

COMPLETE CAR

(Sweden version)

No.	OPERATION	A	Km/1000					Notes (1)
			20	40	60	80	100	
17-10	Check drive shaft and steering box boots for cracks or wear	X	X	X	X	X	X	
21-10	Check front wheel toe-out; adjust if necessary	X						
22-10	Inspect brake system	X	X	X	X	X	X	
22-20	Check front brake pads; and rear drum friction gaskets; possible replacement		X	X	X	X	X	(7)
22-25	Check brake booster vacuum hose for sound condition		X	X	X	X	X	
22-30	Change brake fluid			X		X		(8)
22-40	Check level of fluid in both brake and clutch reservoirs	X	X		X		X	(9)
22-50	Check parking brake stroke; adjust as required	X	X	X	X	X	X	
28-10	Check tire pressure	X	X	X	X	X	X	(5)
30-10	Check air pump, diverter, check-valve and change as necessary. Check hoses and air manifold for soundness		X	X	X	X	X	
30-20	Clean and check air nozzle; change, if necessary			X		X		
40-10	Check battery electrolyte level and top up is necessary; also check terminals for proper tightness and lubrication	X	X	X	X	X	X	(5)
40-20	Check headlights aiming and adjust as required	X						
56-10	Lubricate door and bonnet hinges; adjust striker plates	X	X	X	X	X	X	

- (1) $A = 1300 \div 1700$ Km
- (2) To be performed also at 10, 30, 50, 70, 90 Km/1000 and in any case once a year. Check oil level frequently when refuelling.
- (3) Check and clean cartridge at Km intervals (mileage) stated in item (2) above and even more frequently if driving in very dusty areas
- (4) Check spark plugs at 10, 30, 50, 70, and 90 Km/1000
- (5) Check frequently when refuelling
- (6) Every two years whichever occurs first
- (7) To be performed at Km/1000: 10, 30, 50, 70, 90 and even more frequently when driving under particular stress conditions (sport driving) or on hilly roads.
- (8) Once a year whichever comes first
- (9) Also at Km/1000: 10, 30, 50, 70, 90.

COMPLETE CAR

(Australia version)

No.	OPERATION	A	Km/1000									
			10	20	30	40	50	60	70	80	90	100
21	Test vehicle	X		X		X		X		X		X
22	Change spark plugs			X		X		X		X		X
23	Check accelerator cable; adjust if necessary	X		X		X		X		X		X
24	Replace air cleaner cartridge and air pump cleaner			X		X		X		X		X
25	Clean and change, if necessary air cleaner cartridge and air pump cleaner		X		X		X		X		X	
26	Check air pump, diverter, check-valve and change as necessary. Check hoses and air manifold for soundness			X		X		X		X		X
27	Check automatic starting device; adjust if necessary			X		X		X		X		X
28	Change gearbox-differential oil	X				X		X		X		
29	Clean carburetor					X		X		X		
30	Change brake fluid					X		X		X		
31	Check front wheel toe-out and adjust if necessary	X				X		X		X		
32	Change engine coolant					X		X		X		
33	Clean and check air nozzle; change, if necessary					X		X		X		
34	Replace camshaft drive belts							X				
35	Replace air pump and alternator drive belts							X				
36	Check lights, indicating devices, screen wiper and heater fan	X										
37	Check all bolts for tightness	X										

A = 1300 ÷ 1700 Km
 To be performed in any case every 6 months whichever comes first
 To be performed in any case every 12 months whichever comes first
 Check frequently when refuelling
 To be performed in any case every two years

Type	Application	Classification	Denomination			Notes
			AGIP *	IP *	Other *	
FLUID-	Cooling System - 07		F 1 Antifreeze	Antifreeze		Ethylene glycol (concentrated) Std. n. 3681 - 69956
						Antifreeze (ready for use) Std. n. 3681 - 69958
	Brake - Clutch - 22/12	SAE J 1703 C F.M. V.S.S. N. 116 D.O.T. 3	F 1 Brake Fluid Super HD			
				Auto Fluid FR	ATE "S"	

* It is advisable to use the mentioned products. It is any way possible use of equivalent products.

VISCOSITY SAE

Measurement Unit	°C (°F)	Motor Oil		Gearbox-Differential Oil	
		SAE 10W50		SAE 80W90	
Cst	-17.8 (0)	2600			
	37.8 (100)	165		220	
	50 (122)	110		110.2	
	98.8 (210)	19		18.2	

COMPLETE CAR

Condition	Probable cause	Corrective action
	<ul style="list-style-type: none"> • Compression leaks at cylinder head gasket • Sticking or damaged piston rings • Worn piston rings or cylinder 	<p>Replace gasket</p> <p>Replace</p> <p>Overhaul engine</p>

Trouble-shooting procedure

Pour engine oil into spark plug hole and then measure cylinder compression

Compression increases: Malfunctioning cylinder or piston rings

Compression does not change: Compression leaks from valves, cylinder heads or cylinder head gaskets

IMPROPER ENGINE IDLING

Fuel system out of order

- | | |
|---|---|
| • Incorrect idle adjustment | Adjust |
| • Clogged carburetor jets or fuel filter | Clean |
| • Clogged air cleaner | Replace cartridge |
| • Damaged manifold gasket or carburetor insulator | Replace gasket |
| • Loose intake manifold fittings | Tighten |
| • Incorrect carburetor float level | Adjust and check needle valve tightness |
| • Malfunctioning carburetor throttle valve | Check and adjust |
| • Malfunctioning idle compensator in air cleaner | Check and, if necessary, replace |

Low compression	Previously mentioned	Previously mentioned
Other	<ul style="list-style-type: none"> • Malfunctioning starter • Loose cylinder head bolts • Incorrect valve clearance • Malfunction in ignition system (spark plugs, high voltage cable, contact breaker points, ignition coil, etc.) • Incorrect ignition timing 	<p>Check</p> <p>Tighten</p> <p>Adjust</p> <p>Adjust or, if necessary, replace</p> <p>Adjust</p>

Use only specified fluids taken from sealed tins to be opened only when ready to use.

When refilling, filter should be properly fitted in reservoir.

CAUTION:

If brake pedal travel is long and elastic, it means that there is still air in the system. In this case repeat air bleeding.

CHECKING SERVOBRAKE

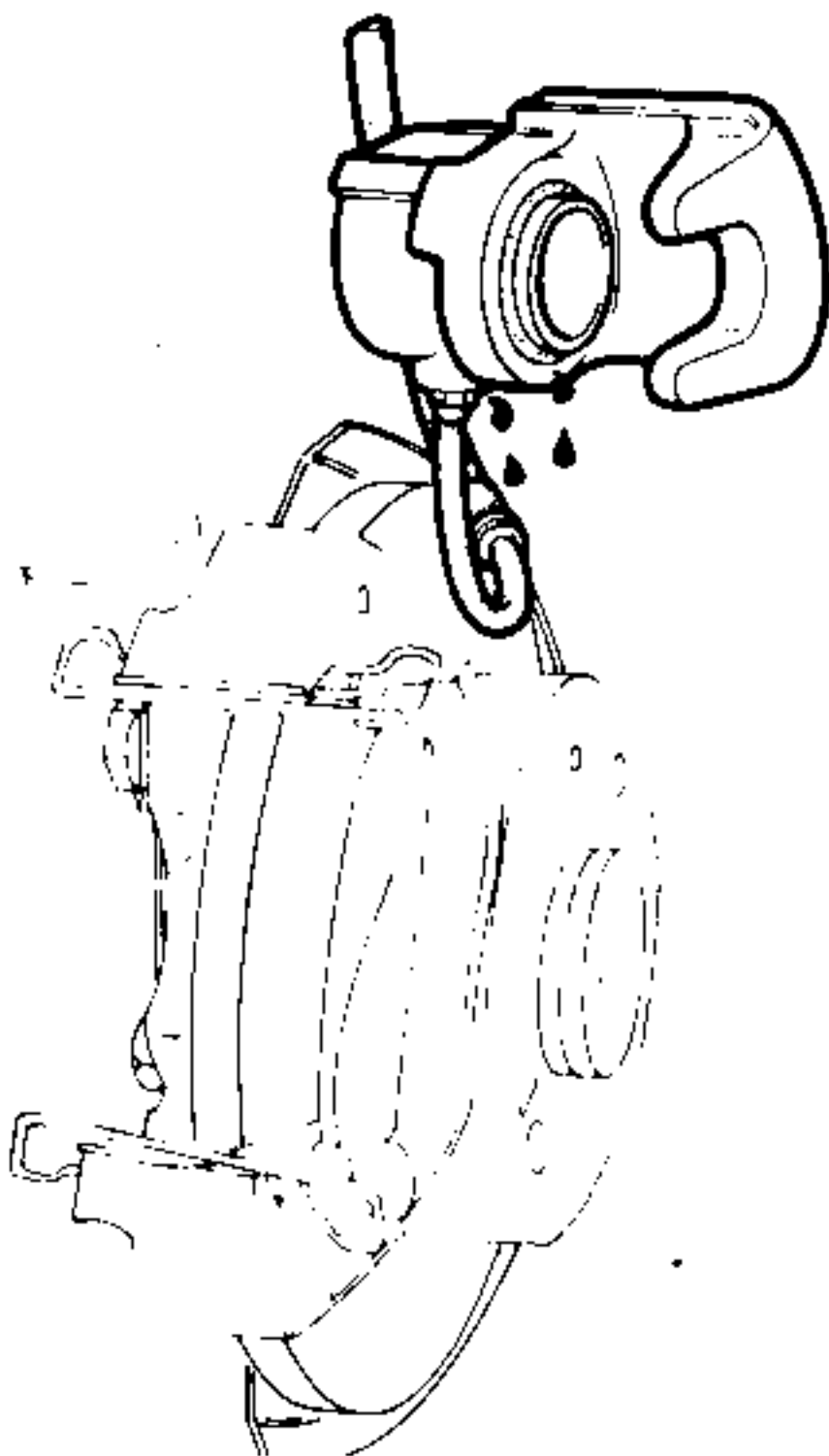
1. Check vacuum hose and relevant unions for any evidence of excessive wear; also check hose for dents.
2. Check and make sure that servobrake vacuum intake hose is not cracked or pinched and that it is properly secured.

CHECKING BRAKE SYSTEM

Check brake system for faulty connections, leaks, abrasions, deteriorations, etc.

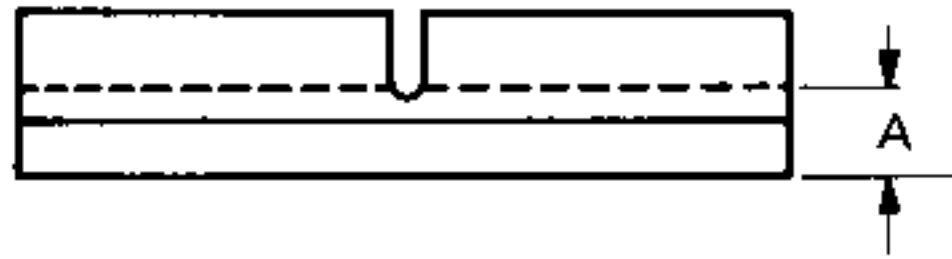
CHECKING DISC BRAKE

Verify wear condition of disc brake components and find possible leak-ages.



1. Check disc thickness making also sure disc is not scored.
2. Check if caliper is in proper working condition and inspect it for leaks.
3. Check pads and discs for wear.

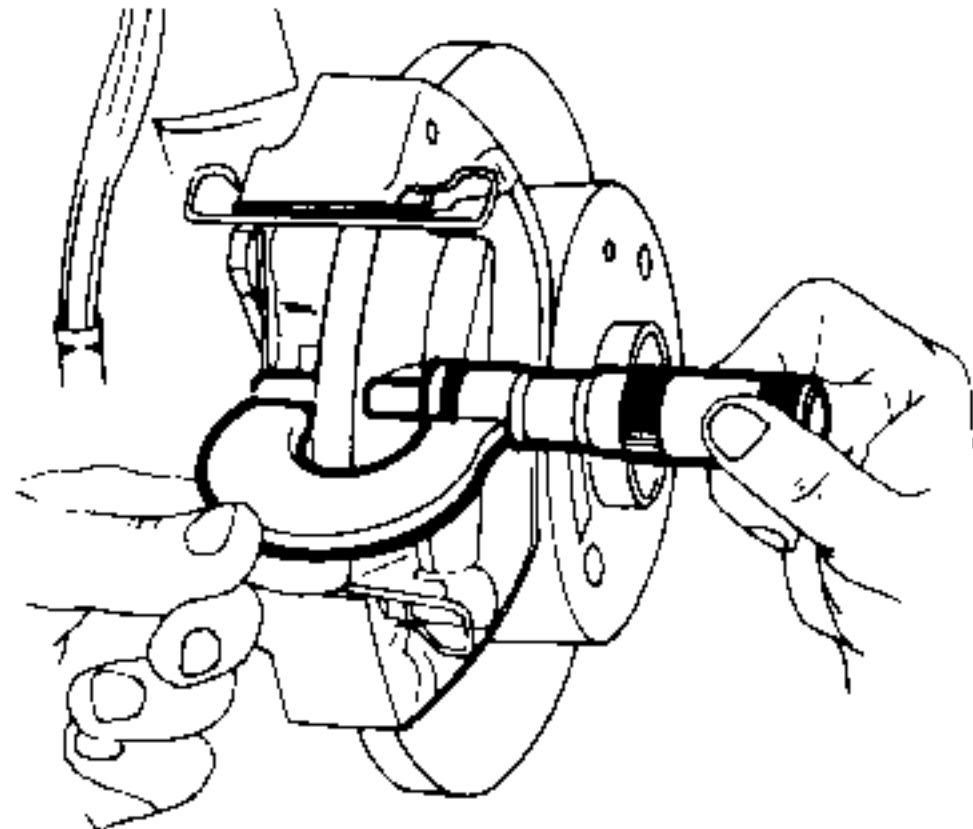
Pad wear limit



Pad, min. thickness
A = 7 mm (0.276 in)

Refer to the procedure described in Front and Rear Brakes.

Disc wear limit

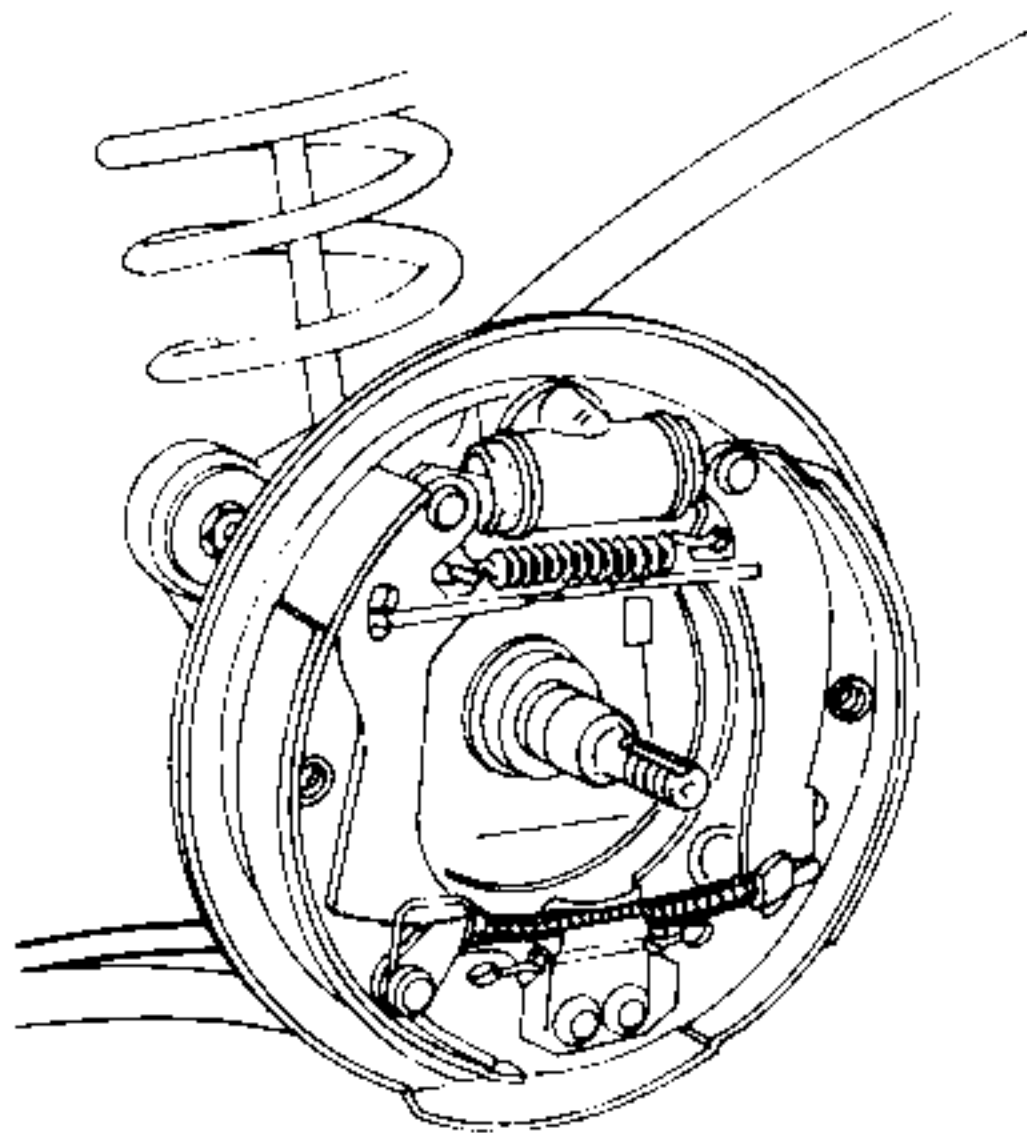


Disc min. thickness
S = 9 mm (0.354 in)

To replace pads and discs refer to Group 22 - Front Disc Brake.

CHECKING DRUM BRAKE

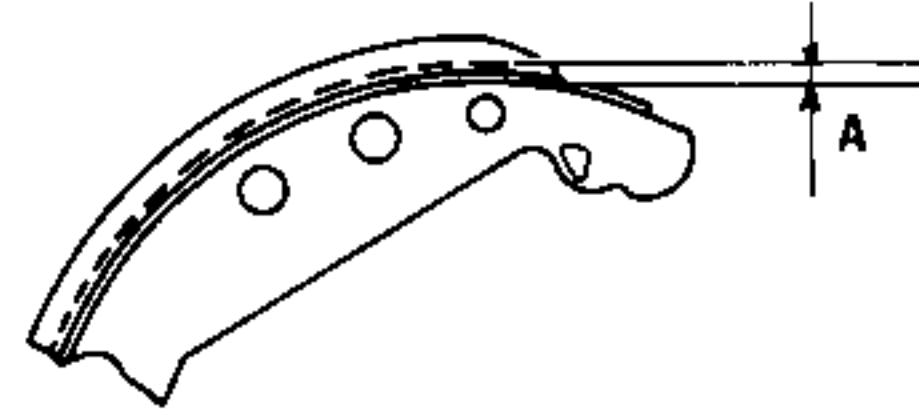
Check condition of drum brake components.



1. Check and make sure shoe lining wear is not below min. allowed limit.
2. Check springs and pins.

3. Check if pistons are in proper working condition and inspect them for leaks.

Lining wear limit

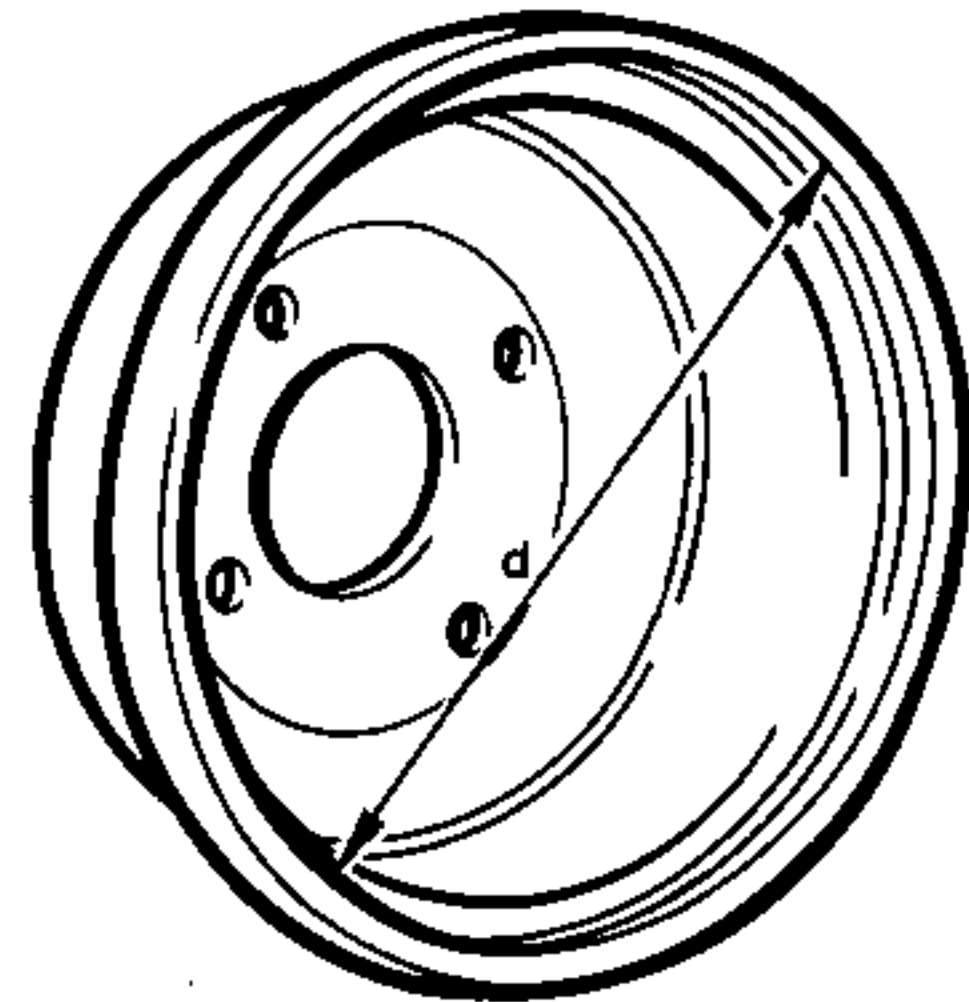


Lining min. thickness
A = 0,5 mm (0.019 in)

In case the prescribed value is not read replace jaws referring to procedure provided in Group 22.

4. Check drum inner surface for scores and measure drum's inner diameter.

Drum wear limit



Max. drum inner diameter
d = 229,6 mm (9,04 in)

CHECKING AND ADJUSTING PARKING BRAKE

1. Operate a few times the pedal control so as to obtain complete recovery of clearances between braking gaskets and rear drums.
2. Operate on parking brake lever and verify that lever travel corresponds to the prescribed number of clicks.

Applied force:
98 N (10 kg - 22 lb)
Travel: 2 clicks

COMPLETE CAR

Cooling system

Testing pressure	kPa	bar	p.s.i.	kg/cm ²
Radiator filler cap relief pressure	68.6	0.69	9.96	0.7
Cooling system testing pressure	107.9	1.08	15.65	1.1

Ignition

Timing (1)	RPM	Advance degrees
Fixed advance	900	8° ± 1°
Max. advance	4,500	36° ± 1°

(1) Timing values are those measured with vacuum corrector hose being disconnected

Fuel system

	Engine		
	1200	1350	1500
Idle-rpm (warm engine, gear in "neutral", clutch engaged) r.p.m.	900 ÷ 1000 850 ÷ 950 (*)		
Idling CO%, total	≤ 3.5 0.7 ÷ 2.4 (*)		

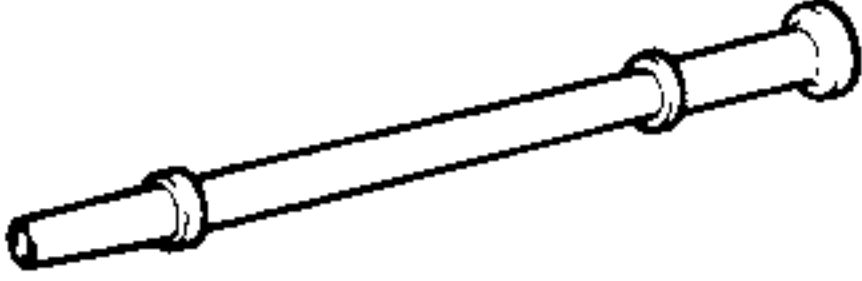
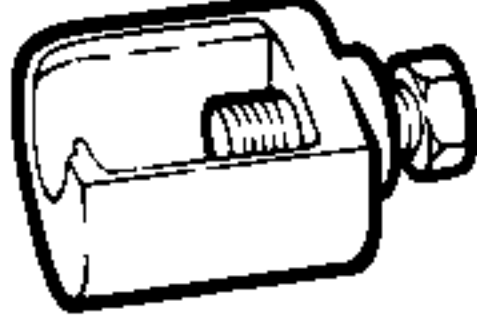
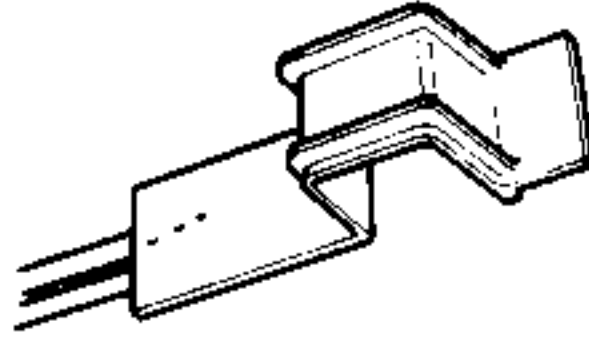
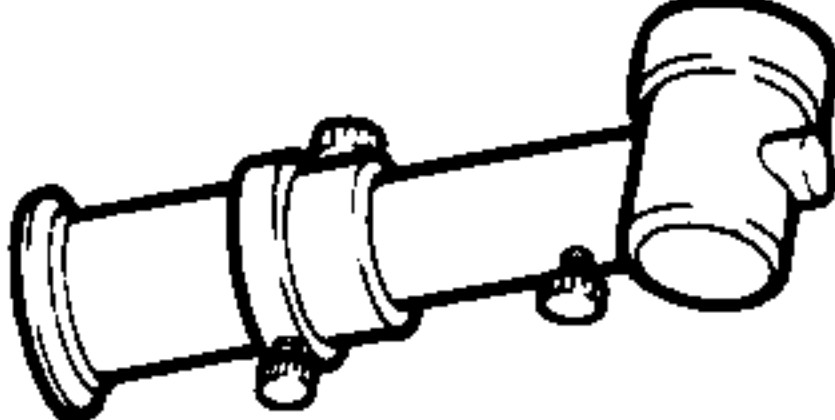
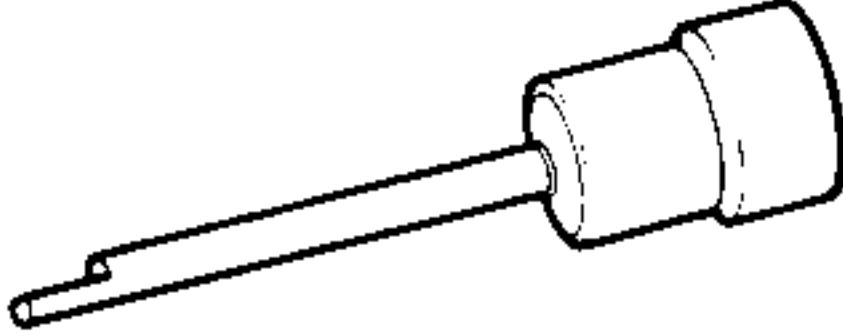

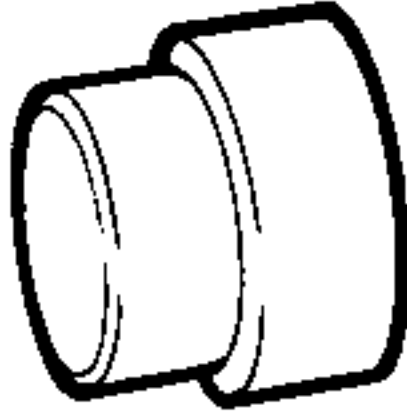

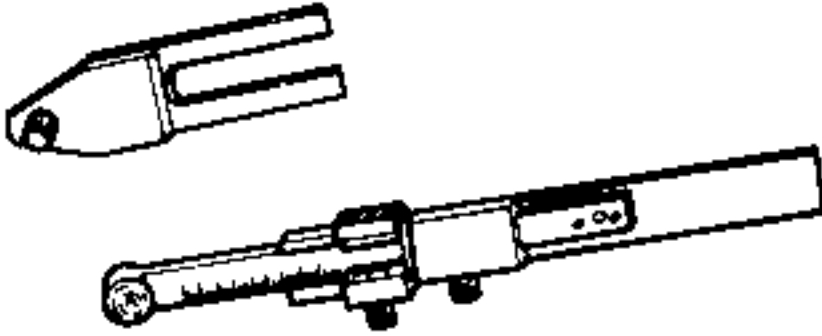
(*) for Switzerland, Sweden, Australia

TIGHTENING TORQUES

Item	N·m	kg·m	ft·lb
Cylinder head screw	(1) 57 ÷ 62	5.8 ÷ 6.3	41.94 ÷ 45.55
	(2) 62 ÷ 67	6.3 ÷ 6.8	45.55 ÷ 49.17
Idler pulley lock nut	(3) 37 ÷ 46	3.8 ÷ 4.7	27.48 ÷ 33.98
	(4) 29 ÷ 35	3 ÷ 3.6	21.38 ÷ 25.8
Spark plugs	25 ÷ 34	2.5 ÷ 3.5	18.08 ÷ 25.31

- (1) Tightening torque with a 300 mm (11.81 in) lever arm torque spanner
- (2) Tightening torque with a 400 mm (15.74 in) lever arm torque spanner
- (3) Cold engine value
- (4) Warm engine value

SPECIAL SERVICE TOOLS

Tool number	Tool name	Refer to page
A.2.0278	Valve cups stopper 	00-24
A.3.0156	Puller of pin from stub axle 	00-42
A.4.0146	Tool for suspension height check 	00-41 00-42
A.4.0149	Tool for suspension height check 	00-41 00-42
A.4.0150	Probe for suspension height check (to be used with A.4.0146 - A.4.0149) 	00-41
A.4.0153	Magnetic adapter for suspension height check (to be used with A.4.0146 - A.4.0149) 	00-41
A.4.0206	Magnetic adapter for suspension height check (to be used with A.4.0146 - A.4.0149) 	00-42
A.5.0193	Wrench for adjusting valve clearance, 5 mm size 	00-24
C.6.0168	Feeler gauge for checking valve clearance 	00-24

ENGINE MAIN MECHANICAL UNIT

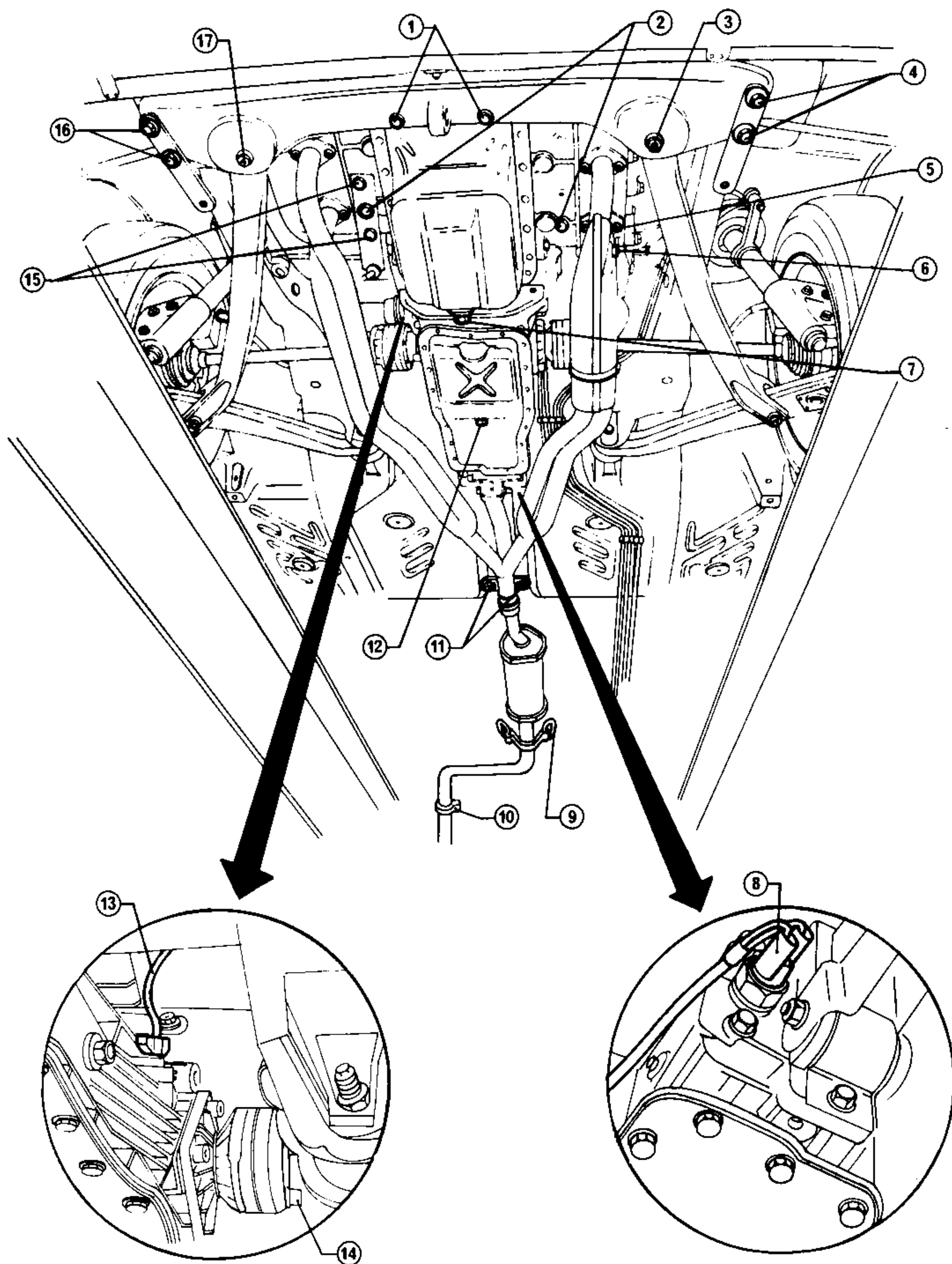


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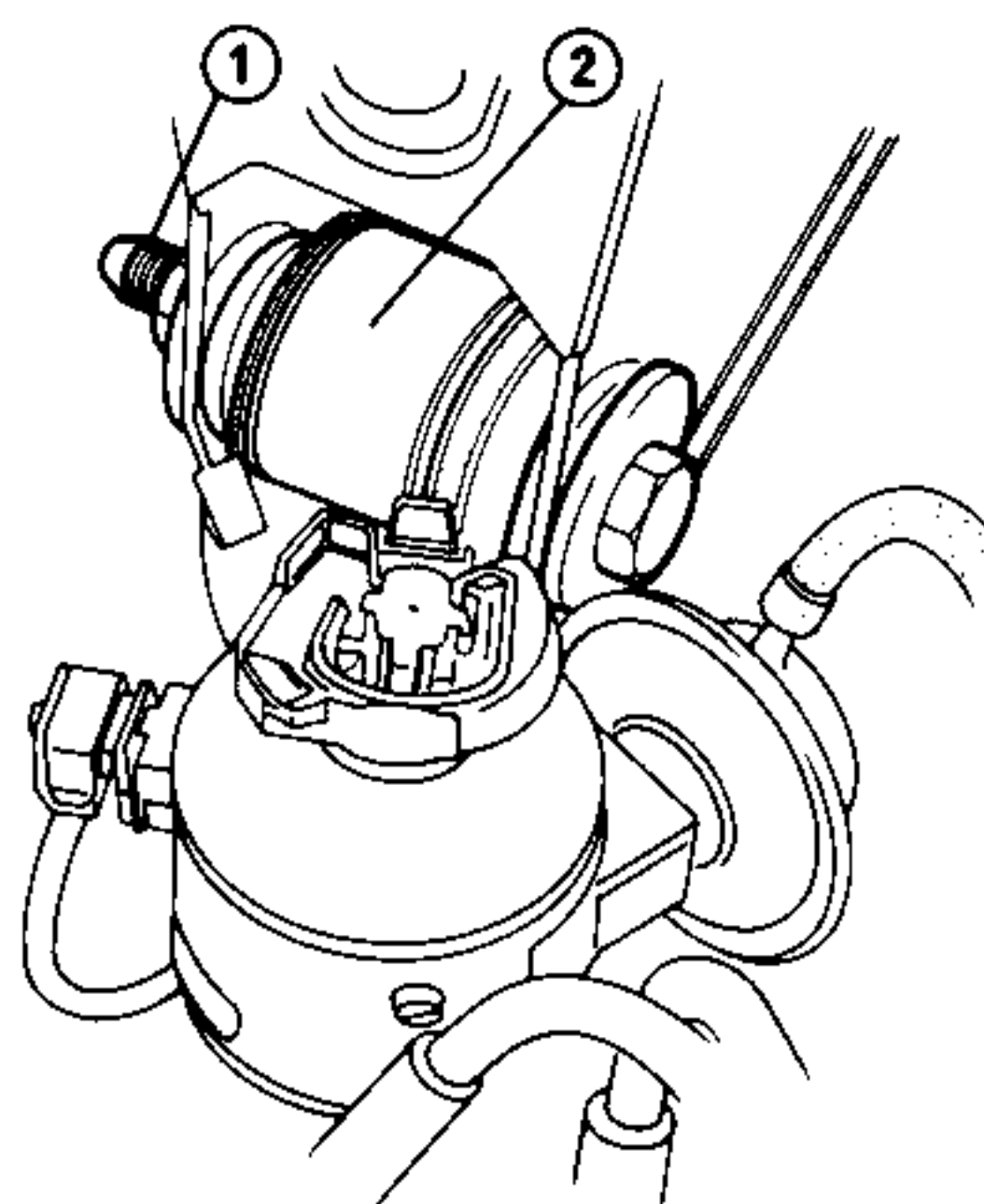
ENGINE MAIN MECHANICAL UNIT

Disconnections to be made from beneath the car



- 1 Engine front support to crossmember fixing screws
- 2 Coolant drain plugs
- 3 Cross member to left strut connecting bolt
- 4 Cross member to body fixing screws
- 5 Exhaust manifold flange nuts
- 6 Hot air intake bracket nut
- 7 Engine oil drain plug
- 8 Reverse light cable
- 9 Exhaust pipe support retaining rings

- 10 Exhaust pipe clamp screw
- 11 Gear box rear support fixing screws
- 12 Gear box oil drain plug
- 13 Speedometer cable
- 14 Drive shaft screws
- 15 Bracket screws
- 16 Cross member to body fixing screws
- 17 Mut jointing cross member - transverse link



1 Bolt 2 Central support

12. Raise the car and from beneath, with reference to figure of page 01-5, carry out the following removals:

(1) Disconnect revers lights cable (8).

(2) Disconnect speedometer wire (13) from gearbox casing by taking off the retaining ring.

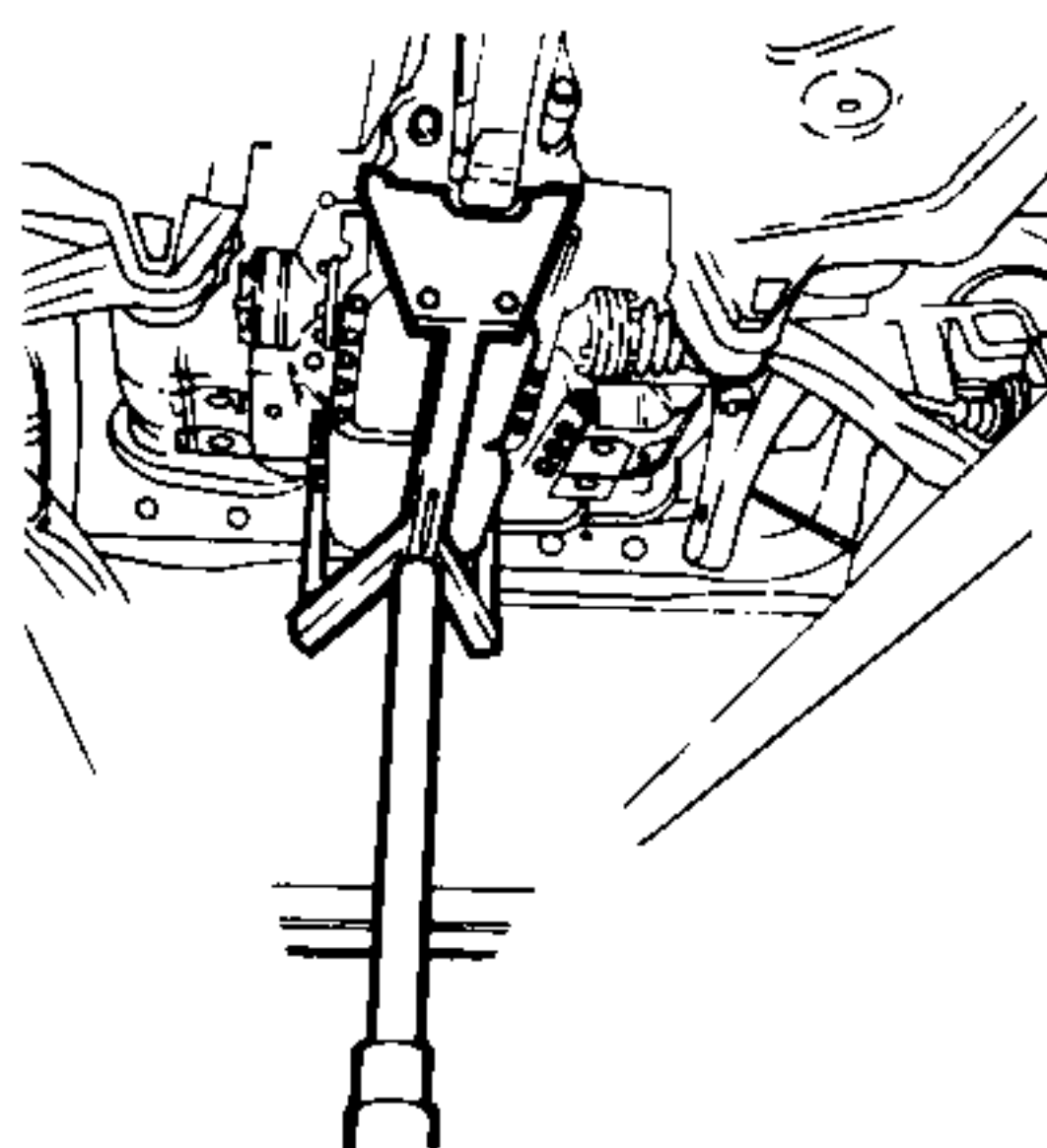
(3) Remove securing nut (6) of warm air intake support bracket to camshaft support rear cover.

(4) Disengage exhaust gas manifolds from the right and left head by unscrewing the nuts (5).

(5) Disconnect exhaust pipe on the car rear side by unscrewing the exhaust pipe end section connecting clamp screw (10), then remove it from flexible support.

(6) Unscrew screws (14) connecting right and left drive shafts, to right and left differential shafts, and disengage them.

(7) Unscrew the two engine anti-shake bar support bracket attachment screws (15) and position under the drive unit a column lifter fitted with a suitable supporting bracket to take part of the drive unit's weight.

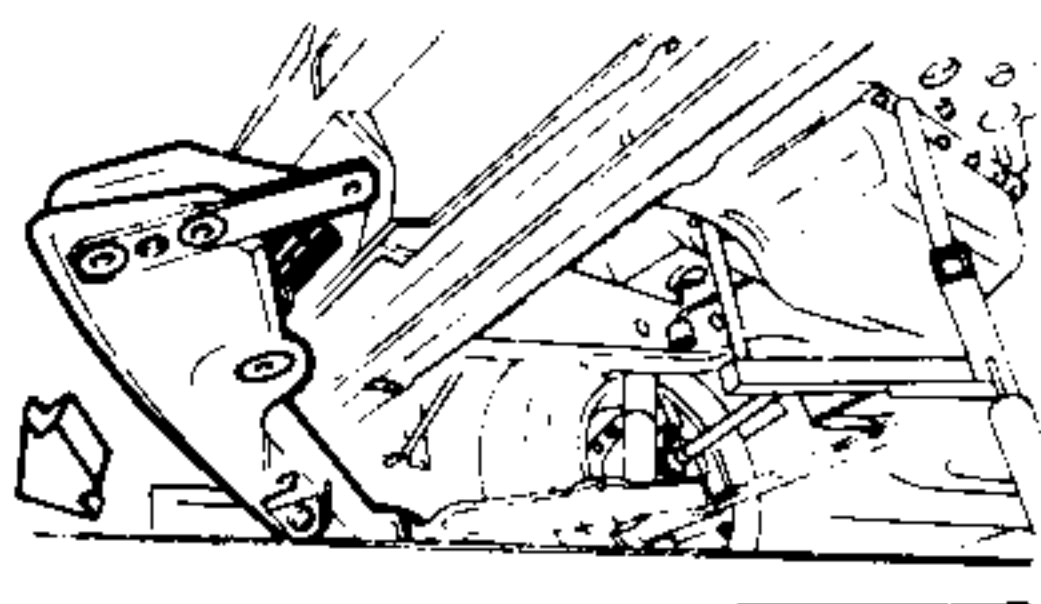


(8) Loose and remove the two screws (1) fixing the engine front support to cross member.

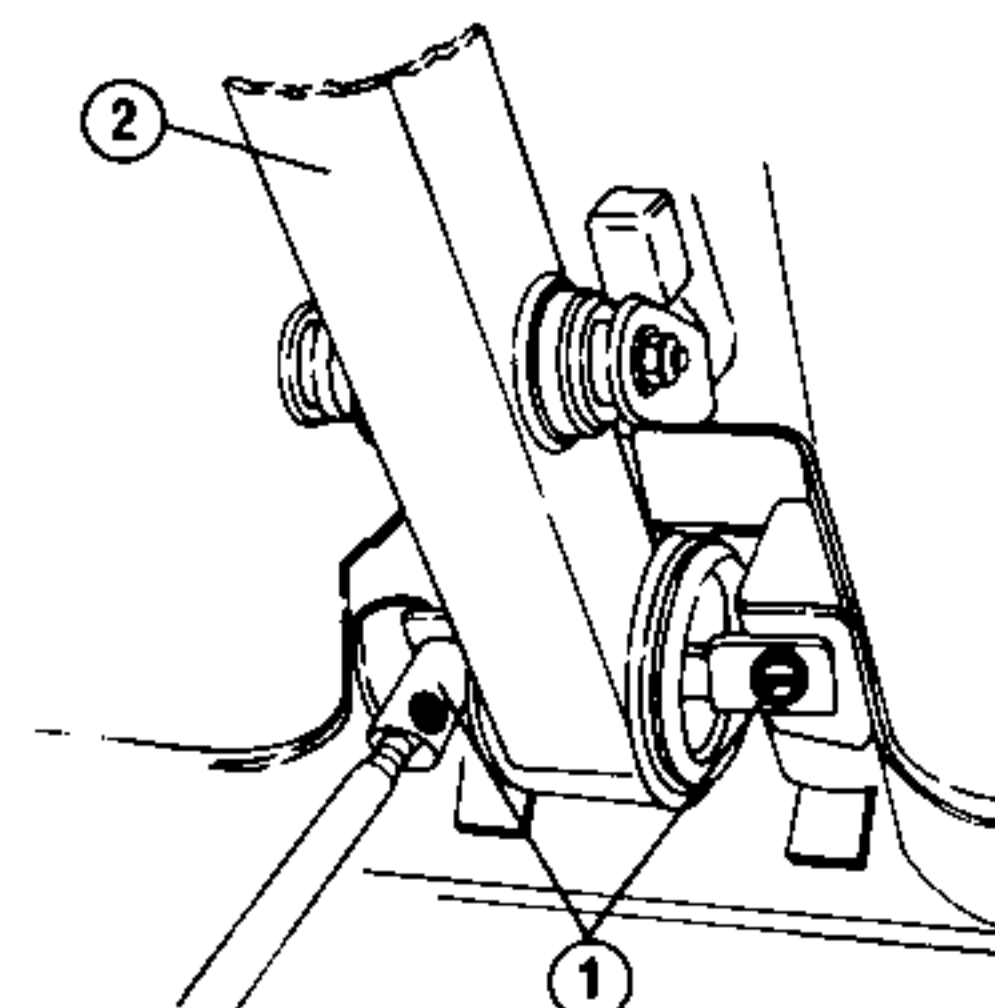
(9) Loose and remove the remaining screws (4) and (16) fixing the front cross member to the body. Loose the bolt (17) securing right strut to cross member.

(10) Unscrew and remove the bolt (3) connecting the front cross member to the left strut; then disengage the strut from the cross member.

(11) Swing the front cross member round as shown in the illustration to allow the drive unit to be taken out downwards.



(12) With reference to the following illustration. Unscrew and remove the two screws (1) fixing the drive unit rear support (2) to the body.



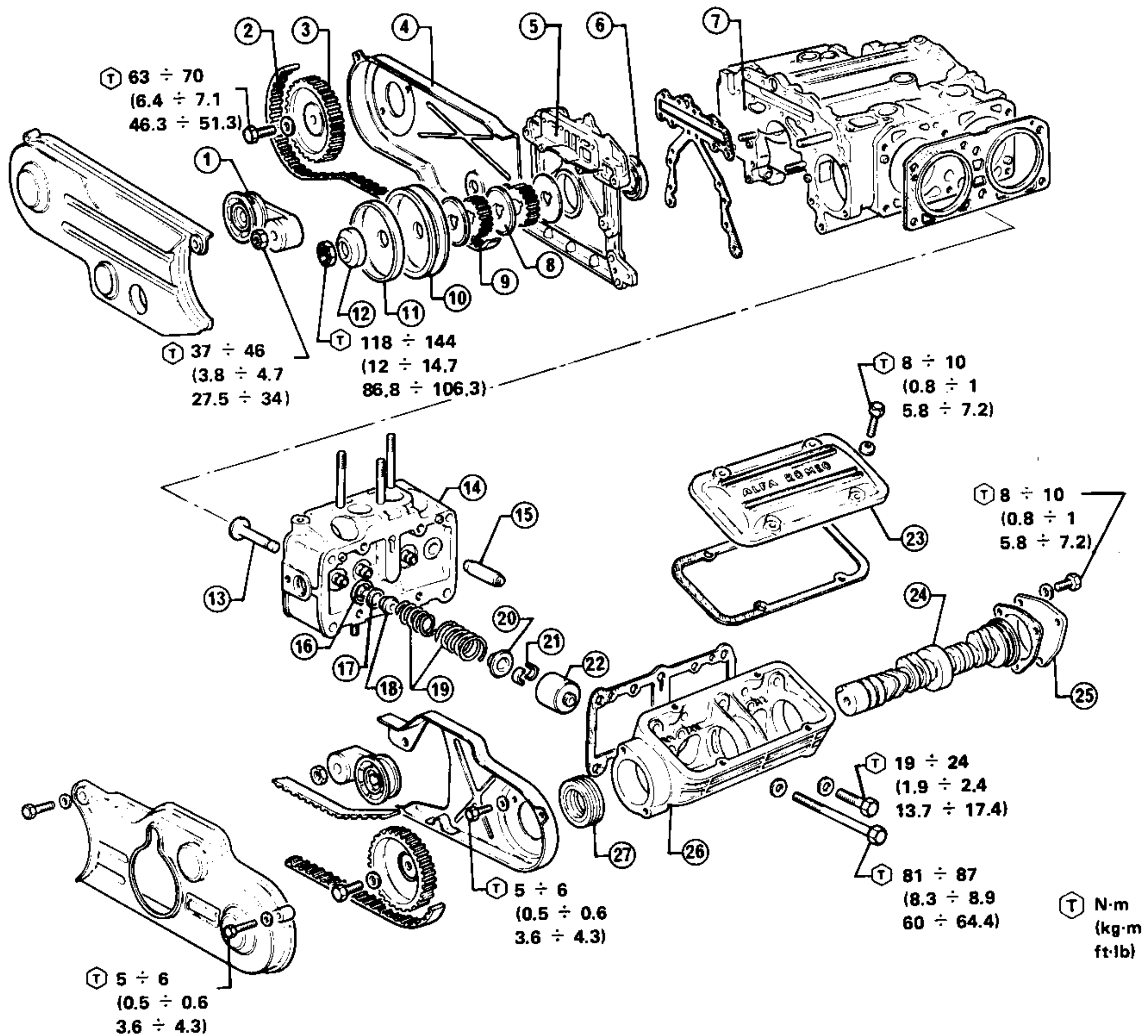
1 Screws 2 Rear support

(13) Remove bolt fixing engine central support to body, unloosened at step 11.

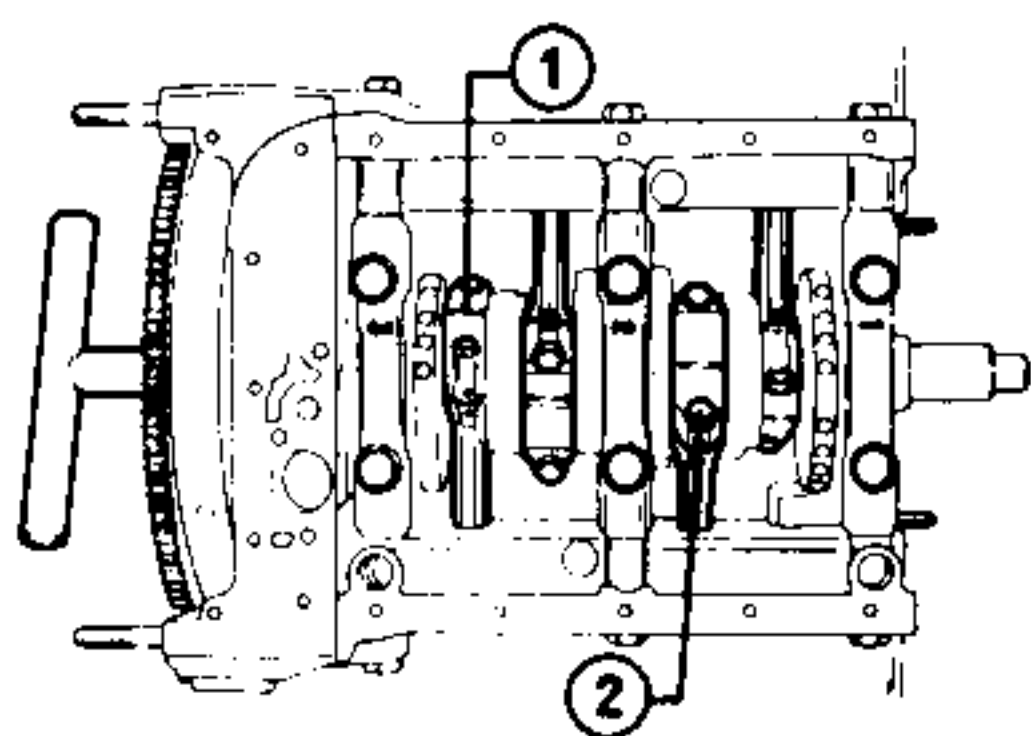
(14) Lower column lift and take the drive unit out from the engine compartment.

ENGINE MAIN MECHANICAL UNIT

Internal parts

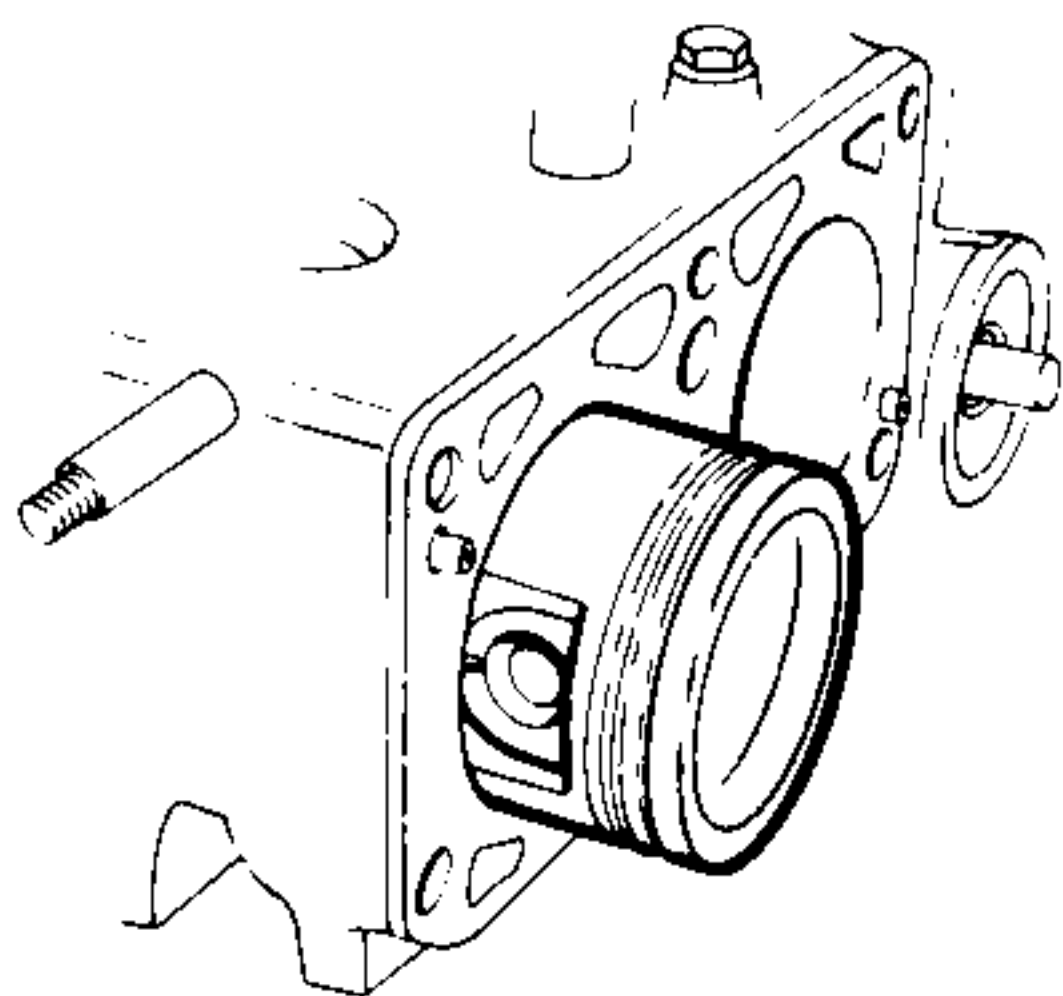


- | | |
|----------------------------|----------------------|
| 1 Jockey pulley | 15 Valve guide |
| 2 Camshaft belt | 16 Lower spring seat |
| 3 Pulley | 17 Washer |
| 4 Camshaft belt rear cover | 18 Seal cap |
| 5 Engine front cover | 19 Springs |
| 6 Seal ring | 20 Spring seat |
| 7 Block | 21 Cotter |
| 8 Spacer | 22 Cup |
| 9 Pulley | 23 Cover |
| 10 Pulley | 24 Camshaft |
| 11 Spacer | 25 Cover |
| 12 Washer | 26 Camshaft support |
| 13 Valve | 27 Seal ring |
| 14 Cylinder head | |

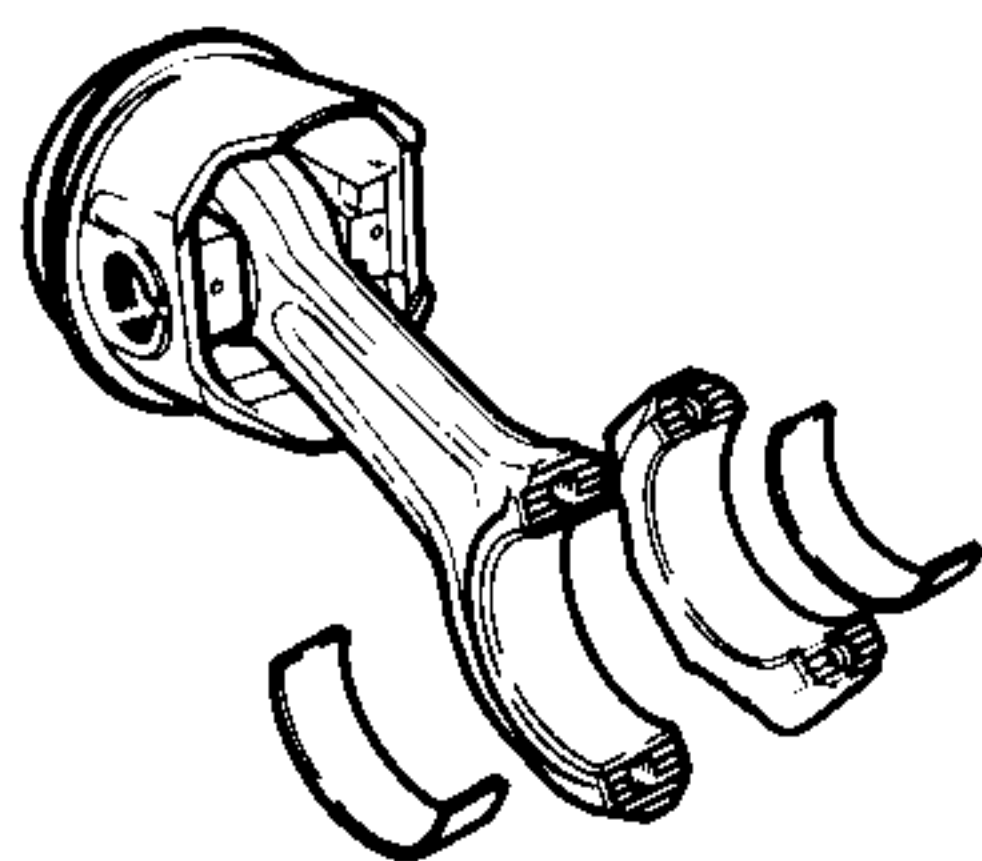


1 Connecting rod caps 2 Screws

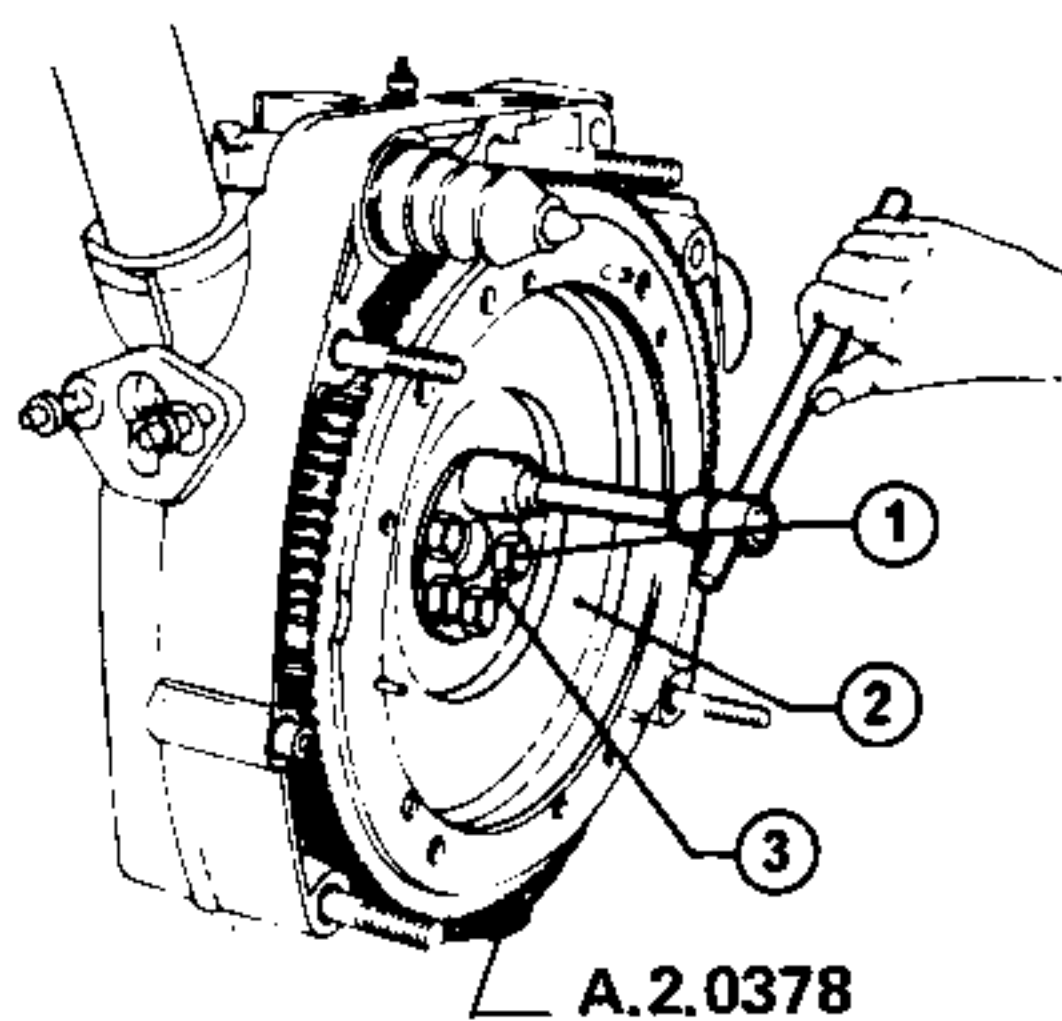
(4) Withdraw pistons together with connecting rods, from the side of the block.



(5) Remove connecting rod bearings from connecting rod big end and cap.

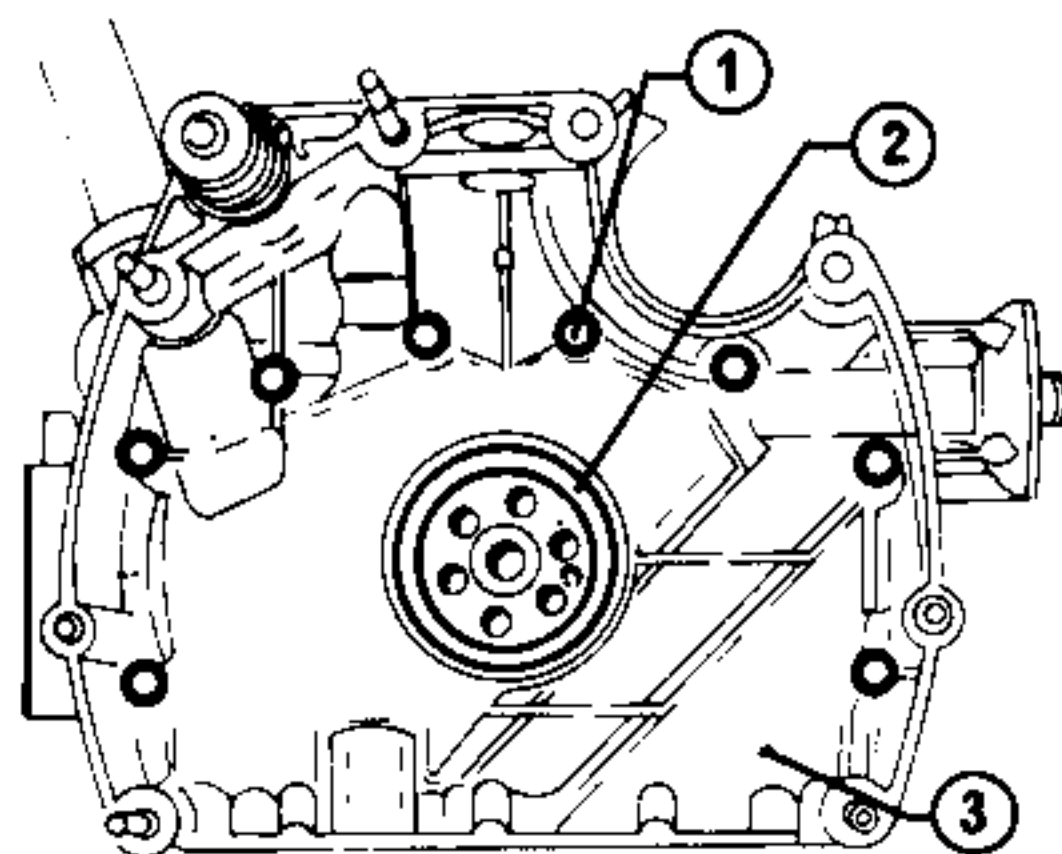


26. Remove flywheel.
(1) Remove tool previously, secured to flywheel which allowed rotation.
(2) Lock flywheel by tool A.2.0378.
(3) Unscrew screws ① securing flywheel to crankshaft, remove securing lock washer ③ and flywheel ②.



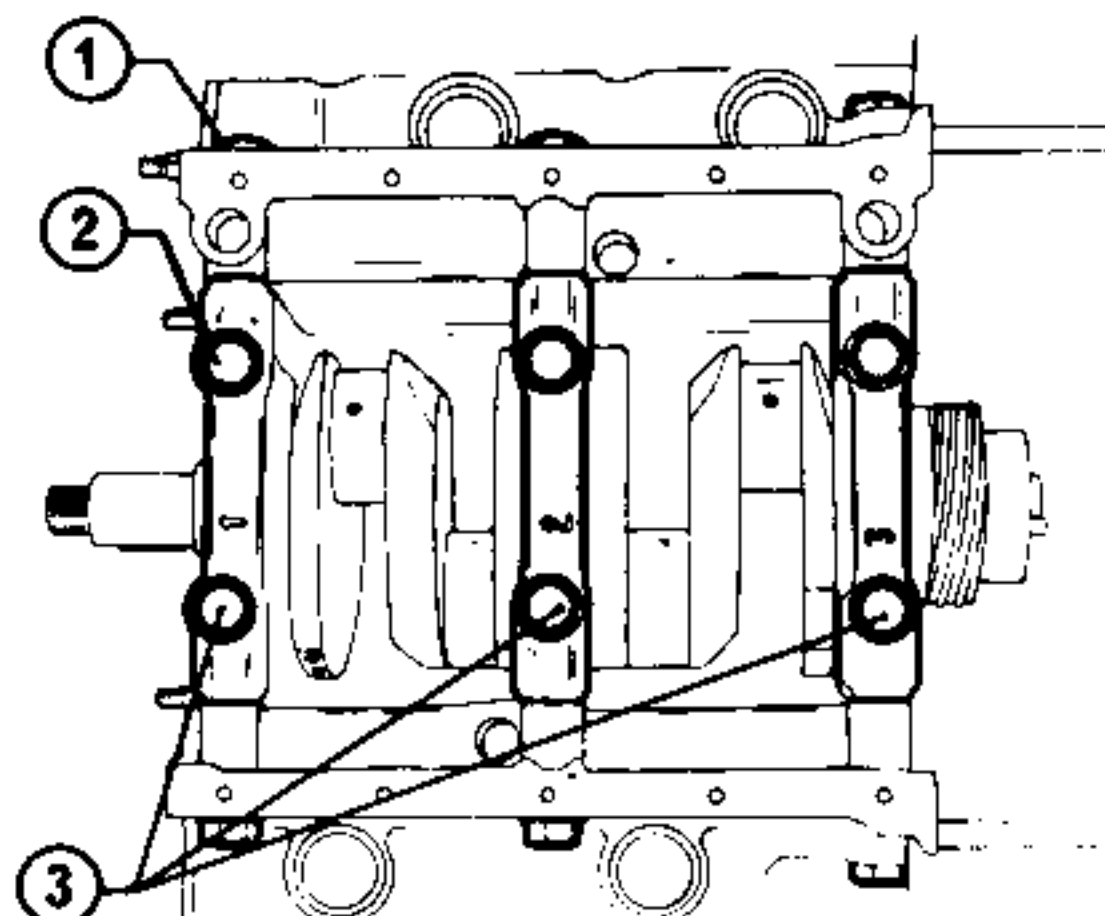
1 Screws 2 Flywheel 3 Washer

27. Remove block rear cover.
(1) Unscrew screws ① with washers securing rear cover to block, remove cover ③ and relevant gasket.
(2) Withdraw crankshaft oil retaining ring ② from cover levering with a screwdriver. Replace ring at re-assembly.



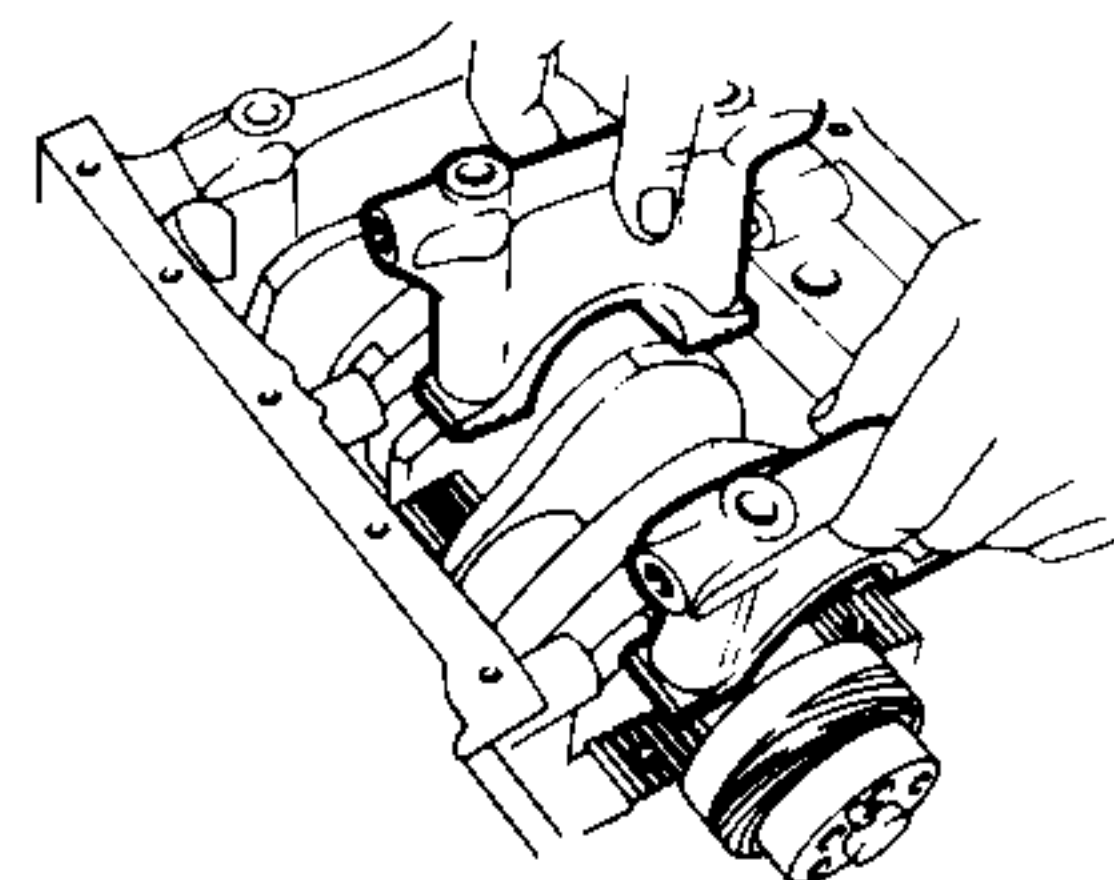
1 Screw 2 Oil retaining ring 3 Block rear cover

28. Remove crankshaft.
(1) Unscrew screws ① securing main bearing caps ③ to block and then screws ② with washers securing main bearing caps to relevant supports.

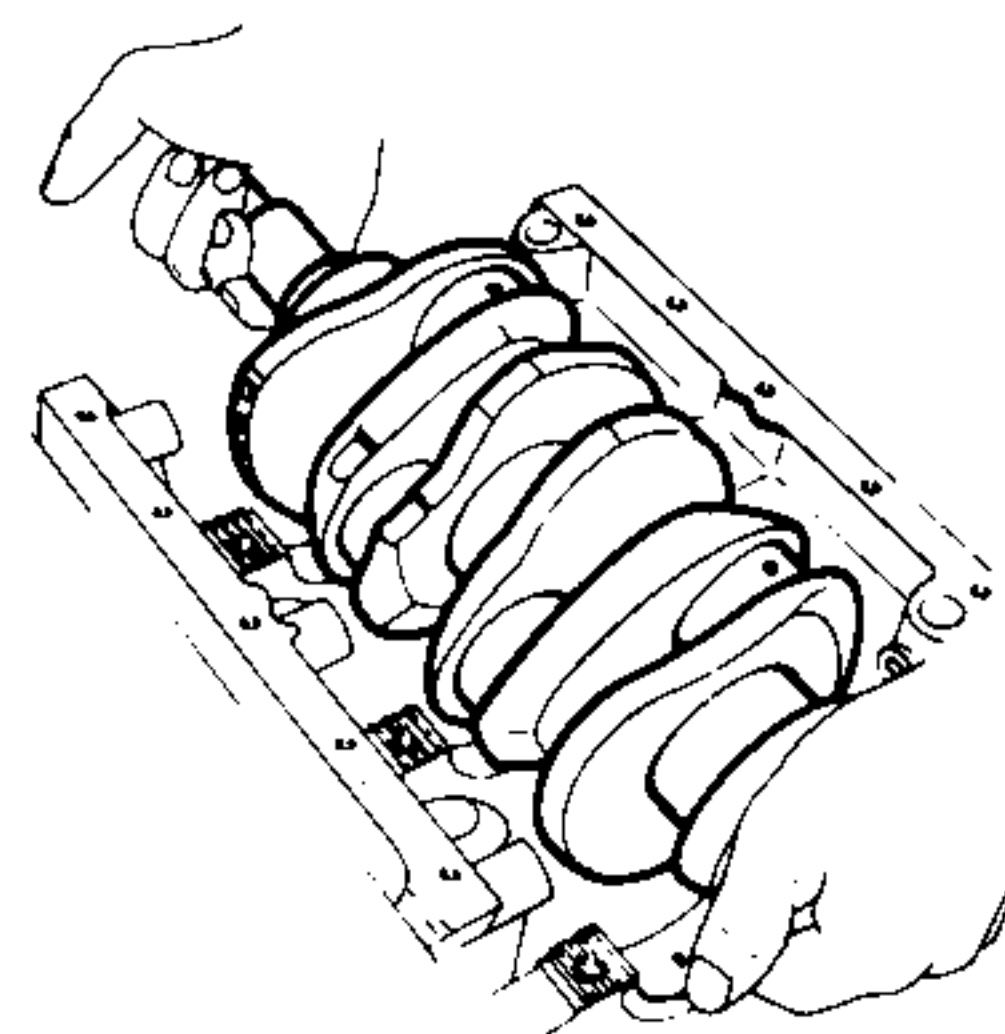


1 Screws 2 Screws 3 Main bearing caps

(2) Remove lower caps and lower main bearings.



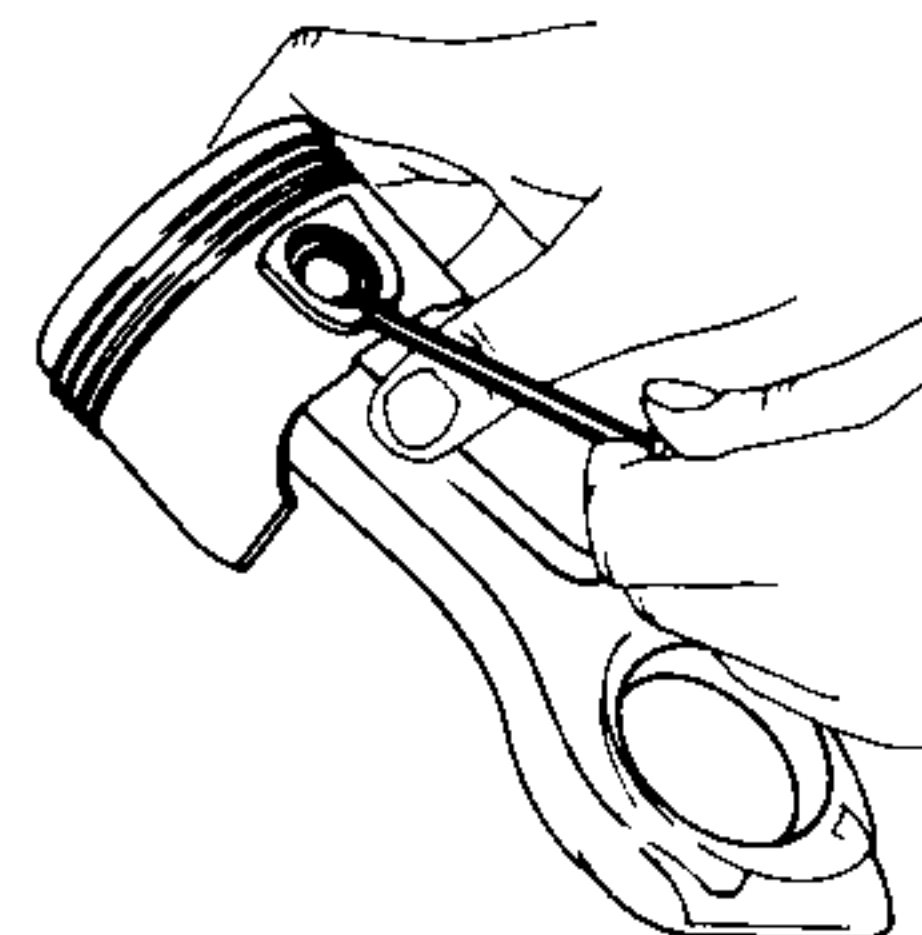
(3) Remove crankshaft from block and upper caps. Mark their position in case of reuse in assembly.



29. Remove thrust half-rings on third support (flywheel side).

PISTONS AND CONNECTING RODS

1. Withdraw two piston pin lock ring by a screwdriver.



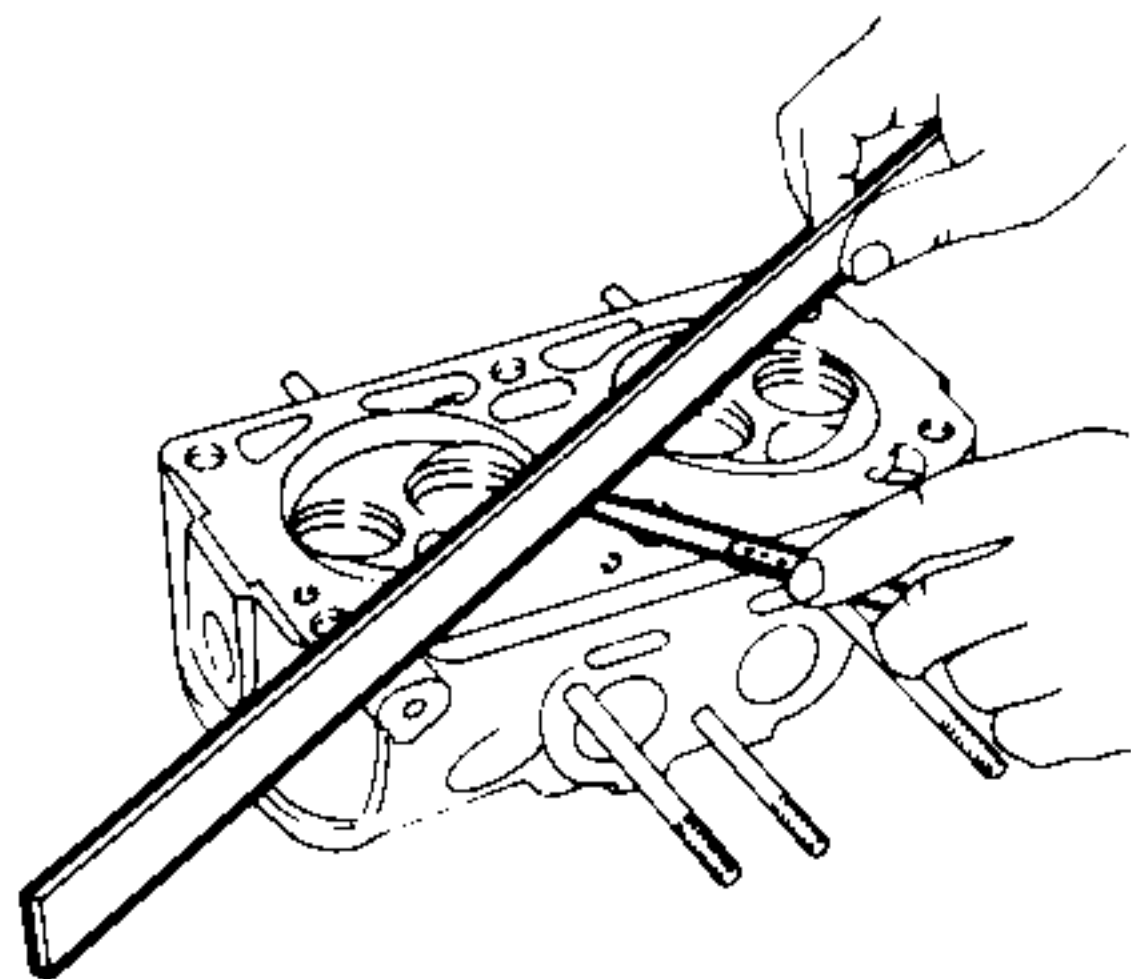
2. Withdraw piston pin.
3. Withdraw compression rings and oil scraper ring from piston.

CHECKS AND INSPECTIONS

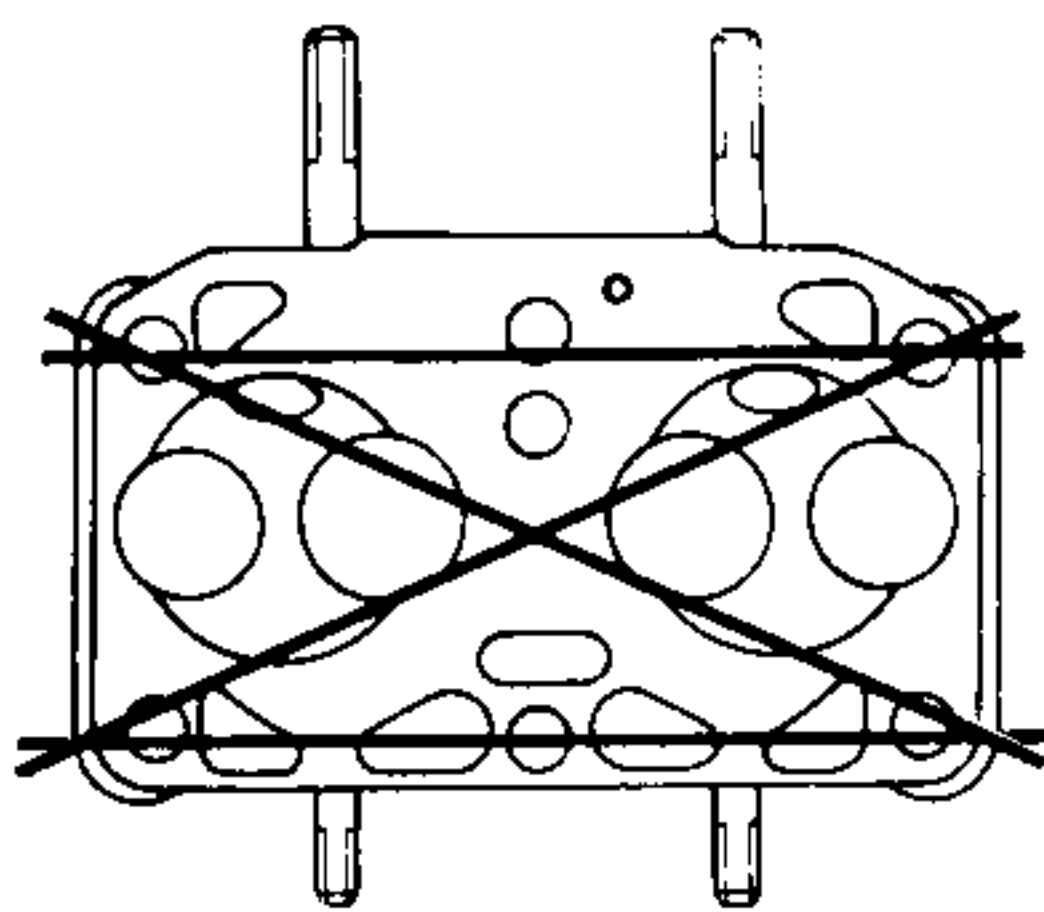
CYLINDER HEADS AND VALVES

INSPECTION OF CYLINDER HEAD LOWER SURFACE

1. Visually check the cylinder head for cracks or flaws.
2. Check flatness of the head lower surface.



positioning the tool as shown below.



Max. flatness error of cyl. head lower surface: 0.03 mm (0.0012 in)

If the head lower surface shows excessive warpage, then both heads will need grinding.

Head's min. height after grinding: 77.25 mm (3.0413 in)
Exceeding the specified allowed limit will cause severe malfunctioning of the engine.

3. Check the head lower surface for perfect smoothness.

Max. allowed roughness value
1.6 μm ($6.29 \cdot 10^{-5}$ in)

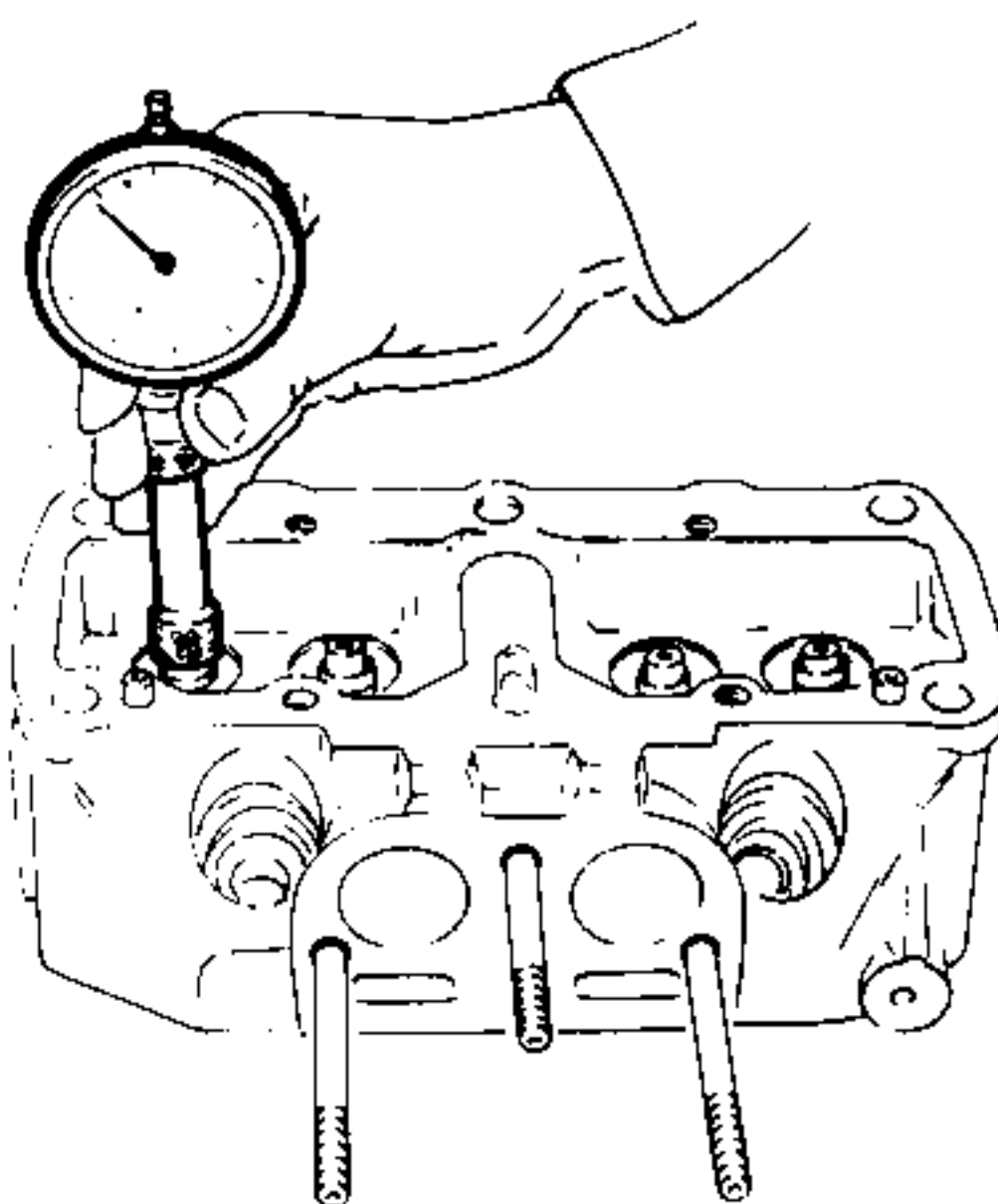
Max. allowed parallelism error
0.05 mm ($1.968 \cdot 10^{-3}$ in)

VALVE GUIDE

Measure the clearance between valve guide and valve stem.
If clearance exceeds the specified limit, replace worn parts.

Determining clearance

1. Measure the diameter of the valve stem with a micrometer in three places and in directions orthogonal to one another.
2. Measure the valve guide bore with a dial gauge.



3. Compute the play by subtracting the maximum stem diameter reading from the valve guide bore value.

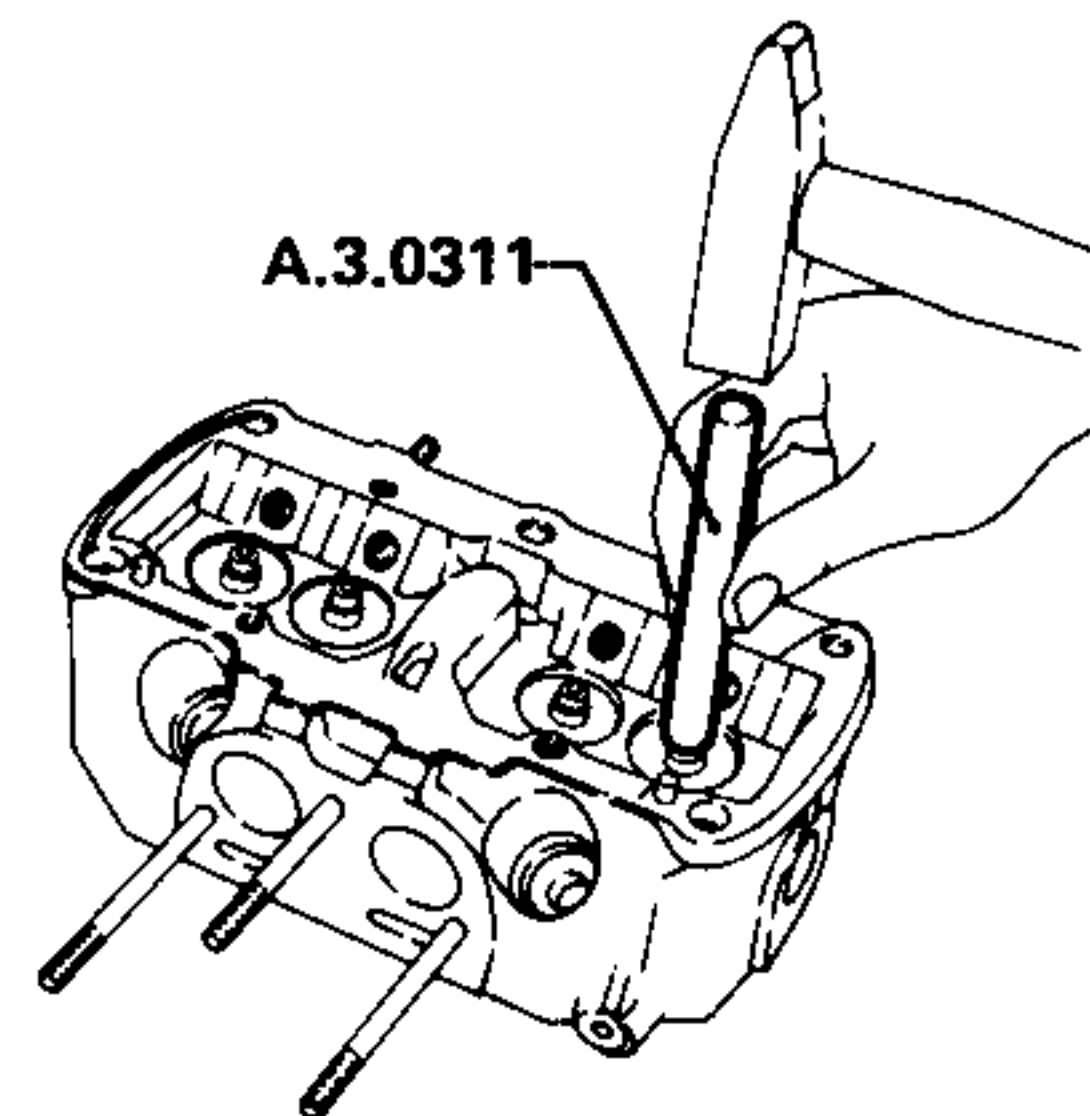
Max. allowed valve stem-to-guide play:

Intake: 0.07 mm (0.0027 in)

Exhaust: 0.09 mm (0.0035 in)

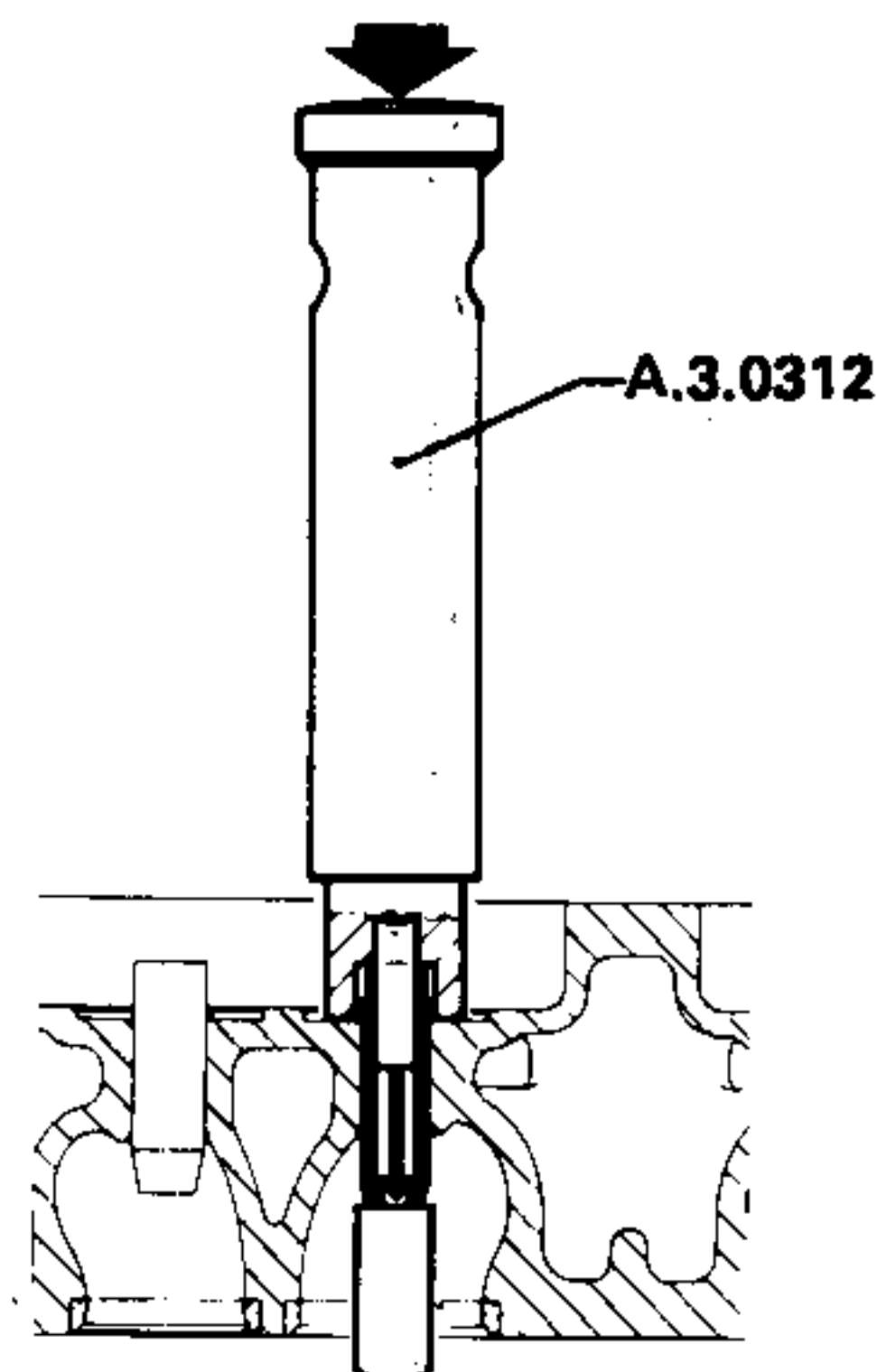
Replacement

1. Visually check valve guides making sure they do not show any scores or evidence of pitting; further ensure they are not deformed or out of their original assembly position.
2. If necessary, remove worn guides using tool A.3.0311.

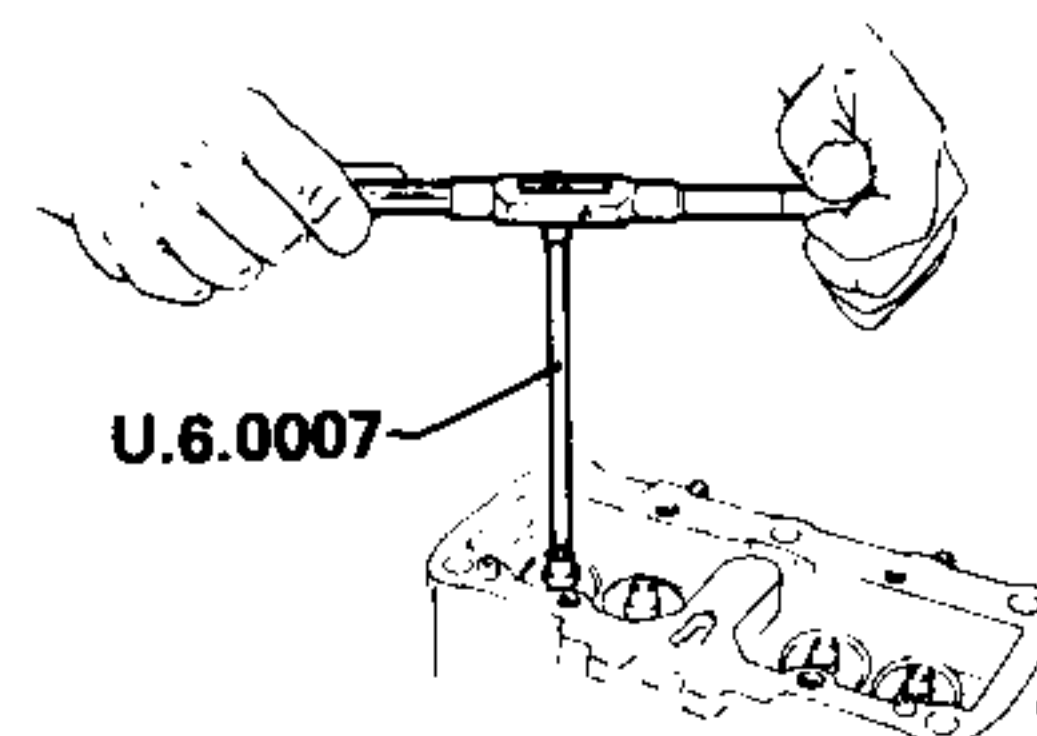


3. Fit new valve guides using tool A.3.0312.

The use of this special tool will ensure protruding of the guides above the lower cup's resting surface.



4. Ream valve guides using Reamer U.6.0007 in order to size the holes according to the specified diameter and then measure the valve guides bore.



Valve guide bore:
8.013 ÷ 8.031 mm
(0.3155 ÷ 0.3162 in)

5. Afterward it will be necessary to slightly adjust the seats through

Diameter of camshaft journals

Front

$$a = 34.940 \div 34.956 \text{ mm} \\ (1.3756 \div 1.3762 \text{ in})$$

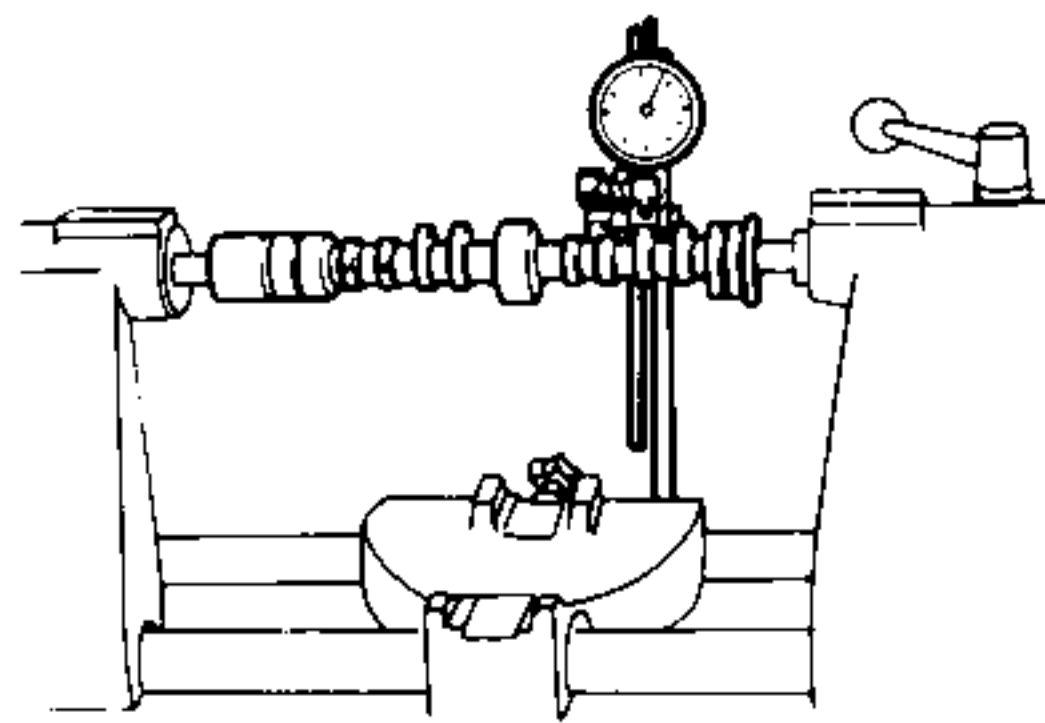
Centre

$$b = 46.440 \div 46.456 \text{ mm} \\ (1.8283 \div 1.8290 \text{ in})$$

Rear

$$c = 46.940 \div 46.956 \text{ mm} \\ (1.8480 \div 1.8487 \text{ in})$$

3. With a comparator measure height of cams; if less than the specified min. limit, replace the camshaft.



	Cam	Engine 1200 1350 1500
Min. cam height mm (in)	i.	8.5 (0.335)
	e.	8.5 (0.335)

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

CRANKSHAFT

1. Check and make sure that the working surfaces of crank pins and journals do not show any scores or any evidence of abnormal wear, pitting or overheating.

2. If required, regrind the shaft finishing it to one of the sizes shown in the following chart.

To be noted that for each of the following undersizes there are crank pin and journal half-bearings available as spare parts.

	Under-size	Engine 1200 1350 1500
Crank pins Ø mm. (in)	1st	59.690 ÷ 59.703 (2.3500 ÷ 2.3505)
	2nd	59.436 ÷ 59.449 (2.3400 ÷ 2.3405)
	3rd	59.182 ÷ 59.195 (2.3300 ÷ 2.3305)
	4th	58.928 ÷ 58.941 (2.3200 ÷ 2.3205)
Journals Ø mm (in)	1st	49.733 ÷ 49.746 (1.9580 ÷ 1.9585)
	2nd	49.479 ÷ 49.492 (1.9480 ÷ 1.9485)
	3rd	49.225 ÷ 49.238 (1.9380 ÷ 1.9385)
	4th	48.971 ÷ 48.984 (1.9280 ÷ 1.9285)

(1) Should regrinding of the rear crank pin shoulders be necessary, the pin's "c" length should be: 28.764 ÷ 28.804 mm (1.1324 ÷ 1.340 in).

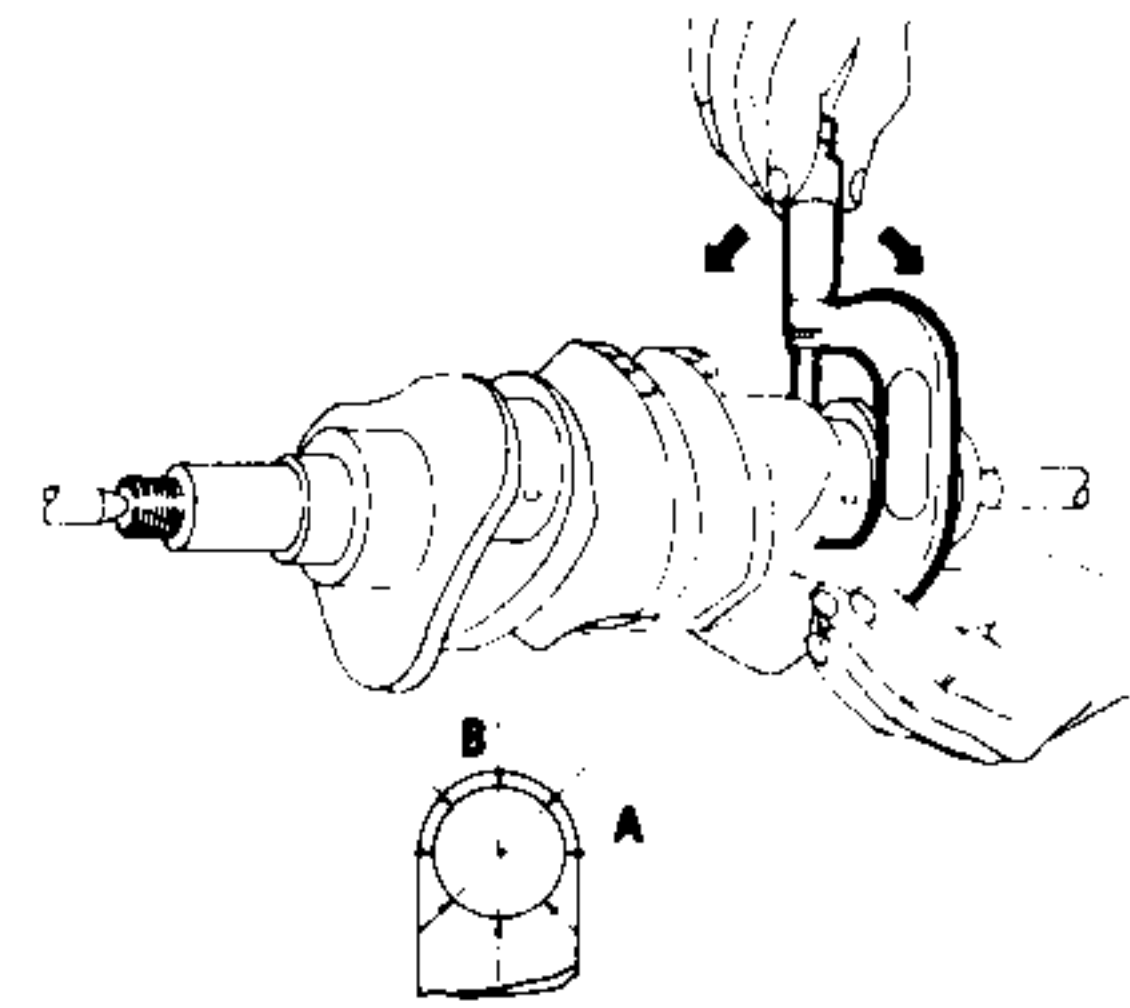
To be noted that attainment of the above mentioned dimension is essential in order to keep crankshaft end play within specified limits after fitting of the oversize thrust half-rings. Moreover, to avoid altering the crankshaft axial position, the thickness of the material removed from each shoulder will have to be the same.

(2) Grinding should be performed in accordance with the tolerances shown in: Service Data and Specifications - "Crankshaft" chart.

(3) Grinding must also ensure that crank pin and journal unions and cylindrical sections are within tolerance as shown in: Service Data and Specifications - "Crankshaft" chart.

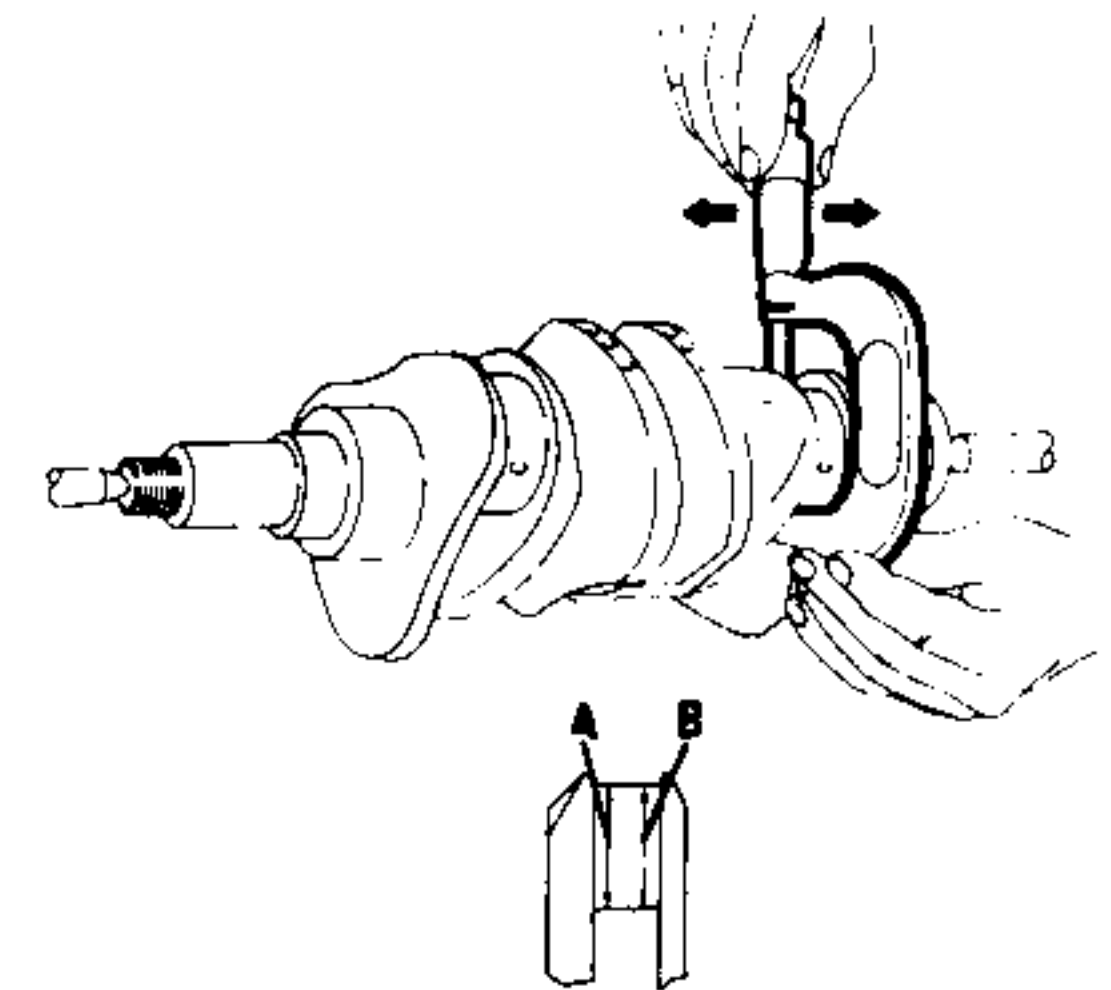
3. Having completed the grinding operation, carefully clean the oil galleries with warm diesel oil and then dry them with compressed air.

4. Check out-of-round of journals by comparing the diameter at different intervals on their circumference.



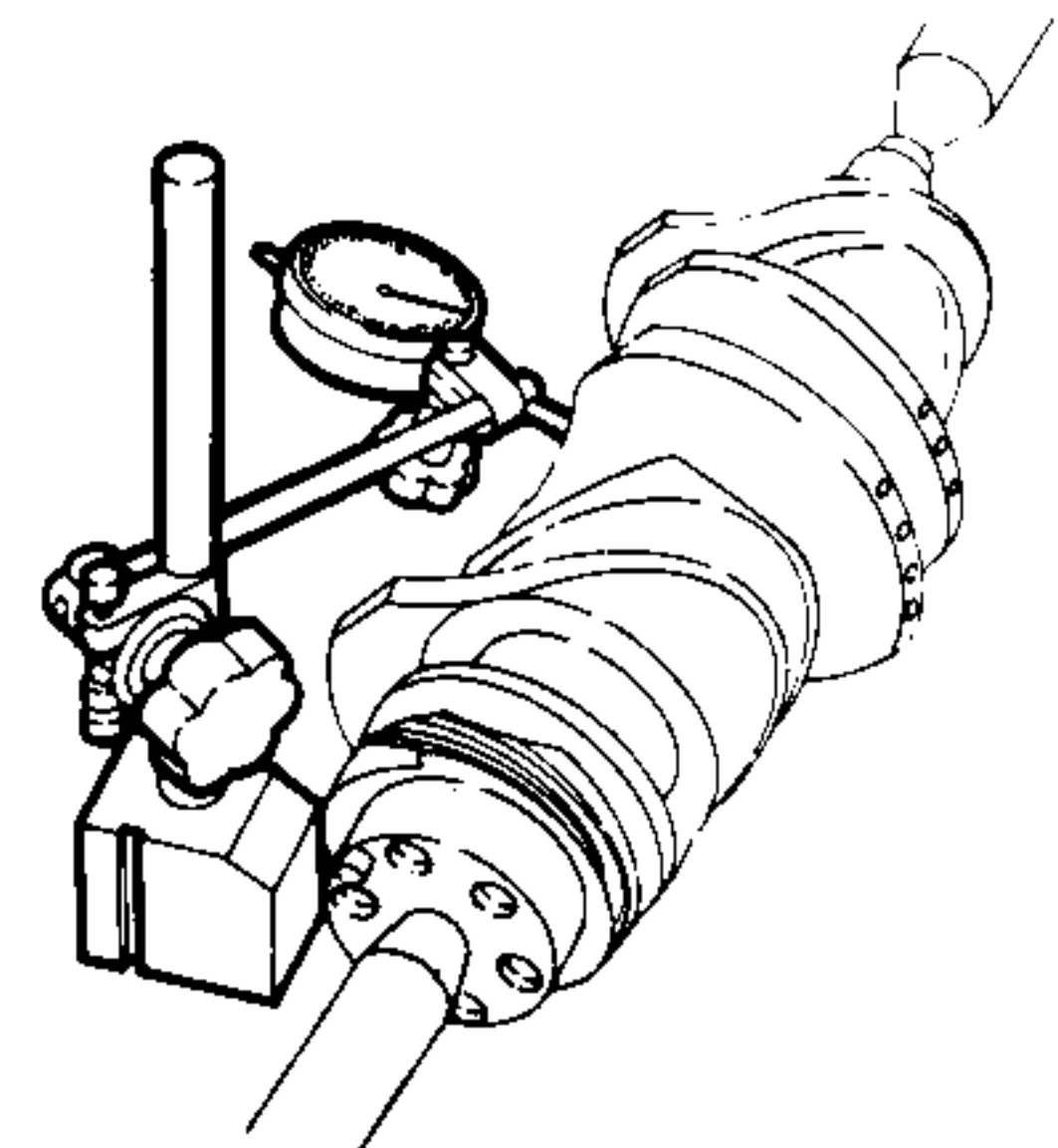
Max. out-of-round
 $A - B = 0.02 \text{ mm } (7.8 \cdot 10^{-4} \text{ in})$

5. Check taper of journals by comparing the diameter of each journal's extreme ends.



Max. taper error
 $A - B = 0.02 \text{ mm } (7.8 \cdot 10^{-4} \text{ in})$

6. Rotate the shaft on two V-blocks placing a dial gauge's indicating finger resting on the centre journal and then proceed to measure the crankshaft's out-of-round.



ENGINE ASSEMBLY

PRECAUTIONS

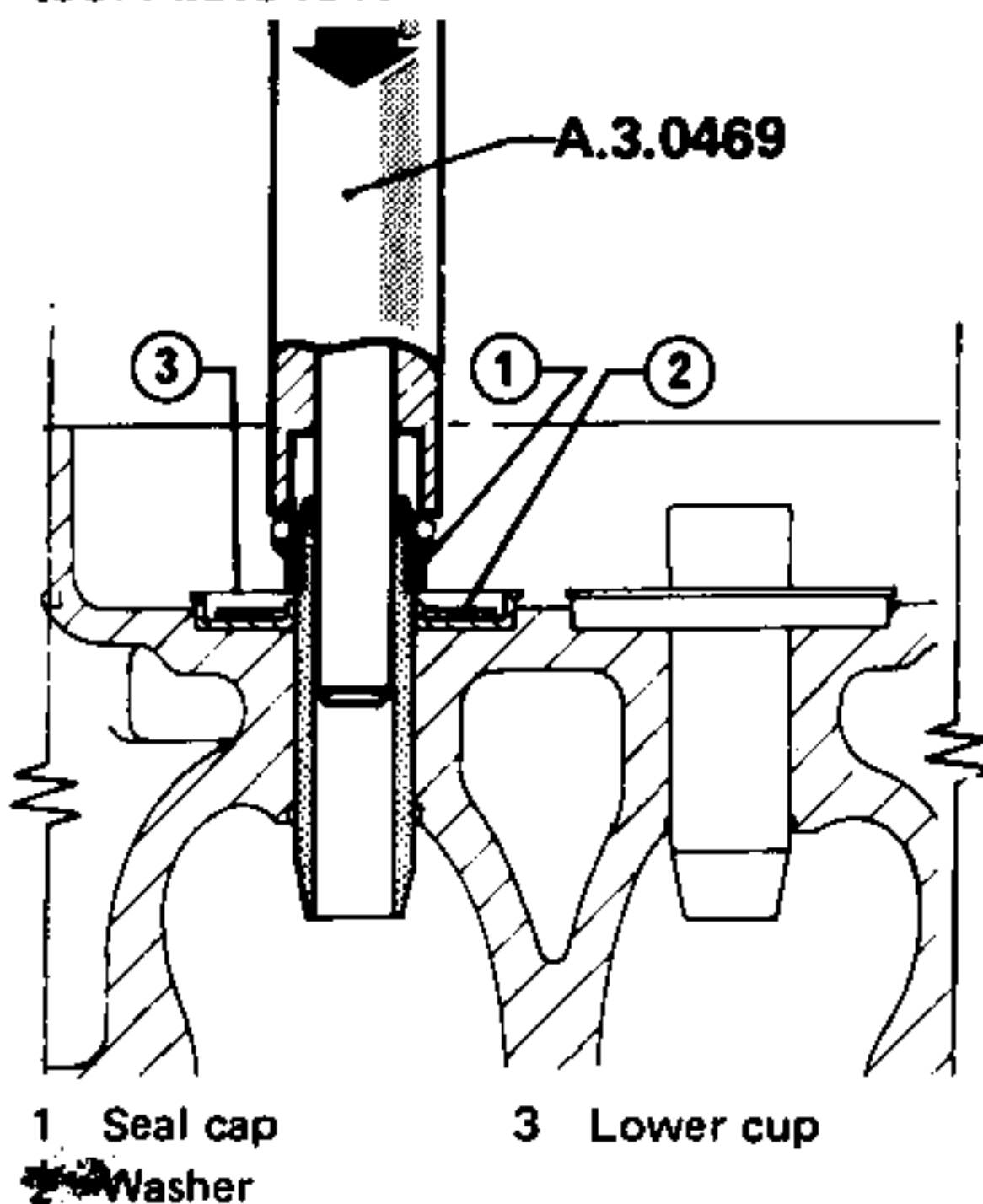
1. Apply engine oil to all bearings and sliding surfaces prior to assembly operations.
2. Use new gaskets, oil seal rings, and spring rings.
3. Tighten all screws and bolts according to specified torques.
4. Apply proper sealant to the following components:
 - Oil sump gasket, cylinder block side
Cement Std. No. 3522-00040
DOW CORNING Silastick 732 RTV
 - Plugs of water galleries in cylinder block and cyl. heads
Cement Std. No. 3524-00011
LOCTITE 601 (green)

Before applying sealant, remove all traces of old sealant and of oil from all surfaces.

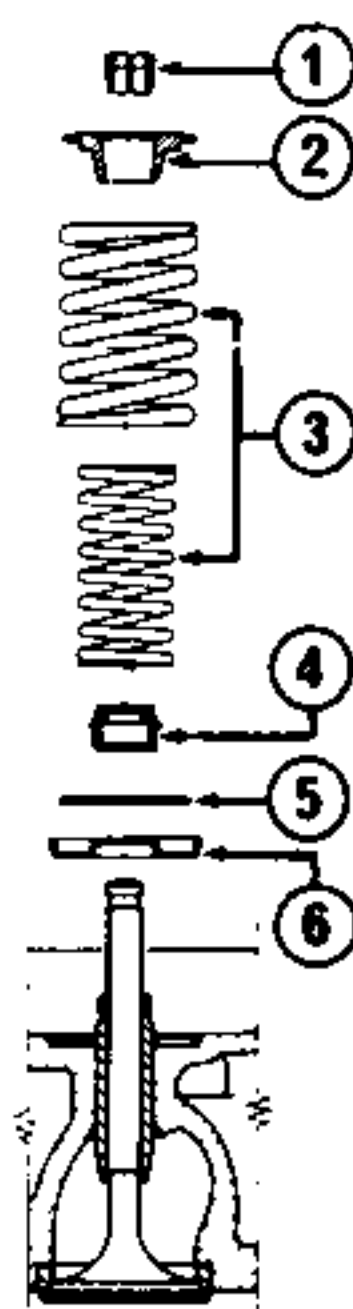
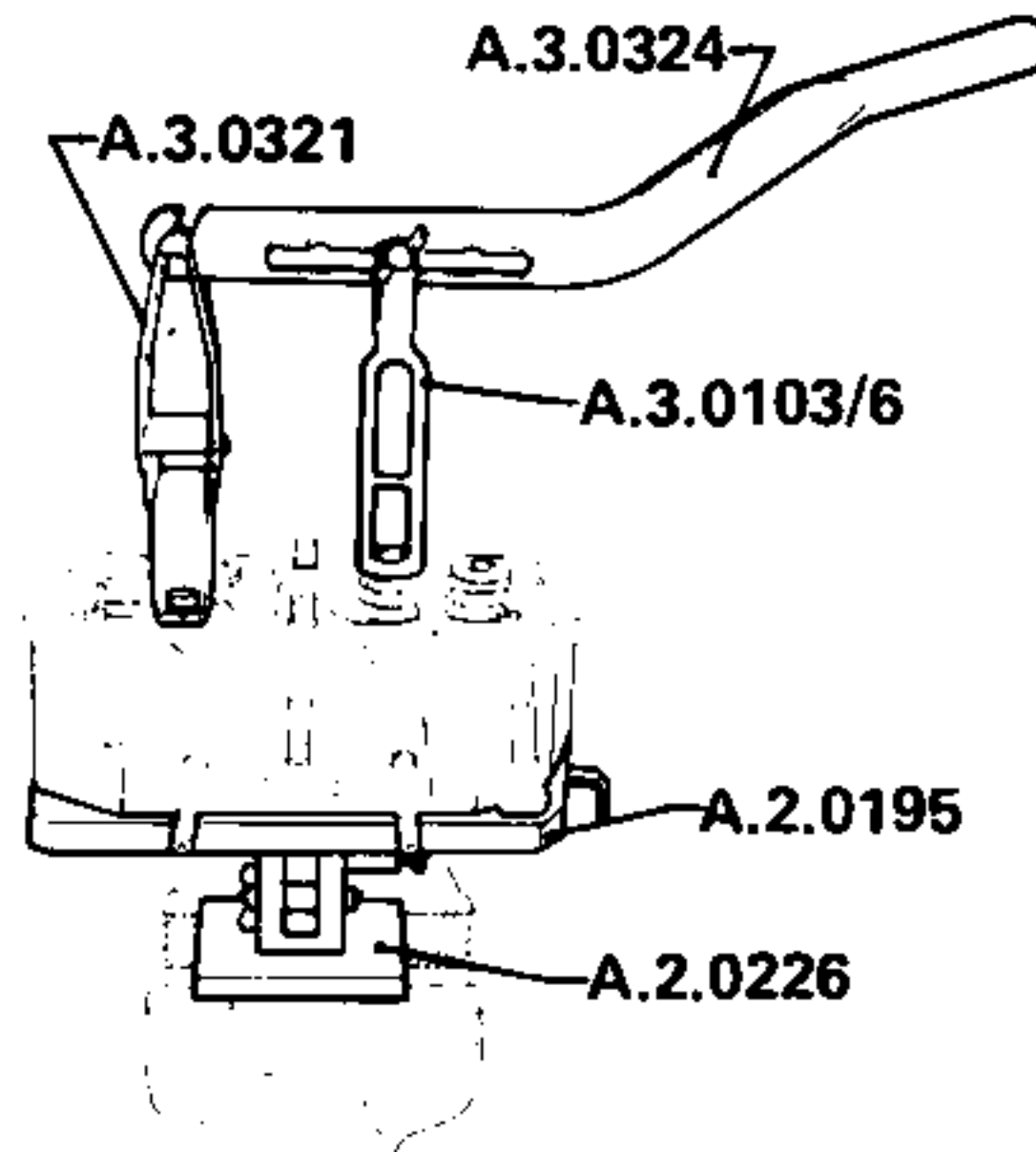
CYLINDER HEADS

Having completed all recommended checks and inspections as well as replacement of defective or damaged parts, proceed to assemble the cylinder head using specific tools in addition to those used during disassembly operations as mentioned in the preceding chapter.

1. Secure the head on mounting base A.2.0195 and A.2.0226 previously locked in a vice.
2. Fit lower cups (3) and washers (2) in the seats located on the head upper surface.
3. Fit seal caps (1) on valve guides tool A.3.0469.

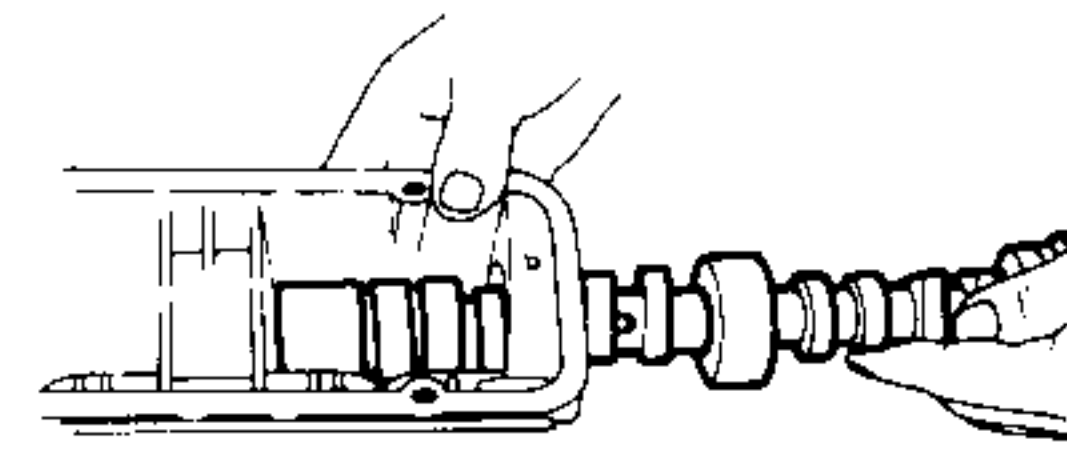


4. Fit valves in head seats and close up the tool with the valve retaining yoke.
5. Having completed the reassembly, fit on valve stems: the inner and outer springs (3), the upper cups (2), and the cotters (1); the latter ones with the help of tools A.3.0103/6, A.3.0321 and A.3.0324. Springs must be fitted with their narrow pitch end resting on the cylinder head.
6. Having completed the reassembly withdraw valve tightness lamina and proceed to check valve tightness following the procedure described in: Checks and Inspections - Cylinder heads and valves.

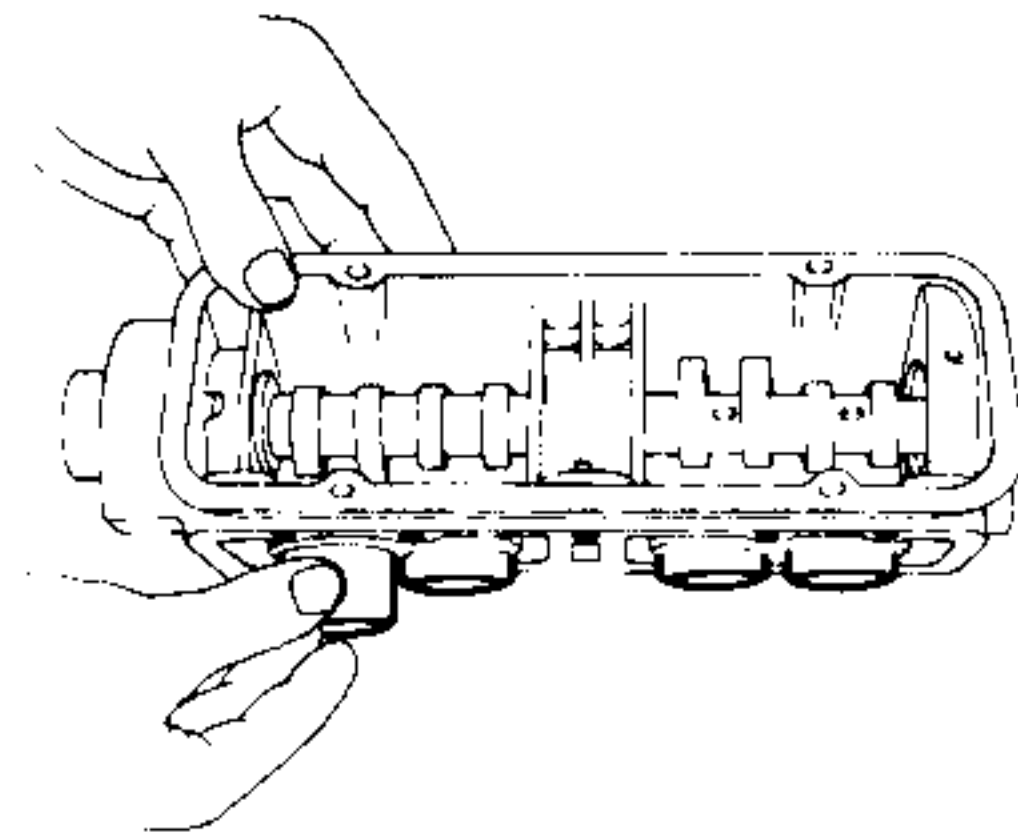


- | | |
|-------------|-------------|
| 1 Cotters | 4 Seal cap |
| 2 Upper cup | 5 Washer |
| 3 Springs | 6 Lower cup |

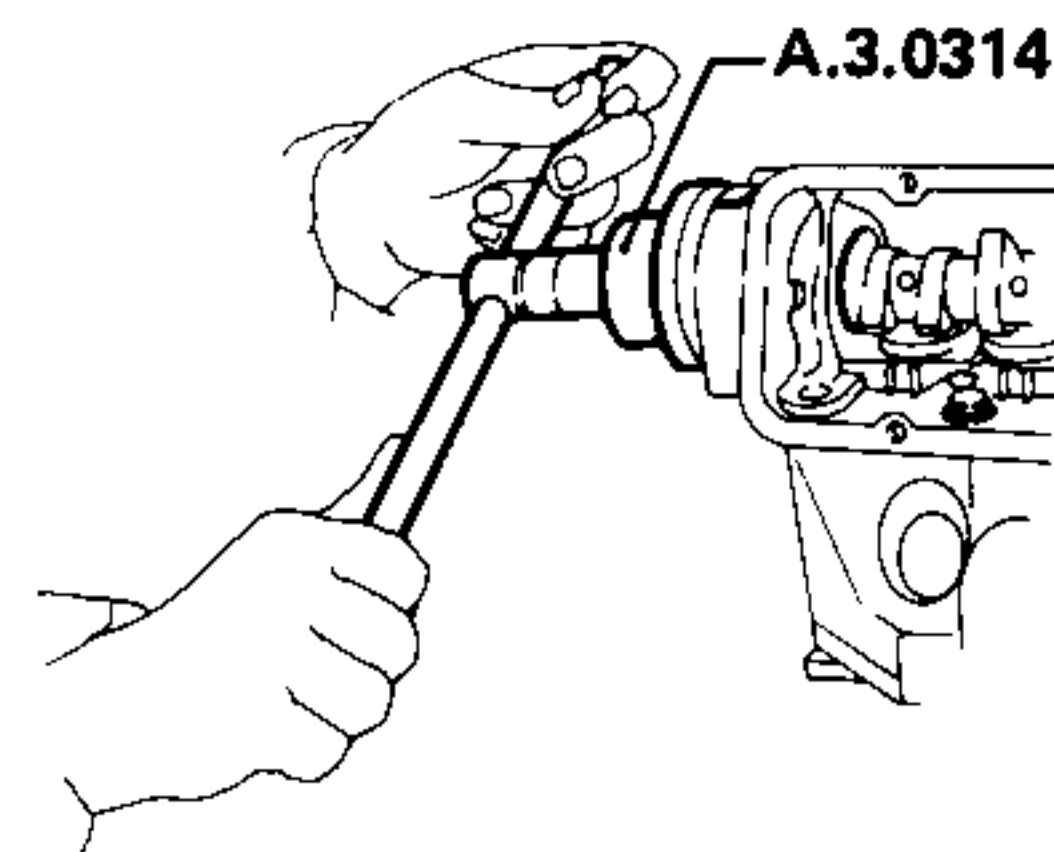
7. Fit camshaft into the support going in from the rear side.



8. Fit cups into the camshaft support seats. Before doing so, be sure to apply engine oil to the cups and to the camshaft.



9. Fit the camshaft support with suitable gasket to the cylinder head and tighten the four screws in bias sequence, without fully locking them.
10. Fit the camshaft seal ring using tool A.3.0314. Before doing so, be sure to apply engine oil to the rings sealing lip, its outer surface, and to its working seat.

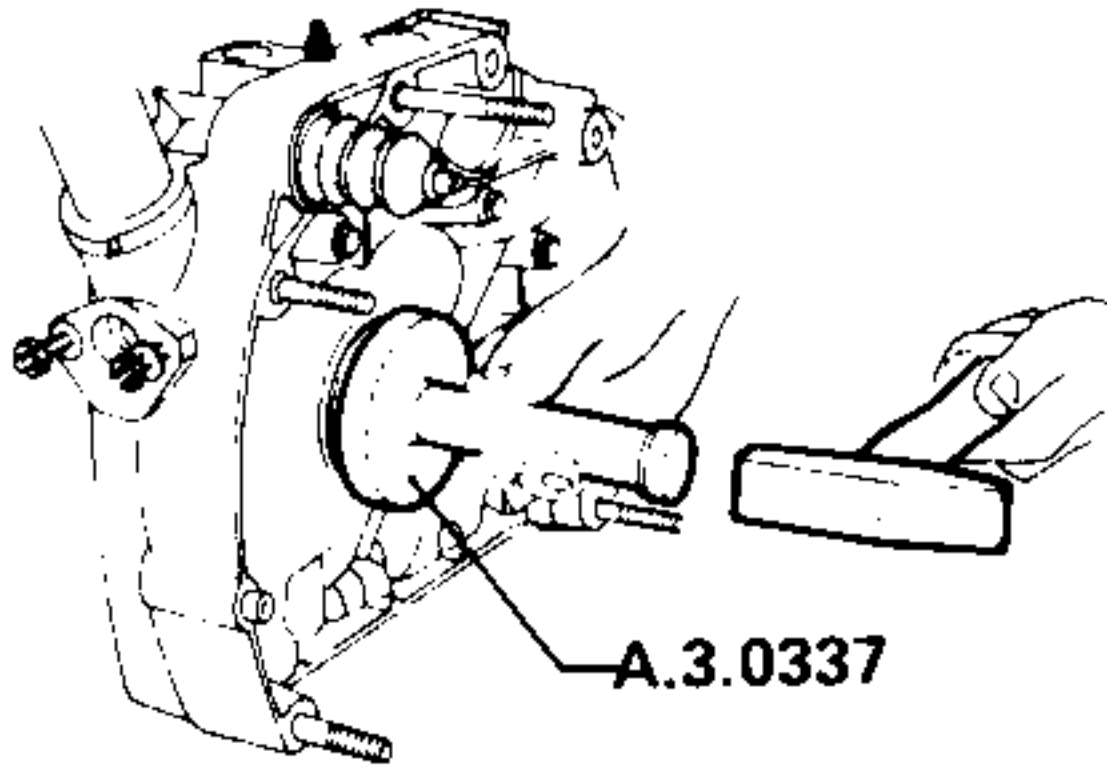


11. Fit the rear cover, with relevant new gasket, to the support and secure it by tightening the three screws.

PISTONS AND CONNECTING RODS

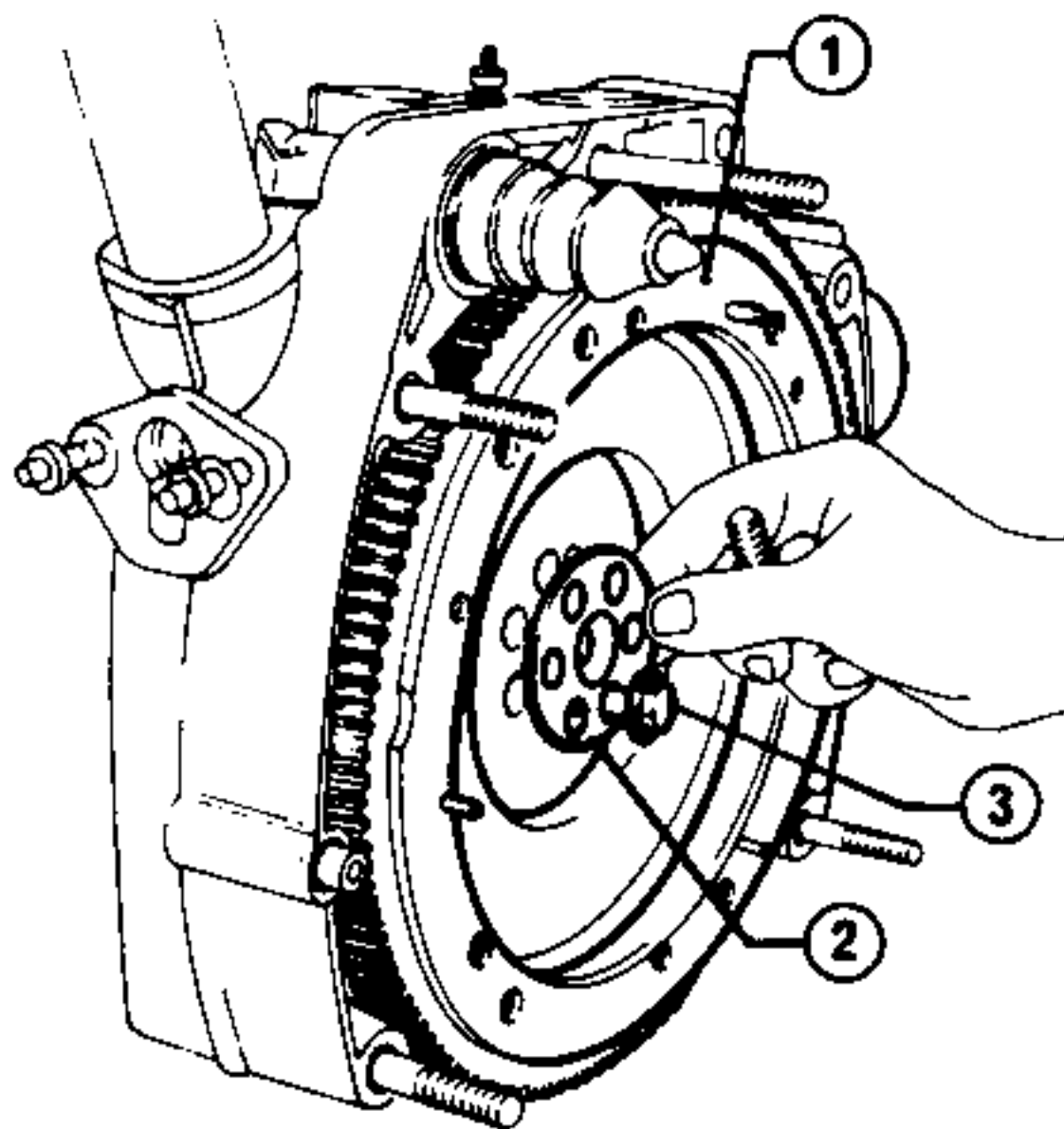
1. Select pistons as described in: Checks and Inspections - Pistons - Cylinder Wall Fit.

- b. Carefully check correct positioning of ring during reassembly.



7. Fit engine flywheel.

- (1) Position flywheel ① on crankshaft and, having fitted the relevant lockwasher ②, tighten all screws ③ without fully locking them.



- 1 Flywheel
2 Lockwasher
3 Screw

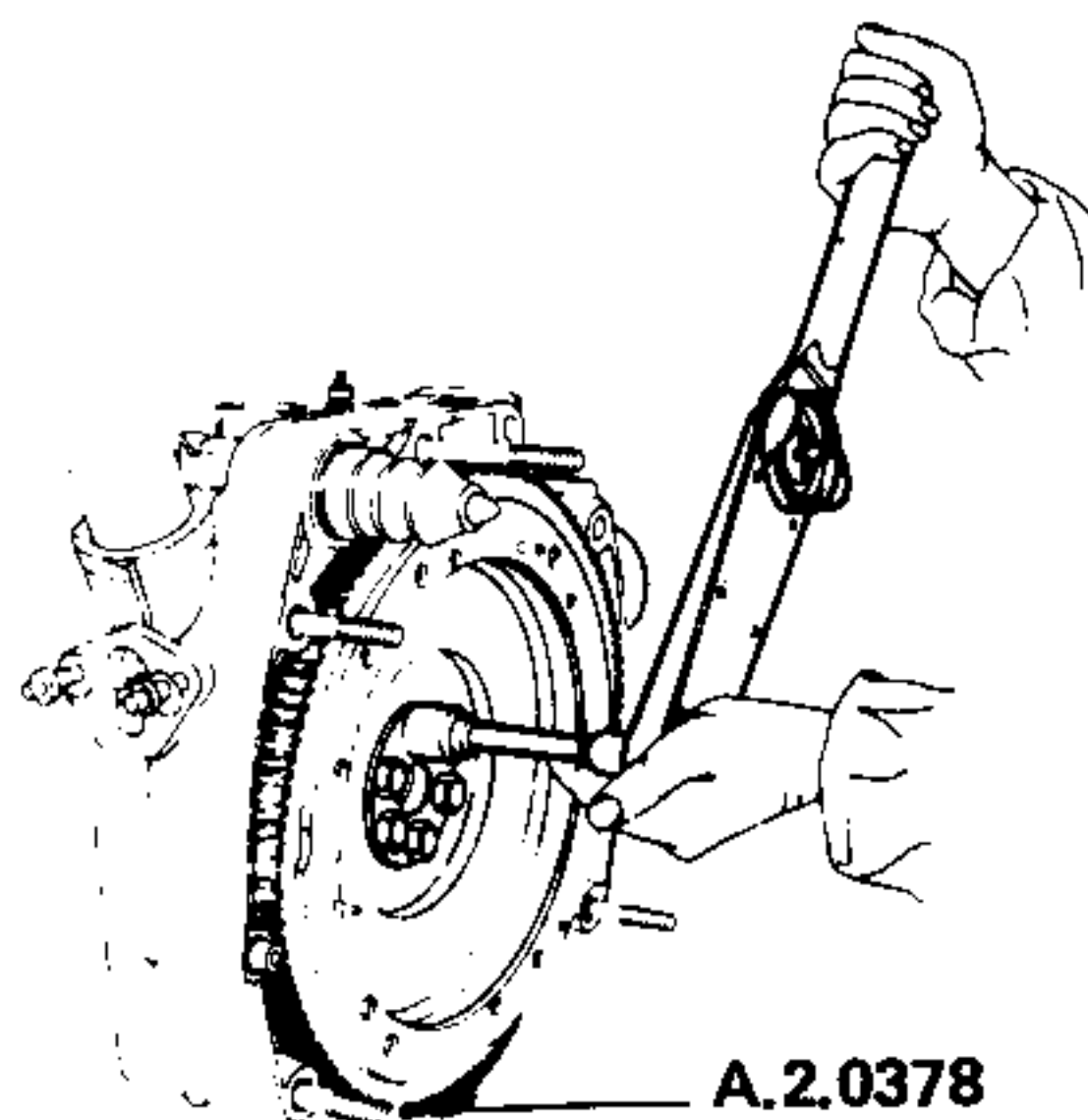
- (2) Using a tool A.2.0378, stop crankshaft from rotating.

- (3) Tighten retaining screws according to specified torque. Prior to fitting, coat screws with engine oil.

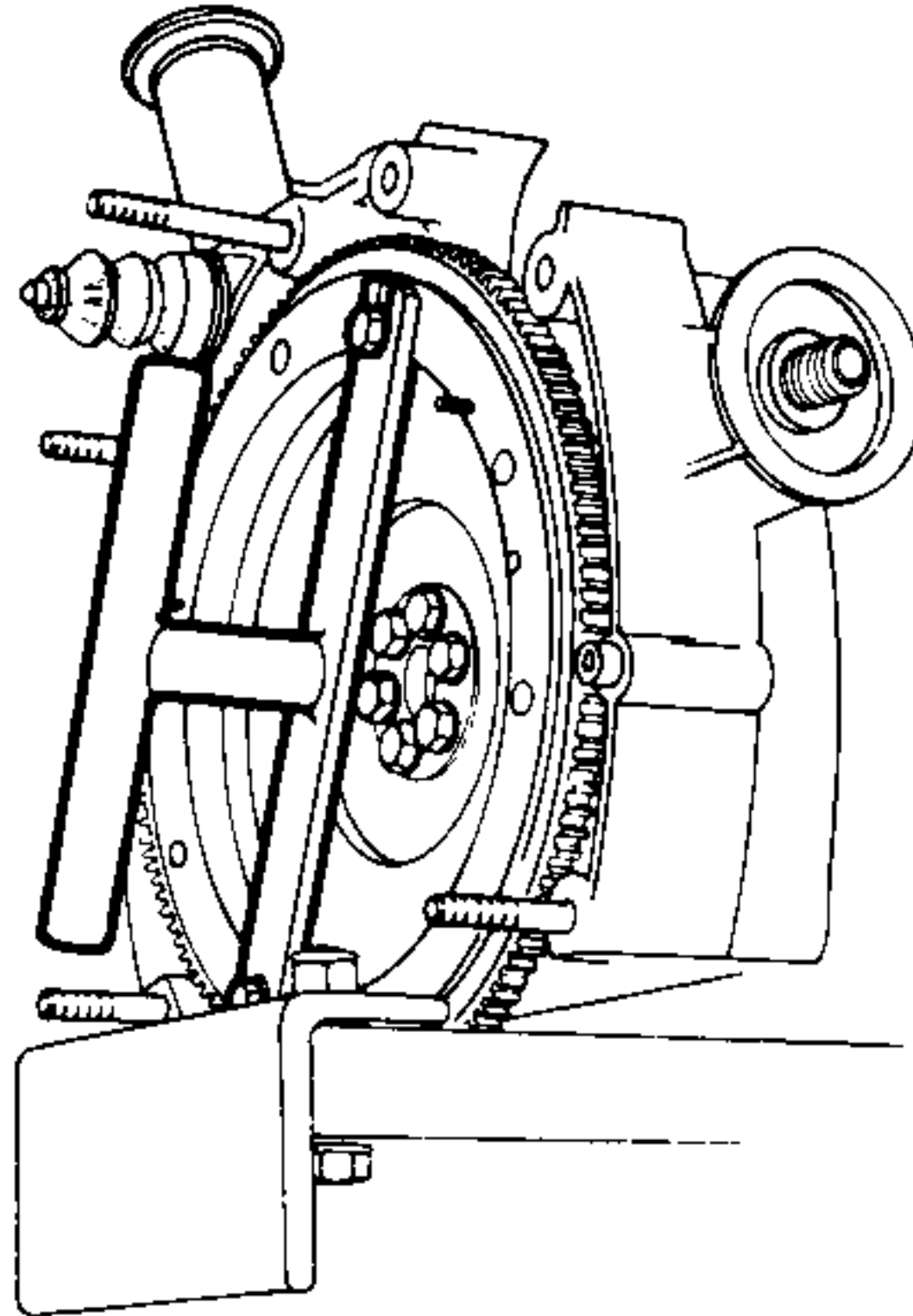
ⓧ: Tightening torque

Flywheel to crankshaft retaining screws:

94 ÷ 105 N·m
(9.6 ÷ 10.7 kg·m
69.4 ÷ 77.4 ft·lb)

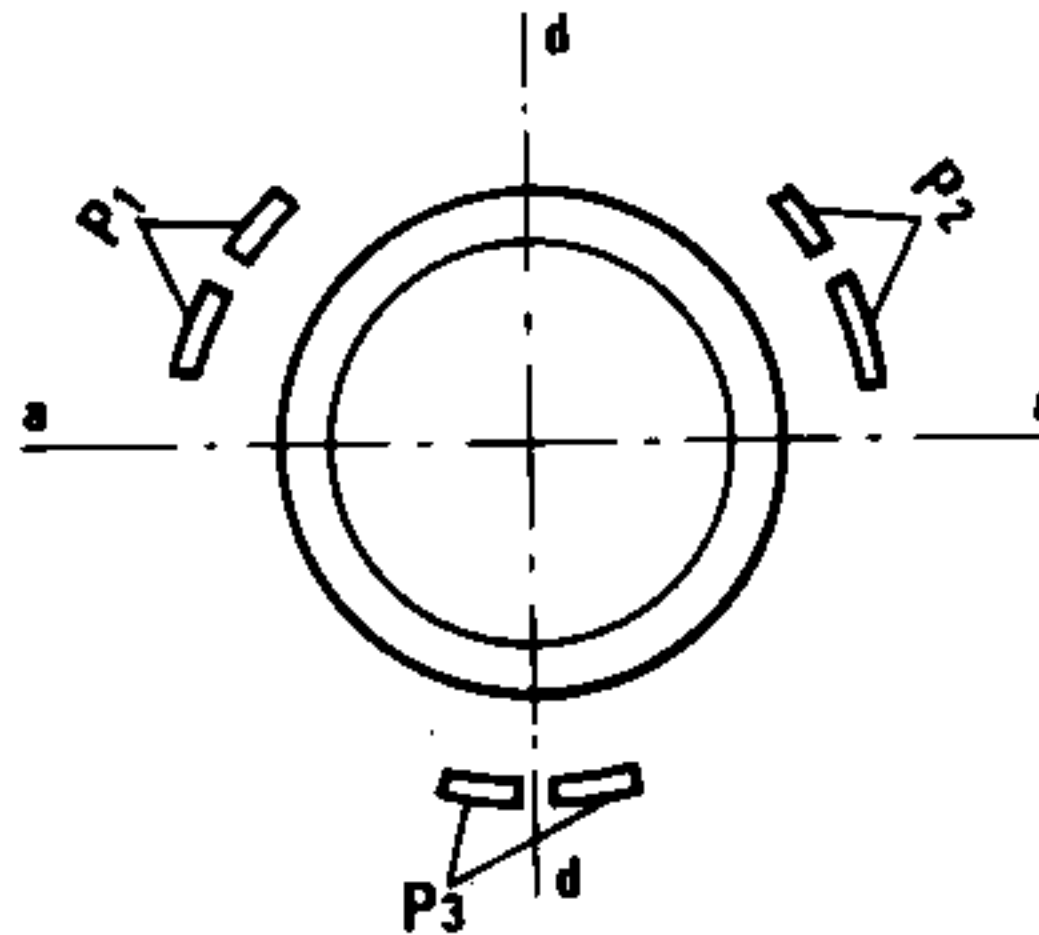


8. Fit a suitable tool on the flywheel that will allow crankshaft rotation and then remove the previously fitted stopper.



9. Fit pistons and connecting rods.

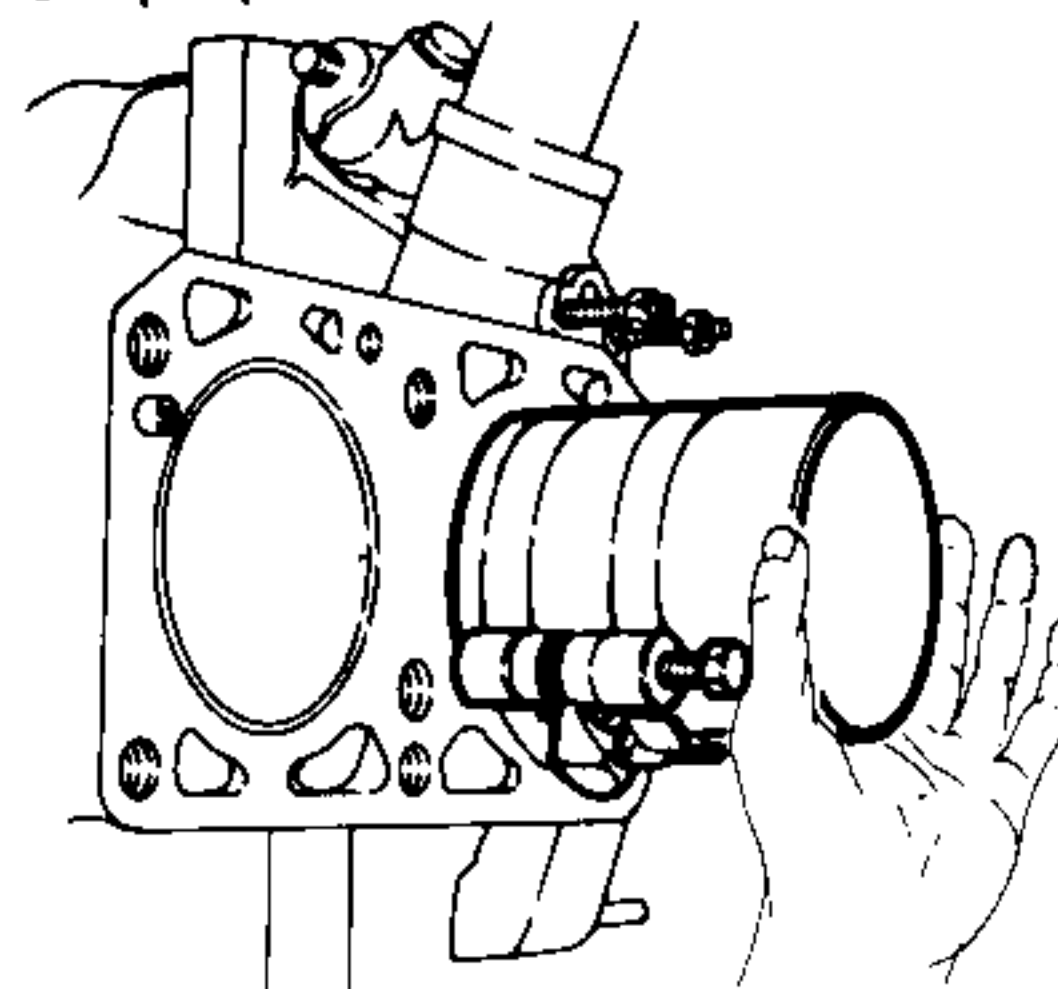
- (1) Fit piston rings into pistons so that cuts are set in a stagger, as shown below.



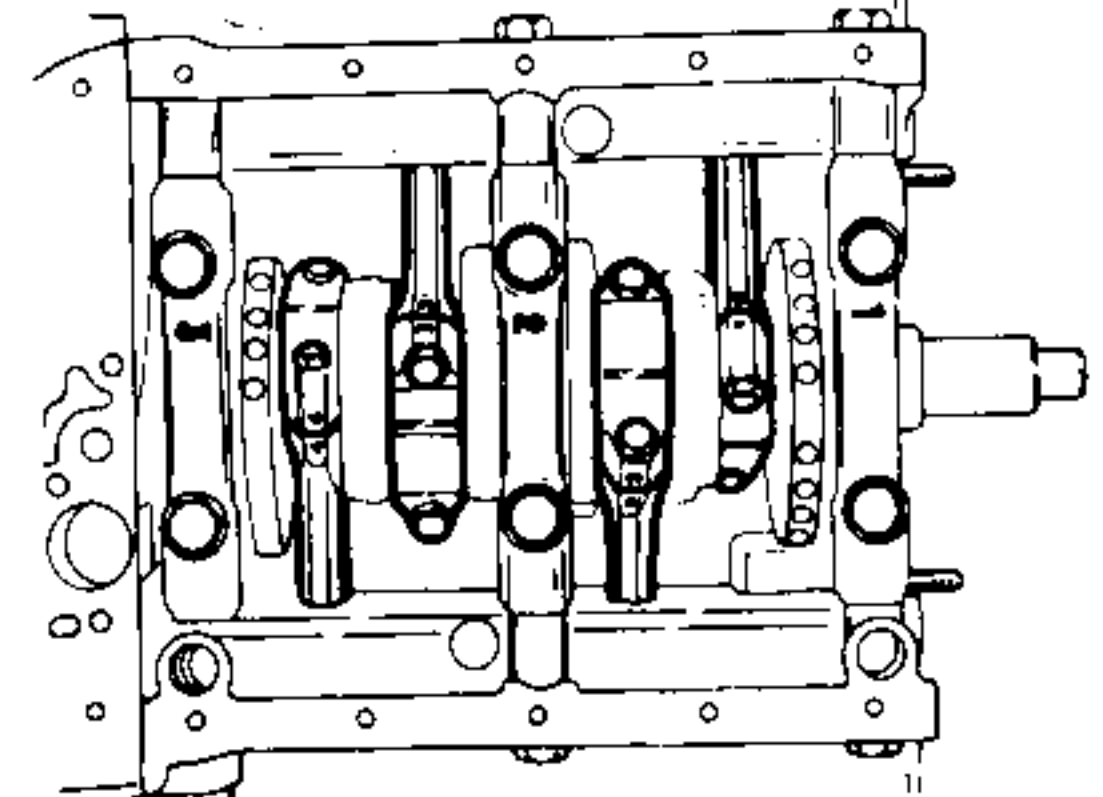
- P₁ position of top compression ring
P₂ position of lower compression ring
P₃ scraper ring position
aa piston pin axis
dd thrust direction

- (2) Fit previously selected half-rings on connecting rod big ends and on corresponding caps.

- (3) Fit pistons and connecting rods into corresponding cylinders using the proper universal tool.



- a. When fitting the pistons, arrange them with the arrow stamped on their crown pointing in the same direction as that of engine rotation, namely: upward for right head pistons and downward for left head pistons.
- b. The position of the connecting rod big end must be such as to allow reading of the identification number.



- (4) Fit connecting rod caps with relevant half-bearings onto connecting rod big ends, tightening screws according to specified torque.

- a. In order to have access to the screw, suitably rotate the crankshaft.
- b. Before tightening the screws, use a thickness gauge to check the play between the crankshaft shoulder and the rod-cap profile.

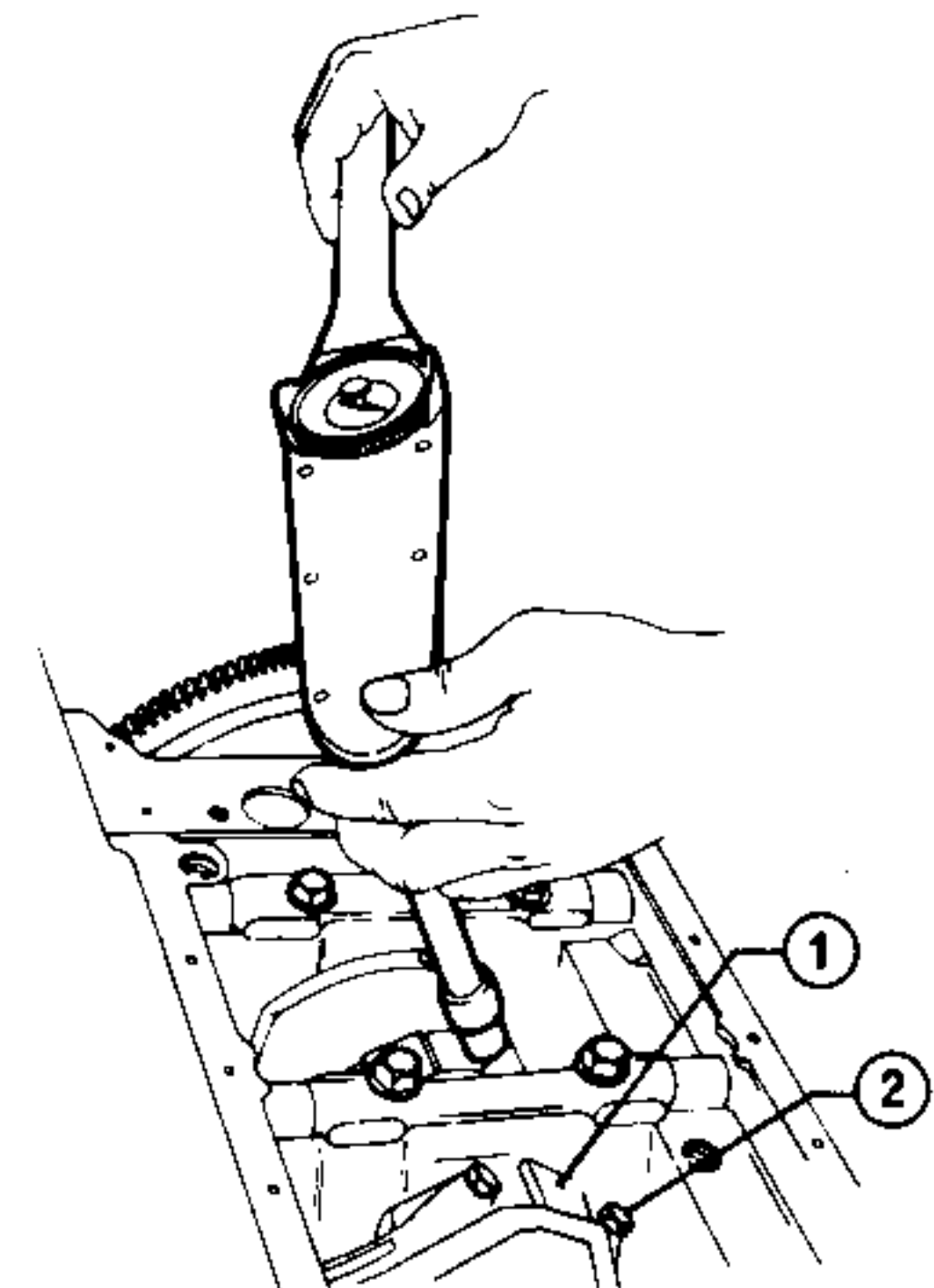
Play between crankshaft and rod-cap profile

0.15 mm (0.0059 in)

ⓧ: Tightening torque

Caps to con. rod big end retaining screws:

43 ÷ 48 N·m
(4.4 ÷ 4.9 kg·m
31.8 ÷ 35.4 ft·lb)

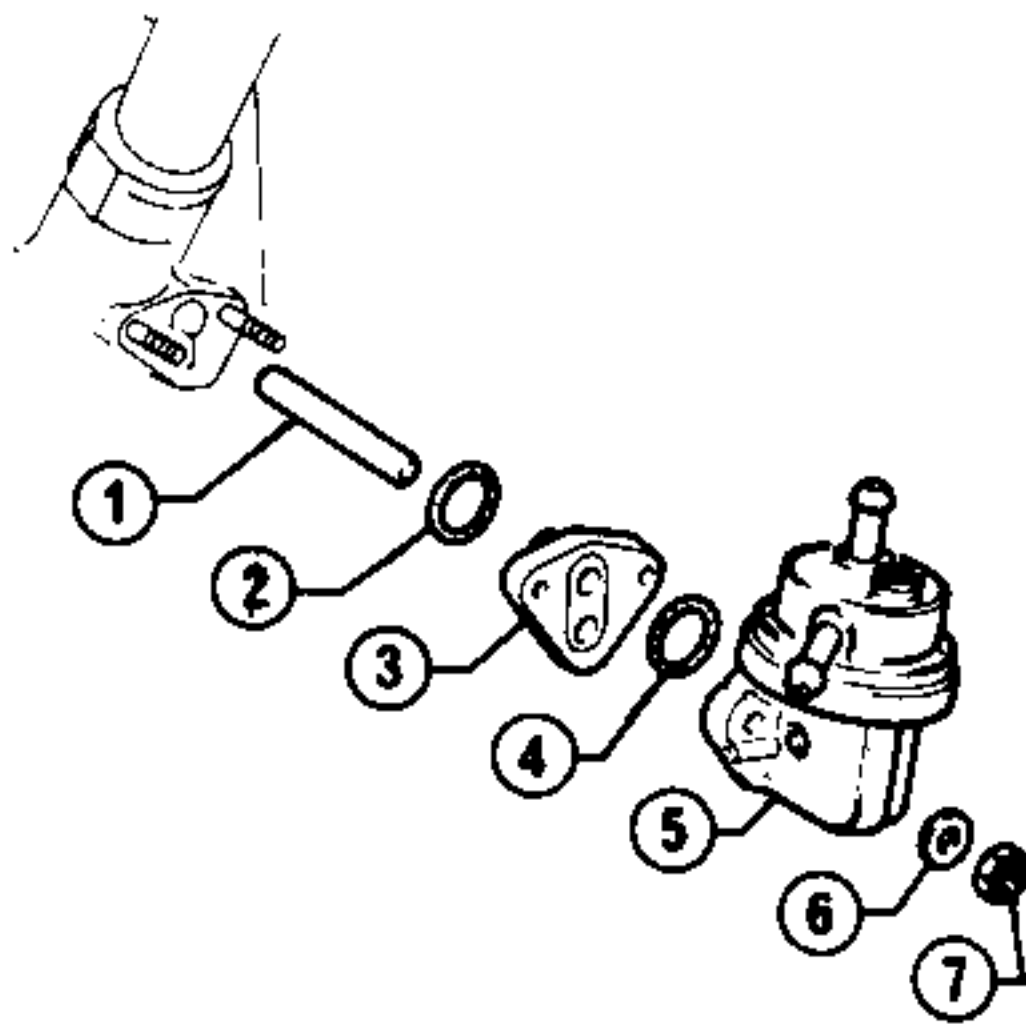


- 1 Connecting rod 2 Screw

24. Fit fuel pump to the engine rear cover.

- (1) Fit spacer (3) with relevant gaskets (2) and (4) on the two studs connecting the pump to the rear cover.
- (2) Coat with oil the pump drive plunger rod (1) and fit it into place.
- (3) Fit the pump body (5) and secure it with the two retaining nuts (7), according to specified torque.

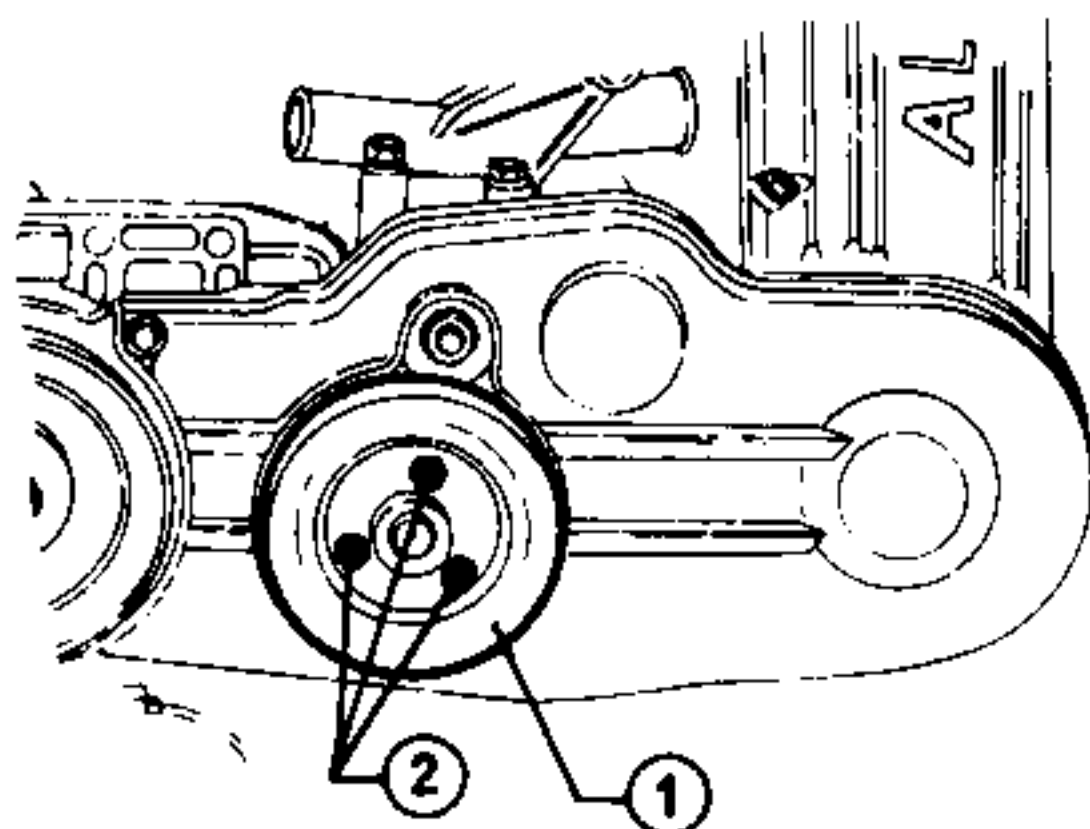
T: Tightening torque
Fuel pump retaining screws
 $19 \div 24 \text{ N}\cdot\text{m}$
 $(1.9 \div 2.4 \text{ kg}\cdot\text{m})$
 $13.7 \div 17.4 \text{ ft}\cdot\text{lb}$



- | | |
|---------------|-------------|
| 1 Plunger rod | 5 Fuel pump |
| 2 Gasket | 6 Washer |
| 3 Spacer | 7 Nut |
| 4 Gasket | |

25. Fit the camshafts belts front plastic covers.

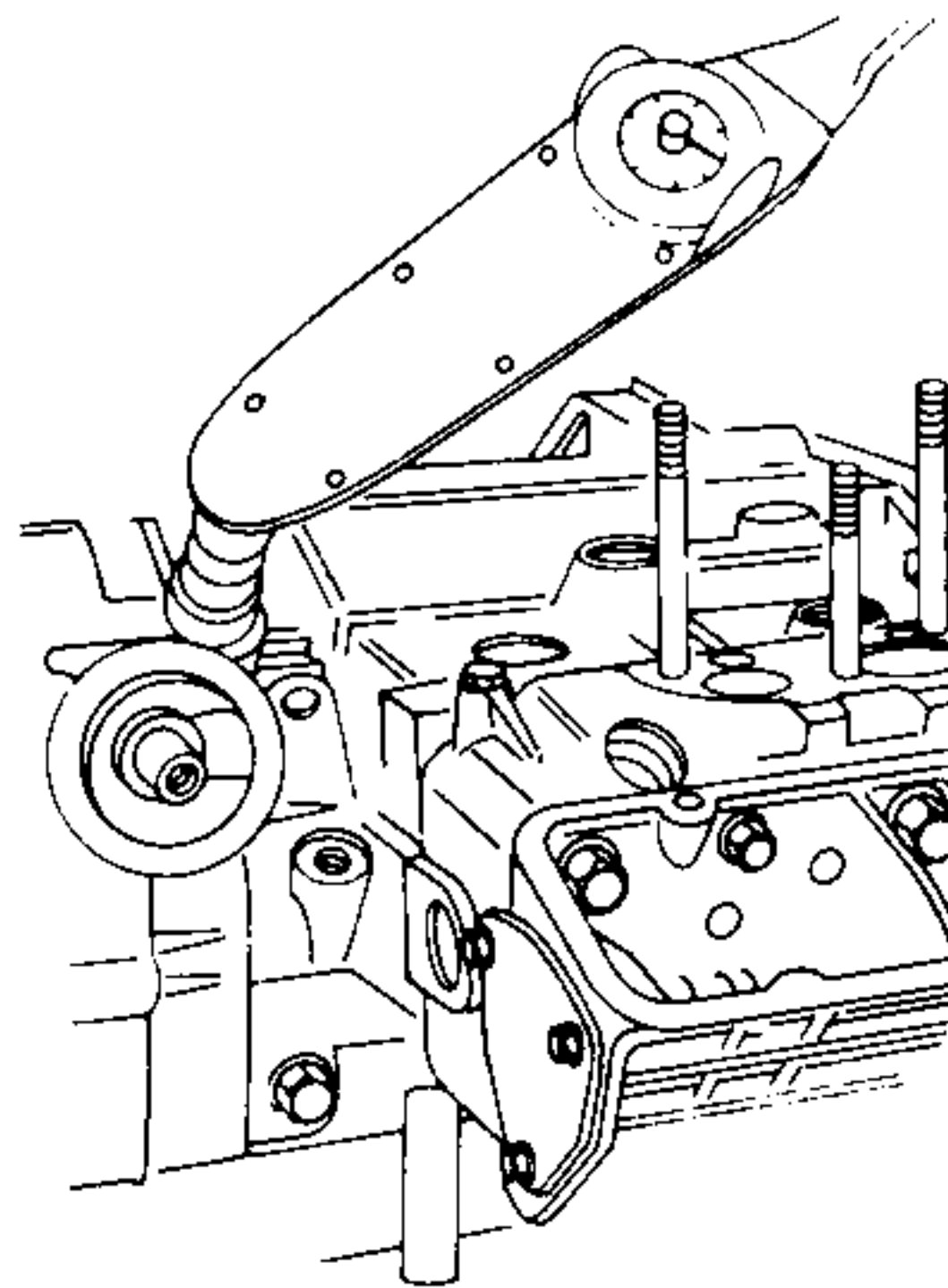
26. Fit pulley (1) on water pump hub and lock it into place with relevant screws (2).



- | | |
|----------|---------|
| 1 Pulley | 2 Screw |
|----------|---------|

27. Tighten the oil pressure switch on engine rear cover according to specified torque.

T: Tightening torque
Oil pressure switch:
 $33 \div 41 \text{ N}\cdot\text{m}$
 $(3.4 \div 4.2 \text{ kg}\cdot\text{m})$
 $24.6 \div 30.4 \text{ ft}\cdot\text{lb}$

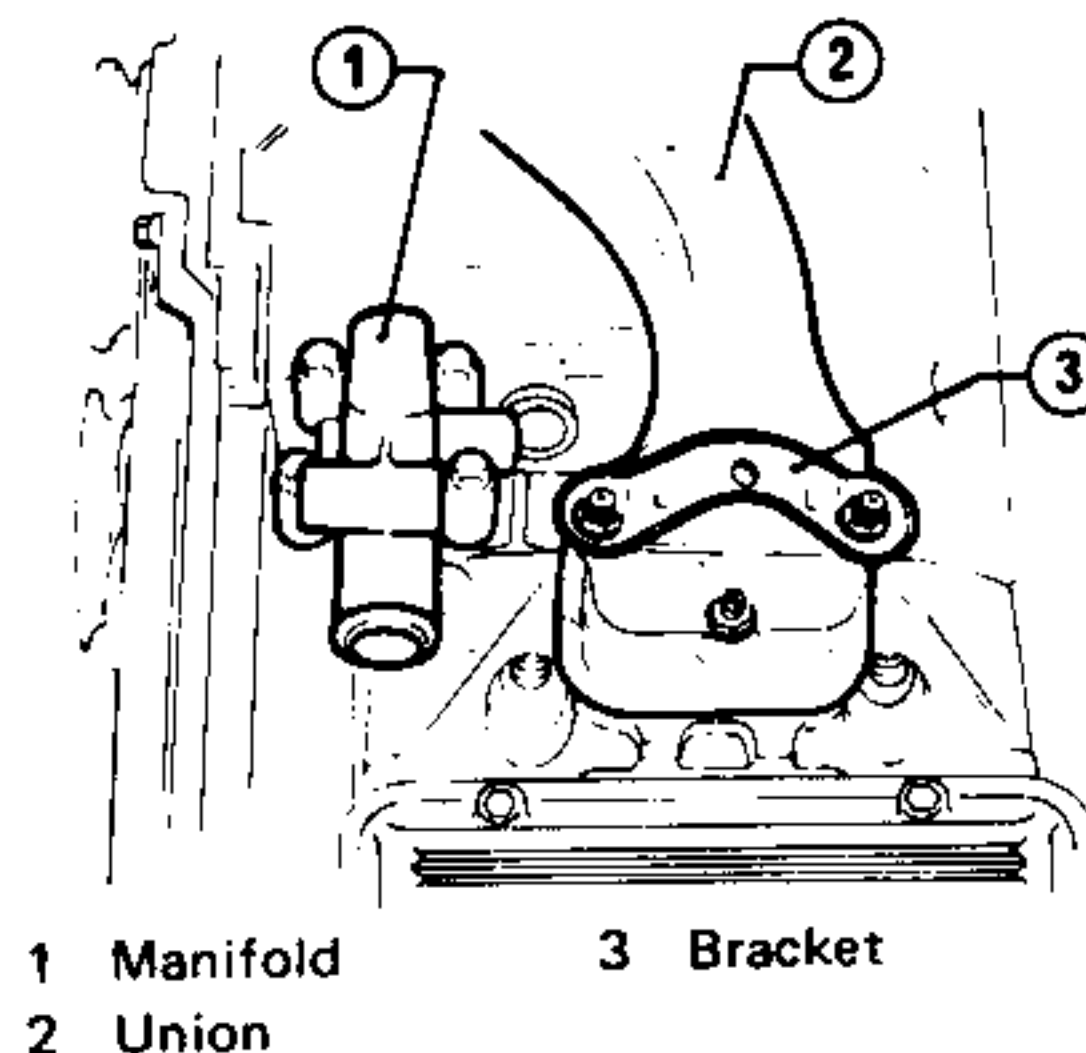


28. Fit the intake manifold assembly with relevant gaskets and then the engine lifting brackets.

T: Tightening torque
Central intake manifold
 $19 \div 24 \text{ N}\cdot\text{m}$
 $(1.9 \div 2.4 \text{ kg}\cdot\text{m})$
 $13.7 \div 17.4 \text{ ft}\cdot\text{lb}$

29. Fit the water inlet union (1) on the cylinder block.

T: Tightening torque
Water inlet union on cylinder block
 $19 \div 24 \text{ N}\cdot\text{m}$
 $(1.9 \div 2.4 \text{ kg}\cdot\text{m})$
 $13.7 \div 17.4 \text{ ft}\cdot\text{lb}$



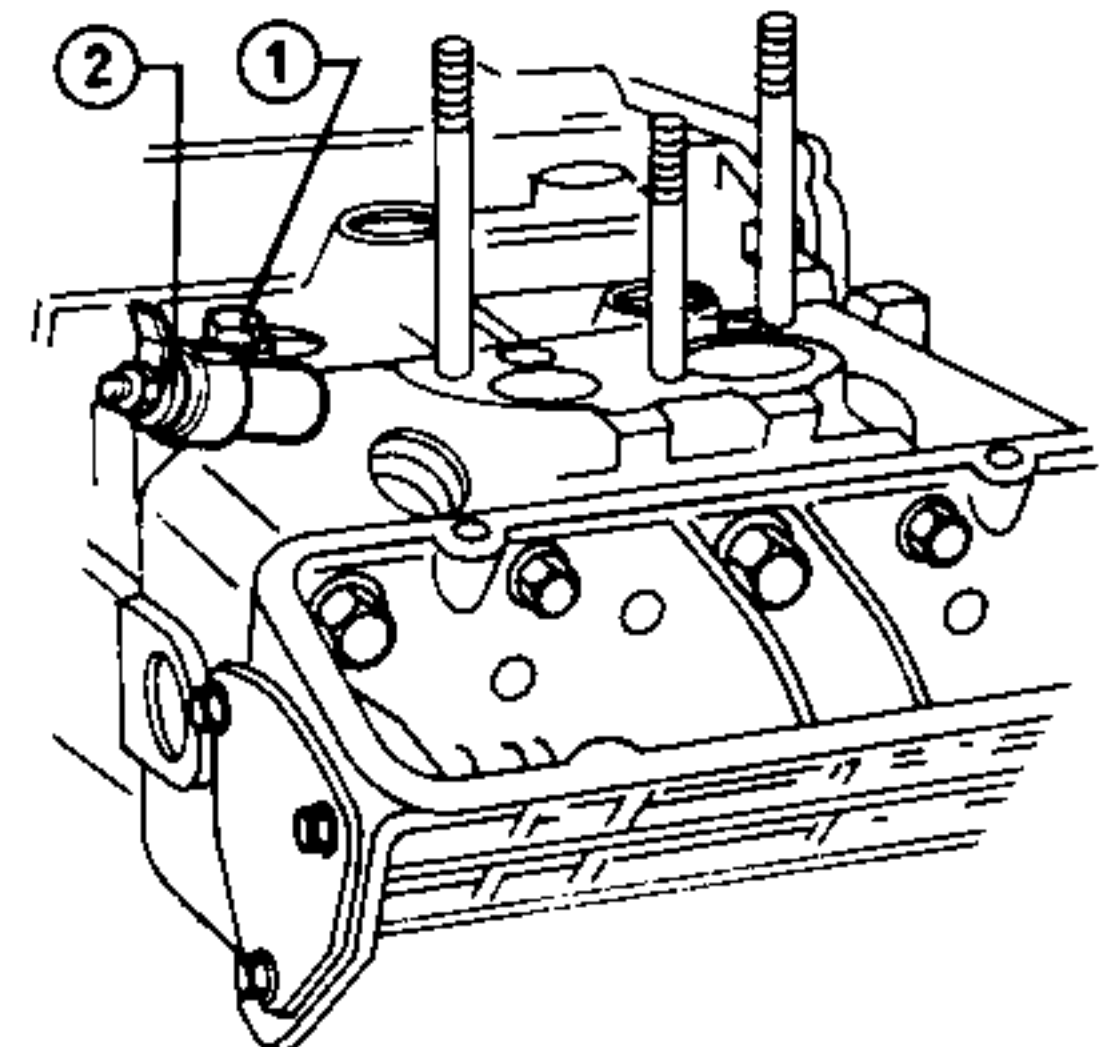
- | | |
|------------|-----------|
| 1 Manifold | 3 Bracket |
| 2 Union | |

30. Fit temperature transmitter on intake manifold rear side.

T: Tightening torque
Water temperature transmitter
 $33 \div 41 \text{ N}\cdot\text{m}$
 $(3.4 \div 4.2 \text{ kg}\cdot\text{m})$
 $24.6 \div 30.4 \text{ ft}\cdot\text{lb}$

31. Lock with screw (1) thermal contact (2) to right head.

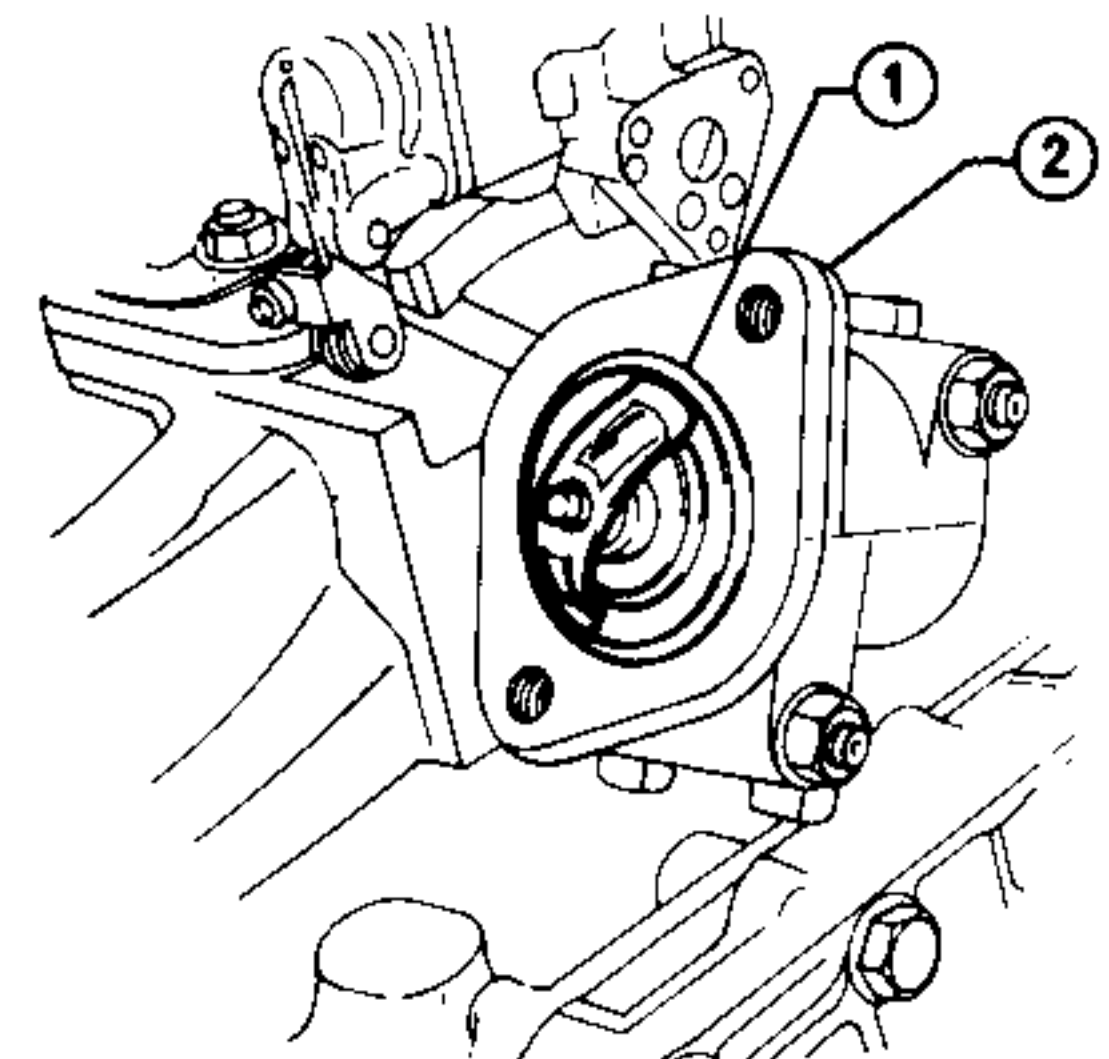
T: Tightening torque
Thermal contact on right head
 $33 \div 41 \text{ N}\cdot\text{m}$
 $(3.4 \div 4.2 \text{ kg}\cdot\text{m})$
 $24.6 \div 30.4 \text{ ft}\cdot\text{lb}$



- | | |
|---------|-------------------|
| 1 Screw | 2 Thermal contact |
|---------|-------------------|

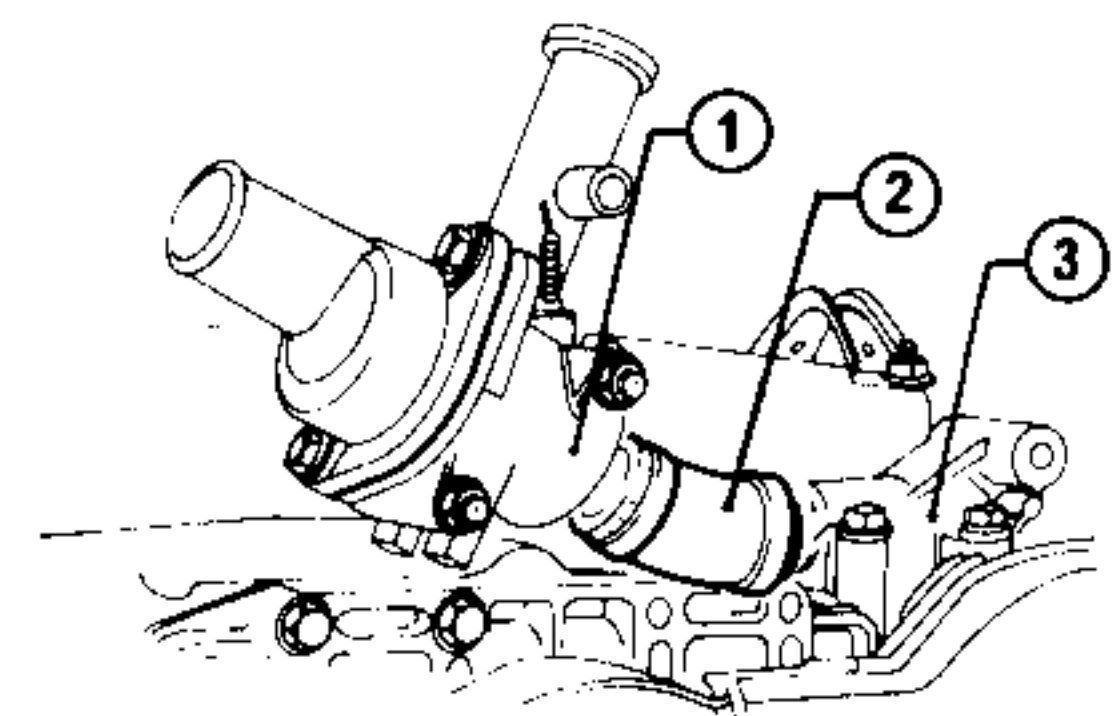
32. Fit on intake manifold the thermostat housing (2), thermostat (1), and cover with relevant gasket.

The thermostat must be positioned with the arrow pointing in the flowing direction of the water.



- | | |
|--------------|-----------|
| 1 Thermostat | 2 Housing |
|--------------|-----------|

33. Fix the cooling system coupling (2) between thermostat housing (1) and water inlet union (3) on the cylinder block; tighten screws of securing clamp.

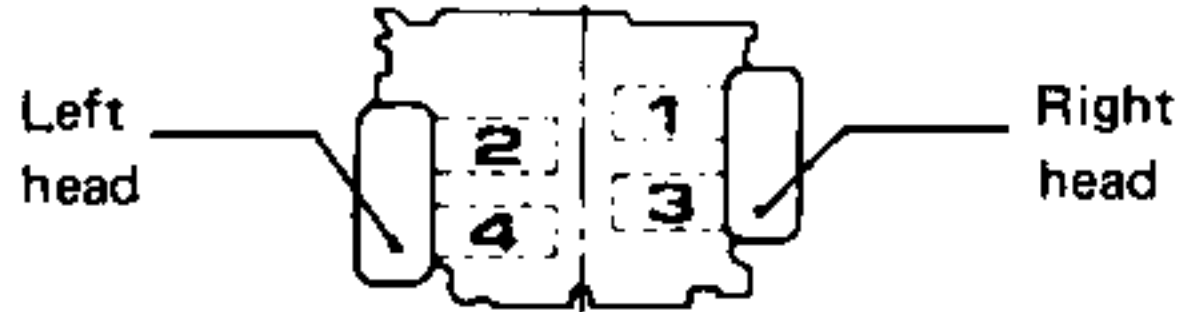


- | | | |
|----------------------|------------|---------|
| 1 Thermostat housing | 2 Coupling | 3 Union |
|----------------------|------------|---------|

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

ENGINES DATA

		Engine		
		1200 305.00	1350 305.02	1500 305.04
Cycle		Otto/4 Stroke		
Numbers of cylinders		4 horizontally opposed		
Cylinder identification				
Bore - Stroke				
Displacement	mm (in) cm ³ (cu.in)	80 x 59 (3.15 x 2.32) 1186 (72.37)	80 x 67.2 (3.15 x 2.65) 1351 (82.44)	84 x 67.2 (3.31 x 2.65) 1490 (90.93)
Combustion chamber volume	cm ³ (cu.in)	37 (2.26)	42.2 (2.6)	46.5 (2.84)
Compression ratio		9	9	9
Power DIN	Max specific kW (HP)	50 (68) 42 (57.3) to 6000 r.p.m.	58 (79) 43 (58.4) to 6000 r.p.m.	62 (84) 41.6 (56.3) to 5800 r.p.m.
Max Torque DIN	Nm (kgm ; ftlb)	90 (9.2 ; 66.56) to 3200 r.p.m.	111 (11.3 ; 82.1) to 3500 r.p.m.	121 (12.3 ; 89.5) to 3500 r.p.m.
Piston mean speed (1)	m/s (ft/s)	11.8 (38.71)	13.4 (43.96)	13 (42.65)
Cylinder compression (2)	kPa (kg/cm ² ; bar; p.s.i.)	1029.6 (10.5; 10.3; 149.39)		
Min. pressure				
Max difference in pressure between cylinders		98 (1; 0.98; 14.21)		
Oil pressure (3)	kPa (kg/cm ² ; bar; p.s.i.)	117.68 ÷ 274.60 (1.2 ÷ 2.8 ; 1.18 ÷ 2.75 ; 17.07 ÷ 39.83 411.89 ÷ 568.81 (4.2 ÷ 5.8 ; 4.12 ÷ 5.69 ; 59.74 ÷ 82.50)		
to 800 r.p.m.				
to 5500 r.p.m.				
Oil consumption (4)	g (oz)	600 (21.16)		

(1) At max power output r.p.m.

(2) Values to be read in these conditions:

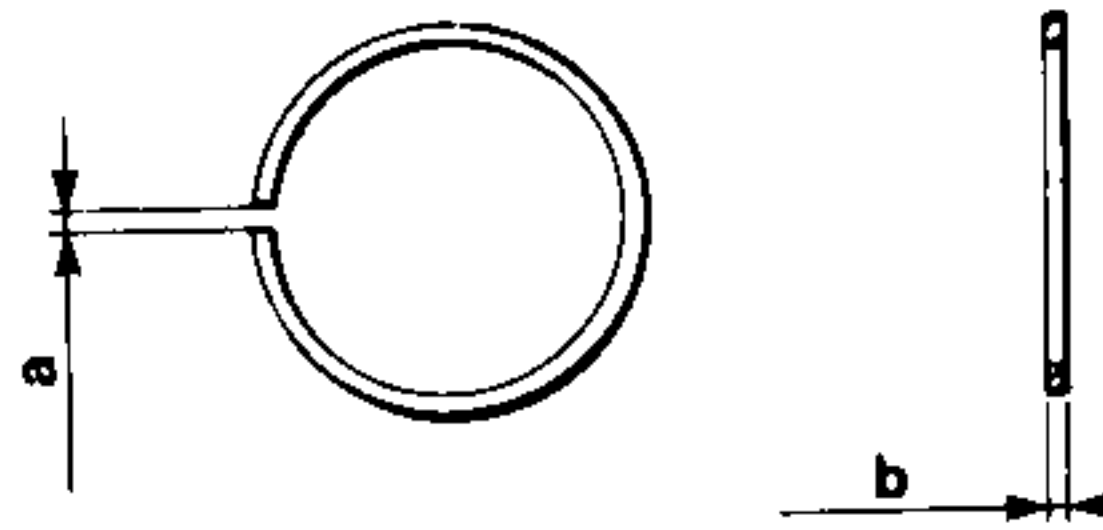
- engine at operating temperature
- fully opened throttles
- engine cranked by starter motor, sparking plugs removed

(3) Values to be read at engine operating temperature (oil at 90°C = 194°F)

(4) Maximum consumption in 1,000 km (621 Mi)

ENGINE MAIN MECHANICAL UNIT

Compression rings

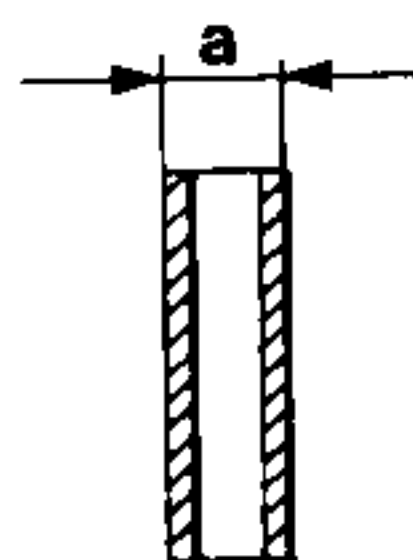


Unit: mm (in)

Inspection data		Engine		
		1200	1350	1500
Ring thickness "b"	First compression ring	1.478 ÷ 1.490 (0.0582 ÷ 0.0587)		
	Second compression ring	1.728 ÷ 1.740 (0.0680 ÷ 0.0685)		
	Oil scraper ring	3.978 ÷ 3.990 (0.1566 ÷ 0.1571)		
Ring gap "a" (1)	First compression ring	0.30 ÷ 0.45 (0.0118 ÷ 0.0177)	0.30 ÷ 0.45 (0.0118 ÷ 0.0177) (2) 0.30 ÷ 0.50 (0.0118 ÷ 0.0197) (3)	
	Second compression ring	0.30 ÷ 0.45 (0.0118 ÷ 0.0177)	0.30 ÷ 0.45 (0.0118 ÷ 0.0177) (2) 0.30 ÷ 0.50 (0.0118 ÷ 0.0197) (3)	
	Oil scraper ring	0.25 ÷ 0.40 (0.0098 ÷ 0.0157)	0.25 ÷ 0.40 (0.0098 ÷ 0.0157) (2) 0.25 ÷ 0.50 (0.0098 ÷ 0.0197) (3)	
	Limit gap for each ring	1 (0.0394)		

- (1) To be measured inside the cylinder bore or inside a ring gauge
 (2) Borgo ring
 (3) Gostze ring

Pin

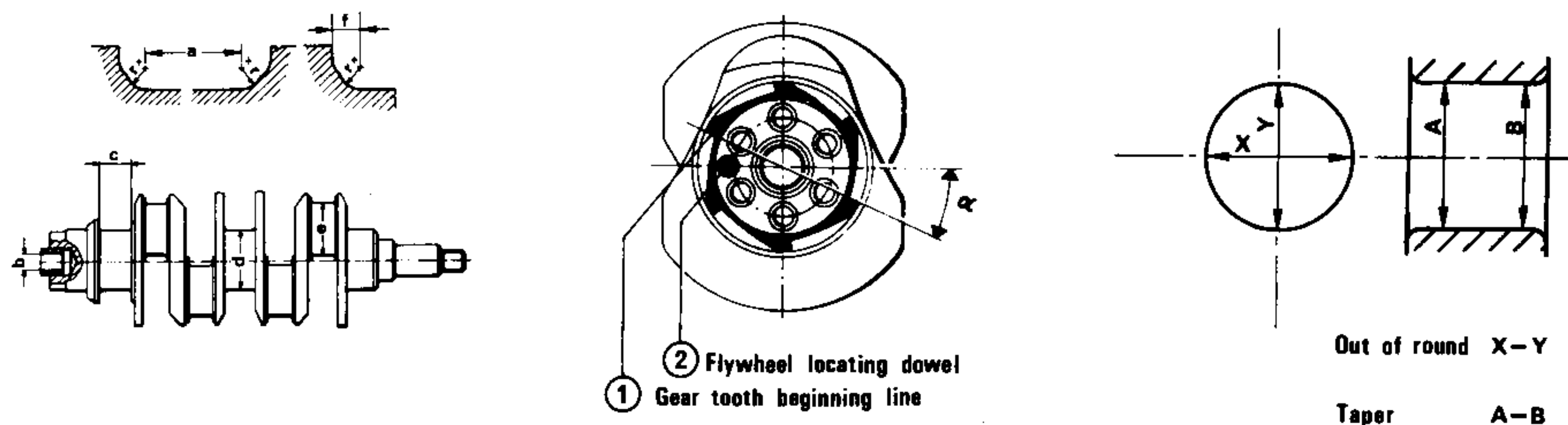


Unit: mm (in)

Inspection data		Engine		
		1200	1350	1500
Pin diameter "a"		20.996 ÷ 21.000 (0.8266 ÷ 0.8268)		
Pin-piston slack	Standard	0.002 ÷ 0.01 (0.0001 ÷ 0.0004)		
	Maximum	0.018 (0.0007)		

CRANKSHAFT, THRUST RINGS AND MAIN BEARINGS

Crankshaft



Unit: mm (in)

Inspection data			Engine		
			1200	1350	1500
Main journal diameter "d"	Standard		59.944 ÷ 59.957 (2.3600 ÷ 2.3605)		
	Undersize	1st	59.690 ÷ 59.703 (2.3500 ÷ 2.3505)		
		2nd	59.436 ÷ 59.449 (2.3400 ÷ 2.3405)		
		3rd	59.182 ÷ 59.195 (2.3300 ÷ 2.3305)		
		4th	58.928 ÷ 58.941 (2.3200 ÷ 2.3205)		
Crank pin diameter "e"	Standard		49.984 ÷ 49.992 (1.9679 ÷ 1.9682) 49.992 ÷ 50.000 (1.9682 ÷ 1.9685)		
	Undersize	1st	49.733 ÷ 49.746 (1.9580 ÷ 1.9585)		
		2nd	49.479 ÷ 49.492 (1.9480 ÷ 1.9485)		
		3rd	49.225 ÷ 49.238 (1.9380 ÷ 1.9385)		
		4th	48.971 ÷ 48.984 (1.9280 ÷ 1.9285)		
Rear main journal length "c"	Standard		28.51 ÷ 28.55 (1.1224 ÷ 1.1240)		
	Oversize		28.764 ÷ 28.804 (1.1324 ÷ 1.1340) (1)		
Fillet radii "r"	Main journals		1.8 ÷ 2 (0.0709 ÷ 0.0787)		
	Rear main journal		1.5 ÷ 1.7 (0.0591 ÷ 0.0669)		
	Crank pins		2.8 ÷ 3 (0.1102 ÷ 0.1181)		
Length of fillet radii portions "f"	Front main journals		2.11 ÷ 2.81 (0.0831 ÷ 0.1106)		
Length of parallel portion "a"	Central main journal		24.05 ÷ 24.15 (0.9469 ÷ 0.9508)		
	Rear main journal		24.22 ÷ 24.32 (0.9535 ÷ 0.9575)		
Surface roughness of main journals and crankpin			0.16·10 ⁻³ (0.63·10 ⁻⁵)		
X-Y Ovality and limit for taper A-B of main journals and crankpins	Standard		0.006 (0.00024)		
	Maximum		0.02 (0.0008)		
Max. error of parallelism between crankpins and main journals			0.015 (0.0006)		
Max. misalignment among main journals			0.02 (0.0008)		

ENGINE MAIN MECHANICAL UNIT

GRINDINGS

Application	Type	Denomination	Q.ty
Grinding valves and valves seats		SIPAL AREXONS: Carbosilicon for valves Std. no. 4100-31502	—

TIGHTENING TORQUES

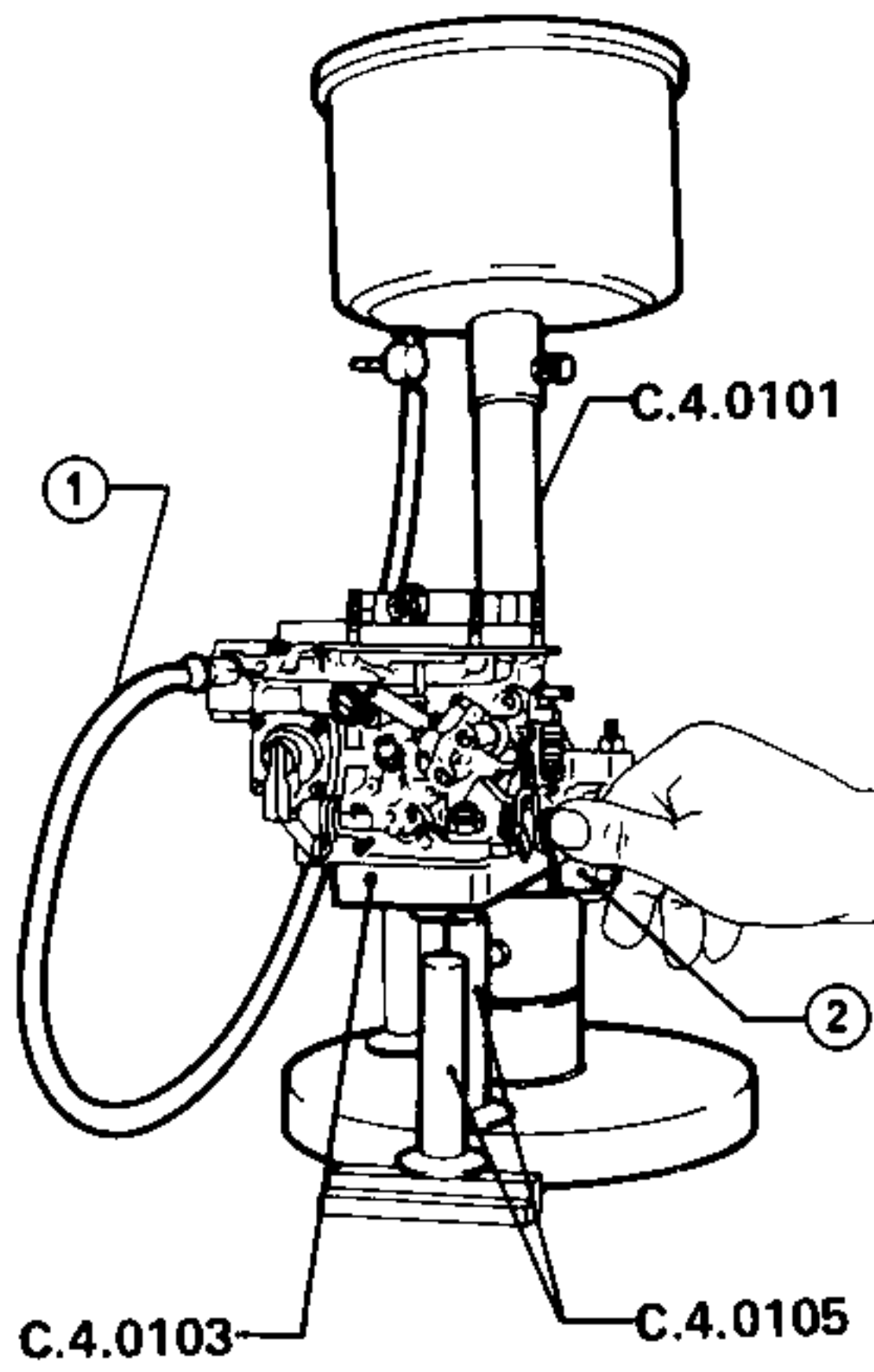
Item	Unit	N·m	kg·m	ft·lb
Rear (front) cover securing screws to cylinder block		19 ÷ 24	1.9 ÷ 2.4	13.7 ÷ 17.4
Retaining screw, pulley to camshaft (with oil)		63 ÷ 70	6.4 ÷ 7.1	46.3 ÷ 51.3
Main bearings cap screws (with oil)		66 ÷ 73	6.7 ÷ 7.4	48.4 ÷ 53.5
Main bearing cap transverse screws (with oil)		40 ÷ 49	4.1 ÷ 5	29.6 ÷ 36.2
Flywheel retaining screws (with oil)		94 ÷ 105	9.6 ÷ 10.7	69.4 ÷ 77.4
Connecting rod screws		43 ÷ 48	4.4 ÷ 4.9	31.8 ÷ 35.4
Retaining nut, driving pulley to crankshaft		118 ÷ 144	12 ÷ 14.7	86.8 ÷ 106.3
Nut securing belt tensioner to crankcase	Engine cold	37 ÷ 46	3.8 ÷ 4.7	27.5 ÷ 34
	Engine warm	29 ÷ 35	3 ÷ 3.6	21.7 ÷ 26
Oil pressure switch		33 ÷ 41	3.4 ÷ 4.2	24.6 ÷ 30.4
Cylinder heads to block screws (1)		81 ÷ 87	8.3 ÷ 8.9	60 ÷ 64.4
Water intake manifold screws		19 ÷ 24	1.9 ÷ 2.4	13.7 ÷ 17.4
Screws (nuts) securing oil (fuel) pump to engine rear cover		19 ÷ 24	1.9 ÷ 2.4	13.7 ÷ 17.4
Carburetor nuts		19 ÷ 24	1.9 ÷ 2.4	13.7 ÷ 17.4
Screws securing oil pump to oil pump support		8 ÷ 10	0.8 ÷ 1	5.8 ÷ 7.2
Screws securing water pump to crankcase		19 ÷ 24	1.9 ÷ 2.4	13.7 ÷ 17.4
Water temperature transmitter on intake manifold		33 ÷ 41	3.4 ÷ 4.2	24.6 ÷ 30.4
Intake manifold nuts		19 ÷ 24	1.9 ÷ 2.4	13.7 ÷ 17.4
Thermal contact on right head		33 ÷ 41	3.4 ÷ 4.2	24.6 ÷ 30.4
Spark plugs tightening		25 ÷ 34	2.5 ÷ 3.5	18.1 ÷ 25.3

FUEL SYSTEM

CONTENTS

AIR CLEANER	04-2	Removal	04-15
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Installation	04-2	EXHAUST SYSTEM	04-16
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ADJUSTMENT	04-12	CORRECTIONS	04-24
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FUEL SYSTEM



- 1 Hose supply
- 2 Choke control lever

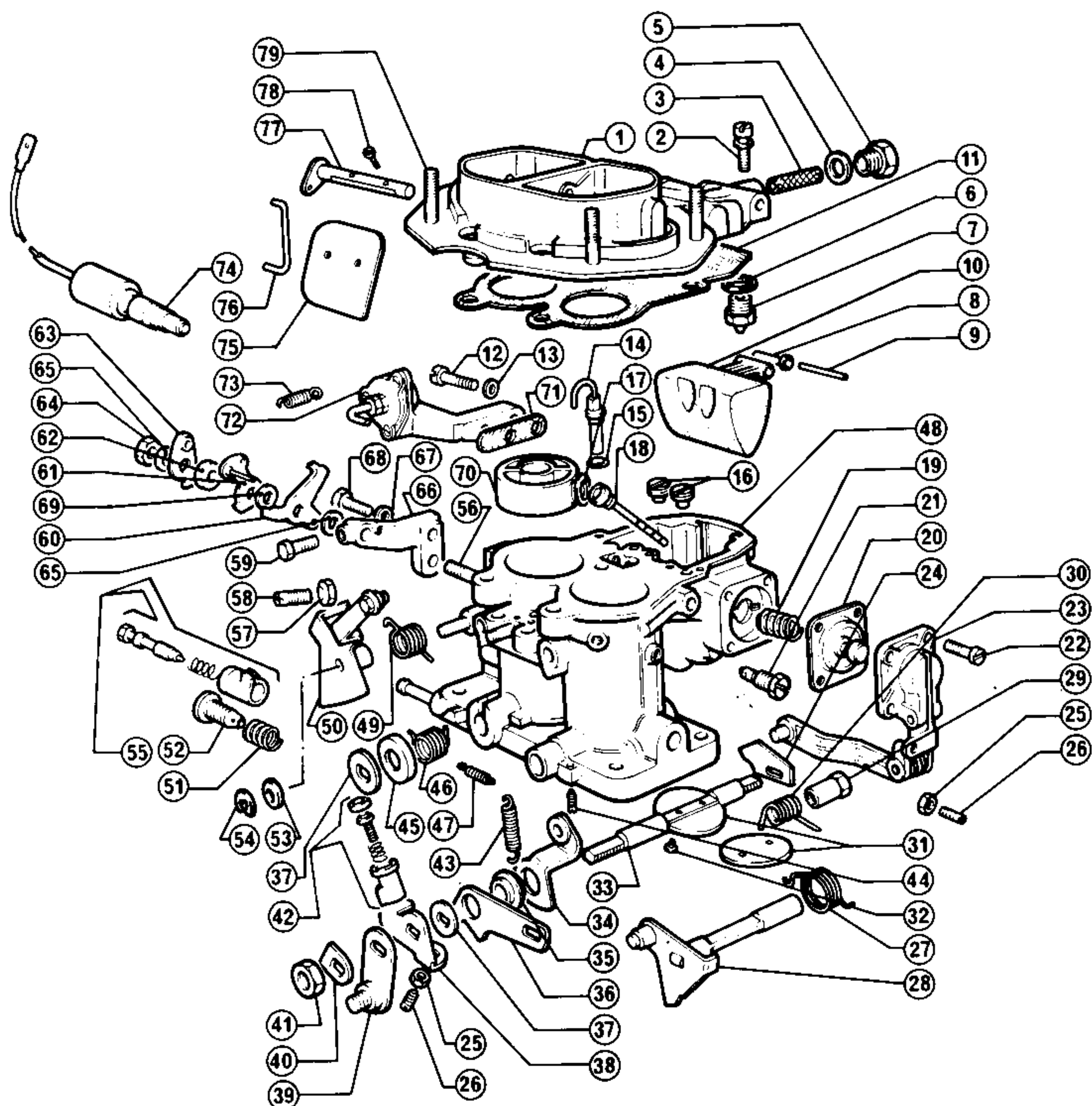
Install carburetor on vehicle (see: Group 01 - Engine Installment - Engine Unit) tightening nuts at the prescribed torque then adjust idle (see: Group 00 - Engine Maintenance).

ⓧ: Tightening torque
Carburetor securing nuts
19 ÷ 23,5 N·m
(1,9 ÷ 2,4 kg·m
13,74 ÷ 17,35 ft·lb)

SOLEX TWIN CARBURETOR

(Except Switzerland, Sweden, Australia)

- C32 EIES 45 *for 1200 model*
- C32 EIES 44 *for 1350 model*
- C32 EIES 43 *for 1500 model*



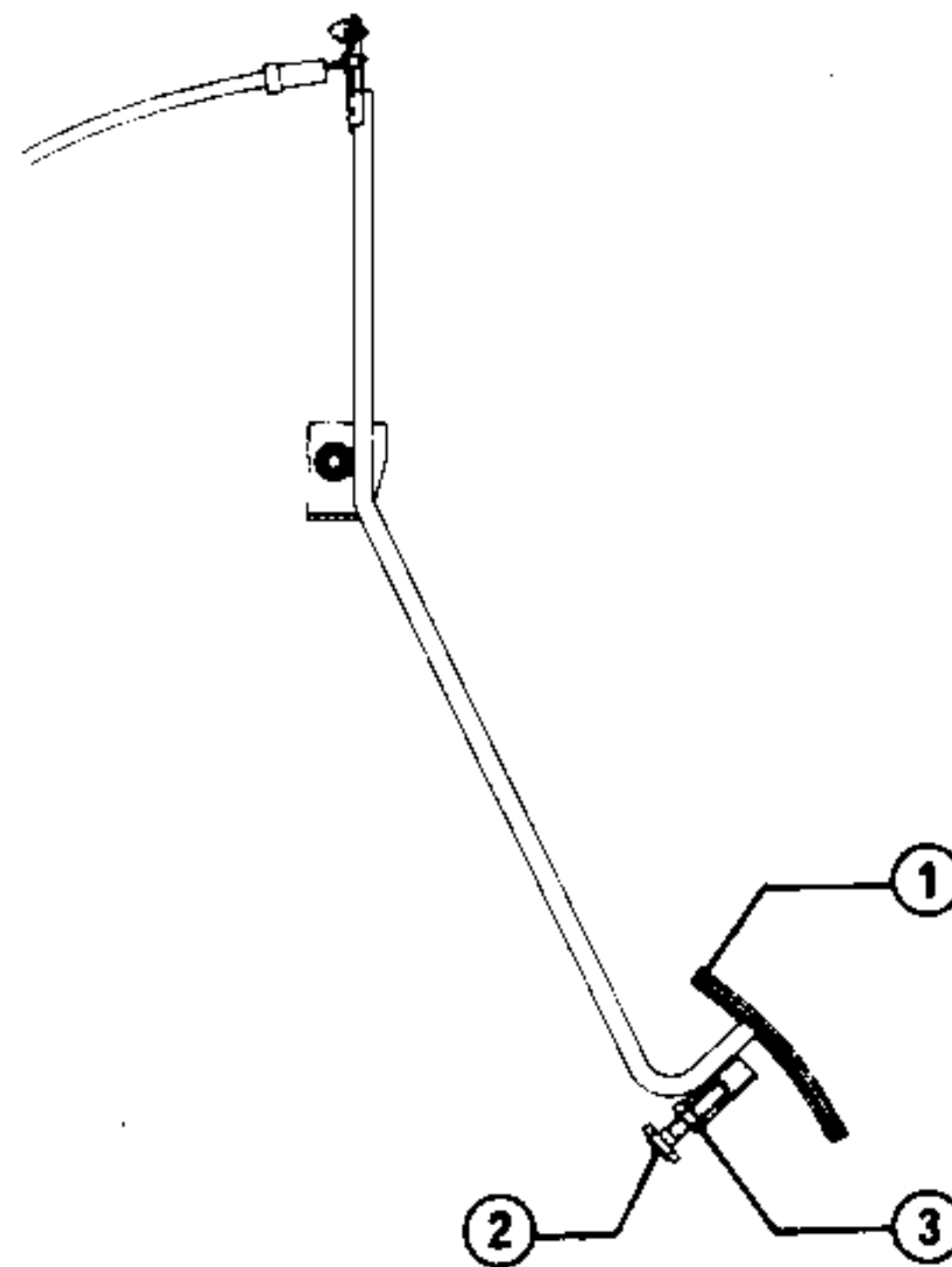
- | | | |
|--|--|---|
| 1 Float chamber cover assy | 20 Pump diaphragm assy | 39 Control lever throttle assy |
| 2 Cover securing screw | 21 Idling jet | 40 Brake washer |
| 3 Strainer | 22 Pump cover securing screw | 41 Nut |
| 4 Gasket | 23 Pump cover assy | 42 Sealed idling throttle adjustment assembly |
| 5 Filter cap | 24 Pump control cam | 43 Intermediate lever return spring |
| 6 Needle seat gasket | 25 Nut | 44 Secondary throttle adjustment screw |
| 7 Needle seat | 26 Adjustment screw | 45 Cup |
| 8 Bush for float shaft | 27 Return spring | 46 Throttle valve return spring |
| 9 Float shaft | 28 Primary shaft throttle valve assy | 47 Spring |
| 10 Float assy | 29 Nut | 48 Carburetor body |
| 11 Float chamber cover gasket | 30 Throttle valve return spring | 49 Air valve lever return spring |
| 12 Economiser securing screw | 31 Throttle valve | 50 Lever assy for air valve cable connection |
| 13 Washer | 32 Throttle securing screw | 51 Spring |
| 14 Pump injector assy | 33 Throttle valve primary shaft | 52 Idling adjustment screw |
| 15 Seal ring | 34 Throttle opening control lever assy | 53 Washer |
| 16 Main jet | 35 Bush | 54 Snap ring |
| 17 Seal ring | 36 Intermediate lever | 55 Sealed adjustment assy for idling mixture |
| 18 Emulsifying tube with air corrector | 37 Washer | 56 Air valve control lever shaft |
| 19 Pump spring | 38 Throttle stop lever | 57 Nut |

4. Keeping accelerator pedal fully depressed, verify if clearance between carburetor throttle valve control lever and the complete opening stop is within specified G_2 limit.

Lever to limit stop clearance
 $G_2 = 1 \div 2$ (0.039 ÷ 0.079 in)

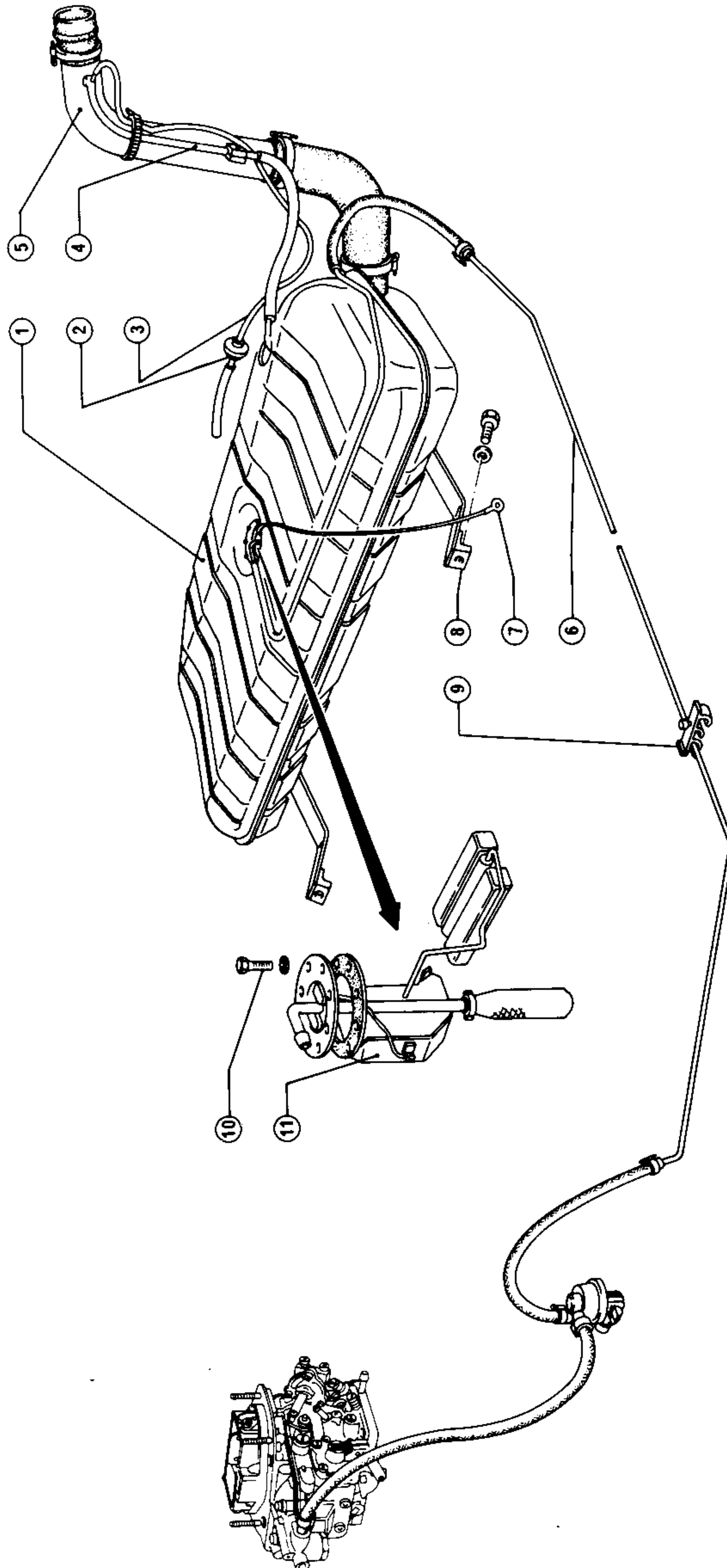
5. If required, adjust as follows working from within passenger compartment:

- (1) Loosen lock nut (3) of accelerator pedal limit stop screw (2).
- (2) Turn screw (2) till specified clearance is reached.
- (3) Tighten lock nut.



- | | |
|---------------------|------------|
| 1 Accelerator pedal | 3 Lock nut |
| 2 Adjusting screw | |

FUEL LINE

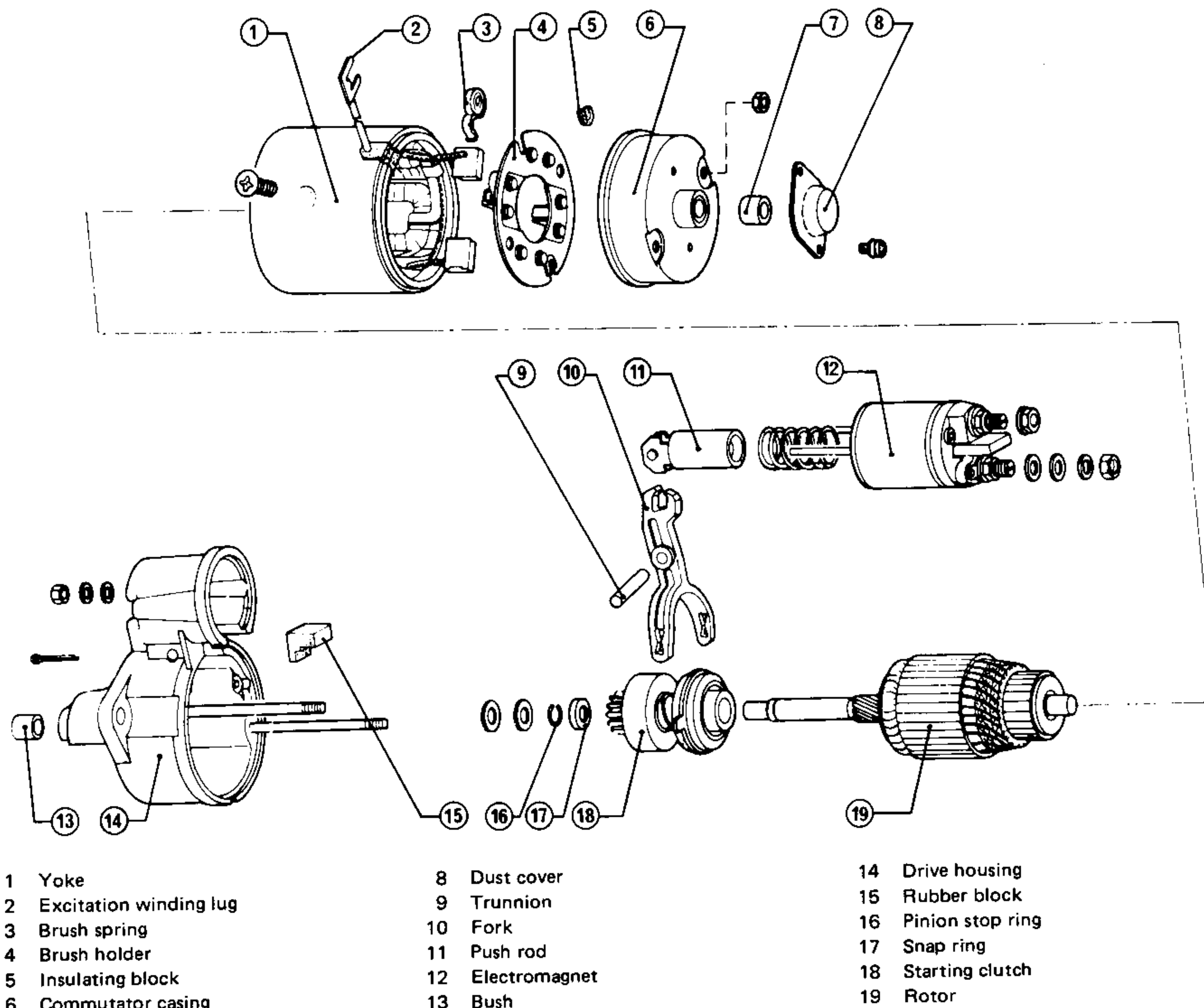


- 9 Feeding pipe holding clamps
- 10 Float securing screw
- 11 Float assy

- 5 Filler hose
- 6 Feed pipe
- 7 Ground cable
- 8 Strap

- 1 Tank
- 2 Retaining valve
- 3 Breather hose
- 4 Breather hose when filling

MARELLI STARTER MOTOR

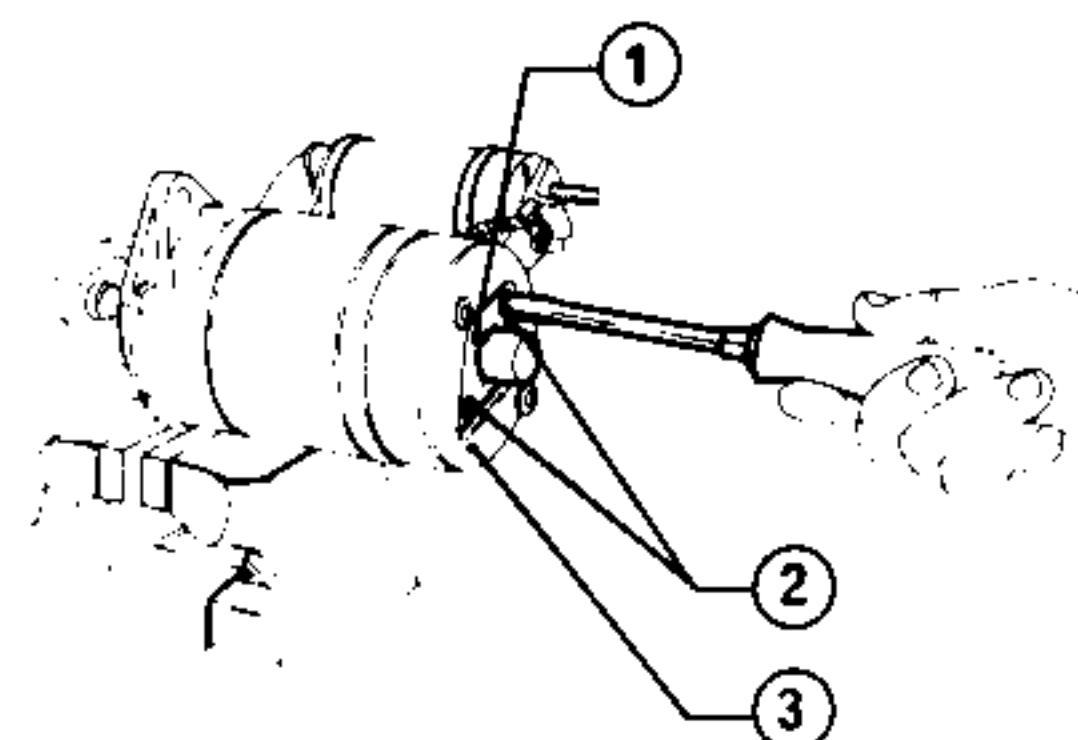


DISASSEMBLY

BOSCH STARTER MOTOR

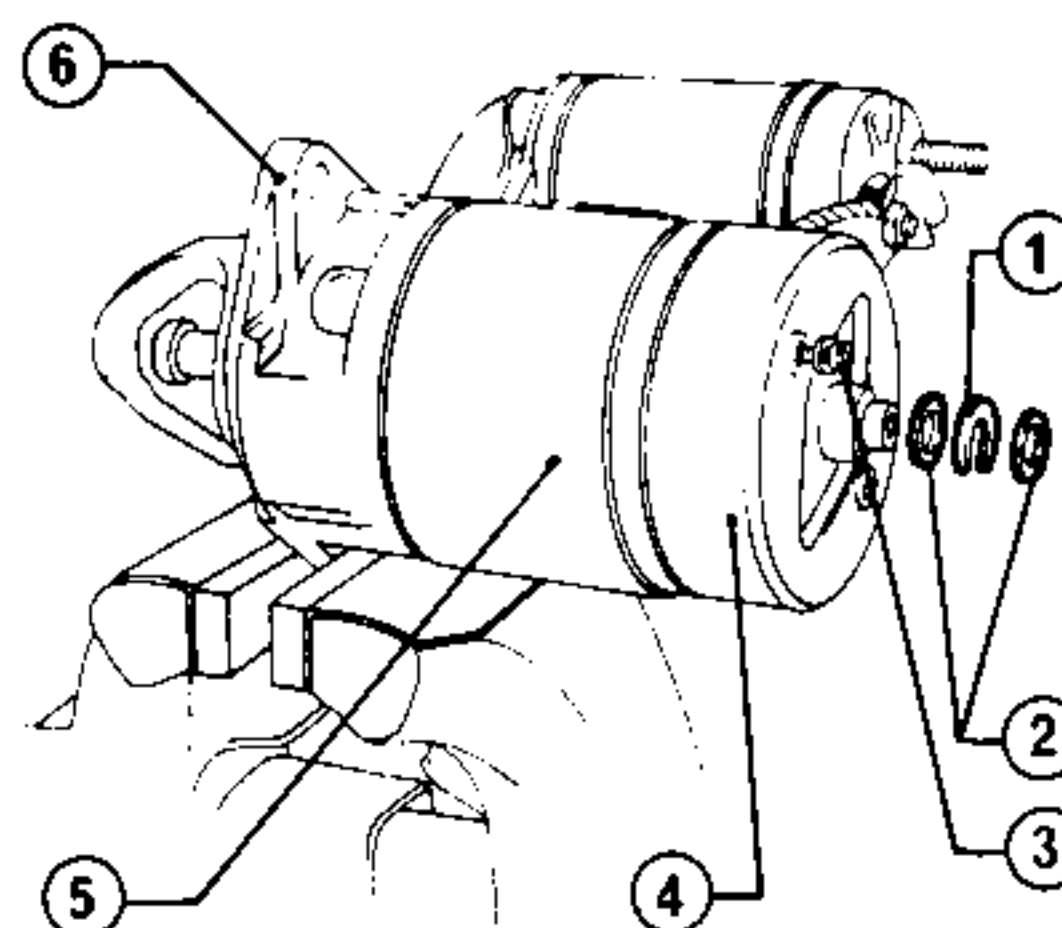
Hold the motor in a vice with caps.

1. Unscrew the two dust cover ① securing screws ② in the commutator casing ③ and take-out the dust cover.



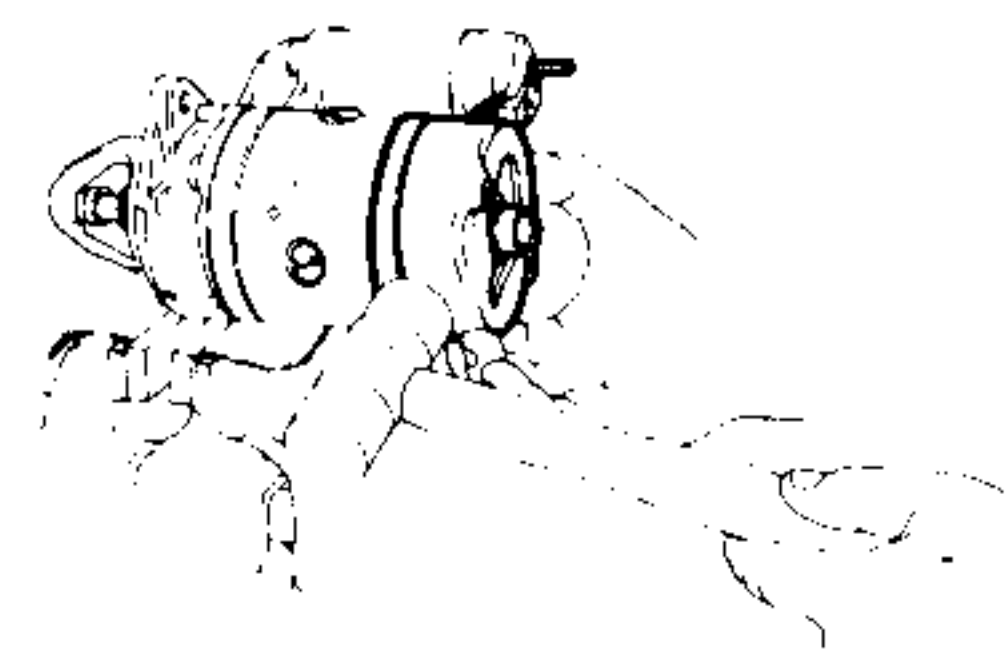
- 1 Dust cover
- 2 Screws
- 3 Commutator casing

2. Extract the pinion shaft rear retaining ring ① and the distance washers ② for pinion clearance.
3. Unscrew the two stays bolts ③ of the drive housing ⑥ and of the commutator casing ④ to the yoke ⑤ assembly.



- 1 Retaining ring
- 2 Distance washers
- 3 Stay bolts
- 4 Commutator casing
- 5 Yoke
- 6 Drive housing

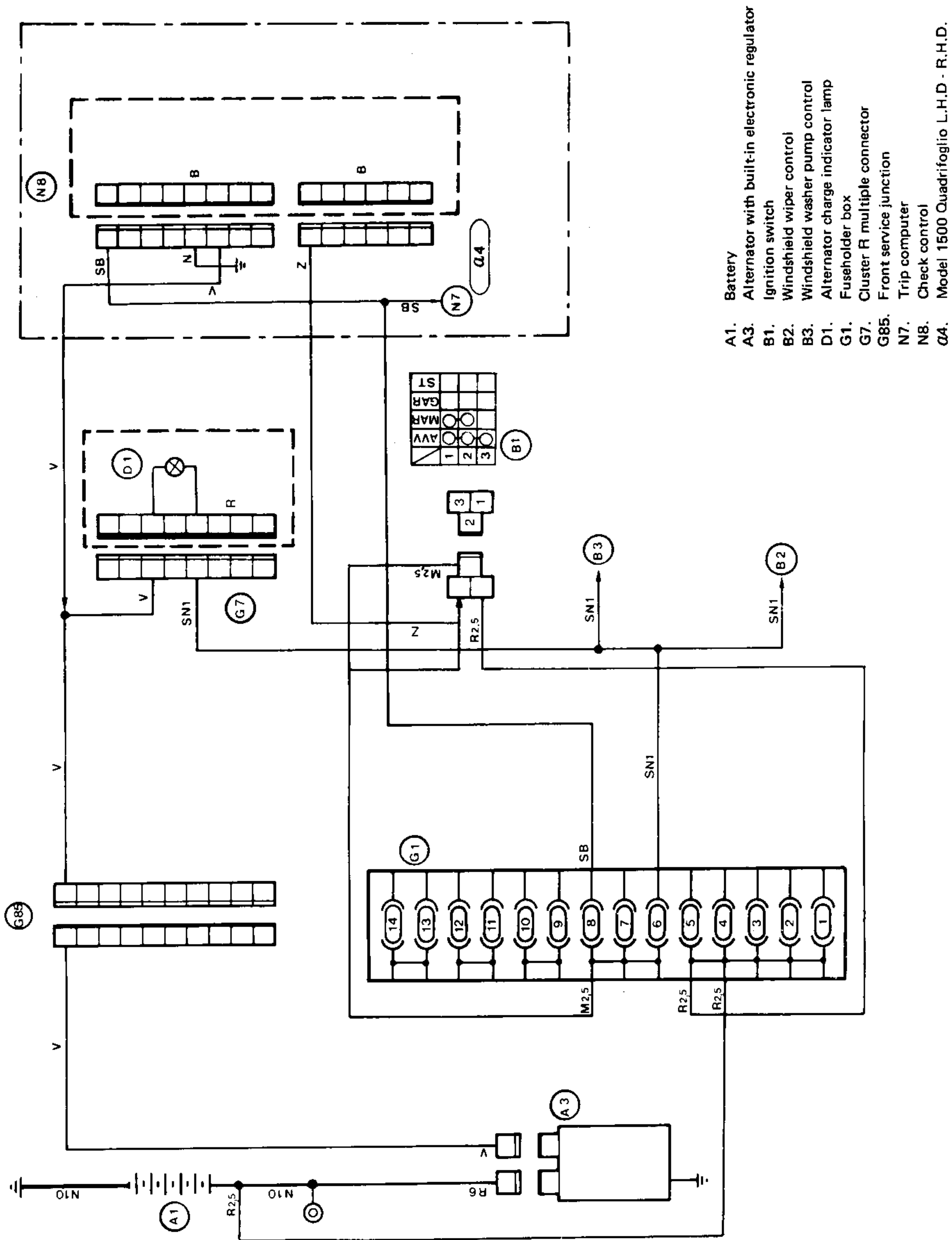
4. Remove the commutator casing with the help of a plastic hammer.



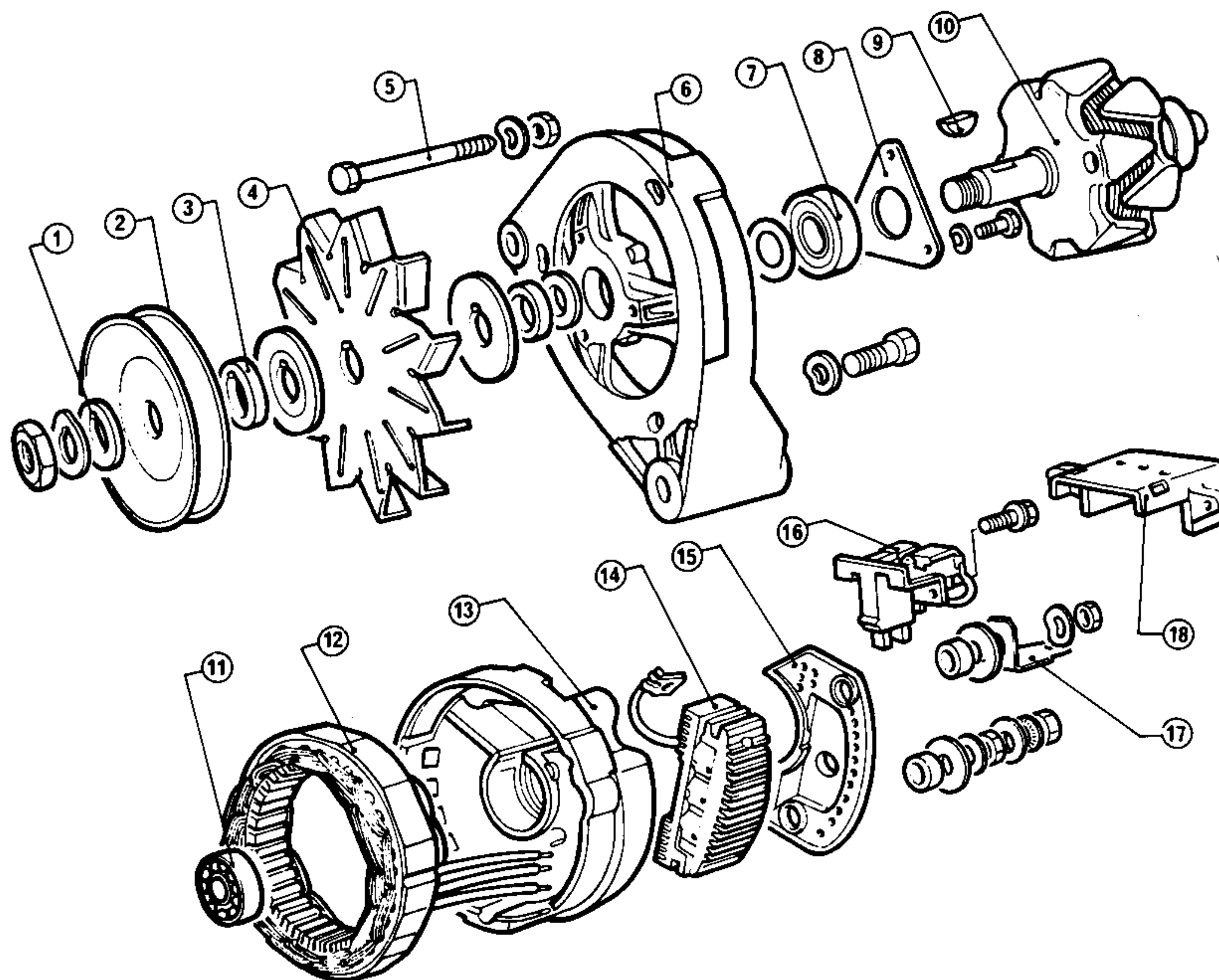
5. Use a screwdriver as shown in the figure to release the brush springs ①.

CHARGING

WIRING DIAGRAM



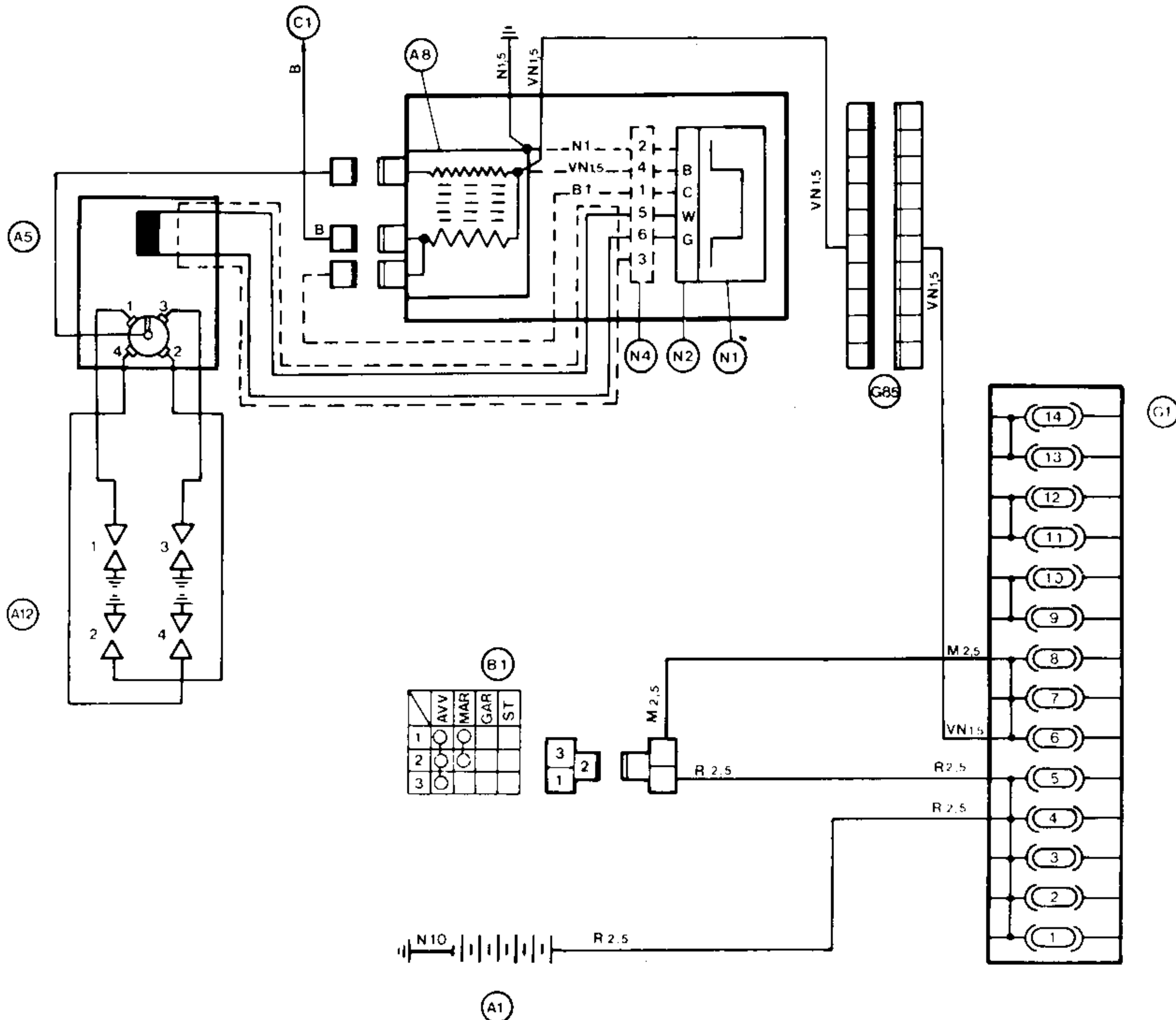
DUCELLIER ALTERNATOR



- | | | | |
|---|----------------------|----|------------------------|
| 1 | Distance piece | 10 | Rotor |
| 2 | Pulley | 11 | Regulator side bearing |
| 3 | Distance piece | 12 | Stator |
| 4 | Fan | 13 | Regulator mounting |
| 5 | Stay bolt | 14 | Rectifier bridge |
| 6 | Drive housing | 15 | Diode cover |
| 7 | Control side bearing | 16 | Brush holders |
| 8 | Plate | 17 | Excitation tang |
| 9 | Feather key | 18 | Voltage regulator |

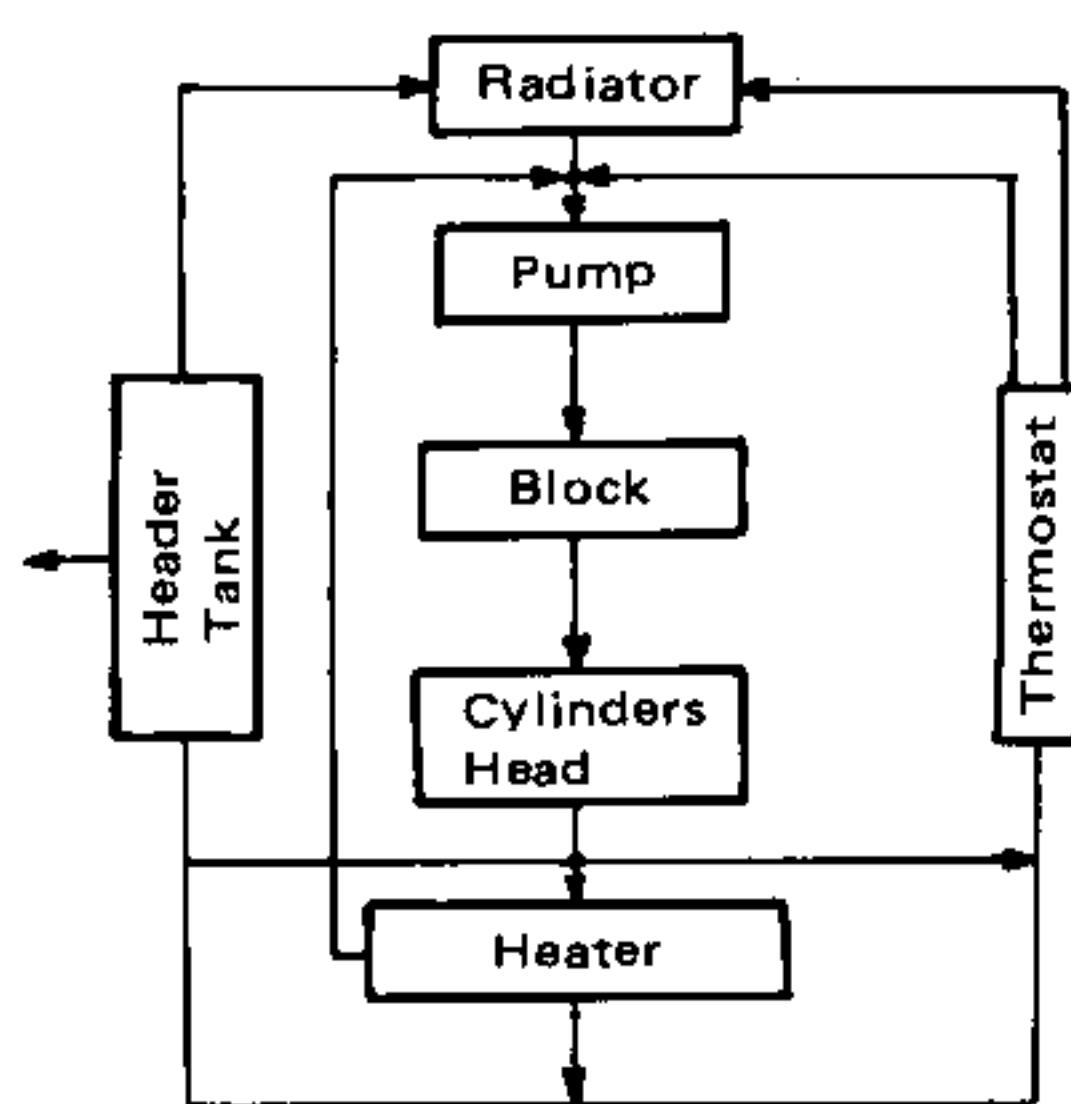
TRANSISTORIZED IGNITION WITHOUT CONTACTS

WIRING DIAGRAM



A1. Battery
A5. Ignition distributor
A8. Ignition coil
A12. Spark plugs
B1. Ignition switch
G1. Fuseholder box

G85. Front service joint
C1. Electronic tachometer
N1. Electronic ignition module
N2. Marelli module connector
N4. Bosch module connector



The system is of the water cooling type with forced circulation by centrifugal pump belt-driven by crankshaft.

A thermostat is fitted to the manifold outlet which allows the engine thermal checking and a quicker warning-up when performing a cold start, since the thermostatic valve opens only when cooling water reaches a temperature of about 80°C (176°F). In addition to the air ram effect, the radiator is also cooled by

an electric fan controlled by a thermal contact placed on the radiator.

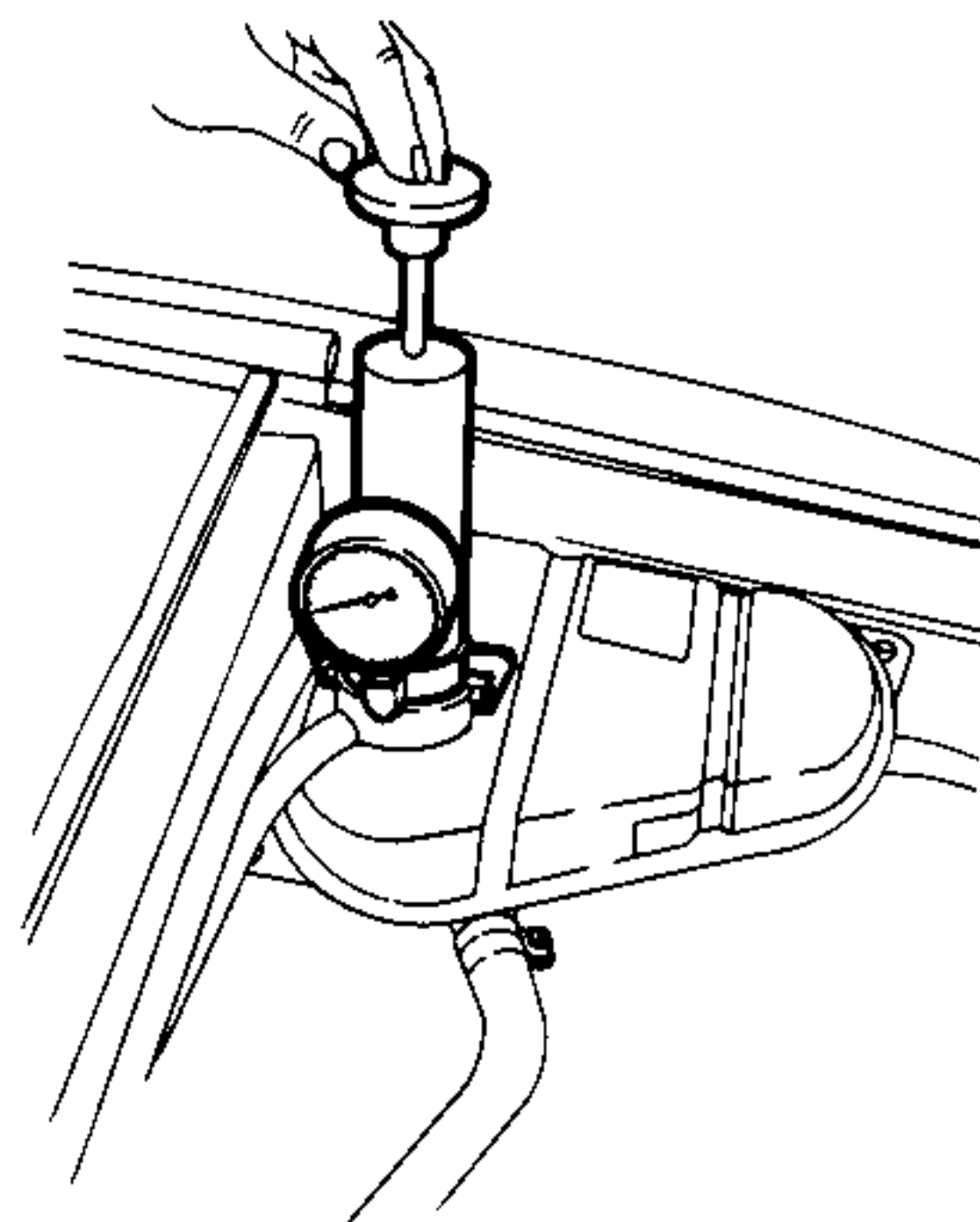
The system is provided with a water temperature transmitter installed on intake manifold and connected to the indicator on the combination meter; a water temperature thermal contact, secured to head, and connected to the warning light on combination meter, visually warns that the maximum permissible value of the cooling temperature (105°C) (221°F) has been exceeded.

HYDRAULIC SYSTEM LEAK TEST

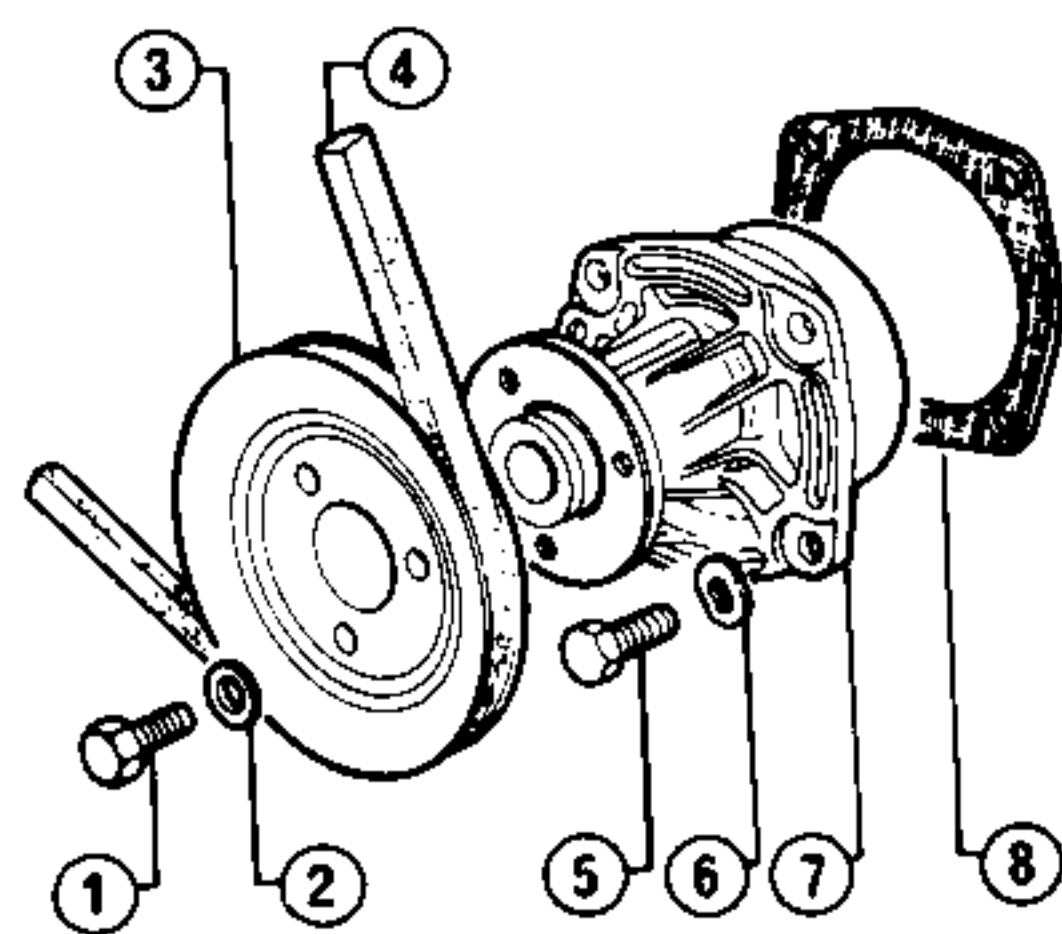
1. Unscrew pressurized plug from header tank.
2. Screw suitable tool to header tank filler to test the system.

3. Act on tool so as to increase pressure in the system and verify on dial indicator that pressure keeps at the prescribed value.

Hydraulic system checking pressure
107.9 kPa (1.0 bar;
1.1 kg/cm² ; 15.64 psi)



WATER PUMP

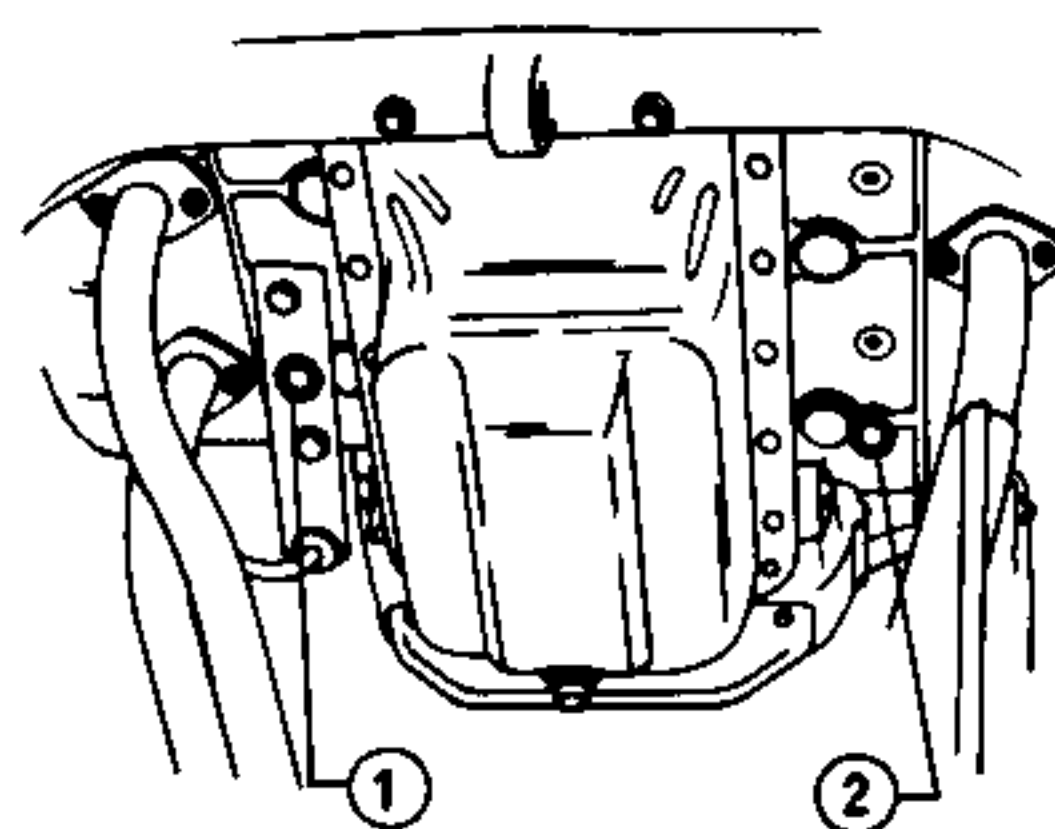


- | | |
|----------|----------|
| 1 Screw | 5 Screw |
| 2 Washer | 6 Washer |
| 3 Pulley | 7 Pump |
| 4 Belt | 8 Gasket |

REMOVAL

1. Drain coolant from system through two plugs ① and ② on cylinder block bottom side.

To avoid burning, do not drain coolant when engine is hot.



- 1 Drain plug 2 Drain plug

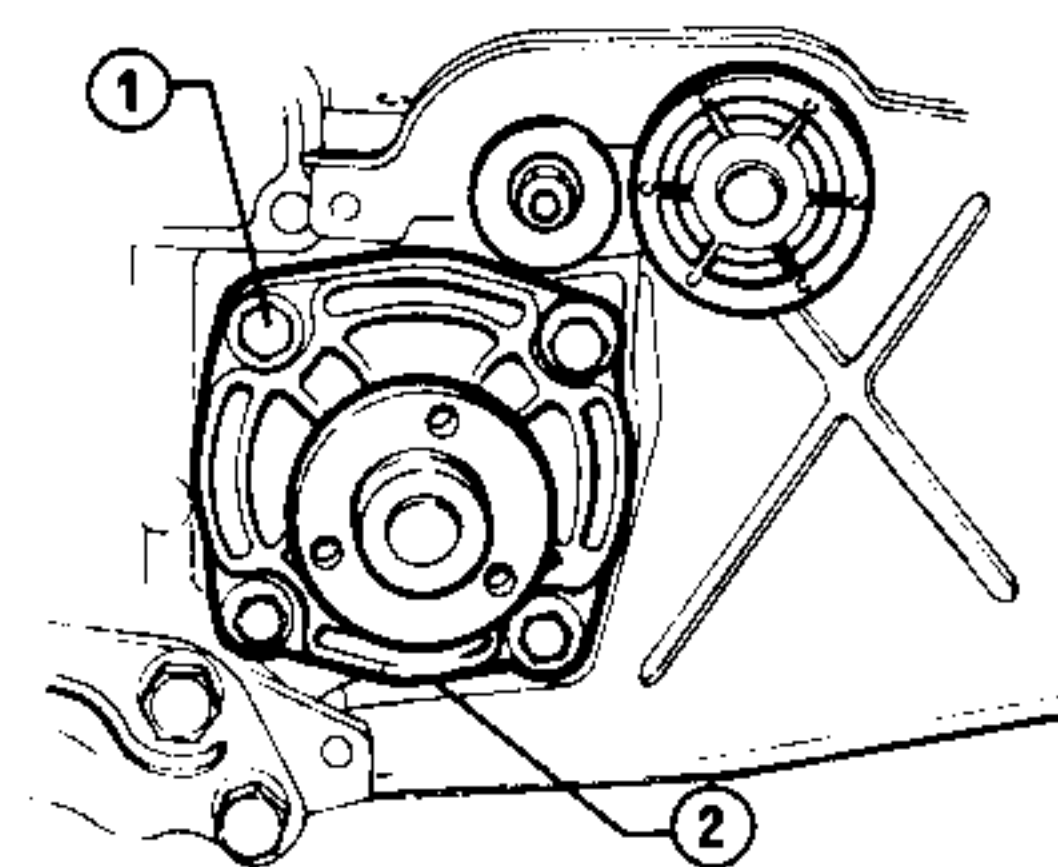
2. Loose alternator securing bolts.
3. Shift alternator so as to loosen driving belt and withdraw from pulleys.
4. Remove alternator.
5. Remove pump driving pulley.
6. Remove left timing belt guard (water pump side).
7. Free camshaft belt from left head.

(1) Loose belt stretcher stop nut and rotate belt stretcher so as to

overcome tension load on belts. Secure belt stretcher in this position by fastening its stop nut.

(2) Withdraw toothed belt from camshaft pulley (left head).

8. Unscrew screws ① and remove pump ② with relevant gasket.

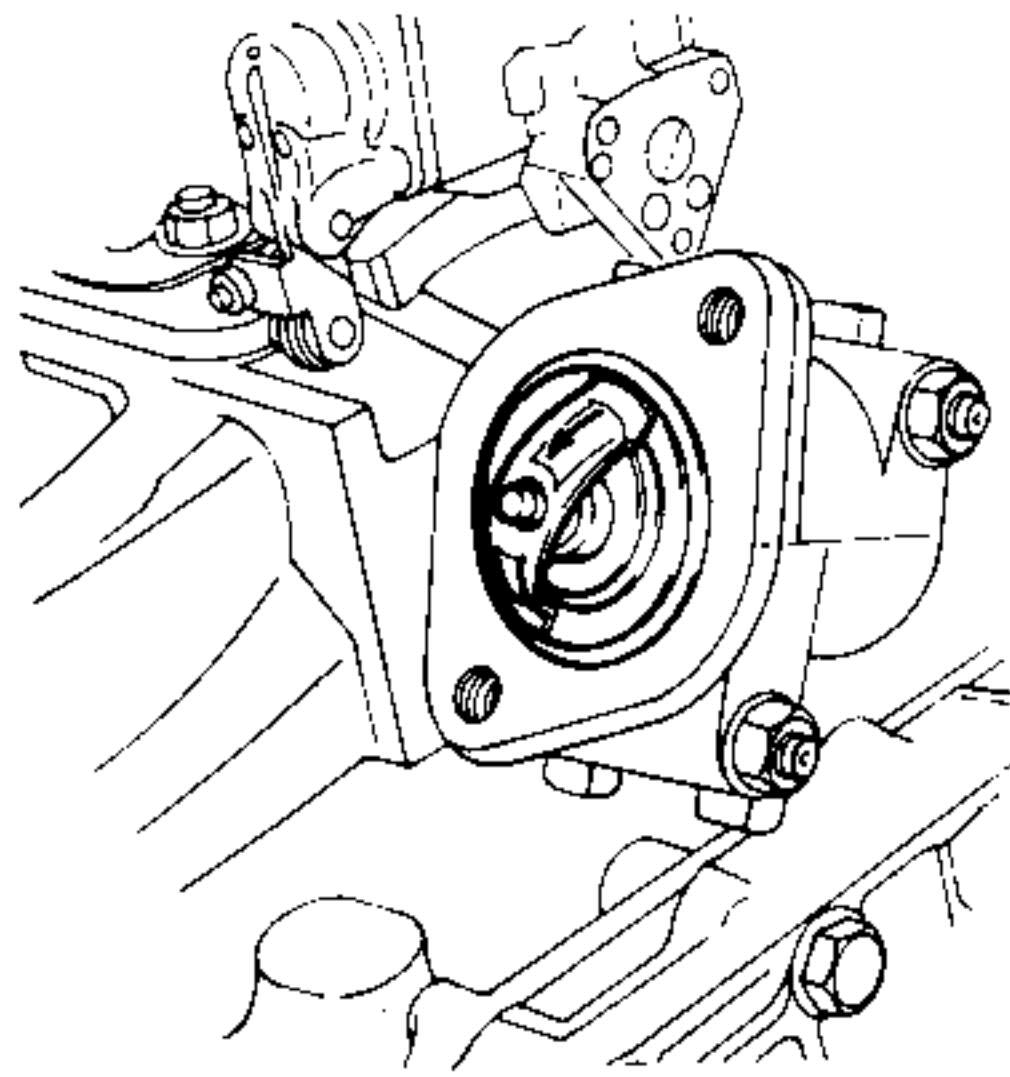


- 1 Screw 2 Pump

INSTALLATION

1. Accomodate thermostat into its housing and, by means of the two junction screws, secure cover with the interposed gasket.

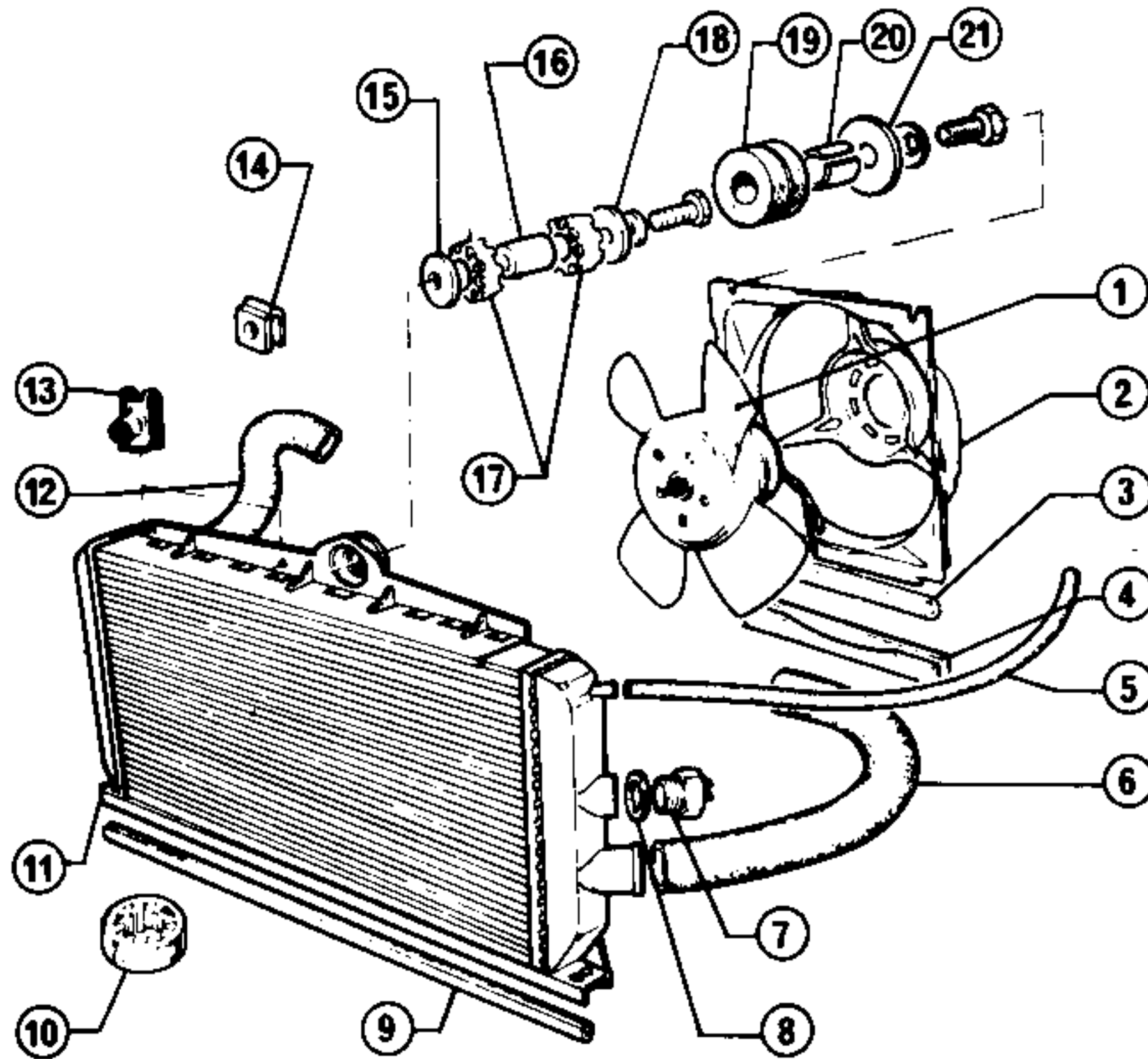
Thermostat must be positioned with the arrow towards flow direction



2. Fit to thermostat cover the radiator water intake manifold and tighten securing clamp.

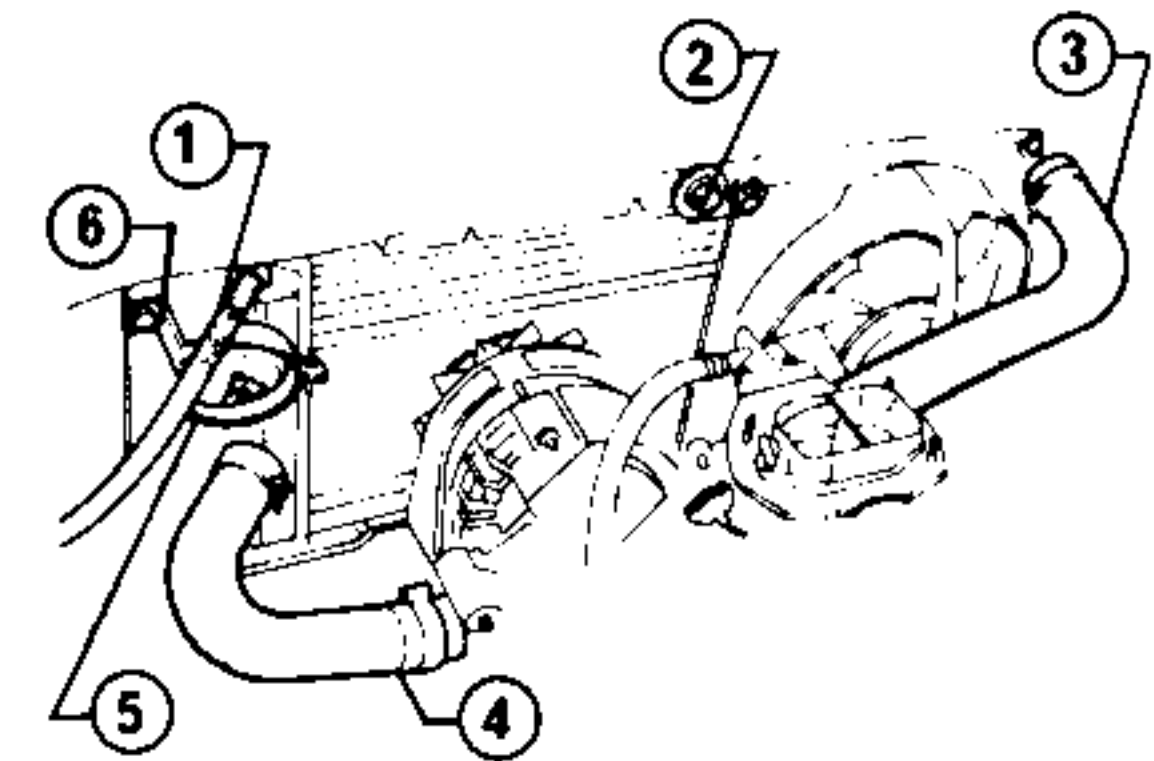
3. At end of assembling procedure fill the circuit with coolant. Let the engine run for a few minutes and check against coolant leakages.

RADIATOR



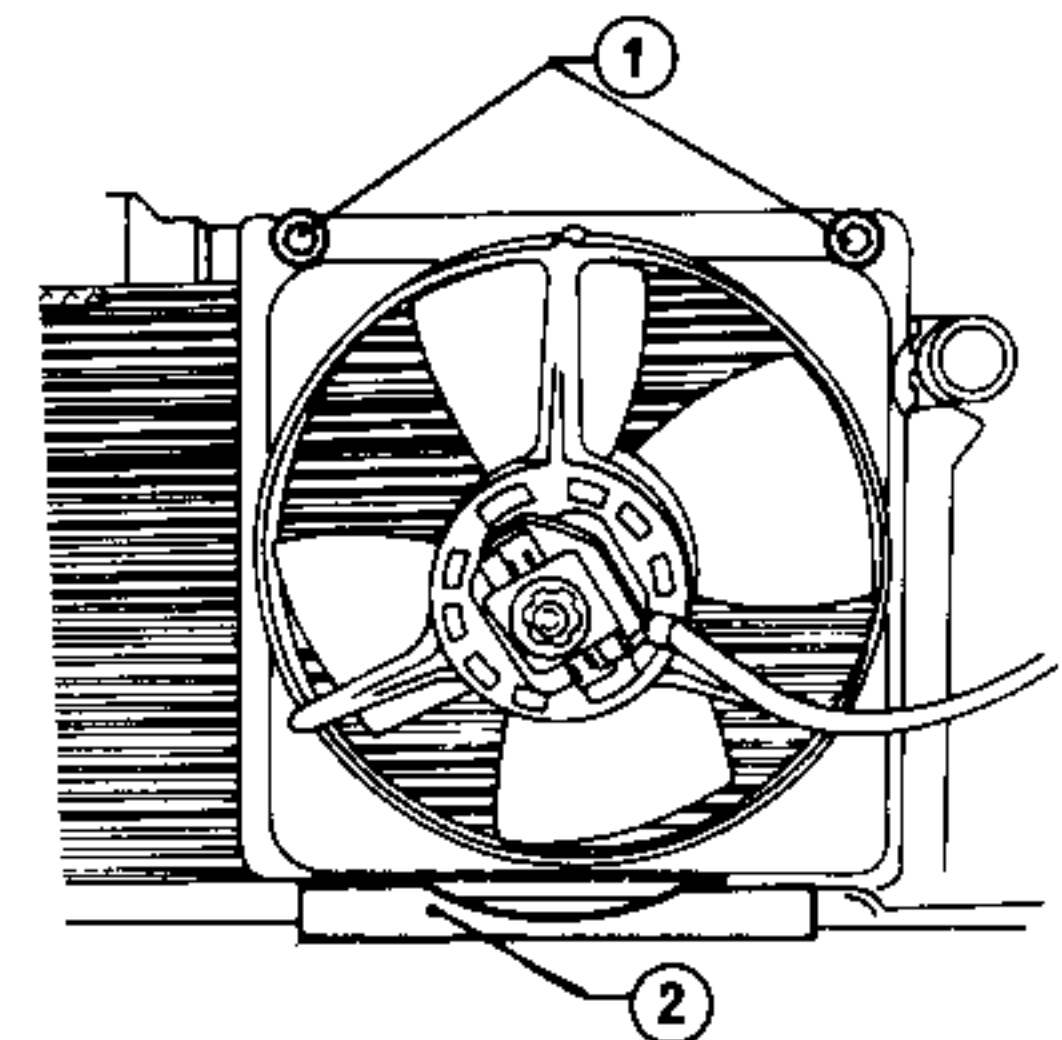
- 1 Electric fan
- 2 Shroud
- 3 Gasket
- 4 Support
- 5 Breather pipe
- 6 Cooling outlet coupling
- 7 Thermal contact
- 8 Gasket
- 9 Gasket
- 10 Rubber pad
- 11 Radiator

- 12 Cooling inlet coupling
- 13 Clip
- 14 Clip
- 15 Washer
- 16 Spacer
- 17 Rubber pad
- 18 Washer
- 19 Flexible support
- 20 Spacer
- 21 Washer



- 1 Breather pipe
- 2 Screw
- 3 Cooling inlet coupling
- 4 Cooling outlet coupling
- 5 Thermal contact
- 6 Bracket

7. Unscrew screws ① with relevant washers and withdraw electric fan from lower support ②, then remove it.



- 1 Screw
- 2 Support

REMOVAL AND INSTALLATION

1. Unscrew plugs on block bottom side and drain coolant.

To avoid burning do not drain coolant when engine is hot.

2. Loosen clamps disconnect two cooling inlet ③ and outlet ④ couplings and radiator breather pipe ①.

3. Disconnect electric fan and thermal contact ⑤ cables.
4. Unscrew nut securing air intake support bracket ⑥ to body, then remove air intake.
5. Unscrew screw ② and remove radiator securing washers.
6. Remove radiator from engine compartment and withdraw rubber pads supporting the radiator.

8. For the installation procedure, refer to the Removal but following the reverse sequence.

9. Pour the coolant then let the engine run for a few minutes and check against coolant leakages.

CLUTCH

CONTENTS

DESCRIPTION	12-2	Crankshaft bush	12-7
HYDRAULIC CONTROL UNIT	12-3	SERVICE DATA AND	
Clutch pedal	12-3	SPECIFICATIONS	12-8
Clutch master cylinder	12-3	General specifications	12-8
Clutch operating cylinder	12-4	Inspections and adjustments	12-8
Hydraulic system piping	12-4	Tightening torques	12-9
Hydraulic system bleeding	12-4	TROUBLE DIAGNOSIS AND	
CLUTCH UNIT	12-5	CORRECTIONS	12-9
Clutch disc and cover	12-5	SPECIAL SERVICE TOOLS	12-11
Thrust bearing	12-7		

CLUTCH

placing the ends in a transparent container filled with system fluid.

3. At the same time loosen bleeder screw and depress fully clutch pedal allowing it to return slowly; repeat operation several times until no air bubble shows up.

4. As clutch pedal is fully depressed, close bleeder screw, remove hose and install protection boot.

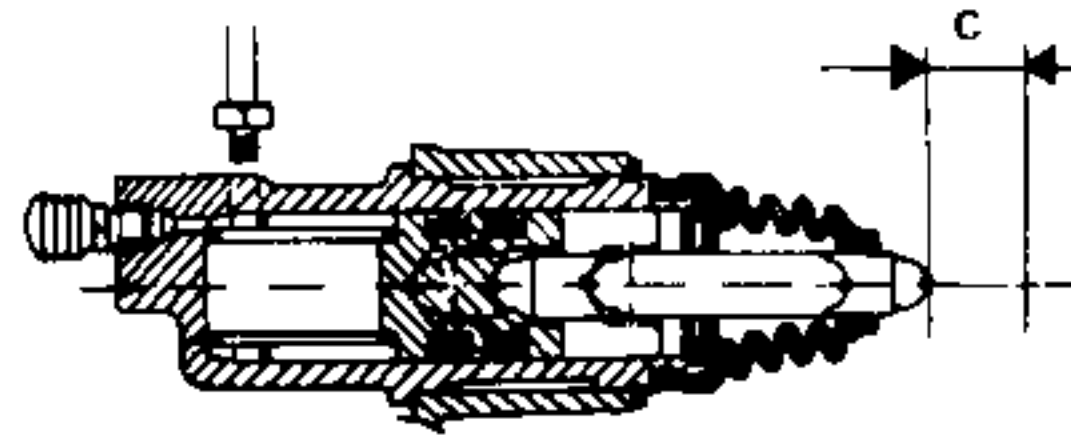
5. Add fluid in reservoir to specified level and install its plug.

6. Check correct declutching and gear engagement. Possibly check

whether operating cylinder push rod performs specified stroke.

Clutch operating cylinder push rod
"C" stroke

16 ÷ 18 mm (0.63 ÷ 0.71 in)

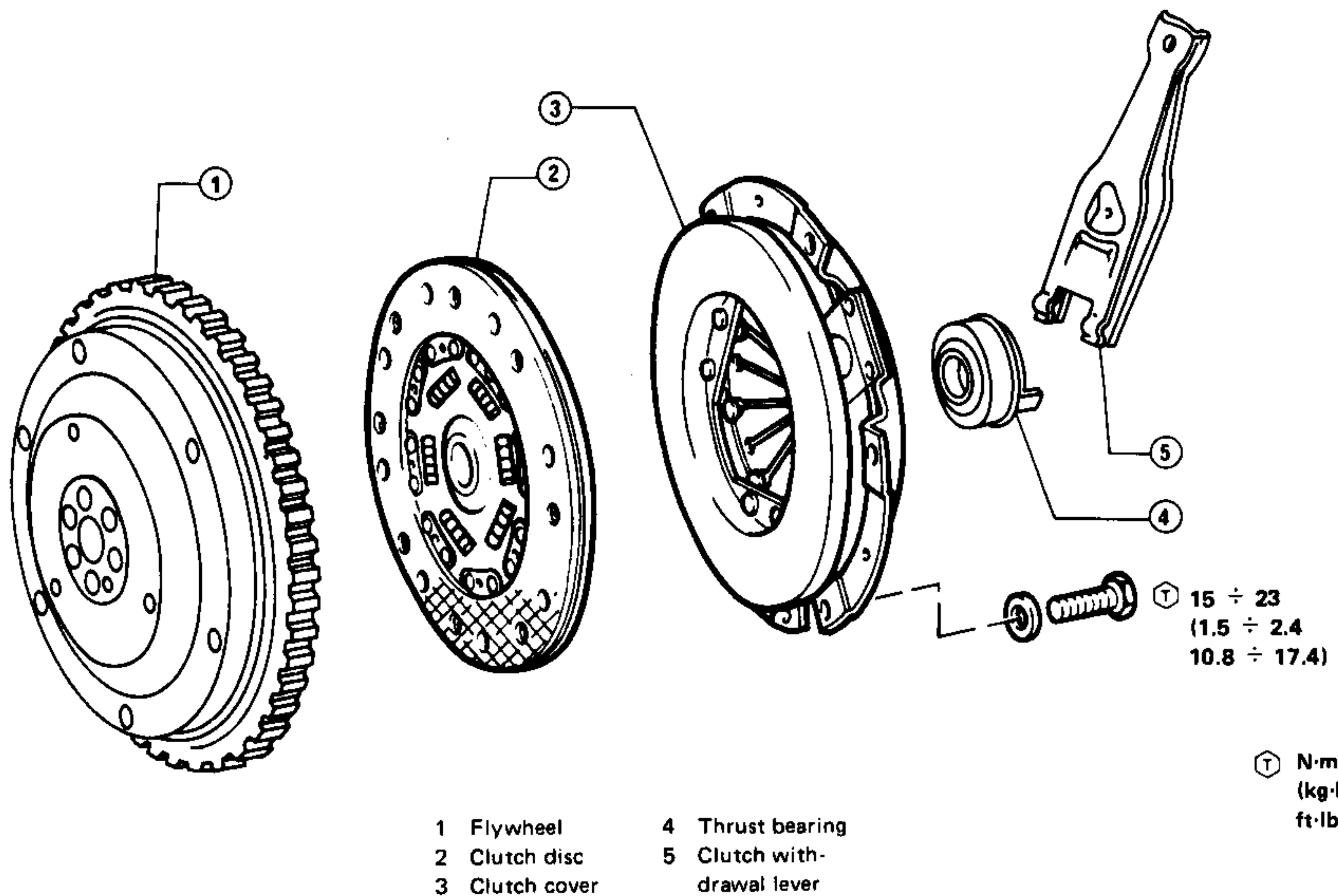


The above stroke is not adjustable and it depends upon the volume of fluid displaced by clutch master cylinder piston.

7. Check operating hydraulic system efficiency if "C" stroke value is not as specified.

CLUTCH UNIT

CLUTCH DISC AND COVER



DISASSEMBLY

1. Remove the gearbox-differential unit from the vehicle (Refer to: Group 13 - Removal and Installation)
2. Perform separation of gearbox

unit from engine unit (Refer to: Group 01 - Separation and Assembly of the Units).

3. Lock engine flywheel ① with tool A.2.0378.

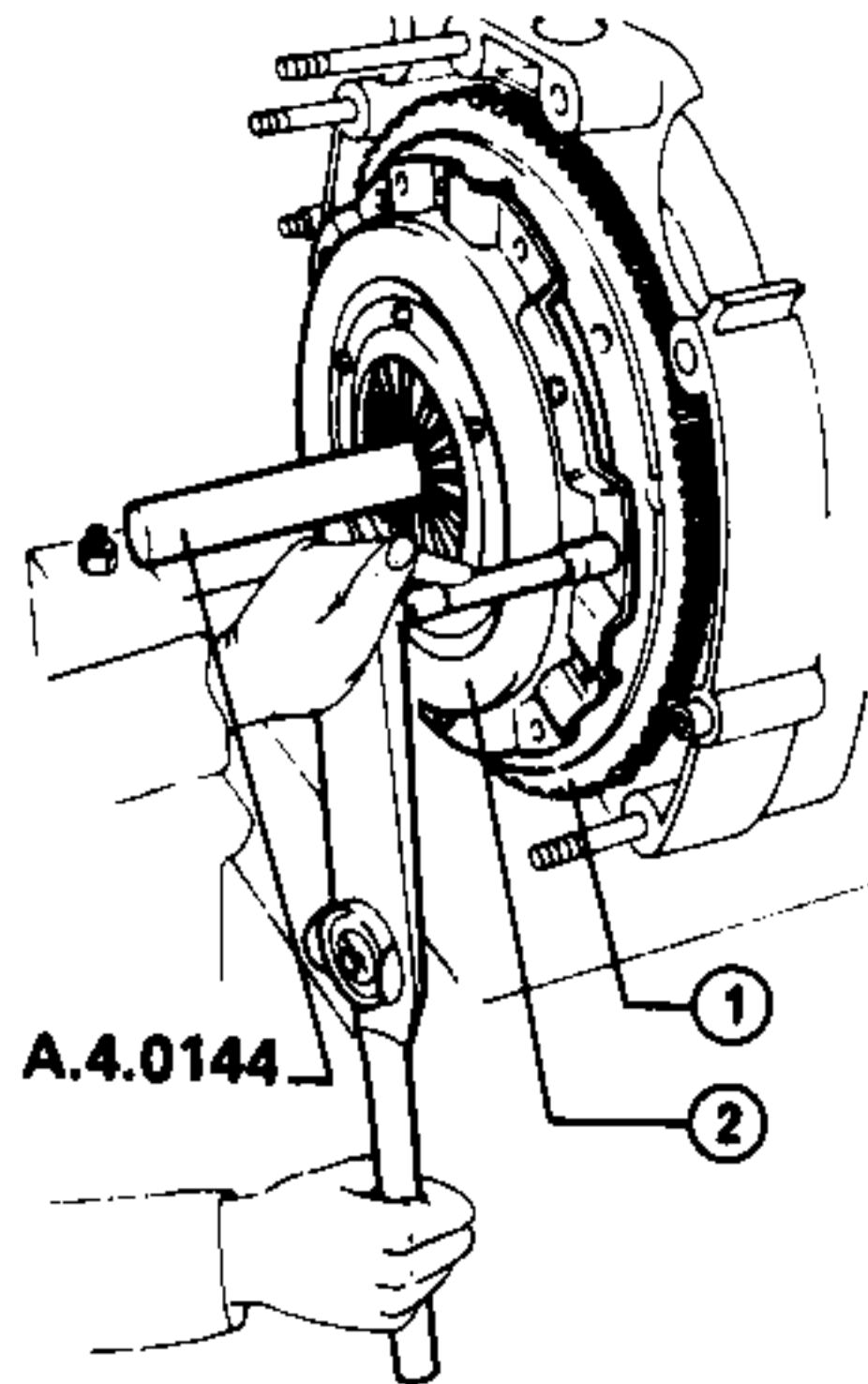
4. Insert tool A.4.0144 into clutch

disc hub.

5. Loosen in a crisscross fashion the six screws ② attaching clutch cover ③ to flywheel and remove them.

CLUTCH

4. Use tool **A.4.0144** to center clutch disc and tighten clutch cover ② screws to flywheel ①.



- 1 Flywheel 2 Clutch cover

5. Tighten in a crisscross fashion clutch cover screws to flywheel at specified torque.

ⓧ : Tightening torque
 $15 \div 23 \text{ N}\cdot\text{m}$
 $(1.5 \div 2.4 \text{ kg}\cdot\text{m})$
 $10.8 \div 17.4 \text{ ft}\cdot\text{lb}$

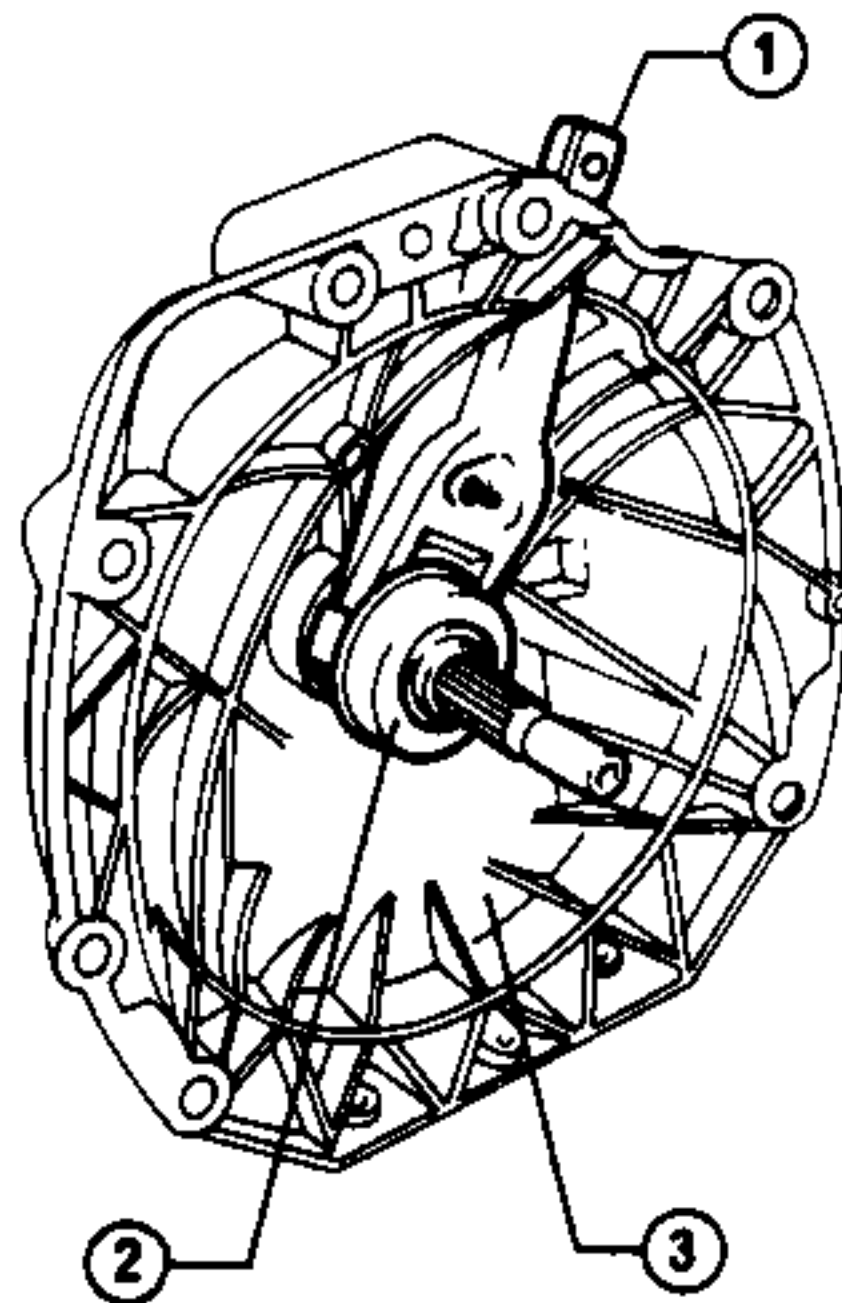
6. Remove locking flywheel tool.
 7. Install operating cylinder, if disassembled (Refer to: Hydraulic Control Unit - Clutch Operating Cylinder) by setting push rod in contact with relevant fork.
 8. Install thrust bearing, its support and control fork, if disassembled (Refer to: Clutch Unit - Thrust Bearing).

9. Reconnect the gearbox-differential unit to the vehicle (Refer to: Group 13 - Removal and Installation)

THRUST BEARING

DISASSEMBLY

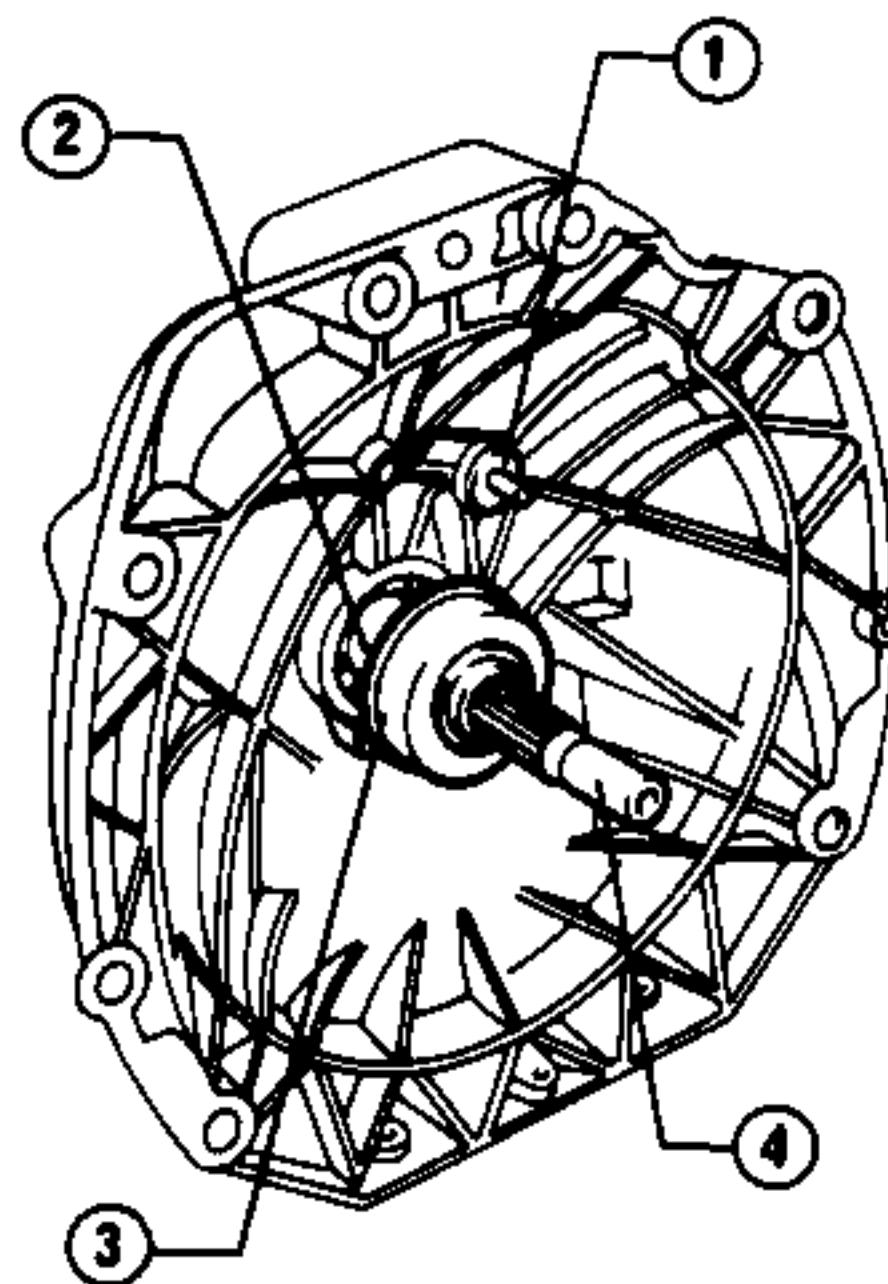
1. Remove gearbox unit from engine unit (Refer to: Group 01 - Separation and Assembly of the Units).
2. Remove thrust bearing ② from support ③ on gearbox.
3. Remove clutch withdrawal lever ① from gearbox.



- 1 Clutch withdrawal lever
 2 Thrust bearing
 3 Support

CHECKS AND INSPECTIONS

1. Check whether self-centering thrust bearing ③ allows crosswise movements with respect to outside casing under the action of slight radial-wise movements.
2. Check there are no seizing marks on sliding surface between bearing ③ and its support ② direct drive shaft ④. Replace parts if necessary. To replace support ② refer to: Group 13 - 5-Speed Manual Gearbox - Shafts and Gears.
3. Check for cracks, distortions or excessive wear in working areas of clutch withdrawal lever. Replace it if necessary.



- 1 Clutch withdrawal lever support
 2 Thrust bearing support
 3 Thrust bearing
 4 Direct drive shaft

INSTALLATION

1. Lubricate thrust bearing working seat with recommended grease (AGIP F1 Grease 33 FD or IP Autogrease FD or ISECO Molykote BR-2). Avoid applying grease as it may run out on the friction facings damaging them.
2. Install clutch withdrawal lever.
3. Install thrust bearing.
4. Reinstall gearbox unit to engine unit (Refer to: Group 01 - Separation and Assembly of the Units).

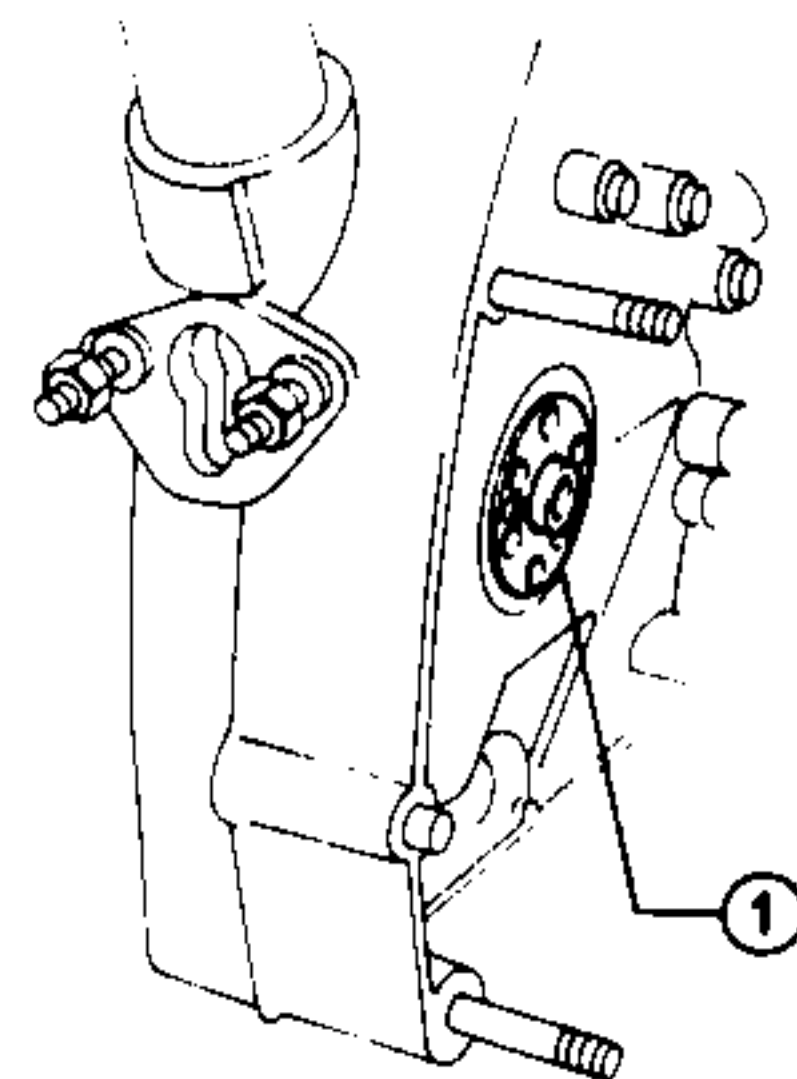
CRANKSHAFT BUSH

DISASSEMBLY

Refer to: Group 01 - Engine Disassembly - Crankshaft).

CHECKS AND INSPECTIONS

Visually inspect crankshaft bush has no seizing marks or excessive wear. If necessary replace it.



- 1 Crankshaft bush

INSTALLATION

Lubricate bushing with recommended grease (ISECO Molykote Paste G) and install it (Refer to: Group 01 - Engine Assembly - Crankshaft).

CLUTCH

Condition	Probable cause	Corrective action
	<ul style="list-style-type: none"> Oil leakage at master cylinder, operating cylinder or hydraulic systems Air in hydraulic system Insufficient pedal stroke Operating cylinder not efficient Eccentric or warped clutch disc Diaphragm spring fatigued Lack of grease on crankshaft bush Clutch facing wet with oil 	<p>Replace faulty parts</p> <p>Bleed air</p> <p>Adjust stroke</p> <p>Replace operating cylinder</p> <p>Replace clutch disc</p> <p>Replace clutch cover</p> <p>Coat with grease</p> <p>Replace clutch disc (replace engine/gearbox oil seals if faulty)</p>
<p>Clutch chatters</p> <p>Symptoms:</p> <p>— clutch chatters when vehicle is justed rolled off with clutch partially engaged</p>	<ul style="list-style-type: none"> Clutch disc facings vitrified due to overheating Oil or grease on clutch facings Clutch facings warped Flywheel friction facing worn or warped Rivets loose Pressure plate facing worn or warped Engine rubber support loose or deteriorated Diaphragm spring fatigued 	<p>Replace clutch disc</p> <p>Replace clutch disc</p> <p>Replace clutch disc</p> <p>Repair or replace flywheel</p> <p>Replace clutch disc</p> <p>Replace clutch cover</p> <p>Secure well or replace</p> <p>Replace clutch cover</p>
Noisy clutch	<p>Noisy declutching:</p> <ul style="list-style-type: none"> Thrust bearing and/or support damaged or improperly lubricated <p>Noise when clutch is engaged:</p> <ul style="list-style-type: none"> Rivets loosen Clutch disc facings cracked Crankshaft bush worn, jammed or damaged Clutch disc torsion springs fatigued 	<p>Replace thrust bearing and/or lubricate</p> <p>Replace clutch disc</p> <p>Replace clutch disc</p> <p>Replace crankshaft bush</p> <p>Replace clutch disc</p>
<p>Rabbit-hopping clutch</p> <p>Symptom:</p> <p>— car will not roll off smoothly from a standing start</p>	<ul style="list-style-type: none"> Oil or grease on clutch disc facings Clutch facings worn or rivets loosen Direct drive shaft or clutch disc splines worn or rusty 	<p>Replace clutch disc</p> <p>Replace clutch disc</p> <p>Clean or replace as required direct drive shaft and/or clutch disc</p>

GEARBOX

If a new assembly is being fitted, remember that planetary and side gears are pre-loaded and therefore their reciprocal movement is not easy but rather hard.

ASSEMBLY

1. Having thoroughly cleaned contact surfaces, fit crown gear to differential casing. Replace retaining screws with new spare part screws since they must be coated with the suitable surface-fixing agent; now tighten them in bias sequence and according to specified torque (refer to: Adjustments - How to Determine Pre-load of Differential Casing Bearings).

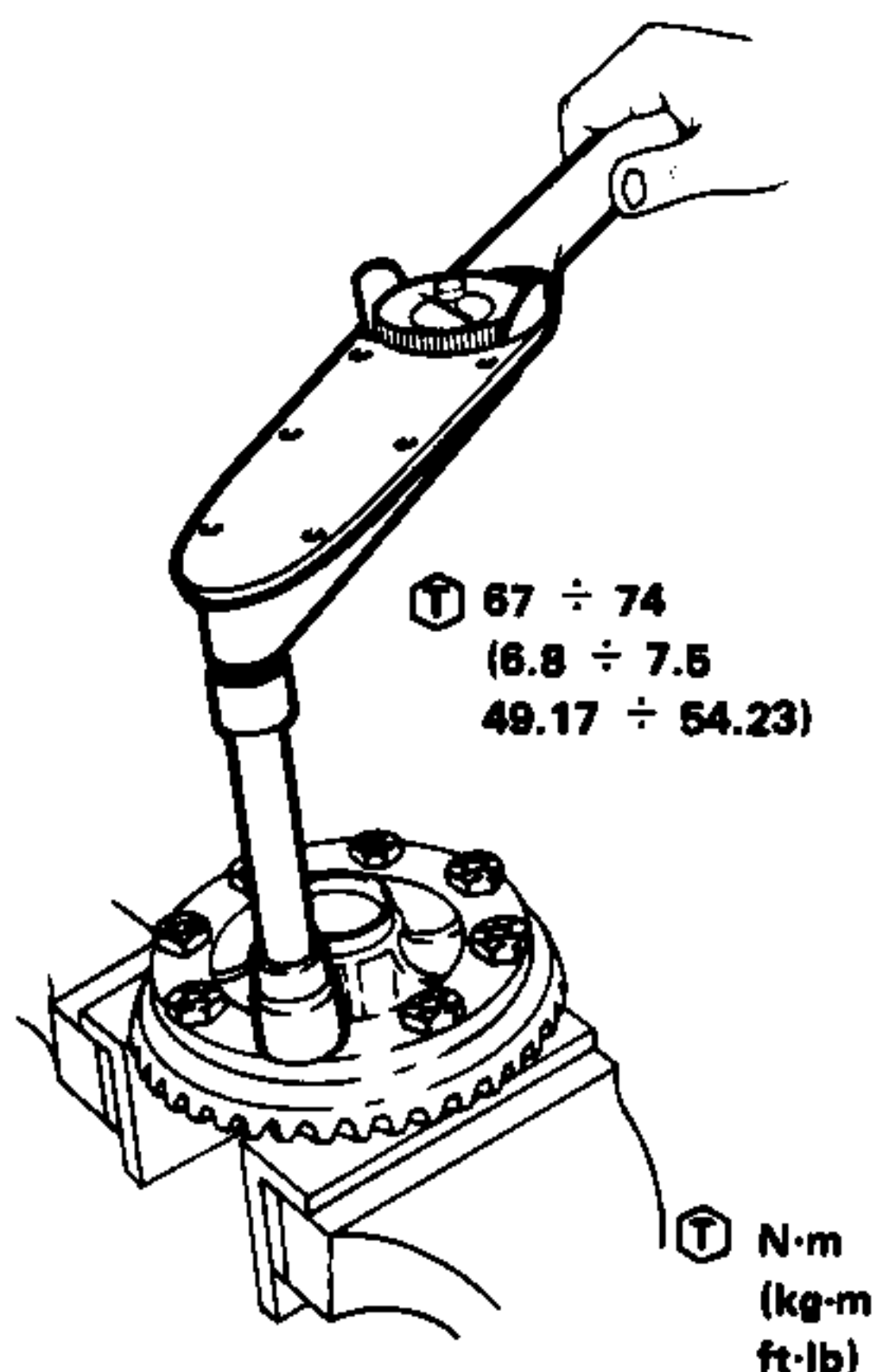
ⓧ: Tightening torque

Crown gear to differential casing retaining screws:

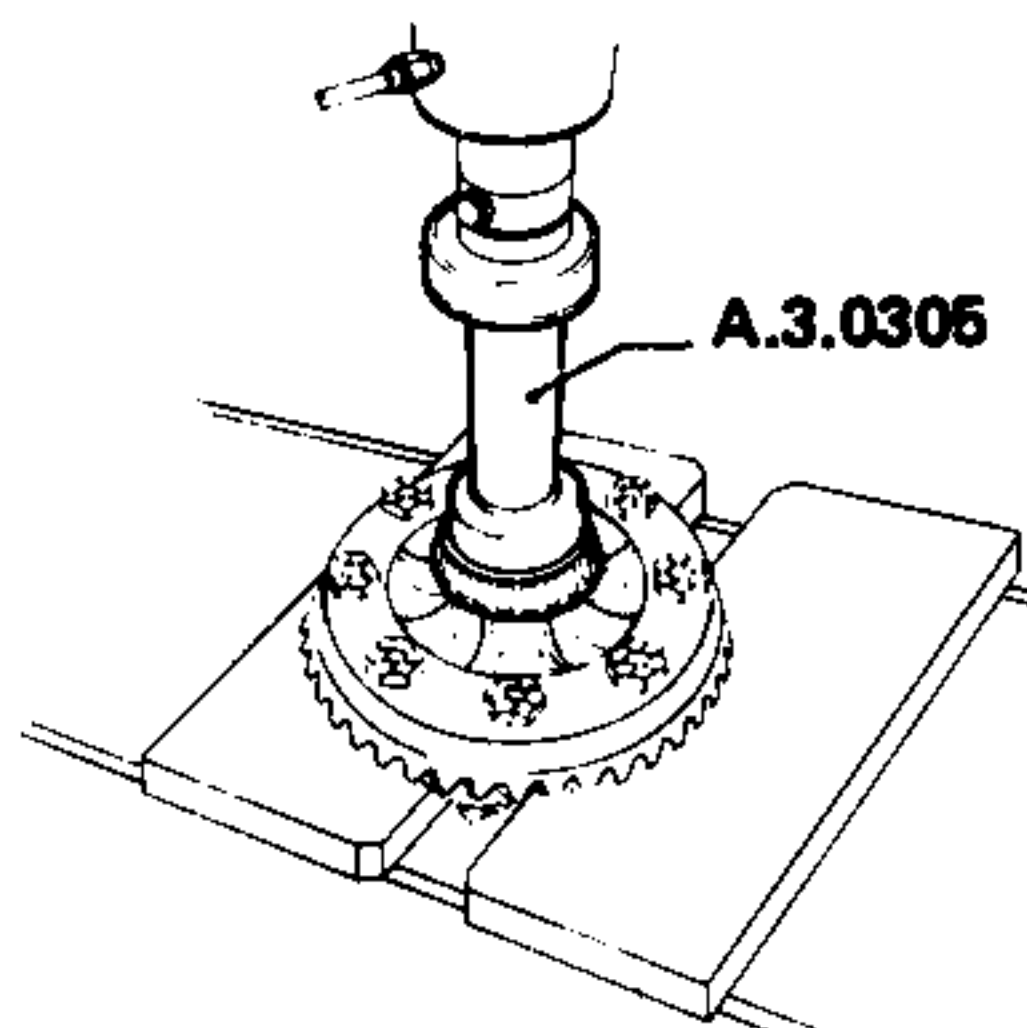
$67 \div 74$ N·m

($6.8 \div 7.5$ kg·m

$49.17 \div 54.23$ ft·lb)



2. With tool A.3.0305 and the help of a press and two half-plates, fit inner races of taper roller bearings to differential casing hubs.



3. Smear the differential carriers outer surface with gearbox oil. Fit differential casing into gearbox casing, position crown gear onto bevel pinion and then proceed to fit above mentioned supports.

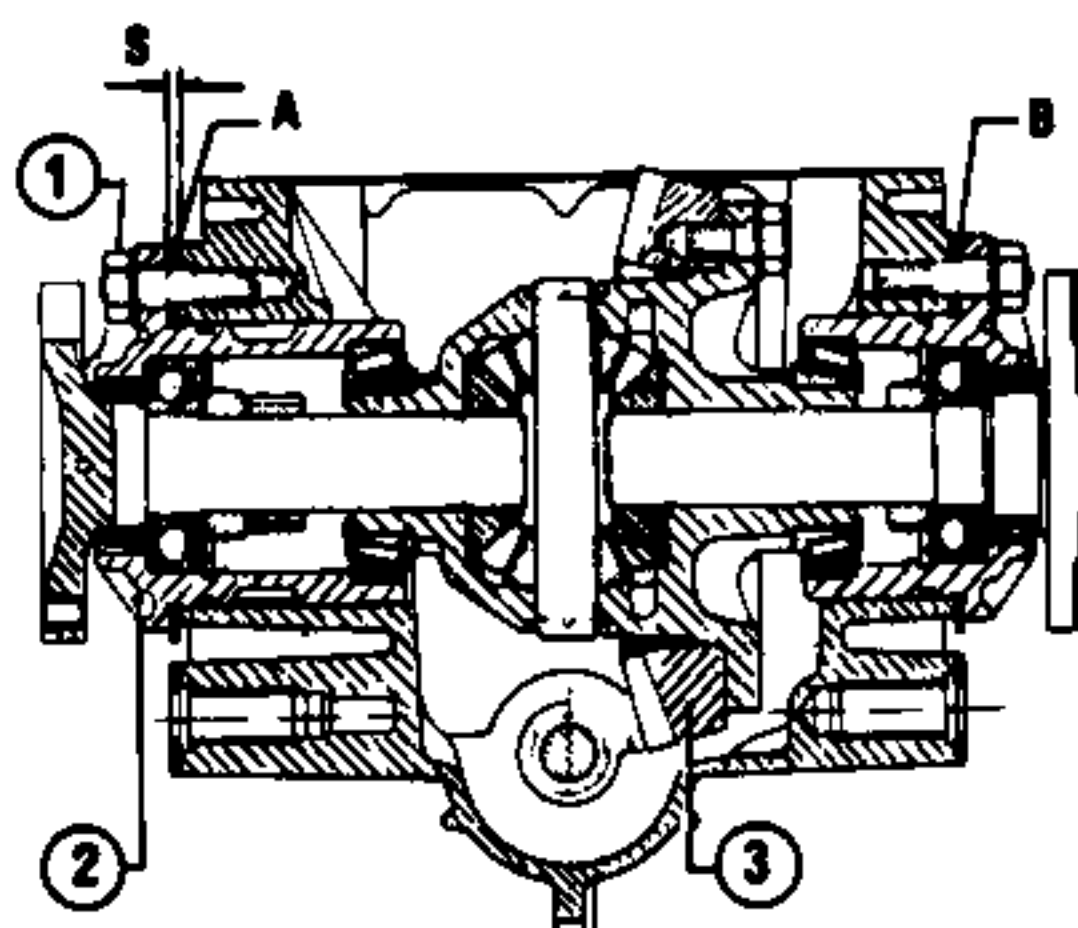
4. First the right hand differential support, and then the left hand one, into the relevant seat on the gearbox casing (refer to: Differential Carriers - Assembly).

ADJUSTMENTS

How to determine pre-load of differential casing bearings

In order to determine pre-load of differential casing taper roller bearings closely follow the procedure hereafter described.

1. Fit two shims A of standard 1.50 mm (0.06 in.) thickness between the carrier ② opposite the crown gear ③ side and the gearbox casing; tighten the gearbox casing securing screws ①.



1 Screw

2 Differential carrier

3 Crown gear

2. Tighten screws in bias sequence according to specified torque.

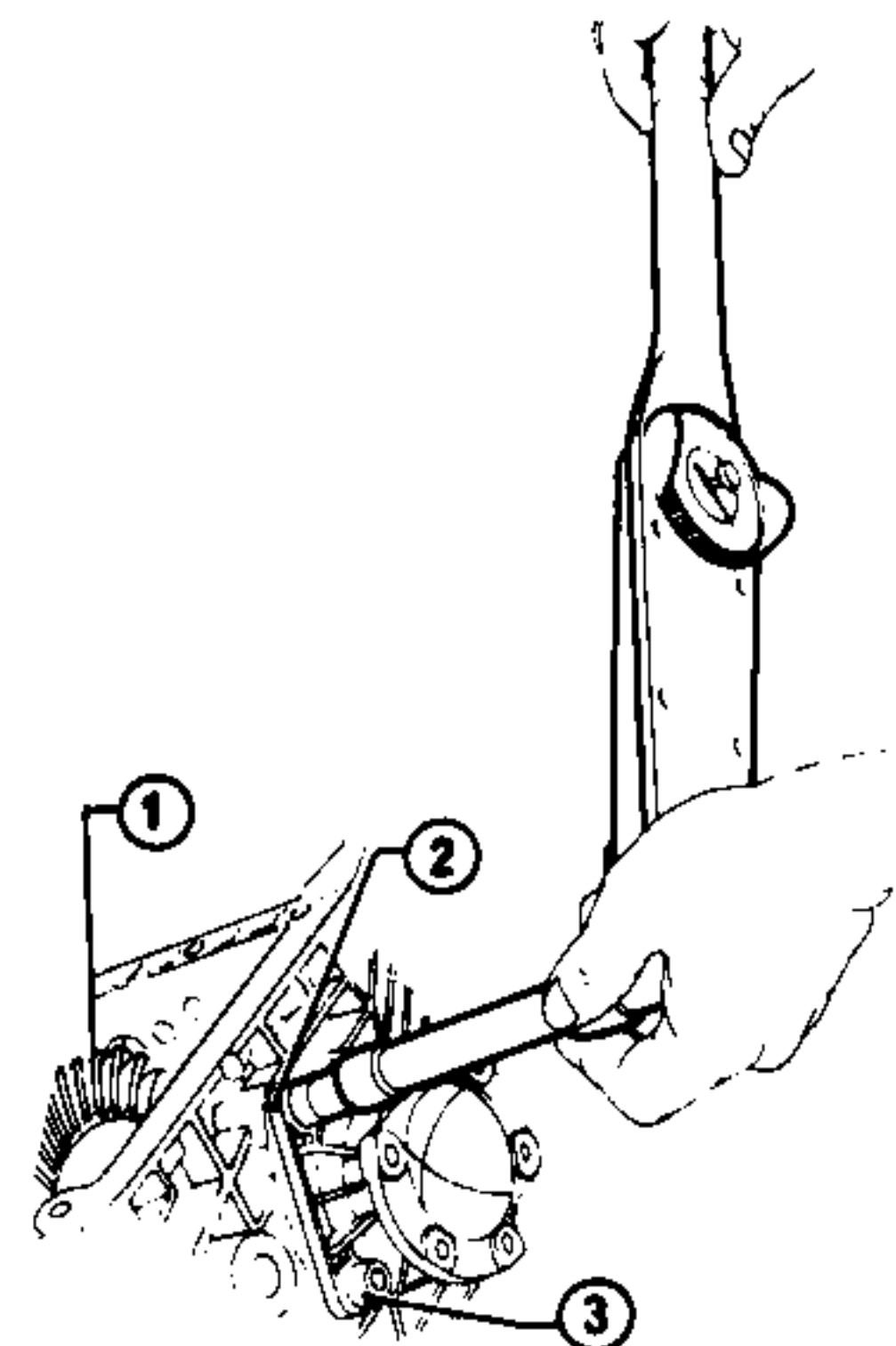
ⓧ: Tightening torque

Screws securing the carrier opposite the crown gear side to the gearbox-differential casing:

$40 \div 49$ N·m

($4 \div 4.9$ kg·m

$28.92 \div 35.43$ ft·lb)



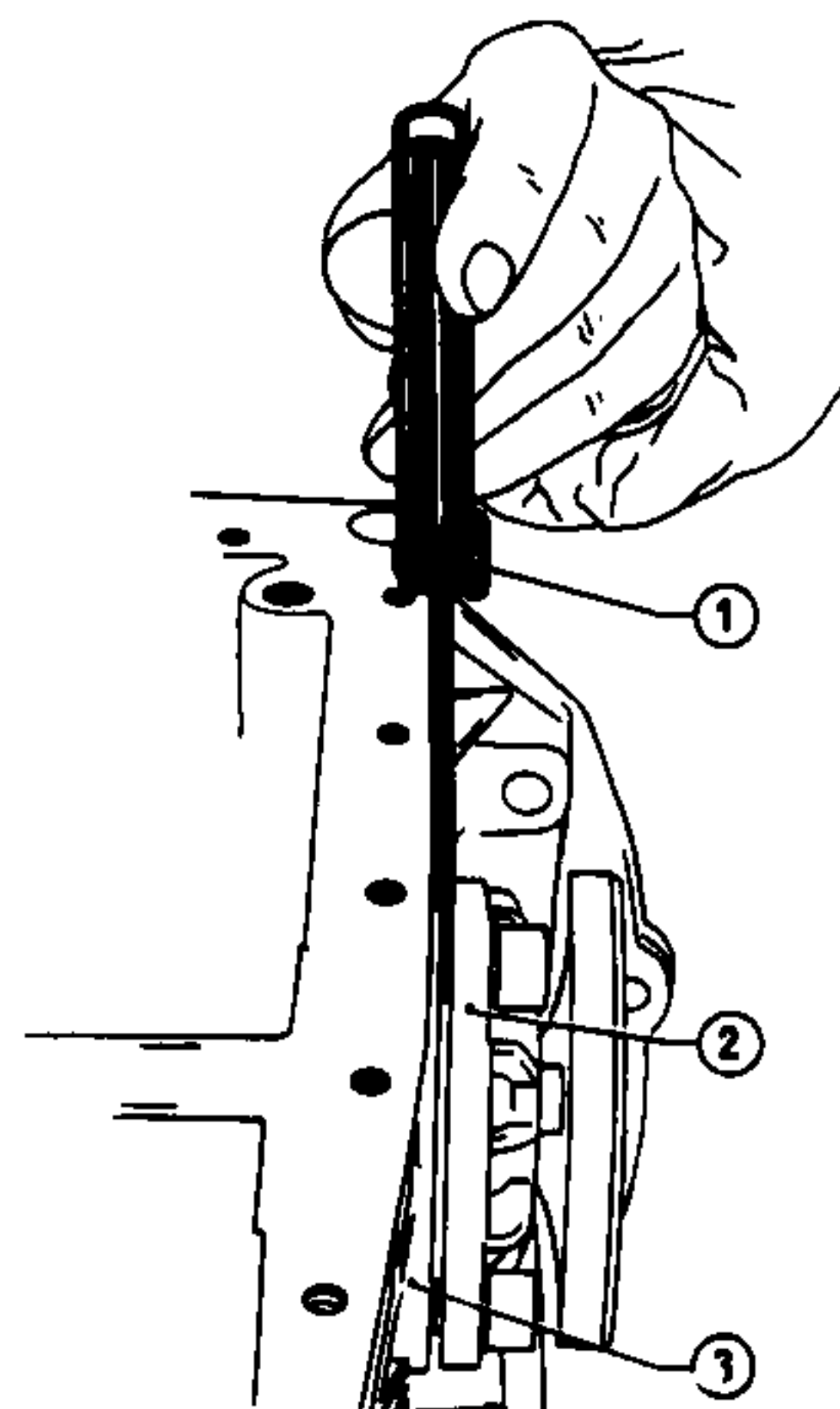
1 Crown gear

2 Differential carrier

3 Screw

3. Tighten by hand the screws of the crown gear side carrier till the play on the taper roller bearings has been taken up, but being careful not to pre-load the bearings.

4. Using a thickness gauge ①, measure the distance between the gearbox casing and the carrier's flange ② at four equidistant points.



1 Thickness gauge

2 Differential carrier flange

3 Gearbox casing

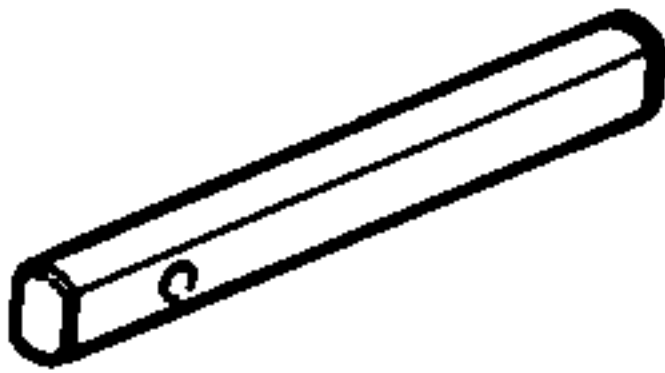
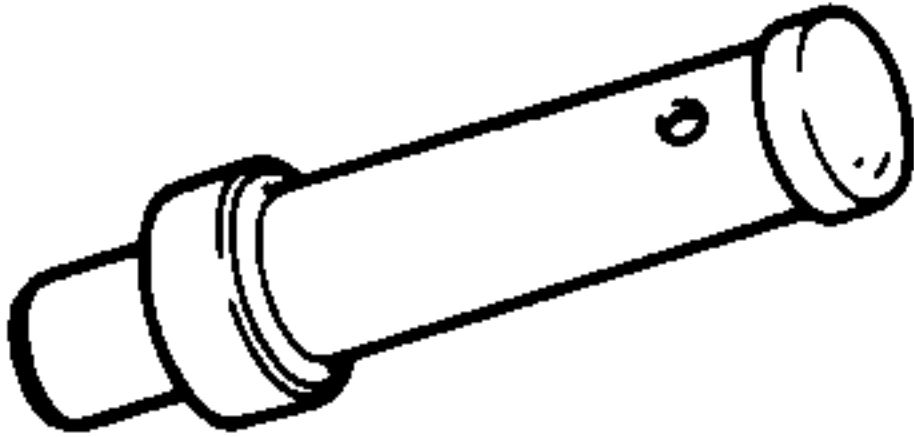
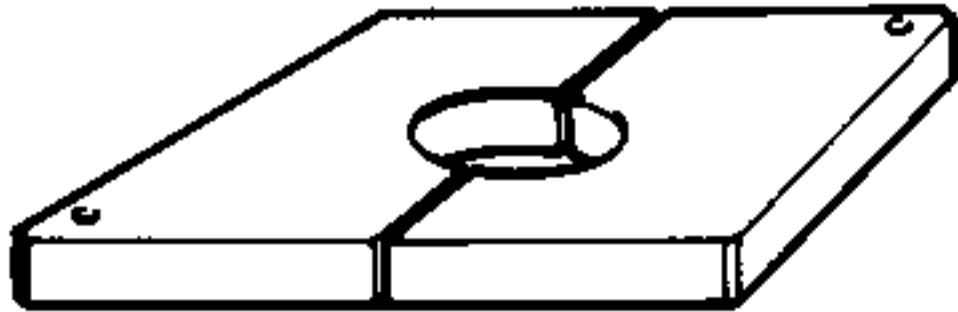

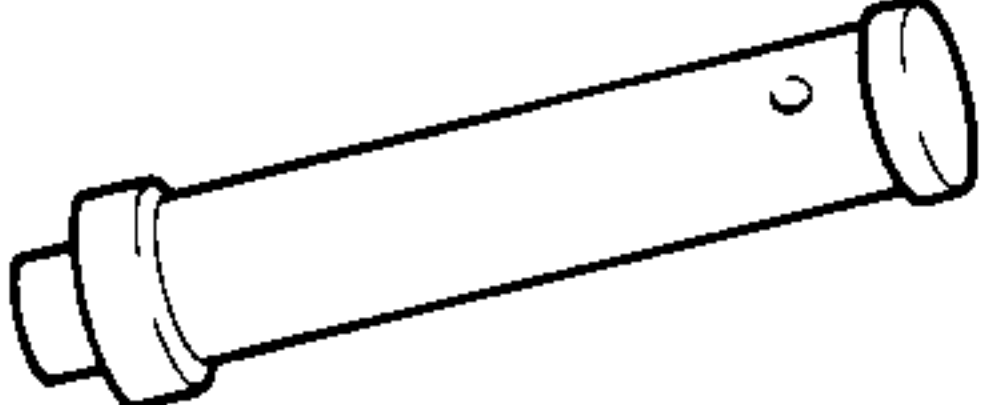
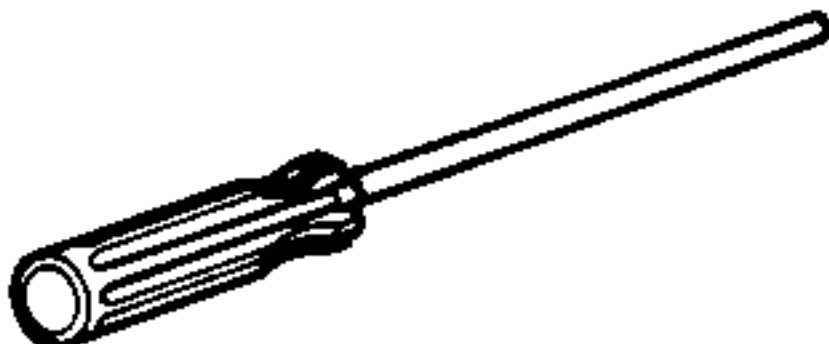
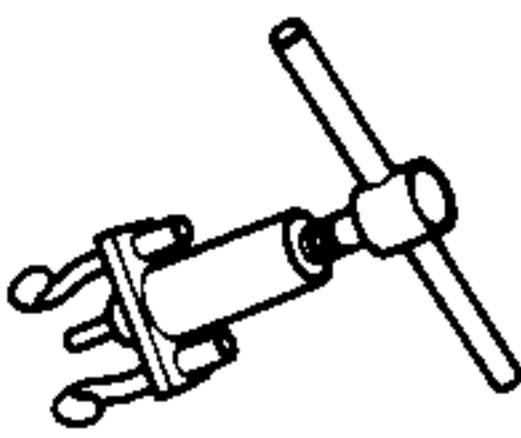
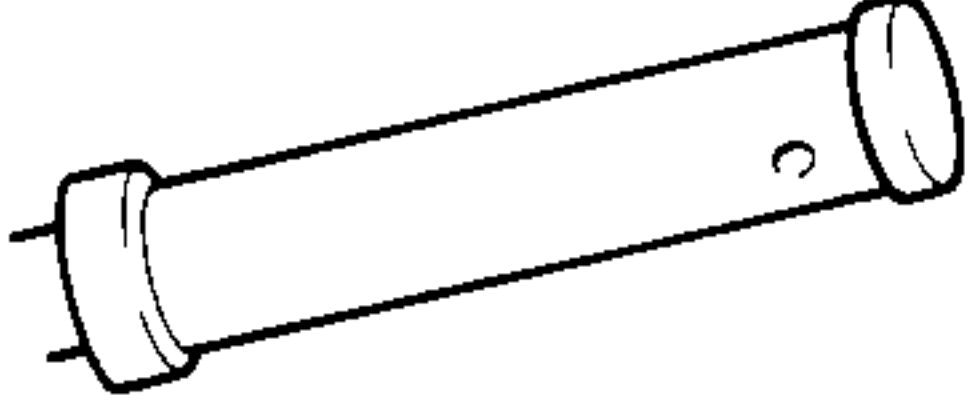
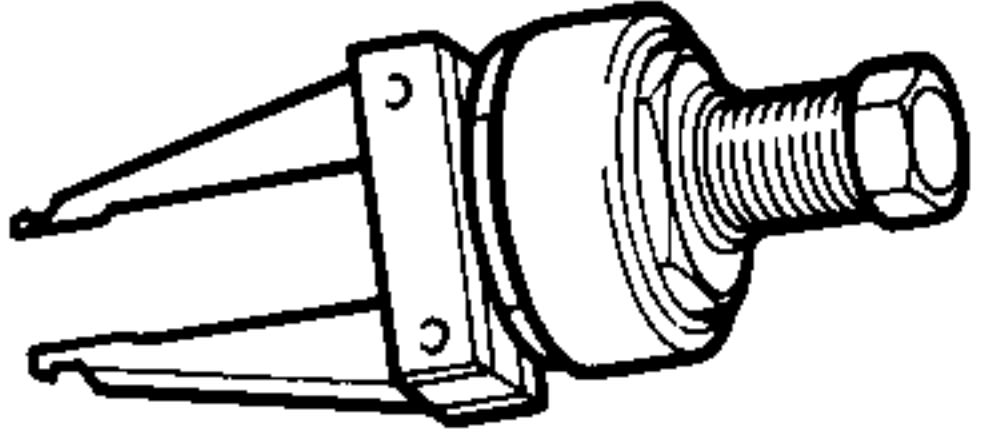
GEARBOX

Item	N·m	kg·m	ft·lb
DIFFERENTIAL CARRIERS			
Screw securing differential carriers to gearbox casing (with specified surface-fixing agent)	40 ÷ 49	4 ÷ 4.9	28.92 ÷ 35.43
Screw securing drive shaft to differential shaft			
— in oil for drive shaft securing screws with outer spacer	34 ÷ 36	3.4 ÷ 3.7	24.58 ÷ 26.75
Screw securing crown gear to differential casing (in oil)	67 ÷ 74	6.8 ÷ 7.5	49.17 ÷ 54.23
SWITCHES			
R.G. light switch to gearbox	40 ÷ 49	4 ÷ 4.9	28.92 ÷ 35.43

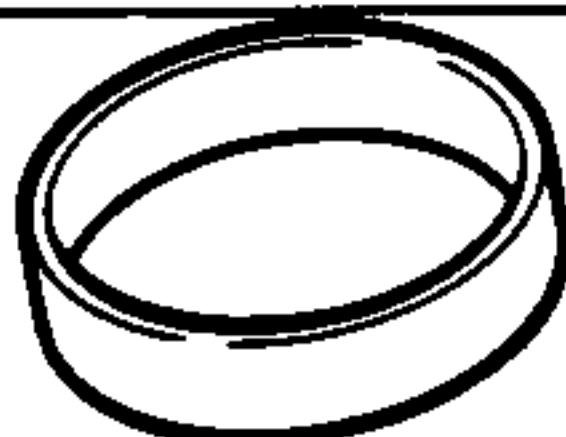
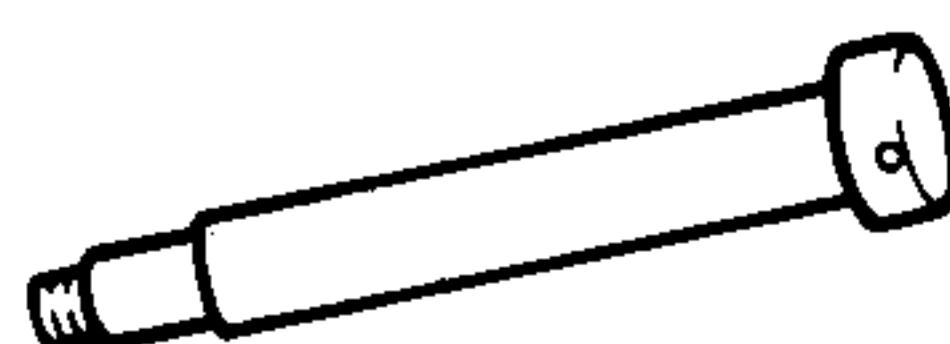
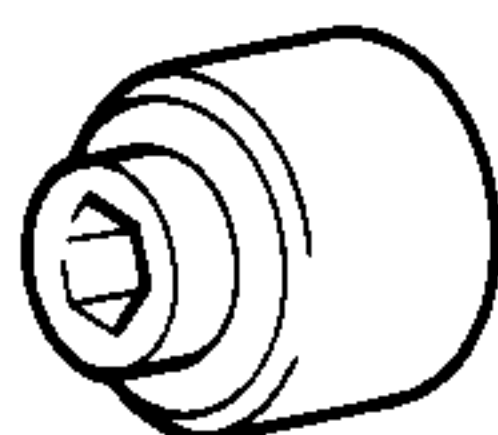

TROUBLE DIAGNOSIS AND CORRECTIONS

Trouble	Probable cause	Corrective action
Transmission is noisy when in forward speeds	<p>Having detected where the noise comes from and established that it does not originate from the engine, proceed as follows in order to locate the defective assembly:</p> <ul style="list-style-type: none"> — run the car to the speed where noise is most emphasized — adjusting the speed as required, shift alternatively - and within reasonable sequences - all different speeds. <p>Having determined the cause of the noise, repair or replace defective parts or assemblies.</p> <ul style="list-style-type: none"> • Oil level is below normal or oil is not of the specified type • Oil leaks from sump and/or rear cover gaskets from differential carriers and/or direct drive shaft oil seal rings, from topping-up plug or from drain plug • Primary shaft bearings (in this case noise should be there even when gearbox is in neutral) • Pinion shaft bearings (noise is present only if speed is engaged and this with all speeds) 	<p>Fill-up to proper level or replace oil with specified type</p> <p>Replace gaskets and/or oil seal rings</p> <p>Replace bearings</p> <p>Replace bearings</p>
Noisy when vehicle is moving, even if gearbox is in neutral	<ul style="list-style-type: none"> • Bearings of differential carriers are defective or seized • Bevel pinion bearings are noisy 	<p>Replace bearings</p> <p>Check and/or replace</p>
Noisy when in one particular speed	<ul style="list-style-type: none"> • Contact surface of gear teeth is worn or pitted 	<p>Replace gears</p>

GEARBOX

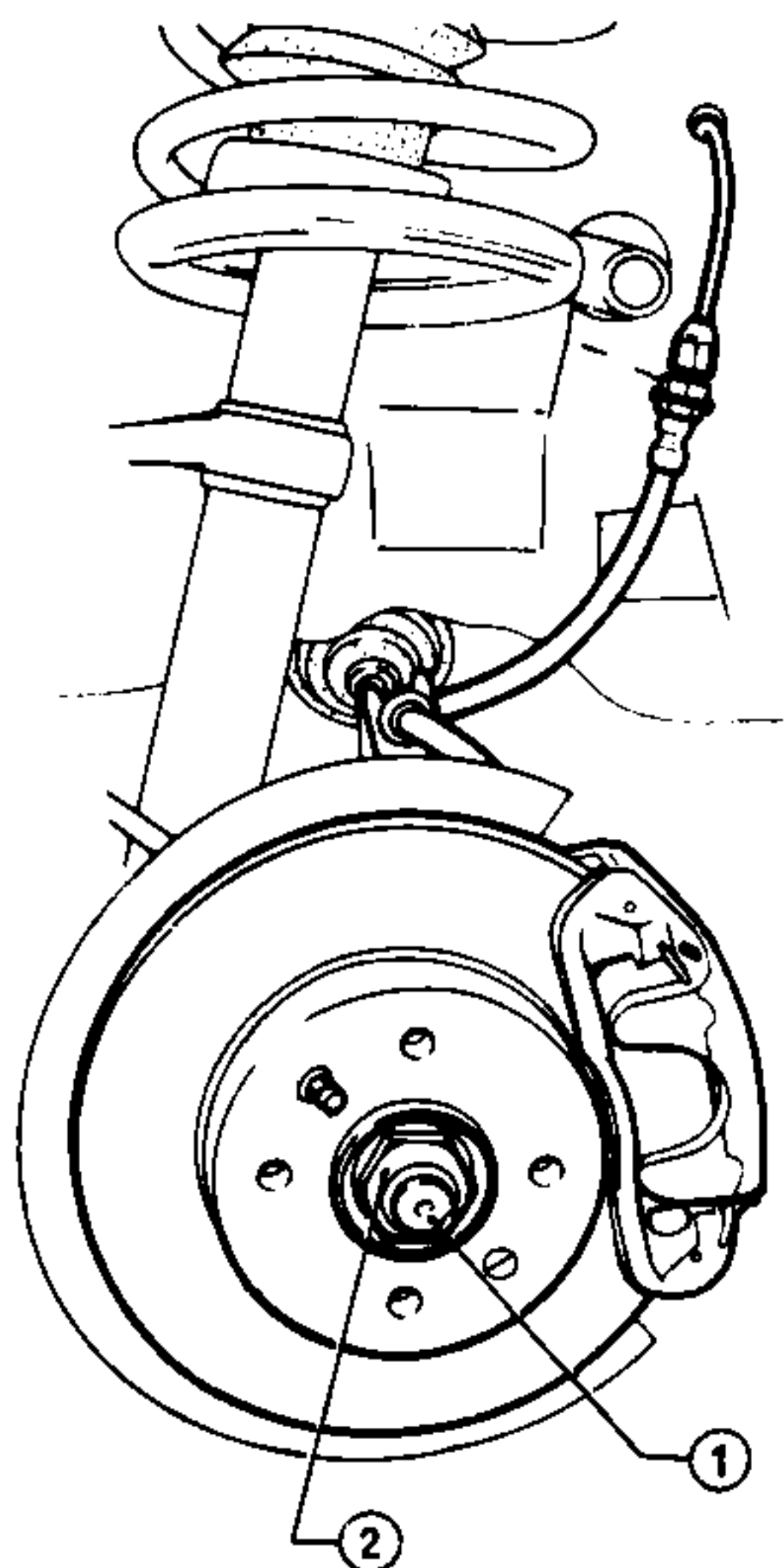
Tool number	Tool name	Refer to page
A.3.0304	Guide for fitting interlock rollers of 1st and 2nd striking rod (use with A.3.0309) 	13-8
A.3.0305	Driver of bearing inner races onto differential housing hubs 	13-23
A.3.0306	Plate for sithdrawal of inner race of front pinion bearing 	13-11
A.3.0307	Driver front pinion bearing inner race 	13-15
A.3.0308	Driver of direct drive shaft bush 	13-19
A.3.0309	Driver of interlock rollers (use with A.3.0303 and A.3.0304) 	13-8 13-9
A.3.0322	Puller / driver of striking rod retainers 	13-7 13-9
A.3.0323	Driver of direct drive shaft seal ring 	13-19
A.3.0429	Puller of gear selector rod seal ring 	13-7

GEARBOX

Tool number	Tool name	Refer to page
A.4.0141	Reference gauge for pre-loading pinion shaft bearings 	13-15
A.4.0142	Dummy pinion for distance setting 	13-16 13-17
A.5.0196	Wrench, 38 mm. (~ 1,5 in.), for pinion shaft nut 	13-10
C.2.0037/0100	Weight, 100 gr. (~ 3.53 oz.) for checking bearing pre-load (to be used with A.2.0274 and C.5.0124) 	13-16 13-17 13-18
C.2.0037/0150	Weight, 150 gr. (~ 5.29 oz), for checking bearing pre-load (to be used with A.2.0274 and C.5.0124)	13-16 13-17 13-18
C.2.0037/0200	Weight, 200 gr. (~ 7.05 oz), for checking bearing pre-load (to be used with A.2.0274 and C.5.124)	13-16 13-17 13-18
C.2.0037/0300	Weight, 300 gr. (~ 10.58 oz), for checking bearing pre-load (to be used with A.2.0274 and C.5.0124)	13-16 13-17 13-18
C.2.0037/0500	Weight, 500 gr. (~ 17.64 oz), for checking bearing pre-load (to be used with A.2.0274 and C.5.0124)	13-16 13-17 13-18
C.2.0037/1000	Weight, 1 kg. (~ 2.20 lb), for checking bearing pre-load (to be used with A.2.0274 and C.5.0124)	13-16 13-17 13-18
C.2.0037/2000	Weight, 2 kg. (~ 4.41 lb), for checking bearing pre-load (to be used with A.2.0274 and C.5.0124)	13-16 13-17 13-18

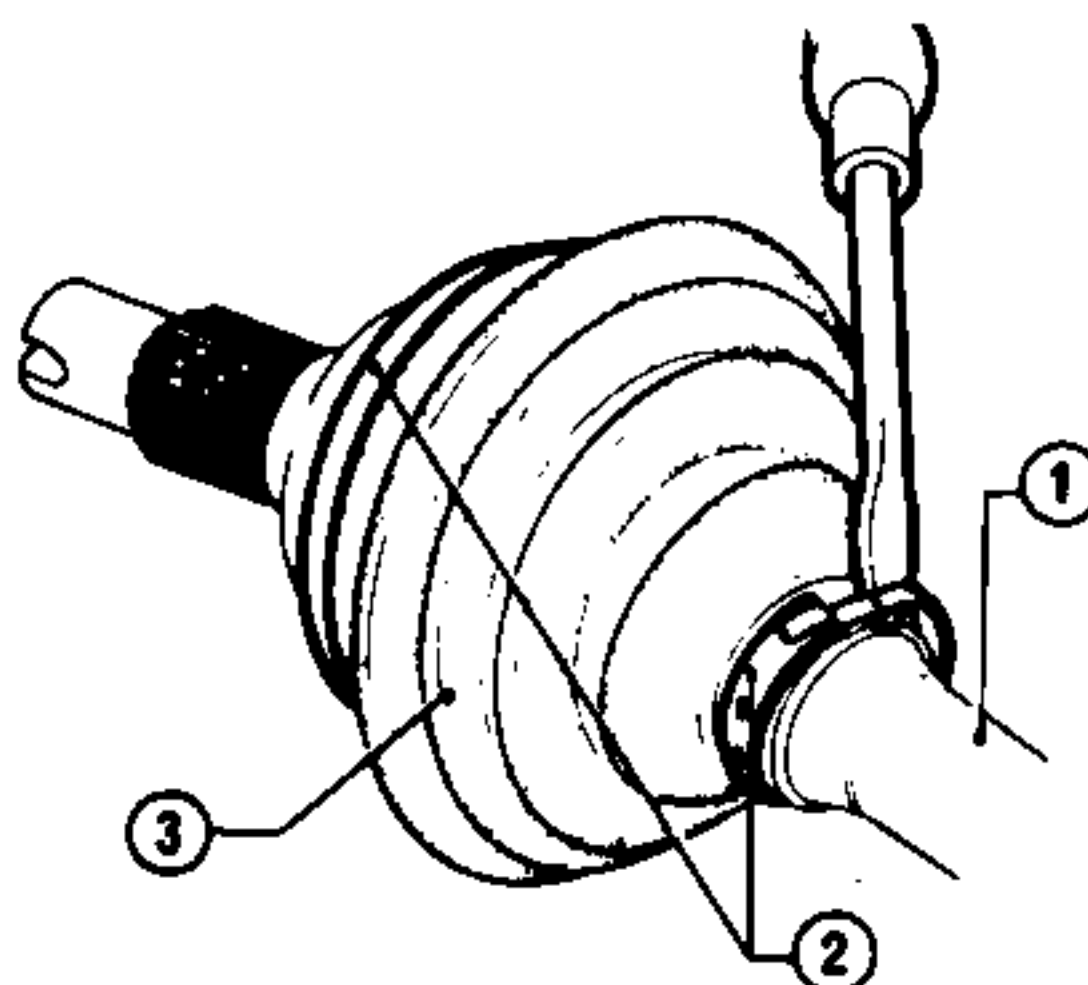
REMOVAL

1. Place the car on lift, block rear wheels and lift the front by means of a jack, then support it on stands sited in adjacent position to the bearing points (see: Group 00 - Lifting Points and Towing).
2. Remove wheel from the operative side.
3. Remove the nut caulking (2) and unscrew it out of the drive shaft end (1).
4. Remove drive shaft from differential shaft by unscrewing the six securing screws. Remove shaft with the two constant-speed joints.



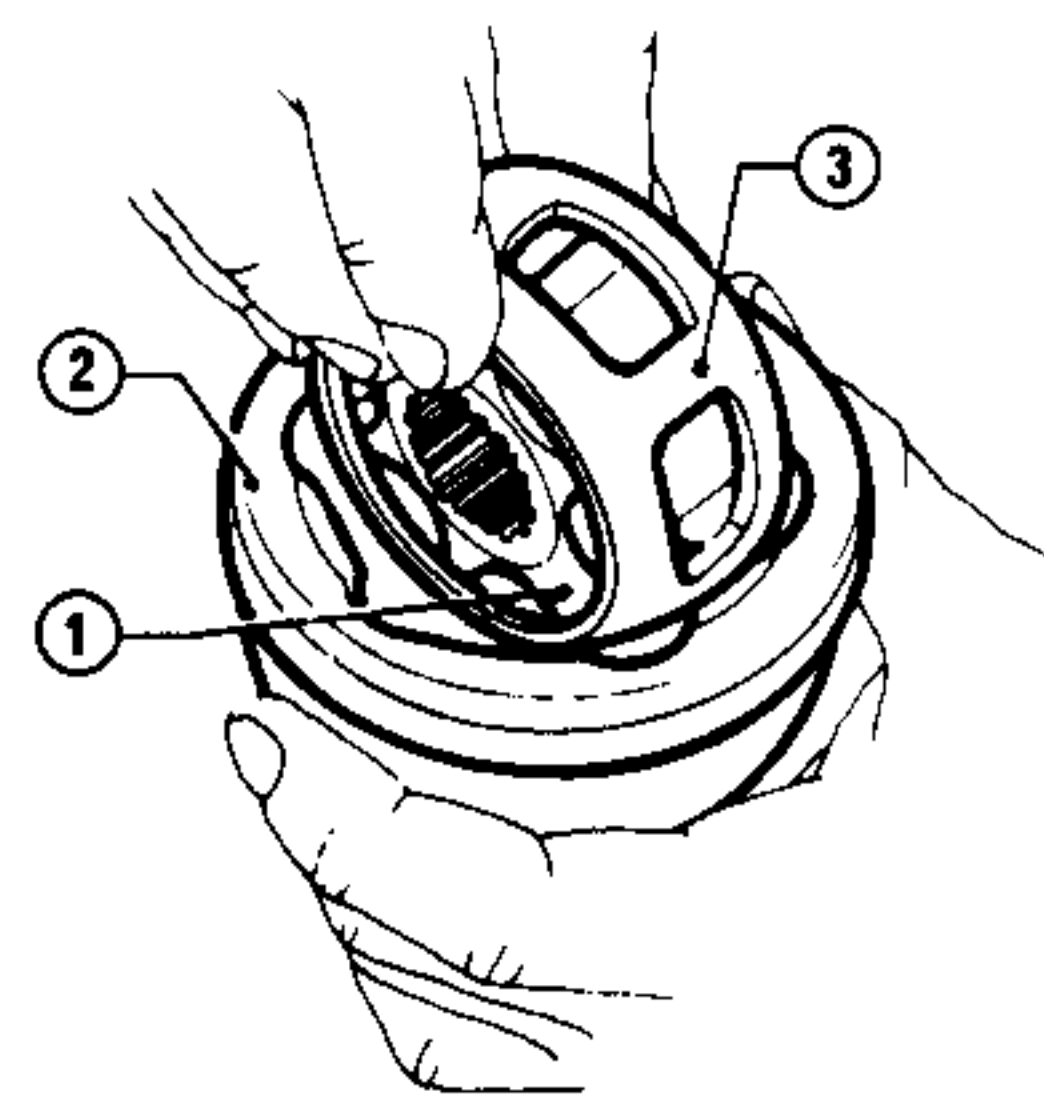
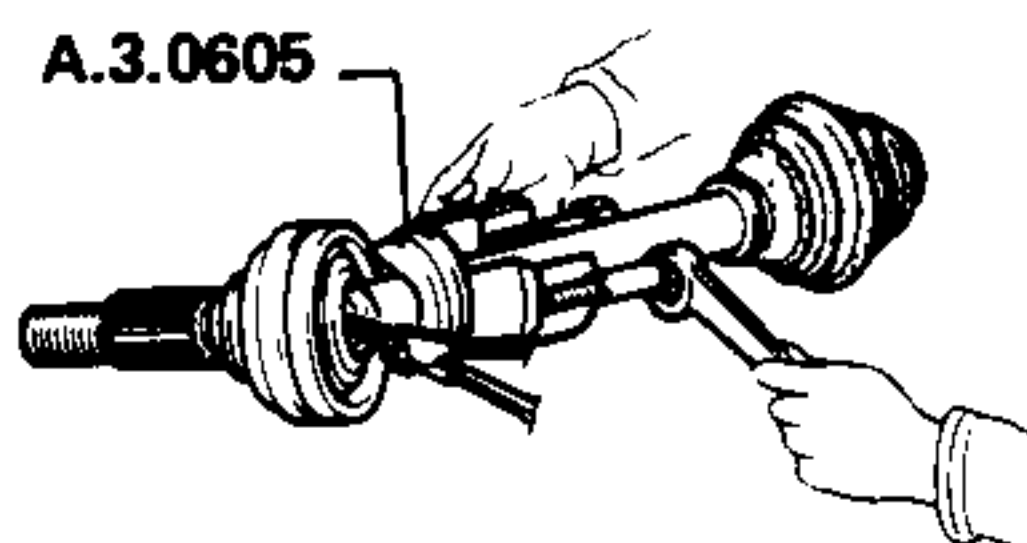
1 Drive shaft 2 Nut

2. With a screwdriver pull boot (3) clamps (2) till they are open. Push boot backwards along the shaft to allow removal of joint.



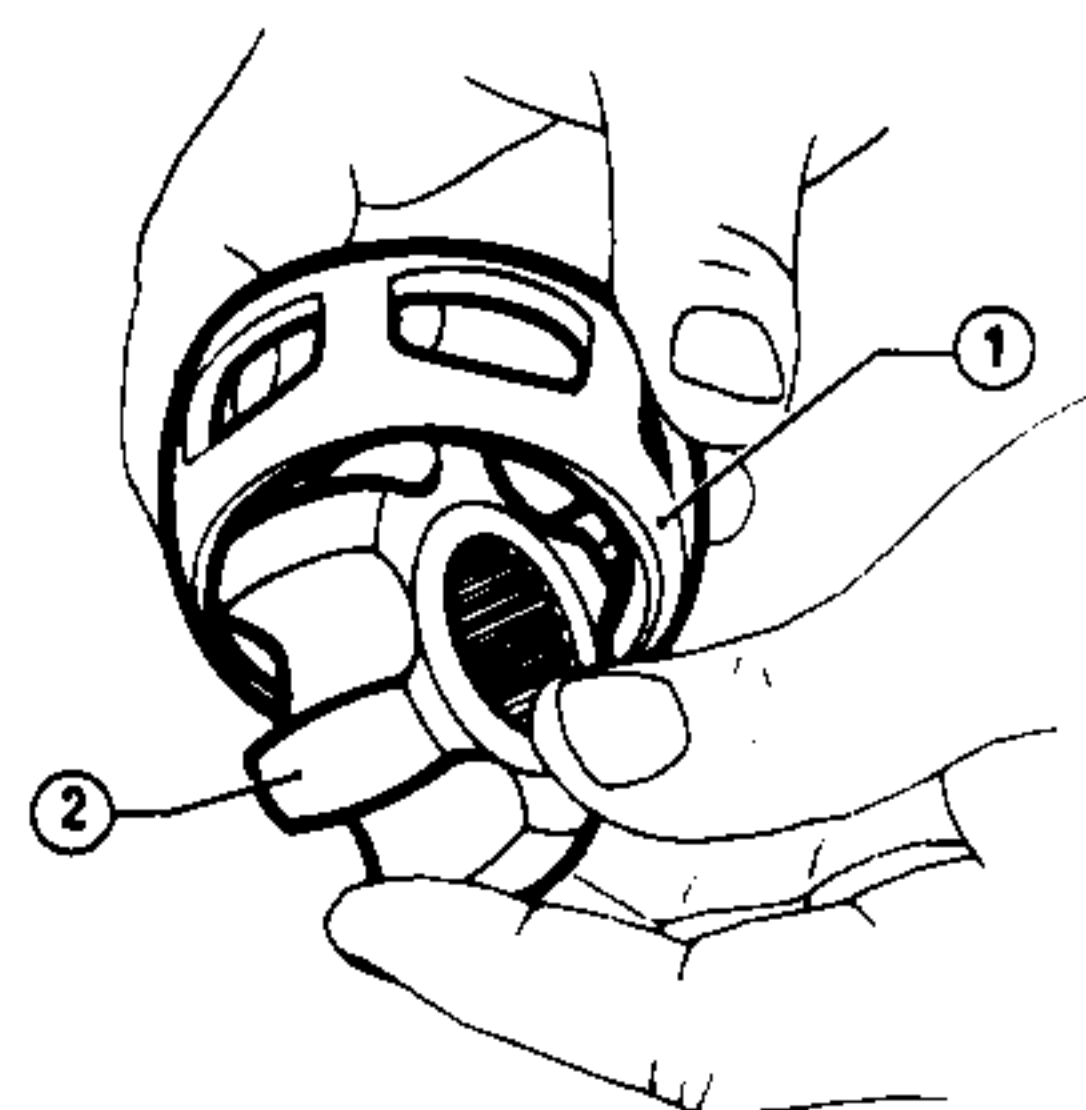
1 Drive shaft 3 Boot
2 Clamps

3. Fit tool A.3.0605 on shaft and bring its fixed part flat against the shaft's projecting parts. Using expanding pliers, open and keep in its seat the lock ring; screw the tool's set of screws till its mobile part is flat against the constant - speed joint's inner race.
4. Remove pliers and continue tightening the screws till the whole constant - speed joint is out. Now number the three washers that slip off at the same time.



1 Inner race 3 Cage
2 Joint body

Separate inner race (2) from cage (1) as shown in the figure.



1 Cage 2 Inner race

DISASSEMBLY

Drive shaft assembly should never be completely disassembled since it was designed so as never to require lubrication, however, if some parts need replacing, proceed as follows for relevant disassembly.

OUTER JOINT (A)

1. Secure drive shaft into a vice equipped with jaws.

5. Remove lock ring from the joint and then remove the drive shaft boot.
6. Mark inner race, cage and joint with a reference line to ensure proper positioning when assembling.
7. Suitably rotate inner race (1) and cage (3) as regards to joint body (2) and then remove the steel balls. Now rotate inner race and cage, as shown in the figure and remove from seat.

INNER JOINT (B)

1. Secure shaft into a vice equipped with jaws.
2. With a screwdriver pull boot clamps till they are open. Push boot 6 backwards along the shaft.
3. Having removed the relevant screws (3), remove the three plates (5) located on the inner cover's (4) side.
4. With the help of a punch, remove the metal outer cover (1) from the joint.

FRONT SUSPENSION

The front suspension is of the independent-wheel type with semi-trailing links, lower transverse links and telescopic strut with coaxial coil springs.

The telescopic strut forms a unique

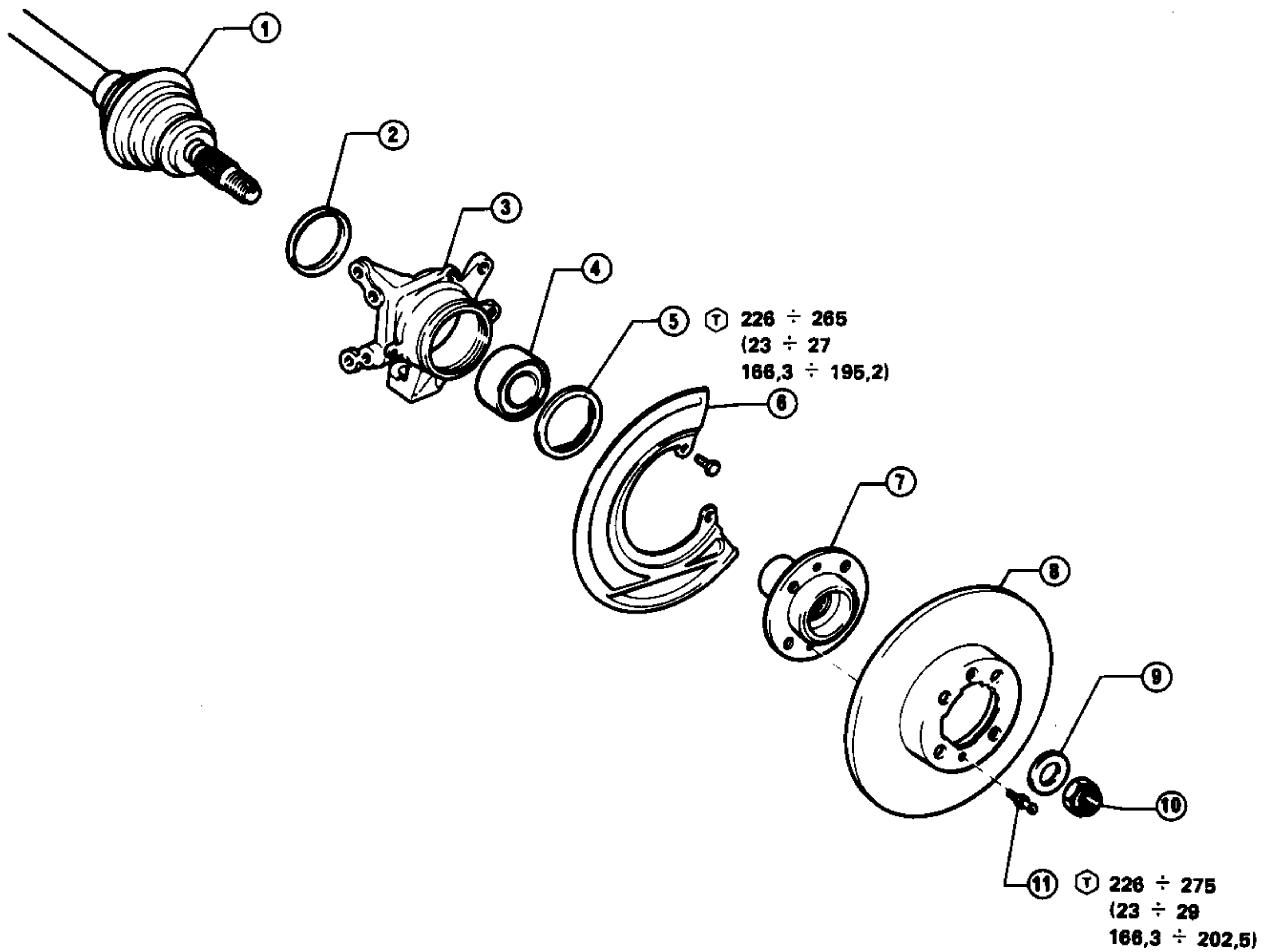
body with the two-tube type shock absorber provided with a diaphragm valve and antiemulsifying oil and the lever connecting to the steering box track rods.

The wheel rebounds are limited by

progressive rubber bumpers located in the strut.

The shock absorbers support the lower seat of the coil springs by an axial needle roller bearing.

FRONT WHEELS HUB



N·m
(kg·m
ft·lb)

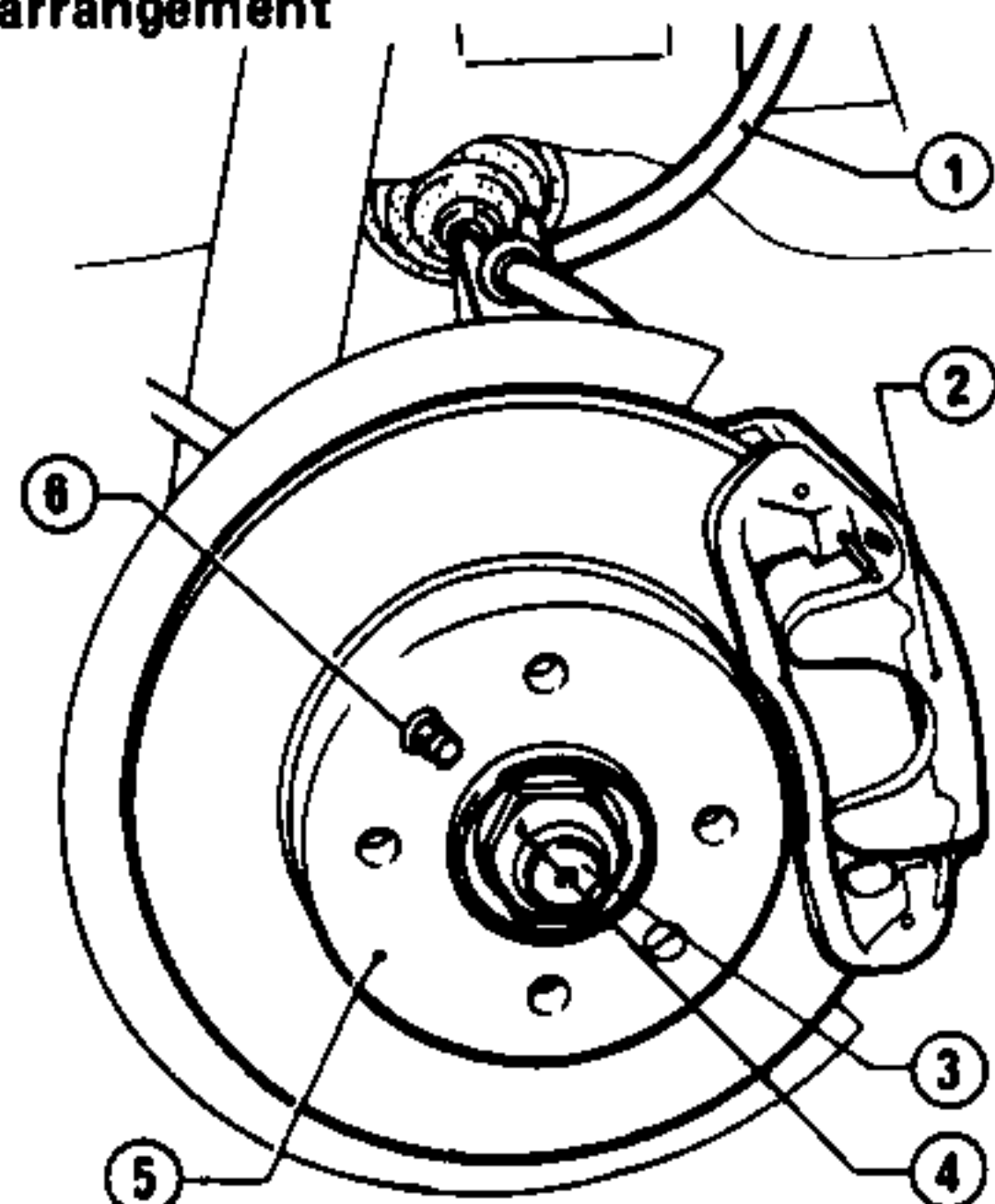
- 1 Drive shaft
- 2 Seal ring
- 3 Hub support
- 4 Bearing
- 5 Ring nut
- 6 Dust cover

- 7 Hub
- 8 Disc
- 9 Washer
- 10 Hub nut
- 11 Dowel

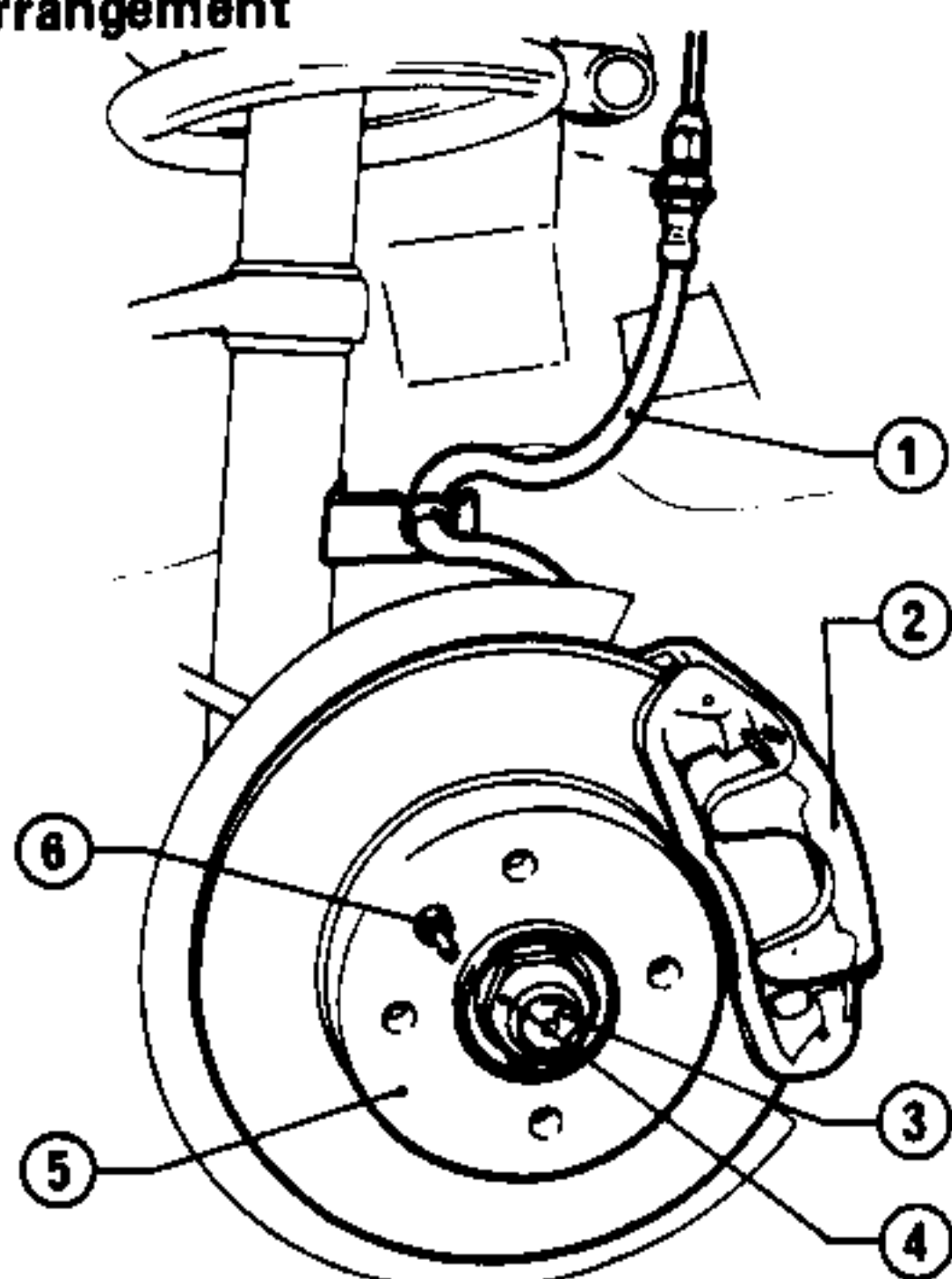
REMOVAL

1. Place the car on lift, block rear wheels and lift the front by means of a jack, then support it on stands sited in adjacent position to the bearing points (refer to: Group 00 - Lifting Points and Towing).
2. Remove wheel from the operative side.
3. Remove the nut caulking (4) and unscrew it out of drive shaft (3) end.
4. Remove drive shaft from differential shaft by unscrewing the six securing screws. Remove shaft with the two constant-speed joints.
5. Detach caliper (2) from hub support, without disconnecting it from hose (1).

Solution before arrangement

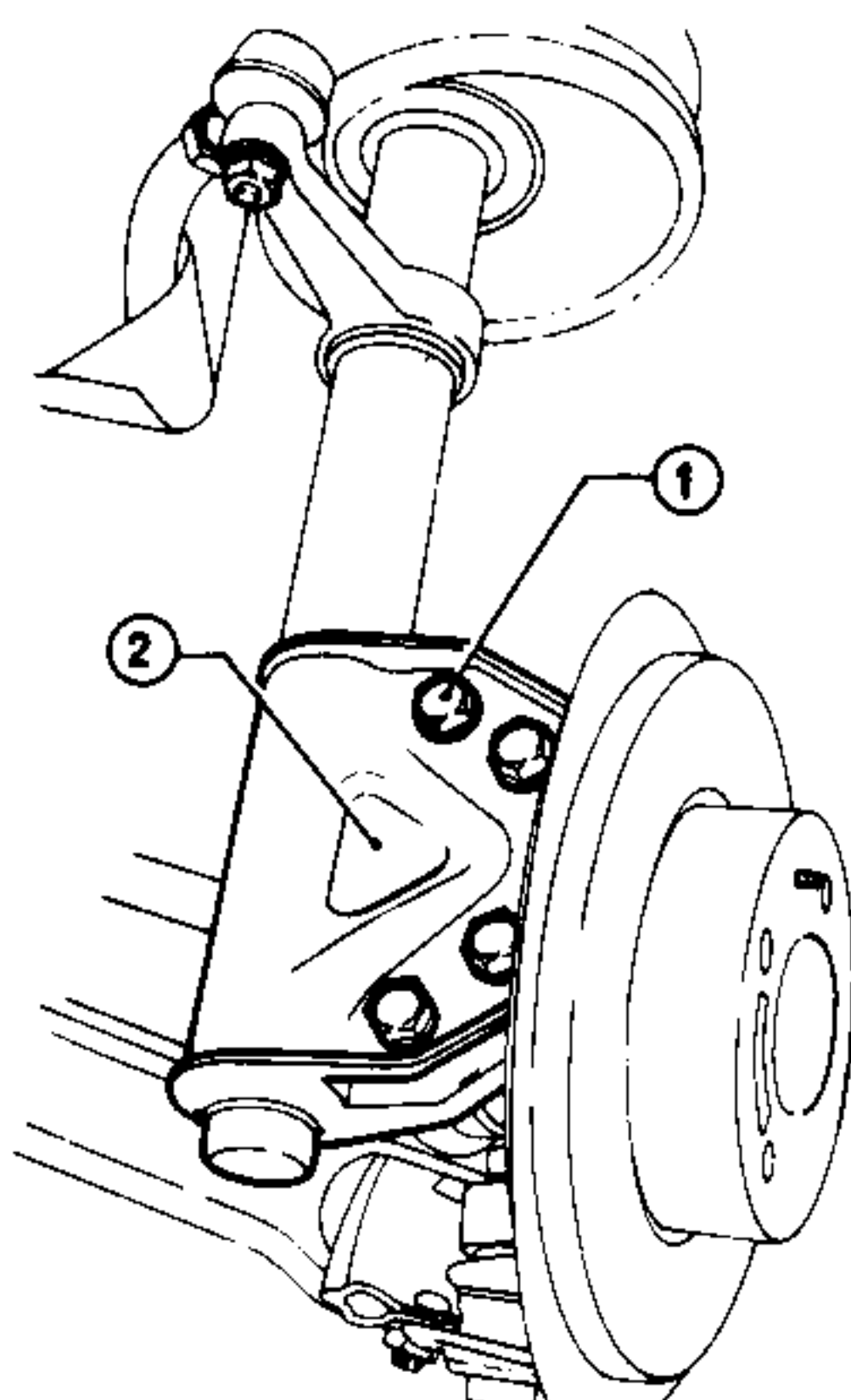


Solution after arrangement



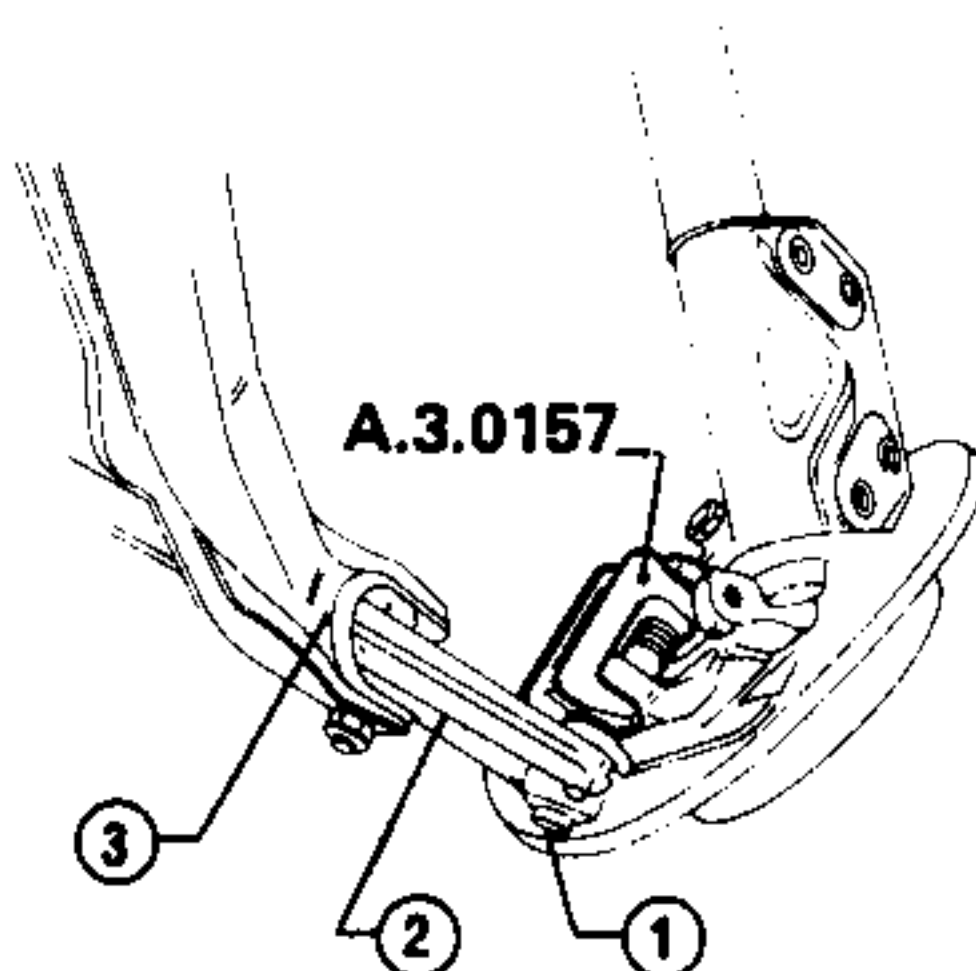
- | | |
|---------------|--------------|
| 1 Hose | 4 Hub nut |
| 2 Caliper | 5 Brake disc |
| 3 Drive shaft | 6 Dowel |

6. Loosen and remove the four screws (1) securing vertical guide bracket (2) to hub support.



- | | |
|----------|-----------|
| 1 Screws | 2 Bracket |
|----------|-----------|

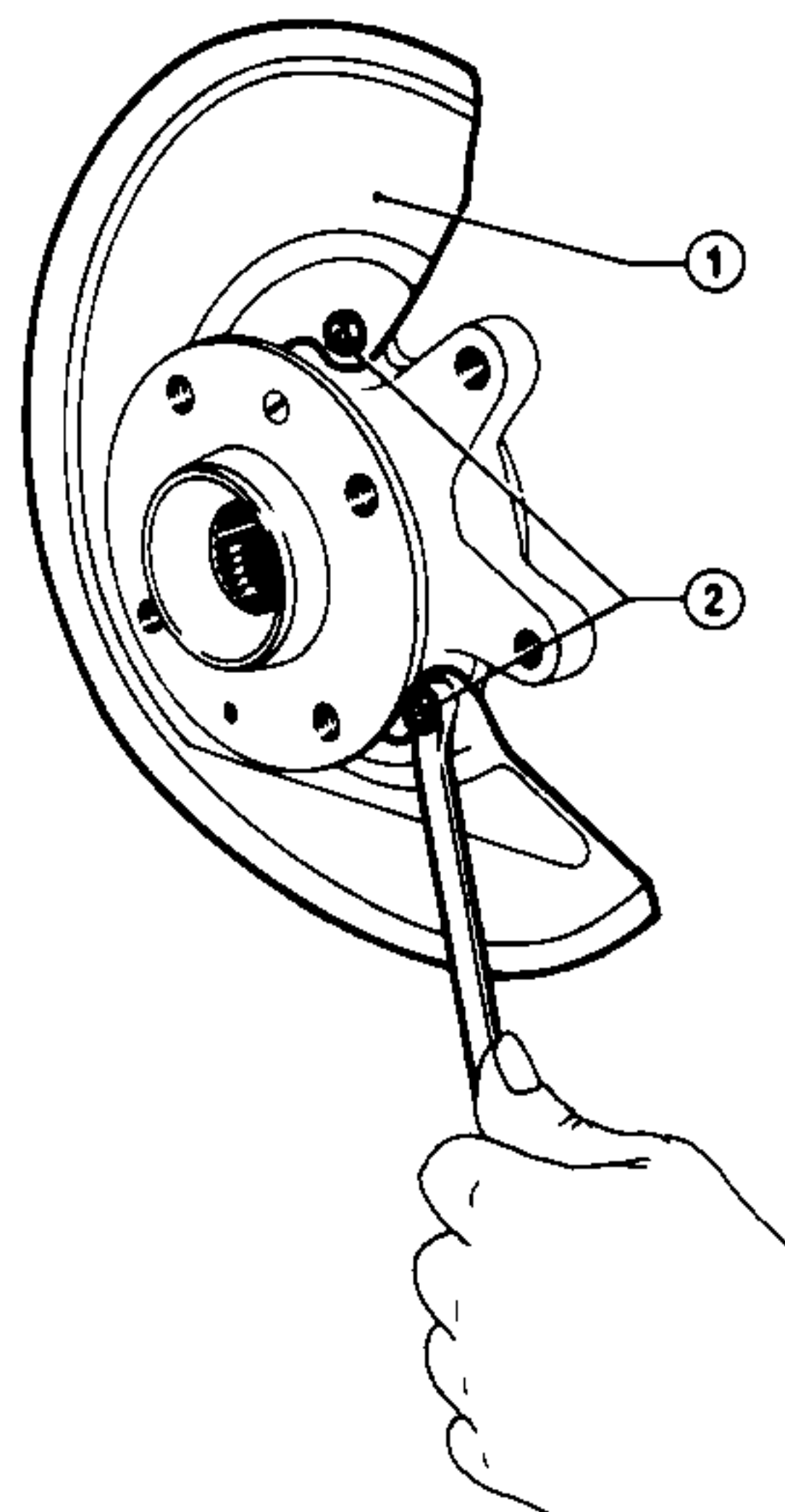
7. Remove caulking, unscrew and remove nut securing ball joint pin (1), on semi-trailing link (2), to hub support. Do not reuse the nut. Hold hub support properly, and by using the A.3.0157 withdraw pin.



- | | |
|----------------------|--------|
| 1 Ball joint | 3 Link |
| 2 Semi-trailing link | |

DISASSEMBLY

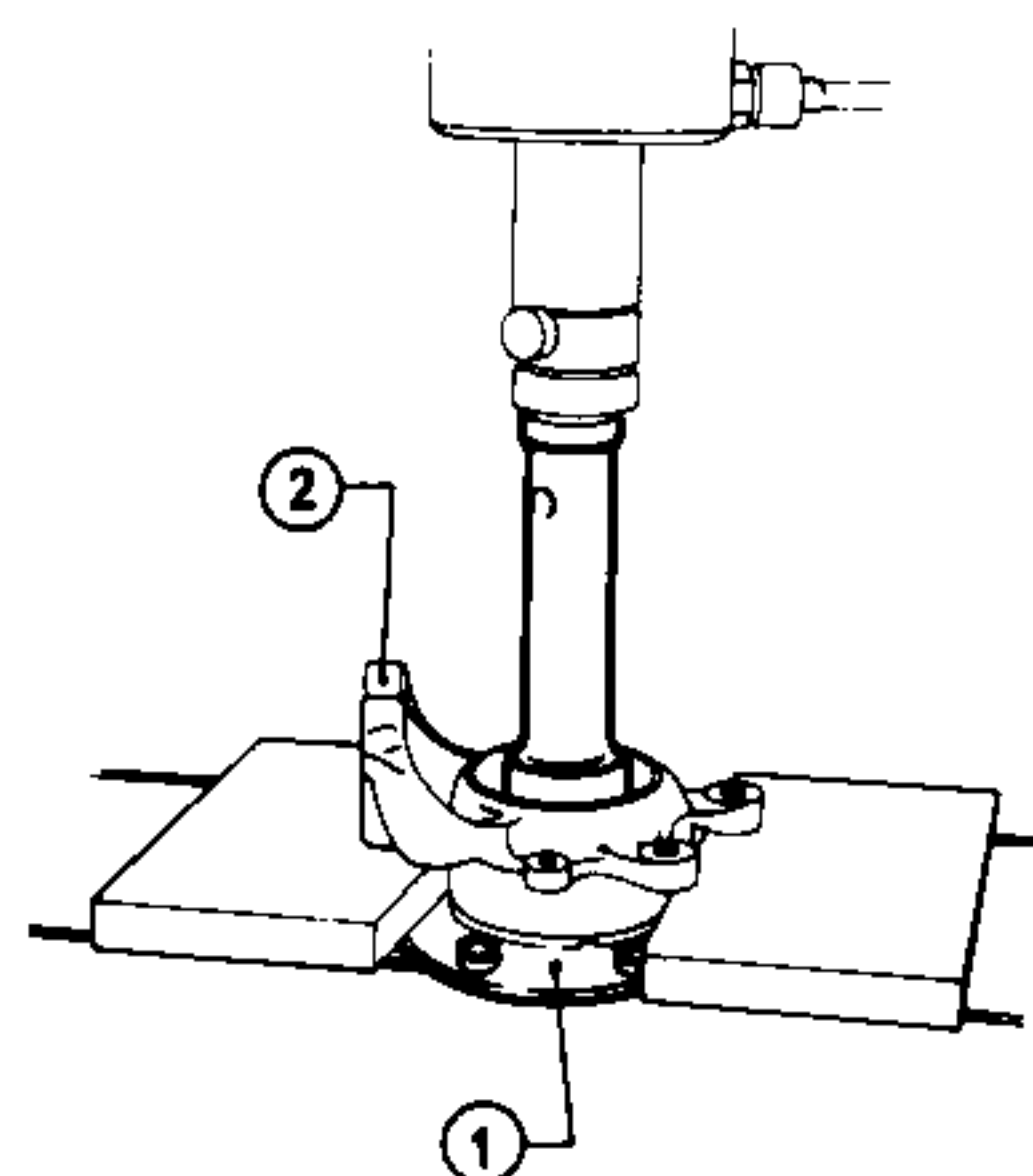
1. Clamp hub support in vice provided with protective jaws, unscrew dowel and remove brake disc. Unscrew screws (2) and remove dust cover (1) from hub support.



- | |
|------------------------------|
| 1 Dust cover |
| 2 Dust cover securing screws |

2. Using a screwdriver withdraw seal ring from hub support (shaft side).

3. Withdraw hub (1) from its support (2) by means of a press, a suitable punch and two plates.



- | | |
|-------|---------------|
| 1 Hub | 2 Hub support |
|-------|---------------|

4. Reclamp hub support in vice provided with jaws and using a punch remove two calkings on ring nut securing bearing to support. Using octagonal spanner A.5.0239 with proper extension unscrew ring nut and withdraw it.

FRONT SUSPENSION

TIGHTENING TORQUES

Unit Item	N·m	kg·m	ft·lb
Ring nut locking bearing on hub support	226 ÷ 265	23 ÷ 27	166.3 ÷ 195.2
Strut bracket screws to hub support	39 ÷ 48	4 ÷ 4.9	28.9 ÷ 35.43
Nuts securing strut to body	12 ÷ 15	1.2 ÷ 1.5	8.85 ÷ 11.06
Nut, steering tie rod ball joint on bracket lever	39 ÷ 48	4 ÷ 4.9	28.9 ÷ 35.43
Nut securing semi-trailing link ball joint pin to hub support	(*) 39 ÷ 48	4 ÷ 4.9	28.9 ÷ 35.43
	(**) 36 ÷ 41	3.7 ÷ 4.2	26.75 ÷ 30.37
Screws securing caliper to hub support	59 ÷ 74	6 ÷ 7.5	43.4 ÷ 54.2
Bolts securing semi-trailing and links	53 ÷ 85	5.4 ÷ 8.7	39.05 ÷ 62.91
Nut securing wheel hub to shaft	226 ÷ 275	23 ÷ 28	166.3 ÷ 202.5
Screws securing constant speed joint to differential carrier	33 ÷ 36	3.4 ÷ 3.7	24.58 ÷ 26.75

(*) Solutions before arrangement

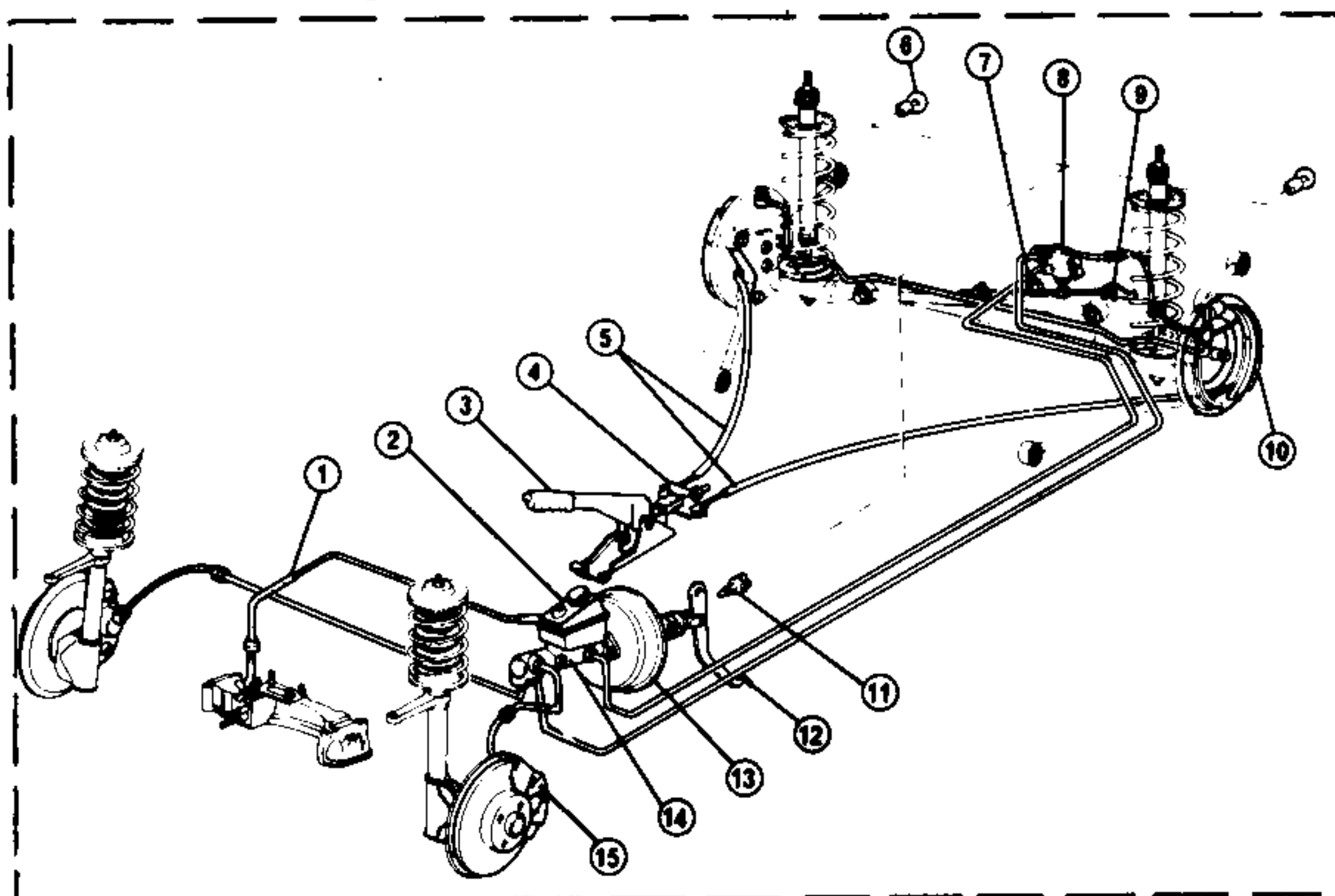
(**) Solutions after arrangement

TROUBLE DIAGNOSIS AND CORRECTIONS

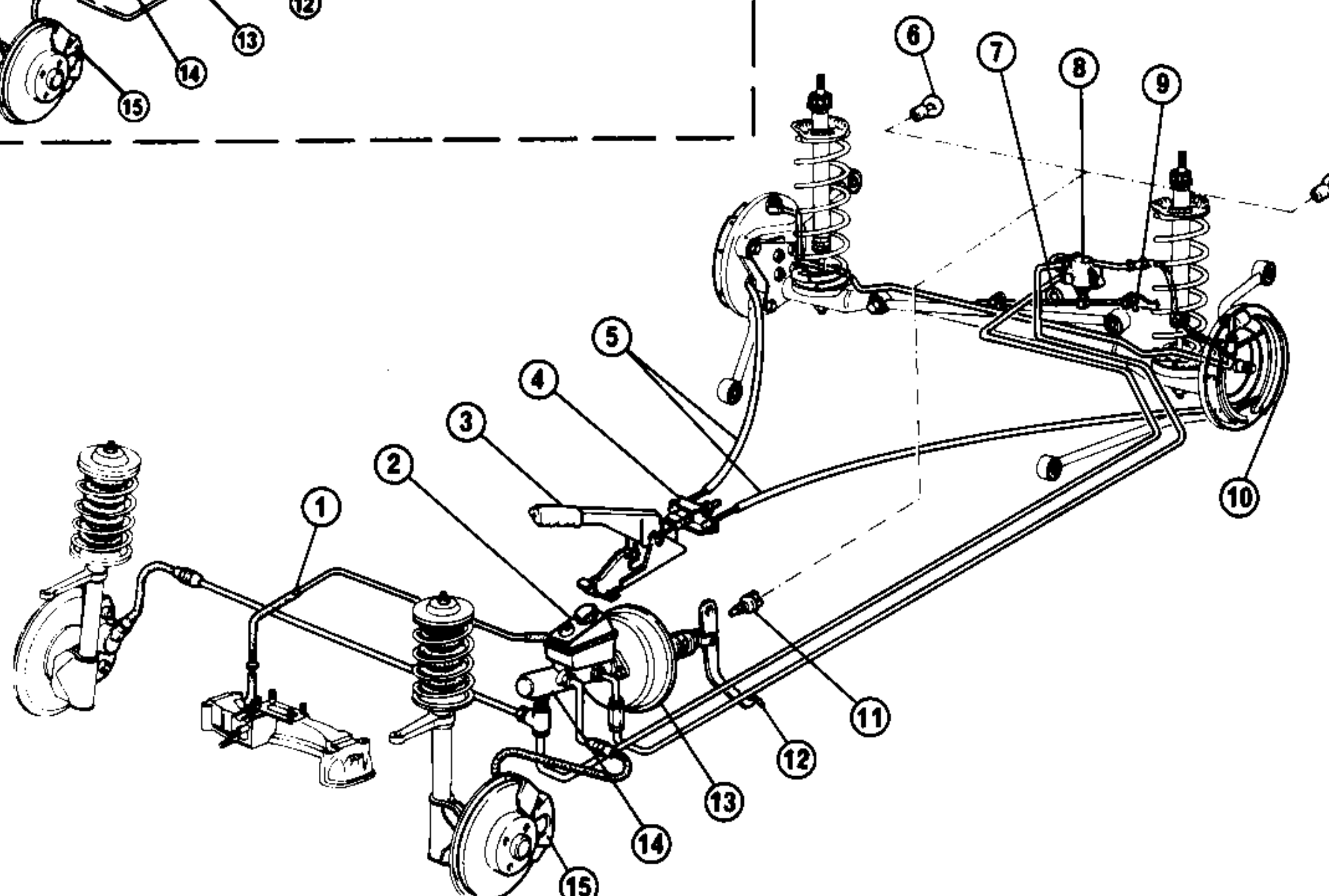
Trouble	Probable cause	Corrective action
Steering wheel shocks, vibrations or shimmying	— Shocks are felt on steering wheel when front wheels encounter obstructions on road. This condition may be due to excessive backlash between pinion and steering box rack or between other steering components.	
	— Steering wheel oscillations are often experienced when there are excessive free plays in steering linkage or in pinion-rack mating, or in oscillations of front wheels.	
	— "Shimmy" is a rapid oscillation transmitted to steering wheel and is often experienced when vehicle reaches a certain speed.	
	• Improper tire air pressure	Adjust
	• Wheel tire out-of-balance or tire rim deformed	Balance or repair
	• Worn tire or wheel securing screws loosen	Replace or tighten
	• Worn suspension connecting ball joint pin	Replace ball joint pin
• Pinion-rack mating incorrectly adjusted	Adjust	
• Faulty suspension linkage flexible bushes	Replace	

DESCRIPTION

Solution before arrangement



Solution after arrangement



- 1 Vacuum intake pipe
- 2 Brake and clutch liquid tank
- 3 Parking brake lever
- 4 Parking brake adjustment device
- 5 Parking brake cables
- 6 Stop lights
- 7 Spring for brake pressure proportioning valve
- 8 Brake pressure regulator

- 9 Equalizer for brake pressure proportioning valve
- 10 Rear brake drum
- 11 Stop lights switch
- 12 Brake pedal
- 13 Servobrake
- 14 Brake master cylinder
- 15 Front brake caliper

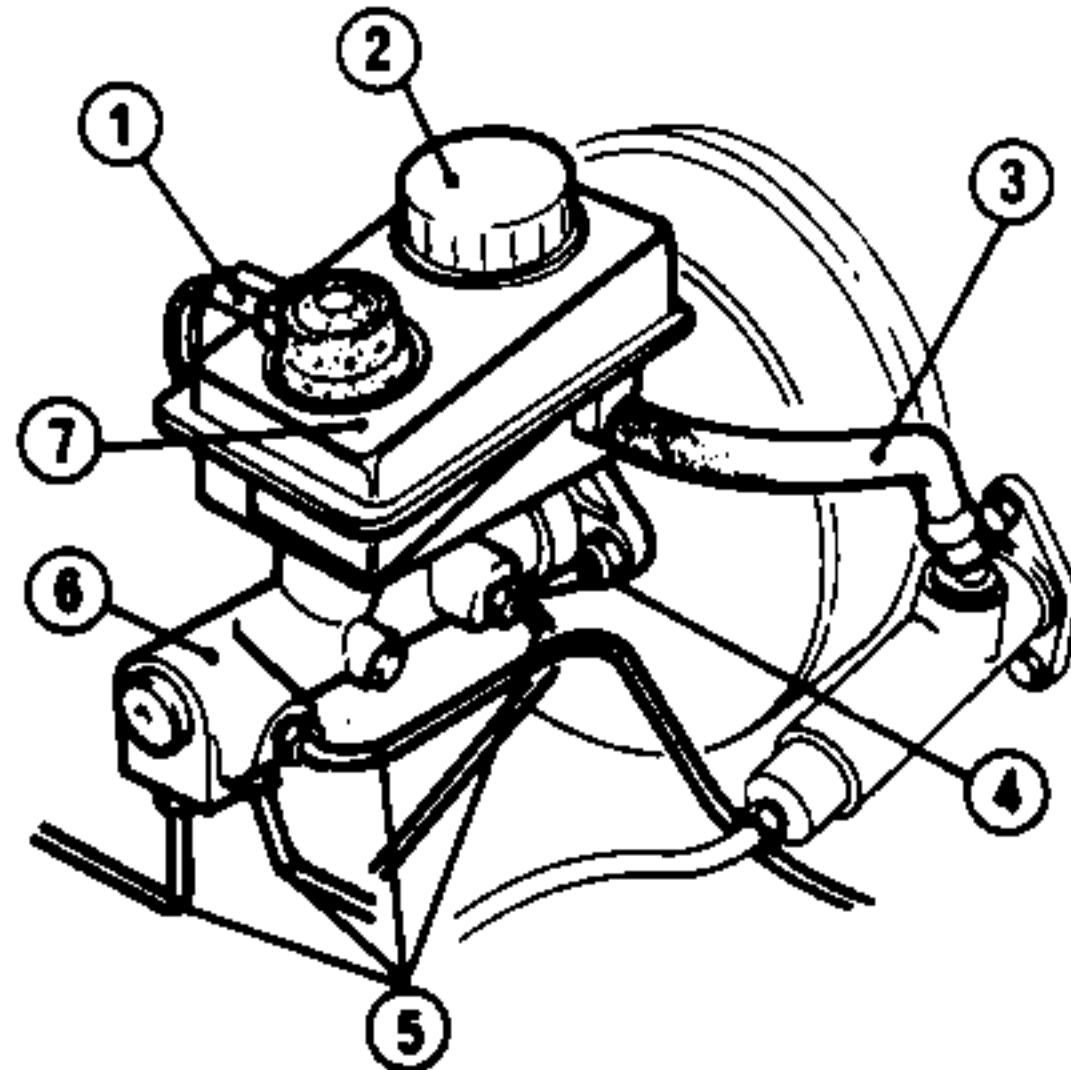
- The brake system is hydraulic with two independent circuits: one working on front wheels, and the other on rear wheels. The system guarantees an effective braking of rear brakes also in case of breaking of one of the two circuits. The servobrake is a device exploiting the vacuum formed in the engine intake manifold, in order to easy operation of the

- brake master cylinder control which is constituted by two coaxial pistons which separately feed the two circuits.
- On rear wheel circuit, it is located a brake pressure proportioning valve which is sensitive to load variations on rear axle and has the purpose of adjusting braking effect so as to prevent locking of wheels.

- Front brakes are of the disc type with floating type calipers and automatic clearance adjustment.
- The drum type rear brakes are equipped with a mechanically operated parking brake and with a clearance adjuster that works upon operation of the pedal brake.

REMOVAL

1. Disconnect cables ① of reservoir oil level indicator and then remove the cap ② with relevant gaskets as well as the filter.
2. With a syringe take out all fluid from the reservoir.
3. Disconnect clutch master cylinder feeding hose ③ from reservoir and plug it up to avoid loss of fluid from the master cylinder.
4. Sconnect unions of the four pipes ⑤ which start from brake master cylinder ⑥.
5. Disconnect master cylinder from servobrake by loosening the two retaining nuts ④ and then remove the master cylinder.
6. Remove reservoir ⑦ from master cylinder and collect all union grommets.

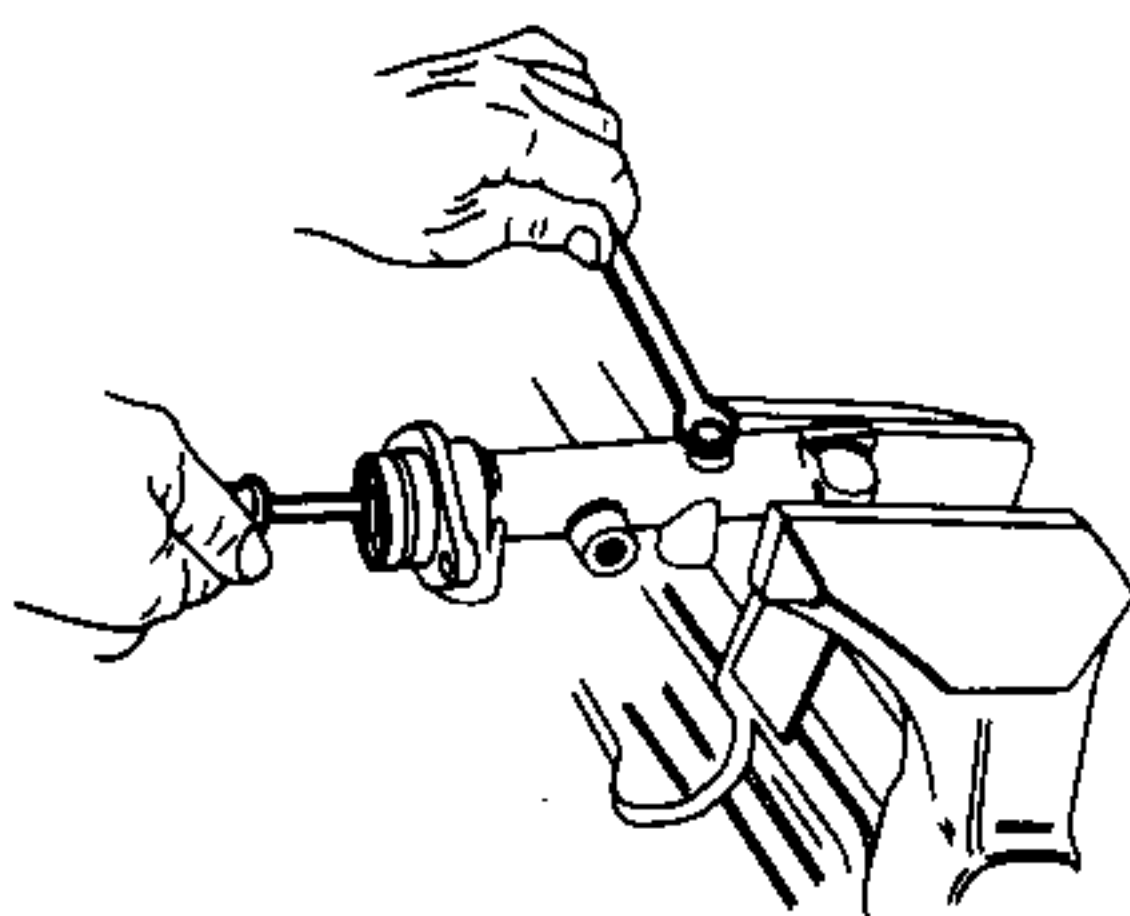


- | | |
|----------|-------------------------|
| 1 Cables | 5 Pipe |
| 2 Cap | 6 Brake master cylinder |
| 3 Hose | 7 Reservoir |
| 4 Nut | |

DISASSEMBLY (PUMP BENDITALIA)

Clamp the pump on the vice fitted with protective jaws and carry out the following operations.

1. With a suitable push rod press the piston flat against the bottom of the master cylinder; loosen the setscrews and remove it together with relevant washer, acting as shown in below figure.



2. With the push rod, press the master cylinder body piston just enough to gain access to the lock rings and then remove same.
3. Remove control piston with all its components from master cylinder body.
4. Open up the vice, remove the master cylinder and turn it upside down, while lightly striking the master cylinder body, in order to let out the complete intermediate piston unit, now proceed to disassemble the piston unit into its various parts.

CHECKS AND INSPECTIONS

1. Thoroughly clean all parts with alcohol or brake fluid and dry them with a jet of compressed air.
2. Check and make sure that master cylinder body inner surface is not in any way scored or shows evidence or corrosion. Corroded master cylinder bodies with scored inner surface must be replaced.

ASSEMBLY (BENDITALIA PUMP)

Since the various types of master cylinders available as spare parts are not interchangeable, check the brand name on the master cylinder body prior to replacing parts and make sure that only original spare parts are used.

1. To make reassembly easier, apply a light coating of brake master

cylinder grease (Bremszylinder Paste or DBA Paste), to all gaskets of both pistons and to the master cylinder inner surface.

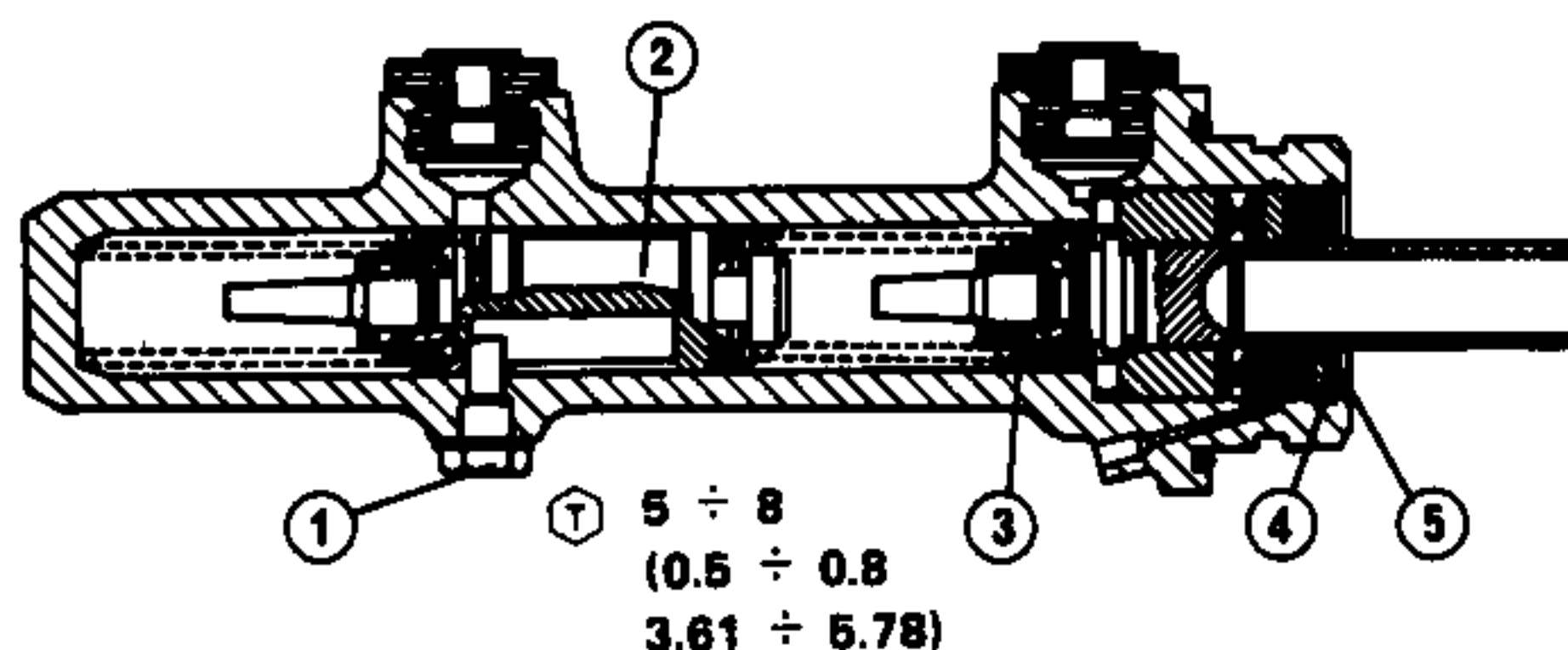
2. Reassemble intermediate piston fitting parts according to the sequence shown in the figure below and paying special attention to gasket orientation.
3. Now fit spring and previously assembled intermediate piston ② into the master cylinder body.
4. Position spline of the intermediate piston towards the hole the stop screw. With a suitable push rod, press the piston till its groove is in line with the hole and then fit the set-screw ①, tightening it according to specified torque.

Ⓣ : Tightening torque

Brake master cylinder setscrew
 $5 \div 8 \text{ N}\cdot\text{m}$
 $(0.5 \div 0.8 \text{ kg}\cdot\text{m})$
 $3.61 \div 5.78 \text{ ft}\cdot\text{lb}$

5. Reassemble rod control piston fitting its various parts according to the sequence shown in the figure below and paying special attention to gasket orientation.

6. Fit spring and pre-assembled piston ③ into master cylinder body.
7. With a suitable push rod pressed against the end washer ④, pack all various parts and then fit the lock ring ⑤.



- | | |
|-----------------------|--------------|
| 1 Setscrew | 4 End washer |
| 2 Intermediate piston | 5 Lock ring |
| 3 Rod control piston | |

Ⓣ $5 \div 8$
 $(0.5 \div 0.8)$
 $3.61 \div 5.78$

Ⓣ N·m
(kg·m
ft·lb)

INSTALLATION

1. Fit brake master cylinder following removal operations in reverse sequence as well as below instructions:

- a. Make sure that the master cylinder to servobrake seal ring is properly fitted into the groove around the master cylinder's flange.

viously disassembled) reassemble the spring hook equalizer without thoroughly tightening bolt.

2. Reconnect to valve the pipe unions of brake system taking care to direction of liquid flow (indicated by crawfeet printed on valve). The valve unions must be tightened to the prescribed torque: $8 \div 10 \text{ N}\cdot\text{m}$ ($0.8 \div 1 \text{ kg}\cdot\text{m}$) ($5.78 \div 7.23 \text{ ft}\cdot\text{lb}$).

3. With the prescribed grease (AGIP F1 GREASE 15), lubricate fork and equalizer of brake pressure regulator and spring support nut of Panhard rod; then, reinstall the control spring.

CAUTION:

Make sure that valve fork is correctly positioned on control spring.

4. Reconnect Panhard rod to body without tightening securing bolt.

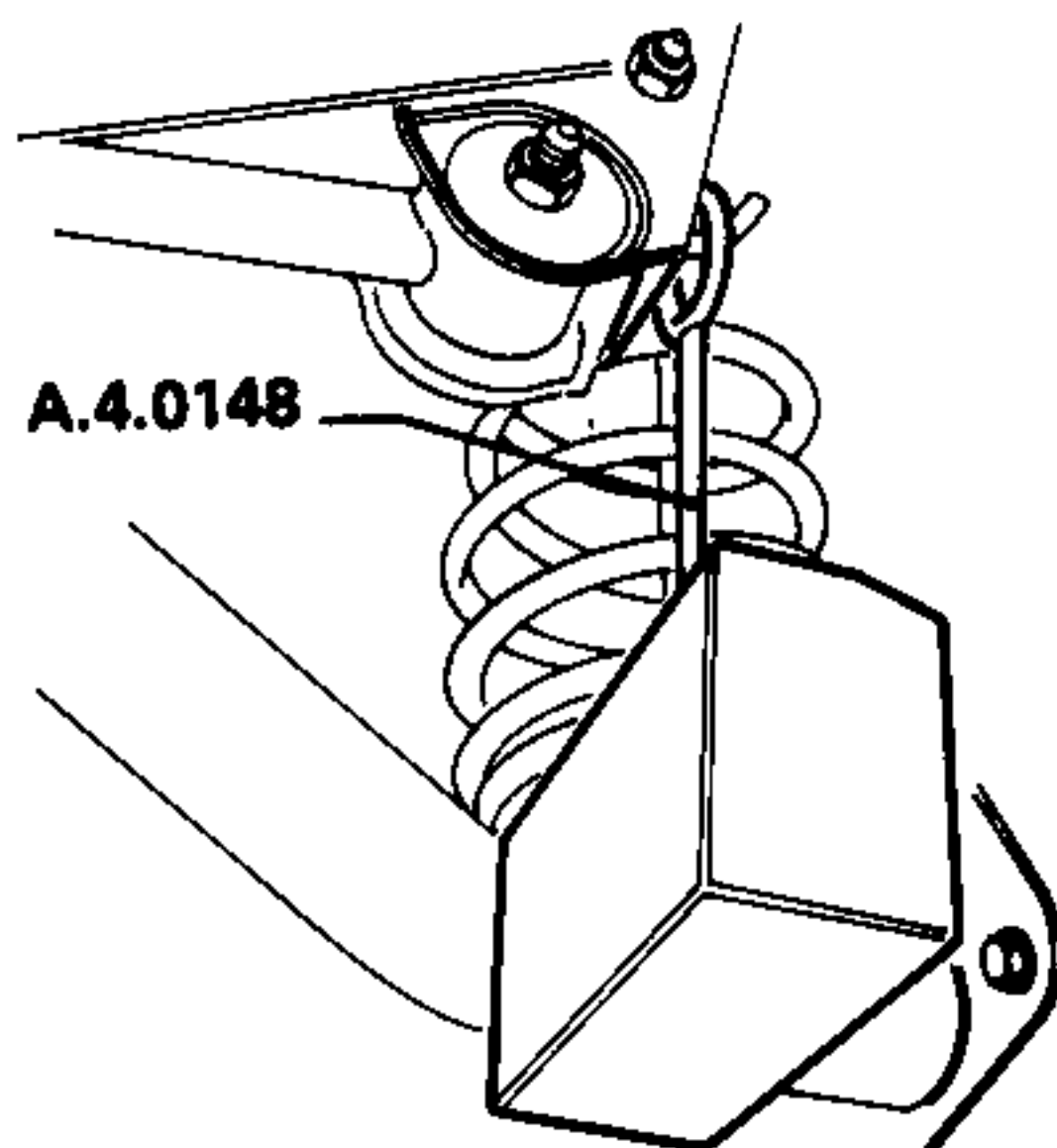
5. Set the car in the nominal attitude corresponding to static load (see: Group 00 - Maintenance of Mechanic Components and Body - Car Attitude Control) and then tighten bolt of Panhard rod to the prescribed torque: $69 \div 85 \text{ N}\cdot\text{m}$ ($7 \div 8.7 \text{ kg}\cdot\text{m}$) ($50.6 \div 62.9 \text{ ft}\cdot\text{lb}$).

6. Carry out adjustment of control spring operating as follows.

CAUTION:

Make sure that equalizer securing bolt is not locked.

(1) Apply to equalizer hook the test fixture A.4.0148 with a 60 N weight (6 kg) (13.23 lb).



(2) Press upward the valve piston up to end of travel and then, tighten equalizer to the prescribed torque by operating the relevant nut and keeping screw still.

T: Tightening torque
Equalizer securing nut
 $39 \div 48 \text{ N}\cdot\text{m}$
($4 \div 4.9 \text{ kg}\cdot\text{m}$)
 $28.9 \div 35.4 \text{ ft}\cdot\text{lb}$

7. Carry out bleeding of brake system (see: Brake System Bleeding) and, if necessary, restore level of brake tank liquid.

The brake pressure regulator valve and the control spring can be disassembled independently from each other.

It must be taken into account that it is necessary to adjust control spring also in case of replacement of one valve only.

SERVOBRAKE

CHECKS AND INSPECTIONS

Verify proper working condition of servobrake by performing following operations:

CAUTION:

Prior to carrying out the test, make sure that the non-return valve on vacuum system works properly (refer to: Vacuum System).

- (1) With engine turned off and with servobrake free of vacuum (having emptied it by pushing brake pedal $5 \div 6$ times), slightly push brake pedal keeping it in that position.
- (2) Start the engine up.
- (3) Keeping pressure on pedal constant, in case of correct vacuum the pedal will go down by itself as a consequence of normal engine effect.
- (4) If on the contrary, during this test the pedal is pushed slightly backward against the driver's foot, it means that the servobrake is not operating properly.

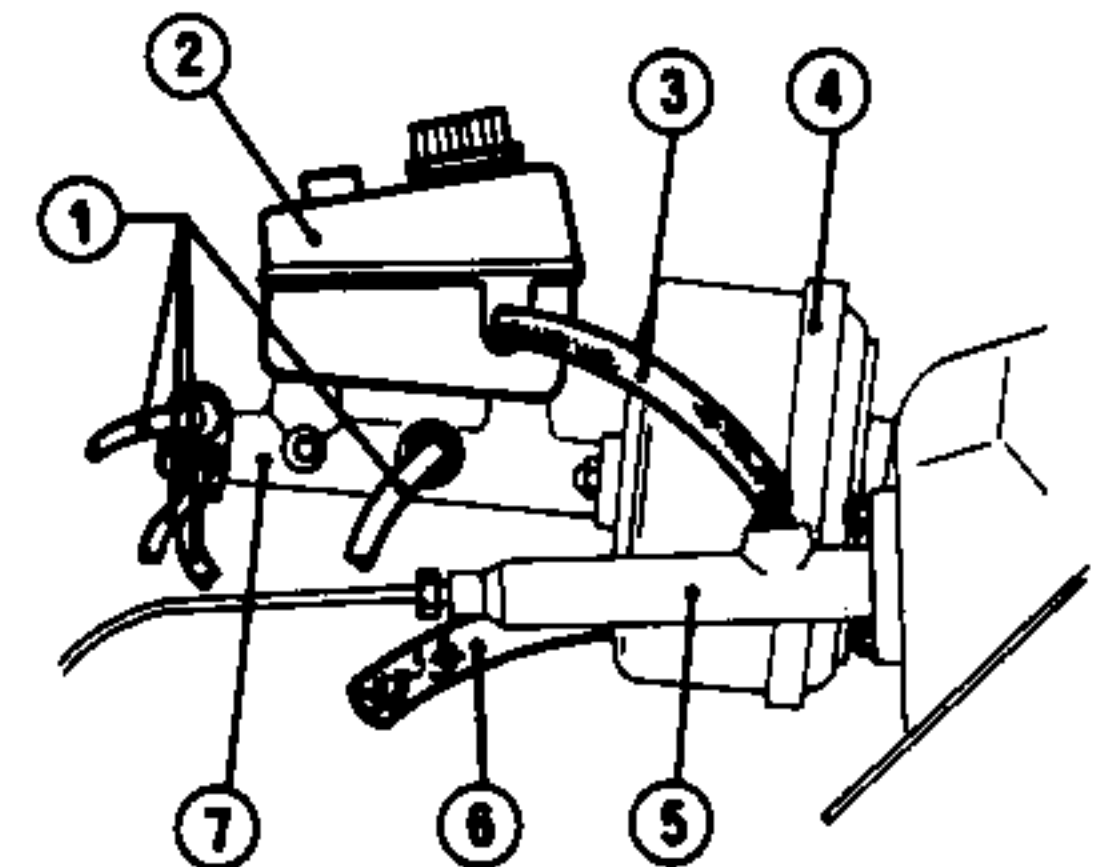
REMOVAL

1. Disconnect electrical wiring and with a syringe empty the brake and clutch system reservoir (2) of its contents.
2. Disconnect clutch master cylinder (5) feeding hose (3) from

reservoir and plug it up to avoid loss of fluid from the master cylinder.

3. Disconnect unions of the four pipes from brake master cylinder (7).

4. Disconnect vacuum intake hose (6) from servobrake union (4).



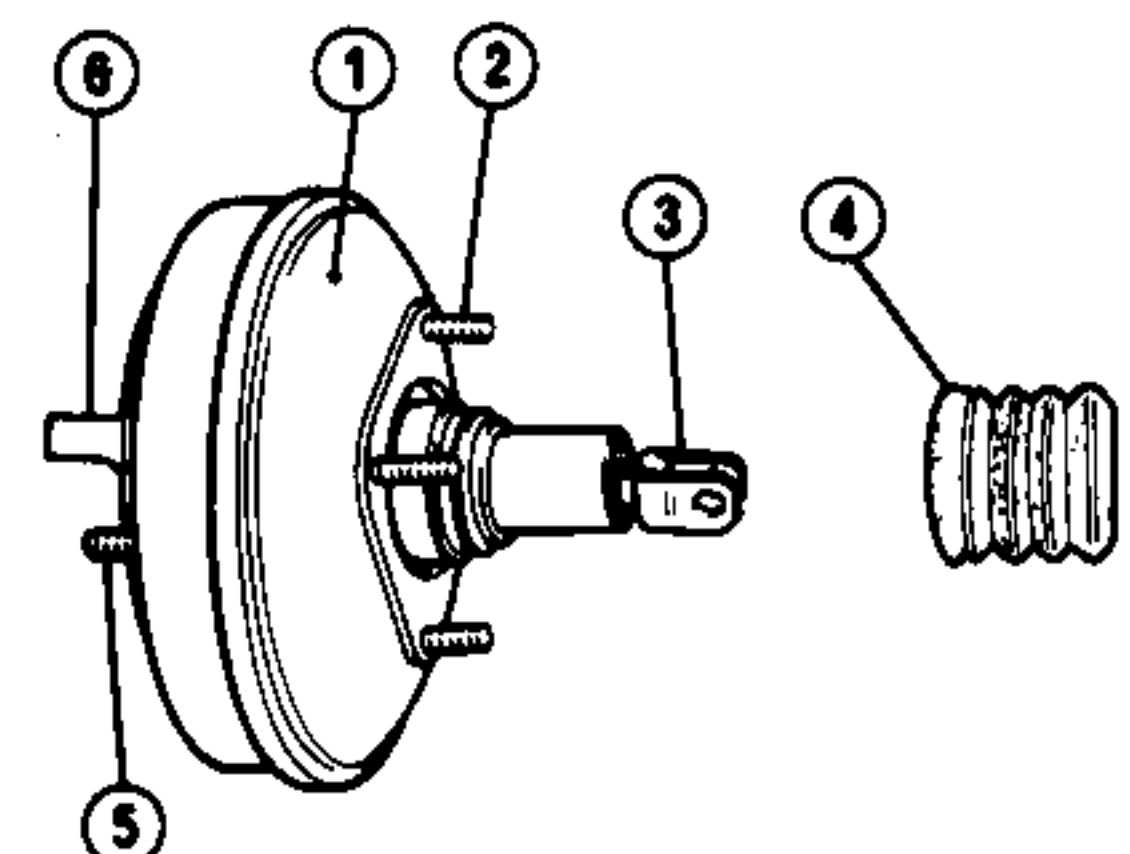
- | | |
|--------------|--------------------------|
| 1 Pipes | 5 Clutch master cylinder |
| 2 Reservoir | 6 Hose |
| 3 Hose | 7 Brake master cylinder |
| 4 Servobrake | |

5. Working from passenger compartment, remove pin and then disconnect control master cylinder fork from brake pedal.

6. Loosen and remove the four servobrake unit retaining nuts and take the unit out of the engine compartment.

7. Separate (on work bench) servobrake master cylinder just by loosening the two relevant retaining nuts.

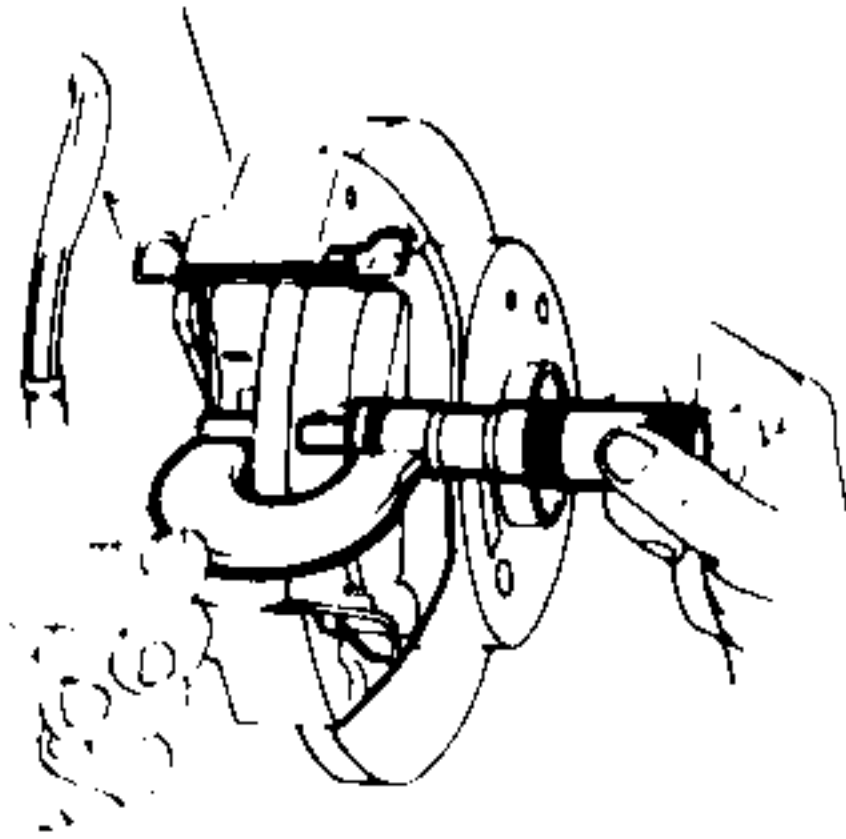
Since in case of failure no repairs are foreseen, meaning therefore that the unit must be replaced, relevant disassembly operations consist only in replacement of the boot, if required, and of the air filter (only on ATE type servobrake).



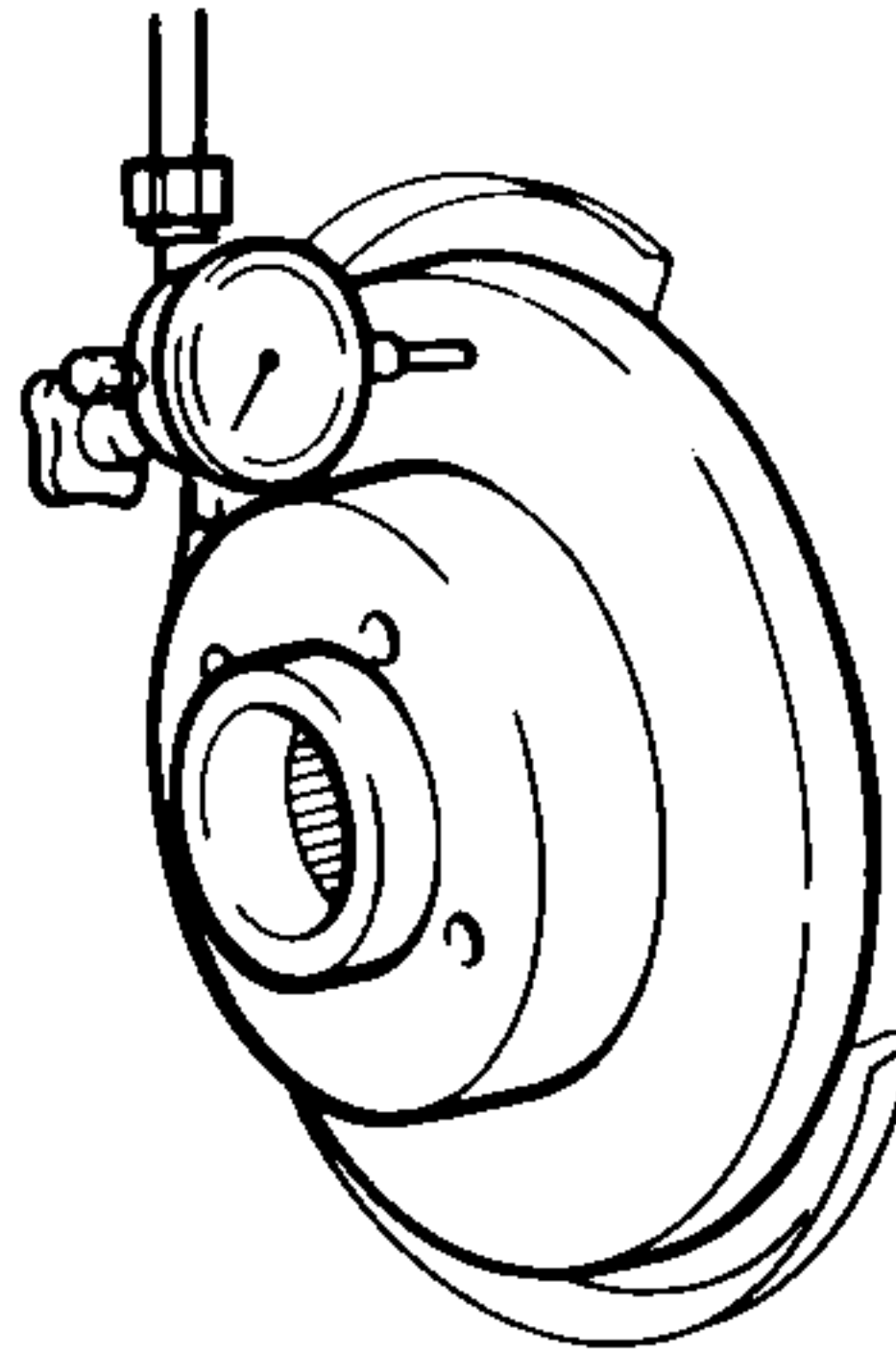
- | |
|-------------------------------------|
| 1 Servobrake body |
| 2 Stud for servobrake securing |
| 3 Control fork |
| 4 Dust cover bellows |
| 5 Stud for master cylinder securing |
| 6 Vacuum system intake union |

FRONT AND REAR BRAKES

Disc thickness



Disc banking



Disc thickness after machining

$$C_{\min} = 10 \text{ mm (0.394 in)}$$

Disc serviceability thickness

$$C_{\min} = 9 \text{ mm (0.354 in)}$$

Max disc banking

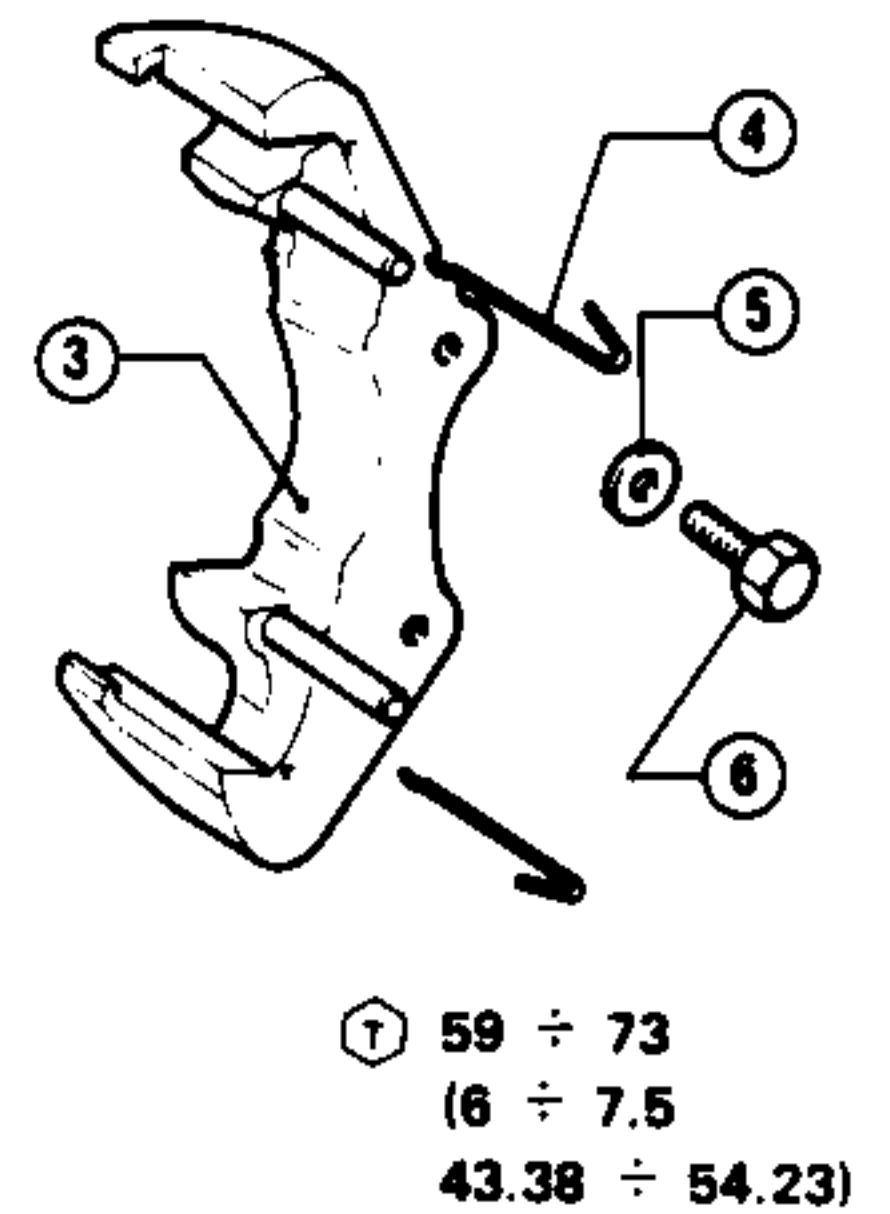
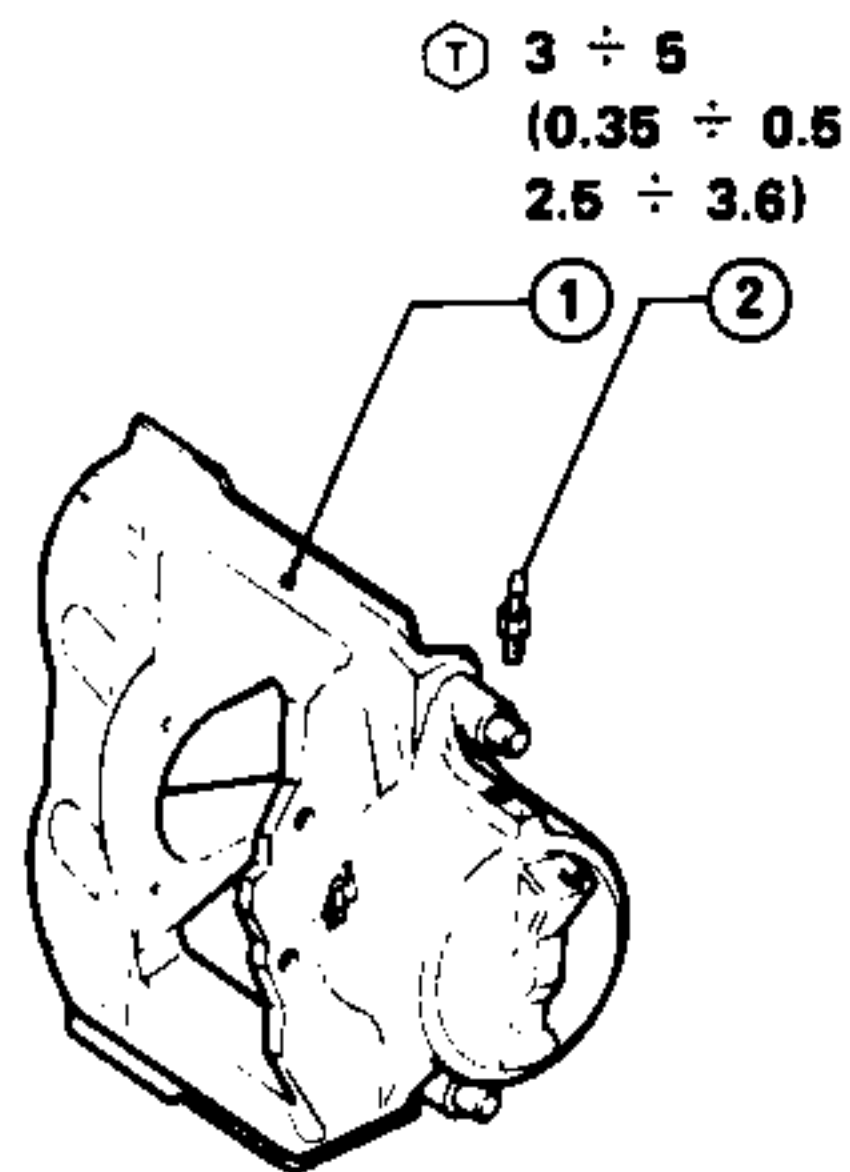
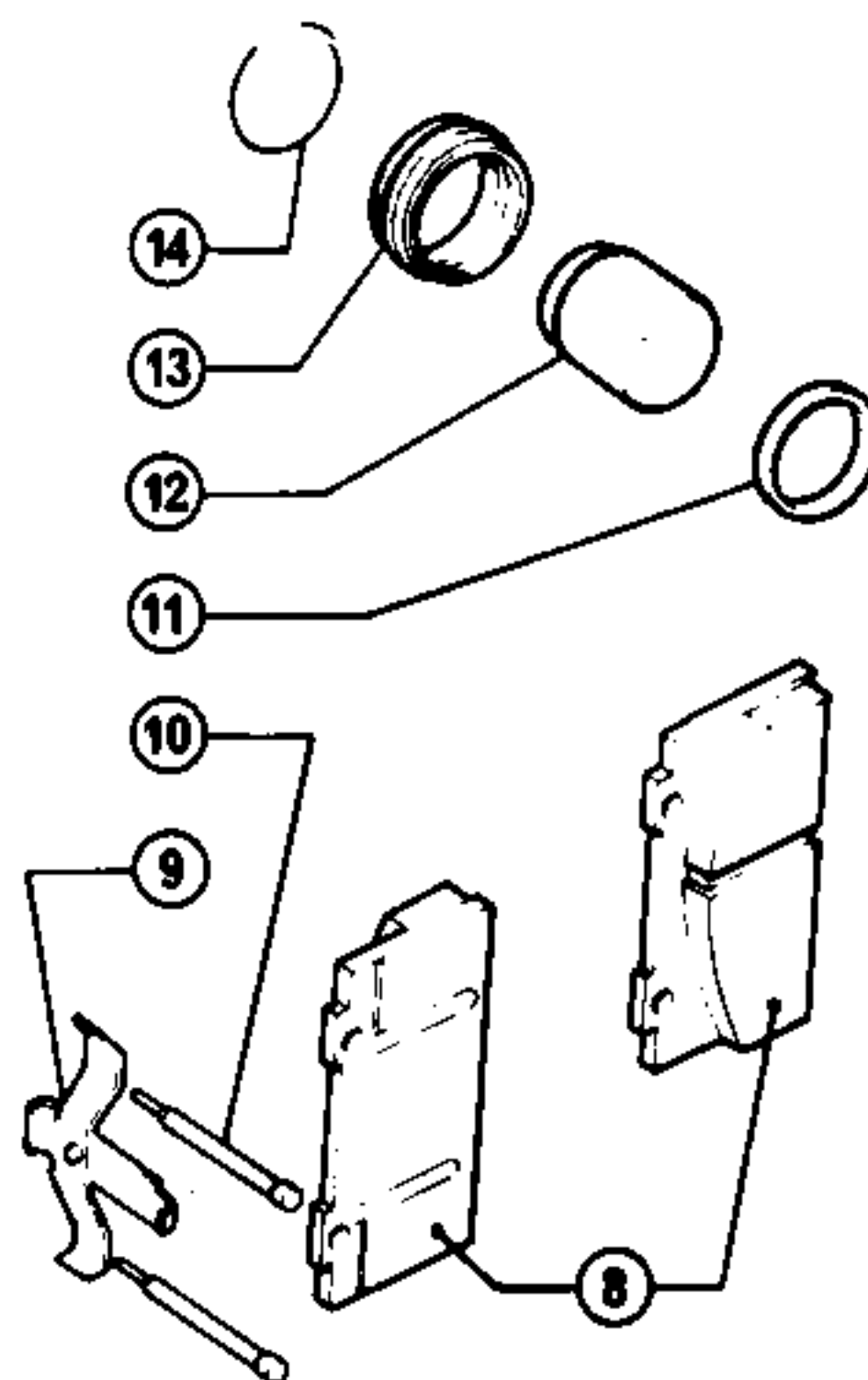
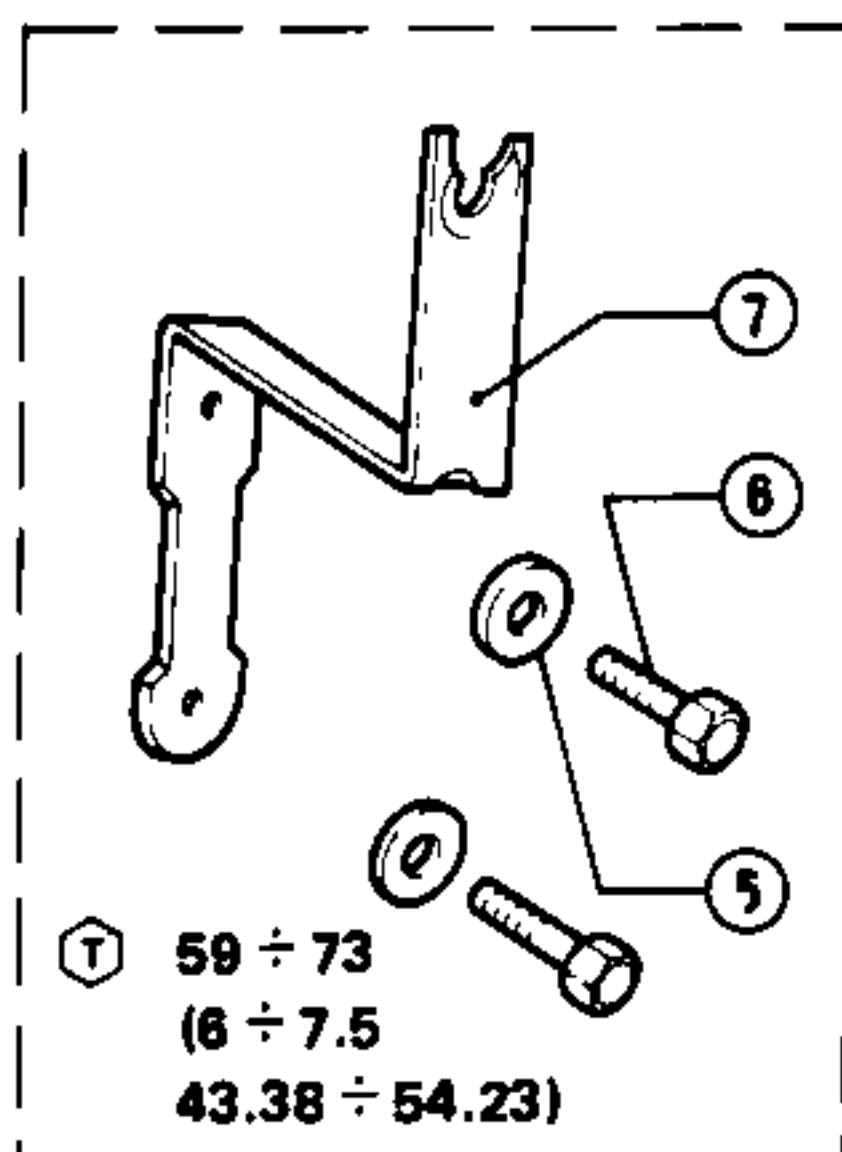
$$0.03 \text{ mm (0.00118 in)}$$

(gauge reading taken at center of disc-pads contact surface)

ATE CALIPER

Solution after arrangement

Solution before arrangement



⊕ N·m
(kg·m
ft·lb)

- | | |
|--------------------|-----------------------|
| 1 Floating caliper | 9 Dowel pin |
| 2 Bleeder | 10 Cross spring plate |
| 3 Caliper support | 11 Seal ring |
| 4 Clip | 12 Piston |
| 5 Washer | 13 Boot |
| 6 Screw | 14 Lock ring |
| 7 Bracket | |
| 8 Pads | |

FRONT AND REAR BRAKES

Checks and inspections

1. Verify cylinder is free from scratches, scorings, wears or oxidations. If required, replace the whole cylinder.
2. Replace, anyway, the components supplied by spare part kit.

Pipe union on control cylinder
 $8 + 10 \text{ N-m}$
 $(0.8 + 1 \text{ kg-m})$
 $5.78 + 7.23 \text{ ft-lb}$

Carry out bleeding from braking system (see: Brake System Bleeding).

3. Contact surfaces, with which shoe linings come into contact, should be fine-finished with emery paper.
4. Using a drum milling cutter, finish brake drum by machining if it shows any evidence of scoring, partial wear or steps on its contact surface.

Reassembly

For reassembly, reverse the order of disassembly and comply with the following.

- a. On reassembly, apply a coat of brake grease or fluid to piston gaskets.
- b. Before reassembling dust covers, lubricate them with brake grease.

Installation

For installation, reverse the order of removal and clamp cylinder on brake holder disc by tightening screws and the brake system pipe union to the prescribed torque.

T : Tightening torques

Screws securing control cylinder to brake holder disc
 $6 + 8 \text{ N-m}$
 $(0.6 + 0.8 \text{ kg-m})$
 $4.34 + 5.78 \text{ ft-lb}$

BRAKE DRUM

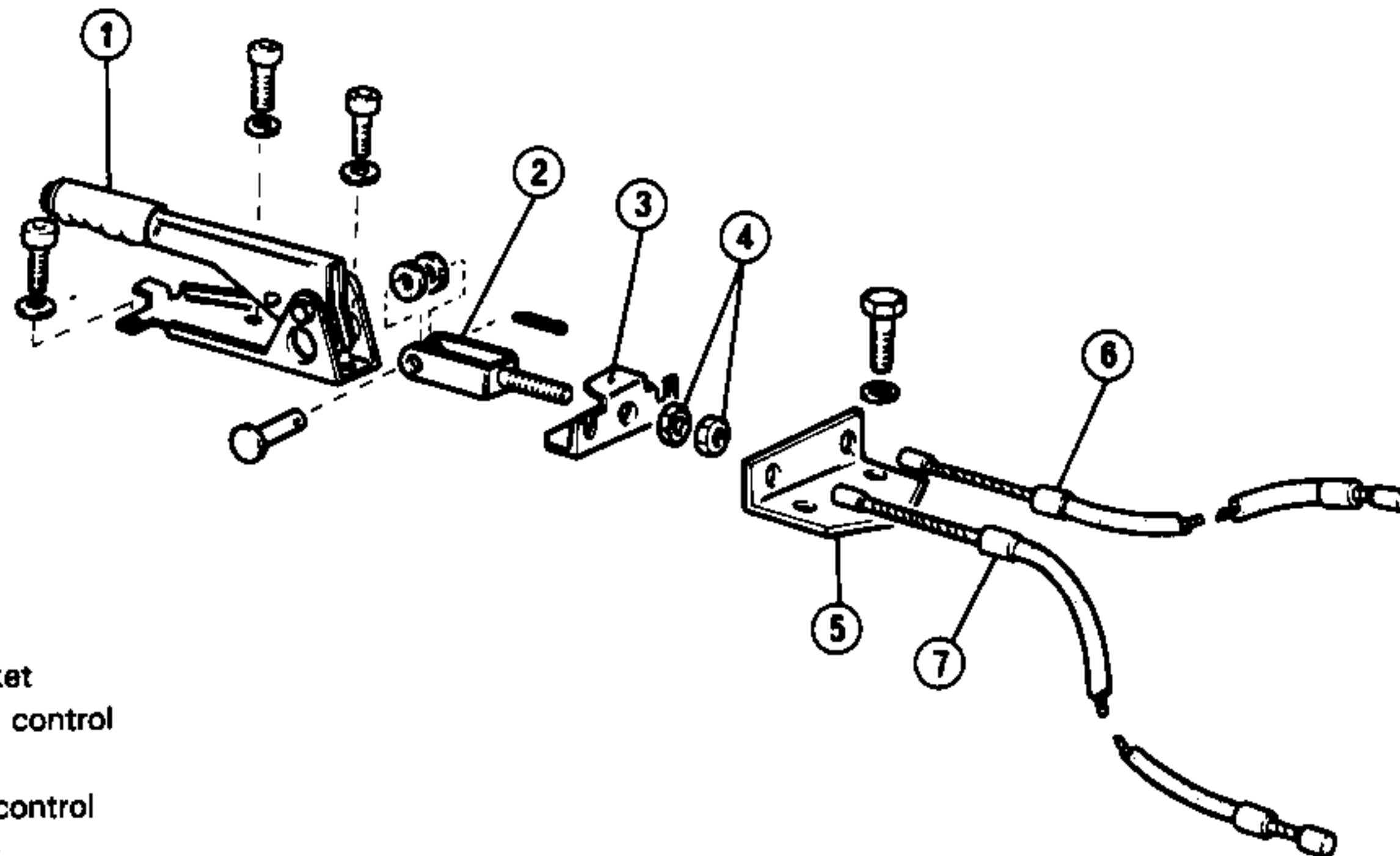
Checks and inspections

1. Check inner diameter of brake drum to make sure it is properly round and tapered. If it is not, repair or replace brake drum.
2. In case of turning of drum working surface, follow the tolerances provided in Service Data and Specifications, item "Inspection and Adjustment".

Serviceability limit dimension
Max internal diameter
229.6 mm (9.04 in)

Limit values after drum grinding
Max internal diameter
229.1 mm (9.02 in)
Roundness error:
 $< 0.03 \text{ mm (0.00118 in)}$
Concentricity error:
 $< 0.08 \text{ mm (0.00315 in)}$

PARKING BRAKE



- | | |
|-------------------------------|-----------------------|
| 1 Lever | 5 Bracket |
| 2 Fork | 6 Right control cable |
| 3 Equalizer | 7 Left control cable |
| 4 Adjustment nut and lock nut | |

CONTROL LEVER

REMOVAL

1. Operating from the driver's compartment, remove rear console.

2. Operate on adjustment lock nut (4) and nut (3), so as to loosen the cables and withdraw them from the bracket (5).
3. Unscrew the three screws (2)

securing lever (1) with support to body and disconnect the electrical contact of the parking brake indicator. Remove lever (1) together with support, recovering the spacers

FRONT AND REAR BRAKES

REINSTALLATION

Lubricate the spring on the cable terminal, wheel side and the adjustment fork screws with specified

grease (AGIP F1 Grease 15 or SHELL RETINAX G11). Reinstall cables by reversing order of removal,

then adjust parking brake and wheel bearings (see: Group 00 - Chassis and Body Maintenance).

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

FRONT BRAKES

Caliper type: ATE or DBA

Pad colours	LIGHT BLUE (FRENO) BLACK (FERODO)
Pad nominal thickness "S"	15 mm (0.590 in)
Disc external diameter	239 mm (9.409 in)
Disc nominal thickness "C"	11 mm (0.433 in)

REAR BRAKES

DRUM:	
Category n.	115.151
Drum nominal internal valve	228.6 + 0.2 mm (9 + 7.9 · 10 ⁻³ in)
Braking gasket thickness	5 mm (0.197 in)

BRAKE MASTER CYLINDER

Type: BENDITALIA or ATE	
Diameter	20.64 mm (0.812 in)
Stroke	32 mm (1.4 + 1.8) 1.26 in (0.55 + 0.71)

SERVOBRAKE

Type: BENDITALIA or ATE	
Diameter of working cylinder	7 in

BRAKE PRESSURE REGULATOR VALVE

Type: BENDITALIA

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Application	Type	Denomination	Q.ty
Brake hydraulic system reservoir	OIL	ATE "S" Std. 3681-69905 AGIP F1 Brake Fluid Super ED Std. 3681-69905 IP Auto Fluid FR Std. 3681-69905	
Wheel cylinder Brake seal ring Brake piston Dust covers	GREASE	ATE Bremszylinder Pasta DPA Pasta	

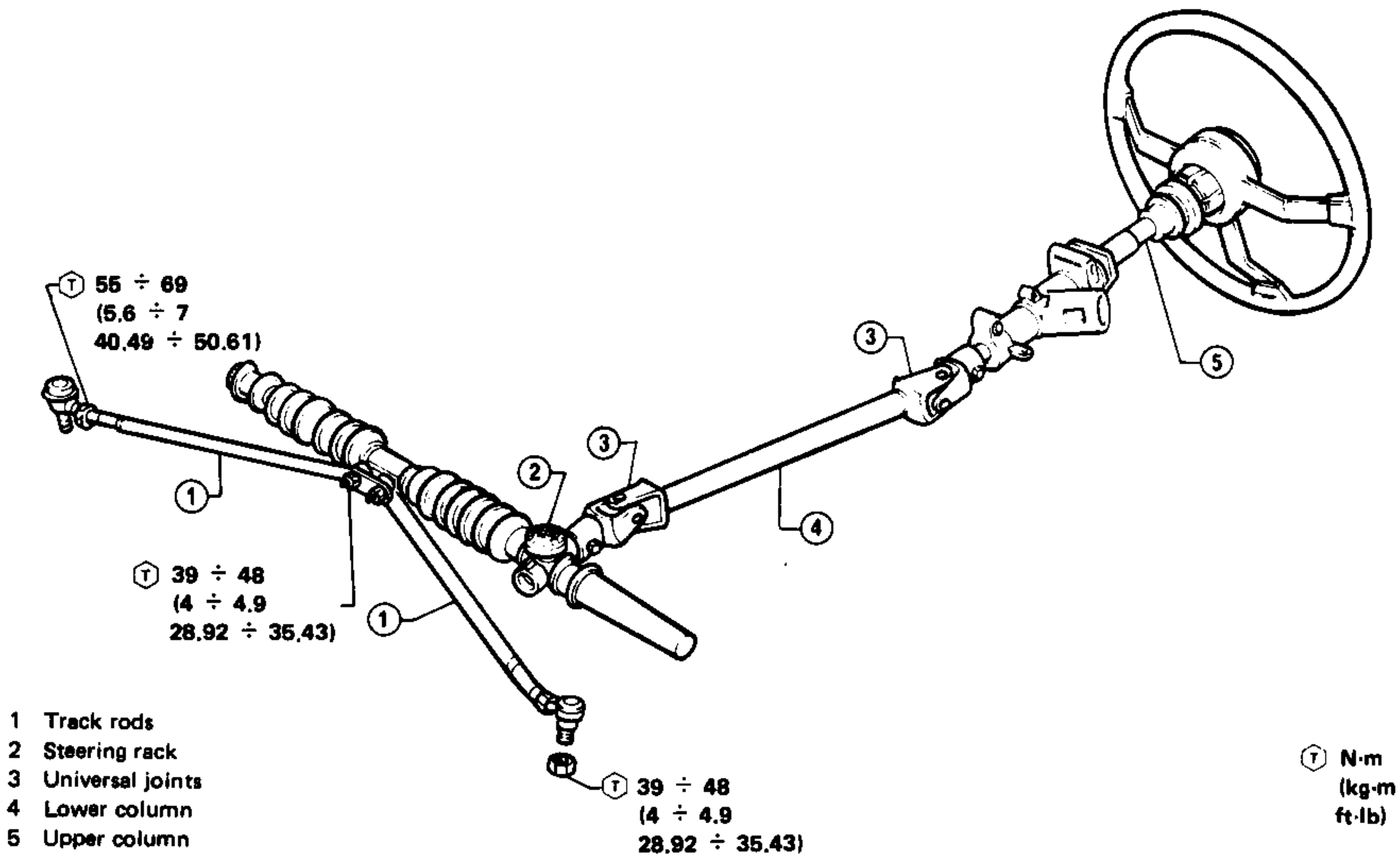
FRONT AND REAR BRAKES

Condition	Probable cause	Corrective action
Poor braking effect (continued)	<ul style="list-style-type: none"> • Deterioration of linings or pads • Local fit of linings or pads • Master cylinder or wheel cylinders in poor condition • Frozen or seized caliper pistons on disc brakes • Binding mechanical linkage at brake pedal and shoes 	<p>Replace linings and/or pads. If necessary grind discs and turn drums</p> <p>Replace linings and/or pads. If necessary grind discs and turn drums</p> <p>Repair or replace</p> <p>Disassemble caliper and free up as required</p> <p>Free up as required</p>
Unbalanced brakes	<ul style="list-style-type: none"> • Improper tire inflation • Improper adjustment of shoes-to-drum clearance • Grease oil mud or water on linings or pads • Mud in brake drum • Excessive wear or deterioration of linings or pads • Wheel cylinder in poor condition • Poor sliding condition of brake shoe • Looseness of cylinder body or back plate securing bolts/nuts • Scored or out-of-round drums • Brake pressure regulator incorrectly adjusted or not efficient • Deteriorated wheel cylinder seal rings • Incorrect adjustment of wheel bearings • Incorrect adjustment of wheel alignment 	<p>Inflate to correct pressure</p> <p>Readjust</p> <p>Clean brake mechanism and check for cause of problem. Replace linings or pads</p> <p>Clean</p> <p>Replace</p> <p>Repair or replace</p> <p>Adjust</p> <p>Fasten or replace</p> <p>Recondition or replace brake drum as required. Check for improper lining contact with drum and grind lining if necessary</p> <p>Adjust or overhaul (if required) or replace brake pressure regulator</p> <p>Recondition or replace cylinder</p> <p>Adjust</p> <p>Adjust</p>
Brakes fade	Use of improper linings or brake linings are contaminated	Replace linings

FRONT AND REAR BRAKES

Condition	Probable cause	Corrective action
Brake chatters	<ul style="list-style-type: none"> • Groove or out-of-round brake drum or rotor • Loose or bent support plate • Distorted brake shoes or pads • Grease or brake fluid on linings 	<p>Grind or replace as required</p> <p>Tighten support plate bolts to specified torque or replace plate</p> <p>Replace as necessary</p> <p>Replace linings</p>
Brake squeals	<ul style="list-style-type: none"> • Dirty or scored brake drums • Distorted brake shoes or bent support plate • Weak or broken brake shoe retaining spring or return spring • Glazed or contaminated brake lining 	<p>Blow out assembly with compressed air or refinish drum</p> <p>Replace faulty unit</p> <p>Replace if faulty</p> <p>Cam ground lining to eliminate glaze. If it does not, replace linings</p>
Brakes drag	<ul style="list-style-type: none"> • Pedal linkage is binding or output rod adjustment is too long • Master cylinder compensator part is obstructed • Seized master cylinder piston • Poor shoe condition • Poor wheel cylinder condition • Deformation of piston cups • Poor condition of caliper because of faulty piston seals • Excessive runout of rotor • Parking brake will not return • Clogged master cylinder return port • Clogged brake lines • Incorrect adjustment of wheel bearings • Improper shoe-to-drum clearance • Weak shoe return springs • No free travel in brake shoe return 	<p>Lubricate linkage check pedal return spring for condition and adjust output rod as necessary</p> <p>Blow out foreign matter with compressed air</p> <p>Disassemble master cylinder and replace piston. Bleed system</p> <p>Clean and repair</p> <p>Repair or replace</p> <p>Replace</p> <p>Replace piston seals</p> <p>Turn rotor on lathe or replace</p> <p>Check and repair</p> <p>Clean</p> <p>Check and clean</p> <p>Adjust</p> <p>Inspect auto-adjuster operation</p> <p>Replace</p> <p>Adjust pedal height</p>

STEERING SYSTEM



GENERAL DESCRIPTION

Steering is by rack and pinion. The track rods are connected to the centre of the rack by means of flexible joints. Owing to their length,

they reduce the variation of wheel movement resulting from suspension movements. The steering column is in two sections. The lower part

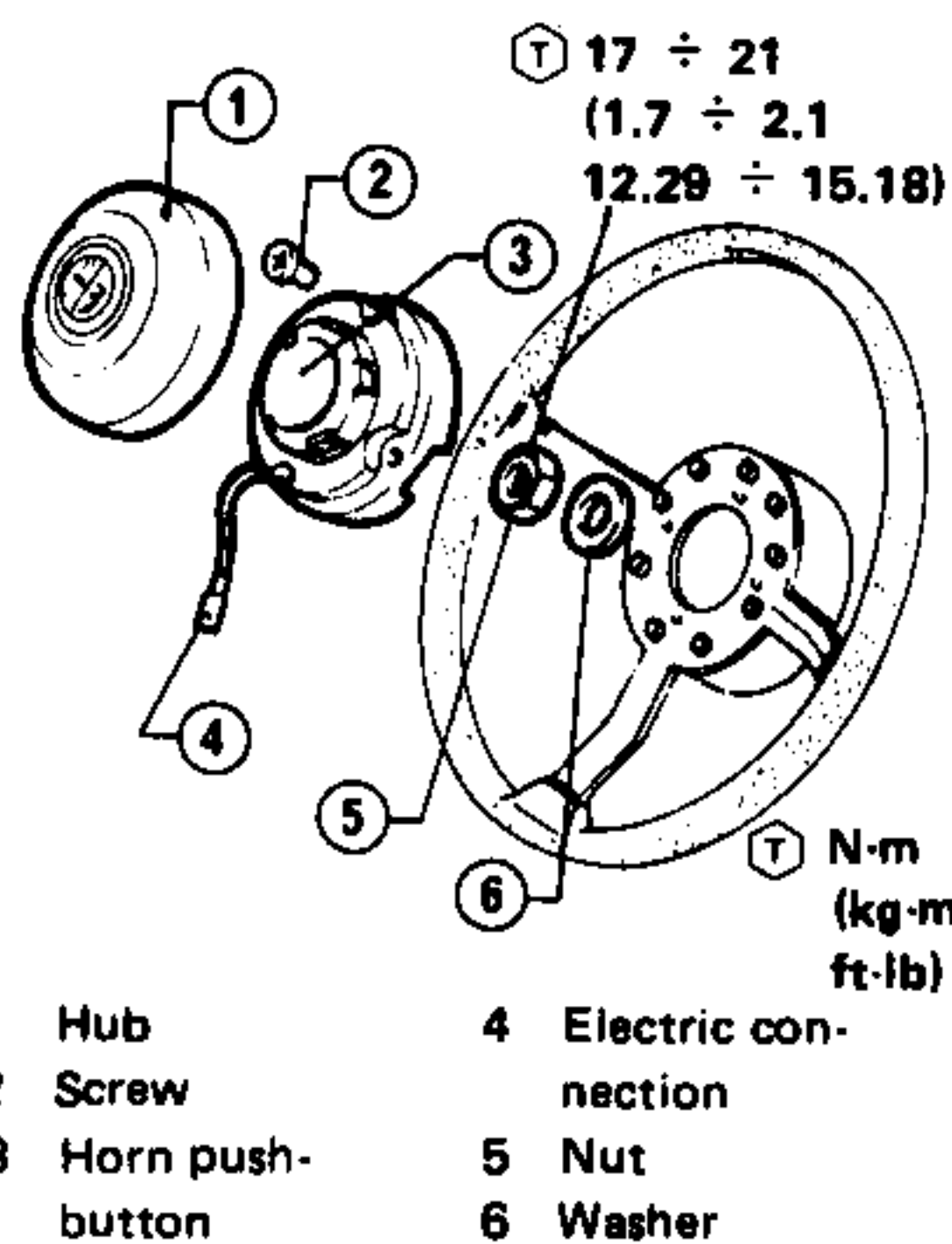
is positioned so as to collapse under axial loads. The upper part is pivoted to allow adjustment of the steering column height.

STEERING WHEEL AND COLUMN

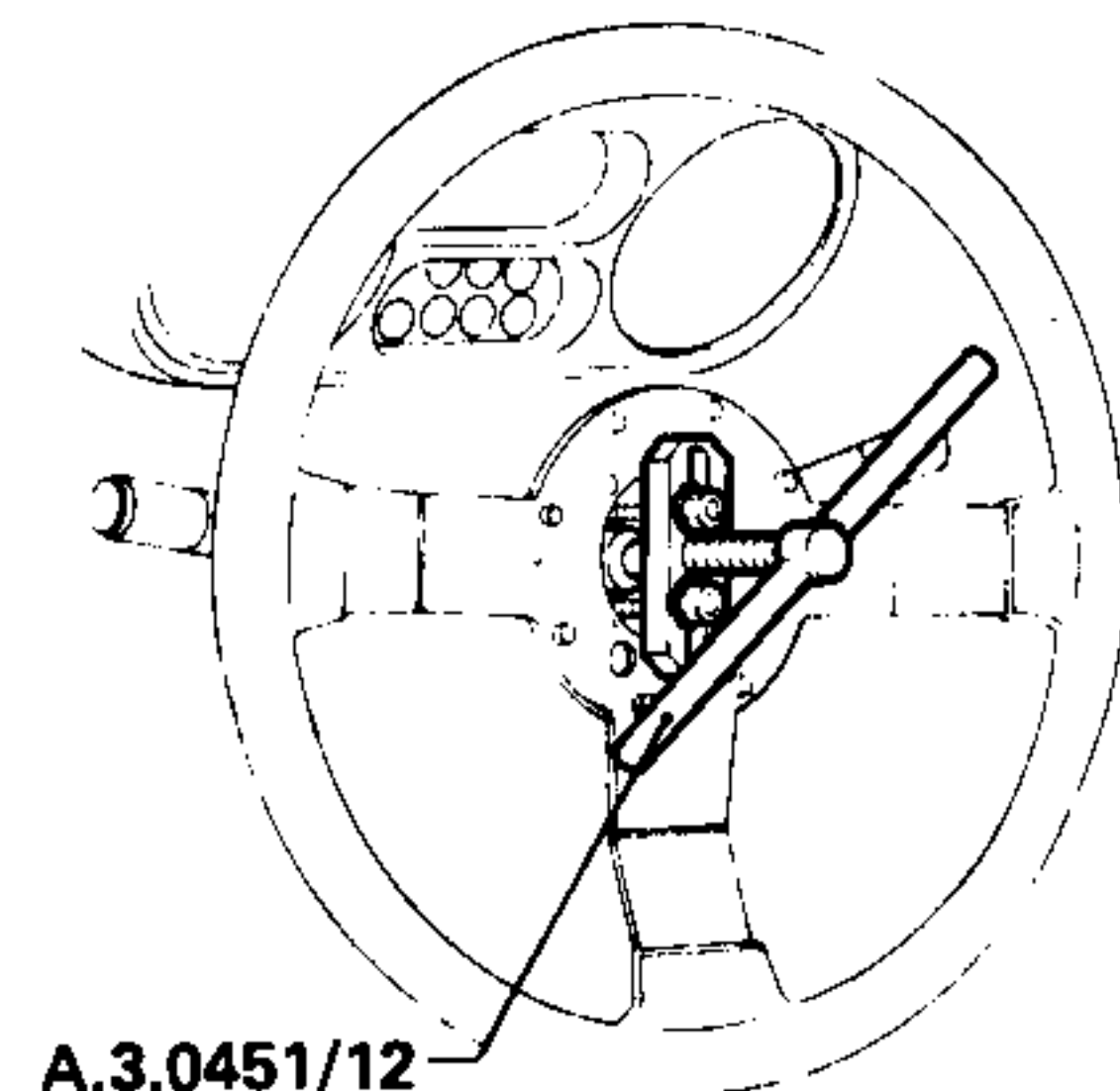
STEERING WHEEL

REMOVAL

1. Remove hub (1), to gain access to screws (2) securing warning horn pushbutton (3) on steering wheel and remove them.
2. Disconnect electric connection (4) of warning horn pushbutton and remove it.
3. Unscrew and remove nut (5) with washer (6) securing steering wheel to column.



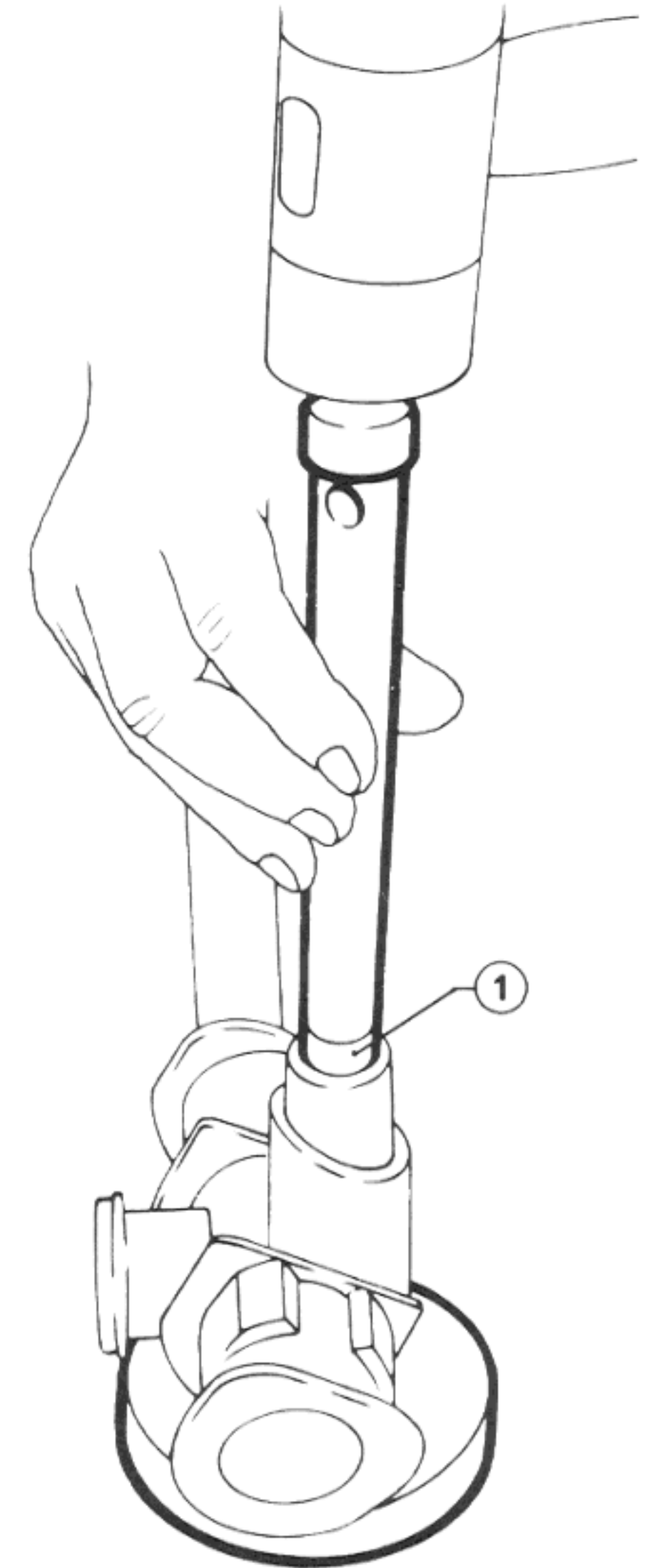
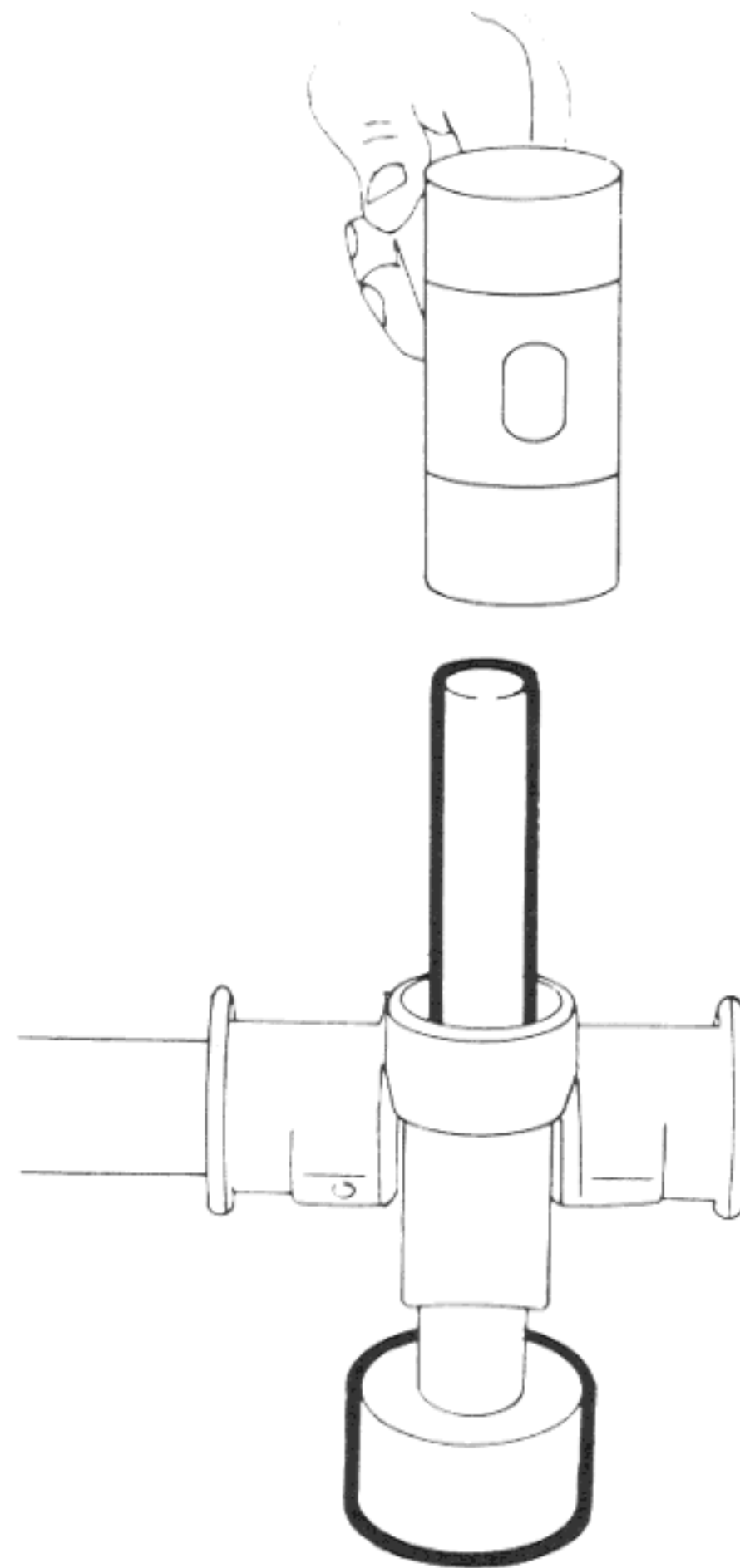
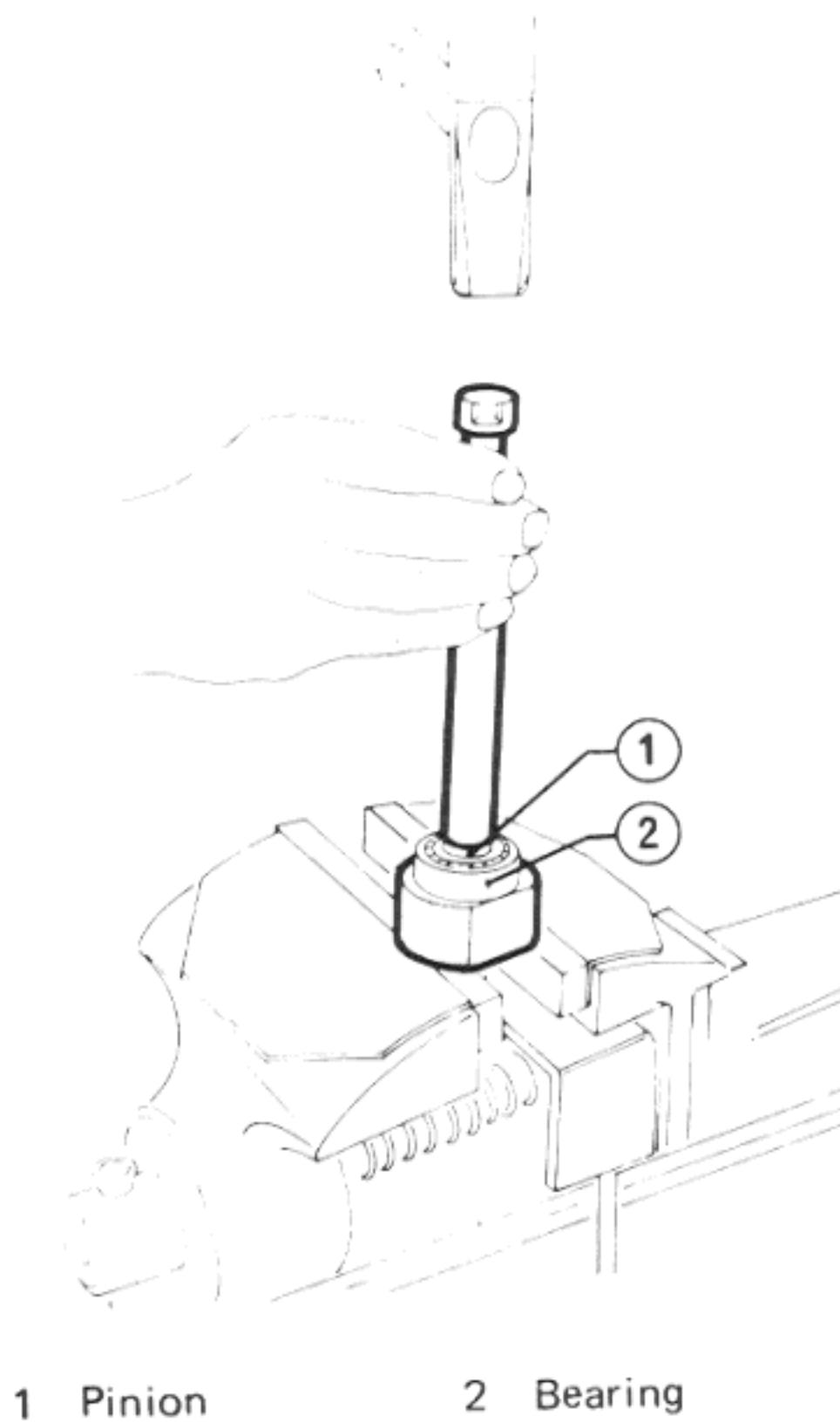
4. By means of tool A.3.0451/12 withdraw steering wheel from column operating as per figure.



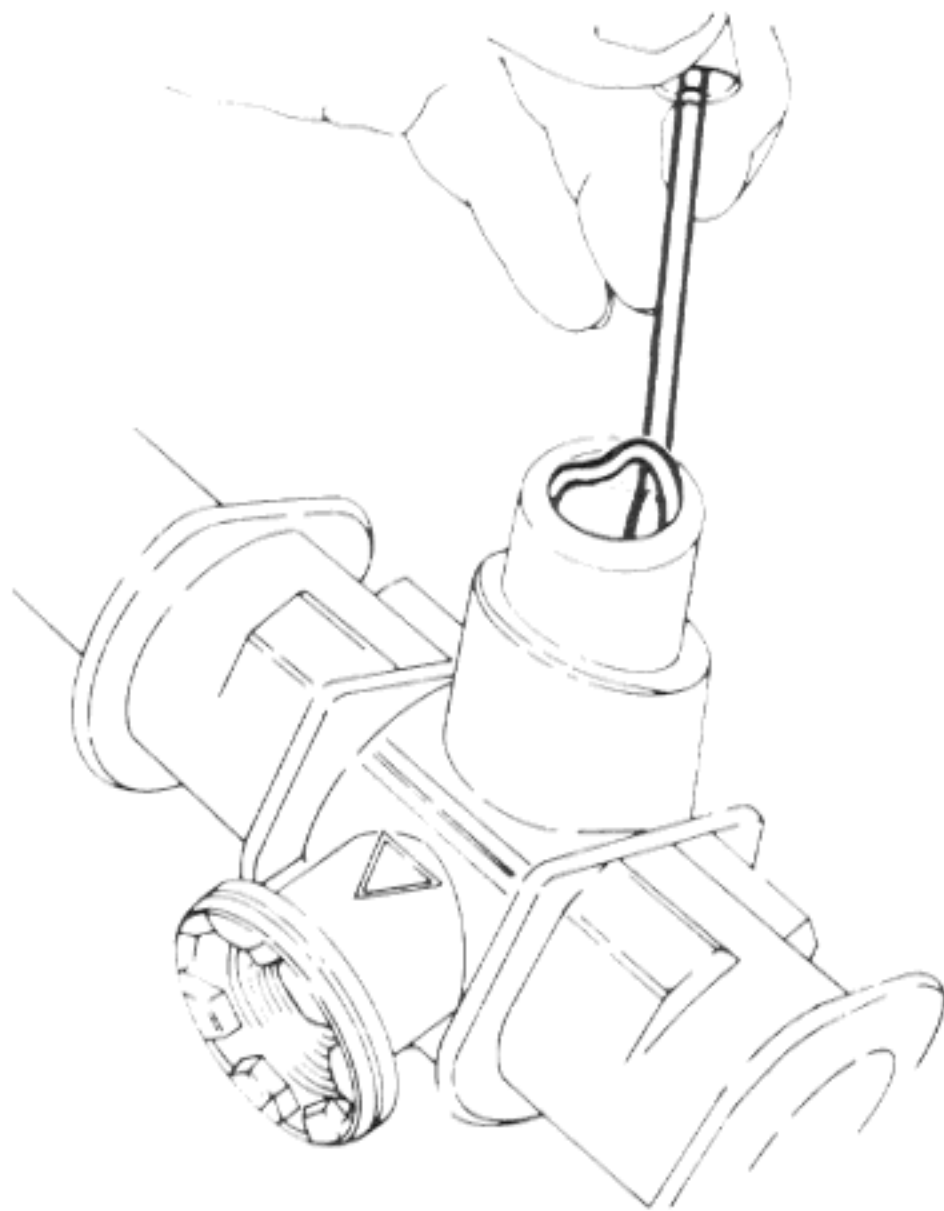
ASSEMBLY

Assemble in reverse order to disassembly and note the following instructions.

1. Assemble pinion selflubricating bush into steering box by means of a suitable tool, then insert a **new** seal ring.



12. Remove seal ring from steering box.



13. Extract pinion bush from steering box by means of a pin and of a suitable base.

CHECKS AND INSPECTIONS

Clean all components carefully.

RUBBER BOOTS

Verify good conditions of rubber boots, presence of cracks or incisions make replacement necessary.

RACK

Verify rack teeth and pinion surfaces and check they do not show oxide traces, indentations or deep scratches.

SELF-LUBRICATING BUSHES

Verify selflubricating bushes of sliding sleeve and steering box do not have too heavy traces.

RACK BOX AND GUIDE TUBE

Verify the operating surface of pinion and of rack guide tube is smooth and does not wear traces in correspondences of the bushes operating seats.

1 Selflubricating bush

2. Assemble bearing on pinion by means of a plastic hammer and a base.

COIL SPRINGS

REMOVAL

Remove coil springs with the same procedure followed for removal of shock absorbers; only remember not to disjoin shock absorber from upper body coupling.

CHECKS AND INSPECTIONS

1. Verify the springs has no stretches or deformations.
2. Verify spring efficiency by comparing its stiffness values with the prescribed ones (see: Service Data and Specifications).
3. Check wear status, verify presence of damages or deformations of rubber components. Replace if necessary.

INSTALLATION

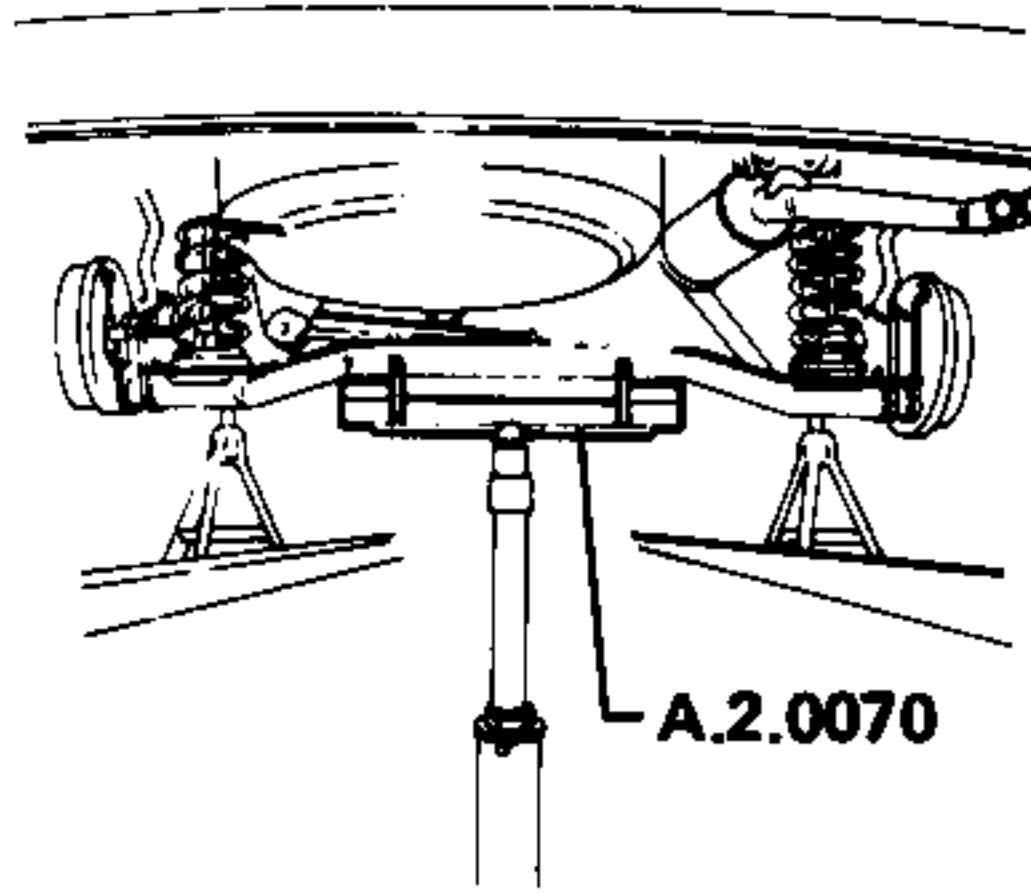
Assemble coil springs onto car again in the inversed order of removal and bear in mind all indications and notes reported in paragraph Shock Absorbers - Installation.

REAR RIGID AXLE

REMOVAL AND INSTALLATION

Place car on hoist bridge, support its rear part by placing some stands in the jack seats and remove the whole rear suspension as follows.

1. Remove wheels.
2. Working from passenger compartment, remove rear console for parking brake equalizer to be accessible. Then act on adjustment fork nut and lock nut and loosen parking brake control cables as much as to allow their releasing from equalizer, extract them from sheath locking bracket.
3. After providing the column hoist with support **A.2.0070**, remove coil springs with caps and gaskets (see: Coil Springs - Removal).



4. Slightly lift column hoist and remove the previously loosened tie rod and Panhard bar bolts.
5. Slowly lower hoist driving the axle and extracting the brake adjustment spring from stud on the Panhard bar.

Assemble again the whole suspension on the car by the inversed procedure than for removal.

IMPORTANT

- With static load car (see: Group 00 - Maintenance of Mechanical Components and Body) set the bolts securing tie rods and Panhard bar to the prescribed torque.

T : Tightening Torque
Tie rod and Panhard bar securing bolts
 $33.35 \div 38.26 \text{ N}\cdot\text{m}$
 $(3.4 \div 3.9 \text{ kg}\cdot\text{m})$
 $24.58 \div 28.2 \text{ ft}\cdot\text{lb}$

- Lubricate with prescribed grease (AGIP F1 Grease 15) the hole in the brake adjustment spring support stud on the Panhard bar and the fork.
- Carry out brake adjustment spring calibration (see: Group 22 - Brake Adjustment).
- Set the brake hydraulic system connections to the prescribed torque and perform air bleeding (see: Group 22 - Brake System Air Bleeding).

T : Tightening Torque
Rigid tube connections
 $7.85 \div 9.8 \text{ N}\cdot\text{m}$
 $(0.8 \div 1 \text{ kg}\cdot\text{m})$
 $5.78 \div 7.23 \text{ ft}\cdot\text{lb}$

Flexible hose connections

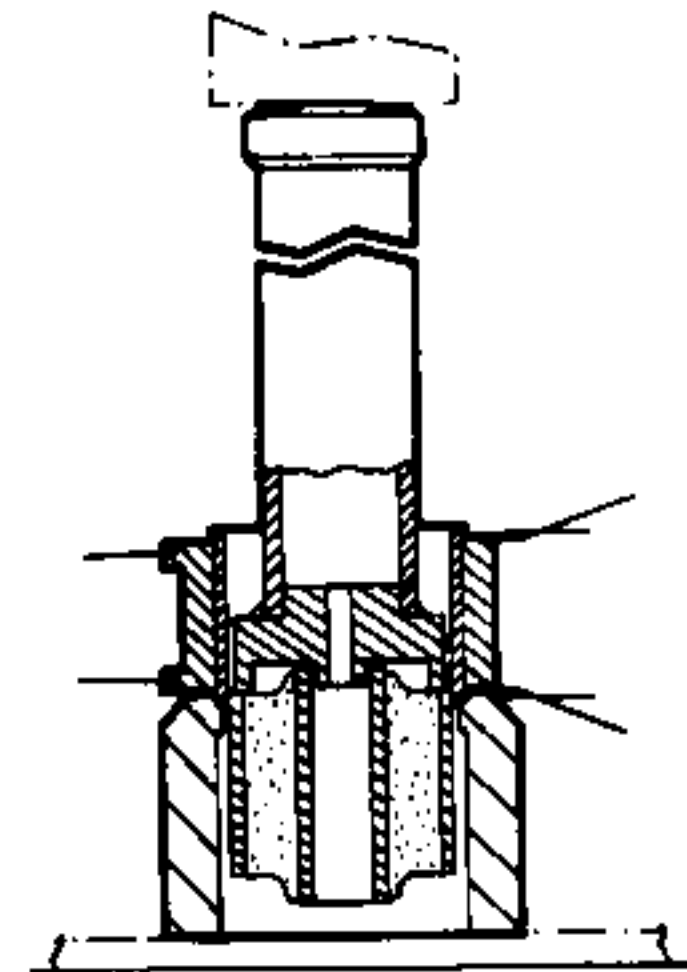
$9.8 \div 14.7 \text{ N}\cdot\text{m}$
 $(1 \div 1.5 \text{ kg}\cdot\text{m})$
 $7.23 \div 10.85 \text{ ft}\cdot\text{lb}$

- Adjust parking brake lever stroke (see: Group 00 - Maintenance of Mechanical Components and Body).

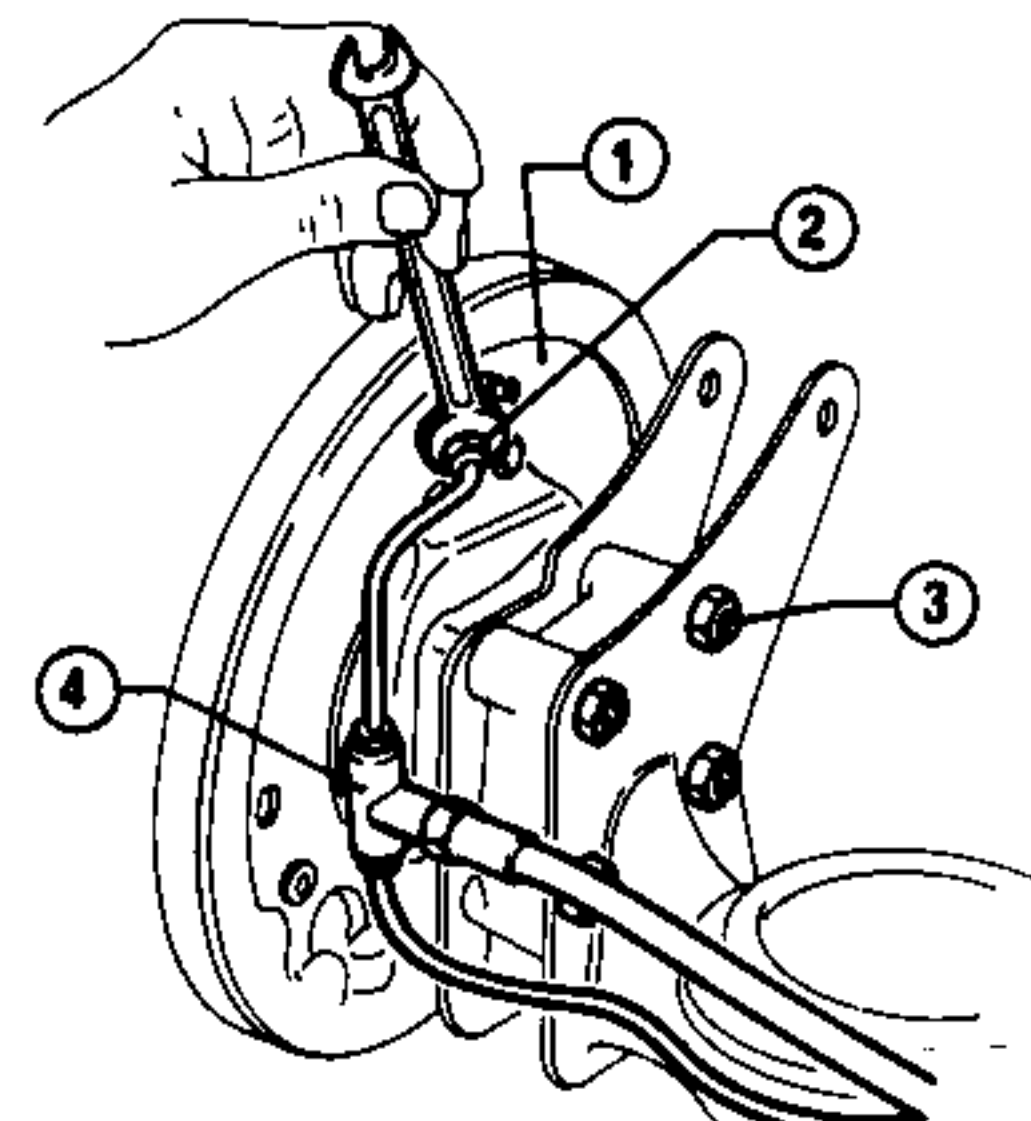
REMOVAL

If necessary, disassemble axle as follows:

1. Release and remove bolts securing tie rods to axle; remove tie rods.
2. If necessary, disassemble silent-blocks from tie rods and Panhard bar by using adequate bases and extractors.



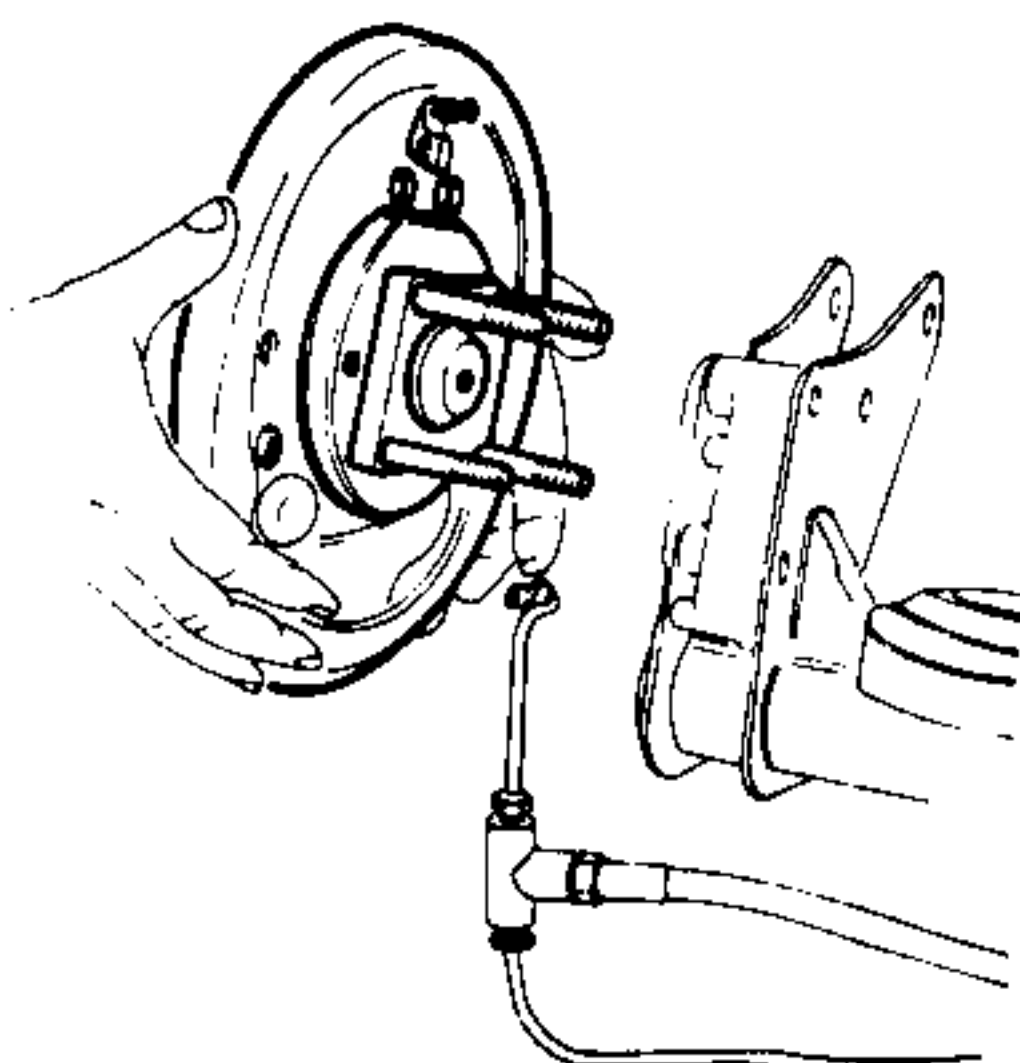
3. Extract dust cover from brake drum and caulk wheel hub nut. Remove nut and drum complete with hub and bearings.
4. Screw out connection ② of brake hydraulic system rigid tube on jaw control cylinders and remove rear tubes ④.
5. Screw out and remove nuts ③ fastening stem pin and brake shoe plate ① to rear axle.



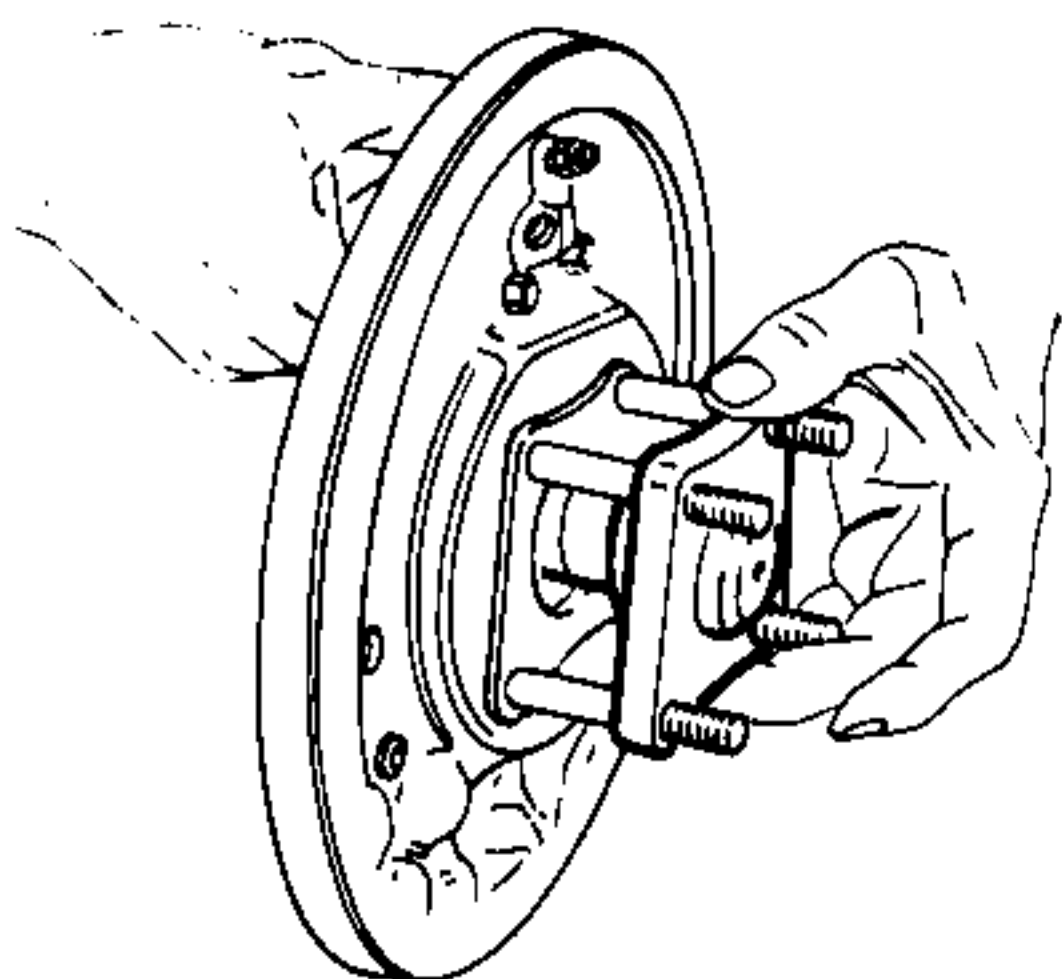
- | | |
|--------------------|--------------|
| 1 Block shoe plate | 3 Nuts |
| 2 Connection | 4 Rear tubes |

REAR SUSPENSION

6. Extract block shoe plate complete with stem pin.



7. Separate from block shoe plate the stem pin and the stud bolt plate.



CHECKS AND INSPECTIONS

Rear axle

Verify the rear axle has no deformations or cracks. Check in particular axle flanges in correspondence of tie rods and stem pin.

Stem pin

By dye penetrant check stem pin surface integrity. In particular check the bearings seats and the threaded end have not suffered damages.

Stud bolt plate

Check plate integrity and the stud bolt threads are not damaged. If necessary, replace.

Tie rods and Panhard bar

Check the tie rods have no deformations. Check silentblock conditions without extracting them from tie rods or from Panhard bar. Replace the silentblocks that show flaws, deformations or other damages.

Brake system rear tubes

Verify rigid tubes are not deformed or corroded and flexible hoses are in good conditions.

RE-ASSEMBLY

Re-assemble rear axle by the inversed procedure to removal and remember the following:

- When re-assembling, lubricate with prescribed grease the bearings and their seats, external surface of seal ring, and introduce a defined quantity of grease into hub inner cavity and into dust cover (see: Service Data and Specifications: Fluids and Lubricants).
- For silentblock re-assembly, make introduction easier by lubricating their external surface with prescribed fluid (UNION CARBIDE CHEMICALS COMPANY: Ucon Lubricant 50 HB-5100 or MILLOIL Lubricant for elastomer seal) then introduce them into the relevant seats by suitable bases and drivers.
- Take the nuts on the stud bolts connecting stem pin to rear axle to the prescribed torque.

T : Tightening Torque
39,2 48.1 N·m
(4 ÷ 4.9 kg·m
28.92 ÷ 35.43 ft·lb)

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

SHOCK ABSORBER

Shock absorber type	double acting hydraulic
Piston rod diameter mm (in)	11.92 ÷ 11.94 (0.4693 ÷ 0.4701)
Stroke rod mm (in)	185 (7.28)

COIL SPRINGS

Wire diameter	mm (in)	11.5 (0.453)
Coil diameter	mm (in)	111 (4.37)
Free length	mm (in)	315 (12.4)
Static load length	mm (in)	204 (8.03)
Stiffness	N/mm	20.45
	kg/mm(lb/in)	116.47

HOW TO READ THE WIRING DIAGRAM

CAUTION:

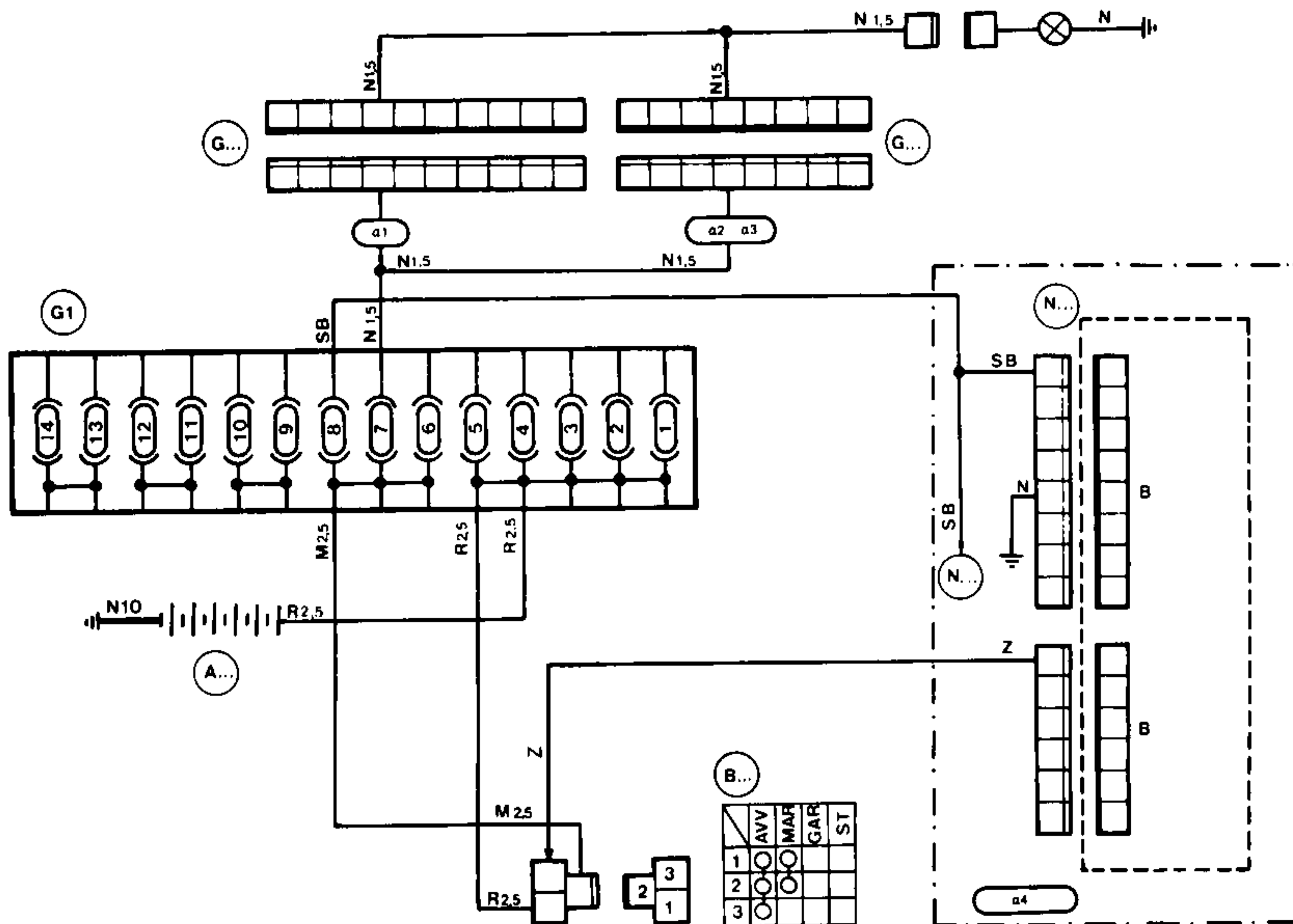
Before starting operations, make sure that the ignition switch is to the "ST" position and that battery ground cable is disconnected.

For detection of failures present in the electric diagram, the following types of diagrams are available.

WIRING DIAGRAM

For each load, the diagram allows identification of the type and the number of connectors, electrical terminal positions in the connector, color coding of wires, and connector codes. Besides, for those cases which

the different car versions involve variations of the electric diagram, wiring diagram sets in evidence each variation by properly dividing the part of the concerned circuit.



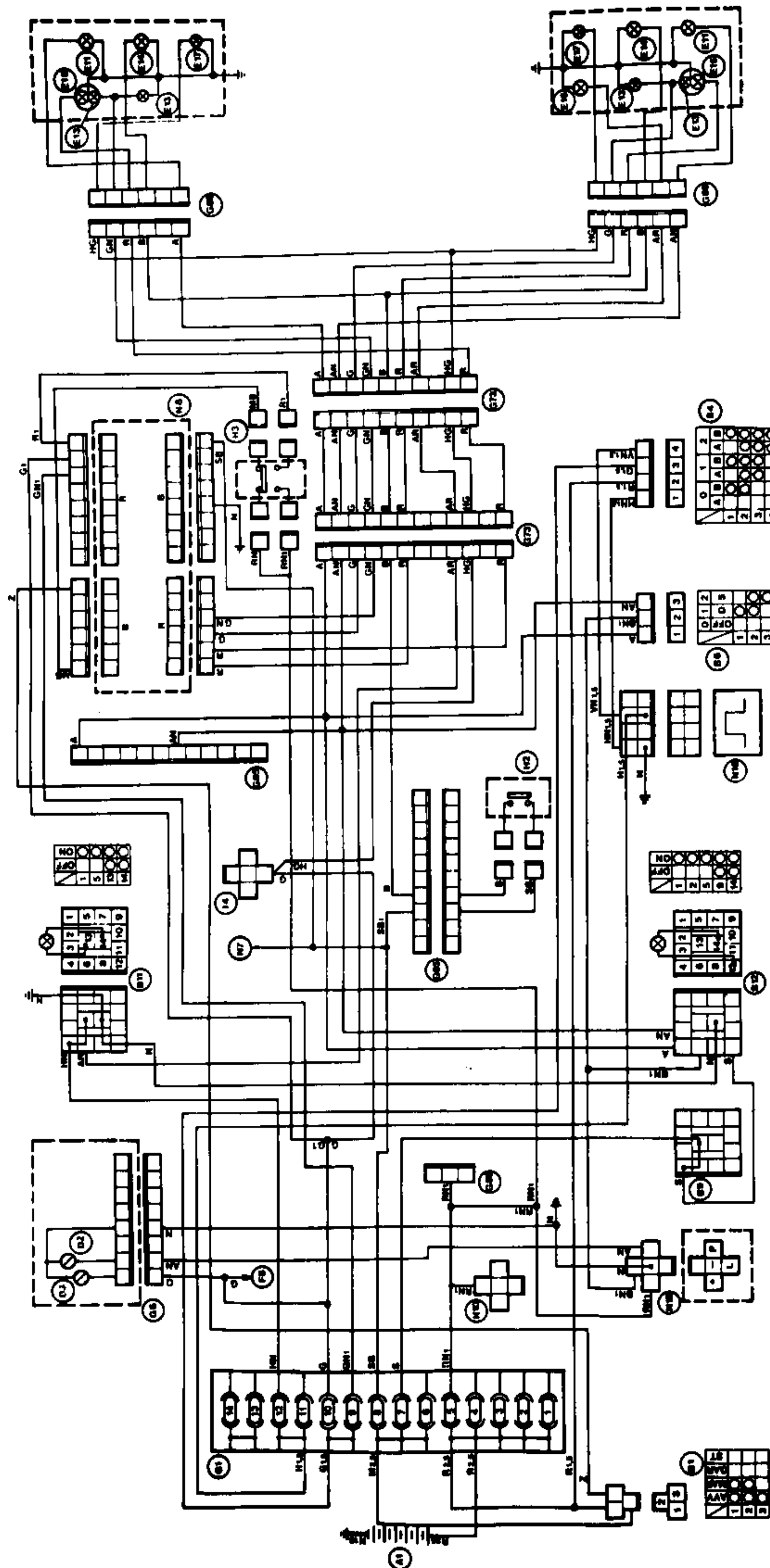
WIRING DIAGRAM SYMBOLOGY

- A Start - recharge
- B Manual electric controls
- C Board instruments
- D Lamp indicators
- E Outside lights
- F Inside lights
- G Fusebox - connector - grounds

- H Switches
- I Relay
- L Transmitters
- M Electromagnets - solenoid valves
- N Electronic devices - intermit-
tances - timers
- O Devices
- P Electric motors
- Q Air ventilation

- a1 : L.H.D. 1200 model
- a2 : R.H.D. - L.H.D. 1350 model
- a3 : R.H.D. - L.H.D. 1500 model
- a4 : R.H.D. - L.H.D. 1500 + oro
model

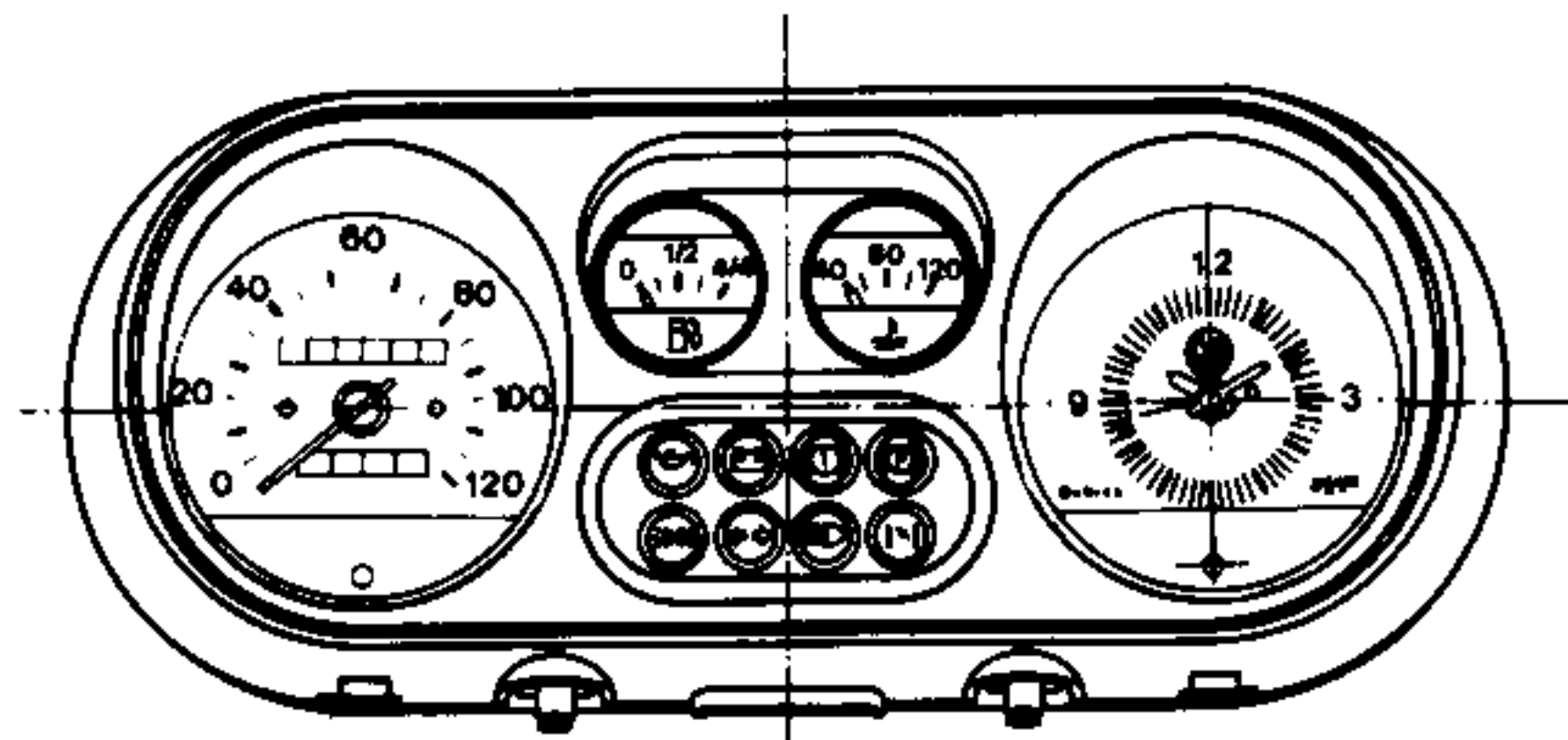
OUTSIDE LIGHTING - REAR SIDE (for the 1500 Quadrifoglio model)



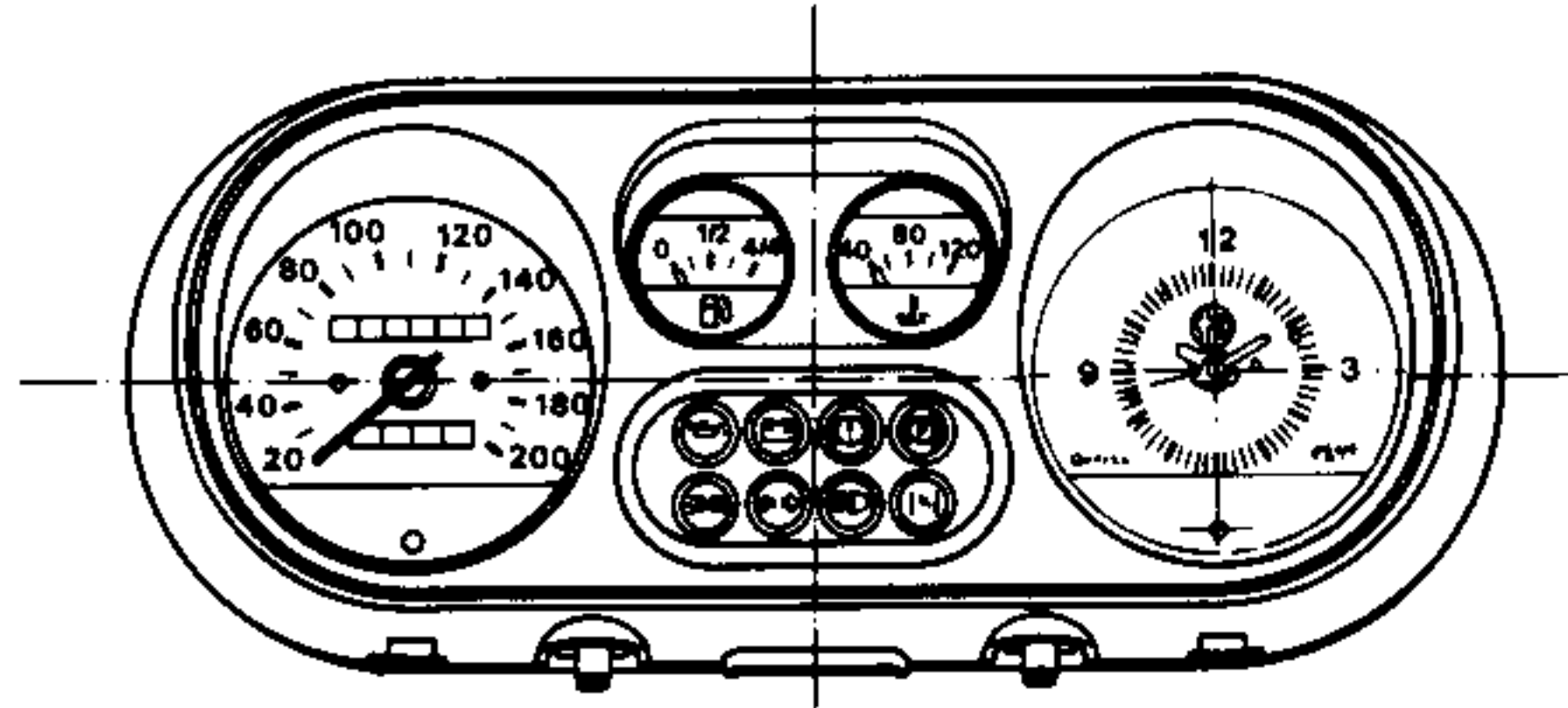
- | | | | |
|-----|--|-----|--|
| A1 | Battery | F8 | Air ventilation controls lighting lamp |
| B1 | Ignition switch | G1 | Fusebox |
| B4 | Control switch for headlight, flashing, low beam and full beam | G6 | Cluster B connector |
| B6 | Direction lights indicator switch | G73 | Rear service connector |
| B9 | Heated rear window control switch | G85 | Front service connector |
| B11 | Rear fog light control switch | G86 | Passenger compartment roof lamp connector |
| B12 | Hazard lights control switch | G88 | Tail lights connector |
| D2 | Direction light warning lamp | H2 | Reverse light switch |
| D3 | Side light warning lamp | H3 | Stop light switch |
| E11 | Rear direction light lamp | I4 | Headlight wiper relay |
| E13 | Tail light lamp | N7 | Trip Computer |
| E14 | Reverse light lamp | N8 | Check Control |
| E15 | Stop light lamp | N10 | Passenger compartment roof lamp timer |
| E16 | Rear fog lamp | N13 | Hazard and direction lights intermittence |
| E17 | Number plate light lamp | N18 | Electronic device for headlights and flashing changeover |

BOARD INSTRUMENTS AND TRANSMITTERS CLUSTER

1200 model

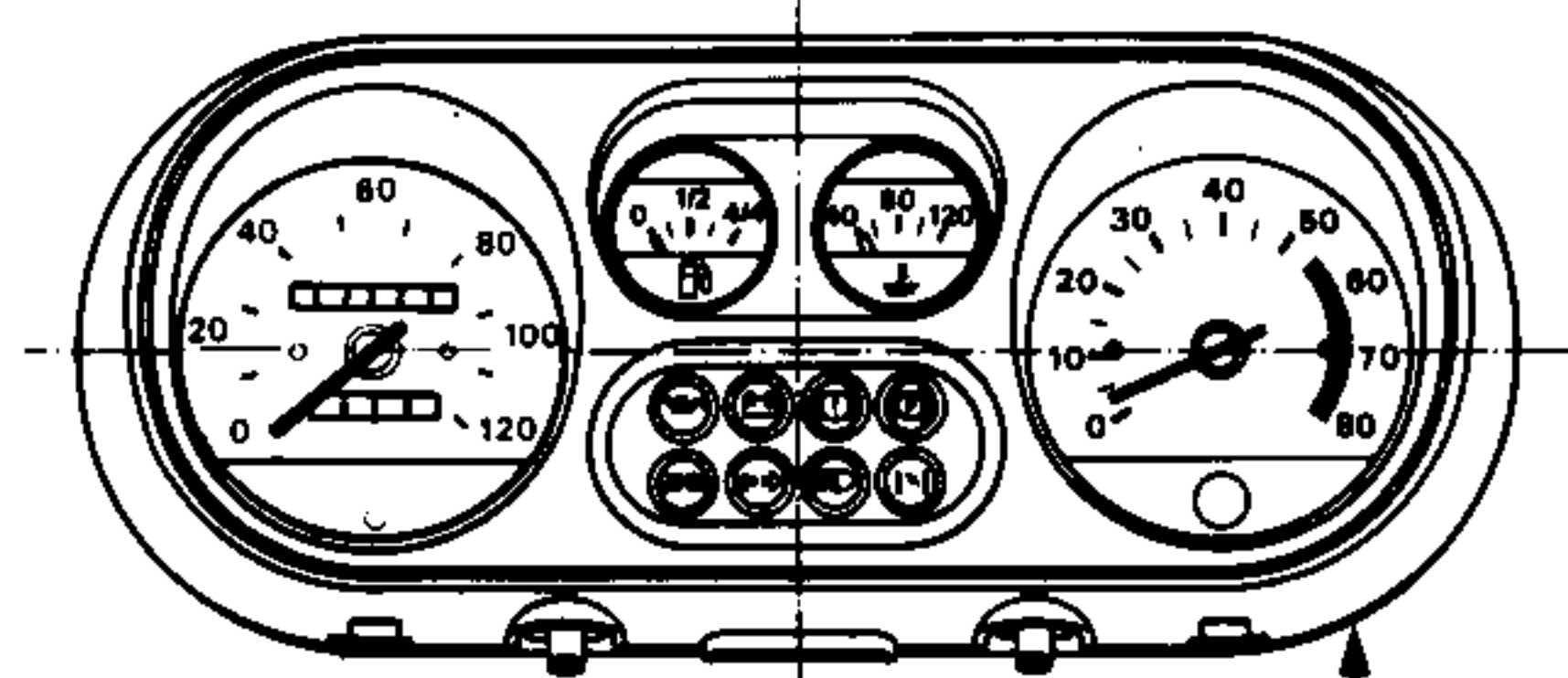


Tachometer calibrated in MPH

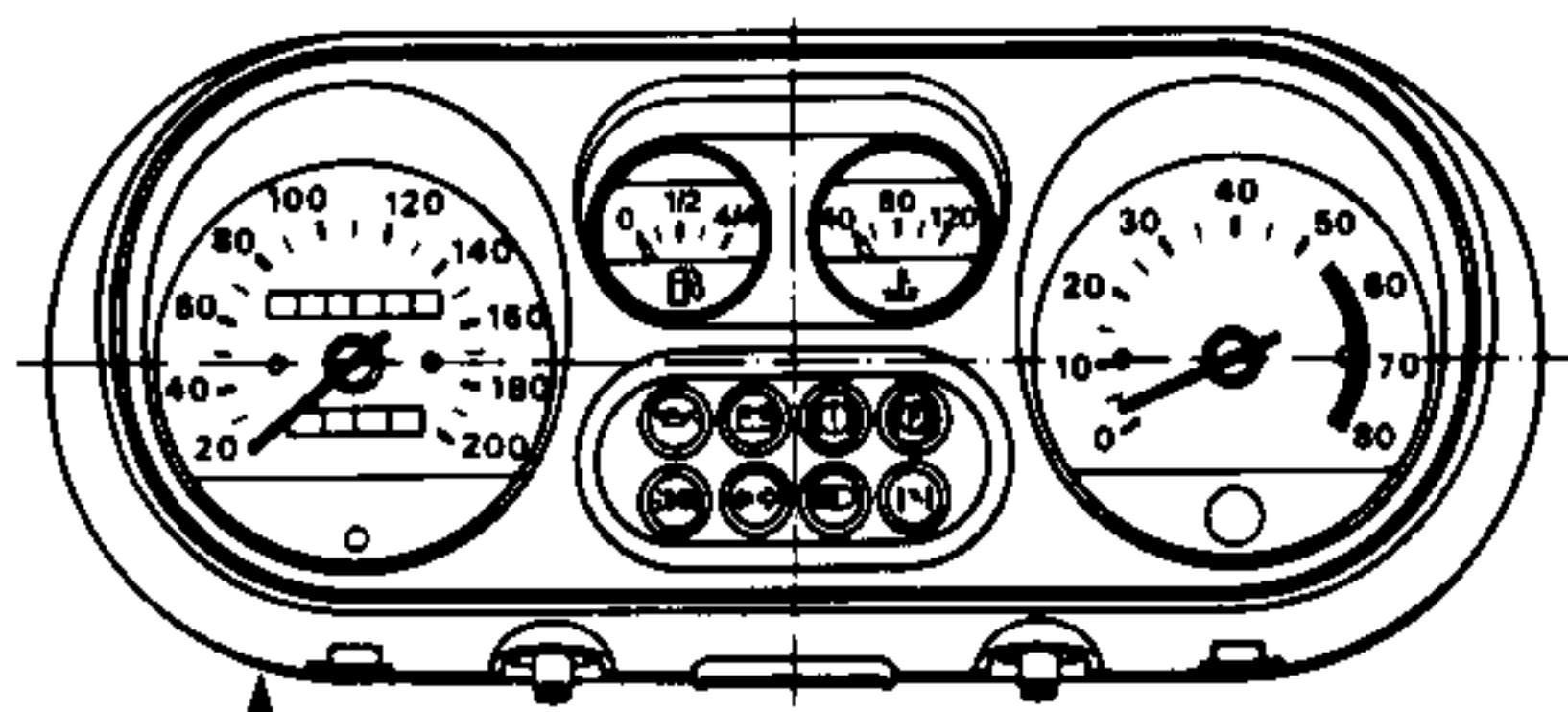


Tachometer calibrated in km/h

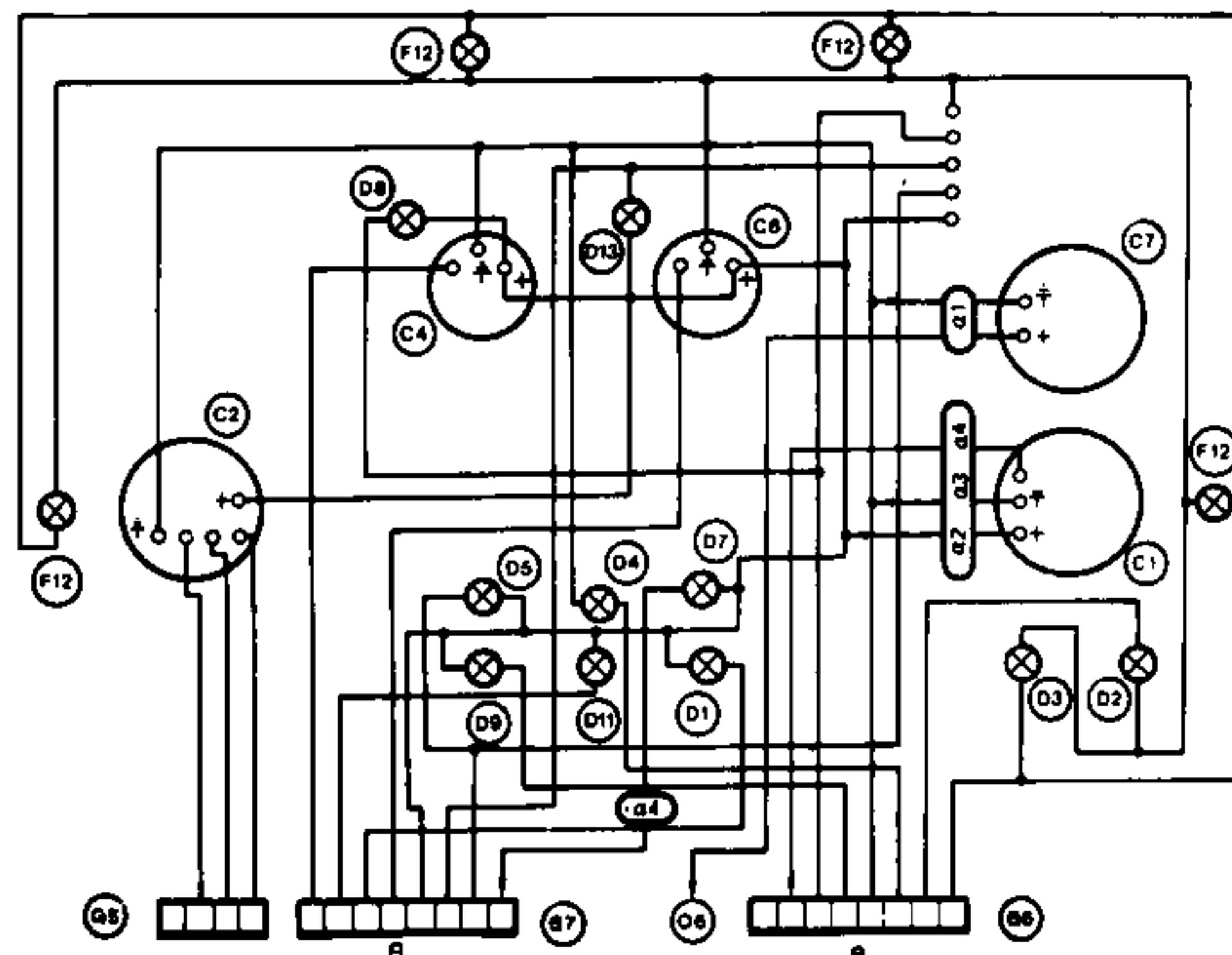
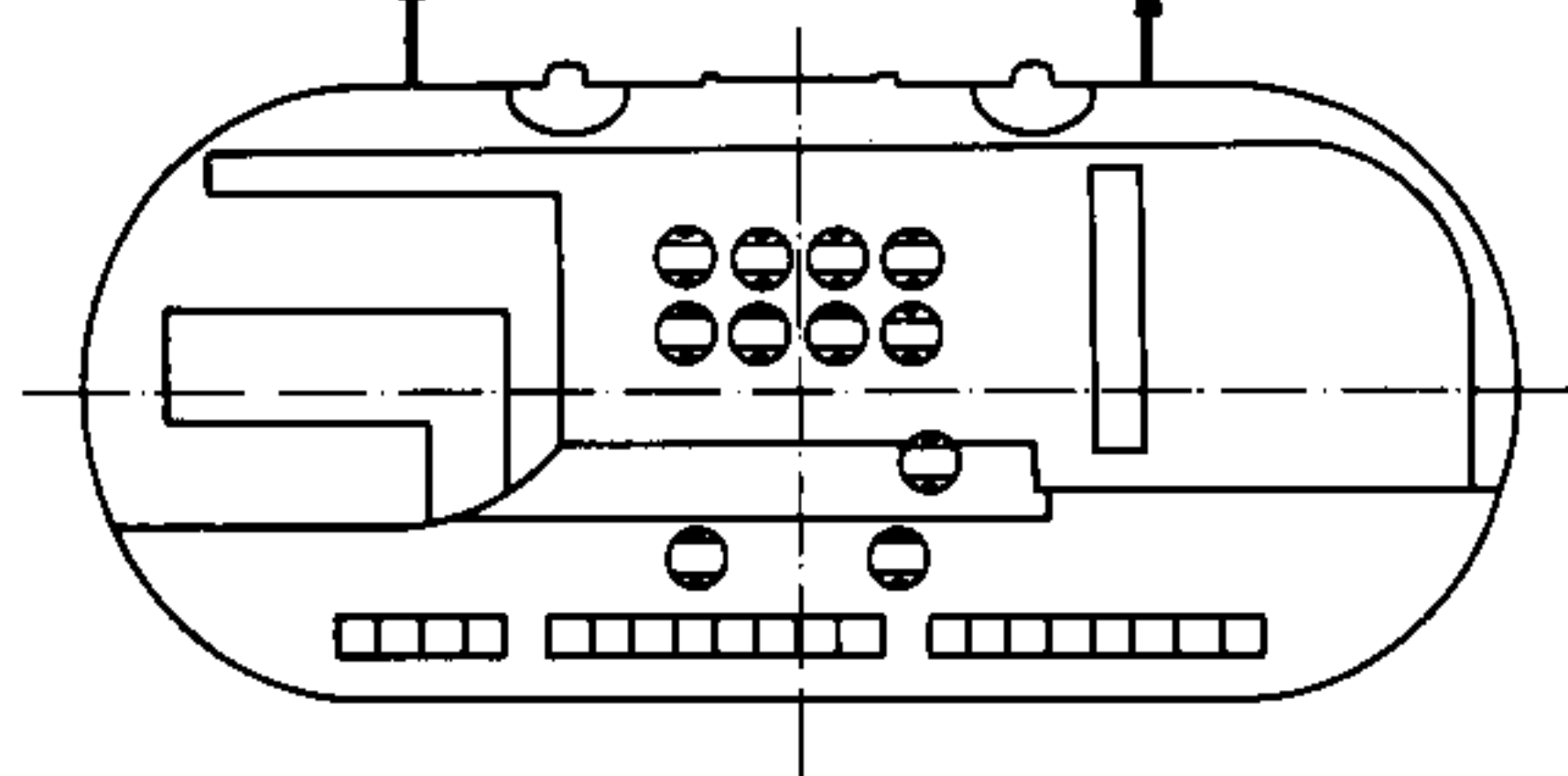
1350-1500-1500 model



Tachometer calibrated in MPH

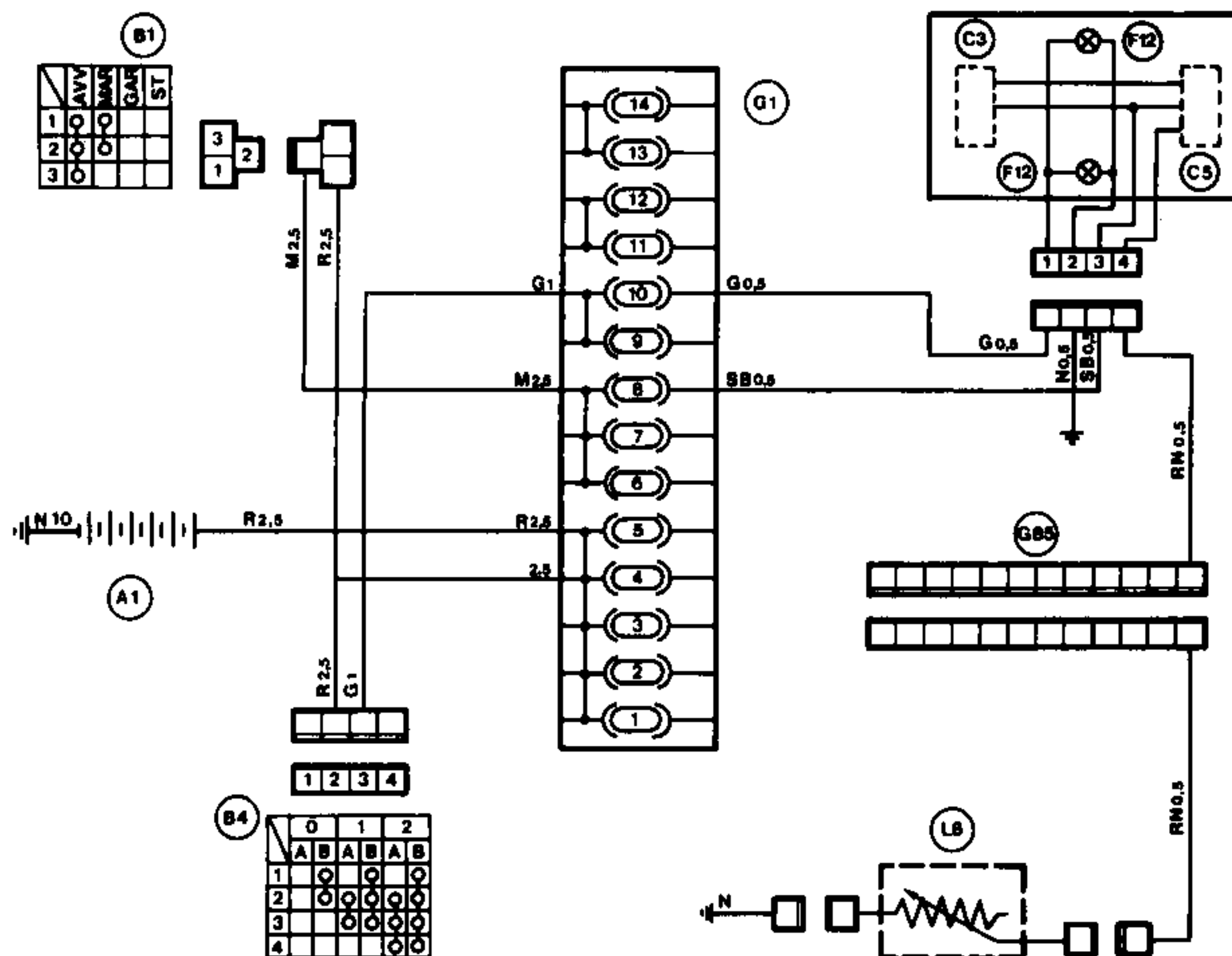
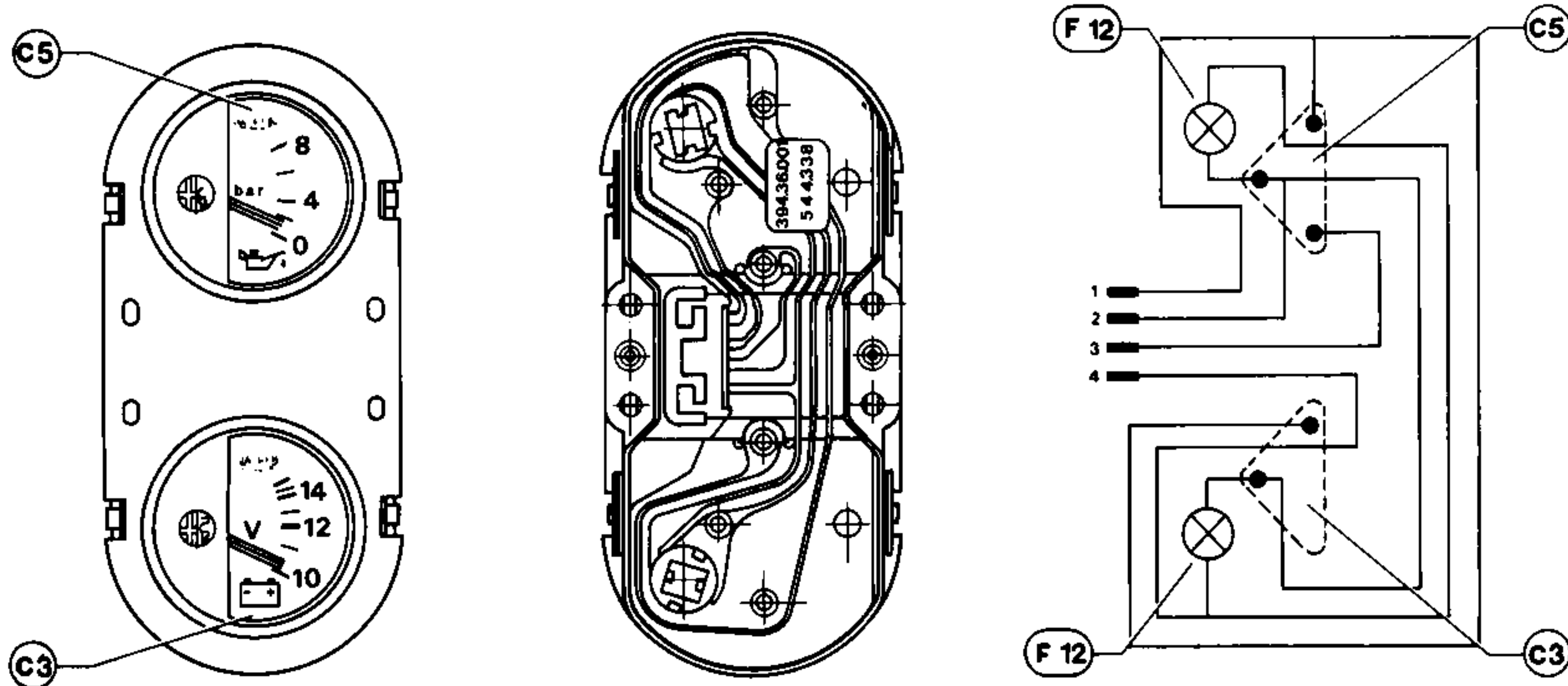


Tachometer calibrated in km/h



- | | |
|-----------------------------------|--|
| C1 Electronic rev. counter | D9 Choke warning lamp |
| C2 Electronic tachometer | D11 Engine oil min. pressure warning lamp |
| C4 Fuel level gauge | D13 Engine coolant max. temperature warning lamp |
| C6 Coolant temperature gauge | F12 Cluster lighting lamp |
| C7 Clock | G5 Connector |
| D1 Alternator charge warning lamp | G6 Cluster B connector |
| D2 Direction light warning lamp | G7 Cluster R connector |
| D3 Side light warning lamp | O6 Cigar lighter |
| D4 Full beam warning lamp | a1 L.H.D. 1200 model |
| D5 Brake fluid level warning lamp | a2 R.H.D. - L.H.D. 1350 model |
| D7 Hand brake warning lamp | a3 R.H.D. - L.H.D. 1500 model |
| D8 Fuel reserve warning lamp | a4 R.H.D. - L.H.D. 1500 model |

AUXILIARY INSTRUMENTS (model 1500 + verde)



- A1 Battery
 B1 Ignition switch
 B4 Control switch for side light, flashing, low beam and full beam
 C3 Voltmeter
 C5 Oil pressure gauge

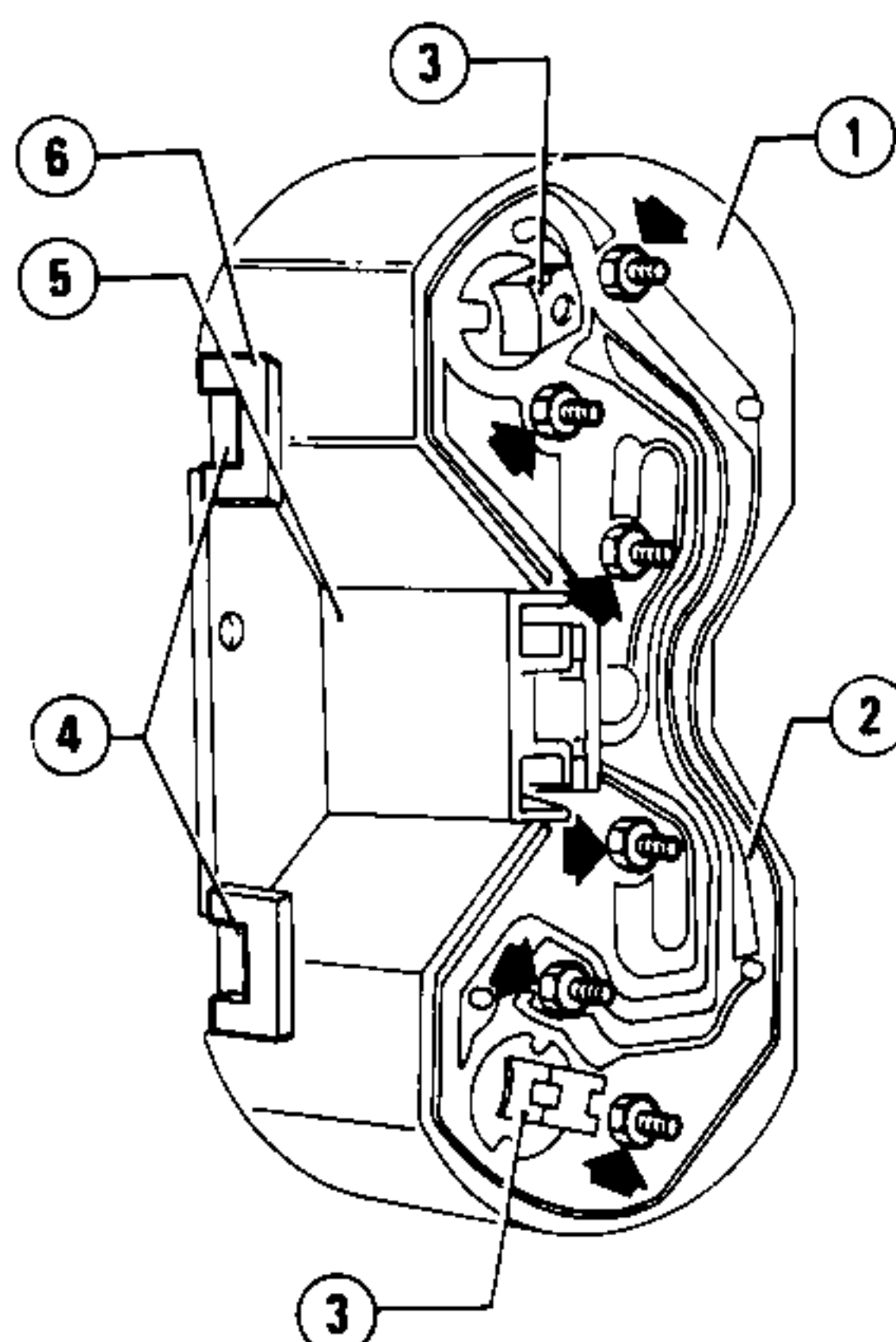
- F12 Cluster lighting lamp
 G1 Fusebox
 G85 Front service connector
 L8 Transmitter for engine oil pressure

REMOVAL AND INSTALLATION

CAUTION:

Before starting operations, make sure that the ignition key is to the "ST" position and ground cable is disconnected.

1. Remove the two instruments from the speed gear console (refer to: Group 66 - "Speed Lever Console").
2. If necessary, remove the two instruments.
 - (1) Remove front rim (6) operating on the special tabs (4).
 - (2) Unscrew the three screws securing the instrument concerned (1) and (2) to container (5). Remove instrument.



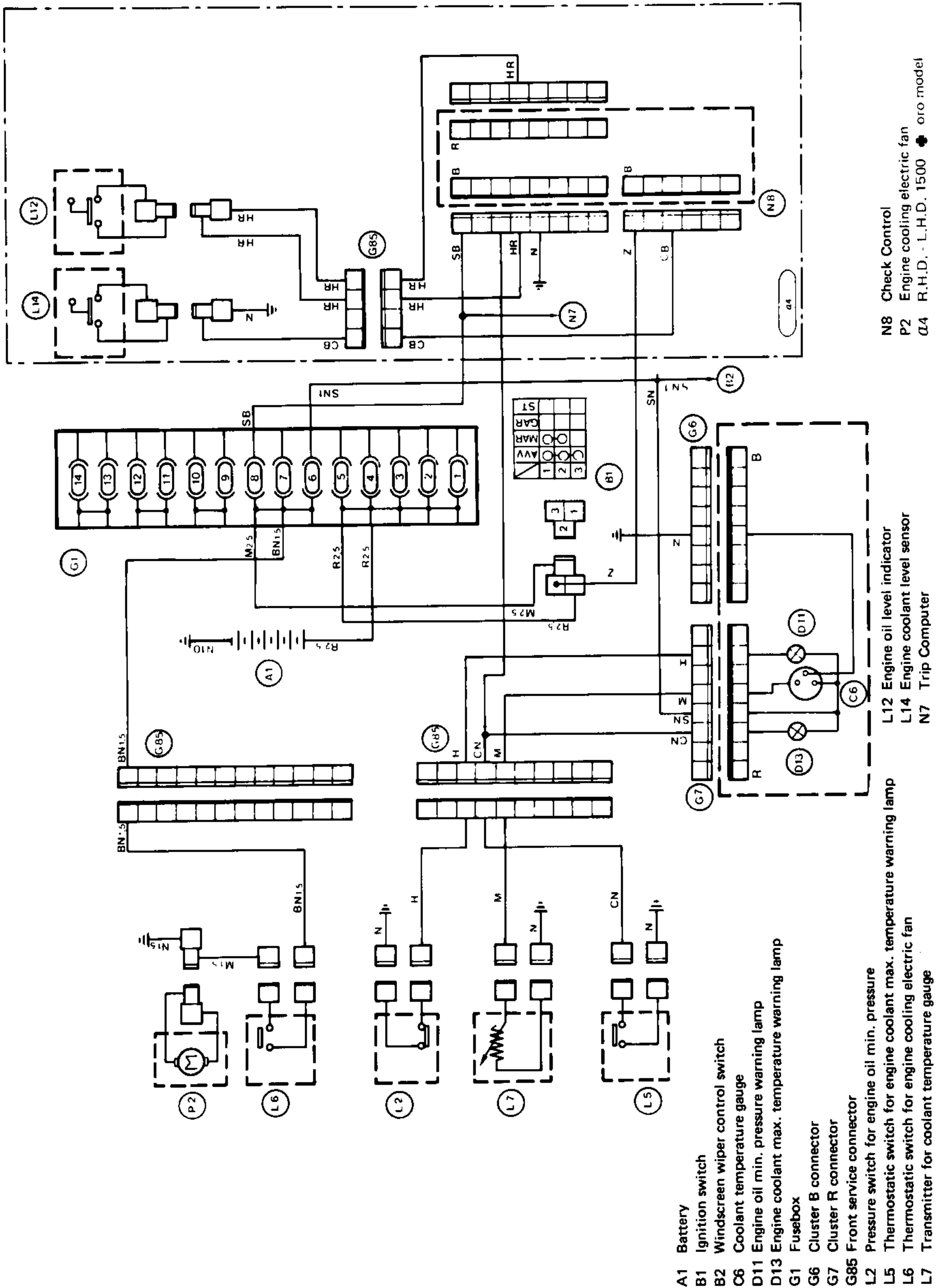
- 1 Oil pressure gauge
- 2 Voltmeter
- 3 Lamp holder
- 4 Tabs securing front rim to container
- 5 Container
- 6 Front rim

3. Install the two instruments by reversing the order of removal.

LAMPS REPLACEMENT

1. Remove the two instruments from the speed gear console (refer to: Group 66 - "Speed Lever Console").
2. Rotate lampholder and withdraw it; then remove lamp from lampholder itself.
3. Replace lamp with an identical one then carry out installation by reversing order of removal.

ENGINE COOLING AND LUBRICATION



ENGINE COOLANT LEVEL SENSOR**Location**

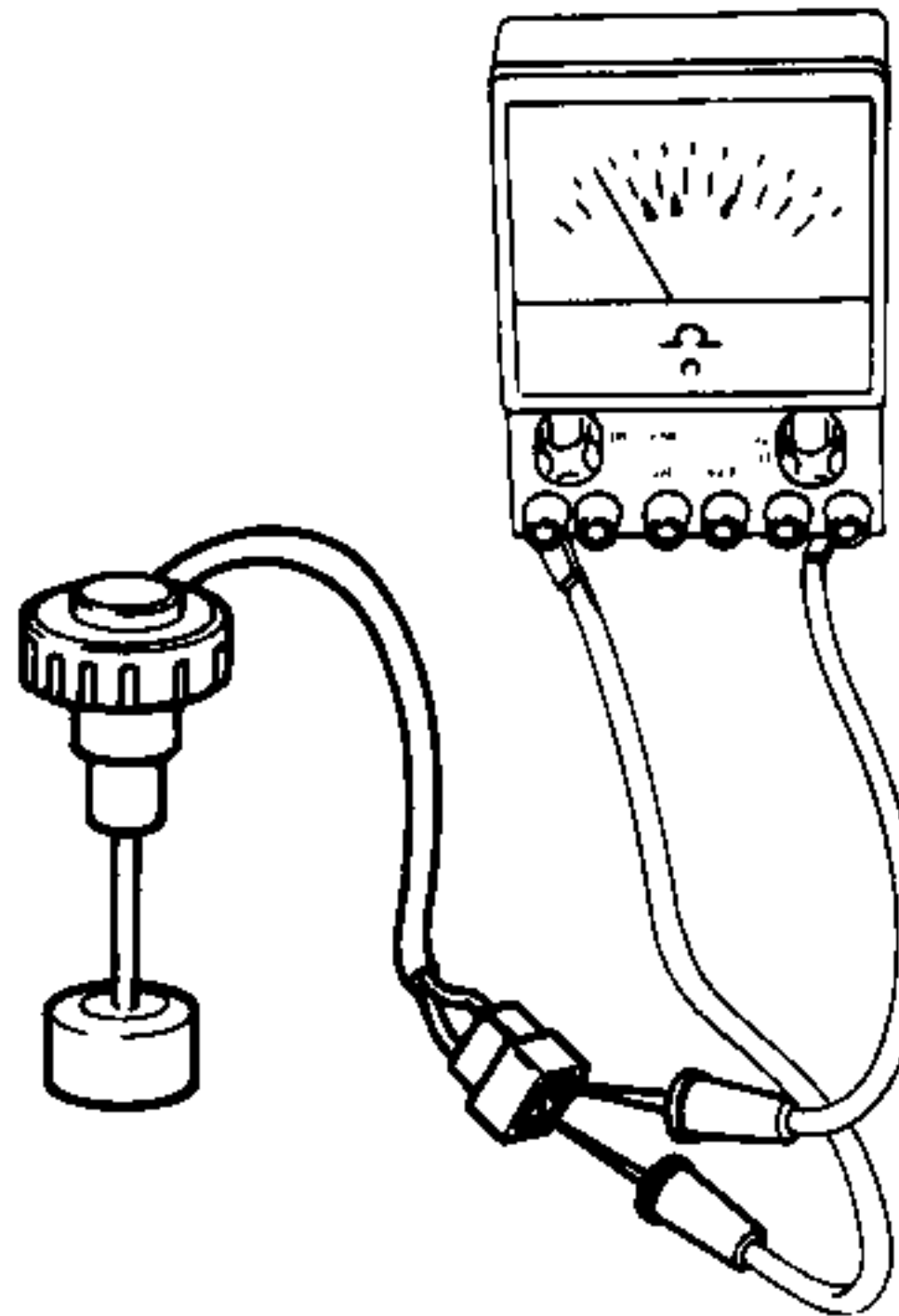
The sensor is inserted into header tank of cooling system.

Check

1. Connect the two ends of tester to sensor connector just as per figure.
2. Check sensor proper functioning by verifying the following:

Float lifted: ∞

Float lowered: 0Ω



3. In the event that an incorrect level be indicated on the Check Control, check the following before replacing the sensor.

- a. Check that the cap is tightened correctly, and to the prescribed torque.

Ⓣ : Tightening torque

Coolant level sensor

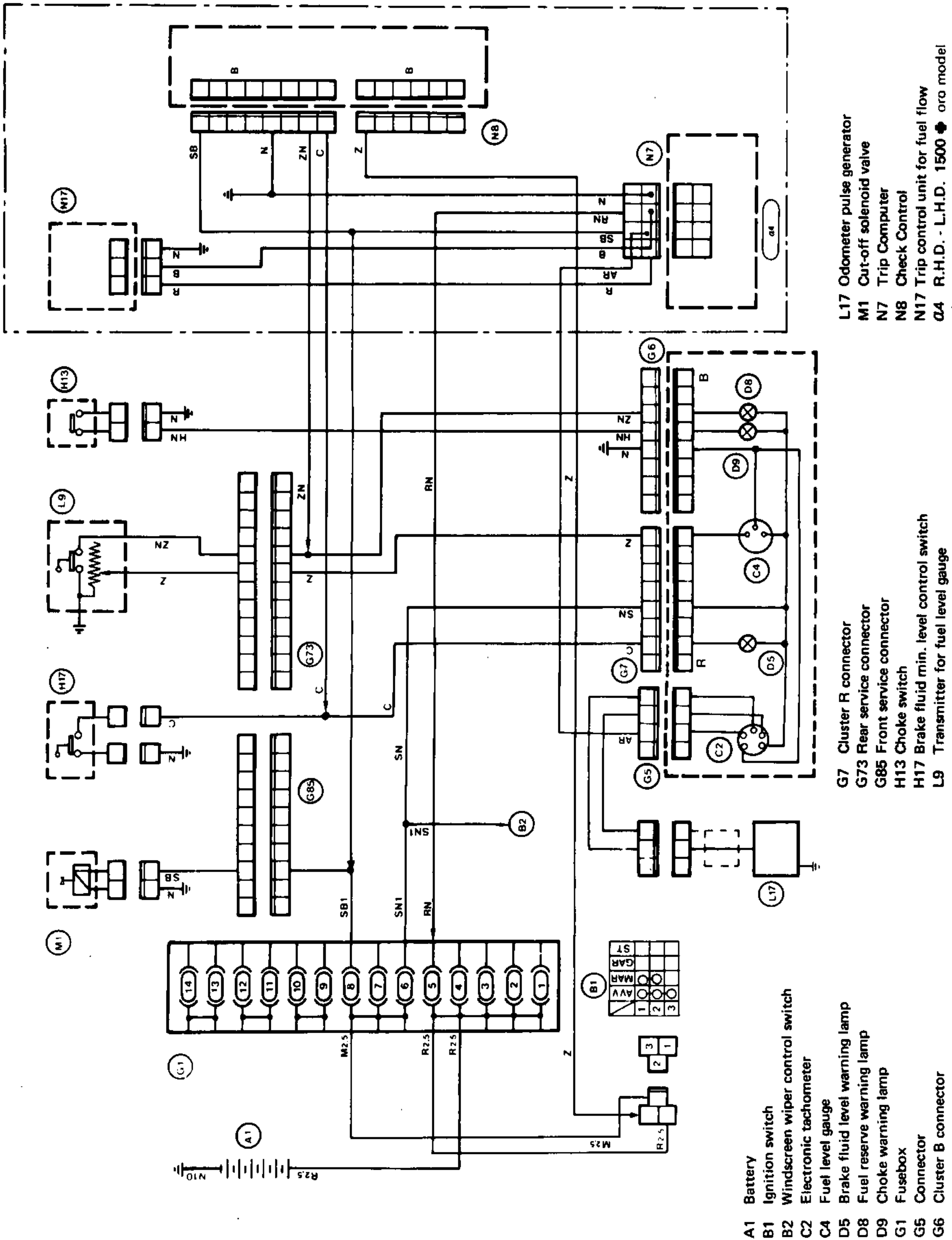
$2 \div 4 \text{ N}\cdot\text{m}$

$(0.2 \div 0.4 \text{ kg}\cdot\text{m})$

$1.45 \div 2.89 \text{ ft}\cdot\text{lb}$

- b. Check for and eliminate any possible burr on the threads before repeating the level check with the Check Control.

FUEL SUPPLY, BRAKE AND CLUTCH OIL MINIMUM LEVEL TRANSMITTER, TACHYMETRIC PULSE GENERATOR

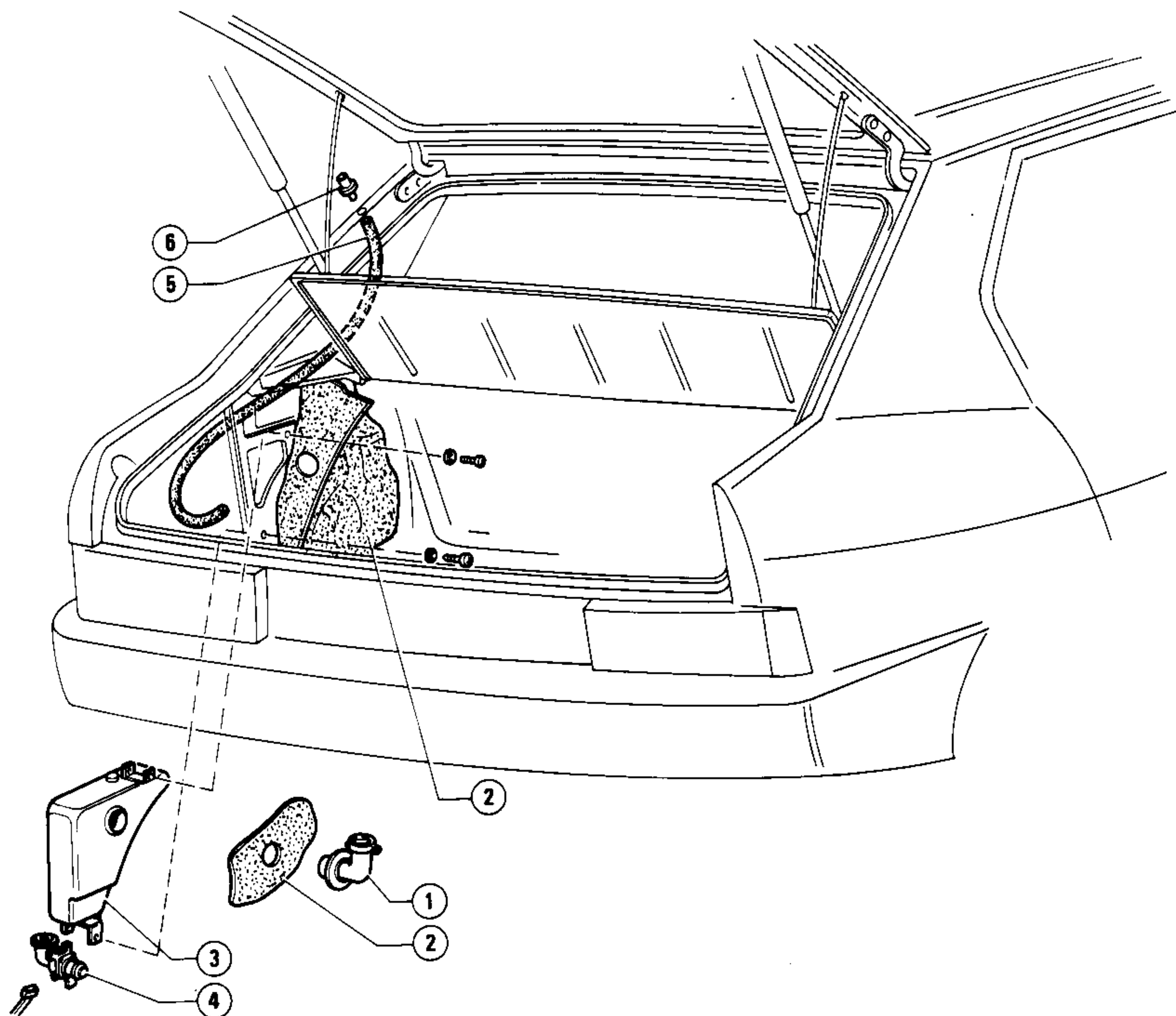


REAR WINDOW WIPER (Some models only)

Refer to same paragraph of "Workshop Manual"

Alfa 33 **4x4**

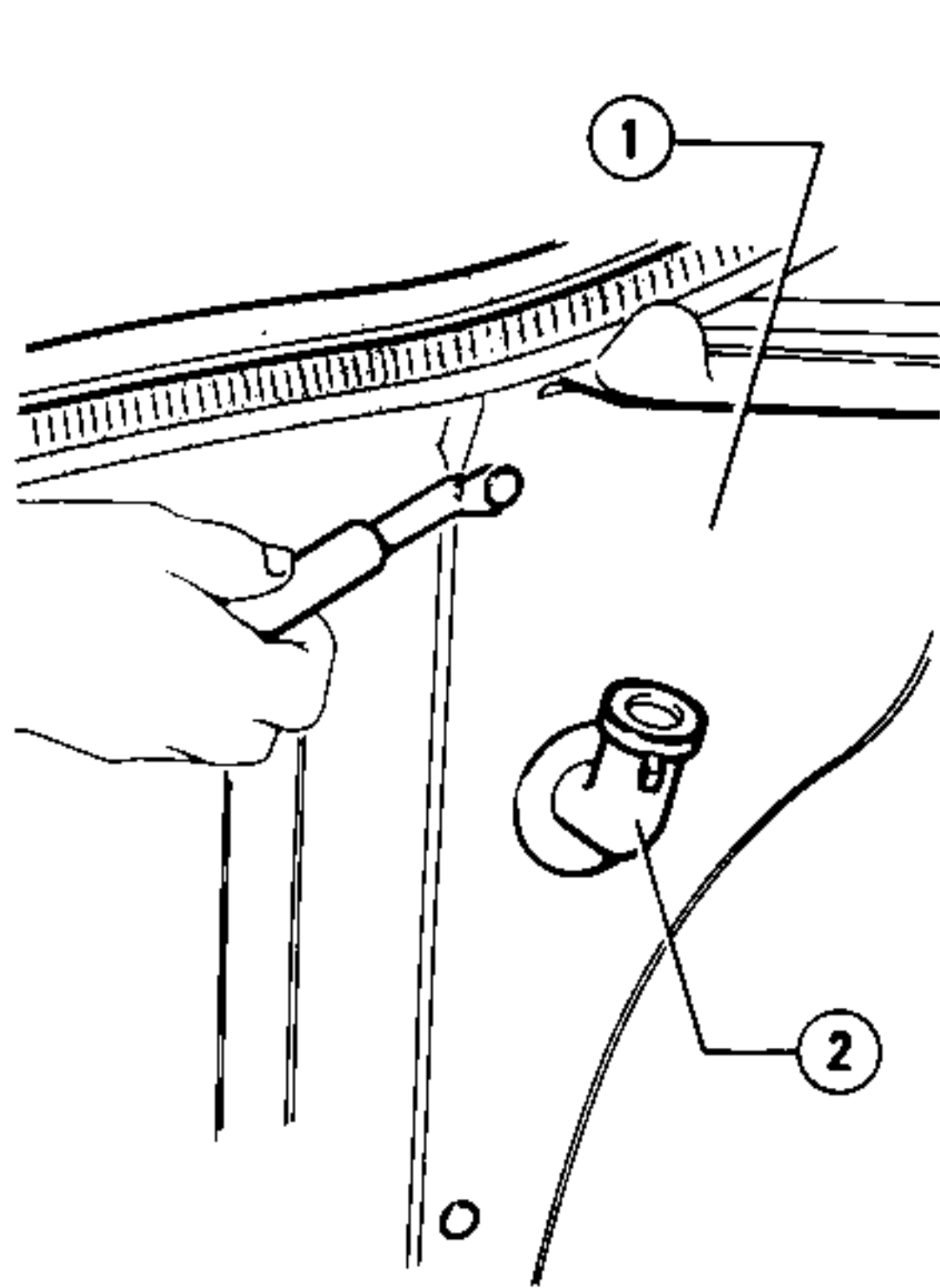
REAR WINDOW WASHER ELECTRIC PUMP (Some models only)



- 1 Liquid fitting pipe
- 2 Side trimming
- 3 Tank
- 4 Electric pump
- 5 Hose
- 6 Spray nozzle

REMOVAL AND INSTALLATION

1. Open back door and remove the pressure inserted pipe (2). Using a suitable tool, remove the two plastic rivets securing trimming (1) to body. Move trimming.

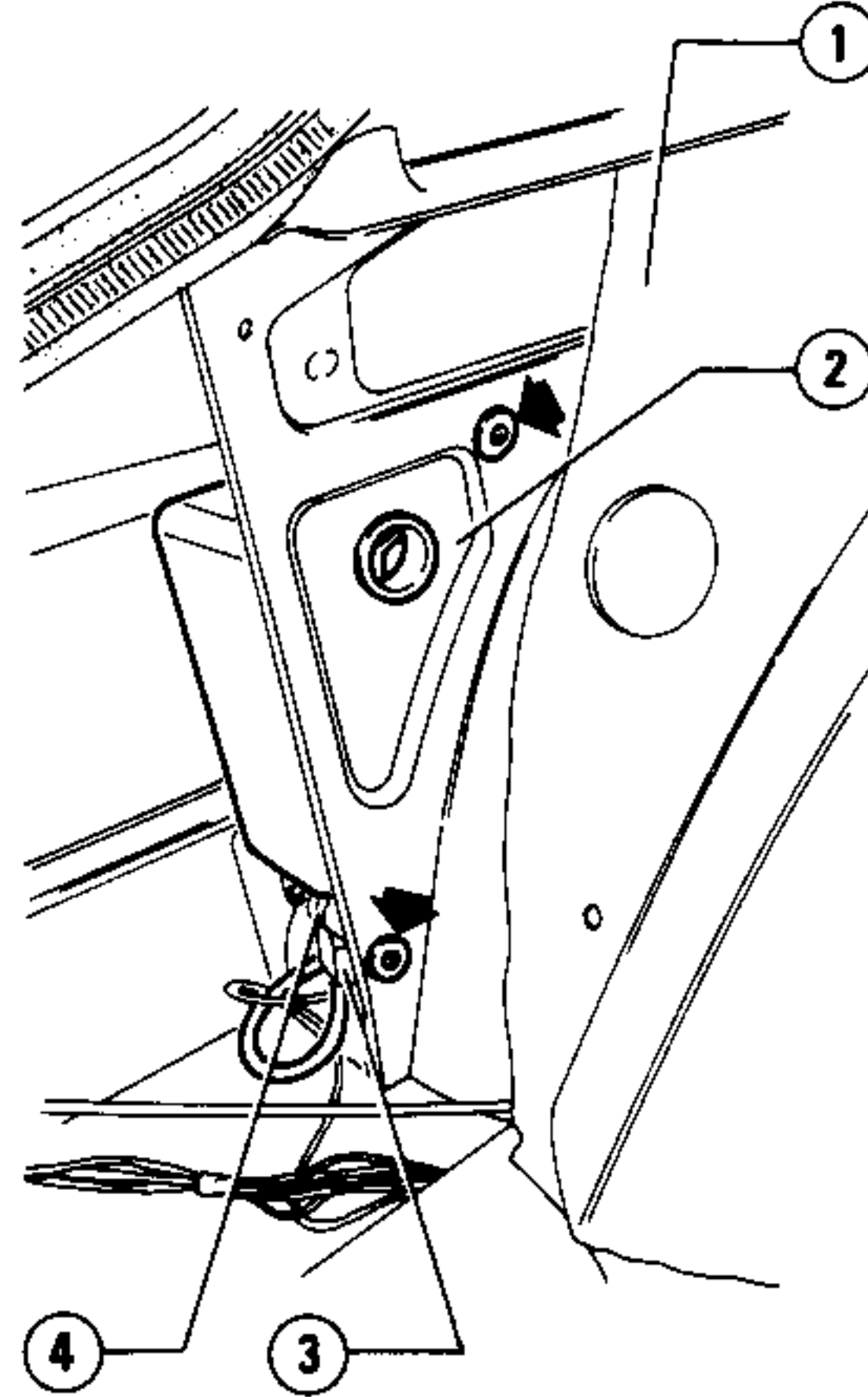


- 1 Side trimming
- 2 Liquid fitting pipe

2. Empty the tank by draining the liquid with a pump.

3. Detach the electric pump (4) supply wiring (3) located on the tank.

4. Unscrew the two screws securing tank (2) to body. Remove from electric pump (4) the water delivery hose. Remove tank.

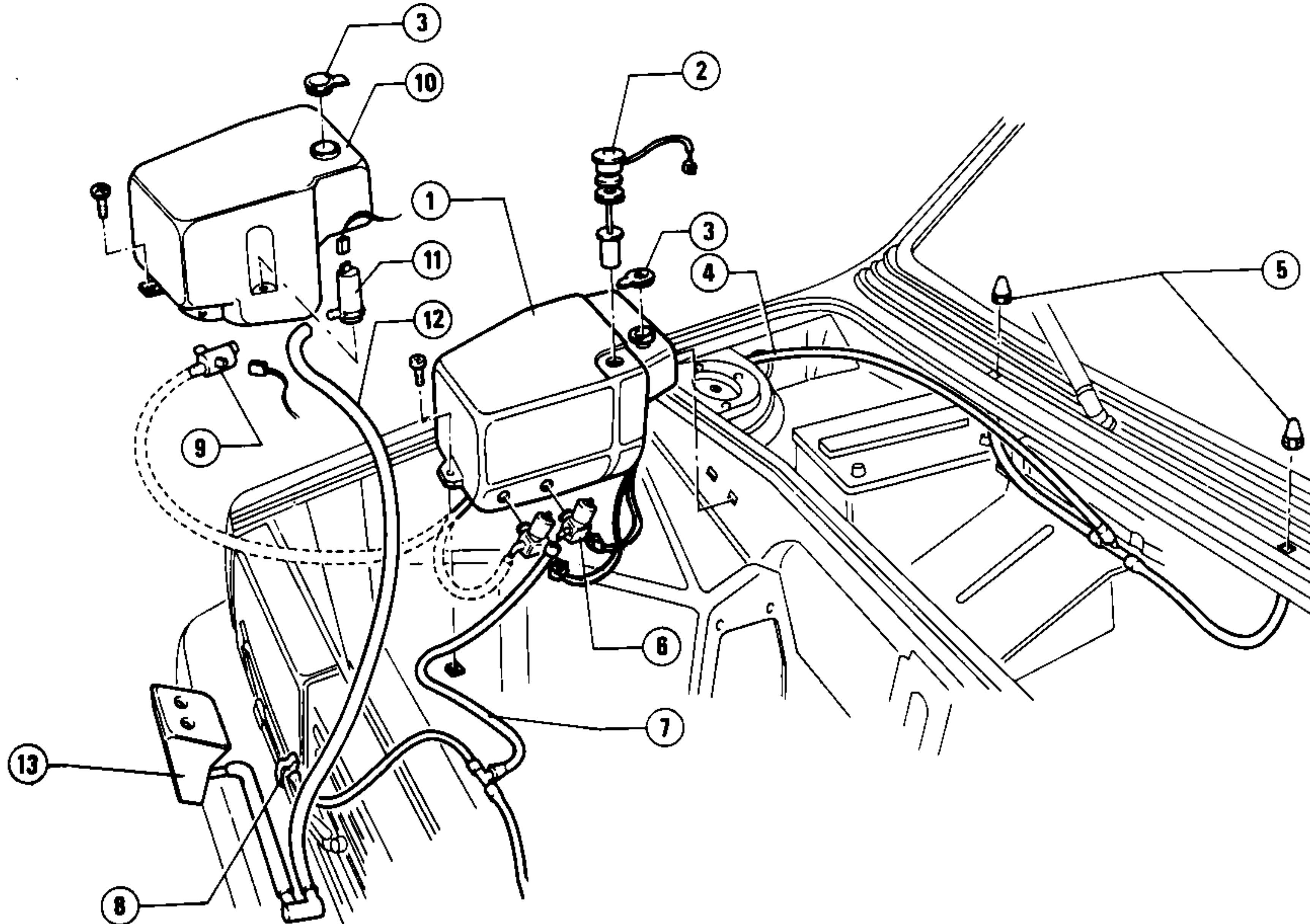


- 1 Side trimming
- 2 Tank
- 3 Wiring
- 4 Electric pump

5. Remove the electric pump, pressure inserted in the tank.

6. Reassemble the electric pump following the removal procedure in inverse order, then fill up with rear window washing liquid.

WINDSCREEN WASHER AND HEADLIGHT WASHER



- 1 Tank
- 2 Liquid level sensor (model 1500 + oro)
- 3 Plug
- 4 Windscreen washer hoses
- 5 Sprayers
- 6 Headlight washer pump (model with headlight wash/wiper)
- 7 Headlight washer hoses (model with headlight wash/wiper)

- 8 Sprayers (model with headlight wash/wiper)
- 9 Windscreen washer pump
- 10 Tank (model with headlight wash/wiper)
- 11 Pump for headlights washer spray nozzles
- 12 Piping for headlights washer spray nozzles
- 13 Spray nozzles

TANK

Removal and installation

1. Remove harness and hoses from the pumps present and properly plug pump delivery. If mounted, disconnect harness of liquid level sensor.
2. Unscrew the screw securing tank to body, then remove tank by moving it forward.
3. For tank installation, reverse order of removal.

PUMP

Removal and installation

1. Drain tank

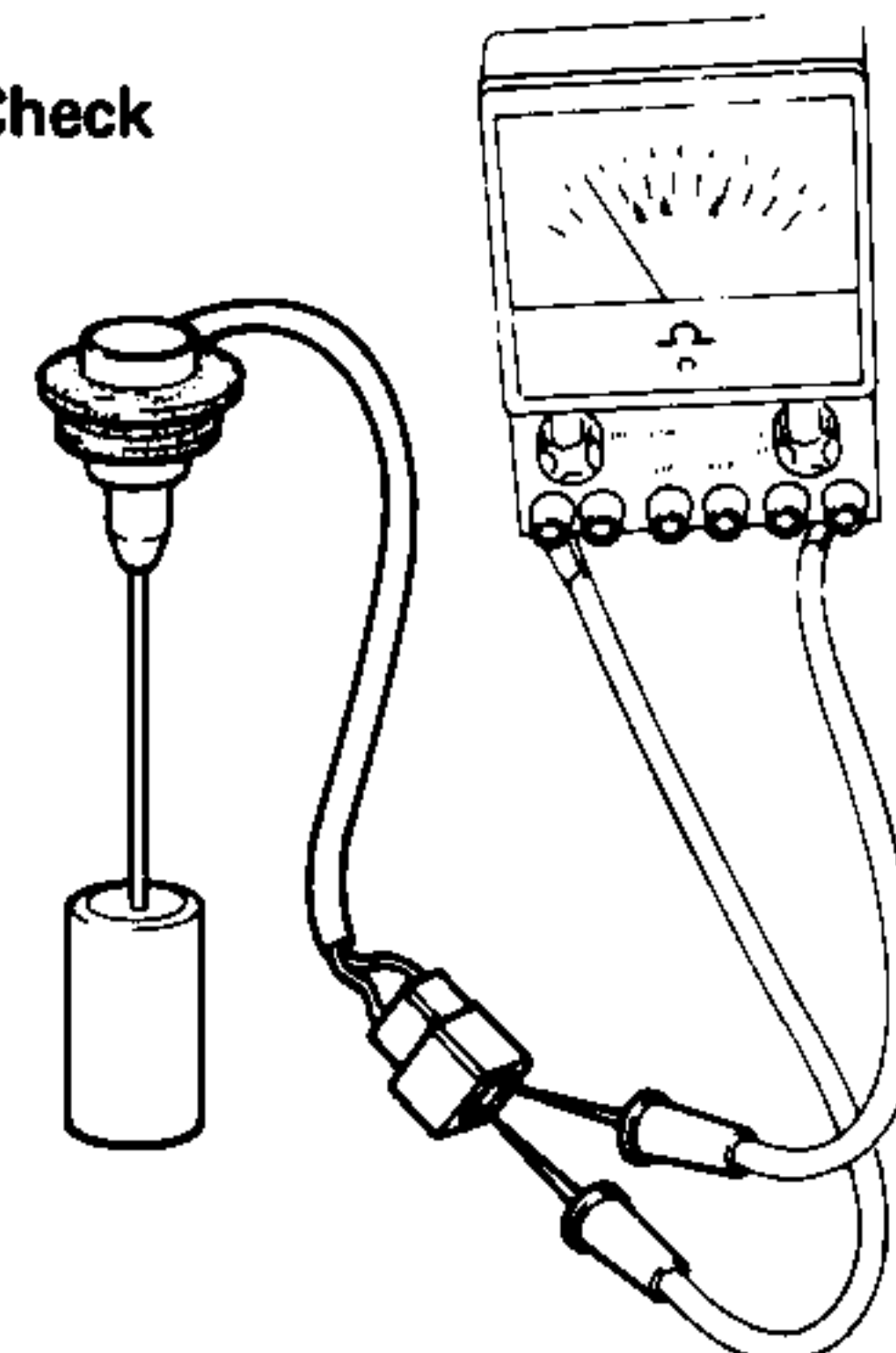
2. Disconnect harness and delivery hoses of the pump concerned checking against presence of leakages.
3. Remove pump by withdrawing it from tank.
4. For pump installation, reverse order of removal.

WINDSCREEN WASHER AND HEADLIGHT WASHER LIQUID LEVEL SENSOR

Location

The sensor is inserted into tank of windscreen washer/headlight washer liquid.

Check



1. Connect the two ends of tester to sensor connector by operating as per figure.
2. Check sensor proper functioning by verifying the following.

Float lifted: ∞

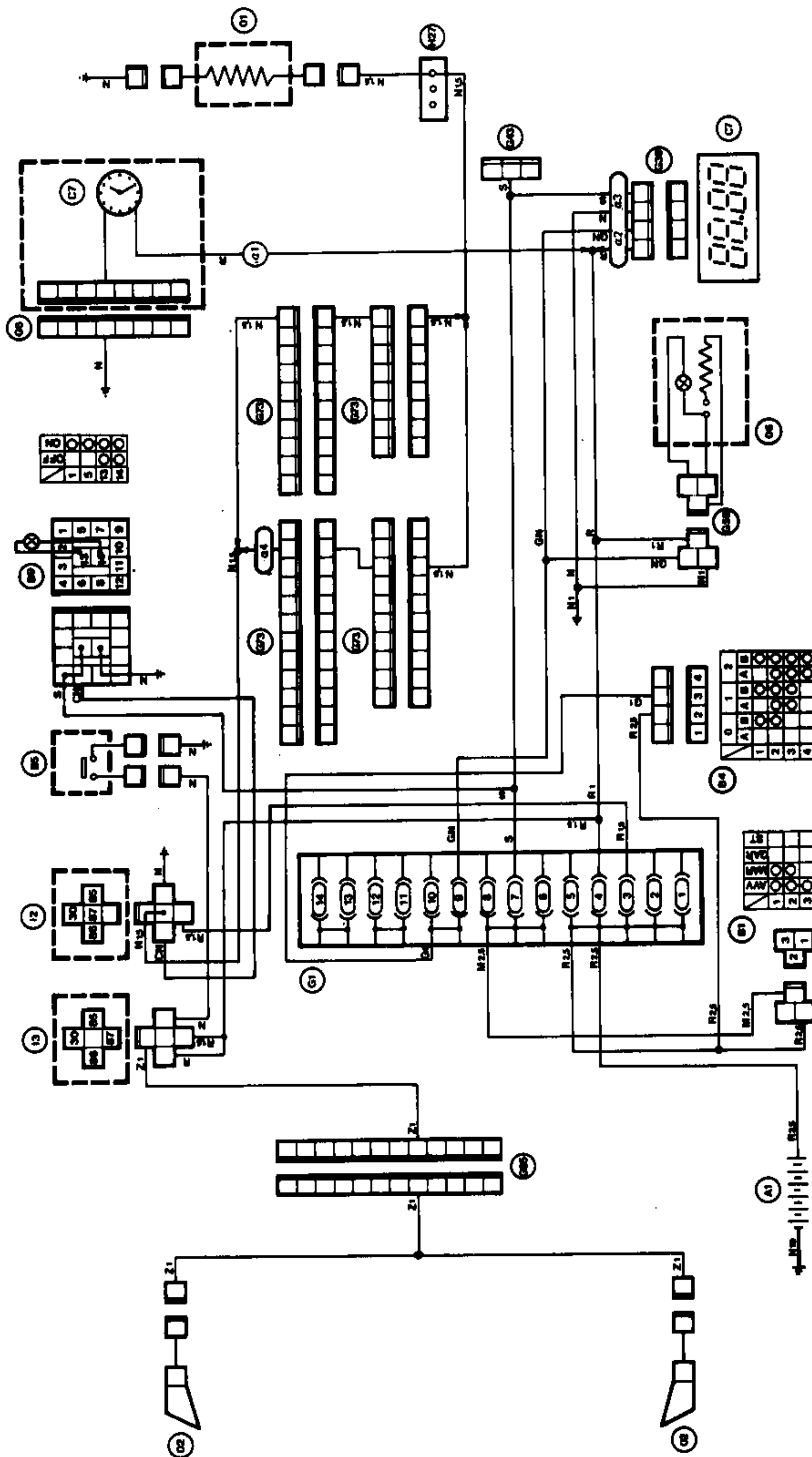
Float lowered: 0Ω

ELECTRIC ACCESSORIES

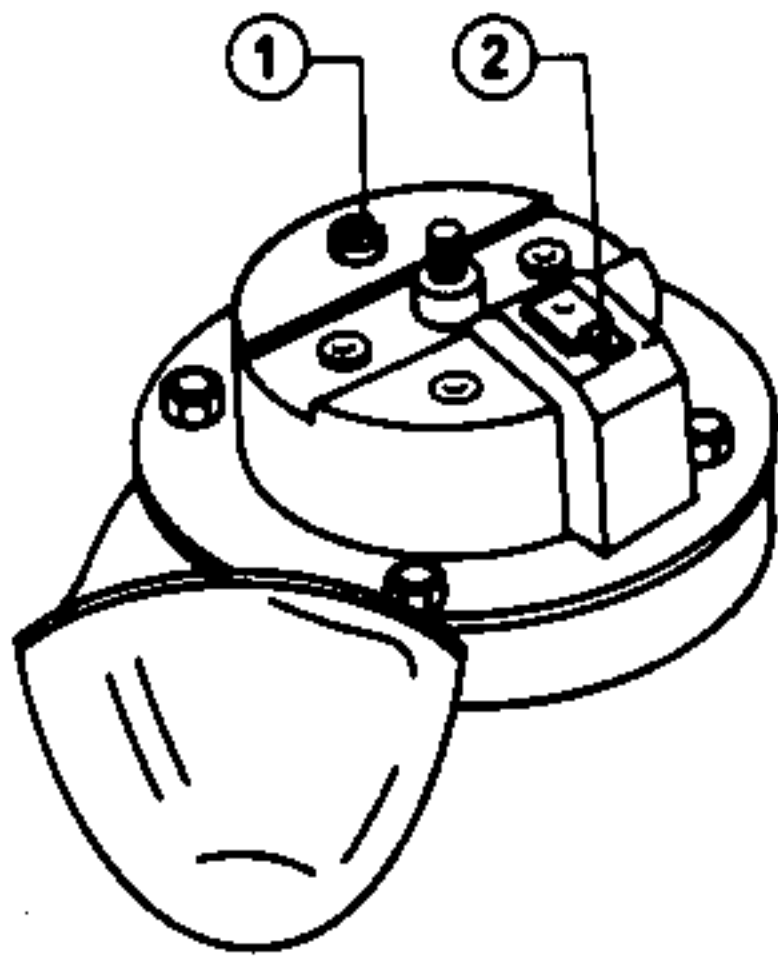
CAUTION:

Before starting operations, make sure that the ignition switch is to the "ST" position and that battery ground cable is disconnected.

HORNS, HEATED REAR WINDOW, CIGAR LIGHTER, CLOCK



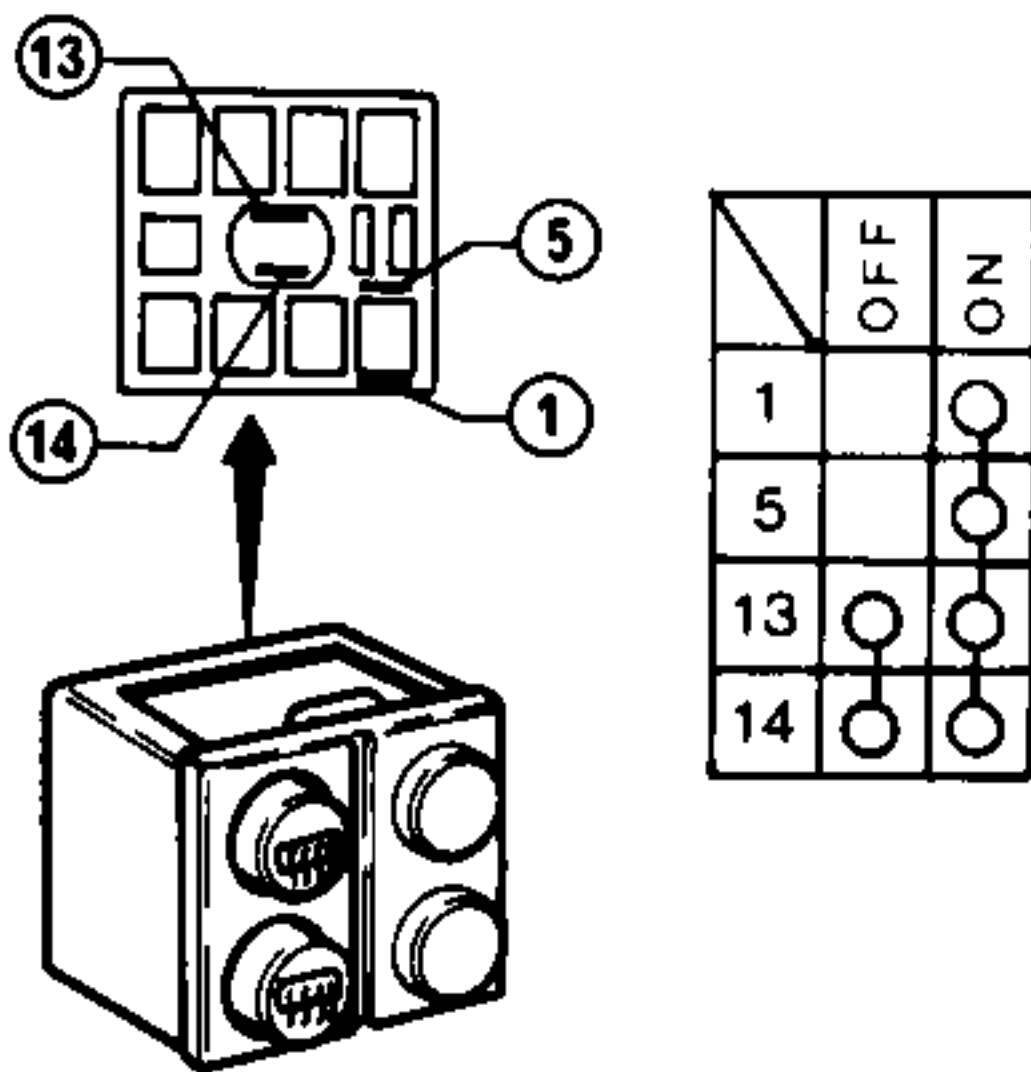
- A1 Battery
 B1 Ignition switch
 B4 Control switch for headlight, flashing, low beam and full beam
 B5 Horns control switch
 B9 Heated rear window control switch
 C7 Clock
 G1 Fusebox
 G6 Cigar lighter
 G39 Clock connector
 G43 Air ventilation control cables connector
 G58 Cigar lighter connector
 G73 Rear service connector
- G85 Front service connector
 H27 Contact switch on rear door for heated rear window
 I2 Heated rear window relay
 I3 Horns relay
 O1 Heated rear window
 O2 Horn
 O6 Cigar lighter
 Q1 L.H.D. 1200 model
 Q2 R.H.D. - L.H.D. 1350 model
 Q3 R.H.D. - L.H.D. 1500 model
 Q4 R.H.D. - L.H.D. 1500 Quadrifoglio model



- 1 Adjusting screw
- 2 Connector

HEATED REAR WINDOW

HEATED REAR WINDOW SWITCH



Location

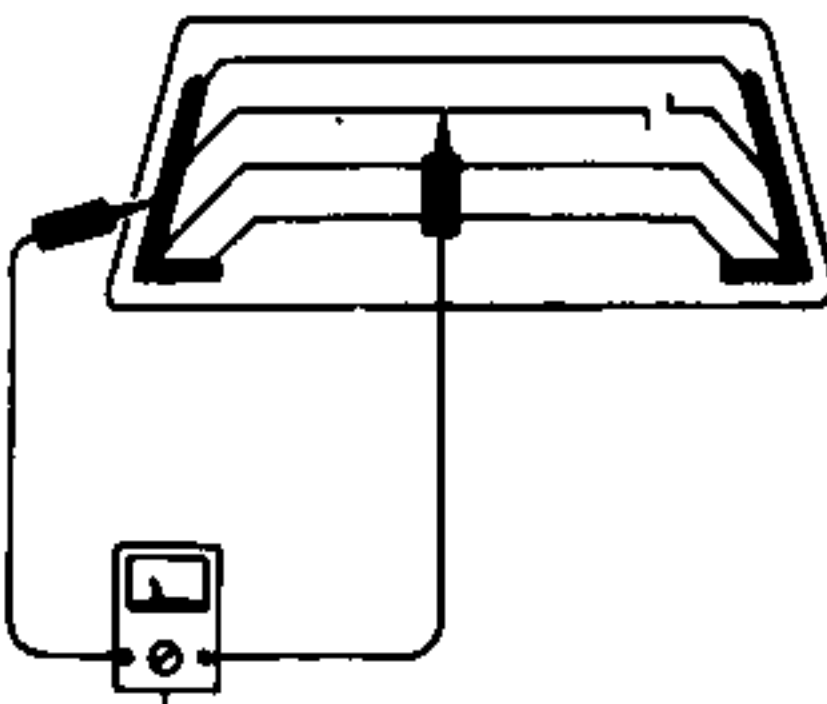
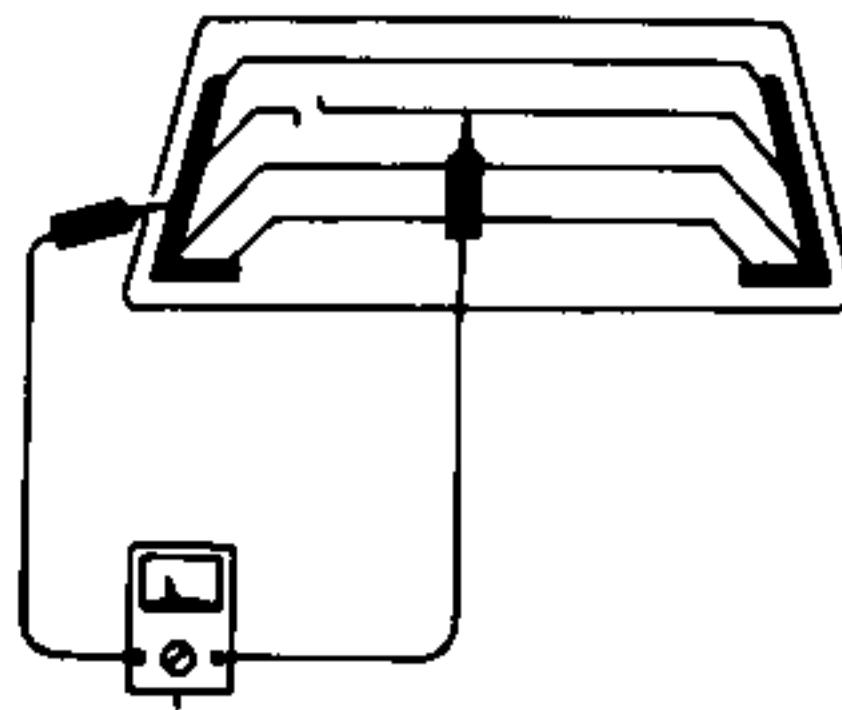
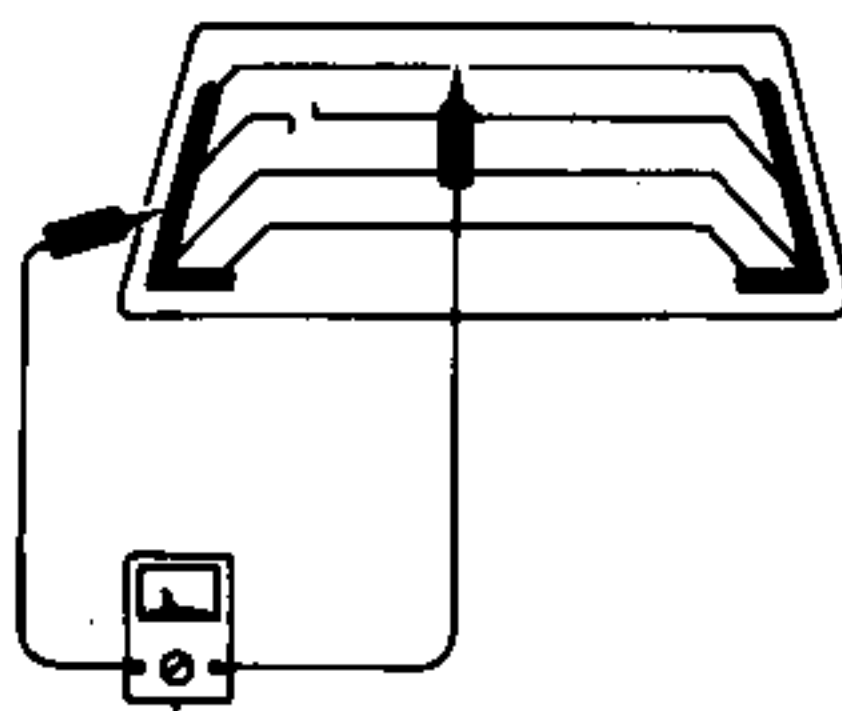
The switch is mounted on ornament of central console (see: Group 66 - Consoles).

Check

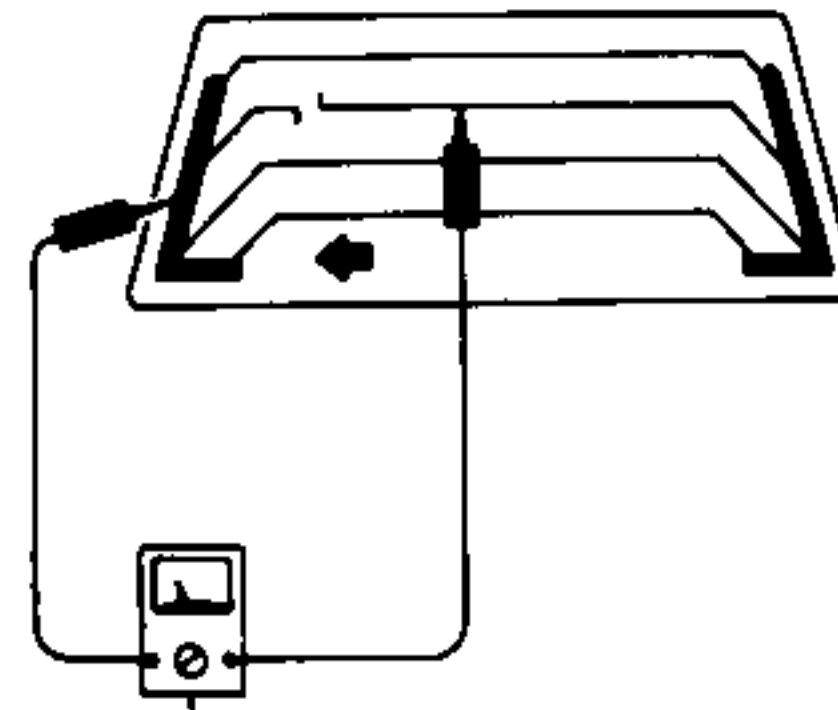
Check proper functioning of switch verifying that continuity between terminals occurs in compliance with indications provided in table.

	OFF	ON
1		○
5		○
13	○	○
14	○	○

2. If a filament is interrupted, the indication on voltmeter must be 0 Volt or 12 Volt.



3. To detect the interruption, it is necessary to move tester probe along filament and to set in evidence the point where instrument indicator moves abruptly.



4. Or, after having verified that current properly flows to heated rear window, check filament electric continuity via switching on of a lamp parallel connected with ends of filament under check.

Filament repair

Tools and materials required for repair:

1. Conductor silver compound
2. Rule (30 cm (11,8 in) length)
3. Ruling pen
4. Heat gun
5. Alcohol
6. Cloth

Repair

1. With a cloth soaked in alcohol, clean the wire interrupted and the surrounding area.
2. On ruling pen end, set a slight amount of conductor silver compound.

Shake the box containing the silver compound before use.

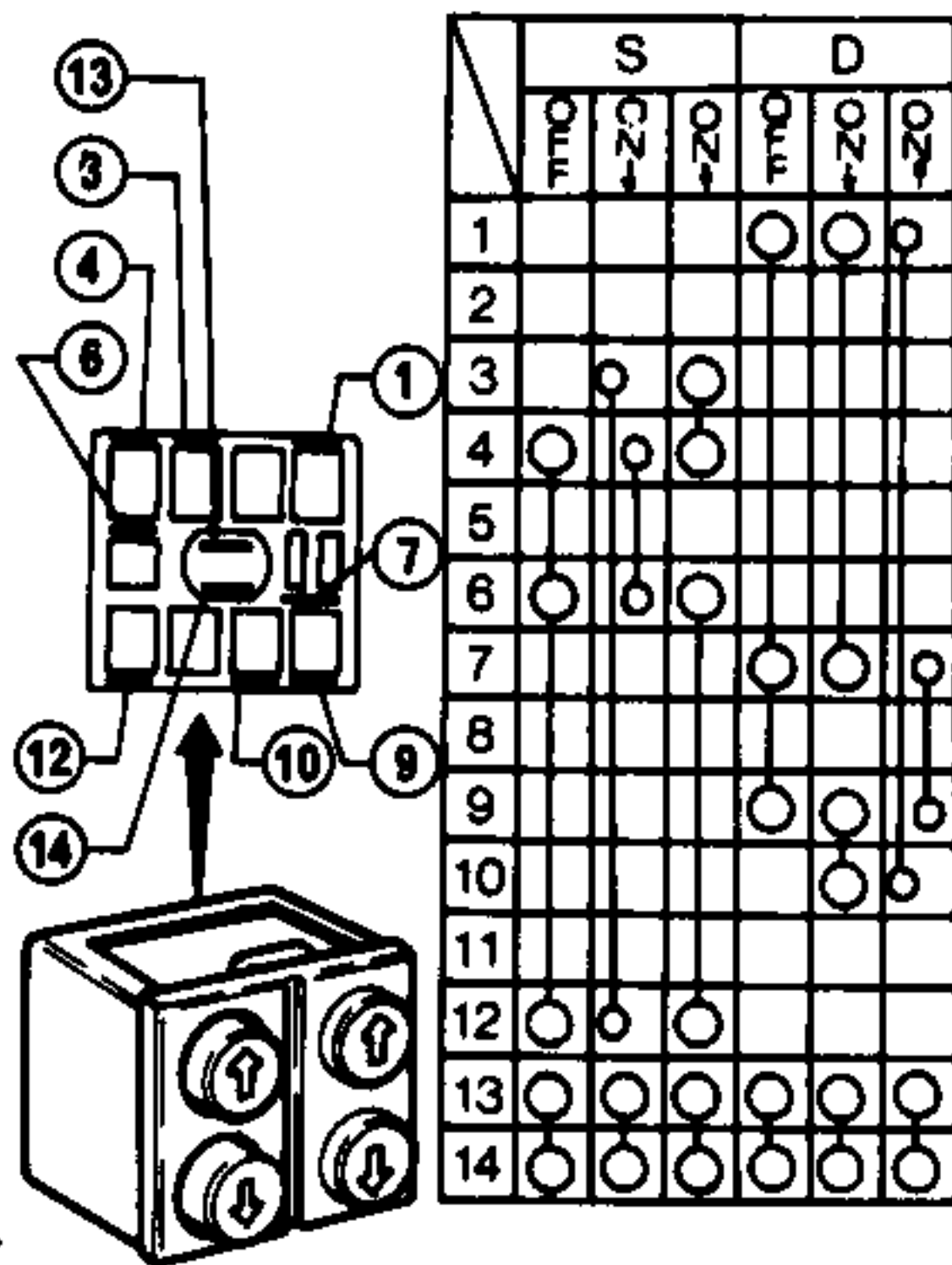
3. Position a rule on glass, in correspondance with the interrupted wire then, by means of the ruling pen, lay the silver compound so as to cover the wire in the interruption area, on both sides, for about 5 mm (0,2 in).

HEATED REAR WINDOW RESISTORS

1. Set terminals of a tester, positioned on a Volt scale (V), one at the end and the other in the middle of each filament of the heated rear window.

If filament is not interrupted, the indication on voltmeter must be 6 Volt.

POWER WINDOW SWITCH



Location

The switch is located on upper ornament of central console (see: Group 66 - Consoles).

Check

Check switch proper functioning by verifying that continuity between terminals occurs in compliance with the indications provided in table.

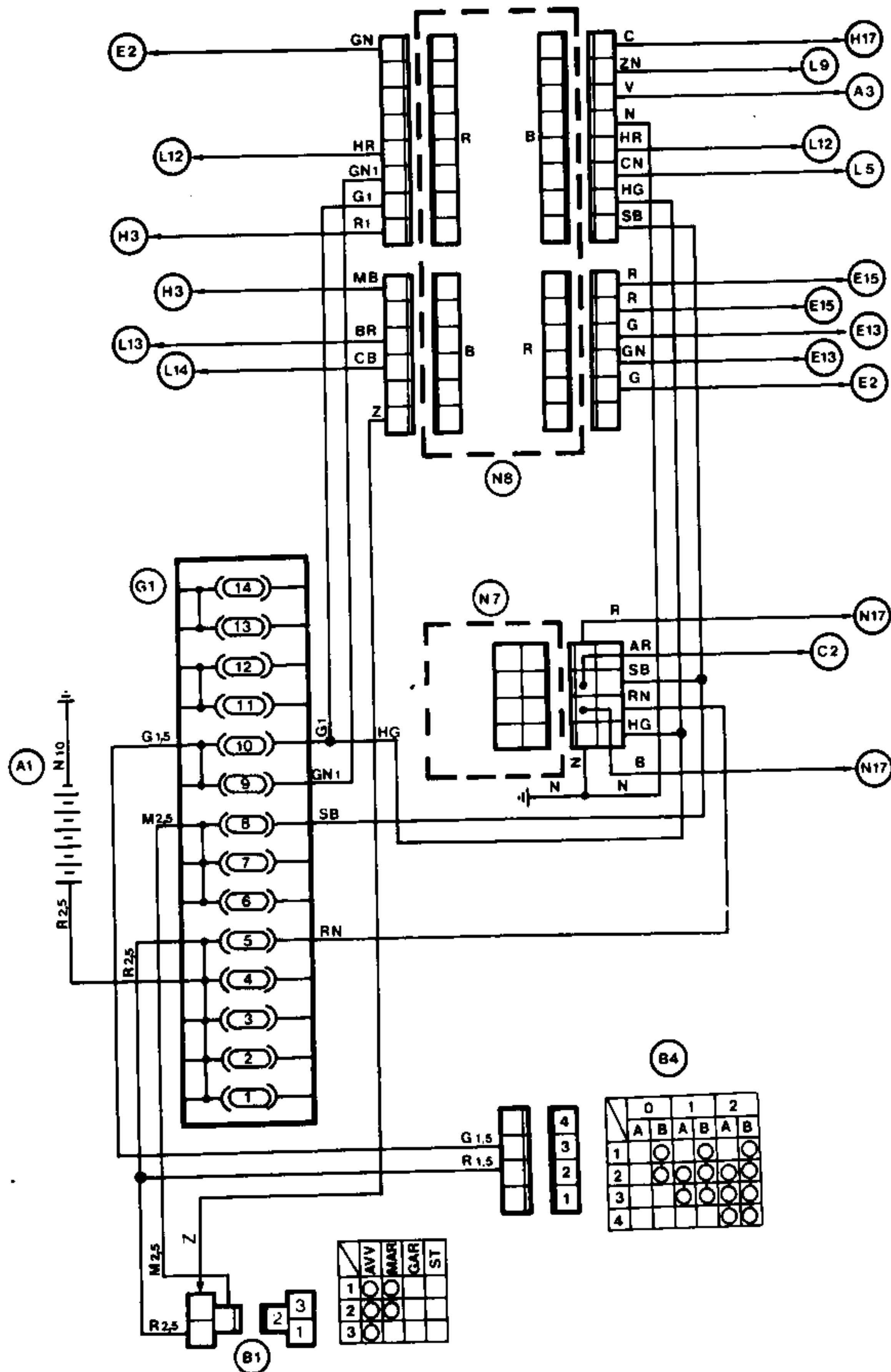
POWER WINDOW MOTOR

Removal and installation

For the "Removal and Installation" procedures see: Group 55 - Front Door - Window Regulator Devices and Glasses.

CHECK CONTROL AND TRIP COMPUTER

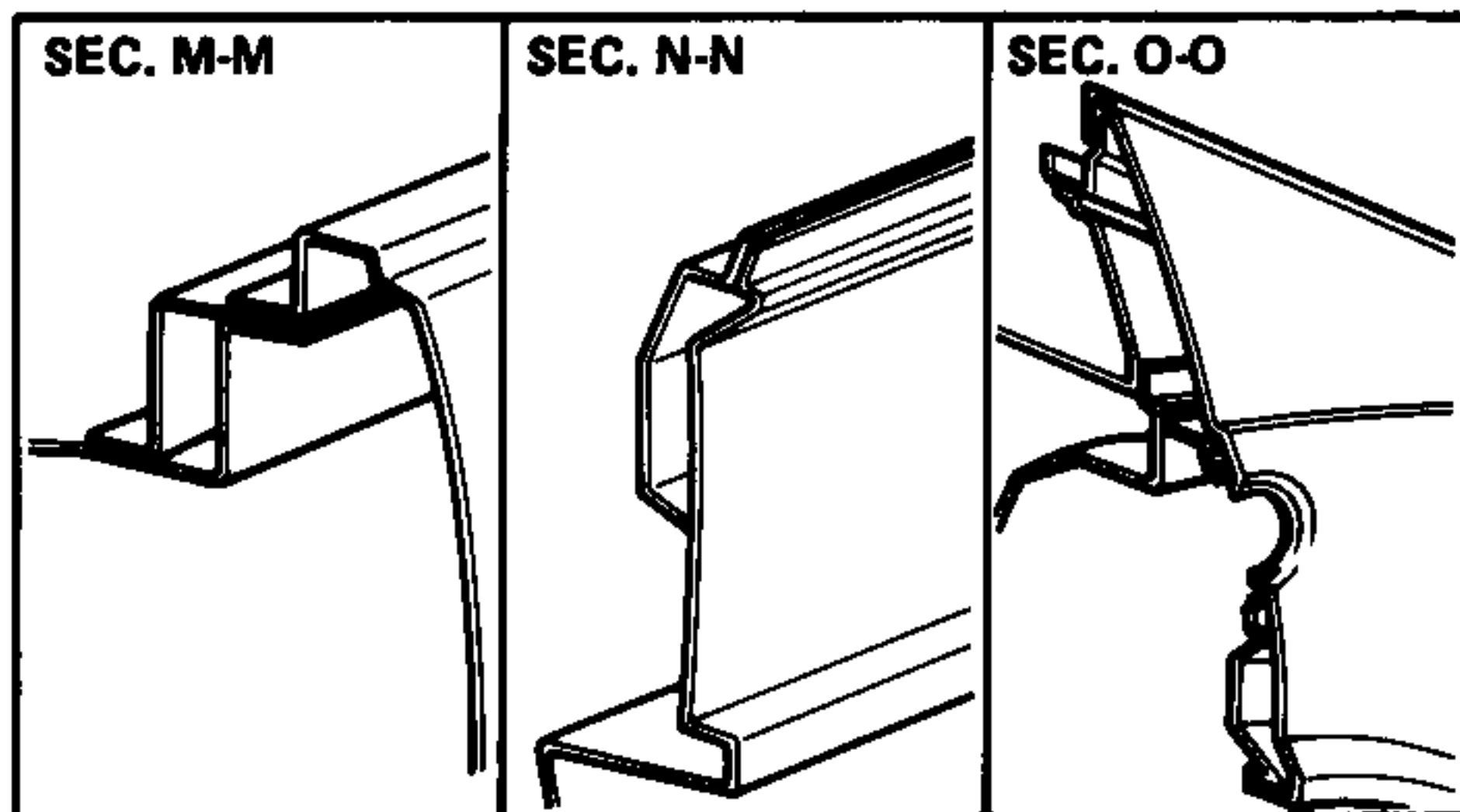
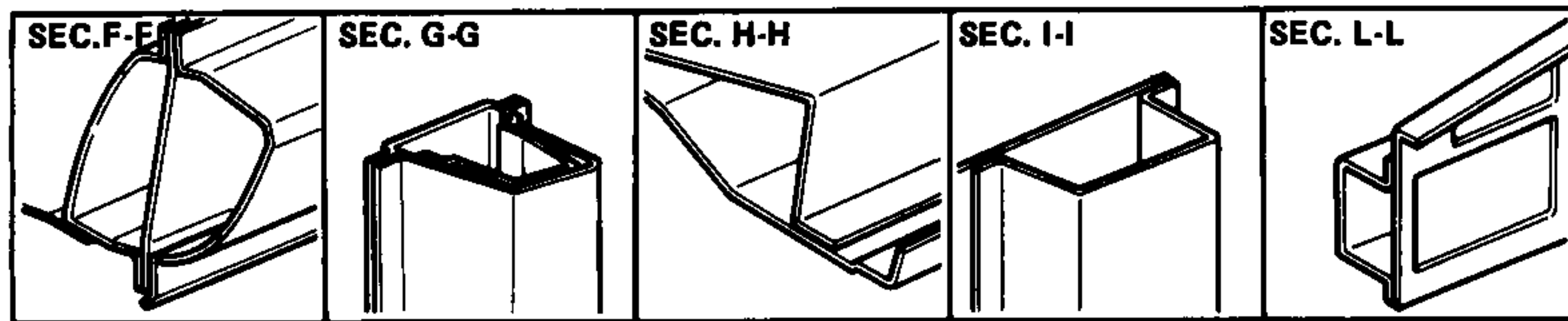
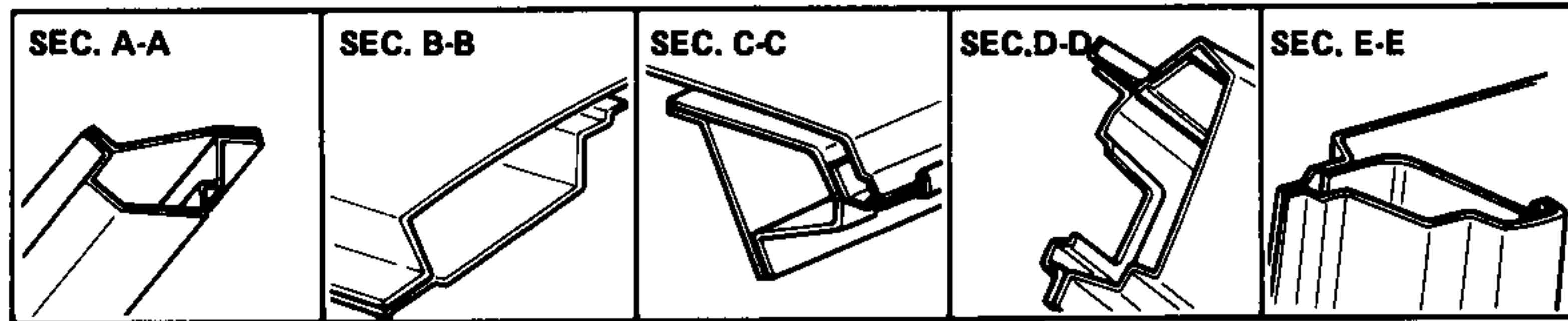
1500 Quadrifoglio model



- A1 Battery
 A3 Alternator with built-in electronic regulator
 B1 Ignition switch
 B4 Control switch for headlight, flashing, low beam and full beam
 C2 Electronic tachometer
 E2 Front side light lamp
 E13 Tail light lamp
 E15 Stop light lamp
 G1 Fusebox
 H3 Stop light switch

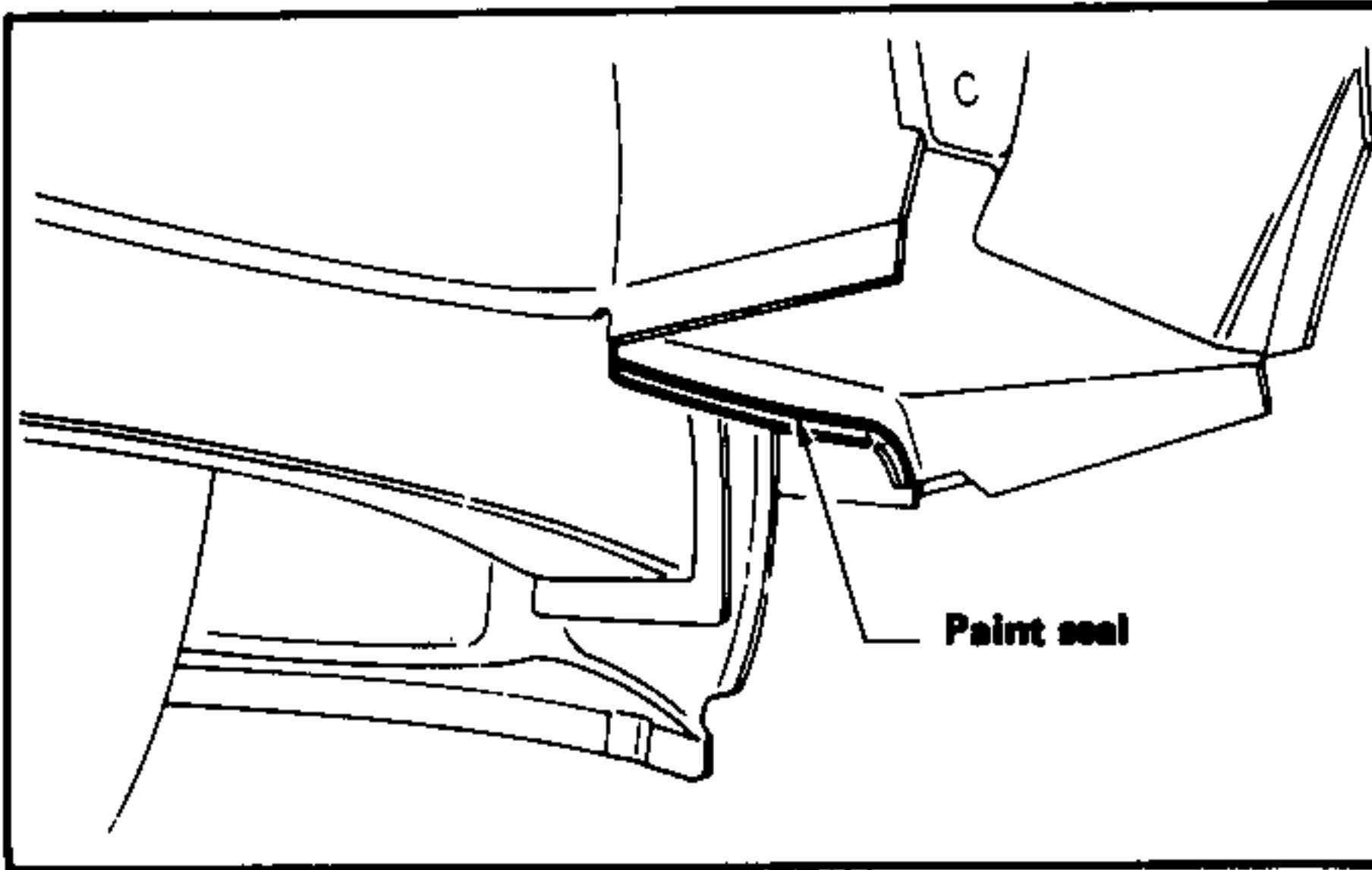
- H17 Brake fluid min. level control switch
 L5 Thermostatic switch for engine coolant max. temperature warning lamp
 L9 Transmitter for fuel level gauge
 L12 Engine oil level indicator
 L13 Windscreen washer liquid level sensor
 L14 Engine coolant level sensor
 N7 Trip Computer
 N8 Check Control
 N17 Trip control unit for fuel flow

BODY – SHEET METAL PANELS

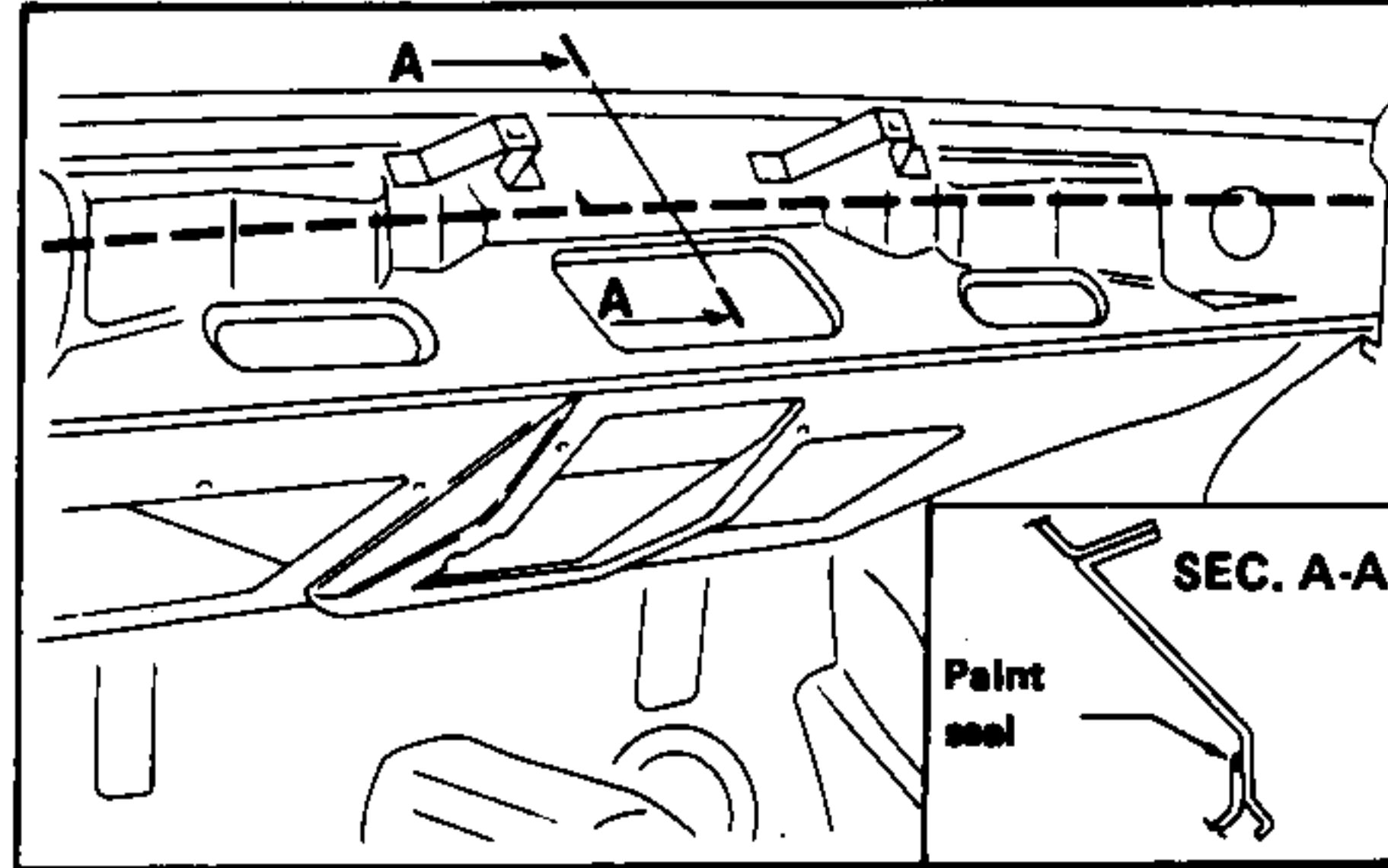


BODY – SHEET METAL PANELS

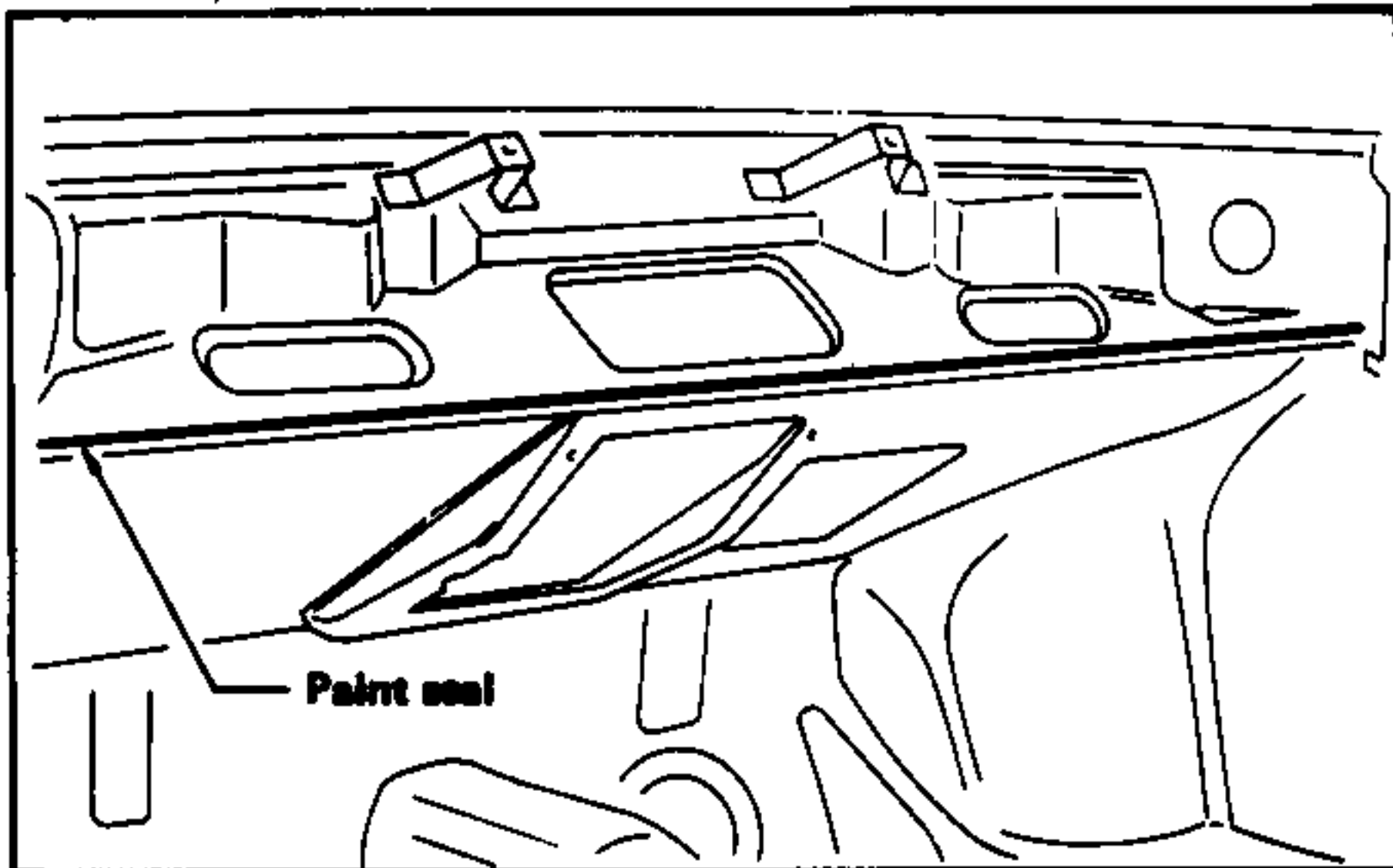
Detail A



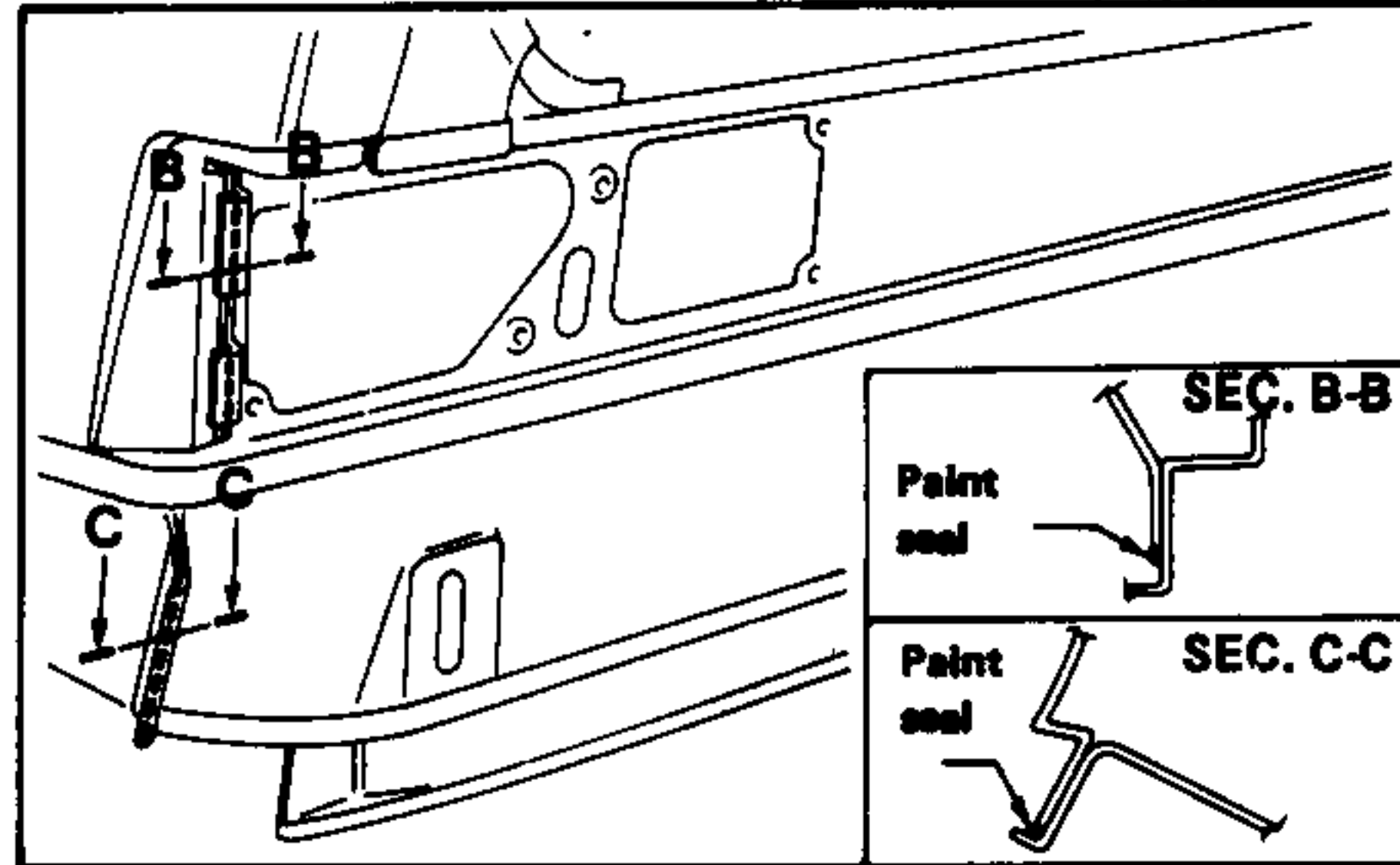
View from B



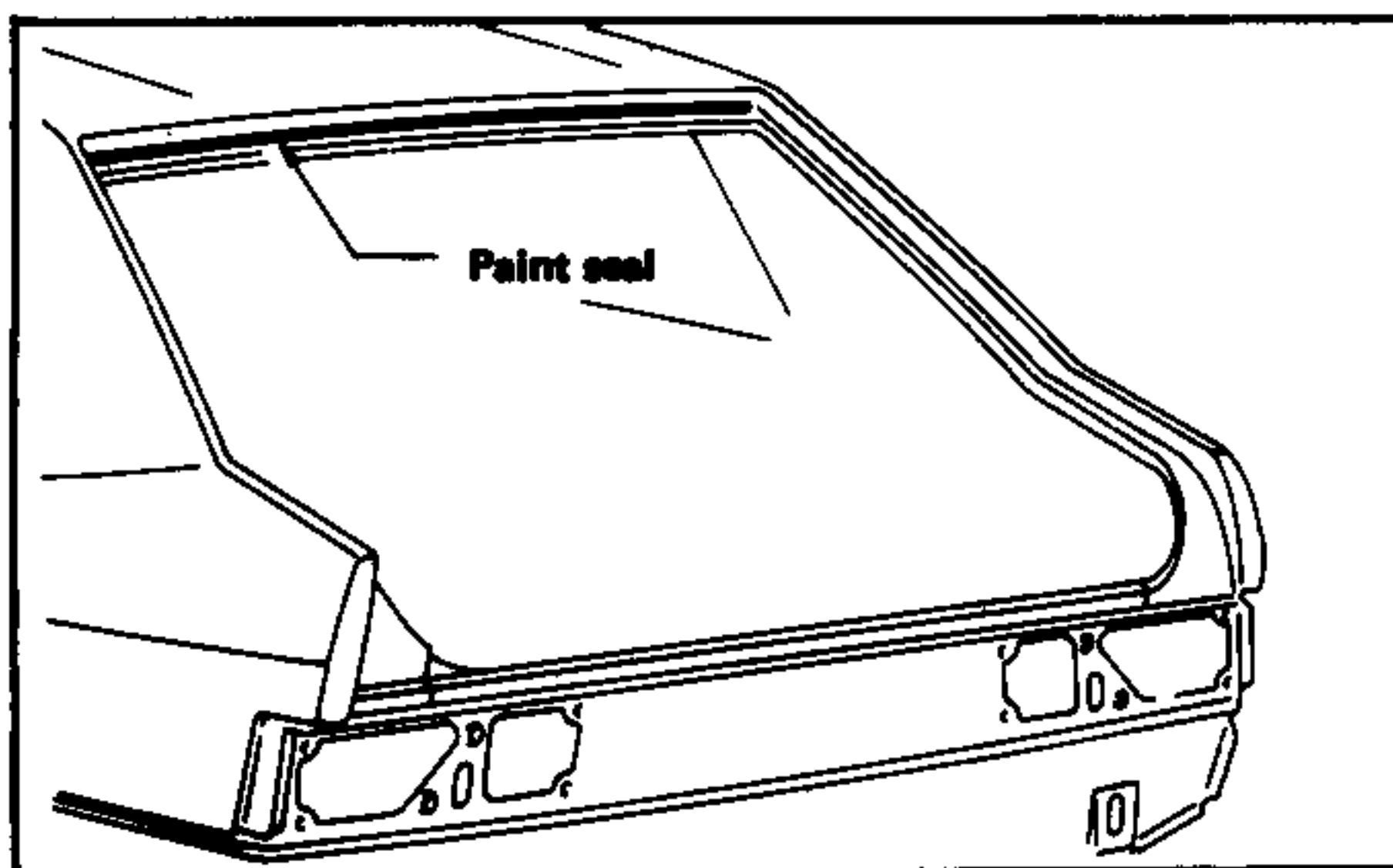
View from C



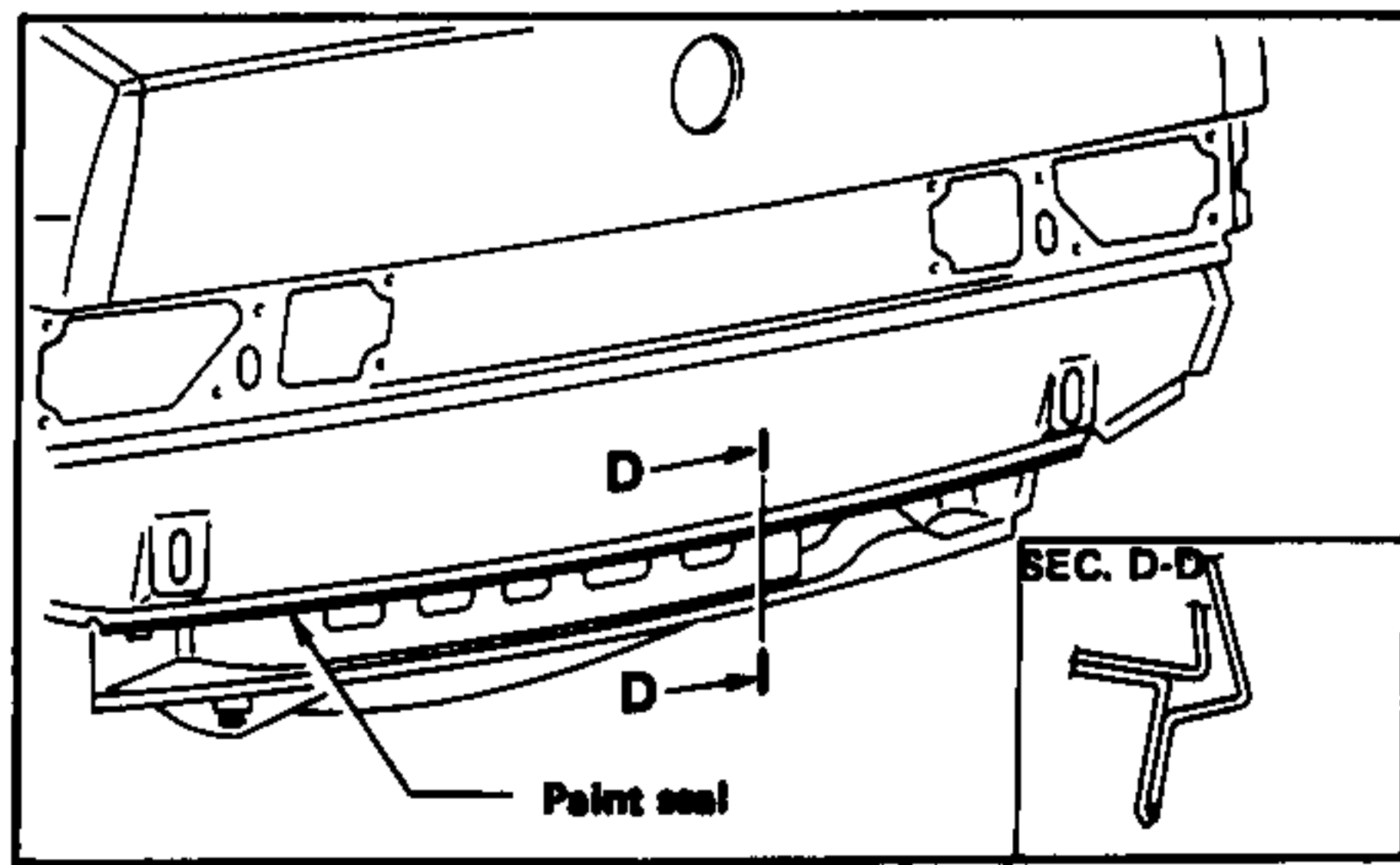
View from D



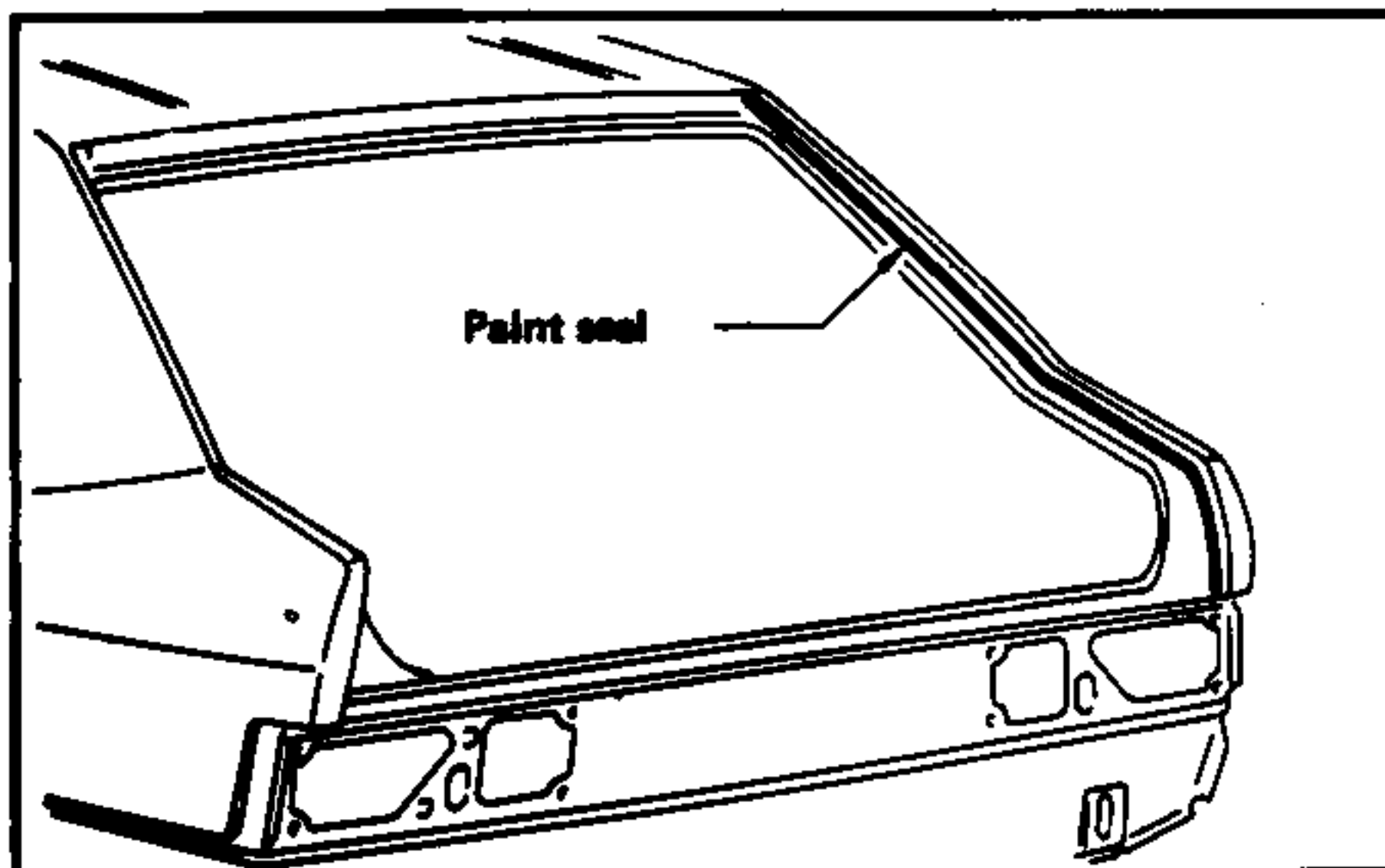
View from E



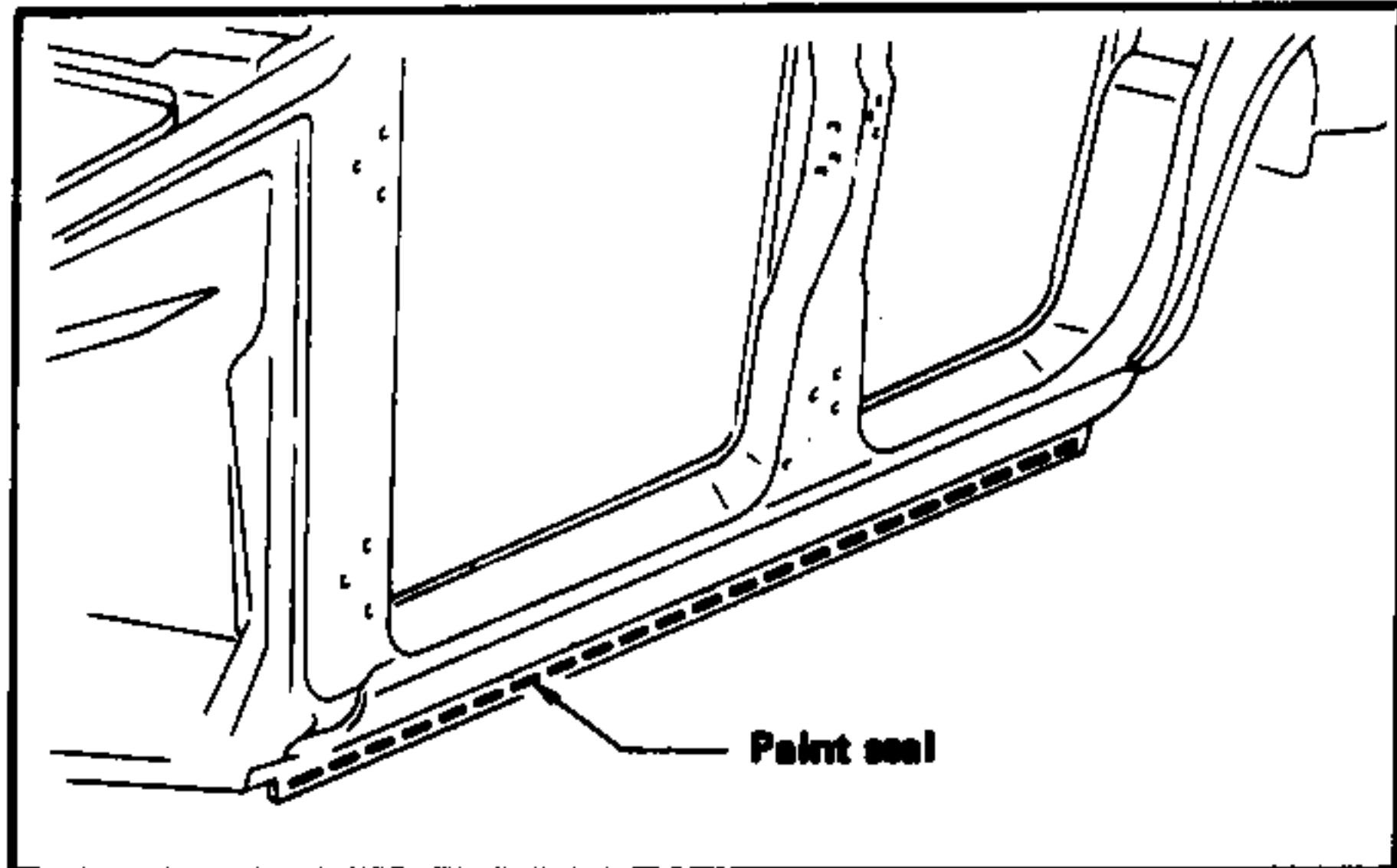
View from F



View from G



View from H

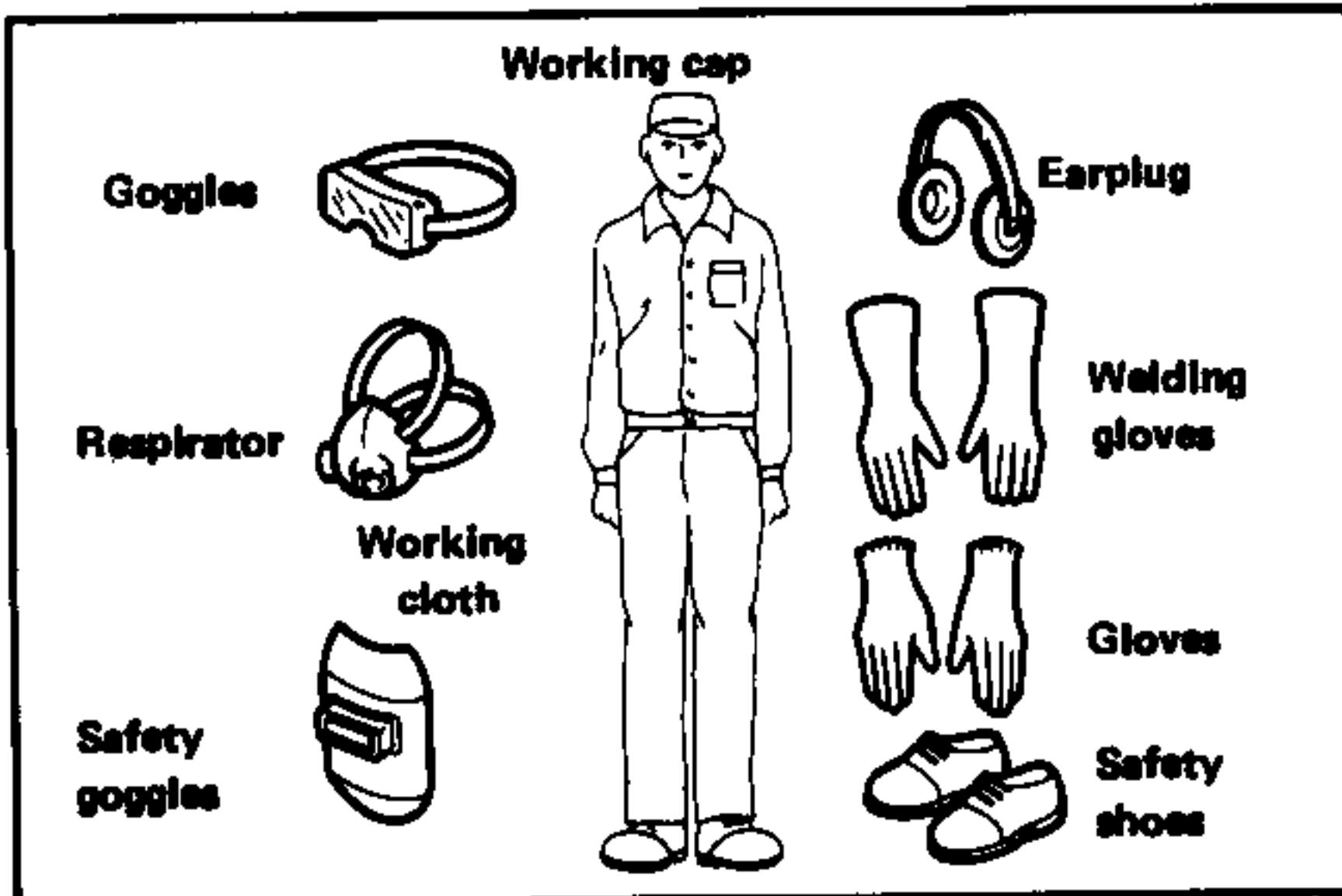


CAUTIONS FOR THE OPERATORS

SAFETY RULES

1. Wear protectors

- Depending on the work to be carried out, make sure to wear goggles, earplug, respirator etc. Always wear working clothes, safety shoes and working cap.

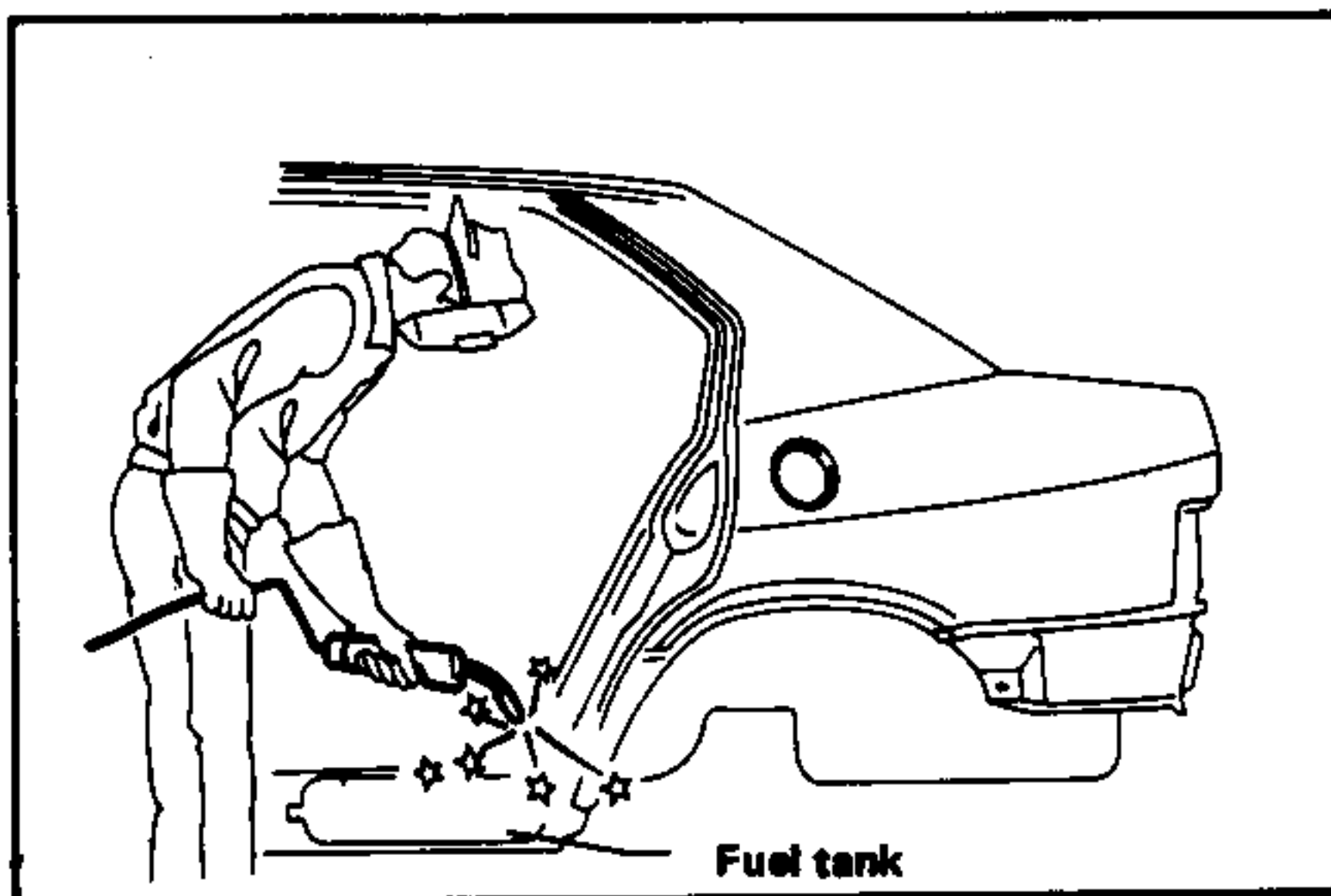


2. Safety stands

- After jacking up the vehicle, support it by means of suitable safety stands. For identification of face points, refer to "Lifting Points".

3. Inflammable

- Before starting any operation, make sure that battery ground cable has been disconnected.
- In case welding operations in proximity to tank are to be carried out, remove it from its compartment and plug the union.
- When removing unions, plug the previously released connections of fuel pipings and of brake fluid.



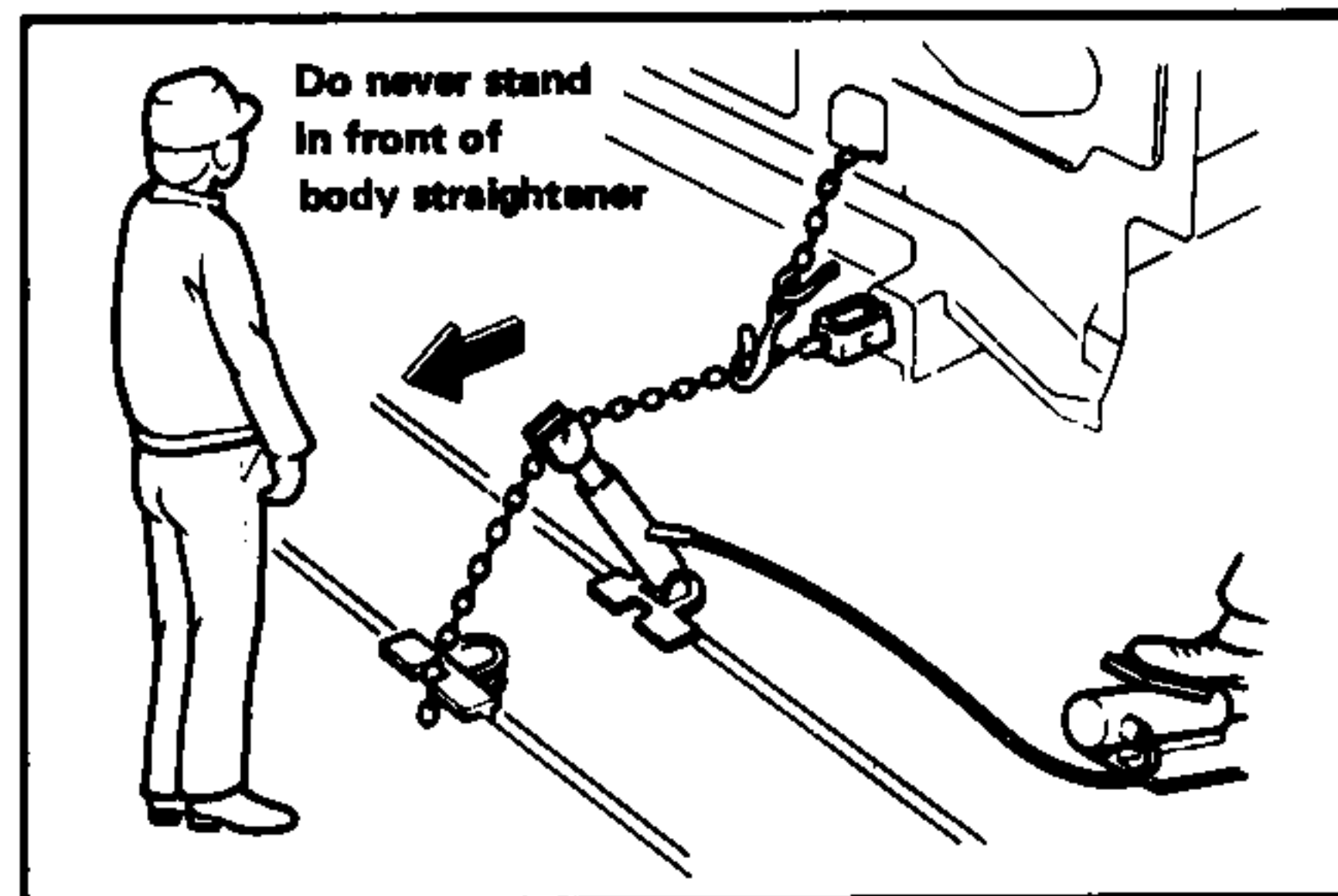
4. Working environment

- The working environment must be well ventilated and illuminated, in order to ensure operator safety.
- Paints and sealants, when heated, may generate

poisonous gases. In order to prevent it, when cutting and removing damaged sheets make use of an air saw or an air chisel instead of gas welder.

- For removal of paint from sheet make use of a belt sander or rotary wire brush.
- Vehicle body straightener
- Make sure that body straightener is properly used in accordance with procedures of Instruction Manual of equipment manufacturer.

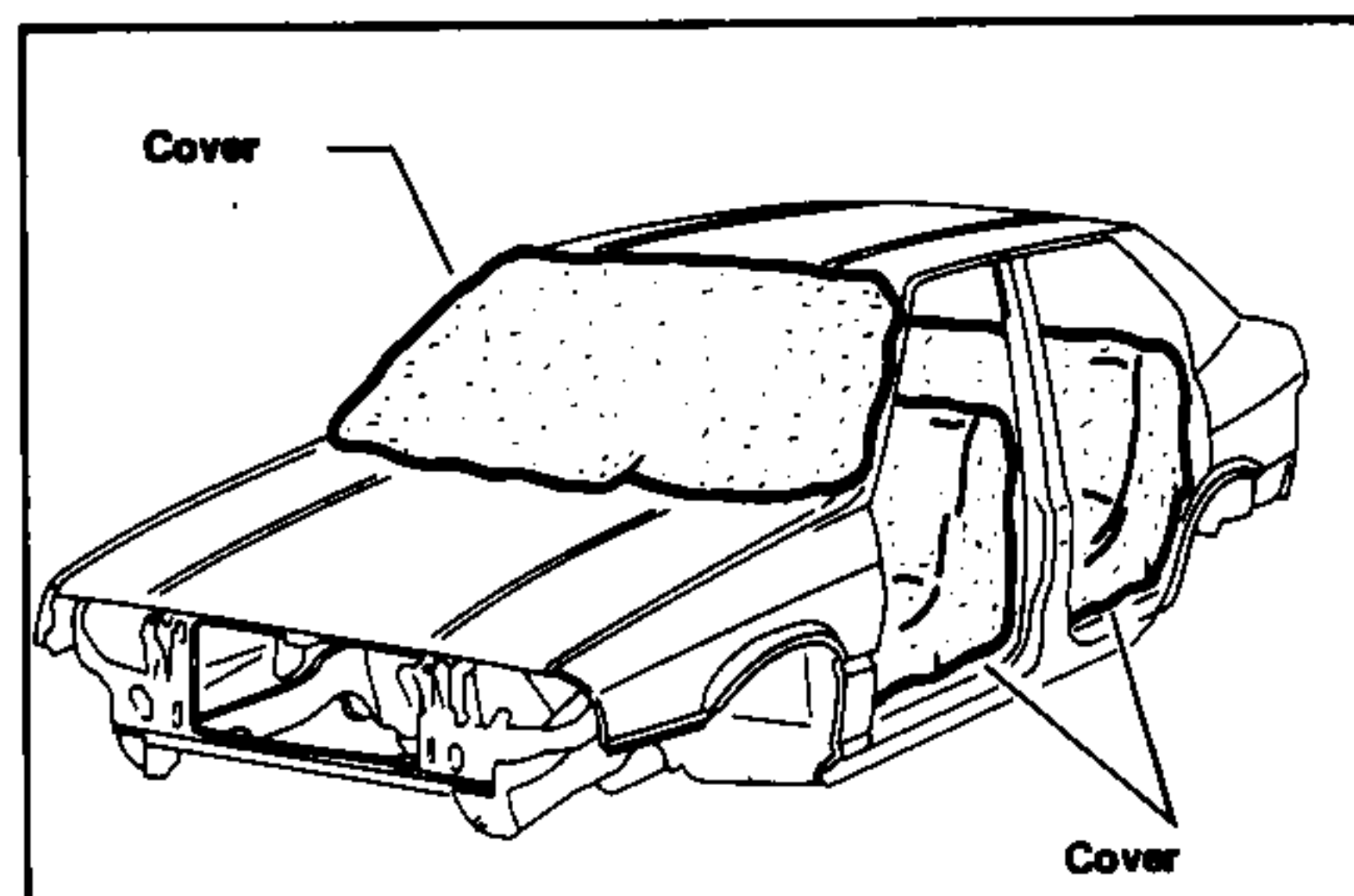
During straightening operations of the damaged body, do never stand in front of the machine in the direction towards which it is straightening.



BODY AND OUTER COMPONENTS PROTECTIONS

1. Body protection

- Remove or cover vehicle trim (upholstery, instruments, carpets).
- Before soldering operations cover glasses, upholstery and carpets, with heat-resistant materials (this protection is highly recommended especially for CO₂ arc welding).



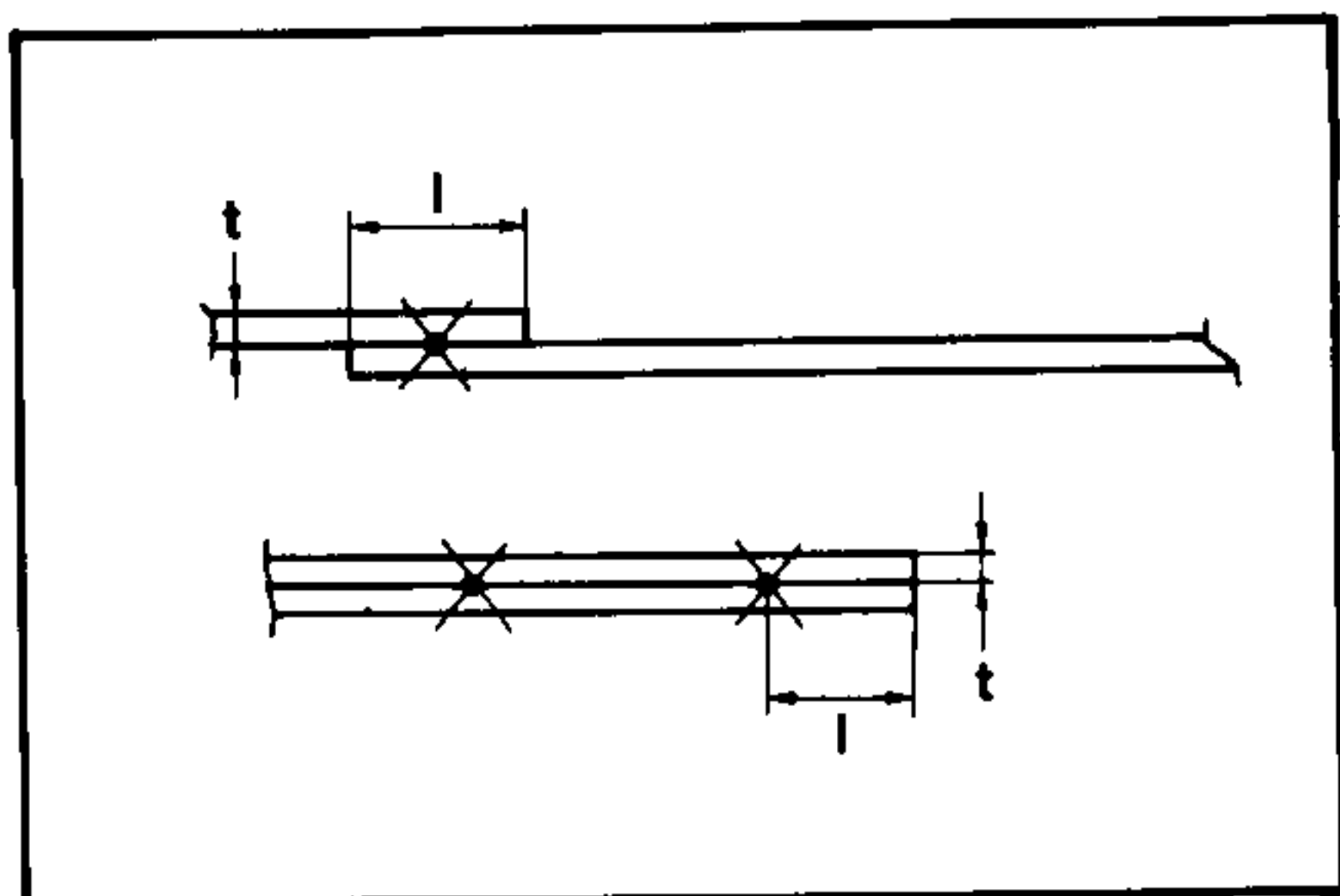
BODY – SHEET METAL PANELS

It is important not to excessively reduce pitch, as it may cause current to flow through the surrounding points and then, a reduction of welding strength.

(6) Welding spot position from panel edge.

In case of welding in proximity to panel edge, comply with dimensions provided in the following table.

Thickness (t) mm (in)	Minimum pitch (l) mm (in)
0.6 (0.024)	11 (0.43) or more
0.8 (0.031)	11 (0.43) or more
1.0 (0.039)	12 (0.47) or more
1.2 (0.047)	14 (0.55) or more
1.6 (0.063)	16 (0.63) or more
1.8 (0.071)	17 (0.67) or more

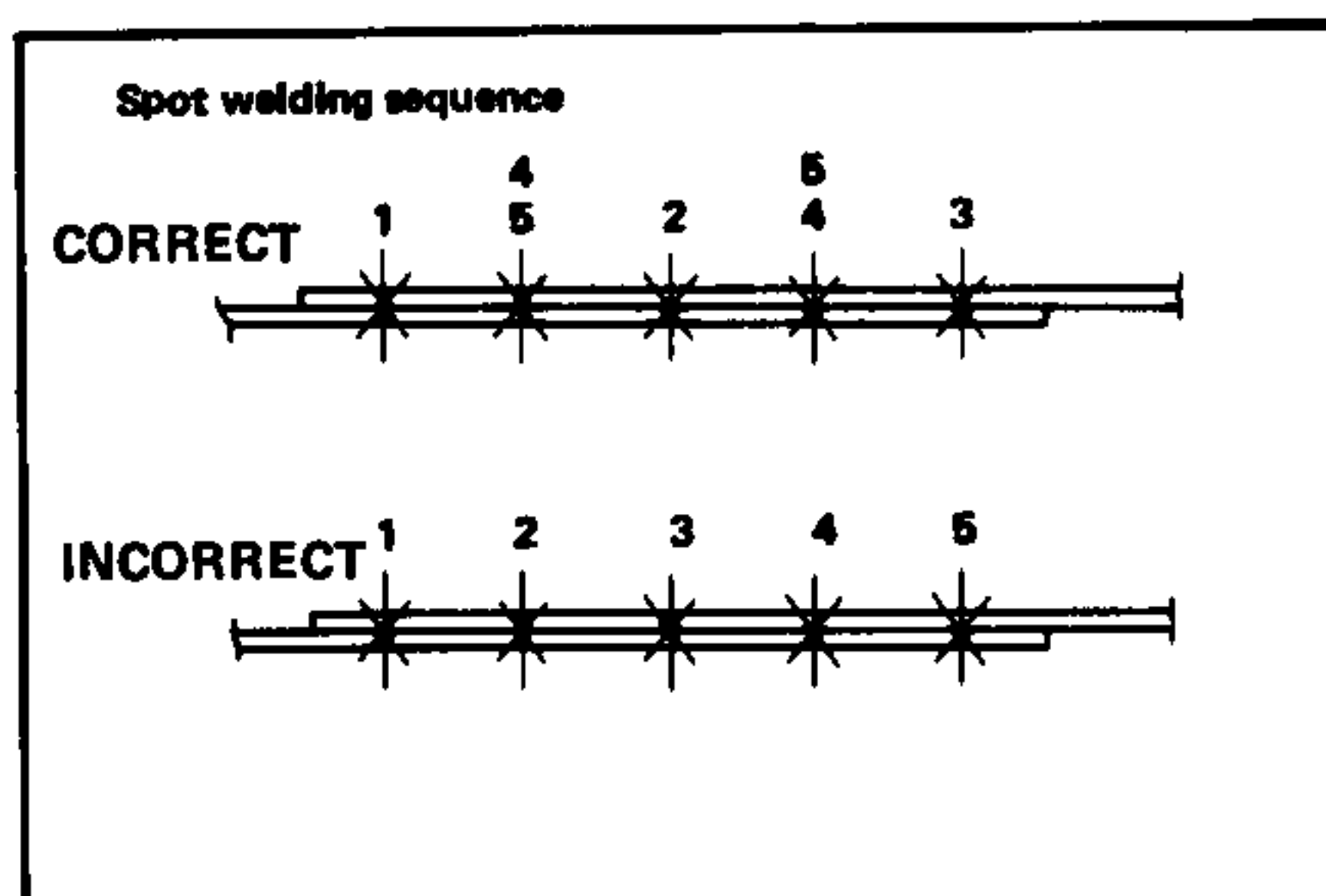


A welding too near to panel edge has no strength enough; besides, sheet can get strained.

(7) Spot welding sequence.

Do not perform continuous spot welding along one direction only. This method generates a weak welding due to the current shunt effect.

Each time electrode ends get overheated or change their color, stop welding and allow ends to cool.

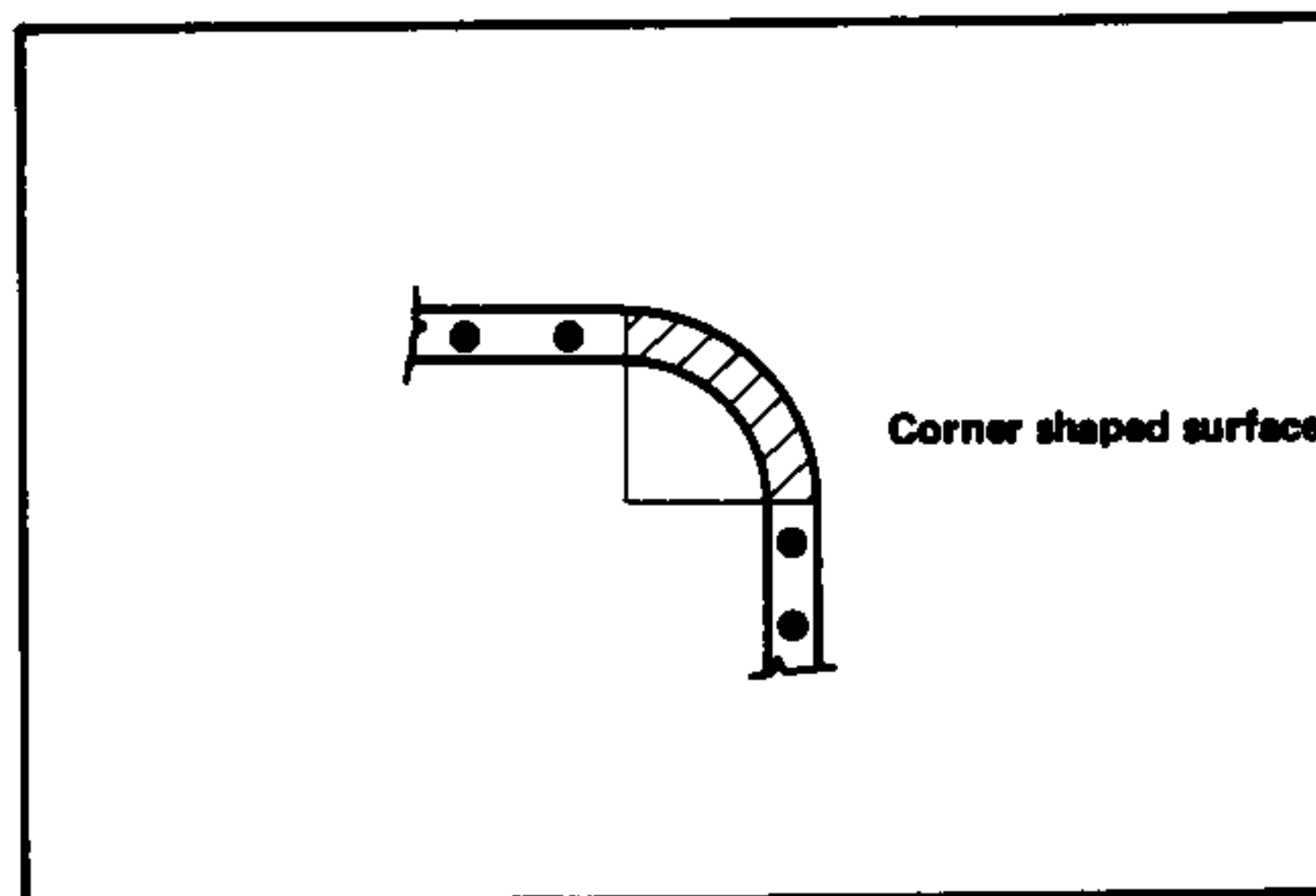


(8) Welding on corner surfaces.

Do not weld on corner surfaces. If not so, the welded surface results under stress concentration which can generate breakages.

e.g.:

- Upper corner of both central and front pillars
- Front upper part of rear fender
- Corners of both front and rear windows



4. Inspection of spot welded areas

Inspection of a spot welded part, can be of two types: visual and destructive. It is recommended to carry out the latter type of inspection both before welding operation and at the end of it.

The welding spots must be equally spaced and positioned on center of flange to be welded.

(1) Test to be carried out before welding, by means of test piece.

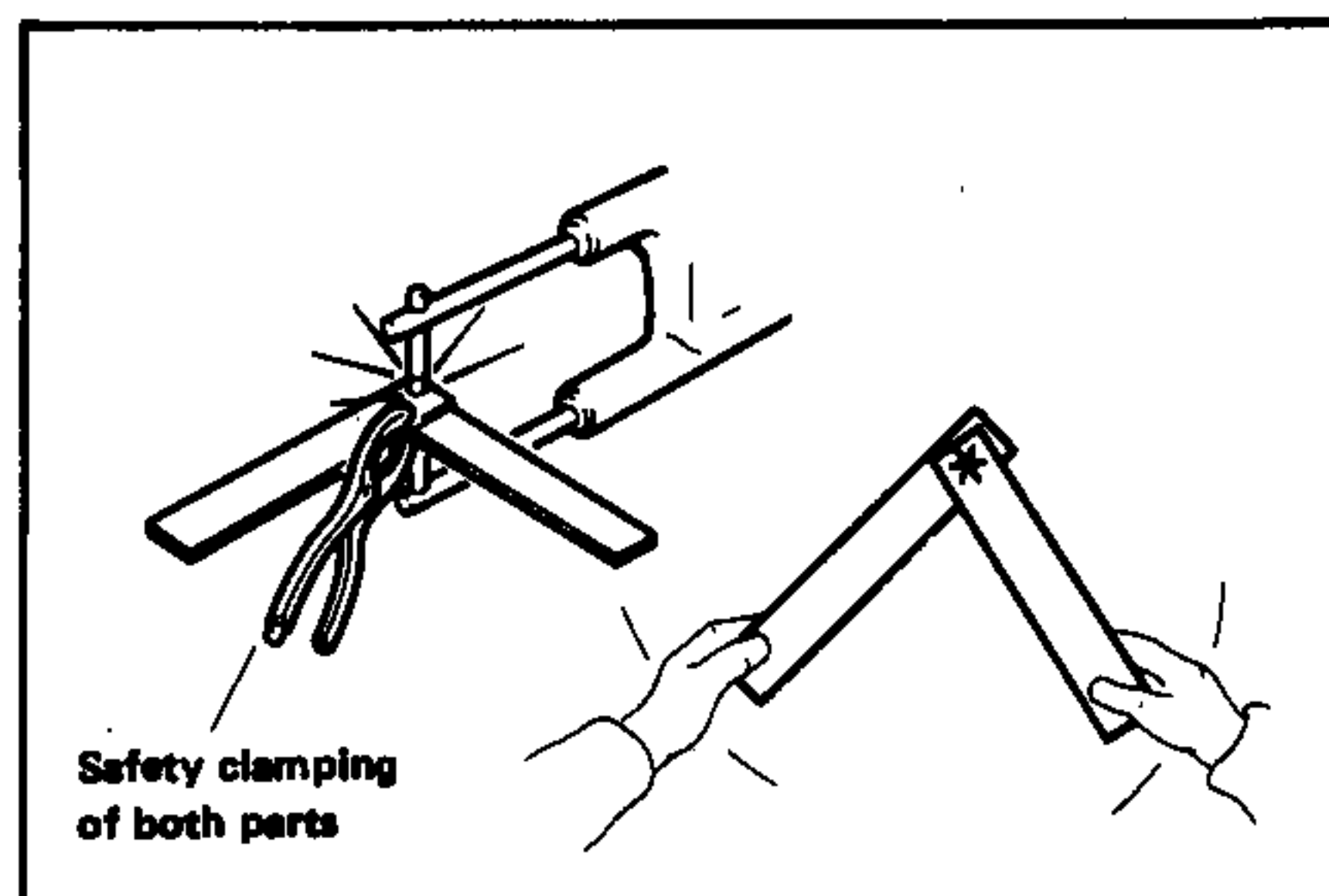
- Prepare test pieces having thickness equal to that of sheets to be welded and clamp them so as they do not slip or move during welding operation.

Carry out welding.

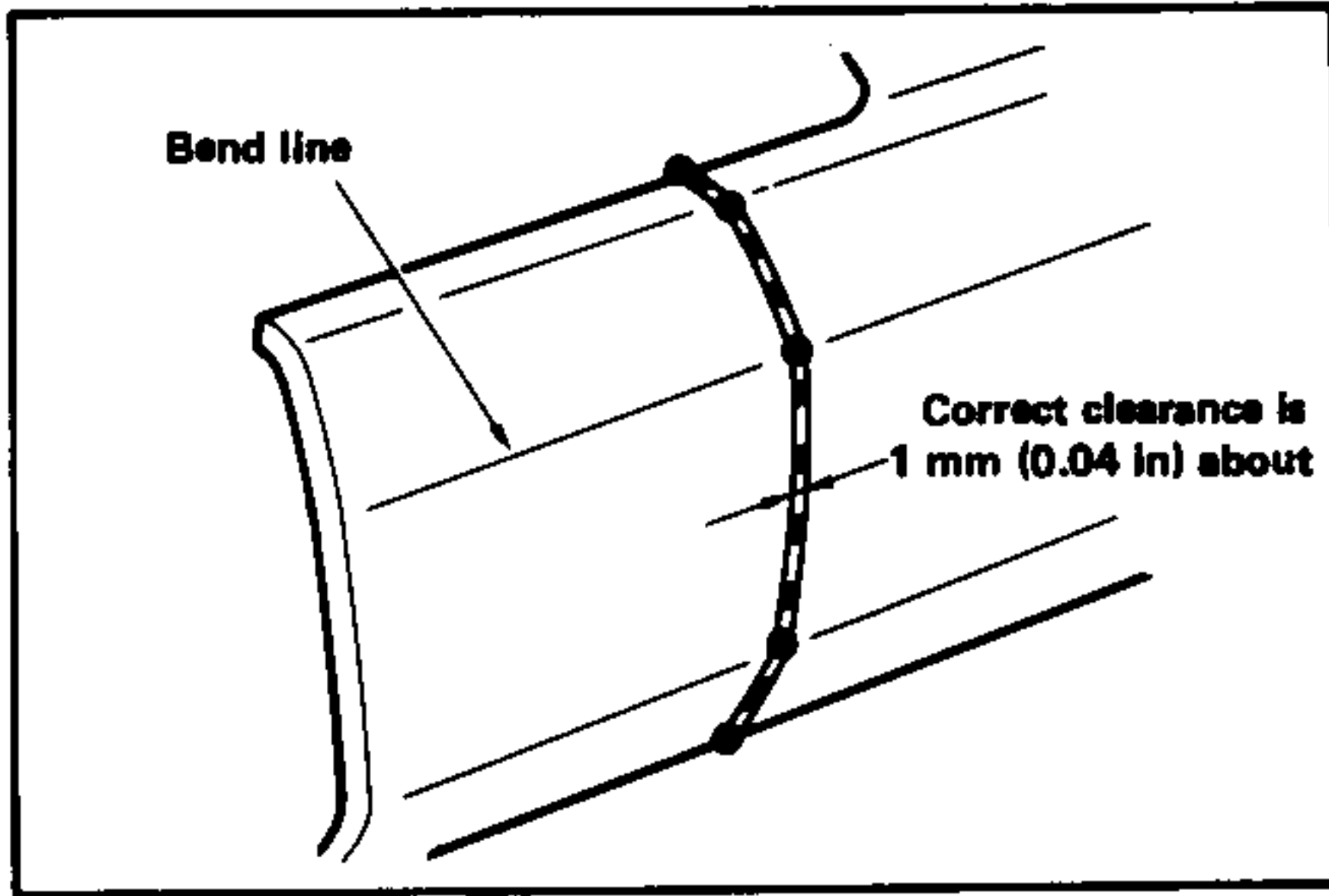
- Detach the welded test pieces by letting them rotate around welding point and verify the breakage areas. The whole welding spot must remain on one of the two sheets while, in the other corresponding one, there must be a circular opening.

If not so, welding conditions are incorrect.

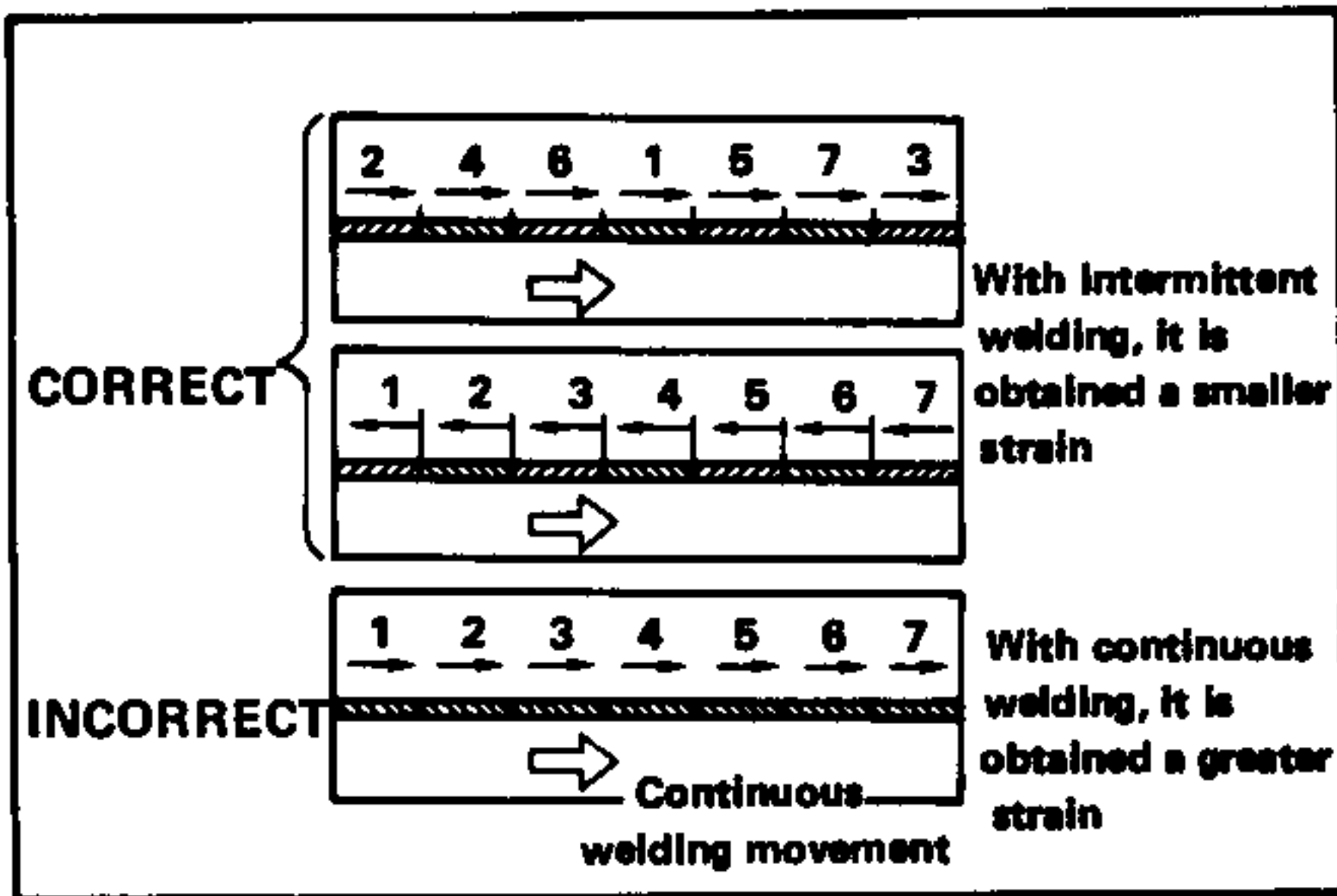
Adjust pressure, welding current, current flow time, and then, the other welding conditions; then, repeat test as long as the optimal result is obtained.



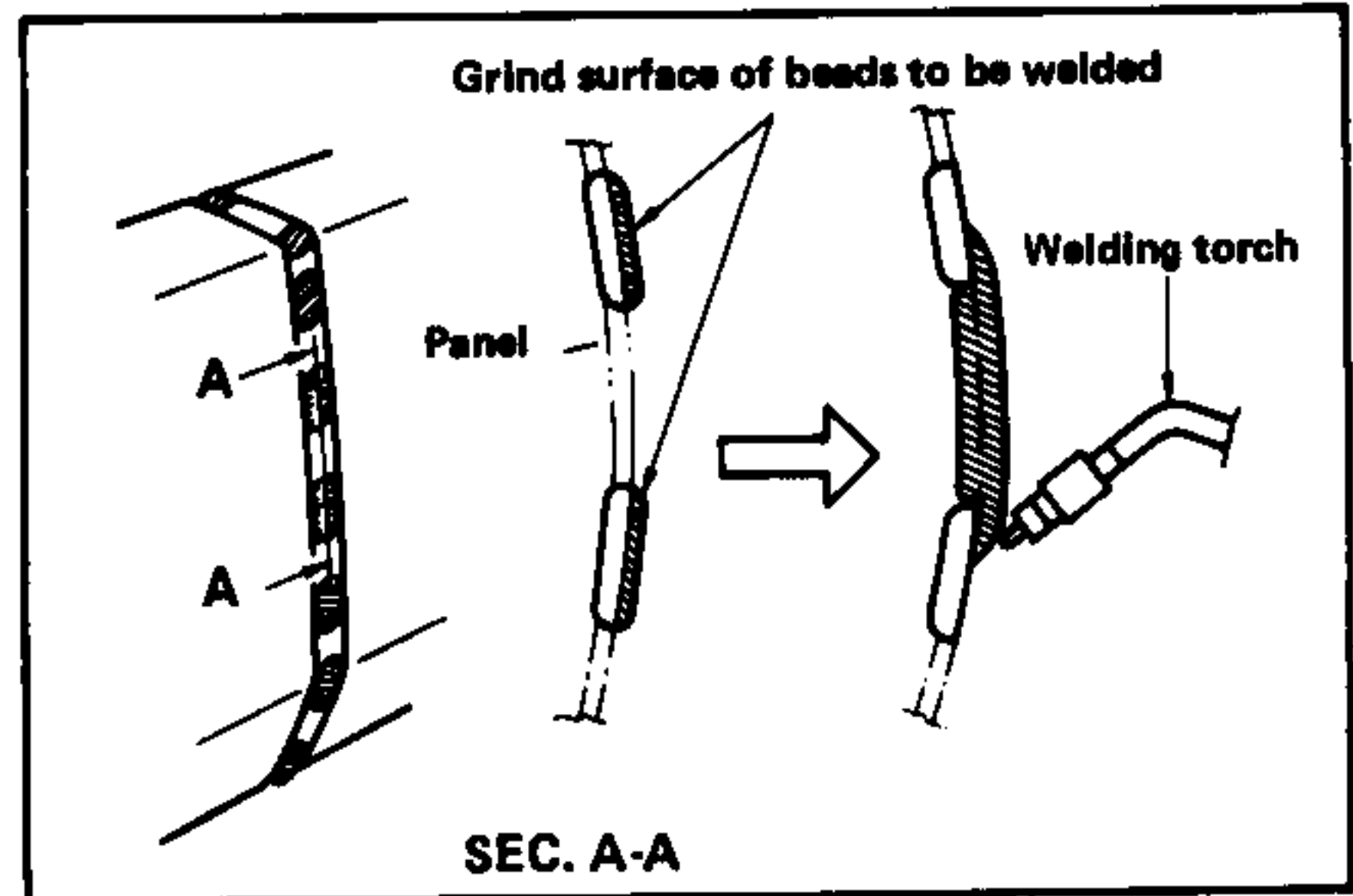
BODY – SHEET METAL PANELS



- b) Do not perform long weld line: it may cause strains. Proceed as shown in figure in order to reduce strain.



- c) Before filling spaces between intermittently placed beads, grind beads by means of a sander following panel shape. If bead surface is not grinded, blow holes may occur.

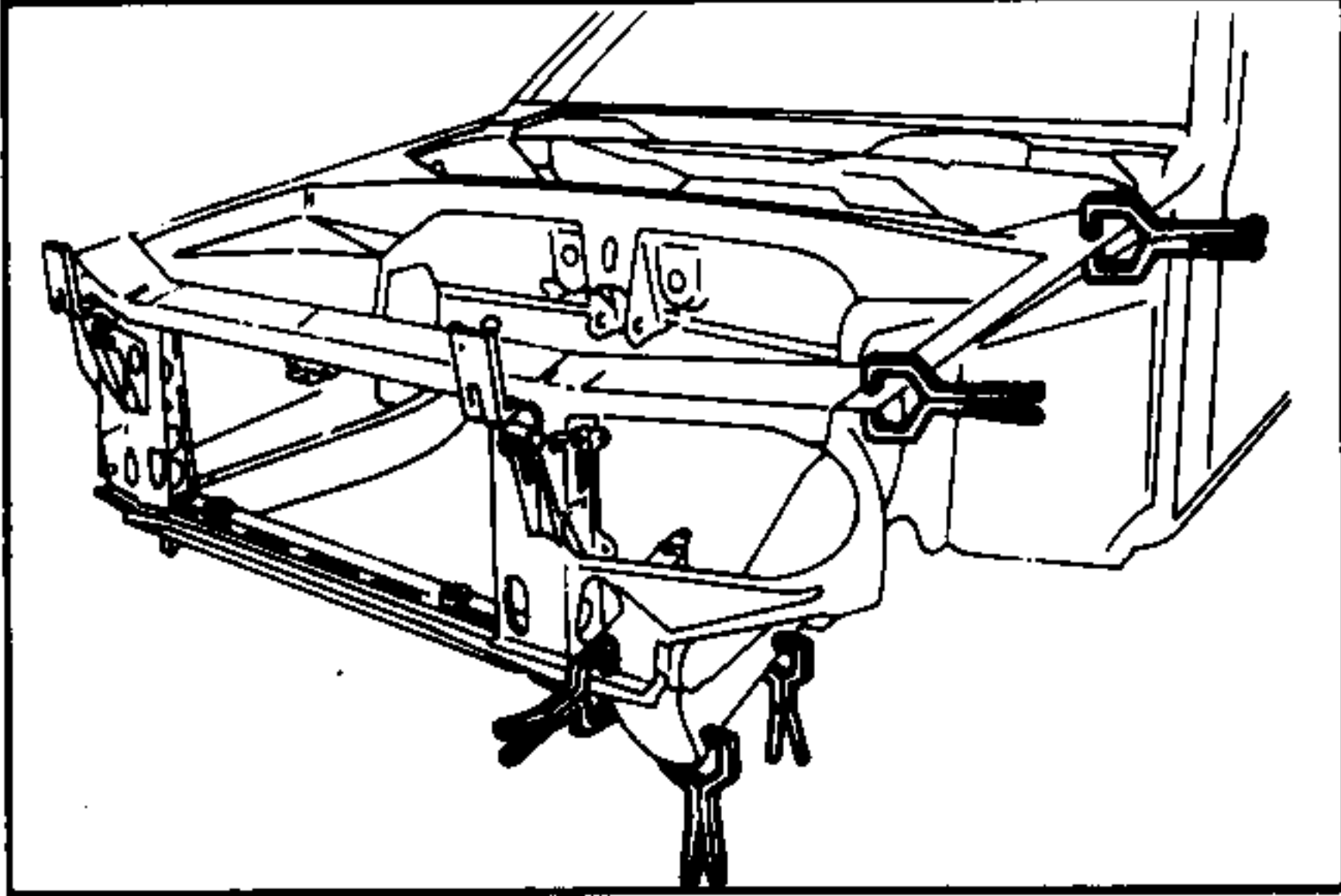


3. Welding inspection.

The inspection procedure is similar to the spot welding one.

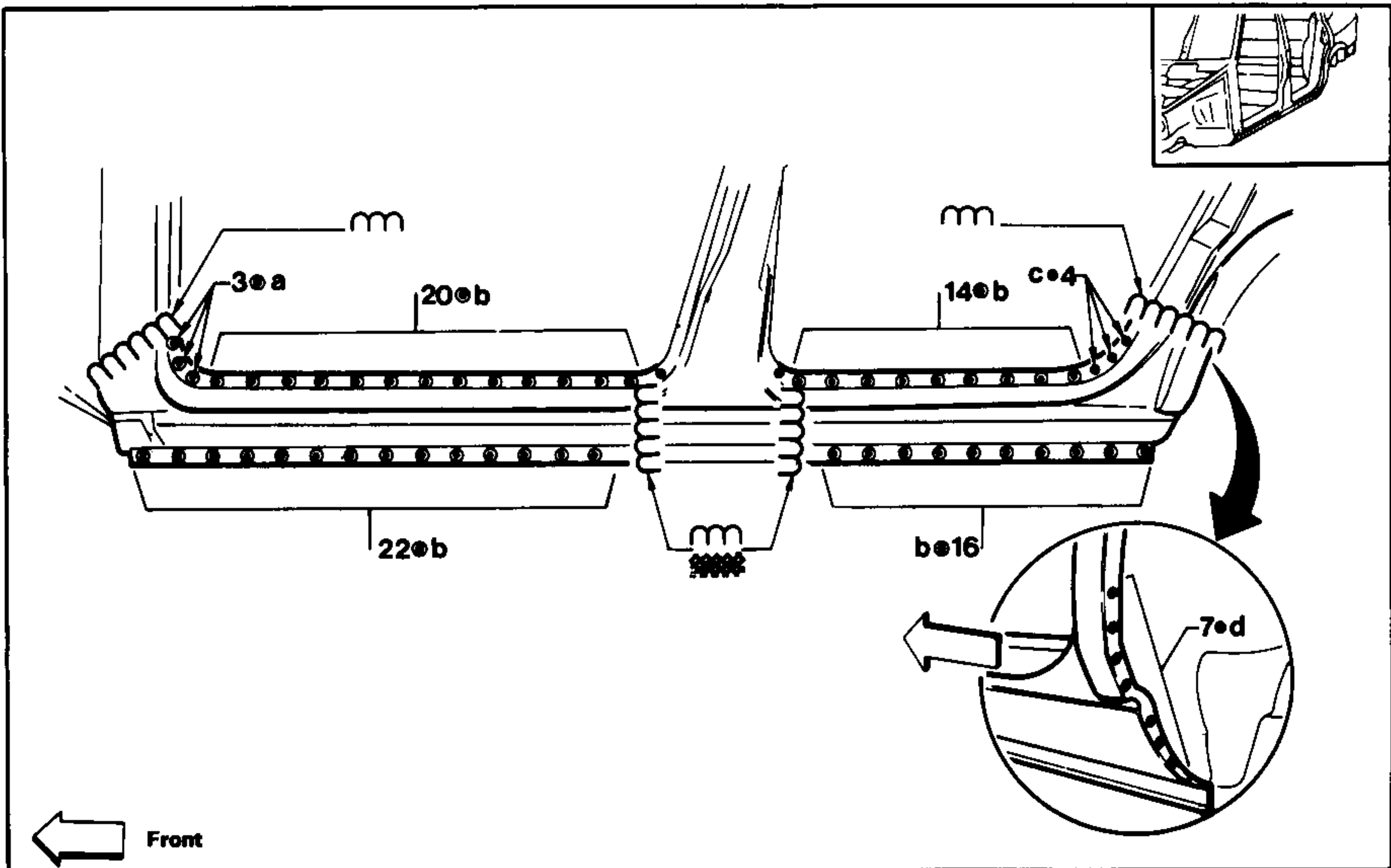
Fender temporary installation

- By means of clamps temporarily secure side member, radiator core support and hoodedge panel; position a cover plate on side member joint then carry out welding.



OUTER SIDE MEMBER (Partial Replacement)

Service joints

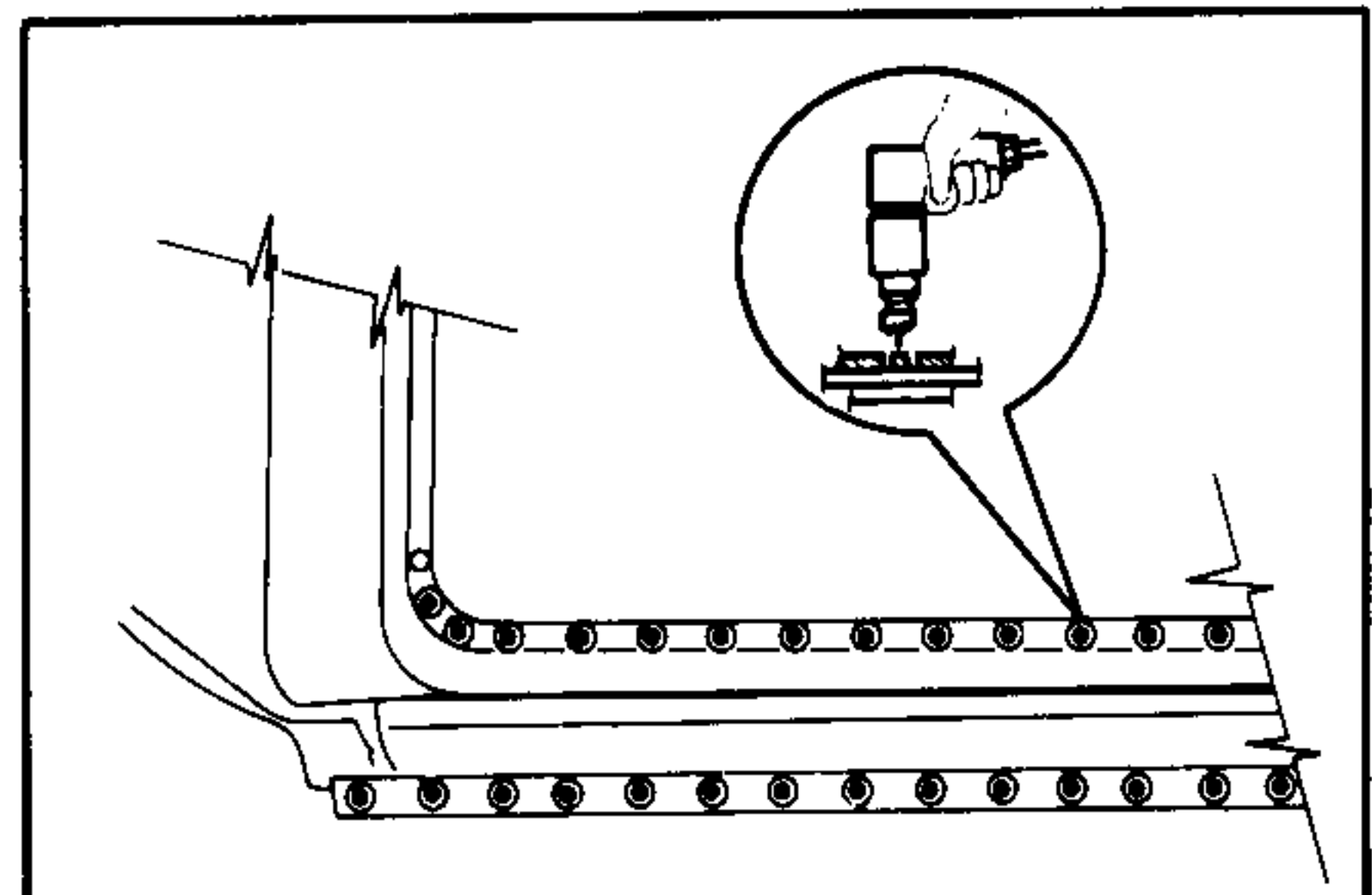
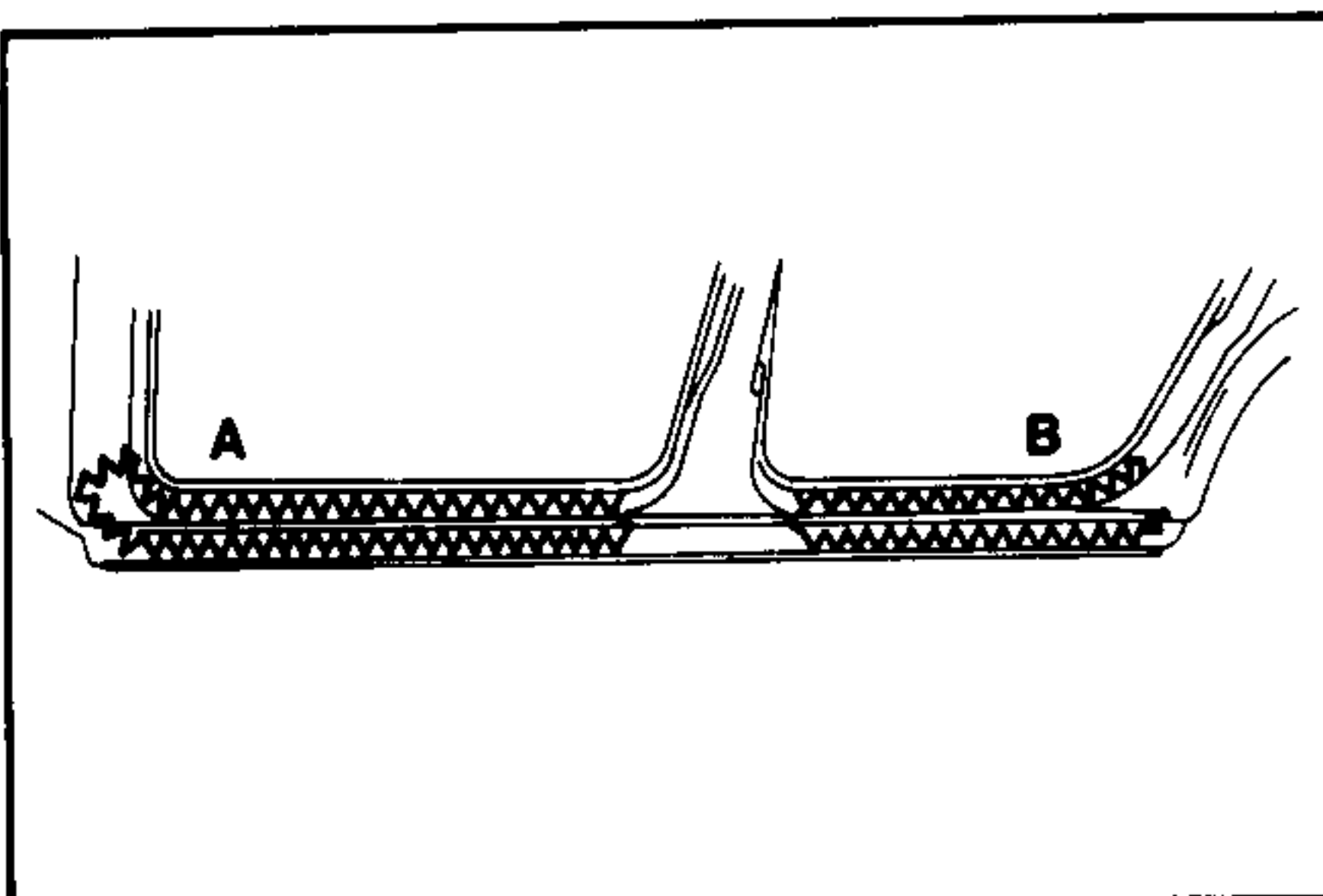


Parts to be welded

- | | |
|--|--|
| a. Outer side member, front side member and inner front pillar | member |
| b. Outer side member, diaphragm and central floor side | c. Outer side member and inner wheelarch |
| | d. Outer side member and outer wheelarch |

REMINDER WHEN REMOVING

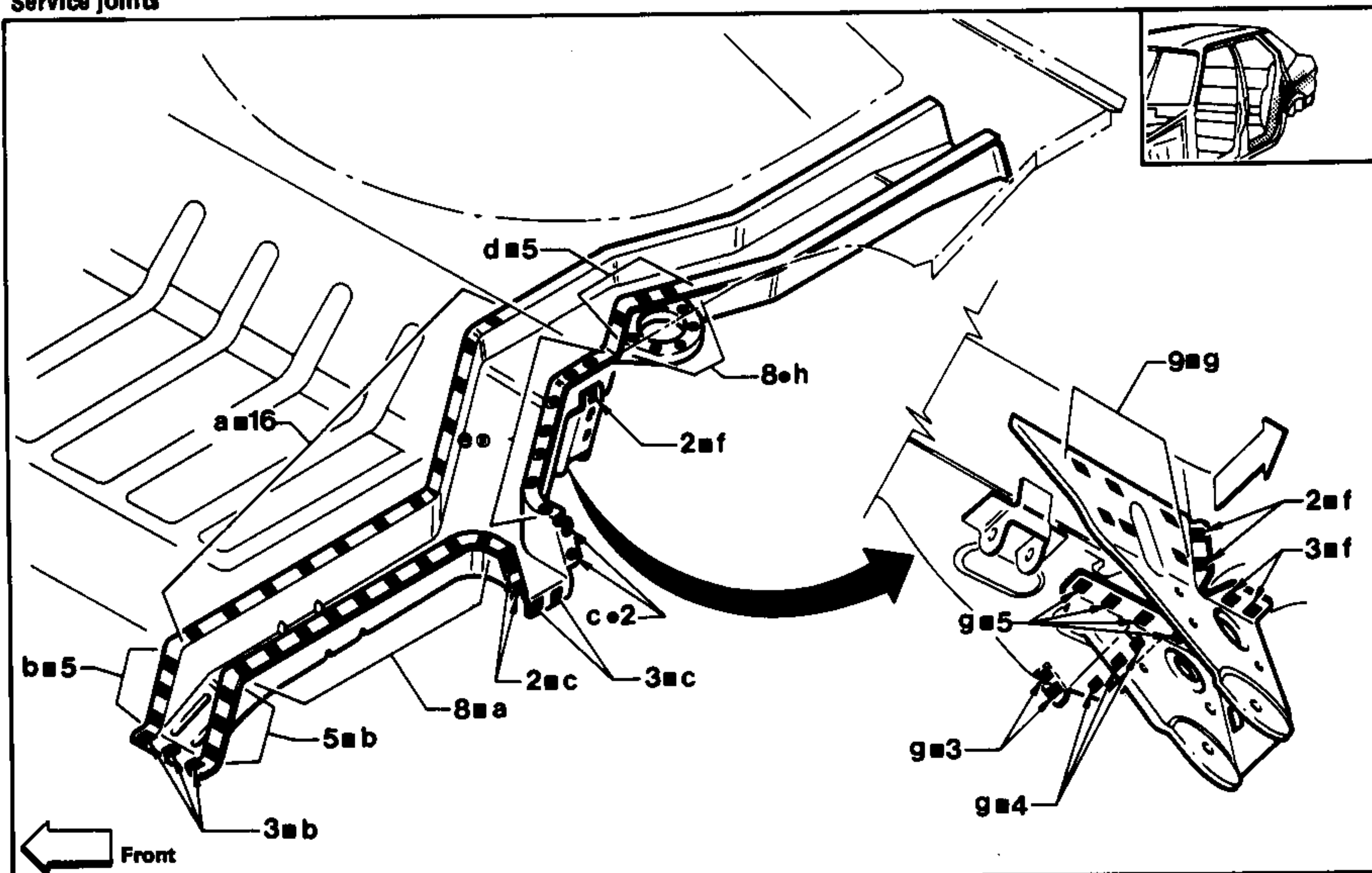
- By means of air chisel, cut according to lines A and B shown in figure.
- By means of a drilling machine, remove welding spots of the three overlapped sheet joints.



REAR SIDE MEMBER WITH REAR PANEL AND REAR FLOOR REMOVED

Carry out replacement after having removed Upper and Lower Rear Panel and Rear Floor.

Service joints

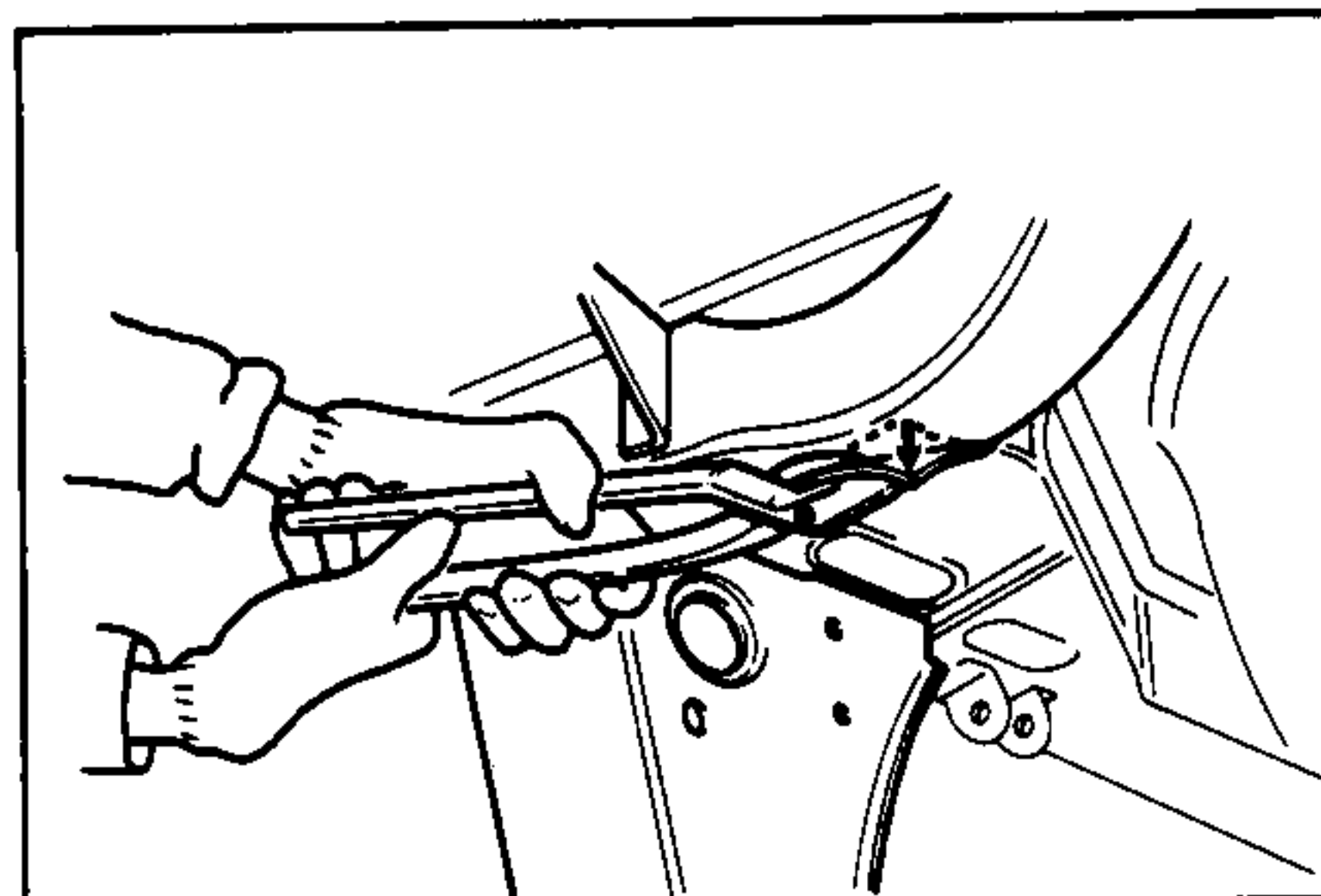
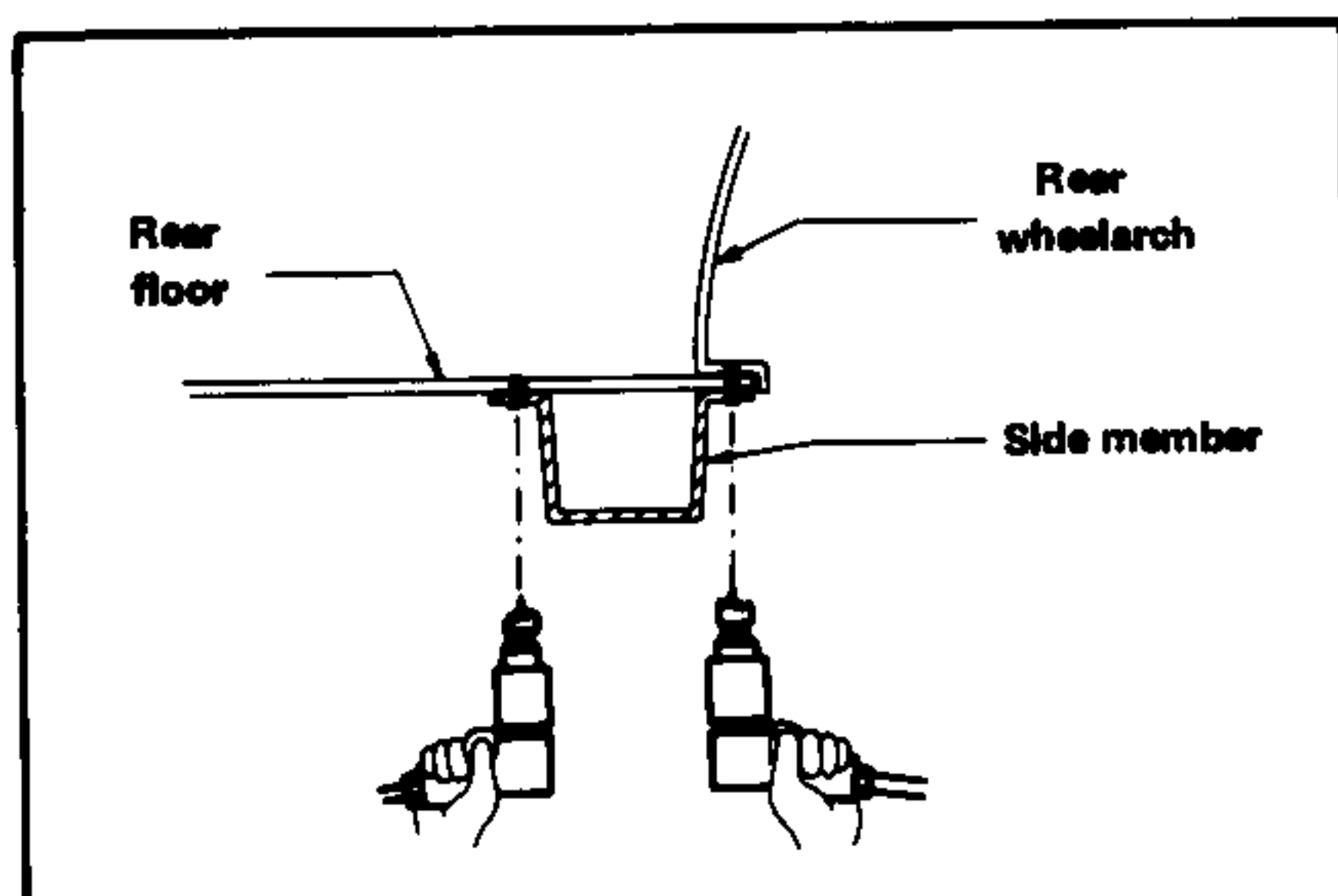


Parts to be welded

- a. Rear side member and rear floor - front part
- b. Rear side member and central floor - rear part
- c. Rear side member and lateral side member
- d. Rear side member and spring support
- e. Rear side member and front side rear floor and outer rear wheelarch
- f. Rear side member and anti-roll bar bracket
- g. Rear side member and rear floor front cross member
- h. Spring support and spring cover

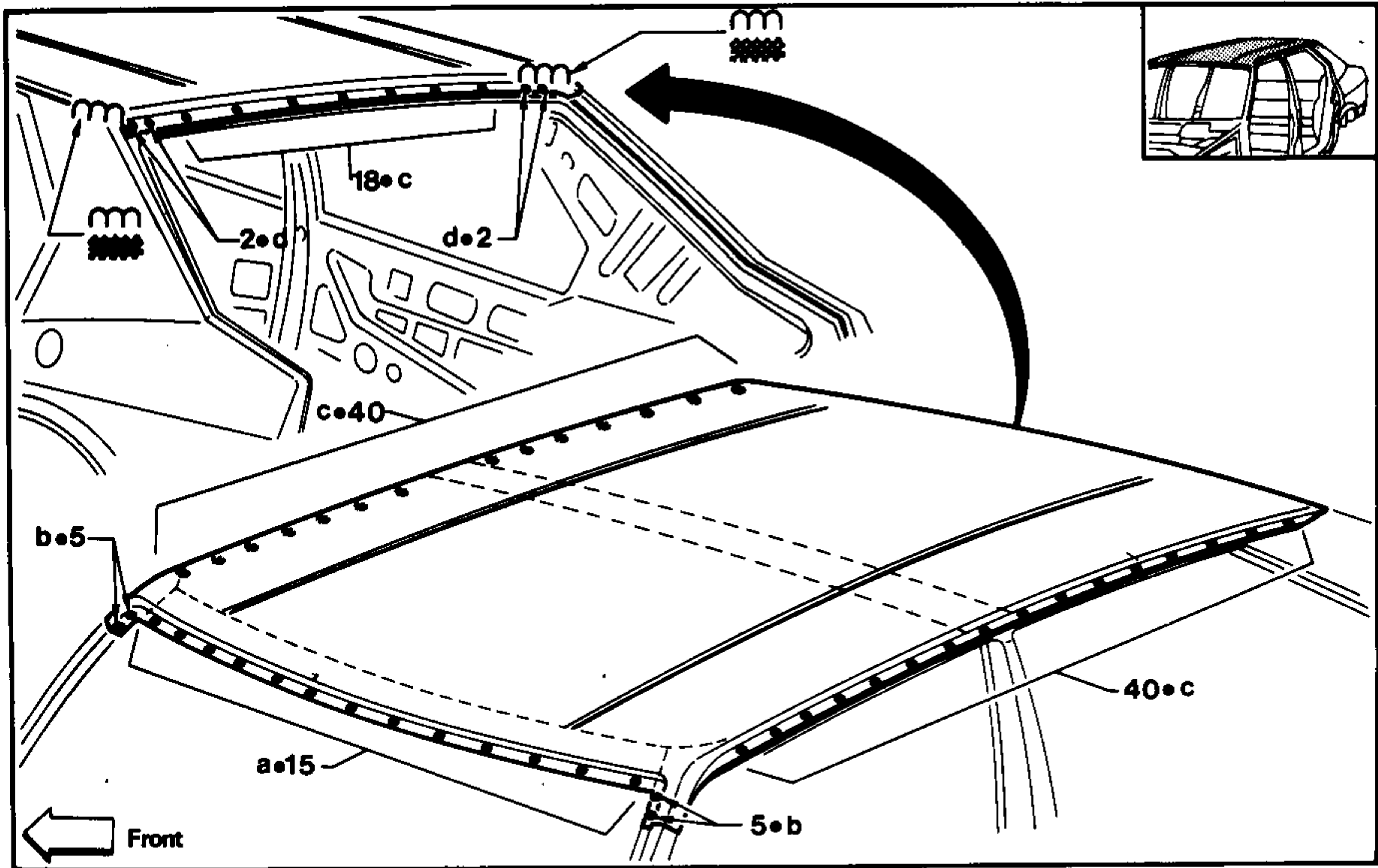
REMINDER WHEN REMOVING

- Remove bumper support brackets.
- By means of a chisel, remove protective film applied to rear floor front side.
- By means of a drilling machine, remove welding spots of the 3-layered sheet joints.
- After removing spot welding, bend tongue of rear floor middle cross member, then remove side member.



ROOF PANEL

Service joints

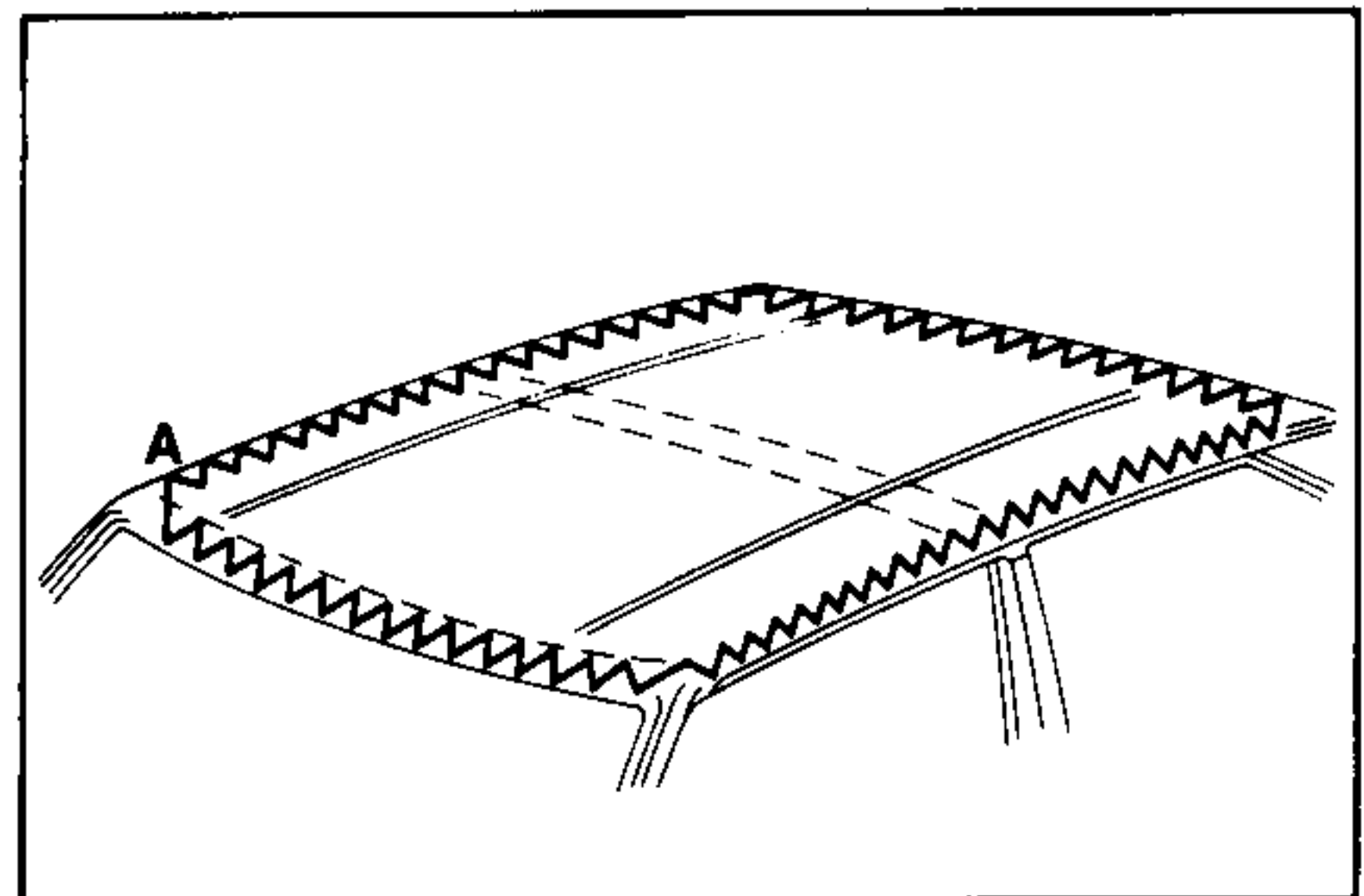
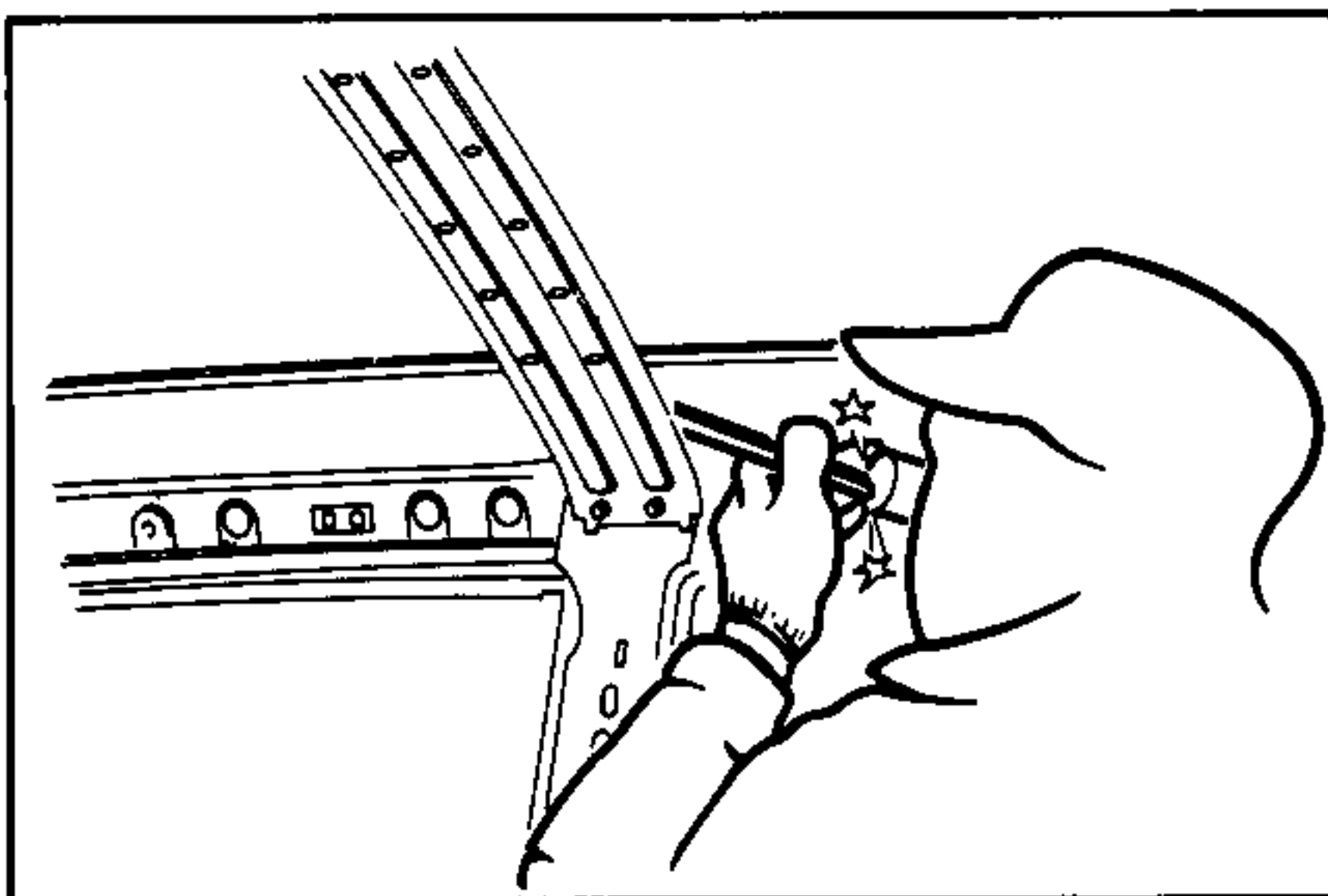


Parts to be welded

- a. Roof panel and windscreen compartment upper cross member
- b. Roof panel and front pillar closing
- c. Roof panel and drip
- d. Roof panel and side drip

REMINDER WHEN REMOVING

- By means of a scraper and blade, remove adhesive between roof panel and central rib.
- By means of air chisel, cut according to line A shown in figure.



HOODS

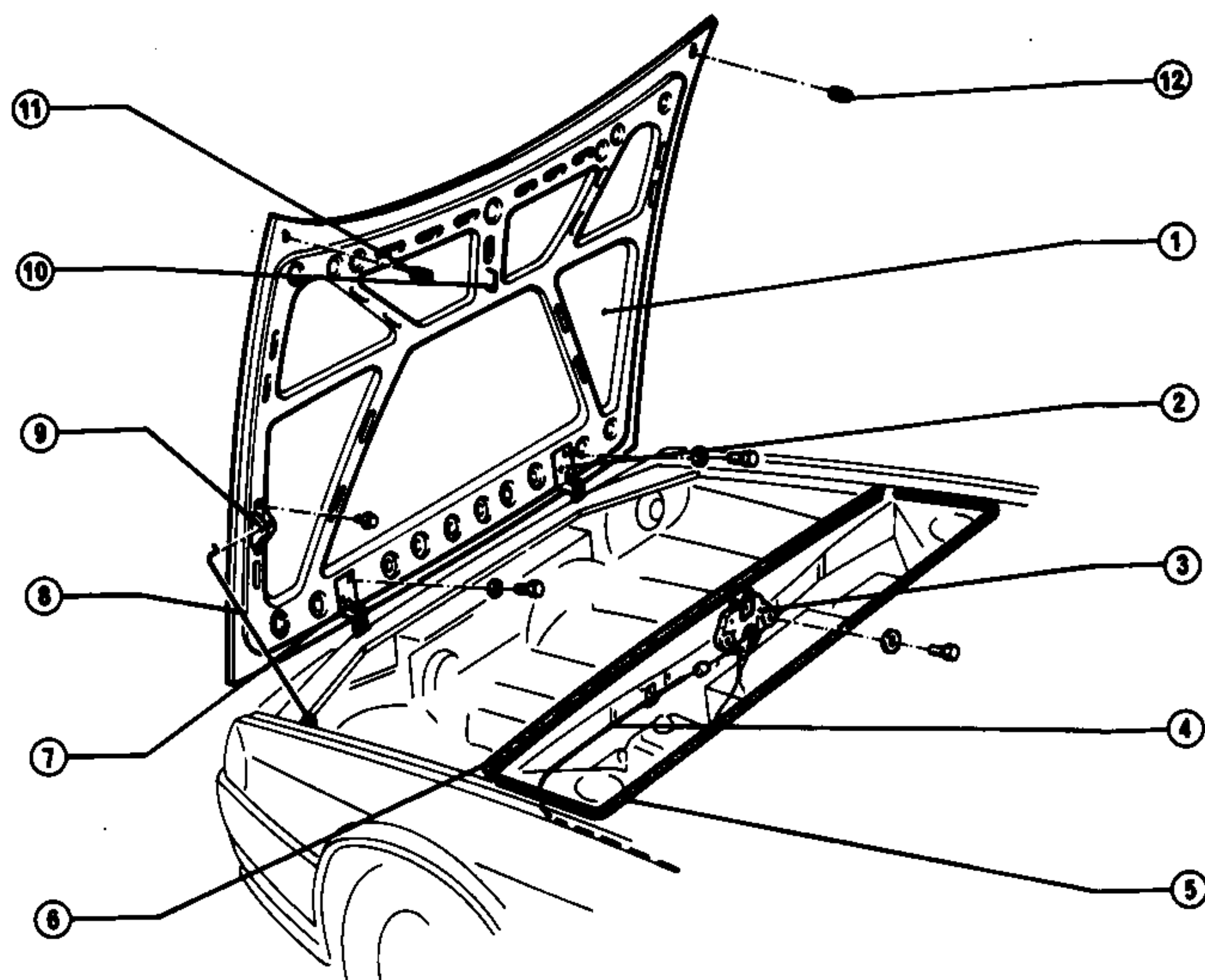


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HOOD



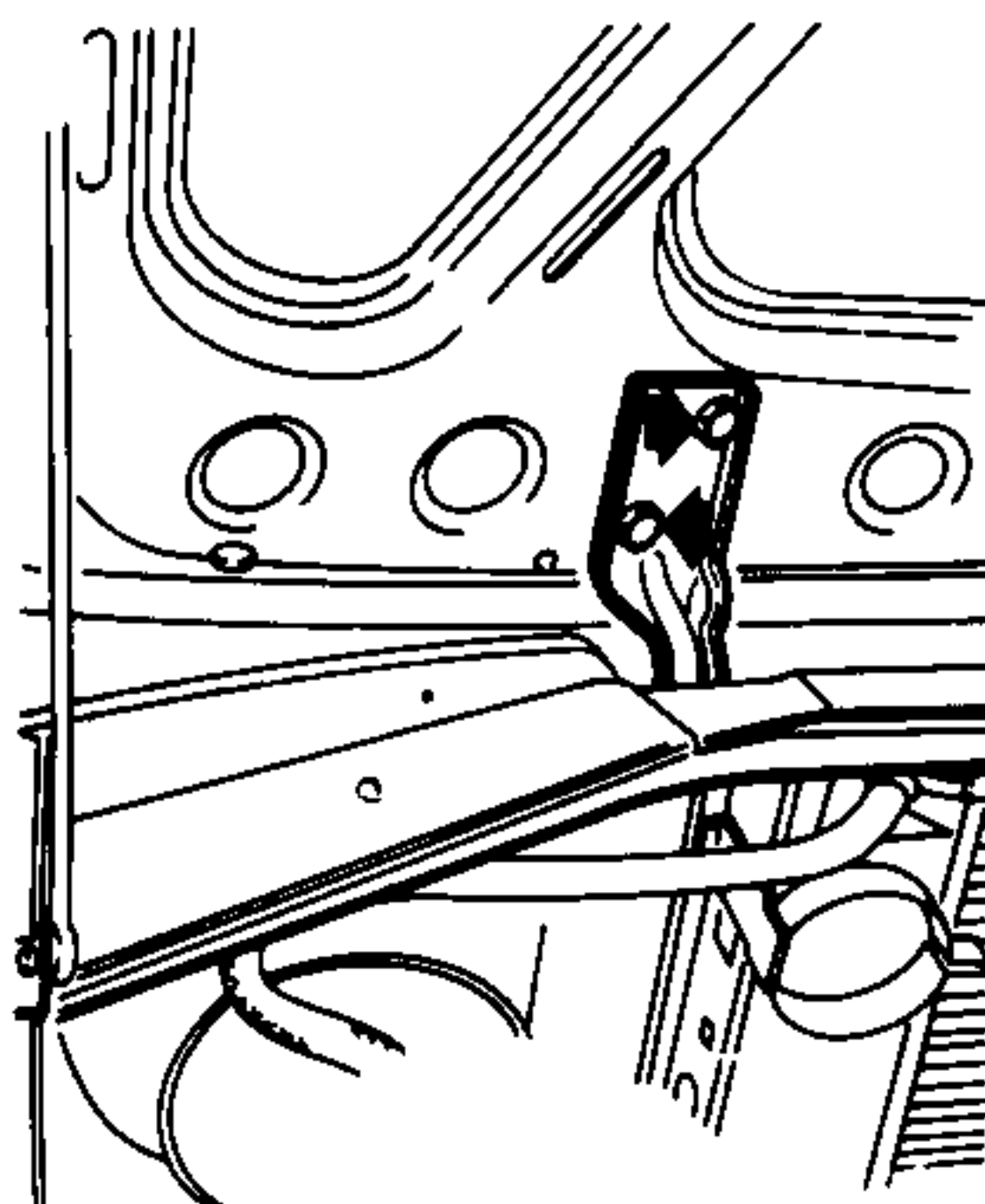
- 1 Hood
- 2 Hinge
- 3 Hood lock device
- 4 Opening control cable
- 5 Seal rubber
- 6 Seal rubber
- 7 Hinge
- 8 Hood support rod
- 9 Bracket
- 10 Striker rod
- 11 Hood bumper
- 12 Hood bumper

REMOVAL AND INSTALLATION

During hood removal and installation, it is necessary to place a cloth or other padding on hood corners in order not to damage or scratch body.

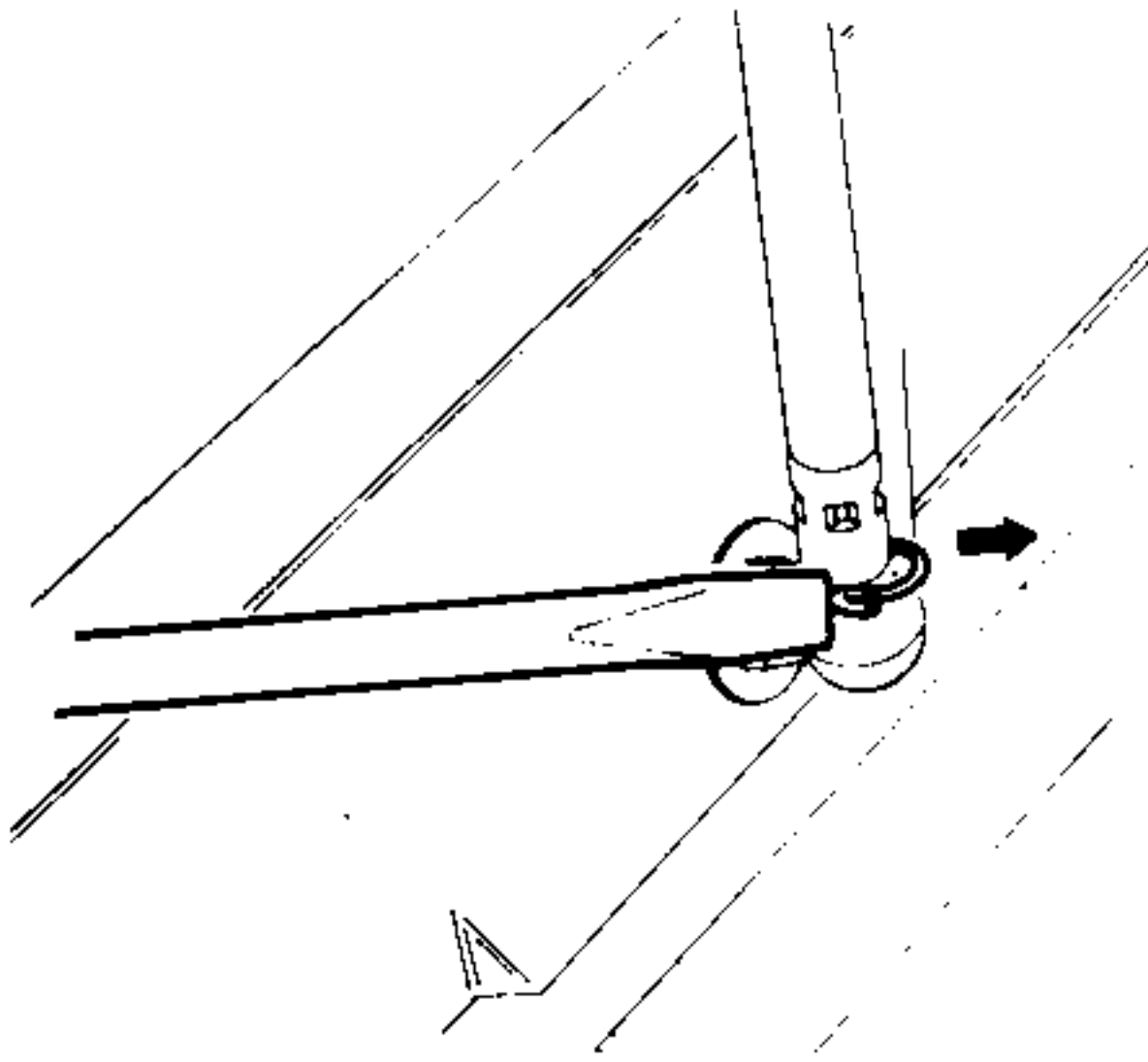
With reference to exploded view above proceed as follows:

1. Release hood support rod (8) from hood.
2. Unscrew the four screws securing hinges (2) and (7) to hood, then remove it.

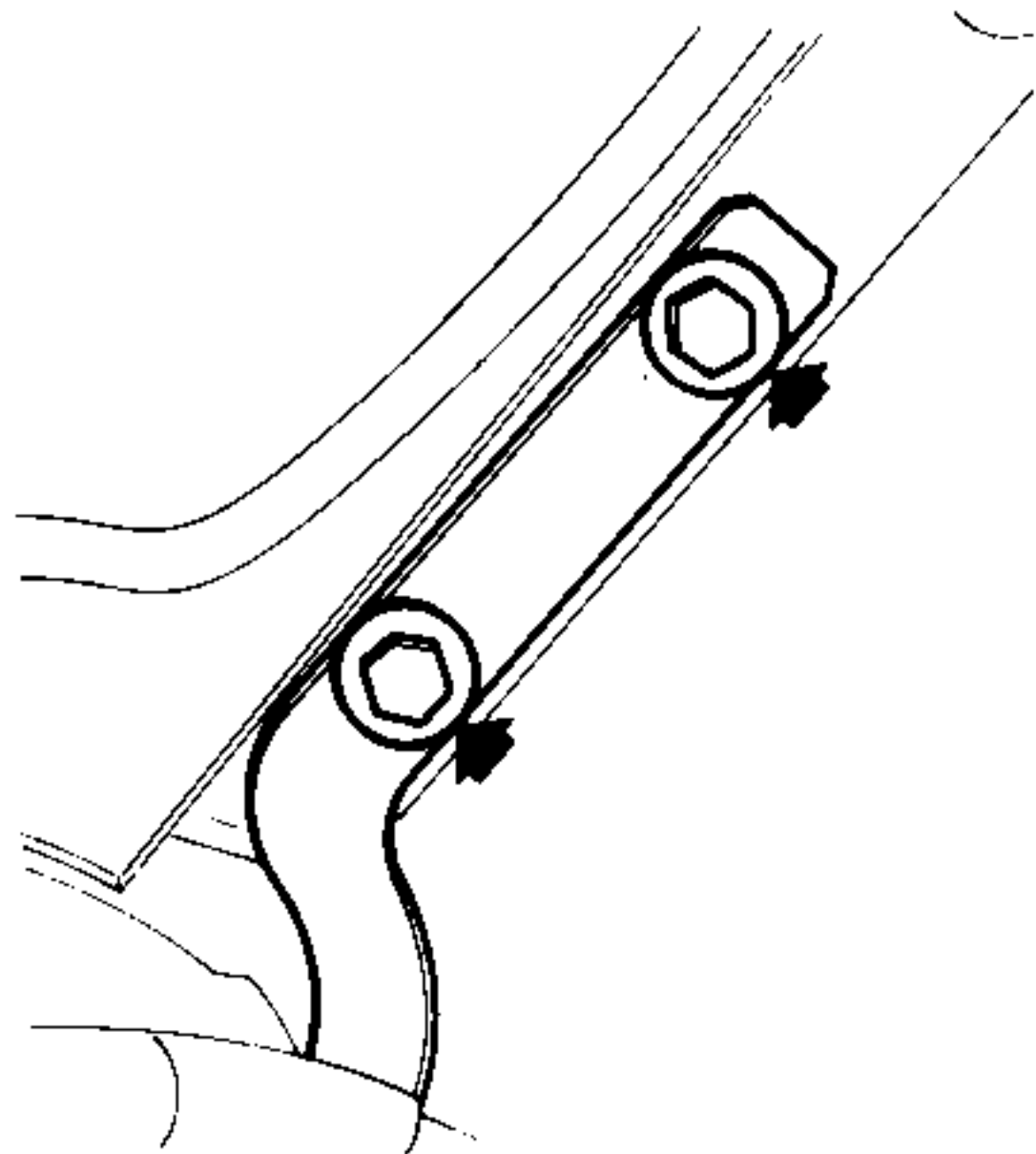


3. Install hood by reversing order of removal and verify it is properly positioned into its seat. If necessary, correct its position operating as per "Hood Position Adjustment".

For hood installation, are required two operators.



2. Unscrew the four screws securing hinges (3) and (11) to backdoor then remove backdoor.



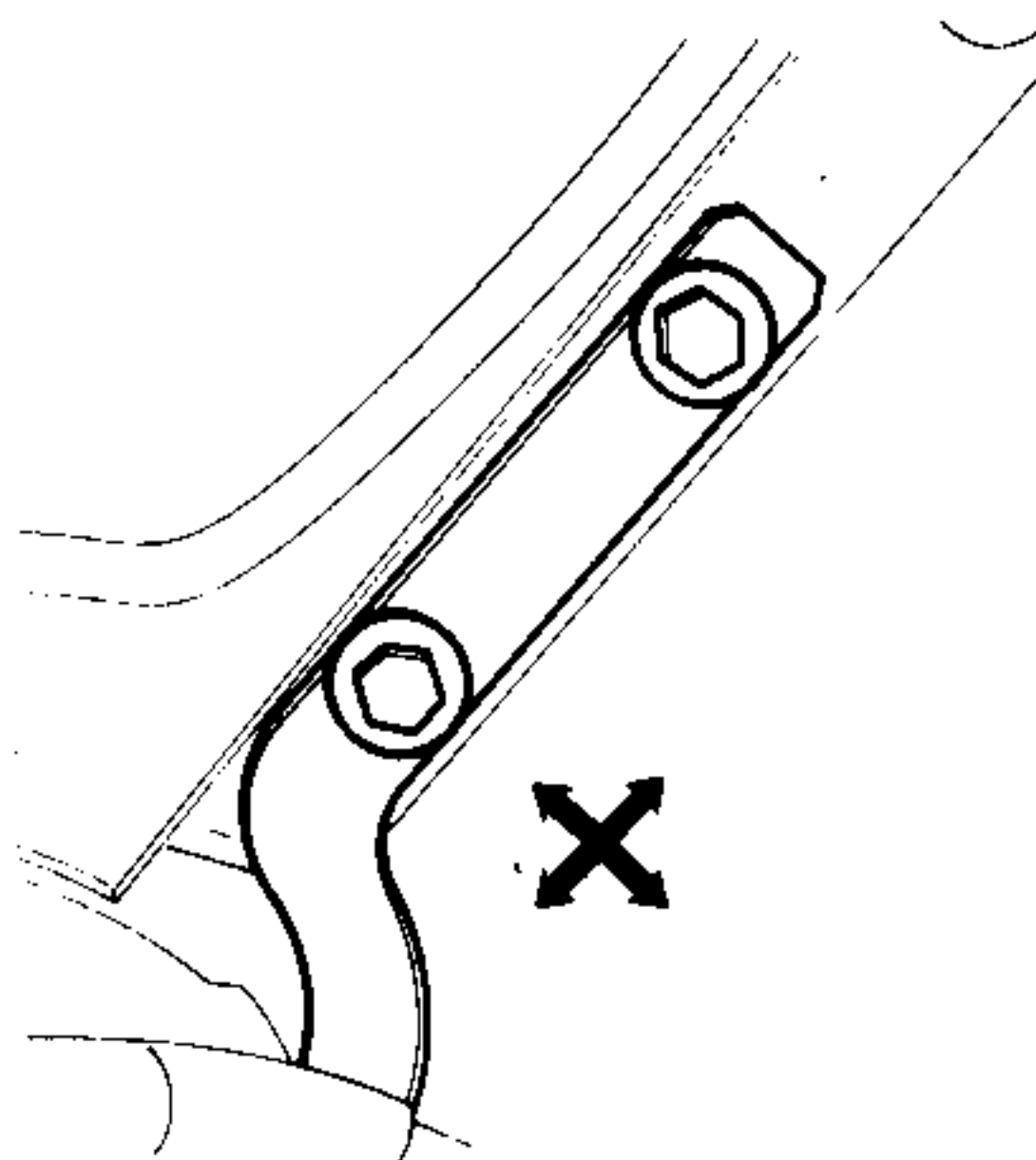
3. Install backdoor on car by reversing order of removal, and supporting the weight as long as support shock absorbers (4) and (10) have been re-assembled. Verify that is properly positioned into its seat; if required, adjust backdoor position as described in "Backdoor Position Adjustment".

WARNING:

- Be careful not to scratch backdoor shock absorbers during installation on car, in order to avoid gas leakage.
- Gas is under pressure. Do not take shock absorbers apart, puncture or apply heat or fire.

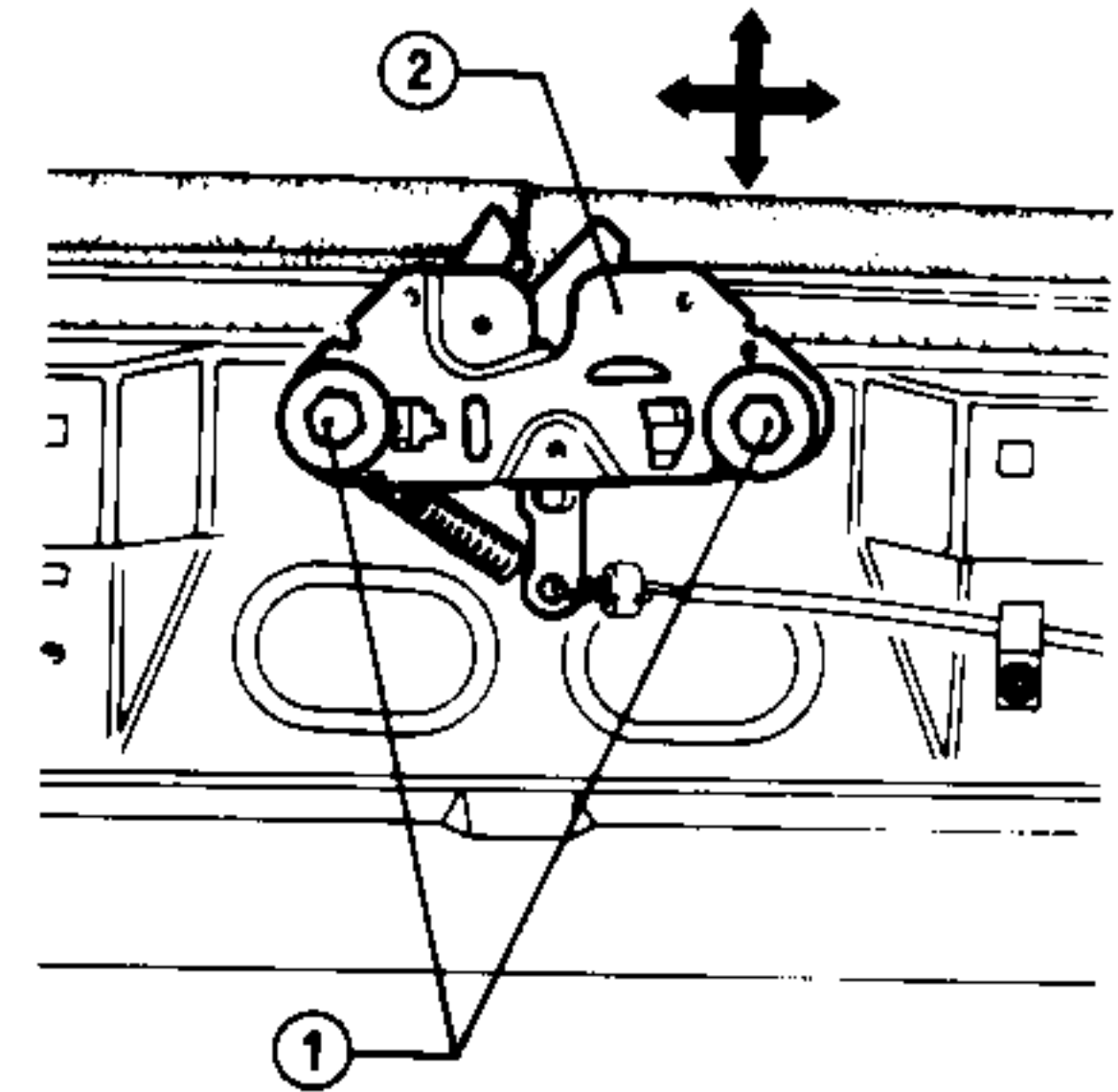
BACKDOOR POSITION ADJUSTMENT

Loosen the nuts securing hinges to backdoor and move backdoor forward, backward and side to side until correct position is obtained.



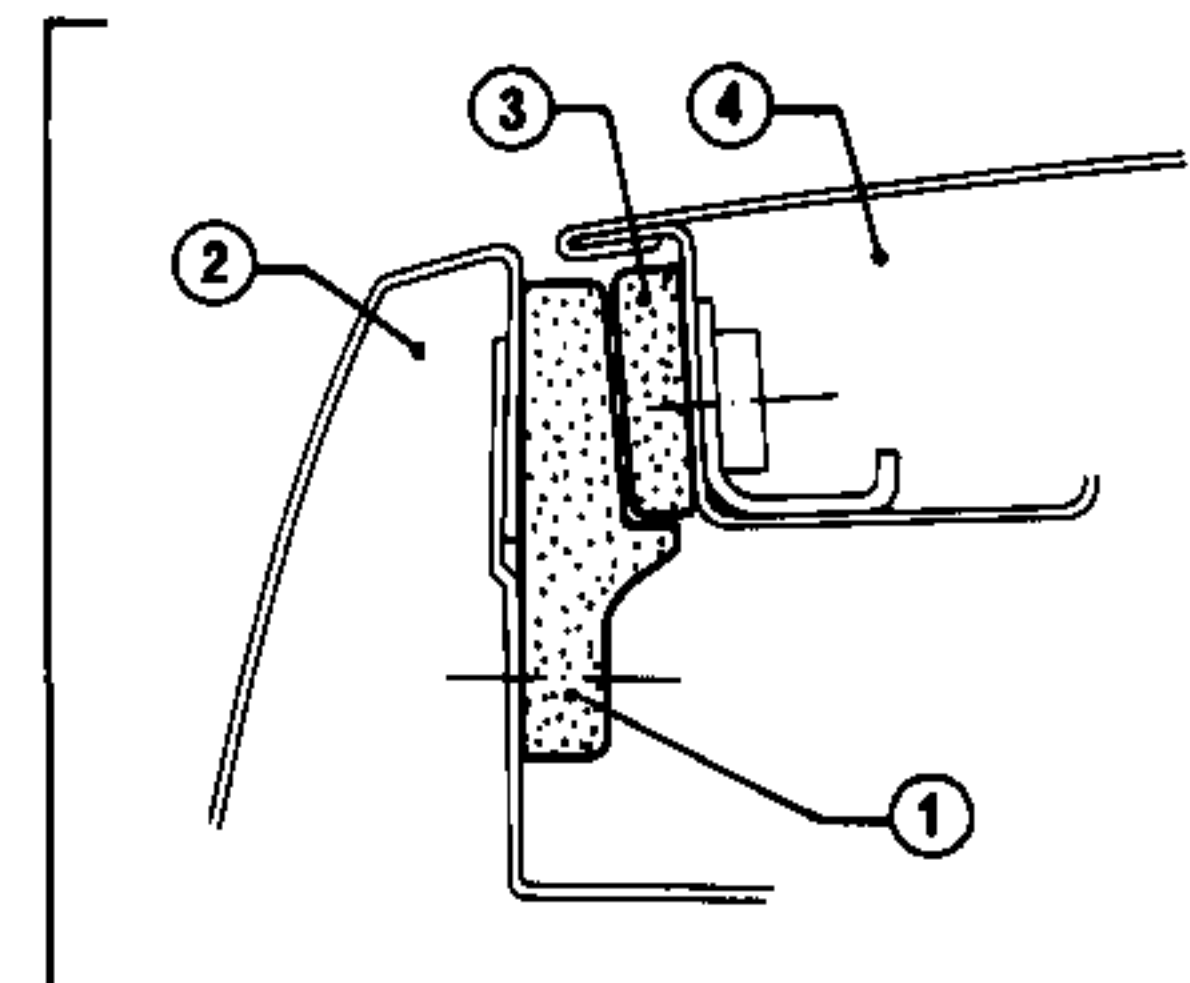
CAUTION:

- During installation of backdoor lock device (2), make sure that striker rod on backdoor is positioned in the center of lock slit by operating on the two screws (1). Then temporarily tighten the lock.



- Screws
- Backdoor lock device

- With the lock temporarily secured, check backdoor alignment verifying that strikers (1) come in contact with the corresponding strikers (3); then secure in a definitive way.



- Strikers
- Body
- Strikers
- Backdoor

- Verify proper functioning of backdoor opening control and lubricate backdoor lock mechanism with proper grease.

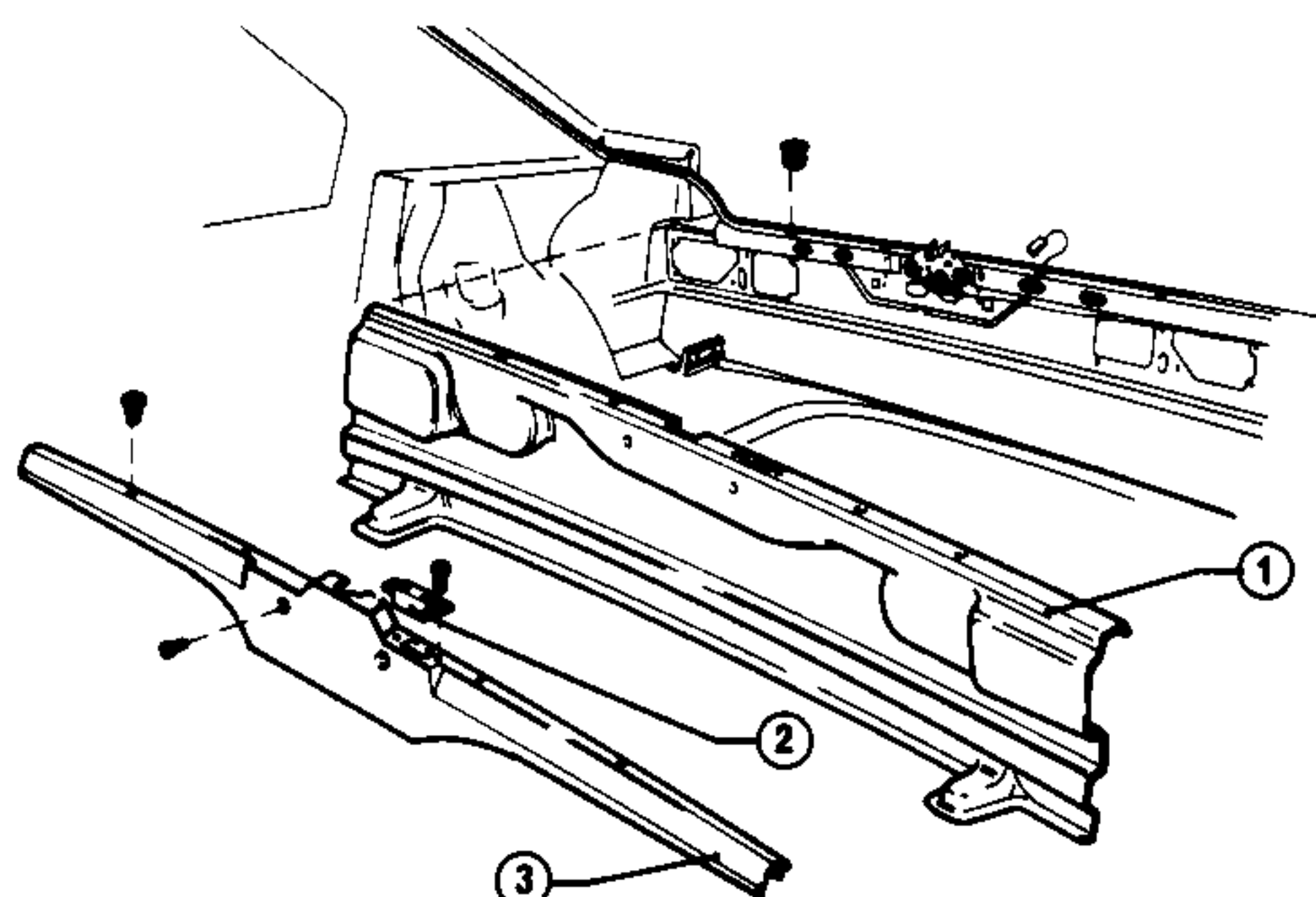
INTERNAL TRIMMING



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REAR TRIM



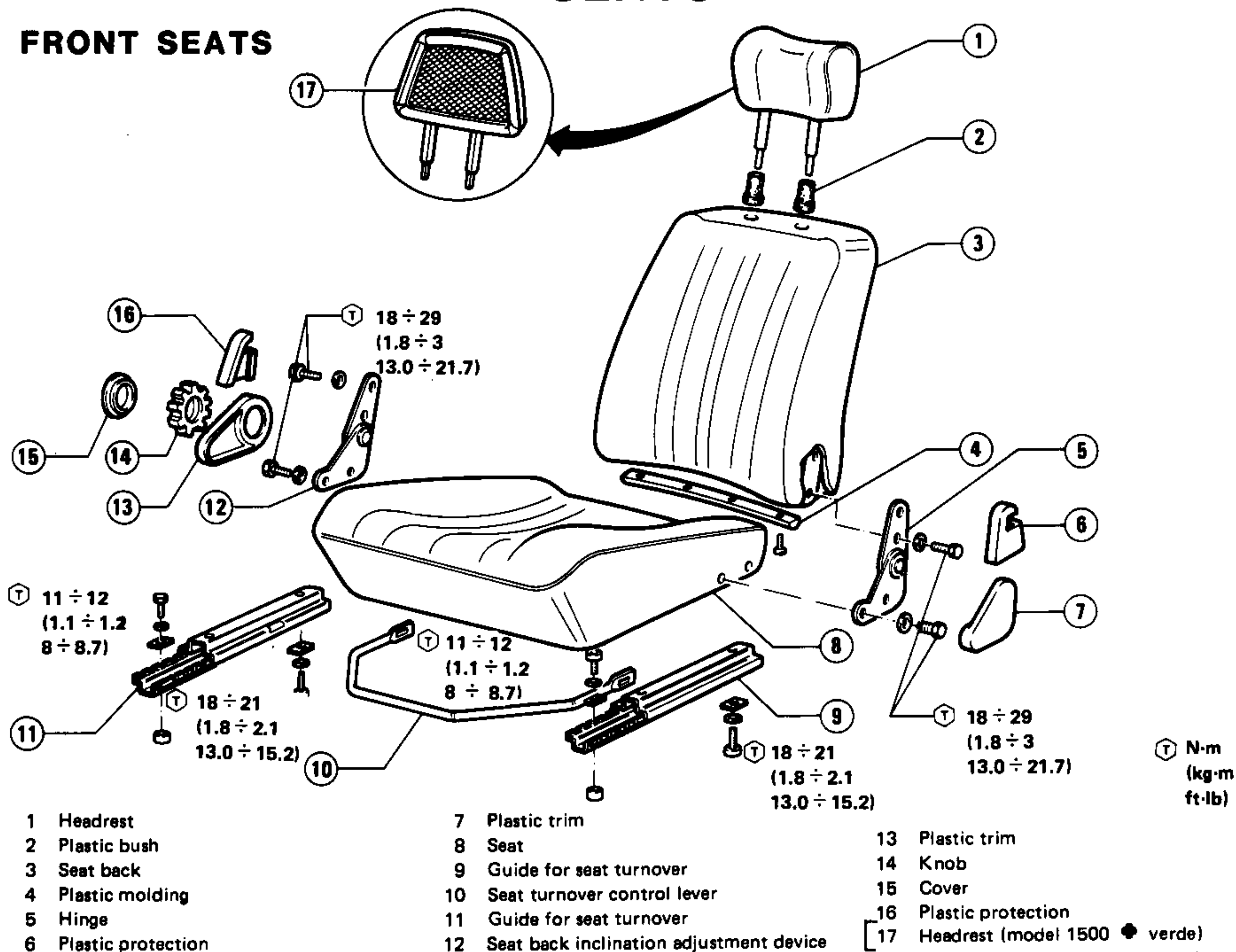
- 1 Rear trim
- 2 Electric contacts plate
- 3 Plastic cover

REMOVAL AND INSTALLATION

1. Open back door.
2. Unscrew the two screws securing electric contact plate to body and disconnect electric wiring, then remove plate together with electric contacts (2).
3. Unscrew the six screws securing to body plastic cover (3) and rear trim (1), then remove them.
4. Install rear trim and plastic cover, by reversing order of removal.

SEATS

FRONT SEATS



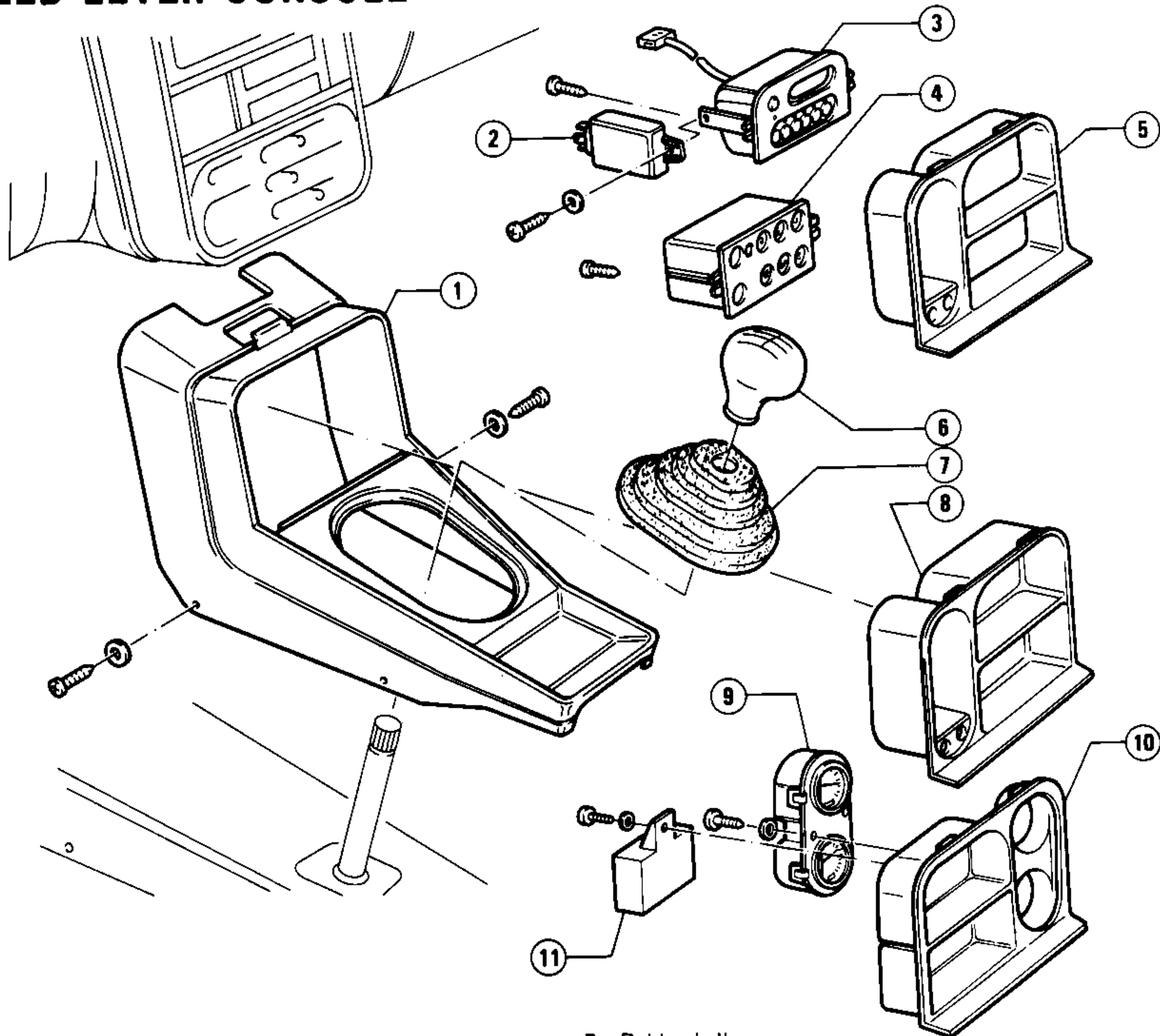
- 1 Headrest
- 2 Plastic bush
- 3 Seat back
- 4 Plastic molding
- 5 Hinge
- 6 Plastic protection

- 7 Plastic trim
- 8 Seat
- 9 Guide for seat turnover
- 10 Seat turnover control lever
- 11 Guide for seat turnover
- 12 Seat back inclination adjustment device

- 13 Plastic trim
- 14 Knob
- 15 Cover
- 16 Plastic protection
- 17 Headrest (model 1500) ◆ verde)

Ⓣ N-m
(kg-m
ft-lb)

SPEED LEVER CONSOLE



- 1 Console
- 2 Door lock control unit (model 1500 + oro)
- 3 Trip Computer (model 1500 + oro)
- 4 Check Control (model 1500 + oro)
- 5 Instrument holder (model 1500 + oro)
- 6 Speed lever knob

- 7 Rubber bellows
- 8 Glove box
- 9 Voltmeter and oil pressure gauge (model 1500 + verde)
- 10 Instrument holder (model 1500 + verde)
- 11 Door lock control unit (model 1500 + verde)

REMOVAL AND INSTALLATION

With reference to exploded view above proceed as follows:

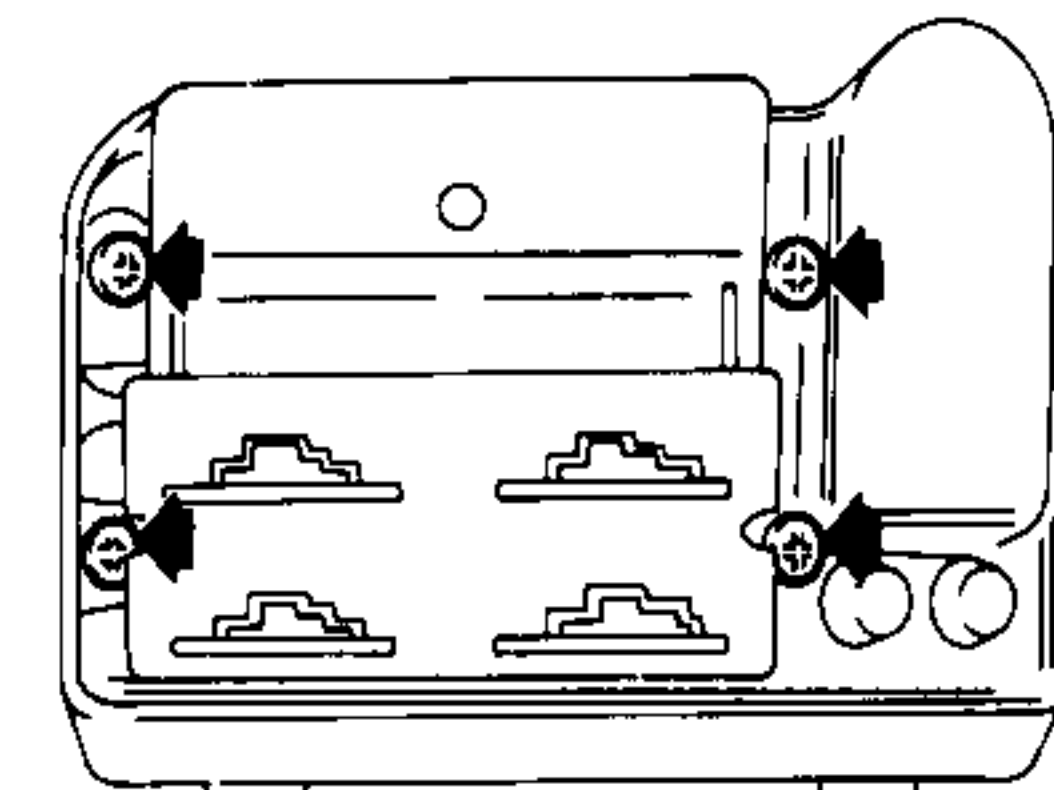
1. Withdraw knob (6) and bellows (7) from speed lever.

2. If present, remove instrument holder (5) or (10), and detach the related wiring.

2a. Model 1500 + oro.

If necessary, remove Check Control (4) and Trip Computer (3) operating as follows:

(1) Unscrew the two screws securing to dashboard (5) the concerned instrument (3) or (4), then remove it.

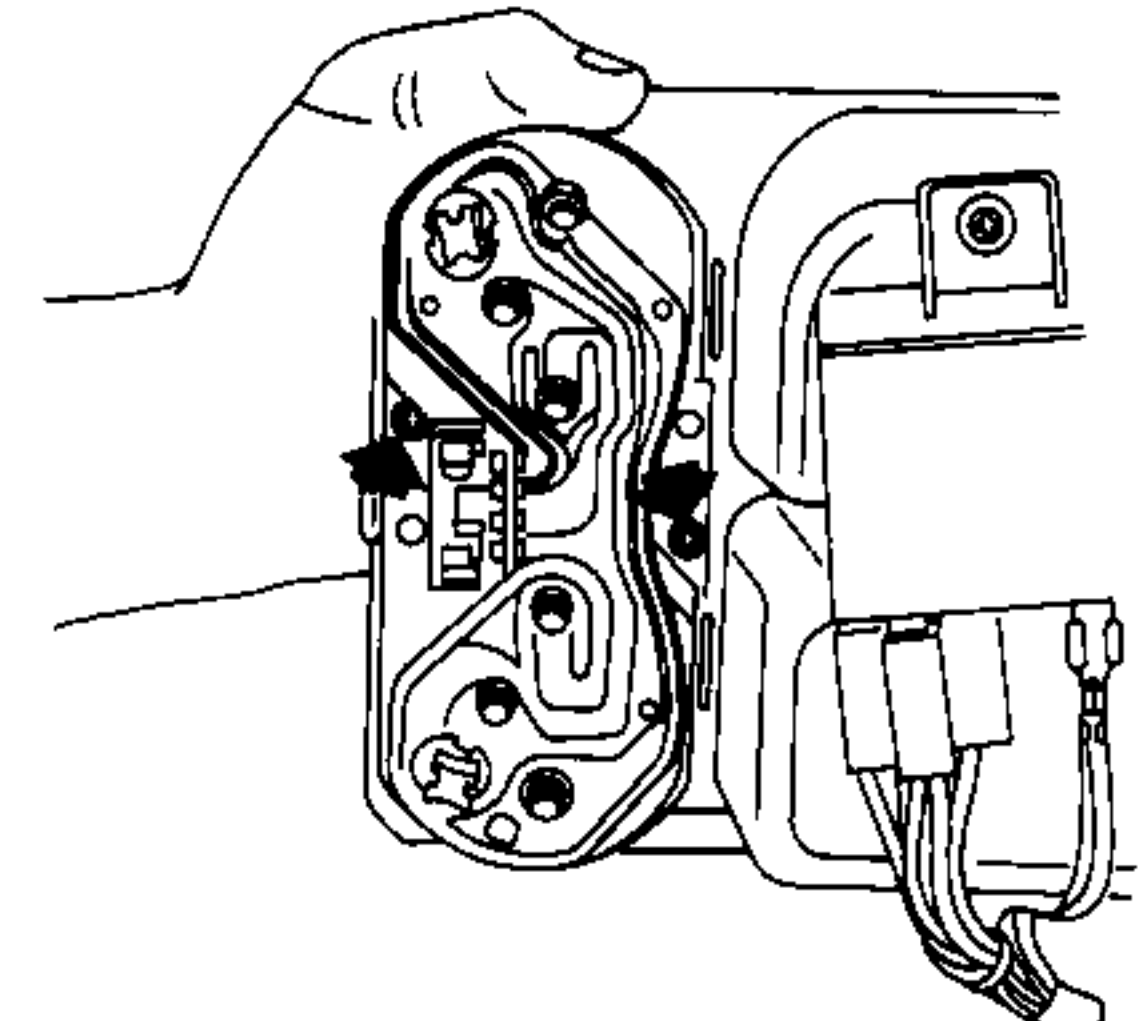


(2) Install instruments by reversing order of removal.

2b. Model 1500 + verde.

If necessary, remove voltmeter and pressure gauge (9) operating as follows:

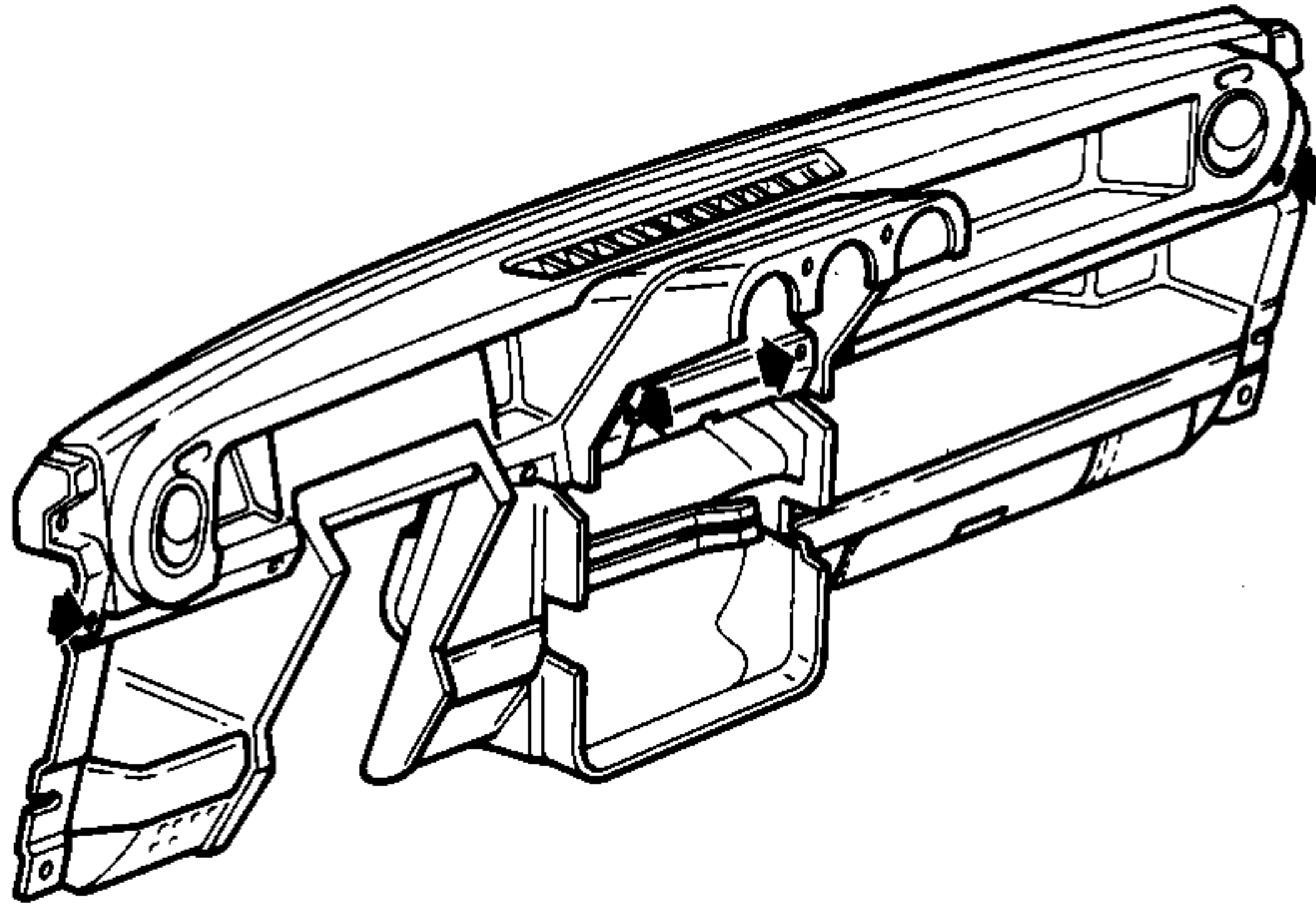
(1) Unscrew the two screws securing instruments, then remove instruments.



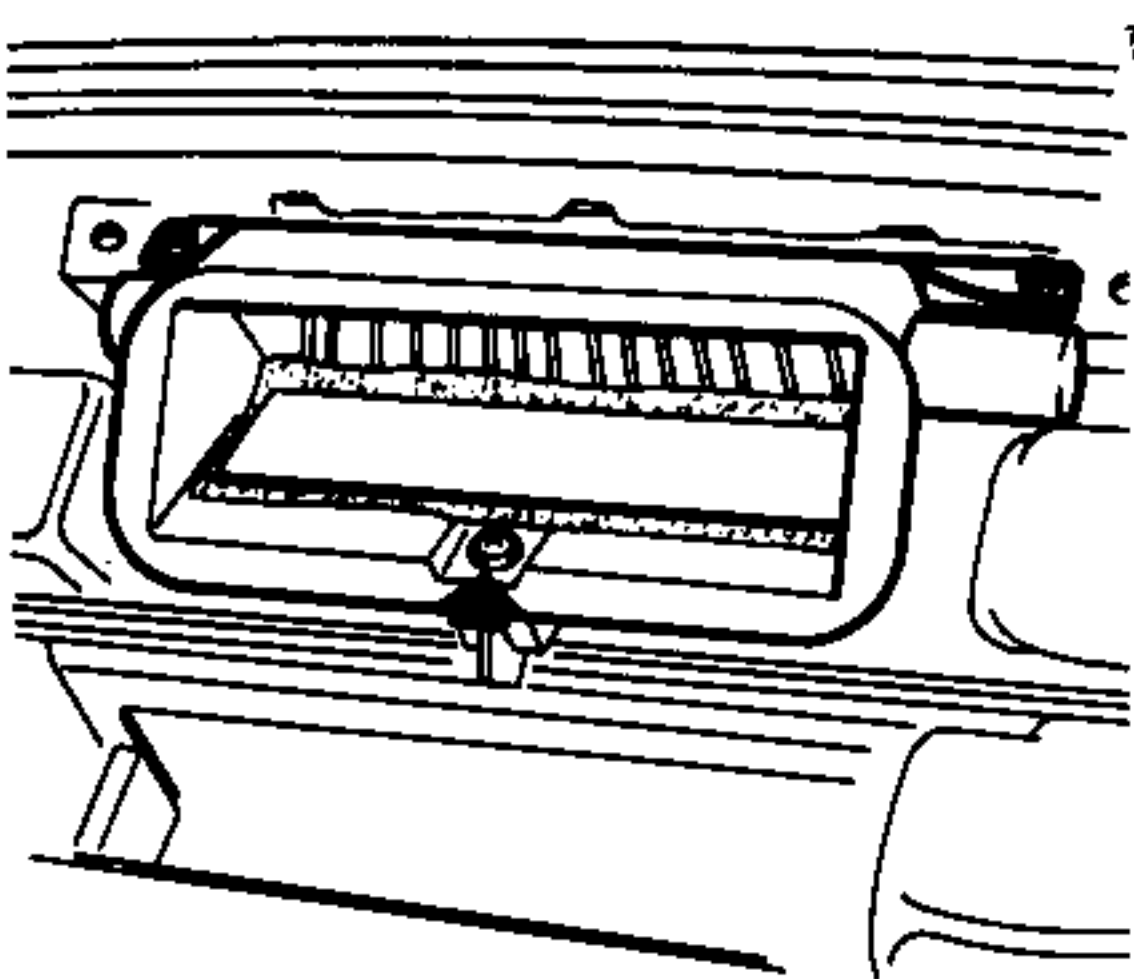
2. Install the instruments by reversing the order of removal.

3. Unscrew the four screws securing console (1) to tunnel, then remove console by moving it backward.

4. Install console by reversing order of removal.



(2) Unscrew the screw securing upper dashboard (5) to lower dashboard (9) and divide the two components.



10. If necessary, remove center ventilation duct (3).

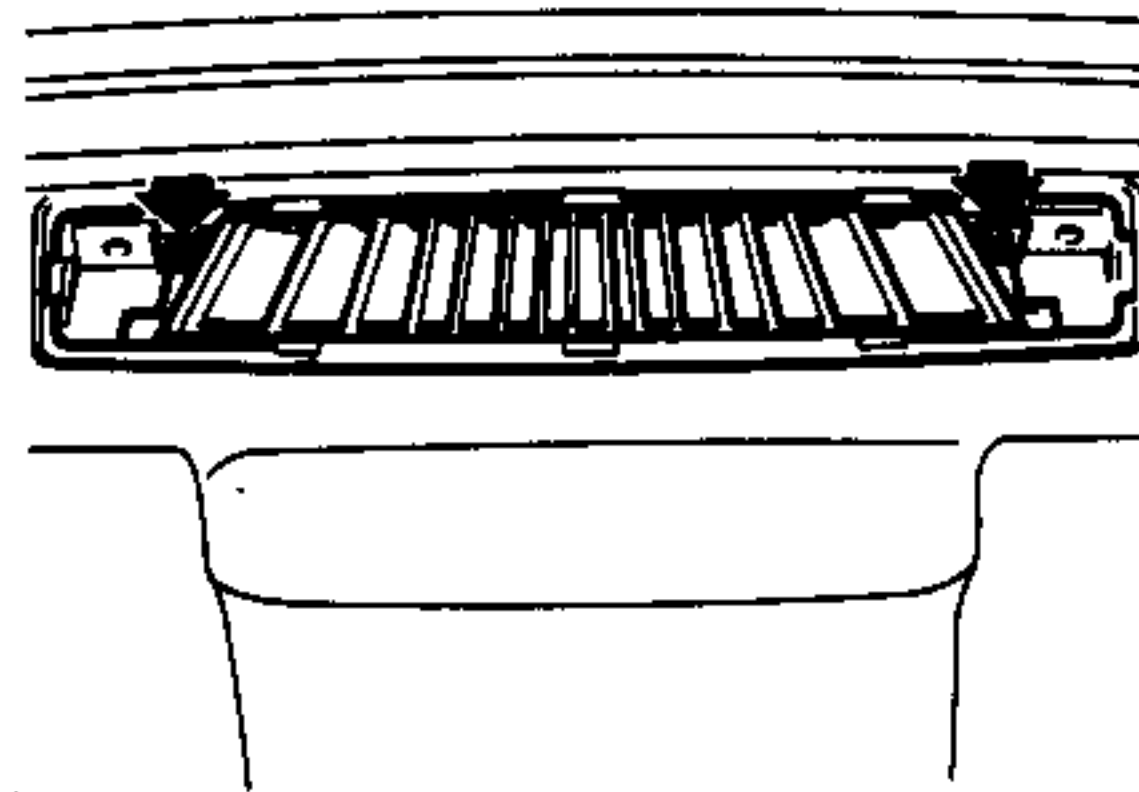
(1) Remove air ducts (16), (1) and (4).

(2) With reference to figure of step 9. (2): unscrew the screw securing center ventilation duct (3) to dashboard (9).

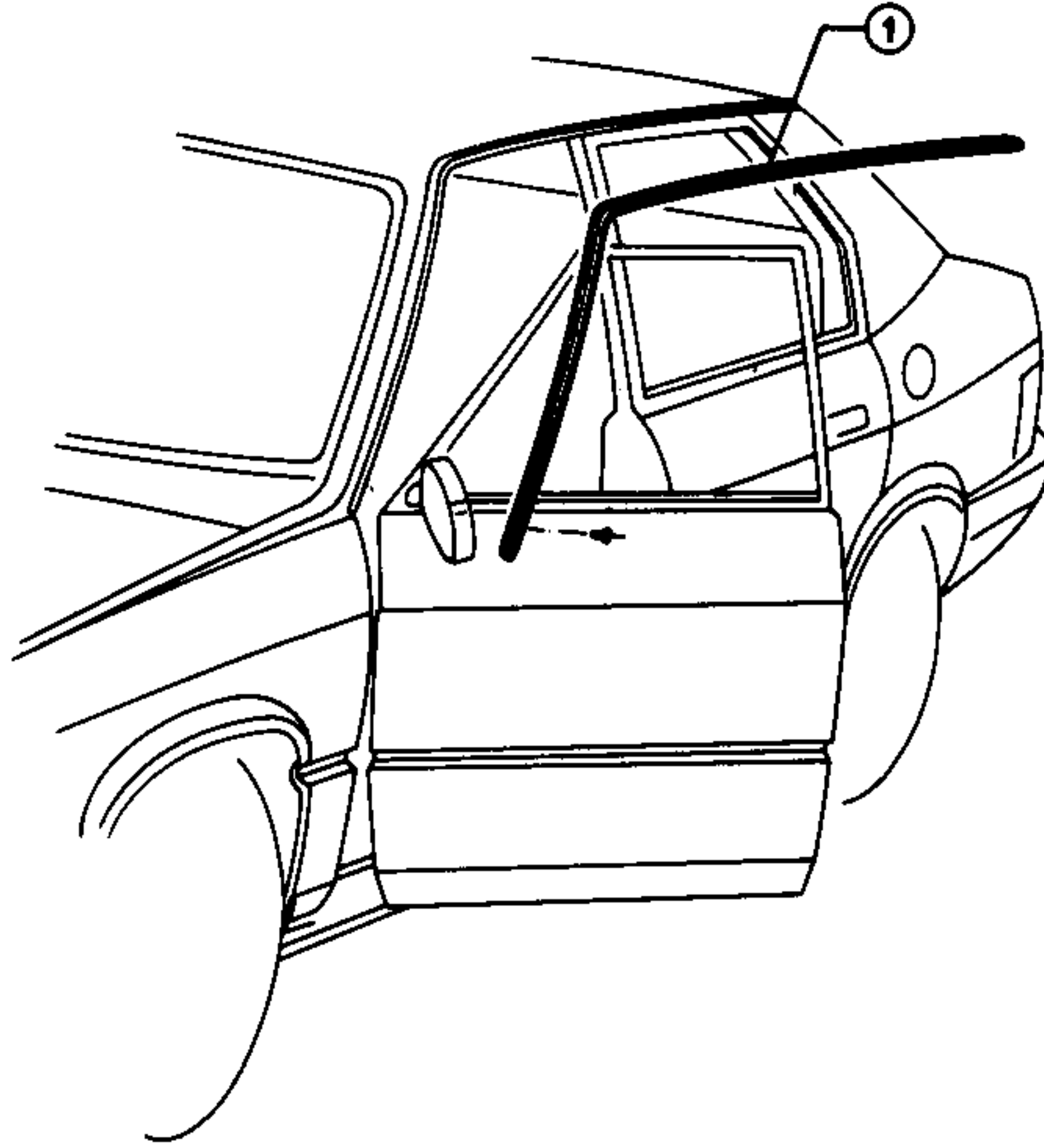
(3) Unscrew the two bolts securing center ventilation duct (3) to dashboard (5) and remove the duct.

11. If necessary, remove glove box seat, countersinking the six dashboard (9) securing rivets.

12. Install dashboard on car by reversing order of removal.



DRIP COVER MOLDING

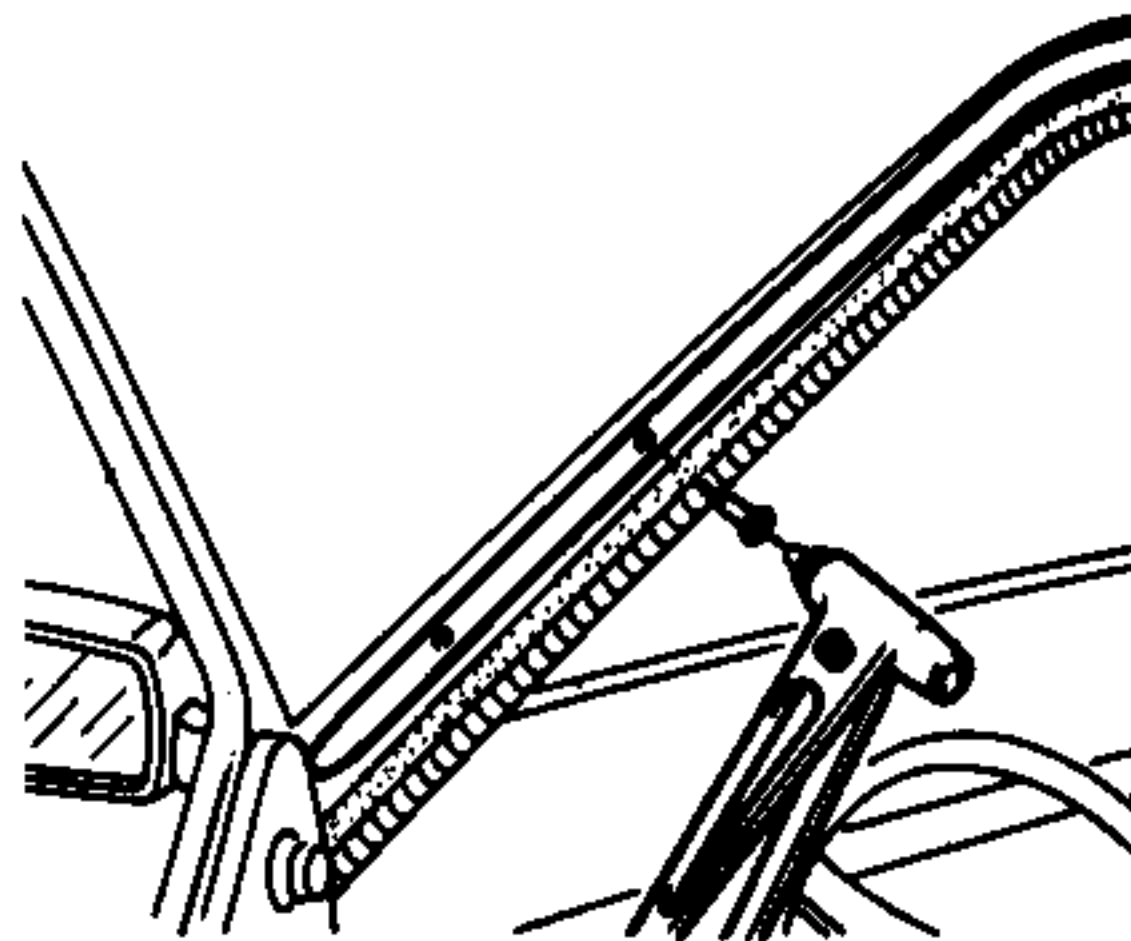
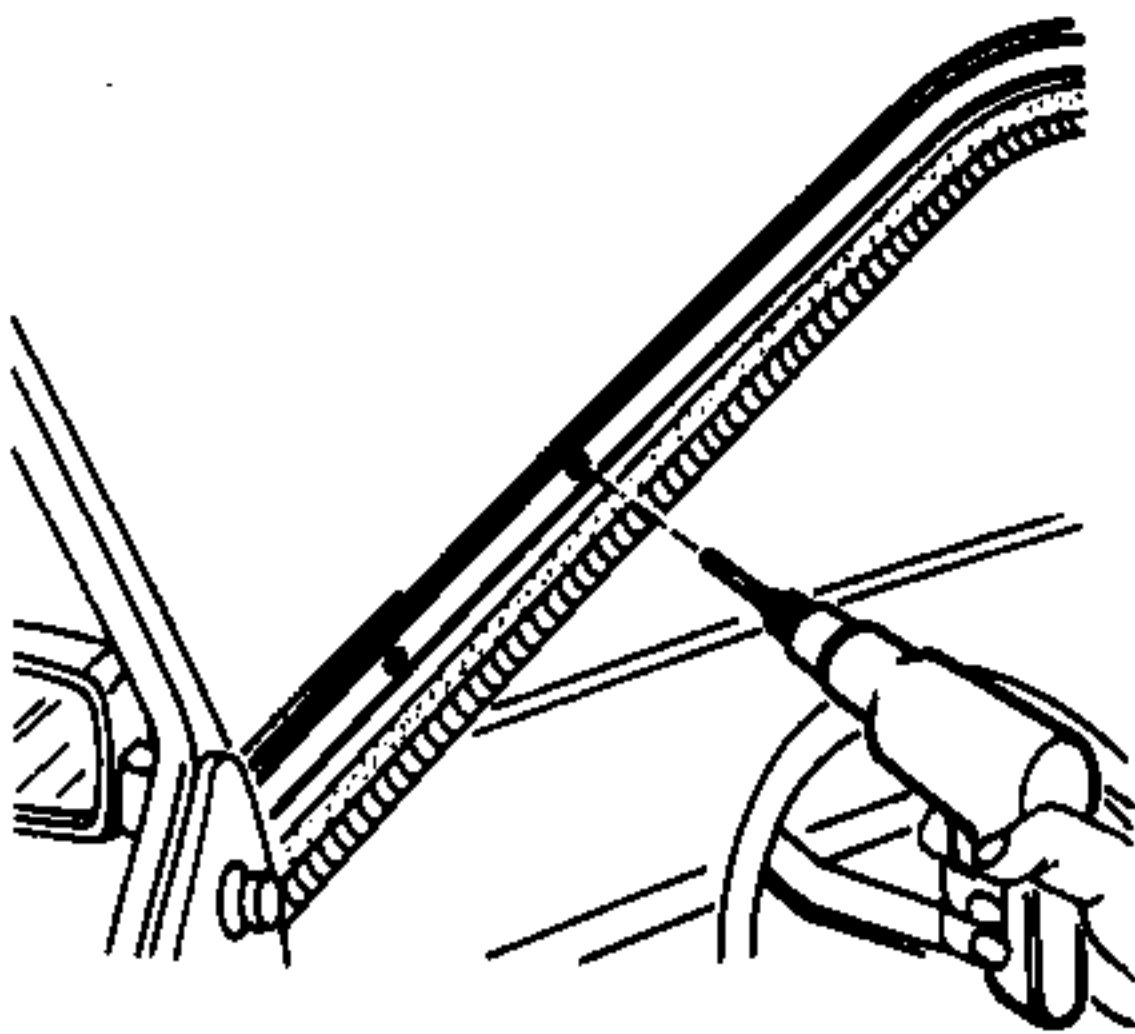


1 Drip cover molding

REMOVAL AND INSTALLATION

1. By means of a drilling machine fitted with suitable drill, countersink rivets securing molding.

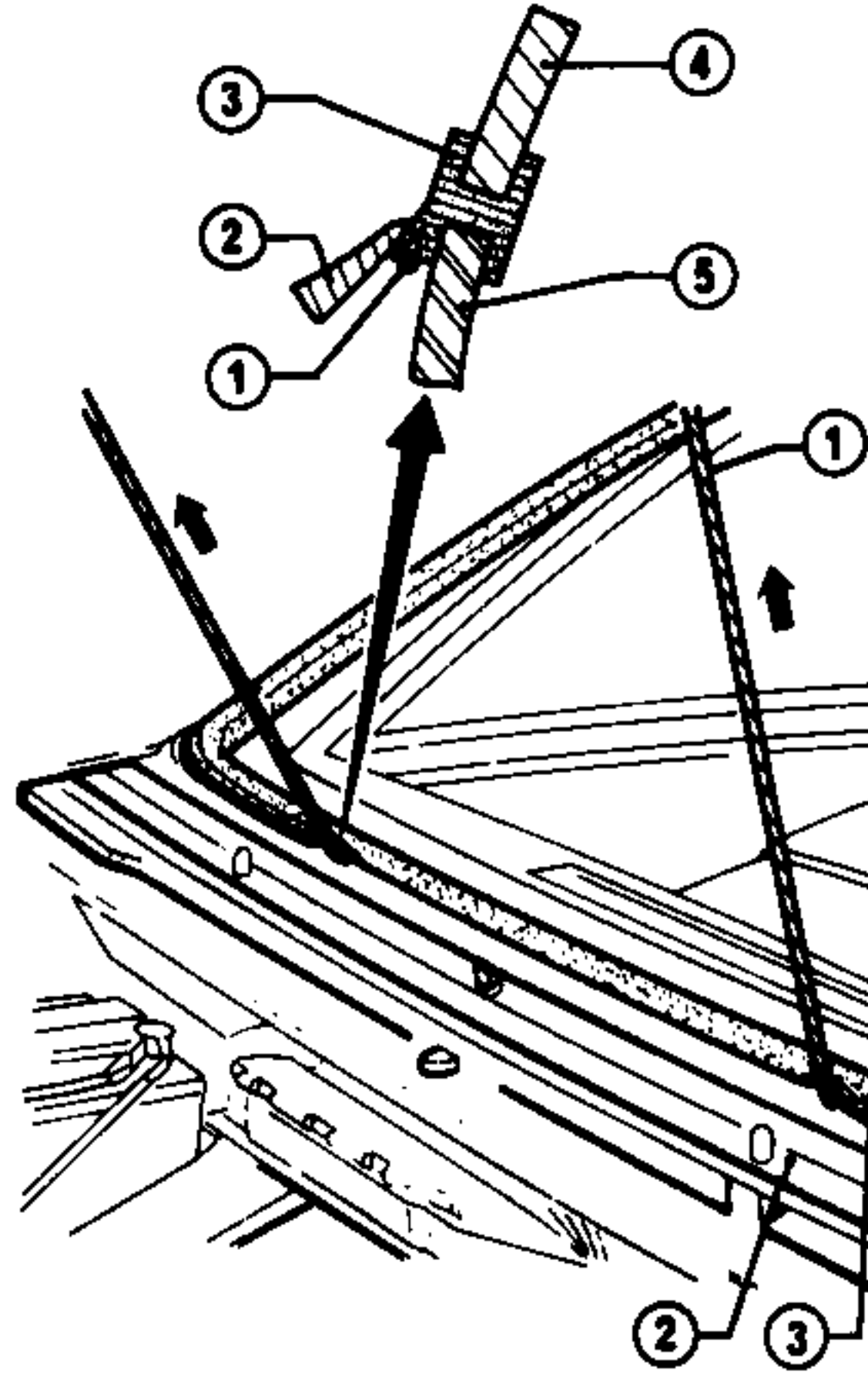
2. Remove drip cover molding.
3. Remove countersink rivets from their seats.
4. Position the new molding on drip verifying correct alignment of holes.
5. Secure molding by means of rivets.



EXTERNAL TRIMMING

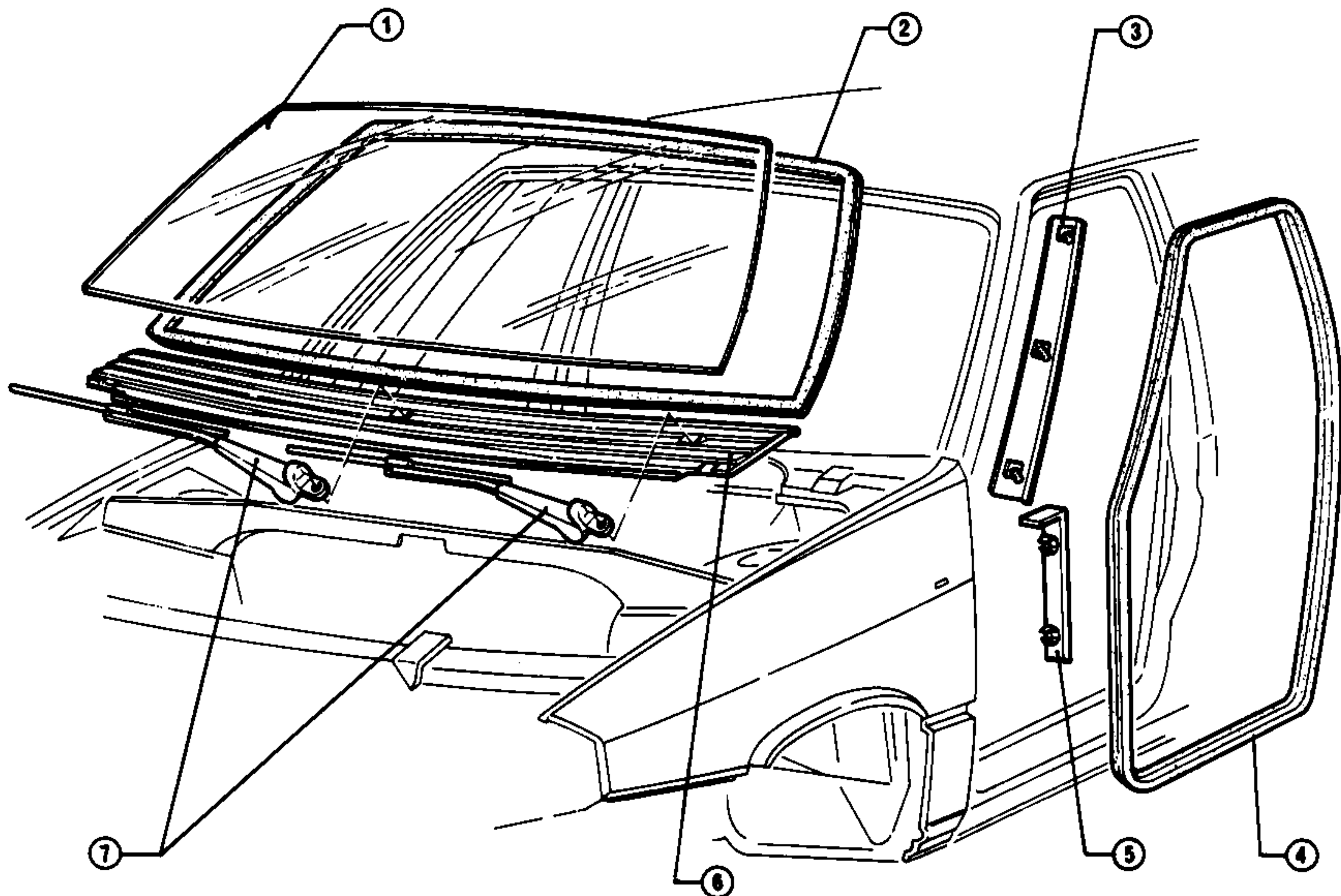
It is recommended to previously insert a cord into windscreen seal and to operate as per figure in order to correctly and rapidly position seal after installing cowl top cover.

- 1 Cord
- 2 Cowl top cover
- 3 Windscreen seal
- 4 Windscreen
- 5 Body



GLASSES

WINDSCREEN



- | | |
|---------------------|-------------------------|
| 1 Windscreen | 5 Ornament |
| 2 Windscreen seal | 6 Cowl top cover |
| 3 Pillar trim | 7 Windscreen wiper arms |
| 4 Door opening seal | |