

1. Self-leveling hydropneumatic suspension strut for model 911 E (option on 911 T and 911 S)

These suspension struts support the weight of the car and act as shock absorbers. The torsion bars with adjusting devices are no longer fitted.

The knuckle joint and steering arm is welded to the lower end of the suspension strut.

For a description of the self-leveling hydropneumatic suspension strut in operation see page SS 15.

To check operation of the self-leveling hydropneumatic suspension struts, see page SS 23.

Warning:

When the car is lowered on to its wheels, note ground clearance. Important when driving over car hoists or similar equipment.

If the car is equipped with self-leveling hydropneumatic suspension struts, pressure is equalised in the struts by means of the control apertures as soon as the strut is extended or the weight of the car lifted from the wheels. When the car is next lowered, the suspension strut will support only the designed basic load, and the car will therefore fall below its nominal static load position.

The height adjustment devices previously fitted to the front axle are not used.

For wheel alignment procedure on cars using self-leveling hydropneumatic suspension struts see page SW 3.

2. Shock absorber struts (new version) with welded-on knuckle joint and steering arm

3. New wishbone with rubber bushes and new type of ball joint in position

4. Modified rack and pinion steering (see page SF 41)

5. Anti-sway bars on front axle

Standard equipment on model 911 S = 15 mm diameter (does not apply to cars with self-leveling hydropneumatic suspension struts).

6. Front track width

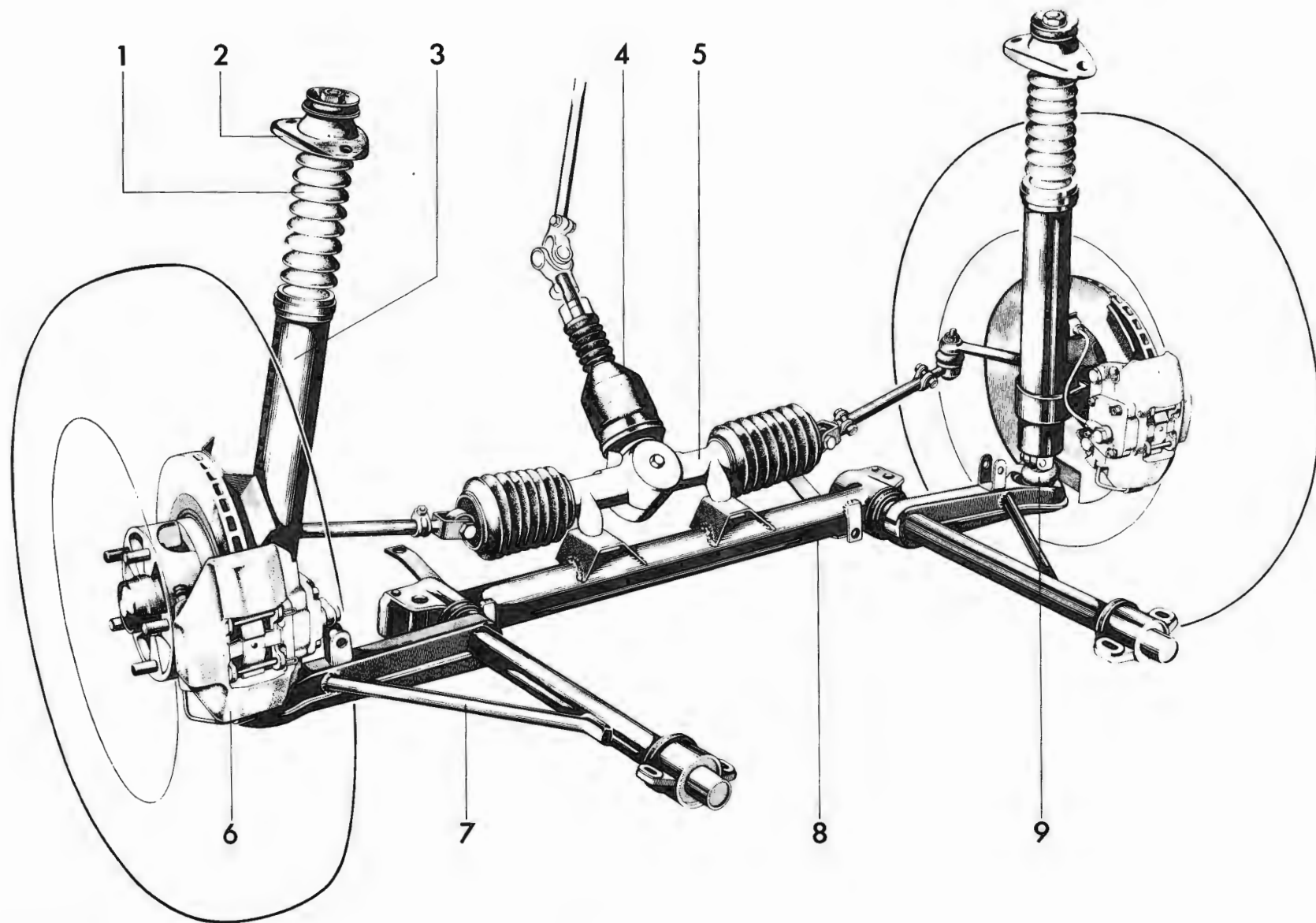
5 1/2 J x 15 wheels (steel disc) = 1362 mm (53.622")

6 J x 15 wheels (light alloy) = 1374 mm (54.095")

5 1/2 J x 14 wheels (light alloy) = 1364 mm (53.701")

7. Wheel alignment data unchanged

We now describe the corresponding assembly procedures:



1 Vukollan-spring
 2 Step bearing with rubber bearing
 3 Self-leveling hydropneumatic suspension strut

4 Rubber sleeve
 5 Steering gear
 6 Brake calliper

7 Transverse guiding link
 8 Auxiliary support
 9 Ball joint

Fig. 1

General

Beginning with the '69 models, self-leveling hydropneumatic suspension struts are being introduced for Type 911 E cars as standard equipment, and are optional in Types 911 T and 911 S.

Particular emphasis was placed in the 911 E on attaining the highest possible degree of comfort. In normal designs, riding comfort was closely related to soft suspensions with deep spring deflection from the empty to fully laden condition. Another disadvantage in such systems is the diminished ground clearance and misalignment of headlamp adjustment under load.

One of the various alternatives to the above is to reduce static spring deflection through the application of pneumatic or hydropneumatic suspension components. As a result of considerable progress made in the development of hydropneumatic suspensions of the self-contained and self-leveling type, there has become available a hydropneumatic suspension strut of outer configurations closely resembling a heavy-duty telescopic shockabsorber.

Function and Design

When passengers or baggage add to the weight of the car, the hydropneumatic front suspension struts will initially deflect, lowering the car's standing height to an extent directly proportional to the load differential. As soon as the car begins to move, wheel oscillations caused by road bumps result in a pumping action in the strut, raising the car's height to a predetermined level.

The struts will bring the car to normal level after covering a distance of anywhere between 300 and 1500 yards, depending on the road irregularities encountered. On rougher roads with vigorous wheel oscillations, normal height might be attained already after approx. 10 mm of travel. The adjusted car height will remain constant when stopping in traffic. In fact, the level will remain constant overnight providing that the load is not increased after the car has been parked. Upon removal of any load from the car, the suspension will first rebound, as in conventional systems, but will quickly proceed to adjust itself to the former height where it then will remain.

Should the axle load be increased to beyond the permissible maximum, the pumping effect will automatically be relieved and height compensation stopped to prevent any overstressing of the system. Consequently, an overload condition can be readily spotted due to the reduced ground clearance, similar to cars with conventional suspensions.

The strut performs its functions with oil and gas. It has an oil-filled cylinder with a damping piston on a hollow rod. Surrounding the damping cylinder is a hydraulic accumulator filled with oil and gas, and divided into a high and low pressure chamber. Gas in the high pressure chamber is isolated from the oil by means of a diaphragm. In the low pressure chamber the gas and oil are not separated. A constant pressure, created by the gas charge, prevails in the strut and equals approx. 90 % of the empty car weight, being the force exerted by the gas in both chambers upon the piston rod area.

Anchored to the top of the damping cylinder is a pump rod which projects into the hollow piston rod forming a hydraulic pump.

Strut oscillations caused by road bumps move the hollow piston rod against the stationary pump rod and, through appropriate inlet and outlet valves, transfer oil from the low pressure cylinder to the high pressure cylinder. As a result, the pressurized gas cushion is further compressed, the pressure in the cylinder increased, and the car thus raised to its predetermined level. The pumping action also provides additional damping force in support of the action accomplished by the damping piston. This damping effect is load-biased, being low under light weight conditions, and high under heavy.

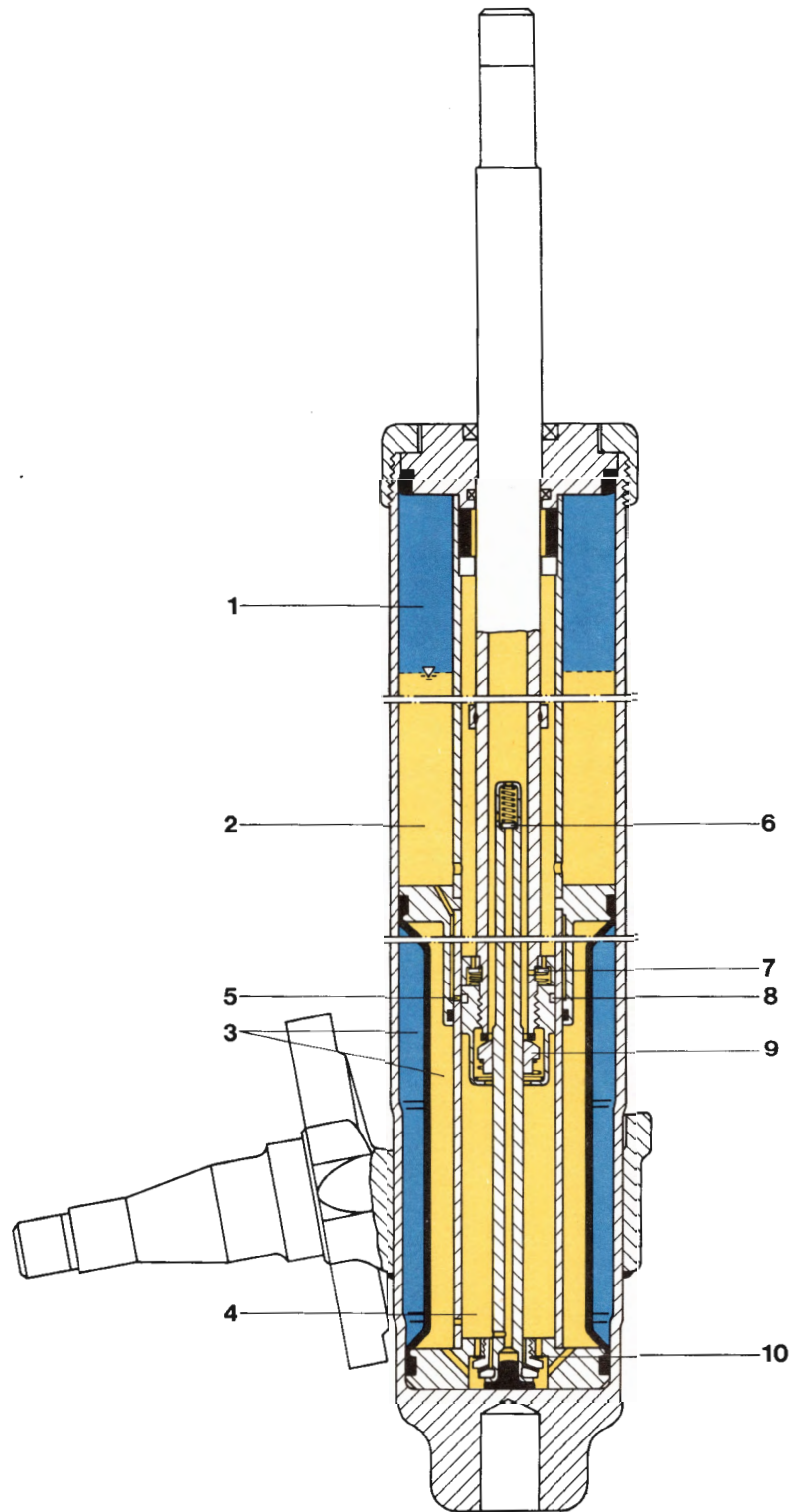
The adjustment of height is brought about through the cycling of oil between the low and high pressure chambers. The adjustment begins with the pumping of oil from the low pressure to the high pressure cylinder when the car is being raised to proper level. It terminates with the relief action once the predetermined height has been reached, at which time the damping piston clears the pressure relief ports in the cylinder. The relief ports are relatively small and do not interfere with the dynamic cushioning process. During the relief cycle, oil returns through the relief ports at the same rate as that of the oil pumped up. When the strut oscillations occur while the car is at its proper height, the relief ports are open for only half the time. As a result, more oil will be pumped up than can flow back when the car is driven on rough roads. Desirably, the car's level will automatically be higher when driving over bumpy stretches. However, to keep the system from lifting the suspension higher than is desired, the pump rod is beveled at one point so that the pumping effect is completely neutralized when the strut extends more than 10 mm beyond its regular height.

The strut has been designed to maintain an exact suspension level while also acting as a shock absorber. Compared with conventional steel-spring-and-shockabsorber suspensions, the hydropneumatic solution provides a marked improvement in comfort throughout the entire load range.

Mechanically, the damping piston divides the cylinder into a low and high pressure cylinder, each of which is hydraulically connected with a low or high pressure chamber within the hydraulic accumulator. In the raised condition, pressure in the high pressure chamber and cylinder always is greater than that in the low pressure chamber and cylinder. When the damping piston moves through the cylinder, one gas cushion is compressed while the other is decompressed. This provides a reciprocally-acting cushioning force which always attempts to push the piston back to its starting position; contained in the high pressure chamber are positive forces, while in the low pressure chamber are negative forces.

As the piston moves back or forth, hydraulic drag results from the displacement of oil from the given cylinder into the respective pressure chamber, and vice versus, providing the double-action shock-absorbing effect.

CROSS-SECTION OF SELF-LEVELING HYDROPNEUMATIC SUSPENSION STRUT



- 1 Low pressure chamber
- 2 Low pressure cylinder
- 3 High pressure chamber
- 4 High pressure cylinder
- 5 Relief port orifice

- 6 Overload valve
- 7 Suction valve
- 8 Piston ring seal
- 9 Pressure valve
- 10 Damping valve

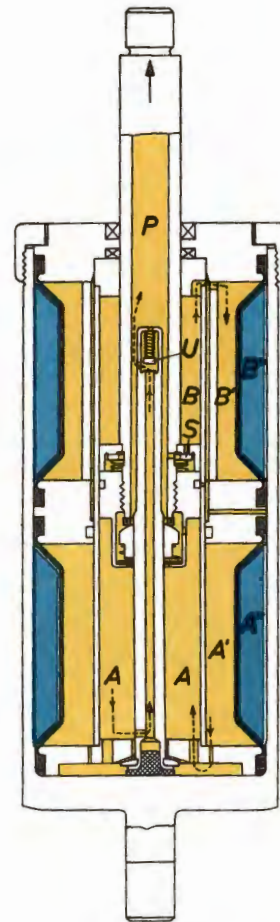
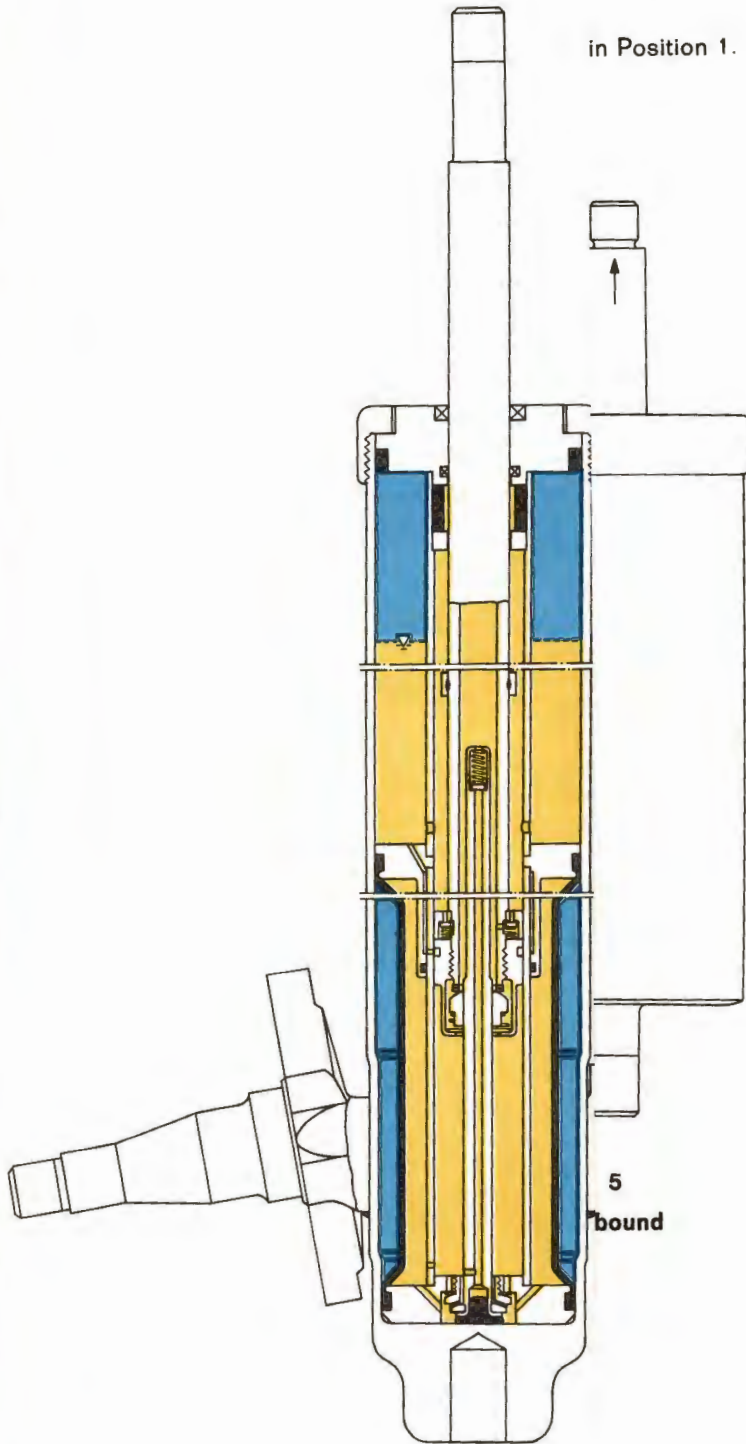
Fig. 2

in Position 1.

A'' expands
through oil flow A' to A,
B'' compresses
through oil flow B to B'.

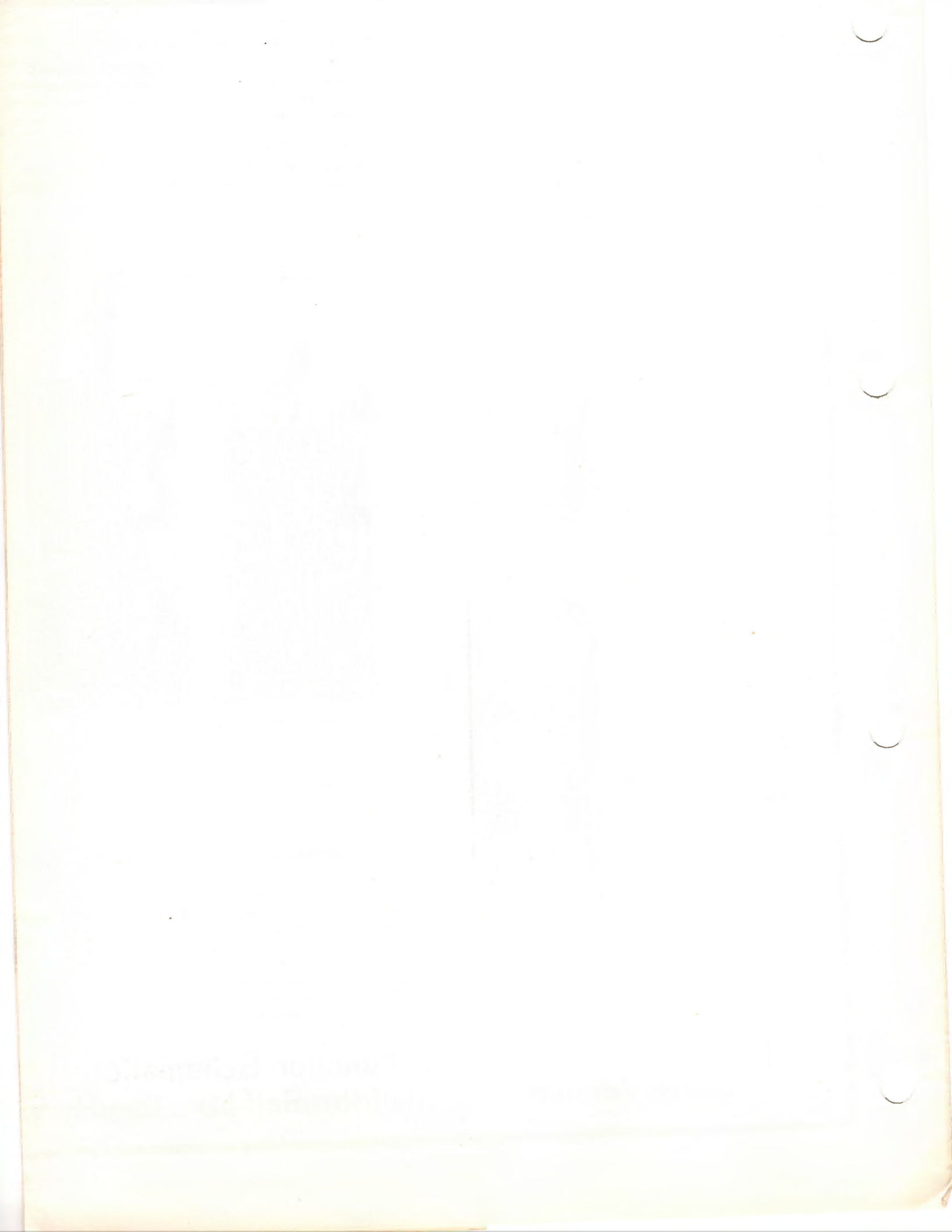
in Position 1.

Suction A to P
Overload valve U open.
Suction valve S closed.



Rebound in Overload

Porsche-Version



Special tools:

P 301b Plug gauge

1. Load the front axle with 100 kp (220 lbs) in such way that both wheels are evenly weighted (spread the load evenly in the luggage compartment).
2. a. The best way to test the pumping action is by driving the car.

Drive car onto level surface and push measuring mandrels (special tool P 301b), from within the compartment of the reinforcing support member, to the stop into the left and right transverse support arm (grease the mandrels slightly to provide some adhesion).

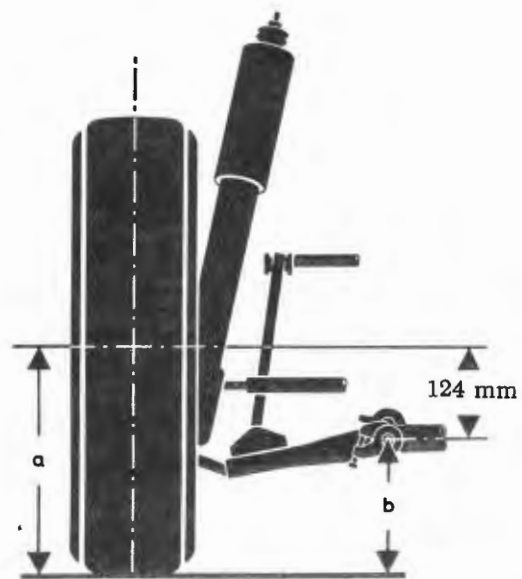


Fig. 4



Fig. 3

Measure distance "a" - from the ground vertical to the front wheel center (Fig. 4). Distance "b" results from distance "a" less 124 mm. Raise the car by the front center with a jack, until distance "b" is attained at the measuring mandrels.

Measure and note the distance from the ground to the bottom edge of the fender across the front wheel center on left and right side. Remove measuring mandrels (special tool P 301b).

NOTE: Before lowering the jack, measure the distance from the wheel flange to the ground, then measure again after lowering the jack to determine the static deflection of the tires on both sides of car. The difference must be deducted from measurements obtained between the ground and lower edge of fender.

Drive car on a relatively rough road surface over a distance of approx. 2 km (1 1/4 miles), without hard braking and bring car to a halt on a smooth surface again. Car-occupants remain inside, and, by second person, measure comparative values at both front fenders. The values must not differ from the determined nominal values by more than ± 10 mm.

2. b. Another way to perform this test is in the workshop by rocking the front end by about 20 times. This is best done by one mechanic who rocks the car by the front bumpers and lets it come up by itself. The body must not be lifted at any time since this could bring the level to the point of the hydro-pneumatic relief cycle, nullifying the pumping effect. The rocking deflection strokes should be at least 30-40 mm (1.25 - 1.60").

If the struts were in use for a considerable distance, it might be necessary to deflect the front end by up to 40 strokes before the car attains its specified height.

This test method also requires that height measurements be taken at the front axle upon weighting it, as outlined under Pt 1, above, before and after the rocking action.

3. Upon completion of the rocking action and measurement of the front axle height, wait for 2 - 5 minutes and then take the measurements again. The body must not drop by more than 10 mm (.4") during that time. Make sure that nothing affects the weight attitude of the vehicle during the above mentioned waiting time.

4. When the specified height cannot be reached, considering the permissible weight limit, and when the car's height decreases within a short time after repeated pumping and testing, replace the defective strut with a new unit.

Loss of height overnight is insignificant.

When new struts are installed, improper storage of the parts (the strut must be stored in upright position) may call for a relatively longer road travel distance before attaining the specified suspension height.

5. When the front axle load exceeds the permissible weight, proper suspension height cannot be reached despite any rocking action and the level will continue to drop with increasing loads, similar to the overload effect in conventional suspensions.

6. When the body swings excessively on rebound, the shock damping part of the suspension strut is defective. This will also be frequently felt through considerable steering wheel shock or front wheel wobble.

7. Prior to salvaging, the hydro-pneumatic suspension struts must first be freed of their static gas charge. To accomplish this, remove both filling plugs from the outer sleeve.

REMOVE AND RE-INSTALL SUSPENSION STRUT OR SHOCK ABSORBER STRUT

Special tools:

P 284b Test gage for steering arm
P 286b Test gage for steering knuckle

VW 266h Puller for track rod ball joint

Removal

1. Raise front of car and take off both front wheels.
2. Detach brake line from clip on suspension strut.
(First depress the brake pedal a short distance with a pedal clamp to prevent brake fluid from escaping from the reservoir.)
3. Loosen bolts holding brake caliper and take off the complete caliper.
4. Use a plastic-headed hammer to loosen the front wheel hub cap slightly, and push it off using a lever on alternate sides.
5. Loosen fillister head screw holding wheel bearing clamp nut, screw out the clamp nut and take off the peg washer.
6. Take off front wheel hub with brake disc and wheel bearing.
7. Loosen the hexagon bolts holding the shield plate, and take off the shield plate.



Fig. 1



Fig. 3



Fig. 2



Fig. 4

8. Remove the split pin from the castellated nut on the track rod joint and pull off the ball joint with special tool VW 266h.

9. Loosen the hexagon bolt (M 10x30 - 10 K) for the ball joint on the suspension or shock absorber strut, and pull the ball joint out of the strut by pressing the wishbone downwards.

Warning:

If the car is fitted with shock absorber struts, the torsion bar adjusting screw must first be loosened and the adjusting arm removed.



Fig. 5

10. Remove the keeper for the hexagon nut on top of the suspension strut or shock absorber strut, unscrew the nut and remove it together with the keeper plate, peg washer and the strut itself. (The trunk side panel must be pulled away.)



Fig. 6

11. If necessary, pull off the spacer ring with a claw-type extractor.

Checking condition of parts

1. Use special tool P 286b to check condition of suspension or shock absorber strut with steering knuckle.

Warning:

Assemble special tool P 286b as follows:

Boge suspension strut (outer tube 64 mm/2.52" diameter) = without sleeves or cap.

Koni shock absorber strut (outer tube 58 mm/2.28" diameter) = thin sleeves and thin cap to be used.

Boge shock absorber strut (outer tube 52 mm/2.05" diameter) = thick sleeves and thick cap to be used.

Note:

Some early models were supplied with Koni shock absorber struts with outer tube diameter 56 mm/2.20". When checking these shock absorber struts a 1 mm (0.39") thick spacer must be fitted at each of the measuring points. The special tool should be used in the version for Koni shock absorber struts with outer tube diameter 58 mm/2.28".

a. Clamp special tool P 286b in the vise. Push the bearing journal of the suspension or shock absorber strut, with spacer ring in position, into the gage holes on special tool P 286b. (See Fig. 7.)

If the bearing journal cannot be pushed in as far as the limit position next to the flange, it is distorted and the suspension or shock absorber strut must be replaced.

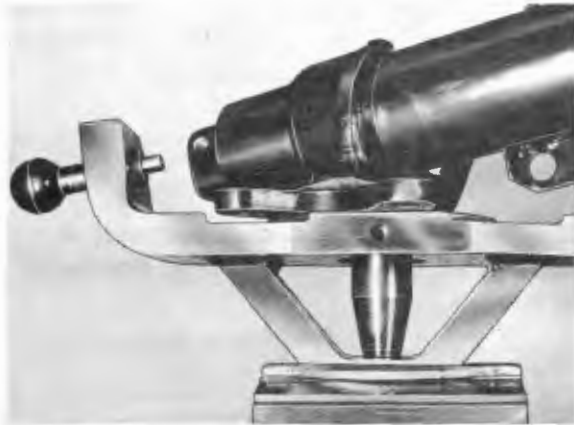


Fig. 7

- b. Turn the suspension or shock absorber strut between the measuring pins and hold in position with the retaining pin.

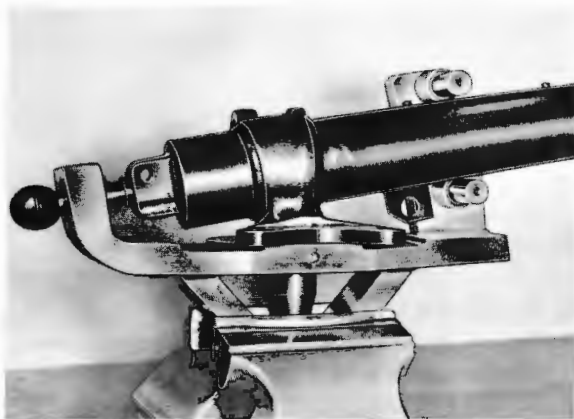


Fig. 8



Fig. 9

If the suspension or shock absorber strut cannot be turned between the two measuring pins, it should be replaced. In addition a max. spacing of 2.2 mm (0.087") is permitted between the outer tube and the front measuring space on the measuring pin. If this distance is exceeded, the suspension or shock absorber strut must be replaced. (See Fig. 9.)

2. Checking self-leveling hydropneumatic suspension strut - see page SS 23.

3. Check hydraulic action and sealing of shock absorber strut.

a. Examine the exterior of the shock absorber strut for oil leaks. If the complete shock absorber tube is covered with oil and dirt, the shock absorber strut must be replaced.

b. Clamp the shock absorber strut vertically into the vise with the piston rod upwards. Compress the shock absorber completely several times so that oil enters the cylinder, then move the shock absorber a short distance in the opposite direction to establish the amount of free travel. If this free travel is excessive, the shock absorber strut must be replaced.

4. Check the steering arm with special tool P 284b.

a. It must be possible to bolt special tool P 284b to the steering knuckle using three M 8x25 bolts, so that the steering arm lies between the test gage holes. (See Fig. 10.)

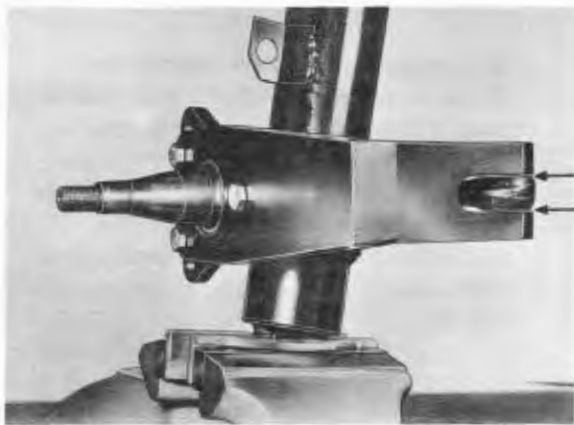


Fig. 10

- b. The larger diameter of the hole in the steering arm for the track rod joint should not lie outside the test hole in special tool P 284b. (Visual check.)

If excessive alignment variations are found, an exchange suspension or shock absorber strut should be installed.

Re-installing

Note the following points when re-installing:

1. If necessary, install with spacer ring. The spacer ring must be heated to about 150°C (300°F) and pushed on.

Warning:

Always install a cord ring seal (OR 25.3x2.4) between the spacer ring and the steering knuckle to prevent the development of corrosion.

2. Do not apply any lubricant to the hollow rubber spring before installing.

3. Tighten the hexagon nut on the suspension or shock absorber strut to 8.0 mkp (58 lb/ft). Use a new keeper plate and make sure that the peg on the keeper plate points upwards.

4. Tighten the hexagon bolt (M 10x30 - 10 K) for the ball joint to 6.5 mkp (47lb/ft). Use a new Schnorr lock washer.

Warning:

Do not forget to re-install the steel washer between the ball joint sealing bellows and the suspension or shock absorber strut.



Fig. 11

5. (Shock absorber strut only:)
Install the adjusting lever on the torsion bar as described below.

a. Press down the wishbone (with shock absorber strut attached) with a tire lever or similar tool until the strut is fully extended and in contact with the lower limit stop. Then push the adjusting lever onto the torsion bar as close as possible to the stop for the adjusting screw on the sub-frame. (The adjusting lever must be provided with a cap.)



Fig. 12

b. Coat the thread of the adjusting screw with Mo S₂ paste and screw up a few turns.

c. Check that the cap is correctly located in the wishbone. If the adjusting lever is incorrectly installed the front of the torsion bar may escape from the splines in the wishbone.

6. Tighten the castellated nut on the track rod joint to 4.5 mkp (32.5 lb/ft).

7. Tighten the hexagon bolts for the shield plate to 2.5 mkp (18 lb/ft).

8. Install and adjust the front wheel bearing (see 4 ST).

9. Tighten the brake caliper retaining bolts to 7.0 mkp (50 lb/ft), using spring washers.

10. Bleed the brake system and check for leaks (see group "T").

11. Carry out optical wheel alignment of the car and adjust if necessary (see group "W").

Special tools:

P 280b Slotted nut wrench

P 288b Wishbone test gage

Removal

1. Lift front of car and take off both front wheels.
2. Unscrew the hexagon bolt (M 10x30 - 10 K) for the ball joint on the suspension or shock absorber strut. Pull the ball joint out of the strut by pushing the wishbone downwards.
Warning:
On cars with shock absorber struts, the torsion bar adjusting screw must first be taken out and the adjusting lever and OWA gasket removed.
3. Loosen the hexagon bolts on the protection bar and the front wishbone bearing, and remove the protection bar.



Fig. 13

4. Unscrew the hexagon bolt holding the wishbone and sub-frame, and pull the wishbone out towards the front.



Fig. 14

5. Clamp the wishbone in a vise (use protective jaws). Remove the keeper from the slotted nut and unscrew the nut using special tool P280b.



Fig. 15

Warning:

To remove both wishbones, take off the wishbone on one side and screw in the hexagon bolt for the wishbone and sub-frame hand tight, so that the sub-frame is held firmly in position.

Checking condition of parts

1. Check wishbone with special tool P 288b.

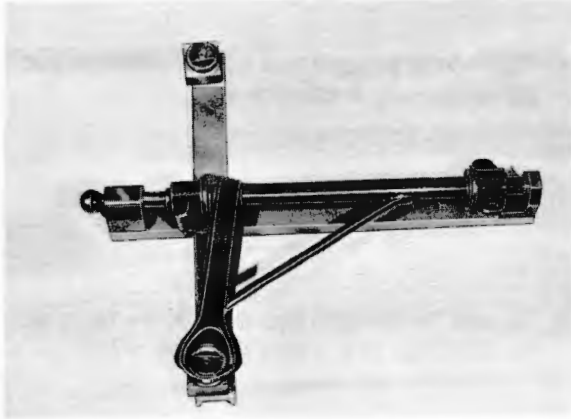


Fig. 16

- a. Use a suitable piece of metal tube to drive the cap for the torsion bar splines out of the wishbone.
 - b. Mount the wishbone in special tool P 288b.
 - c. With the mounting hole for the ball joint placed on the test journal on special tool P 288b, the wishbone should rotate easily and the contact surface for the ball joint should touch the shoulder on the test journal all round its edge.

Distorted or damaged wishbones must be replaced.
 - d. Install the cap with the domed side outwards in the wishbone, and drive it in firmly with a suitable drift.
 - e. Check the wishbone rubber bushes for visible signs of wear. If the bushes are defective, the complete wishbone must be replaced.
2. Check the ball joint. A small amount of friction should be present when the ball journal is moved. If the journal can be moved without resistance, and axial play is detected, the ball joint must be replaced. If the sealing bellows is damaged it can be replaced as follows:
 - a. Use a chisel to separate the damaged bellows from the ball joint.
 - b. Force on the new sealing bellows with a suitable length of tube.
 3. (Cars equipped with shock absorber strut only)
Check for damage to splines on torsion bar. Inspect the painted surface for traces of rust, and replace if necessary.

Re-installing

Note the following procedures when re-installing:

1. Tighten the slotted nut for the ball joint to 15 mkp (108 lb/ft) and prevent from turning by bending over one of the pegs on the keeper plate.



Fig. 17

2. (Shock absorber strut only)
Coat the torsion bar lightly all over with lithium-base grease, in particular the splines. Push the torsion bar into the wishbone. (Do not force out the end cap from the wishbone.)

Insert the wishbone and torsion bar into the sub-frame.

Warning:

The torsion bars are pre-loaded during production. Never interchange right or left wishbones. Wishbones for fitting on left side are marked on the end with an "L", wishbones for fitting on the right with an "R" (see picture).

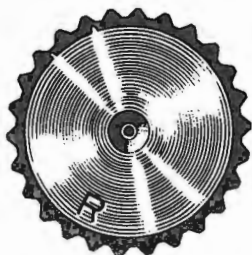


Fig. 18

3. Tighten the hexagon bolt for the wishbone front bearing and protection bar to 4,7 mkp (34 lb/ft).

4. Tighten the hexagon bolt for the wishbone and sub-frame to 9,0 mkp (65 lb/ft).

5. Tighten the hexagon bolt (M 10x30 - 10 K) for the ball joint to 6,5 mkp (47 lb/ft).

6. (Shock absorber strut only)
Push the OWA gasket from the space in the sub-frame onto the torsion bar, and mount the adjusting lever on the torsion bar as described below:

- a. With the shock absorber strut attached, push the wishbone down until the limit stop in the shock absorber strut is reached, using a tire lever or similar tool. Push the adjusting lever onto the torsion bar as close as possible to the adjusting screw stop on the sub-frame. (The adjusting lever must be provided with an end cap.)



Fig. 19

b. Coat the adjusting bolt thread with MoS_2 paste and screw it in slightly.

c. Check that the end cap is seating correctly in the wishbone. If the adjusting lever is not correctly installed the front end of the torsion bar may be driven out of the splines in the wishbone.

7. (Shock absorber strut only:)

Set up front axle to correct height.

8. Carry out optical wheel alignment and adjust as necessary (see group "W").

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Special tools:

P 291 Internal socket head wrench

1. Raise front of car and take off both front wheels.

2. Pull away the trunk side panels in the area of the suspension or shock absorber strut mounting.

3. Remove the keeper from the hexagon nut at the top of the suspension or shock absorber strut, unscrew the nut and take off the keeper plate and peg washer.



Fig. 20

4. Press down the wishbone with the suspension strut and extract the piston rod from the rubber pad.

5. Remove all sealing compound from the pressure plates.

6. Mark the position of the single hole and double hole pressure plates. Unscrew the fillister head bolts with special tool P 291 and remove the thrust bearing with its rubber pad.



Fig. 21

7. Install the new thrust bearing with rubber pad. Tighten the fillister head bolt to 4.7 mkp (34 lb/ft).

8. Tighten the hexagon nut on the suspension or shock absorber strut to 8.0 mkp (58 lb/ft), and fit a keeper. A new keeper plate should be used. Make sure that the peg on the keeper plate faces upwards.

9. Carry out optical alignment check and adjust if required (see group "W").

10. Reseal the pressure plates and thrust bearing with permanently elastic sealing compound, for example "National-Kleber 670".

REMOVE AND RE-INSTALL TRACK ROD TUBE

Removal

1. Disconnect batteries.
2. Take out front trunk mat and open compartment lid.
3. Remove trunk paneling in front of fresh air plenum box.

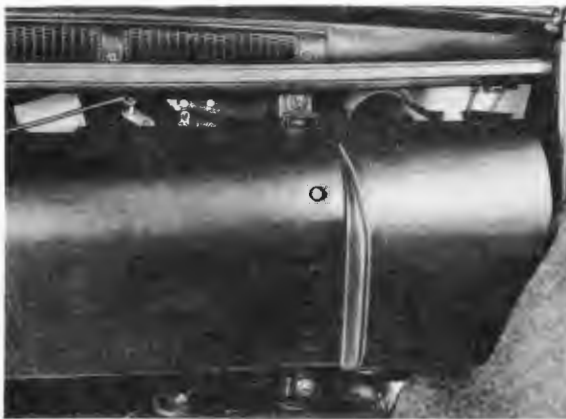


Fig. 1

4. Remove fresh air box with blower:
 - a. Unscrew the four Phillips-head screws on the air grill frame, and pull out the frame with the grill.



Fig. 2

- b. Unscrew the two Phillips-head screws holding the fresh air plenum chamber.



Fig. 3

- c. Detach the left and right connecting hoses on the control boxes.



Fig. 4

- d. Disconnect the electrical plugs from the fresh air box.
- e. Disconnect the wire cable from the flap lever on the fresh air box, and push off the retaining clip for the outer cover. (See Fig. 5.)

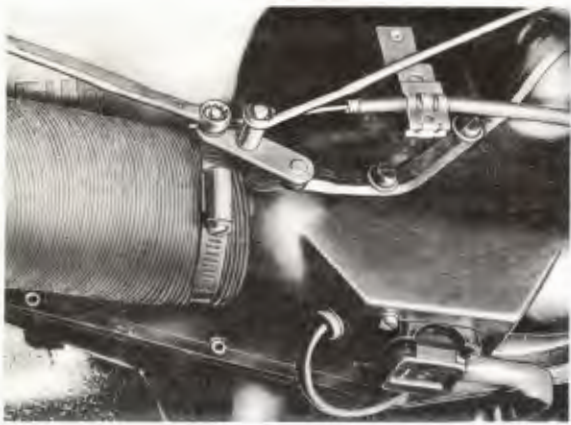


Fig. 5

5. Take off the cover plate for the intermediate steering shaft. (To simplify this job, bend up one of the retaining tongues of the spring nut with a small screwdriver - see Fig. 6.)



Fig. 6

6. Loosen the self-locking hexagon nut on the upper hexagon bolt of the upper universal joint, and the hexagon nut on the lower hexagon bolt of the lower universal joint. Pull out the hexagon bolts.

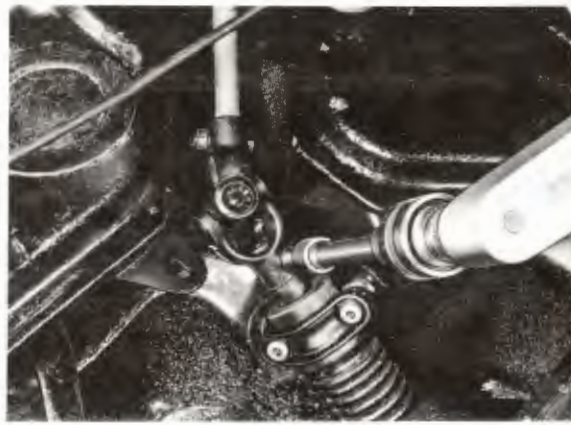


Fig. 7

7. Unscrew the fillister head bolts on the steering shaft bearing cap, and take off the bearing cap.



Fig. 8

8. Pull the lower universal joint out of the steering shaft and remove the intermediate steering shaft with both universal joints.

9. Take off the steering wheel (see 14 ST).

10. Pull out the steering column bearing with a small claw-type extractor.



Fig. 9

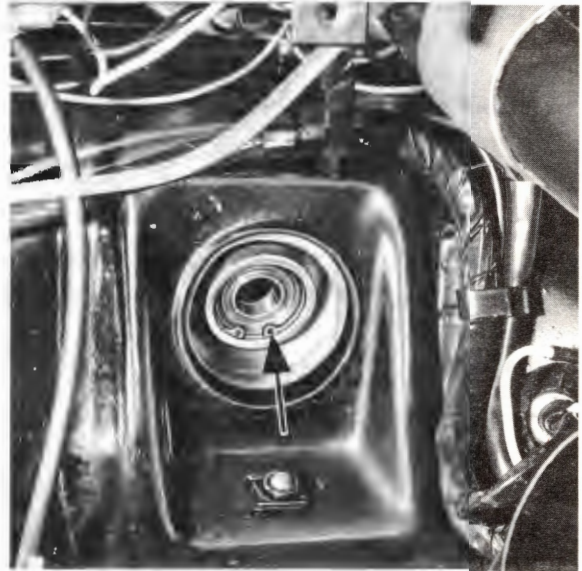


Fig. 11

11. Take off the circlip from the steering shaft and drive the shaft out upwards,



Fig. 10

12. Lever the circlip for the grooved ball bearing out of the steering outer tube, and drive out the ball bearing downwards with a suitable drift.

Checking

1. Check the splines on the steering shaft and replace the shaft if the splines are damaged.
 2. Check the grooved ball bearing and the steering column bearing, and replace if necessary.
 3. Check the universal joints; no play should be detected. If noticeable play is present, replace the universal joints.
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Re-installing

When re-installing, note the following procedures:

1. Pack the grooved ball bearing with lithium-base grease (multi-purpose) and drive the bearing into the steering shaft so that the cover disc on the bearing faces outwards.
 2. Tighten the cheese head bolts for the bearing cap on the steering shaft to 2, 5 mkp (18 lb/ft).
 3. Use new self-locking hexagon nuts for the hexagon bolts on the universal joints. Tighten to 2, 5 mkp (18 lb/ft). (To prevent stresses within the intermediate steering shaft and universal joints the steering shaft bearing cap must be tightened first.)
 4. Re-install the steering wheel (see 14 ST).
 5. Re-install the fresh air plenum box with blower:
 - a. First insert the air inlet aperture of the fresh air box with blower.
 - b. Insert the water drain hose into the drain tube in the trunk floor.
 - c. Make sure that the fresh air box and the inlet aperture in the center part of the bulkhead are correctly aligned.
 - d. Adjust the wire cable so that the air flaps open and shut completely.
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CROSS-SECTION OF STEERING AND CONTROL SWITCH COMPONENTS

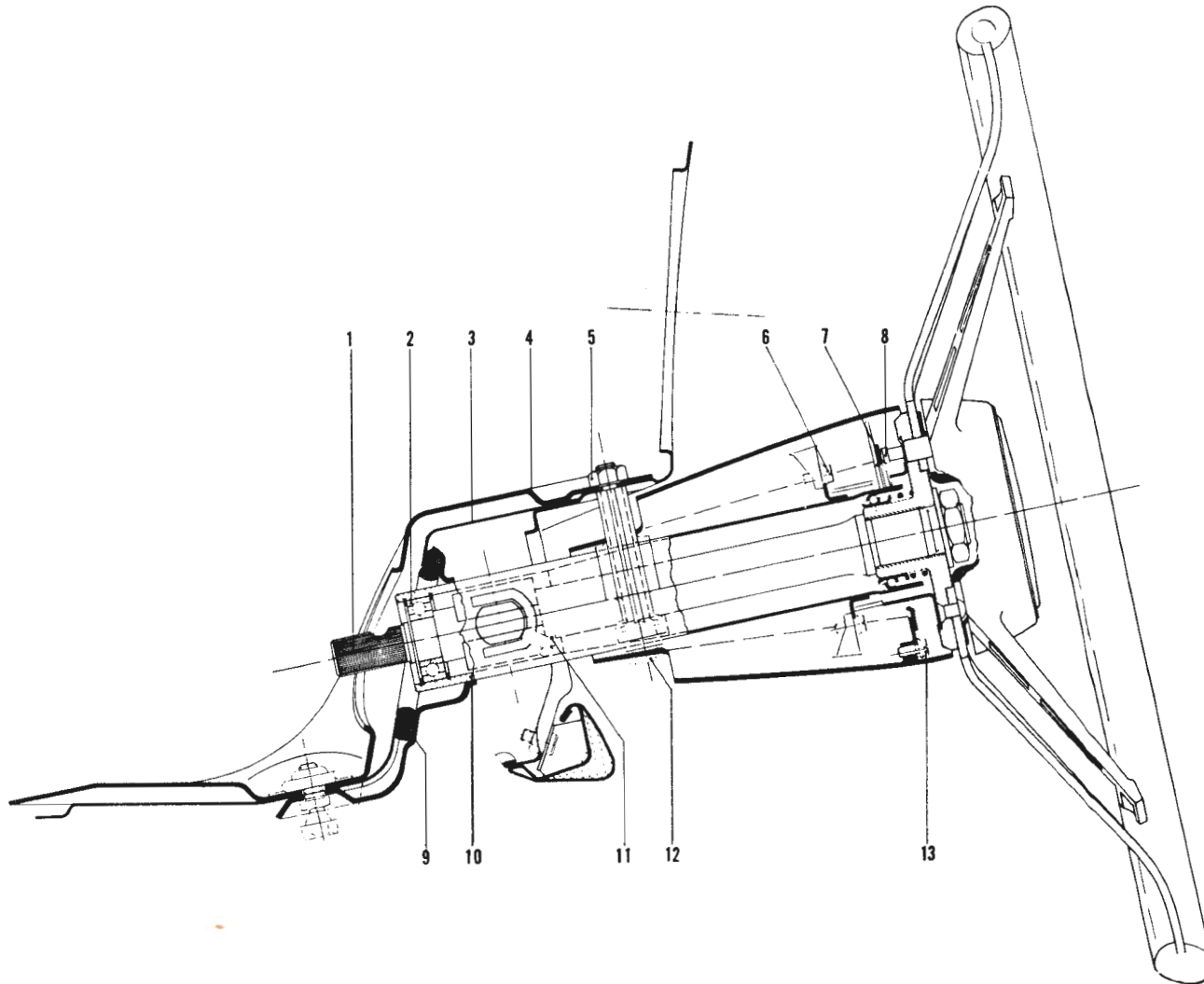


Fig. 12

- 1 Steering upper shaft
- 2 Ballbearing
- 3 Front compartment wall
- 4 Reinforcing panel

- 5 Caged nut
- 6 Fillister screw for switch shroud halves
- 7 Contact ring

- 8 Contact finger
- 9 Seal
- 10 Steering post extension
- 11 Countersunk screw (M 6 x 10)

- 12 Shear bolt
- 13 Fillister screw for contact ring

RACK AND PINION STEERING, FROM 69 MODEL ON

General

From the 69 Model on, a modified rack and pinion mechanism has been used.

Primary modifications:

1. Modified steering box housing; the center line of the rack is now 3 mm (0.12") higher in relation to the front axle.
2. Longer steering rack (previously 485 mm/19.09", now 501 mm/19.72").
3. Number of turns of steering wheel from lock to lock: 3.1 (previously 2.8).

Adjusting values for the rack and pinion steering mechanism have not changed.

REMOVE AND RE-INSTALL JOINT BUSHES ON RACK AND PINION STEERING (FROM 69 MODEL ON)

Special tools:

P 285a Adjusting gage for steering mechanism

Warning:

The joint bushes must be installed in a certain position to ensure correct steering geometry and accurate track rod location (see page S 31, Fig. 73).

Removal

1. Mount the steering mechanism on special tool P 285a, without using the 3 mm (0.12") thick spacing washers.
2. Take off the outside retaining clip from the flexible bellows. Pull the bellows away from its holder. Use a 42 mm wrench to loosen the bellows holder and unscrew the joint bush together with the bellows holder.

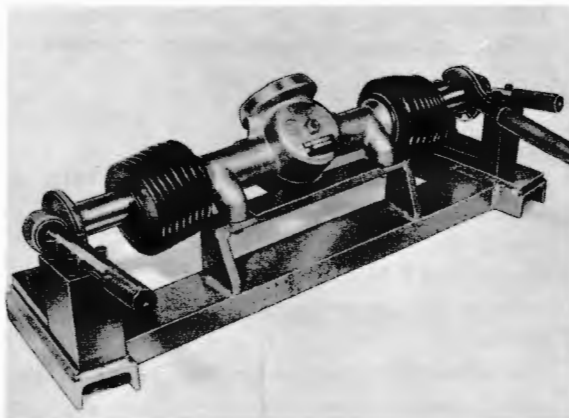


Fig. 13

Checking condition of parts

1. Examine the joint bushes for visible signs of wear and replace if necessary.
2. Check the flexible bellows for cracks and poor sealing and replace if necessary.

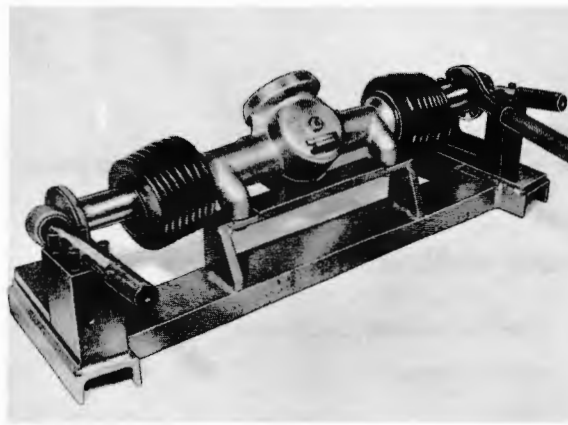


Fig. 14

3. Replace defective retaining clips.

Re-installing

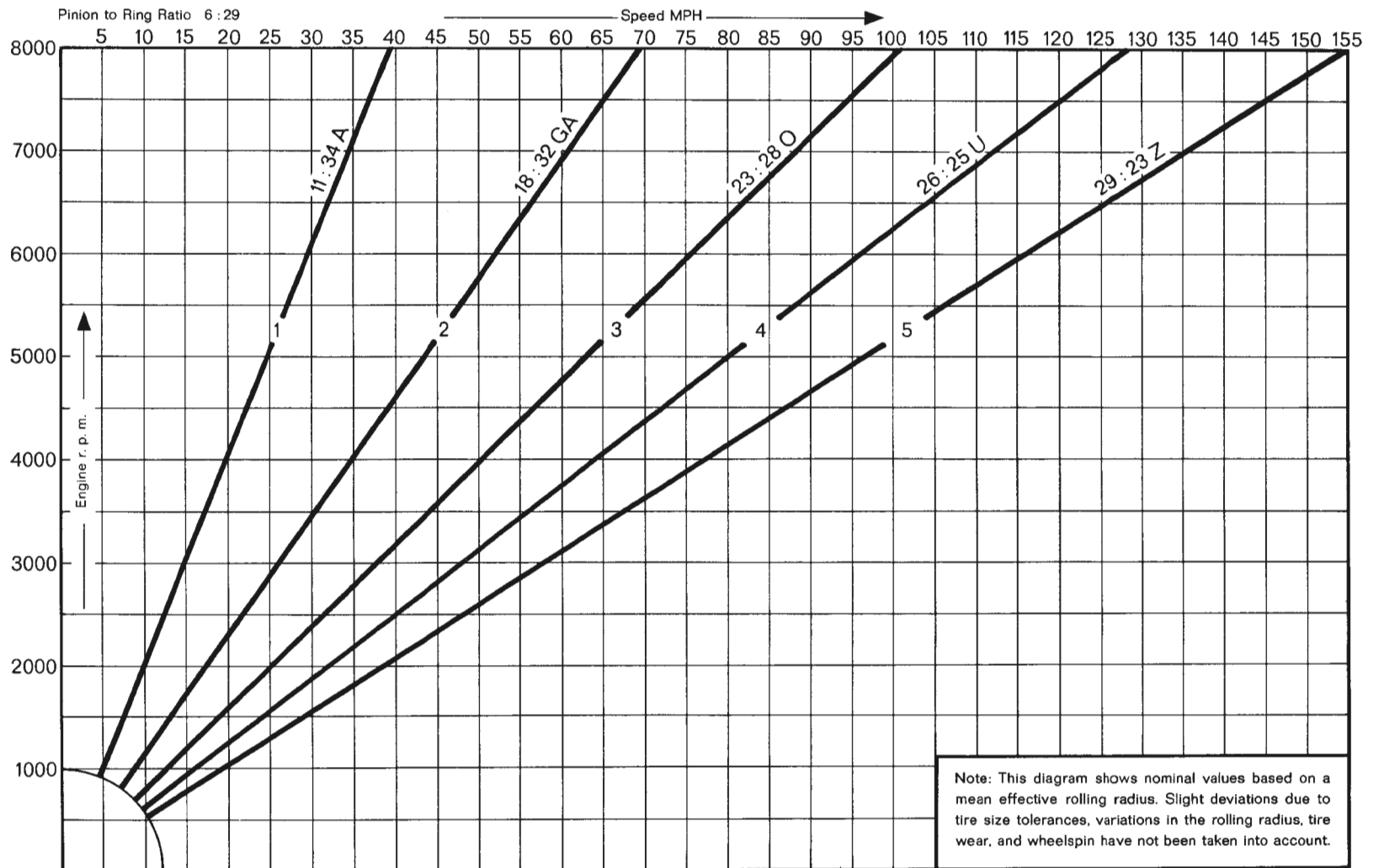
When re-installing note the following procedures:

1. Install both flexible bellows on the steering lock's housing.
2. Screw the bellows holders to the joint bushes, coat the threads of the joint bushes and the front face of the rack with "Teroson Atmosit" sealer, and install the joint bushes.
3. Mount the steering box on special tool P 285a without the 3 mm (0.12") spacing washers. Attach the joint bushes as determined by special tool P 285a and tighten the bellows holders. Tighten to approx. 7.0 mkp (50 lb/ft).
Warning:
The joint bushes must be installed and tightened evenly on both sides.

PORSCHE

Type 912 (5-speed-transmission)

Transmission Diagram



Subject to change without notice

METHOD OF ADJUSTMENT FOR CONTROL VALVE ON SPORTOMATIC
(911 E - 69 MODEL)

General

The method of adjustment used for the control valve on 69 Model cars can also be adapted to suit 68 Model cars.

Before this can be done, the layout of the operating linkage and throttle flaps in relation to the injection pump or the accelerator linkage, and the idling speed of the engine must be adjusted.

a. Upward shifts when accelerating

1. The plunger of the control valve must have 0,5 mm (0,02") reserve stroke in the full throttle position,



Fig. 1

2. Insert spacing washers with a total thickness of 3 mm (0,12") at one stop screw for the throttle flap and adjust the cam disc for the control valve plunger so that the cam just touches the plunger.



Fig. 2

3. A small clearance should always be present between the control valve plunger and the cam disc when the accelerator linkage is in the idling position.

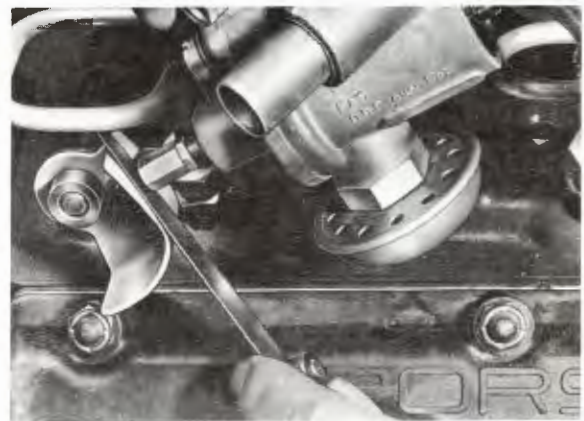


Fig. 3

b. Downward shifts when braking

See page SR 57.

(To correct the downward shift pattern on type 911 E cars the air cleaner need not be removed.)

Removal

1. Detach all hoses from the control valve.
2. Unscrew the hexagon nuts on the control valve holder and remove the valve and holder.
3. Remove the split pin and detach the plug-in cable connection to the control valve.



Fig. 4

4. Unscrew the control valve from the holder

Re-installing

1. After the control valve is removed, adjust the control valve plunger (see "A" in picture).

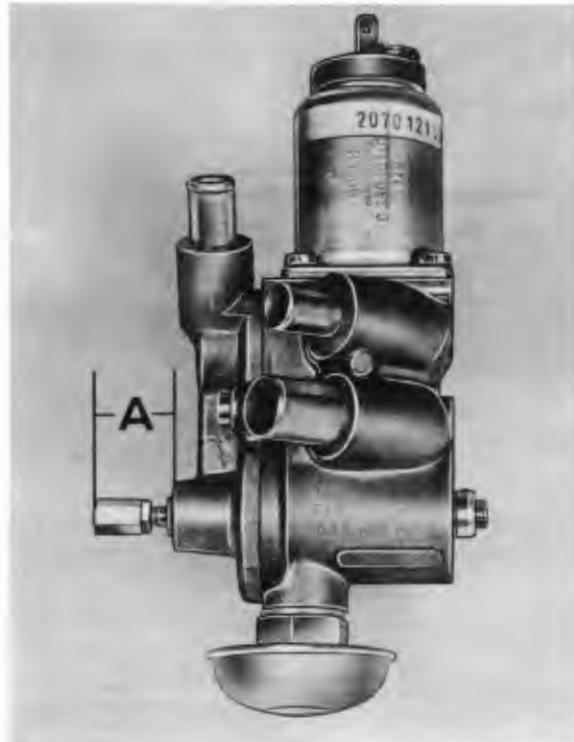


Fig. 5

2. Re-install the control valve and check that the adjustment has not altered. (See page SR 58a, item a "Upward shifts".) If necessary, remove the control valve again and adjust the length of the plunger until the correct result is obtained.

Note:

The cam disc can only be adjusted when the engine-transmission unit is removed from the car.

3. Coat the cam disc with MoS₂ paste where it makes it contact with the plunger.
4. Adjust the downshift action of the control valve (see page SR 58a or SR 57).

GEARBOX AND TRANSAXLE WITH PRESSURE CAST HOUSING

Effective from 30. November, 1968, cars of types 912, 911 T, 911 E and 911 S (not Sportomatic) are fitted as standard with a pressure cast gearbox housing.

Introduction of this pressure cast gearbox housing, together with other modifications to the gearbox and transaxle, have led to the establishment of new gearbox type numbers.

Summary of gearbox types:

Gearbox type 902/14 (4-speed)

7:31 (11:34, 19:32, 24:27, 28:24)

For vehicle type: 912

Gearbox type 902/16 (5-speed)

6:29 (11:34, 18:32, 23:28, 26:25, 29:23)

For vehicle type: 912 (option)

Gearbox type 902/60 (5-speed)

7:31 (11:34, 17:34, 20:31, 23:28, 26:25)

For vehicle type: 912 (option)

Gearbox type 901/12 (4-speed)

7:31 (11:34, 19:31, 25:26, 29:23)

For vehicle type: 911 T and 911 E-USA
911 E and 911 S (option)

Gearbox type 901/13 (5-speed)

7:31 (11:34, 18:34, 22:29, 25:26, 29:23)

For vehicle type: 911 E and 911 S
911 T (option)

Gearbox type 901/80/81/82/83/84 (5-speed)

7:31 (14:37, 18:32, 22:29, 26:26, 28:23)
(12:34, 17:34, 20:31, 22:29, 23:28)
(12:34, 18:34, 21:31, 23:28, 25:26)
(15:36, 20:32, 23:28, 26:26, 28:23)
(14:37, 20:32, 22:29, 25:27, 27:25)

For vehicle type: 911 T, 911 E and 911 S (option)

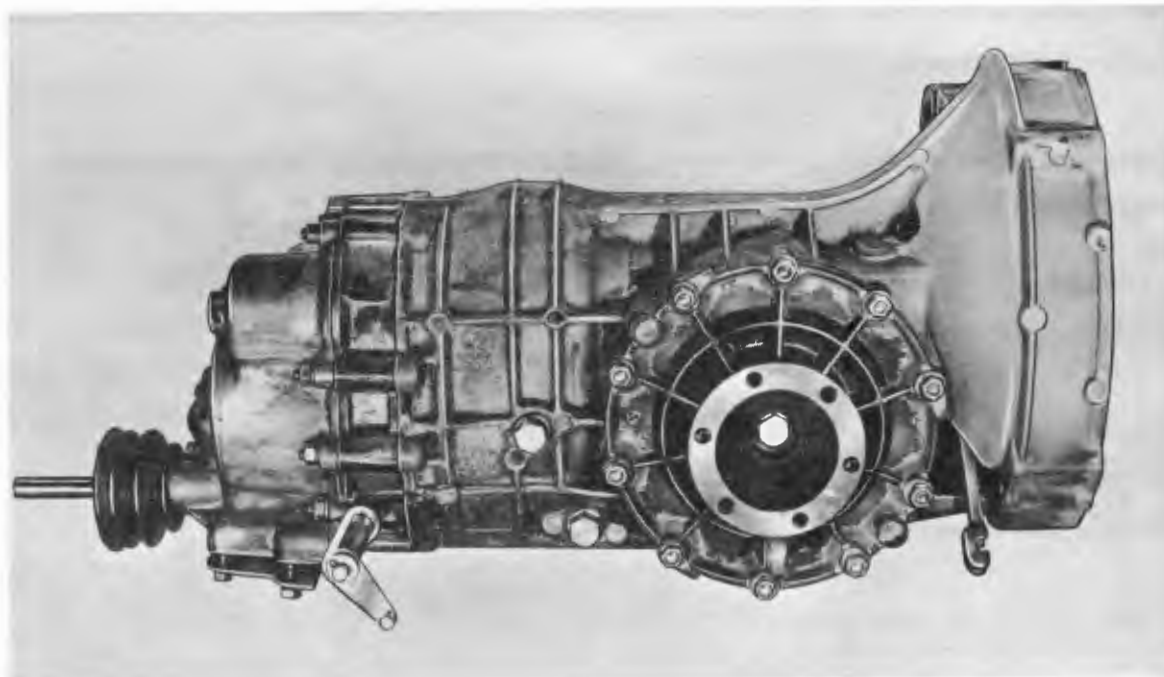


Fig. 1

Gearbox and transaxle with pressure cast housing have been modified as follows:

1. Gearbox housing, intermediate plate, front and side gearbox covers are now pressure castings.
2. To prevent contact corrosion, all studs, washers, etc. are specially corrosion protected.
3. Taper roller bearings for the differential have been enlarged, and this has led to modifications to the differential housing, spacer rings, spacing washers, joint flanges and sealing rings.

Warning:

Pressure-cast parts must not be cleaned with acid, since acids attack magnesium alloys. After any transmission repairs during which the one-season underseal is washed off the gearbox housing, or when the underneath of the vehicle is washed, we recommend that corrosion protection be improved on the pressure-cast gearbox housing by applying a bitumen or wax based one-season underseal, e. g. Tectyl, which should be sprayed or brushed on.

ASSEMBLY INSTRUCTIONS

For repair operations the following additional special tools are needed:

- P 258b Bush (two required)
to be used in conjunction with P 258 for
adjusting the driving shaft
- P 264b Drift
for assembling taper roller bearing in
differential housing

- P 265b Pressure piece
for assembling radial seals in rear axle
joint flanges

Gearbox - dismantling and reassembling

Dismantling

1. Screw special tool P 356b onto joint flange. Loosen joint flange expansion bolt and take off joint flange.

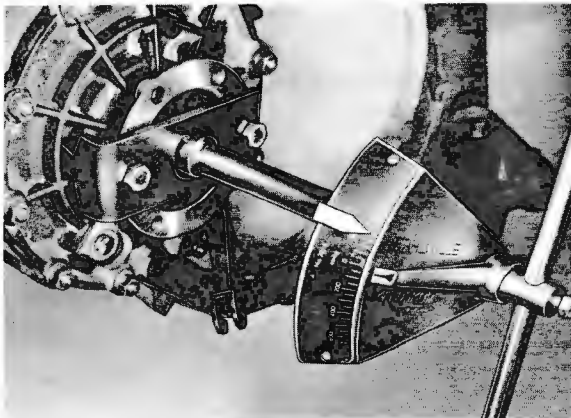


Fig. 2

2. Remove the opposite joint flange in the same way.
3. Unscrew the self-locking hexagon nuts on the side gearbox cover and drive off the cover with alternating blows of a suitable lever.



Fig. 3

4. Take out the differential complete with the crownwheel.
5. Remove the gearbox support on the front gearbox cover.
6. Unscrew the self-locking hexagon nuts on the front gearbox cover and remove the cover.
Warning:
Parts of the reverse gear will fall out.

Other assembly procedures are unchanged;
see page R 13, item 1 RA.

Assembly

See page R 16, item 1 RA.

Also note the following points:

1. When the reinforced 4-point ball bearing, spare part number 999, 052, 016, 00 was introduced, the outer half of the bearing inner race was no longer marked with an "x". The assembly instruction therefore no longer applies. The inner race bearing halves from one bearing must not however be combined with another bearing.
2. Tighten the castellated nut on the driving shaft (M 14x1, 5) to 9-11 mkp (65 - 80 lb/ft).
3. Drive in the radial seals for the rear axle joint flanges using special tool P 265b, until the special tool makes contact with the gearbox housing or the side gearbox cover,



Fig. 4

4. Pull on a new O-ring for the side gearbox cover, oil lightly and tighten the self-locking hexagon nuts to 2,1 - 2,3 mkp (15,2 - 16,6 lb/ft).



Fig. 5

Warning:

Use only special corrosion-proof steel spacing washers, spare part number 900, 031, 001, 02 under the hexagon nuts.

The self-locking hexagon nuts (spare part number 999, 090, 101, 02) can be used more than once.

5. Assemble the front gearbox cover and install; see page SR 146.

Fitting crownwheel

Special tools:

P 258 Gearbox calibrating pin

P 258b Bush (two needed)

See page R 46, item 11 RA.
Fitting procedure is unchanged.



Fig. 10

Adjusting crownwheel tooth backlash

Special tools:

P 259 Retainer and dial gage holder (for measuring crownwheel/pinion tooth backlash)

P 263 Pressure piece (to pull off taper roller bearings from differential housing)

P 264b Drift (for assembling taper roller bearings in differential housing)

P 357 Disc (to prevent differential from turning)

See page R 48, item 12 RA.
Note also the following procedures:

1. Install the side gearbox cover with an O-ring. Oil the O-ring slightly.
2. Tighten all self-locking hexagon nuts on the side gearbox cover to 2,1 - 2,3 mkp (15,2 - 16,6 lb/ft).
3. Push the disc of special tool P 357 onto the joint flange. Mount the joint flange. Place dial gage holder P 259 on the joint flange and secure with a suitable hexagon screw.



Fig. 11

Assembly and installation

See page R 52, item 15 RA.

Note in addition the following points:

1. Install the retaining screw for the angled speedometer drive with a washer, spare part number 900.031.001.02. Tightening torque 1.6 - 1.8 mkp (11.6 - 13 lb/ft).
2. Tighten the self-locking hexagon nuts to 2.1 - 2.3 mkp (15.2 - 16.6 lb/ft).
3. Do not forget to install the aluminum baseplates between the gearbox cover and the gearbox support, and to tighten the self-locking hexagon nuts to 2.1 - 2.3 mkp (15.2 - 16.6 lb/ft).



Fig. 12

Warning:

Use only special corrosion-proof steel washers, spare part number 900.031.001.02 under the hexagon nuts. A large washer must be placed between the ground strap and the gearbox cover. The self-locking hexagon nuts, spare part number 999.090.101.02, can be used more than once.

MODIFICATIONS TO REAR AXLE FROM 69 MODEL ON

1. Longer wheelbase caused by setting back rear wheel center line by 57 mm (2.244"). Wheelbase 2268 mm (89.291") - previously 2211 mm (87.047").

Principal modified parts:

Rear wheel semi-trailing arm (two versions - with and without pivot pin for stabilizer)

Longer rear wheel radius arm

Rear axle halfshaft

Rear axle torsion bar 23 mm (0.906") diameter - previously 22 mm (0.866") diameter

2. "Löbro" rear wheel halfshaft - larger version, to suit longer wheelbase and drive shaft for new wheel bearing.

3. Modified wheel bearing (see Fig. 1).

4. Shock absorber with shorter hollow rubber spring (3 rings) and new settings.

5. Stabilizers for rear axle.

Fitted as standard to model 911 S - 15 mm (0.591") diameter (not used on cars with self-leveling hydropneumatic spring struts).

6. Rear wheel torsion bars 23 mm (0.906") diameter - previously 22 mm (0.866") diameter.

New torsion bar setting: Types 911 T, 911 E and 911 S = $36^{\circ}30'$ to 37° (spring arm inclination)

Type 912 = $33^{\circ}30'$ to 34° (spring arm inclination)

7. Rear track

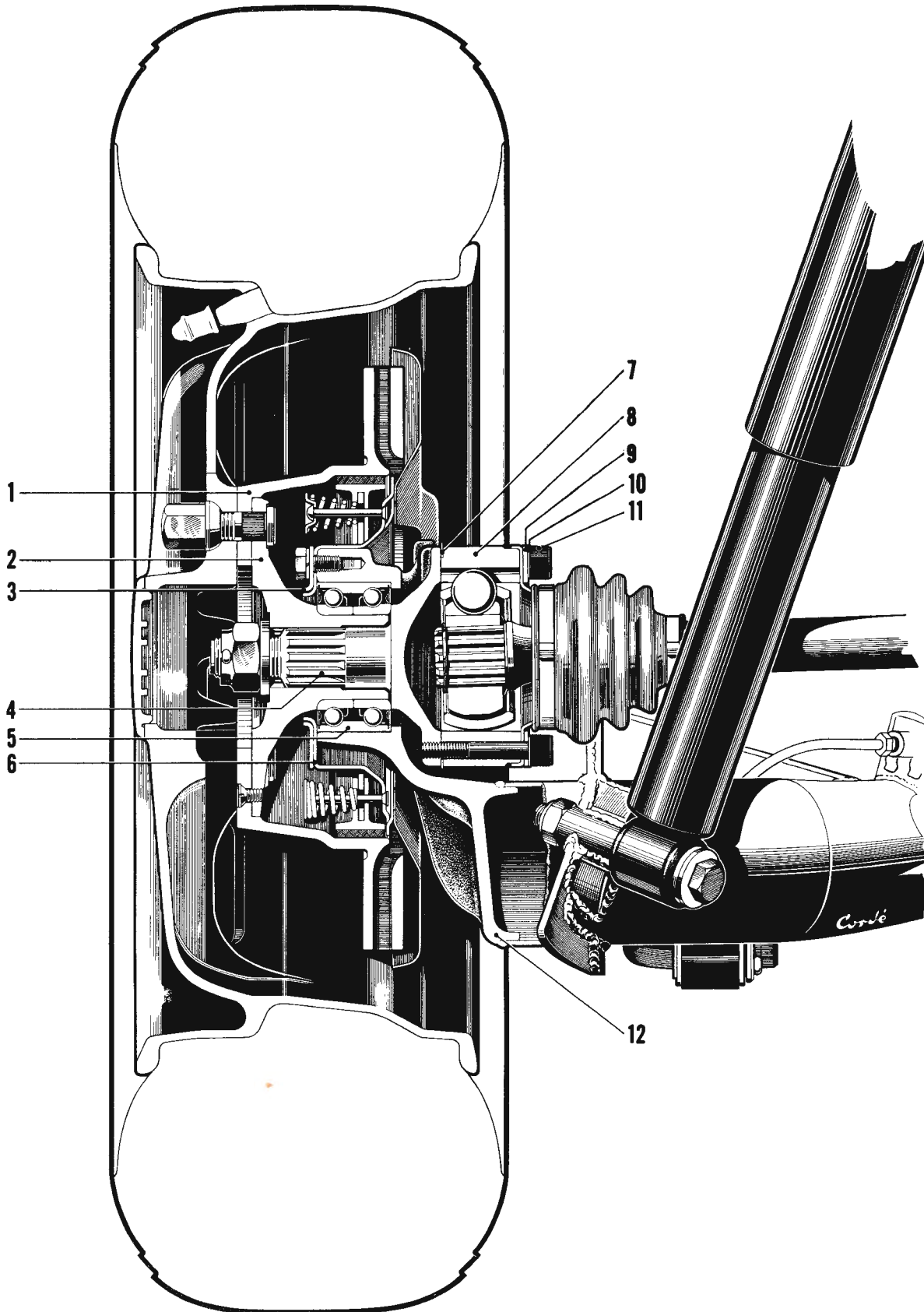
With 5 1/2 J x 15 wheels (steel disc) = 1343 mm (52.874")

With 6 J x 15 wheels (light alloy) = 1355 mm (53.347")

With 5 1/2 J x 14 wheels (light alloy) = 1345 mm (52.953")

8. Wheel alignment setting are unchanged.

The corresponding assembly procedures are described below:



- 1 Brake disc, rear
- 2 Rear wheel hub
- 3 Reinforcing cover
- 4 Stub shaft

- 5 Double-row ballbearing
- 6 Brake carrier plate
- 7 Seal
- 8 LÖBRO half-shaft

- 9 Bolt plate
- 10 SCHNORR serrated washer
- 11 Internal wrench bolt
- 12 Rear wheel control arm

REAR AXLE SEMI-TRAILING ARM - REMOVAL AND RE-INSTALLATION

Special tools:

P 36b Guide and retaining device
P 42a Torque wrench, max. reading 75 mkp
(540 lb/ft)
P 44a Extension
P 289 Spring arm clamping device

P 295b Test gage for semi-trailing arm
P 296 Socket wrench insert for rear axle nut
P 297 Extractor drift for rear wheel hub
P 298b Assembly jig

Removal

Note:

The rear axle semi-trailing arm can only be removed and installed after the complete engine-gearbox assembly has been removed.

1. Raise the car and take off the rear wheels.
2. Remove the brake line between the fixed caliper and the brake hose (first depress the brake pedal slightly with the pedal retaining clip and hold in position to prevent brake fluid from overflowing in the reservoir).



Fig. 1

3. Drive off the brake hose clip from the rear axle semi-trailing arm, and pull off the brake hose.

4. Loosen the bolts holding the fixed brake caliper, and take off the brake caliper.



Fig. 2

5. Loosen the countersunk head bolts on the brake disc and remove the brake disc.



Fig. 3

6. Using special tool P 289, lift the rear axle radius arm (spring link) and unscrew the hexagon bolt for the shock absorber.



Fig. 4

7. Remove the keeper from the castellated nut on the halfshaft and unscrew the nut, using special tools P 42a, P 36b, P 44a and P 296.



Fig. 5

8. Unscrew the cheese-head bolts on the halfshaft at the joint flange. Strike with a flat chisel near the flange gasket to separate the halfshaft from the joint flange, then take off the halfshaft.

Warning:
Do not damage the flange surfaces.



Fig. 6

9. Drive out the rear wheel hub with special tool P 297. If necessary remove the bearing inner race from the rear wheel hub.



Fig. 7

10. Remove the split pin and castellated nut from the brake cable and pull the brake cable out towards the center of the vehicle.



Fig. 8

11. Unscrew the hexagon bolt holding the shield plate.



Fig. 9

12. Unscrew the hexagon bolts on the brake carrier plate and remove the brake carrier plate and shield plate.



Fig. 10

13. Take off the handbrake cable guide.

14. Unscrew the hexagon nuts on the attachment bolts and the eccentric bolts on the rear axle semi-trailing arm flange, and remove the bolts.



Fig. 11

15. Unscrew the self-locking hexagon nut on the hexagon bolt for the semi-trailing arm pivot bearing, and pull out the bolt.



Fig. 12

16. Press out the radial ball thrust bearing.



Fig. 13

17. The flanblocs for the semi-trailing arm pivot bearing can only be removed by breaking them up.

1. Check semi-trailing arm for distortion with special tool P 295b.

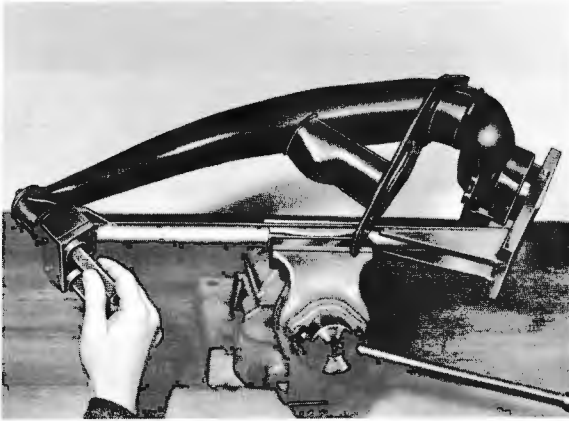


Fig. 14

When the flanblocs are pressed into the semi-trailing arm, it should be possible to fit the test pin on the gage. Distorted semi-trailing arms must be replaced.

2. Check the flanblocs of the semi-trailing arm pivot bearing for wear and damage, and replace if necessary.

When installing, note the following procedures:

1. If the flanblocs were removed, press in new flanblocs until they make contact with the end face in the semi-trailing arm.

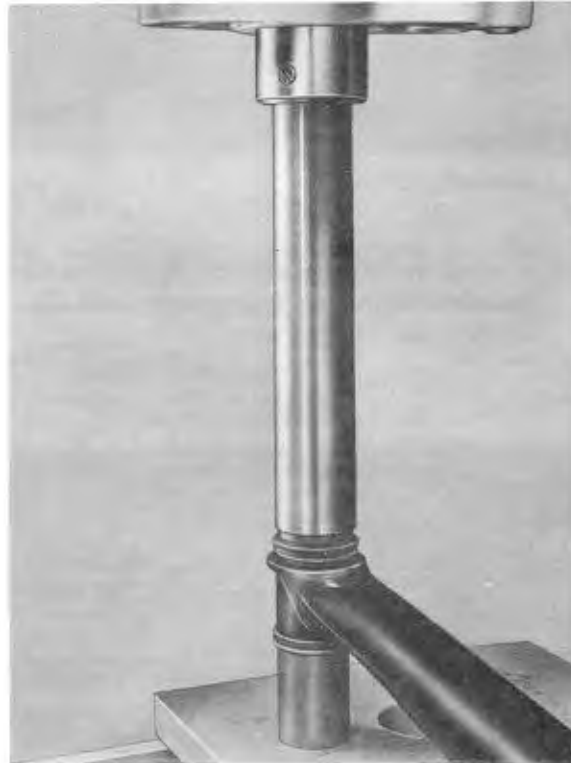


Fig. 15

2. Heat the pivot bearing housing on the semi-trailing arm to approx. 120°C (250°F) and push in a new ball thrust bearing.

Warning:

The radial ball thrust bearing must always be replaced.

3. Use a new self-locking hexagon nut for the hexagon bolt (M14) on the rear axle semi-trailing arm, and tighten to 12 mkp (87 lb/ft). At the same time lift the semi-trailing arm until the lower surface is level with the upper surface of the rear wheel radius arm.

4. Tighten the rear axle radius arm retaining bolts to 9, 0 mkp (65 lb/ft).
5. The camber adjustment cam should be tightened to 6, 0 mkp (43 lb/ft) and the toe-in adjustment cam to 5, 0 mkp (36 lb/ft).
6. Tighten the hexagon bolts for the brake support plate to 2, 5 mkp (18 lb/ft).
7. Tighten the hexagon bolt for the shield plate to 2, 5 mkp (18 lb/ft).
8. Screw on the castellated nut for the handbrake cable until the hole for the split pin and the slot in the castellated nut are aligned. Then secure, using a new split pin.
Warning:
Check correct position of expander clip.
9. Pull rear wheel hub into radial ball thrust bearing, using special tool P 298b and drive shaft.
Warning:
Do not drive the rear wheel hub into the bearing or the bearing may be damaged.
10. Use a new gasket for the joint shaft flange and check that the flange surfaces are smooth and entirely free from grease.
11. Tighten the cheese-head bolts (M 10x55 - 12 K) for the joint shaft flange to 8, 3 mkp (60 lb/ft). The locking washers for the cheese-head bolts must be fitted with the hollow side against the spacing plate.
12. Tighten the castellated nut on the halfshaft to 30 - 35 mkp (215 - 250 lb/ft) and secure with a new split pin.
13. Tighten the hexagon bolt for the shock absorber to 7, 5 mkp (54 lb/ft).
14. Tighten the bolts retaining the brake caliper to 7, 0 mkp (50 lb/ft), using new spring washers.
15. Bleed the brake system, and check for leaks (see group "B").
16. Check handbrake setting and adjust if required (see group "B").
17. Adjust rear wheel track and camber (see group "W").



Fig. 16

Note:

Remove and re-install halfshaft (see page SR 156). If you wish to replace the outer sealing gaiter, it is best to detach the joint section from the drive shaft and to leave the drive shaft with its castellated nut attached to the car.

1. Clamp the halfshaft into the vise, using protective jaws.

2. Using side cutters, cut up and remove the "ear clips".

3. Separate the larger diameter of the sealing gaiter from the protective cap.

4. Unhook the circlip from the half shaft.



Fig. 17

5. Press of the joint section from the halfshaft.



Fig. 18

6. Take off the cup spring and pull of the sealing gaiter.

7. Clean all components.

Warning:

Make sure that the sheet metal protective cap, which is sealed with Curil K, does not become separated from the halfshaft joint section.

8. Attach the cup spring to the joint section with the correct grade of grease, making sure that the hollow side of the spring faces the joint section.

9. Clean all grease from the mating surface for the large diameter of the sealing gaiter, and attach the sealing gaiter with sealing compound (EC 750 M-2G 51). The adhesive is made by:

Minnesota Mining and Manufacturing Co.

10. Tighten the new "ear clip" with blunt-ended pliers, and check that the ears are located at the same height as the spiral pins.



Fig. 19

14. Work the remaining 30 g (1.06 oz.) of grease into the joint from the outside and compress the sealing gaiter slightly so that grease also enters the joint from the inside.

11. Pack the sealing gaiter with 40 g (1.4 oz.) of grease taken from the total specified quantity per joint, inserting the grease through the smaller diameter of the sealing gaiter.

Warning:

Use only the following grades of grease:

Molykote BR 2 or
Shell Retinax AM

Quantity of grease per joint: 70 g (2.5 oz.)

12. Push the joint section with the sealing gaiter onto the halfshaft. Make sure that the cup spring seats correctly, and push the ball hub onto the half-shaft with a suitable of tube.
13. Fit the circlip, making sure that it locates correctly in the groove on the halfshaft.

Special tools:

P 36b Guide and retaining device
P 42a Torque wrench, max. reading 75 mkp
(540 lb/ft)

P 44a Extension
P 289 Spring link clamping device
P 296 Socket wrench insert for rear axle nut

Removal

1. Raise the vehicle and take off both rear wheels.
2. Lift the rear radius arm (spring link) with special tool P 289, and unscrew the hexagon bolt for the shock absorber.



Fig. 20

4. Unscrew the cheese-head bolts on the halfshaft at the joint flange. Separate the halfshaft from the joint flange using a flat chisel along the flange gasket, and take off the halfshaft.

Warning:
Do not damage the flange surfaces.

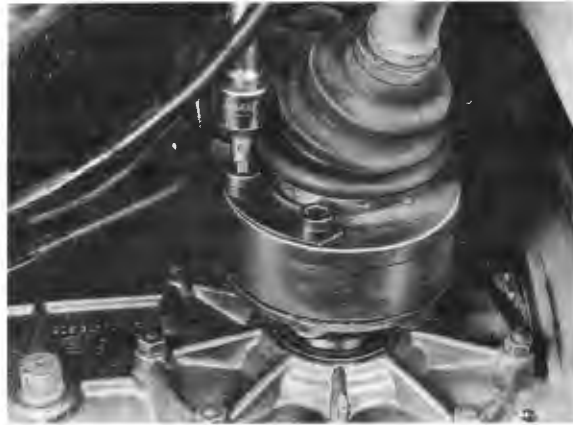


Fig. 22

3. Remove the keeper for the castellated nut on the halfshaft and unscrew the nut, using special tools P 42a, P 36b, P 44a and P 296.



Fig. 21

Checking

Check the halfshaft joints for excessive play. If the joints are defective the halfshaft must be replaced.

Installation

When re-installing, note the following procedures:

1. Use a new gasket for the flange and make sure that the flange surfaces are smooth and completely free from grease.
 2. Tighten the cheese-head bolts (M 10x55 - 12 K) for the halfshaft flange to 8,3 mkp (60 lb/ft). The hollow faces of the locking washers for the cheese-head bolts must lie against the spacer plate.
 3. Tighten the castellated nut on the halfshaft to 30 - 35 mkp (217 - 253 lb/ft), and secure with a new split pin.
 4. Tighten the hexagon bolt for the shock absorber to 7,5 mkp (54 lb/ft).
-

General

The double-row radial ball thrust bearing is permanently packed with grease provided with a seal on both sides and therefore entirely maintenance-free.

Warning:

When the rear wheel hub is dismantled the radial ball thrust bearing will be destroyed and must always be replaced after this job has been carried out.

Removal

1. See "Rear axle semi-trailing arm, removal", page SR 149, items 1, 2 and 4 to 12.
2. Drive out the radial ball thrust bearing with a suitable length of tube,



Installation

1. Force in the new radial ball thrust bearing with a length of tube over the outer race.

Warning:

Never strike the inner race of the radial ball thrust bearing or use the inner race of the bearing to drive the complete bearing into position.

2. Items 6 to 16 on page SR 153, "Rear axle semi-trailing arm - installation".



MEASURING WHEEL ALIGNMENT ON CARS WITH SELF-LEVELING
HYDROPNEUMATIC SUSPENSION STRUTS

Special tool: P 301b Measuring pin

General

Before wheel alignment values can be checked or adjusted the front axle of cars with self-leveling hydro-pneumatic spring struts must first be brought to the correct height,

1. Insert the measuring pins of special tool P 301b through the hollow of the sub-frame until they make contact with the left and right wishbones. Attach the measuring pins with a small quantity of grease.

Warning:

If a hydraulic car jack is used, make sure that the jack does not sink while measuring is taking place.



3. Carry out the normal wheel alignment check and adjustment procedure.

Warning:

Use the wheel alignment values supplied for 68 models.

Fig. 1

2. Lift the car at the front center with a car jack until the correct height of 108 mm (4, 252") is reached (see page W 4).

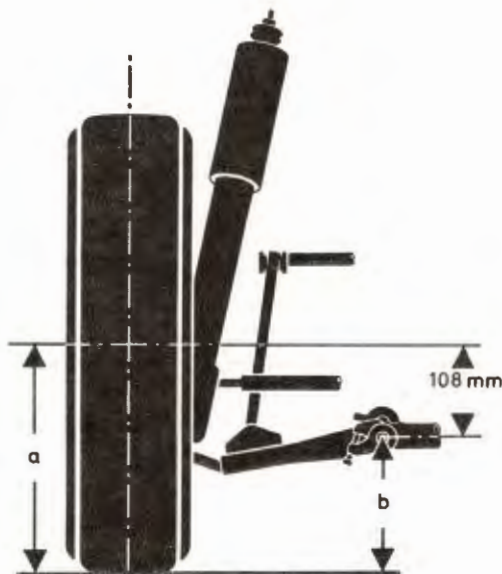


Fig. 2

BRAKE MODIFICATIONS FOR '69 MODELS

Type 912, 912-USA, and 911 T (except Sportomatic)

Technical Data

Effective brake disc diameter, front 235 mm (9.252"); rear 244 mm (9.606") - formerly 243 mm (9.567") -

Brake pad area, per wheel (service brake), front 52.5 cm² (8.14 sq. in.); rear 52.5 cm² (8.14 sq. in.)
- formerly 40.0 cm² (6.20 sq. in.) -

Total effective brake area (service brake) 210 cm² (32.55 sq. in.) - formerly 185 cm² (28.67 sq. in.) -

Total effective brake area (parking brake) 170 cm² (26.35 sq. in.) - formerly 210 cm² (32.55 sq. in.) -

Handbrake drum diameter 180 mm (7.087")

Brake lining width 25 mm (.984") - formerly 30 mm (1.181") -

Brake master cylinder diameter 19.05 mm (.750"); 18/13 stroke

Wheel brake cylinder diameter, front 48 mm (1.890"); rear 38 mm (1.496") - formerly 35 mm (1.378") -

Front Wheel Brakes

Solid-disc brakes.

Main Changes:

Grey-cast fixed caliper "M" with extended bleeder valve for use with 14" wheels.

Rear Wheel Brakes

Solid-disc brakes.

Main Changes:

Grey-cast fixed caliper "M" (formerly grey-cast fixed caliper "L" with connecting line).

Brake disc with wider handbrake pot for use with the new wheel mounting and larger brake caliper.

Brake disc outside diameter 290 mm (1.417"), formerly 285 mm (1.220").

Handbrake lining width 25 mm (.984"), formerly 30 mm (1.181").

Handbrake cables, spacer tube, handbrake cable bracket, disc shroud, and brake lines modified for use with the new rear wheel mounting.

Technical Data

Effective brake disc diameter, front 228 mm (8.976") - formerly 235 mm (9.252") -

rear 244 mm (9.606") - formerly 243 mm (9.567") -

Brake pad area, per wheel (service brake),

front 76 cm² (11.78 sq. in.) - formerly 52.5 cm² (8.14 sq. in.) -

rear 52.5 cm² (8.14 sq. in.) - formerly 40 cm² (6.20 sq. in.) -

Total effective brake area (service brake) 257 cm² (39.84 sq. in.) - formerly 185 cm² (28.67 sq. in.) -

Total effective brake area (parking brake) 170 cm² (26.35 sq. in.) - formerly 210 cm² (32.55 sq. in.) -

Handbrake drum diameter 180 mm (7.087")

Brake lining width 25 mm (.984") - formerly 30 mm (1.181") -

Brake master cylinder diameter 20.64 mm (.813"); 20/11 stroke - formerly 19.05 mm (.750"); 18/13 stroke -

Wheel brake cylinder diameter, front 48 mm (1.890"); rear 38 mm (1.496")

Front Wheel Brakes

Vented-disc brakes.

Main Changes:

Light-alloy fixed caliper "S" in a single housing (formerly grey-cast caliper "M").

Appropriately modified disc shrouds.

Rear Wheel Brakes

Vented-disc brakes.

Main Changes:

Wide version of grey-cast fixed caliper "M" (formerly grey-cast fixed caliper "L" with connecting line).

Brake disc with wider handbrake pot for use with the new wheel mounting and larger brake caliper.

Brake disc outside diameter 290 mm (1.1417"), formerly 286 mm (1.1260").

Handbrake lining width 25 mm (.984"), formerly 30 mm (1.181").

Handbrake cables, spacer tube, handbrake cable bracket, disc shroud, and brake lines modified for use with the new rear wheel mounting.

WHEELS AND TIRES

Summary of standard wheels and tires:

Up to 68 Model	Perforated disc wheels (steel or light alloy): 4 1/2 J x 15 Tires: 165 HR 15 (Types 912 and 911), 165 VR 15 (Type 911 S)	
68 Model	Perforated disc wheels (steel or light alloy): 5 1/2 J x 15 Tires: 165 HR 15 (Types 912, 911 T and 911 L), 165 VR 15 (Type 911 S)	
From 69 Model on	<u>Vehicle types: 912, 912 USA and 911 T</u> Standard equipment: Perforated disc wheels (steel): 5 1/2 J x 15 Tires: 165 HR 15	Special option: Perforated disc wheels (light alloy): 5 1/2 J x 14 and 6 J x 15 Tires: 185 HR 14 and 185/70 VR 15

Type 911 E

Standard equipment:
Perforated disc wheels (light alloy): 6 J x 15 - for USA and Sportomatic 5 1/2 J x 14
Tires: 185/70 VR 15 and 185 HR 14

Type 911 S

Standard equipment:
Perforated disc wheels (light alloy): 6 J x 15
Tires: 185/70 VR 15

Perforated disc wheels (steel or light alloy) - checking

Measuring points for checking vertical and lateral runout on inside of rim, see Fig. 1.
Distance "a" = 8 mm (0,315")

Max. permitted vertical and lateral runout 1,25 mm (0,049")

Warning:
Distorted rims must not be straightened.

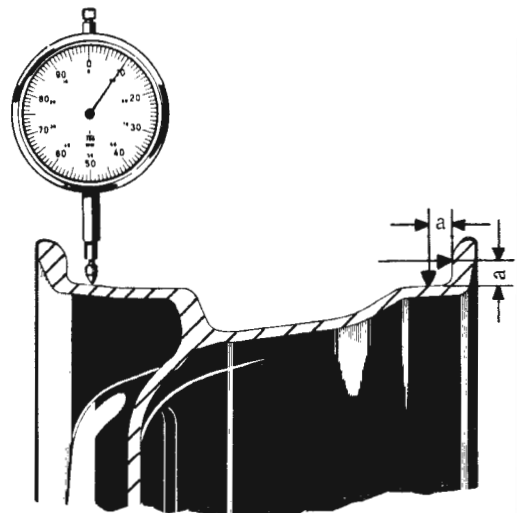


Fig. 1

Wheel changing

When changing wheels, note the following points:

1. Coat the domed ends of the wheel nuts with an MoS_2 paste, for example Molykote G Rapid or LM 348. This is important for aluminum wheel nuts.
2. Make sure that the domed ends of the wheel nuts locate properly in the recesses in the perforated disc wheels.
3. Tighten the wheel nuts in an X pattern to 13 mkp (94 lb/ft).

Balancing wheels

The max. permitted dynamic and static out of balance force is 10 g (.353 oz.).

Warning:

On 5 1/2 J x 14 light alloy perforated disc wheels the balance weights should be secured by adhesive on the outside of the rim only. On the inside of the rim weights should be secured with spring clips (as used for steel disc wheels), since the larger weights of the type secured by adhesive could make contact with the fixed calipers of the disc brakes.

TIRES

Tire sizes

Tire reference no.		165 HR 15 or 165 VR 15 (rim size 5 1/2 J x 15)	185/70 VR 15 (rim size 6 J x 15)	185 HR 14 (rim size 5 1/2 J x 14)
Outside diameter	app.	650 mm (25, 59")	650 mm (25, 59")	650 mm (25, 59")
Nominal width of tire	app.	177 mm (6, 97")	196 mm (7, 72")	188 mm (7, 40")
Effective static radius	app.	295 mm (11, 61")	295 mm (11, 61")	295 mm (11, 61")
Effective dynamic radius	app.	314 mm (12, 36")	314 mm (12, 36")	314 mm (12, 36")

Tire pressures (suggested): (measured with tires cold)

Front 1, 8 atü (26 psi); rear 2, 0 atü (28 psi)

For road speeds above 200 kph (125 mph): Front 2, 2 atü (31 psi); rear 2, 4 atü (34 psi)

Recommended pressures for winter tires: Front 2, 0 atü (28 psi); rear 2, 2 atü (31 psi)

Note:

If the car is parked for a long time without taking the weight off its wheels, tire pressures should first be increased to 4 atü (57 psi), to prevent flat spots forming at the tire contact patches.

Installation instructions:

Light alloy perforated disc wheels

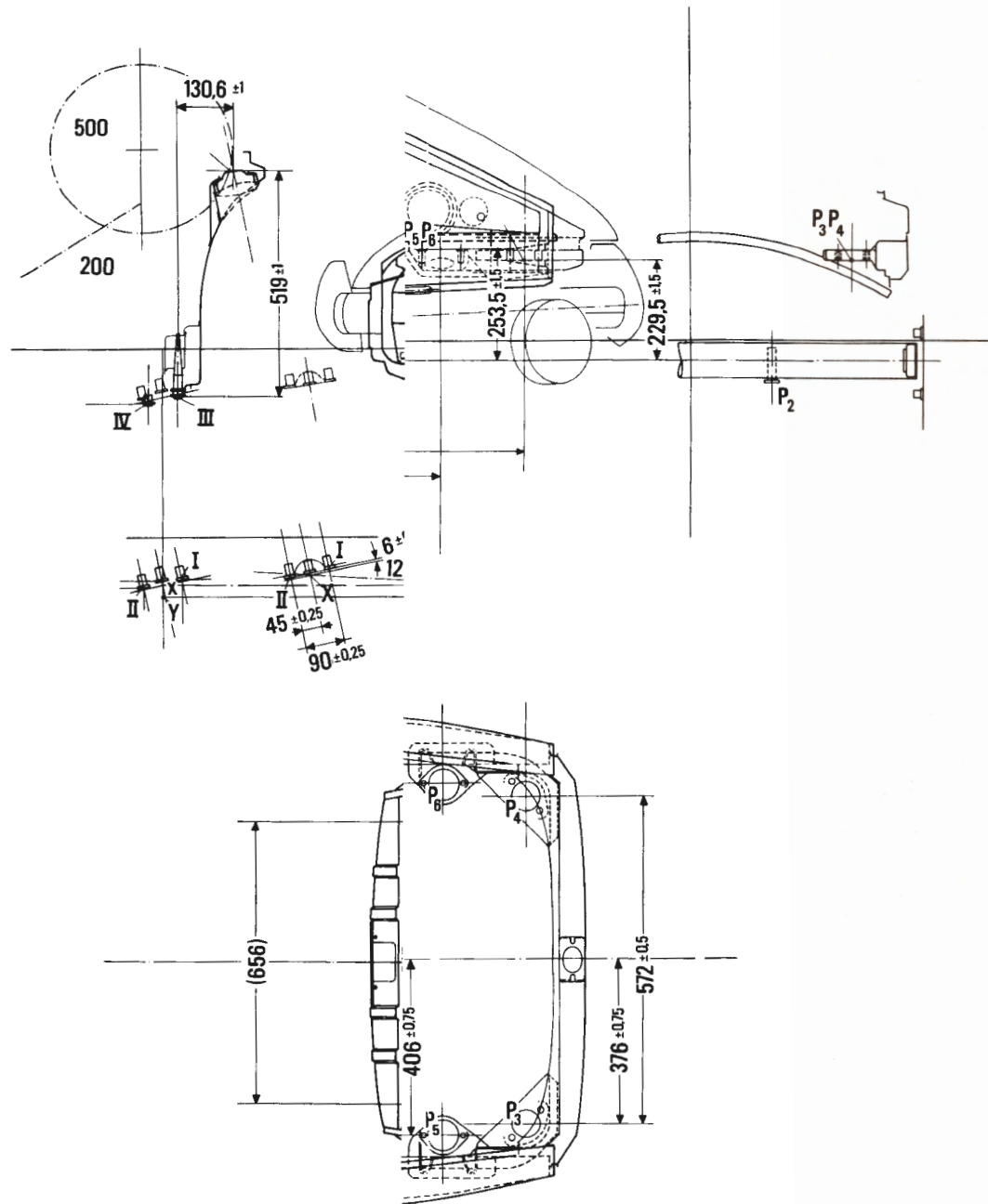
To prevent damage to the light alloy wheels, the tires can be fitted or removed over the inner side of the rim. Use a thick leather protective sheet to prevent damage to the light alloy surfaces by contact between the outer side of the wheel and the tire fitting device.

Warning:

When fitting or removing tires, always coat the tire beads with fitting compound.

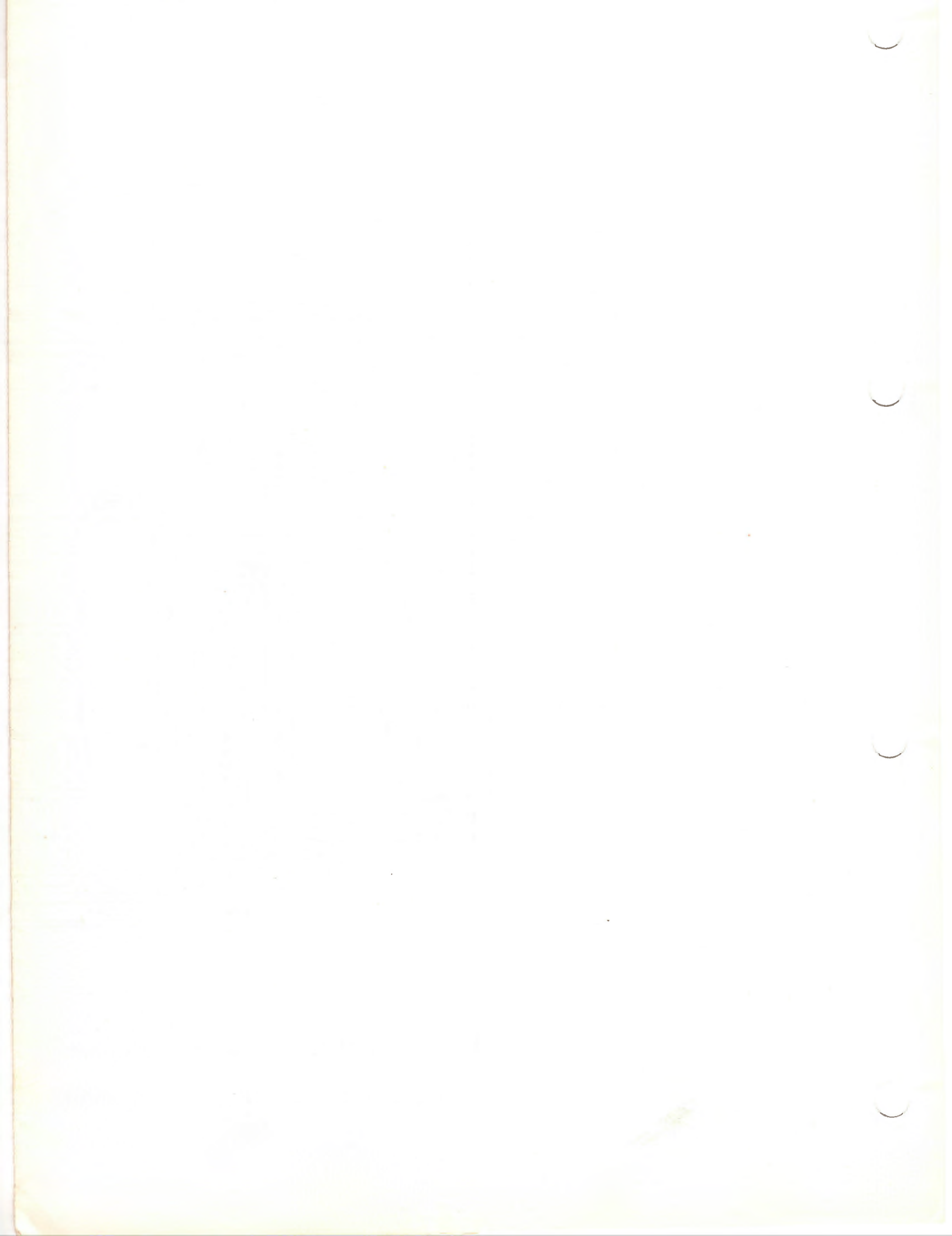
Tubes

For reasons of safety tubes should be fitted only once. When replacing the tires always use new tubes as well. If possible the tubes should be of the same make and size as the tires. Never use a tube which has been repaired.



le fond type 911 et 912

type 911 and 912



CONTENTS

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CHECKING AND RECONDITIONING UNDERSEAL

General

The car's underseal should be checked and reconditioned every two years at the latest. To do this, wash down the underside of the car thoroughly to remove all dirt. Take off any loose areas of the underseal with a trowel or a compressed air jet. Underseal is often damaged in the areas behind the wheels, where stones are thrown up from the road. The check should be carried out with great care because loose areas of underseal can be penetrated by water and dirt and thus render the underseal protection ineffective. Before the underseal coating is reconditioned, areas covered with rust should be cleaned as thoroughly as possible. Grease and oil must also be carefully removed and the surface must be dry, or else the new underseal coating will not adhere. It is normal to apply underseal with a special spray gun, operating at 5 - 6 atm (70 - 85 psi). Smaller damaged areas can be repaired with a brush. Make sure that all joints and corners are filled carefully. Before spraying on underseal these areas should be packed with sealing compound and covered over with adhesive matting. Water drain hose, components of the suspension etc. , and also the outer edges of the body must be blanked off or covered over before the spray gun is used. Underseal coating should be applied between 1.5 and 3 mm (0.06 and 0.12") thick. The work should be carried out in a special area, for example a washing booth, so that other cars are not made dirty by accident. Never use a paint spray booth for the purpose.

Our vehicles are undersealed as standard over the entire underside of the body, inside the luggage and engine compartments and in the rear seat area of the bodyshell.

To recondition the underseal we recommend using N 431 underseal from the National Chemical Co. , or genuine Teroson underseal from the Teroson company.

If other products are used, the supplier or maker should give a guarantee of permanent protection, and the products should fulfil the same requirements. In general, the instructions and conditions imposed by the maker of the underseal should be observed.

If bodysHELLS damaged in an accident are to be aligned on the Celette alignment and assembly stand, we recommend using these alignment charts.

The alignment chart should be used to record accurately and completely all dimensions for the chassis pickup points and all variations from the nominal dimensions. For measuring points with tolerances, see page B 58. The date, chassis number and the name of the tester should be entered at the head of the chart.

Correctly completed alignment charts are a useful source of information for your workshop records. If queries arise, they can be used to provide evidence of damage to the owner or to an insurance company.

Measuring points

I and II	front wishbone pivots
III	sub-frame pickup point
IV	pickup point for radius arm on sub-frame
V	shock absorber pivot points
P I and II	gearbox mountings
P III	engine mounting, type 912
P IV	engine mounting, type 911
P V	rear shock absorber mountings

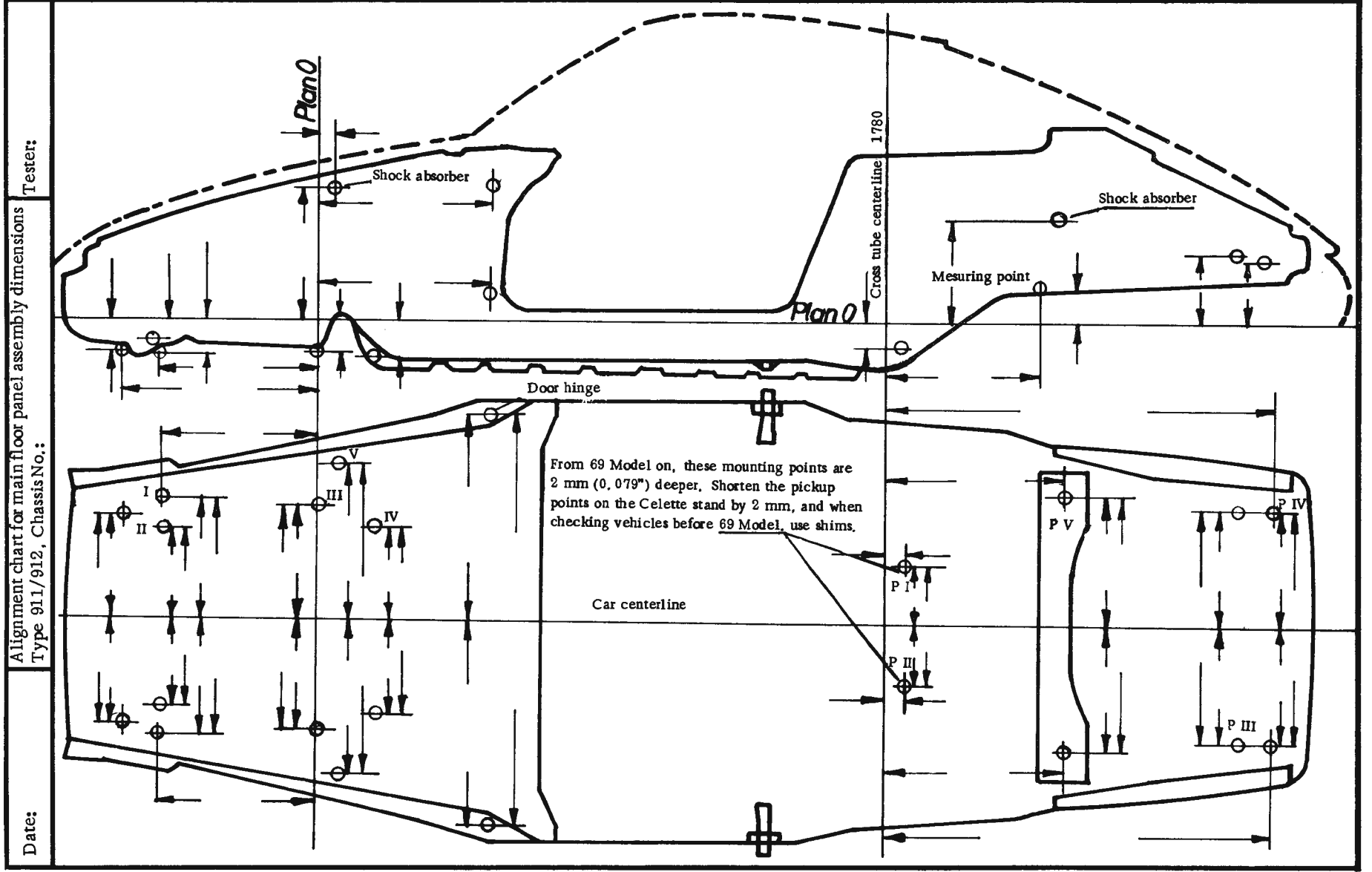


Fig. 1

General

From 69 Models on, the dashboard covering is made in one piece.

The frame for the covering is foam padded and covered with leatherette. The covering is attached to the dashboard with 7 M 6 screws and with plastic clips. A loudspeaker can be installed on the dashboard beneath the perforated cover, which is held in position with spring clips. Cutouts for screens are provided on the front face, and these can be secured with clips over the heater outlet nozzles.

The dashboard trim panels consist of a chromium-plated frame with embossed grain leatherette panels inserted and secured with adhesive. If a radio is subsequently fitted the leatherette trim panel can be removed and a special radio panel inserted.

Various switches, the ignition/starter switch and control levers for heating and ventilation are installed on these panels.

The knee rail is in three sections. The outer sections are secured by two M 6 screws to the dashboard. The center section is attached to the ashtray and protected by a fireproof plate installed at the same time. The ashtray is tilted down to open. If the chromium-plated spring inside is pressed down, the ashtray can be removed from its plastic holder.

A glovebox light is installed above the glovebox lid, and has three switch positions. The light is held in the dashboard by over center spring clips.



Fig. 2

DOOR - DISMANTLING AND DETACHING

Special tools: P 290 Extractor

General

From 69 Models on, door specifications have been changed. The window crank handles are reinforced, the pivot points have been moved and the reduction ratio changed to give 5 complete turns. The window guide rails have longer guide slots and in addition the openings for insertion of the sliding blocks on Targa bodies have been installed at the front. The inside door handles have been recessed into the armrests and are of the pull-up type. The door storage boxes are shaped pressings. The rear storage compartment can be folded down, and its lid is formed by the armrest. The front open compartment has a bar round its edge which can be used on the driver's side to close the door. On the Coupe body the smaller door window is fixed, but on Targa bodies it takes the form of a swivelling vent window. The shape of the door trim panels, decorative strips and armrests have been modified.



Fig. 3

1. Unscrew the decorative strip and the internal door lock knob.
2. Take off the window crank handle padded cover and unscrew the handle.
3. Take off the rubber surround for the folding storage box, detach the box from its retaining spring and unscrew the box.
4. Unscrew the bolts holding the armrest. Detach the lock operating lever from its connecting linkage and remove the armrest.

5. Loosen the plastic sheet, then working from the inside unscrew the rear attachment screw of the door closing bar. Remove the front attachment screw and unscrew the door pocket at the bottom.



Fig. 4

6. Separate the door panel from the inner frame of the door, unscrew the spring plate, pull off the window aperture seal and the plastic sheet and lift off the chromium-plated strip from the upper edge of the door.
7. Unscrew all the threaded connections for the door window frame or the window guide rail (Targa) and pull the frame out upwards.
8. Coupe version:
Push the glass forwards until the sliding block of the window regulator can be freed from the lift rail, then take out the window. After this unscrew the window lift regulator.
Targa version:
First detach the window lift retaining screws, then remove the window.
9. Unscrew the outside door handle. Unscrew the door lock complete with inside locking mechanism and remote control, and remove from the door.
10. Unscrew the outside mirror, detach the door stay at the hinge pillar drive out the hinge pins with special tool P 290 and take off the door.

1. Attach the door at its hinges, install the door stay mechanism and secure, assemble the door lock with remote control and inner catch and install in the door. Attach the small felt pads beneath the connecting rods with adhesive.

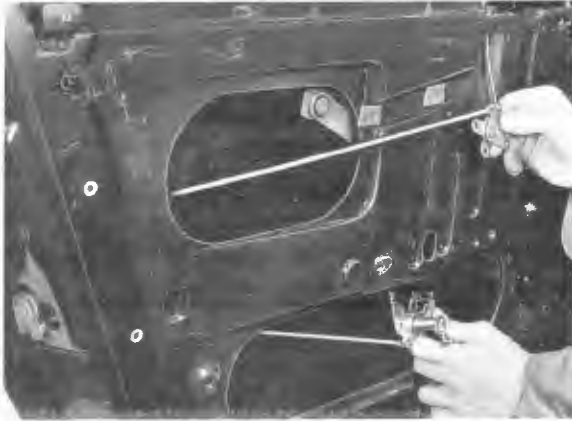


Fig. 5

2. Install the outside door push with washers.
3. Install and tighten the window regulator. Tighten the 6 mm screws to 1,2 mkp (8,7 lb/ft) torque.
4. Press in the window aperture covers.

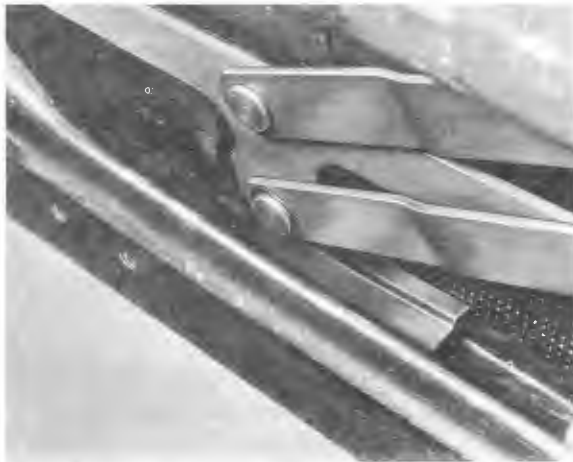


Fig. 6

5. Insert the door window glass and attach the rubber pad to the base with adhesive.

6. Insert the door window frame, guiding the glass into the frame and aligning it with the cutout in the door. Tighten 8 mm screws to 2,2 mkp (16 lb/ft) torque; tighten 6 mm screws to 0,9 mkp (6,5 lb/ft) torque.

Warning:

When light alloy window frames were introduced, 3 mm (0,12") narrower door window glass was used. Glass of this thickness must not be fitted in doors with chrome frames, and the wider windows must not be used for doors with light alloy window frames.



Fig. 7

7. Using sealing compound, fill between the window frame and the inside door panel near the small door window on the inside of the door. Check that the door window moves up and down easily.



Fig. 8

8. Attach the plastic sheet as far as the rear lower opening with adhesive to form a watertight seal with the inner door panel.
9. Screw on the retaining spring plate to the inner door panel. Make sure that the holes for the door pocket and the armrest align with those on the inner panel.

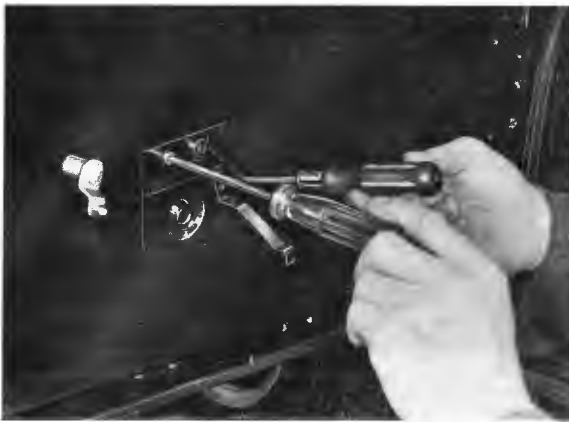


Fig. 9

10. Press in the plastic grommets on the inner door panel, attach the plastic clips to the door trim panel and fix the panel in position. Attach the window crank handle.



Fig. 10

11. Screw on the front door pocket with door closing bar. Push the screws from the rear through the door trim panel and the inner door panel, and tighten with nuts and spring washers. Attach the plastic sheet with adhesive.



Fig. 11

12. Connect the pull up door handle installed in the armrest to the joint and remote control mechanism, and replace the armrest in position with three M 6 internal hexagon screws.



Fig. 12

13. Screw the folding storage box to its hinges so that it is correctly aligned with the door pocket and properly closed by the armrest.

14. Pull the rubber strip through the retaining plates, the folding pocket and the retaining eyes on the inner panel and insert the ends through the inner panel on both sides.

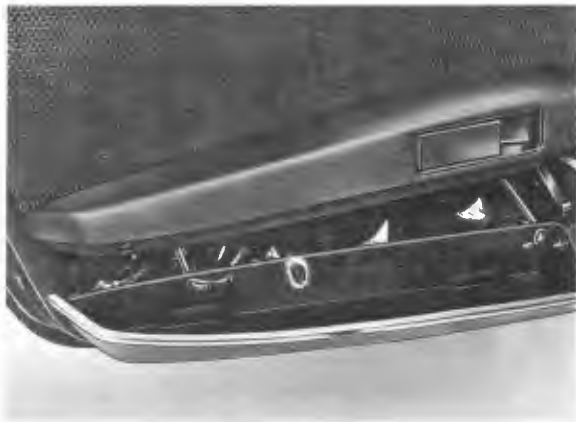


Fig. 13

15. Attach the retaining spring, check operation of the folding box and if necessary alter the run of the rubber strip.

16. Attach the decorative strip and the pushbutton. Install the chromium-plated strip on the upper edge of the door with sealing compound.



Fig. 14

DOOR - REASSEMBLY (TARGA, FROM 69 MODEL ON)

1. Mount door on hinges, install door stay and screw into position, insert and attach door lock with remote control and inner locking mechanism already in position. Attach small felt pads below connecting rods with adhesive.

2. Install the outer door push with washers.

3. Press-in the window well seals.

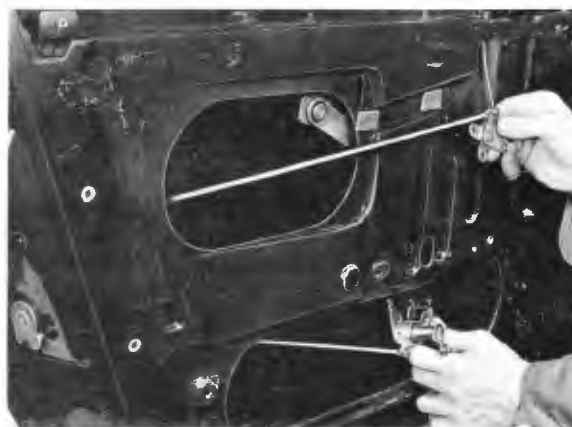


Fig. 15

4. Insert the door window and the window regulator, connect the two parts together and then screw on the window lift mechanism. Tighten 8 mm screws to 2,2 mkp (16 lb/ft) torque; tighten 6 mm screws to 1,2 mkp (8,7 lb/ft) torque.



Fig. 16

5. Install the rubber pad in the door well to support the window lift mechanism with adhesive.
6. Insert the door window frame with the vent window and the window guide rail, adjust to fit and tighten screws.

On new door window frames, rubber corner pieces are used to improve the joint with the folding roof.



Fig. 17

7. Wind up the window fully, adjust the position of the stop angle for the window lift mechanism on the inner door panel, then tighten firmly.

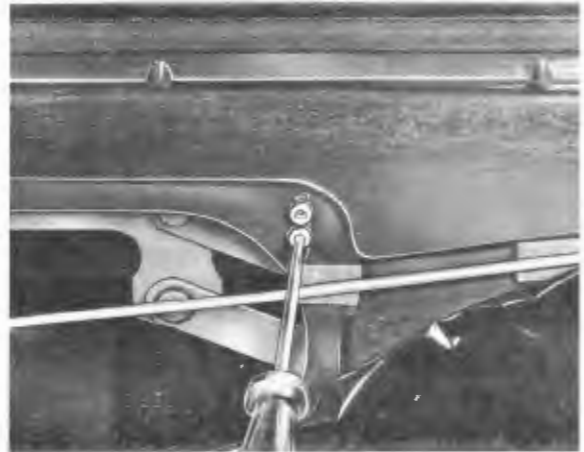


Fig. 18

8. Apply sealing compound to the joint between the window frame and the inner door panel near the swivelling vent window.
9. Attach plastic sheet to inner door panel with adhesive. Make sure that a watertight joint is produced at all edges. (If this is not done, water may enter the interior of the car.)
10. Screw on the retaining spring plate to the inner door panel.

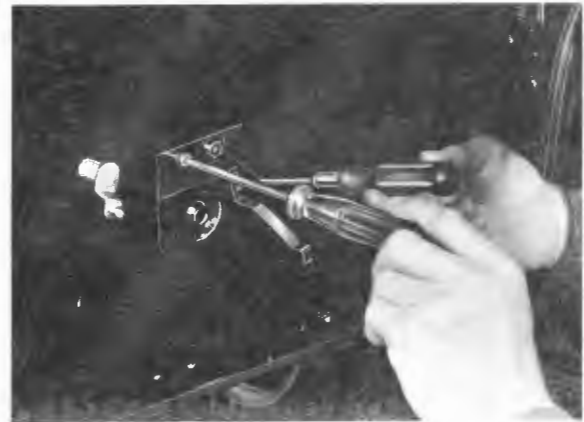


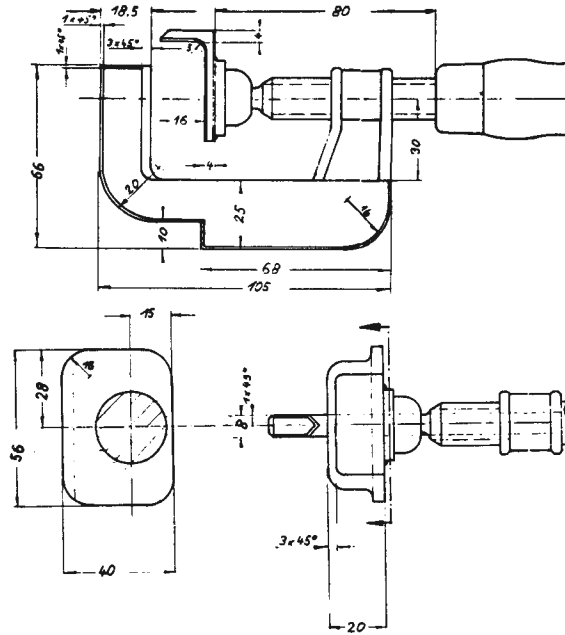
Fig. 19

11. Push the plastic grommets into the inner door panel and the plastic clips onto the door trim panel, and attach the trim panel.
12. Screw on the front door pocket at the top and bottom.
13. Connect the pull up door handle in the armrest with the joint and remote control mechanism, then screw on the armrest.
14. Screw the folding storage box onto its hinges so that it makes a good seal with the armrest and is aligned with the fixed door pocket.
15. Pull the rubber strip through the retaining plate, folding box and retaining eyes on the inner door panel, and tighten and secure at the other end with the second retaining plate. Push the ends of the rubber strip through the inner panel.
16. Attach the retaining spring, check operation of the folding box and if necessary loosen or tighten the rubber strip.
17. Screw on the decorative strip with the inner door lock knob, and check operation. Install the chromium-plated strip on the upper edge of the door with its seals.

Note:

If the gear segment of the window regulator touches the inner door panel when the window is open and causes a rattling noise to be heard, extra clearance should be produced as follows.

Modify screw clamp as shown in the drawing, and press together the strengthened areas on the inner door panel slightly to prevent rattling.



special clamp

Fig. 20

SUBSEQUENT INSTALLATION OF ELECTRIC WINDOW LIFTS

WARNING:
Only suitable for Coupé bodies.

Removal

1. Dismantle the doors completely with the exception of the door locks, and take the doors off.



Fig. 21

2. Cut out rectangular apertures 60 x 36 mm (2,36 x 1,42") in the inner door panels.



Fig. 22

3. Attach three cable clips to the inside door frame, and one to the floor frame. See illustration. Using pop rivets, attach the rubber pad for the window lift with sheet metal frame to the floor panel.

4. Attach the power lift mechanism with flange mounted electric motor. Cover up any remaining screw holes on the electric motor with adhesive strip.

5. Use a new grommet at the front of the door frame. Pull the cable through only until 545 mm (21,5") protrude as far as the cable plug.



Fig. 23

6. Hold the cable in position with the cable clips.

7. Reinstall the window, insert and secure the window frame.

8. Install the angled attachment plate horizontally in the center of the round cutout.

9. Attach the cable junction plate to this panel and wire according to the circuit diagram.

10. Connect cable to rocker switch at the top and check operation of the window lift with a battery.

11. Use new door trim panels, or have the door trim panels re-covered. Make two apertures 32 x 22 mm (1.26 x 0.87") in the door trim panel on the driver's side, cut through the leatherette covering, turn back through the apertures and secure. Install the sheet metal frame for the rocker switches. The door trim panel on the passenger side requires only the front aperture, 32 x 22 mm.



Fig. 24

12. Remove the luggage compartment lining. Detach the heater blower box from the heater hoses and move forwards. Detach the control cables from the control box and unscrew the control boxes.
13. Remove the upper capping from the left and right door wells. Lay the main cable harness in position in the luggage compartment and connect up the couplings on the left and right in the door wells. Connect to ground. Use a 25 Amp fuse in the positive (+) cable.
14. Install the doors. Join the connecting plugs in the door wells and attach the loose door cable in the door well to the water deflector plate on the hinge pillar with a cable clip.
15. Attach a waterproof sheet to the inner door panel with adhesive. Install the door trim panel. Insert the rocker switch and make the electrical connections.
16. Fully reassemble the doors in the usual way.
17. With the doors closed, make sure that the window lifts move up and down easily.
18. Install the blower and control box, and wire up. Re-install the luggage compartment lining.

REMOVING AND RE-INSTALLING HEATED REAR WINDOW (1 OR 2-STAGE)
FOR COUPE

Removal

1. Take out the rear bulkhead lining.
2. Disconnect the cables on the left wheel box bulkhead in the engine compartment and push the cables upwards into the interior of the car.
3. Cut round the rubber seal on the outside of the rear window and take off the trim strips. Disconnect the cables from the window and remove the glass.

Installation

Warning:

Always use a new rubber frame, spare part number 901, 545, 901, 21 for a 1 or 2-stage heated rear window.

1. Lay the screen on a soft surface with the inside upwards. Moisten the edge of the glass with soapy water or turpentine. Place the vulcanized seam at the top center of the glass and pull on the rubber frame.
2. The cable apertures in the stepped section of the rubber strip should be fitted at left and right approx. 20 mm (0.8") below the cable terminals on the window. Use a metal punch to make a slot approx. 5 x 12 mm (0.2 x 0.5") at this point. The apertures can also be made by cutting with a knife.



Fig. 25

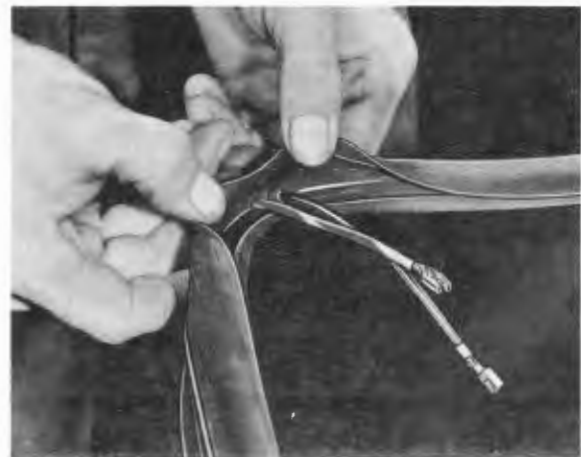


Fig. 26

4. Pull the positive (red/white) cable into position on the left, looking forwards, and connect to the cable terminal. Pull in the ground wire with ring-shaped cable end and attach to the right cable terminal (1-stage heated rear window).
5. Thread a cord through the rubber frame so that the ends overlap by approx. 40 cm (16") at the bottom center of the window.
6. Turn the window over and moisten the rubber seal for the trim strips all round with soapy water. This will greatly simplify installation of the trim. Press in the trim strips, making sure that about 1 cm (0.4") gap remains between the ends. Next push on the connecting clip.

7. Install the window with equal clearance on both sides. Pull the cables through the rubber grommet into the engine compartment. Insert the cord at the top, not forgetting the curved sections, and allow the ends to overlap and hang down on the outside.

8. Now pull out the cord while striking the glass gently with the palm of the hand. The sealing lip will slip completely over the projecting edge. Pull out the cord which is hanging down outside. This will pull the outer sealing lip into the correct position.

9. Connect the cables and check that the heated rear window is operating correctly.

10. Apply sealing compound to the rubber frame on the outside and the glass side. Remove excess sealing compound and clean the window.

11. Re-install the rear bulkhead lining.

Rubber sealing strip with trim, glass and cable.

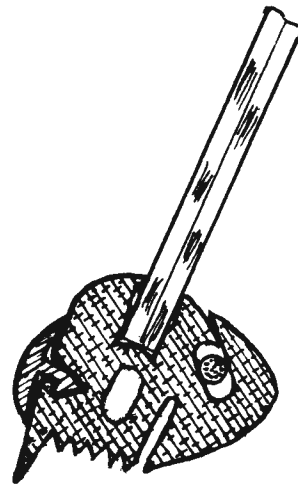


Fig. 27

Note

If a heated 2-stage rear window is subsequently fitted to replace a non-heated rear window, the car must be equipped with an alternator of at least 770 W rating and an additional cable harness with 2-stage switch. Before installation, check that the heated rear window is operating at the correct output.

The heater elements are electro-deposited onto the inside of the rear window. If the elements become damaged so that the circuit is interrupted, they cannot be repaired.

Installing 2-stage heated rear window

Install the 2-stage heated rear window as described above, but make an additional hole in the rubber sealing frame for each extra cable terminal. Pull the 3 cables through into the engine compartment and connect up.

Ensure that the connections to the rear window are correct.

TARGA - REMOVAL AND INSTALLATION OF
1 AND 2-STAGE HEATED REAR WINDOW

Removal

1. Take off the folding roof.
2. Unscrew the box clamps and rear bulkhead lining. Remove the upper rear panel section and the rear seat decorative strips to left and right. Detach the inner treadle panel and remove rearwards.
3. Detach the sealing frame at the front along the roll bar. Remove the self-tapping screws on the chrome treadle panel.
4. Unscrew the chrome panel below the fenders and remove upwards. Pull off the seal rearwards.
5. Cut round the rubber seal on the outside of the glass completely, and remove the trim strips. Disconnect the cable plug from the contact bars. Detach the cable in the engine compartment and remove from the car.
6. Take out the window, pull off traces of rubber and clean to remove any adhesive attached to the window cut out.

Installation

1. Pull a new sealing frame over the window glass.

Warning:

Always use a new rubber frame each time. If the 2-stage heated rear window is subsequently installed, a 770 watt alternator is needed. Also a 2-stage switch must be installed on the dashboard, and an additional cable harness. The heater elements are electro-deposited on the glass of the 2-stage heated rear window in the same way as for the 1-stage window. Once the circuit is interrupted by damage to the elements, they cannot be repaired.

2. Make slots approx. 5 x 12 mm (0.2 x 0.5") long for the cables through the stepped section of the rubber seal at left and right approx. 20 mm (0.8") below the contact bars, using a metal punch or knife.



Fig. 28

3. Punch 2 holes 5 mm (0.2") diameter in the sealing frame on the left above the opening in the upper rear bulkhead leading to the engine compartment, using a metal punch. For the 2-stage heated rear window, punch 3 holes 5 mm (0.2") diameter. Make sure that the holes penetrate the rubber deeply enough to allow the cables to be concealed by the upper section of the rear bulkhead when the window is installed.
4. Pull in the cable and push onto the contact bars. Pull the ground wire (with ring terminal) through on the right, looking forwards. Pull the positive (+) cable (red/white) through on the left.
5. Insert two cords into the slots on the rubber seal.
6. Turn the glass over and moisten the rubber seal with soapy water or similar so that the trim frame can be installed.

Warning:

The trim frame can be installed more easily if the rubber is moist. Press in the trim frame, but make sure that about 1 cm (0.4") gap remains between the ends. Push on the connecting clip.

7. Fit the rear window with an equal gap on both sides. Pull the cable through the rubber grommet into the engine compartment,



Fig. 29

8. Pull out the cord along the edge of the window. At the same time strike the glass lightly with the palm of the hand. This will force the sealing lip completely over the projecting edge.



Fig. 30

9. Connect the cables and check that the heated rear window is operating correctly.

10. Apply sealing compound to the rubber frame on the outside and the glass side. Remove excess sealing compound and clean the window.



Fig. 31

11. Attach the felt strip to the roll bar with adhesive to prevent drumming. Seal off the vent holes with 15 x 15 mm (0,6 x 0,6") Kombri strip so that any water which enters is led away through the escape pipes to the fenders.
12. Complete the installation in the reverse order to that already described.

ATTACHING INTERIOR MIRROR TO WINDSHIELD

Removal

1. Push a thin blade or knife carefully between the windshield and the mirror base plate until the base plate is separated from the glass and the mirror can be removed.
2. Clean off traces of adhesive on the windshield and base plate with cleaning gasoline.

Fitting

1. Remove grease from the adhesive surfaces on the window and the base plate with gasoline, acetone or trichlorethylene. Any remaining traces of adhesive must also be removed.
2. If the label on the windshield indicates spare part number 901.541.101.21 or Catacolor spare part number 901.541.101.31, attach the base plate as indicated by the label. If the windshield has no label, measure 88 mm (3.46") down from the upper edge of the windshield to the upper edge of the base plate. If the windshield is installed, measure 80 mm (3.15") from the lower edge of the rubber seal to the upper edge of the base plate. Make sure that the base plate is in the exact centre of the windshield.
3. Stick the white side of self-adhesive strip spare part number 901.131.133.20 onto the base plate, then attach the complete mirror to the windshield at the correct point.

The adhesive joint is heat resistant up to 100°C (212°F).

Note

If base plate spare part number 901.731.113.00 for the interior mirror, or the 16 x 2.6 mm connecting screw, spare part number 900.014.094.10 are damaged, they can be exchanged for new parts. The interior mirror has an anti-glare position, and is designed so that any sharp contact with the mirror glass causes the connecting screw to pull away from the base plate.



Fig. 32



Fig. 33

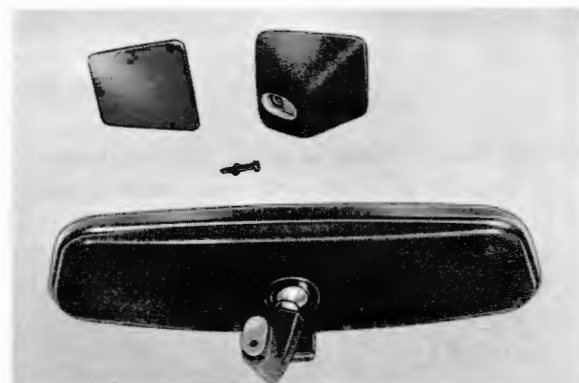


Fig. 34

General

From 69 Models on, the wheel cut-outs in the fenders are swaged outwards. The mounting points for the light boxes have also been modified. Fenders are now installed without using set pins. The fender is fitted, installed and remains on the car even if re-spraying is necessary.

This modified procedure operates installation of the fender a second time.

The following installation procedures have been changed:

1. If the body shell is provided with set pins to locate the fender, they should be heated and driven out before a new type fender is installed.



Fig. 35

2. Paint the new fender at points which will later be covered up; wheel arch wall, centre section at windshield, fender attachment panel and door cut-out. Use the correct color for the car. The undercoat used on the fender can remain in place for installation and should not be washed off.



Fig. 36

3. Attach the Terostat as before, then fit the fender in line with the front compartment lid, bumper and door. When correctly aligned, install. No underlay is required along the centre windshield section. The joint between the fender and the door from the curved section to the edge of the fender should therefore be 1 mm (0.04") wider.
4. Paint the fender, then loosen the bolts in the area where the underlay is to be installed, and push in the underlay.
5. Tighten all attachment bolts and install headlights, light boxes, horn grills etc.

For remaining work, see instructions on pages B 28 and B 29.

FRONT BUMPER - REMOVAL AND INSTALLATION

Removal

1. Unscrew the connecting angle from the bumper at right and left.



Fig. 37

2. Open the front compartment lid and detach the front bumper brackets from the wheel boxes. This is done by removing the two bolts on the left and right in front of the battery boxes.



Fig. 38

3. Pull the bumper forward to remove from the car, then unscrew the front brackets. If necessary pull off the rubber seals.

Fitting and installation

1. Attach the sealing rubber to the lower edge of the fender with adhesive, and pull the centre section into the shaped rails at the front compartment block bulkhead.
2. Line up and attach the front bumper supports so that the bumper makes correct contact with the fender on both sides of the car, then bolt the brackets to the wheel boxes. While doing this push the bumper upwards so that adequate pressure is exerted against the seal.
3. Align the side connecting bracket at the battery boxes, and screw to the battery boxes and bumper. Make sure that the bumper is pressed evenly over its whole length against the seal, and that the seal is pressed against the fenders. If necessary, re-align the lower edge of the fenders at the horn grills and flashing indicators. The end of the bumpers must line up evenly with the fenders at the wheel cut-outs. Tighten all retaining bolts firmly. If the bumpers are straightened, make sure that the upper edge is completely flat.

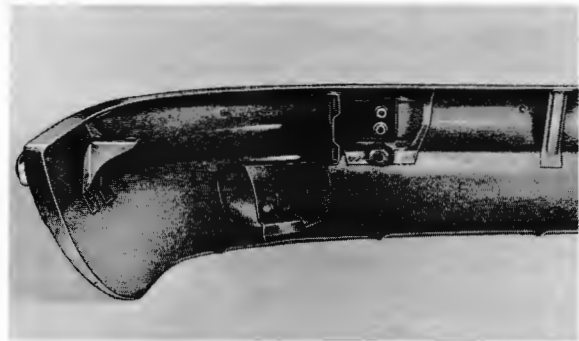


Fig. 39

4. After removing the plastic covers in the lock bulkhead, the front bumper horns can be unscrewed from the bumper.

1. Attach the self adhesive sealing strips to line up with the lower edge of the fender.
2. Install the reflectors and bumper trim strips on the outer sections of the bumper.
3. Rivet on the face plate with the shaped underlay attached with adhesive, using two pop rivets at each end.
4. Screw the outer sections of the bumper with their brackets loosely onto the side members.
5. Screw the angle brackets for the outer sections loosely to the fender brackets and the extended support tube.
6. The bumper ends must align exactly with the wheel cut-outs and the rear edge of the fenders. The sealing strips should be pressed evenly along both the lower edge of the fenders and the bumpers. When this has been checked, tighten all attachment bolts firmly.
7. Pull the sealing strip onto the centre section of the bumper and attach the seal for the rear cross-member with adhesive. Attach the license plate. Attach panel nuts to the lower holes, and push the centre section onto its brackets.
8. Screw the centre section into position with hexagon self tapping screws until it is aligned with the outer sections. If necessary, use galvanized washers at the bottom.
9. Place the underlay on the inside of the bumper horns, attach to the supports and install using internal hexagon bolts. Blank off the apertures at the top with plastic plugs.



Fig. 40

Warning:

The bumper horns must be at an equal distance from the lower edge of the lid, and parallel to the fenders and outer sections of the bumper. If necessary, straighten the supports.

Note:

Shorter decorative strips are now used on the outer sections of the bumper to allow for the reflectors also mounted on the bumper. The lateral section of the "S" rubber protective strip has been reduced on the latest version.



Fig. 41

FRONT SEATS - OPERATION AND REMOVAL

General

In comparison with previous models the front seats are provided with modified guide rail mountings, seat cushion and seat back locks and head rest mounting points.

The locking lever for seat adjustment is now at the front on the inside of each seat. When released the lever engages with a serrated sheet metal section on the centre tunnel. When the lever is lifted the seat can be moved backwards and forwards.

End carriages are provided on both sides of the seat frame for safety belt attachment. The sliding knob on the outer reclining mechanism of the passenger seat releases the seat back lock by means of a wire cable.



Fig. 42



Fig. 43

Removal

1. Move the seat into the fully forward and fully rearward positions, and unscrew the front and rear screws in the guide rails.



Fig. 44



Fig. 45

2. The seat can now be lifted out.
-

3. If the locking screw shown in the picture is now removed the guide tail can be taken out. Make sure that the plastic sliding blocks are complete and the rails lightly greased.



Fig. 46

4. The seat rail supports on the side members can be detached from the guide rails if necessary, for example if the seat is difficult to move, and moved slightly to one side before re-attaching.

INSTALLATION INSTRUCTIONS FOR AUTOMATIC SAFETY BELTS - COUPE

1. Unscrew the hex screw or plastic screw from the reinforced area on the outside of the wheel box wall, approx. 30 cm behind the lock post.



Fig. 47

2. Punch away the cover caps.
3. Cut out side trim panel and anti-drum compound according to the aperture in the carton.



Fig. 48

4. Attach the support panel and safety belt reel to the side trim panel using the enclosed 7/16" bolt and spacer with the supplied underlays.



Fig. 49

5. At the lock post above the center vent wing cut away the screwed hole at the point where it can be felt. Attach the reel bracket with the underlays supplied. The bracket must be able to turn. Pull out the belt horizontally to the front and align the belt reel so that the belt winds up parallel. Finally tighten the belt reel. The support panel must be screwed horizontally.



Fig. 50

6. Attach the hanger knob to the cover. Loosen the upper mounting, push cover 901.555.069.00 under the shaped section rail at the front and secure to support panel with split rosette, using 2 domed head self-tapping screws, 3,5 x13 mm. Drill a 2,9 mm dia. hole in the side member and attach the cover with a 3,5 x22 mm self-tapping screw and rosette.



Fig. 51

7. Bolt on the reel bracket with underlays at the top and push on the protection cap.



Fig. 52

8. Attach the safety belt lock to the bracket on the inside of the seat with the release lever facing down. Screw the belt attachment point to the outer bracket, not forgetting underlays. The screw connection must continue to move freely when the bolts are tightened. Adjust the lap strap of the safety belt accordingly. Check the operation of the automatic windup mechanism. It should be possible to pull the belt out slowly, and it should wind up automatically when released. If pulled out quickly the belt should lock. Release the belt from the lock and attach to the hanger knob.



Fig. 53



Fig. 54

1. Remove the cover strip and side trim panel. Cut into the trim material over the aperture, turn back and stick down with adhesive. Using a self-tapping screw and panel nut, attach the hanger knob to the punched hole on the side trim panel.



Fig. 55



Fig. 56

2. Unscrew the hex, screw or plastic screw from the reinforced area on the outside of the wheel box wall. Punch away the cover caps and free the holes, which should be approx. 40 mm (1.6") in diameter.
3. Screw on the safety belt reel, using a 7/16" bolt and spring washer.

4. In the center of the perforated covering on the rollbar, at the point where the screwed hole can be felt, cut away the material and attach the reel bracket with the underlays supplied. Pull out the belt horizontally to the front and align the belt reel so that the belt winds up parallel. Finally tighten the belt reel. Loosen the reel bracket and insert the side panel trim with covering 901, 803, 139, 00. Re-install the cover strip.



Fig. 57

5. Attach the reel bracket. Check that the bracket can turn when its fastening bolt is tight. Push on the protection cap.
6. Install the belt lock on the bracket on the inside of the seat with the release lever pointing down.



Fig. 58

7. Attach the belt mounting to the outer bracket on the seat cushion side, not forgetting the underlays.



Fig. 59

8. Adjust the lap strap of the safety belt as necessary, and check the automatic mechanism for correct operation. It should be possible to pull out the belt slowly, and it should wind up automatically when released. If pulled out quickly the belt should lock. Open the belt and hang the free loop up on the hanger knob.



Fig. 60

REMOVING DASHBOARD COVERING TRIM PANEL

1. Remove the windshield.
2. Loosen the fresh air box and move to one side.
See page L
3. Unscrew the 2 nuts on the front retaining bolts and the 5 nuts on the vertical part of the dashboard.
4. Lift the trim panel along the front edge, pull out the clips and take off the trim panel.
5. When the dashboard trim panel has been removed the facings for the heater outlets can be taken out.
6. The covering over the loudspeaker cutout is held in the dashboard trim panel by 4 spring clips.

To re-install, work in the reverse order.



Fig. 61

REMOVING AND RE-INSTALLING DASHBOARD FACINGS

1. Detach all controls on the dashboard.
2. Push a spatula or similar flat tool under the facing frame at one side, and at the same time pull on the frame. This will release the facings from the dashboard.
3. Pull off leatherette if damaged. Remove traces of adhesive. Stick on new leatherette. Cut away excess material at edges, leaving enough to turn back and stick down.
4. Clean off traces of adhesive from the dashboard and facing frame.
5. Stick new Scotch tape over the back, and attach the facings to the dashboard by pressing.
6. Re-install the controls.

PLUGS IN SLIDING ROOF

1. Open the roof about 10 cm (4").
2. Detach the clips at the front edge of the lining from the sliding roof, and push back the lining as far as the cutout.
3. Close the roof and detach the front and rear guides. Turn the spring keeper at the back to one side.
4. Take off the sliding roof. If present, pull off the leather strip at the front edge of the cover frame.
5. Drill 4 holes 5,8 mm (0,23") in diameter close to the 4 recesses on the sliding roof frame, 20 mm (0,78") to the rear from the centerline of the rim. Distances from outside 110 mm (4,33") and 346 mm (13,62"). When drilling, push a strip of metal between the frame and the outer paneling to prevent the paintwork from starrng.

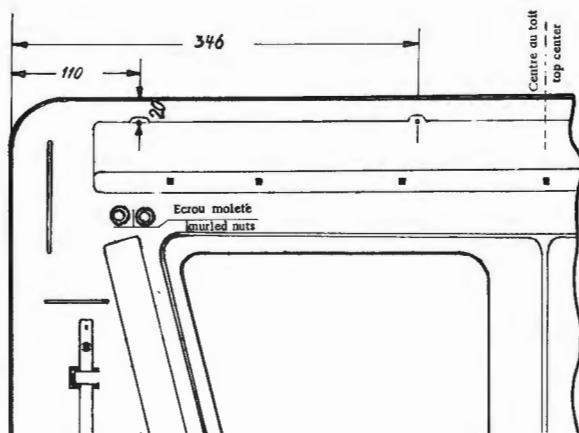


Fig. 62

6. Press in or hammer in the plastic plugs.
7. Re-install the sliding roof and align the new front guides (wider seating surfaces). Screw on the guides and install the spring keeper.



Fig. 63

8. Pull forward the sliding roof lining and press in the clips.
9. Check that the sliding roof moves freely. If the roof rubs against the wind deflector the frame must be bent down lightly along the cable covering, or the front rim slightly shortened at the plastic coverings.

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MODIFICATIONS TO ELECTRICAL SYSTEM FROM 69 MODEL ON

GENERAL

From the 69 model on the following modifications have been made to the electrical system of vehicle types 911 T, 911 E and 911 S.

GENERATOR

The output of the alternator is now 770 Watts.

BATTERIES

These vehicles are provided with two 12 Volt/36 Amp-hr batteries wired in parallel. The negative pole of both batteries goes to ground.

Warning:

When any work on the electrical system is done, both batteries must be disconnected. The batteries are housed in the right and left front wheel boxes and can be reached from the luggage compartment.

IGNITION

911 E and 911 S vehicles use a high tension battery/condenser ignition system developed by Bosch. The high tension ignition system is described on page SL 22.

LIGHTING

The lighting equipment has remained basically unaltered. Halogen headlights are standard equipment for export to all countries where they are allowed or demanded by law. Each headlight unit then contains an H 1 55 Watt halogen bulb for both high and low beams.

Vehicles for the USA are provided in addition with 4 side outline lights which are included in the front and rear turn indicator.

All vehicles are equipped as standard with emergency warning flashers except those intended for Italy.

The fuses are located in two fuse boxes in the front left of the luggage compartment next to the battery, and are protected by plastic covers. The items of electrical equipment connected to each fuse are shown on the inside of the covers.

Fuse ratings

- 25/50 Amp. for window lifts, windshield wipers, emergency warning system
- 16/25 Amp. for cigarette lighter, stop light, sliding roof
- 8/15 Amp. for high and low headlight beams
- 5/ 9 Amp. for turn indicators, side lights, license plate lights



Fig. 1

SUMMARY OF BULBS
12 VOLT SYSTEM

Quantity			
4	Quartz-iodine bulbs for headlights	H 1	55 W
(2)	"Sealed-beam" headlight units (USA)		50/40 W
(2)	Double filament bulbs for headlight		45/40 W
2	Quartz-iodine bulbs for fog lights	H 3	55 W
(2)	Spherical bulbs for fog lights		35 W
4	Spherical bulbs for flashing turn indicators (Europe)		21 W
(4)	Double filament spherical bulbs for front turn indicators, stop lights and rear lights (USA)		32/4 cp
(2)	Spherical bulbs for rear flashing turn indicators (USA)		32 cp
4	Tubular bulbs for side lights and license plate lights (not USA)		4 W
(6)	Spherical bulbs for side lights and license plate lights (USA)		2 cp
2	Double filament spherical bulbs for stop and rear lights (Europe)		5 W
2	Spherical bulbs for reversing lights (Europe)		18 W
2	Spherical bulbs for reversing lights (USA)		15 cp
2	Festoon bulbs for interior light		10 W
2	Spherical bulbs for luggage compartment light		5 W
17	Indicator bulbs for instruments and telltales		2 W

General

The use of high tension condenser ignition gives better results than those obtained from a conventional ignition system. In particular with sports car engines, certain operating conditions can lead to spark plug fouling and cause poor ignition. The high tension condenser ignition system has been introduced to provide greater resistance to these effects.

Advantages of the high tension condenser ignition system

1. Resistance to flashover at the spark plugs caused for example by carbon or lead deposits.
2. Greater reserve of ignition tension for cold starting.
3. No erosion of the contact breaker points, only pure mechanical wear.

Operation of the high tension condenser ignition system

The condenser ignition system consists of a charging section (electronic DC converter), a storage capacitor, a load sensitive switch (thyristor), a control unit and an ignition transformer.

The charging section draws energy from the 12 Volt car battery and charges the storage capacitor up to several hundred volts at the moment of ignition the contact breaker points open and send a control impulse through the control unit to the thyristor. This becomes conductive, and the charge in the storage capacitor is then conveyed by way of the ignition transformer to the high tension side and thus to the spark plug.

The control impulses do not subject the breaker points to heavy loads (low current, battery voltage only, thus no arcing at the breaker points). Another function of the control unit is to prevent faulty ignition impulses as a result of breaker flutter.

Control unit

The control unit consists of a magnesium cast housing with cooling fins. The electronic components are sensitive to heat, and are therefore kept in contact with the cast housing by an aluminum heat sink.

The converter transformer, storage capacitor and resistors with relatively high heat loss are attached direct to the cast housing. The remaining electronic components are mounted on a printed circuit board. The electrical supply connections, with 3 pin flat plug, are recessed into the cast housing. The switch unit itself is mounted on the bottom and provided with sheet metal cover.

Ignition transformer (Ignition coil)

The design and dimensions of the ignition coil correspond to those of a normal high tension ignition coil. The coil is wound to match the electrical characteristics of the switch unit.

Connection scheme for high tension battery ignition condenser - ignition unit

Type 911 E and 911 S

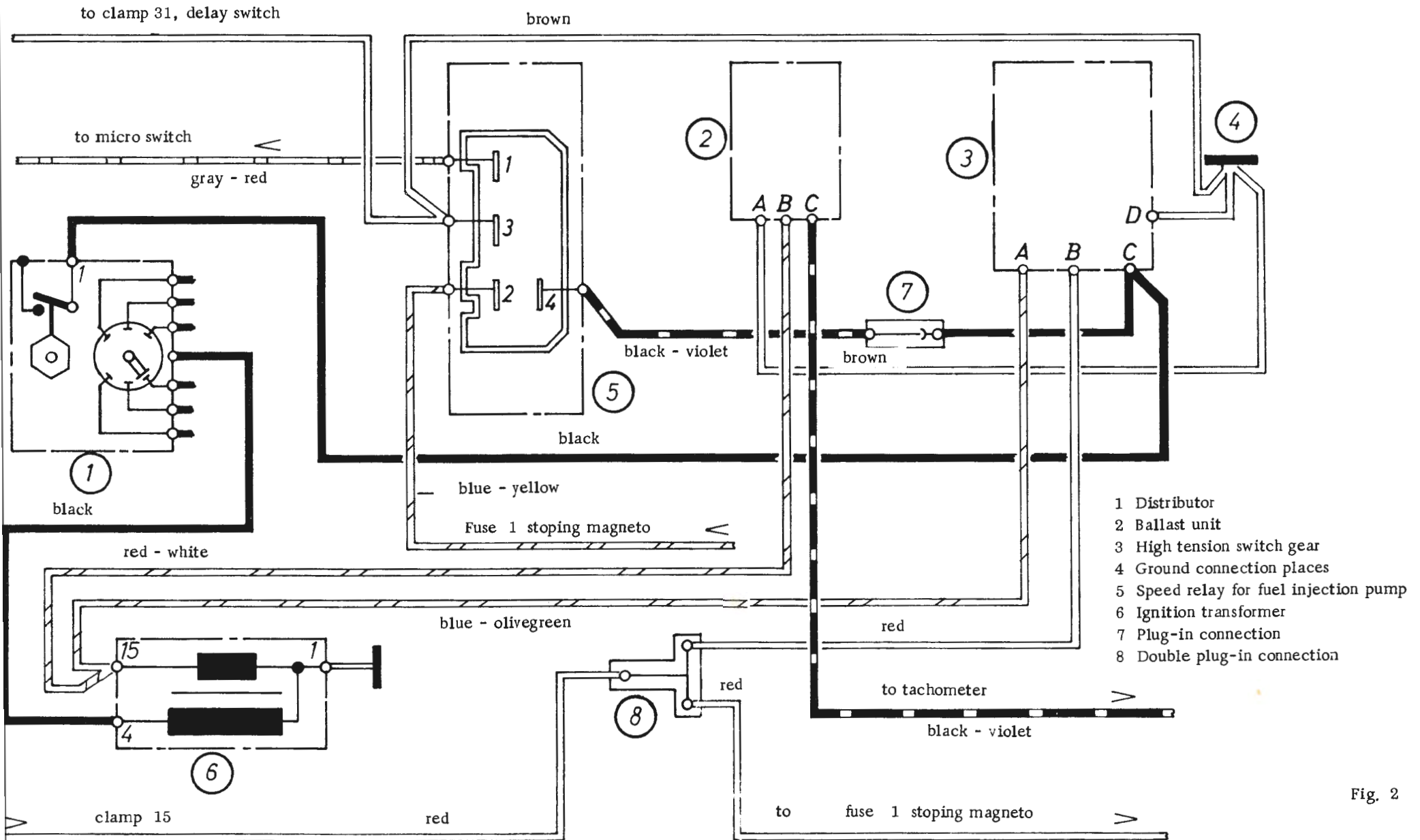


Fig. 2

Warning:

The ignition transformer (ignition coil) is a special version. It must not be replaced by a normal coil or used in a circuit intended for a normal coil.

Terminal of the ignition transformer does not carry the normal battery voltage but approx. 400 Volts. Apart from the standard primary switch unit for the revolution counter, this terminal must not be used for any other telltale lamps, revolution counters, ignition stroboscopes, or any other electrical equipment (including interference suppression capacitors). Even a short circuit to ground of brief duration, or connection to ground with the first two to three minutes after the ignition has been switched off, will destroy the thyristor in the control unit and cause failure of the entire ignition system. To prevent accidental contact, a protecting cap is normally fitted over terminal 15.

Adjusting ignition point

1. Connect test lamp to terminal 1 of the distributor and to ground.
2. Switch on ignition and adjust ignition point (OT = TDC for 911 E and 911 S) as previously.
3. Check the ignition with a stroboscope (ignition point 30° before TDC at 6000 rpm on 911 E and 911 S).

To supply electric current to test equipment (stroboscope exhaust emission tester), the B+ connection on the mounting plate in the engine compartment can be used.

Individual items of test equipment should be connected as follows:

Dwell angle tester (Sun)

Red clip to terminal 1 of distributor,
black clip to ground.

Engine speed tester (Sun)

Attach the impulse contact to the spark plug of cylinder 1.

Stroboscope (Sun)

Attach the impulse contact to the spark plug of cylinder 1
and connect the stroboscope to the tester.

Engine speed and dwell angle tester (Bosch EFAW 104 and EFAW 166 B)

Red clip to terminal 1 of distributor,
green clip to ground.

Engine speed and dwell angle tester in cabinet (Bosch EFAW 170 and EFAW 171)

Red clip to terminal 1 of distributor,
green clip to ground,
black clip not used.

Stroboscope (Bosch EFAW 185 and EFAW 169 A)

Red clip to terminal B+ ,
black clip to ground,
impulse contact attached to spark plug of cylinder 1.

Checking operation of ignition system

1. Examine contact breaker and all electrical connections.
2. Switch on ignition. A high pitched whistle should be heard. If no high pitched whistle can be heard, check that the red cable connected to the control unit at the three pole cable splitter is under tension. If this is the case, the control unit must be replaced.
3. Pull out the ignition cable from the center of the distributor cap not at the ignition transformer. Hold the end of the cable a short distance (approx. 5 mm = 0.2") away from ground or connect to a spark inducing circuit.
4. Turn the engine over with the starter. Sparks should be seen at regular intervals at the end of the cable. If the sparks are not seen, the control unit must be replaced.

At present it is not possible to check the ignition system with an oscillograph, because the voltage rise of high tension condenser system is about ten times faster than that of normal battery ignition systems. Suitable adapters are being developed.

The ignition transformer (coil) and primary switch unit can be checked only with an ohmmeter (cables disconnected). No other tests are possible with existing checking or test equipment.

Test values

For ignition transformer:

Primary resistance (across terminals 1 and 15)	0.4 - 0.6 Ohm
Secondary resistance (across terminals 4 and 15)	650 - 690 Ohm

For primary switch unit:

Resistance across terminals A and B	170 - 210 Ohm
Resistance across terminals A and C	220 - 300 Ohm

Warning:

If the car is resprayed and dried in a booth at more than 80°C (175°F), the control unit and all equipment containing transistors or diodes must be removed.

After drying out at a lower temperature the ignition should not be switched on until it has had time to cool down. Otherwise the additional temperature rise which takes place when the ignition is in operation will destroy the control unit.

The ignition must be switched off when cables are disconnected or re-attached. It is best to disconnect the batteries.

When installing the batteries check polarity (negative terminal to ground).

Do not use rapid battery charging equipment unless the batteries have been disconnected from the electrical system of the car. Starting the engine with the aid of a rapid battery charger is not permitted.



CHANGING QUARTZ - IODINE HEADLIGHT BULBS

1. Remove the bottom Phillips head screw in the headlight rim and take out the headlight.
2. Pull away the cable from the flat pin plug of the defective bulb (high beam = lower bulb, low beam = upper bulb). Press down the retaining clip and push it to one side.
3. Take out the bulb and insert the new bulb. Make sure that the bulb is correctly positioned.



Fig. 4

Warning:

The bulb glass must be clean and free from grease. Handle bulbs only with a clean cloth or soft paper.



Fig. 3

4. Re-attach the bulb retaining clip and push the cable back onto the flat pin plug.
5. Re-attach the headlight unit and tighten the Phillips head screws.
6. Check operation and beam setting of the headlights.

Removal

1. Take out the headlight.
2. Lift away the springs from the bezel.
3. Detach the adjusting screws for low beam (height and width) from the casing.



Fig. 5

4. Unscrew the adjusting screw for high beam width.



Fig. 6

5. Press the screws slightly to one side and lift off the housing.



Fig. 7

Installation

1. Take out the old lens and pull sealing ring on to new lens.
2. Align the lens to the center line of the screw hole (small mark).
3. Install the housing (to do this press the screws slightly to one side).
4. Partly screw up the adjusting screw for high beam width.
5. Secure the springs all round the lens.

Warning:

Retaining springs of various lengths are used in the headlight.

The longer retaining springs are used on the wider side of the headlight ring and the shorter springs on the narrow side. The bezel must not touch the retaining springs at the top (see picture).

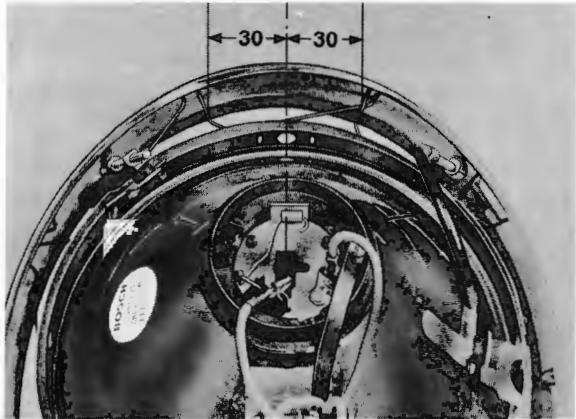


Fig. 8

6. Press in the low beam screws (long pointed screws).

7. Fully tighten the high beam width screw.

8. Install and align the headlight.

QUARTZ - IODINE HEADLIGHT BEZELS - REMOVAL AND INSTALLATION

Removal

1. Remove headlight.
2. Dismantle as described for replacing lens.
3. Core out the adjusting screw for main beam height (with flexible shaft) from its retaining rubber and the reflector hoop. Replace the bezel.

Installation

Attach the adjusting screws (main beam height) with retaining leather and reflector. Remaining assembly procedures as for replacing lens.

If the car is equipped with quartz-iodine headlights, the high and low beams are adjusted separately. The method of adjustment and the correct measurements and data are identical with those described under 15 LI.

The purpose of the adjusting screws is marked in each case on the headlight reflector (A = adjusting screw for low beam, F = adjusting screw for high beam).

By turning the appropriate adjusting screws clockwise or anti-clockwise, the headlight beam can be moved up and down or sideways as required.



Fig. 9

TURN INDICATOR-LOW BEAM-HEADLIGHT FLASHER SWITCH OR
WINDSHIELD WIPER-WASHER SWITCH - REMOVAL AND INSTALLATION

Removal

1. Disconnect batteries.
2. Remove steering wheel (see 14 ST).
3. Detach contact ring for horn.



Fig. 12

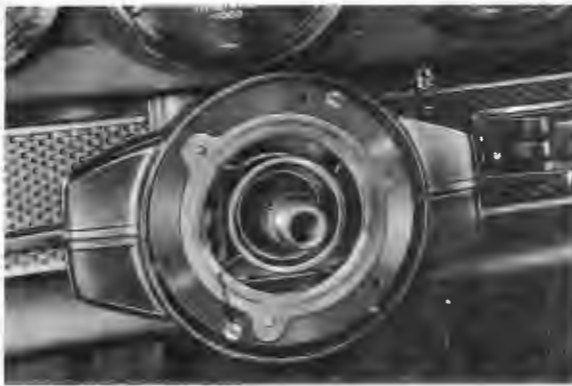


Fig. 10

4. Remove upper and lower parts of switch housing from the steering column outer tube.

5. Disconnect multi-pin plug and all other cable plugs.

6. Detach the indicator and headlight switch or wiper-washer switch as required from the steering column outer tube, and remove.



Fig. 11



Fig. 13

Installation

Ignition/starter switch:

Wiring color code

Terminal 30 red-white
Terminal 57a grey

When installing, the following should be noted.

Light switch:

Terminal 56 yellow and white-black
Terminal 58L grey-black
Terminal 58R grey-red

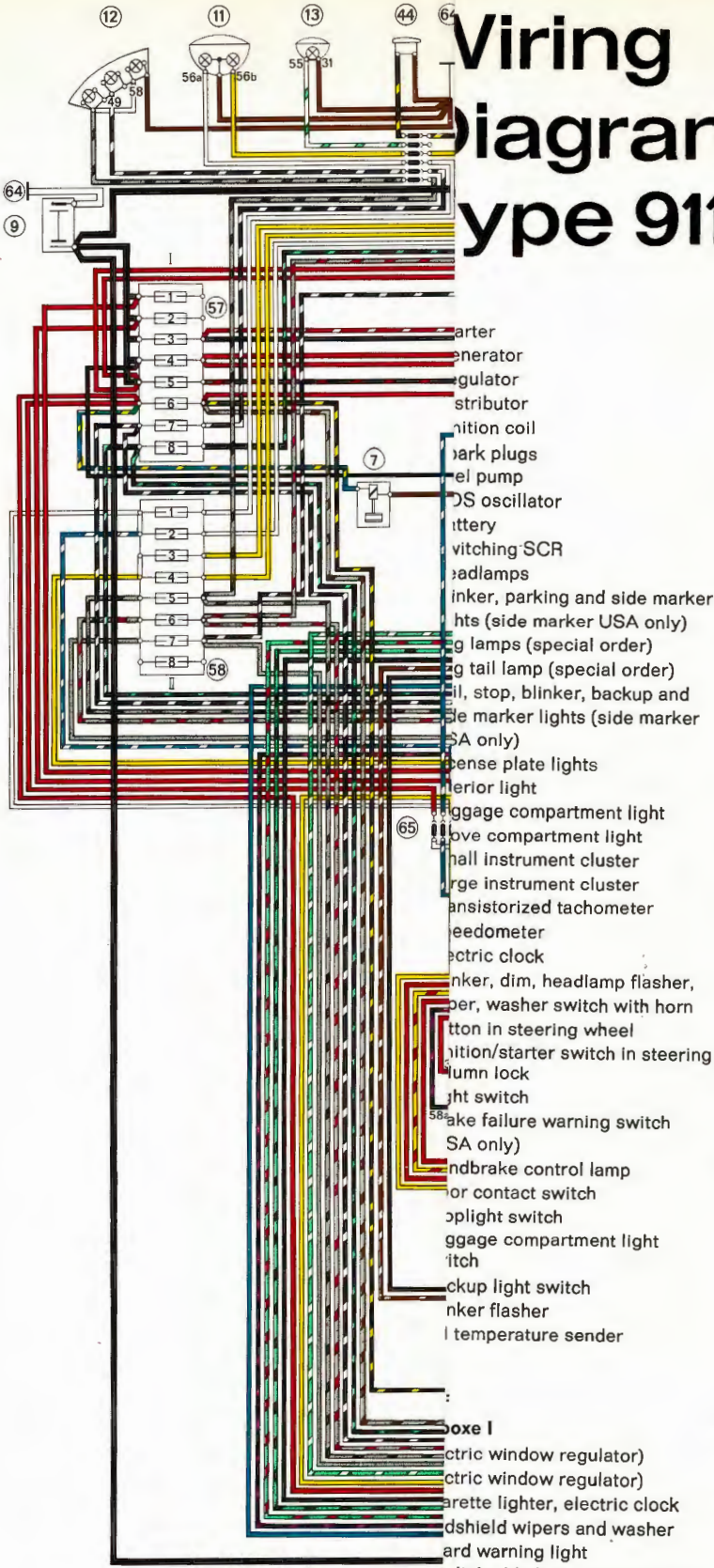
Insert cable plugs at combined switch as described now:

Warning light switch:

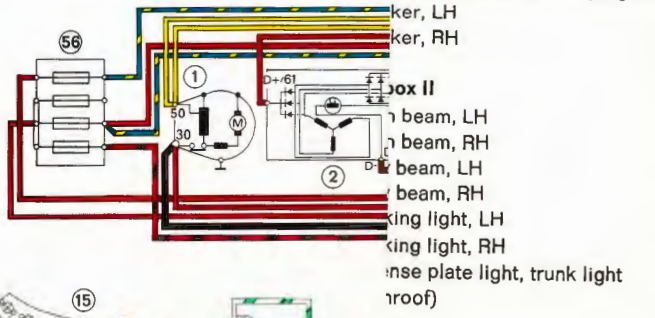
Terminal L black-white
Terminal R black-green
Terminal 49a black-white-green



Wiring Diagram Type 911 E, 911 S



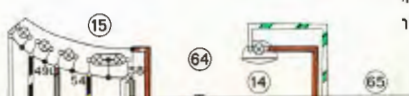
- 36 Fuel gauge sender
- 37 Oil level sender
- 38 Diaphragm oil pressure sender
- 39 Headlamp flasher relay switch
- 40 Wiper motor
- 41 Rear window heating switch
- 42 Rear window heating circuit
- 43 Washer pump
- 44 Signal horn
- 45 Cigarette lighter
- 46 Emergency blinkers
- 47 Glove compartment light switch
- 48 Blower/heater relay switch
- 49 Cigarette lighter relay
- 50 Signal horn relay
- 51 Rear window heating relay switch
- 52 Multiple-pole connector
- 53 Blower motor
- 54 Blower and heater switch
- 55 Gasoline heater switch (special order)
- 56 Rear fuse box
- 57 Fuse box I
- 58 Fuse box II
- 59 Two-pole connector
- 60 Terminal bar
- 61 Multiple-pole connector
- 62 WECO-connector
- 63 Single-pole connector
- 64 Ground taps
- 65 Terminal connectors
- 66 Starting relay switch
- 67 Auxiliary starting relay switch (standard)
- 68 Starting solenoid
- 69 RPM transducer
- 70 Time limit switch
- 71 Temperature switch (start)
- 72 Temperature switch (start assist)
- 73 Microswitch (throttle linkage)
- 74 Shut-off solenoid (start)
- 75 Shut-off solenoid (stop)



- Rear fuse box**
- Shut-off solenoid (start)
 - (Rear window wipers)
 - Shut-off solenoid (stop)
 - Rear window heating circuit

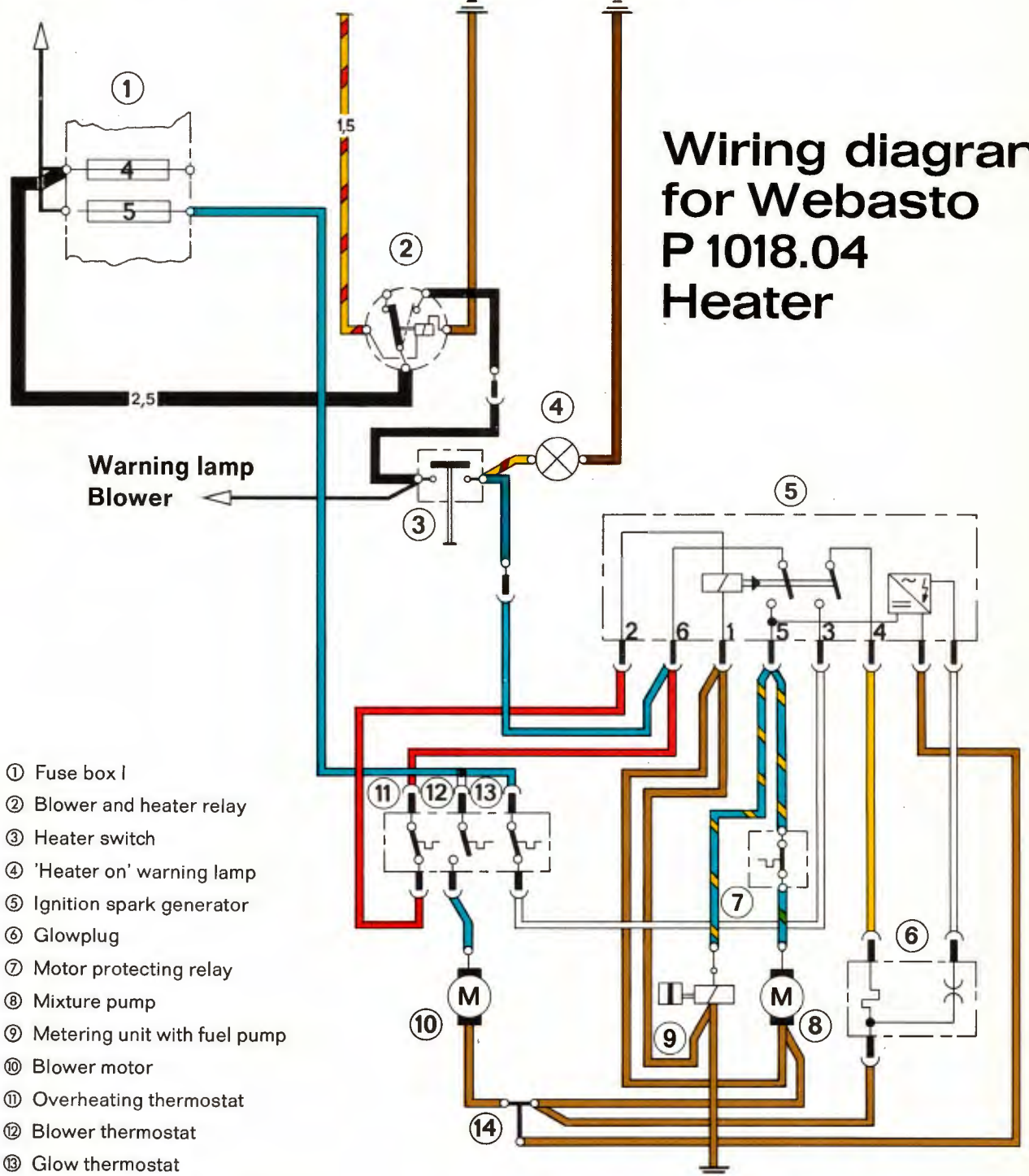
- Earth leads or cables:**
- Battery-body
 - Transmission-chassis
 - Supporting plate-body
 - Fuel spout-body
 - Steering column control switch-body
 - Instruments-body

ATTENTION!
Disconnecting of battery with running engine results in immediate destruction of alternator.



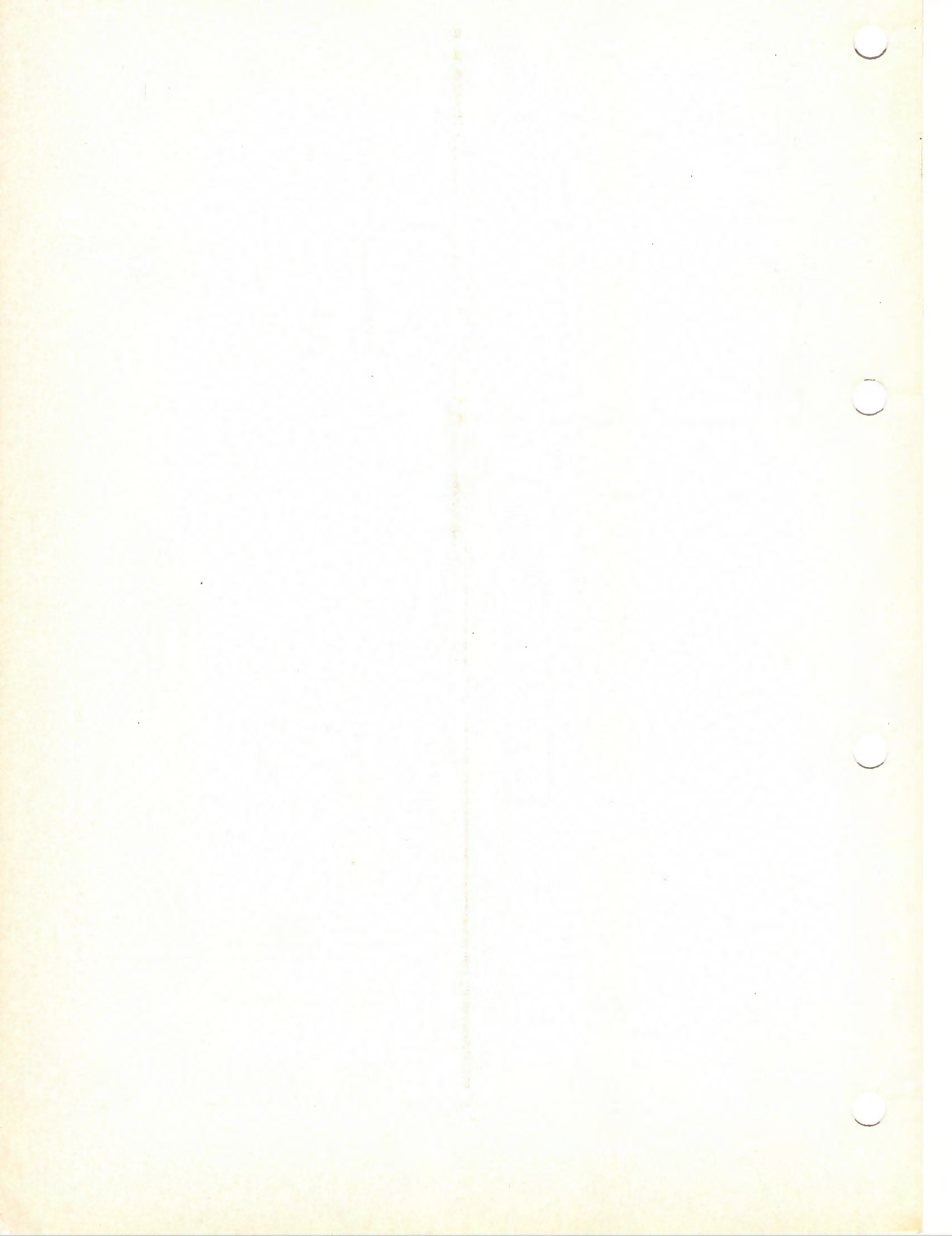
Terminal 30 Battery Terminal 75 Ground Trunk floor

Wiring diagram for Webasto P 1018.04 Heater

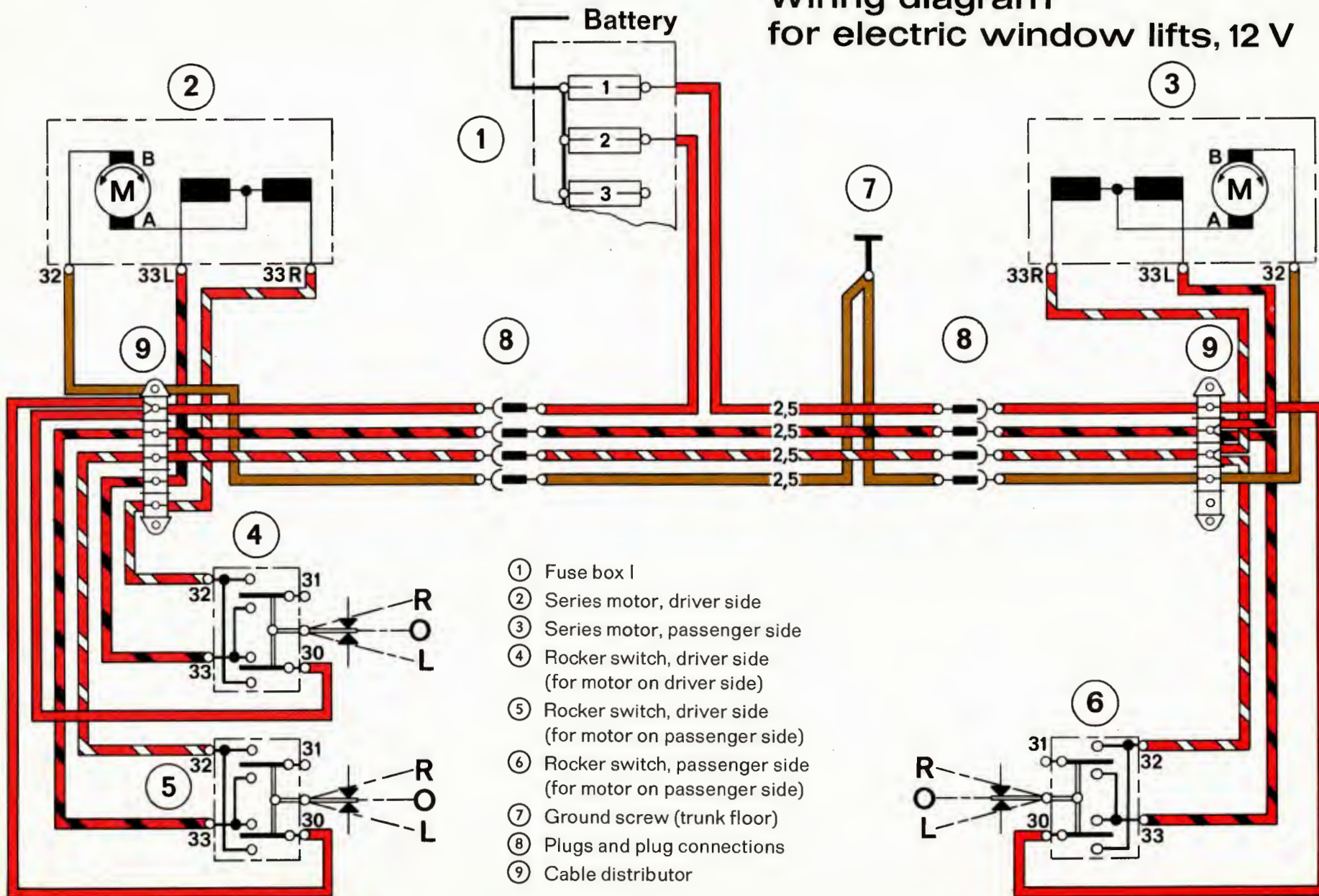


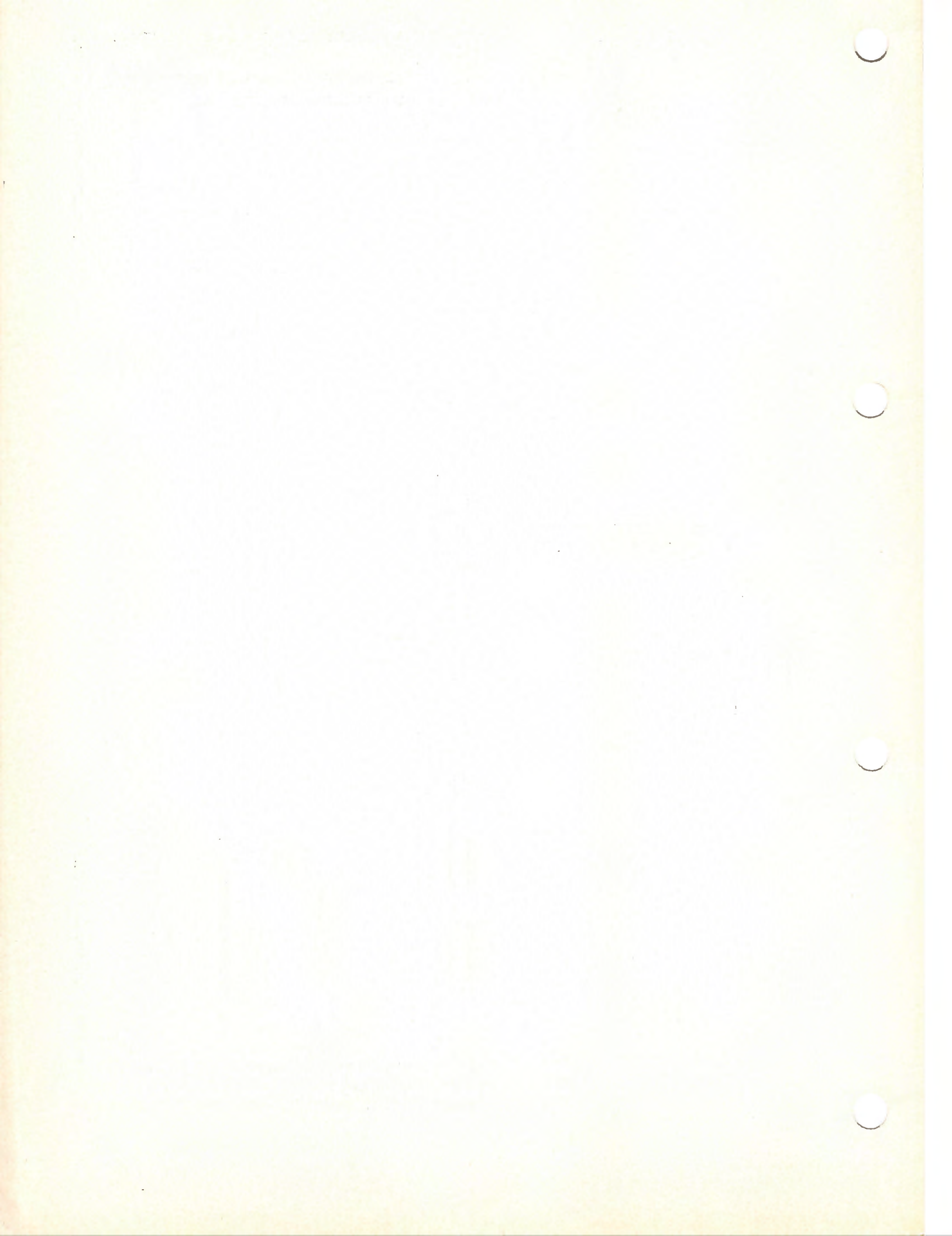
- ① Fuse box I
- ② Blower and heater relay
- ③ Heater switch
- ④ 'Heater on' warning lamp
- ⑤ Ignition spark generator
- ⑥ Glowplug
- ⑦ Motor protecting relay
- ⑧ Mixture pump
- ⑨ Metering unit with fuel pump
- ⑩ Blower motor
- ⑪ Overheating thermostat
- ⑫ Blower thermostat
- ⑬ Glow thermostat
- ⑭ Ground, distributor plug/heater

Ground, trunk floor



Wiring diagram for electric window lifts, 12 V





MODEL 69

SERVICE SCHEDULE, TYPE 911 T

300 to 600 mi.	6,000 to 6,600 mi.	Service required	Repeat every
█	█	Check valve clearance.	6,000
	█	Check compression or pressure drop.	6,000
█	█	Check rocker arm shafts for tightness.	6,000
	█	Check breaker points, ignition timing, and spark plug gap. Lubricate breaker cam.	6,000
█	█	Check adjustment of throttle valve compensator (USA-exports)	6,000
	█	Check carburetor adjustment with exhaust gas analyzer. Lubricate linkage.	6,000
█	█	Check generator V-belt tension.	6,000
█	█	Visually check for fuel and oil leaks.	6,000
	█	Change air filter cartridge.	6,000
	█	Check flame trap cartridge in crankcase breather and check hose connections for firm attachment.	6,000
	█	Remove brake pads, inspect, and measure wear. Check pressure rod clearance between brake master cylinder and brake pedal. Check hand brake and service brake. Inspect all lines, hoses, and hose terminals for damage. Check entire brake system for leaks. Check hydraulic fluid level in reservoir.	6,000
█	█	Check clutch free play and pedal travel.	6,000
	█	Check all mechanical connections and joints in steering. Check dust boots in steering box for firm seating and serviceability.	6,000
█	█	Check front wheel bearing clearance, tire pressure, and tightness of wheel lug nuts.	6,000
█	█	Check battery. Check entire electrical system for defects.	6,000
	█	Check wheel alignment, balance wheels *).	6,000

*) When required, at additional cost.

USA version only: After 500 to 1000 km (300 to 600 miles), and also every 10,000 km (6,000 miles), check setting of throttle butterfly limiter. Every 10,000 km (6,000 miles), check warning device for twin circuit brake system.

MODEL 69

SERVICE SCHEDULE, TYPE 911 E and 911 S

300 to 600 mi.	6,000 to 6,600 mi.	Service required	Repeat every
■	■	Check valve clearance.	6,000
	■	Check compression or pressure drop.	6,000
■	■	Check rocker arm shafts for tightness.	6,000
	■	Check breaker points, ignition timing, and spark plug gap. Lubricate breaker cam.	6,000
	■	Check full power and idle stop positions of fuel injection linkage. Replace fuel filter cartridge. Clean oil strainer in pump lubrication circuit. Check adjustment of fuel injection pump with exhaust gas analyzer. Lubricate linkage.	6,000
■	■	Check tension of generator V-belt and injection pump spur belt.	6,000
■	■	Visually check for fuel and oil leaks.	6,000
	■	Change air filter cartridge.	6,000
	■	Check flame trap cartridge in crankcase breather and check hose connections for firm attachment.	6,000
	■	Remove brake pads, inspect, and measure wear. Check pressure rod clearance between brake master cylinder and brake pedal. Check hand brake and service brake. Inspect all lines, hoses, and hose terminals for damage. Check entire brake system for leaks. Check hydraulic fluid level in reservoir.	6,000
■	■	Check clutch free play and pedal travel.	6,000
	■	Check all mechanical connections and joints in steering. Check dust boots in steering box for firm seating and serviceability.	6,000
■	■	Check front wheel bearing clearance, tire pressure, and tightness of wheel lug nuts.	6,000
■	■	Check battery. Check entire electrical system for defects.	6,000
	■	Check wheel alignment, balance wheels *).	6,000

*) When required, at additional cost.

USA version only: Every 10,000 km (6,000 miles) check warning device for twin circuit brake system.

TECHNICAL DATA

Vehicle type: 911 T

Engine type: 911 T

Engine

Type	Air cooled four cycle gasoline engine in unit with clutch, transmission and differential to form a single assembly at rear of vehicle
Number of cylinders	6
Cylinder arrangement	Horizontally opposed, three cylinders in each bank
Bore	80 mm (3.15")
Stroke	66 mm (2.60")
Total piston displacement	1991 cc
Compression ratio	8.6 : 1
Compression test pressure	9 - 11 kp/cm ² (128 - 157 psi) after 12 compression strokes
Total dry weight	Approx. 184 kg (406 lbs)
Crankcase	Two-part, light alloy
Cylinders	Individual
Cylinder material	Grey cast iron
Cylinder heads	Individual for each cylinder, light alloy
Valve seat inserts	Shrunk in
Valve guides	Shrunk in, special bronze
Spark plug seats	Helicoil inserts
Crankshaft	Forged
Crankshaft main bearings	8 plain bearings
Main bearings 1 thru 7	Split half shells, tri-metal
Main bearing 8	One piece, hard lead
Main bearing 1	Thrust bearing
Connecting rods	Forged steel
Big end bearings	Tri-metal
Piston pin bushings	Kuprodur, machined
Pistons	Die cast, Autotherm,
Piston rings	2 compression rings, 1 oil scraper
Valve operation	OHC, 1 camshaft per cylinder bank
Camshafts	Cast steel, 3 plain bearings directly in camshaft housing
Camshaft drive	Chains
Valve arrangement	Overhead
Valve springs	2 coil springs per valve
Valve test clearance (adjust with engine cold)	
Inlet	0.10 mm (0.004")
Exhaust	0.10 mm (0.004") - measure between valve and rocker arm
Valve timing with 1 mm (0.04") valve clearance	
Inlet opens before TDC	15°
Inlet closes after BDC	29°
Exhaust opens before BDC	41°
Exhaust closes before TDC	5°
Cooling	Air cooled by axial blower on generator shaft
Blower drive	From crankshaft by V-belt

Blower air flow	1320 liters (47 cu. ft.)/sec at 5800 rpm
Lubrication	Dry sump, forced feed
Oil cooling	Oil cooler on crankcase in blower air stream
Oil pressure gauge	Electrically controlled
Ignition	Battery and coil
Coil	TK 12 A 10 mV
Distributor	Marelli S 112 Ax
Contact breaker gap	0.4 ± 0.03 mm (0.016 ± 0.0012"), dwell angle 40° ± 3°
Ignition point	35° BTDC at 6000 rpm
Firing order	1 - 6 - 2 - 4 - 3 - 5
Spark plugs	Bosch W 230 T 30
	Beru 240/14/3
Spark plug threads	14 x 1.25 mm
Electrode gap	0.6 mm (0.024")

Clutch

Type	Fichtel and Sachs - M 215 K single dry plate
Free travel at pedal	Approx. 20 mm (0.8")
Total friction area	203 cm ² (31.5 sq. in.)

Fuel system

Carburetors	Weber Type 40 IDT 3 C or IDT 3 C 1
Air cleaner	Intake silencer with Micronic filter element
Fuel pump	1 Hardi electric
Fuel delivery pressure	0.28 - 0.30 atm (4.1 - 4.5 psi)
Fuel delivery rate	900 cc (30.4 fl. oz.)/min.
Fuel pre-filter	Mesh screen in fuel tank
Fuel filter	Micro-filter in fuel pump

Electrical system

Operating voltage	12 V
Batteries	2 x 12 V, 36 Amp/hr
Alternator	Motorola 14 V 770 W
Regulator	Motorola
Crankshaft-generator shaft ratio	Approx. 1 : 1.4
Starter	Bosch EB (12 V 0.8 hp)
2 headlights, high an low beam (Halogen)	Each 2 x H 1 55 W
2 headlights, high an low beam (standard bulbs) with symmetrical low beams (for driving on left only)	Each 45/40 W
with asymmetrical low beams ...	Each 45/40 W
2 clearance lights for all countries except USA, in headlights	
for USA, in front turn indicators ..	Each 4 Watt

4 side position lights in front and rear turn indicators (USA only)....	Each 4 Watt
2 tail lights in turn/stop tail light cluster)	Each 5 Watt
Emergency warning flashers (front and rear turn indicators)	
2 front turn indicators	Each 18 Watt
2 rear turn/stop/lights	Each 18 Watt
2 license plate lights	Each 4 Watt
1 backup light	25 Watt
Interior lights - Coupé (2)	Each 10 Watt
Glove box light	10 Watt
Tachometer lighting	2 Watt
High beam control lamp	2 Watt
Turn indicator control lamp	2 Watt
Combined instrument cluster lighting	2 Watt
Battery charge control lamp	2 Watt
Oil pressure warning lamp	2 Watt
Speedometer lighting	2 Watt
Fuses	
Window lift, windshield wipers, emergency warning light	25/40 Amp
Cigar lighter, stop lights, electric sliding roof	16/25 Amp
High and low beam headlights	8/15 Amp
Turn indicators, position lights, license plate lights	5/ 9 Amp

Transmission and rear axle

Type	Integral manual shift gearbox and differential
Gearbox	4 forward speeds with Porsche servo synchromesh; 5-speed gearbox optional
Gear ratios	1st - 4th or 1st - 5th; see transmission diagram, Group R
Reverse gear ratio	3, 1473 : 1
Gear shift	Manual rod linkage, ball pivot floor mounted center shift lever
Rear axle drive	Spiral bevel pinion and crownwheel, bevel gear differential; optional limited slip differential
Rear axle ratio	4, 428 : 1

Chassis

Frame	Welded sheet metal box section frame in unit with body
Front suspension	Independent, spring struts and lower wishbones
Rear suspension	Independent, semi-trailing arms and half shafts
Front springs	1 round section longitudinal torsion bar per wheel
Rear springs	1 round section transverse torsion bar per wheel
Rear radius arm attitude (nominal) ..	36°30' - 37°

Front shock absorbers	Acting as suspension struts
Rear shock absorbers	Double acting, telescopic
Steering	ZF-rack and pinion
Total ratio	17.78 : 1 (average)
Steering wheel turns lock to lock	Approx. 3.1
Smallest turning circle	Approx. 10.7 m (35.1 feet)
Toe-in, front	0°
rear	0° ± 10'
Camber, front	0° ± 20'
rear	-50' ± 20'
Steering axis inclination	10°55'
Caster	6°45' ± 45'
Toe-out on turns, 20° wheel lock..	0° - 30' increasing toe-in
Wheels	Steel rim
Rims	5 1/2 J x 15, drop center
Tires	165 HR 15
Tire pressures (nominal), front	1.8 atm (26.5 psi)
rear	2.0 atm (29.5 psi)
Service brake (foot brake)	Disc (twin circuit)
Service brake actuation	Hydraulic
Total effective brake area	210 cm ² (32.55 sq. in.)
Disc brake diameter, front	282.5 mm (11.12")
rear	290 mm (11.42")
Effective brake disc diameter,	
front	235 mm (9.25")
rear	244 mm (9.61")
Parking brake	Mechanical, acting on both rear wheels
Body	
Type	All steel body in unit with frame, declining front contour, fast-back rear on Coupé
Doors	2 doors, front hinged
Width	1050 mm (41.3") average
Opening angle	Approx. 70°
Windows	
Windshield	One piece, constant radius
Door windows	Crank action wind down windows
Rear side windows	Front hinged, with position lock
Rear window	One piece, curved, electrically heated
Type of glass	Safety glass
Windshield wipers	Electric, 2 parallel action arms
Compartment lids	
front	Rear hinged, with hydraulic prop, opened from car's interior
rear	Front hinged, with hydraulic prop, opened from car's interior
Seats	
Seating capacity	2 / 2
Front seats	2 adjustable fully reclining bucket seats
Rear seats	2 occasional seats, folding forward to form luggage platform

Dashboard	Speedometer with total and trip distance recorders, side-light telltale, illuminated
	Electric revolution counter with built-in telltales for high beam and turn indicators, illuminated
	Oil temperature gauge with built-in oil pressure and generator telltale, illuminated
	Fuel gauge with reserve warning light, illuminated
	Clock, illuminated
	3-position switch for windshield wipers on steering column outer tube
	Ignition/starter switch, main light switch
	Cigar lighter, ashtray, lockable glove box, grab handle
	Turn indicator/low beam/headlight flasher switch on steering column
	Steering wheel with horn push
Interior equipment	
Floor	Fitted carpet
Center tunnel	Carpet trim
Front side panels	Carpet trim
Doors and side panels	Upholstered
Roof lining	Plastic material
Heating	Remote controlled warm air heater with hot and cold air mixing, 2 defroster nozzles for windshield and 2 warm air outlets inside members below the doors
	Flap controlled fresh air plenum chamber, with 3-speed blower and air distribution system, centralized control unit
Ventilation	
Various	
Bumpers	Front and rear, each with two overrider horns
Spare wheel	Theft-proof mounting under front lid
Fuel tank	In front compartment
Tools and accessories	In front compartment
Dimensions and weights	
Wheelbase	2268 mm (89.3")
Track front	1362 mm (53.6")
rear	1343 mm (52.8")
Length	4163 mm (163.8")
Width	1610 mm (63.4")
Height (unladen)	1320 mm (52.0")
Overhang, front	865 mm (34.1")
rear	1055 mm (41.6")
Ground clearance (laden)	150 mm (5.9")
Ground clearance between wheels...	140 mm (5.5")
Dry weight (DIN)	1020 kg (2249 lbs)
Permitted total weight	1400 kg (3087 lbs)
Permitted axle load	
front	600 kg (1323 lbs)
rear	840 kg (1773 lbs)
Weight of engine, ready to install, without oil..... approx.	184 kg (406 lbs)
Weight of transmission, ready to install, with oil..... approx.	50 kg (110 lbs)

Filling capacities

Fuel tank	Approx. 62 liters (16.4 US gal.), including 6 liters (1.6 US gal.) reserve
Engine and oil tank	Approx. 9 liters (19 US pints) branded HD oil; in summer SAE 30, in winter SAE 20 for temperatures from -15°C (+ 5°F) to 0°C (32°F), SAE 10 for temperatures below -15°C (+ 5°F)
Transmission and differential	Approx. 2.5 liters (5.3 US pints) SAE 90 hypoid
Brake fluid reservoir	Approx. 0.2 liters (0.42 US pints)
Windshield washer	Approx. 2 liters (4.2 US pints)

Performance

Output	110 BHP (DIN)
at engine speed	5800 rpm
Maximum torque	16 mkp (116 lb/ft)
at engine speed	4200 rpm
Mean piston speed	
at maximum output	12.8 m/sec (2520 ft/min)
Mean effective pressure	
at maximum engine output	8.6 kp/cm ² (122.3 psi)
Min. fuel consumption	230 g/BHP/hr
at engine speed	3300 rpm
Maximum road speed	200 kph (124 mph)
Output per liter	55 BHP
Power/weight ratio (ready for road) .	9.9 kg. (21.8 lbs)/BHP (DIN)
Speeds in indirect ratios(theoretical)	See transmission diagrams, group R

Fuel consumption

Fuel consumption (standard test method)	9 liters per 100 km (26 US mpg)
Min. octane rating	96 (RM)

TECHNICAL DATA

Vehicle type: 911 E

Engine type: 911 E

Engine

Type	Air cooled four-stroke gasoline engine combined to form a single unit with clutch, transmission and rear axle. Mounted at rear of vehicle
Number of cylinders	6
Cylinder layout	Horizontally opposed 3 x 3
Bore	80 mm (3,150")
Stroke	66 mm (2,598")
Capacity	1991 cc (121,5 cu. in.)
Compression ratio	9.1 : 1
Compression test	9 - 11 kp/cm ² (128 - 157 psi) - after 12 compression strokes
Total dry weight	Approx. 184 kg (406 lbs)
Crankcase	Light alloy, two-part
Cylinders	Separate cylinder blocks
Cylinder material	Biral (cast-iron with light alloy fins)
Cylinder heads	Separate, light alloy
Valve seats	Shrink fit
Valve guides	Shrink fit, special bronze
Spark plug seats	Heli-coil inserts
Crankshaft	Forged
Main bearings	8 plain bearings
Main bearings 1 - 7	3-layer split shells
Main bearing 8	1 piece bushing, hard lead
Main bearing 1	Guide bearing
Connecting rods	Forged steel, soft nitrided
Big end bearings	3-layer
Piston pin bushings	Kuprodur, turned
Pistons	Light alloy, forged, box section
Piston rings	2 compression rings, 1 oil scraper
Valve operation	One overhead camshaft for each cylinder bank
Camshaft	Cast, with 3 plain bearings mounted directly in cambox
Camshaft drive	Chains
Valve layout	Overhead
Valve springs	2 coil springs per valve
Valve clearances (adjust with engine cold)	
Inlet	0,10 mm (0,0039")
Exhaust	0,10 mm (0,0039")
Valve test timing (measured with 1 mm/0,04" valve clearance)	
Inlet opens before TDC	29°
Inlet closes after BDC	39°
Exhaust opens before BDC	39°
Exhaust closes after TDC	19°
Cooling	Air cooled with axial blower on generator
Blower drive	By V-belt from crankshaft

Air flow rate	1480 liters (52.5 cu. ft)/sec at 6500 rpm
Lubrication	Dry sump with pressure oil circulation
Oil cooling	Oil cooler on crankcase within flow from blower
Oil pressure gauge	Electric
Ignition	High tension battery/condenser ignition
Ignition transformer (coil)	Bosch
Distributor	Bosch
Contact breaker points (min.)	0.3 mm (0.012")
Ignition point	30° before TDC at 6000 rpm
Firing order	1 - 6 - 2 - 4 - 3 - 5
Spark plugs	
Bosch	W 265 P 21, W 265 T 2SP
Spark plug thread	14 x 1.25 mm
Spark plug gap	0.35 mm (0.014")

Clutch

Type	Fichtel and Sachs - M 215 K single dry plate
Clutch pedal free travel	Approx. 20 mm (0.8")
Total lining area	203 cm ² (31 sq. in.)

Fuel system

Fuel injection	Bosch 6 element double row injection pump
Air cleaner	Intake air muffler with Micronic element
Fuel pump	One electric fuel pump
Delivery pressure of electric pump ..	0.8 ± 0.2 atm (11.38 ± 2.84 psi)
Flow rate of electric pump	approx. 110 liters (29.1 US gal.)/hr.
Fuel purification	Mesh filter in fuel tank
Fuel filter	Micro filter in front of injection pump with built-in restrictor valve

Electrical system

Service voltage	12 Volt
Batteries	2 x 12 Volt, 36 amp/hr.
Generator	Bosch K 1 - 14V 770 W
Regulator	Bosch VDN 1
Crankshaft - Generator shaft drive ration	Approx. 1 : 1.4
Starter	Bosch EB (12 V 0.8 hp)
2 Headlights, high and low beam (Quartz-iodine)	Each 2 x H 1 55 W
2 Headlights, high and low beam (spherical bulbs with vertical dimming) for countries driving on left only	Each 45/40 Watt
for asymmetric low beam	Each 45/40 Watt
2 side lights for all countries except USA, inside headlight units for USA, in front turn indicators .	Each 4 Watt

4 side boundary lights in front and rear turn indicators (USA only).....	Each 4 Watt
2 rear lights in turn indicator - stop - rear light units	Each 5 Watt
Emergency warning flasher system (front and rear turn indicators)	
2 front turn indicators	Each 18 Watt
2 turn indicator - stop lights	Each 18 Watt
2 license plate lights	Each 4 Watt
1 reversing light	25 Watt
Interior light (2 fitted to Coupé)	Each 10 Watt
Glove box light	10 Watt
Revolution counter - instrument lighting	2 Watt
High beam telltale	2 Watt
Turn indicator telltale	2 Watt
Combined instrument lighting	2 Watt
Generator telltale	2 Watt
Oil pressure telltale	2 Watt
Speedometer lighting	2 Watt
Fuses	
Window lifts, windshield wipers, emergency warning light	25/40 Amp.
Cigar lighter, stop light, sliding roof	16/25 Amp.
High beam, low beam	8/15 Amp.
Turn indicators, side lights, license plate lights	5/ 9 Amp.

Transmission and rear axle

Type	5-speed gearbox and differential in combined housing
Manual gearbox	5 forward gears with Porsche servo synchromesh
For 1st to 5th gear ratios, see gearbox diagram, group R	
Reverse gear ratio	3, 1473 : 1
Gear shift	Rod linkage with ball joint gear shift lever in center of floor
Final drive	Spiral bevel pinion, bevel pinion differential option; limited - slip differential
Rear axle ratio	4, 428 : 1

Chassis

Frame	Welded box section steel feet, welded to superstructure
Suspension, front	Independent, with wishbones and spring struts
rear	Independent, semi-trailing arms, drive to rear wheels by half shafts
Springing, front	1 self-levelling hydropneumatic spring strut per wheel
rear	1 round section torsion bar, horizontally mounted, per wheel
Rear radius arm settings (approx. alignment value)	36°30' - 37°

Dashboard	Speedometer with total and trip distance recorders, side-light telltale, illuminated Electric revolution counter with built-in telltales for high beam and turn indicators, illuminated Combined instrument with oil temperature gauge, oil pressure gauge and generator telltale, illuminated Clock 3-position switch for windshield wipers on steering column outer tube Ignition/starter switch, main light switch Cigar lighter, ashtray, lockable glove box, grab handle Turn indicator/low beam/headlight flasher switch on steering column Steering wheel with horn push
Interior equipment	
Floor	Fitted carpet
Center tunnel	Carpet trim
Front side panels	Carpet trim
Doors and side panels	Upholstered
Roof lining	Plastic material
Heating	Remote controlled warm air heater with hot and cold air mixing, 2 defroster nozzles for windshield and 2 warm air outlets inside members below the doors
Ventilation	Flap controlled fresh air plenum chamber, with 3-speed blower and air distribution system, centralized control unit
Various	
Bumpers	Front and rear, each with two overrider horns
Spare wheel	Thief-proof mounting under front lid
Fuel tank	In front compartment
Tools and accessories	In front compartment
Dimensions and weights	
Wheelbase	2268 mm (89.3")
Track front	1374 mm (54.0") - 14" rims = 1364 mm (53.7")
rear	1355 mm (53.3") - 14" rims = 1345 mm (52.9")
Length	4163 mm (163.8")
Width	1610 mm (63.4")
Height (unladen)	1320 mm (52.0") - Coupé
Overhang, front	865 mm (34.1")
rear	1055 mm (41.6")
Ground clearance (laden)	150 mm (5.9")
Ground clearance between wheels ...	140 mm (5.5")
Dry weight (DIN)	1020 kg (2249 lbs)
Permitted total weight	1400 kg (3087 lbs)
Permitted axle load, front	600 kg (1323 lbs)
rear	840 kg (1773 lbs)
Weight of engine, ready to install, without oil	approx. 184 kg (406 lbs)
Weight of transmission, ready to install, with oil	approx. 50 kg (110 lbs)

Filling capacities

Fuel tank	Approx. 62 liters (16.4 US gal.), including 6 liters (1.6 US gal.) reserve
Engine and oil tank	Approx. 9 liters (19 US pints) branded HD oil; in summer SAE 30, in winter SAE 20 for temperatures from -15°C (+ 5°F) to 0°C (32°F), SAE 10 for temperatures below -15°C (+ 5°F)
Transmission and differential	Approx. 2.5 liters (5.3 US pints) SAE 90 hypoid
Brake fluid reservoir	Approx. 0.2 liters (0.42 US pints)
Windshield washer	Approx. 2 liters (4.2 US pints)

Performance

Output	140 BHP (DIN)
at engine speed	6500 rpm
Maximum torque	17.8 mkp (128.8 lb/ft)
at engine speed	4500 rpm
Mean piston speed	
at maximum output	14.3 m/sec (2910 ft/min)
Mean effective pressure	
at maximum engine output	9.75 kp/cm ² (138.7 psi)
Min. fuel consumption	228 g/BHP/hr
at engine speed	3300 rpm
Maximum road speed	215 kph (133 mph)
Output per liter	70 BHP
Power/weight ratio (ready for road) ..	7.8 kg. (17.2 lbs)/BHP (DIN)
Speeds in indirect ratios (theoretical)	See transmission diagrams, group R

Fuel consumption

Fuel consumption (standard test method)	9.6 liters per 100 km (24.5 US mpg)
Min. octane rating	Approx. 98 - 100 (RM)

TECHNICAL DATA

Vehicle type: 911 S

Engine type: 911 S

Engine

Type	Air cooled four-stroke gasoline engine combined to form a single unit with clutch, transmission and rear axle. Mounted at rear of vehicle
Number of cylinders	6
Cylinder layout	Horizontally opposed 3 x 3
Bore	80 mm (3.150")
Stroke	66 mm (2.598")
Capacity	1991 cc (121.5 cu. in.)
Compression ratio	9.9:1
Compression test	9 - 11 kp/cm ² (128 - 157 psi) - after 12 compression strokes
Total dry weight	Approx. 184 kg (406 lbs)
Crankcase	Light alloy, two-part
Cylinders	Separate cylinder blocks
Cylinder material	Biral (cast-iron with light alloy fins)
Cylinder heads	Separate, light alloy
Valve seats	Shrink fit
Valve guides	Shrink fit, special bronze
Spark plug seats	Heli-coil inserts
Crankshaft	Forged
Main bearings	8 plain bearings
Main bearings 1 - 7	3-layer split shells
Main bearing 8	1 piece bushing, hard lead
Main bearing 1	Guide bearing
Connecting rods	Forged steel, soft nitrated
Big end bearings	3-layer
Piston pin bushings	Kuprodur, turned
Pistons	Light alloy, forged, box section
Piston rings	2 compression rings, 1 oil scraper
Valve operation	One overhead camshaft for each cylinder bank
Camshaft	Cast, with 3 plain bearings mounted directly in cambox
Camshaft drive	Chains
Valve layout	Overhead
Valve springs	2 coil springs per valve
Valve clearances (adjust with engine cold)	
Inlet	0.10 mm (0.0039")
Exhaust	0.10 mm (0.0039")
Valve test timing (measured with 1 mm/0.04" valve clearance)	
Inlet opens before TDC	38°
Inlet closes after BDC	50°
Exhaust opens before BDC	40°
Exhaust closes after TDC	20°
Cooling	Air cooled with axial blower on generator
Blower drive	By V-belt from crankshaft

Air flow rate	1550 liters (54.2 cu. ft)/sec at 6800 rpm
Lubrication	Dry sump with pressure oil circulation
Oil cooling	Oil cooler on crankcase within flow from blower
Oil pressure gauge	Electric
Ignition	High tension battery/condenser ignition
Ignition transformer (coil)	Bosch
Distributor	Bosch
Contact breaker points (min.)	0.3 mm (0.012")
Ignition point	30° before TDC at 6000 rpm
Firing order	1 - 6 - 2 - 4 - 3 - 5
Spark plugs	
Bosch	W 265 P 21, W 265 T 2SP
Spark plug thread	14 x 1.25 mm
Spark plug gap	0.35 mm (0.014")

Clutch

Type	Fichtel and Sachs - M 215 K single dry plate
Clutch pedal free travel	Approx. 20 mm (0.8")
Total lining area	203 cm ² (31 sq. in.)

Fuel system

Fuel injection	Bosch 6 element double row injection pump
Air cleaner	Intake air muffler with Micronic element
Fuel pump	One electric fuel pump
Delivery pressure of electric pump ...	0.8 ± 0.2 atm (11.38 ± 2.84 psi)
Flow rate of electric pump	Approx. 110 liters (29.1 US gal.)/hr.
Fuel purification	Mesh filter in fuel tank
Fuel filter	Micro filter in front of injection pump with built-in restrictor valve

Electrical system

Service voltage	12 Volt
Batteries	2 x 12 Volt, 36 amp/hr.
Generator	Bosch K 1 - 14V 770 W
Regulator	Bosch VDN 1
Crankshaft - Generator shaft drive ration	Approx. 1 : 1.4
Starter	Bosch EB (12 V 0.8 hp)
2 Headlights, high and low beam (Quartz-iodine)	Each 2 x H1 55 W
2 Headlights, high and low beam (spherical bulbs with vertical dimming) for countries driving on left only	Each 45/40 Watt
for asymmetric low beam	Each 45/40 Watt
2 side lights for all countries except USA, inside headlight units	
for USA, in front turn indicators..	Each 4 Watt

4 side boundary lights in front rear turn indicators (USA only).....	Each 4 Watt
2 rear lights in turn indicator - stop - rear light units	Each 5 Watt
Emergency warning flasher system (front and rear turn indicators)	
2 front turn indicators	Each 18 Watt
2 turn indicator - stop lights	Each 18 Watt
2 license plate lights	Each 4 Watt
1 reversing light	25 Watt
Interior light (2 fitted to Coupe).....	Each 10 Watt
Glove box light	10 Watt
Revolution counter - instrument lighting	2 Watt
High beam telltale	2 Watt
Turn indicator telltale	2 Watt
Combined instrument lighting	2 Watt
Generator telltale	2 Watt
Oil pressure telltale	2 Watt
Speedometer lighting	2 Watt
Fuses	
Window lifts, windshield wipers, emergency warning light	25/40 Amp.
Cigar lighter, stop light, sliding roof	16/25 Amp.
High beam, low beam	8/15 Amp.
Turn indicators, side lights, license plate lights	5/ 9 Amp.
 Transmission and rear axle	
Type	5-speed gearbox and differential in combined housing
Manual gearbox	5 forward gears with Porsche servo synchromesh
For 1st to 5th gear ratios, see gearbox diagram, group R	
Reverse gear ratio	3, 1473 : 1
Gear shift	Rod linkage with ball joint gear shift lever in center of floor
Final drive	Spiral bevel pinion, bevel pinion differential optional; limited - slip differential
Rear axle ratio	4, 428 : 1
 Chassis	
Frame	Welded box section steel feet, welded to superstructure
Suspension, front	Independent, with wishbones and spring struts
rear	Independent, semi-trailing arms, drive to rear wheels by half shafts
Springing, front	1 self-levelling hydropneumatic spring strut per wheel
rear	1 round section torsion bar, horizontally mounted, per wheel
Rear radius arm settings (approx. alignment value)	36°30' - 37°

Dashboard	Speedometer with total and trip distance recorders, side-light telltale, illuminated Electric revolution counter with built-in telltales for high beam and turn indicators, illuminated Combined instrument with oil temperature gauge, oil pressure gauge and generator telltale, illuminated Clock 3-position switch for windshield wipers on steering column outer tube Ignition/starter switch, main light switch Cigar lighter, ashtray, lockable glove box, grab handle Turn indicator/low beam/headlight flasher switch on steering column Steering wheel with horn push
Interior equipment	
Floor	Fitted carpet
Center tunnel	Carpet trim
Front side panels	Carpet trim
Doors and side panels	Upholstered
Roof lining	Plastic material
Heating	Remote controlled warm air heater with hot and cold air mixing, 2 defroster nozzles for windshield and 2 warm air outlets inside members below the doors
Ventilation	Flap controlled fresh air plenum chamber, with 3-speed blower and air distribution system, centralized control unit
Various	
Bumpers	Front and rear, each with two overrider horns
Spare wheel	Theft-proof mounting under front lid
Fuel tank	In front compartment
Tools and accessories	In front compartment
Dimensions and weights	
Wheelbase	2268 mm (89.3")
Track front	1374 mm (54.0")
rear	1355 mm (53.3")
Length	4163 mm (163.8")
Width	1610 mm (63.4")
Height (unladen)	1320 mm (52.0") - Coupé
Overhang, front	865 mm (34.1")
rear	1055 mm (41.6")
Ground clearance (laden)	150 mm (5.9")
Ground clearance between wheels, ..	140 mm (5.5")
Dry weight (DIN)	995 kg (2194 lbs)
Permitted total weight	1400 kg (3087 lbs)
Permitted axle load	
front	600 kg (1323 lbs)
rear	840 kg (1773 lbs)
Weight of engine, ready to install, without oil	approx. 184 kg (406 lbs)
Weight of transmission, ready to install, with oil	approx. 50 kg (110 lbs)

Filling capacities

Fuel tank	Approx. 62 liters (16.4 US gal.), including 6 liters (1.6 US gal.) reserve
Engine and oil tank	Approx. 9 liters (19 US pints) branded HD oil; in summer SAE 30, in winter SAE 20 for temperatures from -15°C (+5°F) to 0°C (32°F), SAE 10 for temperatures below -15°C (+5°F)
Transmission and differential	Approx. 2.5 liters (5.3 US pints) SAE 90 hypoid
Brake fluid reservoir	Approx. 0.2 liters (0.42 US pints)
Windshield washer	Approx. 2 liters (4.2 US pints)

Performance

Output	170 BHP (DIN)
at engine speed	6800 rpm
Maximum torque	18.5 mkg (133.8 lb/ft)
at engine speed	5500 rpm
Mean piston speed	
at maximum output	14.9 m/sec (2934 ft/min)
Mean effective pressure	
at maximum engine output	11.3 kp/cm ² (160.7 psi)
Min. fuel consumption	236 g/BHP/hr
at engine speed	4000 rpm
Maximum road speed	225 kph (140 mph)
Output per liter	85 BHP
Power/weight ratio (ready for road) ..	6.3 kg (13.9 lbs)/BHP (DIN)
Speeds in indirect ratios(theoretical)	See transmission diagrams, group R

Fuel consumption

Fuel consumption (standard test method)	10.2 liters per 100 km (23 US mpg)
Min. octane rating	approx. 98 - 100 (RM)

Installation:

Note the following points during installation:

General:

Tapered roller bearings of various brands (SKF, FAG and Timken), are installed during assembly at the plant.

New bearing parts, such as the outer race, inner race and roller are interchangeable within a given brand but care must be taken that the complete bearing consists of one-brand parts.

1. Thoroughly clean both tapered roller bearings and check for wear or damage, replace if necessary.
2. Heat wheel hub to 120 - 150°C (250-300°F).
3. Press in the outer race of the inner roller bearing on shop press using special tools VW 407, VW 477i, Spacer 1, and VW 401.

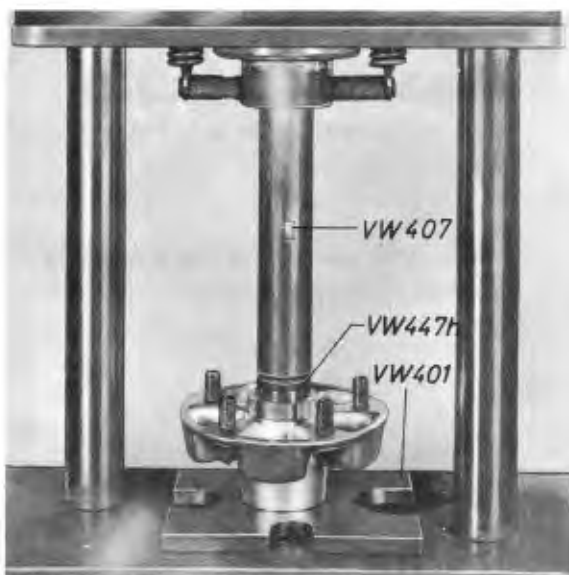


Fig. 26

4. Insert the inner race into the inner tapered roller bearing and press oil seal in with the help of special tools VW 410, VW 433, Spacer 1, and VW 401 until the oil seal is flushed with the wheel hub housing.
5. Press in the outer race of the outer tapered roller bearing with special tools VW 407, VW 447h, and VW 401.

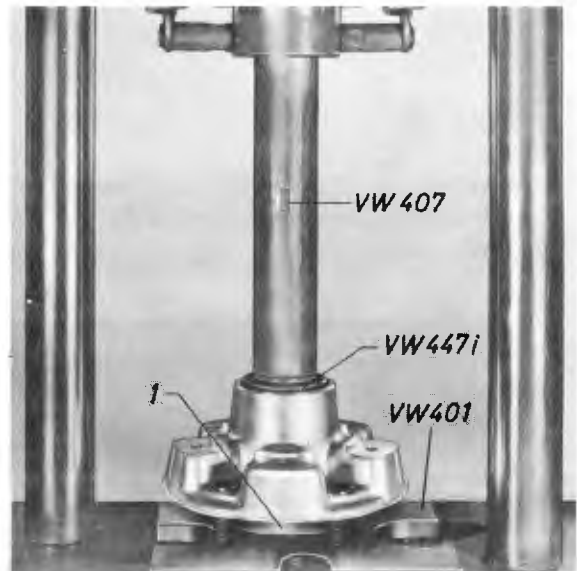


Fig. 27

6. Place brake disk on the wheel hub so that the markings line up.
7. Torque brake disc/wheel hub retaining bolts to 2, 3 mkp (16, 6 lb/ft). Make certain that the bolts are installed from inside to outside so that bolt heads come to rest against the brake disc; place new spring washers under the nuts.
8. Pack the hub with approx. 50 c.c. or 45 g (1.6 oz.) of lithium base multipurpose grease. From 69 models on use 65 c.c. or 60 g (2.1 oz.) of grease. Make sure that the bearings are thoroughly coated with grease. The space between the sealing lips of the sealing ring should also be filled with grease so that the outer sealing ring does not run without lubrication.

9. Adjust front wheel bearings.

- a) Lightly tighten the clamping nut (approx. 1,5 mkp or 10,8 lb/ft) while turning the wheel or hub to well seat the tapered rollers in their races.
- b) Loosen clamping nut so that the thrust washer can be moved sideways under light pressure of a screwdriver yet not bearing play felt when shaking the wheel hub axially.

Note :

The screwdriver should not be pressed against the hub for this purpose but held free for better feel.



Fig. 28

- c) Torque Allen bolt in clamping nut to 1,5 mkp (10,9 lb/ft) making sure that the clamping nut remains in the adjusted position. Recheck adjustment by moving the thrust washer, readjust if necessary.



Fig. 29

- d) Lightly coat the clamping nut and thrust washer with Lithium grease. Install grease cap (without filling it with grease) with the aid of a plastic hammer or similar tool.
10. Install brake caliper retaining bolts with spring washers and torque to 7,0 mkp (50,6 lb/ft).
11. Torque gland nut of brake line at brake caliper to 2,0 mkp (14,5 lb/ft).

7. Remove lock ring and spacer.



Fig. 79

8. Using puller P 282, remove steering pinion from pinion carrier. Caution! Make sure that the ball bearing does not bind against the steering housing.



Fig. 80

9. Remove Woodruff key from its seat in the pinion, press ball bearing off pinion.

10. Mark steering rack for reassembly, slide it out of the housing, and withdraw pinion carrier.



Fig. 81

11. Press ball bearing out of the pinion carrier.

12. Remove rack bushing spring retainer with a punch and a screwdriver (see illustration).

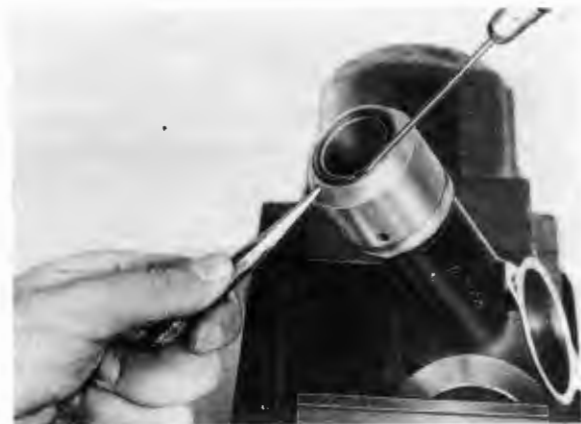


Fig. 82

13. Withdraw supporting ring and drive the rack bushing out by means of the pressure block P 283 and an appropriate pipe.

14. Clean all parts.

Checking parts

1. Check rack and pinion, replace if necessary.
2. Check ball bearings for wear, replace if necessary.
3. Visually check rack bushings for traces of wear and replace if necessary.

Reassembly:

Reassembly is accomplished in reversed order of the above by noting the following points:

1. Insert the wide supporting ring into housing. Using pressure block P 283, drive the rack bushing into the housing with the recessed flank facing outward. (Lightly coat with grease the outer surface of the bushing).

Place the narrow supporting ring onto the rack bushing and install the spring retainer so that its gap is about 90° in relation to the bore.

2. Coat pinion carrier with multipurpose grease LM-KFZ3 or LM-47L and insert into the steering housing.

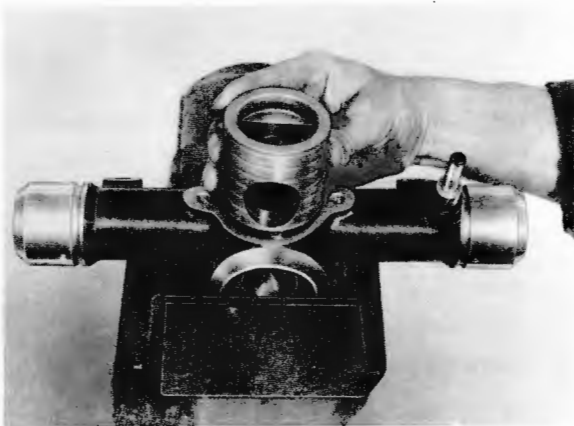


Fig. 83

Note!

During assembly, the steering must be greased with 40 g of multi-purpose grease containing MoS_2 , LM-KFZ3, or LM-47L manufactured by Liqui-Moly GmbH, Ulm/Donau, W-Germany.

3. Coat the rack well with the above mentioned grease and slide it into the housing. (When reinstalling a used rack, note the original position prior to disassembly).
4. Paste the remainder of the 40 g grease into the housing and insert the pinion, with ball bearing and Woodruff key, so that it comes to rest in its seat.
5. Using spacers, adjust axial play of pinion to zero. The following spacer thicknesses are available: 0.1; 0.12; 0.15; and 0.3 mm.

6. Install the shaft sealing ring with the sealing lip facing outwards in the housing. (Shaft sealing ring with part number 901.347.936.02 must be installed with the sealing lip facing inwards.)
7. Install the flange, and make sure that the flat disc spring seats correctly. Coat both sides of the washer with sealing compound, tighten the castellated nut to 2.5 mkp (18 lb/ft) torque, and secure with split pin. (On drive pinions with paper shaft for flange, install the O-ring before the flange, then tighten with self-locking hex nut (M10) to 4.7 mkp = 34 lb/ft.)
8. Install pressure block, spring, and adjusting nut.
9. See paragraph 13 St for adjusting procedure pertaining to the nut and steering gear.
10. Install the paper gasket and the housing cover, and tighten the hexagon bolts to 1.5 mkp (10.8 lb/ft.) torque.

Note:

The special grease filling can also be pressed in after the assembly, i. e., through the hex bolt across from the base plate. Coat hex bolt with gasket compound and install.

Special tools:

P 261 Torquemeter, 0-25 cmkp (0-22 lb/in)

Note:

The steering gear adjusting methods vary according to the type of steering rack pressure block.

Method 1

Method 1 applies to steel pressure blocks with DELRIN (plastic) contact surface. External distinguishing features on the steering housing are: Steering gear with dust boot seat, (see illustration).

2. Tighten adjusting nut to seating contact; the base plate may be used as a wrench in that the plate is placed on the adjusting nut allowing the pins in the plate to engage the teeth in the nut.

3. Back the nut off by three teeth.

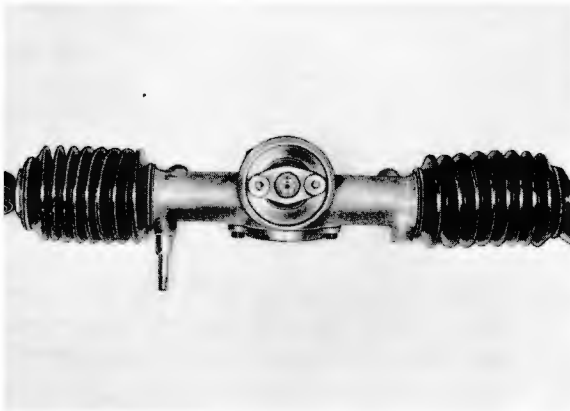


Fig. 84

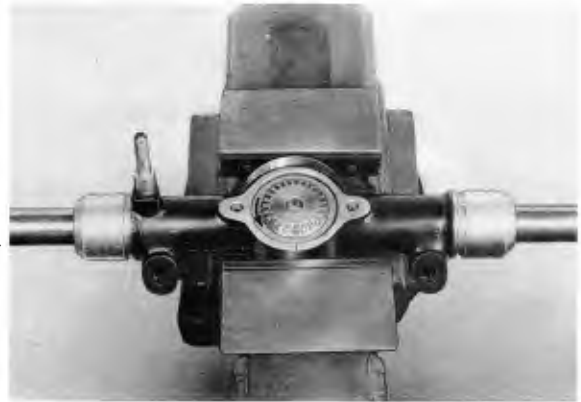


Fig. 86

1. Remove hex retaining bolts from base plate and withdraw plate.

4. Check steering gear drag at pinion flange using torquemeter P 261 over the entire working length of the steering rack. If the measured values are beyond 8 cmkp, loosen the adjusting nut until a drag of 8 cmkp is obtained.

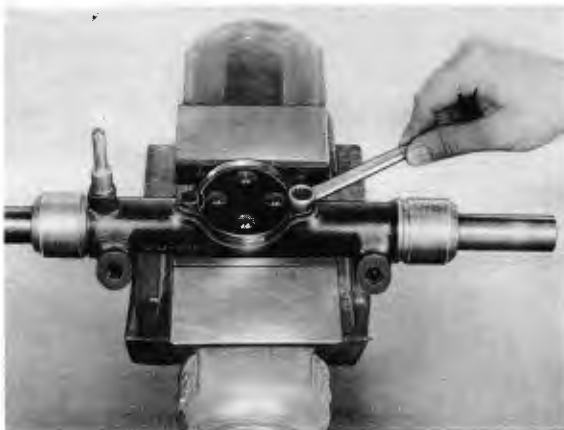


Fig. 85



Fig. 87

It is possible that after backing the nut off by three teeth a drag of not less than 4 cmkp will be noted; in such cases the adjusting nut should not be retightened.

The maximum steering adjustment is:

- a. Adjustment nut backed off by three teeth from its point of contact.
- b. A maximum drag of 8 cmkp in evidence at the pinion flange with tie rods and steering damper disconnected.
- c. A maximum drag of 10 cmkp in evidence at the steering shaft or steering wheel retaining nut, with tie rods and steering damper disconnected.



Fig. 88

5. Install base plate and paper gasket, torque hex bolts to 1.5 mkp (10.9 lb/ft)

Note!

When installing the base plate, the four pins in the plate must easily fit into teeth of the adjusting nut; if necessary move the nut a little.

Method 2

Method 2 applies to DELRIN (plastic) pressure blocks. External distinguishing features on the steering housing are: Steering gear without dust boot seat, see illustration.

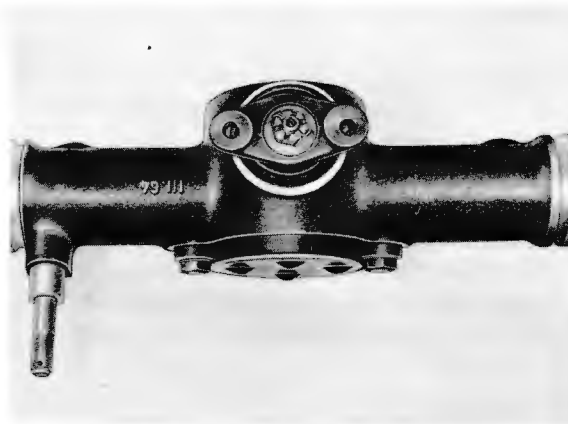


Fig. 89

1. Remove hex retaining bolts from base plate and withdraw plate.
2. Tighten adjusting nut so that a drag of maximum 8 cmkp is obtained over the entire working length of the steering rack, measured with the torquemeter P 261 at the pinion flange.



Fig. 90

Adjustment values:

- a. A maximum drag of 8 cmkp in evidence at the pinion flange with tie rods and steering damper disconnected.
- b. A maximum drag of 10 cmkp in evidence at the steering shaft or steering wheel retaining nut, with tie rods and steering damper disconnected.

- 3. Install base plate and paper gasket, torque hex bolts to 1,5 mkp (10,9 lb/ft).

Note:

When installing the base plate, the four pins in the plate must easily fit into teeth of the adjusting nut; if necessary, move the nut a little.

Removal

1. Disconnect battery.
2. Turn horn button to left and withdraw.



Fig. 91

3. Pull out contact pin.
4. Unscrew steering wheel retaining nut.



Fig. 92

5. Mark relative position of steering wheel and steering upper shaft and withdraw steering wheel (watch for the bearing support ring and spring).

Installation

Note the following points during reassembly:

1. Place spring and support ring onto steering wheel hub.

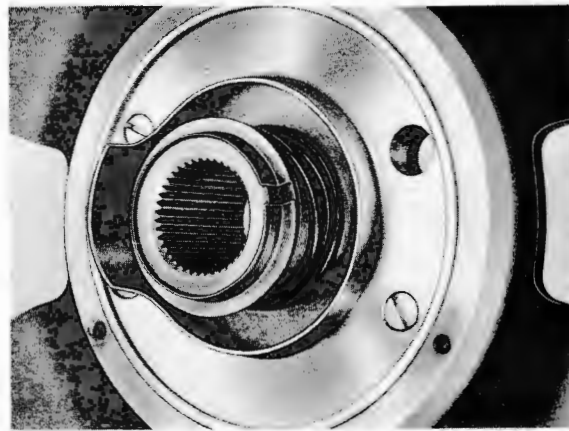


Fig. 93

2. Install steering wheel, with road wheels in straight ahead position, so that the return striker points to the left towards the blinker switch, and the steering wheel spokes are in horizontal position; or place wheel according to markings made at time of disassembly.
3. Torque steering wheel retaining nut to 8,0 mkp (57,9 lb/ft); insert spring washer under nut.
4. Check blinker return striker for proper functioning.
5. Lightly lubricate horn contact ring.
6. Insert contact pin, position horn button and depress, turn right to lock.

INSTALLING STEERING COUPLING

18 ST

When installing the steering coupling it should be ascertained that the large orifices in the coupling flanks (see illustration) always contact the flanges; that is, the flange of the pinion or the flange of the lower shaft. In no case should the safety plates and bolt heads come to rest against the large orifices since the plates and bolt heads could chaff and damage the steering coupling.

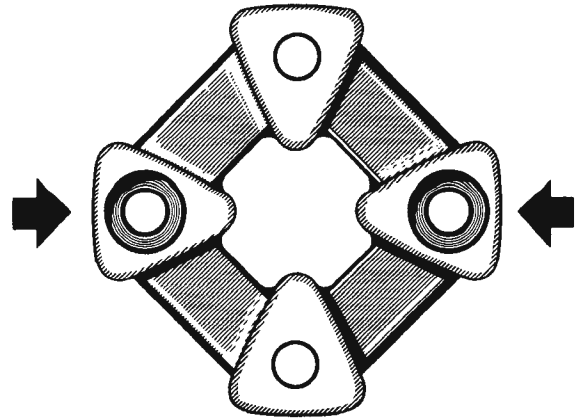


Fig. 115

UNIVERSAL JOINT WITH INTERNAL SPLINES

19 ST

Beginning with Chassis 305 101, 354 001, and 458 101, internally splined universal joints have been introduced. The steering upper shaft, intermediate shaft, and lower shaft have been provided with splines which mate with those in the universal joints.

The splined universal joints and shafts are not interchangeable with joints and shafts without splines or knurling.

When installing internally splined universal joints, it is necessary to install splined upper, intermediate, and lower shafts.

When installing the universal joints note the following:

1. Push the splined universal joints onto the shafts so that the hex bolts enter easily.
2. Torque hex bolts to 2, 5 mkp (18, 1 lb/ft).

Castellated nuts for ball joint (M 12 x 1, 5)	4. 5 mkp (33 lb/ft)
Hex bolt for ball joint (M 10 x 30 - 10 K)	6. 5 mkp (47 lb/ft)
Hex bolts for steering arm (M 10)	4. 7 mkp (34 lb/ft)
Hex nut on shock absorber strap (M 14 x 1, 5)	8. 0 mkp (58 lb/ft)
Castellated nut on wishbone (M 12 x 1, 5)	7. 5 mkp (54 lb/ft)
Slotted nut for ball joint (M 45 x 1, 5)	15. 0 mkp (108 lb/ft)
Castellated nut for track rod joint (M 10 x 1)	4. 5 mkp (33 lb/ft)
Hex bolt for brake support (M 10)	4. 7 mkp (34 lb/ft)
Hex bolt for fixed caliper (M 12 x 1, 5)	7. 0 mkp (51 lb/ft)
Hollow screw on caliper (brake pipe)	2. 0 mkp (14. 4 lb/ft)
Hex bolts for field plate (M 8)	2. 5 mkp (18 lb/ft)
Hex bolts for brake discs (M 8)	2. 3 mkp (16. 6 lb/ft)
Fillister head bolt for clamp nut (wheel bearing, M 7)	1. 5 mkp (10. 8 lb/ft)
Fillister head bolt for flanbloc attachment (M 10)	4. 7 mkp (34 lb/ft)
Hex bolts for bearing mount (M 10)	4. 7 mkp (34 lb/ft)
Hex bolt for auxiliary support (M 12 x 1, 5)	9. 0 mkp (58 lb/ft)
Hex bolt for link to auxiliary support (M 10)	4. 7 mkp (34 lb/ft)
Hex nut for link to auxiliary support (M 16 x 1, 5)	6. 5 mkp (47 lb/ft)
Hex bolts for bearing cap (stabilizer - M 8)	2. 5 mkp (18 lb/ft)
Hex bolts for stabilizer arm (M 8)	2. 5 mkp (18 lb/ft)
Pivot pin for track rod fork end (M 10)	4. 7 mkp (34 lb/ft)
Hex bolts for steering box (M 10)	4. 7 mkp (34 lb/ft)
Fillister head bolts for bearing cap on steering shaft (M 8)	2. 5 mkp (18 lb/ft)
Hex bolts for steering coupling (M 8)	2. 5 mkp (18 lb/ft)
Hex nut for joint bush (M 16 x 1, 5)	6. 5 mkp (47 lb/ft)
Gaiter retainer on joint bush (M 16 x 1, 5)	7. 0 mkp (51 lb/ft)
Castellated nut for flange on drive pinion (M 8)	2. 5 mkp (18 lb/ft)
Self-locking hex nut for drive pinion flange (M 10)	4. 7 mkp (34 lb/ft)
Hex bolts for steering housing cover (M 8)	1. 5 mkp (10. 8 lb/ft)
Hex nut for steering wheel (M 18 x 1, 5)	8. 0 mkp (58 lb/ft)
Fillister head bolt for clamping strap on switch combination (M 8 x 1)	2. 5 mkp (18 lb/ft)
Hex bolts for steering support tube (M 8)	2. 5 mkp (18 lb/ft)
Hex bolts for universal joints (M 8 - 10 K)	3. 5 mkp (25 lb/ft)
Hex bolts for splined universal joints (M 8 - 8 G)	2. 5 mkp (18 lb/ft)
Fillister head bolts for steering hunter tube (M 8)	2. 5 mkp (18 lb/ft)
Wheel nuts	13. 0 mkp (94 lb/ft)

- Heat cover to approx. 120° C (248° F) and install reverse gear shaft making sure that the oil passage in shaft points down (see Fig. 112).

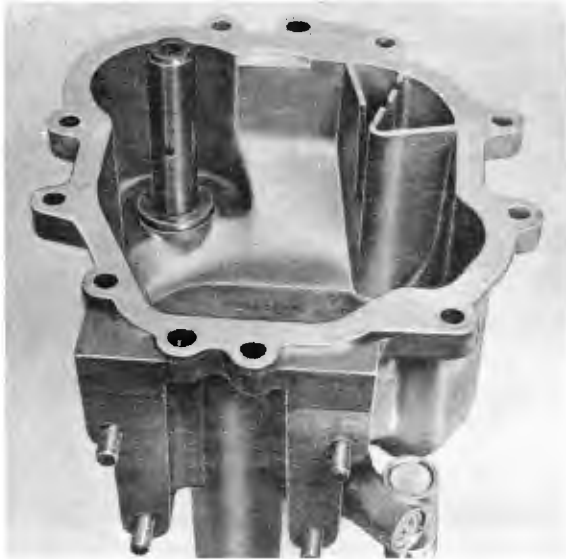


Fig. 112

- Drive retaining pin in.
- Heat bronze thrust washer to approx. 120° C (248° C) and push onto reverse gear shaft until it firmly sets against the cover. The washer must seat well against the cover in order to prevent a reduction of axial play of the reverse gear.
- Install bearing cages and spacer bushing.

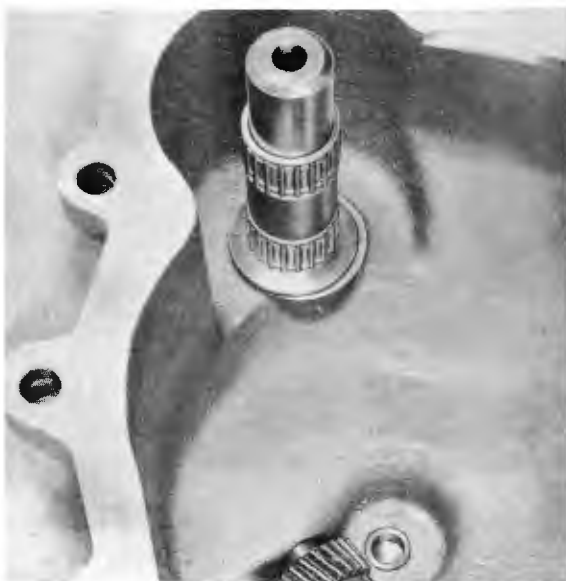


Fig. 113

- Install reverse gear, axial thrust needle bearing, and thrust washer.



Fig. 114

- Insert tachometer elbow drive into cover, make certain that the orifice for the set screw lines up with that in cover (see Fig. 115). Check O-ring, replace if necessary. Install set screw and washer, tighten to 1.6 - 1.8 mkp (11.6 - 13.5 lb/ft)



Fig. 115

9. Place new 0,2 mm thick paper gasket onto the intermediate plate.
10. Install front housing cover; to bring the helical reverse gear past the sliding gear of reverse and 1st speed, pull the reverse gear and its axial thrust needle bearing with thrust washer as far to the end of the shaft as possible (outwards).

Note:

The machined recess in the thrust washer must align with the outer collar of the pinion shaft ball bearing.

11. Tighten cover retaining nuts to 2,1 - 2,3 mkp (15,2 - 16,6 lb/ft)
12. Install transmission support.

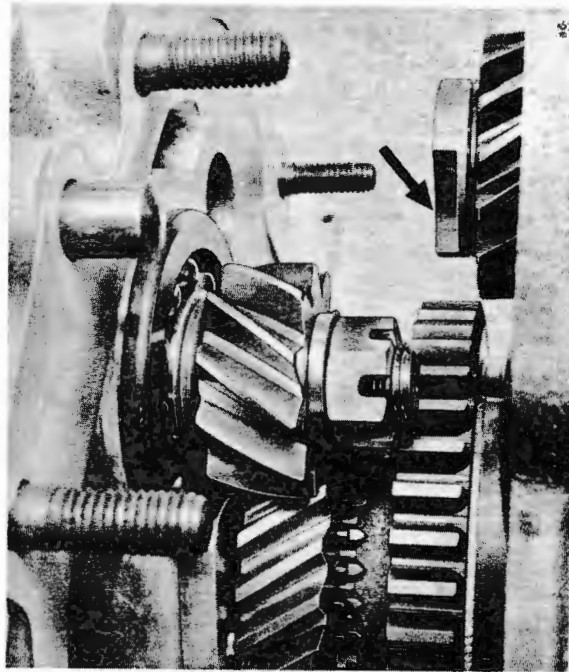


Fig. 116

Special Tools

P 37 Holder for input shaft

P 251 Socket for pinion shaft stretchbolt

General

The tachometer is driven by the transmission pinion shaft over a drive pinion, connecting shaft, and elbow drive, all located in the transmission front cover.

The drive pinion is attached to the pinion shaft stretchbolt by means of a retaining pin.

Tachometer Drive Components

Fig. 117

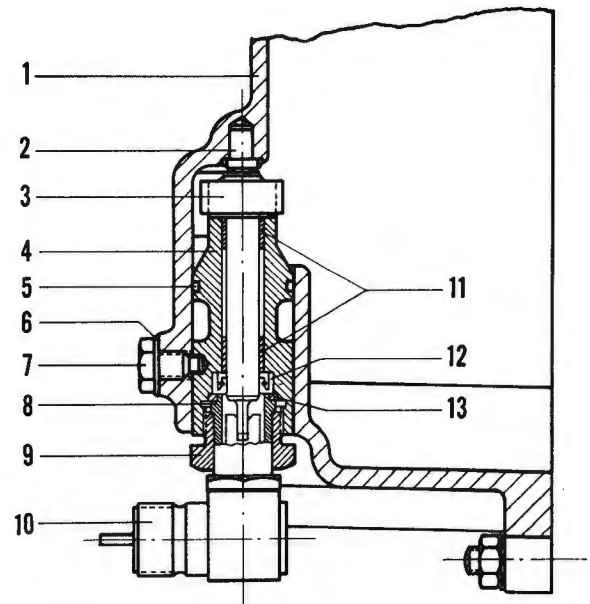


Fig. 118

- | | |
|-------------------------------|----------------------|
| 1 Front cover of transmission | 8 Elbow drive jacket |
| 2 Thrust stud | 9 Coupling nut |
| 3 Connecting shaft | 10 Elbow drive |
| 4 Guide bushing | 11 Support bushings |
| 5 O-ring | 12 Oil seal |
| 6 Spring ring | 13 Centering disc |
| 7 Hex bolt (set screw) | |

Removal**Note:**

The entire elbow drive (including connecting shaft) can be removed when the transmission is in the vehicle providing that the transmission is placed on a prop and the transmission support removed from the housing. However, if it becomes necessary to remove the gear shaft, the transmission must be removed from the vehicle and the transmission housing cover withdrawn from the transmission (see 1 EN and 15 RA).

1. Remove transmission support.
2. Remove tachometer drive set screw and pull out elbow drive.



Fig. 119

3. Remove housing front cover (see 15 RA).
4. Remove pinion shaft stretchbolt using special tool P 251 (transmission in gear, input shaft blocked with special tool P 37).
5. Drive out retaining pin from stretchbolt (pin secures tachometer pinion shaft) (steps 3 to 5 apply only to removal of tachometer pinion shaft).

Disassembly

1. Place guide bushing in a vise (use soft-metal jaw covers). Remove coupling nut and pull out elbow drive and centering disc.



Fig. 120

2. Pull out connecting shaft from guide bushing.
3. The support bushings of the connecting shaft and the oil seal can be withdrawn with a suitable tool, if necessary.

Reassembly

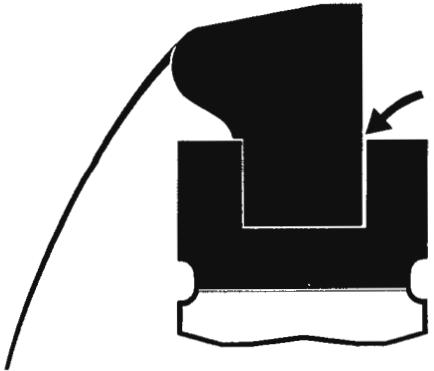

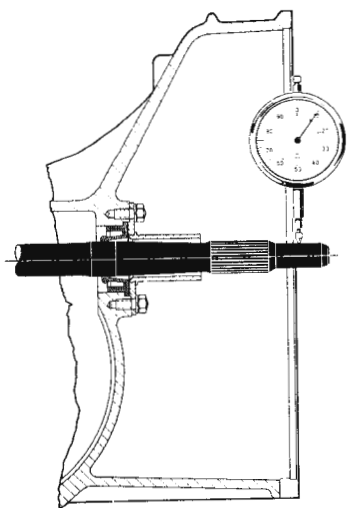
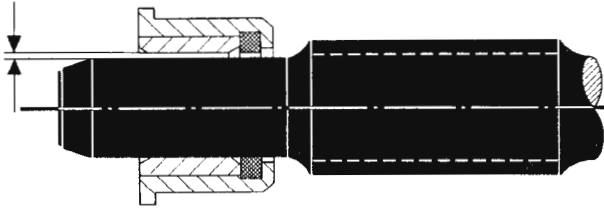
Reassembly is accomplished in reverse order of the above by noting the following points:

1. Wash parts, inspect for wear, replace if necessary.
2. Tighten coupling nut connecting elbow with guide bushing; make sure that the two parts are so oriented that the set screw orifice and the connecting end of the tachometer drive point in the same direction (see Fig. 120).
3. Insert complete drive assembly (with connecting shaft) into transmission cover and make sure that the set screw orifice lines up with that in the cover (see Fig. 121). Check O-ring, replace if necessary. Install set screw and washer, tighten to 1.6 - 1.8 mkp (11.6 - 13.5 lb/ft).



Fig. 121

4. Make sure that the gear shaft bushing and the thrust stud of the connecting shaft have been installed in the cover.
5. If the pinion shaft stretchbolt has been loosened it must be tightened with special tools P 251 and P 37 to 11 - 12 mkp (79-86 lbs/ft).
6. Install front transmission cover (see 15 RA).

Measuring Point	Fitted tolerance (when new) in mm	Wear limit in mm	
<p>4. Selector fork in operating sleeve</p> <p>1st and reverse speed 2nd and 3rd speed 4th and 5th speed</p> <p>End play</p>	<p>0.1 - 0.3 0.1 - 0.3 0.1 - 0.3 (0.003" - 0.011")</p>	<p>0.5 0.5 0.5 (0.019")</p>	
<p>5. Synchronizing rings</p> <p>1st speed 2nd speed 3rd speed 4th speed 5th speed</p> <p>Outer diameter fitted</p>	<p>76.12 - (2.996") 76.48</p>	<p>in accordance with local wear of molybdenum layer a)</p>	
<p>6. First motion shaft</p> <p>a) Run out on guide pin</p>	<p>max. 0.1 (0.003")</p>	<p>max. 0.1 (0.003") (align)</p>	
<p>b) Radial play in bushing of banjo bolt on engine</p>	<p>0.145 - (0.0057") 0.231 (0.0090")</p>	<p>0.3 (0.011")</p>	

Torque tightening figures for screws and nuts on the transmission

M 8 Hexagon nuts on transmission housing:	2, 1 - 2, 3 mkp (15, 2-16, 6 lb. ft.)
M 6 Hexagon nuts on guide tube:	1, 0 mkp (7, 2 lb. ft.)
M 6 Socket head screw for withdrawal fork:	1, 0 mkp (7, 2 lb. ft.)
M 8 Hexagon bolt with pin (angular drive):	1, 6 - 1, 8 mkp (11, 6-13, 5 lb. ft.)
M 12 drain plug on intermediate plate :	2, 5 - 3, 0 mkp (18, 1-21, 7 lb. ft.)
M 24 oil filter plug:	2, 0 - 2, 5 mkp (14, 4-18, 1 lb. ft.)
M 24 magnetic oil drain plug:	2, 0 - 2, 5 mkp (14, 4-18, 1 lb. ft.)
Hexagon bolt for clamping plate of intermediate plate:	2, 1 - 2, 3 mkp (15, 2-16, 6 lb. ft.)
M 24 Hexagon nut on first motion shaft:	10 - 12 mkp (72, 3-86, 8 lb. ft.)
M 12 Crown nut on first motion shaft:	6, 0 - 6, 5 mkp (43, 4-47, 0 lb. ft.)
M 14 crown nut on first motion shaft (reinforced type):	9, 0 - 11, 0 mkp (65, 1-79, 6 lb. ft.)
M 12 expansion screw or drive shaft:	11 - 12 mkp (79, 6-86, 8 lb. ft.)
M 8 Hexagon bolt of selector forks:	2, 5 mkp (18, 1 lb. ft.)
M 12 Hexagon bolts for securing crown wheel:	9, 5 - 10, 0 mkp (68, 7-72, 3 lb. ft.)
M 10 expansion screw for joint flange of differential:	3, 5 - 4, 0 mkp (25, 3-29, 0 lb. ft.)
M 8 ball pin for withdrawal fork:	2, 1 - 2, 3 mkp (15, 2-16, 6 lb. ft.)

6. Torque the retaining bolts of radius arm cover to 4.7 mkp (34 lb-ft).
7. Torque the attaching bolts of control arm, and adjusting eccentric bolts, to 9 mkp (65 lb-ft).
8. The camber eccentric should be torqued to 6.0 mkp (36 lb-ft), the tracking eccentric to 5.0 mkp (43 lb-ft).
9. Torque the shockabsorber retaining bolt to 7.5 mkp (54 lb-ft).
10. Adjust rear wheel camber and tracking (see Group W, Section 4 Wh).

29 RA

ADJUSTING TORSION BAR

Special Tools:

VW 261 Clinometer

General

The exact adjustment of the torsion bar is made by measuring the angle of the radius arm in relation to the horizontal plane of the car at which time the radius arm must hang free.

The horizontal plane of the car can be determined with the aid of special tool VW 261 which is placed onto the lower edge of the door cavity in the body.



Fig. 170

To achieve the specified values in the rear wheel camber adjustment, it is of importance that the adjusted angle of the radius arm is same on both sides of the car. If the radius arm has been adjusted on one side, the other side should be checked as well and its adjustment corrected when necessary.

The adjusted radius arm angle of a free hanging radius arm is:

Type 911 and 911 S Coupe, Targa	36°
From Model '68 on Type 911 (all)	39° (torsion bar diameter of 22 mm - .866")
Type 912 Coupe, Targa	33°
From Model '68 on Type 912	36° (torsion bar diameter of 22 mm - .866")
From Model '69 on Type 911 (all)	36°30' to 37° (torsion bar diameter 23 mm - .906")
From Model '69 on Type 912	33°30' to 34° (torsion bar diameter 23 mm - .906")

Accomplish adjustment as follows:

1. Place the torsion bar into the transverse tube with the inner end splines first.
2. Slip radius arm onto the outer end splines.
3. Place special tool VW 261 onto the lower edge of the door cavity in the body.

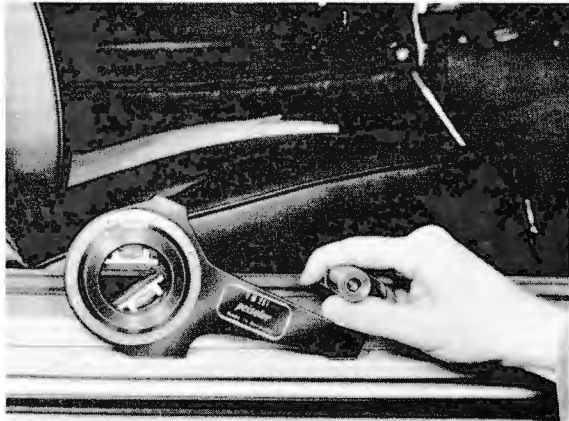


Fig. 171

4. Adjust the clinometer so that the bubble in the glass tube marked "Axle Housing/Angle" is in the center.
5. Reset the glass tube carrier by the value specified for this type vehicle.
6. Place the clinometer onto the free-hanging radius arm and check adjustment of the arm.



Fig. 172

7. If necessary, readjust the radius arm:

An error of one graduation mark on the glass tube shown by the air bubble equals an error in adjustment by $50'$. In this case, the torsion bar and the radius arm must be reset in their splined seats by one spline each, both moving towards each other. It should be noted that the torsion bar must be moved in the same direction in which the glass tube carrier would have to be moved to bring the bubble into center position.

NOTE:

The torsion bar adjustment variations, or those of the radius arm angle, are made possible through a vernier arrangement of splines in both ends of the torsion bar.

Number of splines in torsion bar: Inner end 40 spl.
Outer end 44 spl.

If the torsion bar is reset by one spline at its inner end, a 9° change is effected. If the radius arm is reset by one spline at the outer end of the torsion bar, a change of $8^{\circ}10'$ is effected. This results in the smallest change of $50'$ in the radius arm adjustment.

It should be ascertained that the specified adjustment values are reached to the closest possible degree.

8. Adjust rear wheel tracking and camber (see Group W, Section 4 Wh).

Special Tools:

P 289 Radius arm tensioner

General

Travel of the rear wheel springing on the rebound is limited by the shockabsorber. It is therefore of advantage when changing the rear shockabsorber that the vehicle stands on its wheels (the car can be raised on a ramp lift or else placed over a pit).

The wheels should be removed when they clear the ground while the car is raised. Furthermore, the radius arm should be tensioned with special tool P 289 so that the shockabsorber stress is relieved.

Removal

1. Raise car.
2. Shockabsorber stress must be relieved (vehicle should either stand on its wheels or the radius arm should be tensioned with special tool P 289).
3. Remove rubber cap from shockabsorber top and remove self-locking nut (hold shockabsorber plunger rod if necessary).

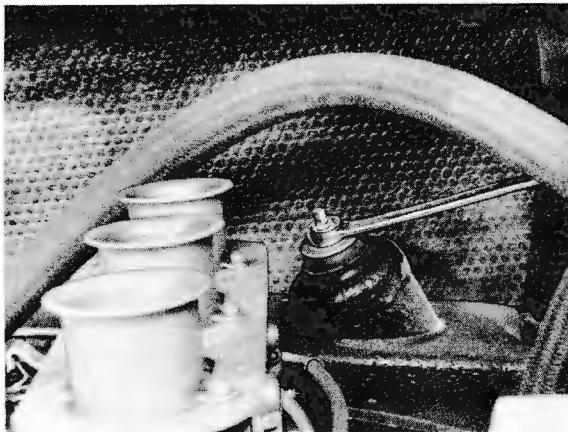


Fig. 173

4. Remove shockabsorber retaining bolt and remove shockabsorber.

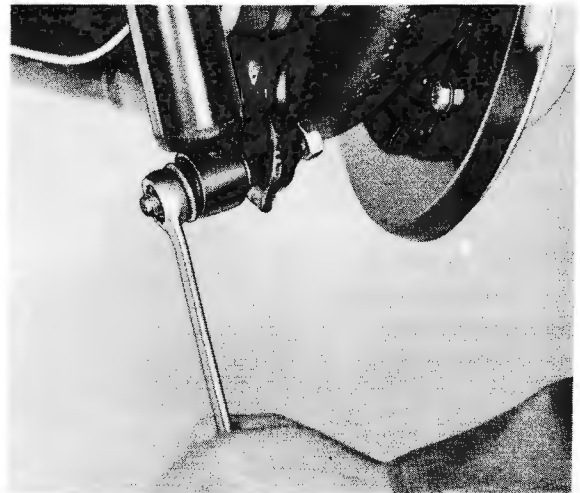


Fig. 174

Inspection

1. Check exterior of shockabsorber for deposits of oily dirt. If the whole shockabsorber is covered with oily dirt, the shockabsorber will have to be replaced.
2. Mount shockabsorber vertically in a vise, with the plunger rod up. Push plunger rod repeatedly in and out to bring the fluid into the shockabsorber cylinder and determine free travel of the plunger rod by short counterstrokes. If the free travel is excessive, the shockabsorber must be replaced.

3. Check the rubber buffer and replace when necessary.

4. Adjust KONI shockabsorbers (see Group S, Section 9 St).

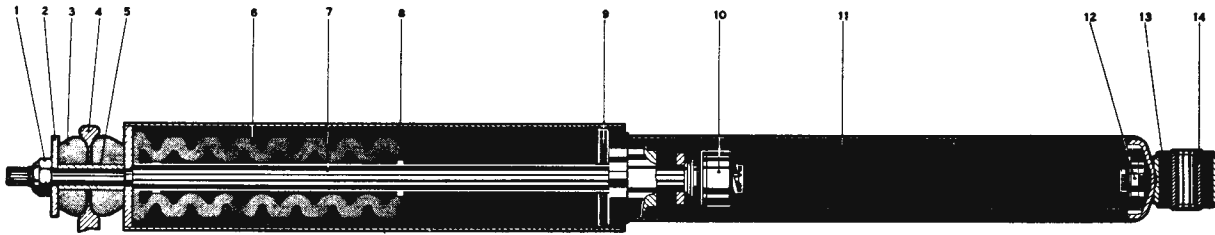


Fig. 175

Rear Shockabsorber

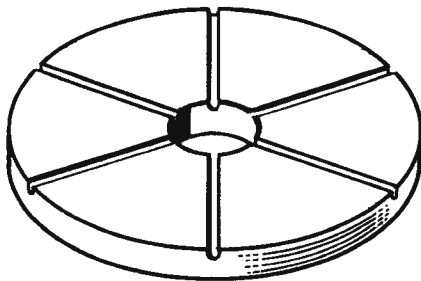
- | | |
|--------------------|--------------------|
| 1 Self-locking nut | 8 Cover tube |
| 2 Washer | 9 Stop disc |
| 3 Grommets | 10 Plunger |
| 4 Seat in vehicle | 11 Cylinder |
| 5 Grommet bushing | 12 Check valve |
| 6 Rubber buffer | 13 Grommet |
| 7 Plunger rod | 14 Grommet bushing |

NOTE: Beginning with 1968 models and in connection with the new rear axle torsion bars of 22 mm (.866") diameter, a longer rubber buffer with 9 rings instead of 8 is being utilized. From 69 model on, rear axle torsion bars 23 mm (.906") in diameter are used together with shock absorbers with different settings and shorter hollow rubber springs with 3 rings only.

Installation

Note the following points during installation:

1. Make sure that the stop disc (Fig. 175, Point 9) grooves face the shockabsorber plunger since otherwise the hydraulic shockabsorber fluid will be syphoned out.
2. Install the rubber buffer dry, without the use of any lubricants.



3. Tighten shockabsorber retaining bolt to 7.5 mkp (54 lbs/ft).

Fig. 176

TORQUE VALUES FOR REAR AXLE FASTENERS

Hex bolt for rear axle control arm (M 14 x 1,5 - 10K)	12.0	(86.8)
Hex bolts for radius arm (M 12 x 1,5 - 10K with 8G nut)	9.0	(65.1)
Camber eccenter bolts for radius arm (M 12 x 1,5 - 10K with 8G nut) ..	6.0	(43.4)
Tracking eccenter bolts for radius arm (M 12 x 1,5 - 10K with 8G nut) .	5.0	(36.2)
Hex bolt for shockabsorber (M 12 x 1,5)	7.5	(54.2)
Castellated nut of rear half shaft	30-35	(217-253)
Allen bolts for NADELLA half shaft flange (M 10 - 8G)	4.7	(34.0)
Allen bolts for LÖBRO half shaft flange (M 8 - 12K)	4.3	(31.1)
Allen bolts for LÖBRO half shaft flange (M 10 x 55 - 12 K)	8.3	(60.0)
Hex bolts for radius arm bearing cap (M 10)	4.7	(34.0)
Wheel nuts	13.0	(94.0)

REMOVING AND INSTALLING SPORTOMATIC TORQUE CONVERTER HOUSING WITH TORQUE CONVERTER AND TRANSMISSION CLUTCH

Removal

1. Remove power train assembly (see page SR 59).

2. Detach engine from transmission (see page SR 62).

3. Withdraw torque converter from torque converter housing.

Caution:

Oil will run out of the torque converter.
Cover opening in torque converter so that no foreign matter can enter.

4. Remove hex nuts (SW 13).



Fig. 38

5. Remove hex nuts (SW 17).

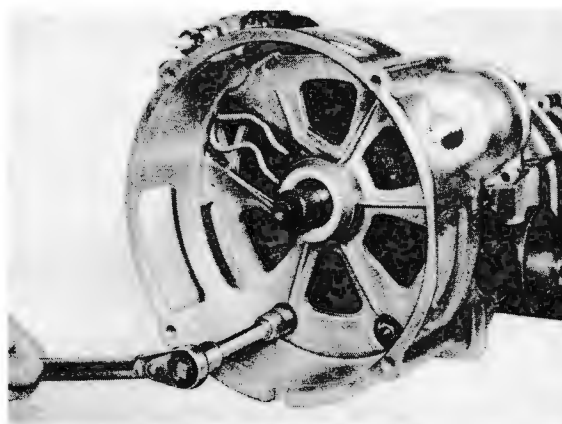


Fig. 39

6. Remove cotter key from actuating rod at intermediate lever and detach actuating rod.



Fig. 40

7. Detach entire torque converter housing from transmission housing and, at the same time, slide the clutch throwout bearing out of the disengaging fork.

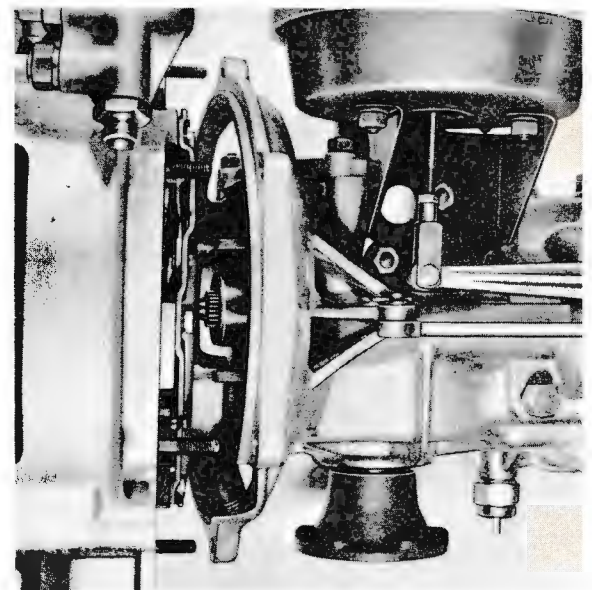


Fig. 41

Installation

Note the following points at installation:

1. Coat sliding contact surfaces at clutch disengaging fork and throwout bearing with multipurpose MoS₂ grease.
2. Lightly coat the pilot pin of input shaft with multipurpose MoS₂ grease. (The needle bearing should also be lightly coated with grease.)
3. Insert engine mounting hex bolt with spring washer into torque converter housing next to the temperature sensor housing (the hex bolt cannot be inserted later on due to obstruction by the vacuum servo unit).
4. Properly guide the throwout bearing into the disengaging fork (see illustration).

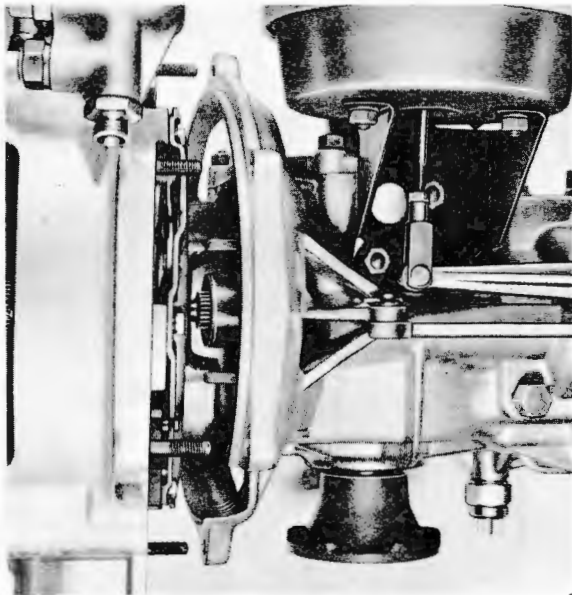


Fig. 42

5. Torque hex nuts (SW 17) to 4.7 mkp (34 lb/ft).
6. Torque hex nuts (SW 13) to 2.2 mkp (16 lb-ft).
7. Slide torque converter onto freewheeling support and turbine shaft.
Caution:
The torque converter should always contain a small amount of oil during assembly since otherwise it may become seriously damaged. Fill new torque converters with approx. 0.5 liter (1/2 US qt) of engine oil.
8. Attach engine to transmission (see page SR 62).
9. Install the power train assembly into car (see page SR 61).

DISASSEMBLING AND REASSEMBLING TORQUE CONVERTER HOUSING AND TRANSMISSION CLUTCH

Special Tools:

P 358 Installer
P 359 Installer

P 362 Driver
P 363 Socket

Disassembly

1. Remove hollow head bolts from the clutch pressure plate with the aid of special tool P 363, loosening these progressively one turn at a time, backing with a screwdriver.

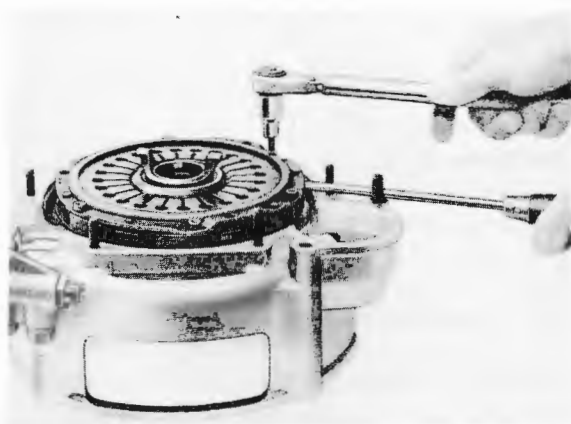


Fig. 43

2. Withdraw clutch pressure plate.
Caution:
Clutch throwout bearing can fall out of the clutch pressure plate.

3. Take the throwout bearing out of the pressure plate by sliding out diagonally to the rear.

4. Remove clutch plate.

5. Remove hollow head bolts from the freewheeling support with the aid of special tool P 363.



Fig. 44

Note:

In the first vehicles in which Allen-type bolts were used for attaching the freewheeling support, strike the socket with a plastic mallet when loosening the bolts to make removal easier.

6. Screw in two hex bolts (6x60) by about 8 mm, located 180° opposite each other, and carefully drive the freewheeling support, with oil seal, out of its seat.



Fig. 45

7. Remove lock ring from turbine shaft,



Fig. 46

8. Drive turbine shaft off its seat. Make sure that the torque converter housing is resting on a good base.



Fig. 47

9. Drive the turbine shaft ball bearing out with the aid of a punch, striking at alternating points.

10. Push oil seal out with the aid of a screwdriver.

Inspecting Parts

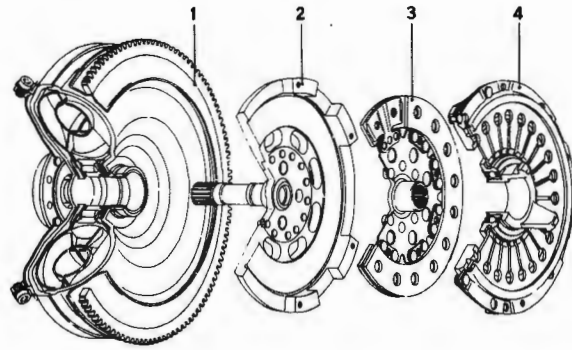


Fig. 48

- 1 Torque converter
- 2 Turbine shaft
- 3 Clutch plate
- 4 Clutch pressure plate

1. Torque converter:

Checking converter for leakage with the test rig (to be made up by yourselves as described in Service Bulletin number W 11/68).

- a. Drain the oil from the converter.
- b. Attach the converter to the test rig and pressurize to 4 - 5 atm (55 - 70 psi).
- c. Place the converter and test rig in a tank of water, and inspect for leaks.

If the torque converter is found to be damaged, it must be replaced as an entire unit. Torque converters cannot be repaired.

2. Turbine shaft and clutch carrier plate assembly:

- a. Check clutch contact surface for scoring. If scoring is considerable, replace the turbine shaft and clutch carrier assembly.

- b. Check needle bearing (see page SR 71 for removal and installation).

- c. Inspect turbine hub seating surface and the oil passage.

12. Place switch top in position and pull dust boot over the assembly.

13. Push new locking sleeve into place in the gearshift knob with the aid of a suitable driver.

14. Mount gearshift lever in a vise through soft grip protectors. Place gearshift knob onto gearshift lever in such way that the shift pattern is displayed properly, and drive knob into its position with the aid of special tool P 299.

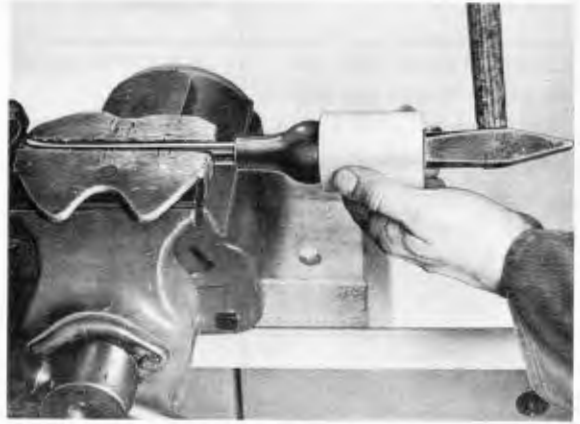


Fig. 79

Malfunction	Cause	Remedy
1. Clutch slipping under full throttle although not only upon completion of a shift	Oily clutch linings Defective clutch Improperly adjusted clutch linkage	Replace clutch plate, eliminate oil leak Replace clutch Readjust linkage (basic adjustment), check clutch free play, check clutch
2. Excessive clutch slippage under open throttle upon completion of a shift	Improperly adjusted control valve	Readjust control valve for acceleration upshift
3. Harsh or delayed clutch engagement upon completion of a downshift	Improperly adjusted control valve	Readjust control valve for deceleration downshift
4. Clutch does not disengage	Improperly adjusted clutch linkage Leaks in connecting hoses or vacuum reservoir Defective diaphragm in vacuum servo unit Defective needle bearing in pilot seat of input shaft in clutch Break in electric solenoid circuit Dirty or oxidized contact points in gearshift lever switch, poor ground to chassis Defective solenoid in control valve Crimped or flattened hoses (blocked air passage)	Check adjustment, reaccomplish basic adjustment if necessary, possibly check the clutch Eliminate leaks Replace vacuum servo unit Replace needle bearing and oil seal in turbine shaft Repair damage, possibly by replacing the fuse Clean contacts or install new switch, as appropriate; check ground connection to chassis Replace control valve Replace defective hoses

Malfunction	Cause	Remedy
5. Engine dies when a shift is made, idle speed cannot be adjusted	<p>Leak in hose between control valve and vacuum servo unit</p> <p>Defective diaphragm in vacuum servo unit</p> <p>Leaking check valves in intake manifold</p> <p>Loose or defective hose between control valve and vacuum reservoir</p> <p>Leak in vacuum reservoir</p>	<p>Replace hose</p> <p>Replace vacuum servo unit</p> <p>Replace check valves</p> <p>Tighten or replace hoses</p> <p>Eliminate leak</p>
6. Clutch does not engage upon completion of a downshift, but engages harsh when throttle is opened	<p>Gearshift switch contacts sticking, or shorting due foreign matter in switch</p> <p>Short circuit in wire between switch and solenoid</p> <p>Sticking solenoid in control valve</p>	<p>Clean switch, free contacts, or replace the switch</p> <p>Repair damage, install new wire if necessary</p> <p>Replace control valve</p>
7. Car leaps when gearshift lever is released while engine is idling and gear engaged (engagement jerk)	<p>Idle speed too high</p> <p>Improperly adjusted control valve</p>	<p>Readjust idle speed</p> <p>Readjust control valve (for deceleration shift)</p>
8. Noisy torque converter (high-pitch whining)	<p>Not enough oil in torque converter</p> <p>Oil pressure too low</p> <p>Torque converter losing oil through pump hub</p> <p>Oil leaking through weld seam between pump and turbine</p>	<p>Replenish oil in oil tank</p> <p>Check oil pump</p> <p>Replace oil seal in pump hub</p> <p>Replace torque converter unit</p>

Malfunction	Cause	Remedy
<p>9. Poor acceleration characteristics despite well performing engine and Sportomatic system</p>	<p>Defective torque converter: check stall speed by setting handbrake, depressing footbrake, shifting into D4, and opening the throttle. Engine speed should be between 2400 and 2800 rpm under the above conditions</p> <p>Caution: When performing the above test, watch the temperature gauge. Do not let the temperature rise to the red field on the dial</p>	<p>If the engine speed is higher than stated here, and possibly continues to rise, it will be necessary to replace the clutch. If the lower value (2400 rpm) cannot be attained, the torque converter will have to be replaced.</p>

24. Guide the selector shaft assembly into the fork rods and into its seat in the transaxle housing bore.



Fig. 117

25. Install guide fork with new gasket and make sure that the selector shaft finger is engaging the guide fork. Place spring washers under retaining nuts and torque to 2.3 mkp (17 lb-ft).

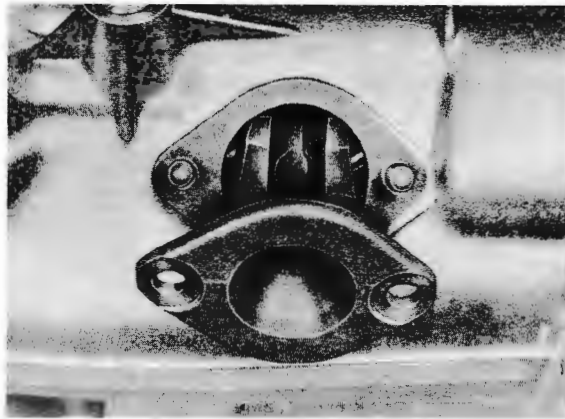


Fig. 118

26. Slide reverse gear selector fork with sliding gear onto selector fork rod and pinion shaft, install selector fork lock ring.

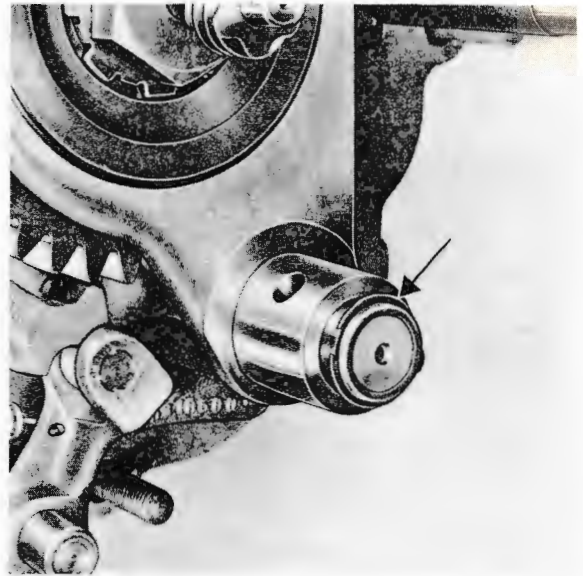


Fig. 119

27. Grease the pin and 7 mm dia. parking lock ball and insert it into the orifice in the selector fork and fork rod. The ball must be installed from the top.

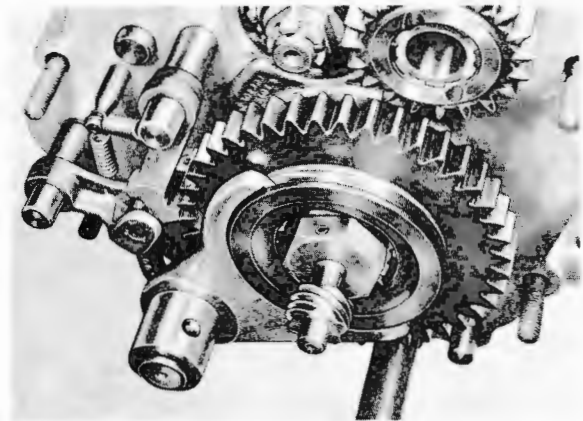


Fig. 120

28. Install parking lock lever and pawl in the intermediate plate and connect return springs (see Fig. 120).

29. Assemble transaxle front cover and install (see page SR 100).

30. Insert actuating pin for backup light switch and screw the switch in (torque it to 3.5 - 4.0 mkp (25.3 - 29.0 lb/ft)).

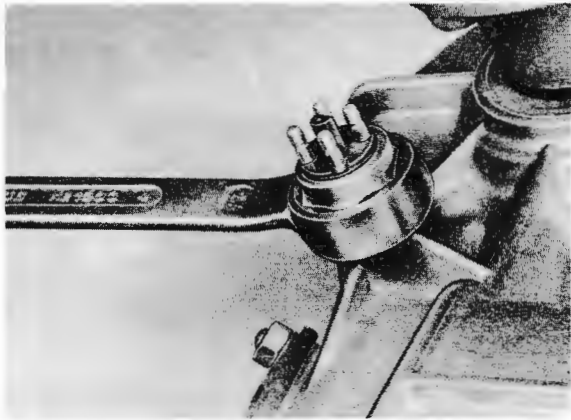


Fig. 121

b. Push the oil seal onto special tool P 364. Using special tool P 360, drive the oil seal in as far as P 360 will go.

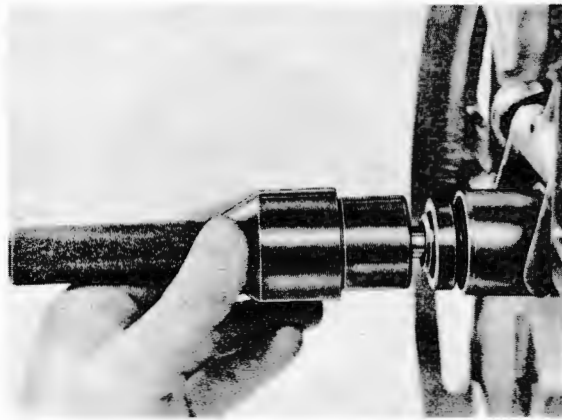


Fig. 123

31. Install input shaft oil seal as follows:

a. Slide special tool P 364 onto input shaft.



Fig. 122

32. Install differential assembly (see page SR 104).

6. Insert the speedometer drive assembly into the housing cover so that the locating hole for the set screw is properly lined up.

Inspect seal and replace, if necessary. Screw the set screw in, with spring washer, and torque to 1,5 mkp (11 lb-ft).



Fig. 130

Caution:

The thrust stud and worm gear bushing must be installed in the cover.

7. Install needle bearing cages and spacer sleeve on the reverse gear shaft.

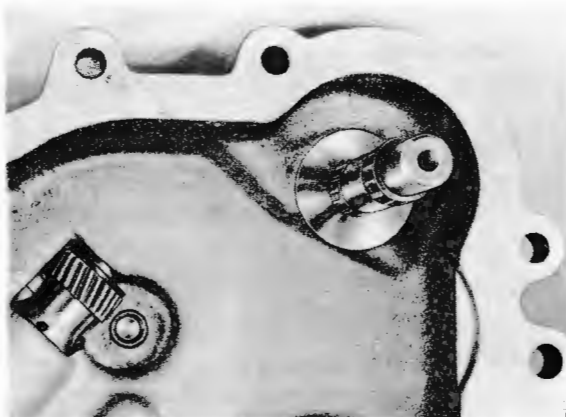


Fig. 131

8. Use new gasket, install transaxle housing front cover. (The parking lock pin and 7 mm ball must be inserted into the selector fork bore and rod with some grease, placing the ball atop.)

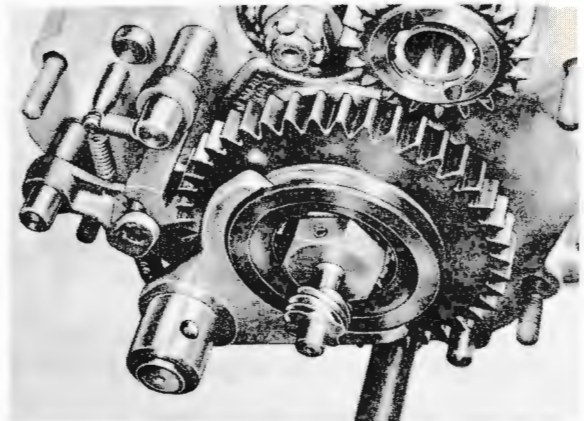


Fig. 132

9. Torque housing cover hex nuts to 2,2 mkp (16 lb-ft).

10. Install parking lock ball (9 mm), spring, and cap screw with gasket, torque to 4,7 mkp (34 lb-ft).

Note:

Beginning with transmissions numbered 4180176 or 3180261, respectively, which are equipped with a spacer beneath the bronze thrust washer of the reverse speed gear, check axial play of the reverse speed gear as follows:

Shift into reverse (turn selector fork rod to the left and pull out). Turn transmission from the input shaft end. Should the reverse speed gear bind, install a second gasket under the transaxle housing front cover.

11. Install bypass switch, torque to 3,5 - 4,0 mkp (25,3-29,0 lb-ft).

12. Install transmission carrier.

Special Tools:

P 37 Input shaft holder

P 251 Pinion shaft stretchbolt socket

General

The speedometer is driven off the end of the transmission pinion shaft thru a worm gear, a connecting shaft, and a 90° elbow drive located in the front cover of the transaxle housing.

The worm gear is attached to the pinion shaft stretchbolt by means of a rollpin.

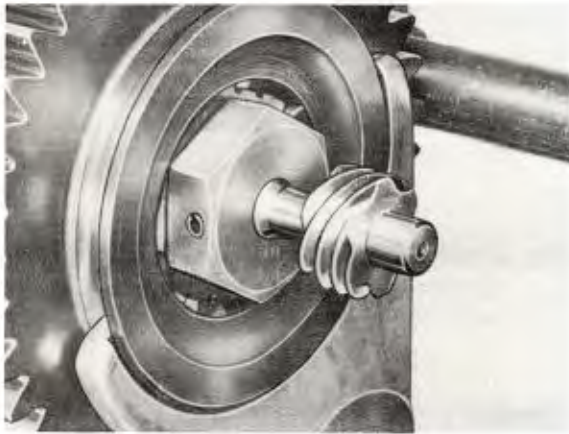


Fig. 133

Removal

Note:

The elbow drive (with connecting shaft) may be removed when the transaxle is installed by supporting the transaxle and removing the carrier brace.

However, to remove the worm gear it is necessary to take the transaxle out of the car and remove the housing front cover.

1. Remove transaxle carrier brace.
2. Remove elbow drive set screw and pull the drive assembly out.

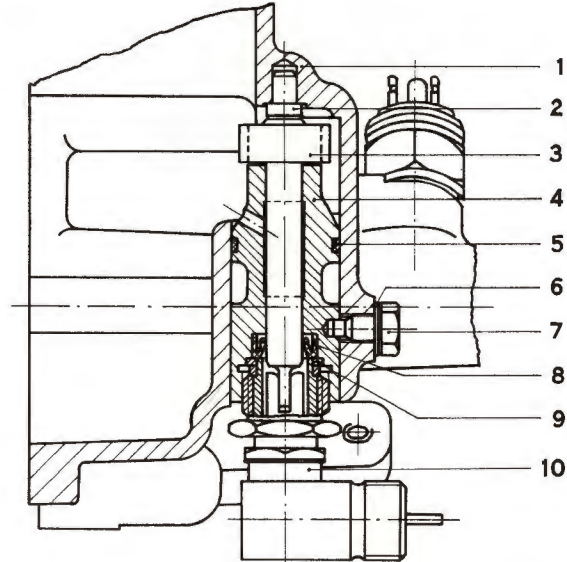


Fig. 134

Speedometer Drive Components

- | | |
|-------------------------|-------------------------|
| 1 Transaxle front cover | 6 Spring washer |
| 2 Thrust stud | 7 Set screw (hex head) |
| 3 Connecting shaft | 8 Oil seal |
| 4 Guide bushing | 9 Centering disc |
| 5 O-ring | 10 Elbow drive assembly |

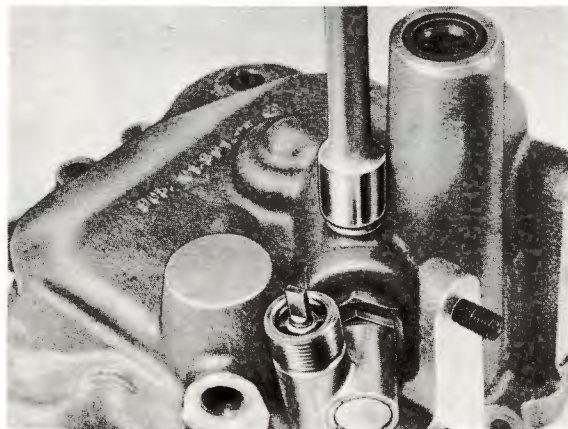


Fig. 135

3. Remove transaxle front cover (see page SR 99).
4. Remove pinion shaft stretchbolt with special tool P 251 (engage a gear and block the transmission with special tool P 37).
5. Remove rollpin from stretchbolt and pull the worm gear out. (Points 3 thru 5 apply only when removing the worm gear.)

Disassembly

1. Place the guide bushing in a vise, holding through grip protectors. Remove coupling nut and take the elbow drive and centering disc out. (It may be necessary to place a special hex bolt into the set screw bore to apply counter-force.)



Fig. 136

2. Take the connecting shaft out of the guide bushing.
3. If required, press the oil seal out with an appropriate tool.

Reassembly

Note the following points at reassembly:

1. Clean the parts, inspect for wear and replace if necessary.
2. When tightening the coupling nut of the elbow drive, align the parts so that the set screw bore and the speedometer cable connecting end face in the same direction.
3. Insert the complete elbow drive (with connecting shaft) into the front cover, making sure that the set screw locating bore is properly oriented.
Check O-ring and replace if necessary.
Install the set screw with spring washer and torque to 1.5 mkp (11 lb-ft).



Fig. 137

4. Make sure that the worm gear bushing and the connecting shaft thrust stud are installed in the housing front cover.
5. If the pinion shaft stretchbolt had been removed, torque with special tools P 251 and P 37 to 11-12 mkp (80-87 lb-ft).
6. Install housing front cover (see page SR 100).

Special Tools:

P 356 Axle flange stop plate

Removal

1. Place special tool P 356 onto the axle flange, remove flange stretchbolt, and take the flange off.



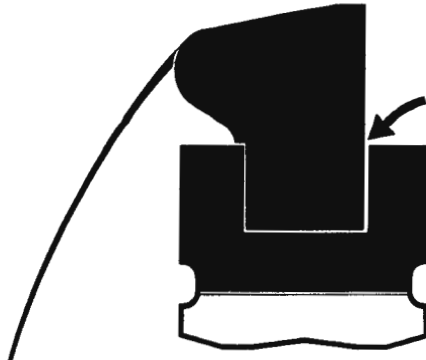

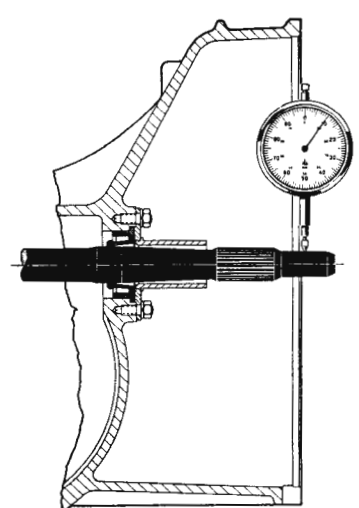
Fig. 138

2. Remove the other flange in same manner.
3. Remove hex nuts from housing side cover and take the cover off.
4. Take the differential assembly out of the housing.

Installation

Note the following points at reassembly:

1. Use new paper gasket for the housing side cover.
2. Check flange oil seals and replace if necessary.
3. Torque side cover retaining nuts to 2.0-2.3 mkp (15-17 lb-ft).
4. Torque flange stretchbolts to 3.5 -4.0 mkp (25.3-29.0 lb-ft).

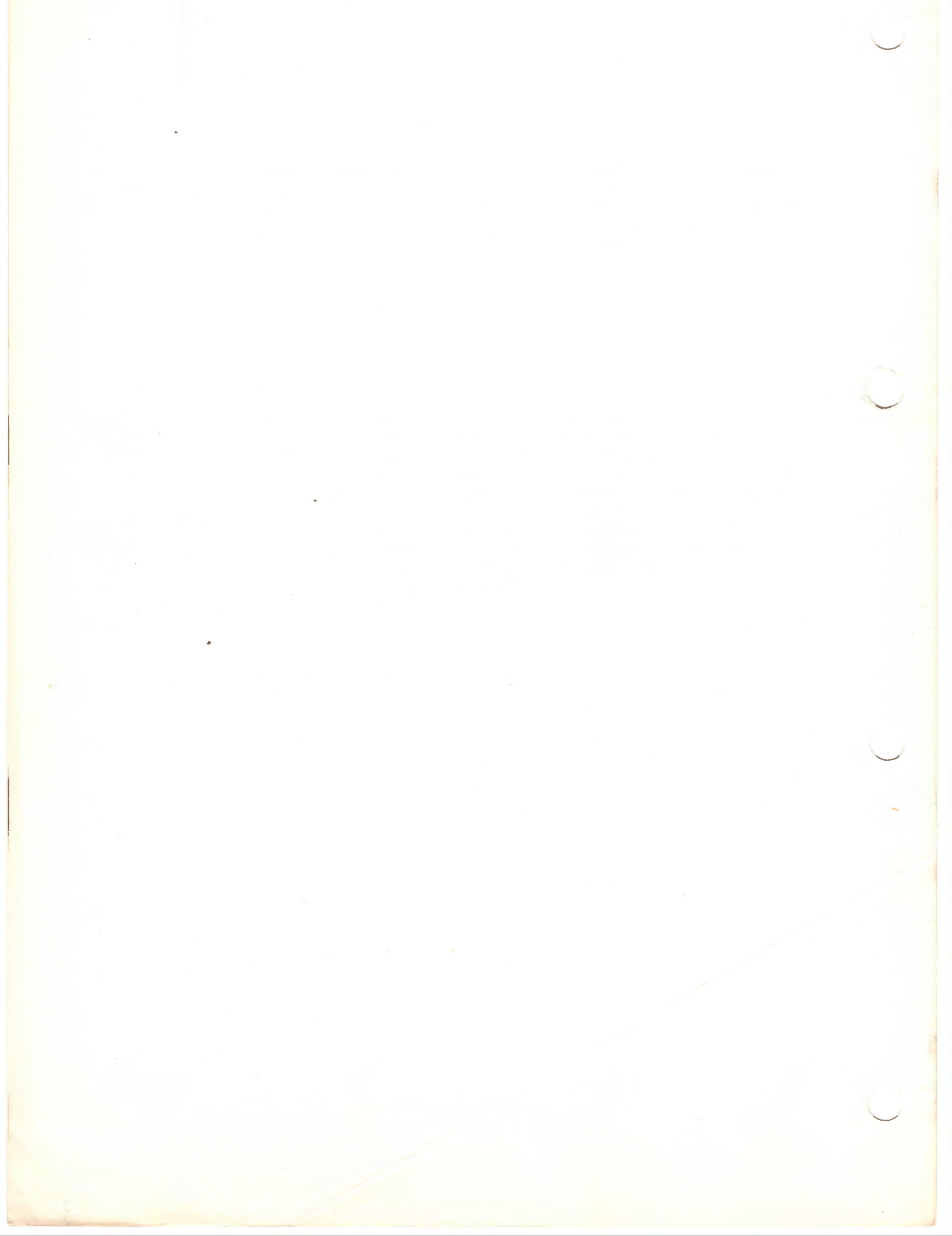
Measuring Point	Tolerance (new) mm/inch	Wear Limit mm/inch	
<p>4. Selector fork in sliding sleeve coupling or sliding gear</p> <p>Reverse gear</p> <p>1st and 2nd speed</p> <p>3rd and 4th speed</p> <p><u>Axial Play</u></p>	<p>0.1-0.3 (.004"-.012")</p> <p>0.1-0.3 (.004"-.012")</p> <p>0.1-0.3 (.004"-.012")</p>	<p>0.5 (.020")</p> <p>0.5 (.020")</p> <p>0.5 (.020")</p>	
<p>5. Synchronizing rings</p> <p>1st speed</p> <p>2nd speed</p> <p>3rd speed</p> <p>4th speed</p> <p>Outside diameter (installed)</p>	<p>76.12-76.48 (2.997" - 3.011")</p>	<p>Depending upon locally worn Molybdenum layer (a)</p>	
<p>6. Input shaft</p> <p>a. Pilot bearing journal</p> <p><u>Runout</u></p>	<p>max. 0.1 (.004")</p>	<p>max. 0.1 (.004")</p>	

	mkp	lb-ft
Hex nuts in transaxle housing, M8	2.1- 2.3	(15.2-16.6)
Hex-head set screw in elbow drive, M8	1.5	(10.8)
Detent cap screw in intermediate plate, M12	2.5-3.0	(18.1-21.7)
Oil filler plug, M24	2.0- 2.5	(14.5-18.1)
Magnetic oil drain plug, M24	2.0- 2.5	(14.5-18.1)
Brace plate retaining hex bolts in intermediate plate	2.1-2.3	(15.2-16.6)
Hex nut on input shaft, M24	10-12	(72-87)
Castellated nut on input shaft, M14	9.0-11.0	(65-80)
Pinion shaft stretchbolt, M12	11 - 12	(80-87)
Selector fork hex bolts, M8	2.5	(18.1)
Ring gear retaining hex bolts, M12	9.5-10.0	(69-72)
Stretchbolts for half-axle U-joint flanges, M10	3.5-4.0	(25-29)
Hex nuts in torque converter and vacuum servo unit, M8	2.1-2.3	(15-17)
Hex nuts in torque converter and starter, M10	4.7	(34)
Parking lock cap screw in transmission front cover, M12x1.5	4.7	(34)
12-point hollow head screws in clutch pressure plate, M6	1.4	(10.0)
12-point hollow head screws in freewheeling support of torque converter, M6	1.4	(10.0)
12-point bolts securing torque converter to coupling plate, M8	2.4-2.6	(17.4-18.8)
Bypass switch, M18x1.5	3.5-4.0	(25-29)
Backup light switch, M18x1.5	3.5-4.0	(25-29)
Hollow screw of elbow drive in guide bushing M 24x1.5	2.2-2.4	(15.9-17.4)

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Reassembly:

Note the following points during reassembly:

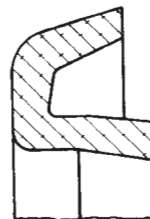
1. Clean all parts in alcohol. Dry the housing and clear compensating ports with compressed air.
2. Check parts for wear. Replace the master cylinder when the cylinder surface should show damage due to scoring or rust, or have other deficiencies.
3. Thinly coat the cylinder walls, piston running surface, and cups with ATE brake cylinder paste.
4. Assemble in sequence shown in the exploded view.
5. Insert secondary piston into master cylinder housing, together with filler disc, primary cup, supporting washer, spring seat, and spring (large coil of spring must face housing bottom).
6. Using a non-metallic tool, push secondary piston into the housing until clearing the hole for the hex stop bolt, then screw the stop bolt in together with washer.

Tightening torque is 1.0 to 1.2 mkp (7.2 to 8.7 lb-ft).

Note: Recheck proper seating of stop screw. The screw must be in position ahead of the secondary piston; the piston must move freely to the housing bottom.

7. Push filler disc, primary cup, and supporting washer onto the primary piston, then fasten spring, spring seat, and stop sleeve to the primary piston with the stroke limiting bolt.
8. Make sure that the lock ring is well seated.
9. When replacing piston cups, make sure that these are installed in proper positions (see exploded view).

profile of the
primary collar



profile of the
separating collar

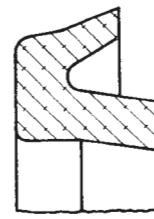


Fig. 12a

10. (Points 10 thru 12 apply only to USA-type vehicles equipped with the circuit failure warning system.)
Coat warning system plungers with ATE brake cylinder paste and install in housing together with springs. See exploded view for assembly sequence.
11. Use new O-ring in cap screw. Torque cap screw to 1.5 mkp (11 lb-ft).
12. Use new O-ring in circuit failure sender. Torque sender to 1.5 mkp (11 lb-ft).

General

The circuit failure warning system in dual circuit brake, required by law in USA, must be tested after every 10,000 km (6,000 miles). In addition, the warning system must be tested whenever any repairs are made in the hydraulic brake system.

Testing

1. Switch ignition on. The handbrake control lamp must light up when the handbrake is set (this is the bulb test).
2. Depress brake pedal to brake actuation point.
3. A second mechanic simulates the failure of a brake circuit by loosening the bleeder valve in a wheel brake cylinder.
4. Depress the brake pedal to brake actuation point in the other brake circuit. The handbrake control lamp must light up.
5. Tighten bleeder valve and release brake pedal.
6. Repeat steps 2 thru 5, this time by loosening the appropriate bleeder valve to simulate the failure of the other brake circuit.

If the lamp should not light up in the course of one of the above tests, check the circuit failure sender in the brake master cylinder, replacing the sender if necessary.
