CONTENTS

GENERAL VIEWS ........................................ 00-2
Dimensions and weights............................. 00-2
MODEL VARIATION ...................................... 00-3
IDENTIFICATION DATA ................................ 00-5
LIFTING POINTS AND TOWING ............................ 00-6
Pantograph jack ........................................ 00-6
Garage jack and safety stands ...................... 00-7
Towing .................................................... 00-7
SPECIAL SERVICE TOOLS ............................... 00-8
INSTRUCTIONS FOR PRE-DELIVERY INSPECTION AND PERIODICAL MAINTENANCE COUPONS ................. 00-8
Pre-delivery ........................................... 00-8
Checking level ......................................... 00-8
Functional tests ....................................... 00-8
Cleaning and finishing inspection .................. 00-8
Maintenance ............................................ 00-10
MAINTENANCE SCHEDULE ............................... 00-11
APPROXIMATE REFILL CAPACITIES ...................... 00-24
ENGINE MAINTENANCE .................................. 00-24
Basic mechanical system .............................. 00-24
Ignition and fuel system .............................. 00-28
Checking CO% ........................................... 00-29
TROUBLE DIAGNOSIS AND CORRECTIONS .............. 00-32
CHASSIS AND BODY MAINTENANCE .................... 00-39
Checking fuel and exhaust system ................... 00-39
Clutch .................................................. 00-39
Gearbox-differential .................................. 00-39
Assembly drive shaft ................................ 00-39
Front axle and front suspension ..................... 00-39
Rear axle and rear suspension ....................... 00-40
Checking suspension heights ......................... 00-40
Wheel alignment ....................................... 00-42
Brake system ........................................... 00-43
Steering system ....................................... 00-45
Body ..................................................... 00-45
SERVICE DATA AND SPECIFICATIONS .................. 00-45
Engine maintenance ................................... 00-45
Chassis and body maintenance ....................... 00-47
SPECIAL SERVICE TOOLS ............................. 00-48

APPROXIMATE REFILL CAPACITIES ........................ 00-24
ENGINE MAINTENANCE .................................. 00-24
Basic mechanical system .............................. 00-24
Ignition and fuel system .............................. 00-28
Checking CO% ........................................... 00-29
TROUBLE DIAGNOSIS AND CORRECTIONS .............. 00-32
CHASSIS AND BODY MAINTENANCE .................... 00-39
Checking fuel and exhaust system ................... 00-39
Clutch .................................................. 00-39
Gearbox-differential .................................. 00-39
Assembly drive shaft ................................ 00-39
Front axle and front suspension ..................... 00-39
Rear axle and rear suspension ....................... 00-40
Checking suspension heights ......................... 00-40
Wheel alignment ....................................... 00-42
Brake system ........................................... 00-43
Steering system ....................................... 00-45
Body ..................................................... 00-45
SERVICE DATA AND SPECIFICATIONS .................. 00-45
Engine maintenance ................................... 00-45
Chassis and body maintenance ....................... 00-47
SPECIAL SERVICE TOOLS ............................. 00-48

May 1983
## Dimensions and Weights

<table>
<thead>
<tr>
<th>Model</th>
<th>1200 Identification number</th>
<th>1350</th>
<th>1500 Identification number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>905.00</td>
<td>905.02</td>
<td>905.04 - 905.05</td>
</tr>
<tr>
<td></td>
<td>905.03</td>
<td>905.06 - 905.07</td>
<td></td>
</tr>
<tr>
<td>Wheelbase</td>
<td>P mm (in)</td>
<td>2455 (96.65)</td>
<td></td>
</tr>
<tr>
<td>Track</td>
<td>Front Ca mm (in)</td>
<td>1392 (54.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear CP mm (in)</td>
<td>1359 (53.5)</td>
<td></td>
</tr>
<tr>
<td>Overall length</td>
<td>L mm (in)</td>
<td>4015 (158.07)</td>
<td></td>
</tr>
<tr>
<td>Overhang</td>
<td>Front Sa mm (in)</td>
<td>800 (31.5)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear SP mm (in)</td>
<td>760 (29.92)</td>
<td></td>
</tr>
<tr>
<td>Overall width</td>
<td>La mm (in)</td>
<td>1612 (63.46)</td>
<td></td>
</tr>
<tr>
<td>Height (unladen)</td>
<td>H mm (in)</td>
<td>1305 (51.28)</td>
<td></td>
</tr>
<tr>
<td>Ground clearance</td>
<td>mm (in)</td>
<td>121 (4.76)</td>
<td></td>
</tr>
<tr>
<td>Min. steering radius</td>
<td>mm (in)</td>
<td>4700 (185.44)</td>
<td></td>
</tr>
<tr>
<td>Kerb weight</td>
<td>kg (lb)</td>
<td>890 (1962.1)</td>
<td></td>
</tr>
<tr>
<td>Max. allowed gross weight</td>
<td>kg (lb)</td>
<td>1315 (2899)</td>
<td></td>
</tr>
<tr>
<td>Payload</td>
<td>kg (lb)</td>
<td>425 (936.91)</td>
<td></td>
</tr>
<tr>
<td>Max. allowed axle gross weight</td>
<td>Front kg (lb)</td>
<td>725 (1598.31)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear kg (lb)</td>
<td>725 (1598.31)</td>
<td></td>
</tr>
<tr>
<td>Max. towing gross weight</td>
<td>kg (lb)</td>
<td>1000 (2204.6)</td>
<td></td>
</tr>
<tr>
<td>Seating capacity</td>
<td>Front</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

*May 1983*
## MODEL VARIATION

*(Except Switzerland, Sweden, Australia)*

<table>
<thead>
<tr>
<th>Model</th>
<th>1200</th>
<th>1350</th>
<th>QUADRIFOGLIO</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>5-door saloon</td>
<td>5-door saloon</td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td>Drive</td>
<td>Left</td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
</tr>
</tbody>
</table>

**Identification No.**
- on certification label: 905.00
- on identification label: 905.04, 905.06, 905.07

**Type approval No.**
- on identification label: 905 A
  - 905 A1, 905 A2, 905 A2

**Serial No.**
- on intermediate bulkhead label: 905 A
  - 905 A1 0, 905 A20, 905 A20

**Engine No.**
- on cylinder block label: 305.00
  - from 000.000.1, 305.04

**Tire dimensions**
- 165/70 SR 13

**Rim dimensions**
- 5J x 13 H2, 5J x 13 H2
  - or 5J x 13 CH, 5J x 13 CH

---

May 1983
COMPLETE CAR

IDENTIFICATION DATA

IDENTIFICATION LABELS
(Except Switzerland, Sweden, Australia)

5 - Door Saloon 1200 - .1350 - 1500

VEHICLE IDENTIFICATION (AND SERVICE) DATA

VEHICLE IDENTIFICATION CODES

A) Chassis numbering

Z A R 9 0 5 A00 05.002.458
(1) (3) (2)

(1) Manufacturer identification letters.

(2) Serial number: progressively assigned by Production.

(3) "Type approval number": not for service identification use; for service purposes, use the "type number" which is stamped on identification label along with the "type approval number".

The following is an example of such label.

(4) Identification number: to be used as vehicle service identification number. This number consists of five figure numbers, divided as follows:

4a) Basic type number: it is assigned to all vehicles having a common design concept (Ex.: 905: Saloon).
4b) Type variant number: it identifies, within the basic type, those vehicles that differ because of some variant that alters their features (Ex.: 905.02 5-door Saloon).
**ENGINE NUMBERING**

It consists of two sets of figures, namely:

1. Type number: assigned to all engines having common general technical characteristics (Ex.: 305.02: 1350 engine with twin carburetor).
2. Serial number: progressively assigned by production.

---

**LIFTING POINTS AND TOWING**

**PANTOGRAPH JACK**

---

**WARNING:**

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

Fit pantograph jack, supplied with the vehicle, to safety points shown in figure.
COMPLETE CAR

GARAGE JACK AND SAFETY STANDS

WARNING:

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

CAUTION:

When raising the vehicle, always place a wooden block under vehicle's lifting points.
Position garage jack and safety stands in a safe manner under the points shown in the figure.

---

TOWING

Closely follow Motor Vehicle Regulations regarding vehicle towing.

CAUTION:

a. Use proper towing equipment to avoid possible damage to the vehicle.
b. Before towing, make sure that front and rear axes as well as steering system are in good working condition; contrarywise use a dolly.
c. If vehicle must be towed with its rear wheels raised, front wheels must be placed on a towing dolly.
d. Set ignition key to “GAR” and do not withdraw it from switch; otherwise antitheft device could become engaged.
e. Release parking brake and set gearshift lever to “neutral” before starting to tow the vehicle.
f. Do not apply lateral forces to towing hook. Keep towing bar or similar devices always in line with the vehicle.
g. Remember that when vehicle is being towed, there is no vacuum in servobrake; consequently, when braking, greater pressure must be applied onto brake pedal.
SPECIAL SERVICE TOOLS

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

- A.O.0000 Special Service Tool
- C.0.0000 Tester
- U.0.0000 Reamer

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

INSTRUCTIONS FOR PRE-DELIVERY INSPECTION AND PERIODICAL MAINTENANCE COUPONS

In this chapter are listed and described all pre-delivery and maintenance operations required by ALFA 33 models. As far as technical specifications regarding each operation are concerned, refer to each section's relevant "Service Data and Specifications" chapter.

PRE-DELIVERY

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

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

If checking operations show that topping up -as foreseen by this text- is required, proceed accordingly; such operation will be considered as part of pre-delivery inspection. In case damages or malfunctions other than those herein described are encountered, they will have to be taken care of repair or adjust according to current technical and administrative procedures. As each operation is being carried out, the relevant card must be filled out and then filed together with the sold vehicle's other documents; also the pre-delivery card included in the Instruction Book supplied to the customer must be duly filled out as demonstration of strictly execution of pre-delivery checks.

CHECKING LEVEL

Coolant
- When engine is cold, check level in expansion reservoir. If required, top up to specified max. level.

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

Brake and clutch fluid
- Check if level in the reservoir is up to max. mark. If required, top up with specified fluid remembering that tins must be sealed and opened only when ready to use.
- Be sure to perform this operation with utmost care and cleanliness.

Battery electrolyte
- Check and make sure electrolyte covers the plate upper edge by 5 mm (0,2 in); contrarilywise, top up with distilled water.

Windshield washer fluid
- Check if relevant reservoir is full; if required, top up with specified solution.

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

FUNCTIONAL TESTS

Engine starting and idling
- Check if engine starts properly. When engine is warm, check specified idle-rpm.
Engine controls
- Check and make sure starter control knob works freely, without sticking; further check that when this knob is pushed in, respective device is not at all engaged on carburetor.
- Check accelerator pedal and make sure it does not stick; also check that when pedal is pushed down all the way, throttle valve is fully open.

Brake, clutch and gearbox controls
- With engine running, push brake pedal and check if it comes without elasticity.
- Also check if parking brake control lever works properly.
- With engine running, push clutch pedal down and make sure that all gearbox speeds engage easily, without sticking and noiselessly.

Tightening wheel screws
- Use a spanner and check if wheel screws, are properly tightened. Also check if screws, are in compliance with vehicle and rim type, as shown in the Spare Parts Catalogue.

Dashboard instruments
- While starting up the engine, check if all electrically controlled instruments work properly (needles are moving): rpm indicator, oil pressure gauge, water temperature gauge, fuel level indicator, and clock.

System circuits tightness
- Visually check circuits of following systems for leaks or evidence thereof: fuel, brake, clutch, and engine cooling.
- Check engine, gearbox and differential for evidence of oil leaks.

Engine cooling electric fan
- Connect and short-circuit wires of radiator thermal contact and check if fan starts and works properly.
- Also make sure that wires are properly and securely connected to thermal contact.

Heating system
- Check proper working condition of levers controlling heater and outlets for admission of air into the vehicle (open and close).
- Check if electric fan works properly at different speeds and if relevant warning light on the board lights up.

Lights, signal, electrical accessory equipment
- With ignition key set to "MAR" check if lights outside and inside the vehicle, as well as relevant warning lights, go on: front and rear parking lights, number plate lights, direction indicators and emergency flasher, stop lights, high and low beam headlights, headlights flasher, reverse gear lights, rear fog lights inside ceiling lamp (through manual as well as door switch), instrument cluster light.
- Check proper working condition of following warning lights: alternator, fuel reserve, oil pressure, brake fluid level, parking brake on, starter on, defroster on, cooling water temperature.
- Check proper operation of horns and cigarette lighter.

Windshield and rear window wiper and washer
- After having installed wiper blades, check if windshield wiper works properly at both speeds as well as it is set to intermittent operation.
- Operate the windshield washer and check if sprayer jets are normal and properly directed toward the windshield's higher section.

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

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

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

CLEANING AND FINISHING INSPECTION

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

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

Exterior/Interior mouldings and fittings
- Visually check all vehicle's out-
side parts: bumpers, mouldings, grills, headlight rims, letters and emblems making sure they are securely fitted, and have no spots or dents.
Verify all upholsteries (roof, carpets, panels etc.) removing possible stains or scratches.

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

MAINTENANCE

Maintenance operations consist in checking and restoring proper working condition of some parts of the vehicle which are most likely to become worn or out-of-adjustment as a consequence of the vehicle’s normal use.
A list of various operations to be performed at different intervals, as shown in the chart that follows, is included in the coupons of the Service Book which accompanies each vehicle.

Coupons will have to be stamped by the Service Organisation Agency to show that specified maintenance operations have been carried out. Just as for pre-delivery inspection, should topping up or change of fluids and lubricants - as described in the text - become necessary, they will be considered as part of maintenance operations. In case damages or malfunctions other than those listed are encountered, they will be taken care of repair or adjust according to current technical and administrative procedures.
<table>
<thead>
<tr>
<th>No</th>
<th>OPERATION</th>
<th>A 1)</th>
<th>Km/1000</th>
<th>Notes 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UU-1U</td>
<td>Test vehicle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00-20</td>
<td>Check all bolts for tightness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01-10</td>
<td>Change engine oil and oil filter; check lubrication system for leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01-20</td>
<td>Check valve clearance and adjust, if necessary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01-40</td>
<td>Check tension and soundness alternator drive belt and adjust, if necessary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01-50</td>
<td>Replace alternator drive belt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01-80</td>
<td>Replace camshaft drive belts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04-10</td>
<td>Check fuel system for leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04-20</td>
<td>Replace air cleaner cartridge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04-30</td>
<td>Replace fuel filter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04-40</td>
<td>Clean carburetor jets and PVC system flame trap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04-50</td>
<td>Check idle-rpm and CD% adjust, if necessary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04-60</td>
<td>Check accelerator cable adjust if necessary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05-10</td>
<td>Check ignition timing adjust if necessary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05-20</td>
<td>Replace spark plugs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07-10</td>
<td>Check coolant level; check cooling system for leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-1U</td>
<td>Change gearbox oil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-20</td>
<td>Check gearbox oil level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-10</td>
<td>Check drive shaft and steering box boots for cracks or wear</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-10</td>
<td>Check front wheel toe-out: adjust if necessary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-10</td>
<td>Inspect brake system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-20</td>
<td>Check brake pads for wear; replace as required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>OPERATION</td>
<td>Km/1000</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------</td>
<td>---------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>22-21</td>
<td>Inspect rear brake drums, check shoe linings for wear and replace as required</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>22-30</td>
<td>Change brake and clutch fluid</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>22-40</td>
<td>Check level of fluid in both brake and clutch reservoirs</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>22-60</td>
<td>Check parking brake stroke; adjust as required</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>26-10</td>
<td>Check tire pressure</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>40-10</td>
<td>Check battery electrolyte level and top up is necessary; also check terminals for proper tightness and lubrication</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>40-20</td>
<td>Check headlights aiming and adjust as required</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56-10</td>
<td>Lubricate door and bonnet hinges; adjust striker plates</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

(1) A = 1300 ÷ 1700 km
(2) To be performed also at 10, 30, 50, 70, and 90 km/1000 and in any case once a year
(3) Check oil level frequently when refuelling
(4) Check and clean cartridge at km intervals (mileage) stated in item (2) above and even more frequently if driving in very dusty areas
(5) Check frequently when refuelling
(6) To be performed also at km intervals (mileage) stated in item (2) above and even more frequently when driving under particular stress conditions (sport driving) or on hilly roads
(7) To be performed in any case once a year
(8) To be performed also at km intervals (mileage) stated in item (2) above
# COMPLETE CAR

## MAINTENANCE SCHEDULE

*(Swiss version)*

<table>
<thead>
<tr>
<th>Km/1000</th>
<th>No.</th>
<th>OPERATION</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>01-10</td>
<td>Test vehicle</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>C1-10</td>
<td>Check all engine bolts for tightness</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>C1-110</td>
<td>Change engine oil and oil filter, check lubrication system for leaks</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>C2-120</td>
<td>Check valve clearance and adjust, if necessary</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>C1-130</td>
<td>Clean the PCV system</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>C1-140</td>
<td>Check tension and soundness of alternator drive belt and adjust, if necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C1-150</td>
<td>Replace alternator drive belt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C1-160</td>
<td>Replace camshaft drive belt</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4-1-50</td>
<td>Replace air cleaner cartridge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4-20</td>
<td>Check fuel system for leaks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4-30</td>
<td>Clean accelerator pet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4-40</td>
<td>Check drive type and CO % adjust, if necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4-50</td>
<td>Check drive type and CO % adjust, if necessary</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4-60</td>
<td>Check temperature control device</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C4-70</td>
<td>Check starter control functioning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5-10-10</td>
<td>Check ignition timing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5-20</td>
<td>Replace spark plugs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6-10</td>
<td>Replace power steering pump</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7-10</td>
<td>Replace coolant for inlet</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7-20</td>
<td>Change cooling system for leaks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9-10</td>
<td>Change power steering ball joint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13-10</td>
<td>Change power steering ball joint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13-20</td>
<td>Check drive belt and power steering ball joint for failure or wear</td>
<td></td>
</tr>
</tbody>
</table>

*May 1983*
<table>
<thead>
<tr>
<th>No</th>
<th>OPERATION</th>
<th>A</th>
<th>Km/1000</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-10</td>
<td>Check front wheel toe-out; adjust if necessary</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-10</td>
<td>Inspect brake system</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>22-20</td>
<td>Check front brake pads and rear drum friction gaskets possible replacement</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>22-25</td>
<td>Check brake booster vacuum hose for sound condition</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>22-30</td>
<td>Change brake fluid</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22-40</td>
<td>Check level of fluid in both brake and clutch reservoirs</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>22-60</td>
<td>Check parking brake stroke; adjust as required</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>28-10</td>
<td>Check tire pressure</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-10</td>
<td>Check battery electrolyte level and top up if necessary; also check terminals for proper tightness and lubrication</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>56-10</td>
<td>Lubricate door and bonnet hinges; adjust striker plates</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) A = 1300 ÷ 1700 Km
(2) To be performed also at 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.
E Operation relevant to emission control.
## MAINTENANCE SCHEDULE

(Sweden version)

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>00-20</td>
<td>Check all bolts for tightness</td>
</tr>
<tr>
<td>01-10</td>
<td>Change engine oil and oil filter; check lubrication system for leaks</td>
</tr>
<tr>
<td>01-20</td>
<td>Check valve clearance and adjust, if necessary</td>
</tr>
<tr>
<td>01-30</td>
<td>Clean the PCV system</td>
</tr>
<tr>
<td>01-40</td>
<td>Check tension and soundness of air pump and alternator drive belt and adjust, if necessary</td>
</tr>
<tr>
<td>01-50</td>
<td>Replace air pump and alternator drive belt</td>
</tr>
<tr>
<td>04-10</td>
<td>Check fuel system for leaks</td>
</tr>
<tr>
<td>04-20</td>
<td>Replace air cleaner cartridge and air pump cleaner</td>
</tr>
<tr>
<td>04-30</td>
<td>Replace fuel filter</td>
</tr>
<tr>
<td>04-40</td>
<td>Clean oil filter</td>
</tr>
<tr>
<td>04-50</td>
<td>Check idle rpm; idle and CO% adjust, if necessary</td>
</tr>
<tr>
<td>04-60</td>
<td>Check accelerator cable adjust if necessary</td>
</tr>
<tr>
<td>04-70</td>
<td>Check automatic starting device; adjust if necessary</td>
</tr>
<tr>
<td>04-75</td>
<td>Check air intake temperature control device</td>
</tr>
<tr>
<td>05-10</td>
<td>Check ignition timing; adjust if necessary</td>
</tr>
<tr>
<td>05-20</td>
<td>Replace spark plugs</td>
</tr>
<tr>
<td>07-10</td>
<td>Change engine coolant; check cooling system for leaks</td>
</tr>
<tr>
<td>13-10</td>
<td>Change gearbox oil</td>
</tr>
<tr>
<td>3-20</td>
<td>Check gearbox oil level</td>
</tr>
</tbody>
</table>

---

May 1983

00-15
## COMPLETE CAR

### MAINTENANCE SCHEDULE

*(Australia version)*

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Kilometers/1000 (Km/1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Change engine oil and filter</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Check battery and top up electrolyte level, if necessary, check terminals</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>Check drive shaft and steering box boots for cracks or wear</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>Check, the pressure</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>Check engine coolant circuit: level, possible topping up</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>Check primary brake pads and rear drum-brake shoes, possible replacement</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>Check level of fluid in both brake and clutch reservoirs</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>Check level of gearbox differential</td>
<td>80</td>
</tr>
<tr>
<td>9</td>
<td>Check oil system fuel system and cooling circuit, for leaks, check vacuum</td>
<td>90</td>
</tr>
<tr>
<td>10</td>
<td>Check oil temperature control device</td>
<td>100</td>
</tr>
<tr>
<td>11</td>
<td>Check valve clearance and adjust, if necessary</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Check valve clearance and adjust, if necessary</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Check air inake temperature control device</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Check idle rpm, fast idle and CO % adjust if necessary</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Clean the PCV system</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Replace fuel filter</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Check alternator drive belt for soundness and tension, adjust if necessary</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Check door and lid hinges and locks for operation and lubrication</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Inspect brake hydraulic system</td>
<td></td>
</tr>
</tbody>
</table>

May 1983
FLUIDS AND LUBRICANTS CHART

- Engine oil filter
- Steering box and drive shaft
- Gearbox differential oil
- Oil sump dipstick
- Brake fluid
- Engine oil
- Battery
- Fuel filter

To be performed at 10, 30, 50, 70, and 90 km/1000

- Frequency check engine oil level when refuelling.

- Windshield, rear window, washing fluid

- 40,000/48,000 (12)
- 60,000/68,000 (24)
- 80,000/88,000 (48)
- 100,000/108,000 (68)
RECOMMENDED FUEL AND -LUBRICANTS

FUEL

To ensure proper engine operation, use petrol with a R.M. Octane Rating \( \geq 98 \) and a Motor Method Octane Rating \( \leq 11 \) sensitivity (1).

(1) Difference between Research Method Octane Rating and Motor Method Octane Rating.
<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Des.</th>
<th>Grade</th>
<th>IP</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine</td>
<td>01</td>
<td>API</td>
<td>SAE J 306 a</td>
<td>F 1</td>
<td></td>
</tr>
<tr>
<td>Gearbox</td>
<td>13</td>
<td>API</td>
<td>GL-S</td>
<td>F 1</td>
<td></td>
</tr>
<tr>
<td>Differential</td>
<td>21</td>
<td>API</td>
<td>SAE 80W/90</td>
<td>F 1</td>
<td></td>
</tr>
<tr>
<td>Front suspension</td>
<td>25</td>
<td>API</td>
<td>SAE 80W/90</td>
<td>F 1</td>
<td></td>
</tr>
<tr>
<td>Rear suspension</td>
<td>15</td>
<td></td>
<td>SAE 80W/90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine fuel system</td>
<td>04</td>
<td></td>
<td>N.L.G.I. n. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Ignition</td>
<td>05</td>
<td></td>
<td>N.L.G.I. n. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clutch</td>
<td>12</td>
<td></td>
<td>F 1 Grease 33 F D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GREASE</td>
<td></td>
<td></td>
<td>Auto Grease FD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clutch</td>
<td>15</td>
<td></td>
<td>F 1 Grease 15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grease</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gearbox</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Differential</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**FLUIDS AND LUBRICANTS**

<table>
<thead>
<tr>
<th>Des.</th>
<th>Grade</th>
<th>IP</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Environmental temperature:**

- SAE: 0°F / -18°C
- API: 10°F / -12°C
- N.L.G.I.: 20°F / -6°C
- F 1: 10°F / -12°C
- Grease: 10°F / -12°C

**IP (Interchangeability Point):**

- SAE: 10°F / -12°C
- API: 10°F / -12°C
- N.L.G.I.: 20°F / -6°C
- F 1: 10°F / -12°C
- Grease: 10°F / -12°C

**Basic Substance:**

- Al - Ca
- Al - Mo
- Ca - Ba
- Molykote A
- Molykote BR2
- Molykote Paste G
- Spermahel: Graphite
- UNION CARBIDE CHEMI: Graphite
- UNION CARBIDE CHEMI: Graphite
<table>
<thead>
<tr>
<th>Type</th>
<th>Application</th>
<th>Classification</th>
<th>Denomination</th>
<th>Other*</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differentia - 17</td>
<td></td>
<td></td>
<td></td>
<td>AGIP *</td>
<td>ISECO: Molykote VV2461/C</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>p*</td>
<td>OPTIMOL: Oilstramy 2 LN 584</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Basic substance: Li</td>
</tr>
<tr>
<td>Front suspension</td>
<td></td>
<td>N.L.G.I. n. 5</td>
<td>F 1 Grease 33 FD</td>
<td>Autogrease FD</td>
<td>UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB 5100</td>
</tr>
<tr>
<td>- 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MILLOIL: Lubricant for elastomer seals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Basic substance: Bentonite Polythene</td>
</tr>
<tr>
<td>Front and Rear Brakes - 22</td>
<td></td>
<td>N.L.G.I. n. 1</td>
<td>F 1 Grease 15</td>
<td></td>
<td>ATE Bremzylinder Peste DBA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Basic substance: Al - Ca</td>
</tr>
<tr>
<td>Steering System</td>
<td></td>
<td>N.L.G.I. n. 3</td>
<td>F 1 Grease 33 FD</td>
<td>Autogrease FD</td>
<td>UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB 5100</td>
</tr>
<tr>
<td>- 23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MILLOIL: Lubricant for elastomer seals</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Basic substance: Bentonite Polythene</td>
</tr>
<tr>
<td>Rear suspension</td>
<td></td>
<td>N.L.G.I. n. 3</td>
<td>F 1 Grease 33 FD</td>
<td>Autogrease FD</td>
<td>UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB 5100</td>
</tr>
<tr>
<td>- 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MILLOIL: Lubricant for elastomer seals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N.L.G.I. n. 1</td>
<td>F 1 Grease 15</td>
<td></td>
<td>Basic substance: Al - Ca</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Basic substance: Bentonite Polythene</td>
</tr>
<tr>
<td>Wheels and Tires - 28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>UNION CARBIDE CHEMICALS COMPANY: Ucon lubricant 50 HB 5100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MILLOIL: Lubricants for elastomer seals</td>
</tr>
</tbody>
</table>
### APPROXIMATE REFILL CAPACITIES

<table>
<thead>
<tr>
<th>APPROXIMATE REFILL CAPACITIES</th>
<th>kg (lb)</th>
<th>l (Imp gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUEL TANK</td>
<td></td>
<td>50 (11)</td>
</tr>
<tr>
<td>FUEL RESERVE</td>
<td></td>
<td>6.5 (1.43)</td>
</tr>
<tr>
<td>COOLANT</td>
<td></td>
<td>7.3 (1.61)</td>
</tr>
<tr>
<td>ENGINE OIL SUMP</td>
<td>With filter</td>
<td>3.6 (7.94)</td>
</tr>
<tr>
<td></td>
<td>Without filter</td>
<td>3.15 (6.94)</td>
</tr>
<tr>
<td>GEARBOX-DIFFERENTIAL OIL</td>
<td></td>
<td>2.3 ± 2.4 (5.1 ± 5.3)</td>
</tr>
<tr>
<td>CONCENTRATE ANTI FREEZE QUANTITY DEPENDING ON TEMPERATURE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E - 10°C (14°F)</td>
<td></td>
<td>1.8 (0.40)</td>
</tr>
<tr>
<td>E - 20°C (64°F)</td>
<td></td>
<td>2.6 (0.57)</td>
</tr>
<tr>
<td>E - 35°C (-31°F)</td>
<td></td>
<td>3.65 (0.80)</td>
</tr>
<tr>
<td>ANTIFREEZE QUANTITY READY FOR USE DEPENDING ON TEMPERATURE</td>
<td></td>
<td>7.3 (1.61)</td>
</tr>
<tr>
<td>E - 20°C (64°F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAM SHAFT SUPPORT SUMPS OIL</td>
<td>Kg 0.250 (lb 0.55) FOR EACH SUPPORT (REFILL TO BE CARRIED OUT IN CASE OF DISASSEMBLIES ONLY-COMPLETELY DRY SUPPORTS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5 (1.1)</td>
</tr>
</tbody>
</table>

### ENGINE MAINTENANCE

#### BASIC MECHANICAL SYSTEM

**CHECK AND POSSIBLE ADJUSTMENT OF VALVE CLEARANCE**

Following operations must be performed while engine is cold.

1. Disassemble spark plugs, remove camshaft support cover and, by means of a syringe, suck oil from tank.
2. Using the feeler gauge C.6.0168 check clearance between cam resting radius and cup crown making sure it is within specified value.

   **Valve clearance (cold engine)**
   - Intake: 0.35 ± 0.40 mm (0.014 ± 0.016 in)
   - Exhaust: 0.45 ± 0.50 mm (0.018 ± 0.020 in)

In case clearance is not within the prescribed values, carry out adjustment operating as follows:

1. Rotate crankshaft till piston is in its compression stroke (valve closed).
2. Insert the key A.50193 into proper hole on camshaft.
3. Further rotate crankshaft so that camshaft hole is in line with the adjusting screw on the cup.
4. Suitably rotate the cup involved in the adjusting operation as well as the one next to it so that relevant cavities will face each other.
5. Introduce tool A.2.0278 for retaining of valve cups in order to prevent rotation of cups during clearance adjustment (tool does not prevent axial sliding).
6. Interpose tool C.6.0168 between tapper bucket upper part and cam minimum radius and, by means of wrench A.5.0193, operate until the prescribed clearance is obtained.
7. For better security check clearance after having removed previously inserted cup locking pin.
8. Repeat the procedure for each valve of the two heads.
9. At the end of operation, restore the tank oil level and reassemble cover and spark plugs.

CHECKING, REPLACING AND ADJUSTING DRIVE BELTS

Alternator and water pump control belt

Inspect belt for cracks or damage. Replace it if necessary. Push on belt longest section, located between engine pulley and alternator pulley, applying an 79 N (8 kg; 3.63 lb) load and verify relevant deflection which should be of 15 mm (0.59 in); contrarilywise proceed to adjust belt tension as follows.

7. Loosen bolts 1 and 2 as well as screws 3 that secure alternator support bracket to the engine's front cover.
2. Move the alternator so as to either stretch or slacken the belt and then tighten again bolt 1.
3. Check again belt tension and then tighten all previously loosened bolts.

REMOVAL

1. Disconnect electric fan wiring, loosen relevant screws 1 and remove fan from radiator through lower channel 2.

2. Remove spark plugs, alternator and water pump control belt.
3. Remove camshaft belts plastic covers.
4. Remove camshaft support covers.
5. Remove timing plastic cover located on cylinder block rear cover, and rotate crankshaft till piston in no. 1 cylinder is set in top dead center on its combustion stroke. Such correct position is achieved when the T-shaped reference mark 2 on flywheel is in line with the mark on rear cover 1.

ASSEMBLY

CAUTION:
Check again engine timing proceeding as per step 5 above.

1. Rotate camshafts till reference marks stamped on same are in line with those stamped on relevant support.
2. Key camshaft control belts onto crankshaft and camshaft pulleys starting with the one of the left hand cylinder head.

(1) Belt keying must take place while belt pulling section (opposite the idler pulleys) is fully stretched.

(2) Loosen idler pulleys lock nuts all the way and then tighten them again.

(3) Let driving shaft rotate in the functioning direction so as to allow belt to set on pulleys.

(4) Set, one by one, the camshafts to the neutral position, then unloosen nuts securing backstand, press a few times on them and secure nuts to the prescribed torque.

(5) Rotate crankshaft a few times in its working direction so that belts may take up their final position.

Rotate camshafts till they are in neutral position: loosen idler pulleys lock nuts pressing idler pulleys a few times, and then tighten relevant nuts according to specified torque.

Rotate crankshaft a few times in its working direction thus allowing belts to settle on pulleys, and then repeat above described tension checking operation while positioning camshafts one at the time - with cups disengaged.

3. Check again engine timing.

4. Fit back camshaft support covers, alternator and water pump control belt, electric fan and spark plugs.

5. Start engine and warm it up to normal running temperature, then remove again camshaft support covers. Working on one cylinder head at the time, proceed as follows: bring relevant camshaft in neutral position, loosen and then tighten again idler pulley lock nut thus giving the belt in its final tension load.

6. Fit back camshaft support covers and timing belts covers.

### CHANGING ENGINE OIL AND REPLACING OIL FILTER

1. With engine warm, remove oil filler cap and oil pan drain plug letting oil drain completely into a suitable container (wait at least 15 minutes).

2. Using an oil filter wrench, remove oil filter.

3. When engine oil is completely drained, clean oil pan drain plug and screw it back into place.

4. Moisten the gasket of the new oil filter and then install the filter tightening it all the way.

5. Refill engine with specified new oil referring to LUBRICANTS chart. Check oil level with dipstick.

### ENGINE OIL QUANTITY

<table>
<thead>
<tr>
<th></th>
<th>kg</th>
<th>(lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camshaft support sumps</td>
<td>0.25</td>
<td>0.55</td>
</tr>
<tr>
<td>Engine oil sump</td>
<td>3.60</td>
<td>7.94</td>
</tr>
<tr>
<td>Sump capacity</td>
<td>3.15</td>
<td>6.94</td>
</tr>
<tr>
<td>Filter capacity</td>
<td>0.45</td>
<td>1.00</td>
</tr>
</tbody>
</table>

(*) Refill to be carried out, for each sump, in case of disassembly only.
6. Fit oil filler cap back and start the engine letting it idle for about 2 minutes.

7. Now check following items for any oil leaks: filter, pan, seal rings, oil pressure transmitter, gaskets of cylinder block and cylinder head covers, and cylinder head gaskets. If necessary, tighten or replace items that are not oil tight.

8. Turn the engine off and wait a few minutes.

9. Take out dipstick and clean it; fit dipstick back, take it out again and check oil level making sure it reaches the MAX reference mark.

---

**COOLING SYSTEM**

**System flushing**

This operation should be performed only if plain water is used as engine coolant in summertime.

1. While engine is cold, remove radiator filler cap.

2. Loosen and remove drain plugs (1), located on bottom of cylinder block, let coolant drain completely and then fit plugs back on cylinder block bottom and tighten them.

---

**Checking the system**

1. Check coolant level in radiator making sure it is within MAX and MIN level marks.

2. Check hoses and unions for leaks making sure they are not in any way damaged.

3. Check filler cap making sure relevant spring, gasket and valves are in good working condition.

4. Test the electric fan as follows:
   (1) Disconnect thermostat wires and short-circuit them.
   (2) Turn ignition key and check if electric fan starts up.

5. Check radiator as per instructions contained in Group 07 - Radiator.

6. If top-up requires an abnormally large amount of coolant, check entire cooling system for leaks and eliminate them.

---

**System refill**

After having drained the cooling system, refill it with the kind and quantity of coolant as shown in the following chart.

**Summer time**

| Drinkable water | 1.73 | (Imp Gal) (1.61) |

**Winter time**

<table>
<thead>
<tr>
<th>Minimum outside temperature °F</th>
<th>-10 (14)</th>
<th>-20 (-4)</th>
<th>-35 (-31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentrated anti-freeze Std. No.</td>
<td>3681-69956</td>
<td>3681-69955</td>
<td>3681-69955</td>
</tr>
<tr>
<td>(Imp Gal)</td>
<td>1.8 (0.40)</td>
<td>2.6 (0.57)</td>
<td>3.65 (0.80)</td>
</tr>
<tr>
<td>Diluting drinkable water</td>
<td>5.5 (1.21)</td>
<td>4.7 (1.03)</td>
<td>3.65 (0.80)</td>
</tr>
<tr>
<td>(Imp Gal)</td>
<td>(1.61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ready-to-use anti-freeze Std. No.</td>
<td>3681-69955</td>
<td>3681-69958</td>
<td></td>
</tr>
<tr>
<td>(Imp Gal)</td>
<td>1.8 (0.40)</td>
<td>3.65 (0.80)</td>
<td></td>
</tr>
</tbody>
</table>

**Radiator filler cap pressure test**

1. Fit union (2) onto tester and then insert it on expansion reservoir cap.

2. Apply pressure to the cap and check tester to make sure that when specified pressure reading is reached, the relief valve opens up.

**Radiator filler cap relief pressure:**

68.6 kPa (0.69 bar; 0.7 kg/cm²; 9.96 p.s.i.)
CHECKING CYLINDER COMPRESSION

When diagnostic poor engine performance because power is not up to normal, it is advisable to test cylinder compression using relevant tester (MOTOMETER) and according to following procedure:

1. Start the engine and warm it up to normal running temperature.
2. Remove spark plugs.
3. Disconnect distributor's high voltage cable.
4. Apply compression tester onto the seat of one spark plug.
5. Crank the engine briefly keeping the accelerator pedal fully pressed so that carburetor throttle valve is fully open.
6. Verify that compression pressure is above min. value (make sure there are no leaks from tester's union).

Min. compression pressure
1030 kPa (10.3 bar; 10.5 kg/cm²; 149.34 p.s.i.)

7. Repeat the test to check compression in other cylinders, being careful to reset the tester each time. Compare the readings and make sure that max. difference between the various cylinder pressure measurements does not exceed specified value.

Max. compression difference between cylinders
98 kPa (0.98 bar; 1 kg/cm²; 14.22 p.s.i.)

If picked up values are not within specified ones, look for the trouble's cause in poor tightness of the valves or between cylinder liners and pistons.

REPLACING AIR CLEANER CARTRIDGE

1. Unfasten air cleaner cover retaining spring clips.
2. Lift cover and remove cartridge.
3. Thoroughly clean cartridge by blowing low pressure compressed air from within.
If necessary, replace cartridge.

IGNITION AND FUEL SYSTEM

CHECKING AND REPLACING SPARK PLUGS

1. Disconnect spark plug wires with relevant protecting boots.
2. Remove spark plugs with spark plug wrench.
3. Clean electrodes and check insulation for cracks and chips.
If electrodes are excessively worn, replace the spark plugs.
Spark plug type: LODGE 25 HL
4. When replacing spark plugs, coat plug thread with specified grease and then fit them in relevant seat tightening them according to specified torque.
Spark plug thread:
ISECO Grease: Molykote A - Std.
No. 4500 - 18304

①: Tightening torque
Spark plugs
25 ÷ 34 N-m
(2.5 ÷ 3.5 kg-m
18.08 ÷ 25.31 ft-lb)

5. Connect spark plug wires and fit back relevant protecting boots according to following sequence: 1 - 3 - 2 - 4.

CHECKING THE DISTRIBUTOR

Visual check
1. Remove distributor cap and rotor ① and check them for cracks or chips.
2. Make sure that distributor cap carbon is securely kept in place in its seat by the relevant spring and that it moves freely thus ensuring proper constant adherence to distributor rotor.
3. Apply a coating of engine oil to felt inside rotor control shaft and a coating of specified grease to cam.

CHECKING CO%

CHECKING AND ADJUSTING IGNITION TIMING, IDLE-RPM AND CO%

1. Connect stroboscopic flash lamp feed clamps to the battery and the pickup to the high voltage cable of cylinder no.1.
2. Connect an electronic tachometer to the engine by fitting feed clamps to the ignition coil’s feeding and the pickup to the coil’s high voltage cable.

CHECKING IGNITION WIRING

1. Visually check ignition wiring for cracks, burns and loose terminals.
2. Measure resistance of high voltage cable by connecting an ohmmeter between the cable’s terminal and the corresponding electrode on the ignition coil.
3. Remove the small plastic cover located on the engine rear cover.

4. Start the engine and warm it up to normal running temperature.
5. Using the stroboscopic flash lamp, check if with engine running at ≈ 900 r.p.m., the mark on the engine rear cover is in line with the fixed advance notch on flywheel.

   Fixed advance
   \[ 8^\circ \pm 1^\circ \]

6. Disconnect the vacuum advance hose from distributor and verify that when engine at 4500 r.p.m. the mark on the engine rear cover is in line with the max. advance notch on flywheel.

   Max. advance
   \[ 36^\circ \pm 1^\circ \]

7. If specified alignment does not take place, loosen the distributor retaining bolt and rotate distributor either clockwise to retard or anti-clockwise to advance.
8. Tighten the distributor retaining bolt and check fixed and max. advance to make sure they are within specified values.
9. Fit the small plastic cover back onto engine rear cover.
10. Fit vacuum advance hose back onto distributor.

If above described adjustment does not succeed in correcting max. advance, overhaul or replace the distributor.

CHECKING AND ADJUSTING IDLE-RPM AND CO%

Preliminary inspection:
   a. Clean or replace air cleaner.
   b. Inspect ignition system making sure following parts are in good working condition: spark plugs, cables, distributor cap, rotor arm, (refer to: Group 05 - Ignition System).
   c. Check ignition timing.
   d. Check adjustment of accelerator control (see: Group 04 - Accelerator Control).

CAUTION:
If during engine tune up there is no extra cooling fan available, keep checking indicator pump and the water temperature gauge on dashboard and immediately suspend testing if temperature goes up, meaning that engine is overheating.

Check idle-rpm and overall CO% as follows:
1. Insert CO-tester probe into the tail pipe.
2. Connect an electronic tachometer to the engine.

May 1983
3. Start the workshop’s gas exhauster.
4. Start the engine and warm it up to normal running temperature.
5. Now check if engine rpm is within specified value.

<table>
<thead>
<tr>
<th>Idle-rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>900 ÷ 1000 r.p.m.</td>
</tr>
<tr>
<td>850 ÷ 950 r.p.m. (*)</td>
</tr>
</tbody>
</table>

(*) (for Switzerland, Sweden, Australia)

6. If not within specified value, adjust idle-r-pm just by turning relevant idle-adjusting screw 2 which makes it possible to change rpm without changing CO percentage (Carbon monoxide).
7. Verify that CO percentage picked up by tester corresponds to specified value and that engine runs smoothly.

**Allowed CO%**

< 3.5 % total

If not within specified value or in case of engine tune up after engine overhauling or after having cleaned or replaced the carburetor, an adjustment involving also mixture metering screw 1 and throttle valve screw 3 is required. In this instance, proceed as follows:
1. Remove seals from mixture metering screw 1 and from throttle valve screw 3.
2. Tighten idling screw 2 all the way.
3. Now act on throttle valve screw 3 and on mixture metering screw 1 till following conditions are present:

<table>
<thead>
<tr>
<th>Rpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>850</td>
</tr>
<tr>
<td>800 (*)</td>
</tr>
<tr>
<td>0.5 ÷ 1% total</td>
</tr>
</tbody>
</table>

(*) for Switzerland, Sweden, Australia

4. Loosen idling adjusting screw 2 till a 900 ÷ 1000 rpm (850 ÷ 950 rpm for Switzerland, Sweden, Australia) idling speed is reached.
5. Act on mixture metering screw 1 till the smoothest possible engine running is obtained, while keeping CO% within the prescribed valves.

<table>
<thead>
<tr>
<th>CO%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3.5% total</td>
</tr>
<tr>
<td>0.7 ÷ 2.4% (*)</td>
</tr>
</tbody>
</table>

(*) for Switzerland, Sweden, Australia

6. Fit back into place mixture metering and throttle valve screw seals.
7. If further optimizing of idle-rpm is desired, just act on relevant idling adjusting screw 2.

**CHECKING HOSES AND UNIONS**

1. Inspect hoses and unions to make sure they are not in any way damaged and that are no leaks.
2. Disconnect all hoses and clean them blowing a jet of compressed air through them.
3. Remove flame trap located in main blow-by hose near the oil filler; wash it with suitable cleaner, blow it with compressed air and, then fit it into place.

**EMISSION CONTROL SYSTEM**

Recycling of exhaust gas and oil vapors, generating in the cylinder block and then burned in the cylinders, is achieved through a series of blow-by hoses.

At any rpm, the vacuum created in the carburetor is sufficient to convey gas and vapors into intake duct and from here into cylinders for final combustion.

When engine is idling or running at medium rpm, the vapors going up the oil filler go through the flame trap located in the hose 3 connecting oil filler to air cleaner; from here then they go through the min. rpm blow-by hose 5 and, downstream from throttle valve, are distributed onto intake manifold 7.

Since when the accelerator is fully depressed the vacuum generated by the engine is not sufficient to completely suck exhaust gases solely through the min. rpm hose, gases are also conveyed inside air cleaner, upstream from carburetor, by means of the max. rpm blow-by hose 2.

1. Air cleaner
2. Max. rpm blow-by hose
3. Main blow-by hose
4. Oil filter
5. Min. rpm blow-by hose
6. Carburetor
7. Intake manifold
8. Cylinder block
CLEANING CARBURETOR JETS
If necessary, clean carburetor jets and blow-by hoses as follows:
   a. Remove air cleaner, carburetor cover, and then remove main jets as well as idle jets.
   b. Clean jets with compressed air (do not use any metal tool) and then fit them back onto carburetor; also fit cover and air cleaner.

REPLACING FUEL FILTER
Loosen hose clamps and remove the filter. Install a new filter paying special attention to the fuel flowing direction as indicated on filter body. Tighten hose clamps.

TROUBLE DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>CANNOT CRANK ENGINE OR SLOW CRANKING</td>
<td>Dead battery</td>
<td>Recharge and check recharge system</td>
</tr>
<tr>
<td></td>
<td>Faulty battery</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>Oxidized battery terminals</td>
<td>Clean terminals</td>
</tr>
<tr>
<td></td>
<td>Loose wiring connections in starting circuit</td>
<td>Correct</td>
</tr>
<tr>
<td></td>
<td>Faulty starter switch</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>Faulty starter</td>
<td>Repair or replace</td>
</tr>
</tbody>
</table>

(Starting circuit trouble-shooting procedure)

Turn on starter while lights are on (set switch to "ON").
If lights go off or dim considerably:
   a. Check battery
   b. Clean battery terminals

If lights stay bright and starter does not work:
   a. Check wiring connection between battery and starter
   b. Check starter switch
   c. Check starter

ENGINE CRANKS NORMALLY BUT WILL NOT START

In most cases the trouble lies either in the ignition system or in the fuel system.

   - Trouble in ignition system
   - Trouble in fuel system
   - Valves do not work properly
   - Low compression

(Trouble-shooting procedure)
First of all check spark plugs as follows:
Disconnect high voltage cable from one spark plug and hold it about 10 mm (0.39 in) from any engine metal part and let the starter run.

CAUTION
Above test must be performed with uttermost care.
DRIVE UNIT REMOVAL AND INSTALLATION

REMOVAL

Drive unit supports

DETAIL A

DETAIL B

DETAIL C

1. Drive unit central support
2. Central support to body fixing bolt
3. Rear support pin
4. Rear support to body fixing screws
5. Gearbox casing
6. Engine unit
7. Engine front support to crossmember fixing screw
8. Engine front support

May 1983

01-2
Engine compartment - Electric wires disconnections

1. Ignition inductor cable
2. Ignition distributor
3. Cooling temperature transmitter cable
4. Coil high voltage cable
5. Tachometer and coil low voltage cables
6. Alternator and alternator warning light supply cable
7. Head lamps cables
8. Electric fan thermal switch cables
9. Fog/lamps cables
10. Horn cables
11. Electric fan supply cable
12. Windshield and rear window washers pump cables
13. Water temperature thermal contact cable
14. Oil pressure manual contact cable
15. Starter supply cables
16. Energization cable
17. Earth cable 01, engine cover

May 1983
Engine compartment - Piping release

1. Fuel pipe
2. Clutch oil supply pipe
3. Expansion tank plug
4. Air bleeder into crankcase
5. Sleeve for water return from radiator
6. Sleeve for water delivery to radiator
7. Servobrake vacuum pipe
8. Hot water to heater supply pipe
9. Heater water return pipe
During engine removal from car, it is necessary to remove engine and gearbox - differential as single unit.
Put the vehicle on the auto lift and engage first gear.

**WARNING:**
Great care is required when dealing with a hot engine.

1. Operating from passenger compartment inside withdraw knob of gearbox lever, then remove the two lever bellows.
2. Remove the hood (refer to: Group 56 - Hoods).
3. Working from inside the engine compartment, disconnect the battery earth cabinet.
4. Disassemble the air filter as follows:
   (1) Disconnect the corrugated air intake pipes from the air filter by taking off the fixing clamps.
   (2) Disconnect the blow-by pipes. Then remove the filter (Refer to: Group 04 Air Filter - Removal).
5. Disconnect accelerator and starter controls as follows:
   (1) Extract the retaining ring, slip the return spring off its clamps and take off the slotted adjuster from the throttle control lever.
   (2) Release accelerator cable together with bracket unscrewing the two securing screws located on intake manifold.
   (3) Disconnect hose and sheath of starter control of operating on sheath securing screw and on starter control lever screw.

6. With reference to the figure on page 01-3 disconnect the following electric cables, preferably as indicated:
   - earth cable from the engine rear cover
   - high voltage cable from the coil
   - low voltage and tachometer cables from coil
   - alternator and warning light supply cable from the alternator
   - water temperature thermal contact cable from the thermal contact on the right hand head electric fan supply cable from the fan
   - windshield and rear window washers pump cables from the pump
   - starter motor supply and energization cables from the starter motor
   - oil pressure switch cable from manual contact on the rear cover
   - electric fan thermal contact cable from the thermal contact on radiator
   - fog lamp supply cables from fog lamp connectors
   - head lamp supply cables from the headlamps
   - horn supply cables from the horns
   - water temperature transmitter cable from the transmitter on the intake manifold
   - electronic ignition inductor cable from distributor
   - remove ignition distributor cap together with spark plug cables
   - oil level sensor cable, from level rod (for models fitted with check control, only)

7. Unscrew and remove the coolant expansion tank plug.
8. Raise the car and from beneath remove the right hand drain plug and then the left hand drain plug under the cylinder block and drain off the coolant; screw the plugs again after draining.
9. Depending on what is to be done, drain the oil from the oil sump by removing the plug and, if necessary, drain the oil from the gearbox by removing the drain plug. Screw the plugs again after draining.

CAUTION:
Unfix the electrical cables from their clamps, separate them from the drive unit so as not to impede its removal.

10. Lower the vehicle and with reference to figure of page 01-4, disconnect the following pipes and couplings, preferably as indicated:
   - hot water to heater delivery pipe, from the supply manifold
   - water from heater return pipe, from the water pump intake
   - delivery pipe to block from the water pump intake
   - water delivery coupling, to radiator
   - radiator water return coupling, from the water pump intake
   - fuel inlet line, from supply pump
   - clutch oil delivery hose, from pipe union (properly plug the hose)
   - servobrake vacuum intake pipe, from the suction manifold.

11. Loosen bolt securing engine central support to body.
INSTALLATION

CAUTION:
Drive unit assembly must be performed in such a way that the gearbox rear support and the engine front support are not respectively upwards and longitudinally pre-loaded.

Referring to preceding illustration, follow as indicated.

1. Raise the drive unit with the column lifter used for disassembly until the centre support axis ① is at about the halfway point of the body slot and tighten the relevant bolt-@-

Connect the left strut to the engine support cross member and fasten the cross member in position to the body with the screws ⑧.

2. Fasten the front support ⑨ in position to the cross member tightening the correct screws.

3. Remove the lifter and unloose the lower bolt ⑥ securing the gearbox to the rear support.

4. Put the rod ④ in the rear support ③, positioning it on its body clamping points and screw up the screws ⑤.

5. Screw up the drive shafts to differential shafts joint screws in oil with the prescribed torque.

33 ± 36 N-m
(3.4 ± 3.7 kg-m
24.58 ± 26.75 ft-lb)

6. Assemble the exhaust pipe ⑦.

7. Clamp the lower bolt ⑥ securing the rear support to the gearbox.

8. With reference to the following illustration put the side rod ④ in the support ③ on the right side rail ② then tighten, first, screw ⑥, second, screw ⑤.

May 1983

01-8
9. Complete the unit assemble carrying out the disassembly operations in reverse order, with particular attention to the following steps.

(I) By means of a spanner, tighten to the prescribed indicative torque, the union connecting hose to clutch control pipe.

\[ T = 15 \div 19 \text{ N-m} \]
\[ T = 1.5 \div 1.9 \text{ kg-m} \]
\[ T = 10.84 \div 13.78 \text{ ft-lb} \]

(2) Check the engine oil level corresponds to the MAX mark on the dipstick, and the gearbox oil level reaches the lower edge of the filler hole. If necessary, top up with the prescribed oil:

- Engine oil
  - AGIP Sint 2000 10W50
  - Ip Super Motor Oil 10W50
- Gearbox oil differential:
  - AGIP F1 Rotra HP SAE 80W90
  - IP Pontiax HD 80W90

(3) Bleed the clutch hydraulic system (See Unit 12 - Hydraulic System Bleeding) and if necessary top up the oil level to the MAX mark on the tank with the prescribed fluid (AGIP F1 Brake Fluid Super HD or IP Auto Fluid FR).

(4) Top up the coolant with the prescribed liquid.

### SEPARATION AND ASSEMBLY OF THE UNITS

#### SEPARATION

With the drive unit on the rotatory stand fitted with suitable supporting equipment, separate the engine unit from the gearbox unit for the purpose of replacement or overhaul of the two units and of the clutch, as follows:

1. Unscrew and take off the nuts and washers \( \#1 \) from the starter motor \( \#3 \) securing screws \( \#2 \) and remove the starter motor from the engine unit.

2. Remove the lower cover \( \#1 \) protecting the engine flywheel after disassembling the screws and washers \( \#2 \) securing the lower cover to the engine rear cover and to the gearbox.

3. Unscrew and remove the remaining nuts and washers \( \#3 \) and complete the separation of the two units.

Withdraw the thrust beating from its support on the gearbox so as not to damage it.

#### ASSEMBLY

1. Lubricate the direct drive shaft working seat with the prescribed grease (Grease Molykote paste G).

2. Perform assembly operations in the reverse order to the separation, tightening connecting nuts and bolts to the prescribed torque.

\[ T = 39 \div 48 \text{ N-m} \]
\[ T = 4 \div 4.9 \text{ kg-m} \]
\[ T = 28.92 \div 35.43 \text{ ft-lb} \]
Internal parts

1. Main bearings
2. Woodroff key
3. Thrust half-ring
4. Oil pump gear
5. Bush
6. Seal ring
7. Rear cover
8. Oil plug
9. Flywheel
10. Washer
11. Lock ring
12. Fin
13. Compression rings
14. Oil scraper ring
15. Oil pump
16. Oil sump
17. Engine oil drain plug
18. Main bearing caps
19. Piston
20. Connecting rod
21. Connecting rod bearings
22. Connecting rod cap
23. Crankshaft

May 1983

ENGINE MAIN MECHANICAL UNIT

01-12
PRELIMINARIES

1. Remove drive unit from car according to procedures: Drive Unit Removal and Installation.

2. Remove gearbox unit and clutch unit from engine according to procedures: Separation and Assembly of the units.

ENGINE UNIT

1. Sequentially remove following parts:
   - Oil filter \(\text{①} \) using proper spanner
   - Dipstick \(\text{③} \)
   - Pressure switch \(\text{②} \) for minimum oil pressure check
   - Thermal contact \(\text{④} \) for water temperature check from right cylinder head.

2. Remove sparking plugs using proper box spanner.

3. Remove distributor assembly.
   (1) Disconnect vacuum advance pipe \(\text{①} \) from carburettor.
   (2) Loosen distributor securing nut \(\text{②} \) and withdraw distributor from rear cover.

4. Remove alternator.
   (1) Loosen securing bolts \(\text{①} \) fixing alternator \(\text{②} \) and remove driving belt.
   (2) Complete bolts \(\text{①} \) removal and take out alternator \(\text{②} \).
   (3) Unscrews screws \(\text{③} \) and remove bracket \(\text{④} \).

5. Remove pipings.
   (1) Loosen screws of clamps and remove fuel supply pipe \(\text{①} \).
   (2) Loosen screws \(\text{③} \) of water system coupling \(\text{②} \) and remove coupling.

6. Unscrew and remove screws \(\text{②} \) fixing union \(\text{①} \) to block, then remove the union.

7. Remove carburettor
   (1) Unscrew the four nuts with securing washers carburettor to intake manifold.
   (2) Remove the accelerator cable return spring securing bracket, carburettor, relevant gaskets and spacer.

8. Remove thermostat
   (1) Unscrew screws \(\text{③} \), remove cover \(\text{⑤} \) and thermostat.
   (2) Unscrew nuts \(\text{②} \) and remove thermostat housing \(\text{①} \) from intake manifold \(\text{④} \).

---

1. Oil filter
2. Pressure switch
3. Dipstick
4. Thermal contact

1. Oil filter
2. Pressure switch
3. Dipstick
4. Thermal contact

1. Vacuum advance pipe
2. Distributor securing nut

1. Bolts
2. Alternator
3. Screws
4. Bracket

1. Fuel pipe
2. Clamp

1. Thermostat housing
2. Nuts
3. Screws
4. Intake manifold
5. Cover

May 1983
9. Remove intake manifold
   (1) Unscrew nuts (3), remove engine lifting bracket (2) and manifold (1).
   (2) Remove water temperature transmitter from intake manifold.

10. Remove fuel pump assembly
    (1) Unscrew nuts with washers securing fuel pump to block rear cover (3).
    (2) Remove pump (3), spacer (2) and pump control push rod (1).

11. Remove camshaft driving toothed belts.
    (1) Loosen securing screws and remove two camshaft driving front belts guards.

12. Un螺丝 screws securing pulleys to camshafts preventing their rotation by toothed spanner A.5.0195, then remove pulleys.

13. Un螺丝 securing nut and remove right belt stretcher (2) and spring (3).

14. Remove camshaft driving belts rear covers.
15. Remove water pump assembly.
    (1) Un螺丝 screws 1 with washers securing pulley 2 to water pump hub and remove pump driving pulley.

16. Un螺丝 nut (1) and remove right jockey pulley.
17. Lock flywheel by tool A.2.0378.
18. Unscrew screws 1 and 3, remove guard @ and engine front support 4.

(2) Suck oil from camshaft supports tanks with a suitable syringe.
(3) Unscrew screws 1 and 2 securing cylinder heads to block; remove heads with relevant gaskets.

19. Remove pulleys from crankshaft.
   (1) Unscrew nut 1.
   (2) Sequentially remove washer 2 and spacer 3, water pump and alternator driving pulley 4, right head camshaft drive toothed pulley 5, spacer 6, left head camshaft drive toothed pulley 7 and pilot belt washer 8.

20. Remove flywheel locking tool, previously fitted.

   (1) Unscrew screws 1 fixing covers 8 to camshaft supports; remove covers with relevant gaskets.

(2) Withdraw upward pump from block.

22. Remove oil sump.
   (1) Unscrew screws with washers 1 securing oil sump to block.
   (2) Remove oil sump and relevant seal gasket.
   (3) If required remove sealant marks on sump and block.

23. Remove oil sump assembly.
   (1) Unscrew screws with washers 1 securing oil pump 2 to block rear cover.

(2) Turn crankshaft to permit access to screws securing connecting rod caps.
   (3) Unscrew and remove screws 2 and connecting rod caps 1.

25. Remove pistons and connecting rods.
   (1) Fit to flywheel a tool which allows crankshaft rotation.
**ENGINE MAIN MECHANICAL UNIT**

**CYLINDER HEADS**

1. Secure head to support stand A.2.0195 connected to fork A.2.0226 previously clamped in a vice.
2. Unscrew screws 2 securing camshaft rear cover 3 to support 1; remove cover with seal gasket.
3. Loosen and remove screws 4 with washers fixing camshaft support to cylinder head; remove support with relevant gasket.
4. Remove cups 2 from housing on support, then camshaft 1 withdrawing from rear side.
5. Withdraw front oil retaining ring from its seat on camshaft support using a screwdriver.
7. If not already done, insert valves retaining yoke 1 into cylinder head support tool A.2.0195.
8. Acting on lever A.3.0324 compress springs and withdraw valve stem cotters using a screwdriver.
9. Sequentially remove upper caps, outer and inner springs, boots from intake valves, washers and lower cups.
10. Repeat removal procedure for each valve.
11. Withdraw yoke from head support tool and take out valves from head lower side.

**CRANKSHAFT**

1. Clamp cranksahft in vice.
2. Secure puller A.3.0402 to shaft and withdraw rear guide bushing from crankshaft.
3. Withdraw oil pump and distributor control gear by using proper plate and press.
grinding, in order to ensure exact guide/seat perpendicularity as well as proper valve working position.

**VALVE SEATS**

1. Check valve seats for any scores, cracks or burrs and make sure they are properly fitted in their respective recess on the cylinder head.

2. If necessary, mount the head on tool A.2.0226 and regrind the valve seats using the proper tool.

This operation may be performed as long as there is sufficient grinding allowance that will permit eliminating the existing flaws while keeping the specified profile; contrarily, valve seats will have to be replaced.

For relevant procedure see paragraph: "Valve Seat Replacement".

(1) Regrind valve contact face till all evidence of wear has been removed and following taper is obtained:

\[ \beta = 90^\circ \div 90^\circ \; 30' \]

of dimension "a" on the "0" reference diameter.

Ø Reference diameter:

<table>
<thead>
<tr>
<th>Intake</th>
<th>37.3 mm (1.4685 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust</td>
<td>31.9 mm (1.2559 in)</td>
</tr>
</tbody>
</table>

"a" dimension at max. regrinding limit:

2.9 mm (0.1142 in)

(2) Machine the valve seat upper face till the Ø reference diameter position obtained through the previous operation is reached, attaining the specified \( \gamma \) taper.

Taper of valve seat upper face

\[ \gamma = 120^\circ \]

(3) Machine the seat inner face till dimension "b" of the valve contact face is restored, attaining the specified \( \gamma \) taper.

Height of inner face:

<table>
<thead>
<tr>
<th>Intake</th>
<th>1.07 ± 1.37 mm (0.0421 ± 0.0539 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhaust</td>
<td>1.26 ± 1.56 mm (0.0496 ± 0.0614 in)</td>
</tr>
</tbody>
</table>

Taper of valve seat lower face:

Intake: \( \gamma = 50^\circ \)

Exhaust: \( \gamma = 30^\circ \)

For seat lapping use the proper lapping compound (SIPAL AREXONS Carbosilicium for valves - Std. no. 4100-31502).

**Valve seat replacement**

1. Remove worn valve seats using the proper tool.

2. With a set of new valve seats verify that dimensions shown in the following table are complied with:

<table>
<thead>
<tr>
<th>Valve</th>
<th>Engine 1200</th>
<th>1350</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve seat outer diameter (mm in)</td>
<td>38.875 ( \div ) 38.9 ( (1.5305 \div 1.5315) )</td>
<td>33.375 ( \div ) 33.4 ( (1.3140 \div 1.3150) )</td>
<td></td>
</tr>
<tr>
<td>Diameter of valve ( i )</td>
<td>38.8 ( \div ) 38.825 ( (1.5276 \div 1.5285) )</td>
<td>33.3 ( \div ) 33.325 ( (1.3110 \div 1.3120) )</td>
<td></td>
</tr>
</tbody>
</table>

3. Oven preheat the head at 140°C (284°F).

4. Fit new valve seats using the proper tool.

**Checking valve tightness**

When replacing guides, after regrinding and lapping of seats, it is advisable to test valve tightness - with valves and sparkplugs duly mounted - according to the following procedure:

1. Mount the head on tool A.2.0226 and A.2.0195 previously secured in a vice.

2. Fill the combustion chamber cavity with gasoline.

3. Let some low-pressure air into the intake ducts and check for presence of air bubbles in the gasoline.

4. Follow the same procedure and check tightness of the exhaust valves by letting low pressure air into the exhaust valve ducts.

5. Should there be some leaks, ascertain that valves are properly fitted in their seats and then repeat above tightness tests; if the results are negative, valve seats will need relapping as indicated in paragraph: Checks and Inspections - Cylinder Heads and Valves - Valve Seats.
SPRINGS

Visually check the springs for cracks and make sure they are not out-of-square if the evidenced flaws suggest it, check the technical data of the inner and outer springs and then with a dynamometer verify that their length under load falls within the values shown in the following table:

<table>
<thead>
<tr>
<th>Load N (kg; lb)</th>
<th>Engine 1200</th>
<th>Engine 1350</th>
<th>Engine 1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer Spring</td>
<td>425.32 ÷ 452.76</td>
<td>(43.4 ÷ 46.2 ; 95.88 ÷ 101.85)</td>
<td></td>
</tr>
<tr>
<td>Inner Spring</td>
<td>194.53 ÷ 208.25</td>
<td>(19.85 ÷ 21.25 ; 43.76 ÷ 46.85)</td>
<td></td>
</tr>
</tbody>
</table>

CAUTION:
Do not remove the valve clearance adjusting screw from the cup.

VALVES

Check and make sure that valves do not show any scores, burns or evidence of sticking with their corresponding cylinder head seats (forming a step); if they do, replace them.

CUPS

Check that the outer surface of the cups as well as the upper surface on which cams work, show no scores, no evidence of pitting or Abnormal wear. Further verify that- carking of the cup's nut is intact and that the cup has retained its original punching position.

CAMSHAFT SUPPORT

1. Visually check the seats of camshaft cups and journals for scores and for any evidence of pitting or abnormal wear.
(1) Reset reamer to testing dimension.
(2) Measure the diameter of camshaft bearings.
   - Front = 35.015 ÷ 35.040 mm (1.3785 ÷ 1.3795 in)
   - Centre = 46.500 ÷ 46.525 mm (1.8307 ÷ 1.8317 in)
   - Rear = 47.000 ÷ 47.025 mm (1.8504 ÷ 1.8514 in)
(3) Following the same procedure, measure the diameter of the four cup seats and determine the relevant fitting play.
   - Diameter of cup seats = 36.00 ÷ 36.025 mm (1.4173 ÷ 1.4183 in)
   - Max. cup-to-seat play = 0.1 mm (0.0039 in)

CAMSHAFT

1. Carefully examine working surfaces of cams and of camshaft journals making sure that there are no scores, no evidence of seizure, overheating or abnormal wear.
2. With a micrometer measure the diameter of camshaft journals.

May 1983
MAIN AND CONNECTING ROD BEARINGS

Thoroughly clean the main and connecting rod bearings and visually check them for scores as well as for any evidence of seizure.

In case of excess wear, replace all bearings. When fitting connecting rod bearings to the crankshaft, be sure to use matching parts, i.e. belonging to the same size class; for this purpose they are identified by same colour dots on the side of the half-bearing and on the relevant crank pin of the shaft. Applicable dimensions and tolerances are shown in: Service Data and Specifications "Connecting rod bearings" and "Main bearings" charts.

PISTONS AND CONNECTING RODS

1. Visually check pistons and connecting rods for cracks, scores and evidence of excess wear.
2. Measure the play between the rings and their seats in the piston. For relevant dimensions and tolerances see: Service Data and Specifications - "Pistons" and "Piston Rings" charts.
3. Check piston diameter with a micrometer. For relevant dimensions and tolerances see: Service Data and Specifications - "Piston" chart.

4. In case the connecting rod piston assembly has been disassembled, check the piston pin seats on the connecting rod small end as well as on the piston pin bosses for excess wear.
5. Should parts not be replaced and therefore used again, remember that working surfaces - especially that of the piston pin seat on the piston - must be totally free of any scores, even the slightest one.

The piston pin must always be replaced.

FLYWHEEL

1. Verify that teeth of gear are not in any way chipped or show any evidence of pitting; contrarywise, replace the flywheel.
2. Check the clutch driven plate contact surface on the flywheel for any scores, chips or evidence of overheating. Before doing so, however, make sure that the contact surface has not been previously ground and that the amount of material available for removal is going to be sufficient for elimination of the existing flaws.

For this purpose, verify that dimension "b" shown in the chart is greater than the min. specified limit and that the removable stock will allow surfacing as required.

Min. limit of dimension "b" 20.95 mm (0.8248 in)

CYLINDER BLOCK

1. Visually check cylinder block for cracks or excess wear of sliding surfaces.
2. Check cylinder walls surfaces for roughness.

Max. allowed roughness of cylinder wall surface

\[ 0.5 \pm 1 \ \mu m (20.10^{-6} \pm 39.10^{-6} \text{ in}) \]

3. See to which size class the cylinder walls refer to and then proceed to check them by measuring them. Cylinder walls are selected according to their inner diameter and are divided into five different classes: A, B, C, D, and E. The class identifying letters are stamped on the cylinder block upper surface next to each wall location.
Dimensions relevant to each class are shown in: Service Data and Specifications "Cylinder block" chart.

1. Reset the reamer by means of a micrometer.

2. Measure the diameter at the recommended depth and then determine taper and out-of-round of cylinders walls.

3. Compare actual values D with nominal ones C of each size class and then determine the cylinders walls max. wear.

   Cylinder wall max. wear:
   \[ C - D = 0.04 \text{ mm} (0.00157 \text{ in}) \]

4. If the dimensions thus established are not within tolerance, cylinders walls must be rebored keeping in mind that three different oversize pistons are available as spare parts; this means that the diameter of walls will have to be in accordance with the tolerances shown in: Service Data and Specifications "Cylinder block" chart.

1. Mount main bearing caps on the cylinder block and tighten screws as specified in: "Engine assembly - Engine unit".

Then proceed to bore cylinder walls so as to stay within the tolerances shown in: Service Data and Specifications - "Cylinder block" chart.

Lapping must be performed so that tool marks cross each other at an angle of 90° ± 120°

2. If wear does not exceed the specified limit but pistons and spring rings need replacing because of some flaws or damage, cylinders walls will need at least to be lapped; in this case measure the diameter of the walls in order to identify the new size class to which they belong and that will have to be kept in mind during piston fit operations, regardless of the letter stamped on the cylinder block. Should lapping cause a size class change, cylinder wall will no longer be identifiable through the letter stamped on the cylinder block which, therefore, must be erased in order to avoid mistakes during future operations.

### PISTON - CYLINDER WALL FIT

1. When original parts are involved, they will be selected by matching each cylinder wall identification letter that is stamped on cylinder block upper surface to the piston that has the same letter stamped on its head or a coloured dot painted on the inside of its crown, according to the following schedule:

<table>
<thead>
<tr>
<th>Engine</th>
<th>Wall identifying letter</th>
<th>Piston identifying letter and colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>A</td>
<td>A - blue</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>B - pink</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>C - green</td>
</tr>
<tr>
<td>1350</td>
<td>D</td>
<td>D - yellow</td>
</tr>
<tr>
<td>1500</td>
<td>E</td>
<td>E - white</td>
</tr>
</tbody>
</table>

If the letter stamped on the cylinder block has been previously erased, matching will take place according to the identification letter stamped on the piston that needs replacing; in this instance, it is advisable to make a double check and measure the cylinder wall diameter.

2. When oversize walls are used, they will be matched to the relevant completely assembled pistons, namely with compression rings and oil scraper ring, which are available as spare parts according to the following oversize scale: G.2 - 0.4 - 0.6 mm (0.0078 - 0.0157 - 0.0236 in).
Cylinder wall to piston play
Standard 0.03 ± 0.05 mm
(0.0012 ± 0.0020 in)
Oversize 0.03 ± 0.06 mm
(0.0012 ± 0.0024 in)

2. Apply engine oil to piston pin, to the connecting rod small end, and to the piston pin supports.
3. Fit the connecting rod's small end between the piston pin supports ensuring that holes are perfectly aligned in order to allow proper piston pin fit.
4. Fit the piston pin into the piston and connecting rod, and then lock it with two spring rings.

a. Position pistons so that the arrow stamped on their crowns points in the direction of engine rotation, namely: upward for the right head pistons and downward for the left head pistons.
b. Fit connecting rods in the pistons so that the position of matching identification numbers and arrows corresponds to that shown in the below Figure.

CRANKSHAFT

1. Fit rear bushing and oil pump drive gear on the crankshaft.
   (1) Fit the crankshaft rear bushing by means of tool A.3.0450.
   (2) Heat the oil pump and distributor drive gear to 150°C (302°F).
   (3) Shrink the gear on the crankshaft positioning it so that the axis of the flywheel centering dowel and the front surface of one of the gear’s form the specified angle.

Positioning of crankshaft rear gear
\[ \alpha = 22^\circ \pm 26^\circ \]

ENGINE UNIT

1. Fit crankshaft on cylinder block.
   (1) Fit main bearings on relevant main bearings supports and lubricate them with oil. Select bearings according to the diameter of crankshaft journals.
   (2) Fit thrust half-rings on the relevant seat obtained in the third main bearings support. Make sure that these half-rings are fitted with oil channels facing the crankshaft shoulders.

(3) Place crankshaft on main bearing supports.
2. Fit main bearing caps on cylinder block.
   (1) Fit main bearings to main bearing caps and lubricate them with oil.
   (2) Fit main bearing caps: front (see markings), centre, and rear, fitted with relevant bearings, on cylinder block supports. Coat supports with engine oil and tighten oiled screws without fully locking them.
   (3) Tighten screws securing the main bearing caps to the relevant cylinder block supports in two or three
successive steps, according to specified torque and sequence (from A to F).

1: **Tightening torque**
Caps to cylinder supports securing screws:

\[
66 \div 73 \text{ N-m} \\
(6.7 \div 7.4 \text{ kg-m} \\
46.4 \div 53.5 \text{ ft-lb})
\]

(4) Subsequently tighten screws securing the main bearing caps to the cylinder block in two or three successive steps, according to specified torque and sequence (from A to F).

1: **Tightening torque**
Caps to cylinder block supports securing screws

\[
40 \div 49 \text{ N-m} \\
(4.1 \div 5 \text{ kg-m} \\
29.6 \div 36.2 \text{ ft-lb})
\]

Having completed tightening of all screws, apply engine oil to the supports and rotate the crankshaft by hand.

3. **Check crankshaft end play.**
(1) Attach a centesimal dial gauge with magnetic base to the cylinder block having the gauge's indicating finger touch the crankshaft parallel-wise to the shaft's axis.
(2) Using a screwdriver, move the crankshaft along its axis and check the gauge's reading to ensure that "g" end play is within specified values.

\[0.35 \text{ mm (0.0137 in)}\]

(3) If the shaft has not been previously reground and therefore the value established as per step above is greater than the specified value, it is possible to regrind the shoulders of the rear journal till its "c" length is such that it will allow fitting of the oversize thrust half-rings available as spare parts.

\[28.764 \div 28.804 \text{ mm} \\
(1.1324 \div 1.1340 \text{ in})\]

4. Fit seal ring in the main oil gallery of the cylinder block rear cover.

5. Fit rear cover, with relevant gasket, on the cylinder block. Tighten all cover retaining screws according to specified torque.

1: **Tightening torque**
Rear cover retaining screws

\[19 \div 24 \text{ N-m} \\
(1.9 \div 2.4 \text{ kg-m} \\
13.7 \div 17.4 \text{ ft-lb})
\]

a. Apply engine oil to the ring's sealing lip, its external surface as well as to its working seat.
10. Fit front cover, with proper gasket, to cylinder block and tighten screws and nuts according to specified torque.

**1**: Tightening torque

Front cover to cylinder block retaining screws:

- **19 ÷ 24 N-m**
- **(1.9 ÷ 2.4 kg-m)**
- **(13.7 ÷ 17.4 ft.lb)**

11. Fit the engine front support and the pulley’s lower guard to the cover.

12. Fit crankshaft oil seal front ring using tool **A.3.0338**. Before doing so, apply a coating of engine oil to the ring’s sealing lip and work surface.

13. Fit crankshaft front pulleys.

1. Key the below mentioned parts according to the indicated sequence: the belt guide washer, the left head camshaft drive toothed pulley, the spacer, the right head camshaft drive toothed pulley, the water pump and alternator drive pulley, the spacer, and the washer.

2. After having suitably locked flywheel rotation, tighten pulley retaining nut according to specified torque.

**1**: Tightening torque

Pulleys to cylinder block retaining nut:

- **118 ÷ 144 N-m**
- **(12 ÷ 14.7 kg-m)**
- **(86.8 ÷ 106.3 ft.lb)**

14. Fit the water pump.

1. Fit new gasket on pump.
2. Fit pump, without pulley, on cylinder block.
3. Fit screws with washers and tighten them to specified torque value.

15. Fit cylinder heads.

1. Turn crankshaft till the piston in No. 1 cylinder is set at Top Dead Center in the compression stroke; this correct positioning is further ensured by the “T” notch on the flywheel matching with the reference on the rear cover.

2. Align the references shown on the camshaft rear journal and on the support rear side panel.
ENGINE MAIN MECHANICAL UNIT

(3) Fit cylinder heads, with relevant gaskets, on the cylinder block.

By extremely careful during this assembly operation in order to avoid that opened valves, projecting above the head surface, might strike the cylinder block surface and thus be damaged.

(4) Position and then tighten the six cylinder heads retaining screws in two or three successive steps, according to the specified torque and sequence (from A to F).

(5) Tighten screws securing the camshaft support to the cylinder heads.

1: Tightening torque

- Head to cylinder block retaining screws:
  \[ 81 \div 87 \text{ N-m} \]
  \[ (8.3 \div 8.9 \text{ kg-m} ) \]
  \[ 60 \div 64.4 \text{ ft-lb} \]

18. Fit camshaft driving belts.

1 Head retaining screw

2 Camshaft support retaining screw

In case of in-car tightening, use extension spanner A.5.0198 in accordance with the following tightening torques:

- for torque spanner with 300 mm (11.811 in) lever arm:
  \[ 57 \div 62 \text{ N-m} \]
  \[ (5.8 \div 6.3 \text{ kg-m} ) \]
  \[ 41.9 \div 45.6 \text{ ft-lb} \]

16. Fit camshaft belts rear covers.

17. Fit belt tensioner assemblies on the cylinder block pins according to the following sequence: supports, spring, washers and washers. Lock belt jockey pulley assemblies with relevant nuts after having pre-loaded belt jockey pulley in order to allow for belt passage.

1 Nut
2 Washer
3 Washer
4 Spring
5 Support

(2) Verify that the crankshaft’s angular position corresponds to the Top Dead Center of cylinder No.1, as previously mentioned for heads assembly.

(3) Rotate camshaft by means of toothed spanner A.5.0195 till the reference stamped on the support’s rear side panel is aligned with the one stamped on the shaft’s rear journal.

(4) Key camshaft drive belts on the crankshaft inner pulleys and on the pulleys of both camshafts. Belt keying must take place with the belt pulling section, opposite the jockey pulleys, fully stretched.

(5) Check that “S” clearance between the camshaft belt and the profile of the engine front support is not below the specified min. value; if it is, modify the profile of the support till it meets the specified value.

“S” min. clearance between camshaft belt and engine from mounting 9 mm (0.3543 in)

(6) Completely loosen the belt jockey pulley lock nuts and then tighten them again.

(7) Turn the crankshaft a few times in its working direction so that the belts may take up their final position.

(8) Act on the camshaft till cams are disengaged; loosen the belt jockey pulley lock nut and then retighten it according to specified torque.

01-29
May 1983
19. Fit oil pump.
(1) Turn crankshaft till piston No. 1 is at Top Dead Center in the compression stroke, as mentioned for heads reassembly.
(2) Turn the pump drive shaft so that the next rotation, which will follow mating of the pump drive gear with that on the crankshaft, will position the distributor coupling according to the specified \( \beta \) angle. Apply a coating of engine oil to the drive shaft.

Distributor coupling positioning \( \beta = 22° \)

20. Fit distributor on rear cover.
(1) Turn the distributor's shaft so that the rotor arm \( \mathbb{1} \) is positioned on the reference mark stamped on the distributor's body. The rotor arm \( \mathbb{1} \) should point toward the No. 1 cylinder. This position corresponds to ignition in No. 1 cylinder and to correct coupling of the oil pump and distributor shafts.
(2) If necessary, correct misalignment of the rotor arm with the reference mark stamped on the distributor's body by rotating the latter and then tightening the lock nut \( \mathbb{2} \) securing the distributor to the cylinder block rear cover.

21. Adjust clearance of intake and exhaust valves while engine is cold. The relevant procedure is described in Group 00 - Engine Maintenance.

Valve clearance (cold engine):
- Intake: 0.35 ± 0.40 mm (0.0138 ± 0.0157 in)
- Exhaust: 0.45 ± 0.50 mm (0.0177 ± 0.0197 in)

22. Fill chambers of camshaft supports with engine oil.

Oil quantity required for fill-up
- 0.250 kg (0.5511 lb) in each chamber

23. Fit support covers \( \mathbb{1} \) with relevant gaskets \( \mathbb{2} \).
34. Assemble carburetor with spacer and the interposed gaskets on intake manifold studs.

1: Tightening torque
Carburetor nuts
19 \( \div \) 24 N-m
(1.9 \( \div \) 2.4 kg-m
13.7 \( \div \) 17.4 ft.lbf)

35. Perform following connections.
- Fuel supply pipe 2 from fuel pump to carburetor.
- Vacuum advance pipe 1 from carburettor and advance controller located on distributor.

36. Fit oil filter by manually tightening it and insert dipstick.
37. By means of adapter A.5.0115 fit spark plugs tightening them according to specified torque.

38. Secure cap to distributor body with relevant springs, then connect ignition cables between spark plugs and distributor cap, securing them to relevant clamps. Cables connection must take place according to the ignition sequence of cylinders.

39. Fit alternator and control belt.
(1) Secure bracket 4 to engine front cover and tightening the relevant screws 3
(2) Position alternator on engine support and tighten bolts 1 without fully locking them.

(3) Key alternator and water pump drive belt on relevant pulleys.
(4) Adjust belt tension according to specified value and then lock bolts 1. For adjusting procedure refer to Group 00 - Engine Maintenance.

Load: 78.40 N (8 kg) (17.4 lb)
Arrow: 15 mm (0.5905 in)

40. Fill the engine with specified engine oil (AGIP Sint 2000 10W50 or IP Super Motor Oil 10W50).

Oil quantity required for fill-up: 3.6 kg (7.93 lb)
The engine is pressure lubricated by means of a gear pump. The pump is mounted on the rear cover of the engine and is actuated by a shaft which is driven by a gear fitted to the crankshaft. The maximum oil pressure is adjusted by means of a proper valve fitted on the pump.

Oil is completely filtered in the suction head by a strainer then by a filter with cartridge placed on the oil passage and provided with a bypass safety valve, should the cartridge become clogged.

The oil filter, on the engine rear cover, has unions for the recirculation of the oil vapours at minimum and high running.

The insufficient oil pressure is indicated on the combination meter by means of a warning light connected to a manual contact inserted on the main oil gallery of the block.

**OIL PUMP**

**OIL PRESSURE CHECK**

1. Start engine and heat oil to 90°C (194°F).
2. Remove oil pressure checking manual contact.
3. Fit gauge to manual contact hole.
4. Start engine and record oil pressure as shown on gauge.
5. Remove gauge and refit manual contact.

If the oil pressure value is not within the limits shown in table, the oil pump is to be checked.

REMOVAL

Remove fuel pump from cover (see: Engine Disassembly - Engine Unit).

1. Drain engine oil and remove oil sump. If required, tap with a wooden mallet on attachment side of sump to block.
2. Unscrew screws and withdraw pump from its seat.

DISASSEMBLY AND ASSEMBLY

1. Unscrew screws securing pump body to pump support.
2. Withdraw driven gear, valve, spring and washer.
3. Reassemble pump carrying out the above procedure but in the reverse sequence. Slightly tighten screws without locking fully home.
4. Manually rotate driving shaft checking for crawling and regular rotation.

CHECKS AND INSPECTIONS

1. Check gears for wear, ensure that teeth are free from cutting or chipping or that wear is regular and not excessive on all the face length.
2. Check driven gear pin for indications of seizing and cutting.
3. Carry out same check as above for the pressure regulator valve, additionally ensuring that it slides in its seat on pump body without crawling. If the spring of the pressure regulator valve is supposed to have yielded, also considering the trouble shown, replace valve.
4. Check that driving gear is correctly positioned on driving shaft of oil pump and that crankshaft driving gear has the pin regularly fitted.
5. Finally check working surfaces of shaft and rear cover, of driving cam of fuel push rod, and the attachment point to the distributor for cutting and signs of seizure.

INSTALLATION

1. Lubricate driving shaft with engine oil as per step 4.
2. Refit oil pump carrying out procedure detailed in: Engine As-
sembly Engine Unit.
3. Tighten screws securing pump to engine rear cover then screws fastening pump body to pump support to the specified torque value.

OIL FILTER REPLACEMENT

1. Drain hot oil of engine from sump.
2. Remove filter using proper tool.
3. Fit a new filter of the prescribed type. Manually screw in the filter.
4. Fill engine with the prescribed engine oil (AGIP Sint 2000 10W50 or IP Super Motor Oil 10W50).

OIL FILTER REPLACEMENT

1. Drain hot oil of engine from sump.
2. Remove filter using proper tool.
3. Fill engine with prescribed engine oil. After fitting new filter, let engine run for a few minutes and check for oil leakages.
ENGINE MAIN MECHANICAL UNIT

INSPECTION AND ADJUSTMENT

CAMSHAFT SYSTEM

![Diagram of camshaft system with right and left supports]

<table>
<thead>
<tr>
<th>Unit: mm (in)</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>306.00 3200</td>
<td>306.00 350</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Camshaft</th>
<th>531.364</th>
<th>531.364</th>
<th>531.364</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tappet clearance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>0.35 ± 0.40 (0.0138 ± 0.0157)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust</td>
<td>0.45 ± 0.50 (0.0177 ± 0.01971)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Value of the angle of timing marks on camshaft supports | | |
| Right support | 23° |
| Left support | 23° |

All values are with cold engine

CHECKING VALVE OPENING AND CLOSING ANGLES

![Diagram of valve opening and closing angles]

<table>
<thead>
<tr>
<th>Unit: mm (in)</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>1350</td>
</tr>
<tr>
<td>305.00</td>
<td>305.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valve clearance for checking</th>
<th>m m (in)</th>
<th>0.7 (0.0276)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening BTDC</td>
<td>a</td>
<td>12°</td>
</tr>
<tr>
<td>Closing ABDC</td>
<td>b</td>
<td>48°</td>
</tr>
<tr>
<td>Exhaust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve clearance for checking</td>
<td>m m (in)</td>
<td>0.7 (0.0276)</td>
</tr>
<tr>
<td>Opening BTDC</td>
<td>c</td>
<td>45°</td>
</tr>
<tr>
<td>Closing ABDC</td>
<td>d</td>
<td>7°</td>
</tr>
</tbody>
</table>

(1) Crankshaft rotation ACW seen from flywheel side.

May 1983 01-36
## ENGINE MAIN MECHANICAL UNIT

### CYLINDER BLOCK

![Diagram of cylinder block](image)

### Inspection Data

<table>
<thead>
<tr>
<th>Cylinder bore &quot;a&quot;</th>
<th>Standard</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Class A</td>
<td>1200</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>Class B</td>
<td>84.00 (\div ) 84.04 (\div ) 84.01 (\div ) 84.02 (\div ) 84.03 (\div ) 84.04 (\div ) 84.05 (\div) 3.3075</td>
</tr>
<tr>
<td></td>
<td>Class C</td>
<td>84.02 (\div ) 84.03 (\div ) 84.04 (\div ) 84.05 (\div) 3.3087</td>
</tr>
<tr>
<td></td>
<td>Class D</td>
<td>84.04 (\div ) 84.05 (\div) 3.3091</td>
</tr>
<tr>
<td></td>
<td>Class E</td>
<td>84.01 (\div ) 84.02 (\div ) 84.02 (\div ) 84.03 (\div ) 84.04 (\div ) 84.04 (\div ) 84.05 (\div) 3.3091</td>
</tr>
<tr>
<td>Oversize</td>
<td>1st</td>
<td>84.00 (\div ) 84.01 (\div ) 84.02 (\div ) 84.03 (\div ) 84.04 (\div ) 84.05 (\div) 3.3091</td>
</tr>
<tr>
<td></td>
<td>2nd</td>
<td>84.00 (\div ) 84.01 (\div ) 84.02 (\div ) 84.03 (\div ) 84.04 (\div ) 84.05 (\div) 3.3091</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
<td>84.00 (\div ) 84.01 (\div ) 84.02 (\div ) 84.03 (\div ) 84.04 (\div ) 84.05 (\div) 3.3091</td>
</tr>
</tbody>
</table>

### Out-of-square between cylinder bore centreline and centreline of main bearings

0.05 \(\div \) 0.00197

### Taper and out-of-round limit

<table>
<thead>
<tr>
<th>Standard</th>
<th>0.01 (\div ) 0.00041</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max</td>
<td>0.02 (\div ) 0.0008</td>
</tr>
</tbody>
</table>

### Cylinder bore surface roughness

0.5 \(\div \) 1 \(\times\) 10^{-3} \(\div\) 0.0197 \(\div \) 0.0394 \(\div \) 10^{-3}

### Cylinder bore grinding angle

90° \(\div \) 120°

### Main bearing diameter "b"

<table>
<thead>
<tr>
<th>Main bearing diameter &quot;b&quot;</th>
<th>Front</th>
<th>Rear</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>63.663 (\div) 63.673</td>
<td>2.5064 (\div) 2.5068</td>
</tr>
<tr>
<td></td>
<td>63.673 (\div) 63.683</td>
<td>2.5068 (\div) 2.5072</td>
</tr>
</tbody>
</table>

### Width of rear main bearing support "c"

23.68 \(\div\) 23.73 \(\div\) 0.9323 \(\div\) 0.9343
# ENGINE MAIN MECHANICAL UNIT

## PISTONS, COMPRESSION RINGS AND PINS

### Pistons

![Piston Diagram](image)

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>1200</th>
<th>1350</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Piston diameter “a” (1)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>79.96 ± 79.97 (3.1480 ± 3.1484)</td>
<td>83.96 ± 83.97 (3.3055 ± 3.3059)</td>
<td></td>
</tr>
<tr>
<td>Class A (Blue)</td>
<td>79.97 ± 79.98 (3.1484 ± 3.1488)</td>
<td>83.97 ± 83.98 (3.3059 ± 3.3063)</td>
<td></td>
</tr>
<tr>
<td>Class B (Pink)</td>
<td>79.98 ± 79.99 (3.1488 ± 3.1492)</td>
<td>83.98 ± 83.99 (3.3063 ± 3.3067)</td>
<td></td>
</tr>
<tr>
<td>Class C (Green)</td>
<td>79.99 ± 80.00 (3.1492 ± 3.14961)</td>
<td>83.99 ± 84.00 (3.3067 ± 3.3071)</td>
<td></td>
</tr>
<tr>
<td>Class D (Yellow)</td>
<td>80.00 ± 80.01 (3.1496 ± 3.1500)</td>
<td>84.00 ± 84.01 (3.3071 ± 3.3075)</td>
<td></td>
</tr>
<tr>
<td>Class E (White)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oversize</strong></td>
<td>79.96 f 79.97 (3.1480 f 3.1484)</td>
<td>83.96 f 83.97 (3.3055 f 3.3059)</td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>80.15 ± 80.17 (3.1555 ± 3.1563)</td>
<td>84.15 ± 84.17 (3.3130 ± 3.3138)</td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>80.35 ± 80.37 (3.1634 ± 3.1642)</td>
<td>84.35 ± 84.37 (3.3209 ± 3.3217)</td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>80.55 ± 80.57 (3.1713 ± 3.1720)</td>
<td>84.55 ± 84.57 (3.3287 ± 3.3296)</td>
<td></td>
</tr>
<tr>
<td><strong>First compression ring groove height “c”</strong></td>
<td>1.525 ± 1.545 (0.0600 ± 0.0608)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.525 ± 1.545 (0.0600 ± 0.0608)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.525 ± 1.545 (0.0600 ± 0.0608)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Second compression ring groove height “d”</strong></td>
<td>1.775 ± 1.795 (0.0699 ± 0.0707)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.775 ± 1.795 (0.0699 ± 0.0707)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.775 ± 1.795 (0.0699 ± 0.0707)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oil scraper ring groove height “c”</strong></td>
<td>4.015 ± 4.035 (0.1581 ± 0.1589)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.015 ± 4.035 (0.1581 ± 0.1589)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.015 ± 4.035 (0.1581 ± 0.1589)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pin seat bore “b”</strong></td>
<td>21.002 ± 21.006 (0.8269 ± 0.8270)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

1. To be measured to right angle to the piston pin at 17 mm (0.6693 in) from piston skirt
2. Borg0 Piston
3. Mondial Piston

May 1983

01-38
### Connecting Rod and Connecting Rod Bearings

#### Connecting Rod

![Diagram of connecting rod with dimensions a and b]

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine 1200</th>
<th>Engine 1350</th>
<th>Engine 1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small end bush bore diameter “a”</td>
<td>21.007 ± 0.015 (0.8270 ± 0.0054)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big end bore diameter “b”</td>
<td>52.696 ± 0.015 (2.0746 ± 0.0054)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Connecting Rod Bearings

![Diagram of connecting rod bearing thickness with dimensions a]

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine 1200</th>
<th>Engine 1350</th>
<th>Engine 1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>1.831 ± 0.002 (0.0721 ± 0.0008)</td>
<td>1.830 ± 0.002 (0.0720 ± 0.0008)</td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>1.827 ± 0.002 (0.0719 ± 0.0008)</td>
<td>1.826 ± 0.002 (0.0719 ± 0.0008)</td>
<td></td>
</tr>
<tr>
<td>Connecting rod bearing thickness “a”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>1.966 ± 0.002 (0.0770 ± 0.0008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd</td>
<td>2.083 ± 0.002 (0.0820 ± 0.0008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd</td>
<td>2.210 ± 0.002 (0.0870 ± 0.0008)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th</td>
<td>2.337 ± 0.002 (0.0920 ± 0.0008)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Inspection Data

<table>
<thead>
<tr>
<th></th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Regrinding dimensions (1)</strong></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>24.0 ± 24.2 (0.9449 ± 0.9528)</td>
</tr>
<tr>
<td>b</td>
<td>≤ 0.2 (0.0079)</td>
</tr>
<tr>
<td>c</td>
<td>≥ 20.95 (0.8248)</td>
</tr>
<tr>
<td><strong>Parallelism of the driven plate contact face compared with flywheel-to-crankshaft support face (as read at a 100 mm radius)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.08 (0.0031)</td>
</tr>
<tr>
<td><strong>Maximum out-of-flat of driven plate contact face</strong></td>
<td>0.02 (0.0008)</td>
</tr>
<tr>
<td><strong>Surface roughness of driven plate contact face</strong></td>
<td>2.10^-3 (0.0787-10^-3)</td>
</tr>
</tbody>
</table>

1. The depot of regrinding, dimension “b”, must be the same both on clutch driven plate contact face and on the face of the register for the clutch cover, so that dimension “a” kept constant. Dimension “c” must not be lower than the specified limit.
**ENGINE MAIN MECHANICAL UNIT**

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
</tbody>
</table>

Max. misalignment between the centrelines of the two pairs of crankpins and the journals centreline

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>0.25</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.0098,</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Max. out-of-square between thrust ring face and main journals

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>0.03</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0.00121</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rear crankshaft bush diameter “b”

<table>
<thead>
<tr>
<th></th>
<th>16.065</th>
<th>16.080</th>
<th>(0.6325</th>
<th>0.6331)</th>
</tr>
</thead>
</table>

Fitment of rear crankshaft gear “U” (distributor/oil pump drive)

<table>
<thead>
<tr>
<th></th>
<th>22°</th>
<th>20°</th>
</tr>
</thead>
</table>

(1) Re-cutting equally spaced on both shoulders

---

**Thrust rings**

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
</tbody>
</table>

Thickness “a”

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>2.310</td>
<td>2.362</td>
<td>(0.0909</td>
</tr>
<tr>
<td>Oversize</td>
<td>2.437</td>
<td>2.489</td>
<td>(0.0959</td>
</tr>
</tbody>
</table>

---

**Main-bearings**

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
</tbody>
</table>

Thickness “a”

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>1.832</td>
<td>1.841</td>
<td>(0.0721</td>
</tr>
<tr>
<td>1st</td>
<td>1.959</td>
<td>1.968</td>
<td>(0.0771</td>
</tr>
<tr>
<td>2nd</td>
<td>2.086</td>
<td>2.095</td>
<td>(0.0821</td>
</tr>
<tr>
<td>3rd</td>
<td>2.213</td>
<td>2.222</td>
<td>(0.0871</td>
</tr>
<tr>
<td>4th</td>
<td>2.340</td>
<td>2.349</td>
<td>(0.0921</td>
</tr>
<tr>
<td>Oversize</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

May 7983
ENGINE MAIN MECHANICAL UNIT

CAMSHAFT SUPPORT, CAMSHAFT AND TAPPET BUCKET

Camshaft support

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
<tr>
<td>Bore of camshaft journal bearing diameter “a”</td>
<td></td>
</tr>
<tr>
<td>Front</td>
<td>35.015</td>
</tr>
<tr>
<td>Central</td>
<td>46.500÷46.525</td>
</tr>
<tr>
<td>Rear</td>
<td>47.000÷47.025</td>
</tr>
<tr>
<td>Seat tappet bucket diameter “b”</td>
<td>36.000÷36.025</td>
</tr>
</tbody>
</table>

Camshaft

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
<tr>
<td>Cam height</td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>34.940÷34.956</td>
</tr>
<tr>
<td>Exhaust</td>
<td>46.440÷46.456</td>
</tr>
<tr>
<td>Front “a”</td>
<td>46.940÷46.956</td>
</tr>
<tr>
<td>Central “b”</td>
<td></td>
</tr>
<tr>
<td>Rear “c”</td>
<td></td>
</tr>
</tbody>
</table>

Tappet bucket

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
<tr>
<td>Diameter “a”</td>
<td>35.973</td>
</tr>
</tbody>
</table>
ENGINE MAIN MECHANICAL UNIT

CYLINDER HEAD, VALVES AND SPRINGS

Cylinder head

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
<tr>
<td>Valve guide seat diameter “d”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13.000 ± 13.018 (0.5118 ± 0.5125)</td>
</tr>
<tr>
<td>Valve guide 0.0. “a”</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>13.050 ± 13.068 (0.5138 ± 0.5145)</td>
</tr>
<tr>
<td>Spare</td>
<td>13.064 ± 13.082 (0.5143 ± 0.5150)</td>
</tr>
<tr>
<td>Diameter of valve guide bore “b”</td>
<td>8.013 ± 8.031 (0.3155 ± 0.3162)</td>
</tr>
<tr>
<td>Valve guide protrusion “e”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.8 ± 10 (0.3858 ± 0.3937)</td>
</tr>
<tr>
<td>Min. cylinder head thickness after resurfacing “c”</td>
<td>77.25 (3.04131) (1)</td>
</tr>
<tr>
<td>Max. error of parallelism between head surfaces</td>
<td>0.05 (0.0020)</td>
</tr>
<tr>
<td>Max. out of flat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.03 (0.0012)</td>
</tr>
<tr>
<td>Surface roughness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.6·10⁻³ (0.0630·10⁻³)</td>
</tr>
</tbody>
</table>

(1) Resurfacing of cylinder head with hemispherical combustion chamber must be done on both banks of the same engine

Valves

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
</tr>
<tr>
<td>Valve stem diameter “a”</td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>7.985 ± 8.000 (0.3144 ± 0.3150)</td>
</tr>
<tr>
<td>Exhaust</td>
<td>7.998 ± 7.983 (0.3137 ± 0.3143)</td>
</tr>
<tr>
<td>Valve head diameter “b”</td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>38.00 ± 38.20 (1.4961 ± 1.5040)</td>
</tr>
<tr>
<td>Exhaust</td>
<td>33.00 ± 33.20 (1.2992 ± 1.3071)</td>
</tr>
</tbody>
</table>

May 1983
### Springs

<table>
<thead>
<tr>
<th>Description</th>
<th>Engine 1200</th>
<th>Engine 1350</th>
<th>Engine 1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of valve spring with valve open “a”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer spring</td>
<td>25.25 (0.9941)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner spring</td>
<td>23.25 (0.9154)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spring rating at length “a”</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer spring</td>
<td>425.32 ÷ 452.76 (43.4 ÷ 46.2) (95.68 ÷ 101.85)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inner spring</td>
<td>194.53 ÷ 208.25 (19.85 ÷ 21.25) (43.76÷46.85)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Valve Seat Recutting

<table>
<thead>
<tr>
<th>Engine</th>
<th>1200</th>
<th>1350</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference diameter “θ R”</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>37.3 (1.4686)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust</td>
<td>31.9 (1.2559)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cut limit of valve seat top surface “a”</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>2.9 (0.1142)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cut limit of valve seat mating surface “b”</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>1.07 ÷ 1.37 (0.0421÷ 0.0539)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust</td>
<td>1.26 ÷ 1.56 (0.0496 ÷ 0.0614)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Valve seat top surface limit angle “α”</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>120°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Valve seat mating surface limit angle “β”</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>90° ÷ 90° 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Valve seat inner face limit angle “γ”</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>50°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unit: mm (in)

May 1983

01-46
## ENGINE MAIN MECHANICAL UNIT

### FITMENT PLAYS OR INTERFERENCE FITS

Unit: mm (in)

<table>
<thead>
<tr>
<th>Inspection data</th>
<th>Engine</th>
<th>1200</th>
<th>1350</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder bore/piston play</td>
<td>Standard</td>
<td>0.03 ÷ 0.05 (0.0012 ÷ 0.0020)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oversize</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-First compression ring</td>
<td></td>
<td>0.035 ÷ 0.067 (0.0014 ÷ 0.0026)</td>
<td>0.035 ÷ 0.072 (0.0014 ÷ 0.0028)</td>
<td>(1)</td>
</tr>
<tr>
<td>Ring/groove end float</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second compression ring</td>
<td></td>
<td>0.035 ÷ 0.067 (0.0014 ÷ 0.0026)</td>
<td>0.035 ÷ 0.072 (0.0014 ÷ 0.0026)</td>
<td>(1)</td>
</tr>
<tr>
<td>Oil scraper ring</td>
<td></td>
<td>0.025 ÷ 0.057 (0.0010 ÷ 0.00221)</td>
<td>0.026 ÷ 0.062 (0.0010 ÷ 0.0024)</td>
<td>(1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum for each ring</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pin/small end play</td>
<td></td>
<td>0.007 ÷ 0.019 (0.0003 ÷ 0.0007)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pin/seat bore play</td>
<td>Standard</td>
<td>0.002 ÷ 0.010 (0.0001 ÷ 0.0004)</td>
<td>0.018 (0.0007)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main bearing to-journal play</td>
<td>Front and rear</td>
<td>0.024 ÷ 0.065 (0.0009 ÷ 0.00261)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central</td>
<td>0.034 ÷ 0.075 (0.0013 ÷ 0.0030)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum (with bearing in seat)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connecting rod bearing-to-crankpin play</td>
<td>Standard</td>
<td>0.034 ÷ 0.662 (0.0013 ÷ 0.0024)</td>
<td>0.032 ÷ 0.64 (0.0013 ÷ 0.0025)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum (with bearing in seat)</td>
<td></td>
<td></td>
<td>0.090 (0.0035)</td>
</tr>
<tr>
<td>Crankshaft end float</td>
<td>Standard</td>
<td>0.056 ÷ 0.25 (0.0022 ÷ 0.0098)</td>
<td>0.35 (0.0138)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>End float of big end bearing</td>
<td>Standard</td>
<td>0.2 40.392 (0.0079 ÷ 0.0164)</td>
<td>0.45 (0.0177)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial clearance between camshaft and bearing</td>
<td>Front</td>
<td>0.059 ÷ 0.100 (0.0023 ÷ 0.0039)</td>
<td>0.044 ÷ 0.085 (0.0017 ÷ 0.0033)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rear</td>
<td>0.044 ÷ 0.085 (0.0017 ÷ 0.0033)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camshaft end float</td>
<td></td>
<td>0.10 ÷ 0.33 (0.0039 ÷ 0.0130)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial clearance between tappet bucket and seat in camshaft support</td>
<td>Standard</td>
<td>0.011 ÷ 0.052 (0.0004 ÷ 0.0020)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Max</td>
<td></td>
<td></td>
<td>0.1 (0.0039)</td>
</tr>
</tbody>
</table>

**01-47**

May 1983
### Inspection data

<table>
<thead>
<tr>
<th>Engine</th>
<th>1200</th>
<th>1350</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve stem-to guide play</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>Standard</td>
<td>0.013 + 0.046 (0.0005 + 0.0018)</td>
<td>Max</td>
</tr>
<tr>
<td>Exhaust</td>
<td>Standard</td>
<td>0.030 + 0.063 (0.0012 + 0.0025)</td>
<td>Max</td>
</tr>
<tr>
<td>Valve guide-to-seat interference fit</td>
<td>Standard</td>
<td>0.032 + 0.068 (0.0013 + 0.0027)</td>
<td></td>
</tr>
<tr>
<td>Spare</td>
<td></td>
<td></td>
<td>0.046 + 0.082 (0.0018 + 0.0032)</td>
</tr>
</tbody>
</table>

(1) Borgo Piston
(2) Mondial Piston

### TEMPERATURES

<table>
<thead>
<tr>
<th>Part</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil pump/distributor drive gear for shrinking onto the crankshaft</td>
<td>150°C (302°F)</td>
</tr>
</tbody>
</table>

### GENERAL SPECIFICATIONS

### FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty kg (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine oil when full</td>
<td>OIL</td>
<td>AGIP SINT 2000 10W50 Std. no. 3631-69352</td>
<td>3.15 (6.94)</td>
</tr>
<tr>
<td>Filter</td>
<td>IP Super Motor Oil 1 0W50 Std. no. 3631-69353</td>
<td>0.45 (0.99)</td>
<td></td>
</tr>
<tr>
<td>Engine oil and filter routine maintenance</td>
<td></td>
<td></td>
<td>3.6 (7.94)</td>
</tr>
<tr>
<td>Camshaft supports chests (1)</td>
<td></td>
<td></td>
<td>0.250 (0.55)(2) into each chest</td>
</tr>
</tbody>
</table>

(1) Applicable only in the case of supports dismantling
(2) This quantity relates to chests supply, completely drain, up to drain holes level

### SEALING COMPOUNDS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint face, cylinder block-to-oil sump</td>
<td>CEMENT</td>
<td>DOW CORNING: Silastick 732 RTV Std. no. 3522-00040</td>
<td>--</td>
</tr>
<tr>
<td>Plugs of water galleries in cylinder block and head</td>
<td>CEMENT</td>
<td>LOCTITE 601 (green) Std. no. 3524-00011</td>
<td>--</td>
</tr>
</tbody>
</table>

(1) Before applying LOCTITE, remove all traces of old Loctite and degrease threads using trichloroethylene or chlorothene

May 1983 01-48
(1) After having heated engine until intervention of radiator cooling electric fan, on cold engine, loosen, oil and tighten the six screws securing heat to base by following the order shown in figure.

(1) In the event of in-car tightening of head nuts with the aid of the extension A.5.0198 to be applied as shown, the torque specifications are:

- Torque spanner having a 300 mm (11.84 in) lever arm
  - N·m: 57 ° 62
  - kg·m: 5.8 ° 6.3
  - lb·ft: 41.9 ° 45.6

- Torque spanner having a 400 mm (15.75 in) lever arm
  - N·m: 62 ° 67
  - kg·m: 6.3 ° 6.8
  - lb·ft: 45.6 ° 49.2

**TROUBLE DIAGNOSIS AND CORRECTIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Noisy engine</td>
<td>Excessive crankshaft end play</td>
<td>Replace thrust bearing</td>
</tr>
<tr>
<td>Knocking of crankshaft and bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piston and connecting rod knocking</td>
<td>• Fit wrong</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Pin float</td>
<td></td>
</tr>
<tr>
<td>Camshaft knocking</td>
<td>• Excessive valve play</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Tappet buckets wrong fit</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Weakened valve spring</td>
<td>Replace</td>
</tr>
<tr>
<td>Water pump knocking</td>
<td>Improper shaft end play</td>
<td>Replace water pump assembly</td>
</tr>
<tr>
<td>I I. Other mechanical trouble</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seized valve seat</td>
<td>• Improper valve clearance</td>
<td>Replace and adjust</td>
</tr>
<tr>
<td></td>
<td>• Weakened valve spring</td>
<td>Replace</td>
</tr>
</tbody>
</table>
## ENGINE MAIN MECHANICAL UNIT

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
</table>
| Excessively worn cylinder and piston | • Worn fit surfaces  
• Poor oil quality  
• Dirty air cleaner  
• Too rich mixture | Adjust or replace  
User proper oil  
Replace filter  
Adjust or replace carburettor |
| Faulty connecting rod           | • Shortage of engine oil  
• Poor engine oil quality  
• Worn or out-of-round crankpin  
• Wrong connecting rod bearing-to-crankpin coupling | Add or replace oil  
Check oil level on daily basis  
Use proper oil  
Grind or replace  
Replace |
| Faulty crankshaft bearing       | • Shortage of engine oil  
• Poor engine oil quality  
• Worn or out-of-round crankshaft journal  
• Wrong connecting rod bearing-to-crankpin coupling | Add or replace oil  
Check oil level on daily basis  
Use proper oil  
Grind or replace  
Replace |
| Belt tensioner knocking         | Wrong belt stretching                                                       | Restore stretch                             |
| Faulty timed                    | Wear of oil pump control gear                                                | Replace                                     |
| Lubrication oil leakage         | • Loosen engine oil drain plug  
• Oil leakage from sump gasket  
• Oil leakage from camshaft supports gasket  
• Oil leakage from engine gaskets and seal rings  
• Oil leakage from oil filter gasket | Tighten  
Replace gasket  
Replace gasket  
Replace gasket  
Screw in filter |
| Decreased of pressure           | • Dirty pressure regulator valve  
• Poor-engine oil quality                                                     | Clean  
Replace |
## SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.2.0195</td>
<td>Base for cylinder head support</td>
<td>01-17, 01-19, 01-24</td>
</tr>
<tr>
<td>A.2.0226</td>
<td>Yoke for cylinder head support</td>
<td>01-17, 01-19, 01-24</td>
</tr>
<tr>
<td>A.2.0378</td>
<td>Tool for locking the flywheel</td>
<td>01-15</td>
</tr>
<tr>
<td>A.3.0103/6</td>
<td>Yoke to remove and refit valves</td>
<td>01-17, 01-24</td>
</tr>
<tr>
<td>A.3.0311</td>
<td>Puller of valve guides</td>
<td>01-18</td>
</tr>
<tr>
<td>A.3.0312</td>
<td>Driver of intake valve guides</td>
<td>01-18</td>
</tr>
<tr>
<td>A.3.0314</td>
<td>Driver of timing gear cover Seal</td>
<td>01-24</td>
</tr>
<tr>
<td>A.3.0321</td>
<td>Support for removing and fitting valves</td>
<td>01-17, 01-24</td>
</tr>
<tr>
<td>A.3.0324</td>
<td>Lever for removing and refitting the valves</td>
<td>01-17, 01-24</td>
</tr>
</tbody>
</table>
FUEL SYSTEM

AIR CLEANER

REMOVAL

Remove air cleaner body with carriage cartridge as follows:
1. Unfasten the five spring clips (9) that secure cover (1) to air cleaner body (8); remove cover.
2. Remove cartridge (2).
3. Disconnect cool air intake sleeve (3) as well as hot air intake sleeve (4).
4. Disconnect blow-by hoses (5) and (7).
5. If necessary, remove flame trap (6) from max. blow-by hose (8).
6. Loosen the four nuts (10) securing air cleaner body to carburetor; remove air cleaner body.

CHECKS AND INSPECTIONS

1. Thoroughly clean cartridge by blowing low pressure compressed air from within; if necessary, replace it.
2. Remove flame trap from blow-by hose, wash both with specific products, then dry them with compressed air. Install flame trap into blow-by hose near oil filler.

INSTALLATION

Fit air cleaner, blow-by hoses and air intake sleeves back together following removal procedure in reverse sequence.

May 1983

04-2
IDLE COMPENSATOR

DESCRIPTION

The idle compensator actually consists of a thermostat that checks the temperature of the engine intake air and as a consequence either opens or closes the throttle valve located in the air cleaner's intake duct. The throttle valve mixes the cool air coming from outside with that coming from the hot air intake, located on the exhaust gas pipes under the left side cylinder head, or it works either fully closed or fully open.

CHECKS AND INSPECTIONS

HOT AIR INTAKE CLOSING TEMPERATURE
1. Warm up engine bringing it up to steady running.
2. Turn engine off.
3. Remove air cleaner cover as well as cartridge.
4. Insert a thermometer next to the thermostat inside the air cleaner.
5. When thermometer shows specified temperature, verify thermostat commands, i.e. opening of throttle valve thus fully closing the hot air intake.

Hot air intake closing temperature 33 ± 37°C (91.4 ± 98.6°F)

COOL AIR INTAKE CLOSING TEMPERATURE
1. With cold engine, remove air cleaner cover as well as cartridge.
2. Insert a thermometer next to the thermostat inside the air cleaner.
3. When thermometer shows specified temperature, verify thermostat commands, i.e. closing of throttle valve thus fully closing the cool air intake.

Cool air intake closing temperature 28 ± 32°C (82.4 ± 89.6°F)

THERMOSTAT REPLACEMENT
1. Remove air cleaner from engine (Refer to: Air Cleaner).
2. Remove rivets securing air intake to air cleaner body.
3. Replace air intake as well as thermostat.
4. Connect air intake back to air cleaner body by riveting it.
5. Fit air cleaner back to engine (refer to: Air Cleaner).

THERMOSTAT REPLACEMENT

FLSP Arm Pump
17.7 ± 29.4 KPa
(0.177 ± 0.294 bar, at 5000 rpm
0.18 ± 0.30 kg/cm², 2.56 ± 4.27 psi)

SAWARA Pump
17.7 ± 29.4 KPa
(0.177 ± 0.294 bar, at 6000 rpm
0.18 ± 0.30 kg/cm², 2.56 ± 4.27 psi)

FUEL PUMP DELIVERY PRESSURE
1. Disconnect fuel delivery hose from pump and from carburetor.
2. Replace same with a T-shaped hose equipped with cutoff cocks.
3. Connect a pressure gauge to the hose's free end.
4. Start engine up and with zero delivery (cock on carburetor side is closed), while keeping gauge at same height as pump, verify that gauge reading is within specified values at relevant engine rpm.
5. If delivery pressure is not within specified values, replace the pump.
6. Disconnect T-shaped hose and restore normal operating conditions.

CHECKS AND INSPECTIONS

CAUTION:
When disconnecting fuel system hoses, use a container with safety lid to collect the petrol that is left over in the hoses.

FUEL PUMP PRESSURE

May 1983
WEBER TWINCARBURETOR

(Except Switzerland, Sweden, Australia.)

- 32 DIR 51A/250 for 1200 model
- 32 DIR 81A/250 for 1350 model
- 32 DIR 71A/250 for 1500 model

* For 32 DIR 81A/250 and 32 DIR 71A/250 only

May 1983
FUEL SYSTEM

CHECKS AND INSPECTIONS

Before removing carburetor from engine, perform following checking and adjusting operations:

1. Float leveling
   Check float position as follows:
   (1) Remove the whole air filter (see Air Cleaner) and disconnect the gasoline feeding hose from float chamber cover.
   (2) Remove float chamber cover 4.
   (3) Make sure float 2 is of the weight prescribed in the technical data, that no deformation is present and that it freely rotates on its pin.
   (4) If checked parts are defective, replace them.
   (5) Keep float chamber cover 4 in vertical position so as that float is slightly in touch on needle valve, which is of the spring-body type. Using a gauge pin, check if float distance from float chamber cover with gasket 3 firmly in place is within specified “QW” value.
   “QW” Dimension
   \[ 6.75 \pm 0.255 \text{ mm} (0.266 \div 0.285 \text{ in}) \]
   (6) To correct “QW” dimension, suitably bend float stopper 1.

2. Needle valve tightness
   Needle valve tightness is checked by means of a vacuum gauge. Keep float chamber cover turned over and in horizontal position and then proceed as follows:
   (1) Connect gauge’s plastic hose 2 to petrol delivery pipe 1 on float chamber cover.
   (2) Load vacuum gauge air pump by acting on cam 3; as a consequence, mercury will go up the graduated scale.
   (3) Wait for about then. seconds, during which mercury will have to remain steady, contrarilywise, replace needle valve.

* Only for 32 DIR 8 1 A/250 and 32 DIR 7 1 A/250
Remove carburetor from car in order to carry out the following checks (refer to: Group 01 Engine Disassembly + Engine Unit).

1. Choke opening (air valve) by economiser

To adjust choke opening proceed as follows:
(1) Fully engage choke by moving starting control lever as shown in relevant figure and at the same time act on the economiser control lever pushing it all the way back.
(2) Insert gauged point between choke edge and duct making sure dimension $G_{W1}$ is within specified value.

$G_{W1}$ Dimension
5.5 ± 6.5 mm (0.216 ± 0.256 in)

(3) In case the verified dimension $G_{W1}$ is not within specified value, remove cap and operate on travel adjustment screw of economiser diaphragm (see following figure).

(4) At the end of adjustment operation, refit cap.

3. Accelerator pump adjustment

Adjust accelerator pump as follows:
(1) Secure carburetor to support C.4.0103 (fitted with gasket) of the pump test instrument C.4.0101.
(2) Supply the carburetor with petrol by connecting it to the tool's reservoir.
(3) Set the graduated measuring tubes C.4.0105 under the foreseen exhaust pipe -on support itself.
(4) Carry out twenty strokes corresponding to as many complete openings and closings of throttle valve, operating on control lever.
(5) Check if volume of petrol collected in the measuring tube corresponds to specified $V_W$ value.

When pumping, briefly stop both in throttle valve fully open and fully closed positions.

Volume of petrol $V_W$ corresponding to 20 strokes of pump control lever:

$V_W = 17 \div 20 \text{ cm}^3$

(1.03 \div 1.22 \text{ cu.in.})

(6) If $V_W$ value is not within specified limit, check diaphragm of acceleration pump and the pump jet.
WEBER TWIN CARBURETOR

For Switzerland, Sweden, Australia.

Carry out checks and adjustments following the procedures performed for the WEBER twin carburetors, previously described and referring to the tables provided in “Technical Data and Specifications” relevant to check dimensions.

WEBER TWIN CARBURETOR — EXPLODED VIEW

(it will be provided in the next issue)
FUEL SYSTEM

KEY

(it will be provided in the next issue)
FUEL SYSTEM

58 Central Venturi securing screw
59 Sheath securing screw
60 Air valve control intermediate lever
61 Air valve control return lever
62 Bush
63 Air valve automatic opening control lever
64 Securing nut
65 Washer
66 Sheath support
67 Washer
68 Support securing screw
69 Bush
70 Central Venturi
71 Economiser gasket
72 Economiser assy
73 Air valve spring
74 Idling cut-off
75 Air valve
76 Air valve control tie rod
77 Air valve shaft assy
78 Air valve securing screw
79 Stud

CHECKS AND ADJUSTMENTS

Before removing carburetor from engine, carry out the following checks.

1. Check of float chamber hydraulic level
   For float chamber hydraulic level check, operate as follows:
   (1) Remove the whole air filter (see: Air cleaner) and disconnect the fuel feeding hose from float chamber cover.
   (2) Remove float chamber cover.
   (3) Make sure that float is of the prescribed weight indicated in the Technical Data, that no deformation is present and that it freely rotates around its pin.
   (4) If checked parts are defective, replace them.
   (5) Verify that value of distance "A" between fuel surface and float chamber cover surface with assembled gasket, is within specified value.

   \[ A = 21 \pm 23 \text{ mm (0.83 \pm 0.91 in)} \]

   (6) To correct "A" dimension, replace washer located under needle valve of properly bend float stopper.
   (7) Reassemble carburetor cover, let the engine executes a few rotations then repeat check operations until the prescribed dimension is obtained.

2. Needle valve tightness
   To check needle valve tightness, see Weber twin carburetor: Checks and Inspections - Needle Valve Tightness.

Remove carburetor from car in order to carry out the following checks (see: Group 01 - Engine Disassemble - Engine Unit).

1. Choke opening by economiser.
   To adjust choke opening proceed as follows:
   (1) Fully engage choke by moving starting control lever as shown in relevant figure and at the same time act on the economiser control lever pushing it all the way back.
   (2) Insert gauged point between choke edge and duct making sure dimension "\( G_{S1} \)" is within specified value.

   \[ "G_{S1}" \text{ Dimension} \]
   \[ 4.5 \pm 4.75 \text{ mm (0.177 \pm 0.187 in)} \]

   (3) In case the verified dimension "\( G_{S1} \)" is not within specified valve loosen lock-nut and operate on diaphragm travel adjustment nut of economiser body (see next figure).
   (4) At end of adjustment, tighten lock-nut.
2. Throttle valve opening (gas valve) with volet inserted.
To adjust throttle valve opening proceed as follows:
(1) Fully engage choke as shown in figure.
(2) Insert a gauged wire between throttle valve edge and the first body duct making sure dimension $G_{S2}$ is within specified value.

$G_{S2}$ Dimension
0.9 ± 1 mm (0.035 ± 0.039 in)

3. Accelerator pump adjustment
To check and adjust accelerator pump refer to: Weber Twin Carburetor: Checks and Inspections - Accelerator Pump.

Volume of petrol $V_S$ corresponding to 20 strokes of pump control lever:

<table>
<thead>
<tr>
<th>Twin carburetor</th>
<th>1st barrel</th>
<th>2nd barrel</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>C32 EIES 45</td>
<td>8 ± 10</td>
<td>8 ± 10</td>
<td>16 ± 20</td>
</tr>
<tr>
<td>(in) (0.49 ± 0.61)</td>
<td>(in) (0.49 ± 0.61)</td>
<td>(in) (0.97 ± 1.22)</td>
<td></td>
</tr>
<tr>
<td>C32 EIES 44</td>
<td>8 ± 10</td>
<td>9 ± 11</td>
<td>17.5 ± 21</td>
</tr>
<tr>
<td>(in) (0.49 ± 0.61)</td>
<td>(in) (0.55 ± 0.67)</td>
<td>(in) (1.04 ± 1.28)</td>
<td></td>
</tr>
<tr>
<td>C32 EIES 43</td>
<td>8 ± 10</td>
<td>10 ± 12</td>
<td>18 ± 22</td>
</tr>
<tr>
<td>(in) (0.49 ± 0.61)</td>
<td>(in) (0.61 ± 0.77)</td>
<td>(in) (1.10 ± 1.34)</td>
<td></td>
</tr>
</tbody>
</table>

Tightening Torque
Carburetor retaining nuts
19 ± 23.5 N·m
(1.9 ± 2.4 kg·m
13.74 ± 17.35 ft·lb)

OVERHAULING
Carburetor should be overhauled only if encountered defects cannot be corrected neither through operations described in Checks and Inspections above nor through cleaning of fuel filter, float chamber or jets. When overhauling, keep following items in mind:

a. Remove carburetor from engine and disassemble it on bench.

All disassembled parts must be thoroughly cleaned.

b. Thoroughly and carefully check most delicate parts such as needle valve, throttle valve shafts, diaphragms, accelerator pump and fuel filter.

c. Replace defective parts only with original ones and always replace all gaskets.

d. Use special care in cleaning jets so as not to damage relevant ratings; if possible blow them with a jet of compressed air.

CAUTION:
Once carburetor has been overhauled, it is advisable to perform adjustments described in preceding paragraph "Checks and Inspections".

ACCELERATOR CABLE ADJUSTMENT

1. Verify that throttle valve control cable can freely slide inside sheath.
2. Verify that clearance between clevis slot and pin on carburetor throttle valve opening shaft is within specified $G_1$ limit.

Clevis slot to pin clearance $G_1 = 1$ mm (0.039 in)

3. If required, adjust as follows:
(1) Loosen adjusting screw's lock nut.
(2) Turn screw till specified clearance is reached.
(3) Tighten lock nut.

CAUTION:
To easy adjustment buck action of return spring by manually partially opening the throttle valve.
FUEL SYSTEM

REMOVAL

WARNING:
Before replacing any fuel line part, carefully follow below instructions:

a. Make sure the shop is equipped with suitable safety equipment.
b. Disconnect battery ground cable.
c. Place petrol drained from the tank into a suitable container equipped with a safety lid.

FUEL TANK UNIT
1. Remove filler cap from filler hose and take out all petrol from the tank with the help of a suitable pump.
2. Loosen clamp 2 and 3 connecting fuel filling sleeve to tank and connecting pipe to feeding hose.
3. Loosen and remove screw securing ground cable 1 to the body.
4. Support tank by means of column lift and loosen screws securing the clamps supporting tank to body.
5. Slowly lower column lift so as to gain access to the float located on tank upper side.
6. Disconnect from the pipe union, on the float, the fuel delivery pipe 3 and remove electric connections 2 of warning lamp and fuel level indicator.
7. Loosen the six screws securing float 1 to tank and remove float.

FUEL TANK FLOAT
Remove float of fuel tank operating as follows:

1. Support tank by means of column lift and loosen screws securing the two clamps supporting tank to body.
2. Slightly lower column lift so as to gain access to float located on tank upper side.
3. Disconnect from pipe union, on the float, the fuel delivery pipe 3 and remove electric connections 2 of warning lamp and fuel level indicator.
4. Loosen the six screws securing float 1 to tank and remove float.

FUEL LINE

CAUTION:
Disconnect feedings pipes only if absolutely necessary.

1. Remove filler cap and take out all petrol from the tank with the help of a suitable pump.
2. Remove clamps from hose unions; plug all hoses and pipes to prevent dust or dirt from going in during disassembly operations.
3. Free pipes from relevant holding clamps on underbody.

CHECK VALVE

Remove check valve from the supporting clip on the fuel tank.

CHECKS AND INSPECTIONS

TANK
Check tank for flaws or any evidence of warpage; if necessary, replace it.

HOSES
Check hoses and make sure they are not porous and show no evidence of abnormal wear; replace hoses that are not flawless.

PIPES
Check and make sure pipes are not clogged, oxidized, or dented.

CHECK VALVE

1. Blow in an air into the valve located of fuel pipe side.
2. Blow in an air jet into the valve from outer side union.
3. If check valve does not comply with above, replace it.

INSTALLATION

Carefully fit all fuel line parts back together following removal operations in reverse sequence and paying special attention to below instructions.
CAUTION:

a. Carefully fit clamps back to line unions without tightening them too much to avoid damaging the hoses.
b. Fit fuel delivery pipes securely to relevant holding clamps on underbody, making sure same are properly fastened. Failure to follow this caution will result in damage to pipe surfaces.
c. Do not bend or twist pipes during installation.
d. Start engine up and make sure there are no leaks from connections.

2. Do not twist or crush breather hoses after fitting; fasten them with relevant clamps.

FLOAT

Be sure to replace the gasket each time float is fitted back into tank.

CHECK VALVE

Be sure to fit check valve according to proper working direction.

EXHAUST SYSTEM

1. Check mufflers and exhaust pipes making sure they are not in any way damaged or cracked and show no evidence of corrosion; contrarywise, replace them.
2. Thoroughly check supports ring and do not hesitate to replace them if they are cracked, porous or worn.
3. Check buffer on exhaust pipe end.
4. Check surface of hot air intake making sure there are no warps or dents that could impair normal air flow.

REMOVAL

a. Instructions hereafter described have been compiled so as to allow separate removal of the exhaust system's single components.
b. Consequently, removal procedure may be changed depending on the operation's purpose.
c. When removing the entire exhaust system, it is advisable to get someone to help you with it.

CHEACKS AND INSPECTIONS

1. Check mufflers and exhaust pipes making sure they are not in any way damaged or cracked and show no evidence of corrosion; contrarywise, replace them.

May 1983 04-16
MANIFOLDS AND MUFFLERS

Referring to the figure on page 04-16, proceed with removal as follows:

1. Raise car on lift.
2. Remove rear muffler as follows:
   (1) Loosen clamp 1 connecting central element with rear one and release this one from support retaining rings 3.
   (2) With a suitable hammer, lightly and repeatedly strike all around the muffler pipes connection area and then alternately turn muffler 2 clockwise and counterclockwise so as to make separation easier.
   (3) If necessary, use a plastic hammer and lightly strike the muffler in the direction of removal till rear muffler comes off the central muffler.
3. Remove central muffler as follows:
   (1) Remove rear muffler (refer to item 2 above).
   (2) Loosen clamps connecting central element with front one and disconnect central element from support retaining rings 3.
   (3) With a suitable hammer, lightly and repeatedly strike all around the pipes connection area and then alternately turn muffler 2 clockwise and counterclockwise so as to make separation easier.
   (4) If necessary, use a plastic hammer and lightly strike the muffler in the direction of removal till central muffler comes off front manifolds.
4. Remove front manifolds as follows:
   (1) Loosen clamp connecting front element to central one and move it from its seat.
   (2) Loosen the nut securing hot air intake bracket to cylinder head and withdraw the warm air intake sleeve.
   (3) Loosen nut 6 securing manifold flanges to cylinder heads.
   (4) Remove manifolds 4.

SUPPORT RINGS

Verify integrity of support rings and replace them if necessary.

HOT AIR INTAKE

1. Raise car on lift.
2. Withdraw sleeve 1 from air intake 2.
3. Loosen bolt 5 connecting air intake to manifolds and then remove clamp 4 thus separating the hot air intake half shells.
4. Loosen nut 6 securing support lever to left head and remove hot air intake.

INSTALLATION

Fit single parts back together following removal operations in reverse sequence and paying close attention to below instructions:

a. Always fit new gaskets between manifold flanges and cylinder heads.

b. Having completed installation, check and make sure that support rings move freely and are free of undue stress; check brackets making sure they have been properly secured.

c. While engine is running check all pipe connections for gas leaks and the whole exhaust system for unusual noises.
## TECHNICAL DATA

### FUEL PUMP

<table>
<thead>
<tr>
<th>Type</th>
<th>ALFA ROMEO part No.</th>
<th>Brand</th>
<th>1200</th>
<th>1350</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>305.00</td>
<td>305.02</td>
<td>305.04</td>
</tr>
<tr>
<td></td>
<td>Mechanical</td>
<td>510.355</td>
<td>FISPA</td>
<td>4041.01</td>
<td>4059.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>531.354</td>
<td>SAVARA</td>
<td>960.084.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>542.140</td>
<td>SAVARA</td>
<td>906.130.00</td>
<td></td>
</tr>
</tbody>
</table>

### FUEL TANK

<table>
<thead>
<tr>
<th>Overall capacity</th>
<th>I 50</th>
<th>Imp. Gall</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserve</td>
<td>I 6.5</td>
<td>Imp. Gall</td>
<td>1.43</td>
</tr>
</tbody>
</table>

## GENERAL SPECIFICATIONS

## FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacer on accelerator pedal rotation pin</td>
<td>GREASE</td>
<td>AGIPF1 Grease 15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard 3671-69810</td>
<td></td>
</tr>
</tbody>
</table>
### CARBURETORS

<table>
<thead>
<tr>
<th>ENGINE (1)</th>
<th>Displacement</th>
<th>Type</th>
<th>1200</th>
<th>1355</th>
<th>1585</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>305.00</td>
<td>305.02</td>
<td>305.04</td>
</tr>
</tbody>
</table>

#### ALFA ROMEO

<table>
<thead>
<tr>
<th>Part No.</th>
<th>534.131</th>
<th>542.131</th>
<th>547.215</th>
<th>547.296</th>
<th>535.985</th>
<th>536.236</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twin</td>
<td>Weber (2) (3)</td>
<td>Solec (2) (3)</td>
<td>Weber (2) (3)</td>
<td>Solec (2) (3)</td>
<td>Weber (2) (3)</td>
<td>Solec (2) (3)</td>
</tr>
<tr>
<td>32 DIR 81A/250</td>
<td>C 32 EIES 85</td>
<td>C 32 EIES 44</td>
<td>C 32 EIES 44</td>
<td>C 32 EIES 44</td>
<td>C 32 EIES 44</td>
<td>C 32 EIES 44</td>
</tr>
</tbody>
</table>

#### CARBURETOR

(Except Switzerland, Sweden, Australia)

<table>
<thead>
<tr>
<th>Position</th>
<th>1st barrel</th>
<th>2nd barrel</th>
<th>1st barrel</th>
<th>2nd barrel</th>
<th>1st barrel</th>
<th>2nd barrel</th>
<th>1st barrel</th>
<th>2nd barrel</th>
<th>1st barrel</th>
<th>2nd barrel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venturi</td>
<td>23</td>
<td>24</td>
<td>23</td>
<td>24</td>
<td>23</td>
<td>24</td>
<td>23</td>
<td>24</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>Main jet</td>
<td>122</td>
<td>130</td>
<td>122</td>
<td>130</td>
<td>122</td>
<td>130</td>
<td>122</td>
<td>130</td>
<td>122</td>
<td>130</td>
</tr>
<tr>
<td>Auxiliary Venturi</td>
<td>3.5 cage</td>
<td>4.5 norm.</td>
<td>3.5 cage</td>
<td>4.5 norm.</td>
<td>3.5 cage</td>
<td>4.5 norm.</td>
<td>3.5 cage</td>
<td>4.5 norm.</td>
<td>3.5 cage</td>
<td>4.5 norm.</td>
</tr>
<tr>
<td>Main air corrector jet</td>
<td>180</td>
<td>170</td>
<td>170</td>
<td>190</td>
<td>180</td>
<td>170</td>
<td>170</td>
<td>190</td>
<td>180</td>
<td>170</td>
</tr>
<tr>
<td>Mixture tube</td>
<td>F68</td>
<td>F67</td>
<td>F68</td>
<td>F67</td>
<td>F68</td>
<td>F67</td>
<td>F68</td>
<td>F67</td>
<td>F68</td>
<td>F67</td>
</tr>
<tr>
<td>Enrichment jet (Ecopress)</td>
<td>40</td>
<td>95</td>
<td>0</td>
<td>85</td>
<td>40</td>
<td>95</td>
<td>0</td>
<td>100</td>
<td>40</td>
<td>95</td>
</tr>
<tr>
<td>Lifting jet</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Mixing air corrector jet</td>
<td>185</td>
<td>115</td>
<td>136</td>
<td>120</td>
<td>185</td>
<td>115</td>
<td>136</td>
<td>120</td>
<td>185</td>
<td>115</td>
</tr>
<tr>
<td>Progression holes</td>
<td>5.0</td>
<td>120</td>
<td>2.0</td>
<td>110</td>
<td>5.0</td>
<td>120</td>
<td>2.0</td>
<td>110</td>
<td>5.0</td>
<td>120</td>
</tr>
<tr>
<td>Acceleration pump jet</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>55</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>55</td>
<td>50</td>
<td>55</td>
</tr>
<tr>
<td>Needle valve</td>
<td>175</td>
<td>160</td>
<td>175</td>
<td>160</td>
<td>175</td>
<td>160</td>
<td>175</td>
<td>160</td>
<td>175</td>
<td>160</td>
</tr>
<tr>
<td>Thickness of gasket under needle valve</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Hot weight</td>
<td>11</td>
<td>7.5</td>
<td>11</td>
<td>7.5</td>
<td>11</td>
<td>7.5</td>
<td>11</td>
<td>7.5</td>
<td>11</td>
<td>7.5</td>
</tr>
<tr>
<td>Secondary lifting air corrector jet</td>
<td>11</td>
<td>3.5</td>
<td>11</td>
<td>3.5</td>
<td>11</td>
<td>3.5</td>
<td>11</td>
<td>3.5</td>
<td>11</td>
<td>3.5</td>
</tr>
<tr>
<td>Secondary lifting mixture corrector jet</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Adjuster hole</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Adjuster mixer hole</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Adjuster air hole</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td>Adjuster axial hole</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pump discharge</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Pump discharge jet</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
<td>36</td>
</tr>
</tbody>
</table>

(2) Carburetor with auxiliary screw for idling adjustment (for adjuster)

(3) Carburetor with throttle adjustment screw and seal/airflow mixture

* Dimensions in $10^2$ mm

(1) Different engine types are identified by the different progressive number (letters and numbers).

See group 00
<table>
<thead>
<tr>
<th>ENGINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FUEL SYSTEM</td>
</tr>
<tr>
<td>Type</td>
</tr>
<tr>
<td>Alfa Romeo</td>
</tr>
<tr>
<td>Part No</td>
</tr>
<tr>
<td>Model</td>
</tr>
<tr>
<td>Position</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>1st barrel</th>
<th>2nd barrel</th>
<th>1st barrel</th>
<th>2nd barrel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Venturi</td>
<td>23</td>
<td>24</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>Auxiliary Venturi</td>
<td>2.5 cage</td>
<td>4.5 norm</td>
<td>2.5 cage</td>
<td>4.5 norm</td>
</tr>
<tr>
<td>Main jet</td>
<td>122</td>
<td>130</td>
<td>122</td>
<td>130</td>
</tr>
<tr>
<td>Primary air corrector jet</td>
<td>180</td>
<td>170</td>
<td>180</td>
<td>170</td>
</tr>
<tr>
<td>Mixture tube</td>
<td>F do</td>
<td>h b</td>
<td>F 67</td>
<td>95</td>
</tr>
<tr>
<td>Enrichment jet</td>
<td>40</td>
<td>95</td>
<td>40</td>
<td>95</td>
</tr>
<tr>
<td>Idle jet</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Jetting air corrector jet</td>
<td>180</td>
<td>115</td>
<td>185</td>
<td>115</td>
</tr>
<tr>
<td>Progression holes</td>
<td>1 hole Ø 120</td>
<td>3 holes Ø 120</td>
<td>3 holes Ø 120</td>
<td>3 holes Ø 120</td>
</tr>
<tr>
<td>Acceleration pump jet</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Fum discharge</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Needle valve</td>
<td>175</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Adjuster air hole</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Adjuster mixture hole</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Adjuster axial hole</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Dimensions in $10^{-2}$ mm
FUEL SYSTEM

INSPECTION AND ADJUSTMENT

FUEL PUMP

<table>
<thead>
<tr>
<th>Fuel pump pressure</th>
<th>Pump delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FISPA</strong></td>
<td></td>
</tr>
<tr>
<td>17.7 ÷ 29.4 KPa</td>
<td></td>
</tr>
<tr>
<td>(0.177 ÷ 0.294 bar)</td>
<td></td>
</tr>
<tr>
<td>(0.18 ÷ 0.30 kg/cm²)</td>
<td></td>
</tr>
<tr>
<td>(2.56 ÷ 4.27 psi)</td>
<td></td>
</tr>
<tr>
<td>at 5000 rpm</td>
<td></td>
</tr>
<tr>
<td><strong>SAVARA</strong></td>
<td></td>
</tr>
<tr>
<td>17.7 ÷ 29.4 KPa</td>
<td></td>
</tr>
<tr>
<td>(0.177 ÷ 0.294 bar)</td>
<td></td>
</tr>
<tr>
<td>(0.18 ÷ 0.30 kg/cm²)</td>
<td></td>
</tr>
<tr>
<td>(2.56 ÷ 4.27 psi)</td>
<td></td>
</tr>
<tr>
<td>at 6000 rpm</td>
<td></td>
</tr>
</tbody>
</table>

WARM - COLD AIR AUTOMATIC MIXER

<table>
<thead>
<tr>
<th>Warm air inlet complete closing</th>
<th>Cold air inlet complete closing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine temperature</td>
<td>Engine temperature</td>
</tr>
<tr>
<td>Thermostat temperature</td>
<td>Thermostat temperature</td>
</tr>
<tr>
<td>Warm</td>
<td>Cold</td>
</tr>
<tr>
<td>Warm</td>
<td>Cold</td>
</tr>
<tr>
<td>&gt; 33 °C</td>
<td>&lt; 28 °C</td>
</tr>
<tr>
<td>&gt; 91.4 °F</td>
<td>&lt; 82.4 °F</td>
</tr>
</tbody>
</table>

ACCELERATOR CONTROL

Clearance between adjustment fork slot and throttle control shaft pin

G₁ mm (in) 1 (0.039)

Clearance between throttle control lever and relevant complete opening stop

G₂ mm (in) 1 ÷ 2 (0.039 ÷ 0.079)

May 1983
### CARBURETORS

<table>
<thead>
<tr>
<th>ENGINE Type</th>
<th>Displacement</th>
<th>1200</th>
<th>1360</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>305.00</td>
<td>305.02</td>
<td>305.04</td>
<td></td>
</tr>
</tbody>
</table>

**CARBURETOR**

(Except Switzerland, Sweden, Australia)

<table>
<thead>
<tr>
<th>Part No</th>
<th>534.637</th>
<th>542.131</th>
<th>536.215</th>
<th>542.096</th>
<th>535.695</th>
<th>536.738</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Twin</td>
<td>Twin</td>
<td>Twin</td>
<td>Twin</td>
<td>Twin</td>
<td>Twin</td>
</tr>
<tr>
<td></td>
<td>Weber</td>
<td>Sollex</td>
<td>Weber</td>
<td>Sollex</td>
<td>Weber</td>
<td>Sollex</td>
</tr>
<tr>
<td></td>
<td>32 DIR 81 A/250</td>
<td>C 32 EIES 45</td>
<td>32 DIR 81 A/250</td>
<td>C 32 EIES 44</td>
<td>32 DIR 71 A/250</td>
<td>C 32 EIES 43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position</th>
<th>CENTRE</th>
<th>CENTRE</th>
<th>CENTRE</th>
<th>CENTRE</th>
<th>CENTRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throttle opening with choke, in use (mm)</td>
<td>0.9±1</td>
<td>0.9±1</td>
<td>0.9±1</td>
<td>0.9±1</td>
<td>0.9±1</td>
</tr>
</tbody>
</table>

| Choke opening by economiser (mm) | 6.5±6.5 | 4.5±4.75 | 5.5±6.5 | 4.5±4.75 | 5.5±6.5 | 4.5±4.75 |
| Pump delivery for 20 strokes (cm³) | 17±20 | 8±10 | 8±10 | 17±20 | 8±10 | 9±11 | 17±20 | 8±10 | 10±12 |

**Float chamber levelling:**

a. cover (with gasket) to float
   - Qₖ = 6.75±7.25

b. Float chamber hydraulic lever (without cover)
   - 21±23
## CARBURETORS

<table>
<thead>
<tr>
<th>ENGINE</th>
<th>Displacement</th>
<th>1360</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1360</td>
<td>1500</td>
</tr>
<tr>
<td></td>
<td>Typs</td>
<td>301.86</td>
<td>305.14</td>
</tr>
<tr>
<td>ALFA ROMEO</td>
<td>506.22&quot;</td>
<td>506.22&quot;</td>
<td></td>
</tr>
<tr>
<td>Part No</td>
<td>Twin Weber 32 DIR 91/150</td>
<td>Twin Weber 32 DIR 91/150</td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>CENTRE</td>
<td>CENTRE</td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td>1st barrel</td>
<td>2nd barrel</td>
<td>1st barrel</td>
</tr>
<tr>
<td>Throttle with choke in use</td>
<td>mm</td>
<td>0.9±1</td>
<td>-</td>
</tr>
<tr>
<td>Choke by vacuum</td>
<td>mm</td>
<td>5.5±6.5</td>
<td>-</td>
</tr>
<tr>
<td>Pump for 20 strokes</td>
<td>cm³</td>
<td>17±20</td>
<td>17±20</td>
</tr>
<tr>
<td>Float raising (a. cover plate) to float Qₚ dimension</td>
<td>mm</td>
<td>6.75±7.25</td>
<td>6.75±7.25</td>
</tr>
</tbody>
</table>
TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N·m</th>
<th>kg·m</th>
<th>ft-lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carburetors retaining nuts</td>
<td></td>
<td>19÷23.5</td>
<td>1.9÷2.4</td>
<td>13.74÷17.35</td>
</tr>
</tbody>
</table>

TROUBLE DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel leakage</td>
<td>• Needle valve is dirty or its seat is loose on thread</td>
<td>Thoroughly clean petrol filter and needle valve; tighten seat firmly; if necessary, replace it with a new one (original parts)</td>
</tr>
<tr>
<td></td>
<td>• Float sticks (hard on pin or sides) or is heavy</td>
<td>Free the float and adjust its movement; if necessary replace it (original parts)</td>
</tr>
<tr>
<td></td>
<td>• Pipes improperly tightened or broken</td>
<td>Tighten pipes and unions or replace defective ones</td>
</tr>
<tr>
<td></td>
<td>• Gaskets are hard, worn or improperly tightened</td>
<td>Replace gaskets and tighten them properly</td>
</tr>
<tr>
<td></td>
<td>• Acceleration pump diaphragm is punctured or torn</td>
<td>Replace diaphragm</td>
</tr>
<tr>
<td>Petrol does not reach carburetor</td>
<td>• Fuel pump or pipes are overheated and bubbles are present</td>
<td>Let bubbles out and try to eliminate overheating causes</td>
</tr>
<tr>
<td></td>
<td>• Fuel pump is mechanically defective</td>
<td>Overhaul pump replacing defective components or replace the whole pump</td>
</tr>
<tr>
<td></td>
<td>• Pipes, fuel filter or carburetor ducts are clogged by foreign matter</td>
<td>Thoroughly clean pipes, filter and carburetor</td>
</tr>
<tr>
<td></td>
<td>• Fuel tank breather hose is clogged or there is a water deposit on tank bottom</td>
<td>Unclog breather hose and eliminate water also from pipes and from carburetor float chamber</td>
</tr>
<tr>
<td>Cold starting is difficult or impossible</td>
<td>• Having verified that fuel level in float chamber is absolutely correct, proceed to check following possible carburetor troubles.</td>
<td>Restore proper fuel level in float chamber</td>
</tr>
<tr>
<td></td>
<td>• Starting control cable does not slide freely, is broken, unhooked, etc.</td>
<td>Repair or replace cable</td>
</tr>
<tr>
<td></td>
<td>• Choke sticks so that it tends to stay either fully open or fully closed</td>
<td>Free choke movement</td>
</tr>
<tr>
<td></td>
<td>• Starting jet, if any, is dirty or has been tampered</td>
<td>Clean or replace jet</td>
</tr>
</tbody>
</table>

May 1983
<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold starting is difficult or impossible</td>
<td>Starting control valve, if any, is sticky</td>
<td>Free valve movement so that it can properly follow control cable</td>
</tr>
<tr>
<td></td>
<td>Ignition and starting systems are out of order</td>
<td>Overhaul ignition and starting systems</td>
</tr>
<tr>
<td>Excessive fuel consumption</td>
<td>Carburation, ignition or compression are defective, as also mentioned in case of insufficient max speed</td>
<td>Checking operations to be performed same as previously mentioned</td>
</tr>
<tr>
<td></td>
<td>Air cleaner intake stopped in the warm position</td>
<td>Replace thermostat located into cleaner air intake</td>
</tr>
<tr>
<td></td>
<td>Twin carburetor goes into action too early</td>
<td>CAUTION: Special attention should be paid when checking fuel consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>since speed load, road type as well as driving habits play an important part in</td>
</tr>
<tr>
<td></td>
<td></td>
<td>establishing actual running fuel consumption</td>
</tr>
<tr>
<td>Slow pickup especially when in direct drive</td>
<td>Carburation, ignition or compression are defective, as also mentioned in case of insufficient max speed (presence of exhaust smoke is possible)</td>
<td>Checking operations to be performed same as previously mentioned</td>
</tr>
<tr>
<td></td>
<td>Acceleration pump not properly adjusted or defective or pump circuit of jet and valves is defective</td>
<td>Overhaul pump and relevant circuits</td>
</tr>
<tr>
<td></td>
<td>Diffuser well is clogged or otherwise defective</td>
<td>Carefully overhaul air jet, diffuser and relevant well making sure that all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>components are properly rated</td>
</tr>
<tr>
<td>Engine easily knocks, overheats or self-ignites</td>
<td>Carburation or ignition are defective, as also mentioned in case of insufficient max speed</td>
<td>Checking operations to be performed same as previously mentioned</td>
</tr>
<tr>
<td></td>
<td>Octane rating of petrol used is too low</td>
<td>Replace petrol in tank with a kind having a higher octane rating</td>
</tr>
<tr>
<td></td>
<td>Engine cooling system is defective</td>
<td>Check radiator, relevant thermostat or shutter, if any, since the latter could be</td>
</tr>
<tr>
<td></td>
<td></td>
<td>improperly adjusted</td>
</tr>
<tr>
<td></td>
<td>Excessive scaling of engine cylinders</td>
<td>Proceed to scale the engine</td>
</tr>
<tr>
<td></td>
<td>Having also excluded any ignition defect, engine compression will have to be tested since there could be leaks coming from piston rings, valves or cylinder head gaskets</td>
<td>Check engine compression by means of suitable gauge screwed onto spark plug holes;</td>
</tr>
<tr>
<td></td>
<td>Engine compression is poor</td>
<td>overhaul or replace any defective engine parts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check compression and, if necessary, overhaul the engine</td>
</tr>
<tr>
<td>Condition</td>
<td>Probable cause</td>
<td>Corrective action</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Improper engine idling or progression phases | • Inadequate fuel level in float chamber or defective starter, ignition or overall engine operation as previously mentioned in connection with difficult cold starting  
  • Adjustment of idling adjusting screws is incorrect  
  • Idling jet is dirty, loose or has been tampered with  
  • Progression holes or channels of idling circuit are clogged or have been tampered with  
  • Air leaks from fitting flanges or other connections  
  • Throttle valve shaft has air leaks from intakes  
  • Throttle valve or relevant controlling parts are sticky  
  • Twin carburetor’s second throttle valve does not work properly | Perform same checks and repairs as previously described  
  Carefully repeat all relevant adjustments as per maintenance instructions  
  Check or replace idling jet  
  Check and thoroughly clean holes and channels  
  Tighten as required and, if necessary, replace relevant worn gaskets  
  Replace shaft and, if necessary, fit an oversize shaft after having suitably reamed relevant holes in the body  
  Free throttle valve  
  Overhaul and clean |
| Power shortage (insufficient max speed)       | • Inadequate fuel level in float chamber or defective starting, ignition or compression as previously mentioned  
  • Main jet, power jet, air adjusting screw or diffuser are clogged, loose or have been tampered with  
  • Fuel filter in tank or in carburetor is clogged  
  • Air cleaner clogged  
  • Throttle valve does not fully open | Perform same checks and repairs as previously described  
  Check, thoroughly clean or replace defective parts  
  Clean the filter  
  Clean air cleaner and replace cartridge  
  Check throttle valve and relevant controlling parts |
| Exhaust system is unusually or excessively noisy | • Holes in manifolds  
  • Holes in pipes  
  • Gas leaks from loose connections | Replace damaged parts  
  Replace damaged parts  
  Tighten properly as required |
## SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.4.0101</td>
<td>Carburetor pump test</td>
<td>04-6</td>
</tr>
<tr>
<td>C.4.0103</td>
<td>Twin carburetor support (to be used with C.4.0101)</td>
<td>04-6</td>
</tr>
<tr>
<td>C.4.0105</td>
<td>Beaker for carburetor pump tests (to be used with C.4.0101)</td>
<td>04-6</td>
</tr>
<tr>
<td>CONTENTS</td>
<td>PAGE</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>BATTERY</td>
<td>05-2</td>
<td></td>
</tr>
<tr>
<td>STARTER</td>
<td>05-4</td>
<td></td>
</tr>
<tr>
<td>Wiring diagram.</td>
<td>05-4</td>
<td></td>
</tr>
<tr>
<td>Disassembly</td>
<td>05-7</td>
<td></td>
</tr>
<tr>
<td>Checks and inspections</td>
<td>05-10</td>
<td></td>
</tr>
<tr>
<td>Reassembly</td>
<td>05-12</td>
<td></td>
</tr>
<tr>
<td>Test stand inspection</td>
<td>05-12</td>
<td></td>
</tr>
<tr>
<td>Service data and specs.</td>
<td>05-12</td>
<td></td>
</tr>
<tr>
<td>Trouble diagnosis &amp; corrections</td>
<td>05-13</td>
<td></td>
</tr>
<tr>
<td>CHARGING</td>
<td>05-15</td>
<td></td>
</tr>
<tr>
<td>Wiring diagram.</td>
<td>05-15</td>
<td></td>
</tr>
<tr>
<td>Disassembly</td>
<td>05-18</td>
<td></td>
</tr>
<tr>
<td>Checks and inspections</td>
<td>05-21</td>
<td></td>
</tr>
<tr>
<td>Reassembly</td>
<td>05-24</td>
<td></td>
</tr>
<tr>
<td>Test stand inspection</td>
<td>05-24</td>
<td></td>
</tr>
<tr>
<td>Service data and specs.</td>
<td>05-24</td>
<td></td>
</tr>
<tr>
<td>Trouble diagnosis &amp; corrections</td>
<td>05-25</td>
<td></td>
</tr>
<tr>
<td>TRANSISTORIZED IGNITION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WITHOUT CONTACTS</td>
<td>05-26</td>
<td></td>
</tr>
<tr>
<td>Wiring diagram.</td>
<td>05-26</td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>05-27</td>
<td></td>
</tr>
<tr>
<td>Checks and adjustments</td>
<td>05-28</td>
<td></td>
</tr>
<tr>
<td>Disassembly</td>
<td>05-31</td>
<td></td>
</tr>
<tr>
<td>Checks and inspections</td>
<td>05-32</td>
<td></td>
</tr>
<tr>
<td>Reassembly</td>
<td>05-33</td>
<td></td>
</tr>
<tr>
<td>Test stand inspection</td>
<td>05-33</td>
<td></td>
</tr>
<tr>
<td>Service data and specs.</td>
<td>05-33</td>
<td></td>
</tr>
<tr>
<td>Trouble diagnosis &amp; corrections</td>
<td>05-36</td>
<td></td>
</tr>
</tbody>
</table>

May 1983
IGNITION, STARTING, CHARGING SYSTEM

BATTERY

WARNING:

a. Do not touch both the positive and negative terminals of the battery at the same time with your bare hands.
b. In case of necessity use a 12-volt booster battery with jumper leads for starting the engine.

CHECKS

1. The container has no cracks in it.
2. Verify that electrolyte level covers electrodes of about $4 \pm 5$ mm (0.16 4 0.2 in).
3. The top of the battery is clean and the terminals are not oxidized or dirty.
4. The lead terminals are well fastened on to the battery terminals and make good contact.

CLEANING

1. Clean the top of the battery, its terminals and the lead terminals with a solution of sodium bicarbonate in water.
2. Before reassembling terminals, it is necessary to grease them with the prescribed grease: Grease REINACH E 10 Tat.

WARNING:
Do not let the cleaning fluid get into the battery: it will react with the electrolyte. The electrolyte is acid and therefore dangerous to eyes, hands and clothes.

SPECIFIC GRAVITY

1. Verify that electrolyte is at correct level.
2. By means of a bulb hydrometer, extract electrolyte from each cell and check the specific gravity.

3. Take the temperature "t" of the electrolyte with a thermometer.
4. Calculate the specific gravity at $25^\circ C (77^\circ F)$ from the formula

$$ s_{g25} = s_{gt} + 0.0007 \ (t - 25) \ (kg/dm^3) $$

where:

- $s_{gt}$ = Specific gravity of electrolyte at $t^\circ C$
- $t$ = Electrolyte temperature

Examples

1. Electrolyte s.g. at $15^\circ C (59^\circ F)$:
   s.g. at $25^\circ C (77^\circ F)$ will be:

$$ s_{g25} = 1.290 + 0.0007 (15 - 25) $$

   = 1.283 kg/dm$^3$

   (35.51 lb/cu in)

2. Electrolyte s.g. at $35^\circ C (95^\circ F)$:
   s.g. at $25^\circ C (77^\circ F)$ will be:

$$ s_{g25} = 1.275 + 0.0007 (35 - 25) $$

   = 1.282 kg/dm$^3$

   (35.48 lb/cu in)

3. Compare then the density calculated at $25^\circ C (77^\circ F)$ with the value prescribed for an efficient battery.

An efficient battery electrolyte specific gravity is

$$ d = 1.28 \pm 0.01 \ kg/dm^3 $$

6. If necessary charge the battery.

Batteries left on the shelf or in cars unused for long periods gradually lose their charge. Therefore they need to be charged up again when they are to be used.

CHARGING

WARNING:

a. Remove the negative connection before starting to charge the battery.
b. Do not let the electrolyte heat up above $45^\circ C (113^\circ F)$ during charging.

CAUTION:

a. Do not use naked flames near the battery while charging.
b. First connect the battery to the charger and then switch on the charger.

CELLS TEST

This test should be performed with the correct electrolyte s.g.

Measure the discharge voltage at the terminals of each cell.

1. Remove the plugs from the filler holes.
2. Put the test probes in two adjacent holes (positive and negative) as shown. The needle should flip over to the green zone (charged).
3. Repeat for the other two pairs of holes.

4. If the needle stops in the red zone (low charge) at the same point for each cell, charge the battery.
IGNITION, STARTING, CHARGING SYSTEM

5. If the needle stops in the red zone (low charge) but at quite different points for the different cells, put in another battery.

USING THE ELECTRONIC BATTERY TESTER (MOTOROLA)

Connect the positive instrument clip to battery positive (+) and negative to negative (−). Set battery voltage switch (3) to 12V, temperature compensator (2) to the estimated battery temperature, and current calibrator (4) to the battery amps according to type.

Voltage test
1. Switch selector (1) to VOLT.
2. The reading on the VOLT scale must be greater than 12.4 V.

3. If battery voltage shows less than 12.4V, charge the battery and repeat the test. If the voltage again shows less than 12.4V, a cell may be shortcircuited. Change the battery for another one.

Battery state
1. Set the instrument selector switch to "Cond. Batt."
2. The needle should flip over to the GREEN zone on the RED-GREEN scale.
3. If it does not, put in another battery.

Power test
1. Set instrument selector switch to "kW".
2. The needle should read between 2 and 4 kW on the kW scale.
3. If it does not, put in another battery.

Charge test
1. Set instrument selector switch to VOLT.
2. Start the engine and let it idle until the needle settles to its reading.
3. The reading should be between 13.6 and 15V.
4. If the reading is outside (above or below) these limits, check the alternator for defects, especially the voltage regulator (see Charging - Checks and Inspections).

Also check alternator belt tension (see: Group 00 Engine Maintenance).

Starting test
1. Set instrument selector switch to VOLT.
2. Take the ignition HT lead off the coil.
3. Start the engine and check the needle does not drop below 9 V on the Volt scale.
4. If it does, examine the starting system (see: Starting).

SERVICE DATA AND SPECIFICATIONS

Technical Data

<table>
<thead>
<tr>
<th>Battery</th>
<th>1200</th>
<th>1350 - 1500</th>
<th>1500 Quadrifoglio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>V</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>Ah</td>
<td>43</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>Discharge current</td>
<td>A</td>
<td>181</td>
<td>255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>185</td>
<td>275</td>
</tr>
<tr>
<td>Electrolyte s.g.</td>
<td>kg/dm³</td>
<td>1.28 ± 0.01</td>
<td>(35.43 ± 0.27)</td>
</tr>
<tr>
<td></td>
<td>(lb/in³)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

05-3
May 1983
General Specifications

FLUID AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery terminals</td>
<td>GREASE</td>
<td>Grease REINACH: E 10 Tac Std. no. 3671 - 69812</td>
<td></td>
</tr>
</tbody>
</table>

STARTER

WIRING DIAGRAM

- A1: Battery
- A1: 1. Starter
- G1: Fuseholder box
- G85: Front service junction
- El: Ignition switch

May 1983

05-4
IGNITION, STARTING, CHARGING SYSTEM

BOSCH STARTER MOTOR

1. Dust cover  
2. Retaining ring  
3. Bush  
4. Commutator casing  
5. Brush holder  
6. Brush spring  
7. Excitation winding lug  
8. Brush  
9. Yoke  
10. Electromagnet

11. Fork  
12. Rubber block  
13. Lamination  
14. Rotor  
15. Starting clutch  
16. Snap ring  
17. Pinion stop ring  
18. Drive housing  

May 1983
1 Washer  
2 Bush  
3 Commutator casing  
4 Brush holder  
5 Brush spring  
6 Brush  
7 Yoke  
8 Electromagnet  
9 Plate  
10 Locator  
11 Trunnion  
12 Fork  
13 Screw  
14 Rotor  
15 Starting clutch  
16 Snap ring  
17 Pinion stop ring  
18 Drive housing  
19 Bush
8. Unscrew the two screws securing the electromagnet to the drive housing and take out the electromagnet.
9. Remove the rubber block with the lamination.
10. Unscrew the bolt serving as clutch fork pivot.

6. Extract the two positive brushes from the brush holder and take off the brush holder with the two negative brushes.

7. Unscrew the excitation winding lug securing nut from the electromagnet terminal and withdraw the yoke complete with excitation winding.

11. Withdraw the rotor together with the starting clutch and the forked lever.

12. Free the pinion stop ring from the snap ring with a box spanner.
13. With a pair of pliers remove the snap ring from the rotor shaft and slip off the pinion stop ring.

14. Withdraw the starting clutch.
15. Unscrew the inductor winding 1 securing screw on the yoke 2 and extract the winding.

1 Inductor winding 2 Yoke

16. If necessary, extract the bushes from the commutator casing and the drive housing with the use of a punch.

**DUCELLIER STARTER MOTOR**

Hold the motor in a vice with caps.

1. Hold the pinion firm with pliers and unscrew the pinion adjusting screw 2. Take out the screw and the washers under it.

2. Unscrew the two nuts clamping the commutator casing 2 and the stator yoke on the pinion housing on to the stud bolts. Remove the commutator casing with the brush holder 3.

3. Unscrew the excitation winding lug 1 fixing nut on the electromagnet. Remove the stator and the rotor 6.

4. Punch on the trunnion 8 for the fork on the pinion housing 5.

5. Unscrew the nuts 2 and remove the electromagnet 1.

6. Hold the electromagnet in a vice with caps. Use a screwdriver to keep the electromagnet shaft from turning and unscrew the pinion clutch fork 2 clamping nut 1. Remove the fork, spring and striker.

7. If necessary take the inductor winding out of the yoke (see: Bosch Starter Motor, step 15.) and the bushes from out of the commutator casing and the drive housing.

**CAUTION:** When unscrewing nut 1, count the exact number of threads to when it is free so that it may be screwed up the same amount in re-assembly and correct fork adjustment had.

8. Strip the rotor as for the Bosch (see: Bosch Starter Motor, steps 12 and 13).

**MARELLI STARTER MOTOR**

Hold the starter motor in a capped vice.

1. Unscrew the two screws 3 securing the dust cover and take it off.

2. Unscrew the two nuts 2 with washers securing the commutator casing 1 and remove it.

3. Unscrew the electromagnet excitation winding lug nut and take the yoke out of the starter motor containing the stator windings.

4. Extract the pivot cotter pin and take the starter engaging fork pivot.

5. Punch on the trunnion 6 for the fork on the pinion housing 5.

1 Nut 2 Fork

1 Electromagnet 2 Nuts

05-9

May 1983
IGNITION, STARTING, CHARGING SYSTEM

5. Remove the rotor electromagnet assemblage and take the rotor to pieces as for the Bosch starter motor (see: Bosch Starter Motor, steps 12., 13. and 14.).

6. If necessary, take the field winding out of the yoke (see: Bosch starter motor. step 15) and the bushes out of the commutator casing and out of the drive housing.

CHECKS AND INSPECTIONS

Before making any electrical inspection thoroughly blow-clean the components and especially the ends of the winding with compressed air and clean the commutator with a cloth slightly wetted with petrol.

Commutator wear
1. Put the rotor on a lathe.
2. Place a magnetic-based centesimal dial gauge on the lathe carriage with the gauge feeler in contact with the commutator.
3. Bosch and Marelli Starter Motors
   Eccentricity should not be more than the stated maximum.

   Max permissible commutator eccentricity
   b.06 mm (0.0024 in)

4. If greater errors than these are pound or if the commutator is badly scored, put in a new rotor unless it would seem enough to turn the rotor and smooth it with a piece of cloth for rotors.

Bosch and Marelli Starter Motors
Max turning depth on nominal thickness
0.25 mm (0.0098 in)

Commutator continuity test
1. Set the tester to the $\Omega \times 100$ scale.
2. Put the prods on the commutator segments of the pack under test:
3. The test should show current flow.

If there is no electrical continuity, put in a new rotor.

CAUTION:
Repeat steps 2. and 3. for all the pairs of commutator segments.

Rotor insulation test
1. Set the tester to $\Omega \times 1$ scale.
2. Put one prod on the commutator and the other on the segment pack or shaft.
3. There should be no sign of current flow by the tester.

CAUTION:
Repeat steps 2. and 3. for all the commutator segments.

Rotor shortcircuit test on test stand
1. Position the rotor between the pole pieces of the rotor testing apparatus and switch on.
2. Slowly rotate the rotor and rest the steel blade on the rotor pack.
3. The blade will stick to the pack in correspondence with the faulty lead cables if there is a short circuit.

Excitation winding insulation test
1. Set the tester to the $\Omega \times 1$ scale.
2. Put one prod on the lug of the induction windings and the other prod on the yoke.

May 1983

OS-10
IGNITION, STARTING, CHARGING SYSTEM

3. The tester should give no sign of current flow.

2. Put one prod on the brush holder plate and the other prod on a positive brush holder.

3. The tester should give no sign of current flow.

4. Repeat the test on the other positive brush holder.

4. If insulation is broken, remove the excitation winding from the yoke and put another winding in its place (see: Bosch Starter Motor, step 15).

Excitation winding continuity test
1. Set the tester to the Ω x 100 scale.
2. Put one prod on the induction winding cable and the other prod on the positive brush. (Repeat with the other brush).
3. The tester should show current flow.

4. If continuity is broken, put in another brush holder plate.

Electromagnetic efficiency check
1. Shortcircuit the electromagnet with the starter pin and connect its positive pole to the positive terminal of a battery.
2. Connect the battery’s negative terminal to the electromagnet’s yoke.

3. The starter drive fork actuator should trip. If it does not, put in another electromagnet.

Pinion efficiency check
1. Rotate the pinion clockwise as shown in the figure. It should rotate freely.
2. Rotate the pinion counterclockwise, i.e., in the direction of meshing. It should lock.

4. If the pinion does not work properly or the teeth show excessive signs of wear replace the starter clutch.

Brush spring check
1. Check that the brush springs have not lost their elasticity and still ensure good brush contact on the commutator.
2. If necessary, put in new springs.

Brush wear inspection
Check that the stator and rotor brushes are not chipped or dirty with carbon deposits and check that their lengths are within the prescribed limits.

Brush lengths (min)
Bosch 11 mm (0.433 in)
Ducellier 9 mm (0.354 in)
Marelli - mm (- in)

Bush wear inspection
1. Check that the two bushes on the front and rear rotor shaft bearings are not excessively or unevenly worn. Side play between shaft and bush should lie within the limits.

Shaft-bush clearance
(0 bush 0 shaft) = 0.02 ± 0.05 mm
(0.00079 ± 0.00197 in)

1. If wear is excessive, put in new bushes (see: Disassembly Bosch...
IGNITION, STARTING, CHARGING SYSTEM

**Starter Motor, step 16).**

**CAUTION:**
Make sure the bushes are assembled properly and the rotor shaft turns easily and without play.

**REASSEMBLY**
Follow the disassembly steps in the opposite order and lubricate the following parts with the prescribed grease.
Surfaces in motion relative to the starter motor
- Commutator casing bush
- Drive housing bush
- Pinion gear
- Starting system sliding spiral coupling
- Electromagnet push rod

**TEST STAND INSPECTION**
Put the starter motor on the test stand to correspond with the crown wheel and connect up to the electrical system.

**CAUTION:**
The battery used in the test should have a high enough capacity to avoid voltage variations.

1. **Under-load test**
   1. Apply the rated voltage to the starter motor. Switch on the starter so that the pinion turns the crown wheel and check for good working.
   2. Brake the crown wheel and adjust the absorber current to the value in the under-load test. The torque should be that shown in the technical particulars.

2. **Across-line test**
   1. Apply the rated voltage to the starter motor.
   2. Lock the crown wheel brake.
   3. Start up the starter motor and take a quick reading. Current, voltage and torque should be those given in the technical particulars.

3. **Test with e.m. switch on the starter motor**
   1. Remove the starter motor away from the crown wheel so that the pinion will not engage it.
   2. Apply the rated voltage to the starter motor. The absorbed current should be that given in the technical data.
   3. **PICK-UP/CUT-IN** voltage should be that given in the technical data.

**SERVICE DATA AND SPECIFICATIONS**

**TECHNICAL DATA AND INSPECTION**

**Starter Motor**

<table>
<thead>
<tr>
<th>Item</th>
<th>533.051</th>
<th>533.052</th>
<th>536.611</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage V</td>
<td>10</td>
<td>10</td>
<td>9.8</td>
</tr>
<tr>
<td>Min brush length mm (in)</td>
<td>11 (0.433)</td>
<td>9 (0.354)</td>
<td></td>
</tr>
<tr>
<td>Max commutator eccentricity mm (in)</td>
<td>0.06 (0.0024)</td>
<td></td>
<td>0.06 (0.0024)</td>
</tr>
<tr>
<td>Shaft-bush side play mm (in)</td>
<td>0.02 ± 0.05 (0.0008 ± 0.002)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Under-load test (pinion meshed with crown wheel with torque dynamometer)**
- Voltage V = 10
- Absorbed current A = 230
- Speed rpm = 1,450
- Torque N·m = 5 (0.5) (3.62)

**Across-line test (pinion meshed with locked crown wheel)**
- Voltage V = 8
- Absorbed current A = 400
- Torque N·m = 10.5 (1) (7.231)

May 1983
05-12
IGNITION, STARTING, CHARGING SYSTEM

Starter Motor

<table>
<thead>
<tr>
<th>Item</th>
<th>533.051</th>
<th>533.052</th>
<th>536.611</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over running torque</td>
<td>N*cm</td>
<td>(kg-cm)</td>
<td>(in-lb)</td>
</tr>
<tr>
<td></td>
<td>13 ÷ 22</td>
<td>(1.3 ÷ 2.2)</td>
<td>(1.13 ÷ 1.91)</td>
</tr>
<tr>
<td>EM Switch on starter motor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>→ Max absorption current at rated voltage</td>
<td>A ≤40</td>
<td>≤40</td>
<td>55</td>
</tr>
<tr>
<td>→ Min pickup voltage</td>
<td>v 8</td>
<td>≤8</td>
<td>7</td>
</tr>
<tr>
<td>Pinion module</td>
<td>2.116</td>
<td>2.116</td>
<td>2.116</td>
</tr>
</tbody>
</table>

TROUBLE DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter motor does not turn and no current flows</td>
<td>Break in electric circuit between battery and starter motor</td>
<td>Locate and repair it. Check battery terminals and starter cable terminals. Tighten up the securing screws</td>
</tr>
<tr>
<td></td>
<td>Break in electric circuit between starter motor and starter switch</td>
<td>Locate and repair it. Check switch contacts and replace if necessary. Clean the terminals and tighten up the connections</td>
</tr>
<tr>
<td></td>
<td>Battery terminals dirty or loose connections</td>
<td>Clean the terminals and tighten up the connections. Clean the moving and fixed contacts of the switch when possible and replace it if necessary.</td>
</tr>
<tr>
<td></td>
<td>Starter motor electromagnet or winding or is earthed</td>
<td>Replace the brushes with other original ones after checking state of commutator.</td>
</tr>
<tr>
<td></td>
<td>Excessively worn brushes not making contact on the commutator</td>
<td></td>
</tr>
<tr>
<td>Current flows but starter motor does not turn, or turns slowly, or starting does not take place</td>
<td>Rotor is rubbing against the pole pieces or is being held between the poles</td>
<td>Replace the bearings if the bushes are too worn. Check bearing alignment. Examine rotor shaft. See that the poles are well located and securely clamped into the yoke. Replace the rotor and the piece with the seized-up bush. Take out the field coils and put in new ones. Replace the rotor. Clean the carbon and copper dust off-the commutator and brush holders and if necessary replace the rotor.</td>
</tr>
<tr>
<td></td>
<td>Rotor shaft seized µ∅</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Field winding short circuited or earthed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Broken or earthed rotor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rotor short circuited</td>
<td></td>
</tr>
<tr>
<td>Starter motor turns but starting does not take place</td>
<td>Crown wheel teeth worn: pinion does not engage</td>
<td>Replace starting ring gear.</td>
</tr>
</tbody>
</table>

May 1983
<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
</table>
| Starter motor turns but starting does not take place (continued) | * Wrong assembly: pinion engages only partially  
* Impurities in the coupling: Clutch does not slide on rotor shaft  
* Pinion engages ring gear properly but the engine does not start | Check concentricity and pinion-ring gear distance  
Clean and lubricate. If necessary clean the coupling completely  
Pinion free wheel defective and must be replaced. Faulty clutch to overhaul or replace. Electra-magnet not working properly: repair or replace |
| Starter motor turns normally but makes excessive or unusual noise | * Defective mechanical parts  
* Foreign bodies have got into it | Check bearings. Examine bushes and if necessary replace bearings  
Clean them out |
| Starter motor does not develop max power | * Brush contact on commutator not good  
* Brushes do not slide freely in the guides | Replace brushes or snug them by running the motor on no-load for some time. Check brush spring loading and replace them if they have lost their elasticity  
Clean the brush-holder guides or replace the brush holders if necessary |
| Excessive brush wear | * Ovalized commutator  
* Mica projecting out of commutator copper sections  
* Brushes press excessively on commutator  
* Wrong brushes | Turn within in prescribed limits, remove mica and clean commutator  
Remove mica and clean commutator  
Check brush spring loadings for prescribed values  
Replace with others of prescribed type |
| Sparking at the commutator | * Electrical overload in general  
* Slack brush springs  
* Mica projecting from copper | Overhaul the engine  
Replace brush springs  
Remove mica and clean the commutator |
IGNITION, STARTING, CHARGING SYSTEM

BOSCH ALTERNATOR

1  Distance piece
2  Semipulleys
3  Distance piece
4  Fan
5  Stay bolt
6  Drive housing
7  Control side bearing
8  Plate
9  Feather key
10  Rotor
11  Regulator side bearing
12  Stator
13  Diode - holder plate
14  Regulator mounting
15  Brush holder-voltage regulator
16  Brush spring
17  Brush
IGNITION, STARTING, CHARGING SYSTEM

MARELLI ALTERNATOR

DISASSEMBLY

CAUTION:
The following procedures are intended for part replacement. If used for component checking and inspection purposes, do not unsolder.

BOSCH ALTERNATOR

1. Hold the alternator pulleys 2 in a vice with caps, Release fan 1 and pulley to rotor shaft 4 securing nut 3. Take off the nut, the lock washer, the two semipulleys with distance pieces and the fan with washers and feather key.

2. Unscrew the two screws securing the voltage regulator 1 to its mounting 2 and take out the brush holder regulator unit.
3. Hold the drive housing 1 in a vice and unscrew the stay bolts clamping the regulator mounting 2 to the housing 1.

4. Remove the regulator mounting by tapping it on its edge with a plastic hammer as shown in the illustration.

5. Extract the rotor 1 by tapping the rotor shaft 2 on its end with a plastic hammer as shown in the illustration.

6. Unsolder the stator 1 (rotor) three-phase connections to the diode holder plate 2.

7. Unscrew the screws 1 securing the diode holder plate to the regulator mounting and extract the diode holder plate.

8. Unscrew the two screws 1 securing the bearing retaining plate 2 to the drive housing and extract the bearing.

9. Extract the bearing 1 on the drive housing end of the rotor shaft 2 with an extractor (see following figure) or a punch press with half-plates.

**CAUTION:**
At reassembly use a new bearing if the old one is worn or damaged and put it on the press with the help of a pipe which must rest only on the inner ring of the bearing.

**DUCELLIER ALTERNATOR**

1. Hold the alternator in a vice with caps. Unscrew the screws 1 and 2 securing the voltage regulator 3 to its mounting and extract the voltage regulator.

2. Unscrew the two screws 2 securing the brush holder 1 and the earthing plate 4.

3. Unscrew the cable terminal securing screw 3 and take out the brush holder.
7. Remove the regulator mounting complete with stator and rectifier bridge (the diode plate) by tapping it on its edge with a plastic hammer.

10. Extract the rotor by tapping the end of the shaft with a plastic hammer as shown in the illustration.

8. Unsolder the stator three-phase connections to the rectifier bridge tabs.

11. Unscrew the three screws securing the bearing retaining plate to the drive housing and extract the bearing (see: Bosch Alternator - step 6).

12. Take the bearing off the drive housing side of the rotor shaft (see: Bosch Alternator - step 7).

**MARELLI ALTERNATOR**

1. On a vice fitted with protective jaws, secure pulley of alternator. Loosen nut securing pulley and fan to rotor shaft; remove nut, washer, pulley and fan together with spacers and feather.
2. Disconnect voltage regulator connectors 1 and 2 of rectifier bridge. Unscrew screw securing brush holder 4 to voltage regulator support 3 and withdraw it.

5. Withdraw rotor 1 hammering by means of a plastic hammer on shaft 2 of rotor itself, as shown in figure.

6. Unscrew nut and screw of rectifier bridge guard 1; withdraw power pin 2 and remove guard.

7. Unsolder connections of stator three phases to finned rectifier bridge.

8. Withdraw rectifier bridge and stator from voltage regulator support; then unscrew positive terminal with relevant washer.

9. By means of an extractor (see: Regulator Alternator Bosch) or a suitable press with plates and punch, withdraw bearing on voltage regulator support side from rotor shaft.

CAUTION:
On reassembly, use a new bearing (in case bearing is damaged or worn) by mounting it on press with the aid of a tube which must face bearing retaining ring.

10. On a vice fitted with protective jaws, tighten control support 1.

11. By means of a drilling machine, remove then rivets 2 securing plate 3 retaining bearing to control support.

12. Withdraw bearing.

CAUTION:
On reassembly, use a new bearing, in case the removed one is damaged or worn.

CHECKS AND INSPECTIONS

CAUTION:
Before starting electrical checks blow-clean all the components thoroughly with compressed air.

1. Slip rings
(1) Inspect for wear,
(2) If the rings are scored, but not badly, put the rotor, on a lathe and rectify the rings with rotor cloth. If the rings are badly scored, put in a new rotor.
2. Rotor winding continuity test
   (1) Set the tester to the $\Omega \times 1$ scale.
   (2) Put the prods on the slip rings.
   (3) Winding resistance should be:

   - Bosch alternator $4 \pm 0.1 \Omega$
   - Marelli alternator $3.1 \pm 0.2 \Omega$
   - Ducellier alternator $6.5 \pm 0.2 \Omega$

   (4) If there is no electrical continuity, put in a new rotor.

3. Rotor insulation test
   (1) Set the tester to the $\Omega \times 1$ scale.
   (2) Put one prod on a slip ring and the other prod on the rotor core.
   (3) The tester should show no sign of current flow.
   (4) If the insulation is broken, put in a new rotor.

4. Stator windings insulation test
   (1) Set the tester to the $\Omega \times 1$ scale.
   (2) Put one prod on the stator pack and the other prod on the terminals of the first phase, then of the second phase, and finally of the third phase.
   (3) The tester should show no sign of current flow.
   (4) If there is insufficient insulation, put in a new stator.

5. Stator windings continuity test
   (1) Set the tester to the $\Omega \times 100$ scale.
   (2) Test for electrical continuity between: 1-2, 1-3, 2-3.
   (3) In each case the tester should show current flow.
   (4) If there is no continuity in the windings, put in a new stator.

6. Brush wear inspection
   6-1. Bosch Alternator
   (1) The brushes in the voltage regulator should not be chipped or dirty with carbon deposits; their lengths should be within the prescribed limits.
   (2) In case of excessive wear, unsolders the brush cable as shown in the illustration and put in new brushes.

   - Brush projection min. 5 mm (0.197 in)

   6-2. Ducellier Alternator and Marelli
   (1) The brushes in the brush holder should not be chipped or dirty with carbon deposits; their lengths should be within the prescribed limits.
   (2) In case if excessive brush wear, put in new brushes: the one by simply withdrawing it from its seat on the brush holder and the other by withdrawing it after unscrewing its securing screw.
7. Brush spring inspection
   The brush springs should be stiff enough to assure good brush contact on the slip rings. If they are not, put in a new voltage regulator unit.

8. Brush holder unit electrical continuity inspection
   (1) Set the tester to the $\Omega \times 100$ scale.
   (2) Put one prod on one and then on the other brush
   (3) Put the other prod on the terminal
   (4) The tester should show current flow.
   (5) If there is no electrical continuity, check the brush holder and if necessary put in new brushes and/or brush holder.

   Reverse the two prods. The tester should show the prescribed resistance.

   Direct current resistance
   \[ R = 0 \div 10 \Omega \]

   (2b) The rester shows current flow and therefore the prescribed resistance. Reverse the prods and the tester shows no current flow (infinite resistance).

   CAUTION:
   All excitation diodes must be tested in this way.

9. Diodes inspection
   9-1 Bosch Alternator
   (1) Set the tester to zero on the $\Omega \times 100$ scale.
   (2) Put the prods on a diode terminals.
   Then either:
   (2a) The tester shows no current flow (infinite resistance).

   Inverse current resistance
   \[ R = \infty \]

   (3) If the tester readings are not those prescribed, put in a new diode holder plate.

   9-2 Ducellier Alternator and Marelli
   Power diodes - Bridge direct rest
   (1) Zero tester in the $\Omega \times 1$ range scale.
   (2) Carry out direct test of positive bridge, by setting the tester negative probe on positive heat sink of bridge and the other probe, sequentially, on each end of the three phases of bridge. Check on tester, that resistance value for direct current is the required one.
   (3) Carry out direct test of negative bridge, by setting the tester positive probe on negative heat-sink of bridge and the other probe, sequentially, on each end of the three phases of bridge. Check on tester, that resistance values is the required one.

   Energization Diodes Direct test
   (1) Zero tester in the $\Omega \times 1$ range scale.
   (2) Connect tester negative probe with output of energization diodes (terminal $D+$) and second probe (in sequence) with the three phases.
   (3) Verify on tester, that resistance values for direct current are the required ones.

   Diode $R$ for direct current
   \[ R = 0 \div 10 \Omega \]

   Energization Diodes Inverted test
   (1) Zero tester in the $\Omega \times 100$ range scale.
   (2) Operate as per direct test by inverting tester probes between output of energization diodes (terminal $D+$) and the three phases (in sequence). Verify, on tester, that current is not present.

   Diode resistance in direct conduction
   \[ R = 0 \div 10 \Omega \]

   Power diodes - Bridge inverted test
   (1) Zero tester in the $\Omega \times 100$ range scale.
   (2) Carry out inverted-test of bridge operating as per direct test, by inverting (in sequence) probes between positive heat sink and the three phases of bridge when testing positive bridge.
   Inverts (in sequence) probes between negative heat sink and the three phases when testing negative bridge.
   (3) Verify on tester that current is not present.

   Diode resistance for inverted conduction
   \[ R = \infty \Omega \]

   05-23
   May 1983
IGNITION, STARTING, CHARGING SYSTEM

TEST STAND INSPECTION
1. Put the alternator on the test stand and connect it to the stand's electric motor.
2. Make the following electrical connections:
   (1) Terminal B+ to test stand positive.
   (2) Terminal B+ to the pilot light and to terminal D+.
   (3) Connection for test stand feet.
3. Let the alternator rotate at 3,000 rpm for an hour with rheostat load to give a voltage of $13 \div 14$V.
4. Slow down the motor until the current output is from $1 \div 2$ A and then disconnect load rheostats to get a voltage again of $13 \div 14$V. Take the current reading and the corresponding rpm.
5. Keeping the voltage constant, vary the speed and the load rheostats and take current readings together with the corresponding rpm at different points up to max current output.
6. The output current readings at the various speeds should all be equal to or greater than those reported in the Technical Data.

CAUTION:
If the required resistance values are not measured, replace rectifier bridge.

REASSEMBLY
Reassemble the alternator following the disassembly steps in the opposite order, and taking care that:

CAUTION:
When soldering the three stator cables on to the diode holder plate and, for the Bosch Alternator, changing the brushes, the soldering must be done as quickly as possible so the diodes are not overheated.

SERVICE DATA AND SPECIFICATIONS

<table>
<thead>
<tr>
<th>Alternator</th>
<th>Alfa Romeo Class</th>
<th>BOSCH 0.120.489.798</th>
<th>DUCELLIER</th>
<th>MARELLI AA 125 - 14V - 45A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal Voltage</td>
<td>V</td>
<td>-</td>
<td>-</td>
<td>14</td>
</tr>
<tr>
<td>Voltage range</td>
<td>V</td>
<td>-</td>
<td>13.75 - 14.35</td>
<td>-</td>
</tr>
<tr>
<td>Current output</td>
<td>Max current output</td>
<td>A</td>
<td>45</td>
<td>43 (1)</td>
</tr>
<tr>
<td></td>
<td>Output starts</td>
<td>rpm</td>
<td>1250</td>
<td>1100 (1)</td>
</tr>
<tr>
<td></td>
<td>2/3 max output</td>
<td>rpm</td>
<td>2400</td>
<td>2300 (1)</td>
</tr>
<tr>
<td></td>
<td>max output</td>
<td>rpm</td>
<td>6000</td>
<td>8000 (1)</td>
</tr>
<tr>
<td>Brush wear limit</td>
<td>mm</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(in)</td>
<td>(0.197)</td>
<td>(0.236)</td>
<td>(0.276)</td>
</tr>
<tr>
<td>Rotor winding resistance</td>
<td>Ω</td>
<td>4 ± 0.1</td>
<td>6.5 ± 0.2</td>
<td>3.1 ± 0.1</td>
</tr>
<tr>
<td>Voltage regulator resistance</td>
<td>Ω</td>
<td>58 ± 72</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Diodes resistance</td>
<td>Ω</td>
<td>0 ± 10</td>
<td>0 ± 10</td>
<td>0 ± 10</td>
</tr>
</tbody>
</table>

(1) Minimum readings when hot after 1 hour's working at 5000 rpm with loading of 25 A

May 1983

05-24
## TROUBLE DIAGNOSIS AND CORRECTIONS

Before starting alternator troubleshooting, the battery should be fully charged (see: Battery)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternator does not charge</td>
<td>• Slack belt</td>
<td>Tension the belt</td>
</tr>
<tr>
<td></td>
<td>• Broken charging or earthing circuit</td>
<td>Check the belt</td>
</tr>
<tr>
<td></td>
<td>• Faulty brushes</td>
<td>Put in new brushes</td>
</tr>
<tr>
<td></td>
<td>• Excitation diodes short circuited</td>
<td>Put in new diode holder plate</td>
</tr>
<tr>
<td></td>
<td>• Broken excitation circuit</td>
<td>Check the circuit</td>
</tr>
<tr>
<td></td>
<td>• Broken rotor winding</td>
<td>Put in new rotor</td>
</tr>
<tr>
<td></td>
<td>• Inefficient voltage regulator</td>
<td>Put in new voltage regulator</td>
</tr>
<tr>
<td></td>
<td>• Stator winding earthed</td>
<td>Put in new stator</td>
</tr>
<tr>
<td>Insufficient or irregular output</td>
<td>• Slack belt</td>
<td>Tension the belt</td>
</tr>
<tr>
<td></td>
<td>• Intermittent break in the charging circuit</td>
<td>Check the circuit</td>
</tr>
<tr>
<td></td>
<td>• Worn brushes</td>
<td>Put in new brushes</td>
</tr>
<tr>
<td></td>
<td>• Inefficient voltage regulator</td>
<td>Put in new voltage regulator</td>
</tr>
<tr>
<td></td>
<td>• An excitation diode disconnected or earthed</td>
<td>Put in new diode holder plate</td>
</tr>
<tr>
<td></td>
<td>• Rotor partly short circuited</td>
<td>Put in new rotor</td>
</tr>
<tr>
<td></td>
<td>• Stator disconnected, earthed or partly short circuited</td>
<td>Put in new stator</td>
</tr>
<tr>
<td>Excessive output</td>
<td>Inefficient voltage regulator</td>
<td>Put in new voltage regulator</td>
</tr>
<tr>
<td>Noisy alternator</td>
<td>• Worn belt</td>
<td>Put in new belt</td>
</tr>
<tr>
<td></td>
<td>• Loose pulley</td>
<td>Tighten up the nut</td>
</tr>
<tr>
<td></td>
<td>• Poor bearings</td>
<td>Put in new bearings</td>
</tr>
<tr>
<td></td>
<td>• An excitation diode short circuited</td>
<td>Put in new diode-holder plate</td>
</tr>
<tr>
<td></td>
<td>• Loose alternator</td>
<td>Tighten up the screws on the bracket</td>
</tr>
</tbody>
</table>
IGNITION, STARTING, CHARGING SYSTEM

DESCRIPTION

The electronic ignition is an inductive discharge transistorized system without contacts, constituted by the following components.

a. Ignition distributor with magnetic pulse generator with magnetic pulse generator A5 with mechanical centrifugal spark advance and vacuum advance calibrator.

b. Ignition coil A8 with electronic module.

c. Electronic module N1

The ignition distributor with magnetic pulse generator differs from the traditional type as, in the place of contacts and of capacitor, it has a magnetic pulse generator (stator) and, in the place of the cam, a toothed timer (rotor).

High voltage distribution to spark plugs is obtained by means of a rotor arm and cap. The pulses are generated by a magnetic pulse generator located into a variable air gap circuit. During rotation of distributor shaft, each time a tooth of the timer passes in front of the fixed pole piece expansion, a signal is generated (by induction) at the winding ends of coil (pulse generator), with consequent control of the electronic module.

The electronic module, constituted by a set of integrated circuits mounted onto a ceramic support enclosed into a proof container, in its turn, mounted together with coil, onto an aluminium finned support which also operates as heat dissipator. Between the electronic module and the support, it is interposed a grease coat with thermal high conductivity, with the purpose of ensuring heat maximum elimination and stable performances.

Besides conducting or interdicting the output transistor, the electronic module has also the purpose of processing the signal provided by the magnetic pulse generator of distributor, conducting one linked with the engine rotation revolution numbers. It is thus obtained a control of the coil charge current and of time duration of conduction with generation of constant energy spark, independently of engine speed and battery voltage.

A coupling capacitor, secured to module radiator and electrically connected with coil terminal and to ground, allows optimization of primary voltage wave form on coil and, consequently, higher performances.
IGNITION, STARTING, CHARGING SYSTEM

CHECKS AND ADJUSTMENTS ON CARS

1. Check general rules

CAUTION:
Each check for presence of voltage or current in electric connections, via sparking, that is, ground discharging the high-and low voltage points, must be avoided unless they are required special verifications expressly listed with application of special devices. Besides, the following operations must be avoided:

- Connection interruption between tap of coil high voltage and distributor, by disconnecting the relevant cable (coil side) when motor is running or during starting phase.
- Ground connection of coil low voltage terminal connected with tachometer.
- Use of trouble diagnosis equipments which allow the short-circuit the low voltage signal, between coil primary winding and tachometer or not allowed.

WARNING:
Before powering the unit, make sure that connectors of the electric system are properly inserted and that the module coil units is secured to ground so as to ensure an effective connection.

2. System functioning verification

(1) With ignition key inserted (ignition switch closed) and engine still, check, by means of voltmeter, that the voltage on terminal 15 of coil is equal to the battery voltage (12V).

(2) After carrying out the ignition timing operation (for timing see: Group 00 Ignition System and Supply) check possible interruptions in the coil windings. To this purpose, disconnect the tachometer cable and, with non-inserted ignition key, check via ohmmeter, that resistance values of both primary and secondary windings are the prescribed ones.

Warning: mardil i.2 5,000
- Bosch

(3) With ignition key not inserted (ignition switch open) verify functioning of ignition distributor by disconnecting the connector between module coil unit and distributor and checking via ohmmeter, that resistance of pulse generator coil corresponds to the prescribed value.

(4) Verify that resistance internal to rotor arm of ignition distributor corresponds to the prescribed value.

WARNING:
Put on insulation gloves and start the engine verifying that spark occur regularly between cable and ground.

<table>
<thead>
<tr>
<th>Distributor</th>
<th>Marelli</th>
<th>Bosch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse generator coil resistance</td>
<td>730±5%</td>
<td>1100±10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distributor</th>
<th>Marelli</th>
<th>Bosch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor arm resistance</td>
<td>5,000</td>
<td>1,000</td>
</tr>
</tbody>
</table>

May 7983

OS-28
MARELLI DISTRIBUTOR

1. Cap
2. Cap securing screw
3. Rotor arm securing screw
4. Rotor arm
5. Pulse generator securing screw
6. Pulse generator (stator)
7. Insulating support
8. Spring
9. Counterweight
10. Distributor body
11. Advance regulator securing screw
12. Advance regulator

May 1983
05-30
DISASSEMBLY

In the following are provided the disassembly operations relevant to ignition distributors, limited to the part on which maintenance is carried out.

BOSCH DISTRIBUTOR

Clamp distributor on a vice fitted with protective jaws.

1. Remove cap ① and withdraw first the rotor arm ② with rev limiter and then the lubrication felt.

The rev limiter is a centrifugal located on the head of rotor arm which interrupts the ignition distribution when the engine exceeds 6800 rpm.

2. Remove dust cover ③.

4. Remove cap securing springs ④ after unscrewing the relevant screw ⑤. Then unscrew ⑥ securing stator to distributor body and screws ⑦ securing advance regulator to distributor body.

6. Lift inductive winding ①, then remove the advance regulator ②.

3. Operating as per figure, remove retaining ring of timer.

5. Operating on screw ①, remove connector ② of distributor body.

7. From distributor shaft, remove in sequence the timer, retaining ring ① and inductive winding ② complete of stator and supporting plate.
IGNITION, STARTING, CHARGING SYSTEM

8. By means of a clamp, release springs \(2\) of counterweights \(1\), then remove stop retaining ring \(3\) and then withdraw counterweights.

MARELLI DISTRIBUTOR

Clamp distributor on a vice fitted with protective jaws.

1. Unscrew screws \(\theta\) securing cap to distributor body; then withdraw cap \(1\).

2. Unscrew screws \(\Theta\) securing rotor arm to body; then withdraw rotor arm \(1\).

3. Withdraw springs \(2\) and remove counterweights \(1\).

4. Unscrew securing screws \(4\), then remove pulse generator \(3\) (stator) and magnetic insulating support \(5\).

5. Unscrew the four screws securing advance regulator to lower base of distributor body, then withdraw body from its seat by using as fulcrum the regulator shaft.

CHECKS AND INSPECTIONS

MARELLI DISTRIBUTOR

By means of a feeler gauge, verify that air gap between pulse generator \(2\) and timer \(1\) corresponds to the “S” prescribed value.

Air gap
\[
S = 0.4 \pm 0.5 \text{ mm (0.016} \pm 0.02 \text{ id}
\]
IGNITION, STARTING, CHARGING SYSTEM

1. Timer  2 Pulse generator

CAUTION:
Marelli Distributor
Every time it is carried out a disassembly or replacement operation of magnetic pulse generator, it is anyway required to reassemble the magnetic spacer of pulse generator support.

TEST STAND INSPECTIONS

1. Vacuum advance
   (1) Mount the ignition distributor on a test bed and carry out electric connections.
   (2) Carry out spark resetting on goniometer disc of test bed by rotating distributor manually or with the test bed motor without exceeding 50 r.p.m. speed.
   (3) Carry out connection of vacuum pipe to vacuometer of test bed.
   (4) On increasing vacuum, read the advance curve (see Service Data and Specifications).
   (5) If the particulars are not within the prescribed values, carefully examine the distributor and, particularly the counterweights and relevant return springs, timer, and pulse generator. Replace faulty the parts.

2. Counterweights advance
   (1) Carry out steps 1 and 2 relevant to vacuum advance verification.
   (2) On vacuum spark advance control disconnected from test bed vacuometer, read, on increasing r.p.m., the automatic advance curve (see: Service Data and Specifications).
   (3) If the particulars are not within the prescribed values, carefully examine the distributor and, particularly the counterweights and relevant return springs, timer, and pulse generator. Replace faulty the parts.

REASSEMBLY

For reassembly reverse the order of disassembly and comply with the following:

1. Lubricate the following components by means of distributor special grease.
   - Counterweights springs
   - Counterweights
2. Lubricate felt of distributor shaft with few oil drops.

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA AND INSPECTIONS

Ignition Distributor

<table>
<thead>
<tr>
<th>Alfa Romeo Class</th>
<th>Type</th>
<th>542.168</th>
<th>542.161</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>MARELLI SM 802 AX</td>
<td></td>
<td>BOSCH 0.237.005.004</td>
</tr>
<tr>
<td>Firing order</td>
<td>I - 3 - 2 - 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse Generator</td>
<td>Ω</td>
<td>730 ± 5%</td>
<td>1100 ± 10%</td>
</tr>
<tr>
<td>Coil Resistance</td>
<td>Ω</td>
<td>5000</td>
<td>1000</td>
</tr>
<tr>
<td>Internal resistance of distributor 1 rotor arm</td>
<td>mm</td>
<td>0.4 ± 0.5</td>
<td>(0.015 ± 0.019)</td>
</tr>
<tr>
<td></td>
<td>(in)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ELECTRONIC MODULE

Supply voltage V ............................................................... 4 ± 16
Maximum controllable current A ........................................ 6
Radiator limit temperature ........................................ -30 ± + 185°C (-22 ± + 365°F)

05-33
May 1983
## IGNITION, STARTING, CHARGING SYSTEM

### AUTOMATIC AND PNEUMATIC ADVANCE CURVES

<table>
<thead>
<tr>
<th>Distr. rpm</th>
<th>Bosch Automatic advance curve</th>
<th>Marelli Automatic advance curve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over</td>
<td>Lower</td>
</tr>
<tr>
<td>100</td>
<td>15°</td>
<td>1° 15'</td>
</tr>
<tr>
<td>270</td>
<td>-30°</td>
<td>45°</td>
</tr>
<tr>
<td>310</td>
<td>0°</td>
<td>0°</td>
</tr>
<tr>
<td>380</td>
<td>30°</td>
<td>-45°</td>
</tr>
<tr>
<td>420</td>
<td>15°</td>
<td>-1°</td>
</tr>
<tr>
<td>500</td>
<td>1° 30'</td>
<td>-1°</td>
</tr>
<tr>
<td>700</td>
<td>5°</td>
<td>2°</td>
</tr>
<tr>
<td>800</td>
<td>5° 45'</td>
<td>3° 45'</td>
</tr>
<tr>
<td>1700</td>
<td>13° 45'</td>
<td>11° 15'</td>
</tr>
<tr>
<td>1800</td>
<td>14°</td>
<td>12°</td>
</tr>
<tr>
<td>2500</td>
<td>13°</td>
<td>11°</td>
</tr>
<tr>
<td>3000</td>
<td>12° 15'</td>
<td>10° 15'</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vacuum mmHg</th>
<th>Bosch Pneumatic advance curve</th>
<th>Marelli Pneumatic advance curve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over</td>
<td>Lower</td>
</tr>
<tr>
<td>0</td>
<td>30°</td>
<td>-30°</td>
</tr>
<tr>
<td>90</td>
<td>30°</td>
<td>-30°</td>
</tr>
<tr>
<td>105</td>
<td>45°</td>
<td>-30°</td>
</tr>
<tr>
<td>150</td>
<td>2° 45'</td>
<td>-30°</td>
</tr>
<tr>
<td>180</td>
<td>4°</td>
<td>1°</td>
</tr>
<tr>
<td>267</td>
<td>7° 30'</td>
<td>4° 45'</td>
</tr>
<tr>
<td>293</td>
<td>7° 30'</td>
<td>5° 30'</td>
</tr>
<tr>
<td>338</td>
<td>7° 30'</td>
<td>5° 30'</td>
</tr>
</tbody>
</table>

May 1983

05-34
## IGNITION COIL

<table>
<thead>
<tr>
<th>Type</th>
<th>MARELLI BAE 207B</th>
<th>BOSCH 0.221.600.002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfa Romeo Class</td>
<td>542.167</td>
<td>542.162</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>0.72 ± 10%</th>
<th>0.7 ± 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary winding resistance</td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td>Secondary winding resistance</td>
<td>Ω</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>7900 ± 10%</th>
<th>6700 ± 9600</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>542.167</td>
<td>542.162</td>
</tr>
</tbody>
</table>

## SPARK PLUGS

<table>
<thead>
<tr>
<th>Type</th>
<th>LODGE 25 HL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfa Romeo Class</td>
<td>535.420</td>
</tr>
</tbody>
</table>

## FLUID AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Demmination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark plug thread</td>
<td>OIL</td>
<td>ISECO Molykote A Standard 4500 - 18304</td>
</tr>
</tbody>
</table>

## TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N·m</th>
<th>kg·m</th>
<th>ft·lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark plugs in ISECO oil: Molykote A</td>
<td></td>
<td>25 ± 34</td>
<td>2.5 ± 3.5</td>
<td>18.08 ± 25.31</td>
</tr>
</tbody>
</table>
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>COOLING SYSTEM</td>
<td>07-2</td>
</tr>
<tr>
<td>General description</td>
<td>07-2</td>
</tr>
<tr>
<td>Removal</td>
<td>07-3</td>
</tr>
<tr>
<td>Hydraulic system leak test</td>
<td>07-3</td>
</tr>
<tr>
<td>WATER PUMP</td>
<td>07-3</td>
</tr>
<tr>
<td>Checks and inspections</td>
<td>07-4</td>
</tr>
<tr>
<td>Installation</td>
<td>07-4</td>
</tr>
<tr>
<td>THERMOSTAT</td>
<td>07-4</td>
</tr>
<tr>
<td>Removal</td>
<td>07-4</td>
</tr>
<tr>
<td>Checks and inspections</td>
<td>07-4</td>
</tr>
<tr>
<td>Installation</td>
<td>07-5</td>
</tr>
<tr>
<td>RAD I AT0 R</td>
<td>07-5</td>
</tr>
<tr>
<td>Removal and installation</td>
<td>07-5</td>
</tr>
<tr>
<td>Leak test</td>
<td>07-6</td>
</tr>
<tr>
<td>ELECTRIC FAN CONTROL</td>
<td></td>
</tr>
<tr>
<td>THERMAL CONTACT</td>
<td>07-6</td>
</tr>
<tr>
<td>Removal and installation</td>
<td>07-6</td>
</tr>
<tr>
<td>Checks and inspections</td>
<td>07-6</td>
</tr>
<tr>
<td>HEADER TANK PRESSURIZED</td>
<td></td>
</tr>
<tr>
<td>PLUG</td>
<td>07-6</td>
</tr>
<tr>
<td>Leak test</td>
<td>07-6</td>
</tr>
<tr>
<td>SERVICE DATA AND</td>
<td></td>
</tr>
<tr>
<td>SPECIFICATIONS</td>
<td>07-6</td>
</tr>
<tr>
<td>Inspection and adjustment</td>
<td>07-7</td>
</tr>
<tr>
<td>Tightening torques</td>
<td>07-8</td>
</tr>
<tr>
<td>TROUBLE DIAGNOSIS AND</td>
<td></td>
</tr>
<tr>
<td>CORRECTIONS</td>
<td>07-8</td>
</tr>
</tbody>
</table>

May 1983
ENGINE COOLING SYSTEM

COOLING SYSTEM

GENERAL DESCRIPTION

1. Electric fan
2. Thermostat
3. Radiator
4. Electric fan thermal contact
5. Cooling drain plugs
6. Centrifugal pump
7. Header tank
8. Cooling temperature transmitter
9. Heater
10. Cooling temperature warning light thermal contact
11. Cooling temperature indicator
12. Cooling temperature warning light
13. Cooling water level sensor for check control
   (1 500 Quadrifoglio model)
14. Cooling water minimum level warning light
   (1500 Quadrifoglio model)

May 1983

07-2
CHECKS AND INSPECTIONS

The water pump cannot be overhauled and in case of failure must be replaced.

1. Check pump body and impeller for indications of wide oxidation and corrosion; if any, replace pump.
2. Verify that there is no excessive play in the rotation and axial movement of impeller.

INSTALLATION

1. Fit water pump with new relevant gasket to block and tighten securing screws to specified torque value.

   : Tightening torque
   Screws securing water pump
   19 ÷ 24 N-m
   (1.9 ÷ 2.4 kg-m
   13.74 ÷ 17.35 ft-lb)

2. Check correct timing of engine and key camshaft belt on camshaft pulley. For the timing and belt keying procedure refer to: Group 00 - Engine Maintenance.
3. Refit front cover of camshaft belt, pulley, alternator, pump and alternator driving belt, in reverse order of removal.
4. Stretch pump-alternator driving belt.
For the stretching procedure of belt refer to: Group 00 - Engine Maintenance.
5. At end of pump installation, pour the coolant and letting the engine run for a few minutes check against coolant leakages.

REMOVAL

1. Drain coolant up to the lower level of thermostat housing.
2. Detach coupling connecting thermostat cover to radiator.
3. Screw out screws and remove cover with relevant gasket.
4. Withdraw thermostat from housing.

THERMOSTAT

CHECKS AND INSPECTIONS

Thermostat should be checked in accordance with the following procedure:
1. Fit thermostat to suitable test equipment.
2. Fill container with water and switch on equipment to heat water.
3. Check that, when thermostat opens, temperature value read on thermometer dial indicator is 84 ÷ 88°C (183.2 ÷ 190.4°F).
4. Additionally check that thermostat is fully open at 98°C (208.4°F) and valve travel greater than 7 mm (0.28 in).

If above values are not met, thermostat must be replaced.
LEAK TEST

1. Remove radiator from car (Refer to: Radiator Removal and Installation).
2. Close radiator outlet and inlet unions.
3. Immmerge radiator in a tank previously filled with water and check for possible leakages inflating compressed air through radiator breather pipe until a pressure of \(98.1 \div 107.9 \text{ kPa}; (0.9 \div 1.0 \text{ bar}; 1 \div 1.1 \text{kg/cm}^2; 14.22 \div 15.64 \text{ psi})\) is reached.
4. If leakages are found, clean area to be soldered by a wire brush and deoxidate by "baked" hydrochloric acid (zinc chloride).
5. Solder the leaking area.
6. Test again radiator for leakages as described above and then refinish radiator with black synthetic enamel. In case of leakages from radiator fitted with side tanks (with gaskets), replace the radiator.
7. Refit radiator to car (Refer to: Radiator - Removal and Installation). Fill with coolant and check for leakages.

ELECTRIC FAN CONTROL THERMAL CONTACT

REMO-VAL AND INSTALLATION

1. Drain coolant.
2. Disconnect thermal contact cables.
3. Unscrew thermal contact from radiator.
4. Installation is carried out in reverse order of removal.
5. At the end of installation procedure, fill the circuit with coolant and let the engine rotates until coolant reaches the temperature of \(88 \div 92^\circ \text{C} (190.4 \div 197.6^\circ \text{F})\) and verify that electric fan inserts.

CHECKS AND INSPECTIONS

Check thermal contact according to the following procedure:
1. Fit thermal contact to the test equipment used for thermostat test.
2. Fill container with coolant and switch on equipment to heat water.
3. When warning light illuminates, verify that temperature shown on thermometer dial indicator corresponds to the thermal contact setting value \(88 \div 92^\circ \text{C} (190.4 \div 197.6^\circ \text{F})\).

HEADER TANK PRESSURIZED PLUG

LEAK TEST

1. Screw fitting to test equipment and insert on header tank pressurized plug.
2. Act on tool to increase pressure and check on dial indicator that blowoff valve opens at the required setting pressure.

Pressurized plug setting pressure \(69.6 \text{ kPa}; (0.69 \text{ bar}; 0.7 \text{ kg/cm}^2; 9.95 \text{ psi})\)
ENGINE COOLING SYSTEM

SERVICE DATA AND SPECIFICATIONS

INSPECTION AND ADJUSTMENT

BELT TENSIONING
Load to be applied: 78.4 N (88 lb)
Resultant arrow: 15 mm (0.6 in)

THERMOSTAT TEMPERATURE
- Start of opening: 84 °C (183.2 °F)
- End of opening: 98 °C (208.4 °F)
- Bulb travel: > 7 mm (> 0.28 in)

RADIATOR
Radiator leak control pressure: 10.7.9 kPa (1.0 bar; 1.0 kg/cm²; 15.64 psi)

PRESSURIZED PLUG
Pressurized plug setting pressure: 68.6 kPa (0.69 bar; 0.7 kg/cm²; 9.95 psi)

ELECTRIC FAN
Electric fan intervention temperature: 88 °C (190.4 °F)

CAUTION: Produit harmful to the paint. Avoid contact with painted parts.

GENERAL SPECIFICATIONS

COOLANT

<table>
<thead>
<tr>
<th>Summer</th>
<th>Winter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Imp. Gall</td>
</tr>
<tr>
<td>Imp. Gall 1.61</td>
<td>Imp. Gall 1.03</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Min. temperature</th>
<th>°C</th>
<th>°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antifreeze cat.</td>
<td>1.8</td>
<td>3.65</td>
</tr>
<tr>
<td>(Imp. gall)</td>
<td>(0.391)</td>
<td>(0.57)</td>
</tr>
<tr>
<td>Water</td>
<td>5.5</td>
<td>10.80</td>
</tr>
<tr>
<td>(Imp. gall)</td>
<td>(1.21)</td>
<td>(1.03)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antifreeze cat. for use cat.</th>
<th>7.3</th>
<th>3.65</th>
</tr>
</thead>
</table>

COOLING SYSTEM SCALES REMOVER
NALCO: 1006
INTERPOIND: Jal Auto Cat. 3681-69955

SEALING AND FIXING COMPOUNDS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sealing compound for cooling system</td>
<td>Sealing powder</td>
<td>AREXONS Cat. 3622-00101</td>
<td>7.3 g 0.20 (oz)</td>
</tr>
</tbody>
</table>

ALUMASEAL can be used as an alternative.

07-7
May 1983
ENGINE - COOLING SYSTEM

TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N·m</th>
<th>kg·m</th>
<th>ft·lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling temperature transmitter on feeding manifold</td>
<td></td>
<td>33441</td>
<td>3.4 ÷ 4.2</td>
<td>24.58 ÷ 30.37</td>
</tr>
<tr>
<td>Water pump securing screws</td>
<td></td>
<td>19 ÷ 24</td>
<td>1.9 ÷ 2.4</td>
<td>13.74 ÷ 17.35</td>
</tr>
</tbody>
</table>

TROUBLE DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water leakage</td>
<td>• Radiator damaged</td>
<td>Repair or replace</td>
</tr>
<tr>
<td></td>
<td>• Leaks in system couplings</td>
<td>Repair</td>
</tr>
<tr>
<td></td>
<td>• Loose or broken clamps</td>
<td>Tighten or replace</td>
</tr>
<tr>
<td></td>
<td>• Leakages from thermostat</td>
<td>Replace gasket or thermostat</td>
</tr>
<tr>
<td></td>
<td>• Damaged cylinder head gasket</td>
<td>Replace. Check engine oil for contamination</td>
</tr>
<tr>
<td></td>
<td>• Loose cylinder head tightening screws</td>
<td>Restore correct tightening</td>
</tr>
<tr>
<td>Poor circulation</td>
<td>• Pipes obstructed</td>
<td>Check pipes and clean system</td>
</tr>
<tr>
<td></td>
<td>• Insufficient coolant</td>
<td>Top up</td>
</tr>
<tr>
<td></td>
<td>• Inoperative water pump</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Water pump and alternator driving belt loosen</td>
<td>Adjust</td>
</tr>
<tr>
<td>Corrosion and scales</td>
<td></td>
<td>Periodically change coolant at intervals recommended.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Follow instructions for use shown on packaging.</td>
</tr>
<tr>
<td>Overheating</td>
<td>• Inoperative thermostat'</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Dirty and scaled radiator</td>
<td>Clean pipes flushing with the specified descaling compound. Follow instructions for use shown on packaging.</td>
</tr>
<tr>
<td></td>
<td>• Ignition out-of-phase</td>
<td>Retime</td>
</tr>
<tr>
<td></td>
<td>• Poor lubrication</td>
<td>Restore oil level</td>
</tr>
<tr>
<td></td>
<td>• Faulty water pump</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Insufficient coolant</td>
<td>Restore coolant level and check system for leaks</td>
</tr>
</tbody>
</table>

May 1983

07-8
This is a hydraulic controlled, dry, singedisc clutch provided with a thrust bearing which is always in contact with pressure plate spring. Diaphragm spring pressure engaged driven plate. Disengagement is obtained by a pedal operated through a master cylinder which transmits fluid pressure increase to operating cylinder piston. The latter operates on the withdrawal lever by a push rod, moves thrust bearing (self centering) and wins diaphragm spring action. By means of gaskets performing on cylinder, piston takes up possible slacks and therefore driven plate wear recovery is automatic.
CLUTCH

HYDRAULIC CONTROL UNIT

CLUTCH PEDAL

REMOVAL
1. Operating from the interior compartment, remove stopper ring \( \text{\textit{4}} \), and remove pin \( \text{\textit{2}} \) disconnecting pedal \( \text{\textit{3}} \) from master cylinder control fork \( \text{\textit{1}} \) and return spring.

2. Operating from the engine room, remove pedal pin stopper spring \( \text{\textit{1}} \) and relevant washer. Unscrew screw \( \text{\textit{3}} \) securing the bracket \( \text{\textit{2}} \) for sheath stopper of accelerator control cable, in order to be able to withdraw pedal pin enough to recuperate the clutch pedal from the interior compartment.

3. Remove the two plastic bushes from pedal.

CHECKS AND INSPECTIONS
1. Inspect pedal and pedal pad for deformation or damage.
2. Inspect bushes of clutch pedal, pin and spacer for excessive wear or seizing.
3. Inspect return spring for fatigue or damage.

INSTALLATION
Install clutch pedal on car in reverse order of removal and apply grease to bushes of clutch pedal and to master cylinder fork connection pin (AGIP F1 Grease 15).

CLUTCH MASTER CYLINDER

REMOVAL
1. Remove filler plug \( \text{\textit{1}} \) on reservoir \( \text{\textit{7}} \), relevant gasket and filter then, with a syringe, drain enough fluid to make level fall below connection to master cylinder \( \text{\textit{4}} \).
2. Disconnect supply flexible hose \( \text{\textit{2}} \) from master cylinder.
3. Loosen connection and disconnect rigid pipe \( \text{\textit{5}} \) from master cylinder.
4. Operating from inside the car, remove stopper ring, remove pin and disconnect cylinder control fork from pedal (see: Clutch Pedal Removal).
5. Unscrew screws \( \text{\textit{3}} \) fixing master cylinder to pedal assy and then remove master cylinder.

DISASSEMBLY
1. Remove boot \( \text{\textit{6}} \), remove stopper ring \( \text{\textit{2}} \), then remove push rod with fork \( \text{\textit{7}} \), gaskets \( \text{\textit{5}} \) and \( \text{\textit{3}} \), piston \( \text{\textit{4}} \), washer \( \text{\textit{8}} \) and spring \( \text{\textit{9}} \).
2. Remove connection \( \text{\textit{11}} \) and gasket \( \text{\textit{10}} \).

CHECKS AND INSPECTIONS

1. Check cylinder bore and piston for score or rust and if found replace.
2. Check cylinder bore and piston for wear. If the clearance between cylinder bore and piston exceeds specified value, replace piston assembly or master cylinder assembly.
3. Check condition of boot and replace it if damaged.
4. Check all recesses, openings and internal passages to ensure that they are clean and free from foreign matter.

CAUTION:
To clean or wash all parts of master cylinder, recommended clean brake fluid must be used. Never use mineral oils or gasoline and kerosene to avoid damaging rubber parts.

1. Plug \( \text{\textit{3}} \)
2. Flexible pipe \( \text{\textit{4}} \)
3. Screws \( \text{\textit{5}} \)
4. Master cylinder
5. Connection
6. Rigid pipe
7. Reservoir
8. Washer
9. Spring
10. Gasket
11. Connection
12. Boot
ASSEMBLY
1. Lubricate sliding part surfaces.
2. Install piston assembly to cylinder body.
3. Make sure that master cylinder operates normally.
4. Make sure that piston can move maximum stroke smoothly.

INSTALLATION
1. Install clutch master cylinder in reserve order of disassembly.
2. Top up oil to correct level in reservoir.
3. Bleed air out of hydraulic system (Refer to: Hydraulic System Bleeding).

TABLE: Tightening torque
Clutch hydraulic piping connections
15 ± 18 N·m
(1.5 ± 1.9 kg·m
10.8 ± 13.7 ft·lbf)

CLUTCH OPERATING CYLINDER
REMOVAL
1. Remove operating cylinder control hose, then remove clutch operating cylinder lock ring 1 from its seat on engine back cover 3.
2. Remove operating cylinder.

DISASSEMBLY
1. Remove push rod 1 with boot 2, piston 9 and piston spring 4 from operating cylinder 6.
2. Remove push rod from boot.

CHECKS AND INSPECTIONS
Visually inspect all disassembled parts and replace parts which are worn or damaged.

CAUTION:
- To clean or wash all parts of operating cylinder, recommended clean brake fluid must be used. Never use mineral oils or gasoline and kerosene. It will ruin the rubber parts of the hydraulic system.
- Check cylinder bore and piston for score or rust.
- Check cylinder wear, spring efficiency and integrity of seal rings.
- Check whether bleeder hole is clean.

ASSEMBLY
Assemble clutch operating cylinder in reverse order of disassembly.

INSTALLATION
Assemble clutch operating cylinder in its seat on engine back cover together with retainer ring.

HYDRAULIC SYSTEM PIPING
CHECKS AND INSPECTIONS
Visually inspect clutch lines for evidence of its integrity. Replace damaged parts. If leakage occurs at joints due to loosening, retighten and if necessary replace damaged parts.

HYDRAULIC SYSTEM BLEEDING
The clutch and brake hydraulic system must be bled whenever hydraulic system has been disconnected or air has entered it. Refer to figure on page 12-2 (see: Description) and observe the following procedure.

CAUTION:
- Do not re-use brake fluid drained during bleeding operation.
- Exercise care to prevent splashing of brake fluid on painted areas as it will damage the paint.
- During bleeding operation fluid level in reservoir must be kept above min. mark.

1. Remove clutch and brake hydraulic system reservoir plug and top up with recommended brake fluid (ATE “S” or AGIP Brake Fluid Super HD corresponding to Alfa Romeo Part No. 3681.69905).
2. Remove bleeder screw protection boot 2 on Operating cylinder 3, install a hose on same
CHECKS AND INSPECTIONS
Wash all disassembled parts except clutch with suitable cleaning solvent to remove dirt and grease before making inspection and adjustment.

Clutch cover
Check pressure plate working surface for overheating marks, uneven wear, scoring and material removal. Replace clutch cover if necessary.

Clutch disc
Inspect clutch disc for burn or oily facings, loose rivets and broken torsional springs.
1. In case of clutch abnormalities due to oil leakage at crankshaft or direct drive shaft oil seal, replace both clutch disc and seals.
2. Check with a sliding gauge for even wear of both facings and whether clutch disc thickness is not near to specified limit. Replace disc if necessary. Wear limit for disc thickness 6.5 mm (0.26 in)
3. Check fit of clutch disc hub on direct drive shaft for smooth sliding or excessive backlash. If necessary replace clutch disc.

INSTALLATION
1. If the two oil seals on crankshaft and on direct drive shaft have been removed when clutch unit was disassembled, install two new oil seals (Refer to: Group 01 Engine Assembly - Crankshaft and Group 13 5-Speed Manual Gearbox Shafts and Gears).
2. Install flywheel if removed in disassembling clutch unit (Refer to: Group 01 - Engine Assembly). Be sure to keep clutch disc, flywheel and pressure plate facings clean and dry.
3. Set clutch disc and clutch cover on flywheel.
## SERVICE DATA AND SPECIFICATIONS

### GENERAL SPECIFICATIONS

#### FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrust bearing working seat</td>
<td>GREASE</td>
<td>AGIPF1 Grease 33 FD Std. N. 3671-69833134</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Autogrease FD Std. N. 3671-69833134</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ISECO Molykote BR2 Std. N. 3671-69841</td>
<td>—</td>
</tr>
<tr>
<td>End crankshaft bush</td>
<td>GREASE</td>
<td>ISECO Molykote Paste G Std. N. 3671-69840</td>
<td>—</td>
</tr>
<tr>
<td>Clutch pedal-cylinder control fork</td>
<td>GREASE</td>
<td>AGIPF1 Grease 15 Std. N. 3671-69840</td>
<td>—</td>
</tr>
<tr>
<td>connection pin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clutch pedal hub</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clutch hydraulic system supply</td>
<td>FLUID</td>
<td>ATE &quot;S&quot; Std. N. 3681-69905</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AGIPF1 Brake Fluid Super HD Std. N. 3681-69905</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Auto Fluid FR Std. N. 3681-69905</td>
<td></td>
</tr>
</tbody>
</table>

### INSPECTIONS AND ADJUSTMENTS

#### FLYWHEEL AND CLUTCH COVER

Grinding limit values on working surfaces ..................................................... 0.2 mm (0.01 in)

#### CLUTCH DISC

Disc thickness at wear limit ................................................................. 6.5 mm (0.26 in)
<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spark is good:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Check spark plug</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Check ignition timing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Check fuel system</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Check cylinder compression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spark is not good:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ignition system is out of order</td>
<td>• Low or no current in primary circuit</td>
<td>Check primary circuit for loose or disconnected terminals</td>
</tr>
<tr>
<td></td>
<td>• Rotor arm current leakage</td>
<td>Verify that the electronic ignition unit is properly functioning</td>
</tr>
<tr>
<td></td>
<td>• Faulty spark plugs</td>
<td>Clean or replace</td>
</tr>
<tr>
<td></td>
<td>• Improper ignition timing</td>
<td>Clean, adjust electrode gap or replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty ignition coil</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Cut-off in high voltage cable</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Loose connection or cut-off in primary circuit</td>
<td>Repair or replace</td>
</tr>
<tr>
<td>Fuel system is out of order</td>
<td>• Lack of fuel</td>
<td>Refuel</td>
</tr>
<tr>
<td></td>
<td>• Dirty fuel filter</td>
<td>Clean</td>
</tr>
<tr>
<td></td>
<td>• Dirty or clogged fuel pipes</td>
<td>Clean</td>
</tr>
<tr>
<td></td>
<td>• Faulty fuel pump</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty carburetor choke</td>
<td>Check and adjust</td>
</tr>
<tr>
<td></td>
<td>• Incorrect float level adjustment</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Improper idling</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Dirty or clogged carburetor jets</td>
<td>Disassemble and clean</td>
</tr>
<tr>
<td></td>
<td>• Clogged fuel tank breather pipe</td>
<td>Repair and clean</td>
</tr>
<tr>
<td>Low compression</td>
<td>• Incorrect spark plug tightening</td>
<td>Tighten to normal</td>
</tr>
<tr>
<td></td>
<td>• Incorrect valve clearance</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Compression leaks from valve seats</td>
<td>Remove cylinder head and lap valves</td>
</tr>
<tr>
<td></td>
<td>• Seized valve stem</td>
<td>Replace valve and valve guide</td>
</tr>
</tbody>
</table>

May 1983
<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>High engine idling</td>
<td>• Stiff accelerator cable and linkage</td>
<td>Check</td>
</tr>
<tr>
<td></td>
<td>• Incorrect idle adjustment</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Malfunctioning throttle valve</td>
<td>Check</td>
</tr>
<tr>
<td>ENGINE POWER NOT UP TO NORMAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low compression</td>
<td>Previous mentioned</td>
<td>Previous mentioned</td>
</tr>
<tr>
<td>Ignition system out of order</td>
<td>• Incorrect ignition timing</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Dirty or worn spark plugs</td>
<td>Clean or replace</td>
</tr>
<tr>
<td></td>
<td>• Incorrect advance</td>
<td>Adjust</td>
</tr>
<tr>
<td>Fuel system out of order</td>
<td>Previous mentioned</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>• Faulty fuel pump</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Clogged fuel pipes</td>
<td>Clean</td>
</tr>
<tr>
<td>Air intake system out of order</td>
<td>• Clogged air cleaner</td>
<td>Replace cartridge</td>
</tr>
<tr>
<td></td>
<td>• Air sucking around manifold gasket or carburetor gasket</td>
<td>Replace gasket</td>
</tr>
<tr>
<td>Overheating</td>
<td>• Insufficient coolant</td>
<td>Replenish</td>
</tr>
<tr>
<td></td>
<td>• Broken water pump drive belt</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty thermostat</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty water pump</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Clogged or leaky radiator</td>
<td>Clean, repair or replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty electric fan</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty thermal switch</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Air in cooling system</td>
<td>Restore proper cooling system tightness</td>
</tr>
<tr>
<td></td>
<td>• Clogged jets (lean mixture)</td>
<td>Overhaul carburetor</td>
</tr>
<tr>
<td></td>
<td>• Incorrect ignition timing</td>
<td>Adjust</td>
</tr>
<tr>
<td>Overcooling</td>
<td>• Faulty thermostat</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty thermal switch</td>
<td>Replace</td>
</tr>
</tbody>
</table>

00-35
May 1983
<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>Petrol used has low octane rating</td>
<td>Replace with petrol having specified octane rating</td>
</tr>
<tr>
<td></td>
<td>Dragging brakes</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>Slipping clutch</td>
<td>Adjust or replace</td>
</tr>
<tr>
<td>NOISY ENGINE (while driving)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine knocking</td>
<td>Overloaded engine</td>
<td>Use proper gear in driving</td>
</tr>
<tr>
<td></td>
<td>Knocking due to carbon deposit</td>
<td>Disassemble cylinder head and remove carbon deposit</td>
</tr>
<tr>
<td></td>
<td>Knocking due to incorrect ignition timing</td>
<td>Adjust ignition timing</td>
</tr>
<tr>
<td></td>
<td>Knocking due to improper petrol</td>
<td>Use petrol having specified octane rating</td>
</tr>
<tr>
<td></td>
<td>. Preignition (due to wrong type spark plugs)</td>
<td>Replace with specified type spark plugs</td>
</tr>
<tr>
<td>Mechanical knocking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crankshaft bearings knocking</td>
<td>Worn crankshaft bearings</td>
<td>Replace bearings and either grind or replace crankshaft. Check lubrication system</td>
</tr>
<tr>
<td></td>
<td>This strong dull noise increases as engine is accelerated</td>
<td></td>
</tr>
<tr>
<td>Connecting rod bearings</td>
<td>Worn connecting rod bearings</td>
<td>Same as for above crankshaft bearings</td>
</tr>
<tr>
<td>knocking</td>
<td>This is a slightly higher-pitched noise than the one caused by knocking of crankshaft bearings and it also increases as engine is accelerated</td>
<td></td>
</tr>
<tr>
<td>Noisy pistons</td>
<td>Pistons and/or cylinder liners are worn</td>
<td>Overhaul the engine</td>
</tr>
<tr>
<td></td>
<td>This is a diffused metallic noise which increases as rpm increase and decreases when engine is warm</td>
<td></td>
</tr>
<tr>
<td>Noisy water pump</td>
<td>Play in rotor</td>
<td>Replace water pump</td>
</tr>
<tr>
<td>Other</td>
<td>Improper adjustment of valve clearance</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>Excessive crankshaft end play</td>
<td>Replace crankshaft axial bearings</td>
</tr>
<tr>
<td>Condition</td>
<td>Probable cause</td>
<td>Corrective action</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>ABNORMAL COMBUSTION</strong> (backfire, self-ignition, detonations)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorrect ignition</td>
<td>Incorrect ignition timing</td>
<td>Adjust timing</td>
</tr>
<tr>
<td></td>
<td>Wrong type spark plugs</td>
<td>Replace with recommended type plugs</td>
</tr>
<tr>
<td><strong>Fuel system out of order</strong></td>
<td>Previously mentioned</td>
<td>Previously mentioned</td>
</tr>
<tr>
<td><strong>Faulty cylinder heads</strong></td>
<td>Incorrect valve clearance</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>Excessive carbon deposit in combustion chambers</td>
<td>Desassemble cylinder heads and remove carbon deposit</td>
</tr>
<tr>
<td></td>
<td>Damaged valve springs (backfire detonations)</td>
<td>Replace</td>
</tr>
<tr>
<td><strong>EXCESSIVE OIL CONSUMPTION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil leaks</td>
<td>Loose oil drain plug</td>
<td>Tighten it</td>
</tr>
<tr>
<td></td>
<td>Loose oil pan screws</td>
<td>Tighten or replace</td>
</tr>
<tr>
<td></td>
<td>Worn or damaged oil pan gasket</td>
<td>Replace gasket</td>
</tr>
<tr>
<td></td>
<td>Worn or damaged cylinder block and cylinder head gaskets and oil seal rings</td>
<td>Replace gaskets and oil seal rings</td>
</tr>
<tr>
<td></td>
<td>Loose oil filter</td>
<td>Tighten or replace, if necessary</td>
</tr>
<tr>
<td></td>
<td>Loose oil pressure switch</td>
<td>Tighten</td>
</tr>
<tr>
<td></td>
<td>Dipstick does not fit tightly</td>
<td>Replace dipstick</td>
</tr>
<tr>
<td>Excessive oil consumption</td>
<td>Worn cylinders and pistons</td>
<td>Grind cylinders and replace pistons</td>
</tr>
<tr>
<td></td>
<td>Improperly assembled piston rings</td>
<td>Assemble properly</td>
</tr>
<tr>
<td></td>
<td>Worn piston rings</td>
<td>Replace piston rings or, if required, grind cylinders and replace pistons</td>
</tr>
<tr>
<td></td>
<td>Worn piston rings and piston ring seats</td>
<td>Replace pistons and rings</td>
</tr>
<tr>
<td></td>
<td>Worn valve guides and grommets</td>
<td>Replace valve guides and grommets</td>
</tr>
<tr>
<td></td>
<td>Worn valve stems</td>
<td>Replace valves</td>
</tr>
<tr>
<td>Other</td>
<td>Improper oil grade</td>
<td>Replace with specified oil type</td>
</tr>
<tr>
<td></td>
<td>Engine overheats</td>
<td>Previously mentioned</td>
</tr>
<tr>
<td>Condition</td>
<td>Probable cause</td>
<td>Corrective action</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **EXCESSIVE FUEL CONSUMPTION** | Engine power not up to normal  
Previously mentioned                                                             | Previously mentioned                                                              |
| Other                         | • Idling too high  
• Improper accelerator recovery  
• Fuel leaks  
• Clogged air cleaner  
• Improperly adjusted carburetor  
• Worn or damaged carburetor gaskets | Adjust idling  
Adjust  
Repair or tighten fuel line unions  
Replace cartridge  
Adjust  
Replace gaskets |
| **OTHER PROBLEMS**            | Reduced oil pressure  
• Improper oil grade  
• Oil is missing  
• Overheating  
• Worn oil pump control valve  
• Worn oil pump  
• Excessive play of sliding parts  
• Clogged oil filter  
• Faulty oil pressure switch | Replace with specified oil type  
Replenish with specified oil type  
Previously mentioned  
Disassemble oil pump, repair or replace it  
Repair or replace  
Disassemble and replace worn parts  
Replace cartridge  
Replace |
| Excessive wear of sliding parts | • Insufficient oil pressure  
• Improper oil grade or contaminated oil  
• Faulty air cleaner  
• Overheating or overcooling | Previously mentioned  
Replace with specified type oil and replace cartridge  
Replace cartridge  
Previously mentioned |
| Seizing of sliding parts      | • Insufficient oil pressure  
• Insufficient clearances  
• Overheating | Previously mentioned  
Adjust to specified values  
Previously mentioned |
CHASSIS AND BODY MAINTENANCE

CHECKING FUEL AND EXHAUST SYSTEM

1. Check fuel and exhaust systems, especially at connections, making sure there are no leaks.
2. Check condition of all fuel and exhaust pipes replacing same if required.
3. Tighten all loose connections.

CLUTCH

CHECKING CLUTCH SYSTEM

Check clutch pump 1 and clutch control cylinder 2 making sure there are no oil leaks. If required, tighten unions according to specified torques or either overhaul or replace faulty parts (Refer to: Group 12 - Tightening Torques). Make sure that clutch pump and control cylinder boots are not in any way damaged.

ASSEMBLY DRIVE SHAFT

CHECKING DRIVE SHAFT ASSEMBLY

Visually check drive shaft assembly for wear or deformation of its various components, making sure protecting boots are not in any way damaged or show grease leakage. If necessary, replace damaged or worn parts.

GEARBOX-DIFFERENTIAL

CHECKING GEARBOX-DIFFERENTIAL OIL LEVEL

Check oil level making sure it reaches filler lower edge; clean relevant cap and tighten it.

REPLACING GEARBOX-DIFFERENTIAL OIL

1. While engine is warm, remove oil pan drain 2 and supply 1 plugs.
2. Let oil drain completely (wait at least 15 minutes); clean drain plug 2 and tighten it.
3. Refill oil pan through supply hole 1 with specified oil type and quantity. Refer to "LUBRICANTS" chart for recommended oil type.

Gearbox-Differential casing oil capacity: 2.3 ÷ 2.4 kg (5.07 ÷ 5.29 lb)

FRONT AXLE AND FRONT SUSPENSION

CHECKING FRONT AXLE AND SUSPENSION

1. Block rear wheels with chocks and raise front of vehicle fitting jack to proper lifting points (Refer to: "Lifting Points and Towing").
2. Check front suspension parts for wear or damage. Also check all bolts for proper tightening; refer to: Group 21 - Tightening Torques for relevant tightening torques.
Replace worn parts according to relevant procedures described in Group 21 Front Suspension.
ADJUSTING WHEEL BEARING PRELOAD

After replacement or disassembly of bearings, carry out adjustment operating as follows.

For wheel bearing replacement refer to Group 25.

1. Tighten wheel bearing lock-nut according to specified torque and at the same time turn hub 4 ÷ 5 times in both directions to allow bearings to settle.

- Tightening torque
  Wheel bearing lock-nut
  \[
  25 \div 29 \text{ N-m}
  \frac{(2.5 \div 3 \text{ kg-m}}{18.08 \div 21.69 \text{ ft-lb})}
  \]

2. Partially unscrew lock-nut and hit the hub with a mallet to ensure outer bearing settling against washer and nut.

3. Tighten the nut (moderately, so as to obtain a less than 1 N-m; 0.1 kg-m; 0.72 ft-lb - torque).

4. Check and make sure axial play is within specified value.

Bearing axial play
\[
0 \div 0.05 \text{ mm (0 \div 0.002 in)}
\]

5. Caulk nut taking care to avoid rotation in order not to alter clearance play.

Apply specified grease quantity to bearings in the suspension.

CHECKING SUSPENSION HEIGHTS

Be sure to perform following preliminary operations:

a. Set up vehicle with all refill liquids at max. level and with spare wheel.

b. Check tire pressure; refer to "Wheels and Tires" for specified values.

c. Place car on lift.

d. Load weights on vehicle as shown in below figure.

e. Move vehicle up and down on suspensions a few times.

Static load equivalent to three passengers plus luggage
Passenger equivalent to
\[
A + B = 490 + 245 = 735 \text{ N}
\frac{(50 + 25 = 75 \text{ kg})}{(110 + 55 = 165 \text{ lb})}
\]

Luggage C = 490 N (50 kg; 10 lb)

REAR AXLE AND REAR SUSPENSION

CHECKING REAR AXLE AND SUSPENSION PARTS

1. Check rear axle and suspension for loose, worn or damaged parts.

2. With vehicle in nominal driving condition, i.e. with static load (Refer to: Checking Suspension Heights), tighten loose bolts according to specified tightening torque. Refer to: Group 25 Service Data and Specifications for relevant tightening torques.

3. Replace worn parts according to the relevant procedures described in Group 25.
FRONT SUSPENSION HEIGHT

Check front wheel alignment picking up specified ‘A’ dimension which is obtained by drawing two lines parallel to floor plane respectively passing through below defined points 1 and 2.

Point 1: it is the intersection between the plane passing on the base of the nut connecting hub support to control arm, and the straight line tangent to the hub support.

Point 2: axis of the bolt securing control arm to chassis.

Front wheel alignment dimension

\[ A = 12 \pm 7 \text{ mm} \]

(0.47 ± 0.28 in)

‘A’ dimension must be picked up for both front right and front left suspensions.

DIMENSION MEASUREMENT

1. Carry out measurement of dimension relevant to step 1. making use of the following tools and setting the graded movable stem of check tool to the complete backward position (see following figure).

   (1) Rule \[ 3 \] A.4.0146.
   (2) Tool for suspension height check \[ 3 \] A.4.0149.
   (3) Probe \[ 3 \] A.4.0150.

2. Carry out measurement of dimension relevant to step 2. making use of the following tools and moving only graded stem of check tool.

   (1) Rule \[ 3 \] A.4.0146.
   (2) Tool for suspension height check \[ 3 \] A.4.0149.
   (3) Magnetic adapter \[ 3 \] A.4.0153.

3. Directly read on graded scale (located on movable stem of check tool) the ‘A’ height dimension value.

REAR SUSPENSION HEIGHT

(1) Check rear wheel alignment by measuring specified ‘B’ dimension which is the distance between the two lines parallel to floor plane and passing through below defined points 1 and 2.
COMPLETE CAR

Point 1:
Axis of bolt securing front rod to wheel support.

Point 2:
Axis of bolt securing front rod to body.

Car rear suspension height dimension
B = 23 ± 7 mm (0.90 ± 0.27 in)

Measurement of "B" dimension must be carried out both for right tie rod and for left tie rod of rear suspension.

DIMENSION MEASUREMENT
1. Carry out measurement of dimension relevant to point 1 and 2 making use of the following tools.
   (1) Rule A.4.0146.
   (2) Tool for suspension heights check A.4.0149.
   (3) Magnetic adapter A.4.0206.

2. Directly read on graded scale (located on movable stem of check tool) the value of "B" height dimension.
   In case the read values differ from the prescribed ones, replace springs.

HEEL ALIGNMENT

CHECKING FRONT WHEEL ALIGNMENT

Be sure to perform following preliminary operations prior to checking and, if necessary, adjust front wheel angles.

a. Check tire pressure; refer to Group 28 - Checking Tire Conditions.

b. Set up vehicle with static load.

c. Pick up front wheel alignment &" dimension as well as rear wheel alignment "B" dimension (Refer to: Checking Suspension Heights).

1. Toe-out
On aligned wheels, verify that steering wheel racks are properly centred. If necessary, withdraw steering wheel and centre racks.

(1) Use suitable equipment and measure toe-out making sure it is within specified value.

Toe-out
H = M = 4 ± 1 mm
(+0.157 ± 0.04 in)

Front toe-out angle
a = 10°

Wheel rim diameter
" = 340 mm (13 in)

(2) If necessary, adjust toe-out as follows:
   a. Loosen side rod lock-nut
   b. By means of tool A-3.0156 disconnect vertical steering lever ball joint (Refer to: Group 21 - Coil Springs and Shock absorbers).
   c. Suitably turn ball joint still specified toe-out is achieved.

Min. possible toe-out adjustment is 42 mm (0.08 in) on H • M difference (variation corresponds to 1 turn - 1 mm (0,039 in) thread lead - of one ball joint) meaning that semi toe-out value is equal to:

L = (1/2 M + 2 ±0,5) mm
(1/2 M + 0.08 ± 0.020 in)

Orientate joint body located on side rod so that, after being connected to steering lever the joint’s upper level is parallel to the lever’s upper level.

Tighten lock-nut and then tighten to specified torque the nuts securing ball joint to steering lever.
1: Tightening torque
Nut securing side rod ball joint onto vertical steering lever

\[ 39 \div 48 \text{ N\textcdot m} \]
\[ (4 \div 4.9 \text{ kg\textcdot m} \]
\[ 28.92 \div 35.43 \text{ ft\textcdot lb}) \]

Camber and caster angles cannot be adjusted.

4. Max steering angle
\[ \delta = 33^\circ 30' \]

CHECKING REAR- WHEEL ALIGNMENT
Rear angles cannot be adjusted.

Tie-in angle
\[ \alpha = 0^\circ \pm 25' \]

Camber angle
\[ \beta = 0^\circ \pm 25' \]

Check and make sure fluid level in reservoir is not more than 1/4 below max. level. If fluid level is extremely low, check brake system for leaks.

CHANGING BRAKE FLUID
1. Connect a hose to wheel bleeder and let brake fluid drain into a suitable container (refer to: Group 22).

CAUTION:
Be extremely careful not to drop any of the brake fluid on painted surfaces since it is highly corrosive.

2. Refill system with new oil and bleed all air from the system (refer to: Group 22 - Brake System Bleeding).
3. If required, carry out travel adjustment by operating on nut and lock nut of adjustment fork located under passenger compartment central console.

4. Besides, verify the following:
   (1) With control lever in the rest position also jaws must be at rest.
   (2) When operating control lever, cables must slide freely.
   (3) Indicator lamp must switch on within one click of parking brake control lever and switch off as soon as control lever is at rest position.

(4) Maneuverability of control lever must result to be easy and smooth running and when control lever is engaged hooking tooth must be into its seat in the scroll gear without difficulty.

STEERING SYSTEM

1. Check steering for sticking or stiffness when turning wheels in both directions.
2. Rotate steering wheel clockwise and anticlockwise checking steering system for excessive play. For relevant adjustment refer to: Group 23 - Checks and Inspections - Rack Box and Guide Tube.
3. Tighten, where required, all steering system connecting points. (Refer to: Group 23 - Tightening torques).
4. Check condition of steering box protecting boots and replace them if necessary.
5. Check steering rod ball and flexible joints; replace them if worn.

SERVICE DATA AND SPECIFICATIONS

ENGINE MAINTENANCE

TECHNICAL DATA - INSPECTION AND ADJUSTMENT

<table>
<thead>
<tr>
<th>Engine</th>
<th>1200</th>
<th>1350</th>
<th>1500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve clearance (cold engine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intake</td>
<td>mm (in)</td>
<td>0.35 ± 0.40 (0.014 ± 0.016)</td>
<td></td>
</tr>
<tr>
<td>Exhaust</td>
<td>mm (in)</td>
<td>0.45 ± 0.50 (0.018 ± 0.020)</td>
<td></td>
</tr>
<tr>
<td>Alternator-pump belt tension</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force applied to belt</td>
<td>N (kg, lb)</td>
<td>79 (8; 3.63)</td>
<td></td>
</tr>
<tr>
<td>Deflection</td>
<td>mm (in)</td>
<td>15 (0.59)</td>
<td></td>
</tr>
<tr>
<td>Cylinder compression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min compression pressure</td>
<td>kPa (bar, p.s.i., kg/cm²)</td>
<td>1030 (10.30, 149.39; 10.5)</td>
<td></td>
</tr>
<tr>
<td>Max compression difference between cylinders</td>
<td>kPa (bar, p.s.i., kg/cm²)</td>
<td>98 (0.98; 14.22; 1)</td>
<td></td>
</tr>
</tbody>
</table>

B O D Y

LOCKS AND HINGES
1. Lubricate hinges and locks.
2. Adjust lock striker plates.

CHECKING SEAT BELTS

CAUTION:
- If seat belts have to be washed, do not use chemical detergents or solvents since they could damage the buckles.
- After a serious accident involving belt stress, replace same even if apparently it does not seem to be damaged.

1. Check anchors making sure they are not loose on mountings.
2. Check belts for wear.
3. Check proper working condition of buckles and tongues.
4. Fasten seat belts and check if in case of sudden movement they are promptly locked. Contrarywise, check retractors' locking system.

If condition of any seat belt component is questionable, replace the entire belt assembly involved.

May 1983
## CHASSIS AND BODY MAINTENANCE

### TECHNICAL DATA - INSPECTION AND ADJUSTMENT

#### Axles and suspensions

<table>
<thead>
<tr>
<th></th>
<th>N (kg, lb)</th>
<th>A + B = 490 + 245 = 735 (50 + 25 = 75)</th>
<th>M - H = 4 ± 1 (0.157 10.04)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle static loading arrangement (1)</td>
<td>A = 12 ± 7 (0.47 ± 0.28)</td>
<td>L = (1/2 M + 2 ± 0.08)(1/2 M + 0.08 ± 0.02)</td>
<td></td>
</tr>
<tr>
<td>Front wheel alignment</td>
<td>mm (in)</td>
<td>B = 23 ± 7 (0.90 ± 0.27)</td>
<td>α = 10°</td>
</tr>
<tr>
<td>Rear wheel alignment</td>
<td>mm (in)</td>
<td></td>
<td>θ = 340 (13.38)</td>
</tr>
<tr>
<td>Front wheel toe-out (2)(3)</td>
<td>mm (in)</td>
<td></td>
<td>α = 0° ± 25°</td>
</tr>
<tr>
<td>Rear wheel semi toe-out (2)(3)</td>
<td>mm (in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front toe-out angle</td>
<td>mm (in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheel rim diameter</td>
<td>mm (in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rear wheel toe-in</td>
<td>mm (in)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front wheel camber (3)</td>
<td></td>
<td></td>
<td>β = 2° 15' ± 30'</td>
</tr>
<tr>
<td>Rear wheel camber</td>
<td></td>
<td></td>
<td>γ = 1° ± 30'</td>
</tr>
<tr>
<td>Front wheel caster (3)</td>
<td></td>
<td></td>
<td>θ = 33° 30'</td>
</tr>
<tr>
<td>Max steering angle (3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>φ = 1° ± 30'</td>
</tr>
</tbody>
</table>

(1) Load vehicle, move it up and down on suspensions a few times. Checking operations must be performed with vehicle fully set up for driving.

(2) When turning a steering side rod joint by 360°, M - H dimension changes by 2 mm (0.079 in).

(3) These values are referred to a vehicle in nominal driving condition, i.e., with static load

### Brake system

<table>
<thead>
<tr>
<th>Disc brake</th>
<th>m m (in)</th>
<th>9 (0.354)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc min. thickness</td>
<td>m m (in)</td>
<td>7 (0.276)</td>
</tr>
<tr>
<td>Pad min. thickness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drum brake</th>
<th>m m (in)</th>
<th>0.5 (0.019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lining min. thickness</td>
<td>m m (in)</td>
<td>229.6 (9.04)</td>
</tr>
<tr>
<td>Max drum inner diameter</td>
<td>m m (in)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parking brake</th>
<th></th>
<th>2 notches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lever stroke, when applying a pulling force of</td>
<td>98 N (10 kg) (22 lb)</td>
<td></td>
</tr>
</tbody>
</table>

---

May 1983
TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N·m</th>
<th>kg·m</th>
<th>ft·lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch cover to engine flywheel unit securing</td>
<td></td>
<td>15÷23</td>
<td>1.5÷2.4</td>
<td>10.8÷17.4</td>
</tr>
<tr>
<td>screws</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gearbox unit to engine rear cover securing</td>
<td></td>
<td>39÷47</td>
<td>4÷4.9</td>
<td>28.9÷35.4</td>
</tr>
<tr>
<td>bolts and nuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic system pipe fitting securing nuts</td>
<td></td>
<td>15÷18</td>
<td>1.5÷1.9</td>
<td>10.8÷11.7</td>
</tr>
</tbody>
</table>

TROUBLE' DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch slip</td>
<td>Some trouble symptoms may also be attributable to engine problems. First determine whether engine or clutch is causing the problem.</td>
<td>To test for slipping proceed as follows:</td>
</tr>
<tr>
<td>Symptom:</td>
<td></td>
<td>To test for slipping proceed as follows:</td>
</tr>
<tr>
<td>- Car will not respond to engine</td>
<td></td>
<td>- engage parking brake</td>
</tr>
<tr>
<td>speed during acceleration</td>
<td></td>
<td>- disengage clutch and shift gears into 4th</td>
</tr>
<tr>
<td>- Insufficient car speed</td>
<td></td>
<td>- increase engine speed and gradually release clutch pedal; if car does not move and engine does not stop, clutch is slipping</td>
</tr>
<tr>
<td>- Lack of power during uphill</td>
<td></td>
<td></td>
</tr>
<tr>
<td>driving</td>
<td></td>
<td>+ Clutch facing excessively worn</td>
</tr>
<tr>
<td>- Increasing of fuel consumption</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Clutch facing wet with oil or grease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Diaphragm spring weak or damaged</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Flywheel or pressure plate warped</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+ Impurities in master cylinder, piston does not return to start position</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace clutch disc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace clutch disc (replace engine/ gearbox oilseals) if faulty</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace pressure plate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repair per replace flywheel or clutch cover</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clean or replace faulty parts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Replace clutch disc</td>
</tr>
<tr>
<td>Clutch does not disengage well</td>
<td>To test for dragging clutch proceed as follows:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- disengage clutch and shift gears into Reverse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- shift gears into Neutral, then gradually increase engine speed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- after a short interval, shift gears into Reverse</td>
<td></td>
</tr>
<tr>
<td></td>
<td>If noise is heard while gears are being shifted, clutch is dragging</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ Clutch disc hub splines or rusted</td>
<td>Clean or replace clutch disc</td>
</tr>
</tbody>
</table>

May 1983
## CLUTCH

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flywheel and/or pressure plate facings worn or warked</td>
<td>Repair or replace flywheel and/or clutch cover</td>
</tr>
<tr>
<td></td>
<td>Engine supports not efficient</td>
<td>Inspect and/or replace engine supports</td>
</tr>
</tbody>
</table>

## SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.2.0378</td>
<td>Tool for locking the flywheel</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.4.0144</td>
<td>Clutch disc aligning bar</td>
<td>12.5, 12.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CONTENTS

5 - SPEED MANUAL GEARBOX... 13-2
  Description .......................... 13-5
  Rear support ........................ 13-5
  Rods and forks ....................... 13-6
  Shafts and gears ..................... 13-10
  Differential carriers ............... 13-19
  Crown gear and pinion .............. 13-22
  Differential casing ................. 13-22
  Gearbox - differential casing ...... 13-24

GEARBOX OUTER LINKAGE... 13-25
  Disassembly ........................ 13-25

Checks and inspections ............. 13-25
Assembly ............................. 13-25
SERVICES DATA AND
SPECIFICATIONS ................. 13-26
  Technical data ...................... 13-26
  General specifications .......... 13-26
  Inspection and adjustment ..... 13-28
  Tightening torques ............... 13-30

TROUBLE DIAGNOSIS AND
CORRECTIONS ....................... 13-31
SPECIAL SERVICE TOOLS ............ 13-33

May 1983
5-SPEED MANUAL GEARBOX

Gearbox-differential unit and rear support

1 Pin
2 Gearbox casing
3 Bushing
4 Central support
5 Oil plug
6 Speedometer sensor
7 Spring ring
8 Dowel
9 Rear cover
10 Valve
11 Plug
12 Plate
13 Pin
14 Flexible support
15 Rear support
16 Spacer
17 Flexible bush
18 Oil seal ring
19 Bracket
20 Bushing
21 Flexible support
22 Reverse gear switch
23 Gasket
24 Plug
25 Drain plug
26 Oil sump
27 Gasket
28 Bushing
29 Oil seal ring
30 Support
31 Lock ring

May 1983
Shafts, gears and differential casing

1. Direct drive shaft
2. Spring
3. Bushing
4. Pin
5. Bearing
6. Reverse gear shaft
7. Reverse gear
8. Primary shaft
9. Longue
10. Bearing
11. Lock ring
12. 5th speed driving gear
13. Oil deflector
14. R.G. driven gear
15. Bushing
16. 1st speed driven gear
17. Retainer
18. Guide sector
19. Locking sector
20. Synchronizing ring
21. Lock ring
22. Sleeve
23. Hub
24. Fietainer
25. 2nd speed drive gear
26. Shouldered ring
27. 3rd speed driven gear
28. 4th speed driven gear
29. Shim
30. Bearing
31. 5th speed driven gear
32. Nut
33. Bearing
34. Shim
35. Pinion
36. Bearing
37. Differential casing
38. Bearing
39. Crown gear
Roda and forks

1 Lever
2 Main selector rod
3 Guide pin
4 3rd-4th speed rod
5 Interlock plunger
6 1st-2nd speed rod
7 Interlock plunger
8 Detent ball
9 5th speed control fork
10 1st-2nd speed lever
11 5th-speed R.G. rod
12 Plug
13 Balls
14 R.G. fork
15 Bushing
16 5th-speed R.G. rod
17 1st-2nd speed control fork
18 3rd-4th speed control fork
19 Selector lever
20 Spring pin

May 1983

13-4
GEARBOX

DESCRIPTION

The gearbox has five forward and one reverse gear. All gears have synchromesh except reverse gear. All gears are in constant mesh and have helical teeth. Reverse gear teeth are straight cut. The gears are operated by means of a floor-type gear lever connected to the selector shafts by means of a remote linkage. Connection of rear support to gearbox casing is obtained through a couple of elastic supports which reduce to a minimum the transmission of vibrations to the speed control lever.

Differential and gearbox form a single assembly. Crown gear-pinion couple is of the hypoid type and has a ratio of 9/35 or 11/39.

TRANSMISSION RATIOS

<table>
<thead>
<tr>
<th>Gear</th>
<th>Gearbox ratio</th>
<th>Crown gear and pinion ratio</th>
<th>Overall ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>9/35</td>
<td>11/39</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1:3.750</td>
<td>1:14.580</td>
<td>1:13.283</td>
</tr>
<tr>
<td>2&quot;</td>
<td>1: 2.050</td>
<td>1: 7.970</td>
<td>1: 7.267</td>
</tr>
<tr>
<td>3&quot;</td>
<td>1:1.387</td>
<td>1: 5.392</td>
<td>1: 4.916</td>
</tr>
<tr>
<td>4&quot;</td>
<td>1: 1.027</td>
<td>2: 3.992</td>
<td>1: 3.640</td>
</tr>
<tr>
<td>5&quot;</td>
<td>1: 0.825</td>
<td>1: 3.207</td>
<td>1: 2.924</td>
</tr>
<tr>
<td>RM</td>
<td>1:3.091</td>
<td>1:12.017</td>
<td>1:10.957</td>
</tr>
</tbody>
</table>

REMOVAL AND INSTALLATION

Removal from vehicle

Should the whole drive unit be removed from the vehicle and the two units be thereafter separated, proceed as follows:

1. Remove drive unit from vehicle (refer to: Group 01 - Drive Unit Removal and Installation).
2. Separate gearbox-differential unit from engine unit (refer to: Group 01 Separation and Assembly of the Units).

Installation of vehicle

In case of assembly of groups and installation on vehicle proceed as follows:

1. Assemble gearbox differential unit and engine unit (refer to: Group 01 Separation and Assembly of the Units).
2. Assemble drive unit on vehicle (refer to: Group 01 Drive Unit - Removal and Installation).
3. After installing drive unit on vehicle fill up with prescribed oil (AGIP FI Rotra MP SAE 80W90 or IP Pontiax HD 80W90), oil should be fed in slowly till the level reaches the lower rim of fill hole, check for oil level and fit in plug.

REAR SUPPORT

DISASSEMBLY

Set gearbox-differential unit on a suitable stand provided with bracket and proceed as follows:

1. Remove remote linkage 1 retaining clip 5 from lever 3 and remove rod.
2. Dissassemble gearbox outer linkage from rear support (see: Gearbox Outer Linkage - Disassembly).
3. Disconnect drive unit rear support from flexible supports 1 and 4 which connect it to gearbox-differential casing 2 by unscrewing the two screws 3.

1 Remote linkage 2 Bush 3 Lever 4 Washers 5 Retaining clip
4. Remove pin 1 inserted into flexible support 2 and remove the flexible support itself from rear support should its replacement be required.

ASSEMBLY
1. Reassemble end flexible support on rear support, the pair of flexible supports on rear cover, then the rear support itself following the reverse order for disassembly and using the same tools previously used.
2. Reassemble the outer linkage of gearbox on rear support (refer to: Gearbox Outer Linkage - Assembly).

RODS AND FORKS

DISASSEMBLY
1. Remove spring pin securing lever to main selector rod 1 and remove lever.

2. Unscrew reverse gear light switch 1 and remove it together with relevant washer from rear cover 2.

3. Unscrew screw 2 and remove plate 3 securing oil bleeder valve to gearbox casing cover and remove valve plug 1 and valve 4 itself.

4. Unscrew and remove screws 1 fixing rear cover 2 to gearbox casing 3 . Use a plastic hammer to loosen cover 2 and remove it together with seal gasket 4.

CAUTION:
Gearbox casing is made of aluminium alloy. Handle with maximum care to avoid damaging it.

CHECKS AND INSPECTIONS
1. Clean metal parts of rear support with solvent and check for its integrity.
2. Check amount of leverage articulation wear.
3. Check on integrity of rubber bushings, and replace worn or damaged ones.
5. Remove main selector rod 2 and seal ring 3 from rear cover 1.

Should removal of seal ring take place while gearbox is fully assembled (on stand or vehicle), special tool A.3.0429 must be used.

5. Remove guide pin 2 for main selector rod 3 and return spring 1.
7. Unscrew and remove screws 4 with relevant fixing washers from oil sump; remove oil sump 5 together with relevant gasket.

8. Unscrew screw 1 securing 1st and 2nd speed control fork 7 on relevant rod 2 and screw 6 securing 1st and 2nd speed lever 5. Remove lever 6 from gearbox casing. Loosen and remove screw 3 fixing 3rd and 4th speed control fork 4 on relevant rod.

9. Use tool A.3.0322 to remove the following spring pins:
   - Pin 3 securing reverse gear and 5th speed lever on rod 4
   - Pin 5 securing safety lever on rod 2
   - Pin 1 securing selector lever on rod 2.

10. Remove main selector rod 4 and recover selector 1, spring 8 3 and lever 2.

11. Engage 5th speed and remove 5th speed and reverse gear rod(4) lock ring 2 place on central support 1. Unscrew and remove the two balls securing plug 3 then remove the balls themselves.
12. Remove 5th speed and reverse gear rod 1 together with 5th speed control fork 3 and sleeve 2.

13. Use a driftpin 3 to remove 3rd and 4th speed rod 2 and recover its relevant fork 8 1 from synchronizer sleeve. Proceed as above for removal of 1st and 2nd speed rod 5 together with fork 4.

14. Remove the following components from the seats on the rear support of gearbox casing:

- The three detent balls 2 from the three rods
- The two interlock plungers 3 after unscrewing screw 4 which give access to a channel which can be inspected by a screwdriver able to move the interlock plungers considered.

The withdrawal 3rd and 4th speed rods and 1st and 2nd speed rods proceeds, as the millings appear, respectively circular and rectangular shaped, in correspondence with the rear support of the gearbox, it is necessary to rotate the rods to prevent the balls from getting inserted into the millings themselves, preventing thus the withdrawal from being completed.

ASSEMBLY

1. Set the corresponding 1st-2nd and 3rd-4th speed control forks on relevant synchronizer sleeve.
2. Insert dummy rod A.3.0303 into assembly seat of 3rd and 4th speed rod. Assemble through hole on dummy rod a new spring with relevant detent ball, after greasing, then by means of the driver tool A.3.0309 insert and compress them so as to be able to move backward tool rod to keep them into position.
3. Insert relevant rod into gearbox casing seat pushing at the same time tool rod. Complete assembly of rod by introducing it into the small hub of the fork and by aligning the hole on the latter with the slot on the rod.

CHECKS AND INSPECTIONS

Wash parts carefully before operating on them. Superficial faults, wear and efficiency of certain organs can be better detected.

1. Inspect whether speed control forks are not excessively worn or warped.
2. Inspect whether rods are not warped.
3. Inspect whether slots on rods bear any nickings.
4. Inspect whether detent balls and interlock plungers bear any nickings or seizing marks.
5. Grease and assemble spring and 1st-2nd speed rod detent ball, using tools A.3.0304 and A.3.0309. Grease and insert relevant ball into radial hole on rod. Insert then rod itself into its seat on the gearbox casing, paying attention to the reciprocal position of milling and of detent ball, and make it pass through the small hub of relevant fork.

6. Use relevant securing plug to close interlock plunger hole.

7. Grease and use tools A.3.0303 and A.3.0309 to assemble spring and 5th speed and reverse gear rod detent ball. Insert then rod 2, together with 5th speed control fork 3, into small hubs of 5th speed and reverse gear lever 1 and into reverse gear control fork 4 together with relevant sliding sleeve.


Insert the two balls into their seats on central support of gearbox casing together with relevant spring, then lock securing plug and unscrew it by one quarter of a rotation. Mount lock ring of 5th speed and reverse gear rod on the end of the rod itself, on the differential side.

9. Assemble partially main selector rod, by introducing it from the rear side of the gearbox casing, insert it then into the selector lever, into the spring and into the lever. Complete then introduction of rod.

Align axes of lever holes with the corresponding ones on rod and mount spring pins using tool A.3.0322.

The speed selector lever pin 2 must be shim fitted while the other lever’s pin 1 must be fitted as a striker on the edges of the pin itself, with the excess portion of the pin protruding on the selector’s side.

10. Fit the guide pin for the main selector rod return spring.

11. Position the 1st-2nd speed lever 8 on the relevant rod 2. Turn rod 2 so that specified “S” clearance is established between lever 8 and rod 5.

12. Align the holes and then fit the retaining screw 1. Tighten it according to specified torque.

13. For gear synchronizing center 1st-2nd and 3rd-4th speed control forks - in that order - on toothed rings with the help of a gauge; now fit retaining screws and tighten them according to specified torque.

CAUTION:
Prior to tightening, thoroughly clean the retaining screw thread with OMNIFIT surface-active agent and then coat it with OMNIFIT 150 H cement

11: Tightening torque
Screw securing 1st-2nd speed selector lever to rod:
25 ± 26 N-m (2.5 ± 2.7 kg-m
18.07 ± 19.52 ft-lb)

13: Tightening torque
Screw securing fork to 1st-2nd and 3rd - 4th speed rod:
21 ± 23 N-m (2.1 ± 2.3 kg-m
15.10 ± 16.63 ft-lb)
GEARBOX

Check working condition of spring-plunger-rod assembly making sure that speed selection is smooth and that speeds do not jump out of their position and become disengaged.

14. Fit oil sump, with a new gasket, on the gearbox casing and tighten relevant screws.
15. Position rear cover, with a new gasket, on both gearbox casing centering seats; fit the oil bleeder valve with relevant retaining plate, and then tighten all screws.
16. Apply a coating of ISECO Molykote BR2 grease to the main selector rod seal ring as well as to its work seat on the rod. Using tool A.3.0294, fit the seal ring on the rod.

TESTING
Check working condition of spring-plunger-rod assembly making sure that speed selection is smooth and that speeds do not jump out of their position and become disengaged.

SHAFTS AND GEARS

SHAFTS AND GEARS

DISASSEMBLY

Pinionshaft gears
1. Remove rods and forks (refer to: Rods and Forks - Disassembly). 
2. Acting on relevant sleeves, engage two speeds in order to prevent pinion from turning.
3. With a punch, eliminate all caulking from the gear train to pinion locking nut.
4. With spanner A-5.0196, loosen the nut and remove the hub, the 5th speed gear with relevant synchronizing unit, and the bushing.

SHIFTER ASSEMBLY

1: Tightening torque
R.G. switch to gearbox casing
40 ÷ 49 N-m
(4 ÷ 4.9 kg-m
28.92 ÷ 35.43 ft-lb)

TESTING
Check working condition of spring-plunger-rod assembly making sure that speed selection is smooth and that speeds do not jump out of their position and become disengaged.

17. Fit the relevant lever on the main selector rod and then, using a punch, fit the retaining pin.
18. Fit reverse gear switch on rear cover.

May 1983

13-10
CAUTION:
If friction between the pinion and the inner race of the rear taper roller bearing hinders withdrawal of the pinion shaft, use tool A.3.0296.

7. Remove the pinion (3) with relevant taper roller bearing (1) and adjusting washer (2), from the gearbox-differential casing.

8. With tool A.3.0296 remove the rear bearing outer race from the gearbox-differential casing.


10. With the help of a press and of plates A.3.0306, remove the front bearing (1) inner race and the adjusting washer (2) from the pinion shaft (3).

Synchronizing units
Remove the lock ring (1) and then remove in sequence: the synchronizer ring (2), the guide sector (3), the locking sector (4), and the retainers (6).

The 1st speed synchronizing unit has only one retainer.

Direct drive shaft
1. Remove the lock ring (1) of the clutch drive thrust bearing support and then remove the support (2).
1. **Lock ring**
2. **Thrust bearing support**

2. Remove the direct drive shaft oil seal ring located on the front of the gearbox casing.

3. To remove oil seal ring, with mounted unit, operate as per figure making use of tool A.3.0452.

4. Having removed the direct drive shaft, if necessary, remove the direct drive shaft bush with the help of tool A.3.0291. This tool removes also the oil seal ring.

5. Remove the spring ring retaining the pin connecting the direct drive shaft to the joint.

3. Remove the spring ring retaining the pin connecting the direct drive shaft to the joint.

4. Remove the pin in question and pull out the direct drive shaft. Now remove the spring ring retaining the pin that connects the primary shaft to the joint; remove this latter pin and pull out the joint from the primary shaft.

**Reverse gear shaft**

1. Loosen and remove the R.G. shaft retaining screw and then remove the shaft, with relevant sliding gear and R.G. fork from its location on gearbox-differential casing.

**Primary shaft**

1. Fit lock tool A.2.0300 at the end of the primary shaft in order to prevent it from turning.
2. Loosen the screw securing the primary shaft to its rear bearing and remove the oil deflector.
3. Using tool A.3.0495 remove the 5th speed driving gear (1).
4. Pull out the tongue securing the 5th speed driving gear to the primary shaft.
5. Loosen and remove the screw securing the primary shaft (4) front: floating bearing (3).
6. Remove lock ring (2) from rear bearing (1).
7. Fit pinion (1) back into the gearbox-differential casing.
8. Fit rear bearing on pinion shaft (1), together with the first section (fork shaped) of tool A.3.0490, at the location of the 4th speed driving gear. Now fit the second section of tool A.3.0490 locking it on the pinion, by means of the relevant nut, at the location of the 5th speed driven gear.
9. Fit tool A.3.0296 on the gearbox-differential casing and then fit the A.3.0492 end piece. Carefully tighten the screws securing tool A.3.0296 to the gearbox-differential casing to avoid damaging the casing's threads.
10. With the above mentioned tool, push the primary shaft toward the differential casing.
11. Remove the 4th speed driving gear and relevant tongue.

May 1983
12. Keeping tool A.3.0296 in place, remove pinion shaft with all the parts that are fitted on it; now totally remove tool A.3.0490.
13. Completely screw the tool A.3.0296 and insert tools A.3.0491 and A.3.0500 on its nut thread. Unscrew tool A.3.0296 and remove primary shaft rear bearing from its seat, then separate it from the tool.

14. Remove the primary shaft from the gearbox-differential casing passing through the seat of the rear bearing.

CHECKS AND INSPECTIONS
Thoroughly wash all parts and visually check them with extreme care for any surface flaws.

Gears and splines
1. Check that teeth contact pattern of primary shaft and bevel pinion gears extends to the entire working surface. Unevenly worn gears or gears with broken teeth must be replaced making sure that relevant mating gears have not been damaged.
2. Also check that above mentioned toothing as well as the groove on the synchronizing ring do not show any scores, evidence of pitting or excessive wear. Replace all parts that are not flawless.

Bushings
Check pinion bushings for excessive wear making sure that working surfaces in contact with gears do not show any scratches or evidence of pitting. Replace all parts that are not flawless.

Synchronizing unit
Check sliding surfaces for scores and make sure that sleeves slide smoothly on relevant hubs; check synchronizing rings for excess wear.

Bearings
1. Carefully inspect all bearings by slowly rotating them: no vibrations, noise or sticking should be noticed if bearings are in good working condition.
2. Check surface of all rings and rotating parts making sure there are no scores, marks or roughness due to friction of foreign matter. Replace all parts that are not flawless.

Reverse gear shaft
If any of the parts making up the reverse gear shaft assembly are defective or damaged, replace them with new ones available as spare parts.

ASSEMBLY
Primary shaft
1. First fit on the primary shaft the tongue for keying of the 4th speed driving gear.
2. Fit the shaft in its seat on the gearbox-differential casing and then fit the 4th speed gear on the shaft.
3. Lock the primary shaft’s front end with tool A.2.0300 (refer to: Primary Shaft - Disassembly).
4. Fit tool A.3.0300 on the primary shaft’s rear end using it to key the 4th speed gear.


Carefully tighten screws of tool A.3.0296 on the gearbox casing to avoid damaging the casing’s threads.
6. With the help of suitable pliers fit the lock ring in its seat on the primary shaft's rear bearing support. Make sure the lock ring is properly lodged in its seat.

7. Keeping the primary shaft locked by means of tool A.2.0300, fit tool A.3.0300 on same shaft's rear end; center the shaft in the rear ball bearing.

Fit primary shaft on rear bearing. Fit roller bearing on the primary shaft's front end being careful to align the hole of the bearing's outer race with the corresponding hole in the gearbox-differential casing. Fit securing screw into the hole in the gearbox-differential casing.

Fit securing screw into the hole and fully tighten it.

Having completed primary shaft assembly, check and make sure it turns freely on the bearings, without sticking.

9. Fit on primary shaft the longue for keying of the 5th speed driving gear.

10. With tool A.3.0300 fit the 5th speed gear in its seat on the primary shaft by the gearbox casing's outer rear side.

11. Fit oil deflector in its seat on the 5th speed gear and tighten the primary shaft retaining screw, without fully locking it.

Reverse gear shaft

1. Fit reverse gear shaft, with relevant sliding gear and driving fork into its seat on gearbox casing.

2. Tighten to specified torque the screw securing the R.G. shaft to the gearbox casing.

R.G. shaft to gearbox casing retaining screw

\[
19 \div 24 \text{ N-m} \\
(1.9 \div 2.4 \text{ kg-m} \\
13.74 \div 17.36 \text{ ft-lb})
\]

Pinion shaft gears

1. Coat with grease (AGIP F1 Grease 33 FD) the outer surface of the pinion taper roller bearings outer races and then fit them on the gearbox casing, using the same tools used during disassembly (Tool A.3.0296 for the rear bearing race, and tool A.3.0296 - together with tool A.3.0297 - for the front bearing race).

CAUTION:
Take special care during assembly making sure that bearing races are exactly flat against casing surface.

2. Fit the proper shim, selected in advance, on the pinion shaft (refer to: Adjustments - How to determine pinion height).

Using a press and tool A.3.0307, fit the taper roller bearing inner race on the pinion shaft.

3. If previously disassembled for overhaul purposes, reassemble synchronizing units (refer to: Synchronizing units).

4. Apply the prescribed engine oil to outer surface of bushings and then fit them on gears according to their relevant position at time of disassembly thus restoring the original working surface pattern.

5. Partially insert bevel pinion into the gearbox casing and then fit all parts making up the train, while slowly pushing the pinion till it reaches its final position. During this operation be sure to follow the sequence and positioning show in the relevant figure, paying special attention to the R.G. driven gear and to the 4th speed shoulder washer.

Fit standard shim A.4.0141 (9.60 mm (0.378 in) thick) and the inner race of the rear taper roller bearing, making sure that it fits flat against the shoulder washer.

May 1983
In case of friction between the bearing’s inner race and the pinion, use tools A.3.0300, A.3.0301 for easier fitting.

6. Fit the bushing and the hub of the 5th speed driven gear and then tighten by hand the pinion gear train lock nut.
7. Engage two gears and then tighten the nut according to specified torque, without caulking.

1: Tightening torque
Pinion gear train to pinion shaft lock nut
220.5 ÷ 245 N·m
(225 ± 25 kg·m
162.70 ÷ 180.77 ft·lb)

8. Now select the shim for final fitting (refer to: How to determine Pinion Shaft Taper Roller Bearing Pre-load).

Synchronizing units
1. As far as 2nd, 3rd, 4th and 5th speed gears are concerned fit retainers 2 and 4nd on gear body 1 placing locking sector 5 and guide sector 3 between them. Fit synchronizing ring 6 on retainers and sectors and then lock into place all parts with relevant lock ring 7.

2. Now follow the same procedure for the 1st speed gear remembering, however, that in this case there is only one retainer (refer to: Disassembly - Synchronizing units).

ADJUSTMENTS
How to determine pinion height

CAUTION:
Use only metric system in order to avoid confusion in computations.

To determine pinion height, and therefore shim thickness, proceed as follows:
1. Fit inner race of the pinion shaft front taper roller bearing on dummy pinion A.4.0142.
2. Insert dummy pinion in gearbox casing.

3. Fit rear taper roller bearing inner race 2 and relevant lock nut onto dummy pinion 1.

4. Tighten the nut according to specified rolling torque using coupling tool A.2.0274, 1 dm. dia. sheave C.5.0124 and weight C.2.0037.

1: Dummy pinion
2 Taper roller bearing inner race

May 1983
5. Turn dummy pinion a few times in both directions to allow bearings to settle.

8. Place the differential carrier, with dial gauge, on the head of dummy pinion and then take reading of "L₁" value.

7. Fit crown axis reference tool C.6.0162 into the differential carrier seat; tighten, in bias sequence and according to specified torque, the four screws securing it to the gearbox-differential casing.

9. Repeat above operation by fitting tool C.6.0162 into the seat of the opposite side differential carrier and take reading of "L₂" value.

11. Determine as follows the "S" thickness of the shim that is to be fitted behind the pinion head:

\[ s = \frac{L₁ + L₂}{2} \pm (\pm \varepsilon) \]

12. Among the various shims available as spare parts, select the one with thickness nearest to the value determined as per above instructions.

Example:

\[ L₁ = 0.86 \]
\[ L₂ = 0.88 \]
\[ c = 0.13 \]

\[ S = \frac{L₁ + L₂}{2} - (\pm \varepsilon) = \frac{0.86 + 0.88}{2} - (0.13) \]

\[ = \frac{1.74}{2} = 0.87 \]

(2)

\[ 0.67 \]

(3)

\[ -0.13 \]

Computed shim thickness \( s = 0.74 \)

Selected shim thickness \( S = 0.75 \) mm

Shim thickness thus determined in this one ensuring correct pinion height since readings have been taken with pinion in its actual operating position.

May 1983
How to determine pre-load of pinion shaft taper roller bearings

**CAUTION:**
Use only metric system in order to avoid confusion in computations.

After having fitted all various parts as described in paragraph “Reassembly Pinion Shaft: Gears, item no. 5”, measure pinion end play by carefully following the procedure described hereafter:

1. Fit bracket A.2.0242 to gearbox casing with the interposed spacers A-2.0234 and then a centesimal dial gauge to the bracket.

![Diagram showing the position of the bracket and dial gauge.]

Properly tighten the screws securing bracket A.2.0242 to the gearbox casing in order to avoid damaging casing threads.

2. Turn pinion in both directions to allow bearings to settle. Push pinion by hand in one direction and reset the dial gauge.

3. Move pinion in the opposite direction and take reading of “G” play on dial gauge.

In case of subsequent end-play readings, it is necessary to rotate again the pinion in both directions to allow bearings to settle.

4. Determine as follows the rear shim “S” thickness for pinion taper roller bearings pre-loading:

\[
S = 9.60 - G - 0.10
\]

whereas 0.10 is a play-correcting factor for taper roller bearing pre-loading.

![Diagram showing the placement of components and notations.]

Select the shim with thickness nearest to the value determined as per above instructions keeping in mind, however, that max. allowed tolerance is ±0.02 mm and that thicknesses available as spare parts have a 0.05 mm variation step.

**Example:**

<table>
<thead>
<tr>
<th>Standard shim thickness</th>
<th>9.60</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>0.37</td>
</tr>
<tr>
<td>Play-correcting factor</td>
<td>0.10</td>
</tr>
<tr>
<td>S</td>
<td>9.60 - G - 0.10</td>
</tr>
</tbody>
</table>

**Computed shim thickness:**

\[
S = 9.60 - 0.37 - 0.10 = 9.23
\]

**Selected shim thickness:**

S = 9.15 mm

5. Loosen and remove the nut as well as the hub, the bushing, the bearing inner race, and the standard shim making sure that the train’s various parts do not rotate.

6. Fit the shim selected as per above computation; now fit the bearing inner race, all the parts making up the 5th speed driven gear set and lastly the nut.

7. Tighten the nut to specified torque.

![Diagram showing the tightening specifications.]

8. Coat all gears of primary and pinion shafts with specified gearbox-differential type oil (AGIPF1 Rotra MP SAE 80W90 or IP Pontiax HD 80W90).

Turn pinion shaft a few times in both rotating directions to allow bearings to settle.

9. Fit coupling tool A.2.0274, the 1 dm rad. sheave C.5.0124, and the C.2.0037 weight to the pinion shaft nut.

![Diagram showing the installation of the coupling tool and weight.]

10. Check that weight descends normally without stopping and without pulling the disc too fast. Check that in such condition rolling torque is as specified.
1: Rolling torque of pinion with gear train.
   a. For original bearings being used again
      \[ 4 \div 7 \text{ N-dm} \]
      \[ (0.40 \div 0.70 \text{ kg-dm} \]
      \[ 0.289 \div 0.506 \text{ ft-lb} \]
   b. For replacement bearings (new)
      \[ 1.3 \div 1.6 \text{ N-dm} \]
      \[ (1.3 \div 1.6 \text{ kg-dm} \]
      \[ 0.939 \div 1.157 \text{ ft-lb} \]

In case of rolling torque values greater or lower than specified ones, correct them by fitting a rear shim either 0.05 mm thinner or thicker than the one previously fitted. In this instance, rechecking of rolling torque is required.

11. Caulk the nut with punch and hammer.

12. First prevent shafts from rotating by engaging two speeds and then tighten the screw securing the oil deflector to the primary shaft according to specified torque.

13: Tightening torque
   Oil deflector retaining screw
   \[ 69 \div 85 \text{ N-m} \]
   \[ (7 \div 8.7 \text{ kg-m} \]
   \[ 50.61 \div 62.91 \text{ ft-lb} \]

CAUTION:
Cover direct drive shaft splines with tape.

5. Fit the clutch drive thrust bearing support and secure it to its seat on the differential casing by means of the relevant lock ring.

Make sure that lock ring is correctly lodged; check that its tongues are facing the sleeve seat and thus pressing it on the casing.

TESTING
Check that hubs and synchronizing rings are in perfect working condition and that engagement of gears is noiseless and easy.

DIFFERENTIAL CARRIERS

Direct drive shaft
1. If previously disassembled, fit direct drive shaft bushing \( 1 \) to gearbox casing using tool A.3.0308.

1 Bushing
2. Fit bushing on primary shaft making sure that holes for subsequent pin fitting are aligned; fit the pin and a new retaining spring ring.
3. Insert direct drive shaft into its seat and connect it to the bushing by fitting the pin and a new retaining spring ring.

Make sure that retaining spring rings are properly lodged in their respective seats so as to prevent pins from dropping out.

4. After having applied grease (ISECO: Molykote BR2) to its sealing lip and to its work seat on the shaft, fit a new oil seal ring on the direct drive shaft with the help of tool A.3.0323. During this operation be careful not to damage the sealing lip of coupling splines.

Use tool A.3.0453 to assemble oil seal ring on direct drive shaft, on assembled unit.

1 Taper roller bearing
2 Phonic wheel
3 King nut
4 Lock ring
5 Ball bearing
6 Shim
7 Seal ring
8 Carrier
9 Seal ring
10 Differential shaft

N-m
(kg-m
ft-lb)
**DISASSEMBLY**

**IMPORTANT:**
The following procedure refers to the right hand differential carrier. Difference between left differential support and right one is only constituted by absence of phonic wheel in the left differential support.

1. Loosen and remove oil sump retaining screws with relevant washers, now remove the sump and the seal gasket.

2. Loosen and remove the screws securing the differential carrier to the gearbox casing. Partially pull back the carrier and remove the two shims, being careful to mark the relevant position to be later followed during reassembly. Now completely disassemble differential carrier.

3. Remove seal ring from differential carrier.

4. Lock differential carrier in a vice and remove the ring nut securing the differential carrier on the bearing and phonic wheel using tool A.3.0298.

5. With the help of a press and of plates A.3.0295, remove differential shaft from the carrier. Remove the oil seal ring.


7. Remove the bearing lock ring from its seat in the differential carrier.

8. Now with tool A.3.0302, remove the ball bearing from the differential carrier.
Following the same procedure, disassemble the left hand differential carrier.

9. In case of malfunction of speed indicator device, remove sensor \( \text{(2)} \) from gearbox after removing retaining spring \( \text{(1)} \) and replace it.

1. Apply gearbox oil to the oil seal ring outer surface and fit it into its seat on the differential carrier using tool A.3.0430.

CAUTION:
Make sure the crowfoot on the oil seal ring points in the direction of the differential shaft rotation.

**CHECKS AND INSPECTIONS**

Having thoroughly washed all parts, perform following checking operations:

1. Carefully inspect all bearings while slowly rotating them: no vibrations, noise or sticking should be noticed if bearings are in good working condition.
2. Check the surface of all rings and rotating parts making sure that there are no scores, marks or roughness due to friction of foreign matter.
3. Check that contact surface of differential shafts splines extends to the entire working surface; if any of the teeth is chipped or show evidence of abnormal wear, replace shafts making sure that relevant mating parts have not been damaged.

**ASSEMBLY**

Referring to the right hand differential carrier, proceed as follows:

1. Apply gearbox oil to the oil seal ring outer surface and fit it into its seat on the differential carrier using tool A.3.0430.

2. With tool A-3.0302 and the help of a press, fit the differential shaft bearing into the carrier.

3. Fit the differential shaft bearing lock ring.

4. Using tool A-3.0292 fit the taper roller bearing outer race into the carrier.

5. Apply grease (ISECO Molykote BR2) to the oil seal ring inner surface and to its seat on the differential shaft. With tool A-3.0293 and the help of a press and a rest plate, fit now the differential shaft.

6. Apply gearbox oil (AGIP Rotra MP SAE 80W90 or IP Pontiax HD80W90) to the mating surfaces on differential shaft of the bearing retaining ring nut. Make sure to fit a new ring nut.

7. On differential shaft install first ring, nut and then phonic wheel, using tool A.3.0293 together with a press and a rest plate.

8. After having applied a coating of gearbox oil, fit the small seal ring in the carrier's groove.

9. Fit the right hand differential carrier in its seat on the gearbox casing.

May 1983
Following the same procedure, reassemble the left hand differential carrier.

10. Fit oil sump with relevant sealing gasket.

CROWN GEAR AND PINION DISASSEMBLY

Crown gear
1. Remove differential carriers from the gearbox-differential casing (refer to: Differential Carriers - Disassembly).
2. Remove differential casing from the gearbox-differential casing (refer to: Differential casing - Disassembly).
3. Loosen and remove the screws securing the crown gear to the differential casing and then remove the crown gear.

Pinion
1. Remove gears from pinion shaft and then withdraw the shaft from its seat in the gearbox-differential casing, with relevant bearings (refer to: Shafts and Gears).

TESTING
Verify back-lash between crown gear and pinion in four diametrically opposite positions. Irregular back-lash, with excessive differences between the measured points, is an indication of crown gear deformation with consequent flatness error between gearbox casing/crown gear place and differential casing plane. Make sure the differential works properly and is completely noiseless. Incorrect assembly of crown gear and pinion or worn taper roller bearings could be the cause of the trouble.

Differential casing

DISASSEMBLY
1. Remove left and right hand differential carriers (refer to: Differential Carriers - Disassembly).
2. Remove differential casing from gearbox-casing.

CHECKS AND INSPECTIONS
Having thoroughly washed all parts, proceed as follows:
1. Slowly rotate bearings checking them for vibrations, noise or sticking.
2. Check surface of all rotating parts and of rolling tracks for scores or any evidence of abnormal wear, pitting or overheating; in the affirmative, replace the parts involved.
3. Make sure that contact pattern of bevel pinion teeth extends to their entire working surface. If any of the teeth are nicked, replace the pinion and make sure the crown gear has not been damaged as a consequence. Check both toothings for scores and any evidence of pitting or excess wear.

ASSEMBLY

Crown gear
1. Following the procedure described in paragraph "Differential Casing - Assembly", fit crown gear to differential casing.
2. Fit differential casing back to gearbox casing.

Pinion
Position the pinion into its seat in the gearbox-differential casing and fit bearings and gears (refer to: Shafts and Gears).

CHECKS AND INSPECTIONS
Having thoroughly washed all parts, perform the following checking operations:
1. Slowly rotate bearings checking them for vibrations, noise or sticking.
2. Check the surface of all rotating parts and of all rolling tracks for scores and any evidence of abnormal wear, pitting or overheating; in the affirmative, replace the parts involved.
3. Visually check gears, both planetary and side gears, making sure that there are no scores or evidence of pitting, that contact pattern extends to their entire working surface and further that mating is noiseless and smooth.

If necessary, replace the whole differential casing; in this case also replace taper roller bearings.
CAUTION: Use only metric system in order to avoid confusion in computations.

5. Compute, as shown below, the average value “Hm” of the four measurements picked-up as per item 4 above and determine the thickness of “B” shims that will have to be fitted behind the crown gear side carrier for pre-loading of taper roller bearings.

\[ B = Hm - 0.20 \]

whereas 0.20 is correcting factor for bearing pre-loading.

Example of computation of the four picked-up measurements:

\[
\begin{align*}
H_1 &= 1.88 \\
H_2 &= 1.94 \\
H_3 &= 1.90 \\
H_4 &= 1.96
\end{align*}
\]

\[ B = Hm - 0.20 = \frac{1.88 + 1.94 + 1.90 + 1.96}{4} - 0.20 = \]

\[ 1.92 - 0.20 = 1.72 \text{ mm} \]

6. Considering that max. allowed tolerance is ± 0.02 mm and that shims available as spare parts have a thickness variation step of 0.05 mm select the thickness nearest to the computed value (in the above instance one would select the 1.70 mm thickness).

7. Fit selected shims behind the crown gear side carrier and tighten retaining screws to specified torque (refer to: Step 2).

Crown gear to pinion backlash

Adjust crown gear to pinion backlash following the procedure hereafter described.

1. Rotate pinion and crown gear to allow relevant bearings to settle and then use tool A.2.0243 to lock the pinion. Properly tighten screws of tool A.2.0243 on gearbox casing.

2. Fit a centesimal dial gauge to a magnetic base and place the gauge’s indicating finger on the outer edge of a crown gear tooth at right angles with the tooth’s side.

3. Rotate crown gear as far as backlash will allow and read the value shown on dial gauge.

4. Repeat the above reading on four different points of the crown gear, equally distant one from the other.

Each of the four measured values must fall within the range of 0.05 to 0.10 mm (2·10⁻³ ± 4·10⁻³ in).

If backlash does not fall within these values, proceed as hereafter described, remembering that total shim thickness (A + B) between differential carriers and gearbox casing must remain constant otherwise it would cause bearings pre-load to change:

- in case backlash is below specified value, move crown gear away from the pinion by decreasing thickness of A shims and equally increasing that of B shims.
- in case backlash is above specified value, move crown gear closer to the pinion by increasing thickness of A shims and decreasing that of B shims by the same extent.

When correcting shim thickness it should be remembered that in order to change dial gauge reading (min. distance between crown gear and pinion teeth) by 0.01 mm (0.4·10⁻³ in), one must move a thickness of 0.015 mm (0.59·10⁻³ in) from one side to the other.

Having completed fitting of shims, tighten retaining screws to specified torque (Refer to: Adjustments – How to Determine Pre-load of Differential Casing Bearings). Double check backlash and if now within specified values, repeat above adjusting operations.

When refitting previously disassembled parts (carriers, differential casing, bearings and crown gear), it is essential that also same A and B shims are used - Or at least new ones of same thickness - and that they are placed back exactly where they were located at time of disassembly.

GEARBOX - DIFFERENTIAL CASING

DISASSEMBLY

1. Remove rear support (Refer to: Rear Support - Disassembly).

2. Remove the clutch control fork and then withdraw the thrust bearing from the direct drive shaft (Refer to: Group 12).

3. With the help of a punch, remove the clutch control fork retaining pin.

4. Remove differential carriers (Refer to: Differential Carriers - Disassembly).

5. Remove differential casing with crown gear (Refer to: Differential Casing - Disassembly).

6. Remove rods and forks (Refer to: Rods and Forks - Disassembly).

7. Remove shafts and gears (Refer to: Shafts and Gears - Disassembly).
GEARBOX

CHECKS AND INSPECTIONS
1. Thoroughly clean casing with solvent and check it for scores, nicks or evidence of pitting.
2. Check the casing's mating surfaces making sure there are no nicks, no evidence of roughness nor or old sealants.
3. Check that the clutch for retaining pin is not in any way damaged.

ASSEMBLY
1. Fit shafts and gears (Refer to: Shafts and Gears Assembly).
2. Fit differential casing (Refer to: Differential Casing - Assembly).
3. Fit differential carriers (Refer to: Differential Carriers - Assembly).
4. Fit rods and forks. Thoroughly clean rear cover and oil sump mating surfaces; fit new gaskets with specified sealants and then fit cover and sump (Refer to: Rods and Forks - Assembly).
5. Fit clutch control fork retaining pin.
6. Fit the clutch control fork and then fit thrust bearing on direct drive shaft (Refer to: Group 12).
7. Fit rear support (Refer to: Rear Support - Assembly).

GEARBOX OUTER LINKAGE

DISASSEMBLY
1. Loosen and remove the nut with washer as well as the screw securing the main selector rod to the gearbox lever; then remove the spacer and the two bushings.
2. Loosen and remove the gearbox lever guide retaining screws with washers; now remove the guide, the boot and the bushing located at lever's end.
3. Loosen and remove the nut and the screw securing the gearbox lever support to the flexible bush located on the rear extensions; now remove side washers as well as the spacer.
4. Remove rear support (Refer to: 5-Speed Manual Gearbox - Rear Support).
5. Lastly remove the flexible bush with the help of following tools: a press, a plate, a base and punch tool.

CHECKS AND INSPECTIONS
1. Thoroughly clean outer linkage metal parts with solvent and make sure they are in good condition.
2. Check linkage articulated joints for excess wear.
3. Make sure boot is in perfect condition; if damaged or worn, replace it.

ASSEMBLY
1. Fit rear support (Refer to: 5-Speed Manual Gearbox - Rear Support).
2. Apply grease (AGIPF1 Grease 15 or SHELL Retinax G) to the spacer on the speed selector lever to main selector rod connection and to the spacer securing the fork to the flexible bush on the gearbox cover.
3. Apply 5 g (0.176 oz) of same grease to the speed selector lever guide.
4. Go on to fit all gearbox outer linkage following disassembly procedure in reverse sequence.
## SERVICE DATA AND SPECIFICATIONS

### TECHNICAL DATA

<table>
<thead>
<tr>
<th>Gearbox differential</th>
<th>Speed selector lever positions</th>
<th>Speed</th>
<th>Gearbox ratio</th>
<th>Differential ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9/35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11/38</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gearbox-</td>
<td>Speed at 1000 r.p.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>differential</td>
<td>Km/h (mi/h)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>overall ratio</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gearbox-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>differential</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>overall ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Speed at 1000 r.p.m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Km/h (mi/h)</td>
</tr>
<tr>
<td>1</td>
<td>1 - 3 - 5</td>
<td>1</td>
<td>1 : 3.750</td>
<td>1 : 14.580</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7.08 (4.39)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
<td>1 : 2.050</td>
<td>1 : 7.970</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12.96 (8.05)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>1 : 1.387</td>
<td>1 : 5.392</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19.15 (11.89)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4</td>
<td>1 : 1.027</td>
<td>1 : 3.992</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>25.67 (16.07)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td>1 : 0.825</td>
<td>1 : 3.207</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32.20 (20.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R.G.</td>
<td>1 : 3.091</td>
<td>1 : 12.017</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.59 (5.34)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engine</td>
<td>1200</td>
<td>1200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1350</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1500</td>
</tr>
</tbody>
</table>

### GENERAL SPECIFICATIONS

#### FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>App. o.</th>
<th>Application</th>
<th>Type</th>
<th>Name</th>
<th>Q. ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inner surface of:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Seal ring of main selector rod</td>
<td>GREASE</td>
<td>ISECO Molykote BR2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Seal ring of primary shaft</td>
<td></td>
<td>Std. No. 367159941</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Seal ring of differential shaft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Seal lip and work seat on shaft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outer surface of:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. Seal rings</td>
<td>OIL</td>
<td>See item 5</td>
<td></td>
</tr>
</tbody>
</table>

May 1983

13-26
## GEARBOX

<table>
<thead>
<tr>
<th>App. No.</th>
<th>Application</th>
<th>Type</th>
<th>Name</th>
<th>Q. ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Outer races of differential casing and pinion taper roller bearings</td>
<td>GREASE</td>
<td>AGIP: F1 Grease 33 FD Std. No. 3671 69833</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mating surfaces of: Ring nut securing bearing to differential shaft</td>
<td>OIL</td>
<td>See item 5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Outer surface of: Spacer on main selector rod to speed selector lever connection Spacer for lever to fork fitting Speed selector lever guide</td>
<td>GREASE</td>
<td>AGIP: F1 Grease 15 SHELL: Retinax G Std. No. 3671-69811</td>
<td>5 g (0.176 oz)</td>
</tr>
<tr>
<td>5</td>
<td>Fill-up of gearbox-differential casing</td>
<td>OIL</td>
<td>AGIP: F1 Rotra MP SAE 80W90 IP: Pontiax HD80W90 Std. No. 363169408</td>
<td>2,300 kg +0,100 kg 5.07 lb + 0.22 lb</td>
</tr>
<tr>
<td>6</td>
<td>Outer surface of differential carriers and relevant seats on gearbox casing Bushings for bevel pinion driven gears</td>
<td>OIL</td>
<td>See item 5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Outer surface of: Gearbox rear flexible support Flexible support for speed selector lever upper joint</td>
<td>GREASE</td>
<td>UNION CARBIDE CHEMICAL COMPANY: Ucon lubricant 50 HE-5100 MIL LLOIL: slipping agent for rubber sections Std. No. 4500-1 7502</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Outer surface of: Fin for gearbox rear flexible support</td>
<td>GREASE</td>
<td>SPCA: spagraph ISECO: Ergon Rubber Grease no. 3 Std. No. 367169816</td>
<td></td>
</tr>
</tbody>
</table>

## SEALANTS AND SURFACE-FIXING AGENTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Name</th>
<th>Q. ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower screws securing differential carriers to gearbox casing</td>
<td>CEMENT</td>
<td>DOW CORNING: Silastic RTV732 Std. No. 3522-00040</td>
<td></td>
</tr>
</tbody>
</table>
GEARBOX

Application | Type | Name | Qty
--- | --- | --- | ---
- Screws securing forks to speed selector rods | CEMENT | Omnifit 150 H Std. No. 352400023 | -
N.B. For surface cleaning use: | SURFACE FIXING AGENT | Omnifit — Std. No. 3514-90003 | -
- Inner surface of bore for oil plug on gearbox casing | CEMENT | DIRING: Heldite Std. No. 3522-00015 | -

INSPECTION AND ADJUSTMENT

REAR SUPPORT

"β" positioning of gearbox rear flexible support

![](image)

$\beta$ degree $90 \pm 2$

RODS AND FORKS

1. "S" clearance between 3rd-4th speed rod and 1st-2nd speed selector lever

![](image)

<table>
<thead>
<tr>
<th>$s$ mm</th>
<th>$1.4 \div 1.9$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(in)</td>
<td>$(5.5 \cdot 10^{-2} \div 7.4 \cdot 10^{-2})$</td>
</tr>
</tbody>
</table>

2. End play between fork and synchronising unit sleeves

<table>
<thead>
<tr>
<th>Clearance</th>
<th>mm</th>
<th>$0.250 \div 0.375$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(in)</td>
<td>$(9.8 \cdot 10^{-3} \div 1.5 \cdot 10^{-2})$</td>
<td></td>
</tr>
</tbody>
</table>

ROLLING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>N·dm</th>
<th>kg·dm</th>
<th>ft·lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dummy pinion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Original bearings being used again</td>
<td>$3 \div 6$</td>
<td>$0.3 \div 0.6$</td>
<td>$0.217 \div 0.434$</td>
</tr>
<tr>
<td>Replacement bearings (new)</td>
<td>$12 \div 15$</td>
<td>$1.2 \div 1.5$</td>
<td>$0.867 \div 1.085$</td>
</tr>
<tr>
<td>Pinion with gear train</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Original bearings being used again</td>
<td>$4 \cdot 7$</td>
<td>$0.4 \div 0.7$</td>
<td>$0.289 \div 0.506$</td>
</tr>
<tr>
<td>Replacement bearings (new)</td>
<td>$13 \cdot 1 6$</td>
<td>$1.3 \div 1.6$</td>
<td>$0.939 \div 1.157$</td>
</tr>
</tbody>
</table>

May 1983

13-28
**DIFFERENTIAL CASING**

Thickness “S” of shims B for pre-loading of differential casing taper roller bearings

<table>
<thead>
<tr>
<th>Thickness (mm)</th>
<th>Part No.</th>
<th>Thickness (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00 (0.04)</td>
<td>101452</td>
<td>1.55 (0.062)</td>
</tr>
<tr>
<td>1.05 (0.042)</td>
<td>101453</td>
<td>1.60 (0.064)</td>
</tr>
<tr>
<td>1.10 (0.044)</td>
<td>101454</td>
<td>1.65 (0.066)</td>
</tr>
<tr>
<td>1.15 (0.046)</td>
<td>101455</td>
<td>1.70 (0.068)</td>
</tr>
<tr>
<td>1.20 (0.048)</td>
<td>101456</td>
<td>1.75 (0.07)</td>
</tr>
<tr>
<td>1.25 (0.05)</td>
<td>101457</td>
<td>1.80 (0.072)</td>
</tr>
<tr>
<td>1.30 (0.052)</td>
<td>101458</td>
<td>1.85 (0.074)</td>
</tr>
<tr>
<td>1.35 (0.054)</td>
<td>101459</td>
<td>1.90 (0.076)</td>
</tr>
<tr>
<td>1.40 (0.056)</td>
<td>101460</td>
<td>1.95 (0.078)</td>
</tr>
<tr>
<td>1.45 (0.058)</td>
<td>101461</td>
<td>2.00 (0.08)</td>
</tr>
<tr>
<td>1.50 (0.06)</td>
<td>101462</td>
<td></td>
</tr>
</tbody>
</table>

**PINION**

1. Thickness “S” of shims for setting of pinion height

\[
S = \frac{L_1 + L_2}{2} - (\pm C)
\]

\[C = \text{value engraved on pinion}\]

\[L_1, L_2 = \text{crown gear shaft deviation values}\]
2. Thickness “S” of shims for pre-loading of pinion taper roller bearings

\[
S = 9.60 - G - 0.10
\]

9.60 = sample washer thickness
G = clearance measured by gauge
0.10 = corrective value

<table>
<thead>
<tr>
<th>Thickness (mm)</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.10 (0.164)</td>
<td>700165</td>
</tr>
<tr>
<td>4.15 (0.166)</td>
<td>700166</td>
</tr>
<tr>
<td>4.26 (0.170)</td>
<td>700167</td>
</tr>
<tr>
<td>4.35 (0.174)</td>
<td>700168</td>
</tr>
<tr>
<td>4.45 (0.178)</td>
<td>700169</td>
</tr>
<tr>
<td>4.55 (0.182)</td>
<td>700170</td>
</tr>
<tr>
<td>4.65 (0.186)</td>
<td>700171</td>
</tr>
<tr>
<td>4.75 (0.190)</td>
<td>700172</td>
</tr>
<tr>
<td>4.80 (0.192)</td>
<td>700173</td>
</tr>
</tbody>
</table>

3. Pinion to crown gear backlash

Backlash (mm) = 0.05 ± 0.10
Backlash (in) = (2 × 10^{-3}) ± (4 × 10^{-3})

TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N·m</th>
<th>kg·m</th>
<th>ft·lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw securing 1st - 2nd speed selector to rod</td>
<td>N·m</td>
<td>25 ÷ 26</td>
<td>2.5 ÷ 2.7</td>
<td>18.07 ÷ 19.52</td>
</tr>
<tr>
<td>Screws securing forks to speed control rods</td>
<td>N·m</td>
<td>21 ÷ 23</td>
<td>2.1 ÷ 2.3</td>
<td>15.10 ÷ 16.63</td>
</tr>
<tr>
<td>Screws securing pin for R.G. sliding gear</td>
<td>N·m</td>
<td>19 ÷ 24</td>
<td>1.9 ÷ 2.4</td>
<td>13.74 ÷ 17.36</td>
</tr>
<tr>
<td>Primary shaft outer bearing retaining screw</td>
<td>N·m</td>
<td>69 ÷ 85</td>
<td>7 ÷ 8.7</td>
<td>50.61 ÷ 62.91</td>
</tr>
<tr>
<td>Bevel pinion gear train retaining ring nut</td>
<td>N·m</td>
<td>2 20 1 24 5</td>
<td>22.5 ÷ 25</td>
<td>162.70 ÷ 180.77</td>
</tr>
<tr>
<td>Trouble</td>
<td>Probable cause</td>
<td>Corrective action</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
<td>---------------------------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Noisy both during acceleration and deceleration (drive shaft assy already checked) | • Differential gears are worn or damaged  
• Excess play of hypoid gears  
• Crown gear securing screws are loose  
• Bevel pinion shim is worn or damaged  
• Pinion shaft retaining nut is loose  
• Excess play in gear train | Replace gears  
Check and replace, if necessary  
Tighten  
Replace shim  
Check shim components and then tighten the nut  
Adjust gear train |
| Transmission is noisy when in curve, both with speed engaged or when in neutral (drive shaft assy already checked) | • Teeth of planetary and side gears are worn, damaged or show evidence of pitting | Replace differential casing |
| Transmission is noisy when in neutral (vehicle is not moving)          | • Irregular variations of driving torque  
• Not enough oil | Adjust engine idling  
Fill up to correct level |
| Transmission is noisy when in reverse gear                              | • Reverse gears are worn or damaged | Replace defective parts |
| Engagement/disengagement of speed is not easy                           | First of all it should be established if the trouble is caused by the gearbox or by the control system. If the clutch still transmits torque when the pedal is pushed-down, it means that it is not disengaged. Verify if the clutch properly couples (pedal is released) and uncouples (pedal is pushed-down) the engine to the gearbox casing. If clutch is not faulty, the trouble originates either from the gearbox or from the control system.  
• Bushing on outer speed selector lever is worn  
• Gearbox outer linkage needs adjusting and/or lubrication of joints is insufficient  
• Stroke of outer linkage parts is not sufficient due to excess play  
• Not enough oil in gearbox-differential casing  
• Synchronizing units are faulty  
• Inner controls are deformed or worn | Replace bushing  
Check linkage, joints and controls  
Check the system and, if necessary, repair or replace worn parts  
Fill-up to correct level  
Refer to “Synchronizing unit is faulty”  
Repair or replace defective parts |
| Speeds become disengaged                                                | • Sleeves and gears are worn or defective  
• Excess end-play of the gear that becomes disengaged (Noisy both during acceleration and deceleration) | Replace worn parts  
Verify adjustment of gear train |
## GEARBOX

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
</table>
| Speed selection is poor | • Bushing on outer speed selector lever is worn  
  • Plungers are worn or damaged  
  • Springs can no longer be used due to fatigue or because they are broken  
  • Rod millings are worn or deformed  
  • Selector fork and/or levers are worn or damaged | Replace bushing  
 Replace plungers  
 Replace springs  
 Replace rods  
 Replace the selector and/or the levers |
| Synchronizing unit is faulty or grinds | • Sleeve and gear front toothing are worn or damaged  
  • Distance between gear and sleeve front toothing is incorrect  
  • Synchronizing ring is worn  
  • Sleeve splines are worn or damaged | Replace defective parts  
 Replace defective parts  
 Replace  
 Replace |
| Reverse gear light do not light up when R.G. is engaged | • Switch of R.G. light is faulty | Replace the switch |
| Speed selector lever vibrates and is noisy | • Lever return spring is out of order due to fatigue  
  • Bushing on outer speed selector lever is faulty  
  • Refer to other items concerning noisy gearbox | Replace faulty parts |
| Seizure, pitting or breakage | • Oil level is below normal or oil is not of the specified type  
  • Incorrect clearances (not enough)  
  • Bearing and gear adjustments are incorrect  
  • Excessive torque or improper use of clutch  
  • Retaining screws are loose | Replace faulty parts and use specified oil  
 Adjust clearances and replace faulty parts  
 Replace faulty parts  
 Replace faulty parts and tighten screws to specified torque |

### SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.2.0234</td>
<td>Spacer for locking of intermediate flange (to be used with A.2.0242)</td>
<td>13-18</td>
</tr>
</tbody>
</table>

May 1983

13-33
<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.2.0242</td>
<td>Support of dial gauge to read pinion spacer thickness (to be used with A.2.0234)</td>
<td>13-18</td>
</tr>
<tr>
<td>A.2.0243</td>
<td>Tool for locking pinion</td>
<td>13-24</td>
</tr>
<tr>
<td>A.2.0274</td>
<td>Adapter of sheave for checking pinion bearing pm-load</td>
<td>13-16 13-18</td>
</tr>
<tr>
<td>A.2.0300</td>
<td>Tool for locking mainshaft (to be used with A.3.0300)</td>
<td>13-12 13-14 13-15</td>
</tr>
<tr>
<td>A.3.0287</td>
<td>Adjustable span puller for differential carrier bearing cones</td>
<td>13-22</td>
</tr>
<tr>
<td>A.3.0291</td>
<td>Puller of bush shim and oil seal from mainshaft and gearshift rod</td>
<td>13-12</td>
</tr>
<tr>
<td>A.3.0292</td>
<td>Driver of differential bearing cups</td>
<td>13-21</td>
</tr>
<tr>
<td>A.3.0293</td>
<td>Driver of bearing and phonic wheel retainer onto differential spindle</td>
<td>13-21</td>
</tr>
<tr>
<td>A.3.0294</td>
<td>Driver of oil seal onto gear shift rod (with assembled unit)</td>
<td>13-10</td>
</tr>
</tbody>
</table>
## GEARBOX

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.3.0295</td>
<td>Plate for withdrawal of differential spindle</td>
<td>13-20</td>
</tr>
<tr>
<td>A.3.0296</td>
<td>Puller / driver of rear pinion bearing cup and puller of pinion shaft and mainshaft</td>
<td>13-11, 13-13, 13-14, 13-15</td>
</tr>
<tr>
<td>A.3.0297</td>
<td>Puller / driver of front pinion bearing cup (use with A.3.0296)</td>
<td>13-11, 13-15</td>
</tr>
<tr>
<td>A.3.0298</td>
<td>Puller of speedometer pinion and ring nut from shaft</td>
<td>13-20</td>
</tr>
<tr>
<td>A.3.0299</td>
<td>Puller of differential bearing outer races</td>
<td>13-20</td>
</tr>
<tr>
<td>A.3.0300</td>
<td>Driver of mainshaft and 5th speed driver gear</td>
<td>13-15, 13-16</td>
</tr>
<tr>
<td>A.3.0301</td>
<td>Driver of pinion</td>
<td>13-16</td>
</tr>
<tr>
<td>A.3.0302</td>
<td>Puller / driver of drive flange bearing</td>
<td>13-20, 13-21</td>
</tr>
</tbody>
</table>

13-35

May 1983
<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.3.0430</td>
<td>Driver of output shaft seal</td>
<td>13-21</td>
</tr>
<tr>
<td>A.3.0452</td>
<td>Puller of drive spindle seal (with unit assembled)</td>
<td>13-12</td>
</tr>
<tr>
<td>A.3.0453</td>
<td>Driver of drive spindle seal</td>
<td>13-19</td>
</tr>
<tr>
<td>A.3.0490</td>
<td>Puller of 4th-speed gear from mainshaft (to be used with A.3.0296 and A.3.0492)</td>
<td>13-73 13-14</td>
</tr>
<tr>
<td>A.3.0491</td>
<td>Puller / driver of rear mainshaft bearing (to be used with A.3.0296)</td>
<td>13-14</td>
</tr>
<tr>
<td>A.39492</td>
<td>Auxiliary shaft for removing 4th-speed gear from mainshaft (to be used with A.3.0296 and A.3.0490)</td>
<td>13-13</td>
</tr>
<tr>
<td>A.3.0495</td>
<td>Puller of 5th-speed drive gear</td>
<td>13-13</td>
</tr>
<tr>
<td>A.3.0500</td>
<td>Tool for removing rear mainshaft bearing (to be used with A.3.0296 and A.3.0491)</td>
<td>13-14</td>
</tr>
<tr>
<td>A.4.0136</td>
<td>Support of dial gauge for pinion setting (to be used with C-6.01 61)</td>
<td>13-17</td>
</tr>
<tr>
<td>Tool number</td>
<td>Tool name</td>
<td>Refer to page</td>
</tr>
<tr>
<td>-------------</td>
<td>----------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>C.5.0124</td>
<td>Sheave for checking differential bearing pm-load (to be used with A.2.0274 and C.2.0037/......)</td>
<td>13-16, 13-17, 13-18</td>
</tr>
<tr>
<td>C.6.0161</td>
<td>Reference gauge for pinion setting (to be used with A.4.0136)</td>
<td>13-17</td>
</tr>
<tr>
<td>C.6.0162</td>
<td>Tool for checking pinion setting (to be used with A.4.0136)</td>
<td>13-17</td>
</tr>
</tbody>
</table>
# DIFFERENTIAL AND DRIVE SHAFT ASSEMBLY

## GROUP 17

## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIFFERENTIAL</td>
<td>17-2</td>
</tr>
<tr>
<td>Crown gear and pinion</td>
<td>17-2</td>
</tr>
<tr>
<td>Differential casing</td>
<td>17-2</td>
</tr>
<tr>
<td>DRIVE SHAFT ASSEMBLY</td>
<td>17-2</td>
</tr>
<tr>
<td>Removal</td>
<td>17-3</td>
</tr>
<tr>
<td>Disassembly</td>
<td>17-3</td>
</tr>
<tr>
<td>Checks and inspections</td>
<td>17-4</td>
</tr>
<tr>
<td>Assembly</td>
<td>17-4</td>
</tr>
<tr>
<td>Installation</td>
<td>17-5</td>
</tr>
<tr>
<td>SERVICE DATA AND SPECIFICATIONS</td>
<td>17-6</td>
</tr>
<tr>
<td>General specifications</td>
<td>17-6</td>
</tr>
<tr>
<td>Tightening torques</td>
<td>17-6</td>
</tr>
<tr>
<td>TROUBLE DIAGNOSIS AND CORRECTIONS</td>
<td>17-6</td>
</tr>
<tr>
<td>SPECIAL SERVICE TOOLS</td>
<td>17-6</td>
</tr>
</tbody>
</table>

May 1983
DIFFERENTIAL AND DRIVE SHAFT ASSEMBLY

DIFFERENTIAL

CROWN GEAR AND PINION

For crown gear and pinion overhauling procedure refer to: Group 13 5-Speed Manual Gearbox - Crown Gear and Pinion.

DIFFERENTIAL CASING

For differential casing overhauling procedure refer to: Group 13 5-Speed Manual Gearbox Differential Casing.

DRIVE SHAFT ASSEMBLY

1. Shaft
2. Wheel nut
3. Washer
4. Drive shaft
5. Washers
6. Stopper ring
7. Inner race
8. Cage
9. Ball
10. Clamp
11. Boot
12. Clamp
13. Clamp
14. Boot
15. Clamp
16. Inner cover
17. Seal ring
18. Outer ring
19. Inner race
20. Cage
21. Ball
22. Stopper ring
23. Outer cover
24. Plate

May 1983

17 - 2
DIFFERENTIAL AND DRIVE SHAFT ASSEMBLY

5. Mark outer ring, cage and joint's inner race with a reference line to ensure proper positioning when assembling.

6. Use pliers to remove lock ring.

7. Now remove the constant-speed joint from the shaft with the help of a press, two half-plates, a punch and a base.

8. Slip boot off the shaft and remove inner cover from the joint.

9. Remove both seal rings from the joint's outer ring.

10. Remove steel balls from the joint and then disassemble the joint into its different components: outer ring \(3\), cage \(2\), and inner race \(1\).

CHECKS AND INSPECTIONS

1. Using suitable equipment, thoroughly clean all joint parts.

2. Check working surfaces and balls for scores or any evidence of wear due to friction of foreign matter; replace the joint, if necessary. Remember that broken boots will cause loss of lubricant and will also allow foreign matter to enter which, in turn, will cause faulty operation of the constant-speed joints; usually this problem is easily detected during testing.

3. Make sure that play in both joints is not too much since excessive play is the cause of noise during sudden torque reversal; this is evidenced by a knocking sound which is easily detected during testing. Should disassembly by required, it is advisable to replace the joint protecting boots as well as the seal rings on the constant-speed joint on gearbox-differential side.

ASSEMBLY

Reassemble joints being careful to fit parts back into their original position, as marked at time of disassembly, and following the procedure hereafter described.

OUTER JOINT (A)

1. Thoroughly coat with grease (Molykote \(VN\) 2461 C or Optimol Olistamoly 2 L N 584) the cage, the inner race and the steel balls; pack the joint's recess with \(40\ g\ (1.41\ oz)\) of the same type grease.

2. Fit boot on shaft being extremely careful not to damage it in any way along the splines; to this effect splines should be covered with tape.

3. Fit lock ring to groove on joint's inner race. Make sure lock ring is properly and securely lodged in its seat on the shaft.

4. Following disassembly procedure in reverse sequence, now fit the inner race and the cage. Inner race should be fitted so that its face, on which lock ring was previously fitted, faces to outside of the joint.

5. Fit steel balls as shown in the figure.

CAUTION:
Do not exchange this joint's steel balls with those of the inner joint as their diameter is different.
6. Fit washers on shaft, wheel side, according to numbering marked at time of disassembly. Now fit the constant-speed joint with the help of a press, of two half-plates and of tool A.3.0605.

7. Finish up lubricating by packing joint with 40 g (1.41 oz) more of the above mentioned grease and make sure that balls are completely surrounded by grease.

8. Fit boot on joint; fit new clamps and tighten them using suitable pliers being careful not to damage the boot in doing so.

INNER JOINT (B)

Thoroughly coat with grease (Molykote 2461 C or Optimal Olistamoly 2 l. N 584) the cage, the inner race and the steel balls; pack the joint’s recess with 40 g (1.41 oz) of the same type grease.

1. Fit boot on shaft being extremely careful not to damage it in any way along the splines; to this effect splines should be covered with tape.

2. Following disassembly procedure in reverse sequence, now fit the inner race and the cage.

3. Fit steel balls as shown in the figure and verify that the joint works properly.

4. Fit inner cover to the joint and then fit the latter on the shaft with the help of a press, of two half-plates, of a base and a punch.

5. Pack joint with 40 g (1.41 oz) more of the above mentioned grease and make sure that balls are completely surrounded by grease.

6. Fit both seal rings on the joint’s outer ring.

7. Fit lock ring following disassembly procedure in reverse sequence.

8. Fit the boot; fit new clamps and tighten them using suitable pliers being careful not to damage the boot in doing so.

9. Fit the three plates to the inner cover, insert relevant screws and washers, and lastly fit the outer cover onto the six screws.

INSTALLATION

1. Insert shaft into wheel hub.

2. Connect shaft to differential drive shaft and lock securing screws to specified torque.

3. By means of a new nut, secure wheel hub to shaft. Tighten nut to specified torque, then caulk it.

4. Fit inner cover to the joint and then fit the latter on the shaft with the help of a press, of two half-plates, of a base and a punch.

5. Pack joint with 40 g (1.41 oz) more of the above mentioned grease and make sure that balls are completely surrounded by grease.

6. Fit both seal rings on the joint’s outer ring.

7. Fit lock ring following disassembly procedure in reverse sequence.

8. Fit the boot; fit new clamps and tighten them using suitable pliers being careful not to damage the boot in doing so.

9. Fit the three plates to the inner cover, insert relevant screws and washers, and lastly fit the outer cover onto the six screws.

CAUTION:

Do not exchange this joint’s steel balls with those of the outer joint as their diameter is different.
DIFFERENTIAL AND DRIVE SHAFT ASSEMBLY

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive shaft assembly constant-speed joints (for each joint)</td>
<td>GREASE</td>
<td>Molykote VN 2461 C or Optimal Olistamoly 2 LN 584 Std. No. 3671-69843</td>
<td>80 g</td>
</tr>
<tr>
<td>Split grease quantity between the two sides of each joint's crown of balls</td>
<td></td>
<td></td>
<td>(2.82 oz)</td>
</tr>
</tbody>
</table>

TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N·m</th>
<th>kg·m</th>
<th>ft·lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws securing (in oil), with outer spacer, drive shaft assembly to differential shaft</td>
<td></td>
<td>33</td>
<td>3.4</td>
<td>24.58</td>
</tr>
<tr>
<td>Nuts securing drive shaft assembly to wheel hub</td>
<td></td>
<td>226</td>
<td>23</td>
<td>166.30</td>
</tr>
</tbody>
</table>

TROUBLE DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Necking during sudden torque reversal</td>
<td>Too much play between seats and steel balls, Not enough lubricating grease and leakage from the boots</td>
<td>Replace the joint, Smear with grease and replace boots</td>
</tr>
</tbody>
</table>

SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.3.0605</td>
<td>Base for withdrawal and fitment of drive shaft from constant speed joint.</td>
<td>17-3, 17-5</td>
</tr>
</tbody>
</table>

May 1983

17-6
FRONT SUSPENSION

GROUP 21

CONTENTS

DESCRIPTION ................... 21-2
FRONT WHEELS HUB ............. 21-3
  Removal ..................... 21-4
  Disassembly .................. 21-4
  Checks and inspections ....... 21-5
  Assembly ..................... 21-5
  Installation .................. 21-6
FRONT SUSPENSION ............. 21-6
  Coil spring and shock absorber .. 21-6
  Transverse and semi-trailing link ... 21-8

SERVICE DATA AND
SPECIFICATIONS ............... 21-9
  Technical data ............... 21-9
  General specifications ....... 21-10
  Checks and inspections ...... 21-10
  Tightening torques .......... 21-11

TROUBLE DIAGNOSIS AND
CORRECTIONS .................. 21-11

SPECIAL SERVICE TOOLS ......... 21-13

Refer to Group 00 – Chassis and Body Maintenance for:
- Checking Suspension Height
- Wheel Alignment

May 1983
DESCRIPTION

1. Coil spring
2. Steering lever
3. Strut
4. Joint boot
5. Shaft
6. Semi-trailing link
7. Transverse link
8. Ball joint
9. Hub support
10. Wheel cover
11. Bearing
12. Hub nut
13. Wheel hub
14. Wheel screw
15. Brake disc
16. Dust cover
17. Rim
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 and unscrew it out of drive shaft 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 from hub support, without disconnecting it from hose.

7. Unscrew and remove nut securing ball joint pin, on semi-trailing link, to hub support. Hold hub support properly, and by using the A.3.0157 withdraw pin.

DISASSEMBLY

1. Clamp hub support in vice provided with jaws, unscrew dowel and remove brake dust cover from hub support.

4. Reclamp hub support in vice provided with jaws and using a punch remove two caulking on ring nut securing bearing to support. Using and octagonal spanner with proper extension unscrew ring nut and
FRONT SUSPENSION

5. Withdraw bearing from hub support by means of press puller A.3.0302 and two plates.

6. Reclamp hub in vice and using a suitable tool withdraw bearing inner race.

CHECKS AND INSPECTIONS

1. Carefully clean hub and hub support and visually check surfaces for damage. Replace damaged parts, if required.
2. Replace, at any rate, bearing assembly, ring nut and seal ring.

ASSEMBLY

2. Clamp hub support in vice provided with jaws, fit a new ring and using octagonal spanner A.5.0239 screw ring nut into its seat on support, tightening it to the specified torque.
3. Caulk ring nut edge.
5. Lubricate seal ring outer surface with prescribed oil (AGIP Rotra HP SAE 80W90 or IP Pontiax HD 80W90) and fit ring in its seat on hub support by means of tool A.3.0330.
6. Clamp hub support in vice provided with jaws and fit dust cover and brake disc.
INSTALLATION

1. Reinstall hub-hub support assembly in the reverse order of removal and tighten following parts to the specified torque values:

<table>
<thead>
<tr>
<th>Description</th>
<th>Torque Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuts securing vertical guide to body</td>
<td>12 ± 15 N·m (1.2 ± 1.5 kg·m 8.84 ± 11 ft·lb)</td>
</tr>
<tr>
<td>Screws securing hub support to strut bracket</td>
<td>39 ± 48 N·m (4 ± 4.9 kg·m 28.9 ± 35.43 ft·lb)</td>
</tr>
<tr>
<td>Screw fixing caliper on hub support</td>
<td>59 ± 74 N·m (6 ± 7.5 kg·m 43.4 ± 54.2 ft·lb)</td>
</tr>
<tr>
<td>Nut securing semi-trailing link ball joint to hub support</td>
<td>39 ± 48 N·m (4 ± 4.9 kg·m 29.9 ± 35.43 ft·lb)</td>
</tr>
<tr>
<td>Screws securing drive shaft to differential shaft</td>
<td>33 ± 36 N·m (3.4 ± 3.7 kg·m 24.58 ± 26.75 ft·lb)</td>
</tr>
</tbody>
</table>

2. Refit caliper to hub support.

<table>
<thead>
<tr>
<th>Description</th>
<th>Torque Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws fixing caliper on hub support</td>
<td>59 ± 74 N·m (6 ± 7.5 kg·m 43.4 ± 54.2 ft·lb)</td>
</tr>
<tr>
<td>Nut securing wheel hub to shaft</td>
<td>226 ± 275 N·m (23 ± 28 kg·m 116.3 ± 202.5 ft·lb)</td>
</tr>
</tbody>
</table>

3. Refit shaft, by doing as follows:

   (1) Insert splined end into wheel hub.
   (2) Connect shaft to differential drive shaft by locking the six securing screws to the designed torque.
   (3) By means of a new nut, secure shaft to wheel hub. Tighten nut to designed torque and caulk it.

FRONT SUSPENSION

COIL SPRING AND SHOCK ABSORBER
FRONT SUSPENSION

REMOVAL
1. Place car on lift, block rear wheels, jack up front of vehicle, then support it by stands placed in adjacent position to jacking points (refer to: Group 00 - Lifting Points and Towing).
2. Remove four screws and wheel.
3. Unscrew nut securing ball pin of steering track rod to lever of strut.
5. Operating within engine compartment, loosen and remove four nuts securing strut to body.
6. Hold strut properly, then loosen and unscrew the four screws securing strut bracket to hub support.

DISASSEMBLY
Clamp strut in vice and carry out disassembly as follows:
1. Hook spring by tool A.2.0251 and screw two nuts of tool so as to progressively compress spring until upper cap is released.
2. Unscrew shock absorber securing nut as shown on following figure.

WARNING:
Compress spring as minimum as possible so as to allow upper cap rotation with relevant gasket and retainer.
When compressing spring, ensure that tool is always hooked firmly to spring and lower cap.

3. Withdraw following parts (refer to figure of page 21-6): washer, upper washer, rubber support, lower washer, with boot, spring rubber seat, with relevant retainer and cap, rubber bound bumper, spring with relevant lower cap secured to compression tool.
If required, gradually release spring from tool, then separate spring from lower cap.
Then remove lever retainer from spring lower cap.
4. Referring to the following figure, dismantle cap retainer to following parts, taking care in numbering them and mark direction to be kept during assembly: roller thrust bearing, bearing washer and lower seal ring.
Mark lower caps so as to identify them during assembly.

May 1983
CHECKS AND INSPECTIONS

Clean all the components.

Self-lubricating bush

Check self-lubricating bushes embodied in strut lower cap retainers for signs of excessive wear which are showed by metallic dust appearing on bush working surface.

Shock absorber

If required verified setting data relevant to shock absorber built-in strut. (Refer to Service Data and Specifications-Checks and Inspections).

Replace shock absorber in case they are removed because of inefficiency or oil leakages are detected.

Springs

Visually check springs for anomalous signs.

Rubber parts

Replace rubber parts if deformed, damaged or aged.

ASSEMBLY

1. Lubricate seal ring and thrust bearing of spring lower cap retainer with grease (AGPIPF1 grease 33 FD, IP Autogrease FD).

Refit all parts of retainer to strut complying with direction and order marked during disassembly.

2. If previously removed, refit tool A.2.0251 to spring and lower cap with tool clamped in vice; compress spring so that subsequent assembly procedure can be carried out.

Refit remaining parts of strut assembly complying with sequence shown on figure.

Spring lower and upper caps should be those corresponding with the-side (righthand or lefthand) to which strut is installed.

INSTALLATION

1. Install strut in the reverse order of removal and tighten following parts to the specified torque:

\[ T \] : Tightening torque

Screw securing hub support to strut bracket

\[ 39 \div 48 \text{ N-m} \]

(4 \div 4.9 \text{ kg-m} 28.9 \div 35.43 \text{ ft-lb})

Nut securing strut to body

\[ 12 \div 15 \text{ N-m} \]

(1.2 \div 1.5 \text{ kg-m} 8.84 \div 11 \text{ ft-lb})

Nut, steering tie rod ball joint on bracket lever

\[ 39 \div 48 \text{ N-m} \]

(4 \div 4.9 \text{ kg-m} 28.9 \div 35.43 \text{ ft-lb})

2. Remove wheel from the operative side.

3. Loosen and remove shaft securing nut (wheel side).

4. Detach constant-speed joint from differential drive shaft by loosening the six securing screws and remove shaft.

5. Remove nut securing semi-trailing link ball joint pin to hub support and withdraw pin using tool A.3.0157.

6. Loosen bolt securing transverse link to engine cross member and bolt securing to semi-trailing link, then withdraw the removing transverse link.

7. Loosen bolt securing semi-trailing link to body and remove the link.

8. If required, after checking flexible joints: remove flexible joints from semi-trailing links and transverse links by means of proper tool.

TRANSVERSE AND SEMI-TRAILING LINK

REMOVAL

1. Place car on lift. Support front of vehicle on stands sited in adjacent -position to jacking points and block rear wheels by hand brake.
CHECKS AND INSPECTIONS
Clean all the components

1. Visually check semi-trailing links and front transverse links for blows, deformations, oxidation, cracks.
2. Examine condition of flexible bushes in semi-trailing and transverse link knuckles.
3. Check that semi-trailing link ball joint pivots free from crawlings or with notable slack in its seat.

Avoid flexible joints coming into contact with oil or grease.

INSTALLATION
1. If previously removed, it flexible joints, inserting them from the chamfered side, to semi-trailing link and front transverse link.

CAUTION: To ease joints installation, lubricate outer surface with the fluid prescribed for rubber parts fitting to metallic seats (MILLOIL Slider for rubber sections; UNION CARBIDE CHEMICALS COMPANY Ucon Lubricant 50 HB-5100).

2. Install transverse links and semi-trailing links to body in reverse order of removal and torque-tighten screw securing semi-trailing link ball joint pin to wheel support to the specified values.

Tighten fixing points of semitrailing and transverse link flexible joints to specified torque with car having its nominal height (see: Car Height).

SERVICE DATA AND SPECIFICATIONS

TECHNICAL DATA

COIL SPRING

<table>
<thead>
<tr>
<th>Wire diameter</th>
<th>mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.6 (0.535)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coil diameter</th>
<th>mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>160 (6.299)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Free length</th>
<th>mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>293 (11.535)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stiffness</th>
<th>N/mm (kg/mm) (lb/in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 5</td>
<td>(2.5)</td>
</tr>
<tr>
<td>(140)</td>
<td></td>
</tr>
</tbody>
</table>

SHOCK ABSORBER

<table>
<thead>
<tr>
<th>Shock absorber type</th>
<th>mm (in)</th>
<th>hydraulic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston rod diameter</td>
<td>20 (0.787)</td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>148.5 (5.846)</td>
<td></td>
</tr>
</tbody>
</table>
GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seal ring and spring lower cap retainer thrust bearing</td>
<td>GREASE</td>
<td>AGIP Grease 33 FD&lt;br&gt;IP Autogrease FD&lt;br&gt;Norm. 3671-69833/34</td>
<td>-</td>
</tr>
<tr>
<td>Hub support seal ring outer surface</td>
<td>FLUID</td>
<td>AGIP ROTRA HP SAE 80W90&lt;br&gt;IP Pontiax HD 80W90&lt;br&gt;Norm. 3631-69408</td>
<td>-</td>
</tr>
<tr>
<td>Outer surface of the semitrailing link and front link silent block</td>
<td>FLUID</td>
<td>MILLOIL: Slider for rubber sections&lt;br&gt;UNION CARBIDE CHEMICALS COMPANY&lt;br&gt;Ucon Lubricant 50 HB-5100&lt;br&gt;Norm. 1500-I 7502</td>
<td>-</td>
</tr>
</tbody>
</table>

CHECKS AND INSPECTIONS

DATA OF SHOCK ABSORBERS SETTING

<table>
<thead>
<tr>
<th>SHOCK ABSORBER</th>
<th>LEFT</th>
<th>RIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfa Romeo Part Number</td>
<td>542.353</td>
<td>542.352</td>
</tr>
<tr>
<td>Low speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compression</td>
<td>N (kg) / (lb)</td>
<td>107.9 ÷ 166.4 (24.25 ÷ 41.89)</td>
</tr>
<tr>
<td>Expansion</td>
<td>N (kg) / (lb)</td>
<td>215.8 ÷ 313.9 (48.5 ÷ 70.55)</td>
</tr>
<tr>
<td>High speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compression</td>
<td>N (kg) / (lb)</td>
<td>421.83 ÷ 559.2 (94.8 ÷ 125.7)</td>
</tr>
<tr>
<td>Expansion</td>
<td>N (kg) / (lb)</td>
<td>1128.15 ÷ 1324.3 (253.5 ÷ 297.6)</td>
</tr>
</tbody>
</table>

NOTE: The shock absorbers are integrated in the strut tubes
<table>
<thead>
<tr>
<th>Troubles</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steering wheel shocks, vibrations or shimmying (cont.)</td>
<td>• Excessive play in steering linkage</td>
<td>Check and replace if required</td>
</tr>
<tr>
<td></td>
<td>• Loose screws securing steering box</td>
<td>Tighten</td>
</tr>
<tr>
<td></td>
<td>• Unserviceable shock absorber or loose securing points</td>
<td>Tighten or replace</td>
</tr>
<tr>
<td>Vehicle drifts or wanders</td>
<td>Drifting becomes evident when vehicle is running on a flat surface with hands off steering wheel. Reference should also be made to: Group 25–Trouble Diagnosis and Corrections</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Worn or faulty tire</td>
<td>Adjust and/or tighten</td>
</tr>
<tr>
<td></td>
<td>• Improper tire air pressure and/or loose wheel nuts</td>
<td>Replace tire with thinnest tread</td>
</tr>
<tr>
<td></td>
<td>• Difference in height between right and left tire tread</td>
<td>Restore</td>
</tr>
<tr>
<td></td>
<td>• Asymmetric suspension height</td>
<td>Restore</td>
</tr>
<tr>
<td></td>
<td>• Incorrect steering geometry</td>
<td>Check and restore working conditions</td>
</tr>
<tr>
<td></td>
<td>• Brake dragging</td>
<td>Replace worn components</td>
</tr>
<tr>
<td></td>
<td>• Worn suspension linkage flexible bush</td>
<td>Replace faulty components</td>
</tr>
<tr>
<td></td>
<td>• Connection steering-suspension faulty</td>
<td></td>
</tr>
<tr>
<td>Steering wheel excessive play</td>
<td>• Pinion-rack mating incorrectly adjusted</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Worn steering components</td>
<td>Replace worn components</td>
</tr>
<tr>
<td></td>
<td>• Loose steering box securing screws</td>
<td>Tighten</td>
</tr>
<tr>
<td>Noise</td>
<td>• Improper tire air pressure</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Damaged and worn ball pin or steering parts; or lack in lubrication</td>
<td>Replace or lubricate</td>
</tr>
<tr>
<td></td>
<td>• Loose steering or suspension linkage</td>
<td>Tighten</td>
</tr>
<tr>
<td></td>
<td>• Faulty shock absorber</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty wheel bearing</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Faulty suspension linkage bush</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Damaged coil springs</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Loose shock absorber securing nut</td>
<td>Tighten</td>
</tr>
<tr>
<td>Tires squeal when taking a curve</td>
<td>• Improper tire air pressure</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Incorrect steering geometry</td>
<td>Restore</td>
</tr>
<tr>
<td></td>
<td>• Incorrect driving</td>
<td>Avoid incorrect driving</td>
</tr>
<tr>
<td>Abnormal tires wear (or uneven)</td>
<td>• Refer to: Group 28-Wheels and Tires</td>
<td>Wheels and tires</td>
</tr>
</tbody>
</table>
### FRONT SUSPENSION

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stiff steering wheel</td>
<td>• Improper tire air pressure</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Excessively worn tire</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Pinion-rack mating incorrectly adjusted</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>After these preliminary operations, if trouble persists, check and operate as follows.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jack up front of vehicle and support on safety stands. Separate strut knuckled arm from track rod and move steering wheel.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) If steering wheel is light to move, check and locate cause of trouble in steering linkage, suspension or front axle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) If steering wheel is hard to move, check and locate cause of trouble in steering box or steering column.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Improper steering box lubrication or/and oil contamination (b)</td>
<td>Lubricate</td>
</tr>
<tr>
<td></td>
<td>• Improper steering linkage lubrication, grease contamination or abnormal steering wheel wear (a)</td>
<td>Correctly lubricate, replace grease or worn parts</td>
</tr>
<tr>
<td></td>
<td>• Worn or seized ball pin (a)</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Deformed steering linkage (a)</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Incorrect steering geometry (a)</td>
<td>Restore</td>
</tr>
</tbody>
</table>

### SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.2.0251</td>
<td>Tool for compressing and retaining spring</td>
<td>21-7 21-8</td>
</tr>
<tr>
<td>A.3.0156</td>
<td>Puller of upper pin from stub axle</td>
<td>21-7</td>
</tr>
<tr>
<td>A.3.0157</td>
<td>Puller of wheel hub support lower joint pin</td>
<td>21-4 21-8</td>
</tr>
</tbody>
</table>
### FRONT SUSPENSION

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.3.0302</td>
<td>Puller/driver of cup of front hub bearings</td>
<td>21-5</td>
</tr>
<tr>
<td>A.3.0330</td>
<td>Driver of seal and bearing of front hubs (to be used with A.3.0415)</td>
<td>21-5</td>
</tr>
<tr>
<td>A.3.0415</td>
<td>Base of withdrawal fitment (to be used with driver A.3.0330)</td>
<td>21-5</td>
</tr>
<tr>
<td>A.5.0239</td>
<td>Wrench for bearing front hub nuts</td>
<td>21-5</td>
</tr>
<tr>
<td>CONTENTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----</td>
<td></td>
</tr>
<tr>
<td>DESCRIPTION ................. 22-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brake system bleeding ........ 22-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pedal assembly ................ 22-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brake master cylinder ......... 22-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic system piping ...... 22-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brake pressure regulator valve ... 22-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Servobrake .................... 22-9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuum system ................. 22-10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front disc brake .............. 22-15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rear drum brake ............... 22-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PARKING BRAKE ................ 22-17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control lever .................. 22-17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control cables ................. 22-18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SERVICE DATA AND SPECIFICATIONS ........................................... 22-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General specifications ........ 22-19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspection and adjustment ... 22-20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tightening torques ............ 22-21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TROUBLE DIAGNOSIS AND CORRECTIONS .......................................... 22-22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPECIAL SERVICE TOOLS ........ 22-26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Refer to Group 00 • Chassis and Body Maintenance for:

* Brake System
FRONT AND REAR BRAKES

SERVICE BRAKE

BRAKE SYSTEM BLEEDING

Bleed brakes following the procedure described hereafter and being careful to perform the following:

a. Check that during bleeding the fluid level in the reservoir does not go below the “MIN” level.

b. Do not reuse the oil drained during bleeding operation.

c. Work with extreme care in order to avoid damaging painted surfaces through contact with the fluid.

1. Place car on a lift.
2. If required, refill reservoir with specified fluid (ATE “S” or AGIPF1 Brake Fluid Super DE or IP Auto Fluid FR).
3. Remove dust covers from bleeders located on calipers or on wheel cylinders.
4. Carry out bleeding operations closely following the instructions described hereafter.
   (1) Fit a small hose to the bleeder of each front brake caliper, of each rear wheel cylinder, and of bleed screw of brake pressure regulator. Place the hose other end into a transparent container previously partially filled with specified brake fluid.
   (2) Loosen the above mentioned bleeders and press a few times the brake pedal all the way down, releasing it very slowly and waiting a few moments in between pressings. Repeat this operation till the fluid coming out of the hoses is free of air bubbles and then press once more the pedal all the way down; now tighten the bleeders.

CAUTION:
During bleeding operation always keep the level of fluid in reservoir above the “MIN” level.

(3) Remove hoses from bleeders and fit relevant caps.
5. Press brake pedal all the way down and check whether, immediately after the pedal’s initial free travel, you feel a direct action on the fluid without elasticity, if not so, repeat bleeding operation.
6. Restore fluid level in the reservoir and close it with relevant cap.

22-3 May 1983
PEDAL ASSEMBLY

DISASSEMBLY

Carry out removal of pedal assembly operating as follows:

a. Engine seat
   1. Disconnect electrical wiring of brake fluid level warning light and with a syringe take out all brake and clutch fluid from reservoir.
   2. Unscrew unions connecting the four pipes that start out from the brake master cylinder. From clutch master cylinder remove the pipe and the hose connecting it to the reservoir.
   3. From servobrake remove the sleeve connected to the vacuum intake pipe.
   4. Remove screw securing sheath clamp plate of the accelerator control cable.

b. Passenger compartment
   1. Separate from accelerator pedal the control cable and release electric connection of the stop light switch.
   2. By removing retaining rings, return springs and connecting pins disconnect the brake and clutch pedals from control forks of the relevant master cylinders.
   3. By unscrewing the four securing nuts, separate from pedal assembly the servobrake - brake master cylinder unit.
   4. By unscrewing the two securing bolts remove clutch master cylinder from pedal assembly.
   5. Unscrew the six nuts (set in evidence by figure) securing pedal assembly to body and remove pedal assembly from engine seat.
   6. Remove, if necessary, the accelerator pedal from hinge to pedal assembly support by unscrewing bolt.
FRONT AND REAR BRAKES

CHECKS AND INSPECTION
1. Verify condition of pedals, of pedal assembly and gasket.
2. Check against presence of excessive wear and mesh in bushes, pin and spacer.
3. Check against presence of yield in return springs.
4. If necessary, remove and replace the stop light switch.

REASSEMBLY
For pedal assembly, reassembly, reverse the order of disassembly and apply a coat of the prescribed grease (AGIPF1 Grease 15) to the parts subject to sliding and to return springs.

INSTALLATION
1. Reinstall pedal assembly to body by reversing order of removal and complying with the following.

(1) Replace, if required, the gasket between pedal assembly and body.
(2) Tighten, to the prescribed torque, the nuts securing pedal assembly to body.

5: Tightening torques of pedal assembly nuts
9 + 15 N-m
(0.9 + 1.5 kg-m
6.51 ÷ 10.85 ft-lb)

(3) Lubricate forks connecting both brake and clutch pedals to the relevant master cylinders, with AGIPF1 GREASE 15; then reconnect them.
2. Reconnect to pedal assembly the servobrake together with brake master cylinder and then clutch master cylinder.
3. If previously removed, reconnect accelerator pedal after lubricating spacer. Make sure that accelerator pedal can freely rotate after tightening securing nut to the prescribed torque.

5: Tightening torque
8 + 10 N-m
(0.8 + 1 kg-m
5.78 ÷ 7.23 ft-lb)

6. Fill the brake and clutch oil tank up to maximum level.
7. Carry out bleeding of brake hydraulic system (see: Brake System Bleeding) and of clutch (see: Group 12 Hydraulic Control Sub-assembly Hydraulic System Bleeding).
BRAKE MASTER CYLINDER

1. Level indicator
2. Reservoir
3. Union
4. Seal ring
5. Spring
6. Support disc
7. Spring
8. Washer
9. Gasket
10. Space sleeve
11. Intermediate piston
12. Gasket
13. Tab washer
14. Lock ring
15. End washer
16. Gasket
17. Washer
18. H shaped gasket
20. Push rod piston
21. Space sleeve
22. Gasket
23. Washer
24. Spring
25. Support disc
26. Retum spring
27. Setscrew
28. Washer
29. Master cylinder body
30. Filter
31. Gasket
32. Cap

May 1983
b. Tighten to the prescribed torque two new nuts securing brake master cylinder to servobrake.

\[ T: \text{Tightening torque} \]
Brake master cylinder nuts to servobrake

\[
\begin{align*}
\text{BENDITALIA} & \quad 12 \div 15 \text{ N-m} \\
& \quad (1.2 \div 1.5 \text{ kg-m}) \\
& \quad 8.68 \div 10.85 \text{ ft-lb}
\end{align*}
\]

ATE

\[
\begin{align*}
& \quad 21 \div 28 \text{ N-m} \\
& \quad (2.1 \div 2.9 \text{ kg-m}) \\
& \quad 15.2 \div 21 \text{ ft-lb}
\end{align*}
\]

c. Pipes must be connected to master cylinder and tightened to the indicative prescribed torque.

\[ T: \text{Tightening torque} \]
Unions securing pipes to brake master cylinder

\[
\begin{align*}
& \quad 8 \div 10 \text{ N-m} \\
& \quad (0.8 \div 1 \text{ kg-m}) \\
& \quad 5.78 \div 7.23 \text{ ft-lb}
\end{align*}
\]

d. Fill reservoir up to proper level using only specified fluid (ATE “S” or AGIP Brake Fluid Super ED, or IP Auto Fluid FR).

2. Bleed brake system (Refer to: Brake System Bleeding) and, if required, also clutch system (Refer to: Group 12 Subgroup Hydraulic Control - Hydraulic System Bleeding).

HYDRAULIC SYSTEM PIPING

CHECKS AND INSPECTIONS

Thoroughly check all brake system piping (pipes and hoses) making sure they are not out of shape or cracked and that outer surfaces of pipes do not show any evidence of oxidation. Replace parts that are not flawless.

REMOVAL AND INSTALLATION

CAUTION:

a. In case of removal or reinstallation of brake pipings, use a syringe in order to suck the liquid of brake clutch tank.

b. As piping is removed, remember to plug up the ends in order to avoid foreign matter from entering.

- To remove pipes, loosen unions on both ends.
- To remove hoses, unscrew unions collecting pipes to hoses and remove them. Then, disconnect hose on the other side.

c. At the end of installation on car, both front and rear flexible cables must not result to be kink. For their check, take as reference the writing with the relevant manufacturer mark located on end of pipes, or the light coloured band (for front cables) located along pipe itself.

d. Having completed installation of piping, fill up brake fluid reservoir to proper level and bleed the brakes (Refer to: Brake System Bleeding).

BRAKE PRESSURE REGULATOR VALVE

REMOVAL

1. Unscrew the three unions of the brake pressure regulator pipes, taking care to close, by means of caps, the two feeding pipes of brake pressure regulator, in order to prevent tank emptying.

2. Remove from body, the brake pressure regulator valve by unscrewing the two securing screws and removing fork from control spring.

INSTALLATION

1. Reinstall to body the brake pressure regulator valve by tightening bolts to the prescribed torque:

\[
\begin{align*}
& \quad 15 \div 24 \text{ N-m} \quad (1.5 \div 2.4 \text{ kg-m}) \\
& \quad 10.85 \div 17.35 \text{ ft-lb}
\end{align*}
\]

4. Lower Panhard bar in order to easy spring withdrawing from pin, and from rubber ring located on rod itself. Remove spring by withdrawing it from equalizer.

5. If necessary, remove bolt and equalizer.

CAUTION:

Do not disassemble components of the brake pressure regulator.
INSTALLATION
1. On bank, reconnect master cylinder to servobrake tightening securing nuts to the prescribed torque (see: Brake Master Cylinder - Installation).
2. For reinstallation on car of the whole unit, reverse order of removal and comply with the following.
   (1) Tighten unions of pipes to the prescribed torque: 10 ÷ 14 N-m (1 ÷ 1.4 kg-m) (7.23 ÷ 10.84 ft-lb).
   (2) Lubricate connecting pin with prescribed grease (AGIPF1 GREASE 15); then reconnect fork to brake pedal.
   (3) Restore level of brake fluid; then carry out bleeding (see: Brake System Bleeding).

VACUUM SYSTEM
1. Visually check hoses making sure they are in no way damaged or clogged; also make sure clips are all properly tightened.

FRONT DISC BRAKE

DBA CALIPER

2. Remove non-return valve 1 after having removed relevant clips 2.

3. Check valve thoroughly making sure it works properly, meaning that it allows air flow only in the direction shown by crawfoot.

4. When fitting non-return valve back to hose, be careful to position it so that the crawfoot in the above figure points towards the intake manifold.

May 1983
 Pad replacement

1. Lift car's front end positioning it on safety stands (Refer to: Group 00 Lifting Points and Towing).
2. Using suitable pliers remove retainers 2 from setting plates 1 as shown in the figure below.

3. With the help of a punch, push plates 1 and 2 and take them out.

Plates are not interchangeable.

4. Press floating caliper so as to push it toward the lower groove and then remove it from the support.

5. Remove both pads, each with relevant dowel pin 1, and then remove pins from pads.

CAUTION:
When pads are off, do not push brake pedal in order to avoid piston from being ejected from its seat on floating caliper. When replacing pads use only original spare parts and replace them on both calipers. Pad assembly must be carried out by positioning the claw foot in the forward rotation direction of the brake disc.

6. Clean pads seats on caliper with alcohol.

CAUTION:
Do not lubricate in any way either the pad's resting seats on calipers nor pad dowel pins.

7. Fit dowel pins on pads and then fit same into relevant seat.
8. Push piston towards its position into floating caliper.

CAUTION:
To avoid overflow of brake fluid when the piston is pushed back, it is advisable to suck some of the fluid from the reservoir by means a syringe.

9. Now fit the floating caliper and both setting plates.

CAUTION:
Do not lubricate setting plates.

10. Fit relevant retainer on each plate,

11. Restore proper brake fluid level in reservoir (ATE “S” or AGIP PF1 Brake Fluid Super ED or IP Auto Fluid FR).

CAUTION:
To restore correct braking, push brake pedal all the way down a few times.

Caliper unit

REMOVAL

Remove caliper unit as follows:
1. By means of a syringe, suck brake fluid from feed tank.
2. Disconnect brake fluid hose 2.
3. Loosen and remove the two screws 1 securing caliper unit to hub support and then remove the whole caliper unit.

CAUTION:
In case of caliper unit replacement, make sure that on front axle are mounted calipers of the same type only.

INSTALLATION

Fit back caliper unit as follows:
1. Fit caliper unit and bracket for brake fluid hose and then tighten relevant retaining screws to specified torque.

 Tightening torque
Caliper retaining screws
59 ± 73 N-m
(6 ± 7.5 kg-m
43.8 ± 54.23 ft-lb)
2. Connect brake fluid hose (Refer to: Hydraulic System Piping).
3. Fill brake fluid reservoir up to max. level (ATE “S” or AGIPF1 Brake Fluid Super ED or IP Auto Fluid FR).
4. Bleed brake system (Refer to: Brake System Bleeding).

Floating caliper

DISASSEMBLY
If required, carry out disassembly of brake caliper operating as follows:
1. Empty brake fluid reservoir with a syringe.
2. Disconnect brake fluid hose.
3. Remove floating caliper (Refer to: Pad Replacement) and close it in a vice equipped with protecting jaws.
4. Remove dust cover and then use a jet of compressed air to remove brake piston from cylinder.
5. Remove seal ring from its seat on cylinder.

CHECKS AND INSPECTIONS
Thoroughly wash all parts in alcohol and dry them with a jet of compressed air.

CAUTION:
Do not use metal tools and detergents containing mineral oil.

Floating caliper body
1. Check cylinder surface for cracks, evidence of excessive wear and presence of rust or foreign matter.
2. To remove rust or foreign matter, clean the surface with a very fine emery cloth.
3. In case of more severe damage replace floating caliper body.
4. Check bleeder and make sure it is in good working condition.

Piston
Check piston outer surface for cracks, evidence of excessive wear, deterioration and presence of rust or foreign matter. In case just one of above flaws is present, replace the piston or the whole floating caliper.

CAUTION:
Do not clean piston surface with emery cloth but go on and replace it.

Seal ring and boot
Replace seal ring and boot each time they are disassembled.

Caliper support
Check element good condition and replace it if necessary.

Clips
Make sure they are not damaged or abnormally worn; replace them if necessary.

INSTALLATION
If previously disassembled, carry out reassembly of floating caliper operating as follows:
1. Grease cylinder, piston and sealing ring applying a coat of the prescribed brake grease (Grease ATE Bremszylinder Paste or DBA Grease); fit seal ring on cylinder and then insert control piston.
2. Lubricate boot inner surface with the above mentioned grease, and fit it into its seat.
3. Fit floating caliper on relevant support (Refer to: Pad Replacement).
4. Connect oil pipe back to floating caliper and tighten relevant union to specified torque; fill reservoir up with specified brake fluid (ATE “S” or AGIPF1 Brake Fluid Super ED or IP Auto Fluid FR).

5. Bleed brakes (Refer to: Brake System Bleeding).

CAUTION:
At the end of installation on car, make sure that hose are not kink.

Brake disc

REMOVAL AND INSTALLATION
1. Remove from hub support, the whole brake caliper without disconnecting it from hose (see: Group 21 - Front Wheel Hub).
2. Remove brake disc from hub support after having removed the dowel pin.
3. Install disc and caliper following removal procedure in reverse sequence.

CHECKS AND INSPECTIONS
1. Thoroughly clean brake discs and check that working surfaces are not deeply scored or porous. Replace or machine them if necessary.
2. Should machining of disc working surfaces be required, keep in mind the following:
   (1) Always machine both surfaces of each disc, removing the same amount of material from each surface.
   (2) Machining must be performed according to tolerances indicated in the Service Data and Specifications Section - “Checks and Adjustments”.

May 1983
Pad replacement

1. Lift car’s front end positioning it on safety stands (Refer to: Group 00 - Lifting Points and Towing).
2. Using a suitable punch, push pad dowel pins (1) as shown, in the figure that follows:

![Image of pad replacement process]

3. Remove, in sequence: the lower pin, the cross spring plate (1), and the upper pin.

4. With suitable pliers, remove the pad on cylinder’s side.
5. With a plastic hammer, strike floating caliper on cylinder’s side thus removing the other pad.

CAUTION:
When pads are off, do not push brake pedal in order to avoid piston from being ejected from its seat on floating caliper. When replacing pads use only original spare parts and replace them on both calipers. Pad assembly shall be carried out by positioning crawfoot towards the forward rotation direction of brake disc.

6. Clean pads’ seats on caliper with alcohol.

CAUTION:
Do not lubricate in any way the pads’ retaining seats on calipers.

7. Push piston back into floating caliper.

CAUTION:
To avoid overflow of brake fluid when the piston is pushed back, it is advisable to withdraw some of the fluid from the reservoir with a syringe.

8. Fit pads into their relevant seat and then complete assembly by fitting, in sequence: the first dowel pin, the cross spring plate, and the second dowel pin.
9. Restore proper brake fluid in reservoir (ATE “S” or AGIP F1 Brake Fluid Super ED or IP Auto Fluid FR).

CAUTION:
To restore correct braking, push brake pedal all the way down a few times.

Caliper unit

REMOVAL AND INSTALLATION
Removal and installation procedures of ATE calipers are like those of DBA calipers (Refer to: DBA Caliper Removal and Installation).

Floating caliper

DISASSEMBLY
If required, carry out disassembly of floating caliper, operating as follows.

1. Empty brake fluid reservoir with a syringe.
2. Disconnect brake fluid hose.
3. Remove pads (Refer to: Pad Replacement).
4. With a plastic hammer, strike floating caliper (1) till it comes off from its support (2).

5. Fit caliper on a vice equipped with protecting jaws and remove the dust cover’s (2) lock ring (1) as well as the boot.
6. Use a jet of compressed air to remove brake piston (3) from cylinder on floating caliper body (5).
7. Remove seal ring (4) from its seat on cylinder.

CHECKS AND INSPECTIONS
For checks and inspections of ATE calipers, refer to: DBA caliper - Checks and Inspections.

INSTALLATION
If previously disassembled, carry out
assembly of floating caliper, operating as follows.
1. Apply a coating of the prescribed brake grease to cylinder, piston and seal ring; fit seal ring on cylinder and then insert control piston.
2. Lubricate boot inner surface with the mentioned brake grease; then secure it with relevant lock ring.

Make sure boot and relevant lock ring are properly fitted.

3. Fit floating caliper on relevant support.
4. Connect oil pipe back to floating caliper.

**Tightening torque**

<table>
<thead>
<tr>
<th>Fastener</th>
<th>Torque (N·m)</th>
<th>(kg·m)</th>
<th>(ft·lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brake pipe to caliper union</td>
<td>10 ± 14</td>
<td>1.5</td>
<td>7.23 ± 10.84</td>
</tr>
</tbody>
</table>

5. Using a square caliper with a 20° angle, verify that brake control piston is properly positioned.

6. If the step on the piston does not match the square caliper's diagonal, rotate the piston with suitable pliers till the position required by the square caliper is reached.

7. Proceed and complete the assembly fitting the pads and securing them by means of relevant dowel pins (Refer to: Pad Replacement).
8. Fill reservoir up with specified brake fluid (ATE "S" or AGIPF1 Brake Fluid Super ED or IP Auto Fluid FR).
9. Bleed brakes (Refer to: Brake System Bleeding).

**CAUTION:**

At the end of installation on car, make sure that hose are not kink.

**Brake disc**

For all operations concerning brake discs refer to: DBA Caliper Brake Disc.

---

**REAR DRUM BRAKE**

**Tightening torque**

<table>
<thead>
<tr>
<th>Fastener</th>
<th>Torque (N·m)</th>
<th>(kg·m)</th>
<th>(ft·lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 ± 9</td>
<td>6.8 ± 0.9</td>
<td>0.9</td>
<td>4.34 ± 6.51</td>
</tr>
</tbody>
</table>

---

1. Bleeder cap
2. Bleeder
3. Dust cover
4. Piston
5. Seal ring
6. Spring
7. Cylinder body
8. Knuckle pin securing plate
9. Jaw driving plate
10. Jaw return spring
11. Spring
12. Swinging lever
13. Pin
14. Vibration damping spring
15. Vibration damping spring stop
16. Spring
17. Pin
18. Spring
19. Adjustment lever
20. Jaw
21. Shoe holder disc

---

22-15  
May 7983
JAW REPLACEMENT

Removal
1. Remove wheel and brake drum together with hub (see: Group 25 Rear Hub).
2. Operating from passenger compartment, loosen control cables of parking brake, by operating on adjustment nut and lock-nut.
3. Operating from wheel side, release control cable end 4 from lever 2 and release it from fairlead 5.
4. By means of a suitable clamp release, in the following order: shoe upper return spring 1, shoe lower return spring 6. Remove then the jaw vibration - damping springs 3.
5. Remove the two jaws from brake holder disc and if required, separate them, after releasing spring 1 from jaw jointing square 2.
6. Disassemble, (if required) the adjustment device, operating as follows:
   (1) Remove retain spring 5, then from jaw, withdraw pin 4 together with spring 2 and lever 3 of the adjustment device.
   (2) Remove seal ring 6 and separate from jaw the swinging lever 1 of the adjustment device.

The removed seal rings must anyway be replaced during reassembly.

Installation
To correctly position the new jaws on brake holder disc, operate by reversing order of removal and coupling with the following:

a. Lubricate with brake grease contact surfaces between the under mentioned components.
   jaws and opening control cylinder.
   toothed surfaces of the jaw adjustment device.
   gears of the jaw return springs.

b. On installed jaws, before assembling drum, set the adjustment device lever so as to maximum reduce opening of jaws.

c. On installed drum, adjust distance between jaw-drum by repeatedly operating on brake pedal.
d. Adjust travel of parking brake control lever (see: Group 00 Chassis and Body Maintenance).

CYLINDER FOR JAW OPENING CONTROL

Removal
1. Remove jaws (see: Jaw Replacement - Removal).
2. Disconnect the oil delivery piping to jaw opening cylinder, by operating on union 2, as shown in figure.
3. Unscrew and remove the two screws 1 securing cylinder to brake holder disc; then remove cylinder.

Disassembly
1. Remove dust covers 1 from cylinder body 4, then, pick up the jaw opening control pistons 2, together with gasket 3, which are ejected by spring 5; then withdraw spring itself.
2. Remove bleeder protection cap 7 and remove bleeder.

May 1983

22-16
placed between support and body.

**DISASSEMBLY**

With reference to the following exploded view remove the control lever operating as follows.

1. Withdraw cotter pin from pin 14 connecting lever 2 to adjusting fork 15, withdraw pin with washers from fork and separate this one from the lever.
2. Unscrew bolt 12 securing the lever to its relevant support 13 and separate the two components.
3. Withdraw bush 9 and handle 1 from lever, remove pin stopper cotter 8 on which ratchet gear pawl 7 rotates and withdraw the pin from its seat.
4. Separate from lever the whole block of ratchet gear control with pushbutton 3, spring 4, stopper 5, rod 6 and pawl 7.
5. If necessary, remove switch of the parking brake indicator from brake support.

**REASSEMBLY**

For reassembly of the support and lever unit, reverse the order of assembly and, in particular comply with the following:

1. Lubricate brake lever bush and ratchet gear components with specified grease (AGIP F1 Grease 15 or SHELL Retinax G11).
2. Tighten to specified torque of $9 \div 15 \ Nm \ (0.9 \div 1.5 \ kg\cdotm), \ (6.51 \div 10.84 \ ft\cdotlb)$ bolt hinging lever to brake support.

---

**CHECKS AND INSPECTIONS**

1. Check components visually against excessive wear and other damages.
2. Check, in particular, surface conditions of the lever coupling bush to support, and wear conditions of pawl teeth and scroll gear.
3. Check against presence of electric cable discontinuity and that parking brake indicator switch is properly functioning.
4. Replace worn or faulty components.

---

**CONTROL CABLES**

**REMOVAL**

1. Operating from the driver's compartment remove rear console and, by operating lock nut and nut of adjustment fork loosen control cables and withdraw them from equalizer.
2. Remove rear wheel and drum together with hub (see: Group 25 - Rear Hub - Removal).
3. Operating on wheel side release control cable end 3 from lever 2 and free it from fair-lead 4. Release control cable from brake shoe holder 1, withdraw it from this last and remove it after releasing it from the underbody clamps.

**REINSTALLATION**

To reinstall control lever with support, reverse the order of removal and complying with the following:

1. Apply a coat of specified grease (AGIP F1 Grease 15 or SHELL Retinax G11) to surfaces where cables slide in the incovered section and to fork adjusting screw.
2. Carry out parking brake adjustment (see: Group 00 Chassis and Body Maintenance).

---

**CHECKS AND INSPECTIONS**

Make sure that control cables are sound; replace them if necessary.
FRONT AND REAR BRAKES

### Application

<table>
<thead>
<tr>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>GREASE</td>
<td>AGIPF1 Grease 15 Std. 3671-69810</td>
<td></td>
</tr>
<tr>
<td>GREASE</td>
<td>AGIPF1 Grease 15 Std. 3671-69810</td>
<td></td>
</tr>
</tbody>
</table>

### FRONT BRAKES

**Brake pad - rotor clearance**
- when installing: 0.1 mm (3.94 \times 10^{-3} \text{ in})
- on operation (clearance determined by pad automatic feed): 0.05 ± 0.2 mm (1.97 \times 10^{-3} ± 7.87 \times 10^{-3} \text{ in})

**Dimension for brake disc burning**

**Brake disc thickness**
- $C_{\text{min. after machining}}$: 9.5 mm (0.374 in)
- $C_{\text{min. serviceability thickness}}$: 9 mm (0.354 in)
- Max disc banking: 0.03 mm (0.00118 in)

### REAR BRAKES

**Brake shoe lining min. thickness**: 0.5 mm (0.02 in)

**Drum wear limit dimensions**
- max. inner diameter: 229.6 mm (9.04 in)

**Dimension for brake drum burning**
FRONT AND REAR BRAKES

BRAKE PRESSURE REGULATOR VALVE

Adjustment.
- Unloaded car
- Valve piston at end of travel
- Load: 60 N (6 kg) (13.22 lb) applied to hook of fixture A.4.0148

HANDBRAKE LEVER ADJUSTMENT

Number of free notches on the sector gear before wheels locking 1 ÷ 3

TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N·m</th>
<th>kg·m</th>
<th>ft·lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unions of brake hydraulic system pipes</td>
<td></td>
<td>8 ÷ 10</td>
<td>0.8 ÷ 1</td>
<td>5.78 ÷ 7.23</td>
</tr>
<tr>
<td>Unions of brake hydraulic system (on calipers and union of shoe holder plate)</td>
<td></td>
<td>10 ÷ 15</td>
<td>1 ÷ 1.5</td>
<td>7.23 ÷ 10.84</td>
</tr>
<tr>
<td>Union of clutch system pipe</td>
<td></td>
<td>15 ÷ 19</td>
<td>1.5 ÷ 1.9</td>
<td>10.84 ÷ 13.74</td>
</tr>
<tr>
<td>Screws retaining caliper to wheel hub</td>
<td></td>
<td>59 ÷ 73</td>
<td>6 ÷ 7.5</td>
<td>43.8 ÷ 54.23</td>
</tr>
<tr>
<td>Screw securing front brake disc to wheel hub</td>
<td></td>
<td>6 ÷ 8</td>
<td>0.6 ÷ 0.8</td>
<td>4.34 ÷ 5.78</td>
</tr>
<tr>
<td>Bolts securing knuckle pin to axle</td>
<td></td>
<td>3 ÷ 9 ÷ 44</td>
<td>4 ÷ 4.5</td>
<td>28.9 ÷ 32.53</td>
</tr>
<tr>
<td>Nut securing pedal assembly unit to body</td>
<td></td>
<td>9 ÷ 15</td>
<td>0.9 ÷ 1.5</td>
<td>6.51 ÷ 10.84</td>
</tr>
<tr>
<td>Intermediate piston setscrew for ATE brake master cylinder</td>
<td></td>
<td>5 ÷ 8</td>
<td>0.5 ÷ 0.8</td>
<td>3.61 ÷ 5.78</td>
</tr>
<tr>
<td>Nut jointing brake master cylinder to servobrake</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BENDITALIA</td>
<td></td>
<td>12 ÷ 15</td>
<td>1.2 ÷ 1.5</td>
<td>8.67 ÷ 10.84</td>
</tr>
<tr>
<td>ATE</td>
<td></td>
<td>21 ÷ 28</td>
<td>2.1 ÷ 2.8</td>
<td>15 ÷ 21</td>
</tr>
<tr>
<td>Securing bolt of brake pressure regulator valve</td>
<td></td>
<td>15 ÷ 24</td>
<td>1.5 ÷ 2.4</td>
<td>10.84 ÷ 17.3</td>
</tr>
<tr>
<td>Equalizer securing nut</td>
<td></td>
<td>39 ÷ 48</td>
<td>4 ÷ 4.9</td>
<td>28.9 ÷ 35.4</td>
</tr>
<tr>
<td>Panhard bar securing bolt</td>
<td></td>
<td>69 ÷ 85</td>
<td>7 ÷ 8.7</td>
<td>50.6 ÷ 62.9</td>
</tr>
<tr>
<td>Screws securing wheel cylinder to back plate</td>
<td></td>
<td>6 ÷ 9</td>
<td>0.6 ÷ 0.9</td>
<td>4.34 ÷ 6.51</td>
</tr>
<tr>
<td>Bolt fixing parking brake lever to support</td>
<td></td>
<td>9 ÷ 15</td>
<td>0.9 ÷ 1.5</td>
<td>6.51 ÷ 10.84</td>
</tr>
</tbody>
</table>

May 1983
## TROUBLE DIAGNOSIS AND CORRECTIONS

The following are the indispensable presuppositions for any trouble diagnosis of braking system verification of:
- Tyre wear
- Tyre pressure
- Brake fluid or any way, verification of compliance with programmed maintenance specifications.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive pedal travel</td>
<td>• Leakage in brake master cylinder</td>
<td>Overhaul brake master cylinder</td>
</tr>
<tr>
<td></td>
<td>• Leakage in clutch master cylinder</td>
<td>Overhaul clutch master cylinder</td>
</tr>
<tr>
<td></td>
<td>• Faulty no-return valve of vacuum system</td>
<td>Replace check valve</td>
</tr>
<tr>
<td></td>
<td>• Fluid leakage from brake pressure regulator</td>
<td>Adjust or replace</td>
</tr>
<tr>
<td></td>
<td>• Fluid leakage from braking system unions</td>
<td>Tighten unions</td>
</tr>
<tr>
<td></td>
<td>• Air in system</td>
<td>Bleed system</td>
</tr>
<tr>
<td></td>
<td>• Faulty brake adjustment</td>
<td>Adjust shoe-to-drum clearance</td>
</tr>
<tr>
<td>Spongy pedal</td>
<td>• Air in system</td>
<td>Correct as necessary</td>
</tr>
<tr>
<td></td>
<td>• Faulty brake adjustment</td>
<td>Adjust shoe-to-drum clearance</td>
</tr>
<tr>
<td></td>
<td>• Reservoir filler cap vent hole clogged</td>
<td>Clean and bleed system</td>
</tr>
<tr>
<td></td>
<td>• Swollen hose due to deterioration or use of poor quality hose</td>
<td>Replace hose and bleed system</td>
</tr>
<tr>
<td></td>
<td>• Distorted brake shoes, or excessively worn or cracked brake drum</td>
<td>Replace faulty parts</td>
</tr>
<tr>
<td></td>
<td>• Soft or swollen caliper seals</td>
<td>Drain hydraulic system, flush with alcohol and replace all seals</td>
</tr>
<tr>
<td></td>
<td>• Use of a brake fluid with too low boiling point</td>
<td>Replace with specified brake fluid and bleed system</td>
</tr>
<tr>
<td>Poor braking effect</td>
<td>• Fluid leakage in brake lines</td>
<td>Check master cylinder, piping and wheel cylinder for leaks, and repair</td>
</tr>
<tr>
<td></td>
<td>• Air in brake lines</td>
<td>Bleed system</td>
</tr>
<tr>
<td></td>
<td>• Excessive shoe-to-drum clearance</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Grease oil mud or water on linings or pads</td>
<td>Clean brake mechanism and check for cause of problem. Replace linings or pads</td>
</tr>
</tbody>
</table>
## FRONTAL AND REAR BRAKES

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor braking effect</td>
<td>• Deterioration of linings or pads</td>
<td>Replace linings and/or pads. If necessary grind discs and turn drums</td>
</tr>
<tr>
<td>(continued)</td>
<td>• Local fit of linings or pads</td>
<td>Replace linings and/or pads. If necessary grind discs and turn drums</td>
</tr>
<tr>
<td></td>
<td>• Master cylinder or wheel cylinders in poor condition</td>
<td>Repair or replace</td>
</tr>
<tr>
<td></td>
<td>• Frozen or seized caliper pistons on disc brakes</td>
<td>Disassemble caliper and free up as required</td>
</tr>
<tr>
<td></td>
<td>• Binding mechanical linkage at brake pedal and shoes</td>
<td>Free up as required</td>
</tr>
<tr>
<td>Unbalanced brakes</td>
<td>• Improper tire inflation</td>
<td>Inflate to correct pressure</td>
</tr>
<tr>
<td></td>
<td>• Improper adjustment of shoes-to-drum clearance</td>
<td>Readjust</td>
</tr>
<tr>
<td></td>
<td>• Grease oil mud or water on linings or pads</td>
<td>Clean brake mechanism and check for cause of problem. Replace linings or pads</td>
</tr>
<tr>
<td></td>
<td>• Mud in brake drum</td>
<td>Clean</td>
</tr>
<tr>
<td></td>
<td>• Excessive wear or deterioration of linings or pads</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Wheel cylinder in poor condition</td>
<td>Repair or replace</td>
</tr>
<tr>
<td></td>
<td>• Poor sliding condition of brake shoe</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Looseness of cylinder body or back plate securing bolts/nuts</td>
<td>Fasten or replace</td>
</tr>
<tr>
<td></td>
<td>• Scored or out-of-round drums</td>
<td>Recondition or replace brake drum as required. Check for improper lining contact with drum and grind lining if necessary</td>
</tr>
<tr>
<td></td>
<td>• Brake pressure regulator incorrectly adjusted or not efficient</td>
<td>Adjust or overhaul (if required) or replace brake pressure regulator</td>
</tr>
<tr>
<td></td>
<td>• Deteriorated wheel cylinder seal rings</td>
<td>Recondition or replace cylinder</td>
</tr>
<tr>
<td></td>
<td>• Incorrect adjustment of wheel bearings</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td>• Incorrect adjustment of wheel alignment</td>
<td>Adjust</td>
</tr>
<tr>
<td>Brakes fade</td>
<td>Use of improper linings or brake linings are contaminated</td>
<td>Replace linings</td>
</tr>
<tr>
<td>Condition</td>
<td>Probable cause</td>
<td>Corrective action</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>-------------------</td>
</tr>
</tbody>
</table>
| Pedal pulsates | • Out-of-round or off-center drum  
• On disc brakes, lateral runout of brake rotor is excessive  
• Excessive variation in thickness of brake rotor surfaces | Turn drum or replace as necessary  
Check with dial indicator, turning disc by hand. If runout exceeds specifications, repair or replace disc  
Measure around disc face with micrometer. Replace disc as required |
| Rear lock (Under light brake pedal force) | Faulty brake pressure regulator | Replace |
| Rear lock (Under heavy brake pedal force) | • Poor front braking effect  
• Grease oil mud or water on linings or pads  
• Excessive wear of linings or pads  
• Local fit of linings or pads  
• Master cylinder or wheel cylinder in poor condition | Disassemble and adjust front brakes  
Clean or replace  
Replace  
Shave or replace  
Repair or replace |
| Servobrake out of order | • Air leakage at check valve  
• Air leakage at seal ring between vacuum box and control body  
• Air leakage at disc valve  
• Air leakage at piston seal ring  
• Air leakage at seal ring between master cylinder and servobrake  
• Damaged piping or connectors | Inspect check valve  
Replace set-servo brake assembly  
Replace seal ring  
Repair or replace |
| Not adjustable engine idle speed (no leakage at connectors) | Engine sucks air through servobrake | Replace check valve or servobrake assembly |
| Parking brake does not brake | • Improper adjustment  
• Front and rear cables damaged or broken  
• Faulty connection of rear cables to brakes | Adjust  
Replace cables  
Check cable connection |
| When parking brake control lever is released, the car remains braked | • Shoes are jammed on drums  
• Return travel of cables is obstructed | Unlock or replace faulty parts  
Remove obstacle and replace cables |

May 1983
### FRONT AND REAR BRAKES

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>When parking brake control lever is released, the car remains braked (continued)</td>
<td>- Control lever release pushbutton does not spring back</td>
<td>Disassemble lever, and release or replace if</td>
</tr>
</tbody>
</table>
| The brake ON indicator does not illuminate | - Wires disconnected  
- Faulty switch  
- Faulty lamp | Restore connection  
Replace  
Replace |

### SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
</table>
| A.4.0148    | Tool for calibrating brake pressure regulator | 22-9  
22-21 |
STEERING SYSTEM

GROUP 23

CONTENTS

STEERING SYSTEM ...................... 23-2
GENERAL DESCRIPTION ............... 23-2
STEERING WHEEL AND COLUMN ...... 23-2
  Steering wheel .................... 23-2
  Steering column ................... 23-3
  Steering lock-ignition switch ... 23-4
STEERING LINK RODS ................. 23-5
  Removal ................................ 23-5
  Checks and inspections .......... 23-6
  Disassembly ......................... 23-6
  Assembly ............................ 23-6
STEERING BOX .......................... 23-7
  Removal ............................. 23-7
  Disassembly ........................ 23-8
  Checks and inspections .......... 23-9
  Assembly ............................ 23-9
SERVICE DATA AND SPECIFICATIONS . 23-11
  General specifications .......... 23-11
  Inspections and adjustments ... 23-12
  Tightening torques ............... 23-12
TROUBLE DIAGNOSIS AND CORRECTIONS . 23-13
SPECIAL SERVICE TOOLS ............. 23-13

May 1983
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, withdraw steering wheel from column operating as per figure.
9. Remove the whole column.

DISASSEMBLY
1. Unscrew bolt securing universal joint to upper column section. Remove lower column.
2. Remove steering lock operating as follows. Secure column support 1 together with upper column 2 on vice fitted with protective jaws and, operating as shown in figure, unscrew the broken head screw securing steering lock to column support; withdraw steering lock.

3. Keeping the unit on a vice, hammer, on upper column, by means of a plastic hammer (as shown in figure) as long as column can be withdrawn from support with relevant upper bearing.

4. Withdraw lower bearing from column support.

CHECKS AND INSPECTIONS
1. Check against presence of damages or malfunctions in column bearings. Lubricate them with the prescribed grease and replace them if necessary. 2. Check against presence of damages or absence of lubrication in universal joints. Replace lower column if necessary.
3. Verify integrity of upper column and, in particular, that: working surfaces of bearings are safe from scratches; tooth of splined parts are not damaged or worn; hole where pin of steering lock works, is sound.
4. Verify integrity of column support and replace it if necessary.

ASSEMBLY
For reassembly reverse order of disassembly and comply with the following:

a. Apply a coat of grease (AGIP F1 Grease 33 FD or IP Autogrease FD) to bearings where upper column rotates.
b. Lower bearing must be completely introduced on column support and upper bearing must be assembled so as it faces upper plane of support.
c. Verify that upper column can freely rotate and that no excessive clearance is present.
d. For securing of steering lock - ignition switch to column support, make use of proper screw supplied as spare part, which must be tightened into its seat until breaking of its head.
e. During junction of lower column to upper one make sure that securing bolt positions correctly with respect to cutout portion.

INSTALLATION
Assemble column by proceeding in reverse order and follow these instructions.

WARNING: Make sure that undue stress is not applied to steering column during assembly.

a. Loosen the wheels and couple the column lower universal joint to pinion of steering box, then insert securing bolt 1 making sure that it positions correctly with respect to pinion cutout portion 2.

b. Adjust tightening of steering wheel inclination lever so as to obtain correct stop of steering wheel in the required position.
c. On steering wheel and cover assembled, make sure that, on all lowered position of steering wheel, B dimension (between cover of steering column and steering wheel structure) corresponds to the prescribed value.

Distance between cover and steering wheel structure

\[ B = 0 \div 6 \text{ mm (0 } \div 0.236 \text{ in)} \]

d. After tightening of components, verify that on maximum travel condition of steering wheel, (straight ahead and straight down) functioning is correct.
e. At the end of assembly, verify proper functioning of combination switch unit and efficiency of warning horn.

STEERING LOCK-IGNITION SWITCH
REMOVAL AND INSTALLATION
1. Remove lower cover of column support (see: Column - Removal).
2. Disconnect harness of the steer-
STEERING SYSTEM

ing lock - ignition switch.
3. Remove the broken head screw securing steering lock to column support.
4. Remove steering - lock unit withdrawing it from its seat in column support.
5. For installation, reverse order of removal and secure steering lock to column support by means of special screw provided as spare part, and tighten it as long as its head breaks.

CHECKS AND INSPECTIONS
1. Verify good conditions of cables and connectors.
2. Check proper operation of the whole assembly by verifying all positions are reached smoothly; check also the locking device operations properly, after rotating steering wheel and extracting key.

STEERING LINK RODS

REMOVAL
1. Place car on lift, block rear wheels, jack up front of vehicle, then support it by stands placed in adjacent position to jacking points (Refer to: Group 00 - Lifting Points and Towing).
2. Remove four screws and wheel.
3. Unscrew nut securing ball pin of steering track rod to lever of strut.
4. Using puller A.3.0156 withdraw ball joint pin of steering track rod upwards, taking it out from strut levers.
5. Turn steering wheel to the right to make easier the disassembly of rods from steering box, remove nuts, washers, and plate, then remove rods.

23-5
May 1983
CHECKS AND INSPECTIONS

1. Check against damage or wear in the steering rods ball joints, and verify that pivot free from crawling or with notable slack in their seats. If necessary, replace them.
2. Check elastic joints against damage, wear or excessive slack. If necessary, replace them.
3. Check steering rods against damage or deformations. If necessary, replace them.

DISASSEMBLY

1. Extract elastic joints from rods by means of a press and of suitable tools (a punch and a base).
2. Measure articulation jut in order to maintain it on reassembly.

ASSEMBLY

Proceed in reverse order to disassembly and use the same tools previously used.
On reassembly of ball joints, make sure that the two tie rods have the same length they had before disassembly.

INSTALLATION

Assemble steering link rods on vehicle by proceeding in reverse order of removal.
1. Assemble rods on steering box studs and fix them with plate, washers and nuts without locking them.
2. Connect rods to levers on steering tubes by tightening the nuts securing the ball joint pin to the specified torques.

During tightening of bolts, make sure that on the static load position, upper plane of ball pin is parallel to gasket face.

3. Lock the elastic joint fixing nuts to the rack studs, with the front suspension in nominal height, corresponding to static load.

4. Verify toe-out (Refer to: Group 00 - Chassis and Body Maintenance).

During tightening of bolts, make sure that on the static load position, upper plane of ball pin is parallel to gasket face.
REMOVAL

1. Place vehicle on ramp and support it by stands placed in the jack seats (refer to: Group 00 Lifting Points and Towing).
2. Remove left wheel after screwing up fixing screws.
3. Turn steering wheel to the right and disconnect rods from steering box (refer to: Steering Link Rods - Removal).
4. Disassemble bolt fixing lower universal joint to pinion.
5. Remove plastic cap protecting rack.
6. Remove screws fixing steering box to body, then remove brackets.
7. After disengaging pinion from universal joint, remove steering box by extracting it from the steering rod slit on the left side and remove rubber supports.

1. Upper cap
2. Adjusting screw
3. Spring
4. Plunger
5. Seal ring
6. Bush
7. Rack box
8. Left cap
9. Pinion
10. Bearing
11. Lock ring
12. Lock ring
13. Lower cap
14. Boot
15. Sleeve
16. Clamp
17. Bush
18. Support
19. Right cap
20. Pad
21. Studs
22. Rack

1 Universal joint
2 Bolt
3 Pinion
4 Protection cap
5
6. N·m (kg·m)
7. ft-lb

May 7983
DISASSEMBLY

1. Remove clamp 4 fixing right boot 3 to sliding sleeve 5.
2. Extract end cap 1, remove plastic support 2 and extract right boot 3.

CAUTION:
Plastic bellows be replaced whenever disassembled from steering tube for any reason.

3. By means of nut and lock unscrew and extract studs 7, then remove plate 5 and spacer 2 for rod support.
4. Remove clamp 3 fixing left boat 4 and extract it from sleeve 1, then extract sleeve from rack tube.

5. Remove the sliding member 2 from rack guide tube 1.

6. Remove the cover 1 from rack box 5, screw up and extract adjustment screw 2, spring 3 and plunger 4 for backlash. Then lever with a screwdriver and remove lower protection cap 6 of rack control pinion.

7. Extract rack 1 from guide tube 2.

8. Remove lock ring 1 fixing pinion bearing to rack box.

9. Remove pinion from rack box together with the bearings, by means of a plastic hammer and a supporting base.

10. Remove lock ring 1 fixing bearing 2 on pinion 3, after placing it in a vice provided with protective jaws.

11. Disassemble bearing 2 from pinion 1 by means of a punch and a suitable base.
1. Pinion 2. Bearing

3. Provide internal room of steering box with 40 g (1.41 oz) grease (AGIP F1 grease 33 FD or IP Autogrease FD), lubricate pinion bush and assemble pinion by means of a punch, a base and a plastic hammer.

4. During assembly use plunger and adjusting screw of the same material (plastic or metal).

5. Lubricate rack with grease (refer to point 3) and introduce it into the guide tube after rotating pinion, in order to realize, when assembly is ready, reciprocate positioning between rack and pinion verified by dimension “A” with pinion oriented with cutout downwards (obtain angle α = 90° ± 26°).

Reference dimension for pinion-rack positioning

\[ A = 125 \text{mm} \ (4.921 \text{ in}) \]

6. Select rack sliding member depending on the available guide tube, as follows:

a. Employment of already existing steering tube.
   (1) Check that the sliding member 2 slides the whole steering tube 3 if pushed by hand with a slight stress; by means of a thickness gauge 1 verify backlash “G” between pad and slot does not exceed the recommended value in any position.

   Maximum allowed backlash “G” between pad and slot
   \[ G = 0.1 \text{ mm} \ (3.94 \cdot 10^{-3} \text{ in}) \]

b. Employment of a new steering tube.
   Replace also the sliding member and use a new one with paint spot of the same color as the steering tube. Maximum backlash in this way is 0.044 mm (1.73 -10^{-3} \text{ in}).

7. Apply 15 g (0.53 oz) of grease, as per item 3, inside the sliding sleeve and lubricate rack tube external surface.

8. Assemble left boot, sliding member, sliding sleeve, then insert studs, spacer and plate. Assemble right boot, a new guide support, checking that the internal tooth fits the tube seat; then place end cap.

9. Lubricate plunger and backlash adjustment screw with grease recommended at point 3. With rack rod in central position assemble plunger, spring and screw and adjust pinion-rack backlash, as follows.
   (1) By means of spanner A.5.0204, tighten plunger adjustment screw to the indicative torque: 3 N·m (0.3 kg·m; 2.17 ft·lb).
STEERING SYSTEM

(2) Check with space in the screw is most centered with respect to a notch in the box; loosen screw until the diametrically opposite space to the one centered with the first notch on the box is aligned.

1. Mount steering box assembly on vehicle by tightening securing screws at the prescribed torque 39 \( \pm \) 48 N·m (4 \( \pm \) 4.9 kg-m, 28.92 \( \pm \) 35.43 ft·lb). Refit end cap on the rack box.
2. With the wheels in the straight ahead position, mount steering rods and tighten them at the prescribed torque 39 \( \pm \) 48 N·m (4 \( \pm \) 4.9 kg-m, 28.92 \( \pm \) 35.43 ft·lb) with vehicle at nominal height.
3. Check toe-out (Refer to: Group 00 - Chassis and Body Maintenance).

INSTALLATION

10. Verify that steering pinion rotates up to the rack rod end-of-stroke in both directions smoothly.
11. Tighten boots fixing clamps, for both ends of each boot not to be rotated with respect to each other, with reference to the boot body junction line.
12. Center steering stroke by obtaining dimension “A” as per figure indicated at step 5.

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column support spacer for hinging to body (external surface)</td>
<td>GREASE</td>
<td>AGIPF1 grease 15 Std. No. 3671-69810</td>
<td></td>
</tr>
<tr>
<td>Steering column bearings</td>
<td>GREASE</td>
<td>AGIPF1 grease 33 FD IP Autogrease FD Std. No. 3671-69833</td>
<td></td>
</tr>
<tr>
<td>Pinion bush</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rack-pinion backlash take-up plunger</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backlash adjustment screw (on thread)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rack sliding sleeve (internal surface)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rack box (int. room)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side rod silentblock (ext. surface)</td>
<td>FLUID</td>
<td>UNION CARBIDE CHEMICALS COMPANY: UCON lubricant 50HB - 5100 MIL LCOI: lubricant for elastomer seal Std. No. 4500-17502</td>
<td></td>
</tr>
</tbody>
</table>

23-11 May 1983
**INSPECTIONS AND ADJUSTMENTS**

1. Dimension "A" for rack rod centering in the steering tube

   ![Diagram of rack rod centering](image)

<table>
<thead>
<tr>
<th>A</th>
<th>mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>125</td>
<td>(4.921)</td>
</tr>
</tbody>
</table>

2. \( \alpha \) cutout positioning angle on rack pinion (rack centered as per point 1)

   ![Diagram of cutout positioning angle](image)

<table>
<thead>
<tr>
<th>( \alpha )</th>
<th>degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 ± 26</td>
<td></td>
</tr>
</tbody>
</table>

3. Light "B" between steering column covers and steering wheel structure

   ![Diagram of light B](image)

<table>
<thead>
<tr>
<th>B</th>
<th>mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ± 0.23</td>
<td></td>
</tr>
</tbody>
</table>

4. Thickness of rack guide pad. The available thickness, in increasing order are provided in the below list (they can be distinguished by the paint mark on pads):

   - white
   - yellow
   - red
   - green
   - blackish blue

5. Maximum clearance "G" between pad and slot

   ![Diagram of clearance G](image)

<table>
<thead>
<tr>
<th>G</th>
<th>mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1 (0.3·10⁻²)</td>
<td></td>
</tr>
</tbody>
</table>

**TIGHTENING TORQUES**

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N·m</th>
<th>kg·m</th>
<th>ft·lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nut securing track rod ball joint to lever on strut</td>
<td></td>
<td>39 ÷ 48</td>
<td>4 ÷ 4.9</td>
<td>28.92 ÷ 35.43</td>
</tr>
<tr>
<td>Nut securing steering wheel to steering column</td>
<td></td>
<td>17 ÷ 21</td>
<td>1.7 ÷ 2.1</td>
<td>12.29 ÷ 15.18</td>
</tr>
<tr>
<td>Nuts securing track rod to steering box</td>
<td></td>
<td>39 ÷ 48</td>
<td>4 ÷ 4.9</td>
<td>28.92 ÷ 35.43</td>
</tr>
<tr>
<td>Bolts securing upper steering column to lower</td>
<td></td>
<td>27 ÷ 31</td>
<td>2.7 ÷ 3.1</td>
<td>19.52 ÷ 22.41</td>
</tr>
<tr>
<td>steering column and to steering box pinion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bolt securing steering column lower support to</td>
<td></td>
<td>14 ÷ 18</td>
<td>1.4 ÷ 1.8</td>
<td>10.29 ÷ 13.01</td>
</tr>
<tr>
<td>body</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nut securing steering column upper support to body</td>
<td></td>
<td>16 ÷ 20</td>
<td>1.6 ÷ 2.0</td>
<td>11.56 ÷ 14.46</td>
</tr>
<tr>
<td>Nut for toe-out adjustment on track rod</td>
<td></td>
<td>55 ÷ 69</td>
<td>5.6 ÷ 7</td>
<td>40.49 ÷ 50.61</td>
</tr>
<tr>
<td>Screw securing steering box to body</td>
<td></td>
<td>39 ÷ 48</td>
<td>4 ÷ 4.9</td>
<td>28.92 ÷ 35.43</td>
</tr>
</tbody>
</table>

(*) With steering wheel release lever to the locked position
## TROUBLE DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive steering wheel backlash</td>
<td>• Loose steering box screws</td>
<td>Tighten screws</td>
</tr>
<tr>
<td></td>
<td>• Damaged steering rods or universal joints</td>
<td>Replace defective components</td>
</tr>
<tr>
<td>Column noise in drive</td>
<td>Worn column bearings</td>
<td>Replace bearings</td>
</tr>
<tr>
<td>Drive noise</td>
<td>• Loose steering box screws</td>
<td>Tighten screws</td>
</tr>
<tr>
<td></td>
<td>• Worn steering levers</td>
<td>Replace defective parts</td>
</tr>
<tr>
<td></td>
<td>• Excessive pinion-rack backlash</td>
<td>Calibrate backlash</td>
</tr>
<tr>
<td>Drive hardening</td>
<td>• Inadequate suspension angles</td>
<td>Restore proper angles</td>
</tr>
<tr>
<td></td>
<td>• Worn or deflated tyres</td>
<td>Check and restore</td>
</tr>
<tr>
<td></td>
<td>• Scarce pinion-rack backlash</td>
<td>Calibrate backlash</td>
</tr>
<tr>
<td></td>
<td>• Scarce lubrication</td>
<td>Lubricate</td>
</tr>
<tr>
<td></td>
<td>• Damaged universal joints</td>
<td>Replace joints</td>
</tr>
<tr>
<td></td>
<td>• Interference of column with switch unit</td>
<td>Calibrate backlash</td>
</tr>
</tbody>
</table>

## SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.3.0156</td>
<td>Track rod ball joint puller</td>
<td>23-5</td>
</tr>
<tr>
<td>A.3.0451</td>
<td>Steering wheel puller</td>
<td>23-2</td>
</tr>
<tr>
<td>A.5.0204</td>
<td>Spanner for adjustment of steering rack plunger and clearance</td>
<td>23-10</td>
</tr>
</tbody>
</table>
REAR SUSPENSION

GROUP 25

CONTENTS

DESCRIPTION .......................... 25-2
REAR HUB .............................. 25-3
   Removal ............................. 25-3
   Checks and inspections .......... 25-4
   Installation ....................... 25-4
REAR SUSPENSION ...................... 25-5
   Shocks absorbers ................. 25-5
   Coil springs ...................... 25-7
   Rear rigid axle .................. 25-7

SERVICE DATA AND
SPECIFICATIONS ...................... 25-8
   Technical data .................... 25-8
   General specifications .......... 25-9
   Controls and regulations ....... 25-9
   Tightening torques ............... 25-9

TROUBLE DIAGNOSIS AND
CORRECTIONS .......................... 25-10
SPECIAL SERVICE TOOLS ............. 25-11

Refer to Group 00 - Chassis and Body Maintenance
for:
  * Rear Axle and Rear Suspension
  * Wheel Alignment
  * Checking Suspension Height

May 1983
The rear suspension is a rigid axle one. The axle longitudinal anchorage is carried out by means of two tension rods, on each side, connected to the body and placed according to a Watt parallelogram, so as to limit car raising when braking.

The transversal connection is carried out by means of a tension rod (Panhard bar) anchored on one side to the axle and on the other to the body, in order to prevent body side movements with respect to the wheels.

Between axle and body near the wheel hubs are interposed the suspension springs with coaxial shock absorber. The wheel rebounds are limited by rubber pads assembled on the shock absorber.
REAR SUSPENSION

REAR HUB

1. Grease seal ring 5. Washer
2. Inner bearing 6. Nut
3. Drum 7. Hub cover
4. Outer bearing

REMOVAL

1. Block front wheels with a suitable system, then lift rear part of car and position it on support stands (see: Group 00 - Lifting Points and Towing).
2. Remove wheel from the operative side.
3. Withdraw dust cover from its seat.
4. Operating as per figure, remove wheel hub stop nut caulking and remove it.
5. Move hub with drum, withdraw washer and outer bearing.

CAUTION:
Do not drop bearing.

6. Operating in bench and using a screwdriver withdraw grease seal ring from hub. The seal ring must not be reutilized.

7. Withdraw inner bearing from its seat.
8. Using tool A.3.0349, withdraw from its seat outer ring of outer bearing.

CHECKS AND INSPECTIONS

Clean bearings and other details carefully, then dry them with compressed air.

WHEEL BEARING

If the surfaces of tracks and conical rollers present pittings, roughnesses and ovalizations, replace bearing unit.

CAUTION:
Should a bearing be no more utilizable, replace both the inner and the outer one at the same time.

KNUCKLE PIN

Make sure knuckle pin is not damaged and thread is sound; replace pin if necessary (for replacement see: Rigid Axle).

INSTALLATION

1. By using taker-in A.3.0328 assemble outer ring of outer bearing on hub, inserting it wholly in its seat.

2. By using taker-in A.3.0329, assemble outer ring of inner bearing on hub, inserting at wholly in its seat.

3. Lubricate outer rings of bearings with bearing specified grease (AGIP F1 Grease 33 FD, or IP Autogrease FD), and insert 40 ⅔ 55 g. into the hub inner chamber.

4. Lubricate hub inner bearing with 9 specified grease and insert into its seat. Lubricate seal ring with specified grease and insert it into its seat on hub by using tool A.3.0459. Lay off a coat of the same grease on the knuckle pin, on its relevant threaded end, on washer and on securing nut.

5. Assemble hub on stem pin and then insert outer bearing lubricated with specific grade, washer and new check nut.

6. Carry out wheel bearings pre-loading adjustment (see: Group 00 Maintenance of Mechanical Components and Body), then peen nut.

7. Apply specific bearings grease onto the dust cover lid then assemble it on the stem pin; re-assemble wheel.

CAUTION:
The grease must not get in touch with drum braking surface.
REAR SUSPENSION

REAR SUSPENSION

SHOCKS

ABSORBERS

REMOVAL

After duly blocking front wheels, lifting car front and placing it on supports stands (see: Group 00 - Lifting Points and Towing) remove shock absorbers as follows:

1. Remove wheels.
2. Release bolts securing front tie rods to body.
3. Release bolts and bolt securing rear tie rods and Panhard bar to body respectively.

1 Front tie rod 2 Bolt

May 1983
REAR SUSPENSION

6. From luggage compartment release and remove lock nut and nut of upper shock absorber fastener, the remove cap and anti-shock rubber bumper.

b. Insert springs coaxially to the shock absorbers and make sure caps and upper spring support gaskets are properly assembled and positioned.

c. Set up car in nominal position, corresponding to static load (see: Group 00 Maintenance of Mechanical Components and Body) and set the bolts securing tie rods and Panhard bar to body to the prescribed torque.

d. Restore rear brake oil delivery tube connection and perform brake system air bleeding (see: Group 22 - Front and Rear Brakes - Brake Air Bleeding).

CHECKS AND INSPECTIONS

1. Check shock absorber efficiency and replace it, if oil leaks are found.
2. If necessary, verify shock absorber calibration data (see: Service Data and Specifications - Inspection and Adjustment); replace shock absorbers, if required.
3. Check wear status, damages and deformations of rubber components. Replace them, if required.

INSTALLATION

Assemble shock absorbers on car in the inverted order with respect to removal and remember the following indications:

a. Assemble shock absorber components and secure their upper part to the body.
REAR SUSPENSION

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 inverse 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 inverse 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.

| 1 | : Tightening Torque | Tie rod and Panhard bar securing bolts |
| 3.35 ± 3.826 N-m | (3.4 ± 3.9 kg-m) |
| 24.58 ÷ 28.2 ft-lb |

- Lubricate with prescribed grease (AGIPF1 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).

| 1 | : Tightening Torque | Rigid tube connections |
| 7.65 ± 9.8 N-m | (0.8 ± 1 kg-m) |
| 5.78 ÷ 7.23 ft-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.

Flexible hose connections
9.8 ÷ 14.7 N - m
(1÷ 1.5 kg-m) |
7.23 ÷ 10.85 ft-lb |

Lubricate with prescribed grease (AGIPF1 Grease 15) the hole in the brake adjustment spring support stud on the Panhard bar and the fork.

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.

| 1 | : Tightening Torque | Tie rod and Panhard bar securing bolts |
| 3.35 ± 3.826 N-m | (3.4 ± 3.9 kg-m) |
| 24.58 ÷ 28.2 ft-lb |

- Lubricate with prescribed grease (AGIPF1 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).

| 1 | : Tightening Torque | Rigid tube connections |
| 7.65 ± 9.8 N-m | (0.8 ± 1 kg-m) |
| 5.78 ÷ 7.23 ft-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.
NOTE FOR CAR OVERLOADED ON REAR AXLE

Should high overloads be applied to the rear axle, like in the case of gas installation, the series rear springs can be replaced on sedan versions with springs having part number 705.507, in case of overload of about 980 N (100 kg) (220.46 lb) with respect to static load, they allow a “rear position” level increased by about 15 mm (0.59 in) with respect to the one indicated in Group 00 - Checking Wheel Alignment.

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheel hub inner cavity and dust cover</td>
<td>GREASE</td>
<td>AGIPF1 Grease 33 FD</td>
<td>40-55 g</td>
</tr>
<tr>
<td>Seal ring rim</td>
<td></td>
<td>IP Autogrease FD</td>
<td>1.41-1.54 oz.</td>
</tr>
<tr>
<td>Bearing inner rings and relevant outer races</td>
<td></td>
<td>Std. No. 3671-69833/34</td>
<td></td>
</tr>
<tr>
<td>Bearing housings on pin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal diameter of hole in brake adjustment spring</td>
<td>GREASE</td>
<td>AGIPF1 Grease 15</td>
<td></td>
</tr>
<tr>
<td>spring support stud on Panhard bar.</td>
<td></td>
<td>Std. No. 3671-69810</td>
<td></td>
</tr>
<tr>
<td>Brake adjustment fork</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tie rod end (front and rear) silentblock</td>
<td>FLUID</td>
<td>UNION CARBIDE CHEMICALS CO. Ucon Lubricant 50</td>
<td></td>
</tr>
<tr>
<td>outer surface and Panhard bar (at assembly)</td>
<td></td>
<td>HB-5100</td>
<td></td>
</tr>
<tr>
<td>Outer surface of rubber bound bumper (at shock absorber assembly)</td>
<td></td>
<td>MILLOIL Lubricant for elastomer seal</td>
<td></td>
</tr>
<tr>
<td>Outer surface of wheel hub seal ring</td>
<td>OIL</td>
<td>AGIPF1ROTRA MP SAE SOW90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Pontiac HD SOW90</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Std. No. 3631-69408</td>
<td></td>
</tr>
</tbody>
</table>

CONTROLS AND REGULATIONS

STEERING GEOMETRY
(See: Group 00 - Rear Axle and Suspension)

WHEELS BEARINGS PRELOADING ADJUSTMENT
(See: Group 00 - Rear Axle and Suspension)
## REAR SUSPENSION

### DATA FOR SHOCK ABSORBER CALIBRATION

<table>
<thead>
<tr>
<th>Alfa Romeo Part Number</th>
<th>542.147</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low speed</td>
<td></td>
</tr>
<tr>
<td>Compression N (kg)</td>
<td>59</td>
</tr>
<tr>
<td>Extension N (kg)</td>
<td>78</td>
</tr>
<tr>
<td>High speed</td>
<td></td>
</tr>
<tr>
<td>Compression N (kg)</td>
<td>275</td>
</tr>
<tr>
<td>Extension N (kg)</td>
<td>638</td>
</tr>
</tbody>
</table>

**NOTE:** Values to be measured with shock absorbers at 20 ± 2°C (68 ± 3.6°F) temperature

### TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N-m</th>
<th>kg-m</th>
<th>lb-ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolts securing Panhard bar to body</td>
<td></td>
<td>68.67</td>
<td>7</td>
<td>50.63</td>
</tr>
<tr>
<td>Bolts securing front and rear tie rods to body</td>
<td></td>
<td>33.35</td>
<td>3.4</td>
<td>24.58</td>
</tr>
<tr>
<td>Bolts securing stem pin to axle</td>
<td></td>
<td>39.24</td>
<td>4</td>
<td>29.92</td>
</tr>
<tr>
<td>Brake hydraulic system rigid tube connections</td>
<td></td>
<td>7.85</td>
<td>0.8</td>
<td>5.78</td>
</tr>
<tr>
<td>Brake hydraulic system flexible hose connections</td>
<td></td>
<td>9.8</td>
<td>1</td>
<td>7.23</td>
</tr>
</tbody>
</table>

### TROUBLE DIAGNOSIS AND CORRECTIONS

When rear suspensions are suspected of being noisy, carry out a careful check to determine if the noise actually originates in the rear suspensions or if it is due to the tires, road surface, exhaust system, engine, transaxle or wheel bearings.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise</td>
<td>• Loose wheel screws</td>
<td>Tighten to specified torque</td>
</tr>
<tr>
<td></td>
<td>• One or more attaching bolts loosen</td>
<td>Tighten to specified torque</td>
</tr>
<tr>
<td></td>
<td>• Lack of lubricating grease on bearings</td>
<td>Lubricate as required</td>
</tr>
<tr>
<td></td>
<td>• Faulty shock absorber</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Damaged or worn wheel bearing</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Wheel and tire out-of-balance</td>
<td>Balance</td>
</tr>
<tr>
<td></td>
<td>• Damage to rubber parts such as lower arm bushing</td>
<td>Replace damaged parts</td>
</tr>
</tbody>
</table>
## REAR SUSPENSION

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instability in driving.</td>
<td>• Loose wheel screws</td>
<td>Tighten to specified torque</td>
</tr>
<tr>
<td>This trouble is also related to front</td>
<td>• Shock absorber malfunction</td>
<td>Repair or replace</td>
</tr>
<tr>
<td>suspensions. For trouble diagnoses also refer</td>
<td>• Incorrect steering geometry</td>
<td>Yielded coil springs</td>
</tr>
<tr>
<td>to</td>
<td>• Yielded coil spring</td>
<td>Replace</td>
</tr>
<tr>
<td>Group 21</td>
<td>• Damaged tie rod silent-blocks</td>
<td>Replace</td>
</tr>
<tr>
<td></td>
<td>• Loosen tie rod connections</td>
<td>Tighten or replace</td>
</tr>
</tbody>
</table>

### SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.2.0070</td>
<td>Rear axle support</td>
<td>25-6, 25-7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3.0328</td>
<td>Driver of rear hub outer conical bearing outer race</td>
<td>25-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3.0329</td>
<td>Driver of rear hub inner conical bearing outer race</td>
<td>25-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3.0349</td>
<td>Hub outer bearing outer race extractor</td>
<td>25-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3.0355</td>
<td>Hub inner bearing outer race extractor</td>
<td>25-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A.3.0459</td>
<td>Driver of front hub seal</td>
<td>25-4</td>
</tr>
</tbody>
</table>
CHECKING TIRE CONDITIONS

CHECKING TIRE

1. Check tread thickness. If below min. allowed limit (1 mm; 0.04 in.) replace tires.

If tires are provided with "tread wear indicator", when marks appear, replace tires.

2. Remove pebbles, glass or any other foreign material embedded in the threads.

3. Check tread and side walls for cracks, holes, separation or damage.

4. Check tire valves for air leakage.

TIRE INFLATION

1. Check tire pressure. If necessary, adjust it to specified value.

Tire pressure should be measured when tire is cold.

2. After inflating tires, check valves for leakage. Whenever tire pressure is checked, be sure to tighten valve caps firmly by hand to keep dust and water out.

Abnormal tire wear
Correct abnormal tire wear according to below chart.

<table>
<thead>
<tr>
<th>Trouble</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder wear</td>
<td>Underinflation (both sides wear)</td>
<td>Check and adjust pressure</td>
</tr>
<tr>
<td></td>
<td>Hard cornering</td>
<td>Reduce speed</td>
</tr>
<tr>
<td></td>
<td>Lack of rotation</td>
<td>Rotate tires</td>
</tr>
<tr>
<td>Overinflation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Center wear</td>
<td>Incorrect toe-in or toe-out</td>
<td>Adjust as required</td>
</tr>
<tr>
<td>Feathered edge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toe-in or toe-out wear</td>
<td>Unbalanced wheel</td>
<td>Balance or replace</td>
</tr>
<tr>
<td></td>
<td>Malfunctioning dampers</td>
<td>Replace dampers</td>
</tr>
<tr>
<td></td>
<td>Lack of rotation</td>
<td>Rotate tires</td>
</tr>
<tr>
<td>Uneven wear</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

May 1983
TIRE ROTATION

Operation to be carried out every 5,000 km (3,107 miles).

1. Tires tend to wear unevenly and become unbalanced after a certain running distance. Uneven tire wear often results in problems that, however, one tends to think as being caused by other car components. Front tires also tend to wear unevenly because of improper alignment of front wheels.

2. Therefore, to equalize tire wear, it is necessary to rotate tires periodically. Following are some different allowed arrangements for tire rotation.

TIRE REPLACEMENT

CAUTION:
Different types of tires, such as bias, bias belted and radial tires, must not be under any circumstances. Different types of tires can adversely affect vehicle handling and may cause driver to lose control.

a. When replacing a worn or damaged tire, use a replacement tire of the same size and load carrying capacity as that with which the car was originally equipped with by the Manufacturer. The use of tires having different size and/or load capacity than those approved by the manufacturer is not allowed since it changes the car's technical characteristics.

b. For the same above mentioned reasons, do not use tires and wheels other than those recommended, and do not mix tires of different brand or tread pattern.

The use of tires and wheels other than those recommended or the mixed use of tires of different brands can adversely affect riding, braking, handling, ground clearance, body-to-tire clearance, and speedometer calibration.

c. It is recommended to fit new tires in pairs on the same axle. When replacing only one tire, it should be paired with the one having the most tread in order to equalize braking action.

d. When replacing tires refer to the procedure described in the relevant paragraph: “Replacement”.

REPLACEMENT

1. To replace a tire using a jack in a safe manner, refer to: Lifting Points for jacking up.

WARNING:
Never get under the vehicle while it is supported only by jack.
Always use safety stands to support side member of body construction when you must get beneath the

2. After having positioned the wheel, fit the four screws properly into place.

3. Tighten screws by hand as far as possible keeping the wheel in correct position

4. Tighten wheel screws with proper wheel wrench in crisscross and progressive fashion.

Be sure to check wheel screws for tightness, after the wheel has been run for the first 1,000 km (621 miles); do the same thing in case of flat tire repair, tire rotation, etc.
WHEEL SCREW

CAUTION:
Two types of wheel screws are used: one is designed for use with steel wheels and the other for use with light alloy wheels. Do not mix different type wheel screws.

Be careful not to smear threaded portion of screw not relevant seat with oil or grease.

CHECKING WHEEL CONDITIONS

Inspect wheels thoroughly paying special attention to the following points, in order to ensure satisfactory steering condition as well as maximum tire life. If any defect is present, repair or replace as required.

1. Check wheel rim, especially rim flange and bead set, for rust, distortion, cracks or other faults which might cause air leaks. Proper functioning of tubeless tires depends on effective sealing between tire bead and wheel rim.
2. Thoroughly remove rust, dust, oxidized rubber or sand from wheel rim. Rim’s bead seats should be suitably cleaned (for ex. using neutral type detergent, cloth, etc...) being careful not to damage the wheel surface’s protecting film.
3. Replace wheel when any of the following occurs:
   - Bent, dented or heavily rusted wheel
   - Bolt holes are out-of-round
   - Excessive side or radial runout
   - Air leaks through welds

WHEEL BALANCE

Inspect wheel and tire for proper wheel balance; if unbalanced, correct it taking the following points into consideration:
1. Correct unbalance as soon as relevant symptoms appear such as wheel tramp and shimmy.
2. Balance wheel with tire both statically and dynamically.

WHEEL BALANCING PROCEDURE

CAUTION:
Considering the special construction features of the differential assembly, it is imperative that balancing of wheels - especially of front ones - be performed according to the procedure hereafter described in order to avoid serious damage.

Front wheels
1. Lift car front with a dolly-type hydraulic jack placing same under relevant lifting point (Refer to: Lifting Points for jacking up). 2. Place two stands in line with front jacking points located under car body. 3. Lower car till it rests on stands but locking the jack as well (thus achieving a three-point support).
4. Lock rear wheels by means of two wedges, one for each wheel. 5. Set up balancing machine and auxiliary equipment; make sure indicating finger is placed under suspension’s cross arm and in line with the arm-wheel support joint. 6. Start up the engine, engage 4th speed and then rev engine up to max. speed as per speedometer reading. 7. Perform wheel balancing according to usual “Equitron” type balancing machine procedure.

Rear wheels
1. Lock front wheels by means of two wedges, one for each wheel.
2. Lift car rear, inserting jack under axle. Position two stands in correspondence with stand rear seats and then lower the car.
3. Set up balancing machine and auxiliary equipment; make sure probe is placed under the suspension spring. Let the wheel rotate by means of a wheel accelerator device, then carry out balancing operations with the modalities for balancing machine of the “Equitron” type.

May 1983
WHEELS AND TIRES

BALANCE WEIGHTS POSITIONING

1. Balance weights

Maximum allowable at rim flange: 8 g (0.28 oz)

Balance weights:
10 ÷ 40 (0.35 ÷ 1.40 oz)

at 10 g (0.35 oz) interval

a. Be sure to place correct balance weights on inner edge of rim.
b. Do not pure more than two weights on each side.
c. Two types of balance weights are used: one is designed for use with steel wheels and the other for use with light allowy wheels. Do not mix different type balance weights.
d. Properly rebalance wheel and tire whenever puncture is repaired.

L₁  = location of balance weights
D   = tramp direction
S   = shimmy direction
L₂  = location of unbalance causing heavy area

SERVICE DATA AND SPECIFICATIONS

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

<table>
<thead>
<tr>
<th>Application</th>
<th>Type</th>
<th>Denomination</th>
<th>Q.ty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tire beads</td>
<td>FLUID</td>
<td>UNION CARBIDE CHEMICALS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>COMPANY: Ucon lubricant 50 HE-5100</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MILLOIL: lubricant for elastomer seals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stel. No. 4500-17502</td>
<td></td>
</tr>
</tbody>
</table>

INSPECTIONS AND ADJUSTMENTS

DYNAMIC BALANCE
Max. allowed residual unbalance. .............................................................. 8 g (0.280 oz)
Thread thickness limit ................................................................. 1 mm (0.04 in)
Wheel screws tightening after the first .................................................. 1,000 km (621 miles)
Balance weights (at 10 g (0.35 oz) interval) ........................................ 10 ÷ 40 g (0.35 ÷ 1.40 oz)
# Technical Data

## WHEELS AND TIRES

## Technical Data Table

<table>
<thead>
<tr>
<th>TIRE</th>
<th>RIM</th>
<th>MODEL IDENTIFICATION No.</th>
<th>Dimension</th>
<th>Class</th>
<th>Load</th>
<th>Unit of measure</th>
<th>1200</th>
<th>1350</th>
<th>1600</th>
<th>905.00</th>
<th>905.02</th>
<th>905.04</th>
<th>905.06</th>
<th>905.05</th>
<th>905.07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michelin XZX Tbl 165/70.13</td>
<td>S.R.</td>
<td>5 J x 13 H2 (1)</td>
<td>N</td>
<td></td>
<td>kg/cm²</td>
<td>1.8</td>
<td>1.6</td>
<td>1.8</td>
<td>1.6</td>
<td>1.8</td>
<td>1.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firestone S1 Tbl 165/70.13</td>
<td>S.R.</td>
<td>5 J x 13 H2 (1)</td>
<td>N</td>
<td></td>
<td>bar</td>
<td>1.76</td>
<td>1.57</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firelli P3 Cinturato Tbl 165/70.13</td>
<td>S.R.</td>
<td>5 J x 13 H2 (1)</td>
<td>N</td>
<td></td>
<td>kPa</td>
<td>176</td>
<td>157</td>
<td>25.6</td>
<td>22.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kleber V16TI Tbl 165/70.13</td>
<td>S.R.</td>
<td>5 J x 13 H2 (1)</td>
<td>N</td>
<td></td>
<td>p.s.i.</td>
<td>25.6</td>
<td>22.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coat Radial Velo Tbl 165/70.13</td>
<td>S.R.</td>
<td>5 J x 13 H2 (1)</td>
<td>N</td>
<td></td>
<td>kg/cm²</td>
<td>1.8</td>
<td>1.6</td>
<td>1.8</td>
<td>1.6</td>
<td>1.8</td>
<td>1.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Year Grand Prix S Tbl 165/70.13</td>
<td>S.R.</td>
<td>5 J x 13 H2 (1)</td>
<td>N</td>
<td></td>
<td>bar</td>
<td>1.76</td>
<td>1.57</td>
<td>1.76</td>
<td>1.57</td>
<td>1.76</td>
<td>1.57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firestone S 211 Tbl 165/70.13</td>
<td>S.R.</td>
<td>5 J x 13 H2 (1)</td>
<td>N</td>
<td></td>
<td>kPa</td>
<td>176</td>
<td>157</td>
<td>25.6</td>
<td>22.76</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Inflating Pressure (**) Inflating pressures measured with cold tires.

In particularly heavy operating conditions (max. load, high temperatures, high speeds, etc.) it is advisable to increase inflating pressures by 0.2 kg/cm² (0.2 bar : 20 kPa ; 2.84 p.s.i.)

In the event of rear axle overloading (trailer hauling, L.P.G. tank, etc.) it is advisable to increase rear tires inflating pressure by 0.6 kg/cm² (10.6 bar : 60 kPa ; 8.85 p.s.i.)

### Notes:
- A = Front
- P = Rear
- N = With reduced load and touring riding
- V = With full load and steady top speed riding
- S.R. rating = Up to 180 km/h (120 m.p.h.)
- (*) = Only for 1350 and 1500 models

### Balance (max. allowed residual balance)
- Balance weights
- Chain "s" max. dimensions

<table>
<thead>
<tr>
<th>g (oz)</th>
<th>8 (0.28)</th>
</tr>
</thead>
<tbody>
<tr>
<td>g (oz)</td>
<td>10 - 40 (at 10 g intervals)</td>
</tr>
<tr>
<td>mm (in)</td>
<td>16 (0.63)</td>
</tr>
</tbody>
</table>
ELECTRICAL SYSTEM

GROUP 40

CONTENTS

HOW TO READ THE WIRING
DIAGRAM ............................ 40-2
Wiring diagram ...................... 40-2
Power supply routing .............. 40-3
POWER SUPPLY ROUTING ............ 40-4
Schematic/Power supply routing ... 40-4
Fuses ............................... 40-5
Ignition switch ...................... 40-6
ELECTROMECHANIC AND
ELECTRONIC DEVICES ............... 40-7
Relays and timer ..................... 40-7
Electronic devices and intermittence; 40-7
LIGHTING SYSTEM .................. 40-10
Lamps ............................... 40-10
Combination switch assembly ...... 40-11
Outside lighting .................... 40-13
Front combination lamps .......... 40-17
Rear combination lamps .......... 40-19
Inside lighting ..................... 40-20
BOARD INSTRUMENTS AND
TRANSMITTERS ..................... 40-22
Cluster ............................. 40-22
Engine cooling and lubrication . . 40-24
Fuel supply, brake and clutch oil
minimum level transmitter, tachy-
metric pulse generator .......... 40-26
WINDSCREEN WASH/WIPER AND
HEADLIGHT WASH/WIPER .......... 40-28
Windscreen wash/wiper .......... 40-28
Windscreen wiper ................. 40-29
Headlight wash/wiper ............. 40-32
Headlight wiper .................... 40-33
Windscreen washer and headlight
washer ............................... 40-34
ELECTRIC ACCESSORIES ........... 40-36
Horns, heated rear window, cigar
lighter, clock ....................... 40-36
Horns ............................... 40-37
Heated rear window ................ 40-38
Power window ....................... 40-39
Power windows and door locks ... 40-41
Door lock control unit .......... 40-42
Check Control and Trip Computer .. 40-43
ELECTRIC COMPONENT LOCATION. 40-45
Engine compartment ............... 40-45
Passenger compartment .......... 40-45
HARNESS LAYOUT ................... 40-46
General harness .................... 40-46
Engine compartment ............... 40-46
Passenger compartment and luggage
room (LH) .......................... 40-47
Dashboard (LH) ..................... 40-48
SWITZERLAND-AUSTRALIA MODEL
VARIATION ......................... 40-49
Tachymetric control unit - fast idle.
electromagnet - hand brake switch. 40-49
CIRCUIT DIAGRAM ................. 40-50

May 1983
ELECTRICAL SYSTEM

The chain line, on wiring diagram, delimits those areas containing the specific variations for the models indicated by "α...".

The connection identifies two wiring variations, present in alternative and connected in the same way. The wiring variations are referred to the models indicated by "α...".

The example shows continuity between terminals 2 and 3 with the control set to position 1.

The detail shows a reference to knot relevant to electronic device N ...

The figure shows the type of diagram used to identify the two connectors relevant to each joint: for the male connector it is applicable diagram (m); for the female one it is applicable diagram (f).

Cable colors

<table>
<thead>
<tr>
<th>Letter</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Light blue</td>
</tr>
<tr>
<td>AB</td>
<td>Light blue - white</td>
</tr>
<tr>
<td>AN</td>
<td>Light blue - black</td>
</tr>
<tr>
<td>AR</td>
<td>Light blue - red</td>
</tr>
<tr>
<td>B</td>
<td>White</td>
</tr>
<tr>
<td>BN</td>
<td>White - black</td>
</tr>
<tr>
<td>BR</td>
<td>White - red</td>
</tr>
<tr>
<td>BLN</td>
<td>Blue - black</td>
</tr>
<tr>
<td>BLR</td>
<td>Blue - red</td>
</tr>
<tr>
<td>C</td>
<td>Orange</td>
</tr>
<tr>
<td>CN</td>
<td>Orange - black</td>
</tr>
<tr>
<td>CB</td>
<td>Orange - white</td>
</tr>
<tr>
<td>H</td>
<td>Grey</td>
</tr>
<tr>
<td>HG</td>
<td>Grey - white</td>
</tr>
<tr>
<td>HN</td>
<td>Grey - black</td>
</tr>
<tr>
<td>HR</td>
<td>Grey - red</td>
</tr>
<tr>
<td>HV</td>
<td>Grey - green</td>
</tr>
<tr>
<td>G</td>
<td>Yellow</td>
</tr>
<tr>
<td>GB</td>
<td>Yellow - white</td>
</tr>
<tr>
<td>GN</td>
<td>Yellow - black</td>
</tr>
<tr>
<td>GR</td>
<td>Yellow - red</td>
</tr>
<tr>
<td>GV</td>
<td>Yellow - green</td>
</tr>
<tr>
<td>N</td>
<td>Black</td>
</tr>
<tr>
<td>NZ</td>
<td>Black - violet</td>
</tr>
<tr>
<td>M</td>
<td>Brown</td>
</tr>
<tr>
<td>MB</td>
<td>Brown - white</td>
</tr>
<tr>
<td>MG</td>
<td>Brown - yellow</td>
</tr>
<tr>
<td>R</td>
<td>Red</td>
</tr>
<tr>
<td>RN</td>
<td>Red - black</td>
</tr>
<tr>
<td>S</td>
<td>Pink</td>
</tr>
<tr>
<td>SB</td>
<td>Pink - white</td>
</tr>
<tr>
<td>SN</td>
<td>Pink - black</td>
</tr>
<tr>
<td>V</td>
<td>Green</td>
</tr>
<tr>
<td>VB</td>
<td>Green - white</td>
</tr>
<tr>
<td>VN</td>
<td>Green - black</td>
</tr>
<tr>
<td>Z</td>
<td>Violet</td>
</tr>
<tr>
<td>ZN</td>
<td>Violet - black</td>
</tr>
</tbody>
</table>

In case of mixed color, the base color is indicated first, followed by the present stripe color, i.e. BN = White with Black stripes

Cable section

Cable section not indicated is 0.5 mm² (0.39 . 10⁻⁵ in²).

POWER SUPPLY ROUTING

This type of diagram is helpful in identification of specific troubles relevant to the part of electric diagrams concerning supply i.e.: the windscreen wiper is not functioning. A first check shows efficiency of instrumentation supply. From distribution diagram it can be noted that supply of both instrumentation and windscreen wiper are realized via ignition switch and fusebox. The result is then that ignition switch operates correctly and no failure is present along wiring between battery and switch itself.

Failure must then be due either to fusebox (see.: Fuses - Services protected by fuses) or to the following parts of the electric system, that is in the wiring windscreen wiper or in the ground connection.

For fault identification, refer then to the windscreen wiper wiring diagram.
POWER SUPPLY ROUTING

SCHEMATIC/POWER SUPPLY ROUTING

May 1983

40-4
FUSES

LOCATION

The fusebox is an integral part of the support board and is located on the left side of the intermediate bulkhead, in the engine compartment.

CAUTION:

a. In case a fuse blows, before replacing it, make sure that the cause of failure has been removed.

b. Use fuse having the prescribed amperage, only. Do never use fuses having amperage greater than the prescribed one.

c. Correctly insert fuse into fusebox, aligning it carefully with respect to its seat.

d. Should car remain stationary for a long time, remove fuse protecting supply circuit of clock.

SERVICES PROTECTED BY FUSES

In the following table, for each model, it is specified which are the services protected by each fuse.

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Protected Service</th>
<th>Ampere</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1200</td>
<td>1350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>905.00</td>
<td>905.02</td>
</tr>
<tr>
<td>1</td>
<td>Power windows</td>
<td>16</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>Door lock control unit</td>
<td>16</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>Heated rear window</td>
<td>16 X X X X</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Clock</td>
<td>16 X X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Horns-cigar lighter</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5</td>
<td>Passenger compartment roof lamp- Intermittence of direction and hazard lights- Stop switch</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Roof lamp timer</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trip Computer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Windscreen wiper-Windscreen Wiper electronic intermittence generator. Windscreen wiper control-Windscreenwasher pump control-Cluster</td>
<td>8 X X X X</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Heated rear window switch- Hazard lights switch</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heater switch</td>
<td>8</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Power window switch Power window</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clock</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

May 1983
### ELECTRICAL SYSTEM

#### IGNITION SWITCH

**Modal**

<table>
<thead>
<tr>
<th>Flag</th>
<th>Ampere</th>
<th>1200 905.00</th>
<th>1360 905.02 305.03</th>
<th>1500 a. 905.04 905.05</th>
<th>1500 905.06 905.07</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>11</td>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>13</td>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>14</td>
<td>8</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

G = Quadrifoglio

---

#### REMOVAL AND INSTALLATION

For removal and installation of the ignition switch - antitheft steering lock group, refer to: Groupe 23 - Steering Wheel and Column.
ELECTROMECHANIC AND ELECTRONIC DEVICES

RELAYS AND TIMER

LOCATION
The relays and the roof lamp timer are inserted into the special socket which is integral part of the fusebox support board, located on left side of intermediate bulkhead. For location, refer to “Electric Component Location”.

CHECK
The relays and the timer, must be of the type indicated in the specific table on page 40-8.

ELECTRONIC DEVICES AND INTERMITTENCES

LOCATION
The electronic device for headlights and flashing changeover, and the windscreen wiper electronic intermit- tence generator, are mounted on a support board, located in the inter- mediate bulkhead, in proximity to the fuse holder box. The device which controls intermit- tences of both side lights and hazard lights, is located in the dashboard inside. For identification of the various devices, see: “Electric Component Location”.

CHECK
The electronic devices and intermit- tences must be of the type indicated in the specific table on page 40-9.
“Relays and Timer” Table

<table>
<thead>
<tr>
<th>Component</th>
<th>External view</th>
<th>Symbols</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger compartment roof lamp timer</td>
<td><img src="image1" alt="Passenger compartment roof lamp timer" /></td>
<td><img src="image2" alt="Symbols" /></td>
<td>1</td>
</tr>
<tr>
<td>Horns relay</td>
<td><img src="image3" alt="Horns relay" /></td>
<td><img src="image4" alt="Horns relay symbols" /></td>
<td>2</td>
</tr>
<tr>
<td>Heated rear window relay</td>
<td><img src="image5" alt="Heated rear window relay" /></td>
<td><img src="image6" alt="Heated rear window relay symbols" /></td>
<td>3</td>
</tr>
<tr>
<td>Headlight wiper relay</td>
<td><img src="image7" alt="Headlight wiper relay" /></td>
<td><img src="image8" alt="Headlight wiper relay symbols" /></td>
<td>4</td>
</tr>
<tr>
<td>Front power windows relay</td>
<td><img src="image9" alt="Front power windows relay" /></td>
<td><img src="image10" alt="Front power windows relay symbols" /></td>
<td>5</td>
</tr>
</tbody>
</table>
"Intermittences and electronic devices

<table>
<thead>
<tr>
<th>Component</th>
<th>External view</th>
<th>Symbols</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windscreen wiper electronic intermittence</td>
<td></td>
<td>![Symbol N14]</td>
<td></td>
</tr>
<tr>
<td>Electronic device for headlights and flashing changeover</td>
<td>![Symbol N18]</td>
<td>![Symbol N18]</td>
<td>2</td>
</tr>
<tr>
<td>Hazard and direction lights intermittence</td>
<td>![Symbol N13]</td>
<td>![Symbol N13]</td>
<td></td>
</tr>
</tbody>
</table>
LIGHTING SYSTEM

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

LAMPS

Lamp characteristic data, type and electric power are listed in the following table.

<table>
<thead>
<tr>
<th>Lamps</th>
<th>Electric power (W)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front combination lamps:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- low beam and full beam (H4 halogen lamp)</td>
<td>55/60</td>
<td>A</td>
</tr>
<tr>
<td>- front side light</td>
<td>4</td>
<td>B</td>
</tr>
<tr>
<td>- front direction indicator</td>
<td>21</td>
<td>B</td>
</tr>
<tr>
<td>Side direction indicator lamp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>3</td>
<td>D</td>
</tr>
<tr>
<td>Rear combination lamps:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- rear direction indicator</td>
<td>21</td>
<td>B</td>
</tr>
<tr>
<td>- rear side light</td>
<td>5</td>
<td>B</td>
</tr>
<tr>
<td>- number plate light</td>
<td>5</td>
<td>B</td>
</tr>
<tr>
<td>- reversing light</td>
<td>21</td>
<td>B</td>
</tr>
<tr>
<td>- rear fog light</td>
<td>21</td>
<td>B</td>
</tr>
<tr>
<td>- rear side and stop light</td>
<td>5/21</td>
<td>B</td>
</tr>
<tr>
<td>Warning lamp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>1.2</td>
<td>D</td>
</tr>
<tr>
<td>Roof lamp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td>10</td>
<td>C</td>
</tr>
</tbody>
</table>

TYPES OF LAMPS

The lamps used for the car are of four types. For removal the following procedure is recommended.

1. Halogen lamp - type A
   To remove it from lampholder, disconnect connector, then rotate retaining spring being careful not to touch it with naked hands.

2. Bayonet lamp - type B
   To remove it from lampholder, press the bulb, rotate it counterclockwise, then withdraw it.

3. Cylindrical lamp - type C
   To remove it from lampholder, release it from contacts pulling towards outside of lampholder.

4. Whole glass - type D
   It is pressed into lamp holder and to remove it, it is necessary to withdraw lamp out of lampholder.

For installation of lamps, reverse order of removal.
COMBINATION SWITCH ASSEMBLY

1 Left lever
2 Turning stalk
3 Connector
4 Connector
5 Connector
6 Connector
7 Connector
8 Right lever

May 1983
ELECTRICAL SYSTEM

The following table shows the correspondances between positions of combination switch controls and the concerned services.

<table>
<thead>
<tr>
<th>Control</th>
<th>Position</th>
<th>Service enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stall rotation</td>
<td>0</td>
<td>- zero position</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>- side lights</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>- low beams</td>
</tr>
<tr>
<td>Movement parallel to steering wheel axis</td>
<td>A</td>
<td>- zero position</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>- full beam flashing (paired to rotation in the 0 and 1 positions)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Headlight change over (paired to rotation in position 2)</td>
</tr>
<tr>
<td>Movement parallel to steering wheel plane</td>
<td>D</td>
<td>- Right - hand direction indicator</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>- Neutral position</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>- Left - hand direction indicator</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control</th>
<th>Position</th>
<th>Service enabled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Movement parallel to steering wheel plane</td>
<td>0</td>
<td>- zero position</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>- windscreen wiper intermittence</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>- windscreen wiper 1st speed</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>- windscreen wiper 2nd speed</td>
</tr>
<tr>
<td>Movement parallel to steering wheel axis</td>
<td>ON</td>
<td>- windscreen washer and/or headlight wash-wiper with wiping stroke driven from control unit</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>- zero position</td>
</tr>
</tbody>
</table>

REMOVAL AND INSTALLATION

1. Removing steering wheel.
2. Unscrew the five securing screws and remove upper and lower shell covers of steering column (see Group 23 - Steering Wheel and Column).
3. Disconnect connectors (2) of the combination switch unit.
4. Remove combination switch unit by unscrewing the two screws (1) securing it to steering column.
If necessary, disassemble combination switch unit separating the two levers.
5. For installation reverse order of removal.

CHECKS AND INSPECTIONS

Check harness integrity and, by means of a tester, check electric continuity.

May 1983
OUTSIDE LIGHTING

OUTSIDE LIGHTING - FRONT SIDE
OUTSIDE LIGHTING - REAR SIDE
(for the 1200 - 1350 - 1500 models)

ELECTRICAL SYSTEM

May 1983
HEADLIGHT SWITCH
Low beam/full beam light change-over is executed via left lever of combination switch (see: Combination Switch Assembly).

DIRECTION LIGHT SWITCH
Operation of direction indicators is executed via left lever of combination switch (see: Combination Switch Assembly).

HAZARD LIGHTS SWITCH
Location
The switch is mounted on upper ornament of central console (see: Groupe 66 - Consoles).

Check
Verify switch functioning by checking whether continuity between terminals occurs in accordance with the indications provided in table.

REVERSE LIGHT SWITCH
Location
The switch is mounted on gearbox (see: Group 13).

Check
Connect a tester to terminals of reverse switch and verify the following resistance values.

When in the OFF position = \(\infty\) \(\Omega\)
When in the ON position = 0 \(\Omega\)

STOP LIGHT SWITCH
Location
The switch is mounted on the relevant bracket of pedal assembly.

Check
Connect a tester to terminals of stop light switch and verify the following resistance values.

When in the OFF position = \(\infty\) \(\Omega\)
When in the ON position = 0 \(\Omega\)

REAR FOG LIGHT SWITCH
Location
The switch is mounted on upper ornament of central console (see: Groupe 66 - Consoles).

Check
Verify switch functioning by checking whether continuity between terminal occurs in accordance with the indications provided in table.
FRONT COMBINATION LAMPS

REMOVAL AND INSTALLATION

With reference to the exploded view proceed as follows.

1. Operating from engine compartment inside, disconnect harness from cover 5.
2. Remove grille (see: Group 75 - Grille).
3. Unscrew the two nuts securing combination lamps to body.

5. For combination lamp installation, reverse order of removal.

6. Adjust luminous beam by following the procedures described in "Setting of headlights low beam".

Replacement of transparent cover 10 can be carried out on mounted combination lamps 1, by operating from engine compartment inside.

1) Rotate lampholder 8 counterclockwise and withdraw it from transparent cover 10.

4) Operating from fender inside, unscrew nut securing combination lamps to fender itself and remove it.

(2) Unscrew the two screws securing transparent cover 10 to combination lamps 1, then remove it.
For installation of transparent cover, reverse order of removal.

**LAMP REPLACEMENT**

Headlights and front side lights

1. Operating from engine compartment inside, rotate cover clockwise, then remove it.

2. Disconnect supply connector.
3. Rotate securing spring counterclockwise, and remove it.
4. Withdraw halogen lamp and replace it. On reassembly, replace the lamp, make sure the cover is properly positioned by correct alignment of the notches.
5. To remove headlight lamp, withdraw lampholder, press bulb and rotate it counterclockwise.

6. For installation, reverse order of removal.

**CAUTION:**
Do not touch with the hands glass of headlight halogen lamp. If this occurs, wash the glass.

**Front direction indicators**

1. Operating from engine compartment inside, rotate lampholder counterclockwise, then remove it.
2. Press lamp bulb and rotate it in order to withdraw lamp.
3. Replace the lamp and install lampholder.

**Side direction indicators**

1. Operating from fender inside, compress the two springs securing transparent cover of side direction indicator to fender, then remove it.
2. Withdraw lampholder from direction indicator.
3. Replace lamp by pulling the relevant bulb.
4. Install direction indicator by reversing order of removal.

**SETTING OF HEADLIGHTS LOW BEAM**

Carry out the following procedure to adjust headlight low beam.

1. Check that tires are inflated at the right pressure and that car is free from any load excepted those of service supplies and of one passenger equivalent.
2. Position the car and the possible test equipment on an horizontal plane. If no test equipment is available, place the car in front of a clear screen.
3. Move car back of about 10 m (32.8 ft) and switch on low beams. The luminous beam must be in compliance with geometric dimensions provided in figure.
ELECTRICAL SYSTEM

A = distance of headlight centre from ground
B = height of luminous beam
C = 10 m (32.8 ft)

Orientation is correct when the following condition occurs:

\[ B = 470 \text{ mm} \ (18.5 \text{ in}) \]

Distance D between luminous beams centre must be equal to distance E between headlight centre.

The dimensions indicated in the diagram comply with provisions in force in Italy. For other countries, comply with national provisions.

For correction of possible orientation errors, from engine compartment inside, operate on adjusting screws of headlights set in evidence in the following figure.

REAR COMBINATION LAMPS

REMOVAL AND INSTALLATION
With reference to the exploded view, operate as follows.
1. Open back door and lift rear trim.
2. Disconnect connector.
3. Unsaw the six nuts securing combination lamps to body, then remove combination lamps.

LAMP REPLACEMENT
The following procedure is applicable to all lamps and lampholders.

4. For installation of combination lamps, reverse order of removal.
1. Open back door and lift rear trim.
2. Press on lampholder side, pull; then remove it.
3. Press bulb of lamp and rotate it in order to remove.
4. Replace lamp and refit lampholder.
5. For identification of lamp location, refer to diagram of the following figure.

Diagram refers to the left rear combination lamp. The right-hand one is specular with respect to the left-hand.

The rear fog light is present in the left rear combination lamp only.

1. Rear fog light
2. Side light
3. Stop and side lights
4. Direction indicator
5. Reverse light
6. Number plate light

INSIDE LIGHTING
1200 and 1350 model

May 1983

40-20
ROOF LAMP

Lamp replacement

1. By means of proper tool, remove transparent cover, pressure inserted into lampholder.
2. Withdraw and replace the lamp.
3. For lamp installation, reverse order of removal.
ELECTRICAL SYSTEM

CAUTION:
Before starting operations, make sure that the ignition key is to the “ST” position and ground cable is discon-
nected.

REMOVAL AND
INSTALLATION
1. Unscrew the four screws (5) securing cluster (1) to support bracket (4).
2. Remove the pressure inserted cover (3), disconnect harness (2), then remove cluster.
3. For installation, reverse order of removal.

LIGHTING AND WARNING
LAMPS REPLACEMENT
1. Remove cluster (see: Removal and Installation).
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.

1 Cluster
2 Connector5
3 Cover
4 Bracket
5 Screw
ENGINE COOLANT LEVEL SENSOR

Location
The sensor is inset-ted 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: $\infty\Omega$
   - Float lowered: $0\ \Omega$
FUEL LEVEL TRANSMITTER

Removal and installation
For removal and installation see:
Groupe 04 • Supply System.

CLUTCH AND BRAKE OIL MINIMUM LEVEL TRANSMITTER

Check
1. Set the ignition key to the MAR position.

2. Connect a lamp indicator to pins of float plug, as per figure.
3. Check device proper functioning by verifying the following.

   Float lifted:
   lamp indicator off

   Float lowered:
   lamp indicator on
ELECTRICAL SYSTEM

WINDSCREEN WASH/WIPER AND HEADLIGHT WASH/WIPER

WINDSCREEN WASH/WIPER

A1 Battery
B1 Ignition switch
B2 Windsreen wiper control switch
B3 Windscreen washer and/or headlight wash/wiper pump control switch
G1 Fusebox
G85 Front service connector
L13 Windscreen washer liquid level sensor
N7 Trip Computer
N8 Check Control
N14 Windscreen wiper electronic intermittence
P1 Windscreen wiper motor
P9 Windscreen washer electric pump
CL4 R.H.D. L.H.D. Quadrifoglio model
WINDSCREEN WIPER

1. Motor
2. Motor cover
3. Linkage
4. Nut
5. Spacer

REMOVAL AND INSTALLATION

1. Disconnect motor harness.
2. Withdraw brushes from wiper arms.
3. Lift covers of nut securing wiper arms, unscrew nuts, then remove wiper arms.
4. Remove cowl top cover (see: Group 75 - Cowl top cover).
5. Withdraw bush, unscrew nut, then remove it together with spacer.
6. Unscrew the three screws securing linkage to body, then remove it.
7. Unscrew the three screws securing motor to linkage and nut securing motor shaft to linkage.
8. Remove motor and withdraw cover.
9. For windscreen wiper installation, reverse order of removal.

May 1983
### TROUBLE DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windshield wiper does not operate</td>
<td>Burnt fuse</td>
<td>Replace fuse</td>
</tr>
<tr>
<td>Windshield wiper operating speed is too slow</td>
<td>Loosen connection or open circuit, Improper switch contact, Foreign material interrupts link mechanism, Disconnected rod, Seized or rusted arm shaft</td>
<td>Restore connection, Verify combination switch; (right light); replace, if necessary, Take off foreign material, Connect rod, Replace shaft</td>
</tr>
<tr>
<td>Windshield wiper does not stop correctly</td>
<td>Faulty auto-stop device, Faulty wiper motor</td>
<td>Replace auto-stop device, Replace motor</td>
</tr>
<tr>
<td>Washer fluid does not eject (washer motor operates)</td>
<td>Clogged washer nozzle or hose</td>
<td>Free nozzle or hose</td>
</tr>
<tr>
<td>Wiper does not operate intermittently but operates at low and high speeds</td>
<td>Faulty wiper switch, Faulty wiring, Faulty intermittence</td>
<td>Replace combination switch (right lever), Verify wiring, Replace intermittence</td>
</tr>
<tr>
<td>Intermittent speed is too short for proper wiping</td>
<td>Faulty auto-stop device, Faulty intermittence</td>
<td>Replace auto-stop device, Replace intermittence</td>
</tr>
<tr>
<td>Intermittent speed is too long, for proper wiping</td>
<td>Line voltage below 10 volts, Faulty intermittence</td>
<td>Restore voltage, Replace intermittence</td>
</tr>
</tbody>
</table>
## ELECTRICAL SYSTEM

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent speed is erratic</td>
<td>• Faulty wiper switch</td>
<td>Replace switch</td>
</tr>
<tr>
<td></td>
<td>• Faulty wiring</td>
<td>Verify wiring</td>
</tr>
<tr>
<td></td>
<td>• Faulty wiper motor</td>
<td>Replace motor</td>
</tr>
<tr>
<td></td>
<td>• Faulty intermittence</td>
<td>Replace intermittence</td>
</tr>
</tbody>
</table>

May 1983
HEADLIGHT WIPER

1500 Quadrifoglio model

REMOVAL AND INSTALLATION

With reference to the exploded view above proceed as follows.

1. Disconnect harness of motor 1.
2. Lift cover of nuts 6 and 8, securing wiper arms 5 and 8, unscrew nut and disconnect headlight washer hoses 3 and 9.
4. Remove grille (see: Group 75 - Grille).
5. Unscrew the six screws securing motors 1 and 11 to bracket 2 and 10, then remove motors.
6. For windscreen wiper installation, reverse order of removal.
## SPECIAL SERVICE TOOLS

<table>
<thead>
<tr>
<th>Tool number</th>
<th>Tool name</th>
<th>Refer to page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.3.0602</td>
<td>Wiper arm puller</td>
<td>40-33</td>
</tr>
</tbody>
</table>
# ELECTRICAL SYSTEM

## HORNS

**Location**
The horns are mounted inside engine compartment on support brackets located under front combination lamps.

**Removal and installation**
1. Operating from engine compartment inside, disconnect horn harness 1.
2. Unscrew the nut 2 securing horn 2 to support bracket 3; then remove the bracket.
3. For installation, reverse order of removal.

## HORN CONTROL PUSHBUTTON

**Location**
The pushbutton is located at centre of steering wheel (see: Group 23 - Steering Wheel and Column).

**Check**
1. Connect ends of tester to pushbutton terminal, operating as per figure.
2. Check pushbutton proper functioning by verifying the following:

   - Pushbutton lifted: $\infty \Omega$
   - Pushbutton depressed: 0 $\Omega$

## TROUBLE DIAGNOSIS AND CORRECTIONS

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only one side operates</td>
<td>Faulty hose</td>
<td>Replace horn</td>
</tr>
<tr>
<td></td>
<td>Loose connector contact</td>
<td>Restore connection</td>
</tr>
<tr>
<td>Poor tone quality on one side</td>
<td>Tone adjustment not good</td>
<td>Adjust tone by operating on the relevant adjusting screw 1</td>
</tr>
<tr>
<td>Both horn volume reduced</td>
<td>Low battery charge</td>
<td>Charge battery or replace</td>
</tr>
<tr>
<td></td>
<td>Faulty charging system</td>
<td>Verify charging system</td>
</tr>
<tr>
<td></td>
<td>Faulty connector contact</td>
<td>Restore connection</td>
</tr>
<tr>
<td>Both horns do not operate</td>
<td>Wiring cut-out</td>
<td>Restore connection</td>
</tr>
<tr>
<td></td>
<td>Faulty control push button</td>
<td>Replace push button</td>
</tr>
<tr>
<td></td>
<td>Discharged battery</td>
<td>Charge battery</td>
</tr>
<tr>
<td></td>
<td>Both horns faulty</td>
<td>Replace both horns</td>
</tr>
</tbody>
</table>
4. Dry end of ruling pen to remove silver compounds.
5. Once the repair has been carried out, wait for about 10 minutes, then verify electric continuity of the wire in object.

During test, do not touch with the fingers the repaired resistor,

6. By means of a hot air jet, heat the repaired area for about 20 minutes, keeping the orifice of heat-gun at about 3 cm (1.2 in) from surface. If a heat-gun is not available, let dry for 24 hours.

```
1 Filament  3 Rule
2 Interruption  4 Ruling pen
```

**POWER WINDOW**

*1350 model (Italy, only) and 1500 model*

```
A1 Battery
B1 Ignition switch
B9 Heated rear window control switch
B12 Hazard lights control switch
B21 Right front power window control switch
B22 Left front power window control switch
G1 Fusebox
G36 Power window switch cable connector
I12 Front power windows relay
P14 Right front power window motor
P1 5 Left front power window motor
```
POWER WINDOWS AND DOOR LOCKS

1500 Quadrifoglio model
DOOR LOCK CONTROL UNIT

LOCATION
The door lock control unit is located inside passenger compartment, in the gear lever console, behind Check Control and Trip Computer.

REMOVAL AND INSTALLATION
1. Withdraw instrument holder 3 and disconnect the relevant harness.
2. Remove control unit 1 by unscrewing the screw securing it to Trip Computer 2.
   For control unit installation, reverse order of removal.

1 Door lock control unit
2 Trip Computer
3 Instrument holder
4 Check Control
LOCATION
Check Control and Trip Computer are inserted into a special instrument holder integrated into gear lever console, in centre position, under dashboard.

REMOVAL AND INSTALLATION
1. Withdraw instrument holder 3 from console and disconnect the relevant harness.
2. Remove Check Control 2 and Trip Computer 1 by unscrewing, for each one, the two securing screws to instrument holder.

For an easier comprehension of the symbology used for the two instruments, in the following table reference is made to Trip Computer Indications and the Check Control signalings, pairing them to relevant symbols.

<table>
<thead>
<tr>
<th>Trip Computer</th>
<th>Check Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

1 Trip Computer 3 instrument holder
2 Check Control

3. For instrument installation, reverse order of removal.
When reading a red led diode is used to set in evidence the enabled function in order to allow user an easy identification.
ELECTRIC COMPONENT LOCATION

ENGINE COMPARTMENT

1. Passenger compartment roof lamp timer
2. Horns relay
3. Heated rear window relay
4. Headlight wiper relay
5. Front power windows relay
6. Fusebox
7. Electronic device for headlights and flashing changeover
8. Windscreen wiper electronic intermittence

PASSENGER COMPARTMENT

1. Hazard and direction lights intermittence
ELECTRICAL SYSTEM

HARNESS LAYOUT

GENERAL HARNESS

1 Engine compartment harness
2 Front part and dashboard harness
3 Roof lamp harness
4 Luggage room harness
5 Passenger compartment harness

ENGINE COMPARTMENT

A3 Alternator with built-in electronic regulator
A8 Ignition coil
A1 Starter
D1 Alternator charge warning lamp
E9 Side direction light lamp
G1 Fusebox
G46 Headlight connector
G53 Engine compartment ground
G73 Rear service connector
G85 Front service connector
H2 Reverse right switch
H17 Brake fluid min. level control switch
L2 Pressure switch for engine oil min. pressure
L5 Thermostatic switch for engine coolant max. temperature warning lamp
L6 Thermostatic switch for engine cooling electric fan
L7 Transmitter for coolant temperature gauge
L17 Odometer pulse generator
M1 Cut-off solenoid valve
N14 Windscreen wiper electronic intermittence
N18 Electronic device for headlights and flashing changeover
P2 Horn
P2 Engine cooling electric fan
P4 Headlight wiper motor
P10 Windscreen washer electric pump
Q1 Air ventilation heater fan

May 1983

40-46
ELECTRICAL SYSTEM

DASHBOARD (L.H. DRIVE)

- B1 Ignition switch
- B2 Windscreen wiper control switch
- B4 Control switch for headlight, flashing, low beam and full beam
- B5 Horns control switch
- B6 Direction lights indicator switch
- B9 Heated rear window control switch
- B11 Rear fog light control switch
- B12 Hazard lights control switch
- B21 Right front power window control switch
- B22 Left front power window control switch
- C7 Clock

- F8 Air ventilation controls lighting lamp
- G5 Connector
- G6 Cluster B connector
- G7 Cluster R connector
- G86 Passenger compartment roof lamp connector
- H3 Stop light switch
- H13 Choke switch
- N13 Hazard and direction lights intermittence
- 06 Cigar lighter
- Q4 Air ventilation heater fan control
SWITZERLAND-AUSTRALIA MODEL VARIATION
TACHYMERIC CONTROL UNIT-FAST IDLE ELECTROMAGNET
-HAND BRAKE SWITCH

TACHYMERIC CONTROL UNIT - FAST IDLE/ ELECTROMAGNET
(For vehicles 1350 - 1500 and 1500 Quadrifoglio models for SWITZERLAND and AUSTRALIA) and HAND BRAKE SWITCH
(For 1500 Quadrifoglio vehicles, AUSTRALIA models)

A1 Battery
A8 Ignition coil
B1 Ignition switch
B2 Windscreen wiper control switch
C1 Electronic rev. counter
D7 Hand brake warning lamp
G1 Fusebox
G6 Cluster B connector

HANDBRAKE INDICATOR SWITCH
(1500 Quadrifoglio)

Check
1. Set the ignition key to the MAR position.
2. Connect a tester to terminal of

handbrake indicator as shown in figure.
3. The following resistance values shall be read.

Brake engaged: 0 Ω
Brake disengaged: ∞Ω

May 1983
KEY

A1 Battery
A2 Alternator with built-in electronic regulator
A3 Ignition distributor
A4 Ignition coil
A5 Starter
A6 Spark plugs
B1 Ignition switch
B2 Windscreen wiper control switch
B3 Windscreen washer and/or headlight wash/wiper pump control switch
B4 Control switch for headlight, flashing, low beam and full beam
B5 Horns control switch
B6 Direction lights indicator switch
B7 Heated window control switch
B8 Rear fog light control switch
B9 Hazard lights control switch
B10 Right front power window control switch
B11 Left front power window control switch
C1 Electronic rev. counter
C2 Electronic tachometer
C3 Fuel level gauge
C4 Coolant temperature gauge
C5 Clock
D1 Alternator charge warning lamp
D2 Direction light warning lamp
D3 Side light warning lamp
D4 Full beam warning lamp
D5 Brake fluid level warning lamp
D6 Hand brake warning lamp
D7 Fuel reserve warning lamp
D8 Choke warning lamp
D9 Engine oil min. pressure warning lamp
D10 Engine coolant max. temperature warning lamp
E1 Front direction indicator light lamp
E2 Front side light lamp
E3 Low beam and full beam lamp
E4 Side direction light lamp
E5 Rear direction light lamp
E6 Tail light lamp
E7 Reverse light lamp
E8 Stop light lamp
E9 Number plate light lamp
F1 Passenger compartment roof lamp
F2 Air ventilation controls lighting lamp
F3 Cluster lighting lamp
F4 Ignition switch lighting lamp
F5 Switches lighting lamp
G1 Fusebox
H1 Handbrake switch
H2 Reverse light switch
H3 Stop light switch
H4 Roof lamp switch on passenger compartment pillar
H5 3 Choke switch
H6 Brake fluid min. level control switch
H7 Contact switch, on rear door, for heated rear window
I2 Heated rear window relay
I3 Horns relay
I4 Headlight wiper relay
I5 Front power windows relay
I6 Pressure switch for engine oil min. pressure
I7 Thermostat switch for engine coolant max. temperature warning lamp
I8 Thermostat switch for engine cooling electric fan
I9 Transmitter for coolant temperature gauge
I10 Transmitter for fuel level gauge
I11 Oil level indicator
I12 Engine oil level indicator
I13 Windscreen washer liquid level sensor
I14 Engine coolant level sensor
I15 Engine oil pressure warning lamp
I16 Coolant temperature sensor
I17 Odometer pulse generator
I18 Mopar solenoid valve
I19 Idle speed electromagnet
I20 Module for electronic ignition
I21 Trip Computer
I22 Check Control
I23 Passenger compartment roof lamp timer
I24 Door lock control unit
I25 Hazard and direction lights intermittence
I26 Windscreen wiper electronic intermittence
I27 Tachymetric control unit
I28 Trip control unit for fuel flow
I29 Electronic device for headlights and flashing changeover
I30 Heated rear window
I31 Horn
I32 Cigar lighter
I33 Windscreen wiper motor
I34 Engine cooling electric fan
I35 Headlight wiper motor
I36 Right front door lock motor
I37 Left front door lock motor
I38 Right rear door lock motor
I39 Left rear door lock motor
I40 Right front power window motor
I41 Left front power window motor
I42 Windscreen washer electric pump
I43 Headlight washer electric pump
I44 Air ventilation heater fan
I45 Air ventilation heater fan control
I46 L.H.D. 1200 model
I47 L.H.D. - R.H.D. 1350 model
I48 L.H.D. - R.H.D. 1500 model
I49 L.H.D. - R.H.D. 1500 Quadrifoglio model

May 1983

40-50
**KEY**

A1 Battery
A3 Alternator with built-in electronic regulator
A5 Ignition distributor
A8 Ignition coil
A11 Starter
A12 Spark plugs
B1 Ignition switch
B2 Windscreen wiper control switch
B3 Windscreen washer and/or headlight wash/wiper pump control switch
B4 Control switch for headlight, flashing, low beam and full beam
B5 Horns control switch
B6 Direction lights indicator switch
B8 Heated rear window control switch
B11 Rear fog light control switch
B12 Hazard lights control switch
B21 Right front power window control switch
B22 Left front power window control switch
C1 Electronic rev. counter
c2 Electronic tachometer
c4 Fuel level gauge
C6 Coolant temperature gauge
C7 Clock
D1 Alternator charge warning lamp
D2 Direction light warning lamp
D3 Side light warning lamp
D4 Full beam warning lamp
D5 Brake fluid level warning lamp
D7 Hand brake warning lamp
D8 Fuel reserve warning lamp
D9 Choke warning lamp
D11 Engine oil min. pressure warning lamp
D13 Engine coolant max. temperature warning lamp
E1 Front direction indicator light lamp
E2 Front side light lamp
E3 Low beam and full beam lamp
E9 Side direction light lamp
E11 Rear direction light lamp
E12 Tail light lamp
E14 Reverse light lamp
E15 Stop light lamp
E16 Rear fog light lamp
E17 Number plate light lamp
F3 Passenger compartment roof lamp
F8 Air ventilation controls lighting lamp
F12 Cluster lighting lamp
F15 Ignition switch lighting lamp
F17 Switches lighting lamp
G1 Fusebox
H1 Handbrake switch
H2 Reverse light switch
H3 Stop light switch
H4 Roof lamp switch on passenger compartment pillar
H17 Brake fluid min. level control switch
H27 Contact switch on rear door, for heated rear window
I2 Heated rear window relay
I3 Horns relay
I4 Headlight wiper relay
I12 Front power windows relay
L2 Pressure switch for engine oil min. pressure
L5 Thermostatic switch for engine coolant max. temperature warning lamp
L6 Thermostatic switch for engine cooling electric fan
L7 Transmitter for coolant temperature gauge
L9 Transmitter for fuel level gauge
L12 Engine oil level indicator
L13 Windscreen washer liquid level sensor
L14 Engine coolant level sensor
L17 Odometer pulse generator
M1 Cut-off solenoid valve
M4 Idle speed electromagnet
N1 Module for electronic ignition
N7 Trip Computer
N6 Check Control
N10 Passenger compartment roof lamp timer
N11 Door lock control unit
N13 Hazard and direction lights intermittence
N14 Windscreen wiper electronic intermittence
N16 Tachymetric control unit
N17 Trip control unit for fuel flow
N18 Electronic device for headlight and flashing changeover
01 Heated rear window
02 Horn
06 Cigar lighter
P1 Windscreen wiper motor
P2 Engine cooling electric fan
P4 Headlight wiper motor
P10 Right front door lock motor
P11 Left front door lock motor
P12 Right rear door lock motor
P13 Left rear door lock motor
P14 Right front power window motor
P15 Left front power window motor
P19 Windscreen washer electric pump
P20 Headlight washer electric pump
Q1 Air ventilation heater fan
Q4 Air ventilation heater fan control
Q1 L.H.D. 1200 model
a2 L.H.D. - R.H.D. 1350 model
a3 L.H.D. - R.H.D. 1500 model
a4 L.H.D. - R.H.D. 1500 Quadrifoglio model

May 1983

40-53
BODY-SHEET METAL PANELS

GROUP 49

CONTENTS

GENERAL INFORMATION ........................................ 49-2
   Identification codes .................................... 49-2
   Lifting points .......................................... 49-3
   Wheel alignment .......................................... 49-3
BODY COMPONENT PARTS ....................................... 49-5
   Body components ........................................ 49-5
   Under body components .................................. 49-6
BODY CONSTRUCTION .......................................... 49-7
   Body construction ........................................ 49-7
BODY SEALING ................................................ 49-9
   Description ............................................. 49-9
BODY ALIGNMENT .............................................. 49-11
   Measurement operations ................................. 49-11
   Measurement points ...................................... 49-12
CAUTIONS FOR THE OPERATORS ............................... 49-14
   Safety rules ............................................. 49-14
   Body and outer components protections .................. 49-14
   Cautions during replacement operations ................. 49-15
   Cautions during welding operations ..................... 49-15
REPLACEMENT OPERATIONS .................................. 49-20
   How to read this chapter ............................... 49-20
   Symbology ................................................ 49-21
   Removal and installation procedures ..................... 49-22
   Radiator core support .................................. 49-29
   Hoodledge panel with core support removed .............. 49-31
   Hoodledge panel with radiator core support removed (Partial replacement) .............................. 49-33
   Front side member ...................................... 49-35
   Central pillar ........................................... 49-37
   Outer side member ....................................... 49-39
   Outer side member (Partial replacement) .................. 49-41
   Rear fender ............................................. 49-43
   Drip with rear fender removed ........................... 49-45
   Lower rear panel ......................................... 49-46
   Upper rear panel ......................................... 49-47
   Rear part of rear floor with rear fender and rear panel removed ...................................... 49-49
   Rear side member with rear panel and rear floor removed .................................. 49-51
   Roof panel .............................................. 49-52

May 1983
GENERAL INFORMATION

IDENTIFICATION DATA

Identification and certification label
See Group 00 - Identification Data

Chassis No.
(see Group 00 - Identification Data)

Identification and certification label

Chassis no.
(see Group 00 - Identification Data)

May 1983

49-2
LIFTING POINTS

Jack and safety stands

WARNING:

a. After lifting the car by means of hydraulic jack, provide to support car weight by means of safety stands.
b. Before lifting car rear (front) side place wheel chocks by positioning them at front (rear) wheels.

Securely position hydraulic jack and safety stands in the points identified in figure.

WHEEL ALIGNMENT

CAUTION:
The technicians assigned to the repair and replacement operations of sheet panels, shall always take into account, content of the remaining part of the “Workshop Manual” in order always to maintain original quality and functioning conditions of car as a whole. As restoration of car correct alignment is of particular importance, in the following part are provided the data relevant to geometry of both front and rear suspensions. For any further information, refer to the specific Groups.

1. Front axle and suspension

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toe-out</td>
<td>mm</td>
<td>M-H = 4 ± 1</td>
</tr>
<tr>
<td></td>
<td>(in)</td>
<td>M-H = 0.16 ± 0.04</td>
</tr>
<tr>
<td>Half toe-out</td>
<td>mm</td>
<td>L = 1/2 M - 2 ± 0.5</td>
</tr>
<tr>
<td></td>
<td>(in)</td>
<td>L = 1/2 M - 0.08 ± 0.02</td>
</tr>
<tr>
<td>Toe-out angle</td>
<td></td>
<td>α = 10°</td>
</tr>
<tr>
<td>Rim diameter</td>
<td>mm</td>
<td>θ = 340</td>
</tr>
<tr>
<td></td>
<td>(in)</td>
<td>θ = 13.39</td>
</tr>
<tr>
<td>Camber angle</td>
<td></td>
<td>β = -2°15’ ± 30’</td>
</tr>
<tr>
<td>Caster angle</td>
<td></td>
<td>γ = 1° ± 30’</td>
</tr>
<tr>
<td>Max steering angle</td>
<td></td>
<td>δ = 3350’</td>
</tr>
</tbody>
</table>

2. Rear axle and suspension

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toe-in angle</td>
<td></td>
<td>α = 0° ± 25’</td>
</tr>
<tr>
<td>Camber angle</td>
<td></td>
<td>β = 0° ± 25’</td>
</tr>
</tbody>
</table>

Wheel alignment is measured with car under nominal height (see: Group 00 - Wheel alignment).
BODY - SHEET METAL PANELS

UNDER BODY COMPONENTS

1. Lower front cross member
2. Lower floor side member
3. Front sheet reinforcement side member
4. Radiator core support
5. Radiator core support liner upper rail
6. Radiator core assembly
7. Front fender side reinforcement
8. Intermediate bulkhead front cross member assembly
9. Windscreen lower closing
10. Windscreen lower frame
11. Air duct assembly
12. Intermediate bulkhead (lower part)
13. Dashboard sheet (front part)
14. Plastic suspension support bracket (rear part)
15. Dashboard sheet (rear part)
16. Front fender sheet
17. Rear fender sheet
18. Cross member under rear seat
19. Rear floor sheet (front part)
20. Rear floor upper central sheet
21. Rear floor sheet (rear part)
22. Bumper rear securing bracket
23. Bumper rear securing bracket
24. Rear floor rear frame member
25. Rear louver brace
26. Rear floor intermediate cross member
27. Rear floor side member
28. Rear suspension spring support bracket
29. Rear suspension step plate bar anchor bracket
30. Rear suspension rear member
31. Bumpers for central floor side member
32. Central floor rear side member
33. Central floor cross member
34. Central floor assembly
35. Lower front half wheel arch
36. Front axle member
37. Upper front half wheel arch

May 1983
49-6
BODY - SHEET METAL PANELS

BODY SEALING

DESCRIPTION

The following figures show the body areas which are sealed by Manufacturer.
The sealings applied to these areas must be smooth and free from scratches or gaps.

Take care not to apply too much sealing and not to allow other unaffected parts to come in contact with the sealing.

Body components sealing
Paint seal, after priming or painting, and then sleek by means of a brush along all sheet joints in order to remove possible sealing faults.

ICIR: Paraflex Alpha 3M
8531 /E
8536/E
Alternative: part. no. 3522-00014

Sealant for bolted joints
Sealant for joints between panels assembled by bolting.

3M - Autosealer 8573E • part. no. 3522-00045

May 1983
BODY ALIGNMENT

MEASUREMENT OPERATIONS

Method of measurement operation

- When a tram tracking gauge is used, adjust pointers (A) and (B) to equal lengths as shown in the following figure. Check pointers and gauge itself in order to make sure that no clearance is present.

- When a measuring tape is used, verify there is no elongation, twisting or bending.

If, during measurement operations, tape interfere with one or more parts of car body, accurate measurement of distance and length will not be possible.
<table>
<thead>
<tr>
<th>References and Tolerances</th>
<th>A 1 + 2</th>
<th>C ± 2</th>
<th>E ± 2</th>
<th>Q ± 0.5</th>
<th>R ± 2</th>
<th>S ± 0 - 15</th>
<th>T ± 0 - 15</th>
<th>U ± 1</th>
<th>V ± 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Control Dimensions</td>
<td>2315 (91.14)</td>
<td>2450 (96.46)</td>
<td>2457 (96.73)</td>
<td>78</td>
<td>169</td>
<td>237</td>
<td>496.5</td>
<td>952.5</td>
<td>91.5</td>
</tr>
</tbody>
</table>

- A – From wheel middle to Panhard rod connection
- C – From wheel middle to shock absorber lower connection
- E – From wheel middle to shock absorber upper connection
- Q – Distance between holes of guide tube bracket fixing bolts
- R – From tube guide lever fixing bolt hole to vertical reference plane
- S – From guide tube, upper fixing bolt hole to vertical reference plane
- T – From rear suspension front tie rod connection to Panhard rod connection
- U – From rear suspension front tie rod connection to rear suspension rear tie rod connection
- V – From horizontal reference plane to rear suspension front tie rod

Unit: mm (in)
<table>
<thead>
<tr>
<th>References and Tolerances</th>
<th>B ± 0.5</th>
<th>D -1 +2</th>
<th>F ± 2</th>
<th>G ± 1.5</th>
<th>H ± 1.5</th>
<th>I ± 1</th>
<th>L ± 0.75</th>
<th>M ± 1</th>
<th>N ± 2</th>
<th>O ± 1</th>
<th>P ± 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Control Dimensions</td>
<td>405 (15.94)</td>
<td>502 (19.76)</td>
<td>507 (19.96)</td>
<td>2,313.65 (91.09)</td>
<td>493.93 (19.45)</td>
<td>2,826.7 (111.29)</td>
<td>881 (35.08)</td>
<td>519 (20.43)</td>
<td>535 (21.06)</td>
<td>392 (15.33)</td>
<td>196 (7.72)</td>
</tr>
</tbody>
</table>

- **B** — From car longitudinal reference axis to Panhard rod connection
- **D** — From car longitudinal reference axis to shock absorber lower connection
- **F** — From car longitudinal reference axis to shock absorber upper connection
- **G** — From dowel reference hole to shock absorber upper connection
- **H** — From car longitudinal reference axis to shock absorber upper connection
- **I** — From anti-roll bar connection to dowel reference hole
- **L** — Distance between holes of anti-roll bar bracket fixing bolts
- **M** — From car longitudinal reference axis to rear suspension front tie rod connection
- **N** — From car longitudinal reference axis to rear suspension rear tie rod connection
- **O** — Distance between guide tube bracket holes
- **P** — From car longitudinal reference axis to hole for guide tube bracket fixing bolt

Unit: mm (in)
2. Outer parts protection

When removing external parts (hood, back door, moldings, finishings) it is necessary to protect body surfaces with clothes, protection tape or other materials, in order not to damage or scratch vehicle body.

The scratched painted surfaces must be repaired: even a slight scratch may cause corrosion.

CAUTIONS DURING REPLACEMENT OPERATIONS

Use genuine spare parts.

It is recommended always to use genuine spare parts. This allows perfect repair and restoration of vehicle original functioning.

CAUTIONS DURING WELDING OPERATIONS

Spot welding
1. Spot welder
Before starting welding operations, carry out the following checks in order to obtain welding sufficient strength:
   (1) Welder arm adjustment
   a) Keep the arm as short as possible in order to obtain welding maximum pressure.
   b) Tighten arm and tips securely so as they do not get loose during soldering operations.

2. Condition and preparation of panels to be soldered
If the surface of the parts to be welded presents gap, paint film, rust or dust, this prevents welding current flow, thus reducing soldering area and, as consequence, strength of welding spot.
Before starting welding, verify conditions of the parts to be welded, carrying out proper corrections.
   (1) Clearance between the parts to be welded.
   Presence of any clearance between surfaces to be welded, causes reduction of current flow. The welding thus obtained, results to be insufficient and poor in strength.
   Before carrying out soldering, match the surfaces and, when necessary, tighten them by means of a clamp.

(3) Electrode end diameter
It is necessary to carefully verify diameter of electrode ends in order to obtain the required welding strength. Before starting working, make sure that end diameter (D) has a value proportional to sheet thickness. Remove burnt and foreign matters from electrode ends.

(2) Electrode alignment
Align ends of upper and lower electrodes. A misalignment of electrodes generates insufficient pressure of soldering points and, as consequence, an insufficient strength of points themselves.
(2) Welding of metal surfaces. Prepare the surfaces to be welded, removing all impurities and foreign matters (paint, dust, rust) in order to obtain perfect welding.

(3) Anti-corrosion procedure applicable to all metal surfaces. Coat the surface to be welded high conductivity anti-corrosion agent. It must be applied to end of surface to be welded, also.

3. Cautions during spot welding
(1) Spot welding selection
Use the direct welding method (for the parts this method can not be applied to, use the MIG welding method).

(2) Electrode installation. Operate such as sheet forms a tight angle with electrodes. If not so, current flow will be low and the obtained welding strength is insufficient.

(3) Welding of three or more overlapped sheets. In the areas where three or more sheets are overlapped, spot welding must be repeated.

(4) Number of spot welding points.
Generally, efficiency of spot welders available in the Repair Shop is lower than efficiency of spot welders used at the Factory. As consequence, the number of spot welding points performed at the Service Shop should be increased by 20-30% with respect to weldings performed at the Factory.

(5) Minimum welding pitch.
The minimum welding pitch is function of thickness of sheet to be welded. Generally, the values provided in the following table, should be observed.

<table>
<thead>
<tr>
<th>Thickness (t) mm (in)</th>
<th>Minimum pitch (l) mm (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.6 (0.024)</td>
<td>10 (0.39) or more</td>
</tr>
<tr>
<td>0.8 (0.031)</td>
<td>12 (0.47) or more</td>
</tr>
<tr>
<td>1.0 (0.039)</td>
<td>18 (0.71) or more</td>
</tr>
<tr>
<td>1.2 (0.047)</td>
<td>20 (0.79) or more</td>
</tr>
<tr>
<td>1.6 (0.063)</td>
<td>27 (1.06) or more</td>
</tr>
<tr>
<td>1.8 (0.071)</td>
<td>31 (1.22) or more</td>
</tr>
</tbody>
</table>

May 1983

49-16
Conditions of panel to be welded.

By means of belt sander or wire brush, remove any foreign matter from surface. Paint films, rust or oils present on sheet surface, causes decrease of welding strength, thus generating blow holes.

Cautions during welding operations.

1. Plug welding (of pre established holes)
   a) Make a hole, having 5 to 6 mm diameter (0.20 to 0.24 in) on one of the two sheets to be welded, then match the two sheets and clamp them.
   b) Position the torch at right angle with respect to sheet, then fill metal into the hole.
   Each time welding is stopped, on the surface an oxide film generates which causes blow holes. If this occurs, remove oxide by means of a wire brush.
   c) Make sure that welding between upper and lower sheet is perfect.

2. Butt welding.
   a) By means of intermittent weld, tack the two surfaces to be welded in order to prevent strains and align the two surfaces, then, fill in the spaces by placing small welding beads.
**REPLACEMENT OPERATIONS**

**HOW TO READ THIS CHAPTER**

The formulation of the present part of the manual is uniform for all the replacement operations. For its structure, refer to the following example.

**I. HOODLEDGE PANEL WITH RADIATOR CORE SUPPORT REMOVED**

**III. PARTS TO BE WELDED**

Upper hoodledge assembly and lower hoodledge
Lower hoodledge assembly and right-hand lower sheet
Upper hoodledge assembly and right-hand lower sheet
Lower hoodledge assembly and left-hand lower sheet
Upper hoodledge assembly and left-hand lower sheet
Upper hoodledge assembly and engine upper cross member
Upper hoodledge assembly and engine upper cross member

**IV. REMINDER WHEN REMOVING**

- By means of all M8x50 according to lines A, B, C and, by means of M14 holes, according to line G.
- Carry out, from both sides, M6 plug existing a drilled holes.

The parts represented by chain line, set in evidence the components which must result to be removed or for which it is required the preliminary removal, accordingly to step (I).

**III. PARTS TO BE WELDED**

A list is provided relevant to the components which are to be welded using the methods indicated in step (II).

**IV. REMINDER WHEN REMOVING/INSTALLING**

Indication is provided, relevant to the main operations to be carried out, with special care in identification of the areas concerned in the cut operations, selection of the equipments to be used and definition of welding methods to be adopted.

In detail:

(I) "HOODLEDGE PANEL WITH RADIATOR CORE SUPPORT REMOVED"

In the title it is indicated the element to be removed (hoodledge) specifying, if required, the operative condition (in this case, radiator on core support removed). If the element is not in the required conditions, it is necessary, to execute preliminary removal of the other components; in the present case, it is necessary to remove the radiator core support, referring to the specific replacement procedures.

(II) "SERVICE JOINT"

Any information concerning the welding operations to be carried out is shown in the figure indicating the welding method and the spot numbers, together with accurate location of spots on the elements to be joined.

Example: a 3 -Welding spot number

Welding type (spot welding: see simbolgy on page 21)
Parts to be welded

May 1983

49-20
CUTTING AND WELDING/BRAZING OPERATIONS

The symbology used for the cutting and welding/brazing operations is shown in the following figures.

Cutting performed by means of air saw or air chisel

Spot welding

CO₂ arc welding

Spot welder

MIG plug weld

MIG seam weld/point weld

Spot welding of two overlapped sheets
Spot welding of three overlapped sheets

The value in parenthesis ( ) indicates the number of weld spots

 Brazing
REMOVAL AND INSTALLATION PROCEDURES

COMPONENT REMOVAL

(1) Make sure that all the damaged parts have been detected, by measuring the installation main dimensions. Refer to “Body Alignment” drawing.

Tools required:
- Centering gauge
- Tracking gauge
- Convex rule
- Rack-and-lever jack or car lift

(2) With a body-frame repair system, carry out draw operations, depending on deformation condition. Reuse of the reclaimable parts must be performed in accordance with the figures contained in “Body Alignment”.

Caution during operation:
- Carefully secure drawing chains to body and equipment, so as to prevent accidental release during operation execution.
- Apply draw stress in the direction opposite to collision.

(3) Cut-off damaged parts.

Tools required:
- Air saw
- Air chisel

(4) If welding spots are not visible, remove paint by means of rotary wire brush.

Tools required:
- Rotary wire brush

(5) Punch all the welding spots in order to make centering of a drill.

Tools required:
- Hammer
- Center punch
Caution during operation
- Punch deeply in the center of each, welding spot. A non-centered punch does not allow complete cut of nugget. Besides, a shallow marked hole location does not allow a reliable drive of drill.
- As a rule, punching must be executed from sides of the components that are to be removed.

(6) Remove welding spots by means of a spot cutter or an air drill.

Tools required:
- Spot cutter
- Air drill

Caution during operation:
- Use a drill speed of about 1000 r.p.m. in order to obtain the best results.

(7) By means of a chisel remove the remaining spot welding parts.

Tools required:
- Chisel
- Hammer

PREPARATION FOR MATING PARTS INSTALLATION

(1) By means of a sander, grind sheet in correspondence with welding spots.

Tools required:
- Air sander
- Disc sander

Cautions when grinding
- Take care not to cut much on base metal: this may generate decrease of sheet thickness and, then, welding strength.

Cautions during operation:
- Take care not to drill mating parts. In case holes have been made, plug them making use of gas or MIG plug welding.
- Presence of holes, decreases strength of the concerned component, besides, it may generate water leakage.
- When, for new components, are used holes already drilled in welded parts (just as per those of the spot welding) make use of a drilling machine having small diameter drill (below 8 mm (0.31 in)) and complete welding as soon as possible.
• Carefully remove iron powder from the surfaces which have been ground and from surrounding areas. Presence of iron powder causes decrease of welding efficacy and can also generate corrosion.

(2) By means of a hammer and dolly correct deformed areas.
Tools required:
- Hammer
- Dolly
Cautions during operation:
- Check against presence of even the smallest deformations, in particular, in the inner panels where they are hard to be found. In fact, if they are not removed, they can cause a strength decrease due to stress concentration.

(3) Remove paint from welding edges.
Tools required:
- Belt sander
- Disc sander

Before welding apply conductive antitrust paint on edges of all sheet parts which are to be assembled.
Recommended paint:
Part. No. 3540-44401
SAVID: Zincoid No. 7949
SCHRAM LACK: Extrinom Punktschweifarbe
GLASURIT: Glassomax 7 F 4625 (red color)*

* To be used with catalyst
Glassomax Harter 965-7/1 in the proportion 1:10 (part. No. 3541-20003).

Panels must be welded within 15 minutes of the paint application (air drying time of paint film).

The film thickness after drying must be 0.005 to 0.025 mm. (2 to 9.8) $10^{-4}$ in.
PREPARATION FOR NEW COMPONENT INSTALLATION

(1) If a partial replacement is to be carried out, it is necessary to maintain an overlapping tolerance of about 50 mm (1.97 in) during cut of non-USable sheets, in order to have a sufficient mating surface.

Tools required:
- Air saw
- Hack saw
- Tracking gauge
- Convex rule (or equivalent)

It is recommended always to use genuine spare parts. This ensures a perfect repair and restoration of vehicle functioning.

(2) MIG plug weld.
This method must be used for those areas which cannot be reached by spot welder. To carry out this operation, drill, in the welding spots, making holes having 5 to 6 mm. (0.20 to 0.24 in) dia.

Tools required:
- Puncher
- Air drill

Cautions during operation:
- Remove paint from both sides of components that are to be welded, such as the surfaces to be spot welded, spot welding rims and edges of surfaces to be butt welded. The remaining paint prevents current flow into spot weldings, with consequent poor strength of spot. It can also generate depressions in the plug MIG welding.

(3) Remove paint from components to be welded.

Tools required:
- Belt sander
- Disc sander

(4) Apply primer to component and body surfaces which are to be spot welded.

Tools required:
- Wire brush
- Conductive anti-rust paint

INSTALLATION

(1) New service parts temporary installation.

Tools required:
- Vise pliers
- Convex rule
- Tracking gauge (sight)
- Centering gauge
- Port power
- Jack
- Spot welder
- Mig welder

49-25

May 1983
Cautions during operation:
- Position components as per figures provided in “Body Alignment”. Into body compartments, install the movable parts (i.e. windscreen, doors, hood, back door) in order to carry out check of clearances, grades and parallelism. If necessary, adjust sheets until correct alignment is obtained.
- Clamp parts to be welded by means of pliers and some welding spot.

(2) Execution of the required weldings.
Carry out welding complying with specifications provided in “Cautions during Welding”.
Tools required:
- Spot welder
- MIG welder
- Autogenous welder

(3) Grind MIG welding by means of a sander machine.
Tools required:
- Air sander
- Disc sander

Cautions during operation:
- Take care not to grind excessively on spot weldings: it may generate decrease of sheet thickness and, consequently, welding strength.
- Remove iron powder from grinded surfaces and surrounding areas. Presence of iron powder, causes decrease of welding efficacy and can also generate corrosion.

(4) After welding execution, remove clamps used for securing edges and remove possible dinging.
(5) Apply anti-corrosion agent to the welded components.
(6) Apply sealer to joints. This operation must be carried out carefully in order to prevent corrosion in the welded joints. Refer to figures provided in “Body Sealing”.

(7) For under body protection, apply a coat having 4 mm (0.16 in) thickness:

- Antidrum: part. No. 3523 - 00001
- Alternatives: 3M
  - Body Plast 8874 E
  - Body Schutz 8864 E
  - IVI Grey protective acrylic 854751
RADIATOR CORE SUPPORT

Parts to be welded
a. Radiator core support and engine support lower cross member
b. Radiator core support and hoodledge panel upper part
c. Radiator core support and hoodledge panel upper part
d. Radiator core support and engine support lower cross member
e. Radiator core support and hoodledge panel

REMINDER WHEN REMOVING
- By means of air saw, cut along line A.

REMINDER WHEN INSTALLING
- By means of clamps, temporarily secure new radiator core support, then adjust it.
- Install parts temporarily
- Check and adjust clearances, grades and parallelisms.
HOODLEDGE PANEL WITH RADIATOR CORE SUPPORT REMOVED

Carry out replacement after Radiator Core Support has been removed.

Parts to be welded

a. Upper hoodledge assembly and lower hoodledge
b. Lower hoodledge assembly and dashboard lower sheet
c. Upper hoodledge assembly and dashboard lower sheet
d. Lower hoodledge assembly and side member
e. Lower hoodledge assembly and side member
f. Lower hoodledge assembly and front side member
g. Upper hoodledge assembly and engine upper cross member
h. Upper hoodledge assembly and engine upper cross member
i. Hoodledge assembly and engine upper cross member (spring seat cap reinforcement)
j. Hoodledge assembly and hoodledge side reinforcement
k. Hoodledge assembly, hoodledge side reinforcement and engine upper cross member
l. Hoodledge assembly, hoodledge side reinforcement and engine upper cross member

REMINDER WHEN REMOVING

- By means of air saw, cut according to lines A, B, D and, by means of air chisel, cut according to line C.
When are removed welding spots of the three overlapped sheets drill the whole (welding spots are identified by dimension line shown in the figure).

**Remainder When Installing**
- Install together radiator core support and hoodledge panel; then verify alignment dimensions concerning hoodledge panel. Refer to drawings provided in "Body Alignment".
- Carry out, from both sides, MIG plug welding of drilled sheets.
HOODLEDGE PANEL WITH RADIATOR CORE SUPPORT REMOVED
(Partial Replacement)

Carry out partial replacement after Radiator Core Support has been removed.

Service joints

Parts to be welded
a. Upper part hoodledge and lower part hoodlege

REMINDER WHEN REMOVING
- By means of air saw, cut according to lines A and B.

REMINDER WHEN INSTALLING
Precaution when cutting the spare half hoodledge panel
* Cut spare half hoodedge panel aligned with non-replaced panel part.
Dimension check and fender temporary installation

- Install together radiator core support, half hoodledge panel and body.
- Check alignment dimensions referring to drawings provided in “Body Alignment”.

May 1983
FRONT SIDE MEMBER WITH HOODLEDGE PANEL REMOVED

Carry out replacement after Hoodledge Panel has been removed.

Service joints

Parts to be welded
a. Plate and replaced side member
b. Plate and present side member

REMINDER WHEN REMOVING
• By means of air saw, cut according to line A in figure, in correspondence with the hole located on side member.

REMINDER WHEN INSTALLING
Precaution when cutting spare side member.
• Cut spare side member aligned with non-replaced side member part.
CENTRAL PILLAR

Service joints

Parts to be welded

a. Pillar and pillar inner reinforcement
b. Outer pillar and inner pillar
c. Outer pillar and inner pillar
d. Inner pillar and roof panel side member

REMLNDER WHEN REMOVING

- Unscrew the two screws securing rib to roof panel inner side member.
- By means of air saw, cut according to lines A and B, shown in figure.
- Remove paint in correspondence with the four welding spots of pillar reinforcement lower part at about 115 mm (4.52 in) from lower edge of outer side member (see sect. A-A). Punch the four welding spots and remove the reinforcement pat-t.
- By means of disc sander carry out grinding of continuous welding joining central floor side member to inner central pillar.

1 Reinforcement
2 Body side ring
3 Central floor side member
4 Inner central pillar
REMINDER WHEN INSTALLING

Precaution when cutting spare pillar
- Cut spare pillar aligned with the upper and lower part of non-replaced pillar part.
- By means of clamps, temporarily secure central pillar. Check component alignment.
- After continuous welding of central pillar, carry out tinning.
- Temporarily secure both front and rear doors.
- Check and adjust clearance, grades and parallelism.
OUTER SIDE MEMBER

Service joints

Parts to be welded

- a. Outer side member, front side member and inner front pillar
- b. Outer side member, diaphragm and central floor side member
- c. Outer side member and closing inner central pillar
- d. Outer side member and inner wheelarch
- e. Outer side member and outer wheelarch
- f. Outer side member and central pillar reinforcement

REMINDER WHEN REMOVING

- By means of air chisel, cut according to line A shown in figure.
- Remove paint in correspondence with the four welding spots of pillar reinforcement lower part at about 115 mm (4.52 in) from lower edge of outer side member (see section A-A).
- Punch the four welding spots.
- By means of a drilling machine, remove welding spots of the 3-layered sheet joints.

May 1983
REMINDER WHEN INSTALLING

Precaution during cutting of outer side member
- Cut outer side member aligned with non-replaced panel part

- The continuous welding areas of outer side member to central, front and rear pillar, must be tinned.

![Overlapping tolerance]

Welding indications
- Use the MIG welding method to weld the three overlapped sheets along the whole perimeter from both sides.

- Apply anti-corrosion agent to boxed part inside.
REMINDER WHEN INSTALLING

Precaution when cutting outer side member
- Cut outer side member aligned with non-replaced panels

Welding indication
- Use MIG welding method to weld the three overlapped sheets along the whole perimeter from both sides.

- The continuous welding areas of outer side member to central, front and rear pillar, must be tinned.
- Apply anti-corrosion agent to boxed part inside.
REAR FENDER

Parts to be welded
a. Fender and outer wheelarch
b. Fender and inner wheelarch
c. Fender and inner fender reinforcement
d. Fender and outer wheelarch
e. Fender and floor
f. Fender and drip
g. Fender and upper rear panel
h. Fender and upper rear panel

REMINDER WHEN REMOVING
• By means of air chisel, cut the area shown in figure.

REMINDER WHEN INSTALLING
Precaution when cutting spare fender
• Cut spare fender aligned with non-replaced panel part.
Fender temporary installation
- By means of clamps, temporarily secure rear fender.

- The fender area of continuous welding to roof panel side member, must be tinned.

Sealer application
- Apply sealer to wheelarch outer side.

- Temporarily secure the adjacent components: door and backdoor. Check clearances, grades and parallelism.
DRIP WITH REAR FENDER REMOVED
Carry out replacement after Rear Fender has been removed.
Service joints

Parts to be welded
a. Drip and rear fender inner frame
b. Drip and rear panel,

REMINDER WHEN REMOVING
- By means of air saw cut according to lines A and B shown in figure.
Take care not to cut fender frame.

REMINDER WHEN INSTALLING
Caution when cutting spare drip
- Cut spare drip aligned with the non-replaced drip part.
LOWER REAR PANEL

Service joints

Parts to be welded
a. Cross member and rear panel
b. Cross member and floor
c. Cross member and side member

REMINDER WHEN REMOVING
- By means of a saw, cut areas A and B taking care not to cut central area, mentioned in the figure, in order not to cut floor in correspondence with spare wheel compartment.
- Punch junction points of lower rear panel to rear floor of spare wheel area.

Precaution during welding
- For the spot welding, make use of a brass wire.
UPPER REAR PANEL

Service joints

Parts to be welded
a. Rear panel and drip
b. Rear panel and outer fender
c. Rear panel and outer fender
d. Rear panel and floor

REMINDER WHEN REMOVING
- By means of air saw, cut according to line A.

REMINDER WHEN INSTALLING
- By means of clamps, temporarily secure the upper rear panel.
Temporarily secure backdoor and check clearances, grades and parallelisms. Check correct positioning and alignment of bumper to rear panel.

Precaution during welding
- For the spot welding, make use of a brass wire.
REAR PART OF REAR FLOOR WITH REAR FENDER AND REAR PANEL REMOVED

Carry out replacement after Rear Fender and both Lower and Upper Rear Panel have been removed.

Service joints

Parts to be welded
a. Rear floor and rear side member  
b. Rear floor and rear side member  
c. Rear floor and central cross member  
d. Rear floor, rear side member and inner rear wheelarch  
e. Rear floor and rear seat cross member  
f. Rear floor and outer fender

REMEMBER WHEN REMOVING
- By means of air saw, cut according to line A.  
- By means of a drilling machine, remove welding spots from the S-layered sheets joints.
REMINDER WHEN INSTALLING

- Secure rear floor temporarily and carry out marking along side member and cross member from floor underside. This easy drilling operation of the MIG welded spots.
- In order to obtain the best welding result, make use of spot welder as far as possible.
- Carry out holes for the MIG welding in the rear floor where spot welder can not be used.
- In rear floor installation, temporarily secure fender and rear panel. Check installation dimensions in accordance with drawings provided in “Body Alignment”.
- With the components temporarily secured, carry out temporary MIG weldings in some points of rear floor.

- Apply sealant to non-replaced surfaces of rear wheel-arch and of floor, in accordance with “Body Sealing”.
- Apply anti-corrosion agent to weldings under floor, then apply primer.
REMINDER WHEN INSTALLING

- After temporary securing of side member to rear floor, carefully check dimensions provided in “Body Alignment”.

May 1983

49-52
REMINDER WHEN INSTALLING

- Before carrying out welding, apply the adhesive to joints between roof and central rib.
- Apply sealant to the areas indicated in “Body Sealing”.
- Carry out tinning in the areas between roof and rear fender, which are continuous welded.
# CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRONT DOOR</td>
<td>55-2</td>
</tr>
<tr>
<td>Door assembly</td>
<td>55-3</td>
</tr>
<tr>
<td>Internal finishing panels</td>
<td>55-3</td>
</tr>
<tr>
<td>Window regulator devices and</td>
<td></td>
</tr>
<tr>
<td>glasses</td>
<td>55-3</td>
</tr>
<tr>
<td>Door locks and handles</td>
<td>55-4</td>
</tr>
<tr>
<td>Door mirror</td>
<td>55-4</td>
</tr>
<tr>
<td>Moldings and seals</td>
<td>55-4</td>
</tr>
<tr>
<td>REAR DOOR</td>
<td>55-6</td>
</tr>
<tr>
<td>Door assembly</td>
<td>55-7</td>
</tr>
<tr>
<td>Internal finishing panels</td>
<td>55-7</td>
</tr>
<tr>
<td>Fixed glasses</td>
<td>55-7</td>
</tr>
<tr>
<td>Window regulator devices and</td>
<td></td>
</tr>
<tr>
<td>glasses</td>
<td>55-7</td>
</tr>
<tr>
<td>Door locks and handles</td>
<td>55-8</td>
</tr>
<tr>
<td>Moldings and seals</td>
<td>55-8</td>
</tr>
<tr>
<td>SERVICE DATA AND SPECIFICATIONS</td>
<td>55-9</td>
</tr>
<tr>
<td>Tightening torques</td>
<td>55-9</td>
</tr>
</tbody>
</table>

May 1983
DOORS

FRONT DOOR

1. Door
2. Door lock device
3. Lock block clamp plate
4. Lock block
5. Handle
6. Molding and weatherstrip
7. Molding
8. Molding
9. Glass velvet seal with trim
10. Glass
11. Door mirror
12. Ring nut
13. Rubber
14. Hinge
15. Tie rod
16. Hinge
17. Window regulator device
18. Panel lower clamps
19. Seal
20. Sealing screen
21. Upper trim and weatherstrip
22. Door lock control
23. Panel
24. Window regulator handle
25. Arm rest
26. Power window switch (1500 and 1500 Quadrifoglio models)
27. Power door locks device (1500 Quadrifoglio model)

May 1983

55-2
DOORS

DOOR ASSEMBLY

REMOVAL AND INSTALLATION

With reference to exploded view proceed as follows:
1. Disconnect door from tie rod and from hinges 14 and 18 by unscrewing the six screws, then remove it.
1a. Only for the 1500 and 1500 Quadrifoglio models. Disconnect harness and then proceed as per step 1.

2. For door installation reverse order of removal and tighten screws securing hinges to door to the prescribed torque.

\[ \tau : \text{Tightening torque} \]
\[ \text{Screws securing hinges to door} \]
\[ 13 \pm 21 \text{N-m} \]
\[ (1.36 \div 2.2 \text{ kg-m} \]
\[ 9.83 \div 15.9 \text{ ft-lb} \]

INTERNAL FINISHING PANELS

Cover end of the tool used for removing plastic rivets in order not to damage or scratch the body.

REMOVAL AND INSTALLATION

1. Lift ornament of arm rest 23 and unscrew the three securing screws, then remove it.
2. Remove ornament covering the door securing screws, then remove window regulator handle 22.
3. Remove plastic rivets securing panel 23 to door. Remove panel by bending it.
4. Remove plastic rivets securing upper trim 21 to door.
5. Remove hook of door lock control rod. Then remove upper trim 21.

6. For upper trim and panel installation, reverse order of removal.

WINDOW REGULATOR DEVICES AND GLASSES

REMOVAL AND INSTALLATION

1. Remove panel 23, upper trim 21 and sealing screen 20.
2. Lower glass 10 completely, unscrew the two nuts securing window regulator device 17 to glass, then remove by rotating it.
3a. Only for 1500 and 1500 Quadrifoglio models Disconnect harness of window regulator motor, unscrew the five nuts securing power window 26 to door, then remove it.

4. Install window regulator and glass by reversing order of removal.
DOORS

DOOR LOCKS AND HANDLES

REMOVAL AND INSTALLATION
1. Remove panel 23, upper trim 21 and move sealing screen 20.
2. Lift glass 10 completely in order to avoid damage.
3. Remove plastic fasteners securing levers to door.
4. 1500 Quadrifoglio model - Release connecting rod between lock 2 and door lock electric device 0. To remove it, if necessary, disconnect harness, and unscrew the two nuts securing it to door.
5. Release connecting rod between lock block 4 and lock 2.
6. Withdraw clamp plate of lock block 3 by means of proper tool and remove lock block 4.
7. Unscrew the three screws securing lock 2 to door then remove lock.
8. Unscrew the two nuts securing handle @ to door, then remove handle.
9. Install handle and lock by reversing order of removal.
10. Verify proper functioning of door opening control and, if necessary, loosen the three screws securing door lock clamp and move it until perfect closing is obtained.

DOOR MIRROR

REMOVAL AND INSTALLATION
1. Remove panel 23 and upper trim 21.
2. Withdraw rubber 13 and unscrew the two screws securing mirror 11 to door.
3. Unscrew ring nut 12 and remove door mirror 11.
4. Install door mirror by reversing order of removal.

MOLDINGS AND SEALS

Cover end of the tool used for removing moldings in order not to damage or scratch the body.

REMOVAL AND INSTALLATION
1. Operating as per figure, remove molding with weatherstrip 6.
2. Remove molding ⑧.
3. Remove panel ③ and upper trim with weatherstrip ②.
4. Remove door mirror ①.
5. Remove molding 7.
6. Remove glass ⑧0 and glass velvet with trim ⑧.
7. Reposition moldings and seals by reversing order of removal.
8. With reference to the following figure take care to secure glass velvet seal on clamp ② of glass guide ① located inside the door.

CAUTION:
Apply proper grease to hinges, tie rod and door lock device.
DOORS

REAR DOOR

1. Door
2. Spacer
3. Door lock device
4. Rubbers
5. Handle
6. Fixed glass
7. Molding
8. Fixed glass guide
9. Molding
10. Glass velvet seal with trim
11. Glass
12. Molding and weatherstrip
13. Door lock control
14. Hinge
15. Window regulator device
16. Hinge
17. Panel lower clamp
18. Seal
19. Sealing screen
20. Upper trim and weatherstrip
21. Door lock control
22. Window regulator handle
23. Arm rest
24. Panel
25. Door lock electric device (1500 Quadrifoglio model)

May 1983

55-6
DOORS

DOOR ASSEMBLY

REMOVAL AND INSTALLATION

With reference to exploded view proceed as follows:
1. Unscrew the four screws securing hinges 14 and 16 to door and remove it.
2. Only for the 1500 and 1500 Quadrifoglio models.
   Disconnect harness and then proceed as per step 1.

3. Remove ornament covering the door securing screw, then remove window regulator handle 22.
4. Remove plastic rivets securing panel 23 to door. Remove panel by bending it.
5. Remove hook of door lock control rod, then remove upper trim 24 to door.

INTERNAL FINISHING PANELS

Cover end of the tool used for removing plastic rivets in order not to damage or scratch the body.

REMOVAL AND INSTALLATION

1. Lift ornament of armrest 23 and unscrew the three securing screws, then remove it.
2. For door installation reverse order of removal, tighten screws securing hinges to door to the prescribed torque:
   1: Tightening torque
   Screws securing hinges to door
   13 = 21 N-m
   (1.36 ÷ 2.2 kg-m)
   9.83 ÷ 15.9 ft.lb

FIXED GLASSES

REMOVAL AND INSTALLATION

1. Remove panel 24, upper trim 20 and lower completely glass 11.
2. Lower completely glass 11 and windscreen the two nuts securing window regulator device to glass.
3. Unscrew the three nuts securing window regulator 15 to door and remove it from lower side by lifting glass 11.
4. Remove fixed glass guide 8 and fixed glass 9.
5. Remove glass 0.
6. Install glass and window regulator by reversing order of removal.

WINDOW REGULATOR DEVICES AND GLASSES

REMOVAL AND INSTALLATION

1. Remove panel 24, upper trim 20 and lower completely glass 11.
2. Lower completely glass 11 and windscreen the two nuts securing window regulator device to glass.
DOOR LOCKS AND HANDLES

REMOVAL AND INSTALLATION

1. Remove panel 24, upper trim 20 and move sealing screen 19.
2. Lift glass 11 completely in order not to damage it.
3. Release door lock control rod 13 from door lock 3.
4. Unscrew from door the door lock control rod 13 securing screw and remove it.
5. Release from door the door opening control rod.
6. Only for 1500 Quadrifoglio model
   Release connecting rod between lock 3 and door lock electric device 29. To remove it, if necessary, disconnect harness and unscrew the two nuts securing it to door.
7. Unscrew the three screws securing lock 3 to door, then remove lock.
8. Unscrew the two nuts securing handle 5 to door, then remove handle.
9. Install handle and lock by reversing order of removal.
10. Verify proper functioning of door opening control and, if necessary, loosen the three securing screws of lock clamp and move it until perfect closing is obtained.

MOLDINGS AND SEALS

Cover end of the tool used for removing moldings in order not to damage or scratch body.

REMOVAL AND INSTALLATION

1. Operating as per figure, remove molding with weatherstrip 12.
2. Remove molding 7 and 9.
3. Remove panel 24 and upper trim with weatherstrip 20.
4. Remove fixed glass-guide 8, fixed glass 6 and glass 14.
5. Remove glass velvet seal with trim 10.
6. Reposition moldings and seal by reversing order of removal.
7. With reference to the following figure, take care to secure glass velvet seal on clamp (2) of glass guide (1) located inside the door.

CAUTION:
Apply proper grease to hinges and door lock device.

1 Glass guide
2 Glass velvet seal clamp

SERVICE DATA AND SPECIFICATIONS

TIGHTENING TORQUES

<table>
<thead>
<tr>
<th>Item</th>
<th>N-m</th>
<th>kg-m</th>
<th>ft-lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws securing hinges to front door</td>
<td>13421</td>
<td>1.36 + 2.2</td>
<td>9.83 15.9</td>
</tr>
<tr>
<td>Screws securing hinges to rear door</td>
<td>13 + 21</td>
<td>1.36 + 2.2</td>
<td>9.83 15.9</td>
</tr>
</tbody>
</table>
HOOD POSITION
ADJUSTMENT

Loosen the four screws securing hinges to hood and move hood forward, backward and side to side until correct position is obtained.

![Diagram of hood position adjustment]

**CAUTION:**
- During installation of hood lock, make sure that striker rod is positioned in the center of hood lock slit by operating on the two screws. Then, temporarily tighten the lock.

- With the hood lock temporarily tightened to body, verify that hood bumper, located on hood, come in contact with body; if not so, properly change hood bumper height by screwing or unscrewing them.

- Fix hood lock by tightening securing screws.
- Verify proper functioning of hood lock opening control.
- Lubricate hood lock mechanism with proper grease.

REPLACEMENT OF HOOD OPENING CONTROL CABLE

**CAUTION:**
In case of breakage of hood opening control cable, it is possible to open the hood by pulling the nylon-made emergency cable, located in the passenger compartment inside.

1. Cut the cable in proximity to hood lock device and loosen screw of sheath supporting bracket.
2. Operating from vehicle inside, withdraw cable and sheath of hood opening control lever.
3. Insert the new cable with sheath and secure it to hood opening control lever.

![Diagram of replacement of hood opening control cable]

1. Cable
2. Hood lock device
3. Cable retaining ring
4. Bracket
5. Hood opening control
6. Nylon-made emergency cable
4. Operating from engine compartment inside, insert cable ① into eyelet of hood lock ② and secure cable end to cable retaining ring ③. Verify functioning of hood opening control.

5. If necessary, adjust sheath position by operating on special bracket ④.

**CAUTION:**
- Lubricate the cable with suitable oil letting it slide into sheath.
- Do not bend excessively cable sheath in engine compartment in order to prevent opening stress increase.

---

**BACKDOOR**

1. Backdoor
2. Backdoor trim
3. Hinge
4. Shock absorber
5. Seal
6. Movable shelf
7. Vibration-damper striker
8. Seal
9. Backdoor lock device
10. Shock absorber
11. Hinge
12. Support
13. Vibration damper striker
14. Badge
15. Label
16. Electric contacts
17. Backdoor striker

---

**REMOVAL AND INSTALLATION**

Before removal or installation, proceed as follows:
- Place a cloth or other padding on backdoor corners in order to avoid damaging or scratching vehicle body.
- Provide a support for backdoor to be used on removal from shock absorbers.
- Release the two cables supporting shelf under rear window.
- For removal and installation of backdoor, two operators are required.

With reference to exploded view above proceed as follows:
1. By means of a screwdriver drill, remove the two rings securing rods of shock absorbers ④ and ⑩ and withdraw rods from their seat.
REPLACEMENT OF BACKDOOR OPENING CONTROL CABLE

1. Cut cable 1 in proximity to backdoor lock device 2 and loosen screw of bracket 4 sheath securing.

2. Operating from vehicle inside, withdraw cable and sheath from backdoor opening control lever 5.

3. Insert new cable with sheath and secure it to backdoor opening control lever.

4. Operating from luggage room, insert cable 0 into eyelet of backdoor lock device 2 and secure cable end on cable retaining ring 3.

5. Verify proper functioning of backdoor opening control.

6. If necessary, adjust sheath position operating on special bracket 4.

CAUTION:
- Lubricate the cable with proper oil letting it slide into sheath.
- Do not bend excessively cable sheath in the luggage room, in order to prevent opening stress increase.
INTERNAL TRIMMING

TRIM

ROOF TRIM

REMOVAL AND INSTALLATION

Be careful not to stain roof.

With reference to exploded view above proceed as follows:
1. Open protection of screws securing passenger handles 5, 6, 7 and 8 to roof panel, unscrew them and remove handles.
2. By means of proper tool, remove taps 2.
3. Disconnect harness and remove roof lamps 7 and 10.
4. Remove inside mirror 1 in order to gain access to the three screws securing mirror support 9 to roof panel and remove it.
5. Remove sun screens 3 and 4.
6. Remove weatherstrip of doors and of backdoor in contact with roof; move upper part of front pillar trim.
7. Remove roof trim 1 and withdraw it from backdoor compartment.
8. For installation, reverse order of removal.

CAUTION:
For installation, it is recommended to position roof trim starting from rear side and then use a cord to reposition windshield seal in its place (see: Group 75 - Windshield Installation).
INTERNAL TRIMMING

REMOVAL AND INSTALLATION
With reference to exploded view above proceed as follows:
1. **Remove rear seat**, front seats, rear console, speed level console and safety belt anchors (see the relevant paragraphs).
2. Unscrew the fourteen screws securing kick plate to body and remove them.
3. By means of proper tool, withdraw plastic rivet securing to body the accelerator pedal end of travel; then remove it.
4. **Remove seals of front door compartments in the part where they cover floor trim and remove the adhesive tape strips securing trim to body.**
5. Unscrew nut and lock nut of parking brake adjustment fork and withdraw the two cables from bracket.
6. **Remove floor trim by withdrawing it from parking brake and, if necessary, remove soundproofing material trim.**
7. Install floor trim by reversing order of removal. After installing handbrake cables, adjust it by following procedures described in Group 00 - Maintenance of Mechanic Components and Body.

CENTRAL PILLAR TRIM AND FRONT SAFETY BELTS

1. Move front seat completely forward.
2. Remove door opening seals.
3. Lift protection of screw securing safety belt anchor bracket to body.
4. After removing protection, unscrew the screw securing safety belt support, unscrew it and remove the support.

May 1983 66-4
INTERNAL TRIMMING

5. By means of proper tool, remove plastic rivet securing cover to trim and remove it.
6. Remove pillar trim by lifting it.
7. Unscrew the screw securing safety belt retractor and remove it.
8. After removing protection, unscrew the screw securing safety belt anchor on tunnel and remove it.

9. -Install safety belt and pillar trim by reversing order of removal. All the anchor safety belt screws, must be tightened to the prescribed torque.

 consolidate: Tightening torque
Safety belt anchor screws
27 N.m
(2.8 ± 4.4 kg-m
20.25 ± 31.8 ft-lb)

CAUTION:
If the vehicle is collided or overturned, replace the entire belt assembly regardless of nature of accident.

FIXED PART TRIM
OF SHELF UNDER REAR WINDOW

1. Fixed part trim of shelf under rear window
2. Movable shelf hinge
3. Seat back clamping device
4. Seat back fixed part

REMOVAL AND INSTALLATION
With reference to the exploded view above proceed as follows:
1. Remove movable shelf under rear window.
2. Unscrew screw securing seat back fixed part to body, lift seat back and remove it.
3. Unscrew the screw securing to body hinge of movable shelf, and remove hinge.
4. Unscrew the two screws securing to body the seat back clamping device and remove it.
5. By means of proper tool, withdraw the two plastic rivets and unscrew the two screws securing to body, trim of fixed part of shelf under rear window, then remove trim.
6. Install trim by reversing order of removal.

May 1983
INTERNAL TRIMMING

REAR PILLAR TRIM

REMOVAL AND INSTALLATION

1. Remove door opening seal 4 in the part where it covers trim 2.
2. Detach plastic cap 3 and remove pillar trim 2.
3. Install trim by reversing order of removal.

LUGGAGE ROOM SIDE TRIM

REMOVAL AND INSTALLATION

1. Remove seat back clamping device 4, seat back fixed part 5, and trim of fixed part shelf under rear window 2 (see: Trim of fixed part shelf under rear window).
2. By means of proper tool, remove plastic rivets securing side trim to body, then remove it.
3. Install side trim by reversing order of removal.
INTERNAL TRIMMING

REMOVAL AND INSTALLATION

Take care not to stain seat and seat back upholstery.

With reference to the above exploded view proceed as follows:

1. Move seat completely forward and unscrew the two rear screws securing guides 9 and 11 to floor.

(2) Remove guides by unscrewing the four securing screws to seat 8.

(3) Install guides and control lever by reversing order of removal and tightening screws to the prescribed torque.

(1) Tightening torque

Screws securing guides to seat

\[ 17 \pm 2 \text{ N-m} \]

(1.8 \pm 2.1 \text{ kg-m})

(13.0 \pm 15.2 \text{ ft-lb})

5. If necessary, remove seat back adjustment device 12, hinge 5, and seat back 3.

(1) Lift cover 15 of seat back adjustment device 12.

(2) Keeping knob 14 still, by means of proper plier, rotate counterclockwise the plate securing knob; then remove it.

2. Move seat completely backward and unscrew the two front screws securing guides 9 and 11 to floor.

(5) Remove the four screws securing trim 4 to seat back 3 upholstery.

(6) Lift clamps securing seat back upholstery, turn it inside out and lift it until protections 6 and 16 of seat back adjustment device 12 securing screws and of hinge 5 are uncovered.

3. Remove seat together with guides, from car.

4. If necessary, remove guides 9 and 11 from seat.

(1) By means of proper tool, release the seat turnover control lever 10 from guides.

(7) Remove plastic protections 6 and 16 and unscrew the four screws securing to seatback the seatback adjustment device and hinge; then remove them.
INTERNAL TRIMMING

For installment reverse order of removal. Tighten the screws of seatback adjustment device and of hinge to the prescribed torque.

6. If necessary, remove headrest by operating on knurled part as shown in figure.

7. Install seat on car by reversing order of removal and tightening screws securing seat guides to floor, to the prescribed torque.

1: Tightening torque
Securing screws of seat back adjustment device and of hinge
17 \div 29 \text{ N-m}
\left(1.8 \div 3 \text{ kg-m} \quad 13 \div 21.7 \text{ ft-lb}\right)

10 \div 11 \text{ N-m}
\left(1.1 \div 1.2 \text{ kg-m} \quad 8 \div 8.7 \text{ ft-lb}\right)

(8) For installment reverse order of removal. Tighten the screws of seatback adjustment device and of hinge to the prescribed torque.

REAR SEATS

1 Seat
2 Seat back fixed part
3 Seat back
4 Shelf under rear window fixed part
5 Seat back clamping device
6 Luggage room and seat back trim
7 Seat back
8 Seat back hinge
INTERNAL TRIMMING

REMOVAL AND INSTALLATION
Take care not to stain seat and seat back upholstery.
1. Lift and remove seat.
2. Unscrew the screw securing to body the seat back fixed part then lift seat back and remove it.

3. By means of proper tool, withdraw plastic rivets securing luggage room upholstery to seat back.

4. Unscrew nut securing seat back to body and remove it.

5. Carry out same procedure for removal of the other seat back.
6. Install seat backs and seat, by reversing order of removal.

CONSOLES

REAR CONSOLE

1. Remove rubber bellows located on parking brake.
2. Remove ashtray, which is pressure secured.
3. Unscrew the screw securing console and remove it by moving it first forward in order to withdraw it from clamp located on floor tunnel.

4. Install console by reversing order of removal.
Internal Trimming

Removal and Installation

Caution:
- Disconnect battery ground cable.
- Before removing the components fitted with harness, make sure that relevant connections have been disconnected.

With reference to exploded view above proceed as follows:

1. Remove by pulling, knobs 19 and 20 of heater control assembly.
2. Detach finisher 23 and disconnect harness of clock 21, lighter seat 14 and lamp 11.
3. Remove finisher 23.
4. If necessary, remove lighter seat 14 by unscrewing ring nut 8 and withdrawing bush 10 and ornament 12.
5. By means of proper tool, remove finisher 2.
6. Disconnect harness of switches 6, 7 and 8; then remove finisher 2.
7. Unscrew the four screws securing heater control assembly 24 to console 1.
8. Remove the four screws securing console 1 to dashboard.
9. Remove console 1 being careful during lamp 25 and harness removal.
10. Install console and its components, by reversing order of removal.

May 1983
INTERNAL TRIMMING

REMOVAL AND INSTALLATION

CAUTION:
- Remove battery ground cable.
- Before removing the components fitted with harness, make sure that relevant connections have been disconnected.

With reference to exploded view above proceed as follows:
1. Remove central console (see: Central Console).
2. Remove steering wheel and column shell covers (see: Group 23 - Steering Wheel and Column).
3. Remove cluster (1).
   (1) Unscrew the four screws securing cluster (7) to support bracket.

Low view

(2) Open cover (8) pressure inserted, disconnect harness; then remove cluster (7).
4. Operating as per figure, remove spring securing center ventilation duct (3) control cable to heater control assembly.

5. By means of proper tool, remove ornaments (8) and (13).
6. By means of proper tool, remove finisher (2) of duct (3) and unscrew the two screws securing dashboard (5) to body.

7. Unscrew the seven screws securing dashboard (5) and (9) to body.

CAUTION:
To remove the whole dashboard, two operators are required.

5. Remove the whole dashboard (5) and (9).
6. Remove the whole dashboard (5) and (9).
(1) By means of a drilling machine fitted with suitable drill, countersink the four rivets securing upper dashboard (5) to lower dashboard (9).

May 1983
## INTERNAL TRIMMING

### SERVICE DATA AND SPECIFICATIONS

## TIGHTENING TORQUE

<table>
<thead>
<tr>
<th>Item</th>
<th>Unit</th>
<th>N-m</th>
<th>kg-m</th>
<th>ft-lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENTRAL PILLAR TRIM AND SAFETY BELTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety belt anchor screws</td>
<td>N-m</td>
<td>27</td>
<td>2.8</td>
<td>20.25</td>
</tr>
<tr>
<td></td>
<td>kg-m</td>
<td>43</td>
<td>4.4</td>
<td>31.8</td>
</tr>
<tr>
<td>FRONT SEATS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screws securing guides to seat</td>
<td>N-m</td>
<td>17</td>
<td>1.8</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>kg-m</td>
<td>20</td>
<td>2.1</td>
<td>15.2</td>
</tr>
<tr>
<td>Securing screws of seat back adjustment device and of hinge</td>
<td>N-m</td>
<td>17</td>
<td>1.8</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>kg-m</td>
<td>29</td>
<td>3</td>
<td>21.7</td>
</tr>
<tr>
<td>Screws securing seat guides to floor</td>
<td>N-m</td>
<td>10</td>
<td>1.1</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>kg-m</td>
<td>11</td>
<td>1.2</td>
<td>8.7</td>
</tr>
</tbody>
</table>
EXTERNAL TRIMMING

CONTENTS

FRONT BUMPER .................. 75-2
REAR BUMPER .................. 75-3
DRIP COVER MOLDING .......... 75-4
GRILLE ......................... 75-5
COWL TOP COVER ............. 75-6

GLASSES ....................... 75-7
Windscreen ..................... 75-7
Rear window .................... 75-9
SPECIAL SERVICE TOOLS ..... 75-11

May 1983
FRONT BUMPER.

REMOVAL AND INSTALLATION

With reference to exploded view above proceed as follows:

1. If present, disconnect fog light\(^4\) and\(^5\) harness.
2. Operating from engine compartment inside, disconnect harness of the two electromagnetic horns, unscrew the nut securing each horn to bracket, and remove horns.
3. Unscrew the four screws securing brackets\(^2\) and\(^3\) to sills.
4. Unscrew the two screws securing bumper to fenders.
5. Remove bumper and, if necessary, disassemble fog lights.
6. Connect bumper to body by reversing order of removal.
REAR BUMPER

REMOVAL AND INSTALLATION

With reference to exploded view above proceed as follows:

1. Lift luggage room upholstery and rear trim.
2. Unscrew the four screws securing bumper brackets 2 and 3 to brackets 4 and 5.
3. Unscrew the two screws securing bumper 1 to body.
4. Remove bumper.
5. If necessary, unscrew the eight screws securing brackets 4 and 6 to rear floor.
6. Install bumper, by reversing order of removal.

May 1983
REMOVAL AND INSTALLATION

With reference to exploded view above proceed as follows:
1. Open hood completely removing it from stay.
2. By means of a magnetic screwdriver, unscrew screw securing grille to body.
3. Remove grille, by means of suitable wooden tool.
4. Install grille by reversing order of removal.

CAUTION:
- Be careful not to exert excessive force during operations, as grille is made of plastic.
- Take care to keep oil away from grille.
With reference to exploded view above proceed as follows:
1. Open hood and remove seal (4).
2. Lift protections of nuts securing wiper arms (6), unscrew the relevant screws; then remove wiper arms.
3. By means of proper tool, remove the five springs securing cowl top cover (1) to body.
4. Unscrew the two screws, protected by a cover, securing cowl top cover (1) to body; then lift cowl.
5. Disconnect windscreen washer pipings (5) separating them from sprayers (7) which are pressure inserted into cowl top cover, then remove cowl top cover.
6. Install cowl top cover by reversing order of removal.
EXTERNAL TRIMMING

REMOVAL
With reference to exploded view above proceed as follows:
1. Remove wiper arms (7) and move cowl top cover (6) forward (see: Cowl-Top Cover).
2. Operating from vehicle inside, remove, by means of proper tool ornament (5).
3. Remove door opening seal (4) in the part where it covers pillar trim (3).
4. By means of proper tool, remove pillar trim (3), then remove it.
5. Operating as per the following figure, set end of tool A.9.0051 out of every 10 cm (4 in), starting from centre of windscreen upper rim; between body and windscreen seat.

6. Carefully pull upper part of windsreen, remove it from body, then remove it completely.

INSTALLATION
For installation, two operators are required.

CAUTION:
By means of silicone, lubricate rim of windscreen weatherstrip in order to allow an easy insertion of weatherstrip on body.

1. Into weatherstrip rim (2), insert two cords (A and B) arranged as per figure in order to allow repositioning of weatherstrip (2) on body.
2. Rest windscreen on lower side of its seat into body and verify it is properly centered with weatherstrip mounted on lower side, only.

3. Slowly pull first cord starting from upper rim and follow positioning of weatherstrip rim by slightly tapping, with the hand, on windscreen from outside.

4. Repeat same operation with second cord until complete installation of windscreen.

5. Carry out installation of pillar trim, of door compartment seal and of ornament, by reversing order of removal.

6. Install cowl top cover and wiper arms.

---

**REAR WINDOW**

1. Rear window
2. Rear window weatherstrip
3. Backdoor
4. Movable shelf
EXTERNAL TRIMMING

REMOVAL
With reference to exploded view above proceed as follows:
1. Open back door and release the two cables supporting shelf (4) under rear window.
2. Disconnect electric cables of heated rear window.
3. Operating as per the following figure, set end of tool A-9.0051 out of every 10 cm (4 in), starting from center of rear window upper rim, between back door (3) sheet and rear window weatherstrip seal (2).

CAUTION:
Do not damages filaments of heated rear window with tool A.9.0051.

INSTALLATION
For installation; two operators are required.

CAUTION:
By means of silicone, lubricate rim of rear window weatherstrip in order to allow an easy insertion of weatherstrip on body.

1. Into seal rim (2) inset-t two cords (A and B) arranged as per figure in order to allow repositioning of weatherstrip on back door.
CONTENTS

WIRING DIAGRAM ................. 80-2
AIR VENTILATION UNIT .......... 80-3
   Removal and installation .... 80-4

Heater fan switch ............... 80-5
TROUBLE DIAGNOSIS AND
CORRECTIONS ................... 80-5

May 1983
A  Battery
E1  Ignition switch
B4  Control for headlight, flashing, low beam and full beam
F8  Air ventilation control lamp
G  Fusebox
Q1  Air ventilation heater fan
Q4  Air ventilation heater fan control
     (IV — Low speed)
     (2V— High speed)
REMOVAL AND INSTALLATION

CAUTION:
- Remove battery ground cable.
- Before removing components fitted with harness, make sure the relevant connections have been disconnected.
- Be careful when removing air ventilation unit pipings, otherwise liquid leakages from heater core may occur.

With reference to exploded view above proceed as follows:
1. Remove lower finisher of central console and unscrew the four screws securing air ventilation unit controls to console (see Group 66 - Central Console).
2. Unscrew the four nuts securing air ventilation unit to body.
3. Operating from engine compartment inside, disconnect harness of heater fan.
4. By means of two terminals, clamp liquid delivery pipings to air ventilation unit, in order to prevent leakages.
5. Loosen metal clamps securing pipings to air ventilation unit; then remove pipings.
6. Unscrew the two screws securing frame of outer air duct to air ventilation unit; then remove both.
7. Carefully withdraw air ventilation unit and air ventilation unit controls.
8. If necessary, disassemble air ventilation unit in order to gain access to its inner components.
   (1) Operating as per figure, remove the eight springs keeping together shell covers and of air ventilation unit.
   (2) Remove or cut seals.
   (3) Separate the two shell covers and.
   (4) If necessary, with reference to exploded view above, release control cables of doors and by operating with suitable wrench on the screw securing levers to door hinges as shown in figure.
   (5) If required, disassemble components of air ventilation unit controls operating as per figure.
9. If necessary, operate on air ventilation unit components present in the dashboard by following the indications provided in Group 66 - Dashboard.
10. Install air ventilation unit by reversing order of removal.
**HEATER**

**HEATER FAN SWITCH**

**LOCATION**

The switch is located in the lower 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.

---

**TROUBLE DIAGNOSIS AND CORRECTIONS**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probable cause</th>
<th>Corrective action</th>
</tr>
</thead>
</table>
| Insufficient heating performance (No heated air flow to ducts) | • Cooling water temperature too low  
• Heater care plugged  
• Insufficient cooling water level  
• Malfunctioning air mix door | Check thermostat: replace if necessary  
Clean heater  
Refill  
Check door and adjust |
| Insufficient air flow to floor | • Blower motor speed too low  
• Malfunctioning air floor door  
• Malfunctioning door control | Check blower motor and:  
— restore poor connections  
— replace blower motor if necessary  
Check door and adjust  
Check control and adjust |
| Insufficient defrosting performance (Cold air to ducts) | Refer to “No heated air flow to ducts” | Check blower motor and:  
— restore poor connections  
— replace blower motor if necessary |
| Insufficient air flow to defroster (Refer to: Group 66 - Dashboard) | • Blower motor speed too low  
• Malfunctioning air main duct door  
• Malfunctioning door central | Check door and adjust  
Check door control and adjust |
| Control lever drags | • Bad cable sliding  
• Control cable bent excessively  
• Air intake door not operate properly | Adjust  
Correct  
Check and adjust |
| Noise from blower motor | • Loose bolt in blower motor  
• Broken blower blade(s) | Check and tighten  
Replace blower |