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14.9 CALIPERS FOR RIGHT FRONT, LEFT AND REAR BRAKES (fig. 151)

These calipers consist of two light alloy bodies «2» and «3» joined by two screw «8».

Each body incorporates a cylinder housing which acts as a guide for piston «5».

Sealing is assured by a gasket «4» lodged in a groove inside the cylinder housing.

The sealing is automatically adjusted by the wear of pads «9» which increase the piston exit out of the cylinder housing.

Dust cap «6» which is internally secured to the round groove of the piston and externally around the annular hole of the cylinder, prevents the entrance of moisture and foreign matter.

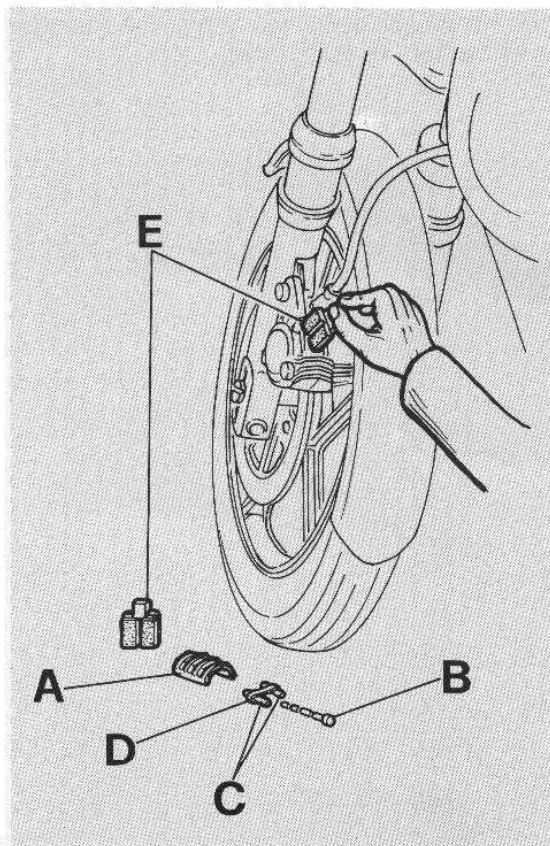
The 2 pistons act directly on the 2 pads between which is the disc the pads are secured by pin «12».

Two taper pins «10» pressed in spring «11» prevent pad flapping, and make the settling down of the disc easier after braking.

Cap «13» mounted over the caliper prevents the cap from getting too wet because of rain or mud. Brake fluid is delivered through the hole in one of the caliper bodies and hydraulic connection between the caliper bodies is assured by two inner holes.

Sealing is assured by gasket «7».

Each caliper body is provided with a drain plug «14» for the bleeding of the air bubbles.



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Inspection and check (see fig. 152)

Every 3000 km it is well to check pad wear as follows:

- remove cap «A»;
- remove central pin «B», spring «D» and pins «C»;
- slip off pads «E»; pad thickness:
 - new pad 7 mm;
 - wear limit 3.5 mm.

If thickness is under the wear limit, the pads have to be replaced.

The friction material has not to be used right down to the metal plate as if this contacts the disc it will not only irretrievably damage it but prevent proper thermal insulation between pads and brake fluid.

Replace pads as follows:

- push pistons inside the caliper bodies, being careful not to damage the dust caps;
- fit new pads «E»;
- fit pads retaining pins «C» with spring «D», also central pin «B».

By using the above procedure it is not necessary to bleed the air from the circuits.

It is sufficient to operate the lever or pedal several times to allow the plungers to assume their normal operating position.

IMPORTANT – For about 100 km after pad replacement, it is recommended to operate the new pads gently in order to allow the friction material to evenly and properly settle down.

NB – When replacing the pads it is a good rule to take out a small amount of fluid from the reservoir as the backing of the pistons might cause the fluid to overflow.

Inspection and replacement of caliper components

The replacement of caliper gaskets is necessary when fluid leakages occur through the cylinder housings.

Traces of fluid will be noticed on the disc and calipers, also the level of the oil in the reservoir will drop down considerably and in continuity. Fluid leakages will cause poor braking efficiency and a too elastic movement of the pedal or lever.

To replace the gaskets, proceed as follows:

- remove and plug up the fluid delivery pipe;
- remove caliper;
- remove pad slot sealing cap;
- remove pin, spring, retaining pins, and the pads;
- separate the caliper bodies;
- remove dust cap from the leaking caliper body;
- from the body remove the piston using a jet of compressed air.

Do this operation with care so as not to score the plunger surface;

- using a needle, remove the defective gasket from its housing with care so as not to score the cylinder walls;

■ clean the plunger and cylinder thoroughly, checking for damages.

It is also advisable to check wear of the cylinder and piston:

– max admissible I/D of cylinder:

32.071 mm;

– min admissible O/D of piston:

31.930 mm

■ fit a new gasket in the cylinder housing;

■ fit the plunger into the cylinder (Do this only by finger pressure);

■ fit the dust cap after ensuring it is not cracked or torn (ensure it is properly anchored in its housing on the piston and caliper);

■ join up both caliper bodies, ensuring the gasket seat properly in its housing.

Use a torque wrench set 2.5 to 2.9 kgm;

■ fit caliper on fork cover.

Tighten screws to a torque of 2.2 to 2.4 kgm;

■ fit pads, retaining pins and position spring with pin;

■ connect fluid delivery pipe to caliper.

■ bleed the braking circuit.

NB – Before mounting, ensure all rubber and metal parts are moistened with brake fluid.

Never use mineral oil or grease.

Pipes

Check their condition accurately and replace immediately if in any way damaged.

14.10 BRAKING DISCS

The discs are the rotating parts contacted by the pads during the braking action and their condition can have a marked influence on braking efficiency.

For specific motorcycle purposes, the surfaces of the braking disc have been suitably treated to prevent oxidations.

This treatment is done on the braking surface. However, after several brakings, this protective film is rubbed away, thus creating an ideal pad-disc coupling.

Inspection and checks

Checking the brake disc is very important.

The disc surface should always be perfectly clean, free from dust, oil grease or any other dirt.

If the disc is damaged it should be replaced.

diameter of braking disc	
FRONT DIA.	REAR DIA.
260 mm	235 mm

The thickness of front and rear disc (new disc): 5.85 to 6.00 mm.

When overhauling or replacing a disc, check its wobbling.

This checking is carried out with a gauge and the wobbling should not exceed 0.2 mm.

If the play is greater, check the mounting position of the disc on wheel hub and also the wheel bearing play.

Tighten the wheel hub screws fixing the disc with a wrench set to 2.2 to 2.4 kgm.

Braking circuit faults

CAUSE	REMEDY
<p>Brake screeching</p> <ol style="list-style-type: none"> 1. Caliper not completely locked 2. Missing or defective springs 3. Worn out pads 4. Oil or greasy pads 5. Fitting of incorrect type pads 	<ol style="list-style-type: none"> 1. Tighten securing screws 2. Fit new spring 3. Fit new pads, after checking condition of disc 4. Replace pads 5. Replace pads
<p>Excessive heating of disc (normal riding)</p> <ol style="list-style-type: none"> 1. Piston locking, pads glued to disc 2. No play at control lever 	<ol style="list-style-type: none"> 1. Check condition of plungers, clean pads, housing in caliper 2. Adjust lever play according to instructions
<p>Poor braking</p> <ol style="list-style-type: none"> 1. Dirty or oily brake disc 2. Excessively worn or vitrified pads 3. Oily or greasy pads 4. Plungers jammed 	<ol style="list-style-type: none"> 1. Clean disc 2. Change pads, check disc 3. Replace pads 4. Restore sliding to plungers
<p>Brake locking</p> <ol style="list-style-type: none"> 1. Friction coefficient of pads too high 2. Disc oxidized 	<ol style="list-style-type: none"> 1. Fit proper pads 2. Grind-in disc
<p>High pad wear</p> <ol style="list-style-type: none"> 1. Pads jammed in housings, brake disc surface in continuous contact 2. Plunger jammed 3. Disc deeply scored 	<ol style="list-style-type: none"> 1. Clean pad housing in caliper, check if properly mated with guides 2. Restore sliding condition 3. Grind-in or replace disc
<p>Irregular or slantways pad wear</p> <ol style="list-style-type: none"> 1. Dirty pad housings 2. Piston slides improperly 3. Defective pad spring 4. Caliper mounted slantways 	<ol style="list-style-type: none"> 1. Clean pad housings 2. Restore sliding condition 3. Replace springs 4. Check and fit up properly
<p>Control lever run too long</p> <ol style="list-style-type: none"> 1. Disc wobbling more than 0.2 mm 2. Presence of air bubbles in the braking circuit 3. Deeply scored brake disc 	<ol style="list-style-type: none"> 1. Grind or replace brake disc 2. Bleed the air from the circuit 3. Grind disc or replace disc

CAUSE	REMEDY
<p>Sticking of master cylinder floater</p> <ol style="list-style-type: none"> 1. U-bolt securing screws excessively tightened 2. Lever bolt excessively tightened (non-original bolt) 3. Lever-cylinder housing coupling incorrect (lever too thick) 4. Scraper deformed by etching liquids 5. Dirty fluid 6. Defective floater return spring 	<ol style="list-style-type: none"> 1. Loosen screws partially 2. Loosen bolt partially 3. Replace lever 4. Replace scraper ring 5. Strip master cylinder, clean and check components (replace if scored or seized) and replace fluid 6. Change the spring
<p>Fluid leakage from reservoir</p> <ol style="list-style-type: none"> 1. Gaiter wrongly fitted 2. Damaged gaiter 3. Damaged reservoir rim 	<ol style="list-style-type: none"> 1. Fit gaiter properly in its housing, close cap gently 2. Replace gaiter 3. Repair or replace pump

14.11 RECOMMENDATIONS

All rubber components (master cylinder seals and gaskets, scraper, gaiter, caliper joining gaskets, dust cap) are made of special compound resisting to the brake fluid action but not to the etching that are sometimes used to wash down the byke.

Accordingly, it is strongly recommended to avoid any contact of these liquids with rubber parts of the braking circuit.

For instance, it might occur that the scraper ring due to getting in contact with such liquids may, also partially, stick to the floater and so prevent it from sliding properly.

For some unknown reasons, the caliper gaskets are somewhat subject to sticking to the plungers.

This peculiarity may occur within a comparatively period of time (abt 2÷4 months).

This time, however, is influenced by many factors such as machining tolerance, rubber compound tolerances, ambient condition when the calipers are either stored or the machine is kept inoperative for long periods.

If an event of this kind turns up, it is necessary to proceed as follows:

a pull the front cylinder lever or push the pedal repeatedly for the rear cylinder till the correct pad-disc distance is obtained;

b if the above operation does not give satisfactory results, proceed as follows:

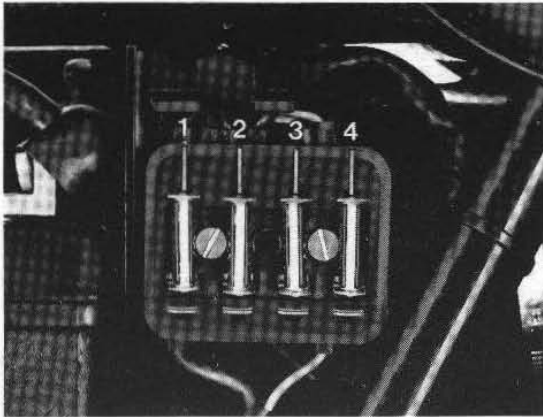
– remove the plastic cap from the caliper;

- remove one pad and actuate the master cylinder so as to allow the plunger to come out from its housing in the caliper about 4÷6 mm;
- push in the plunger taking care not to damage it, or the disc, or the rubber components;
- re-fit the pad;
- proceed likewise for the other pad;
- operate as indicated at a).

NB – When carrying out the above operations make sure the pad position is not reversed.

The electrical equipment consists of:

- battery
- starter motor
- contact breakers plate
- condensers
- automatic advance
- ignition coils
- rectifier
- regulator
- fuse block (No. 4 fuse of 16A)
- flashing light relay
- starter relay
- headlight
- tail light
- turn signal lamps
- ignition key switch
- light switch
- turn light, horn, flashing light switch
- horn
- panel indicator lights: neutral (orange); parking and town driving (green); oil pressure (red); high beam (blue); generator (red).



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15.1 TERMINAL BLOCK WITH FUSES

(fig. 153)

It is centrally located on the machine. It is accessible by raising the seat and removing the side cover (R/H). The box contains No. 4 fuses of «16A». Before replacing any fuse it is necessary to look for and eliminate the cause for its burning.

15.2 BATTERY (fig. 154)

These models fit a 12 V battery with a 20 Ah capacity which is directly charged by the generator.

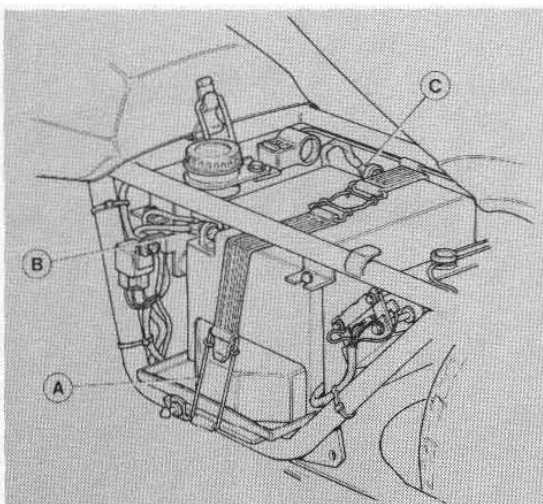
To access to the battery:

- raise the seat using the special lever;
- disconnect its anchoring rubber strap «A»,
- undo cables «B» and «C» clamp screws;
- take out the battery from its housing.

Putting a dry battery in service

(new battery)

- 1 Remove seal and undo the plugs. In each cell introduce sulphuric acid, for batteries, with a specific gravity of $1.26 = 30^\circ \text{Bé}$, at a temperature of not less than 15°C , until the level does not pass 5 to 10 mm the separator edge or splash guard.
- 2 Let the battery at rest for about 2 hours.
- 3 Now charge the battery for 6-8 hours – intensity $1/10$ th of its capacity – until the acid has reached the value of about $1.27 = 31 \text{ Bé}$ and



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such gravity has remained constant for at least 3 consecutive hours.

4 After charging, top up the acid, screw in the plugs, and clean the battery cover accurately.

Servicing the battery under service conditions

CLIMATE	SPECIFIC GRAVITY AT FILLING	SPECIFIC GRAVITY AT END OF CHARGE	MAX TEMPERATURE PERMISSIBLE DURING CHARGE
Temperate (normally under 32 °C)	1260	1270 + 1280	50 °C
Tropics (normally over 32) °C	1230	1220 + 1230	60 °C

1 Be sure the electrolyte always covers the separators.

To top up use distilled water.

Never add sulphuric acid.

2 If too frequent water additions are required, have the electrical system checked over as the battery works in an overcharged condition and will deteriorate quickly.

3 If the battery discharges quickly, the electrical system should also be checked over.

4 In case new or second hand batteries are left unused for fairly long periods of time, it is a good rule to re-charge them every month.

5 Always keep the battery terminals spotlessly clean and smeared with neutral vaseline.

6 Always keep the battery cover dry, avoiding overflows of electrolyte which will reduce insulation and corrode battery brackets.

NB – If the batteries are for use in tropical climates (average temperature higher than 33 °C it is recommended to reduce acid gravity to 1.230.

Measuring density and temperature of electrolyte (fig. 155)

This operation should be carried out periodically in each cell after topping up.

Use a hydrometer to check density.

Use a thermometer with its rounded end completely immersed in the liquid to check temperature.

Correcting the specific gravity reading compared to temperature

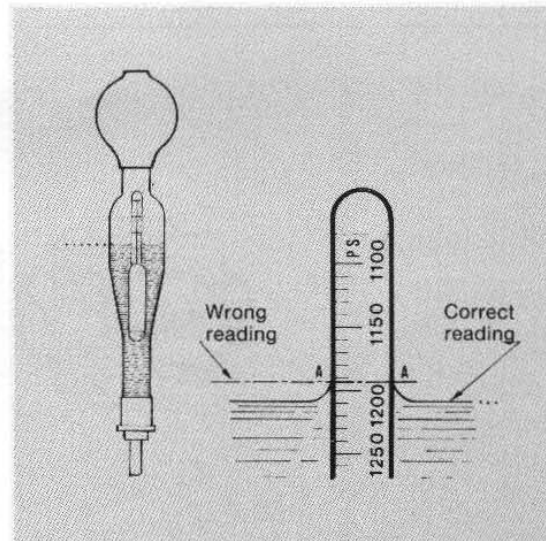
All readings should be brought down to the standard temperature of 25 °C.

For each 10 °C difference it is necessary to add or detract 7 g/l in order to bring the reading to said value of 25 °C.

For example:

■ a reading of 15 °C = 1290 g/l;

– the corresponding gravity at 25 °C will be $1.290 - 7 = 1.283$ g/l;



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This corrective factor should always be within 1.270+1.280 g/l.

When measuring specific gravity, the following precautions should be taken:

- take reading at eye level holding the tube vertically and ensuring the float is free (fig. 155);
- after measurement put back the acid in the cell from which it was taken;
- if any drops of acid have dripped, dry them with a wollen cloth.

The previous table page 115 shows specific ratings in respect to climate.

■ a reading of 35 °C = 1275 g/l;

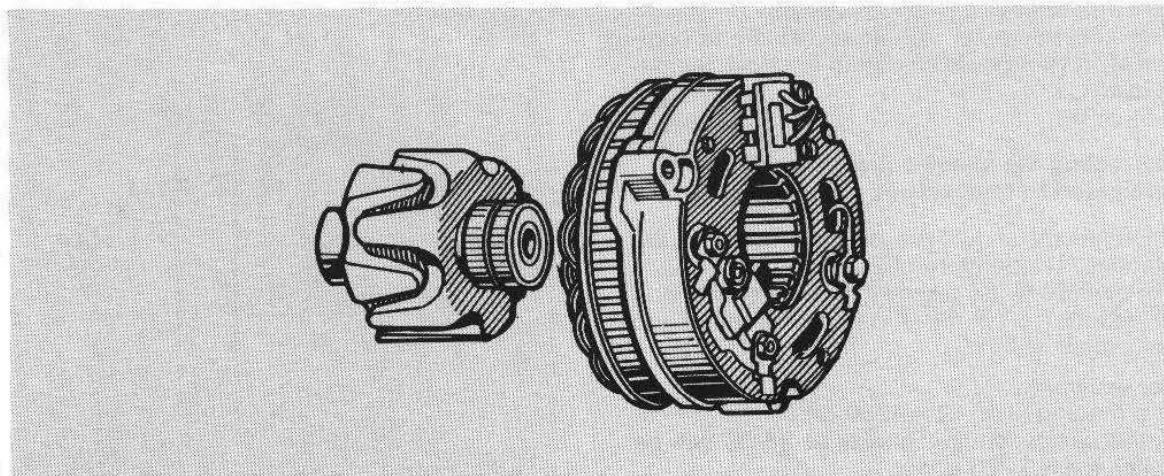
- the corresponding gravity brought down to 25 °C shall be 1.275 + 7 = 1.282 g/l.

15.3 ALTERNATOR-GENERATOR (fig. 156)

Type	BOSCH G1 (R) 14 V 20 A 21 No. 0120340002
Max output	280 W - 14 V
Max current intensity	20 Amp.
Starting of charge	1000 rpm.
Max permissible speed	10.000 rpm
Direction of rotation (seen from commutator side)	Clockwise
Max eccentricity	0.06 mm
Field winding resistance	3.4 Ohms + 10%
3-phase winding resistance of stator (A. C.)	0.38 Ohms + 10%

Bench test control of generator

POWER TEST	LOAD	MAX RMP.
Power values (with regulator)	4 A	1250 rpm
	13 A	2100 rpm
	20 A	6750 rpm



Re-charging equipment

Control on vehicle

When the panel light indicates an irregularity in the charging system, an accurate control becomes essential.

An initial check can be made without removing the generator from the vehicle with the engine not running and relatively cold in order to avoid burnings.

Disconnect cable «B+» (red cable, positive rectifier plate) and insert an amperometer-voltmeter as indicated in fig. 157.

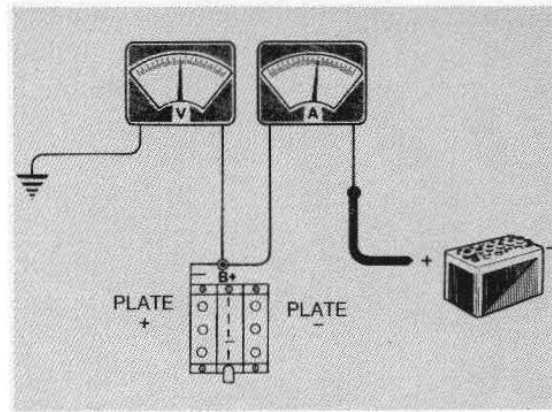
Start the engine.

Switch on any of the electrical switches, such as the headlight, and watch load and voltage.

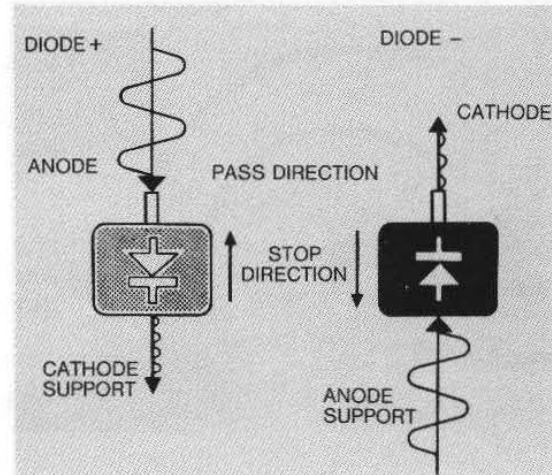
If between 12-13 Volts, the generator operation can be considered as normal and the fault has to be looked for elsewhere.

Check all connections accurately, especially the cables to the warning light in the panel, to the regulator and to the rectifier.

If all seems to be in order but the failure persists, it is necessary to proceed with various testings.



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158

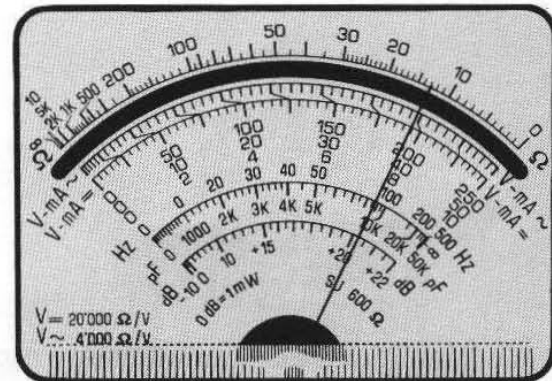
Testing a positive diode using a «ohmmeter»

Press the positive contact point of the ohmmeter against the anode of the diode and the other contact point against the cathode.

The diode is thus energized and the ohmmeter needle will immediately start to move in the first 3rd of the dial scale.

By reversing the diode polarity, the diode will block and the needle will stop.

As concerns the ohmmeter values, see fig. 159.



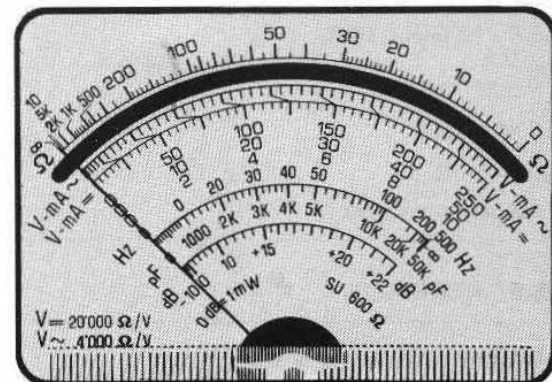
159

Testing a negative diode using a «ohmmeter»

This element works like a positive diode and accordingly by having the positive point of the ohmmeter contact the anode of the diode and with the other point in touch with the cathode, the diode will be energized and the ohmmeter needle will move suddenly in the first third of the dial scale.

By reversing the said contacts the diode de-energizes and the needle will stand still.

In regard to the ohms values, see fig. 160

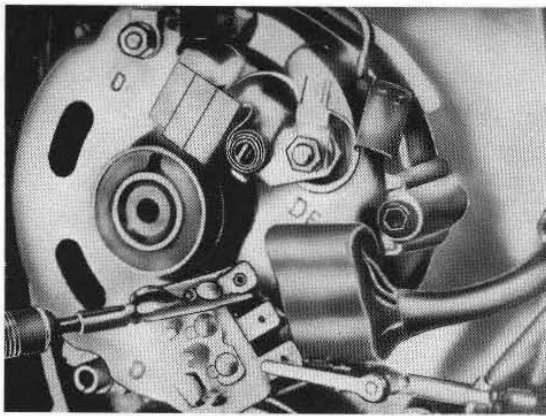


160

Testing an excited diode using a «ohmmeter»

This element works like a positive diode, therefore:

contacting the positive point of the ohmmeter between anode and diode and the other point the cathode, the diode will be energized and the ohmmeter needle will move suddenly to the first third of the dial scale.



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By reversing the said contacts the diode de-energizes and the needle will stand still. In regards to the ohms values see fig. 159 and fig. 160.

Should a diode be found to be defective, it is necessary to change the complete diode assembly.

Resistance test of the stator winding (fig. 161)

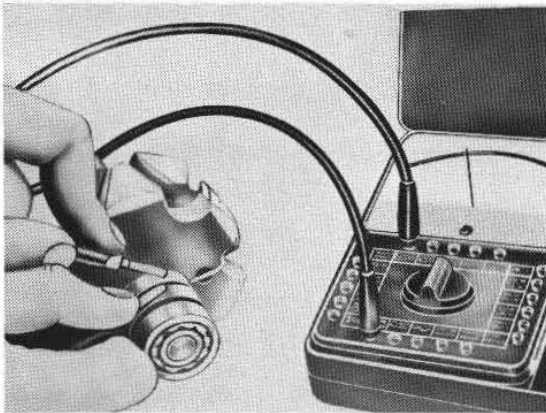
From the alternator disconnect all cables «D» and «DF» and unplug «U-V-W».

This test can easily be carried out with any of the ohmmeters available on the market or with any alternator tester.

Measure the resistance of the stator winding at exits «U-V», «U-W», «V-W».

All readings should be equal.

Resistance of the stator 3-phase winding (A.C.) should be 0.38 Ohms + 10%.



162

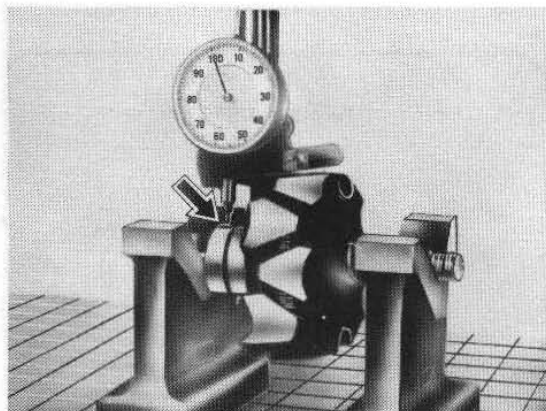
Rotor winding

The rotor excitation winding is measured with a ohmmeter.

It should be 3.4 Ohms + 10% (fig. 162).

After turning on the lathe, check concentricity of the slip rings (fig. 163).

Maximum admissible eccentricity 0.06 mm



163

Correcting faults on alternator fed systems

In case of any faults in any current producing equipment, it is necessary to ensure in the first place that the cause is not only due to malfunctions of the alternator or regulator but to some battery cable disconnection or possible faults in other points of the circuit.

The following table indicates possible breakdowns, possible causes, and remedies.

15.4 REGULATOR

Model	BOSCH AD 1/14 No. 0190601009
Test speed	4500 rpm
Test load	13 Amp
Adjusting voltage	13.9 - 14.8 V

15.5 RECTIFIER

Model	BOSCH 14 V-22 A No. 0197002003
-------	--------------------------------

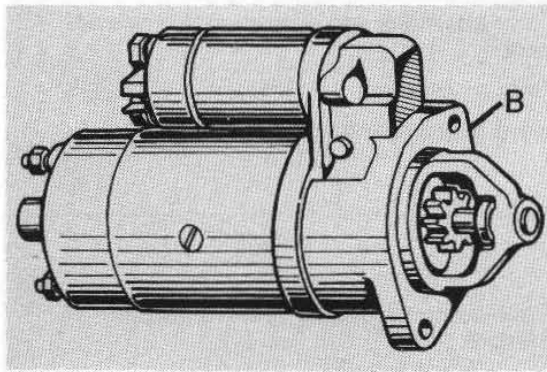
CAUSE	REMEDY
<p>Battery discharged or insufficiently charged</p> <ol style="list-style-type: none"> 1. Obstruction or reduced voltage in the charging circuit 2. Defective battery 3. Defective alternator 4. Defective regulator 	<ol style="list-style-type: none"> 1. Remove obstruction or reduced voltage cause 2. Replace battery 3. Have alternator repaired in a competent shop 4. Replace regulator
<p>Generator charge light does not light up with ignition key on (idling engine)</p> <ol style="list-style-type: none"> 1. Burnt indicator bulb 2. Discharged battery 3. Defective battery 4. Damaged or disconnected cables 5. Defective regulator 6. Shorted positive diode of alternator 7. Worn out brushes 8. Slip rings oxidized, interruption of rotor winding 	<ol style="list-style-type: none"> 1. Fit new bulb 2. Charge battery from an external electric source 3. Replace battery 4. Replace or connect cables 5. Replace regulator 6. Have alternator repaired in a specialized shop 7. Change brushes 8. Have alternator repaired
<p>Generator light stays lit at higher revs</p> <ol style="list-style-type: none"> 1. Conductor D +/-61 grounded 2. Defective regulator 3. Defective rectifier, dirty slip rings, direct current in conductor DF or in rotor winding 	<ol style="list-style-type: none"> 1. Replace conductor or remove ground contact 2. Replace regulator 3. Have alternator repaired in a qualified shop
<p>Generator light is lighted on engine stopped but sparkles or darkens on running engine</p> <ol style="list-style-type: none"> 1. Contact resistances in charge circuit or in cable to indicator light 2. Defective regulator 3. Defective alternator 	<ol style="list-style-type: none"> 1. Eliminate the resistance to the contact 2. Replace regulator 3. Have alternator repaired
<p>Generator light flickers</p> <ol style="list-style-type: none"> 1. Incorrect calibration in the contact type regulator or burnt out resistance of regulator 	<ol style="list-style-type: none"> 1. Replace regulator

15.6 STARTER MOTOR (No. 0001157016) («B» di fig. 164)

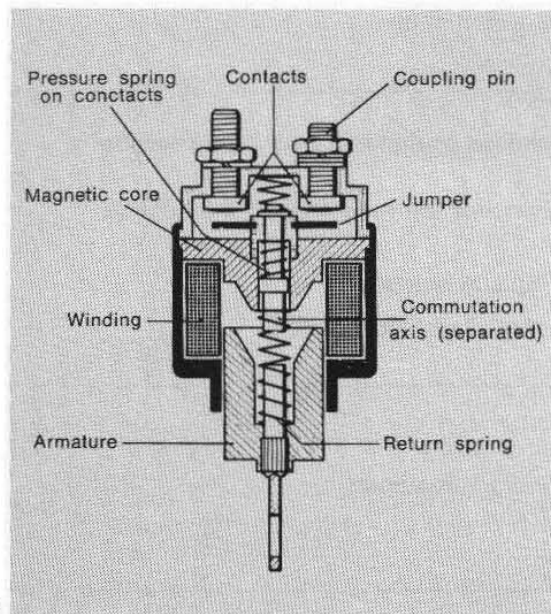
Type	BOSCH DF 12 V 0.7 KW
Voltage	12 V
Power	0.7 KW
Pinion	Z = 8 mod. 2.5
Pinion rotation	Anticlockwise
Brush pression	800 + 900 gr
Min. brush length	11.5 mm

Electric tests

RUNNING	VOLTAGE V	AMPERAGE A	RPM	TORQUE kpm ³
Idle	11.5	20 + 40	6500 + 8500	
Short circuit	9	320 + 400	—	0.92
	8	280 + 360	—	0.82



164



165

Operation of relays (fig 165 and 166)

Main purpose of a relay is to contact a high voltage with a somewhat lower one.

Since a starter motor voltage can be of several hundreds amperes, a starter motor system usually employs relays.

To introduce a lower current, a mechanical switch is generally sufficient (starter button, ignition key, or riding switch).

The relay construction is exemplified in fig. 165. The core is in unit with the casing and on one side it projects against the inner side of the winding while on the other side it projects against the movable part of the armature relay. The core-rotor distance is the travel of the armature.

The relay casing, core, and rotor form a magnetic circuit.

In many executions the relay winding consists of two winding groups: a propelling winding and a holding winding.

This solution is useful in so far as thermal load is concerned.

In the course of the engagement, a higher magnetic force is generated.

When the start circuit closes, the propelling winding is shorted and the only force of the holding winding is sufficient to energize the relay until the start contact is opened again.

Under the action of the magnetic force generated after engagement the armature is drawn into the winding and the bridge is pushed against the contacts by the spring located between armature and bridge.

The return spring assures that contacts will open.

In addition to relays with single commutation, in starter motors are also used engaging relays in

which the rotor movement is further exploited by the axial displacement of the pinion. The coupling magnet, also used on starter motor, works in the same way but does not make any commutation.

Screwing on type and translation starter motor

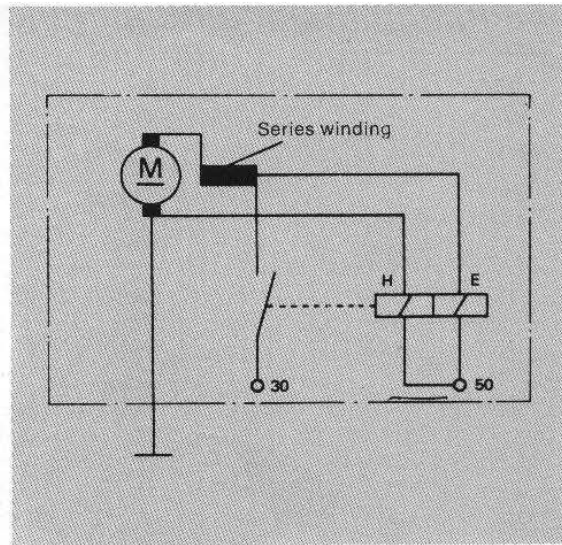
Construction of these motors and their internal circuits is shown in figs. 167-168-169. Starter motors of this type are operated by an incorporated engaging relay. At its jutting end, the relay armature has a groove which engages the operating lever with a predetermined clearance which is called free run. Purpose of this free run is that, on disengaging, the relay return spring pushes the armature towards the initial position just enough to allow such free run, thus assuring separation of the contact bridge.

This is necessary when the pinion does not come out of the crown gear. (In previous models the engaging lever was rigidly connected with the relay armature with a spring for opening in the engaging device). The armature shaft, at the pinion side, has a helical groove (figs. 167-168-169) in which is housed an entraining ring which is mated to the pinion by a roller type free wheel. The helical direction is such that the pinion is kept still and engages the crown wheel when the armature is rotating. The entraining ring fits two sliding guiding discs into which enter the forked lever ends. In between the guiding disc and the entraining ring there is the so called return spring so that the engaging lever is always moving till it bottoms up and the current can also come through (this occurs when the bridge and contact close), if one of the pinion teeth is pressing against one of the crown wheel teeth.

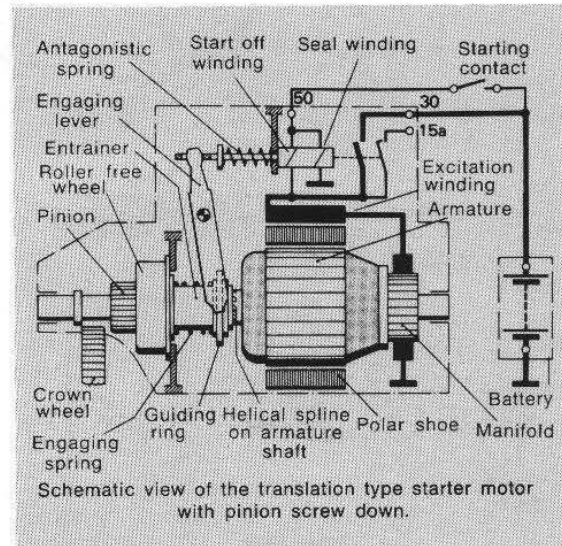
Thus, the engaging lever pushes the entrainer and pinion forward. In addition, due to the screwing in effect in the helical groove, the pinion is pushed right in fully. Only when the pinion is fully engaged, the helical groove allows a couple to be transmitted to the engine to be started. The free wheel coupling provides forced inter-connection between the motor armature and the engine flywheel after the engagement has occurred and disconnects as soon the engine revs. get higher than the starter motor speed.

Engagement

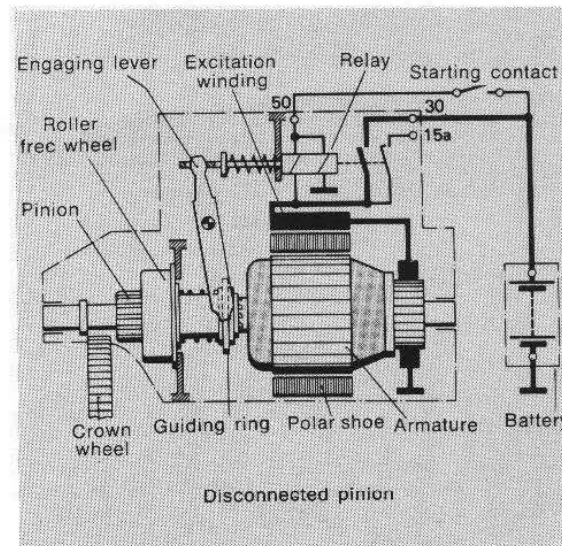
The pinion-wheel coupling process occurs in two stages: translation and screwing in. This is why this type of starting device is called «translation and screwing in starter motor». However, the engagement of the starter motor really occurs in a single stage. Initially, after pressing the start button, the engaging lever moves towards a spring but does



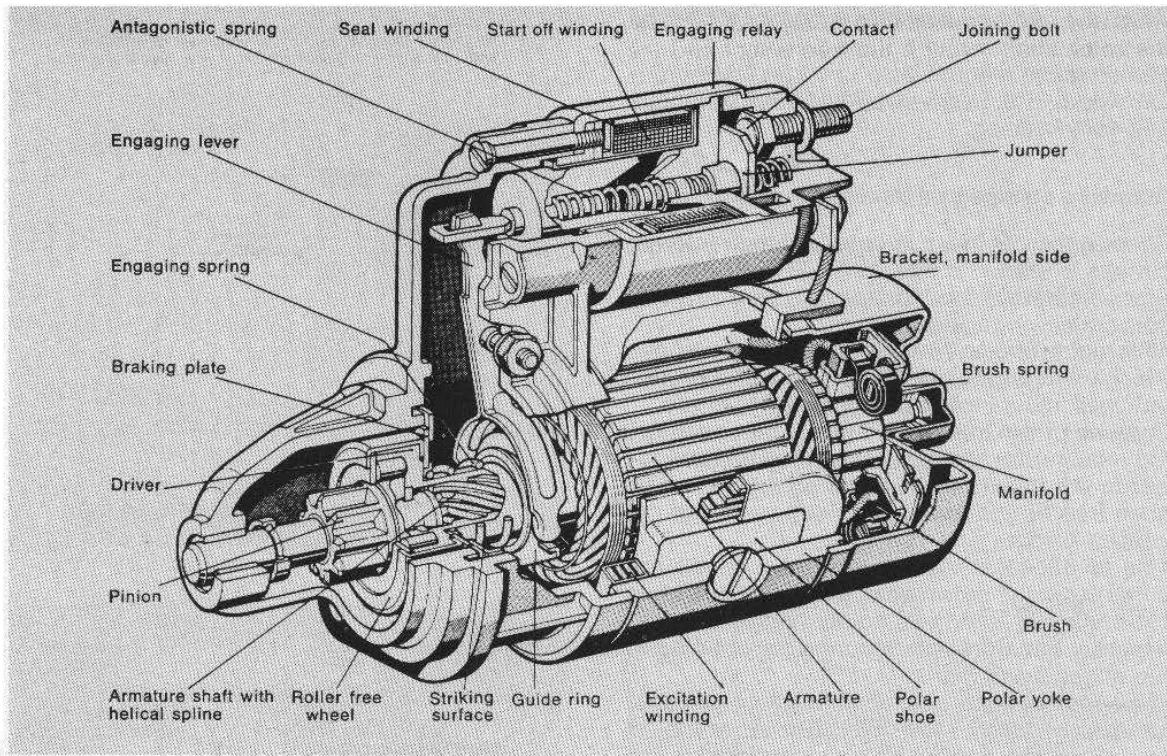
166



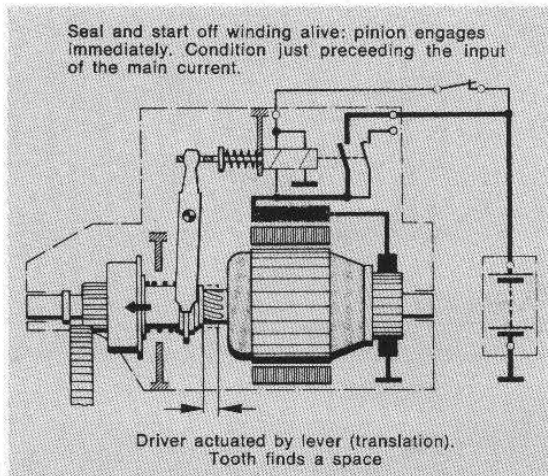
167



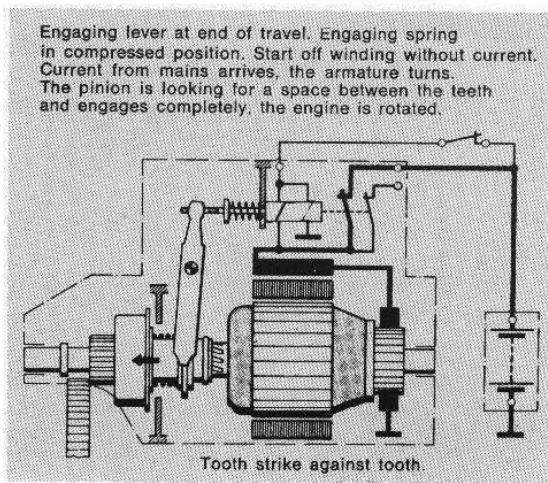
168



169



170



171

not fully activate the excitation windings and the armature.

In this stage the motor does not yet revolve. Through the pinion side guiding ring and the engaging spring, the entrainer-pinion assembly is pushed against the crown wheel and in so doing these parts start rotating due to the helical effect.

In this way, if the pinion meets a space between 2 of the crown wheel teeth (fig. 170), it immediately engages as deep as allowed by the engaging lever pressure or in other words until the bridge starts pushing on the relay contacts. Accordingly, the pinion has done its translation run.

If in its initial movement the pinion strikes against a tooth (fig. 171), then the engaging lever, through the guide ring on the pinion side, compresses the spring to such an extent as to close the contact on the bridge and the motor starts rotating.

The pinion slides on the tooth head and under pressure of the preloaded helical spring and mainly because of the pressure resulting from the screwing in action, engages into the space of the next teeth.

At the end of this translation movement, that is just before the complete cycle, the contacts of the engaging relay close and the starting current is inserted.

The rotor is now revolving and because of the helical groove pushes the pinion (which cannot now turn) deeper into the crown wheel right against the armature spindle.

When the pinion is fully home it cannot move for-

ward any further and is so forcibly coupled with the rotor shaft through the free wheel and the entrainer.

The starter motor can now spin the engine (fig. 172).

Disengagement

When starting, the engine rotates faster than the starter motor, the forced pinion-armature shaft coupling is accordingly taken off the free wheel thus protecting the armature from an inadmissible number of revolutions.

The pinion will stay engaged until the engaging lever stays in its engaged position.

Only when the starter button is disconnected, the coupling lever, entrainer, and the pinion return to their idle position till the next starting operation, and this irrespective of the vibrations caused by the running engine.

Free roller wheel

For safety's sake, translation type starter motors are equipped with a free wheel (fig. 173) to engage the pinion with the driving device (entrainer) so that when the armature shaft rotates the pinion is driven and when the pinion turns faster, the coupling is interrupted.

To obtain this interruption, the rollers are allowed to move on a slanting track in such a way that on starting they clamp the free wheel stop ring in the narrow space with the round part of the pinion.

When the engine starts up, the rollers which are pushed by the pinion which is rotating faster than the armature, overcome the resistance offered by the springs and move over to the wider space where they can only lightly contact the free wheel restrainer and the pinion.

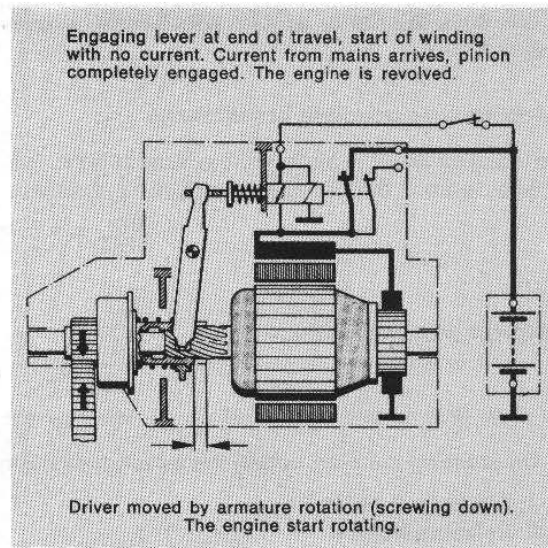
The springs, either directly or through bushes or guide pins, push the rollers in the rest position in the narrow section of the hollow space to allow the pinion coupling with the free wheel when the start button is pushed.

In this so called external dogs of the free wheel, the sliding section (the dogs) are machined in the free wheel ring which turns externally and is connected to the armature shaft by the driving device (entrainer).

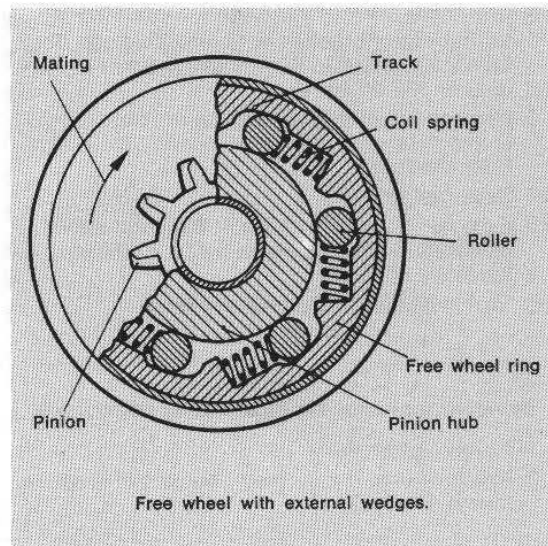
This particular set up offers the advantage of allowing the use of a small size pinion and also the starting torque when the engine exceeds a certain number of revolutions which goes for longer life of the starter motor components and bearings.

Rotor braking

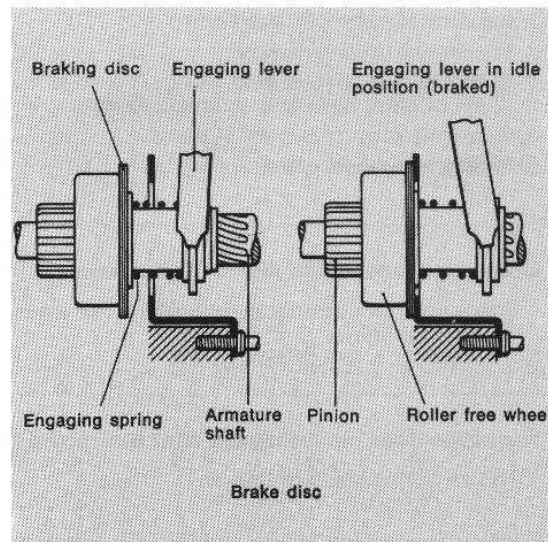
In order that the starter motor may stop quickly after the contact is interrupted and so allow, if necessary, to make a new starting attempt, the starter motor incorporates an armature brake (fig. 174).



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This is mostly made up of a mechanical brake (disc brake).

How to cure possible breakdowns

In case of any breakdown, the first thing to be considered is that the cause may not necessar-

ily depend on the starter motor, battery switches, electrical conductors or connections, parts not properly grounded but also to fault in the ignition or carburation systems.

The following table sums up the most common breakdowns due only to the starter motor.

Starter motor breakdowns

CAUSE	REMEDY
<p>On pressing the start button the motor does not turn or turn too slowly</p>	
<ol style="list-style-type: none"> 1. Discharged battery 2. Defective battery 3. Loose or oxidized battery connections 4. Grounded starter motor terminals or brushes 5. Starter motor brushes not contacting slip ring, brushes jammed in their housing, worn broken, dirty or oily brushes 6. Damaged starter motor button or relay (components so worn as to prevent the motor from starting) 7. Damaged relay 8. Excessive drop of voltage in the conductors, damaged or disconnected leads, oxidized terminals or reeds 9. Malfunction of starter motor circuits 	<ol style="list-style-type: none"> 1. Charge battery 2. Have it seen to in a qualified workshop 3. Tighten, clean or grease battery poles and/or terminals 4. Remove ground contact 5. Check brushes, clean or replace them, and eventually clean the guides or holders 6. Replace start button or relay 7. Have it repaired in a competent workshop 8. Check all conductors and connections 9. Check if all thermal cutouts are efficient and connected
<p>The rotor turns but the pinion does not engage</p>	
<ol style="list-style-type: none"> 1. Pinion carrier stuck 2. Pinion or crown deformed because of crashes, formation of burrs 	<ol style="list-style-type: none"> 1. Clean carrier and lightly lubricate it 2. File off burrs and/or have pinion and crown replaced in a workshop
<p>On pressing the start button the rotor turns, the pinion engages but the engine will not start</p>	
<ol style="list-style-type: none"> 1. Insufficiently charged battery 2. Insufficient brush pressure 3. Defective relay circuit (engaging or control relay) or other defective external relays 4. Excessive drop of current in leads 5. Sliding free wheel clutch 	<ol style="list-style-type: none"> 1. Charge battery 2. Check brushes, clean or replace as necessary 3. Have relays repaired in qualified workshop 4. Control leads and connections 5. Replace or have clutch repaired in a qualified workshop
<p>Motor continues to turn after button release</p>	
<ol style="list-style-type: none"> 1. Starter button does not open or defective internal or external relays 	<ol style="list-style-type: none"> 1. Stop motor immediately and have button and relays checked in a workshop. Change them, if necessary
<p>The pinion does not disengage after the engine has started</p>	
<ol style="list-style-type: none"> 1. Return spring slack or broken 	<ol style="list-style-type: none"> 1. Have starter motor repaired in a specialized workshop

16.1 IGNITION FEATURES

Battery-coil ignition with double contact breaker and automatic advance with centrifugal masses.

V 35 - V 50

Initial advance (fixed)	10°
Automatic advance	25±20°
Full advance (fixed + automat.)	35±2°

V 65

Initial advance (fixed)	7°
Automatic advance	26°
Full advance (fixed + automat.)	33±3°
Contact breaker gap	0.35 to 0.45 mm

16.2 MAINTENANCE, CHECKING AND ADJUSTING THE DOUBLE CONTACT BREAKER

Maintenance (fig. 176)

Every 3000 km.

- Check contact breaker gap;
- Lightly moisten cam felt pad «A» with a few drop of engine oil.

Inspection

- Remove the double contact breaker cover, after undoing its securing screws;
 - if contacts are dirty or greasy, clean them with a petrol soaked rag.
- If damaged or worn, replace them;
- Check the contact breaker gap which should be between 0.35÷0.45 mm.

Adjusting the contact points (fig. 177)

Contact «1»: left cylinder;

Contact «2»: right cylinder.

- Bring cam «B» to its maximum lift, loose screw «C» and shift plate «D» acting on the proper notch.

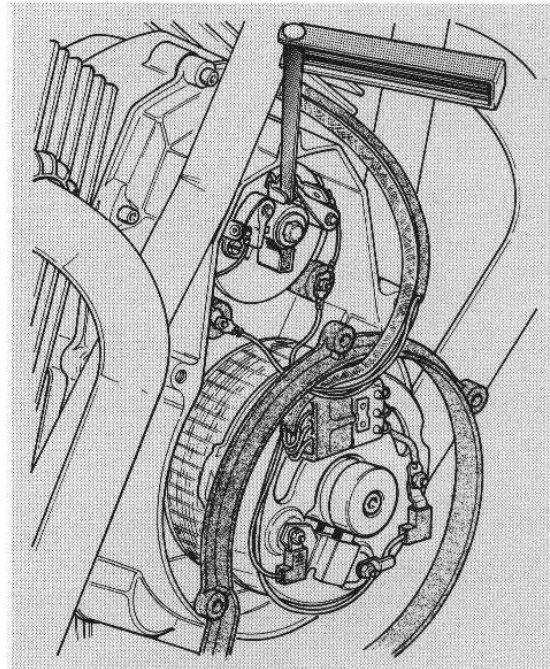
When the correct gap has been obtained, lock screw «C».

Repeat the same operations for the other contact.

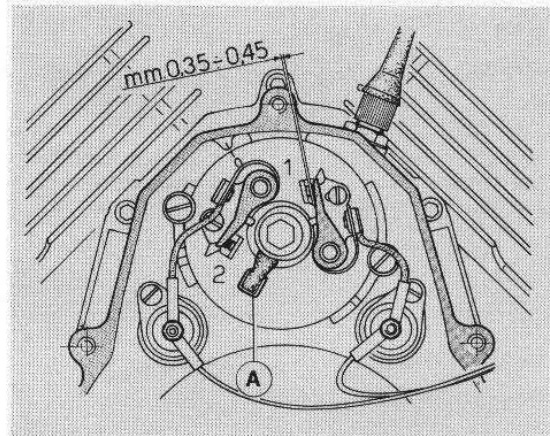
When adjusting the contact points it is necessary to check the ignition timing as well.

16.3 CHECKING AND ADJUSTING THE IGNITION TIMING (FIXED ADVANCE)

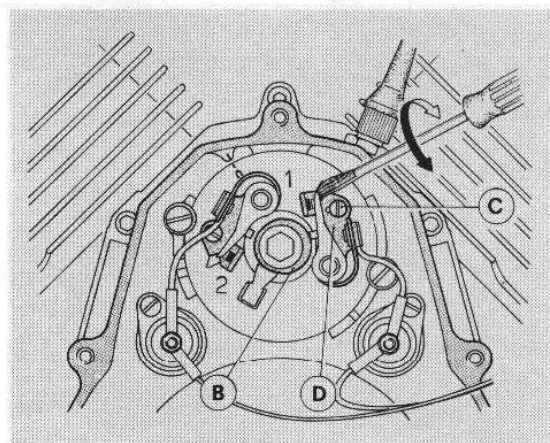
With the contact breaker gap adjusted at 0.40 mm and with the notch «0» on the contact points plate aligned with the mark on the crankcase, the engine is timed; it is advisable to check the timing acting as follows:



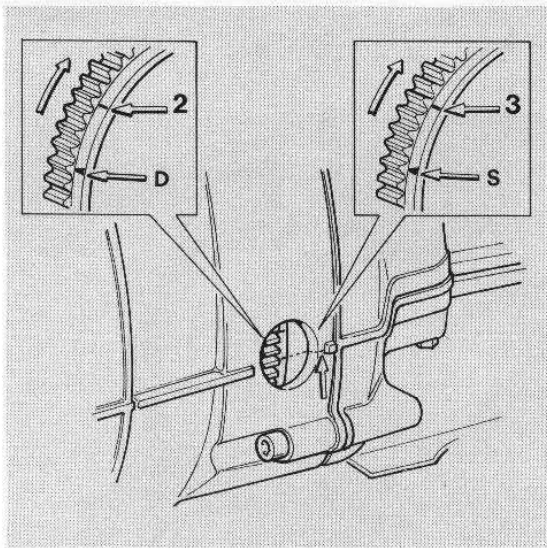
175



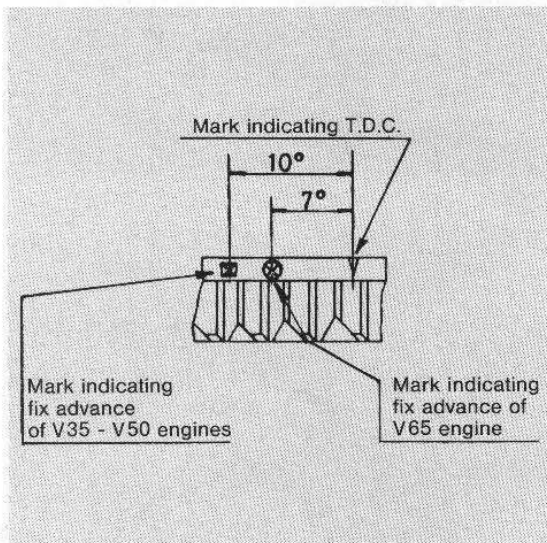
176



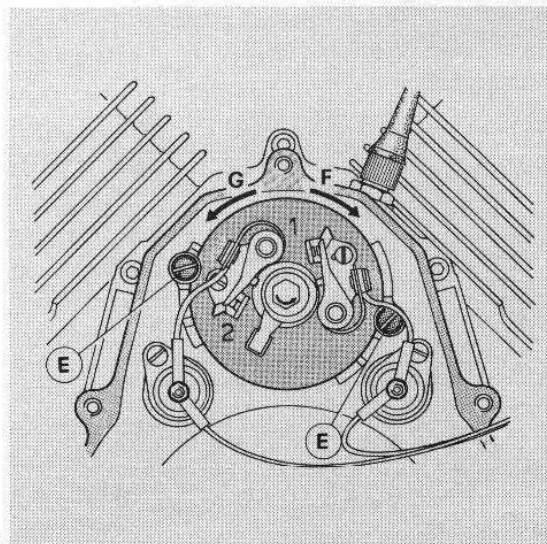
177



179

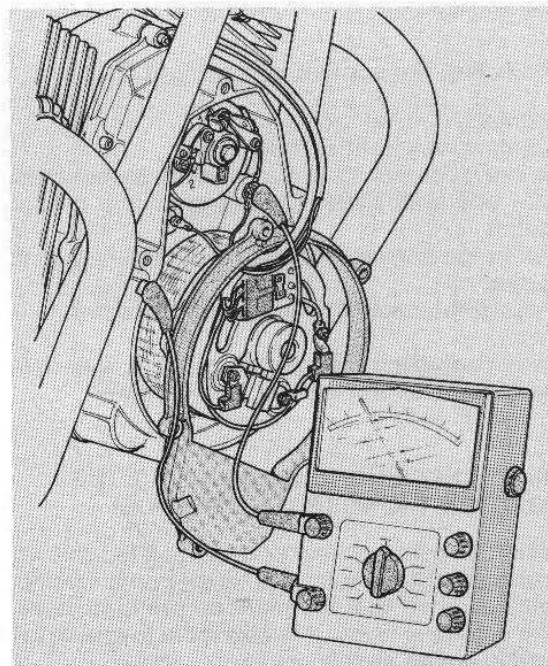


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- to find the exact moment when the points start separating, it is advisable to use an appropriate timing light to be set up between the breaker feeding clamp being checked and the ground;
- remove the rubber cap which seals the inspection hole on the R/H side of the gearbox opposite the flywheel;
- turn the flywheel anticlockwise (engine rotation) until the piston is at the end of its compression stroke T.D.C. (both valves closed). At this stage mark «S» on the flywheel should coincide with the mark on the inspection hole;
- slightly turn the flywheel clockwise and then anticlockwise till mark «3» is perfectly aligned with the mark on inspection hole: at this point (fixed advance) contact points of breaker «1» should start to open;
- if this does not occur, it is necessary to slacken the two screws «E» fixing the contact plate and shift the plate same, bearing in mind that shifting in arrow «F» direction ignition is advanced while shifting in arrow «G» direction ignition is delayed;
- lock screws «E» and check the opening of R/H cylinder contact (breaker No. 2) following the procedure of L/H cylinder. Bear in mind that marks «D» and «2» on the flywheel indicate respectively T.D.C. position and fixed advance of R/H cylinder.
- If contact breaker No. 2 does not open in the fixed advance position stamped on the flywheel, it will be necessary to change the contact gap of this breaker, or of both breakers, within the indicated gap: 0.35 ± 0.45 mm.
- Bear in mind that changing the contact gap of breaker No. 1 (L/H cylinder) it will be necessary to repeat its timing.



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16.4 CHECKING THE IGNITION ADVANCE USING A STROBE LAMP

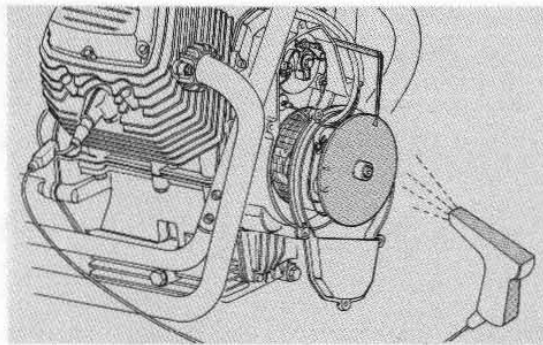
By means of a strobe lamp it is possible to verify, with the engine running, the maximum advance (AF + automatic advance) and the regularity of the automatic advance progression, operating as follows:

- lock front cover spacer so that it does not touch the timing plate when rotating;
- in the crankcase fit up timing plate code 14927400 and secure indexing arrow in the crankcase;
- zero set the gauge (left cylinder at T.D.C. - indexing arrow in line with the degree plate zero) and place the references as indicated in the figure.

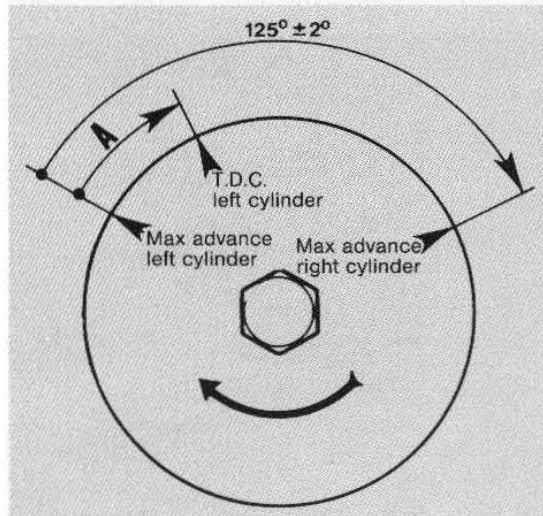
To determine T.D.C. position keep to the alignment of the marks on the flywheel with the reference on inspection hole or, for a better determination of this position, use a dial gauge which will indicate the exact position of the piston (to fit the dial gauge in the spark plug hole, use the special stand code 17948260).

Start the engine and using a high precision rev counter verify that the automatic advance at the different peaks, correspond to the values indicated in the graph.

Bear in mind that the absolute values read with the strobe lamp on the degree plate include also the fixed advance value; while the graph, hereafter, has been foreseen for the automatic advance only.



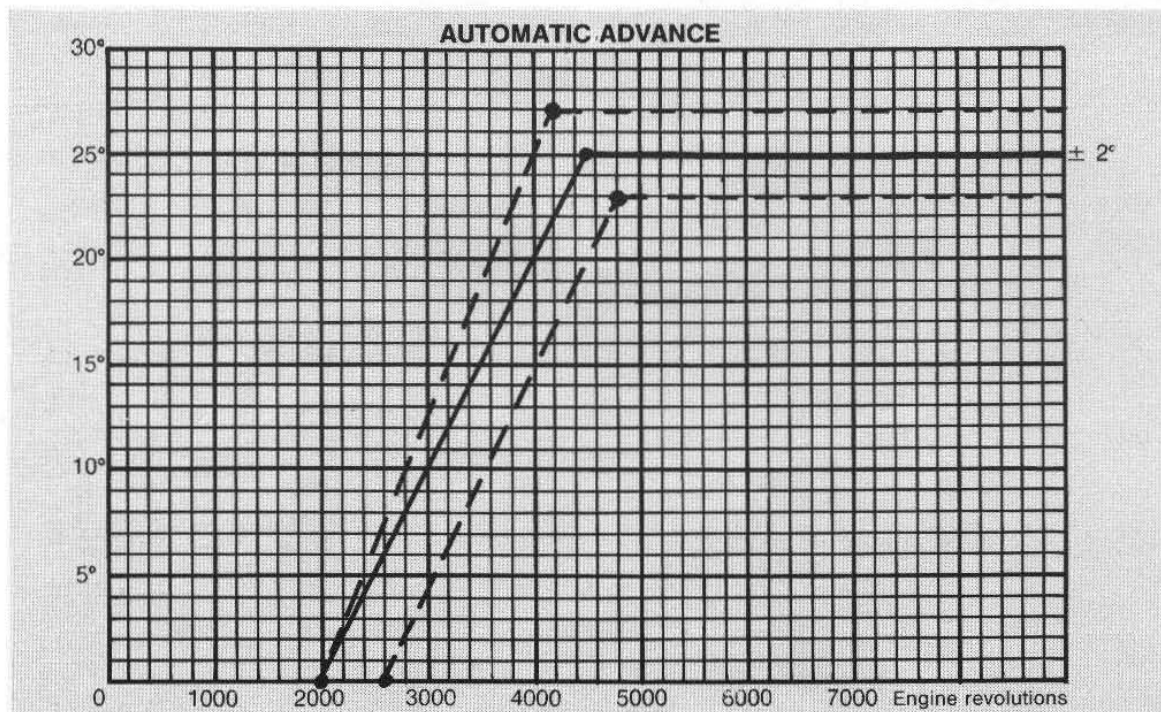
182



Scheme for the application of the references on the degree plate to check the max advance by means of a strobe lamp

A	V35 - V50	$35^\circ \pm 2^\circ$
	V65	$33^\circ \pm 3^\circ$

183



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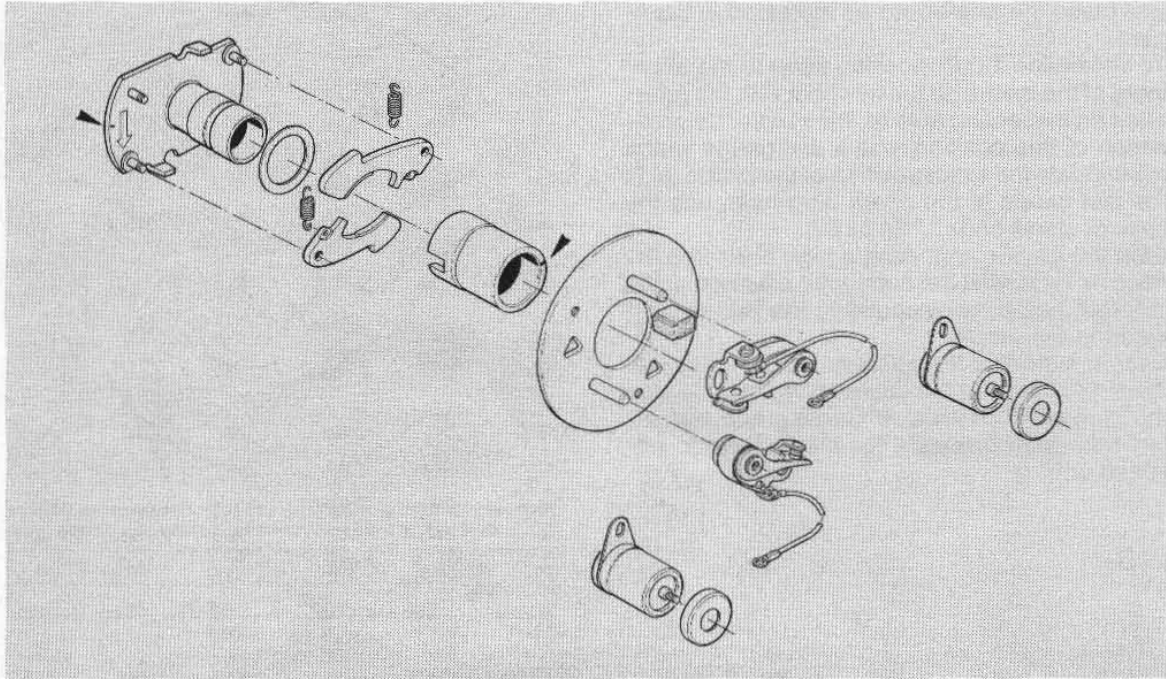
Cam lubrication

Periodically lubricate cam joints using Bosch 57 00 00 30 25 grease or similar.

To do this it is necessary to take out contact breaker plate and to remove the cam.

When reassembling insert joints claws of the centrifugal masses in the proper groves on the cam.

The cam must be reassembled in such a way that the frontal marks on the cam same will be in a position diametrically opposed to the arrow stamped on the plate.



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LEGEND (fig. 186)

- 1 Tachometer (3 W bulb)
- 2 Rev counter (3 W bulb)
- 3 Warning light, front and rear right indicator (1.2 W bulb - Green)
- 4 Warning light, front and rear left indicator (1.2 W bulb - Green)
- 5 Neutral position warning light (1.2 W bulb - Green)
- 6 Oil pressure warning light (1.2 W bulb - Red)
- 7 Generator warning light (1.2 W bulb - Red)
- 8 Parking warning light (1.2 W bulb - Green)
- 10 Parking position light (4 W bulb)
- 11 Low beam 40 W (40/45 W bulb)
- 12 High beam 45 W
- 13 Turn indicator light, front right (21 W bulb)
- 14 Turn indicator light, front left (21 W bulb)
- 15 Engine start and stop button
- 16 4-way connection
- 17 15-way connection
- 18 12-way connection
- 19 Control device for: turn signals, horn and flashing lights, lighting
- 20 Light and engine starting switch (3 positions)
- 21 Oil pressure switch
- 22 Neutral position switch
- 23 Horn
- 24 Flashing light relay
- 28 Flasher box
- 29 Rotor
- 31 Coils
- 32 Front brake switch
- 33 Rear brake switch
- 34 Rectifier
- 35 Alternator
- 36 Regulator
- 37 Battery
- 38 Terminal block with fuses (16 A fuses)
- 39 Starting relay
- 40 Starter motor
- 41 Turn indicator light, rear left (21 W bulb)
- 42 Turn indicator light, rear right (21 W bulb)
- 43 Tail light
- 44 Rear stop light (21 + 21 W bulb)
- 45 Number plate lighting and rear parking light (5 + 5 W bulb)
- 46 6-way connector Molex

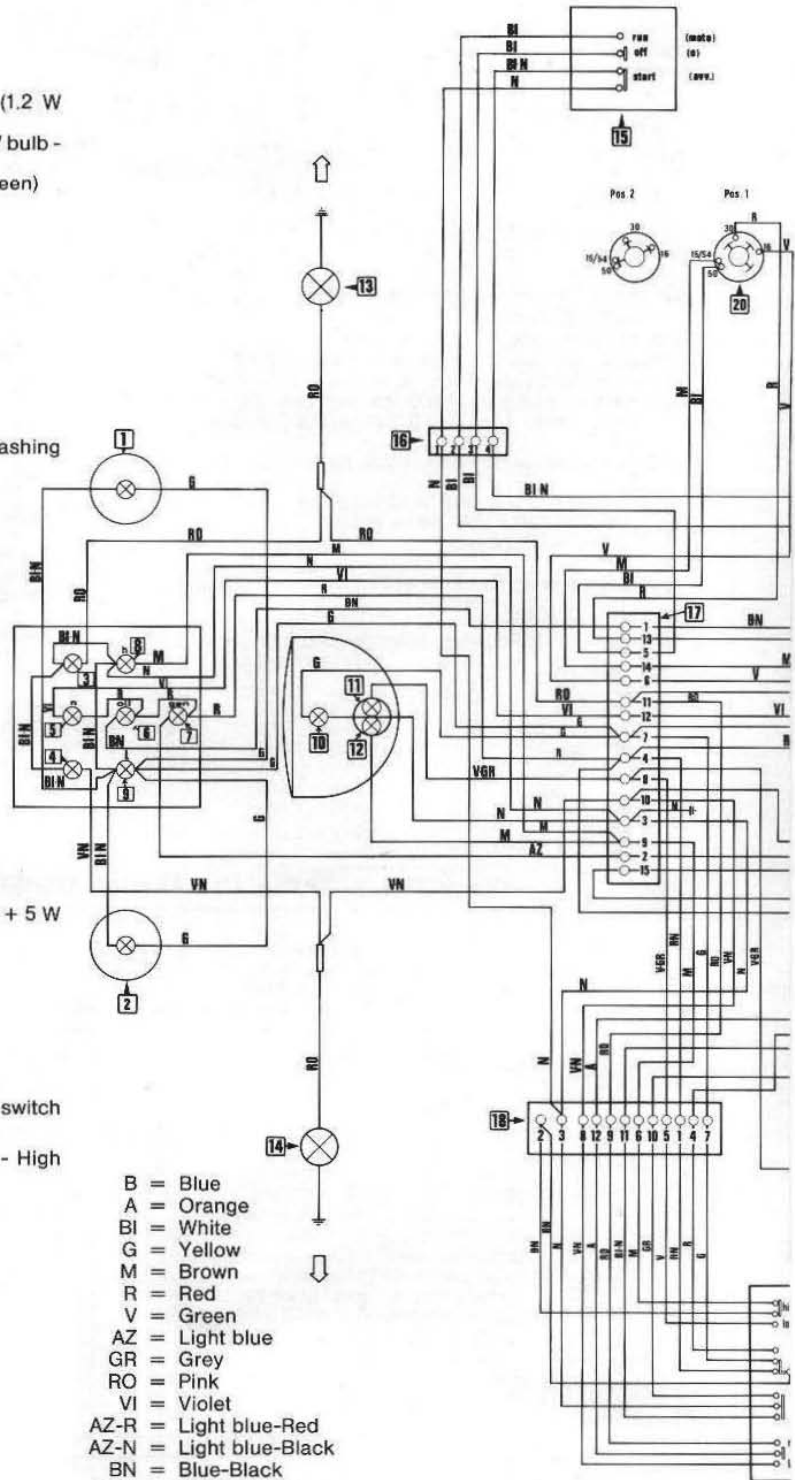
Fuse No. 1
Turn signals - Horn

Fuse No. 2
Flashing light relay - Starting relay - Rear stop light switch

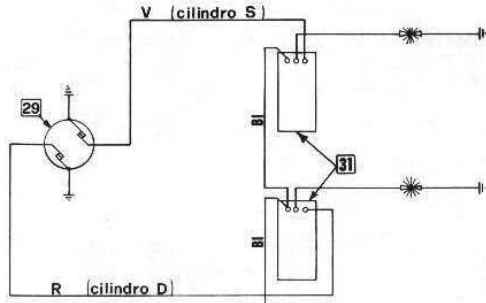
Fuse No. 3
Warning lights (generator - oil pressure - Neutral - High beam)

Fuse No. 4
Parking light - Instrument lighting - Lighting

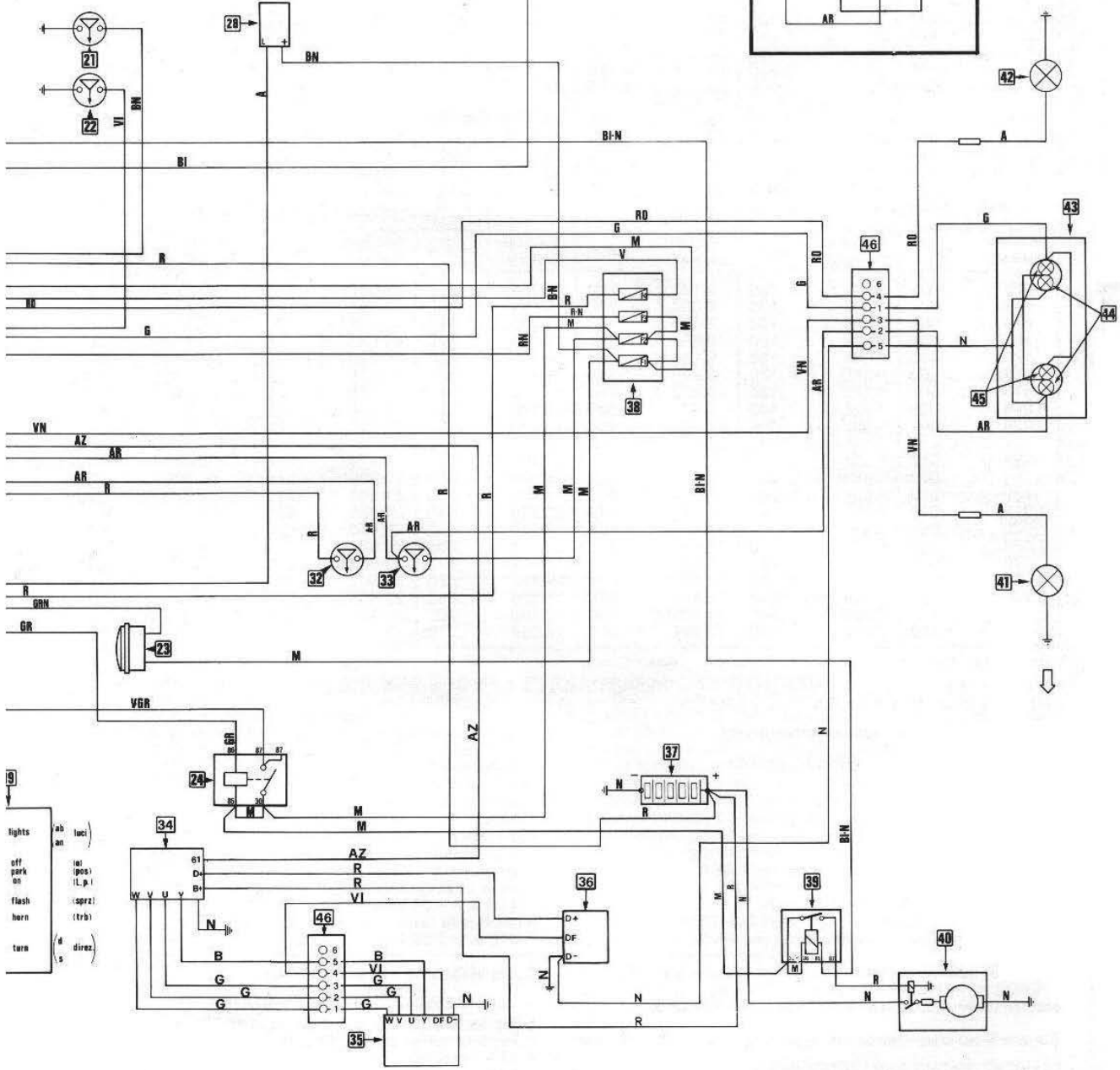
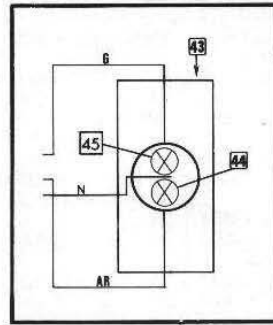
- B = Blue
- A = Orange
- BI = White
- G = Yellow
- M = Brown
- R = Red
- V = Green
- AZ = Light blue
- GR = Grey
- RO = Pink
- VI = Violet
- AZ-R = Light blue-Red
- AZ-N = Light blue-Black
- BN = Blue-Black
- BI-N = White-Black
- G-N = Yellow-Black
- G-R = Yellow-Red
- GR-N = Grey-Black
- R-N = Red-Black
- V-N = Green-Black
- V-GR = Green-Grey



Pos. 3



(Modification for mod.)
V 35C-V 50C



lights (ab luci)
off (an)
park (al)
on (pos)
flash (L.p.l)
horn (sprz)
turn (trb)
(d direz)
(s)

INCHES AND MILLIMETERS CONVERSION CHART

MILLIMETERS TO DECIMAL (inches) EQUIVALENT											
mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)
1	.039	21	.827	41	1.614	61	2.402	81	3.189	125	4.921
2	.079	22	.866	42	1.654	62	2.441	82	3.228	150	5.906
3	.118	23	.906	43	1.693	63	2.480	83	3.268	175	6.890
4	.157	24	.945	44	1.732	64	2.520	84	3.307		
5	.197	25	.984	45	1.772	65	2.559	85	3.346		
6	.236	26	1.024	46	1.811	66	2.598	86	3.386	200	7.874
7	.276	27	1.063	47	1.850	67	2.638	87	3.425	225	8.858
8	.315	28	1.102	48	1.890	68	2.677	88	3.465	250	9.843
9	.354	29	1.142	49	1.929	69	2.717	89	3.504	275	10.827
10	.394	30	1.181	50	1.969	70	2.756	90	3.543		
11	.433	31	1.220	51	2.008	71	2.795	91	3.583	300	11.811
12	.472	32	1.260	52	2.047	72	2.835	92	3.622	325	12.795
13	.512	33	1.299	53	2.087	73	2.874	93	3.661	350	13.780
14	.551	34	1.339	54	2.126	74	2.913	94	3.701	375	14.764
15	.591	35	1.378	55	2.165	75	2.953	95	3.740		
16	.630	36	1.417	56	2.205	76	2.992	96	3.780	400	15.748
17	.669	37	1.457	57	2.244	77	3.031	97	3.819		
18	.709	38	1.496	58	2.283	78	3.071	98	3.858		
19	.748	39	1.535	59	2.323	79	3.110	99	3.898		
20	.787	40	1.575	60	2.362	80	3.150	100	3.937		

DECIMAL (inches) TO METRIC EQUIVALENT											
DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =	DECIMAL (Inches)	mm =
.025	.001	3.048	.120	8.128	.320	13.208	.520	18.288	.720	23.368	.920
.051	.002	3.302	.130	8.382	.330	13.462	.530	18.542	.730	23.622	.930
.076	.003	3.556	.140	8.636	.340	13.716	.540	18.796	.740	23.876	.940
.102	.004	3.810	.150	8.890	.350	13.970	.550	19.050	.750	24.130	.950
.127	.005	4.064	.160	9.144	.360	14.224	.560	19.304	.760	24.384	.960
.152	.006	4.318	.170	9.398	.370	14.478	.570	19.558	.770	24.638	.970
.178	.007	4.572	.180	9.652	.380	14.732	.580	19.812	.780	24.892	.980
.203	.008	4.826	.190	9.906	.390	14.986	.590	20.066	.790	25.146	.990
.229	.009	5.080	.200	10.160	.400	15.240	.600	20.320	.800		
.254	.010	5.334	.210	10.414	.410	15.494	.610	20.574	.810	25.400	1.000
.508	.020	5.558	.220	10.668	.420	15.748	.620	20.828	.820	50.800	2.000
.762	.030	5.842	.230	10.922	.430	16.002	.630	21.082	.830	76.200	3.000
1.016	.040	6.096	.240	11.176	.440	16.256	.640	21.336	.840	101.600	4.000
1.270	.050	6.350	.250	11.430	.450	16.510	.650	21.590	.850	127.000	5.000
1.524	.060	6.604	.260	11.684	.460	16.764	.660	21.844	.860	254.000	10.000
1.778	.070	6.858	.270	11.938	.470	17.018	.670	22.098	.870	381.000	15.000
2.032	.080	7.112	.280	12.192	.480	17.272	.680	22.352	.880	508.000	20.000
2.286	.090	7.366	.290	12.446	.490	17.526	.690	22.606	.890	635.000	25.000
2.540	.100	7.620	.300	12.700	.500	17.780	.700	22.860	.900	1.270.000	50.000
2.794	.110	7.874	.310	12.954	.510	18.034	.710	23.114	.910	2.540.000	100.000

WEIGHTS AND MEASURES (*) - PESI E MISURE (*)

Measures of Length - Misure di lunghezza

IN GREAT BRITAIN AND UNITED STATES

- line (abbr. l.), 1 l. = 2,12 mm
- inch (abbr. in.), 1 in. = 2,54 cm
- foot (abbr. ft.), 1 ft. = 12 in. = 30,48 cm
- yard (abbr. yd.), 1 yd. = 3 ft. = 91,44 cm
- fathom (abbr. fm.), 1 fm. = 2 yd. = 1,83 m
- rod (abbr. rd.), pole (abbr. po.), perch, 1 rd. = 1 po. = 1 perch = 5,5 yd. = 5,03 m
- chain (abbr. chn.), 1 chn. = 4 rd. = 20,11 m
- furlong (abbr. fur.), 1 fur. = 10 chn. = 201,17 m
- (statute) mile (abbr. , sta. mi.), 1 sta.mi. = 8 fur. = 1,61 km
- (nautical) mile (abbr. (naut.) mi.), knot (abbr. k.) 1 naut.mi. = 1 k. = 1,15 sta.mi. = 1,853 km
- league (abbr. lea.), 1 lea. = 3 naut.mi. = 5.559,78 m

Square Measures - Misure di superficie

IN GREAT BRITAIN AND UNITED STATES

- square inch (abbr. sq. in.), 1 sq. in. = 6,45 cm²

- square foot (abbr. sq. ft.), 1 sq. ft. = 144 sq. in. = 9,29 dm²
- square yard (abbr. sq. yd.), 1 sq. yd. = 9 sq. ft. = 0,83 m²
- square rod (abbr. sq. rd.), square pole (abbr. sq. po.), square perch, 1 sq. rd. = 1 sq. po. = 1 sq. perch = 30,25 sq. yd. = 25,29 m²
- rod (abbr. ro.), 1 ro. = 40 sq. rd. = 10,11 a = 10,11 dam²
- acre (abbr. a.), 1 a. = 4 ro. = 40,46 a = 0,40 ha
- square chain (abbr. sq. chn.), 1 sq. chn. = 16 sq. rd. = 4,04 a = 4,04 dam²
- square mile (abbr. sq. mi.), 1 sq. mi. = 6.400 sq. chn. = 640 a. = 2,59 km²

Cubic Measures - Misure di volume

IN GREAT BRITAIN AND UNITED STATES

- cubic inch (abbr. cu. in.), 1 cu. in. = 16,38 cm³
- cubic foot (abbr. cu. ft.), 1 cu. ft. = 1.728 cu. in. = 28,31 dm³
- cubic yard (abbr. cu. yd.), 1 cu. yd. = 27 cu. ft. = 0,76 m³

Measures of Capacity - Misure di capacità
for liquid commodities - per liquidi

IN GREAT BRITAIN

gill (abbr. gi.), 1 gi. = 0,14 l
pint (abbr. pt.), 1 pt. = 4 gi. = 0,57 l
quart (abbr. qt.), 1 qt. = 2 pt. = 1,13 l
(imperial) gallon (abbr. (imp.) gal.), 1 imp. gal. = 4 qts. = 4,54 l
barrel (abbr. bbl.), 1 bbl. = 36 i.p. gal. = 163,65 l
hogshead (abbr. hhd.), 1 hhd. = 52,5 imp. gal. = 238,66 l
pipe, 1 pipe = 2 hhd. = 105 imp. gal. = 477 l
butt, 1 butt = 108 imp. gal. = 491 l
(wine) gallon (abbr. gal.) (arc.), 1 gal. = 3,78 l
tierce (abbr. tc.) (arc.), 1 tc. = 42 wine gal. = 159 l
puncheon (abbr. pun.) (arc.), 1 pun. = 2 tc. = 318 l
tun (arc.), 1 tun = 252 wine gal. = 953,9 l

IN UNITED STATES

U.S. gill (abbr. gi.), 1 U.S. gi. = 0,12 l
U.S. pint (abbr. pt.), 1 U.S. pt. = 4 U.S. gi. = 0,47 l
U.S. quart (abbr. qt.), 1 U.S. qt. = 2 U.S. pt. = 0,94 l
U.S. gallon (abbr. gal.), 1 U.S. gal. = 4 U.S. qts. = 3,78 l
U.S. barrel (abbr. bbl.), 1 U.S. bbl. = 31,5 U.S. gal. = 119,24 l
U.S. hogshead (abbr. hhd.), 1 U.S. hhd. = 63 U.S. gal. = 238,47 l
pipe, 1 pipe = 2 U.S. hhd. = 126 U.S. gal. = 477 l
butt, 1 butt = 129,7 U.S. gal. = 491 l
 4 U.S. pk. = 35,24 l

Avoirdupois Weights - Pesì avoirdupois

IN GREAT BRITAIN

grain (avoirdupois) (abbr. abbr. gr. av.), 1 gr. av. = 0,064 g

dram (abbr. dr.), 1 dr. = 27,34 gr. av. = 1,77 g
ounce (avoirdupois) (abbr. oz. av.), 1 oz. av. = 16 dr. = 28,35 g
pound (avoirdupois) (abbr. lb. av.), 1 lb. av. = 16 oz. av. = 16 oz. av. = 453,60 g
stone (abbr. st.), 1 st. = 14 lb. av. = 6,35 kg
quarter (abbr. qr.), 1 qr. = 28 lb. av. = 12,70 kg
central (abbr. ctl.), 1 ctl. = 100 lb. av. = 45,36 kg
hundredweight (abbr. cwt.), 1 cwt. = 112 lb. av. = 50,80 kg
ton (abbr. t.), 1 t. = 2.240 lb. av. = 1,016 t

IN UNITED STATES

grain (avoirdupois) (abbr. gr. av.), 1 gr. av. = 0,065 g
dram (abbr. dr.), 1 dr. = 27,34 gr. av. = 1,77 g
ounce (avoirdupois) (abbr. oz. av.), 1 oz. av. = 16 dr. = 28,35 g
pound (avoirdupois) (abbr. lb. av.), 1 lb. av. = 16 oz. av. = 453,60 g
U.S. quarter (abbr. qr.), 1 U.S. qr. = 1/4 short cwt. = 25 lb. av. = 11,34 kg
U.S. quarter (abbr. qr.), 1 U.S. qr. = 1/4 long cwt. = 28 lb. av. = 12,70 kg
U.S. quarter (abbr. qr.), 1 U.S. qr. = 1/4 s.t. = 500 lb. av. = 226,79 kg
U.S. quarter (abbr. qr.), 1 U.S. qr. = 1/4 l.t. = 560 lb. av. = 254 kg
short hundredweight (abbr. cwt.), 1 short cwt. = 100 lb. av. = 45,36 kg
long hundredweight (abbr. cwt.), 1 long cwt. = 112 lb. av. = 50,80 kg
short ton (abbr. s.t.), 1 s.t. = 2.000 lb. av. = 907,18 kg
long ton (abbr. l.t.), 1 l.t. = 2.240 lb. av. = 1,016 t

CONVERSION TABLE (*) - TAVOLA GENERALE DI CONVERSIONE (*)

	to convert per trasformare	into in	multiply by below moltiplicare per i valori sotto indicati
0,3937	<i>inches</i> , pollici	<i>centimetres</i> , centimetri	2,54
3,2808	<i>feet</i> , piedi	<i>metres</i> , metri	0,3048
1,0933	<i>yard</i> , iarde	<i>metres</i> , metri	0,9144
0,6214	<i>statute miles</i> , miglia	<i>kilometres</i> , chilometri	1,6093
0,5396	<i>nautical miles</i> , miglia marine	<i>kilometres</i> , chilometri	1,85315
0,1550	<i>square inches</i> , pollici quadrati	<i>square centimetres</i> , centimetri quadrati	6,4516
10,7639	<i>square feet</i> , piedi quadrati	<i>square metres</i> , metri quadrati	0,09290
1,1960	<i>square yards</i> , iarde quadrate	<i>square metres</i> , metri quadrati	0,8361
0,3861	<i>square miles</i> , miglia quadrate	<i>square kilometres</i> , chilometri quadrati	2,590
0,06102	<i>cubic inches</i> , pollici cubici	<i>cubic centimetres</i> , centimetri cubici	16,3870
35,3148	<i>cubic feet</i> , piedi cubici	<i>cubic metres</i> , metri cubici	0,02831
1,3080	<i>cubic yards</i> , iarde cubiche	<i>cubic metres</i> , metri cubici	0,7646
2,20462	<i>pounds avoirdupois</i> , libbre avoirdupois	<i>kilogrammes</i> , chilogrammi	0,4536
0,03527	<i>ounces avoirdupois</i> , once avoirdupois	<i>grammes</i> , grammi	28,3495
15,3846	<i>grains</i> , grani	<i>grammes</i> , grammi	0,064
0,01968	<i>hundredweights</i>	<i>kilogrammes</i> , chilogrammi	50,80
0,984	<i>(long) tons</i> , tonnellate (inglesi)	<i>tons</i> , tonnellate (metriche)	1,016
0,220	<i>(imperial) gallons</i> , galloni	<i>litres</i> , litri	4,546
0,9863	<i>horsepowers</i>	<i>chevaux-vapeurs</i> , cavalli-vapore	1,0139
multiply by above moltiplicare per i valori sopra indicati	to obtain per ottenere	from da	

(*) Metric punctuation used: point divides number in periods (thousands etc), comma divides the decimal part.

(*) La punteggiatura adottata per i numeri è quella metrica anche per le misure del sistema anglosassone, ossia: il punto divide il numero in periodi (migliaia, ecc.), la virgola invece divide la parte decimale.