MODEL VARIATIONS

(Except Switzerland, Sweden, Australia)

Identification: Model / Variations		Alfa 75									
		1.6		1.8		2.0		2.0 turbodiesel		6V iniezione	
Body		4 - door saloon									
Drive		LH	RH	LH	RH	LH	RH	LH	RH	LH	RH
Identification No.	– on identification label	161.000	161.010	161.020	162.030	161.080	161.090	161.040	–	161.180	161.190
Type approval No.	– on identification label	162.B2 (1) 162.B2A (2)		162.B1 (1) 162.B1A (2)		162.BA (1) 162.BF (2)		162.BD		162.B3 (2) 162.B3A (1)	
	– on rear right side of luggage compartment floor	162.B20		162.B10		162.B00		162.B00		162.B30	
Chassis No.	– on rear right side of luggage compartment floor	From 00.001.011	From 03.001.011	From 00.001.011	From 03.001.011	From 00.200.011	From 03.010.011	From 00.001.011		From 00.001.011	From 03.001.011
Engine type and serial No.	– on left rear side of engine block	061.00 From 000.001		062.02 From 000.001		062.12 From 000.001		VM.80A From 00.001		016.46 From 000.001	

(1) Type/Model with gearbox - rear axle long ratios

(2) Variation for type/model with gearbox - rear axle short ratios

WEIGHTS AND LOADS

Unit: kg (lb)

Weights and Loads \ Model / Variations		Alfa 75				
		1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Max weight allowed		1485 (3274)	1485 (3274)	1495 (3296)	1615 (3560)	1585 (3494)
Kerbweight		1068 (2355)	1060 (2337)	1070 (2359)	1190 (2624)	1160 (2557)
Useful load		425 (936)	425 (936)	425 (936)	425 (936)	425 (936)
Max gross weight per axle allowed	Front	820 (1808)	820 (1808)	820 (1808)	940 (2072)	850 (1873)
	Rear	990 (2182)	990 (2182)	990 (2182)	990 (2182)	990 (2182)
Max towing gross weight		1200 (2645)	1200 (2645)	1200 (2645)	1300 (2866)	1200 (2645)
Max vertical load on tow hook		77 (169)	77 (169)	77 (169)	90 (198)	84 (185)
Seating capacity	Front	2	2	2	2	2
	Rear	3	3	3	3	3

Unit. kg (lb)

Weights and Loads \ Model / Variations		75				
		1.6 1.8	2.0	TURBO D	6V 2.5	6V 3.0
Max weight allowed		1485 (3274)	1495 (3296)	1615 (3560)	1585 (3494)	1675 (3693)
Kerbweight		1060 (2337)	1070 (2359)	1190 (2624)	1160 (2557)	1250 (2756)
Useful load		425 (936)	425 (936)	425 (936)	425 (936)	425 (936)
Max gross weight per axle allowed	Front	820 (1808)	820 (1808)	940 (2072)	850 (1873)	850 (1873)
	Rear	990 (2182)	990 (2182)	990 (2182)	990 (2182)	990 (2182)
Max towing gross weight		1100 (2425)	1100 (2425)	1300 (2866)	1200 (2645)	1300 (2866)
Max vertical load on tow hook		77 (169)	77 (169)	90 (198)	84 (185)	65 (143)
Seating capacity	Front	2	2	2	2	2
	Rear	3	3	3	3	3

Identification: Model / Variations		1.6		1.8		2.C		TURBO D		6V 2.5		6V 3.0	
Body		4 - door saloon											
Drive		LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH
Identification No.	– on identification label	161.000	161.010	161.020	162.030	161.080	161.090	161.040	–	161.180	161.190	161.200	161.210
Type approval No.	– on identification label	162.B2 (1) 162.B2A (2)		162.B1 (1) 162.B1A (2)		162.BA (1) 162.BF (2)		162.BD		162.B3		162.B6	
	– on rear right side of luggage compartment floor	162.B20		162.B10		162.B00		162.B00		162.B30		162.B60	
Chassis No.	– on rear right side of luggage compartment floor	From 00.001.011	From 03.001.011	From 00.001.011	From 03.001.011	From 00.200.011	From 03.010.011	From 00.001.011		–	–	From 00.001.001	From 03.001.001
Engine type and serial No.	– on left rear side of engine block	061.00 From 000.001		062.02 From 000.001		062.12 • From 000.001		VM.80A From 00.001		016.46 From 000.001		061.20 From 000.001	

(1) Type/Model with gearbox - rear axle long ratios

(2) Variation for type/model with gearbox - rear axle short ratios

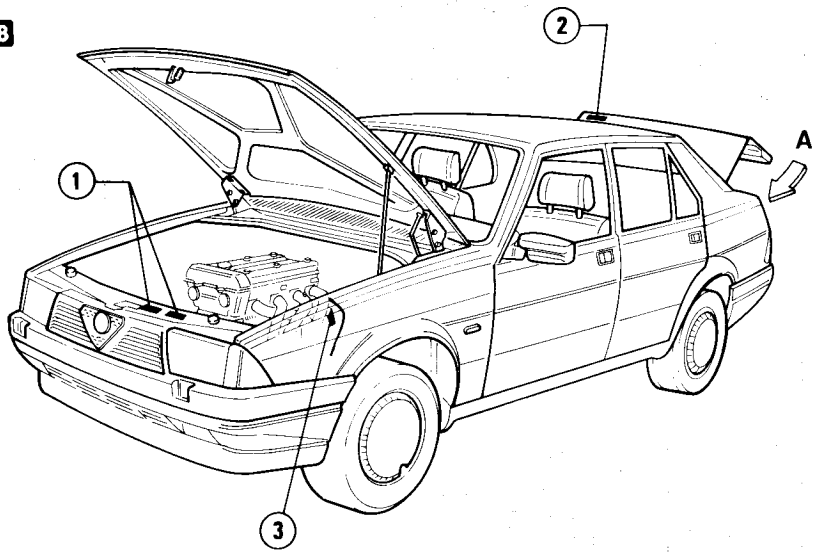
(For Switzerland, Sweden, Australia)

Model / Variations / Identification		Alfa 75					
		1.8		2.0		⊛ 6V iniezione	
Body		4 - door saloon					
Drive		LH	RH	LH	RH	LH	RH
Edition		Switzerland 1985	Australia 1986	Switzerland 1985 Sweden 1985	Australia 1986	Switzerland 1986 Sweden 1986	Australia 1986
Identification No.	– on identification label	161.020	161.030	161.080	161.090	161.180	161.190
Type approval No.	– on identification label	162.B1A		162.BF		162.B3	
	– on rear right side compartment floor	162.B10		162.B00		162.B30	
Chassis serial No.	– on rear right side of luggage compartment floor	From 00.001.011	From 03.001.011	From 00.200.011	From 03.010.011	From 00.001.011	From 03.001.011
Engine type and serial No.	– on rear left side of engine block	062.02 From 000.001		062.12 From 000.001		016.46 From 000.001	

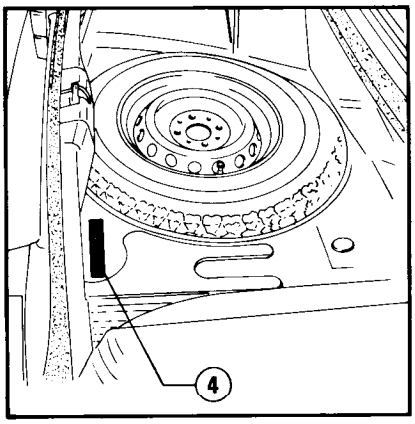
SERVICE AND IDENTIFICATION DATA

IDENTIFICATION LABELS

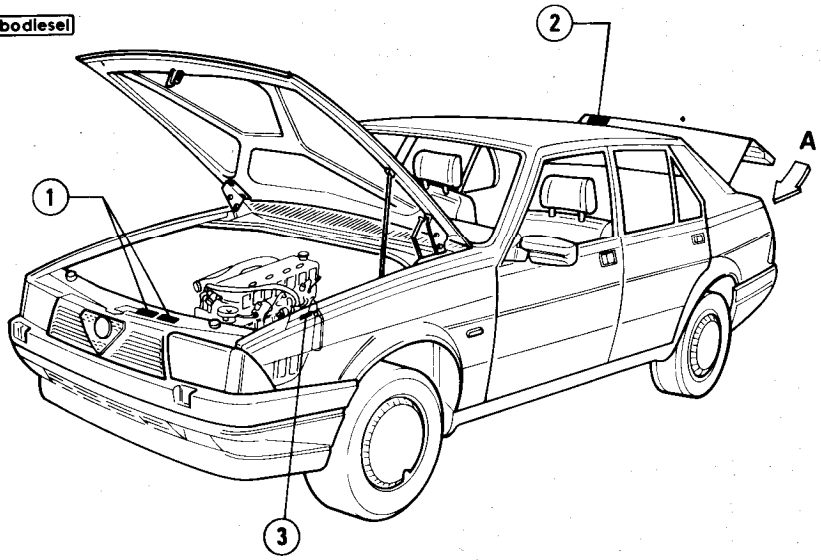
1.6 1.8
2.0



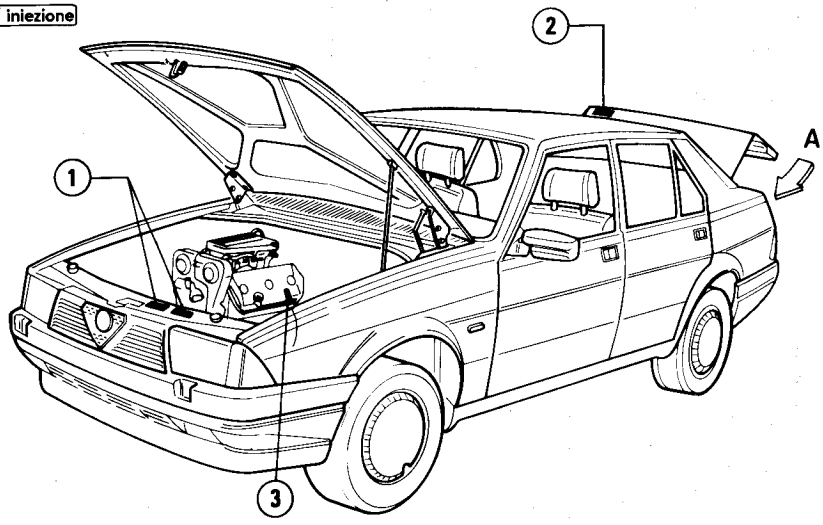
View from A



2.0 turbodiesel



6V iniezione



1 Identification label (identification number and type approval number)
2 Paint products label
3 Label on engine block, left rear side (engine type and serial number)
4 Label on luggage compartment floor (type approval number and serial number)

Lubrication label (lubrication data) (*)

(*) Position to be defined

VEHICLE IDENTIFICATION CODES

A) Chassis numbering

It is composed of groups of numbers and/or reference identifications

(2a) (2b)

Z A R 162.B30 ★ 00.001.011

(2) (3)

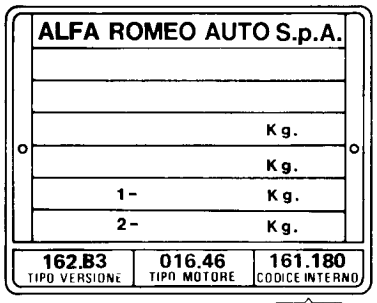
(1) Manufacturer identification characters

(2) Number of "Type and version approved".
It is composed of six figures, subdivided as follows:

(2a) Base type number: is assigned to each vehicle having a common design project (ex. **162** series Alfa 90 and based Alfa 75).

(2b) Type variant number: identifies the variations within the base type (ex. **162.B30** - Alfa 75 ❄ 6V iniezione).

(3) Serial number: is progressively assigned at factory.



161.180
4a 4b
(4)

(4) Identification number (on identification label).
It is composed of five figures, subdivided as follows:

(4a) Basic type code: is assigned to all vehicles having a common design project to distinguish the different models (**162** series Alfa 90 **161** series Alfa 75)

4b) Type variant number: identifies, within the base type, those vehicles that differ because of some variant that alters their features (ex: **161.180** Alfa 75 ❄ 6V iniezione LHD).

For servicing purposes, indicate only the identification number (4).

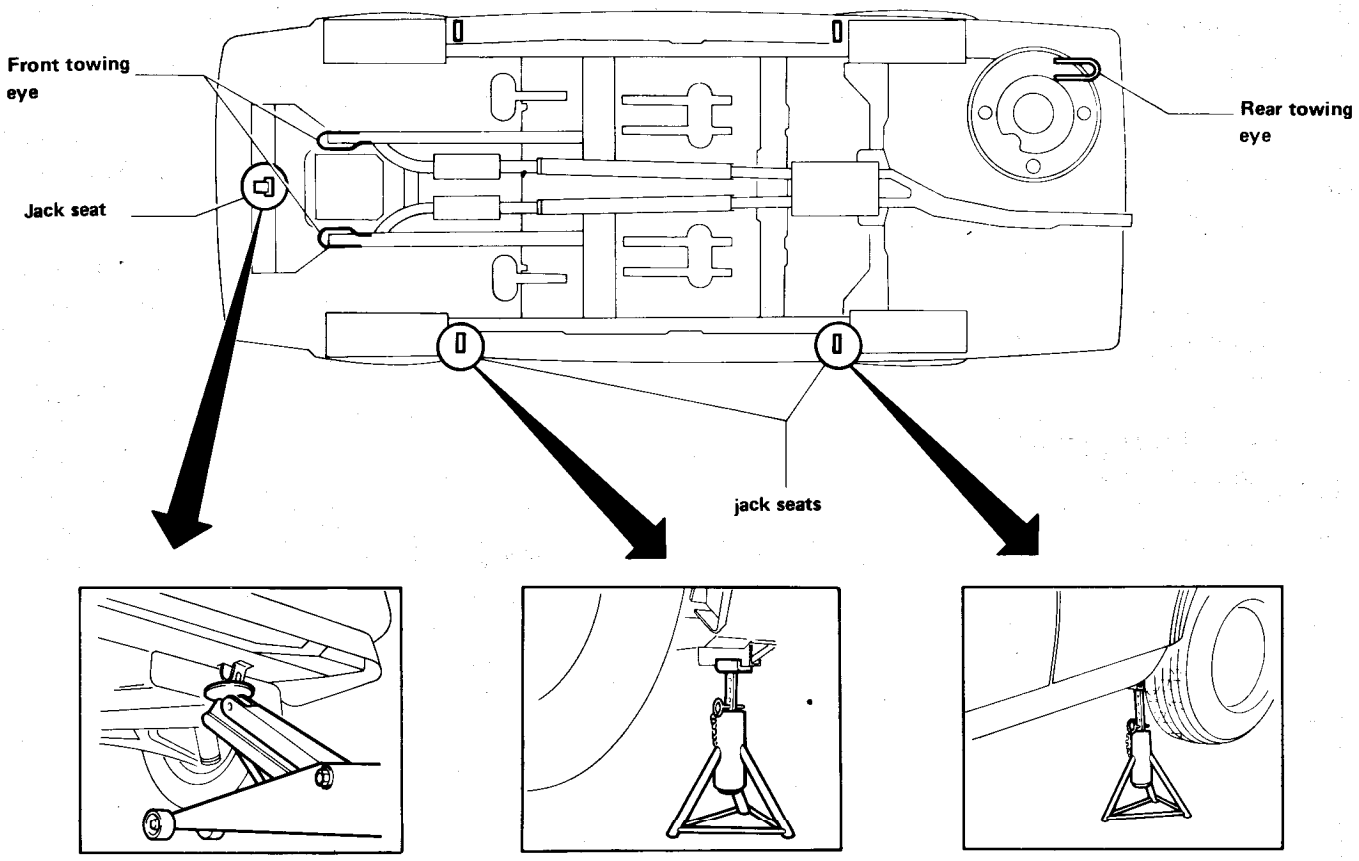
B) Engine numbering

016.46 **000.001**
(1) (2)

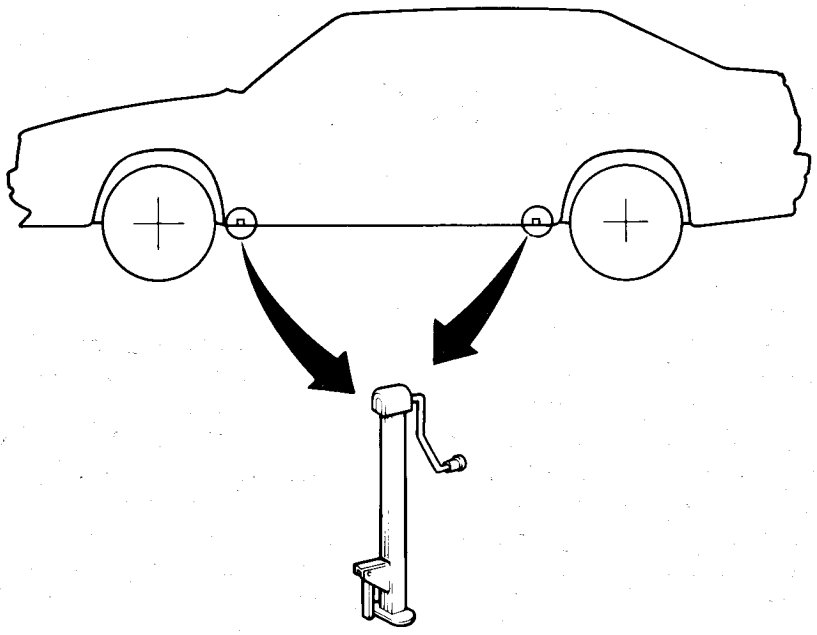
(1) Type number (ex: **016.46** - engine **2500** INIEZIONE L-Jetronic; **VM 80 A** engine **2000** turbodiesel intercooler).

(2) Engine serial number: is progressively assigned at factory.

LIFTING AND TOWING POINTS



JACK



WARNING:
a. Never get under the vehicle while it is supported only by the jack. Always use safety stands to support frame when you have to work under the vehicle.
b. Place wheel chocks at both front and back of the wheels diagonally opposite to jack position.

Position the jack, supplied with the vehicle, in the safety points shown in the figure.

HYDRAULIC JACK AND SAFETY STANDS

WARNING:
a. When raising vehicle with the jack, be sure to support it with safety stands.
b. When jacking up the rear (front) of the vehicle, place chocks in front (back) of the front (rear) wheels.

CAUTION:
When raising the vehicle, always place a wooedn block under vehicle lifting points.
Position the jack and the safety stands in a safe manner under the points shown in the figure.

TOWING

Closely follow the motor vehicle regulations concerning vehicle towing.

CAUTION:
a. Use suitable towing equipment to prevent damaging the vehicle.
b. Before towing, make sure that front and rear axles as well as steering wheel are in good working conditions. If not so, make use of a dolly.
c. If vehicle must be towed with its rear wheel raised, the front wheels must be placed on a towing dolly.
d. Set the ignition key to "0" position and do not withdraw it from the ignition block; otherwise, the steering lock could become engaged.
e. Before starting vehicle towing, release handbrake and shift the speed gear lever to "neutral".
f. Do not apply lateral forces to towing bar. Keep towing bar, or similar devices, always in line with the vehicle.
g. Remember that when vehicle is being towed, there is no vacuum in the servobrake; as a consequence, when braking, exert a greater pressure on brake pedal.

SPECIAL SERVICE TOOLS

Special service tools play a very important role in a vehicle's maintenance since they are essential to ensure accurate, reliable and quick service. To this effect, it must be remembered that times taken relevant to the various maintenance operations are computed assuming that said special tools are being used. All special service tools, made expressly on the Manufacturer's design, needed for overhauling, maintenance and repair of models are listed and illustrated in this manual. The identification number is determined by the relevant ordering part number and consists of a letter followed by a five figure number according to the following schedule:

A.0.0000 **Special Service Tool**
C.0.0000 **Tester**
U.0.0000 **Reamer**

Order of the listed tools by the authorized workshop, must be performed according to the usual systems already followed by each Service - net.

INSTRUCTIONS FOR PRE-DELIVERY INSPECTION

This chapter lists and describes the pre-delivery operations required for the Alfa 75 vehicles. The operation description does not refer to each version, but gives general information concerning the parts for which inspection is required.
As regards the technical specifications related to each operation, and the lubricant products (and similar), refer to the "Technical Data and Specifications" present in each section.

CAUTION:
Pre-delivery inspection of a new vehicle, prior to customer delivery, consists in carrying out all checking operations and tests hereafter described in order to detect and thus eliminate any damage or malfunction.
It goes without saying, however, that when Dealer personnel picks up the vehicle, should perform a visual check in order to:

a. **make sure that vehicle is in normal driving condition, especially as regards level of fluids and controls in general**
b. **detect any dents or scratches on body or other damage to the vehicle interior (upholstery).**
c. **make sure nothing is missing, especially factory supplied accessories, spare tire and any parts that are to be fitted on vehicle as pre-delivery completion.**

If, as consequence of the checks, topping up is required proceed accordingly; this operation is to be considered as part of pre-delivery inspection. In the event of interventions (malfunctions) different from those indicated, carry out the adjustments according to the current technical and administrative procedures.

As each operation is being carried out, the relevant card must be filled out and then filled together with the sold vehicle's other documents; also the pre-delivery card included in the Instruction Book supplied to the customer must be duly filled out as demostration of strictly execution of pre-delivery checks.

OPERATIONS IN THE ENGINE COMPARTMENT

Coolant

– On cold engine, check the header tank lever. Top up if necessary with the prescribed liquid, up to the max level.

Engine oil

– Check that level is up to the "MAX" mark on the dipstick (carry out this operation after having parked the vehicle on an even surface, and after the engine has been off for a few minutes). If required, top up with specified oil.

Power steering oil

– Check that level is up to the "MAX" mark on the plug stick (before carrying out the check, with the engine idling, rotate the steering wheel completely in both directions in order to carry out bleeding).

Brake and clutch fluid

– Check that the level in the tank is up to the "MAX" mark on the tank. If required, top up with specified fluid remembering that tins must be sealed and opened only when ready to use.
Be sure to perform this operation with utmost care and cleanliness.

Battery electrolyte

– Check that the electrolyte covers the plates upper edge by **5 mm (0.197 in)**. If lower, top up with distilled water.

Windscreen washer liquid

– Check that the related tank is full. Top up, if necessary, with appropriate solution.

Engine electric fan

– Connect the thermal switch cables between them and verify the electric fan functioning.
– Verify that cables are firmly connected to thermal switch.

OPERATIONS ON VEHICLE OUTER SIDE AND IN THE PASSENGER COMPARTMENT

Exterior cleaning

– If required, dewax the vehicle using suitable products and procedures; wash the vehicle's exterior with a solution of water and shampoo, rinse it thoroughly and dry it.
Finish up cleaning by removing any stubborn spots by means of suitable compounds.

Paint

– Visually and thoroughly check all painted surfaces and remove accidental or manufacturing flaws, if any.

Exterior moldings and fittings

- Visually check all vehicle's outside parts: bumpers, moldings, grills, headlight rims, letters and emblems making sure they are securely fitted, and have no spots or dents.

Doors and hoods

- Visually check all weatherstrips for tight fit and make sure they are not damaged, out of shape or dirty.
- See if doors and bonnets are aligned and centered with relevant openings.

Factory issued accessory equipment

- Check if following items are in their proper place in the vehicle: tool kit, spare tire, jack, Instruction Book and Service Book.

Locks, hinges, windows

- Check proper working condition of all door locks (close, lock, open from inside and outside). Check in the same manner also locks on bonnet and boot.
- Check door and bonnet hinges for smooth noiseless operation.
- Check if windows can be opened and closed all the way without sticking and noiselessly.

Interior finishings

- Verify all upholsteries (roof, carpets, panels etc....) removing possible stains or scratches.

Seats, seat belt and accessory equipment

- Inspect seats checking if they slide freely on tracks without sticking and noiselessly. Also check proper working condition of seat and head-rest adjusting devices.
- Check inside and outside rear-view mirrors making sure they swing easily and stay firmly in place when set; also check snap switch on mirror for day/night driving.
- Check if seat belts and relevant retractors are in good working condition.
- Check maneuverability of sun-visors, ashtrays, glove compartment and any other accessory.

Heating and air conditioning system

- Verify correct functioning of heater controls and air inlet lids and lowers (opening and closing).
- Verify that electric fan operates correctly at the various speeds.
- For the vehicles equipped with air conditioner, start the engine and verify that, when operating the related control on vehicle, the closing• of the electromagnetic coupling occurs and, consequently, the compressor operation.

Lights, indicators, electric accessory equipment

- With the ignition key set to "MAR", check whether lights outside and inside the vehicle, as well as the related warning lamps, illuminate: front and rear side lights, number plate lights, direction and hazard lights, stop lights, high/low beams, headlight flashing, reverse light, engine and luggage compartment lights, passenger compartment light (through manual control, and on doors) and the related switch off timer, front and rear spot lights, cluster lights and related adjustment rheostat (or rheostats), glove compartment light.
- Check whether the following warning lamps illuminate: alternator, fuel reserve, engine oil pressure, brake fluid level, handbrake on, starter on, heated rear window on, engine temperature; verify correct functioning of the ALFA ROMEO control warning lamps which illuminate all at the same time as soon as the ignition switch is set to the "MAR" position and then switch off after a few seconds.
- Verify proper functioning of horns, cigar lighters, door locking device, power window controls, and front seats electric controls.

Windscreen wash/wipe and headlight washer

- After having installed the wiper blades, check whether windscreen wiper works properly at the different speeds, as well as intermittently.
- Operate the windscreen washer and verify that spray nozzle jet in uniform and correctly directed towards window upper part.
- Verify that headlight washer jet is correctly directed towards headlights (only where required by Regulations).

Tire pressure

- Check tire pressure and, if required, restore to specified values. Use higher p.s.i. for the spare wheel.

Tightening of wheel nuts or screws

- By means of a spanner, check that nuts or screws of wheels are completely tightened. Verify also that nuts are appropriate for the type of vehicle and rim, as indicated in the spare Parts Catalogue.

OPERATIONS ON VEHICLE LOWER PART

Speed gear-differential oil

- Remove filler plug and check that the lubricant level reaches the lower rim of the related hole. Top up if necessary with the prescribed oil and re-fit filler plug.

Systems tightness

- Visually check for leaks or leaks traces in the following systems: fuel, power steering, brakes, clutch, engine cooling.
- Check for oil leaks from engine, speed gear and differential.

FUNCTIONAL TESTS

Engine controls

- Verify that the starter control operates without stricking along the whole travel and that, when the related knob is pushed down, the related device is completely disengaged from carburetor.
- Verify that the pedal accelerator control operates without sticking and, with the pedal at the end of travel, the throttle valve is fully open.

Engine start-up and functioning

- Verify that engine starts correctly. With hot engine, verify steady functioning of the engine at the prescribed idle r.p.m.

Instruments

- With engine running, verify correct functioning of all electrically operated instruments: rev counter, speedometer, oil pressure gauge, water thermometer, fuel level gauge, clock, Trip Computer.

Brake, clutch and speed gear controls

- With engine running, push the brake pedal and check that, after the initial empty stroke, it stops without elasticity.
  Check also proper functioning of hand brake lever.
- With engine running, push the clutch pedal and check that all speeds can be shifted without sticking or noise.

MAINTENANCE

Maintenance operations consist in checking and restoring proper working condition of some parts of the vehicle which are most likely to become worn or out-of-adjustment as a consequence of the vehicle's normal use.
A list of the various operations to be performed at different intervals, as shown in the chart that follows, is included in the coupons of the Service Book which accompanies each vehicle.
Coupons will have to be stamped by the Service Organisation Agency to show that specified maintenance operations have been carried out.
Just as for pre-delivery inspection, should topping up or change of fluids and lubricants - as described in the text - become necessary, they will be considered as part of maintenance operations. In case damages or malfunctions other than those listed are encountered, they will be taken care of repaired of adiusted according to current technical and administrative procedures.

VEHICLE MAINTENANCE SCHEDULE

(Except Switzerland, Sweden, Australia)

No.	OPERATION	A (1)	Km/1000																				Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
1	Change engine oil and filter - check lubrication system tightness	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(2)
2	Change speed gear - differential oil	X				X				X				X				X				X	
3	Check speed gear - differential oil level			X				X				X				X				X			
4	Check (and top up if necessary) the level of windscreen wash/wiper and headlight washer liquid-verify the system functioning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(3)
5	Check brake fluid level	X	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		
6	Change brake fluid level					X				X				X				X				X	(4)
7	Check power steering oil level	X		X		X		X		X		X		X		X		X		X		X	
8	Check antifreeze mixture level and verify cooling system tightness	X	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		(3)
9	Change antifreeze mixture and verify cooling system tightness					X				X				X				X				X	(5)
10	Check bolts and nuts tightening	X																					
11	Check front wheel toe-out, adjust if necessary	X																					
12	Check good conditions of drive shaft and steering box boots	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
13	Check braking system	X		X		X		X		X		X		X		X		X		X		X	
14	Check brake pads wear degree - replace if necessary		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(6)
15	Check hand-brake travel - adjust if necessary	X		X		X		X		X		X		X		X		X		X		X	
16	Check tyre pressure	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(3)
17	Check correct tightening of bolts and nuts of water outlet manifolds and sleeves, supply and drain manifolds, turbocharger connections, screws securing oil sump and engine front cover	X																					(7)
18	Check tightening of cylinder head screws/nuts	X																					(13)
19	Check accelerator cable - adjust if necessary	X																					
20	Check valve clearance adjust if necessary - Check timing and tensioning of belt or control chain (where required)	X		X		X		X		X		X		X		X		X		X		X	

No.	OPERATION	A (1)	Km/1000																				Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
21	Check good condition of alternator drive belt tensioning, air conditioner compressor, power steering pump - adjust if necessary	X		X				X				X				X				X			
22	Replace alternator drive belt, air conditioner compressor, power steering pump					X				X				X				X				X	
23	Replace timing system drive belts (where present)							X						X						X			
24	Check supply system tightness	X		X		X		X		X		X		X		X		X		X		X	
25	Check and clean the air filter cartridge		X		X		X		X		X		X		X		X		X		X		(8)
26	Replace air filter cartridge			X		X		X		X		X		X		X		X		X		X	
27	Check tightness of air supply system after the air flow gauge	X		X		X		X		X		X		X		X		X		X		X	(9)
28	Replace fuel filter									X								X					(9)
29	Replace fuel filter cartridge			X		X		X		X		X		X		X		X		X		X	(7)(10)
30	Drain water from fuel filter		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(7)
31	Clean filter of fuel supply pump									X								X					(7)
32	Clean carburetor jets and exhaust gas return system spark arrester			X		X		X		X		X		X		X		X		X		X	(11)
33	Replace fuel filter or replace cartridge and clean container	X				X				X				X				X				X	(11)
34	Check the idle r.p.m. and exhaust emissions - adjust if necessary	X		X		X		X		X		X		X		X		X		X		X	(12)
35	Check the idle r.p.m. - adjust if necessary	X		X		X		X		X		X		X		X		X		X		X	(7)
36	Check and adjust injectors - replace spray nozzles if necessary					X				X				X				X				X	(7)
37	Check of end play and running clearance of turbocharger rotor shaft, and by-pass valve											X										X	(7)
38	Check of ignition advance - adjust if necessary	X		X		X		X		X		X		X		X		X		X		X	(12)
39	Check and clean spark plugs		X		X		X		X		X		X		X		X		X		X		(12)
40	Replace spark plugs			X		X		X		X		X		X		X		X		X		X	(12)

No.	OPERATION	A (1)	Km/1000																			Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
41	Check pre-heating glow plugs			X		X		X				X		X		X				X		X	(7)
42	Replace pre-heating glow plugs									X								X					(7)
43	Check battery electrolyte level - top-up if necessary; clamp and grease terminal	X		X		X		X		X		X		X		X		X		X		X	(3)
44	Check headlights setting - adjust if necessary	X																					
45	Lubricate doors bonnet and boot hinges adjust strikers if necessary; grease bonnet and boot catches	X		X		X		X		X		X		X		X		X		X		X	
46	Check underbody and frame			X		X		X		X		X		X		X		X		X		X	
47	Vehicle final inspection	X		X		X		X		X		X		X		X		X		X		X	

(1) A = 1,000 to 1,500 km (621 to 932 mi)

(2) To be carried out every 6 months in any case. Check oil level frequently, when refuelling

(3) To be carried out frequently, when refuelling

(4) To be carried out every year, in any case

(5) To be carried out every two year, in any case

(6) To be carried out when driving under particular stress conditions (sport driving) or on hilly roads

(7) Only for 2.0 turbodiesel model

(8) Check more frequently if driving in very dusty areas

(9) Only for models ✱ 6V iniezione

(10) To be carried out every year, and more frequently when using fuel containing impurities

(11) Only for models 1.6 1.8 2.0

(12) Except the 2.0 turbodiesel model

(13) Except the 2.0 turbodiesel model which has the indication (yellow adhesive) DO NOT RETIGHTEN THE CYLINDER HEAD SCREWS on rockers cover

(For Switzerland)

No.	OPERATION	A (1)	Km/1000																				Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
1	Change engine oil and filter - check lubrication system tightness	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(2) E
2	Change speed gear - differential oil	X				X				X				X				X				X	
3	Check speed gear - differential oil level		X	X				X				X				X				X			
4	Check (and top-up if necessary) the level of windscreen wash/wiper and headlight washer liquid-verify the system functioning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(3)
5	Check brakes and clutch fluid level	X	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		
6	Change brake and clutch fluid					X				X				X				X				X	(4)
7	Check power steering oil level	X		X		X		X		X		X		X		X		X		X		X	
8	Check cooling system liquid level and verify system tightness	X	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		(3) E
9	Change cooling system liquid and verify cooling system tightness					X				X				X				X				X	(5) E
10	Check bolts and nuts tightening	X																					
11	Check front wheel toe-out - adjust if necessary	X																					
12	Check good conditions of drive shaft and steering box boots	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
13	Check braking system	X	X	X		X		X		X		X		X		X		X		X		X	
14	Check good conditions of servobrake vacuum intake hose	X	X	X		X		X		X		X		X		X		X		X		X	E
15	Check brake pads wear degree - replace if necessary		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(6)
16	Check handbrake travel - adjust if necessary	X	X	X		X		X		X		X		X		X		X		X		X	
17	Check tyres pressure	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(3)
18	Check correct tightening of cylinder head screws/nuts	X																					E
19	Check accelerator cable - adjust if necessary	X																					
20	Check valve clearance - adjust if necessary. Check timing or tensioning of belt or control chain (where required)	X	X	X		X		X		X		X		X		X		X		X		X	E

No.	OPERATION	A (1)	Km/1000																				Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
21	Check good condition of alternator drive belt tensioning air conditioner compressor, power steering pump - adjust if necessary	X	X	X				X				X				X				X			E
22	Replace alternator drive belt, air conditioner compressor, power steering pump					X				X				X				X				X	E
23	Replace timing speed drive belts (where present)							X						X						X			E
24	Check supply system tightness	X	X	X		X		X		X		X		X		X		X		X		X	E
25	Check and clean the air filter cartridge		X		X		X		X		X		X		X		X		X		X		(8) E
26	Check of air-to filter thermostatic device		X	X		X		X		X		X		X		X		X		X		X	(9) E
27	Replace air filter cartridge			X		X		X		X		X		X		X		X		X		X	E
28	Check tightness of air supply system after the air flow gauge	X	X	X		X		X		X		X		X		X		X		X		X	(9) E
29	Replace fuel filter									X								X					(9) E
30	Clean carburetor jets and exhaust gas return system spark arrester		X	X		X		X		X		X		X		X		X		X		X	(9) E
31	Check starter control functioning	X	X	X		X		X		X		X		X		X		X		X		X	E
32	Replace fuel filter or cartridge. Clean casing	X				X				X				X				X				X	(9) E
33	Check and adjust (if necessary) the idle r.p.m., fast r.p.m. and exhaust emissions	X	X	X		X		X		X		X		X		X		X		X		X	E
34	Check of ignition advance - adjust if necessary	X	X	X		X		X		X		X		X		X		X		X		X	E
35	Check and clean spark plugs		X		X		X		X		X		X		X		X		X		X		E
36	Replace spark plugs			X		X		X		X		X		X		X		X		X		X	E
37	Check battery electrolyte level - top-up if necessary; clamp and grease terminals	X	X	X		X		X		X		X		X		X		X		X		X	(3)
38	Check headlights setting - adjust if necessary	X																					
39	Lubricate doors bonnet and boot hinges adjust strikers if necessary; grease bonnet and boot catches	X	X	X		X		X		X		X		X		X		X		X		X	

No.	OPERATION	A (1)	Km/1000																				Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
40	Check underbody and frame			X		X		X		X		X		X		X		X		X		X	
41	Vehicle final inspection	X	X	X		X		X		X		X		X		X		X		X		X	

(1) A = 1,000 to 1,500 km (621 to 932 mi.)

(2) To be carried out every 6 months in any case - check oil level frequently, when refuelling

(3) To be carried out frequently, when refuelling

(4) To be carried out every year, in any case

(5) To be carried out every two years, or before if necessary

(6) To be carried out when driving under particolar stress conditions (sport driving) or on hilly roads

(7) Check more frequently if driving in very dusty areas

(8) Only for models ❁ 6V iniezione

(9) Only for models 1.8 - 2.0

E Operation related to emission check

No.	OPERATION	A (1)	Km/1000																				Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
1	Change engine oil and filter - check lubrication system tightness	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(2) E
2	Change speed gear - differential oil	X				X				X				X				X				X	
3	Check speed gear - differential oil level		X	X				X				X				X				X			
4	Check the liquid level of windscreen and headlights washer - top-up if necessary	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(3)
5	Check brakes and clutch fluid level	X	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		
6	Change brake and clutch fluid					X				X				X				X				X	(4)
7	Check power steering oil level	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
8	Check cooling system liquid level and verify cooling system tightness	X	X	X	X		X	X	X		X	X	X		X	X	X		X	X	X		(3) E
9	Change cooling system liquid and verify system tightness					X				X				X				X				X	(5) E
10	Check engine bolts and nuts proper tightening	X																					
11	Check front wheel toe-out - adjust if necessary	X																					
12	Check good conditions of drive shaft and steering box boots	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
13	Check braking system	X	X	X		X		X		X		X		X		X		X		X		X	
14	Check good conditions of servobrake vacuum intake hose	X	X	X		X		X		X		X		X		X		X		X		X	E
15	Check brake pads wear degree - replace if necessary		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(6)
16	Check handbrake travel - adjust if necessary	X	X	X		X		X		X		X		X		X		X		X		X	
17	Check tyres pressure	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	(3)
18	Check correct tightening of bolts and nuts of water outlet manifolds and sleeves, supply and drain manifolds	X																					E
19	Check correct tightening of cylinder head screws/nuts	X																					E
20	Check accelerator cable - adjust if necessary	X																					

(For Australia)

No.	OPERATION	A (1)	Km/1000																				Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
21	Check valve clearance - adjust if necessary. Check timing and tensioning of control belt or chain (where required)	X	X	X		X		X		X		X		X		X		X		X		X	E
22	Check good condition of alternator belt tensioning air conditioner compressor, power steering pump - adjust if necessary	X	X	X				X				X				X				X			E
23	Replace alternator drive belt, air conditioner compressor, power steering pump					X				X				X				X				X	E
24	Replace timing drive belts (where present)							X						X						X			E
25	Check supply system tightness. Check fuel vapour emission system. Clean if necessary	X	X	X		X		X		X		X		X		X		X		X		X	E
26	Check and clean the air filter cartridge		X		X		X		X		X		X		X		X		X		X		(7) E
27	Check of air-to filter thermostatic device		X	X		X		X		X		X		X		X		X		X		X	E
28	Replace air filter cartridge			X		X		X		X		X		X		X		X		X		X	E
29	Check tightness of air supply system after the air flow gauge	X	X	X		X		X		X		X		X		X		X		X		X	(8)
30	Replace fuel filter									X								X					(8)
31	Clean carburetor jets and exhaust gas return system spark arrester		X	X		X		X		X		X		X		X		X		X		X	(9) E
32	Check starter control functioning	X	X	X		X		X		X		X		X		X		X		X		X	E
33	Replace fuel filter or replace cartridge and clean carburetor	X				X				X				X				X				X	(9) E
34	Check and adjust (if necessary) the idle r.p.m., fast idle r.p.m. and exhaust emissions	X	X	X		X		X		X		X		X		X		X		X		X	E
35	Check ignition advance - adjust if necessary	X	X	X		X		X		X		X		X		X		X		X		X	E
36	Check and clean spark plugs		X		X		X		X		X		X		X		X		X		X		E
37	Replace spark plugs			X		X		X		X		X		X		X		X		X		X	E
38	Check battery electrolyte level - top-up if necessary; clamp and grease terminals	X	X	X		X		X		X		X		X		X		X		X		X	(3)
39	Check headlights setting - adjust if necessary	X																					

(For Australia)

No.	OPERATION	A (1)	Km/1000																				Notes
			10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	
40	Lubricate doors bonnet and boot hinges - adjust strikers if necessary; grease bonnet and boot catches	X	X	X		X		X		X		X		X		X		X		X		X	
41	Check underbody and frame			X		X		X		X		X		X		X		X		X		X	
42	Vehicle final inspection	X	X	X		X		X		X		X		X		X		X		X		X	

(1) A = 1,000 to 1,500 km (621 to 932 mi.)

(2) To be carried out every 6 months in any case - check oil level frequently, when refuelling

(3) To be carried out frequently, when refuelling

(4) To be carried out every year, in any case

(5) To be carried out every two years, in any case, or before, if necessary

(6) To be carried out more frequently when driving under particular stress conditions (sport driving) or on hilly roads

(7) Check more frequently if driving in very dusty areas

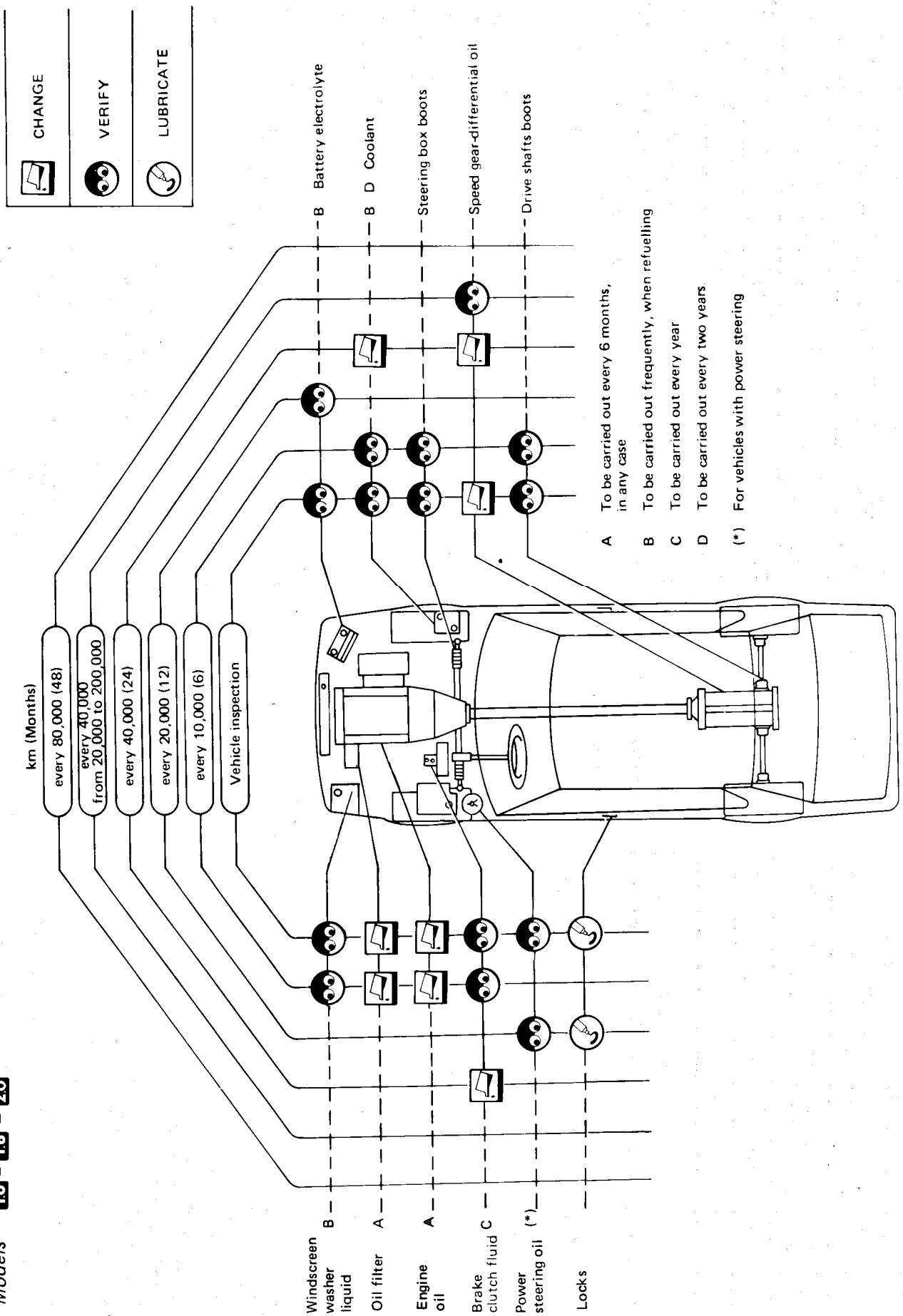
(8) Only for models [6V iniezione]

(9) Only for models [1.8] - [2.0]

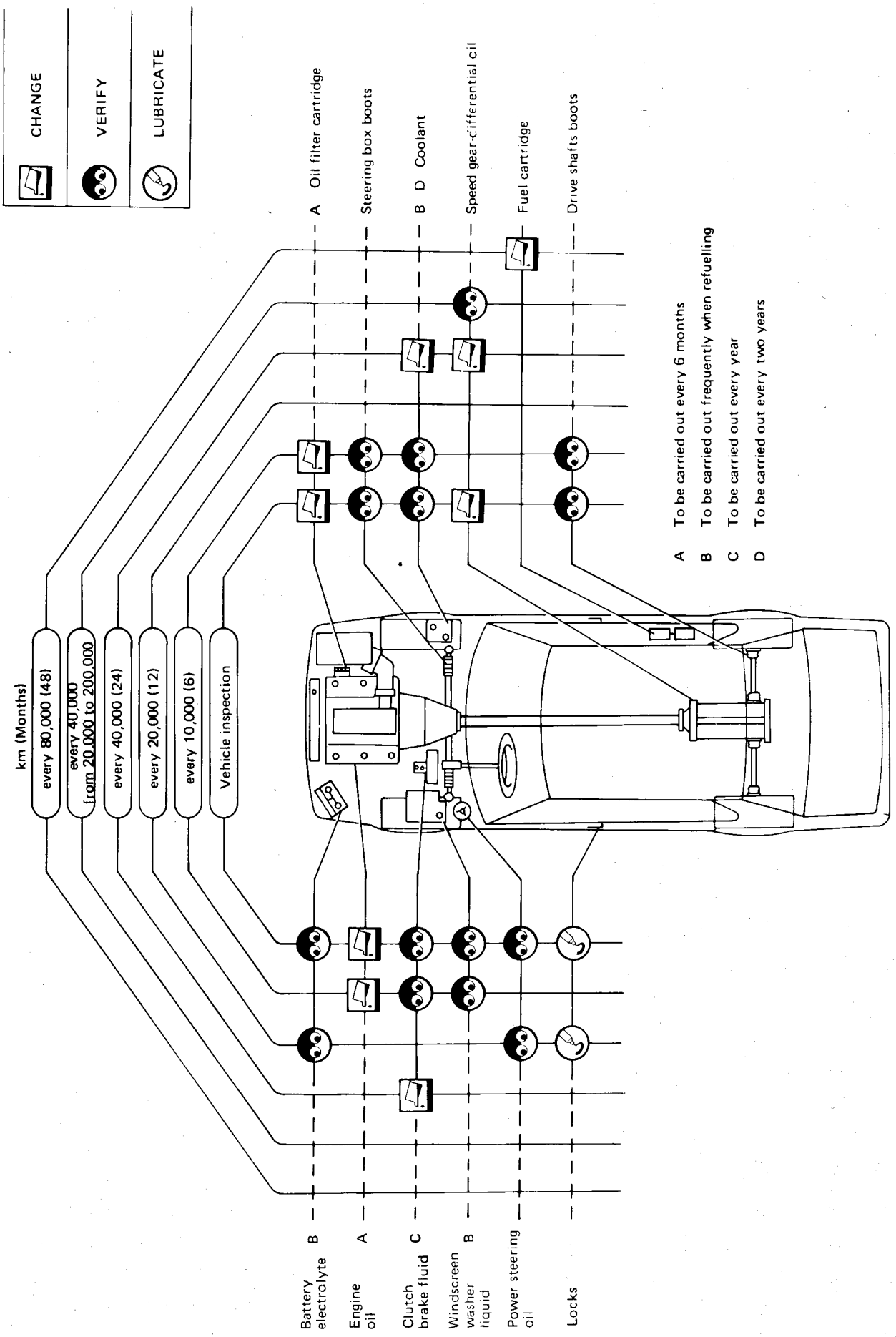
E Operation related to emission check

(For Australia)

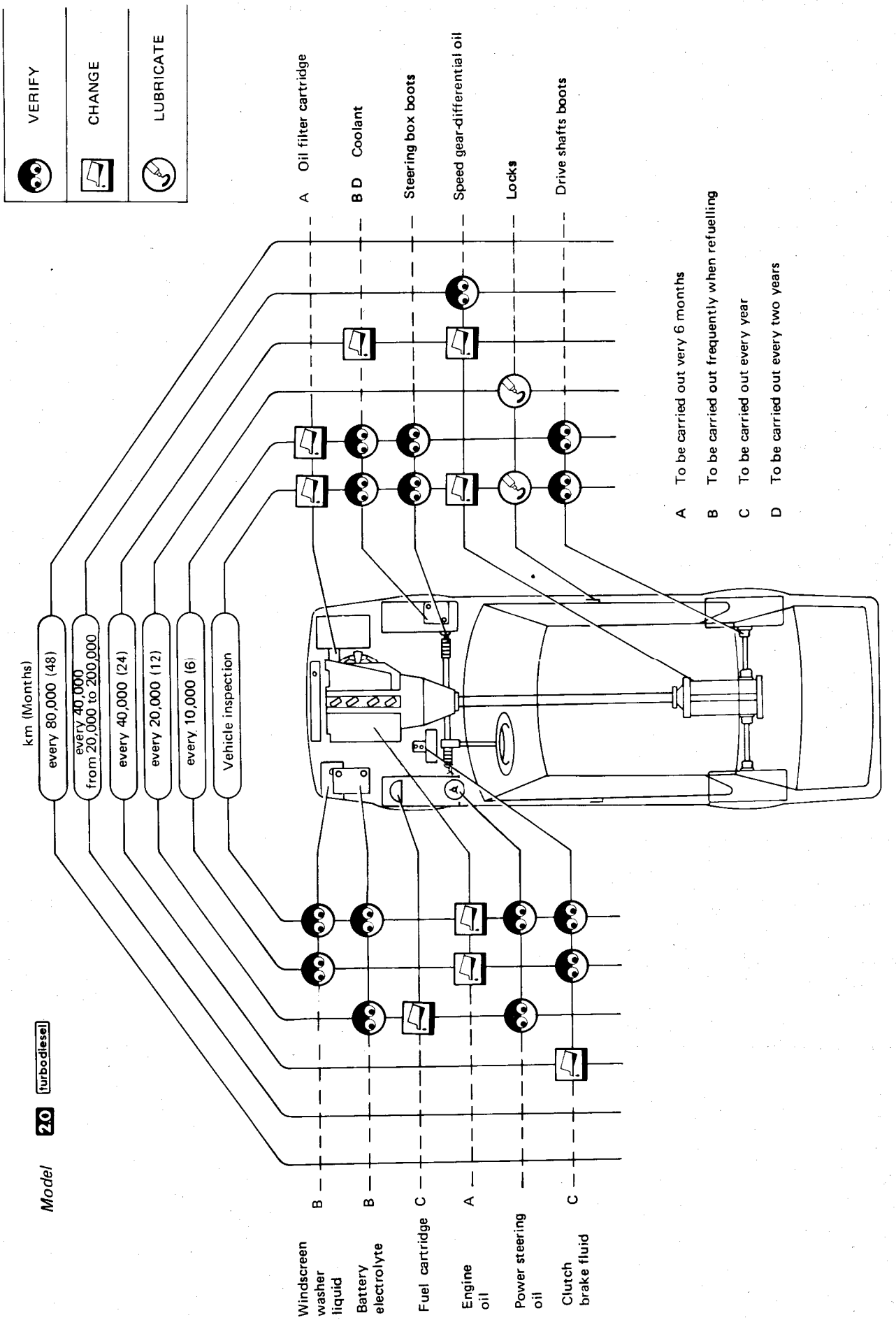
FLUIDS AND LUBRICANTS LAYOUT



Models 1.6 - 1.8 - 2.0



Model ⊛ δV injezione


VERIFY
CHANGE
LUBRICATE
km (Months)
every 80,000 (48)
every 40,000 from 20,000 to 200,000
every 40,000 (24)
every 20,000 (12)
every 10,000 (6)
Vehicle inspection
A Oil filter cartridge
B D Coolant
Steering box boots
Speed gear-differential oil
Locks
Drive shafts boots
A To be carried out very 6 months
B To be carried out frequently when refuelling
C To be carried out every year
D To be carried out every two years
Windscreen washer liquid B
Battery electrolyte B
Fuel cartridge C
Engine oil A
Power steering oil
Clutch brake fluid C
Model 20 turbodiesel

RECOMMENDED FUEL AND LUBRICANTS

FUEL

Otto cycle engines

To ensure proper engine operation, use petrol with a ⩾ 98 Octane Rating (R.M.) and a ⩽ 11 sensitivity (1). (1) Difference between Research Method Octane Rating and Motor Method Octane Rating.

Diesel cycle engines

To ensure proper engine operation, use diesel fuel with a ⩾ 48 Cetane Rating (CUNA NC 630-01-1977).

	External temperature	
	⩾0° C (32° F)	0 to –20°C (32 to –4°F)
Normal diesel fuel	100 %	–
Cold weather diesel fuel	–	100 %

DIESEL FUEL ADDITIONAL AGENTS

Use	Name	Quantity
For cold climates	D/MIX–IP	1 l (0.22 Imp. Gall.) every 200 l (43.99 Imp. Gall.) fuel (one mark of the graded scale every 20 l (4.40 Imp. Gall.) fuel)
To reduce exhaust fumes	NEW CLEANER FOR DIESEL ENGINES +1 – CHALLOIS	one 0.150 kg (0.33 lb) tin (0.125 l) (0.027 Imp. Gall.) every 50 l (11 Imp. Gall.) fuel

Type	Application	Classification	Name			Notes
			AGIP	IP	Other	
OIL	Engine - 01	SAE SE ASTM SE API SF	Sint 2000 SAE 10W50	Sintiax SAE 10W 40		Ambient temperature –18 to 40° C (–0,4 to 104°F)
			Sint DIESEL SAE 10W40	Sintiax TURBODIESEL SAE 10W40	SHELL Myrina 15W40	
	Gearbox - Differential - 13 - 17	SAE J 306 a API GL-5	Rotra SX SAE 75W90	Pontiax HDS SAE 75W90		Ambient temperature –40 to 150°C (–40 to 302°F)
	Front suspension - 21	SAE J 306 a API GL-5	Rotra SX SAE 75W90	Pontiax HDS SAE 75W90		Ambient temperature –40 to 150°C (–40 to 302°F)
	Steering box/wheel - 23	DEXRON B	ATF DEXRON B 11297	DEXRON FLUID B 11297		
	Air Conditioner - 80				SUNISO 4 G SUNISO 5 DS	
GREASE	Engine - 01				UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB - 5100	
					MILLOIL: Lubricant for elastomer seals	
					ISECO:Std.No.3671-69841	
					SIPAL AREXONS - Carbo silicon for valves	
					ISECO: Molykote BR2	
					ISECO: Molykote A	
	Engine - Fuel System - 04	N.L.G.I. No. 1	Grease 15			Basic substance: Al - Ca
					ISECO: Molykote Paste G	
					ISECO: Molykote Long-term No. 2	
					REINACH: E10 TAC	

Type	Application	Classification	Name			Notes
			AGIP	IP	Other	
GREASE	Engine ignition - 05				REINACH - E10 TAC	
	Engine cooling system - 07				Antiseize R. GORI Never Seez	
	Clutch - 12	N.L.G.I. No. 3	Grease 33 FD	Autogrease FD		Basic Substance Bentonite Polythene
					ISECO: Molykote BR2	
	Gearbox - 13	N.L.G.I. No. 3	Grease 33 FD	Autogrease FD		Basic substance Bentonite Polythene
					ISECO: Molykote Longterm No. 2	
					ISECO: Molykote BR2	
	Transmission - 15				ISECO: Molykote BR2	
					ISECO: Molykote G RAPID	
	Differential - 17				ISECO: Molykote VN 2461/c	
					OPTIMOL: Ollstamoly 2LN584	Basic Substance; Li
					ISECO: Molycote BR2	
	Front suspension - 21	N.L.G.I. No. 3	Grease 33 FD	Autogrease FD		Basic Substance Bentonite Polythene
					ISECO: Molykote BR2 SHEEL RETINAX AX	
					ISECO: Ergon Rubber Grease No. 3 ESSO NORVA 275	
					SPCA: Spagraph	
					REINACH: Sferul B2AR	

Type	Application	Classification	Name			Notes
			AGIP	IP	Other	
GREASE	Front suspension - 21				Antiseize compound R. GORI Never Seez	
					ISECO: Molykote Longterm No. 2	
	Front and Rear brakes - 22	N.L.G.I. No. 1	Grease 15			Basic Substance: Al - Ca
					ATE: Bremszylinder Paste	
					ISECO: Molykote Longterm No. 2	
	Steering box wheel - 23	N.L.G.I. No. 3	Grease 33 FD	Autogrease FD		Basic Substance: Bentonite Polythene
					REINACH: Sferul B2AR SHELL RETINAX AX	
					SPCA: Spagraph ESSO NORVA 275	
					ISECO: Ergon Rubber Grease No. 3	
					B.P. Energrease HT MP00	
					ISECO: Molykote Paste G	
					CALYPSOL	
	Rear Suspension - 25				SPCA: Spagraph	
					ISECO: Ergon Rubber Grease No. 3	
					Antiseize Compound R. GORI: Never Seez	
					MILLA: Protection LT	
					HOUGHTON: Rust veto 1064	
	Wheels and Tyres - 28				UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB - 5100	

Type	Application	Classification	Name			Notes
			AGIP	IP	Other	
GREASE	Wheels and Tyres - 28				MILLOIL: Lubricant for elastomer seals	
	Air Conditioner - 80				UNION CARBIDE CHEMICALS COMPANY: Ucon Lubricant 50 HB - 5100	
					MILLOIL: Lubricant for elastomer seals	
FLUID	Engine Cooling - 07		Antifreeze	Antifreeze		Ethylene Glycol (concentrated) Std. No. 3681 - 69956
						Antifreeze (ready for use) Std. No. 3681-69958
	Brakes - Clutch - 22 - 12		Brake Fluid Super HD	Auto Fluid FR		
					ATE "S"	
	Air Conditioner - 80				Freon 12	

SAE VISCOSITY

Measurement Unit	°C (°F)	Motor Oil	Gearbox - Differential Oil
		SAE 10W50	SAE 80W90
Cps	– 40 (– 40)	–	150000
Cst	– 20 (– 4)	2600	–
	40 (104)	165	118
	50 (122)	110	–
	100 (212)	19	14.3 to 15.3

APPROXIMATE REFILL CAPACITIES

Approximate refill capacities \ Vehicle model				1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
FUEL TANK			l (Imp. gall)	49 (10.8)				
FUEL RESERVE			l (Imp. gall)	8 (1.76)				
ENGINE OIL SUMP		With filter	kg (lb)	5 (11)	5 (11)	5 (11)	6 (13)	6 (13)
		Without filter	kg (lb)	4.5 (8.8)	4.5 (8.8)	4.5 (8.8)	5.5 (12)	5.5 (12)
CAMSHAFT SUPPORT SUMPS (*)			kg (lb)	0.415 (0.91)	0.415 (0.91)	0.415 (0.91)	–	0.450 (0.99)
GEARBOX - DIFFERENTIAL OIL			kg (lb)	2.07 (4.5)	2.07 (4.5)	2.07 (4.5)	2.07 (4.5)	2.07 (4.5)
POWER STEERING SYSTEM OIL			kg (lb)	–	–	0.8 (1.76)	0.8 (1.76)	0.8 (1.76)
COOLANT	Min T °C (°F)	CONCENTRATED ANTIFREEZE	l (Imp. gall)	3 (0.66)	3 (0.66)	3 (0.66)	3.6 (0.79)	3.6 (0.79)
		DISTILLED WATER	l (Imp. gall)	5 (1.1)	5 (1.1)	5 (1.1)	6.4 (1.4)	6.4 (1.4)
	–20 (–4)	ANTIFREEZE READY TO USE	l (Imp. gall)	8 (1.76)	8 (1.76)	8 (1.76)	10 (2.2)	10 (2.2)
		CONCENTRATED ANTIFREEZE	l (Imp. gall)	4 (0.88)	4 (0.88)	4 (0.88)	5 (0.88)	5 (1.1)
		DISTILLED WATER	l (Imp. gall)	4 (0.88)	4 (0.88)	4 (0.88)	5 (0.88)	5 (1.1)
	–35 (–31)	ANTIFREEZE READY TO USE	l (Imp. gall)	–	–	–	–	–

(*) Replacement to be carried out only in the case of disassembly

ENGINE MAINTENANCE

1.6, 1.8, 2.0, Carburetors; 1.8, 2.0, Carburetors with timing variator for (CH) (SWE)

ENGINE MAIN MECHANICAL UNIT

REPLACEMENT OF ENGINE OIL AND OIL FILTER – CHECK OF LUBRICATION SYSTEM TIGHTNESS

As per:

Alfa 90 1.8 - 2.0

2.0 - (CH) - (SWE)

2.0 iniezione

CHECK OF BOLTS AND NUTS TIGHTENING

As per:

Alfa 90 1.8 - 2.0

2.0 - (CH) - (SWE)

2.0 iniezione

TIGHTENING OF CYLINDER HEAD NUTS

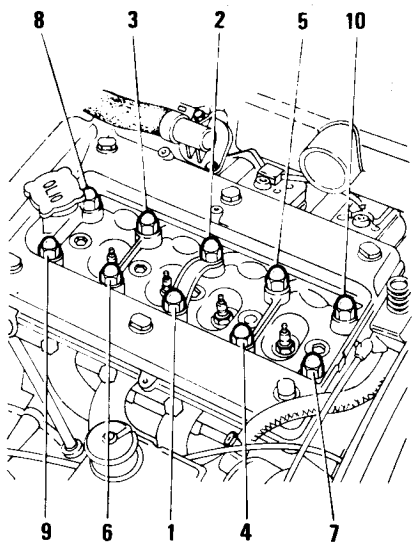
1. During first free maintenance operation

a. Remove the air supply sleeve.
b. On cold engine, loosen nuts by one turn, one at a time, according to the order indicated, moisten the surfaces between washer and nut with oil; tighten to the prescribed torque.

(T): Tightening torques

1.8 - 1.8 - (CH) - (SWE) **76 to 78 N·m (7.8 to 8 kg·m 56 to 57 ft·lb)**

1.6 - 2.0 - 2.0 - (CH) - (SWE) **86 to 88 N·m (8.8 to 9 kg·m 63 to 65 ft·lb)**



c. Reconnect the air supply sleeve.

2. When reassembling cylinder head

a. **Lubricate** washer, nut and threading with engine oil and, on cold engine, tighten nuts to the prescribed torque, tightening them gradually and at intervals.

(T): Tightening torques

1.8 - 1.8 - (CH) - (SWE) **71 to 73 N·m (7.2 to 7.4 kg·m 52 to 54 ft·lb)**

1.6 - 2.0 - 2.0 - (CH) - (SWE) **77 to 79 N·m (7.9 to 8.1 kg·m 55 to 56 ft·lb)**

b. Run the engine at the normal running temperature and tighten to the prescribed torque, without loosening.

(T): Tightening torques

1.8 - 1.8 - (CH) - (SWE) **75 to 76 N·m (7.6 to 7.7 kg·m 55 to 56 ft·lb)**

1.6 - 2.0 - 2.0 - (CH) - (SWE) **82 to 83 N·m (8.4 to 8.5 kg·m 60 to 61 ft·lb)**

c. After having covered about **1000 km (621 mi.)** operate, with cold engine, as per step 1.

CHECK AND ADJUSTMENT OF VALVE CLEARANCE

1.6 - 1.8 - 2.0

As per:

Alfa 90 1.8 - 2.0

CHECK OF TIMING SYSTEM AND CONTROL CHAIN TENSIONING

1.6 - 1.8 - 2.0

As per:

Alfa 90 1.8 - 2.0

CHECK AND ADJUSTMENT OF VALVE CLEARANCE

1.8 - (CH) - (SWE)

2.0 - (CH) - (SWE)

As per:

Alfa 90 2.0 - (CH) - (SWE)

2.0 iniezione

CHECK OF TIMING SYSTEM AND CONTROL CHAIN TENSIONING

1.8 2.0 (CH) (SWE)

As per: Alfa 90

2.0 (CH) (SWE)

2.0 iniezione

CHECKING AND RESTORING THE TIMING VARIATOR FUNCTIONING

1.8 (CH) (SWE)

2.0 (CH) (SWE)

As per: Alfa 90

2.0 (CH) (SWE)

2.0 iniezione

CHECKING GOOD CONDITIONS, REPLACING AND ADJUSTING THE ALTERNATOR DRIVE BELT TENSIONING

1.6 1.8

As per: Alfa 90

1.8 2.0

CHECK OF CYLINDER COMPRESSION

As per: Alfa 90

CHECKING GOOD CONDITIONS, REPLACING AND ADJUSTING TENSIONING OF DRIVE BELTS OF ALTERNATOR, AIR CONDITIONER COMPRESSOR, POWER STEERING PUMP

2.0

As per: Alfa 90

2.0 iniezione

FUEL SYSTEM

As per: Alfa 90

1.8 2.0 2.0 (CH) (SWE)

ENGINE IGNITION

As per: Alfa 90

1.8 2.0 1.8 (CH) (SWE)

2.0 (CH) (SWE)

ENGINE COOLING

As per: Alfa 90

1.8 2.0 2.0 (CH) (SWE)

2.0 iniezione

TROUBLE DIAGNOSIS AND CORRECTIONS

ENGINE

As per: Alfa 90

1.8 2.0 2.0 (CH) (SWE)

2.0 iniezione

IGNITION

1.6 1.8 2.0

As per: Alfa 90

1.8 2.0 2.0 iniezione

FUEL SUPPLY

1.6 1.8 2.0

As per: Alfa 90

1.8 2.0

FUEL SUPPLY/IGNITION

1.8 2.0 (CH) (SWE)

As per: Alfa 90

1.8 (CH) (SWE)

ENGINE MAINTENANCE

2.0 turbodiesel

CHECK AND ADJUSTMENT OF IDLE R.P.M.

As per: Alfa 90 2.4 turbodiesel except for "Check and Adjustment of idle R.P.M.".

Procedure as per: Alfa 90

2.4 turbodiesel

Value prescribed
800 to 850 r.p.m.

ENGINE MAINTENANCE

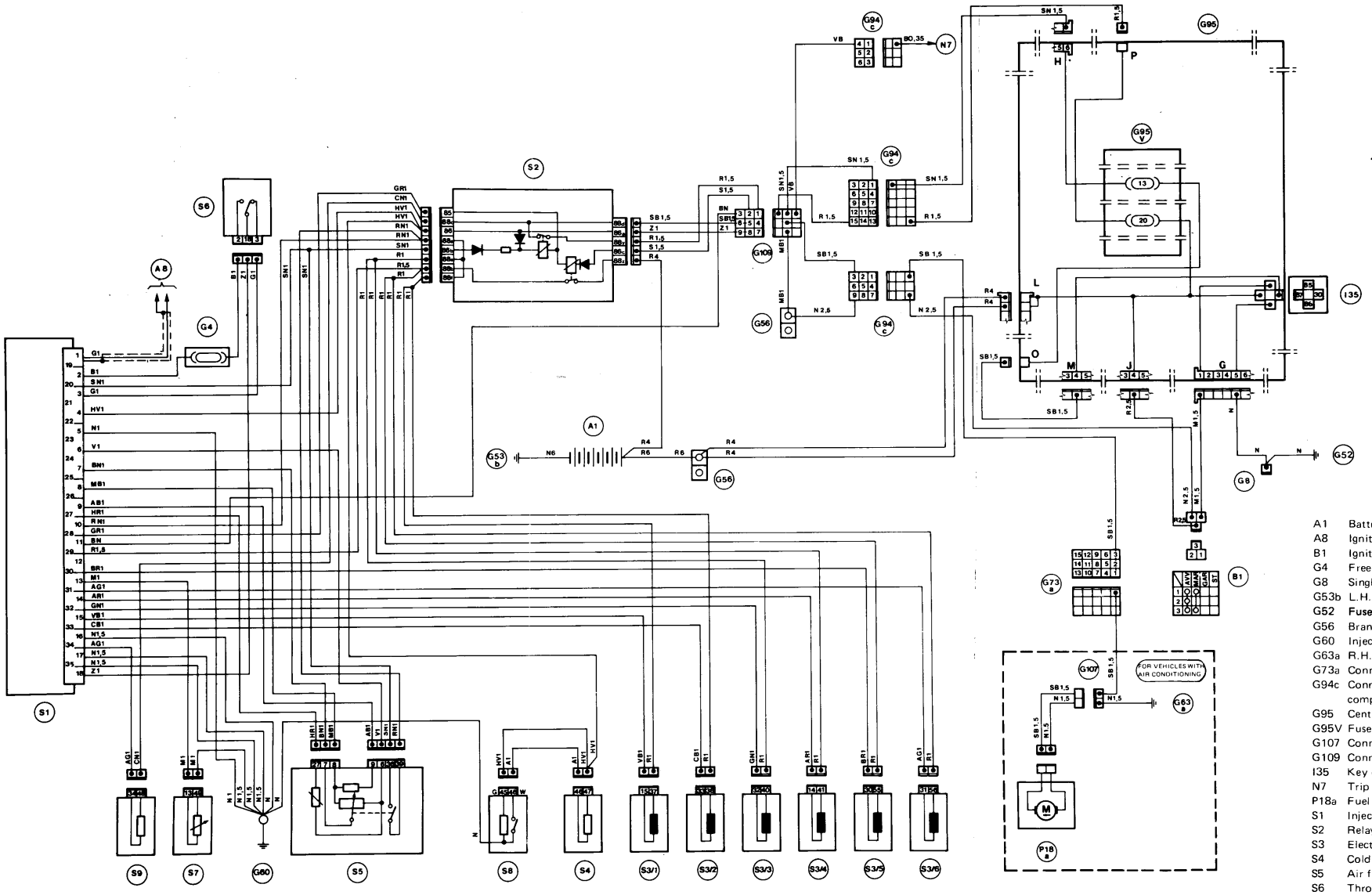
6V iniezione

As per: Alfa 90 2.5 iniezione except for: "Injection wiring diagram".

INJECTION WIRING DIAGRAM

Alfa 75 | 6V iniezione

6V 2.5



A1 Battery
A8 Ignition coil
B1 Ignition switch
G4 Free fusebox
G8 Single connector
G53b L.H. Engine compartment ground
G52 Fusebox ground
G56 Branch terminal board
G60 Injector wiring ground
G63a R.H. Rear ground
G73a Connector for R.H. rear services
G94c Connector for R.H. engine compartment
G95 Central fusebox
G95V Fuses
G107 Connector for fuel pump
G109 Connector for injection wiring
I35 Key operated supply relay
N7 Trip Computer
P18a Fuel electric pump
S1 Injection control unit
S2 Relay set
S3 Electroinjectors
S4 Cold start-up electroinjector
S5 Air flow gauge
S6 Throttle switch
S7 Engine water temperature sensor
S8 Thermo - time switch
S9 Auxiliary air valve

ENGINE MAINTENANCE

6V 3.0

As per Alfa 90 2.5 iniezione except:

ENGINE MAIN MECHANICAL UNIT

As per Alfa 90 2.5 iniezione except:

TIGHTENING OF CYLINDER HEAD NUTS

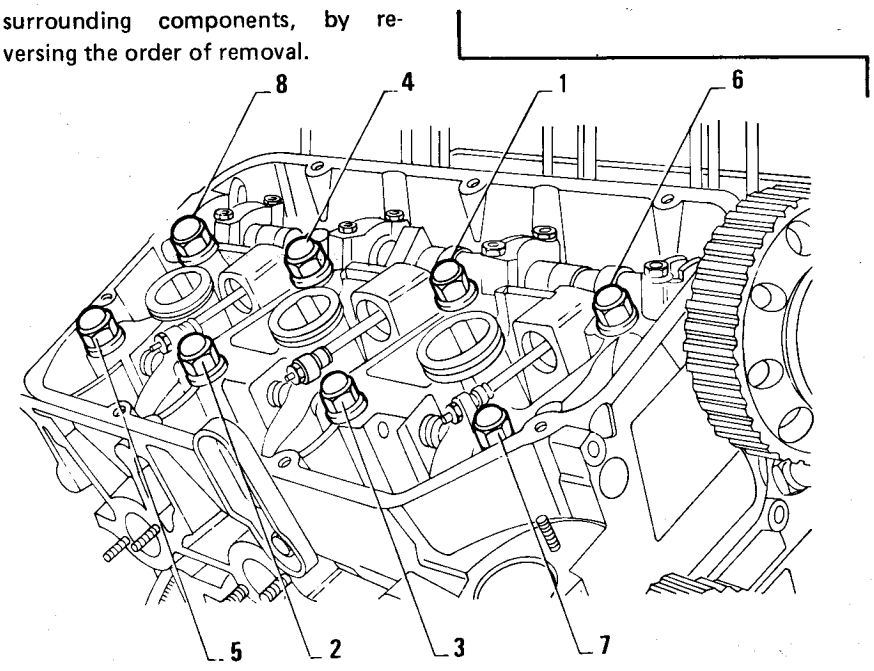
1. During first free maintenance

a. Remove the timing system covers operating as per: "Check and Adjustment of Valve Clearance - Removal of Timing System Covers".
b. On cold engine, loosen the nuts by one turn, and one at a time, according to the given sequence, lay a coat of oil on the surfaces between washer and nuts, then tighten to the prescribed torque.

The figure shows the right-hand head; as regards the left-hand head, the tightening sequence is symmetrical.

(T): Tightening torque
100.4 to 105.5 N·m
(10.2 to 10.8 kg·m;
73.7 to 78.1 ft·lb)

c. Install head covers and the surrounding components, by reversing the order of removal.



2. When reassembling cylinder heads

a. **Lubricate** the surfaces between washer, nut and threads with engine oil and, on cold engine, tighten nuts gradually to the prescribed torque.

(T): Tightening torque
88.5 to 97.8 N·m
(9 to 10 kg·m;
65.1 to 72.3 ft·lb)

b. After having covered about 1,000 km, operate, with cold engine, as per step 1.

FUEL SYSTEM

As per Alfa 90 2.5 iniezione except:

CHECK AND ADJUSTMENT OF IDLE R.P.M. AND EXHAUST EMISSIONS

As per Alfa 90 2.5 iniezione with the following prescribed values:

- **Engine idle r.p.m.**
  800 ± 100 r.p.m.
- **Exhaust CO% at idle r.p.m.**
  CO% = 0.5 to 1.1

ENGINE IGNITION

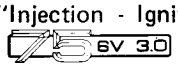
As per Alfa 90 2.5 iniezione except:

CHECK AND ADJUSTMENT OF SPARK ADVANCE

As per Alfa 90 2.5 iniezione taking into account the following max advance value:

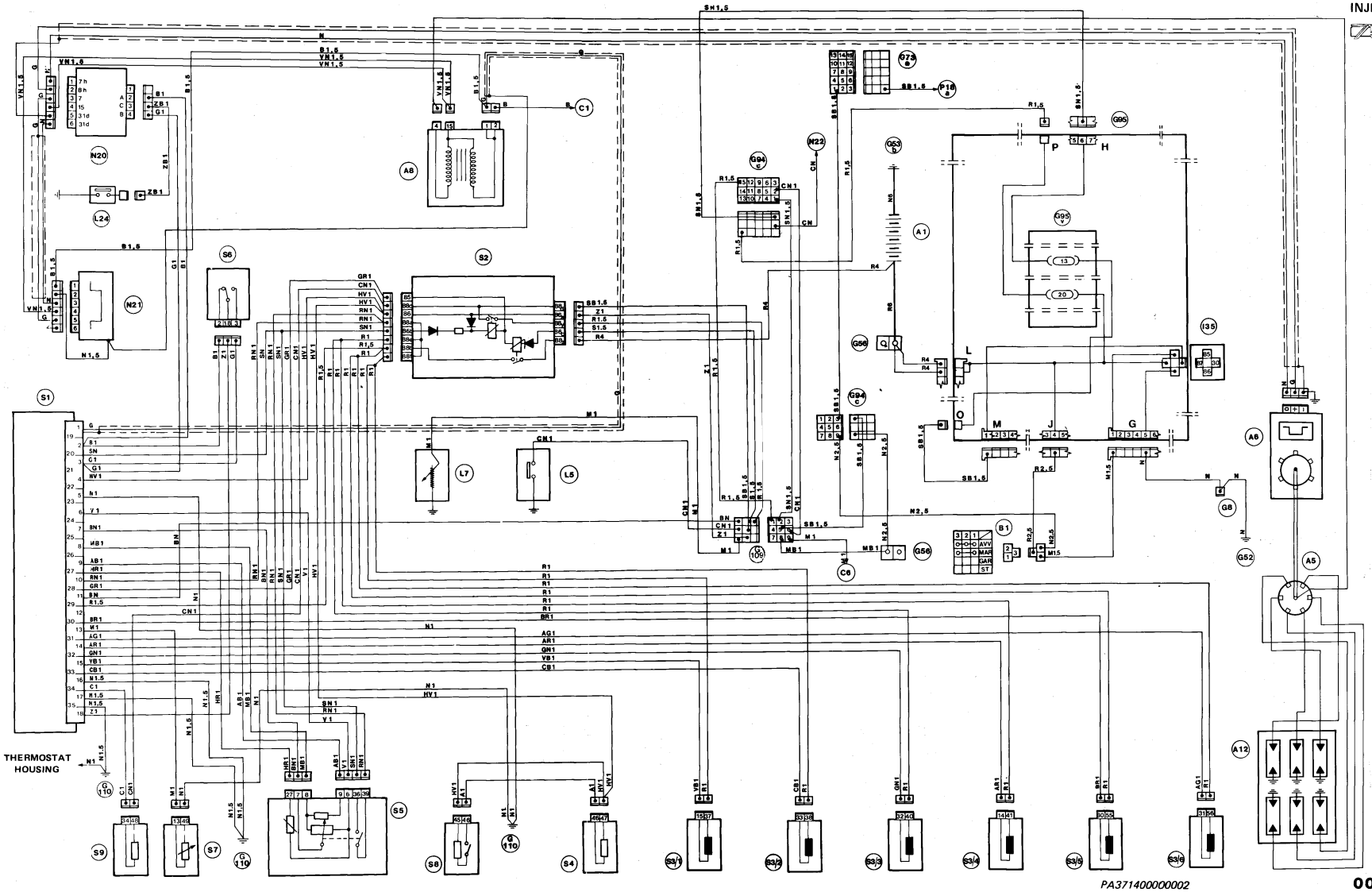
Advance degrees before T.D.C.
at 5000 r.p.m.
32° ± 1°

TROUBLE DIAGNOSIS AND CORRECTIONS

As per Alfa 90 2.5 Iniezione
except: "Injection - Ignition Wiring
Diagram  ".

INJECTION - IGNITION WIRING DIAGRAM

6V 30



A1 Battery
A5 Ignition distributor
A6 Pulse generator
A8 Ignition coil
A12 Spark plugs
B1 Ignition switch
C1 Electronic rev-counter
C6 Coolant temperature gauge
G8 Single connector
G52 Fusebox ground
G53b Engine compartment ground - left side
G56 Branch terminal board
G73a Connector for right rear services
G94c Engine compartment connector - right side
G95 Central fusebox
G95V Fuses
G109 Injection wiring ground
G110 Thermostat housing ground
I35 Key - operated supply relay
L5 Thermal switch for engine coolant max temperature warning lamp
L7 Engine coolant temperature gauge sender
L24 Coolant temperature sensor for ignition advance adjustment
N20 Advance variation control unit
N21 Power module
N22 ALFA ROMEO Control control unit
P18a Electric fuel pump
S1 Injection control unit
S2 Relay set
S3 Injectors
S4 Cold start-up electroinjector
S5 Air flow sensor
S6 Accelerator throttle switch
S7 Engine coolant temperature sensor
S8 Thermo-time switch
S9 Auxiliary air device

PA371400000002

MAINTENANCE OF MECHANICAL COMPONENTS AND BODY

As per Alfa 90 except:

FRONT AXLE AND SUSPENSION

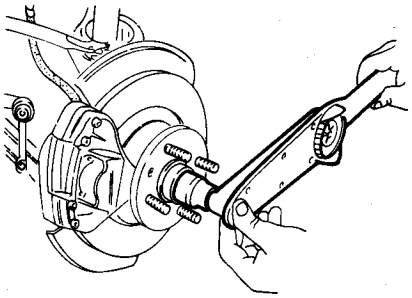
As per Alfa 90 except:

ADJUSTMENT OF WHEEL BEARINGS PRELOAD

- As for the wheels bearings that are secured with nut and split pin, proceed as directed for Alfa 90
- As for the wheels bearings that are secured with calked nuts, proceed as follows.

The calked nut solution can be identified by the letter "M" (red) on hub cover.
Grease the bearings applying the quantity prescribed.

1. Tighten the nut securing the hub to **24.5 N·m (2.4 kg·m; 17.35 ft·lb)** torque, rotating hub, at the same time, by **4 to 5 turns** to facilitate bedding of bearings into their seats and to prevent bevel races from being damaged by rollers.



2. Unscrew the nut enough to release the torque.
3. Use a hammer to strike the end of steering knukle so as to permit outer bearing to set.
4. Slightly tighten the nut manually in order to obtain a torque lower than
   1 N·m (0.1 kg·m; 0.72 ft·lb)
5. Calk the nut carefully so as to prevent it rotating.
6. At the end of operation, verify that end float of nut does not exceed
   0.01 to 0.05 mm
   [(0.4 to 2.0) · 10^{-3} in]

CHECK OF VEHICLE HEIGHT

As per Alfa 90 except:

REAR HEIGHT

Rear height value
T = x-y = 83 ± 5 mm (3.27 ± 0.2 in)
C = y-z = 13 ± 5 mm (0.51 ± 0.2 in)

WHEEL ALIGNMENT

CHECK OF FRONT WHEELS ALIGNMENT

For vehicles Alfa 75, refer to Alfa 90
For vehicles 75 apply the procedures described for Alfa 90 taking into account the following specific technical data:

Toe-out value

Dimensions / Models	E–D mm (in) (1)	Angle α	Rim diameter mm (in)
1.6 1.8	2 ± 1 (0.08±0.04)	9'	340 (13.3)
2.0			365 (14.4)
TURBO D			340 (13.3)
6V 2.5 6V 3.0			365 (14.4)

(1) Values relating to vehicle at nominal height, corresponding to static load.

Caster angle

Models	Angle γ (1)
1.6 1.8	3° 30' ± 30'
2.0	4° 30' ± 30'
TURBO D	3° 30' ± 30'
6V 2.5 6V 3.0	4° 30' ± 30'

(1) Values relating to vehicle at nominal height, corresponding to static load.

BODY

As per Alfa 90 except:

SEAT BELTS

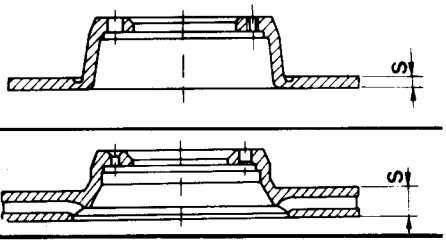
(T) : **Tightening torque**
Seat belt screws
28 to 48 N·m
(2.8 to 4.8 kg·m;
20.25 to 34.71 ft·lb)

FRONT AND REAR BRAKES

As per Alfa 33 except:

Rear discs / Models	Discs thickness wear limit
All	S = 8 mm (0.315 in)

Front discs / Models	Discs thickness wear limit
1.6 1.8 2.0 turbodiesel	S = 10.7 mm (0.421 in)
2.0	S = 9 mm (0.354 in)
6V iniezione	S = 20 mm (0.787 in)



SERVICE DATA AND SPECIFICATIONS

ENGINE MAINTENANCE

TECHNICAL DATA – CHECKS AND ADJUSTMENTS

Engine unit

Inspection data \ Model		1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Valve clearance (cold engine)						
Intake	mm (in)	0.400 to 0.450 (0.016 to 0.018)			0.30 (0.012)	0.475 to 0.500 (0.019 to 0.020)
Exhaust	mm (in)	0.450 to 0.500 (0.018 to 0.020)			0.30 (0.012)	0.225 to 0.250 (0.009 to 0.011)
Alternator - pump belt tensioning						
Force applied to belt	N (kg; lb)	78 (8; 17.6)			147 (15; 33.1)	147 to 294 (15 to 30; 33.1 to 66.1)
Arrow	mm (in)	10 to 15 (0.39 to 0.59)			22 (0.866)	16 (0.63)
Power steering pump belt tensioning						
Force applied to belt	N (kg; lb)	–	–	147 to 294 (15 to 30; 33.1 to 66.2)	147 ± 9.8 (15 ± 1; 33.1 ± 2.2)	147 to 294 (15 to 30; 33.1 to 66.1)
Arrow	mm (in)			13 (0.51)	15 (0.59)	13 (0.51)
Air conditioner compressor belt tensioning						
Force applied to belt	N (kg; lb)	78 (8; 17.6)			167 (17; 37.5)	196 to 343 (20 to 35; 44.1 to 77.2)
Arrow	mm (in)	10 to 15 (0.39 to 0.59)			19 (0.74)	14 (0.55)

Cooling system

Test Pressure \ Model		1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Pressurized cap adjustment	kPa	68.6 ± 9.8			98 ± 9.8	68.6 ± 9.8
	bar	0.686 ± 0.098			0.98 ± 0.098	0.686 ± 0.098
	kg/cm^2	0.7 ± 0.1			1 ± 0.1	0.7 ± 0.1
	p.s.i.	9.95 ± 1.42			14.2 ± 1.42	9.95 ± 1.42
Hydraulic system	kPa	107.9				
	bar	1.08				
	kg/cm^2	1.1				
	p.s.i.	15.6				

Ignition

Timing (1) \ Model		1.6	1.8 - 2.0		6V iniezione	
Static advance	r.p.m.	900 $^{+100}_{-50}$	900 $^{+100}_{-50}$	835 ± 80 (*)	900 ± 100 (**) 800 ± 100 (***)	
	advance degrees	7° ± 1° (2)	7° ± 1° (2)	5° ± 1° (3)(*)	7° ± 1° (2)	0° ± 1° (*)
Max advance	r.p.m.	5100	5100	3550±100(*)	5000	
	advance degrees	38° - 3°	38° - 3°	38° (*)	31° - 3° (**) 32° ± 1° (***)	

(1) Timing values must be measured on vacuum advance calibrator tube disconnected
(2) Before T.D.C.
(3) After T.D.C.
(*) For Switzerland, Sweden, Australia
(**) For Alfa 75 6V iniezione only; (***) For 75 6V 3.0 only

Fuel system

Inspection data \ Model		1.6	1.8 - 2.0	2.0 turbodiesel	6V iniezione
Engine idle r.p.m. (hot engine - speed gear into neutral - clutch engaged)	r.p.m.	900 $^{+100}_{-50}$	900 $^{+100}_{-50}$ 835 ± 80 (*)	825 ± 25	900 ± 100 (**) 800 ± 100 (***)
Exhaust CO percentage with idle r.p.m.	% in vol.	⩽3,5 –	⩽3,5 1 ± 0,5 (*)	–	1 ± 0.5 (**) 0.5 $^{+0.5}_{-0.2}$ (*) 0.5 to 1.1 (***)
Exhaust HC values with idle r.p.m.	p.p.m.	–	– ⩽350 (*)	–	⩽480 ⩽300 (*)
Fuel pump delivery pressure	kPa bar kg/cm² p.s.i.	29.4 to 44.1 0.294 to 0.441 (1) 0.30 to 0.45 4.26 to 6.40		20 0.2 0.2 2.9	225.5 to 264.8 2.26 to 2.65 2.3 to 2.7 32.7 to 38.4
Fuel system tightness test pressure	kPa bar kg/cm² p.s.i.	29.4 to 44.1 0.294 to 0.441 0.30 to 0.45 4.26 to 6.40		3 to 4 0.03 to 0.04 0.03 to 0.04 0.435 to 0.58	250 2.5 2.55 36.3
Injectors setting pressure	kPa bar kg/cm² p.s.i.	–	–	14700 to 15500 147 to 155 150 to 158 2133 to 2247	–
Injector tightness test pressure	kPa bar kg/cm² p.s.i.	–	–	12740 127,4 130 1849	–
Turbocharger end-play	mm (in)	–	–	0.08 to 0.11 (0.0031 to 0.0043)	–
Turbocharger running clearance	mm (in)	–	–	0.42 (0.0165)	–

(1) Fuel delivery pressure at zero delivery and with engine r.p.m. within 5000 to 6000
(*) For Switzerland, Sweden, Australia
(**) For Alfa 75 6V iniezione only; (***) For 75 6V 3.0 only

FLUIDS AND LUBRICANTS

Refer to: Fluids and Lubricants Layout - Recommended Fuel and Lubricants - Approximate Refill Capacities

WHEELS AND TYRES

As regards tyre pressure, refer to paragraph "Tyres".

Engine (Cont.d)

Unit: N·m (kg·m; ft·lb)

Item \ Model	1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Spark plugs tightening (3)	25 to 34 (2.5 to 3.5; 18 to 25)			–	25 to 34 (2.5 to 3.5; 18 to 25)
Nut securing camshaft front hub	–	–	–	–	97 to 117 (9.9 to 11.9; 71 to 86)
Coolant temperature transmitter on thermostat housing (2)	–	–	–	–	20 to 25 (2 to 2.5; 15 to 18)
Unions on injectors and on injection pump	–	–	–	14.7 to 19.6 (1.5 to 2; 10.8 to 14.4)	–
Nut securing injectors (1)	–	–	–	24.5 to 29.4 (2.5 to 3; 18 to 21.7)	–

(*) During first free maintenance operation, operate as per step B, except for 2.0 turbodiesel model which has the indication (yellow adhesive) DO NOT RETIGHTEN THE CYLINDER HEAD SCREWS on rockers cover.

(**) Only for Alfa 75 6V iniezione (***) Only for 75 6V 3.0

(1) In oil

(2) With antiseize R. GORI: Never Seez

(3) In oil: ISECO Molykote A

(4) Tightening is performed by loosening the screws 30°

(•) Further angular tightening performed by rotating the screws 50°

(••) Further angular tightening performed by rotating the screws 30°

(•••) Further angular tightening performed by rotating the screws 100°

Engine ground wiring

Unit: N·m (kg·m; ft·lb)

Item \ Model	1.6	1.8	2.0	2.0 turbodiesel	❄ 6V iniezione	6V 3.0
ENGINE GROUND WIRING						
Screw securing engine ground braid to engine rear cover	18 to 22 (1.8 to 2.2; 13.0 to 15.9)			–	18 to 22 (1.8 to 2.2; 13.0 to 15.9)	
Screw securing ground braid to body side member	11 to 14 (1.1 to 1.4; 7.9 to 10.1)			–	11 to 14 (1.1 to 1.4; 7.9 to 10.1)	
Screw and nut securing ground to rear eyelet of air conditioner compressor (if installed)	22 to 28 (2.2 to 2.8; 15.9 to 20.2)			–	22 to 28 (2.2 to 2.8; 15.9 to 20.2)	
Screw securing electronic injection wiring ground cables to right-hand side of upper cover	–			–	9 to 11 (0.9 to 1.1; 6.5 to 7.9)	
Screws securing electronic injection wiring ground cables and auxiliary air valve to right-hand side of upper cover	–			–	5 to 6 (0.5 to 0.6; 3.6 to 4.3)	
Screw securing ground braid to intake air box	–			–	5 to 6 (0.5 to 0.6; 3.6 to 4.3)	
Screw securing intake air box ground braid to head left-hand upper cover	–			–	9 to 11 (0.9 to 1.1; 6.5 to 7.9)	
Screw securing wiring ground cable to thermostat housing	–			–	5 to 6 (0.5 to 0.6; 3.6 to 4.3)	
Screw securing battery ground cable to power steering pump support	–			–	18 to 22 (1.8 to 2.2; 13.0 to 15.9)	
Screw securing ground braid of front carburettor support to supply manifold	18 to 22 (1.8 to 2.2; 13.0 to 15.9)			–	–	
Nut securing ground braid on front carburettor support	18 to 22 (1.8 to 2.2; 13.0 to 15.9)			–	–	
Nut securing performance gauge wiring ground on supply manifold	18 to 22 (1.8 to 2.2; 13.0 to 15.9)			–	–	

Engine

Unit: N·m (kg·m; ft·lb)

Item	Model	1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
TIGHTENING OF CYLINDER HEAD NUTS (*)						
A) On reassembly						
1. - cold engine	Nuts	77 to 79 (7.9 to 8.1; 57 to 59)	71 to 73 (7.2 to 7.4; 52 to 54)	77 to 79 (7.9 to 8.1; 57 to 59)	–	78 (8; 58) (**) 88.5 to 97.8(9 to 10; 65 to 72) (***)
	Internal screws 1st stage	–	–	–	29 (3; 21.7)	–
	Internal screws 2nd stage	–	–	–	(•)	–
	Internal screws 3rd stage	–	–	–	(•)	–
	External screws	–	–	–	88 (9; 65.1)	–
2. - hot engine	Nuts	82 to 83 (8.4 to 8.5; 60 to 61)	75 to 76 7.6 to 7.7; 55 to 56)	82 to 83 (8.4 to 8.5; 60 to 61)	–	–
	Internal screws	–	–	–	(••)	–
	External screws (4)	–	–	–	88 (9; 65.1)	–
B) After 1000 km - cold engine	Nuts	86 to 88 (8.8 to 9; 63 to 65)	76 to 78 (7.8 to 8; 56 to 58)	86 to 88 (8.8 to 9; 63 to 65)	–	88 (9; 65) (**) 100.4 to 105.5 (***) (10.2 to 10.8; 73.7 to 78.1)
	Internal screws 1st stage	–	–	–	29 (3; 21.7)	–
	Internal screws 2nd stage	–	–	–	(•••)	–
	External screws (4)	–	–	–	88 (9; 65.1)	–
Nuts securing camshaft caps (1)		20 to 22 (2 to 2.25; 15 to 16)			–	16 to 18 (1.6 to 1.8; 22 to 24.5)

Axles and Suspensions

Inspection data \ Model		1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Vehicle static load diagram (1)	N (kg; lb)	A + B = 490 + 245 = 735 (50 + 25 = 75; 110 + 55 = 165)				
Front height	mm (in)	E = B – A = 44 ± 5 (1.73 ± 0.19)				
Rear height	mm (in) mm (in)	C = 13 ± 5 (0.51 ± 0.2) T = 83 ± 5 (3.27 ± 0.2)				
Front toe-out (2)	mm (in)	E – D = 1 ± 1 (0.039 ± 0.039)				
Front toe-out angle		$\alpha = 9'$				
Wheel rim diameter	mm (in)	340 (13.3)		365 (14.4)	(340 (13.3)	365 (14.4) 390 (15.4)
Rear toe-in angle		$\alpha = 0° \pm 10'$				
Tie-rod length		G = H				
Front camber angle (2)		$\beta = -30' \pm 30'$				
Rear camber angle (2)		$\beta = 0° \pm 30'$				
Front caster angle (2)		$\gamma = 3° 30' \pm 30'$				
Max steering lock (2)		$\delta = 30°$				

(1) After loading, move care up and down to settle suspensions. Suspension height is to be carried out with vehicle in running order.

(2) Values referring to vehicle in nominal height, corresponding to static load.

Braking system

Inspection data \ Model		1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Front disc brakes						
Disc min thickness	mm (in)	10.7 (0.42)		9 (0.35)	10.7 (0.42)	20 (0.79)
Rear disc brakes						
Disc min thickness	mm (in)	8 (0.31)				
Parking brake						
Number of notches available on scroll gear before wheel locking		4 to 6				

Axles and Suspensions

Inspection data / Variations		Model 75					
		1.6	1.8	2.0	TURBO D	6V 2.5	6V 3.0
Vehicle static load diagram (1)	N (kg; lb)	A + B = 490 + 245 = 735 (50 + 25 = 75; 110 + 55 = 165)					
Front height	mm (in)	E = B − A = 44 ± 5 (1.73 ± 0.19)					
Rear height	mm (in)	C = 13 ± 5 (0.51 ± 0.2)					
	mm (in)	T = 83 ± 5 (3.27 ± 0.2)					
Front toe-out (2)	mm (in)	E − D = 2 ± 1 (0.078 ± 0.039)					
Front toe-out angle		α = 9′					
Wheel rim diameter	mm (in)	Ø 340 (13.3)		Ø 365 (14.4)	Ø 340 (13.3)	Ø 365 (14.4)	
Rear toe-in angle		α = 0° ± 10′					
Tie-rod length		G = H					
Front camber angle (2)		β = − 30′ ± 30′					
Rear camber angle (2)		β = 0° ± 30′					
Front caster angle (2)		γ = 3° 30′ ± 30′		γ = 4° 30′ ± 30′	γ = 3° 30′ ± 30′	γ = 4° 30′ ± 30′	
Max steering lock (2)		δ = 30°					

(1) After loading, move care up and down to settle suspensions. Suspension height is to be carried out with vehicle in running order

(2) Values referring to vehicle in nominal height, corresponding to static load

Braking system

Inspection data / Variations		Model 75					
		1.6	1.8	2.0	TURBO D	6V 2.5	6V 3.0
Front disc brakes							
Disc min thickness	mm (in)	10.7 (0.42)		9 (0.35)	10.7 (0.42)	20 (0.79)	
Rear disc brakes							
Disc min thickness	mm (in)	8 (0.31)					
Parking brake							
Number of notches available on scroll gear before wheel locking		4 to 6					

Front suspension

Unit: N m (kg·m; ft·lb)

Item \ Model	1.8	2.0	2.0	2.0 turbodiesel	6V iniezione
Wheel hub nut; first tightening	20 to 24 (2 to 2.5; 15 to 18)				
Wheel hub nut; second tightening	5 to 10 (0.5 to 1; 3.7 to 7.4)				
Lower lever support end nut	29 to 34 (3 to 3.5; 21 to 25)				
Lower lever ring nut	20 to 34 (2 to 3.5; 15 to 25)				
"Palnut" lock washer for lower lever ring nut	59 to 71 (6 to 7.2; 43 to 52)				
Nut securing ball joint to lower lever	15 to 20 (1.5 to 2; 11 to 15)				
Nuts securing lower lever support to frame	80 to 90 (8.2 to 9.2; 59 to 66)				
Nut securing lower lever ball joint to steering knuckle	44 to 54 (4.5 to 5.5; 32 to 40)				
Nut securing upper lever ball joint to steering knuckle	80 to 90 (8.2 to 9.2; 59 to 66)			45 to 55 (4.6 to 5.6; 33 to 41)	
Nut securing upper lever to frame	39 to 44 (4 to 4.5; 29 to 32)				
Nut securing strut to frame	39 to 44 (4 to 4.5; 29 to 32)				
Nut securing strut to upper lever	39 to 44 (4 to 4.5; 29 to 32)				
Locknut securing shock absorber to frame	24 to 29 (2.4 to 3; 18 to 21)				
Screws securing shock absorber to upper lever	25 to 31 (2.5 to 3.2; 18.4 to 22.8)				
Nut securing anti-roll bar link to lower lever	18 to 23 (1.8 to 2.3; 13 to 17)				
Screws securing anti-roll bar flexible supports	25 to 29 (2.5 to 3; 18 to 21)				
Screws securing front brake caliper to steering knuckle	74 to 83 (7.5 to 8.5; 54 to 61)				
Nut securing steering wheel tie-rod ball joint to steering knuckle	45 to 55 (4.6 to 5.6; 33 to 40)				

Front and rear brakes

Unit: N·m (kg·m; ft·lb)

Item \ Model	1.6	1.8	2.0	2.0 turbodiesel	❄ 6V iniezione
Screws securing front brake caliper to steering knuckle	74 to 83 (7.5 to 8.5; 54 to 61)				
Nuts securing rear brake caliper to speed gear-differential casing	46 to 52 (4.7 to 5.3; 34 to 38)				
Screws securing spacer and rear brake disc to internal drive shaft					49 to 54 (5 to 5.5; 36 to 40)
Screws securing spacer to external drive shaft					44 to 54 (4.5 to 5.5; 32 to 40)
Screws securing rear brake disc to differential shaft	29 to 35 (3 to 3.6; 21 to 26)				–
Unions for brake hydraulic system pipes	10 to 12 (1 to 1.2; 7.4 to 8.8)				
Unions for brake hydraulic system hoses	10 to 15 (1 to 1.5; 7.4 to 11)				
Nuts securing servobrake to pedals support	12 to 15 (1.2 to 1.5; 8.8 to 11)				
Nuts securing brake master cylinder to servobrake	12 to 15 (1.2 to 1.5; 8.8 to 11)				
Locknut for backlash adjusting screw of rear brake disc pad	7 to 10 (0.7 to 1; 5.15 to 7.4)				

Rear suspension

Unit: N·m (kg·m; ft·lb)

Item \ Model	1.6	1.8	2.0	2.0 turbodiesel	❄ 6V iniezione
Ring nut securing wheel hub bearing	226 to 265 (23 to 27; 166 to 195)				
Wheel hub securing nut	265 to 324 (27 to 33; 195 to 238)				
Screws securing speed-gear unit support cross member to body	39 to 44 (4 to 4.5; 29 to 32)				
Screws securing axle to speed gear unit support cross member	88 to 108 (9 to 11; 65 to 79)				
Bolts securing Watt parallelogram tie-rods to rocker arm and supports on body	39 to 49 (4 to 5; 29 to 36)				
Nut securing rocker arm to De Dion axle pin	59 to 98 (6 to 10; 43 to 72)				
Lock nuts for shock absorber upper and lower securing (nut tightened thoroughly)	23 to 27 (2.3 to 2.8; 17 to 20)				
Locknuts securing anti-roll bar to axle	23 to 27 (2.3 to 2.8; 17 to 20)				
Screws securing anti-roll bar to body	19 to 24 (1.9 to 2.4; 14 to 18)				

Transmission

Unit: N·m (kg·m; ft·lb)

Item \ Model	1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Unions for clutch hydraulic system pipes	8 to 10 (0.8 to 1; 5.9 to 7.4)				
Unions for clutch hydraulic system hoses	10 to 15 (1 to 1.5; 7.4 to 11)				
Bolt and screw securing fixing bracket to speed gear flexible support	8.1 to 10 (0.8 to 1; 5.9 to 7.4)				
Bolt securing clutch-speed gear-differential unit rear support rubber bushing	72 to 89 (7.2 to 8.9; 53 to 65)				
Screws securing speed gear-differential unit to lateral supports	18.6 to 23.5 (1.9 to 2.4; 13.7 to 17.3)				
Bolt securing lever to speed control outer lever	13 to 16 (1.3 to 1.6; 9.6 to 11.8)				
Nut securing ball joint connecting rear lever to transmission lever	25.1 to 31 (2.5 to 3.2; 18.5 to 23)				
Nuts securing speed selection tie-rod	11.3 to 14 (1.1 to 1.4; 8.3 to 10.3)				
Bolt securing speed selection and transmissione lever to speed engagement and transmission lever	8.1 to 10 (0.8 to 1; 5.9 to 7.4)				
Screws securing spacer and rear brake disc to internal drive shaft	–				49 to 54 (5 to 5.5; 36 to 40)
Screws securing external drive shafts to internal drive shafts	–				44 to 54 (4.5 to 5.5; 32 to 38)
Screws securing drive shaft to differential shaft and wheel shaft	29 to 35 (3 to 3.6; 21 to 26)				–
Screws securing drive shaft to spacer and wheel shaft	–				44 to 54 (4.5 to 5.5; 32 to 40)
Nuts securing front flexible coupling to rear flexible coupling	39 to 49 (4 to 5; 27 to 36)				55 to 57 (5.6 to 5.8; 40.5 to 42)
Nuts securing central flexible coupling to propeller shaft fork	39 to 49 (4 to 5; 27 to 36)				
Nuts securing fork to transmission central support	93 to 103 (9.5 to 10.5; 68 to 76)				
Screws securing speed gear unit support cross member to body	39 to 49 (4 to 5; 27 to 36)				

Steering wheel/box

Unit: N·m (kg·m; ft·lb)

Item \ Model	1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Steering wheel lateral tie-rod on rack	70 (7.1; 51.5)				
Screws securing steering box to cross member	26 to 29 (2.7 to 3; 19 to 21)				
Locknut securing ball joint to steering wheel lateral tie rod	54 to 88 (5.5 to 9; 40 to 65)				
Nut securing steering wheel lateral tie rod joint to ball joint	44 to 54 (4.5 to 5.5; 32 to 40)				
Bolt securing universal joint connecting intermediate shaft to pinion shaft (Tighten further until inserting split pin)	15 (1.5; 11)				
Bolt securing steering wheel column to body lower support	4.9 to 7.35 (0.5 to 0.75; 3.6 to 5.4)				
Nut securing steering column to body upper support (with steering wheel heigh adjusting lever in the locked position)	21 to 26 (2.1 to 2.6; 15.5 to 19)				
Nut for sliding sleeve connecting steering column to intermediate shaft (Nut must be tightened so as to obtain a sliding load, on the splined section, equal to the value indicated) N (kg)	34 to 44 (3.5 to 4.6; 25 to 32)				
Nut securing steering wheel to steering column	28 to 32 (2.85 to3.26)				
Data related to power steering					
Steering column lateral tie rod on rack	63 to 77 (6.4 to 7.8; 46 to 57)				
Oil delivery hose on power steering pump union	28 to 31 (2.9 to 3.2; 20.5 to 23)				
Union for oil return hose on power steering pump union	45 to 50 (4.6 to 5.1; 33 to 37)				
Union for oil delivery hose on distribution box	22 to 24 (2.2 to 2.4; 16 to 18)				
Union for oil return hose on distribution box	38 to 43 (3.9 to 4.4; 28 to 32)				
Unions for oil pipes on steering box	20 (2.0; 15)				

Trimming

Unit: N·m (kg·m; ft·lb)

Item \ Model	1.6	1.8	2.0	2.0 turbodiesel	6V iniezione
Seat belts securing screws	28 to 48 (2.8 to 4.8; 20.2 to 34.7)				

GROUP 00

CONTENTS

00

CONTENTS (cont.)

(△) As per Alfa 90 2.4 turbodiesel
(▲) As per Alfa 90
(○) As per Alfa 90 1.8 Carburetors, 2.0 Carburetors
(●) As per Alfa 90 2.0 Carburetors with timing variator for (CH) (SWE)
(*) As per Alfa 90 2.5 iniezione

CONTENTS (cont.)

(△) As per Alfa 90 2.4 turbodiesel
(▲) As per Alfa 90
(○) As per Alfa 90 1.8 Carburetors, 2.0 Carburetors
(●) As per Alfa 90 2.0 Carburetors with timing variator for (CH) (SWE)
(*) As per Alfa 90 2.5 iniezione

CONTENTS (cont.)

(△) As per Alfa 90 2.4 turbodiesel
(▲) As per Alfa 90
(○) As per Alfa 90 1.8 Carburetors, 2.0 Carburetors
(●) As per Alfa 90 2.0 Carburetors with timing variator for (CH) (SWE)
(*) As per Alfa 90 2.5 iniezione

CONTENTS (cont.)

(△) As per Alfa 90 2.4 turbodiesel
(▲) As per Alfa 90
(○) As per Alfa 90 1.8 Carburetors, 2.0 Carburetors
(●) As per Alfa 90 2.0 Carburetors with timing variator for (CH) (SWE)
(*) As per Alfa 90 2.5 iniezione

ENGINE REMOVAL ALFETTA AND ALFA 90 MOTRONIC (017.13) VEHICLES

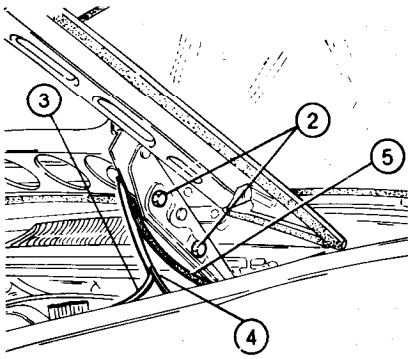
PRELIMINARY OPERATIONS

a. Place the vehicle over a garage lift and chock front wheels.

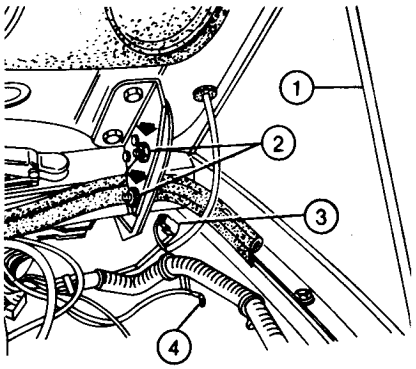
CAUTION:
When the engine is hot, proceed with caution to avoid burns.

b. Lift covers from covers from windshield wiper arm retaining nuts.
Slacken nuts and remove wipers.
Open hood and secure in open position with associated strut (1). Remove hinge bolts (2) and lay hood back in fully open position, **protecting contact areas with suitable soft materials**.
If necessary, disconnect engine compartment light supply (3) and ground (4) cables and windshield washer hose (5).

ALFETTA VEHICLE



ALFA 90 VEHICLE



1. Strut
2. Bolts
3. Engine compartment light supply (in-line connection)
4. Engine compartment light ground cable
5. Windshield washer hose

CAUTION:
For maximum safety, the hood should be secured in the open position to prevent it from falling suddenly.

ENGINE COMPARTMENT COMPONENT DISCONNECTION

For location of parts identified by reference numbers below, see the view of the engine compartment for the vehicle in question.

a. Disconnect positive and negative cables from battery (1). Disconnect the battery tie rods and lift out battery complete with tray.

b. **Cooling circuit disconnection**
— Place a suitable container under the vehicle to collect drained coolant.
— Disconnect lines as follows:
• disconnect suction hose (2) from water pump;
• disconnect delivery hose (3) from thermostat unit;
• disconnect heater return line (4) from water pump;
• disconnect expansion tank/radiator line (5) from radiator;
• disconnect expansion tank/cooling circuit line (6) from pipe tee;
• disconnect heater delivery (7);
• disconnect vent line (8).

c. **Radiator removal**
— Disconnect fan control cable (9) from temperature switch on radiator.
— Disconnect fan supply cable (10) from in-line connection.
— Remove screw (11) retaining radiator to body shell, retrieving spacer and the two cushion pads.
— Remove radiator (12) together with fan (13).

d. **Air intake circuit removal**
— Disconnect cable (14) from air flow sensor.
— Slacken screws on clips (15) and remove corrugated intake duct (16).
— Release clips (17), remove cover (18) together with air flow sensor, and take out the filter element.
— **Alfa 90 - post-modification version** Remove the air weighing extension (49) disconnecting it from the fitting on the body shell and from the air filter container.

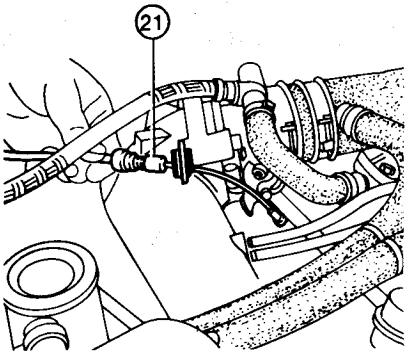
e. **Fuel supply circuit disconnection**

CAUTION:
Fuel supply circuit is pressurized. Consequently, fuel tank should be drained before disconnecting delivery line. After disconnection, line ends should be held up.

Moreover, make sure that the workshop is provided with proper equipment, so as to work safely.

— Disconnect lines as follows:
• disconnect fuel delivery line (19) and remove from fuel inlet manifold side;
• disconnect fuel leak-back line (20) and remove from pressure regulator side.

f. **Accelerator cable disconnection**
— Turn accelerator lever so as to relieve tension on cable and free detent at cable end.
— Release lever and withdraw accelerator cable (21) with associated sheath from bracket.



g. Detach corrugated alternator cooling hose (22) from air intake and from seat on alternator. Remove hose.

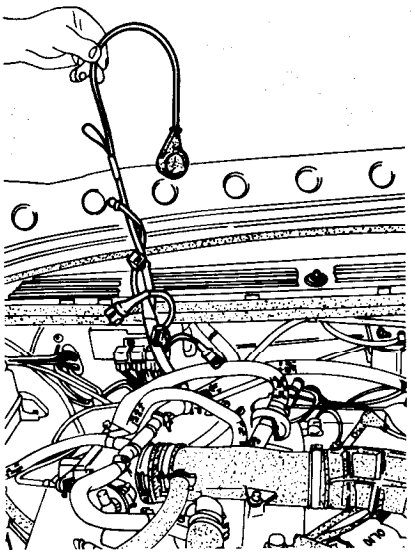
h. Disconnect vacuum servo line (23) from intake manifold.

i. **PVC circuit disconnection:**
— Disconnect crankcase vapour line (24) from valve cover.
— Disconnect oil vapour recirculation line (25) from throttle body.
— Disconnect separator return line (26) from dipstick base.

j. **Disconnect the following electrical cables** and remove, preferably as indicated.
— HT cable (27) from ignition coil.
— Alternator supply cable (28) and battery charge indicator cable (29) from terminal board (30) on L.H. side of vehicle (first remove cover).
— Supply cable (31) and field cable (32) from starter.
— Engine oil pressure indicator cable (33) from sending unit on engine block.
— Valve timing variator cable (34) from variator.
— Control cables (35) from electroinjectors.
— Coolant temperature sensor cable (36) from sensor on cylinder head.
— Coolant temperature gauge cable (37) from sending unit on cylinder head.

— High coolant temperature indicator cable (38) from sending unit on cylinder head.
— Throttle position sending unit cable (39) from idle or WOT contact.
— Auxiliary air cable (40) from auxiliary air valve.
— Ground cable (41) from intake manifold and from auxiliary air valve.
— Rev. and timing transducer cables (42) from associated connections.

NOTE:
Withdraw electroinjector cables together with all other cables contained in the same sheath.



— Engine oil level indicator cable (43) from in-line connection adjacent to sensor on engine block (see alternator position).
— Low engine oil pressure indicator cable (44) from sending unit on engine block (see distributor position).

Release cables from any clips and arrange so they will not interfere with engine removal.

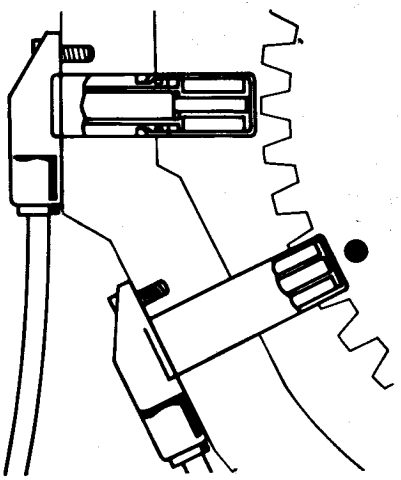
k. Remove two screws (45) retaining heat guard on L.H. engine mount.
l. Remove upper retaining screws (46) from both side engine mounts.
m. **Power steering circuit disconnection**
— Disconnect supply line (47) from power steering unit.
— Disconnect exhaust line (48) from power steering unit.

UNDERBODY COMPONENT DISCONNECTION

Alfetta Motronic vehicles: follow procedure described in paragraphs a. through h. for standard Alfetta and Giulietta vehicles. Before starting the procedure outlined in para. h. carry out operation outlined in para. 1. below.
For location of parts, see view of underbody, Alfetta and Giulietta vehicles.

Alfa 90 Motronic vehicles: follow procedure described in paragraphs a. through h. for standard Alfa 90 vehicles. Before starting the procedure outlined in para. h. carry out operation outlined in para. 1. below.
For location of parts, see view of underbody, Alfa 90 vehicles.

1. Back off socket screws and remove engine rev. and timing transducers from bell housing.



ENGINE INSTALLATION ALFETTA AND ALFA 90 MOTRONIC (017.13) VEHICLES

UNDERBODY COMPONENT INSTALLATION

Alfetta Motronic vehicles: follow procedure described in paragraph a. through j. for standard Alfetta and Giulietta vehicles.
For location of parts, see view of underbody, Alfetta and Giulietta vehicles.

Alfa 90 Motronic vehicles: follow procedure described in paragraphs a. through k. for standard Alfa 90 vehicles.
For location of parts, see view of underbody, Alfa 90 vehicles.

ENGINE COMPARTMENT CONNECTIONS

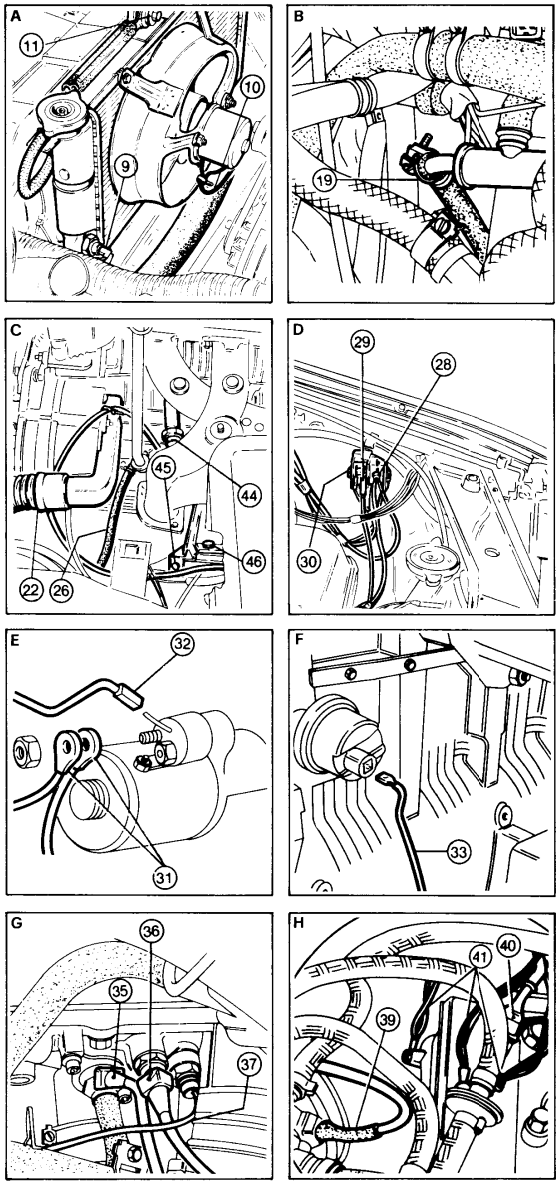
For location of parts identified by reference numbers below, see view of engine compartment for the vehicle in question.

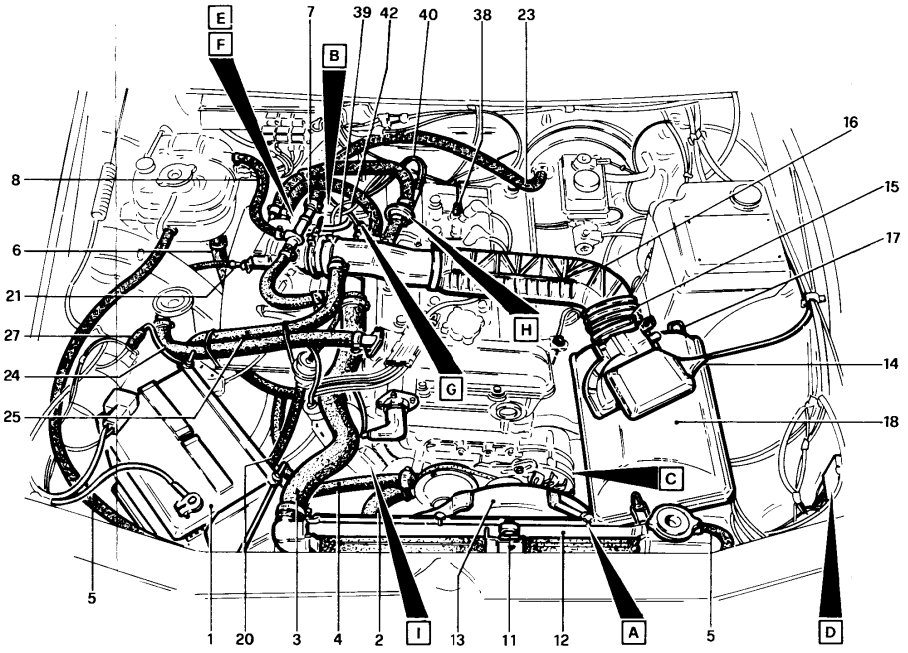
a. Lower vehicle and secure top of heat guard through screws (45).
b. Secure top of engine mounts to crossmember through screws (46).
c. Connect power steering supply line (47) and exhaust line (48). Restore all electrical connections; to do so, follow the procedure described in paragraph j., «Engine compartment component disconnection», in reverse order.
d. Connect PVC circuit lines following the procedure described in paragraph i., «Engine compartment component disconnection», in reverse order.
e. Connect accelerator cable following the procedure described in paragraph f., «Engine compartment component disconnection», in reverse order.
f. Connect alternator cooling hose (22) and vacuum servo line (23) to intake manifold.
g. Connect fuel and air intake circuits following the procedures described in paragraphs e. and d., «Engine compartment component disconnection», in reverse order.
h. Install radiator and fan following the procedure described in paragraph c., «Engine compartment component disconnection», in reverse order.
i. Connect cooling circuit lines following the procedure described in paragraph b., «Engine compartment component disconnection» in reverse order.
j. Position battery (1) and associated tray in engine compartment. Secure battery with retainer and connect terminals.
k. Top up fluids and lubricants and carry out adjustments as described in the «Specifications» paragraph of each Group. For **Alfa 90** vehicles, see also «GROUP 00».
l. Hold up hood and install hinge bolts on both sides of vehicle.
m. Install windshield wiper arms and blades.

VIEW OF ENGINE COMPARTMENT ALFETTA 2.0 MOTRONIC (017.13) VEHICLE

Engine compartment components to be removed or disconnected are listed below in numerical order. For further details, see «ENGINE REMOVAL AND INSTALLATION PROCEDURES».

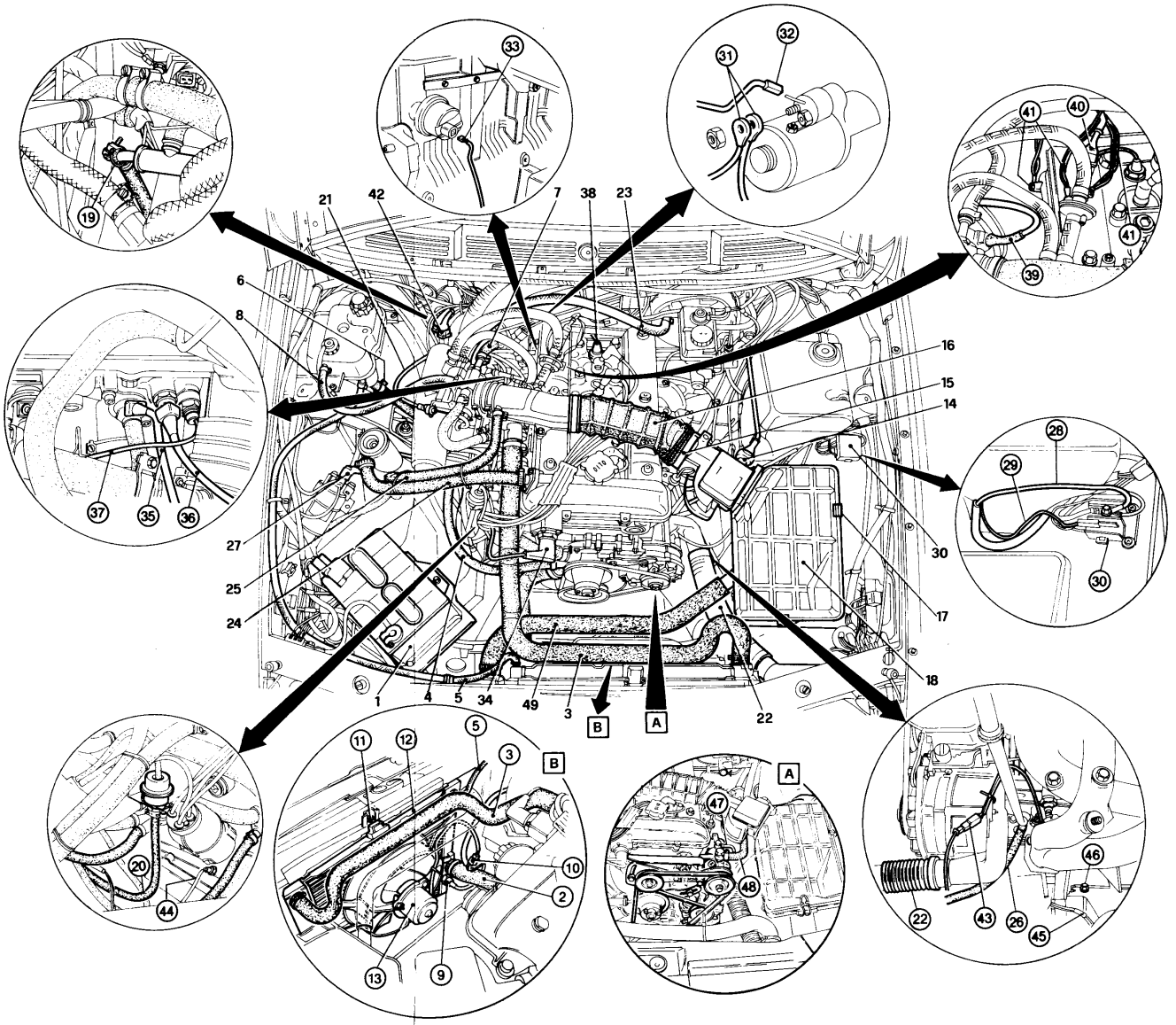
1. Battery
2. Coolant suction hose (radiator/pump)
3. Coolant delivery hose (engine/radiator)
4. Heater return hose
5. Expansion tank/radiator line
6. Expansion tank/cooling circuit line
7. Heater delivery line
8. Vent line
9. Fan control cable
10. Fan supply cable
11. Radiator retaining screw
12. Radiator
13. Fan
14. Air flow sensor cable
15. Clip
16. Intake duct
17. Clips
18. Cover with air flow sensor
19. Fuel delivery line
20. Fuel return line
21. Accelerator cable
22. Alternator cooling hose
23. Vacuum servo line
24. Crankcase vapour line to oil separator
25. Oil vapour recirculation line
26. Separator return line to oil pan
27. HT cable
28. Alternator supply cable
29. Battery charge indicator cable
30. Terminal board
31. Starter supply cable
32. Starter field cable
33. Engine oil pressure indicator cable
34. Valve timing variator cable
35. Electroinjector control cables
36. Coolant temperature sensor cable
37. Coolant temperature gauge cable
38. Coolant temperature indicator light cable
39. Throttle position sending unit cable
40. Auxiliary air cable
41. Ground cable
42. Rev. and timing transducer cables
43. Engine oil level indicator cable
44. Low engine oil pressure indicator cable
45. Heat guard upper retaining screws
46. Engine mount upper retaining screws



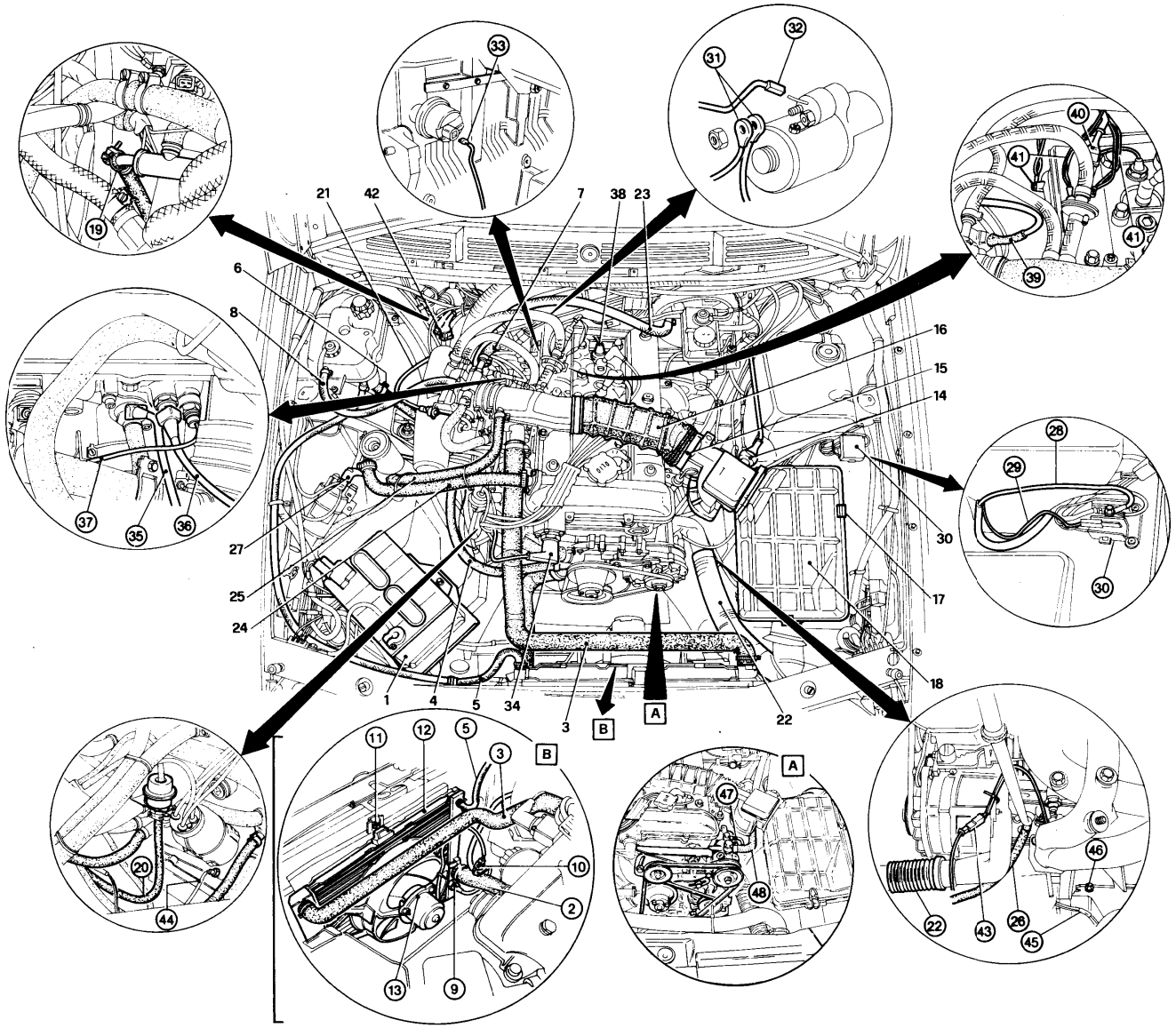


VIEW OF ENGINE COMPARTMENT Alfa 90 2.0 (017.13) (POST-MODIFICATION VERSION)

1. Battery
2. Coolant suction hose (radiator/pump)
3. Coolant delivery hose (engine/radiator)
4. Heater return hose
5. Expansion tank/radiator line
6. Expansion tank/cooling circuit line
7. Heat delivery line
8. Vent line
9. Fan control cable
10. Fan supply cable
11. Radiator retaining screw
12. Radiator
13. Fan
14. Air flow sensor cable
15. Clip
16. Intake duct
17. Clips
18. Cover with air flow sensor
19. Fuel delivery line
20. Fuel return line
21. Accelerator cable
22. Alternator cooling hose
23. Vacuum servo line
24. Crankcase vapour line to oil separator
25. Oil vapour recirculation line
26. Separator return line to oil pan
27. HT cable
28. Alternator supply cable
29. Battery charge indicator cable
30. Terminal board
31. Starter supply cable
32. Starter field cable
33. Engine oil pressure indicator cable
34. Valve timing variator cable
35. Electroinjector control cables
36. Coolant temperature sensor cable
37. Coolant temperature gauge cable
38. Coolant temperature indicator light cable
39. Throttle position sending unit cable
40. Auxiliary air cable
41. Ground cable
42. Rev. and timing transducer cables
43. Engine oil level indicator cable
44. Low engine oil pressure indicator cable
45. Heat guard upper retaining screws
46. Engine mount upper retaining screws
47. Steering supply line
48. Steering exhaust line
49. Air weighing extension



VIEW OF ENGINE COMPARTMENT Alfa 90 2.0 (017.13) (PRE-MODIFICATION VERSION)



1. Battery
2. Coolant suction hose (radiator/pump)
3. Coolant delivery hose (engine/radiator)
4. Heater return hose
5. Expansion tank/radiator line
6. Expansion tank/cooling circuit line
7. Heat delivery line
8. Vent line
9. Fan control cable
10. Fan supply cable
11. Radiator retaining screw
12. Radiator
13. Fan
14. Air flow sensor cable
15. Clip
16. Intake duct
17. Clips
18. Cover with air flow sensor
19. Fuel delivery line
20. Fuel return line
21. Accelerator cable
22. Alternator cooling hose
23. Vacuum servo line
24. Crankcase vapour line to oil separator
25. Oil vapour recirculation line
26. Separator return line to oil pan
27. HT cable
28. Alternator supply cable
29. Battery charge indicator cable
30. Terminal board
31. Starter supply cable
32. Starter field cable
33. Engine oil pressure indicator cable
34. Valve timing variator cable
35. Electroinjector control cables
36. Coolant temperature sensor cable
37. Coolant temperature gauge cable
38. Coolant temperature indicator light cable
39. Throttle position sending unit cable
40. Auxiliary air cable
41. Ground cable
42. Rev. and timing transducer cables
43. Engine oil level indicator cable
44. Low engine oil pressure indicator cable
45. Heat guard upper retaining screws
46. Engine mount upper retaining screws
47. Steering supply line
48. Steering exhaust line

ENGINE REMOVAL AND INSTALLATION

Alfa 75 1.8 turbo

FOREWORD

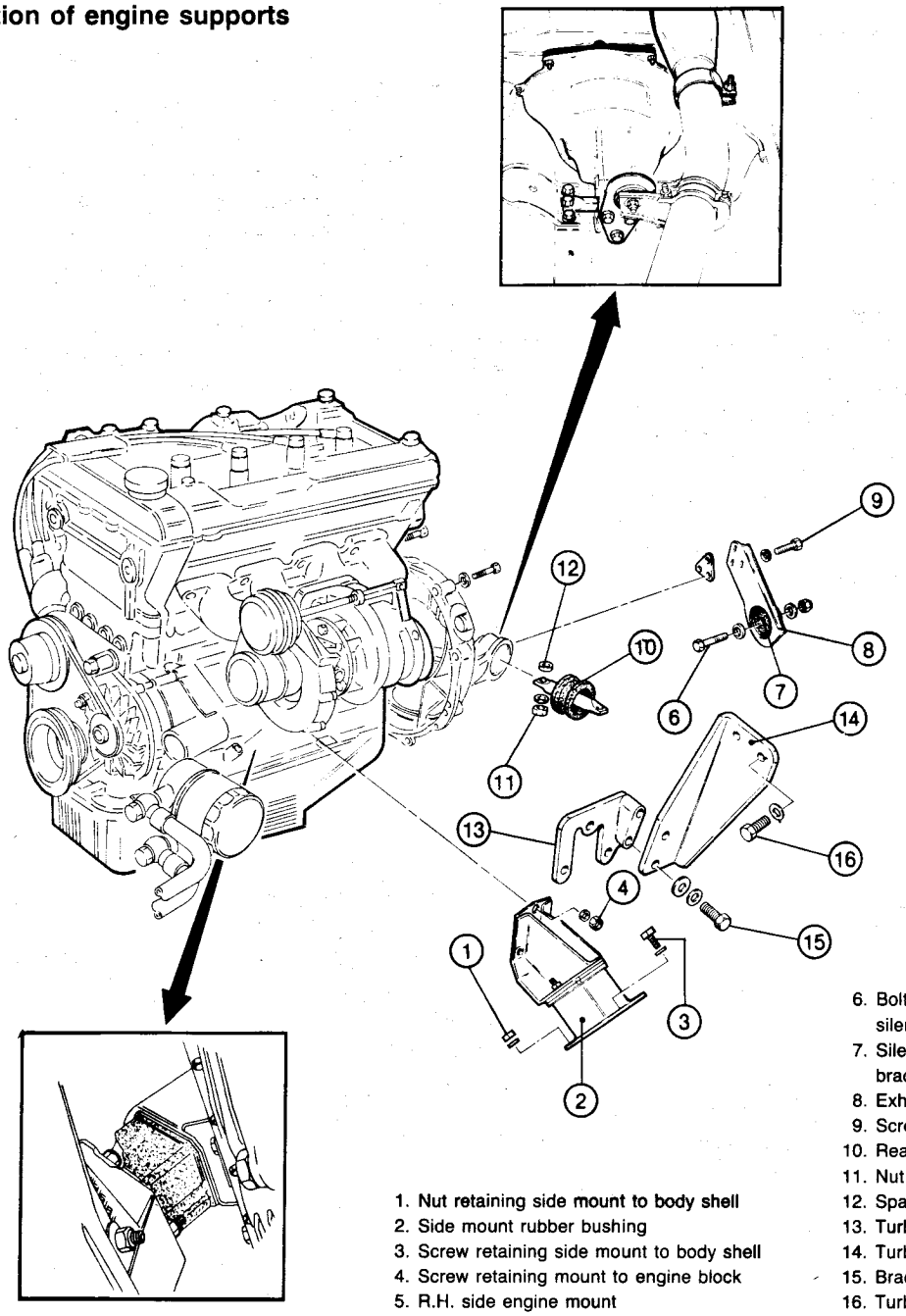
This section contains all the data and procedures relating to the removal and installation of the engine fitted on the following Alfa Romeo vehicle:

Alfa 75 1.8 turbo

Given that the operations involved in removing and installing the engine are somewhat numerous, the operator is urged to read the intervention procedures carefully and to examine with care the illustration of the assembly that give an indispensable but of course incomplete overall view of the engine.

Following the above advice permits the correct operational techniques to be acquired and familiarizes the technician with the technical data, and caution and warning captions.

Location of engine supports



1. Nut retaining side mount to body shell
2. Side mount rubber bushing
3. Screw retaining side mount to body shell
4. Screw retaining mount to engine block
5. R.H. side engine mount
6. Bolt retaining exhaust pipe bracket to silentbloc
7. Silentbloc for exhaust pipe support bracket
8. Exhaust pipe support bracket
9. Screw retaining bracket to flywheel cover
10. Rear mount
11. Nut retaining rear mout to the body shell
12. Spacer
13. Turbocharger bracket support
14. Turbocharger bracket
15. Bracket retaining screw
16. Turbocharger retaining screw

REMOVAL

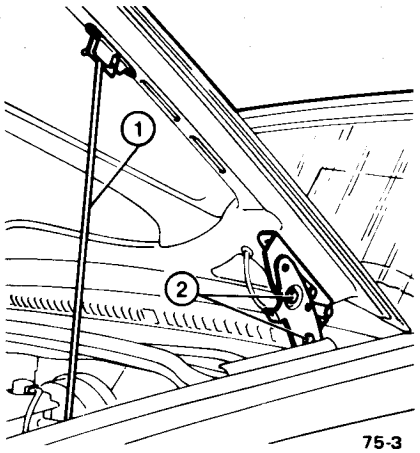
1. Preliminary operations

a. Place vehicle on lift platform and chock wheels.

CAUTION:
When the engine is hot, proceed with caution to avoid burns.

b. Open hood and secure in open position with associated strut (1).
Remove hinge bolts (2) and lay hood back in fully open position.

CAUTION:
Protect contact points with suitable soft materials.



1. Strut
2. Bolts

CAUTION:
For maximum safety, the hood should be secured in the open position to prevent it from falling suddenly.

For location of parts identified by reference numbers below, see the view of the engine compartment for the vehicle in question.

c. Disconnect positive «+» and negative «—» terminals from battery (1).
d. Slacken screw (2) retaining intercooler air intake (3) and battery bracket (4) (see detail **A**).
e. Disconnect power brake vacuum servo line (5) from the intercooler union, loosening the relative clamp (see detail **E**).
f. Unscrew the four screws (7) retaining air intake duct to the front panel of the body shell.
Remove air intake duct (3), complete with sleeve (8), withdrawing it from intercooler (9) (see detail **A**).

2. Air supply system removal

a. Disconnect from the supercharging pressure control solenoid valve (10) the following components (see detail **B**):
— connector (11) for solenoid valve supply cable;
— hose (12) to oil vapor sedimenter;
— pressure line (13) from the turbocharger compressor;
— hose (14) to overpressure valve (Waste-Gate).
b. If necessary remove solenoid valve (10) from the air filter cover, unscrewing two nuts with washers (15).
c. Disconnect union (16) from air flow meter (17).
d. Unscrew upper screw (18) retaining air intake duct bracket to air flow meter.
e. Slacken the two clamps (19) retaining air intake duct to air flow meter.
f. Release clips (20) securing air filter cover (21) and remove it together with air flow meter (17), withdrawing it from the air intake duct.
g. Remove filtering element and, if necessary, unscrew the two nuts and the screw securing the air filter casing to the body and remove it.
h. Slacken clamp (22) securing air intake duct (23) to turbocharger compressor inlet (see detail **C**).
i. Slacken clamp (24) securing oil vapour exhaust hose to the oil vapour sedimenter and remove air intake duct (23), withdrawing it from the turbocharger compressor inlet.

WARNNG:
Plug the turbocharger compressor inlet so as to prevent any foreign matter from entering.

3. Coolant lines and radiator

a. Disconnect the following pipes and hoses, removing them preferably from the end indicated:
— slacken clamp (25) and remove coolant return sleeve (26) from the thermostat;
— slacken the clamp and remove coolant delivery sleve (27) from the water pump (see detail **D**);

NOTE:
Place a suitable container under the vehicle to collect drained coolant.

— slacken the clamp and remove heater coolant return hose (28) from the water pump (see detail **D**);
— slacken the clamp and remove radiator delivery line (29) from tee (see detail **D**);
— slacken the clamp and remove breather line (30) from the radiator (see detail **D**);
— slacken the clamp and remove cooling system breather line (31) from union on cylinder head (see detail **E**);
— slacken the clamp and remove heater coolant delivery line (32) from union on cylinder head (see detail **E**).
b. Disconnect fan control cable (33) from the temperature switch on the lower right part of the radiator (see detail **F**).
c. Disconnect fan supply cable (34) from in-line connection (see detail **F**).
d. Remove screw (35) retaining radiator (36) to front of body steel and remove it together with the fan.

4. Removal of fuel system

WARNING:
- **Proceed with caution: the supply system may be under pressure.**
- **Keep tubing pointing upwards to prevent fuel escaping.**
  Ensure also, that the workshop is correctly equipped to enable operations to be performed safely.

a. Disconnect fuel return hose from lower part of pressure regulator (37).
b. Slacken the nut and disconnect fuel delivery line (38) from the lower part of hammering damper (39) (see detail **G**).

CAUTION:
There may be residual pressure between fuel pump and hammering damper which could cause petrol to spray out; plug disconnected hose (38).

5. Accelerator cable disconnection
a. Slacken the three retaining screws and remove accelerator control protection plate (40).
b. Rotate fully, anticlockwise, accelerator control cam (41) and withdraw the pawl of control cable (42) from the end of the cam (see detail **H**).
c. Withdraw accelerator control cable (42) from support bracket (43), withdrawing it from the bottom (see detail **H**).

6. Oil cooling system removal
a. Unscrew union (44) and disconnect oil delivery hose (45) to cooling radiator (see detail **I**).
b. Unscrew union (46) and disconnect oil return hose (47) from cooling radiator (see detail **I**).

NOTE:
Place a suitable container under the vehicle to collect any oil leakage.

7. Electrical cable disconnection
a. Disconnect the following electrical cables and remove as indicated:
- supercharging pressure sender cable (6) from manifold on intercooler;
- HT cable (48) from ignition coil;
- throttle position sending unit cable (49) from mobile connection (see detail **H**);
- minimum cut-out switch (50) cables from relative switch (see detail **H**);
- supply cables (51) and ground cables (52) from auxiliary air solenoid (see detail **E**);
- air intake manifold ground cables (52)A from the right side of cylinder head (see detail **E**);
- maximum coolant temperature cable (53) from thermal switch on the cylinder block (see detail **E**);
- Hall effect cable (54) from distributor (see detail **D**);
- alternator supply (56) and warning light (57) cables from terminal board (58) on engine compartment left valance panel (see detail **L**);
- engine oil pressure indicator cable (59) from bulb on right side of engine block (see detail **M**);
- engine oil minimum pressure indicator light cable (60) from transmitter on oil filter support (see detail **N**), or from mobile connection (61) near alternator (see detail **C**);
- engine oil minimum pressure indicator light cable (55) from transmitter on R.H. side of engine block, under the distributor (see detail **D**);
- coolant temperature indicator cable (62), from bulb on cylinder head, under intake manifold (see detail **O**);
- coolant temperature sensor cable (63) from transmitter on cylinder head, under intake manifold (see detail **O**);
- pulse sensor cable (64) from relative connector on cylinder head, under intake manifold (see detail **M**);
- electro-injector feed cables (65) from respective connectors (see detail **O**);
- feed (66) and energizing cables (67) from starting motor on R.H. side of rear cover (see detail **O**).

NOTE:
Release the electrical cables from any clips and arrange so that they will not interfere with engine removal.

8. Final operations
a. Remove the three screws (68) securing heat guard (69) to brake/clutch system pump and remove heat guard.
b. Slacken and remove bolt (70) securing collar (71); this collar joins turbocharger exhaust gas union to the exhaust pipe (see detail **P**).
c. Slacken (but do not remove), on both sides, screws (72) fixing the upper part of the engine side mounts to the body steel (see detail **P**).
d. Remove heat guard (73) from L.H. side mount (see detail **P**).

For the following steps see the figure «View of underbody».

9. Oil discharge
(if required by the operations to be performed)
a. Raise the vehicle on the garage lift.
b. Unscrew plug (1) and drain engine oil.
Screw plug on again after the job has been completed.

10. Exhaust pipe removal
a. Slacken nut (2) securing clamp (3) connecting exhaust pipe front and centre sections (see detail **A**).
b. Separate front section (4) from centre section and from turbocharger exhaust gas union.
c. Remove the three screws (5) securing bracket (6) to end of flywheel cover (see detail **A**).
d. Slacken nut (7) securing clamp (8)

connecting centre section (9) of exhaust pipe and tail pipe (10) (see detail **B**).

e. Free centre section (9) from rubber support rings (11), and withdraw from tail pipe to remove.

11. Propeller shaft removal

a. Remove centre cross member (12) after removing screws (13) securing it to the body shell.

b. Slide off boot (14), unscrew and remove bolt (15) and disconnect gear selector rod (16) (see detail **C**).

If necessary, remove screws (17) securing gear lever support (18) and move it to permit the removal of the propeller shaft (see detail **C**).

c. Slacken bolts (19) and remove flywheel guard (20),

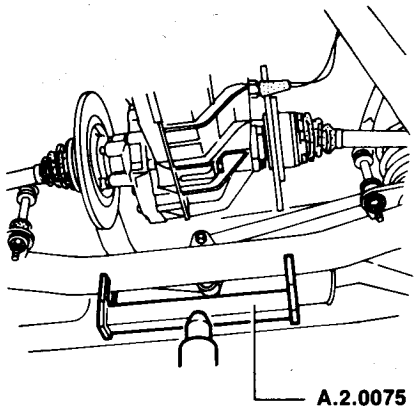
d. With gearbox in neutral, rotate propeller shaft (21), alternately slackening nuts (22) and bolts (23) securing it, respectively, to the flywheel and to the clutch yoke (see details **D** and **E**).

e. Remove the two screws (24) and disconnect pin (25) of engine rear mount from the body shell (see detail **A**).

f. Slacken the two nuts (26) and disconnect propeller shaft centre support (27) from the body shell (see detail **C**).

g. Remove the six screws (28) securing rear cross member (29) to body shell and remove it.

h. Raise the rear axle using a column lift provided with cradle **A.2.0075** and then extract propeller shaft from the clutch yoke.



A.2.0075

i. Lower the column lift and remove the propeller shaft.

12. Final operations

a. Remove the screw from the body steel and disconnet the ground cable (30).

b. Fit a suitable operating lever on the engine rear support to aid engine removal operations.

c. Slacken and remove lower nuts (31) retaining side engine mounts (32) (see detail **F**).

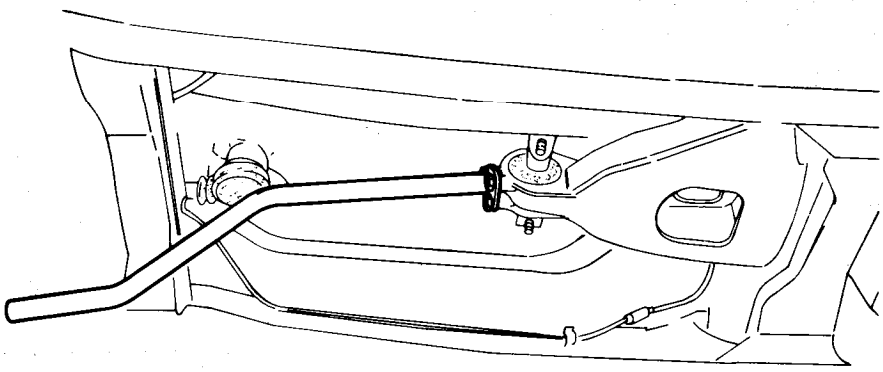
d. Lower garage lift and then unscrew and remove upper screws (33) retaining side mounts (32) (see detail **F**).

Raise the garage lift.

e. Hook a suitable hydraulic lift to engine lift bracket.

Activate lift and raise engine while tilting with a suitable lever.

NOTE:
If necessary, disconnect center spark plug cables and remove spark plug.



INSTALLATION

For the following operations refer to bottom view of vehicle in question.

1. Preliminary operations

a. Install service handle on rear engine mount.

b. Fasten engine to lifting bracket and, using a suitable hoist, lower powerplant slowly in engine compartment guiding it with the service handle.

c. Centralize engine in engine compartment over the two side mounts and ensure that holes for screws and studs are correctly aligned on both mounts.

d. Start and tighten screws (33) retaining cushion mounts to body on both sides.

e. Raise vehicle, start and tighten nuts (31) retaining mounts to body at bottom on both sides.

f. Remove service handle from rear engine mount.

g. Connect ground cable (30) to body steel and tighten the relative screws.

2. Install the propeller shaft group

a. Install the propeller shaft group by following the removal procedures in reverse order («Removal» step 11.) and noting the points below:

— **Lubricate** shaft front bushing and rear joint spherical seat using **5 cm³ (0.2 fl·oz)** of **ISECO MOLYKOTE BR2** grease.
If necessary lubricate the flywheel bushings with the same grease.

— Restrain shaft by suitable means and tighten nuts (22) and bolts (23) of flex. couplings each in turn to the specified torque.

(T) : **Tightening torque**
Nuts and bolts retaining shaft flex. couplings to flywheel and clutch fork
55 to 57 N·m
(5.6 to 5.8 kg·m
40.6 to 42.0 ft·lb)

CAUTION:
When assembling use new self-locking nuts.

— Tighten nuts (26) retaining center bearing (27) to underbody.

(T) : **Tightening torque**
Center bearing nuts
93 to 103 N·m
(9.5 to 10.5 kg·m
6.6 to 76.0 ft·lb)

b. Fix pin (25) or engine rear support using the two screws (24).

c. Assemble flywheel guard (20) and tighten bolts (19).

d. Re-connect rod (16) to the gearlever with bolt (15) and slide on boot (14).

(T) : **Tightening torque**
Nut retaining gear control rod to rear lever
13 to 16 N·m
(1.3 to 1.6 kg·m
9.4 to 11.6 ft·lb)

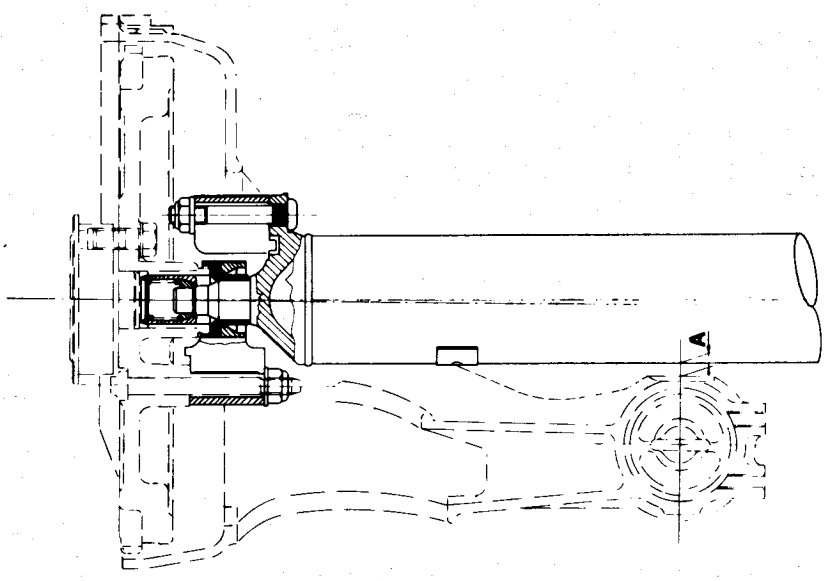
e. Secure crossmember (12) to body shell using screws (13).

f. Tighten transmission unit crossmember (29) to body capscrews (28) to the specified torque.

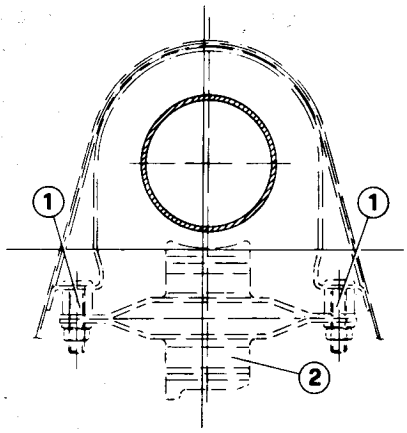
(T) : **Tightening torque**
Transmission unit crossmember to body capscrews
39 to 44 N·m
(4.0 to 4.5 kg·m
28.8 to 32.5 ft·lb)

g. Check the specified distance **«A»** between the propeller shaft and rear engine support.

Distance «A» between the propeller shaft and rear engine support
A = 7 mm (0.28 in)



h. If this distance differs from the specified one, vary the length of the spacers (1) placed between the rear engine support (2) and the body accordingly.



1. Spacer
2. Rear engine support

3. Exhaust pipe installation

a. Place centre section (9) of the exhaust pipe on rubber support rings (11).

b. Connect centre section (9) of the exhaust pipe to tail pipe (10) without tightening the nut (7) on clamp (8).

c. Connect centre section (9) of the exhaust pipe to the front section (4) without tightening the nut (2) on clamp (3).

d. Tighten screws (5) securing bracket (6) to the end of the flywheel cover.
e. Rock exhaust pipe to obtain proper alignment.
f. Tighten fully nuts (2) and (7) securing clamps (3) and (8) respectively.

In order to follow the following steps of the procedure consult the figure «View of the Engine Compartment» of the vehicle in question.

4. Installation of radiator
Refit radiator together with electric fan, then reconnect cooling system tubing by reversing the order of the procedure described in «Removal» step 3.

5. Air filter installation
Assemble the air filter and then re-connect the air supply hoses by following the procedures described in «Removal» step 2. in reverse order.

6. Fuel supply system
Assemble the fuel supply system by following the procedures described in «Removal» step 4. in reverse order.

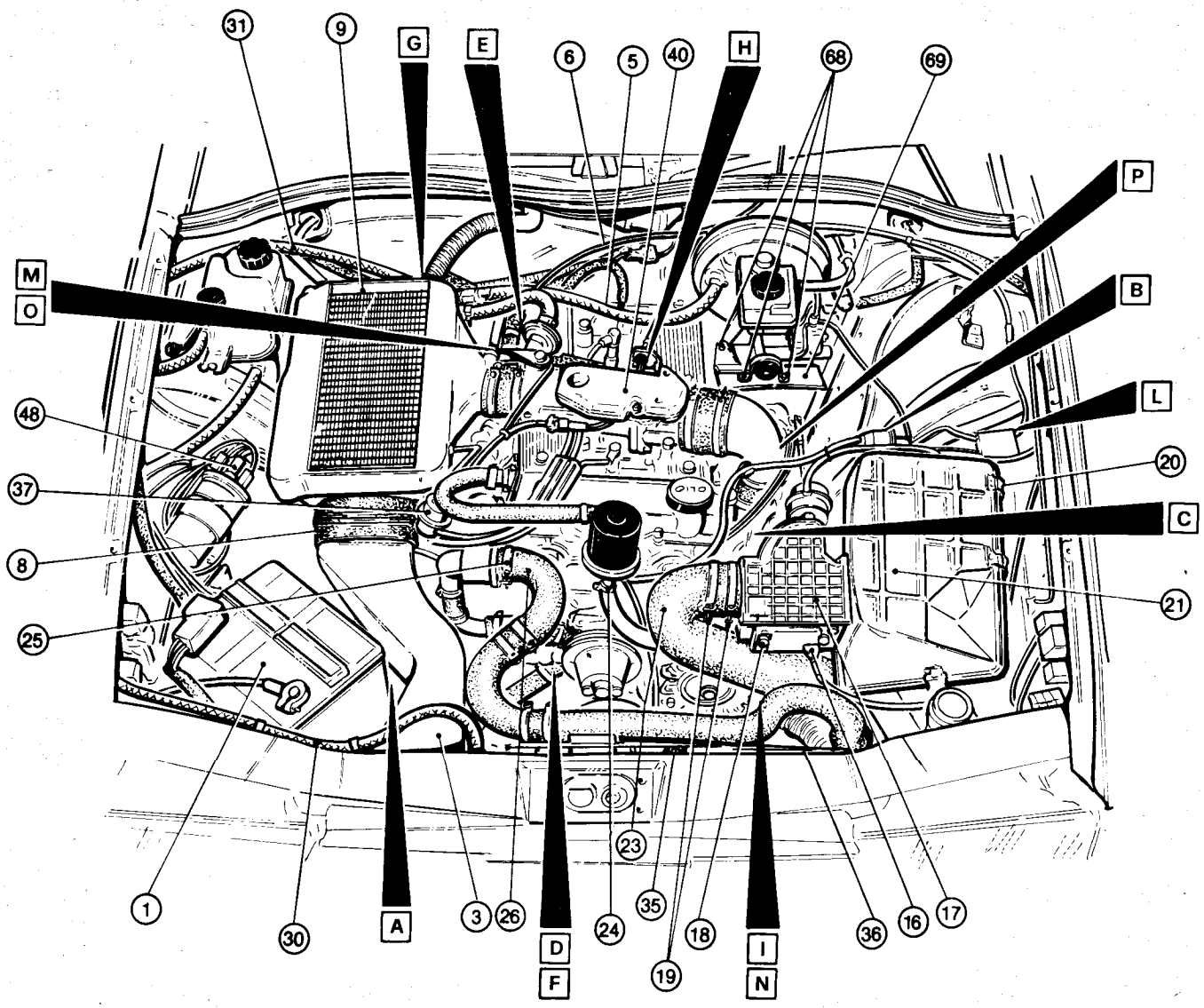
7. Accelerator cable
Connect accelerator cable adopting a reversal of the «Removal» sequence, step 5.

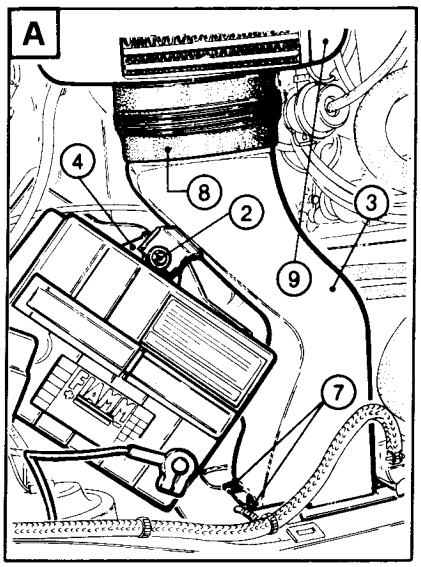
8. Oil cooling system
Restore the oil cooling circuit by following the procedures described in «Removal» step 6. in reverse order.

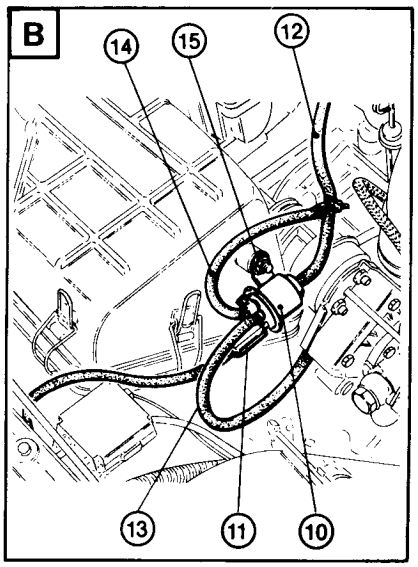
9. Electrical connections
Restore electrical connection, reversing the order of the procedure described in «Removal» step 7.

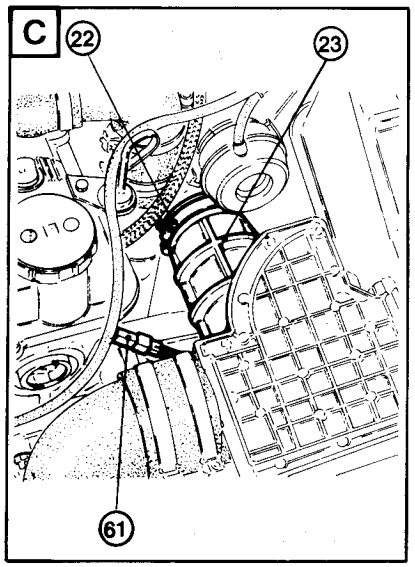
10. Final operations
a. Assemble heat guard (69) on the brake/clutch system pump by tightening the three screws (68).
b. Tighten bolt (70) securing collar (71) joining turbocharger exhaust gas union to the front section of the exhaust pipe.
c. Re-connect servobrake vacuum intake hose (5) to the union on intercooler.
d. Re-connect hose (6) from turbocharger pressure gauge to the union on the intercooler.
e. Assemble air intake duct (3), complete with sleeve (8), to intercooler (9) and fix it to the front body shell panel using the four screws (7).
f. Place battery (1) in engine compartment and secure with bracket (4); secure bracket and air intake duct support using screws (2) and then re-connect battery terminals.
g. For references and adjustments see specifications of appropriate groups.
h. Release hood, prop up and install hinge bolts on both sides of vehicle.

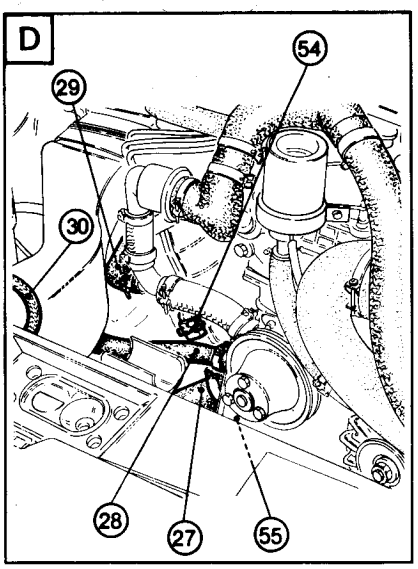
VIEW OF ENGINE COMPARTMENT Alfa 75 1.8 turbo







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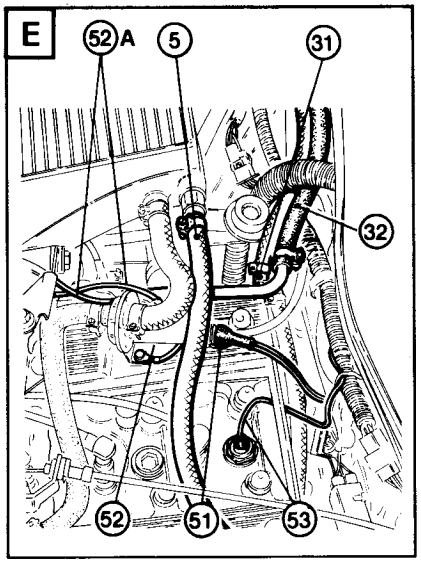
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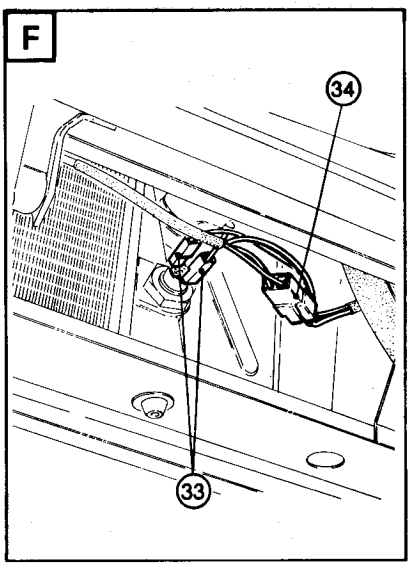
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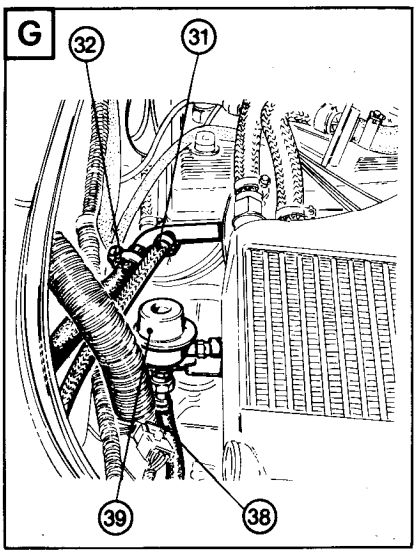
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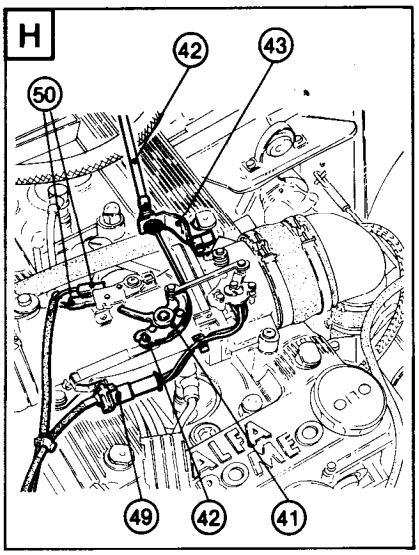
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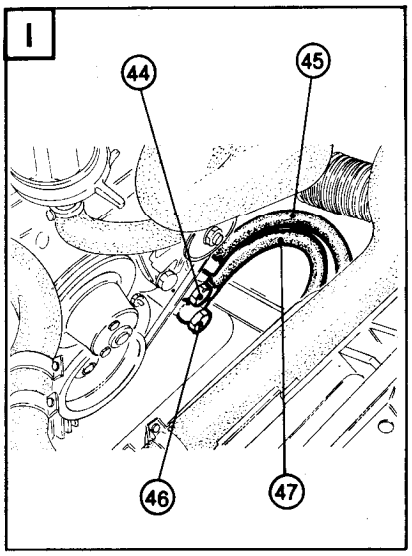
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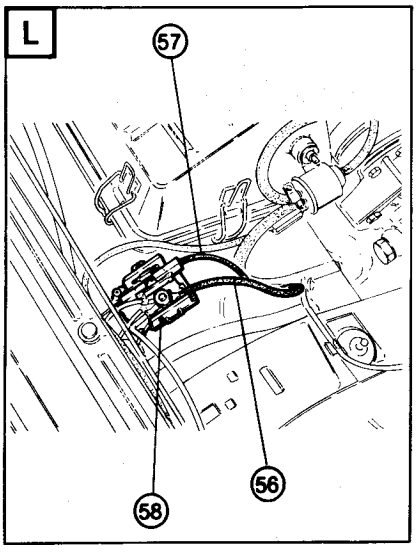
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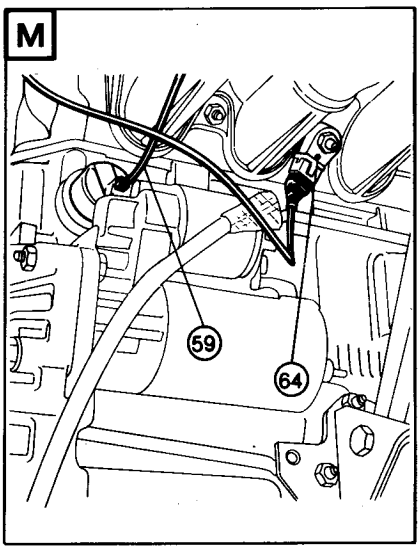
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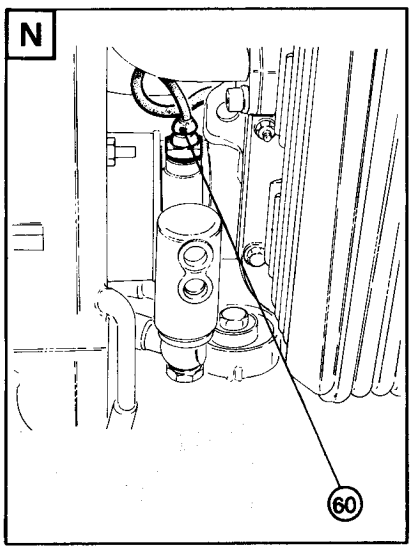
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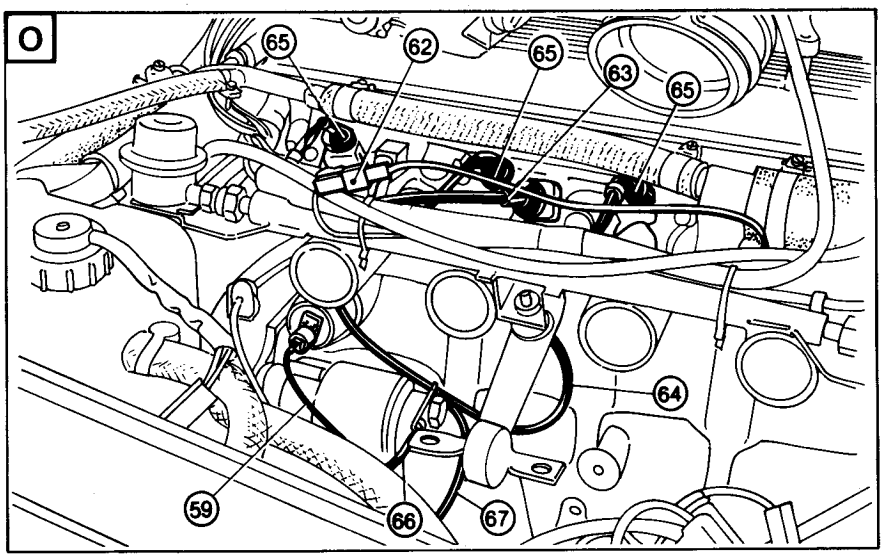
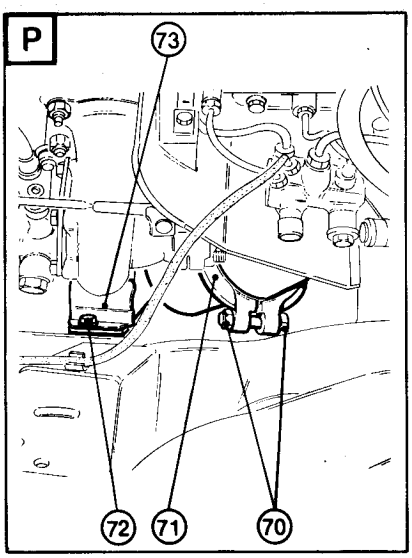




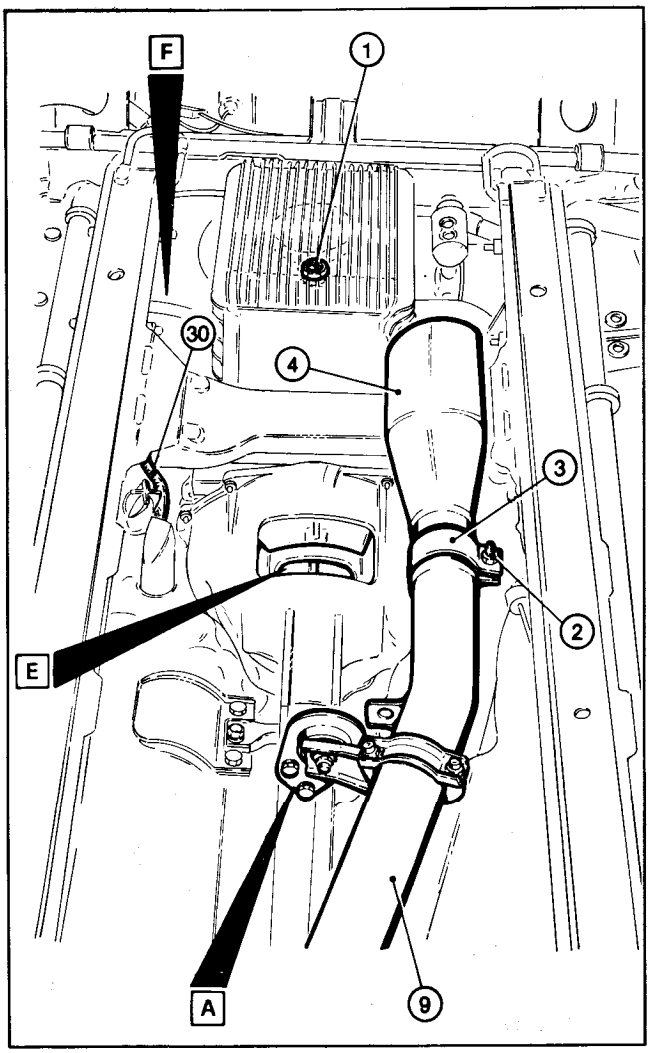
1. Battery
2. Air intake and battery bracket retaining screws
3. Intercooler air intake
4. Battery retaining bracket
5. Servo brake vacuum intake hose
6. Supercharging pressure sender cable
7. Intercooler air intake retaining screws
8. Sleeve
9. Intercooler
10. Supercharging pressure control solenoid valve (Pierburg)
11. «Pierburg» solenoid valve supply cable
12. Hose connecting oil sedimenter
13. Pressure intake hose (from compressor)
14. Hose connecting overpressure valve
15. Nuts and washers retaining «Pierburg» valve
16. Air flow meter cable
17. Air flow meter
18. Air intake upper retaining screw
19. Air intake retaining clamps
20. Air filter cover retaining clips
21. Air filter cover
22. Clamp securing air intake duct to compressor
23. Air intake duct
24. Oil vapour exhaust hose
25. Sleeve clamp
26. Coolant return sleeve
27. Coolant delivery sleeve
28. Coolant return hose (from heater)
29. Radiator coolant supply hose
30. Radiator breather hose
31. Cooling system breather hose
32. Coolant delivery hose (to heater)
33. Fan control cable
34. Fan supply cable
35. Radiator retaining screw
36. Radiator
37. Pressure regulator
38. Fuel delivery hose
39. Hammering damper
40. Accelerator control guard
41. Accelerator control cam (throttle control)
42. Accelerator control cable
43. Accelertor control cable support bracket
44. Union
45. Oil delivery hose (to radiator)
46. Union
47. Oil return hose (from radiator)
48. Ignition coil cable
49. Throttle position sending unit cable
50. Minimum cut-out switch
51. Auxiliary air solenoid valve supply cable
52. Auxiliary air solenoid valve ground cables

52A Air intake manifold ground cables

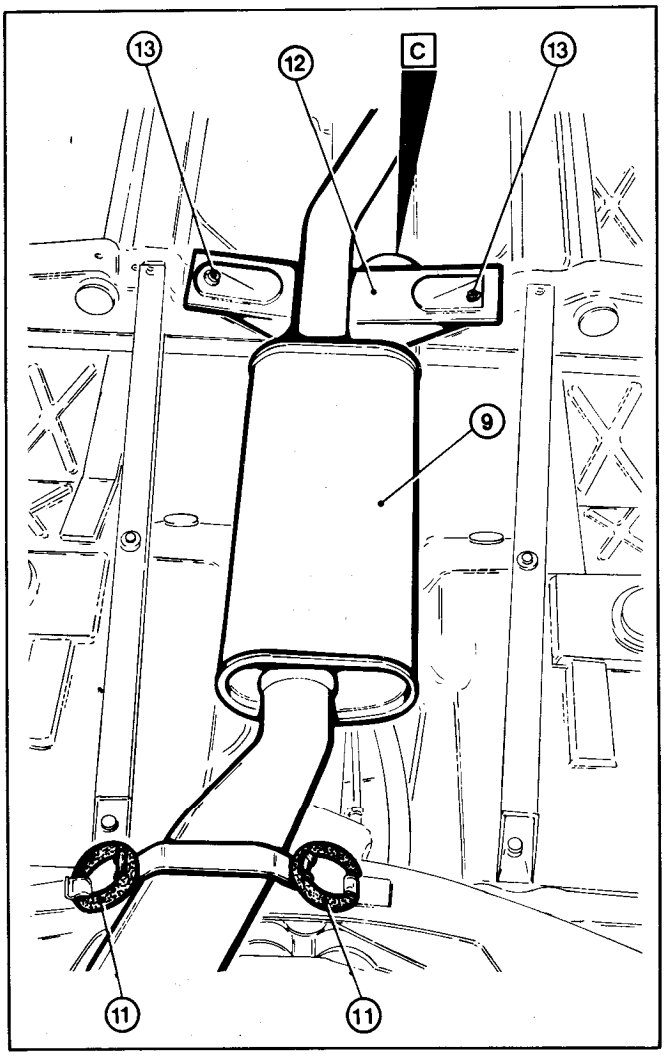
53. Coolant maximum temperature indicator light cable
54. Hall effect sensor cable
55. Engine oil level indicator light cable
56. Alternator supply cable
57. Alternator indicator light cable
58. Terminal board
59. Engine oil pressure indicator cable
60. Low engine oil pressure indictor light cable
61. Connector for low engine oil pressure cable
62. Coolant temperature indicator cable
63. Coolant temperature sensor cable
64. Knock sensor cable
65. Electro-injector supply cables
66. Starting motor supply cables
67. Starting motor electromagnet energizing cable
68. Heat guard retaining screws
69. Heat guard
70. Collar retaining bolt
71. Collar
72. Engine mount upper retaining screws
73. Heat guard (on LH mount)

VIEW OF UNDERBODY Alfa 75 1.8 turbo

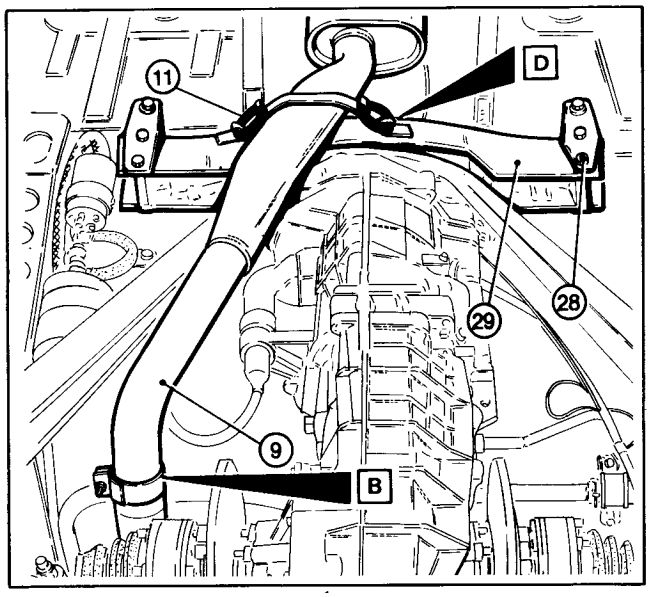
FRONT SECTION

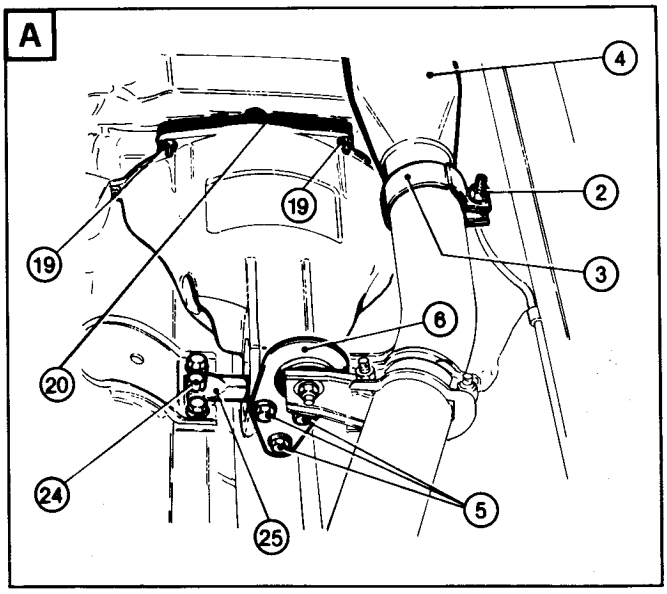


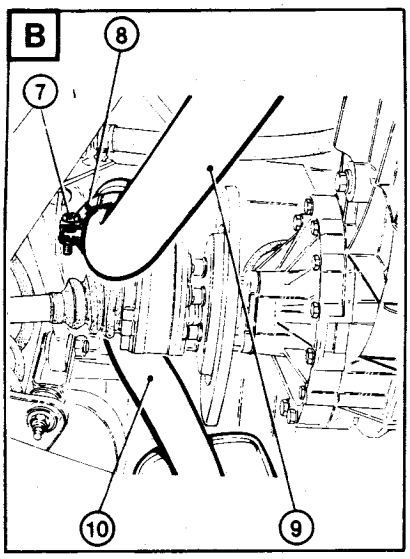
CENTRE SECTION

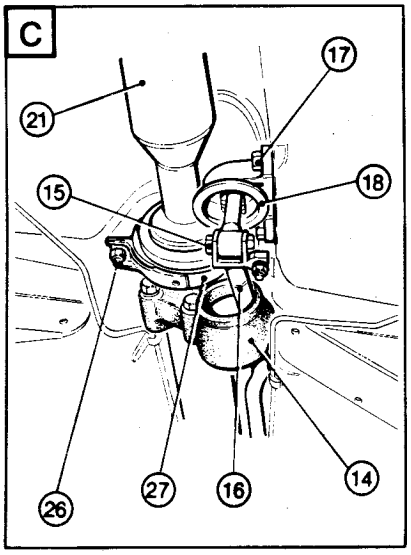


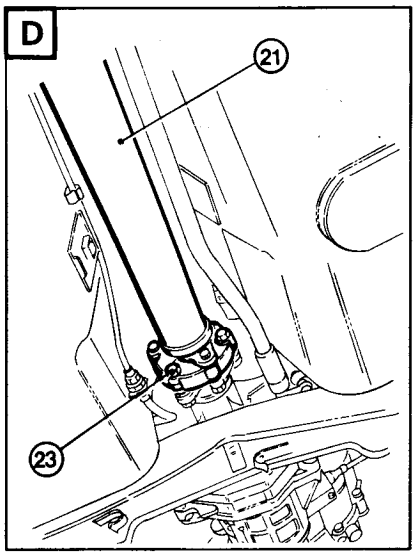
REAR SECTION

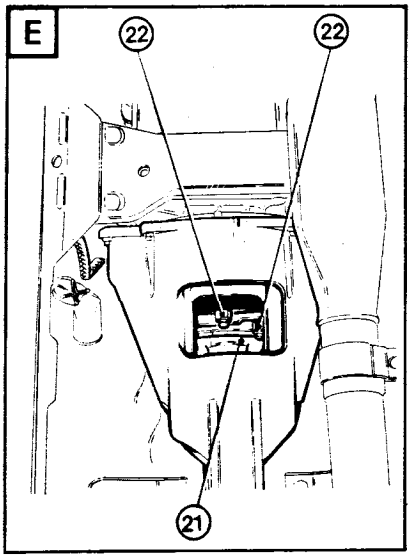


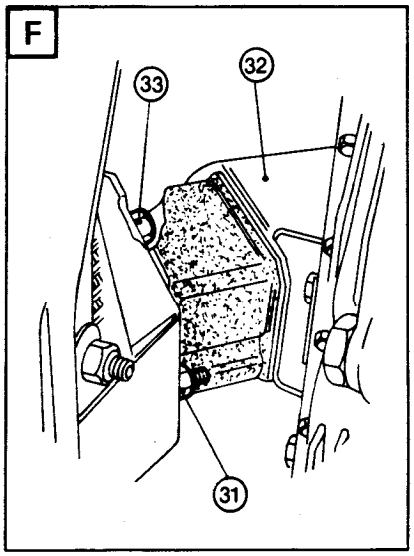






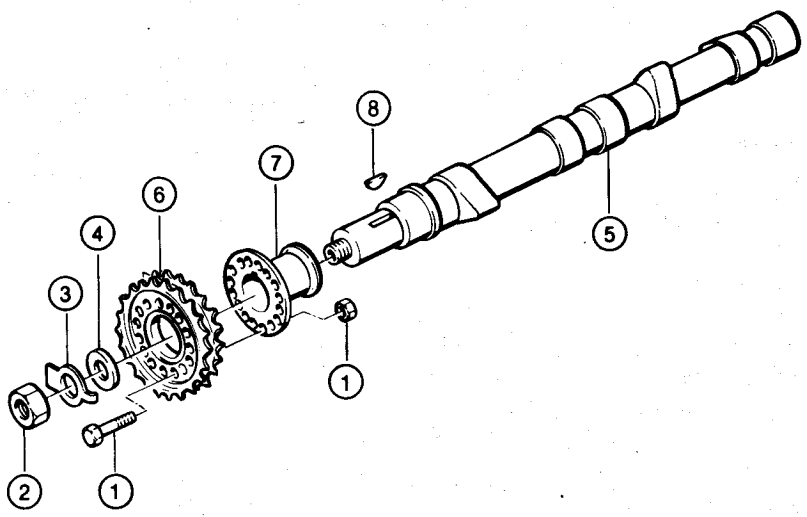






1. Oil drain plug
2. Clamp nut
3. Clamp
4. Exhaust pipe front section
5. Bracket retaining screws
6. Exhaust pipe centre section support bracket
7. Clamp nut
8. Clamp
9. Exhaust pipe centre section
10. Tail pipe
11. Exhaust pipe centre section rubber support rings
12. Cross member
13. Cross member rataining screws
14. Boot
15. Retaining bolt
16. Gear rod
17. Support retaining screws
18. Gear lever support
19. Guard retaining bolts
20. Flywheel guard
21. Transmission shaft
22. Front flexible coupling retaining nuts
23. Rear flexible coupling retaining bolts
24. Pin retaining bolts
25. Engine rear support pin
26. Propeller shaft centre support retaining nuts
27. Propeller shaft centre support
28. Rear crossmember retaining screws
29. Rear crossmember
30. Ground cable
31. Engine side mount lower retaining nuts
32. Engine side mounts
33. Engine side mount upper retaining screws

g. Remove the following parts from camshafts (5):
— Bolt (1).
— Nut (2), lockwasher (3) and washer (4) on drive gear.
— Gear (6), flange (7) and woodruff key (8).



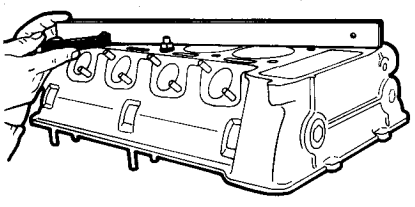
1. Bolt
2. Nut
3. Lockwacher
4. Washer
5. Camshaft
6. Drive gear
7. Flange
8. Woodruff key

CHECKS AND INSPECTION

CYLINDER HEADS AND VALVES

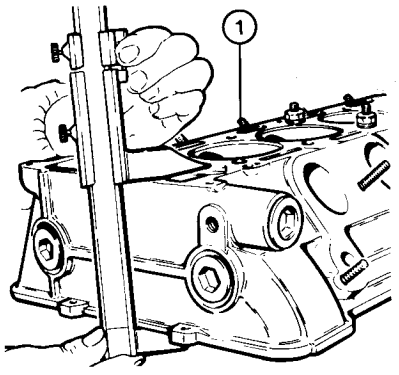
CYLINDER HEAD SEALING SURFACE INSPECTION

a. Thoroughly clean head surfaces using butyl acetate or methylethylketone to remove any gasket fragments.
b. Visually inspect head for cracks or other defects.
c. Check head sealing surface for warpage using a straightedge and feeler gauge positioned as shown.



Maximum flatness error of cylinder head sealing surface: 0.05 mm (0.002 in)

d. In the event of excessive warpage, head must be refaced. Before refacing, remove the four exhaust manifold studs (1).



1. Studs

Minimum cylinder head height after refacing: 111.5 mm (4.390 in)

Do not machine head below the minimum allowable thickness, otherwise severe engine damage might result.

e. Check finish of machined surface.

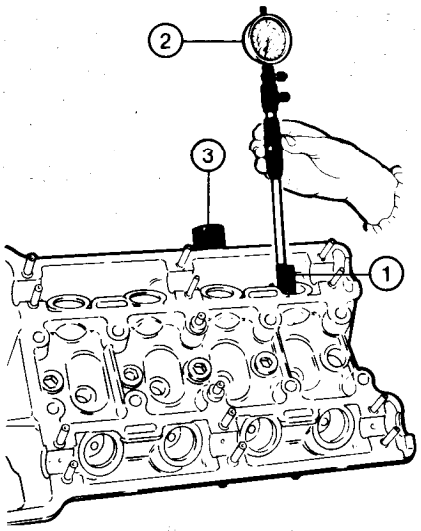
Maximum allowable surface roughness:
1.6 μm (63 microinch)

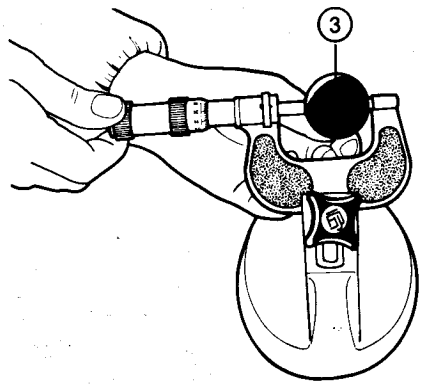
Head top and bottom faces must be parallel to within:
0.087 mm (0.0034 in)

TAPPETS AND TAPPET HOUSING BORES

a. Check tappet housing bores using a bore gauge (1) and a dial indicator (2). Compare readings with dimensions and tolerances given in Inspection Specifications Tables.

b. Check tappet skirt and head for signs of scuffing, score marks or excessive wear. Check diameter of tappet (3) using an outside micrometer, referring to Inspection Specifications Tables for dimensions and tolerances.





1. Bore gauge
2. Dial indicator
3. Tappet

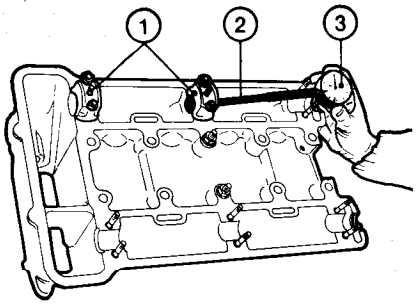
CAMSHAFTS AND CAMSHAFT JOURNAL HOUSING BORES

a. Install caps (1), lubricate nuts, and tighten to the specified torque.

b. Using a bore gauge (2) with dial indicator (3), measure camshaft journal housing bore diameter.

(T) : Tightening torque
Camshaft cap nuts
20 to 22 Nm
(2 to 2.25 kgm
14.7 to 16.2 ft.lb)

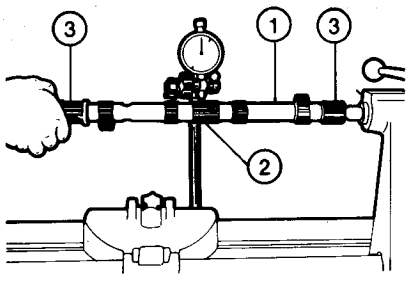
Camshaft journal housing bore diameter:
27.000 to 27.033 mm
(1.0630 to 1.0643 in)



1. Caps
2. Bore gauge
3. Dial gauge

c. Check cam lobes and camshaft journals for score marks, scuffing, signs of overheating or excessive wear.

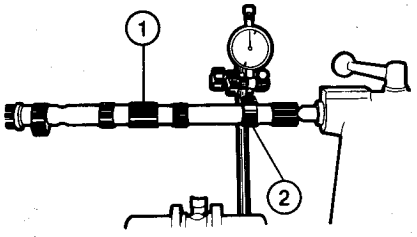
d. Measure camshaft journal diameter using an outside micrometer. Check for out-of-round condition using a dial gauge.



1. Camshaft
2. Center journal
3. End journals

Camshaft journal diameter:
26.959 to 26.980 mm
(1.0614 to 1.0622 in)

e. Check height of cam lobes using a dial indicator. Scrap and replace camshaft if height falls below requirements.



1. Camshaft
2. Cam

Minimum cam lobes height mm (in)

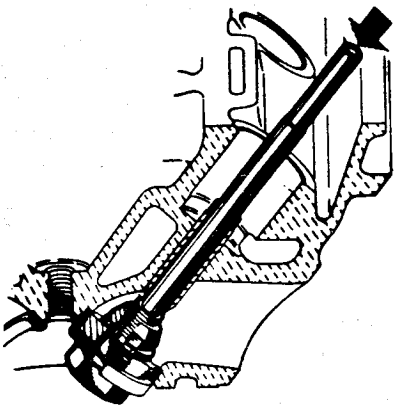
Cam	Engine			
	016.00	016.78 016.55	017.13 061.00 062.02 062.12	061.34
i.	9 (0.35)	9.5 (0.37)	11 (0.43)	8 (0.31)
e.	9 (0.35)	9.5 (0.37)	9 (0.35)	9 (0.35)

i. = intake valve cam
e. = exhaust valve cam

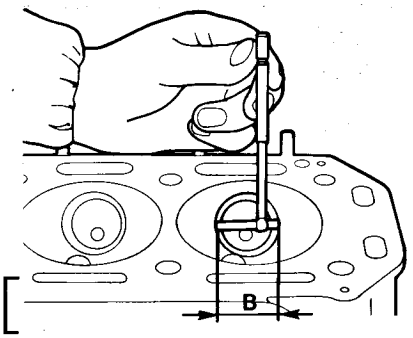
VALVE SEAT INSERT REPLACEMENT

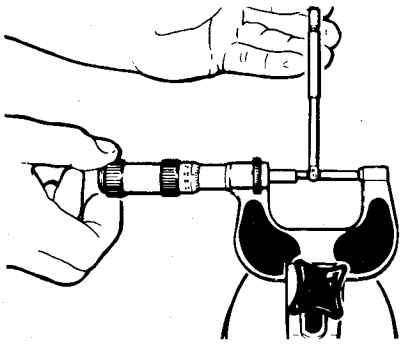
a. Check seat inserts for nicks, cracks or burn marks, and ensure that they are firm in housing bores. Replace if necessary.

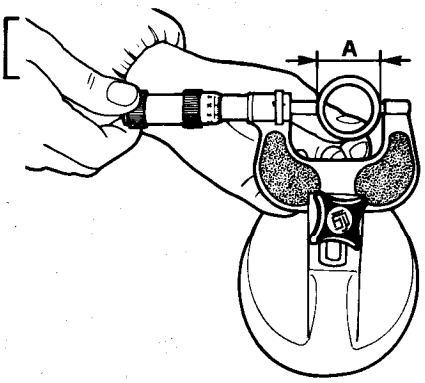
b. To remove seat inserts, use a suitable tool as shown below.



c. Prior to installing new seat inserts, check insert and housing bore dimensions against specifications shown in table.







Valve	Engine 016.00 - 016.78 061.00 - 062.02	
Seat insert O.D. [A = mm (in)]		
Standard	i.	42.597 to 42.632 (1.6770 to 1.6784)
	e.	38.597 to 38.632 (1.5196 to 1.5209)
Oversize	i.	42.897 to 42.932 (1.6889 to 1.6902)
	e.	38.897 to 38.932 (1.5314 to 1.5328)

Valve	Engine 016.55 - 017.13 062.12 - 061.34	
Seat insert O.D. [A = mm (in)]		
Standard	i.	45.065 to 45.100 (1.7742 to 1.7756)
	i.	42.597 to 42.632 (1.6770 to 1.6784)(1)
	e.	41.065 to 41.100 (1.6167 to 1.6181)
	e.	38.642 to 38.658 (1.5213 to 1.5220)(1)
Oversize	i.	45.365 to 45.400 (1.7860 to 1.7874)
	i.	42.897 to 42.932 (1.6888 to 1.6902)(1)
	e.	41.365 to 41.400 (1.6285 to 1.6299)
	e.	38.492 to 38.958 (1.5154 to 1.5338)(1)

i. = Intake valve e. = Exhaust valve

(1) For 061.34 engine only

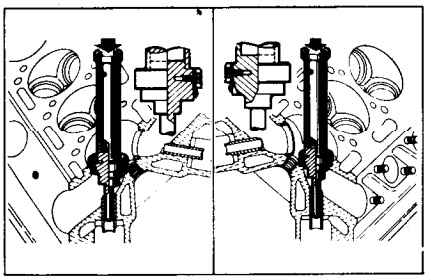
Valve	Engine 016.00 - 016.78 061.00 - 062.02 - 061.34	
Insert housing bore O.D. [B = mm (in)]		
Standard	i.	42.532 to 42.557 (1.6745 to 1.6755)
	e.	38.532 to 38.557 (1.5170 to 1.5180)
Oversize	i.	42.832 to 42.857 (1.6863 to 1.6873)
	e.	38.832 to 38.857 (1.5288 to 1.5298)

Valve	Engine 016.55 - 017.13 062.12	
Insert housing bore O.D. [B = mm (in)]		
Standard	i.	45.000 to 45.025 (1.7717 to 1.7726)
	e.	41.000 to 41.025 (1.6142 to 1.6152)
Oversize	i.	45.300 to 45.325 (1.7835 to 1.7844)
	e.	41.300 to 41.325 (1.6260 to 1.6270)

i. = Intake valve e. = Exhaust valve

d. Heat cylinder head in oven to 100°C (212°F).

e. Install valve seat inserts using a suitable driver as shown.



VALVE GUIDES

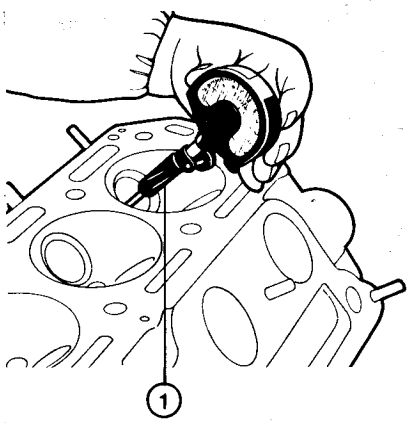
Check valve stem clearance in guide, if clearance exceeds tolerance scrap and replace worn parts.

Clearance measurement

a. Using an outside micrometer, measure valve stem at three different points, each offset by 90 degrees.

b. Measure guide I.D. using a bore gauge (1).

Valve guide I.D.:
9.000 to 9.015 mm
(0.3543 to 0.3549 in)



1. Bore gauge

c. Calculate clearance by subtracting maximum stem diameter from guide I.D.

Valve stem/guide clearance:

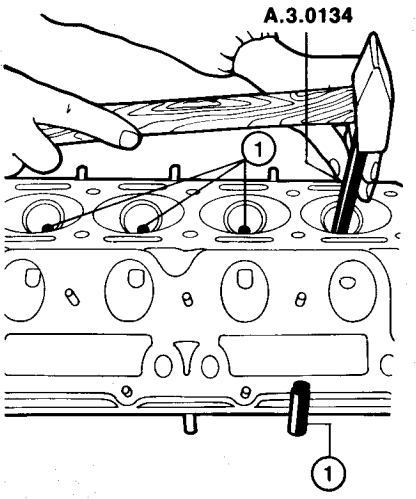
Intake: 0.013 to 0.043 mm
(0.0005 to 0.0017 in)
Exhaust: 0.040 to 0.080 mm
(0.0016 to 0.0031 in)
Exhaust: 0.040 to 0.075 mm (1)
(0.0016 to 0.0030 in) (1)
Exhaust: 0.040 to 0.070 mm (2)
(0.0016 to 0.0028 in) (2)

(1) For 061.34 engine only
(2) For Eaton-Livia valve, 061.34 engine

Valve guide replacement

a. Check valve guides for score marks, scuffing, distortion or signs of movement in seats.

b. If replacement is necessary, remove worn guides using driver **A.3.0134** as shown.



1. Valve guides

c. Check guide seat diameter and O.D. of new guides; interference fit must be within specified tolerances.

Valve guide seat diameter:
13.990 to 14.018 mm
(0.5508 to 0.5519 in)

Valve guide O.D.:
14.033 to 14.044 mm
(0.5525 to 0.5529 in)
(intake and exhaust)

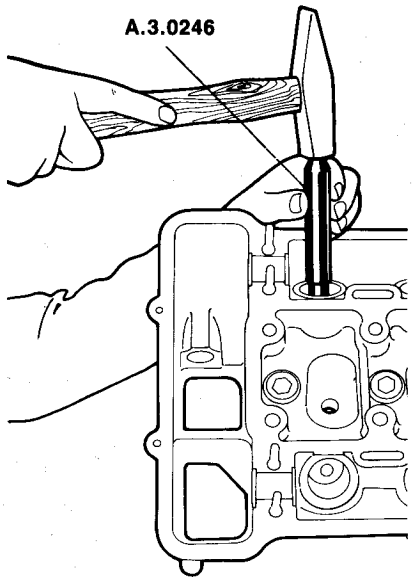
14.048 to 14.059 mm
(0.5531 to 0.5535 in)
(exhaust) (1)

Valve guide/seat interference fit:
0.015 to 0.054 mm
(0.0006 to 0.0021 in)
(intake and exhaust)

0.030 to 0.069 mm
(0.0012 to 0.0027 in)
(exhaust) (1)

(1) For 061.34 engine only

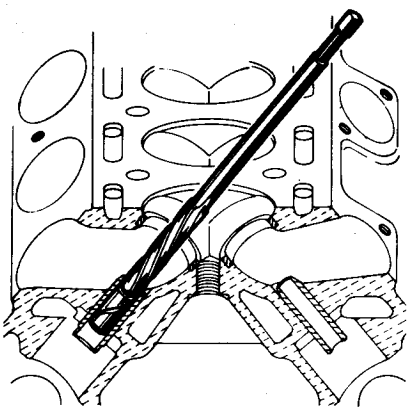
d. Install new guides using tool **A.3.0246** for intake valve guides and a suitable tool for exhaust valve guides. These tools ensure that the correct guide stand-out from the bottom spring cup abutment surface on cylinder head is maintained.



Valve guide stand-out mm (in)	
Valve	**Engine 016.00 - 016.78 - 016.55 062.02 - 062.12 - 061.34**
Intake	13.300 to 13.500 (0.5236 to 0.5315)
Exhaust	16.300 to 16.500 (0.6417 to 0.6496)

Valve	**Engine 017.13 - 061.00**
Intake	11.800 to 12.000 (0.4646 to 0.4724)
Exhaust	16.300 to 16.500 (0.6417 to 0.6496)

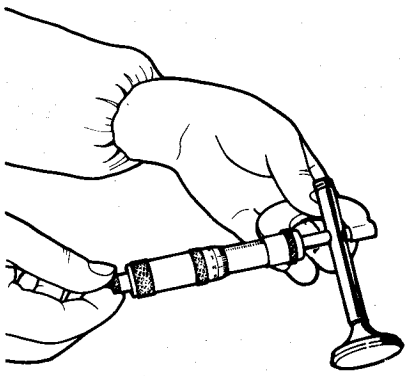
e. Ream valve guides to the specified diameter.
Check I.D. after reaming.



Valve guide fitted I.D. after reaming:
9.000 to 9.015 mm
(0.3543 to 0.3549 in)

VALVES AND VALVE SEATS

Check valves for nicks, burns or excessive deposits due to poor sealing between valve face and seat. If necessary, scrap and replace valves.
a. If valves are in good condition, check dimensions against specifications.



Valve stem diameter:
Intake: 8.972 to 8.987 mm
(0.3532 to 0.3538 in)
Exhaust: 8.935 to 8.960 mm
(0.3518 to 0.3528 in)
Exhaust: 8.940 to 8.960 mm (1)
(0.3520 to 0.3528 in) (1)
Exhaust: 8.945 to 8.960 mm (2)
(0.3522 to 0.3528 in) (2)

(1) ATE valve stem diameter for 062.12 and 061.34 engine
(2) Eaton-Livia valve stem diameter for 061.34 engine

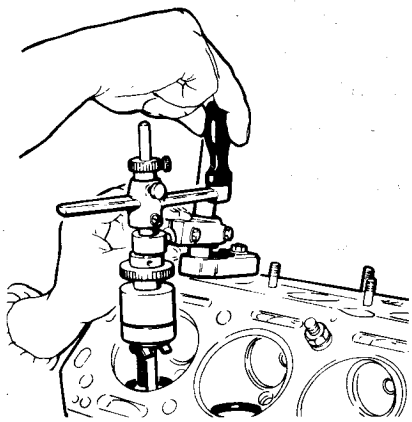
Valve head diameter mm (in)		
Type		**Engine 016.00 - 016.78 - 061.00 062.02 - 061.34**
Ate	i.	41.000 to 41.200 (1.6142 to 1.6220)
	e.	37.000 to 37.200 (1.4567 to 1.4646)
Eaton Livia	i.	41.000 to 41.150 (1)(2) (1.6142 to 1.6201) (1)(2)
	e.	37.000 to 37.150 (1.4567 to 1.4626)

Type		**Engine 017.13 - 016.55 - 062.12**
Ate	i.	44.010 to 44.150 (1.7327 to 1.7382)
	e.	40.010 to 40.150 (1.5752 to 1.5807)
Eaton Livia	i.	44.000 to 44.150 (1.7323 to 1.7382)
	e.	40.000 to 40.150 (1.5748 to 1.5807)

i. = intake valve e. = exhaust valve

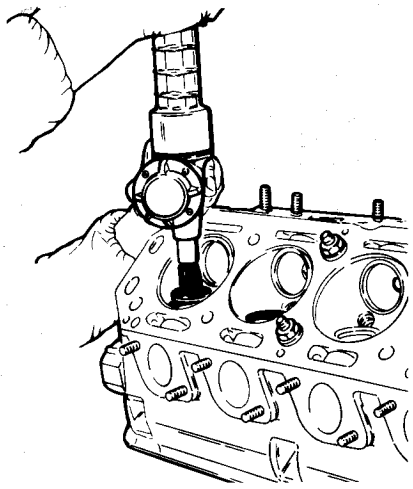
(1) For 062.02 and 061.00 engines: 41.850 to 42.000 (1.6476 to 1.6535)
(2) For 061.34 engine: 41.800 to 42.000 (1.6457 to 1.6535)

b. Grind valve seats using suitable equipment as shown below.



Seat angle is the same for both intake and exhaust valve seats, and should be:
120°

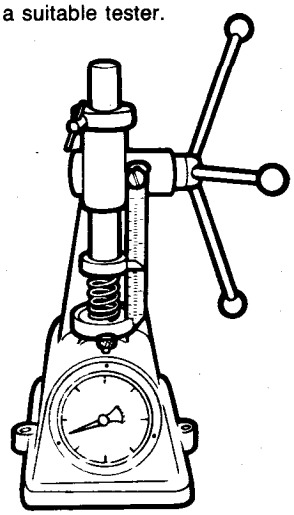
c. To produce correct seat angle, position grinder at 30°.
d. After machining, grind each valve into the associated seat using a suitable tool.



— When grinding valves and seats, use SIPAL AREXONS Carbosilicium abrasive paste, Part No. 4100-31502.
— Lubricate valve stems with engine oil.
— Thoroughly clean valves and seats using kerosene or solvent.

VALVE SPRINGS

Inspect valve springs for cracks or lack of tension. If poor spring performance is suspected, check inner and outer spring compressed length against specifications using a suitable tester.



Inspection load N (kg) (lb)		
Spring	Engine	
	016.00 - 016.78	016.55
Outer	348.8 to 366.1 (35.67 to 37.33) (78.4 to 82.3)	379.5 to 395.2 (38.7 to 40.3) (85.3 to 88.9)
Inner	218.1 to 227.1 (22.24 to 23.16) (49.1 to 51.1)	218.1 to 227.1 (22.24 to 23.16) (49.1 to 51.1)

Spring	Engine 061.00 - 062.02 - 062.12 017.13 - 061.34
Outer	452.1 to 469.8 (46.10 to 47.90) (101.7 to 105.7)
Inner	243.9 to 252.3 (24.87 to 25.73) (54.9 to 56.7)

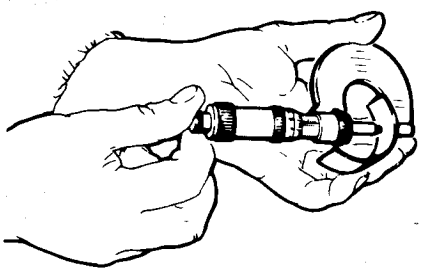
Spring compressed length mm (in)		
Spring	Engine	
	016.00 - 016.78 016.55	017.13 - 061.00 062.02 - 062.12 061.34
Outer	27.5 (1.08)	25.5 (1.00)
Inner	26 (1.02)	23.5 (0.93)

ENGINE BLOCK

a. Inspect engine block for cracks or excessive wear in cylinder bores.
b. Thoroughly clean engine block faces with butyl acetate or methylethylketone to remove any gasket fragments.

MAIN AND CONNECTING ROD BEARINGS

a. Clean main and connecting rod bearings and check for scoring or scuffing.
b. In the event of excessive wear, scrap and replace all bearings.
c. Connecting rod and main bearing assembly to crankshaft must be carried out matching parts of the same grade, identified by paint marks of the same colour (RED or BLUE) applied on the side of each bearing and the associated crankshaft journal or crankpin.
d. Measure wall thickness of bearing halves using an outside micrometer and compare results with specifications. Replace any excessively worn bearings.

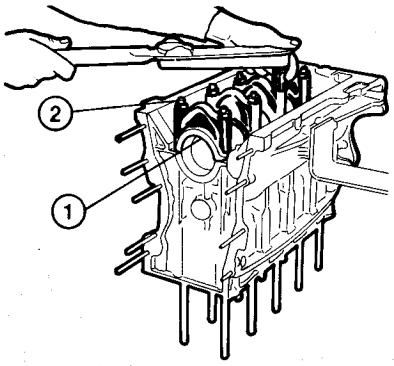


Grade	Bearing	
Red	Main	1.829 to 1.835 mm (0.0720 to 0.0722 in)
	Conn. rod	1.829 to 1.835 mm (0.0720 to 0.0722 in)
Blue	Main	1.835 to 1.841 mm (0.0722 to 0.0725 in)
	Conn. rod	1.835 to 1.841 mm (0.0722 to 0.0725 in)

MAIN BEARING CAPS

a. Install main bearing caps (1) in engine block. Caps are numbered to ensure proper positioning.
b. Lubricate cap nuts and associated washers (2) in engine oil and tighten to the specified torque.

(T) : Tightening torque
Main bearing cap nuts
46 to 49 Nm
(4.7 to 5 kgm
33.9 to 36.1 ft.lb)

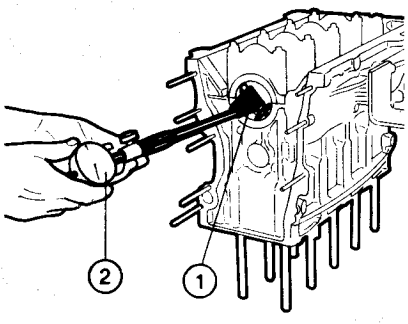


1. Main bearing caps
2. Nuts and washers

c. Using a bore gauge (1) with dial indicator (2), measure installed diameter of main bearings and compare with specifications.

Main bearing diameter:
63.647 to 63.666 mm
(2.5058 to 2.5065 in)

For
061.00 - 061.34 - 062.02 - 062.12
engines:
63.652 to 63.671 mm
(2.5060 to 2.5067 in)



1. Bore gauge
2. Dial indicator

d. Check centre main bearing housing width.

Centre main bearing housing width:
25.15 to 25.20 mm (0.990 to 0.992 in)

THRUST RINGS

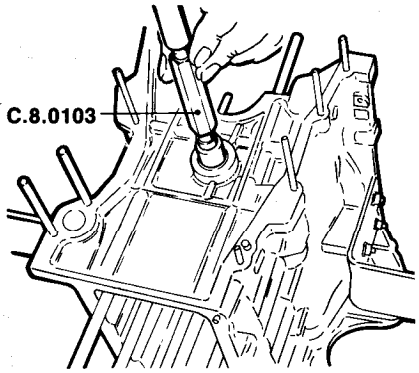
a. Measure thrust ring thickness and compare with specifications.

Thrust ring thickness:
2.310 to 2.360 mm (0.091 to 0.093 in)

For 061.34 engine:
2.311 to 2.362 mm (0.0910 to 0.930 in)

CAMSHAFT IDLER GEAR BUSHING

a. Using plug gauge **C.8.0103**, check the camshaft idler gear bushing for wear.

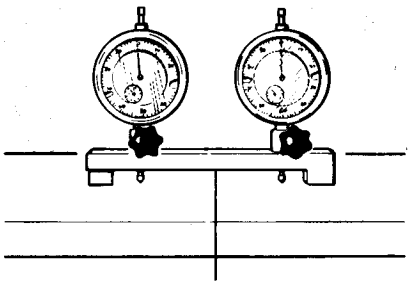


b. If replacement is necessary, remove bushing using puller **A.3.0210**. Also scrap and replace bushing on front cover at this time.

CYLINDER LINER STAND-OUT

a. Thoroughly clean liners and insert in block.

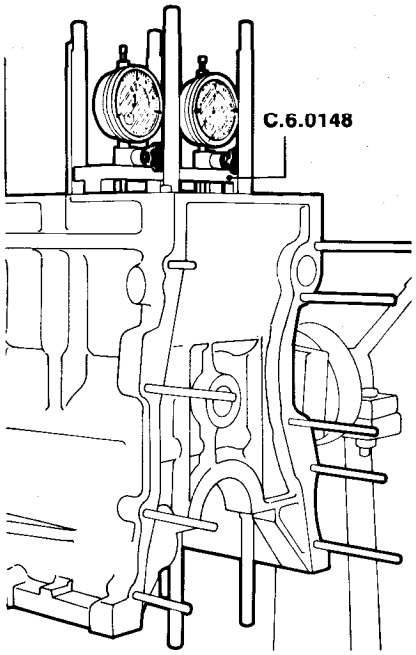
b. Apply dial indicators to gauge **C.6.0148**. Place gauge on a surface plate and zero the dial indicators.



C.6.0148

c. Place gauge on cylinder block so that dial indicator styluses rest on edges of liner. Read liner stand-out off dial indicator.

d. Compare stand-out reading with specifications.



Cylinder liner stand-out:

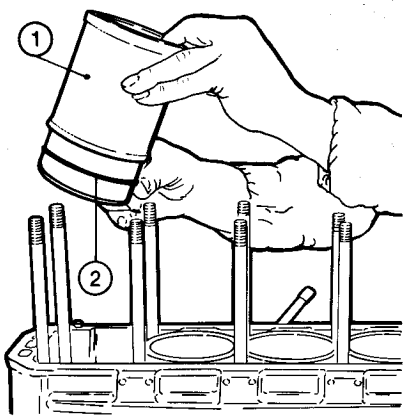
016.00 engine =
0.00 to 0.06 mm (0.0000 to 0.0024 in)

016.78 - 062.02 - 016.55 - 062.12
061.00 - 017.13 - 061.34 engines =
0.01 to 0.06 mm (0.0004 to 0.0024 in)

e. If liner (1) stand-out must be checked with seals (2) installed, proceed as follows:

— Secure liners in block using retainers **A.2.0117**.

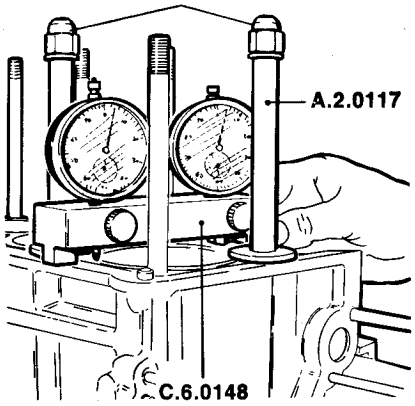
— Tighten retainer nuts to the specified torque.



1. Cylinder liners
2. Seals

— Position gauge on block and check stand-out as directed in paragraph d.

(T) : 10 to 15 Nm
(1 to 1.5 kgm
7.4 to 11.0 ft.lb)



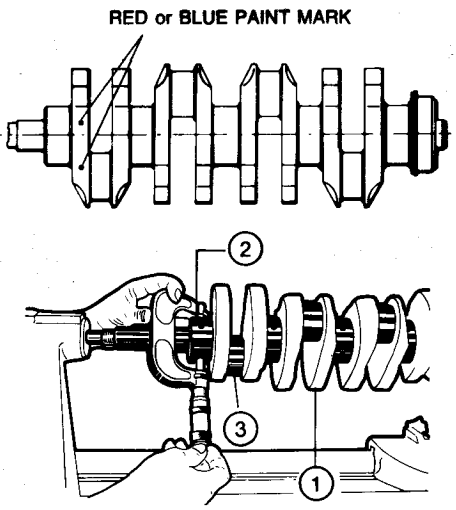
CRANKSHAFT

a. Examine crankshaft main journals and crankpins for uneven wear, scoring, scuffing or overheating.

NOTE:
Crankshaft has been carbonitrided, and thus cannot be reconditioned. Consequently, if measurements reveal excessive wear, crankshaft must be scrapped and replaced.

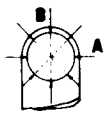
b. Measure crankshaft main journal and crankpin diameters and compare with data given in Inspection Specifications under Crankshaft.

Crankshaft main journals and crankpins are graded according to machining tolerances. Grades are identified by RED or BLUE paint marks.



1. Crankshaft
2. Main journal
3. Crankpin

c. Measure main journal and crankpin diameter at several points to check for ovality.



Maximum permissible main journal and crankpin ovality:
A-B = 0.007 mm (0.0003 in)

d. Measure main journal and crankpin diameter at points A and B shown below to check for taper.

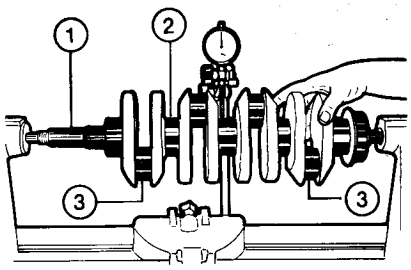
Maximum permissible main journal and crankpin taper:
A-B = 0.01 mm (0.0004 in)

e. Support crankshaft on V-blocks or a lathe. Place dial indicator stylus in contact with main hournals and crankpins and compare dimensions with the following specifications:

Maximum main journal eccentricity:
0.04 mm (0.0016 in)

Maximum crankpin misalignment relative to main journals:
0.015 mm (0.0006 in)

Maximum crankpin centerline misalignment relative to main journal centerline:
0.3 mm (0.012 in)

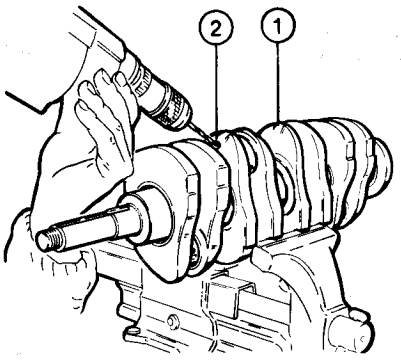


1. Crankshaft
2. Main journal
3. Crankpin

f. Check width of center main journal, which should be **30.000 to 30.035 mm (1.1811 to 1.1825 in)**.

g. If the foregoing inspection shows crankshaft to be in good condition, clean oil passages as follows:

— Drill out the aluminum plugs blocking the oil passages.



1. Crankshaft
2. Oil passages

— Clean oil passage using a wire brush.
— Clean the crankshaft and oil passages with hot fuel oil and dry with compressed air.
— Block passages with new aluminum plugs.
Stake plugs in place using a suitable tool.

CYLINDER LINERS

a. Note liner grade and check dimensions.

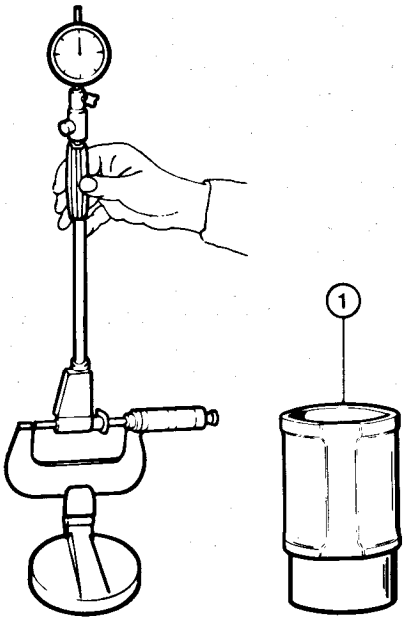
Liners are graded A, B, or C according to bore diameter. Grades are identified by paint marks on the outside of liners. Colour for each grade is as follows:

BLUE = A PINK = B GREEN = C

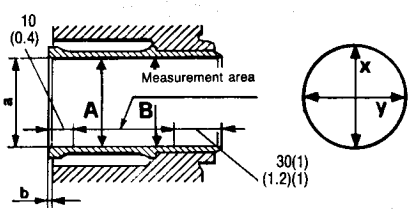
b. Refer to the Liner and Piston Inspection Specifications Table for the correct dimensions for each grade.

To check dimensions, proceed as follows:

— Zero the bore gauge on a suitable outside micrometer.
— Measure bore at the points indicated. Compare measurements to establish liner (1) taper and ovality.



1. Cylinder liners



(1) 26 mm (1 in) for 062.12 engines

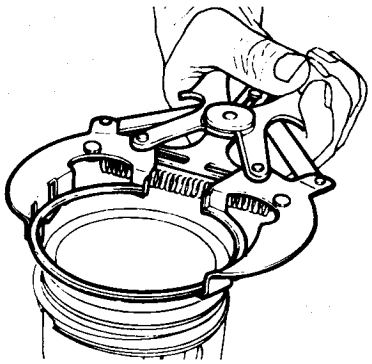
Maximum liner taper:
A-B = 0.01 mm (0.0004 in)

Maximum liner out-of-round:
X-Y = 0.01 mm (0.0004 in)

— Compare results of measurements with nominal dimensions for each liner grade and determine maximum wear.

PISTONS AND CONNECTING RODS

a. Remove compression rings and oil control ring together with expander spring as shown.



b. Using a screw driver, remove piston pin retaining ring.

c. Withdraw piston pin and separate connecting rod from piston.

d. Thoroughly inspect pistons for score marks on skirt or damaged ring grooves. Damaged or scored pistons must be scrapped and replaced.

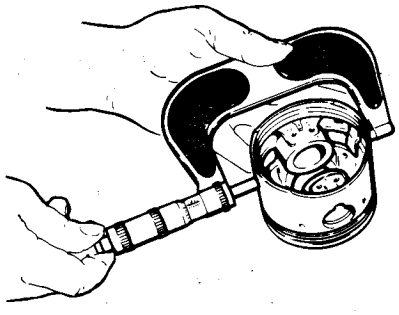
Like the cylinder liners, pistons are graded according to machining tolerances.

Grades are identified by paint marks on the piston head.

Colour for each grade is as follows:

BLUE = A PINK = B GREEN = C

e. Using an outside micrometer, measure the diameter of the piston skirt at right angles to the piston pin bore and at the following distance from the bottom edge of the skirt:



016.00 - 061.00 engines:

Borgo piston: 17 mm (0.67 in)

Mondial piston: 20 mm (0.79 in)

016.78 - 061.34 - 062.02 engines:
15 mm (0.59 in)

016.55 - 062.12 - 017.13 engines:
17 mm (0.67 in)

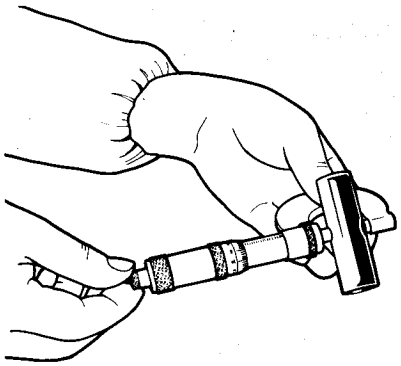
Compare results of measurement with tolerances given on Piston Specifications Table.

f. Check pin bores in piston and coneting rod for excessive wear.

g. Measure pin diameter with an outside micrometer.

Measure piston bore diameter using a bore gauge.

Compare measurements with specifications for the grade concerned.



Piston pin bore diameter:

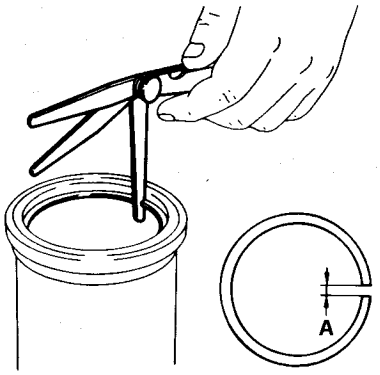
Black	**22.000 to 22.002 mm**
	(0.86614 to 0.86622 in)
	22.001 to 22.003 mm (1)
	(8.8662 to 0.8663 in) (1)
White	**22.003 to 22.005 mm**
	(0.86626 to 0.86634 in)

(1) For 061.34 engine only

Pin diameter:

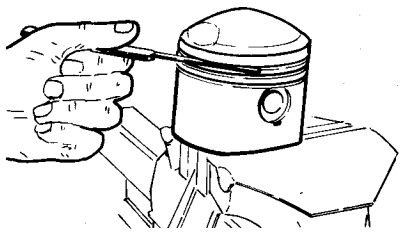
Black	**21.994 to 21.997 mm**
	(0.8659 to 0.8660 in)
White	**21.997 to 22.000 mm**
	(0.8660 to 0.8661 in)

h. Measure thickness of compression and oil control rings. Install rings in a suitable checking fixture or in cylinder liner and check ring gap «A» with a feeler gauge.



Measure ring clearance in groove using a feeler gauge.

Compare results of measurement with dimensions and tolerances given in «Piston and Piston Ring Inspection Specifications Table».

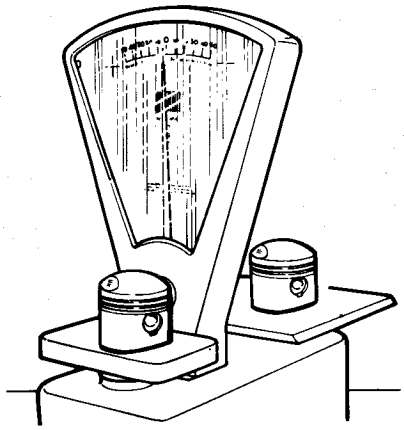


i. Match piston pins with pistons of the same grade.

Grade is identified by WHITE or BLACK paint marks on the inside of the pin and on the pin boss in the piston.

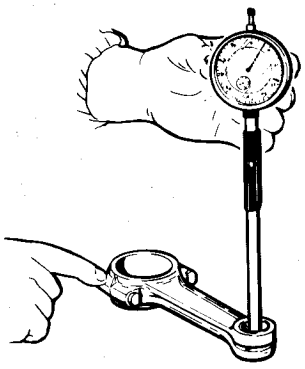
j. Pistons and pins may be reused if contact surfaces, particularly those in the piston bosses, are completely free from scratches or scoring of any kind.

k. Install pins in pistons of the same grade and fit retaining rings. Using a balance scale similar to that shown, **check that the weight difference between pistons does not exceed 4 grams**.



l. Examine connecting rods for cracks, scoring or signs of excessive wear. If connecting rods and caps are undamaged, carry out the measurements described below to determine whether they may be reused.

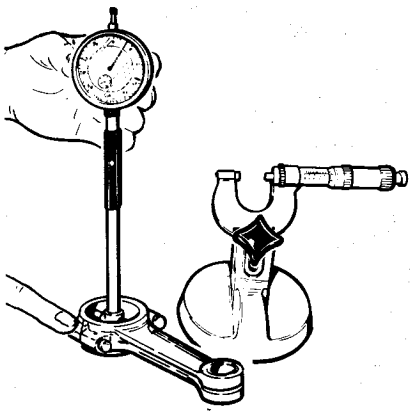
m. Measure fitted diameter of small end bushing using a bore gauge and dial indicator.



Small end bushing fitted diameter:
22.005 to 22.015 mm
(0.8663 to 0.8667 in)

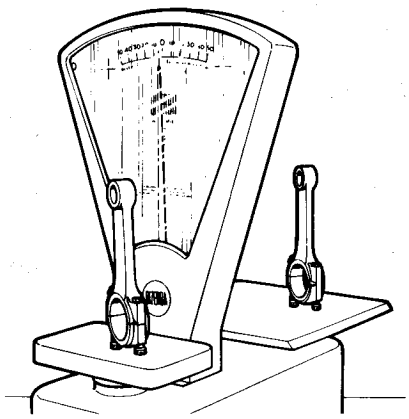
n. Install connecting rod caps, lubricate nuts and washers in oil and tighten to the specified torque.
Measure big end bore as described in paragraph m. above.

(T) : **Tightening torque**
Connecting rod cap nuts (wet)
49 to 52 Nm
(5 to 5.3 kgm
36.1 to 38.4 ft.lb)

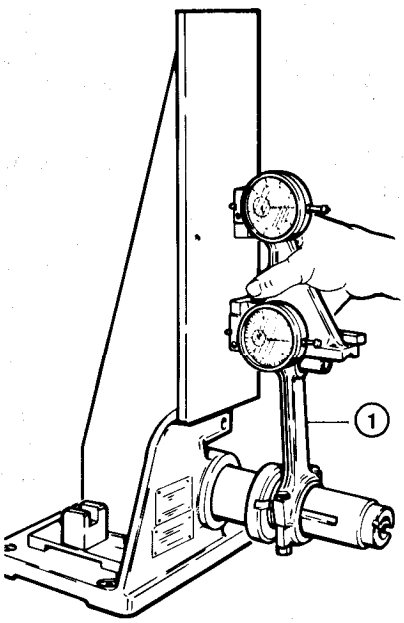


Big end bore diameter:
53.695 to 57.708 mm
(2.1140 to 2.1145 in)

o. Using a balance scale similar to that shown, check that the weight difference between connecting rods complete with caps and fasteners **does not exceed 2 grams.**



p. Check alignment of connecting rods (1) using a fixture as shown.



1. Connecting rod

NOTE:
Misaligned connecting rods must be scrapped and replaced, as they impose excessive loads on bearings, pistons and cylinder walls, which leads to irregular piston and rod wear.

CYLINDER LINER, PISTON AND CONNECTING ROD MATCHING

a. **Cylinder liners and pistons.** Cylinder liners and pistons must be paired using parts of the same grade, identified by paint marks of the same colour on the piston head and on the outside of the cylinder liner as described in the foregoing paragraphs.

Liner/piston clearance:

016.00 - 061.00 - 062.02 - 016.78 engines:
0.030 to 0.049 mm
(0.0012 to 0.0019 in)

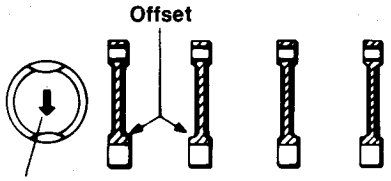
016.55 - 061.34 - 062.12 - 017.13 engines:
0.040 to 0.059 mm
(0.0016 to 0.0023 in)

b. **Pistons and pins.** Pistons and pins must be paired using parts of the same grade, identified by paint marks of the same colour on the inside of the pin and on the piston boss.

Pin/piston bore clearance:
(black and white)
0.003 to 0.008 mm
(0.00012 to 0.00031 in)

061.34 engine:
0.004 to 0.009 mm (black)
(0.00016 to 0.00035 in) (black)
0.003 to 0.008 mm (white)
(0.00012 to 0.00031 in) (white)

c. **Pistons and connecting rods.** Connecting rods must be installed with the offset facing towards the intermediate main journals.
For 1800 and 2000 engines, pistons must be positioned with the arrow stamped on the head toward the exhaust side.



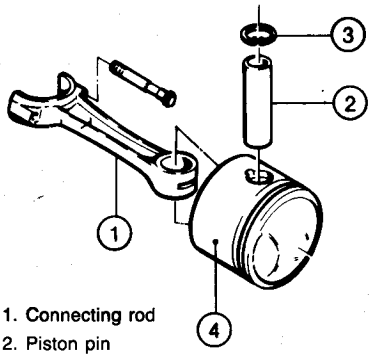
Arrow
(1800 and 2000 cc engines only)

Pin/small end clearance:

Black	**0.008 to 0.021 mm**
	(0.0003 to 0.0008 in)
White	**0.005 to 0.018 mm**
	(0.0002 to 0.0007 in)

d. Insert small end of connecting rod between piston bosses and align bores for piston pin installation.

e. Insert piston pin (2) through piston (4) and connecting rod (1). Secure pin with two retaining rings (3).



1. Connecting rod
2. Piston pin
3. Retaining rings
4. Piston

FLYWHEEL

a. Check inside diameter of center bushing.
If necessary, install a new bushing and ream to the specified size.

Flywheel center bushing I.D. (after reaming): 26.010 to 26.023 mm (1.0240 to 1.0245 in)

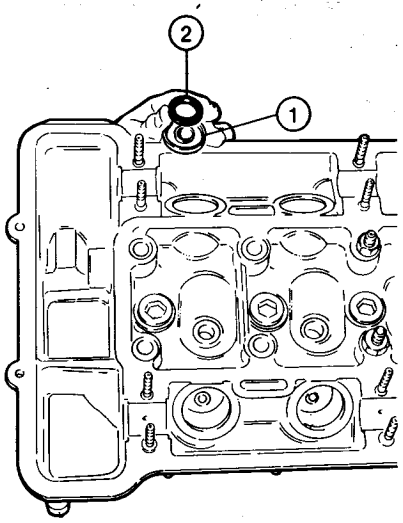
b. Check ring gear teeth for chipping or signs of pick-up.
If damaged, remove ring gear using a hydraulic press and replace.

c. Thoroughly clean mating surfaces of flywheel and new ring gear.
d. Heat the new ring gear evenly to 120 to 140°C (248 to 284°F).
Fit ring gear over flywheel and check that it is correctly seated.
e. Allow ring gear to cool slowly at room temperature.
Do not attempt to accelerate cooling.

ENGINE ASSEMBLY

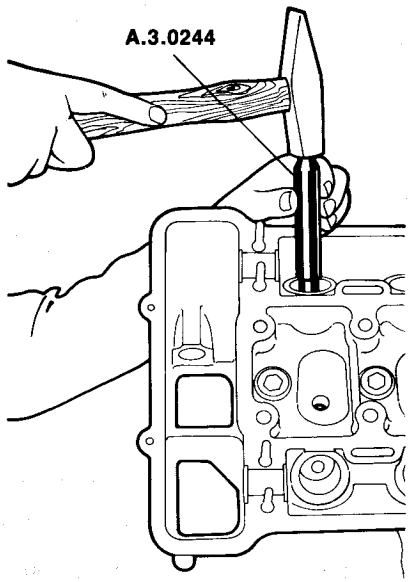
CYLINDER HEAD ASSEMBLY

After inspecting as described above and replacing defective parts, assemble engine using the special purpose tools described during engine disassembly and the assembly tools indicated below.
a. Clamp support **A.2.0195** and fork **A.2.0196** in vice and install cylinder head on fork.
b. Fit bottom spring cups (1) and abutment washers (2) over intake and exhaust valve guides.

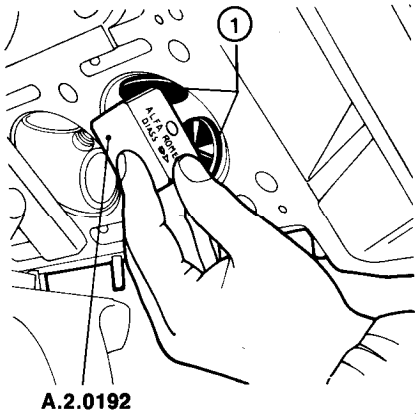


1. Bottom spring cup
2. Abutment washer

c. Install oil seals on intake valve guides using tool **A.3.0244**.

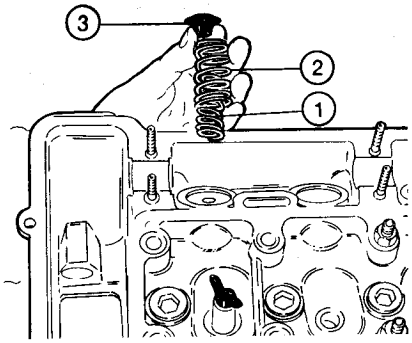


d. Lubricate valve stems with clean engine oil and install in the associated guides.
Retain valves using support tool **A.2.0192**. Support should be secured to spark plug hole through the associated wing nut.



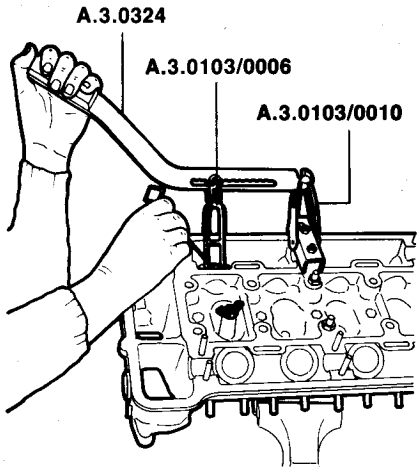
1. Valves

e. Insert inner springs (1), outer springs (2) and top spring cup (3) over valve stems. Damping coils of springs must face downward.

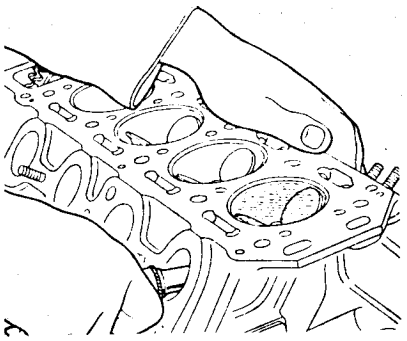


1. Inner springs
2. Outer springs
3. Top spring cups

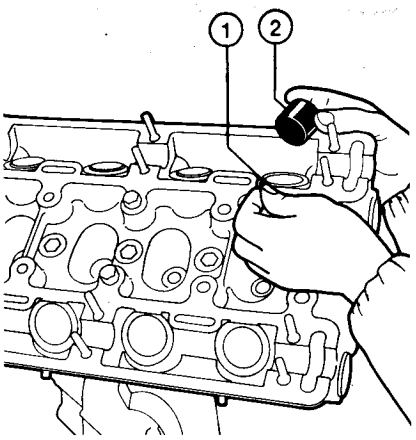
f. Install support **A.3.0103/0010** on head center studs and, using spring compressor **A.3.0103/0006** and lever **A.3.0324**, compress springs and install spring retainer locks in grooves on valve stem.



Valve leakage test.
Install spark plugs in seats.
Pour enough fuel in a combustion chamber to barely cover the head of the valve under test.
Introduce air at low pressure into the intake and exhaust passages and check for air bubbles in the fuel.
If leakage is detected, check that valves are properly seated and repeat leakage test.
If leakage persists, regrind the valve seats as described under «Inspection - Valves and valve seats».

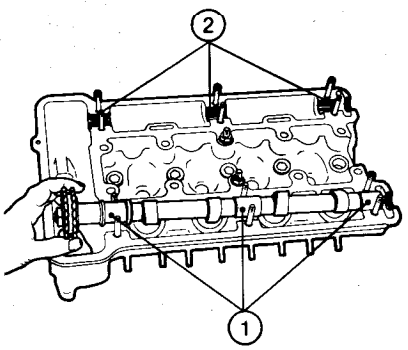


g. Install valve tip caps (1) ensuring that they are returned to their original positions.
Lubricate tappets (2) with clean engine oil and install in associated seats.



1. Valve tip caps
2. Tappets

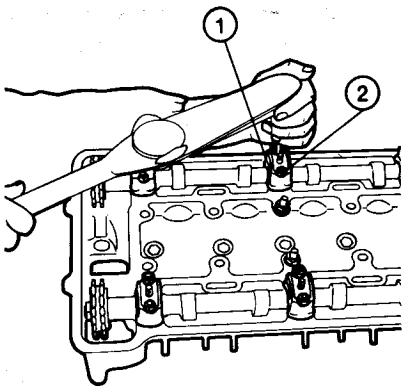
h. Install flanges and woodruff keys on camshafts.
Position gears with washers, lockwashers and nuts.
Tighten nuts.
i. Using clean engine oil, lubricate camshaft journals (1) and housings (2) on cylinder head.



1. Camshaft journals
2. Housings

j. Position caps (1) in numerical order (numbers are marked on caps).
Lubricate nuts and washers (2) with engine oil and tighten to specified torque.
Check camshaft journal running clearance and camshaft end float against specifications.

(T) : **Tightening torque**
Camshaft cap nuts (wet)
20 to 22 Nm
(2 to 2.25 kgm
14.8 to 16.2 ft.lb)

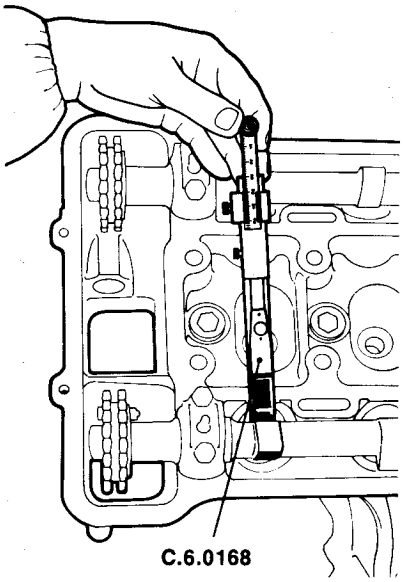


1. Camshaft caps
2. Nuts and washers

Camshaft journal running clearance:
0.020 to 0.074 mm (0.0008 to 0.0029 in)

Camshaft end float:
0.065 to 0.182 mm (0.0026 to 0.0072 in)

k. Using gauge **C.6.0168**, check clearance between cam heel radius and tappet head against specifications.
To adjust clearance, remove valve tip cap and install another of the correct thickness.
Use a suitable tool to check tip cap thickness.

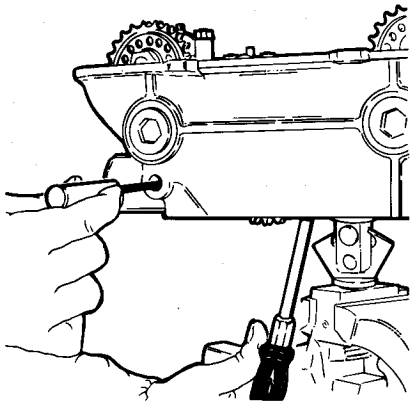


Valve clearance:

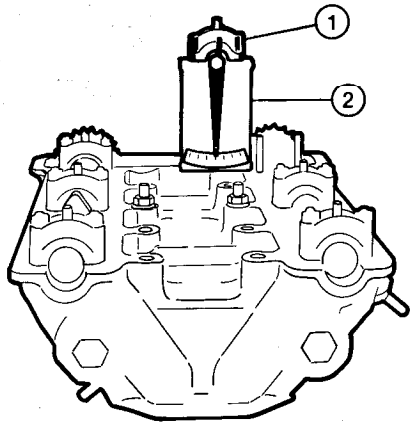
Intake:	**0.400 to 0.450 mm (0.0157 to 0.0177 in)**
Exhaust:	**0.450 to 0.500 mm (0.0177 to 0.0197 in)**
Exhaust:	**0.500 to 0.600 mm** (1) **(0.0197 to 0.0236 in)** (1)

(1) For 061.34 engine only

l. Grease chain tensioner spring and insert in tensioner. Insert spring retainer plate in slot on tensioner and install tensioner assembly in seat on cylinder head.
Install screw as shown below, ensuring that it is aligned with hole on spring retainer plate.



m. If a new cylinder head is used, restore timing marks on front camshaft caps (1) using a suitable tool (2).



1. Front caps
2. Timing tool

Angular position of timing mark on front bearing cap

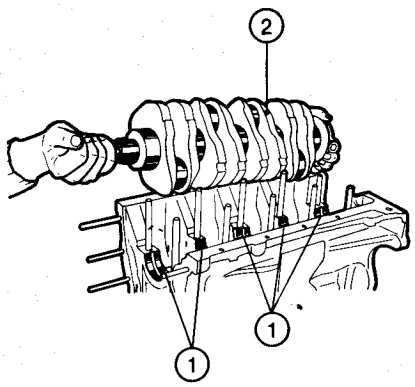
	Engine		
	016.00	**016.78 016.55**	**061.34**
Intake (β)	+1°	—0°15'	—1°20'30"
Exhaust (α)	—4°	+0°15'	—7°

	Engine	
	017.13	**062.02 - 061.00 - 062.12**
Intake (β)	+12°45'	—2°04'
Exhaust (α)	—1°	—1°06'

ENGINE BLOCK ASSEMBLY

CRANKSHAFT

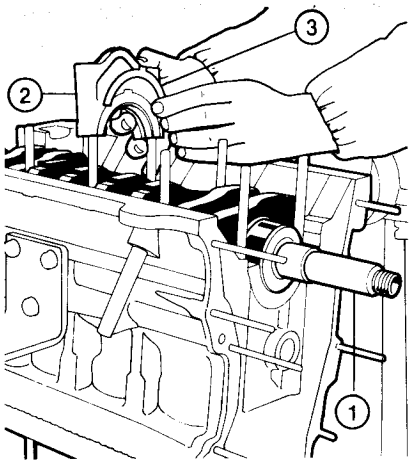
a. **Install crankshaft in block as follows:**
— Install the main bearing halves in the block and **lubricate with oil.**
Crankshaft (2) must be matched with main bearings of same grade, identified by paint marks of the same colour (RED or BLUE) applied on the side of each bearing (1) and associated crankshaft journal.



1. Top main bearing halves
2. Crankshaft

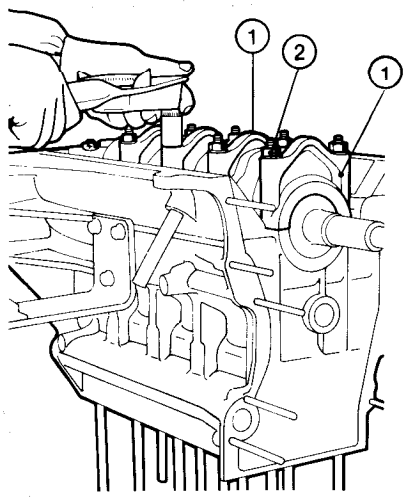
— **Lubricate** crankshaft journals and position crankshaft (1) over main bearings.
— Insert thrust ring halves in seat on center main bearing.
Rotate crankshaft to settle thrust rings. When installing thrust rings, make sure that oil grooves face crankshaft throws.

b. **Main bearing cap installation.**
— Install bearing halves in caps and **lubricate with oil.**
— Install center bearing cap (2) together with bearing half and thrust ring halves (3). Parts should be postioned as indicated by number on bearing cap.



1. Crankshaft
2. Center main bearing cap
3. Thrust ring half

— Install front and rear bearing caps (1) together with associated bearing halves. Parts should be positioned as indicated by numbers on bearing cap.
— **Lubricate** nuts and washers (2) with engine oil. Start nuts until they are finger tight.



1. Main bearing caps
2. Nuts and washers

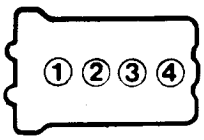
— Tighten the bearing cap nuts to the specified torque in two or three stages.

(T) : **Tightening torque**
Main bearing cap nuts (wet)
46 to 49 Nm
(4.7 to 5 kgm
33.9 to 36.1 ft.lb)

c. **Crankshaft end play check.**
— Apply a dial indicator (1) with magnetic base on engine block so that indicator stylus a contacts crankshaft parallel to crankshaft centerline.

SPECIFICATIONS

ENGINE SPECIFICATIONS

		Engine	
		1800	
		(061.34)	
Type		Otto cycle, 4-stroke	
No. and arrangement of cylinders		4 in-line	
Cylinder numbering			
Bore - Stroke	mm	80 x 88,5	
	(in)	(3.15 x 3.48)	
Displacement	cm^3	1779	
	(cu.in)	(108.55)	
Combustion chamber volume	cm^3	68.4	
	(cu.in)	(4.17)	
Compression ratio		7.5	
Power output DIN			
Maximum	kW (HP)	114 (153)	
		at 5800 rpm	
Max. torque DIN	Nm (kgm)	225.4 (23)	
	(ft·lb)	(166)	
		at 2600 rpm	
Mean effective piston speed (1)	m/sec	15.34	
	(ft/s)	(50.3)	
Octane rating	N.O. - R.M.	≥ 98	
	Sensitivity (2)	≤ 11	
Engine oil pressure (3)			
Minimum at idle		49.03	
		(0.49; 0.5; 7.1)	
Minimum at peak rpm	kPa	343.19	
	(bar; kg/cm^2; psi)	(3.43; 3.5; 49.7)	
Maximum at peak rpm		441.24 to 490.27	
		(4.41 to 4.90; 4.5 to 5.0; 63.9 to 71)	

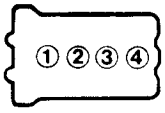
(1) At maximum output rpm

(2) Difference between Research Method and Motor Method Octane Rating

(3) Check with oil at operting temperature (90°C; 194°F)

SPECIFICATIONS

ENGINE SPECIFICATIONS

		Engine			
		1600	1800	2000	2000
		(061.00)	(062.02)	(062.12)	(017.13)
Type		Otto cycle, 4-stroke			
No. and arrangement of cylinders		4, in-line			
Cylinder numbering					
Bore - Stroke	mm	78 x 82	80 x 88.5	84x88.5	84 x 88.5
	(in)	(3.07 x 3.23)	(3.15 x 3.48)	(3.31 x 3.48)	(3.31 x 3.48)
Displacement	cm^3	1570	1779	1962	1962
	(cu.in)	(95.80)	(108.55)	(119.72)	(119.72)
Combustion chamber volume	cm^3	51	52	61.3	61.3
	(cu.in)	(3.11)	(3.17)	(3.74)	(3.74)
Compression ratio		9	9.5	9	10
Power output DIN					
Maximum	kW (HP)	81 (110)	88 (120)	94 (128)	94 (128)
		at 5800	at 5300 rpm	at 5400 rpm	at 5400 rpm
Max. torque DIN	Nm (kgm)	146 (14.9)	168.8 (17)	179.5 (18.2)	176.5 (17.9)
	(ft.lb)	(107.7)	(124.4)	(132.4)	(130.2)
		at 4000 rpm	at 4000 rpm	at 4000 rpm	at 4000 rpm
Mean effective piston speed (1)	m/sec	15.3	15.6	15.93	15.93
	(ft/s)	(50.2)	(51.2)	(52.3)	(52.3)
Octane rating	N.O. - R.M.	≥ 98			
	Sensitivity (2)	≤ 11			
Engine oil pressure (3)					
at 800 - 900 rpm	kPa (bar; kg/cm^2; psi)	49.03 to 98.06 (0.49 to 0.98; 0.5 to 1; 7.1 to 14.2)			
at 5000 rpm		343.21 to 490.3 (3.43 to 4.90; 3.5 to 5; 49.8 to 71.1)			

(1) At maximum output rpm

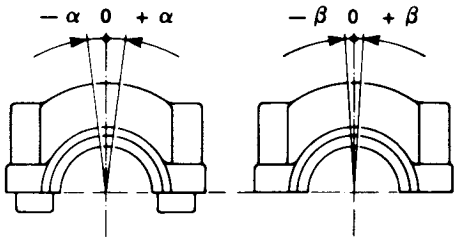
(2) Difference between Research Method and Motor Method Octane Rating

(3) Check with oil at operating temperature (90°C; 194°F)

CHECKS AND ADJUSTMENTS

VALVE TIMING DATA (1)

REFERENCE MARKS ON FRONT CAMSHAFT BEARING CAP (viewed from flywheel side)

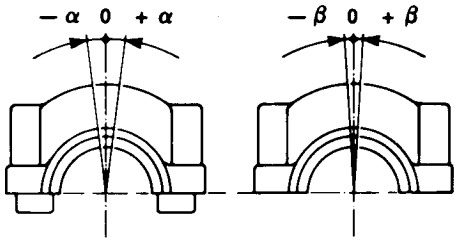


			Engine			
			1600	1800	2000	
			(016.00)	(016.78)	(016.55)	(017.13)
Camshafts	Intake		105.20.03.200.00	105.48.03.200.01		116.85.03.200.01
	Exhaust		105.20.03.200.00	105.48.03.200.01		105.20.03.200.00
Clearance between cam heel radius and tappet head	Intake	mm (in)	0.400 to 0.450 (0.016 to 0.018)	0.400 to 0.450 (0.016 to 0.018)		
	Exhaust	mm (in)	0.450 to 0.500 (0.018 to 0.020)	0.450 to 0.500 (0.018 to 0.020)		
Angular position of timing mark on front bearing cap	Intake	(β)	+1°	–0°15'		+12°45'
	Exhaust	(α)	–4°	+0°15'		–1°
Nominal lift	Intake	mm (in)	9 (0.35)	9.5 (0.37)		11 (0.43)
	Exhaust	mm (in)	9 (0.35)	9.5 (0.37)		9 (0.37)

(1) Engine cold

VALVE TIMING DATA (1)

REFERENCE MARKS ON FRONT CAMSHAFT BEARING CAP (viewed from flywheel side)

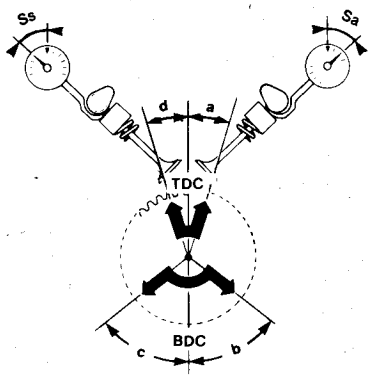


			Engine			
			1600	1800	2000	1800
			(061.00)	(062.02)	(062.12)	(061.34)
Camshafts	Intake		116.55.03.200.08			116.99.03.200.00
	Exhaust		105.20.03.200.00			105.20.03.200.00
Clearance between cam heel radius and tappet head	Intake	mm (in)	0.400 to 0.450 (0.016 to 0.018)			0.400 to 0.450 (0.016 to 0.018)
	Exhaust	mm (in)	0.450 to 0.500 (0.018 to 0.020)			0.550 to 0.600 (0.022 to 0.024)
Angular position of timing mark on front bearing cap	Intake	(β)	–2°04'			–1°20'30"
	Exhaust	(α)	–1°06'			–7°
Nominal lift	Intake	mm (in)	11 (0.43)			8 (0.31)
	Exhaust	mm (in)	9 (0.35)			9 (0.35)

(1) Engine cold

VALVE TIMING DATA (1)

VALVE OPENING AND CLOSING ANGLE CHECK (crankshaft rotation counterclokwise when viewed from flywheel side)



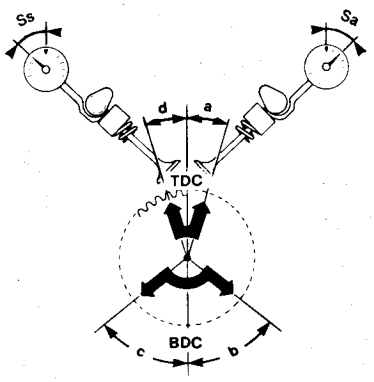
mm (in)

				Engine			
				1600	1800	2000	
				(016.00)	(016.78)	(016.55)	(017.13)
Intake	Opening	Linear displacement of tappet	(Sa)	0.25 (0.010)			
		Corresponding angular movement (BTDC) (2)	(a)	14°46' to 17°46'	21°30' to 24°30'		4° to —3°
	Closing	Linear displacement of tappet	(Sa)	0.25 (0.010)			
		Corresponding angular movement (ABDC)	(b)	38°46' to 41°46'	40°30' to 43°30'		65° to 72°
Exhaust	Opening	Linear displacement of tappet	(Ss)	0.20 (0.008)			
		Corresponding angular movement (BBDC)	(c)	44°46' to 47°46'	40°30' to 43°30'		38°30' to 41°30'
	Closing	Linear displacement of tappet	(Ss)	0.20 (0.008)			
		Corresponding angular movement (ATDC)	(d)	8°46' to 11°46'	21°30' to 24°30'		14°30' to 17°30'

(1) Engine cold
(2) ATDC for 017.13 engines

VALVE TIMING DATA (1)

VALVE OPENING AND CLOSING ANGLE CHECK (crankshaft rotation counterclockwise when viewed from flywheel side)



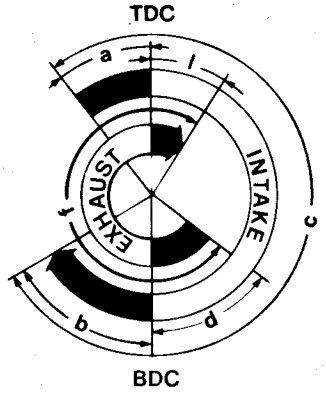
mm (in)

				Engine			
				1600	1800	2000	1800
				(061.00)	(062.02)	(062.12)	(061.34)
Intake	Opening	Linear displacement of tappet	(Sa)	0.25 (0.010)			0.25 (0.010)
		Corresponding angular movement (BTDC)	(a)	27°30' to 30°30'			14°49' to 17°49'
	Closing	Linear displacement of tappet	(Sa)	0.25 (0.010)			0.25 (0.010)
		Corresponding angular movement (ABDC)	(b)	38°30' to 41°30'			28°49' to 31°49'
Exhaust	Opening	Linear displacement of tappet	(Ss)	0.20 (0.008)			0.125 (0.005)
		Corresponding angular movement (BBDC)	(c)	38°30' to 41°30'			50°45'30'' to 53°45'30''
	Closing	Linear displacement of tappet	(Ss)	0.20 (0.008)			0.125 (0.005)
		Corresponding angular movement (ATDC)	(d)	14°30' to 17°30'			2°45'30'' to 5°45'30''

(1) Engine cold

VALVE TIMING DATA (1)

VALVE TIMING DIAGRAM
(crankshaft rotation clockwise when viewed from front)

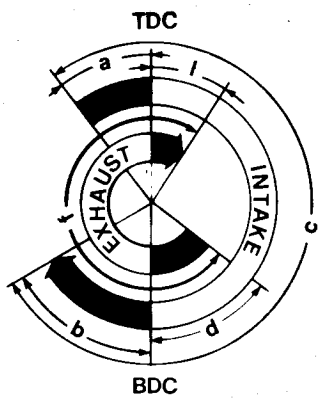


			Engine			
			1600	1800	2000	
			(016.00)	(016.78)	(016.55)	(017.13)
Intake	Opens (BTDC)	(a)	40°30'	48°		28°44' to 21°44'
	Closes (ABDC)	(b)	64°30'	67°		90°28' to 97°28'
	Angle	(c)	285°8'	295°		299°12'
Exhaust	Opens (BBDC)	(d)	63°54'	60°20'		58°12'
	Closes (ATDC)	(e)	27°54'	41°20'		33°48'
	Angles	(f)	271°48'	281°40'		272°

(1) Engine cold

VALVE TIMING DATA (1)

VALVE TIMING DIAGRAM
(crankshaft rotation clockwise when viewed from front)

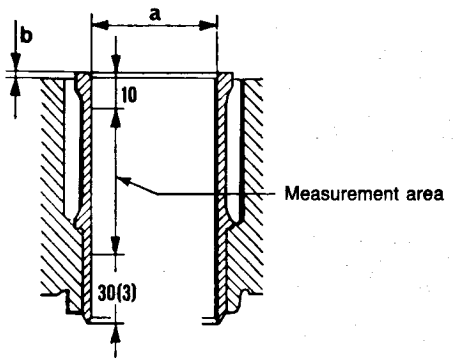


			Engine			
			1600	1800	2000	1800
			(061.00)	(062.02)	(062.12)	(061.34)
Intake	Opens (BTDC)	(a)	53°44'	53°44'		40°36'
	Closes (ABDC)	(b)	65°28'	65°28'		54°36'
	Angle	(c)	299°12'			275°12'
Exhaust	Opens (BBDC)	(d)	58°12'			60°
	Closes (ATDC)	(e)	33°48'			12°
	Angle	(f)	272°			252°

(1) Engine cold

CYLINDER LINERS, PISTONS, RINGS AND PINS

Cylinder liners

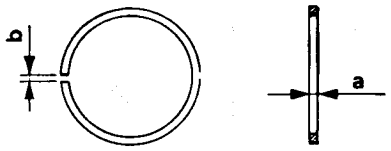


mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Liner bore dia. (a)	Class A (Blue)		77.985 to 77.994 (3.0703 to 3.0706)	79.985 to 79.994 (3.0703 to 3.0706)	83.985 to 83.994 (3.3065 to 3.3068)	
	Class B (Pink)		77.995 to 78.004 (3.0707 to 3.0710)	79.995 to 80.004 (3.1494 to 3.1497)	83.995 to 84.004 (3.3069 to 3.3072)	
	Class C (Green)		78.005 to 78.014 (3.0711 to 3.0714)	80.005 to 80.014 (3.1498 to 3.1502)	84.005 to 84.014 (3.3073 to 3.3076)	
Liner stand-out (1)		(b)	0.00 to 0.06 (0.00 to 0.0024)	0.01 to 0.06 (0.0004 to 0.0024)		
Max. ovality and taper (2)			0.01 (0.0004)			
Max. out-of-roundness			0.01 (0.0004)			

(1) Check after fitting liner retainers and tightening nuts to 10 - 15 Nm (1 to 1.5 kgm; 7.4 to 11.1 ft.lb)
(2) Max. limit along entire liner length (a)
(3) 26 mm (1 in) for 2000 engines (062.12)

Piston rings



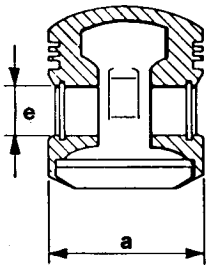
mm (in)

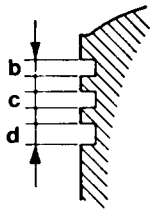
Description			Engine			
			1600	1800	2000	
			(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Ring thickness	(a)	Top compression ring	1.478 to 1.490 (0.0582 to 0.0587)		1.478 to 1.490 (0.0582 to 0.0587)	1.728 to 1.740 (0.0680 to 0.0685)
		2nd compression ring	1.728 to 1.740 (0.0680 to 0.0685) 1.478 to 1.490 (0.0582 to 0.0587) (2)		1.728 to 1.740 (0.0680 to 0.0685)	1.478 to 1.490 (0.0582 to 0.0587)
		Oil control ring	3.978 to 3.990 (0.1566 to 0.1571) 3.478 to 3.490 (0.1369 to 0.1374) (2)		4.478 to 4.490 (0.1763 to 0.1768)	3.478 to 3.490 (0.1369 to 0.1374)
Ring gap (1)	(b)	Top compression ring	0.30 to 0.45 (0.012 to 0.018) 0.30 to 0.50 (0.0118 to 0.0197) (2)		0.25 to 0.40 (0.010 to 0.016)	0.30 to 0.45 (0.012 to 0.018)
		2nd compression ring	0.30 to 0.45 (0.012 to 0.018) 0.30 to 0.50 (0.0118 to 0.0197) (2)		0.30 to 0.45 (0.012 to 0.018)	0.25 to 0.45 (0.010 to 0.018)
		Oil control ring	0.30 to 0.45 (0.012 to 0.018)	0.25 to 0.40 (0.010 to 0.016) 0.25 to 0.50 (2) (0.010 to 0.011) (2)	0.25 to 0.40 (0.010 to 0.016)	0.25 to 0.40 (0.010 to 0.016)

(1) Fitted in checking fixture or cylinder liner

(2) For 061.34 engine only

Pistons



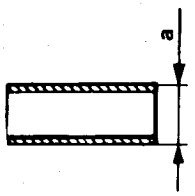


mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00 - 061.00)	(016.78 - 062.02 - 061.34)	(016.55 - 061.12)	(017.13)
Piston diameter (1)	(a)	Class A (Blue)	77.945 to 77.955 (3.0687 to 3.0691)	79.945 to 79.955 (3.1474 to 3.1478) 79.935 to 79.945 (4) (3.1470 to 3.1474) (4)	83.935 to 83.945 (3.3045 to 3.3049)	
		Class B (Pink)	77.955 to 77.965 (3.0691 to 3.0695)	79.955 to 79.965 (3.1478 to 3.1482) 79.845 to 79.955 (4) (3.1435 to 3.1478) (4)	83.945 to 83.955 (3.3049 to 3.3053)	
		Class C (Green)	77.965 to 77.975 (3.0695 to 3.0699)	79.965 to 79.975 (3.1482 to 3.1486) 79.555 to 79.965 (4) (3.1320 to 3.1482) (4)	83.955 to 83.965 (3.3059 to 3.3057)	
Top compression ring groove width		(b)	1.535 to 1.555 (2) (0.0604 to 0.0612) (2) 1.525 to 1.545 (3) (0.0600 to 0.0608) (3)	1.525 to 1.545 (0.0600 to 0.0608)		
2nd compression ring groove width		(c)	1.775 to 1.795 (0.0699 to 0.0707) 1.525 to 1.545 (0.0600 to 0.0608) (4)			
Oil control ring groove width		(d)	4.015 to 4.035 (0.1581 to 0.1589) 3.515 to 3.535 (0.1384 to 0.1392) (4)		4.515 to 4.535 (0.1778 to 0.1785)	3.515 to 3.535 (0.1384 to 0.1392)
Pin bore dia.		(e) Black	22.000 to 22.002 (0.86614 to 0.86622) 22.001 to 22.003 (0.86617 to 0.86626) (4)			
		White	22.003 to 22.005 (0.86626 to 0.86634)			

(1) Measure at right angles to pin bore and at the following distance from lower edge of skirt:
1600 engine [Borgo piston, 17 mm (0.67 in) — Mondial piston, 20 mm (0.79 in)] - 1800 engine (15 mm, 0.59 in) - 2000 engine (17 mm, 0.67 in)
(2) Borgo piston (3) Mondial piston (4) For 061.34 engine only

Piston pins



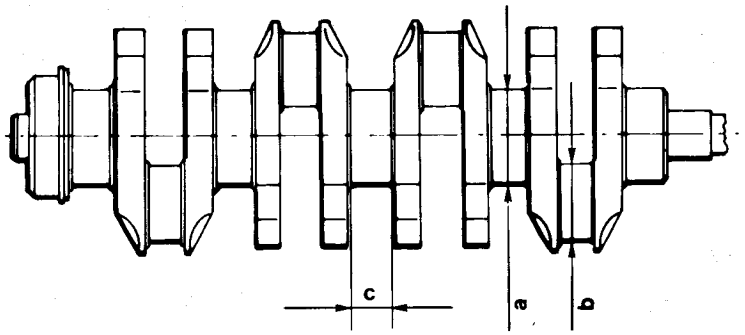
mm (in)

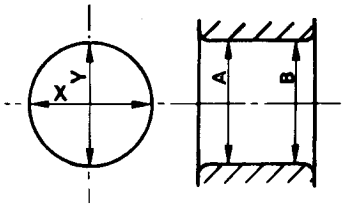
Description			Engine			
			1600	1800	2000	
			(016.00 - 061.000)	(016.78 - 062.02 - 061.34)	(016.55 - 062.12)	(017.13)
Pin diameter	(a)	Black	21.994 to 21.997 (0.8659 to 0.8660)			
		White	21.997 to 22.000 (0.8660 to 0.8661)			
Pin clearance		Black	0.003 to 0.008 (0.0001 to 0.0003) 0.004 to 0.009 (0.0002 to 0.0004) (1)			
		White	0.003 to 0.008 (0.0001 to 0.0003)			

(1) For 061.34 engine only

CRANKSHAFT, ENGINE BLOCK, CONNECTING RODS, BEARINGS AND FLYWHEEL

Crankshaft





Ovality: X-Y
Taper: A-B

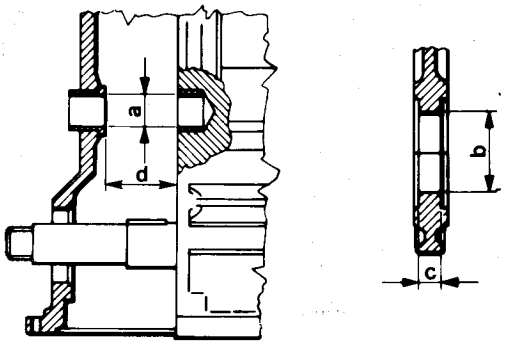
mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00)	(016.78 - 062.02)	(016.55 - 017.13)	(062.12)
Main journal diameter	(a)	Standard Blue	59.951 to 59.961 (2.3603 to 2.3607)			59.956 to 59.966 (2.3605 to 2.3609)
		Standard Red	59.961 to 59.971 (2.3607 to 2.3611)			59.966 to 59.976 (2.3609 to 2.3613)
Crankpin diameter	(b)	Standard Blue	49.978 to 49.988 (1.9676 to 1.9680)			
		Standard Red	49.988 to 49.998 (1.9680 to 1.9684)			
Center main bearing journal width	(c)	Standard	30.000 to 30.035 (1.1811 to 1.1825)			
Max permissible main journal and crankpin ovality			0.007 (0.0003)			
Max. permissible main journal and crankpin taper			0.01 (0.0004)			
Max. crankpin misalignment relative to main journals			0.015 (0.0006)			
Max. main journal eccentricity			0.04 (0.0016)			
Max. crankpin offset (crankpin centerline to main journal centerline)			0.3 (0.012)			

Description			Engine		
			1600	1800	
			(061.00)	(061.34)	
Main journal diameter	(a)	Standard Blue (1)	59.956 to 59.966 (2.3605 to 2.3609)		
		Standard Red	59.966 to 59.976 (2.3609 to 2.3613)		
Crankpin diameter	(b)	Standard Blue (1)	49.978 to 49.988 (1.9676 to 1.9680)		
		Standard Red	49.988 to 49.998 (1.9680 to 1.9684)		
Center main bearing journal width	(c)	Standard	30.000 to 30.035 (1.1811 to 1.1825)		
Max permissible main journal and crankpin ovality			0.007 (0.0003)		
Max. permissible main journal and crankpin taper			0.01 (0.0004)		
Max. crankpin misalignment relative to main journals			0.015 (0.0006)		
Max. main journal eccentricity			0.04 (0.0016)		
Max. crankpin offset (crankpin centerline to main journal centerline)			0.3 (0.012)		

(1) Standard Light Blue for 061.34 engine only

Engine block



mm (in)

Description		Engine			
		1600	1800	2000	
		(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Timing idler jackshaft bushing fitted I.D. (after reaming) (1)	(a)	20.677 to 20.698 (0.8141 to 0.8149)			
Main bearing housing bore width	(b)	63.647 to 63.666 (2.5058 to 2.5065) [63.652 to 63.671 (3)] [(2.5060 to 2.5067) (3)]			
Center main bearing housing width over thrust faces	(c)	25.15 to 25.20 (0.990 to 0.992)			
Width between timing idler jackshaft bushings (2)	(d)	47.720 to 47.820 (1.8787 to 1.8827)			

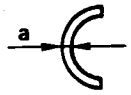
(1) Should replacement become necessary, always replace both bushings
(2) Check with cover and gasket installed and tightened
(3) For 1600 (061.00) - 1800 (062.02 and 061.34) and 2000 (062.12) engines only

Connecting rod

mm (in)

Description		Engine			
		1600	1800	2000	
		(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Small end bore I.D.	(a)	22.005 to 22.015 (0.8663 to 0.8667)			
Big end bore dia.	(b)	53.695 to 53.708 (2.1140 to 2.1145)			

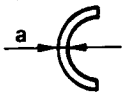
Connecting rod bearings



mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Connecting rod bearing wall thickness	(a)	Standard Blue	1.835 to 1.841 (0.0722 to 0.0725)			
		Standard Red	1.829 to 1.835 (0.0720 to 0.0722)			

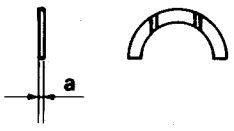
Main bearings



mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Main bearing wall thickness	(a)	Standard Blue	1.835 to 1.841 (0.0722 to 0.0725)			
		Standard Red	1.829 to 1.835 (0.0720 to 0.0722)			

Thrust rings

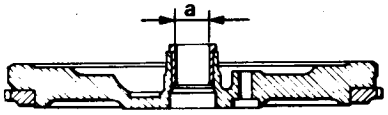


mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Thrust ring thickness	(a)	Standard	2.310 to 2.360 (0.0909 to 0.0929)		2.311 to 2.362 (0.0910 to 0.0930) (1)	

(1) For 061.34 engine only

Flywheel

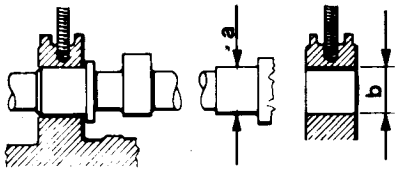


mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Center bushing fitted I.D.	(a)	After reaming	26.010 to 26.023 (1.0240 to 1.0245)			

CAMSHAFT, TAPPET, SPRINGS, CYLINDER HEAD AND VALVES

Camshaft



mm (in)

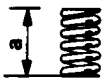
Description		Engine			
		1600	1800	2000	
		(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Camshaft journal diameter	(a)	26.959 to 26.980 (1.0614 to 1.0622)			
Camshaft journal housing bore dia.	(b)	27.000 to 27.033 (1.0630 to 1.0643)			

Tappet

mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Tappet diameter	(a)	Standard	34.973 to 34.989 (1.3698 to 1.3775)			
		Oversize	35.173 to 35.189 (1.3848 to 1.3854)			

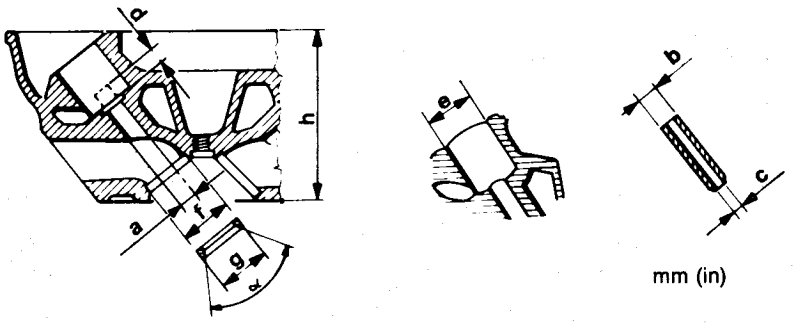
Springs



Description			Engine			
			1600	1800	2000	
			(016.00)	(016.78)	(016.55)	(017.13)
Spring length with valve open (a)	Outer spring	mm (in)	27.5 (1.08)			25.5 (1.00)
	Inner spring	mm (in)	26 (1.02)			23.5 (0.93)
Load at length (a)	Outer spring	kg (lb)	35.67 to 37.33 (78.6 to 82.3)		38.7 to 40.3 (85.3 to 88.3)	46.10 to 47.90 (101.6 to 105.6)
	Inner spring	kg (lb)	22.24 to 23.16 (49.0 to 51.1)			24.87 to 25.73 (54.8 to 56.7)

Description			Engine			
			1600	1800	2000	
			(061.00)	(062.02 - 061.34)	(062.12)	
Spring length with valve open (a)	Outer spring	mm (in)	25.5 (1.00)			
	Inner spring	mm (in)	23.5 (0.93)			
Load at length (a)	Outer spring	kg (lb)	46.10 to 47.90 (101.6 to 105.6)			
	Inner spring	kg (lb)	24.87 to 25.73 (54.8 to 56.7)			

Cylinder head

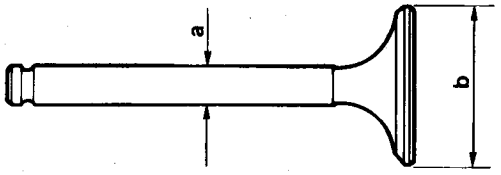


mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00 - 061.000)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Valve guide housing bore dia.		(a)	13.990 to 14.018 (0.5508 to 0.5519)			
Valve guide O.D.	(b)	Intake	14.033 to 14.044 (0.5525 to 0.5529)			
		Exhaust	14.033 to 14.044 (0.5525 to 0.5529) 14.048 to 14.059 (0.5531 to 0.5535) (4)			
Valve guide fitted I.D. (after reaming)		(c)	9.000 to 9.015 (0.3543 to 0.3549)			
Valve guide stand-out	(d)	Intake	13.300 to 13.500 (0.5236 to 0.5315) 11.800 to 12.000 (0.4646 to 0.4724) (3)			
		Exhaust	16.300 to 16.500 (0.6417 to 0.6496)			
Tappet housing bore dia.	(e)	Standard	35.000 to 35.025 (1.3780 to 1.3789)			
		Oversize	35.200 to 35.225 (1.3858 to 1.3868)			
Valve seat insert housing bore dia.	(f)	Intake (1)	42.532 to 42.557 (1.6745 to 1.6755)		45.000 to 45.025 (1.7717 to 1.7726)	
		Exhaust (1)	38.532 to 38.557 (1.5170 to 1.5180)		41.000 to 41.025 (1.6142 to 1.6152)	
		Intake (2)	42.832 to 42.857 (1.6863 to 1.6873)		45.300 to 45.325 (1.7835 to 1.7844)	
		Exhaust (2)	38.832 to 38.857 (1.5288 to 1.5298)		41.300 to 41.325 (1.6260 to 1.6270)	
Valve seat insert O.D.	(g)	Intake (1)	42.597 to 42.632 (1.6770 to 1.6784)		45.065 to 45.100 (1.7742 to 1.7756)	
		Exhaust (1)	38.597 to 38.632 (1.5196 to 1.5209) 38.642 to 38.658 (1.5213 to 1.5220) (4)		41.065 to 41.100 (1.6167 to 1.6181)	
		Intake (2)	42.897 to 42.932 (1.6889 to 1.6902)		45.365 to 45.400 (1.7860 to 1.7874)	
		Exhaust (2)	38.897 to 38.932 (1.5314 to 1.5328) 38.942 to 36.958 (1.5331 to 1.5338) (4)		41.365 to 41.400 (1.6285 to 1.6299)	
Seat insert face angle		(α)	120°			
Min. cylinder head height after dressing		(h)	111,5 (4.39)			
Max. parallelism error between head faces			0.087 (0.0034)			
Max. head bottom face warpage			0.05 (0.002)			

(1) Standard
(2) Oversize
(3) For 1600 (061.00) and 2000 (017.13) engines only
(4) For 061.34 engine only

Valves



mm (in)

Description			Engine			
			1600	1800	2000	
			(016.00)	(016.78)	(016.55)	(017.13)
Valve stem diameter	(a)	Intake	8.972 to 8.987 (0.3532 to 0.3538)			
		Exhaust	8.935 to 8.960 (0.3518 to 0.3528)			
Valve head dia. - ATE type	(b)	Intake	41.000 to 41.200 (1.6142 to 1.6220)		44.010 to 44.150 (1.7327 to 1.7382)	
		Exhaust	37.000 to 37.200 (1.4567 to 1.4646)		40.010 to 40.150 (1.5752 to 1.5807)	
Valve head dia. - Eaton-Livia type	(b)	Intake	41.000 to 41.150 (1.6142 to 1.6201)		44.000 to 44.150 (1.7327 to 1.7382)	
		Exhaust	37.000 to 37.150 (1.4567 to 1.4626)		40.000 to 40.150 (1.5752 to 1.5807)	

Description			Engine			
			1600	1800	2000	1800
			(061.00)	(062.02)	(062.12)	(061.34)
Valve stem diameter	(a)	Intake	8.972 to 8.987 (0.3532 to 0.3538)	8.972 to 8.987 (0.3532 to 0.3538)		8.972 to 8.987 (2) (0.3532 to 0.3538) (2)
		Exhaust	8.935 to 8.960 (0.3518 to 0.3528)	8.935 to 8.960 (0.3518 to 0.3528) (1)		8.940 to 8.960 (0.3520 to 0.3528) 8.945 to 8.960 (2) (0.3522 to 0.3528) (2)
Valve head dia. - Ate type	(b)	Intake	41.000 to 41.200 (1.6142 to 1.6220)	41.000 to 41.200 (1.6142 to 1.6220)	44.000 to 44.150 (1.7323 to 1.7382)	41.000 to 41.200 (1.6142 to 1.6220)
		Exhaust	37.000 to 37.200 (1.4567 to 1.4646)	37.000 to 37.200 (1.4567 to 1.4646)	40.010 to 40.150 (1.5752 to 1.5807)	37.000 to 37.200 (1.4567 to 1.4646)
Valve head dia. - Eaton-Livia type	(b)	Intake	41.850 to 42.000 (1.6476 to 1.6535)	41.850 to 42.000 (1.6476 to 1.6535)	44.000 to 44.150 (1.7323 to 1.7382)	41.850 to 42.000 (1.6476 to 1.6535)
		Exhaust	37.000 to 37.150 (1.4567 to 1.4626)	37.000 to 37.150 (1.4567 to 1.4626)	40.000 to 40.150 (1.5748 to 1.5807)	37.000 to 37.150 (1.4567 to 1.4626)

(1) ATE exhaust valve stem diameter is 8.940 to 8.960 mm (0.3520 to 0.3528 in) for 2000 engine (062.12)
(2) For Eaton-Livia valve

FITTING DATA

mm (in)

Description		Engine			
		1600	1800	2000	
		(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Liner/piston clearance		0.030 to 0.049 (0.0012 to 0.019) 0.040 to 0.059 (0.0016 to 0.0019) (3)		0.040 to 0.059 (0.0016 to 0.0023)	
Ring/groove clearance	Top compression ring	0.045 to 0.077 (1) (0.0018 to 0.0030) (1) 0.035 to 0.067 (2) (0.0014 to 0.0026) (2)	0.035 to 0.067 (0.0014 to 0.0026)		
	2nd compression ring	0.035 to 0.067 (0.0014 to 0.0026)			
	Oil control ring	0.025 to 0.057 (0.0010 to 0.0022)			
Pin/piston bore clearance	Black	0.003 to 0.008 (0.0001 to 0.0003) 0.004 to 0.009 (0.0002 to 0.0003) (3)			
	White	0.003 to 0.008 (0.0001 to 0.0003)			
Pin/small end clearance	Black	0.008 to 0.021 (0.0003 to 0.0008)			
	White	0.005 to 0.018 (0.0002 to 0.0007)			
Main bearing journal running clearance	Blue	0.004 to 0.045 (0.0002 to 0.0018)			
	Red	0.006 to 0.047 (0.0002 to 0.0019)			
Crankpin running clearance	Blue	0.025 to 0.060 (0.0010 to 0.0024)			
	Red	0.027 to 0.062 (0.0011 to 0.0024)			
Crankshaft end play		0.080 to 0.265 (0.0031 to 0.0104)			
Big end end play		0.2 to 0.3 (0.008 to 0.012)			
Camshaft journal running clearance		0.020 to 0.074 (0.0008 to 0.0029)			
Camshaft end play		0.065 to 0.182 (0.0026 to 0.0072)			
Tappet working clearance		0.011 to 0.052 (0.0004 to 0.0020)			
Valve stem/guide	Intake	0.013 to 0.043 (0.0005 to 0.0017)			
	Exhaust	0.040 to 0.080 (0.0016 to 0.0031) 0.040 to 0.075 (0.0016 to 0.0030) (3) 0.040 to 0.070 (0.0016 to 0.0028) (4)			
Valve guide interference fit	Intake	0.015 to 0.054 (0.0006 to 0.0021)			
	Exhaust	0.015 to 0.054 (0.0006 to 0.0021) 0.030 to 0.069 (0.0012 to 0.0027) (3)			
Seat insert interference fit	Intake	0.04 to 0.10 (0.002 to 0.004)			
	Exhaust	0.04 to 0.10 (0.002 to 0.004) 0.085 to 0.126 (0.0033 to 0.050) (3)			

(1) Borgo piston (2) Mondial piston (3) For 061.34 engine only (4) For Eaton-Livia valve

SHRINK-FIT TEMPERATURE

Component	Temperature
Cylinder head (valve seat installation)	100°C (212°F) 140°C (284°F) (1)
Starter ring gear	120° to 140°C (248 to 284°F)

(1) For 061.34 engine only

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Application	Type	Name	Quantity - kg (lb)
Rear main bearing cap seals	FLUID	UNION CARBIDE CHEMICALS CO: Ucon Lubricant 50HB-5100 MILLOIL: Lubricant for rubber Part No. 4500-17502	As required
Crankshaft seals (front and rear) — Outer surface — Lip	 OIL GREASE	 AGIP SINT 2000 10W50 Part No. 3631-69352 ISECO Part No. 3671-69841	 As required As required
Engine oil - full oil pan Filter Difference between max et min level on dipstick Routine changes - pan and filter Cylinder head well (1)	OIL	AGIP SINT 2000 10W50 Part No. 3631-69352 IP SINTIAX 10W40 Part No. 3631-69352	4.5 (9.9) 0.5 (1.1) 1.150 (2.54) 5 (11) 0.415 (0.91) per well (2)
Spark plug threads	OIL	ISECO: Molykote A Part No. 4500-18304	As required

(1) Fill only after camshaft removal
(2) With cylinder head completely dry

SEALANTS

Application		Type	Name	Quantity
Front cover screws (to head)	(1)	SEALING COMPOUND	DIRING: Curil Part No. 3522-00017	As required
Camshaft cover contact surface	(1)	SEALING COMPOUND	DIRING: Heldite Part No. 3522-00015	As required
Flywheel screws Timing variator spigot on camshaft	(2) (2)	SEALING COMPOUND	LOCTITE 270 (green) Part No. 3524-00009	As required
Carburetter cushion pad gaskets		SEALING COMPOUND	DIRING Heldite DOW CORNING: Hermetite Part No. 3522-00015	As required

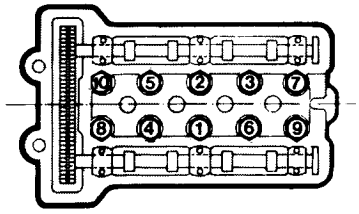
(1) To remove traces of old gasket from cylinder head or block faces use butyl acetate or methylketone
(2) Before applying sealing compound, remove all traces of old sealant from threads using a suitable brush and compressed air
Always degrease threads using trichloroethylene or chlorothene

ABRASIVES

Application	Type	Name	Quantity
Valves and valve seats	GRINDING PASTE	SIPAL AREXONS: Carbosilicium for valves Part No. 4100-31502	As required

TIGHTENING TORQUES

Nm (kgm; ft.lb)

Part	Engine			
	1600	1800	2000	
	(016.00 - 061.00)	(016.78 - 062.02) (061.34)	(016.55 - 062.12)	(017.13)
Main bearing cap nuts (wet)	46 to 49 (4.7 to 5; 33.9 to 36.1)			
Flywheel screws (with specified sealant)	110 to 113 (11.2 to 11.5; 81.1 to 83.3)			
Connecting rod cap nuts (wet)	49 to 52 (5 to 5.3; 36.1 to 38.4)			
Crankshaft pulley nut (wet)	187 to 195 (19 to 20; 137.9 to 143.8)			
Variator on camshaft				98 to 117 (10 to 12; 72.3 to 86.3)
Variator gear lockring (wet)				108 to 118 (11 to 12; 79.7 to 87.0)
Cylinder head nut tightening sequence (1)				
a) On head installation proceed as follows: — with engine cold, tighten progressively in proper sequence with washers, nuts and threads lubricated	77 to 79 (7.9 to 8.1; 56.8 to 58.3)	71 to 73 (7.2 to 7.4; 52.3 to 53.8)	77 to 79 (7.9 to 8.1; 56.8 to 58.3)	
— with engine warm, tighten without slackening	82 to 83 (8.4 to 8.5; 60.5 to 61.2)	75 to 76 (7.6 to 7.7; 55.3 to 56.1)	82 to 83 (8.4 to 8.5; 60.5 to 61.2)	
b) After 1000 km (620 mi.), slacken nuts one at a time by one turn in proper sequence when engine is cold, lubricate washer and nut contact surfaces and re-tighten	86 to 88 (8.8 to 9; 63.4 to 64.9)	76 to 78 (7.8 to 8; 56.1 to 57.5)	86 to 88 (8.8 to 9; 63.4 to 64.9)	
Camshaft bearing cap nuts (wet)	20 to 22 (2 to 2.25; 14.8 to 16.2)			
Main bearing locknut (wet)	11 to 13 (1.1 to 1.3; 8.1 to 9.6)			
Camshaft cover knobs	14 to 20 (1.4 to 2; 10.3 to 14.8)			
Front cover and water pump nuts	14 to 22 (1.36 to 2.25; 10.3 to 16.2)			
Spark plugs	25 to 34 (2.5 to 3.5; 18.4 to 25.1)			
Coolant temperature sending unit on intake manifold	34 to 39 (3.5 to 4; 25.1 to 28.8)			
High coolant temperature indicator sending unit on cylinder head	20 to 25 (2 to 2.5; 14.8 to 18.4)			
Thermostat cover screws (2)	10 to 16 (1 to 1.6; 7.4 to 11.8)			
Nuts securing turbocharger to exhaust manifold (3)		38 to 47 (3.9 to 4.8; 28 to 34.6)		
Nuts securing turbochager exhaust gas union to turbine (3)		38 to 47 (3.9 to 4.8; 28 to 34.6)		
Bolts securing turbocharger exhaust gas union to exhaust pipe (3)		19 to 24 (1.9 to 2.4; 14 to 17.7)		
Nuts securing exhaust manifold to cylinder head (3)		19 to 24 (1.9 to 2.4; 14 to 17.7)		
Bolts securing turbocompressor lower support to engine block (3)		19 to 24 (1.9 to 2.4; 14 to 17.7)		
Bolts securing turbocharger to lower support (3)		19 to 24 (1.9 to 2.4; 14 to 17.7)		
Bolts securing oil delivery hose to turbocompressor (3)		19 to 24 (1.9 to 2.4; 14 to 17.7)		
Nut securing oil filter support (3)		19 to 24 (1.9 to 2.4; 14 to 17.7)		
Bolt securing oil delivery hose union to engine block (3)		40 to 50 (4.0 to 5.0; 29.5 to 36.8)		
Bolt securing water delivery hose union to turbocharger (3)		50 to 62 (5.0 to 6.2; 36.8 to 45.7)		
Bolt securing water delivery hose union to engine block (3)		50 to 62 (5.0 to 6.2; 36.8 to 45.7)		

(1) Proceed as described in paragraph b) for service coupons A and B (2) Excluding 061.34 engine (3) For 061.34 engine only

TURBOCHARGER TROUBLESHOOTING

Defect	Possible cause	Remedy
Turbocharger noisy or vibrating	• Inefficient lubrication of rotor arm bearings	Check engine oil pressure and turbocharger oil ducts
	• Leakage into the intake or exhaust manifold	Tighten screws of defective connections and/or replace gaskets
	• Rotor shaft unbalanced	Replace turbocharger
Supercharging pressure too low (check pressure gauge) or insufficient engine power	• Leakage in the section between turbocharger and cylinder head	Tighten the retaining screws and/or replace defective gaskets
	• Waste-gate valve badly adjusted	Adjust waste-gate valve and replace if necessary
	• Waste-gate valve does not close	
	• Supercharging pressure regulating valve open	Check valve
	• Exhaust pipe clogged	Clear or replace
	• Air filter clogged	Replace air filter
	• Intercooler clogged	Clean intercooler
Supercharging pressure too high (check pressure gauge)	• Waste-gate valve badly adjusted	Adjust waste-gate valve
	• Waste-gate valve blocked in closed position (stem bent)	Replace waste-gate valve
Oil leakage from rotor shaft gaskets (blue exhaust fumes)	• Faulty oil return to engine	Check for obstruction
	• Oil leakage into turbine	Excessively worn rotor segments Replace turbocharger
	• Engine oil filter clogged	Replace oil filter
	• Turbocharger rotor gasket worn	Replace turbocharger

NOTE:
Supercharged engines are also subject to all the classic troubles (noise, etc.) of induction engines.

TROUBLESHOOTING

Defect	Possible cause	Remedy
Engine noisy. Crankshaft knocks	Excessive bearing journal or crankpin clearance and/or excessive play at thrust rings	Replace bearings and/or thrust rings
Pistons and connecting rods knock	• Improper installation • Pin shifts sideways	Remove and install correctly Remove and install correctly
Camshafts and valves knock	• Excessive valve clearance • Bad tappet fit • Failed valve spring • Worn camshafts	Adjust Replace Replace Replace
Water pump noisy	Excessive impeller shaft bearing clearance	Replace water pump

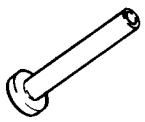
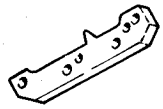
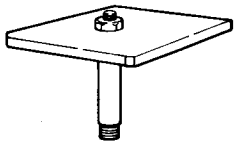
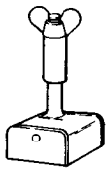
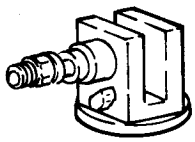
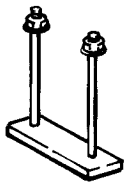
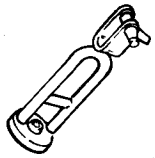
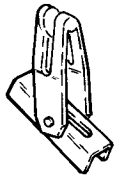
Other mechanical problems

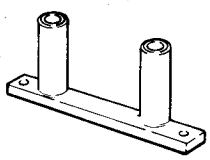
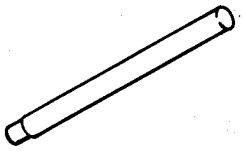
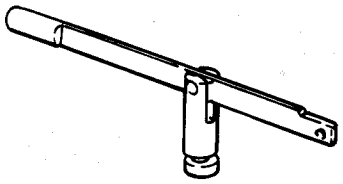
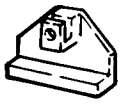
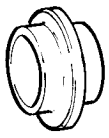
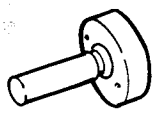
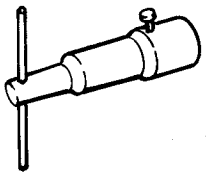
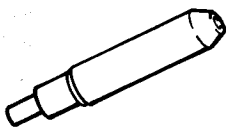
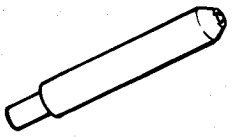
Burnt valves	• Incorrect valve clearance • Failed valve spring	Replace and adjust clearance Replace
Excessive piston and cylinder liner wear	• Bad piston fit • Poor quality oil • Air cleaner dirty or ineffective • Fuel mixture too rich	Install correctly Use suitable oil Replace air cleaner Adjust or replace carburetter
Damaged connecting rod bearing	• Oil starvation • Poor quality oil • Crankpins worn or out-of-round • Crankpin/bearing grade mismatched	Check lubrication system Use suitable oil Re-condition or replace Replace
Damaged main bearing	• Oil starvation • Poor quality oil • Main bearing journals worn or out-of-round • Main journal/bearing grade mismatched	Check lubrication system Use suitable oil Re-condition or replace Replace
Timing chain and chain tensioner noisy	• Worn chain • Incorrect chain tension • Noisy tensioner	Replace Adjust tensioner Replace
Incorrect ignition timing	Distributor incorrectly installed	Adjust

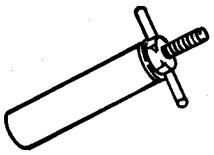
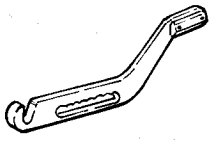
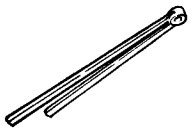
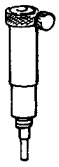
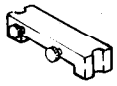
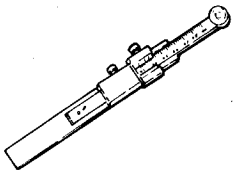
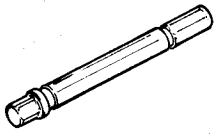
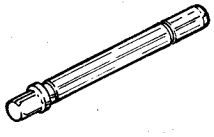
Lubrication

Oil leakage	• Loose drain plug • Leakage past oil pan gasket • Leakage past camshaft cover gasket and/or seals • Leakage past crankshaft seals and gaskets • Leakage past filter gasket	Tighten Replace gasket Replace gasket and seals Replace worn gasket and seals Tighten filter
Low oil pressure	• Clogged pressure regulating valve • Poor quality oil	Clean valve Change oil

SERVICE TOOLS

Reference number	Description	Page
A.2.0117	Cylinder liner retainer (2 pieces) 	01-29
A.2.0145	Flywheel retainer 	01-31
A.2.0146	Cylinder head removal tool 	01-29
A.2.0192	Valve support 	01-34
A.2.0195	Cylinder head support base 	01-33
A.2.0196	Cylinder head support fork 	01-33
A.3.0103/0006	Valve spring compressor 	01-34
A.3.0103/0010	Valve spring compressor lever support 	01-34

Reference number	Description	Page
A.3.0113	Rear main bearing cap seal installer 	01-47
A.3.0134	Valve guide remover 	01-37
A.3.0139/0001	Rear main bearing cap remover lever 	01-32
A.3.0139/0002	Rear main bearing cap puller 	01-32
A.3.0146	Front crankshaft seal installer 	01-50
A.3.0178	Rear crankshaft seal installer 	01-47
A.3.0210	Timing idler bushing puller, adjustable from 15 to 22 mm (0.6 to 0.9 in) dia. 	01-40
A.3.0244	Intake valve guide seal installer 	01-44
A.3.0246	Intake valve guide installer 	01-38

Reference number	Description	Page
A.3.0247	Valve guide seal remover 	01-34
A.3.0324	Valve spring compressor lever 	01-34
A.5.0103	Camshaft rotator 	01-51
C.6.0122	Top dead center gauge 	01-52
C.6.0148	Cylinder liner/piston standout gauge 	01-40
C.6.0168	Valve clearance gauge 	01-45
C.8.0103	Idler gear bushing plug gauge 	01-40
U.2.0040	Idler gear bushing roughing reamer 	01-47
U.2.0041	Idler gear bushing finishing reamer 	01-47

INSTALLATION

For the following operations refer to «Underbody» view of vehicle in question.

CAUTION:
Proceed with great care to avoid damaging the servo-assisted steering box.

1. Preliminary operations

a. Fit the operating lever on the engine rear support.
b. Hook the engine on the appropriate lifting bracket, and using a hoist, drop it slowly into the engine compartment, positioning it as necessary with the operating lever.
c. Centre the engine in its compartment, resting it on the two side supports, and make sure that the screw and stud holes correspond on both supports.
d. Insert and lock on both sides, screws (24) securing the flexible supports to the body.
e. Lift the vehicle, screw and lock, on both sides, nuts (22) securing the lower part of the flexible supports to the body.
f. Remove the operating lever from the engine rear support.

2. Installation of propeller shaft

a. Reinstall the complete propeller shaft unit on the vehicle by reversing the removal procedure and observing the following instructions.

— **Lubricate** propeller shaft front bush and the rear coupling spherical seat with **5 cm³ (0.30 u·in)** of **ISECO MOLYKOTE BR2** grease.
— Rotate the propeller shaft a little at a time, blocking it in a suitable way, and tightening the flexible couplings bolts and nuts to the prescribed torque.

(T) : **Tightening torque**
Nuts and bolts securing the propeller shaft flexible couplings to the engine flywheel and clutch fork
55 to 57 N·m
(5.6 to 5.8 kg·m
40.5 to 42.0 ft·lb)

— Lock the nuts securing propeller shaft centre support to vehicle floor.

(T) : **Tightening torque**
Nuts securing propeller shaft centre support
93 to 103 N·m
(9.5 to 10.5 kg·m
70.0 to 77.4 ft·lb)

b. Secure engine rear support pin (3) to body.
c. Refit engine flywheel protective cover (6).
d. Reconnect rod (14) to speed gear lever with bolt (13), then fit boot (15).
e. Secure centre cross member (7) to the body.

3. Installation of exhaust pipe

a. Position exhaust pipe on retaining rings (8).
b. Loosen bolts (18).
c. Connect the centre section of the exhaust pipe to the end section without tightening clamp (17).
d. Secure the exhaust pipes to the corresponding manifolds inserting **new** gaskets.
e. Shake he exhaust pipe several times to ensure that it is correctly aligned.
f. Tighten bolts (18) and clamp (17) on end section.

For the following qperations refer to «View of engine compartment» of vehicle in question.

4. Installation of power steering

a. Position power steering pump (20), secure it to front bracket (26), and lock both screws.
b. Screw, without locking, the two screws securing the pump to the rear bracket.
c. Fit the drive belt on the pulleys, move the pump outwards to obtain prescribed belt tension, then lock the securing screws on front and rear brackets.

Load to be applied to belt centre:
P = 15 to 30 kg (33.1 to 66.1 lb)

Deflection:
F = 13 mm (0.51 in)

5. Installation of air conditioner compressor

a. Reconnect compressor lower bracket to engine block securing it from under the vehicle with the corresponding screws.
b. Refit compressor drive belt, and lock nut (48).
c. Restore correct tension to compressor drive belt and lock nut (47).

Load to be applied to belt centre:
P = 20 to 35 kg (44.1 to 77.2 lb)

Deflection:
F = 14 mm (0.55 in)

d. If hose unions (50) are disconnected, secure them to compressor (46).

6. Installation of radiator

Refit radiator together with electric fan, then reconnect cooling system tubing by reversing the order of the procedure described in «Removal» - step 5.

7. Electrical connections

Restore electrical connection, reversing the order of the procedure described in «Removal» - step 3.

8. Installation of accelerator control cable

a. Insert the accelerator control cable with sheath under the intake air box, and position it on bracket (9).
b. Rotate lever (7) and hook up the end of the accelerator control cable.

9. Air and fuel supply system

Restore air and fuel supply system by reversing the procedure described in «Removal» - step 2.

10. Final operations

a. Reconnect servobrake vacuum intake hose (14) to single - acting valve on intake air box.
b. Position battery in its compartment and secure it with the appropriate bracket.
c. Refill and adjust the following (see: «WORKSHOP MANUAL»

Alfa 90 / Alfa 75 — Group 00, Group 80.

— Engine oil
— Engine coolant
— Power steering system oil level
— Air conditioning system Freon
— Timing check
— Accelerator control cable adjustment
— Engine idle speed adjustment
— Adjustment of percentage off exhaust CO at idle
— Electric fan activation check on engine at normal running temperature

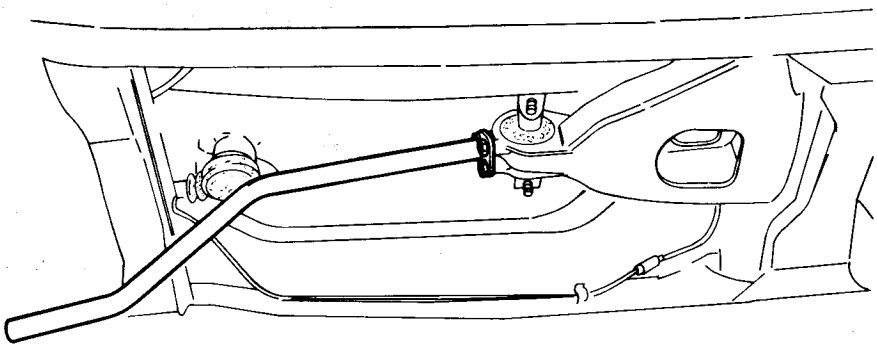
10. Exhaust pipe

a. Back off nuts retaining down pipe (5) to manifolds.

b. Back off three screws (20) retaining bracket (19) to bell housing.

c. Slacken clip (17) and separate center pipe to tail pipe.

d. Remove down pipe and center pipe together releasing four straps (8).



11. Propeller shaft

a. Back off retaining screws and remove center crossmember (7).

b. Slide off dust excluder (15), back off bolt (13) and disconnect link (14).

If necessary, back off four screws from support (12) and move support to facilitate propeller shaft removal.

c. Back off bolts and remove flywheel protector (6).

d. With transmission in neutral, suitably turn propeller shaft and remove each nut (2) and bolt (16) retaining shaft to flywheel and clutch fork respectively.

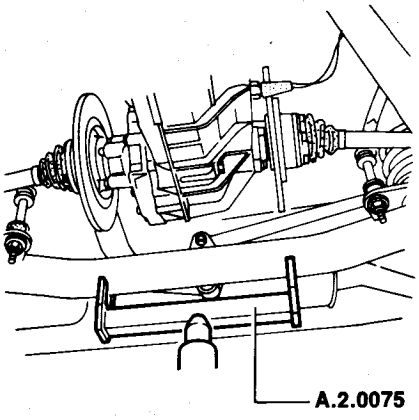
e. Back off two screws (4) and disconnect rear engine mount pivot (3) from body.

f. Back off two nuts (10) and disconnect center bearing (11) from body.

g. Back off screws retaining rear crossmember to body.

h. Raise rear axle using a platform lift with cradle **A.2.0075**.

Remove propeller shaft from clutch fork.



i. Lower the platform lift and remove the propeller shaft.

12. Final operations

a. Install a suitable service handle on rear engine mount to facilitate engine removal.

b. Back off nuts (22) retaining side mounts (23) at bottom.

c. Lower platform lift, and back off screws (24) retaining side mounts (23) at top.

d. Secure engine to lifting brackets, hoist engine and lift clear of engine compartment guiding it with the service handle.

NOTE:
Pay the utmost attention to prevent damaging power steering housing.

INSTALLATION

For the following operations refer to bottom view of vehicle in question.

NOTE:
Pay the utmost attention to prevent damaging power steering housing.

1. Preliminary operations

a. Install service handle on rear engine mount.

b. Fasten engine to lifting bracket and, using a suitable hoist, lower powerplant slowly in engine compartment guiding it with the service handle.

c. Centralize engine in engine compartment over the two side mounts and ensure that holes for screws and studs are correctly aligned on both mounts.

d. Start and tighten screws (24) retaining cushion mounts to body on both sides.

e. Raise vehicle, start and tighten nuts (22) retaining mounts to body at bottom on both sides.

f. Remove service handle from rear engine mount.

2. Propeller shaft

a. Reverse the removal sequence and adhere to the following instructions:

— **Lubricate** shaft front bushing and rear joint spherical seat using **5 cm³ (0,2 fl·oz)** of **ISECO MOLYKOTE BR2** grease.

— Restrain shaft by suitable means and tighten nuts and bolts of flex. couplings each in turn to the specified torque.

(T) **: Tightening torque**
Nuts and bolts retaining shaft flex. couplings to flywheel and clutch fork
55 to 57 N·m
(5.6 to 5.8 kg·m
40.6 to 42.0 ft·lb)

— Tighten nuts retaining center bearing to underbody.

(T) **: Tightening torque**
Center bearing nuts
93 to 103 N·m
(9.5 to 10.5 kg·m
68.6 to 76.0 ft·lb)

b. Fasten rear engine mount pivot (3) to body.

c. Install flywheel protector (6).

d. Connect remote control link (14) to gear lever using bolt (13) and position dust excluder (15).

e. Fasten center crossmember (7) to body.

3. Exhaust system

a. Position exhaust pipe over straps (8).
b. Finger tighten bolts (18).
c. Connect center pipe to rail pipe without tightening clip (17).
d. Fasten down pipes to manifolds installing **new** gaskets.
e. Rock exhaust pipe to obtain proper alignment.
f. Tighten bolts (18) and clip (17) on tail pipe.

In order to follow the following steps of the procedure consult the figure «View of the Engine Compartment» of the vehicle in question.

4. Steering pump

a. Position steering pump (55), fasten to front bracket (57) and tighten two capscrews.
b. Start two screws retaining pump to rear bracket.
c. Install drive belt on pulleys, move pump outward to obtain correct tensioning and tighten screws on front and rear brackets.

Force to be applied to belt at mid-leg:
P = 15 to 30 kg (33.1 to 66.1 lb)

Belt yield:
F = 13 mm (0.5 in)

5. Air conditioner compressor

a. Install compressor bottom bracket to block and secure with the associated screws from vehicle underside.
b. Install compressor drive belt and tighten nut (52).
c. Tension belt and tighten nut (51).

Force to be applied to belt at mid-leg:
P = 20 to 35 kg (44.1 to 77.2 lb)

Belt yield:
F = 14 mm (0.6 in)

d. If previously disconnected, install fittings of pipes (54) to compressor (53).

6. Radiator

Install radiator with attached fan, and connect coolant lines adopting a reversal of the removal sequence, op. 6.

7. Electrical connections

Establish electrical connections, adopting a reversal of the removal sequence, op. 4.

8. Accelerator cable

Connect accelerator cable adopting a reversal of the removal sequence, op. 5.

9. Air and fuel system

Establish connections of air induction and fuel system adopting a reversal of the removal sequence, ops. 2 and 3.

10. Final operations

a. Connect brake servo vacuum pipe (1) to right cylinder head connection.
b. Install battery in its recess, secure with bracket and connect terminal clamps.
c. For references and adjustments see specifications of appropriate groups.
d. Release hood, prop up and install hinge bolts on both sides of vehicle.
e. Install wiper arms.

ENGINE REMOVAL AND INSTALLATION

GTV 6 2.5

FOREWORD

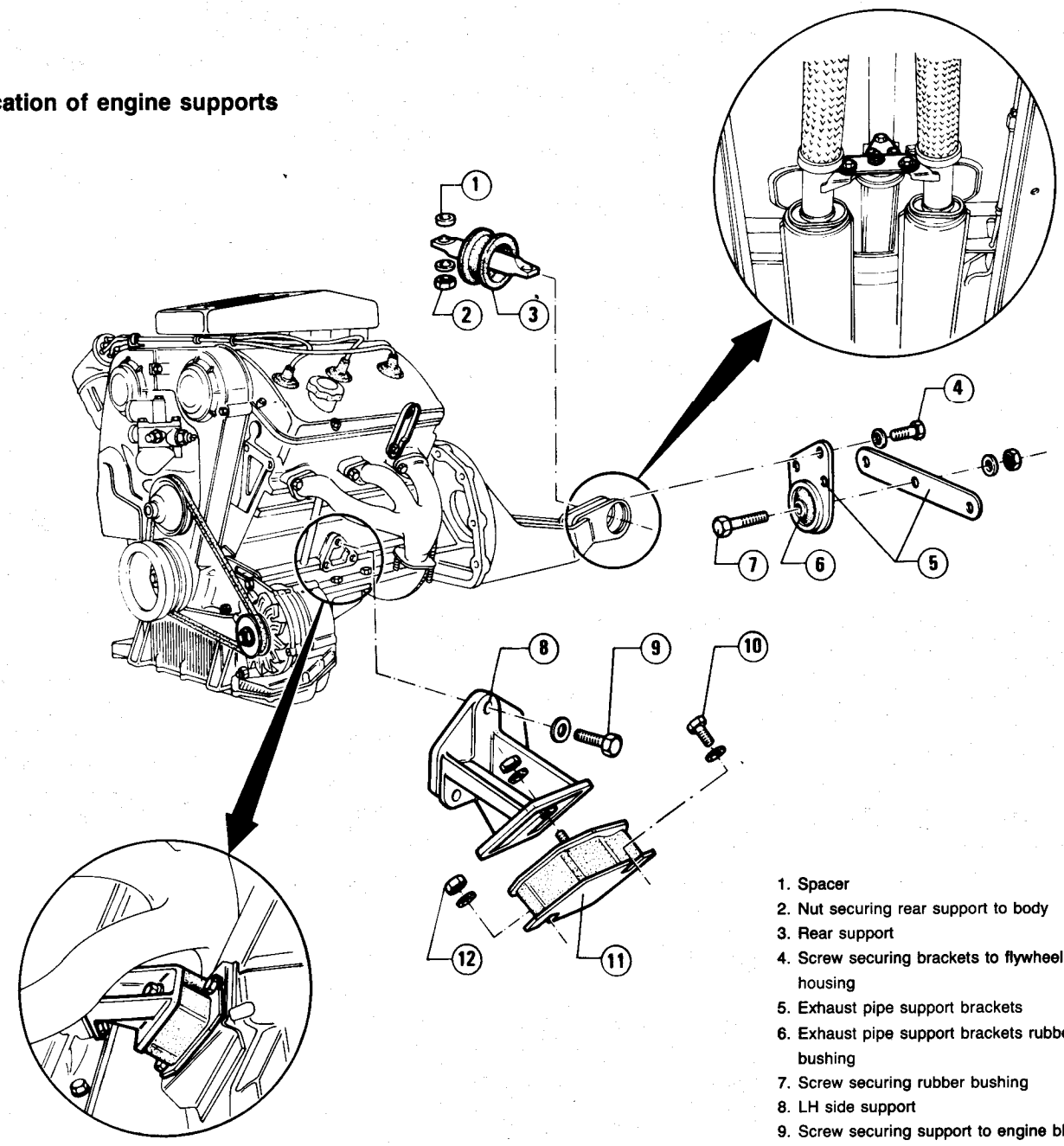
This section contains all the data and procedures relating to the removal and installation of the engine fitted on the following Alfa Romeo vehicle:

GTV 6 2.5 (016.46)

Given that the operations involved in removing and installing the engine are somewhat numerous, the operator is urged to read the intervention procedures carefully and to examine with care the illustration of the assembly that give an indispensable but of course incomplete overall view of the engine.

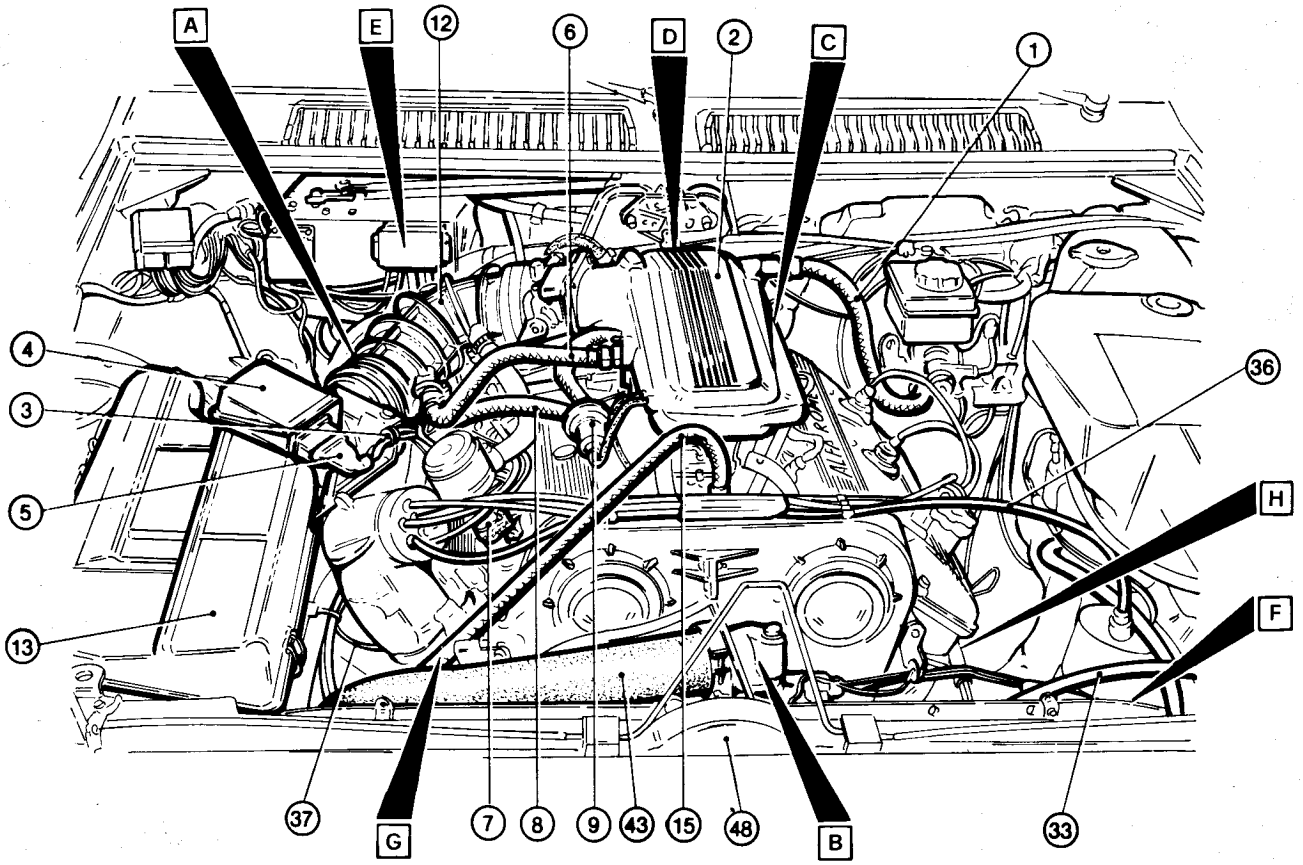
Following the above advice permits the correct operational techniques to be acquired and familiarizes the tecnician with the technical data, and caution and warning captions.

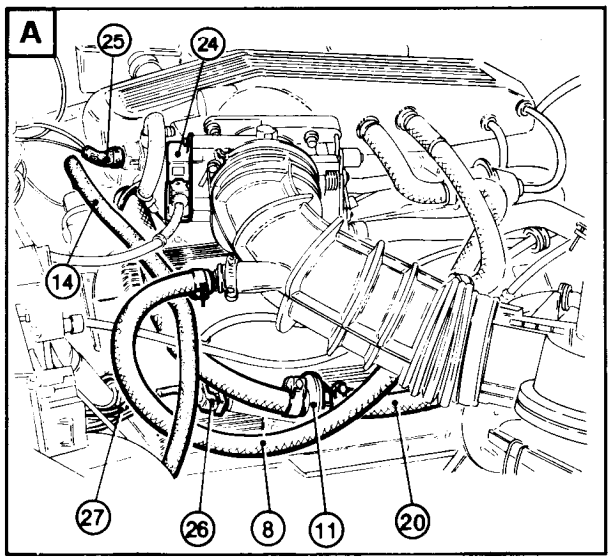
Location of engine supports

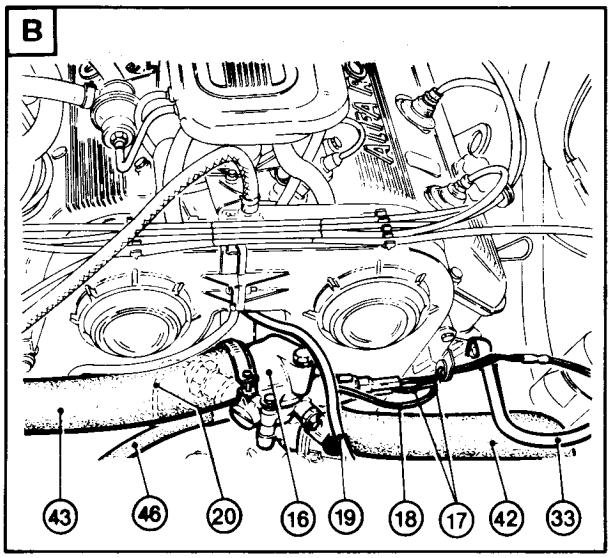


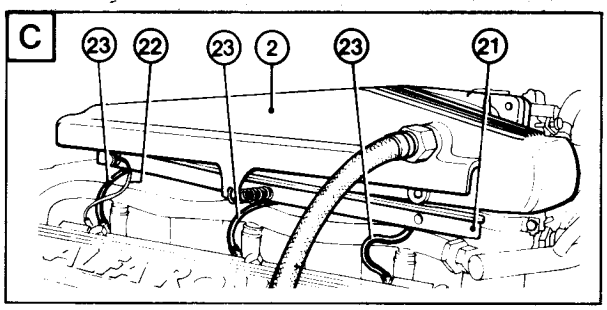
1. Spacer
2. Nut securing rear support to body
3. Rear support
4. Screw securing brackets to flywheel bell housing
5. Exhaust pipe support brackets
6. Exhaust pipe support brackets rubber bushing
7. Screw securing rubber bushing
8. LH side support
9. Screw securing support to engine block
10. Screw securing side support to body
11. LH side support flexible component
12. Nut securing side support to body

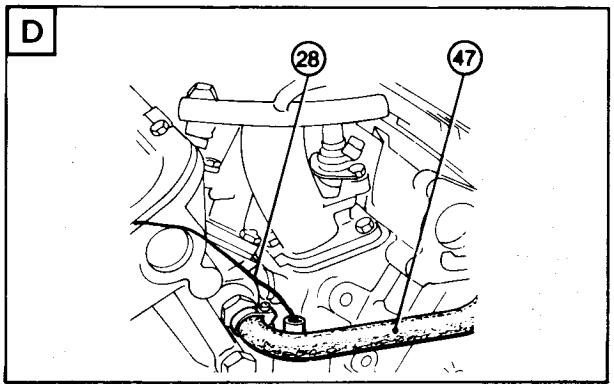
VIEW OF ENGINE COMPARTMENT GTV 6 2.5 (016.46)

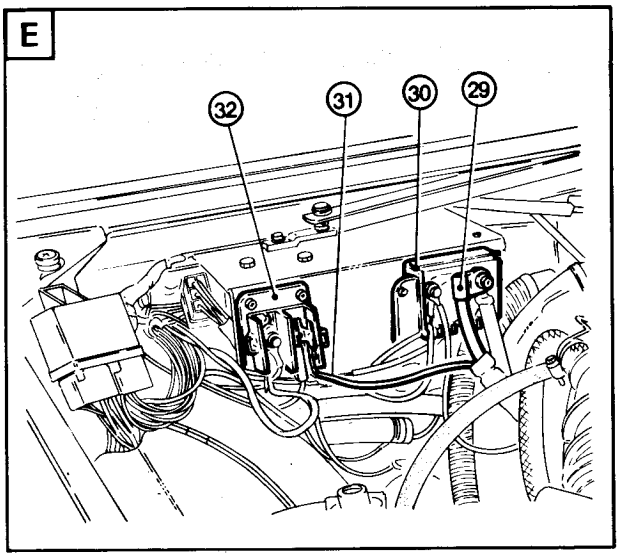


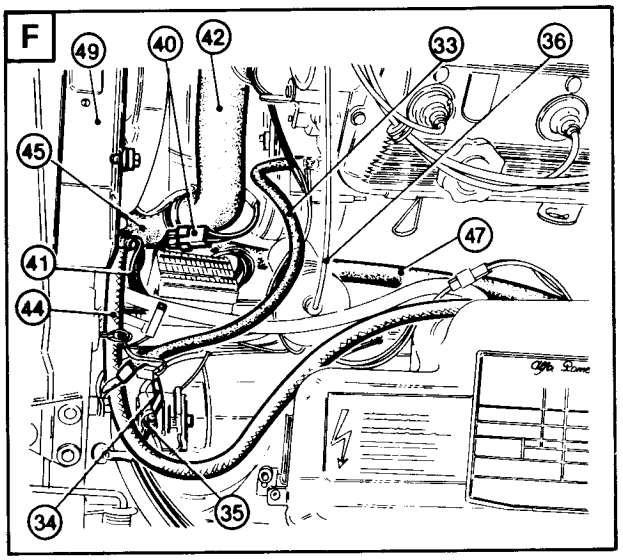


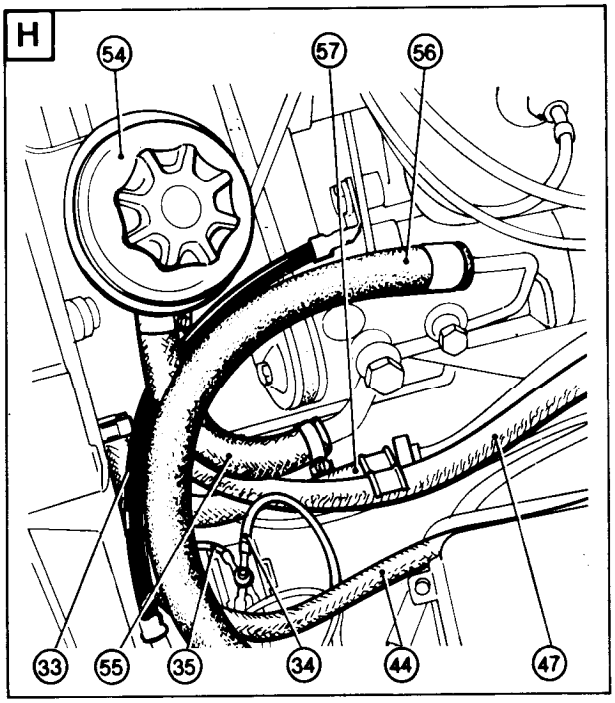


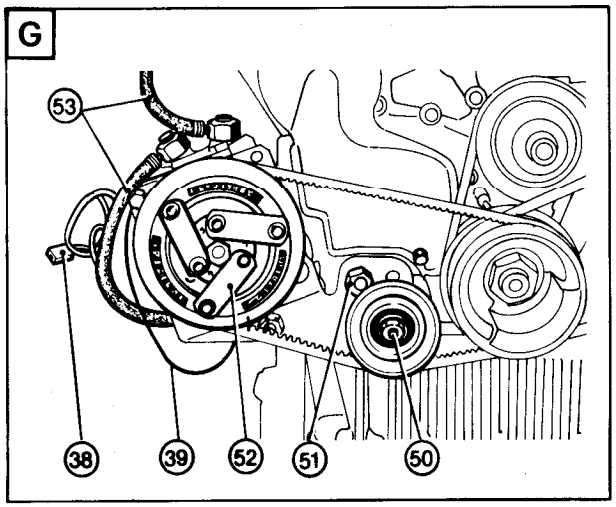






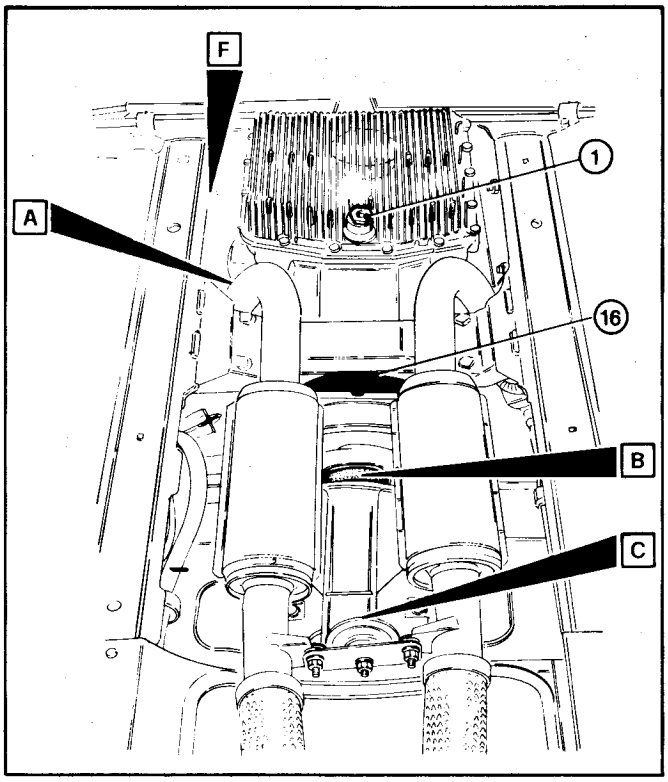




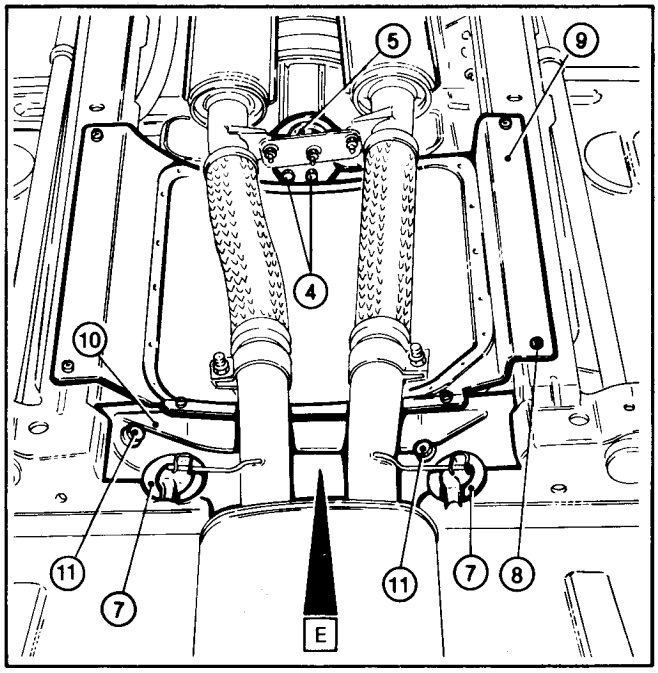


1. Vacuum servo line
2. Air intake box
3. Air supply measurement cable
4. Air supply measuring device
5. Bracket
6. Idling adjustment by-pass line
7. Oil vapour vent pipe
8. Vacuum regulating valve air intake line (versions: Switzerland, Sweden, Australia)
9. Vacuum regulating valve (versions: Switzerland, Sweden, Australia)
10. Auxiliary air delivery line for cold starting
11. Auxiliary air solenoid valve
12. Corrugated sleeve
13. Air filter cover
14. Fuel delivery line to manifold
15. Excess fuel return line
16. Thermostat group
17. Coolant temperature warning light and indicator cables
18. Thermostat group earth cable
19. Cable transmitting coolant temperature to ECU
20. Cold starting thermal switch cable
21. Air intake box guard
22. Earth plait
23. Electrical supply cables
24. Throttle opening position sender cable
25. Electro-injector supply cable for cold starting
26. Auxiliary air solenoid valve supply cable
27. Earth cable
28. Oil pressure sender cable
29. Starter supply cable
30. Terminal board
31. Energizing cable
32. Terminal board
33. Engine earth cable
34. Generator supply cable
35. Battery re-charging cable
36. Coil high voltage cable
37. Low voltage cable
38. Compressor electro-magnetic coupling supply cable
39. Conditioner compressor earth cable
40. Right and left fan supply cable
41. Fan enabling cable
42. Coolant return sleeve to thermostat group
43. Coolant return sleeve to radiator
44. Radiator vent pipe
45. Coolant outlet sleeve from radiator
46. Liquid return line from heater
47. Radiator filling line
48. Radiator fixing screws
49. Radiator
50. Compressor belt stretcher retaining nut
51. Belt stretcher bracket retaining screw
52. Conditioning system compressor
53. Compressor Freon inlet/outlet lines
54. Power steering oil reservoir
55. Power steering oil reservoir line
56. Pressure line
57. Return line

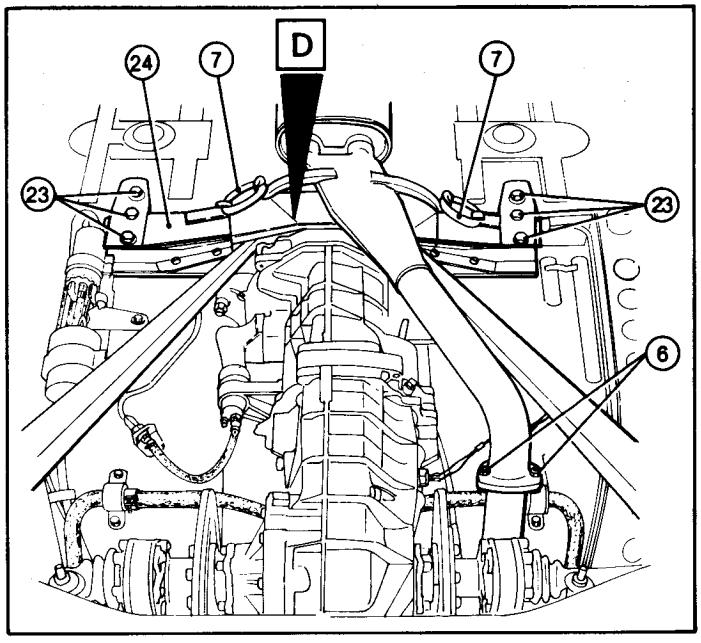
VIEW OF UNDERBODY GTV 6 2.5 (016.46)



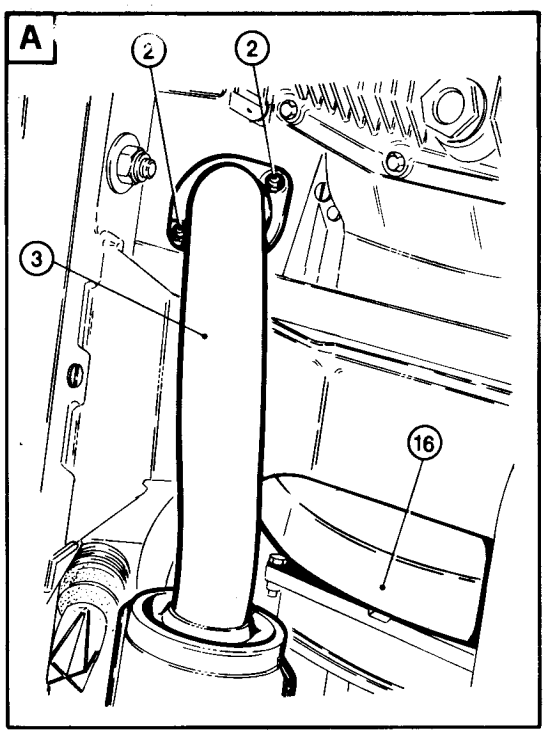
FRONT SECTION

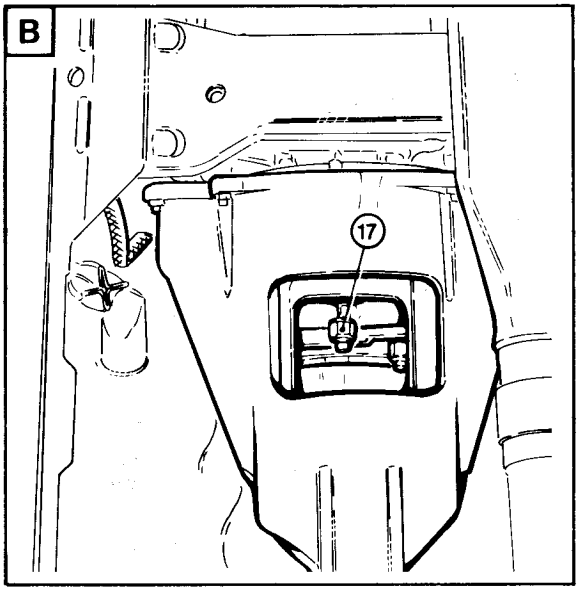


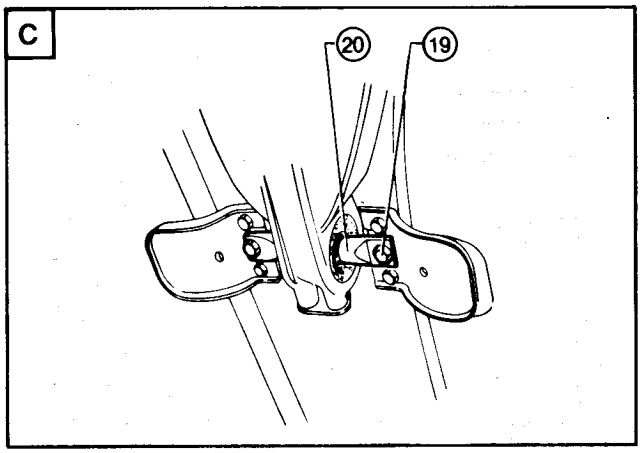
CENTRE SECTION

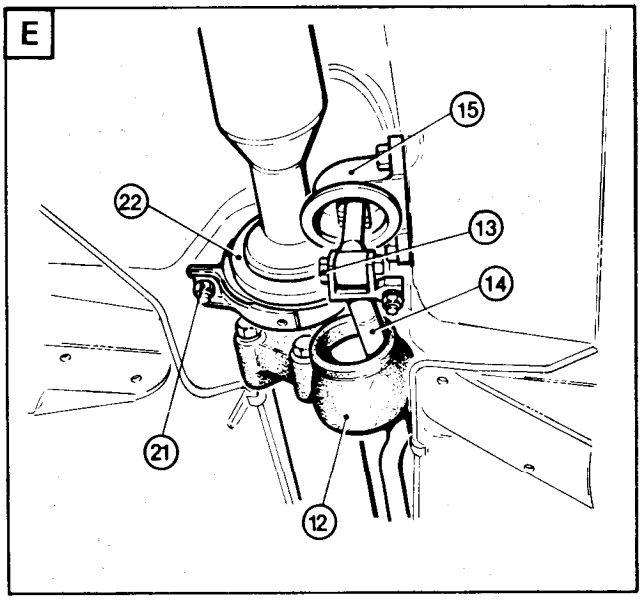


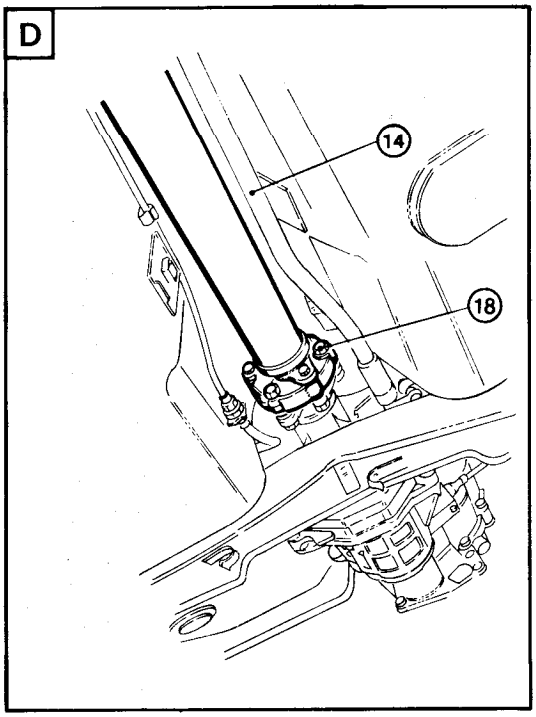
REAR SECTION

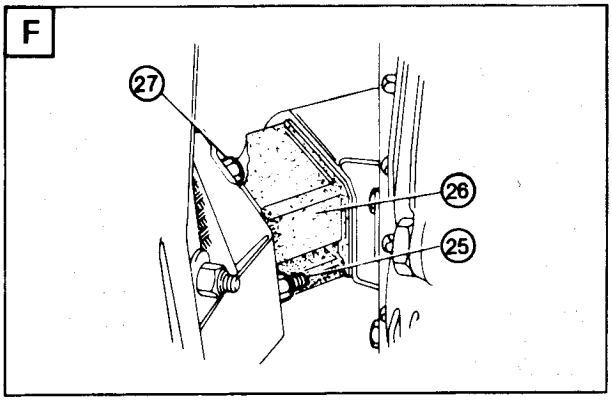












1. Oil drain plug
2. Exhaust pipe (front section) retaining nuts
3. Exhaust pipe (front section)
4. Exhaust pipe support bracket retaining bolts
5. Exhaust pipe support bracket
6. Exhaust pipe (centre section) retaining nuts
7. Retaining rings
8. Propeller shaft guard retaining screws
9. Propeller shaft guard
10. Centre cross member
11. Centre cross member retaining bolts
12. Boot
13. Gear control rod lever connecting bolt
14. Gear control rod
15. Gear control lever support
16. Engine flywheel protection plate
17. Front flexible coupling retaining nuts
18. Rear flexible coupling bolts
19. Bolts securing engine rear support to body shell
20. Engine rear support pin
21. Propeller shaft centre support retaining nuts
22. Propeller shaft centre support
23. Rear cross member retaining bolts
24. Rear cross member
25. Engine side support lower retaining nut
26. Engine side support
27. Engine side support upper retaining bolt

REMOVAL

1. Preliminary operations

a. Place the vehicle over a garage lift and chock front wheels.

Open bonnet and secure in open position with associated strut (1).

WARNING:
When the engine is hot, proceed with caution to avoid burns.

b. Disconnect positive and negative terminals from the battery in the boot.

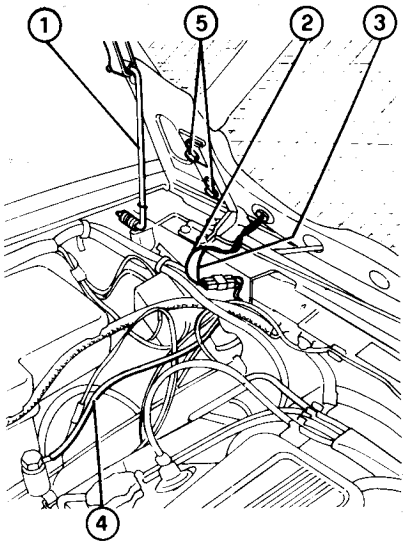
c. Disconnect power supply cable (2) and earth cable (3) from the engine compartment light.

d. Remove windscreen washer hose (4) from the electric pump on the reservoir.

e. Support bonnet and remove screws (5) and associated shims which retain bonnet to hinges.

Retrieve shims, which must be replaced in the same positions upon hood installation to ensure correct centralization.

f. Remove hood and protect contact areas with suitable soft materials.



1. Hood strut
2. Engine compartment light supply cable
3. Ground cable
4. Windshield washer hose
5. Hood retaining screws

For the following steps see the figure «View of the engine compartment».

g. Disconnect brake vacuum servo line (1) from the one-way valve on the air intake box (2).

2. Removal of air and fuel supply circuit

a. Disconnect cable (3) from air flow sensor (4) and run it through the bracket (5).

b. Disconnect the following lines, removing them from the side indicated:

- Line (6), from the air intake box fitting.
- Line (7), from tappet cover.
- Line (8), from vacuum regulating valve (9) (Switzerland, Sweden, Australia versions only).
- Line (10), from auxiliary air solenoid valve (11).
- Corrugated sleeve (12), from throttle body.

c. Unhook the retaining springs and remove the air filter cover (13) together with air flow sensor (4), corrugated sleeve (12) and the lines connected to it.

d. Remove the filter element, loosen the screws and nuts retaining the air filter container and remove it from the vehicle.

e. Disconnect the fuel supply lines, removing them from the side indicated:

- Line (14), from the fitting on the manifold.
- Line (15), from the pressure regulator.

WARNING:

- **Proceed with caution: the supply system may be under pressure.**
- **Keep tubing pointing upwards to prevent fuel escaping.**
  Ensure also, that the workshop is correctly equipped to enable operations to be performed safely.

f. Disconnect accelerator cable.

3. Disconnect of electrical cables

a. Disconnect cables (17), (18), (19) and (20) from the thermostat group (16).

b. Release the above wiring harness from the support brackets fixed to the thermostat group and to the timing belt guard.

c. Unscrew the two retaining screws and remove guard (21) from the air intake box (2).

One of the two screws secures the relative grounding plait (22) to the air intake box.

d. Disconnect the following electrical cables, removing them from the side indicated:

- Cable (23), from the electro-injectors.
- Cable (24), from the switch on the throttle.
- Cable (25), from the electro-injector for cold starting.
- Cable (26) and (27), from the auxiliary air solenoid valve.
- Cable (28), from bulb on the cylinder block.
- Cable (29), from terminal board (30) on the engine bulkhead.
- Cable (31), from terminal board (32) on the engine bulkhead.
- Cable (33), from the left head.
- Cable (34) and (35), from the terminal board on the left wing.
- Cable (36), from the coil.
- Cable (37), from the distributor.
- Cable (38), from the conditioner compressor electro-magnetic connection (if installed).
- Cable (39), from the conditioner compressor (if installed).
- Cable (40), from the respective mobile connections.
- Cables (41), from the thermal switch on the lower side of the radiator.

CAUTION:
Detach the electric cables from any clamps, separate them from the propeller unit to prevent them obstructng the units removal.

4. Cooling circuit disconnection

a. Disconnect the following lines and sleeves, preferably removing them from the side indicated:

- Sleeve (42), from the thermostat group.

Place a suitable container under the vehicle to collect drained coolant.

- Sleeve (43), from the thermostat group.
- Line (44), from the radiator.
- Sleeve (45), from the 3-way connector.
- Line (46), from the thermostat group.
- Line (47), from the connector on the left head.

b. Unscrew screw (48) securing radiator (49).
Remove radiator together with the electric fans.

5. Conditioner compressor removal

a. Slacken nut (50) securing the chain stretcher pulley; slacken the belt driving the compressor and remove it.
b. Unscrew nut (51) and, from under the vehicle, the two screws securing the lower bracket to the block.
c. Move compressor (52) on the right side of the the vehicle and secure it in a suitable way.
d. If it is considered necessary, discharge the Freon and disconnect hoses (53) from the compressor.

6. Power steering circuit removal

a. Discharge, or suck, using a syringe, the oil from reservoir (54).
b. Disconnect lines (55), (56) and (57) from the power steering pump.

For the following steps see the figure «View of underbody».

7. Oil discharge (if required by the operations to be performed)

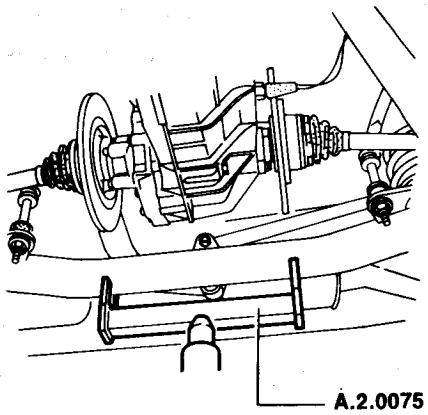
a. Raise the vehicle on the garage lift.
b. Unscrew plug (1) and drain engine oil. Screw plug on again after the job has been completed.

8. Exhaust pipe removal

a. Unscrew nuts (2) retaining the front part of the exhaust pipe (3) to exhaust manifolds.
b. Remove the 3 bolts (4) fixing bracket (5) to the end of the flywheel cover.
c. Remove the 3 nuts (6) and separate the centre and rear sections of the exhaust pipe.
d. Remove the front and centre sections of the exhaust pipe and free from the rubber support rings (7).

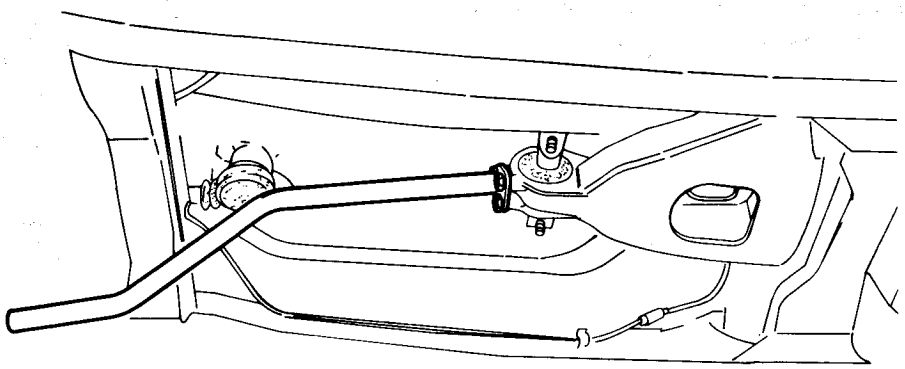
9. Propeller shaft removal

a. Remove the 6 screws (8) and the propeller shaft guard (9).
b. Remove the centre cross member (10) and unscrew the 4 bolts (11) securing the body shell.
c. Take off boot (12), unscrew and remove bolt (13), disconnecting rod (14).
If it is considered necessary, unscrew the 4 screws retaining support (15) and move it to facilitate the removal of the propeller shaft.
d. Unscrew the bolts and remove flywheel guard (16).
e. With the gearbox in neutral, rotating the propeller shaft as necessary, alternately unscrew nuts (17) and bolts (18) connecting it, respectively, to the flywheel and clutch yoke.
f. Unscrew the 2 bolts (19) and disconnect engine rear support pin (20) from the body shell.
g. Unscrew the 2 nuts (21) and disconnect propeller shaft centre support (22) from the body shell.
h. Remove the 6 bolts (23) fixing the rear cross member (24) to the body shell.
i. Raise the rear axle using a column lift provided with cradle **A.2.0075** and then extract propeller shaft from the clutch yoke.
j. Lower the column lift and remove the propeller shaft.



10. Final operations

a. Fit a suitable operating lever on the engine rear supporto to aid engine removal operations.
b. Unscrew and remove nuts (25) securing the lower part of side supports (26).
c. Lower the garage lift, unscrew and remove upper bolts (27) securing side supports (26).
d. Hook the engine on the lifting brackets, lift it out of the engine compartment with a hoist, positioning it with the operating lever.



INSTALLATION

For the following operations refer to «Underbody» view of vehicle in question.

1. Preliminary operations

a. Fit the operating lever on the engine rear support.

b. Hook the engine on the appropriate lifting bracket, and using a hoist, drop it slowly into the engine compartment, positioning it as necessary with the operating lever.

c. Centre the engine in its compartment, resting it on the two side supports, and make sure that the screw and stud holes correspond on both supports.

d. Install and lock the bolts (27) securing the flexible supports to the body shell on both sides of the engine.

e. Lift the vehicle, screw and lock, on both sides, nuts (25) securing the lower part of the flexible supports to the body.

f. Remove the operating lever from the engine rear support.

2. Install of propeller shaft

a. Reinstall the complete propeller shaft unit on the vehicle by reversing the removal procedure and observing the following instructions.

— **Lubricate** propeller shaft front bush and the rear coupling spherical seat with **5 cm³ (0.30 cu·in) of ISECO MOLYKOTE BR2** grease.

— Rotate the propeller shaft a little at a time, blocking it in a suitable way, and tightening the flexible couplings bolts and nuts to the prescribed torque.

(T) : **Tightening torque**
Nuts and bolts securing the propeller shaft flexible couplings to the engine flywheel and clutch fork
55 to 57 N·m
(5.6 to 5.8 kg·m
40.5 to 42.0 ft·lb)

— Lock the nuts securing propeller shaft centre support to vehicle floor.

(T) : **Tightening torque**
Nuts securing propeller shaft centre support
95 to 105 N·m
(9.5 to 10.5 kg·m
68.7 to 75.9 ft·lb)

b. Secure engine rear support pin (20) to body.

c. Refit engine flywheel protective cover (16).

d. Reconnect rod (14) to speed gear lever with bolt (13), then fit boot (12).

e. Secure centre cross member (10) to the body.

3. Exhaust pipe installation

Connect exhaust pipe to tail pipe in the opposite order to that described in «Removal», step 8.

Fix the front part of the pipe to the relative manifolds.

Use **new** gaskets.

For the location of parts identified by reference numbers below see «View of engine compartment» for the vehicle in question.

4. Poer steering circuit connection

a. Re-connect lines (55), (56) and (57) to the power steering pump.

The tightening torques are:

(T) : **Tightening torques**
Oil return line connector (55) on power steering pump connector
45 to 50 N·m
(4.3 to 5.1 kg·m
34.4 to 36.8 ft·lb)

Oil delivery line connector (56) on power steering pump connector
28 to 31 N·m
(2.9 to 3.2 kg·m
20.1 to 23.1 ft·lb)

b. Top up the tank with specified oil (AGIP ATF DEXRON B 11297; IP DEXRON FLUID B 11297) to the limit.

c. On the pump fitting, loosen the return pipe fitting (55) until a little oil flows out and all air is bled.

d. Lock the fitting to the specified torque.

e. Start the engine and feed the tank until level settles.

f. With the engine running, carry out a few full steering locks to right and left, then top up the oil in the tank to the «MAX» mark.

g. Reassemble the tank plug.

5. Installation of air conditioner compressor

a. Reconnect compressor lower bracket to engine block securing it from under the vehicle with the corresponding screws.

b. Refit compressor drive belt, and lock nut (51).

c. Restore correct tension to compressor drive belt and lock nut (50).

Load to be applied to belt centre:
P = 20 to 35 kg (44.1 to 77.2 lb)

Deflection:
F = 14 mm (0.55 in)

d. If hose unions (52) are disconnected, secure them to compressor (53).

6. Installation of radiator

Refit radiator together with electric fan, then reconnect cooling system tubing by reversing the order of the procedure described in «Removal» - step 4.

7. Electrical connections

Restore electrical connection, reversing the order of the procedure described in «Removal» - step 3.

8. Air and fuel supply system

Restore air and fuel supply system by reversing the procedure described in «Removal» - step 2.

9. Final operations

a. Reconnect servobrake vacuum intake hose (1) to single - acting valve on intake air box.

b. Refill and adjust the following:

— Engine oil
— Engine coolant
— Power steering system oil level
— Air conditioning system Freon
— Timing check
— Accelerator control cable adjustment
— Adjustment of percentage of exhaust CO at idle
— Electric fan action check on engine at normal running temperature.

c. Replace the hood (bonnet) by proceeding in the opposite order to that described in «Preliminary operations».

ENGINE DISASSEMBLY

Alfa 90 2.5 iniezione

Alfa 90 2.0 6V iniezione

Alfa 75 6V iniezione

GTV 6 2.5

PRELIMINARY OPERATIONS

a. Remove the engine group from the vehicle using the procedures described in the paragraph «Engine Removal and Installation» for the vehicle in question.

b. Prepare the engine assembly for installation on the rotating engine overhaul stand by placing it on the bench and lifting it be means of a suitable hoist (if possible a hydraulic type).

c. **Removal of the exhaust manifolds and starting motor**

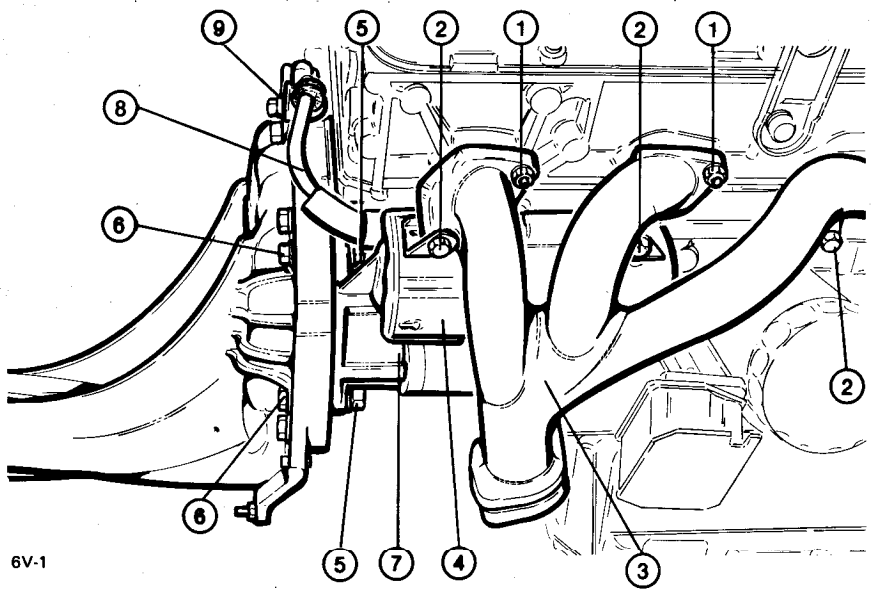
— From the right side of the engine remove the nuts with washers (1) and unscrew the three screws (2) retaining the exhaust manifolds to the right cylinder head.

— Remove the exhaust manifolds (3) and heat shield (4) protecting the starting motor.

— Slacken and remove nuts and washers (5) from screws (6) retaining the starting motor.

— Remove the starting motor (7) with relative wiring (8) by sliding it out from the brackets (9) on the rear cover.

— Proceed in a similar way for the removal of the exhaust manifolds from the left side of the engine.



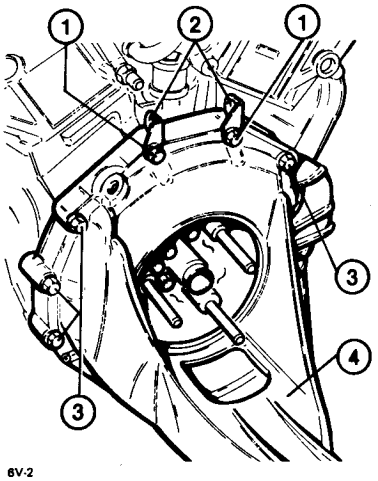
6V-1

1. Nuts and washers
2. Screws
3. Exhaust manifolds
4. Heat shield
5. Nuts and washers
6. Screws
7. Starting motor
8. Wiring
9. Brackets

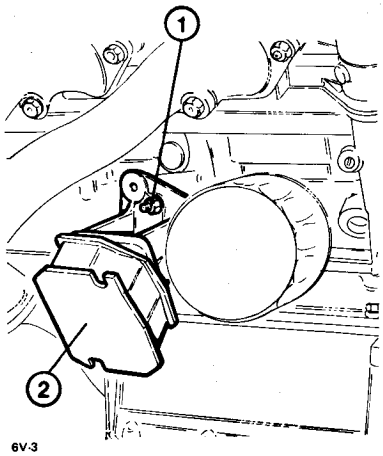
d. **Removal of rear cover**

— Unscrew the two upper screws (1) to recover the two brackets (2) supporting the starting motor wiring bundle.

— Unscrew the remaining screws (3) and remove the rear cover (4).



6V-2



6V-3

1. Upper screws
2. Wiring support brackets
3. Screws
4. Rear cover

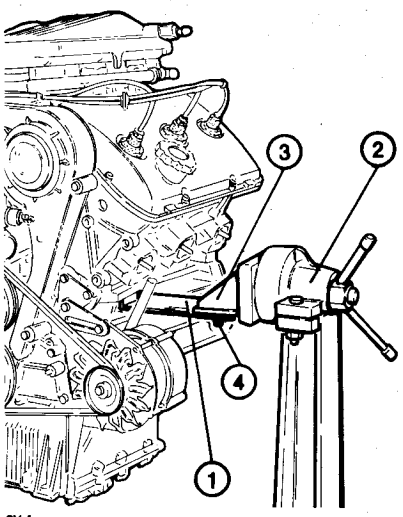
e. Slaken and remove the washers and nuts (1) and remove the engine supports (2) on both sides of the engine block.

1. Nuts and washers
2. Engine supports

f. Install the motor support brackets (1) and secure them to the engine block by means of the nuts with washers for fixing the engine supports.

g. Place the engine assembly on the overhaul stand (2) using a suitable hoist. Secure the engine support brackets (1) to supports (3) of the rotating engine overhaul stand by means of bolts (4).

h. Remove the engine oil dipstick; remove the drain plug of the lower sump and drain the engine oil (operation to be performed if the oil has not been discharged during the «Engine Removal»).

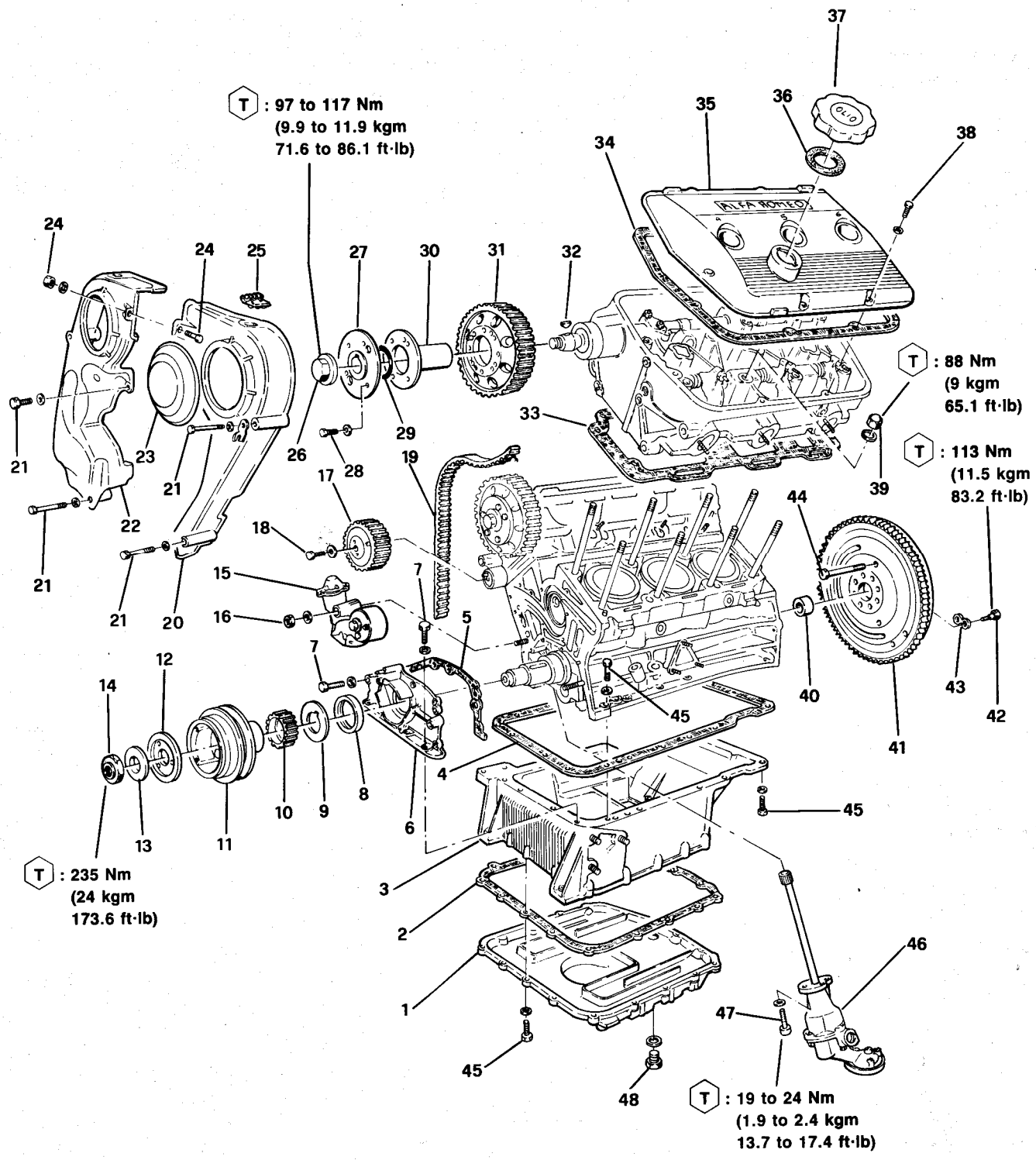


6V-4

1. Engine support brackets
2. Rotary engine overhaul stand
3. Rotary stand supports
4. Bolts

1. Oil sump cover
2. Oil sump cover gasket
3. Oil sump
4. Oil sump gasket
5. Front cover gasket
6. Front cover
7. Front cover retaining screws
8. Front oil seal
9. Back up washer
10. Camshaft drive pulley
11. Crankshaft pulley
12. Spacer
13. Lock washer
14. Crankshaft pulley locknut
15. Hydraulic belt stretcher
16. Belt stretcher locknut
17. Distributor and oil pump drive belt
18. Pulley retaining screws
19. Camshaft drive belt
20. Left guard
21. Guard retaining screws
22. Right guard
23. Camshaft hub covers
24. Guard joining bolt
25. Spark plug cable clamps
26. Toothed pulley locknut
27. Toothed pulley hub
28. Hub retaining screws
29. Seal ring
30. Hub and toothed pulley support
31. Camshaft drive pulley
32. Camshaft drive key
33. Cylinder head gasket
34. Cylinder head cover gasket
35. Cylinder head cover
36. Plug gasket
37. Oil filler plug
38. Cylinder head cover screws
39. Nuts securing cylinder head to engine block
40. Rear bushing or bearing of crankshaft
41. Engine flywheel
42. Screws securing flywheel to crankshaft
43. Lock washer
44. Screws securing flywheel to clutch group
45. Oil sump retaining screws
46. Oil pump
47. Oil pump retaining screws
48. Oil drain plug

EXTERNAL PARTS (Cylinder heads and engine block)



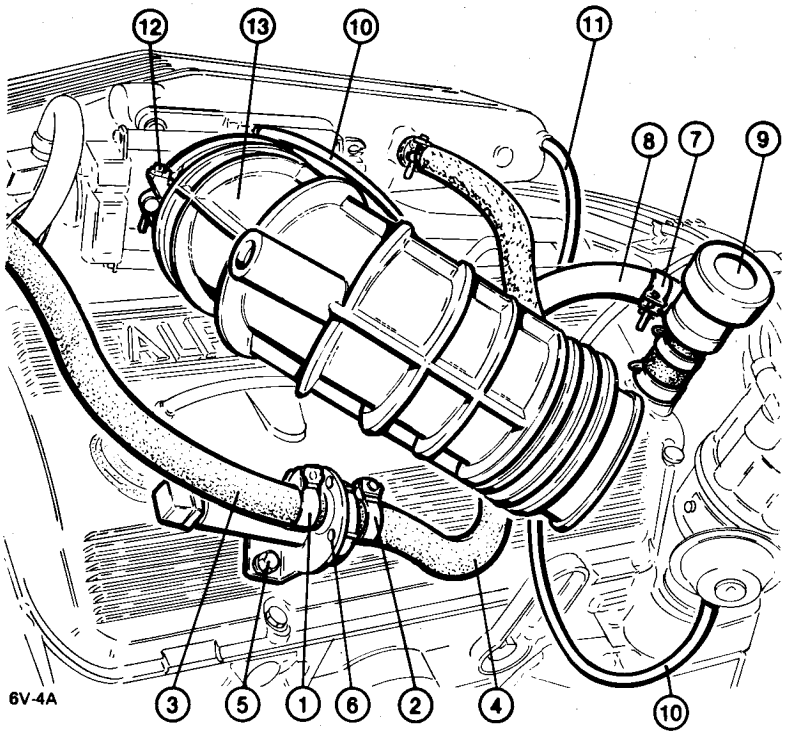
REMOVAL OF FUEL SYSTEM COMPONENTS

Alfa 90 2.5 iniezione

Alfa 75 6V iniezione

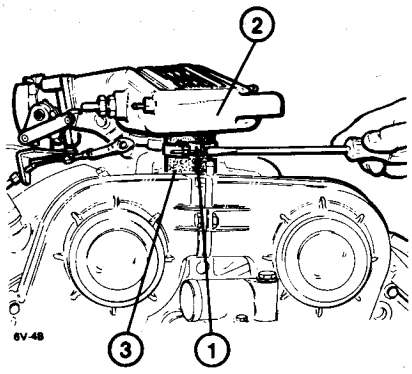
GTV 6 2.5

a. Slacken clamps (1) and (2) and disconnect supplementary air feed pipe (3) from plenum chamber and pipe (4) feeding air to the supplementary air solenoid valve.
b. Unscrew screws (5) and remove supplementary air solenoid valve (6) from right cylinder head cover.
c. Slacken clamp (7) and disconnect oil vapour recirculation pipe (8) from oil vapour separator (9).
d. Disconnect vacuum pipe (10) of the pneumatic spark advance regulator from the intake capacity and the distributor.
e. Disconnect vacuum pipe (11) from the intake capacity and from the pressure regulator.
f. Slacken clamp (12) and disconnect the corrugated sleeve (13) from the throttle housing.



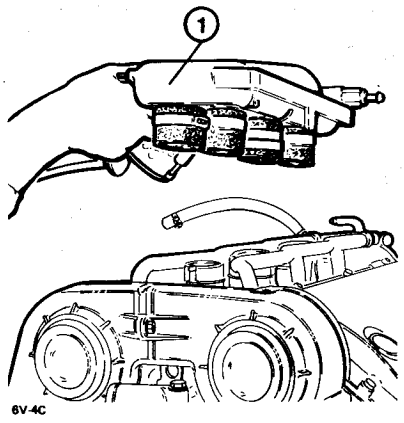
1. Clamp
2. Clamp
3. Supplementary air pipe to the plenum chamber
4. Air feed pipe to the supplementary air solenoid valve
5. Screws
6. Supplementary air solenoid valve
7. Clamp
8. Oil vapour recirculation pipe
9. Oil vapour separator
10. Vacuum pipe for spark advance pneumatic regulator
11. Vacuum pipe for pressure regulator
12. Clamp
13. Corrugated sleeve

g. Slacken clamps (1) fixing the plenum chamber (2) to the rubber sleeves (3) of the intake manifolds.



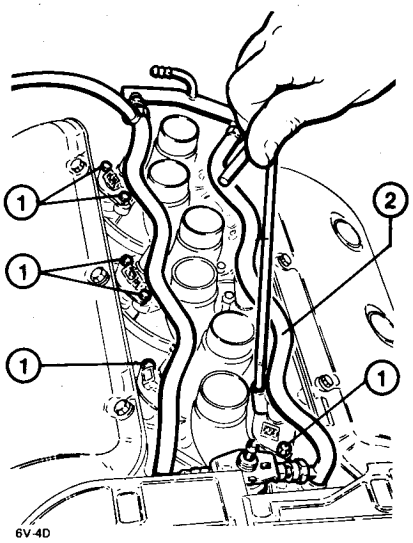
1. Clamp
2. Plenum chamber
3. Rubber sleeve connecting plenum chamber to intake manifold

h. Remove the plenum chamber (1) complete with throttle housing and rubber sleeves forming the connection with the intake manifolds.



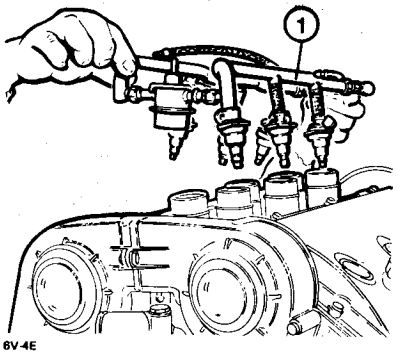
1. Plenum chamber

i. Unscrew the screws (1) securing the electro-injectors to the air feed manifold (two for each injector) and to the petrol intake throat (2).



1. Electro-injector retaining screws
2. Petrol intake throat

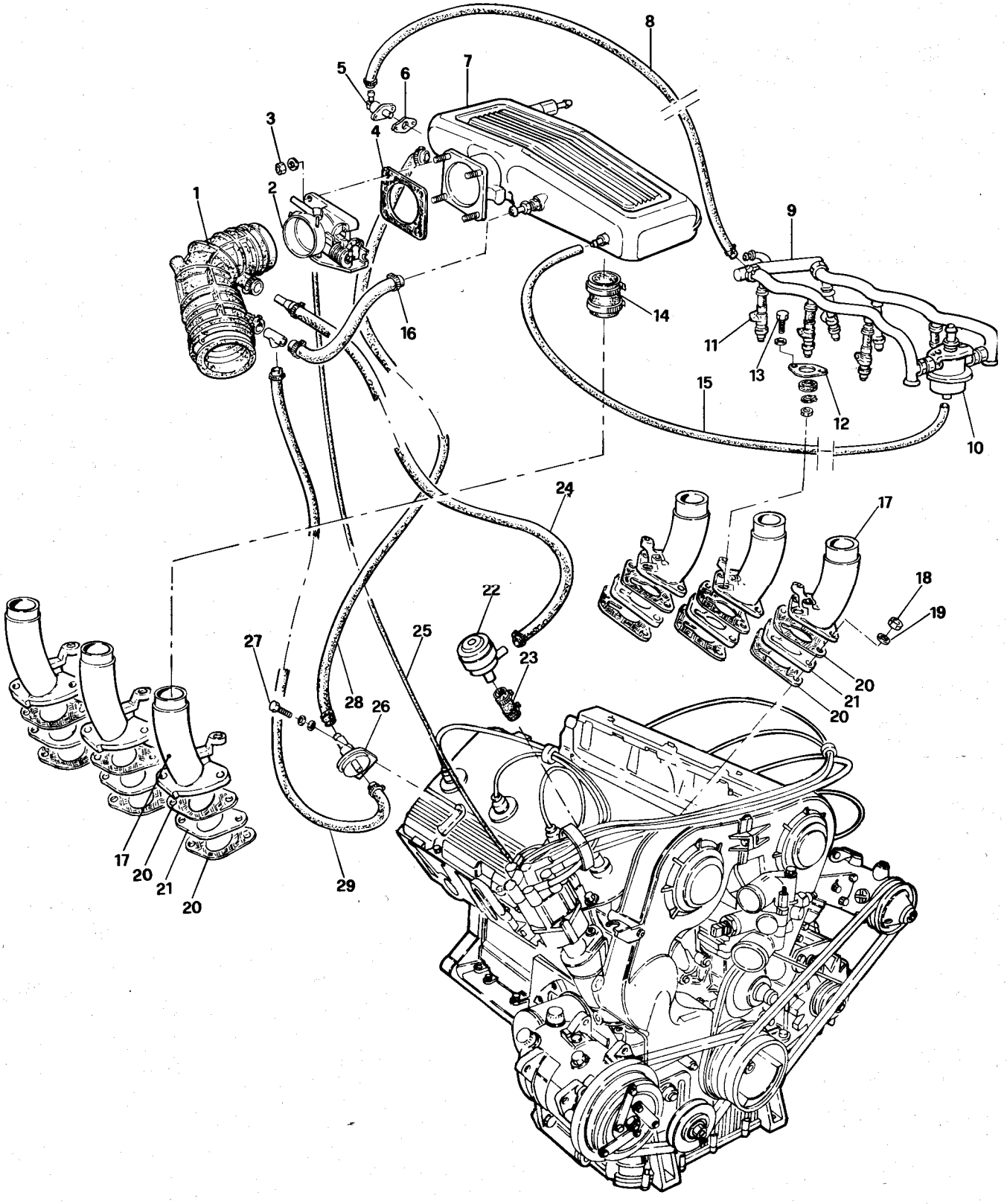
j. Remove the petrol intake throat (1) together with the electro-injectors.



1. Petrol intake throat

NOTE:
For further disassembly and/or checks of the fuel supply system refer to Group 04 «FUEL SYSTEM» for Alfa 90, Alfa 75 and GTV - 6 cylinders.

FUEL SYSTEM COMPONENTS (L-JETRONIC System)

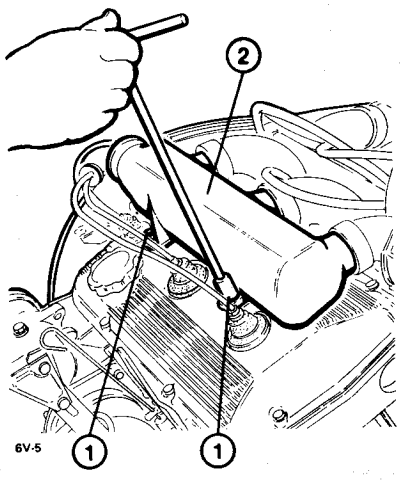


1. Corrugated sleeve
2. Throttle housing
3. Throttle housing locknuts
4. Gasket
5. Cold starting electro-injectors
6. Gasket
7. Plenum chamber
8. Cold starting electro-injector feed pipe
9. Fuel supply manifold
10. Fuel pressure regulator
11. Electro-injectors
12. Electro-injector flange
13. Screws securing electro-injectors to intake stub pipes
14. Sleeve connecting intake capacity to respective stub pipes
15. Vacuum take-off pipe for pressure regulator
16. By-pass pipe for idling adjustment
17. Intake stub pipes
18. Stub pipe lock nuts
19. Washer
20. Gaskets
21. Insulating gasket
22. Oil vapour separator
23. Oil recovery pipe
24. Oil vapour re-circulation pipe
25. Vacuum offtake pipe for pneumatic spark advance regulator
26. Supplementary air solenoid valve
27. Solenoid valve retaining screws
28. Pipe taking supplementary air to the plenum chamber
29. Pipe taking air to the supplementary air solenoid valve

REMOVING FUEL SYSTEM COMPONENTS

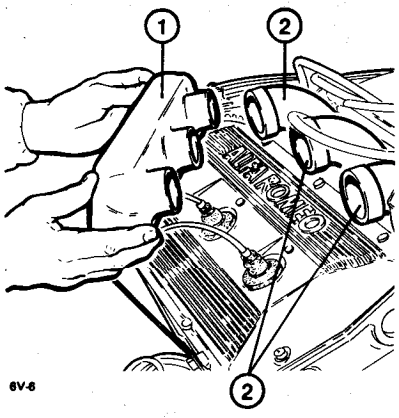
Alfa 90 2.0 6V iniezione

a. Slacken the two nuts with washers (1) securing the left air collector box (2) to the cylinder heads.



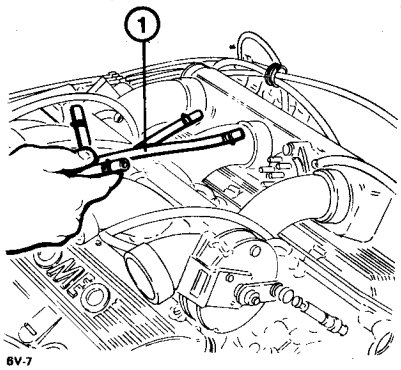
1. Nuts and washers
2. Left air box

b. Remove the left air box (1) by extracting it from the three rubber sleeves (2).



1. Left air box
2. Rubber sleeves

c. Disconnect the six small tubes (1) connected to the idling air fittings of the respective cylinders from the idling air block on the right air collector box.

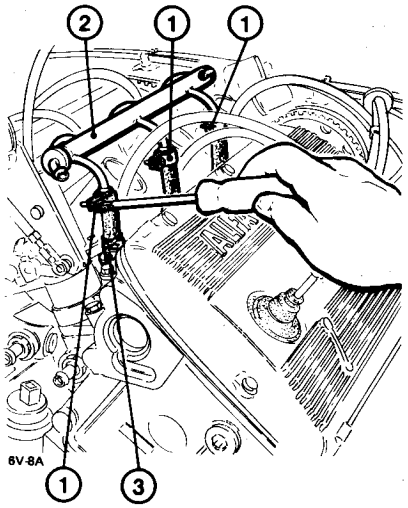


1. Small air intake tubes connecting the idling air block to the cylinder air fittings

d. Slacken the two nuts with washers securing the right collector box to the cylinder head.
Remove the right box (1) complete with idling air block (2), extracting it from the three sleeves (3) connecting it to the throttle housing.
Remove the six rubber sleeves.

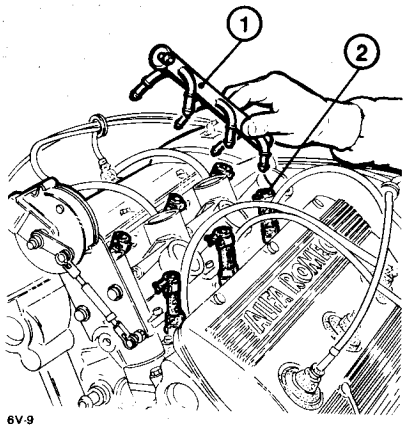
1. Right collector box
2. Idling block
2. Rubber sleeves

e. Slacken the six clamps (1) securing the distribution tube (2) to electro-injectors (3).



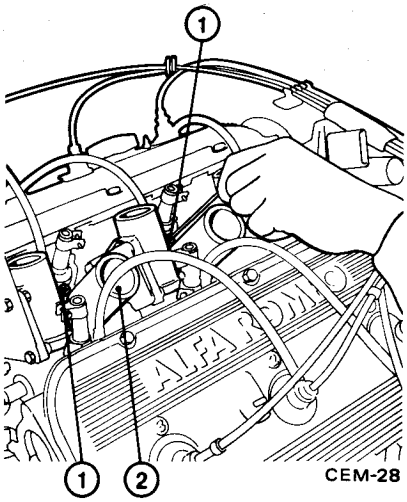
1. Clamps
2. Distribution tube
3. Electro-injectors

f. Remove the distribution tube (1) extracting it from the feed tube sof the electro-injectors (2).



1. Distribution tube
2. Electro-injector feed tubes

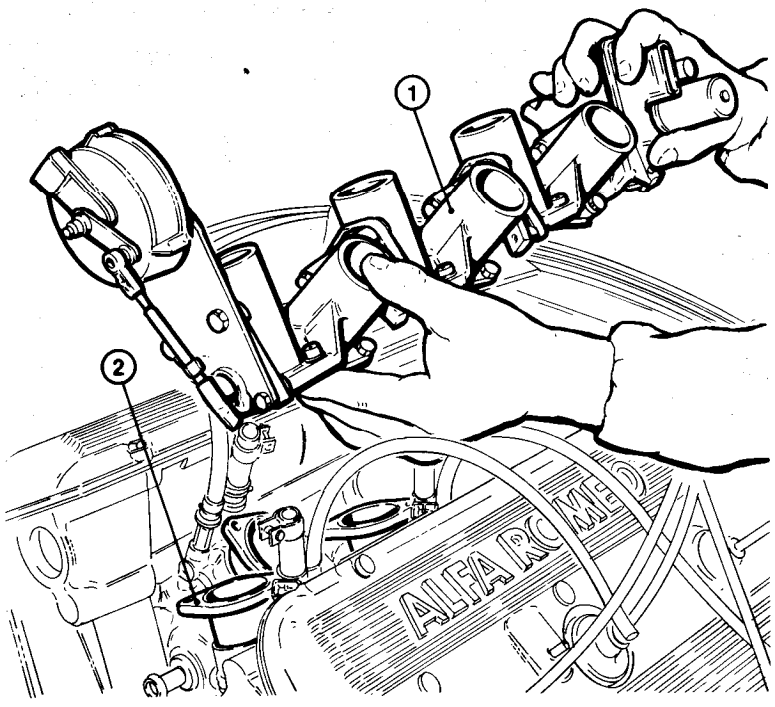
g. Slacken and remove the twelve socket screws (1) securing the three throttle housings (2) (front-centre-rear) to the respective lower intake stub pipes.



1. Socket screws (twelve)
2. Throttle housings

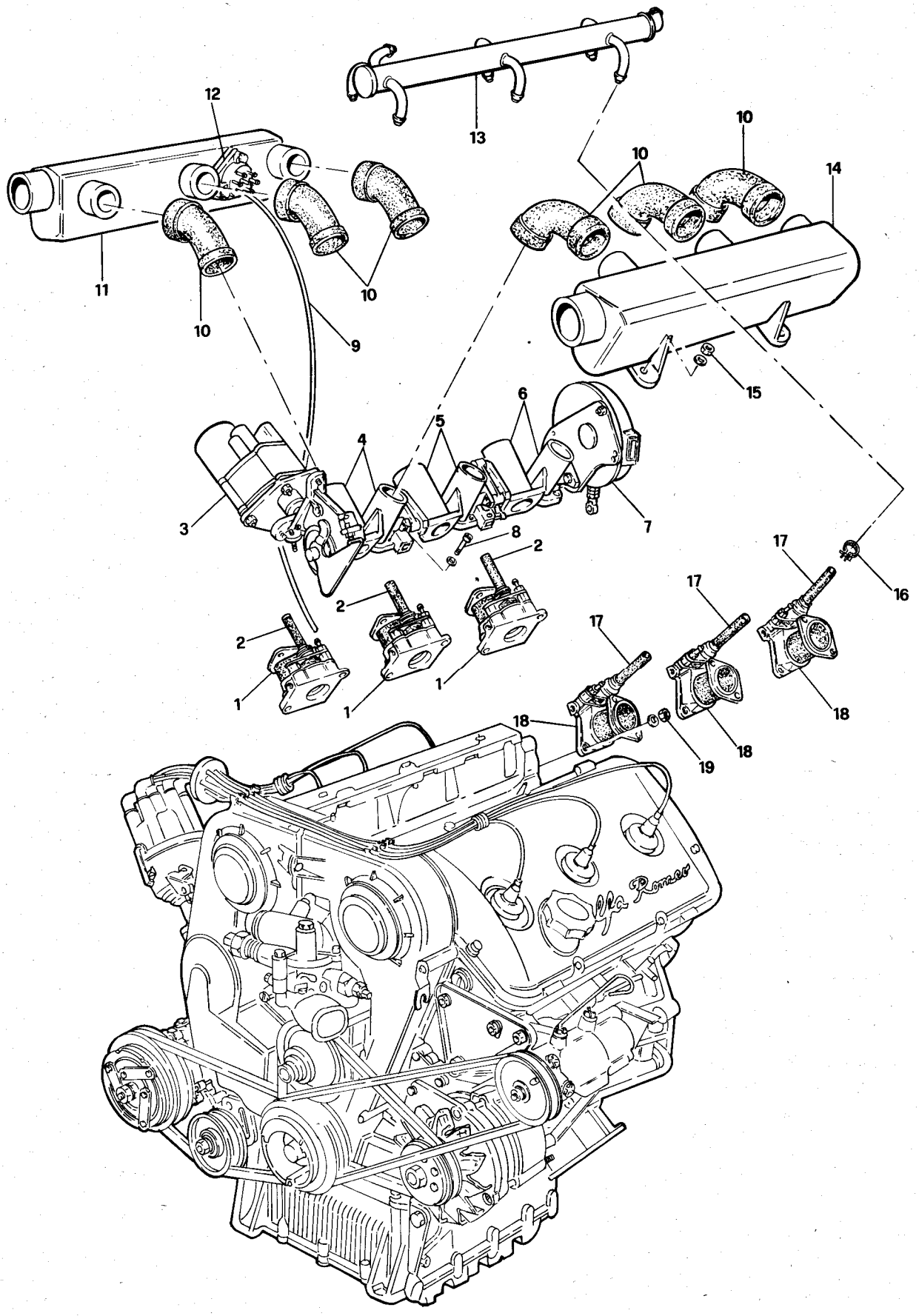
h. Remove the throttle assembly (1) by raising the respective lower intake stub pipes (2) and release the earthing plait connected to the left cylinder head.

1. Throttle assembly (front-centre-rear)
2. Lower intake stub pipes



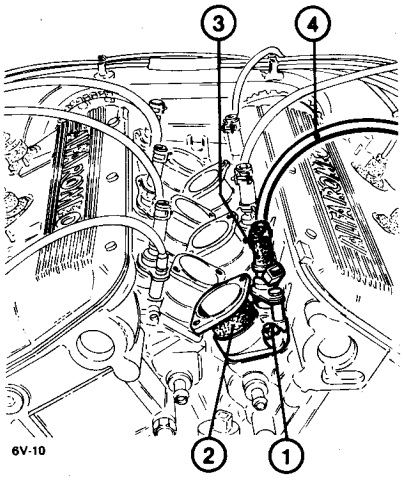
1. Lower intake stub pipes (right side)
2. Electro-injectors (right side)
3. Constant idling actuator
4. Front - throttle housing
5. Centre - throttle housing
6. Rear - throttle housing
7. Throttle angle sensor
8. Screws securing throttle housing to the lower intake stub pipes
9. Idling air offtake pipe (six, one for each cylinder)
10. Rubber sleeves
11. Right box (plenum chamber)
12. Idling air block
13. Petrol distributor pipe
14. Left box (plenum chamber)
15. Box locknuts
16. Clamp fixing electro-injectors to distribution pipe
17. Electro-injectors (left side)
18. Lower intake stub pipes (left side)
19. Intake stub pipe locknut

FUEL SYSTEM COMPONENTS (CEM System)



i. Slacken the two nuts (1) (two for each stub pipe) securing the lower intake stub pipe (2) to the cylinder head.
Remove stub pipe (2) complete with electro-injector (3) and minimum air tube (4); proceed in the same way for the removal of the remaining stub pipes.

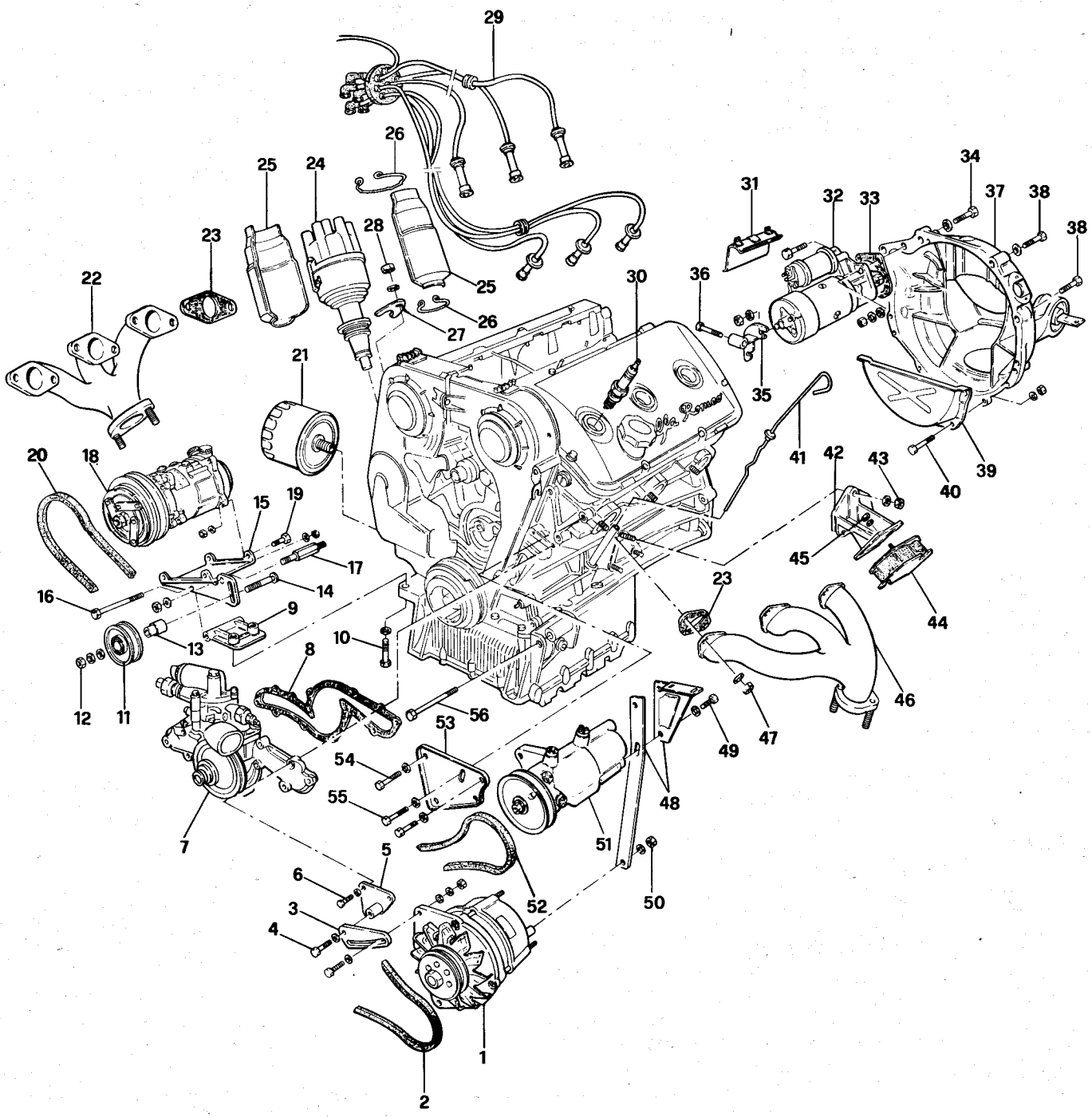
NOTE:
For further disassembly and/or checking of the fuel supply system refer to Group 04 «FUEL SYSTEM» for the Alfa 90 2.0 - 6V iniezione.



1. Nuts and washers
2. Lower intake stub pipe
3. Electro-injector
4. Idling air intake tube

1. Generator
2. Drive belt (generator and water pump)
3. Regulation bracket
4. Bracket retaining screws
5. Generator support
6. Support and water pump retaining screws
7. Water pump complete with thermostat group
8. Water pump gasket
9. Bracket fixing compressor to oil sump
10. Bracket retaining screws
11. Belt stretcher
12. Belt stretcher locknut
13. Belt stretcher pulley hub
14. Belt stretcher fixing pin
15. Compressor support
16. Screws fixing support to bracket
17. Pin fixing support to cylinder block
18. Air conditioner compressor
19. Compressor retaining screw
20. Drive belt
21. Engine oil filter
22. Exhaust manifold (right side)
23. Gasket
24. Distributor
25. Shields
26. Retaining springs
27. Retaining bracket
28. Locknut
29. High voltage wires complete with suppressors
30. Spark plug
31. Starting motor shield
32. Starting motor
33. Gasket
34. Screws fixing starting motor
35. Starting motor rear support
36. Support retaining screws
37. Rear cover
38. Rear cover retaining screws
39. Flywheel lower guard
40. Guard retaining screws
41. Engine oil dipstick
42. Engine side support
43. Support locknut
44. Rubber shock absorber
45. Shock absorber locknut
46. Exhaust manifold (left side)
47. Exhaust manifold locknut
48. Power steering pump rear bracket
49. Screw fixing pump to bracket
50. Nut fixing pump to generator
51. Power steering pump
52. Drive belt
53. Bracket fixing pump to engine block
54. Bracket retaining screw
55. Power steering pump retaining screws
56. Lower screw fixing generator

EXTERNAL COMPONENTS (Accessories)



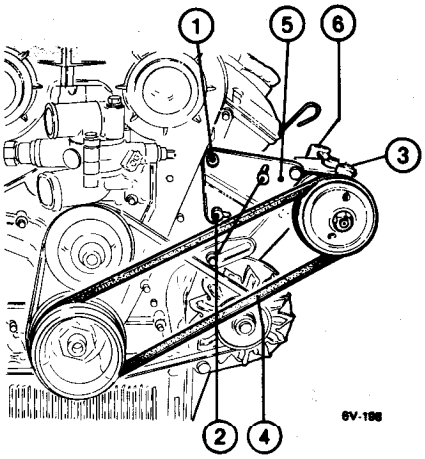
REMOVAL OF ACCESSORIES

a. **Removal of power steering pump**

— Slacken screw (1) securing the power steering, screws (2) determining the tension of the V-belt and the bolt securing the rear bracket (6).

— Move the power steering pump (3) towards the cylinder head and remove the V-belt (4) from the crankshaft pulley.

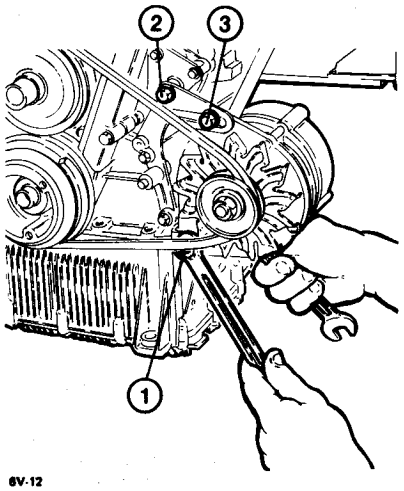
— Unscrew completely screws (1) and (2) and the rear bracket bolt (already slackened) and remove the power steering pump (3) complete with support bracket (5).



1. Retaining screws
2. Adjustment screws
3. Power steering pump
4. V-belt
5. Support bracket
6. Rear bracket

b. **Removal of the generator**

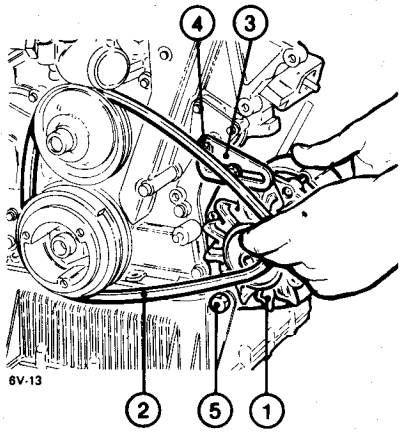
— Slacken nuts (1) and (2) and nut (3) which determine the tension of the V-belt.



1. Lock nut
2. Lock nut
3. Adjustment nut

— Move the generator (1) towards the engine block and remove the V-belt (2) from the crankshaft and water pump pulleys.

— Remove the generator (1) together with the adjustment bracket (3), after having unscrewed bolts (4) and (5) completely.



1. Generator
2. V-belt
3. Adjustment bracket
4. Retaining bolt
5. Retaining bolt

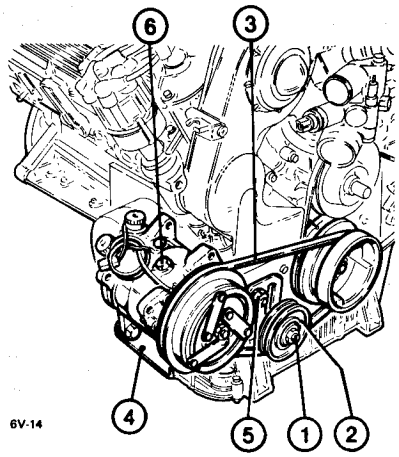
c. **Removal of the conditioning system compressor**

— Slacken nut (1) securing the belt stretcher (2).

— Slip off the V-belt (3) from the compressor pulley and from the crankshaft pulley (to facilitate this turn the crankshaft).

— Slacken and then completely unscrew the screws fixing the support brackets (4) of the compressor to the oil sump.

— Slacken and unscrew bolt (5) and remove the compressor (6).



1. Nut
2. Belt stretcher
3. V-belt
4. Support bracket
5. Bolt
6. Compressor of conditioning system

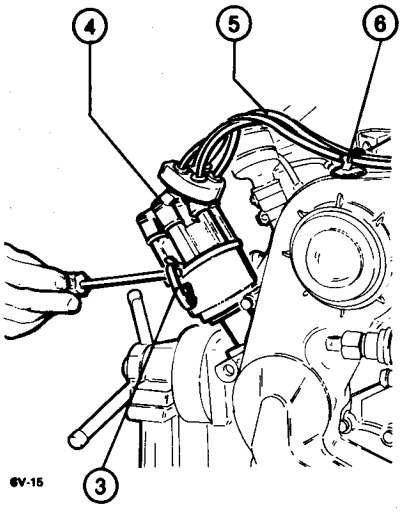
d. **Removal of distributor cap**

— Disconnect suppressors (1) from spark plugs (2).

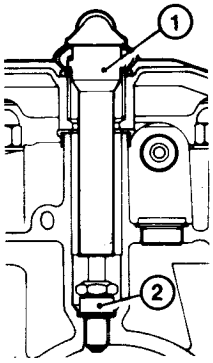
— Free springs (3) securing the distributor cap.

— Remove cap (4) from the distributor complete with the high voltage wires (5) after removing them from the respective cable clamps (6) located above the distributor belt guard.

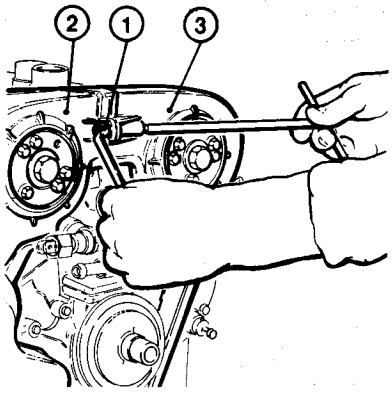
— Remove spark plugs (2).



DETAIL OF SPARK PLUG AREA

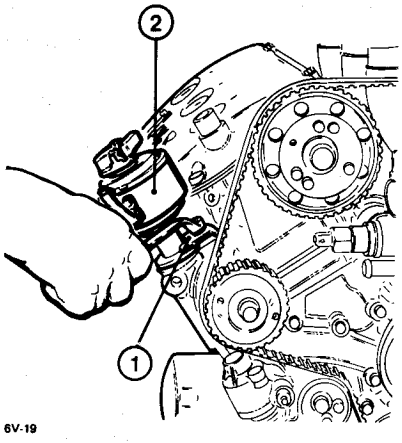


1. Suppressors
2. Spark plugs
3. Spring
4. Distributor cap
5. High voltage cables
6. Cable clamp



6V-17

1. Guard joining bolt
2. Right guard
3. Left guard

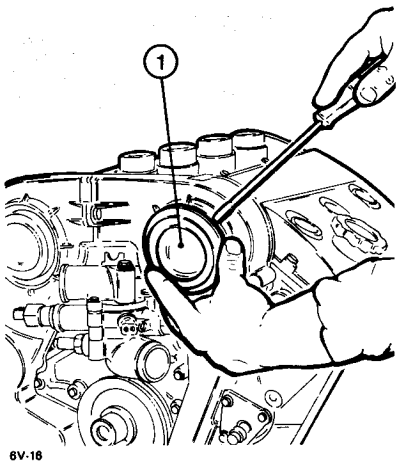


6V-19

1. Connecting plate
2. Distributor

e. Removal of timing belt guard

— Remove covers (1) from the toothed timing belt guard.

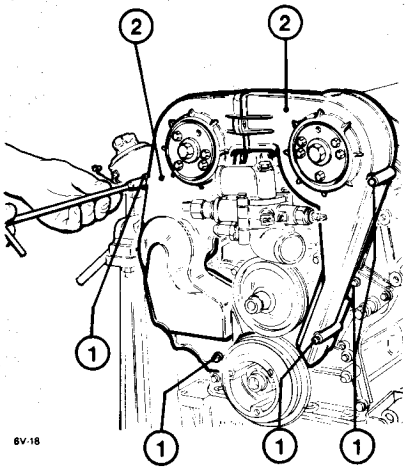


6V-18

1. Covers

— Unscrew bolt (1) that joins right guard (2) to left guard (3).

— Release and remove screws (1) securing guards (2) to the engine.



6V-18

1. Retaining screws
2. Guards

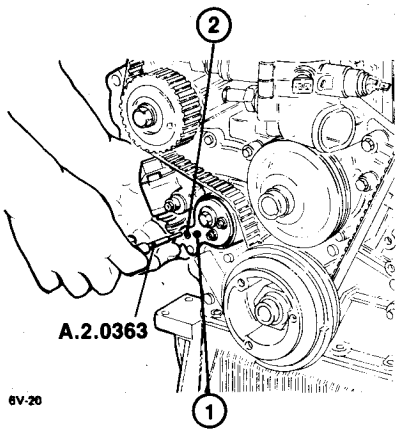
f. Removal of distributor

— Release and remove the nut securing the connecting plate (1).
Remove connecting plate (1).

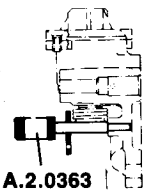
— Extract distributor (2).

g. Removal of hydraulic belt stretcher and timing belt

— Stop the hydraulic belt stretcher from rotating (of the distributor belt, raise the arm of the belt stretcher (1) and use tool **A.2.0363** to lock the belt stretcher. To insert tool **A.2.0363** seating hole (2) must coincide with that on the belt stretcher body.

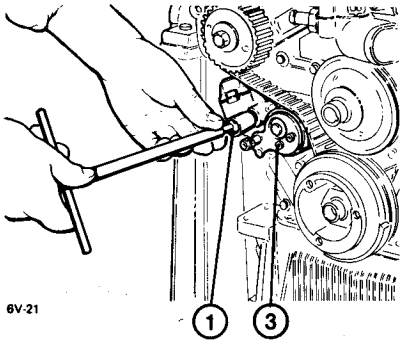


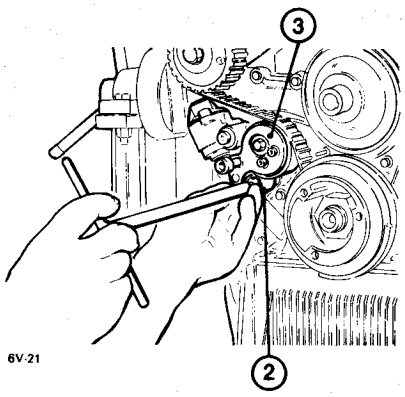
6V-20



1. Belt stretcher arm
2. Tool insertion seat

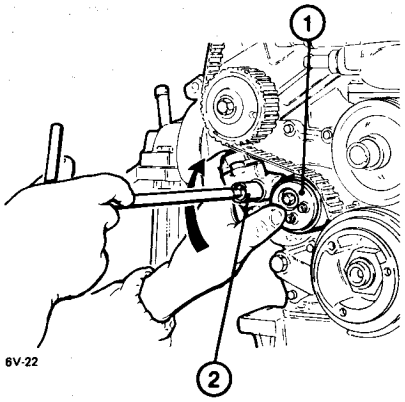
— Slacken nuts (1) and (2) securing the body of belt stretcher (3) to the engine block.

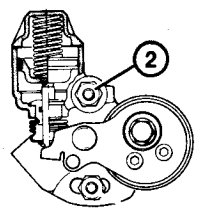




1. Locknut
2. Locknut
3. Hydraulic belt stretcher

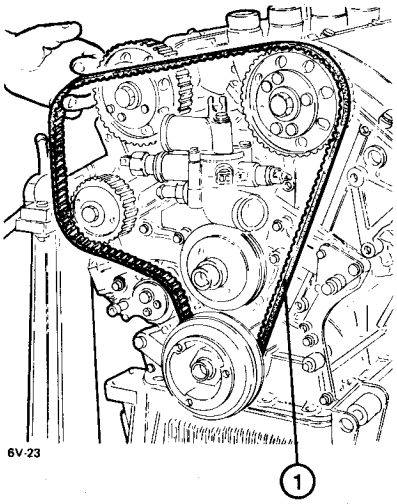
— Rotate the hydraulic belt stretcher (1) upward and lock it in this position by tightening nut (2), previously slackened.





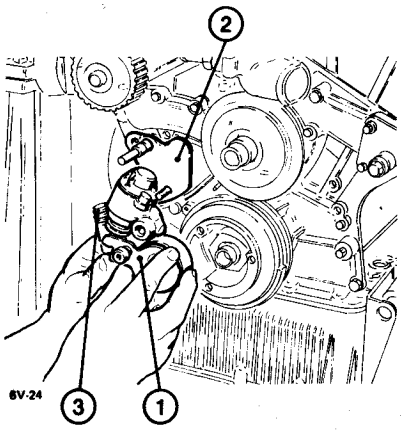
1. Hydraulic belt stretcher
2. Locknut

— Slip off and remove timing belt (1) from the toothed pulleys installed on the cylinder heads and slide out from the crankshaft front pulley.



1. Toothed timing belt

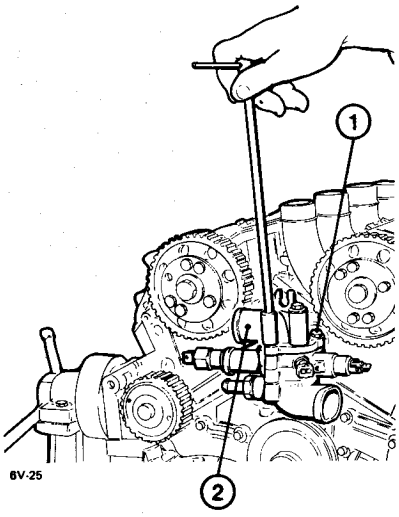
— Unscrew the two screws fixing the belt stretcher body to the cylinder block. Remove the hydraulic belt stretcher (1) together with the spring and plate (2) holding the belt stretcher spring (3).



1. Hydraulic belt stretcher
2. Plate
3. Belt stretcher spring

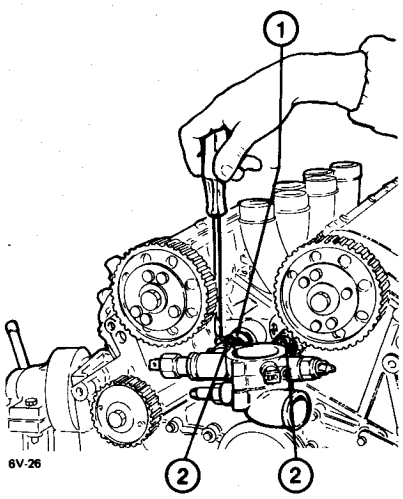
h. **Removal of thermostat group**

— Unscrew the three screws with washers (1) fixing the cover of the thermostat group.
Remove cover (2) complete with thermostat valve.



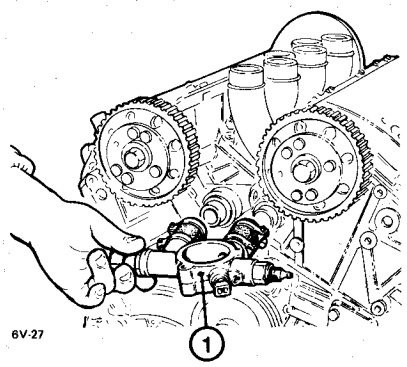
1. Screws with washers
2. Cover with thermostat valve

— Open metal clamps (1) holding the rubber sleeves (2) to the cooling ducts of each cylinder head.



1. Metal clamps
2. Rubber sleeves

— Remove housing (1) of the thermostat group by sliding it out from the cooling ducts of each cylinder head.

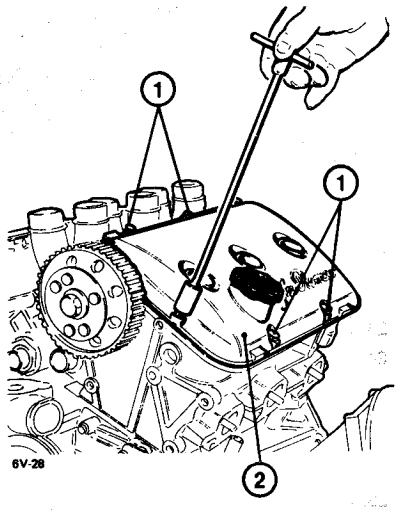


1. Thermostat group housing

NOTE:
For the disassembly and/or checking of the setting of the thermostat valve refer to Group 07 «COOLING SYSTEM» for Alfa 90, Alfa 75 and GTV - 6 cylinders.

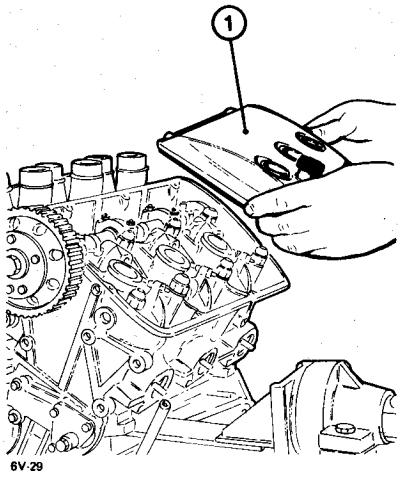
REMOVAL OF THE CYLINDER HEADS

a. Slacken and remove screws with washers (1) securing the valve cover (2) to the cylinder head.



1. Screws with washers
2. Valve cover

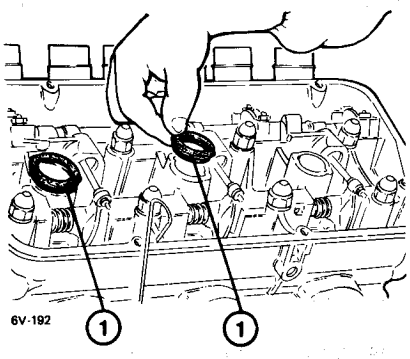
b. Remove the valve cover (1) and relative gasket under it.



1. Valve cover

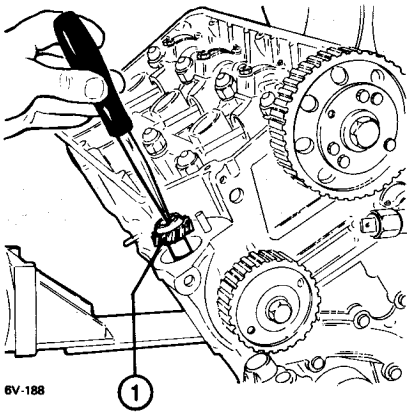
NOTE:
Perform the above mentioned operations on both cylinder heads.

c. Remove packings (1) from the six spark plug wells.



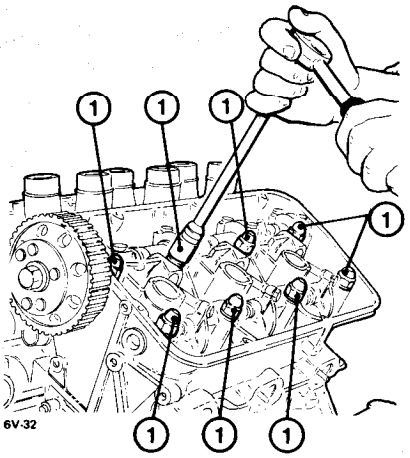
1. Rubber packing

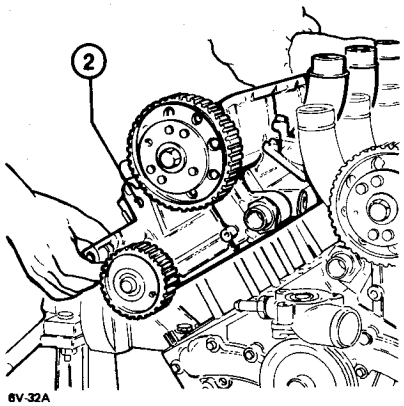
d. Extract intermediate gear (1) operating the distributor and oil pump from the right cylinder head.



1. Intermediate gear

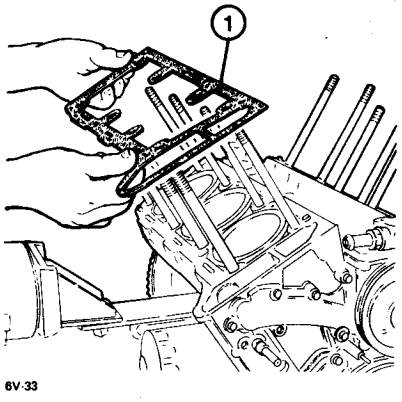
e. Slacken and remove nuts with washers (1) (eight for each head) securing the cylinder heads to the block.
Remove cylinder heads (2), paying particular attention not to damage the studs of the engine block while lifting the heads.

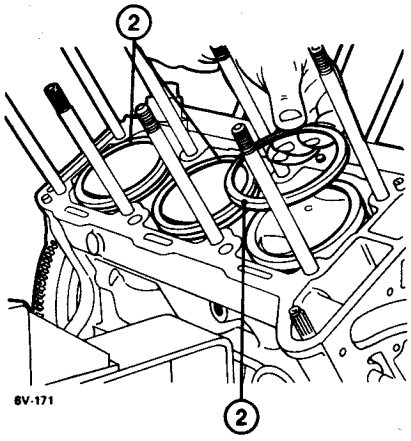


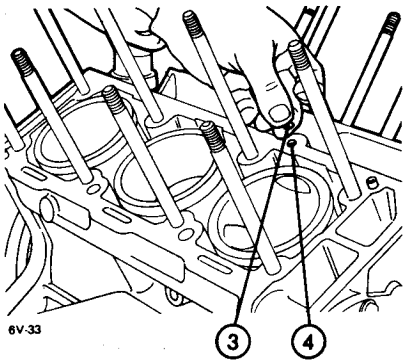


1. Nuts with washers
2. Cylinder heads

f. Remove the following from the engine block:
— (1), cylinder head gasket;
— (2), flameproof rings (fitted on each cylinder liner);
— (3), O-ring for lubrication pipe (4) (one for each side of the cylinder block).



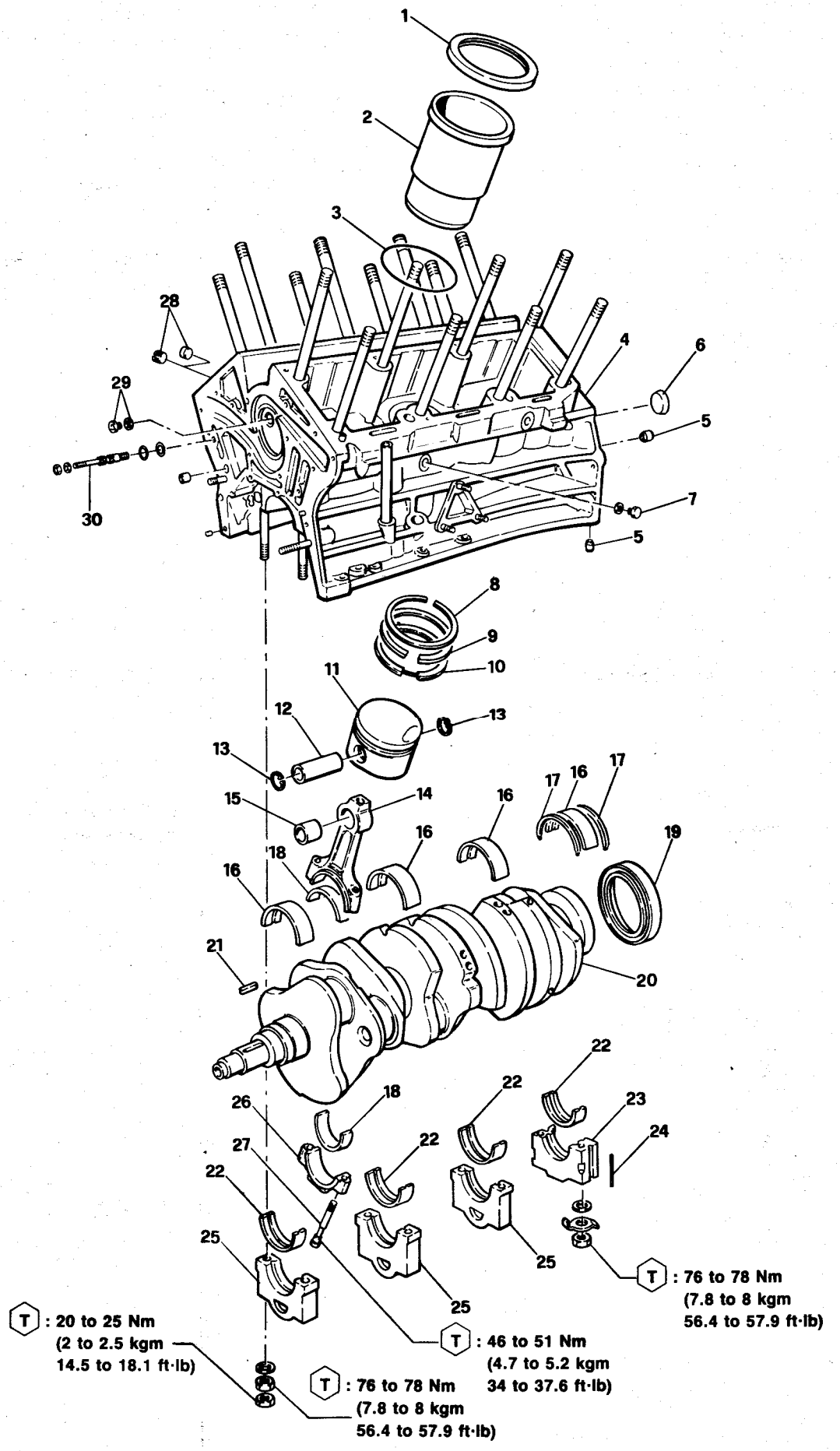




1. Cylinder head gasket
2. Flameproof rings
3. O-ring
4. Lubrication pipe

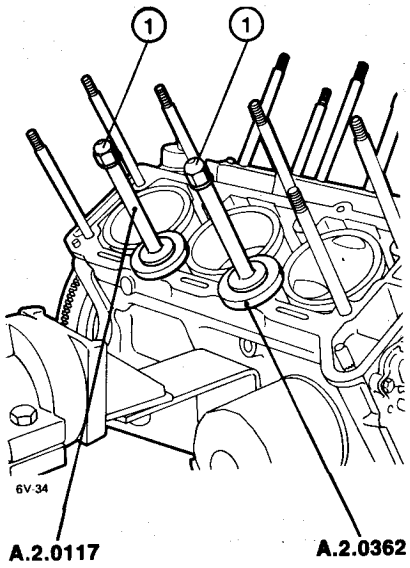
1. Flameproof ring
2. Cylinder liner
3. Seal ring
4. Engine block
5. Lubrication ducts
6. Plug
7. Water cooling circuit plug
8. First seal ring
9. Second seal ring
10. Oil scraper ring
11. Piston
12. Gudgeon pin
13. Lock ring
14. Connecting rod
15. Bushing
16. Upper main half-bearings (four)
17. Rear thrust half rings (two)
18. Upper and lower rod half-bearings (twelve)
19. Seal ring (rear)
20. Crankshaft
21. Key for crankshaft pulley
22. Lower main half-bearings (four)
23. Rear main bearing cap
24. Grommets
25. Main bearing caps (three)
26. Connecting rod caps (six)
27. Special screw for fixing con rod caps (twelve)
28. Plugs
29. Plug for cooling system
30. Pin for hydraulic belt stretcher

ENGINE BLOCK



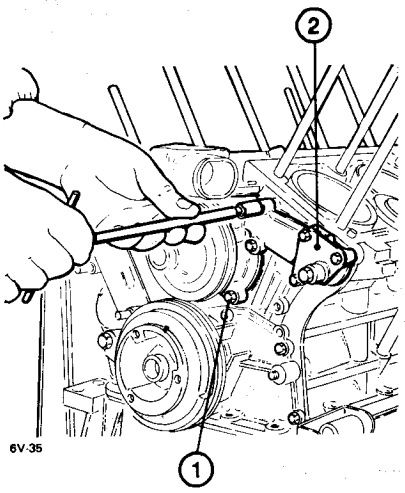
REMOVAL OF COMPONENTS FROM ENGINE BLOCK

a. Insert cylinder liner locking tool **A.2.0117** with the respective complementary washers (**A.2.0362**), in the engine block studs as shown in the figure.
Lock tools **A.2.0117** with the nuts and washers (1) used to fix the cylinder head.



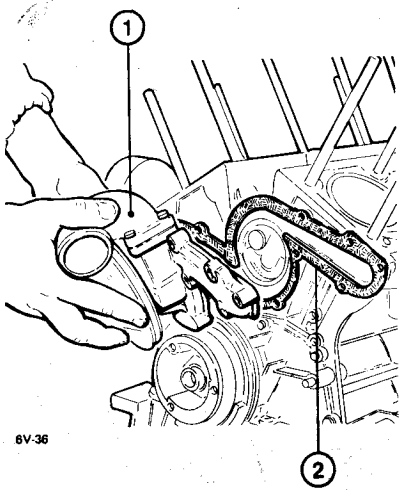
1. Nuts and washers

b. Slacken and remove all the screws with washers (1) fixing the water pump to the engine block.
Remove support (2) which secures the generator adjustment bracket.



1. Screws and washers
2. Support for generator bracket

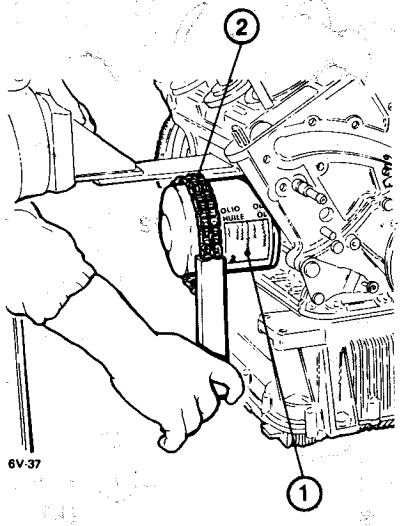
c. Remove water pump (1) and put the gasket (2) aside.



1. Water pump
2. Gasket

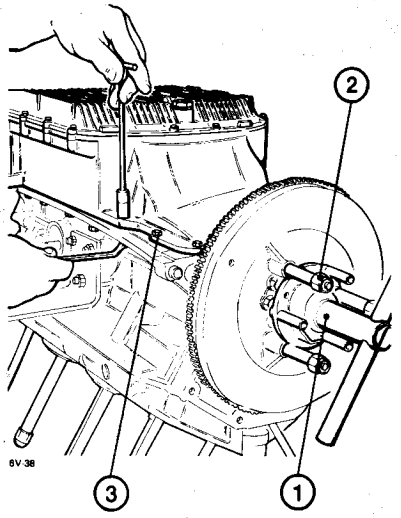
NOTE:
For the inspection and/or testing of the water pump refer to Group 07 «COOLING SYSTEM» for Alfa 90, Alfa 75 and GTV - 6 cylinders.

d. Remove engine oil filter (1) by unscrewing it from the engine block using a suitable spanner (2) (belt or chain type).



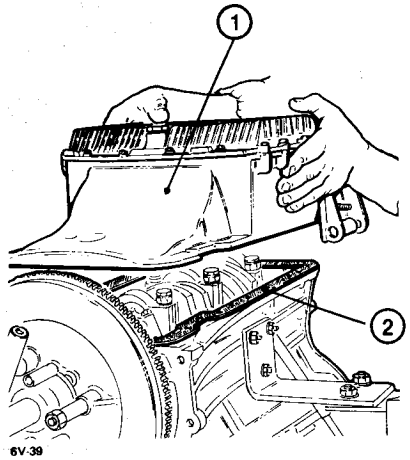
1. Engine oil filter
2. Filter removal spanner

e. Free the overhaul stand and turn the engine assembly 180°.
Fit a suitable tool (1) to the flywheel to permit the rotation of the crankshaft and lock it by means of the self-locking nuts (2).
Unscrew all the screws and washers (3) holding the oil sump to the engine block.



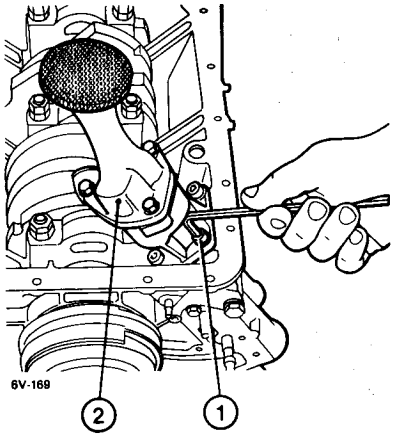
1. Tool for rotation
2. Self-locking nuts
3. Screws and washers securing oil sump

f. Remove the oil sump (1) complete and the relative gasket (2).
If necessary, remove traces of sealant on the oil sump or engine block.



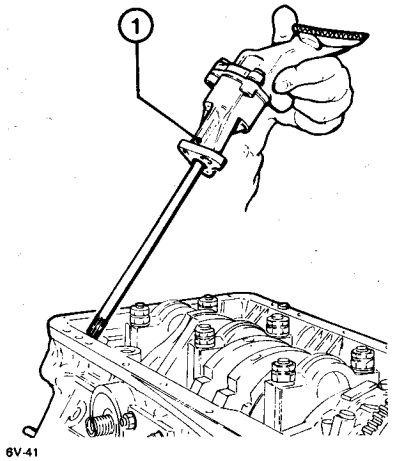
1. Sump
2. Gasket

g. Unscrew the three socket screws (1) securing sump (2) to the engine block.



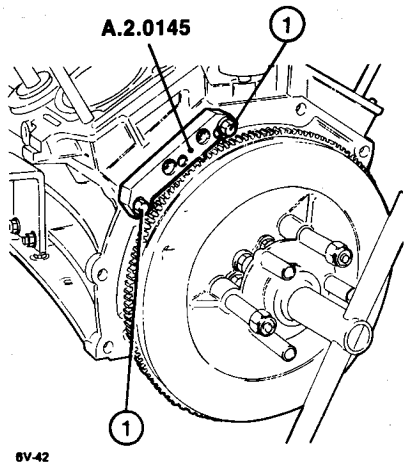
1. Socket screws
2. Oil pump

h. Extract oil pump (1) from the engine block (pull it upwards and save the seal ring).



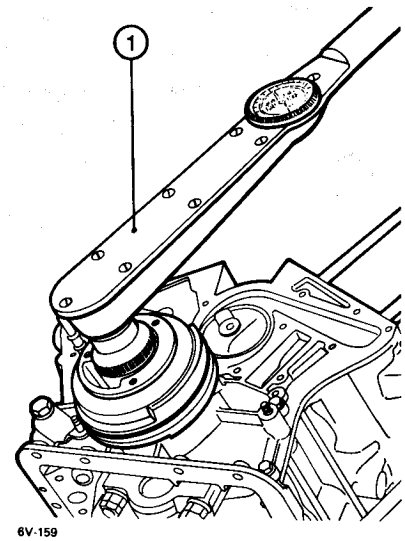
1. Oil pump, complete

i. Free the engine overhaul stand and turn the engine assembly 180°.
Fit tool **A.2.0145** to lock the rotation of the flywheel.
Ensure, before locking it with screws (1), that the tooth is perfectly aligned with those of the toothed crown of the flywheel.



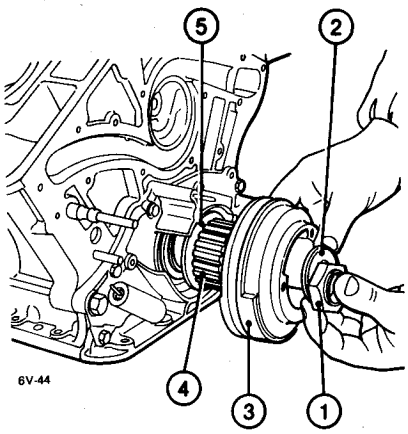
1. Tool retaining screws

j. **Removal of crankshaft front pulley**
Working on the front side remove the crankshaft pulley.
Proceed as follows:
— Eliminate the calking from the collar of the nut securing the pulley.
— Using a torque spanner (1) with adequate extension slacken and unscrew the nut fixing the pulley.



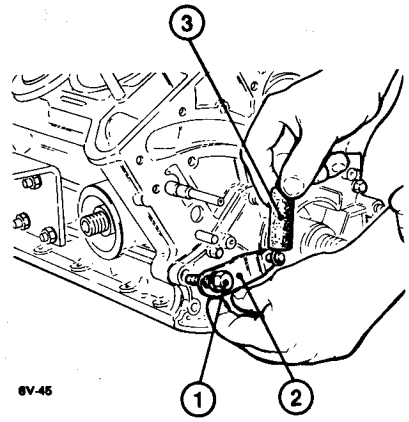
1. Torque spanner

— Unscrew nut (1) completely and remove in order: washer (2), crankshaft pulley (3), toothed pulley (4) of timing belt and cup washer (5) (the convex part of the washer faces inwards), which serves as a shoulder for the timing drive belt.



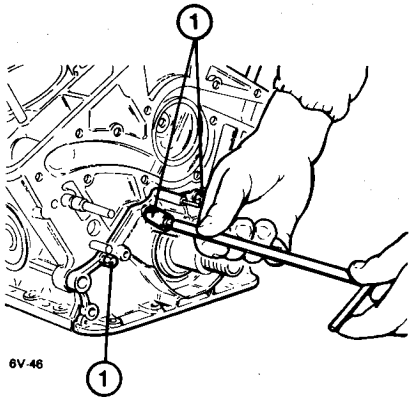
1. Nut
2. Washer
3. Crankshaft pulley
4. Toothed pulley
5. Cup washer

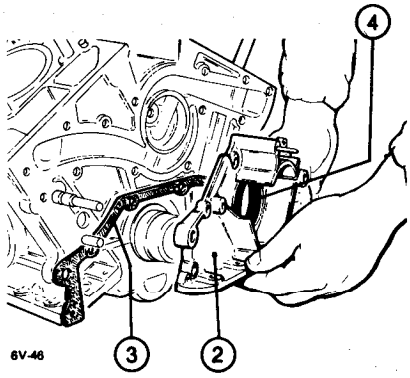
k. Unscrew screw with washer (1) and remove the plate (2) securing hydraulic belt stretcher spring (3).

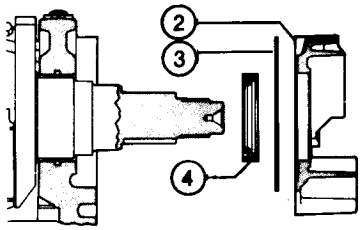


1. Screws and washers
2. Securing plate
3. Hydraulic belt stretcher spring

l. Slacken and remove screws with washers (1) securing the front cover.
Remove front cover (2) and retrieve the gasket under it (3).
Extract seal ring (4) from the front cover.



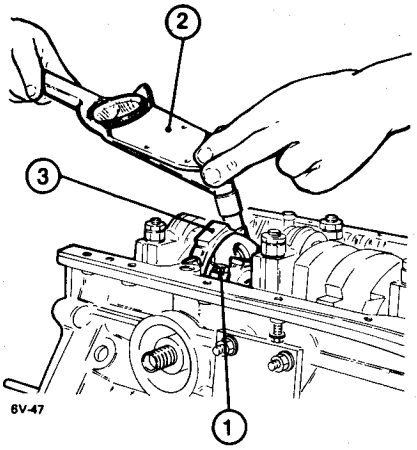




1. Screws with washers
2. Front cover
3. Gasket
4. Seal ring

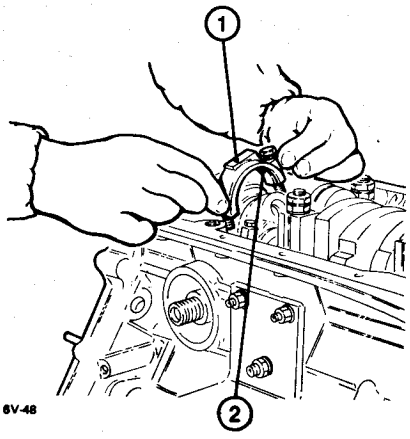
m. **Removal of piston liners, pistons and connecting rods**

— Remove tool **A.2.0145** which prevents the rotation of the engine flywheel.
Turn the crankshaft so as to make screws (1) securing the con rod caps to the con rods accessible.
Slacken and remove screws (1), using a torque spanner (2), which secure the con rod caps (3).



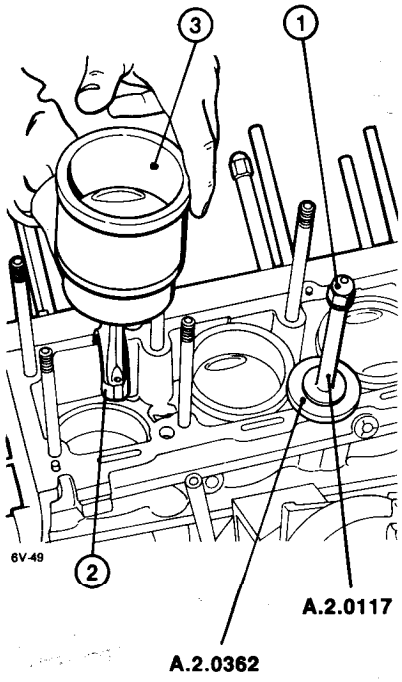
1. Screws securing con rod caps
2. Torque spanner
3. Con rod caps

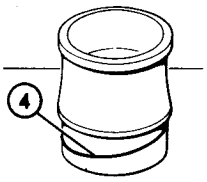
— Remove con rod caps (1) complete with respective lower half-bearings (2).
Proceed in the same way for the remaining con rod caps.



1. Con rod caps
2. Con rod lower half-bearings

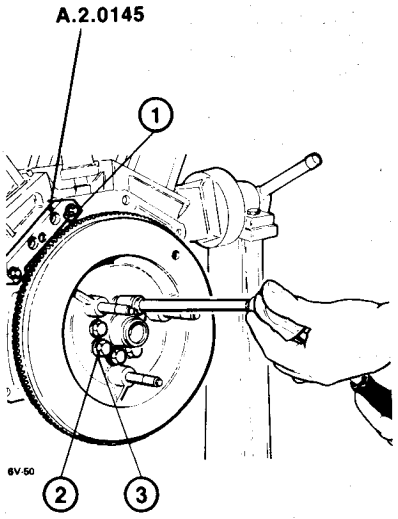
— Free the overhaul stand and turn the engine 180°.
Unscrew nut with washer (1) and remove the liner locking tool **A.2.0117** and respective washer **A.2.0362**.
Extract all the con rod-piston groups (2) complete with con rod upper half-bearings and together with the cylinder liners (3).
Remove seal ring (4) from each cylinder liner.





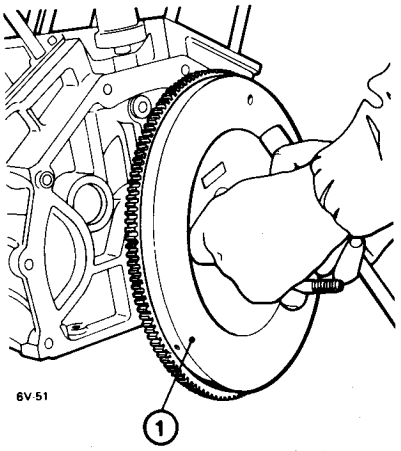
1. Nut with washer
2. Con rod-piston group
3. Cylinder liner
4. Seal ring

n. Tilt the cylinder block slightly and fit tool **A.2.0145** again.
Lock with screws (1).
Remove the tool from the engine flywheel to permit the rotation of the crankshaft.
Unscrew screws (2) securing the flywheel to the crankshaft (the screws securing the flywheel are sealed on mounting with LOCTITE 270 (green) cement P/N 3524-00009).
Remove screws (2) and lock washers (3).



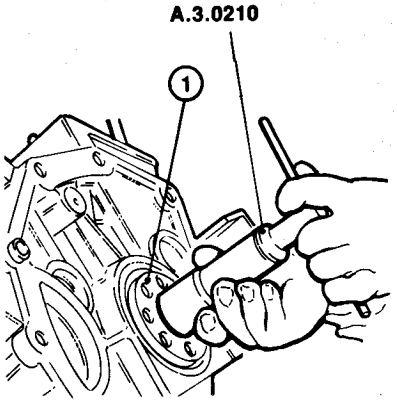
1. Tool fixing screws
2. Flywheel fixing screws
3. Lock washers

o. Remove tool **A.2.0145** and remove flywheel (1).



1. Engine flywheel

p. Extract the flywheel center bushing from the rear flange of crankshaft (1); the bushing should be extracted with extracting tool **A.3.0210**.

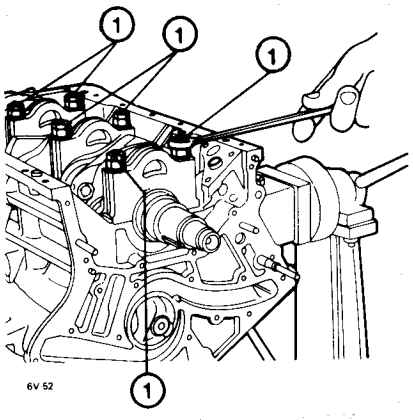


1. Crankshaft rear flange

q. **Removal of crankshaft**

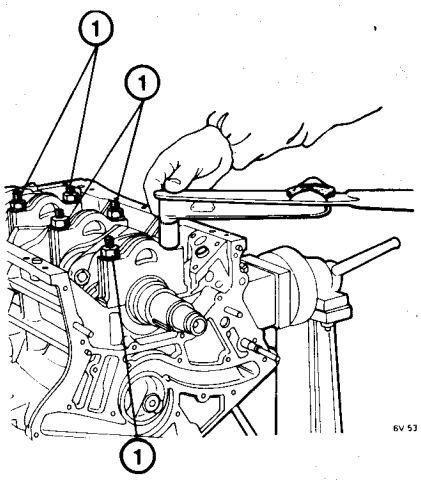
1. Remove the three front main bearing caps as follows:

— Remove lock nuts (1) using a suitable spanner.



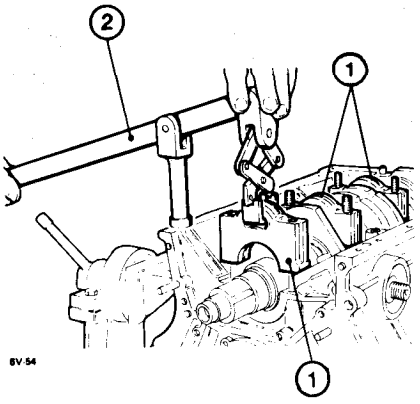
1. Lock nuts

— Slacken and unscrew, using a torque spanner, the remaining nuts and washers (1) fixing the front main bearing caps (six).



1. Nuts and washers fixing the front main bearing caps

— Remove the three front main bearing caps (1), using a suitable extracting tool (2) if necessary.

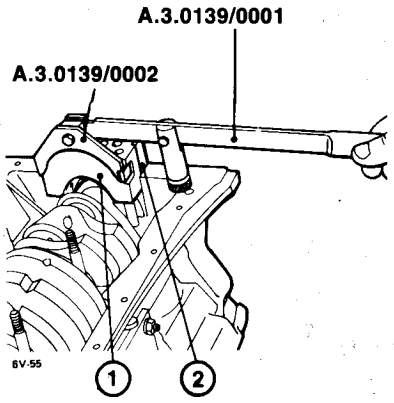


1. Front main bearing caps
2. Extracting tool

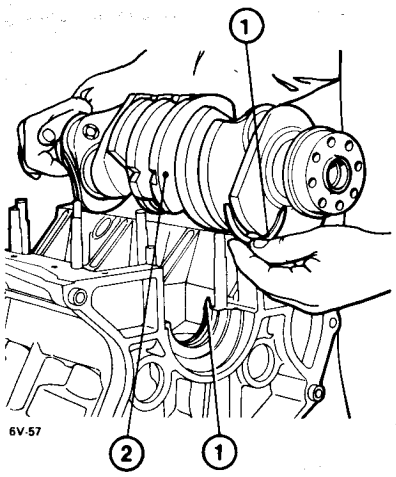
2. Remove the rear main bearing cap as follows:

— Straighten the safety tabs which secure the nuts of the rear main bearing cap.
Slacken and remove the nuts with the respective tabs.

— Remove the rear main bearing cap (1) using the extraction tool composed of lever **A.3.0139/0001** and fork **A.3.0139/0002**.
Retrieve the grommets (2) on the sides of the rear main bearing cap.

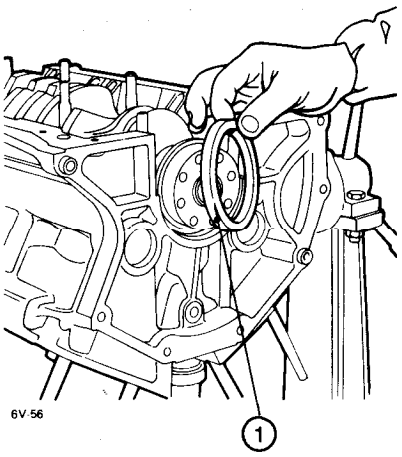


1. Rear main bearing cap
2. Grommets



1. Thrust half-rings
2. Crankshaft

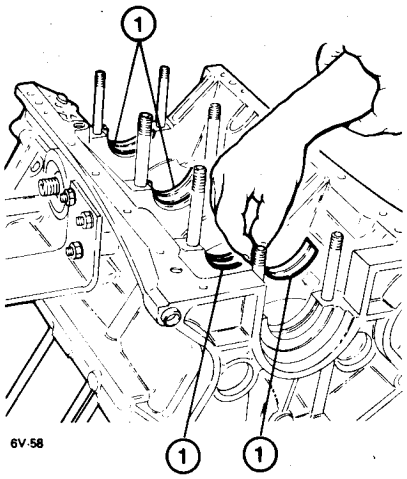
3. Remove the seal ring (1) from the rear flange of the crankshaft.



1. Rear seal ring

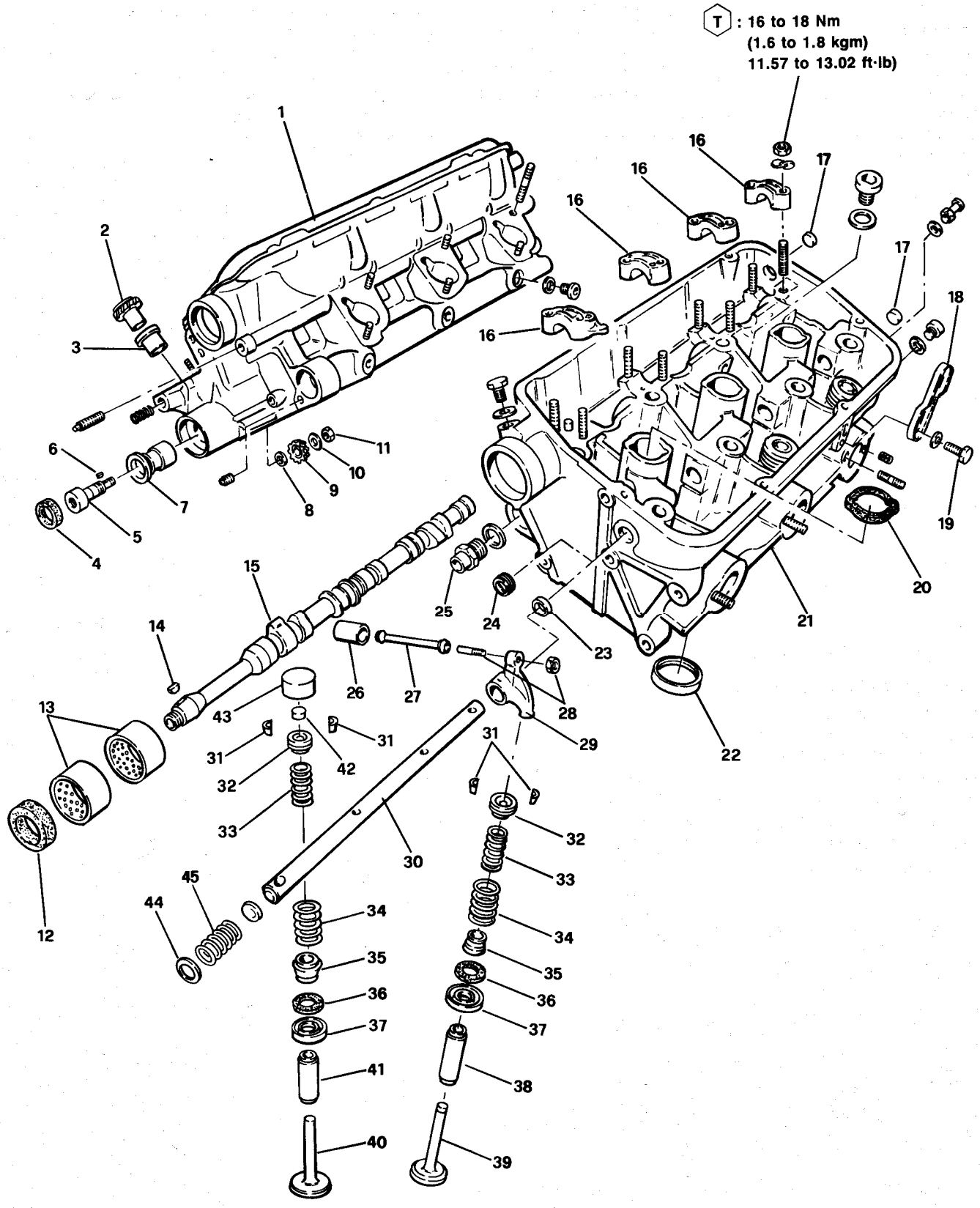
4. Extract the two rear thrust half-rings (1) and turn the crankshaft to facilitate its extraction.
Remove the crankshaft (2) from the cylinder block.

5. Remove the upper main half-bearings (1) located in their respective seats on the main bearings.
Mark the reciprocal position of the half-bearings (1) in case they are re-utilized when re-assembling.



1. Upper main half-brearings

CYLINDER HEAD



1. Right cylinder head, complete
2. Idle gear
3. Bushing
4. Seal ring
5. Shaft for toothed pulley
6. Key
7. Bushing
8. Spacer
9. Distributor and oil pump drive gear
10. Lock washer
11. Lock nut
12. Seal ring
13. Bushings
14. Key
15. Camshaft
16. Camshaft caps (four)
17. Plugs
18. Engine lifting bracket
19. Retaining screws
20. Spark plug well gasket
21. Left cylinder head
22. Valve seats
23. Rocker shaft bushing
24. Plug
25. Cylinder head cooling union
26. Exhaust valve tappet
27. Rods
28. Exhaust valve adjustment screw and nut
29. Rockers
30. Rocker shaft
31. Cotters
32. Upper cap
33. Inner spring
34. Outer spring
35. Grommet
36. Stop ring
37. Lower cap
38. Exhaust valve guide
39. Exhaust valve
40. Intake valve
41. Intake valve guide
42. Adjustment cap for intake valve
43. Intake valve tappet
44. Washer
45. Spring

DISASSEMBLY OF THE CYLINDER HEAD ON BENCH

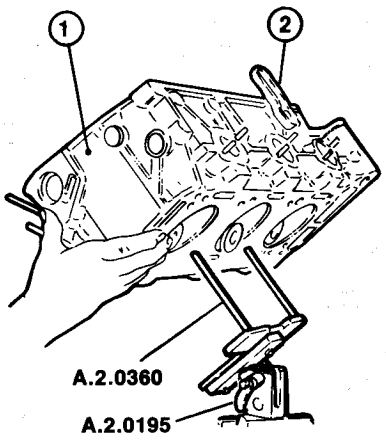
The disassembly operation described here is for the right cylinder head. To disassemble the left cylinder head proceed in the same way.

PRELIMINARY OPERATIONS

a. Lock revolving support (tool **A.2.0195**) in a vice, fit the fork to support the cylinder head (tool **A.2.0360**) and fix it to the revolving support.

b. Place cylinder head (1) on the fork and fix it with two lock nuts of the cylinder head (removed previously).

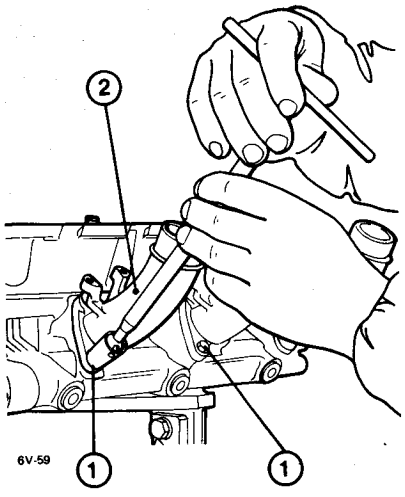
c. Remove engine lifting bracket (2).



1. Cylinder head
2. Engine lifting bracket

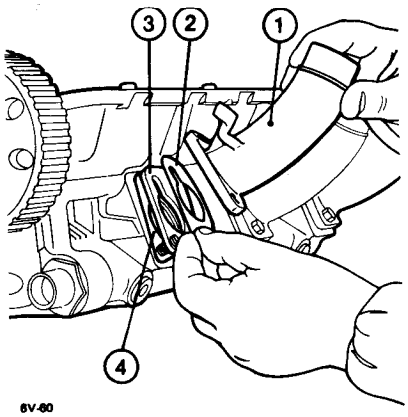
REMOVAL OF INTAKE STUB PIPES (Only for vehicles with L-JETRONIC injection)

a. Slacken and remove nuts with washers (1) securing the intake stub pipes (2) to the cylinder head.



1. Nuts and washers
2. Intake stub pipes

b. Remove the intake stub pipes (1) and then remove, in order, the following parts: gasket (2), insulating gasket (3) and gasket (4).



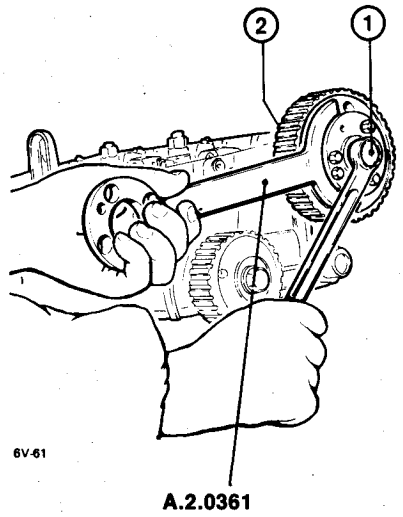
1. Intake stub pipes
2. Gasket
3. Insulating gasket
4. Gasket

REMOVAL OF THE CAMSHAFT PULLEY

Remove the toothed pulley driving the camshaft in the following way:

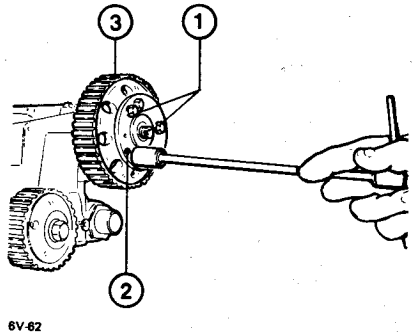
a. Unscrew nut (1).

Use the lever (tool **A.2.0361**) to prevent toothed pulley (2) from rotating.



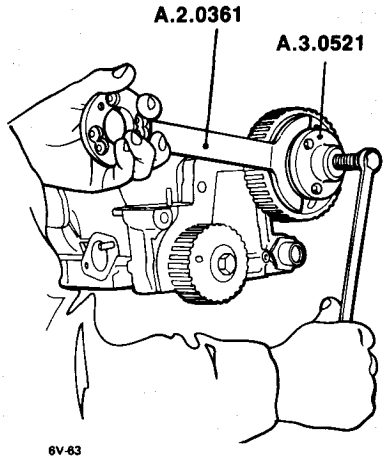
1. Nut
2. Toothed pulley

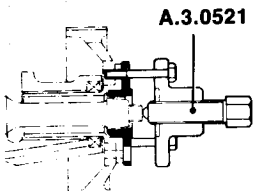
b. Slacken and unscrew screws (1) fixing the support hub (2) to the toothed pulley (3).



1. Screws
2. Support hub
3. Toothed pulley

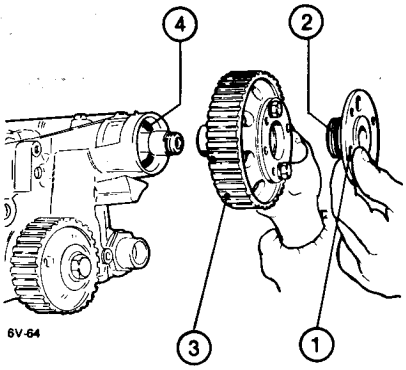
c. Free the support hub, which is interference-fitted, using the puller (tool **A.3.0521**) and lever (tool **A.2.0361**).

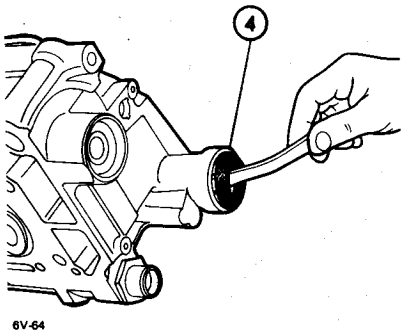




d. Slide out hub (1) complete with seal (2).

Extract toothed pulley (3) and retrieve seal (4).





1. Hub
2. Seal ring
3. Toothed pulley
4. Seal ring

REMOVAL OF DISTRIBUTOR AND OIL PUMP DRIVE PULLEY

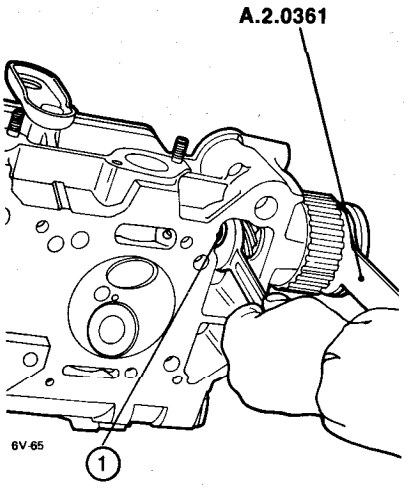
a. Raise the safety tab of nut (1) securing the gear.

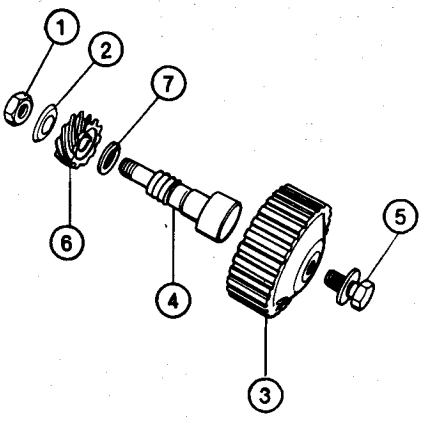
b. Slacken nut (1) (use lever - tool **A.2.0361** to maintain it).

c. Unscrew and remove nut (1) with relative washer (2).

d. Slide out toothed pulley (3) complete with drive shaft (4) secured by screw with washer (5).

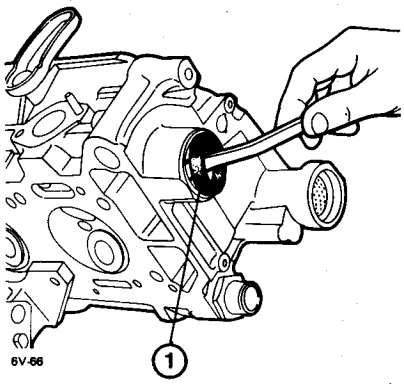
At the same time retrieve gear (6) and relative spacer (7) from the lower part of the cylinder head.





1. Nut
2. Lock washer
3. Toothed pulley
4. Drive shaft
5. Screw with washer
6. Gear
7. Spacer

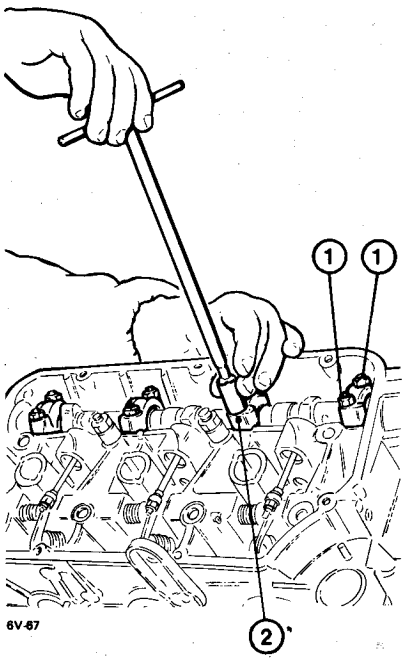
e. Remove the oil ring (1) from under the cylinder head.



1. Seal (oil ring)

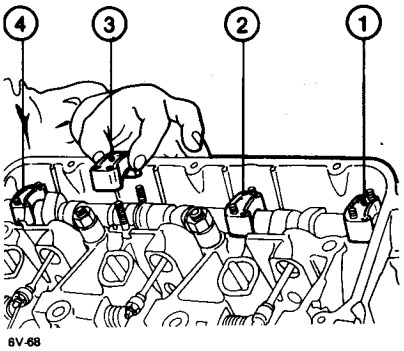
REMOVAL OF CAMSHAFT

a. Slacken and remove nuts with washers (1) securing the caps (2) of the camshaft.



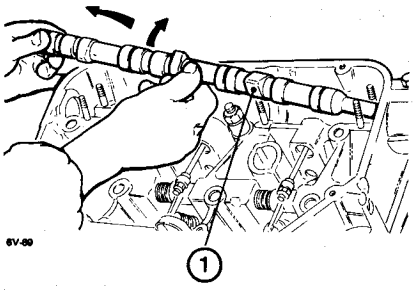
1. Nuts with washers
2. Camshaft caps

b. Remove caps. The camshaft caps are numbered progressively (1-2-3 etc.).
Cap (1) is located on the front part of the cylinder head.
When reassembling fit the caps in the same order.



1. Cap no. 1
2. Cap no. 2
3. Cap no. 3
4. Cap no. 4

c. Remove camshaft (1) by raising the rear part first and then sliding it out in the direction indicated by the arrows in the figure.



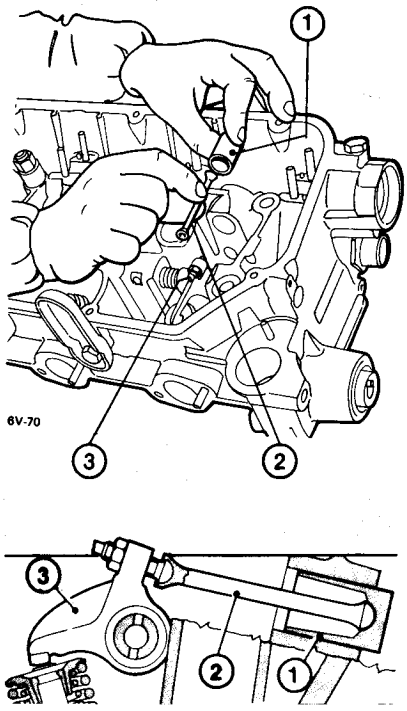
1. Camshaft

REMOVAL OF ROCKER ARM SHAFT AND VALVES

Disassemble the rocker arm support shaft as follows:

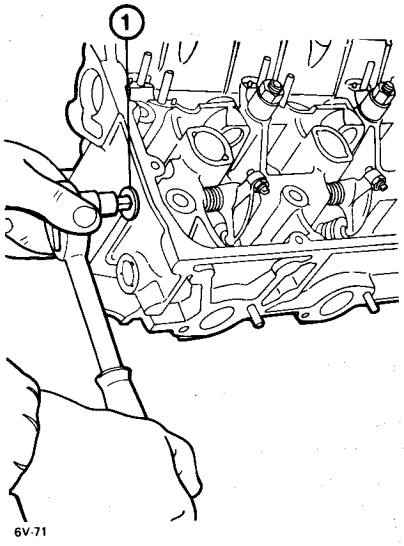
a. Remove tappets (1) from their seats in the cylinder head.

b. Slide out push rods (2) operating rocker arms (3) of the exhaust valves.



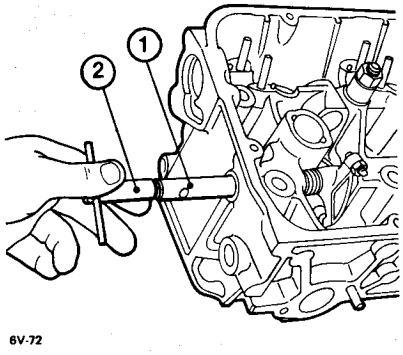
1. Tappet
2. Push rods
3. Rocker arms

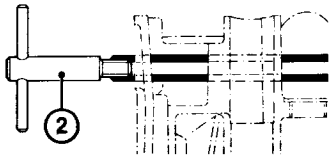
c. Slacken and unscrew plug (1) sealing the rocker arm support shaft.



1. Plug

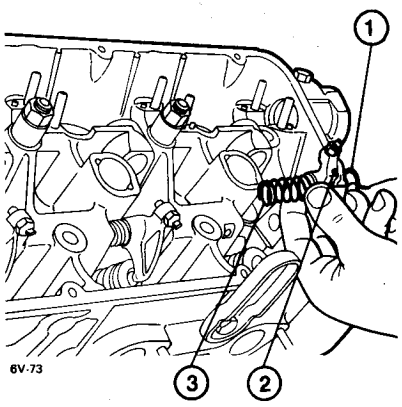
d. Screw a suitable tool (2) to the threaded shank of the rocker arm support shaft (1).

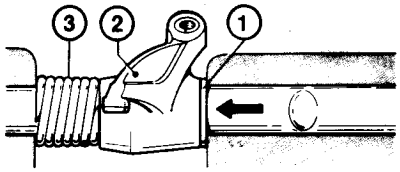




1. Rocker arm support shaft
2. Tool for removing shaft

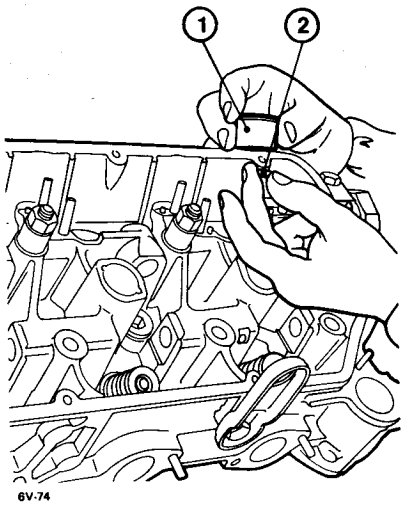
e. Gradually extract the rocker arm shaft and retrieve, one at a time, the following parts:
— washer (1);
— rocker arms (2);
— spring (3).





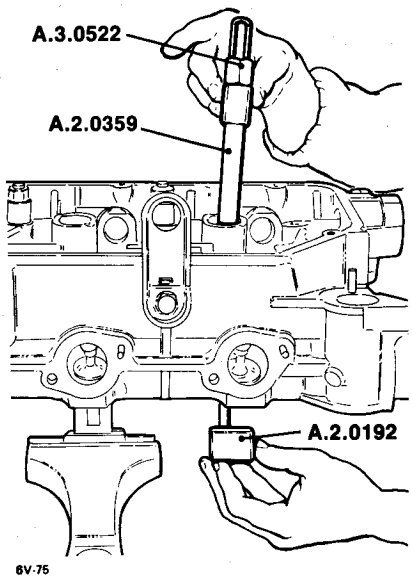
1. Washer
2. Rocker arms
3. Spring

f. Slide out tappets (1) located on the intake valves, complete with cap nut (2) which determines valve clearance.
Remove in sequence so that they can be replaced in the same order.

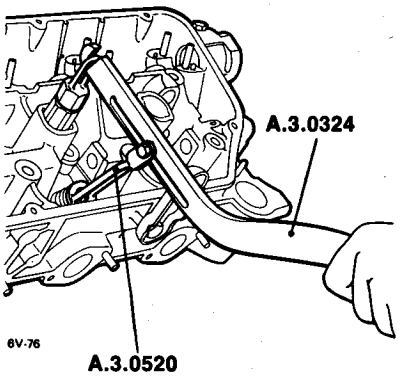


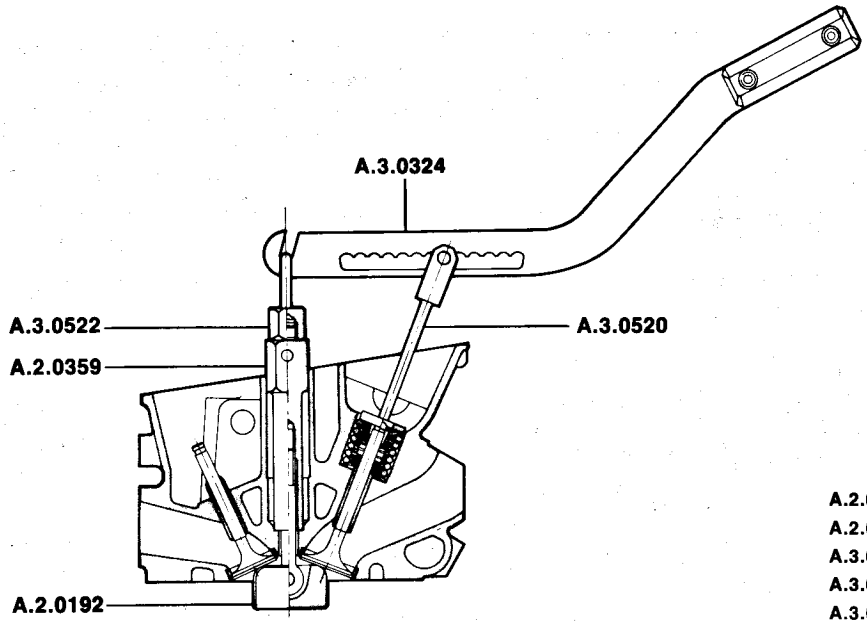
1. Intake valve tappets
2. Valve clearance adjustment cap nut

g. **Disassemble the valves** in the following way and using the following tools:
— Insert tool **A.2.0192** to support the valves by passing it under the spark plug well and lock it with special nut (tool **A.2.0359**). Screw support (tool **A.3.0522**) to the threaded shank of tool **A.2.0359**.



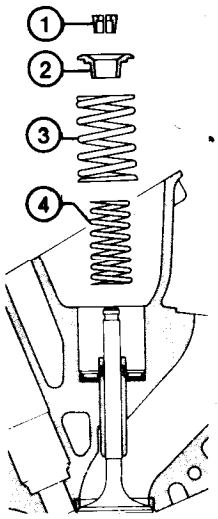
— Fit the cage for the removal and refitting of the cotters (tool **A.3.0520**) to the lever (tool **A.3.0324**) and fit the group to the tools already mounted, as shown in the figure.

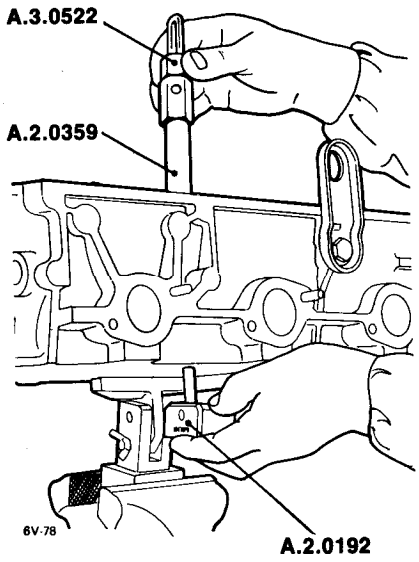


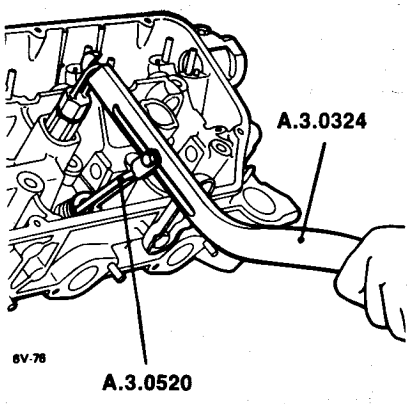


A.2.0192 Support for valves
A.2.0359 Special nut to secure A.2.0192
A.3.0522 Support for lever A.3.0324
A.3.0324 Lever for disassembly
A.3.0520 Cage for disassembling cotters

— Disassemble each pair of valves (intake and exhaust) and move the tool group each time.
Press the lever (tool **A.3.0324**) to overcome the resistance of the valve springs and remove cotters (1) (for this operation use a small screwdriver).
Then disassemble in the following order: upper cap (2), outer spring (3) and inner spring (4).

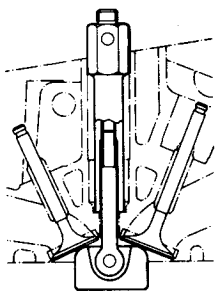


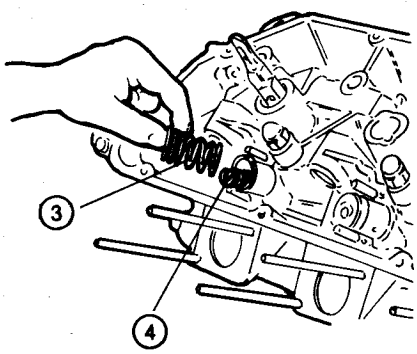




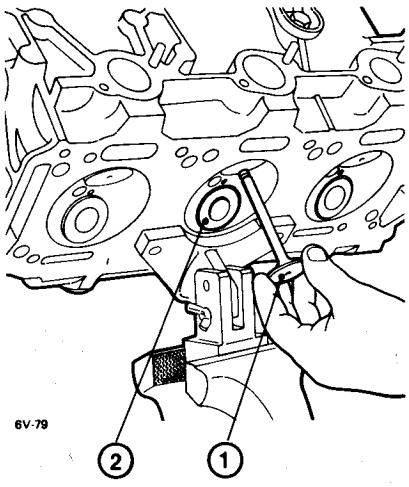
1. Cotters
2. Upper cap
3. Outer spring
4. Inner spring

— Unscrew special nut (tool **A.2.0359**) complete with support (tool **A.3.0522**) from valve support (tool **A.2.0192**).

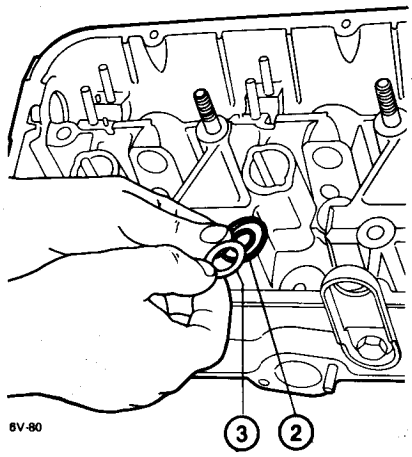




— Withdraw pair of valves (exhaust valve (1) and intake valve (2)) from the respective guides.
Repeat the operations described for the remaining pairs of valves.

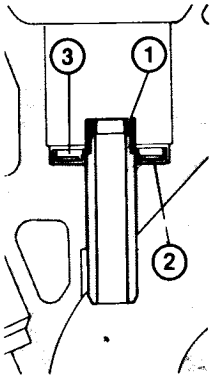


1. Exhaust valves
2. Intake valves

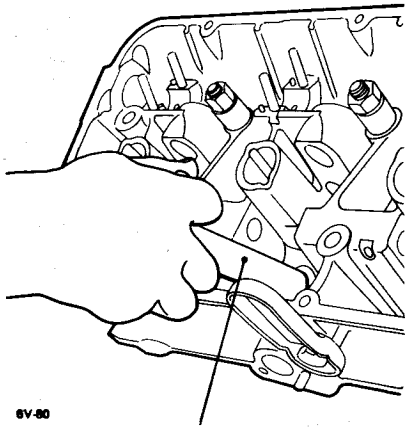


h. **Removal of rubber oil seals and lower caps from the valves**

— Using tool **A.3.0247** remove rubber oil seals (1) from the guides of the intake and exhaust valves.
Remove lower caps (2) from both intake and exhaust valves, complete with spring seat rings (3).



1. Rubber oil seals
2. Lower caps
3. Spring seat rings



A.3.0247

CHECKING AND TESTING THE CYLINDER HEADS

CHECKING AND TESTING CYLINDER HEAD AND VALVES

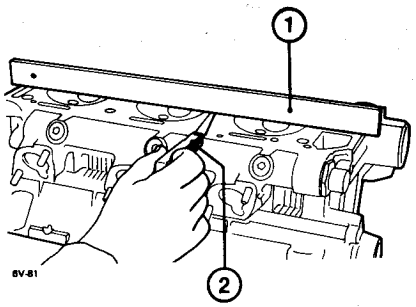
a. Examine visually and with care, the casting and all the parts making up the cylinder head to check for cracks, burns, seizing or signs of excessive wear.

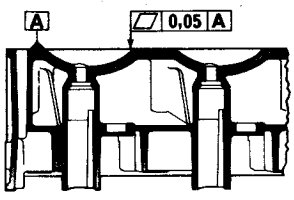
b. If this inspection should indicate the possibility of re-utilizing one or more parts check, according to the instructions given and after thorough cleaning of the head, the dimensions of the same.

CHECKING CYLINDER HEAD FLATNESS

a. Thoroughly clean the surfaces of the cylinder head to remove any gasket fragments. Use butyl acetate or methylethylketone.

b. The checking of the flatness of the lower surface of the cylinder head must be performed by means of a straight edge (1) placed on the lower surface of the head; the extent of deformation should be measured with a suitable thickness gauge (2).

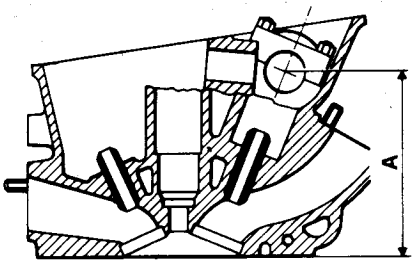




1. Straight edge
2. Thickness gauge

Maximum flatness error of the lower surface of the cylinder head:
A = 0.05 mm (0.002 in)

c. If the lower surface of the cylinder head should prove to be excessively deformed it must be levelled.
Levelling must be performed on both heads.



A. Distance between camshaft axis and lower surface of cylinder head

Min. permitted height of cylinder head after regrinding:
A = 124.5 mm (4.902 in)

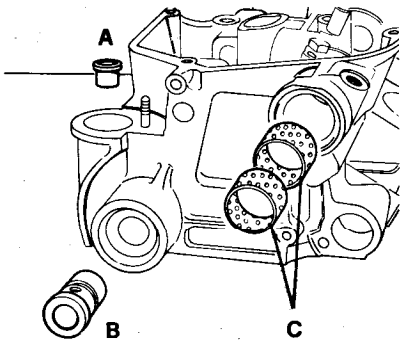
CAUTION:
Do not exceed the minimum limit permitted as this can cause serious engine malfunctions.

d. Check that the lower surface of the head is well-finished.

CHECKING CYLINDER HEAD BUSHINGS

a. Measure the diameter of the following bushings mounted on the cylinder head:
— **«A»**, bushing for the distributor and oil pump drive gear;
— **«B»**, bushing for the distributor and oil pump drive pulley shaft;
— **«C»**, bushings for the shaft of the toothed pulley driving the camshaft.

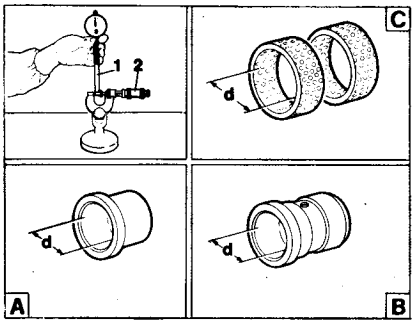
NOTE:
Bushings «A» and «B» are not mounted on the left cylinder head.



A. Distributor and oil pump bushing
B. Distributor and oil pump bushing toothed pulley
C. Camshaft toothed pulley bushing

b. Measure the internal diameter as follows:
— using a micrometer (2) establish dimension **«d»** to be measured (refer to the table);

— fit the most suitable bore gauge (1) to the stem of the dial indicator;
— zero-set the dial indicator at the dimension established on the micrometer and then measure diameter «d» of the bushings measured on 120° of the circumference.

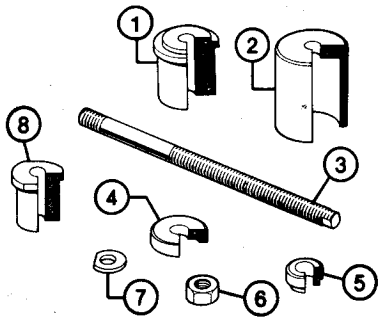


«d» mm (in)
(bushing I.D.)

Bushing		
A	B	C
19.000 to 19.021 (0.7480 to 0.7489)	19.000 to 19.021 (0.7480 to 0.7489)	32.000 to 32.025 (1.2598 to 1.2608)

1. Bore gauge and dial indicator
2. Micrometer

c. If the values obtained are not within the prescribed limits replace the bushings involved. For removal and installation use the tool illustrated (**A.3.0528**) as shown below.

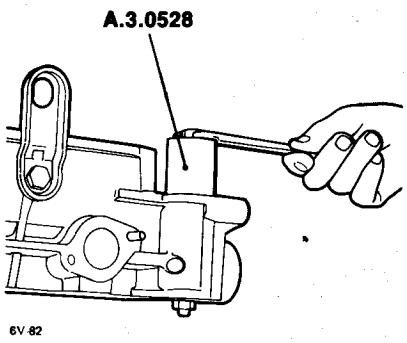


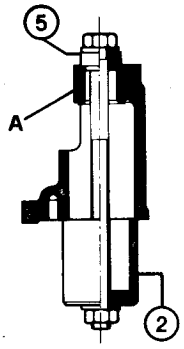
Components of tool A.3.0528

1. Spool
2. Bowl
3. Tie rod
4. Flange
5. Special washer
6. Hex nut (M10 x 1.25)
7. Shaped washer
8. Spool

d. **Removal of bushings**

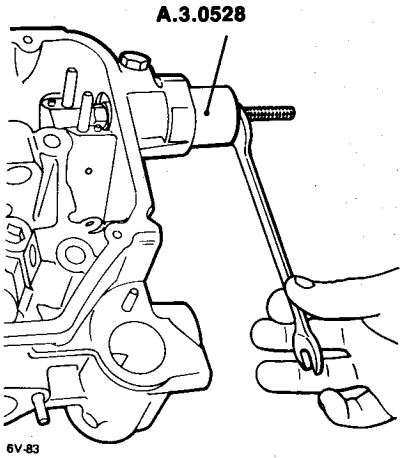
— Bushing «A» of the gear operating the oil pump and the distributor should be withdrawn using special washer (5) as a pusher, and using bowl (2) as a support (which will accompany the bushing as it is extracted).

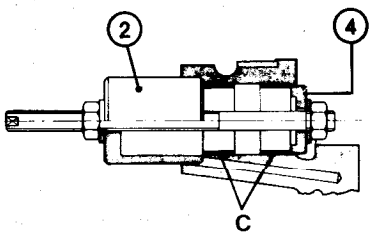




A. Bushing
2. Bowl (A.3.0528)
5. Special bushing (A.3.0528)

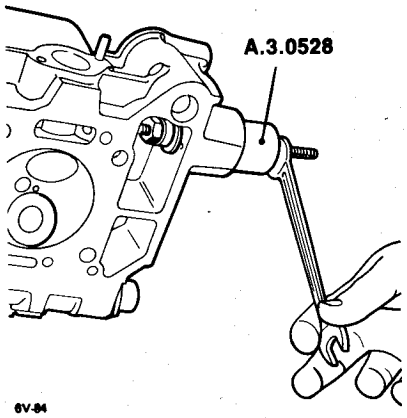
— Proceeding in the same way as described above, withdraw the two bushings «C» of the toothed pulley support shaft operating the camshaft. Use flange (4) as a pusher, together with cup (2).

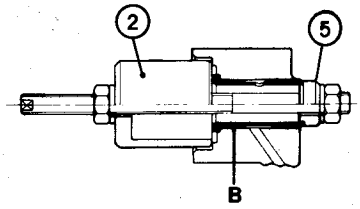




C. Bushings
2. Bowls (A.3.0528)
4. Flange (A.3.0528)

— Extract bushing «B» for the shaft of the pulley operating the oil pump and the distributor using, in addition to cup (2), special washer (5) as a pusher.

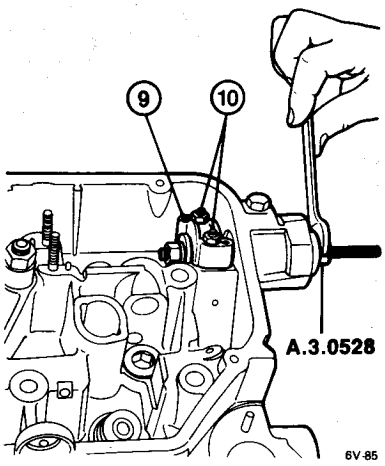


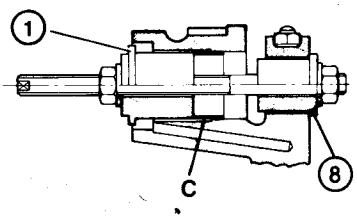


B. Bushing
2. Cup (A.3.0528)
5. Special washer (A.3.0528)

e. Installation of the bushings

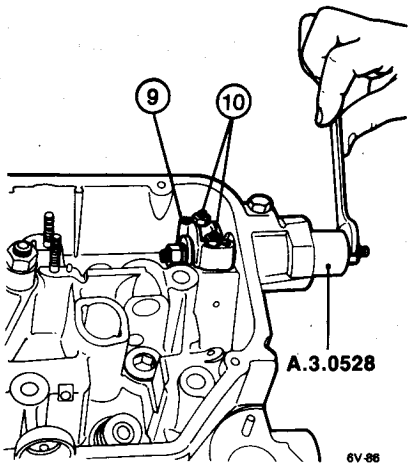
— Bushings «C», made of antifriction metal, for the shaft of the pulley operating the camshaft, must be inserted in the following way.
Temporarily fit cap (9) of the camshaft and lock it with nuts (10).
Place the rear bushing «C», **recognizable because it is thinner**, so that it is sufficiently centered in its seat.
Place, as illustrated in the figure, tool **A.3.0528** comprising spool (1) which acts as a pusher, and spool (8).
Insert until the lip of spool (1) touches the bushing seat.

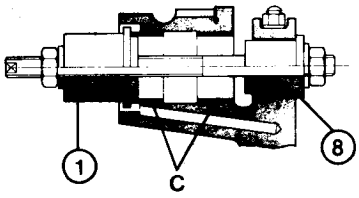




C. Bushing
1. Spool (A.3.0528)
8. Spool (A.3.0528)
9. Cap
10. Nuts

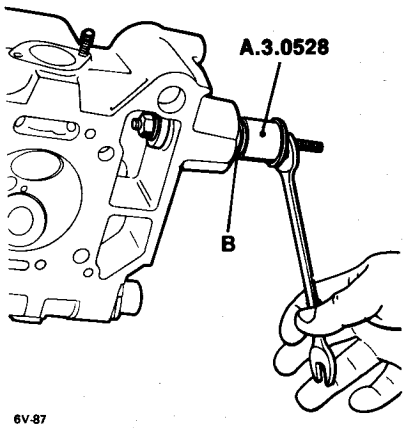
— To insert the front bushing «C» proceed in the same way but use spool (1) in inverted position as illustrated in the following figure so as to obtain the correct position of the bushing.



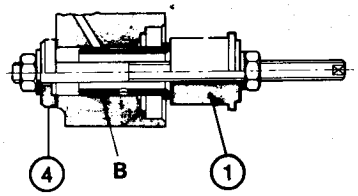


C. Bushings
1. Spool (A.3.0528)
8. Spool (A.3.0528)
9. Cap
10. Nuts

— Insert bushing «B» for the shaft of the toothed pulley operating the oil pump and the distributor using spool (1) as a pusher and flange (4) as a support.

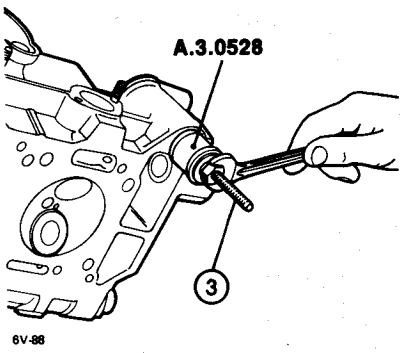


6V-87

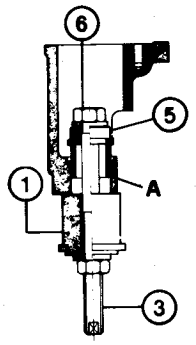


B. Bushing
1. Spool (A.3.0528)
4. Flange (A.3.0528)

— Insert, from the upper side of the distributor seat, bushing «**A**» for the distributor and oil pump drive gear. Place tool **A.3.0528** in the following way: insert tie rod (3) complete with nut (6) and special nut (5) (as pusher); from the opposite side insert support spool (1) in the tie rod and complete the insertion of the bushing «**A**» in this way.



6V-88

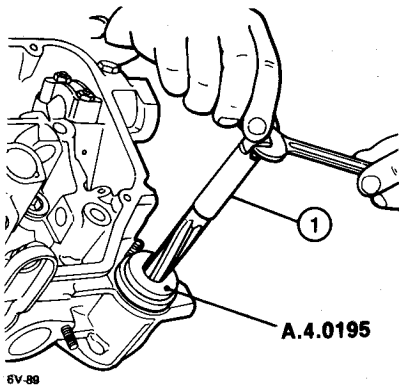


A. Bushing
1. Spool (A.3.0528)
3. Tie rod (A.3.0528)
5. Special washer (A.3.0528)
6. Nut (A.3.0528)

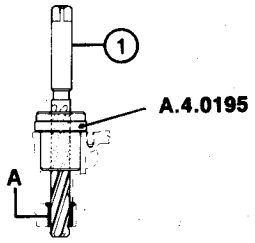
f. Reaming bushings «A» and «B»

After inserting the two bushings «**A**» and «**B**» for the distributor and oil pump drive mechanism, they must be reamed to the prescribed dimensions.

— Bushing «**A**»; insert tool **A.4.0195** and then, using a suitable reamer (1) [19 mm H7 (0.7480 to 0.7489 in)] bore as prescribed.



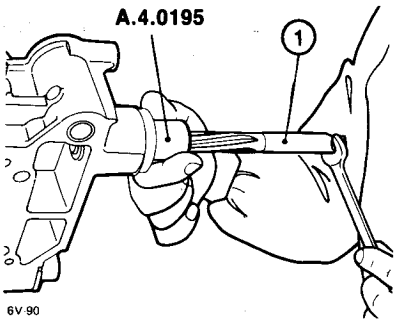
6V-89

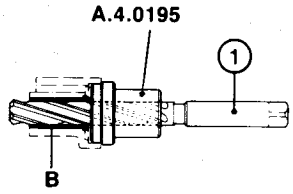


A. Bushing
1. Reamer [19 mm H7 (0.7480 to 0.7489 in)]

Diameter after reaming; bushing for distributor and oil pump drive gear shaft: 19.000 to 19.021 mm (0.7480 to 0.7489 in)

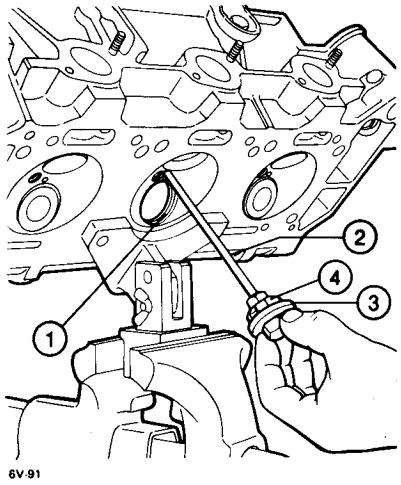
— Bushing «**B**»; insert guide tool **A.4.0195** and then, using a suitable reamer (1) [19 mm H7 (0.7480 to 0.7489 in)] bore as prescribed.

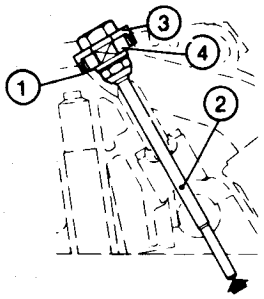




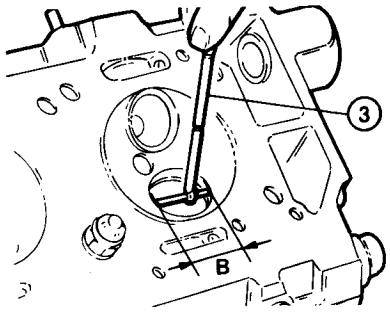
B. Bushing
1. Reamer [19 mm H7 (0.7480 to 0.7489 in)]

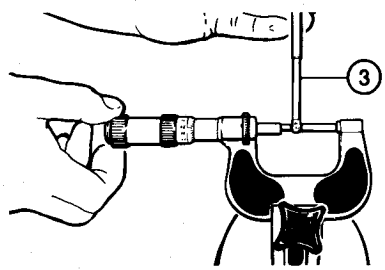
Diameter after reaming; bushing for distributor and oil pump drive pulley shaft: 19.000 to 19.021 mm (0.7480 to 0.7489 in)





1. Valve seat
2. Mandrel for extraction
3. Stop ring
4. Screw tap for threading the valve seats to be extracted





1. Micrometer
2. Valve seat
3. Bore meter

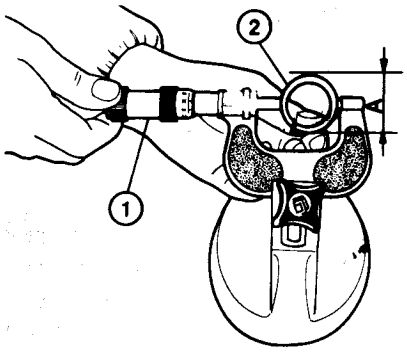
CHECKING VALVE SEATS

a. Check that the valve seats do not exhibit scoring, cracking or burning and that they are well-fitted in their respective seats on the cylinder head - if necessary replace them.

b. Withdraw the valve seats (1) using a suitable tool as illustrated in the figure. Proceed as follows:

— fit and lock stop ring (3) and screw tap (4) (selected according to the diameter of the valve seat to be extracted) on mandrel (2);
— insert the group thus formed in the valve guide until screw tap (4) comes into contact with the valve seat (1);
— thread the valve seat by means of a no. 22 mm spanner on the head of the mandrel until ring (3) touches the surface of the valve seat - then unscrew a half turn;
— tap the extremity of the mandrel protruding from the head to extract the valve seat.

c. Use a micrometer (1) to measure the diameter of the new valve seat (2) and a bore meter (3) to measure that of the respective seat in the cylinder head to check the correct fitting interference. Compare the values obtained with those given in the table.



Valve		Engine 062.10
Valve seat O.D. A = mm (in)	Normal	i. 37.565 to 37.600 (1.4789 to 1.4803) e. 32.565 to 32.600 (1.2821 to 1.2835)
	Oversize	i. 37.865 to 37.900 (1.4907 to 1.4921) e. 32.865 to 32.900 (1.2939 to 1.2953)

Valve		Engine 016.46
Valve seat O.D. A = mm (in)	Normal	i. 42.065 to 42.100 (1.6561 to 1.6575) e. 37.065 to 37.100 (1.4593 to 1.4606)
	Oversize	i. 42.365 to 42.400 (1.6679 to 1.6693) e. 37.365 to 37.400 (1.4711 to 1.4724)

Valve		Engine 062.10
Valve seat housing I.D. B = mm (in)	Normal	i. 37.500 to 37.525 (1.4764 to 1.4774) e. 32.500 to 32.525 (1.2795 to 1.2805)
	Oversize	i. 37.800 to 37.825 (1.4882 to 1.4892) e. 32.800 to 32.825 (1.2913 to 1.2923)

Valve		Engine 016.46
Valve seat housing I.D. B = mm (in)	Normal	i. 42.000 to 42.025 (1.6535 to 1.6545) e. 37.000 to 37.025 (1.4567 to 1.4577)
	Oversize	i. 42.300 to 42.325 (1.6654 to 1.6663) e. 37.300 to 37.325 (1.4685 to 1.4695)

i. = Intake valve e. = Exhaust valve

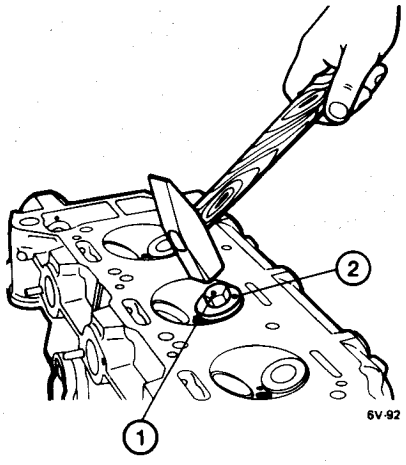
d. Pre-heat the cylinder head in a suitable oven to **120°C (274°F)**.

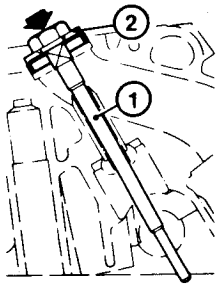
e. Insert the valve seat (of intake and exhaust valves) using the tool used for the removal in the following way:

— fit and lock stop ring (2) (selected according to the diameter of the valve seat to be fitted) on mandrel (1);

— insert the group thus formed into the valve guide until stop ring (2) comes into contact with the valve seat;

— tap the extremity of mandrel (1) protruding from the head, to insert the valve seat.





1. Mandrel for insertion
2. Stop ring

CHECKING VALVE GUIDES

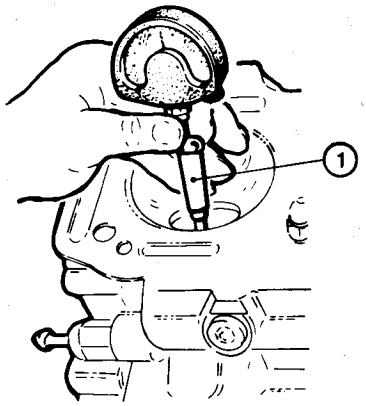
Determine the clearance between valve guide and the stem.

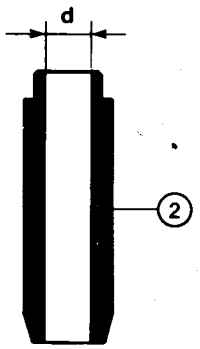
If the clearance exceeds the permitted tolerance replace the worn parts.

a. **Determination of clearance**

— Using a micrometer measure the diameter of the valve stem in three places and in directions at right angles to each other.

— Using a bore gauge (1) measure the I.D. of the valve guide «**d**».





1. Bore gauge
2. Valve guide

Valve guide I.D. (intake and exhaust):
d = 9.000 to 9.015 mm
(0.3543 to 0.3549 in)

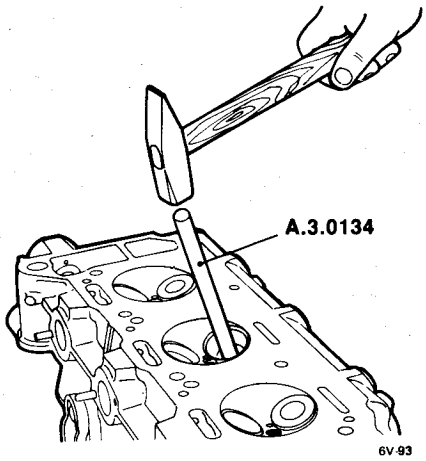
— Calculate the clearance, subtracting the maximum diameter of the valve stem from the I.D. of the valve guide.

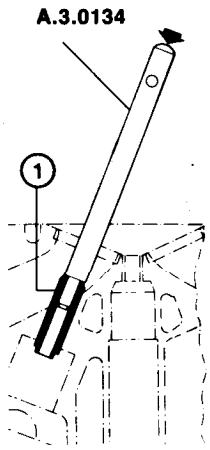
Radial clearance between valve stem and valve guide I.D.:
Intake: 0.013 to 0.043 mm
(0.0005 to 0.0017 in)
Exhaust: 0.040 to 0.080 mm
(0.0016 to 0.0031 in)

b. **Replacing the valve guide**

— Visually check the valve guides, ensuring that there is no scoring or traces of seizing and that they have not undergone deformation or moved from mounting position.

— If necessary remove the worn valve guides (1) using extracting tool **A.3.0134** as illustrated in the figure.





1. Valve guide

c. **Insertion of the valve guide**

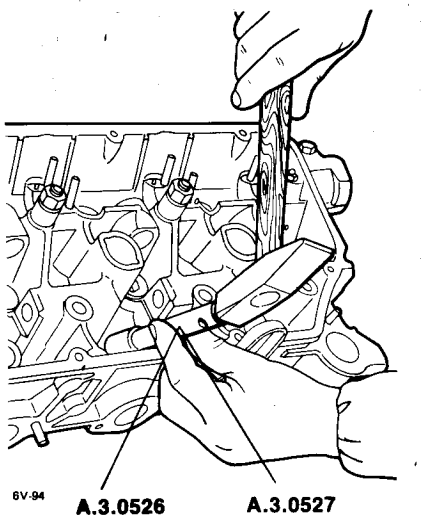
— Check the I.D. of the valve guide seat and the O.D. of the new valve guide; the fitting interference should be within the prescribed limits (the values are valid for both intake and exhaust valves).

Valve guide seat I.D.:
13.990 to 14.018 mm
(0.5508 to 0.5519 in)

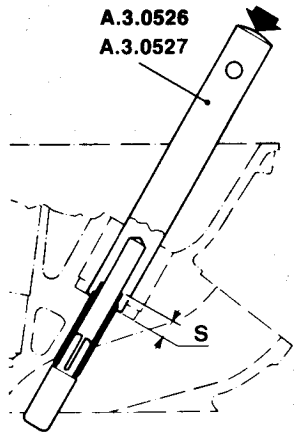
Valve guide O.D.:
14.033 to 14.044 mm
(0.5525 to 0.5529 in)

Interference between valve guide and seat of valve guide:
0.015 to 0.054 mm
(0.0006 to 0.0021 in)

— Insert the new valve guides using tool **A.3.0526** for the intake valve guides and tool **A.3.0527** for the exhaust valve guides.



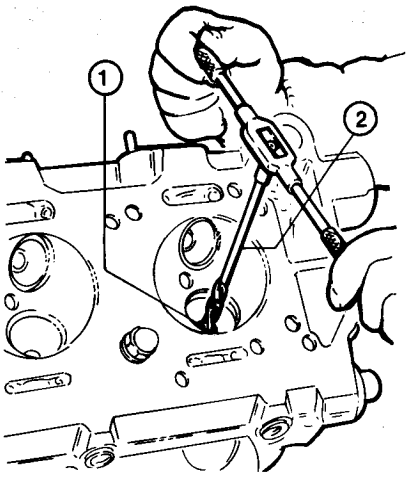
— These tools ensure the correct protrusion of the valve guides with respect to the support surface of the lower spring cap on the cylinder head.

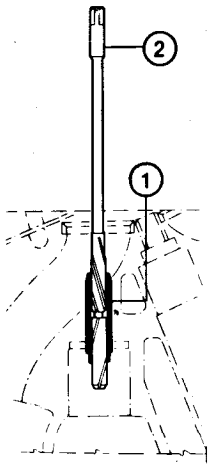


Protrusion of the valve guides from the cylinder head:
S = 10.2 to 10.6 mm
(0.402 to 0.417 in)

d. **Reaming the valve guides**

— Ream intake and exhaust valve guides (1) using a 9 mm H7 (0.3543 to 0.3549 in) reamer (2) to calibrate the holes to the prescribed diameter and then measure the I.D. of the valve guides.





1. Valve guides
2. Reamer
[diameter 9 mm H7 (0.3543 to 0.3549 in)]

I.D. of the intake and exhaust valve guides:
9.000 to 9.015 mm
(0.3543 to 0.3549 in)

e. **Turning the valve seats**

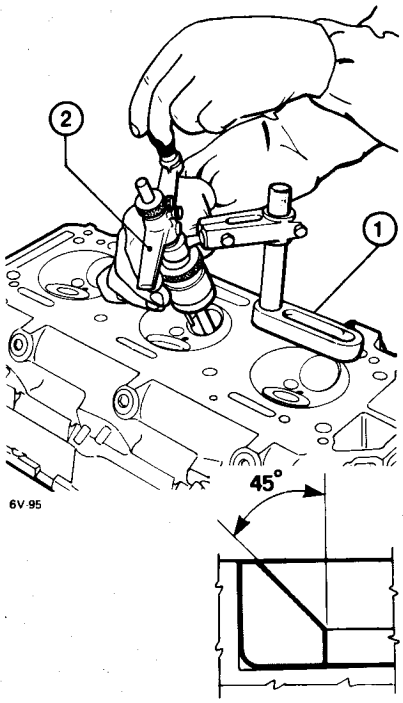
— Wait until the cylinder head is cooled and perform the turning of the valve seats in the following way.

— Position support (1) of the portable lathe (2) on the cylinder head and secure it in a suitable way.

— The angle of turning, which is identical for both intake and exhaust, should be:

Taper of intake and exhaust valve seats:
α = 90°

— Taper α is obtained with the tool of the portable lathe at 45° (for both intake and exhaust valves).



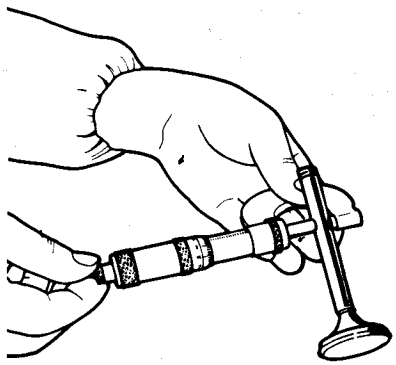
1. Portable lathe support
2. Portable lathe

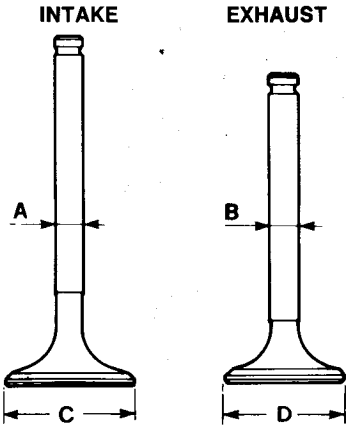
CAUTION:
The turning of the valve seats which do not require replacing is suitable for the elimination of minor defects of the working area: however, ascertain, before performing the operation, that there is sufficient machining allowance.

CHECKING THE VALVES

Check that the valves are not scored or burnt or do not exhibit mating marks (steps) with the corresponding seats on the cylinder head.
Renew them if necessary.

a. If the valves are in good condition check the diameters of the stem and heads (which must be within the tolerances given in the table).





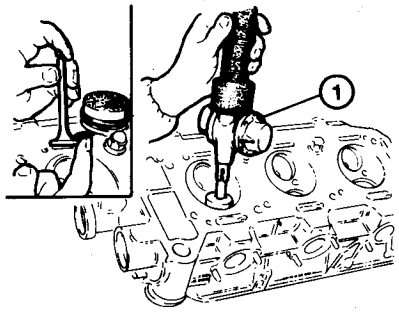
Diameter of valve stem [mm (in)]		
Reference		**Engine 062.10**
Intake valve	A	8.972 to 8.987 (0.3532 to 0.3538)
Exhaust valve	B	8.940 to 8.955 (0.3520 to 0.3526)
Reference		**Engine 016.46**
Intake valve	A	8.972 to 8.987 (0.3532 to 0.3538)
Exhaust valve	B	8.935 to 8.960 (0.3518 to 0.3528)

Diameter of valve head [mm (in)]		
Reference		**Engine 062.10**
Intake valve	C	36.350 to 36.500 (1.4311 to 1.4370)
Exhaust valve	D	32.450 to 32.600 (1.2776 to 1.2835)
Reference		**Engine 016.46**
Intake valve	C	40.850 to 41.000 (1.6083 to 1.6142)
Exhaust valve	D	36.400 to 36.600 (1.4331 to 1.4409)

GRINDING OF THE VALVES AND VALVE SEATS

a. After checking the valves and valve guides grind as follows:

— spread polishing paste (SIPAL AREXONS Carbosilicium for valves - P/N 4100-31502);
— use engine oil to lubricate the valve stem;
— attach the lower surface of the head of the valve to the suction cup of the pneumatic grinder (1);
— insert the valve in its guide, turn on the pneumatic grinder (1) and grind.



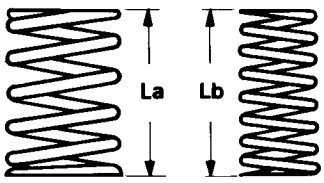
1. Pneumatic grinder for valves and valve seats

— Grind and then carefully clean the valves and valve seats using petrol or solvent.

CHECKING VALVE SPRINGS

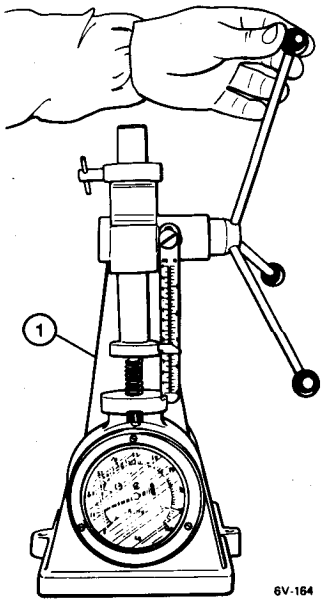
a. Carefully examine the valve springs and, if there are no signs of excessive wear or yielding, check that:

— the terminal turns must be parallel and perpendicular to the axis of the spring (max. error **2°**);
— the lenght of the **«free»** springs corresponds to the following values;



Length of free springs [mm (in)]		
External spring	La	44.6 (1.756)
Internal spring	Lb	44.1 (1.736)

— The flexibility values, measured by means of a dynamometer (1) must be within the limits given in the table.



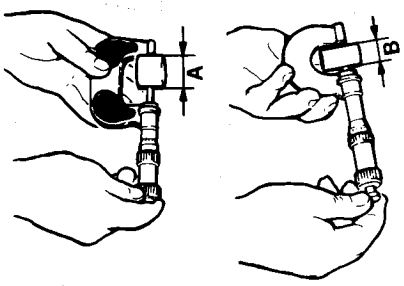
1. Dynamometer

External spring		
Spring length	**mm (in)**	**Test force**
With valve closed	32.5 (1.280)	24.80 to 25.66 kg (243.2 to 251.6 N) (54.6 to 56.5 lb)
With valve open	23.5 (0.925)	47.95 to 49.75 kg (470.2 to 487.8 N) (105.7 to 109.7 lb)
Internal spring		
Spring length	**mm (in)**	**Test force**
With valve closed	30.5 (1.201)	12.82 to 13.28 kg (125.7 to 130.2 N) (28.3 to 29.3 lb)
With valve open	21.5 (0.846)	22.67 to 23.53 kg (222.3 to 230.7 N) (50.0 to 51.9 lb)

CHECKING TAPPETS AND TAPPET SEATS

a. Check that the external surface of the tappets and the upper surface on which the cams operate are free from any trace of seizing, scoring or abnormal wear.
If they can be re-utilized check the dimensions.

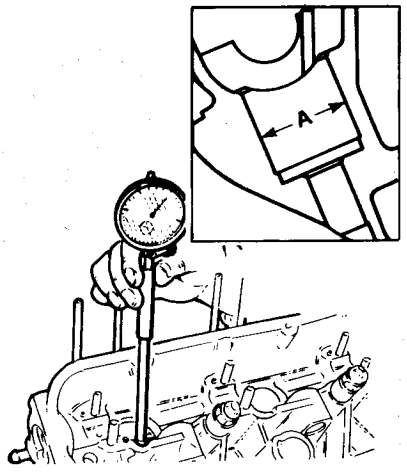
— Using a micrometer check the outside diameters are within the prescribed limits.



A = intake tappet diameter:
34.973 to 34.989 mm
(1.3769 to 1.3775 in)

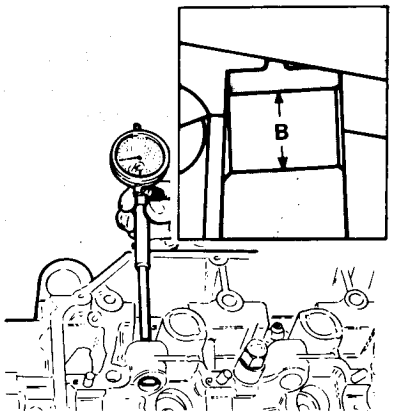
B = exhaust tappet diameter:
21.971 to 21.989 mm
(0.8650 to 0.8657 in)

— Check the tappet seats formed in the cylinder head casting and check the dimensions with a bore gauge applied to a dial indicator.
Compare the value obtained for the tappet seat of the intake valve with the prescribed tolerance.



A = intake valve tappet seat diameter:
35.000 to 35.025 mm
(1.3780 to 1.3789 in)

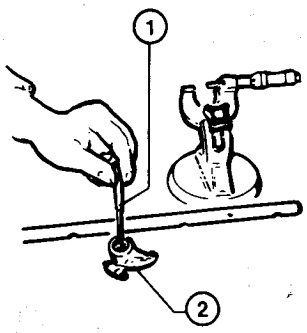
— In the same way as described previously measure the value for the exhaust valve tappet seat and compare it with that prescribed.



B = exhaust valve tappet seat diameter:
22.000 to 22.021 mm
(0.8661 to 0.8670 in)

CHECKING ROCKER ARMS AND ROCKER ARM SHAFT

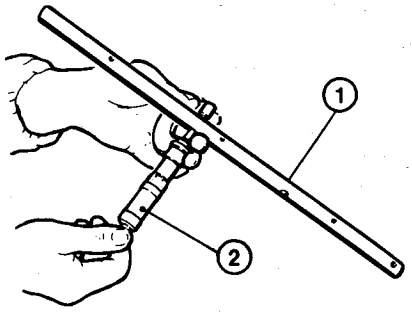
— Use bore gauge (1) to measure the I.D. of the rocker arms (2) and check that they are within the prescribed tolerances.



1. Bore gauge
2. Rocker arms

A = diameter of shaft hole in rocker arm:
16.016 to 16.034 mm
(0.6306 to 0.6313 in)

— Measure the O.D. of the rocker arm shaft with a micrometer (1) and compare the values with those prescribed.



1. Rocker arm shaft
2. Micrometer

B = rocker arm shaft diameter:
15.988 to 16.000 mm
(0.6294 to 0.6299 in)

CHECKING CAMSHAFTS AND JOURNAL BEARINGS

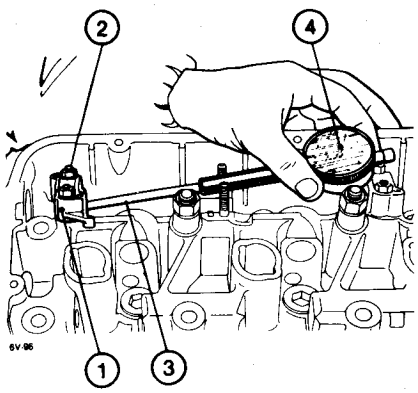
a. Check the dimensions of the camshaft journal bearings in the following way:

— Fit caps (1) in the order indicated by the numbers stamped on the caps themselves - cap no. 1 must be fitted towards the front of the cylinder head.

— Screw nuts (2) fixing the caps of the camshaft, lubricate them and tighten to the torque prescribed.

(T) : Torque wrench setting
Camshaft cap lock nuts
16 to 18 N·m
(1.6 to 1.8 kg·m
11.57 to 13.02 ft·lb)

— Check, using a bore gauge (3) applied to a dial indicator (4) the diameter of the camshaft journal bearings and compare the values measured with those prescribed.

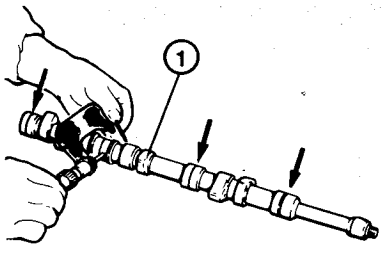


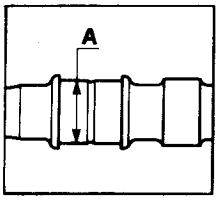
1. Camshaft caps
2. Lock nuts
3. Bore gauge
4. Dial indicator

Diameter of camshaft main journal seat:
27.000 to 27.033
(1.0630 to 1.0643 in)

b. Carefully examine the working area of the cams and the main journals of the camshaft and ensure they are free from scoring, traces of seizing or signs of overheating or abnormal wear. Check the diameters of the camshaft main journals as follows:

— Measure the diameter of the camshaft main journals (1) at the four points indicated by the arrows in the figure and compare them with the prescribed values.





1. Camshaft

A = diameter of camshaft main journals:
26.949 to 26.970 mm
(1.0610 to 1.0618 in)

— Check the eccentricity of the camshaft main journals between two supports by means of a dial indicator.
— Measure the heght of the cams with a dial indicator.
If the cam height is less than the prescribed value replace the shaft.

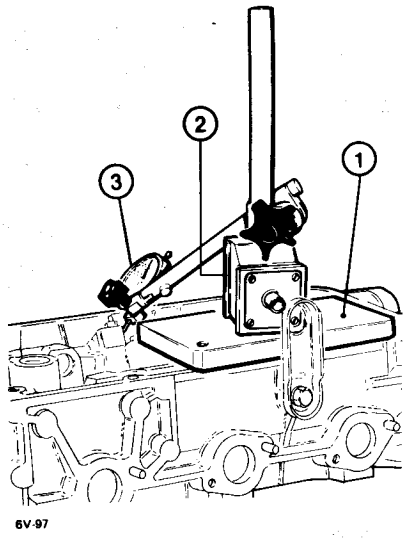
Minimum cam height [mm (in)]		
Intake valve cam	9	(0.354)
Exhaust valve cam	6.4	(0.252)

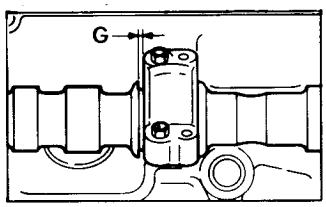
CHECKING END FLOAT OF CAMSHAFT

a. Fit the caps, noting the sequence indicated by the numbers stamped on the caps themselves.
Cap no. 1 must be fitted towards the front part of the cylinder head.
b. Screw on the nuts securing the camshaft caps, lubricate them and tighten.

(T) : Torque wrench setting
Camshaft cap lock nuts
16 to 18 N·m
(1.6 to 1.8 kg·m
11.57 to 13.02 ft·lb)

c. Place plate (1) on the upper surface of the cylinder head.
d. Apply magnetic base (2) to the plate (1) and place the sensor of dial indicator (3) so that it is in contact with the camshaft as illustrated in the figure.
e. Move the camshaft axially and measure the end play; check that the value is within the limits prescribed.
If not the camshaft must be replaced.





1. Support plate
2. Magnetic base
3. Dial indicator

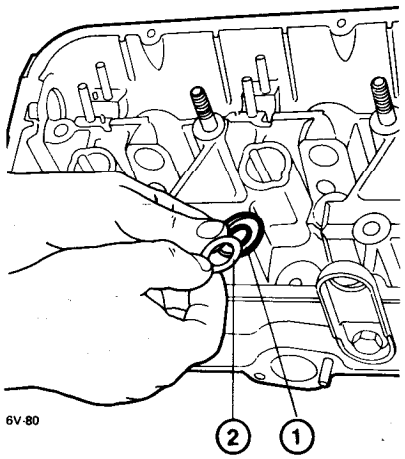
G = camshaft end float:
0.065 to 0.200 mm
(0.0026 to 0.0079 in)

ASSEMBLY OF THE CYLINDER HEADS (ON BENCH)

INSTALLATION OF VALVES AND ROCKER ARM SHAFTS

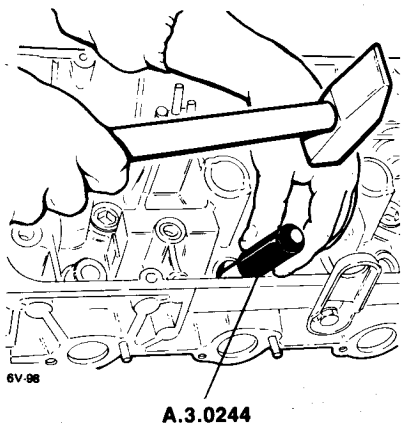
CAUTION:
The re-fitting of the valves is performed by using the same set of tools used for removal.
It is therefore necessary to reinstall the pair of valves (intake and exhaust) of each cylinder by moving the tool group each time.

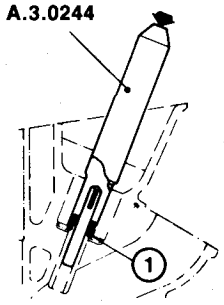
a. Insert the lower caps (1) and stop washers (2) on the guides of the intake and exhaust valves.



1. Lower caps
2. Stop washers

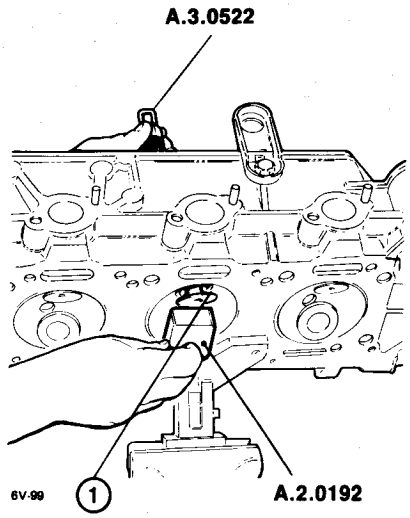
b. Fit rubber oil seals (1) on the guides of the intake and exhaust valves using tool **A.3.0244**.

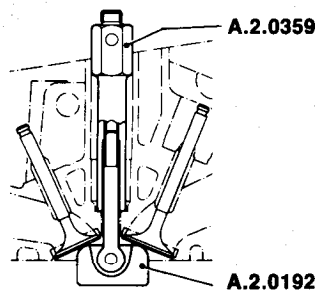




1. Rubber oil seal

c. Lubricate the stem of the valve with clean engine oil, insert valves (1) into the respective guides and support them with tool **A.2.0192** which, in turn must be fixed to the spark plug well by means of special nut **A.2.0359**, complete with support for valve fitting, tool **A.3.0522**.

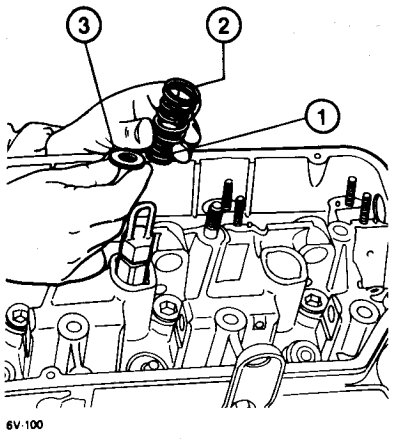


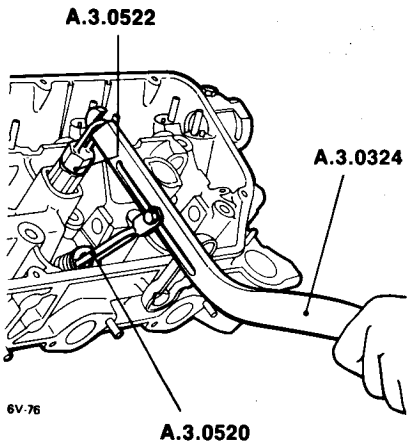


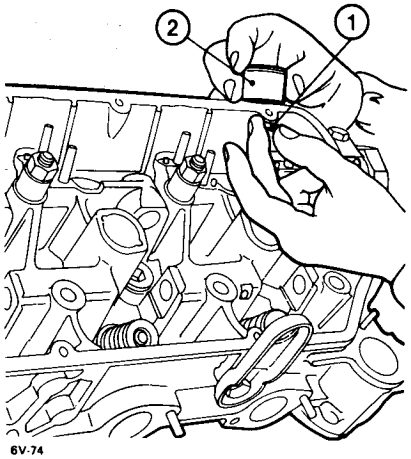
1. Intake and exhaust valves

d. Complete fitting by inserting the following in the sequence given, on the valve stem:
— inner springs (1);
— outer springs (2);
— upper caps (3).

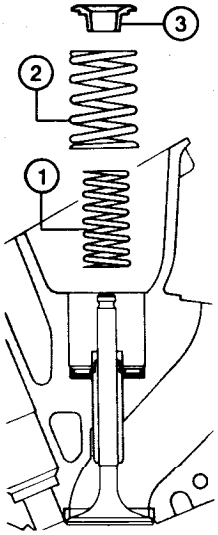
NOTE:
The damping coils of the springs must be facing downwards.





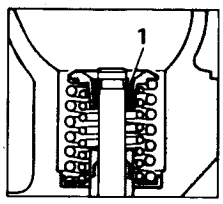


1. Caps
2. Bowls



1. Inner springs
2. Outer springs
3. Upper caps

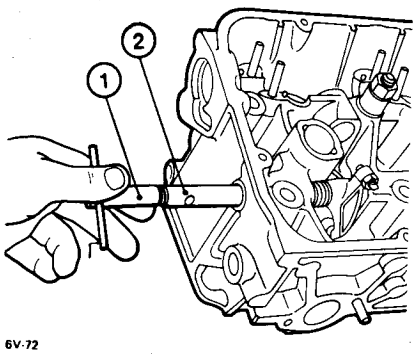
e. Connect lever (tool **A.3.0324**) complete with cage (tool **A.3.0520**) to support (tool **A.3.0522**).
Using lever **A.3.0324** compress the spring and insert cotters (1).
During fitting ensure that the cotters are correctly seated in the channel in the valve stem.

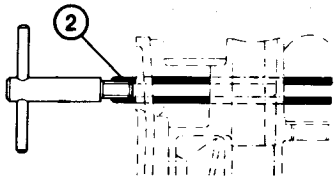


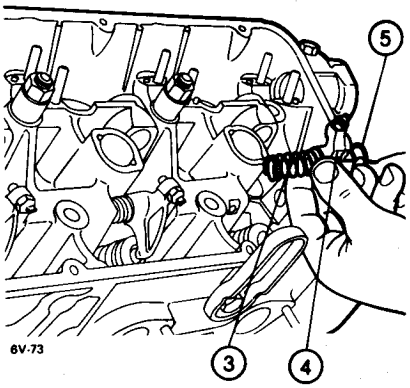
1. Cotters

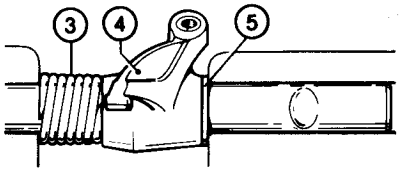
f. **Checking tightness of valves and valve seats**
Insert the spark plugs in their seats.
Put a little petrol in a combustion chamber so that the valve head being examined is just covered.
Introduce low pressure air into the intake and exhaust ducts and check that there are no air bubbles in the petrol.
If there is leakage ensure that the valves are perfectly seated and repeat the tightness test.
If the result is negative the grinding of the valve seats must be repeated as specified in the paragraph «CHECKING VALVES AND VALVE SEATS».
g. After fitting all the valves mount the caps (1) (which determine the clearances) on the intake valves.
The positions should be the same as those before removal.
Lubricate tappets (2) with clean engine oil and insert them in their respective seats.

h. **Re-fitting of rocker arms and rocker arm shaft**
Perform the following operations to re-fit the shaft and rocker arms which operate the exhaust valves:
— screw on a suitable tool (1) to the threaded shank of the rocker arm shaft (2);
— insert the shaft, suitably lubricated with engine oil, in the seat in the cylinder head and, on this, in sequence: springs (3), rocker arms (4) and washers (5), previously lubricated with engine oil.



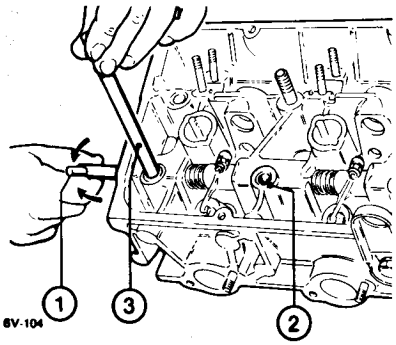


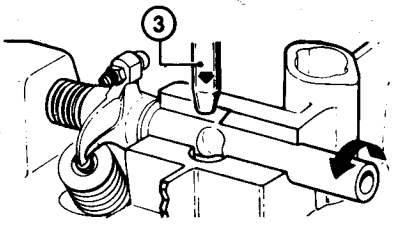




1. Shaft insertion tool
2. Rocker arm shaft
3. Springs
4. Rocker arms
5. Washers

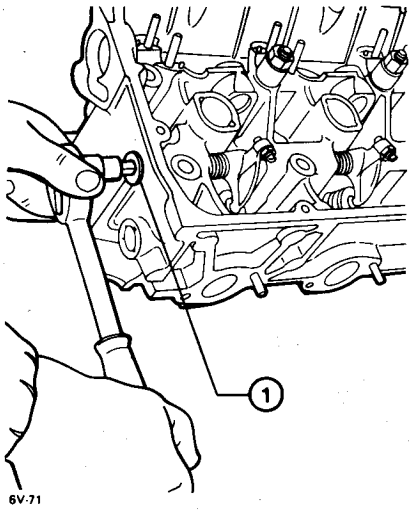
— After completing the re-fitting of the rocker arms rotate the shaft using tool (1) until the notches on the shaft are aligned with holes (2) in order to permit the passage of the cylinder head support studs; to check that this is so use a **12 mm (0.472 in)** dia. pin (3).





1. Tool
2. Stud holes
3. 12 mm (0.472 in) dia. pin

— Remove the tool from the rocker arm shaft and re-screw plug (1) with relative gasket.



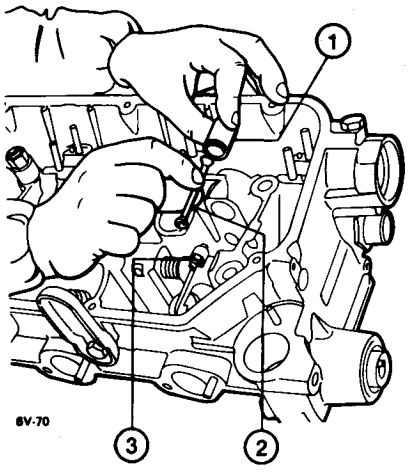
1. Plug with gasket

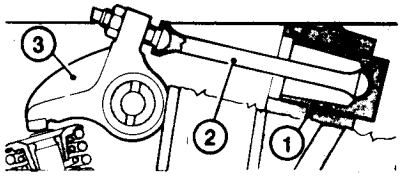
i. **Re-fitting of push rods and exhaust valve tappets**

Lubricate tappets (1) with engine oil and insert them in their respective seats in the cylinder head.

Reinstall push rods (2) (after lubricating them) taking care to:

— rotate rocker arm (3) forwards and downwards to facilitate fitting;
— position the ball head of the rod in the seat provided in the tappet.

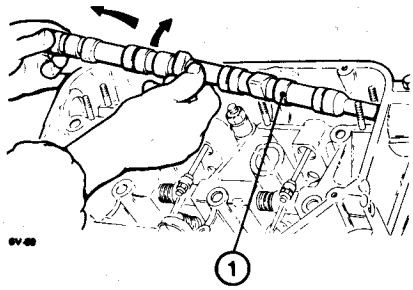




1. Tappets
2. Rods
3. Rocker arms

INSTALLATION OF CAMSHAFT

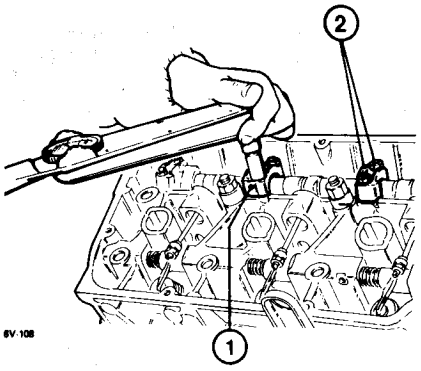
a. Using clean engine oil lubricate the journals of camshaft (1) and the respective seats on the cylinder head on which the shaft must be placed (as shown by the arrows).



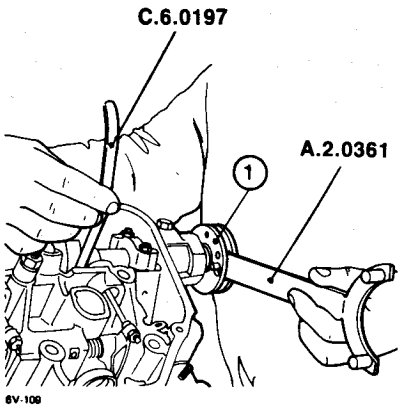
1. Camshaft

b. Position caps (1) in sequence according to the numbers (no. 1 should be fitted on the front of the cylinder head); place and tighten the nuts with respective washers (2) in oil to the required torque.

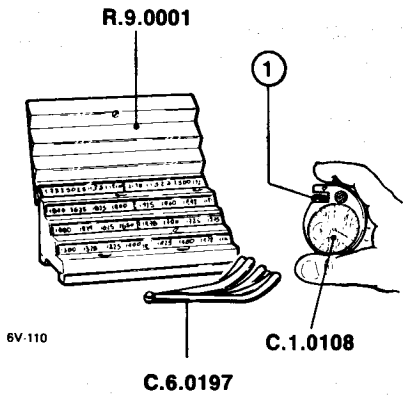
(T) : **Torque setting**
Camshaft cap stop nuts (in oil)
16 to 18 N·m
(1.6 to 1.8 kg·m
11.57 to 13.02 ft·lb)



1. Camshaft caps
2. Nuts and washers



1. Hub for toothed pulley operating the camshaft



1. Caps

VALVE CLEARANCE ADJUSTMENT

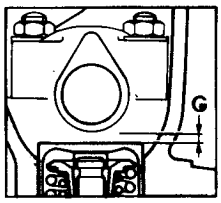
a. **Checking the intake valve clearance**

After re-fitting the camshaft check the intake valve clearance in the following way:

— temporarily fit hub (1) which serves to fix the toothed pulley operating the timing system;

— rotate, using lever **A.2.0361**, the camshaft until it is possible to fit thickness gauge **C.6.0197** on the cam of the valve of which the clearance is to be measured (cams in rest position facing upwards);

— note the values for each valve and compare them with those prescribed.



G = clearance between lowest radius of the cam and the crown of the tappet operating the intake valve: 0.475 to 0.500 mm (0.018) to 0.0197 in)

b. **Adjustment of intake valve clearance**

If necessary adjust valve clearance as follows:

— Remove the caps fixing the camshaft and the camshaft itself;

— withdraw the tappets and retrieve caps (1) underneath;

— measure the thickness of the caps using specific gauge **C.1.0108** and then, on the basis of the difference with respect to the values obtained previously, select from the set of caps (**R.9.0001**) those which will restore the correct clearance of each valve.

Reinstall tappets, camshaft and caps.

Tighten the nuts on camshaft caps to the prescribed torque and check valve clearance again.

c. **Checking and adjustment of exhaust valve clearance**

Adjust the exhaust valve clearance to restore the clearance between the crown of the tappet and the lowered radius of the cams.

For the adjustment use special spanner (tool **A.5.0220**) as follows:

— temporarily install hub (1) which serves to fit toothed pulley operating the timing system;

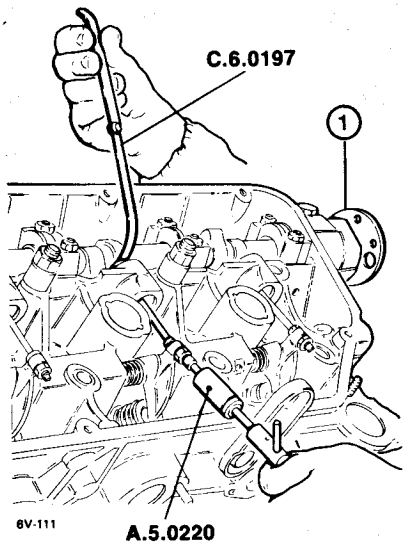
— rotate, using lever **A.2.0361**, the camshaft until it is possible to fit thickness gauge **C.6.0197** on the cam of the valve of which the clearance is to be measured (cams in rest position facing the opposite side of the tappet);

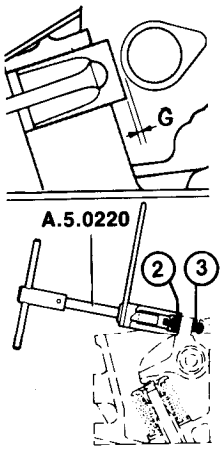
— note the values measured for each valve and compare them with those prescribed;

— slacken lock nut (2) securing adjustment screw (3) using the lever of the spanner (tool **A.5.0220**) combined 3 and 11 mm (0.12 and 0.43 in) spanner;

— rotate screw (3) using spanner **A.5.0220** until the prescribed value is obtained (determine by means of a blade-type thickness gauge **C.6.0197**;

— tighten lock nut (2) and check the exhaust valve clearance again.





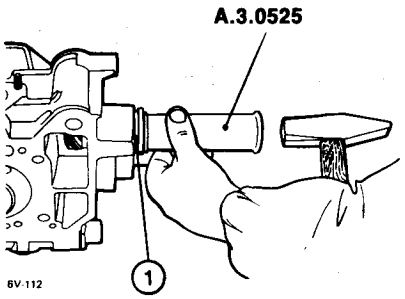
1. Hub
2. Lock nut
3. Adjustment nut

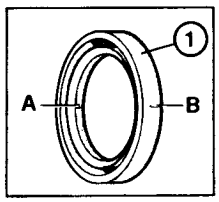
G = clearance between lowered radius of the cam and crown of the tappet operating the exhaust valve: 0.225 to 0.250 mm (0.0089 to 0.0098 in)

INSTALLATION OF DISTRIBUTOR AND OIL PUMP DRIVE PULLEY

Re-fit the toothed pulley which operates, together with the relative gear, the distributor and oil pump.

a. Lubricate the sealing lip «A» of seal ring (1) with the prescribed grease and the outer surface «B» with clean engine oil. Then insert ring using tool **A.3.0525**.

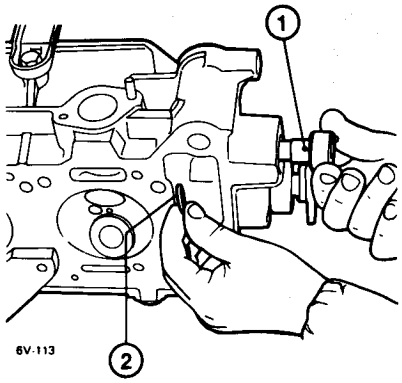




1. Seal ring

A. Sealing lip: lubricate with ISECO Molykote BR2
B. Outer surface: lubricate with clean engine oil

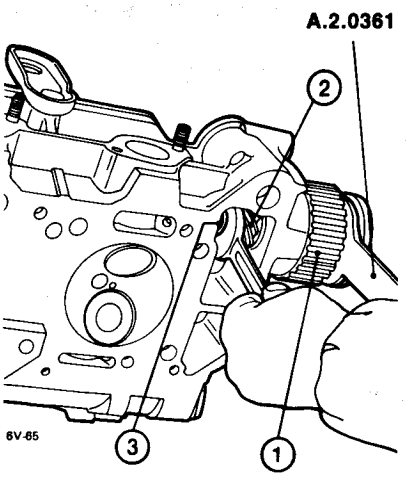
b. Insert operating shaft (1) in its seat and insert spacing washer (2) from the other side.



1. Drive shaft
2. Spacing washer

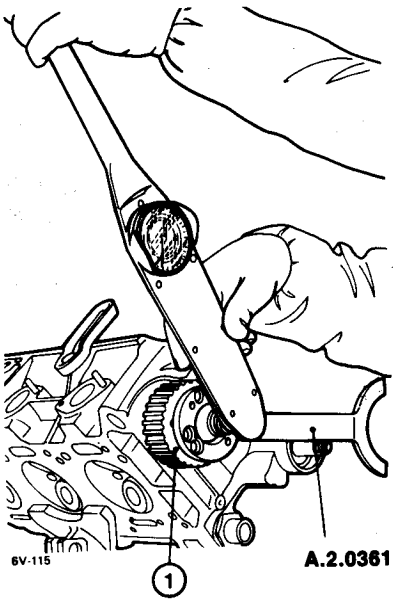
c. Fit toothed pulley (1) on the drive shaft and then fit gear (2) operating the distributor and the oil pump.

Lock the gear with the relative nut (3) complete with washer having a safety tab: prevent the rotation of the pulley using the lever of tool **A.2.0361**.
After tightening the nut bend the safety tab over.



1. Toothed pulley
2. Gear operating camshaft and oil pump
3. Lock nut

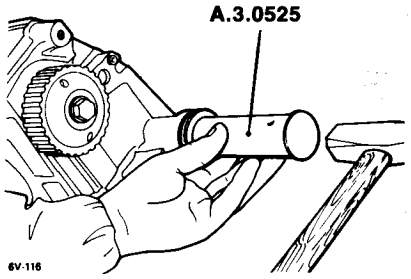
d. Tighten the screw with washer fixing pulley (1) to its shaft.
Prevent the rotation of the pulley with lever (tool **A.2.0361**) and then lock the screw using a torque spanner.

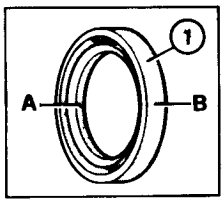


1. Toothed pulley

INSTALLATION OF CAMSHAFT DRIVE PULLEY

a. Remove the hub of the toothed pulley, mounted temporarily, and refit the seal ring of the camshaft (after having lubricated the outer surface «B» with engine oil and sealing lip «A» with the prescribed grease).
Seal ring (1) must be fitted using insertion tool **A.3.0525**.





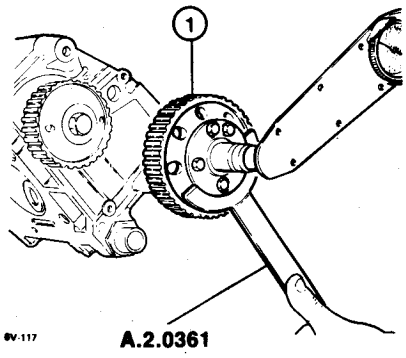
1. Seal ring

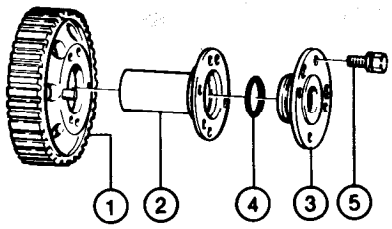
A. Sealing lip: lubricate with ISECO Molykote BR2 grease
B. Outer surface: lubricate with clean engine oil

b. Lubricate surface «A» of the anti-friction bushings using clean engine oil.
Fit toothed pulley (1) on the shank of the camshaft; re-fit pulley support (2) and hub (3) complete with rubber ring (4) and tighten screws (5) fixing it to the pulley.

c. Tighten the nut fixing the toothed pulley (1) to the camshaft; prevent the rotation of the pulley with the lever (tool **A.2.0361**) and tighten the nut to the prescribed torque.
Also fully tighten screws (5) fixing the hub to the pulley.

(T) : **Torque setting**
Nut securing front hub of camshaft
97 to 117 N·m
(9.9 to 11.9 kg·m
71.6 to 86.1 ft·lb)

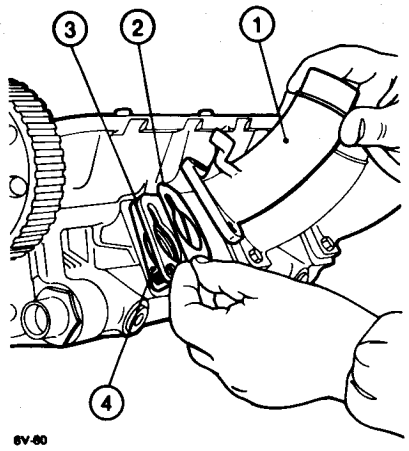




1. Toothed pulley
2. Pulley support
3. Hub
4. Rubber ring
5. Hub securing screws

INSTALLATION OF INTAKE STUB PIPES

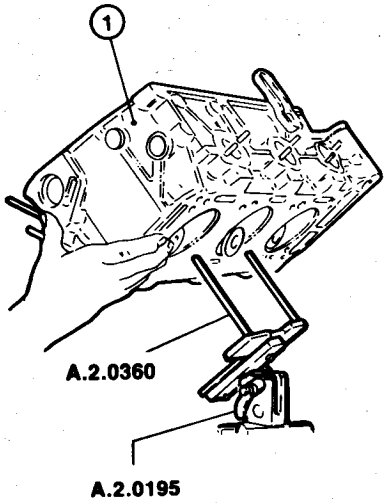
a. **Only for vehicles with L-JETRONIC fuel system**
Install the intake stub pipes (1) as follows:
— insert gasket (2) in the studs of the cylinder head;
— insert insulating gasket (3);
— insert gasket (4);
— fix intake stub pipes (1) to the studs of the cylinder head by means of the nuts with relative washers.



1. Intake stub pipes
2. Gasket
3. Insulating gasket
4. Gasket

REMOVAL OF CYLINDER HEAD FROM THE BENCH

After the re-assembly of the cylinder head remove the head (1) from the support yoke (tool **A.2.0360**) after removing the two lock nuts.
Remove the support yoke complete with adjustable support (tool **A.2.0195**) from the vice.



1. Cylinder head

CHECKING THE ENGINE BLOCK

CHECKING THE ENGINE BLOCK

a. Check the block visually for cracks and signs of excessive wear of the sliding surfaces.

b. Carefully clean the surfaces of the block to remove any gasket fragments. Use butyl acetate or Methylethylketone.

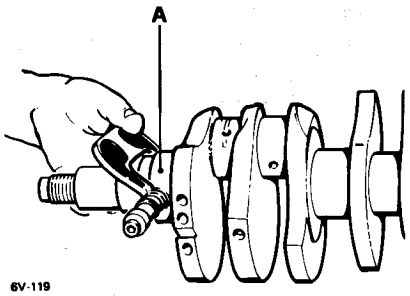
CRANKSHAFT

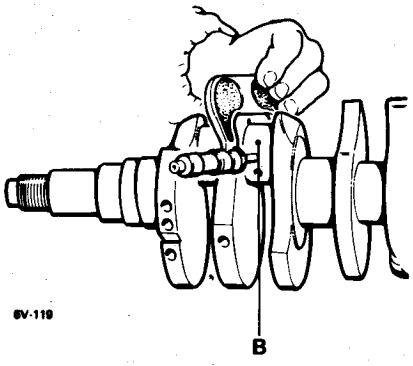
a. Check that the working area of the main and rod journals do not exhibit signs of abnormal wear, scoring or traces of seizing or overheating.

WARNING:
The chrome-molybdenum steel crankshaft has been subjected to a nitriding treatment and thus cannot be ground. For this reason the crankshaft must be replaced if it exhibits signs of excessive wear.

b. Place the crank shaft on the bench between supports and measure the diameter of main journals «**A**» and rod journals «**B**» and compare them with the prescribed values.

WARNING:
The range of tolerances permitted for the machining of the main and rod journals has been divided into two classes.
It is possible to identify the class of the journal being checked as the respective counterweights have indelible RED or BLUE marks.



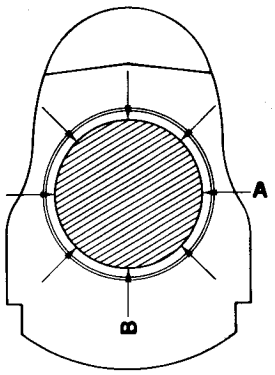


A. Main journals
B. Rod journals

Class		RED [mm (in)]
Diameter of main journal	A	59.961 to 59.971 (2.3607 to 2.3611)
Diameter of main journal for oversized crankshaft	A	59.971 to 59.981 (2.3611 to 2.3615)
Diameter of rod journal	B	51.990 to 52.000 (2.0433 to 2.0472)
Class		**BLUE [mm (in)]**
Diameter of main journal	A	59.951 to 59.961 (2.3603 to 2.3607)
Diameter of main journal for oversized crankshaft	A	59.961 to 59.971 (2.3607 to 2.3611)
Diameter of rod journal	B	51.980 to 51.990 (2.0465 to 2.0469)

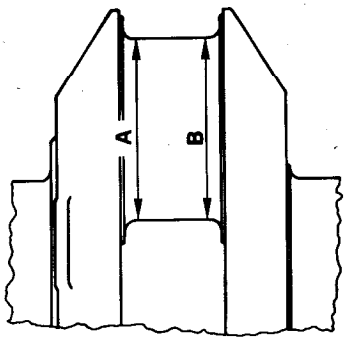
c. **Also check the following**:

— Check the ovalization (○) of the rod journals and main journals by comparing the diameter at various points of their circumference.



Maximum main or rod journal ovalization error:
A-B = 0.004 mm (0.0002 in)

— Check the taper (⌭) of the main and rod journals by comparing the diameter at the ends of the journal.



Maximum main or rod journal taper error:
A-B = 0.010 mm (0.0004 in)

— Check the concentricity (◎) between the centre main journals and front and rear main journals.

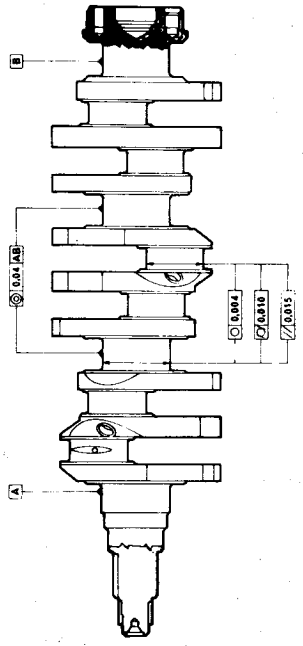
Maximum eccentricity of main journals:
0.040 mm (0.0016 in)

— Check the parallelism (//) between the centerlines of the main and rod journals.

Maximum parallelism error between main and rod journals:
0.015 mm (0.0006 in)

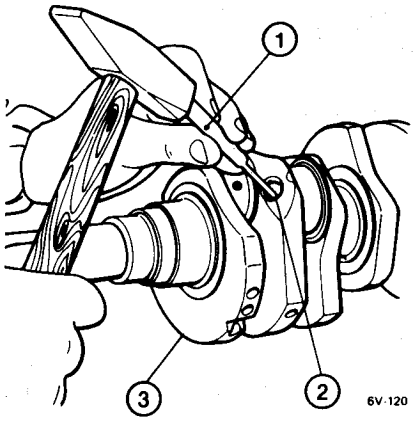
— Check the length of the rear main journal (which must be within the prescribed values).

Maximum length of the rear main journal:
C = 31.300 to 31.335 mm
(1.2323 to 1.2337 in)



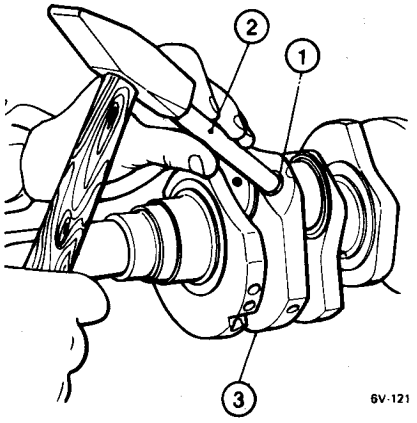
d. If, after these checks, the shaft can be re-utilized, proceed with the cleaning of the drilled oil passages:

— Use a punch (1) to make a hole in plugs (2) sealing the extremities of the oil passages.
Extract plugs and eliminate any burrs created by the previous calking.



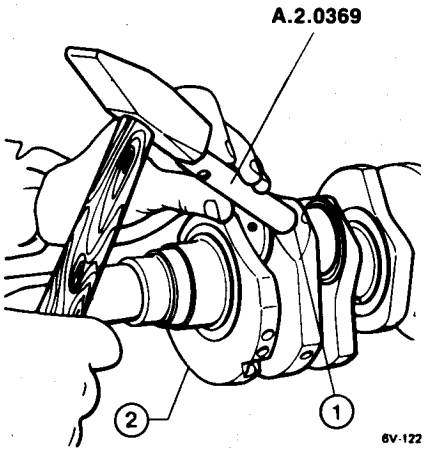
1. Punch
2. Plugs
3. Crankshaft

— Clean the oil passages with a steel wire pipe brush.
— Wash the shaft and oil passages with hot solvent and dry with compressed air (paying particular attention to the oil passages).
— Apply sealant (**LOCTITE 270 Green**) to the new plugs (1) and seal the holes in the oil passages with new plugs (using a suitable tool (2)).



1. Plugs
2. Insertion tool
3. Crankshaft

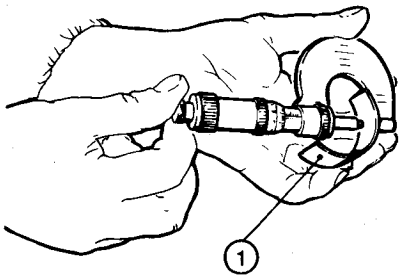
— After completing the sealing of the oil passages calk the edges of plugs (1) with a suitable tool **A.2.0369**.



1. Plugs
2. Crankshaft

MAIN AND CONNECTING ROD HALF-BEARINGS

a. Clean the main and con rod half-bearings and check visually for signs of scoring or seizing.
b. If there are sings of excessive wear replace all the half-bearings.
c. The fitting of main and rod half-bearings to the crankshaft must be performed by pairing pieces of the same dimensional class, identifiable by a mark of the same colour **RED** or **BLUE** on the side of the half-bearing and on the relative journal of the crankshaft.
d. Using a micrometer measure the width of the half-bearings (1) and compare the values with those given in the table; replace the half-bearings if their values are not within the prescribed tolerances.



1. Main and rod half-bearings

Class	Half-bearings [mm (in)]	
Red	Main	1.829 to 1.835 (0.0720 to 0.0722)
	Rod	1.737 to 1.745 (0.0684 to 0.0687)
Blue	Main	1.835 to 1.841 (0.0722 to 0.0725)
	Rod	1.741 to 1.749 (0.0685 to 0.0689)
Green	Rod	1.845 to 1.851 (1) (0.0726 to 0.0729) (1)

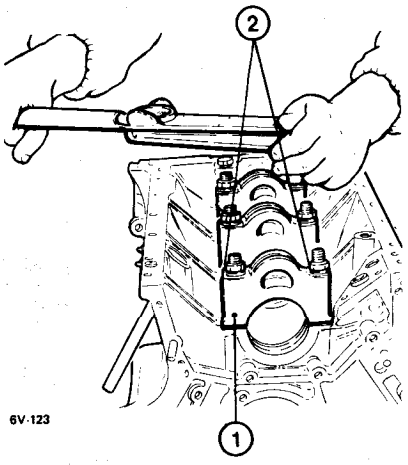
(1) Only to be used on a **non-oversized** crankshaft if the end play between journal and half-bearing is greater than 0.050 mm (0.0020 in) after checking the dimensions of each individual journal.

MAIN BEARINGS AND MAIN BEARING CAPS

a. Fit the main bearing caps (1) on the main bearings, positioning them according to the numbering on them (cap no. 1 must be fitted on the front part of the main bearings).

b. Tighten in oil the nuts, with respective washers (2) securing the main bearing caps, to the required torque.

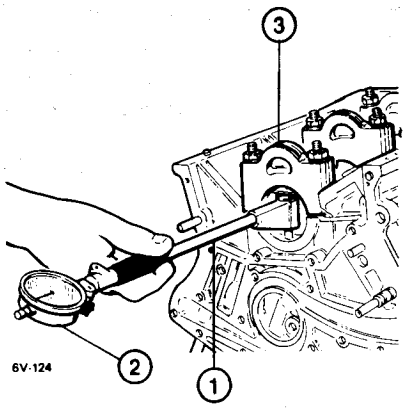
(T) : **Torque setting**
Nuts securing the main bearing caps to the cylinder block supports
76 to 78 N·m
(7.8 to 8 kg·m
56.4 to 57.9 ft·lb)



1. Main bearing caps
2. Nuts and washers

c. Using bore gauge (1) fitted to a dial indicator (2) measure the diameter of the main bearings (3) and check that they are within the prescribed tolerances.

Main bearing diameter:
63.657 to 63.676 mm
(2.5062 to 2.5069 in)



1. Bore gauge
2. Dial indicator
3. Main bearings

d. Check the length of the shoulder of the rear main bearing.

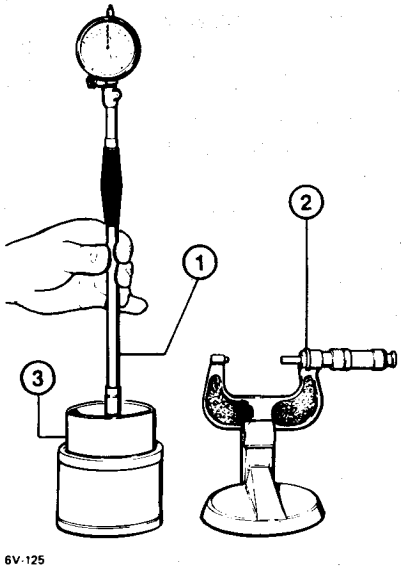
Length of the shoulder of the rear main bearing:
26.450 to 26.500 mm
(1.0413 to 1.0433 in)

THRUST RINGS

a. Check the thickness of the thrust rings (fitted on the rear main bearing).
The value must be within the prescribed tolerances.

Thrust ring thickness:
2.310 to 2.360 mm
(0.0909 to 0.0929 in)

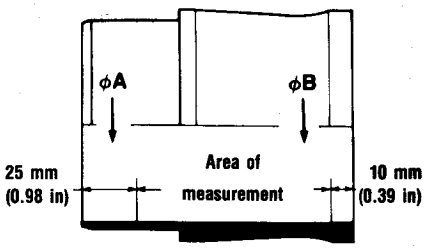
b. To check the dimensions proceed as follows:
- Zero set bore gauge (1) using a suitable micrometer (2).
- Use the bore gauge (1) fitted to a dial indicator to measure the I.D. of the cylinder liners (3) measured at 120° of the median, upper and lower circumference included in the «area of measurement» illustrated in the figure.
- Check that the values obtained are within the prescribed tolerances (divided into classes) given in the table.
- Check that the maximum taper and ovalization are within the prescribed values.

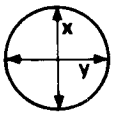


1. Bore gauge
2. Micrometer
3. Cylinder liner

CYLINDER LINERS

a. Determine the class of the cylinder liners and then check the dimensions.
The liners are divided, on the basis of their I.D., into three classes **«A»**, **«B»** and **«C»** and are identifiable by indelible spots of paint - **BLUE**, **PINK** and **GREEN** - on the outside of each cylinder liner.





Maximum taper of the liner:
A-B = 0.01 mm (0.0004 in)

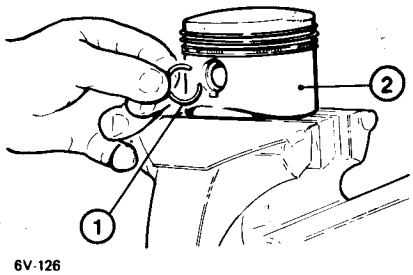
Maximum ovalization of the liner:
X-Y = 0.01 mm (0.0004 in)

Cylinder liner diameter [mm (in)]		
Class	Engines	
	062.10	016.46
A (Blue)	79.985 to 79.994 (3.1490 to 3.1494)	87.985 to 87.994 (3.4640 to 3.4643)
B (Pink)	79.995 to 80.004 (3.1494 to 3.1498)	87.995 to 88.004 (3.4644 to 3.4647)
C (Green)	80.005 to 80.014 (3.1498 to 3.1502)	88.005 to 88.014 (3.4648 to 3.4651)

DISASSEMBLY OF CONNECTING ROD-PISTON ASSEMBLY

Before making measurements divide the con rod-piston assembly as follows:

a. Using a suitable screwdriver extract the two snap rings (1) securing the pin holding the con rod to the piston (2).



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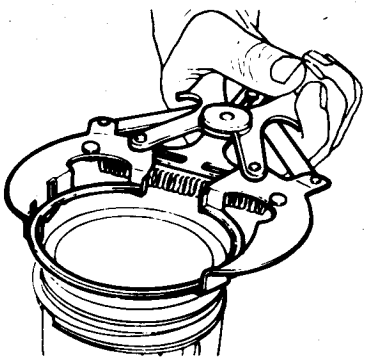
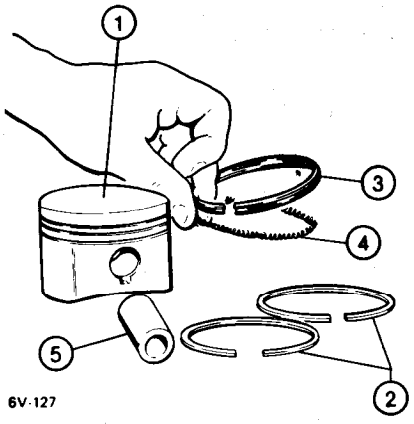
1. Snap rings
2. Piston

b. Extract seal rings (2) and oil scraper ring (3) from piston (1) using a suitable tool; proceed with care to avoid the accidental breaking of rings which could be re-utilized.
Retrieve spring (4).

c. Withdraw gudgeon pin (5) and separate the piston from the connecting rod.





6V-127

1. Piston
2. Seal rings
3. Oil scraper ring
4. Spring
5. Gudgeon pin

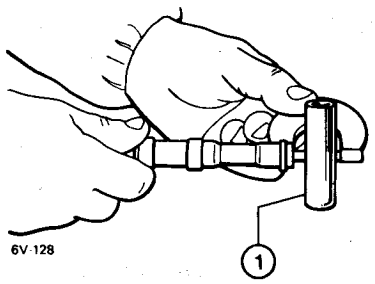
PISTONS AND GUDGEON PINS

The pistons and gudgeon pins are paired when fitting according to the dimensional class (established by the different machining tolerances).

It is possible to identify the class by the paint marks **WHITE** or **BLACK**, inside the gudgeon pin and on the outside of the piston boss.

a. Using a micrometer, measure the O.D. of the gudgeon pin (1) and, using a bore gauge, measure the diameter of the hole for the connection to piston (2).

b. Ensure that the values are within the tolerances given for the various dimensional classes in the table.



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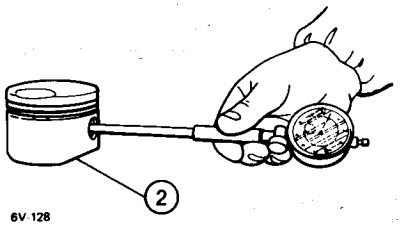

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1. Gudgeon pin
2. Piston

Diameter of gudgeon pin hole in piston [mm (in)]		
Engines	BLACK	WHITE
062.10	22.000 to 22.003 (0.86614 to 0.86626)	22.003 to 22.005 (0.86626 to 0.86634)
016.46	22.003 to 22.006 (0.86626 to 0.86638)	22.006 to 22.009 (0.86638 to 0.86650)

Gudgeon pin O.D.:
Black = 21.994 to 21.997 mm (0.86591 to 0.86602 in)
White = 21.997 to 22.000 mm (0.86602 to 0.86614 in)

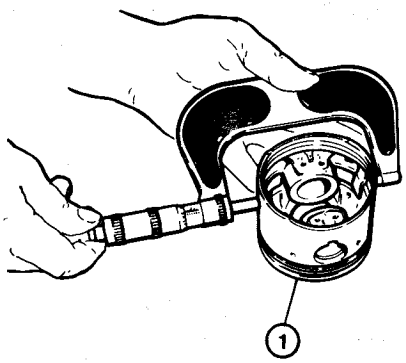
c. Check that the seats of the gudgeon pin in the connecting rod small end and in the piston bosses are not excessively worn.

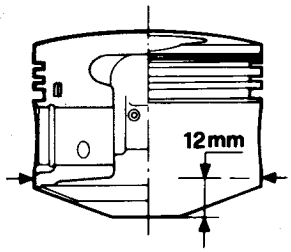
d. Carefully examine the piston before measuring for deep scoring of the skirt or the grooves of the rings, which would require replacing.

The pistons, like the cylinder liners, are divided into three classes according to the machining tolerances.
In this case too the classes are called «A», «B» and «C» and identified by indelible paint marks (**BLUE**, **PINK** and **GREEN**) on the piston top.

e. Check the O.D. of piston (1) with a micrometer.
The O.D. must be measured perpendicular to the gudgeon pin hole at a distance of **12 mm (0.47 in)** from the lower edge of the skirt.

f. Compare the value measured with the prescribed tolerances, according to the class, in the table.

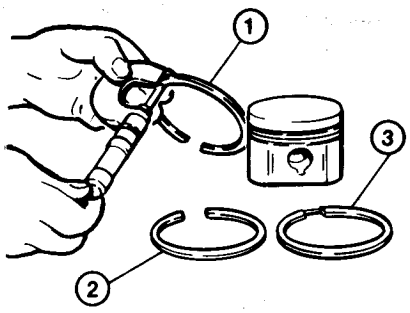


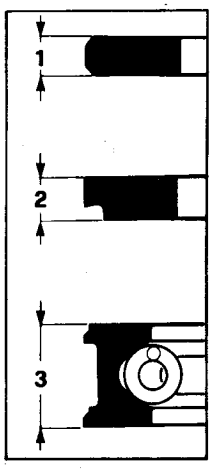


1. Piston

Piston diameter [mm (in)]		
Class	Engines	
	062.10	016.46
A (Blue)	79.945 to 79.955 (3.1474 to 3.1478)	87.935 to 87.945 (3.4620 to 3.4624)
B (Pink)	79.955 to 79.965 (3.1478 to 3.1482)	87.945 to 87.955 (3.4624 to 3.4628)
C (Green)	79.965 to 79.975 (3.1482 to 3.1486)	87.955 to 87.965 (3.4628 to 3.4632)

g. Measure the thickness of compression rings (1) and (2) and that of oil control ring (3); check that the values measured are within the tolerances given in the table.

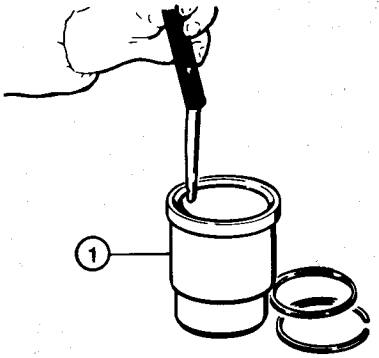


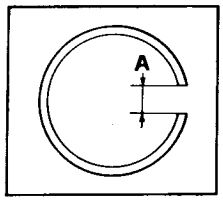


1. First compression ring
2. Second compression ring
3. Oil control ring

Piston ring thickness [mm (in)]	
	Engine 062.10
First ring	1.478 to 1.490 (0.0582 to 0.0587)
Second ring	1.728 to 1.740 (0.0680 to 0.0685)
Oil control ring	3.478 to 3.490 (0.1369 to 0.1374)
	Engine 016.46
First ring	1.478 to 1.490 (0.0582 to 0.0587)
Second ring	1.728 to 1.740 (0.0680 to 0.0685)
Oil control ring	3.978 to 3.990 (0.1566 to 0.1571)

h. Insert the piston rings in the cylinder liner (1) and check gap «A» using a feeler gauge.

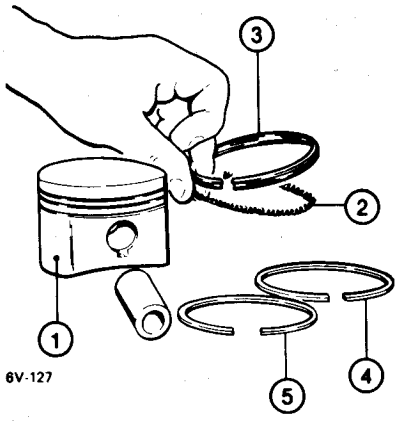




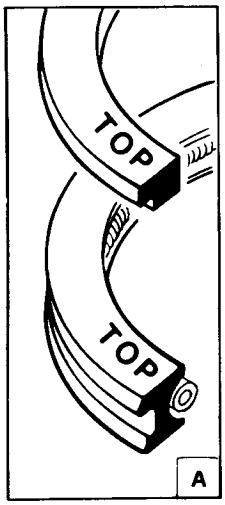
1. Cylinder liners

Piston ring gap (A) [mm (in)]	
	Engine 062.10
First ring	0.30 to 0.50 (0.012 to 0.020)
Second ring	0.30 to 0.50 (0.012 to 0.020)
Oil control ring	0.25 to 0.50 (0.010 to 0.020)
	Engine 016.46
First ring	0.30 to 0.45 (0.012 to 0.018)
Second ring	0.30 to 0.45 (0.012 to 0.018)
Oil control ring	0.25 to 0.40 (0.010 to 0.016)

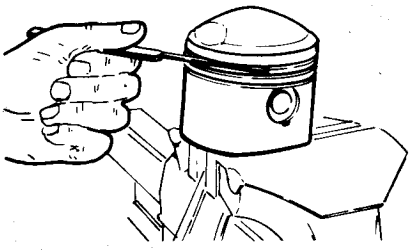
i. Lubricate the piston rings with clean engine oil and reinstall them in their respective seats on the piston (1), taking care to insert, in sequence:
— spring (2) and oil control ring (3) in the third groove, bearing in mind that the spring joint must be at 180° with respect to the cut of the ring;
— compression rings (4) and (5) in the second and first groove respectively.
Position the rings so that the word «TOP» stamped on the rings is facing upwards.

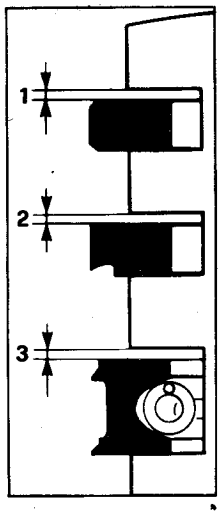


1. Piston
2. Spring
3. Oil control ring
4. Second compression ring
5. First compression ring



j. Measure the clearance between piston grooves and rings using a feeler gauge.





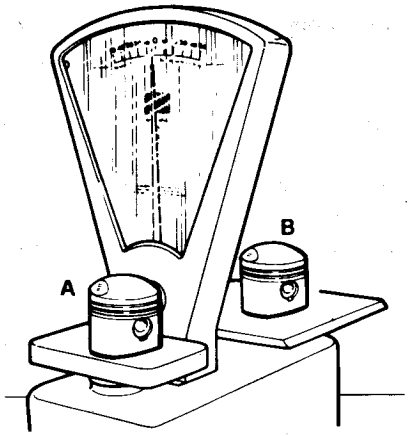
1. First compression ring
2. Second compression ring
3. Oil control ring

Clearance between piston grooves and rings [mm (in)]	
First ring	0.035 to 0.067 (0.0014 to 0.0026)
Second ring	0.035 to 0.067 (0.0014 to 0.0026)
Oil control ring	0.025 to 0.057 (0.0010 to 0.0022)

k. **Examine the gudgeon pins in order to** pair them with pistons marked with paint of the same colour (**White** or **Black**). The mark is located on the external surface of the boss and on the inside of the gudgeon pin.

l. If the parts are to be re-utilized bear in mind that the working areas, in particular the seat of the gudgeon pin in the piston should be free from even the slightest scoring.

m. Insert the gudgeon pin in each piston (selected according to the class - **Black** and **White**); lock with the snap rings and, using a balance similar to the one illustrated check that **the difference between the weights of the pistons is no greater than 4 grams (0.14 oz).**

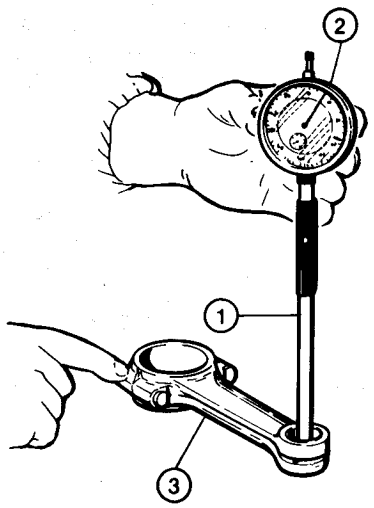


A-B = 4 grams (0.14 oz) (max)

CONNECTING RODS AND CONNECTING ROD CAPS

a. Check the con rods visually for cracks, scoring and signs of excessive wear. The con rods and con rod caps which can be re-utilized must be checked for the correct dimensions as follows.

b. Using a bore gauge (1) fitted to a dial indicator (2) measure the diameter of the bushing in the con rod small end (3).

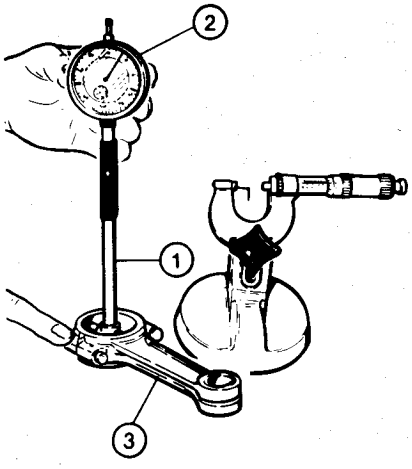


1. Bore gauge
2. Dial indicator
3. Connecting rod

Bushing I.D. - Connecting rod small end:
22.005 to 22.015 mm
(0.8663 to 0.8667 in)

c. Fit the con rod caps, tightening the respective screws in oil to the prescribed torque. Check the diameter of the con rod small end as described in point b.

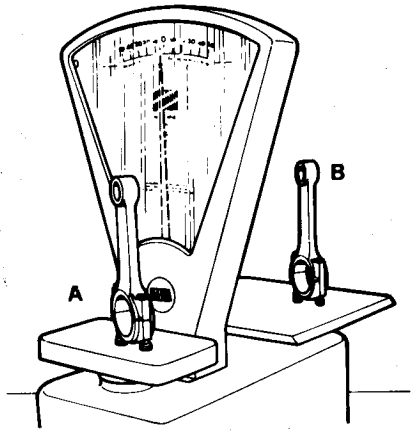
(T) : **Torque setting**
Screws retaining con rod caps (in oil)
46 to 51 N·m
(4.7 to 5.2 kg·m
34 to 37.6 ft·lb)

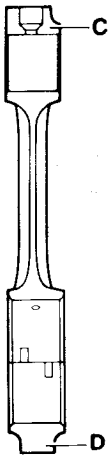


1. Bore gauge
2. Dial indicarator
3. Connecting rod

Connecting rod I.D.:
55.511 to 55.524 mm
(2.1855 to 2.1860 in)

d. Using a balance similar to the one illustrated, check that the difference between the weights of the two con rods (complete with caps, half-bearings and screws) **is no greater than 2 grams (0.07 oz)**. To restore the exact weight remove the excess metal from parts **«C»** and **«D»**.

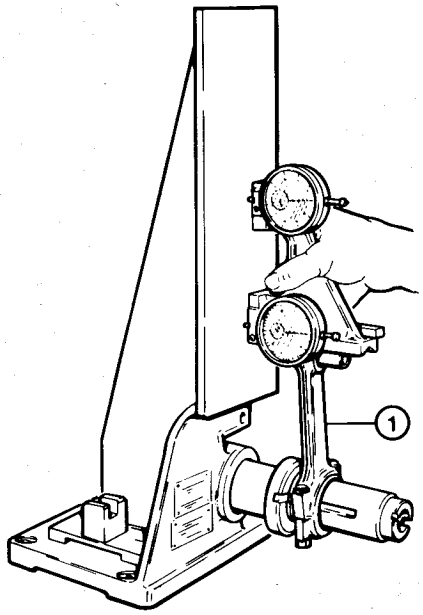




A-B = 2 grams (0.07 oz) (max)

C. } **area to be machined to**
D. } **obtained the exact weight**

e. Check the perpendicularity of connecting rods (1) using a jig similar to the one illustrated.



1. Connecting rods

WARNING:
If the connecting rod is not true it must be replaced to avoid abnormal stress during engine running and consequent irregular wear of the piston and the con rod itself.

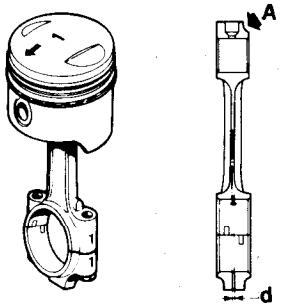
REASSEMBLY OF THE CONNECTING ROD-PISTON ASSEMBLY

Reassemble the assembly formed by the connecting rod and the piston considering that:

a. If the previously disassembled pistons and con rods are to be re-utilized the initial pairing (i.e. piston no. 1 with con rod no. 1) must be restored.

b. The connecting rods for the **right** side of the engine which match pistons no. 1, 2, 3, must be fitted with the offset towards the rear of the engine while those for the **left** side which match pistons no. 4, 5 and 6, must be fitted with offset towards the front.

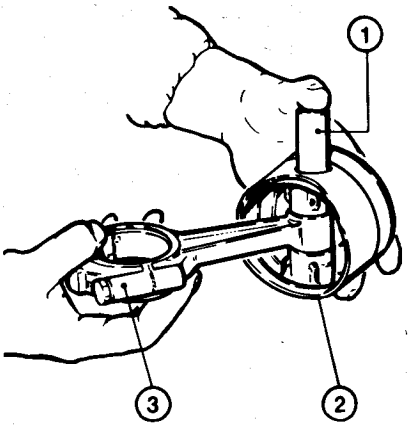
c. Remember that the arrow stamped on the top of the piston should face toward the front of the engine.



A: the notch to which the arrow points indicates the offset side **«d»**.

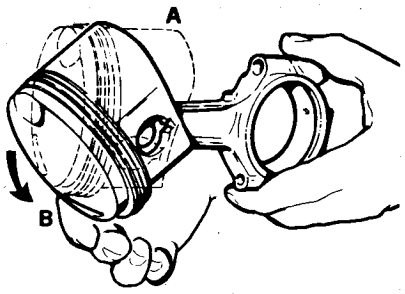
d. The piston and the gudgeon pin must belong to the same dimensional class (this can be seen from the **White** or **Black** paint marks on the piston boss and inside the gudgeon pin).

e. The gudgeon pin (1) should enter the piston (2) easily with the pressure of the thumb alone.



1. Gudgeon pin
2. Piston
3. Connecting rod

f. After mounting the snap rings retaining the gudgeon pin the piston should move freely but be quite precise; to check this position the assembly as in the figure and ensure that the piston, as a result of its own weight, passes **slowly** from position **«A»** to position **«B»**.



Clearance between con rod small end bushing hole and gudgeon pin:
Black = 0.008 to 0.021 mm (0.0003 to 0.0008 in)
White = 0.005 to 0.018 mm (0.0002 to 0.0007 in)

Clearance between piston hole and gudgeon pin:
engine 062.10 = 0.003 to 0.008 mm (0.0001 to 0.0003 in)
engine 016.46 = 0.006 to 0.012 mm (0.0002 to 0.0005 in)

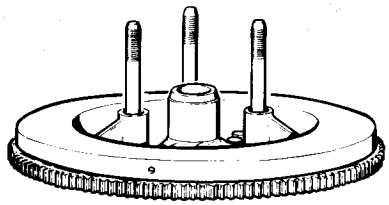
REPLACING FLYWHEEL RING GEAR

Check the flywheel ring gear and, when necessary, replace it as follows:

a. Heat the flywheel in a suitable oven, until the prescribed temperature is reached.

b. Remove the flywheel from the oven and, using a suitable mallet, separate the ring gear from the flywheel.

c. Heat the new ring gear uniformly up to the required temperature and then mount it on the engine flywheel, taking care that it is positioned correctly.



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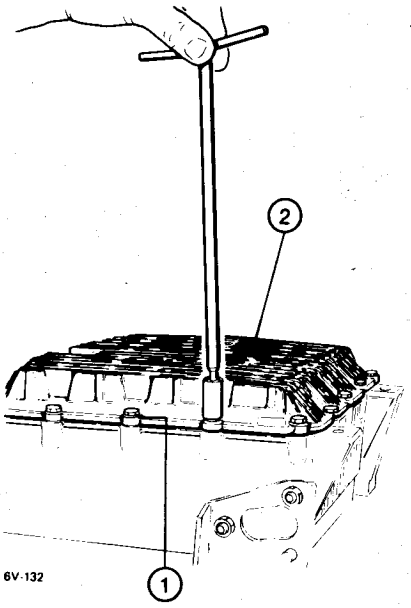
Temperature to which the ring gear should be heated for fitting/removing on/from the engine flywheel: 120 to 140°C (248 to 284°F)



6V-132

1. Screws and washers
2. Oil sump cover

c. Carefully clean the contact surface of the oil sump and its cover, fit a new gasket (1) covered with the prescribed sealant on both sides.

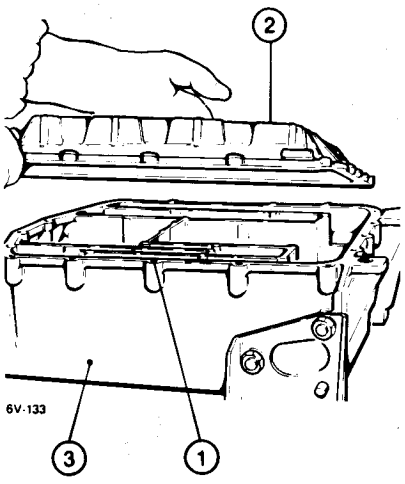
d. Replace cover (2) on oil sump (3), screw all the screws (with washers) and oil drain plug.

REPLACING OIL SUMP COVER

If necessary it is possible to replace the oil sump cover in the following way:

a. Slacken and unscrew screws with washers (1) which fix cover (2) to the oil sump.

b. Remove the gasket bearing in mind that it was spread with sealant during assembly.



6V-133

1. Gasket
2. Cover
3. Oil sump

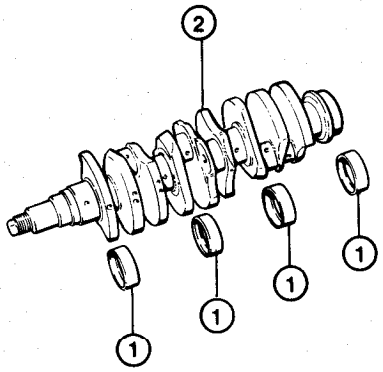
ASSEMBLY OF ENGINE BLOCK

CRANKSHAFT

Mount the crankshaft on the block in the following way:

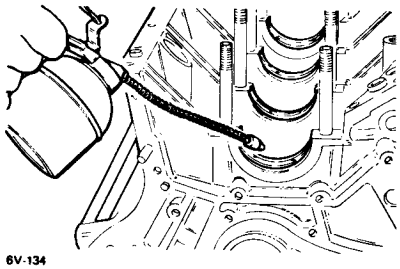
a. Select the main half-bearings pairing them with the relative shaft journals (according to the dimensional class).

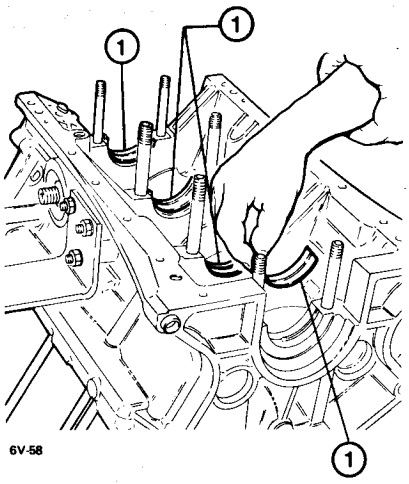
b. The assembly on the crankshaft must be performed by pairing parts of the same dimensional class, identified by paint marks of the same colour **Red** or **Blue**, on the side of semi-bearing (1) and on crankshaft journal (2).



1. Main half-bearings
2. Crankshaft

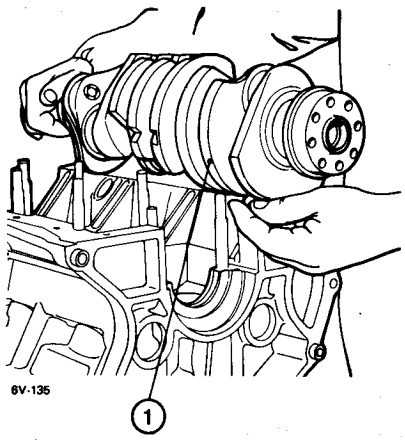
c. Clean the main bearings, lubricate them with clean engine oil and then position the upper main half-bearings (1), taking care that, during fitting, that the safety notches are in their respective seats in the cylinder block.





1. Upper main half-bearings

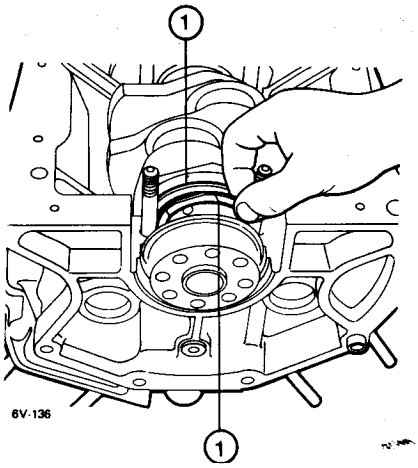
d. Lubricate the main bearings and crankshaft journals again with clean engine oil and place the shaft (1), correctly positioned, on the main bearings.



1. Crankshaft

e. Insert thrust half-rings (1) and settle them by rotating the crankshaft.

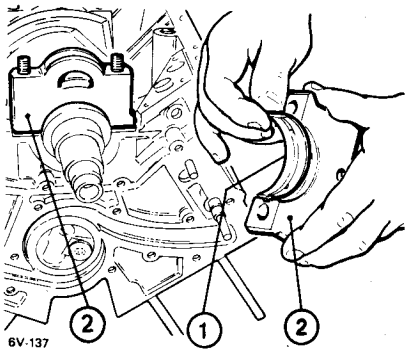
CAUTION:
The half-rings must be fitted ensuring that the lubrication grooves are facing towards the shoulders of the crankshaft.



1. Thrust half-rings

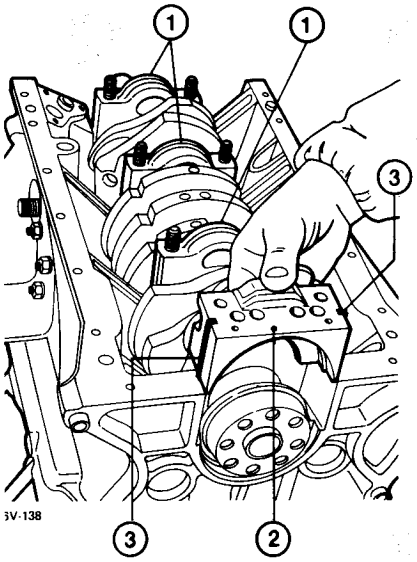
MAIN BEARING CAPS

a. Place the lower main half-bearings (1) in the respective main bearing caps (2) after lubricating them with clean engine oil; check that the safety notches are correctly positioned.



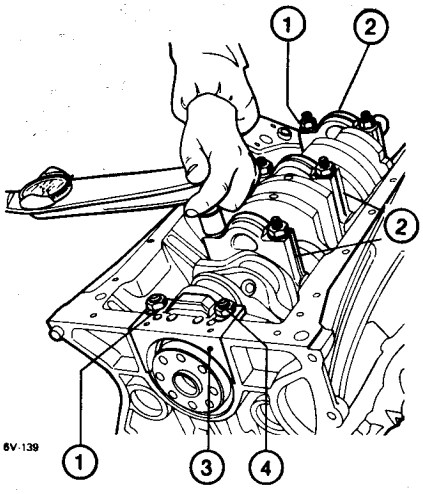
1. Lower main half-bearings
2. Main bearing caps

b. Re-fit caps (1) on the first three main bearings.
They must be oriented so that the safety notches coincide with those of the cylinder block; their position and orientation should be according to the numbers stamped on them (cap no. 1 should be fitted on the front bearing).
c. Re-fit rear main bearing cap (2), taking care not to damage the rubber seals (3).
Lubricate rubber seals (3) using lubricant 50HB-5100 or MILLOIL (Norm. 4500-17502).



1. Front main bearing caps
2. Rear main bearing cap
3. Rubber seals

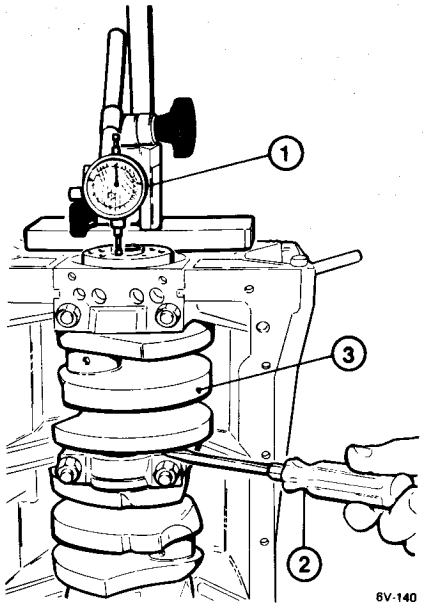
d. Tighten, in oil, nuts with washers (1) fixing main bearing caps (2).
Use the prescribed torque setting.
The nuts fixing the rear main bearing cap (3) are provided with safety tabs (4) which, temporarily **must not be removed**.



1. Nuts and washers
2. Front main bearing caps
3. Rear main bearing cap
4. Safety tab

(T) : **Torque setting**
Main bearing cap fixing screws (in oil)
76 to 78 N·m
(7.8 to 8 kg·m
56.4 to 57.9 ft·lb)

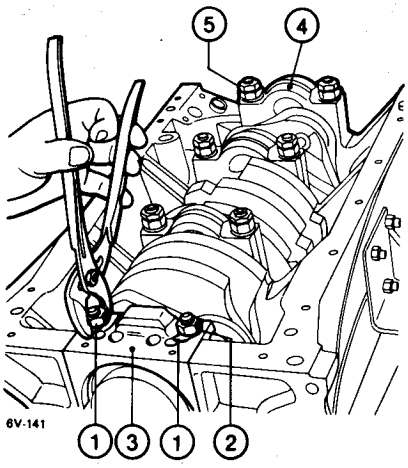
e. Checking the crankshaft end float
— Apply a dial indicator (1) with magnetic base so that the sensor of the instrument is in contact with the crankshaft parallel to the shaft axis.
— Using a screwdriver (2) move the crankshaft (3) and use the dial indicator to check that the end float is within the prescribed limits.
— Compare the value with that prescribed and, if necessary replace the thrust half-rings.
— To replace them it is necessary to remove the rear main bearing cap again.



1. Dial indicator
2. Screwdriver
3. Crankshaft

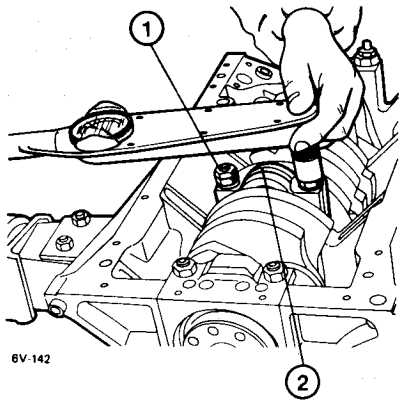
End float of crankshaft:
0.080 to 0.265 mm
(0.0031 to 0.0104 in)

f. After fitting the new half-rings check the crankshaft end float and, if it is within the prescribed tolerance, bend the safety tabs (1) of nuts (2) of the rear main bearing cap (3).
g. Screw locknuts (5) on the remaining front main bearing caps (4).



1. Safety tabs
2. Nuts
3. Rear main bearing cap
4. Front main bearing caps
5. Locknuts

h. Tighten locknuts (1) of the front main bearing caps (2) to the prescribed torque.

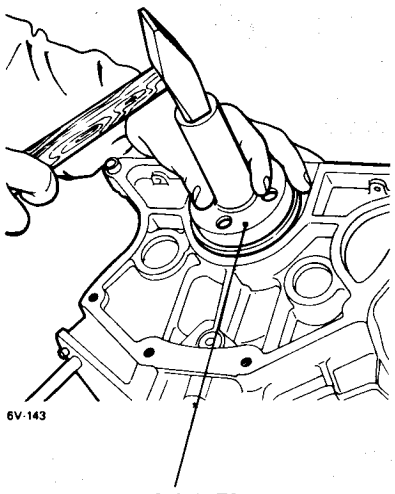


1. Locknuts
2. Front main bearing caps

(T) : **Torque setting**
Locknuts securing main bearing caps (in oil)
20 to 25 N·m
(2 to 2.5 kg·m
14.5 to 18.1 ft·lb)

OIL SEAL (REAR)

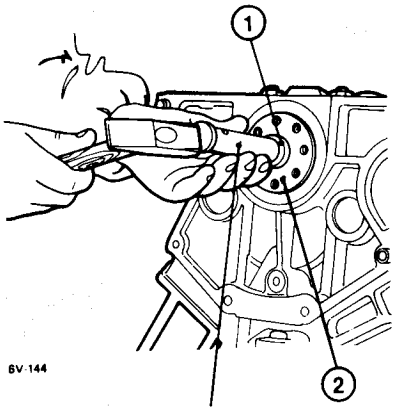
a. Lubricate the outer surface and the lip of the rear oil seal with clean engine oil.
b. Contain the internal spring of the rear oil ring by applying a thin layer of ISECO Molykote BR2 grease (P/N 3671-69841).
c. Place the oil seal on the flared surfaces of the centering ring of tool **A.3.0178**.
Fit the oil seal using tool **A.3.0178**; ensure that it is in the correct position during mounting.



A.3.0178

ENGINE FLYWHEEL

a. **Fitting of flywheel center bushing**
— Mount bushing (1) on the rear flange of the driving shaft (2) using inserting tool **A.3.0305**.



A.3.0305

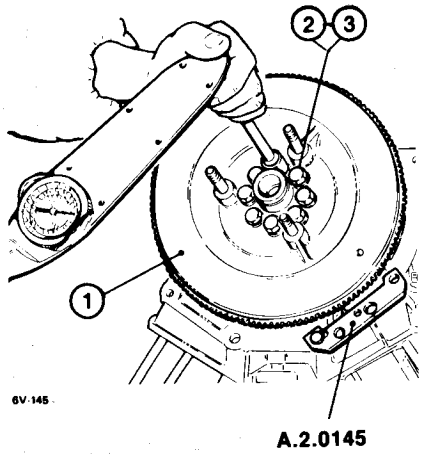
1. Flywheel center bushing
2. Crankshaft rear flange

b. **Fit the engine flywheel** in the following way:
— clean the crankshaft flange and the contact surface of the flywheel carefully;
— rest the flywheel (1) on the flange. The flywheel can only be mounted in one position due to the fact that the mounting holes are not equidistant; position safety washer (2) in the same way;
— finger tighten screws (3) securing the flywheel (after spreading the prescribed sealant over them).

CAUTION:
Before applying the sealant to the threads of the screws (LOCTITE 270 - Green) eliminate any trace of the old sealant by brushing and blowing air over the threads. In any case remove any grease from the threads with trichloroethylene or chlorothene.

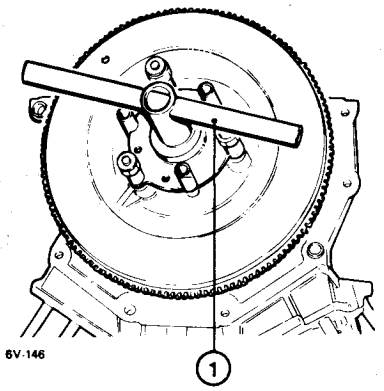
— fit tool **A.2.0145** to prevent the rotation of flywheel (1);
— tighten securing screws (3) to the prescribed torque.
Before mounting **lubricate** the screws with engine oil.

(T) : **Torque setting**
Screws securing flywheel to crankshaft
113 N·m
11.5 kg·m
83.2 ft·lb)



1. Engine flywheel
2. Safety washers
3. Retaining screws

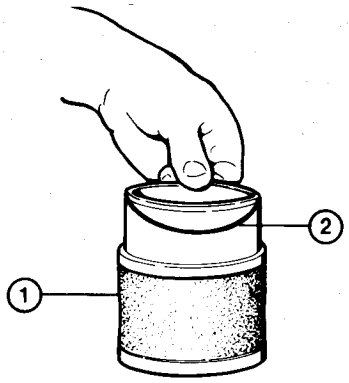
c. Fit a suitable tool (1) on the flywheel that will permit the rotation of the crankshaft and remove the stop device previously fitted (tool **A.2.0145**).

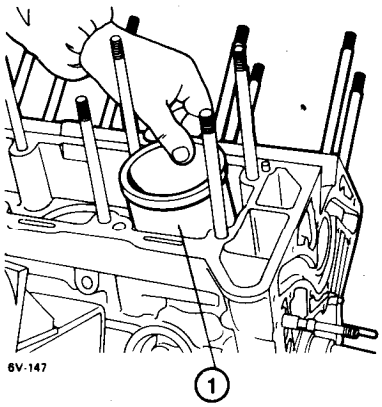


1. Tool for turning crankshaft

CYLINDER LINERS, PISTONS AND CONNECTING RODS

a. Clean the cylinder liners (1) carefully and fit seal (2). Then insert the liners in the block, ensuring that they go all the way.

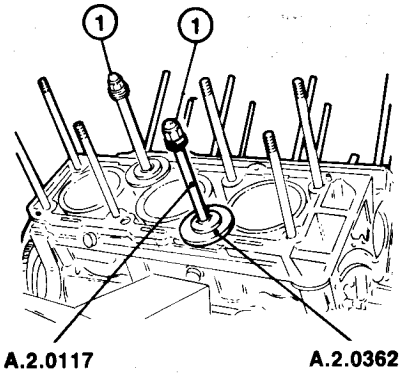




1. Cylinder liners
2. Seal ring

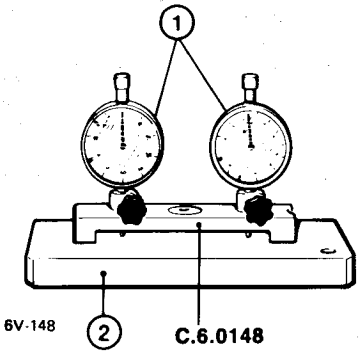
b. **Checking the protrusion of the cylinder liners**
If it is necessary to check the protrusion of the cylinder liners with the seal rings fitted proceed as follows:
— Fix the cylinder liners to the block by means of cylinder liner fixing tool **A.2.0117** (complete with additional rings **A.2.0362**).
— Secure the liner fixing tools and tighten the respective nuts (1) to the prescribed torque.

(T) : **Torque setting**
Cylinder liner locknuts
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)



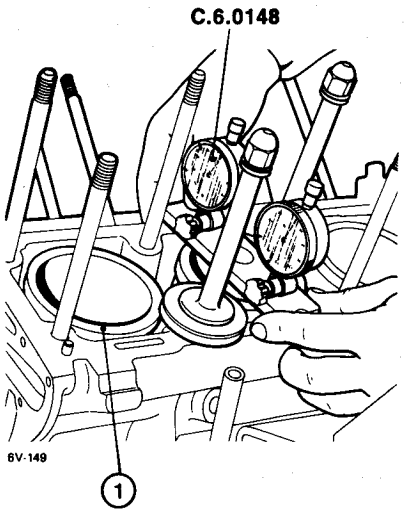
1. Cylinder liner locknuts

— Apply the dial indicators (1) to the gauge, tool **C.6.0148**.
Place the group on a surface plate (2) and zero the indicators.



1. Dial indicators
2. Surface plate

— Apply gauge, tool **C.6.0148** to the cylinder block so that the sensors of the dial indicators rest on the edge of the cylinder liner (1) indicating the protrusion.
— Check that the values obtained are within the prescribed tolerances.



1. Cylinder liners

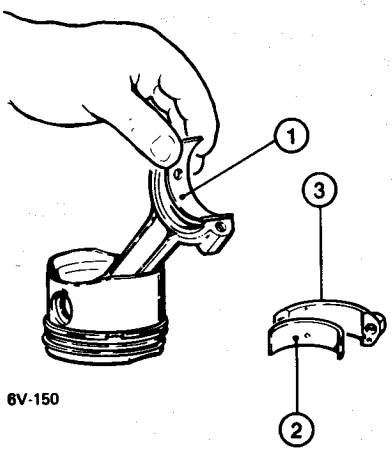
Protrusion of cylinder liner from cylinder block:
0.01 to 0.06 mm (0.0004 to 0.0024 in)

— Remove the liner fixing tools, **A.2.0117** complete with additional washers, **A.2.0362**.

c. **Fitting pistons and connecting rods**

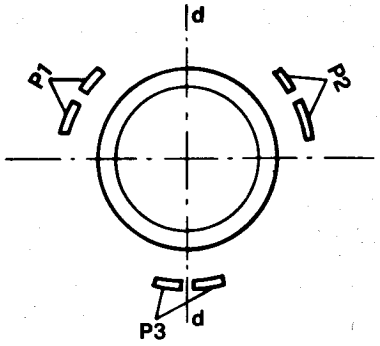
Fit the previously selected half-bearings on the connecting rod big end and on the respective caps. Proceed as follows:

— Position the half-bearings (1) and (2) in the con rod big end and in cap (3) respectively, after having lubricating them with clean engine oil.



1. Upper half-bearings
2. Lower half-bearings
3. Connecting rod cap

— Using clean engine oil, lubricate the piston and position the respective piston rings so that the cuts (openings) are staggered as in the figure.

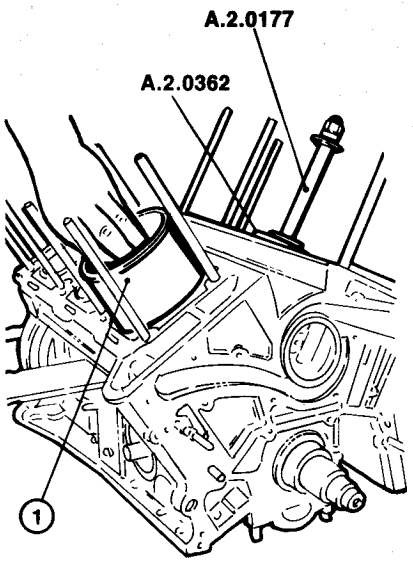


P_1. Position of first compression ring
P_2. Position of second compression ring
P_3. Position of oil control ring
aa. Gudgeon pin axis
dd. Direction of thrust

— Insert the con rod-piston group in the respective liner, ensuring that the **arrow** stamped on the top of the piston **is facing towards the front** of the engine; a suitable guide tool (1) must be used for insertion.

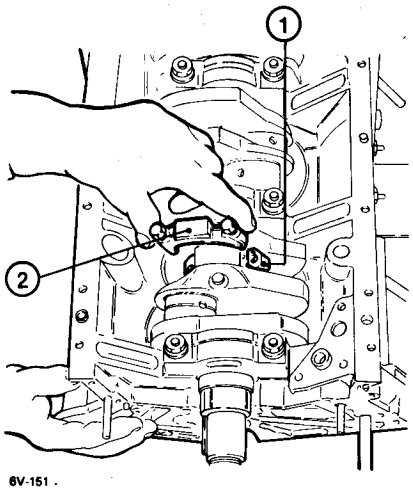
CAUTION:
To avoid scoring the cylinder liners the con rod must be guided during the insertion of the piston.

— Fix the cylinder liners with suitable tools **A.2.0117** complete with additional washers **A.2.0362**.



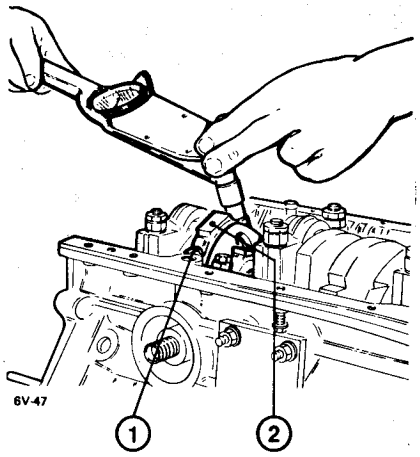
1. Guide [I.D. 88 mm (3.465 in)] for the insertion of the pistons in the cylinder liners

— Lubricate the con rod caps and respective crankshaft journals with clean engine oil.
Free the cylinder block from the rotating stand and turn it over.
Bring con rod (1) to the respective journal of the crankshaft and fit con rod cap (2) so that it matches the notches of the half-bearings.



1. Connecting rod
2. Connecting rod cap

— Insert screws (1) securing the con rod caps (2) and tighten them to the prescribed torque (after lubricating them with engine oil).



1. Retaining screws
2. Connecting rod caps

(T) : **Torque setting**
Retaining screws of con rod caps (in oil)
46 to 51 N·m
(4.7 to 5,2 kg·m
34.0 to 37.6 ft·lb)

FRONT COVER

Free the overhaul stand and turn the cylinder block over (restoring it to normal position).

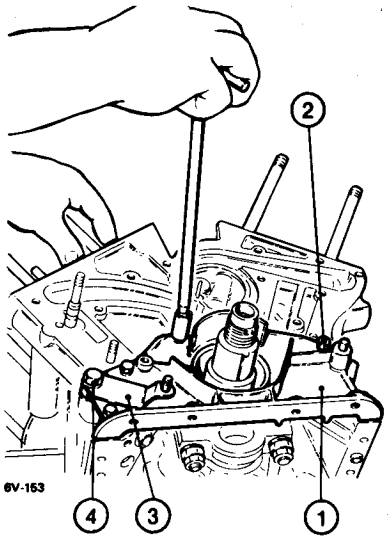
a. Before fitting the front cover clean the cylinder block support surfaces and the cover itself to remove any fragments of gasket.

Use butyl acetate or methylethylketone.

b. Insert the gasket over the studs.

c. Fit the cover (1) and screw and lock retaining screws (2).

d. Mount plate (3), for the pre-loading spring of the hydraulic belt stretcher, on the front cover and fix it by means of screw with washer (4).



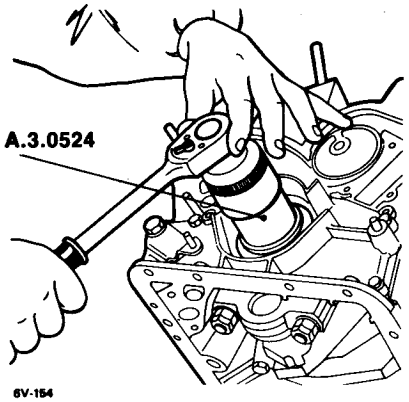
1. Front cover
2. Retaining screws
3. Plate
4. Retaining screw

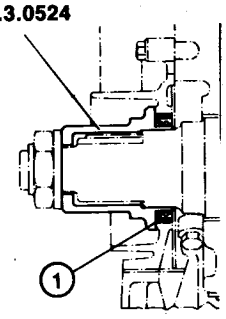
CRANKSHAFT FRONT PULLEY

Re-fit crankshaft seal ring on the front cover.

a. Lubricate the outer surface of the seal ring (1) with clean engine oil and the respective lip with ISECO Molykote BR2 grease (P/N 3671-69841).

b. Drive the seal ring (1) onto the crankshaft using tool **A.3.0524**.

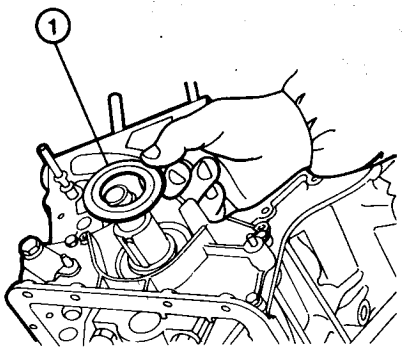




1. Seal ring

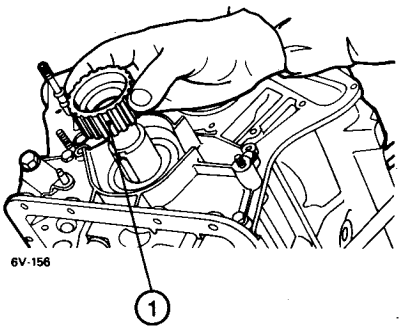
c. Stop the flywheel from rotating by means of tool **A.2.0145**.

d. Mount ring (1) on the crankshaft. This serves as a shoulder for the timing mechanism toothed belt; the crown of the ring must face inwards.



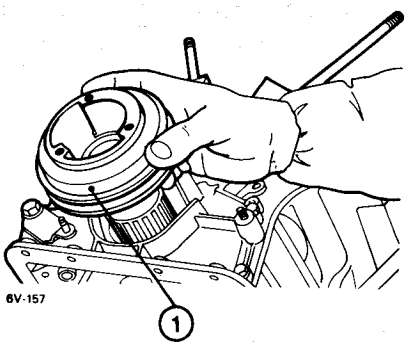
1. Shoulder ring

e. Mount the timing mechanism drive toothed pulley (1) on the crankshaft.



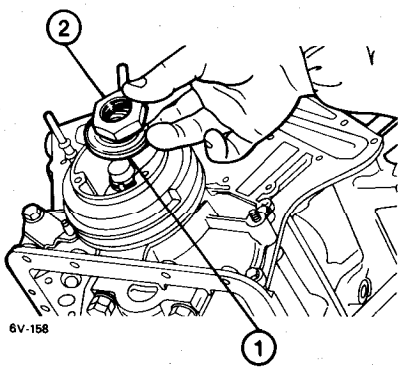
1. Toothed pulley

f. Mount the front pulley (1) fitting it into respective slot with the key on the crankshaft.



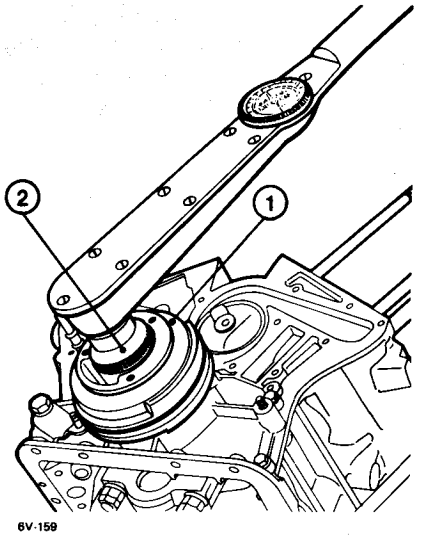
1. Front pulley

g. Fit washer (1) onto the crankshaft and finger tighten the locknut (2).



1. Washer
2. Locknut

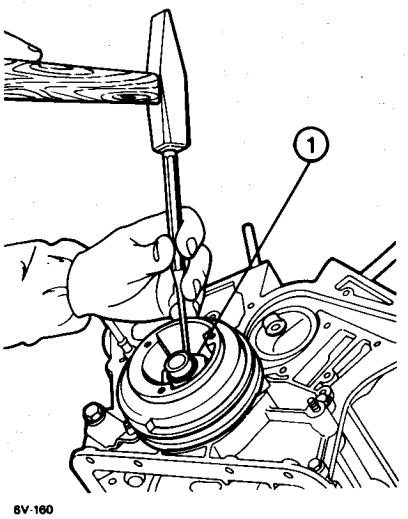
h. Tighten the nut securing the front pulley (1) (in oil) to the required torque; use a suitable tool (2) to tighten the nut.



1. Front pulley
2. Nut tightening tool

(T) : Torque setting
Nut securing crankshaft front pulley (in oil)
235 N·m
(24 kg·m
174 ft·lb)

i. Caulk the collar of nut (1) after tightening to the prescribed torque.

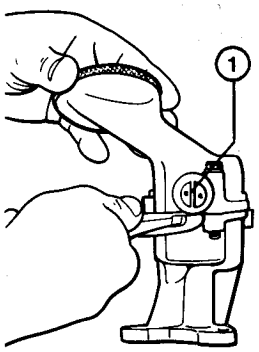


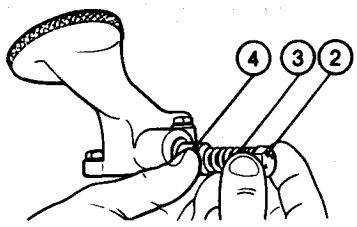
1. Front pulley locknut

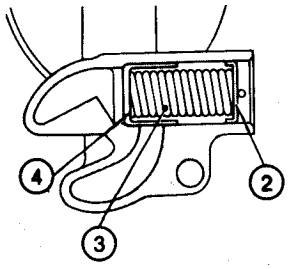
OIL PUMP

Disassembly

a. Maintain the oil pump in a vice and disassemble the pressure regulation group:
— remove the cotter pin (1);
— extract, in sequence: cover (2), spring (3) and piston (4).

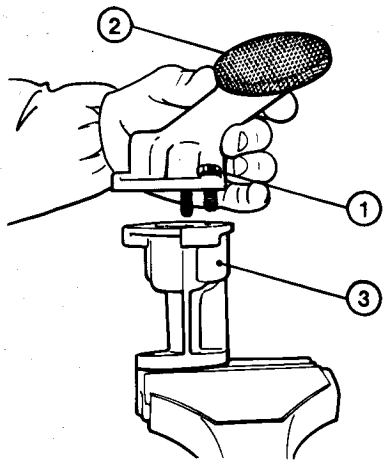






1. Cotter pin
2. Cover
3. Spring
4. Piston

b. Separate the oil suction housing (2) from the pump housing (3) after removing screws (1).

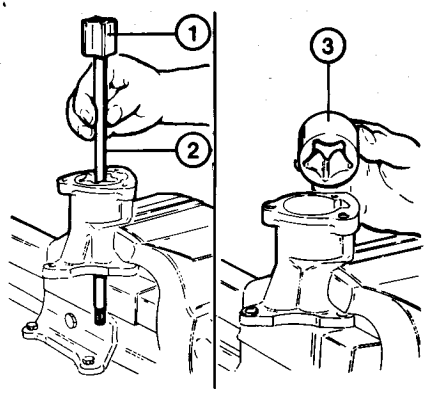


6V-162

1. Retaining screws
2. Oil suction housing
3. Pump housing

c. Extract the inner rotor (1), complete with spindle (2) and the driven rotor (3) from the pump housing.

IMPORTANT:
Inner rotor (1) must not be removed from spindle (2).



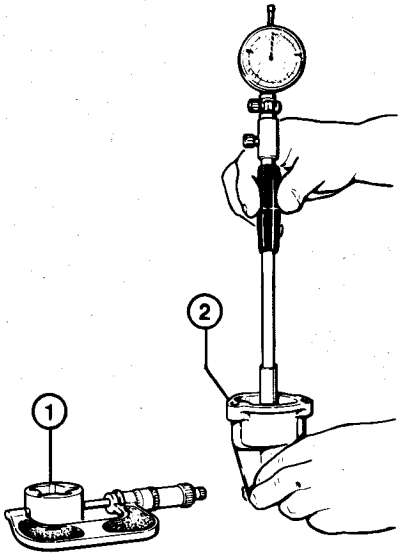
1. Inner rotor
2. Spindle
3. Driven rotor

Checking

Check the rotors visually for deep scoring or evidence of seizure; check the piston of the valve regulating the oil pressure in the same way.

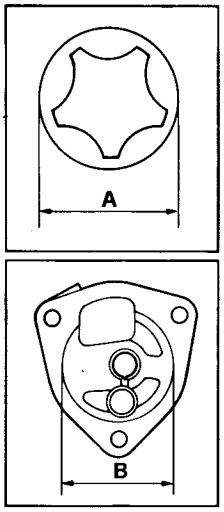
a. Using a micrometer measure the O.D. of the driven rotor (1) and, using a bore gauge, measure the I.D. of the pump housing (2).

Ensure that the values obtained are within the prescribed tolerances.



6V163

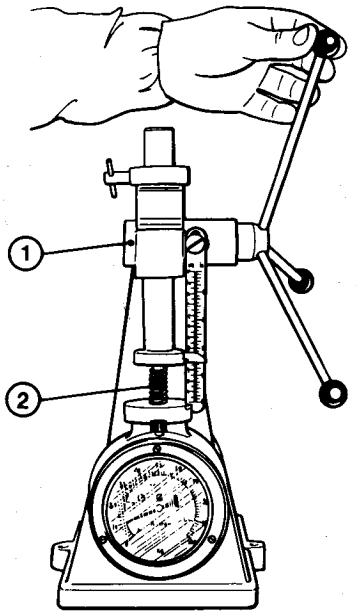
1. Inner driven rotor
2. Pump housing



A = O.D. of driven rotor:
49.100 to 49.155 mm
(1.9331 to 1.9352 in)

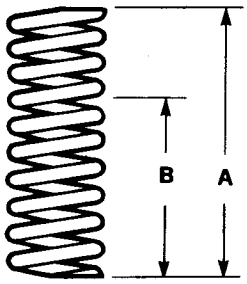
B = I.D. of rotor seat in pump housing:
49.325 to 49.375 mm
(1.9419 to 1.9439 in)

b. Use a dynamometer (1) to check the flexibility of the spring (2) operating the oil pressure regulation valve; see table for prescribed values.



6V-164

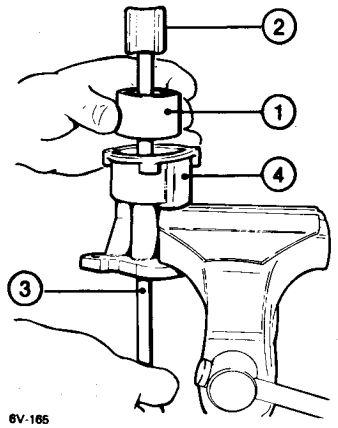
1. Dynamometer
2. Spring



Test load		17.31 to 17.97 kg (38.2 to 39.6 lb)
Length of free spring	A	49.29 mm (1.941 in)
Length of loaded spring	B	31.90 mm (1.256 in)

Re-assembly

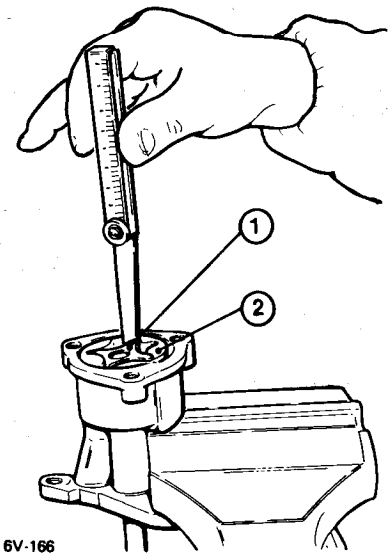
a. Re-assemble the oil pump as follows:
— insert driven rotor (1) in the pump housing (4) and then insert the inner rotor (2) complete with spindle (3).



6V-165

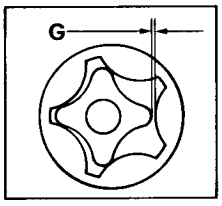
1. Driven rotor
2. Inner rotor
3. Spindle
4. Pump housing

— position the rotors as indicated in the figure and measure the clearance «G» that exists between the lobe of the inner rotor (1) and that of the driven rotor (2); compare the clearance with that prescribed.



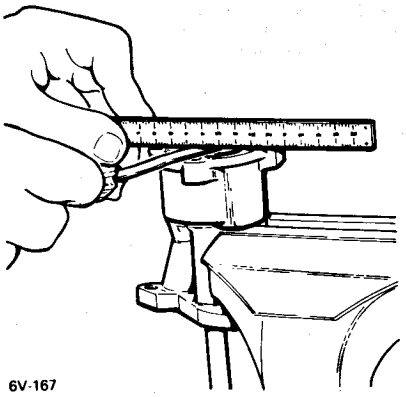
6V-166

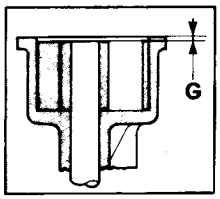
1. Inner rotor
2. Driven rotor



G = Clearance between driven rotor and inner rotor of the oil pump: 0.040 to 0.290 mm (0.0016 to 0.0114 in)

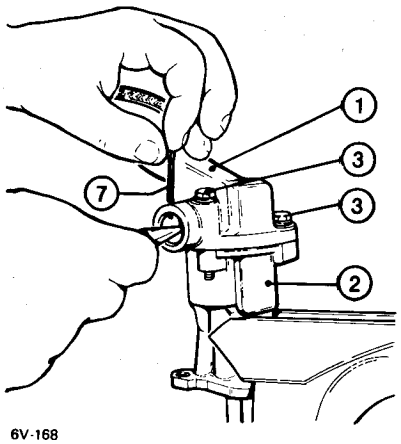
— check the end float «G» of the two rotors with respect to the pump housing surface; this is done with a thickness gauge placed between the rotors themselves and the test roller resting on the surface.


6V-167

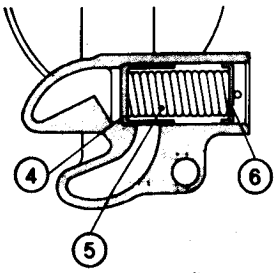


G = End float between the two rotors with respect to the pump housing surface: 0.025 to 0.075 mm (0.0010 to 0.0030 in)

b. Re-assemble the oil movement group (1) complete with suction rose on the pump housing (2) and secure with screws and washers (3).
Re-assemble the valve regulating the oil pressure by reinstalling: piston (4), spring (5) and cover (6).
Overcome, with the aid of a pair of long-nosed pliers, the force of the valve spring and insert safety cotter (7).



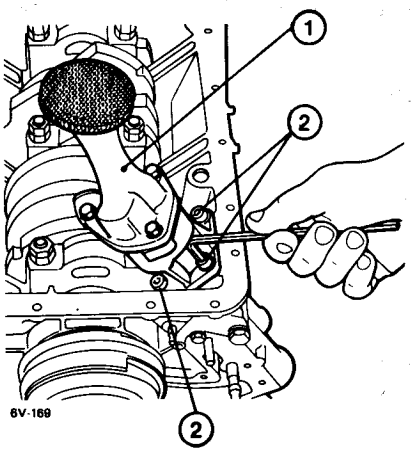
6V-168



1. Oil movement group
2. Pump housing
3. Screws and washers
4. Piston
5. Spring
6. Cover
7. Safety cotter

Re-fitting the oil pump to the block

a. Insert the oil drive shaft in its seat in the cylinder block.
b. Fix the oil pump (1) to the base using the three socket head screws (2).



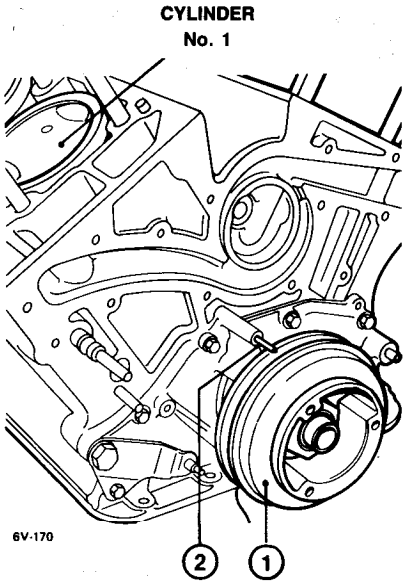
6V-169

1. Oil pump
2. Retaining screws

REINSTALLATION OF CYLINDER HEADS

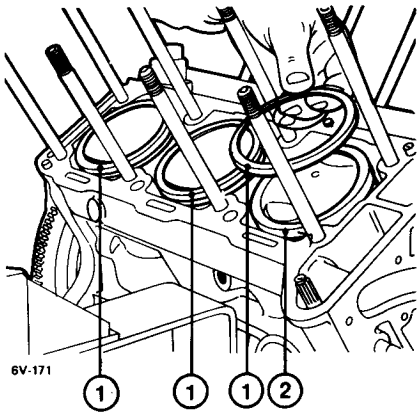
a. Free the overhaul stand and turn the block over.
Remove tool **A.2.0145** preventing the rotation of the flywheel.

b. Turn the crankshaft until the piston of cylinder no. 1 is in T.D.C. position during explosion stroke; this position is assured by the collimation of the notch on the engine pulley (1) and mark (2) on the front cover.



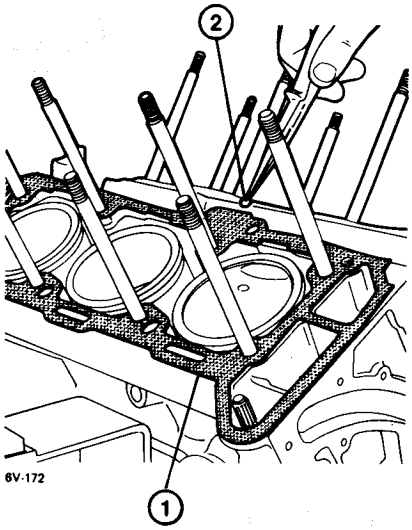
1. Engine pulley
2. Reference mark

c. Remove the cylinder liner fixing tools **A.2.0117** and additional washers **A.2.0362**, insert the fireproof gasket (1) on the cylinder liners (2).



1. Fireproof gasket
2. Cylinder liners

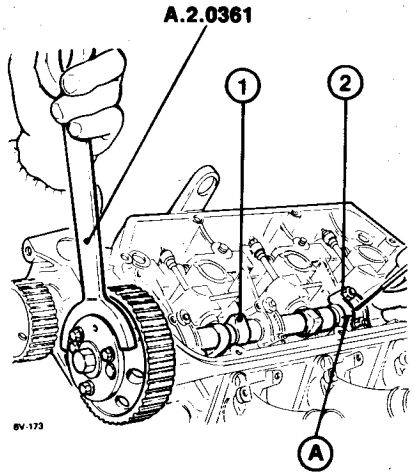
d. Insert gasket (1) of the cylinder head and position seal ring (2) of the lubrication oil pipes.



1. Cylinder head gasket
2. Seal ring

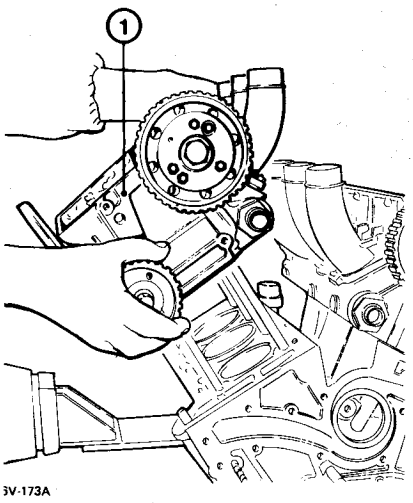
e. Prepare, as described, the two cylinder heads for re-fitting on the block:

— with lever (tool **A.2.0361**), turn camshaft (1) of each head until the timing notches (ref. **A**) coincide with the timing notches of the specified fixing caps (2).
On the RIGHT head the notch corresponds with the **third** cap, while on the LEFT head it is on the **second** cap.



1. Camshaft
2. Camshaft cap
A. Timing notches

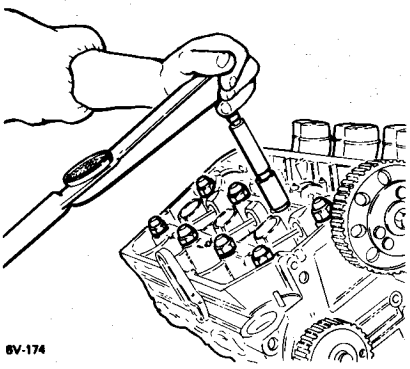
f. Fit the cylinder heads (1) to the block and lubricate the threads of the studs, the washers and locknuts with clean engine oil; proceed with care so as not to damage the studs.

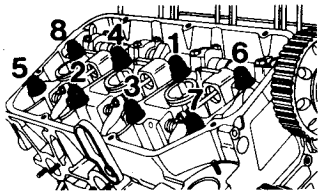


1. Cylinder head

g. Screw and tighten (to the required torque) the eight locknuts of the cylinder heads according to the sequence indicated in the following figure.

NOTE:
The operation illustrated is that for the RIGHT head.
For the LEFT head the tightening order is symmetrical.





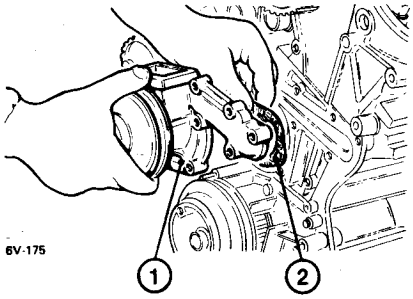
(T) : Torque setting
Nuts securing cylinder head to block
78 N·m
(8 kg·m
57.9 ft·lb)

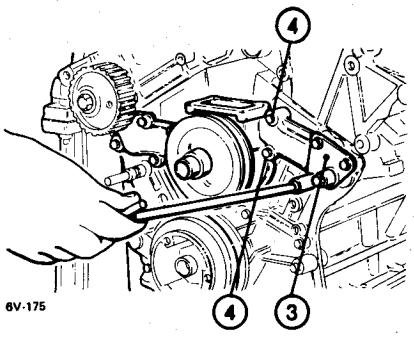
CAUTION:
After about 1000 km, with a cold engine, slacken the nuts by 1 turn one at a time in the order indicated.
Moisten the surfaces between washer and nut with oil and re-tighten to the following torque:
88 N·m
(9 kg·m) (65.1 ft·lb)

REINSTALLING OF ACCESSORIES

WATER PUMP

a. Fit the water pump (1) complete with the new gasket (2), to the front part of the cylinder block.
b. Mount support (3) for the generator regulation bracket and secure the water pump (1) tightening screws with washers (4) to the required torque.

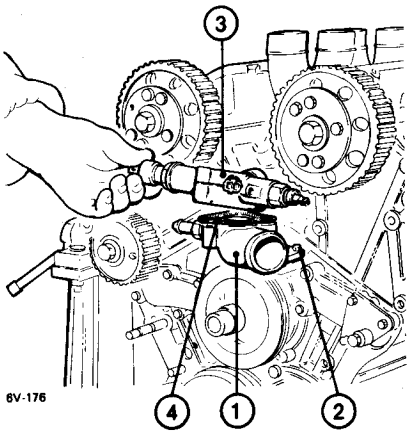




1. Water pump
2. Gasket
3. Support
4. Screws with washers

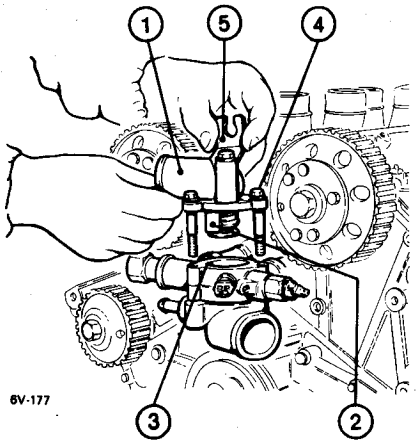
(T) : Torque setting
Water pump retaining screws
14 to 22 N·m
(1.36 to 2.25 kg·m
9.8 to 16.3 ft·lb)

c. Mount union (1) on the water pump, first fitting a new gasket, and secure by tightening screws (2).
d. Mount intermediate union (3) (fitting a new gasket (4)) and simultaneously connecting rubber sleeves with clamps to the cylinder head cooling pipes.



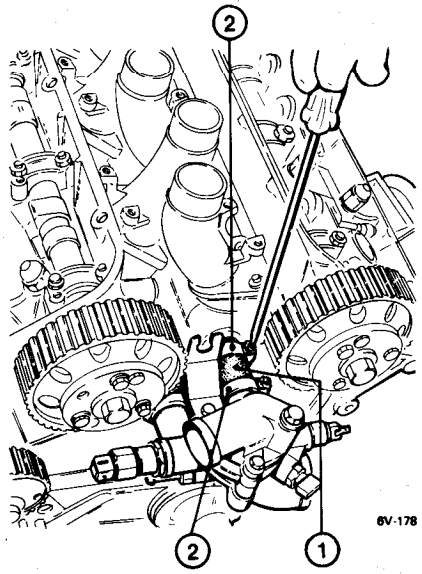
1. Water pump union
2. Retaining screws
3. Intermediate union
4. Gasket

e. Fit cup (1) complete with thermostat (2), inserting a new gasket (3) and securing the entire group by tightening screws (4).
Fit plate (5) for the thermostat group wiring harness on the thermostat cup.



1. Cup
2. Thermostat
3. Gasket
4. Retaining screws
5. Plate

f. Finally connect rubber sleeves (1) to the cylinder head cooling pipes.
Tighten clamps (2).

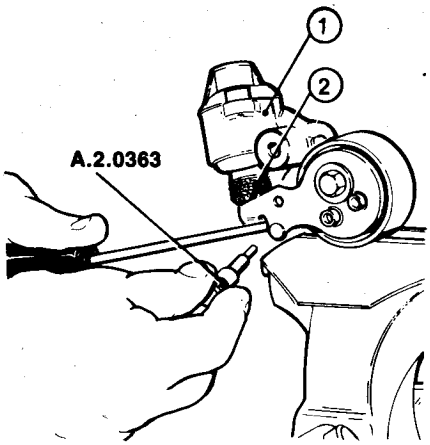


1. Rubber sleeves
2. Clamp

HYDRAULIC BELT STRETCHER

Disassembly

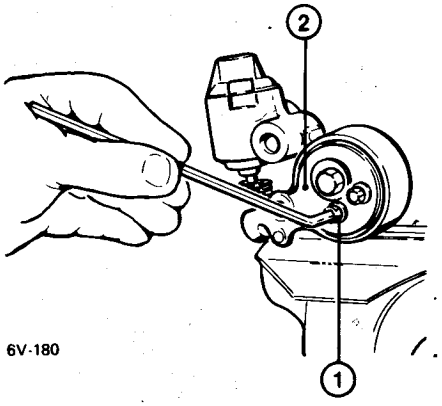
a. Lock the hydraulic belt stretcher (1) in a vice and, proceeding as illustrated in the figure, extract the pin (tool **A.2.0363**) to relieve the internal spring (2).



6V-179

1. Hydraulic belt stretcher
2. Spring

b. Unscrew socket head screws (1) and disassemble the belt stretcher plate (2).

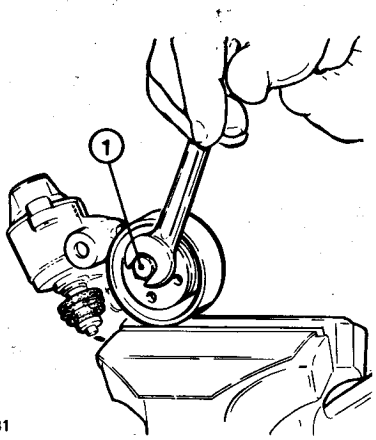


6V-180

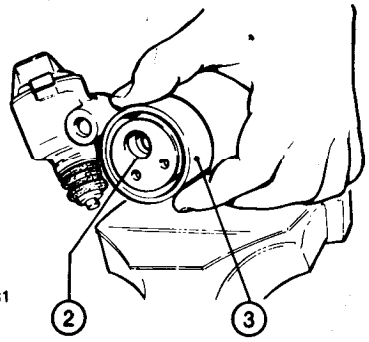
1. Retaining screws
2. Belt stretcher plate

c. Disassemble the belt-stretcher pulley as follows:

— unscrew screw (1) and remove spacer below;
— retrieve seal ring (2) from the pulley pin;
— withdraw pulley (3) and retrieve the inner seal ring.



6V-181

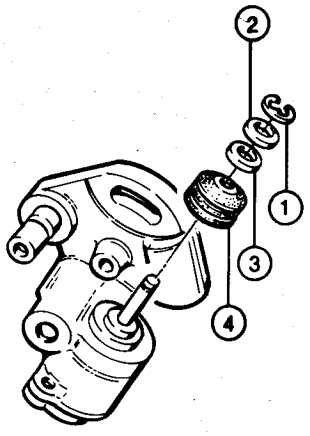


6V-181

1. Retaining screws
2. Seal ring
3. Pulley

d. Disassemble the piston in the following manner:

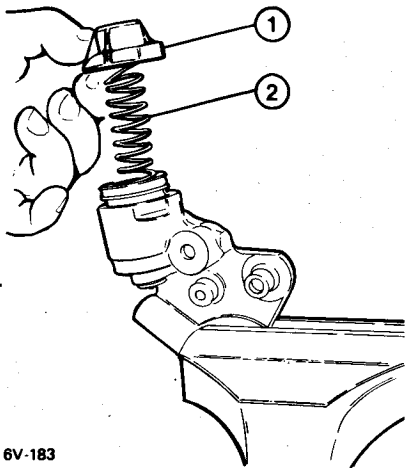
— remove snap ring (1) and slide washer (2) from the rod of the piston;
— then extract rubber (3) and bellows (4).



6V-182

1. Snap ring
2. Washer
3. Rubber
4. Bellows

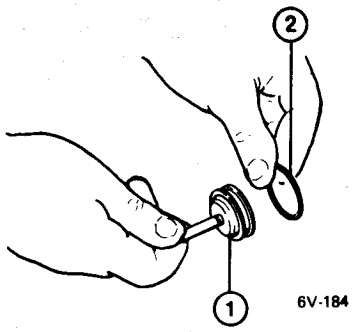
— slacken and unscrew the screws, remove cover (1) and, simultaneously retrieve spring (2) and the cover gasket.

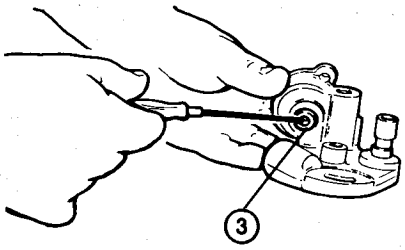


6V-183

1. Cover
2. Spring

— extract piston (1) from the belt stretcher housing and retrieve seal ring (2); then remove ring (3) from the lower part of the belt stretcher housing.





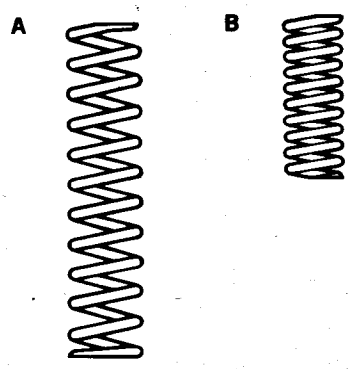
1. Piston
2. Seal ring
3. Seal ring

Checks

Subject the disassembled parts to a thorough visual examination in order to ascertain if there are signs of excessive wear; in the same way check the pin of the belt stretcher pulley for excessive wear.

CAUTION:
It is advisable to replace all the rings each time the belt stretcher is overhauled.

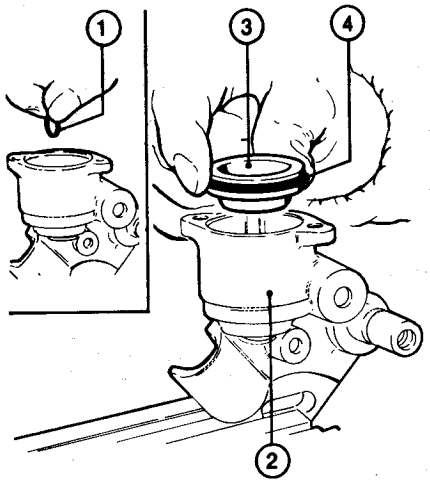
a. Also inspect spring «A», which acts on the piston and spring «B» which determines the pre-loading of the hydraulic belt stretcher.
Then check that the setting corresponds to that given in the table.



Belt stretcher spring	A	B
No. of useful coils	12	9
Length of free spring	93 mm (3.66 in)	45.5 mm (1.79 in)
Static test load	93.16 N 9.5 kg (20.9 lb)	98 N 10 kg (22 lb)
Length of spring under load	48 mm (1.89 in)	30 mm (1.18 in)

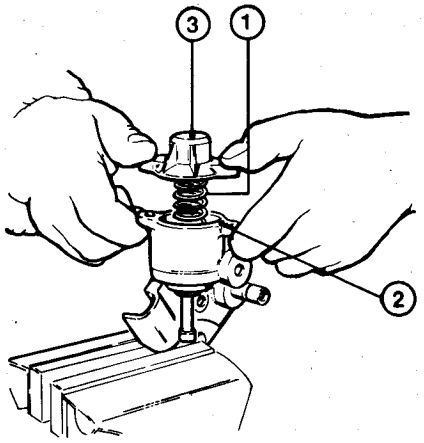
Reassembly

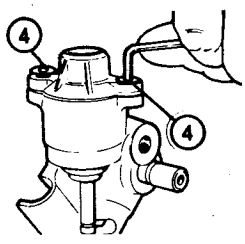
a. Insert seal ring (1), suitably lubricated with engine oil and place it in the lower bushing of the belt stretcher housing (2). Insert piston (3) complete with seal ring (4), suitably lubricated with engine oil.



1. Seal ring
2. Belt stretcher housing
3. Piston
4. Seal ring

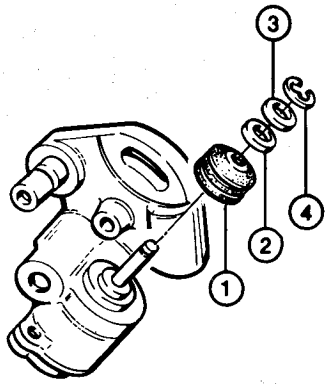
b. Position spring (1) on the piston and gasket (2) on the belt stretcher housing. Then, compressing the spring close cover (3) and fix it with the relative Allen screws (4).





1. Spring
2. Gasket
3. Cover
4. Retaining screws

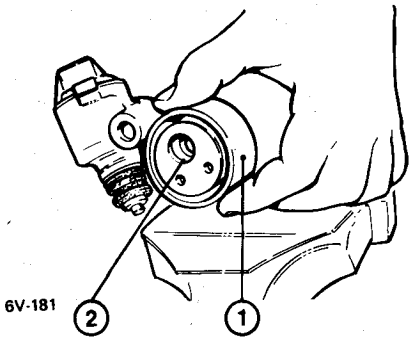
c. Reinstall bellows (1) on the piston rod, taking care to fit it on the lower bushing of the belt stretcher housing, and then install rubber (2), washer (3) and safety snap ring (4).



6V-182

1. Bellows
2. Rubber
3. Washer
4. Snap ring

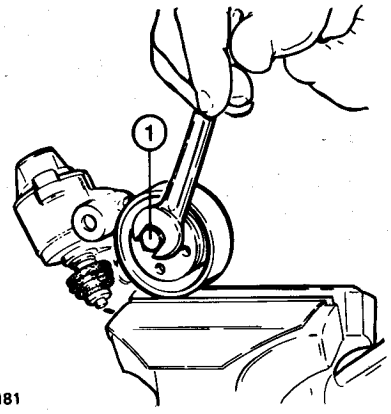
d. Position the inner seal ring on the pulley, reassemble pulley (1) on the belt stretcher pin suitably lubricated with ISECO Molykote BR2 grease, and fit the outer seal ring (2).



6V-181

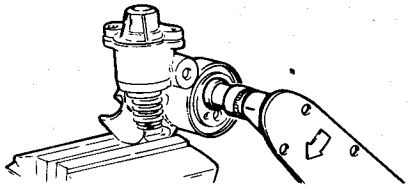
1. Pulley
2. Outer seal ring

e. Re-fit the spacer and screw in screw (1) securing the pulley.
Then tighten the screw to the prescribed torque.



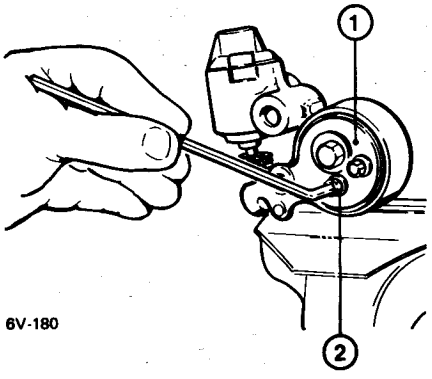
6V-181

1. Pulley retaining screw



(T) : **Torque setting**
Screw securing belt stretcher pulley to the support pin
17 to 20 N·m
(1.7 to 2 kg·m
12.30 to 14.47 ft·lb)

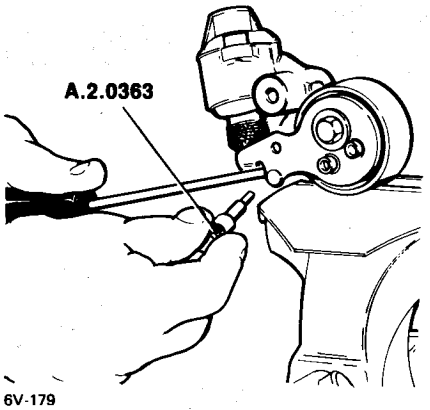
f. Fit the belt stretcher plate (1) and, after having positioned it correctly re-tighten the two Allen screws (2).



6V-180

1. Belt stretcher plate
2. Retaining screws

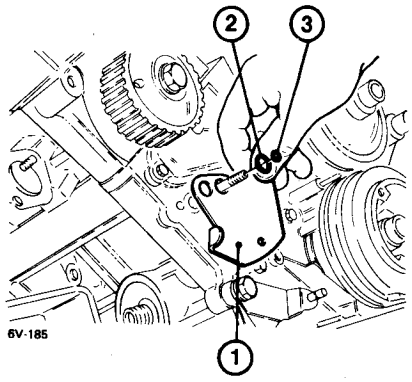
g. When reassembly is complete lock the belt stretcher plate in spring compressed position using the pin (tool **A.2.0363**).



6V-179

Reinstallation on the cylinder block

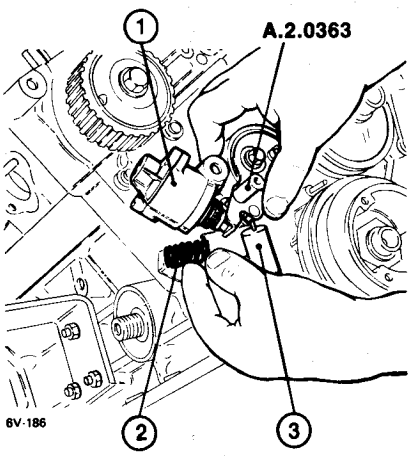
To reinstall the hydraulic belt stretcher proceed as follows:
a. Mount plate (1) restraining the spring placing it over the belt stretcher support pin.
b. Position rubber seals (2) and (3) on the belt stretcher support pin.



6V-185

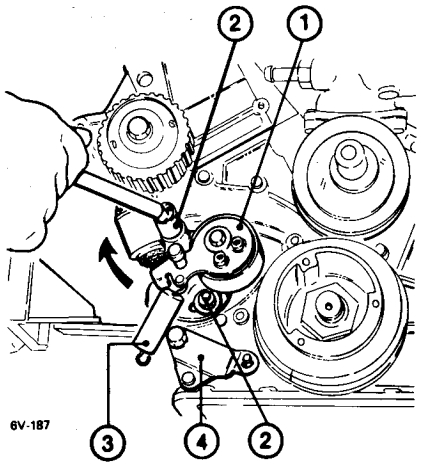
1. Spring restraining plate
2. Rubber seal
3. Rubber seal

c. Check that belt stretcher (1) is locked by the pin (tool **A.2.0363**) and then mount it on the support pin complete with pre-loading spring (2) and reaction spring (3).



1. Hydraulic belt stretcher
2. Pre-loading spring
3. Reaction spring

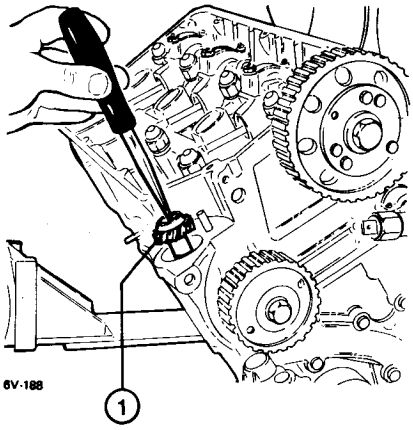
d. Fix belt stretcher (1) to the cylinder block, turning it clockwise as far as it goes and screwing the nuts washers (2); fit reaction spring (3) on the pin of plate (4).

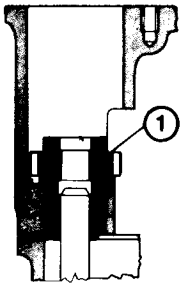


1. Belt stretcher
2. Nuts and washers
3. Reaction spring
4. Plate

DISTRIBUTOR

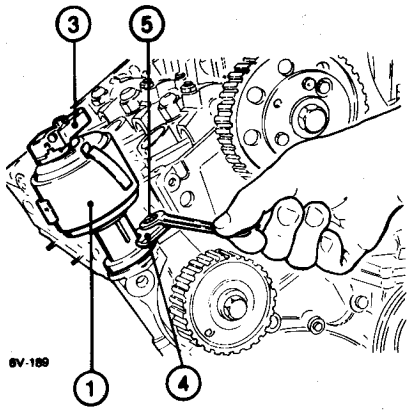
a. After lubricating it with engine oil, insert gear (1).
This engages the oil pump spindle and drives the pump and the distributor.

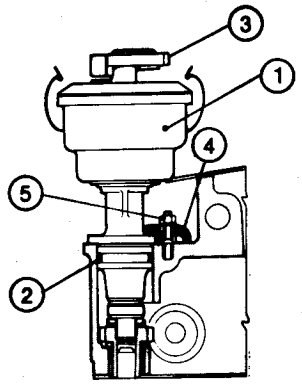




1. Gear

b. Fit the distributor (1), with a new seal ring (2).
Position rotating brush (3) **towards the** cylinder no. 1, and thus with the notch on the distributor housing.
Mount plate (4) and secure the distributor with nut and washer (5); **do not tighten nut (5) at this time.**





1. Distributor
2. Seal ring
3. Rotating brush
4. Plate
5. Nut and washer

INSTALLATION OF TIMING BELT AND CHECK OF ENGINE TIMING

a. Mount tool **C.6.0183** complete with dial indicator in the spark plug seat of the 1st cylinder.
b. Turn the crankshaft in the normal direction until piston of cylinder no. 1 reaches T.D.C. position during the compression stroke (with both valves closed); this condition is indicated by the static period between the clockwise and anti-clockwise oscillations of the dial indicator pointer.
c. Check that in this position the following conditions occur:
— notch «P» on the engine pulley (1) must be aligned with reference pin (2) on the cylinder block;
— notches (3) and (4) on the camshaft must be aligned with the corresponding reference notches on the relative caps;

— rotating brush (5) of the distributor must be facing towards cylinder no. 1 and aligned with the reference notch on the distributor housing.

CAUTION:
During all the belt re-fitting operations check that there is still alignment.

d. Fit the timing belt (6) on the pulleys, maintaining the driving legs taught and respecting the following assembly order:

A. Crankshaft toothed pulley;
B. Left cylinder head toothed pulley;
C. Right cylinder head toothe pulley;
D. Camshaft and oil pump drive pulley;
E. Hydraulic belt stretcher pulley.

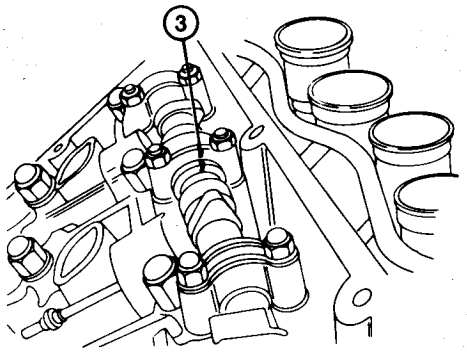
e. Slacken the nuts securing the hydraulic belt stretcher and seat the timing belt by means of the device fixed to the flywheel and turning the crankshaft in the normal rotation direction for two or three complete turns, taking care to maintain the drive legs of the toothed belt taught.

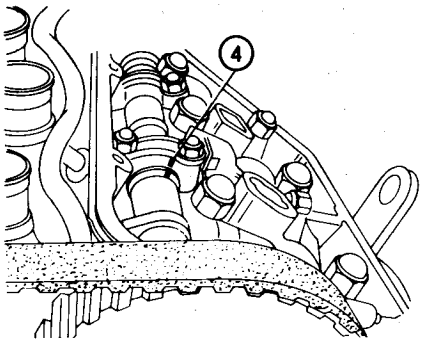
f. Keep the belt taught, press the pulley of the belt stretcher against the belt itself and lock the belt stretcher with the two screws.

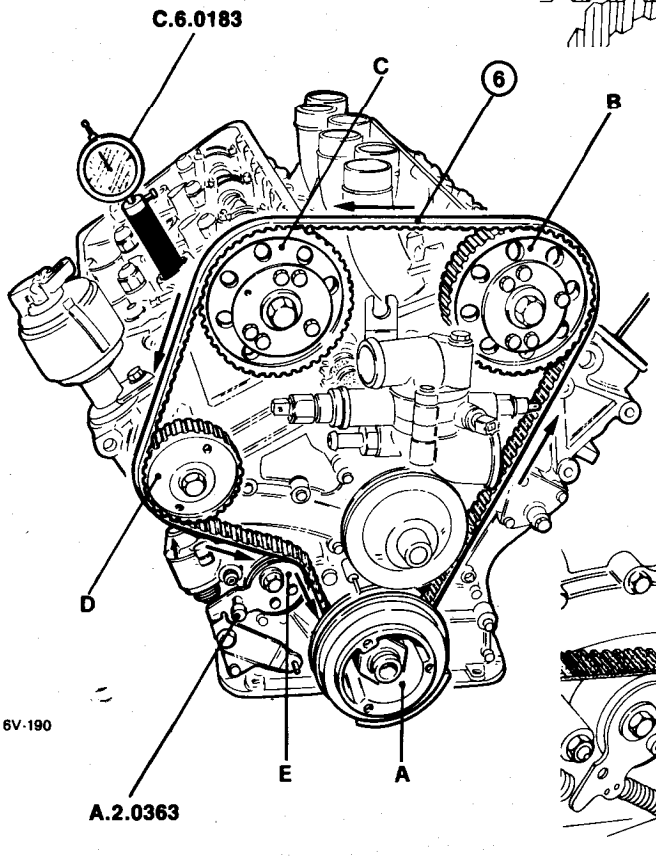
g. Raise the belt stretcher arm slightly, remove pin **A.2.0363** and release the arm.

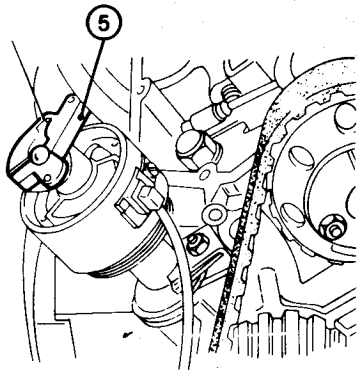
h. Bring the piston of cylinder no. 1 to T.D.C. once more and check that all the alignment and timing conditions listed in steps b. and c. are fulfilled.

i. If the notches on the camshafts and relative caps are not aligned proceed with the timing procedure as described in the WORKSHOP MANUAL **Alfa 90** or **Alfa 75** — ENGINE MAINTENANCE - in the paragraph entitled «Checking the Timing and Drive Belt Tension».

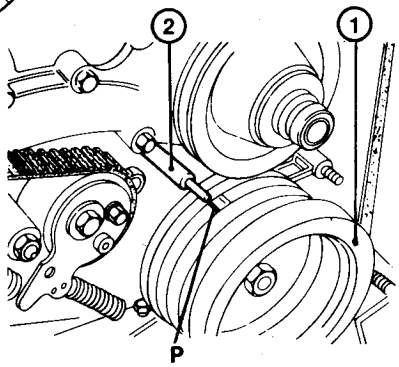






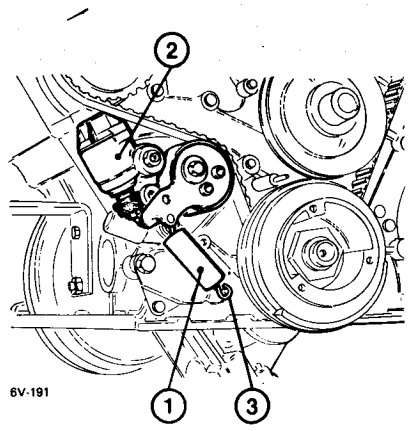


6V-190



1. Crankshaft pulley
2. Reference pin
3. Notches on right camshaft
4. Notches on left camshaft
5. Rotating brush
6. Camshaft toothed belt

j. Hook reaction spring (1) to hydraulic belt stretcher (2) and to the pin of plate (3).



1. Reaction spring
2. Hydraulic belt stretcher
3. Plate

CYLINDER HEAD COVERS

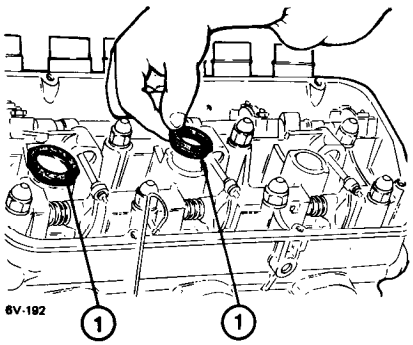
a. Mount gaskets (1) on the spark plug holes.

b. Fill the wells of the camshaft bearings after checking that they are perfectly dry. Use the prescribed engine oil.

Quantity of oil required for each well: 0.450 kg (1 lb)

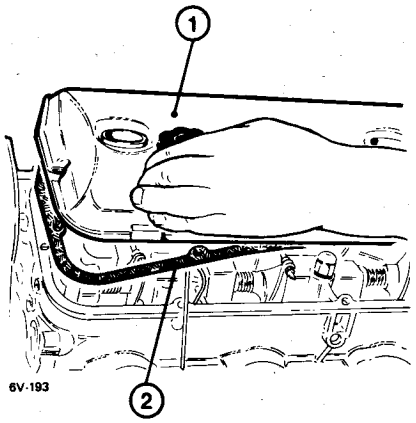
c. Clean the support face of the cylinder head covers to remove any fragments of gasket remaining.
Use butyl acetate or methylethylketone.

CAUTION:
Before mounting the head covers spread the prescribed cement (DIRING Heldtite) over the gaskets (only surfaces in contact with the head).



1. Spark plug hole gaskets

d. Place covers (1) on the cylinder heads complete with respective gaskets (2) and fix them with the respective screws and washers.



1. Cylinder head covers
2. Gaskets

OIL SUMP

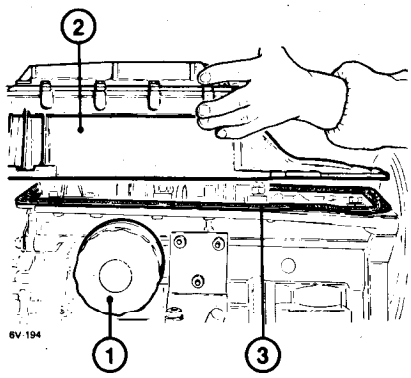
a. Rotate the engine assembly by unlocking the overhaul stand and fit the oil filter (1) using a suitable spanner.

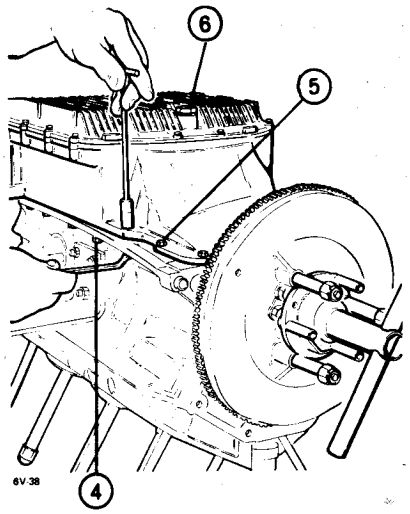
b. Apply the prescribed cement (DIRING Heldtite P/N 3522-00015) uniformly over the gasket.

c. Before applying the cement eliminate any trace of the old cement by de-greasing the surface.

d. Fit the oil sump (2) complete with gasket (3) and tighten with lag screws (4) and through screws (5).
Screw the oil discarge plug (6) to the oil sump.

e. Free the engine assembly from the overhaul stand and turn the assembly over again.

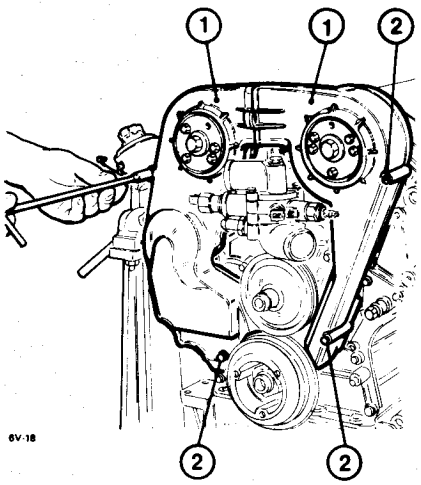




1. Oil filter
2. Oil sump
3. Gasket
4. Lag screws
5. Through screws
6. Oil discharge plug

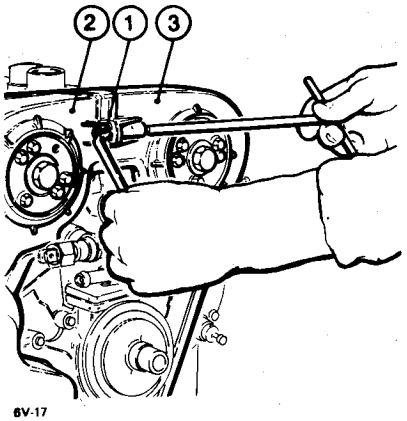
TIMING BELT GUARD

a. Place plastic guards (1) covering the timing belt in position and fix them to the cylinder block and cylinder heads with screws (2).



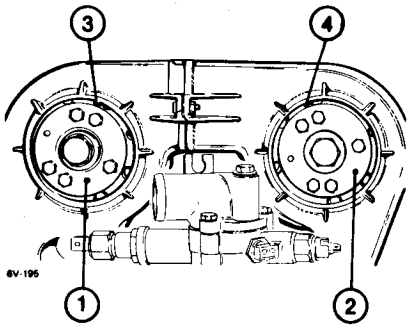
1. Guard
2. Retaining screws

b. Connect guards (2) and (3) with bolt (1).



1. Connecting bolt
2. Right guard
3. Left guard

CAUTION:
To check that the engine timing is correct, with engine installed, ensure that the notches on the hubs of toothed pulleys (1) and (2) are aligned with the respective tabs (3) and (4) on the belt guards.



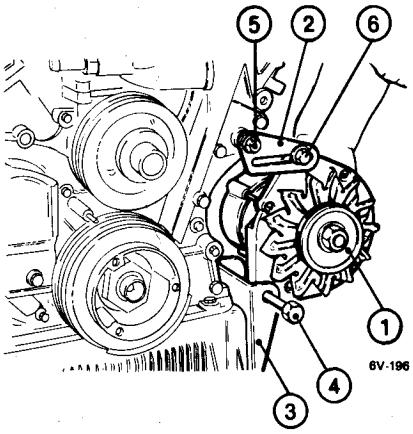
1. Right toothed pulley hub
2. Left toothed pulley hub
3. Right guard tab
4. Left guard tab

c. Reinstall the covers of the toothed pulley hubs on the guards.

GENERATOR

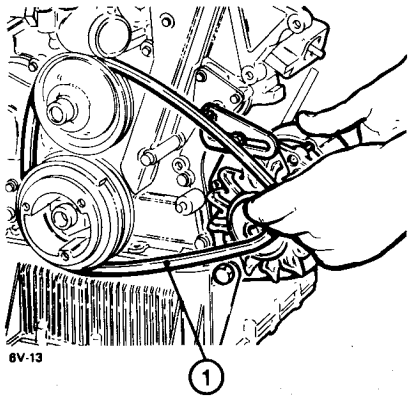
a. Fit generator (1) complete with regulation bracket (2) on support (3) of the oil sump, insert screw (4) and secure without tightening the respective nut.

b. Turn without tightening screw (5) and bolt (6).



1. Generator
2. Regulation bracket
3. Generator support
4. Screw and nut
5. Screw
6. Bolt

c. Move the generator toward the cylinder block and slide the V-belt (1) onto the crankshaft and water pump pulleys.



1. V-belt

d. Move generator (1) outwards, levering it as shown in the figure, until the correct tension of the V-belt (2) is obtained.

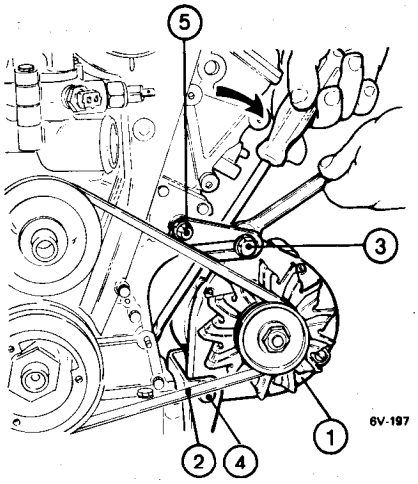
The tension of the belt is correct if, when subjected to a load of about

147 to 294 N
(15 to 30 kg; 33 to 66 lb)

at the centre point, the belt deflection is:

12 to 16 mm (0.47 to 0.63 in)

e. Secure the generator tightening in sequence: bolt (3), bolt (4) and screw (5).



1. Alternator
2. V-belt
3. Bolt
4. Bolt
5. Screw

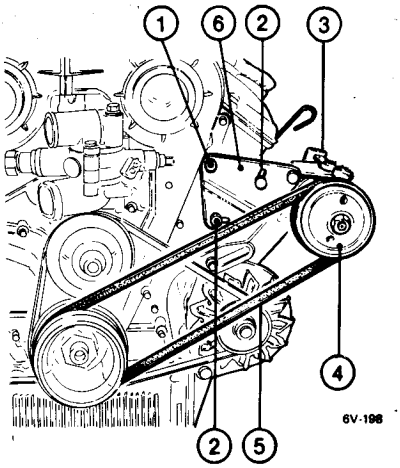
The tension is correct if, when subjected to a load of about

147 to 294 N
(15 to 30 kg; 33 to 66 lb)

at the centre point, the belt deflection is:

11 to 13 mm (0.43 to 0.51 in)

d. Tighten the adjustment screws (2), screw (1) fixing the support bracket (6) and the bolt fixing the rear bracket (3).



1. Retaining screw
2. Adjustment screws
3. Rear bracket
4. Power steering pump
5. V-belt
6. Support bracket

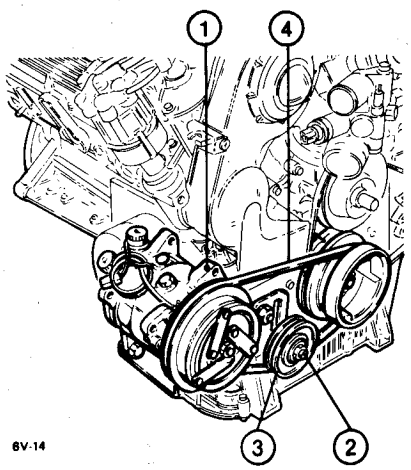
The tension is correct when a load of about

196 to 343 N
(20 to 35 kg; 44 to 77 lb)

at the centre of the belt causes a belt deflection of about

12 to 14 mm (0.47 to 0.55 in)

e. Fully tighten nut (2) securing the belt stretcher pulley (3).



1. Compressor
2. Nut
3. Belt stretcher pulley
4. V-belt

POWER STEERING PUMP

a. Place the pump, complete with support bracket, on the cylinder block without locking screw (1), adjustment screws (2) and the locking bolt of the rear bracket (3).
b. Move the power steering pump (4) towards the cylinder block and slide the V-belt (5) onto the crankshaft pulley and onto that of the power steering pump.
c. Move the power steering pump outwards until the correct tension of the belt is obtained.

CONDITIONER COMPRESSOR

a. Place the compressor of the air conditioner (1) complete with its support bracket, on the flange of the oil sump and secure it with the two screws.
b. Slacken nut (2) securing belt stretcher pulley (3).
c. Slide the V-belt (4) onto the crankshaft pulley, onto the belt stretcher pulley and onto the compressor pulley.
d. Lower the belt stretcher pulley (3) until the correct belt tension is obtained.

INSTALLATION OF FUEL SYSTEM COMPONENTS

Alfa 90 2.5 iniezione

Alfa 90 2.0 6V iniezione

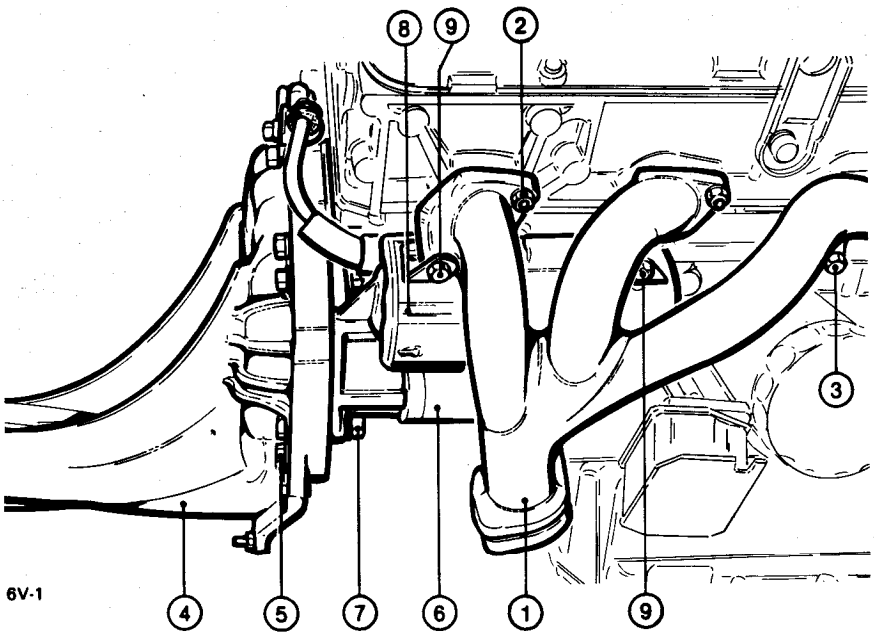
Alfa 75 6V iniezione

GTV 6 2.5

a. To reinstall the components of the fuel system proceed in the opposite order to that described for removal and follow these instructions.

b. **For Alfa 90, Alfa 75 and GTV 6 vehicles** with L-Jetronic fuel supply.
For further checks and/or final adjustments refer to GROUP 04 - FUEL SYSTEM - L-Jetronic Fuel Supply.

c. **For Alfa 90 - 2.0 vehicle** with CEM fuel supply system.
For further checks and/or final adjustments refer to GROUP 04 - FUEL SYSTEM - CEM Fuel Supply.



6V-1

1. Exhaust manifolds
2. Nuts and washers
3. Screws
4. Rear cover
5. Screws
6. Starting motor
7. Nuts and washers
8. Heat shield
9. Screws

FINAL OPERATIONS

a. Remove the tool previously fixed to the flywheel so that the flywheel rotates freely.

b. Fit right exhaust manifolds (1) with relative gaskets to the cylinder head and lock them with nuts and washers (2) and screws (3).

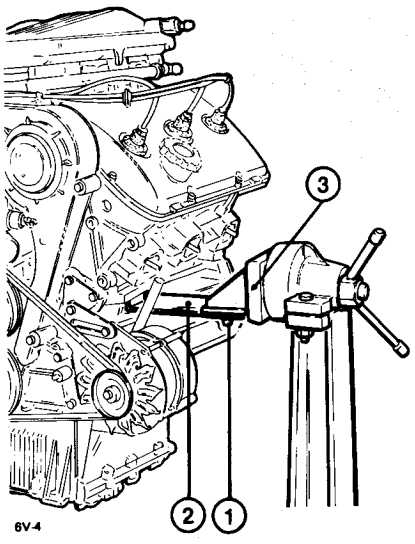
c. Proceed in the same way for the exhaust manifolds to be mounted from the left side of the engine.

d. Fit the rear cover (4) to the rear flange of the cylinder block and lock it with screws (5).

e. Position the spacer and starting motor (6) on the rear cover, screw on nuts with washers (7) and tighten.

f. Install the heat shield (8) protecting the starting motor and fix it with screws (9).

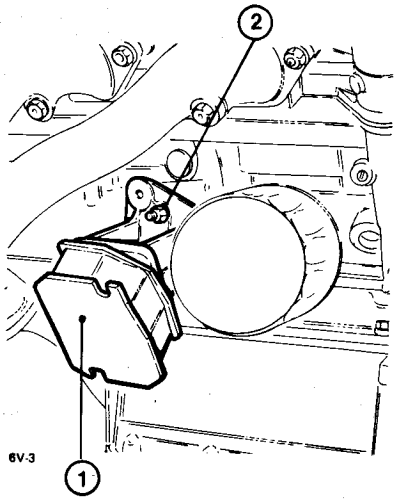
g. Hook a suitable hoist to the lifting brackets and, maintaining a slight tension, slacken bolts (1) connecting brackets (2) and (3) fixed to the overhaul stand.



6V-4

1. Bolts
2. Engine support brackets
3. Overhaul stand supports

h. Replace the brackets fixed to the cylinder block with right and left engine supports (1); lock nuts and washers (2) on the cylinder block studs.



1. Engine supports
2. Nuts and washers

i. Install the engine group in the vehicle following the procedure described in the paragraph «ENGINE REMOVAL AND INSTALLATION» for the vehicle in question.

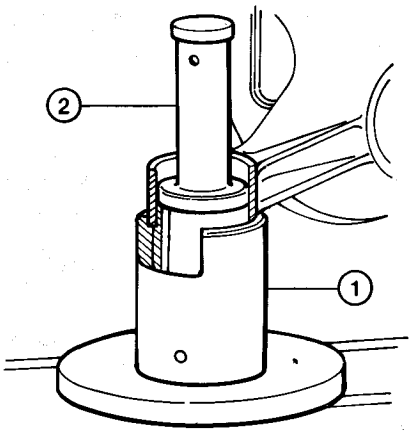
REPLACING THE REAR COVER SILENTBLOC

To replace the silentbloc of the rear cover proceed as follows:

a. Provide a suitable base (1) for the extraction of the Silentbloc and position it as illustrated in the figure.

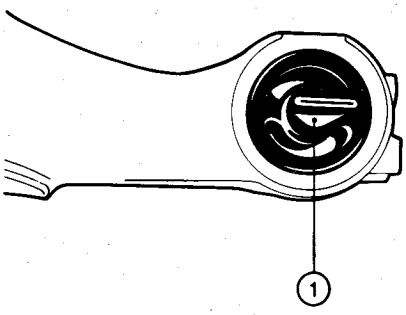
b. Using a suitable punch (2) extract the Silentbloc.

c. Fit the new Silentbloc using the same equipment.



1. Base
2. Punch

CAUTION:
The Silentbloc (1) must be placed parallel to the side of the bevel in the seat on the rear cover as shown in the figure.



1. Silentbloc

LUBRICATION SYSTEM

DESCRIPTION

The engine lubrication system is of the forced flow type with replaceable filter element.
The oil circulation is provided by a rotating lobe pump which is operated by the toothed timing belt through a toothed pulley and an auxiliary shaft.
The oil pump is installed in the lower part of the cylinder block.
The oil pressure is regulated by a maximum pressure valve in the pump housing.
The oil is filtered, with total passage, during suction by means of a screen fitted on the oil feed housing of the pump and then by a cartridge filter (total flow) on the delivery pipe.
The filter cartridge is provided with a by-pass valve permitting the normal circulation of the oil even if the cartridge is completely clogged.
The oil filler is located on the cover of the left cylinder head.
The right cylinder head cover is provided with fittings for the re-circulation of the oil vapour at idling and high speed.
Insufficient oil pressure is signalled on the instrument panel by means of an indicator light connected to a pressure sender on the main channel of the cylinder block.

CHECKING THE OIL PRESSURE

a. Start the engine and let the engine oil heat up to normal running temperature (90°C; 194°F). Then stop the engine.
b. Remove the oil pressure sender.
c. Apply a pressure gauge to the sender hole.
d. Start the engine and read the oil pressure indicated on the pressure gauge.

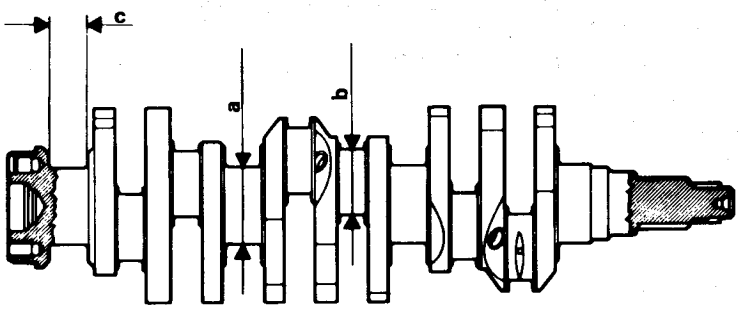
Engine speed (rpm)		Engine oil pressure
800 to 900	kPa	49.03 to 147.01
	bar	0.49 to 1.47
	kg/cm^2	0.5 to 1.5
	psi	7.1 to 21.3
5500	kPa	343.21 to 490.3
	bar	3.43 to 4.90
	kg/cm^2	3.5 to 5
	psi	49.8 to 71

e. Remove the pressure gauge and re-fit the sender.
f. If the oil pressure is not within the limits indicated in the table check the oil pump.

d. Release the bonnet, support it and reconnect bolts securing hinges on both sides of the vehicle.
e. **Alfa 90:** if previorisly disconnected, restore connections of engine compartment lamp ground and power supply cables, then connect battery terminals.
f. **Alfa 90:** refit windscreen wipers.

CRANKSHAFT, CRANKCASE, CONNECTING RODS, BEARINGS AND FLYWHEEL

Crankshaft

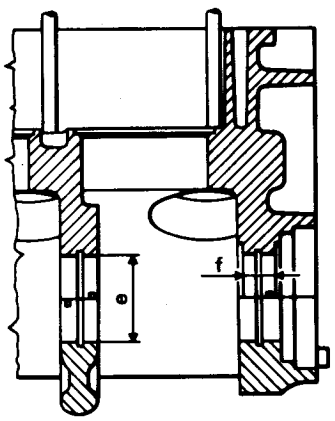


Unit: mm (in)

Check dimensions			Engine	
			2000	2500
			(062.10)	(016.46)
Main journal diameter	(a)	Red	59.961 to 59.971 (2.3607 to 2.3610) 59.971 to 59.981 (2.3610 to 2.3614) (1)	
		Blue	59.951 to 59.961 (2.3603 to 2.3607) 59.961 to 59.971 (2.3607 to 2.3610) (1)	
Crankpin	(b)	Red	51.990 to 52.000 (2.0468 to 2.0472)	
		Blue	51.980 to 51.990 (2.0465 to 2.0468)	
Lenght of rear main journal	(c)		31.300 to 31.335 (1.2323 to 1.2336)	
Maximum permissible ovality for main journals and crankpins			0.004 (0.0002)	
Maximum permissible taper for main journals and crankpins			0.01 (0.0004)	
Maximum variation in parallelism between main and crankpins			0.015 (0.0006)	
Maximum eccentricity between main journals			0.04 (0.002)	

(1) Oversize crankshaft

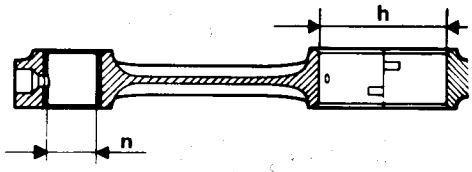
Crankcase



Unit: mm (in)

Check dimensions		Engine	
		2000	2500
		(062.10)	(016.46)
Main bearing support bore diameter	(e)	63.657 to 63.676 (2.5062 to 2.5069)	
Length of rear main bearing support shoulder	(f)	26.45 to 26.50 (1.041 to 1.043)	

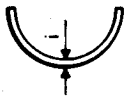
Connecting rod



Unit: mm (in)

Check dimensions		Engine	
		2000	2500
		(062.10)	(016.46)
Big end bore diameter	(h)	55.511 to 55.524 (2.1854 to 2.1860)	
Small end bush hole diameter	(n)	22.005 to 22.015 (0.8663 to 0.8667)	

Main bearings

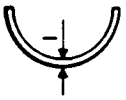


Unit: mm (in)

Check dimensions			Engine	
			2000	2500
			(062.10)	(016.46)
Thickness of main bearing	(i)	Red	1.829 to 1.835 (0.0720 to 0.0722)	
		Blue	1.835 to 1.841 (0.0722 to 0.0725)	
		Green	1.845 to 1.851 (0.0726 to 0.0729) (1)	

(1) Only to be used on standard **(non-oversized)** crankshafts if the radial mating clearance between pin and half-bearings is greater than **0.050 mm (0.0020 in)** (after checking the dimensions of each single bearing

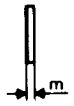
Big end bearings



Unit: mm (in)

Check dimensions			Engine	
			2000	2500
			(062.10)	(016.46)
Thickness of big end bearing	(l)	Red	1.737 to 1.745 (0.0684 to 0.0687)	
		Blue	1.741 to 1.749 (0.0685 to 0.0689)	

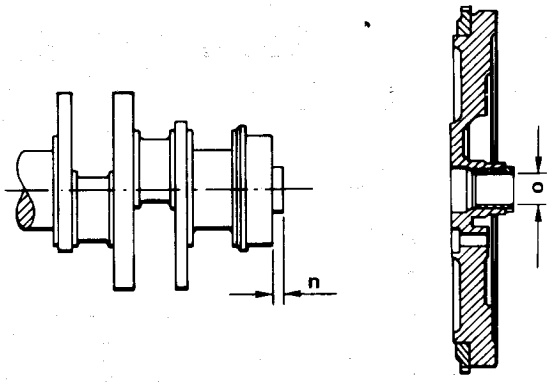
Thrust rings



Unit: mm (in)

Check dimensions		Engine	
		2000	2500
		(062.10)	(016.46)
Thickness of thrust ring	(m)	2.31 to 2.36 (0.091 to 0.093)	

Flywheel

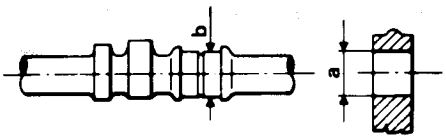


Unit: mm (in)

Check dimensions		Engine	
		2000	2500
		(062.10)	(016.46)
Protrusion of flywheel center bushing from rear surface of crankshaft	(n)	4 (0.2)	
I.D. of flywheel centre bushing (reamed)	(o)	26.010 to 26.023 (1.0240 to 1.0245)	

CAMSHAFT, ROCKERS, BOWLS, SPRINGS, VALVES AND CYLINDER HEAD

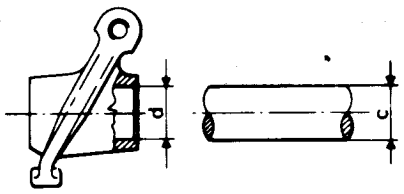
Camshaft



Unit: mm (in)

Check dimensions		Engine 2000 (062.10)	Engine 2500 (016.46)
Camshaft journal seat diameter	(a)	27.000 to 27.033 (1.0630 to 1.0643)	
Camshaft journal diameter	(b)	26.949 to 26.970 (1.0610 to 1.0618)	

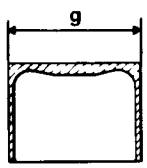
Rockers



Unit: mm (in)

Check dimensions		Engine 2000 (062.10)	Engine 2500 (016.46)
Rocker shaft diameter	(c)	15.988 to 16.000 (0.6.294 to 0.6299)	
Rocker shaft bore diameter	(d)	16.016 to 16.034 (0.6305 to 0.6313)	

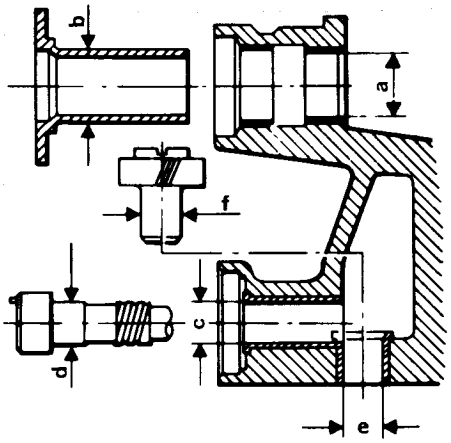
Bowls

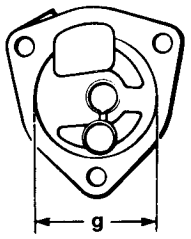


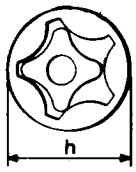
Unit: mm (in)

Check dimensions			Engine 2000 (062.10)	Engine 2500 (016.46)
Valve Bowl diameter	(g)	Intake	34.973 to 34.989 (1.3769 to 1.3775)	
		Exhaust	21.971 to 21.989 (0.8650 to 0.8657)	

CAMSHAFT DRIVE — OIL PUMP







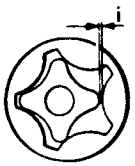
Unit: mm (in)

Check dimensions		Engine	
		2000	2500
		(062.10)	(016.46)
Diameter of camshaft pulley hub bush (reamed)	(a)	32.000 to 32.025 (1.2598 to 1.2608)	
Diameter of camshaft pulley hub	(b)	31.959 to 31.975 (1.2582 to 1.2589)	
Diameter of bush for distributor/oil pump drive pulley hub (reamed) (1)	(c)	19.000 to 19.021 (0.7480 to 0.7489)	
Diameter of distributor/oil pump drive gear hub (reamed) (1)	(d)	18.967 to 18.980 (0.7467 to 0.7472)	
Diameter of distributor/oil pump drive gear hub (reamed) (1)	(e)	19.000 to 19.021 (0.7480 to 0.7489)	
Diameter of distributor/oil pump drive gear hub (1)	(f)	18.967 to 18.980 (0.7467 to 0.7472)	
Diameter of outer rotor seat in oil pump housing	(g)	49.325 to 49.375 (1.9419 to 1.9439)	
Outside diameter of outer oil pump rotor	(h)	49.100 to 49.155 (1.9330 to 1.9352)	

(1) Only on RH cylinder head

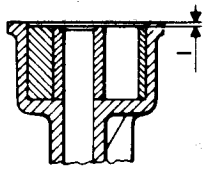
ASSEMBLY INTERFERENCE FITS AND CLEARANCES

Unit: mm (in)

Check dimensions		Engine	
		2000 (062.10)	2500 (016.46)
Piston clearance in cylinder		0.030 to 0.049 (0.0012 to 0.0019)	0.040 to 0.059 (0.0016 to 0.0023)
Compression rings end float in groove	Compression ring no. 1	0.035 to 0.067 (0.0014 to 0.0026)	
	Compression ring no. 2	0.035 to 0.067 (0.0014 to 0.0026)	
	Oil scraper ring	0.025 to 0.057 (0.0010 to 0.0022)	
Gudgeon pin clearance in piston		0.003 to 0.008 (0.0002 to 0.0003)	0.006 to 0.012 (0.0002 to 0.0004)
Gudgeon pin clearance in small end bush	Black	0.008 to 0.021 (0.0003 to 0.0008)	
	White	0.005 to 0.018 (0.0002 to 0.0007)	
Running clearance between main bearings and main journals	Red	0.016 to 0.057 (0.0006 to 0.0022) 0.006 to 0.047 (0.0002 to 0.0018) (3)	
	Blue	0.014 to 0.055 (0.0006 to 0.0022) 0.004 to 0.045 (0.0002 to 0.0018) (3)	
Running clearance between big end bearings and crankpins	Red	0.021 to 0.060 (0.0008 to 0.0024)	
	Blue	0.023 to 0.062 (0.0009 to 0.0024)	
Crankshaft end-float		0.080 to 0.265 (0.0031 to 0.0104)	
Big end-float		0.2 to 0.3 (0.008 to 0.012)	
Running clearance between journal and camshaft seat		0.030 to 0.084 (0.0012 to 0.0033)	
Camshaft end-float		0.065 to 0.200 (0.0026 to 0.0079)	
Running clearance between rockers and rocker shaft		0.016 to 0.046 (0.0006 to 0.0018)	
Running clearance between valve bowl and seat	Intake	0.011 to 0.052 (0.0004 to 0.0020)	
	Exhaust	0.011 to 0.050 (0.0004 to 0.0020)	
Valve stem running clearance in valve guide	Intake	0.013 to 0.043 (0.0005 to 0.0017)	
	Exhaust	0.040 to 0.080 (0.0016 to 0.0031)	
Interference fit of valve guide in cylinder head		0.015 to 0.054 (0.0006 to 0.0021)	
Interference fit of valve seat in cylinder head		0.040 to 0.100 (0.0016 to 0.0039)	
Clearance between inner and outer oil pump rotors (1) (i)		0.040 to 0.290 (0.0016 to 0.0114)	

(CONTINUED)

Unit: mm (in)

Check dimensions		Engine	
		2000	2500
		(062.10)	(016.46)
Rotor end-float in oil pump body (I)		0.025 to 0.075 (0.0010 to 0.0030)	
Running clearance between outer rotor and oil pump body		0.170 to 0.275 (0.0067 to 0.0108)	
Running clearance between bush and camshaft pulley hub		0.025 to 0.066 (0.0010 to 0.0026)	
Running clearance between bush and distributor/oil pump pulley hub (2)		0.020 to 0.054 (0.0008 to 0.0021)	
Running clearance between bush and distributor/oil pump drive gear hub (2)		0.020 to 0.054 (0.0008 to 0.0021)	

(1) Measure with the rotors in the position illustrated
(2) Only on RH cylinder head
(3) Only on oversize crankshaft

HEATING TEMPERATURES

Component	Temperatures
Cylinder head temperature for fitting valve seats	120°C (248°F)
Starter ring gear temperature for shrinking onto flywheel	120° to 140°C (248 to 284°F)

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Application	Type	Name	Q.ty [kg (lb)]
Gasket for rear main bearing cap	FLUID	UNION CARBIDE CHEMICALS CO Ucon Lubricant 50 HB-5100 MILLOIL: Lubricant for rubber sections Part No. 4500-17502	—
Crankshaft oil seals — Front: outer surface	OIL	AGIP SINT 2000 10W50 IP Sintiax 10W40 Part No. 3631-693/52	—
Lip	GREASE	ISECO Molykote BR2 Part No. 3671-69841	—
— Rear: outer surface Lip	OIL	IP Sintiax 10W40 Part No. 3631-693/52	—
Cylinder head support umps (1) Engine oil sump	OIL	AGIP Sint 2000 10W50 IP Sintiax 10W40 Part No. 361-639/52	0.450 (0.99) 6.0 (13.23)
The quantity indicated includes the following capacities: — Sump at max. level — Filter and corresponds to periodic replacements during maintenance — Defference between min and max level on dipstick			5.5 (12.13) 0.5 (1.10) 2.0 (4.41)
Camshaft oil seals Sealing ring for distributor/oil pump drive pulley shaft — Outer surface	OIL	AGIP Sint 2000 10W40 IP Sintiax 10W40 Part No. 3631-693/52	—
— Lip	GREASE	ISECO Molykote BR2 Part No. 3671-69841	—
Pin for hydraulic tensioner	GREASE	ISECO Molykote paste G Part No. 3671-69840	—

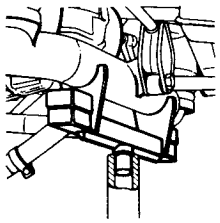
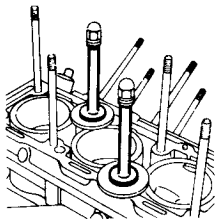
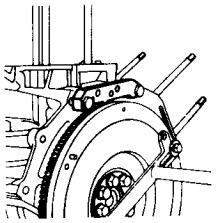
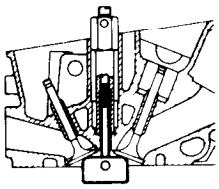
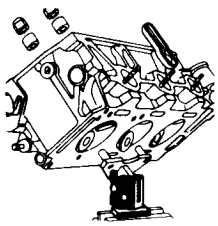
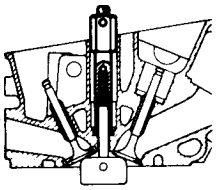
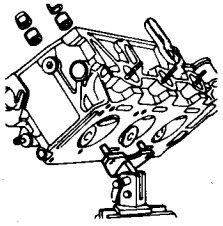
(1) Refill only if disassembled (cylinder head dry)

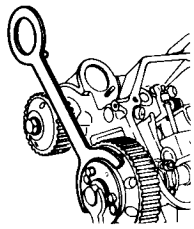
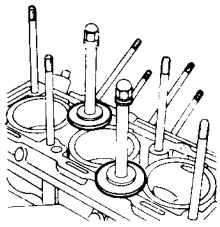
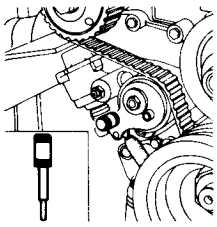
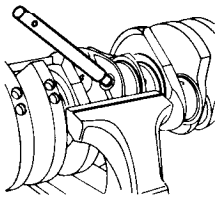
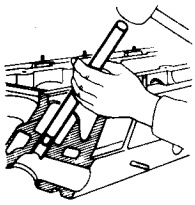
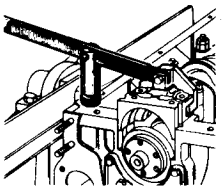
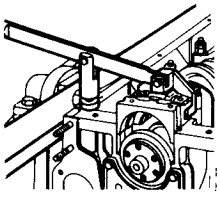
TROUBLE DIAGNOSIS AND CORRECTIONS

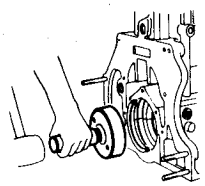
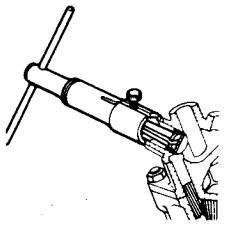
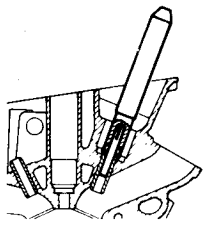
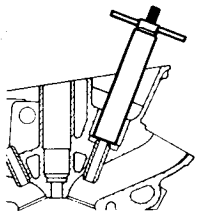
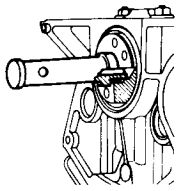
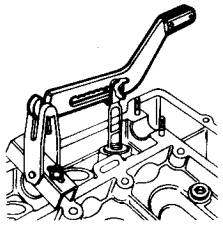
Condition	Probable cause	Corrective action
Noisy engine knocking of crankshaft	Excessive crankshaft running clearance on bearings and/or end play on semi-thrust rings	Replace bearings and/or semi-thrust rings
Piston and connecting rod knocking	• Fit incorrect	Adjust
	• Pin end float	Adjust
Camshaft and valves knocking (intake side)	• Excessive valve clearance	Adjust
	• Valve bowls incorrect fit	Replace
	• Valve spring broken	Replace
	• Camshafts worn	Replace
Water pump noisy	Rotor shaft excessive backlash	Replace water pump
Other mechanical troubles		
Valve seat seized	• Improper valve clearance	Replace and adjust
	• Valve spring broken	Replace
Cylinders and pistons excessively worn	• Fit surfaces defective	Restore correct installation
	• Poor oil quality	User proper oil
	• Air cleaner dirty or inefficient	Replace filter
Big end bearings faulty	• Shortage of engine oil	Check lubrication system
	• Poor engine oil quality	Use proper oil
	• Crank pins worn or out-of-round	Grind or replace
	• Big end bearing - crankpin coupling incorrect	Replace

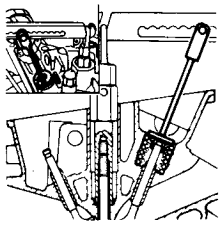
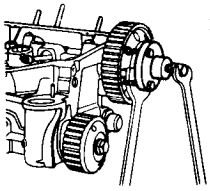
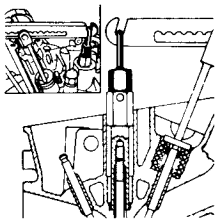
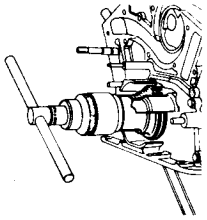
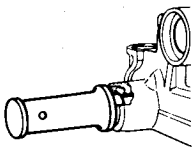
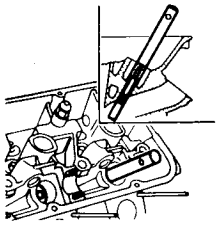
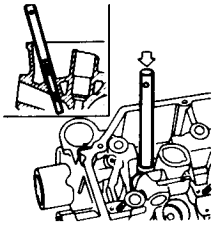
Condition	Probable cause	Corrective action
Main bearings faulty	• Shortage of engine oil	Check lubrication system
	• Poor engine oil quality	Use proper oil
	• Main journal worn or out-of-round	Grind or replace
	• Main bearings main journal coupling incorrect	Replace
Lubrication		
Oil leakage	• Oil sump drain plug loosened	Tighten
	• Oil leakage from sump gasket	Replace gasket
	• Oil leakage from camshaft seal-rings	Replace seal rings
	• Oil leakage from engine gaskets and seal rings	Replace seal rings and worn gaskets
	• Oil leakage from oil filter gasket	Tighten filter
Pressure decreases	• Pressure regulating valve dirby	Clean
	• Poor engine oil quality	Replace

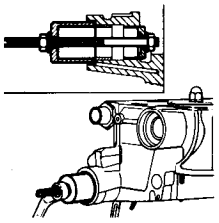
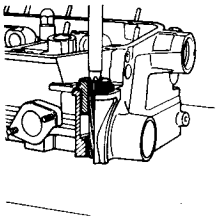
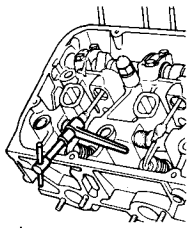
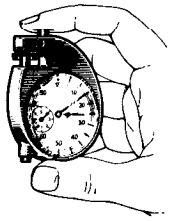
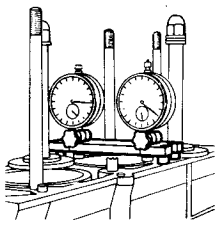
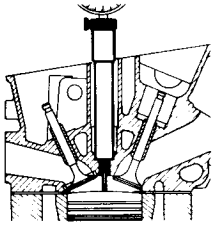
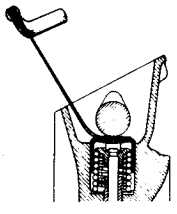
SPECIAL TOOLS

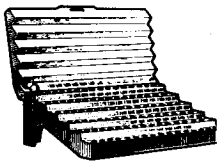
Reference number	Description		Page
A.2.0075	Vehicle lift support		01-88/5 01-88/13
A.2.0117	Cylinder liner retainer (4 pieces - to be used with tool A.2.0362)		01-88/32
A.2.0145	Flywheel retainer (for overhaul on bench)		01-88/33
A.2.0192	Valve support (to be used with tools A.2.0359 and A.3.0522)		01-88/41
A.2.0195	Cylinder head support (to be used with tool A.2.0360)		01-88/38
A.2.0359	Special nut for valve supporting tool (to be used with tools A.2.0192 and A.3.0522)		01-88/41
A.2.0360	Yoke for cylinder head support (to be used with tool A.2.0195)		01-88/38

Reference number	Description		Page
A.2.0361	Tool for rotating camshaft and auxiliary control pulleys		01-88/39
A.2.0362	Washer for stopping cylinder liners (4 pieces are necessary - to be used with tool A.2.0117)		01-88/32
A.2.0363	Stop pin for hydraulic belt stretcher device		01-88/27
A.2.0369	Tool for caulking crankshaft oil passage plugs		01-88/62
A.3.0134	Valve guide remover		01-88/50
A.3.0139/0001	Rear main bearing cap remover lever (to be used with tool A.3.0139/0002)		01-88/36
A.3.0139/0002	Rear main bearing cap puller (to be used with tool A.3.0139/0001)		01-88/36

Reference number	Description	Page
A.3.0178	Rear crankshaft seal installer 	01-88/73
A.3.0210	Extractor (expandable pincers) for crankshaft rear bearing 	01-88/35
A.3.0244	Valve guide seal driver 	01-88/55
A.3.0247	Valve guide seal remover 	01-88/43
A.3.0305	Flywheel bushing driver 	01-88/73
A.3.0324	Valve spring compressor lever (to be used with tools A.3.0520, A.2.0192, A.2.0359 and A.3.0522) 	01-88/41

Reference number	Description		Page
A.3.0520	Yoke for assembling and disassembling valve (to be used with tools A.2.0192, A.3.0324, A.3.0522 and A.2.0359)		**01-88/41**
A.3.0521	Puller of camshaft pulley		01-88/39
A.3.0522	Loop for assembly and disassembly of valves (to be used with tools A.3.0324, A.2.0359, A.2.0192 and A.3.0520)		**01-88/41**
A.3.0524	Driver of crankshaft front oil seal		**01-88/76**
A.3.0525	Driver of front oil seal on camshafts and auxiliary controls		**01-88/59**
A.3.0526	Intake valve guide driver		**01-88/51**
A.3.0527	Exhaust valve guide driver		**01-88/51**

Reference number	Description		Page
A.3.0528	Puller-driver of oil pump shaft, camshaft bushings and ignition distributor		**01-88/46**
A.4.0195	Guide for reaming of the bush seats of distributor control shaft [use with dia.: 19 mm (0.75 in) reamer]		**01-88/48**
A.5.0220	Combined 3 mm and 11 mm wrench for adjusting exhaust side tappets		**01-88/58**
C.1.0108	Dial gauge for checking valve caps		**01-88/58**
C.6.0148	Cylinder liner/piston standout gauge		**01-88/74**
C.6.0183	Tool for checking T.D.C.		**01-88/85**
C.6.0197	Feeler gauge for checking valve clearance		**01-88/58**

Reference number	Description	Page
R.9.0001	Container for valve clearance adjustment caps 	01-88/58

GROUP 01

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6 cylinders Alfa 75 2.5 6V iniezione

6 cylinders Alfa 90 2.0 6V iniezione

6 cylinders GTV 6 2.5

CONTENTS (Contd)

6 cylinders Alfa 90 2.5 iniezione

6 cylinders Alfa 75 2.5 6V iniezione

6 cylinders Alfa 90 2.0 6V iniezione

6 cylinders GTV 6 2.5

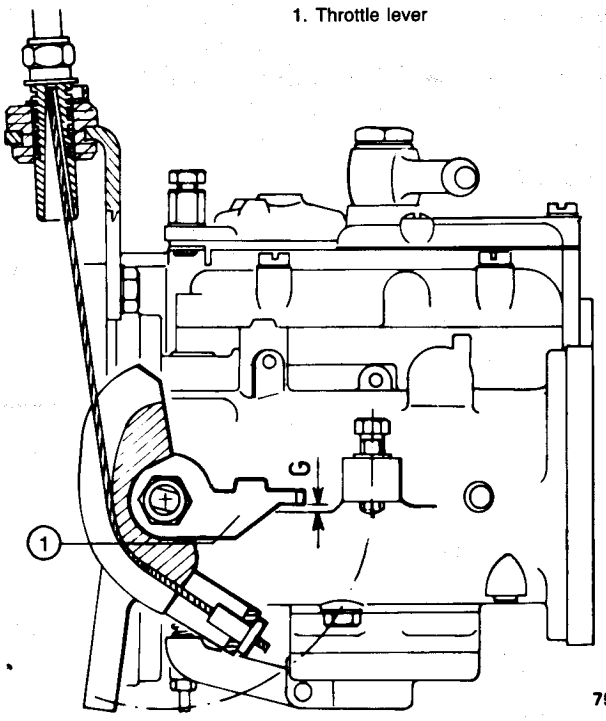
ACCELERATOR LINKAGE ADJUSTMENT

1.6 1.8 2.0

a. Check that flexible shafting does not bind in its conduit.
b. With the accelerator pedal fully depressed check distance «G» from throttle lever pivot (1) to stop.

Pivot pin to stop clearance:
Gap «G» = 1 to 2 mm
(0.04 to 0.08 in).

c. To adjust work from the car interior proceeding as follows:
— Back off locknut on accelerator pedal stop screw.
— Adjust stop screw to obtain the specified clearance.
— Tighten locknut.



1. Throttle lever

75-18

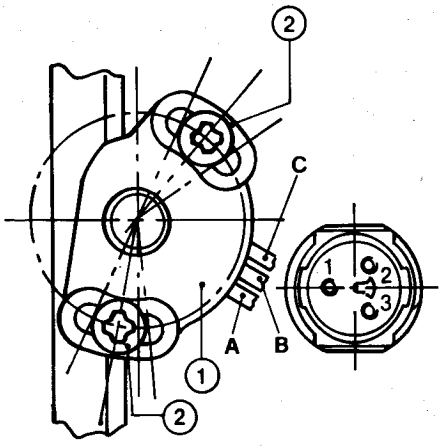
LOAD SENSOR ADJUSTMENT

Alfa 90 1.8 2.0

Alfa 75 1.6 1.8 2.0

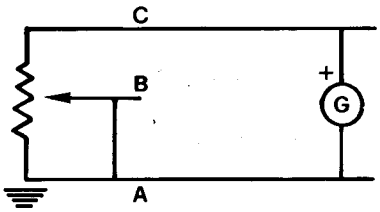
a. Supply load sensor (1) at 4.9 ± 0.05 V through terminals 1 and 3.
b. Keep throttle shaft on rear carburetter against stop in idle position.
c. Turn sensor (1) to obtain a 4 ± 0.1 V output measured across terminals 1 and 2.
d. Tighten load sensor capscrews (2) to the specified torque.

CAUTION:
When tightening capscrews (2) ensure that output voltage is not altered by possible load sensor rotation.



1. Load sensor
2. Capscrews

Connections diagram



Cables	Terminals	Colours
A	1	Orange
B	2	Green
C	3	Black

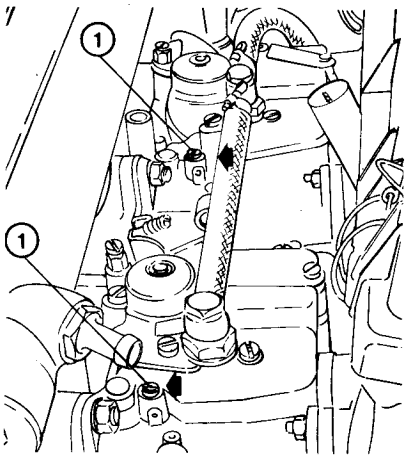
(T) : **Tightening torque**
Load sensor capscrews
11 to 18 Nm
(1.17 to 1.8 kgm
8.1 to 13.3 ft.lb)

ON VEHICLE ACCELERATING PUMP OUTPUT TEST

1.6 1.8 2.0

With the carburetter on vehicle, and preferably with the engine cold, check the accelerating pump as follows:

a. Remove four capscrews (1) and lift out the accelerating pump jets from the respective venturi.



1. Jet capscrews

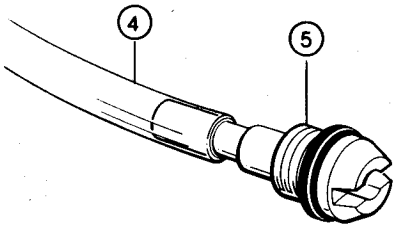
b. Screw four tester rods (1) into jet holes according to type of carburetter.

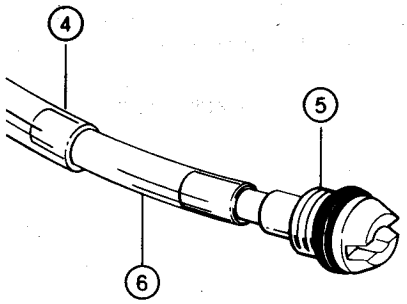
Horizontal carburetter tester:	
Weber:	**C.4.0124**
Solex:	**C.4.0123**
Dellorto:	**C.4.0125**

c. Install four supports (2) complete with respective graduated test tubes (3) on top of four rods (1).

d. Connect four plastic hoses (4) to the ends of the four rods (1).

e. Connect free ends of plastic hoses (4) to the respective accelerating pump jets (5), previously removed.

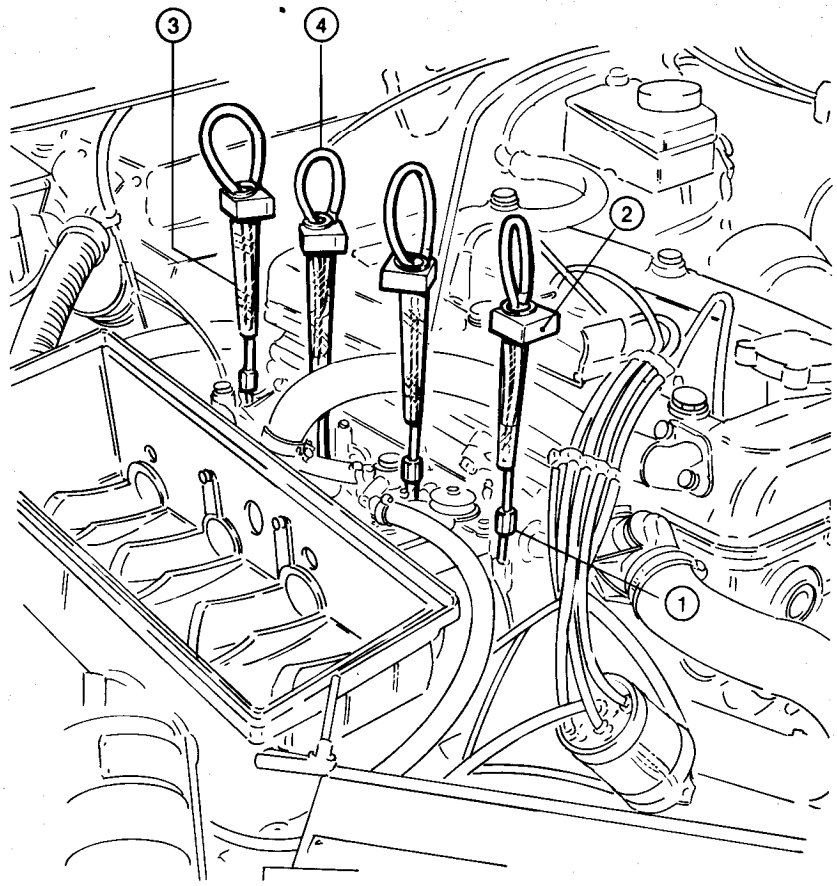




NOTE:
For SOLEX carburetters insert a reducing tube (6) between jet and plastic hose.

f. Place four pump jets (5) inside the respective graduated test tubes (3).

g. To ensure that the carburetter chamber is filled turn the engine over for a few seconds through the starter.



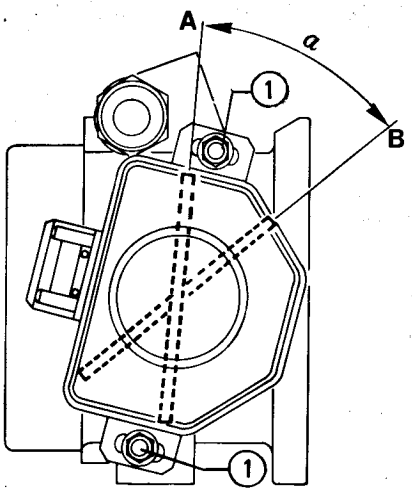
1. Rods
2. Supports
3. Graduated test tubes
4. Plastic hoses
5. Accelerating pump jets
6. Reducing tube

2. If not so, loosen screws (1) and rotate switch until contact (~ **0** Ω resistance) between terminals 2 and 18 is obtained, with throttle fully closed; retighten the screws.

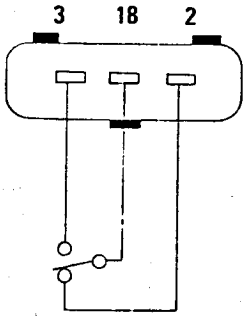
3. Rotate throttle by **72°** and verify that the full load contact closes, by measuring the following resistances with a tester on male connector:

- **0** Ω resistance (approx.) must be measured between terminals 3 and 18, when accelerator throttle is open by an angle of $\alpha \simeq$ **72°**.

4. If the values measured are not those prescribed check accelerator control, or replace switch.



1 Screws securing switch to throttle body
2 Idle r.p.m. terminal (corresponding to position A: throttle closed)



3 Peak r.p.m. terminal (corresponding to position B: throttle open)

EXHAUST SYSTEM

Refer to: 1.6 1.8 2.0 "Exhaust system".

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

SUPPLY AND INJECTION SYSTEM COMPONENTS

Component		ALFA ROMEO Std. Number	Type
Main fuel pump		116.46.04.021.00	BOSCH 0.580.464.020
Fuel pressure regulator		195.00.32.045.00	BOSCH 0.280.160.213
Electroinjectors	Pre-modification	116.85.11.300.00 (1)	BOSCH 0.280.150.128
	Post-modificaion	195.26.11.300.01 (2)	BOSCH 0.280.150.707
Air flow gauge	Pre-modification	195.00.11.013.00	BOSCH 0.281.202.045
	Post-modification	195.26.11.013.00	BOSCH 0.280.202.078
Control unit	Pre-modification	195.00.11.042.00	BOSCH 0.261.200.044
	Post-modification	161.10.11.042.00	BOSCH 0.261.200.063

(1) Black nozzle
(2) Yellow nozzle

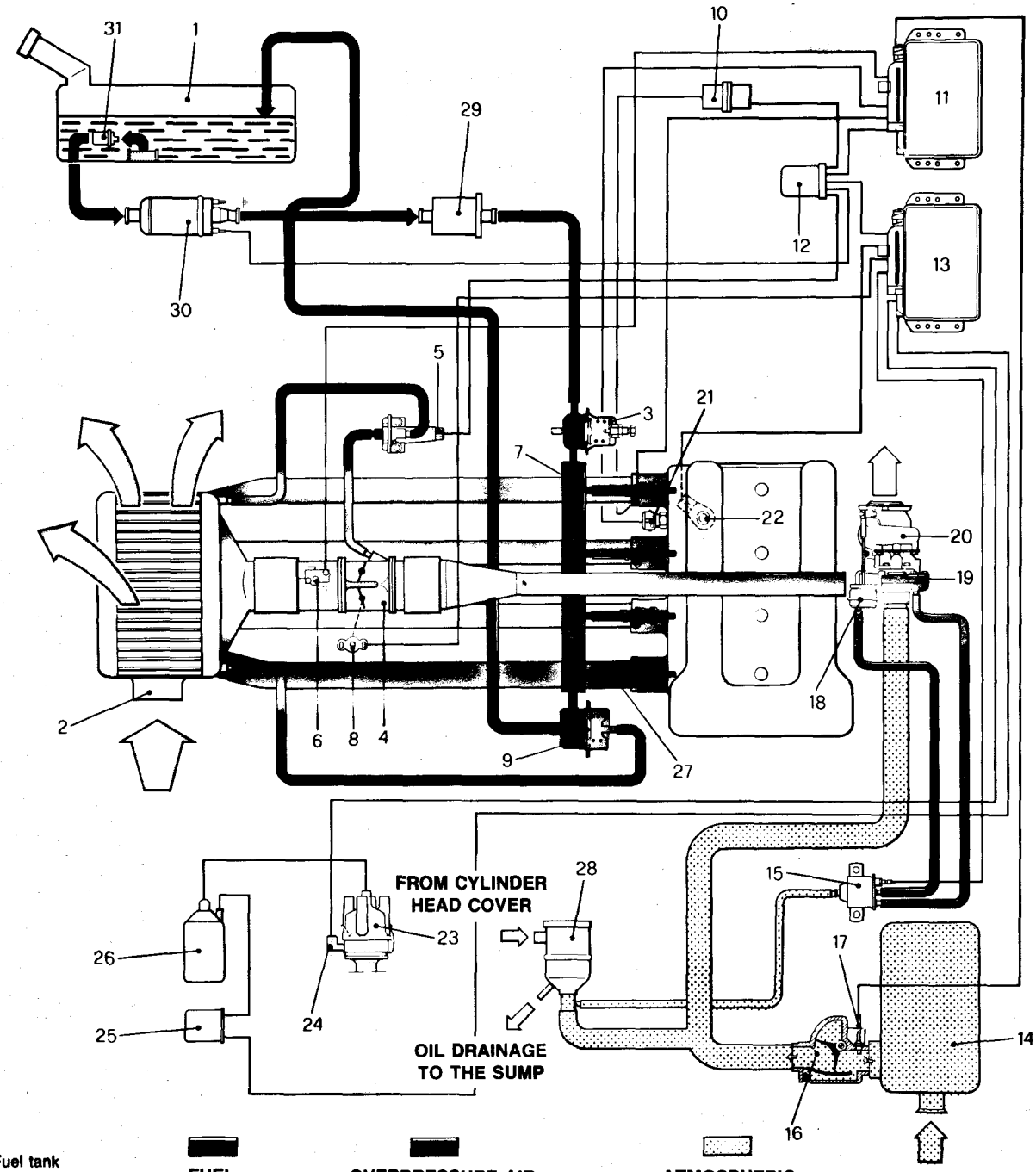
FUEL TANK

Data	Measurement unit	
	litres	(Imp.gall)
Overall capacity	49	10.78
Reserve	8	1.76

DESCRIPTION

Alfa 75 1.8 turbo

FUEL SUPPLY SYSTEM DIAGRAM (LE2 JETRONIC AND EZ 201K TURBO)



1. Fuel tank
2. Intercooler
3. Hammering damper
4. Throttle body
5. Auxiliary air valve
6. Minimum cutout switch
7. Fuel distributor manifold
8. Throttle position sending unit
9. Fuel pressure regulator
10. Electro-injector resistances
11. Fuel supply ECU
12. Speedometer relay
13. Ignition ECU
14. Air filter
15. Supercharging pressure regulation solenoid valve
16. Air flow gauge
17. Intake air temperature sensor
18. Waste-gate valve
19. Compressor
20. Turbine
21. Coolant temperature sensor
22. Knock sensor
23. Ignition distributor
24. HALL effect sensor
25. Power module
26. Ignition coil
27. Electroinjectors
28. Oil vapour sedimenter
29. Fuel filter
30. Main fuel pump
31. Auxiliary fuel pump

GENERAL DESCRIPTION

The fuel is supplied, by means of the two electric pumps (30) and (31) from tank (1) to the electroinjectors (27) through hammering damper (3).
Pressure regulator (9) regulates the fuel pressure in fuel distributor manifold (7) excluding to the intercooler (2) air intake pressure in order to maintain the difference between the fuel pressure and the pressure in the intake manifold constant.
When the feul pressure exceeds the maximum pressure set (3 bar; 43.50 psi) the pressure regulator causes the return of the excess fuel to the tank. The quantity of fuel injected therefore depends exclusively on injection time (which is determined by injection control unit (11) on the basis of the quantity of intake air), its temperature and the temperature of the engine.

The quantity of intake air and its temperature are measured, respectively, by air flow gauge (16) and sensor (17), while the temperature of the engine is measured by sensor (21).
From air flow gauge (16) the air enters compressor (19), where it is compressed, and then throttle body (4) composed of two throttles mechanically connected so that when the accelerator is depressed the second throttle begins opening after the first has rotated about 40°.
The degree of opening of the throttles is measured by throttle position sending unit (8) which sends the relative signal to ignition ECU (13).
A minimum cutout switch (6) is also fitted on the throttle body. When this switch is activated by the release of the accelerator pedal it sends a signal to injection control unit (11) which cuts off the supply of fuel to the electroinjectors.

From the throttle body the compressed intake air, before entering the cylinders, passes through intercooler (2) where it is cooled to reduce the possibility of spark knock is detected by knock sensor (22) which sends a signal to ignition ECU (13) which corrects the spark advance (towards a delay) until the knock is eliminated. If this correction of the advance does not solve the problem the ignition ECU, will, by means of supercharging pressure regulation solenoid valve (15) regulate waste-gate valve (18) in order to reduce the supercharging pressure.

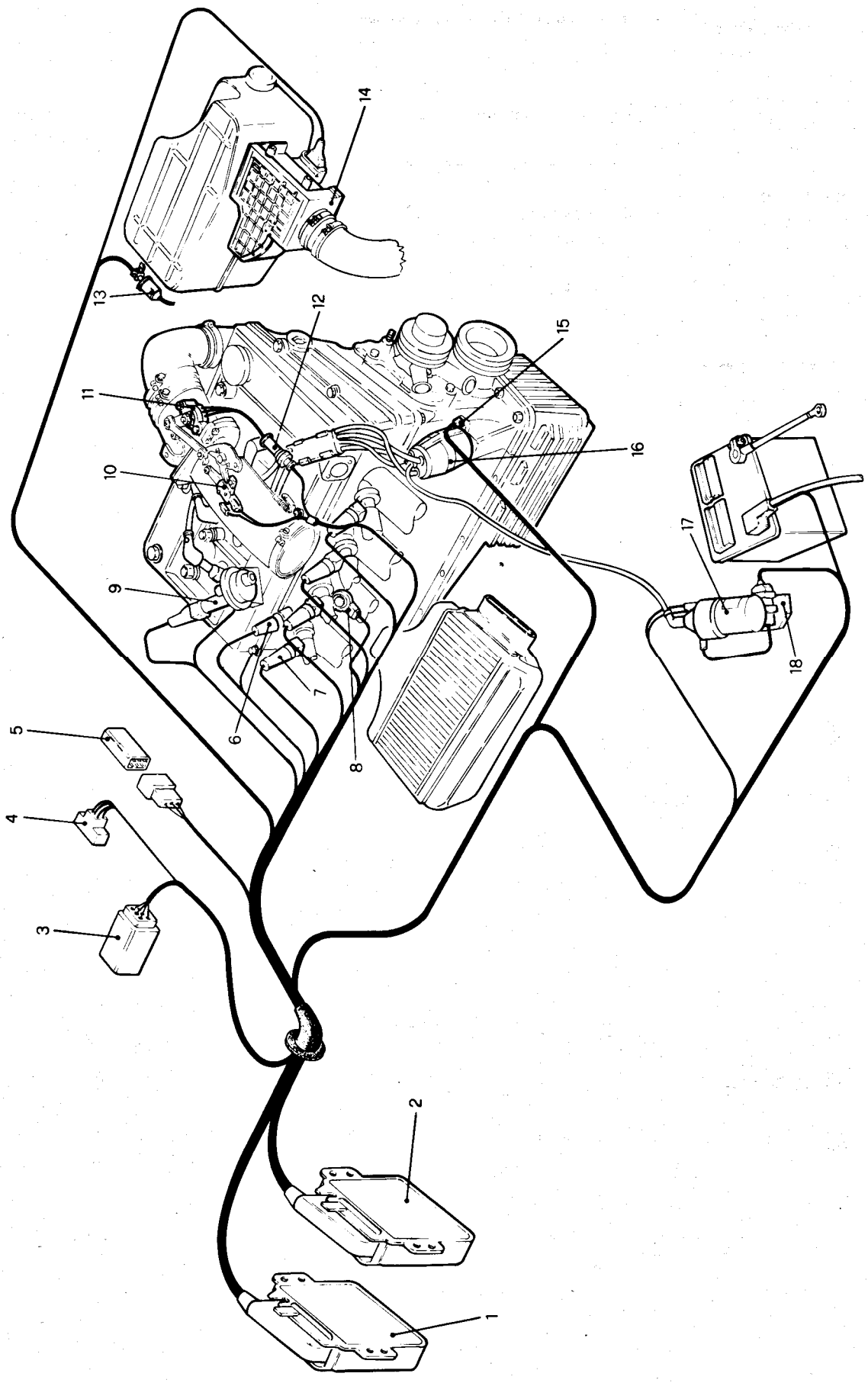
In normal operating conditions the supercharging pressure is regulated by the ignition ECU on the basis of the throttle opening signal from throttle position sending unit (8), the rpm signal provided by the Hall effect sensor (24) on the ignition distributor (23) and engine efficiency.

Engine starting is controlled by speedometer relay (12), injection control unit (11) and ignition ECU (13).
The speedometer relay, receiving the impulse from starting block, is energized and supplies the ECUs, petrol pump and electroinjectors.

After the completion of the starting operation the relay is maintained energized by the feed voltage from ignition coil (26) and by the engine rpm signal from the ignition control unit.
Should there fail to be one of these signals the speedometer relay will be de-energized, thus cutting off the power to the fuel supply system.

During running with a cold engine a greater quantity of mixture is supplied for combustion.
This increased quantity is determined by auxiliary air valve (5) located on bypass of the throttle body (4) which progressively closes with the increase of the engine temperature.

WIRING AND MAIN COMPONENTS OF COMBINED LE2 JETRONIC AND EZ 201K TURBO SYSTEM

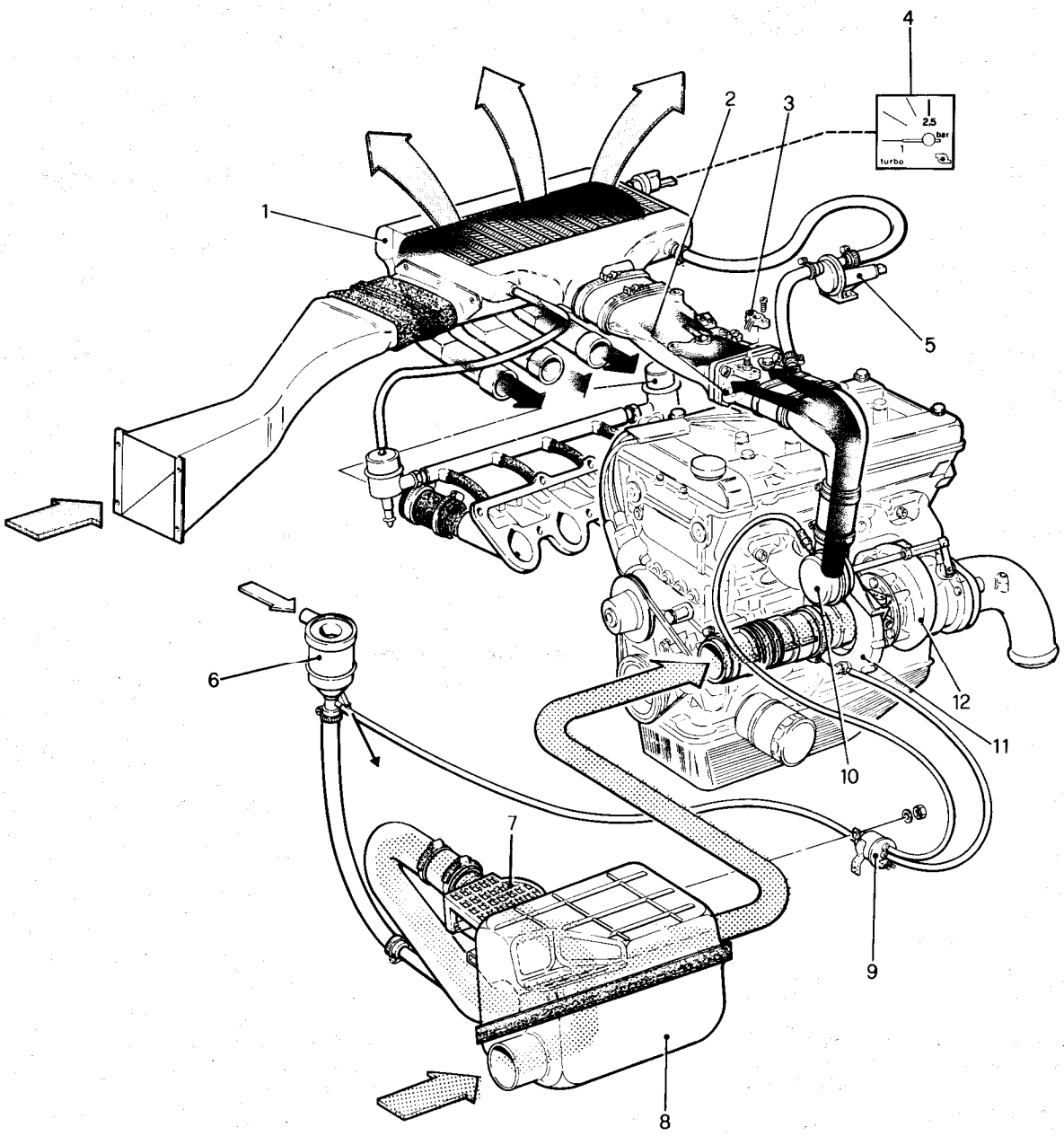


1. Injection control unit
2. Ignition ECU
3. Speedometer relay
4. Body wiring junction
5. Elektroinjector resistances
6. Coolant temperature sensor
7. Electroinjectors
8. Knock sensor
9. Auxiliary air valve
10. Fuel cut-off switch
11. Throttle position sending unit
12. Throttle position sending unit connector
13. Supercharging pressure regulator solenoid valve
14. Air flow gauge
15. Hall effect sensor
16. Ignition distributor
17. Ignition coil
18. Power module

IMPORTANT GENERAL INFORMATION

- **Never disconnect the battery while the engine is running or with the ignition on (position 2) as this would cause serious and irreversible damage to the electrical and electronic components of the ECUs of the system.**
- Never start the engine unless the battery terminals are fully tightened.
- Never start the engine by fast battery charging.
- Always disconnect the battery completely from the system before recharging.
- Never start the engine if electrical connections are incorrect or if components have been removed from their seats.
- Never ground the high/low voltage parts or break connections while the engine is running.
- Remove the electronic control units if vehicle is to be furnace-painted at temperatures higher than 80°C (176°F).
- In the event of installation or ancillary equipment, always disconnect the electronic control units in order to carry out the functional test of ancillary equipment itself with ECUs disconnected.
  Never connect other devices to ECU wiring.
- Before beginning work on the various components of the system check for disconnected connectors, loose clamps or cut or visibly obstructed tubes.
- Never connect the plug to the ECU leads (or disconnect it) with ignition on.
- Never ground the high/low voltage cables for test purposes.
- Verify that shielded wire connectors are correctly secured.
- Verify the efficiency of the ignition system and the spark plugs and check that the timing cover is not wet or cracked. Check that the cables between coil and distributor and between distributor and spark plugs are correctly connected and that the insulation reveals no trace of burning or abrasion.
- When replacing fuses disconnect the power supply (disconnect the contact).
  If a fuse burns repeatedly seek the cause of the short circuit.
  Never replace a fuse with a piece of cable.
  A burnt fuse must be replaced with another of the same amperage.

AIR SUPPLY AND SUPERCHARGING SYSTEM



1. Intercooler
2. Throttle body
3. Throttle position sending unit
4. Supercharging pressure gauge
5. Auxiliary air valve
6. Oil vapour sedimenter
7. Air flow gauge
8. Air filter
9. Supercharging pressure regulation solenoid valve
10. Waste-gate valve
11. Compressor
12. Turbine

OUTSIDE AIR

COMPRESSED AIR

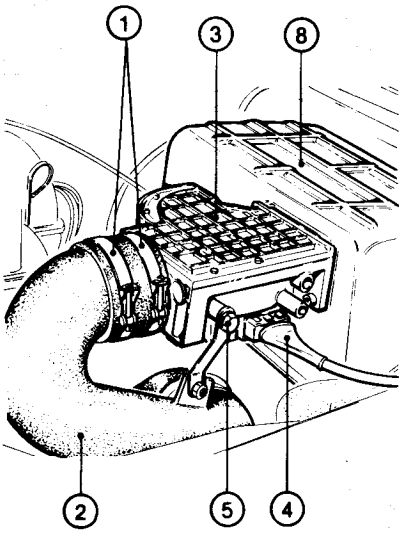
AIR FILTER

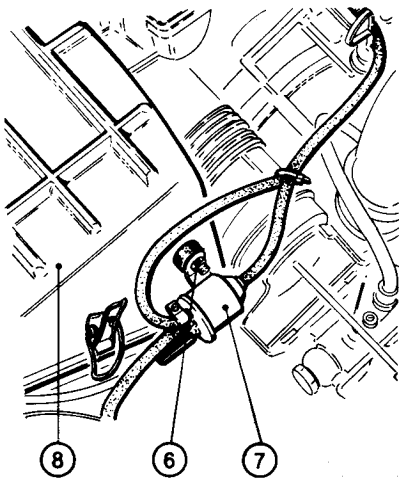
REMOVAL

Remove air filter unit operating as follows:

1. Slacken clamp (1) and detach sleeve (2) from air flow gauge (3).
2. Detach connector (4) from air flow gauge (3) and remove securing bolt (5).
3. Remove nuts (6) and solenoid valve (7) from air filter cover (8).
4. Release the five clips securing the cover and remove it together with air flow gauge.

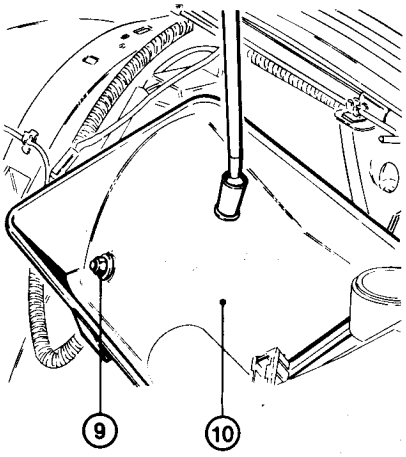
Remove filtering element.





1. Clamps
2. Air duct
3. Air flow gauge
4. Air flow gauge connector
5. Air duct securing bolt
6. Solenoid valve securing nuts
7. Supercharging pressure regulation solenoid valve
8. Air filter cover

5. If required, unscrew the screws (9) securing air filter container (10) to body and remove.



9. Container securing nuts
10. Air filter container

CHECKS AND INSPECTIONS

1. Thoroughly clean the filtering element by blowing low-pressure compressed air through it.

Replace the filtering element if required.

INSTALLATION

Install air filter by reversing the order of removal.

NOTE:
Position the filtering element on air filter container, complying with the mark indicating upper part (on filtering element upper side).

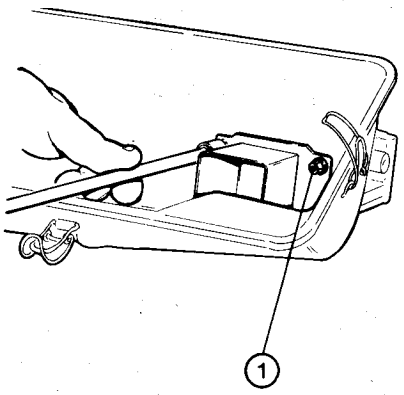
AIR FLOW GAUGE

ELECTRICAL TESTS

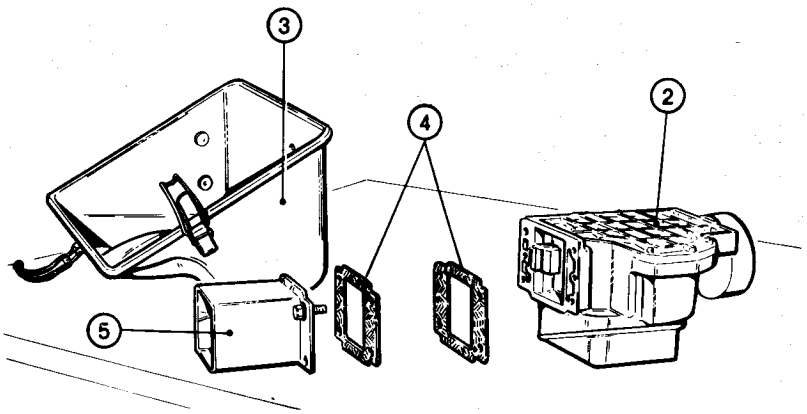
Refer to «Electrical Tests».

REMOVAL

1. Remove air filter unit (see «Air Filter — Removal»).
2. Unscrew the four screws (1) securing the air flow gauge (2) to the filter cover (3).
3. Remove air flow gauge (2) with relative gaskets (4) and inlet flange (5) from the filter cover.



1. Air flow gauge securing screws
2. Air flow gauge
3. Air filter cover
4. Gaskets
5. Inlet flange



CHECKS AND INSPECTIONS

Press the floating blade of the air flow gauge and check that it rotates without sticking, that there are no impediments up to stop position, and that there is no scoring or traces of dirt.
If necessary, clean the internal surfaces of the air flow gauge with a clean, dry cloth.

INSTALLATION

1. Install the air flow gauge by reversing the order of removal; replace gaskets.

CAUTION:
Pay particular attention to the tightening of the unions in order to prevent local air inlets.

2. After installation check (and adjust if necessary) the exhaust CO percentage (refer to: «Settings and Adjustments»).

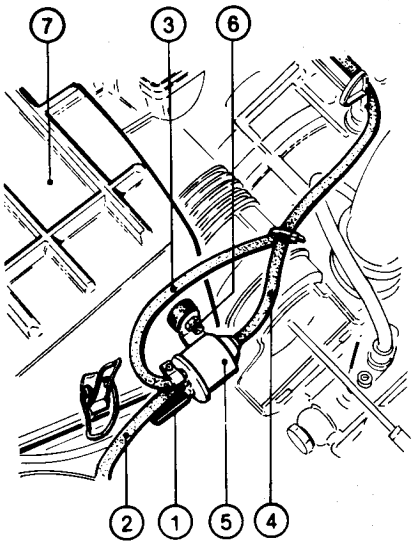
SUPERCHARGING PRESSURE REGULATION SOLENOID VALVE

ELECTRICAL TESTS

Refer to: «Electrical Tests».

REMOVAL

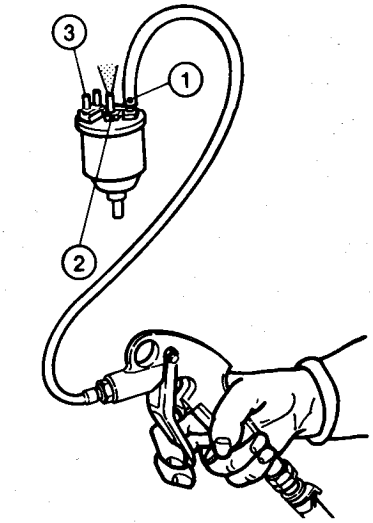
1. Disconnect connector (1).
2. Disconnect hoses (2), (3) and (4) from solenoid valve (5).
3. Remove nuts (6) and then the solenoid valve from air filter cover (7).

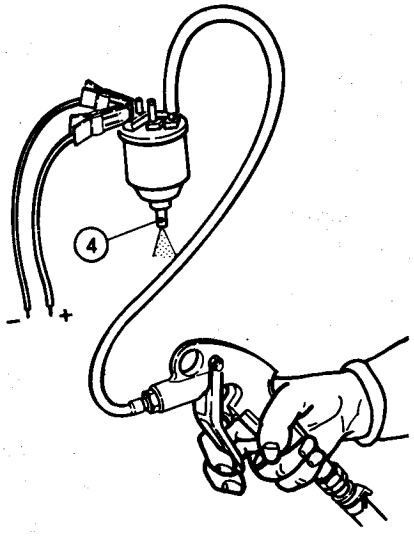


1. Solenoid valve connector
2. Pressure intake hose from compressor
3. Waste-gate valve connecting hose
4. Oil vapour sedimenter connecting hose
5. Solenoid valve
6. Solenoid valve retaining nuts
7. Air filter cover

CHECKS AND INSPECTIONS

1. Pass compressed air (the pressure must not be excessive so as not to damage the solenoid valve) through inlet (1) and check that the air comes out outlet (2).
2. Apply a voltage of 12 V to connector (3) and check that air comes out outlet (4).





1. Waste-gate valve connection
2. Pressure intake from compressor
3. Solenoid valve connector
4. Oil vapour sedimenter connection

INSTALLATION

Install the supercharging pressure regulation solenoid valve by reversing the order of removal.

CAUTION:
When re-connecting the hoses take care that they are in exactly the same positions (it is especially important that the waste-gate valve be connected to the blue connector of the solenoid valve).

AUXILIARY AIR VALVE

CHECKS AND INSPECTIONS

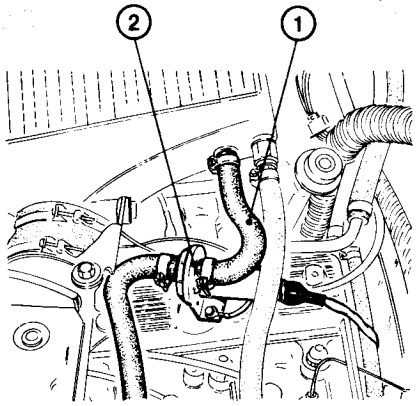
1. Valve opening check

a. Make sure that the engine is cold, then start it and throttle (several times) outlet hose (1) of valve (2).

b. Verify that engine r.p.m. decreases, and that this decrease is more and more gradual (at an ambient temperature of **20°C (68°F)** the r.p.m. decrease is no longer evident after about **3 min.**).

2. Valve closing check

With the engine at normal running temperature, throttle outlet hose (1) of the solenoid valve and verify that engine r.p.m. does not decrease.

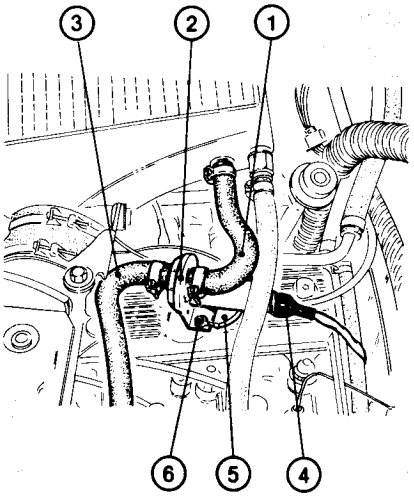


1. Air outlet hose
2. Auxiliary air valve

3. Check of valve electrical continuity
Refer to: «Electrical Tests».

REPLACEMENT

1. Detach connector (4).
2. Loosen clamps and detach hoses (1) and (3) from valve (2).
3. Unscrew screws (6) and remove valve (2) from timing system cover, disconnecting ground cables (5).



1. Air outlet hose
2. Auxiliary air valve
3. Air inlet hose
4. Valve connector
5. Ground cables
6. Screw securing valve to timing system cover

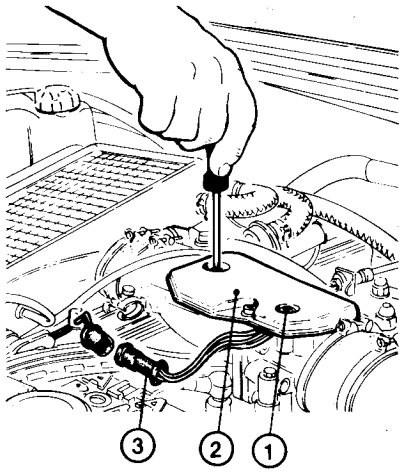
4. Position the new valve on the timing system cover and secure it together with the ground cables, using new washers. Reconnect both inlet and outlet air hoses and make the electrical connection.

THROTTLE BODY

REMOVAL

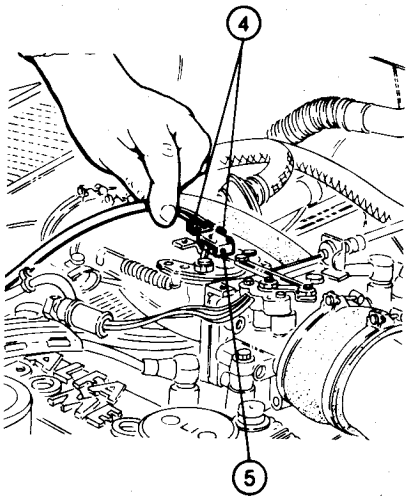
Remove throttle body assembly in the following manner:

1. Detach the negative terminal from the battery.
2. Unscrew retaining screws (1), remove protective cover (2) and detach connector (3).



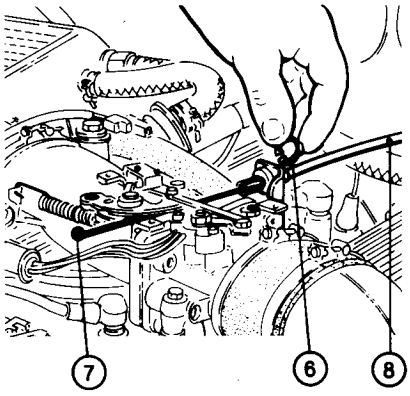
1. Cover retaining screws
2. Protective cover
3. Sending unit connector

3. Detach cables (4) from minimum cutout switch (5).



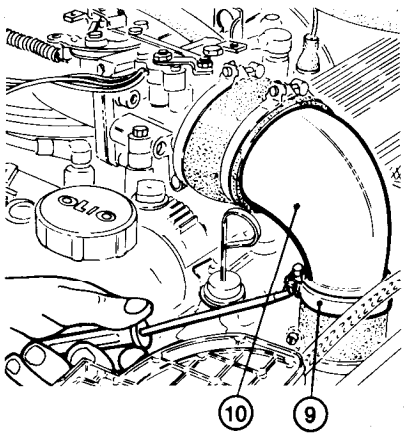
4. Minimum cutout switch feed cables
5. Minimum cutout switch

4. Remove stop ring (6), detach accelerator control cable (7) and release sheath (8) from bracket.



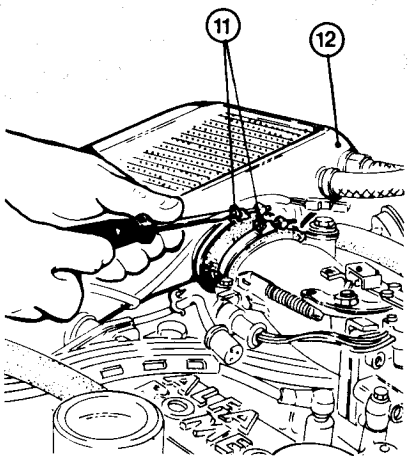
6. Stop ring
7. Accelerator cable
8. Sheath

5. Loosen clamp (9) securing throttle body union (10) to turbocharger.



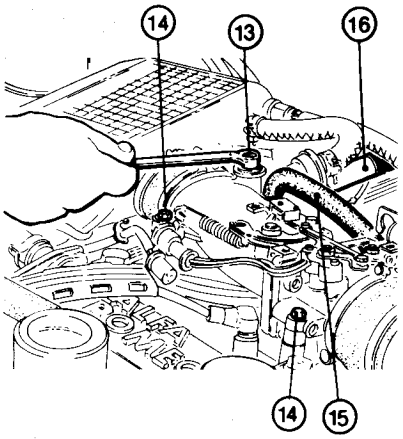
9. Clamp
10. Union

6. Loosen clamps (11) securing throttle body to intercooler (12).



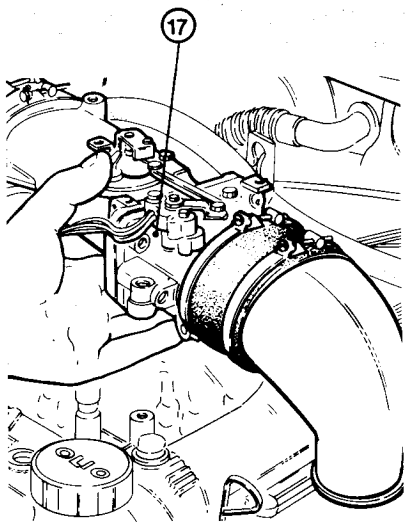
11. Clamps
12. Intercooler

7. Unscrew the screw (13) and screws (14) securing the throttle body to the timing system cover.
8. Detach hose (15) from auxiliary air valve (16).



13. Intercooler retaining screw
14. Throttle body retaining screws
15. Auxiliary air hose
16. Auxiliary air valve

9. Remove throttle body (17) complete.



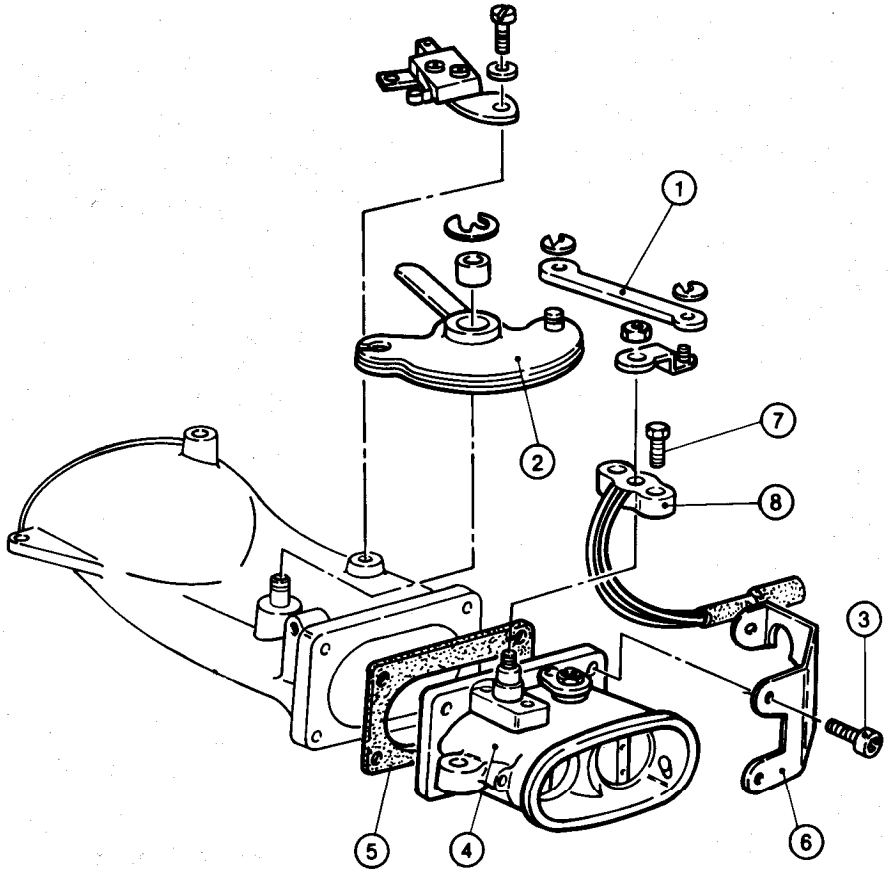
17. Throttle body

CAUTION:

- **Never tamper with throttle body adjustment.**
- **Plug the turbocharger delivery duct and intercooler intake to prevent the entrance of foreign matter.**

Throttle body disassembly

1. Remove throttle body complete with union connecting turbocharger and rubber sleeve connecting intercooler.
2. Detach tie rod (1) from cam (2).
3. Remove the four retaining screws (3), withdraw throttle body (4) and retrieve gasket (5) and bracket (6).
4. Unscrew the two screws (7) and remove throttle sending unit (8).



1. Tie rod
2. Cam
3. Throttle body retaining screws
4. Throttle body
5. Gasket
6. Accelerator cable support bracket
7. Sending unit retaining screws
8. Sending unit

Throttle body assembly

Carry out the installation by reversing the order of removal.
Check gasket (5), replacing it if necessary and adjust throttle position sending unit (8) (refer to: «Settings and Adjustments»).

INSTALLATION

Carry out installation of the complete throttle body by reversing the order of removal, taking care to restore the electrical connections correctly and fully tighten the clamps on the supercharging air intake.
If necessary, set the throttle body (refer to: «Settings and Adjustments»).

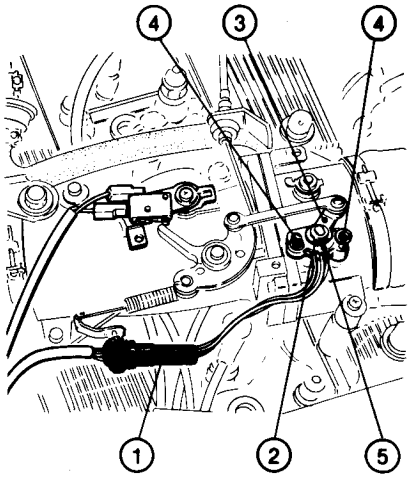
THROTTLE POSITION SENDING UNIT

ELECTRICAL TESTS

Refer to: «Electrical Tests».

REPLACEMENT

1. Detach connector (1).
2. Remove nut (2) and withdraw tie rod (3).
3. Remove screws (4) and throttle position sending unit (5).



1. Connector
2. Tie rod retaining nut
3. Tie rod
4. Sending unit retaining screws
5. Sending unit

4. Install a new throttle position sending unit and register it (refer to paragraph: «Settings and Adjustments»).

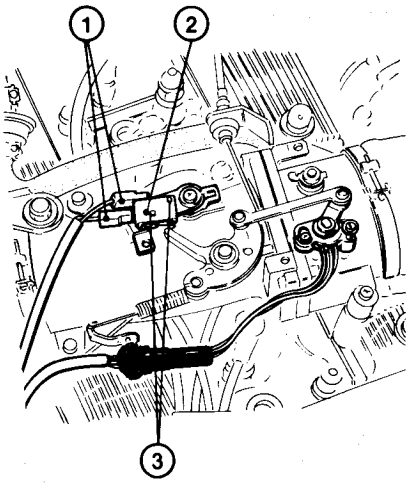
MINIMUM CUTOUT SWITCH

ELECTRICAL TESTS

Refer to: «Electrical Tests».

REPLACEMENT

1. Detach connectors (1) from switch (2).
2. Remove the two screws (3) and remove the switch



1. Switch connectors
2. Minimum cutout switch
3. Switch retaining screw

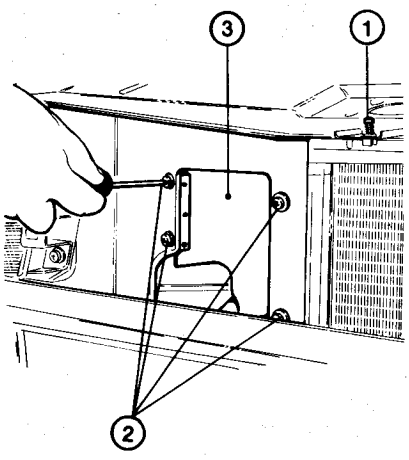
3. Fit a new switch and set it (refer to: «Setting and Adjustments»).

INTERCOOLER

REMOVAL

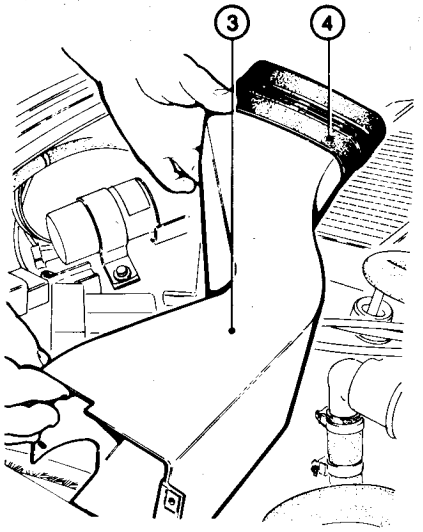
Remove the intercooler in the following way:

1. Disconnect battery terminals.
2. Unscrew screw (1) and remove front mask.
3. Unscrew and remove the four screws (2) securing air intake duct (3) to the body front panel and remove the bolt securing the duct to the battery bracket.



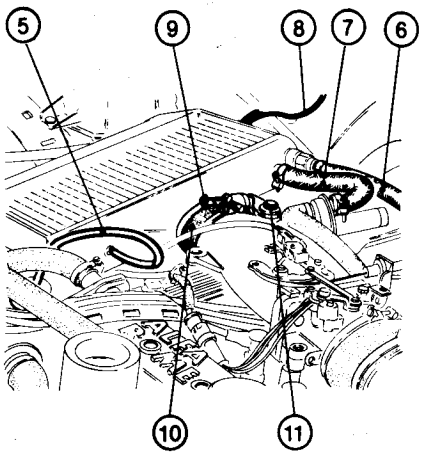
1. Mask retaining screw
2. Duct retaining screws
3. Air intake duct

4. Then remove duct (3) together with sleeve (4).



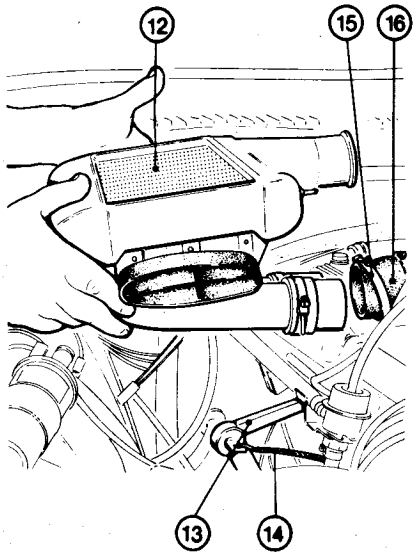
3. Air intake duct
4. Sleeve

5. Detach the following hoses and wires from the intercooler:
   - Pressure intake hose (5).
   - Servobrake vacuum line (6).
   - Auxiliary air hose (7).
   - Supercharging pressure sender cable (8).
6. Loosen clamp (9) securing supercharging air intake rubber sleeve (10).
7. Remove screw (11) securing reinforcing bracket.



5. Pressure regulator pressure intake
6. Servobrake vacuum intake hose
7. Auxiliary air valve
8. Supercharging pressure sender cable
9. Clamp
10. Sleeve
11. Screw

8. Unscrew the two securing screws and disconnect intercooler (12) from support bracket (13), paying attention to ground cable (14) secured to one of the two screws.
9. Loosen clamps (15) securing intercooler to rubber connectors (16) of the air intake manifold and remove intercooler (12).



12. Intercooler
13. Intercooler support bracket
14. Ground cable
15. Clamp
16. Rubber connector

CHECKS AND INSPECTIONS

1. Clean the intercooler thoroughly by blowing compressed air over the finning.

INSTALLATION

Proceed with the installation of the intercooler by reversing the order of removal, paying particular attention to the following:

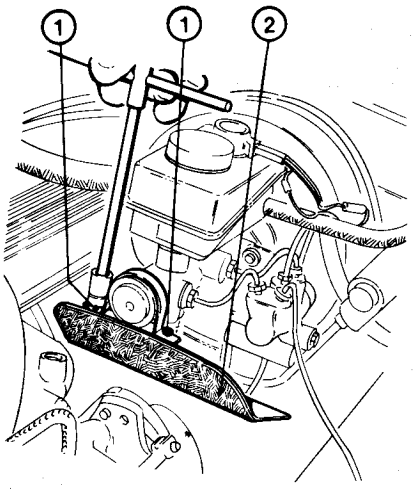
- Clamps (15) securing rubber connectors (16) to intercooler must be tightened to prevent the leakage of supercharged air.
- Re-connect the ground cable (14) to one of the screws securing the intercooler to bracket (13).

TURBOCHARGER

REMOVAL

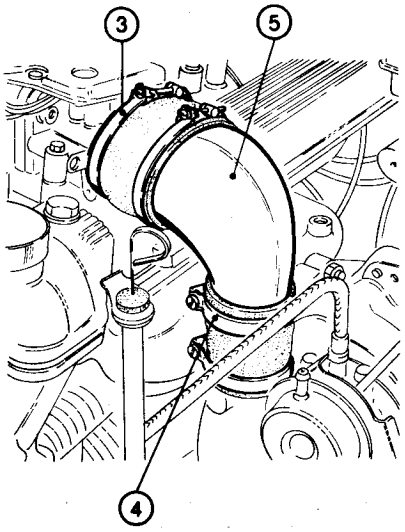
Proceed with the removal of the turbocharger as follows:

1. Remove the air filter together with the air flow gauge (with relative air intake ducts and filter casing) (see paragraph «Air filter — Removal»).
2. Unscrew the three bolts (1) and remove thermal shield (2).



1. Thermal shield securing screws
2. Thermal shield

3. Loosen clamps (3) and (4) and remove throttle body union (5).

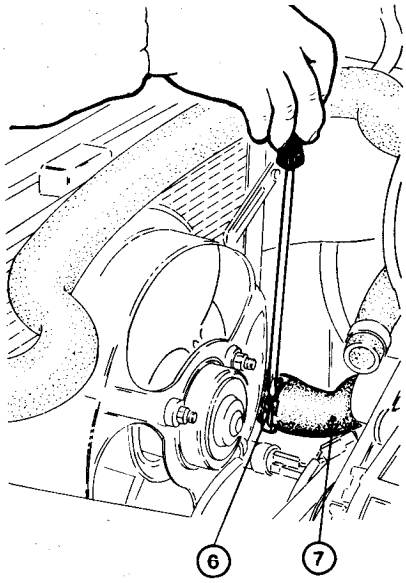


3. Clamp
4. Clamp
5. Throttle body union

CAUTION:
Plug turbocompressor openings to prevent the entry of foreign matter which could damage the rotors.

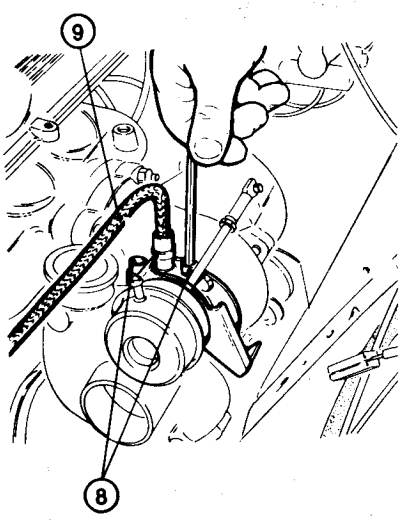
4. Loosen clamp (6) and disconnect sleeve (7) from the radiator.

NOTE:
Place a suitable container under the vehicle to collect coolant.



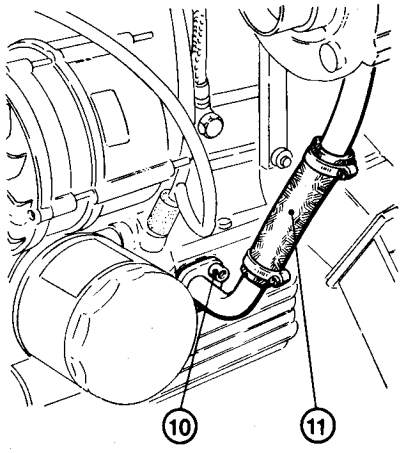
6. Clamp
7. Radiator water drain sleeve

5. Remove the two screws (8) and disconnect hose (9) from the connector on the turbocharger. Remove the gasket.



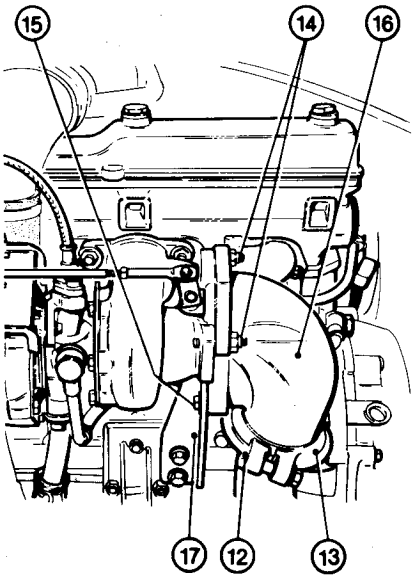
8. Screws
9. Turbocharger oil delivery hose

6. Remove the two screws (10) and disconnect hose (11) from the union on the oil sump.
Remove the gasket.



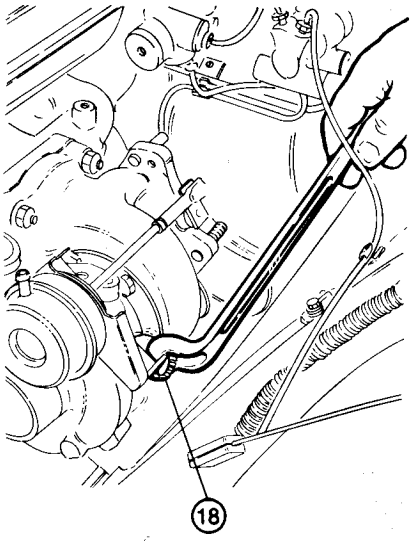
10. Screws
11. Oil-to-sump return hose

7. Unscrew the two bolts (12) and remove collar (13).
8. Unscrew the two nuts (14) and the two bolts (15) securing the turbocharger exhaust gas union (16) to lower support bracket (17).
Remove union (16) and the interposed gasket.



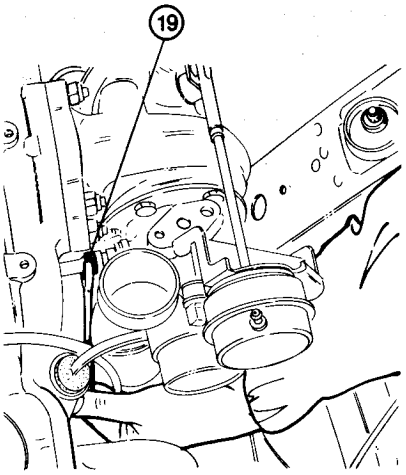
12. Bolts
13. Exhaust pipe retaining collar
14. Nuts
15. Bolts
16. Turbocharger exhaust gas union
17. Union support bracket

9. Remove bolt (18) and disconnect coolant-to-turbocharger delivery hose.



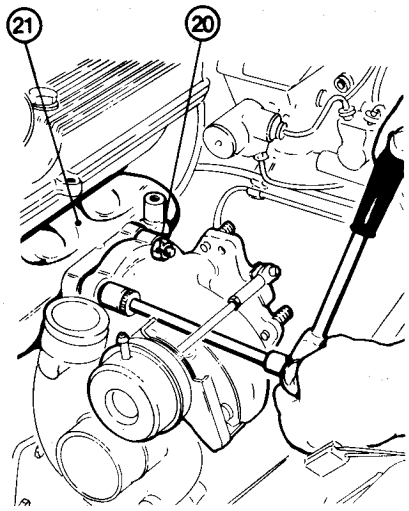
18. Coolant delivery hose securing bolt

10. Loosen nut (19) and disconnect coolant return hose from turbocharger.



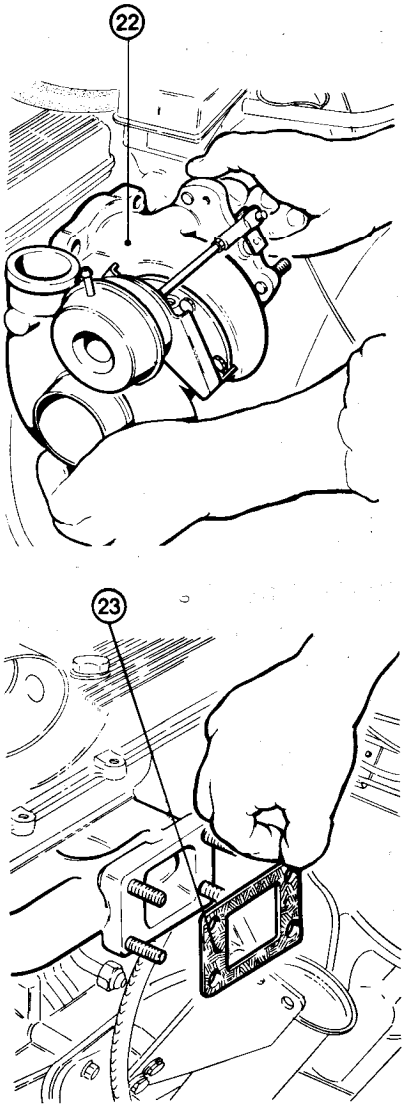
19. Nut retaining coolant return hose

11. Unscrew the four nuts (20) retaining the turbocharger to the exhaust manifold (21).



20. Turbocharger retaining nuts
21. Exhaust manifold

12. Withdraw the turbocharger group (22) from the exhaust manifold studs and retrieve the interposed gasket (23).



22. Turbocharger
23. Gasket

CHECKS AND INSPECTIONS

1. Check all the hoses and check that there are no cracks in the manifold and that the mating surfaces of the flanges are sound.
2. Check that the turbocharger shaft turns freely and that the play of the rotor is not excessive and that they do not touch the outer casing.
3. Visually check the integrity of the blading of the turbine and compressor.

INSTALLATION

Proceed with the installation of the turbocharger by reversing the order of removal, paying particular attention to the following:

- Replace the gaskets mentioned in «Removal».
- Replace the self-locking nuts securing the turbine to the exhaust manifold, the turbine to the exhaust union, the bolts securing the turbine to the support and the bolts securing the exhaust union to the exhaust pipe.
- Tighten the following to the prescribed torques:

— Nuts retaining turbocharger to exhaust manifold (1).
— Nuts retaining turbo exhaust union to turbine (2).

(T) : **Tightening torque**
38 to 47 N·m
(3.9 to 4.8 kg·m
28.02 to 34.66 ft·lb)

— Bolts securing turbocharger exhaust union to exhaust pipe (3).
— Nuts securing exhaust manifold to cylinder head (4).
— Bolts securing turbocharger lower support to engine block (5).
— Bolts securing turbocharger to lower support (6).
— Bolts securing oil delivery hose to turbocharger (7).

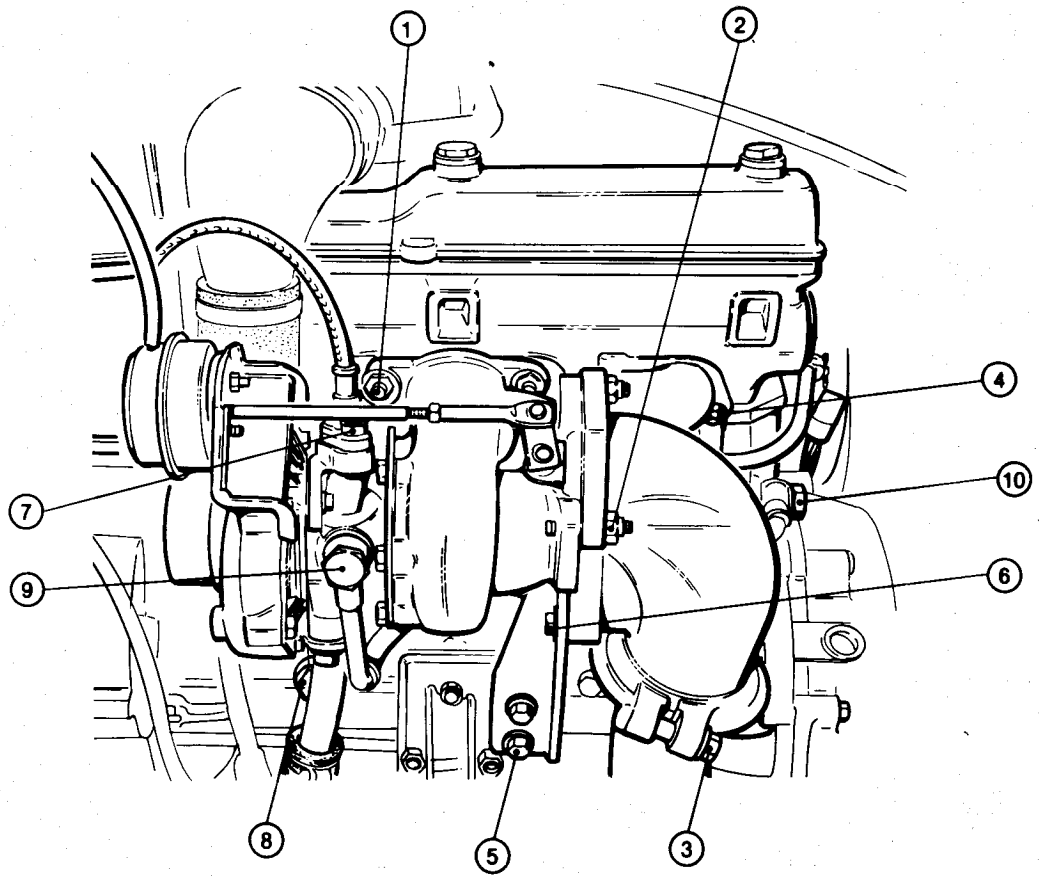
(T) : **Tightening torque**
19 to 24 N·m
(1.9 to 2.4 kg·m
14.01 to 17.70 ft·lb)

— Bolt securing oil delivery hose to engine block (8).

(T) : **Tightening torque**
40 to 50 N·m
(4.0 to 5.0 kg·m
29.50 to 36.90 ft·lb)

— Bolt securing water delivery hose union to turbocompressor (9).
— Bolt securing water delivery hose union to engine block (10).

(T) : **Tightening torque**
50 to 62 N·m
(5.0 to 6.2 kg·m
36.90 to 45.73 ft·lb)



1. Nuts securing turbocharger to exhaust manifold
2. Nuts securing turbocharger exhaust union to turbine
3. Bolts securing turbocharger exhaust union to exhaust pipe
4. Nuts securing exhaust manifold to cylinder head
5. Bolts securing turbocompressor lower support to engine block
6. Bolts securing turbocharger to lower support
7. Bolts securing oil delivery hose to turbocharger
8. Bolts securing oil delivery hose union to engine block
9. Bolt securing water delivery hose union to turbocharger
10. Bolt securing water delivery hose union to engine block

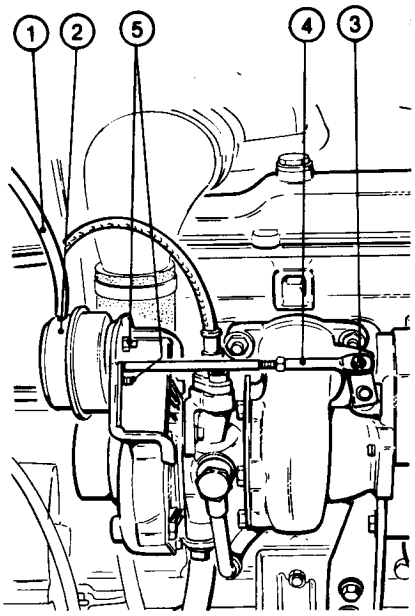
WASTE-GATE VALVE

CHECKS AND INSPECTIONS

Consult the paragraph: «Settings and Adjustments».

REMOVAL

1. Detach hose (1) from waste-gate valve (2).
2. Remove snap ring (3) and detach control stem (4).
3. Unscrew the two retaining screws (5) and remove waste-gate valve (2).



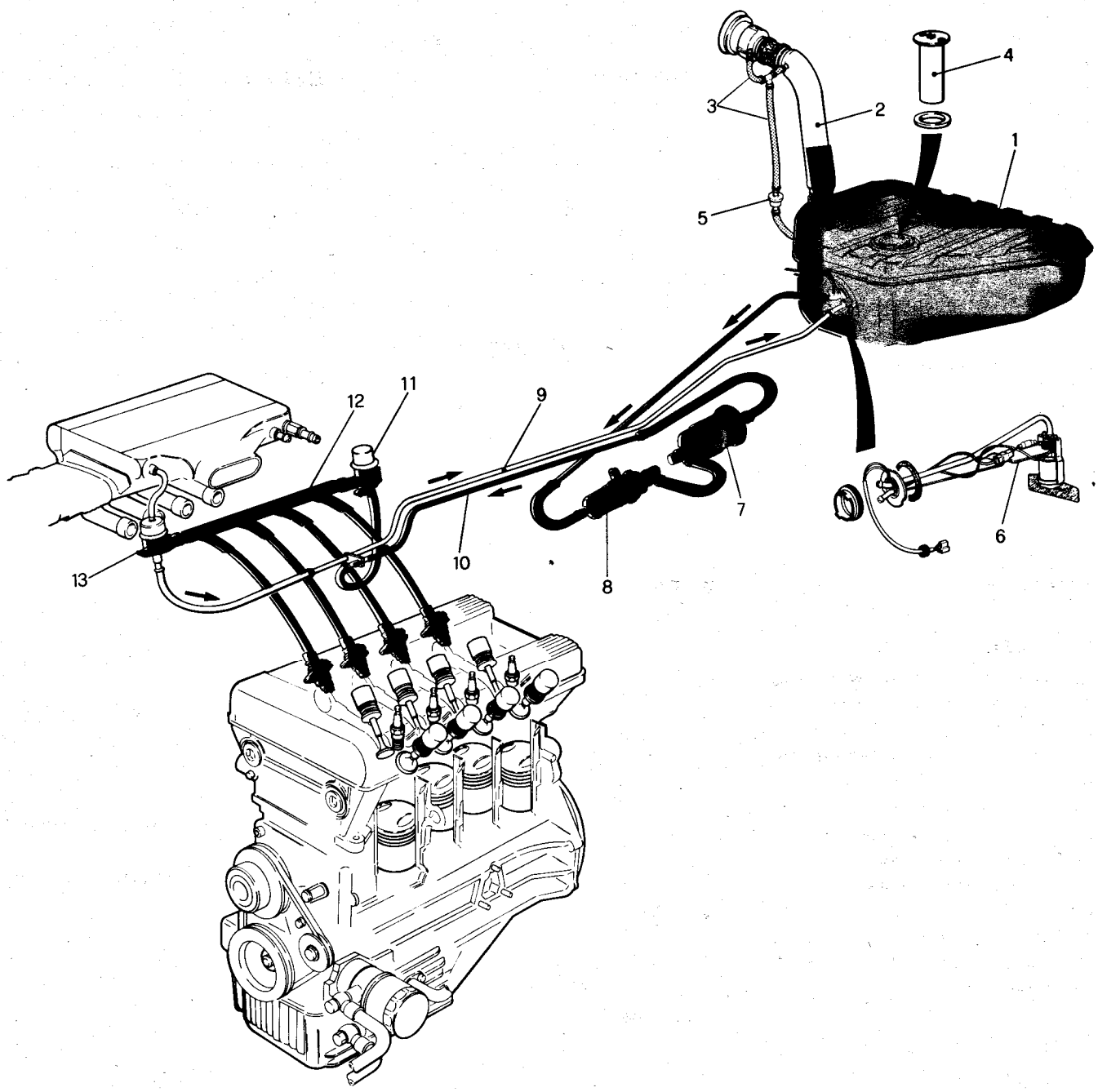
1. Hose connecting waste-gate to supercharging pressure regulation solenoid valve
2. Waste-gate valve
3. Snap ring
4. Waste-gate valve control stem
5. Nuts

INSTALLATION

Proceed with the installation of the waste-gate valve by reversing the order of removal.

If necessary adjust as prescribed in the paragraph «Settings and Adjustments».

FUEL SUPPLY SYSTEM



FUEL DELIVERY CIRCUIT

FUEL RETURN CIRCUIT

1. Tank
2. Filler
3. Fill-up breather hose
4. Fuel level gauge
5. Check valve
6. Submerged pump
7. Filter
8. Main pump
9. Fuel return piping
10. Fuel delivery piping
11. Hammering damper
12. Fuel distributor manifold
13. Fuel pressure regulator

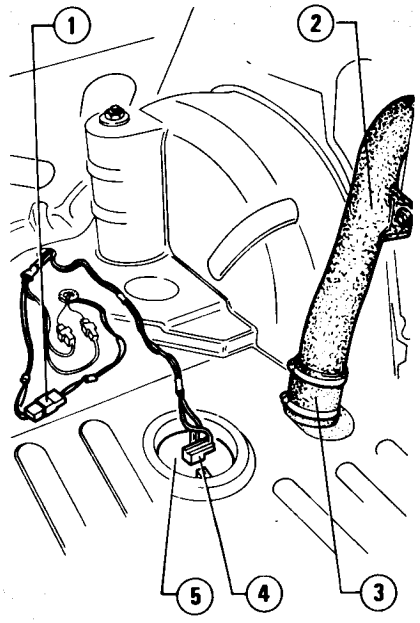
WARNING:
Strictly follow the below indications before replacing the fuel system components:
a. Ensure that the workshop is correctly equipped to enable operations to be performed safely (fire extinguishers, etc.).
b. Detach the battery ground cable.
c. Pour the fuel drawn from the tank into a suitable container fitted with safety cover.

CAUTION:
After having reassembled the fuel system components, verify system tightness when at 4 bar (58 psi) pressure.

FUEL TANK

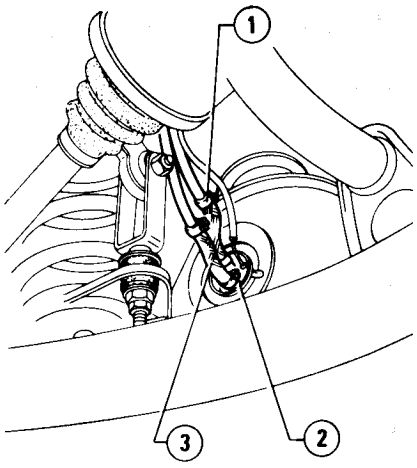
REMOVAL

1. Set vehicle on a lift; remove filler plug and suck fuel from tank by means of a suitable pump.
2. Remove lower trim of luggage compartment, move side trim (right-hand side), and remove the fuel level gauge cover.
3. Detach connectors (1) and (4), then extract connector (1) from the related cable-raceway withdrawing it from under the vehicle.
4. Loosen the clamp and detach sleeve (3) from tank without damaging the rubber gasket underneath.



1. Submerged pump supply connector
2. Fuel filler
3. Sleeve connecting filler to tank
4. Fuel level gauge connector
5. Fuel level gauge

5. Raise vehicle on lift, and disconnect hoses (1) and (3) from flange (2).



1. Fuel return hose
2. Submerged pump flange
3. Fuel delivery hose

6. Support tank by means of a column lift, unscrew the three screws which secure tank to body and remove.
7. Disassemble tank, if required.

CHECKS AND INSPECTIONS

Check for cracks or deformations in the tank; replace if required.

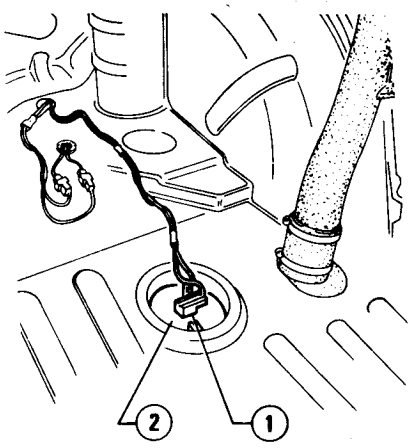
INSTALLATION

1. Install tank on vehicle by reversing the order of removal, verifying that the rubber gasket between tank and luggage compartment floor is correctly positioned in correspondance with filler.

FUEL LEVEL GAUGE

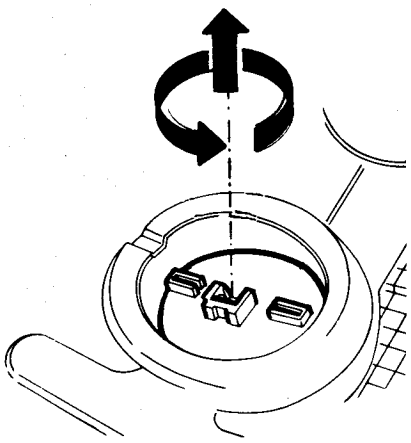
REPLACEMENT

1. Remove the luggage compartment floor trim.
2. Remove cover of fuel level gauge (2) and detach connector (1).

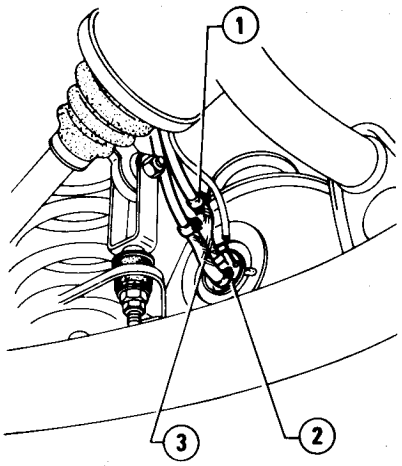


1. Fuel level gauge connector
2. Fuel level gauge

3. By means of a suitable tool, rotate fuel level gauge counterclockwise; then withdraw it from tank together with the related gasket.

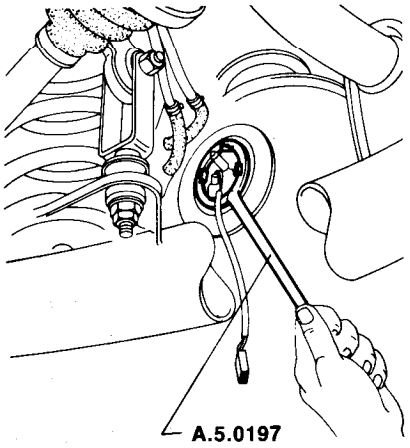


4. Replace gasket before installing the fuel level gauge on tank.



1. Fuel return hose
2. Submerged pump flange
3. Fuel delivery hose

4. By means of tool **A.5.0197** rotate the submerged pump flange counterclockwise, then withdraw the unit from tank, together with the related gasket.



5. **Replace** gasket before installing the submerged pump unit; reinstall it by means of tool **A.5.0197**.

AUXILIARY FUEL PUMP AND GRID FILTER

REPLACEMENT

1. Set vehicle on lift; remove filler cap and suck fuel from tank by means of a suitable pump.
2. Lift the luggage compartment floor trim, detach the submerged pump supply connector, and extract it from the related cable raceway withdrawing it from under the vehicle.
3. Raise vehicle by means of the lift, then detach hoses (1) and (3) from flange (2).

FUEL PIPING

STACCO

CAUTION:
Disconnect fuel system piping only when strictly required.

1. Set vehicle on lift.
2. Remove filler plug and, by means of a suitable pump, suck fuel from the tank.
3. Loosen the clamps which secure the ends of the hoses to be removed.

CAUTION:
When disassembling, plug both pipes and hoses so as to prevent dust or impurities from entering.

4. To remove the piping located on the floor inside the passenger compartment, remove the floor trim on the right-hand side.

CHECKS AND INSPECTIONS

1. Check for porosity and deterioration of hoses; replace the faulty ones.
2. Check for oxidation, clogging and dents of pipes.

INSTALLATION

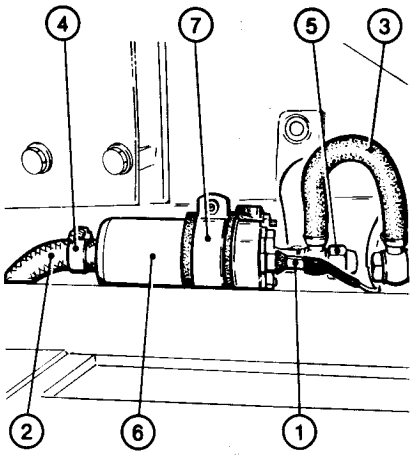
Carefully install piping by reversing the order of removal and complying with the following.

CAUTION:
a. Carefully install clamps on system joints.
Do not tighten clamps excessively so as to prevent damaging piping.
b. Do not bend or twist pipes when installing them on vehicle.
c. The piping inside the vehicle must be inserted into the related pipe-raceway up to the red reference strips marked on each pipe/hose.
d. Start the engine and check for leaks from joints.

MAIN FUEL PUMP

REPLACEMENT

1. Set vehicle on a garage lift and disconnect the battery negative terminal.
2. Working from under the vehicle, disconnect pump supply cables (1).
3. Throttle hoses (2) and (3), remove clamp (4), unscrew union (5) and then detach hoses (2) and (3) from pump (6).
4. Loosen clamp (7) and remove pump (6).



1. Pump supply cables
2. Fuel inlet hose to pump
3. Fuel outlet hose from pump
4. Clamp
5. Union
6. Fuel pump
7. Pump clamp

5. Install the new fuel pump by reversing the order of removal, paying special attention to the following:

- The pump is supplied by spares in a sealed package, filled with protective oil and with unions plugged.
  It is not necessary to empty it when installing.
- Take care not to invert the supply cable connections (1).
- Lock the following to the prescribed torque:

— Union (5) of pump fuel outlet hose.

(T) : Tightening torque
10 to 16 N·m
(1.02 to 1.6 kg·m
7.37 to 11.80 ft·lb)

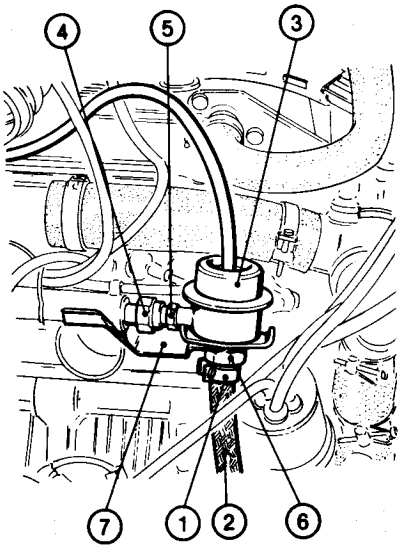
— Pump support clamp retaining nut (7).

(T) : Tightening torque
1.9 to 2.4 N·m
(0.19 to 0.24 kg·m
1.40 to 1.77 ft·lb)

FUEL PRESSURE REGULATOR

REPLACEMENT

1. Remove intercooler (see paragraph «Intercooler — Removal»).
2. Guarding against the possibility of fuel escaping, loosen clamp (1) and disconnect hose (2) from pressure regulator (3) and plug hose.
3. Unscrew union (4), applying a second spanner to checking nut (5).
4. Unscrew nut (6) securing the pressure regulator to bracket (7), retrieve the washer under it and remove regulator.



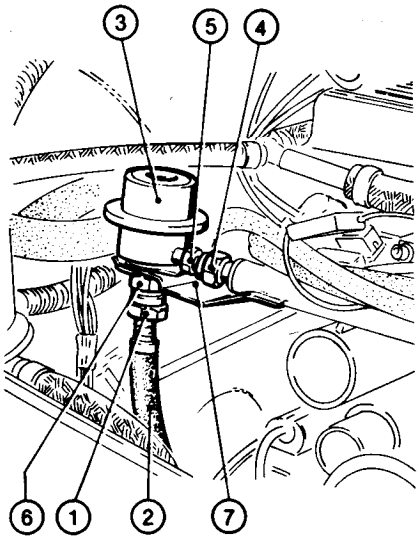
1. Clamp
2. Fuel return hose
3. Pressure regulator
4. Union
5. Checking nut
6. Regulator retaining nut
7. Support bracket

5. Assemble a new pressure regulator by proceeding in the opposite order to removal.
6. Assemble the intercooler (see paragraph «Intercooler — Installation»).

HAMMERING DAMPER

REPLACEMENT

1. Remove intercooler (see paragraph «Intercooler — Removal»).
2. Taking precautions against fuel escape, loosen union (1), disconnect hose (2) from hammering damper (3) and plug hose.
3. Unscrew union (4) applying a second spanner to checking nut (5).
4. Unscrew nut (6) securing hammering damper to bracket (7), retrieve the washer under it and remove damper.



1. Fuel delivery hose union
2. Fuel delivery hose
3. Hammering damper
4. Union
5. Checking nut
6. Damper securing nut
7. Support bracket

5. Assemble a new hammering damper by proceeding in the opposite order to removal.
6. Assemble intercooler (see paragraph «Intercooler — Installation»).

ELECTROINJECTORS

CHECKS AND INSPECTIONS

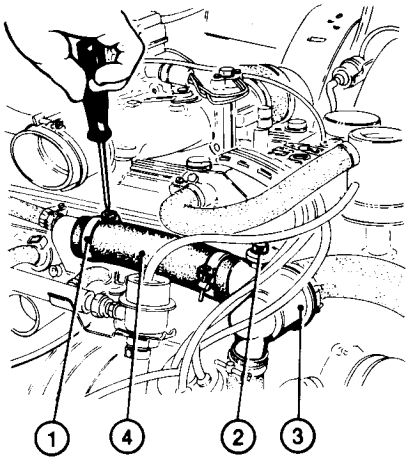
1. Electrical tests
Refer to: «Electrical Tests».

2. Check of electroinjectors opening
a. Measurement of exhaust CO emission (see paragraph «Settings and Adjustments»).
b. Detach electroinjector connectors one at a time, check the CO percentage each time, a verify that value is constant at each check.
c. If not so, identify the faulty electroinjector and replace it (see paragraph «Replacement»).
d. However, a visual confirmation of electroinjectors functioning can be obtained by comparing the spark plug electrodes colour:
— Black colour indicates a too rich mixture.
— Light colour indicates a too lean mixture.

3. Check of electroinjector tightness
a. Detach the electroinjector-fuel distributor manifold unit operating as indicated in «Replacement», keeping the fuel supply system connected.
b. Detach electroinjector connectors.
c. Operate starter and check for fuel leaks from electroinjectors; if leaks are present, replace the faulty electroinjector.

REMOVAL

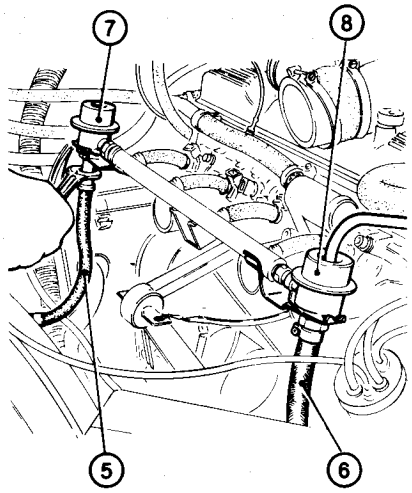
1. Remove intercooler (see paragraph «Intercooler — Removal»).
2. Place a suitable container under the vehicle and drain engine coolant system.
3. Detach supply connectors from electroinjectors, from water temperature sensor and sender, and from oil level sensor. Remove clamps securing the electrical wiring to the fuel distributor manifold.
4. Loosen clamp (1), remove screw (2) securing thermostatic cup (3) and then disconnect sleeve (4).



1. Clamp
2. Screw
3. Thermostatic cup
4. Sleeve

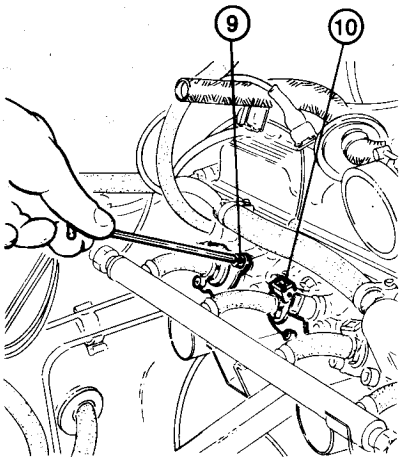
5. Detach hoses (5) and (6) from hammering damper (7) and pressure regulator (8) respectively.

WARNING:
When detaching hose (5) operate carefully as residual pressure in the fuel system may cause fuel to escape.



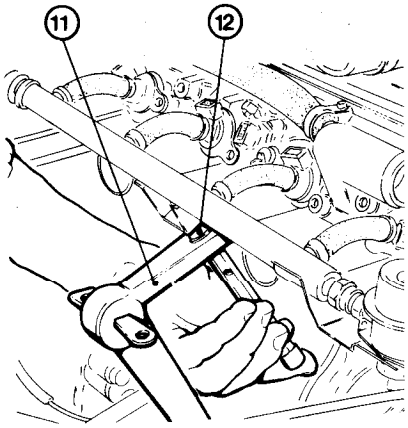
5. Fuel delivery hose
6. Fuel return hose
7. Hammering damper
8. Pressure regulator

6. Remove the eight screws (9) securing electroinjectors (10) to fuel intake manifold.



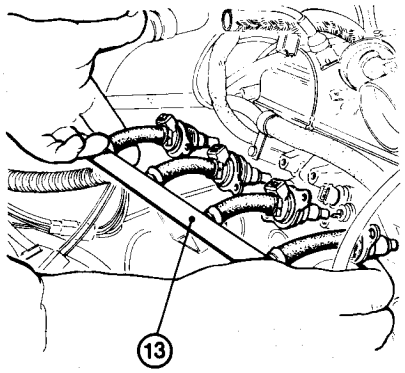
9. Electroinjector retaining screws
10. Elettroinjectors

7. Unscrew nut on bracket (11) and retrieve silentblock (12).



11. Intercooler support bracket and fuel distributor manifold
12. Silentblock

8. Remove fuel distributor manifold (13) complete with electroinjectors.

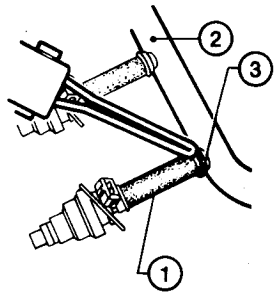


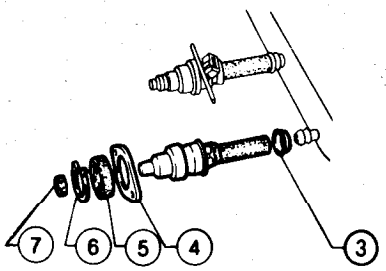
13. Fuel distributor manifold with electroinjectors

REPLACEMENT

CAUTION:
Before replacing an electroinjector, take note of connector position on electroinjector so that it can be correctly repositioned when installing the new electroinjector.

1. Cut hose (1) using a welder, detach it from fuel distributor manifold (2) and recover bush (3).





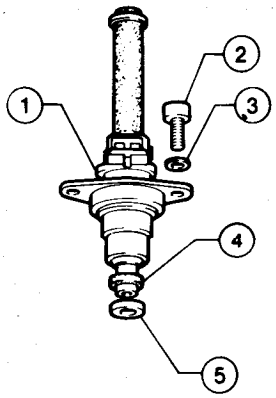
1. Electroinjector supply hose
2. Fuel distributor manifold
3. Bush
4. Flange
5. Rubber gasket
6. Seeger ring
7. O-ring

2. Install a **new** electroinjector fitting bush and supply hose on fuel distributor manifold until it strikes against bush itself.

CAUTION:
Electroinjector must be fitted on fuel distributor manifold with the related connector towards cylinder heads.
To fit the electroinjector, it is recommended to wet the related rubber hose with fuel. However, for this operations never use grease or vaseline.

INSTALLATION

1. Replace O-ring (4).
2. Install electroinjectors into the related seats, taking care to position seal ring (5) correctly.



1. Flange
2. Electroinjector securing screw
3. Washer
4. O-ring
5. Seal ring

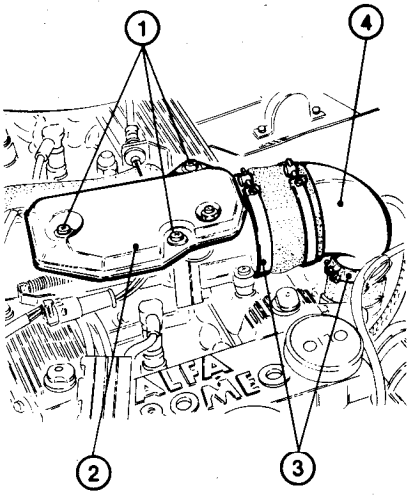
3. Install the other components by reversing the order of removal, complying with the following indications:
- Restore coolant correct level.
- Check the exhaust CO percentage; adjust if necessary (see paragraph «Setting and Adjustments»).

SETTINGS AND ADJUSTMENTS

SETTING OF THROTTLE BODY (Check with Flowmeter)

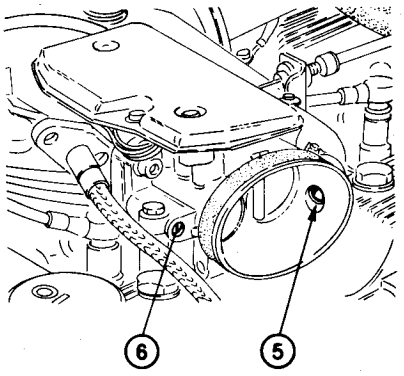
Check the tightness of the throttle body discs as follows:

1. Remove the three screws (1) and remove protective cover (2). Then loosen clamps (3) and detach union (4) from throttle body.



1. Cover retaining screws
2. Protective cover
3. Union retaining clamps
4. Throttle body union

2. Stop the hole of the auxiliary air valve supply duct hole (5) and check that there is no leakage through idle r.p.m. adjustment screw (6) (which must be fully tightened).

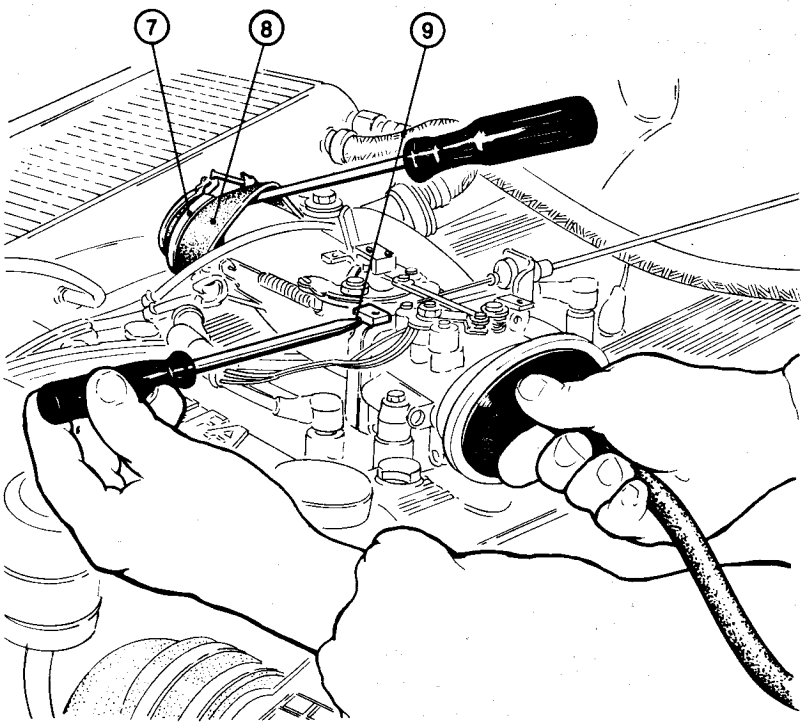


5. Auxiliary air valve supply duct hole
6. Idle r.p.m. adjustment screw

3. Loosen clamp (7) and place a suitable tool in sleeve (8) to permit air to escape during the flowmeter check.
4. Rest the flowmeter tap **C.2.0055** on throttle body inlet.
5. Measure the air flow through throttle and verify that it is within prescribed values.

Air flow from accelerator throttle in closed position (Solex flowmeter): 350 on scale N

6. If the flowmeter does not show this value adjust screw (9) until it is obtained.



7. Clamp
8. Sleeve
9. Primary throttle regulation screw

7. Install the components detached by reversing the order of removal.
8. Adjust idle r.p.m. (see paragraph «Check and Adjustment of Idle r.p.m.»).

THROTTLE POSITION SENDING UNIT ADJUSTMENT

NOTE:
Before adjusting the throttle position sending unit ensure that the throttle body is correctly adjusted (see paragraph «Setting of Throttle Body»).

1. Disconnect the connector (multi-pin) from the ignition control unit (located inside the vehicle on the front right wheelhouse) and connect it to interface **C.1.0134**.

2. Working from inside the engine compartment, remove protective cover detach the throttle position sending unit connector and connect it to adjustment device **C.1.0131**.

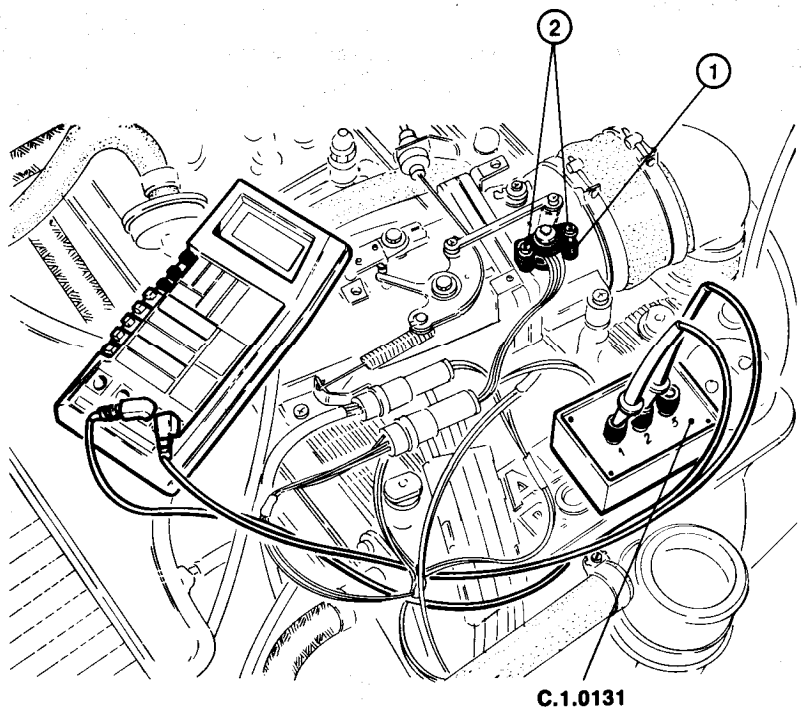
3. Take a 2 V FSR multimeter and insert the black prod in bush no. 1 of adjustment device **C.1.0131** and red prod in bush no. 2.

4. Insert the ignition key and check that the multimeter indicates

1050 to 1100 mV

5. If the prescribed value is not obtained adjust throttle position sending unit (1) by loosening retaining screws (2) and rotating it until a reading of 1050 to 1100 mV is obtained on the multimeter.

6. Then lock the sending unit, take out the ignition key, disconnect the test instrument and fit the protective cover.



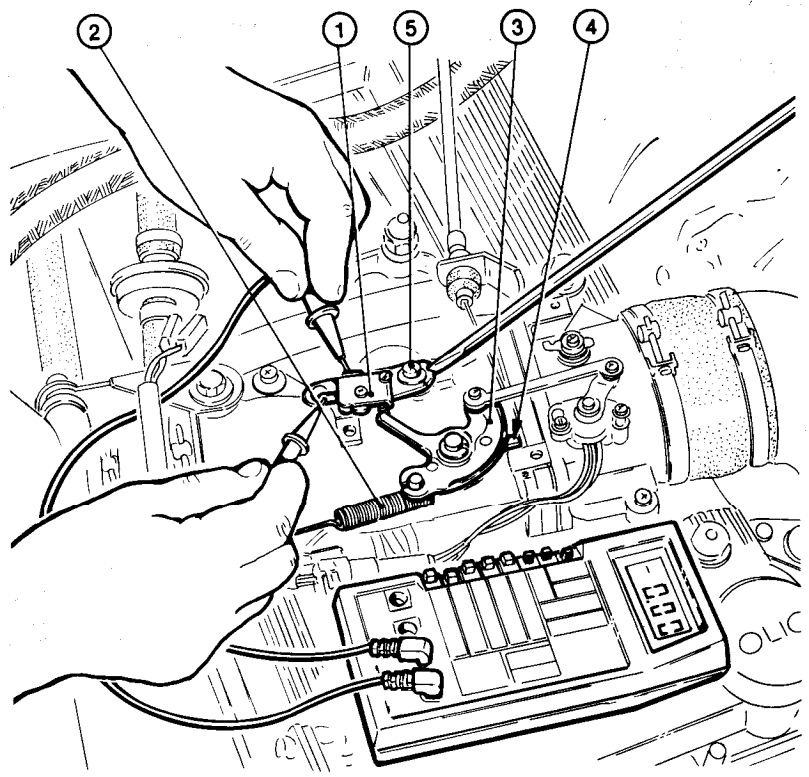
C.1.0131

1. Throttle position sending unit
2. Sending unit retaining screws

MINIMUM CUTOUT SWITCH ADJUSTMENT

NOTE:
Before adjusting the minimum cutout switch ensure that the throttle body is correctly adjusted (see paragraph «Setting of Throttle Body»).

1. Remove the protective cover and disconnect the supply cables from the minimum cutout switch (1).
2. With spring (2) attached ensure that cam (3) is stopped against adjusting screw (4).
3. Loosen screw (5) and place the prods of a multimeter on the terminals of the switch.
4. Insert a screwdriver in the seat provided, turn the switch until (**0** Ω) apppears on the multimeter (circuit closed) and lock switch by tightening screw (5).
5. Re-connect supply cables to the switch and re-fit protective cover.

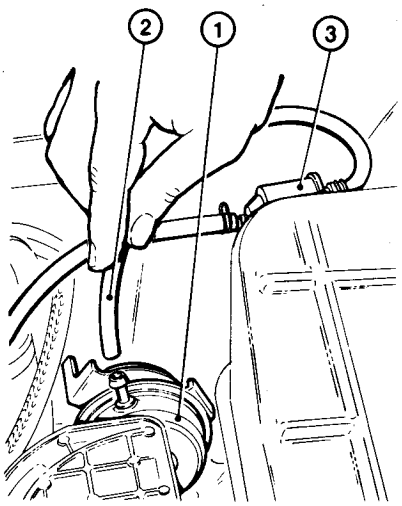


1. Minimum cutout switch
2. Spring
3. Accelerator control cam
4. Adjusting screw
5. Switch locking screw

WASTE-GATE VALVE CHECKS AND ADJUSTMENTS

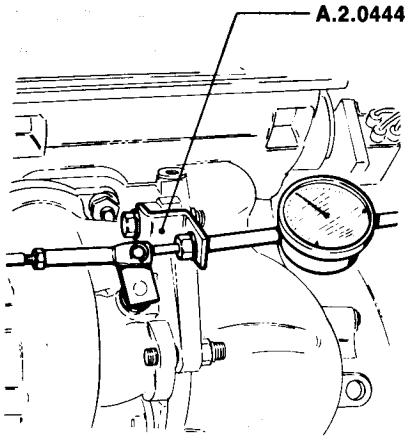
With cold engine, check the setting of the waste-gate valve as follows:

1. Detach connecting hose (2) together with supercharging pressure solenoid valve (3) from waste-gate valve (1).



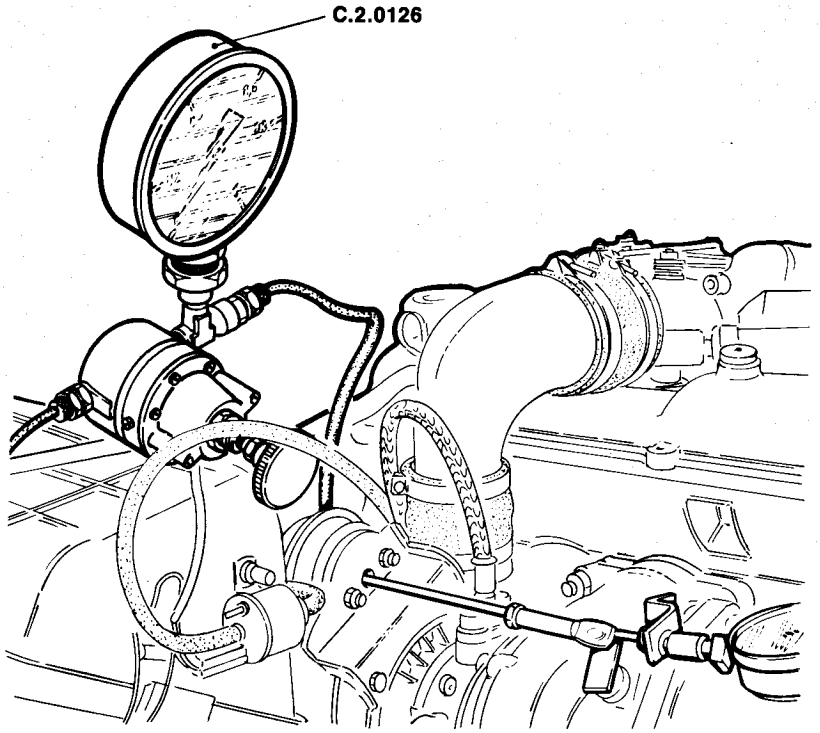
1. Waste-gate valve
2. Hose from waste-gate valve to supercharging pressure regulation solenoid valve
3. Supercharging pressure regulation solenoid valve

2. Fit connecting plate **A.2.0444** using the free threaded hole on the turbocharger flange and fix it with a bolt.
3. Fit a dial gauge with extension to this square so that it can reach the end of the waste-gate valve stem.
Zero-set the dial gauge.



4. Connect pressure gauge **C.2.0126** to the waste-gate valve and then connect the pressure gauge to a low pressure compressed air supply.

WARNING:
Before connecting the pressure gauge ensure that the pressure regulation knob is completely closed in order to prevent damage to the pressure gauge by the excessive pressure.

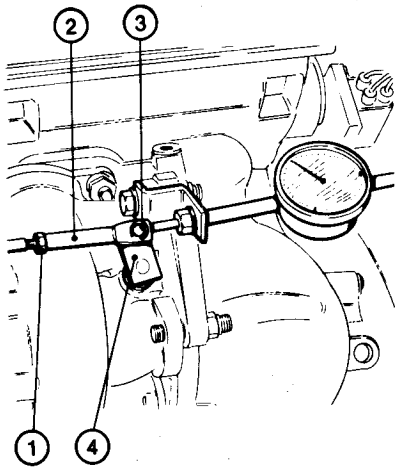


5. Supply a pressure of **0.276 bar (4 psi)** (by adjusting the pressure gauge knob) and check on the dial gauge that the stem travel is **1.27 mm (0.05 in)**.
6. If the prescribed value is not obtained adjust the waste-gate valve as follows:

a. Completely relieve the pressure in the pressure gauge.

b. Loosen lock nut (1) of adjustment tie-

rod (2) and remove stop ring (3).
c. Detach tie rod (2) from lever (4) controlling the exhaust gas shutter and adjust its length by screwing or unscrewing it.
d. Re-connect the rod to the lever and check the travel (see point 5.).
7. After adjustment lock nut (1), remove the dial gauge and the pressure gauge and re-connecting hose to the supercharging pressure regulation solenoid valve.



1. Lock nut
2. Tie rod
3. Stop ring
4. Exhaust gas shutter control lever

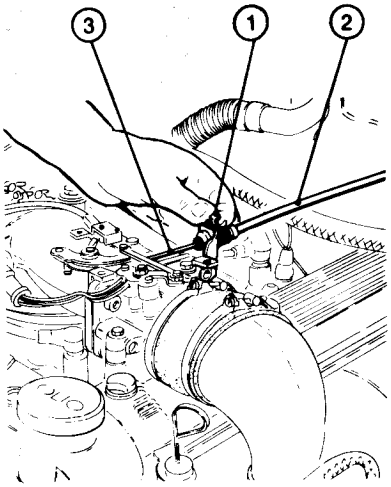
ADJUSTMENT OF ACCELERATOR CONTROL

1. Checking of cable sliding
Check that the control cable moves freely in its sheath.

2. Check of cable backlash
a. With the accelerator pedal reaised check that the accelerator cable end play on the control lever is

1 to 2 mm (0.04 to 0.08 in)

b. If necessary, adjust the cable backlash by extracting the adjusting spring (1) and moving sheath (2) in order to produce the prescribed backlash on cable (3). Then re-insert the spring in the new position.

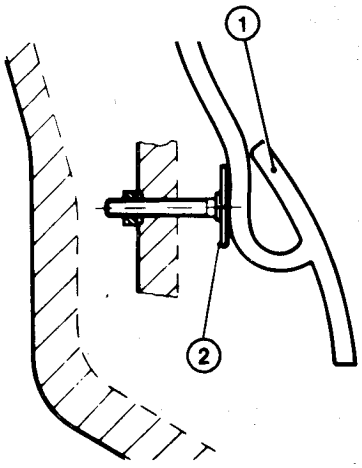


1. Adjusting spring
2. Accelerator cable sheath
3. Accelerator cable

3. Check of throttle valve max opening
a. With accelerator pedal fully depressed check that the accelerator control cam can still rotate

1 to 2 mm (0.04 to 0.08 in)

b. If necessary proceed with the adjustment by means of end of travel screw (2) under accelerator pedal (1).

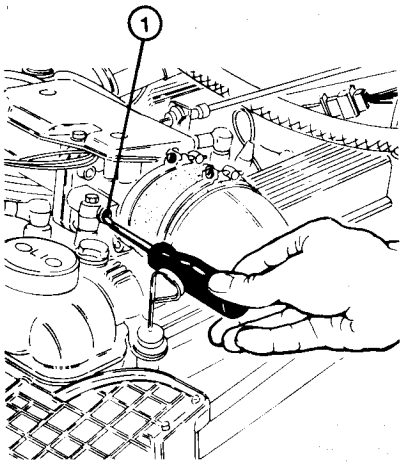


1. Accelerator pedal
2. End of travel screw

CHECK AND ADJUSTMENT OF IDLE R.P.M.

This is to be carried out with engine at normal running temperature, gearbox in neutral and all the ancillary devices excluded.
Using a screwdriver adjust screw (1) to obtain prescribed value.

Idle r.p.m.:
900 ±50 r.p.m.

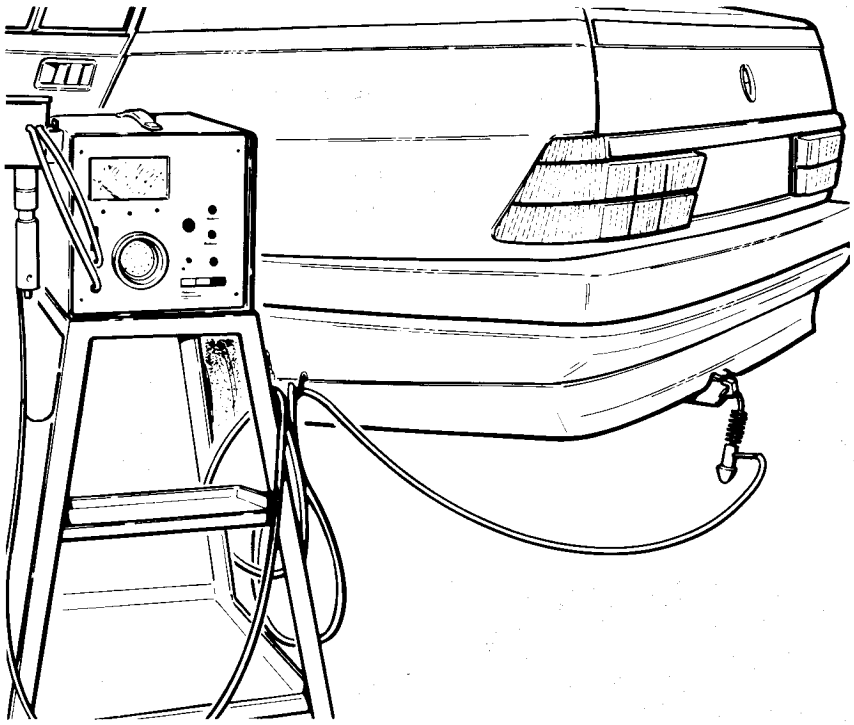


1. Idle r.p.m. adjusting screw

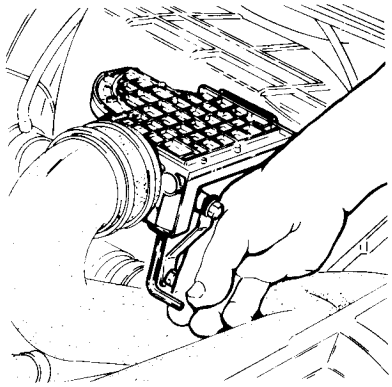
CHECK AND ADJUSTMENT OF EXHAUST EMISSIONS (CO)

This check is to be carried out with engine at normal running temperature (after the electric fan has switched on and off) and after having carried out the idle r.p.m. adjustment (refer to: «Adjustment of Idle r.p.m.»).
Also the following preliminary checks are to be carried out:
— Check of engine oil level
— Cleaning of air filter cartridge
— Check of ignition system efficiency
— Ignition timing
a. Insert tester probe into the fan pipe; the carbon monoxide percentage (CO %), read on tester, shall be within the prescribed values:

% CO = 0.4 to 1.2



c. Operate on the adjusting screw, keeping the idle r.p.m. constant, according to the following indications:
— when tightening, the CO% increases;
— when loosening, the CO% decreases.

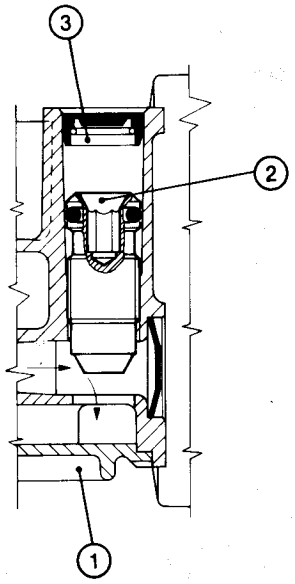


d. Verify, on tester, that the HC value does not exceed the prescribed value

HC ≤350 p.p.m.

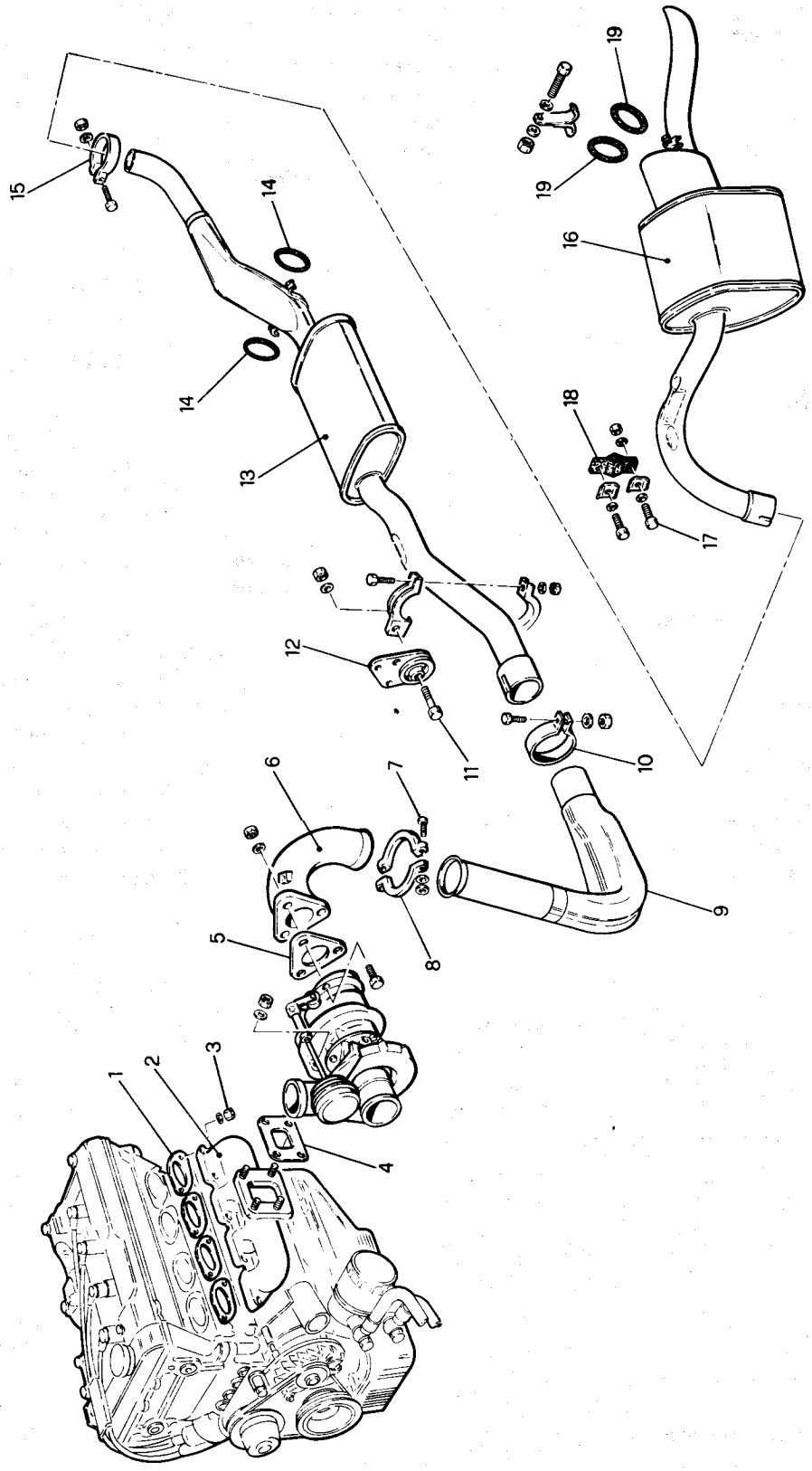
e. After adjusting insert a new sealing cap.

b. If the CO percentage is not within the specific range remove sealing cap (3) on the underside of air flow gauge (1) in order to reach adjusting screw (2).



1. Air flow gauge
2. Adjusting screw
3. Sealing cap

EXHAUST SYSTEM



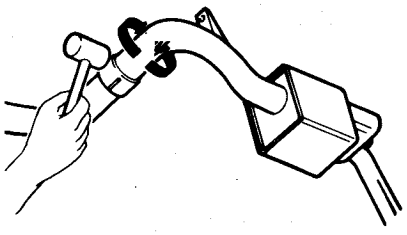
1. Exhaust manifold gaskets
2. Exhaust manifold
3. Manifold retaining nuts
4. Turbocharger gasket
5. Gasket
6. Exhaust pipe union
7. Collar retaining bolts
8. Collar
9. Front section
10. Clamp
11. Bolt
12. Support
13. Centre section
14. Retaining ring
15. Clamp
16. Front section
17. Bolt
18. Rubber support
19. Retaining rings

a. The procedures described, permit single components of the system to be removed, when required.
b. The removal procedure can be modified according to the purpose of the operation.
c. The removal of the whole exhaust system, may require the aid of another operator.

MANIFOLD AND SILENCERS

REMOVAL

With reference to the previous figure, carry out removal, operating as follows:
1. Raise vehicle on lift.
2. Detach rear section (16) from the exhaust system, operating as follows:
a. Loosen clamp (15).
b. Unscrew and remove bolt (17) which secure support (18).
c. Release rear section (16) from retaining rings (19).
d. By means of a hammer, tap slightly and repeatedly along the piping circumference, in correspondance with the connection between the two sections; then rotate the rear section alternatively in both directions, with respect to central section so as to make separation easier.



3. Disconnect centre section (13) of the exhaust system, operating as follows:
a. Loosen clamp (10), remove bolt (11) retaining the centre section to support (12) and release retaining rings (14).
b. Remove centre section by lightly tapping (with a plastic hammer) the area where it is joined to the front section.
4. Disconnect front section (9) by loosening the two bolts (7) retaining collar (8).
5. Remove exhaust manifold (2), operating as follows:
a. Remove turbocharger (see paragraph «Turbocharger — Removal»).
b. Unscrew nuts (3) securing the manifold to the cylinder head.
c. Remove manifold (2) together with gaskets (1).

CHECKS AND INSPECTIONS

1. Check silencers and exhaust piping, and verify that no damages, cracks or corrosion signs are present.
Replace if required.
2. Check rings and rubber supports; replace them in the event of cracks, scratches, porosity, or if worn.

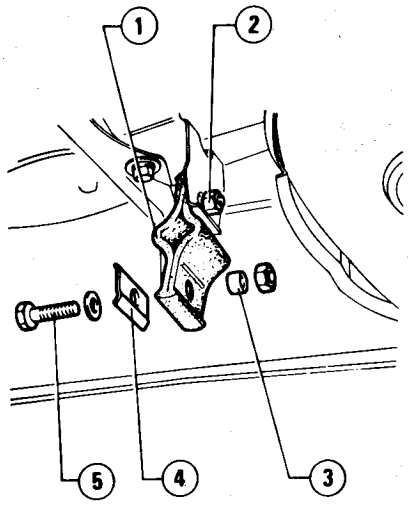
INSTALLATION

Install each element by reversing the order of removal, and complying with the following indications:
- Install new gaskets between the flanges of the manifold and the cylinder head.
- Use new self-locking nuts to secure the exhaust manifold to the turbocharger group.
- Shake exhaust pipe so as to obtain correct alignment.
- On running rengine, check for gas leaks from piping and inusual noisy.

RUBBER SUPPORTS

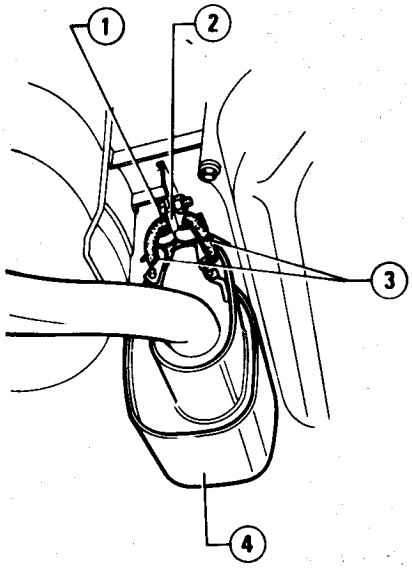
REPLACEMENT

1. Raise vehicle on lift.
2. Unscrew lower bolt (5), recover plate (4) and spacer (3).
3. Unscrew bolt (2) and remove support (1) with related plate (4) and spacer.



1. Rubber support
2. Bolt securing support to body
3. Spacer
4. Plate
5. Bolt securing exhaust pipe to support

4. For the O-rings, simply release them from hooks.
5. If required, unscrew bolt (1) and remove rear hook (2).
6. Carry out the installation by reversing the order of removal, making sure that, after installation, the supports can swing freely and are not tout.



1. Bolt
2. Rear hook
3. Retaining rings
4. Silencer - rear section

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

SUPPLY AND INJECTION COMPONENTS

Component	ALFA ROMEO Part No	Type
Main fuel pump — Rated voltage: 12 V — Operating voltage: 7 to 15 V — Operating pressure: 3.8 bar (55.1 psi) — Max. permissible fuel temperature: 60°C (140°F) — Max. permissible temperature difference between pump and tank: ≤2°C (≤3.6°F) — Operating temperature: —30° to +70°C (—22°F to 158°F) — Rated delivery [temperature 20°C (68°F), voltage 12 V, pressure 3.0 bar (43.5 psi)]: 130 l/h (28.6 Imp.Gal/h) (minimum) — Current consumption [temperature 20°C (68°F), voltage 12 V, pressure 3.0 bar (43.5 psi)]: 6.5 A	113.54.04.021.00	BOSCH 0.580.464.024
Auxiliary fuel pump — Rated voltage: 13.5 ±0.05 V — Rated delivery: ≥115 l/h (25.3 Imp.Gal/h) at 160 mbar (*) ≥67 l/h (14.7 Imp.Gal/h) at 230 mbar (*) 0 (0 Imp.Gal/h) at 298 to 436 mbar (*) (*) Pressure measured at pump level	115.41.32.009.00	GENERAL MOTORS 6441336
Fuel pressure regulator — Rated pressure at a delivery of 40 l/h (8.8 Imp.Gal/h) at 20°C (68°F): 3 bar (43.5 psi) over pressure — Temperature range on the mounting seat: —30°C to +100°C (—22° to 212°F)	195.00.32.045.00	BOSCH 0.280.160.214
Hammering damper — Operating pressure: 1.7 to 3.7 bar (24.65 to 53.65 psi) — Temperature range on the mounting seat: —30° to +100°C (—22°F to 212°F)	195.05.04.550.00	BOSCH 0.280.161.029
Electroinjectors — Rated voltage: supplied by ECU — Rated static delivery [with 3.0 bar (43.5 psi) test overpressure]: 236 cm^3/min (14.40 cu.in/min) — Rated dynamic delivery [with 3.0 bar (43.5 psi) test overpressure]: 6.9 cm^3/1000 (0.42 cu.in/1000 lifts (injection time 2.5 ms) — Operating pressure: 2.0 to 3.0 bar (29 to 43.5 psi) overpressure — Permissible temperature range: —30° to +110°C (—22°F to 230°F) — Colour: anthracite	195.05.011.300.01	BOSCH 0.280.150.152
Air flow gauge — Rated voltage: supplied by ECU — Temperature range: —30° to +110°C (—22° to 230°F) — Rated air flow at 980 mbar, 20°C (68°F): 420 m^3/h (14826 cu.ft/h)	195.05.11.013.00	BOSCH 0.280.202.058
Auxiliary air valve — Rated voltage: 12 V — Max. permissible voltage: 15 V — Temperature range on the mounting seat: —30° to +120°C (—22°F to 248°F) — Average time from open to closed at 20°C (68°F) and 14 V: 3 min. 20 sec. — Air flow at 20°C (68°F): 10 m^3/h (353 cu.ft/h) — Rated power at 20°C (68°F): 3 W	195.00.11.017.00	BOSCH 0.280.140.166
Supercharging pressure regulation solenoid valve — Rated voltage: 12 V — Minimum operating voltage: ≤9 V — Maximum voltage: 16.5 V — Current consumption at 12 V: 0.7 A — Operating temperature: —40° to +80°C (—40°F to 176°F)	195.05.05.020.01	PIERBURG 7.12990.00

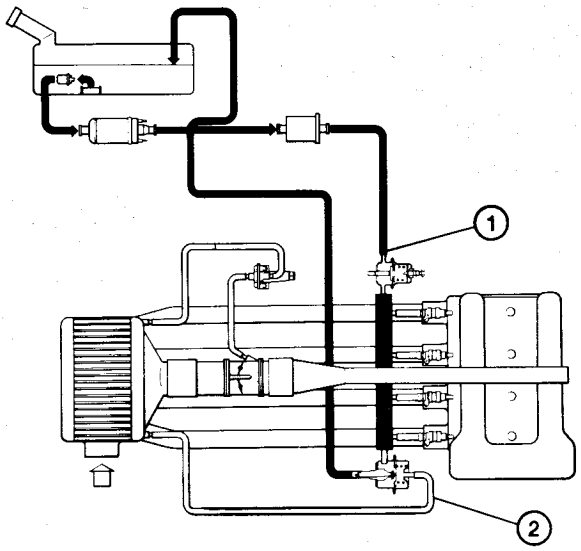
Component	ALFA ROMEO Part No	Type
Injection control unit	195.05.11.042.00	BOSCH 0.280.000.320
Ignition control unit	195.05.05.012.01	BOSCH 0.277.400.024
Coolant temperature sensor — Rated resistance at 20°C (68°F): 2 x 2.5 kΩ ±5% — Rated voltage: supplied from ECU — Temperature range on the mounting seat: —30° to +130°C)—22°F to 266°F)	195.05.11.010.000	BOSCH 0.280.130.032
Knock sensor	195.05.05.017.00	BOSCH 0.261.231.001
Turbocharger	195.49.08.090.00	GARRET TB0353

FUEL TANK

Description	Unit of measure	
	liters	Imp.Gal
Total capacity	49	10.8
Reserve	8	1.76

CHECKS AND ADJUSTMENTS

FUEL SUPPLY SYSTEM PRESSURE CHECK



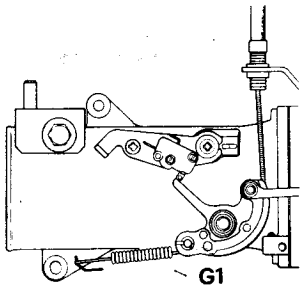
1. Pressure measurement point
2. Vacuum intake hose for pressure regulator

Check	Values	
Working pressure to be measured at point (1) with hose (2) disconnected and engine idling	kPa	284.3 to 323.6
	bar	2.8 to 3.2
	kg/cm²	2.9 to 3.3
	psi	40.6 to 46.4

ACCELERATOR CONTROL

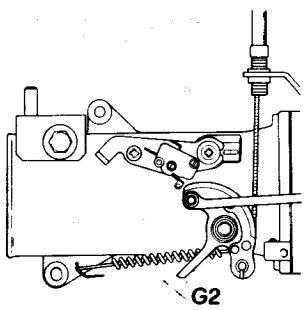
Accelerator control cable backlash (with accelerator pedal at rest)

G_1 = 1 to 2 mm (0.04 to 0.08 in)



Accelerator control cam backlash (with accelerator pedal fully depressed)

G_2 = 1 to 2 mm (0.04 to 0.08 in)



ENGINE IDLE R.P.M. AND EXHAUST CO%

Check	Values
Engine idle r.p.m. (with warm engine, gearbox in neutral and ancillary devices excluded)	900 ±50 r.p.m.
Exhaust CO percentage at idle r.p.m.	0.4 to 1.2

SETTING OF THROTTLE BODY (Check with Flowmeter)

Check	Values
Air passage with throttle valve in closed position The reading of the values on the Solex Flowmeter must be performed by applying a tap at throttle body inlet	(Solex Flowmeter) 350 N Scale

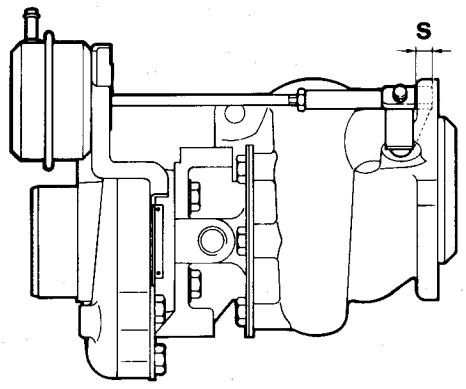
SETTING OF MINIMUM CUTOUT SWITCH

Check	Values
Resistance between terminals with accelerator pedal at rest	0 Ω
Resistance between terminals with accelerator pedal depressed	∞

CHECK AND ADJUSTMENT OF WASTE-GATE VALVE

Exhaust gas shutter control lever travel with supercharging pressure of 0.276 bar (4 psi)

S = 1.27 mm (0.045 in)



GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Application	Type	Name	Q.ty
Accelerator pedal spindle (on rubber supports)	GREASE	ISECO Molykote Longterm n. 2 Part no 3671-69831	—

FUEL

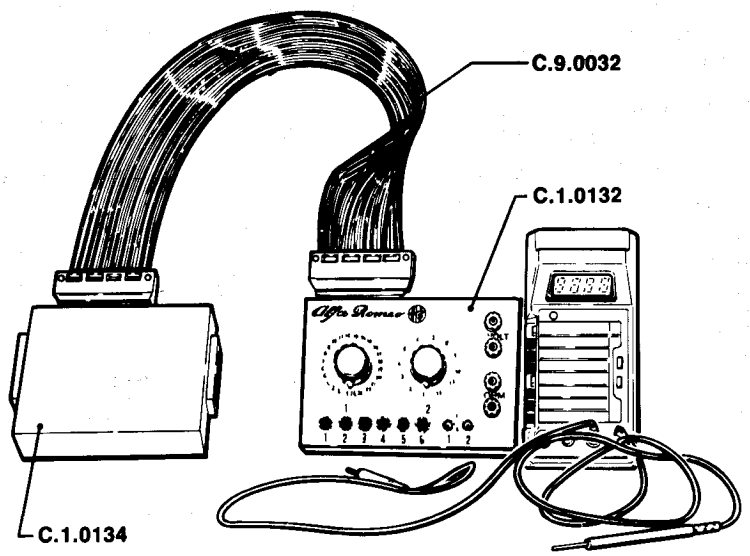
Petrol with Octane Number: ≥98 and sensitivity (1) ≤11

(1) Difference between Research Method Octane Number and Motor Method Octane Number

ELECTRICAL TESTS WITH DIAGNOSTIC INSTRUMENT

PRELIMINARY OPERATIONS

1. Take out ignition key.
2. Disconnect the connectors from the ignition and injection control units.
3. Connect interface **C.1.0134** to cable side of connectors.
4. Connect interface to multimeter **C.1.0132** using cable **C.9.0032**.



INSTRUCTIONS FOR VOLTAGE MEASUREMENTS

1. Put selectors (1) and (2) in position 1.
2. Put switch (1) in position 2.
3. Put switch (2) in position 1.
4. Connect 200 mV FSR multimeter to the «VOLT» bushes of the diagnosis instrument.
5. Disconnect the fuel pump fuse.
6. Detach auxiliary air valve connector.
7. Turn the key to IGNITION ON position.

TEST NO. 1

CHECK INJECTION CONTROL UNIT 5-PIN CONNECTOR GROUND

— Selector (1) in position 1.
Volmeter reading < 10 mV.

TEST NO. 2

CHECK OF IGNITION CONTROL UNIT 20-PIN CONNECTOR GROUND

— Selector (1) in position 2.
— Voltmeter reading < 10 mV.

TEST NO. 3

CHECK OF INJECTION CONTROL UNIT 13-PIN CONNECTOR GROUND

— Selector (1) in position 3.
— Voltmeter reading < 10 mV.

TEST NO. 4

CHECK OF +12 WITH KEY INSERTED ON PIN 6 OF IGNITION CONTROL UNIT CONNECTOR

— Position 20 V FSR voltmeter.
— Selector (1) in position 4.
— Voltmeter reading 12 V.
— Take out ignition key.
— Voltmeter reading 0 V.
— Turn ignition key to IGNITION ON POSITION again.

TEST NO. 5

CHECK OF SPEEDOMETER RELAY - PIN 9 OF INJECTION CONTROL UNIT CONNECTOR

— Selector (1) in position 5.
— Voltmeter reading 0 V.
— Commutate switch (2) momentarily to position 2 - during this time 12 V should be read.
— Repeat the test with button (2) pressed.

TEST NO. 6

CHECK OF SPEEDOMETER RELAY - PIN 19 OF IGNITION CONTROL UNIT CONNECTOR

— Selector (1) in position 6.
— Voltmeter reading 0 V.
— Try starting - voltmeter should read > 10 V only during this time.

Set switch (2) to position 2

TEST NO. 7

STARTING SIGNAL TEST (50) ON PIN 4 OF INJECTION CONTROL UNIT CONNECTOR

— Selector (1) in position 7.
— Try starting; voltmeter should read > 10 V.

TEST NO. 8

FUEL CUT-OFF TEST ON PIN 2 OF INJECTION CONTROL UNIT CONNECTOR

— Selector (1) in position 8.
— Voltmeter reading 12 V.
— Depress accelerator pedal slightly.
— Voltmeter reading 0 V.

TEST NO. 9

FUEL MINIMUM CUT-OUT SWITCH ON PIN 7 OF IGNITION CONTROL UNIT CONNECTOR

— Selector (1) in position 9.
— Repeat procedure described in previous point.

TEST NO. 10

AIR FLOW GAUGE TEST

— Selector (1) in position 10.
— Voltmeter reading 7 to 8.5 V (depending on outside temperature - the higher the temperature the higher the value).
— Move the disc of the air flow gauge and check that the voltage varies between 7 to 8.5 V and 100 to 250 without intermediate voltage holes.

TEST NO. 11

HALL EFFECT SENSOR TEST

— Selector (1) in position 11.
— 2 V FSR Voltmeter.
— Try prolonged starting.
— During this time read the value corresponding to the number of starting revs on the voltmeter
e.g. 300 r.p.m. = 300 mV
400 r.p.m. = 400 mV

TEST NO. 12

ELECTROINJECTOR ELECTRICAL TEST

— Selector (1) in position 12.
— Voltmeter 190 to 230 mV.
— A more thorough test, especially if the values are near the extremes, consists of momentarily disconnecting, one at a time, the electroconnectors.
There should be an increase of 60-80 mV each time.

TEST NO. 13

THROTTLE POSITION SENDING UNIT TEST

— Selector (1) in position 13.
— 2 V FSR voltmeter.
— Voltmeter reading 1050 to 1100 mV.

TEST NO. 14

ELECTRICAL TEST OF SUPERCHARGING PRESSURE REGULATION SOLENOID VALVE

— Selector (1) in position 14.
— 20 V FSR voltmeter.
— Voltmeter 12 V.
— Set switch (1) to position 1.
— Voltmeter reading <1 V.

IMPORTANT:
Commutating the switch to position 1 the energizing of the solenoid valve should be heard.

TEST NO. 15

SELF-TEST EFFICIENCY TEST

— Commute self-test light enabling switch to upper position.
— Press button (1) and check that the light comes on.

PREPARATION FOR OHMMETER MEASUREMENTS

1. Set selectors (1) and (2) in position 1.
2. Set switch (1) to position 2.
3. Set switch (2) to position 1.
4. Connect multimeter (2 kOHM FSR) to the «OHM» bushes of the diagnosis instrument
5. Leave the fuel pump fuse disactivated.
6. Leave the auxiliary air valve connector disactivated.
7. Turn the ignition key to IGNITION ON position.

TEST NO. 1

SETTING TEST FOR VARIOUS MARKETS

— Selector (2) in position 1.
— Ohmmeter reading: 100 Ω for normal versions.
— Ohmmeter reading: 0 Ω for Switzerland version.

TEST NO. 2

TEST OF CONNECTION BETWEEN PIN 18 OF IGNITION CONTROL UNIT CONNECTOR AND PIN 3 OF INJECTION CONTROL UNIT

— Selector (2) in position 2.
— Ohmmeter reading 200 Ω.

TEST NO. 3

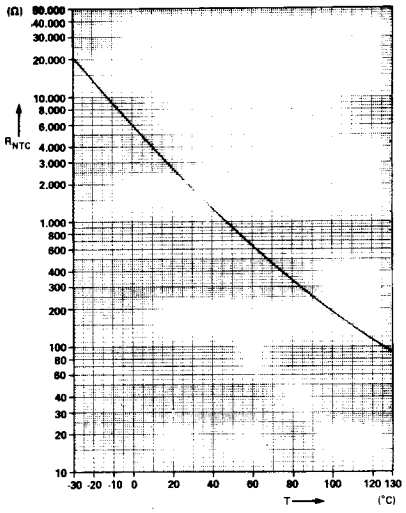
TEST OF CONNECTION BETWEEN PIN 8 OF IGNITION CONTROL UNIT AND PIN 6 OF INJECTION CONTROL UNIT

— Selector (2) in position 3.
— Ohmmeter reading 300 Ω.

TEST NO. 4

WATER TEMPERATURE SENSOR TEST

— Selector (2) in position 4.
— Ohmmeter 20 kΩ FSR
— The ohmmeter reading depends on the engine temperature (see curve).



TEST NO. 5

KNOCK SENSOR TEST

— Selector (2) in position 5.
— Ohmmeter on 2000 kΩ FSR
— Ohmmeter reading 490 to 550 kΩ.

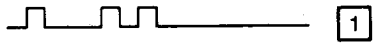
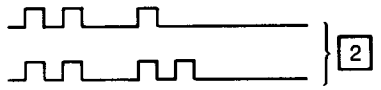
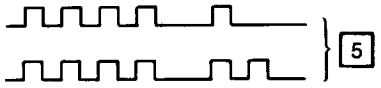
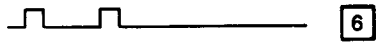
NOTE:
The reading is 220 kΩ higher than the actual resistance of the sensor.

TROUBLE DIAGNOSIS AND CORRECTIONS

NOTE:
The correct use of this trouble diagnosis procedure assumes vehicle to be in order (transmission in particular), engine in good functioning conditions (valves, cylinders, couplings) and ignition system efficient (spark plugs, distributor, coil).

IGNITION ELECTRONIC CONTROL UNIT SELF-TEST

The warning of an ignition ECU fault is provided by a light located on the dashboard. The light is operated by commutating the relative control switch to the upper position In the case of an ignition system fault the light will be constant but will start flashing when engine r.p.m. falls below 1550. This flashing will permit the identification of the type of fault.
In the event of simultaneous faults the one signalled will be governed by the priority scale given in the table below:

INDICATOR LIGHT FLASHING FREQUENCY IN ORDER OF PRIORITY	FAULT	NOTES
 1	Battery voltage insufficient	Alarm remains until fault corrected (Check battery).
 2	Knock sensor fault	Alarm remains memorized during running. (Check and restore connection or correct installation).
 3	Knock identification system fault	Alarms remains memorized during running. (Check ECU).
 4	Anomalous load signal	Alarm remains memorized during running.
 5	Throttle position sending unit fault. Supply lacking.	Alarm remains memorized during running. (Restore connection).
 6	Maximum spark advance delay has been reached	Alarm remains until fault is corrected or the fuel cut-out switch is pressed (**accelerator pedal completely depressed**).

ENGINE — TROUBLESHOOTING

Condition	Probable cause	Corrective action
Engine fails to start	• Ignition and fuel supply system connectors badly connected	Check efficiency of connections
	• No electrical continuity in ignition or fuel supply wiring	Check for electrical continuity (see paragraph «Fuel supply and ignition system — Trouble-shooting»)
	• Tachometer relay faulty	Check electrically and replace tachometer relay if necessary
	• Air and/or fuel hose badly connected or damaged	Check and take appropriate action
	• Main and/or auxiliary fuel pump not working	Check fuel pumps and wiring
	• Fuel pressure irregular: - if excessive	 - Check fuel return line - Replace pressure regulator
	- if insufficient	- Check functioning of pressure regulator and fuel pumps - Check fuel supply circuit filter and gauge filter on the auxiliary pump - Check fuel delivery line
	• Faulty air flow meter	Perform mechanical and electrical check of meter efficiency
	• Water temperature sensor faulty	Measure sensor resistance and replace it if necessary
	• Leaks in suction circuit	Check for leaks
	• Ignition and/or injection ECU defective	Replace the ECU involved
Engine starts and stalls immediately	Perform checks listed in the first point «Engine fails to start»	
	• Auxiliary air valve inefficient (problem arises with cold engine)	Check efficiency of the valve
	• Incorrect idling adjustment	Adjust idling
Irregular idle rpm	All idling checks must be performed with hot engine and accessories off	
	• Poor tightness of air supply system	Check tightness
	• Air filter clogged	Replace filter
	• Incorrect ignition timing	Check timing
	• Mixture too rich or too lean	Adjust mixture strength by operating on the by-pass screw of the air flow gauge using a CO tester
	• Throttle position sending unit badly adjusted or defective	Check adjustment and replace if necessary
	• Fuel cutout switch badly adjusted or defective	Adjust switch and replace if necessary
	• Fuel pressure irregular	Perform all checks of piping and pressure regulator
	• Water temperature sensor defective	Check sensor resistance and replace if necessary

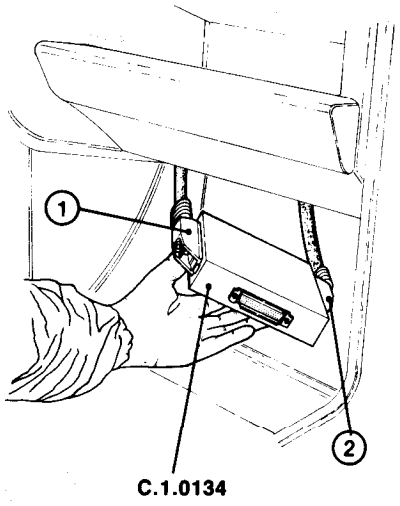
Condition	Probable cause	Corrective action
Irregular idle rpm (contd)	• Air flow gauge defective	Perform mechanical and electrical test of the gauge
	• One or more of the electro-injectors faulty	Check using CO tester, removing the electro-injector connectors one at a time to locate the faulty one
Engine will not accelerate	• Fuel cutout switch faulty	Replace switch
	• Air flow gauge defective	Performa a mechanical and electrical test of gauge efficiency
Insufficient acceleration	Perform tests listed in the first point «Engine fails to start»	
	• Air filter clogged	Clean and replace if necessary
	• Insufficient supercharging due to:	
	- supercharging regulation valve non functioning correctly	Check and replace if necessary
	- waste-gate malfunction	Check and replace if necessary
	- turbocharger rotor bearings siezed	Replace turbocharger and check efficiency of lubrication system
	• Knock sensor faulty	Replace sensor
	• One or more sensors defective	Check, using a CO tester, removing electro-injector connectors one at a time in order to identify the faulty one
	• Throttle position sending unit badly adjusted or defective	Check adjustment and replace if necessary
Vehicle fails to reach maximum speed	Perform checks listed in previous point «Insufficient acceleration»	
	• Throttle not completely open	Adjust accelerator linkage
	• Intercooler clogged	Clean with compressed air
Engine misses in all running conditions	• Spark plugs defective	Replace using spark plugs of the prescribed type
	• High voltage wiring defective	Check electrical continuity
	• One or more electro-injectors faulty	Check using CO tester, removing the electro-injector connectors one at a time in order to identify the faulty one
	• Malfuction of rev sensor located in the distributor (Hall effect)	Replace distributor
	• Ignition and/or injection ECU defective	Replace ECU involved
Sudden loss of power	• Tachometer relay defective	Perform electricla check and, if necessary, replace
	• Occasional continuity in the ignition and fuel supply electrical wiring	Check electrical continuity
	• Great fluctuation of fuel pressure	Check pressure regulator, pumps and plant

Condition	Probable cause	Corrective action
Persistent engine knocking during acceleration	• Incorrect ignition timing	Check timing
	• Fuel octane value insufficient	Replace fuel in tank
	• Knock sensor inefficient	Replace knock sensor
	• Supercharging pressure excessive	Adjust waste-gate valve and check efficiency of supercharging pressure regulating valve
	• Ignition ECU defective	Replace ECU
Excessive fuel consumption	• Air filter clogged	Clean and, if necessary, replace
	• Fuel pressure too high	Check efficiency of pressure regulator
	• One or more electro-injectors defective	Check idling CO value: if it is high replace defective electro-injectors and repeat CO test
	• Fuel cutout switch badly adjusted or defective	Adjust or replace switch
	• Fuel supply ECU defective	Replace ECU
	• Air flow gauge inefficient	Replace gauge
Irregular engine running during warming up	• Water temperature sensor defective	Measure sensor resistance and replace if necessary
	• Fuel supply ECU and/or ignition ECU defective	Replace the ECU(s) involved

FUEL SUPPLY AND IGNITION SYSTEM — TROUBLESHOOTING

PRELIMINARY OPERATIONS

1. Turn off ignition.
2. Disconnect connector from ignition control unit (located on the right passenger compartment valance panel) and the connector from the fuel supply control unit (located under the floor pan on the right side of the passenger compartment).
3. Connect interface unit **C.1.0134** to the connectors of the wiring.

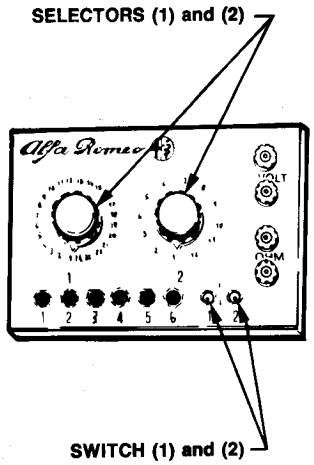


1. Injection ECU connector
2. Ignition ECU connector

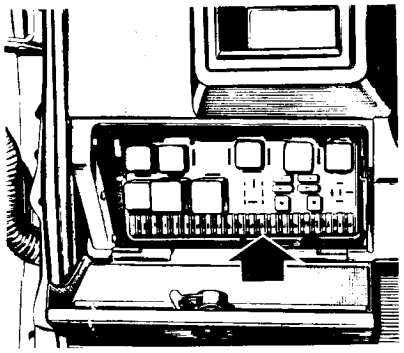
4. Connect interface unit **C.1.0134** to tester **C.1.0132** by means of cable **C.9.0032**.

INSTRUCTIONS FOR VOLTAGE MEASUREMENTS

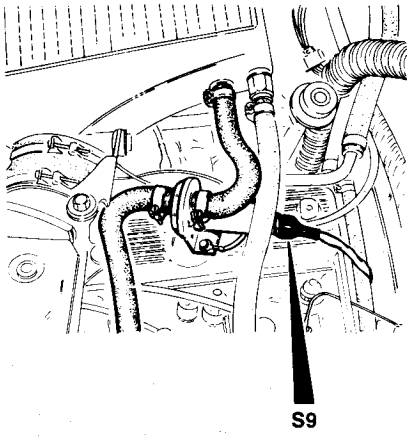
1. Set selectors (1) and (2) to position 1.
2. Set switch (1) to position 2.
3. Set switch (2) to position 1.



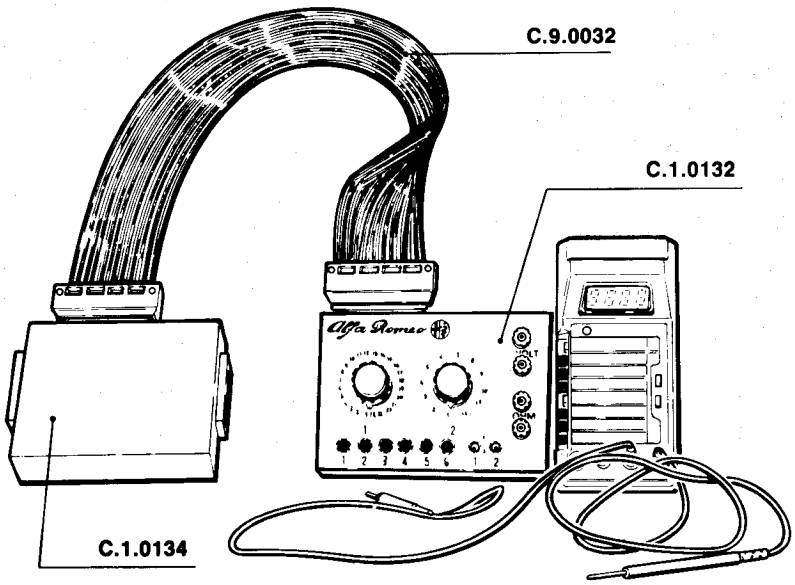
4. Apply a 200 mV FSR multimeter to the «VOLT» bushings of the tester.
5. Disconnect the pump fuse (position 13 from the left).



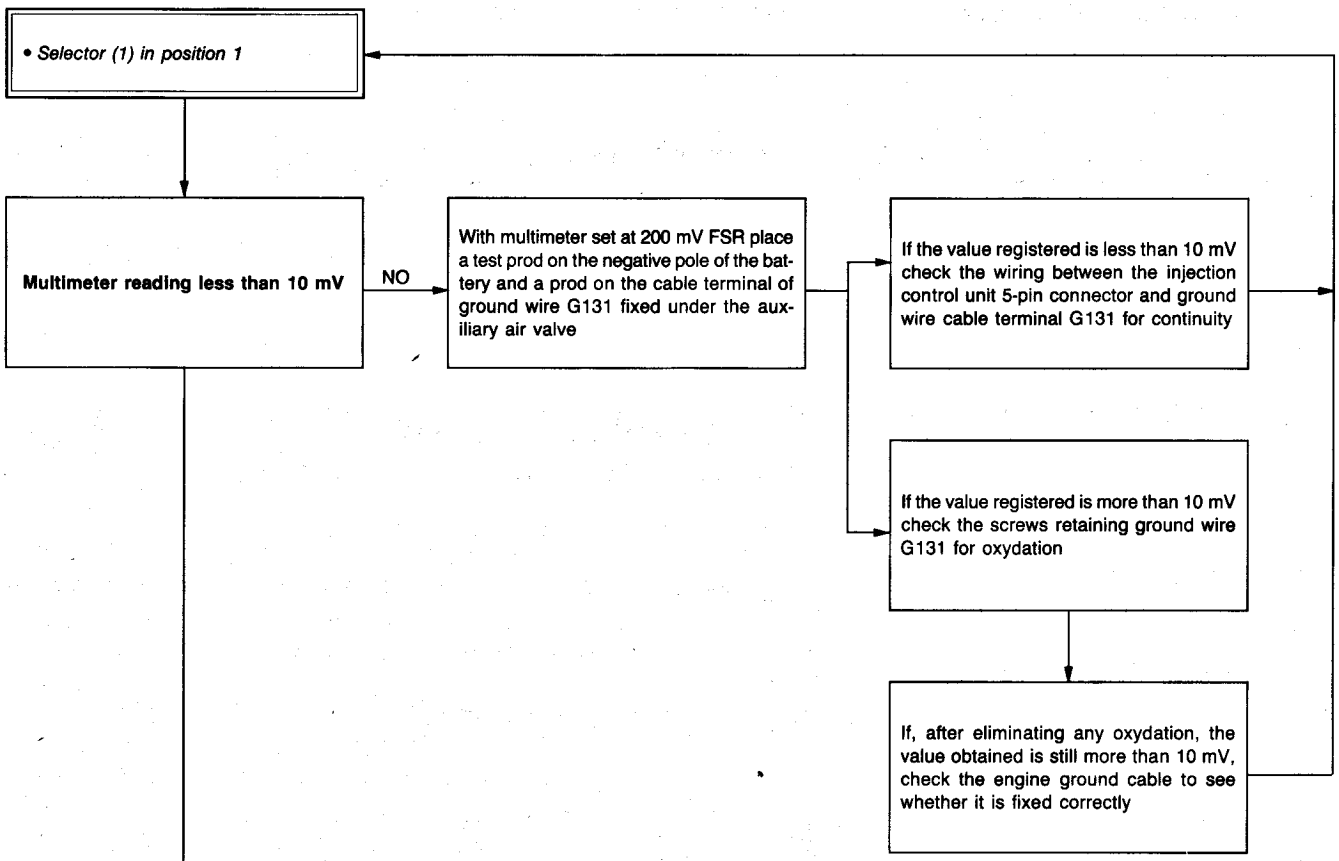
6. Disconnect the connector of the auxiliary air valve (S9).



7. Turn the key to «IGNITION ON» position.



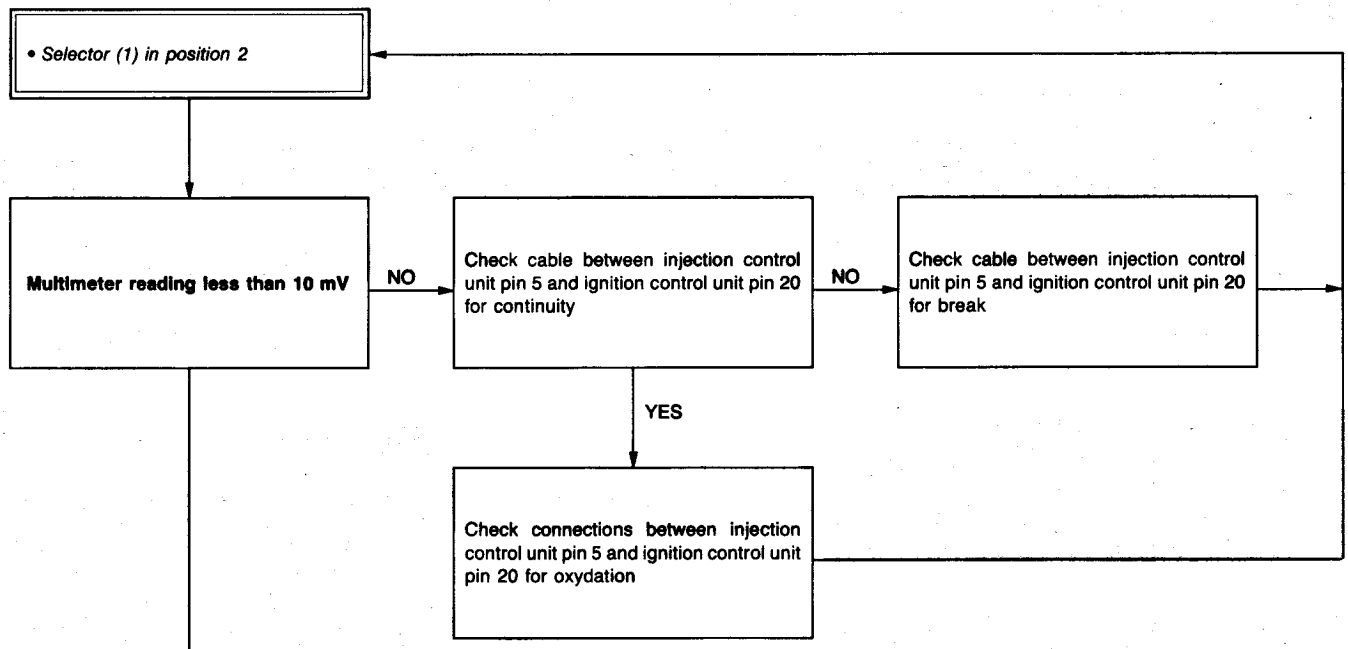
TEST No. 1 — CHECK OF INJECTION CONTROL UNIT 5-PIN CONNECTOR GROUND



TEST No. 2

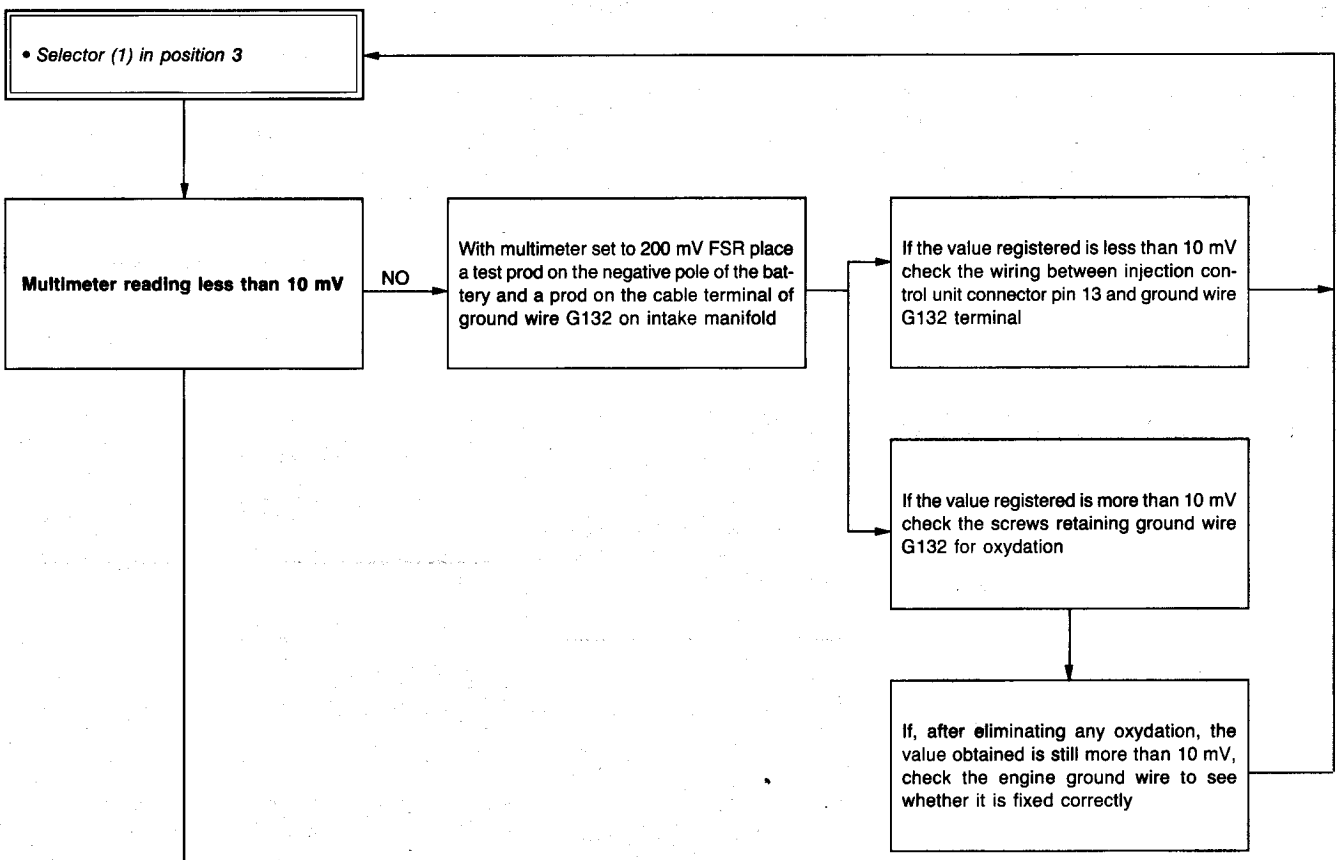
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 2 — CHECK OF IGNITION CONTROL UNIT 20-PIN CONNECTOR GROUND



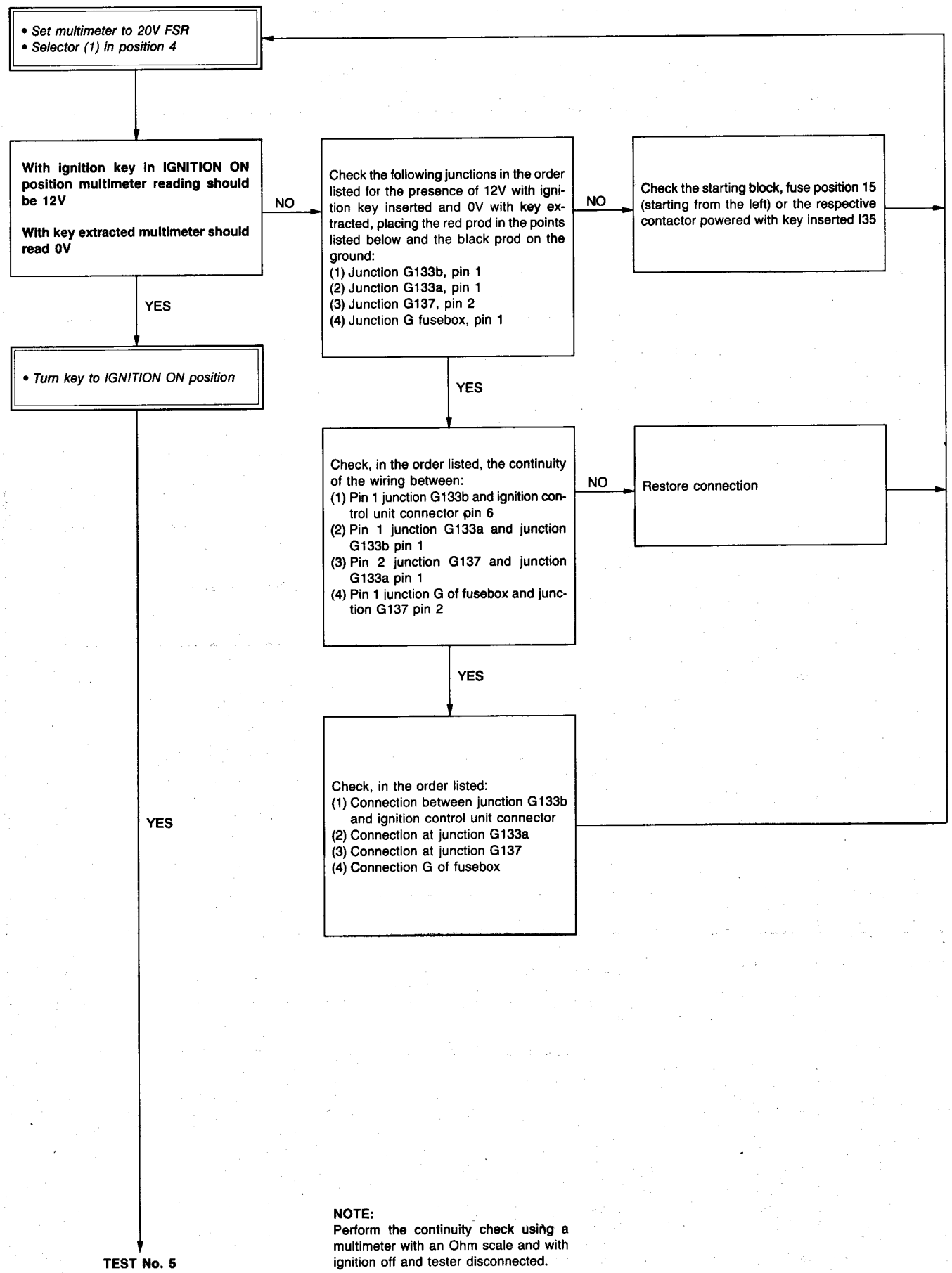
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 3 — CHECK OF INJECTION CONTROL UNIT 13-PIN CONNECTOR EARTH



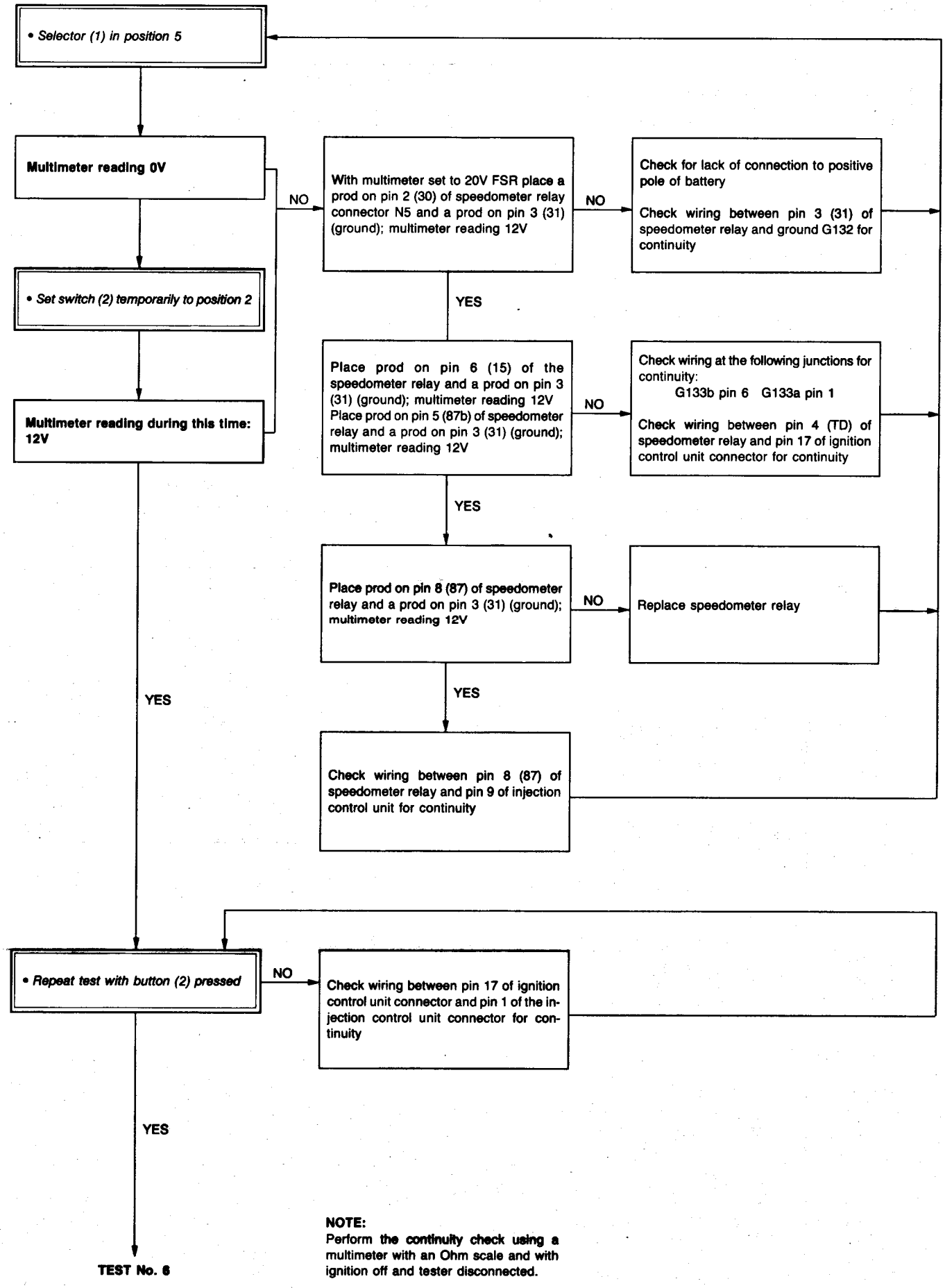
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 4 — CHECK OF +12V WITH KEY INSERTED ON PIN 6 OF IGNITION CONTROL UNIT SELECTOR



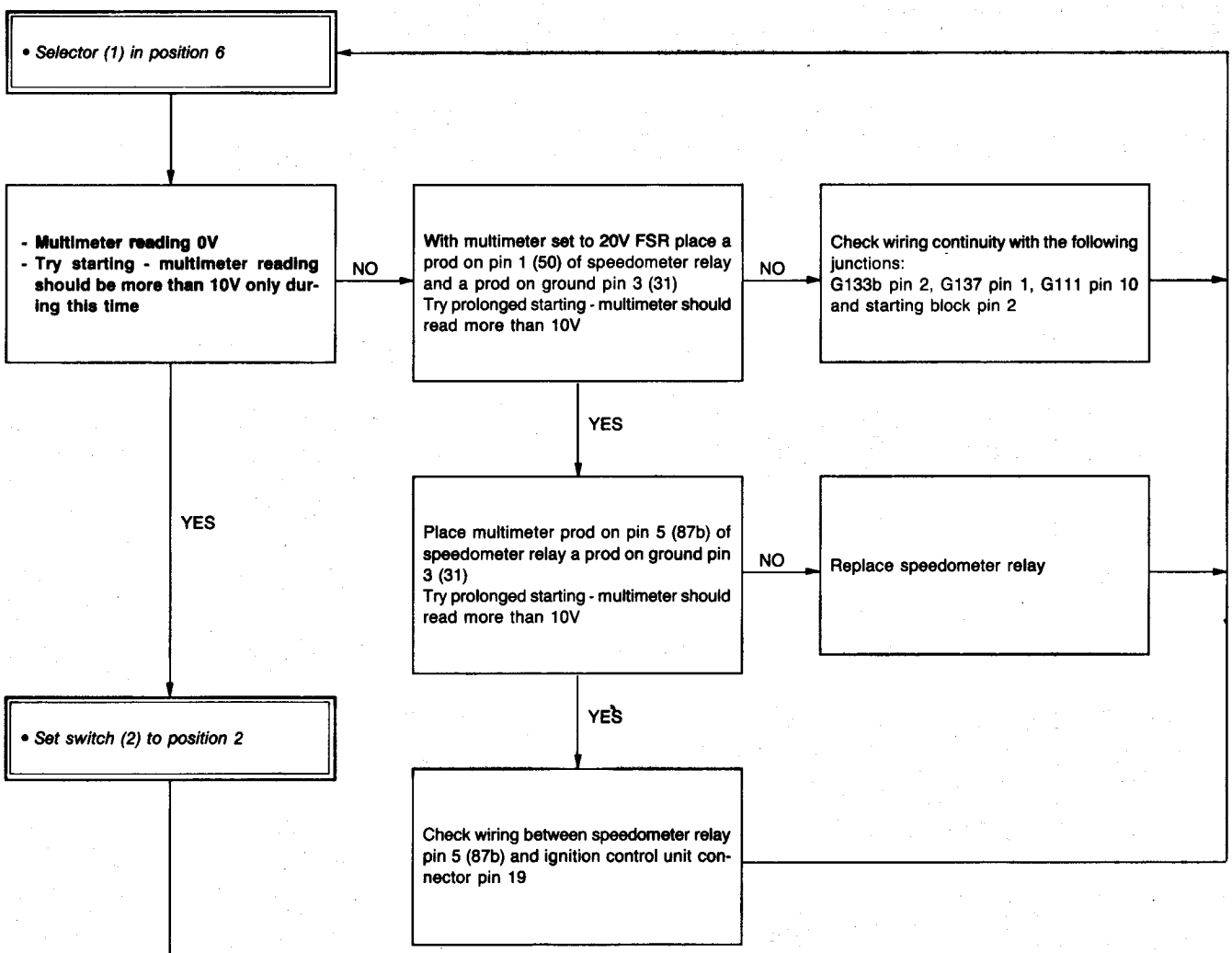
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 5 — CHECK OF SPEEDOMETER RELAY - PIN 9 OF INJECTION CONTROL UNIT CONNECTOR



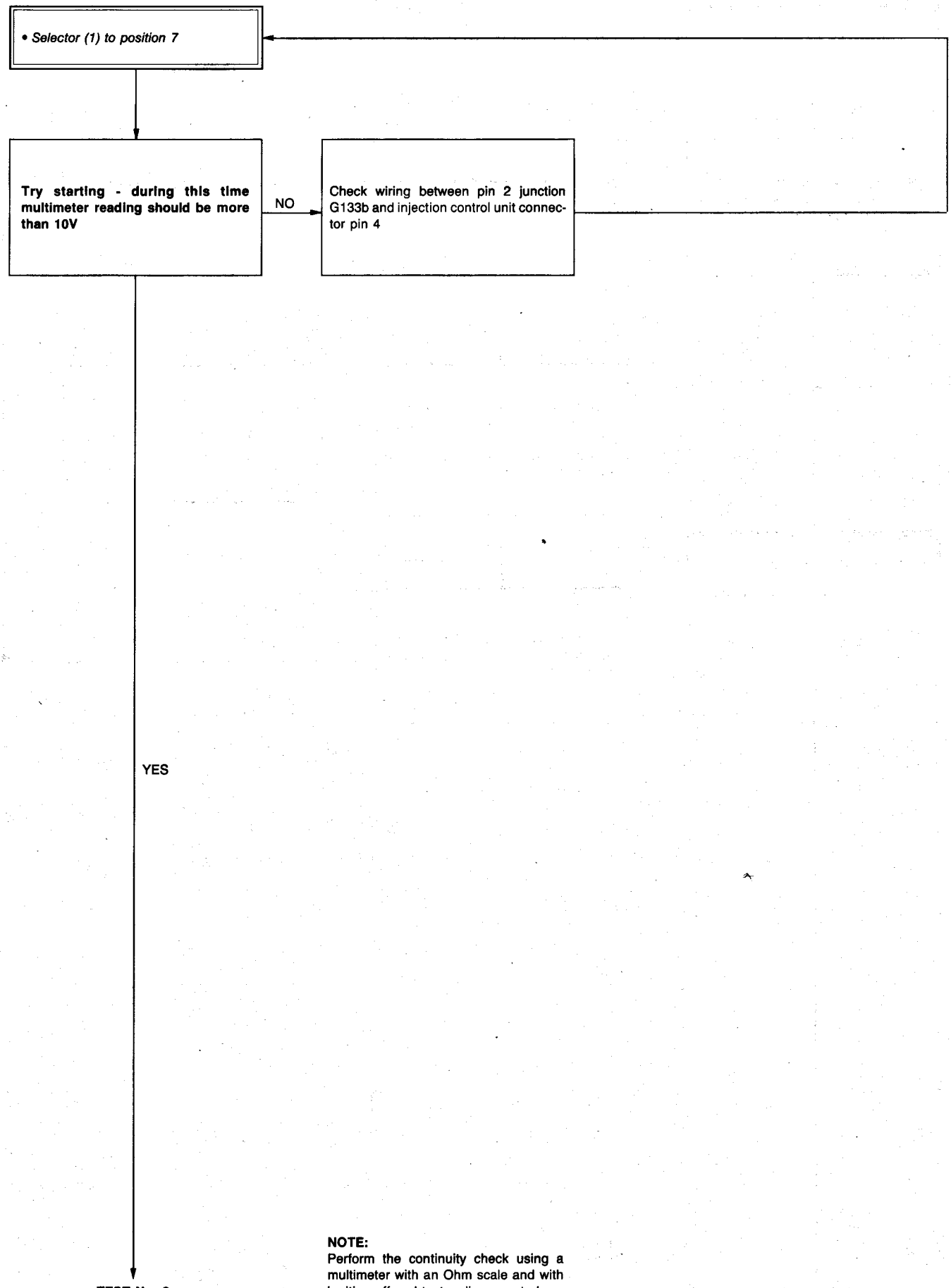
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 6 — CHECK OF SPEEDOMETER RELAY - PIN 19 OF IGNITION CONTROL UNIT



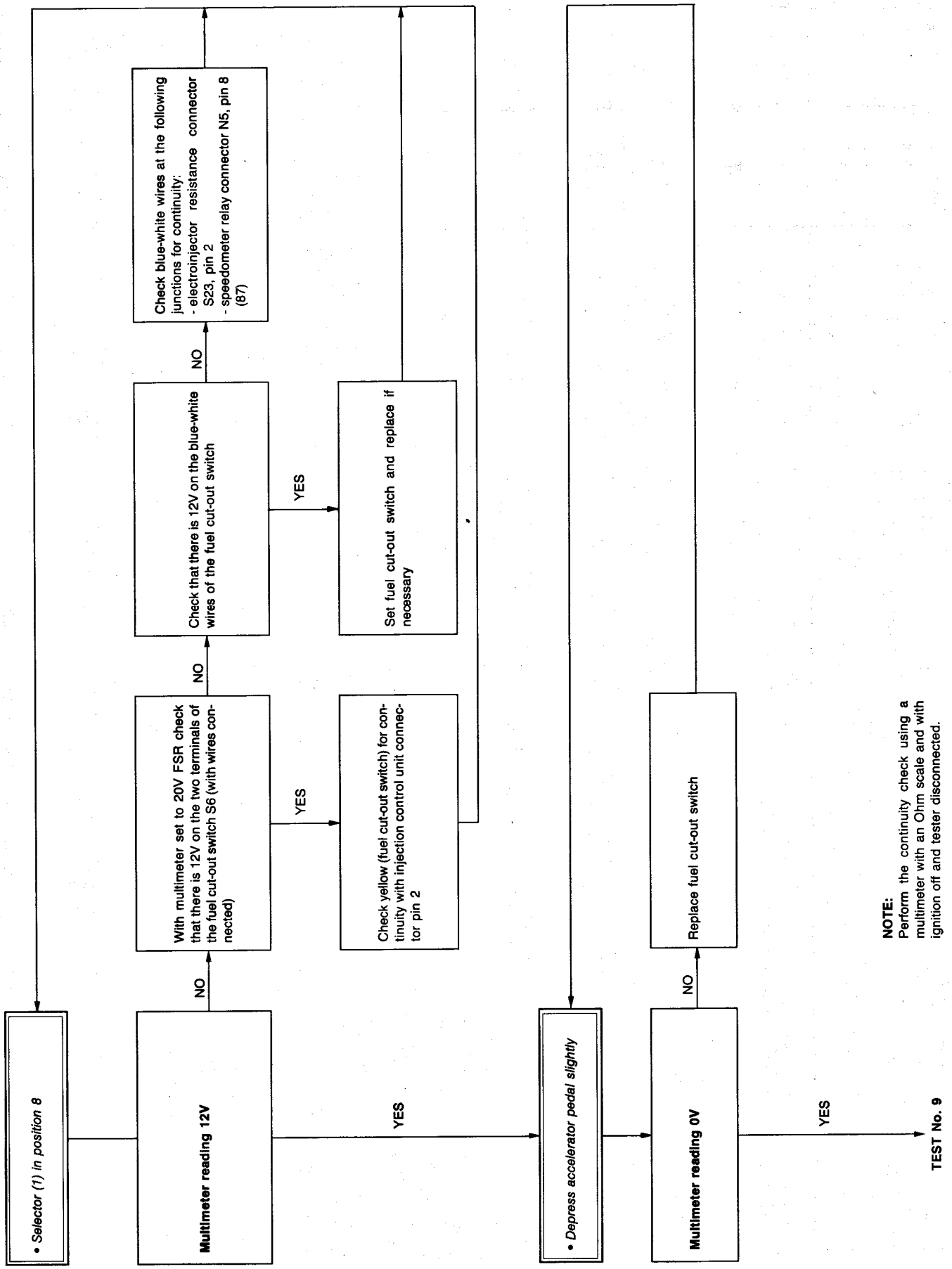
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 7 — STARTING SIGNAL TEST (50) ON PIN 4 OF INJECTION CONTROL UNIT CONNECTOR



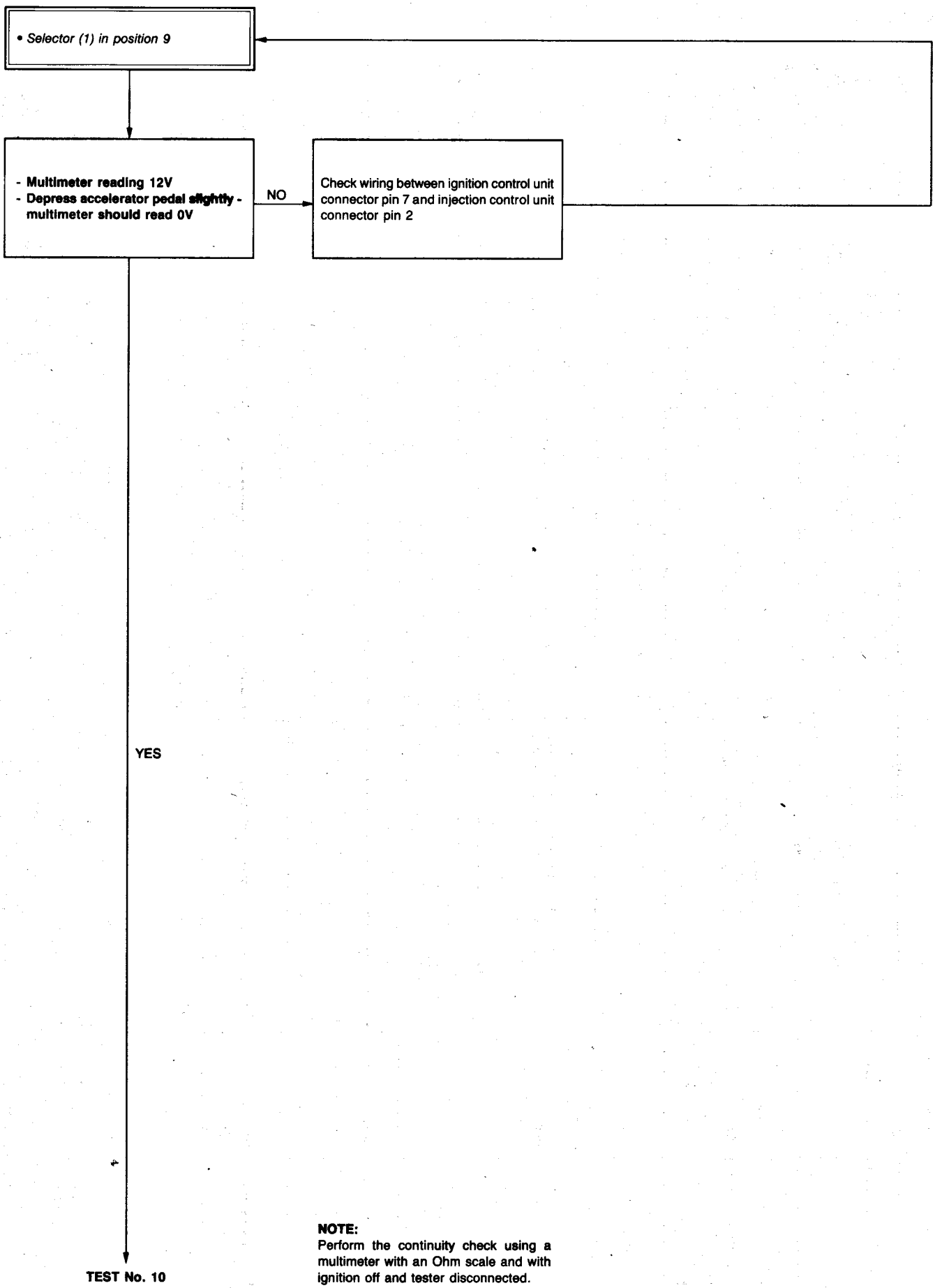
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 8 — FUEL CUT-OUT SWITCH TEST ON INJECTION CONTROL UNIT PIN 2



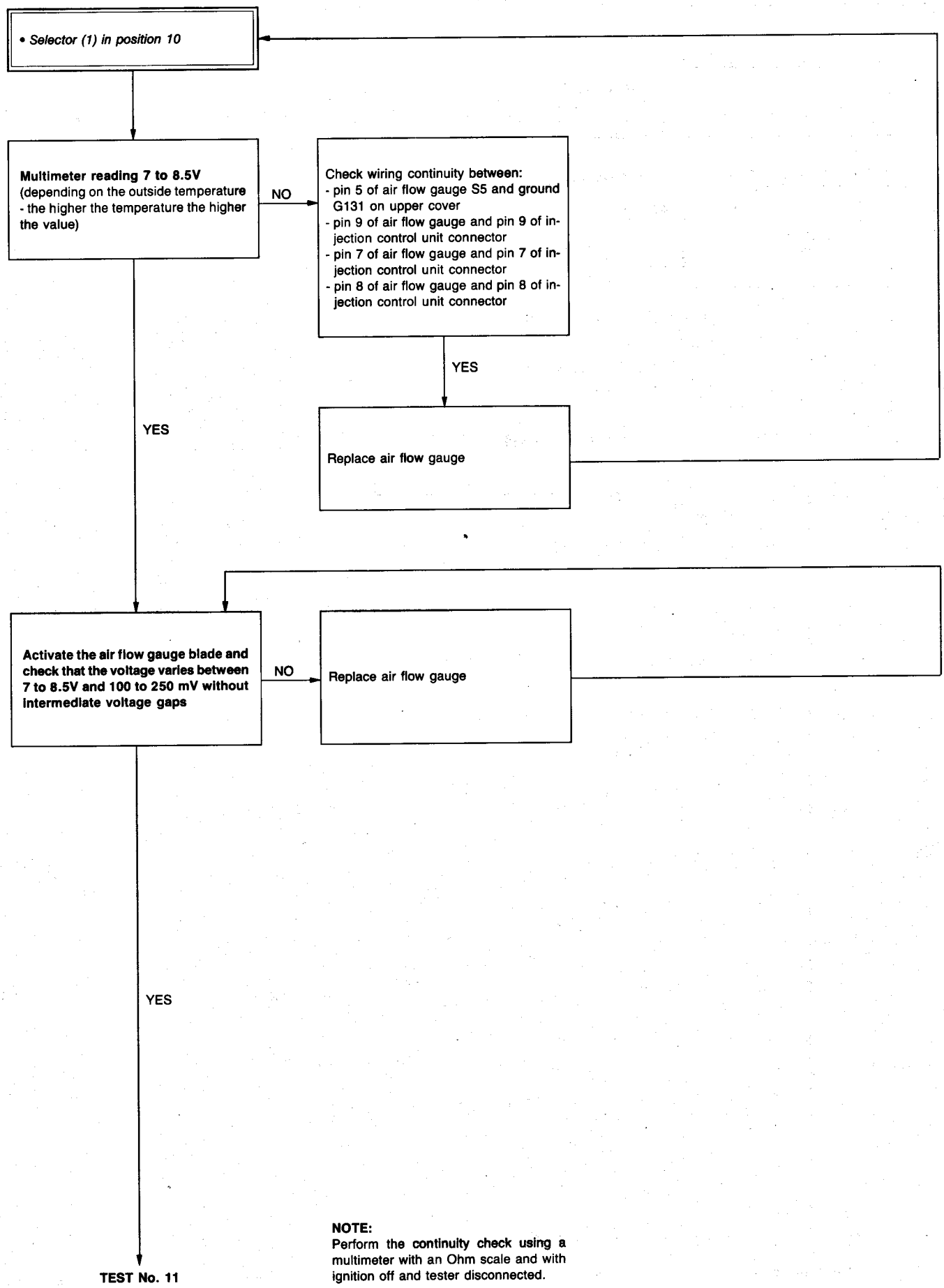
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 9 — FUEL CUT-OUT SWITCH TEST OF PIN 7 OF IGNITION CONTROL UNIT CONNECTOR



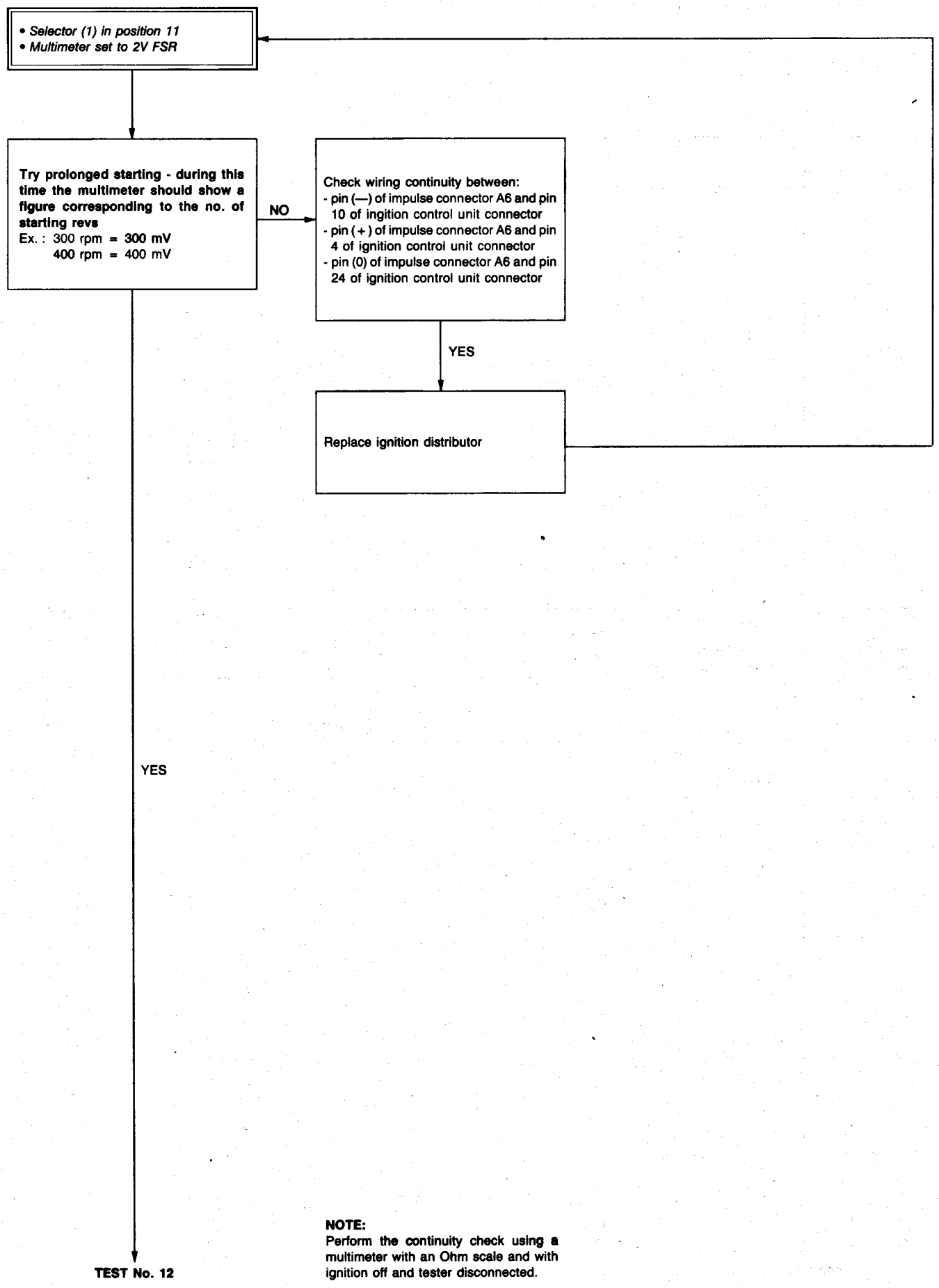
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 10 — AIR FLOW GAUGE TEST



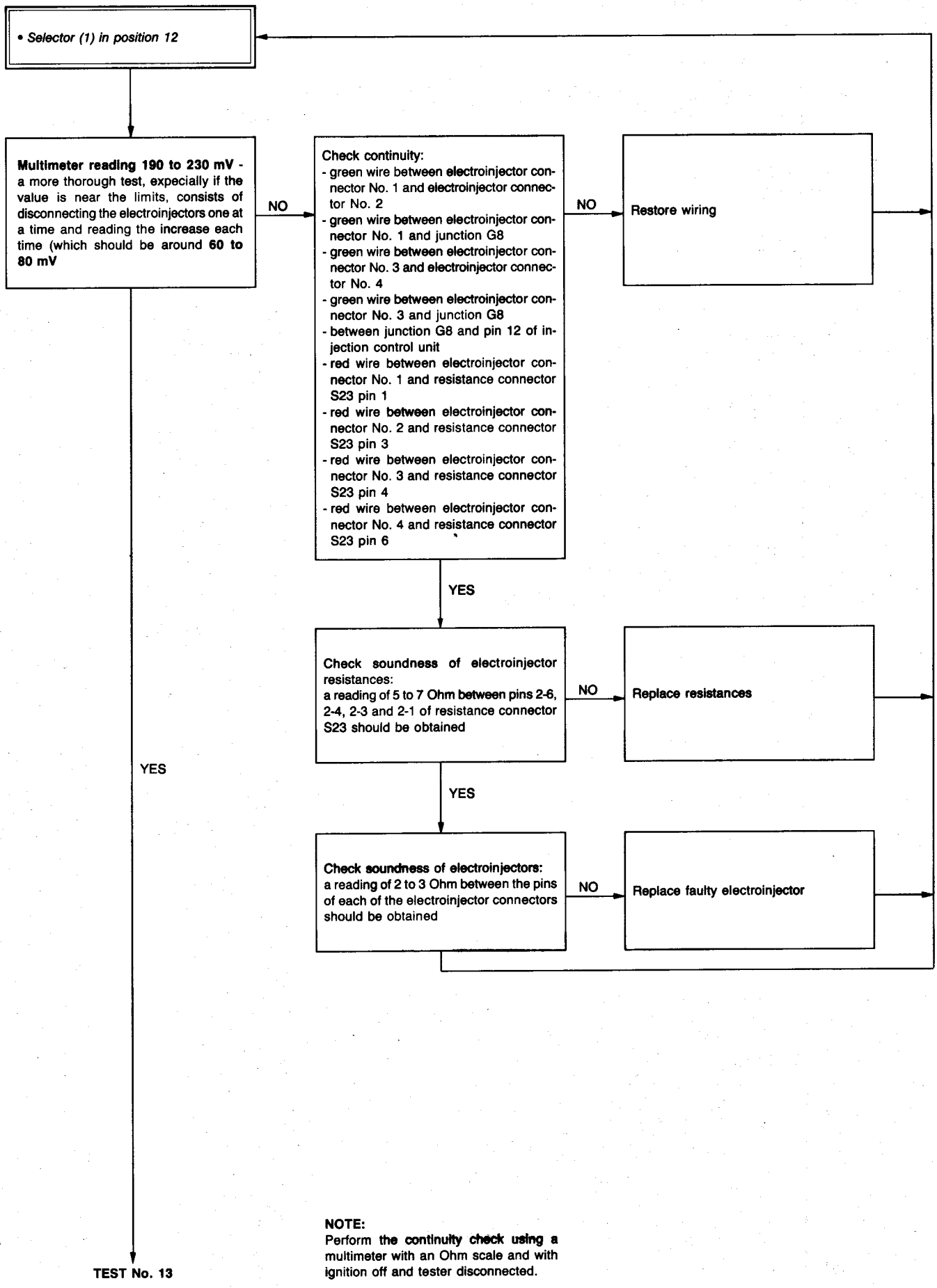
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 11 — HALL EFFECT SENSOR



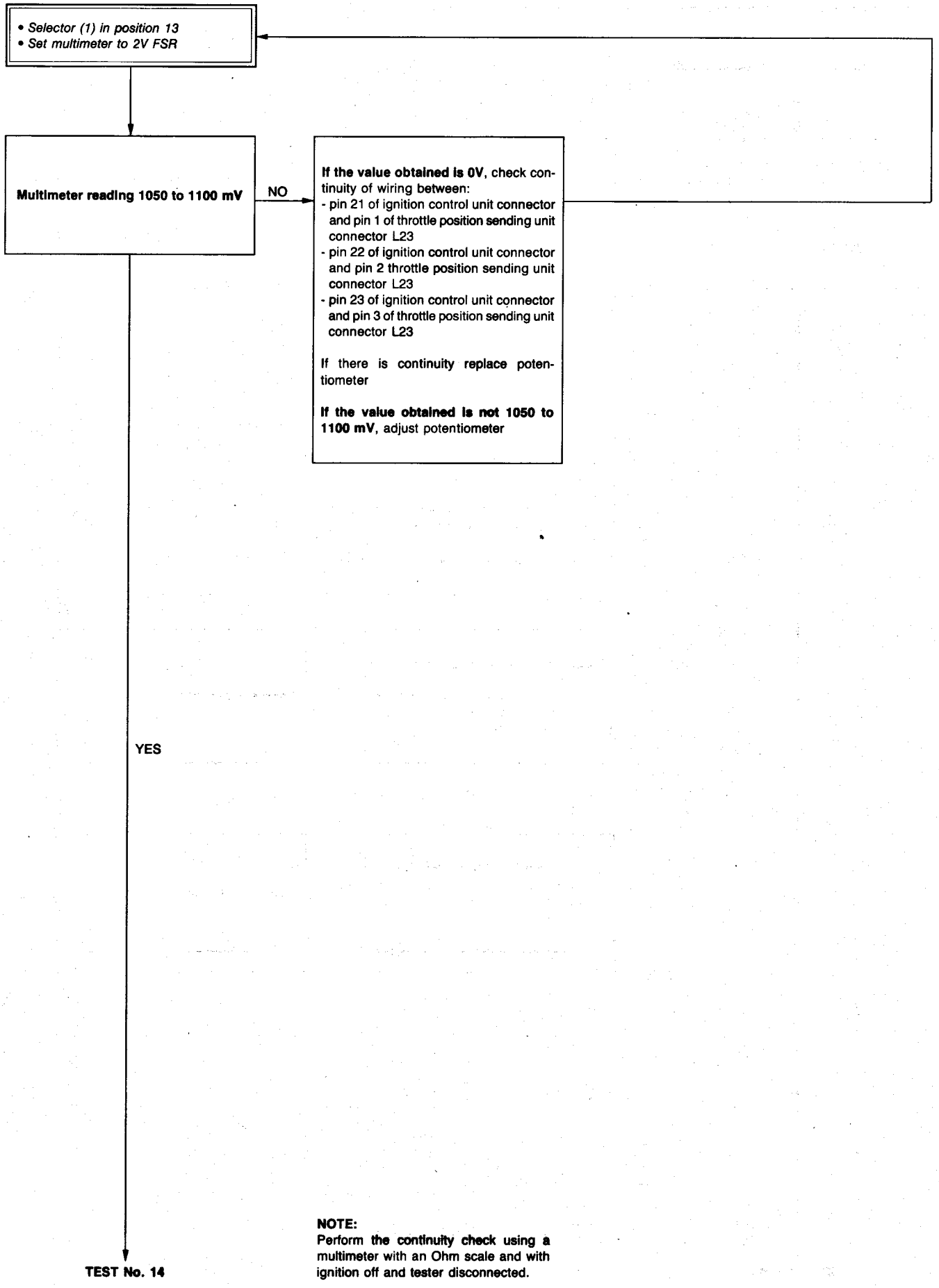
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 12 — ELECTROINJECTORS ELECTRICAL TEST



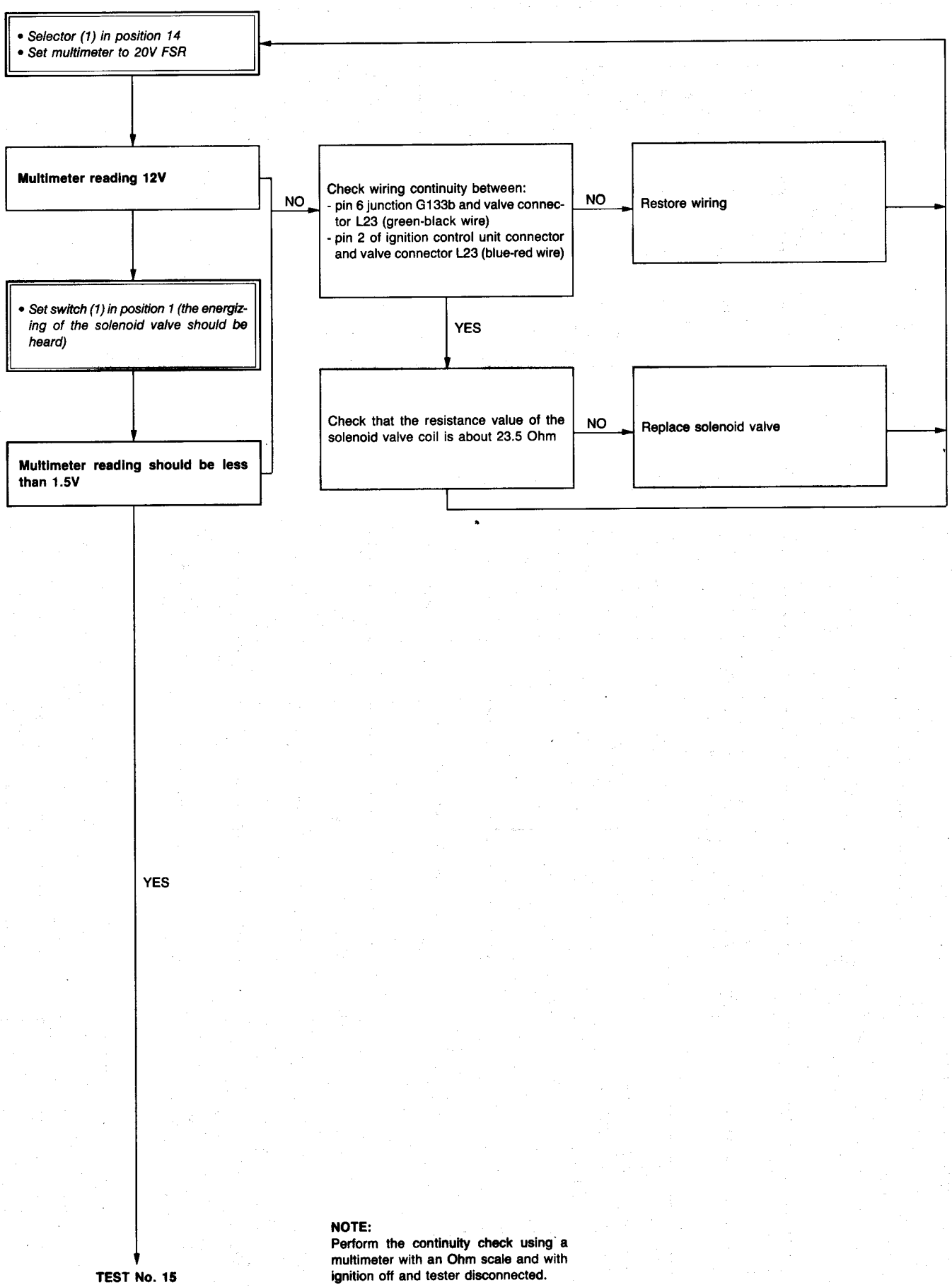
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 13 — THROTTLE POSITION SENDING UNIT TEST



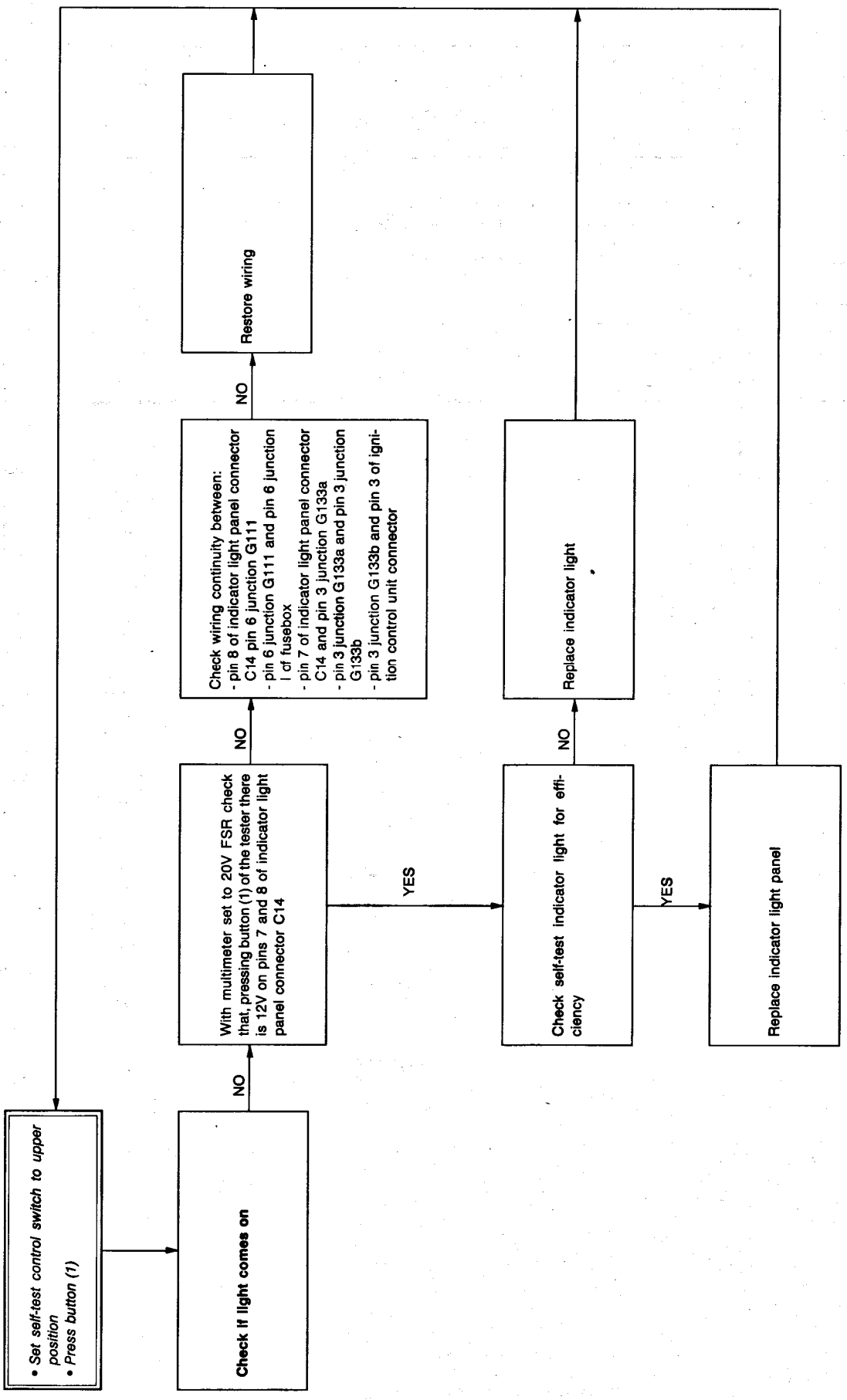
NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 14 — ELECTRICAL TEST OF SUPERCHARGING PRESSURE REGULATION SOLENOID VALVE



NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

TEST No. 15 — SELF-TEST EFFICIENCY TEST

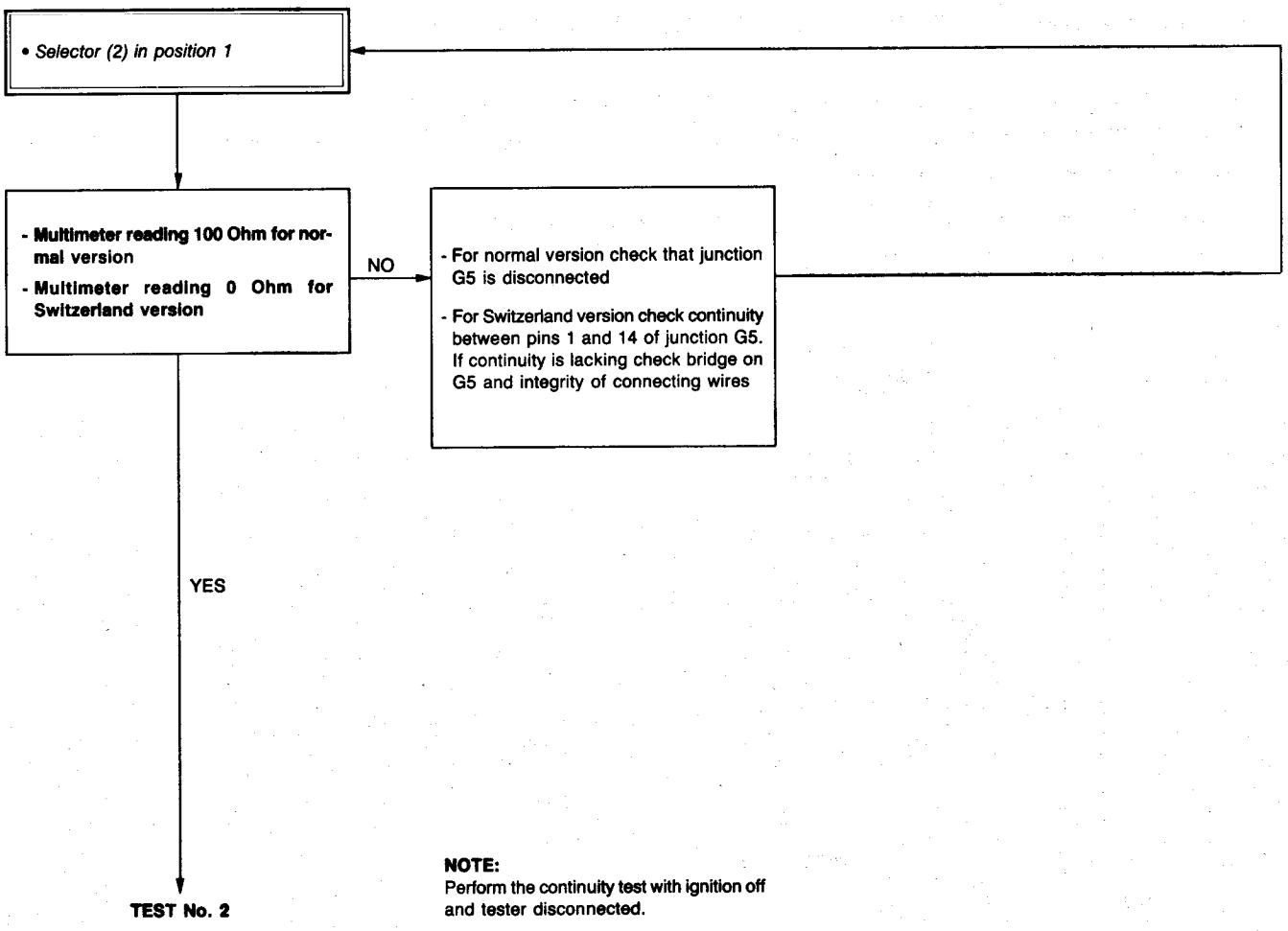


NOTE:
Perform the continuity check using a multimeter with an Ohm scale and with ignition off and tester disconnected.

INSTRUCTIONS FOR OHM MEASUREMENTS

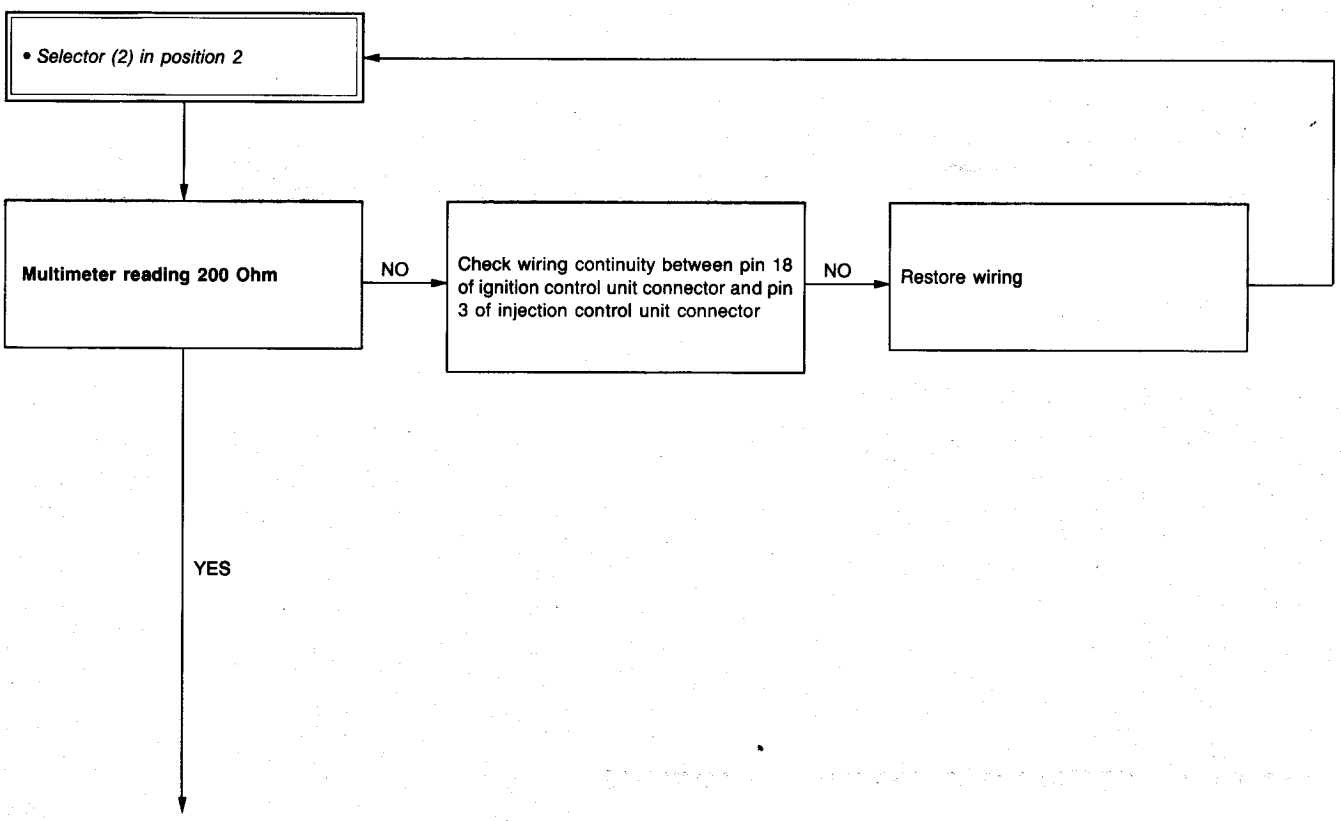
1. Set selectors (1) and (2) to position 1.
2. Set switch (1) to position 2.
3. Set switch (2) to position 1.
4. Apply a multimeter (2 kOhm FSR) to the «OHM» bushes of the tester.
5. Leave pump fuse disactivated.
6. Leave the auxiliary air valve connector disconnected.
7. Turn the ignition key to IGNITION ON position.

TEST No. 1 — SETTING TEST FOR VARIOUS MARKETS

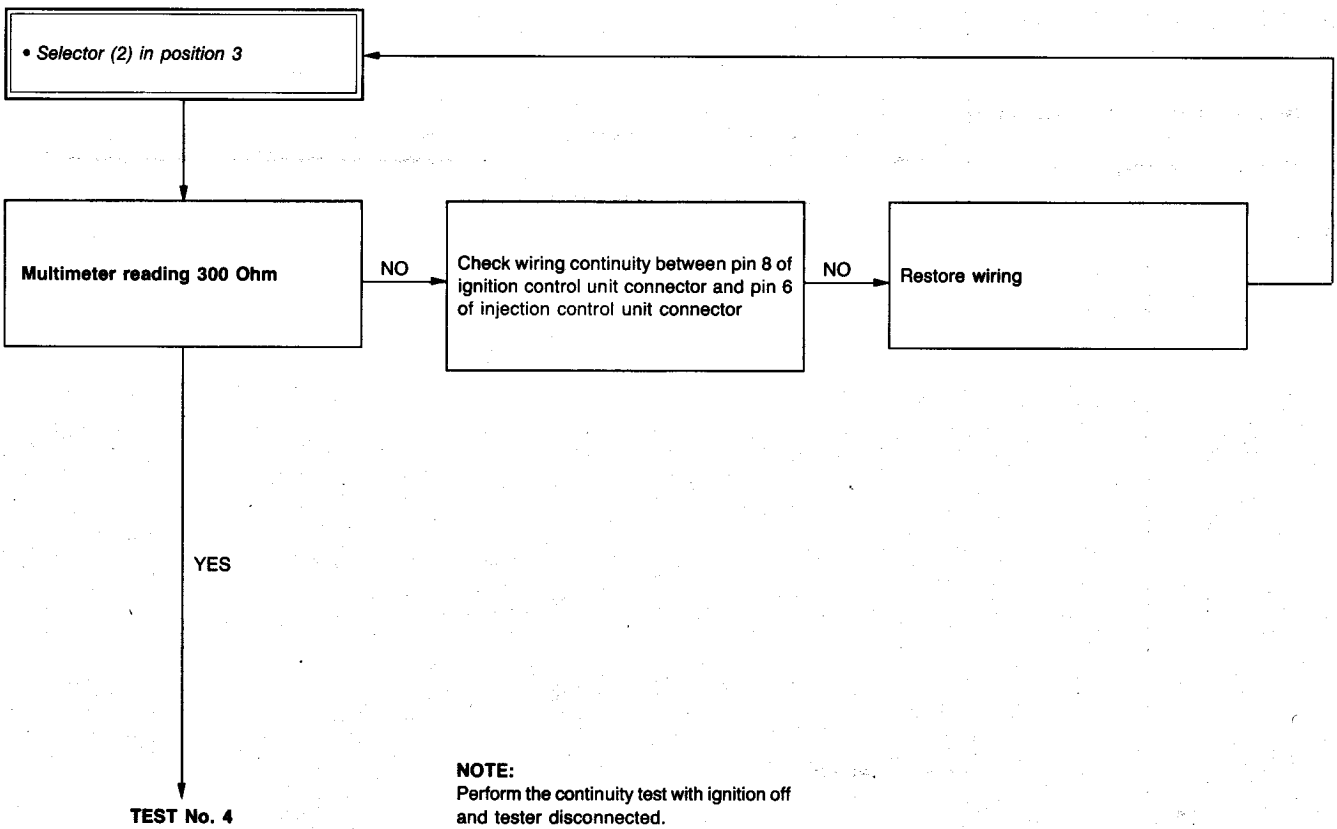


NOTE:
Perform the continuity test with ignition off and tester disconnected.

TEST No. 2 — CHECK OF CONNECTION BETWEEN PIN 18 OF IGNITION CONTROL UNIT CONNECTION AND PIN 3 OF INJECTION CONTROL UNIT



TEST No. 3 — CHECK OF CONNECTION BETWEEN PIN 8 OF IGNITION CONTROL UNIT CONNECTOR AND PIN 6 OF INJECTION CONTROL UNIT CONNECTOR

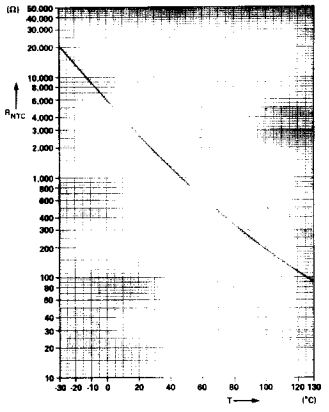


NOTE:
Perform the continuity test with ignition off and tester disconnected.

TEST No. 4 — WATER TEMPERATURE SENSOR TEST

- *Selector (2) in position 4*
- *Multimeter set to 20 kOhm FSR*

The multimeter resistance reading will depend on the engine temperature (see curve)



NO → Check wiring continuity between sensor connector S7 and pin 10 of injection control unit connector

NO → **Restore wiring**

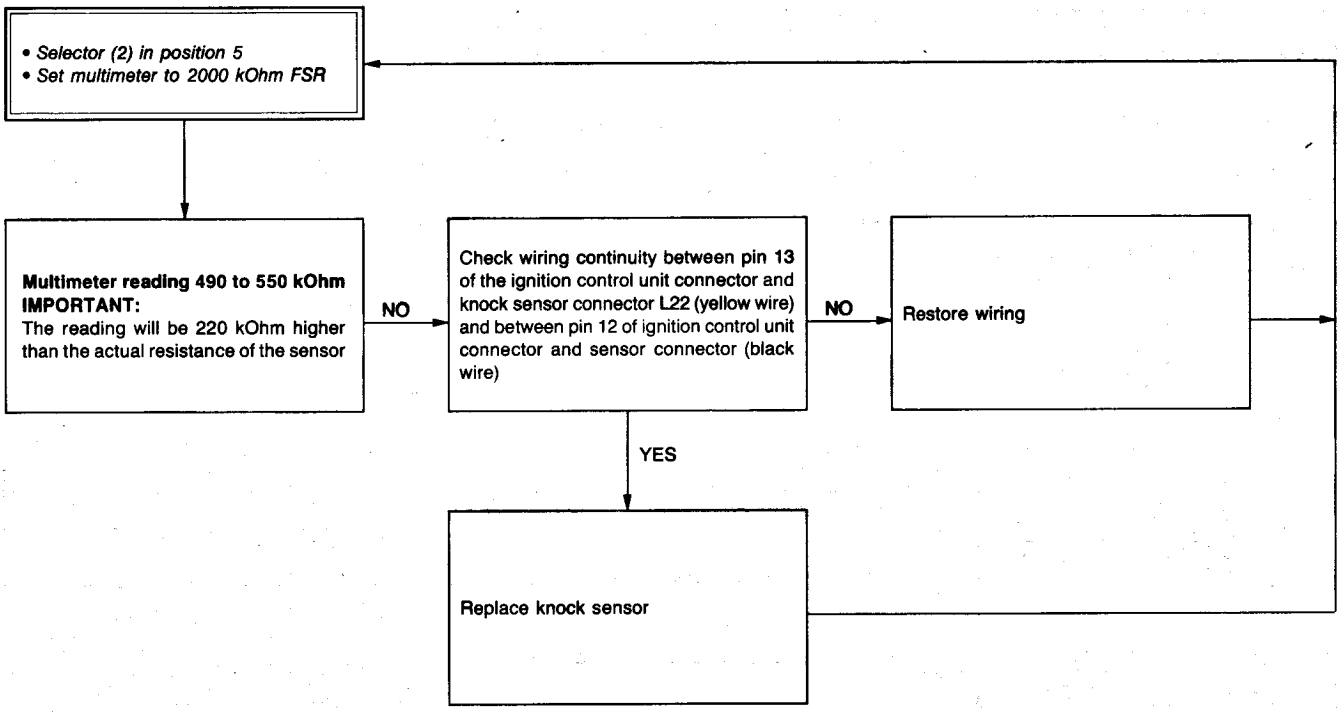
YES → Replace water temperature sensor

YES

TEST No. 5

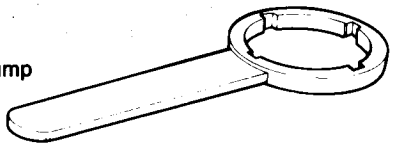
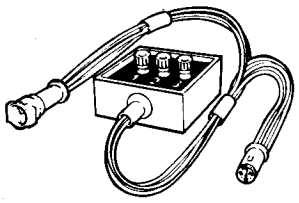
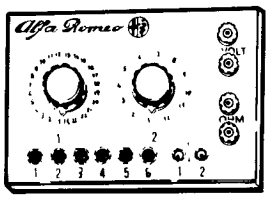
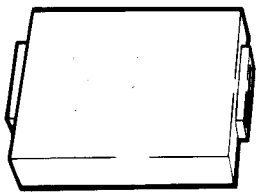
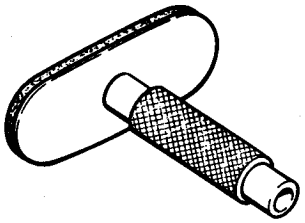
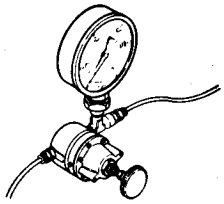
NOTE:
Perform the continuity test with ignition off and tester disconnected.

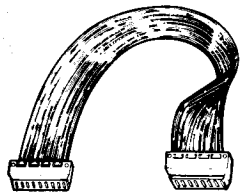
TEST No. 5 — KNOCK SENSOR TEST



NOTE:
Perform the continuity test with ignition off and tester disconnected.

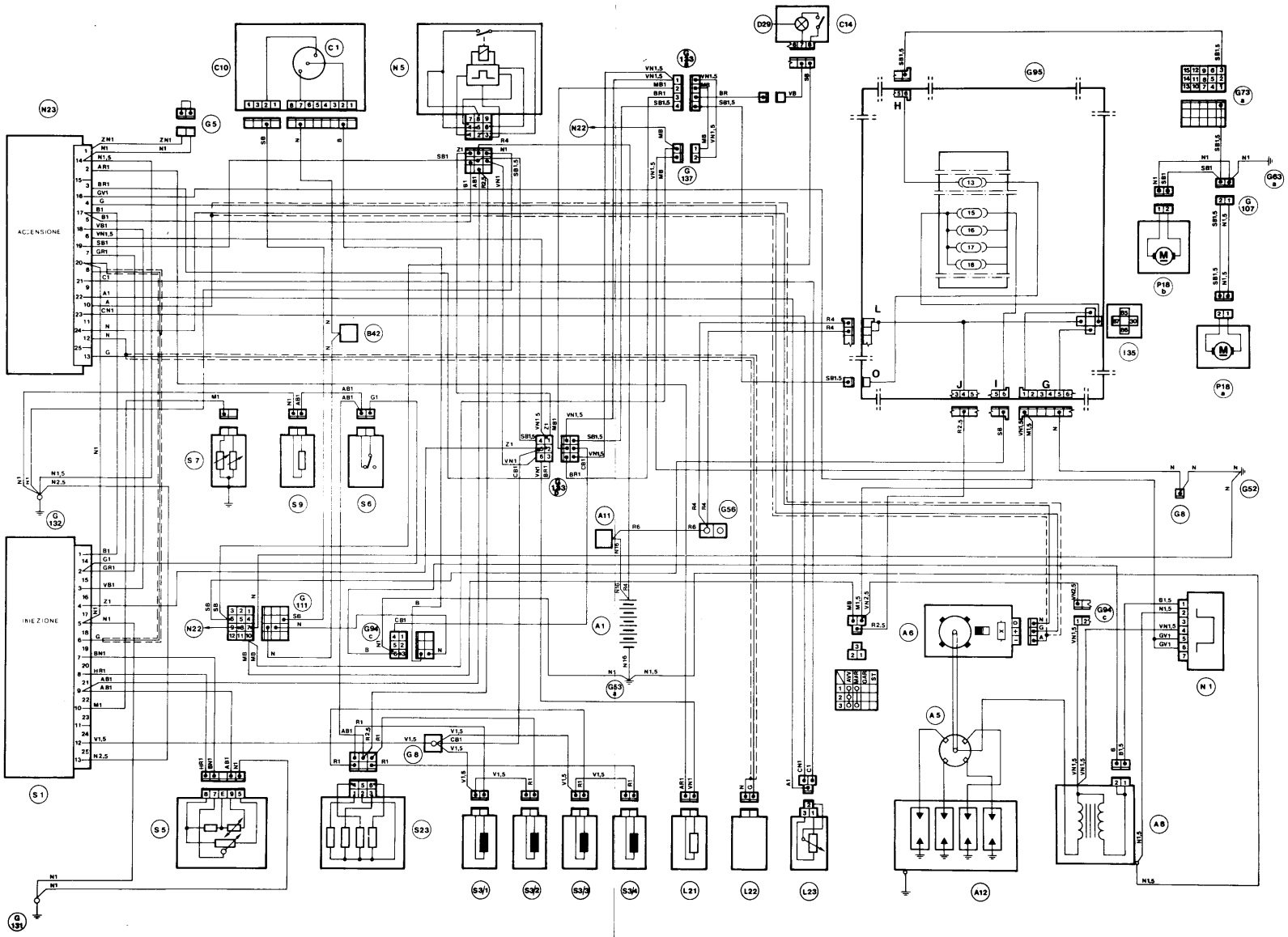
SPECIAL TOOLS

Code no.	Description	Page ref.
A.2.0444	Dial gauge securing tool 	04-70/24
A.5.0197	Spanner for lock nut securing auxiliary fuel pump 	04-70/17
C.1.0131	Device for setting throttle position sending unit 	04-70/22
C.1.0132	Multimeter 	04-70/35 04-70/41
C.1.0134	Interface 	04-70/22 04-70/35 04-70/41
C.2.0055	Tap for throttle body flowmeter 	04-70/21
C.2.0126	Pressure gauge 0 to 0.6 bar 	04-70/24

Code no.	Description	Page ref.
C.9.0032	Cable connecting interface to multimeter 	04-70/35 04-70/41

INJECTION (LE2 JETRONIC) AND IGNITION (EZ 201K TURBO) WIRING DIAGRAM

A1	Battery
A5	Ignition distributor
A6	Impulse generator
A8	Ignition coil
A11	Starter motor
A12	Spark plugs
B42	Lamp dimmer rheostat
C1	Electronic rev-counter
C10	Cluster
C14	Warning lamp panel
D29	Ignition diagnosis warning lamp
G5	Multiple connector
G8	Single connector
G52	Fusebox ground
G53a	Engine compartment ground - right side
G56	Branch terminal board
G63a	Rear right ground
G73a	Connector for right rear services
G94c	Engine compartment connector - right side
G95	Central fusebox
G107	Connector for fuel pump
G111	Connector for dashboard instruments wiring
G131	Ground on upper cover
G132	Ground on manifold
G133a	Electronic injection-ignition wiring connection
G133b	Electronic injection-ignition wiring connection
G137	(Electronic) supply-injection wiring connection
I35	Key-operated supply relay
L21	Solenoid valve regulating the supercharging pressure
L22	Knocking sensor
L23	Potentiometer
N1	Electronic ignition module
N5	Tachymetric switch device
N22	ALFA ROMEO Control control unit
N23	Ignition control unit
P18a	Fuel electric pump
P18b	Auxiliary fuel electric pump
S1	Injection control unit
S3/1	Electroinjector No. 1
S3/2	Electroinjector No. 2
S3/3	Electroinjector No. 3
S3/4	Electroinjector No. 4
S5	Air flow gauge
S6	Throttle switch
S7	Engine coolant temperature sensor
S9	Auxiliary air valve
S23	Electroinjector resistor



DESCRIPTION

6 cylinders Alfa 90 2.5 iniezione

6 cylinders Alfa 75 2.5 6V iniezione

6 cylinders GTV 6 2.5

GENERAL DESCRIPTION

The L-JETRONIC electronic system is composed of an indirect-intermittent fuel injection, fitted with a control unit.
Ignition occurs through an electronic injection system fitted with an electronic power module.
The parameters required to actuate the various controls are picked up by suitable sensors and changed into electric signals.
Parameters are as follows:

- battery voltage
- accelerator throttle position signal (fully open/closed)
- engine coolant temperature
- quantity of air sucked by engine
- starter operation signal
- engine rev number (from distributor).

The electronic control unit (ECU) collects the data and calculates the opening time of injectors, in relation to the instantaneous r.p.m. and load conditions of engine.
After calculating, the control unit provides to open the electroinjectors for the period required.
Since the difference between fuel pressure and air pressure in the manifold is kept constant by a regulator, the amount of fuel injected is proportional to the period of delivery time.
In addition, the injection control unit is capable of executing, each time, the most suitable operations according to engine requirements (i.e., cold start electroinjector fuel delivery cut off during deceleration).

L-JETRONIC INJECTION SYSTEM

The system, composed of an air supply system and a fuel supply system, includes:

- a main pump and an auxiliary pump (Alfa 90 and Alfa 75 only) submerged in the tank, with relative filters for fuel delivery;
- Alfa 90 and Alfa 75 : a dashpot, provided to eliminate pulsation due to pressure surging;
- one pressure regulator; it keeps the pressure between fuel system and intake manifold constant;
- six electroinjectors which, tanks to regulator, provide to inject a fuel amount in relation to their opening period;
- one electroinjector for cold starting, it injects a very fine spray of fuel, controlled by a timed thermal switch;
- one air flow gauge; it measure the quantity of air sucked by engine (regulated in relation to air temperature), fitted with an idle r.p.m. CO regulator;
- one auxiliary air solenoid valve; it supplies auxiliary air when engine is cold;
- one device for the idle r.p.m. adjustment;
- one switch on the accelerator throttle which senses the two position of throttle (i.e. fully open/closed);
- one sensor for the engine coolant temperature;
- one sensor for rotation speed;
- piping and wiring; this last including control relays and control unit.
- **(For Switzerland, Sweden and Australia versions only)** a vacuum regulating valve which is activated when the accelerator is released if there is a greater vacuum than prescribed in the suction tank.

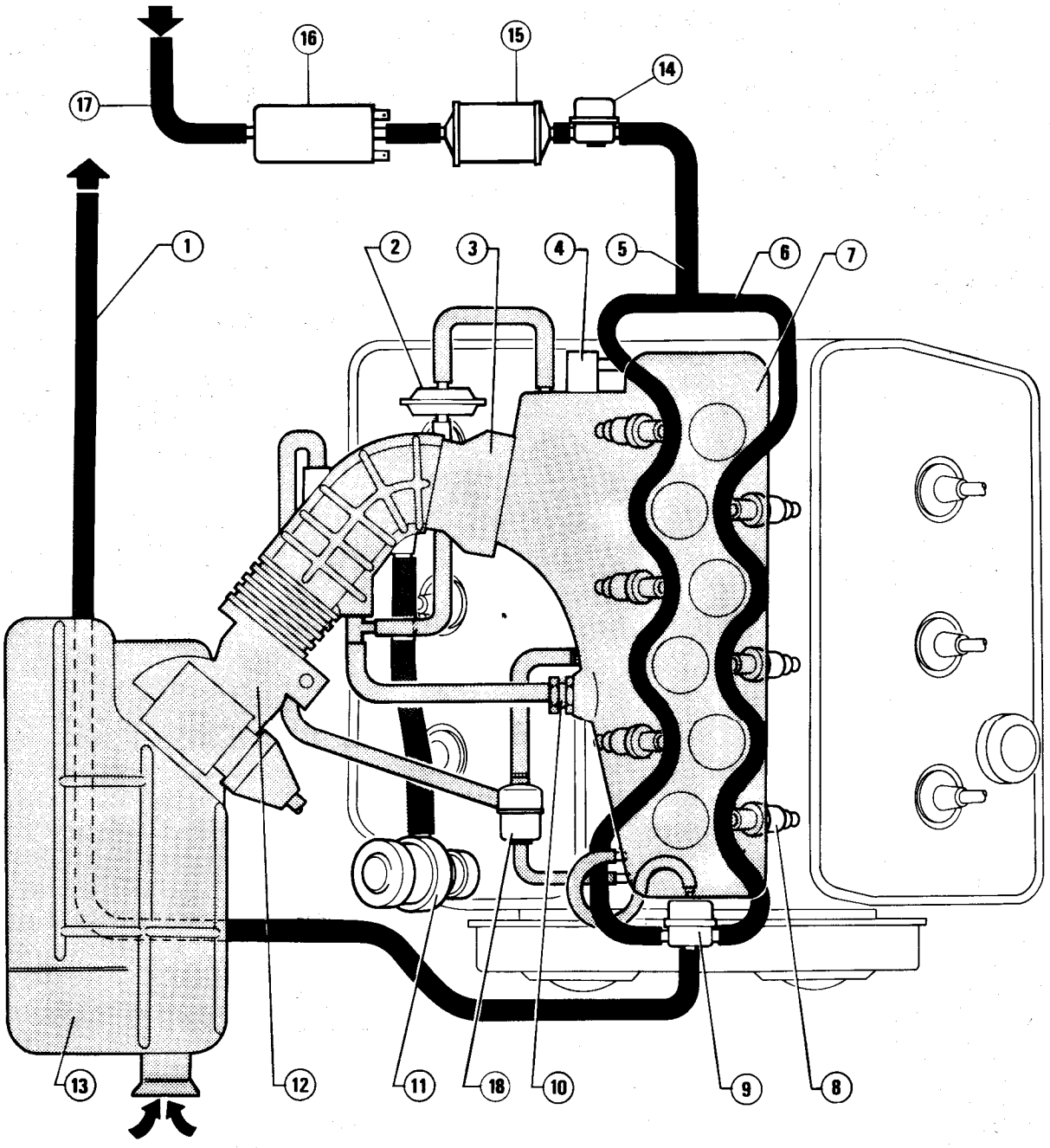
IGNITION SYSTEM

This system is composed of:

- one electronic power module integrated with the coil for the generation of the high voltage discharge
- one high voltage distributor which sends current to spark plugs
- six ignition spark plugs
- high/low voltage wiring

L-JETRONIC FUEL SUPPLY DIAGRAM

(For Switzerland, Sweden, Australia)

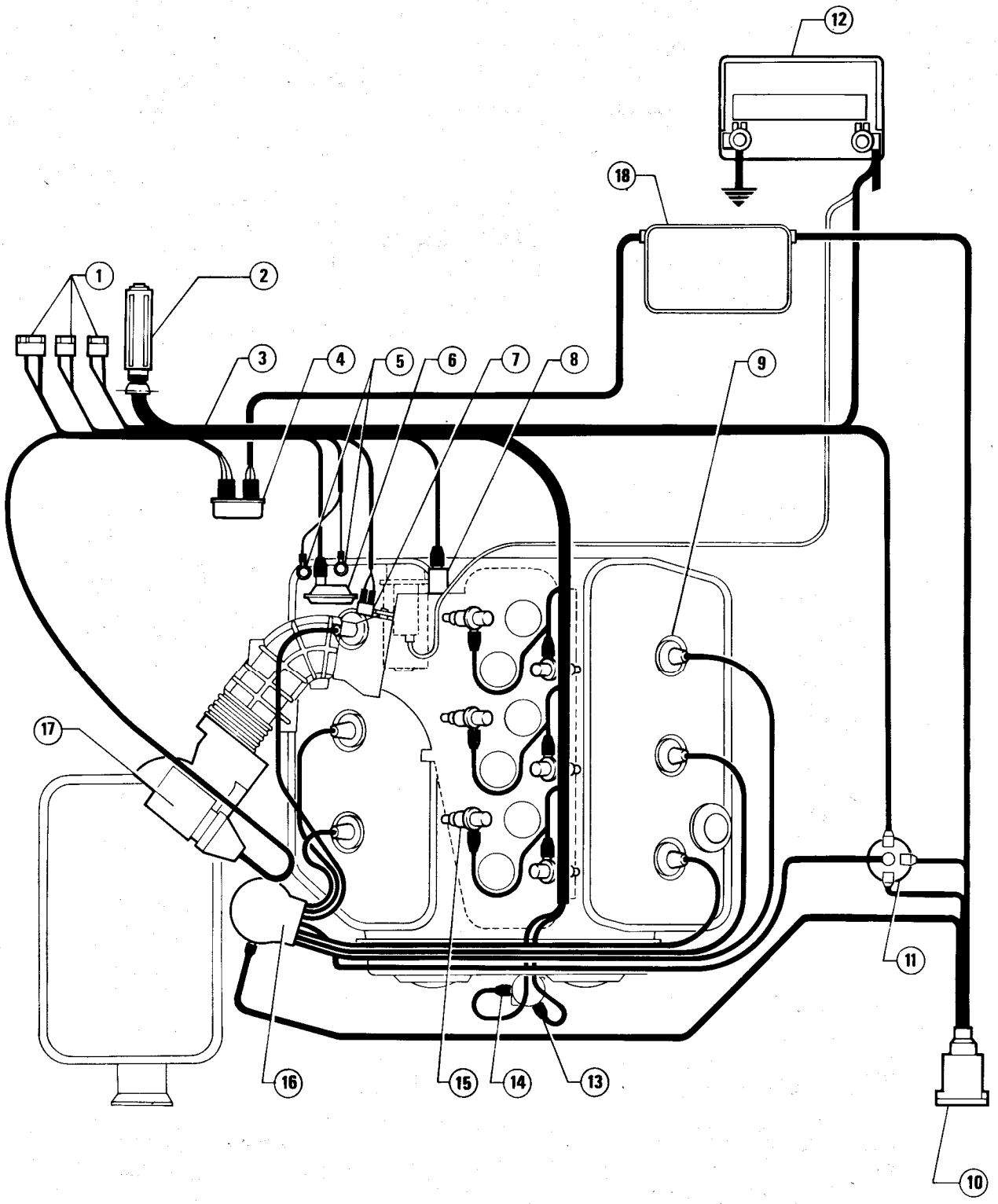


Fuel supply
Oil vapour return
Air supply

1. Fuel return piping
2. Auxiliary air solenoid valve
3. Throttle body
4. Cold starting electroinjector
5. Fuel delivery piping
6. Fuel system manifold
7. Intake air box
8. Electroinjector
9. Pressure regulator
10. Idle r.p.m. adjusting device
11. Oil vapour sedimenter
12. Air flow gauge
13. Air filter
14. Dashpot (Alfa 90 and Alfa 75)
15. Fuel filter
16. Fuel pump
17. Fuel delivery line
18. Vacuum regulating valve

WIRING AND MAIN COMPONENTS OF L-JETRONIC SYSTEM

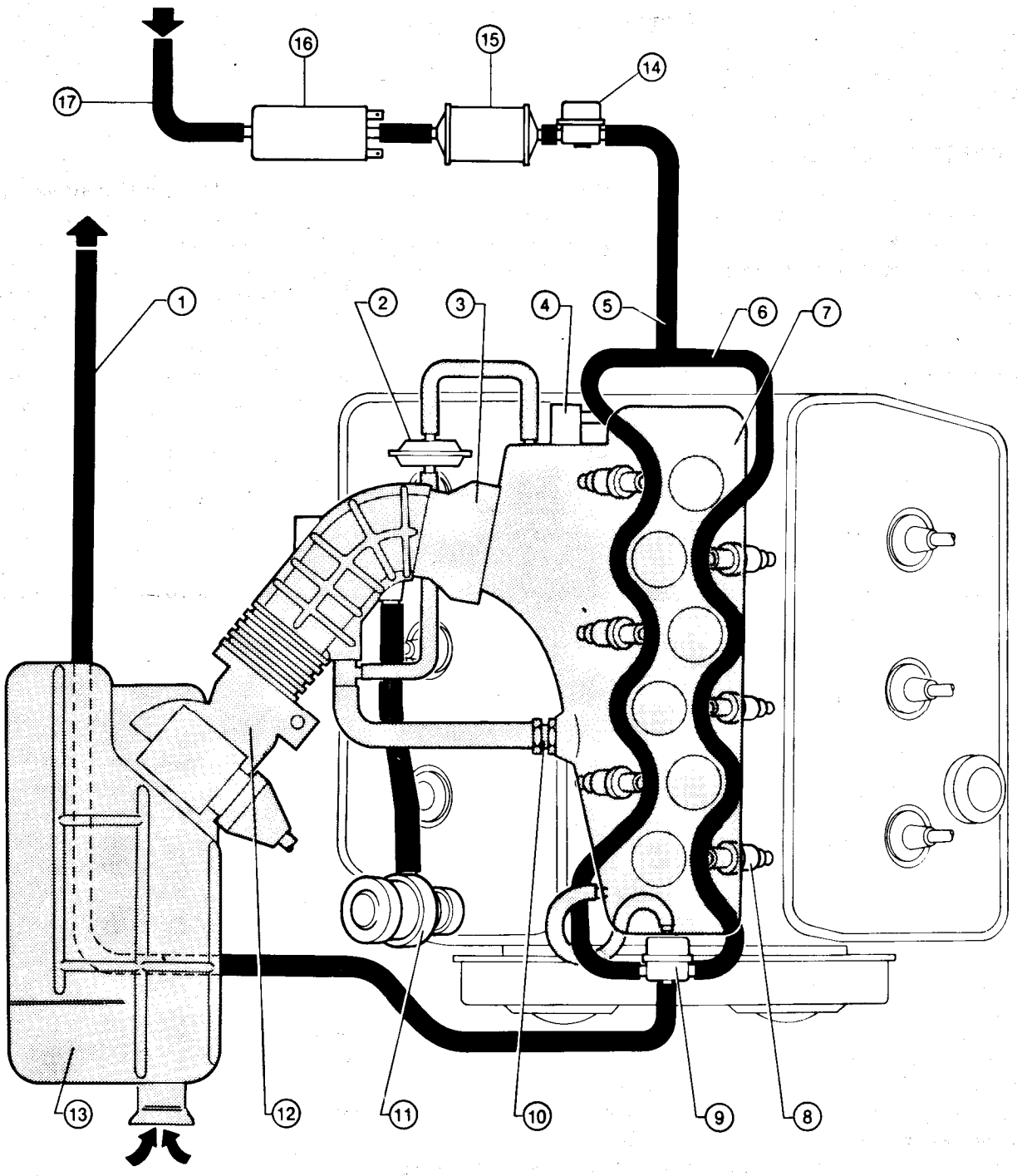
GTV 6 2.5



1. Vehicle wiring connectors
2. Electronic control unit
3. L-Jetronic wiring
4. Double relay
5. Ground terminals (common)
6. Auxiliary air solenoid valve
7. Accelerator throttle switch
8. Cold starting electroinjector
9. Spark plug
10. Electronic power module
11. Ignition coil
12. Battery
13. Engine coolant temperature sensor
14. Thermo-time switch
15. Electroinjector
16. Ignition distributor
17. Air flow gauge
18. Fusebox

L-JETRONIC FUEL SUPPLY DIAGRAM

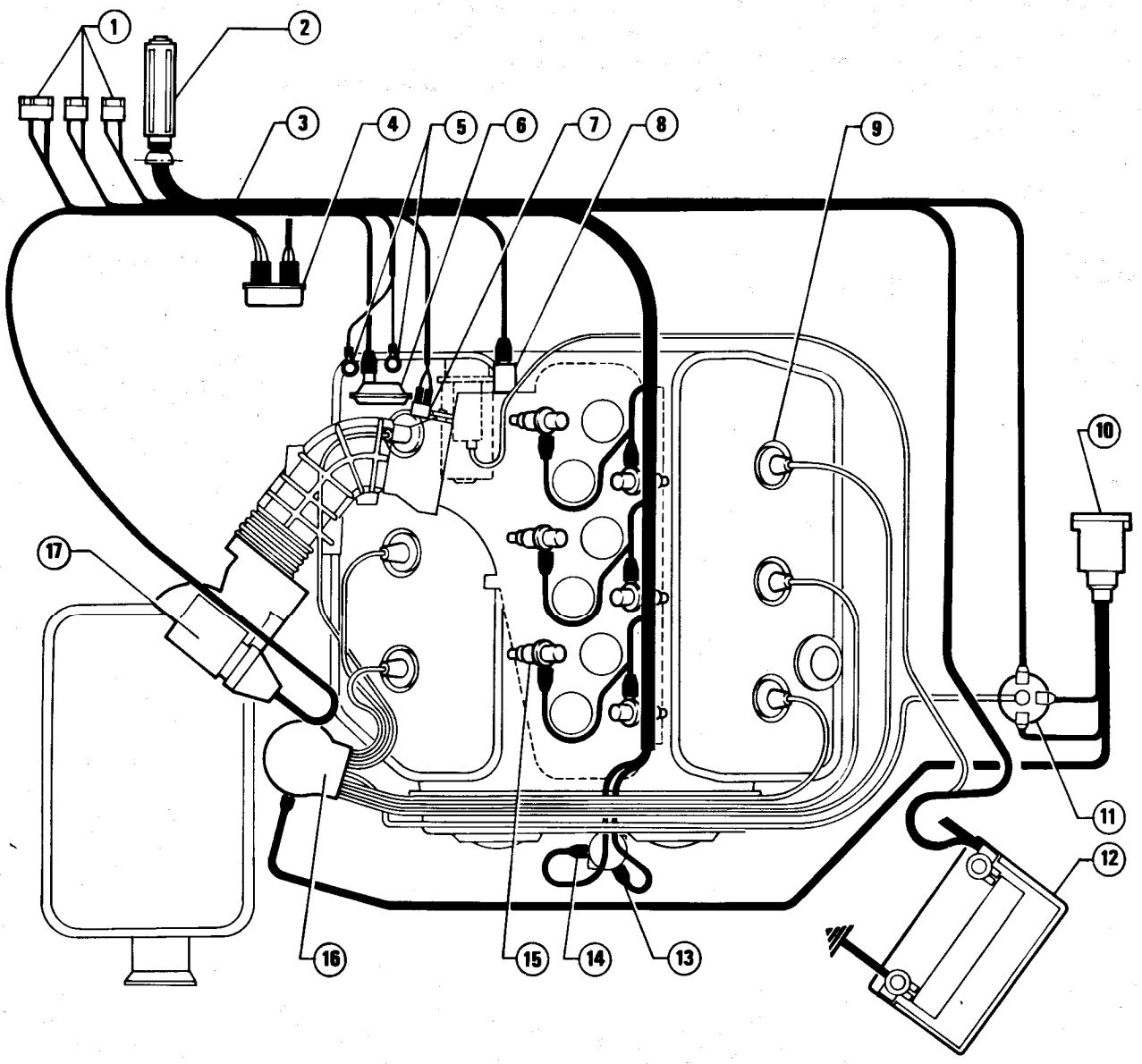
(Except Switzerland, Sweden, Australia)



1. Fuel return piping
2. Auxiliary air solenoid valve
3. Throttle body
4. Cold starting electroinjector
5. Fuel delivery piping
6. Fuel system manifold
7. Intake air box
8. Electroinjector
9. Pressure regulator
10. Idle r.p.m. adjusting device
11. Oil vapour sedimenter
12. Air flow gauge
13. Air filter
14. Dashpot (Alfa 90 and Alfa 75)
15. Fuel filter
16. Fuel pump
17. Fuel delivery line

WIRING AND MAIN COMPONENTS OF L-JETRONIC SYSTEM

Alfa 90 Alfa 75

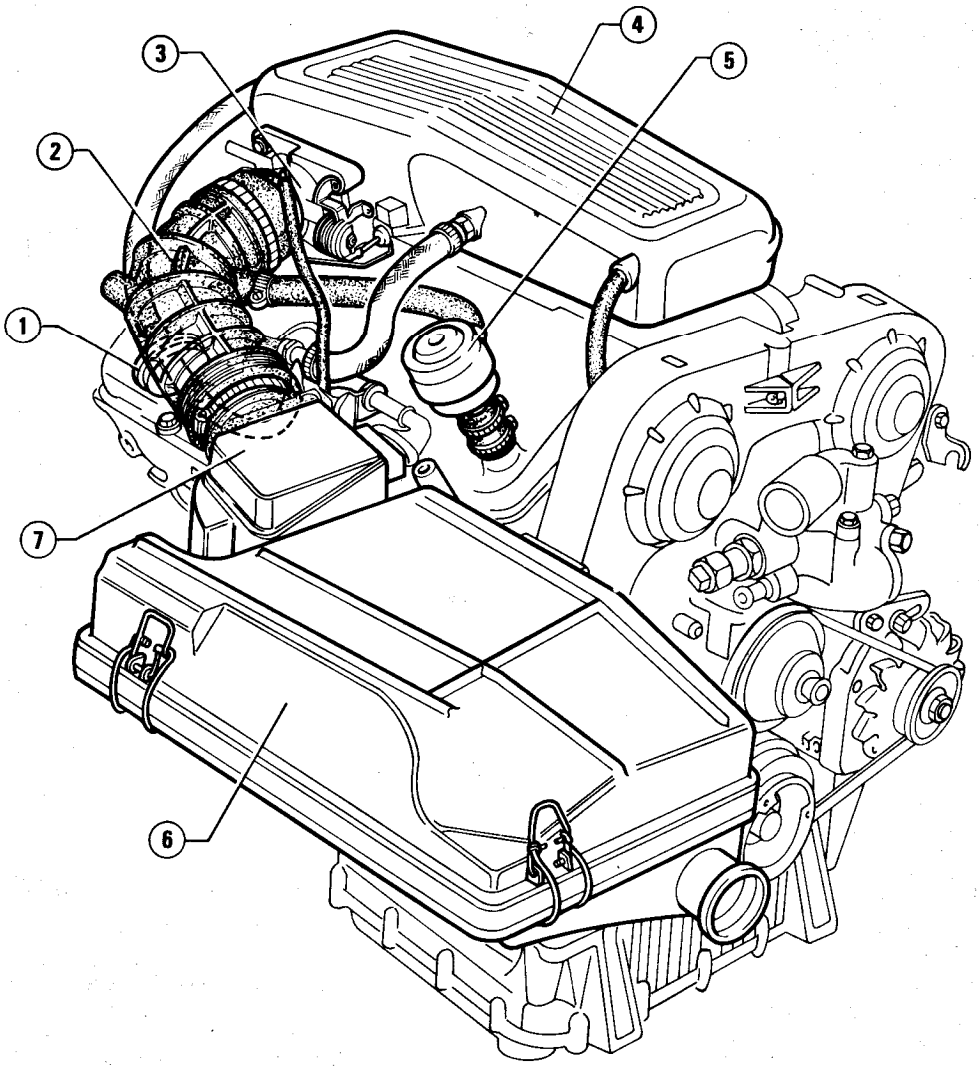


1. Vehicle wiring connectors
2. Electronic control unit
3. L-Jetronic wiring
4. Double relay
5. Ground terminals (common)
6. Auxiliary air solenoid valve
7. Accelerator throttle switch
8. Cold starting electroinjector
9. Spark plug
10. Electronic power module
11. Ignition coil
12. Battery
13. Engine coolant temperature sensor
14. Thermo-time switch
15. Electroinjector
16. Ignition distributor
17. Air flow gauge

IMPORTANT GENERAL INFORMATION

- **Never start the engine when battery cables are connected incorrectly.**
- **Never use fast charging to start the engine.**
- **Never detach battery from the vehicle electronic system when engine is running.**
- **Never perform battery fast charging.**
- **Remove the electronic control unit if vehicle is to be furnace-painted at temperatures higher than 80 °C (176°F).**
- **Verify that the shielded wire connectors are correctly secured.**
- **Never attach/detach connector to/from the electronic control unit leads with ignition on.**
- **Never ground the high/low voltage cables for test purposes.**
- **In the event of installation of ancillary equipment on vehicle, always disconnect the electronic control unit in order to carry out functional test of ancillary equipment itself with ECU disconnected. Never by to connect other devices to ECU wiring.**

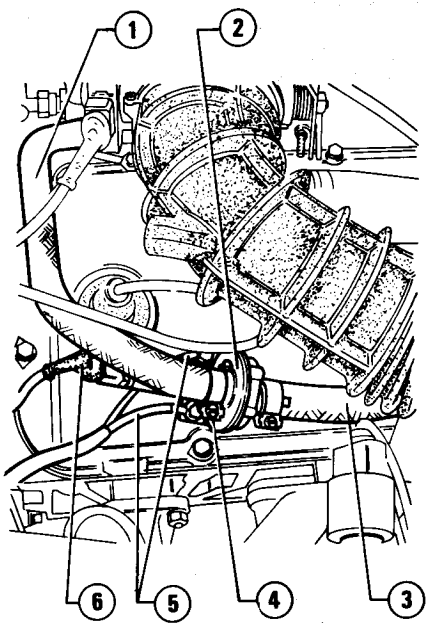
AIR SUPPLY SYSTEM



1 Auxiliary air solenoid valve
2 Corrugated sleeve
3 Throttle body
4 Intake air box
5 Oil vapour sedimenter
6 Air filter
7 Air flow gauge

REPLACEMENT

1. Detach connector (6).
2. Loosen clamps and detach hose (1) and (3) from solenoid valve (2).
3. Unscrew screws (4) and remove solenoid valve (2) from timing system cover, disconnecting ground cables (5).
4. Position the new solenoid valve on the timing system cover and secure it to tappets cover, together with the ground cables of the L-JETRONIC injection system, using **new** washers.
Reconnect both inlet and outlet air hoses to valve.

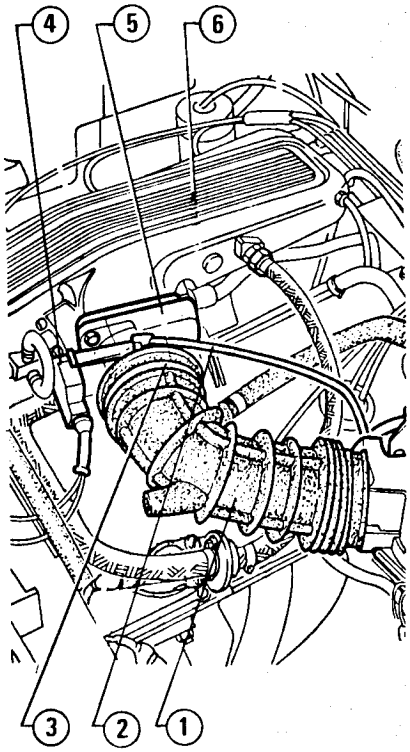


1 Air outlet hose
2 Auxiliary air solenoid valve
3 Air inlet hose
4 Screw securing solenoid valve to timing system cover
5 Ground cables
6 Solenoid valve control cable connector

THROTTLE BODY

REMOVAL

1. Detach accelerator control cable from lever on throttle body and release sheath from bracket.
2. Detach hose (2) and sleeve (1) from throttle body (5).
3. Detach connector from switch (4).
4. Unscrew the nuts which secure throttle body (5) to air intake box (6), and remove throttle body and the related gasket.
5. If required, remove switch and the accelerator cable securing braket from throttle body.



1 Corrugated sleeve
2 Vacuum intake hose for ignition advance pneumatic regulator
3 Clamp
4 Accelerator throttle switch
5 Throttle body
6 Intake air box

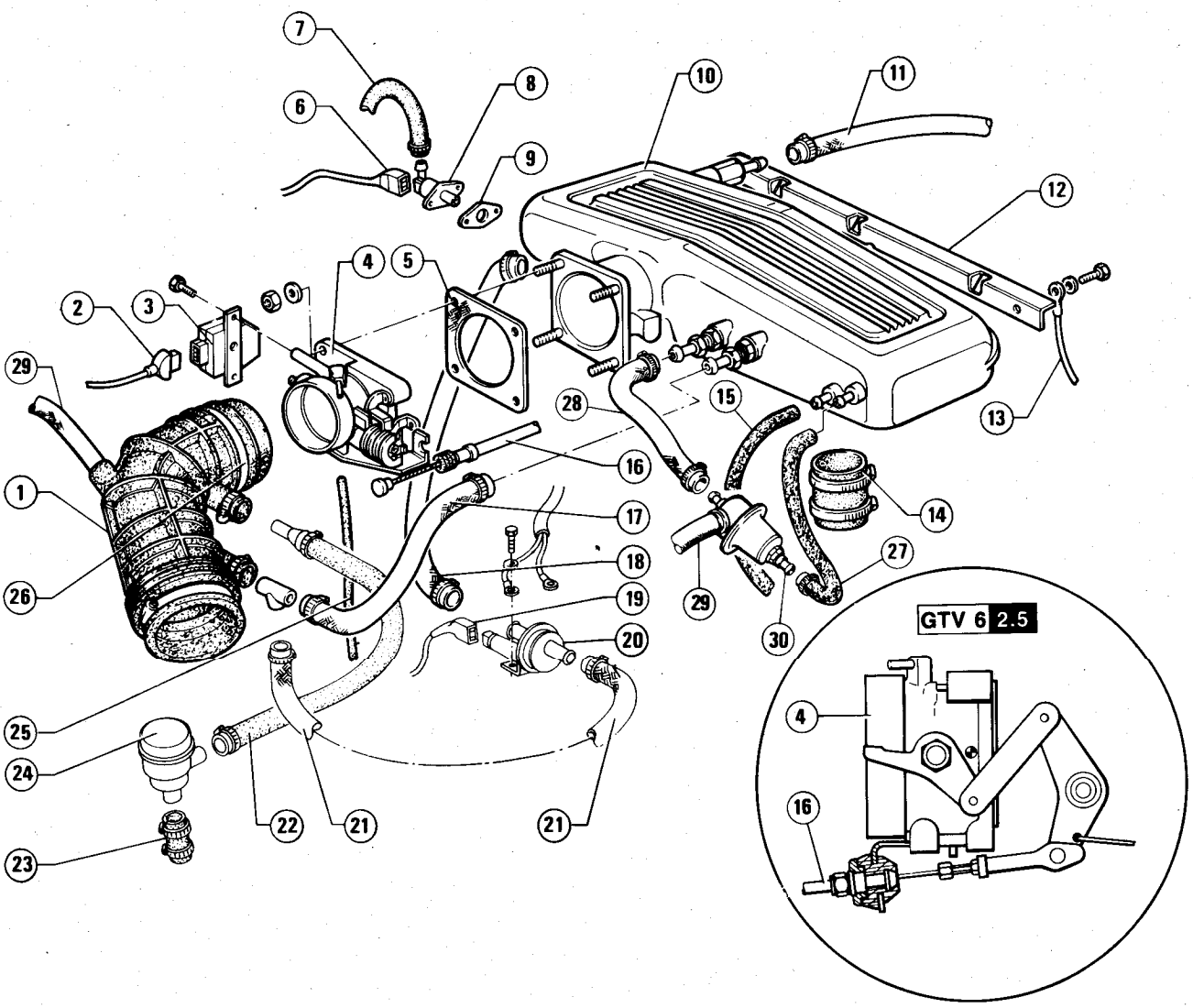
INSTALLATION

Carry out the installation by reversing the order of removal, compying with the following indications.

- Interpose a **new** gasket between throttle body and intake air box.
- Perform the settings and adjustments (refer to: Settings and Adjustments).

INTAKE AIR BOX

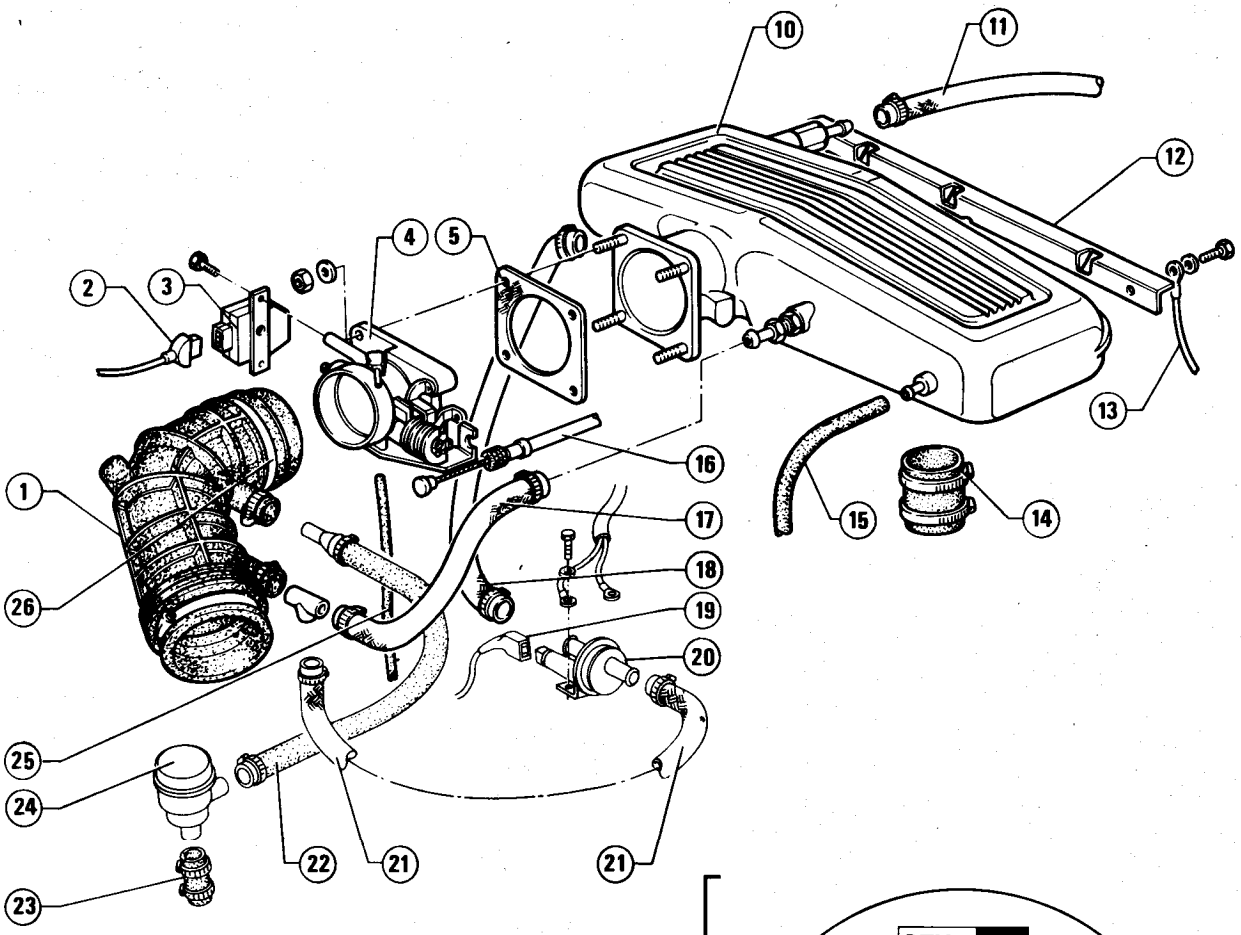
(For Switzerland, Sweden, Australia)

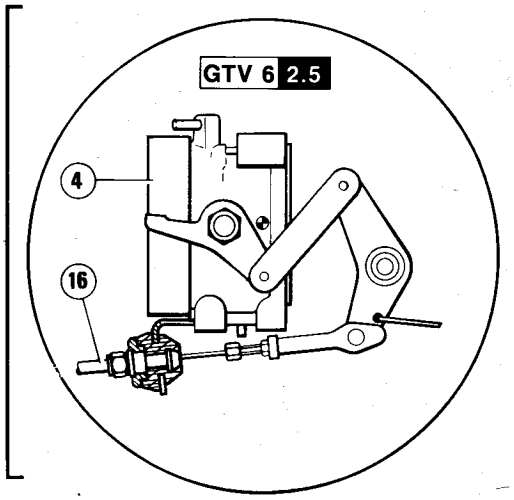


1. Corrugated sleeve
2. Connector
3. Throttle body switch
4. Throttle body
5. Gasket
6. Connector
7. Supply hose for cold starting electroinjector
8. Cold starting electroinjector
9. Gasket
10. Intake air box
11. Servo brake vacuum intake hose
12. Wiring protection
13. Intake air box earth braid
14. Sleeve connecting intake air box to intake manifold
15. Vacuum intake hose for pressure regulator
16. Accelerator control cable
17. By-pass hose for idle r.p.m. adjustment
18. Hose for auxiliary air delivery to intake air box
19. Connector
20. Auxiliary air solenoid valve
21. Hose for air delivery to auxiliary air solenoid valve
22. Oil vapour return hose
23. Oil recovery hose
24. Oil vapour sedimenter
25. Vacuum intake hose for ignition advance pneumatic regulator
26. Clamp
27. Vacuum intake hose for valve control
28. Hose for air delivery to air intake box
29. Air weighing hose for vacuum regulating valve
30. Vacuum regulating valve

INTAKE AIR BOX

(Except Switzerland, Sweden, Australia)





1. Corrugated sleeve
2. Connector
3. Throttle body switch
4. Throttle body
5. Gasket
6. Connector
7. Supply hose for cold starting electroinjector
8. Cold starting electroinjector
9. Gasket
10. Intake air box
11. Servo brake vacuum intake hose
12. Wiring protection
13. Intake air box earth braid
14. Sleeve connecting intake air box to intake manifold
15. Vacuum intake hose for pressure regulator
16. Accelerator control cable
17. By-pass hose for idle r.p.m. adjustment
18. Hose for auxiliary air delivery to intake air box
19. Connector
20. Auxiliary air solenoid valve
21. Hose for air delivery to auxiliary air solenoid valve
22. Oil vapour return hose
23. Oil recovery hose
24. Oil vapour sedimenter
25. Vacuum intake hose for ignition advance pneumatic regulator
26. Clamp

REMOVAL

With reference to the exploded view, operate as follows:

1. Loosen clamps and disconnect hoses (11) and (17) from intake air box, and sleeve (1) from throttle body.
2. Detach hose (25) from throttle body, and hose (15) from intake air box.

2A. **(Only for Switzerland, Sweden and Australia)** Disconnect hoses (27) and (28) from the intake air box.

3. Detach hose (18) from the auxiliary air solenoid valve.
4. Detach accelerator control cable (16) from the lever on throttle body, and release sheath from securing bracket.
5. Detach connector (2) from switch (3) on throttle body.
6. Detach connector (6) from electroinjector (8).
7. Detach hose (7) from electroinjector (8).

WARNING:
Operate carefully: fuel system may be under pressure.

8. Unscrew the screws which secure cover (12) and remove it.
One of these screws secures earth braid (13).
9. Loosen the clamps which secure intake air box (10) to sleeves (14) of intake manifolds; remove intake air box (10) complete with throttle body (4).
10. If required, disassemble the intake air box operating at bench, by proceeding as follows.

a. Unscrew the nuts which secure throttle body (4) to intake air box (10), remove them and withdraw gasket (5).

b. Unscrew the screws which secure electroinjector (8) and remove it together with the related gasket.

c. Remove the union for idle r.p.m. adjustment and the servo brake single-acting valve.

d. Detach the auxiliary air inlet hose (18).

INSTALLATION

Carry out the installation by reversing the order of removal, complying with the following indications.

- If the intake air box has been disassembled, interpose **new** gaskets between:
  - throttle body and intake air box
  - cold starting electroinjector and intake air box
  - single-acting valve, for servobrake vacuum intake, and intake air box
- Install a **new** O-ring on the union for the idle r.p.m. adjustment.
- If required, replace the sleeves between intake air box and intake manifolds.
- Perform the checks and adjustments (refer to: Checks and Adjustments).

VACUUM REGULATING VALVE

(For Switzerland, Sweden and Australia

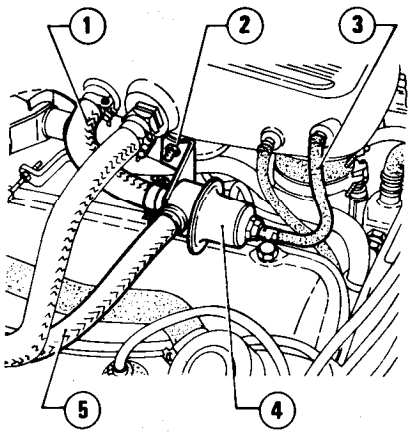
CHECKS AND INSPECTION

This valve operates during the acceleration release phase. If during transient, a vacuum exceeding that prescribed is generated in the intake air box, the valve opens and delivers auxiliary air to engine, so as to reduce the exhaust emissions.
Check the valve functioning by operating in one of the following ways:

- Bring engine to **5000 r.p.m.**, then release accelerator immediately. If value operates, a vibration can be felt inside it, during deceleration. However, the vibration felt is very slight.
- Detach the air intake hose from the valve, bring engine to **5000 r.p.m.**, then release accelerator immediately. If valve operates, a vacuum can be felt, during deceleration, on the valve inlet union.

REPLACEMENT

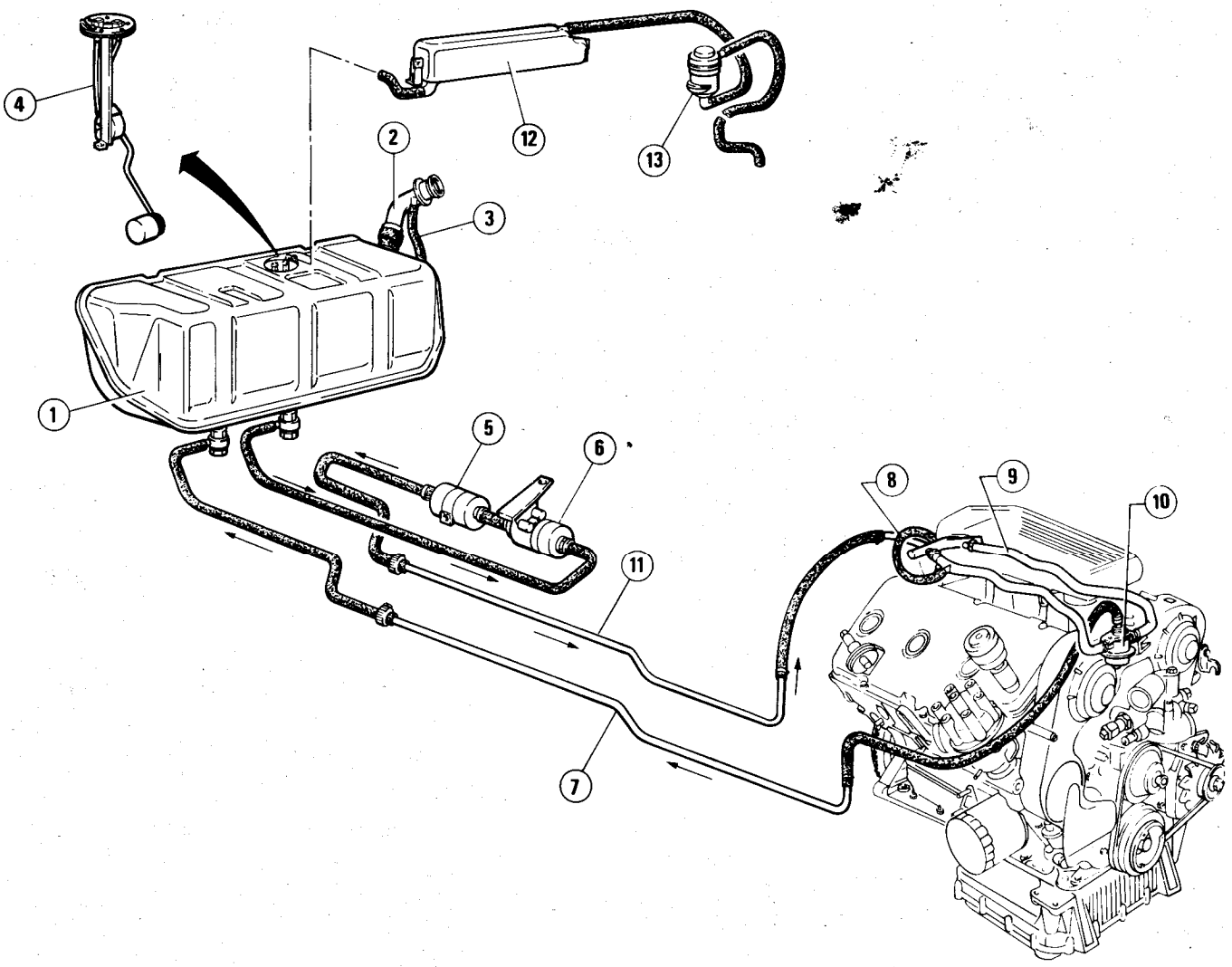
1. Disconnect hoses (1), (3) and (5) from the vacuum regulating valve.
2. Unscrew nut (2), and remove valve (4).
3. Carry out installation by reversing the order of removal.



1 Hose for air delivery to intake air box
2 Nut
3 Vacuum intake hose for valve control
4 Vacuum regulating valve
5 Hose for air intake from corrugated sleeve

FUEL SUPPLY SYSTEM

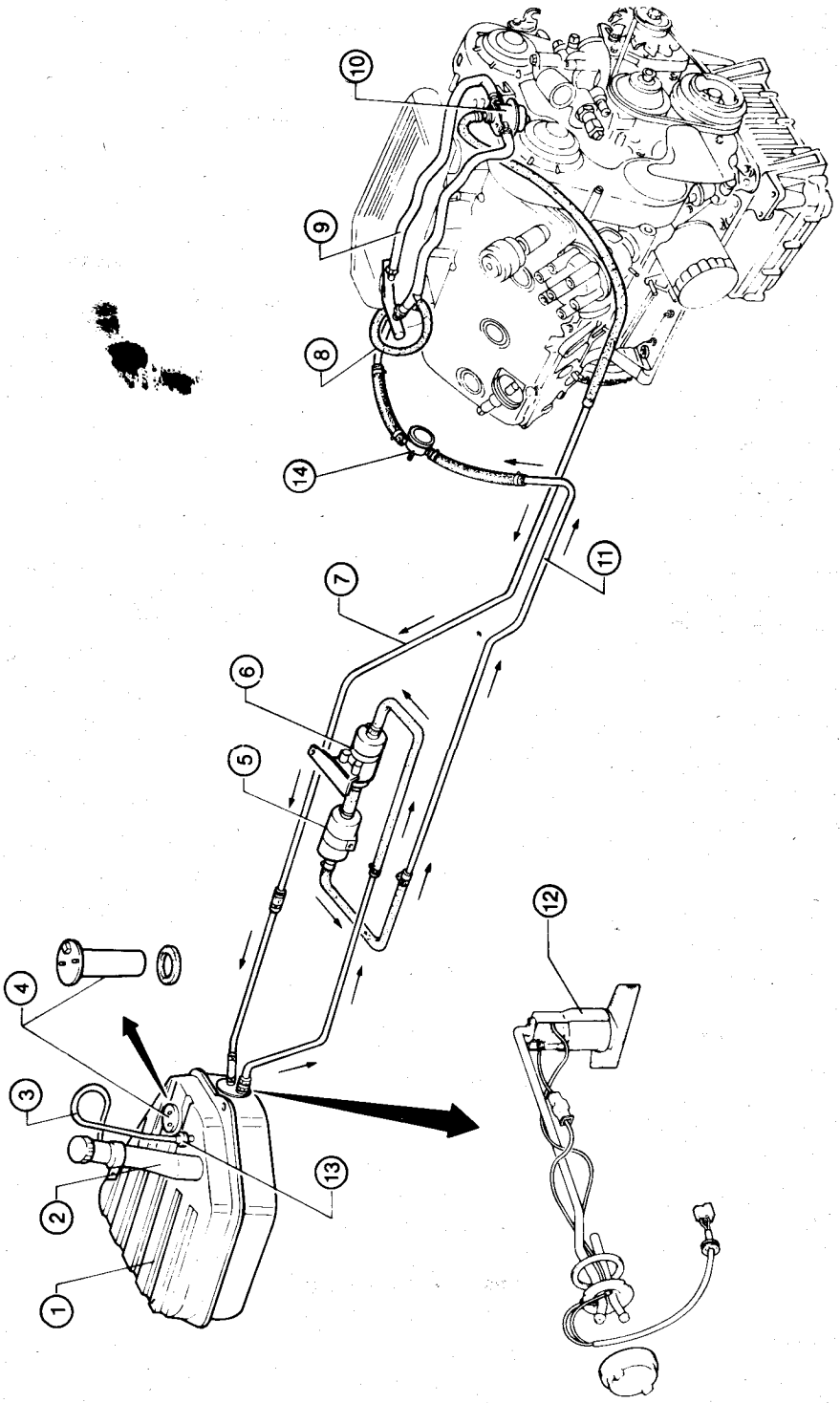
GTV 6 2.5



1. Tank
2. Filler
3. Fill-up breather hose
4. Fuel level gauge
5. Filter
6. Main pump
7. Excess fuel return hose
8. Supply hose for cold starting electroinjector
9. Fuel supply manifold
10. Pressure regulator
11. Fuel delivery hose
12. Fuel vapour venting tank
13. Tank venting inertia valve (Except Australia version)

FUEL SUPPLY SYSTEM

Alfa 90 Alfa 75



1. Tank
2. Filler
3. Fill-up breather hose
4. Fuel level gauge
5. Filter
6. Main pump
7. Excess fuel return hose
8. Supply hose for cold starting electroinjector
9. Fuel supply manifold
10. Pressure regulator
11. Fuel delivery hose
12. Submerged pump
13. Relief valve
14. Dashpot

WARNING:
Strictly follow the below indications before replacing the fuel system components:

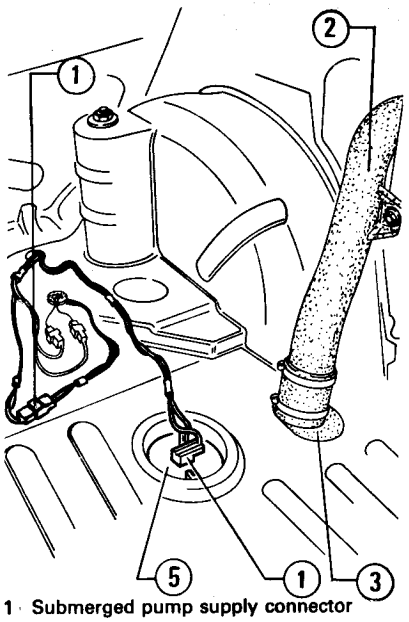
a. **Ensure that the workshop is correctly equipped to enable operations to be performed safety (five extinguishers, etc.).**
b. **Detach the battery ground cable.**
c. **Pour the fuel drawn from the tank into a suitable container fitted with safety cover.**

CAUTION:
After having reassembled the fuel system components, verify system tightness when at 2.5 bar.

COMPLETE FUEL TANK

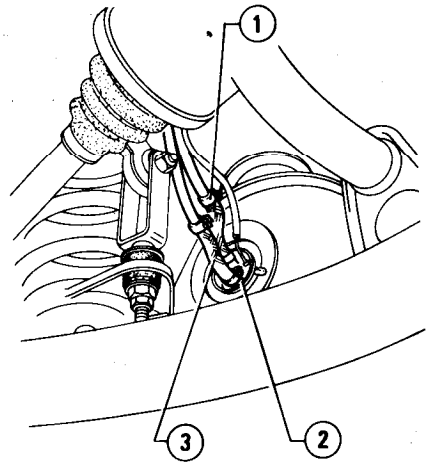
REMOVAL

1. Set vehicle on a lift; remove filler plug and suck fuel from tank by means of a suitable pump.
2. Remove lower trim of luggage compartment, move side trim (right-hand side), and remove the fuel level gauge cover.
3. Detach connectors (1) and (4), then extract connector (1) from the related cable raceway withodrawing it under the vehicle.
4. Loosen the clamp and detach sleeve (3) from tank without damaging the rubber gasket underneath.



1 Submerged pump supply connector
2 Fuel filler
3 Sleeves connecting filler to tank
4 Fuel level gauge connector
5 Fuel level gauge

5. Raise vehicle on lift and disconnect hoses (1) and (3) from flange (2).



1 Fuel return hose
2 Submerged pump flange
3 Fuel delivery hose

6. Support tank by means of a column lift, unscrew the three screws which secure tank to body and remove.
7. Disassemble tank if required.

CHECKS AND INSPECTIONS

Check for cracks or deformations in the tank; replace if required.

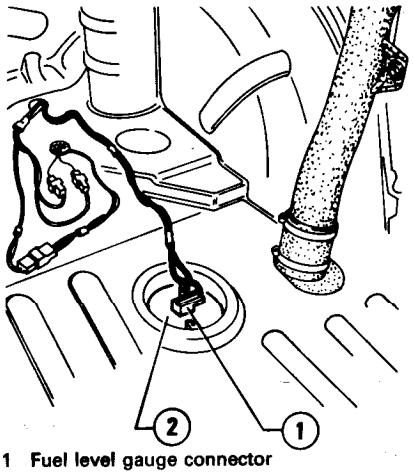
INSTALLATION

1. Install tank on vehicle by reversing the order of removal, verifying that the rubber gasket between tank and luggage compartment floor is correctly positioned in correspondance with filler.

FUEL LEVEL GAUGE

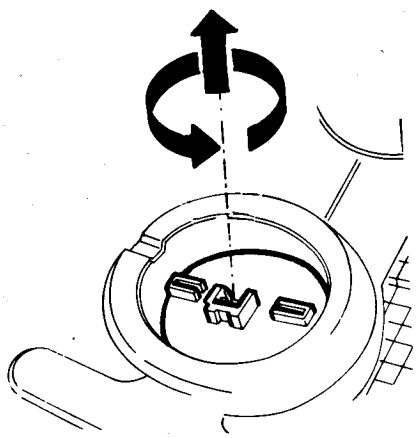
REPLACEMENT

1. Remove the luggage compartment floor trim
2. Remove cover of fuel level gauge (2) and detach connector (1).



1 Fuel level gauge connector
2 Fuel level gauge

3. By means of a suitable tool, rotate fuel level gauge counter-clockwise; then withdraw it from tank together with the related gasket.



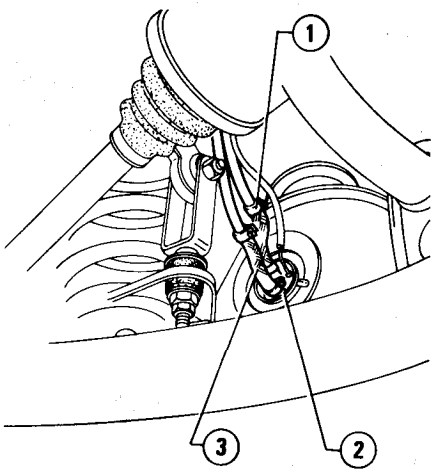
4. Replace gasket before installing the fuel level gauge on tank.

SUBMERGED PUMP AND GRID FILTER

Alfa 90 Alfa 75

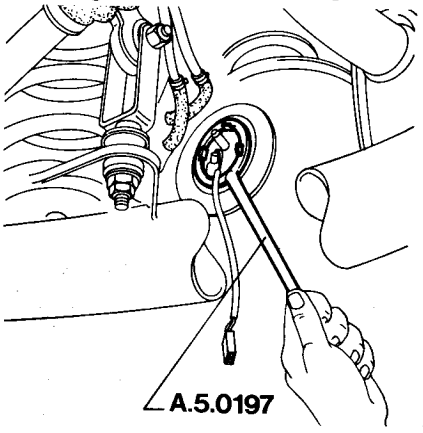
REPLACEMENT

1. Set vehicle on lift, remove filler cap and suck, the fuel from tank by means of a suitable pump.
2. Lift the luggage compartment floor trim, detach the submerged pump supply connector, and extract it from the related cable raceway withdrawing it from under the vehicle.
3. Raise vehicle by means of the lift, then detach hoses (1) and (3) from flange (2).



1 Fuel return hose
2 Submerged pump flange
3 Fuel delivery hose

4. By means of tool **A.5.0197**, rotate the submerged pump flange counterclockwise, then withdraw the unit from tank, together with the related gasket.



5. **Replace** gasket before installing the submerged pump unit; reinstall it by means of tool **A.5.0197**.

FUEL PIPING

REMOVAL

CAUTION:
Disconnect fuel system piping only when strictly required.

1. Set vehicle on lift.
2. Remove filler plug and, by means of a suitable pump, suck fuel from the tank.
3. Loosen the clamps which secure the ends of the hoses to be removed.

CAUTION:
When disassembling, plug both pipes and hoses so as to prevent dust or impurities from entering.

4. To remove the piping located on the floor inside the passenger compartment, remove the floor trim on the right-hand side.

CHECKS AND INSPECTIONS

1. Check for porosity and deterioration of hoses; replace the faulty ones.
2. Check for oxidation, clogging and dents of pipes.

INSTALLATION

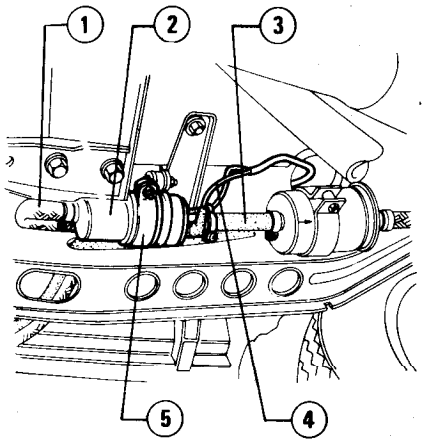
Carefully install piping by reversing the order of removal, and complying with the following.

CAUTION:
a. **Carefully install clamps on system joints. Do not tighten clamps accessively so as to prevent damaging piping.**
b. **Do not bend or twist pipes when installing them on vehicle.**
c. **The piping inside vehicle must be inserted into the related pipe-raceway up to the red reference strips marked on each pipe/hose.**
d. **Start the engine and check for leaks from joints.**

MAIN FUEL PUMP

REPLACEMENT

1. Set vehicle on a lift and detach the battery negative terminal.
2. Operating from under the vehicle, detach pump supply cables (4).
3. Throttle hoses (1) and (3), then loosen clamps and detach hoses from pump.
4. Loosen clamp (5) and withdraw pump (2).



1 Fuel inlet hose to pump
2 Fuel pump
3 Fuel outlet hose from pump
4 Pump supply cables
5 Pump support clamp

5. Install the new fuel pump securing it with the related clamp; then reconnect hoses.

Pump is supplied as spare part into a sealed pack, filled with protective oil and with unions closed by caps. When installing the pump it is not necessary to empty it.

6. Reconnect the pump supply cables, taking care not to exchange them.
7. After installation, remove the toools used to throttle hoses, and reconnect battery.

DASHPOT

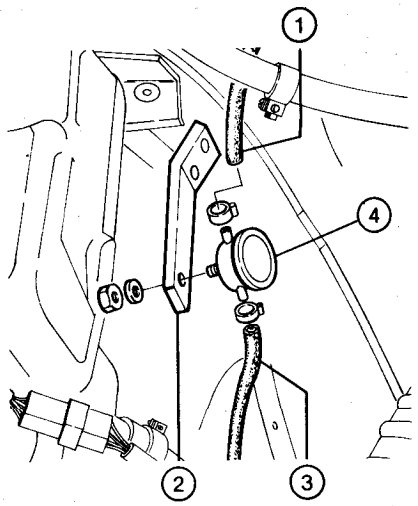
Alfa 90 Alfa 75

REPLACEMENT

1. Back off nut retaining dashpot (4) to bracket (2).
2. Disconnect fuel in hose (3) and fuel out hose (1).

CAUTION:
Be alert: fuel system may be under pressure.

3. Install a **new** dashpot adopting a reversal of the removal sequence.



1. Fuel out hose
2. Bracket
3. Fuel in hose
4. Dashpot

COLD STARTING ELECTROINJECTOR

CHECKS AND INSPECTIONS

1. Electric Continuity check.

Refer to: Electrical Tests

2. Functional test.

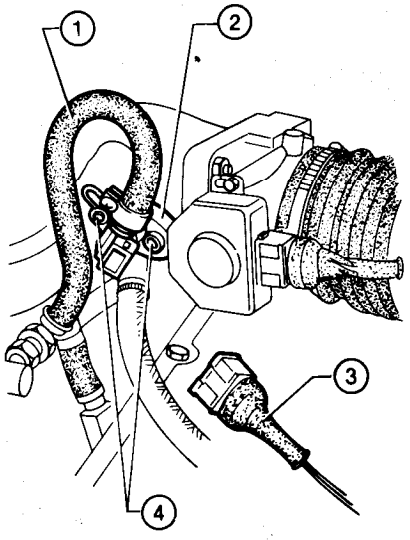
a. Unscrew the two screws which secure electroinjector to intake air box; detach electroinjector without disconnecting wiring.
b. On cold engine, operate starter and verify that fuel is sprayed by electroinjector.
With engine at the normal running temperature, verify that no fuel is sprayed by electroinjector.
c. If the above conditions do not take place, replace the cold starting electroinjector (refer to: Replacement).

REPLACEMENT

1. Detach electroinjector supply connector (3).
2. Loosen clamp and detach hose (1) from electroinjector.

WARNING:
Operate carefully: fuel system may be under pressure.

3. Unscrew the two screws which secure electroinjector to intake air box; remove electroinjector together with the related gasket.



1 Fuel supply hose
2 Cold starting electroinjector
3 Supply connector
4 Screws securing electroinjector to intake air box

4. Install electroinjector by reversing the order of removal taking care to interpose a new gasket between electroinjector and intake air box.

ELECTROINJECTORS

CHECKS AND INSPECTIONS

1. Check of electroinjectors electric continuity.
Refer to: Electrical Tests.

2. Check of electroinjectors opening.

a. Measurement of exhaust CO emission. (Refer to: Alfa 90 "WORK SHOP MANUAL"- GROUP 00 - Engine Maintenance - Check and Adjustment of Idle r.p.m. and Exhaust Emissions).
b. Detach electroinjector connectors one at a time; check the CO percentage each time, and verify that value is constant at each check.
c. If not so, identify the faulty electroinjector and replace it
(refer to: Replacement).
d. However, a visual confirmation of electroinjectors functioning can be obtained by comparing the spark plug electrodes colour.
- Black colour indicates a too rich mixture.
- Light colour indicates a too lean mixture.

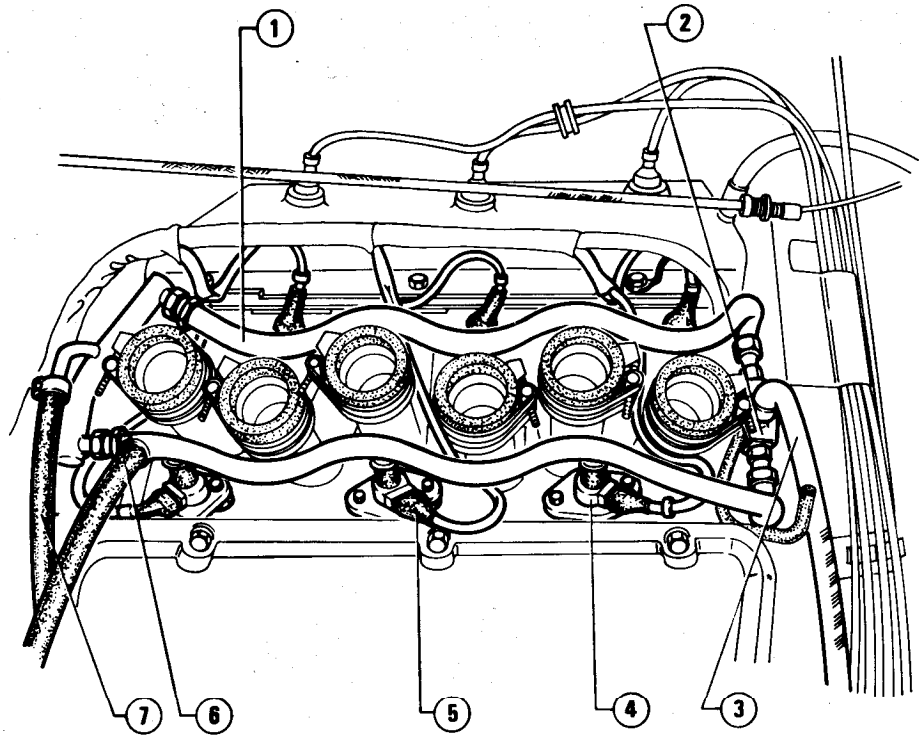
3. Check of electroinjector tightness

a. Detach the electroinjector - fuel distributor manifold unit operating as indicated in "Replacement", keeping the fuel supply system connected.
b. Detach electroinjector connectors and re-connect battery.
c. Operate starter and check for fuel leaks from electroinjectors; if leaks are present, replace the faulty electroinjector.

REPLACEMENT

Removal

1. Remove the intake air box (refer to: Air Supply System - Intake Air Box - Removal - step 1 to step 9).
2. Detach connectors (5) from electroinjectors.
3. Detach hose (7) from supply manifold (1), and hose (3) from pressure regulator.
4. Unscrew the screws which secure electroinjectors (4) to air supply manifolds, then remove electroinjectors together with manifold (1).

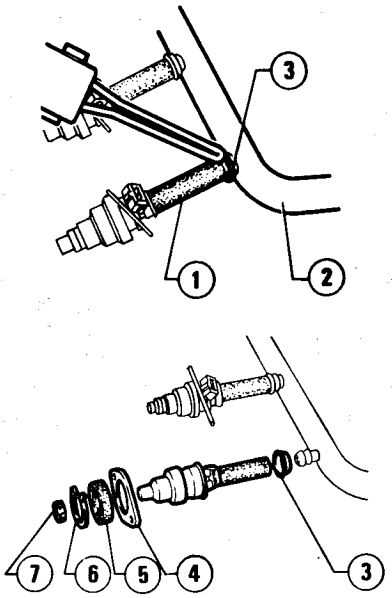


1 Fuel supply manifold
2 Pressure regulator
3 Excess fuel return hose
4 Electroinjectors
5 Electroinjector control cable connector
6 Supply hose for cold starting electroinjector
7 Fuel to - manifold delivery hose

5. Replace electroinjectors operating as follows.

CAUTION:
Before replacing an electroinjector, take note of connector position on electroinjector so that it can be correctly re-positioned when installing the new electroinjector.

a. Cut hose (1) by means of a welder, remove it from fuel manifold, and recover bush (3).



1 Electroinjector supply hose
2 Fuel distributor manifold
3 Bush
4 Flange
5 Rubber gasket
6 Seeger ring
7 O-Ring

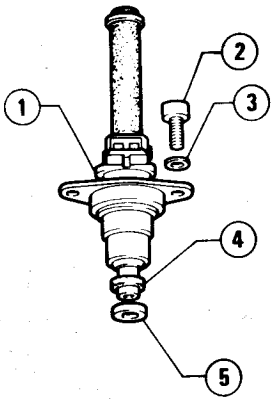
b. Install a new electroinjector fitting bush and supply hose on fuel distributor manifold until it strikes against bush itself.

CAUTION:
Electroinjector must be fitted on fuel distributor manifold with the related connector towards cylinder heads.

To fit the electroinjector, it is recommended to wet the related rubber hose with fuel. However, for this operation never use grease or vaseline.

INSTALLATION

1. Replace O-ring (4).
2. Install electroinjectors into the related seats, taking care to position seal ring (5) correctly.



1 Flange
2 Electroinjector securing screw
3 Washer
4 O-Ring
5 Seal ring

3. Install the other components by reversing the order of removal, complying with the following indications.

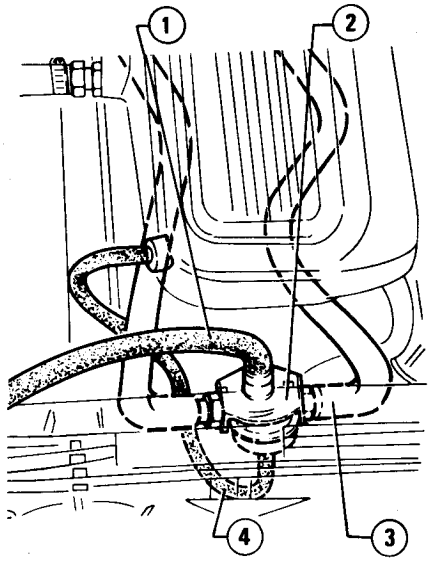
- Check the exhaust CO emission; adjust if necessary.

FUEL PRESSURE REGULATOR

REPLACEMENT

WARNING:
Operate carefully: fuel system may be under pressure.

1. Detach hoses (1) and (4) from pressure regulator (2).
2. Unscrew the unions which secure regulator (2) to supply manifold (3); remove pressure regulator.
3. Carry out installation by reversing the order of removal.



1 Excess fuel return hose
2 Pressure regulator
3 Supply manifold
4 Pressure regulator vacuum intake

SETTINGS AND ADJUSTMENTS

SETTING OF THROTTLE BODY (Check with flowmeter)

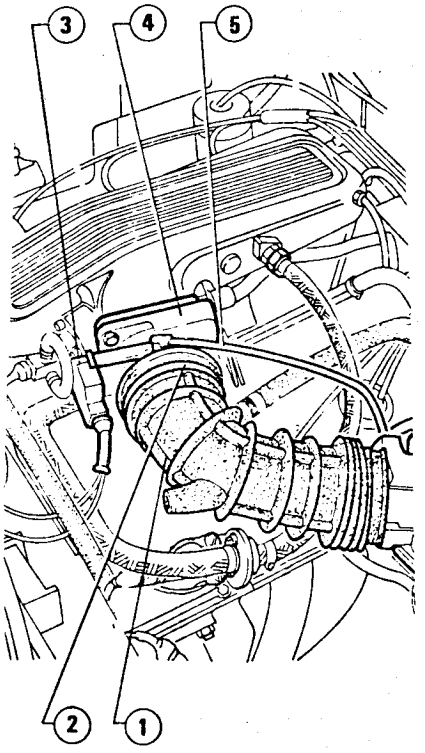
1. Loosen clamp (2) and disconnect sleeve (1) from throttle body (4).
2. Disconnect hose (5) and suitably plug the related union on throttle body.
3. Loosen the screws which secure switch (3) to throttle body.
4. Disconnect the accelerator control cable.
5. By means of a flow meter, check the throttle body setting, operating as follows.

a. Rest the flow meter tap on throttle body inlet.

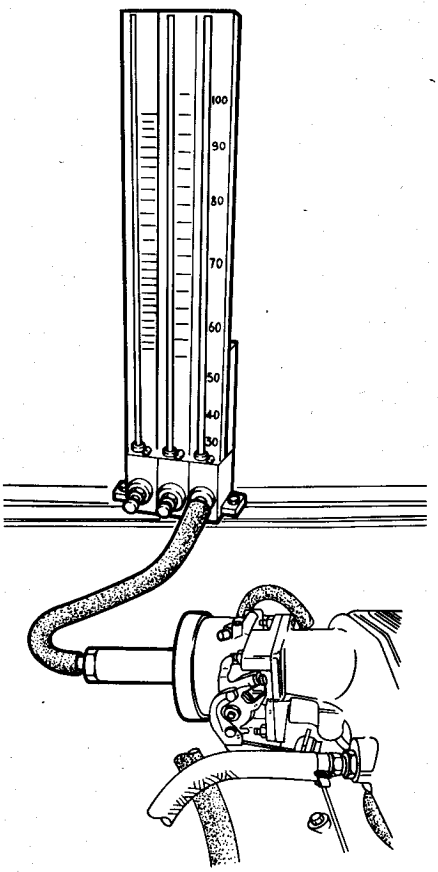
b. Measure the air flow through throttle and verify that it is within the prescribed values.

Air flow from accelerator throttle in the closed position (flowmeter Solex):

300 on N scale



1 Corrugated sleeve
2 Clamp
3 Accelerator throttle switch
4 Throttle body
5 Vacuum intake hose for ignition advance pneumatic regulator

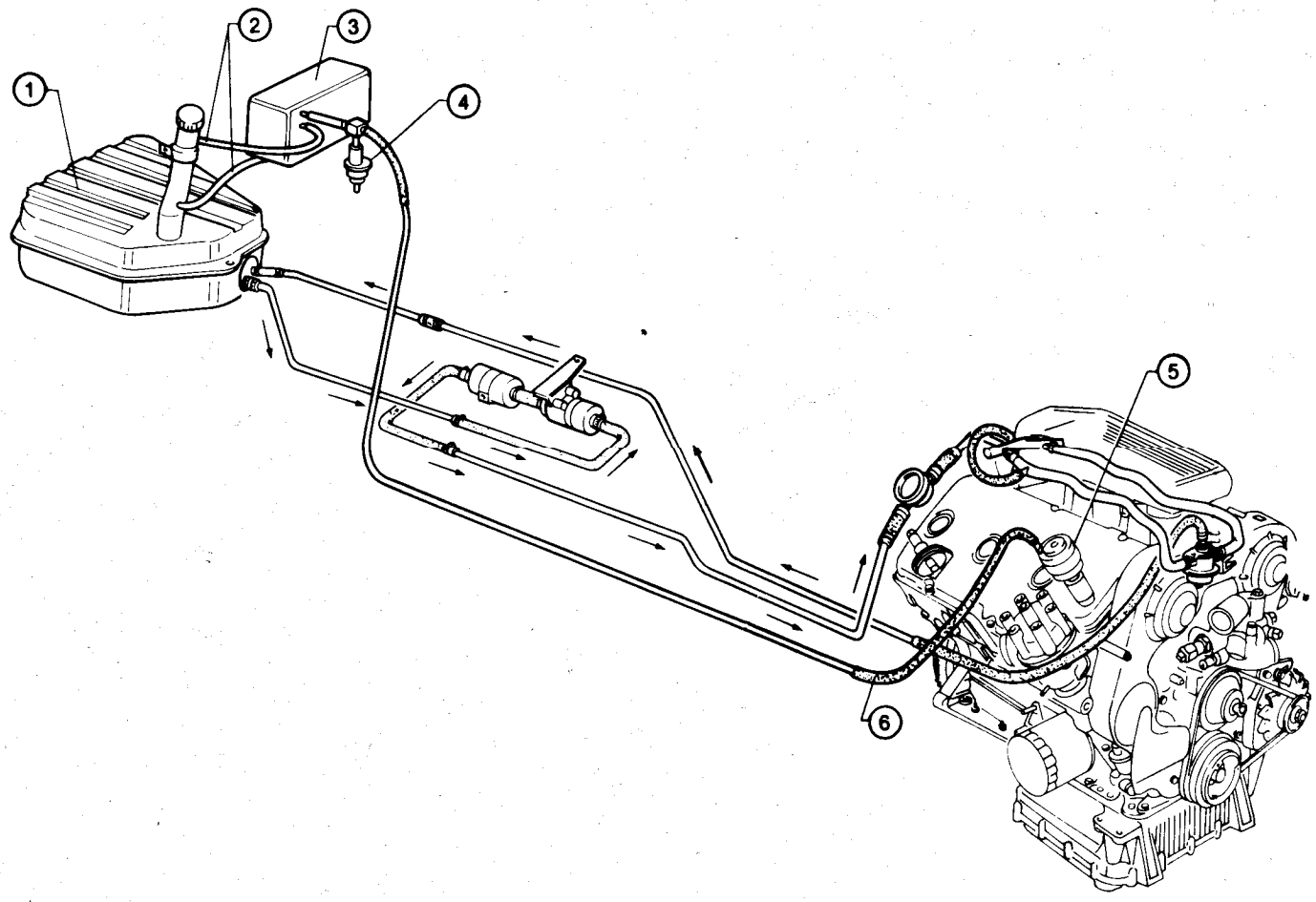


EXHAUST EMISSION CONTROL SYSTEM

Alfa 90

Alfa 75

(For Australia only)

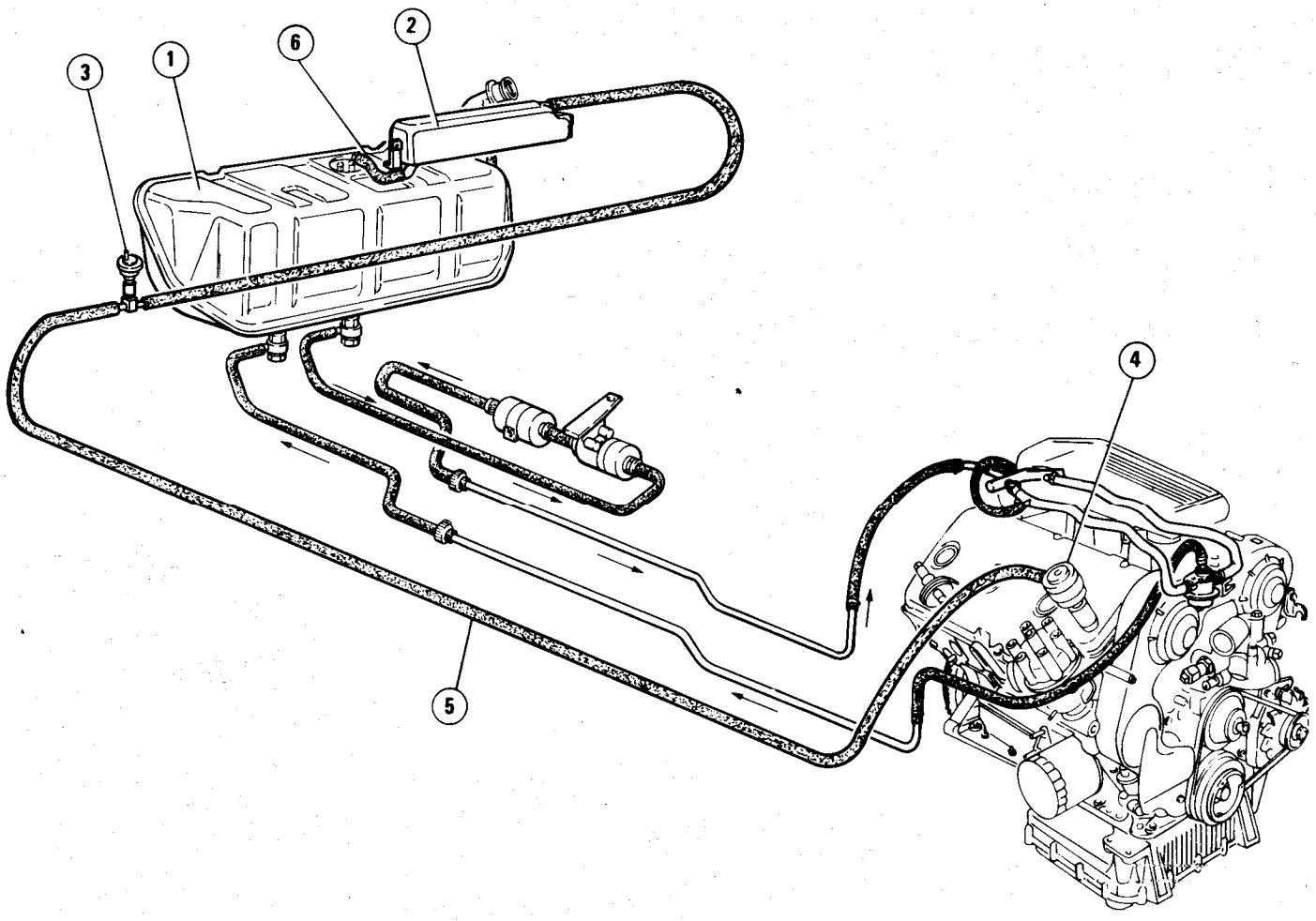


1. Fuel tank
2. Fuel vapour ventiling hose
3. Vapour separating tank
4. Fuel vapour venting valve
5. Oil vapour separator
6. Fuel vapour hose

EXHAUST EMISSION CONTROL SYSTEM

GTV 6 2.5

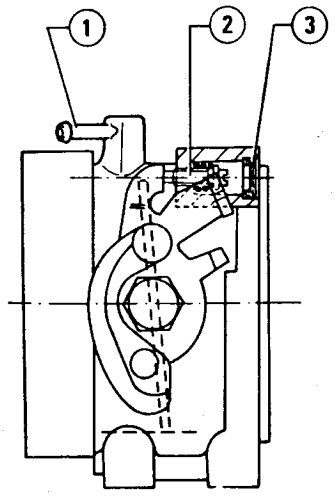
(For Australia only)



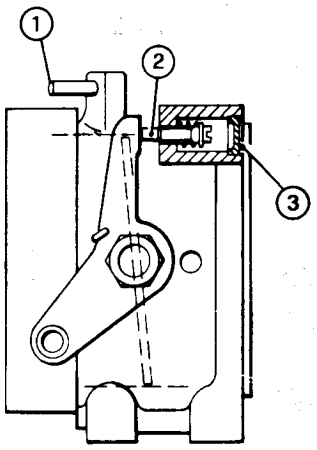
1. Fuel tank
2. Vapour separating tank
3. Fuel vapour venting valve
4. Oil vapour separator
5. Fuel vapour hose
6. Fuel vapour venting hose

6. If not so, carry out the adjustment.
a. Remove seal (3) and operate on adjusting screw (2) until the prescribed flow value is obtained.

Alfa 90 **Alfa 75**



GTV 6 **2.5**



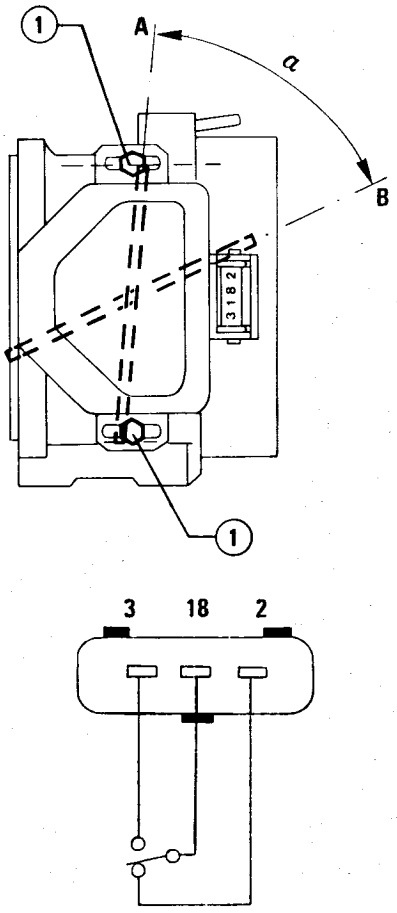
1. Vacuum intake union
2. Adjusting screw
3. Seal

b. Carry out the adjustment and seal again the adjusting screw seat by means of the suitable cap.
7. Install the detached components by reversing the order of removal, then carry out further adjustment.

SETTING OF ACCELERATOR THROTTLE SWITCH

1. Detach the female connector from throttle switch and, by means of a tester, check the following resistances on the male connector.
a. With throttle fully closed, **0** Ω resistance must be measured between terminals (2) and (18).
b. Rotate throttle slowly: with tester between terminals (2) and (18), ∞ resistance must be measured before throttle is rotated by **1°** with respect to the fully closed position.
2. If not so, loosen screws (1) and rotate switch until contact (≃ **0** Ω resistance) between terminals (2) and (18) is obtained, with throttle fully closed; retighten the screws.
3. Rotate throttle by **58°** and verify that the full load contact closes, by measuring the following resistances with a tester on male connector.
- **0** Ω resistance (approx.) must be measured between terminals (3) and (18), when accelerator throttle is open by an angle of $\alpha \simeq 58°$.

4. If the values measured are not those prescribed, check accelerator control, or replace switch.

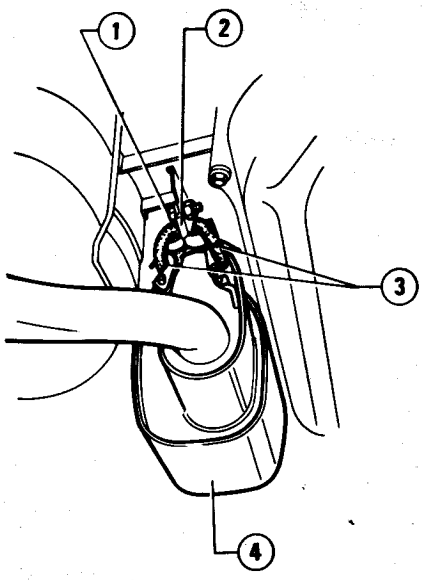


1 Screws securing switch to throttle body
2 Idle r.p.m. terminal (corresponding to position A: throttle closed)
3 Peak r.p.m. terminal (corresponding to position B: throttle open)

4. For the O-rings, simply release them from hooks.

5. If required, unscrew bolt (1) and remove rear hook (2).

6. Carry out the installation by reversing the order of removal, making sure that, after installation, the supports can swing freely and are not tout.



1 Bolt
2 Rear hook
3 Retaining rings
4 Silencer - rear section

SPECIFICATIONS AND GENERAL REQUIREMENTS

6 cylinders Alfa 90 2.5 iniezione

6 cylinders Alfa 75 2.5 6V iniezione

6 cylinders GTV 6 2.5

SPECIFICATIONS

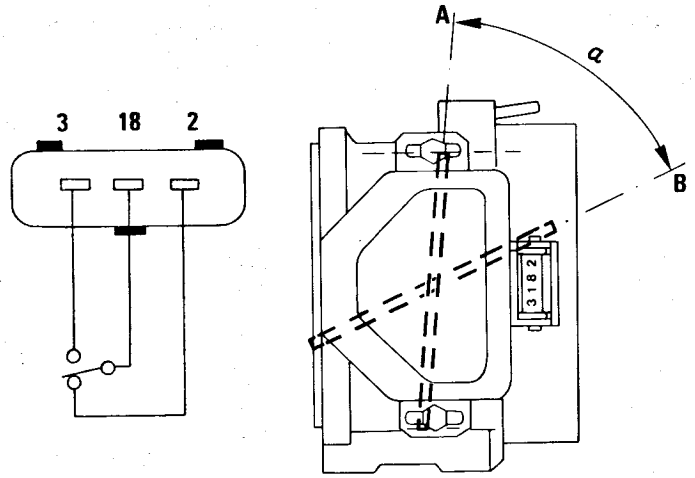
SUPPLY AND INJECTION SYSTEM COMPONENTS

Component	ALFA ROMEO Std. Number	Type
Main fuel pump	116.46.04.021.00 119.11.04.021.00	BOSCH 0.580.464.020 BOSCH 0.580.464.013
Fuel pressure regulator	119.11.32.045.00	BOSCH 0.280.160.210
Electroinjectors	119.11.11.300.00	BOSCH 0.280.150.105
Air flow gauge	116.46.11.013.00	BOSCH 0.280.202.013
Control unit	116.46.11.042.00	BOSCH 0.280.001.117

FUEL TANK

Features	Unit: litres (Imp.gall)	
	Alfa 90 Alfa 75	GTV 6 2.5
Overall capacity	49 (10.78)	75 (16.5)
Reserve	8 (1.76)	8 to 10 (1.76 to 2.2)

SETTING OF ACCELERATOR THROTTLE SWITCH



2 — Idle r.p.m. terminal
(corresponding to position A: throttle closed)
3 — Peak r.p.m. terminal
(corresponding to position B: throttle open)

Unit: Ω

	Resistance	
	Terminals 2-18	Terminals 3-18
Accelerator throttle fully closed	0	∞
Accelerator throttle open by an angle α = 58°	∞	0

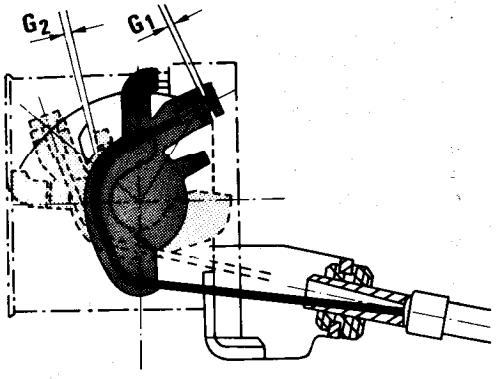
ACCELERATOR CONTROL Alfa 90 Alfa 75

Backlash between throttle control lever and accelerator cable end
(with accelerator pedal at rest)

G_1 = 1 to 2 mm (0.0394 to 0.0787 in)

Backlash between throttle control lever and end-of-travel
(with accelerator pedal at the end-of-travel)

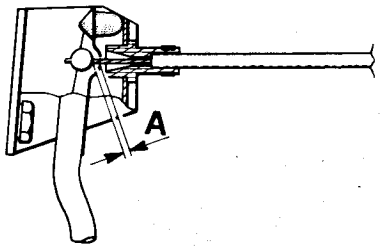
G_2 = 1 to 2 mm (0.0394 to 0.0787 in)



ACCELERATOR CONTROL GTV 6 2.5

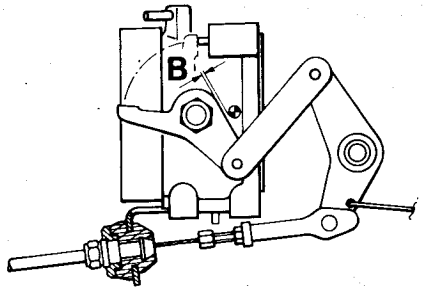
Accelerator pedal idle before throttle opening

A = 1 mm (0.0394 in)



Backlash between throttle control lever and end-of-travel
(with accelerator pedal at the end-of-travel)

B = 0.5 to 1 mm (0.0196 to 0.0394 in)



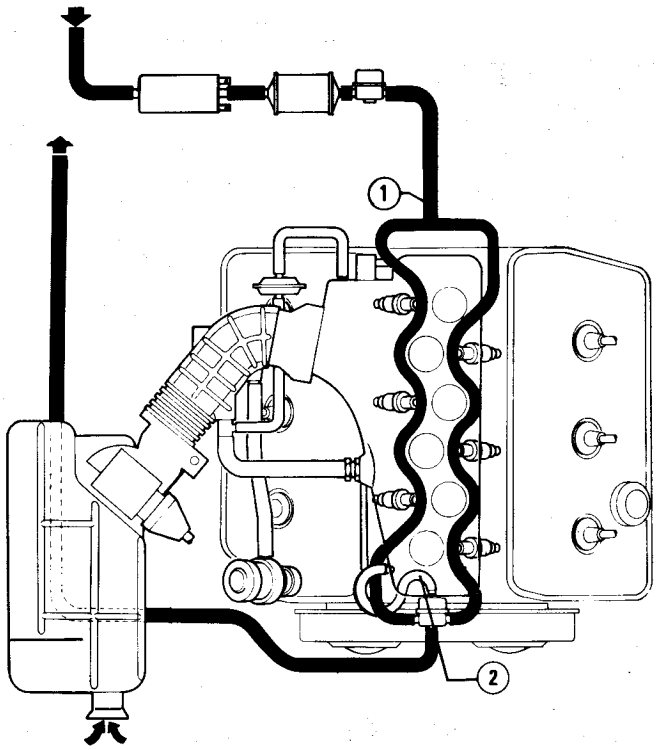
ENGINE IDLE R.P.M. AND EXHAUST CO%

		Values
Engine idle (1)	r.p.m.	800 to 1000
Exhaust CO percentage at idle r.p.m. (1)	% in vol.	0.5 to 1.5 $1\ ^{+1}_{-0.5}$ (2)

(1) On hot engine, speed gear into neutral, clutch engaged, auxiliary equipment off
(2) For Switzerland, Sweden and Australia

CHECKS AND ADJUSTMENTS

FUEL SUPPLY SYSTEM



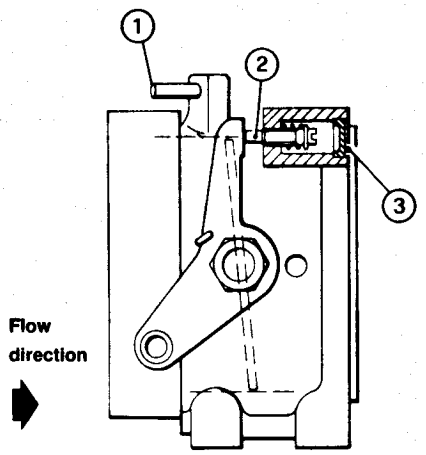
1. Pressure measurement point
2. Pressure regulator vacuum intake hose

		Values
Fuel delivery pressure (1)	kPa	225.5 to 264.8
	(bar)	(2.26 to 2.65)
	(kg/cm^2)	(2.3 to 2.7)
	(p.s.i.)	(32.71 to 38.40)
Delivery at zero pressure	l/1'	1.5 to 2
	(Imp.gall/1')	(0.33 to 0.44)

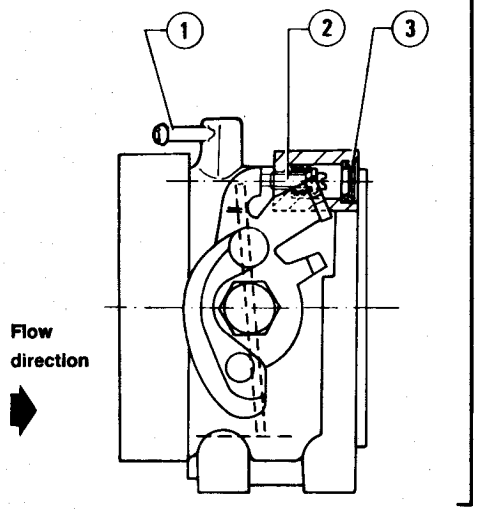
(1) To be measured at point (1) with hose (2) disconnected

SETTING OF THROTTLE BODY (CHECK WITH FLOWMETER)

GTV 6 2.5



Alfa 90 Alfa 75



1. Vacuum intake union
2. Adjusting screw
3. Seal

	Reading
Air passage with throttle valve in the closed position (Flowmeter Solex) (1)	300 N scale

(1) Plug the vacuum intake union when carrying out the measurement

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

Application	Type	Name	Q.ty
Accelerator pedal shaft (on support rubbers)	GREASE	ISECO Molykote Longterm n. 2 Std. N. 3671-69831	—

FUEL

Petrol with Octane Number: (R.M.) ≥98 and sensitivity (1) ≤11

(1) Difference between Research Method Octane Number and Motor Method Octane Number

TROUBLE DIAGNOSIS AND CORRECTIVE ACTION

QUICK DIAGNOSIS

NOTE:
The correct use of this trouble diagnosis procedure assumes vehicle to be in order (transmission in particular), and engine in good functioning conditions (valves, cylinders, couplings).

1 Cold starting is difficult or impossible
2 Warm starting is difficult or impossible
3 Engine starts and stalls immediately
4 Irregular functioning during warm-up
5 Irregular idle r.p.m.
6 Fail to reach max speed
7 Excessive fuel consumption
8 Engine misses in all running conditions
9 Idle CO value too high
10 Idle CO value too low

Symptoms

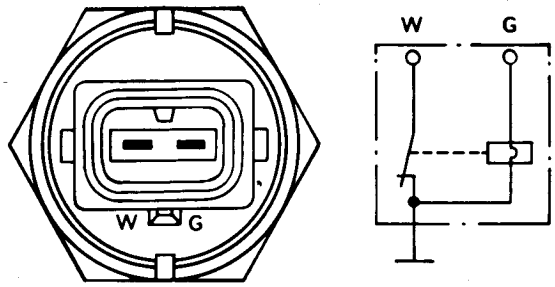
1	2	3	4	5	6	7	8	9	10	Probable cause	Corrective action
X	X	X	X	X	X	X	X			• Poor connections of system connectors and/or wiring continuity absent	Check correct connection of connectors and electric continuity
X	X	X								• Double relay faulty	Replace relay
X	X	X		X	X					• Air and/or fuel piplug incorrectly connected or damaged	Check, and restore if required
X	X	X			X		X			• Fuel pump faulty or delivery insufficient	Check pump and related connector
X	X	X		X	X		X		X	• Fuel pressure too low	Check functioning of pump and pressure regulator Check delivery piping Verify supply system filter
	X	X		X		X				• Fuel pressure too high	Check pressure regulator Check return piping
X										• Cold starting electroinjector fails to open	Replace electroinjector

ELECTRICAL DATA

COLD STARTING ELECTROINJECTOR

Data	Measurement unit
Resistance between terminals	4 Ω

THERMO-TIME SWITCH



		Values
Triggering temperature	°C (°F)	30 to 40 (86 to 104)
Triggering max time (at —20°C)	s.	8

Resistance		Temperature	
		<30°C (<80°F)	>40°C (>104°F)
Between Terminal W and ground	Ω	0	100 to 160
Between Terminal G and ground and between Terminals G and W	Ω	25 to 40	50 to 80

ENGINE TEMPERATURE SENSOR

Resistance between terminals	Temperature
7 to 12 kΩ	10°C (50°F)
2 to 3 kΩ	20°C (68°F)
250 to 400 Ω	30°C (86°F)

c. Turn throttle unit as directed under «Tuning and Adjustments».

THROTTLE STOP ACTUATOR (TSA)

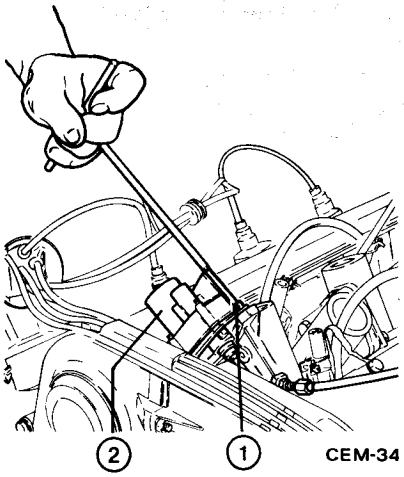
TSA consists of a d.c. motor activated directly by ECU.
TSA actuates throttle abutment lever.
Upon starting, TSA permits correct throttle opening to secure optimum starting conditions in relation to engine temperature.
During warm-up, TSA progressively reduces throttle angle down to normal idle, and thereafter maintains idle speed whenever extra loads (i.e. air conditioner, fans heated rear window) are inserted.
TSA operates only with accelerator pedal released; upon accelerating TSA remains in the position previously taken up.

ELECTRICAL CHECKS

See «Electrical Checks» section.

REMOVAL

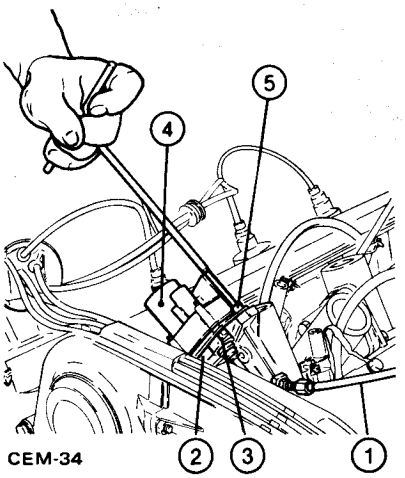
a. Back off two hex. socket head capscrews (1) and remove TSA (2) from front throttle body support.



1. TSA screws
2. Throttle stop actuator

INSTALLATION

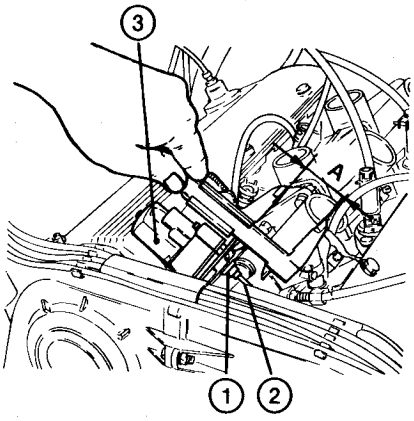
For TSA installation proceed as follows:
a. Check for proper accelerator cable (1) connection to pulley.
b. Install TSA carrier plate (2) on TSA tightening nuts (3) to 5.5 Nm (0.56 kgm; 4.05 ft.lb).
c. Install TSA (4) to support on front throttle body using two hex. socket head capscrews (5).



1. Accelerator cable
2. TSA carrier plate
3. Retaining nut
4. TSA
5. Retaining screw

d. Install screw (2) on TSA plunger (1) adjusting standout «A» with switch closed to 34 ± 0.25 mm (1.33 ± 0.009 in).
To close switch press on plunger lightly.

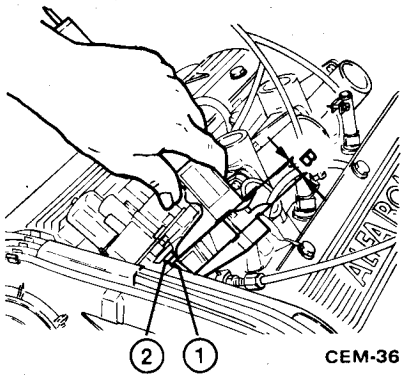
A = Screw and plunger standout (switch closed, plunger in) 34 ± 0.25 mm (1.33 ± 0.009 in)



1. Plunger
2. Adjusting screw
3. TSA

e. Check that standout «B» of screw (1) from plunger (2) is 16.5 to 18.5 mm (0.64 to 0.72 in).
If this requirement is not met it is possible that plunger is not fully in.
Move plunger fully back as directed below, then readjust standout «B» of screw (1).

B = Screw standout relative to plunger 16.5 to 18.5 mm (0.64 to 0.72 in)

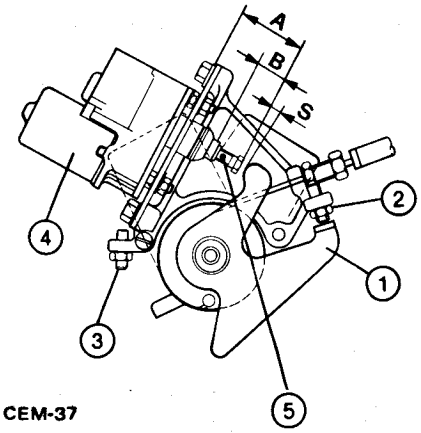


CEM-36

1. Adjusting screw
2. Plunger

f. Turn pulley to bring lever (1) in abutment with idle stop screw (2).
g. Check that gap «S» with switch closed is 0.8 to 3.8 mm (0.03 to 0.15 in). Adjust idle screw (2) as necessary.

S = Gap between actuator screw (plunger fully back) and throttle lever
0.8 to 3.8 mm
(0.03 to 0.15 in)



CEM-37

1. Idle limit travel lever (throttles closed)
2. Idle adjusting screw
3. WOT adjusting screw
4. TSA
5. Actuator screw

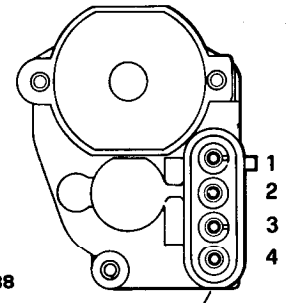
A = Screw and plunger standout (plunger in)
34 ± 0.25 mm
(1.33 ± 0.009 in)

B = Screw standout relative to plunger
16.5 to 18.5 mm
(0.64 to 0.72 in)

S = Gap between plunger and lever
0.8 to 3.8 mm
(0.03 to 0.15 in)

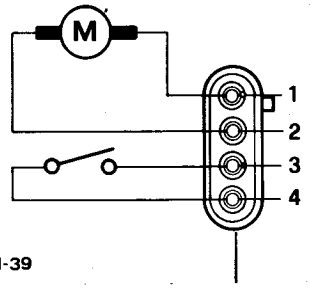
Plunger backup

To move plunger fully back without damaging TSA, establish electrical connections as indicated in the wiring diagram below or using tool **C.9.0031** to be connected to TSA connector.



CEM-38

TSA connector



CEM-39

Wiring connector

Wiring connector

a. Lightly press on TSA plunger to close the switch.
b. Supply circuit at 10 to 12 V through terminals (3) and (4) until plunger stops in fully back position as switch opens.

CAUTION:
Do not connect TSA motor directly through terminals (1) and (2) otherwise TSA may be damaged as plunger locks at stroke end.

THROTTLE ANGLE SENSOR (TAS)

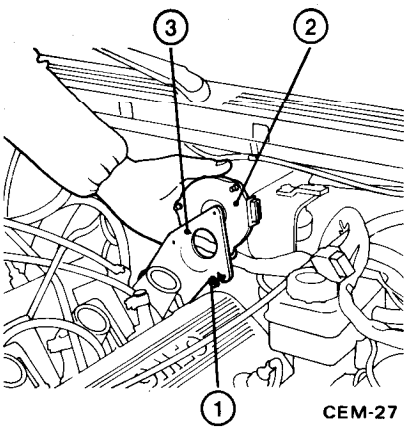
TAS is connected to throttle lever on rear body to provide information on load required by engine and produce exact ignition advance and the correct volume of fuel to be injected.

ELECTRICAL CHECKS

See «Electrical Checks» section.

REMOVAL

a. Back off three nuts and washers (1) and remove TAS (2) from support (3) on rear throttle body.



CEM-27

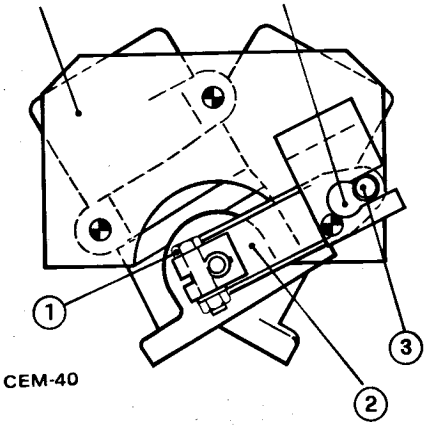
1. Nuts and washers
2. TAS
3. Support

INSTALLATION

For TAS installation proceed as follows:
a. **TAS lever adjustment**
— Slacken screw (1) of TAS lever (2) on rear throttle body so that it is free to turn relative shaft.
— Install tool **C.4.0500** for positioning lever (2) as shown in figure, inserting ball end (3) in tool socket.

— Tighten screw (2) to lock lever in this position.

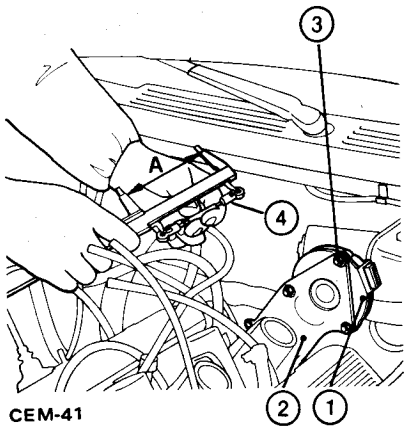
C.4.0500 Socket



CEM-40

1. Retaining screw
2. TAS lever
3. Ball end

b. In position shown TAS lever angle is 62° ±5'.
c. Install TAS (1) on support (2) using nuts and washers (3).
d. Check that length of link (4) (center distance) is 105.75 to 106.15 mm (4.12 to 4.15 in).

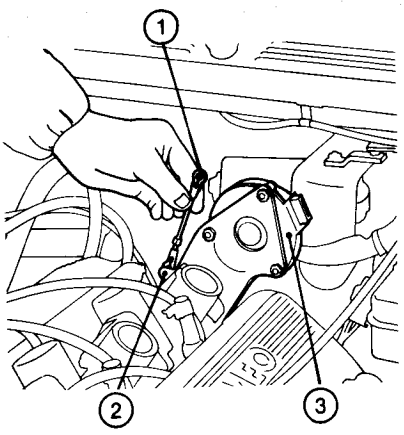


CEM-41

1. TAS
2. TAS support
3. Nuts and washers
4. Connecting link

A = Link length
(ball end center distance)
105.75 to 106.15 mm
(4.12 to 4.15 in)

e. Install link (1) with **turnbuckle hexagon facing throttle lever.**
On link installation ensure that ball ends are spotlessly clean on both levers and link.

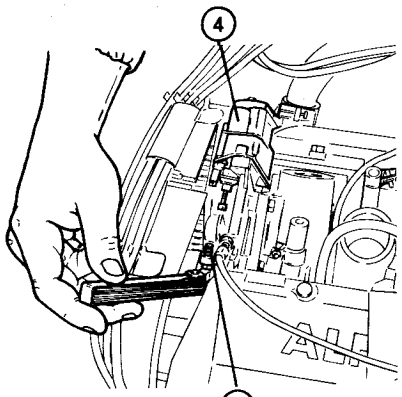


CEM-42

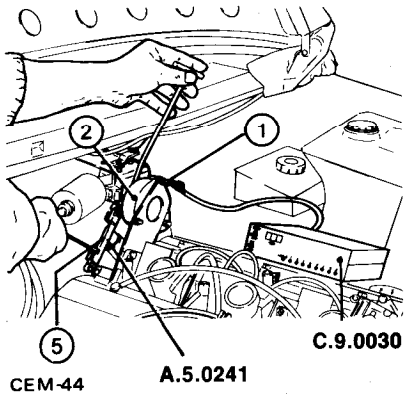
1. Link
2. Throttle lever
3. TAS

f. Connect diagnostic tester **C.9.0030** to TAS as follows:
— Disconnect harness connector from TAS;
— Connect tester connector to connector (1) of TAS (2);
— Connect tester positive (red) to battery positive and tester negative (black) to battery negative.
Pay attention not to reverse polarity.
g. Insert a 0.35 to 0.36 mm (0.0135 to 0.0140 in) feeler between idle stop screw (3) and abutment on pulley.
Ensure that pushrod of TAS (4) is fully in, otherwise proceed as directed under «Throttle Stop Actuator», «Plunger Backup».
h. Hold feeler in position and check that tester displays 4th TAS position, i.e. α = 003.

i. If reading is higher than α = 003, shorten link (5) by rotating turbnbuckle counterclockwise until the specified reading is obtained.
If the reading is lower than α = 003 lengthen link by turning clockwise.
In the process hold both link ends (5) still with tool **A.5.0241** as shown.



CEM-43



C.9.0030
A.5.0241
CEM-44

1. Diagnostic connector
2. TAS
3. Stop screw (idle adjust.)
4. TSA
5. Connecting link

j. Remove feeler and with throttles against abutment at idle check that diagnostic tester display shows first TAS position α = 000.
If the specified reading is not obtained check for the anomaly preventing throttle closing.

CAUTION:
Do not actuate throttles through sensor lever otherwise correspondence of throttle opening to configuration indicated by sensor may be adversely affected.

COOLANT TEMPERATURE SENSOR (CTS)

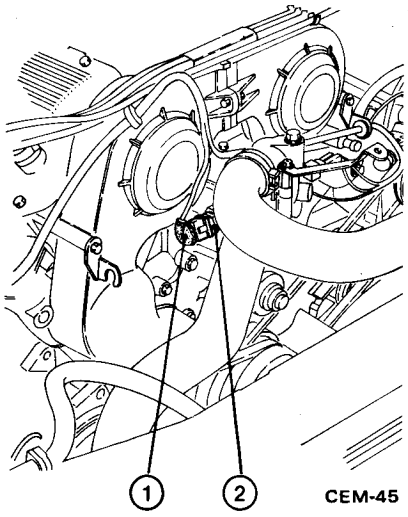
Engine temperature is monitored through NTC sensor (resistance varies in proportion to temperature, namely low resistance for high temperatures and vice versa) which picks up coolant temperature.
Upon starting this information is used to determine injection time, and thereafter to correct injection time contained in ECU map up to end of warm-up period.

INSPECTION

See «Electrical Tests» section.

REPLACEMENTS

a. Disconnect harness connector (1) from CTS.
b. Using a suitable wrench, back off CTS (2) from thermostat on engine front end.



1. Sensor connector
2. CTS

INSTALLATION

a. For CTS installation adopt a reversal of the removal sequence.
b. Check and if necessary adjust CO emission as directed in «WORKSHOP MANUAL», **Alfa 90 - 6V 2.0 iniezione** — Group 00 — Engine Maintenance, para. «Idle and Emission Check and Adjustment».

ELECTRONIC CONTROL UNIT (ECU)

DESCRIPTION

Signals picked up by ATS, CTS, MRS, TAS and rpm and timing sensor are fed to ECU microprocessor.

ECU processes sensor signals comparing them to optimum engine operation data stored in program memory (map).

Based on the results obtained, microprocessor supplies engine with suitable control signals through interface circuitry.

These signals include injector opening time, ignition advance and TSA commands.

INSPECTION

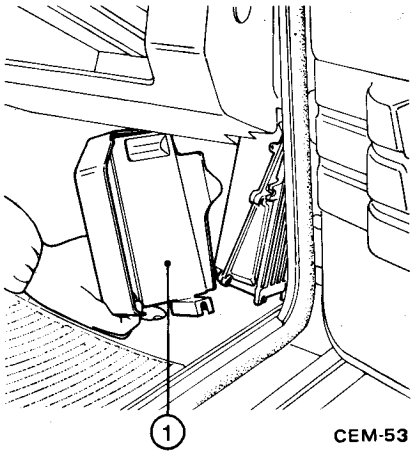
See «Electrical Tests», «Power Supply Check».

REPLACEMENT

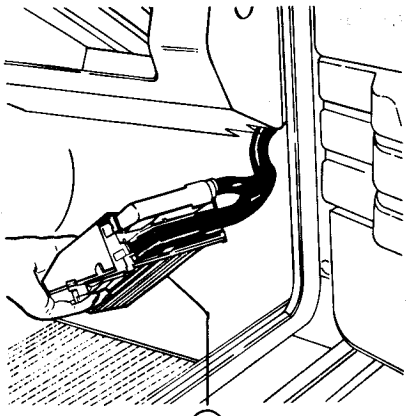
a. Disconnect negative battery terminal.

b. Back off plastic protector screw and remove protector (1).

c. Back off retaining screws and remove ECU (2) from right side panel.



CEM-53



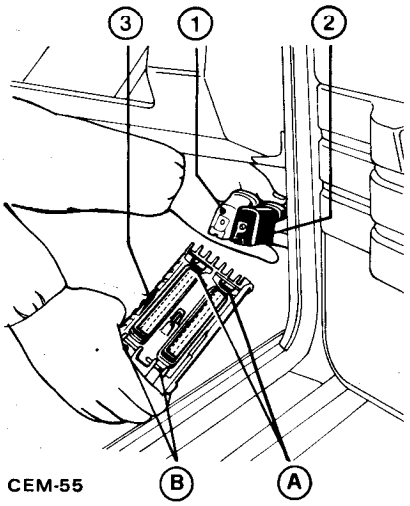
CEM-54

1. Plastic protector
2. ECU

d. Disconnect WHITE connector (1) and BLACK connector (2) from ECU (3) as follows:

— Lightly press retainer in direction A.

— Pull out connector upward, releasing them from pin B on ECU.



CEM-55

1. WHITE connector
2. BLACK connector
3. ECU

A. Retainer

B. Pin

INSTALLATION

For ECU installation adopt a reversal of the removal sequence.

a. Engage connectors to pin B first, and then press fully into retainer A, taking care not to damage the contacts.

b. BLACK connector must be inserted nearer the side panel.

However, wrong connection is impossible as width of engagement of pin B on the two connectors is different.

BLACK connector is narrower than WHITE connector.

RPM AND TIMING SENSOR

DESCRIPTION

RPM and timing sensor, located on bell housing, reads sets of reference slots machined in the flywheel.

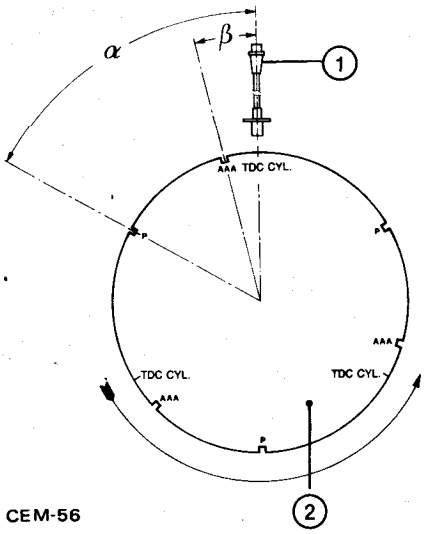
— Set of three **reference slots P**. During normal operation these slots represent the starting point of ignition advance calculation.

— Set of three **reference slots AAA**. During normal running, these slots permit calculation of RPM and fuel injection timing.

Upon starting and up to a given rpm rate slots «P» are not utilized, whereas slots «AAA» provide static ignition advance, as well as normal running functions.

As the flywheel completes two revolutions to each engine cycle, the same reference slots control all cylinders, which are one flywheel revolution out of phase.

The figure below shows flywheel position for TDC position in cylinder no. 1.



CEM-56

1. RPM and timing sensor
2. Flywheel

β 13°

α 60°

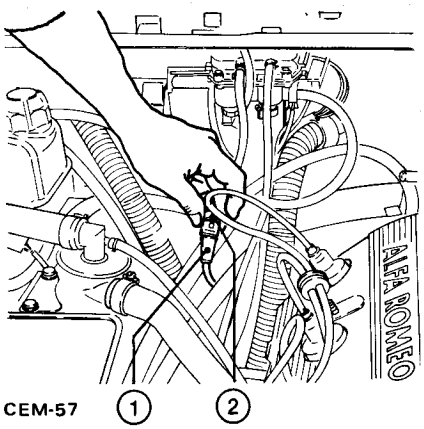
INSPECTION

See under «Electrical Tests».

REPLACEMENT

For RPM and timing sensor replacement proceed as follows:

a. Disconnect sensor terminal (1) from connector (2) of wiring harness.



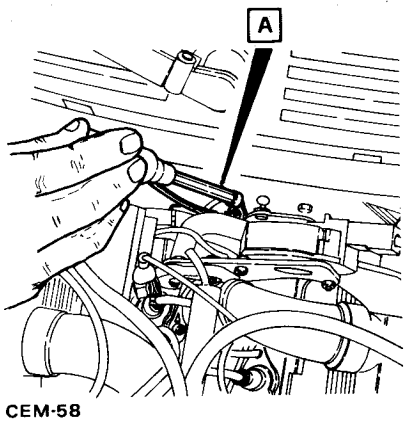
CEM-57

1. Sensor terminal (WHITE)
2. Wiring connector (BLACK)

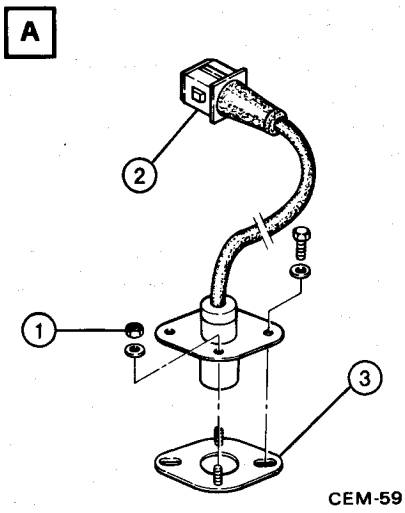
b. Back off two nuts (1) and remove sensor (2).

NOTE:
Do not disturb sensor carrier plate (3).

c. Install new sensor and fasten to plate.



CEM-58



CEM-59

1. Sensor retaining nuts
2. RPM and timing sensor
3. Sensor carrier plate

INSTALLATION

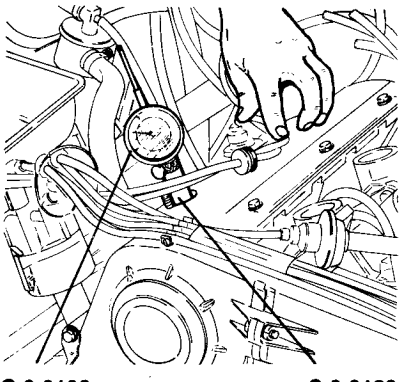
If flywheel, bell housing or sensor plate has been removed, proceed as follows:

a. Disconnect battery negative terminal.

b. Remove spark plug from cylinder no. 1 using appropriate articulated wrench **A.5.0258**.

c. Install dial support **C.6.0183** on cylinder no. 1 spark plug seat.

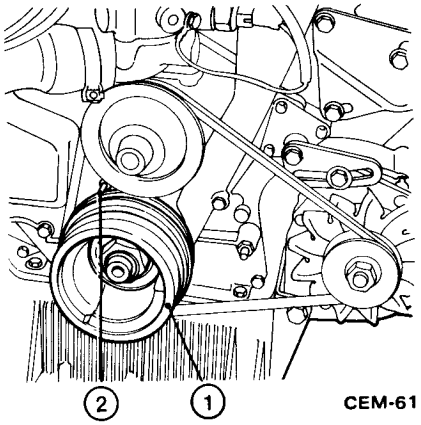
Install dial gauge **C.6.0198** on support. Gauge should permit 30 mm (1.17 in) stroke.



C.6.0198 **C.6.0183**

CEM-60

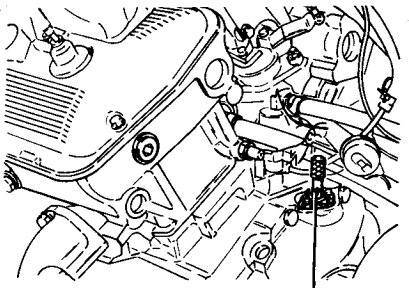
d. Rotate crankshaft through pulley to bring piston of cylinder no. 1 to TDC on expansion stroke.
This position is reached when gauge needle dwells between clockwise and counterclockwise oscillation.
e. Also check that mark «F» stamped on pulley of crankshaft (1) lines up with fixed pointer (2) on engine block.

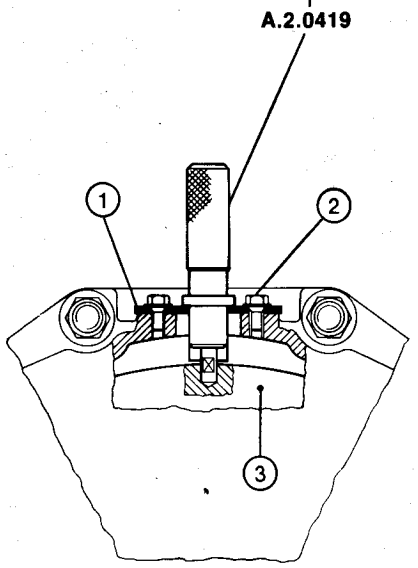


CEM-61

1. Crankshaft pulley
2. Fixed pointer

f. Install sensor plate (1) on bell housing and fasten using two screws (2).
Do not tighten screws.
g. Zero dial gauge.
h. Bring piston of cylinder no. 1 to compression stroke (turning crankshaft clockwise, as seen from flywheel end) to a position giving a 19.70 ± 0.04 mm (0.77 ± 0.002 in) reduction from zero gauge reading (equivalent to 60° ± 4' BTDC crank angle).
i. Introduce tool **A.2.0419** in sensor plate bore and move plate along elongated holes to permit insertion of tool **A.2.0419** protrusion in associated hole on the flywheel.
j. In this position tighten plate to bell housing through the associated screws and remove tool **A.2.0419**.
k. Install sensor and fasten to plate.
Finally, connect sensor terminal to wiring connector.


CEM-62



CEM-63

1. Sensor carrier plate
2. Plate retaining screws
3. Flywheel

TUNING AND ADJUSTMENTS

THROTTLE TUNING (Air leakage with throttle closed)

a. Remove induction chambers, and proceed as directed under «Air Induction Chambers», paras. a. through i.

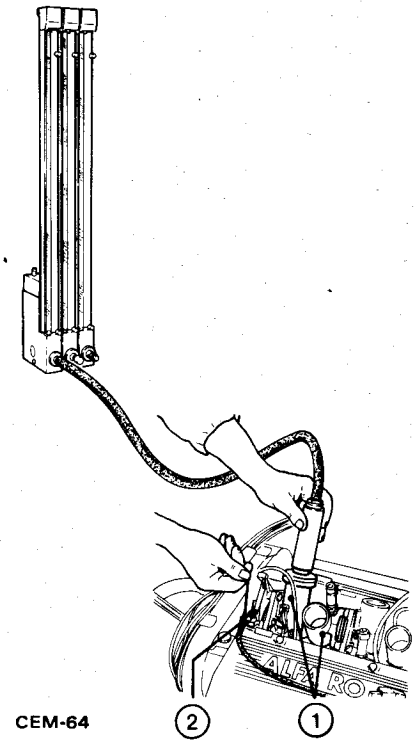
b. Check throttle unit tuning using a suitable flowmeter as follows:

— Connect Solex flowmeter plug to scale D.

— With throttles closed rest plug on inlet of front throttle body (1) (cylinder no. 1 and no. 4).

— Measure air flow through each port (on front body) and compare to specified readings.

— To adjust back off locknut and turn adjusting screw (2) until the correct flow rate is obtained.

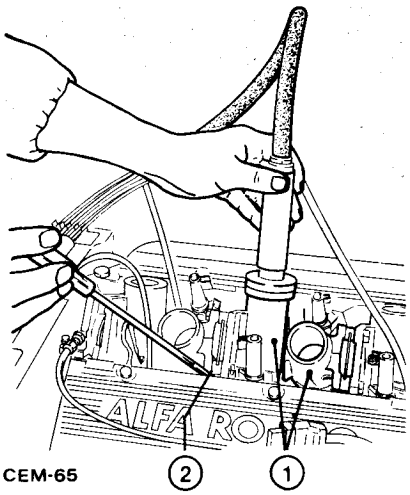


CEM-64

1. Front throttle body
2. Idle adjusting screw

— Still with throttles closed, rest flowmeter plug on inlet of center throttle body (1) (cylinders no. 5 and no. 2).

— Measure air flow through each port (in center body) and turn adjusting screw (2) until higher equivalent flow on center body (1) is equal to the higher flow on front throttle body.

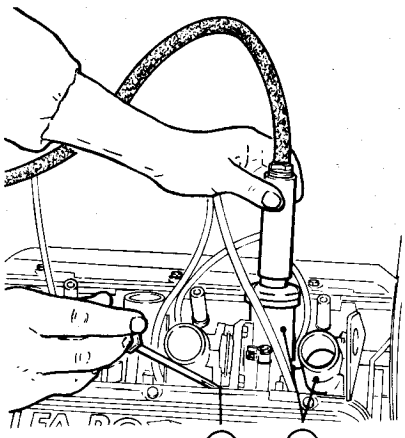


CEM-65

1. Center throttle body
2. Adjusting screw

— With throttles closed, rest plug on inlet of rear throttle body (1) (cylinder no. 3 and no. 6).

— Measure air flow through each port (rear body) and turn adjusting screw (2) until equivalent higher flow on rear throttle body (1) is equal to the higher flow on front throttle body.



CEM-66

1. Rear throttle body
2. Adjusting screw

c. **Scale D readings on Solex flowmeter must indicate 75 to 90 with plug upstream of throttles and accelerator released.**

d. Install parts previously removed adopting a reversal of the removal sequence and proceed with adjustment.

ACCELERATOR CONTROL ADJUSTMENT

1. Cable binding check

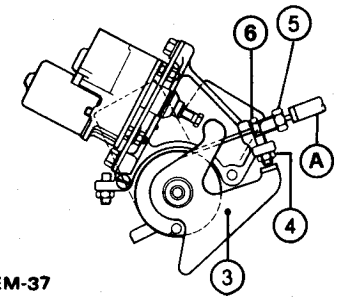
Check accelerator cable for binding in conduit.

2. Cable clearance check

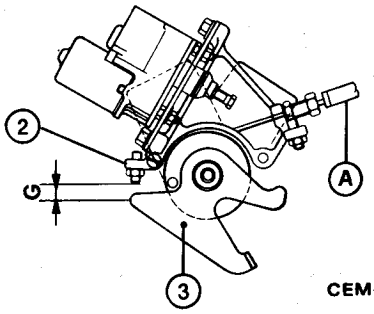
a. With accelerator pedal raised, insert a shim **S = 1 mm (0.039 in)** between pedal stop pad (1) and sheet metal (2).

b. With pulley register (3) contacting idle adjusting screw (4) back off cable adjusting screw (5) until pulley starts to turn.

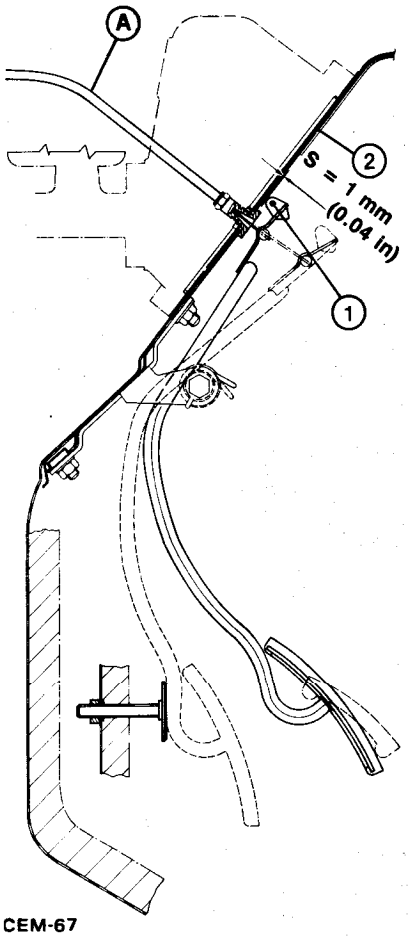
c. Remove shim, check that register (3) makes full contact with idle adjusting screw (4) and tighten locknut (6) on adjusting screw of cable (5).



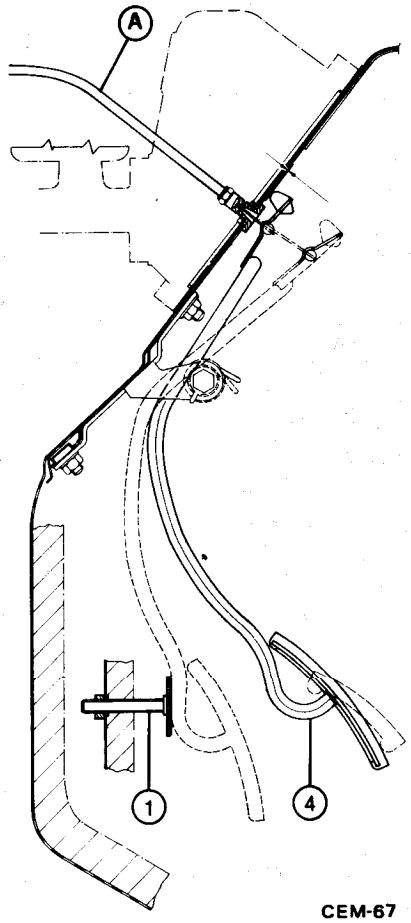
CEM-37



CEM-68



CEM-67



CEM-67

1. Accelerator pedal stop pad
2. Sheet metal
3. Pulley register
4. Idle adjusting screw
5. Cable adjusting screw
6. Locknut

1. Limit travel screw
2. WOT stop screw
3. Pulley register
4. Accelerator pedal

3. Wide open throttle (WOT) check

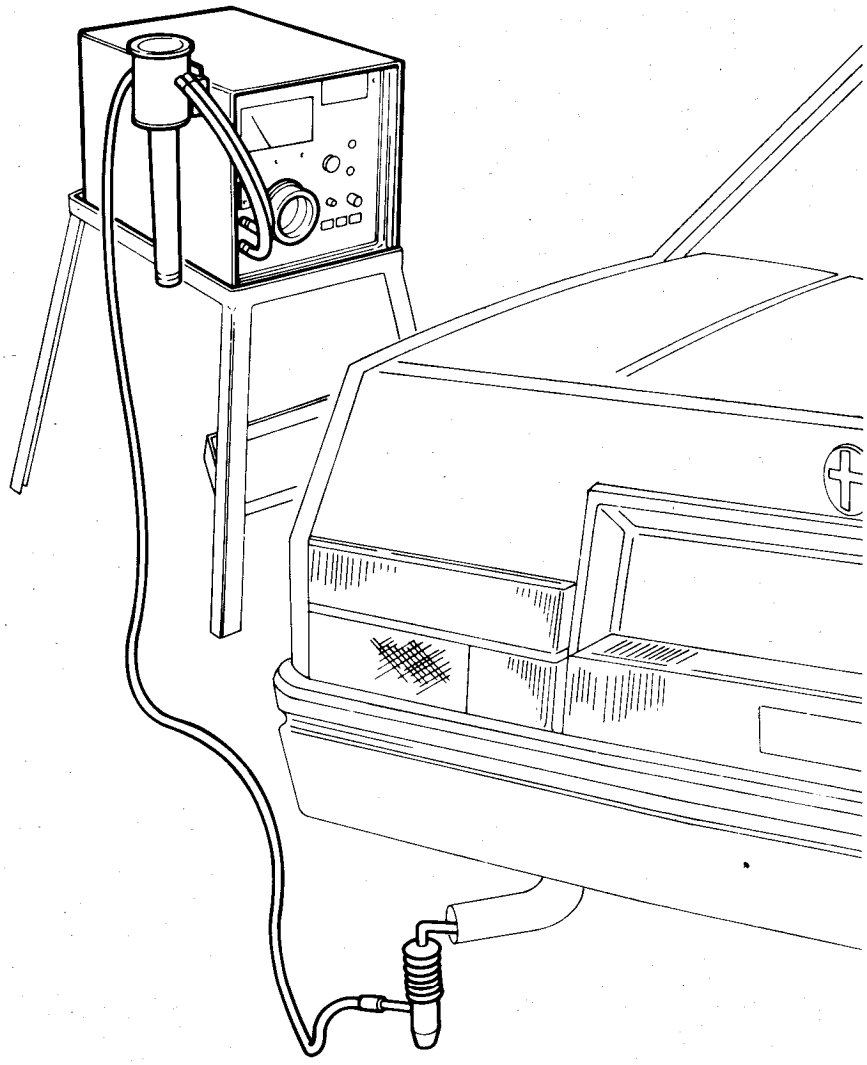
a. With accelerator pedal depressed to contact limit travel screw (1), check that gap between WOT stop screw (2) and register (3) on pulley is:

G = 1.5 mm (0.06 in)

b. To adjust screw in or back off limit travel screw (1) under accelerator pedal (4) as necessary.

EMISSION CHECK AND ADJUSTMENT

After warm-up idling for 5 to 10 minutes check CO percentage as directed below.



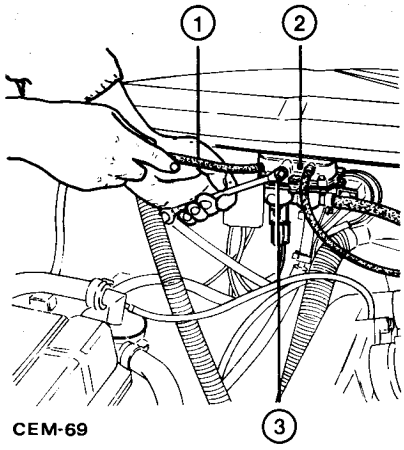
a. Introduce analyzer probe in tail pipe % CO tester reading must be as specified.

% CO = 0.5 to 1.5

b. To adjust proceed as follows:
— Disconnect idle air tube (1) from pressure regulator tube (2). Tube is connected to air cleaner.
— Slacken locknut (3) and turn adjusting screw as follows:
- Screw in to reduce % CO.
- Back off to increase % CO.

c. Tighten adjusting screw with locknut (3).

d. Connect idle air tube (1) to pressure regulator.



1. Idle air tube, air cleaner to pressure regulator
2. Pressure regulator
3. Adjusting screw locknut

Emission check cylinder by cylinder

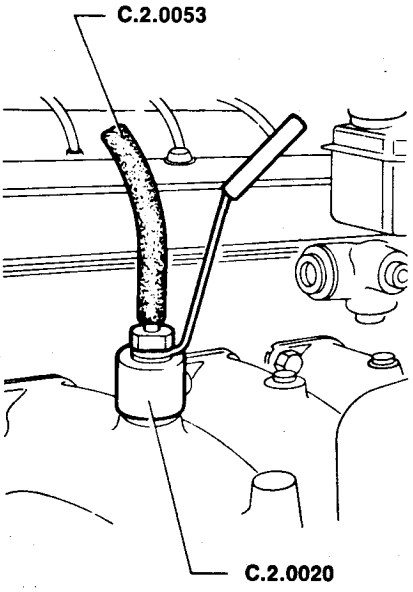
a. After warm-up adjust overall CO to 1 to 1.5%.

b. Check % CO cylinder by cylinder. To do this remove plug from each exhaust manifold in turn and install connector **C.2.0020** and hose **C.2.0053** for CO analyzer.

c. Check individual cylinder CO and scrap injectors of cylinders exhibiting CO < 0.3% or > 6%.

d. If overall CO cannot be adjusted to below 1.5%, check individual COs and replace injectors of cylinders exhibiting higher, or at any rate > 6%, reading, and repeat the check.

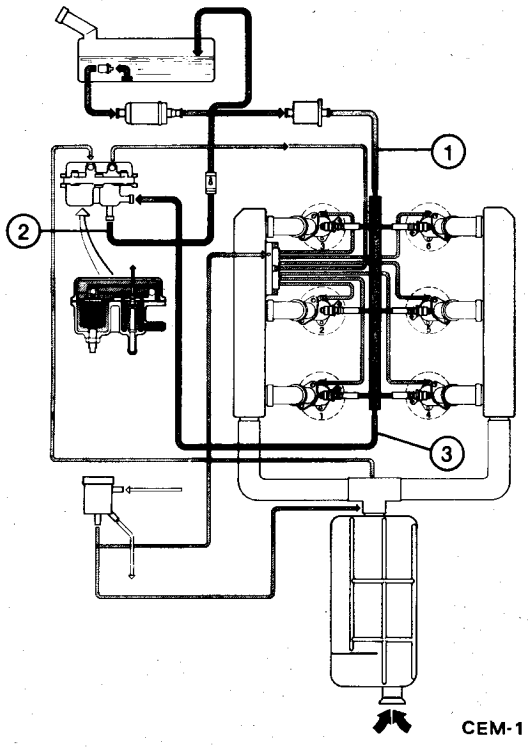
e. If overall CO cannot be adjusted to at least 1% check individual COs and replace injectors of cylinders exhibiting lower, or at any rate < 0.3%, reading, and repeat the check.



CHECKS AND ADJUSTMENTS

FUEL SUPPLY SYSTEM

Description	Values
Operating pressure: To be measured at points (1) and (2) disconnecting fuel delivery line at fuel manifold and pressure regulator fuel leak-back line.	kPa 170 bar 1.7 kg/cm^2 1.7 psi 24.65
Pressure regulator operating pressure: To be measured at point (3) disconnecting fuel return line to pressure regulator. Pressure varies in relation to atmospheric pressure. mbar (mm Hg) 1013 (760) mbar (mm Hg) 954 (716) mbar (mm Hg) 898 (674) mbar (mm Hg) 845 (634)	kg/cm^2 1.90 psi 27 kg/cm^2 1.70 psi 24 kg/cm^2 1.50 psi 21 kg/cm^2 1.30 psi 18



CEM-1

1. Fuel delivery line
2. Leak-back line to tank
3. Fuel return to pressure regulator

THROTTLE TUNING (Air leakage with throttle closed)

Description	Reading
Air leakage with throttle closed. Flowmeter readings must be taken applying plug upstream of throttles.	(Solex flowmeter) Scale D 75 to 90

GENERAL REQUIREMENTS

FLUIDS AND LUBRICANTS

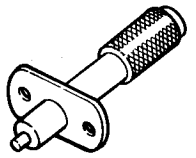
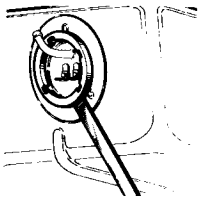
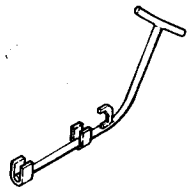
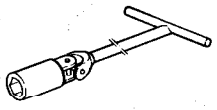
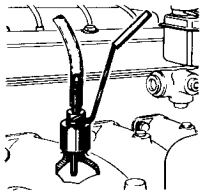
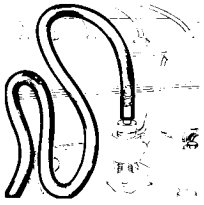
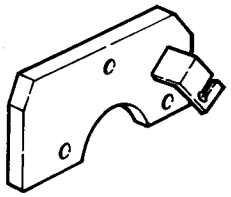
Application	Type	Description	Q.ty
Accelerator pedal shaft	GREASE	ISECO Molykote Longterm n. 2 Part No. 3671-69831	—

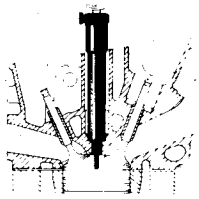
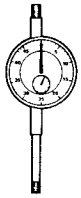
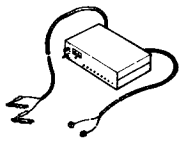
FUEL

Gasoline: Octane Number (R.M.) ≥98 and sensitivity (1) ≤11

(1) Difference between NORM and NOMM

SPECIAL TOOLS

Part No.	Description	Page ref.
A.2.0419	Positioner, sensor plate 	04-129
A.5.0197	Wrench, tank pump and fuel level indicator sender lockring 	04-123
A.5.0241	Adjuster, TAS link 	**04-119**
A.5.0258	Wrench, articulated, spark plug 	04-128
C.2.0020	Connector, exhaust manifold (use with **C.2.0053**) 	04-132
C.2.0053	Hose, CO probe 	**04-132**
C.2.0125	Fitting, pump pressure test 	04-124
C.4.0500	Positioner, TAS lever 	04-118 04-119

Part No.	Description	Page ref.
C.6.0183	Carrier, TDC gauge 	04-128
C.6.0198	Gauge, clock, 30 mm (1.17 in) stylus stroke (use with **C.6.0183**) 	04-128
C.9.0030	Tester, diagnostic, CEM System 	04-119 04-149
C.9.0031	Backer, throttle actuator, for mechanical adjustment 	04-118

GROUP 04

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4 cylinders Alfa 75 1.8 turbo

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6 cylinders Alfa 90 2.5 iniezione

6 cylinders Alfa 75 2.5 6V iniezione

6 cylinders GTV 6 2.5

CONTENTS (Contd)

6 cylinders Alfa 90 2.0 6V iniezione

(*) Refer to: Workshop Manual Alfa 90 - GROUP 00

(**) Refer to 1.6 - 1.8 - 2.0 EXHAUST SYSTEM

(•) Refer to: Workshop Manual Alfa 90 2.0 6V iniezione - GROUP 00

(••) Refer to: 6 cylinders Alfa 90 2.5 iniezione - GROUP 04 - Exhaust System

BATTERY

CAUTION:
a. Do not touch positive and negative battery poles simultaneously with bare hands.
b. When starting engine with jumper leads through auxiliary battery, source voltage should not exceed 12 V.

INSPECTION

a. Check battery container for cracks.
b. Ensure that electrolyte level is 4 to 5 mm (0.15 to 0.20 in) above top of plates.
c. Check that battery top is clean and that contacts are free from oxidation.
d. Check terminal clamps for tightness, to ensure efficient contact.

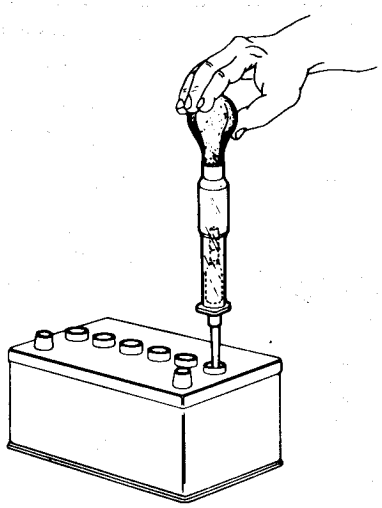
CLEANING

a. Clean battery top, posts and clamp using a solution of water and sodium bicarbonate.
b. Prior to installing clamps, coat with the specified type of grease (REINACH: E10 Tac).

NOTE:
Do not allow cleaning solution to mix with electrolyte, as the two react chemically. Remember that electrolyte is an acid and constitutes a hazard for eyes, hands and clothes.

DENSITY CHECK

a. Check electrolyte level.
b. Use a hydrometer to check density in each element.



c. Measure electrolyte temperature «t» by dipping a thermometer bulb in the fluid.
d. Check density at 25°C (77°F) using the following formula:

$$d_{25} = d_t + 0.0007\ (t-25)\ (kg/dm^3)$$

where d_t is density at temperature t°C

Examples:

1. **Reading at 15°C (59°F):**
   1.290 kg/dm³
   Density at 25°C (77°F) will be:

   $$d_{25} = 1{,}290 + 0.0007\ (15-25)$$
   $$= 1.283\ kg/dm^3$$

2. **Reading at 35°C (95°F):**
   1.275 kg/dm³
   Density at 25°C (77°F) will be:

   $$d_{25} = 1.275 + 0.0007\ (35-25)$$
   $$= 1.282\ kg/dm^3$$

e. Compare calculated density at 25°C (77°F) to reading required for an efficient battery.

Electrolyte density of efficient battery
$$d = 1.28 \pm 0.01\ kg/dm^3$$

f. Recharge battery as necessary.

Batteries left in storage or fitted to vehicles remaining inoperative for long periods are subject to slow discharging, and should be recharged immediately before use.

RECHARGING

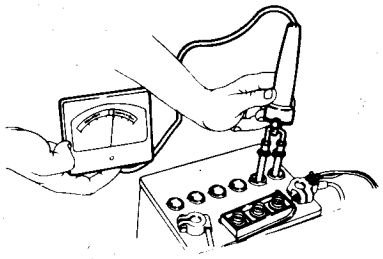
NOTE:
a. Prior to recharging batteries disconnect negative terminal.
b. Make sure that electrolyte temperature does not exceed 45°C (139°F) during recharging.

CAUTION:
a. Do not use open flames in the neighbourhood of battery when recharging.
b. When using a battery charger, connect leads to battery first, and then activate charger.

ELEMENT TESTING

To be carried out after hydrometer test to ensure that density is correct.

Check discharge voltage across terminals of each element proceeding as follows:
a. Remove filler caps.
b. Dip tester prongs in two adjacent holes (positive and negative) as shown and check that needle moves over the green sector, indicating a good state of charge.
c. Repeat the above operation on the two remaining pairs of filler holes.



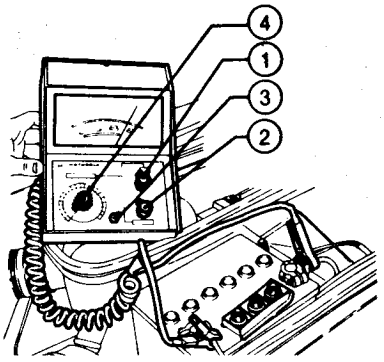
d. If needle dwells over red sector (insufficient charge) and the three readings are equal, the battery should be recharged.
e. If needle remains over red sector (low charge) and the three readings are considerably different from one another, the battery should be replaced.

ELECTRONIC TEST (MOTOROLA TESTER)

Connect positive tester clip to battery positive terminal post and negative clip to negative post.
Turn switch (3) to 12 V, temperature compensator (2) to estimated battery temperature and selector (4) to current rating depending on type of battery under test.

Voltage test

a. Turn selector (1) to «VOLT».
b. Check reading on voltage scale.
The voltage is correct if the reading is higher than 12.4 V.



1. Selector
2. Temp. compensator
3. Battery voltage switch
4. Calibration switch

c. If battery voltage is below 12.4 V, rechargè battery and repeat voltage test. If the trouble persists, element short circuit (S/C) may be the cause. Replace battery without hesitation.

Battery condition check

a. Turn selector to «Cond. Batt.».
b. Check on RED-GREEN scale that needle lies over GREEN sector.
c. If needle lies over RED sector replace battery.

Output test

a. Turn selector to «kW» on tester.
b. Check that needle reads 2 to 4 kW.
c. If reading is not as specified replace battery.

Charging test

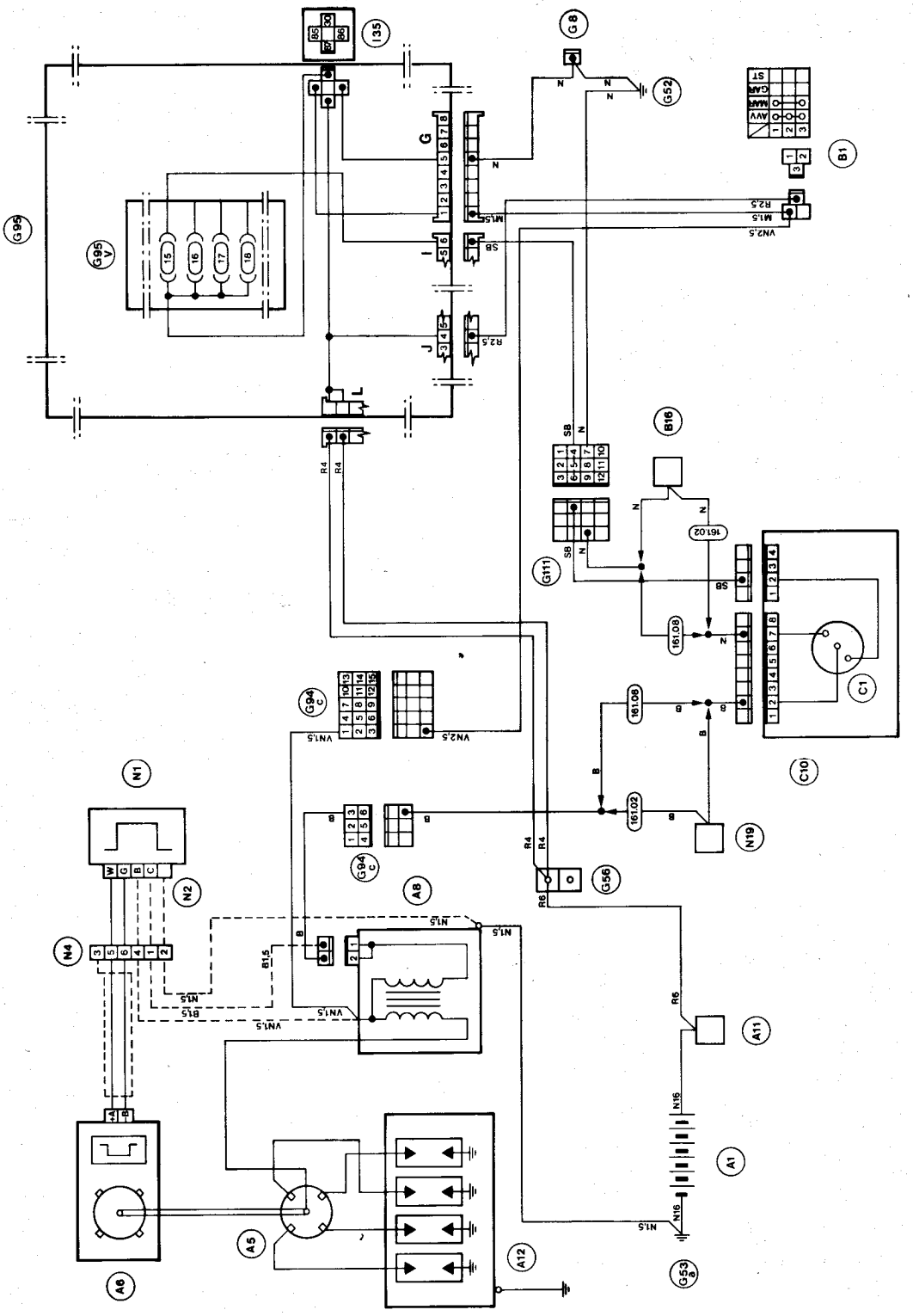
a. Turn selector to «VOLT».
b. Start engine and run in no-load condition until tester needle stabilizes.
c. Needle should read 13.6 to 15 V.
d. If reading is lower or higher check for alternator anomalies, paying particular attention to voltage regulator (see: Recharging - Inspection).

Also check alternator belt tension. (For servicing and adjustment data refer to «Inspection Specifications» paragraph in individual Group of this manual. For **Alfa 90** vehicles, see also Group 00 of publication: PA360300000000).

Starting test

a. Move tester selector to «VOLT».
b. Neutralize ignition system by disconnecting coil H.T. lead.
c. Start engine and check on «VOLT» scale that needle does not read below 9 V.
d. If reading is lower than specified check starting system (see: Starting).

ENGINE IGNITION Alfa 75 1.6 1.8 2.0



A1 Battery
A5 Ignition distributor
A6 Impulse generator
A8 Ignition coil
A11 Starter motor
A12 Spark plugs
B1 Ignition switch
B16 Cluster lighting dimmer rheostat
C1 Electronic rev-counter
C10 Cluster
G8 Single connector
G52 Fusebox ground
G53a Engine compartment ground - Right
G56 Branch terminal board
G94c Engine compartment connector - Right
G95 Central fusebox
G95V Fuses
G111 Connector for dashboard instruments wiring
I35 Key-operated supply relay
N1 Electronic ignition module
N2 Connector for Marelli module
N4 Connector for Bosch module
N19 Performance gauge control unit

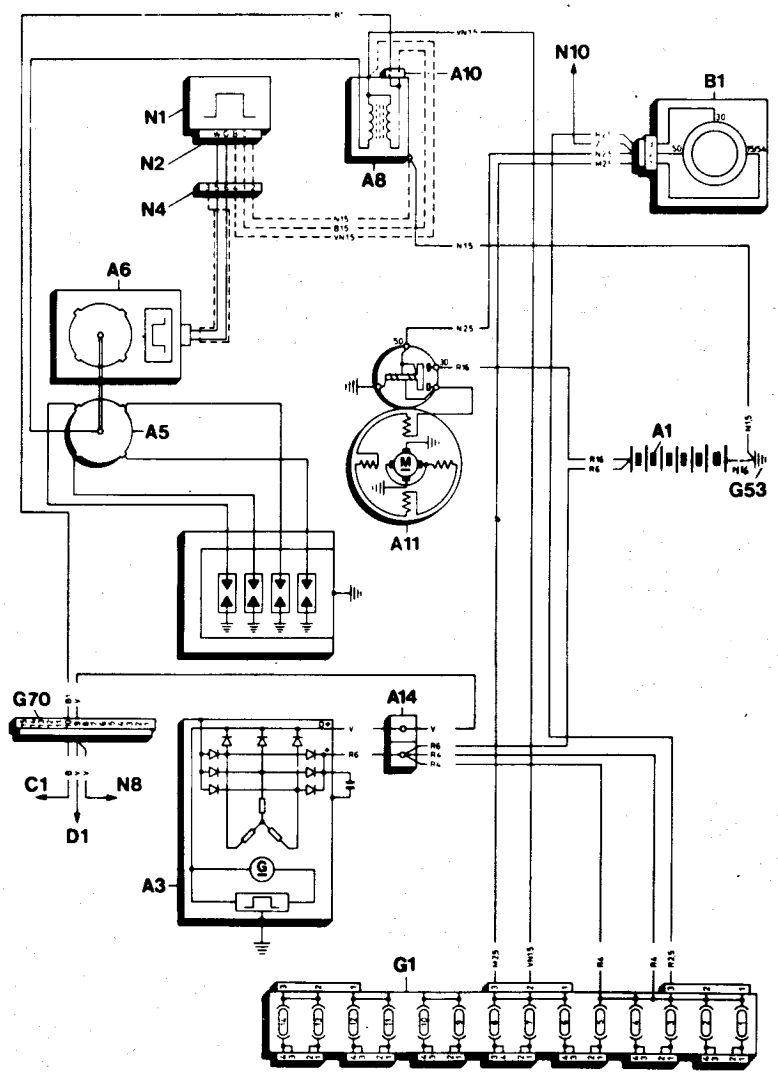
ELECTRICAL SYSTEM

ENGINE IGNITION

Giulietta 1.6 1.8 2.0

Alfetta 1.6 1.8 2.0

GTV 2.0

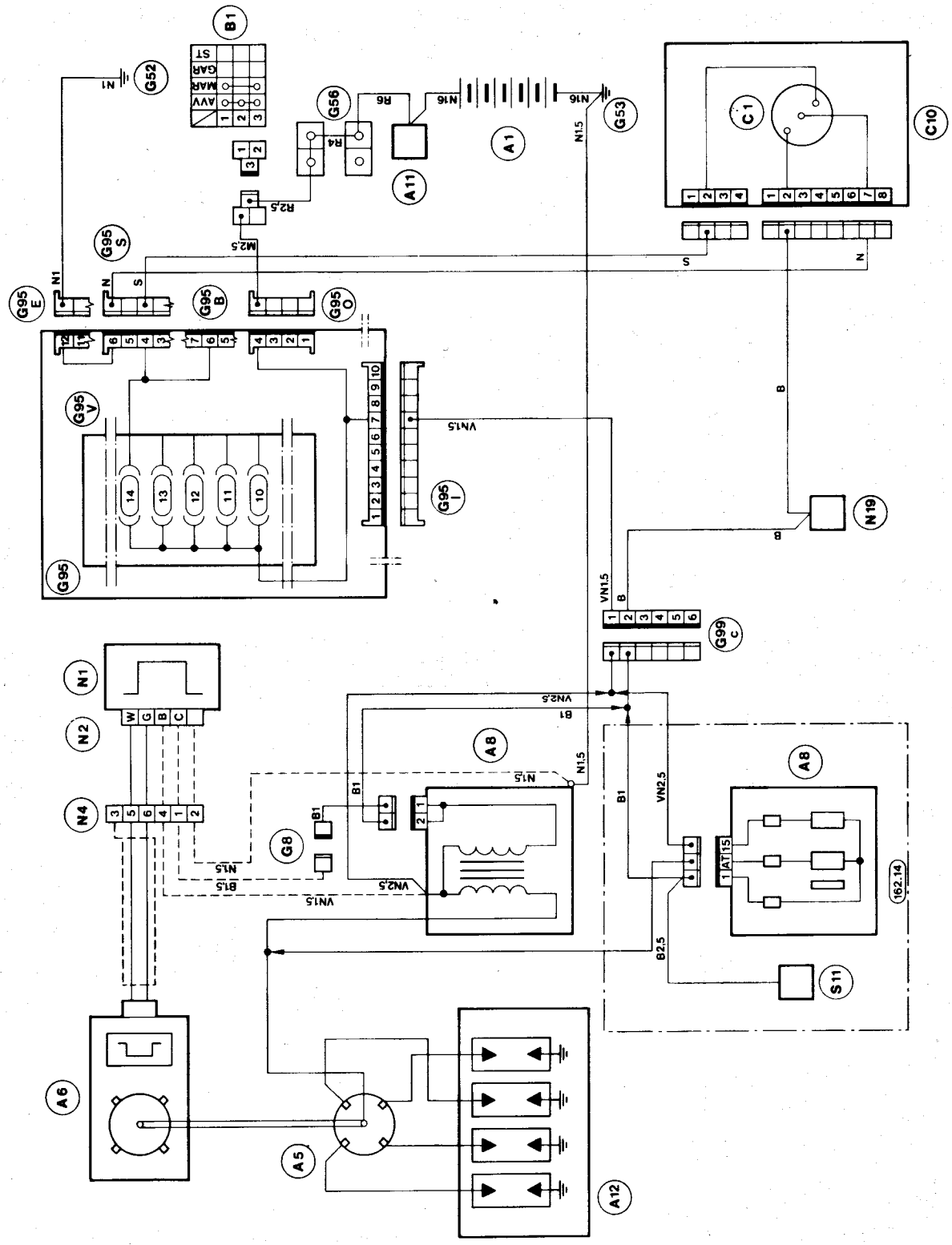


NOTE:
Leads shown in broken lines apply to BOSCH ignition system.
On MARELLI ignition system these leads are pre-wired in coil-electronic unit.

A1	Battery
A3	Alternator with integral voltage regulator
A5	Ignition distributor
A6	Pulse generator
A8	Ignition coil
A10	Two-way coil connector
A11	Starter
A14	Alternator terminal block
B1	Ignition switch
C1	Electronic rev-counter
D1	Alternator warning lamp
G1	Fuse unit
G53	Engine compartment ground
G70	Connection C with cabling loom
N1	Electronic ignition module
N2	Connector for Marelli module
N4	Connector for Bosch module
N8	Alfa Romeo control
N10	Courtesy light timer

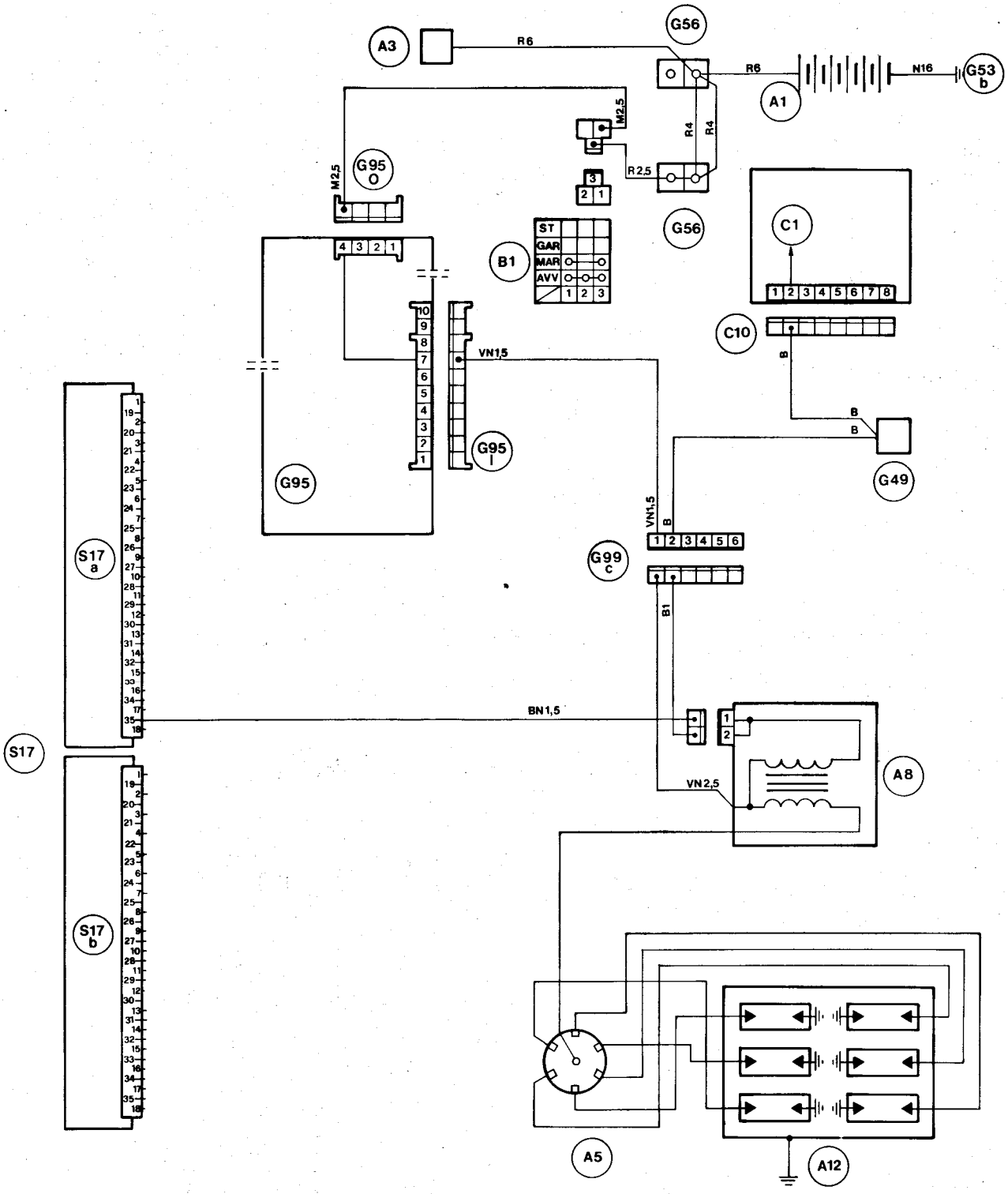
ENGINE IGNITION Alfa 90 1.8 2.0 2.0 iniezione

Alfetta 2.0



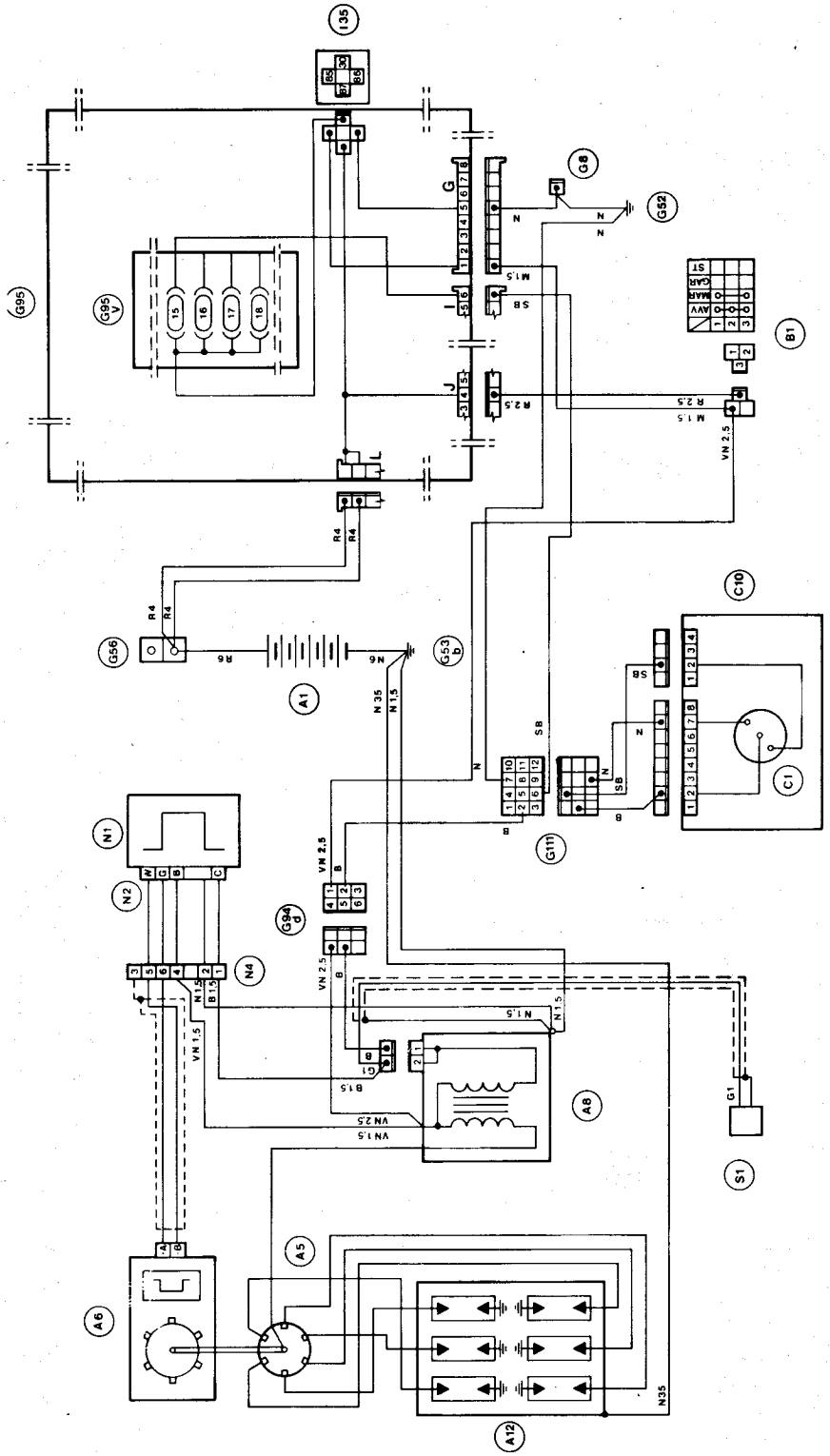
A1 Battery
A5 Ignition distributor
A6 Impulse generator
A8 Ignition coil
A11 Starter motor
A12 Spark plugs
B1 Ignition switch
C1 Electronic rev-counter
C10 Instrument panel
G8 Single connector
G52 Fuse box earth
G53 Engine compartment earth
G56 Branch terminal board
G95 Centralized fuse box
G95B Switch connector
G95E Console connector
G95I DX interface connector
G95O Ignition switch connector
G95S Instrument panel connector
G95V Fuses
G99c Engine bulkhead C connector
N1 Electronic ignition module
N2 Connector for Marelli module
N4 Connector for Bosch module
N19 Performance gauge
S11 Motronic unit

ENGINE IGNITION Alfa 90 2.0 6V iniezione



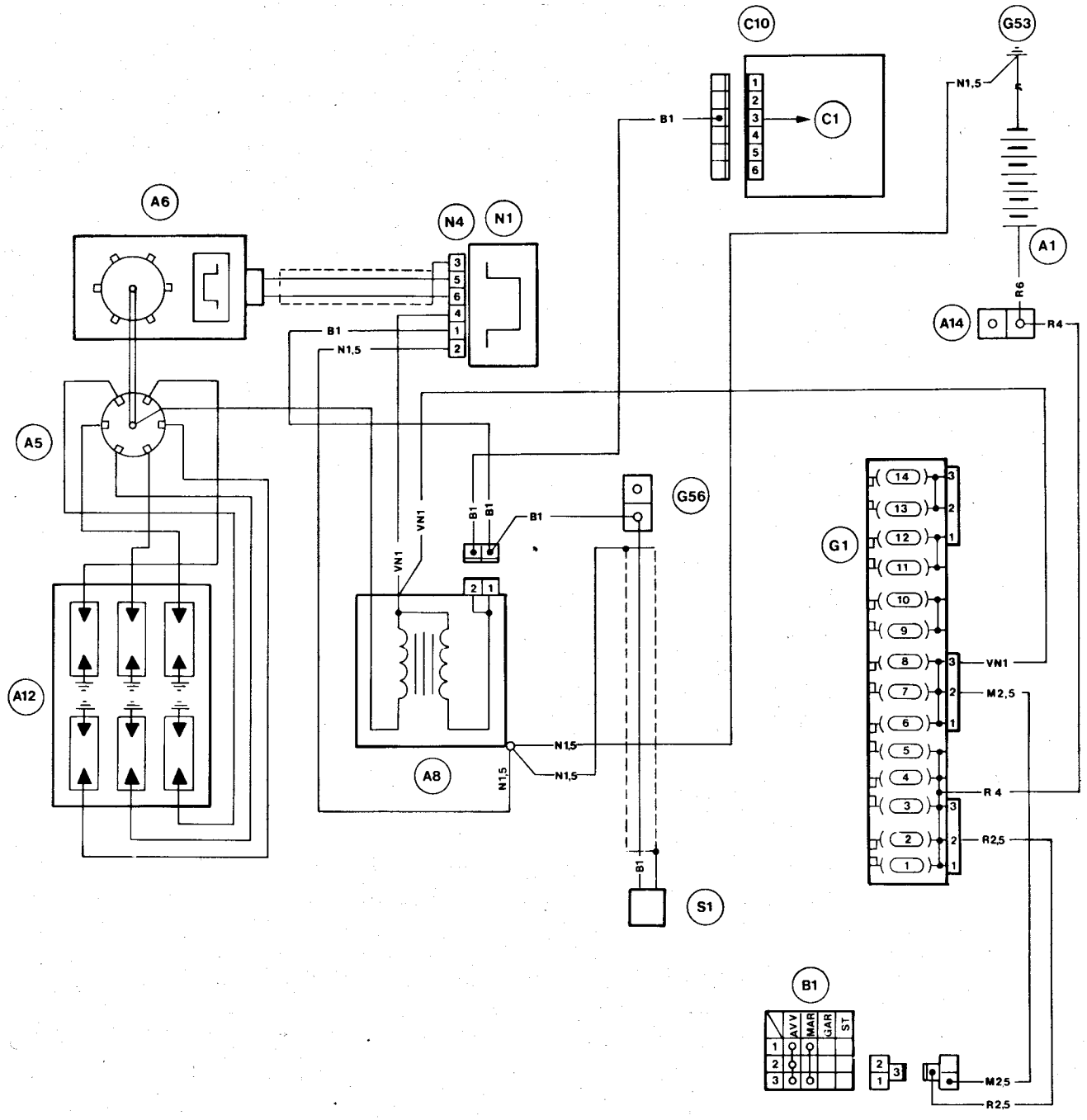
A1 Battery
A3 Alternator with electronic regulator
A5 Ignition distributor
A8 Ignition coil
A12 Spark plugs
B1 Ignition switch
C1 Electronic rev-counter
C10 Cluster
G49 Connection
G53b Engine compartment ground, left
G56 Branch terminal board
G95 Central fusebox
G95I Interface connector, right
G95O Ignition switch connection
G99c Engine bulkhead C connector
S17 ECU
S17a ECU WHITE connector
S17b ECU BLACK connector

ENGINE IGNITION Alfa 75 6V iniezione



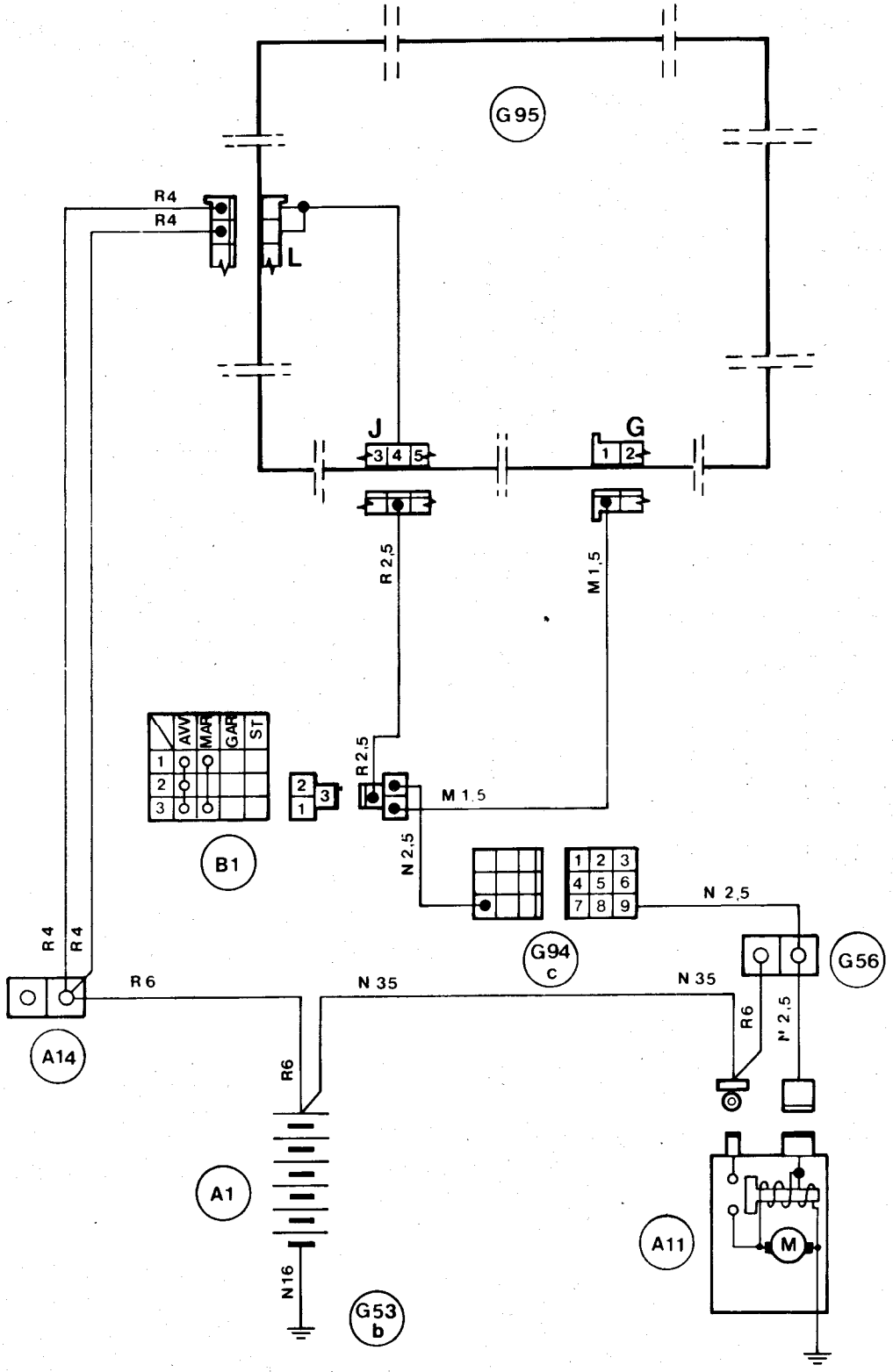
A1 Battery
A5 Ignition distributor
A6 Impulse generator
A8 Ignition coil
A12 Spark plugs
B1 Ignition switch
C1 Electronic rev-counter
C10 Cluster
G8 Single connector
G52 Fusebox ground
G53b Engine compartment ground - Left
G56 Branch terminal board
G94d Engine compartment connector - Left
G95 Central fusebox
G95V Fuse
G111 Connector for dashboard instruments wiring
I35 Key-operated supply relay
N1 Electronic ignition module
N2 Connector for Marelli module
N4 Connector for Bosch module
S1 Injection control unit

ENGINE IGNITION GTV 6 2.5



A1 Battery
A5 Ignition distributor
A6 Impulse generator
A8 Ignition coil
A12 Spark plugs
A14 Alternator cable terminal board
B1 Ignition switch
C1 Electronic rev-counter
C10 Cluster
G1 Fusebox
G53 Engine compartment ground
G56 Branch terminal board
N1 Electronic ignition module
N4 Connector for Bosch module
S1 Ignition control unit

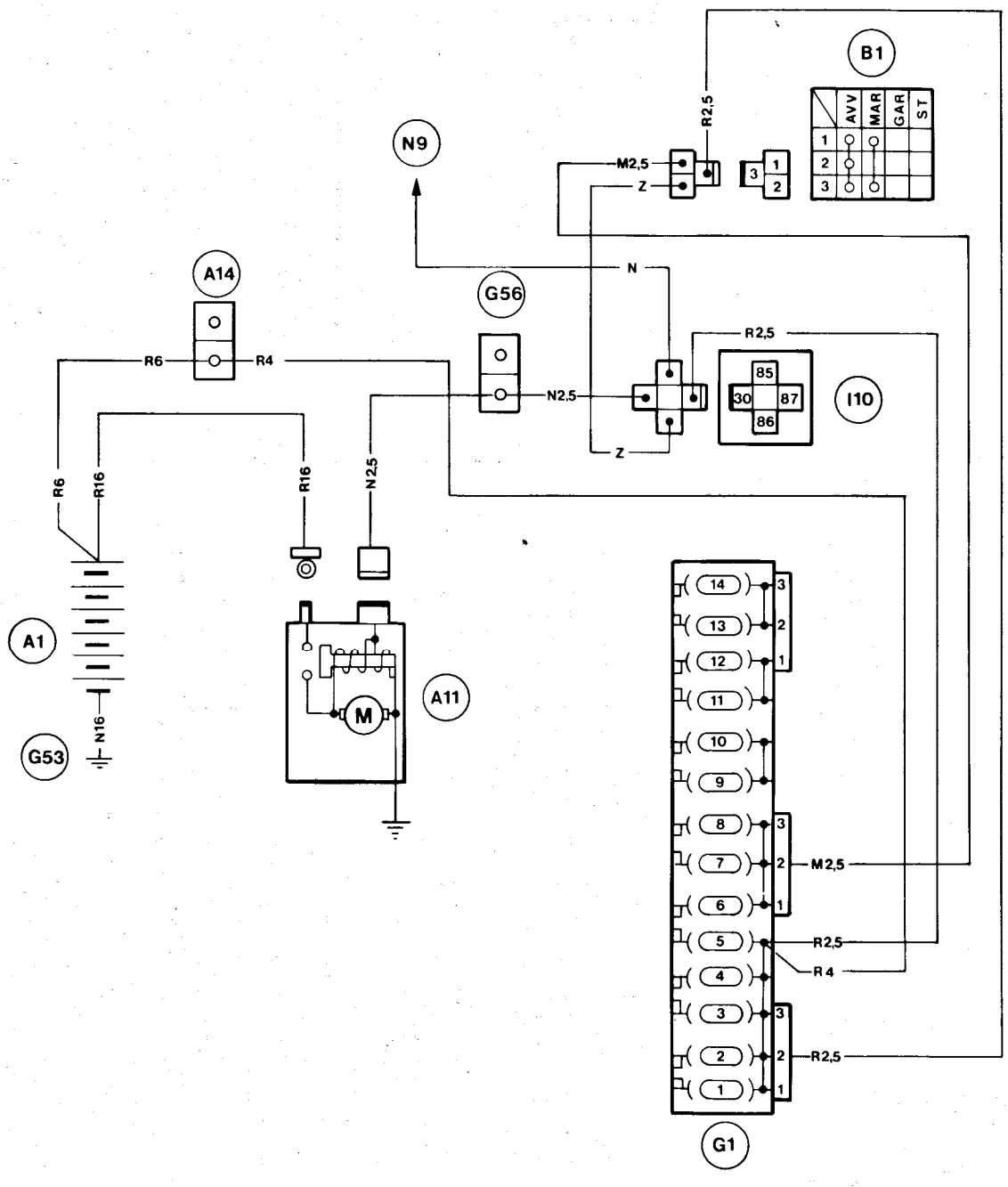
ENGINE STARTER Alfa 75 6V iniezione



A1 Battery
A11 Starter motor
A14 Alternator cable terminal board
B1 Ignition switch

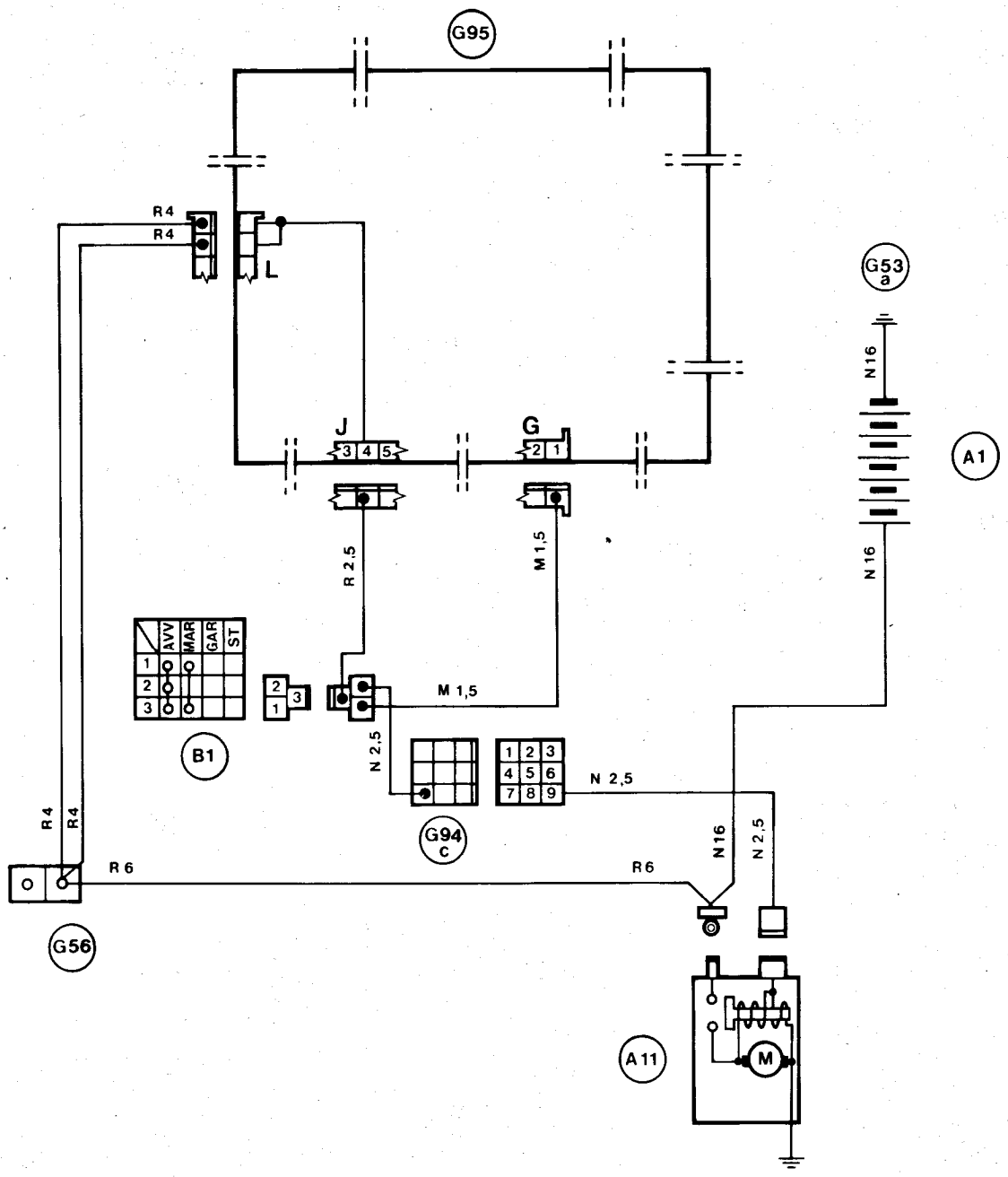
G53b Engine compartment ground - Left
G56 Branch terminal board
G94c Engine compartment connector - Right
G95 Central fusebox

ENGINE STARTER GTV 6 2.5



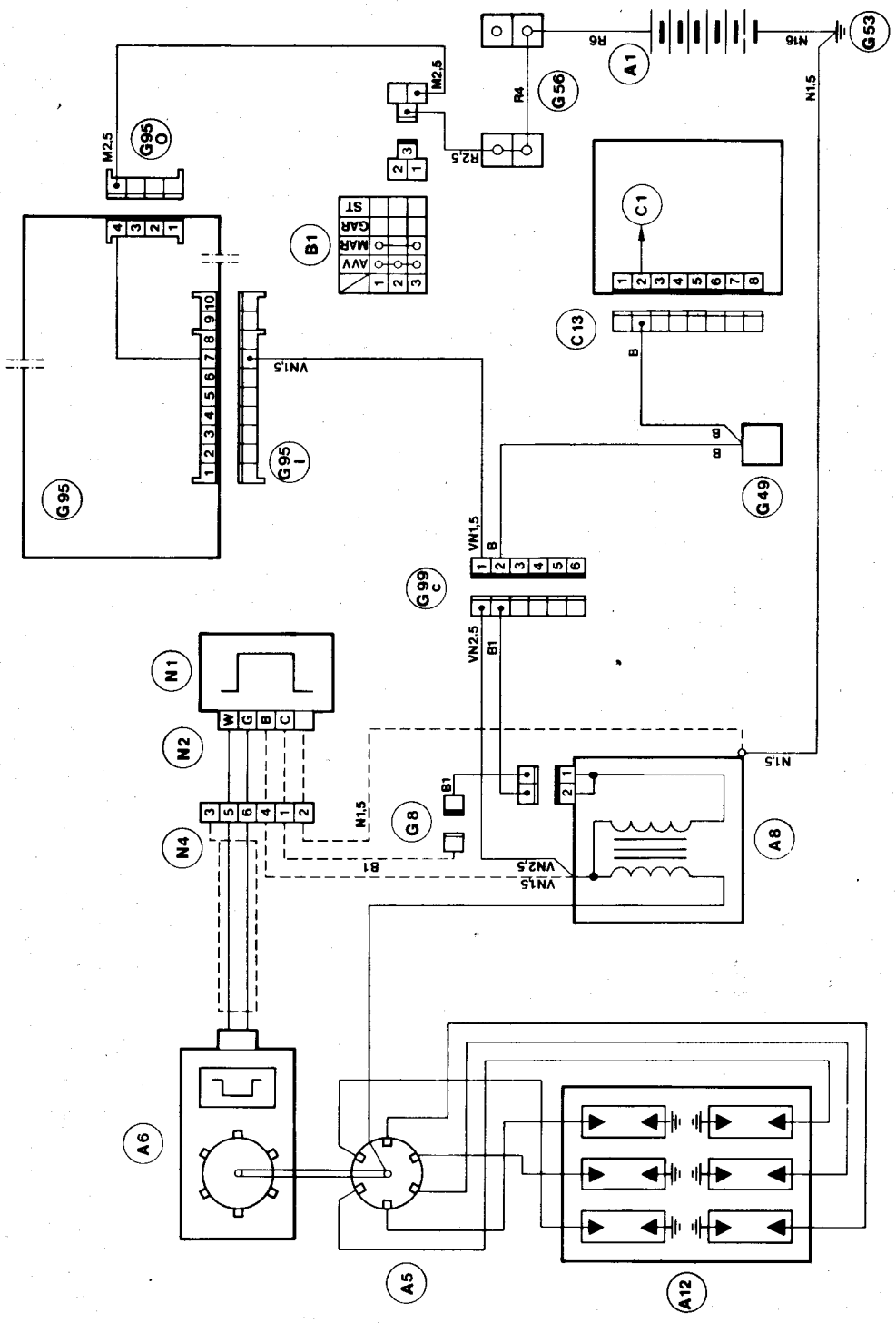
A1 Battery
A11 Starter motor
A14 Alternator cable terminal board
B1 Ignition switch
G1 Fusebox
G53 Engine compartment ground
G56 Branch terminal board
I10 Starter inhibitor relay
N9 Brake pad wear control unit

ENGINE STARTER Alfa 75 1.6 1.8 2.0 1.8 turbo



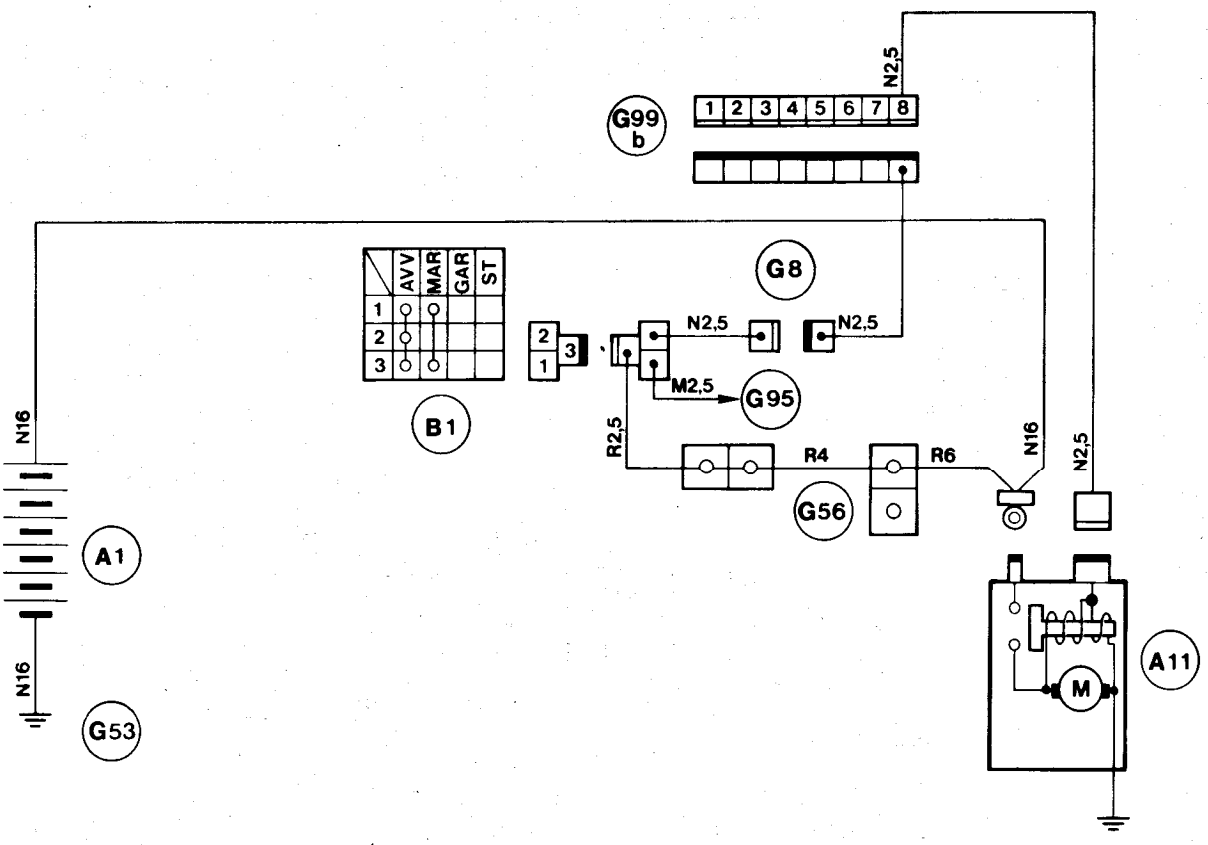
A1 Battery
A11 Starter motor
B1 Ignition switch
G53a Engine compartment ground - Right
G56 Branch terminal board
G94c Engine compartment connector - Right
G95 Central fusebox

ENGINE IGNITION Alfa 90 2.5 iniezione



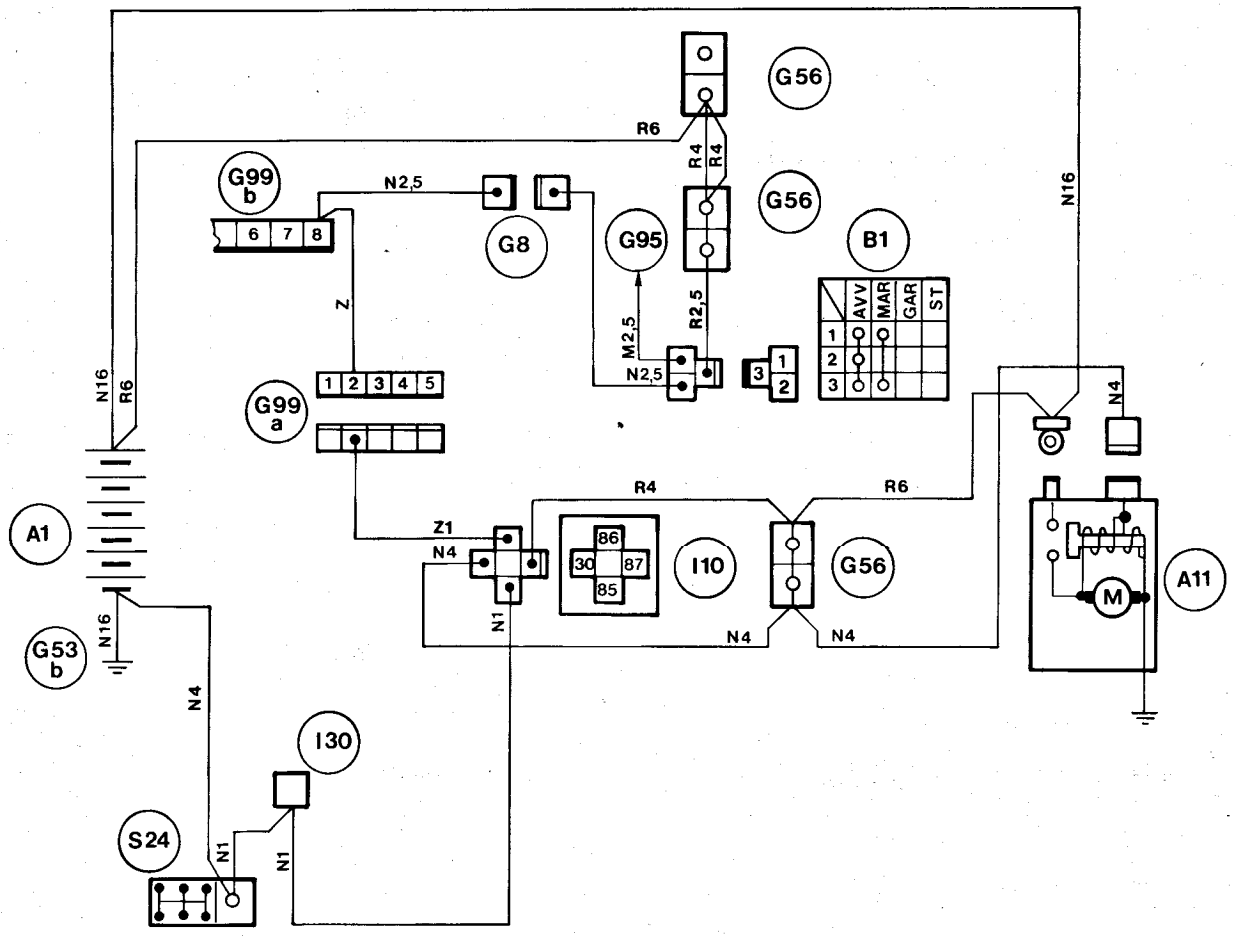
A1 Battery
A5 Ignition distributor
A6 Impulse generator
A8 Ignition coil
A12 Spark plugs
B1 Ignition switch
C1 Electronic rev-counter
C13 Opto-electronic instrument panel
G8 Single connector
G49 Provision for connection
G53 Engine compartment ground
G56 Branch terminal board
G95 Centralized fuse box
G95I Interface connector - Right
G95O Ignition switch connector
G99c Engine bulkhead C connector
N1 Electronic ignition module
N2 Connector for Marelli module
N4 Connector for Bosch module

ENGINE STARTER Alfa 90 1.8 2.0 2.0 Iniezione



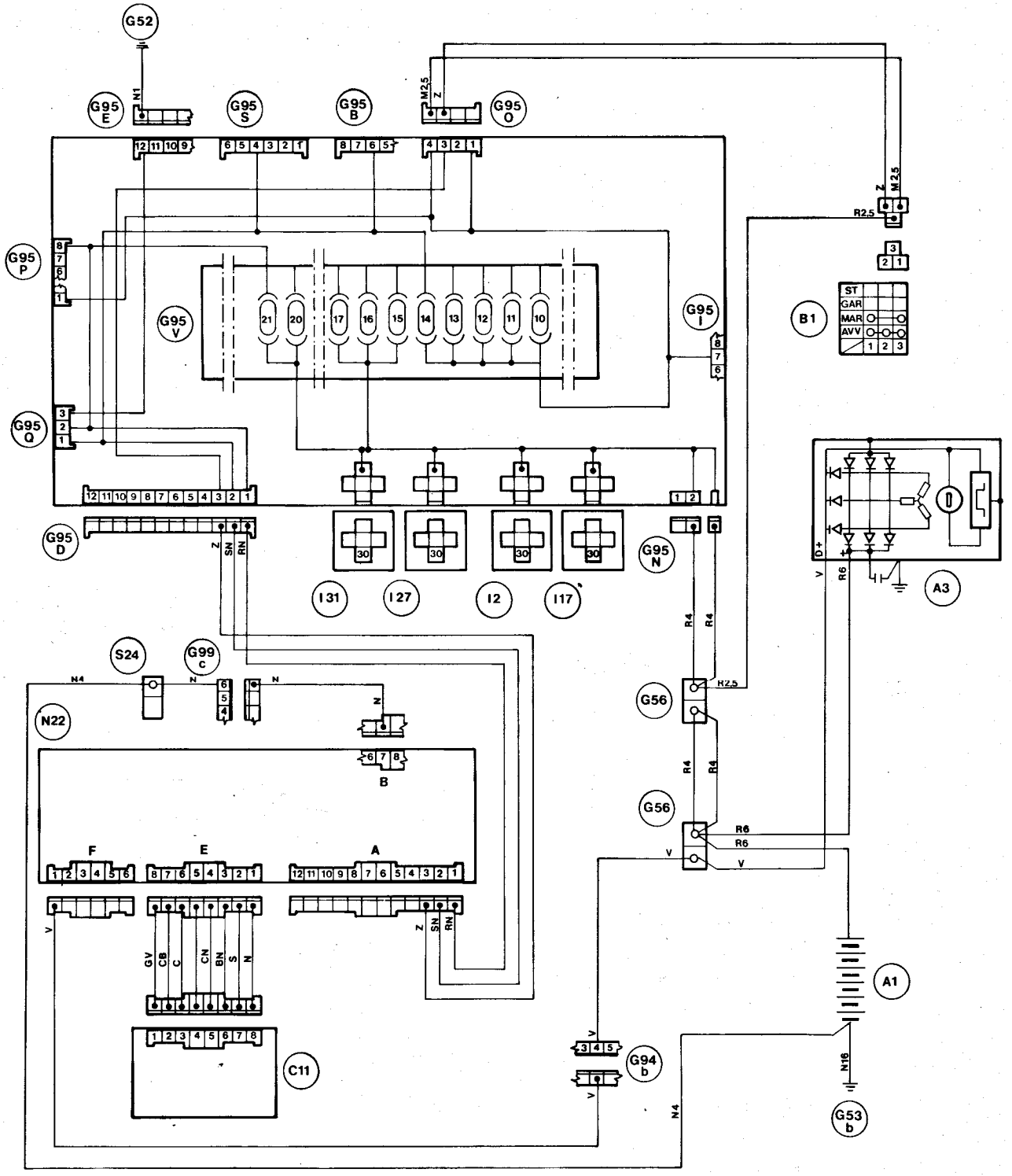
A1 Battery
A11 Starter motor
B1 Ignition switch
G8 Single connector
G53 Engine compartment ground
G56 Branch terminal board
G95 Centralized fusebox
G99b Engine bulkhead B connector

ENGINE STARTER Alfa 90 2.0 6V iniezione



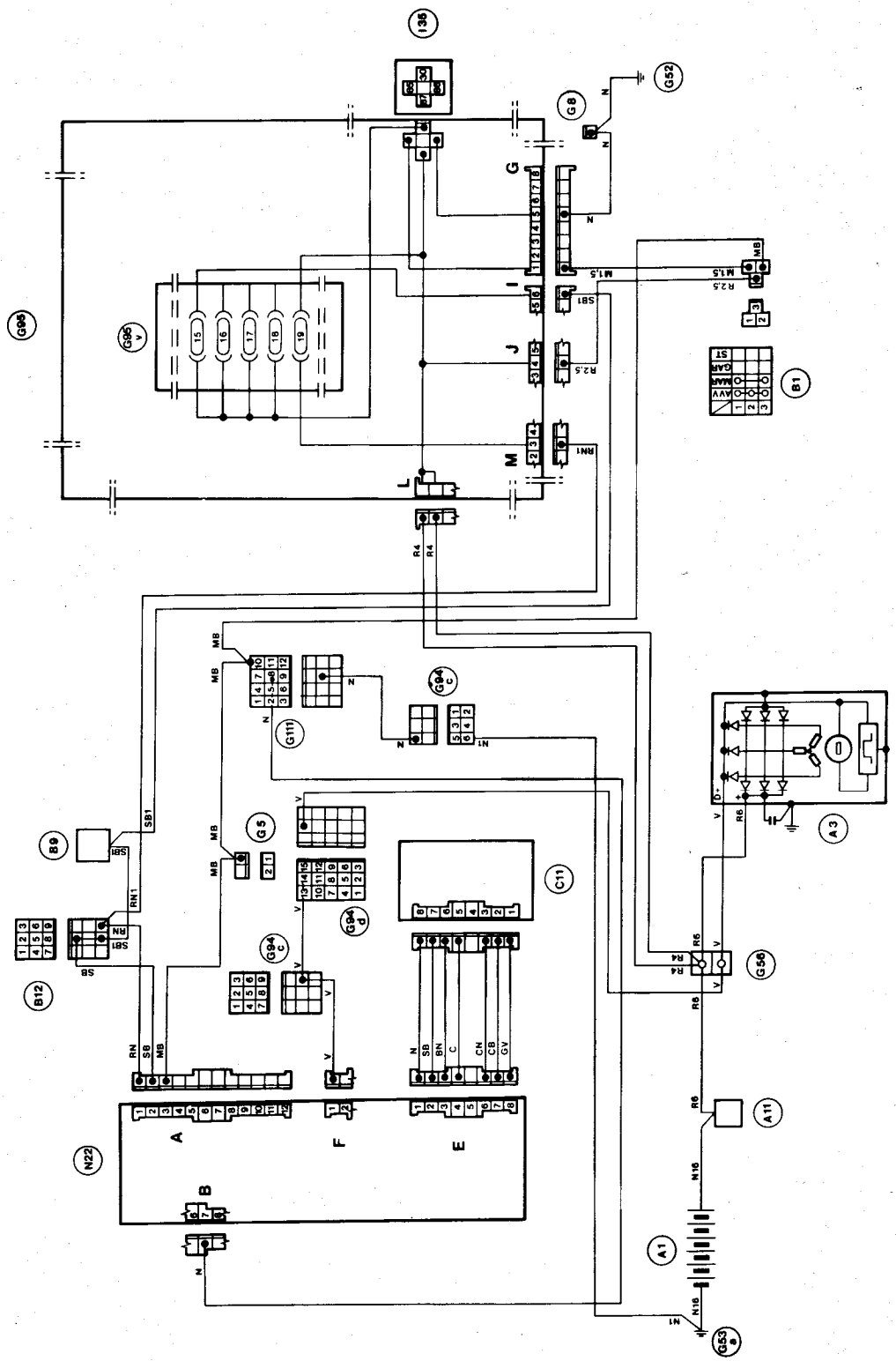
A1 Battery
A11 Starter motor
B1 Ignition switch
G8 Single connector
G53b Engine compartment ground, left
G56 Branch terminal board
G95 Central fusebox
G99a Engine bulkhead A connector
G99b Engine bulkhead B connector
I10 Starter inhibitor relay
I30 CEM relay and diode
S24 Injector terminal

ENGINE CHARGING Alfa 90 2.0 6V iniezione



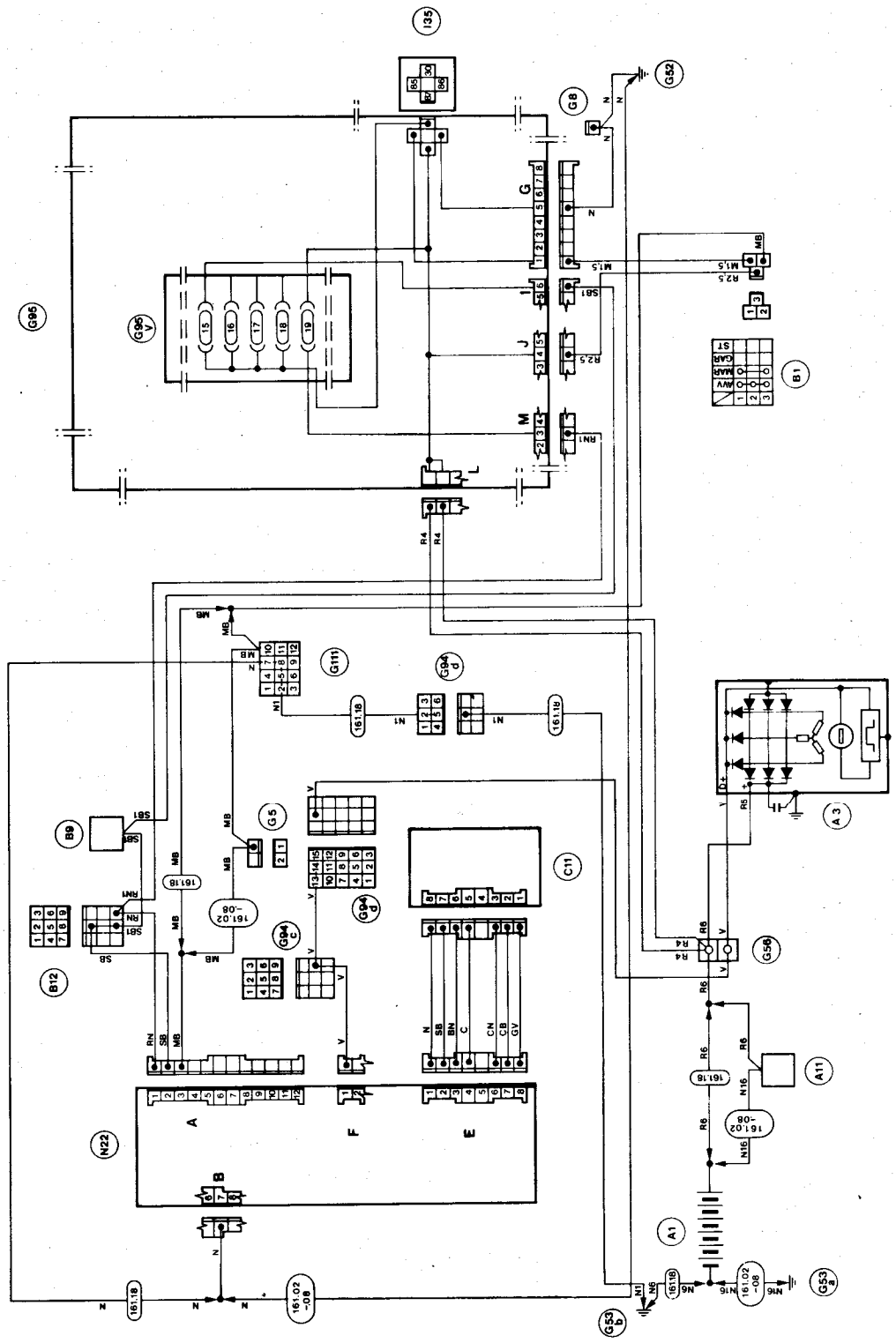
A1 Battery
A3 Alternator with electronic regulator
B1 Ignition switch
C11 Alfa Romeo Control display
G52 Fusebox ground
G53b Engine compartment ground, left
G56 Branch terminal board
G94b 8-way engine compartment connector
G95B Switch connector
G95D Alfa Romeo Control display connector
G95E Console connector
G95I Interface connector, right
G95N Battery connector
G95O Ignition switch connector
G95P Door circuit connector
G95Q Efficiency meter connector
G95S Instrument panel connector
G95V Fuses
G99c Engine bulkhead C connector
I2 Heated rear window relay
I17 Fog-light relay
I27 Seat lift relay
N22 Alfa Romeo Control display unit
S24 Injector terminal

ENGINE CHARGING Alfa 75 1.8 turbo



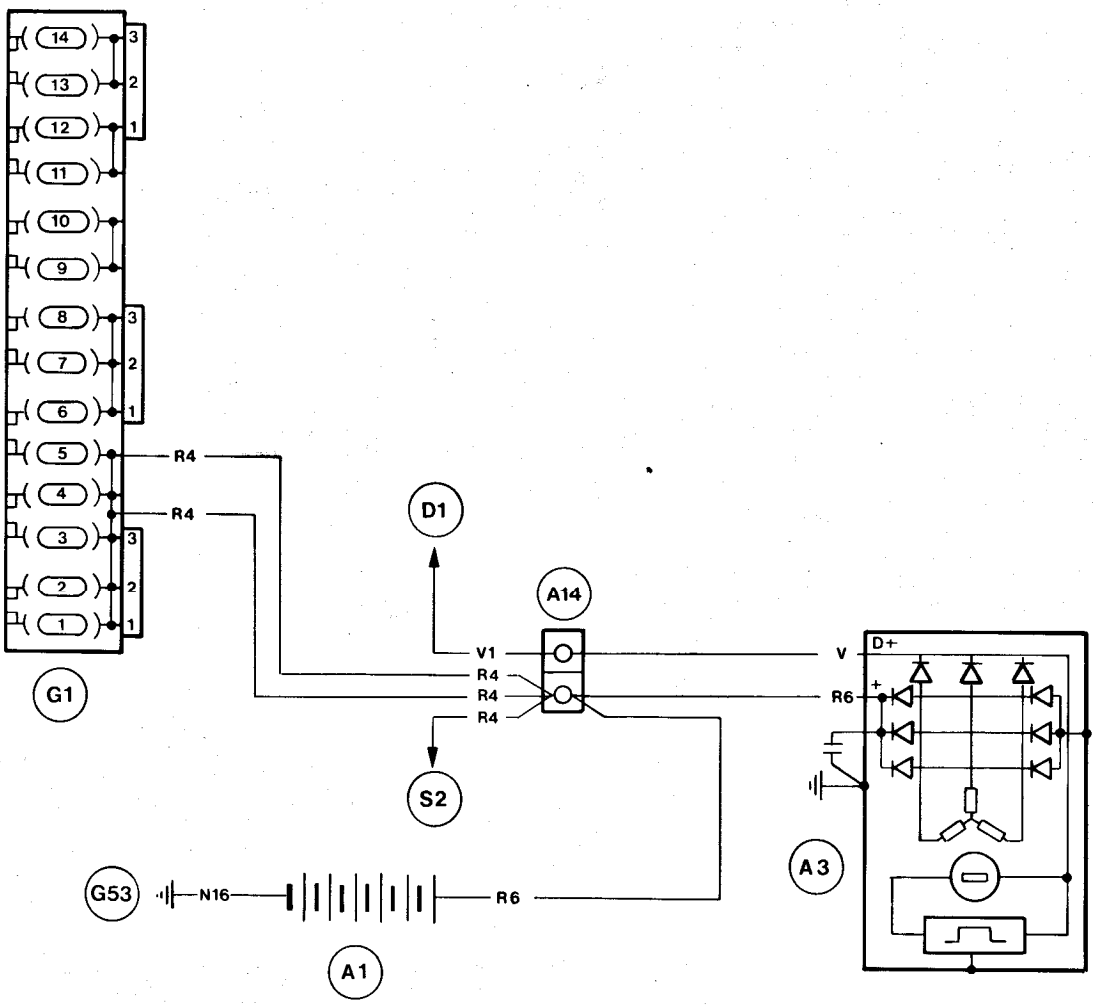
A1 Battery
A3 Alternator with electronic regulator
A11 Starter motor
B1 Ignition switch
B9 Heated rear window control switch
B12 Road hazard lights control switch
C11 Alfa Romeo Control display
G5 Multiple connector
G8 Single connector
G52 Fusebox ground
G53a Engine compartment ground - Right
G56 Branch terminal board
G94c Engine compartment connector - Right
G94d Engine compartment connector - Left
G95 Central fusebox
G95V Fuses
G111 Connector for dashboard instruments wiring
I35 Key-operated supply relay
N22 Alfa Romeo Control control unit

ENGINE CHARGING Alfa 75 1.6 1.8 2.0 6V iniezione



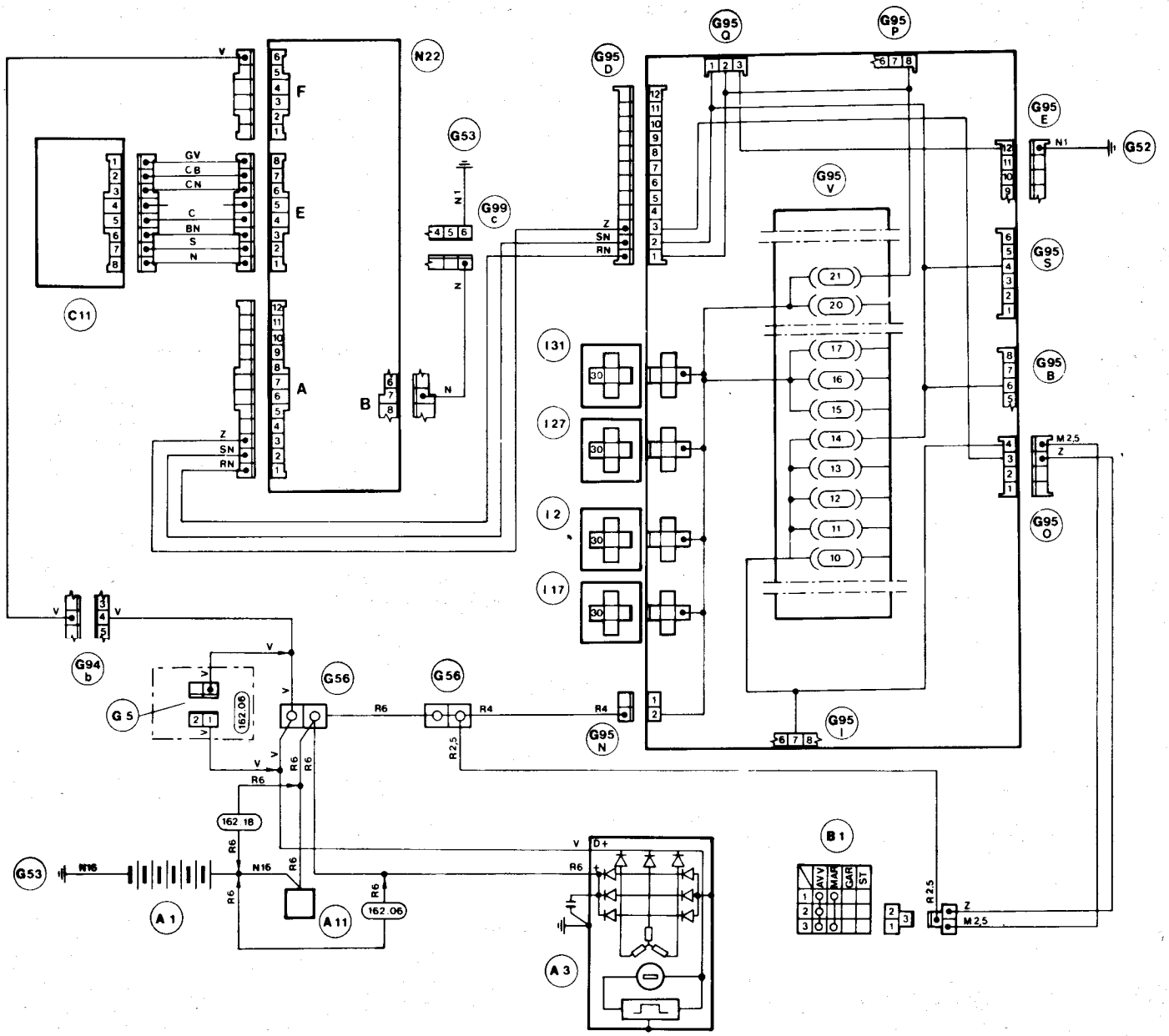
A1 Battery
A3 Alternator with electronic regulator
A11 Starter motor
B1 Ignition switch
B9 Heated rear window control switch
B12 Road hazard lights control switch
C11 Alfa Romeo Control display
G5 Multiple connector
G8 Single connector
G52 Fusebox ground
G53a Engine compartment ground - Right
G53b Engine compartment ground - Left
G56 Branch terminal board
G94c Engine compartment connector - Right
G94d Engine compartment connector - Left
G95 Central fusebox
G95V Fuses
G111 Connector for dashboard instruments wiring
I35 Key-operated supply relay
N22 Alfa Romeo Control control unit

ENGINE CHARGING GTV 6 2.5



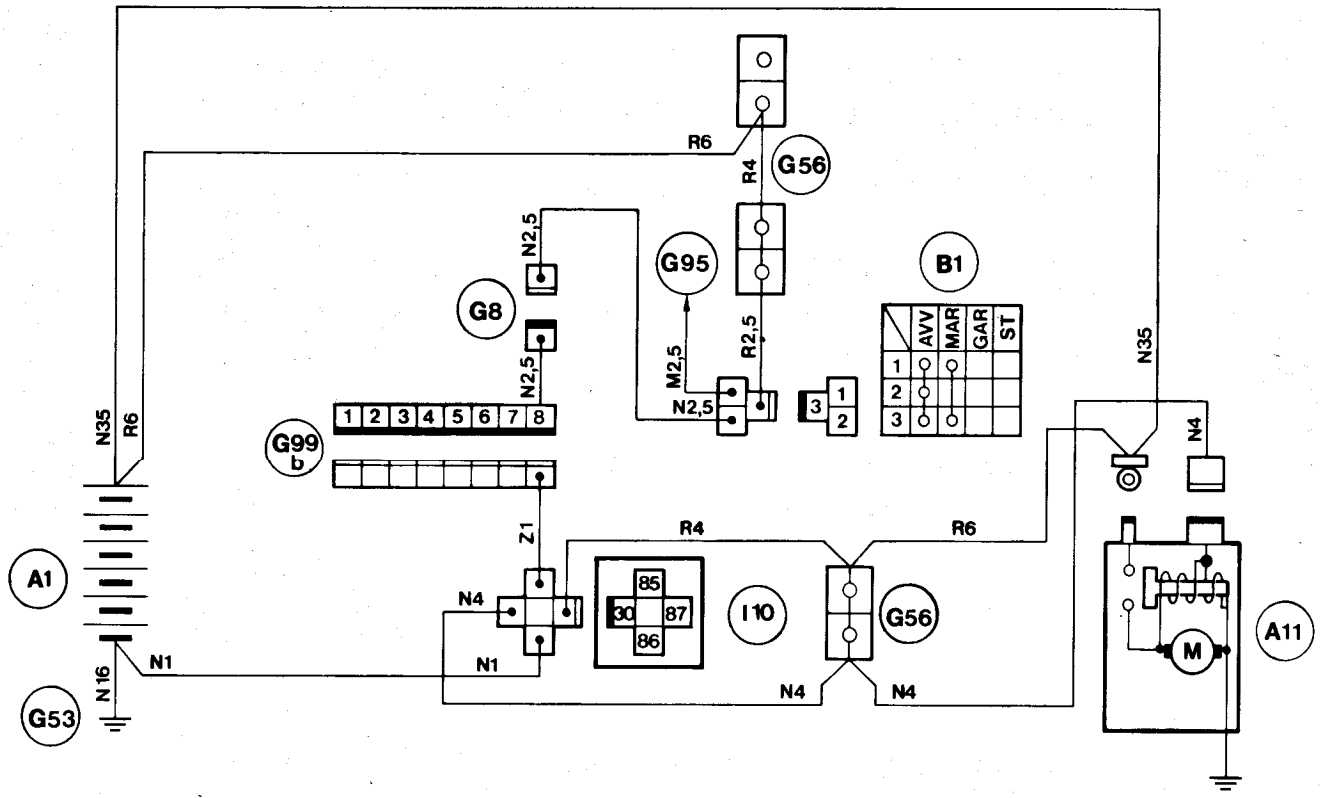
A1 Battery
A3 Alternator with electronic regulator
A14 Alternator cable terminal board
D1 Alternator warning lamp
G1 Fusebox
G53 Engine compartment ground
S2 Relay set

ENGINE CHARGING Alfa 90 1.8 2.0 2.0 iniezione 2.5 iniezione



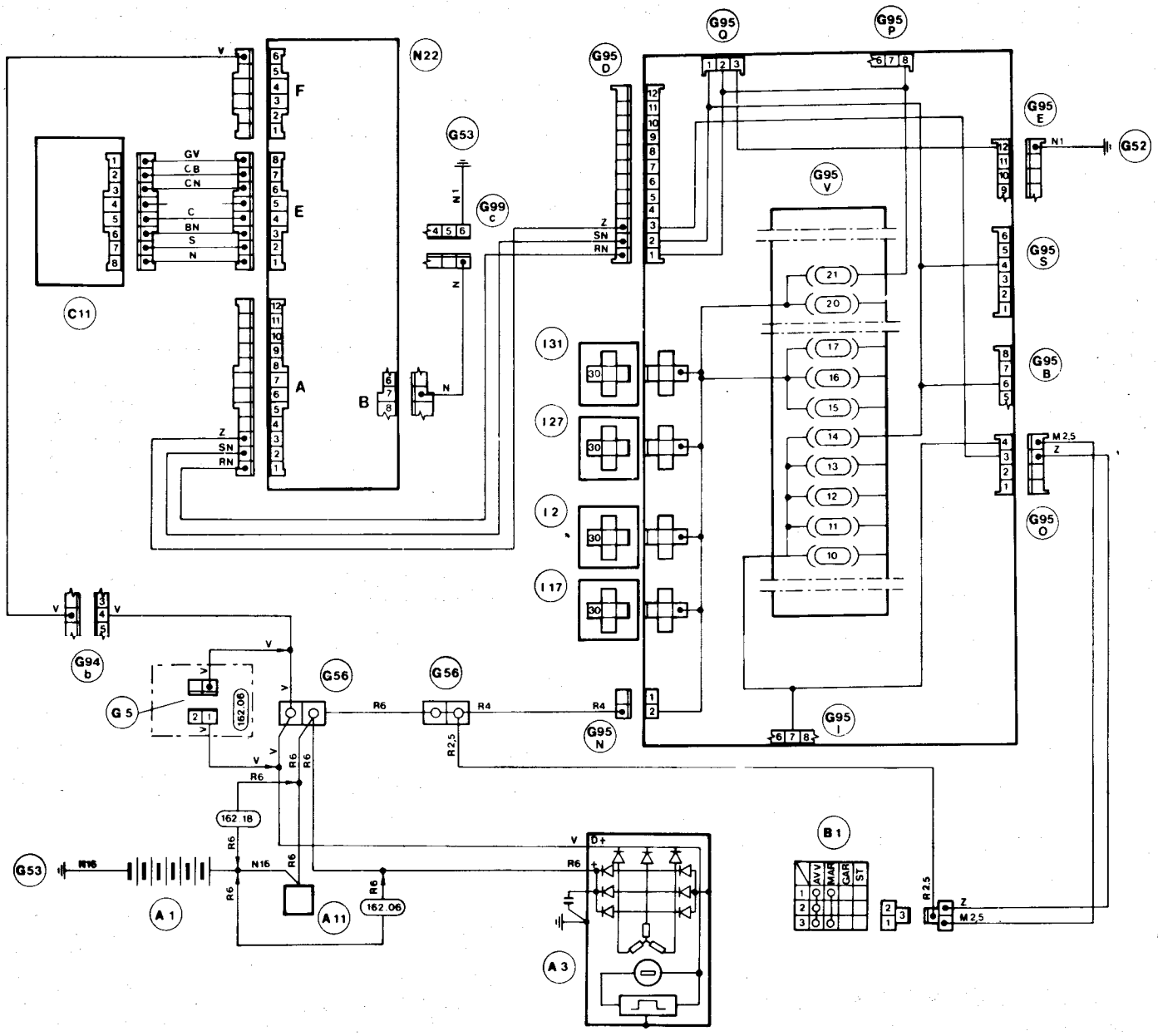
A1 Battery
A3 Alternator with electronic regulator
A11 Starter motor
B1 Ignition switch
C11 Alfa Romeo control display
G5 Multiple connector
G52 Fusebox ground
G53 Engine compartment ground
G56 Branch terminal board
G94b 8-way engine compartment connector
G95B Switch connector
G95D Alfa Romeo control display connector
G95E Console connector
G95I Interface connector, right
G95N Battery connector
G95O Ignition switch connector
G95P Door circuit connector
G95Q Efficiency meter connector
G95S Instrument panel connector
G95V Fuses
G99c Engine bulkhead C connector
I2 Heated rear window relay
I17 Fog-light relay
I27 Seat lift relay
I31 Front electric window/heater fan relay
N22 Alfa Romeo Control control unit

ENGINE STARTER Alfa 90 2.5 iniezione



A1 Battery
A11 Starter motor
B1 Ignition switch
G8 Single connector
G53 Engine compartment ground
G56 Branch terminal board
G95 Central fusebox
G99b Engine bulkhead B connector
I10 Starter inhibitor relay

ENGINE CHARGING Alfa 90 1.8 2.0 2.0 iniezione 2.5 iniezione



A1 Battery
A3 Alternator with electronic regulator
A11 Starter motor
B1 Ignition switch
C11 Alfa Romeo control display
G5 Multiple connector
G52 Fusebox ground
G53 Engine compartment ground
G56 Branch terminal board
G94b 8-way engine compartment connector
G95B Switch connector
G95D Alfa Romeo control display connector
G95E Console connector
G95I Interface connector, right
G95N Battery connector
G95O Ignition switch connector
G95P Door circuit connector
G95Q Efficiency meter connector
G95S Instrument panel connector
G95V Fuses
G99c Engine bulkhead C connector
I2 Heated rear window relay
I17 Fog-light relay
I27 Seat lift relay
I31 Front electric window/heater fan relay
N22 Alfa Romeo Control control unit

INSPECTION SPECIFICATIONS

DATA

Battery	Car model		
	1600	1800	2000
	113.48 - 113.49 - 117.18 161.00 - 161.01	113.50 - 113.51 - 117.17 161.02 - 161.03	117.13 - 117.14 - 117.01 162.02 - 162.12 - 162.14 113.17 - 113.18 161.08 - 161.09
Voltage (V)	12		
Capacity (Ah)	50 or 60 (1)		60 or 66 (1)
Discharge rating (A)	240 or 275 (1)		275 or 290 (1)
Electrolyte density (kg/dm³)	1.28 to 0.01		

(1) Air conditioned version

Battery	Car model		
	2000	2500	1800
	162.10	162.46 - 161.80 - 161.190	161.34
Voltage (V)	12		
Capacity (Ah)	66		60
Discharge rating (A)	290		255
Electrolyte density (kg/dm³)	1.28 to 0.01		

General requirements

FLUIDS AND LUBRICANTS

Description	Type	Recommended product	Quantity
Battery terminal	GREASE	Grease REINACH: E10 Tac Part No. 3671-69812	As necessary

COMPONENTS Alfa 75 Alfa 90 Alfetta GTV 6 2.5

Engine	Starter	Alternator (1)	Distributor	Coil/electronic module	Spark plug
1600 (016.00)	116.00.05.030.09 PARIS-RHONE D8E 145	116.10.05.060.08 BOSCH 0.120.489.549 K1→14V55A20	116.97.05.011.00 BOSCH 0.237.002.018	116.97.65.079.00 BOSCH 0.221.600.002	105.14.05.106.01 LODGE 2HL
1600 (061.00)	116.00.05.030.10 MAGNETI MARELLI E95-0,9/12				
1800 (016.78)	116.08.05.030.00 BOSCH 0.001.211.207 EF→12V-0,7CV				
	116.08.05.030.03 DUCELLIER DmE124P1				
1800 (062.02)	113.48.05.030.00 (3) BOSCH 12V-0,8 kW				
2000 (016.55)	105.12.05.030.03 BOSCH 0.001.311.110 GF→12V-1,1CV	116.10.05.060.12 PARIS-RHONE A13R192	116.97.05.011.01 MAGNETI MARELLI SM802BX	116.55.65.079.02 MAGNETI MARELLI AEI200B	
1600 (061.00) 2000 (062.12)	117.01.05.030.00 BOSCH 0.001.108.024 12V-1,4 kW				
2000 (017.13) (5)	105.12.05.030.03 BOSCH 0.001.311.110 GF→12V-1,1CV	116.55.05.060.00 MAGNETI MARELLI	115.44.05.011.00 BOSCH 0.237.051.002	195.00.65.079.00 (2) BOSCH 0.221.122.344	119.00.05.106.01 SILVER LODGE 2HL-E
2000 (017.13) (6)	117.01.05.030.000 BOSCH 0.001.108.024 12V-1,4 kW 116.55.05.030.03 BOSCH 0.001.108.011 12V-1,4 kW				
2000 (062.10)	116.46.05.030.00 BOSCH 0.001.311.139 GF→12V-1,1kW	119.13.05.060.00 BOSCH 0.120.489.715.716 K1→14V65A21	195.15.05.011.00 (4) MAGNETI MARELLI DT454A	117.20.05.079.00 (2) MAGNETI MARELLI BAE209C	105.14.05.106.01 LODGE 2HL
2500 (016.46)	116.46.05.030.00 BOSCH 0.001.311.139 GF→12V-1,5CV		116.46.05.011.00 BOSCH 0.237.301.008	116.97.65.079.00 BOSCH 0.221.600.002	119.00.05.106.01 SILVER LODGE 2HL-E

(1) Integral electronic voltage regulator
(2) Coil
(3) Models 161.00 - 161.02 and 162.02 only
(4) Integral Master Reset sensor
(5) Models 117.13
(6) Models 162.14

COMPONENTS (GIULIETTA)

Engine	Starter	Alternator [Regulator]	Distributor	Coil	Spark plug
1600 (016.00)	116.08.05.030.00 BOSCH 0.001.211.207 EF→12V0,7CV 116.00.05.030.10 MARELLI E95-0,9/12 116.00.05.030.09 PARIS RHONE D8E 145	116.10.05.060.03 BOSCH 0.120.400.848 K1→14V45A22 [105.36.65.028.00 BOSCH AD1] 116.10.05.060.01 PARIS RHONE A13R121 [116.10.65.028.01 PARIS RHONE AYC2112] 116.10.05.060.18 SEV MARCHAL A14/55A 71212702 [116.10.65.028.05 SEV MARCHAL-blue dot]	116.55.05.011.00 BOSCH 0.231.170.229 116.55.05.011.01 MARELLI S168BX	105.26.65.079.00 BOSCH 0.221.119.008 116.42.65.079.00 MARELLI BE 200H 105.48.65.079.00 KLITZ G 53 SB 105.12.65.079.02 SEV MARCHAL-3H	105.14.05.106.01 LODGE 2HL
1800 (016.78)	116.00.05.030.09 (1) PARIS RHONE D8E 145 116.08.05.030.03 (1) DUCELLIER DmE 124P1	116.10.05.060.08 (2) BOSCH 0.120.489.549 K1→14V55A20 116.10.05.060.12 (2) PARIS RHONE A13R192 116.55.05.060.00 (2) MARELLI	116.55.05.011.03 DUCELLIER 4533 A	105.12.65.079.03 ISKRA ATA-0105 105.12.65.079.01 DUCELLIER 2792 A	
2000 (016.55)	105.12.05.030.03 BOSCH 0.001.311.110 GE→12V1,1PS 116.55.05.030.00 PARIS RHONE D10E70 116.55.05.030.01 MARELLI E 100-1,3-1,2	116.10.05.060.08 (2) BOSCH 0.120.489.549 K1→14V55A20 116.10.05.060.12 (2) PARIS RHONE A13R192 116.55.060.00 (2) MARELLI	116.55.05.011.00 BOSCH 0.231.170.229 116.55.05.011.01 MARELLI S168BX 116.55.05.011.03 DUCELLIER 4533A	116.33.65.079.00 MARELLI BZR 202 B 116.55.65.079.01 BOSCH 0.221.119.044	105.14.05.106.01 LODGE 2HL

(1) 1600 engine only (016.00)
(2) Integral electronic voltage regulator

Electronic ignition

Engine	Coil with electronic module	Magnetic distributor	
1600 (016.00) 1800 (016.78)	116.55.65.079.02 MAGNETI MARELLI AEI 200 B	116.97.05.011.01 MAGNETI MARELLI SM 802 EX	
2000 (016.55)	116.97.65.079.00 BOSCH 0.221.600.002	116.97.05.011.00 BOSCH 0.237.02.018	
2500 (016.46)		—	

COMPONENTS GTV 2.0

Engine	Starter	Alternator [Regulator]	Distributor	Coil	Spark plug
2000 (016.55)	105.12.05.030.03 BOSCH 0.001.311.110 GF→12V-1,1PS	116.10.05.060.03 BOSCH 0.120.400.848 K1→14V45A22 [105.36.65.028.00 BOSCH AD1]	116.55.05.011.00 BOSCH 0.231.170.229	116.55.65.079.00 BOSCH 0.221.119.044	105.14.05.106.01 LODGE 2HL
		116.10.05.060.01 PARIS RHONE A13R121 [116.10.65.028.01 PARIS RHONE AYC2112]	116.55.05.011.01 MARELLI S168BX	116.33.65.079.01 MARELLI BZR202B	
	116.55.05.030.00 PARIS RHONE D10E70	116.10.05.060.18 SEV MARCHAL A14/55A 71212702 [116.10.65.028.05 SEV MARCHAL-blue dot]	116.55.05.011.03 DUCELLIER 4533 A	116.55.65.079.01 BOSCH 0.221.119.044	
	116.55.05.030.10 MARELLI E100-1,3-1,2	116.10.05.060.08 (1) BOSCH 0.120.489.549 K1→14V55A20	116.97.05.011.01 (2) MARELLI SM802BX	116.55.65.079.02 (3) MARELLI AEI 200B	
		116.10.05.060.12 (1) PARIS RHONE A13R192	116.97.05.011.00 (2) BOSCH 0.237.002.018	116.97.65.079.00 (3) BOSCH 0.221.600.002	
		116.55.05.060.00 (1) MARELLI			

(1) Integral electronic voltage regulator
(2) Electonic ignition engines
(3) Coils with electronic module for electronic ignition

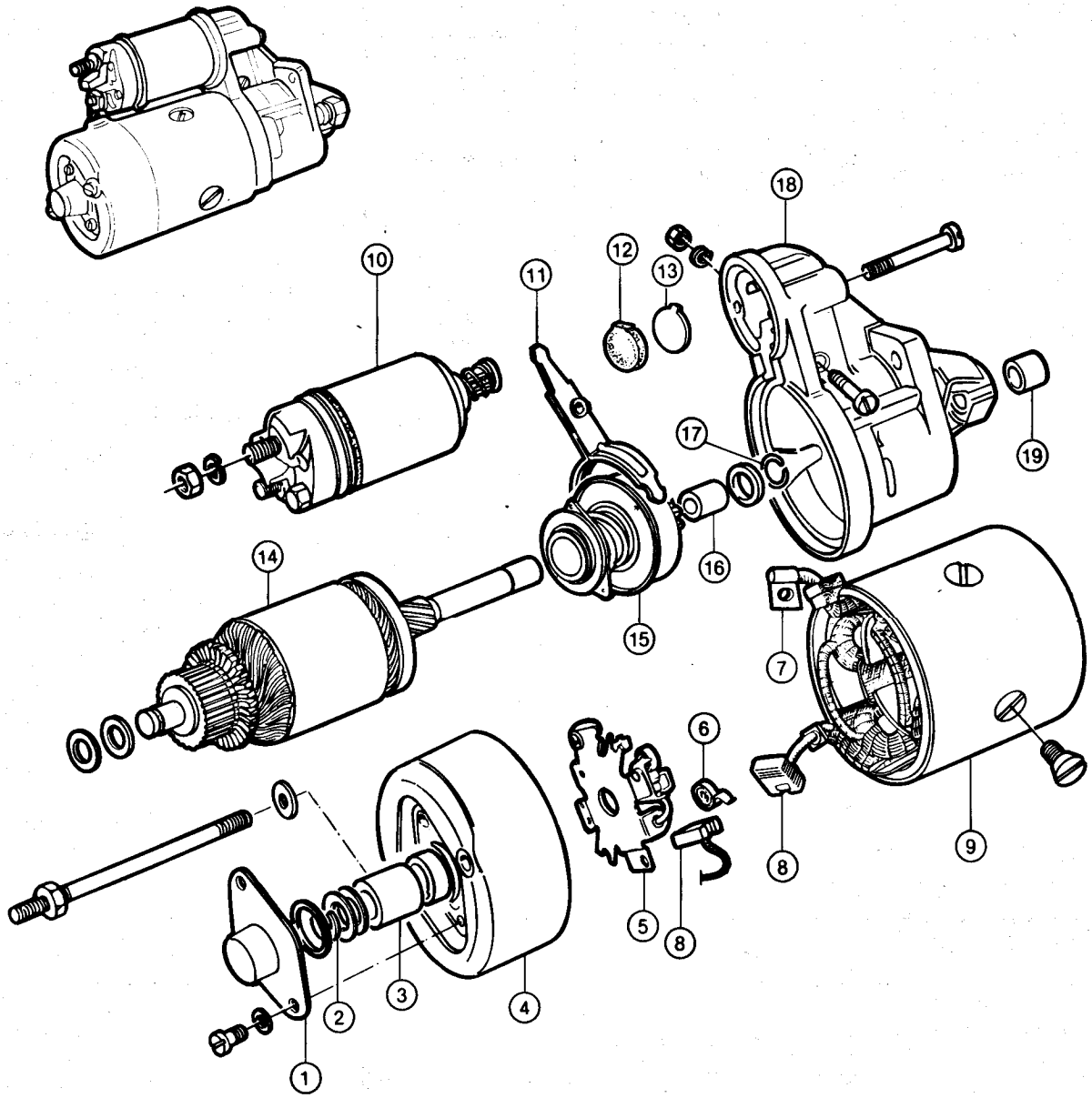
COMPONENTS Alfa 75 1.8 turbo

Engine	Starter	Alternator (1)	Distributor	Coil/electronic module	Spark plug
1800 (061.34)	116.00.05.030.09 PARIS-RHONE D8E 145	116.10.05.060.08 BOSCH 0.120.489.549 K1→14V55A20	195.05.05.011.02 BOSCH 0.237.520.001	116.97.65.079.00 BOSCH 0.221.600.002	195.05.05.106.00 TURBO LODGE 2XL
	116.00.05.030.10 MAGNETI MARELLI E95-0,9/12				
	116.08.05.030.00 BOSCH 0.001.211.207 EF→12V-0,8CV	116.10.05.060.12 PARIS-RHONE A13R192			
	116.08.05.030.03 DUCELLIER DmE124P1	116.55.05.060.00 MAGNETI MARELLI			
	113.48.05.030.00 BOSCH 12V-0,8 kW				

(1) Integral electronic voltage regulator

STARTING

BOSCH STARTER



1. Dust excluder
2. Retaining ring
3. Bush
4. Commutator end support
5. Brush carrier
6. Brush spring
7. Field winding terminal
8. Brush
9. Yoke
10. Solenoid
11. Fork
12. Rubber plate
13. Backing plate
14. Armature
15. Starter drive
16. Bush
17. Pinion stop ring
18. Drive end support
19. Bush

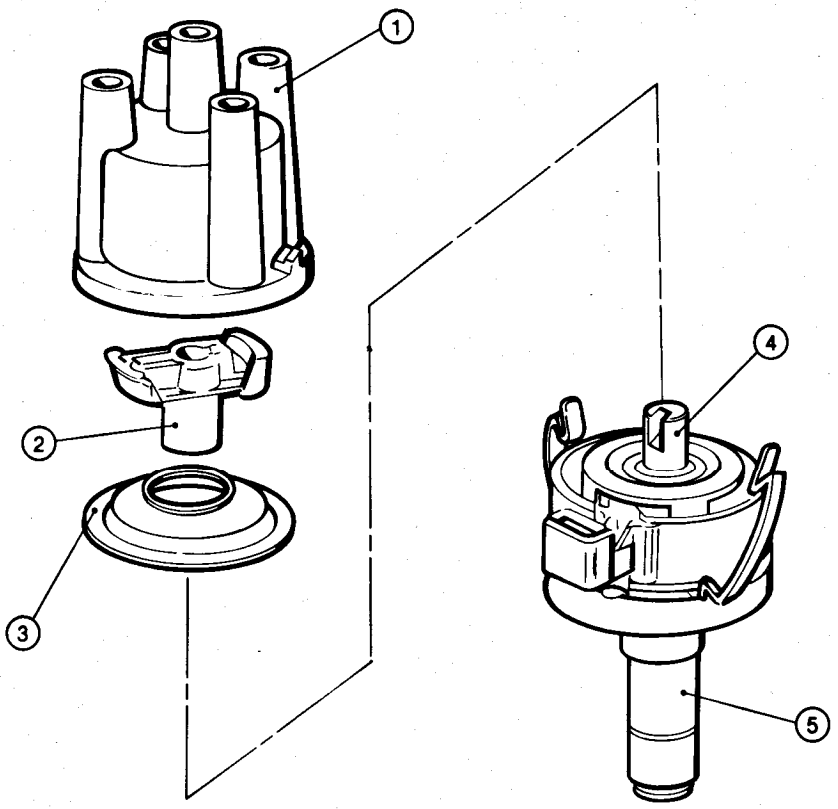
Starter	Alfa Romeo Part No.	117.01.05.030.00	113.48.05.030.00	116.55.05.030.00	116.00.05.030.09
	Type	BOSCH 12 V 1.4 kW 0.001.108.024	BOSCH 12 V 0.8 kW	PARIS-RHONE D10E70	PARIS-RHONE D8E145 12 V 0.92 kW
Rated voltage	V	12	12	12	12
Rated output	kW (HP)	1.4 (1.9)	0.8 (1.1)	—	0.92 (1.25)
Max. brush length	mm	11	11	9	9
	(in)	(0.43)	(0.43)	(0.35)	(0.35)
Max. commutator eccentricity	mm	0.06	0.06	0.05	0.05
	(in)	(0.0024)	(0.0024)	(0.002)	(0.002)
Armature shaft running clearance	mm	0.02 to 0.05 (0.001 to 0.002)			
Running torque test (pinion meshing with braked ring gear)					
— Voltage	V	9	9.3	9.2	9.3
— Current consumption	A	≤315	≤250	≤280	≤230
— Speed	rpm	≥1700	≥1300	1450	1600 to 1700
— Torque	Nm	7.5	6	8	5
	(kgm)	(0.75)	(0.60)	(0.8)	(0.5)
	(ft.lb)	(5.5)	(4.4)	(5.9)	(3.7)
Lock torque test (pinion meshing with locked ring gear)					
— Voltage	V	4	7.1	6.8	7.2
— Current consumption	A	≤750	≤480	510	≤410
— Torque	Nm	≥16	≥9.5	20	11.8
	(kgm)	(≥1.6)	(≥0.95)	(2)	(1.2)
	(ft.lb)	(≥11.8)	(≥7.0)	(14.8)	(8.7)
Freewheel overrunning torque	Ncm	12 to 18	12 to 18	12 to 19	12 to 19
	(kgcm)	(1.2 to 1.8)	(1.2 to 1.8)	(1.2 to 1.9)	(1.2 to 1.9)
	(in.lb)	(1.1 to 1.6)	(1.1 to 1.6)	(1.1 to 1.7)	(1.1 to 1.7)
Starter-mounted switch test					
— Max. draw at rated voltage	A	≤40		≤55	≤55
— Min. cut-in voltage	V	≤7.8 (*)	≤7.8 (*)	≤12.5	—
Pinion teeth module		2.1167	2.1167	2.116	2.116

(*) At 20 to 25°C (68 to 77°F)

Starter		Alfa Romeo Part No.	116.46.05.030.00	116.55.05.030.03	
		Type	BOSCH GF 12 V 1.4 kW 0.001.311.139	BOSCH 12 V 1.4 kW 0.001.108.011	
Rated voltage	V		12	12	
Rated output	kW (HP)		1.1 (1.5)	1.4 (1.9)	
Max. brush length	mm		—	—	
	(in)		—	—	
Max. commutator eccentricity	mm		—	—	
	(in)		—	—	
Armature shaft running clearance	mm		0.02 to 0.05	0.02 to 0.05	
	(in)		(0.001 to 0.002)	(0.001 to 0.002)	
Running torque test (pinion meshing with braked ring gear)					
— Voltage	V		9	9	
— Current consumption	A		290 max.	≤315	
— Speed	rpm		1200 min.	≥1700	
— Torque	Nm		8	7.5	
	(kgm)		(0.8)	(0.75)	
	(ft.lb)		(5.9)	(5.4)	
Lock torque test (pinion meshing with locked ring gear)					
— Voltage	V		6	4	
— Current consumption	A		500 max.	≤750	
— Torque	Nm		13	≥1.6	
	(kgm)		(1.3)	(≥0.16)	
	(ft.lb)		(9.6)	(≥1.2)	
Freewheel overrunning torque	Ncm		14 to 20	12 to 18	
	(kgcm)		(1.4 to 2.0)	(1.2 to 1.8)	
	(in.lb)		(1.2 to 1.8)	(1.04 to 1.6)	
Starter-mounted switch test					
— Max. draw at rated voltage	A		38	≤40	
— Min. cut-in voltage	V		7.5 (*) 9.5 (**)	≤7.8 (***)	
Pinion teeth module			2.1167	2.1167	

(*) At —20°C (—4°F)
(**) At +80°C (+176°F)
(***) At 20 to 25°C (68 to 77°F)

BOSCH DISTRIBUTOR Alfa 75 1.8 turbo



1. Cap
2. Rotor arm
3. Dust cover
4. Drive shaft
5. Distributor body

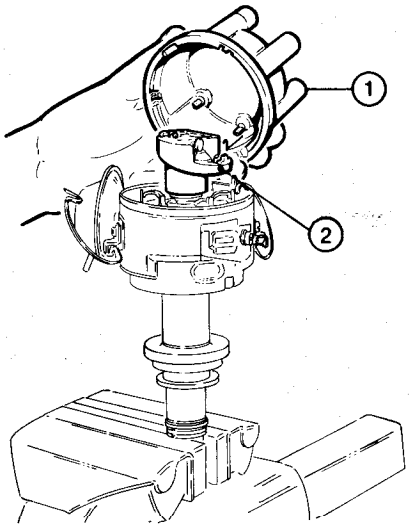
BOSCH DISTRIBUTOR

2.5 iniezione

Clamp distributor in a vice provided with protective jaw liners.

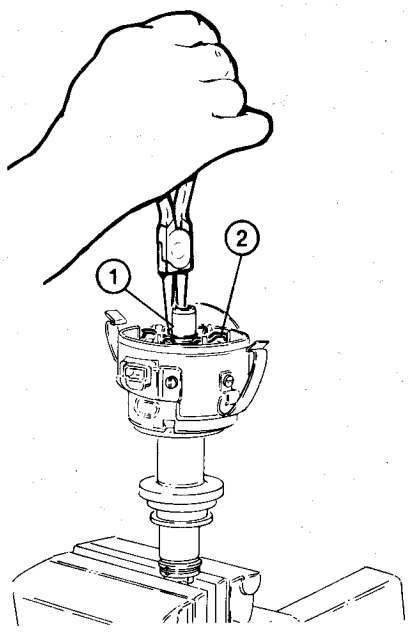
a. Remove cap (1) and take off rotor arm (2) with associated rpm limiter and then the lubricating felt.

The rpm limiter is a centrifugal device situated on the head of the rotor arm used to cut off ignition when the engine exceeds 6300 ± 150 rpm.



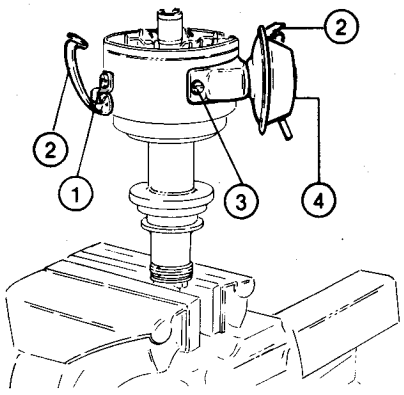
1. Distributor cap
2. Rotor arm with rpm limiter device

b. Proceeding as shown below, take off retaining ring (1) from timer (2) and retrieve the washer below.



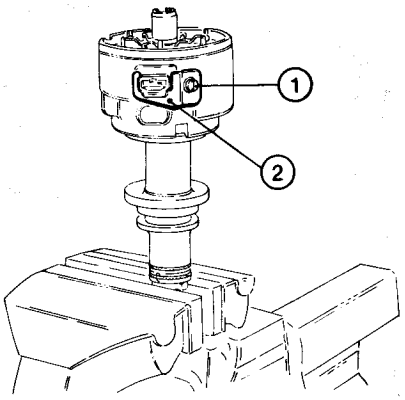
1. Retaining ring
2. Timer

c. Back off screws (1) and remove distributor cap springs (2).
Back off screws (3) retaining advance device (4) to distributor body.



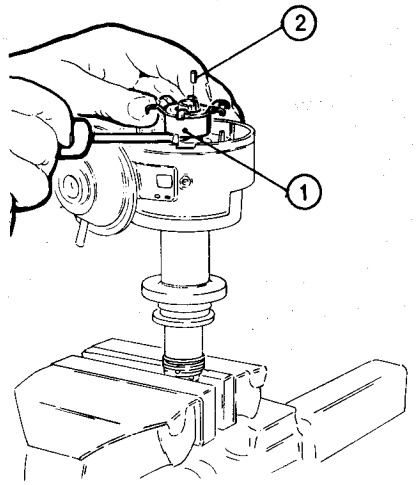
1. Spring retaining screw
2. Spring
3. Advance device retaining screw
4. Advance device

d. Remove connector (2) from distributor body by backing off screw (1).



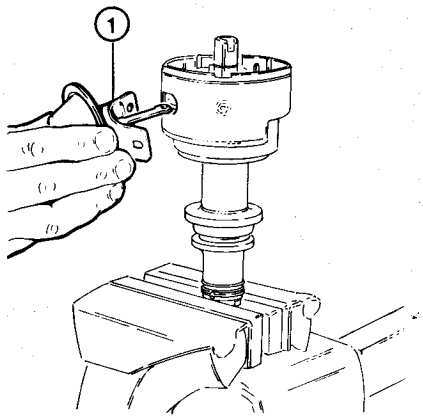
1. Connector retaining screw
2. Connector

e. Remove timer (1) from distributor shaft and retrieve the associated drive roller (2) as shown.



1. Timer
2. Drive roller

f. Remove advance device (1) releasing it from the field winding.



1. Advance device

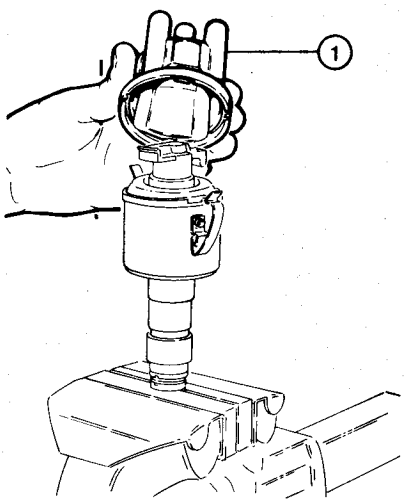
BOSCH DISTRIBUTOR

2.0 iniezione

1.8 turbo

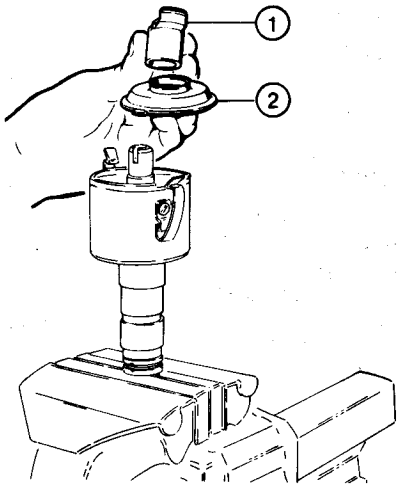
Clamp distributor in a vice provided with soft jaw liners.

a. Remove cap (1) from distributor body.



1. Cap

b. Remove rotor arm (1) and dust cover (2) from distributor shaft.



1. Rotor arm
2. Dust cover

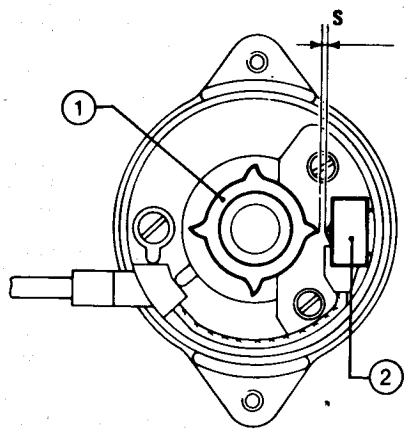
INSPECTION

1.6 1.8 2.0 2.5 iniezione

Using a suitable feeler gauge check the air gap between pulse generator (2) and timer (1).

Gap S should be as specified.

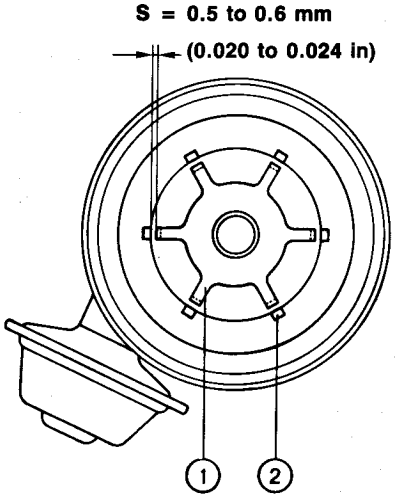
4-CYLINDER DISTRIBUTOR



Gap S:
0.5 to 0.6 mm (0.020 to 0.024 in)
(model SM802BX)

1. Timer
2. Pulse generator

6-CYLINDER DISTRIBUTOR



1. Timer
2. Pulse generator

ASSEMBLY

To assembly reverse the disassembly procedure, noting the following points:

a. **Lubricate** the following components using distributor grease:
- Flyweight springs
- Flyweights

b. **Moisten** distributor shaft felt with a few drops of oil.

NOTE:
Marelli distributor
Whenever the magnetic pulse generator is removed or replaced remember to insert the magnetic spacer on installation.

BENCH TEST

1.6 1.8 2.0 2.5 iniezione

a. **Vacuum advance**
- Install distributor on tester and establish the necessary connections.
- Zero the spark on angle dial on tester turning distributor by hand or through tester motor.
  Do not exceed 50 rpm.
- Connect vacuum pipe to tester vacuum gauge.
- Read advance curve in a condition of increasing vacuum (see: Inspection Specifications).
- If the curve obtained is not as specified, replace vacuum advance device.

b. **Centrifugal advance**
- Carry out the first two operations specified for vacuum advance test.
- With vacuum advance device disconnectted from tester, read automatic advance curve at increasing rpm rate (see: Inspection Specifications).
- If advance characteristics are not as specified, inspect distributor with particular reference to flyweights and springs, timer and pulse generator. Replace any inefficient components.

ON-VEHICLE DISTRIBUTOR INSTALLATION

1.6 1.8 2.0

To install the ignition distributor on the engine proceed as follows:

a. Turn the crankshaft to bring piston number 1 on compresion stroke, i.e. with both valves closed.

To this end, turn crankshaft pulley (1) so that reference mark «F» stamped on the pulley, lines up with reference pointer (2) attached to water pump.

b. Remove the cap and install the distributor in the engine front cover.

Insert drive coupling (3) in the groove provided on the spigot of oil pump (4).

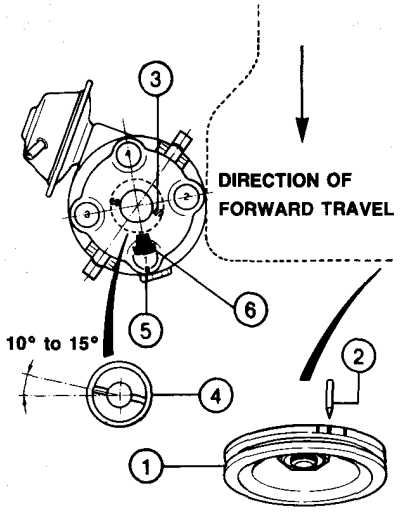
c. Position the distributor correctly by suitably rotating it until reference mark (5) on the edge of distributor body lines up with the centerline of rotor arm (6) as shown.

d. Fasten the distributor in this position through the clamp provided.

e. Install cap on distributor and connect the spark plug leads in the correct ignition sequence (1-3-4-2).

f. Carry out ignition timing using a stroboscopic lamp.

CYLINDER HEAD COVER



1. Crankshaft pulley
2. Reference pointer
3. Drive coupling
4. Oil pump spigot
5. Reference mark
6. Rotor arm

ON-VEHICLE DISTRIBUTOR INSTALLATION

2.0 iniezione

To install the ignition distributor on the engine proceed as follows:

a. Turn crankshaft to bring piston number 1 on compression stroke, i.e. with both valves closed.

To this end, turn crankshaft pulley (1) so that reference mark «F», stamped on pulley, lines up with reference pointer (2) attached to water pump.

b. Remove the cap and install distributor on front engine cover.

Insert drive coupling (3) in the groove on the spigot of oil pump (4).

c. Correctly position the distributor turning it until reference mark (5) on the edge of the body lines up with the centerline of rotor arm (6) as shown.

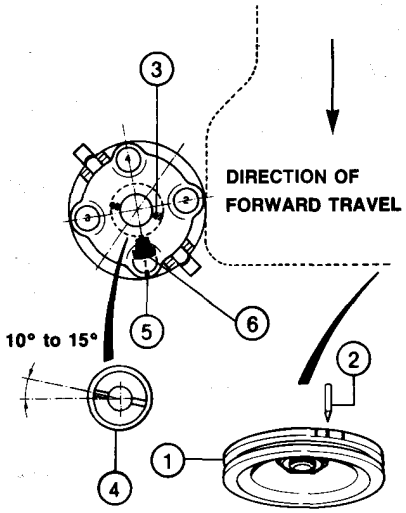
d. Fasten the distributor in this position using the clamp provided.

e. Install the cap on the distributor and connect the spark plug leads in the correct sequence (1-3-4-2).

f. Warm up engine and check with a stroboscopic gun that at 900 ± 50 rpm idle speed, ignition occurs with reference mark «F» (10° ± 1° before T.D.C.) aligned to the pointer.

CAUTION:
The system does not require and does not permit any ignition advance adjustment.
Therefore, DO NOT TURN the distributor, otherwise the ignition sequence might be altered with extremely serious consequences.

CYLINDER HEAD COVER



1. Crankshaft pulley
2. Reference pointer
3. Drive coupling
4. Oil pump spigot
5. Reference mark
6. Rotor arm

ON-VEHICLE DISTRIBUTOR INSTALLATION

Alfa 75 1.8 turbo

To install the ingition distributor on the engine proceed as follows:

a. Turn crankshaft to bring piston number 1 on compression stroke, i.e. with both valves closed.

To this end, turn crankshaft pulley (1) so that reference mark «F», stamped on pulley, lines up with reference pointer (2) attached to the water pump.

b. Remove the cap and install distributor on front engine cover.

Insert drive coupling (3) in the groove on the spigot of oil pump (4).

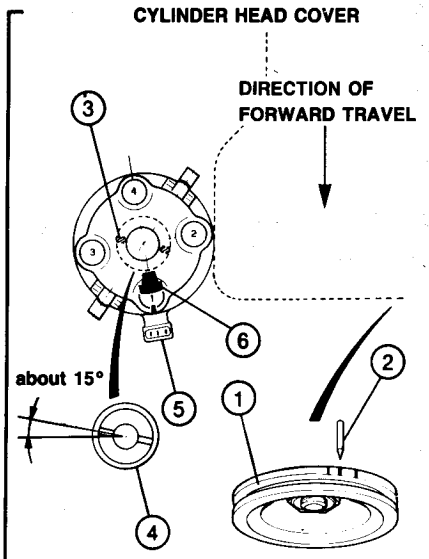
Ensure that the reference mark is facing as indicated in the figure.

c. Position the distributor correctly by suitably rotating it until connection point (5) for supply cable connector lines up with the centreline of rotor arm (6) as shown.

d. Fasten the distributor in this position using the clamp provided.

e. Install the cap on the distributor and connect the spark plug leads in the correct sequence (1-3-4-2).

f. Warm up engine and check with a stroboscopic gun that at 900 ±50 rpm idle speed, ignition occurs with reference mark «F» (9° before T.D.C.) aligned to the pointer.

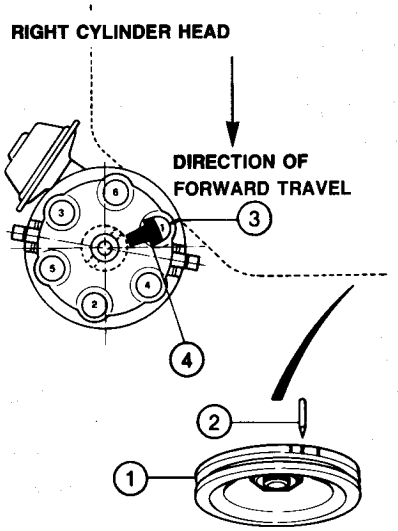


1. Crankshaft pulley
2. Reference pointer
3. Drive coupling
4. Oil pump spigot
5. Connection point
6. Rotor arm

e. Install cap on distributor and connect the spark plug leads in the correct ignition sequence (1-4-2-5-3-6).

f. Carry out ignition timing using a stroboscopic lamp.

CAUTION:
The distributor rotor arm is provided with a rpm limiter that cuts off ignition when the engine speed exceeds 6300 ± 150 rpm.



1. Crankshaft pulley
2. Reference pointer
3. Reference mark
4. Rotor arm

ON-VEHICLE DISTRIBUTION INSTALLATION

2.5 iniezione

To install the ignition distributor on the engine proceed as follows:

a. Turn the crankshaft to bring piston number 1 on compression stroke, i.e. with both valves closed.

To this end, turn crankshaft pulley (1) so that reference mark «F» stamped on the pulley, lines up with reference pointer (2)

b. Remove the cap and install the distributor with the rotor arm pointing toward cylinder number 1.

c. Position the distributor correctly by suitably rotating it until reference mark (3) on the edge of distributor body lines up with the centerline of rotor arm (4) as shown.

d. Fasten the distributor in this position through the clip provided.

INSPECTION SPECIFICATIONS

IGNITION DISTRIBUTOR Alfa 75 Alfa 90 Alfetta GTV 6 2.5

Distributor	Alfa Romeo Part No.	116.97.05.011.00	115.44.05.011.00 (1)	116.97.05.011.01	116.46.05.011.00 (2)
	Type	BOSCH 0.237.002.018	BOSCH 0.237.501.002 (1)	MARELLI SM802BX	BOSCH 0.237.301.008 (2)
Firing order		1-3-4-2			1-4-2-5-3-6
Pulse generator coil resistance	Ω	1000 ± 5%	—	730 ± 5%	—
Rotor arm internal resistance	Ω	1000 ± 0.2	—	5000 ± 1	—
Gap	mm (in)	— —	— —	0.5 to 0.6 (0.020 to 0.024)	—

(1) Distributor fitted to engine 017.13 (Motronic)
(2) Distributor fitted to engine 016.46 (2500)

IGNITION DISTRIBUTOR Giulietta GTV 2.0

Distributor	Alfa Romeo Part No.	116.55.05.011.00	116.55.05.011.01	116.55.05.011.03
	Type	BOSCH 0.231.170.229	MARELLI S168BX	DUCELLIER 4533A
Firing order		1-3-4-2		
Pulse generator coil resistance	Ω	—	—	—
Rotor arm internal resistance	Ω	≥ 4500	5000 ± 1	5000
Contact gap	mm (in)	0.35 (0.014)	0.37 to 0.43 (0.015 to 0.017)	0.35 (0.014)
Contact dwell angle		62° ± 3°	55° ± 3°	57° ± 3°
Contact load	g (oz.)	500 (17.6)	475 ± 50 (16.7 ± 1.8)	450 ± 50 (15.8 ± 1.8)

Distributor	Alfa Romeo Part No.	116.97.05.011.01 (1)	116.97.05.011.00 (1)	
	Type	MARELLI SM802BX	BOSCH 0.237.002.018	
Firing order		1-3-4-2		
Pulse generator coil resistance	Ω	730 ± 5%	1000 ± 5%	
Rotor arm internal resistance	Ω	5000 ± 1	1000 ± 0.2	
Gap	mm (in)	0.5 to 0.6 (0.020 to 0.024)	0.5 to 0.6 (0.020 to 0.024)	

(1) Distributor fitted to electronic ignition engines

ECU

Supply voltage ..... 4 to 16 V
Max. current ..... 6 A
Heat sink temperature gauge ..... —30 to +125°C (—22 to +257°F)

IGNITION ADVANCE

Advance (1)	Engines			
	016.00 - 016.78 - 016.55 061.00 - 062.02 - 062.12	017.13	016.46	061.34
Static advance (2)	7° ±1° B.T.D.C. at idle	10° ±1° B.T.D.C. at idle	7° ±1° B.T.D.C. at idle	9° B.T.D.C. at idle
Max. advance (3)	38° $^{+0°}_{-3°}$ B.T.D.C. at 5100 rpm	—	31° $^{+0°}_{-3°}$ B.T.D.C. at 5100 rpm	—

(1) Check static and max. advance with distributor vacuum pipe disconnected
(2) Static advance position: Align pointer to ref. mark «F»
(3) Max. advance position: Align pointer to ref. mark «M»

AUTOMATIC AND VACUUM ADVANCE CURVES

BOSCH 0.237.002.018

Speed (rpm)	Auto. advance curve		Vacuum mmHg (inHg)	Vacuum advance curve	
	Max.	Min.		Max.	Min.
100	15'	1°30'	0 (0)	30'	—30'
230	—30'	45'	60 (2.36)	45'	—30'
280	0°	0°	90 (3.54)	2°	—30'
330	15'	—45'	101 (3.98)	2°45'	—30'
380	0°	—1°	150 (5.91)	6°	3°
470	1°	—1°15'	195 (7.68)	8°30'	5°45'
900	6°	3°30'	210 (8.27)	8°45'	6°30'
1900	11°15'	9°	225 (8.86)	8°45'	6°45'
2500	15°15'	12°45'	300 (11.81)	8°45'	6°45'
2700	15°30'	13°30'			
3000	15°	13°			

BOSCH 0.231.170.229

Speed (rpm)	Auto. advance curve		Vacuum mmHg (inHg)	Vacuum advance curve	
	Max.	Min.		Max.	Min.
150	Start	Start	0 (0)	30'	—30'
200	30'	—30'	50 (1.97)	30'	—30'
400	30'	—30'	100 (3.94)	4°15'	—30'
550	2°30'	—30'	212 (8.35)	9°45'	6°45'
800	5°45'	2°15'	320 (12.60)	9°45'	6°45'
1000	7°30'	4°30''			
1500	10°	7°			
2550	16°30'	13°30'			
3000	16°30'	13°30'			

BOSCH 0.237.301.008

Speed (rpm)	Auto. advance curve		Vacuum mmHg (inHg)	Vacuum advance curve	
	Max.	Min.		Max.	Min.
100	—15'	45'	0 (0)	30'	—30'
300	—30'	30'	90 (3.54)	30'	—30'
350	—15'	—15'	105 (4.13)	1°	—30'
400	15'	—45'	128 (5.04)	2°30'	—30'
450	15'	—45'	165 (6.50)	5°	2°15'
600	2°15'	—10'	180 (7.09)	5°45'	3°15'
1300	10°45'	8°	196 (7.72)	6°	4°
1500	12°	9°45'	300 (11.81)	6°	4°
1900	13°30'	11°30'			
2100	14°	12°			
2400	13°45'	11°45'			
3000	13°	11°			

MARELLI SM802BX

Speed (rpm)	Auto. advance curve		Vaccum mmHg (inHg)	Vacuum advance curve	
	Max.	Min.		Max.	Min.
250	0°	0°	0 (0)	30'	—30'
300	15'	—15'	40 (1.58)	30'	—30'
450	30'	—1°	100 (3.94)	2°30'	—30'
550	1°30'	—30'	212 (8.35)	9°45'	6°45'
800	4°15'	2°	300 (11.81)	9°45'	6°45'
1000	6°15'	4°30''			
1900	11°30'	9°			
2550	15°30'	13°30'			
3000	15°15'	13°15'			

MARELLI S168BX

Speed (rpm)	Auto. advance curve		Vacuum mmHg (inHg)	Vacuum advance curve	
	Max.	Min.		Max.	Min.
150	Start	Start	0 (0)	30'	—30'
200	45'	—30'	70 (2.76)	30'	—30'
450	45'	—30'	100 (3.94)	2°30'	—30'
550	2°45'	—30'	212 (8.35)	9°45'	6°45'
700	6°	1°30'	320 (12.60)	9°45'	6°45'
800	7°	2°45''			
1000	8°15'	5°15'			
2550	16°30'	13°30'			
3000	16°30'	13°30'			

DUCELLIER 4533A

Speed (rpm)	Auto. advance curve		Vacuum mmHg (inHg)	Vacuum advance curve	
	Max.	Min.		Max.	Min.
150	Start	Start	0 (0)	30'	—30'
200	45'	—30'	70 (2.76)	30'	—30'
450	45'	—30'	100 (3.94)	2°30'	—30'
550	2°45'	—30'	212 (8.35)	9°45'	6°45'
700	6°	1°30'	300 (12.60)	9°45'	6°45'
800	7°	2°45'			
1000	8°15'	5°15'			
2550	16°30'	13°30'			
3000	16°30'	13°30'			

IGNITION COIL Alfa 75 Alfa 90 Alfetta GTV 6 2.5

Coil	Alfa Romeo Part No.	116.97.65.079.00 (1)	195.00.65.079.00 (2)	116.55.65.079.02 (1)	
	Type	BOSCH 0.221.600.002	BOSCH 0.221.122.344	MAGNETI MARELLI BAE207B	
Primary winding resistance [at 20°C (68°F)]	Ω	0.7 to 1	0.5 ± 10%	0.72 ± 10%	
Secondary winding resistance [at 20°C (68°F)]	Ω	6700 to 9600	6000 ± 10%	7900 ± 10%	

(1) Coil with ECU
(2) Coil fitted to engine 017.13 (Motronic)

IGNITION COIL Giulietta

Coil	Alfa Romeo Part No.	105.26.65.079.00	116.42.65.079.00	105.48.65.079.00	105.12.65.079.02
	Type	BOSCH 0.221.119.008	MARELLI BE200H	KLITZ G53SB	SEV MARCHAL 3H
Primary winding resistance [at 20°C (68°F)]	Ω	2.9 to 3.4	3.14 ± 4%	2.9 to 3.2	>3
Secondary winding resistance [at 20°C (68°F)]	Ω	6000 to 10000	9400 ± 10%	5400 to 8000	5250 to 6000

Coil	Alfa Romeo Part No.	105.12.65.079.03	105.12.65.079.01	116.33.65.079.00	116.55.65.079.01
	Type	ISKRA ATA-0105	DUCELLIER 2792A	MARELLI BZR202B	BOSCH 0.221.119.044
Primary winding resistance [at 20°C (68°F)]	Ω	3.2	2.8 to 3.4	1.70 ± 4% (1)	1.7 to 2.2 (2)
Secondary winding resistance [at 20°C (68°F)]	Ω	6740	6000 to 10000	8500 ± 10%	7000 to 12000

Coil	Alfa Romeo Part No.	116.55.65.079.02 (3)	—	
	Type	MARELLI BAE207B	BOSCH (3) 1.227.020.010	
Primary winding resistance [at 20°C (68°F)]	Ω	0.72 ± 10%	0.82	
Secondary winding resistance [at 20°C (68°F)]	Ω	7900 ± 10%	8.25	

(1) Fitted to 2000 engine (016.55) r = 0.8 ± 10%
(2) Fitted to 2000 engine (016.55) r = 0.9 ± 5%
(3) Coil with ECU fitted to electronic ignition engine

IGNITION COIL (GTV 2.0)

Coil	Alfa Romeo Part No.	116.55.65.079.00	116.33.65.079.01	116.55.65.079.01	116.55.65.079.02 (3)
	Type	BOSCH 0.221.119.044	MARELLI BZR202B	BOSCH 0.221.119.044	MARELLI BAE207B
Primary winding resistance [at 20°C (68°F)]	Ω	1.7 to 2.2	1.70 ± 4% (1)	1.7 to 2.2 (2)	0.72 ± 10%
Secondary winding resistance [at 20°C (68°F)]	Ω	7000 to 12000	8500 ± 10%	7000 to 12000	7900 ± 10%

Coil	Alfa Romeo Part No.	116.97.65.079.00 (3)
	Type	BOSCH 0.221.600.002
Primary winding resistance [at 20°C (68°F)]	Ω	0.7 to 1
Secondary winding resistance [at 20°C (68°F)]	Ω	6700 to 9600

(1) Resistance r = 0.8 ± 10%
(2) Resistance r = 0.9 ± 5%
(3) Coil with ECU fitted electronic ignition engine

SPARK PLUGS

Alfa Romeo Part No.	105.14.05.106.01	119.00.05.106.01 (1)	— (2)
Type	LODGE 2 HL	SILVER LODGE 2 HL-E	TURBO LODGE 25XL

(1) Spark plug fitted to engines 017.13 (Motronic), 062.10 and 016.46 (2500)
(2) Spark plug fitted to engine 061.34 (1800)

FLUID AND LUBRICANTS

Description	Type	Type of product	Quantity
Spark plug thread	OIL	ISECO Molykote A Part No. 4500-18304	As required

TIGHTENING TORQUES

Description	Unit of measure		
	Nm	kgm	ft.lb
Spark plug (wet, ISECO Molykote A)	25 to 34	2.5 to 3.5	18.4 to 25.1

TROUBLESHOOTING

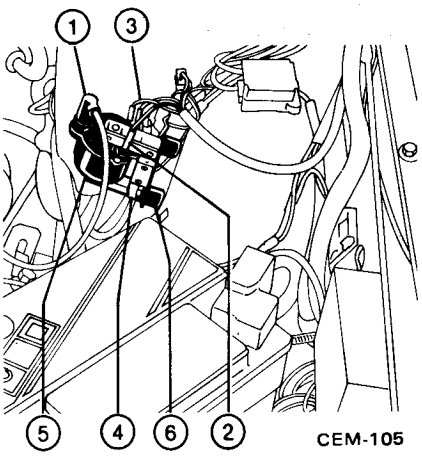
Defect	Probable Cause	Remedy
Engine misfires	• Erratic HT connections	Replace or fasten HT connections
	• Ignition coil cap sparking or burnt	Replace coil
	• Distributor cap sparking or burnt	Replace distributor cap
	• Rotor arm sparking or burnt	Replace rotor arm
	• Coil secondary S/C or O/C (coil sparks weak)	Replace coil
	• Mechanical fault in distributor (visually check for gap between rotor and stator)	Disassemble distributor and replace defective parts. If necessary, replace entire distributor
	• Pulse generator resistance inside distributor not as specified	Replace pulse generator coil
	• Incorrect ignition timing	Check and adjust ignition timing
	• Defective fuel supply system	Remedy as necessary
	• Defective ECU	Replace ECU
Engine will not fire	• Connections O/C	Trace and rectify O/C or replace connections
	• Ignition coil cap burnt through by HT or grounded	Replace ignition coil
	• Distributor cap burnt through by HT or grounded	Replace ignition distributor cap
	• Rotor arm burnt through or grounded	Replace rotor arm
	• Coil primary S/C or grounded	Replace ignition coil
	• Coil secondary O/C	Replace ignition coil
	• Distributor gap incorrect	Disassemble distributor and replace any defective parts

IGNITION COIL

6 cylinders Alfa 90 2.0 iniezione

DESCRIPTION

Closed core coil is characterized by reduced primary winding resistance and inductance.
Because of this, primary current signal must be strictly controlled in terms of both peak and RMS values.
Control is effected directly by ECU, which also regulates charging time as a function of engine rpm rate, thereby providing optimum spark power characteristics.



1. HT lead
2. Coil secondary lead
3. Coil primary lead
4. Retaining nuts
5. Coil
6. Cushion pads

ELECTRICAL TESTS

a. Connect a voltmeter across ground and coil positive 15.
b. Turn ignition key to ON position and check for +12 V signal.
c. Turn off ignition key and, using the ohmmeter, check for open circuits across coil negative 1 and pin 35 of WHITE connector on ECU.
d. Disconnect conductors from coil.
e. Using the ohmmeter, check that secondary resistance across positive 15 and HT terminal is **3.7 Ohm ±10%**.
f. Using the ohmmeter, check that primary resistance across positive 15 and negative is virtually nil **(0.344 Ohm)**.

INSTALLATION

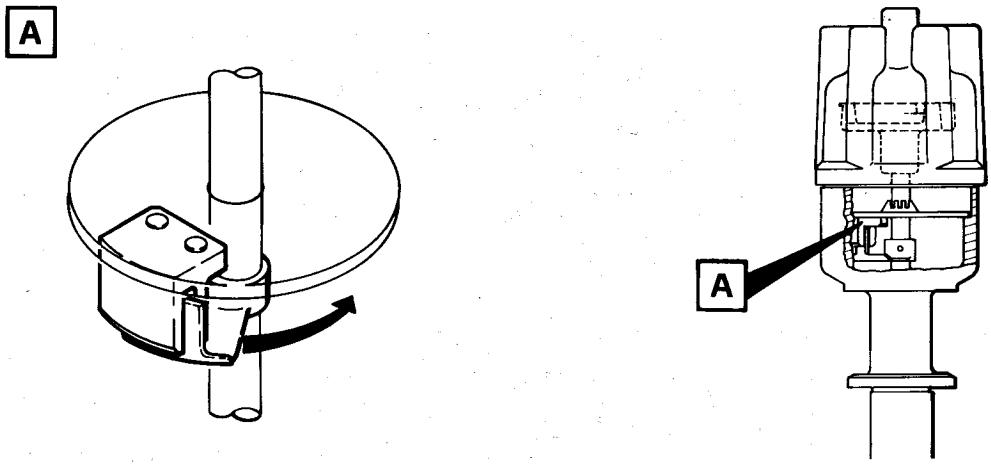
For installation adopt a reversal of the removal sequence, and note the following points:
— Interpose **new** cushion pads between coil and vehicle left side wall.
— Ensure that HT and primary and secondary winding connectors are tight.

REPLACEMENT

a. Disconnect battery negative terminal.
b. Disconnect HT lead (1) from coil.
c. Disconnect lead (2) from positive coil secondary terminal 15.
d. Disconnect leads (3) from negative coil primary terminal 1.
e. Back off nuts and washers (4) retaining coil to vehicle left side wall.
f. Remove coil (5) and two cushion pads (6).

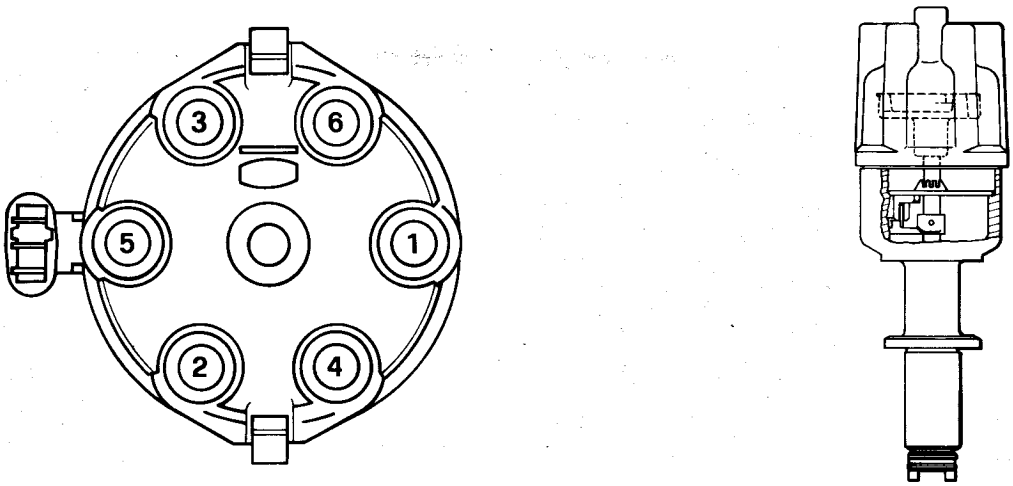
SPECIFICATIONS

MASTER RESET SENSOR



Description	Unit of measure
Supply voltage (d.c.)	5 V ± 0.25 V
Max. permissible load	40 mA
Signal initiation (advance angle relative to TDC cylinder No. 1)	113°
Signal on angle	23° to 31°
Low voltage level (I ≤10 mA)	≤0.4 V
High voltage level (I ≤10 μA)	3.5 to 5 V

DISTRIBUTOR



Distributor	Alfa Romeo Part No.	195.15.05.011.00 (1)	
	Type	MARELLI DT 454A	
Firing order		1-4-2-5-3-6	

(1) Distributor with integral master reset sensor

GROUP 05

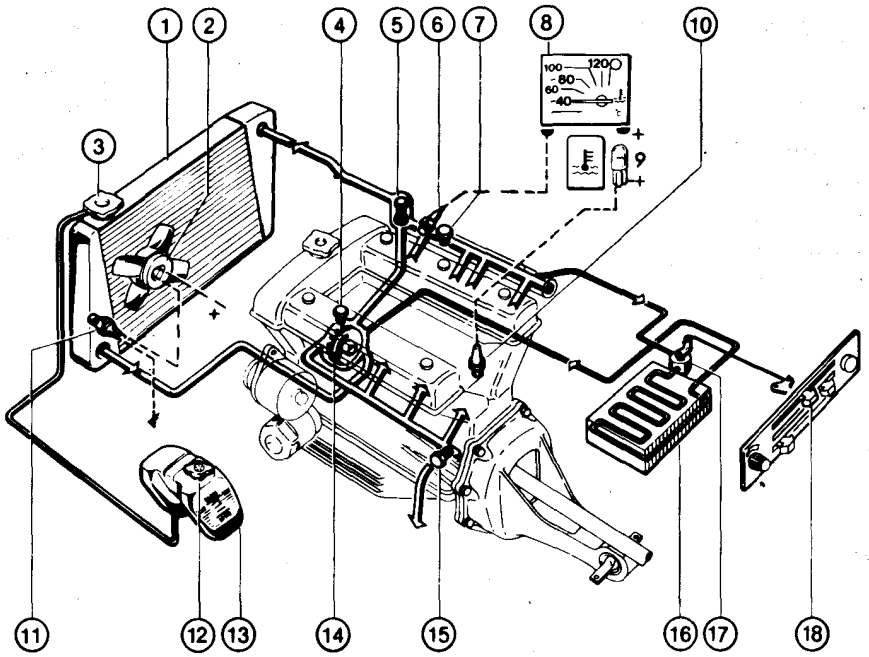
CONTENTS

6 cylinders Alfa 90 2.0 6V iniezione

COOLING SYSTEM

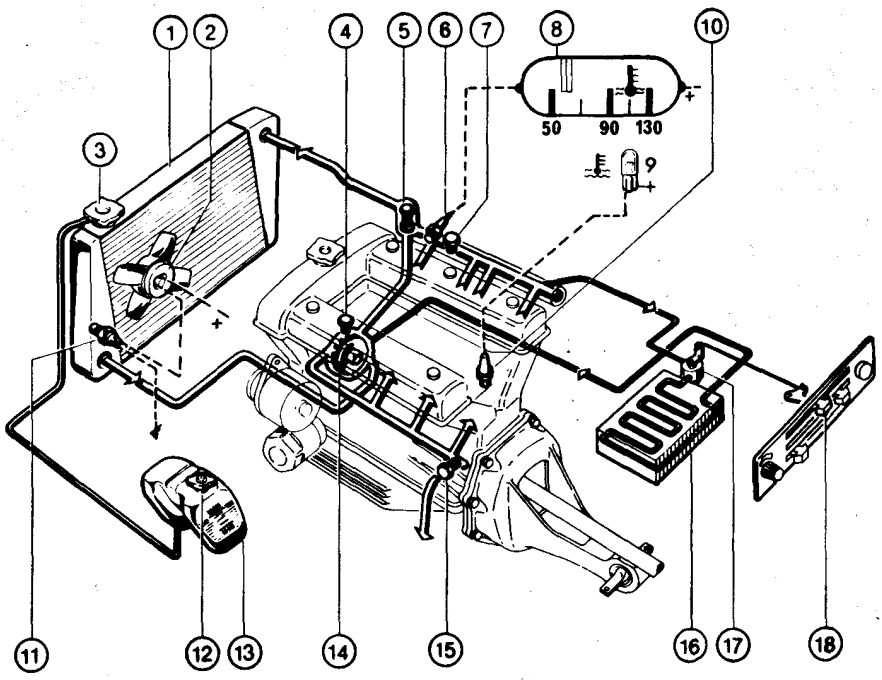
4 cylinders 1.6 1.8 2.0 2.0 Iniezione

ALFETTA Engines 1600 (016.00) - 1800 (016.78) - 2000 (016.55)



1. Radiator
2. Cooling fan
3. Radiator cap
4. Pump vent screw
5. Thermostat
6. Temp. gauge sending unit
7. Manifold vent screw
8. Water temp. gauge
9. High water temp. indicator
10. High water temp. indicator sending unit
11. Fan temp. switch
12. Expansion tank cap
13. Expansion tank
14. Water pump
15. Engine block water drain
16. Heater
17. Heater cock
18. Heater cock control

GIULIETTA Engines 1600 (016.00) - 1800 (016.78) - 2000 (016.55)



GENERAL DESCRIPTION

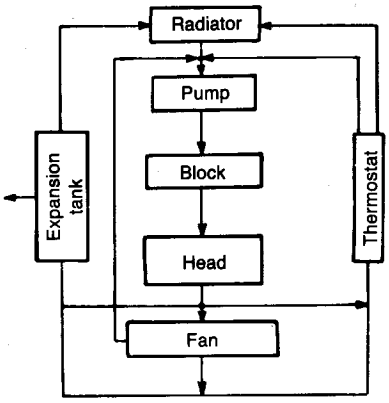
1.6 **1.8** **2.0** **2.0** **iniezione**

Forced-feed water cooling system incorporates centrifugal pump U-belt driven from engine crankshaft.

Thermostat on water manifold controls engine temperature and permits speedy warm-up after starting from cold. To this end thermostat valve will only open when temperature approximates 80°C (176°F).

In addition to ram effect, radiator cooling is helped by an electric fan activated by radiator mounted temperature switch.

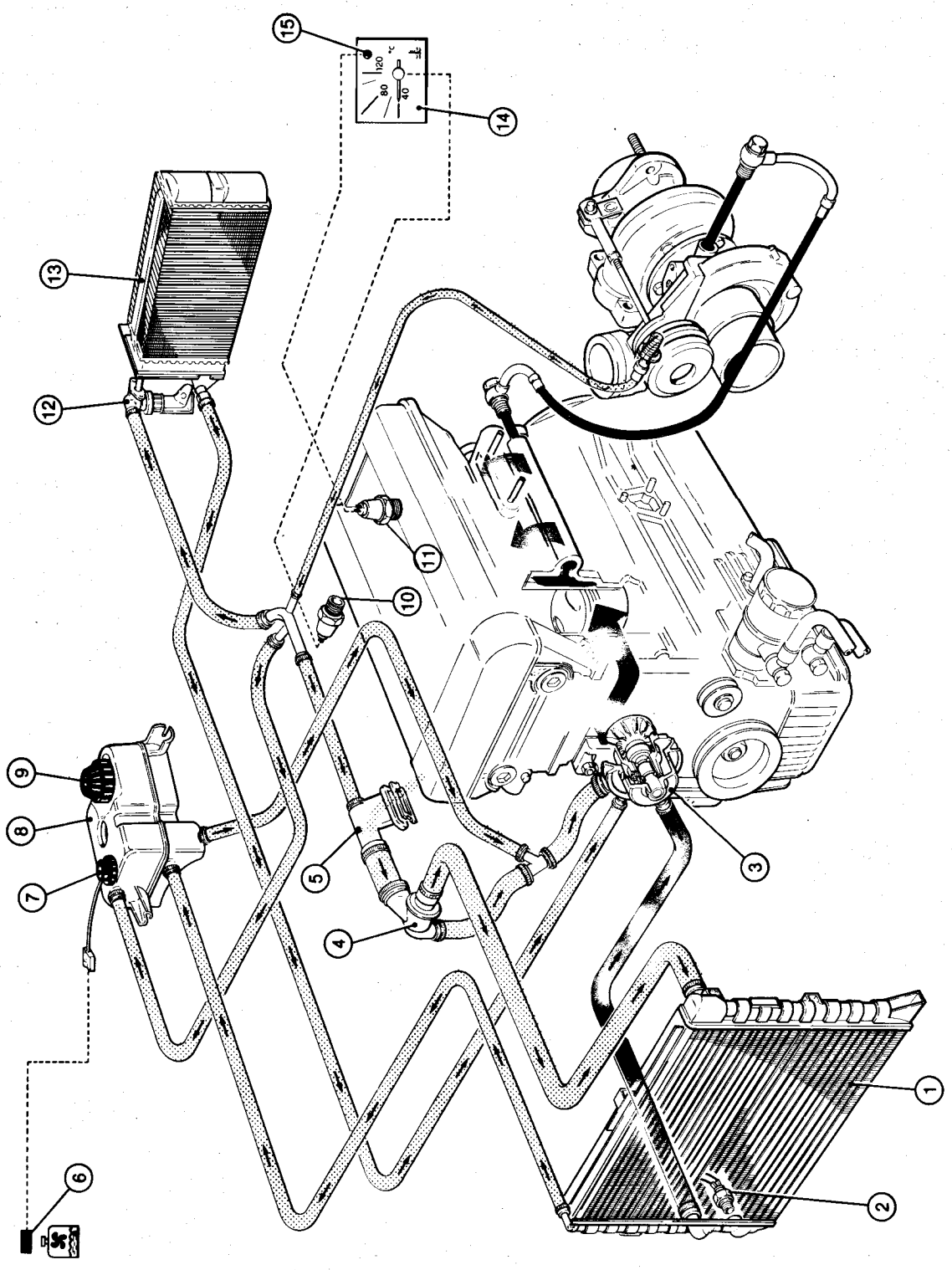
A water temp. gauge sending unit located on supply manifold is connected to a dashboard mounted water temp. gauge. Moreover, a high water temp. indicator sending unit on cylinder head is connected to a dashboard mounted high water temp. indicator which lights up when the system temperature exceeds 105°C (221°F).



COOLING SYSTEM

4 cylinders 1.8 turbo

Vehicle Alfa 75 1.8 turbo **engine 061.34**



1. Radiator
2. Fan control sending unit
3. Water pump
4. Thermostat valve
5. Manifold
6. Minimum water level indicator light (ALFA ROMEO Control)
7. Water level sensor
8. Expansion tank
9. Expansion tank cap
10. Water temperature gauge sending unit
11. Water maximum temperature indicator sending unit
12. Heater cock
13. Heater
14. Water temperature indicator
15. Water maximum temperature indicator light

DELIVERY CIRCUIT

RETURN CIRCUIT

GENERAL DESCRIPTION

1.8 turbo

The cooling circuit is of the sealed type with circulation by means of a centrifugal pump operated by the crankshaft through a V-belt.

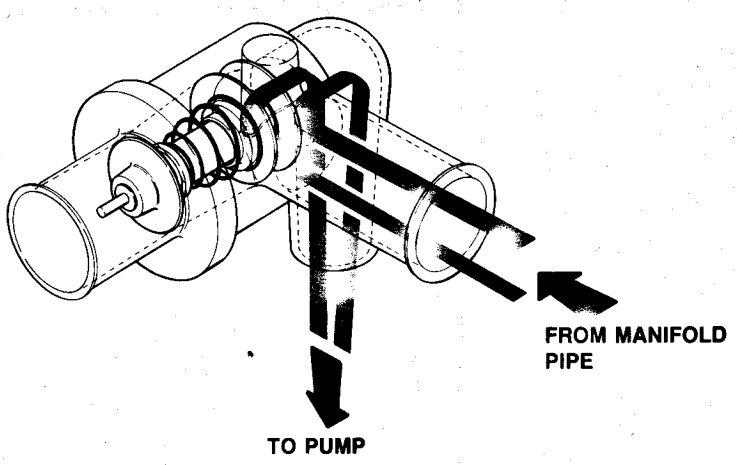
Rotation of water pump (3) creates a vacuum in the return circuit which draws the liquid coming from the cylinder group through manifold pipe (5) or from radiator-heater (13) when control cock (12) is open (circulation of the liquid in the radiator-heater).

At the outlet of manifold pipe (5) there is a thermostat (4) whose function is to ensure that the engine reaches normal running temperature in a short time and subsequently ensure that it is kept in the optimal temperature range.

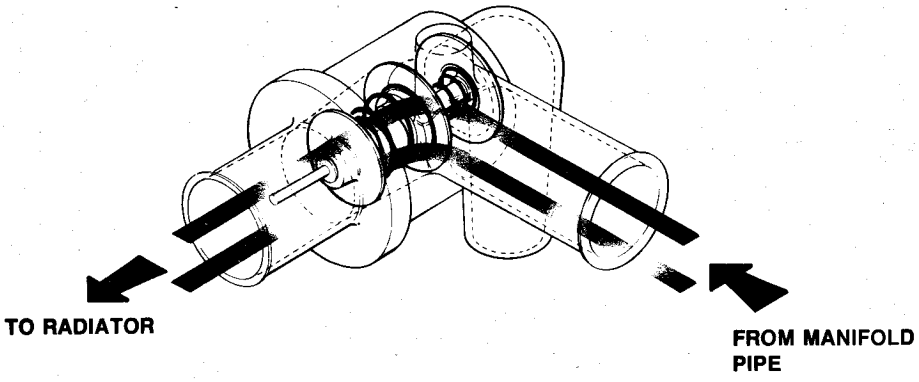
Until the engine temperature reaches 81 to 85°C (178 to 185°F) the thermostat valve remains closed, diverting the liquid directly towards pump (3).

At higher temperatures the opening of the thermostat valve permits the passage of the liquid to the radiator (1).

THERMOSTAT VALVE CLOSED



THERMOSTAT VALVE OPEN



The radiator, in addition to the dynamic air, is also cooled by an electric fan activated by thermal contact (2) whenever the temperature of the lower part of the radiator reaches about 88°C (190°F).

The circulation of the water in the radiator (13) is governed by cock (12), opened by the heater control knob.

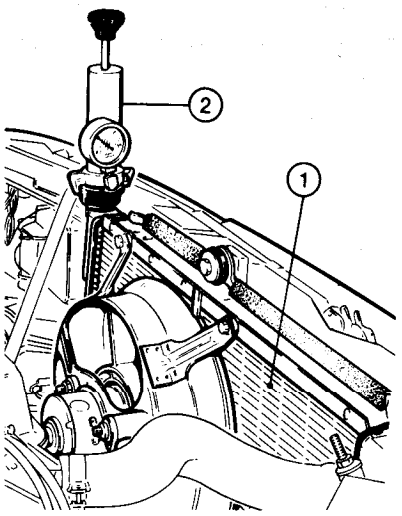
Connected to the delivery duct there is also a pipe to cool the oil circulating in the turbocharger.

LEAKAGE TEST

Alfetta **Giulietta**

a. Remove pressurized radiator cap (1).
b. Apply tester to filler neck.
c. Pressurize system and check on gauge (2) that pressure reaches and stays at the specified rating.
d. If the system does not hold the specified pressure, check radiator for leakage. If necessary, remove radiator and test as directed under «Radiator».

Coolant system leakage test pressure
107.9 kPa
(1.0 bar or 1.1 kg/cm², 15.6 psi)

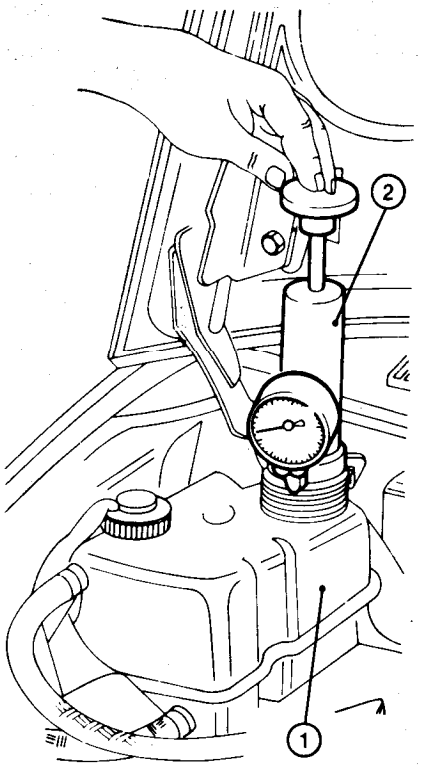


1. Radiator
2. Tester

GTV 2 0 **Alfa 75** **Alfa 90**

a. Unscrew pressurized cap from the expansion tank (1).
b. Screw on instrument (2) for the testing on the hydraulic system onto the filler neck of the expansion tank.
c. Pressurize the system and check on gauge that the pressure is maintained at the required level.
d. If the pressure is not maintained check the circuit for leaks from sleeves or radiat or.
If necessary, proceed with radiator removal as directed under «Radiator».

Coolant system leakage test pressure
107.9 kPa
(1.08 bar; 1.1 kg/cm²; 15.6 psi)

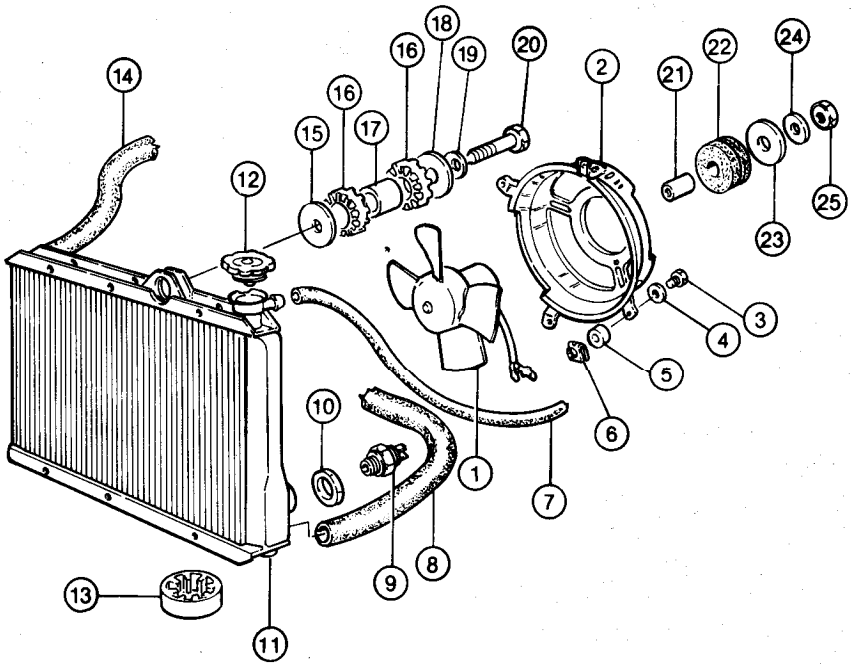


1. Expansion tank
2. Tester

RADIATOR

ALFETTA - GIULIETTA - GTV

1.6 1.8 2.0 2.0 iniezione



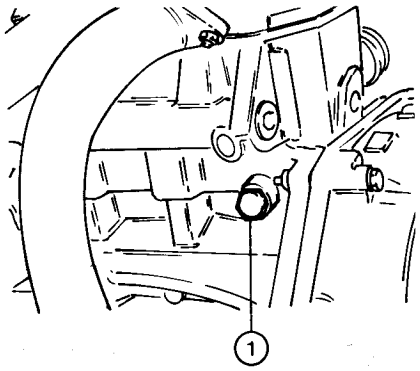
1. Fan
2. Air scoop
3. Capscrew
4. Washer
5. Spacer
6. Retainer
7. Supply hose (expansion tank to radiator)
8. Outlet hose
9. Termp. switch
10. Seal
11. Radiator
12. Radiator cap
13. Cushion pad
14. Hose (thermostat to radiator)
15. Washer
16. Cushion pads
17. Spacer
18. Washer
19. Washer
20. Capscrew
21. Spacer
22. Cushion pad
23. Washer
24. Washer
25. Nut

REMOVAL

a. Place a container of adequate capacity under the vehicle for coolant draining.

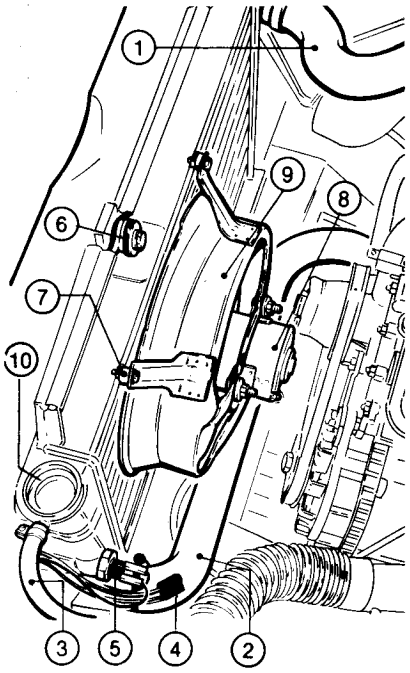
If the engine is warm proceed with care to prevent scalding.

b. Remove plug (1) from engine block and allow to drain completely.



1. Plug

c. Drain radiator as follows:
— slacken hose clip and disconnect radiator outlet hose (2);
— slacken hose clip and disconnect radiator inlet hose (1);
— slacken hose clip and disconnect supply hose (3) from radiator;
— to facilitate draining remove cap from filler (10) and open heater cocks.



1. Water inlet hose (thermostat-radiator)
2. Water outlet hose (radiator-engine)
3. Supply hose
4. Fan connection
5. Temp. switch
6. Radiator capscrew
7. Fan capscrew
8. Fan
9. Air scoop
10. Filler neck

d. Disconnect electrical leads from fan (4) and temp. switch (5).
e. Back off capscrews (6) and remove interposed radiator washers.
f. Lift radiator clear of engine compartment and take off radiator cushion pads.
g. Back off four capscrews (7) with interposed washers and remove fan (8) with attached air scoops (9).

LEAKAGE TEST

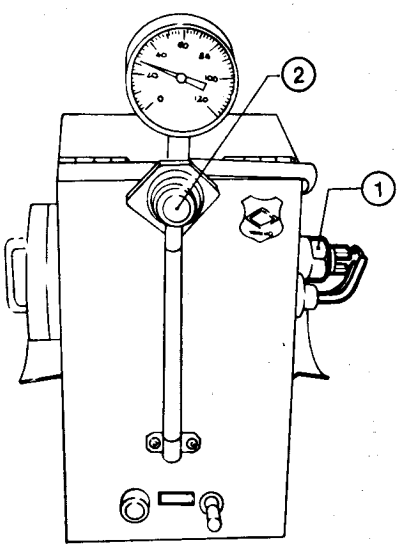
a. Plug radiator inlet and outlet ports.
b. Dip radiator in a water tank, admit compressed air to radiator through supply hose, pressurize to 98.1 to 107.9 kPa (0.9 to 1.0 bar or 1 to 1.1 kg/cm², 14.2 to 15.6 psi) and check for leakage.
c. If leakage is detected, wire brush the affected area and deoxidize using «cured» hydrochloric acid (zinc chloride).
d. Tin solder the affected area.
e. Repeat leakage test as directed in para b. and recoat radiator using black synthetic enamel.
If leakage is detected on radiators fitted with tank seals, replace radiator without hesitation.
f. Install radiator in engine compartment (see: «Radiator - Removal and Installation»), fill the system and check for leakage.

FAN TEMPERATURE SWITCH

1.6 1.8 2.0 2.0 iniezione
1.8 turbo

OPERATION TEST

Test temp. switch as follows:
a. Back off and remove switch from engine.
b. Install switch (1) on thermostat tester.
c. Pour water in bowl and turn on switch to heat the water.
d. When indicator bulb (2) lights up check that tester temperature is equal to specified switch calibration setting (88 to 92°C, 190 to 198°F).



1. Temperature switch
2. Indicator bulb

PRESSURIZED CAP

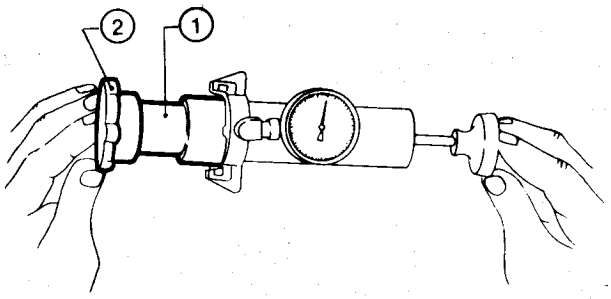
1.6 1.8 2.0 2.0 iniezione

1.8 turbo

Cap pressure setting:
68.6 kPa (0.69 bar; 0.7 kg/cm², 10 psi)

LEAKAGE TEST

a. Fasten connector (1) to tester and insert in pressurized cap (2).
b. Apply pressure and check on tester that upon reaching the specified pressure setting the unload valve cracks off.



1. Connector
2. Cap setting

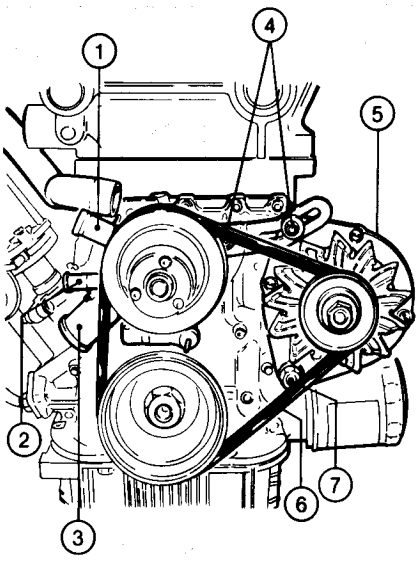
WATER PUMP

1.6 1.8 2.0 2.0 iniezione

1.8 turbo

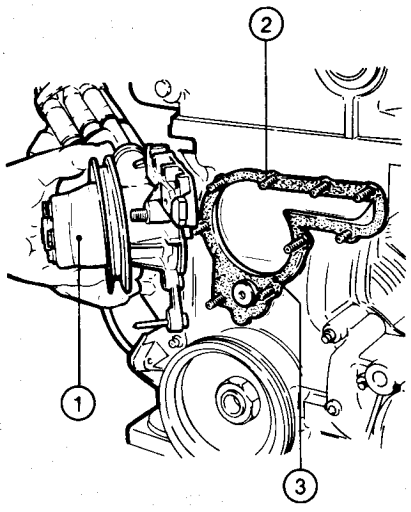
REMOVAL

Prior to removing water pump take off radiator as directed under «Radiator - Removal».
a. Slacken hose clips and disconnect supply hose (1), remove adapters (2) and (3) and heater water return hose and radiator water return hose.



1. Water supply hose
2. Heater water return adapter
3. Radiator water return hose
4. Alternator capscrews
5. Alternator
6. Drive belt
7. Bolt

b. Back off nuts (4) retaining alternator (5), move the latter to loosen drive belt (6) and take off belt.
Remove nuts (4).
c. Back off and remove nine nuts and washers retaining water pump (1) to studs (2) on engine block.
d. Remove water pump (1) and associated gasket (3).



1. Water pump
2. Studs
3. Gasket

INSPECTION

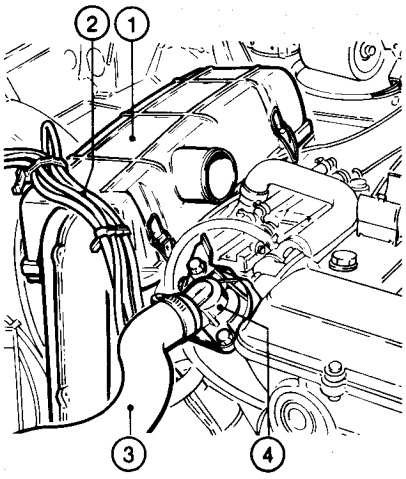
The water pump cannot be overhauled. If defective the water pump should be replaced without hesitation.
a. Check pump body and impeller; if they are found to be badly rusted or corroded, replace without hesitation.
b. Check impeller for radial and end play. If undue play is detected replace the pump.

THERMOSTAT

1.6 1.8 2.0 2.0 iniezione

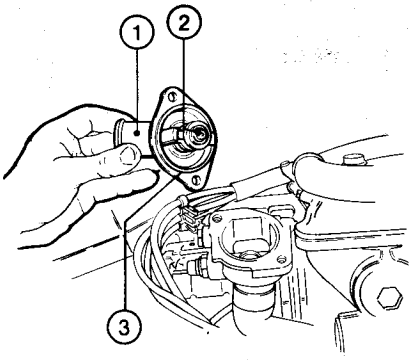
REMOVAL

a. Remove hose connecting warm air intake to air cleaner (1).
b. Disconnect HT leads (2) from spark plugs.
c. Drain coolant until level is down to the bottom of thermostat chamber.



1. Air cleaner
2. HT leads
3. Water outlet hose
4. Thermostat cover

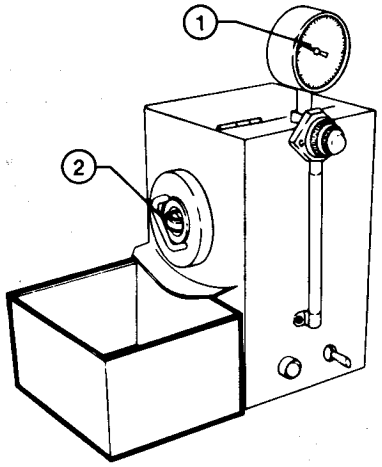
d. Slacken hose clip and disconnect hose (3) between thermostat cover (4) and radiator.
e. Back off two screws and remove cover (1) with attached thermostat (2) and sealing ring (3).



1. Thermostat cover
2. Thermostat
3. Sealing ring

INSPECTION

Check thermostat as follows:
a. Install thermostat (2) on tester.
b. Pour water in bowl and energize tester to heat the water.



1. Temperature gauge
2. Thermostat

c. Check that thermostat opening temperature indicated by the gauge (1) is 81° to 85°C (178° to 185°F).
d. Also check that at 95°C (203°F) thermostat is fully open and that valve travel is 7.5 mm (0.30 in) min.
e. If the above requirements are not met replace the thermostat.

INSTALLATION

For installation reverse the removal sequence as applicable.

THERMOSTAT

a. Install thermostat with cover in the associated housing with interposed sealing ring and tighten the two capscrews to the specified torque.

(T) : **Tightening torque**
Thermostat cover capscrews
10 to 16 Nm
(1 to 1.6 kgm
7.4 to 11.8 ft.lb)

Position thermostat with arrow pointing toward the direction of water flow.

WATER PUMP

a. Install water pump with a new gasket on front cover and tighten retaining nuts to the specified torque.

(T) : **Tightening torque**
Water pump nuts
14 to 22 Nm
(1.36 to 2.25 kgm
10.3 to 16.2 ft.lb)

b. Install water pump and alternator drive belt reversing the removal sequence.
c. Connect hose to water pump and tighten hose clips.
d. Tension water pump/alternator drive belt correctly.
For belt tension adjustment see Group 00 - Engine Maintenance.

TEMPERATURE SWITCH

a. To install reverse the removal sequence.
b. After installation, fill cooling system (see: Cooling System Filling) and run engine to warm up coolant (84° to 88°C, 183° to 190°F) anche check for fan cut-in.

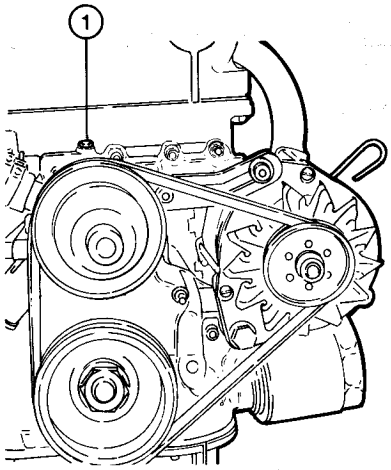
(T) : **Tightening torque**
Fan control switch
(wet with anti-seize compound)
20 to 25 Nm
(2 to 2.5 kgm
14.8 to 18.4 ft.lb)

RADIATOR

For radiator installation reverse the removal sequence.

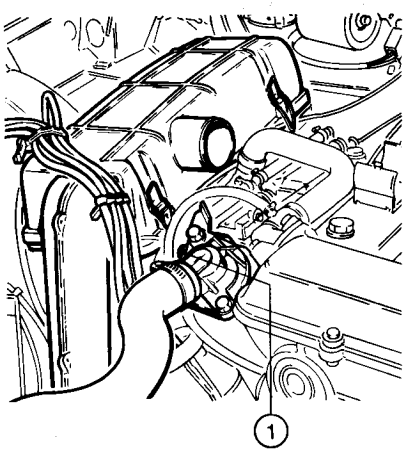
COOLING SYSTEM FILLING

a. Fill cooling system using the coolant indicated under «Inspection Specifications».
b. Remove vent screw (1) on water pump.



1. Vent screw

c. Remove vent screw (1) on supply manifold.



1. Vent screw

d. Pour coolant through radiator filler until coolant flows out of water pump vent hole. Install vent screw on water pump.

e. Resume pouring until coolant flows out of vent hole in supply manifold.
f. Start engine and run at idle speed until all air remaining in engine has been expelled. Stop engine.
g. Install vent screw on supply manifold.
h. Top up radiator and install radiator cap.
i. Fill expansion tank up to max. level shown on tank itself and install expansion tank cap.
j. Start engine and run for a few minutes ensuring no loss of coolant takes place.

INSPECTION SPECIFICATIONS

1.6 1.8 2.0 2.0 iniezione
1.8 turbo

CHECKS AND ADJUSTMENTS

DRIVE BELT

Load	78.4 N (8 kgm, 17.6 lb)
Yield	15 mm (0.6 in)

THERMOSTAT

TEMPERATURE

— Initial opening	81 to 85°C (178 to 185°F)
— Fully open	95°C (203°F)
— Bulb travel	≥7.5 mm (0.3 in)

RADIATOR

Leakage test pressure	107.9 kPa (1.0 bar; 1.1 kg/cm², 15.6 psi)

PRESSURIZED CAP

Calibration pressure	68.6 kPa (0.69 bar; 0.7 kg/cm², 10 psi)

FAN

Cut-in temperature	84 to 88°C (183 to 190°F)

GENERAL

COOLANT

Summer			
Water	liters (Imp.Gal)	8 (1.75)	

Winter			
Min. temp.	°C (°F)	-20 (-4)	-35 (-22)
Antifreeze liquid Part No. 3681-69956	liters (Imp.Gal)	3 (0.66)	4 (0.88)
Distilled water	liters (Imp.Gal)	5 (1.1)	4 (0.88)
Antifreeze mixture Part No. 3681-69958	liters (Imp.Gal)	8 (1.75)	— —

CAUTION:
Antifreeze reacts with paint. Keep away from bodywork.

NOTES:
a. For increased protection from -20°C to -35°C (-4 to -22°F) without emptying system, drain off part of the mixture from radiator and expansion tank and replace using an equal volume of antifreeze liquid Part No. 3681-69956 to be poured in radiator and expansion tank in the following proportion:
— radiator 1.66 liters (0.4 Imp.Gal)
— expansion tank 0.34 liters (0.6 pints)
b. On vehicles incorporating pressurized cooling system, after replacing low water level indicator sending unit located in tank, fully tighten retaining cap to prevent water leakage.

COOLING SYSTEM DESCALER

NALCO: 1006
INTERPROIND: Jal Auto
Part No. 3681-69955

FLUIDS AND LUBRICANTS

Description	Type	Recommended product	Quantity
Radiator fan switch thread	Antiseize	R. GORI: Never Seez Part No. 3671-69850	As necessary

SEALANTS

Description	Type	Recommended product	Quantity
Cooling system leak preventer	Powder	AREXONS Part No. 3522-00101	8 g (0.3 oz.)

Alternative product: ALUMASEAL.

TIGHTENING TORQUES

Description	Unit of measure		
	Nm	kgm	ft.lb
Sending unit, water temp. gauge	34 to 39	3.5 to 4	25.1 to 28.8
Nuts, water pump to front cover	14 to 22	1.36 to 2.25	10.3 to 16.2
Capscrews, thermostat cover	10 to 16	1 to 1.6	7.4 to 11.8
Temp. switch (1), radiator fan (wet, antiseize, see above)	20 to 25	2 to 2.5	14.8 to 18.4
Sending unit, high water temp. indicator	20 to 25	2 to 2.5	14.8 to 18.4

(1) For guidance only (using standard wrench)

TROUBLESHOOTING

1.6 1.8 2.0 2.0 iniezione

1.8 turbo

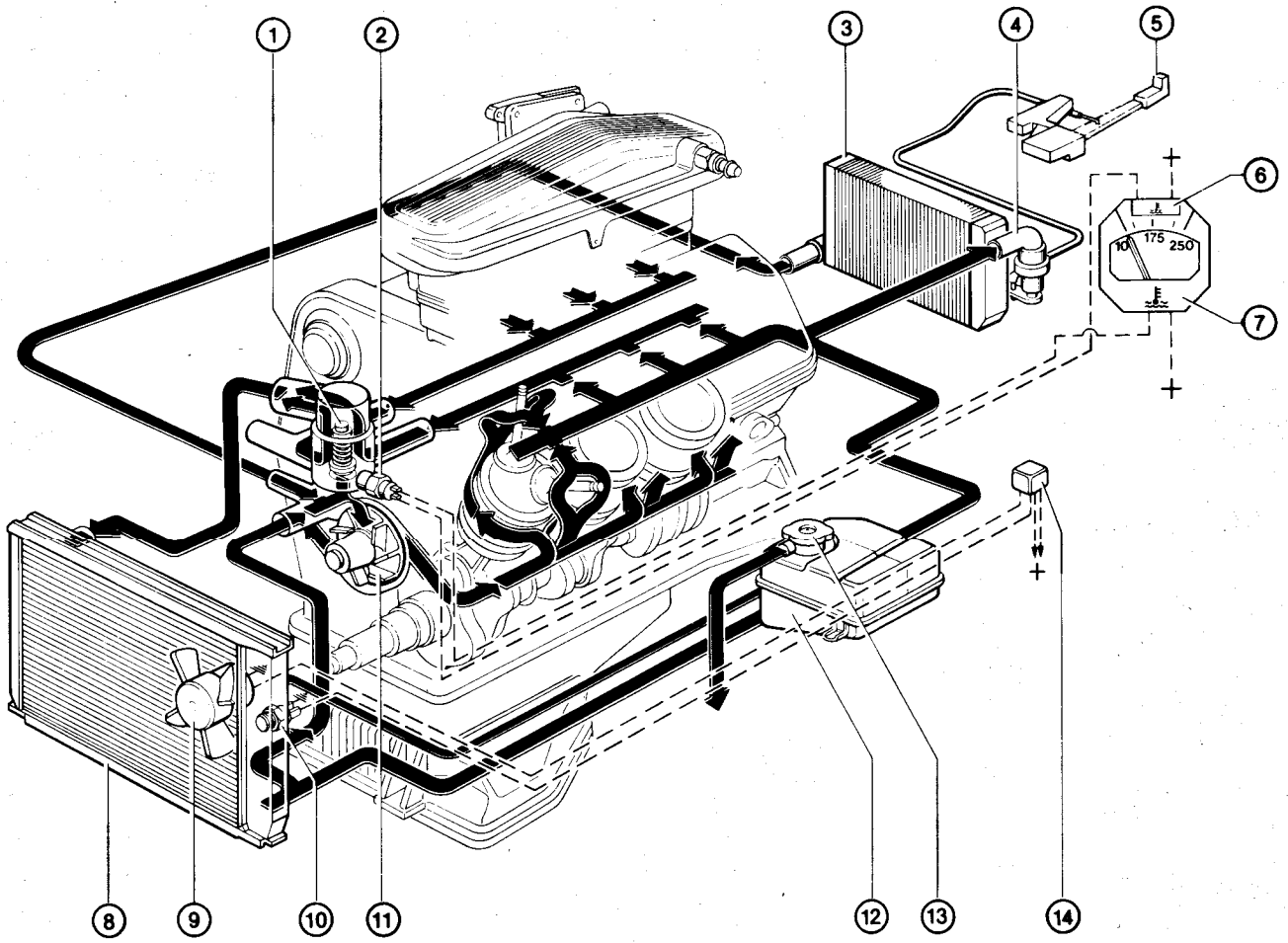
Defect	Possible Cause	Remedy
Water leakage	• Radiator damaged	Repair or replace radiator
	• Hose leakage	Replace hoses
	• Hose clips loose or failed	Tighten or replace hose clips
	• Thermostat leakage	Replace gasket and/or thermostat
	• Cylinder head gasket damaged	Replace. Check for oil contamination
	• Cylinder head capscrew loose	Tighten to correct torque

Defect	Possible Cause	Remedy
Low water flow	• Line obstruction	Check lines and clean system
	• Low coolant level	Top up to correct level
	• Defective water pump	Replace water pump
	• Alternator/water pump drive belt loose	Adjust belt tension
Corrosion and scale		Replace coolant at the specified time intervals; for use follow instructions printed on product containers
Overheating	• Failed thermostat	Replace thermostat
	• Scaled or dirty radiator	Clean internally using special descaler specified. For use follow instructions printed on product containers
	• Incorrect ignition timing	Adjust timing
	• Insufficient lubrication	Top up oil level
	• Water pump failure	Replace water pump
	• Low coolant level	Top up and check system for leakage

COOLING SYSTEM

6 cylinders GTV 6 2.5

GENERAL DESCRIPTION



1. Thermostat
2. Bulb for coolant temperature indicator and max water temperature warning lamp
3. Heater
4. Heater cock
5. Heater control
6. Max coolant temperature warning lamp
7. Coolant temperature indicator
8. Radiator
9. Electric fan
10. Electric fan control bulb
11. Water pump
12. Header tank
13. Header tank cap
14. Electric fan control relay

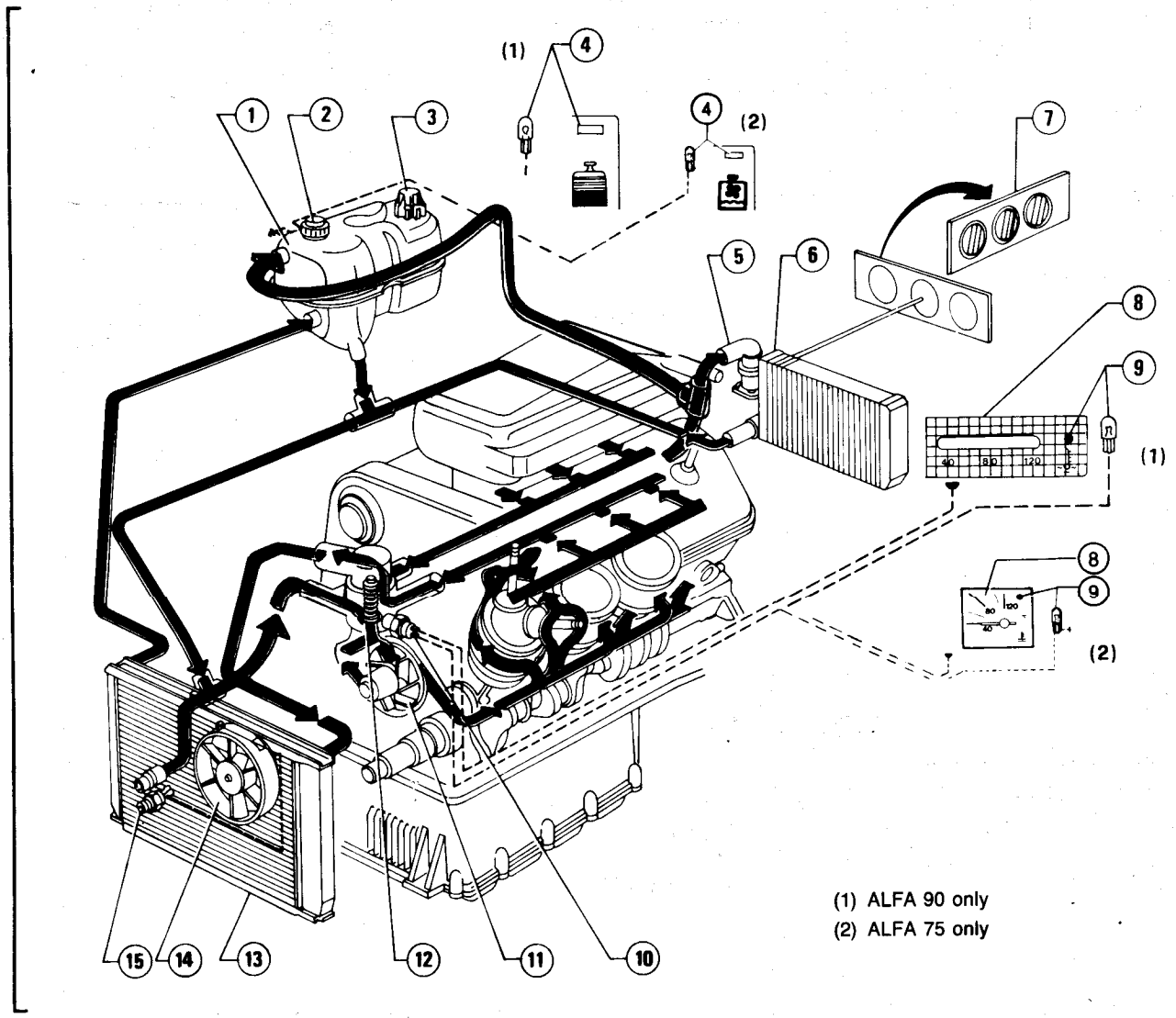
COOLING SYSTEM

6 cylinders Alfa 90 2.0 iniezione

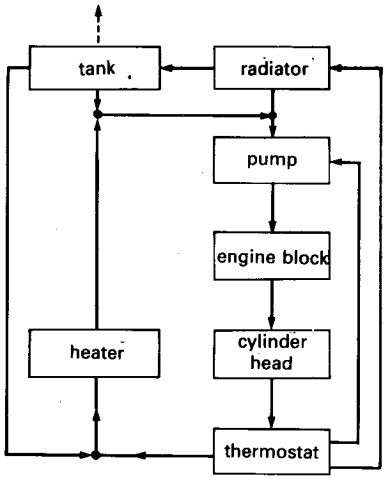
6 cylinders Alfa 90 2.5 iniezione

6 cylinders Alfa 75 2.5 iniezione

GENERAL DESCRIPTION



1 Header tank
2 Coolant level sensor
3 Pressurized cap
4 Min coolant level warning lamp (ALFA ROMEO Control)
5 Heater cock
6 Heater
7 Heater control
8 Coolant temperature indicator
9 Max coolant temperature warning lamp
10 Bulb for coolant temperature indicator and max water temp. warning lamp
11 Water pump
12 Thermostat
13 Radiator
14 Electric fan
15 Electric fan control thermal switch



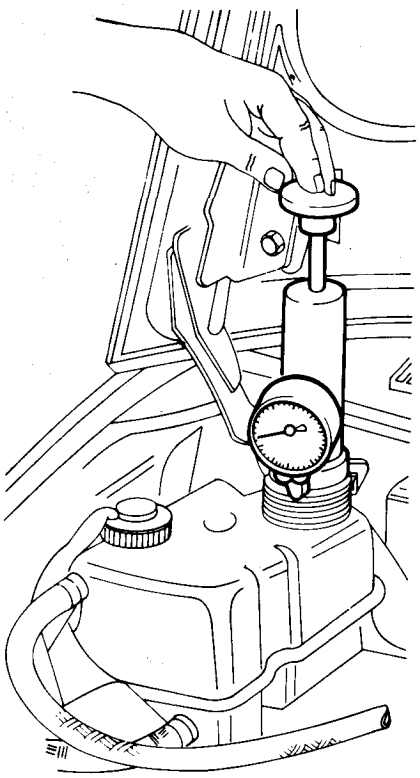
Cooling system is of the sealed type, with forced circulation by centrifugal pump belt - driven by crankshaft.
A thermostat permits the engine to be brought quickly at the normal running temperature and kept at the optimal values; thermostat opens when coolant reaches **80° C (176° F)** approx.
In addition to the air ram effect, the radiator is also cooled by an electric fan controlled by a thermal switch located on radiator.

The system is fitted with a coolant temperature sensor which supplies the max temperature indicator and warning lamp, on cluster.
The warning lamp illuminates when coolant temperature exceeds **105° C (221° F)**.
A sensor, on header tank provides an indication (through "ALFA ROMEO Control") whenever coolant level in the tank goes below the min value.

HYDRAULIC SYSTEM TIGHTNESS TEST

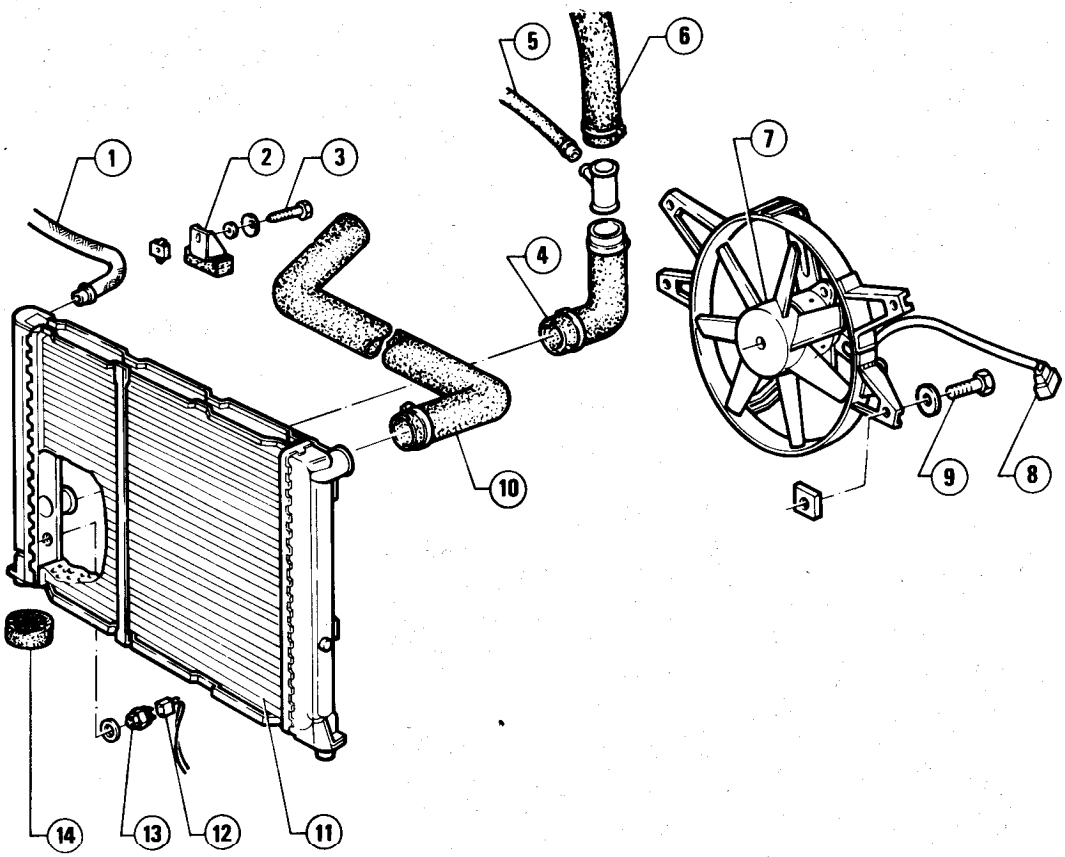
1. Unscrew the header tank pressurized cap.
2. Screw tester on header tank union.
3. Pressurize the system and verify, on tester, that pressure remains within the prescribed value.

Cooling system check pressure
107.9 KPa (1.08 bar; 1,1 Kg/cm^2; 15.64 psi)



RADIATOR

Alfa 90 Alfa 75



1. Radiator breather hose
2. Bracket
3. Screw securing radiator to body
4. Coolant outlet sleeve from radiator
5. Return hose to heater
6. Coolant-to pump delivery sleeve
7. Electric fan
8. Connector for electric fan supply cable
9. Screw securing electric fan to radiator
10. Coolant-to radiator delivery sleeve
11. Radiator
12. Connector for electric fan control cables
13. Electric fan control thermal switch
14. Rubber pad

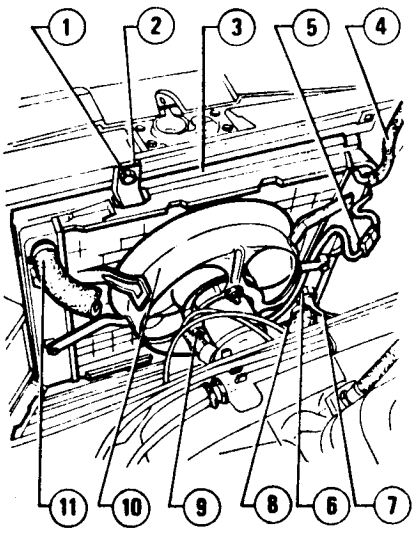
REMOVAL

Alfa 90 Alfa 75

1. Disconnect battery.
2. Disconnect sleeve (8) from radiator; drain and recover coolant.

WARNING:
Take the utmost care when draining coolant with hot engine, to avoid being burned.

3. Detach sleeve (11) and hose (4) from radiator.
4. Detach connector (5), of electric fan supply cables, and connector (7) from thermal switch (6).
5. Unscrew screw (1) which secured radiator to body; remove radiator from engine compartment, and withdraw rubber pads.
6. If required, unscrew screws (9) and remove electric fan (10).



1. Radiator securing screw
2. Bracket
3. Radiator
4. Breather hose
5. Electric fan supply cables connector
6. Thermal switch
7. Connector
8. Sleeve
9. Electric fan securing screw
10. Electric fan
11. Sleeve

Alfa 90 Alfa 75

To increase the antifreeze protection from **—20°C (—4°F) to —35°C (—31°F)** without draining the whole system, replace **2.5 litres (0.55 Imp.gall)** mixture with as many litres of specific concentrated antifreeze.

GTV 6 2.5

To increase the antifreeze protection from **—20°C (—4°F) to —35°C (—31°F)** without draining the whole system, replace **2.9 litres (0.63 Imp.gall)** mixture with as many litres of specific concentrated antifreeze.

CAUTION:
Products harmful to paint.
Avoid contact with painted surfaces.

b. Start the engine, run it to the normal running temperature so as to allow coolant to flow in the system, and operate on heater control, in order to open the cock of radiator core liquid.
c. On cold engine, top-up the system up to the max level marked on header tank.

LEAKAGE TEST

1. Remove radiator from vehicle as described in «Removal and Installation».
2. Close the radiator liquid inlet/outlet union.
3. Immerge radiator into a tank; previously fitted with water, and identify any leaks by blowing compressed air from radiator breather hose, until reaching pressure

107.9 kPa
(1.08 bar; 1.1 kg/cm²; 15.64 psi)

4. If leaks are present, replace radiator operating as described in «Removal and Installation».

ELECTRIC FAN CONTROL THERMAL SWITCH

REPLACEMENT

1. Drain and recover coolant.
2. Detach connectors from thermal switch on radiator.
3. Unscrew thermal switch and remove it from radiator.
4. Lubricate thermal switch threading with **Anti-seize E. GORI: Never Seez**, then screw it on taking care to interpose a new gasket; then tighten it to the prescribed torque.

(T) : **Tightening torque**
Thermal switch for electric fan control on radiator
20 to 25 N·m
(2 to 2.5 kg·m
14.5 to 18.1 ft·lb)

5. Restore liquid level in the cooling system.
6. Start the engine and warm it up until coolant reaches a temperature within **84 to 88°C (183.2 to 190.4°F)**.
7. Verify that, at this temperature, thermal switch enables electric fan.

PRESSURIZED CAP

LEAKAGE TEST

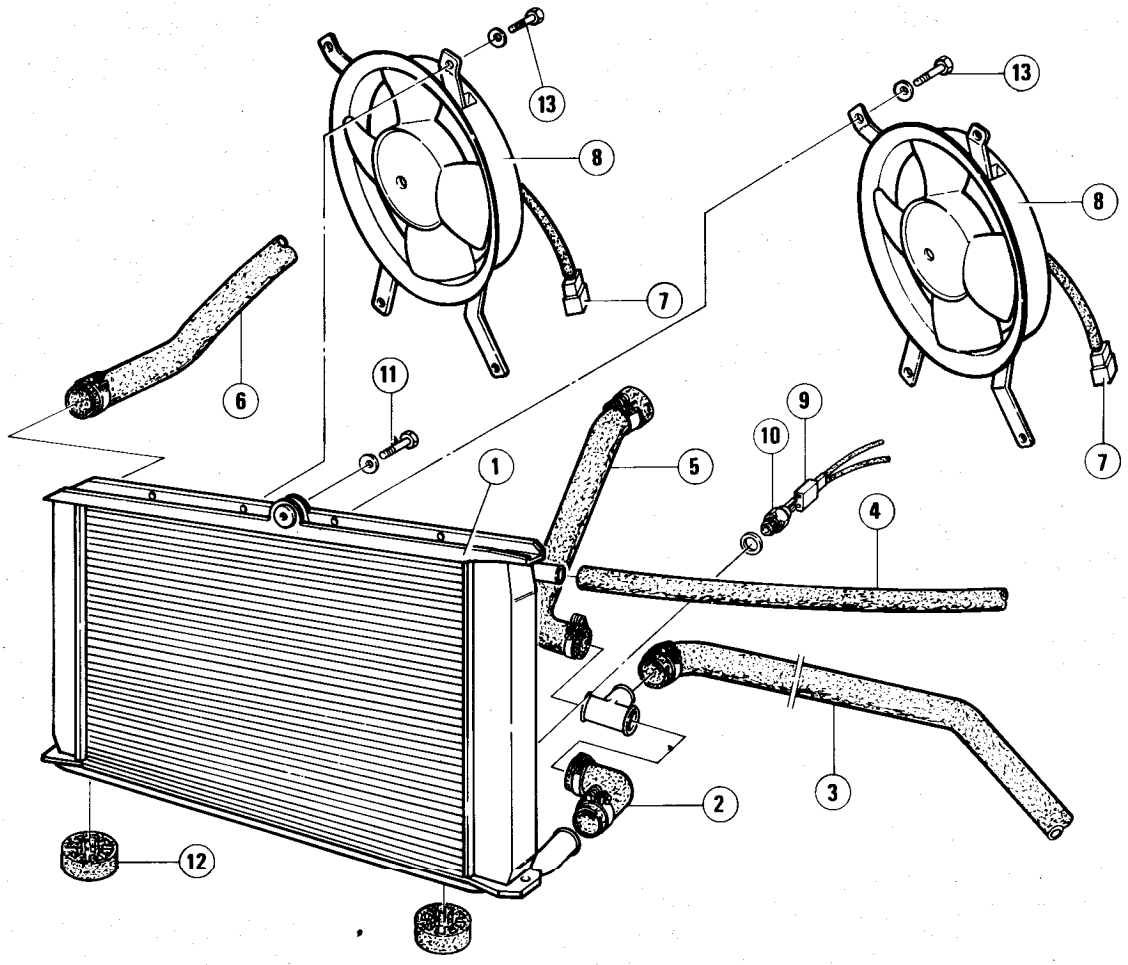
Refer to: 4 cylinders

1.6 1.8 2.0 2.0 iniezione

Pressurized cap setting pressure
88.3 to 107.9 kPa
(0.88 to 1.08 bar)
(0.9 to 1.1 kg/cm²)
(12.8 to 15.64 psi)

RADIATOR

GTV 6 2.5



1. Radiator
2. Coolant outlet sleeve from radiator
3. Radiator filling sleeve
4. Radiator breather hose
5. Coolant return sleeve
6. Coolant delivery hose
7. Connector for electric fan supply cable
8. Electric fans
9. Connector for electric fan control cable
10. Electric fan control thermal switch
11. Screw securing radiator to body
12. Rubber pad
13. Screws securing electric fan to radiator

REMOVAL

GTV 6 2.5

1. Place a suitable container under the vehicle to collect the coolant.

WARNING:
Take the utmost care when draining coolant with hot engine to avoid burns.

2. Remove sleeve (2) from radiator (1) and drain coolant.
3. Disconnect hose (4) and sleeve (6) from the radiator.
4. Disconnect connector (7) of electric fan supply cables (8) and connector (9) from thermal switch (10).
5. Unscrew screw (11) which secures radiator to body; remove radiator from engine compartment and withdraw rubber pads (12).
6. If necessary, **unscrew screws** (13) and remove the electric fans.

INSTALLATION

Alfa 90 Alfa 75 GTV 6 2.5

1. Carry out installation by reversing the order of removal; then carry out refilling, operating as follows:
- Remove header tank cap, and refill cooling system with the liquid prescribed.

Cooling system refill

Min. external temperature °C (°F)	—20 (—4)	—35 (—31)
	l (Imp.gall)	
Concentrated antifreeze std. No. 3681-69956	3.6 (0.79) (1) 4.2 (0.92) (2)	5 (1.10) (1) 6 (1.32) (2)
Dilution distilled water	6.4 (1.41) (1) 7.8 (1.71) (2)	5 (1.10) (1) 6 (1.32) (2)
Antifreeze ready to use std. No. 3681-69958	10 (2.20) (1) 12 (2.64) (2)	— —

(1) For vehicle Alfa 90 and Alfa 75
(2) For vehicle GTV 6 2.5

WATER PUMP

REMOVAL

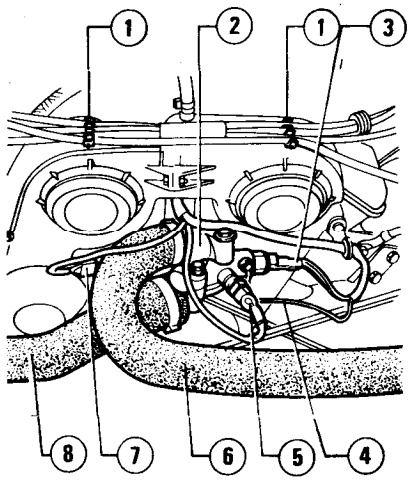
1. Detach the battery negative terminal.
2. Detach connectors (3), (5) and (7) from thermostat unit (2), then disconnect ground cable (4).
3. Disconnect sleeve (8) from radiator and drain coolant; disconnect sleeves (6) and (8) from thermostat unit.

GTV 6 2.5: Disconnect sleeve (9) from the thermostat unit.

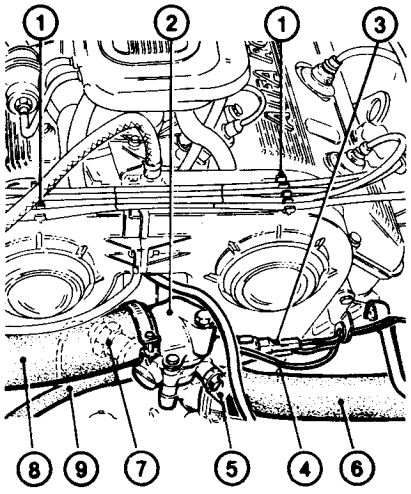
Recover coolant.

4. Release the spark plug supply cables from fasteners (1) on timing case covers.

Alfa 90 **Alfa 75**



GTV 6 2.5



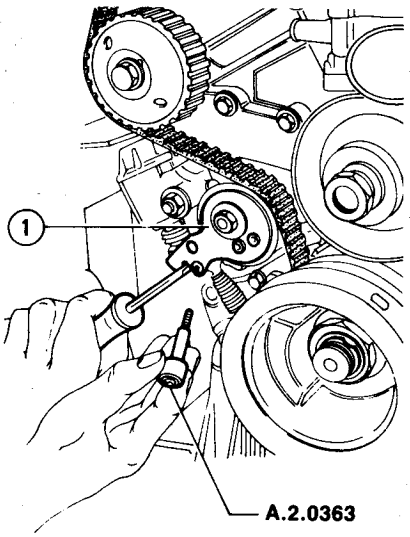
1. Fasteners
2. Thermostat unit
3. Connectors for indicator and coolant temperature warning lamp (for cluster)
4. Ground cable
5. Connector for coolant temperature sender cable (for ECU)
6. Outlet sleeve from thermostat unit
7. Connector for cold starting thermal switch
8. Inlet sleeve to thermostat unit
9. Sleeve supplying liquid to heater (GTV 6 2.5)

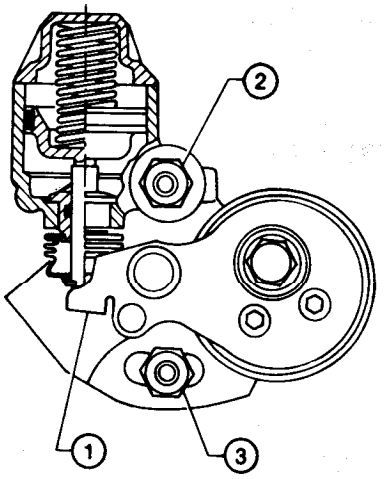
5. Loosen and remove the drive belts of the following components:
   - air conditioner compressor (if present)
   - power steering pump
   - water/alternator pump
6. Remove distributor covers and disconnect the related cap; remove the covers on timing case.
7. Engage the 5th speed, move vehicle forwards so as to rotate crankshaft in the running direction, until notch **P** (marked on engine pulley) is aligned with the reference pin (piston of first cylinder in the expansion stroke).

If engine is timed, the notches on camshaft pulleys are aligned with the references on timing cases.

In addition, the middle of distributor rotor arm must be towards the first cylinder.

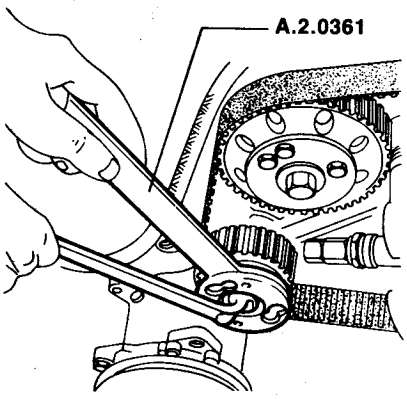
8. Unscrew the screws which secure timing cases; separate these last and remove them by releasing the fuel return hose and ECU cables from brackets.
9. Lift belt tightener arm (1) and insert pin **A.2.0363** into the arm hose, so as to keep arm itself lifted.
10. Unscrew nuts (2) and (3), so as to loosen the timing system drive belt; then remove both belt and tightener.



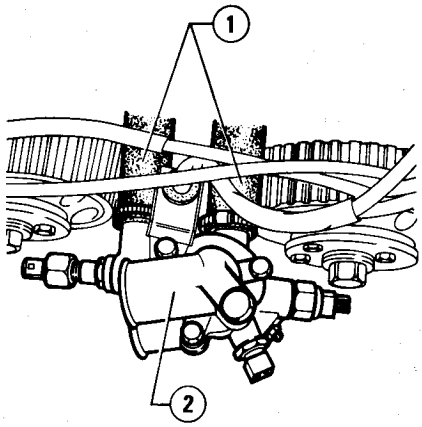


1. Belt tightener arm
2. Nut
3. Nut

11. By means of tool **A.2.0361**, unscrew the screw which secures distributor drive pulley; remove pulley.



12. Loosen clamps of hoses (1), and detach these last from thermostat unit (2).



1 Coolant return hoses from heads
2 Thermostat unit

13. Unscrew the screws which secure pump body to engine block; then remove pump together with thermostat unit.

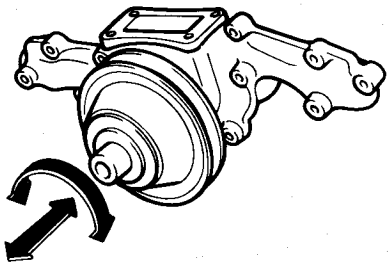
14. If required, operating at bench, unscrew the four screws which secure pump body to thermostat unit and separate them.

CHECKS AND INSPECTIONS

1. Thoroughly clean pump body and the related mating surfaces.

2. Check pump body and impeller; in the event of serious oxidation signs replace pump.

3. Verify that there is no excessive play in the rotation and axial movement of impeller.



INSTALLATION

Install pump by reversing the order of removal, complying with the following indications.

- Thoroughly clean the mating surfaces between pump body, engine block and thermostat unit; interpose new gaskets.
- Tighten to the prescribed torque:

Ⓣ: **Tightening torques**
Screws securing pump body to engine block
8.1 to 9.3 N·m
(0.83 to 0.95 Kg·m; 6 to 6.9 ft·lb)

- Carry out timing system adjustment, fit timing system belt and restore correct tensioning (refert to: Alfa 90 WORKSHOP MANUAL - Group 00 - Engine Maintenance - Engine main Mechanical unit - Check of Timing System and Drive Belt Tensioning).
- Restore correct tensioning of drive belts related to pump of coolant and alternator, and pump of power steering and air conditioner compressor (if present) (refer to Alfa 90 WORKSHOP MANUAL - Group 00 - Engine Maintenance - Engine Main Mechanical Unit. Checking Good Conditions, Replacing and Adjusting Drive Belts of Alternator, Air Conditioner Compressor, Power Steering Pump).
- Restore coolant level
- Start the engine, run it to the normal running temperature and check for leaks from system.

THERMOSTAT

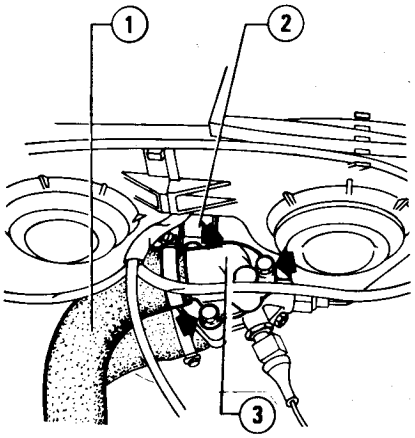
REMOVAL

1. Drain and recover coolant, up to lower edge of thermostat housing.

2. Detach sleeve (1) from thermostat (3).

3. Unscrew the three securing screws of thermostat, then remove it together with gasket and bracket (2).

CAUTION:
Take care not to detach lower gasket between thermosat intermediate spacer and thermostat housing.



1 Coolant - to radiator delivery sleeve
2 ECU wiring support bracket
3 Thermostat

CHECKS AND INSPECTIONS

By means of suitable equipment, verify that:

- Thermostat opens when coolant temperature is between **81 to 85° C (177.8 to 185° F)**
- When coolant temperature reaches **95° C (203° F)** thermostat opens fully, also verify that, when in this conditions, the thermostat movement is greater or equal to **7,5 mm (0.295 in)**.

If not so, replace thermostat.

INSTALLATION

1. Clean the mating surfaces of thermostat.

2. Position thermostat on intermediate spacer, interposing a new gasket; reconnect the sleeve for coolant delivery to radiator.

3. Restore coolant level.

INSPECTION AND SPECIFICATIONS

CHECK AND ADJUSTMENTS

Refer to: 4 cylinders «Checks and Adjustments».

GENERAL

COOLANT

Min. external temperature °C (°F)	—20 (—4)	—35 (—31)
	l (Imp.gall)	
Concentrated antifreeze std. No. 3681-69956	3.6 (0.79) (1) 4.2 (0.92) (2)	5 (1.10) (1) 6 (1.32) (2)
Dilution distilled water	6.4 (1.41) (1) 7.8 (1.71) (2)	5 (1.10) (1) 6 (1.32) (2)
Antifreeze ready to use std. No. 3681-69958	10 (2.20) (1) 12 (2.64) (2)	— —

(1) For vehicle Alfa 90 and Alfa 75
(2) For vehicle GTV 6 2.5

CAUTION:

Alfa 90 Alfa 75

a. To increase the antifreeze protection from —20°C (—4°F) to —35°C (—31°F), without draining the whole system, replace part of mixture with as many litres of concentrated antifreeze (2.5 litres; 0.55 Imp.gall).

GTV 6 2.5

a. To increase the antifreeze protection from —20° (—4°F) to —35°C (—31°F), without draining the whole system, replace part of mixture with as many litres of concentrated antifreeze (2.9 litres; 0.63 Imp.gall)

b. If the coolant level sensor is to be replaced, take care, when reassembling, to tighten cap thoroughly so as to ensure tightness.

WARNING:
Products harmful to paint. Avoid contact with painted surfaces.

FLUIDS AND LUBRICANTS

Application	Type	Name	Q.ty
Threading of electric fan control thermal switch on radiator Threading of coolant temperature sender, engine temperature sensor and thermo - time switch	Anti-seize	R. GORI: Never Seez Std. No. 3671-69850	As required

SEALANT AND FIXING AGENTS

Application	Type	Name	Q.ty
Cooling system sealant	Sealing powder	AREXONS Std. No. 3522-00101	30 g (1.058 oz)

In alternative ALUMASEAL can be used.

TIGHTENING TORQUES

Item \ Measurament unit	N·m	Kg·m	ft·lb
Coolant temperature sender on thermostat housing (1)	20 to 25	2 to 2.5	14.5 to 18.1
Electric fan control thermal switch on radiator (1)	20 to 25	2 to 2.5	14.5 to 18.1
Engine temperture sensor on thermostat casing (1)	15	1.5	10.8
Thermo-time switch on thermostat housing (1)	29	3	21.7
Screws securing pump body to engine block	8.1 to 9.3	0.83 to 0.95	6 to 6.9

(1) With anti-seize R. GORI: Never Seez

TROUBLE DIAGNOSIS AND CORRECTIVE ACTION

Condition	Probable cause	Corrective action
Coolant leakage	• Radiator damaged	Replace radiator
	• Leaks in system couplings	Replace
	• Loose or broken clamps.	Tighten or replace
	• Leakages from thermostat	Replace gasket or thermostat
	• Damaged cylinder head gasket	Replace. Check engine oil for contamination
	• Loose cylinder head tightening screws	Restore correct tightening
Poor circulation of coolant	• Pipes obstructed	Check pipes and clean system
	• Insufficient coolant	Top up
	• Inoperative coolant pump	Replace
	• Coolant pump and alternator driving belt loosen	Adjust

GROUP 07

CONTENTS

4 cylinders 1.6 1.8 2.0 2.0 iniezione 1.8 turbo

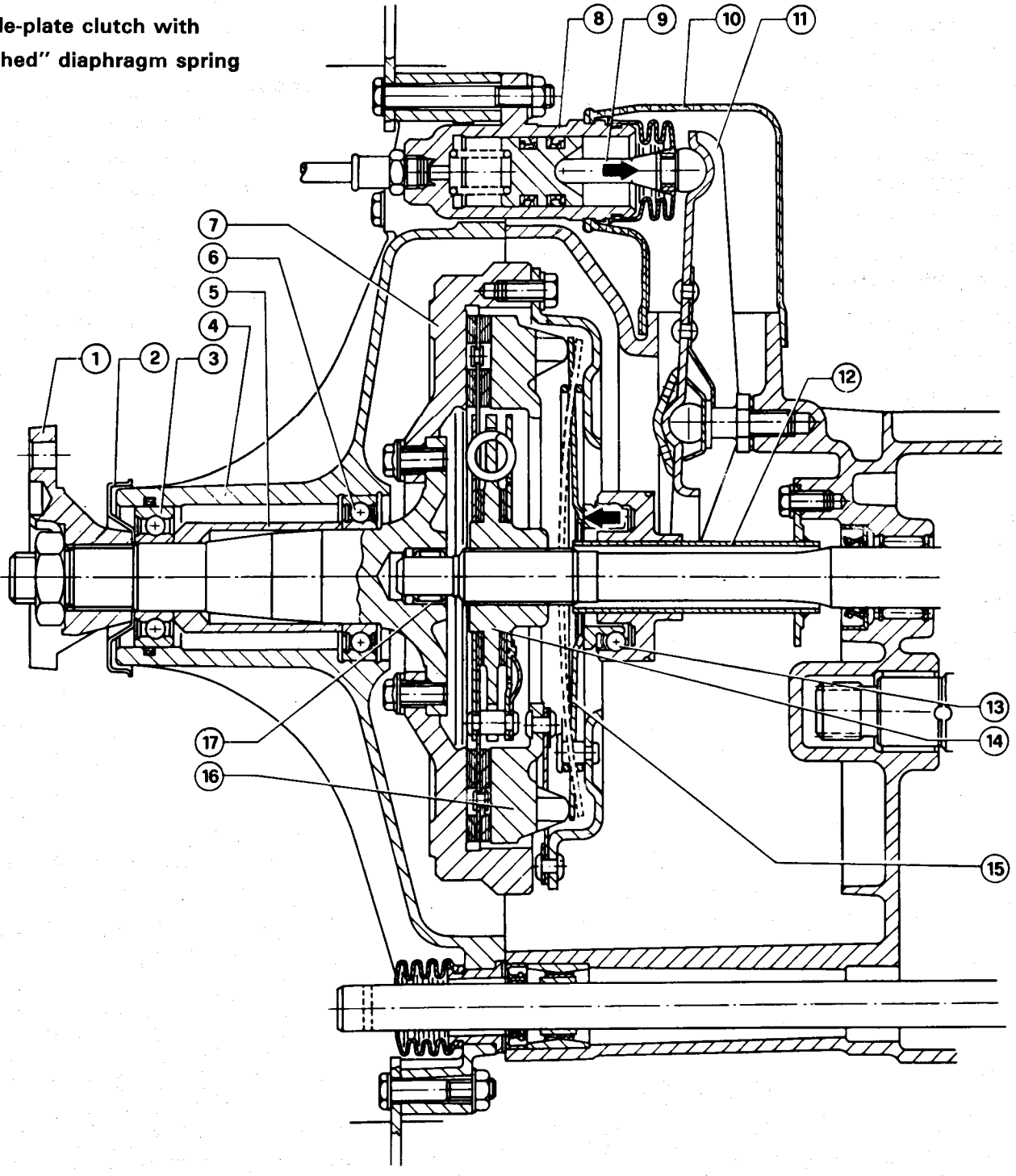
6 cylinders Alfa 90 2.0 6V iniezione Alfa 90 2.5 iniezione

6 cylinders Alfa 75 2.5 6V iniezione GTV 6 2.5

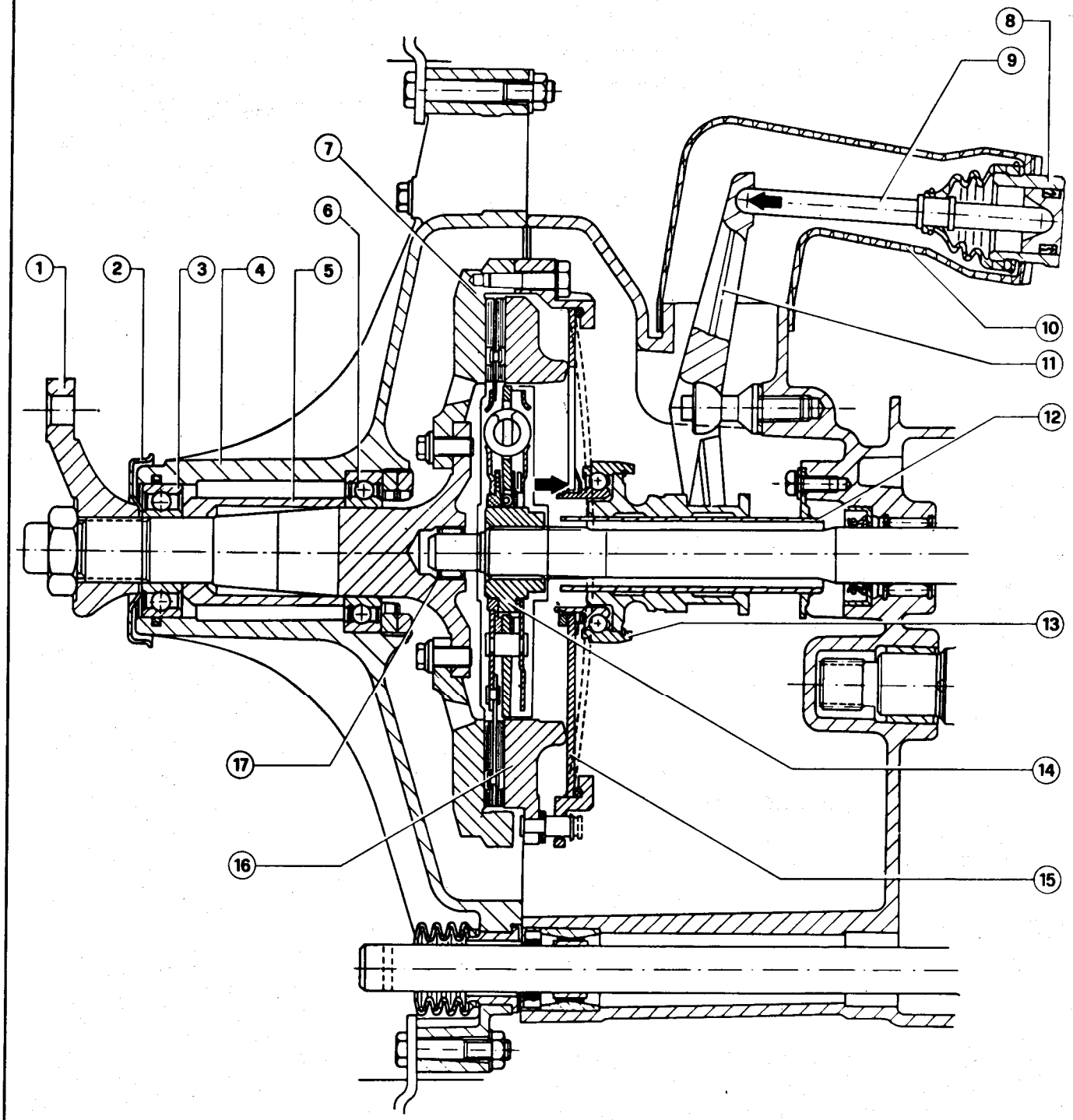
DESCRIPTION

- The clutches used (single-plate or double-plate type according to motorization) are of the hydraulic control type with automatic taking-up.
- Clutch disengagement is realized by means of the special master cylinder which, operated by clutch pedal transmits the pressure increase of system (supplied by the clutch and brake fluid tank) to piston of operating cylinder (8).
  This last, through push rod (9) operates on clutch disengagement fork (11) which moves thrust bearing (13) and wins diaphragm spring (15) action with consequent backing of driven plate (plates) (14) and clutch disengagement.
- The peculiarity of the hydraulic control is that of keeping thrust bearing (13) in contact with diaphragm spring (15) of pressure plate body (16), independently of driven plate (plates) wear degree, thus realizing taking-up in an automatic and progressive way. As a consequence, no adjustment is required for the clutch.

Single-plate clutch with "pushed" diaphragm spring

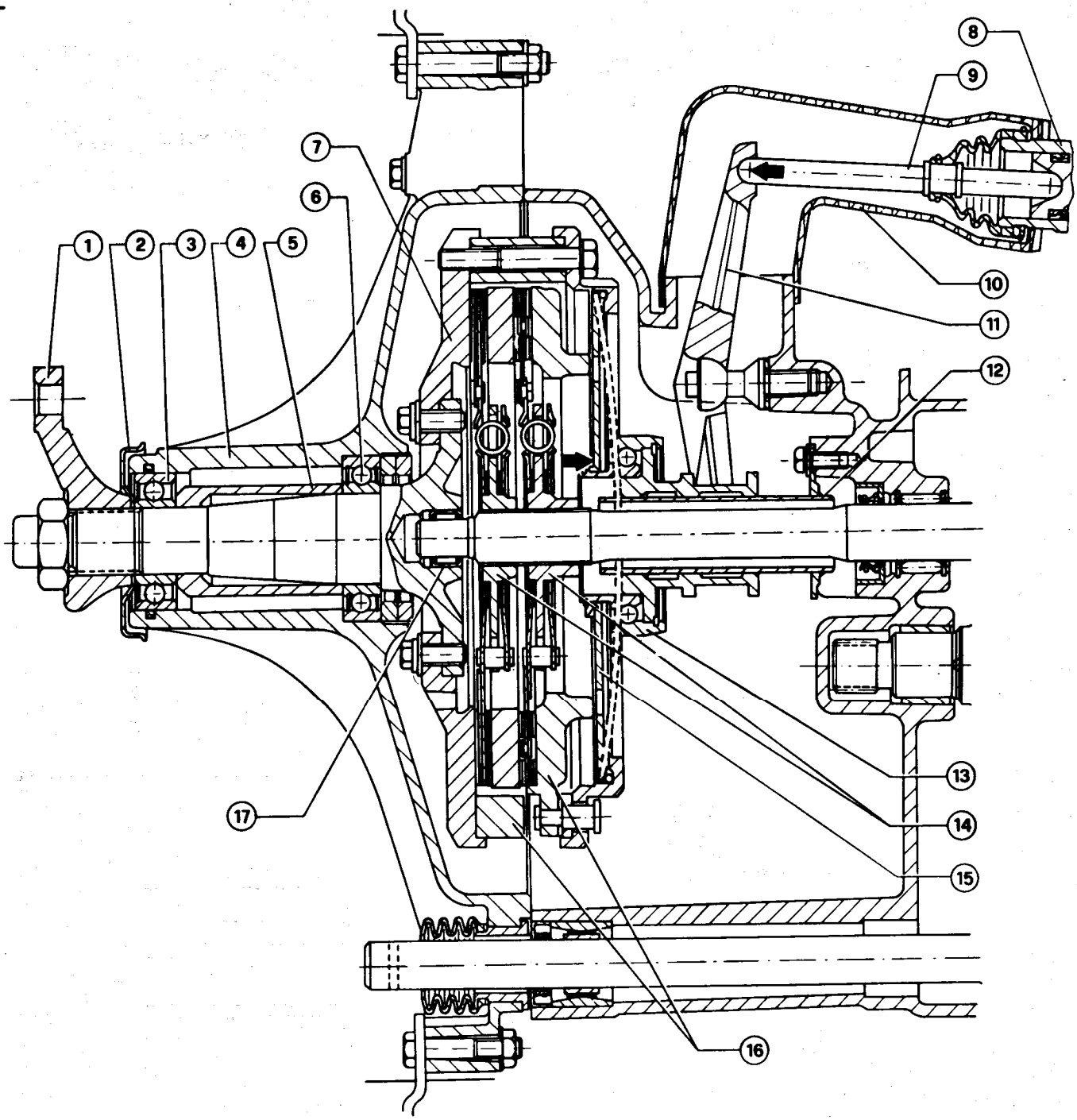


Single-plate clutch with "drawn" diaphragm spring



1 Propeller shaft connection fork
2 Dust cover
3 Clutch shaft support front bearing
4 Clutch cover
5 Spacer
6 Clutch shaft support rear bearing
7 Clutch flywheel
8 Clutch operating cylinder
9 Push rod
10 Guard
11 Clutch disengagement fork
12 Sleeve
13 Thrust bearing
14 Driven plate
15 Diaphragm spring
16 Pressure plate body
17 Speed gear main shaft centering needle bearing

Double-plate clutch



1 Propeller shaft connection fork
2 Dust cover
3 Clutch shaft support front bearing
4 Clutch cover
5 Spacer
6 Clutch shaft support rear bearing
7 Clutch flywheel
8 Clutch operating cylinder
9 Push rod
10 Guard
11 Clutch disengagement fork
12 Sleeve
13 Thrust bearing
14 Driven plates
15 Diaphragm spring
16 Pressure plates bodies
17 Speed gear main shaft centering needle bearing

HYDRAULIC CONTROL

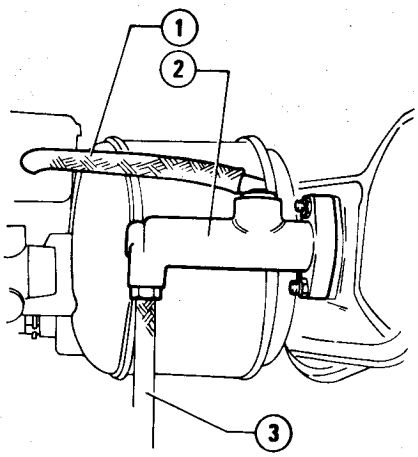
PEDAL

For clutch pedal removal procedure, refer to Group 22 - Front and Rear Brakes - Pedals - Removal.

CLUTCH MASTER CYLINDER

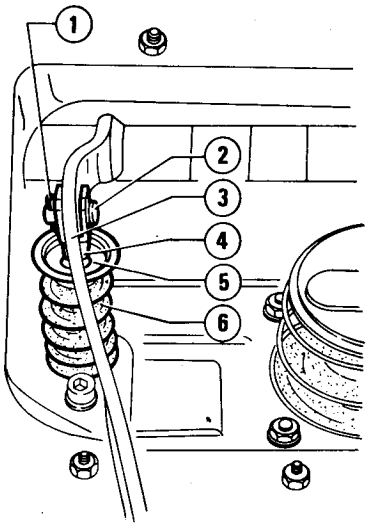
REMOVAL

1. Operating from engine compartment, remove plug from brake and clutch system supply tank, then drain fluid until level is below master cylinder supply hose.
2. Unscrew the screws securing windshield washer liquid tank to body and move tank sideways.
3. Detach hose (1) from clutch master cylinder (2).
4. Unscrew union of pipe (3) and disconnect it from master cylinder.



1 Master cylinder supply hose
2 Clutch master cylinder
3 Clutch control pipe

5. Operating from vehicle inside, remove split pin (1) and withdraw pin (2) then detach pedal (3) from fork (4).
6. Remove cup (5) and recover spring (6).



1 Split pin
2 Pin
3 Clutch pedal
4 Clutch master cylinder control fork
5 Cup
6 Spring

7. Unscrew the two screws securing master cylinder to pedals casing and remove master cylinder by withdrawing it from engine compartment.

INSTALLATION

To install clutch master cylinder, reverse the order of removal and comply with the following.

- Tighten to the prescribed torques

(T): **Tightening torques**
Clutch hidraulic system pipe unions
8 to 10 N·m
(0.8 to 1 kg·m
5.8 to 7.2 ft·lb)

Clutch hydraulic system hose unions
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

- Restore tank level making use of the fluid prescribed.

Clutch hydraulic system fluid
ATE "Blau S"
or
AGIP Brake Fluid Super HD
or
IP Auto Fluid FR

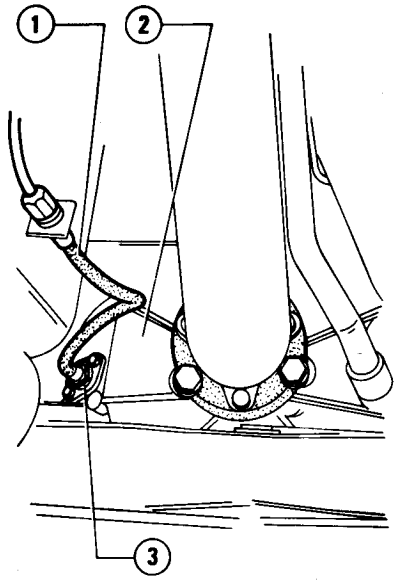
- Carry out air bleeding from clutch hydraulic system (refer to: "Hydraulic System Bleeding").

CLUTCH OPERATING CYLINDER

REMOVAL (INTERVENTION ON VEHICLE)

Single-plate clutch with "pushed" diaphragm spring

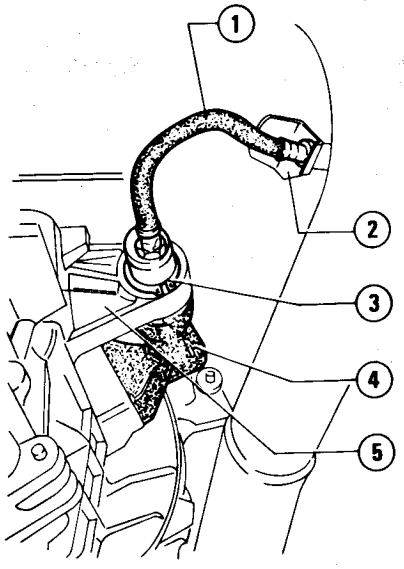
1. Disconnect hose (1) from bracket on body and plug it suitably.
2. Unscrew the two screws securing operating cylinder (3) to clutch box (2), then remove it together with guard.



1 Operating cylinder control hose
2 Clutch box
3 Clutch operating cylinder

Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

1 Disconnect hose (1) from bracket on body and plug it suitably.
2. Remove ring (3) on operating cylinder body.
3. Remove guard (4) and withdraw clutch control fork.
4. Remove operating cylinder from bracket (5).

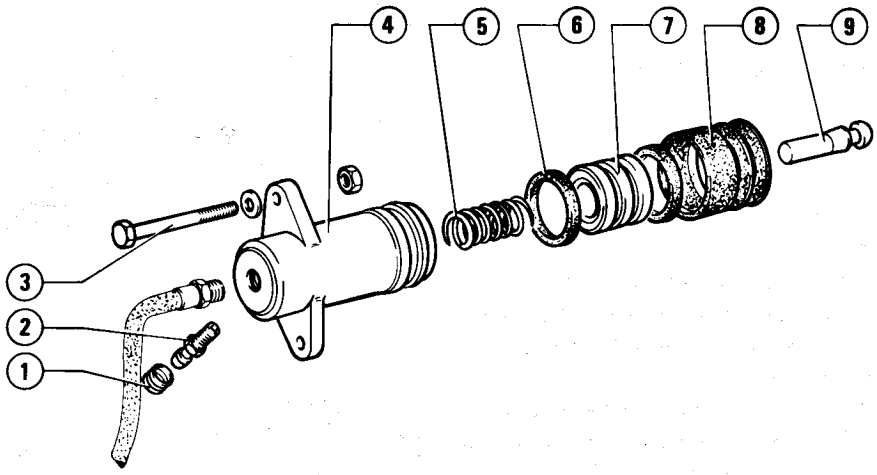


1 Clutch hose
2 Bracket
3 Retaining ring
4 Guard
5 Support bracket

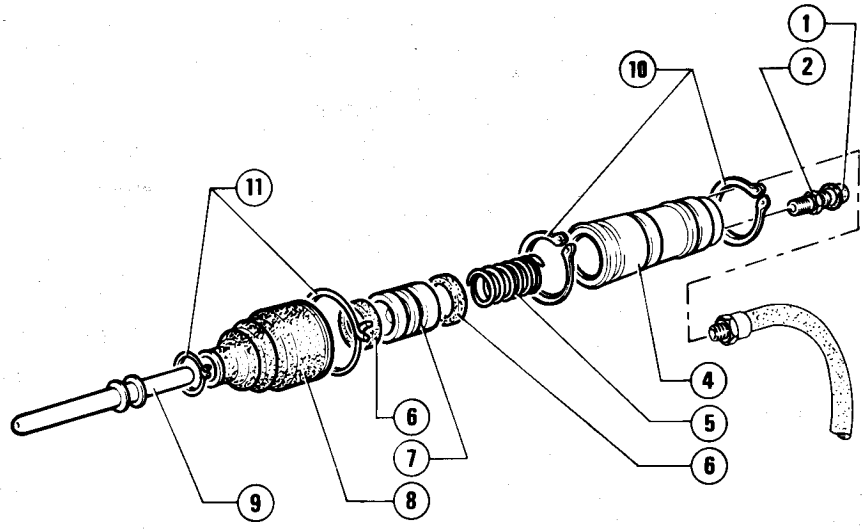
DISASSEMBLY

1. Remove the following items from operating cylinder (4): push rod (9) with guard (8), piston (7) with seal rings (6), and spring (5).
2. Withdraw push rod from guard and remove bleeder screw (2).

Single-plate clutch with "pushed" diaphragm spring



Single-plate clutch with "drawn" diaphragm spring and double-plate clutch.



1 Bleeder screw cap
2 Bleeder screw
3 Bolt securing operating cylinder to clutch cover
4 Operating cylinder
5 Spring
6 Seal ring
7 Piston
8 Guard
9 Push rod with spherical pin
10 Retaining rings
11 Securing springs

CHECKS AND INSPECTIONS

Visually check the disassembled components and replace the worn or damaged ones, supplied in the spare part kit.

CAUTION:
Wash all components of operating cylinder using suitable fluid. Do not use gasoline, kerosene or mineral oils in order not to damage the rubber parts of hydraulic system.

---

1. Check for scratches and rust on piston and inside clutch operating cylinder.
2. Check spring efficiency and integrity of seal rings.
3. Verify that bleeder hole is free from impurities.

REASSEMBLY

Reassemble the clutch operating cylinder by reversing the order of disassembly.

INSTALLATION

For installation, reverse the order of removal and comply with the following.

- Tighten the hydraulic system hose union to support bracket pipe to the prescribed torque.

Ⓣ: **Tightening torques**
Unions of clutch hydraulic system hoses
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

Unions of clutch hydraulic system pipes
8 to 10 N·m
(0.8 to 1 kg·m
5.8 to 7.2 ft·lb)

- Carry out system bleeding (refer to: "Hydraulic System Bleeding").

HYDRAULIC SYSTEM PIPING

CHECKS AND INSPECTIONS

Visually check system piping integrity. Replace damaged parts. In the event of fluid leaks from unions, if due to loosening, tighten them and, if necessary, replace the damaged components.

DISASSEMBLY

1. Remove the top-up plug on supply tank and drain the fluid by means of a syringe.
2. Loosen securing nuts of pipe connecting master cylinder to clutch operating cylinder; then remove pipe.

REASSEMBLY

1. Reassemble piping on vehicle by reverse the order of disassembly.
2. Tighten unions to the prescribed torque.

Ⓣ: **Tightening torques**
Unions of clutch hydraulic system hoses
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

Unions of clutch hydraulic system pipes
8 to 10 N·m
(0.8 to 1 kg·m
5.8 to 7.2 ft·lb)

3. Restore correct fluid level into tank, then bleed air from hydraulic system (refer to: "Hydraulic System Bleeding").

HYDRAULIC SYSTEM BLEEDING

CAUTION:
The clutch hydraulic system must be bled whenever hydraulic system has been disconnected or air has entered it.

Carefully comply with the following procedure:

1. Remove plug of brake and clutch hydraulic system supply tank and, if necessary, restore level with the prescribed fluid.

Fluid for clutch hydraylic system
ATE "Blau S"
or
AGIP Brake Fluid Super HD
or
IP Auto Fluid FR

2. Remove bleeder screw cap on operating cylinder and fit a hose on it dipping hose ends into a transparent tank fitted with system fluid.

3. At the same time, loosen bleeder screw and press clutch pedal up to end of travel, then release it slowly; repeat this operation until all possible air bubbles have been ejected.

4. With clutch pedal pressed to end of travel, close the bleeder screw, remove hose and install cap.

5. Restore fluid level into tank and install the related plug.

CAUTION:
a. **Do not re-use the hydraulic fluid drained during bleeding operations.**
b. **Operate carefully in order to prevent hydraulic fluid from getting in contact with paint, with consequent damage of paint itself.**
c. **During bleeding operation, fluid level in the tank, must be kept above the min. mark.**

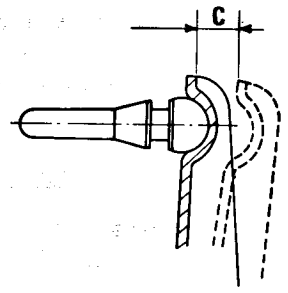
6. Verify that clutch disengagement and speeds engagement takes place properly.

If necessary, verify travel of operating cylinder push rod.

This travel can not be adjusted and depends on the volume of fluid moved by the clutch master cylinder piston.

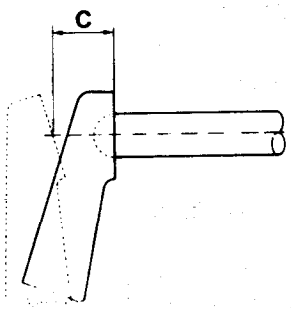
Single-plate with "pushed" diaphragm spring:

C = 11 to 12.7 mm
(0.43 to 0.50 in)



Single-plate with "drawn" diaphragm spring:

C = 12.5 mm
(0.49 in)



7. If **"c"** stroke value is not as specified, check efficiency of control hydraulic system.

REMOVAL AND INSTALLATION OF CLUTCH-SPEED GEAR-DIFFERENTIAL UNIT

Refer to: Group 17 -"Removal and Installation of Clutch Speed Gear-Differential Unit."

SEPARATION AND RECONNECTION AT BENCH OF CLUTCH UNIT FROM/TO SPEED GEAR AND DIFFERENTIAL UNITS

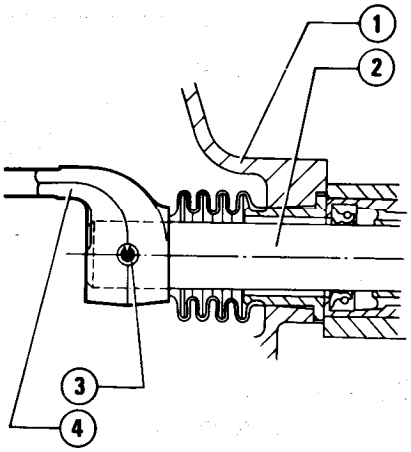
SEPARATION

Set the clutch-speed gear-differential unit on a suitable turning stand (refer to: Group 17 -"Removal and Installation of Clutch-Speed Gear-Differential Unit") then proceed to clutch unit removal operation.

SINGLE-PLATE CLUTCH WITH "PUSHED" DIAPHRAGM SPRING

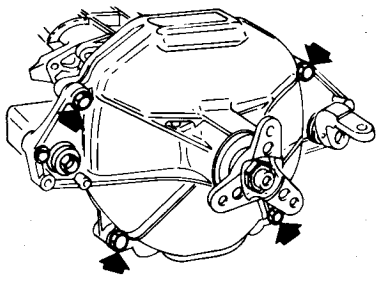
1. Clutch unit disassembly.

a. Remove pin (3) from rod (2) and withdraw lever (4).

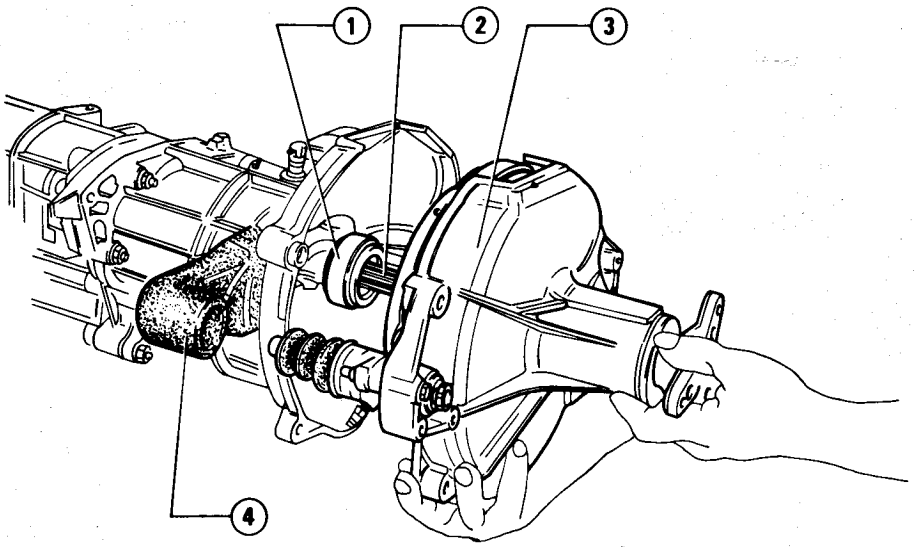


1 Clutch box
2 Speed gear engagement and selection rod
3 Spring pin
4 Lever

b. Loosen and remove the screws securing clutch unit to clutch-speed gear casing.



c. Withdraw clutch unit (3) from shaft (2) and remove cap (4).

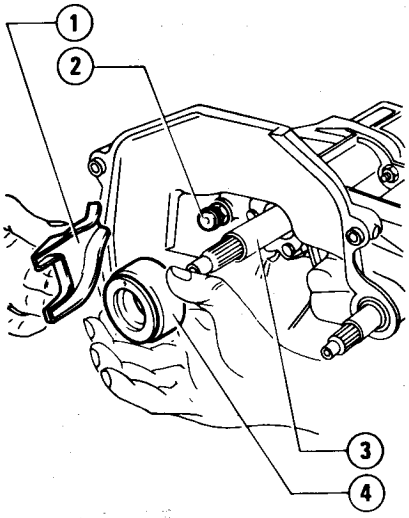


1 Thrust bearing
2 Main shaft
3 Clutch unit
4 Fork control cylinder cap

2. Fork and thrust bearing

a. Withdraw thrust bearing (4) from sleeve (3).

b. Remove fork (1) by releasing it from pin (2).



1 Control fork
2 Spherical pin
3 Guide sleeve
4 Thrust bearing

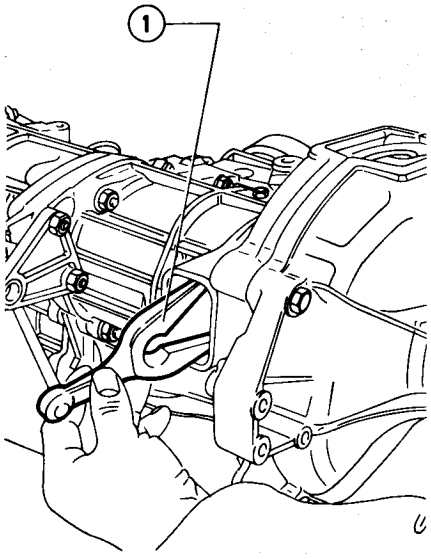
SINGLE-PLATE CLUTCH WITH "DRAWN" DIAPHRAGM SPRING AND DOUBLE-PLATE CLUTCH

DOUBLE-PLATE CLUTCH

1. Clutch unit disassembly.

a. Remove clutch operating cylinder from clutch-speed gear casing.

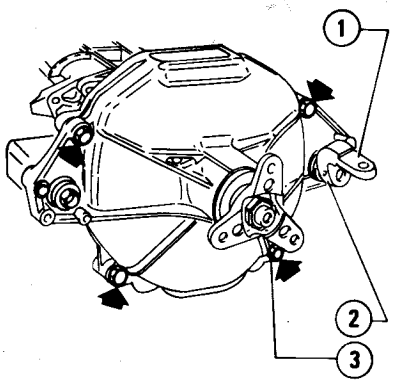
b. Remove fork (1) operating as per figure.



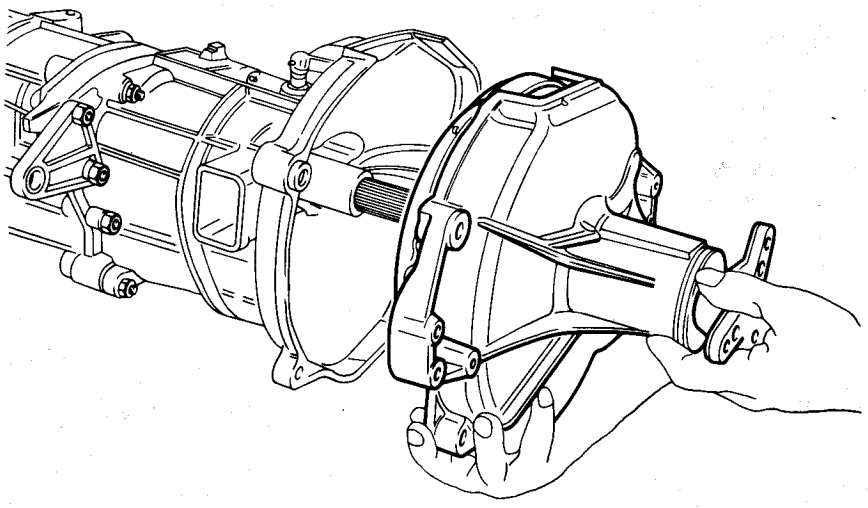
1 Clutch disengagement fork

c. Remove pin (2) securing lever (1) to speeds engagement and selection rod.

d. Loosen and remove the four screws (3).



1 Lever
2 Pin
3 Screws securing clutch box to speed gear-clutch box



e. Withdraw clutch unit from shaft.

RECONNECTION

To reassemble clutch unit to speed gear-differential unit, reverse the order of disassembly and comply with the following:

a. **Lubricate** spherical pin on clutch operating cylinder with the prescribed grease.

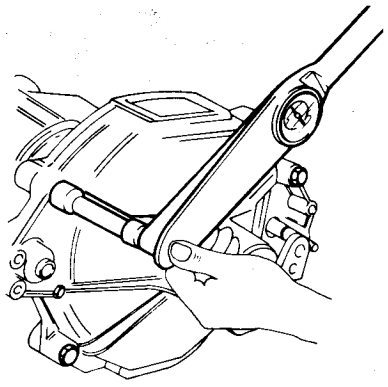
Clutch disengagement fork spherical pin
Grease:
AGIP Grease 33 FD
IP Autogrease FD

b. **Lubricate** the thrust bearing guide sleeve and fork working surfaces with the prescribed grease.

Thrust bearing and clutch disengagement fork working seat
Grease:
AGIP Grease 33 FD
IP Autogrease FD

c. Tighten crosswise the securing screws to the prescribed torque.

(T): **Tightening torque**
Screws securing clutch unit to speed gear-differential unit
29 to 32 N·m
(2.9 to 3.3 kg·m
21 to 23.9 ft·lb)



d. If previously detached, reconnect hose end of hydraulic system to operating cylinder tightening union to the prescribed torque.

(T): **Tightening torque**
Union of clutch hydraulic system hose
10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

e. Reinstall lever on speeds engagement and selection rod, and secure it with a new securing pin.

CLUTCH UNIT REMOVAL AND INSTALLATION (Intervention on vehicle)

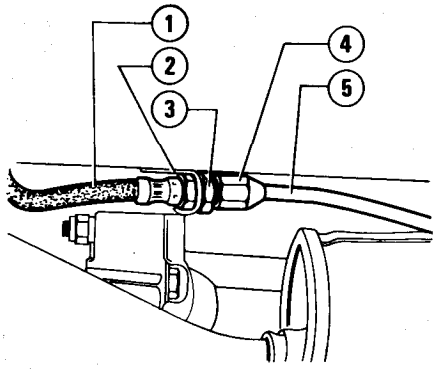
REMOVAL

Single-plate clutch with "pushed" diaphragm spring

1. Remove front and central part of exhaust system, disconnect propeller shaft from clutch shaft fork, remove speeds engagement and selection rod and disconnect isostatic control from gear lever, operating as per: Group 13 - "Outer Linkage - Speed Gear Control Assembly - Removal".

2. Unscrew union (4) disconnecting hose (1) and pipe (5) of clutch system. Plug pipe so as to prevent leaks.

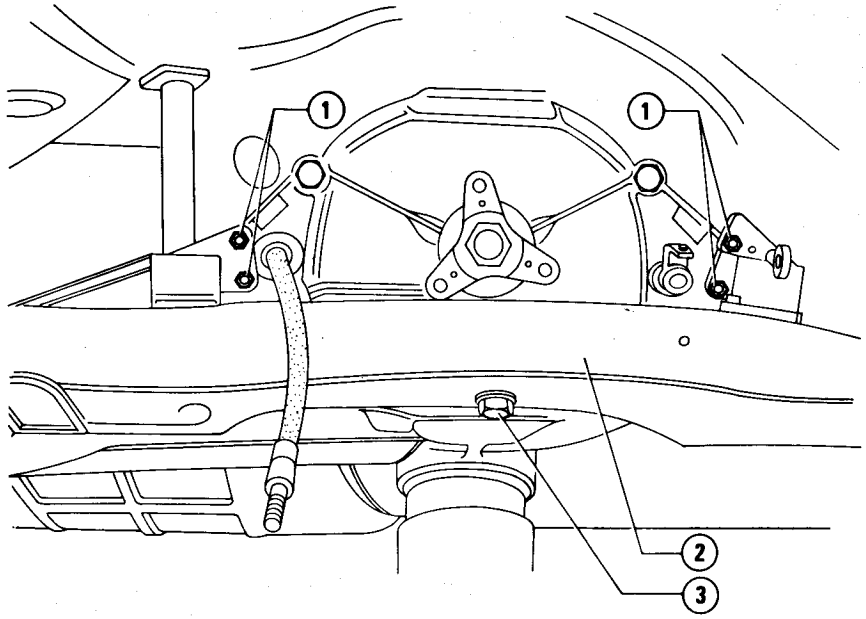
3. Unscrew nut (3) and disconnect hose (1) from bracket (2).



1 Hose
2 Support bracket
3 Nut securing hose to bracket
4 Pipe - hose union
5 Pipe

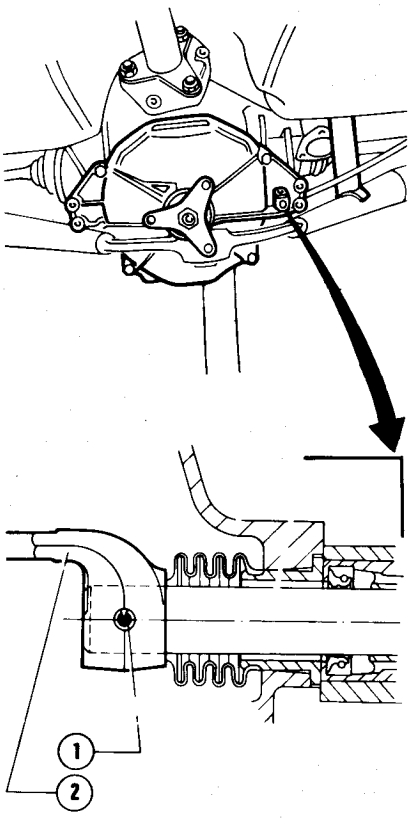
4. Unscrew and remove bolts (1) securing clutch-speed gear-differential unit to flexible supports on cross member (2).

Unscrew nut (3) and remove cross member.



1 Bolts securing clutch-speed gear- differential unit to supports
2 Cross member
3 Nut securing cross member

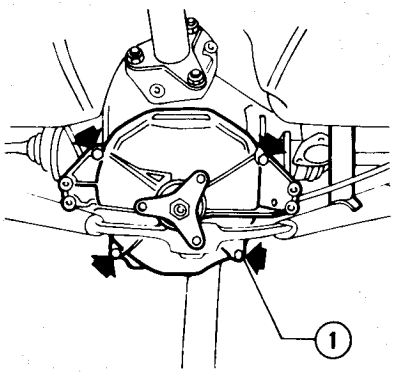
5. Withdraw pin (1) from lever (2), then remove lever.



1 Spring pin
2 Speeds control rear lever

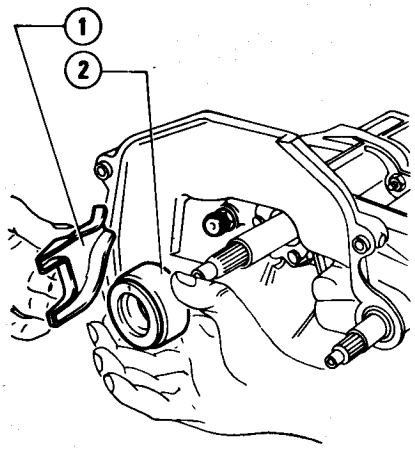
6. Remove boot from clutch operating cylinder

7. Unscrew screws (1) and remove unit from main shaft splined section.



1 Screw securing clutch unit to speed gear-differential unit

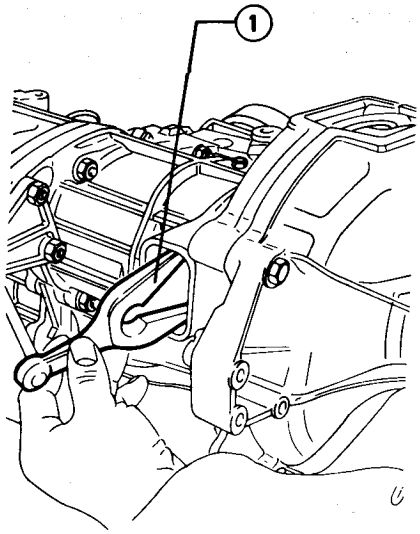
8. Withdraw bearing (1), protection sleeve and fork (2) from sleeve on shaft.



1 Thrust bearing
2 Clutch disengagement fork

Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

Proceed per the single-plate clutch with "pushed" diaphragm spring, taking care to withdraw fork (1) before removing the clutch unit.



1 Clutch disengagement fork

INSTALLATION

For installation, reverse the order of removal and comply with following:

- **Lubricate** the following items with the prescribed grease: clutch fork spherical pin; thrust bearing seat and spherical seat of operating cylinder push rod.

Grease:
AGIP Grease 33 FD
or
IP Autogrease FD

- **Lubricate** the spherical seat of propeller shaft rear joint with the prescribed grease.

Grease:
ISECO Molykote BR2

- Comply with the following tightening torques

(T): Tightening torques

— **Screws securing clutch unit to speed gear-differential unit**

29 to 32 N·m
(2.9 to 3.9 kg·m
21 to 23.9 ft·lb)

— **Screws securing propeller shaft joint to clutch shaft fork**

Single-plate clutch with "pushed" diaphragm spring

40 to 50 N·m
(4 to 5 kg·m
28.9 to 36.1 ft·lb)

Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

55 to 57 N·m
(5.6 to 5.8 kg·m
40.5 to 41.9 ft·lb)

— **Unions of clutch hydraulic system pipes**

8 to 10 N·m
(0.8 to 1 kg·m
5.8 to 7.2 ft·lb)

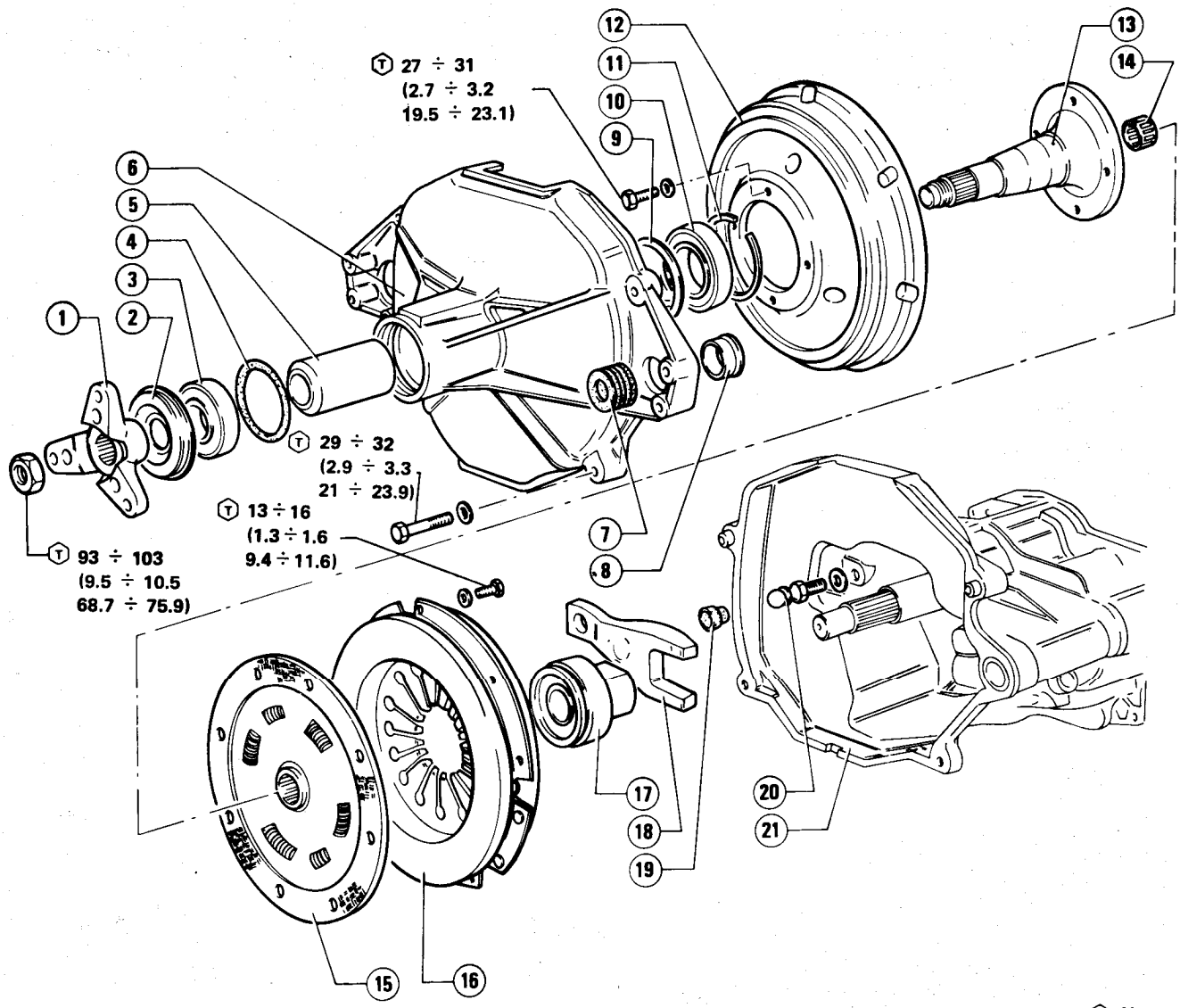
— **Unions of clutch hydraulic system hoses**

10 to 15 N·m
(1 to 1.5 kg·m
7.2 to 10.8 ft·lb)

- If necessary, carry out air bleeding from clutch hydraulic system (refer to: "Hydraulic System Bleeding").
- Install the lever on the speeds control rod making use of a new pin.

CLUTCH UNIT OVERHAUL AT BENCH

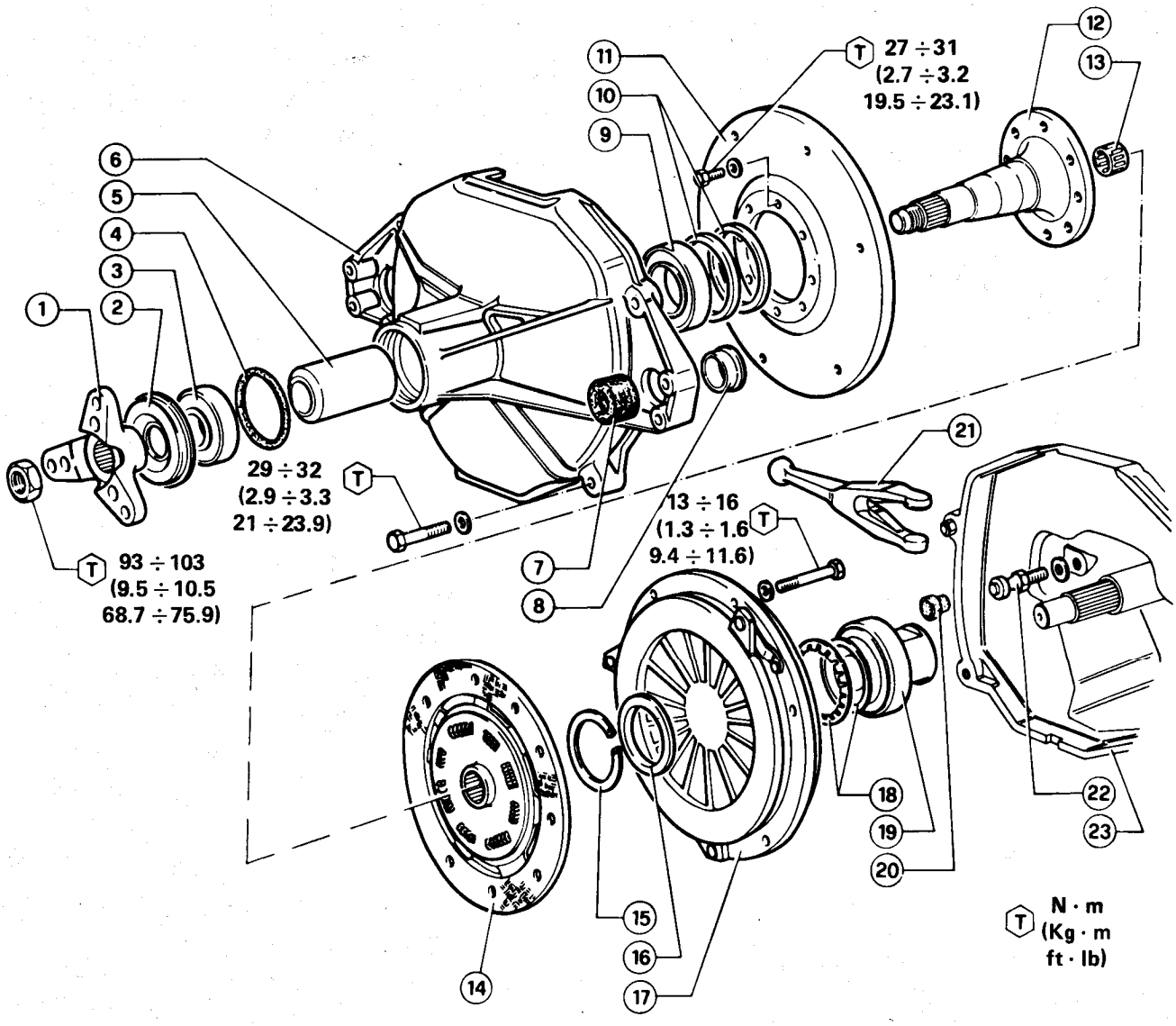
Single-plate clutch with "pushed" diaphragm spring



(T) N·m
(kg·m
ft·lb)

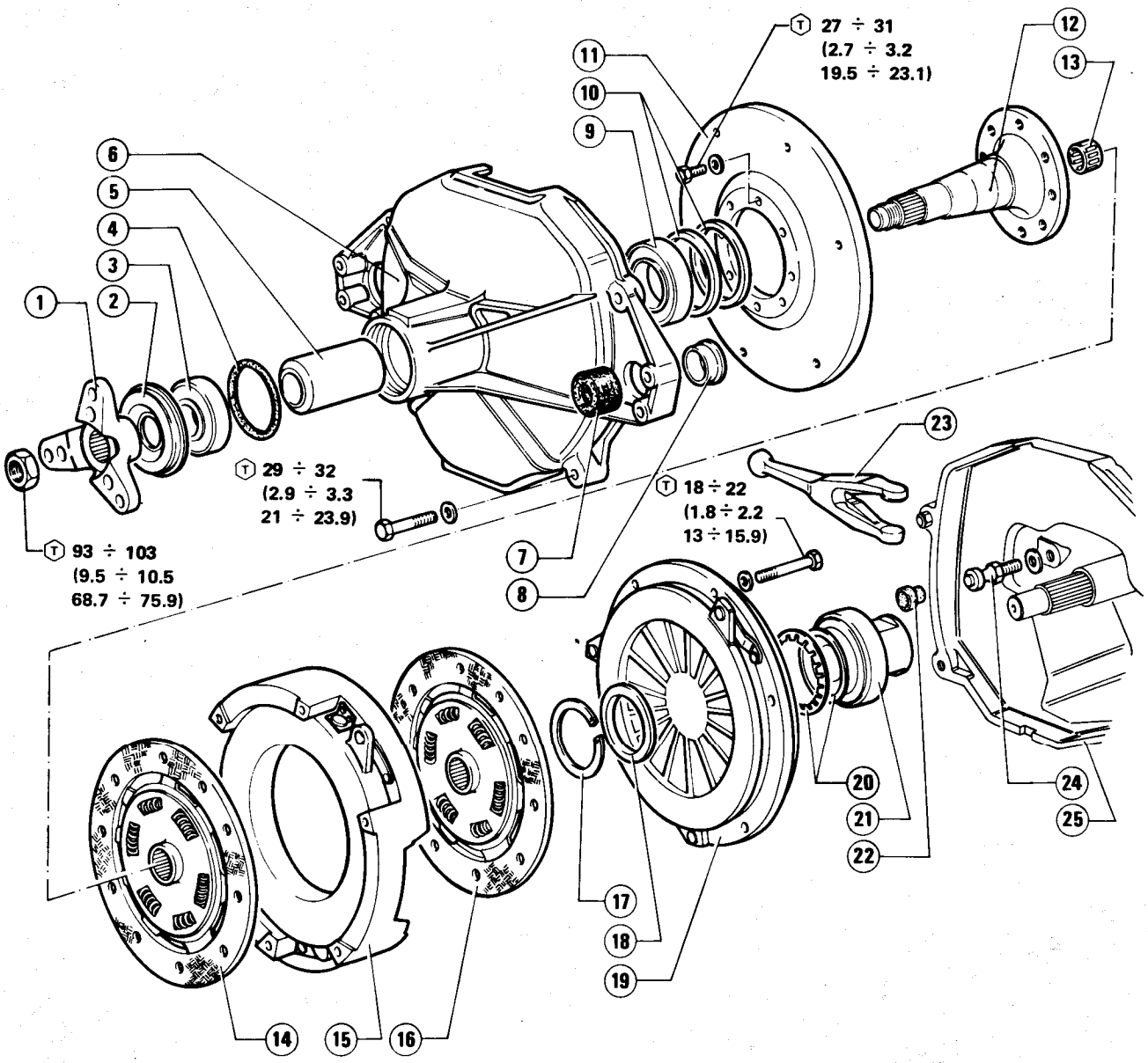
1 Propeller shaft connection fork
2 Dust cover
3 Clutch cover front bearing
4 O-ring
5 Spacer
6 Clutch cover
7 Speeds engagement and selection rod boot
8 Speeds engagement and selection rod bush
9 Shoulder washer
10 Clutch cover rear bearing
11 Rear bearing retaining ring
12 Clutch flywheel
13 Clutch shaft
14 Needle bearing
15 Clutch plate
16 Pressure plate body
17 Thrust bearing
18 Fork
19 Rubber cap on spherical pin
20 Spherical pin
21 Clutch-speed gear casing

Single-plate clutch with "drawn" diaphragm spring



1 Propeller shaft connection fork
2 Dust cover
3 Clutch cover front bearing
4 O-Ring
5 Spacer
6 Clutch cover
7 Speeds engagement and selection rod boot
8 Speeds engagement and selection rod bush
9 Clutch cover rear bearing
10 Threaded ring nuts for rear bearing securing
11 Clutch flywheel
12 Clutch shaft
13 Needle bearing
14 Clutch plate
15 Retaining ring
16 Ring
17 Pressure plate body
18 Belleville springs
19 Thrust bearing
20 Rubber cap on spherical pin
21 Fork
22 Spherical pin
23 Clutch-speed gear casing

Double-plate clutch



T N·m
(kg·m
ft·lb)

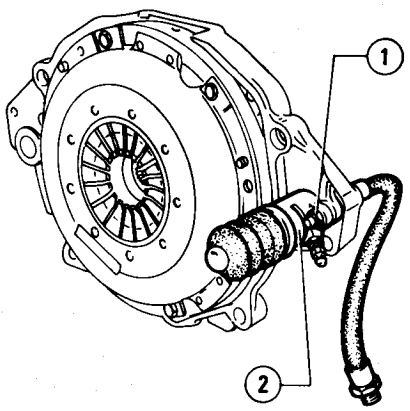
1 Propeller shaft connection fork
2 Dust cover
3 Clutch cover front bearing
4 O-Ring
5 Spacer
6 Clutch cover
7 Speeds engagement and selection rod boot
8 Speeds engagement and selection rod bush
9 Clutch cover rear bearing
10 Threaded ring nuts for rear bearing securing
11 Clutch flywheel
12 Clutch shaft
13 Needle bearing
14 Front clutch plate
15 Intermediate pressure plate body
16 Rear clutch plate
17 Retaining ring
18 Ring
19 Rear pressure plate body
20 Belleville springs
21 Thrust bearing
22 Rubber cap on spherical pin
23 Fork
24 Spherical pin
25 Clutch-speed gear casing

SINGLE-PLATE CLUTCH WITH "PUSHED" DIAPHRAGM SPRING

DISASSEMBLY

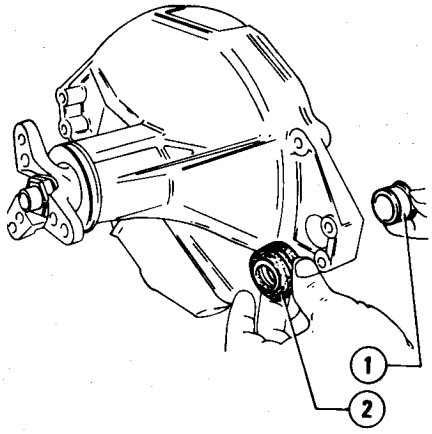
1. Clutch cover removal

a. Unscrew and remove bolt (1), then remove operating cylinder (2).



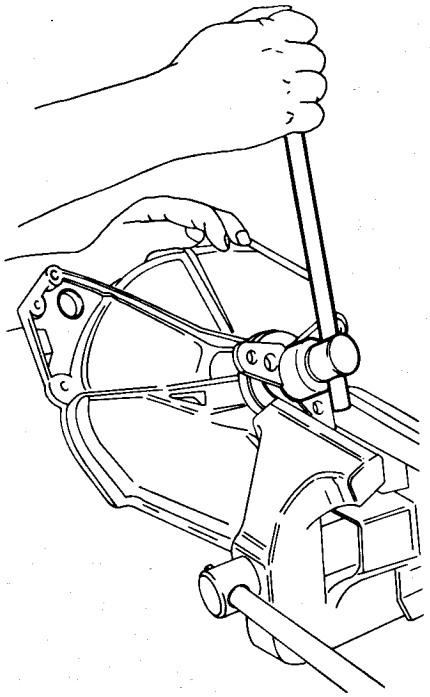
1 Bolt securing operating cylinder to clutch cover
2 Clutch operating cylinder

b. If necessary, remove boot (2) and bush (1) from clutch cover.

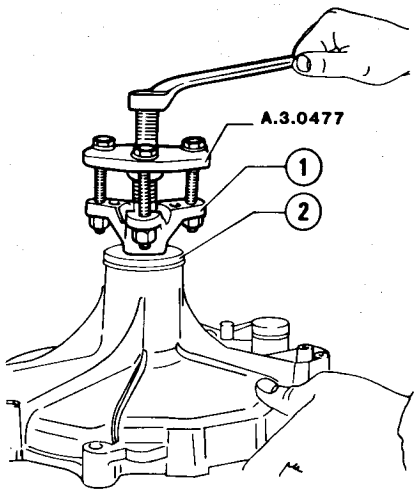


1 Speeds engagement and selection rod bush
2 Speed engagement and selection rods boot

c. Secure clutch cover on vice fitted with jaws, as per figure.
Release and remove the nut securing propeller shaft fork.

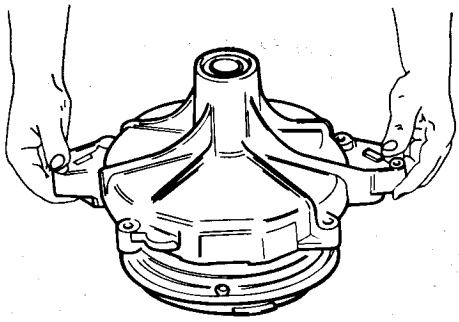


d. By means of extractor **A.3.0477**, withdraw fork (1), then remove dust cover (2).



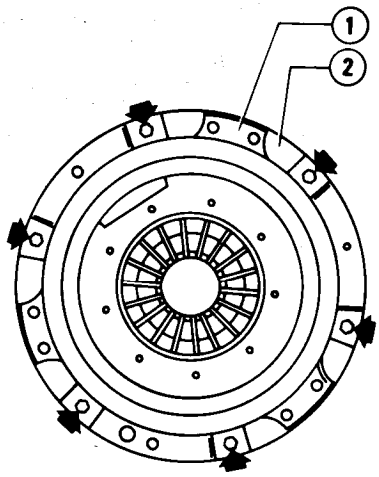
1 Propeller shaft connecting fork
2 Dust cover

e. Withdraw cover of clutch flywheel shaft.



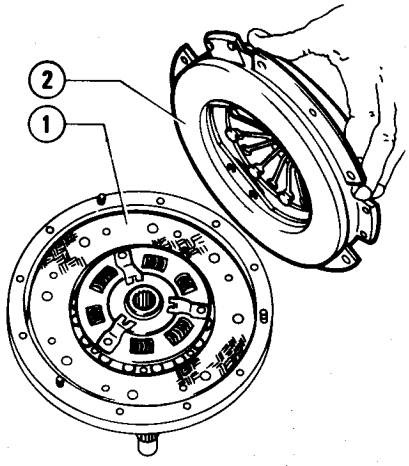
2. Clutch unit disassembly

a. If not present, carry out the countermarking between flywheel and pressure plate body so that correct order can be maintained when reassembling.
Loosen and release the screws with related washers securing pressure plate body (1) to flywheel (2).



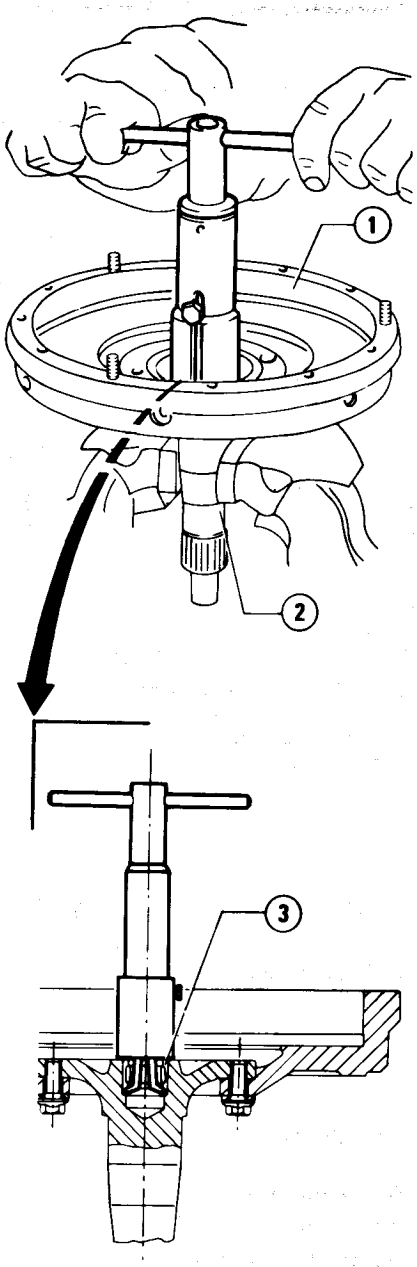
1 Pressure plate body
2 Clutch flywheel

b. Separate pressure plate body (2) and clutch plate (1) from flywheel.



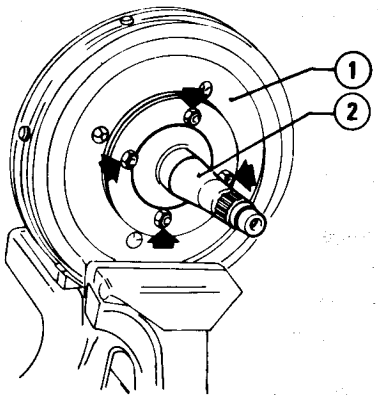
1 Clutch plate
2 Pressure plate body

c. If necessary, withdraw centering bearing (3) of speed gear main shaft from shaft (2), by means of suitable extractor.



1 Clutch flywheel
2 Clutch shaft
3 Needle bearing

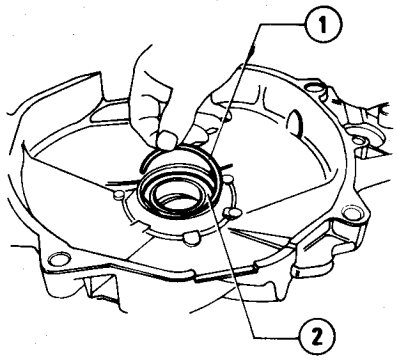
d. If necessary, unscrew and remove the screws with related washers securing flywheel (1) to shaft (2).



1 Clutch flywheel
2 Clutch shaft

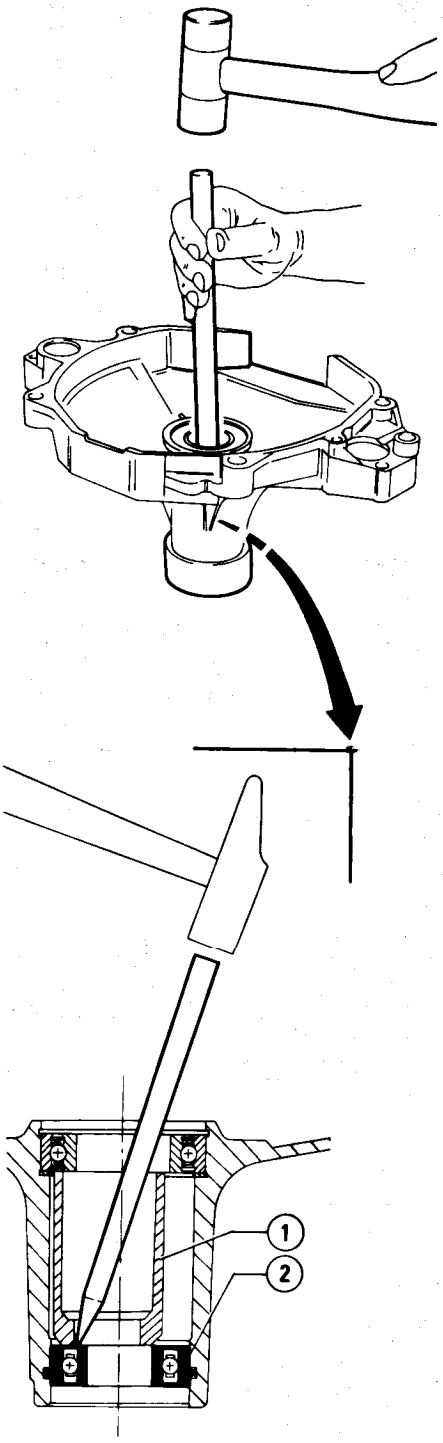
3. Removal of clutch cover bearings

a. Remove retaining ring (1) of rear bearing (2).



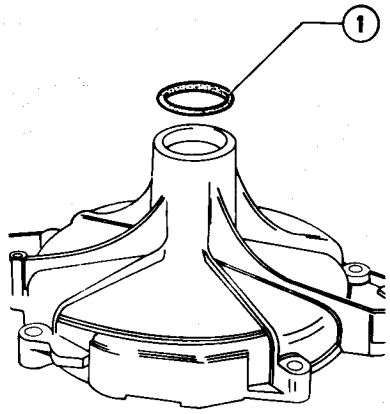
1 Rear bearing retaining ring
2 Clutch cover rear bearing

b. Set clutch cover on a suitable base and, disaligning spacer, tap uniformly, by means of a punch, on outer race of front bearing (2) in order to remove it from the related cover; recover spacer (1).



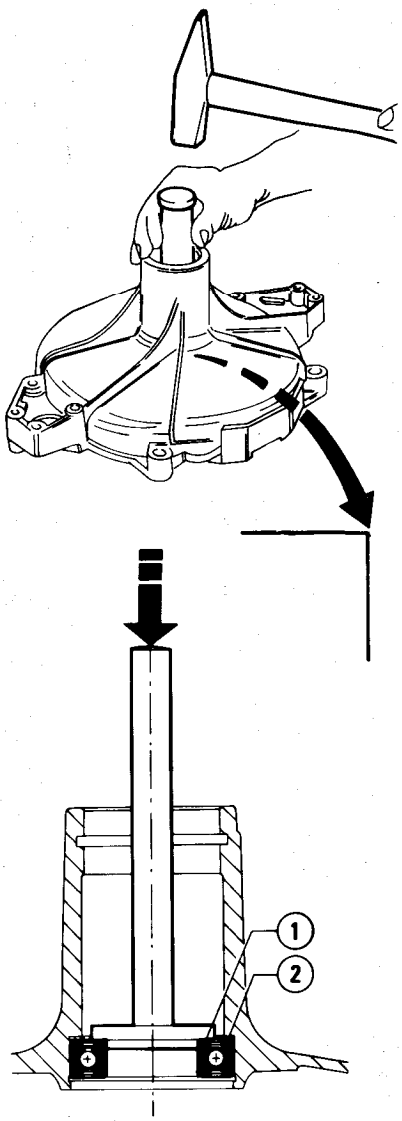
1 Bearings spacer
2 Clutch cover front bearing

c. Withdraw ring (1) from cover.



1 O-Ring

d. By means of a suitable extractor, withdraw rear bearing (1) together with shoulder washer (2).



1 Clutch cover rear bearing
2 Shoulder washer

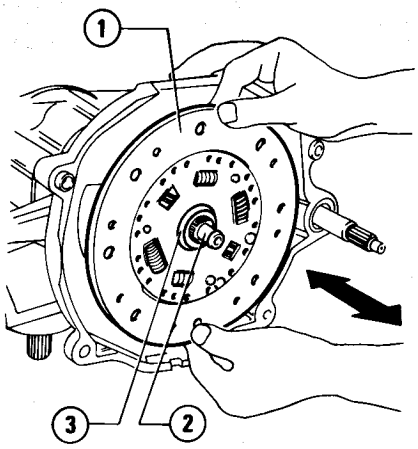
CHECKS AND INSPECTIONS

Before carrying out the checks and inspections, wash with suitable solvent all the disassembled items (exception made for the driven plate), to eliminate the residual dust and grease.
Use denatured ethyl alcohol to eliminate sealant residuals.

1. Clutch plate

Verify wear degree of clutch plate and check that:

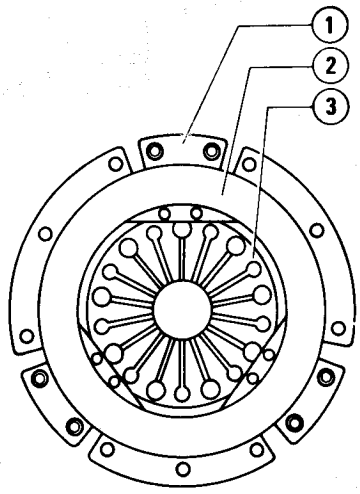
- Plate gaskets are free from burns, greasy residuals and vetrification.
- Wear is uniform.
- Gaskets securing rivets are perfectly riveted.
- Clutch plate springs are in good conditions.
- In the event of clutch malfunctions, due to oil leaks from seal ring on the direct drive shaft, both clutch plate and seal ring are replaced.
- Hub of plate (3) is in good conditions and slides without sticking or excessive backlash on direct drive shaft coupling (2). If necessary, replace the whole plate.



1 Clutch plate
2 Direct drive shaft
3 Clutch plate hub

2. Pressure plate

Verify that pressure plate working surface (2) is free from overheating, uneven wear, scores and removal of material.
If necessary, replace the pressure plate.



1 Pressure plate
2 Pressure plate working surface
3 Diaphragm spring

3. Clutch disengagement fork and thrust bearing

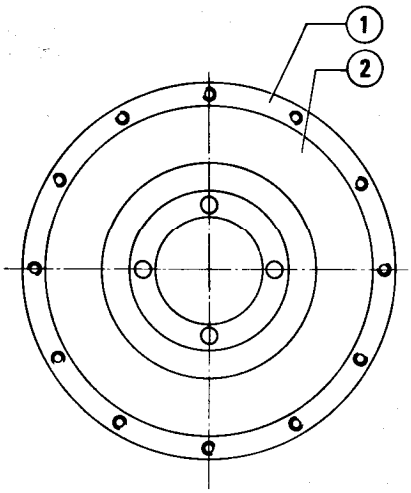
a. Verify that thrust bearing is not noisy, free from excessive backlash and that it slides freely on guide sleeve.
b. Verify that clutch disengagement fork is free from cracks, deformations and excessive wear of working surfaces. Replace it, if necessary.

4. Clutch cover

Check for good conditions of clutch cover; examine accurately the ball bearings supporting clutch flywheel shaft; replace them if too worn or in the event of seizing or noise.

5. Flywheel

Check for overheating, uneven wear, scoring or removal of material on flywheel working surface (2). If necessary, disassemble flywheel and grind both working surface and pressure plate support plane (1).

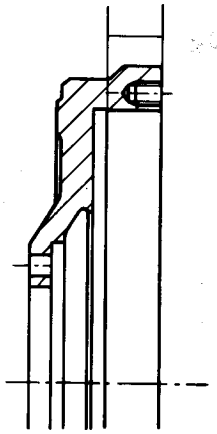


1 Pressure plate support plane
2 Working surface

The following must be taken into account when grinding flywheel:

a. Removal of material on driven plate support plane must be such that the dimension between driven plate support plane and pressure plate is within the below values.

- **For clutch plates Ø 200 mm dia. (7.87 in)**
  A = 25 + 0.2 mm (0.9842 + 0.0078 in)
- **For clutch plates Ø 215 mm dia. (8.46 in)**
  A = 22.5 + 0.2 mm (0.8858 + 0.0078 in)



b. Should dimension A be out of tolerance, remove material also from support plane of pressure plate.

c. As regards the tolerances, refer to: "Service Data and Specifications".

CAUTION:

a. Should replacement operations or interventions be required on flywheel, pressure plate and flywheel-clutch shaft, the whole unit should be replaced so as not to alter balancing.

b. Or, after grinding or replacement of a few components, carry out balancing of the whole unit.

---

6. Needle bearing

Verify that centering needle bearing of main shaft, previously removed from clutch shaft, is free from seizures, excessive wear; replace it if necessary.

7. Clutch flywheel shaft

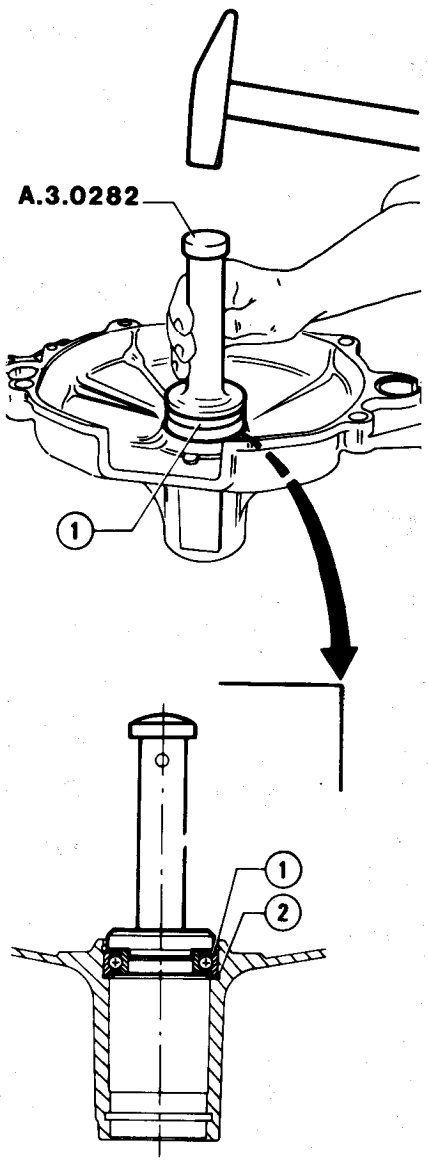
Examine thoroughly the clutch flywheel shaft. Replace it if working surfaces are worn.

REASSEMBLY

1. Clutch cover bearing insertion

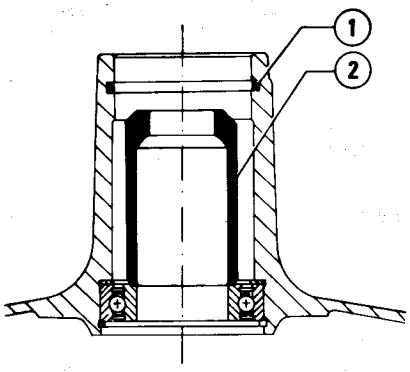
Operate as follows to reassemble clutch cover.

a. Insert shoulder washer (2) on cover and, by means of tool **A.3.0282**, fit bearing (1) completely. Install retaining ring making sure it is housed in the related seat.



1 Cover rear bearing
2 Shoulder washer

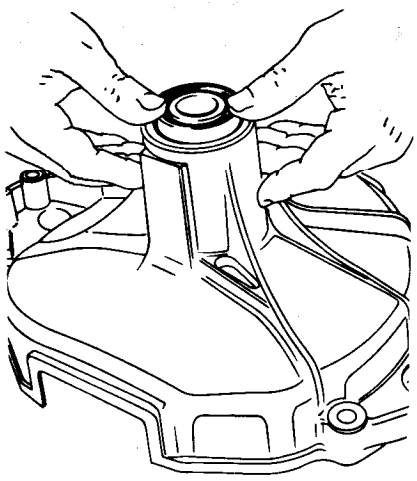
b. Overturn cover and install spacer (2) taking care to position it with the chamfered side towards front part of cover, then install O-ring (1).



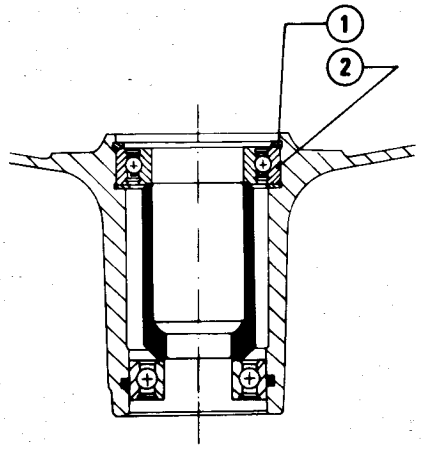
1 O-ring
2 Spacer

c. Insert front ball bearing.

d. Refit retaining ring (1) of clutch cover bearing (2).



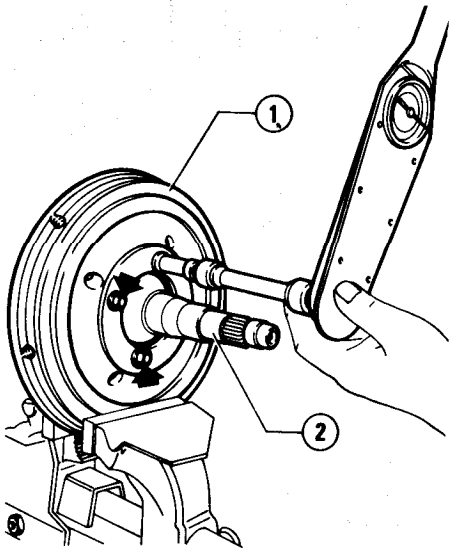
1 Ring
2 Rear bearing



2. Clutch unit reassembly

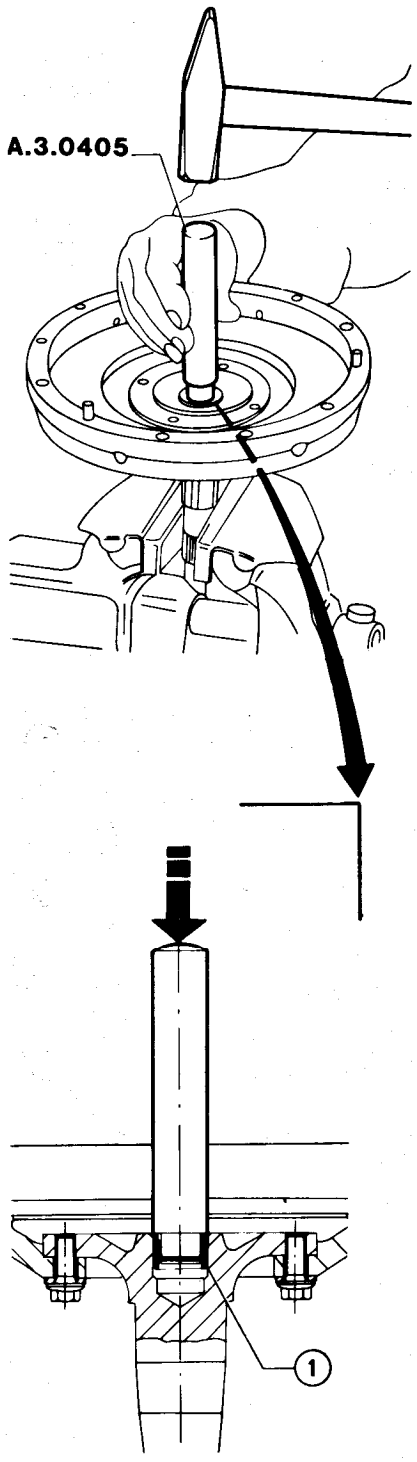
a. If previously disassembled, reassemble flywheel unit (1) and shaft (2) To carry out this operation, tighten the new securing screws treated with **LOCTITE sealing compound Stud Lok (red)** to the prescribed torque, operating as per figure, with flywheel arranged on vice fitted with protective jaws.

(T): **Tightening torque**
Screws securing clutch shaft to flywheel
27 to 31 N·m
(2.7 to 3.2 kg·m
19.5 to 23.1 ft·lb)



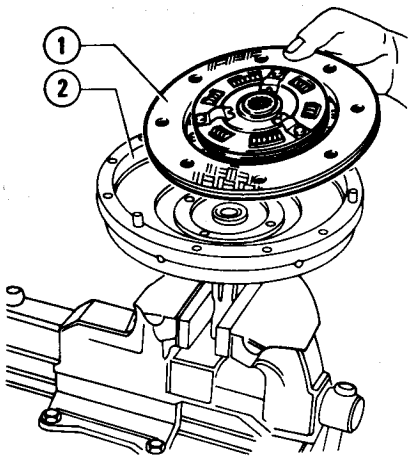
1 Clutch flywheel
2 Clutch shaft

b. If previously disassembled, insert bearing (1), housed in the clutch flywheel shaft, by means of tool **A.3.0405.**



1 Needle bearing

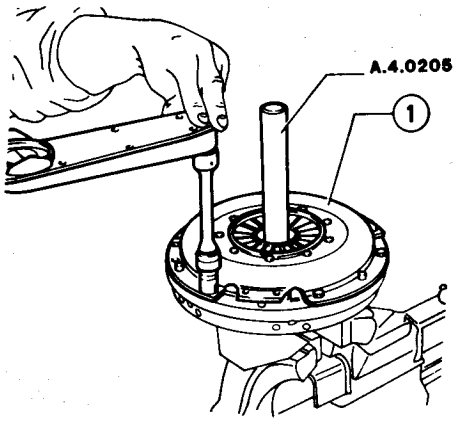
c. Insert driven plate (1) into flywheel (2) with the hub jutting part towards outside, as shown in the figure.



1 Driven plate
2 Clutch flywheel

d. Install pressure plate body on flywheel. By means of spindle **A.4.0205**, center the clutch plate and tighten, crosswise, the screws securing pressure plate body (1) to flywheel.

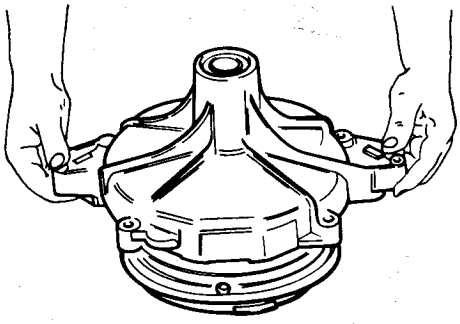
T : Tightening torque
Screws securing pressure plate body to flywheel
13 to 16 N·m
(1.3 to 1.6 kg·m
9.4 to 11.6 ft·lb)



1 Pressure plate body

3. Clutch cover reassembly

a. Remove spindle **A.4.0205** and reinstall cover on clutch unit.

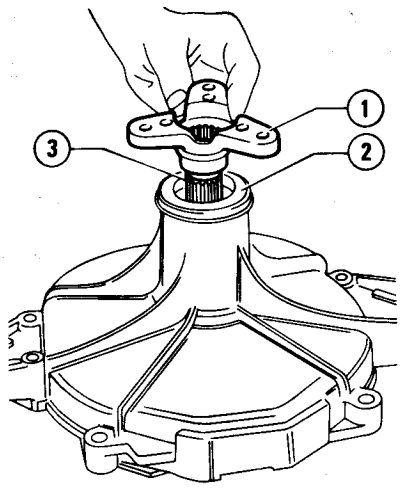


b. Insert dust cover (2)

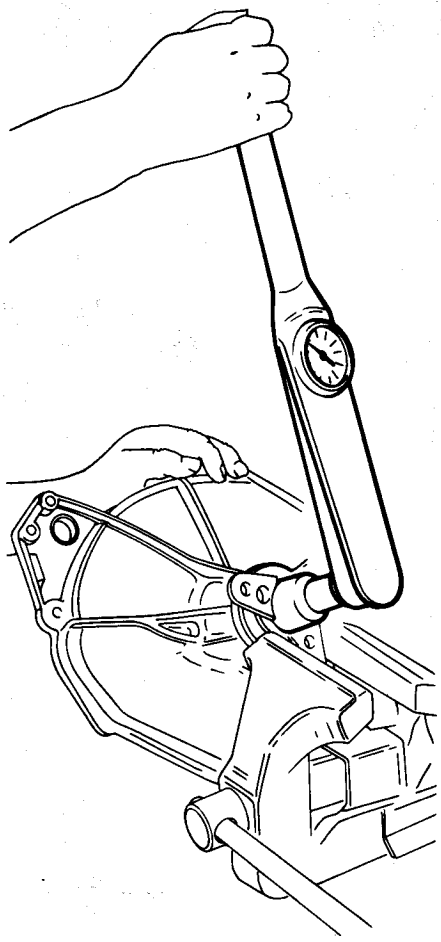
c. Apply a layer of **Sealing compound LOCTITE 242 (Blue)** on shaft tang, taking care to remove previous sealant residuals by swabbing and blowing the surfaces concerned. However, remove grease from surfaces by means of denatured ethyl alcohol.

d. Insert fork (1) on clutch shaft and secure it with the related nut lock fork on a vice fitted with protective jaws, as per figure, and tighten nut to the prescribed torque.

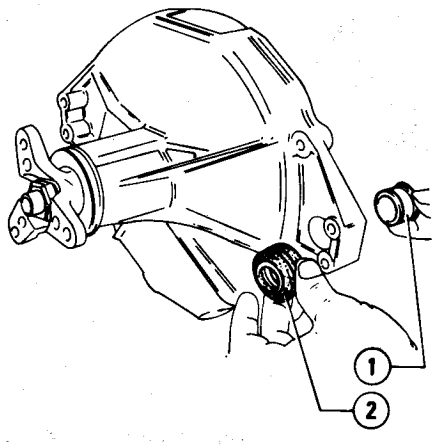
T : Tightening torque
Nut securing propeller shaft connecting fork to clutch shaft
93 to 103 N·m
(9.5 to 10.5 kg·m
68.7 to 75.9 ft·lb)



1 Fork
2 Dust cover
3 Splined tang

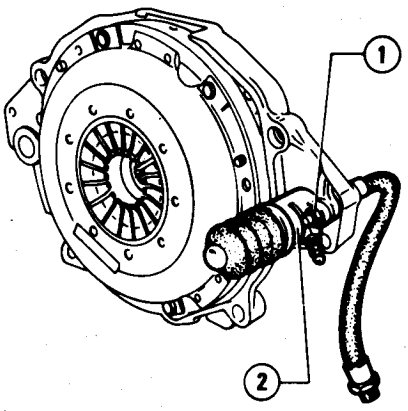


e. Reinstall bush (1) and boot (2).



1 Bush for speeds engagement and selection rod
2 Boot

f. Reconnect operating cylinder (2) to clutch cover and tighten bolt (1).



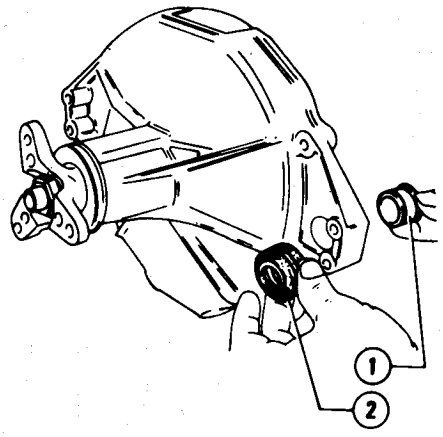
1 Clutch cover securing bolt
2 Fork operating cylinder

SINGLE-PLATE CLUTCH WITH "DRAWN" DIAPHRAGM SPRING

DISASSEMBLY

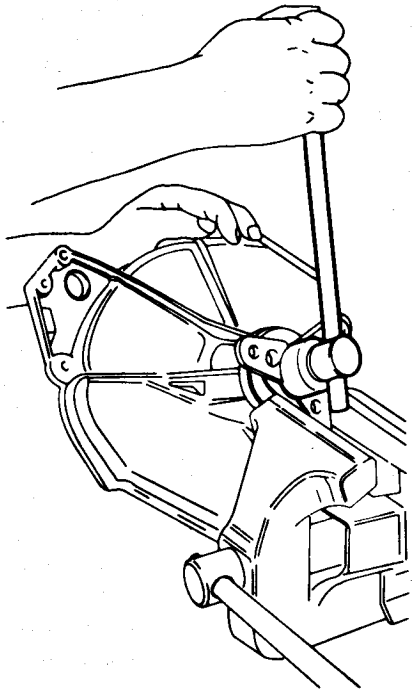
1. Clutch cover removal

a. If necessary, remove boot (2) and bush (1) from clutch cover.

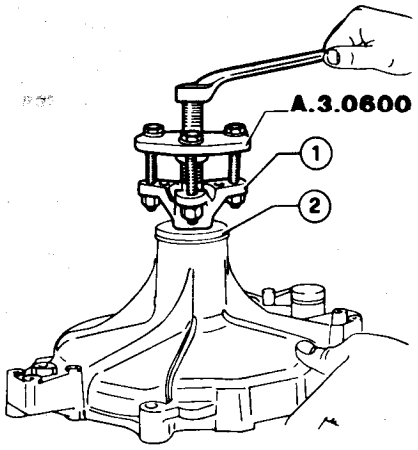


1 Speeds engagement and selection rod bush
2 Speed engagement and selection rods boot

b. Secure clutch cover on vice fitted with jaws, as per figure.
Release and remove the nut securing propeller shaft fork.

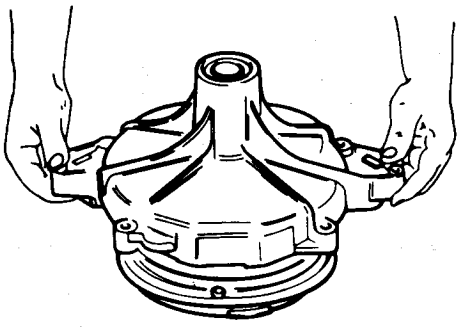


c. By means of extractor **A.3.0600** withdraw fork (1), then remove dust cover (2).



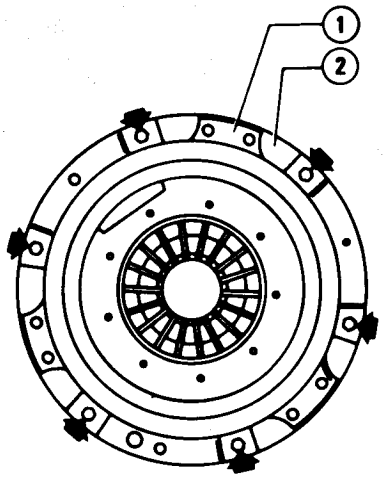
1 Propeller shaft connecting fork
2 Dust cover

d. Withdraw cover of clutch flywheel shaft.



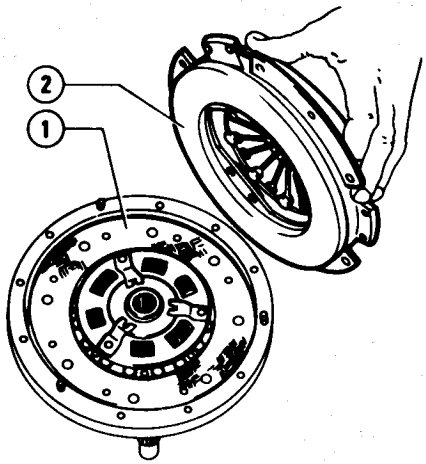
2. Clutch unit disassembly

a. If not present, carry out the countermarking between flywheel and pressure plate body so that correct order can be maintained when reassembling.
Loosen and release the screws with related washers securing pressure plate body (1) to flywheel (2).



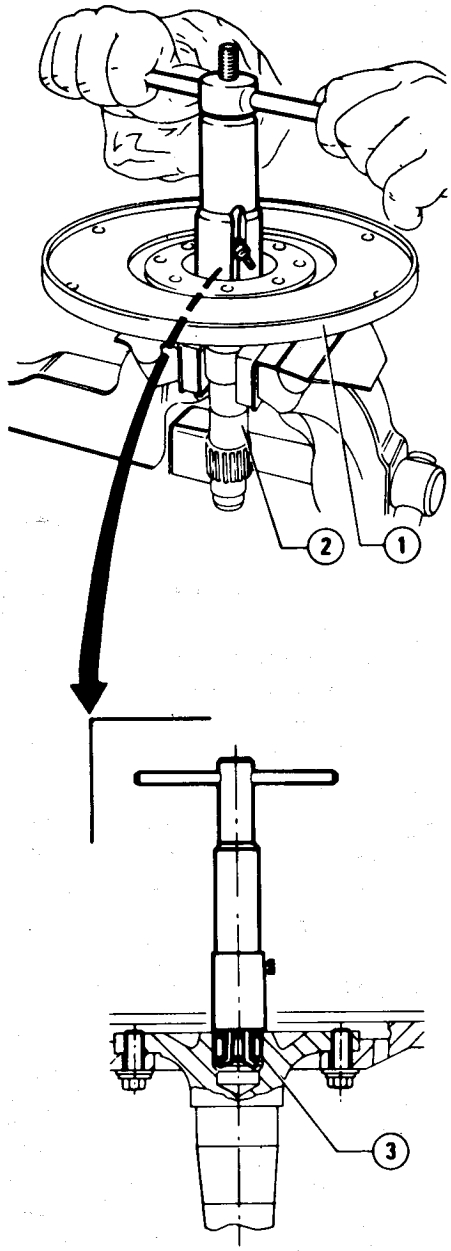
1 Pressure plate body
2 Clutch flywheel

b. Separate pressure plate body (2) and clutch plate (1) from flywheel.



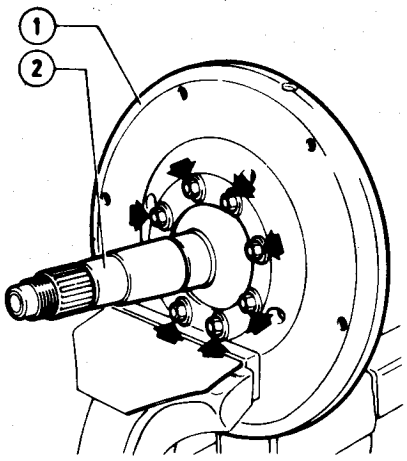
1 Clutch plate
2 Pressure plate body

c. If necessary, withdraw centering bearing (3) of speed gear main shaft from shaft (2), by means of suitable extractor.



1 Clutch flywheel
2 Clutch shaft
3 Needle bearing

d. If necessary, unscrew and remove the screws with related washers which secure flywheel (1) to shaft (2); separate shaft from flywheel.

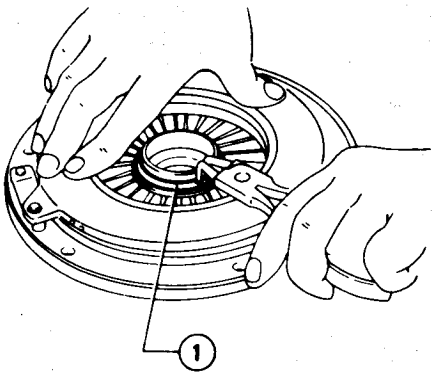


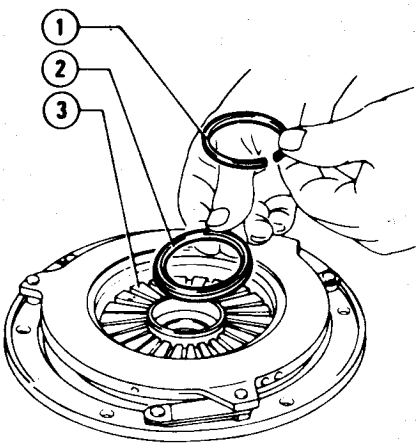
1 Clutch flywheel
2 Clutch shaft

3. Thrust bearing removal

a. Set rear pressure plate body as per figure, then slightly press on it to overcome the reaction of bearing Belleville spring and remove retaining ring (1).

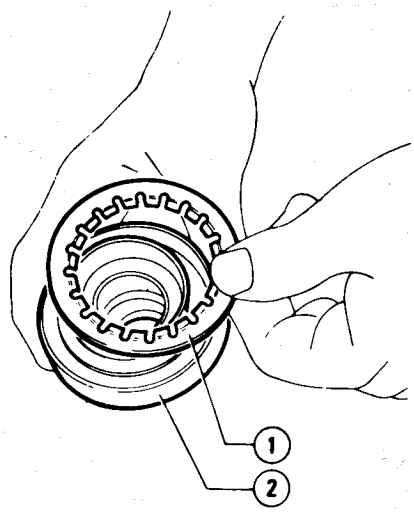
b. Remove ring (2) securing thrust bearing to diaphragm spring (3).





1 Retaining ring
2 Ring
3 Diaphragm spring

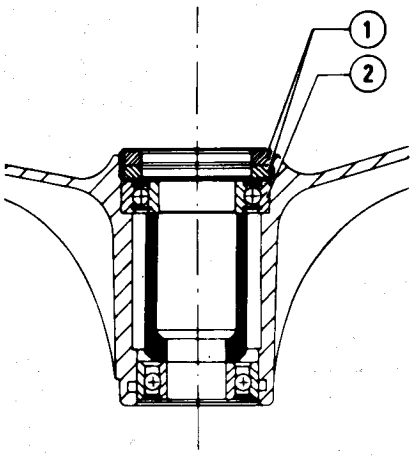
c. Remove bearing (2) from rear pressure plate body and recover spring (1).



1 Belleville spring
2 Thrust bearing

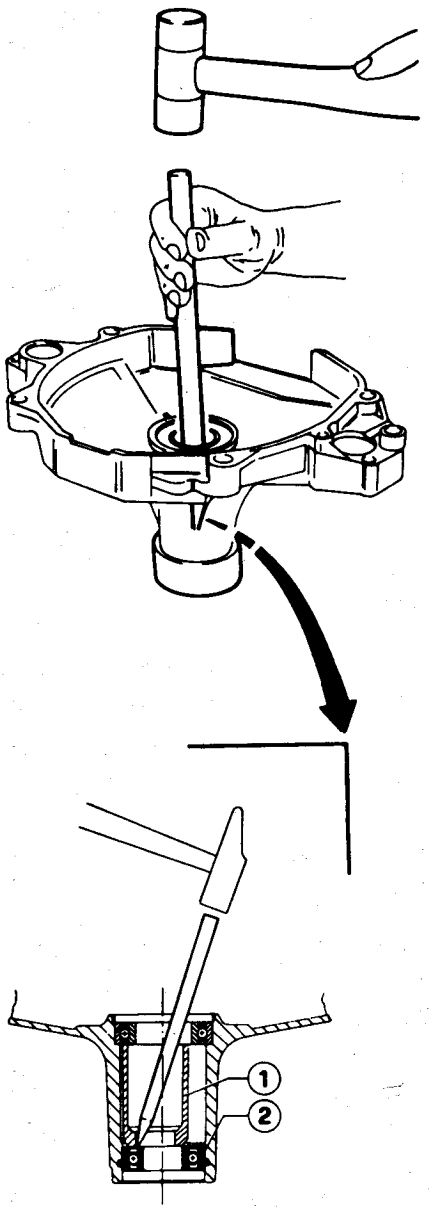
4. Removal of clutch cover bearings

a. Unscrew the two ring nuts (1) securing bearing (2).



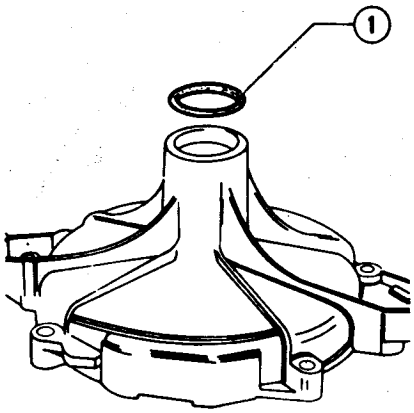
1 Threaded ring nuts
2 Rear bearing

b. Set clutch cover on a suitable base and, disaligning spacer, tap uniformly, by means of a punch, on outer race of front bearing (2) in order to remove it from the related cover; recover spacer (1).



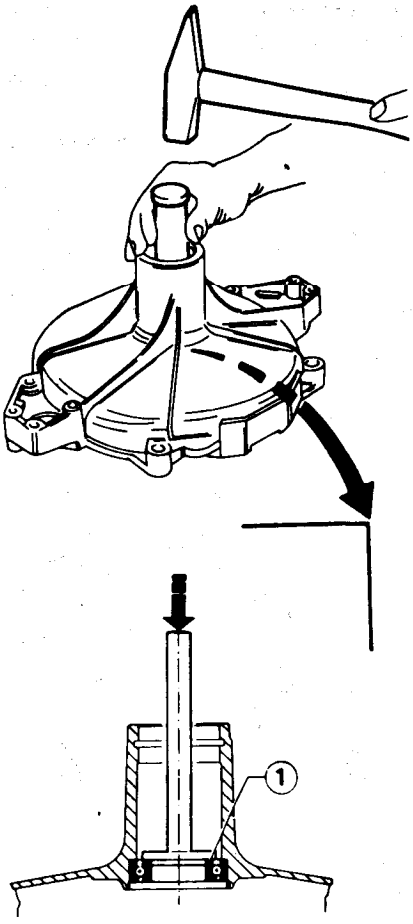
1 Bearings spacer
2 Clutch cover front bearing

c. Withdraw ring (1) from cover.



1 O-Ring

d. By means of a suitable extractor, withdraw rear bearing (1).



1 Clutch cover rear bearing

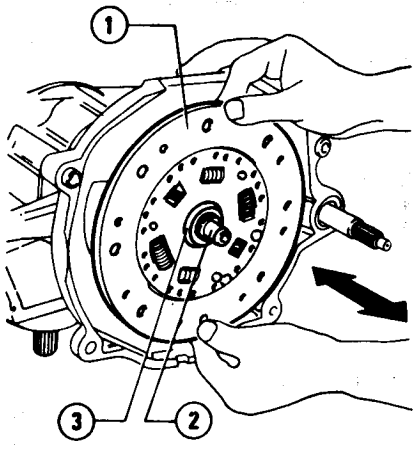
CHECKS AND INSPECTIONS

Before carrying out the checks and inspections, wash with suitable solvent all the disassembled items (exception made for the driven plate), to eliminate the residual dust and grease.
Use denatured ethyl alcohol to eliminate sealant residuals.

1. Clutch plate

Verify wear degree of clutch plate and check that:

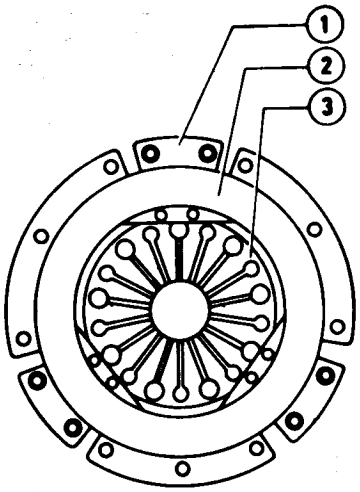
- Plate gaskets are free from burns, greasy residuals and vetrification.
- Wear is uniform.
- Gaskets securing rivets are perfectly riveted.
- Clutch plate springs are in good conditions.
- In the event of clutch malfunctions, due to oil leaks from seal ring on the direct drive shaft, both clutch plate and seal ring are replaced.
- Hub of plate (3) is in good conditions and slides without sticking or excessive backlash on direct drive shaft coupling (2). If necessary, replace the whole plate.



1 Clutch plate
2 Direct drive shaft
3 Clutch plate hub

2. Pressure plate

Verify that pressure plate working surface (2) is free from overheating, uneven wear, scores and removal of material.
If necessary, replace the pressure plate.



1 Pressure plate
2 Pressure plate working surface
3 Diaphragm spring

3. Clutch disengagement fork and thrust bearing

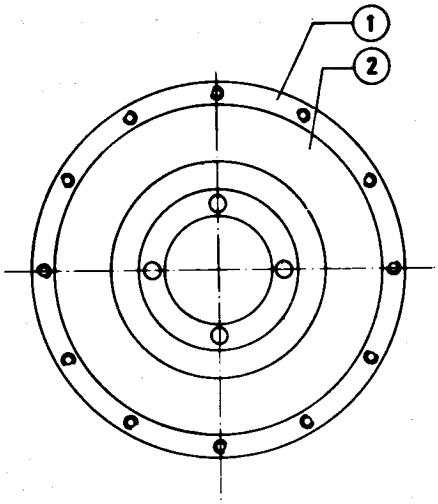
a. Verify that thrust bearing is not noisy, free from excessive backlash and that it slides freely on guide sleeve.
b. Verify that clutch disengagement fork is free from cracks, deformations and excessive wear of working surfaces.
Replace it, if necessary.

4. Clutch cover

Check for good conditions of clutch cover; examine accurately the ball bearings supporting clutch flywheel shaft; replace them if too worn or in the event of seizing or noise.

5. Flywheel

Check for overheating, uneven wear, scoring or removal of material on flywheel working surface (2). If necessary, disassemble flywheel and grind both working surface and pressure plate support plane (1).



1 Pressure plate support plane
2 Working surface

For grinding tolerances, refer to "Service Data and Specifications".

CAUTION:

a. **Should replacement operations or interventions be required on flywheel, pressure plate and flywheel-clutch shaft, the whole unit should be replaced so as not to alter balancing.**
b. **Or, after grinding or replacement of a few components, carry out balancing of the whole unit.**

---

6. Needle bearing

Verify that centering needle bearing of main shaft, previously removed from clutch shaft, is free from seizures, excessive wear; replace it if necessary.

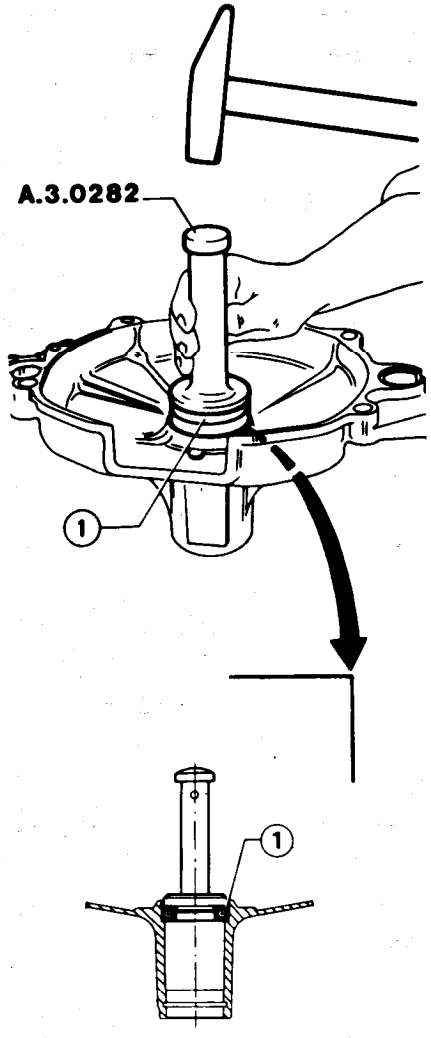
7. Clutch flywheel shaft

Examine thoroughly the clutch flywheel shaft. Replace it if working surfaces are worn.

REASSEMBLY

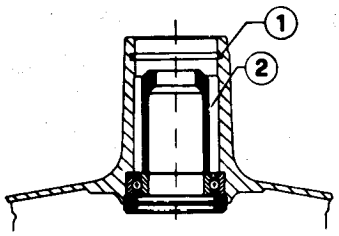
1. Clutch cover bearing insertion

Operate as follows to reassemble clutch cover.
a. By means of tool **A.3.0282** fit bearing (1) fully home and fix it by the two-threaded ring nuts.



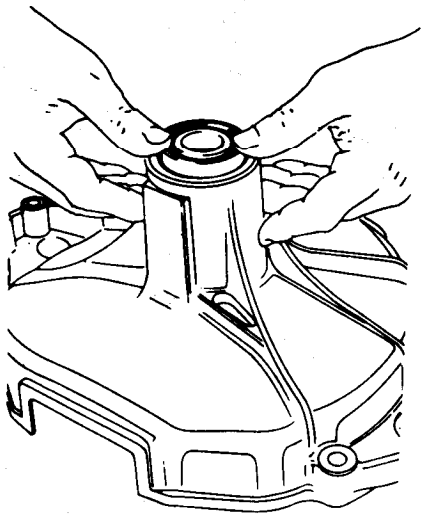
1 Cover rear bearing

b. Overturn cover and install spacer (2) taking care to position it with the chamfered side towards front part of cover, then install O-ring (1).



1 O-Ring
2 Spacer

c. Insert front ball bearing.



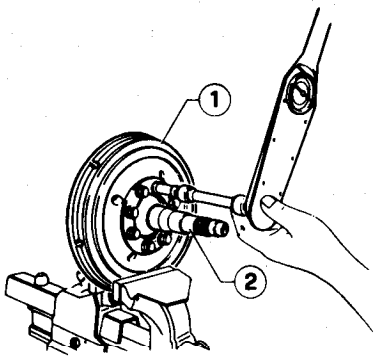
2. Thrust bearing reassembly

To reassemble thrust bearing, reverse the order of disassembly.

3. Clutch unit reassembly

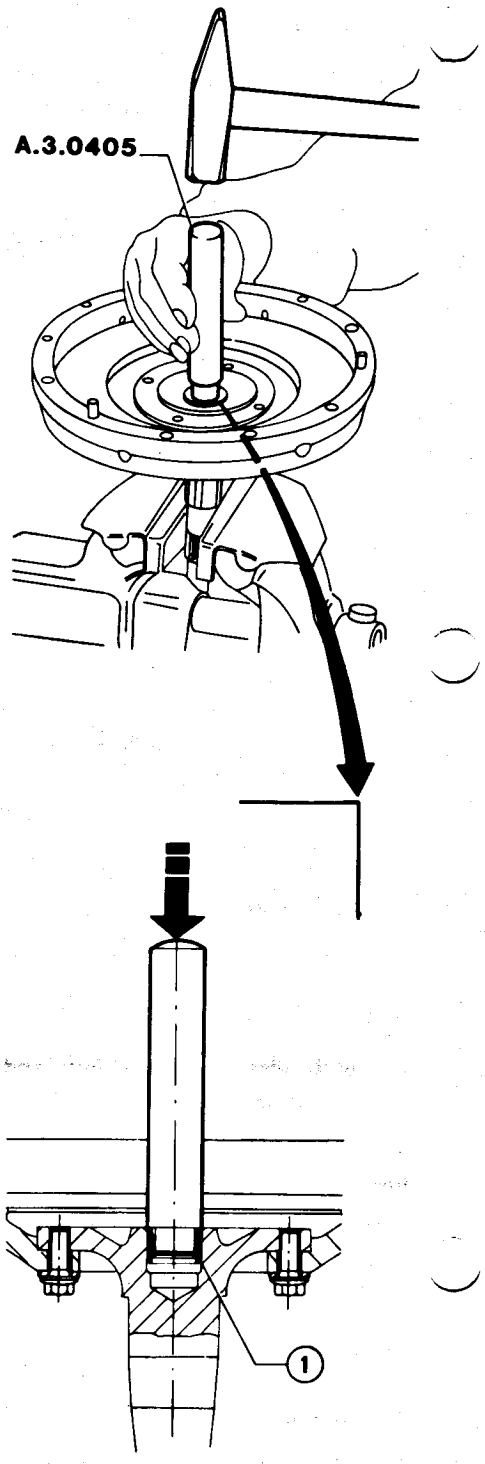
a. If previously disassembled, reassemble flywheel unit (1) and shaft (2).
To carry out this operation, tighten the new securing screws treated with **LOCTITE sealing compound Stud Lok (red)** to the prescribed torque, operating as per figure, with flywheel arranged on vice fitted with protective jaws.

(T) : **Tightening torque**
Screws securing clutch shaft to flywheel
27 to 31 N·m
(2.7 to 3.2 kg·m)
(19.5 to 23.1 ft·lb)



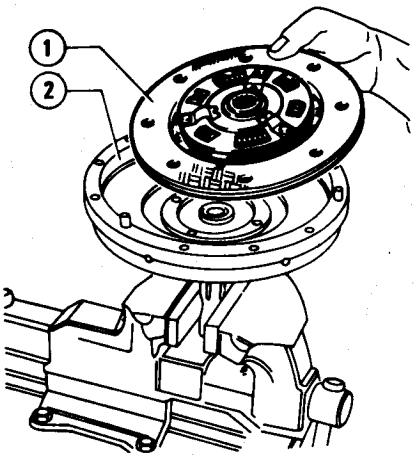
1 Clutch flywheel
2 Clutch shaft

b. If previously disassembled, insert bearing (1), housed in the clutch flywheel shaft, by means of tool **A.3.0405**.



1 Needle bearing

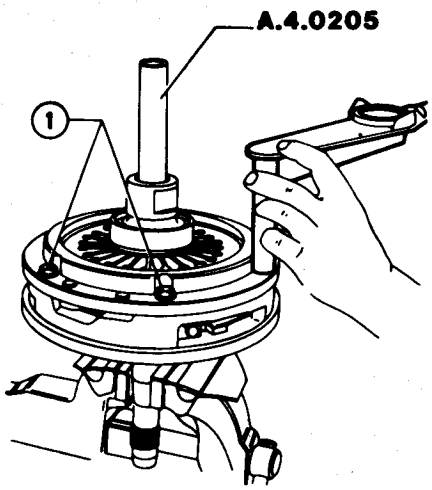
c. Insert driven plate ① into flywheel ② with the hub jutting part towards outside, as shown in the figure.

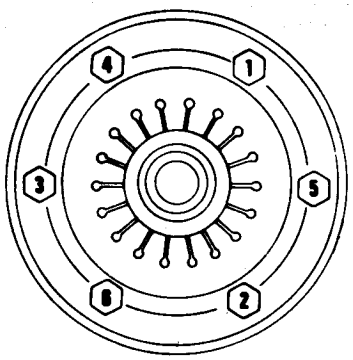


1 Driven plate
2 Clutch flywheel

d. Install pressure plate body on flywheel. By means of spindle **A.4.0205**, center the clutch plate and tighten, crosswise, the screws ① securing pressure plate body to flywheel.

Ⓣ : **Tightening torque**
Screws securing pressure plate body to flywheel
13 to 16 N·m
(1.3 to 1.6 kg·m)
(9.4 to 11.6 ft·lb)

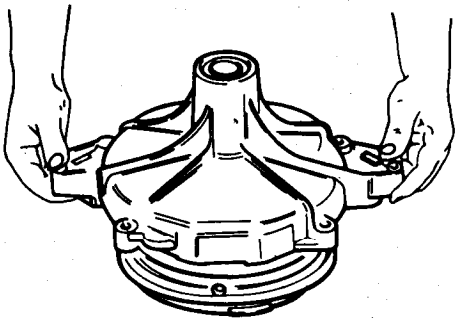




1 Screws securing pressure plate body to flywheel

4. Clutch cover reassembly

a. Remove splindle **A.4.0205** and reinstall cover on clutch unit.

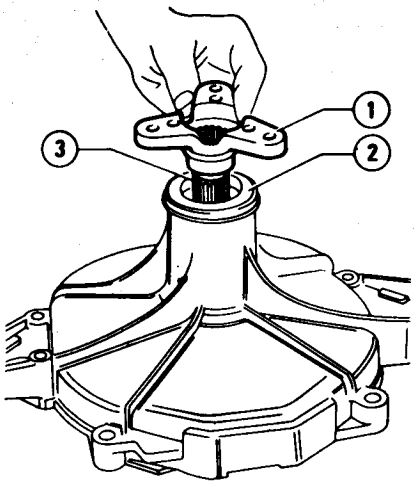


b. Insert dust cover ②.

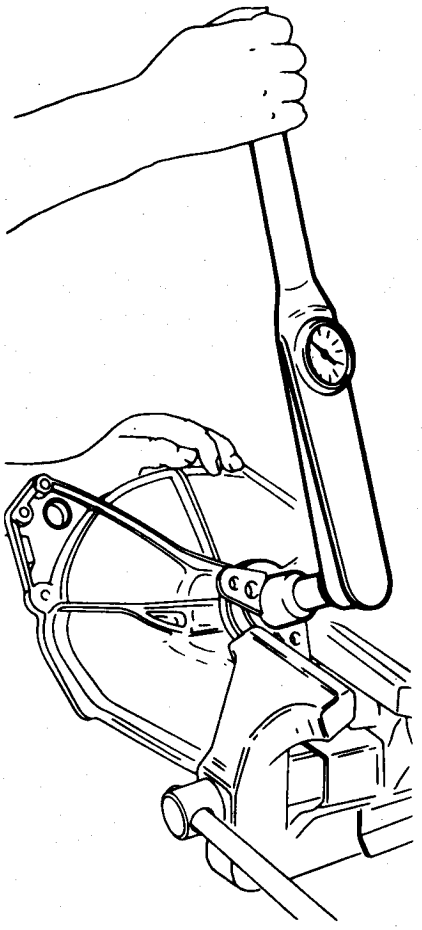
c. Apply a layer of **Sealing compound LOCTITE 242 (Blue)** on shaft tang, taking care to remove previous sealant residuals by swabbing and blowing the surfaces concerned. However, remove grease from surfaces by means of denatured ethyl alcohol.

d. Insert fork ① on clutch shaft and secure it with the related nut lock fork on a vice fitted with protective jaws, as per figure, and tighten nut to the prescribed torque.

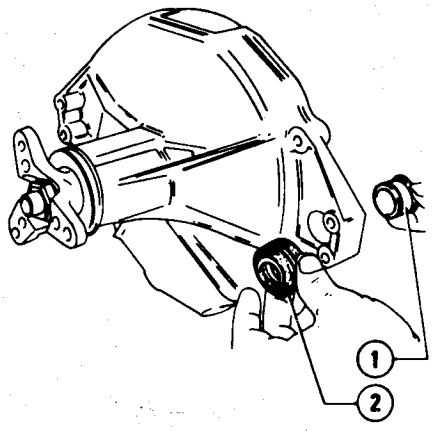
Ⓣ : **Tightening torque**
Nut securing propeller shaft connecting fork to clutch shaft
93 to 103 N·m
(9.5 to 10.5 kg·m)
(68.7 to 75.9 ft·lb)



1 Fork
2 Dust cover
3 Splined tang



e. Reinstall bush ① and boot ②.



1 Bush for speeds engagement and selection rod
2 Boot

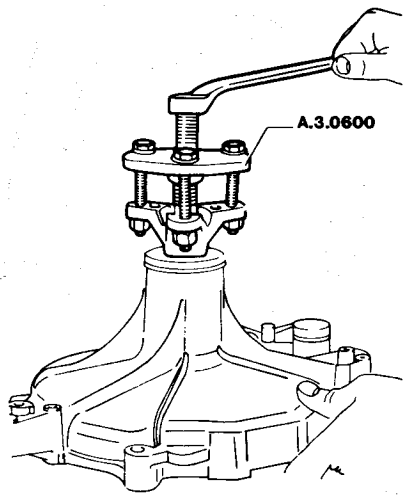
DOUBLE-PLATE CLUTCH

REMOVAL

1. Clutch cover removal

Operate as per "Single-Plate Clutch with "Drawn" Diaphragm Spring - Disassembly - Clutch Cover Removal.

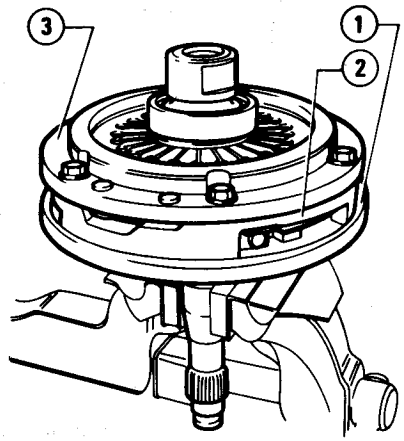
To remove propeller shaft connecting fork, make use of puller A.3.0600.



2. Clutch unit disassembly

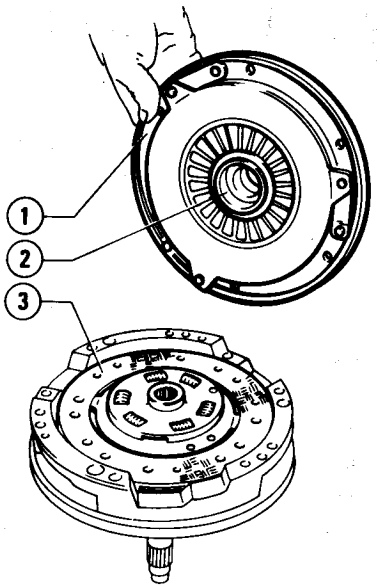
a. If not present, carry out markings between flywheel (1) and pressure plates bodies (2) and (3).

Release and remove the screws with washers securing rear pressure plate body (3) to flywheel (1).



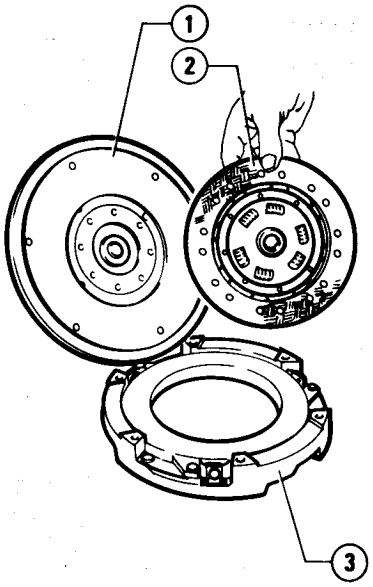
1 Flywheel
2 Intermediate pressure plate body
3 Rear pressure plate body

b. Withdraw rear pressure plate body (1) with the related thrust bearing (2) and clutch plate (3).



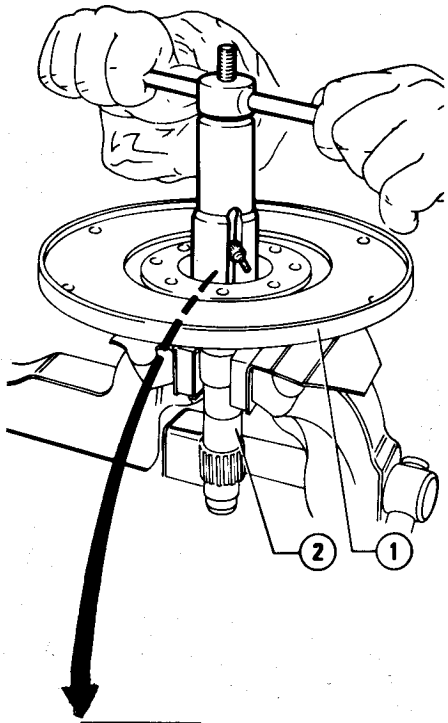
1 Rear pressure plate body
2 Thrust bearing
3 Rear clutch plate

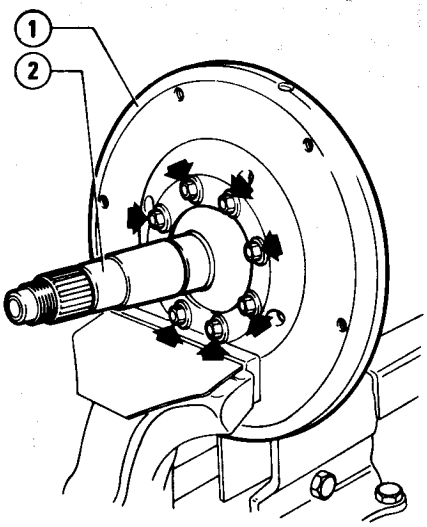
c. Separate intermediate pressure plate body (3) and clutch plate (2) from flywheel (1).



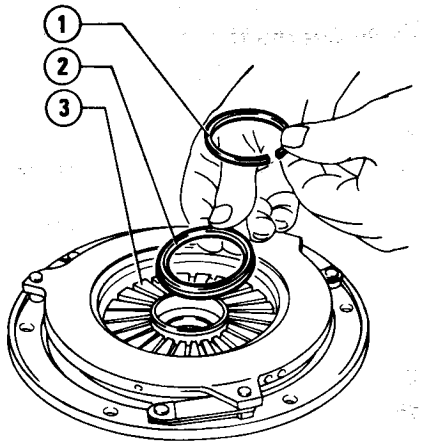
1 Flywheel
2 Front clutch plate
3 Intermediate pressure plate body

d. If necessary, withdraw speed gear main shaft centering bearing (3) from shaft (2), by means of suitable puller.



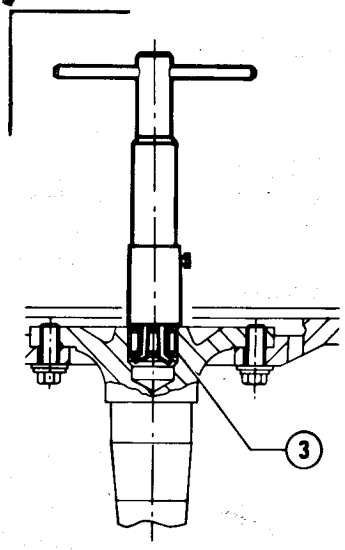


1 Clutch flywheel
2 Clutch shaft



1 Retaining ring
2 Ring
3 Diaphragm spring

c. Remove bearing (2) from rear pressure plate body and recover spring (1).

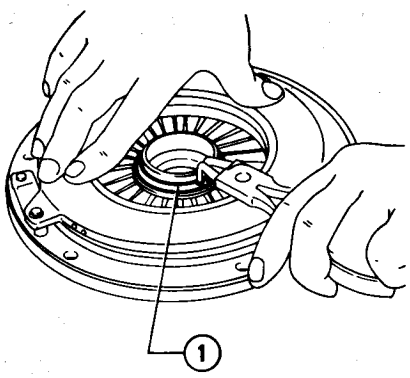


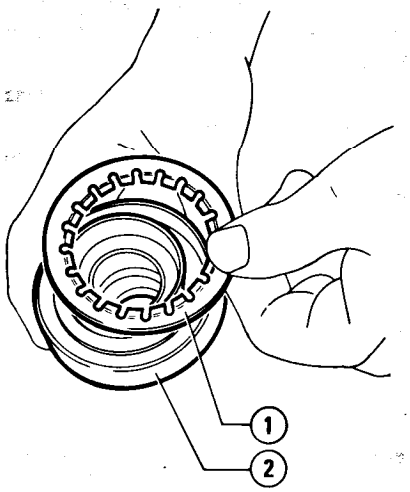
1 Clutch flywheel
2 Clutch shaft
3 Needle bearing

e. If necessary, unscrew and remove the screws with related washers which secure flywheel (1) to shaft (2); separate shaft from flywheel.

3. Thrust bearing removal

a. Set rear pressure plate body as per figure, then slightly press on it to overcome the reaction of bearing Belleville spring and remove retaining ring (1).
b. Remove ring (2) securing thrust bearing to diaphragm spring (3).





1 Belleville spring
2 Thrust bearing

4. Removal of clutch cover bearings

Operate as per "Single-Plate Clutch with "Drawn" Diaphragm Spring - Disassembly - Removal of Clutch Cover Bearings.

CHECKS AND INSPECTIONS

For the base checks, refer to: "Single-Plate Clutch with "Drawn" Diaphragm Spring - Checks and Inspections".
As regards the specific components of Double-Plate Clutch, comply with the following:

1. Clutch plate

Check wear degree of both driven plates.

CAUTION:
In the event of malfunctions identified on one plate only, the replacement of both plates is however required.

2. Pressure plate body

For this type of clutch, no grindings nor repair operations are to be executed for both pressure plates bodies.
As a consequence, in the event of excessive wear of deep scratches on both bodies, the whole unit must be replaced.

3. Clutch flywheel

For grinding tolerances, refer to "Service Data and Specifications".

REASSEMBLY

1. Insertion of clutch cover bearing

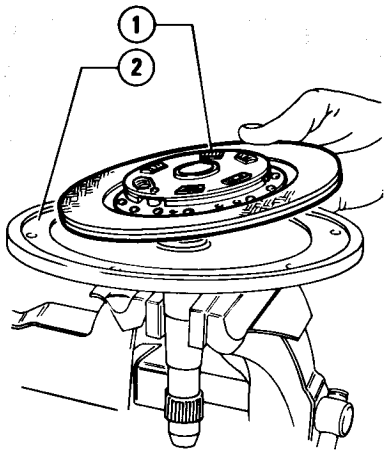
To reinstall bearings, operate as per: "Single-Plate Clutch with "Drawn" Diaphragm Spring - Reassembly - Insertion of Clutch Cover Bearing".

2. Thrust bearing reassembly

To reassemble thrust bearing, reverse the order of disassembly.

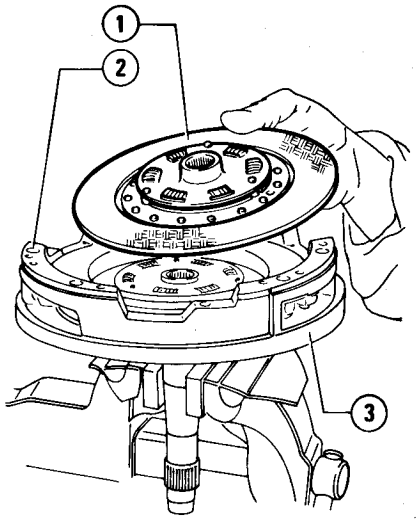
3. Clutch unit reassembly

a. Refer to "Single-Plate Clutch with "Drawn" Diaphragm Spring - Reassembly - Clutch Unit Reassembly - steps a. - b.".
b. Install front clutch plate (1) on flywheel (2).



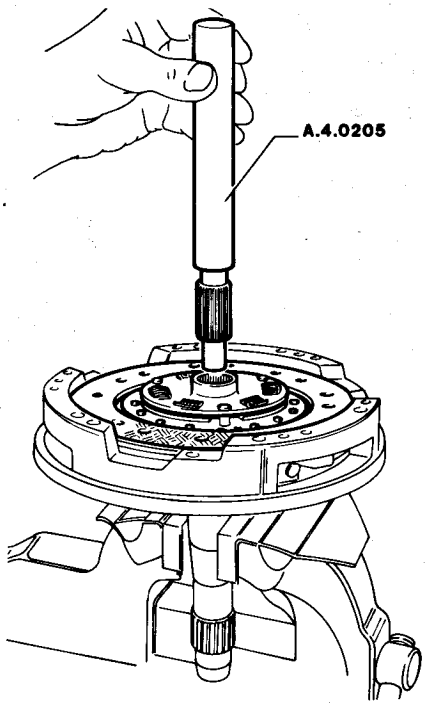
1 Front clutch plate
2 Clutch flywheel

c. Install intermediate pressure plate body (1) (complying with counter-marks executed when disassembling) and rear clutch plate (2).

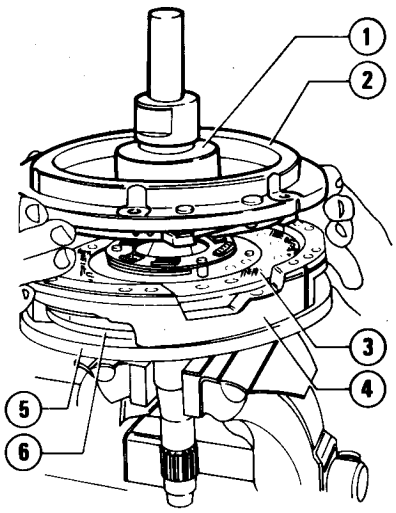


1 Intermediate pressure plate body
2 Rear clutch plate
3 Clutch flywheel

d. By means of tool **A.4.0205**, align hubs grooves of the two clutch plates.



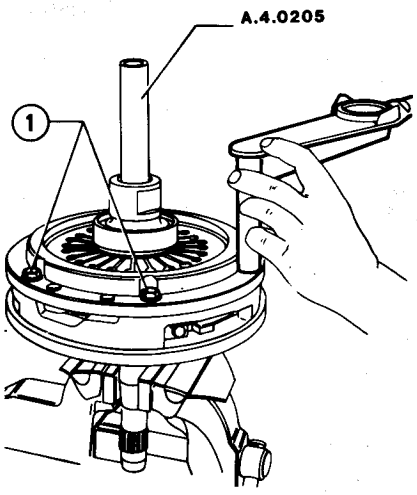
e. Position pressure plate body (2), complete with thrust bearing (1) complying with the countermarks executed when disassembling.

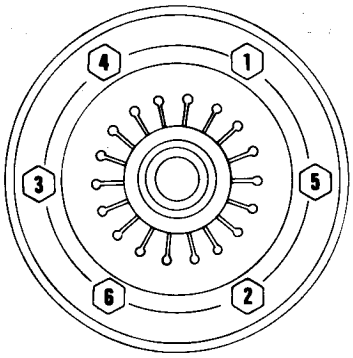


1 Thrust bearing
2 Rear pressure plate body
3 Rear clutch plate
4 Intermediate pressure plate body
5 Clutch flywheel
6 Front clutch plate

f Insert screws (1) securing pressure plate bodies to clutch flywheel, secure them according to the specified sequence, then, by means of tool **A.4.0205**, tighten the screws to the prescribed torque.

(T): **Tightening torque**
Screws securing pressure plate to clutch flywheel
18 to 22 N·m
(1.8 to 2.2 kg·m
13.0 to 15.9 ft·lb)

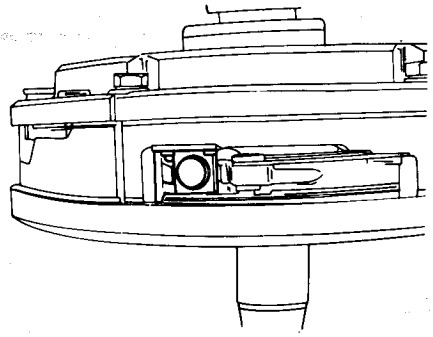




1 Screws

g. After tightening to the prescribed torque, make sure that pressure plate bodies and clutch plates mate perfectly and are coplanar to clutch flywheel.

To carry out verification, visually check that clearance **"A"** (shown in figure), due to diaphragm spring action, occurs in the vicinity of the taking up devices. This condition is necessary to guarantee the clutch unit disengagement travel.



h. Withdraw tool **A.4.0205.**

4. Clutch cover reassembly

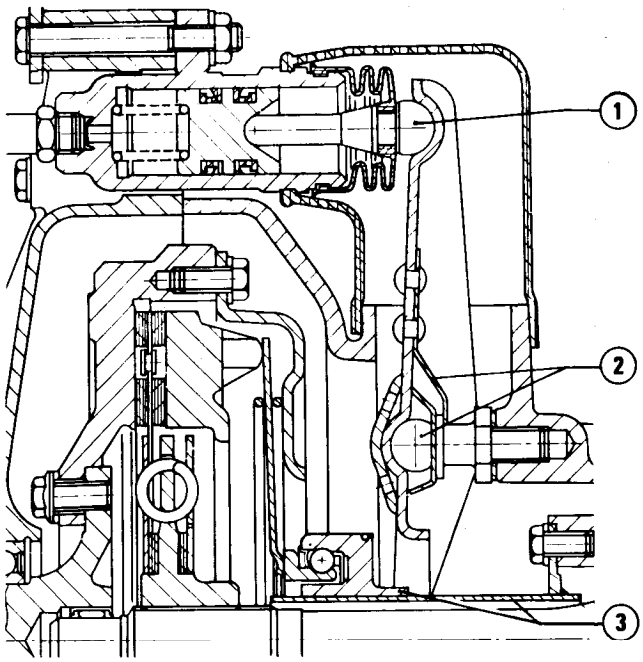
Ressemble clutch cover by proceeding as per: "Single-Plate Cluch with "Drawn" Diaphragm Spring - Reassembly - Clutch Cover Reassembly".

SERVICE DATA AND SPECIFICATIONS

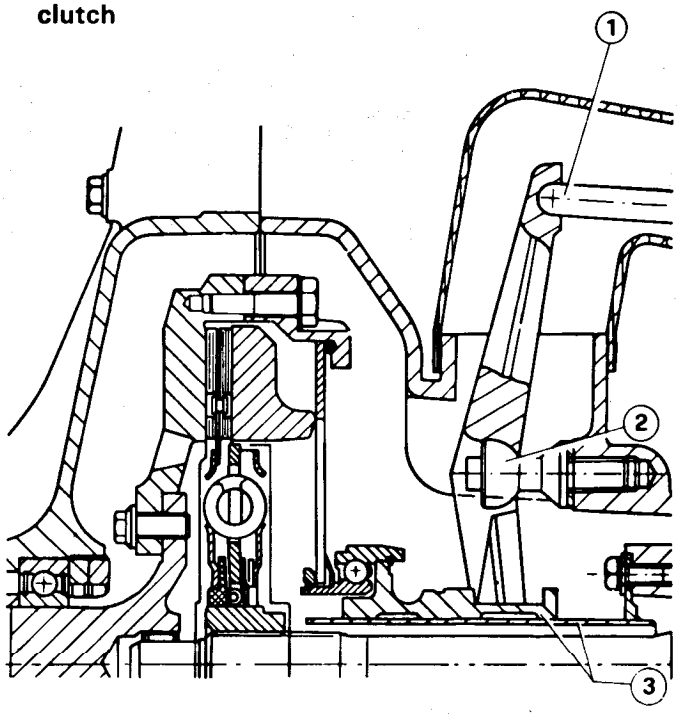
GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Single-plate clutch with "pushed" diaphragm spring



Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

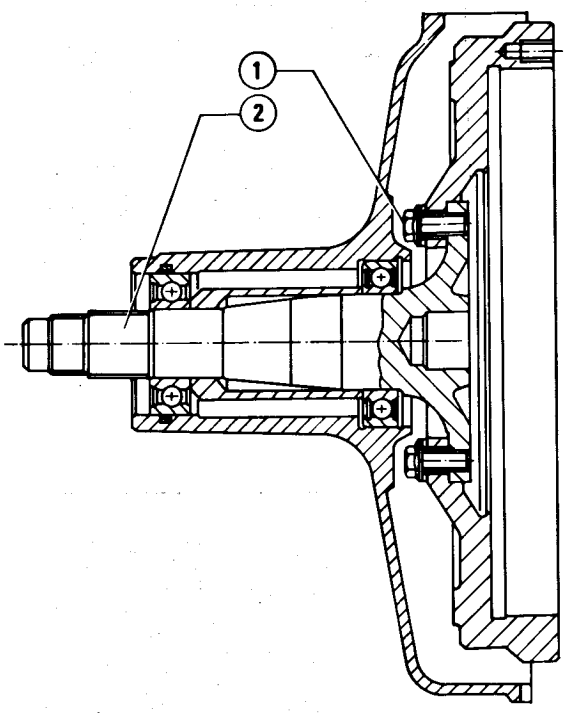


Application	Type	Name	Q.ty
(1) Spherical seat and clutch operating cylinder push rod (1 and 2) (2) Rubber washer on spherical pin for clutch disengagement fork (1) (2) Spherical pin and clucth disengagement fork spherical seat (2) (3) Thrust bearing seat and clutch disengagement fork (1 and 2)	GREASE	- AGIP Grease 33FD - IP Autogrease FD Std. No. 3671-69833/34	-
Propeller shaft rear joint spherical seat	GREASE	ISECO Molykote BR2 Std. No. 3671-69841	5 cm^3 0.3 cuin
Clutch hydraulic system filling (1 and 2)	FLUID	- AGIP Brake Fluid Super HD - ATE "Blau S" - IP Auto Fluid F.R. Std. No. 3681-69905 **CAUTION:** **Product harmful to paint. Keep it away from paint on view**	-

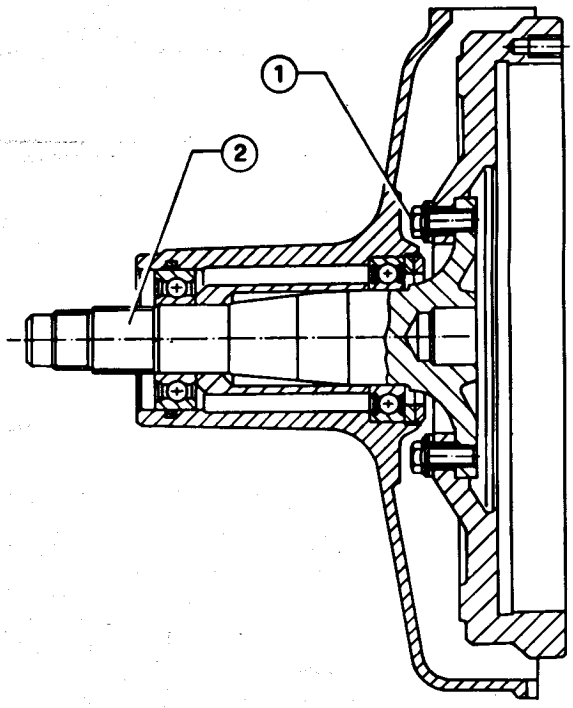
(1) For single-plate clutch with "pushed" diaphragm spring
(2) For single-plate clutch with "drawn" diaphragm spring and for double-plate clutch

SEALANTS

Single-plate clutch with "pushed" diaphragm spring



Single-plate clutch with "drawn" diaphragm spring and double-plate clutch

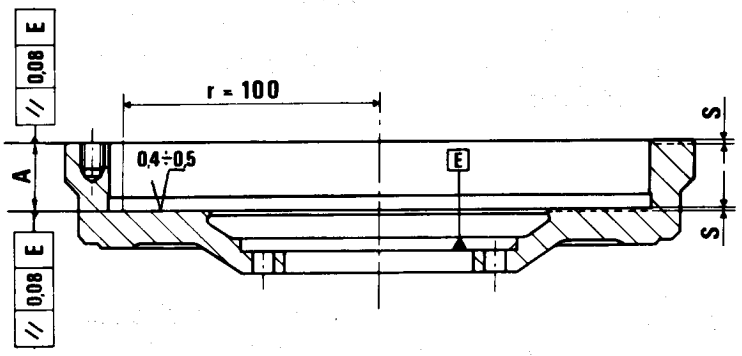


	Application	Type	Name	Q.ty
(1)	Threading of screws securing clutch shaft to flywheel - See note (1)	SEALING COMPOUND	LOCTITE Stud Lok (Red) Std. No. 3524-00002	-
(2)	Clutch shaft splined tang for propeller shaft connecting fork See note (1)	SEALING COMPOUND	LOCTITE 242 (Blue) Std.No. 3524-00010	

(1) Before applying sealing compound, remove any trace of old compound by swabbing and blowing the surfaces concerned. Remove grease from surfaces with thriclorethylene and clorothene.

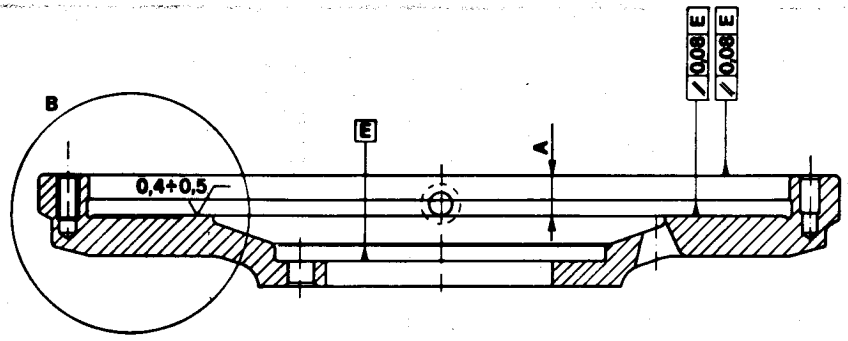
CHECKS AND ADJUSTMENTS

SINGLE-PLATE CLUTCH FLYWHEEL WITH "PUSHED" DIAPHRAGM SPRING



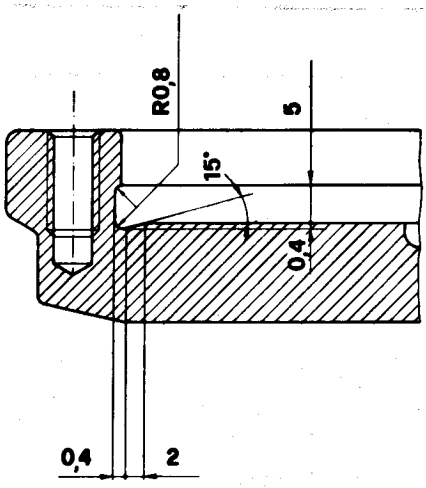
Dimensions \ Clutch diameter		215 mm (8.46 in)	200 mm (7.87 in)
Rectification Removal of material on driven plate support plane must be such that the dimension between driven plate support plane and clutch cover is within the **A** value. Should dimension **A** be out of tolerance, remove material also from support plane of clutch cover.	A mm (in)	22.5+0.2 (0.89+0.01)	25+ 0.2 (0.98+0.01)
Tolerances — Parallelism error between driven plate support plane and clutch shaft connection plane (measured on a radius with "r" length)	// mm (in)	0.08 (0.003)	0.08 (0.003)
— Parallelism error between clutch cover support plane and clutch shaft connection plane	// mm (in)	0.08 (0.003)	0.08 (0.003)
— Roughness of driven plate support plane	√ μm	0.4 to 0.5	0.4 to 0.5

SINGLE-PLATE CLUTCH FLYWHEEL WITH "DRAWN" DIAPHRAGM SPRING



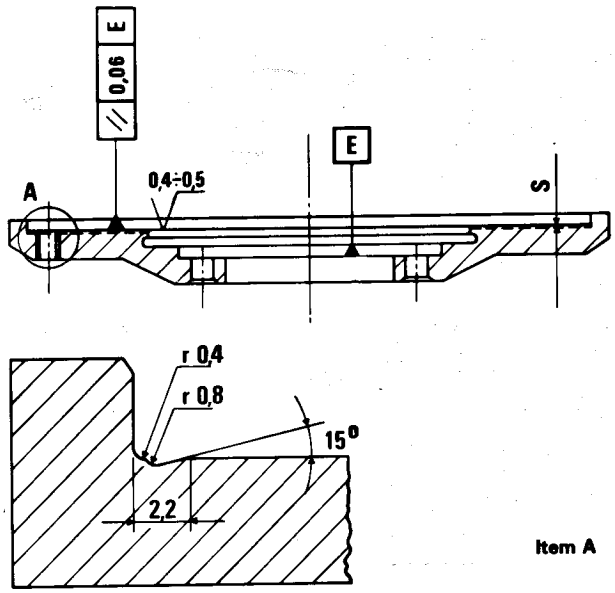
Dimensions \ Clutch diameter		215 mm (8.46 in)
Rectification Removal of material on driven plate support plane must be such that the dimension between driven plate support plane and clutch cover is within the **A** value.	A mm (in)	12.5 + 0.2 (0.49 + 0.01)
Should dimension A be out of tolerance, remove material also from support plane of clutch cover.		
Tolerances		
– Parallelism error between driven plate support plane and clutch shaft connection plane	⫽ mm (in)	0.08 (0.003)
– Parallelism error between clutch cover support plane and clutch shaft connection plane	⫽ mm (in)	0.08 (0.003)
– Roughness of driven plate support plane	√ µm	0.4 to 0.5

Item B



DOUBLE-PLATE CLUTCH FLYWHEEL

Dimensions		
Removal of material from driven plate support plane and clutch cover, shown by the "S", dimension must be	S mm (in)	0.2 max (0.01)
Tolerances		
Maximum parallelism error between driven plate support plane and clutch shaft connection plane	// mm (in)	0.06 (0.0024)
Roughness of driven plate support plane	√ µm	0.4 to 0.5



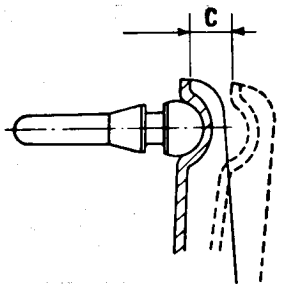
Item A

CLUTCH

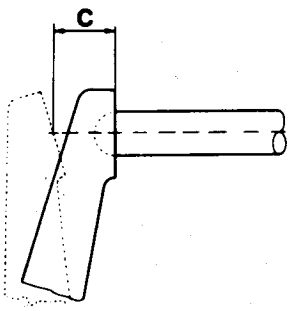
DIMENSIONS (1)		
Pressure plate-flywheel static balancing (max out-of balance allowed)	g·cm (in·lb)	10 (0.0086)

Operating cylinder pushrod travel

Single-plate clutch with "pushed" diaphragm spring:
C = 11 to 12.7 mm
(0.443 to 0.5 in)



Single-plate clutch with "drawn" diaphragm spring:
C = 12.5 mm
(0.49 in)



(1) Dimensions applicable to all versions with single-plate clutch

TIGHTENING TORQUES [N·m (Kg·m; ft·lb)]

Application \ Clutch type	Single-plate with "pushed" diaphragm spring	Single-plate with "drawn" diaphragm spring	Double-plate
Screws securing propeller shaft coupling to clutch shaft fork	39 to 49 (4 to 5 28.9 to 36)	55 to 57 (5.6 to 5.8 40.5 to 41.9)	55 to 57 (5.6 to 5.8 40.5 to 41.9)
Screws securing pressure plate to clutch flywheel	13 to 16 (1.3 to 1.6 9.4 to 11.6)	13 to 16 (1.3 to 1.6 9.4 to 11.6)	18 to 22 (1.8 to 2.2 13 to 15.9)
Screws securing clutch shaft to flywheel (for sealant compounds refer to: "Sealants")	27 to 31 (2.7 to 3.2 19.5 to 23.1)	27 to 31 (2.7 to 3.2 19.5 to 23.1)	27 to 31 (2.7 to 3.2 19.5 to 23.1)
Nut securing propeller shaft connecting fork to clutch shaft	93 to 103 (9.5 to 10.5 68.7 to 75.9)	93 to 103 (9.5 to 10.5 68.7 to 75.9)	93 to 103 (9.5 to 10.5 68.7 to 75.9)
Screws securing clutch unit to differential-speed gear unit.	29 to 32 (2.9 to 3.3 21 to 23.9)	29 to 32 (2.9 to 3.3 21 to 23.9)	29 to 32 2.9 to 3.3 21 to 23.9)
Hydraulic system pipe unions: Hoses	10 to 15 (1 to 1.5 7.2 to 10.8)	10 to 15 (1 to 1.5 7.2 to 10.8)	10 to 15 (1 to 1.5 7.2 to 10.8)
Pipes	8 to 10 (0.8 to 1 5.8 to 7.2)	8 to 10 (0.8 to 1 5.8 to 7.2)	8 to 10 (0.8 to 1 5.8 to 7.2)
Screws securing speed gear-differential unit to lateral support small block	18.6 to 23.5 (1.9 to 2.4 13.7 to 17.3)	18.6 to 23.5 (1.9 to 2.4 13.7 to 17.3)	18.6 to 23.5 (1.9 to 2.4 13.7 to 17.3)

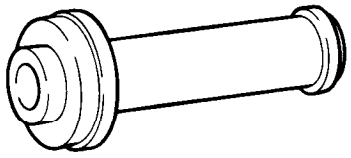
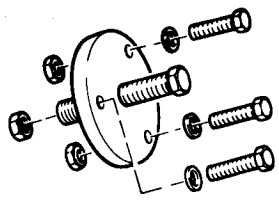
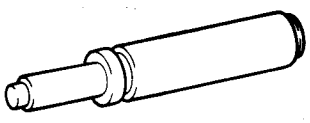
TROUBLE DIAGNOSIS AND CORRECTIVE ACTION

Condition	Probable cause	Corrective action
Clutch slips Symptoms: – Vehicle does not respond to engine speed when accelerating	Some trouble symptoms can be also due to engine malfunctions. First of all, determine whether trouble is caused by engine or clutch. Proceed as follows to test clutch slipping: – engage parking brake – disengage clutch and change to 4th speed – accelerate, then gradually release clutch pedal: if car does not move and engine does not stop, clutch is slipping	
– Wheel power insufficient when uphill driving	• Clutch plate gaskets too worn	Replace clutch plate
– Abnormal increase of fuel consumption	• Oil or grease present on gaskets	Replace clutch plate (if faulty, replace oil seal ring of main shaft).
	• Diaphragm spring damaged or worn condition in correspondance with thrust bearing support area	Replace pressure plate cover
	• Flywheel or pressure plate deformed	Repair or replace flywheel a/o pressure plate
	• Pushrod of clutch operating cylinder does not return to initial position: Operating cylinder piston or master cylinder piston seized	Overhaul operating cylinder or master cylinder
Clutch can not be easily disengaged Symptoms: Noise when changing speed (especially in low gear ratio)	Proceed as follows to check clutch disengagement: – disengage clutch and change to Reverse speed – change to Neutral and accelerate progressively, keeping clutch pedal depressed – after a short interval, change to Reverse speed If noise is heard when changing speed, clutch is dragging.	
	• Wear or rust on splined section of clutch plate hub.	Clean or replace clutch plate hub.
	• Oil leaks from master cylinder, operating cylinder and hydraulic system	Replace faulty components
	• Air in the hydraulic system	Bleed air
	• Pedal travel insufficient	Adjust travel
	• Operating cylinder inefficient	Overhaul or replace operating cylinder
	• Master cylinder inefficient	Overhaul or replace master cylinder

Condition	Probable cause	Corrective action
Clutch can not be easilydisengaged (continue)	• Clutch plate deformed or eccentric	Replace clutch plate
	• Diaphragm spring fatigued	Replace diaphragm spring
	• Oil in clutch plate gaskets	Replace clutch plate (if faulty, replace oil seal ring of main shaft)
Clutch chatters	• Clutch plate gaskets vitrified due to overheating	Replace clutch plate
Symptoms:	• Oil or grease on clutch plate gaskets	Replace clutch plate
Clutch pedal chatters when vehicle is started and clutch still partially engaged	• Clutch plate gaskets deformed	Replace clutch plate
	• Flywheel working surface worn or deformed	Repair or replace flywheel
	• Pressure plate working surface worn or deformed	Replace pressure plate
	• Gaskets rivets loose	Replace clutch plate
	• Rubber supports of clutch-speed gear-differential unit loose or deteriorated	Secure or replace supports
	• Diaphragm spring fatigued	Replace pressure plate
	• Clutch shaft bearings damaged	Replace bearings
Noisy clutch	• Thrust bearing inusable	Replace thrust bearing
	Noisy disengagement:	
	• Thrust bearing a/o support damaged or not suitably lubricated	Replace or lubricate thrust bearing a/o support
	Noise when clutch is engaged:	
	• Gaskets rivets loose	Replace clutch plate
	• Clutch plate gaskets cracked	Replace clutch plate
	• Clutch plate springs fatigued	Replace clutch plate
	• Clutch shaft bearings damaged	Replace bearings
Clutch jerks	• Oil or grease on clutch plate gaskets	Replace clutch plate (if faulty, replace main shaft oil seal ring).

Condition	Probalde cause	Corrective action
Clutch jerks (continue) Symptoms: – Vehicle does not start smoothly	• Gaskets worn or rivets loose	Replace clutch plate
	• Wear or rust on direct drive shaft a/o clutch plate splined sections	Clean or replace (according to requirements) the direct drive shaft a/o clutch plate.
	• Flywheel a/o pressure plate friction surfaces worn or deformed	Repair or replace flywheel a/o clutch cover.
	• Supports of clutch-speed gear-differential unit loose or deteriorated	Secure or replace supports

SPECIAL SERVICE TOOLS

Tool P.M.	Name		Page Ref
A.3.0282	Driver for rear bearing		12-19 12-25
A.3.0405	Driver for centering bush on flywheel-clutch shaft		12-20 12-26
A.3.0477	Puller for propeller shaft connecting fork (for single-plate clutch with "pushed" diaphragm spring)		12-16
A.3.0600	Puller for propeller shaft connecting fork (for single-plate clutch with "drawn" diaphragm spring and for double-plate clutch)		12-22 12-28
A.4.0205	Tool for clutch plate centering		12-21 12-27 12-30 12-31

GROUP 12

INDEX

12

DESCRIPTION

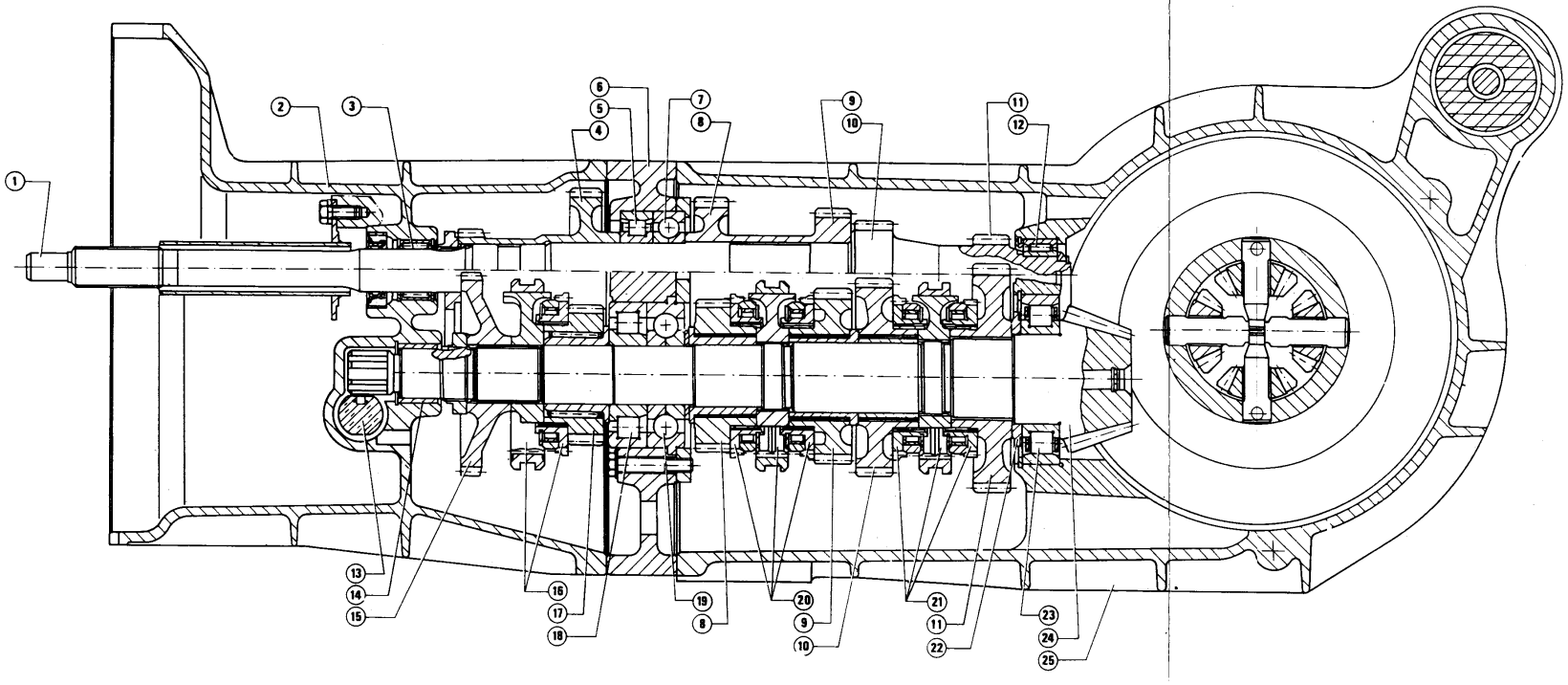
- The speed gear is of the "mechanical type" with 5 speeds plus reverse and is part of a mechanical assembly including also the clutch and differential units.
  Mamely, the front part includes the clutch unit with thrust bearing and control fork, and supports the ends of both main and pinion shafts.
  The intermediate part is composed of a flange on which speed gear shafts with the related forks and rods for speed selection and engagement are supported and secured. This part constitutes a compact assembly which can be easily removed from rear part which, on its turn, supports the ends of speed gear shafts, acts as differential-speed gear casing, and contains the differential system.
- Speed change takes place via a central floor lever connected to gearbox through a speed control lever and a linkage of "isostatic type".
  This type of linkage allows a very smooth speed change to be obtained preventing the slightest sticking.
  The isostatic control makes use of two levers: one for the speed selection and the other for the speed engagement, both housed on gearbox.

The first lever, through tie rod and bracket, controls the rotation of speed selector rod around its axis, thus allowing speed selection to be obtained.
The second lever permits the longitudinal movements of speed selector rod, thus determining the engaging of the previously selected speeds.

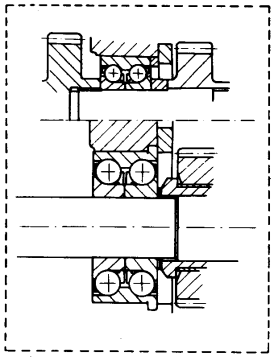
- The forward speeds gears, in constant mesh, are helical-toothed to guarantee the utmost quietness and are fitted with synchronizers operated by sleeves.
- The reverse gears are straight toothed. Engagement takes place through the movement of a sliding gear which transmits the rotation of main shaft gear to that of pinion shaft thus causing motion reversal.
- The sleeves movement takes place through forks operated by the speed selector rods. The rods slide on a flange inside which are located the positioning devices and some interlock plungers having the purpose of preventing the simultaneous engagement of several speeds.
  Another safety device for the reverse speed is secured on the clutch speed gear casing; it has the purpose of preventing the accidental transition from 5th speed to reverse.The synchronizers, via friction action, cause the driven gear and coupling sleeve to assume same speed. This ease final coupling which causes the mating of coupling toothing between sleeve and driven gear.
  In detail, the synchronizers of 2nd, 3rd, 4th and 5th speed, are fitted with two equal retainers: one used to gear down and the other to gear up, with a guide sector and a locking sector. The 1st speed synchronizer, in addition to the conventional retainer for the transition from the 2nd to 1st speed, and the guide and locking sectors, is fitted with another retainer for the transition from the neutral to the first speed, with spring, two plates and a pawl.
  This solution allows a very smooth engagement of 1st speed to be obtained; infact, in the event of sticking of sleeve toothing on gear front toothing, the spring is compressed and permits the gears to perform a slight rotation and then, a correct mating.

NOTE:
On certain models (See Unit 00 - Use of Units in the Car), a modified pinion underhead bearing, without retainer ring, is now assembled.
The two types of bearing are not interchangeable.

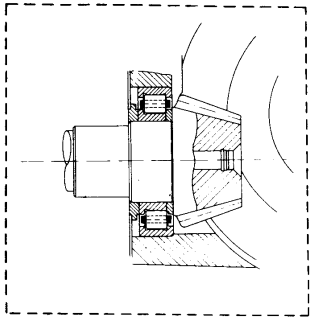
Solution with intermediate roller-ball compound bearings



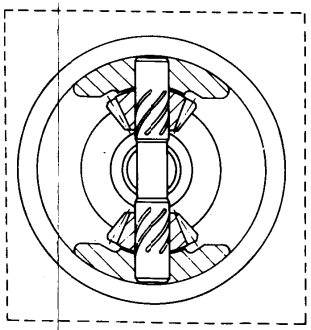
1 Main shaft
2 Clutch-speed gear casing
3 Main shaft support front needle bearing
4 5th and reverse speeds gear
5 Main shaft intermediate roller bearing
6 Intermediate flange
7 Main shaft intermediate ball bearing
8 4th speed gear
9 3rd speed gear
10 2nd speed gear
11 1st speed gear
12 Main shaft support rear needle bearing
13 Electronic odometer socket
14 Pinion shaft support front bush
15 Reverse speed gear
16 5th speed synchronizers
17 5th speed gear
18 Pinion shaft intermediate roller bearing
19 Pinion shaft intermediate ball bearing
20 3rd and 4th speeds synchronizers
21 1st and 2nd speeds synchronizers
22 Ring nut for pinion shaft rear roller bearing
23 Pinion shaft rear roller bearing
24 Pinion shaft
25 Differential-speed gear casing



Solution with intermediate skew ball bearings



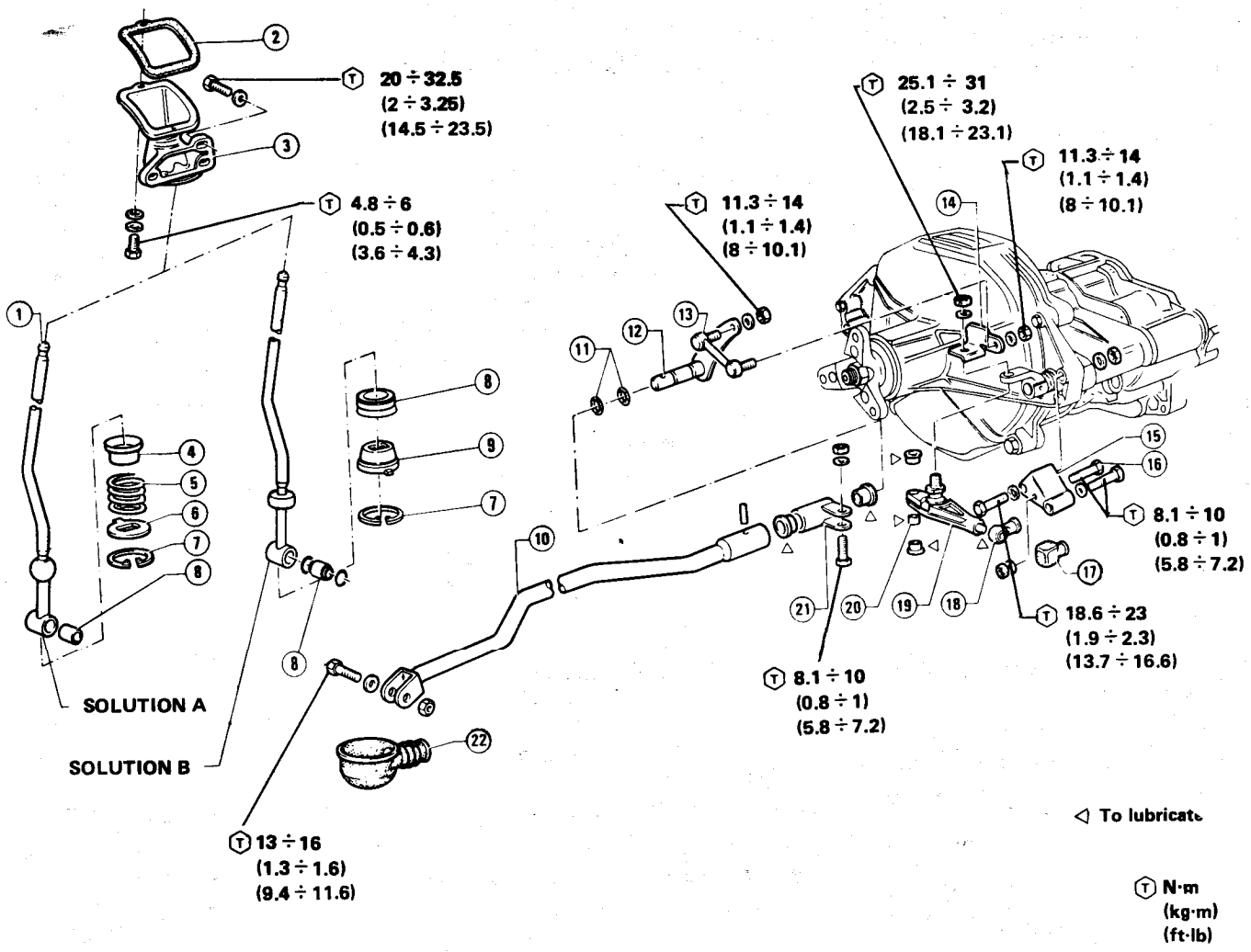
Pinion bearing, modified



Two-side pinion differential

OUTER LINKAGE

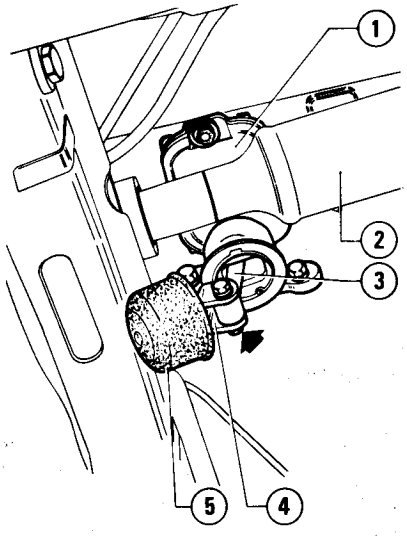
SPEED GEAR CONTROL ASSEMBLY



1 Speed gear control lever
2 Gasket
3 Speed gear control lever support
4 Cup
5 Spring
6 Plate
7 Retaining ring
8 Bush
9 Spacer
10 Speed gear control outer rod
11 O-Rings
12 Speed transmission and selection lever
13 Speed selection tie rod
14 Bracket
15 Securing bracket
16 Bolt securing bracket to speed gear rubber pad
17 Guard
18 Pin with bush for speed transmission and engagement lever
19 Speed transmission and engagement lever
20 Bush
21 Bush for speed transmission and selection lever
22 Boot

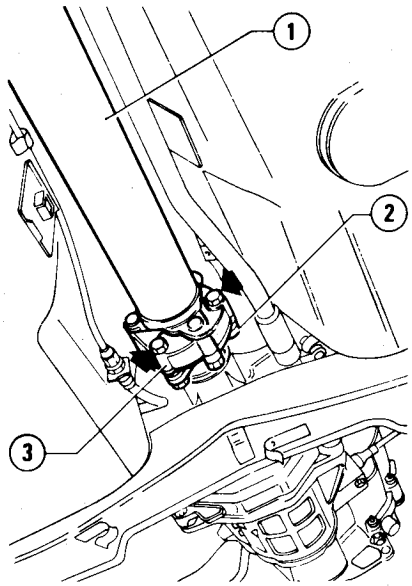
REMOVAL

1. Set vehicle on lift, remove front and central element of exhaust pipe (Refer to: Group 04 - "Exhaust system - Removal" of the "WORKSHOP MANUAL - Engines").
2. Move boot (5) and detach rod (4) from the related lever (3) by unscrewing the securing bolt. Recover boot.



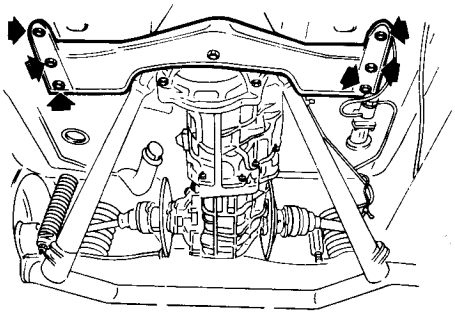
1 Speed gear control lever support
2 Propeller shaft
3 Speed gear control lever
4 Speed control rod
5 Boot

3. Detach propeller shaft (1) by unscrewing the three bolts securing rubber pad (3) to flange (2).

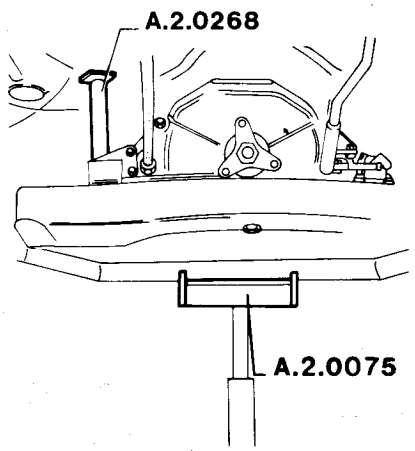


1 Propeller shaft
2 Flywheel-clutch shaft flange
3 Rubber pad

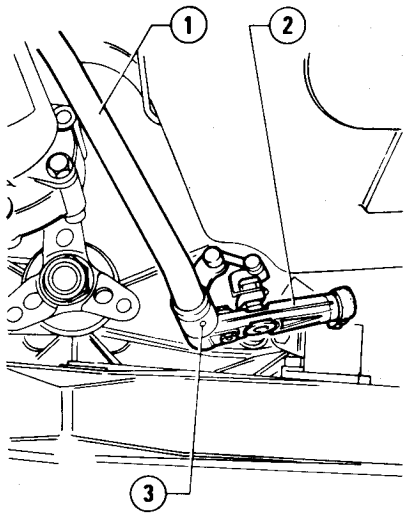
4. Unscrew the six screws securing axle front cross member to body.



5. By means of a column lift fitted with support **A.2.0075**, operate on the De Dion axle in order to lower cross member together with clutch-speed gear-differential unit and then, interpose spacer **A.2.0268** between one arm of axle and body.

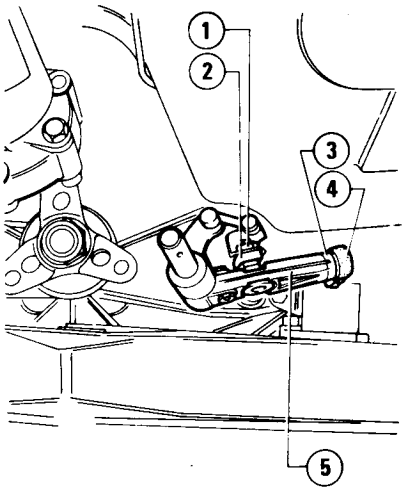


6. Withdraw pin (3) and remove rod (1) separating it from lever (2).

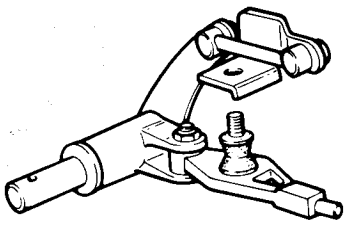


1 Speed control rod
2 Speed transmission and engagement lever
3 Connection pin

7. Unscrew and remove nut (1) securing lever (5) to lever (2) on speed selection and engagement lever.
Release the speed transmission and engagement lever from lever (2) and remove it by withdrawing pin (3) of lever (5) from boot (4) inner ball joint.



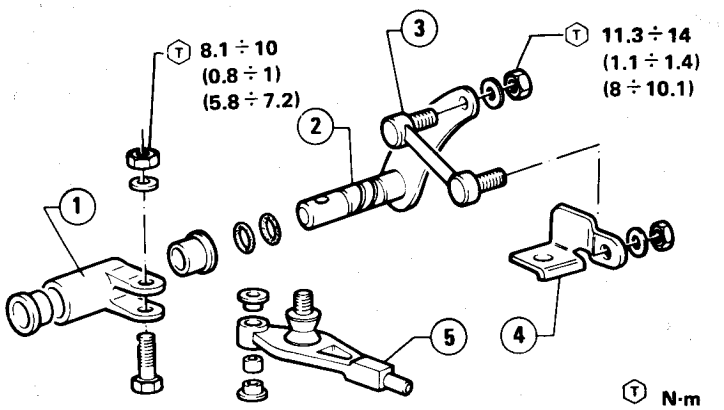
1 Nut securing speed transmission and engagement lever to rear lever
2 Rear lever on speed selection and engagement rod
3 Pin for speed transmission and engagement lever
4 Boot
5 Speed transmission and engagement lever



CHECKS AND INSPECTIONS

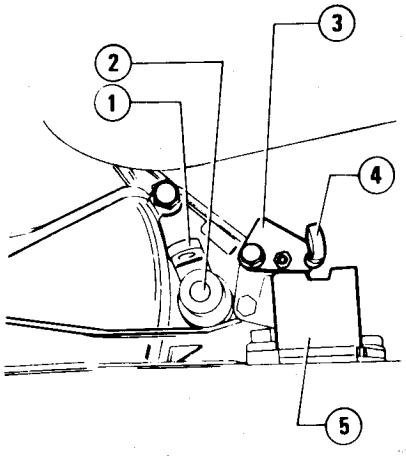
1. Clean the metal items of outer linkage with alcohol and verify they are in good conditions.
2. Check wear degree of bushes on linkage articulated joints.
3. Check ball joints of speed transmission and engagement lever and of speed selection tie rod. Replace them in the event of excessive clearance or seizing.
4. Check that rubber boot is in good conditions. Replace it if worn or damaged.
5. If required, disassemble the isostatic control assembly as shown in the figure.

- **O-Rings must be replaced at each disassembly.**
- **Reassemble the unit tightening screws and nuts to the prescribed torque shown in the figure.**



1 Bush for speed transmission and selection lever
2 Speed transmission and selection lever
3 Speed selection tie rod
4 Bracket
5 Speed transmission and engagement lever

6. If required, unscrew the two bolts securing bracket (3) to clutch - speed gear - differential unit and to rubber pad (5). Remove the bracket.



1 Rear lever speed selection and engagement rod
2 Speed selection and engagement rod
3 Securing bracket
4 Isostatic control articulated joint
5 Rubber pad

INSTALLATION

For the installation, reverse the order of removal and comply with the following. Refer to figure of page 13-5.

1. Lubricate the below items with the prescribed grease **(Molykote Longterm No. 2)**.

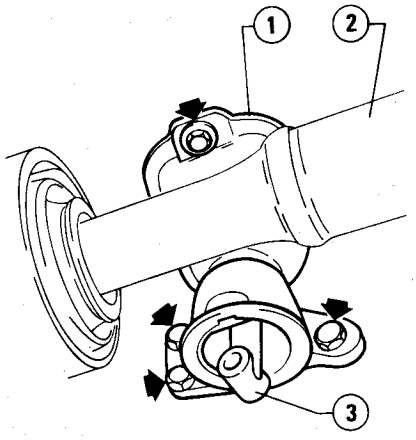
- Bushes for speed transmission and selection lever
- Ball joint for speed transmission and engagement lever
- Innerside of bushes for speed transmission and engagement lever

2. Replace the connecting spring pin with a new one.
3. Tighten screws and bolts to the torques specified in "Service Data and Specifications - Tightening Torques".
4. Check proper functioning of isostatic control.

SPEED GEAR CONTROL LEVER

REMOVAL

1. Operating from passenger compartment inside, withdraw knob of speed gear lever and rubber boot.
2. Carry out steps 1 and 2 of paragraph "Speed Gear Control Assembly - Removal".
3. Unscrew the four screws securing support (1) to body and remove it with lever (3).



1 Speed gear control lever support
2 Propeller shaft
3 Speed gear control lever

DISASSEMBLY

With reference to figure of page 13-5 remove retaining ring (7) by means of suitable pliers, and withdraw plate (6), spring (5), cup (4) and lever (1).

CHECKS AND INSPECTIONS

1. Verify components' good conditions.
2. Verify that spring is not strained.

REASSEMBLY

To reassemble, reverse the order of disassembly taking care to **lubricate** the ball joint of speed gear control lever with the prescribed grease **(ISECO Molykote BR2)**.

INSTALLATION

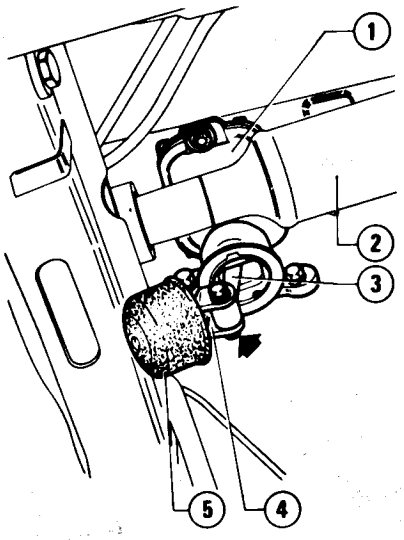
To reinstall lever, reverse the order of removal and comply with the following.
1. Take care when inserting lever into dust cover to prevent damaging it.
2. Tighten screws and bolts to the prescribed torques indicated in "Service Data and Specifications - Tightening Torques".

SPEED CONTROL ROD

REMOVAL AND INSTALLATION

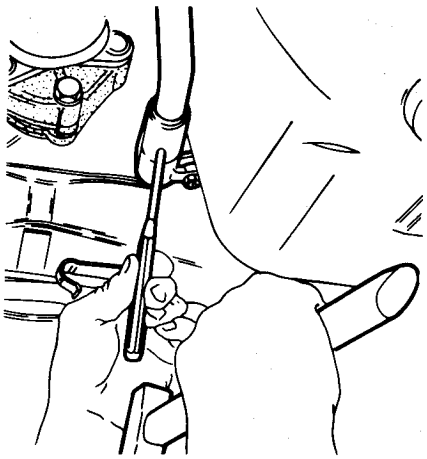
1. Set vehicle on a lift, remove front and central component of exhaust pipe (Refer to: Group 04: "Exhaust system - Removal" of the "WORKSHOP MANUAL - Engines").

2. Move boot (5) and disconnect rod (4) from the related lever (3) by unscrewing the securing bolt. Recover boot.



1 Speed control lever support
2 Propeller shaft
3 Speed control lever
4 Speed control rod
5 Boot

3. By means of a suitable punch, remove the speed control rod securing pin from the speed transmission and selection lever bush; remove rod.



4. Reassemble in reverse order to disassembly operations, replacing the connecting spring pin with a new one.

REMOVAL AND INSTALLATION OF CLUTCH-SPEED GEAR - DIFFERENTIAL UNIT

Refer to Group 17 "Removal and Installation of clutch-speed Gear-Differential Unit".

SEPARATION AND RECONNECTION AT BENCH OF SPEED GEAR UNIT FROM/TO DIFFERENTIAL UNIT

SEPARATION

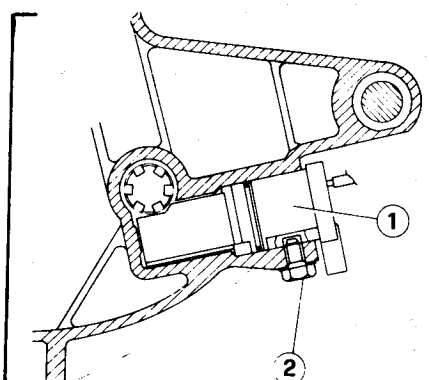
1. Clutch unit separation.

Refer to: Group 12 "Separation and Reconnection at Bench of Clutch Unit from/to speed Gear and Differential Units - Separation".

2. Separation of clutch-speed gear casing.

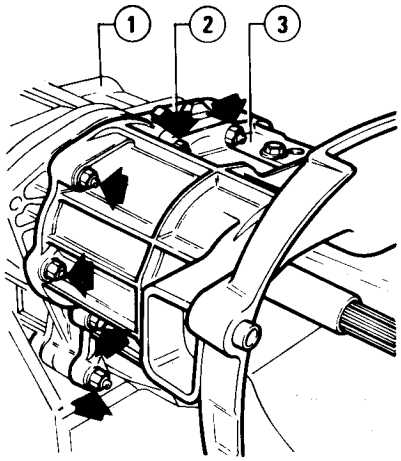
a. Drain the oil from unit, if not already done during unit removal from vehicle.

b. Unscrew the securing screw and remove the odometer electronic pulse transmitter (1).



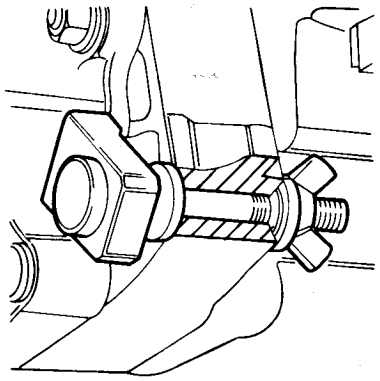
1 Odometer electronic pulse transmitter
2 Transmitter securing screw

c. Loosen and remove the nuts with related washers securing casing (3) to flange (2).



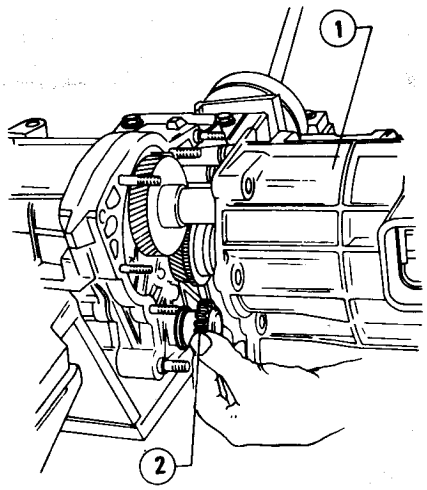
1 Speed gear-differential casing
2 Intermediate flange
3 Speed gear-clutch casing

CAUTION:
The intermediate flange surfaces mating with clutch-speed gear casing and speed gear-differential casing are fitted with sealant.
When removing only the clutch-speed gear casing, the intermediate flange can be secured to the speed gear-differential casing not concerned in the disassembly, by means of suitable clamps.



d. Withdraw casing (1) and, at the same time, recover gear (2).

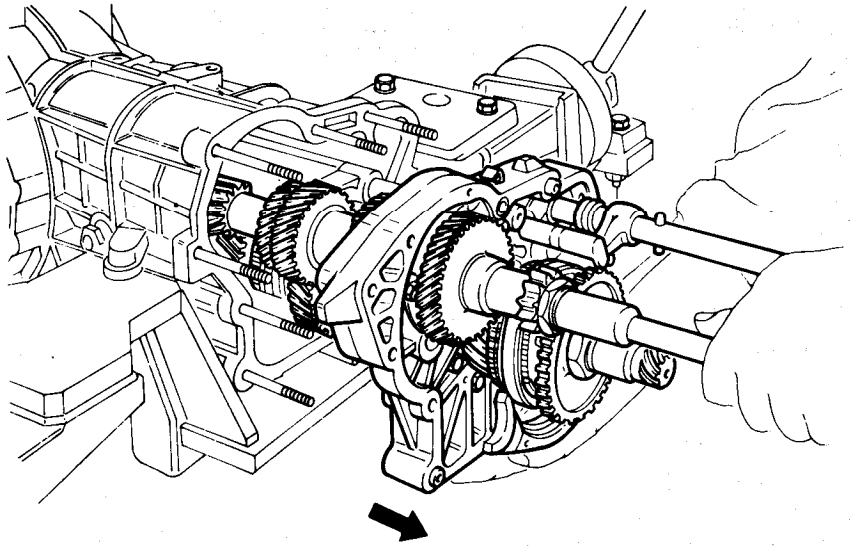
CAUTION:
Take care not to drop the Reverse transmission gear.

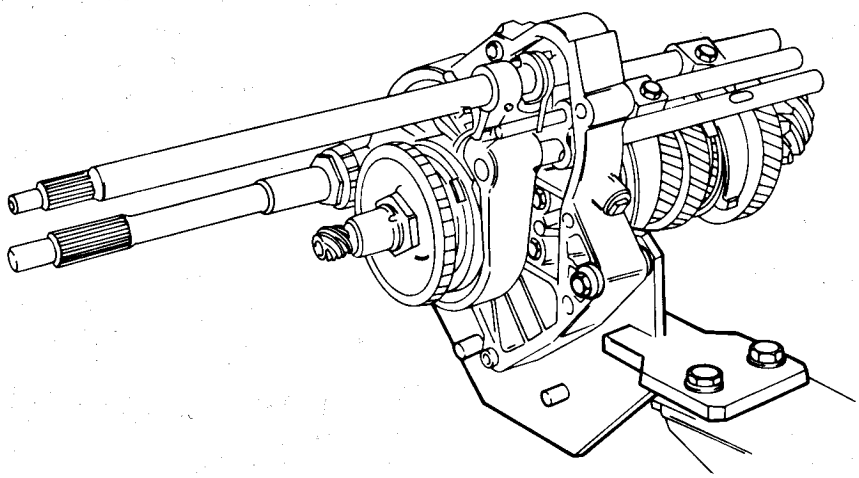


1 Clutch-speed gear casing
2 Reverse sliding gear

3. Intermediate flange positioning on overhaul stand.

a. Withdraw intermediate flange complete with primary and pinion shafts and rods and forks from differential-speed gear casing.
b. Apply the special support to intermediate flange, complete with the related shafts and control devices, then secure flange to an overhaul stand fitted with connection brackets.





RECONNECTION

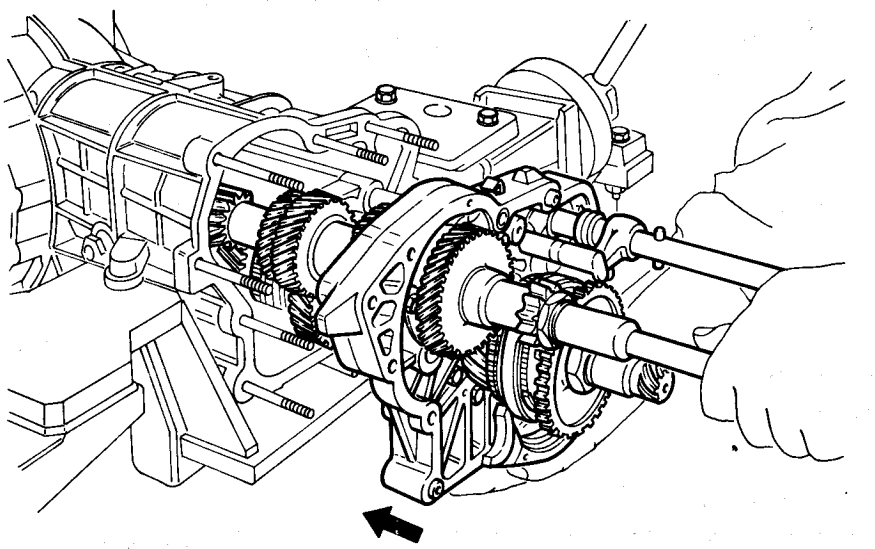
1. Intermediate flange connection to differential-speed gear casing

a. Clean the intermediate flange surfaces mating with clutch-speed gear casing and differential-speed gear casing with denatured ethyl alcohol.

Apply a coat of sealant to the mentioned seal surfaces.

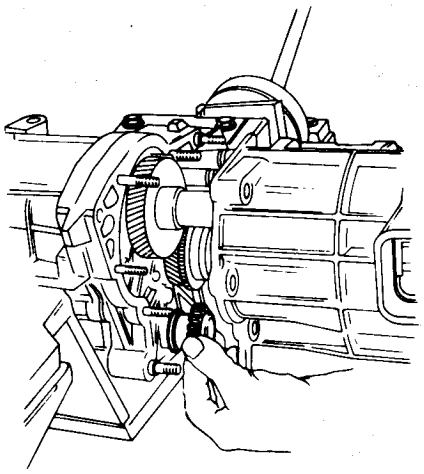
Sealant:
Sealing compound LOWAC Perfect Seal

b. Mount intermediate flange, complete with shafts, rods and forks on differential-speed gear casing.



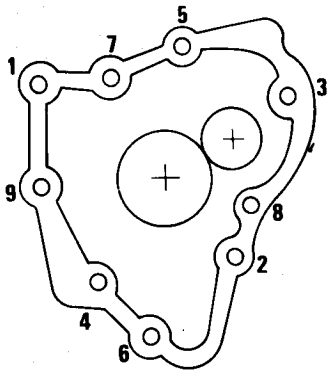
c. **Lubricate** pin of the reverse speed sliding gear housed in the clutch-speed gear casing.

d. Apply the clutch-speed gear casing to intermediate flange taking care to position the reverse speed gear on the 5th and reverse speeds control fork, subsequently centering it in the related pin.

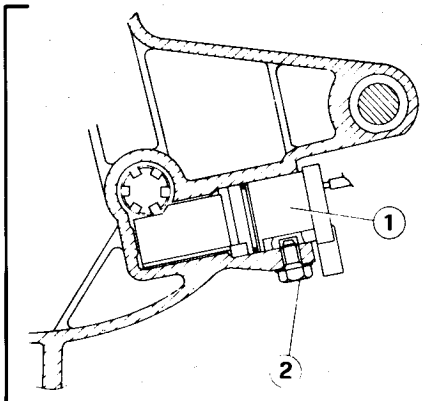


e. Screw the nuts securing clutch-speed gear casing to intermediate flange and tighten them crosswise (refer to figure for the tightening order) to the prescribed torque.

(T): Tightening torque
Nuts securing clutch-speed gear casing to intermediate flange
12 to 13 N·m
(1.2 to 1.4 kg·m)
(8.7 to 10.1 ft·lb)



f. Mount the odometer electronic pulse transmitter and secure it with the suitable screw.



1 Odometer electronic pulse transmitter
2 Transmitter securing screw

2. Clutch unit installation

a. Reconnect clutch unit to differential-speed gear unit (refer to: Group 12 - "Separation and Reconnection at Bench of Clutch Unit from/to speed Gear and Differential Units - Reconnection")

b. Fill the differential-speed gear casing with the prescribed quantity of suggested oil.

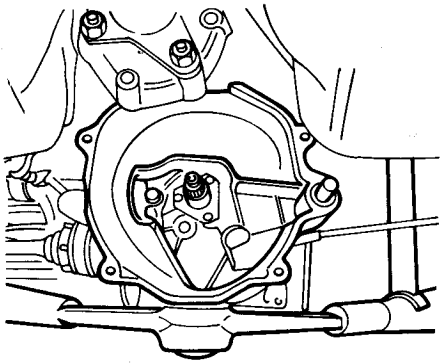
Differential-speed gear refilling

Oil:
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

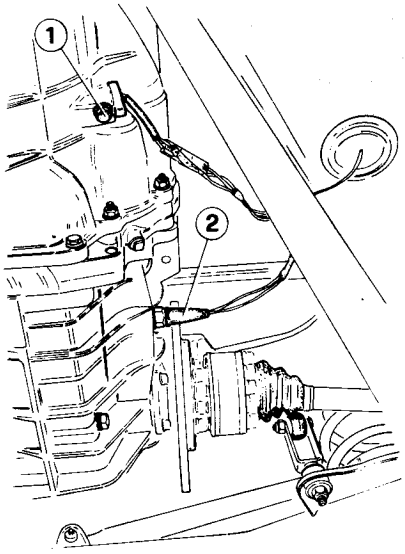
REMOVAL AND INSTALLATION OF SPEED GEAR UNIT (Intervention on vehicle)

REMOVAL

1. Set vehicle on lift and lock front wheels with suitable safety chocks.
2. Raise vehicle and drain oil from differential-speed gear casing.
3. Detach clutch unit (refer to Group 12 - "Clutch Unit Removal and Installation (Intervention on vehicle) Removal")

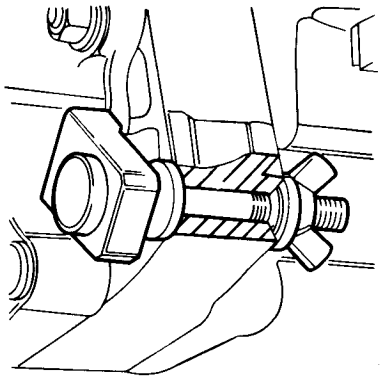


4. Disconnect connection (2), unscrew screw (1) and remove odometer pulse transmitter.



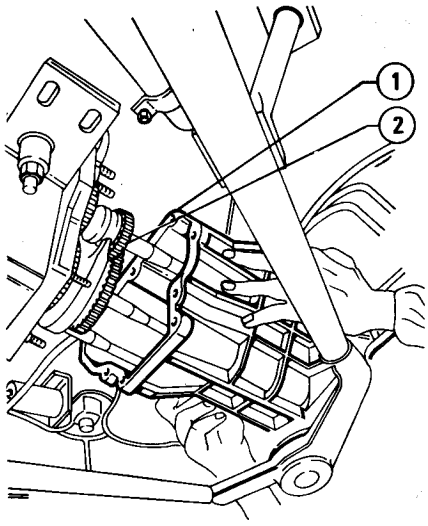
1 Screw securing odometer pulse transmitter to gearbox
2 Connection for reverse lights switch cable

5. By means of suitable clamps, secure intermediate flange to differential-speed gear casing.
Set a column lift under speed gear unit, in the vicinity of intermediate flange, the column lift must be fitted with a support with clamps to secure support itself to gearbox.



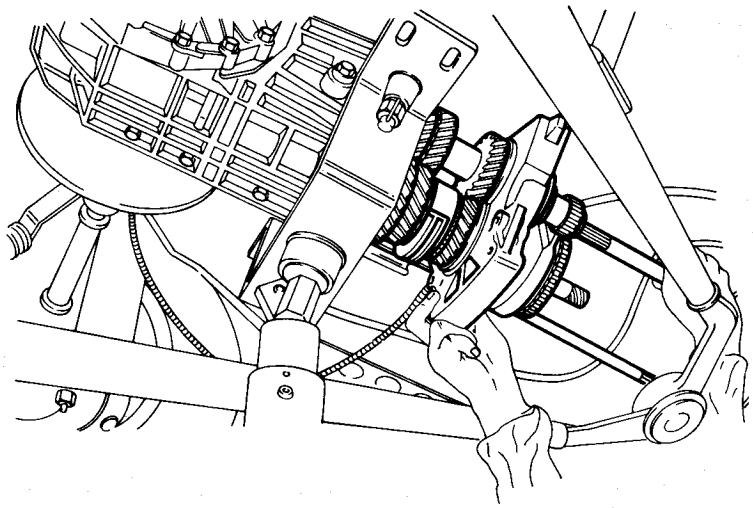
Unscrew screws and nuts connecting clutch-speed gear and differential-speed gear casings.
Remove clutch-speed gear casing (1); if necessary, tap by means of a resin mallet; then recover gear (2).

Take care not to drop the reverse speed transmission gear.



1 Clutch-speed gear casing
2 Reverse speed transmission gear

6. If required, disconnect the intermediate flange previously secured to differential-speed gear casing and remove it, complete with shafts, gears and speed engagement devices.



INSTALLATION

For installation, reverse the order of removal and comply with teh following.

- Clean the flange surfaces mating with differential-speed gear and clutch-speed gear casings with denatured ethyl alcohol, then lay a coat of the prescribed sealant.

Sealant:
Sealing compound LOWAC Perfect Seal

- **Lubricate** clutch fork spherical pin and the thrust bearing seat with the prescribed grease.

Grease:
AGIP Grease 33 FD
IP Autogrease FD

- **Lubricate** the seat of propeller shaft rear joint with 5 cm^3 (0.30 cu.in) of the prescribed grease.

Grease:
ISECO Molykote BR2

- Comply with the following tightening torques

(T): **Tightening torques**
- **Nuts securing clutch-speed gear casing to differential-speed gear casing**

Perform tightening crosswise
12 to 13 N·m
(1.2 to 1.4 kg·m)
(8.7 to 10.1 ft·lb)

- **Screws securing clutch unit to differential-speed gear casing**
29 to 32 N·m
(2.9 to 3.2 kg·m)
(21 to 23.1 ft·lb)
- **Screws securing propeller shaft joint to clutch shaft fork**

Solution with intermediate skew ball bearings
40 to 50 N·m
(4 to 5 kg·m)
(28.9 to 36.1 ft·lb)

Solution with intermediate roller/ball bearings
55 to 57 N·m
(5.6 to 5.8 kg·m)
(40.5 to 41.9 ft·lb)

- **Unions of clutch hydraulic system pipes**
8 to 10 N·m
(0.8 to 1 kg·m)
(5.8 to 7.2 ft·lb)

- **Unions of clutch hydraulic system hoses**
10 to 15 N·m
(1 to 1.5 kg·m)
(7.2 to 10.8 ft·lb)

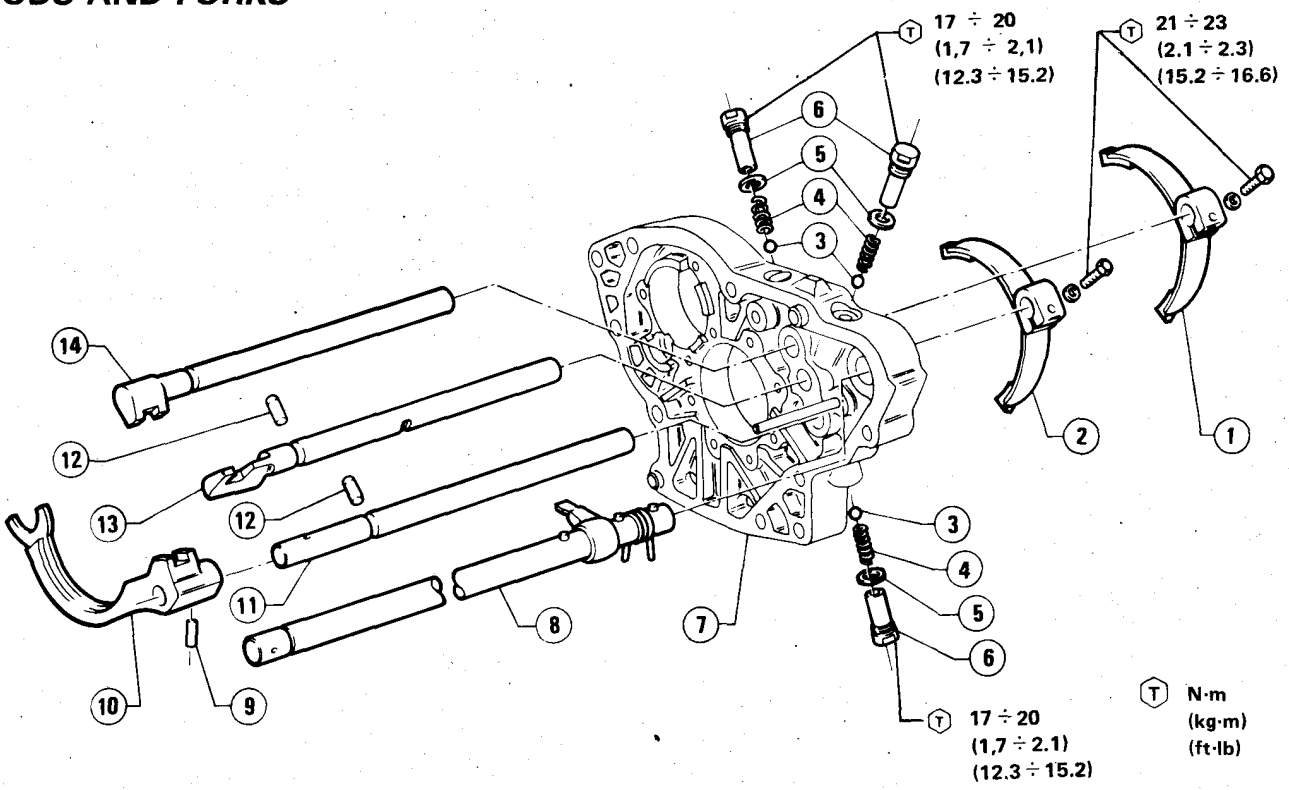
- Refill the differential-speed gear casing with the prescribed oil up to reaching filler hole level.

Oil:
AGIP Rotra SX 75W90
or
IP Pontiax HDS 75W90

- Bleed air from clutch system

OVERHAUL AT BENCH OF SPEED GEAR UNIT

RODS AND FORKS



1 1st - 2nd speeds fork
2 3rd - 4th speeds fork
3 Ball
4 Spring
5 Washer
6 Plug-container
7 Intermediate flange
8 Speed selection and engagement control rod
9 Spring pin
10 5th and reverse speeds fork
11 5th and reverse speeds rod
12 Detent ball
13 3rd and 4th speeds rod
14 1st and 2nd speeds rod

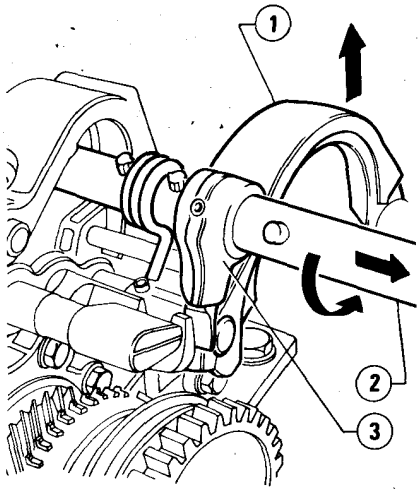
DISASSEMBLY

Set the intermediate flange on an overhaul stand (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential Unit") then disassemble rods and forks operating as follows.

1. Disassembly of speed selection and engagement rod

a. Rotate rod (2) counterclockwise to win reaction of spring thus obtaining the rotation of lever (3) tooth; at the same time rotate counterclockwise fork (1), then withdraw rod (2).

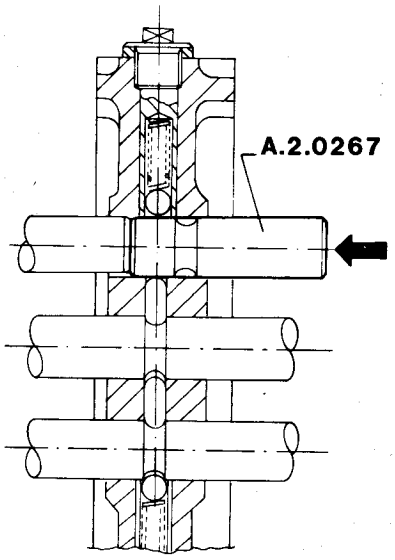
To rotate rod, temporarily insertion is recommended of the related lever with securing pin.

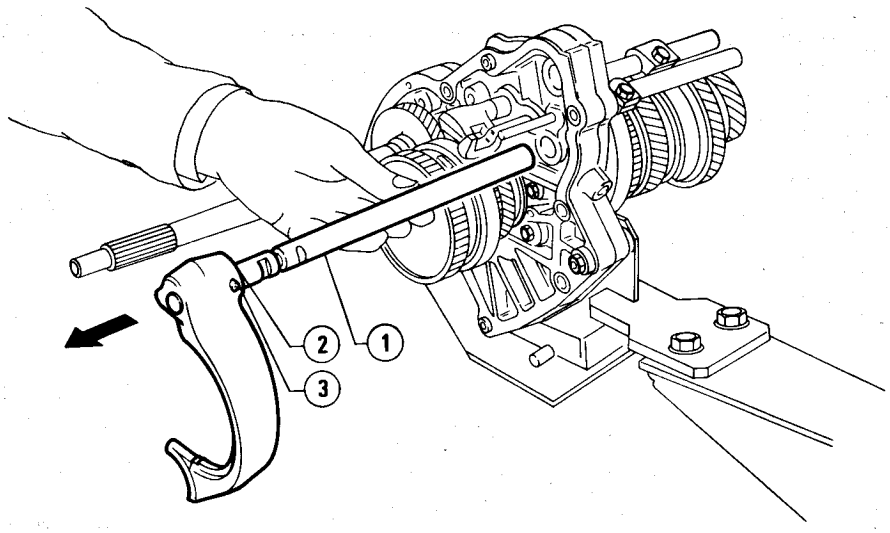


1 5th - Reverse speeds fork
2 Speed selection and engagement lever
3 Speed selection lever

2. Disassembly of speed engagement rods

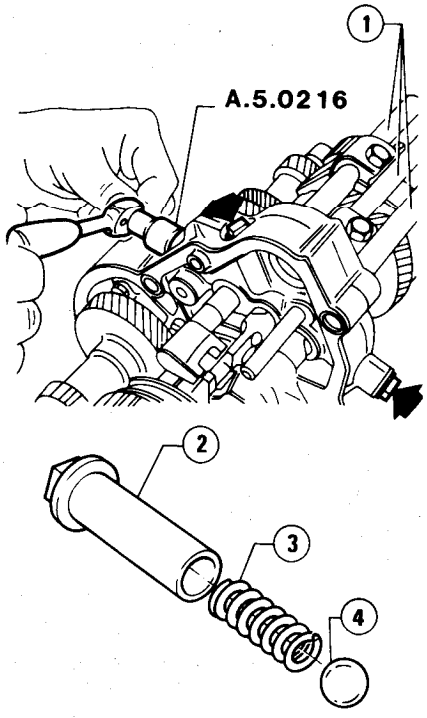
Should removal of one rod only, or no check related to rods detent ball unit and speed engagement interlock plungers be required, interlock plungers must be secured by means of dummy rods A.2.0267 to be inserted, at the same time, at the opposite side with respect to withdrawal of speed engagement rods.





1 5th and Reverse speeds rod
2 5th and Reverse speeds fork
3 Securing pin

a. By means of spanner **A.5.0216**, unscrew and remove the three containers (2), shown in the figure, with the related springs (3) and rods (1) positioning balls (4).

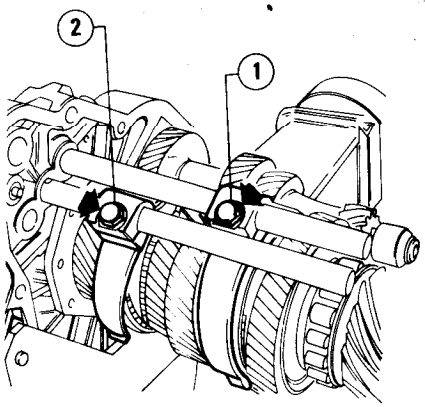


1 Speed engagement rods
2 Container
3 Thrust spring
4 Detent ball

b. Remove rod (1) with fork (2) for 5th and reverse speeds engagement control and, if required, disassemble them by removing pin (3) by means of a punch.

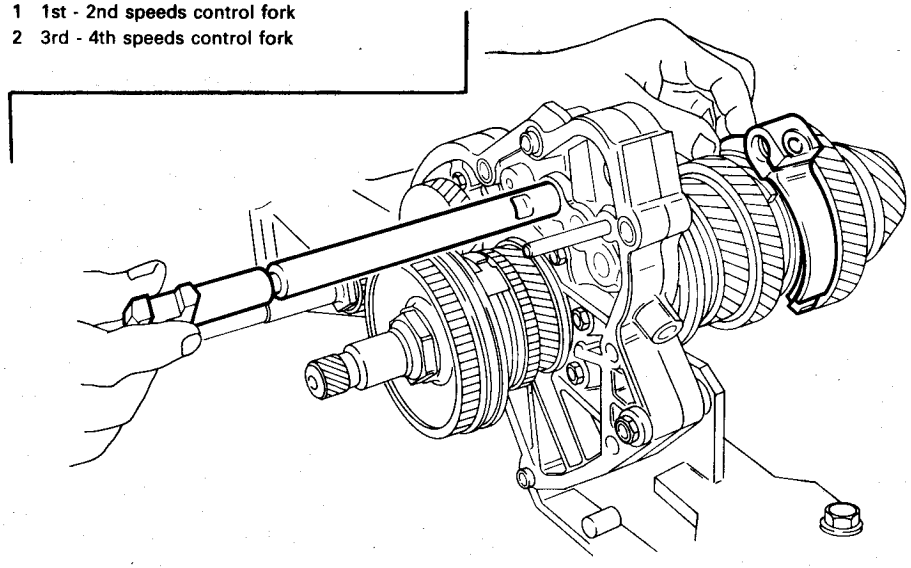
Mark the position related to rod-fork so that correct position can be restored when reassembling.

c. Unscrew and remove the screws securing forks (1) and (2) to the related rods.

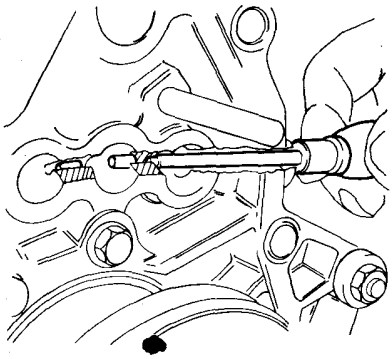


1 1st - 2nd speeds control fork
2 3rd - 4th speeds control fork

d. Withdraw the 1st-2nd speeds engagement control rod and subsequently that related to 3rd-4th speeds engagement control by removing, at the same time, the related forks.



e. Remove the speed engagement interlock plungers from intermediate flange.



CHECKS AND INSPECTIONS

Before carrying out the check-operations, carefully wash the components. This allow the superficial defects, wear degree and efficiency of a few items to be better identified.

1. Springs, balls, pawls.

a. Verify good conditions of rods detent ball thrust springs; in the event of suspected strain, replace them.
If required, check spring stiffness.

Test load

C = 90 to 97.6 N
(9.18 to 9.95 kg)

Unloaded spring length

L = 30.6 mm (1.2 in)

Loaded spring length

L_c = 18.8 mm (0.74 in)

b. Verify that rods detent balls and interlock plungers are free from scratches or seizing.

2. Rods and forks

a. Verify that rods are free from deformations and that no sign of scratch or seizing is present on control rod slots.
b. Verify that speed control forks are not deformed or too worn.
c. Verify that rods slide freely in their seats without excessive clearance.

REASSEMBLY

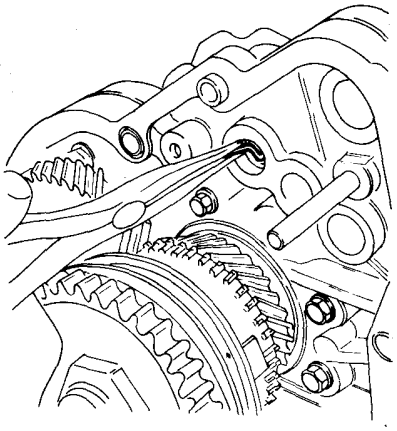
1. Reassembly of speed engagement rods.

a. **Lubricate** the speed engagement interlock plungers with the prescribed grease, then insert them into the related seats on intermediate flange.

Speed engagement and anti-slipping devices

Grease:

AGIP F1 Grease 33 FD
IP Autogrease FD

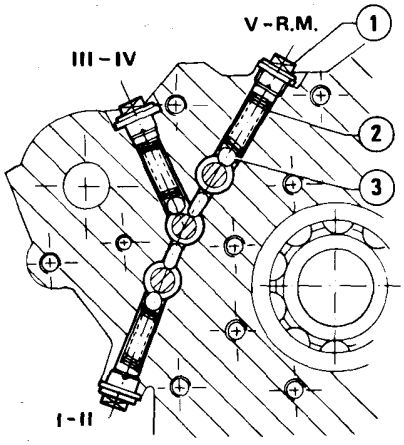


b. Position fork on 1st-2nd speed sleeve. **Lubricate** the working surfaces and insert the related rod into intermediate flange inserting if on fork.
c. Carry out same procedure to reassemble rod and fork of 3rd-4th speed.
d. If previously detached, reconnect 5th. Reverse speeds control fork on the related rod by means of a new pin, then insert the unit into intermediate flange.

When reassembling fork, align the marks carried out during disassembly.

e. **Lubricate** detent balls (3) with the prescribed grease (**Grease: AGIP F1 Grease 33 FD** or **IP Autogrease FD**) then insert them into the related seats on intermediate flange, together with springs (2). Screw plugs (1) and tighten them with spanner **A.5.0216** to the prescribed torque.

(T): **Tightening torque**
Containers securing springs and rods detent balls
17 to 20 N·m
(1.7 to 2.1 kg·m)
(12.3 to 15.2 ft·lb)



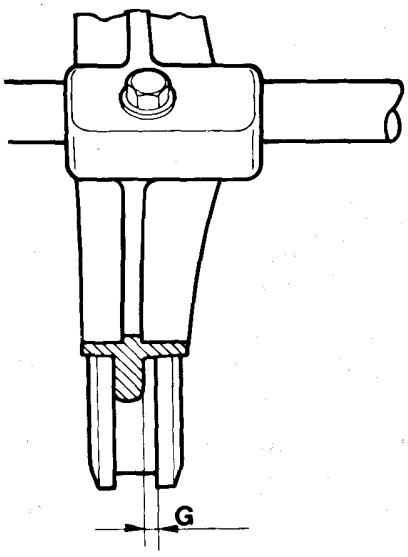
1 Plug
2 Thrust spring
3 Speed engagement rods detent ball

2. Securing of speed engagement forks.

To correctly secure the 1st-2nd and 3rd-4th speeds control forks follow the below procedures.
a. Set speed gear unit to neutral position.
b. Center the synchronizers sleeves, related to the mentioned speeds, on the related hubs and tighten the forks securing screws.
c. Engage the 1st speed, then the 2nd verifying each time that sleeve axial clearance **"G"** is that prescribed.

Sleeve axial clearance

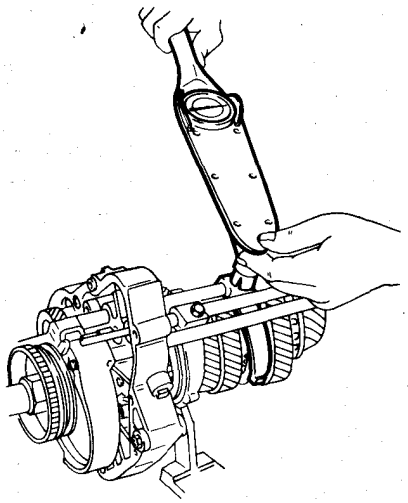
G = 0.7 to 0.9 mm
(0.0275 to 0.0354 in)



d. Repeat same operation for the 4th and 5th speeds.

e. If necessary, carry out the suitable adjustments, then tighten to the prescribed torque.

Ⓣ: **Tightening torque**
Screws securing 1st-2nd and 3rd-4th speeds forks
21 to 23 N·m
(2.1 to 2.3 kg·m)
(15.2 to 16.6 ft·lb)



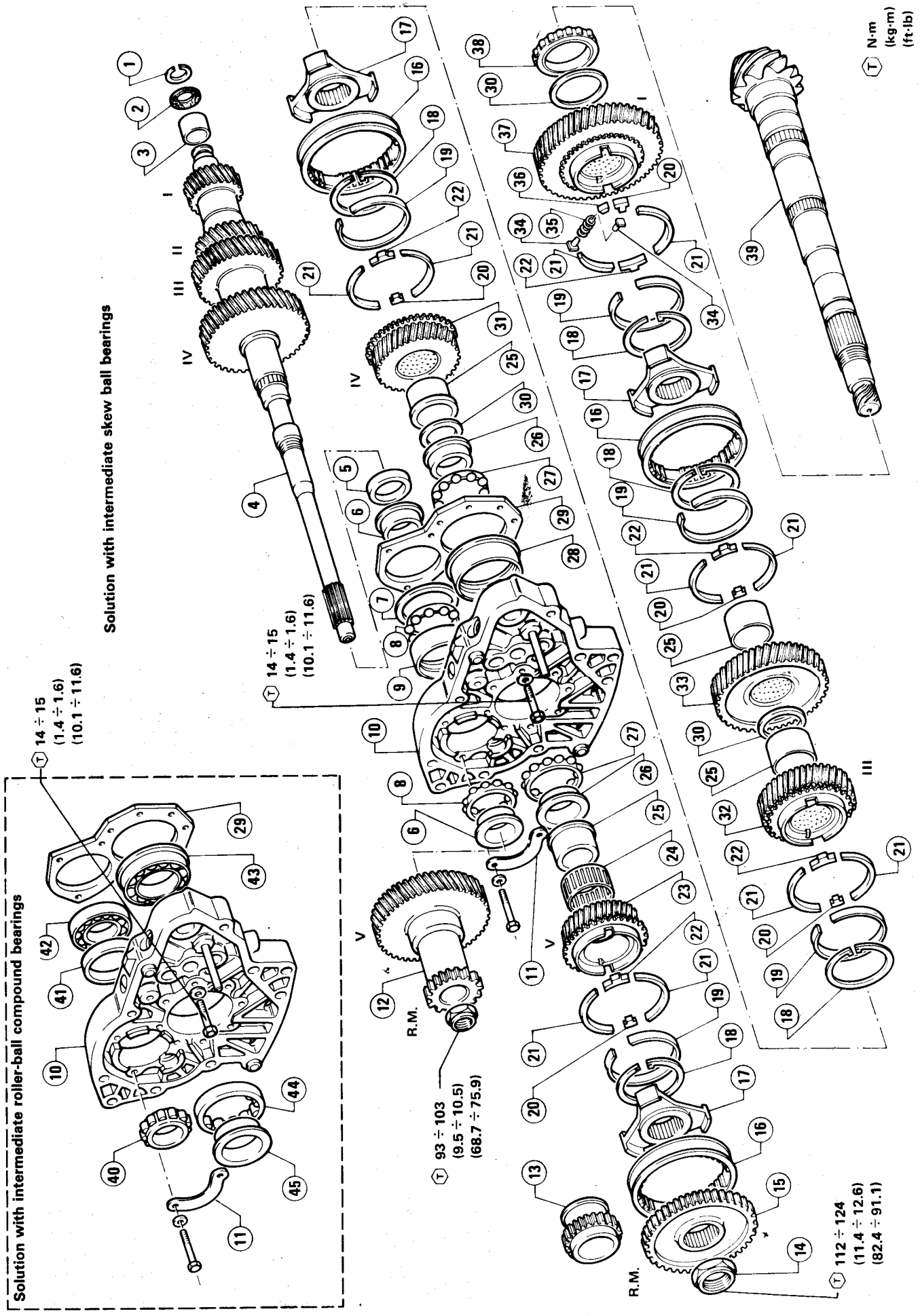
3. Reassembly of speed selection and engagement rod.

Install the speed selection and engagement rod taking care to centre tooth of the related lever on the slots of the speed control devices for 1st-2nd and 3rd-4th speed rods.

Correctly bed the return spring on stud.

SHAFTS AND GEARS

1 Retaining ring
2 Plastic bevel bush
3 Inner ring for main shaft rear needle bearing
4 Main shaft
5 Spacer
6 Inner ring for main shaft intermediate flange bearing
7 Spacer
8 Cage with balls for mainshaft intermediate flange
9 Outer ring for main shaft intermediate flange bearing
10 Intermediate flange
11 Fastener for main shaft intermediate flange bearings outer ring
12 5th and reverse speeds driving gear
13 Reverse speed idle gear
14 Nut
15 Reverse speed driven gear
16 Sleeve
17 Hub
18 Retaining ring
19 Synchronizer ring
20 Guide sector
21 Retainer
22 Locking sector
23 5th speed driven gear
24 Pinion shaft cage with needles
25 Bush
26 Internal ring for pinion shaft intermediate flange bearing
27 Cage with balls for pinion shaft intermediate flange
28 Outer ring for pinion shaft intermediate flange bearing
29 Shoulder plate
30 Shim
31 4th speed driven gear
32 3rd speed drive gear
33 2nd speed driven gear
34 Strikers
35 Spring
36 Pawl
37 1st speed driven gear
38 Pinion shaft roller bearing
39 Pinion shaft
40 Roller bearing for main shatf intermediate flange
41 Outer ring for main shaft intermediate flange roller bearing
42 Main shaft intermediate flange ball bearing
43 Pinion shaft intermediate flange ball bearing
44 Outer ring for pinion shaft intermediate flange roller bearing
45 Inner ring for pinion shaft intermediate flange roller bearing
46 Ring nut


Solution with intermediate skew ball bearings
Solution with intermediate roller-ball compound bearings
T N·m (kg·m) (ft·lb)
T 14 ÷ 15 (1.4 ÷ 1.6) (10.1 ÷ 11.6)
T 93 ÷ 103 (9.5 ÷ 10.5) (68.7 ÷ 75.9)
T 112 ÷ 124 (11.4 ÷ 12.6) (82.4 ÷ 91.1)
R.M.
I
II
III
IV
V

DISASSEMBLY

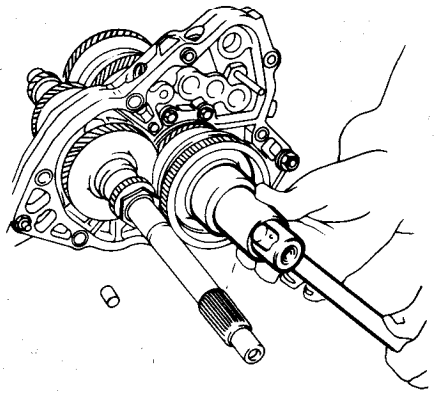
1. Rods and forks disassembly.

Refer to: "Rods and forks - Disassembly".

2. Measurement of pinion shaft dimensions.

Should the speed gear only be overhauled without interventions on differential unit, the "A" dimension must be measured between intermediate flange inner plane and pinion head outer plane.
This measurement is indispensable to restore the initial working conditions of bevel pinion.

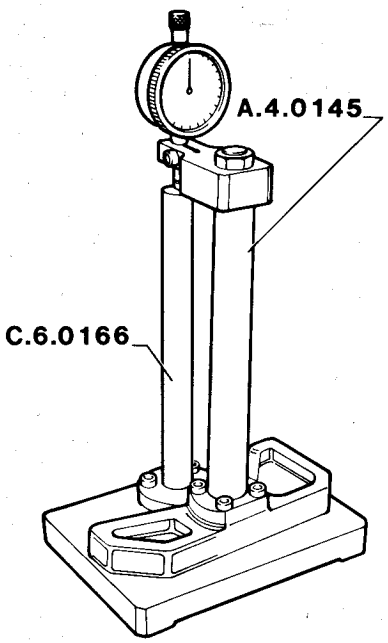
a. Remove the traces of old sealant from intermediate flange planes using denatured ethyl alcohol.
b. Operate on control sleeves related to 1st-2nd and 3rd-4th speeds to engage two speeds in order to block shafts rotation..
c. Remove calking from pinion shaft securing nut, then release pinion shaft.



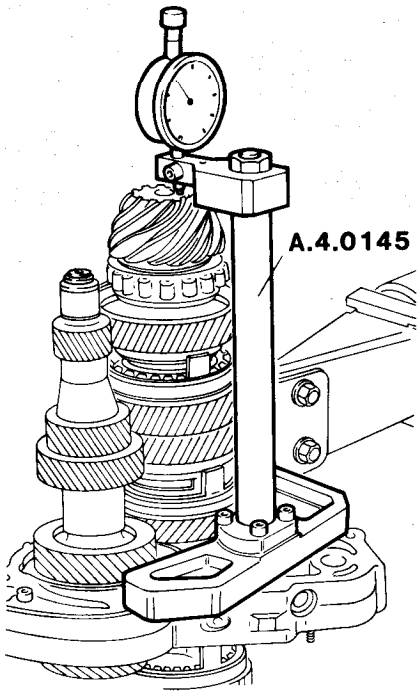
d. Retighten nut to the prescribed torque.

(T): **Tightening torque**
Pinion shaft securing nut
112 to 124 N·m
(11.4 to 12.6 kg·m.)
(82.4 to 91.1 ft·lb)

e. Install a centesimal gauge on support **A.4.0145**, the reset gauge on reference gauge **C.6.0166** to the nominal dimension **"A"**.

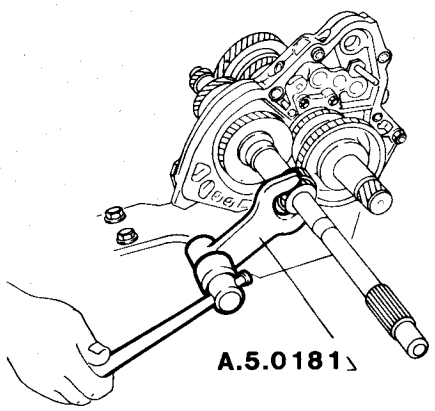


f. Rest the centesimal gauge support on intermediate flange inner plane and gauge probe on pinion head plane.
Measure and note down the read value.

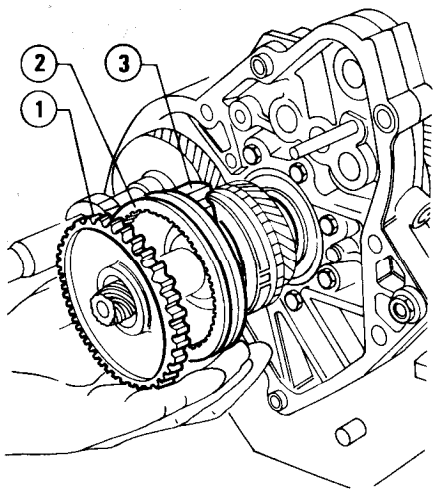


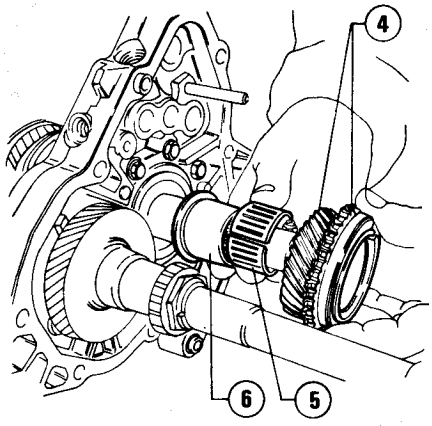
3. Shafts disassembly

a. By means of a suitable spanner, unscrew the pinion shaft securing nut.
b. Remove calking from main shaft securing nut, then release it by means of spanner **A.5.0181**.



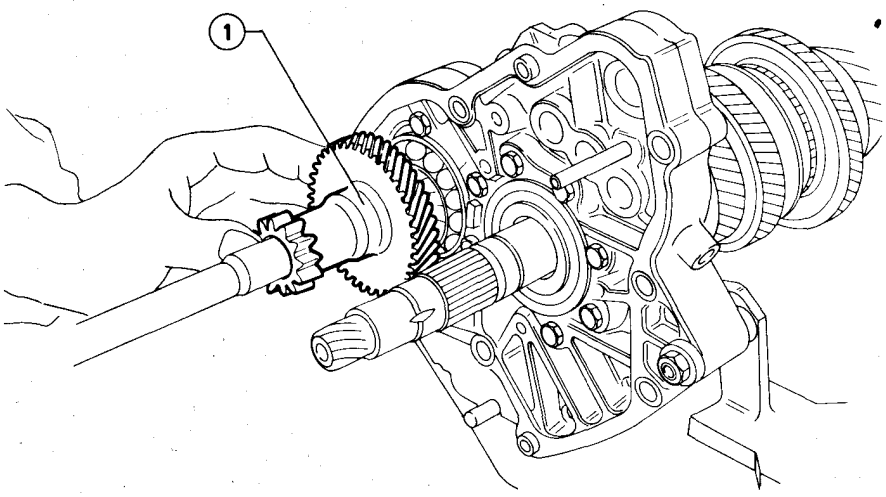
c. Remove the following items from pinion shaft: the nut previously loosened, gear (1), sleeve (2) with the hub (3) located underneath, gear (4), cage (5) with related bush (6).





1 Reverse speed driven gear
2 5th - Reverse speeds sleeve
3 5th - Reverse speeds hub
4 5th speed driven gear
5 Cage with needles for 5th and Reverse speeds
6 5th - Reverse speeds bush

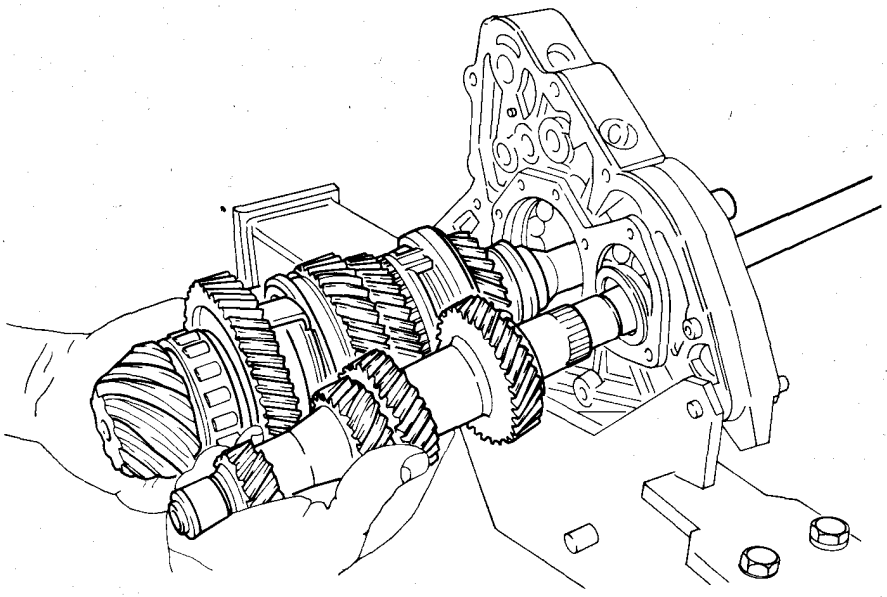
d. Remove the previously loosened nut and gear (1) from main shaft.



1 5th - Reverse speeds driving gear

e. By means of a resin mallet, tap on tangs of main and pinion shafts then withdraw them at the same time from intermediate flange. The rear inner races of intermediate flange ball bearings must be removed at the same time of shafts removal.

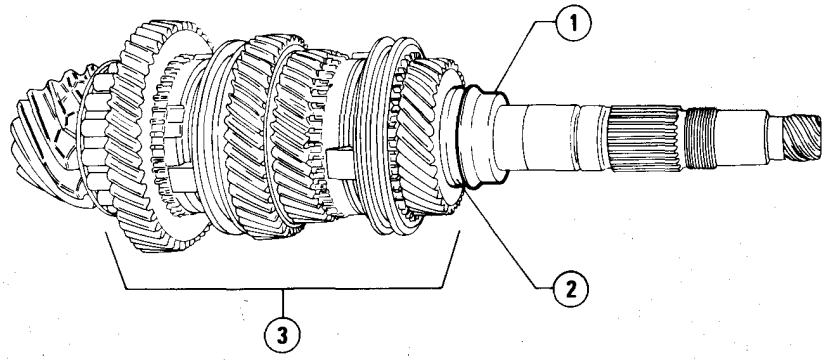
Take care not to drop front inner half-races of bearings.



f. Remove front inner half-races from intermediate flange.

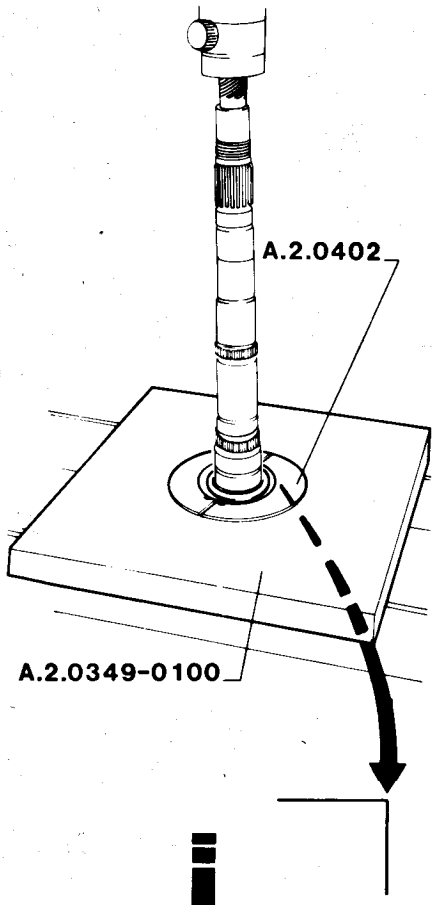
4. Pinion shaft disassembly

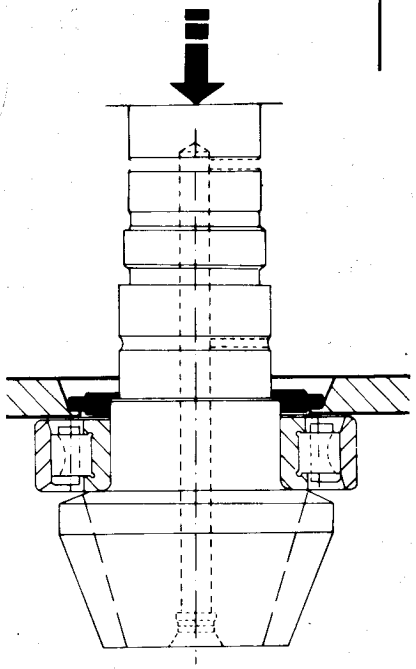
a. Remove inner half-race (1), shim ring (2) and then the whole gear package (3) composing shaft itself from pinion shaft.



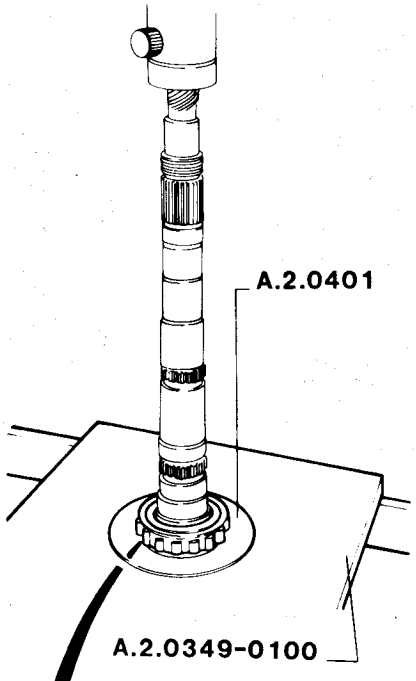
1 Intermediate flange bearing inner half-race
2 Shim ring for pinion-ring bevel gear distance adjustment
3 Driven gear package

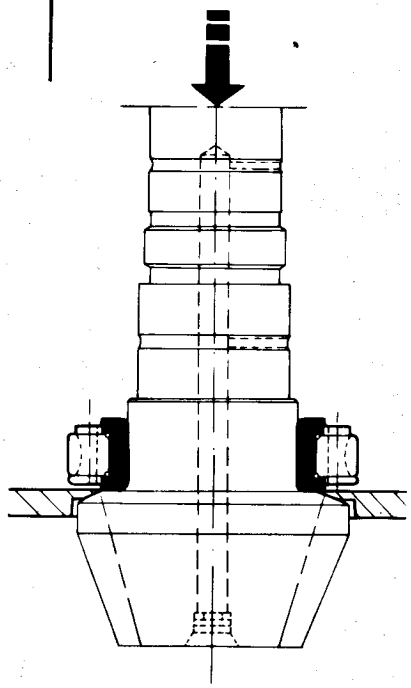
b. Withdraw rear roller bearing ring nut from pinion shaft operating at press and making use of plate **A.2.0349-0100** with tool **A.2.0402.**





c. Withdraw rear roller bearing inner race from pinoin shaft always operating at press with plate **A.2.0349-0100** and tool **A.2.0401.**

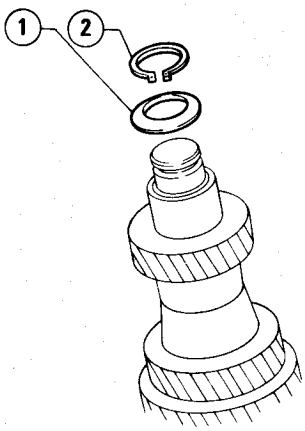




5. Main shaft disassembly

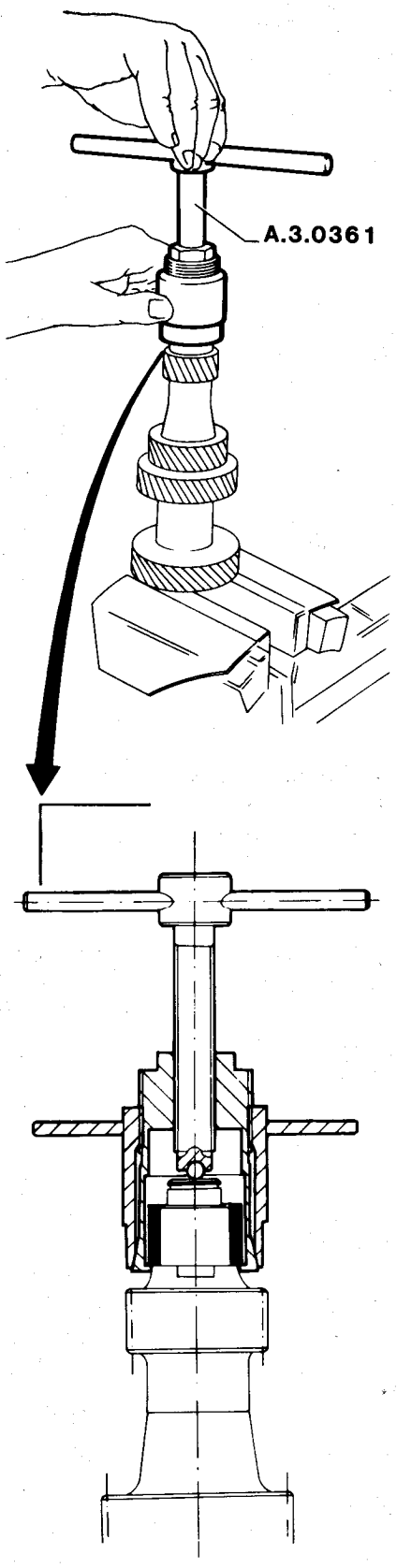
a. Withdraw inner half-race oif intermediate flange bearing from main shaft.

b. Secure main shaft to rice fitted with protective jaws, then remove retaining ring (1) and bush (2).



1 Retaining ring
2 Plastic bevel bush

c. Withdraw inner race of rear needle bearing from main shaft, by means of puller **A.3.0361.**

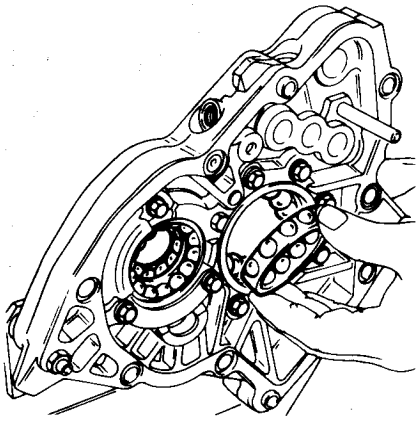


6. Intermediate flange disassembly

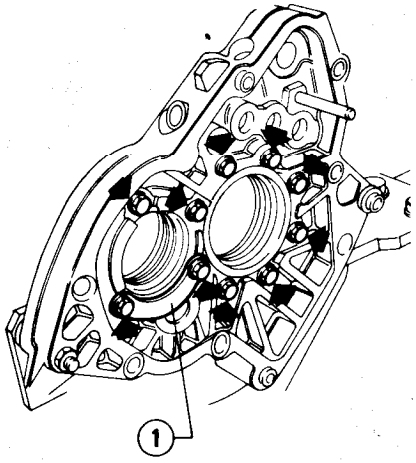
Solution with intermediate skew ball bearings.

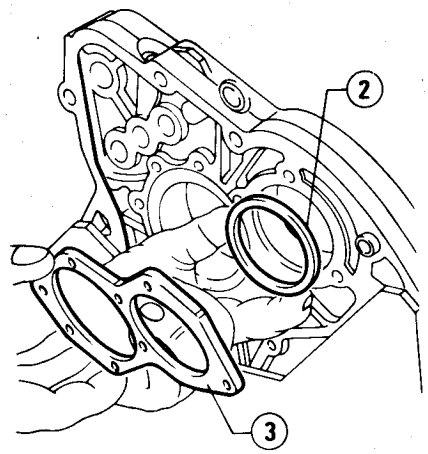
a. Withdraw rolling elements (balls with cages) from outer races of intermediate flange bearings.

CAUTION:
If bearings are not to be replaced, mark them so that original position can be restored during reassembly.



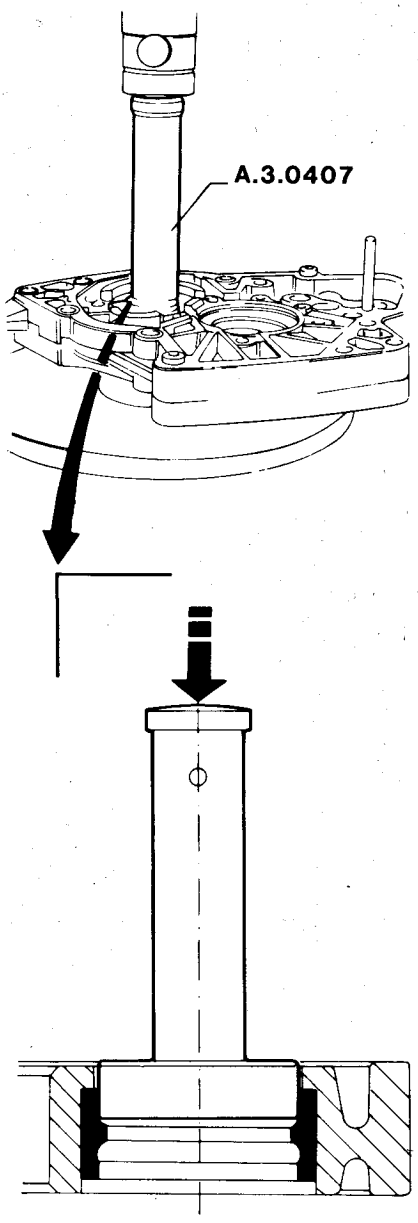
b. Unscrew and remove the screws with related washers securing plate (3) to intermediate flange. Recover clamp (1), plate itself and spacer (2).
Remove intermediate flange from support on overhaul stand.



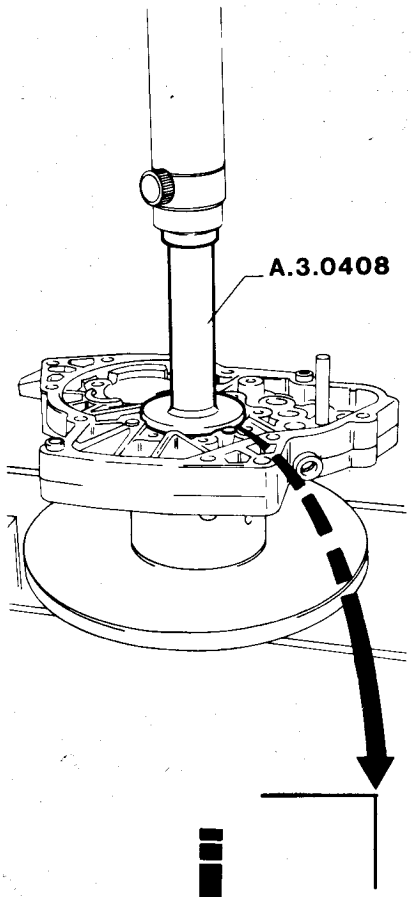


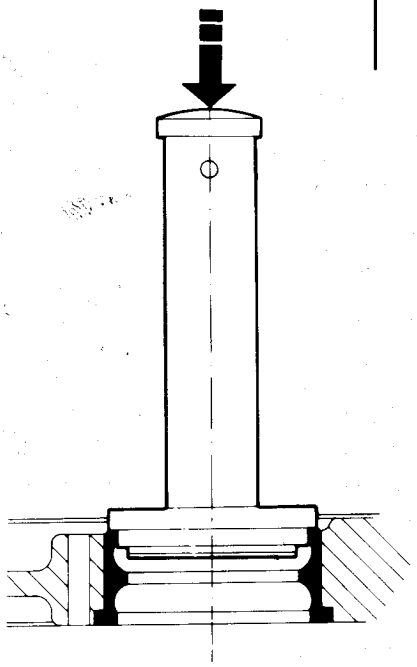
1 Bearing outer race clamp
2 Shoulder spacer
3 Shoulder plate for bearing outer races

c. Withdraw main shaft bearing outer ring from intermediate flange operating at press, with suitable base and puller **A.3.0407**.



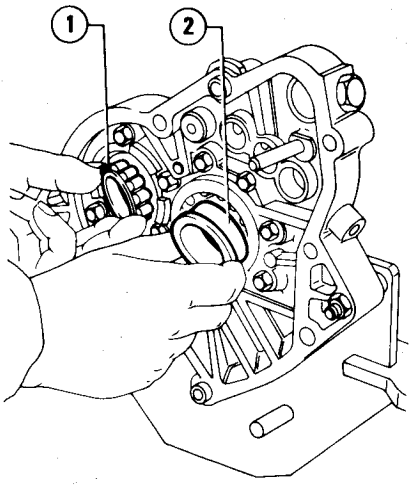
d. Withdraw pinion shaft bearing outer ring from intermediate flange always operating at press, with suitable base and puller **A.3.0408**.





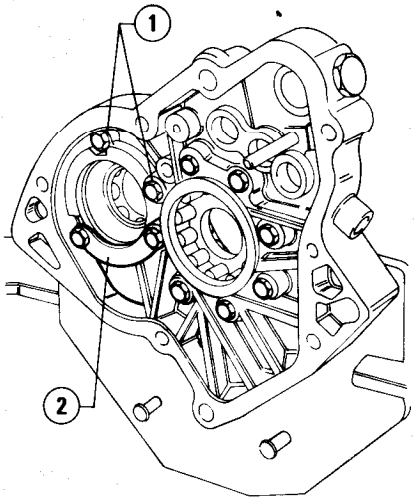
Solution with intermediate roller/ball bearings

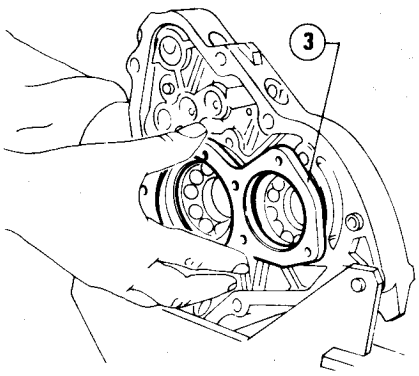
a. Disassemble inner races (1) and (2) of roller bearings related to main and pinion shaft.



1 Main shaft bearing inner race
2 Pinion shaft bearing inner race

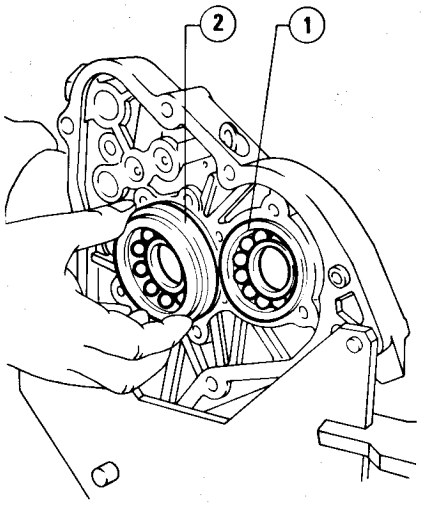
b. Unscrew and remove screws (1) with related washers securing plate (3). Recover retainer (2) and plate itself.





1 Plate securing screws
2 Bearing retainer
3 Bearing retaining plate

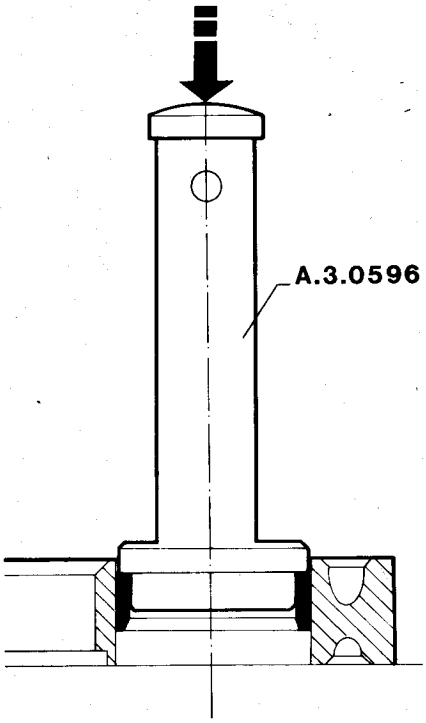
c. Withdraw ball bearings of main (1) and pinion (2) shafts.

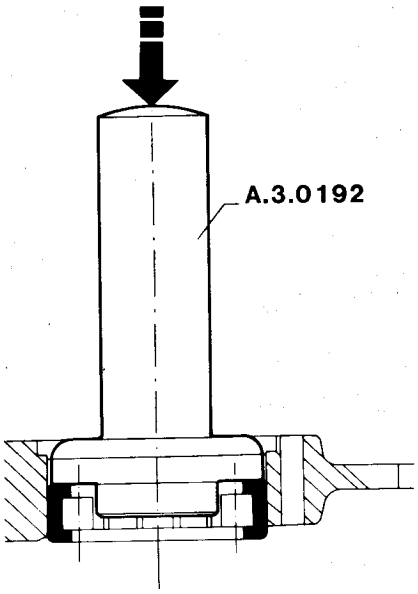


1 Main shaft ball bearing
2 Pinion shaft ball bearing

d. Operating at press with suitable base and puller **A.3.0596**, withdraw outer ring of main shaft bearing from intermediate flange.

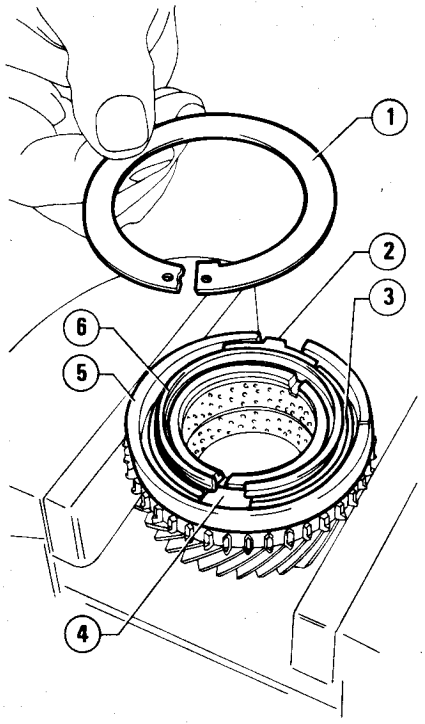
e. Always operating at press with suitable base and puller **A.3.0192** withdraw outer ring of pinion shaft bearing from intermediate flange.





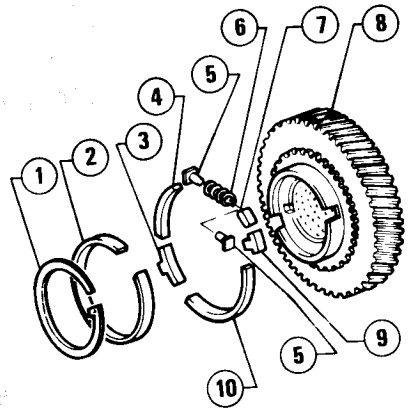
7. Synchronizers disassembly

a. Synchronizers for 1st, 2nd, 3rd, 4th, 5th speeds.
Secure the gear concerned on a vice fitted with protective jaws and, by means of a plier, remove retaining ring (1). Then, withdraw ring (5), sectors (2) and (4) and retainers (3).



1 Retaining ring
2 Locking sector
3 Retainers
4 Guide sector
5 Synchronizing ring

b. 1st speed synchronizer
Operating as per the previous step, remove retaining ring (1), then withdraw ring (2), sectors (3) and (9), retainers (4) and (10), spring (6) with the two strikers (5) and pawl (7).



1 Retaining ring
2 Synchronizing ring
3 Locking sector
4 Retainer
5 Strikers
6 Spring
7 Pawl
8 Gear
9 Guide sector
10 Retainer

CHECKS AND INSPECTIONS

Before carrying out the checks, carefully wash the items, then blow them with compressed air. This permits a better identification of superficial defects, wear and efficiency of a few components.

a. Gears and splined sections

Verify gears teeth. If irregular wear or spalled teeth are found on gears, replace the gears and verify that gears they mate with are not spalled.
Verify also the threaded and splined surfaces of shafts and, particularly, the housings fo bearings inner races.

Gear axial and radial clearance
0.10 to 0.15 mm
(0.00394 to 0.00591 in)

b. Bearings

Verify conditions of surfaces related to rings and rolling elements making sure they are free from scratches, imprintings, grinding caused by scoring due to foreign matters.

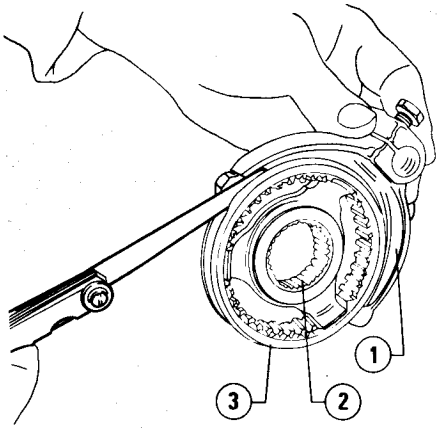
c. Synchronizers

Verify that:
- Synchronizer rings are free from excessive wear.
- Retainers are free from overheating signs in the working points.
- Locking and guide sectors are not excessively scratched in the working points.
- Synchronizer sleeves slide freely on the related hubs.
- Engagement front toothing on sleeves and the corresponding toothing on gears are free from seizing and excessive wear.

d. Forks and sleeves

Check working surfaces of forks (1) and slinding sleeves (3) verifying they are free from seizing and that axial clearance is within the prescribed values.

Sleeve fork axial clearance
0.7 to 0.9 mm
(0.0275 to 0.0354 in)

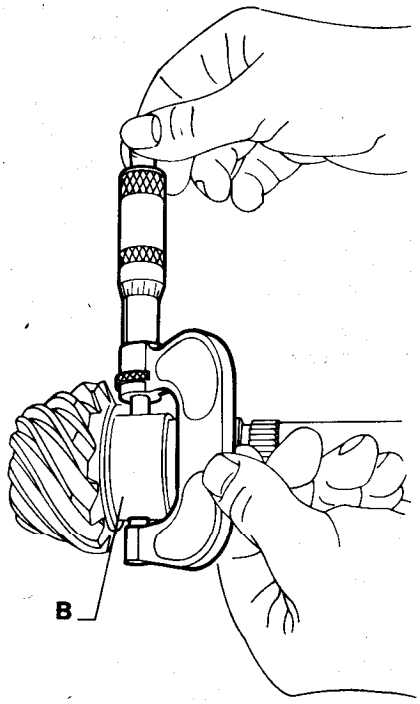


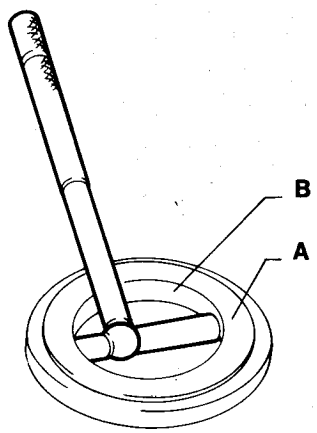
1 Control fork
2 Hub
3 Sleeve

e. Pinion shaft and rear spacer

Verify that squareness deviation of ring nut support plane **A** of pinion shaft rear roller bearing does not exceed **0.02 mm (0.000787 in)** and that installation interference fit between seats **B** of pinion shaft and ring nut is within the prescribed values, i.e.:

0.019 to 0.060 mm
(0.000748 to 0.0024 in)

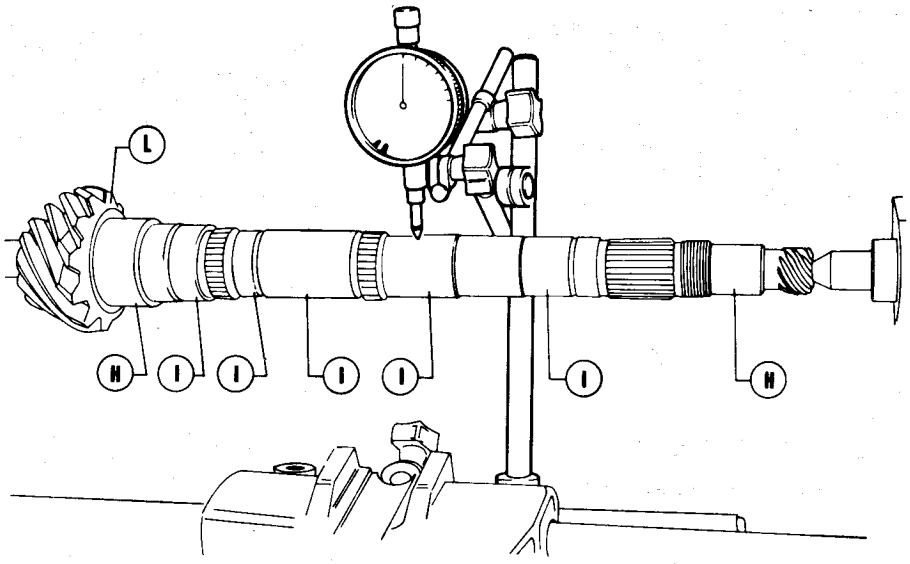




By means of gauge, verify that:

- pinion shaft eccentricity in the seats **H** of front needle bearing and rear roller bearing with respect to seats **I** of bushes related to gears and intermediate bearings does not exceed **0.02 mm. (0.000787 in).**
- Squareness deviation of abutment plane **L** related to rear bearing inner race with respect to seats **H** of bearings must not exceed:

0.02 mm (0.000787 in)

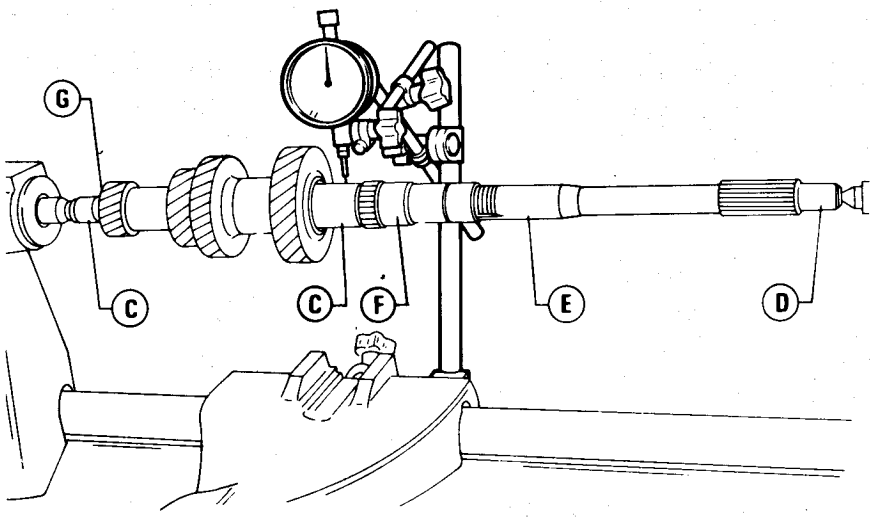


f. Main shaft

By means of gauge, verify that:

- main shaft eccentricity in the seats **C** of bearings related to differential-speed gear casing and of intemediate flange with respect to clutch shaft centering seat **D**, seat **E** of differential-speed gear casing bearing and to seat **F** of 5th speed gear does not exceed **0.03 mm (0.00118 in)** tolerance.
- Squareness deviation of abutment plane **G** related to rear bearing inner race with respect to seats **C** of bearings does not exceed:

0.03 mm (0.00118 in).

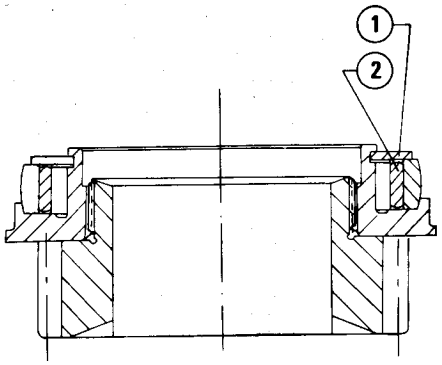


REASSEMBLY

1. Synchronizers reassembly

a. Synchronizers for 2nd, 3rd, 4th, 5th speeds.
Reassemble synchronizers on gears, starting with the positioning of locking and guide sectors followed by retainers, synchronizing ring and retaining ring.

CAUTION:
At the end of reassembly, make sure that ring (1) is correctly mounted in its seat and that ring (2) can move freely.

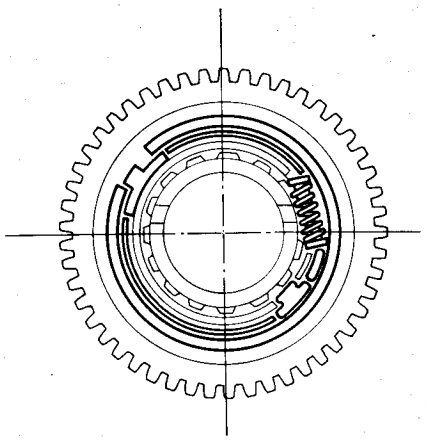


1 Retaining ring
2 Synchronizing ring

b. Ist speed synchronizer

Reassemble synchronizer operating as per the previous step and by correctly positioning the spring with the related strikers and the pawl.

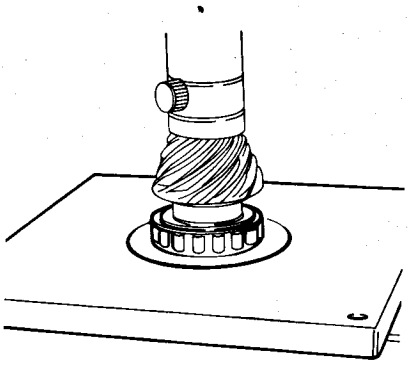
CAUTION:
The retainers are of different length, as a consequence, they must be mounted just as per figure.

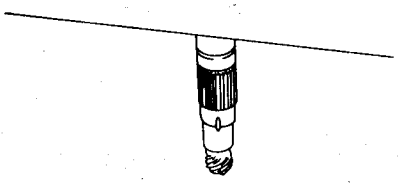


2. Pinion shaft reassembly

a. If previously disassembled, reassemble roller bearing runner race at the press and by means of a plate.

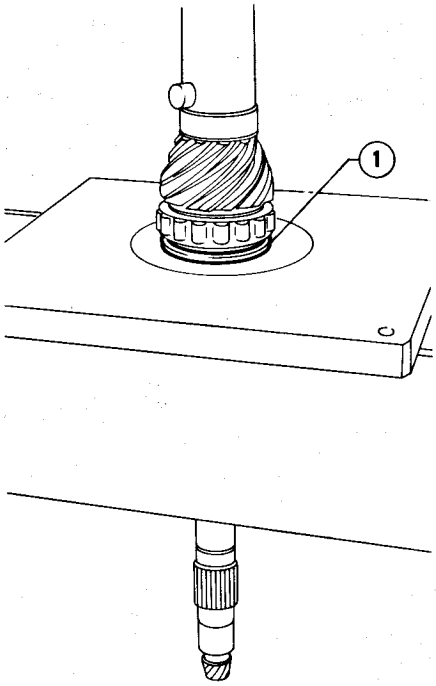
Install bearing with the protrusion towards pinion head.





b. Heat ring nut (1) **(140 °C, 284 °F)** and insert it into pinion shaft, by means of the plate mentioned above.

To obtain the best installation, cool down the ring nut with compressed air when it is still under pressure, held in the press.



1 Ring nut

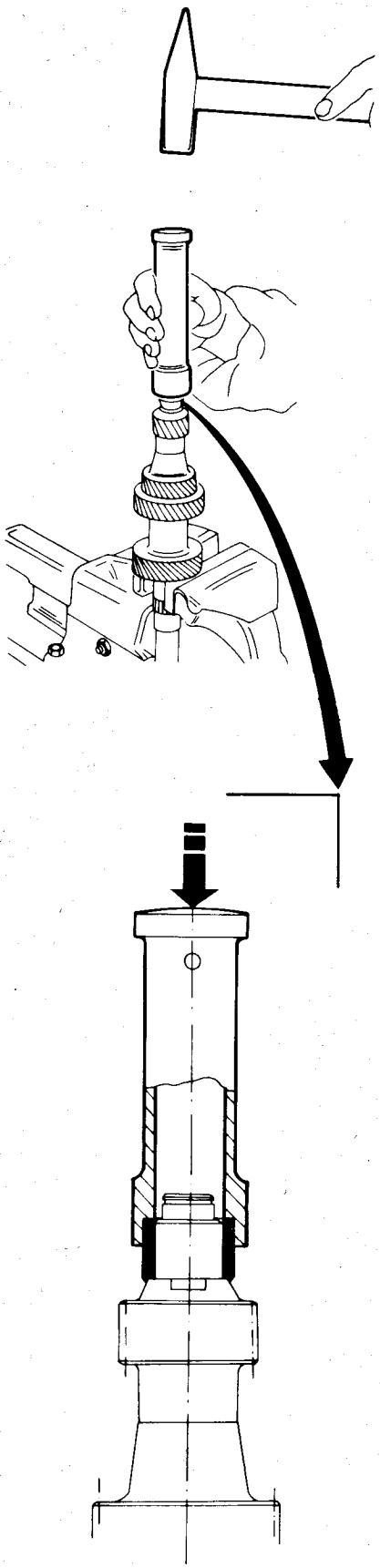
c. To complete pinion shaft reassembly, reverse the disassembly operations taking care to **lubricate** gears bushes, before reassembly, with the prescribed oil.

Oil:
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

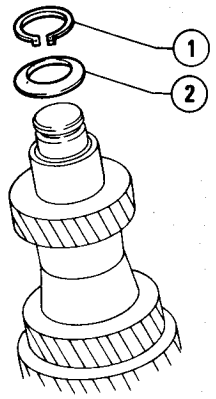
For correct installation of gear package, refer to exploded views of page 13-17

3. Main shaft reassembly

a. If previously disassembled, mount the rear bearing inner race on main shaft, making use of a suitable driver.

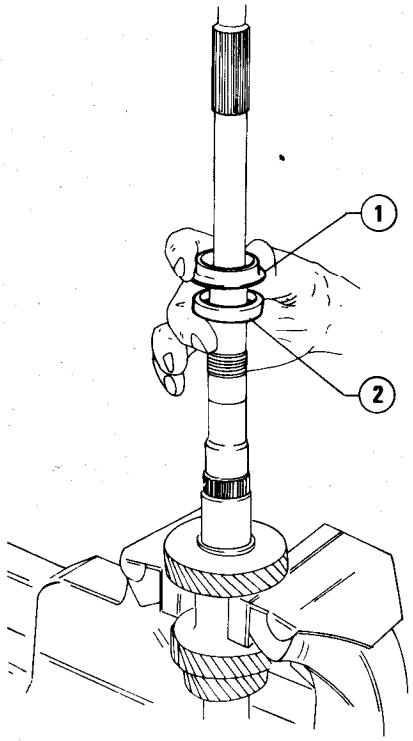


b. Reinstall bush (1) and secure it with ring (2).



1 Plastic bush
2 Retaining ring

c. Insert spacer (2) and then rear inner half-race (1) of intermediate flange bearing on main shaft.



1 Rear inner half-race
2 Spacer

4. Intermediate flange reassembly

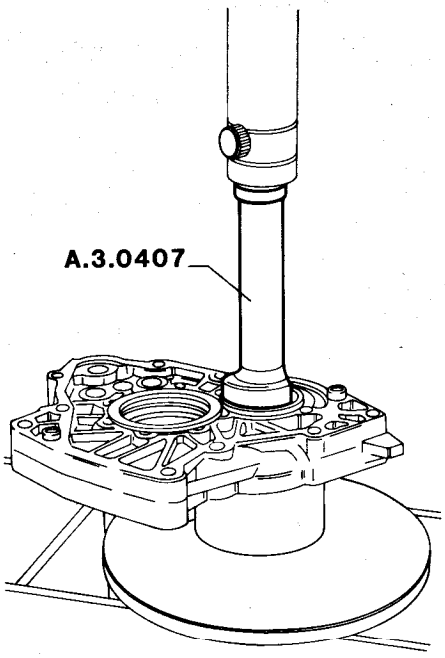
CAUTION:
Before installing roller bearings, lubricate them with the prescribed grease.

Grease:
AGIP F1 Grease 33 FD
IP Autogrease FD

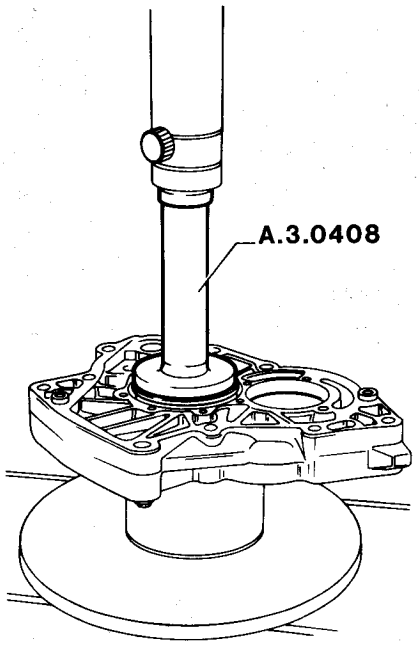
Solution with intermediate skew ball bearings

a. Operating at press and making use of tool **A.3.0407** insert outer race of main shaft ball bearing until it strikes against the intermediate flange striker.

Exert the utmost care during insertion in oder not to force the intermediate flange striker.



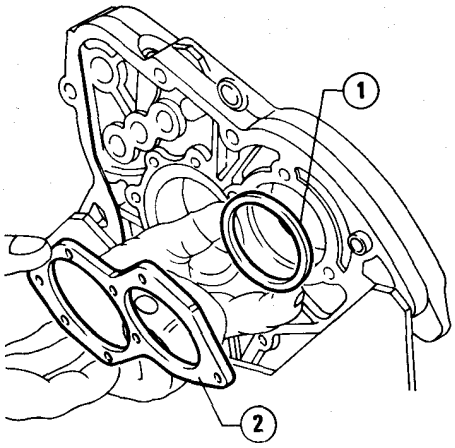
b. Always operating at the press and making use of tool **A.3.0408**, insert outer race of pinion shaft ball bearing until it mates with the plane of intermediate flange front side.

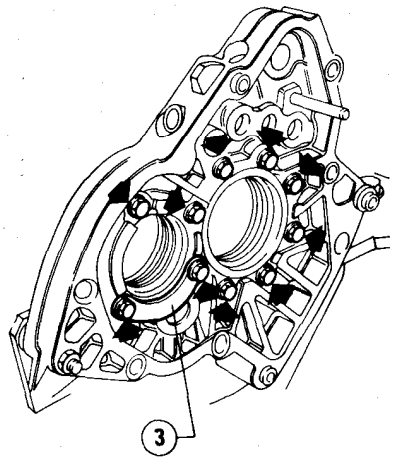


c. Set intermediate flange on the special support, then secure it on an overhaul stand fitted with connection brackets.

d Position spacer (1) and plate (2) on intermediate flange rear side.

e. Apply retainer (3) on rear side, then screw the plate securing screws without tightening them.

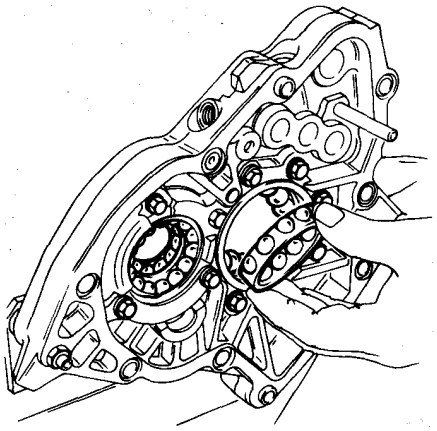




1 Shoulder spacer
2 Bearings shoulder plate
3 Bearing outer race retainer

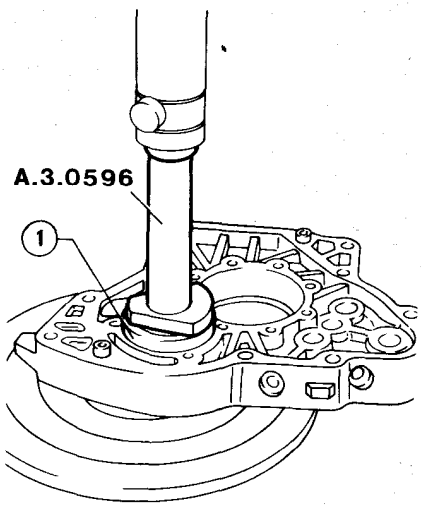
f. Reinstall both front and rear cages with balls related to intermediate flange bearings.

For the re-used bearings, the cages with rolling elements must occupy the same position noted during disassembly.



Solution with intermediate roller/ball bearings

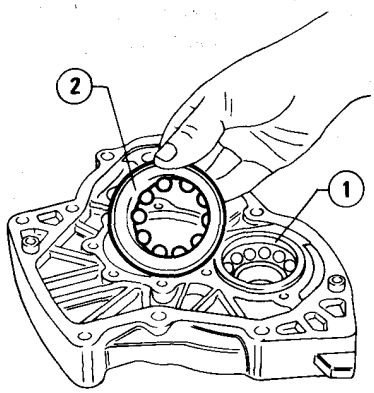
a. Operating at press and by means of tool **A.3.0596**, insert outer race (1) of main shaft roller bearing until it mates with interne diare flange striker.



1 Roller bearing outer race

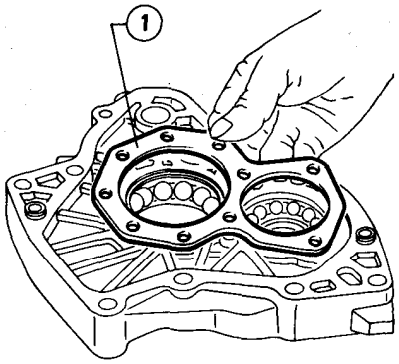
b. Reinstall on flange in the following order:

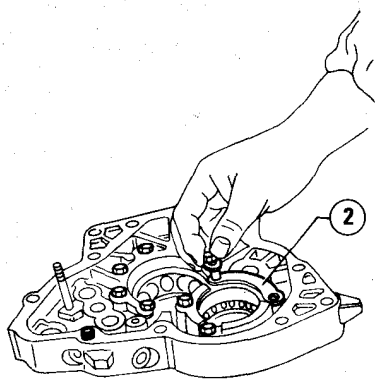
— main shaft ball bearing (1) complete with inner half-race.
— pinion shaft ball bearing (2) taking care to position it correctly with the thinner lip upwards.



1 Main shaft ball bearing
2 Pinion shaft ball bearing

c. Temporarily apply the bearings retaining plate (1) and retainer (2) to flange by screwing the plate securing screws without tightening them.

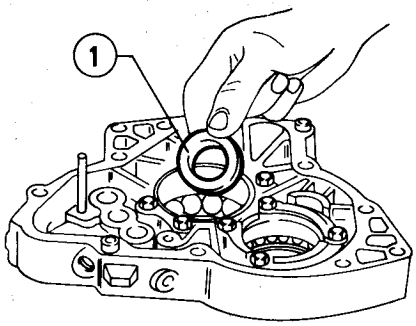


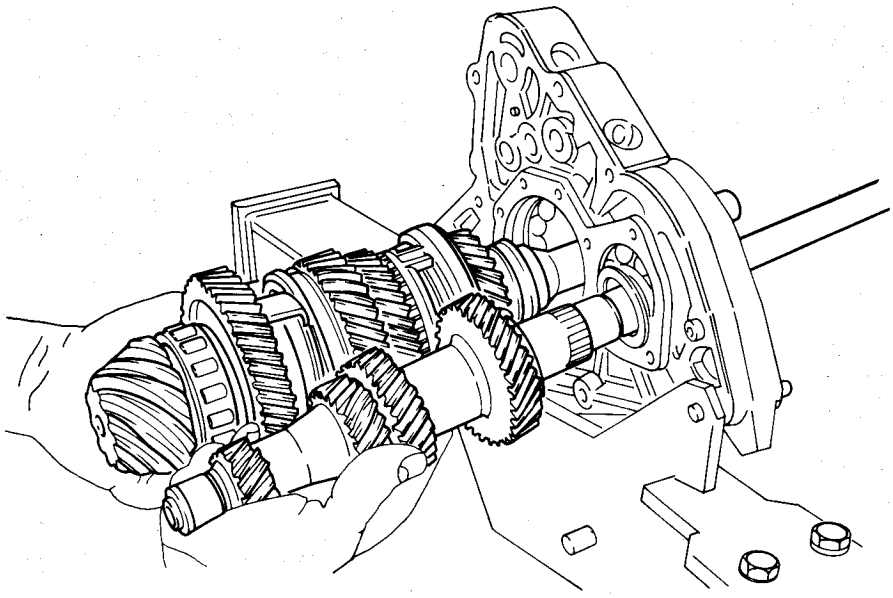


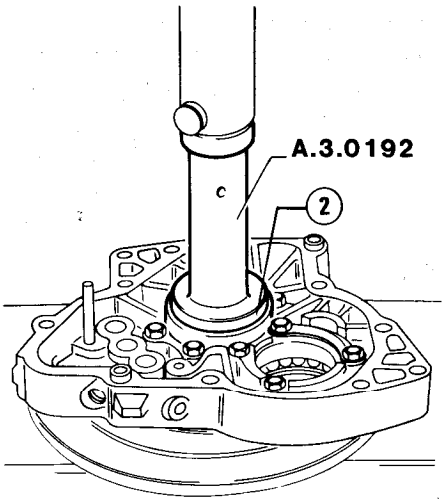
1 Bearings retaining plate
2 Bearing retainer

d. Reassemble inner half-race (1) of pinion shaft ball bearing then, with the press and by means of tool **A.3.0192**, insert pinion shaft roller bearing (2).

Insertion must be carried out with the utmost care without forcing components.







1 Pinion shaft inner half-race
2 Pinion shaft roller bearing

b. Position intermediate flange on differential-speed gear casing taking care to align pinion shaft correctly, then rotate both speed gear shafts so as to bed the bearings. Next tighten the bearing retaining plate securing screws to the prescribed torque.

(T): **Tightening torque**
Screws securing shoulder plate to intermediate flange
14 to 15 N·m
(1.4 to 1.6 Kg·m)
(10.1 to 11.6 ft·lb)

c. Remove intermediate flange complete with main and pinion shafts from differential-speed gear casing, and set it on an overhaul stand to complete the reassembly operations.

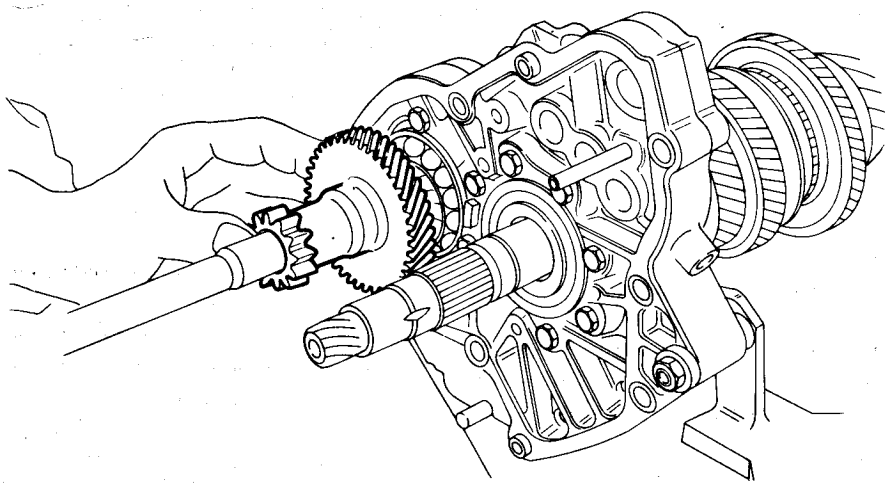
6. Shafts reassembly

a. Insert front inner half-races of intermediate flange bearings on shafts, taking care to bed them into the related seats on flange itself.
b. Install the 5th and Reverse speeds gear on main shaft, then screw nut without tightening it.

e. Set intermediate flange on the special support, then secure it to an overhaul stand fitted with connection brackets.

5. Tightening of bearings retaining plate screws

a. Insert roller bearings inner races of main and pinion shafts; then install shafts themselves positioning them, at the same time, in the intermediate flange.



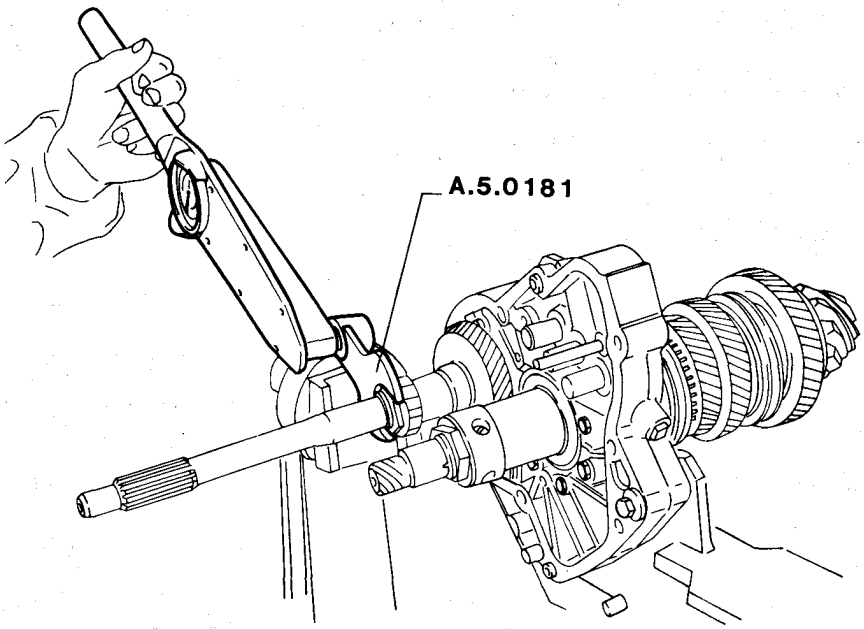
c. Install the 5th and Reverse speeds gear package on pinion shaft, then screw nut without tightening it.

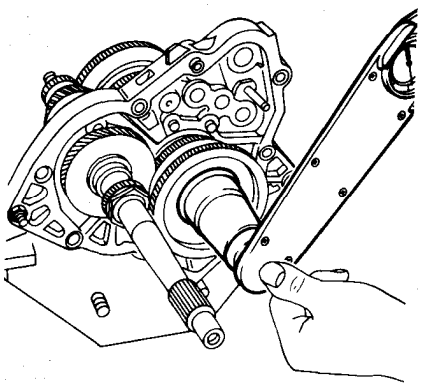
For correct installation of package, refer to exploded views of page 13-17.

d. Operate on the control sleeves for the 1st-2nd and 3rd-4th speeds to engage two speeds in order to block shafts rotation.

e. By means of a torque spanner, tighten pinion shaft nut to the prescribed torque.

(T): **Tightening torque**
Bevel pinion nut
112 to 124 N·m
(11.4 to 12.6 kg·m)
(82.4 to 91.7 ft·lb)





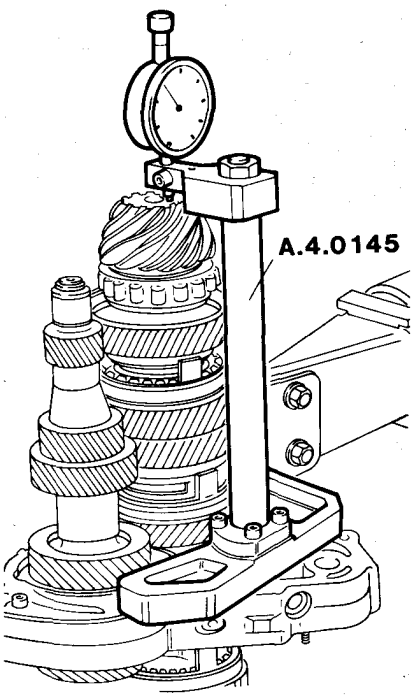
f. By means of a torque spanner fitted with wrench **A.5.0181**, tighten main shaft nut to the prescribed torque.

(T): **Tightening torque**
Main shaft nut
93 to 103 N·m
(9.5 to 10.5 kg·m)
(68.7 to 75.9 ft·lb)

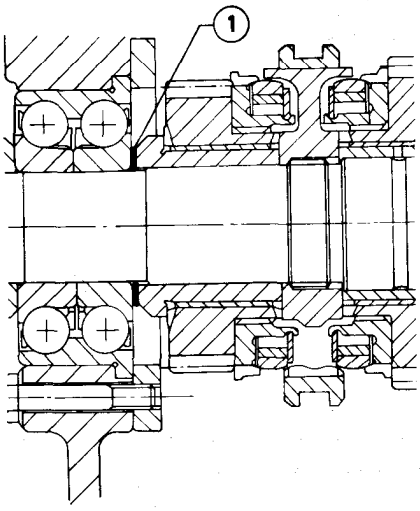
7. Verification of pinion shaft dimension

a. By means of a centesimal gauge mounted on support **A.4.0145**, verify that dimesion **"A"** measured between intermediate flange inner plane and pinion head upper plane corresponds to the value measured before disassembly.

0.03 mm (0.00118 in) tolerance is allowed.



b. If the value does not correspond to that prescribed, modify thickness of the ring (1) between bush of 4th speed gear and half-race of intermediate bearing.



1 Shim ring

c. Caulk the nuts of both speed gear shafts from one side only.

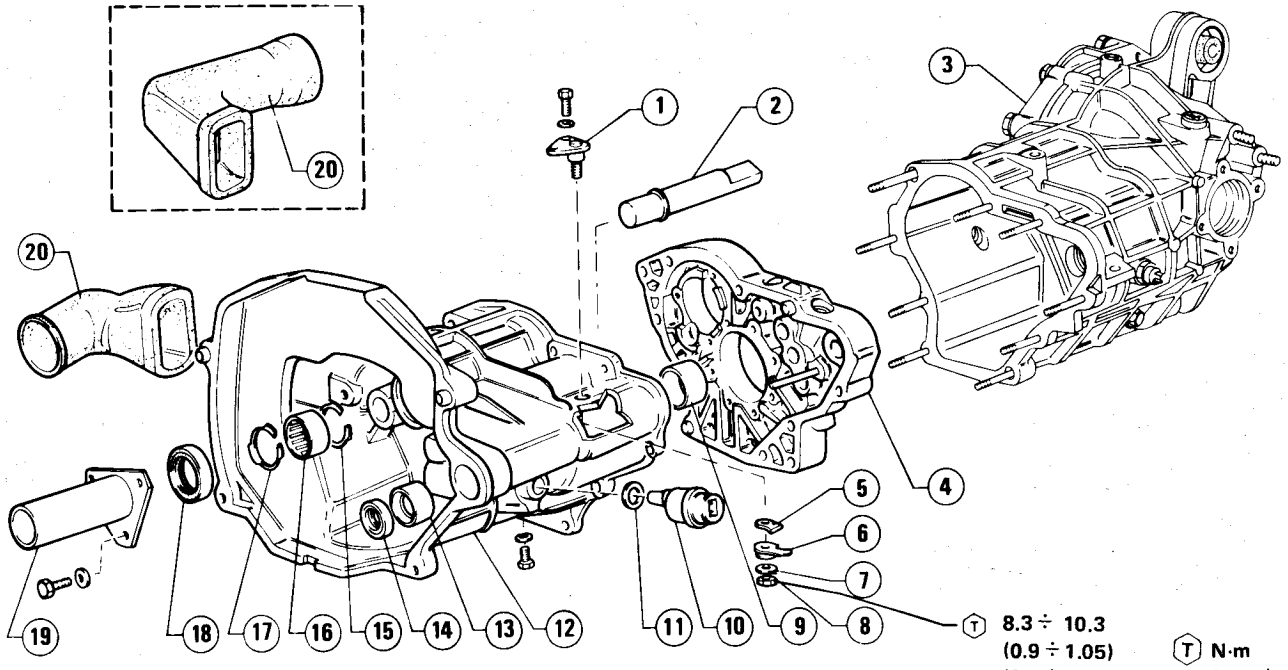
8. Rods and forks reasembly.

Refer to: "Rods and Forks - Reassembly".

CLUTCH - SPEED GEAR CASING

Solution with intermediate roller/ball bearings

Solution with intermediate skew ball bearings



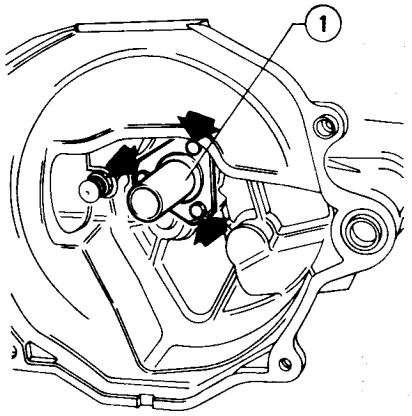
1 Safety device support
2 Reverse speed gear pin
3 Differential-speed gear casing
4 Intermediate flange
5 Plate
6 Pawl
7 Washer
8 Nut
9 Pinion shaft bush
10 Odometer pulse transmitter
11 Washer
12 Clutch - speed gear casing
13 Guide bush
14 Oil seal ring
15 Retaining ring
16 Main shaft needle bearing
17 Retaining ring
18 Oil seal ring
19 Tube
20 Sleeve

CAUTION:
The clutch - speed gear casing in aluminium alloy, take then the utmost care to prevent damaging it.

DISASSEMBLY

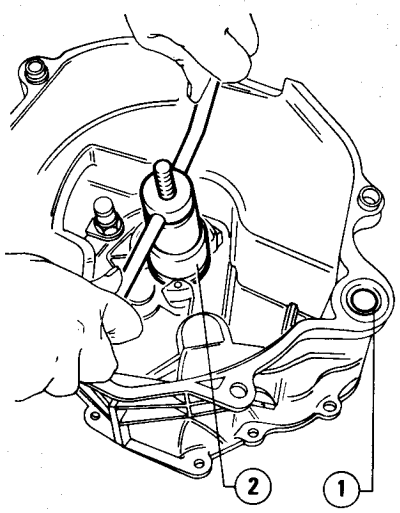
Remove the clutch - speed gear casing from the whole unit (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential unit - Separation") and disassemble it operating as follows:

1. Release and remove the screws with the related washers securing tube (1) from clutch - speed gear casing; remove tube.



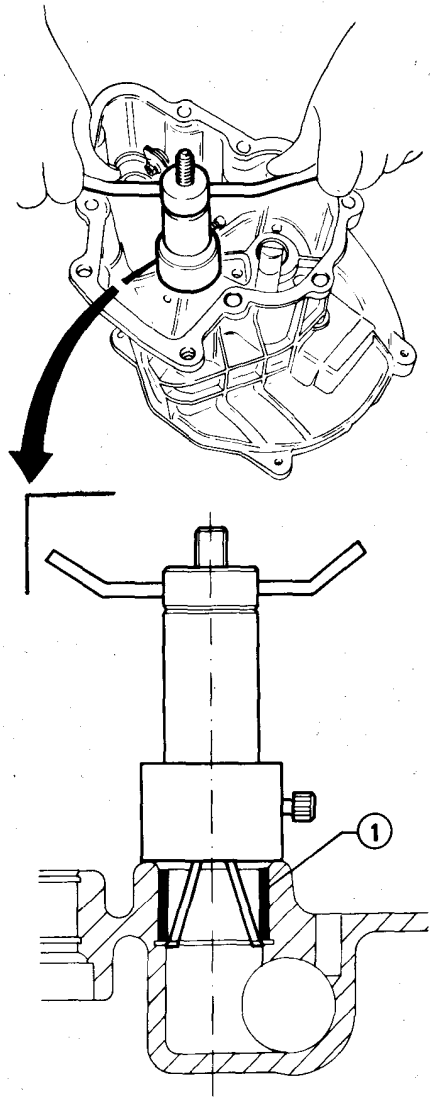
1 Thrust bearing guide tube

2. By means of suitable puller, remove oil seal rings (1) and (2).



1 Oil seal ring for speed selection and engagement rod
2 Main shaft oil seal ring

3. By means of same puller, remove bush (1).



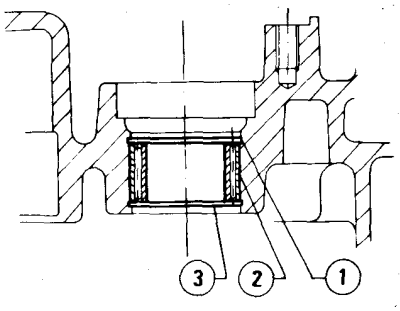
1 Pinion shaft support bush

4. Withdraw main shaft needle bearing operating as follows:

a. Remove retaining ring (1).

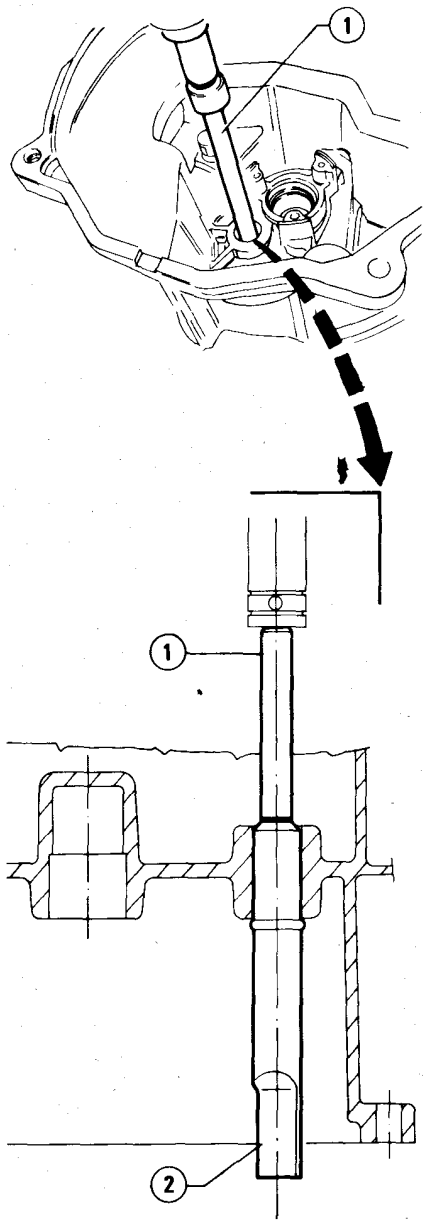
b. Withdraw bearing (2).

c. If necessary, remove retaining ring (3).



1 Front retaining ring
2 Needle bearing
3 Rear retaining ring

5. Rest clutch-speed gear casing on half-plates and, by means of suitable punch, remove pin (2).

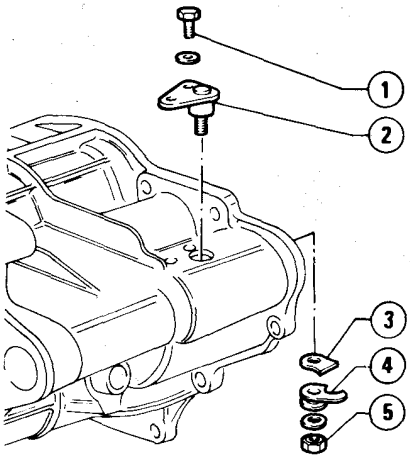


1 Punch
2 Reverse speed pin

6. Disassemble interlock plunger (it prevents accidental transition from 5th to reverse speed) operating as follows:

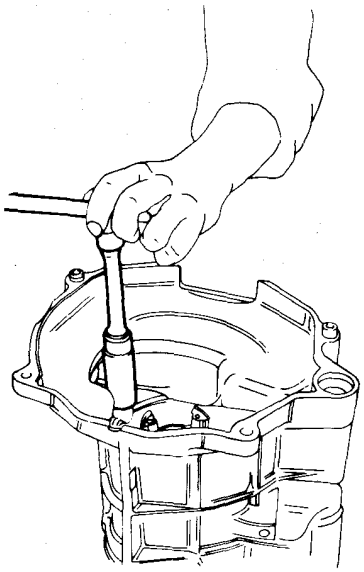
a. Unscrew nut (5), withdraw interlock plunger (4) and the plate (3) underneath.

b. Loosen the two screws (1) and remove support (2).

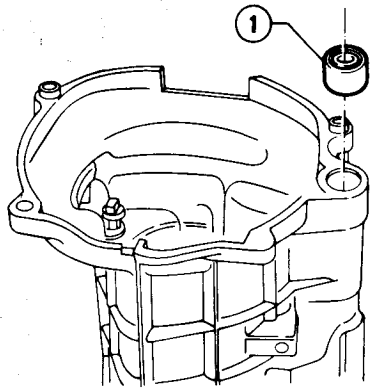


1 Screw
2 Safety device support
3 Plate
4 Interlock plunger
5 Inner nut securing interlock plunger

7. By means of suitable spanner, unscrew the clutch fork pin and remove it with the washer underneath.



8. If necessary, withdraw bush (1) from clutch-speed gear casing.



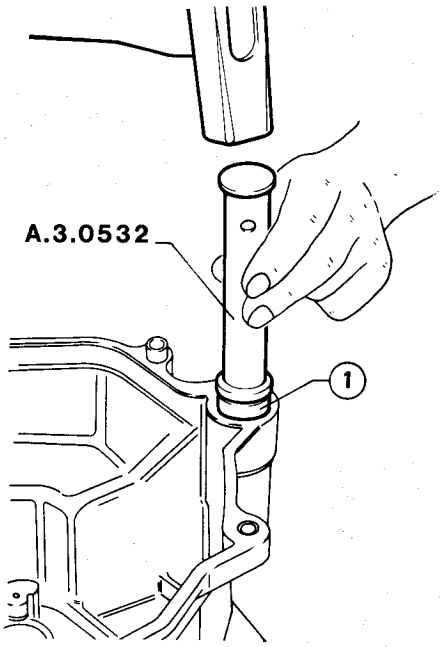
1 Guide bush for speed selection and engagement rod

CHECKS AND INSPECTIONS

1. Clean the casing with solvent removing sealant traces in correspondance with mating surfaces between clutch-speed gear casing and intermediate flange and in correspondance with the housing of reverse speed safety device.
2. Verify that casing is free from scratches and splinters.

REASSEMBLY

1. If previously removed, reinstall guide bush of speed selection and engagement rod operating as follows:
a. By means of driver **A.3.0532**, reinstall bush (1) on clutch-speed gear casing, previously heated at a temperature within **140 to 160 °C (284 to 320 °F)**.



1 Guide bush for speed selection and engagement rod

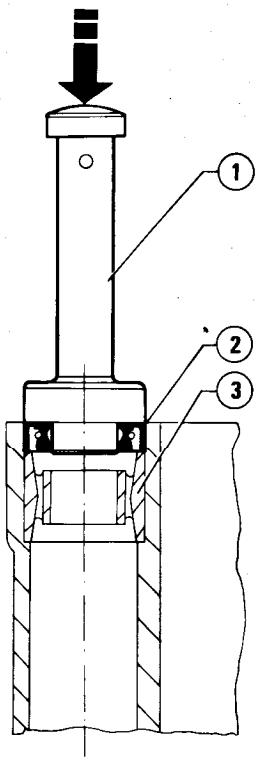
b. Let the clutch-speed gear casing cools down, then install oil seal ring (2) inserting it by means of driver (1) after **lubricating** outer surfaces and inner leap with the prescribed oil and grease, respectively.

Oil:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

Grease:

ISECO Molykote BR2



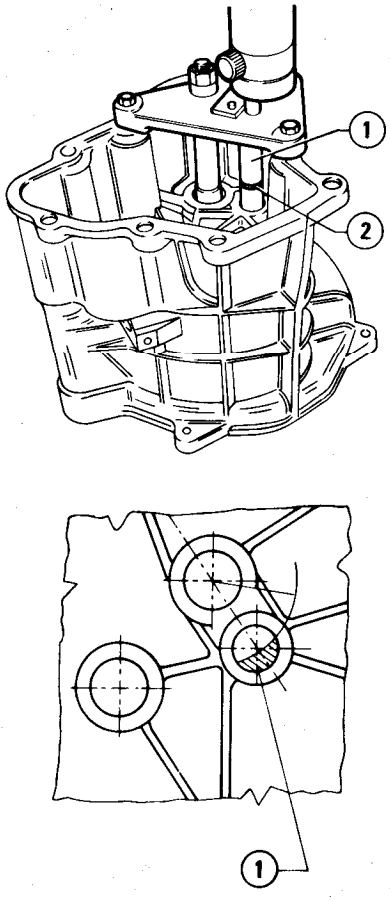
1 Oil seal ring driver
2 Oil seal ring
3 Guide bush for speed selection and engagement rod

2. Tighten fork pin into the related seat.
3. Reassemble interlock plunger by reversing the order of disassembly (Refer to: "Disassembly" - step 6) applying a coat of the prescribed sealant on the mating surface between the support for reverse speed engagement safety device and clutch-speed gear casing.

Sealant:
Sealing compound LOWAC Perfect Seal

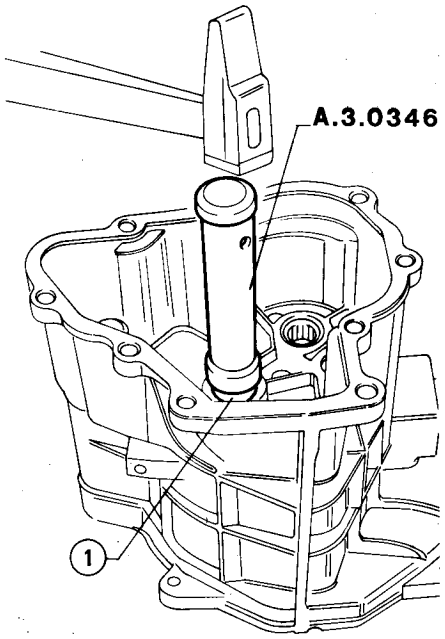
(T): **Tightening torque**
Nut securing plate for reverse speed engagement safety device
8.3 to 10.3 N·m
(0.9 to 1.05 kg·m)
(6.5 to 7.2 ft·lb)

4. Reassemble the reverse speed pin operating as follows:
a. Install retaining ring (2) on pin.
b. Heat the clutch-speed gear casing at a temperature within **140 to 160 °C**.
c. Position pin into the related seat on clutch-speed gear casing. Secure the pin positioning tool to clutch-speed gear casing.
d. Insert pin until retaining ring comes into contact with clutch-speed gear casing.



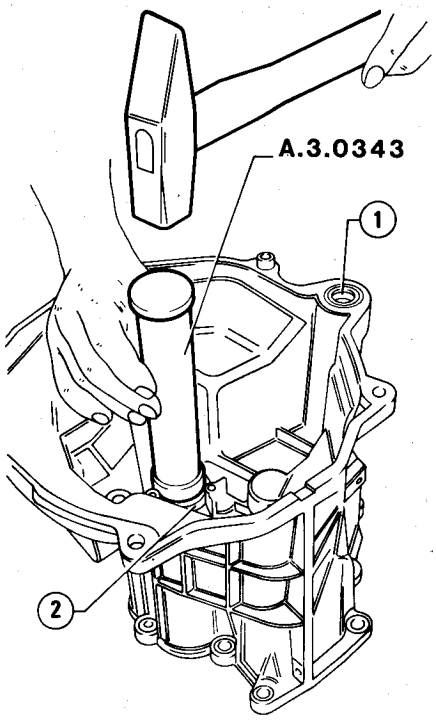
1 Reverse speed pin
2 Retaining ring

5. Reassemble the main shaft needle bearing by reversing the order of disassembly (Refer to: "Disassembly" - step 4).
6. Reinstall bush (1) making use of driver **A.3.0346**.



1 Pinion shaft support bush

7. Reassemble oil seal rings (1) and (2) operating as per figure, by means of driver **A.3.0343**.



1 Oil seal ring for speed selection and engagement rod
2 Main shaft oil seal ring

8. Reassemble guide tube by reversing the order of disassembly (Refer to: "Disassembly" - step 1)

Once the clutch-speed gear casing has been reassembled, reconnect it to Differential unit (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential Unit - Reconnection").

Gear ratios		Alfa 90 18 LH 162.02	Alfa 90 18 RH —	Alfa 90 20 LH 162.12	Alfa 90 20 RH —	Alfa 90 20 iniezione LH 162.14	Alfa 90 20 iniezione RH 162.15	Alfa 90 20 6V iniezione LH 162.10	Alfa 90 20 6V iniezione RH —	Alfa 90 24 turbodiesel LH 162.06	Alfa 90 24 turbodiesel RH —	Alfa 90 25 • iniezione LH 162.18	Alfa 90 25 • iniezione RH 162.19
Speed gear ratios	1st speed	1 : 3.500						1 : 2.875		1 : 3.500			
	2nd speed	1 : 1.956						1 : 1.720		1 : 1.956			
	3rd speed	1 : 1.258						1 : 1.226		1 : 1.258			
	4th speed	1 : 0.946						1 : 0.946		1 : 0.946			
	5th speed	1 : 0.780						1 : 0.780		1 : 0.780			
	R speed	1 : 3.000						1 : 3.000		1 : 3.000			
Differential ratio		11/42				10/43 (1)		9/41		12/41		11/39 (2)	
Differential-speed gear overall ratios	1st speed	1 : 13.364				1 : 15.05		1 : 13.096		1 : 11.960		1 : 12.409	
	km/h (mi/h)	8.508 (5.29)				7.543(4.69)		8.681 (5.40)		9.507 (5.91)		9.162 (5.69)	
	2nd speed	1 : 7.468				1 : 8.41		1 : 7.835		1 : 6.684		1 : 6.935	
	km/h (mi/h)	15.224 (9.46)				13.497 (8.39)		14.512 (9.02)		17.012 (10.57)		16.395 (10.19)	
	3rd speed	1 : 4.803				1 : 5.40		1 : 5.584		1 : 4.299		1 : 4.460	
	km/h (mi/h)	23.671 (14.71)				20.987 (13.04)		20.362 (12.66)		26.451 (16.44)		25.492 (15.84)	
Nominal speed at 1000 r.p.m.	4th speed	1 : 3.612				1 : 4.07		1 : 4.309		1 : 3.232		1 : 3.354	
	km/h (mi/h)	31.478 (19.56)				27.906 (17.34)		26.387 (16.40)		35.174 (21.86)		33.900 (21.07)	
	5th speed	1 : 2.978				1 : 3.35		1 : 3.553		1 : 2.665		1 : 2.765	
	km/h (mi/h)	38.178 (23.73)				33.846 (21.04)		32.001 (19.89)		42.660 (26.51)		41.114 (25.55)	
	R speed	1 : 11.454				1 : 12.90		1 : 13.665		1 : 10.251		1 : 10.636	
	km/h (mi/h)	9.926 (6.17)				8.80 (5.47)		8.320 (5.17)		11.092 (6.89)		10.689 (6.64)	

(1) Alfa 90 2.0 and Alfa 90 2.0 iniezione versions for Switzerland, Sweden and Australia

(2) Also valid for versions for Switzerland, Sweden and Australia

Alfa 90 Super / Gear ratios		18		20 iniezione (*)		20 6V iniezione		24 turbodiesel		25 6V iniezione (*)	
		LH 162.02.1	RH —	LH 162.14.1 162.14.2	RH 162.16.1	LH 162.10.1	RH —	LH 162.06.1	RH —	LH 162.18.1	RH 162.19.2
Speed gear ratios	1st speed	1 : 2.875						1 : 3.500		1 : 2.875	
	2nd speed	1 : 1.720						1 : 1.956		1 : 1.720	
	3rd speed	1 : 1.226						1 : 1.258		1 : 1.226	
	4th speed	1 : 0.946						1 : 0.946		1 : 0.946	
	5th speed	1 : 0.780						1 : 0.780		1 : 0.780	
	R. speed	1 : 3.000						1 : 3.000		1 : 3.000	
Differential ratio		9/41		10/43		9/41		12/41		10/41	
Differential-speed gear overall ratios	1st speed	1 : 13.096		1 : 12.362		1 : 13.096		1 : 11.960		1 : 11.787	
	km/h (mi/h)	8.683 (5.39)		9.198 (5.71)		8.682 (5.39)		9.507 (5.90)		9.646 (5.99)	
	2nd speed	1 : 7.835		1 : 7.396		1 : 7.835		1 : 6.684		1 : 7.052	
	km/h (mi/h)	14.511 (9.01)		15.374 (9.55)		14.512 (9.01)		17.012 (10.57)		16.123 (10.01)	
	3rd speed	1 : 5.584		1 : 5.272		1 : 5.584		1 : 4.299		1 : 5.027	
	km/h (mi/h)	20.362 (12.65)		21.567 (13.40)		20.362 (12.65)		26.452 (16.43)		22.620 (14.05)	
Nominal speed at 1000 r.p.m.	4th speed	1 : 4.309		1 : 4.068		1 : 4.309		1 : 3.232		1 : 3.879	
	km/h (mi/h)	26.387 (16.39)		27.948 (17.36)		26.387 (16.39)		35.174 (21.85)		29.314 (18.21)	
	5th speed	1 : 3.553		1 : 3.354		1 : 3.553		1 : 2.665		1 : 3.198	
	km/h (mi/h)	32.002 (19.88)		33.900 (21.06)		32.002 (19.88)		42.660 (26.50)		35.552 (22.08)	
	R. speed	1 : 13.665		1 : 12.900		1 : 13.665		1 : 10.251		1 : 12.300	
	km/h (mi/h)	8.321 (5.17)		8.815 (5.48)		8.314 (5.16)		11.093 (6.89)		9.245 (5.74)	

(*) Also valid for versions for Switzerland, Sweden and Australia

Gear ratios		Alfa 75 (1)	1.6		1.8		2.0		6V iniezione	
			LH 161.000	RH 161.010	LH 161.020	RH 161.030	LH 161.080	RH 161.090	LH 161.180	RH 161.190
Speed gear ratios	1st speed		1 : 3.500							
	2nd speed		1 : 1.956							
	3rd speed		1 : 1.258							
	4th speed		1 : 0.946							
	5th speed		1 : 0.780							
	R. speed		1 : 3.000							
Differential ratio			11/42						12/41	
Differential-speed gear overall ratios	1st speed		1 : 13.364						1 : 11.960	
	km/h (mi/h)		8.149 (5.06)						9.105 (5.66)	
	2nd speed		1 : 7.468						1 : 6.684	
	km/h (mi/h)		14.582 (9.06)						16.293 (10.13)	
	3rd speed		1 : 4.803						1 : 4.299	
	km/h (mi/h)		22.673 (14.09)						25.331 (15.74)	
Nominal speed at 1000 r.p.m.	4th speed		1 : 3.612						1 : 3.233	
	km/h (mi/h)		30.149(18.74)						33.694 (20.94)	
	5th speed		1 : 2.978						1 : 2.665	
	km/h (mi/h)		36.568 (22.73)						40.863 (25.40)	
	R. speed		1 : 11.454						1 : 10.251	
	km/h (mi/h)		9.507 (5.91)						10.623 (6.60)	

(1) Model with gearbox-rear axle long ratios (Switzerland, Sweden and Australia excluded).

Gear ratios	Giulietta	16		18		20		20 turbodiesel EDITION '83
		LH 113.48	RH 113.49	LH 113.50	RH 113.51	LH 113.56	RH 113.57	LH 113.52
Speed gear ratios	1st speed	1:3.500						
	2nd speed	1:1.956						
	3rd speed	1:1.258						
	4th speed	1:0.946						
	5th speed	1:0.780						
	R. speed	1:3.000						
Differential ratio		11/42		11/42		10/43		11/43
Differential-speed gear overall ratios	1st speed	1:13.37		1:13.37		1:15.05		1:13.681
	km/h (mi/h)	8.11 (5.04)		8.13 (5.05)		7.20 (4.47)		7.96 (4.94)
	2nd speed	1:7.47		1:7.47		1:8.41		1:7.646
	km/h (mi/h)	14.51 (9.01)		14.56 (9.04)		12.89 (8.01)		14.243 (8.85)
	3rd speed	1:4.80		1:4.80		1:5.40		1:4.917
	km/h (mi/h)	22.57 (14.02)		22.64 (14.06)		20.04 (12.45)		22.148 (13.76)
Nominal speed at 1000 r.p.m.	4th speed	1:3.61		1:3.61		1:4.07		1:3.698
	km/h (mi/h)	30.01 (18.64)		30.09 (18.69)		26.65 (16.55)		29.448 (18.29)
	5th speed	1:2.98		1:2.98		1:3.35		1:3.049
	km/h (mi/h)	36.31 (22.55)		36.52 (22.68)		32.32 (20.07)		35.717 (22.18)
	R. speed	1:11.42		1:11.42		1:12.90		1:11.727
	km/h (mi/h)	9.46 (5.87)		9.49 (5.89)		8.40 (5.22)		9.286 (5.77)

Gear ratios	Giulietta	1.6		1.8		2.0		2.0 turbodiesel EDITION '83
		LH 113.48	RH 113.49	LH 113.50	RH 113.51	LH 113.56	RH. 113.57	LH 113.52
Speed gear ratios	1st speed	1:3.500						
	2nd speed	1:1.956						
	3rd speed	1:1.258						
	4th speed	1:0.946						
	5th speed	1:0.780						
	R. speed	1:3.000						
Differential ratio		11/42		11/42		10/43		11/43
Differential-speed gear overall ratios	1st speed	1:13.37		1:13.37		1:15.05		1:13.681
Nominal speed at 1000 r.p.m.	km/h (mi/h)	8.11 (5.04)		8.13 (5.05)		7.20 (4.47)		7.96 (4.94)
	2nd speed	1:7.47		1:7.47		1:8.41		1:7.646
	km/h (mi/h)	14.51 (9.01)		14.56 (9.04)		12.89 (8.01)		14.243 (8.85)
	3rd speed	1:4.80		1:4.80		1:5.40		1:4.917
	km/h (mi/h)	22.57 (14.02)		22.64 (14.06)		20.04 (12.45)		22.148 (13.76)
	4th speed	1:3.61		1:3.61		1:4.07		1:3.698
	km/h (mi/h)	30.01 (18.64)		30.09 (18.69)		26.65 (16.55)		29.448 (18.29)
	5th speed	1:2.98		1:2.98		1:3.35		1:3.049
	km/h (mi/h)	36.31 (22.55)		36.52 (22.68)		32.32 (20.07)		35.717 (22.18)
	R. speed	1:11.42		1:11.42		1:12.90		1:11.727
	km/h (mi/h)	9.46 (5.87)		9.49 (5.89)		8.40 (5.22)		9.286 (5.77)

Alfa 75		1.6		1.8		turbo		2.0		2.0 turbodiesel		6V iniezione	
Gear ratios		LH 161.000	RH 161.010	LH 161.020	RH 161.030	LH 161.340	RH 161.350	LH 161.080	RH 161.090	LH 161.040	RH —	LH 161.180	RH 161.190
Speed gear ratios	1st speed	1 : 2.875								1 : 3.500		1 : 2.875	
	2nd speed	1 : 1.720								1 : 1.956		1 : 1.720	
	3rd speed	1 : 1.226								1 : 1.258		1 : 1.226	
	4th speed	1 : 0.946								1 : 0.946		1 : 0.946	
	5th speed	1 : 0.780								1 : 0.780		1 : 0.780	
	R. speed	1 : 3.000								1 : 3.000		1 : 3.000	
Differential ratio		9/41		10/43		11/43		10/43		11/39		10/41	
Differential-speed gear overall ratios	1st speed	1 : 13.096		1 : 12.362		1 : 11.238		1 : 12.362		1 : 12.407		1 : 11.787	
Nominal speed at 1000 r.p.m.	km/h (mi/h)	8.315 (5.17)		8.809 (5.47)		9.690 (6.02)		8.809 (5.47)		8.777 (5.45)		9.239 (5.74)	
	2nd speed	1 : 7.835		1 : 7.396		1 : 6.723		1 : 7.396		1 : 6.934		1 : 7.052	
	km/h (mi/h)	13.899 (8.64)		14.724 (9.15)		16.198 (10.07)		14.724 (9.15)		15.705 (9.76)		15.442 (9.60)	
	3rd speed	1 : 5.584		1 : 5.272		1 : 4.792		1 : 5.272		1 : 4.460		1 : 5.027	
	km/h (mi/h)	19.502 (12.12)		20.656 (12.84)		22.725 (14.12)		20.656 (12.84)		24.417 (15.18)		21.663 (13.46)	
	4th speed	1 : 4.309		1 : 4.068		1 : 3.698		1 : 4.068		1 : 3.353		1 : 3.879	
	km/h (mi/h)	25.273 (15.71)		26.770 (16.64)		29.448 (18.30)		26.770 (16.64)		32.478 (20.19)		28.074 (17.45)	
	5th speed	1 : 3.553		1 : 3.354		1 : 3.049		1 : 3.354		1 : 2.765		1 : 3.198	
	km/h (mi/h)	30.650 (19.05)		32.469 (20.18)		35.717 (22.19)		32.469 (20.18)		39.385 (24.48)		34.052 (21.16)	
	R. speed	1 : 13.665		1 : 12.900		1 : 11.727		1 : 12.900		1 : 10.635		1 : 12.300	
	km/h (mi/h)	7.969 (4.95)		8.442 (5.25)		9.286 (5.77)		8.442 (5.25)		10.240 (6.36)		8.854 (5.50)	

Gear ratios	Alfetta	16		18		20		20 ●		20 turbodiesel	24 turbodiesel
		LH 117.18	RH –	LH 117.17	RH –	LH 117.01	RH –	LH 117.13	RH 117.14	LH 117.06	LH 117.02
Speed gear ratios	1st speed	1:3.500								1:3.500	1:3.500
	2nd speed	1:1.956								1:1.956	1:1.956
	3rd speed	1:1.258								1:1.345	1:1.258
	4th speed	1:0.946								1:1.026	1:0.946
	5th speed	1:0.780								1:0.780	1:0.780
	R. speed	1:3.000								1:3.000	1:3.000
Differential ratio		11/43		11/42						10/41	11/42
Differential-speed gear overall ratios	1st speed	1:13.681		1:13.363						1:14.35	1:13.363
	km/h (mi/h)	8.298 (5.15)		8.495 (5.28)						7.90 (4.91)	8.508 (5.28)
	2nd speed	1:7.646		1:7.468						1:8.019	1:7.468
	km/h (mi/h)	14.847 (9.22)		15.201 (9.44)						14.17 (8.8)	15.225 (9.46)
	3rd speed	1:4.917		1:4.803						1:5.514	1:4.803
	km/h (mi/h)	23.087 (14.34)		23.635 (14.68)						22 (13.66)	23.673 (14.7)
Nominal speed at 1000 r.p.m.	4th speed	1:3.698		1:3.612						1:4.206	1:3.612
	km/h (mi/h)	30.697 (19.07)		31.428 (19.52)						29.26 (18.17)	31.478 (19.55)
	5th speed	1:3.049		1:2.978						1:3.198	1:2.978
	km/h (mi/h)	37.232 (23.12)		38.119 (23.68)						35.49 (22.04)	38.180 (23.71)
	R. speed	1:11.727		1:11.454						1:12.3	1:11.454
	km/h (mi/h)	9.680 (6.01)		9.911 (6.15)						9.22 (5.73)	9.927 (6.16)

Gear ratios		GTV 2.0		GTV 6 2.5 Vers. 1985	
		LH 113.17	RH 113.18	LH 113.15.1 113.15	RH 113.16.1 113.16
Speed gear ratios	1st speed	1 : 3.500		1 : 2.875	
	2nd speed	1 : 1.956		1 : 1.720	
	3rd speed	1 : 1.258		1 : 1.226	
	4th speed	1 : 0.946		1 : 0.946	
	5th speed	1 : 0.780		1 : 0.780	
	R. speed	1 : 3.000		1 : 3.000	
Differential ratio		10/43		10/41	
Differential speed gear overall ratios	1st speed	1 : 15.05		1 : 11.788	
	km/h (mi/h)	7.53 (4.68)		9.646 (6.00)	
	2nd speed	1 : 8.41		1 : 7.052	
	km/h (mi/h)	13.48 (8.37)		16.123 (10.01)	
	3rd speed	1 : 5.40		1 : 5.027	
	km/h (mi/h)	20.98 (13.03)		22.620 (14.05)	
Nominal speed at 1000 r.p.m.	4th speed	1 : 4.07		1 : 3.879	
	km/h (mi/h)	27.90 (17.33)		29.315 (18.21)	
	5th speed	1 : 3.35		1 : 3.198	
	km/h (mi/h)	33.83 (21.01)		35.553 (22.08)	
	R. speed	1 : 12.90		1 : 12.30	
	km/h (mi/h)	8.79 (5.46)		9.244 (5.74)	

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Applicat. No.	Application	Type	Name	Q.ty
1	Differential-speed gear roller bearings Detent devices Clutch fork spherical pin and thrust bearing seat	GREASE	– AGIP: Grease 33 FD – IP: Autogrease FD Std. No. 3671-69833	–
2	Propeller shaft rear joint seat Ball joint on speed control lever Reverse speed sliding gear inner bush Bush for bevel pinion on clutch-speed gear casing	GREASE	ISECO: Molykote BR2 Std. No. 3671-69841	5 cm^3 –
3	Clutch-speed gear casing seal rings – Inner seal lip – Outer surface	GREASE OIL	ISECO: Molykote BR2 Std. No. 3671-69841 – AGIP: Rotra SX 75W90 – IP: Pontiax HDS 75W90 Std. No. 3631-69412	–
4	Differential-speed gear unit oil refilling	OIL	– AGIP: Rotra SX 75W90 – IP: Pontiax HDS 75W90 Std. No. 3631-69412	kg 2.570 (1) (5.66 lb) kg 2.070 (2) (4.56 lb)
5	Bushes for speed transmission and selection lever and speed transmission and engagement lever (isostatic control) (2) Ball joint on speed transmission and engagement lever end	GREASE	Molykote Longterm No. 2 Std. No. 3671-69831	–

(1) For models Alfetta.
For cars with high top-up plug of models: Giulietta GTV 2.0 and GTV6 2.5

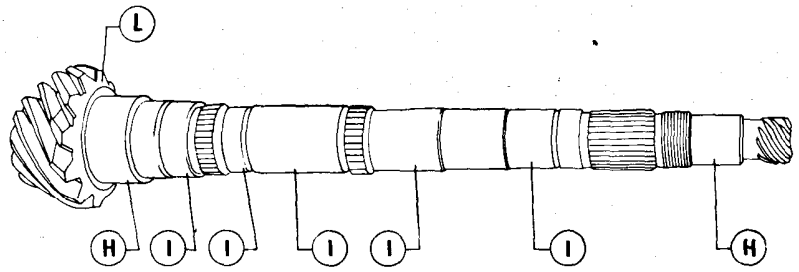
(2) For models Alfa 90 and Alfa 75
For cars with low top-up plug of models: Giulietta GTV 2.0 and GTV6 2.5

SEALANTS AND SURFACE FIXING AGENTS

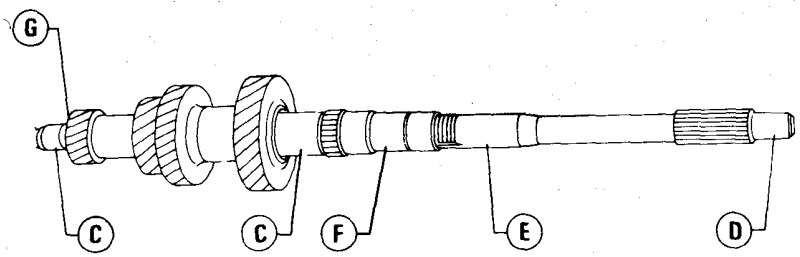
Application	Type	Name	Q.ty
Surfaces of differential-speed gear casing and clutch-speed gear casing mating with intermediate flange Mating surfaces between Reverse speed engagement safety devices and differential-speed gear casing NOTE: Use denatured ethyl alcohol to clean the surfaces	SEALING COMPOUND	LOWAC Perfect Seal Seal Std. No. 3522-00011	–

CHECKS AND ADJUSTMENTS

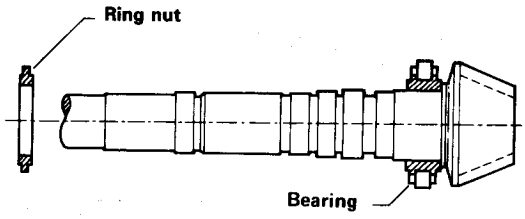
Axial clearance between fork and synchronizers sleeves	G	mm (in)	0.7 to 0.9 (0.0275 to 0.0354)
Spring test load	C	N (Kg lb)	90 to 97.6 (9.18 to 9.95; 20.25 to 21.96)
Spring length			
– Unloaded	L	mm (in)	30.6 (1.2)
– Loaded	L_C	mm (in)	18.8 (0.74)
Gears axial and radial clearance		mm (in)	0.1 to 0.15 (0.00394 to 0.00591)
Pinion, shaft and rear ring nut			
– Squareness deviation of ring nut support planes		mm (in)	0.02 (0.000787)
– Ring nut installation interference fit		mm (in)	0.019 to 0.060 (0.000748 to 0.00236)
– Eccentricity in seats H of front and rear bearings with respect to seats I of gear bushes and intermediate bearings		mm (in)	0.02 (0.000787)
– Squareness deviation for abutment plane L of rear bearing inner race with respect to seats H		mm (in)	0.02 (0.000787)



Main shaft			
– Eccentricity in seats C of differential-speed gear casing bearings and intermediate flange with respect to centering seat D on clutch shaft, to seat E of clutch-speed gear casing bearing and to seat F of 5th speed gear		mm (in)	0.03 (0.00118)
– Squareness deviation of abutment plane G for rear bearing inner race with respect to seats C of bearings		mm (in)	0.03 (0.00118)



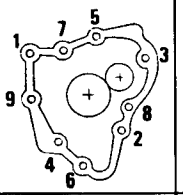
HEATING TEMPERATURES

Application \ Measurement unit	°C (°F)
Heating temperature for roller bearing locking ring nut of bevel pinion shaft (head side)  	140 (284)
Heating temperature of clutch-speed gear casing for installation of Reverse speed gear pin, and bush of speed selection and engagement rod	140 to 160 (284 to 320)
Heating temperature of 3rd and 4th speed driving gears for installation on main shaft	195 to 210 (383 to 410)

TIGHTENING TORQUES

PA360900000001

Unit: N·m (kg·m; ft·lb)

Application \ Gearbox type	With roller-ball compound bearings	With skew ball bearings
Main shaft nut	93 to 103 (9.5 to 10.5; 68.7 to 75.9)	
Bevel pinion shaft securing nut	112 to 124 (11.4 to 12.6; 84.4 to 91.1)	
Nuts securing differential speed gear casing and clutch-speed gear casing to intermediate flange  Tightening order	12 to 13 (1.2 to 1.4; 8.7 to 10.1)	
Screws securing shoulder plate to intermediate flange	14 to 15 (1.4 to 1.6; 10.1 to 11.6)	
Containers for the laking of spring and balls securing rods	17 to 20 (1.7 to 2.1; 12.3 to 15.2)	
Nut securing speed control rear lever to speed selection and engagement lever (1)	28 to 32 (2.8 to 3.3; 20.3 to 23.9)	
Nut securing joint connecting rear lever to speed control rod (1)	20 to 31 (2 to 3,2; 14.5 to 23.1)	
Nut securing ball joint connecting rear lever to transmission lever (2)	25.1 to 31 (2.5 to 3.2; 18.1 to 23.1)	
Nut securing speed selection tie rod (2)	11.3 to 14 (1.1 to 1.4; 8 to 10.1)	
Bolt securing speed selection and transmission lever to speed transmission and engagement lever (2)	8.1 to 10 (0.8 to 1; 5.8 to 7.2)	

Unit: N·m (kg·m; ft·lb)

Application \ Gearbox type	With roller-ball compound bearings	With skew ball bearings
Bolt and screw securing bracket to speed gear rubber pad (2)	8.1 to 10 (0.8 to 1 5.8; to 7.2)	
Bolts securing speed gear unit rubber pads to casing	18.6 to 23 (1.9 to 2.3; 13.7 to 16.6)	
Fast idle switch (on intermediate flange)	40 to 48 (4.1 to 4.9; 26.9 to 35.4)	
Screws securing clutch unit to differential speed gear unit	29 to 32 (2.9 to 3.2; 21 to 23.1)	
Screws securing propeller shaft joint to clutch shaft fork	55 to 57 (5.6 to 5.8) (40.5 to 41.9)	39 to 49 (4 to 5) (28.9 to 36.1)
Unions for clutch hydraulic system pipes	8 to 10 (0.8 to 1; 5.8 to 7.2)	
Unions for clutch hydraulic system hoses	10 to 15 (1 to 1.5; 7.2 to 10.8)	
Screws securing forks of 1st-2nd-3rd and 4th speed	21 to 23 (2.1 to 2.3; 15.2 to 16.6)	
Screws securing speed gear-differential unit to lateral support small block	18.6 to 23.5 (1.9 to 2.4; 13.7 to 17.3)	
Screws (lower) securing speed control lever support to body	20 to 32.5 (2 to 3.25; 14.5 to 23.5)	
Screws (upper) securing speed control lever support to body	4.8 to 6 (0.5 to 0.6; 3.6 to 4.3)	
Nut securing plate for Reverse speed engagement safety device	8.3 to 10.3 (0.9 to 1.05; 6.5 to 7.2)	
Bolt securing lever to external speed control rod	13 to 16 (1.3 to 1.6; 9.4 to 11.6)	

(1) For versions Giulietta Alfetta GTV 2.0 GTV6 2.5 without "isostatic" control

(2) For versions Giulietta Alfetta GTV 2.0 GTV6 2.5 with "isostatic" control

TROUBLE DIAGNOSIS AND CORRECTIVE ACTION

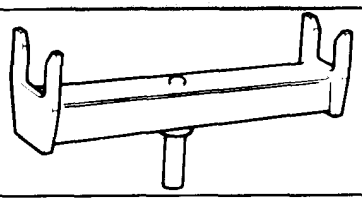
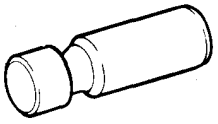
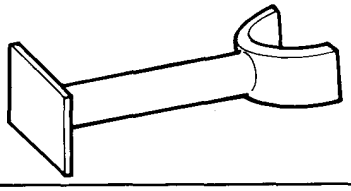
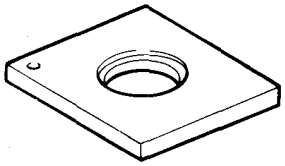
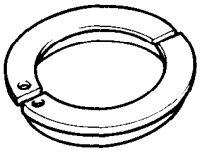
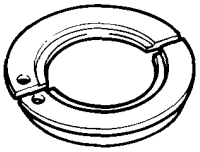
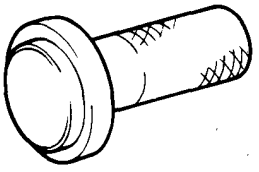
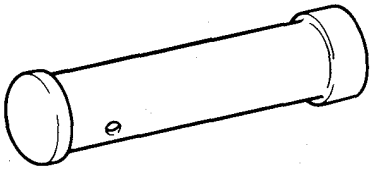
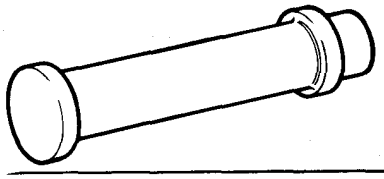
Condition	Probable cause	Corrective action
Transmission is faulty when in forward speeds	Once detected where the noise comes from and established that it does not originate from the engine, proceed as follows in order to, identify the faulty unit – run the car to the speed where noise is most enphasized. – adjusting the speed as required, change alternatively - and within reasonable sequences - all different speeds Once determined the cause of the noise, repair or replace the faulty components	
	• Oil level insufficient or oil not of the prescribed type	Fill-up to proper level or replace oil with the prescribed type
	• Oil leaks from oil seal rings of differential carrier a/o from topping-up or drain plugs	Replace oil seal rings a/o plugs
	• Main shaft bearings (in this case, noise should be present also with speed gear in neutral)	Replace bearings
	• Pinion shaft bearings (noise present only if speed is engaged and this with all speeds)	Replace bearings
Noisy when vehicle is moving even if speedgear is in neutral	• Bearings of differential inner drive shafts faulty or seized	Replace bearings
	• Bevel pinion bearings noisy	Check a/o replace
Noisy when in one particular speed	• Gear teeth mating surfaces worn or seized	Replace gears
Noisy both during acceleration and deceleration (drive shafts already checked)	• Differential gears worn or damaged	Replace gears
	• Hypoid gear excessive clearance	Verify and replace if necessary
	• Crown wheel and pinion securing screws loosened	Tighten the screws
	• Bevel pinion shim (determining pinion-crown axis distance) worn or damaged	Replace washer with another with shim determined by adjustment
	• Pinion shaft securing nut loosened	Check speed gear components a tighten nut
	• Gear package excessive clearance	Adjust package

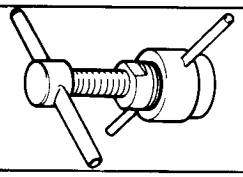
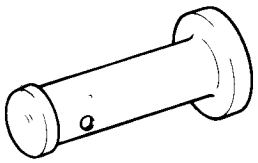
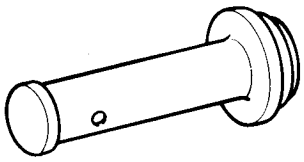
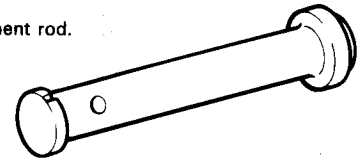
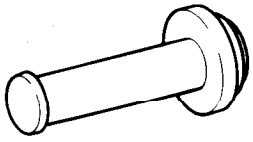
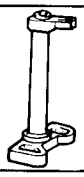
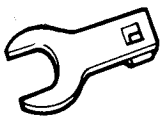
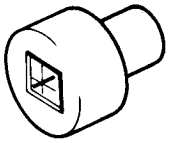
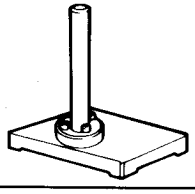
Condition	Probable cause	Corrective action
Transmission noisy when in curve, both with speed engaged and when in "neutral" (drive shafts already checked)	• Teeth of side pinion and crown wheel gears worn, damaged or seized	Replace differential casing
Transmission noisy when in "neutral" (with vehicle stationary)	• Driving torque irregular variation	Adjust idling r.p.m.
	• Not enough oil	Fill up to correct level
Transmission noisy when in reverse speed	• Reverse gears worn or damaged	Replace the faulty components
Speed engagement/disengagement is difficult	First of all, determine whether trouble is due to speed gear or control system. Check whether clutch correctly engages when pedal is released and disengages when pedal is pressed. If clutch s not faulty, the trouble is due to speed gear control system.	
Stiffening of speed gear control a/o non-return of lever to neutral	• Excessive friction in the rotation of tie rod joints of speed transmission and engagement lever	Replace selection tie rod and central ball joint of speed transmission and engagement lever
	• Excessive tightening between speed transmission and selection lever bush and speed transmission and engagement lever	Replace levers, shoulder rings, bushes and pin
	• Insufficient lubrication of speed transmission and selection lever and speed transmission and engagement lever bushes	Grease the points subject to friction
	• O-rings for speed transmission and selection lever broken or too worn, with consequent water a/o dust seepage	Replace O-rings and grease pin of speed transmission and selection lever
	• Insufficient oil level in the differential-speed gear casing	Restore oil correct level
	• Synchronizing unit faulty	Refer to: "Synchronizing unit grinds or is faulty"
	• Inner controls deformed or worn	Repair or replace the faulty components
Excessive clearance in speed selection	• Abnormal wear of pin and related bushes connecting speed transmission and engagement lever with speed transmission and selection lever bush	Replace the worn components

Condition	Probable cause	Corrective action
Noisy	• Incorrect positioning of the unit in the longitudinal direction with interferences	Verify a/o adjust control assembly position
	• Interference with rear floor sidewall	Rivet the area concerned
Speed slip out	• Sleeves and gears worn or faulty	Replace the worn components
	• Excessive clearance of the gear which becomes disengaged (Noise present both in acceleration and deceleration)	Verify gear package adjustment
Speed engagement is poor	• Control levers bushes worn	Replace the worn components
	• Pawls worn or damaged	replace pawls
	• Springs fatigued or broken	Replace springs
	• Rods milling warn or damaged	Replace rods
	• Selector fork a/o lever worn or damaged	Replace selector a/o levers
Synchronizing unit grinds or is faulty	• Sleeve and gear with front toothing worn or damaged	Replace the faulty components
	• Incorrect distance between front toothing of gear and sleeve	Replace the faulty components
	• Synchronizing ring worn	Replace
	• Sleeve splines worn or damaged	Replace
Reverse lights do not light when engaging the Reverse speed	• Reverse lights switch faulty	Replace switch
Speed selector lever vibrates and is noisy	• Lever return spring fatigued	Replace the faulty components
	• Speed control lever bushes faulty	Replace the faulty components
	• Refer to other steps concerning the noisy speed	

Condition	Probable cause	Corrective action
Seizure or breakage	• Insufficient oil level or oil not of the prescribed type	Replace the faulty components and use the prescribed oil
	• Insufficient clearances	Adjust clearances and replace the faulty components
	• Gears and bearings incorrect adjustment	Check the speed gear unit
	• Excessive torque or improper use of clutch	Replace the faulty components
	• Securing screws loosened	Replace the faulty components and restore the rightening torques

SPECIAL SERVICE TOOLS

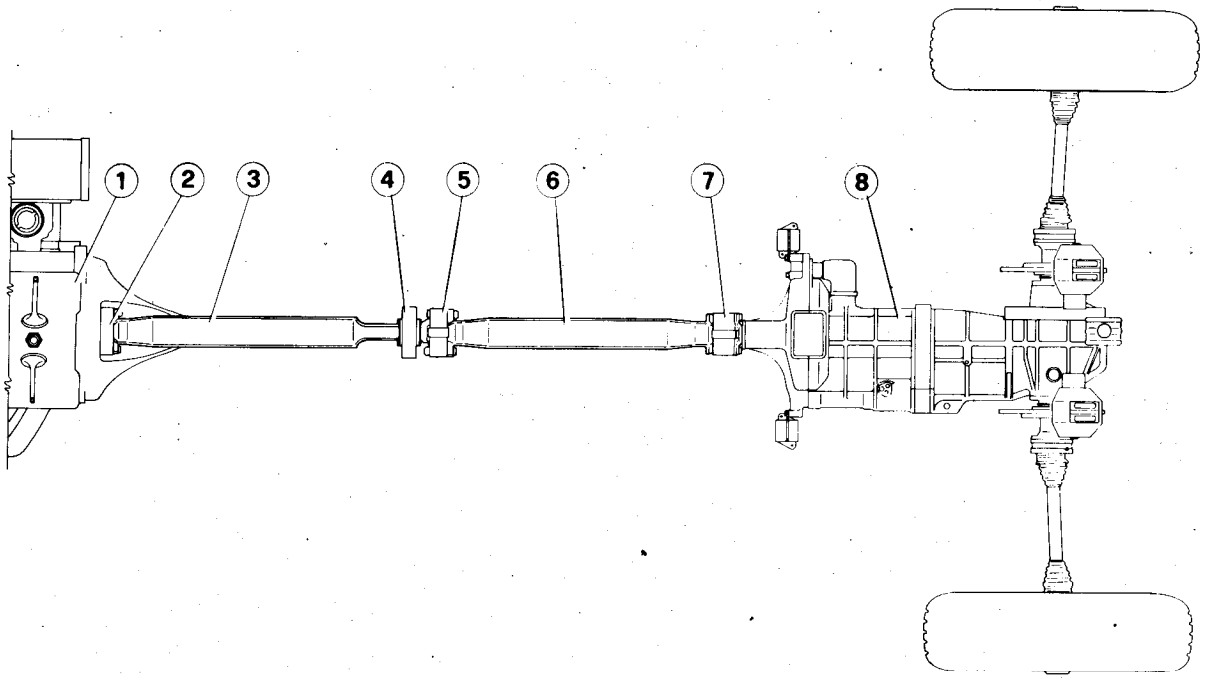
Tool number	Tool name	Page ref.
A.2.0075	Support for jacking up car 	13-6
A.2.0267	Dummy rods for striking rod balls and speed engagement detent balls. 	13-13
A.2.0268	Spacer for removing De Dion axle 	13-6
A.2.0349-0100	Half-ring support plate for disassembling ring nut and inner race of pinion shaft bearing (to be used with A.2.0401 and A.2.0402) 	13-20
A2.0401	Half-rings for removing inner race of pinion shaft rear bearing - (to be used with A.2.0349/0100) 	13-20
A.2.0402	Half-rings for removing ring nut of pinion shaft rear bearing - (to be used with A.2.0349-0100) 	13-20
A.3.0192	Puller-driver for outer race of pinion shaft bearing on intermediate flange (Solutions with intermediate roller/ball bearings) 	13-22 13-27
A.3.0343	Driver for main shaft oil seal ring 	13-33
A.3.0346	Driver for pinion shaft bush 	13-32

Tool number	Tool name	Page ref.
A.3.0361	Puller for inner race of main shaft rear bearing 	13-20
A.3.0407	Puller-driver for outer race of pinion shaft intermediate bearing (Solution with intermediate skew ball bearings) 	13-21 13-26
A.3.0408	Puller-driver for outer race of pinion shaft intermediate bearing (Solution with intermediate skew ball bearings) 	13-21 13-26
A.3.0532	Driver for bush of speed selection and engagement rod. 	13-32
A.3.0596	Puller-driver for outer race of main shaft bearing on intermediate flange (Solution with intermediate roller/ball bearings) 	13-22 13-27
A.4.0145	Support of gauge for determining pinion shim (to be used with C.6.0166) 	13-18 13-29
A.5.0181	Wrench, 30 mm. for main shaft nut 	13-18 13-29
A.5.0216	Spanner for plug of speed control rod ball 	13-14 13-15
C.6.0166	Reference gauge for determining pinion shim (to be used with A.4.0145) 	13-18

GROUP 13

INDEX

DESCRIPTION



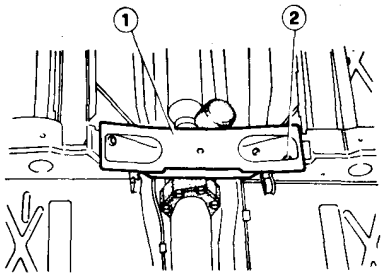
1 Engine
2 Front joint
3 Front shaft
4 Center bearing
5 Center, joint
6 Rear shaft
7 Rear joint
8 Clutch - transmission - axle drive assembly

Drive line consists of shafting connecting engine to clutch - transmission - axle drive assembly.
This unique layout allows propeller shaft to be positively connected to engine at all times.
Propeller shaft consists of two halves connected to one another and to anchor points by means of flexible joints.
Propeller shaft is anchored to body through a center bearing assembly provided with a ball bearing.

PROPELLER SHAFT

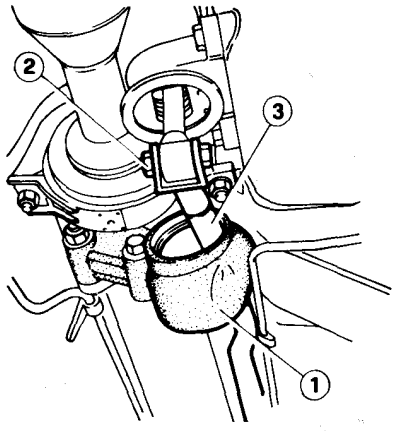
REMOVAL

1. Raise car on a platform lift.
2. Remove exhaust pipe front and center section as specified in Group 04: Exhaust system - Removal.
3. Back off capscrews (2) and remove center crossmember (1).



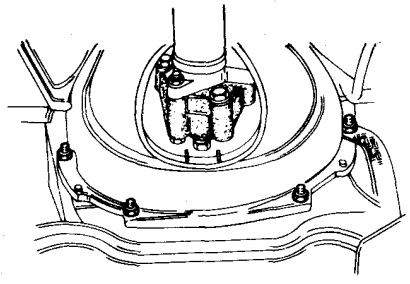
1 Center crossmember
2 Crossmember/body capscrew

4. Remove bellows (1), back off and remove bolt (2) and disconnect rod (3).



1 Bellow
2 Transmission remote control rod/lever bolt
3 Transmission remote control rod

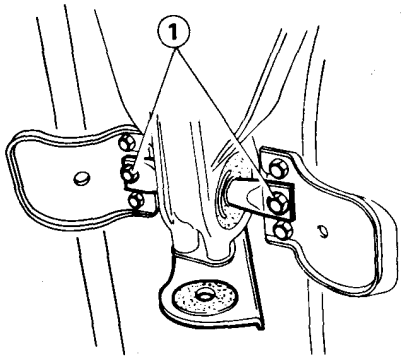
5. Back off plate-bell housing securing bolts and remove plate.



6. Disconnect bell housing from body.

a. For vehicles with high-torque propeller shaft (see: Group 00 - Complete Car - Use of Units in Car):

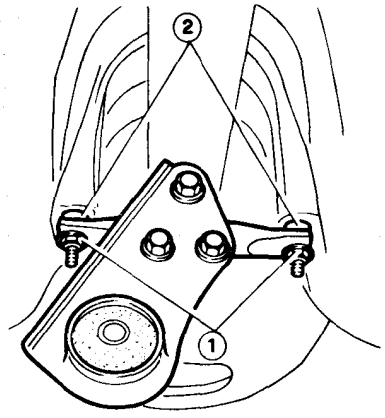
- Back off capscrews (1) and disconnect rear engine mount from body.



1 Rear engine mounting capscrews

b. **All other** models:

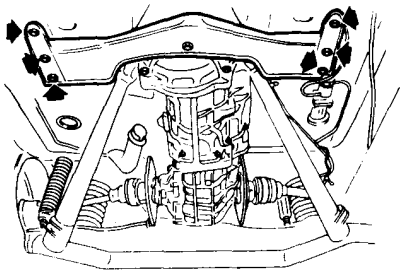
- Back off nuts (1), disconnect rear engine mount from body, retrieving spacers (2).



1 Rear engine mounting retaining nuts
2 Spacers

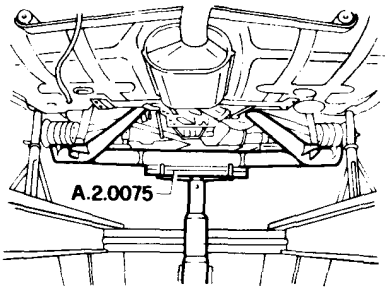
7. Clamp propeller shaft and back off bolts connecting shaft joints to flywheel and clutch fork; rotate shaft and back off the remaining bolts.

8. Back off six screws retaining axle front crossmember to body.

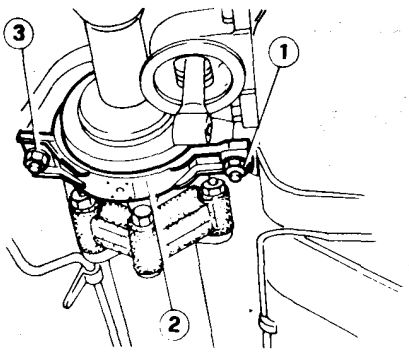


WARNING:
On Alfetta, Giulietta and GTV 2.0 there is no need to disturb the crossmember.

9. Position a column lift provided with cradle **A.2.0075** under De Dion axle.
10. Acting on De Dion axle, lower crossmember and transmission unit.



11. Back off nuts (1) and disconnect support (2) from body.



1 Center bearing to body retaining nut
2 Center bearing
3 Washer

12. Take off shaft disconnecting from clutch shaft fork first and then from flywheel.

INSTALLATION

Install by reversing removal sequence and adhering to the instructions given below.

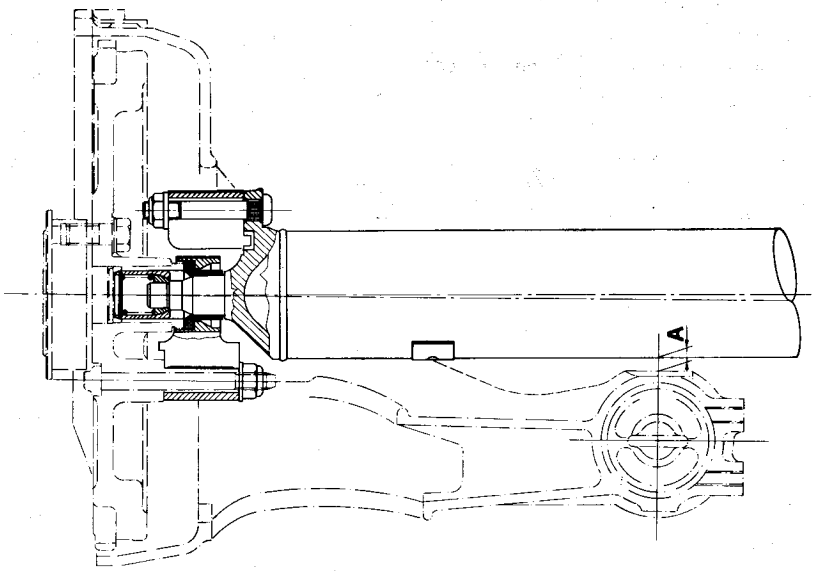
- Where not already carried out during overhaul, lubricate front bush and rear centering bush using the recommended grease (ISECO Molykote BR2) (quantity: see Inspection Specifications - Fluids and Lubricants).
  If necessary, wet flywheel bush using the same type of grease.
- Tighten nuts retaining flexible joints to flywheel and clutch fork to the specified torque (see Inspection Specifications - Tightening Torques).

WARNING:
On assembly, use new self-locking nuts.

- Tighten transmission unit crossmember to body capscrews to the specified torque.

Ⓣ : **Tightening torque**
Transmission unit crossmember to body capscrews
39 to 44 N·m
(4 to 4.5 kg·m)
(28.8 to 32.5 ft·lb)

- For 4 cylinder petrol and turbo diesel cars.
  Check that distance A between the propeller shaft and the rear engine support is as specified.

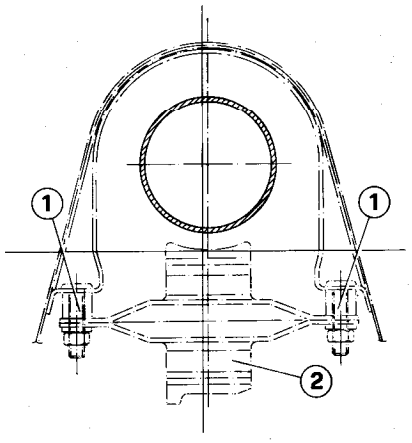


Distance A between the propeller shaft and rear engine support.

4 cylinder petrol run car:
A = 7 mm (0.28 in)

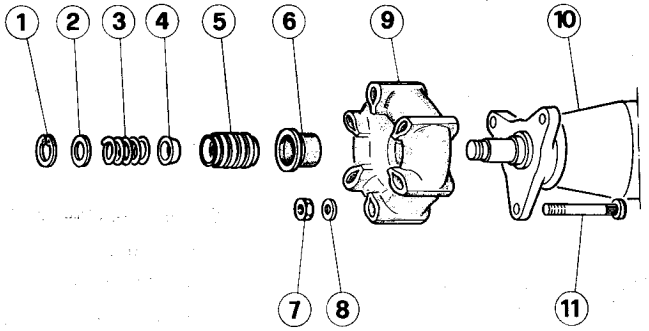
Turbo diesel car:
A = 24 mm (0.94 in)

If this distance differs from the specified one, vary the length of the spacers ① placed between the rear engine support ② and the body accordingly.



1 Spacer
2 Rear engine support

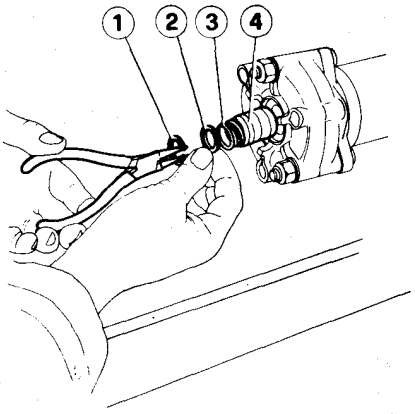
FRONT JOINT



1 Retaining ring
2 Washer
3 Spring
4 Ball cap
5 Bush
6 Rubber cap
7 Nut
8 Washer
9 Flexible member
10 Front shaft
11 Capscrew

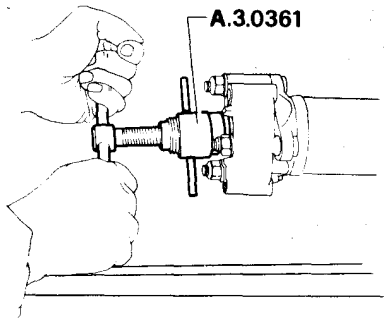
DISASSEMBLY

1. Clamp front shaft in a vice and remove retaining ring (1) from bush (4), take off washer (2) and spring (3).

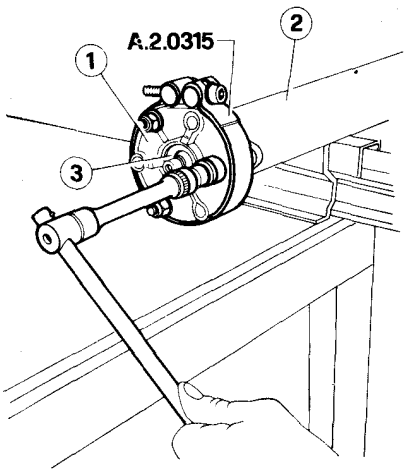


1 Retaining ring
2 Washer
3 Spring
4 Bush

2. Using tool **A.3.0361**, remove bush and ball joint from front shaft spigot.



3. Install tool **A.2.0315** on flexible joint. Back off three nuts retaining joint (1) to front shaft (2), retrieve associated washers, remove joint and rubber ring (3).



1 Flexible joint
2 Front shaft
3 Rubber ring

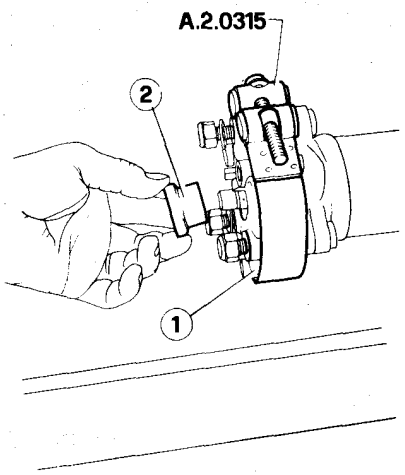
INSPECTION

Clean all parts

1. Check that bush and ball working surface is not worn; replace damaged parts as necessary.
2. Check flexible joint (replace if cracked or dented).

ASSEMBLY

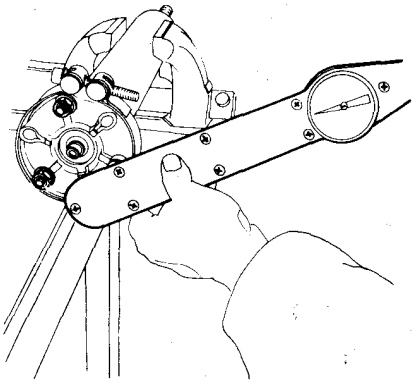
1. Using tool **A.2.0315**, install flexible joint (1) and position rubber ring (2).



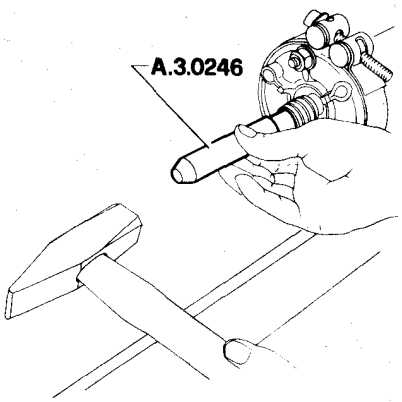
1 Flexible joint
2 Rubber ring

CAUTION:
If flexible joint has been replaced, tool A.2.0315 is not required for assembly.

2. Tighten three flexible joint nuts with associated washers to the specified torques (see Inspection Specifications - Tightening Torques).

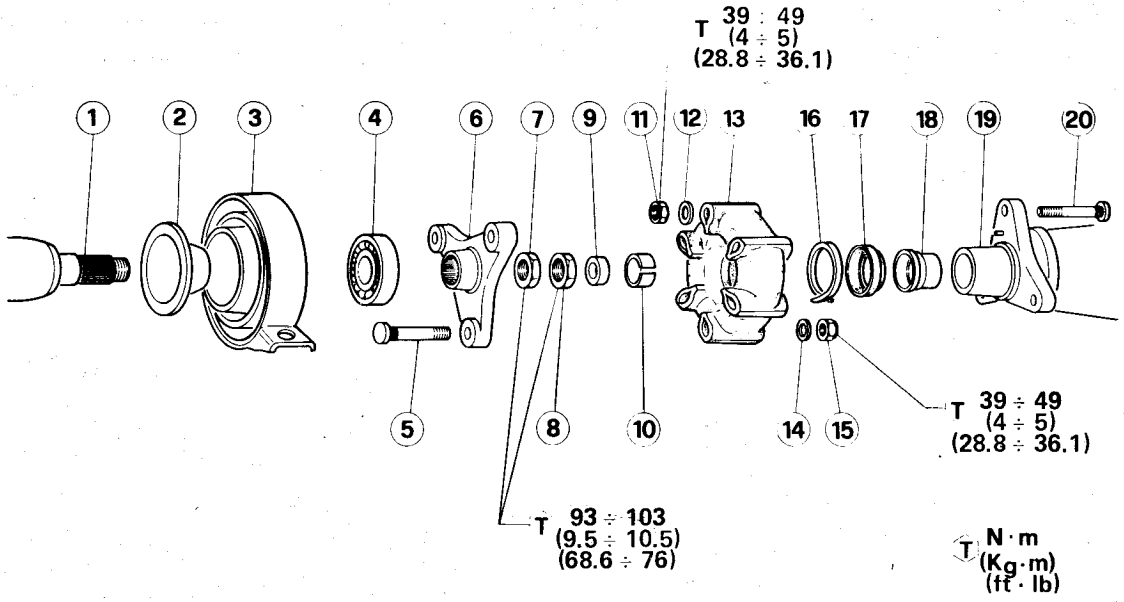


3. Lubricate bush using the recommended grease (ISECO Molykote BR2) (*quantity: see Inspection Specifications - Fluids and Lubricants*) and coat ball joint and bush working surfaces using recommended grease (ISECO Molykote G Rapid).
4. Insert ball cap in bush and position on front shaft spigot using tool **A.3.0246**.



5. Insert spring and washer in bush and position retaining ring. Remove tool **A.2.0315**.

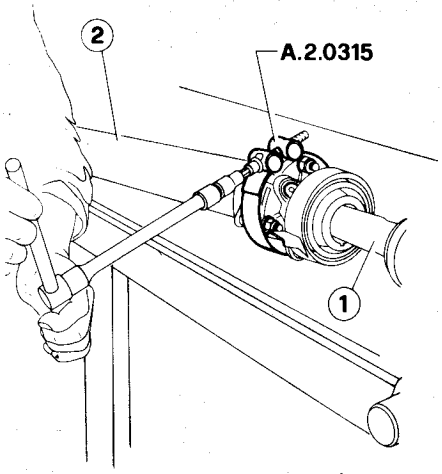
CENTER BEARING



1 Front shaft
2 Cup
3 Center bearing support
4 Bearing
5 Capscrew
6 Fork
7 Nut
8 Locknut
9 Ball
10 Spherical seat
11 Nut
12 Washer
13 Flexible joint
14 Washer
15 Nut
16 Retaining ring
17 Rubber cap
18 Front bush
19 Rear shaft
20 Capscrew

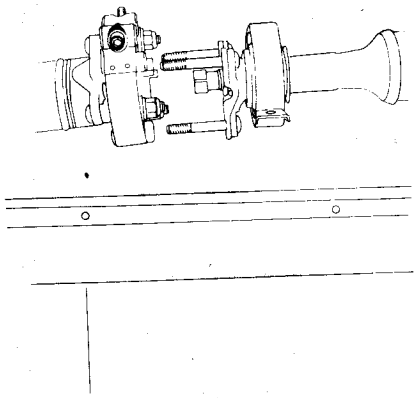
DISASSEMBLY

1. Clamp front shaft (1) in a vice, mark front and rear (2) shaft position, install tool **A.2.0315** on center flexible joint.



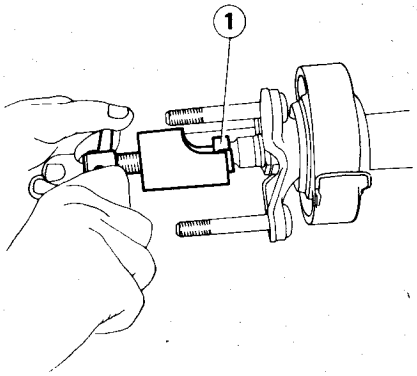
1 Front shaft
2 Rear shaft

2. Back off three nuts retaining front shaft to center bearing, remove associated washers and take off both shafts.



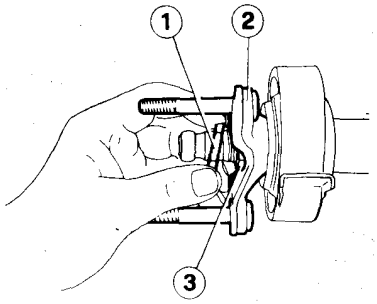
3. Mark front shaft fork and spigot to facilitate assembly.

4. Using a puller, take off spherical seat (1) from front shaft spigot.



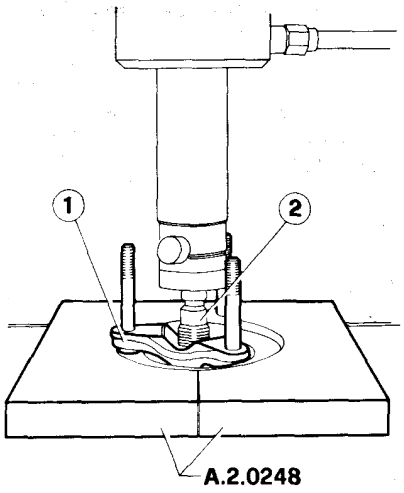
1 Spherical seat

5. Back off and remove locknut (1) and nut (3) retaining fork (2).



1 Locknut
2 Fork
3 Nut

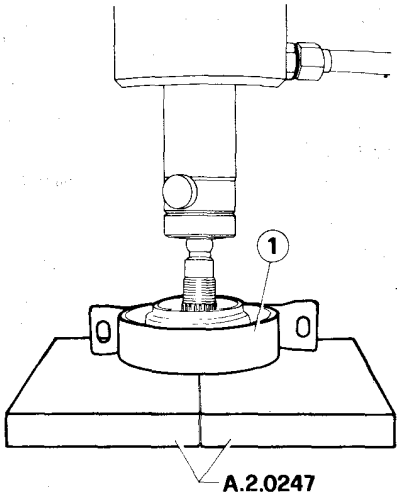
6. Using a press with adapter plates of tool **A.2.0248** take off fork (1) from front shaft (2).



1 Fork
2 Front shaft spigot

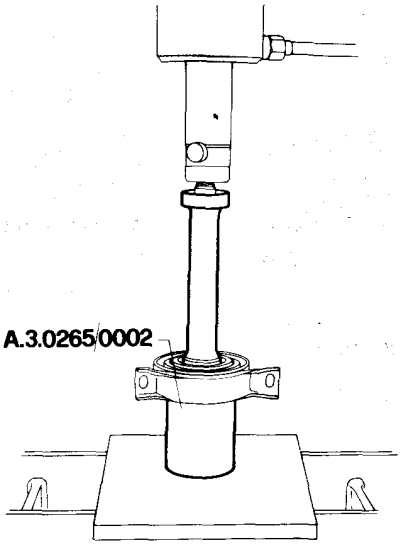
CAUTION:
On disassembly do not damage fork as its replacement will affect shaft balancing.

7. Using a press with adapter plates of tool **A.2.0247**, take off center support (1) after marking front and rear sides, and retrieve associated cup.

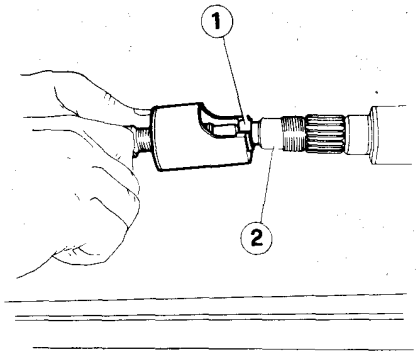


1 Center support

8. Using tool **A.3.0265/0002**, take off center support bearing at the press.

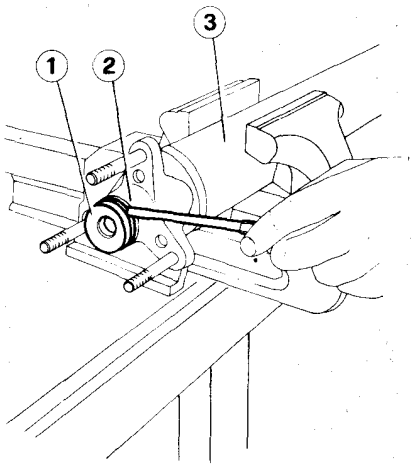


9. Take off ball (1) from front shaft spigot (2).



1 Ball
2 Front shaft spigot

10. Clamp rear shaft in a vice, mark center support position with respect to shaft, install tool **A.2.0315** on joint, back off three retaining nuts, remove associated washers and take off joint.
11. Remove rear shaft front bush rubber ring (1) after removing retaining ring.



1 Rubber ring
2 Front bush
3 Rear shaft

INSPECTION

Clean all parts.
1. Check support bearing: replace if necessary.
2. Check that ball or spherical seat working surface is not worn or scored; replace damaged parts as necessary.
3. Check flexible joint; if cracked or dented, replace without hesitation.

ASSEMBLY

1. Lubricate bush and rubber ring using 5 cc of recommended grease (ISECO Molykote BR2).
2. Install rubber ring (2) in bush (1) and lock through associated retaining ring.