

CHECKING CONTROL VALVE ADJUSTMENT

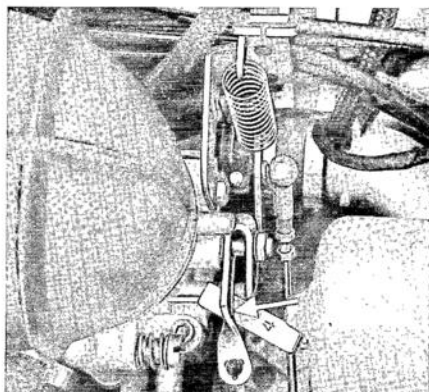
This requires that the throttle operating linkage and engine idle speed are adjusted correctly.

Full throttle position
(upshifting on acceleration)

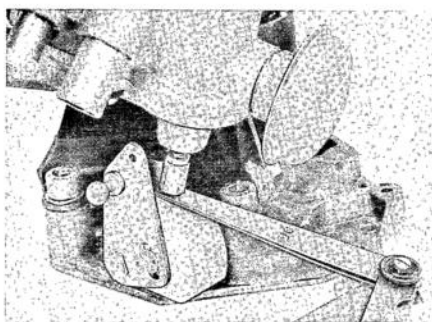
To check the control valve adjustment and make changes if necessary, it will be necessary to remove various parts of the CIS (continuous fuel injection) equipment.

- a) Disconnect battery.
- b) Remove air cleaner cover.
- c) Remove heater blower.
- d) Remove holder.
- e) Detach No. 3 cylinder injection line at injector.
- f) Remove No. 3 cylinder intake pipe.

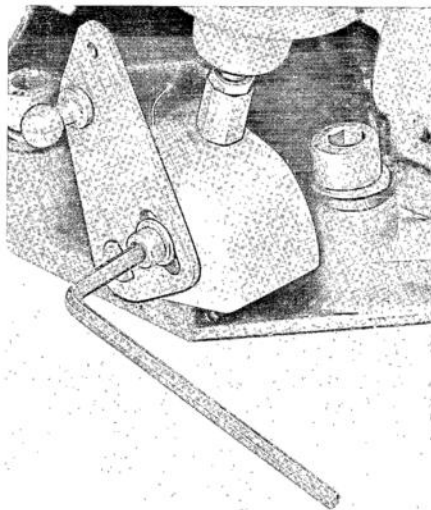
2. Place a strip of 4 mm thick metal between the stop and idle limit screw (this opens throttle partially).



1. There must be a play of 1.5 mm between the control valve plunger and the throttle linkage cam in idle position. Use feeler gauge, lock plunger with lock nut. Make sure that the cam on the operating lever for the linkage is set back all the way.



Using a 3 mm socket wrench loosen the cam clamping screw and turn the cam until the control valve plunger just barely touches the cam surface. Tighten cam clamping screw.



Remove strip of metal at idle limit screw. The idle play set at 1.5 mm at the beginning could change because of cam movement, but there must be at least 1 mm of play.

Closed throttle position (downshifting on deceleration)

The closed throttle position can be adjusted at the self-locking control screw with a screwdriver, without removing engine parts.

Basic adjustment

The closed throttle position can only be checked for correct adjustment by downshifting a car on the road or possibly on a roller test stand. The following information can be used as a reference point for adjustments on a stationary car.

- a) Start engine and allow to idle.
- b) Apply parking brakes.
- c) Move lever to driving range.

There should be 0.3 to 0.5 seconds from the moment the shift lever is released to the time the clutch engages.

Road test

Drive in range "D" at 4500 rpm and shift back to range "L". Clutching should take place without delay, yet the rear wheels should not lock. The adjustment can be altered to suit the customer.

- a) Tighten control screw (turn clockwise) to provide a softer, delayed clutch engagement.
- b) Loosen control screw (turn counterclockwise) to provide a firmer, quicker clutch engagement.

Caution

Only turn control screw 1/4 to 1/2 turn at a time in either direction, because this will be sufficient to alter the engagement considerably.

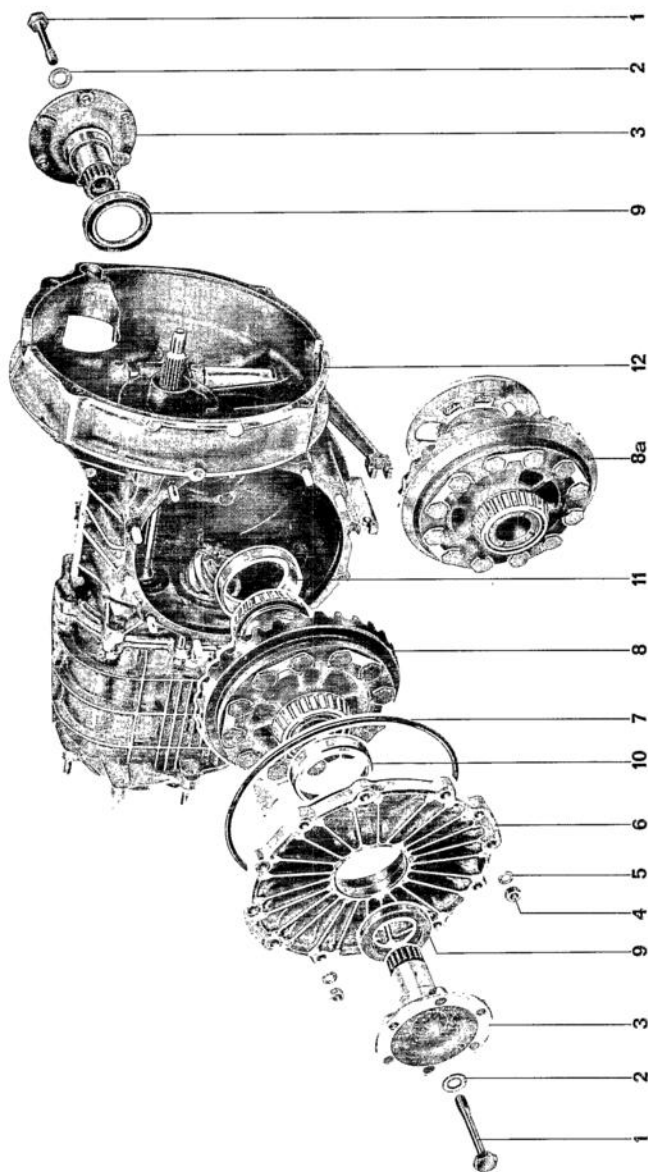
REMOVING AND INSTALLING FINAL DRIVE

TOOLS



Nr.	Description	Special Tool	Remarks
	Thrust piece	P 265c	

Removing and Installing Final Drive

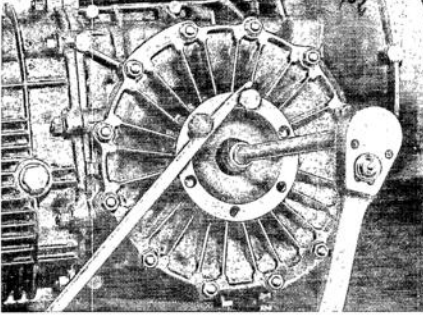


Nr.	Description	Qty	Note when		Special Instructions see
			Removing	Installing	
1	Expansion bolt	2		Tighten to correct torque.	5.1-1/4
2	Washer	2			5.1-1/4
3	Flange shaft	2			
4	Self-locking nut	12		Tighten to correct torque.	
5	Washer	12			
6	Final drive side cover	1			
7	O-ring	1		Replace if necessary. Oil lightly.	
8	Differential	1		Readjust if necessary.	5.1-5/5
8a	Differential with magnetic carrier disc	1		Adjust, if necessary. No adjusting necessary when replacing magnetic carrier disc	
9	Seal	2	Knock out with drift.	Install with P 265c	
10	Bearing outer race	1	Knock out with drift.	Heat transmission cover to approx. 120°C (250°F) and install with appropriate tubing.	
11	Bearing outer race	1	Knock out with drift.	Heat transmission cover to approx. 120°C (250°F) and install with appropriate tubing.	
12	Final drive housing	1			

REMOVING AND INSTALLING

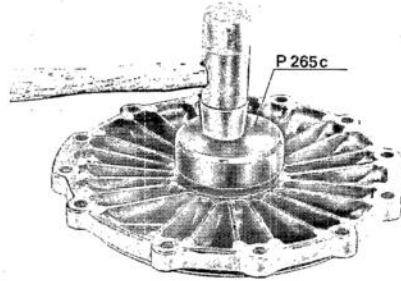
Removing

1. Unscrew joint flange mounting bolt and remove joint flange.



2. Drive seals and bearing outer races out of final drive housing and side cover with an appropriate drift.

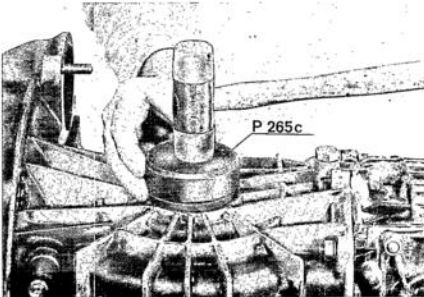
2. Apply light coat of oil to side cover seal.



3. Install seal in side cover with special tool P 265c.

Installing

1. Install seal in final drive housing with special tool P 256c.

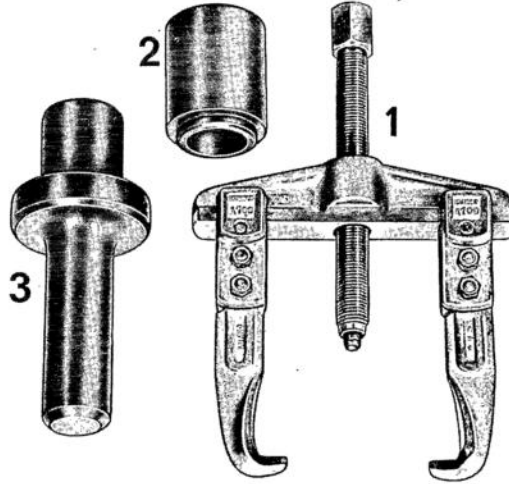


MODIFICATION ON DIFFERENTIAL

The joint flanges and mounting bolts were also changed with introduction on the new differential (similar to 928). A M 10 x 80 hexagon head bolt without washer is used on these transmissions to mount the joint flanges instead of the expansion bolt with washer. Tightening torque value is different (see page 0. 2-1/4).

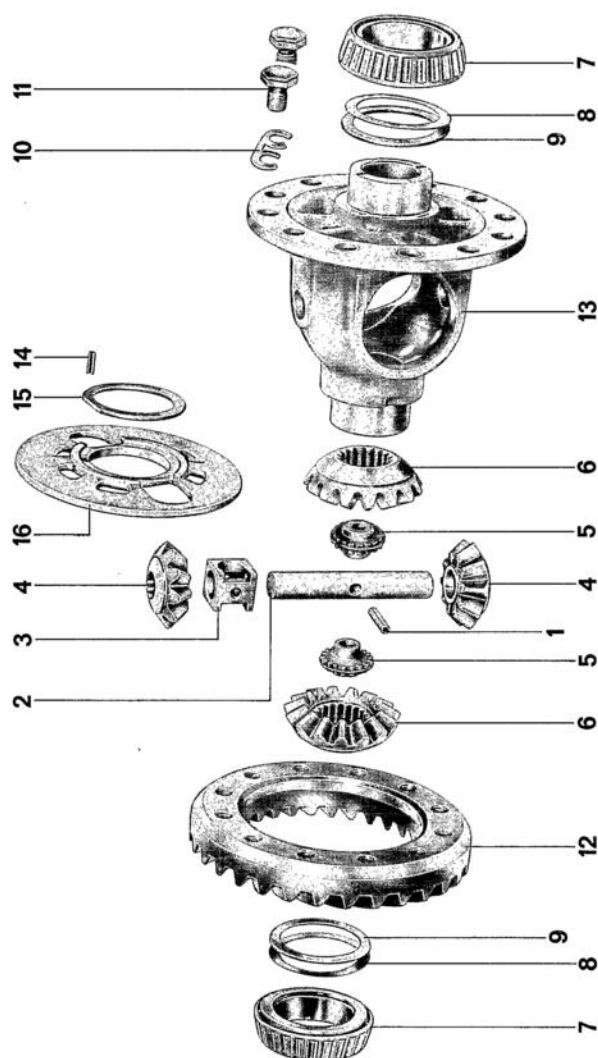
DISASSEMBLING AND ASSEMBLING DIFFERENTIAL

TOOLS



Nr.	Description	Special Tool	Remarks
1	Puller	40 - 19 (AUDI)	or similar
2	Thrust piece	P 263	
3	Thrust piece	P 264b	

Disassembling and Assembling Differential



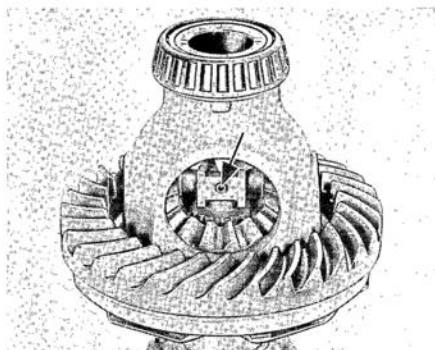
Nr.	Description	Qty	Note when		Special instruc. see
			Removing	Installing	
1	Roll pin	1	Drive out.	Replace if necessary	
2	Shaft	1	Drive out.	Note location of roll pin bore.	
3	Anchor piece	1			
4	Small differential pinion (spider gear)	1		Coat thrust areas with Molykote or similar lubricant.	3.1-2/4
5	Threaded retainer	2		Position properly.	3.1-2/5
6	Large differential pinion (side gear)	2		Coat thrust areas with Molykote or similar lubricant.	
7	Tapered roller bearing	2	Remove with puller No. 40-19 and P 263	Drive on with P 264b	3.1-2/4
8	Shim	2	Keep together with mechanic's wire for reassembly.	If necessary, re- calculate thickness	5.1-5/5
9	Spacer washer	2	Keep together with mechanic's wire for reassembly.	If necessary, re- calculate thickness	5.1-5/5
10	Lock plate	6		Replace	
11	Bolt	12		Torque to specify	
12	Ring gear	1	Check for wear	Make sure ring gear and pinion have matching pair num- bers.	5.1-4/1
13	Differential housing	1			
14	Pin	1			*
15	Spacer	1	Mark for re- installation	Determine thickness again if necessary	5.1 - 5/5 *
16	Magnetic carrier disc	1		Determine thickness again if necessary	5.1 - 5/5 *

* Parts only in conjunction with electronic speedometer

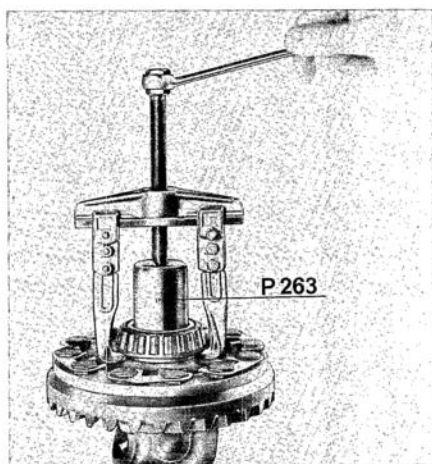
DISASSEMBLING AND ASSEMBLING DIFFERENTIAL

Disassembling

1. Drive out differential pinion shaft roll pin.



2. Drive out differential pinion shaft with a mandrel and remove anchor piece.
3. Remove tapered roller bearing with a puller and thrust piece P 263.



Caution

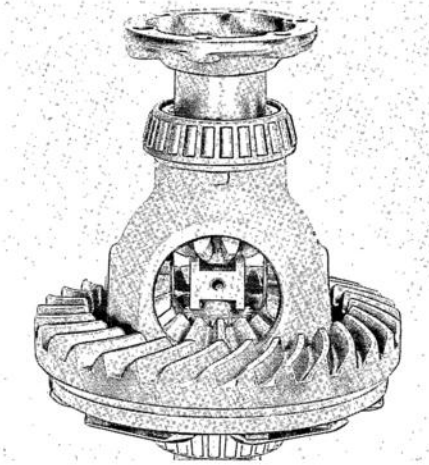
Do not interchange spacer washers and shims. Attach tags to prevent mixing up right side with left and vice versa.

4. Remove lock plates from ring gear retaining bolts. Remove bolts and take off ring gear.

Assembling

1. Slide lock plates into grooves in bolt heads. Close open ends with pliers to firmly attach the plates to bolt heads. Secure bolts by bending the plates down on one side of the hex surface.
2. Coat thrust surfaces of the differential pinions in the differential housing with Molykote or similar lubricant. Insert large differential pinion (side gears) through oval opening in the housing. Center the pinions by inserting the flange shafts.
3. Insert small differential pinions through the opening in the housing and position them opposite each other so that bores align with the bores in the housing.

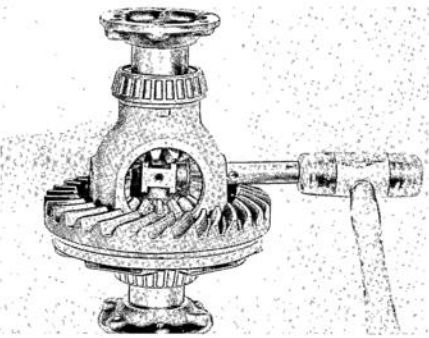
4. Insert threaded retainers with lock rings into the large differential pinions (side gears) and slide the anchor piece between the threaded retainers (see illustration).



Caution

Position the locating hole of the differential pinion shaft so it aligns with the hole of the anchor piece.

5. Hold the anchor piece in place (so prevent binding) and drive in the differential pinion shaft.

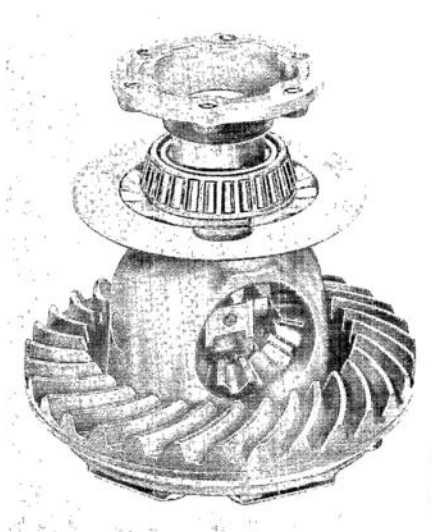
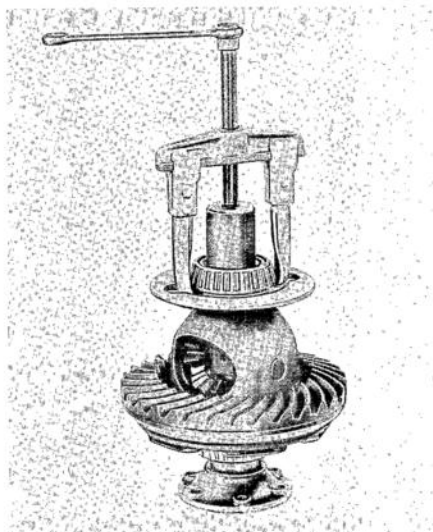


6. Place marked or measured bearing shims and spacer washers on the differential housing. Install tapered roller bearing using thrust piece P 264.
7. Re-adjust ring and pinion gears if necessary. See "Adjusting Ring Gear and Pinion".

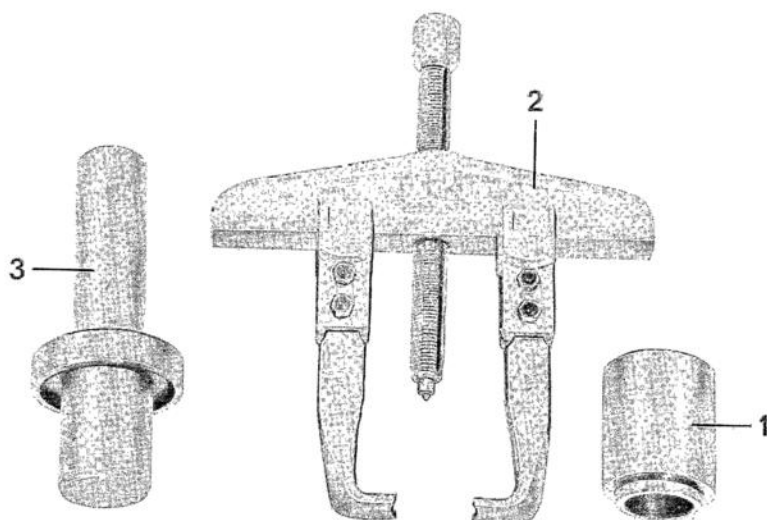
Note

With the 1976 Model the tapered roller bearing is pulled off through openings in the magnetic carrier disc with an extractor and special tool P 263.

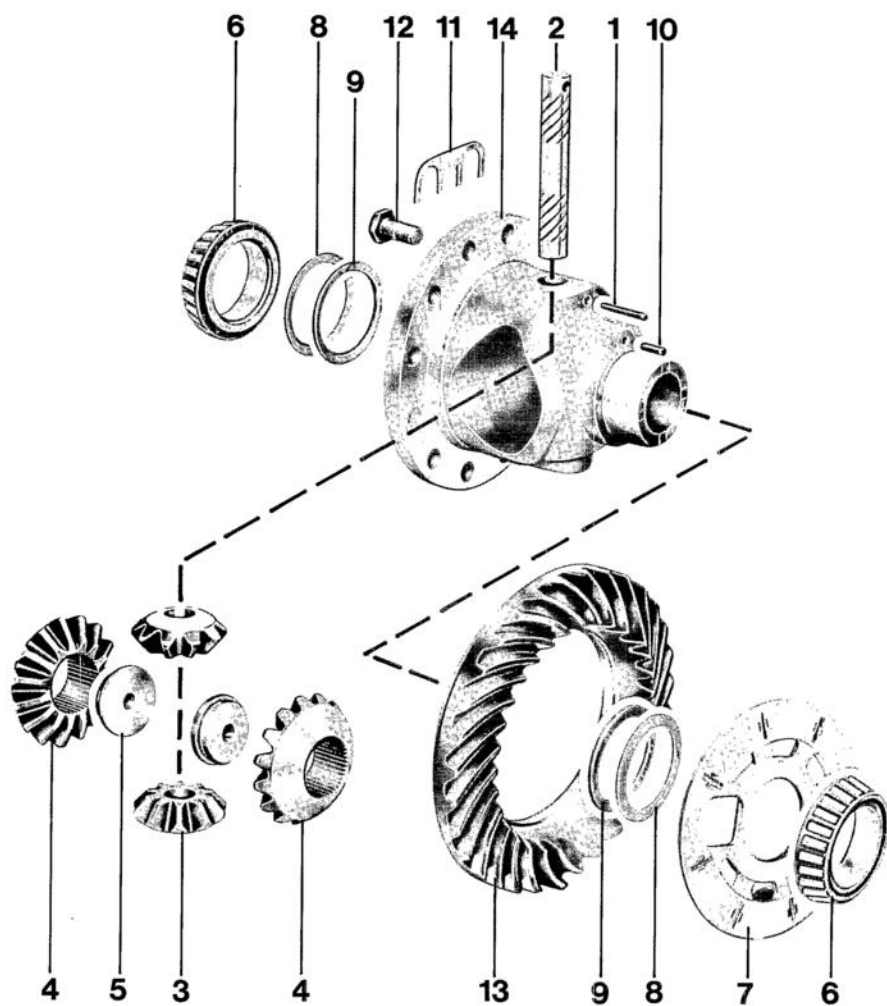
When replacing the magnetic carrier disc the tapered roller bearing preload does not have to be checked if the same shims are used again.



TOOLS



No.	Description	Special Tool	Remarks
1	Pressure pad	P 263	
2	Puller	US 1078	or 40 - 19
3	Pressure pad	P 264 b	

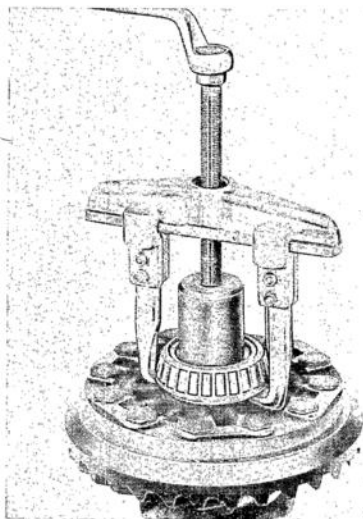


No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
1	Roll pin	1			
2	Shaft	1			
3	Small differential gear	2		Coat with MoS ₂ paste. Replace only in sets (with large differential gears).	
4	Large differential gear	2		Coat with MoS ₂ paste. Replace only in sets (with small differential gears)	
5	Threaded retainer	2			
6	Taper roller bearing inner race	2	Pull off with US 1078 and P 263.	Drive on with P 264 b.	
7	Magnetic carrier disc	1			
8	Washer	X	Mark for reinstallation.	Determine new thickness, if necessary.	
9	Shim	X	Mark for reinstallation	Determine new thickness, if necessary.	
10	Key	1			
11	Lockplate	6		Replace	
12	Bolt	12		Threads dry and without grease. Tighten to 115... 120 Nm (83... 86 ft lb).	
13	Ring gear	1		Heat to about 120° C/248° F. Tapped bores for ring gear bolts must be dry and without grease. Watch pair code number. Adjust, if necessary.	
14	Differential case	1			

DISASSEMBLING AND ASSEMBLING INSTRUCTIONS

Disassembling

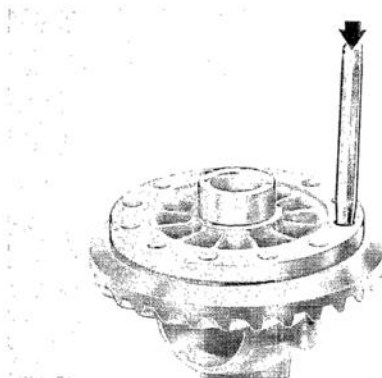
1. Pull off taper roller bearing inner races with a puller (e. g. US 1078) and Special Tool P 263.



Note

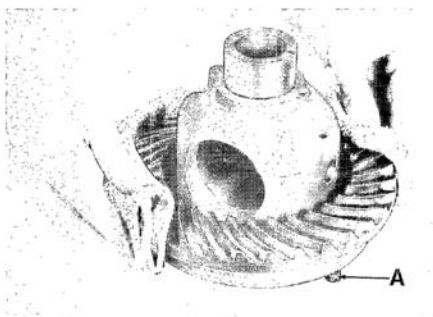
Claws of both arms must be machined, if necessary.

2. Knock ring gear off of case with a suitable mandrel.



Assembling

1. Heat ring gear to about $120^{\circ}\text{C}/248^{\circ}\text{F}$ and install. Use locally made centering pins as guides.

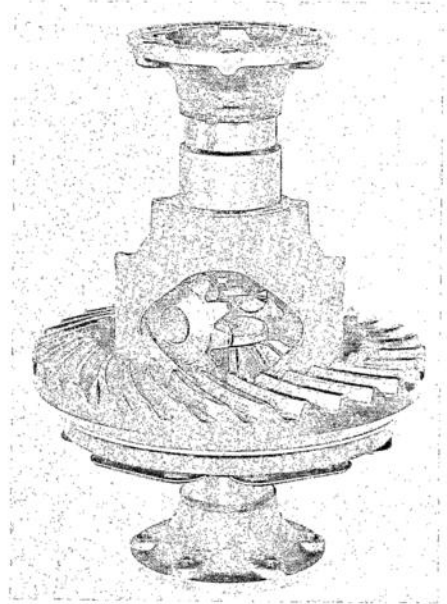
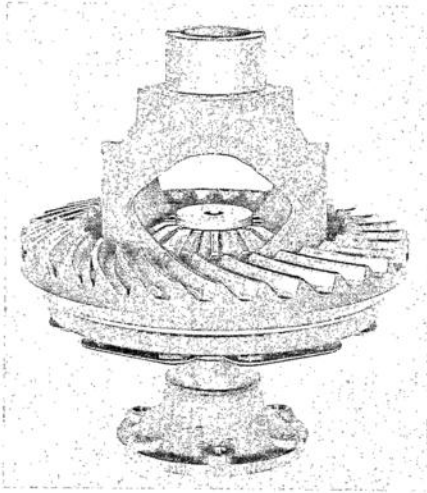


A - Centering pins (made locally)

2. Tighten ring gear bolts to specified torque value. Push lockplate in groove of bolts, squeeze front with pliers (so that lockplate is connected tightly on bolts) and bend down over a hexagon surface to lock.

3. Coat differential gears with MoS_2 paste.

4. Insert large differential gears with press-fit threaded retainers through large opening in differential case and locate with joint flanges.



5. Insert small differential gears between large differential gears and turn until bores of gears are aligned with bores in case.

6. Drive in differential shaft in correct position and lock with roll pin.

7. Drive on taper roller bearing inner races with Special Tool P 264.

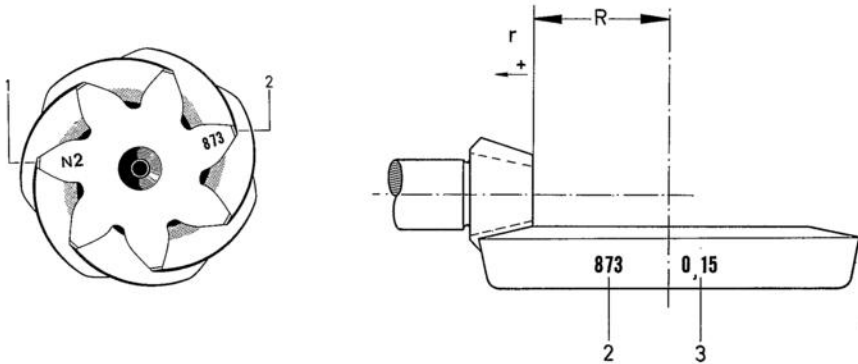
ADJUSTING RING GEAR AND PINION

General

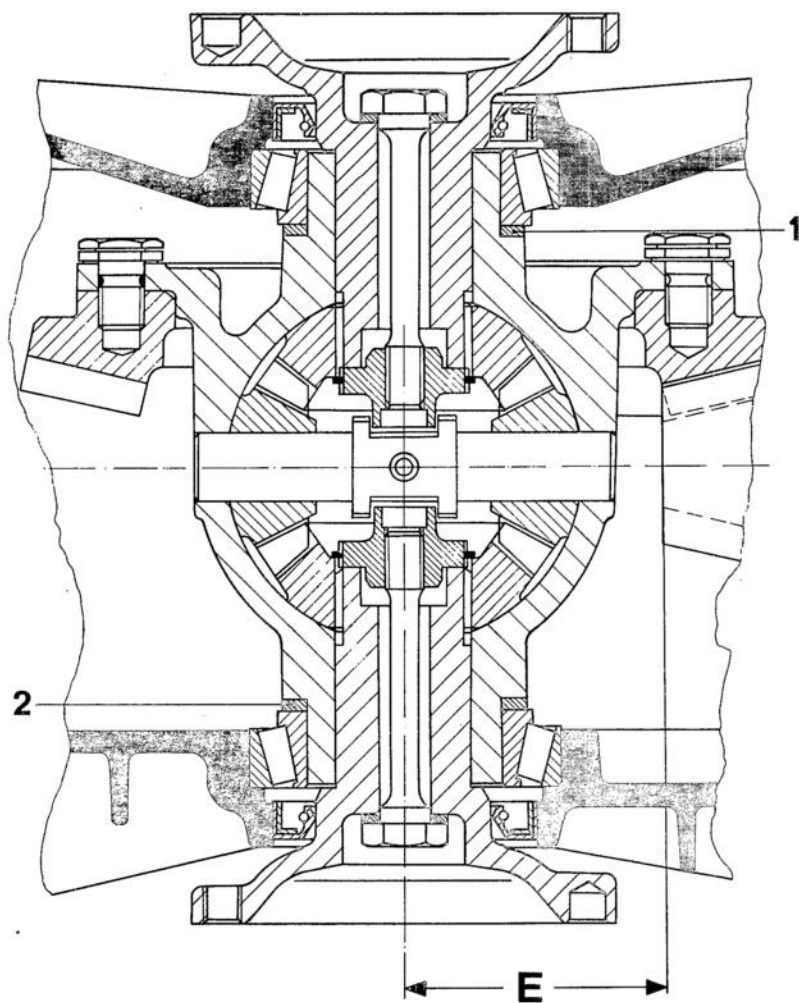
Adjustment of the ring gear and pinion is important for quiet operation of the rear axle assembly. For this reason the pinion shaft and ring gear is already matched as a pair during production. They are checked on testing machines for correct contact pattern and low noise level in both directions of rotation. When the ring gear and pinion is tested, it is set according to the design dimension "R". Dimension "R" is the distance from the face of the pinion to the ring gear center line. The pinion is then moved in or out of mesh until the quietest operation is determined. The deviation from the design dimension (the in or out movement of the pinion) is called "r" and is etched on the face of the pinion. While making this test, the ring gear backlash is kept within a tolerance of 0.12 - 0.18 mm. The ring gear and pinion shaft is designed in such a way that the deviation "r" must always be added to the design dimension "R".

Earlier pinion assemblies had either a plus (+) or a minus (-) etched in front of the deviation "r" whereas on the newer pinion assemblies, the letter "N" precedes the deviation "r" on the pinion shaft.

Ring gear and pinion shaft sets are also stamped with a matching set number and should always be replaced as a complete set.



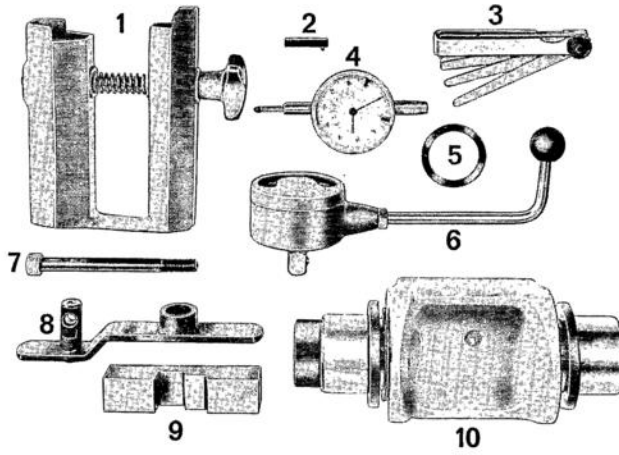
- R - Design Dimension (66.30 mm)
- r - Deviation from design dimension, shown in 1/100 mm
- 1 - Deviation r
- 2 - Matching set number
- 3 - Backlash



- 1 - Spacer S1
- 2 - Spacer S2
- E - Adjusting value

ADJUSTING RING GEAR AND PINION

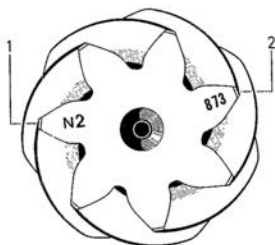
TOOLS



Nr.	Description	Special Tool	Remarks
1	Holder	P 259a	
2	Sensor	P 259b	
3	Feeler gauge	-	0.05 to 1.0 mm
4	Dial indicator	-	0 to 10 mm scale
5	Washer	-	From P 357
6	Torque wrench	US 8020 or similar	0 to 60 cmkp
7	Bolt	-	M 10 x 110
8	Dial indicator holder	-	From P 259
9	Gauge block	P 258c	
10	Mandrel	P 258	With bushings

ADJUSTING PINION SHAFT

By adding the design dimension "R" and the deviation "r" you get the adjusting dimension "E". Dimension "E" is the distance from the ring gear center line to the face of the pinion at which the ring and pinion set has been found to operate best.



- 1 - Deviation r in 1/100 mm
2 - Mating number

Example

The pinion shaft face end shows the deviation "r" to be 0.02 mm.

R (design dimension)	66.30 mm
+ r (deviation)	+ 0.02 mm
E (adjusting dimension)	<u>66.32 mm</u>

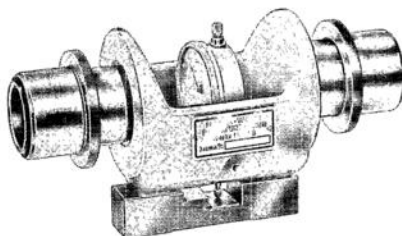
1. After finding the "Adjusting dimension E", attach input and pinion shafts, without shims, to final drive housing with clamping plates.

Caution

Tighten flange nut on input shaft to correct torque before making any measurements.

Install plate P 260a. Assemble 5th speed gears with synchro hub and shifting sleeve. Engage 5th gear. Block input shaft with holder P 37a and torque flange nut to specification.

2. Place mandrel P 258 on gauge block P 258a. Attach dial gauge to mandrel with a 1 mm preload.



3. Install mandrel P 258, with tapered roller bearings, in the differential housing so that there is an axial preload of approx. 0.1 mm when the side cover is installed. The mandrel should not have axial play during the measurement. Play can be eliminated by using differential shims.

Caution

Make sure the dial indicator sensor does not point into the center bore of the pinion shaft.

4. Rotate the mandrel carefully until the sensor forms a right angle with the face of the pinion. At this point the dial indicator will show the highest reading. A notch on the end of the mandrel shows the position of the dial indicator sensor. Record the reading.

By adding the mandrel and gauge block dimensions the "actual adjusting dimension" is obtained.

Example:

Mandrel dimension	54.015 mm
+ Gauge block dimension	+ 12.595 mm
Actual adjusting dimension	66.610 mm
	=====

Note the following when reading the dial indicator:

If the pointer reads to the right (clockwise), the distance is smaller than the "actual adjusting dimension" (66.61 mm). Therefore subtract the dial indicator reading from the "actual adjusting dimension" to determine the distance from ring gear center to face of pinion.

The distance from the center line of the mandrel to its resting base is shown on the side of the mandrel.

Example:

Actual adjusting dimension	66.61 mm
- Dial indicator reading	- 0.39 mm
Distance from ring gear center to face of pinion	66.22 mm
	=====

The distance from the measuring surface of the gauge block to its support surface is indicated on the side of the gauge block.

Adjusting dimension "E"	
(as in example on P 5.1-5/2)	66.32 mm
- Distance from ring gear center to face of pinion	- 66.22 mm
Shim thickness	0.10 mm
	=====

The pinion shaft must therefore be moved away from the ring gear center by 0.10 mm. This can be achieved by inserting a 0.10 mm thick shim. (End numbers from 3 or more should be rounded off to 5, and from 7 or more to 10).

Should the dial indicator read clockwise, the deviation when added to the "actual adjusting dimension" (mandrel dim. + gauge block dim.) should not exceed 0.03 mm.

Shims are available in the following thicknesses: 0.10, 0.15 and 0.20 mm. Total thickness of shims must not exceed 0.50 mm.

Adjusting dimension E should be rechecked after shims have been installed. A deviation of ± 0.03 mm is permissible. It is not necessary to check the gear tooth contact pattern.

DETERMINING TOTAL SPACER THICKNESS FOR RING GEAR ADJUSTMENT

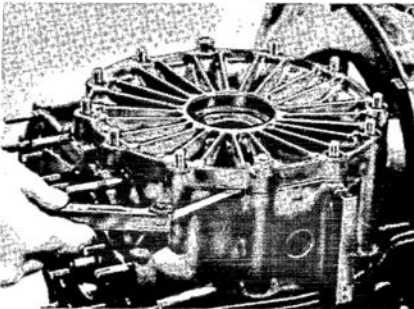
1. Make sure that side bearing outer races are fully seated in the housing and side cover.
2. Install a 3.5 mm spacer (S_1) on the ring gear side beneath the side bearing. Install a 3.0 mm spacer (S_2) on the opposite side beneath the other bearing.
3. Install differential with side bearings in housing and install side cover without O-ring and without oil seal. Do not tighten.
4. Lightly tighten the side cover using two nuts opposite each other. This preloads the side bearings. Check the gap between the cover and housing with a feeler gauge. The nominal value for the side bearing preload is 0.30 to 0.40 mm.
5. If the nominal value of 0.30 to 0.40 mm is not reached, replace the (S_1) spacer (ring gear side) with an appropriate spacer.

Example:

Feeler gauge measurement	0.65 mm
- Nominal value for side bearing preload	0.40 mm
	0.25 mm

The installed spacer S_1 (3.5 mm) must therefore be replaced with one 0.25 mm thinner, that is, it should be 3.25 mm thick.

6. Tighten side cover to correct torque.



7. Place washer from special tool P 357 on the U-axle flange. Install the axle flange. Slightly tighten the expansion bolt.

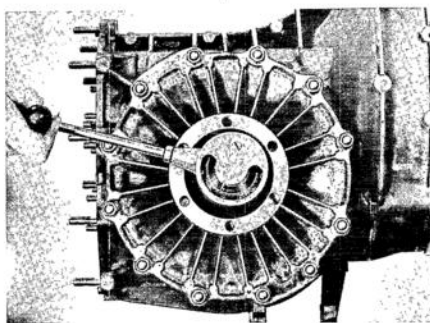
CAUTION

When measuring differential drag, the pinion shaft must be disengaged and the axle flange oil seal must be removed from the side cover to prevent additional drag.

8. Measure drag of the assembled differential with a torque wrench. The following values must be obtained to ensure proper side bearing preload.

SKF bearings = 300 to 420 Ncm
(26 - 37 in. lb)

FAG bearings = 350 to 650 Ncm
(30 - 56 in. lb)



If the differential drag is not within tolerance, replace the spacer washer.

9. Remove differential. Then pull off both side bearings.

CAUTION

Do not interchange spacer washers after removal.

10. Measure the thickness of both spacers with a micrometer. Add these measurements to obtain the total thickness of the spacers for ring gear adjustment.

Note

In order to check backlash correctly (a subsequent procedure), the spacer S_1 should be 0.1 mm (0.004 in.) thinner than one half of the sum of spacers S_1 and S_2 . The spacer S_2 should be 0.1 mm (0.004 in.) thicker than one half of the sum of spacers S_1 and S_2 .

Example:

Total thickness of spacers ($S_1 + S_2$) ... 6.25 mm

$$\frac{6.25 \text{ mm}}{2} = 3.125 \text{ mm}$$

$$\text{Thickness of spacer } S_1 = 3.025 \text{ mm}$$

$$\frac{6.25 \text{ mm}}{2} = 3.125 \text{ mm}$$

$$\text{Thickness of spacer } S_2 = 3.225 \text{ mm}$$

Spacers are available in increments of 0.10 mm from 2.4 to 3.7 mm.

A shim, 0.25 mm thick, permits adjustments to the nearest 0.05 mm. The rounded off spacer thickness should not differ from the calculated spacer thickness.

Example:

Calculated spacer thickness

$$S1 + S2 = 3.025 + 3.225 = 6.25 \text{ mm}$$

Rounded off spacer thickness

$$S1 + S2 = 3.0 + 3.25 = 6.25 \text{ mm}$$

Before measuring, remove any burr that may be on the edges of the spacer. Measure the thickness of the two spacers with a micrometer at four different points; the thickness tolerance is 0.02 mm (0.008 in.).

ADJUSTING RING GEAR BACKLASH

1. Install gear cluster with shims determined at time of pinion shaft adjustment.

Caution

Make sure pinion shaft flange nut is tightened to correct torque before making any adjustments.

2. Install differential with side bearings and correct shims (S1 and S2).

3. Install side cover with oil seal. Apply light coat of oil to seal.

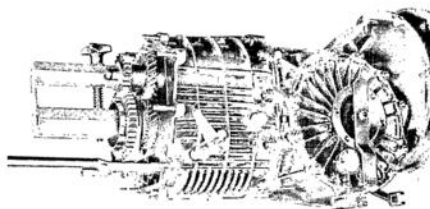
Caution

When tightening the nuts, take care that a certain amount of side clearance exists. Make sure the pinion shaft does not jam.

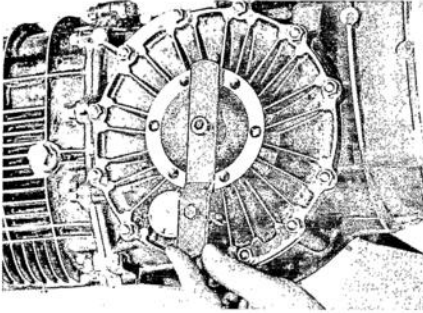
Tighten side cover bolts to correct torque.

4. Block pinion shaft with holder P 259a.

5. Place washer from special tool P 357 onto the axle flange. Attach dial indicator with sensor P 259b. Bolt dial indicator holder over the axle flange with the 10 x 110 mm bolt. The dial indicator should have a slight preload.



6. Move dial indicator holder back and forth.
Read backlash on dial indicator.



8. Spacers S1 and S2 can be replaced with special tools P 263 and P 264b until proper backlash is attained. Be sure that the total spacer thickness is not changed.

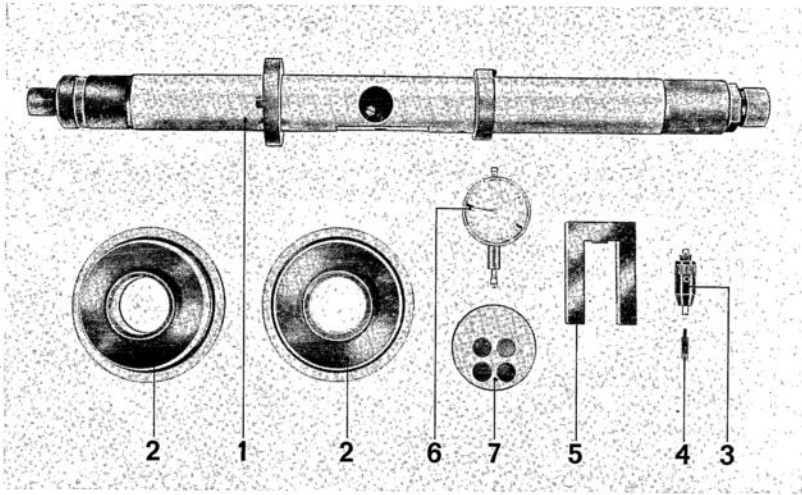
7. Turn ring gear about 90° and measure backlash again. The readings must not vary by more than 0.05 mm.

Caution

The accurate backlash is marked on the ring gear.

Backlash tolerance: 0.12 to 0.18 mm.

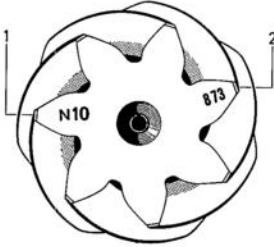
TOOLS



Nr.	Designation	Special Tool Nr.	Remarks
1	Setting gage shaft	VW 385/1	
2	Gage block	VW 385/4	
3	Gage contact plunger	VW 385/14	
4	Gage contact-extension	VW 385/53	14 mm
5	Master plate	VW 385/52	R = 66.30 mm
6	Dial indicator	---	3 mm range
7	Setting pad	VW 385/17	50 mm ϕ

ADJUSTING PINION SHAFT WITH UNIVERSAL SETTING GAGE VW-385

Determine adjustment value E from known design value R = 66.30 mm by adding deviation "r" which is shown on pinion face.



- 1 - Deviation "r" in 1/100 mm
2 - Mating number

Example:

The pinion face shows deviation "r" to be N 10

R = Design value	66.30 mm
r = Deviation	+ 0.10 mm
E = Adjustment value	= 66.40 mm

1. Assemble gear cluster without selector forks or adjustment shims.
Tighten preload plate nuts to specified torque.

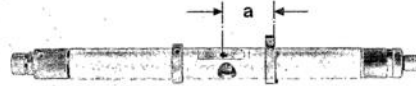
NOTE:

The collar nut on the pinion shaft must definitely be tightened to specified torque prior to measuring.

Fasten gear housing with 2 nuts. Install free gear of 5th speed together with spider. Block pinion shaft with clamp P 37a. Engage 4th speed and tighten collar nut to specified torque.

2. Make sure that outer races of bevel roller bearings are firmly seated in gear housing and housing side cover.

3. Move adjustable collar on setting gage VW 385/1 to dimension "a".

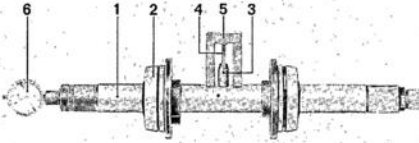


$$a = \text{ca. } 52 \text{ mm}$$

4. Slide gage blocks VW 385/4 onto the setting gage shaft and screw contact plunger VW 385/14, together with the contact extension VW 385/53 (14 mm), into place.

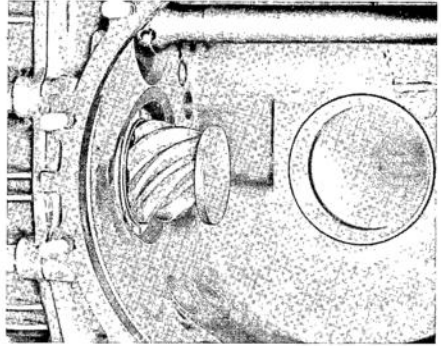
NOTE: Turn adjustable collar back to stop.

5. Place master plate VW 385/52 ($R = 66.30 \text{ mm}$) in position and adjust dial indicator (3 mm range) to 0 under a 1 mm preload (small pointer on 1, long pointer on 0).

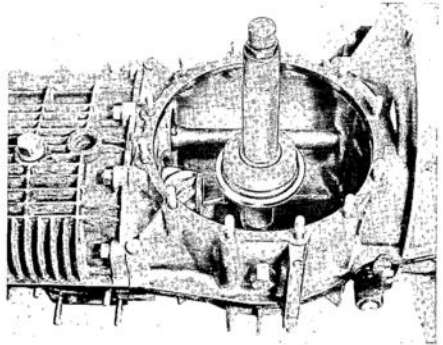


- | | | | |
|---|---|-----------|------------------------|
| 1 | = | VW 385/1 | Setting gage shaft |
| 2 | = | VW 385/4 | Gage block |
| 3 | = | VW 385/14 | Gage contact plunger |
| 4 | = | VW 385/53 | Gage contact extension |
| 5 | = | VW 385/52 | Master plate |
| 6 | = | --- | Dial indicator |

6. Place setting pad VW 385/17 on the pinion face.



7. Remove master plate and place setting gage in gear housing, making sure that the dial indicator extension is oriented towards the setting pad.



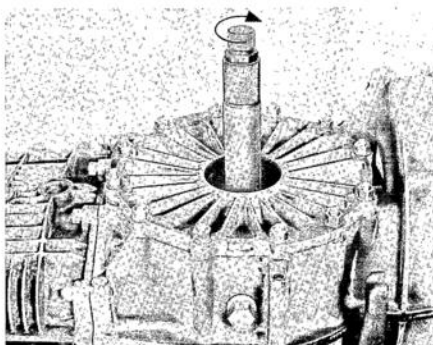
8. Insert housing side cover (without O-ring) and tighten nuts to specified torque.

Caution:

Never use a hammer when installing the housing side cover. This may cause the magnetically attached setting pad to fall off the pinion.

Bring side cover into proper place only by evenly tightening the retaining nuts.

9. Using the spindle, pull the second gage block so far outwards that the setting gage shaft can still be barely turned.



10. Carefully turn setting gage until the gage contact extension is positioned perpendicular to the pinion shaft face. In this instance, the indicator shows the highest reading which is to be noted.

Note the following points when reading the dial indicator:

The design value $R = 66.30$ mm was set by means of the master plate VW 385/52.

If the value indicated on the gage deviates clockwise from the set design value ($R = 66.30$ mm), then the dimension is smaller than 66.30 mm, that is, the amount of deviation from 0 must be subtracted from the value of 66.30 mm.

Example:

The small pointer on the indicator is between 1 and 2, and the long pointer shows 0.29 mm.

Adjusted design value	
(master plate VW 385/52)	66.30 mm
minus measured value	- 0.29 mm
Distance to pinion shaft face	= 66.01 mm

Adjustment value (as example)	66.40 mm
Distance to pinion shaft face	66.01 mm
Shim thickness	= 0.39 mm

This means that the pinion shaft must be moved away from the ring gear center by 0.39 mm. This is accomplished by installing two 0.20 mm thick shims (end values of 3 or more should be rounded off to 5, and from 7 on to 10).

Recheck adjustment value E (shown as 66.40 mm in the example) upon installation of shims; a deviation of ± 0.03 mm is permissible. A tooth contact pattern test need not be performed.

NOTE:

If the shims were selected in proper thickness, the dial indicator must show the value of deviation "r" (shown in the example as 0.10 mm) within a tolerance of ± 0.03 mm during the recheck.

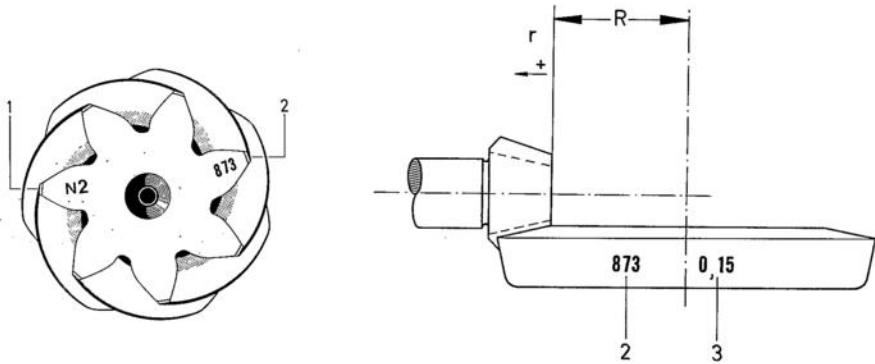
ADJUSTING RING GEAR AND PINION

General

Adjustment of the ring gear and pinion is important for quiet operation of the rear axle assembly. For this reason the pinion shaft and ring is already matched as a pair during production. They are checked on testing machines for correct contact pattern and low noise level in both directions of rotation. When the ring gear and pinion is tested it is set according to the design dimension "R". Dimension "R" is the distance from the face of the pinion to the ring gear center line. The pinion is then moved in or out of mesh until the quietest operation is determined. The deviation from the design dimension (the in or out movement of the pinion) is called "r" and is etched on the face of the pinion. While making this test, the ring gear backlash is kept within a tolerance of 0.12 - 0.18 mm. The ring gear and pinion shaft is designed in such a way that the deviation "r" must always be added to the design dimension "R".

Earlier pinion assemblies had either a plus (+) or a minus (-) etched in front of the deviation "r" where as on the newer pinion assemblies, the letter "N" precedes the deviation "r" on the pinion shaft.

Ring gear and pinion sets are also stamped with a matching number and should always be replaced as a complete set.



R Design dimension (59.70 mm for Sportomatic transmissions 925/00 and 925/01).

r Deviation from R indicated in 1/100 mm.

1 Deviation r

2 Matching set number

3 Backlash

ADJUSTING RING GEAR AND PINION

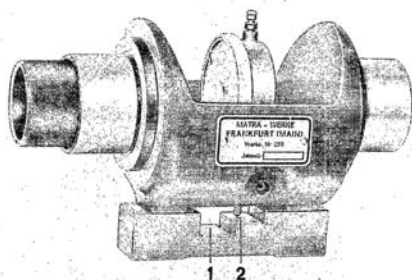
1. The design dimension "R" and the basic approximation value have been changed in the 925/00 and 925/01 transmission versions.

Design dimension "R" 59.70 mm
(formerly 54.20 mm)

Basic distance 60.70 mm
(approximation value)
(formerly 55.70 mm)

2. When determining the "Actual Adjusting Dimension", the gauge block P 258c must be used.

Adjustment is made in the same way as for manual units. See Type 911 workshop manual, volume I, 11 RA, page 46.

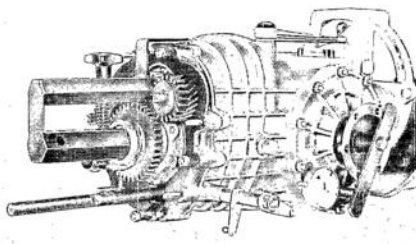


- 1 - Calibration surface for Type 915 transmission
- 2 - Calibration surface for Type 925 transmission

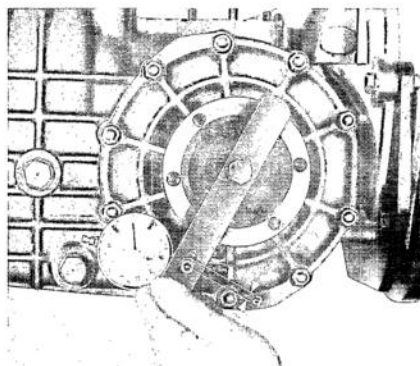
Note

When using gauge block P 258c, make sure to use the appropriate calibration surface.

3. The holder P 357a is needed for blocking the pinion shaft when measuring gear backlash.



4. When measuring backlash, be sure to use the modified dial indicator holder (must have a second 6.5 mm hole - see illustration).



a = 10 mm

Vorderachse
Front Axle
Essieu AV
Assale anteriore

4

4

4

4

4

4

4

4

4

4

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FRONT AXLE CHANGES - BEGINNING WITH 1972 MODELS

1. BOGE shockabsorber struts are installed in front axles of all vehicles.
Available on special order are BILSTEIN or KONI shockabsorber struts, and BOGE or KONI suspension struts.

2. The basic adjustment of suspension struts has been changed.
To attain the highest degree of driving comfort, damping forces have been reduced. This softer adjustment can also be used in earlier models. In such cases make sure that struts of same setting are used on both left and right side:

Two complete shockabsorber struts, or one complete shockabsorber strut and one strut insert, or two strut inserts.

3. The ball joint mount in shockabsorber strut has been changed.
The ball joint assembly is now attached by a double-wedge arrangement. The former clamp-mount in the shockabsorber strut is no longer in use.

4. Type 911 S vehicles have 15 mm dia. stabilizers in front and rear as standard equipment.

DESCRIPTION OF THE SELF - LEVELING HYDROPNEUMATIC SUSPENSION SYSTEM

General

Beginning with 1972 models, self-leveling hydropneumatic front suspension struts are optional equipment for all Type 911 vehicles.

Operation - General Outline

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 a normal level after covering a distance of anywhere between 300 and 1500 yards, depending on the road irregularities encountered. When the car is driven on particularly rough roads, the struts will pump the car, up to 10 mm more than the predetermined height. The height remains 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 predetermined height where it then will remain.

Should the suspension be loaded 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 noticed by the reduced ground clearance, similar to cars with conventional suspensions.

The suspension strut is filled with oil with the exception of two gas cushions. One of the gas cushions is located in the high-pressure part, between the damping cylinder and outer cover. The gas (nitrogen) is separated from the oil by a diaphragm. The second gas cushion is located in the low-pressure part above the damping cylinder, within the oil reservoir, and is not separated from the oil.

The pressure of the gas cushions is such that the force it exerts on the piston is equal to 90 percent of the empty weight of the vehicle.

A piston divides the damping cylinder. The space below the piston is in contact with the high-pressure part, and the space above the piston with the oil reservoir. A pressure valve is located on the piston.

The hollow piston rod accommodates the pump cylinder whose upper section is limited by a suction valve with a return flow orifice.

The pump rod is in the damper housing which is supported by the housing base. It also contains a needle valve which is suspended in the pump rod with the aid of a spring.

Pump Action Under Load

Irregularities in the road surface cause the piston rod to move in relation to the pump rod. Through this motion, the pump rod displaces a certain amount of oil from the pump cylinder, through the pressure valve, into the space below the piston.

During the suction stroke, a certain amount of oil is sucked from the space above the piston through the suction valve.

Due to the reduced oil supply above the piston, gas expands in the oil reservoir thus causing a pressure drop. At the same time, gas is compressed in the high-pressure chamber. The force under the piston is increased and the vehicle rises. This cycle repeats until the pump rod guide clears several orifices in the pump rod. On the subsequent suction stroke, oil also flows from the high-pressure chamber through the orifices into the oil reservoir. The pump also is neutralized, and the vehicle is no longer raised.

A balance is thus achieved since at higher vehicle level a return flow orifice is cleared by the needle valve permitting a small amount of oil to flow back to the oil reservoir.

In the balanced condition, the amount of oil pumped up equals the amount flowing back through the return flow orifice. The vehicle is at its predetermined level.

Action on Rebound

When the load is decreased, the car will rise briefly. As a result, the needle valve will open the return flow orifices until enough oil has returned to reestablish the normal oil level.

When the piston moves, the oil below the piston flows through the damper housing, creating a damping action. The oil velocity is kept within specified limits, thus limiting piston speed.

The required damping and springing characteristics are achieved through exact calibration of passages and valves, same as in conventional hydraulic shock absorbers.

In addition, the pumping action results in supplemental damping which increases in proportion to the load. In other words, the damping effect is load-sensitive.

Springing Action

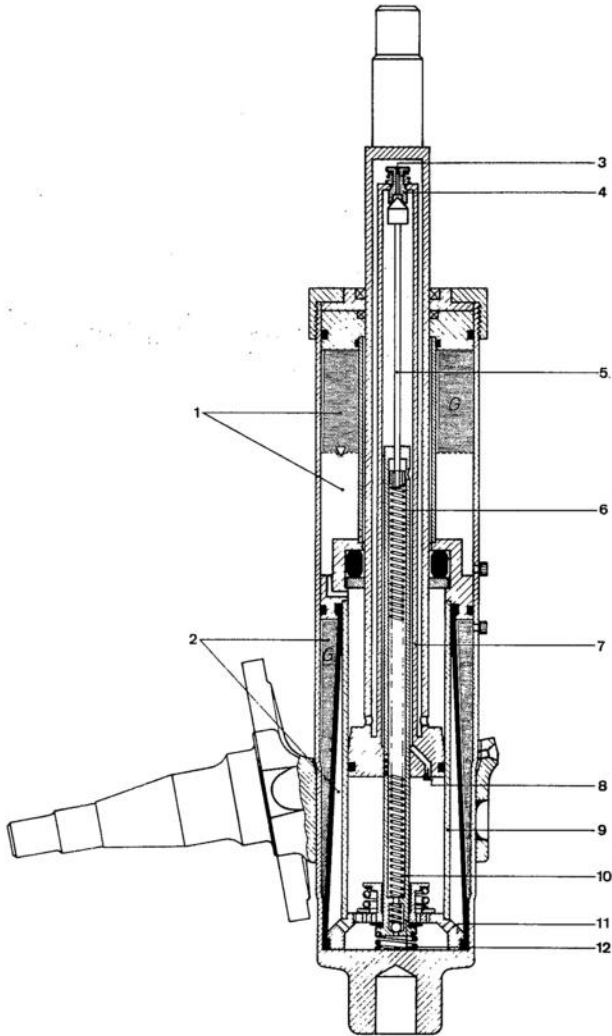
Pressure in the oil reservoir acts on the top surface of the piston and exerts a small downward force on the piston. Pressure in the high-pressure chamber exerts a large upward force on the bottom surface of the piston. The load capacity of the suspension element can be obtained from the difference between these two forces.

Suspension compression results in increased pressure below the piston and a pressure drop above it. The spring rate of both gas cushions is cumulative. When the load increases, the displacement increases in the oil reservoir and decreases in the high-pressure chamber.

During this action the spring rate of both gas cushions changes in such a way that the piston rod related spring rate adjusts itself to the new load. Thus the spring rate of the suspension strut adjusts itself to the given load, maintains constant vehicle height, and has an optimal damping effect.

Compared with the conventional suspensions incorporating steel springs and dampers, this system offers improved comfort characteristics.

Cross-Section of Self-Leveling Hydropneumatic KONI Suspension Strut



- 1. Low pressure chamber
- 2. High pressure chamber
- 3. Return flow orifice
- 4. Suction valve
- 5. Needle valve
- 6. Spring

- 7. Pump cylinder
- 8. Pressure valve
- 9. Main cylinder
- 10. Pump rod
- 11. Damper housing
- 12. Overload valve

G - Gas cushions

GENERAL SPECIFICATIONS

TYPE 911 VEHICLES - BEGINNING WITH 1972 MODELS

Wheel suspension	independent, with shockabsorber struts and transverse control arms
Springing	1 round longitudinal torsion bar per wheel (hydropneumatic suspension struts optional)
Shockabsorbers	double-action hydraulic shockabsorber struts
Stabilizer	15 mm dia, standard in Type 911 S only (optional in Type 911 T and 911 E)
Wheelbase	2271 mm (89.4 in.)
Track, front (wheel center 108 mm above torsion bar center)	911 T = 1360 mm / 53.54 in. (5 1/2 J x 15 rim) 911 E & 911 S = 1372 mm / 54.02 in. (6 Jx15 rim)
Max. axle load, front	600 kp (1320 lbs.)
Mean steering ratio	17.78 : 1
Steering wheel turns, lock-to-lock	approx. 3.1
Smallest turning circle	approx. 10.7 m (35.1 ft.)
Nominal Adjustment Values and Wear Tolerance (at DIN curb weight)	
Toe angle, overall (pressed 15 kp)	$\pm 0'$
Camber, front	$0^{\circ} \pm 10'$
Max. camber difference, left to right	$10'$
Caster	$6^{\circ} 5' \pm 15'$
Steering difference angle, front wheels turned 20°	0° to $30'$
Front axle height adjustment (wheel center above torsion bar center)	$108 \text{ mm} \pm 5 \text{ mm}$ ($4.25 \pm 0.20 \text{ in.}$)
Height difference, left to right	max. 5 mm (0.20 in.)
Steering drag (measured at steering assembly flange without tie rods or damper connected)	8 - 14 cmkp (6 - 12 in.lbs.)

TECHNICAL DATA - 1974 Models

Vehicle Type	911	911 S	Carrera
Wheel suspension	independent, with shock absorber struts and transverse control arms		
Springing	1 round longitudinal torsion bar per wheel (hydropneumatic suspension struts optional)		
Shock absorbers	double-action hydraulic shock absorbers struts		
Stabilizer, diameter front/rear	16 mm/---	16 mm/---	20 mm/18 mm
Torsion bar dia.	18.8 mm	same as 911	same as 911
Wheelbase	2271 mm	2271 mm	2271 mm
Track, front (wheel center 108 mm above torsion bar center)	1360 mm (5 1/2 Jx15 rim)	1372 mm (6 Jx15 rim)	1372 mm (6 Jx15 rim)
Max. axle load, front	600 kg	same as 911	same as 911
Mean steering ratio (steering wheel angle to road wheel angle)	17.78 : 1	same as 911	same as 911
Steering wheel turns, lock-to-lock	approx. 3.1	same as 911	same as 911
Nominal Adjustment Values and Wear Tolerances (at DIN curb weight)			
Overall toe-in, front (pressed 15 kg)	$\pm 0'$	same as 911	same as 911
front wheel camber	$0^\circ \pm 10'$	same as 911	same as 911
Max. camber difference, left to right	10'	same as 911	same as 911
Caster	$6^\circ 5' \pm 15'$	same as 911	same as 911
Steering difference angle, front wheels turned 20°	0° to $30'$	same as 911	same as 911
Front axle height adjustment (wheel center above torsion bar center)	108 mm ± 5 mm	same as 911	113 mm ± 5 mm
Height difference, left to right	max. 5 mm	same as 911	same as 911
Steering drag (measured at the steering assembly flange with tie rods disconnected)	8 - 14 cmkp	same as 911	same as 911

TECHNICAL DATA - 1975 Models

Model	911 S	Carrera
Wheel suspension	Independent with transverse control arms and shock absorber struts	
Springing	One round longitudinal torsion bar per wheel	
Shock absorbers	Double action hydraulic shock absorber struts	
Stabilizer dia. front/rear	20 mm/18 mm	same as 911 S
Torsion bar dia.	18,8 mm	same as 911 S
Wheelbase	2271 mm	same as 911 S
Track width, front	1372 mm with 6 J x 15 wheel	same as 911 S
Front axle height adjustment: center of wheel above center of torsion bar (at curb weight according to DIN)	93 $\pm$ 5 mm	same as 911 S
Max. axle load, front	600 kg (1323 lb)	same as 911 S
Steering ratio (overall)	17,78 : 1	same as 911 S
No. of steering wheel turns from lock to lock	approx. 3,1	same as 911 S
Adjusting, reference and wear specifications (at curb weight according to DIN)		
Total toe, front (wheels pressed together with 15 kg)	$\pm$ 0'	same as 911 S
Camber, front	+ 30' $\pm$ 10'	same as 911 S
Max. camber difference between left and right	10'	same as 911 S
Caster	6° 5' $\pm$ 15'	same as 911 S
Toe difference angle at 20° lock	0° to 30'	same as 911 S
Height difference between left and right	max. 5 mm	same as 911 S
Steering drag (measured at steering gear flange with tie rods disconnected)	8 to 14 cmkp	same as 911 S

TECHNICAL DATA - from 1976 Model

	1976/77 Models 911 S	From 1978 911 SC
Wheel suspension	Independent wheel suspension on control arms and spring/absorber struts	
Springing	One round torsion bar per wheel in forward direction	
Shock absorbers	Double-action hydraulic shock absorbers	
Stabilizer dia. front/rear	16 mm/---	20/18 mm
Torsion bar dia.	18,8 mm	18,8 mm
Track width, front	1361 mm with rim 6 J x 15	1361 mm with rim 6 J x 15
Wheelbase	2272 mm	2272 mm
Front axle height (wheel center over torsion bar center) (at DIN curb weight)	99 $\pm$ 5 mm	99 $\pm$ 5 mm
Height difference, left to right	max. 5 mm	max. 5 mm
Max. axle load, front	600 kg	model 1978/79: 600 kg/1323 lb model 1980/81: 650 kg/1433 lb
Steering ratio at center (steering wheel lock to lock)	17,78 : 1	17,78 : 1
No. of steering wheel turns from lock to lock	approx. 3.1	approx. 3.0
Adjusting, reference and wear limit values (at DIN curb weight)		
Total toe, front (wheels pressed together with 15 kg/150 N)	0°	0°
Toe difference angle at 20° steering lock	0° to + 30'	0° to + 30'
Camber of front wheels	+ 30' $\pm$ 10'	+ 30' $\pm$ 10'
Max. camber difference, left to right	10'	10'
Caster	6° 5' $\pm$ 15'	6° 5' $\pm$ 15'
Steering drag (measured on flange of steering gear with tie rod disconnected)	0,8 to 1,4 Nm (8 to 14 cmkg)	0,8 to 1,4 Nm (8 to 14 cmkg)

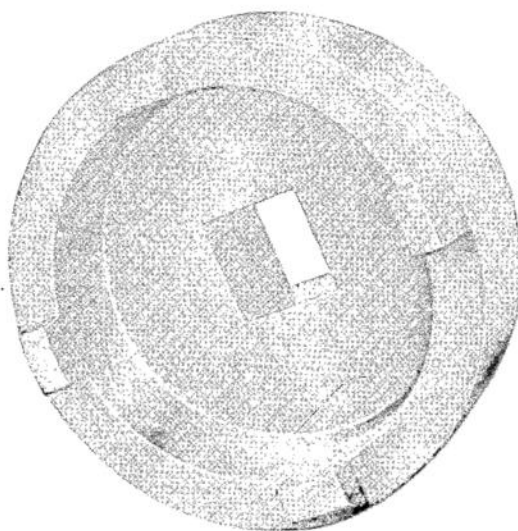
TIGHTENING TORQUES FOR FRONT AXLE AND STEERING

Location	Description	Thread	Grade	mkp	ft. lbs.
Shockabsorber strut to upper mounting plate	Nut	M 14 x 1.5	8	8	57.9
Tie rod clamping sleeve	Nut	M 8	8.8	1.5	10.8
Strut upper mounting plate to body	Allen bolt	M 10	8.8	4.7	34.0
Auxiliary support to body	Bolt	M 12 x 1.5	8.8	9	65.1
Undershield fastener	Bolt	M 10	8.8	4.7	34.0
Undershield fastener	Bolt	M 8	8.8	2.5	18.1
Flanbloc attachment	Bolt	M 10	8.8	4.7	34.0
Auxiliary support attachment	Bolt	M 10	8.8	4.7	34.0
Steering unit attachment	Bolt	M 10	8.8	4.7	34.0
Tie rod to steering unit	Bolt	M 10	8.8	4.7	34.0
Stabilizer mount to body	Bolt	M 8	8.8	2.5	18.1
Stabilizer lever to stabilizer	Bolt	M 8	8.8	2.5	18.1
Wheelbearing clamping nut to axle	Allen bolt	M 7	10 K	1.5	10.0
Ball joint to shockabsorber strut	Nut	M 8	8	2.2	15.9
Ball joint to shockabsorber strut	Bolt	M10x30	10.9	4.5	32.5
Ball joint to transverse arm	Notched nut	M 45 x 1.5	8.8	25	180.0
Plug for BOGE shockabsorber strut	Plug			12 + 2	86.8 + 14.5
Plug for KONI shockabsorber strut	Plug			20	144.7
Wheel to hub	Lug nut	M 14 x 1.5	10 K	13	94.0
Brake disc to wheel hub	Nut	M 8	8.8	2.3	16.6
Cover shroud to steering knuckle	Bolt	M 8	8.8	2.5	18.1
Brake caliper to steering knuckle	Bolt	M 12 x 1.5	8.8	7.0	50.6

Location	Description	Thread	Grade	mkp	ft. lbs.
Hollow bolt to brake caliper	Hollow bolt	M 10 x 1		2.0	14.5
Steering coupling to steering shaft	Bolt	M 8	8.8	2.5	18.1
Steering shaft to steering unit	Bolt	M 8	8.8	2.5	18.1
Steering support attachment	Allen bolt	M 8	8.8	2.5	18.1
U-joint to steering shaft	Bolt	M 8	8.8	2.5	18.1
Steering wheel attachment	Nut	M 18 x 1.5	8	7.5	54.2
Dust boot support to steering rack	Notched nut	M 16 x 1.5	8	7.0	50.6
Ball joint to steering arm	Castellated nut	M 10 x 1	8	4.5	32.5
Coupling flange to steering pinion (self-locking)	Nut	M 10	8	4.7	34.0
Housing cover to steering housing	Bolt	M 8 x 1	8.8	1.5	10.8
Centering screw to steering lock	Stud	M 8	10.9	0.2-0.3	1.4-2.2
Lock nut for centering screw	Nut	M 8	8	1.8	13

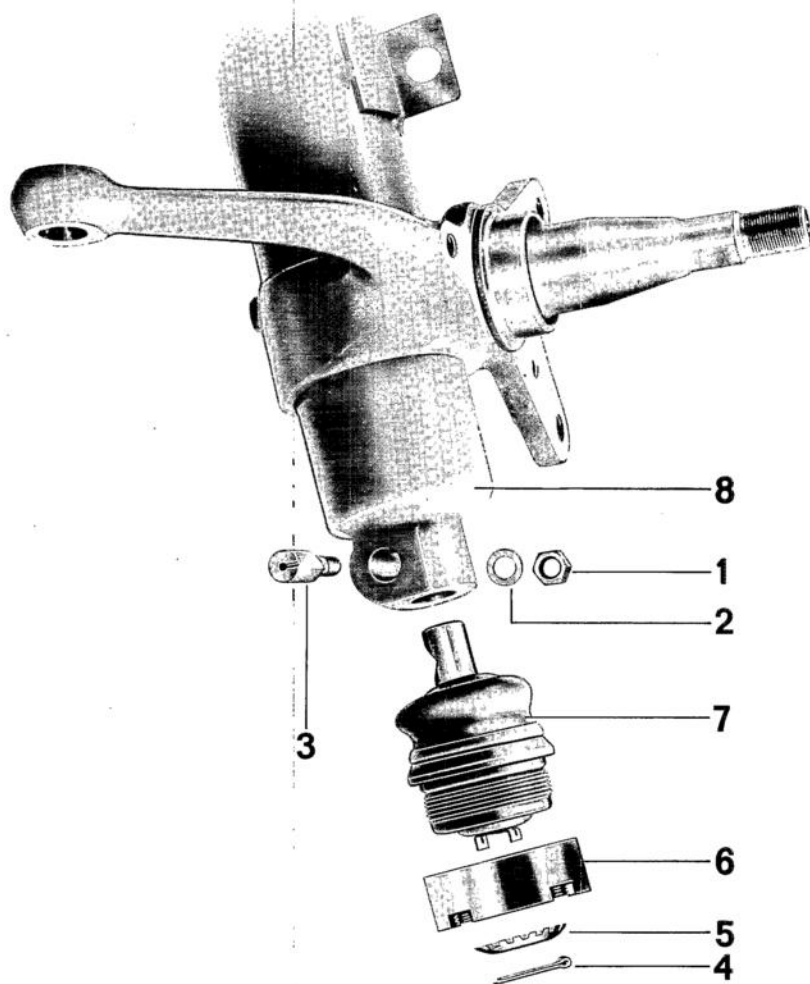
REMOVING AND INSTALLING FRONT AXLE BALL JOINT

TOOLS



Nr.	Description	Special Tool	Remarks
1	Wrench	P 280b	

REMOVING AND INSTALLING FRONT AXLE BALL JOINT

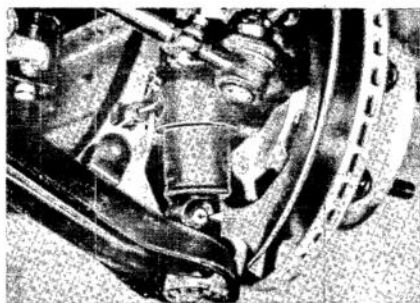


Nr.	Description	Qty	Note when		Special instructions see
			removing	installing	
1	Nut M 8	1		Torque to specification.	
2	Washer	1			
3	Double-wedge bolt	1	Drive out.	Install with multipurpose grease, noting proper seating. Replace.	
4	Cotter pin	1		Replace.	
5	Lock plate	1		Replace if necessary.	
6	Nut	1	Remove with special tool P 280b.	Torque to specification.	
7	Ball joint	1		Check, replace if worn.	
8	Shockabsorber strut (suspension strut)			Check, replace if necessary.	

INSTRUCTIONS FOR DISASSEMBLY AND REASSEMBLY

Assembling

1. Coat double-wedge bolt with multipurpose grease before assembling.
2. Installed position of the double-wedge is so that the retaining nut points forward in the direction of travel.
The notch on the face of the double-wedge piece and the wedge contour must point toward the wheel stub axle.



3. Make sure the double-wedge bolt is properly seated by tapping with a hammer before tightening the nut.
4. Torque Stop-nut to 2.2 mkp.

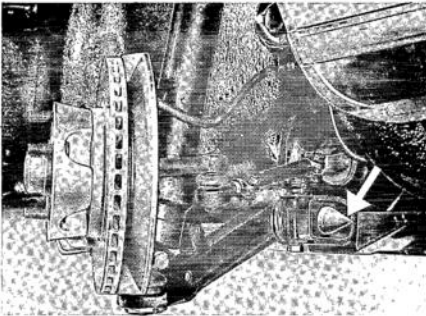
CHECKING SELF-LEVELING HYDROPNEUMATIC SUSPENSION STRUTS

Special Tools:

P 301b Measuring Mandrel

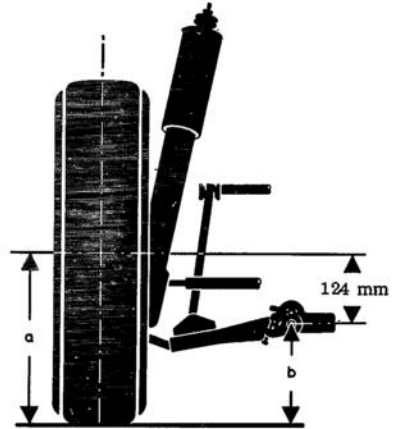
1. Load the front axle with a ballast of 100 kp (220 lbs) in such way that both wheels are evenly weighted (distribute the load evenly in the luggage compartment).
2. The best way to test the pumping action is by driving the car.

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



Measure distance "a" - from the ground vertically to the front wheel center.

Distance "b" equals distance "a" less 124 mm (5.0 in). 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 the car. The difference must be deducted from measurements obtained between the ground and lower edge of fender.

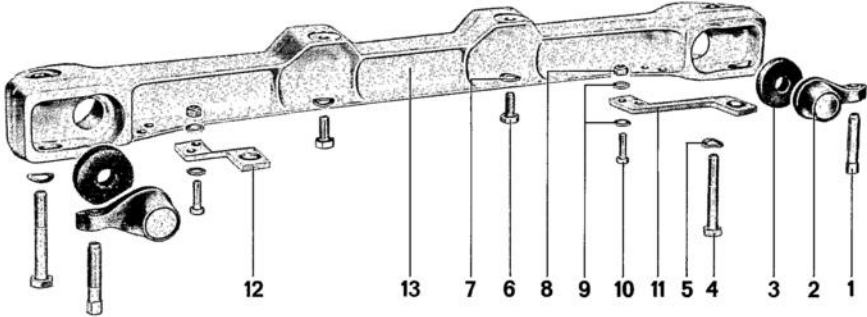
Drive the car on a relatively straight but rough road over a distance of approx. 2 km (1 1/4 miles), without hard braking, and stop car on a level surface. Keeping car occupants in the car, have another person make comparison measurements at both front fenders. The values should not differ from the determininal nominal values by more than ± 10 mm (13/32 in).

LIGHT-ALLOY AUXILIARY CROSS MEMBER FOR CARRERA 2.7

General

Carrera 2.7 vehicles are equipped with a new, forged light-alloy auxiliary cross member. Tightening torques for the front axle remain unchanged.

DISASSEMBLY AND REASSEMBLY



No.	Description	Qty	Note when		Special instructions see
			removing	installing	
1	Adjusting screw	2		Coat with multi-purpose MOS ₂ grease.	
2	Adjusting lever	2			
3	OWA-gasket	2			
4	Bolt, M 12 x 1,5	2		Tighten to specified torque.	
5	Spring washer	2		Replace.	
6	Bolt, M 10 x 20	2		Tighten to specified torque.	
7	Spring washer	2		Replace.	
8	Self-locking nut M 8	4		Replace if necessary.	
9	Washer	8			
10	Allen bolt M 8	4			
11	Right brace	1			
12	Left brace	1			
13	Auxiliary cross member	1			

STABILIZER 1974 MODELS

General

Beginning with the 1974 models, all vehicles are equipped with a new, one-piece front axle stabilizer.

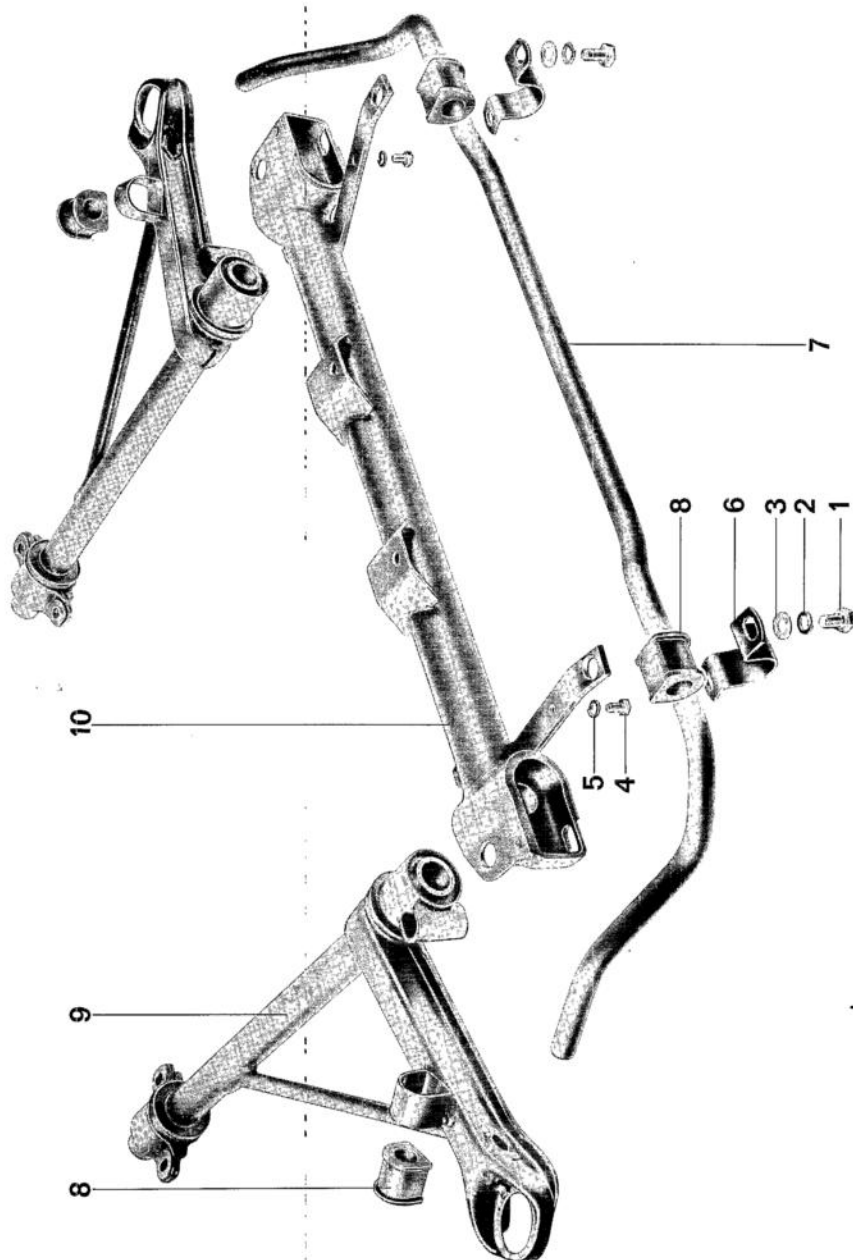
The stabilizer bar diameter is

16 mm in 911 and 911 S vehicles

20 mm in Carrera vehicles

The stabilizer is mounted in rubber bushings located in the transverse control arms and the auxiliary support. It is attached by means of two clamps which are bolted to the modified support struts of the auxiliary support.

DISASSEMBLY AND REASSEMBLY

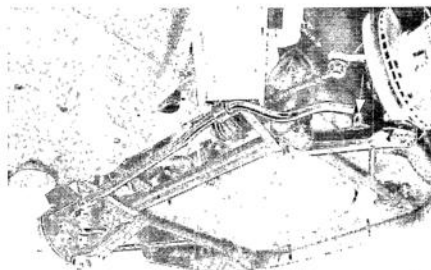


No.	Description	Qty	Note during removal installation	References
1	Bolt M 8	2	Tighten to specified torque	
2	Lock washer	2	Replace	
3	Washer	2		
4	Bolt M 8	2	Tighten to specified torque	
5	Lock washer	2	Replace	
6	Clamp	2		
7	Stabilizer	1		
8	Rubber bushing	4	Check for wear Use rubber lubricant	
9	Transverse control arm	2		
10	Auxiliary support	1		

INSTRUCTIONS FOR REMOVAL AND INSTALLATION

Removal

1. Remove stone guard.
2. Remove both support clamps from auxiliary support.
3. Remove stabilizer rearward by first pulling it out of one mounting point in the transverse control arm, and then out of the other.



Installation

1. First push the stabilizer end into one mounting point, then into the other. Use rubber lubricant.

INSTALLATION NOTES FOR SHOCK ABSORBER/SPRING STRUTS

With the 1975 Models a different height adjustment was introduced. When installing the shock absorber/spring struts, make sure that spacer, Part No. 911.341.615.00, is installed between the guard tube and support bracket.



STEERING COLUMN ARRANGEMENT BEGINNING WITH 1974 MODELS

General

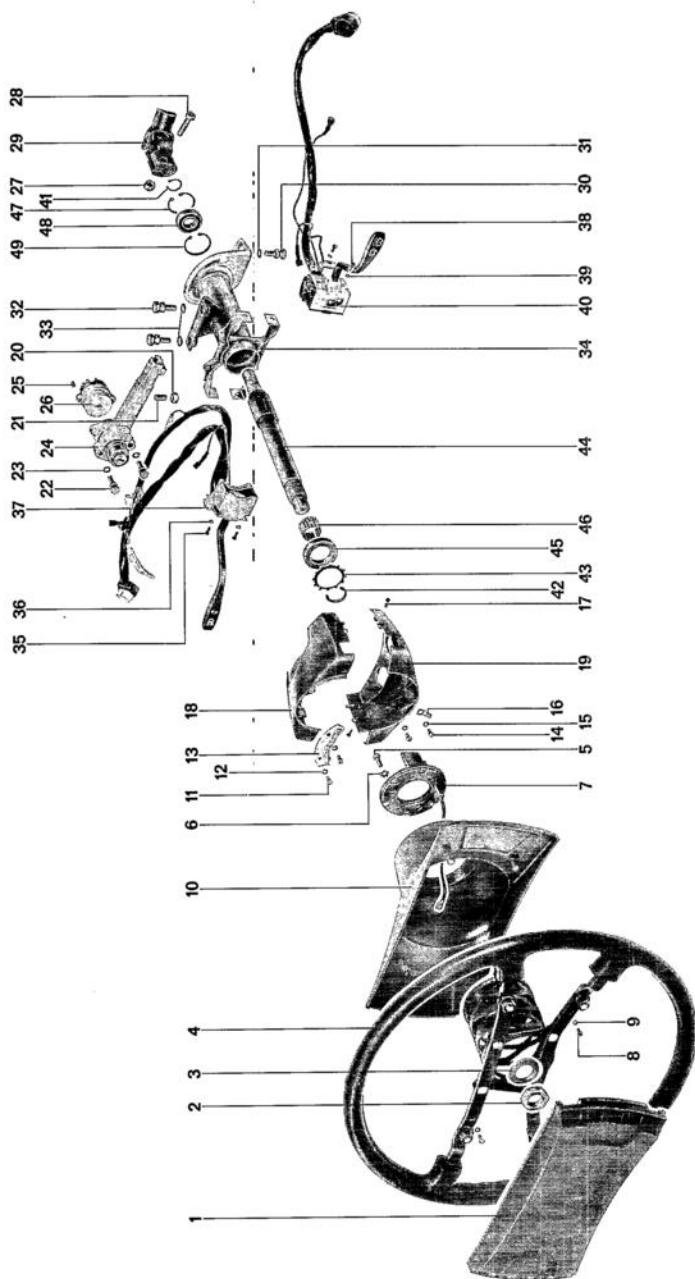
Beginning with 1974 models, the steering column attachment to the instrument panel has been changed.

A safety steering wheel has been introduced at the same time.

This modification necessitated changes in the following parts: steering shaft, steering shaft tube, and the switch assembly mounted on the steering column.

This steering column version with safety steering wheel can be subsequently installed in 1968 and later vehicles.

DISASSEMBLY AND REASSEMBLY



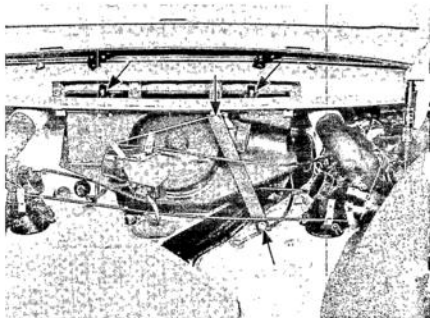
No.	Description	Qty	Note when:		Remarks
			removing	installing	
1	Pad	1	Pull off steering wheel	Press into place	
2	Nut, SW 27	1		Torque to specification	0,2 - 2/2
3	Spring washer	1		Replace if necessary	
4	Safety steering wheel hub and energy absorbing support	1		Install with road wheels in straight ahead position, release ring on left side	
5	Oval head screw M 3,5 x 10	3			
6	External tooth lock washer	3		Replace if necessary	
7	Contact ring	1		Lightly grease contact surface (such as KONDOR T 250 contact grease)	
8	Fillister head screw	4			
9	Lock washer	4		Replace if necessary	
10	Hub cover	1			
11	Fillister head screw, M 4 x 10	2		Replace if necessary	
12	Lock washer	2		Replace if necessary	
13	Contact plate	1		Lightly grease contact surface (such as KONDOR T 250 contact grease)	
14	Fillister head screw, M 3 x 8	4			
15	Lock washer	4		Replace if necessary	
16	Contact tab	1			
17	Fillister head screw, M 3 x 10	2			

No.	Description	Qty	Note when: removing installing	Remarks
18	Switch housing top	1		
19	Switch housing bottom	1		
20	Nut, M 8	1		
21	Stud	1		
22	Shear bolt, M 8	2	drill bolt head off. Tighten until bolt head shears off	4.2 - 1/6
23	Lock washer	2	Replace if necessary	
24	Ignition steering lock	1		
25	Fillister screw M 3	2		
26	Ignition/starter switch	1		
27	Self-locking nut M 8	1	Replace. Torque to specification	0.2 - 2/2
28	Bolt M 8	1		
29	Universal joint	1	Check, replace if necessary	
30	Shear bolt M 8	1	Drill bolt head off Tighten until bolt head shears off	
31	Lock washer	1	Replace if necessary	
32	Shear bolt M 8	2	Drill bolt head off, or grind it off if necessary. (Remove tachometer.)	4.2 - 1/7
33	Lock washer	2	Replace if necessary	

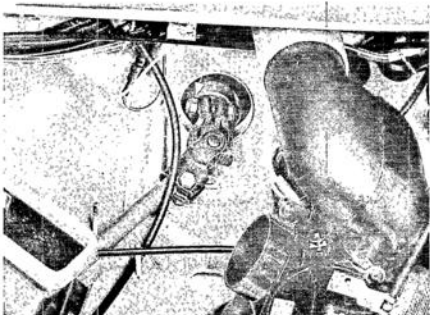
No.	Description	Qty	Note when:		Remarks
			removing	installing	
34	Steering shaft tube	1	Remove from instrument panel together with steering shaft and switches		
35	Fillister head screw, M 3 x 8	2			
36	Lock washer	2	Replace if necessary		
37	Directional signal and dimmer switch	1			
38	Fillister head screw, M 8 x 3	2			
39	Lock washer	2	Replace if necessary		
40	Wiper/washer switch	1			
41	Lock washer	1	Replace if necessary		
42	Lock washer	1	Replace if necessary		
43	SEGER retaining ring	1	Press out with a screwdriver	Press into seat	
44	Steering shaft	1	Drive out of steering shaft tube		
45	Ball bearing	1	Check, replacing if necessary. Grooved ball bearings with plastic inner races from 1975 models.		4.2 - 1/7
46	Contact ring	1	Replace if necessary. Deleted from 1975 models.		4.2 - 1/7
47	Circlip	1	Must be seated in groove in steering shaft groove		
48	Ball bearing	1	Check, replace if necessary		
49	Circlip	1	Must be seated in groove in steering shaft groove		

Disassembly

1. Remove blower.



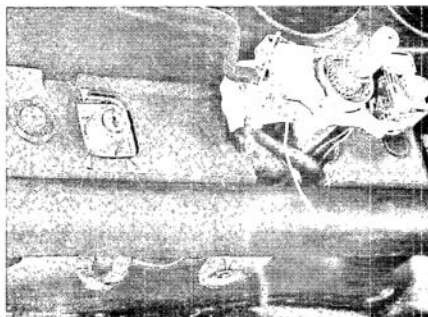
2. Remove steering shaft cover and take off universal joint retaining bolt.



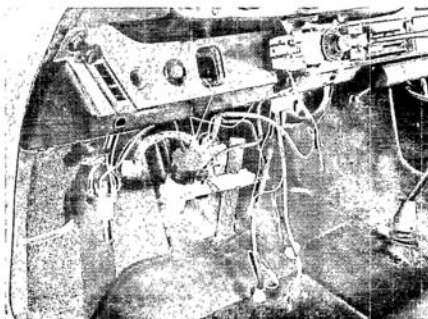
3. Remove knee strip.

4. Remove light switch and tachometer.

5. Drill off or grind off shear bolts in steering switch attachment and ignition/starter switch.



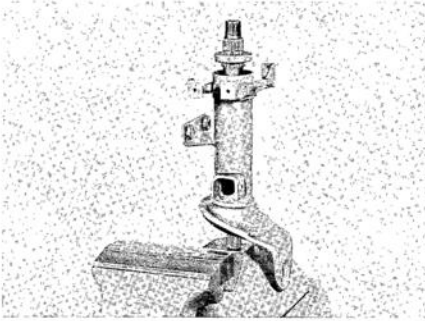
6. Detach wire connectors and multiple plugs.



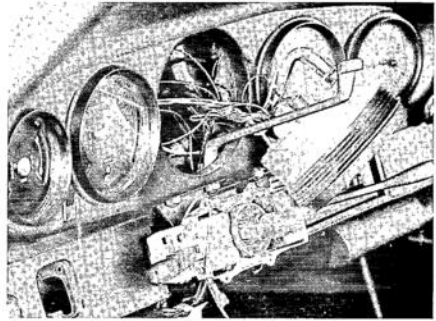
7. Remove complete steering switch from instrument panel.

Reassembly

1. Place contact ring and bearing together on the steering shaft.



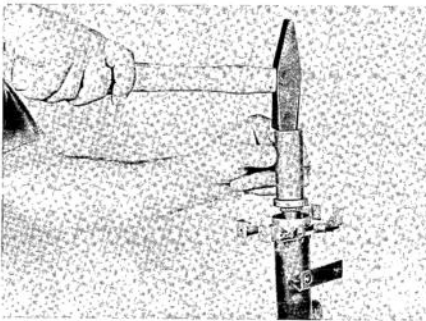
3. Tighten shear bolts for steering tube attachment until the heads break off.



2. Drive bearing into place with a pipe section (inside dia. 24 mm, outside dia. 28 mm).

NOTE

The pipe section should contact the bearing inner race only.



Hinterachse
Rear Axle
Essieu AR
Assale posteriore

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REAR AXLE CHANGES - BEGINNING WITH 1972 MODELS

1. Beginning with 1972 models, rear axle shockabsorbers have been modified. The outside diameter and overall length of the shockabsorbers has been increased:

Outer diameter

new:	62 mm (2.44 in.)
old:	58 mm (2.28 in.)

Extended length

new:	599 ± 2.0 mm (23.59 ± 0.08 in.)
old:	574 ± 2.5 mm (22.61 ± 0.10 in.)

Closed length

new:	407.5 ± 2.0 mm (16.04 ± 0.08 in.)
old:	390 ± 2.5 mm (15.37 ± 0.10 in.)

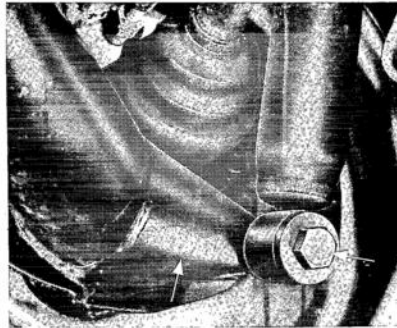
2. The BOGE shockabsorbers are standard on the rear axle. BILSTEIN or KONI shockabsorbers are optional.

The various shockabsorber types can be distinguished by their color:

BOGE	black
KONI	red
BILSTEIN	green

To allow for the larger shocks, the lower mount has been moved rearward 10 mm. The upper mounting has also been moved slightly forward and in towards the vehicle longitudinal axis. This change was also necessary due to the new transmission which has its axle flanges approximately 10 mm further to the rear.

The shockabsorber mounting bolt has been changed from the former 12 mm diameter to 14 mm diameter.



GENERAL SPECIFICATIONS

TYPE 911 VEHICLES - BEGINNING WITH 1972 MODELS

Wheel suspension	independent, with longitudinal trailing arms (radius arms)	
Springing	1 round transverse torsion bar per wheel	
Shockabsorbers	double-action, hydraulic shockabsorbers	
Stabilizer	transverse, 15 mm (0.59 in.) dia, in Type 911 S only	
Wheelbase	2271 mm (89.4 in.)	
Rear trailing arm adjustment (trailing arm inclination)	36° 30' to 37°	
Track, rear	911 T	1342 mm/52.8 in. (5 1/2 J x 15 rim)
	911 E and 911 S	1354 mm/53.3 in. (6 J x 15 rim)
Max. axle load, rear	840 kp (1852 lbs.)	
Nominal Adjustment Values and Wear Tolerances (at empty weight DIN)		
Toe-in	0° to + 20 ' per wheel	
Camber, rear	-1° to + 10'	

GENERAL SPECIFICATIONS BEGINNING WITH 1974 MODELS

Vehicle Type	911	911 S	Carrera
Wheel suspension	independent, with triangulated control arms		
Springing	1 round transverse torsion bar per wheel, 23 mm dia.		
Shock absorbers	double-action, hydraulic shock absorbers		
Stabilizer, transverse	optional	optional	18 mm dia.
Wheelbase	2271 mm	same as 911	same as 911
Trailing arm adjustment (trailing arm inclination)	36° 30' to 37°	same as 911	same as 911
Track, rear (wheel center 12 mm below center of transverse tube)	1342 mm (5 1/2 J x 15 rim)	1354 mm (6 J x 15 rim)	1380 mm (7 J x 15 rim)
Max. axle load, rear	840 kg	same as 911	same as 911
Nominal Adjustment Values and Wear Tolerances (at empty weight DIN)			
Toe-in	+ 20' - 20' per wheel	same as 911	same as 911
Camber, rear	- 1° ± 10'	same as 911	same as 911

TECHNICAL DATA (1975 MODELS)

Model	911 S	Carrera
Wheel suspension	Independent with triangulated control arms	
Springing	One round transverse torsion bar per wheel	
Torsion bar dia.	23 mm	same as 911 S
Shock absorbers	Double action hydraulic shock absorbers	
Transverse stabilizer	18 mm dia.	same as 911 S
Wheelbase	2271 mm	same as 911 S
Trailing arm inclination		
Coupe	42°	same as 911 S
Targa	+ 0,5°	same as 911 S
Air conditioner	+ 0,5°	same as 911 S
Sportomatic	+ 0,5°	same as 911 S
Models with Bilstein shock absorbers	41°	same as 911 S
Track width, rear	1342 mm with 6J x 15 wheel	1368 mm with 7J x 15 wheel
Rear axle height adjustment: center of wheel below center of cross tube	37 ± 5 mm	same as 911 S
Max. axle load, rear	840 kg (1852 lb)	same as 911 S
Adjusting, reference and wear specifications (at curb weight according to DIN)		
Toe	+ 20' - 20'	same as 911 S
Camber, rear wheel	0° ± 10'	same as 911 S

TECHNICAL DATA - from 1976 Model

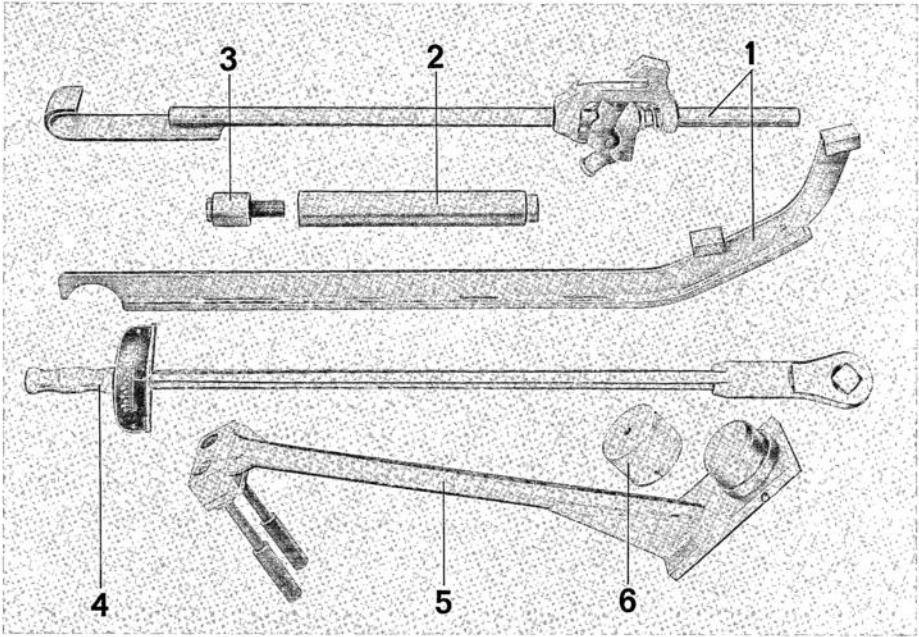
	1976/77 Models	from 1978
	911 S	911 SC
Wheel suspension	Independent on trailing arms	
Springs	One round transverse torsion bar per wheel	
Torsion bar dia.	23 mm	24.1 mm
Shock absorbers	Double-action hydraulic absorbers	
Transverse stabilizer dia.	18 mm (optional)	18 mm
Wheelbase	2272 mm	2272 mm
Trailing arm inclination		
Coupe	42°	40°
Targa	+ 0.5°	+ 0.5°
Air conditioner	+ 0.5°	+ 0.5°
Sportomatic	+ 0.5°	+ 0.5°
With Bilstein shock absorbers	41°	39°
Rear track width	1342 mm with 6 J x 15 wheels	1367 mm with 7 J x 15 wheels
Rear axle height		
Wheel center below cross tube center	37 ± 5 mm	37 ± 5 mm
Max. rear axle load	840 kg/1852 lb	78/79 model: 840 kg/1852 lb 1980 model: 880 kg/1940 lb 1981 model:950 kg/2094 lb
Adjusting, reference and wear limit specifications (at DIN curbweight)		
Toe per wheel	+ 10' ± 10'	+ 10' ± 10'
Camber of rear wheels	0° ± 10'	0° ± 10'

TIGHTENING TORQUES

Location	Description	Thread	Grade	mkp	ft. lbs.
Bearing cap to body	Bolt	M 10	8.8	4.7	33.9
Rear radius arm to axle cross	Bolt	M 14x1,5	10 K	9.0	65.1
Radius arm to spring plate	Eccenter	M 12x1,5	8.8	6.0	43.4
Radius arm to spring plate	Bolt	M 12x1,5	10 K	9.5	68.7
Brake caliper to arm	Bolt	M 12x1,5	8.8	7.0	50.6
Shockabsorber to arm	Bolt	M 14x1,5	8.8	12.5	90.4
Shockabsorber to body	Nut	M 10x1	8	2.5	18.1
Brake hose to brake lines	Brake hose	M 10x1		1.5	10.9
Stabilizer to body	Bolt	M 8	8.8	2.5	18.1
CV flange attachment	Allen bolt	M 10	12 K	8.3	60.0
		M 8	12.9/10	4.2	30.4
Parking brake assembly to arm	Bolt	M 8	8.8	2.5	18.1
Wheel to hub	Wheel lug	M 14x1,5		13	94.0
Wheel hub to axle	Castellated nut	M 20x1,5	10 K	30-35	217-243
Brake disc to wheel hub	Countersunk screw	M 6	8.8	0.5	3.6 (43 in. lbs.)
Parking brake cable housing to arm	Bolt	M 6	8.8	0.5	3.6 (43 in. lbs.)
Adjusting lever to spring strut	Hex. hd. bolt	M 16x1,5	10.9	24.5	177
Adjusting lever to spring strut	Eccentric bolt	M 16x1,5	10.9	24.5	177

REAR AXLE CONTROL ARMS

TOOLS



No.	Description	Special Tool	Remarks
1	Trailing arm positioner	P 289	
2	Driver for removing rear wheel hub	P 297 a	
3	Installer, rear wheel hub into control arm	P 298 b	
4	Torque wrench, 75 mkp	US 118/40	
5	Rear axle control arm alignment gauge	P 295 b	
6	Adapter for control arms beginning with 1974 models	P 295 c	Used with P 295 b

No.	Description	Qty	Note when:		Remarks
			removing	installing	
1	Brake line	1		Torque to specification	0.2 - 2/1
2	Brake line retaining clip	1			
3	Brake hose	1	Pull out towards center of vehicle		
4	Bolt, M 12 x 1,5	2		Torque to specification	0.2 - 2/1
5	Lock washer	2		Replace if necessary	
6	Brake caliper	1			
7	Cotter pin	1		Replace	
8	Castellated nut	1		Torque to specification	0.2 - 2/1 2.1 - 1/6
9	Washer	1			
10	Countersunk screw, M 6 x 12	2		Torque to specification	
11	Brake disk	1			
12	Bolt, M 14 x 1,5	1		Torque to specification	
13	Washer	1			
14	Shock absorber	1			
15	Wheel shaft	1	Drive out towards center of vehicle		
16	Wheel hub	1	Drive out with P 297 a		2.1 - 1/7

No.	Description	Qty	Note when:		Remarks
			removing	installing	
17	Bolt, M 8	4		Torque to specification	
18	Lock washer	4		Replace if necessary	
19	Reinforcing cover	1			
20	Cotter pin	1		Replace	
21	Castellated nut M 6	1			
22	Washer	1			
23	Expander	1		Seat properly	
24	Spring	1			
25	Parking brake cable	1	Pull out towards vehicle center		
26	Spacer tube	1		Seat properly. Large cross-section faces towards vehicle center	
27	Washer	1			
28	Nut, M 8	2		Torque to specification	
29	Spring washer	2		Replace if necessary	
30	Bolt, M 8	2			
31	Backing plate with brake shoes	1		Remove whole assembly	
32	Nut, M 12	2		Torque to specification	
33	Toothed washer	2		Replace if necessary	

No.	Description	Qty	Note when:		Remarks
			removing	installing	
34	Washer	2			
35	Bolt, M 12	2			
36	Washer	2			
37	Nut (thin), M 12	2		Torque to specification	
38	Toothed washer	2			
39	Eccentric bolt for toe-in adjustment	1			
40	Eccentric bolt for camber adjustment	1			
41	Self-locking nut, M 14	1		Replace, torque to specification	
42	Washer	2			
43	Bolt, M 14	1			
44	Axle control arm (aluminum)	1		Check for deformation, replace if necessary	
45	Double-row ball bearing	1	Press out with fitting thrust piece.	Replace. Press in with appropriate thrust piece	2.1 - 1/7
46	Rubber mount	2		If rubber mounts are removed, install new ones	2.1 - 1/7
47	Torsion plate (trailing arm)	1			

INSTRUCTIONS FOR DISASSEMBLY AND REASSEMBLY

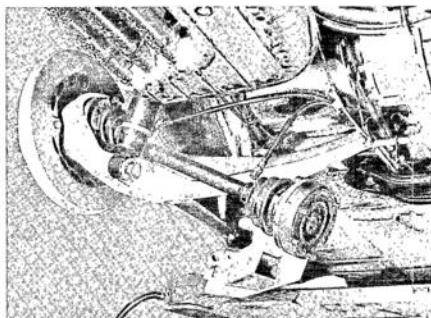
Disassembly

1. Detach drive shaft from transmission flange.
Use flat chisel in the area of the flange gasket to separate shaft assembly from flange.

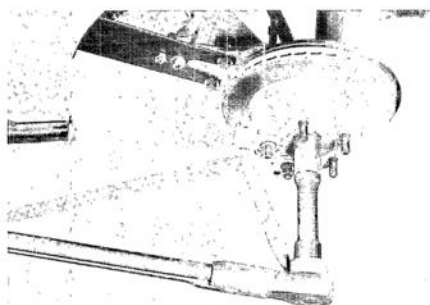
CAUTION

Do not damage the flange surfaces.

2. Detach brake line from brake caliper and control arm assembly (first depress brake pedal with pedal holder to keep brake fluid from draining out of the brake fluid reservoir).

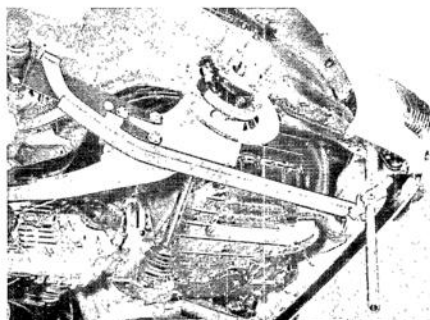


3. Remove cotter pin from the castellated nut in the wheel shaft and remove nut with the aid of P 42 a, P 36 b, P 44 a, and P 296.



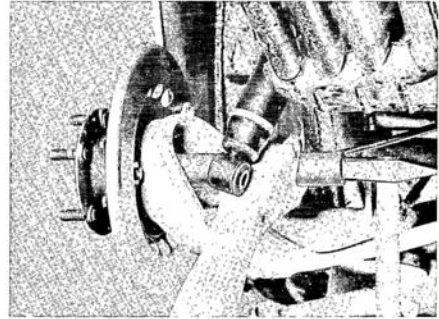
4. Remove brake disk.

5. Raise torsion plate (trailing arm) with the aid of P 289. Remove shock absorber retaining bolt.



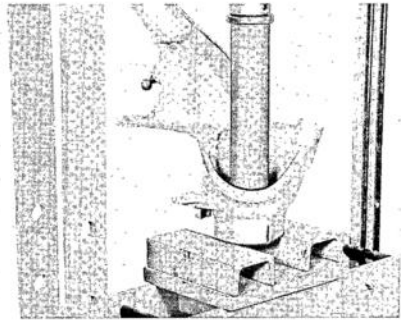
6. Drive wheel shaft out towards vehicle center.

7. Drive rear wheel hub out with the aid of P 297a.



8. Remove cotter pin and castellated nut from brake cable stub. Pull brake cable out towards vehicle center.

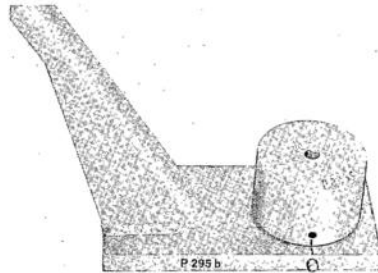
9. Press ball bearing out with an appropriate thrust piece (approx. 65 mm dia.).

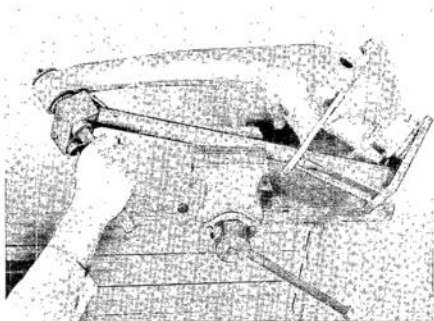


Checking Parts

1. Check rubber mounts in rear axle control arms for wear or damage, replace if necessary.

2. Install special tool P 295c (adapter for mounting aluminum axle control arm) in special tool P 295b. Marker in the P 295c adapter must point towards the marker in P 295b.

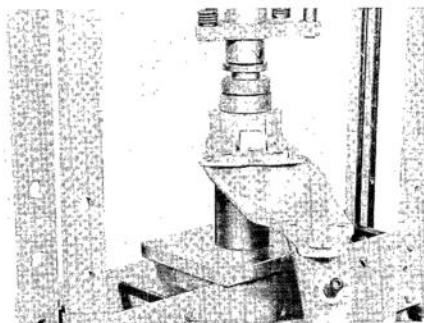




3. Using P 295b and P 295c, check axle control arm for deformation.

If the control arm is in alignment, it will be possible to push the test mandrel in with the rubber mounts installed. Deformed axle control arms must be replaced.

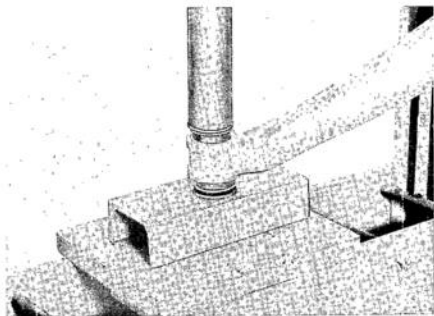
Reassembly



1. Using an appropriate press adapter (approx. 79 mm dia.), press the double-row ball bearing fully in (apply pressure to bearing outer race).

NOTE:

The double-row ball bearing must always be replaced because it is damaged during removal from the axle control arm.

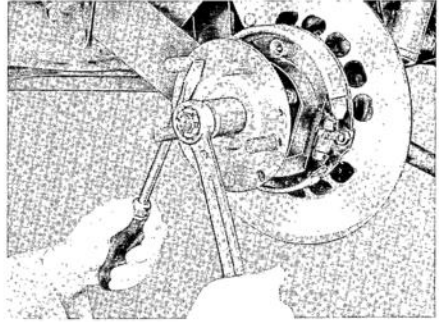


2. If the rubber mounts were removed, install new ones by pressing them fully in.

3. Using P 298b and the wheel shaft, press the wheel hub into the double-row ball bearing.

NOTE:

Do not drive the wheel hub into the bearing with a hammer since this will damage the bearing.



AXLE DRIVESHAFTS - LIGHTER VERSION

General

Beginning with October 6, 1971 production, all 911 models have new and lighter axle driveshafts (approx. 0.9 kp. (2 lbs.) lighter).

The CV (constant velocity) joints are 8 mm (0.31 in.) narrower (dimension A). As a result, the axle shafts are 8 mm longer.

Installation Note:

From 1969 models on, old-type drive shafts can be replaced with the new version on individual basis from 1969 models on.



When installing the newer axle drive shafts, it is necessary to use the new socket head bolts, M 10 x 48, as well as new supporting plates.

Dimension A - new driveshaft version = 32 mm

Dimension A - old driveshaft version = 40 mm

Bremsen, Räder, Reifen
Brakes, Wheels, Tires
Freins, Roues, Pneus
Freni, Ruote, Gomme

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4 - WHEELS AND TIRES

4.1 Wheels and Tires

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Item	Dimensions and Adjustment Values	Wear Tolerances
Tandem Brake Master Cylinder		
Bore	19.05 mm Ø	
Stroke	18/13 mm	
Reduction ratio at brake pedal	5.4 : 1	
Clearance, actuating rod to piston	1 mm	
Front Wheel Brakes		
Brake disc outer diameter	282.5 mm, vented	
Thickness, new	20.0 mm resp. 20,5 mm	
Minimum thickness when reconditioned *	18.6 mm	18.0 mm
Thickness tolerance	max. 0.03 mm	
Brake disc lateral runout	max. 0.05 mm	
Lateral runout when installed	0.2 mm	
Caliper piston Ø	48 mm	
Brake lining thickness	10 mm	2.0 mm
Lining to rotor clearance when released	0.2 mm	
Lining area per wheel: Type 911 T and E Type 911 S	52.5 cm ² 76.0 cm ²	
Rear Wheel Brakes		
Brake disc outer diameter	290 mm, vented	
Thickness, new	20.0 mm	
Minimum thickness when reconditioned *	18.6 mm	18.0 mm
Thickness tolerance	max. 0.03 mm	
Brake disc lateral runout	max. 0.05 mm	
Lateral runout when installed	max. 0.2 mm	
Disc surface finish when reconditioned	max. 0.006 mm	
Caliper piston Ø	38 mm	
Lining thickness	10 mm	2.0 mm
Lining to rotor clearance when released	0.2 mm	
Lining area per wheel	52.5 cm ²	

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Item	Dimensions and Adjustment Values	Wear Tolerances
Parking Brake		
Parking brake drum $\varnothing$, new	180 mm	181 mm
Parking brake lining thickness		2.0 mm

General Information for Brakes with Brake Booster

Brake Booster

Type	T 52, 7 inch
Mean multiplication factor	2.2

Tandem Brake Master Cylinder

Bore	20,64 mm dia.
Stroke	20/12 mm
Play at brake pedal with brakes bled and engine stopped	10 mm

GENERAL DATA - from 1978 Model

Description	Specifications	Wear Limits
Service brakes (foot-operated)	Hydraulic dual circuit brake system, separate circuit for each axle, brake booster, inboard vented brake discs on front and rear axles	
Brake booster dia.	7 inches	
Brake master cylinder dia.	20.64 mm	
Brake disc dia., front	282.5 mm	
rear	290 mm	
Eff. brake disc dia., front	228 mm	
rear	244 mm	
Brake caliper piston dia., front	48 mm	
rear	38 mm	
Brake pad area/each front wheel	76.0 cm ²	
Brake pad area/each rear wheel	52.5 cm ²	
Total pad area	257 cm ²	
Pad thickness, front	10 mm	2 mm
rear	10 mm	2 mm
Brake disc thickness when new		
Front	20.5 mm	
Rear	20.0 mm	
Min. brake disc thickness after machining *		
Front	19.1 mm	18.5 mm
Rear	18.6 mm	18.0 mm
Max. brake disc thickness tolerance	0.02 mm	
Max. brake disc lateral runout	0.05 mm	
Max. brake disc lateral runout when installed	0.1 mm	
Max. peak-to-valley surface finish after machining	0.006 mm	
Play at brake pedal with brakes bled and engine stopped	10 mm	

* Brake discs must always be machined on both sides by the same amount.

Description	Specifications	Wear Limits
Parking brake (hand-operated)	Drum brake mechanical action on both rear wheels	
Brake drum dia.	180 mm	181 mm
Brake shoe width	25 mm	
Brake lining area per wheel	85 cm ²	
Brake lining thickness	4.5 mm	2 mm

TIGHTENING TORQUES FOR FRONT AND REAR BRAKES

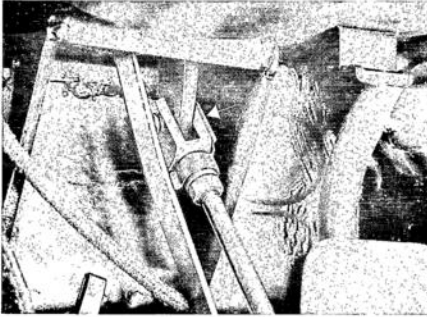
Location	Designation	Thread	Grade	ft. lbs.	mkp
Tandem brake master cylinder to transverse wall	Nut	M 8	8.8	18	2.5
Attachment of piston rod to eyebolt end	Nut (flat)	M 10	C 45/6	7.3	1.0
Brake line connection	Hollow bolt	M 10x1	5.8	11	1.5
Hollow bolt in caliper	Hollow bolt	M 10x1		14, 5	2.0
Caliper to steering knuckle	Bolt	M 12x1.5	8.8	51	7.0
Lock nut to steering knuckle	Allen bolt	M 7	10 K	11	1.5
Brake disc to wheel hub	Nut	M 8	8.8	17	2.3
Disc shroud	Bolt	M 8	8.8	7, 3	1.0
Caliper housing bolt (front)	Allen bolt	M 8	10 K	25	3.4
Caliper housing bolt (rear)	Allen bolt	M 6	12 K	16	2.2
Caliper to rear control arm	Bolt	M 12x1.5	8.8	51	7.0
Brake disc to rear wheel hub	Countersunk bolt	M 6	8.8	3.6	0.5
Brake carrier plate to rear control arm	Bolt	M 10		34	4.7
Shroud to brake carrier plate	Bolt	M 8	8.8	18	2.5
Parking brake cable to control arm	Bolt	M 6	8.8	3.6	0.5
Wheel to wheel hub	Spherical flange nut	M 14x1.5		94	13.0
Bleeder valve in caliper SW 7 wrench size	--	--	--	2.2	0.3

No.	Description	Qty.	Note when removing installing	Remarks
1	Lock pin	1	Install in correct position Pull back brake pedal to stop. Lock pin must now be installed without tension, adjust operating rod if necessary	1.1 - 1/3
2	Lock clip	1	Check for proper fit	
3	Operating rod	1	Adjust, if necessary	
4	Socket head bolt	1	Can only be removed after removing pedal assembly	Torque to specifications
5	Lock washer	1	Replace, if necessary	
6	Bolt	1	Torque to specifications	
7	Lock washer	1	Replace, if necessary	
8	Washer	1		
9	Hose clamp	1		
10	Bolt	1	Torque to specifications	
11	Lock washer	1	Replace, if necessary	
12	Washer	1		
13	Brace	1		
14	Nut	4	Torque to specifications	
15	Spring washer	4	Replace, if necessary	
16	Brake booster with tandem master cylinder	1		

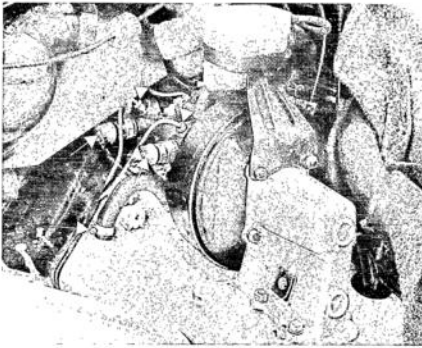
REMOVING AND INSTALLING INSTRUCTIONS

Removing

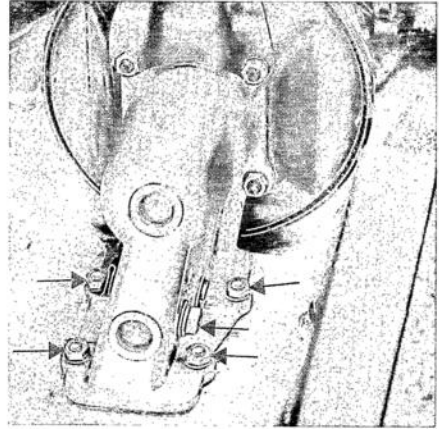
1. Remove lock pin for operating rod.



2. Remove mounting bolt for brake master cylinder (located inside on luggage compartment floor plate).
3. Drain brake fluid reservoir with siphoning device.
4. Disconnect stop light switch plugs. Loosen vacuum hose clamp and remove brake line.

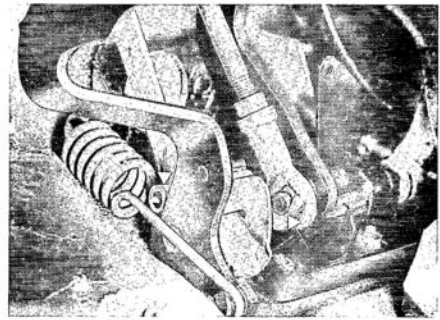


5. Remove upper bolt for brace and nuts for booster base.



Note

Brace and operating rod do not have to be detached at pedal assembly to remove brake booster.



Installing

1. Install brake booster with brake master cylinder in reverse sequence.
2. Lock pin (item 1) for operating rod must be installed so that the spring can be inserted from above (see arrow, upper left picture).

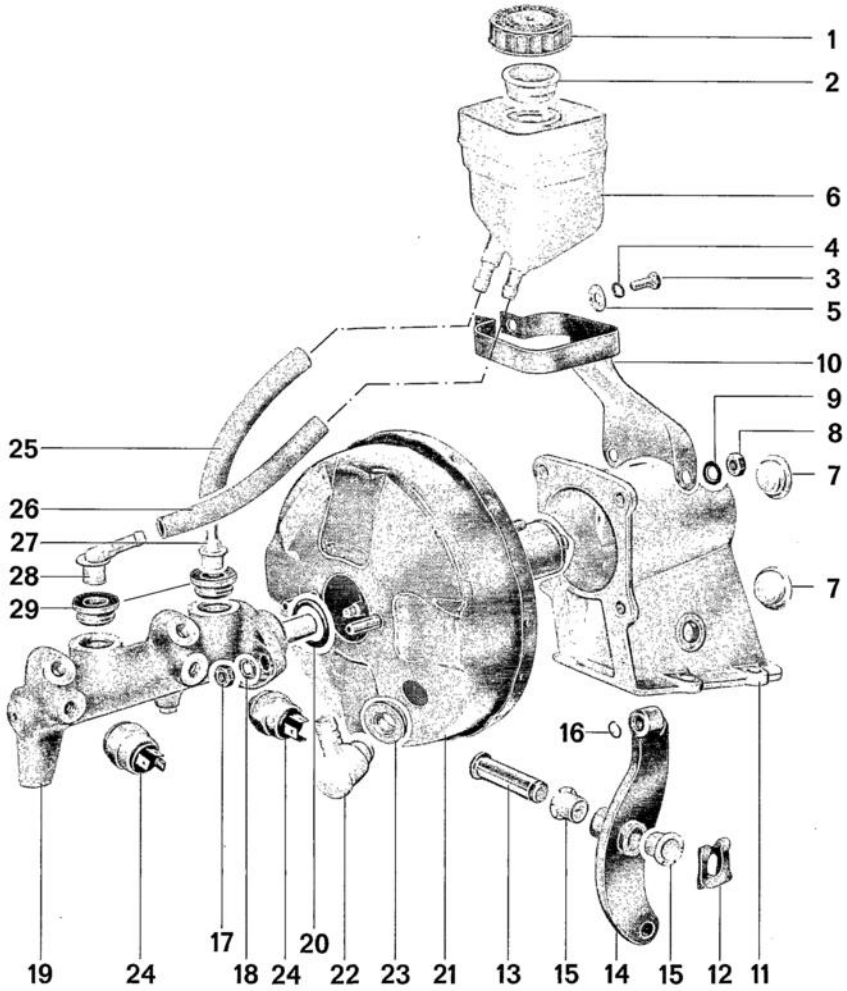
ADJUSTING BRAKE OPERATING ROD

Note

The operating rod must be attached when the brake pedal is at its rest position without any force applied to the operating lever. The play set at the factory must not be changed.

1. Pull brake pedal back to stop.
 2. Loosen nuts on operating rod. Adjust operating rod until the lock pin for the operating lever can be installed without tension.
 3. Tighten nuts on operating rod.
 4. To verify the clearances required in the brake booster, check the operating rod play at the brake pedal by manual operation after the brakes have been bled and the engine is stopped. This play must be at least 10 mm.
-

DISASSEMBLING BRAKE BOOSTER AND BRAKE MASTER CYLINDER (PARTIALLY)



No.	Designation	Qty.	Notes		Remarks
			Removal	Installation	
1	Bolt cap	1			
2	Filter screen	1			
3	Hex. head screw	1		Torque to specifications	
4	Lockwasher	1		Replace, if necessary	
5	Washer	1			
6	Tank	1			
7	Plug	2			
8	Hexagon nut	4		Torque to specifications. Not too tight! If staybolt is stretched or broken, replace brake booster.	
9	Spring washer	4		Replace, if necessary	
10	Holder	1			
11	Base	1			
12	Lock	1		Check for proper fit	
13	Bearing pin	1		Coat with all-purpose lube containing MOS ₂	
14	Operating lever	1		Coat ball socket with all-purpose lube containing MOS ₂ . Make sure that piston rod fits properly.	
15	Bearing bushing	2			
16	Snap ring	1			

No.	Designation	Qty.	Notes		Remarks
			Removal	Installation	
17	Hexagon nut	2		Torque to specifications. Not too tight! If staybolts are stretched or broken, replace brake booster.	
18	Lockwasher	2		Replace, if necessary	
19	Tandem master cylinder	1		Check, if necessary repair or replace	
20	Seal	1		Replace	
21	Brake booster	1		Check, replace if necessary	
22	Check valve	1		Check, replace if necessary	
23	Plug	1			
24	Stop light switch	2		Torque to specifications	
25	Hose	1			
26	Hose	1			
27	Supply neck	1			
28	Supply neck 75°	1			
29	Plug	2			

Checking Brake Booster

Depress and release brake pedal several times with the engine stopped to remove any vacuum out of the booster.

Now depress brake pedal to braking position with medium effort and start engine.

If the brake booster functions properly, it will be felt as the pedal gives slightly underneath the foot (booster takes effect).

Troubleshooting Chart

Condition	Cause	Correction
1 - Pedal pressure unusually high, no support from booster	a - Vacuum line connections loose	Tighten clamps
	b - Roller diaphragm loose	Replace booster
	c - Master cylinder seal leaking	Replace large seal, replace master cylinder
	d - Vacuum check valve malfunctions (closed always)	Check function of vacuum check valve, by blowing into valve in direction of arrow. Valve must lift off of seat. Valve must be tight against direction of arrow
2 - Pedal pressure increases very much at certain pedal position	Pressure rod piston scored at one point. Once secondary cup passes this point, outside air comes into booster through vent bore	Repair or replace master cylinder
3 - Pedal can be pressed to stop without braking effect Brake fluid runs out at vent bore	Cups leak	Repair or replace master cylinder

Note

When a brake circuit fails or after repairs on the brake system, a brake warning light installed in the dashboard comes on.

After brake repairs, the brake warning light can be turned off by disconnecting the battery ground strap.

CHECKING WHEEL RIMS

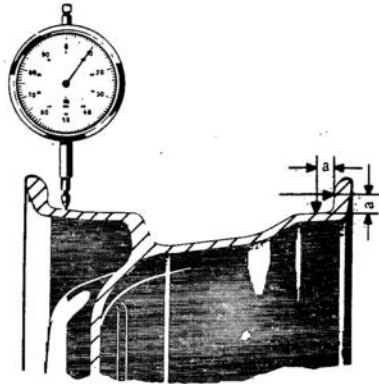
Points for measuring radial and lateral runout on inside and outside shoulders of rim.

Distance "a" = 8 mm.

Max. permissible radial runout for steel rims	1.25 mm
Max. permissible radial runout for aluminum rims	1.0 mm
Max. permissible lateral runout for steel rims	1.25 mm
Max. permissible lateral runout for aluminum rims	0.8 mm

Max. permissible radial and lateral runout
for rim + tire
(also refer to pages 4.1 - 1/3 and 4.1 - 1/4)

1.5 mm



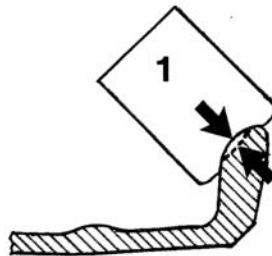
Note

Straightening of deformed rims is not permitted.

Check flanges of aluminum wheel rims for wear. The inside rim flange is more subject to wear. Check with a standard 8 mm radius gauge. If applicable, first remove sharp edges and burrs. Wear limit = 1 mm. Replace wheel rim, if necessary.

Checking Rim Flange Shape

- New condition
 - - - - - After wear
 → ← Max. wear 1 mm
 1 Radius gauge 8 mm



GENERAL ASSEMBLY INFORMATION ON TIRES AND TUBES

Always also use new tubes or rubber valve stems each time tires are replaced!

Tubes should only be used in "tubeless" tires in an emergency situation. It cannot be recommended to combine tires and tubes of different make. Tubes are not available for series 50 and 55 tires!

When mounting tubes with steel valve stems remember that valve core is screwed in only after inflation of the tire.

Be careful not to turn the tire valve when tightening the nut.

"Tubeless" tires may only be mounted without tubes on rims with a double hump. If this type rim is not available, this tire must also be mounted with a pertinent tube. When necessary tubeless tires can be used on an axle with tube tire as long as the make, size and type are identical.

Double hump rims (H2) were used on a general basis in the 1975 model year.

Original Porsche rims are identified by the Porsche part number in the wheel rim. Meaning of number: 901.361.xxx.xx (rim without hump) or 911.361.xxx.xx (rim with double hump), whereby x = digit for internal designation of version and paint.

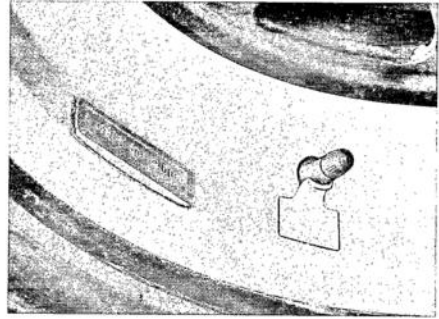
Diecast rims are not always sufficiently leak-proof because of the coarser grain structure and consequently can only be used for tubeless tires when tested accordingly. From 1976 models on Porsche diecast rims are checked for leaks with a special fixture and therefore suitable for use with "tubeless" tires.

Part numbers of these rims:

Rim Size	Untested Diecast Tires (tires with tubes)	Leak-proof Diecast Tires ("tubeless" tires)
6 J x 15 (silver)	911.361.023.10	911.361.023.40
6 J x 15 (unpainted)	911.361.023.14	911.361.023.44
7 J x 15 (silver)	911.361.023.20	911.361.023.54

For cars, which have center pin wheel centering, we recommend always using rims with centering pins. Wheel nuts made of steel should be used on steel rims.

To prevent excessive loads on rubber tire valve stems (tube or tubeless version) caused by position of valve stem bore, 7" and 8" Porsche rims must be fitted with a valve stem support, Part No. 911. 361. 561.00 or 01.



7 J x 15 diecast rims (ATS) sometimes have a special cast boss in area of the valve stem bore, so that safe support can be guaranteed without a holding plate. On rims, which have this cast boss, the wall thickness is so great at the valve stem hole that the 3 mm wide bead ring on the valve stem should not be pulled in when installing tubeless tire valves (as common on steel rims). Pulling in the valve stem bead would stretch the valve stem excessively.

Check sealing surfaces of tire and wheel rim for dirt and damage when mounting a tubeless tire. In conjunction with this point remember that the bead base of a tubeless tire provides the seal. If the bead flank is used for sealing, air could escape when driving aggressively.

Check flanges of aluminum wheel rims for wear (see page 4.1 - 1/1).

Always coat tire beads with rubber lubricant when mounting.

Apply talcum powder inside of tire in tube type.

Inflate tubeless tires to about 4 bar/58 psi after mounting without valve core to guarantee proper fit on rim. With 3.3 bar/48 psi pressure the tire bead should jump over the rim hump. Screw in valve core and inflate tire to specified pressure.

Max. permissible radial and lateral runout of wheel (tire + rim) is 1.5 mm/0.59 in. If necessary, turn tire on rim 180° (uncontrolled matching) to reach an acceptable value.
Controlled matching: align highest point of rim (not marked on 911, determine) with green dot on side wall of tire.

New tires should be used on the front axle, since

1. the rear axle is more critical over stability and
2. the front wheels must first make a track on wet roads,
in which the rear wheels can follow.

(Not possible on cars with different size tires front and rear.)

When replacing a defective tire, make sure difference in tread depth on one axle is not greater than 30 %.

BALANCING WHEELS

Max. permissible dynamic and static unbalance 5 grams.

Check radial and lateral runout of wheels when there is vibration and steering wheel shake in spite of perfect wheel suspension parts, perfect wheel centering, correctly adjusted wheel bearing play and properly balanced wheels.

Check on tires run warm (to exclude flat spots from standing) with a standard tester.

Max. permissible radial and lateral runout of wheel (tire + rim) = 1.5 mm.

Max. permissible radial and lateral runout of wheel rim = see page 4.1 - 1/1.

If testing is not performed on a stationary balancing machine, but direct on the car, a very slight lateral runout of wheel hub from manufacturing, wheel bearing play and also any error in wheel centering will be reflected in the measured value. If these factors are eliminated or compensated and the value is still greater than 1.5 mm, check whether an acceptable value can be reached by turning tire on rim 180° (uncontrolled matching).

INFORMATION ON CEMENTED WEIGHTS FOR ALUMINUM WHEEL RIMS

General

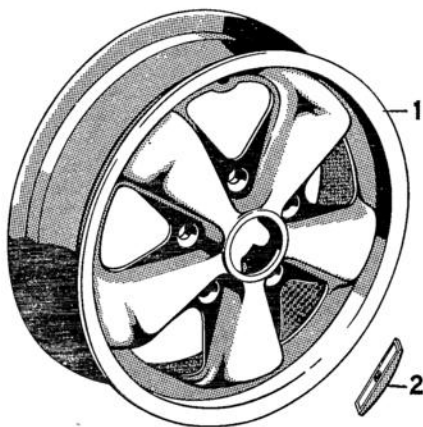
Aluminum wheel rims may only be balanced with balance weights which are cemented. The cemented type balance weights supplied by Porsche are available in steps of 10 g from 10 to 80 g.

Installation

1. Determine exact position of balance weights (if applicable first hold balance weights with pieces of tape until correct position has been determined).
2. Prepare adhesive surface on rim. Adhesive surfaces must be absolutely clean and free of grease.
3. Pull off paper backing from adhesive surface of weight and press weight on firmly.

Note

Pull off paper backing only immediately before pressing on weight, since the effect of air over a long time will impair the adhesion and there is also danger of dirt getting on the adhesive surface.



- 1 Aluminum rim
2 Adhesive balance weight

The adhesive balance weight must be located accurately on the flat surface of the rim. It must rest uniformly on the entire bearing surface. For rims of size 5 1/2 J x 14 the adhesive weights must be contoured to the rim with a plastic hammer to match the smaller radius (prior to pulling off the green paper backing).



4. Check tight fit of balance weight after trial run on a balancing machine.
The newly installed balance weight must not become loose from the rim when load is applied transversely to it.

Note

Adhesive weights may only be installed on the outside of 5 1/2 J x 14 aluminum hole-type wheel rims. Weights with spring clips must be used on the inside of these rims (as for steel hole-type rims).

From 1973 models on 5 1/2 J x 15 steel rims have tire valve holding sleeves instead of spring clips. The sleeve is fitted from inside of the rim and held in position by the tube or valve stem. This sleeve can also be used subsequently on older models.

COLLAPSIBLE SPARE TIRE

A spare wheel with a collapsible tire is used in cars with a 85 liter fuel tank to save space.

From 1974 models on a 80 liter steel tank and a collapsible tire/ wheel are standard in all models.

Rim size 5 1/2 J x 14, tire size 7,35/185 - 14 SST or from 1973 models on.

Rim size 5 1/2 J x 15, tire size 165 - 15/4, 75/10, 00 - 15 SST

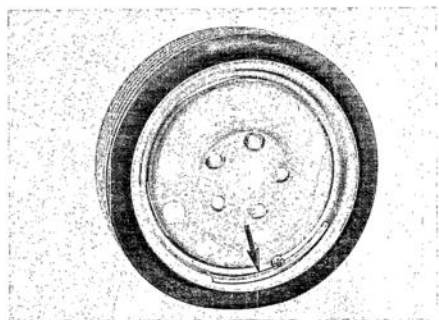
When required the tubeless tire may be inflated to only 2.2 bar/32 psi. The tire will return to its original shape when discharging the air from the collapsible tire.

A collapsible tire cannot be repaired or mounted with conventional workshop equipment. Only the manufacturer should perform work on the collapsible tire/wheel.

This collapsible tire/wheel is only for an emergency situation and should not be used for long driving. The max. permissible speed with this wheel is 80 km/h (50 mph).

Replacing:

Only new version collapsible tires/wheels will be available after depletion of old stocks. Label on rim has been changed. Part number of collapsible tire/wheel remains unchanged.



SURVEY OF WHEEL RIMS AND TIRES - from 1972 Models

Type	Standard Rim	Tire	Optional Equipment	
			Rim	Tire
911 T	St. 5 1/2 J x 15	165 HR 15	5 1/2 J x 15 LMg	185 HR 15
911 E	Mod. 72 St. 6 J x 15	185/70 VR 15	6 J x 15 St	185/70 VR 15
911 S	Mod. 73 LMg 6 J x 15	185/70 VR 15	6 J x 15 LMgs	185/70 VR 15
	LMgs 6 J x 15			

SURVEY OF WHEEL RIMS AND TIRES - from 1974 Models

Type	Standard Rim	Tire	Optional Equipment	
			Rim	Tire
911	St. 5 1/2 x 15	165 HR 15	6 J x 15 LMgs	185/70 VR 15
911 S	LMg 6 J x 15	185/70 VR 15	6 J x 15 LMgs	185/70 VR 15
Carrera	Front LMgs 6 J x 15	185/70 VR 15		
	Rear LMgs 7 J x 15	215/60 VR 15		

LMg	Cast aluminum rim
LMgs	Forged aluminum rim
St	Painted steel rim

Winter tires and tire inflation values same as for 1975 models, see page 4.1 - 1/8.

SURVEY OF WHEEL RIMS AND TIRES - from 1975 Models

Type	Standard Rim	Tire	Optional Equipment	
			Rim	Tire
911 S	LMg 6 J x 15	185/70 VR 15	LMgs 6 J x 15	185/70 VR 15
Carrera	Front LMgs 7 J x 15 Rear LMgs 8 J x 15	185/70 VR 15 215/60 VR 15		

Winter Tires *

Tire	Rim
165 R 15 M+S	5 1/2 J x 15
185/70 R 15 M+S	5 1/2 J x 15 6 J x 15

Inflation Pressure for Cold Tires:

Front	2.0 bar/29 psi
Rear	2.4 bar/35 psi
Spare	2.2 bar/32 psi

LMg	Cast aluminum rim
LMgs	Forged aluminum rim
St	Painted steel rim

* SR or HR version

WHEELS AND TIRES - from 1976 Model

Type	Standard Wheel	Tire	Optional	
			Wheels (check fender clearance and position of wheels in wheel housings)	Tires
911 S	LMg 6 J x 15	185/70 VR 15	LMgs 6 J x 15	185/70 VR 15
			front 6 J x 15 rear 7 J x 15	185/70 VR 15
			front 7 J x 15 rear 7 J x 15	185/70 VR 15
			front 6 J x 15 rear 7 J x 15	185/70 VR 15 215/60 VR 15
			front 7 J x 15 rear 8 J x 15	185/70 VR 15 215/60 VR 15

LMg = cast light alloy

Winter Tires *

Tires	Wheels Type 911 S
165 R 15 M+S	5 1/2 J x 15
185 R 14 M+S	5 1/2 J x 14
185/70 R 15 M+S	5 1/2 J x 15 6 J x 15

Cold Tire Pressure

front	2.0 bar/28 psi
rear	2.4 bar/34 psi
spare wheel	2.2 bar/31 psi

* = SR or HR version

WHEELS AND TIRES - from 1978 Model

Type	Standard Wheels	Tires	Optional	
			Wheels	Tires
911 SC	front 6 J x 15	185/70 VR 15	front 6 J x 16	205/55 VR 16
	rear 7 J x 15	215/60 VR 15	rear 7 J x 16	225/50 VR 16

Winter Tires *

Tires	Wheels
185 R 14 M+S	5 1/2 J x 14
185/70 R 15 M+S	6 J x 15
	7 J x 15
	6 J x 15 front/
	7 J x 15 rear
205/55 R 16 M+S	6 J x 16
	6 J x 16 front/
	7 J x 16 rear

Cold Tire Pressure:

front	2.0 bar/28 psi
rear	2.4 bar/34 psi
spare wheel	2.2 bar/31 psi

* = SR or HR version

Hebelwerk
Pedal System and Levers
Pédalier et Leviers
Pedaleria e Leve

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Gear Shift Linkage, disassemble and reassemble	1.1 - 1/1
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Gear Shift Linkage, adjust	1.1 - 2/1
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Notes for Disassembly and Reassembly	1.1 - 1/5
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Gear Shift Linkage, disassemble and reassemble, from 1973-model	1.1 - 1/7
---	-----------

Instructions for Disassembly and Reassembly	1.1 - 1/11
---	------------

1.2 Heater and hand throttle controls from 1975 models

Dismantling and assembling heater and hand throttle controls	1.2 - 1/1
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Removing and installing heater and hand throttle controls	1.2 - 1/3
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Adjusting heater controls	1.2 - 1/6
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Adjusting hand throttle control	1.2 - 1/7
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Heater Blower Switch, remove and install	1.2 - 1/8
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2 - PEDAL CONTROLS

2.1 Pedal Controls

Pedal Controls, disassemble and reassemble	2.1 - 1/1
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Notes for Disassembly and Reassembly	2.1 - 1/6
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Disassembly and Reassembly of Pedal Controls 1974 Models	2.1 - 1/7
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Instructions for Disassembly and Reassembly	2.1 - 1/12
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Adjusting Clutch	2.1 - 2/1
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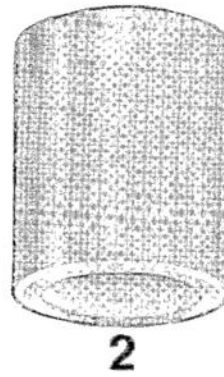
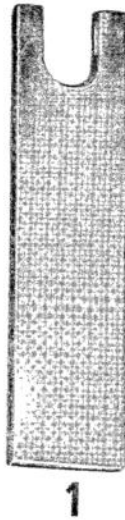
Adjusting Clutch from 1977 Models (with Servo Clutch on Transmission)	2.1 - 2/3
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TIGHTENING TORQUES FOR MANUAL AND PEDAL CONTROLS

Location	Designation	Thread	Grade	mkp
Support bracket to shift lever housing	Bolt	M 6	8.8	0.6
Shift lever housing to center tunnel	Allen bolt	M 8	8.8	2.1
Set screw in shift rod head	Taper screw	M 8	8.8	1.5
Set screw in shift rod coupling	Taper screw	M 8	8.8	1.5
Clamp bolt	Bolt	M 8	8.8	2.5
Parking brake, heater, and throttle support bracket to body	Bolt	M 8	8.8	2.1
Set screw in throttle control rod	Pointed set screw	M 5	8.8	0.2
Parking brake switch to support bracket	Countersunk screw	M 4	5.8	0.1
Throttle pedal to body	Bolt	M 6	8.8	0.6
Pedal assembly support bracket to body	Nut	M 8	8.8	2.5
Throttle shaft attachment	Nut	M 6	6.6	0.5
Ball socket lock nut	Nut	M 5	St 34-2K/8	0.3

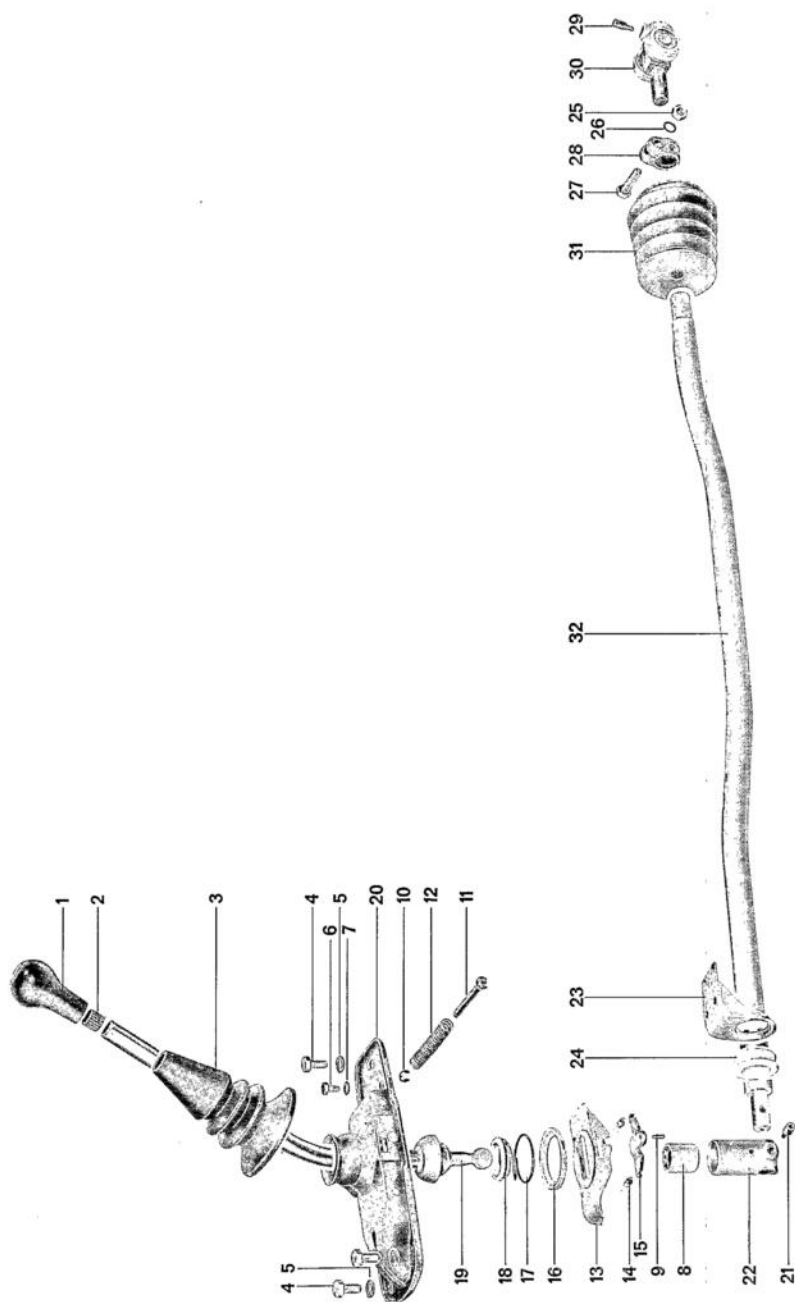
DISASSEMBLING AND ASSEMBLING SHIFT LEVER ASSEMBLY

TOOLS



Nr.	Description	Special Tools	Remarks
1	Assembly lever		Locally manufactured
2	Installer	P 299	

DISASSEMBLING AND ASSEMBLING SHIFT LEVER ASSEMBLY



Nr.	Description	Qty	Note when		Special instructions see
			removing	installing	
1	Shift knob	1			
2	Shift knob retaining ring	1		Replace.	
3	Dust boot	1			
4	Bolt, M8	3			
5	Lock washer	3		Replace.	
6	Bolt, M6	2			
7	Spring washer	2			
8	Ball socket	1		Use multipurpose grease with molybdenum additive.	
9	Pin, 30 x 10	1	Drive out with punch.	Replace if necessary.	
10	Snap ring	4		Replace.	
11	Guide pin	2			
12	Spring	2			
13	Stop plate	1		Use multipurpose grease with molybdenum additive.	
14	Lock pawl return spring	2			
15	Lock pawl	1		Use multipurpose grease with molybdenum additive.	
16	Spring seat, lower	1		Use multipurpose grease with molybdenum additive.	
17	Spring				
18	Spring seat, upper	1		Use multipurpose grease with molybdenum additive.	
19	Gearshift lever				
20	Support plate	1			
21	Tapered bolt	1			
22	Shift rod joint	1		Coat inner side with multipurpose grease.	
23	Guide bracket	1			
24	Bushing	1			
25	Nut, M8	1			

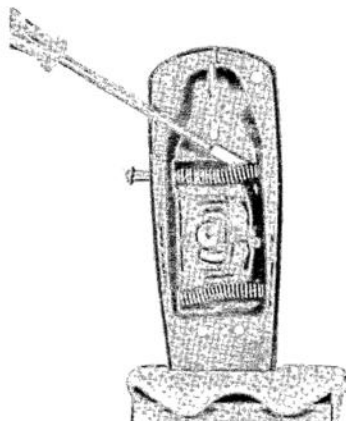
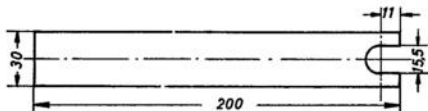
Nr.	Description	Qty	Note when		Special instructions see
			removing	installing	
26	Serrated washer	1		Replace.	
27	Bolt, M8 x 32	1			
28	Clamping bolt	1			
29	Tapered bolt	1			
30	Shift rod coupling	1			
31	Dust boot	1			
32	Shift rod	1		Lubricate pivot point.	

DISASSEMBLING AND ASSEMBLING SHIFT LEVER ASSEMBLY

Disassembling

1. Clamp the shift lever into a vice equipped with soft jaws. Drive off shift knob using the self-made tool. See illustrations.

Drawing for self-made tool



1/4 inch flat stock, all edges rounded off.

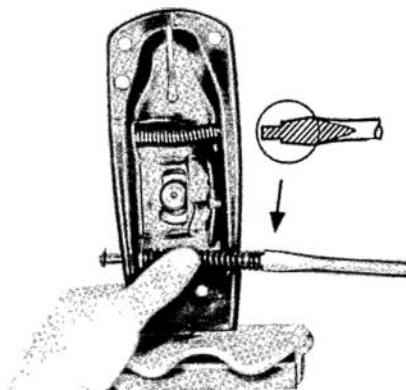
Assembling

2. Pull retaining ring out of shift knob with a hook.
3. Remove shift boot. Pry plastic ball socket off shift lever with a screwdriver.
4. Clamp shift lever mounting bracket into vice.
1. Push lower spring seat on the shift lever compression spring until the spring is seated.
2. Coat the lower part of the shift lever well with Molykote or similar lubricant. Insert lever into shift bracket.

Caution

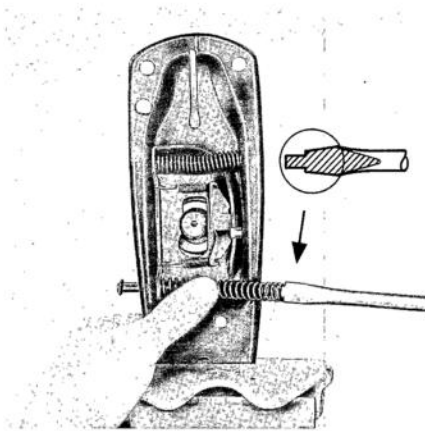
Use care when removing the guide pin springs. They are under tension and may fly out. Cover the springs with a rag. Remove the guide pin snap springs. Remove the guide pin springs one at a time.

5. Remove remaining parts.



3. To install the guide pin springs:

- a. Position the stop plate to the shift bracket of the guide pins.
- b. Insert the second guide pin with snap ring at an angle.
Slip the spring over the pin.
- c. Carefully push one end of the spring into the cutout. Align the spring and push the pin in completely.
- d. Install the spring on the other guide pin in the same way.



4. Slide on the shift boot.

5. Insert new retaining ring into shift knob (as far as the stop).

6. Place shift knob on lever so that the shift pin is in the correct position. Install using special tool P 299.

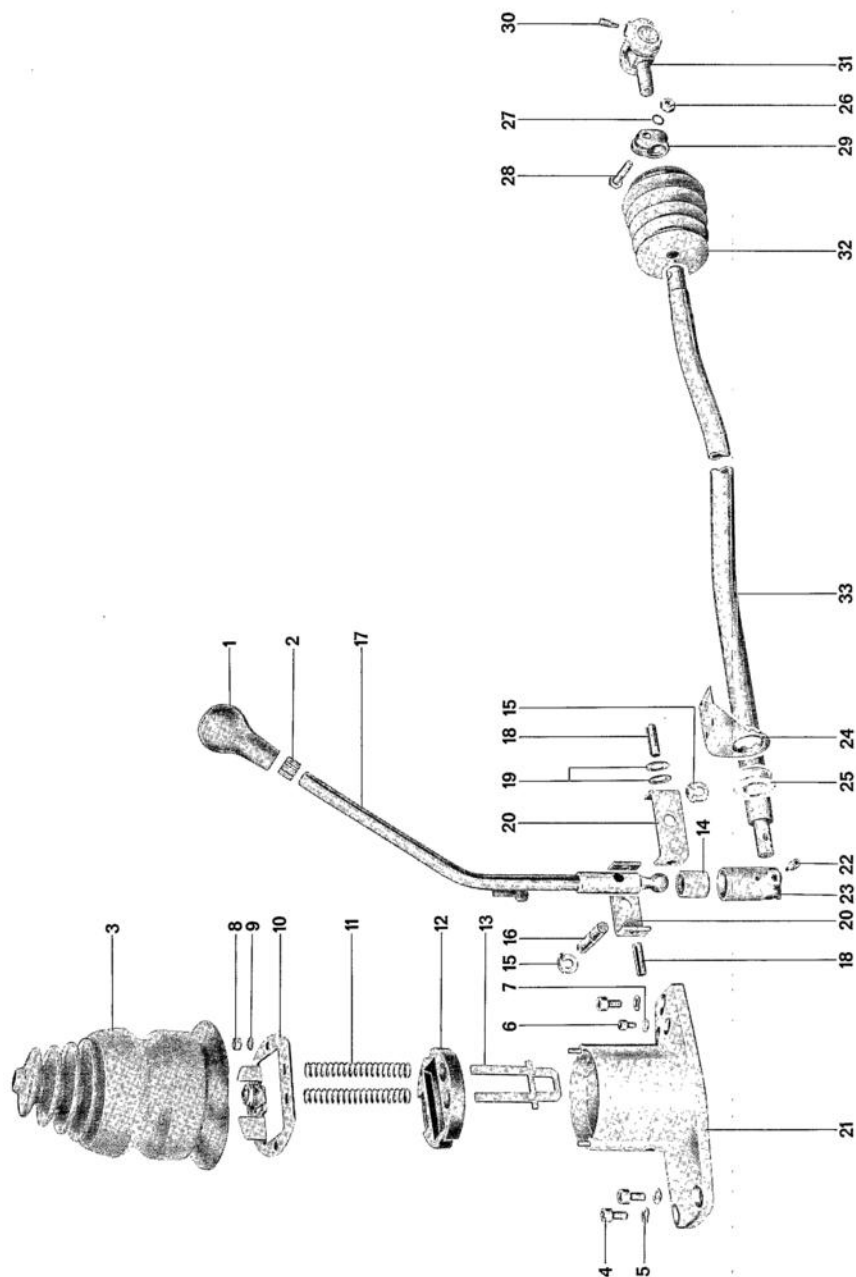
GEAR SHIFT ASSEMBLY EFFECTIVE WITH 1973 MODELS

General

Beginning with the 1973 models, a new pressure-cast shift lever housing is installed in all Type 911 vehicles equipped with a 5-speed transmission.

This shift lever housing can also be installed in older vehicles from 1972 model year on.

DISASSEMBLY AND REASSEMBLY



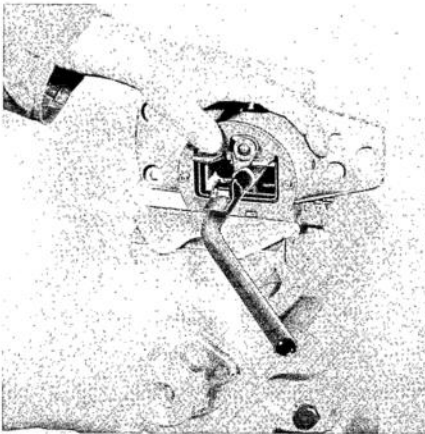
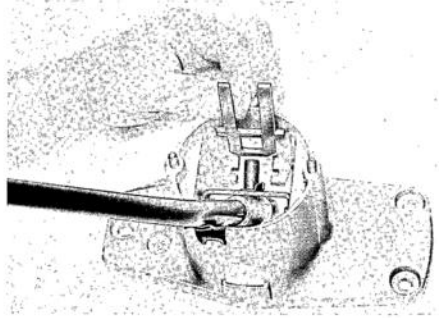
Nr.	Description	Qty	Note when:		Remarks
			removing	installing	
1	Shift knob	1			
2	Interference sleeve	1		Replace	
3	Dust boot	1			
4	Allen bolt, M8x20	3			
5	Spring washer	3		Replace	
6	Allen bolt, M6x20	2			
7	Spring washer	2		Replace	
8	Nut, M 6				
9	Lock washer	2			
10	Lock pawl carrier plate with lock pawl	1		Apply MoS ₂ multi-purpose grease	
11	Spring	2			
12	Buffer plate	1			
13	Guide plate	1		Apply MoS ₂ multi-purpose grease	
14	Ball socket	1		Apply MoS ₂ multi-purpose grease	
15	Lock ring	2		Replace if necessary	
16	Pivot pin	1	Check for wear	Apply MoS ₂ multi-purpose grease	
17	Gear shift lever	1		Apply MoS ₂ multi-purpose grease in the pivot area	
18	Roll pin	2	Drive out with punch	Replace if necessary. Install flush with shift lever housing	
19	Spacer	X	Note number of shims and their thickness	If necessary, redetermine required number and thickness	1.1 - 1/11

Nr.	Description	Qty	Note when:		Remarks
			removing	installing	
20	Fork	2		Apply MoS ₂ multi-purpose grease to friction points	
21	Shift lever housing	1			
22	Set screw	1			
23	Shift rod head	1		Apply MoS ₂ multi-purpose grease to the inner surfaces	
24	Support bracket	1			
25	Bearing bush	1			
26	Nut, M 8	1			
27	Schnorr lock washer	1		Replace	
28	Bolt, M 8 x 32	1			
29	Clamp	1		Torque to specification	
30	Set screw	1			
31	Shift rod coupling	1			
32	Dust boot	1			
33	Shift rod	1		Apply MoS ₂ multi-purpose grease to friction points	

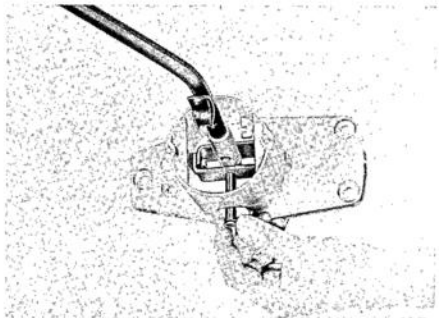
INSTRUCTIONS FOR DISASSEMBLY AND REASSEMBLY

Disassembly

1. Remove shift knob (see 1.1 - 1/5).
2. Mount shift lever housing in a vise.
3. Remove both lock pawl carrier plate retaining nuts (M 6).
4. Open the vise slowly, holding the lock pawl carrier plate with one hand.
5. Take guide plate out of the shift lever housing through the top.



6. Remove lock rings from pivot pin with a screwdriver and pull pivot pin out of the shift lever housing.

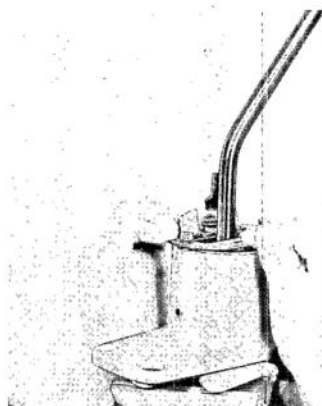
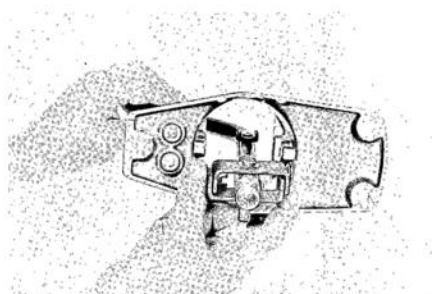
**Caution:**

The springs are under strong pressure and can cause the lock pawl carrier plate to snap out.

7. Take gear shift lever out of the housing.

Reassembly

1. Install gear shift lever, with forks and pin in place, into the shift lever housing.
2. Insert spacers. Select the spacers to achieve a clearance of 0 to 0.1 mm between the forks and housing.



5. Place gear shift knob onto the shift lever and drive it into place with special tool P 299.

6. Install gear shift lever assembly in vehicle and adjust (see 1.1 - 2/1).

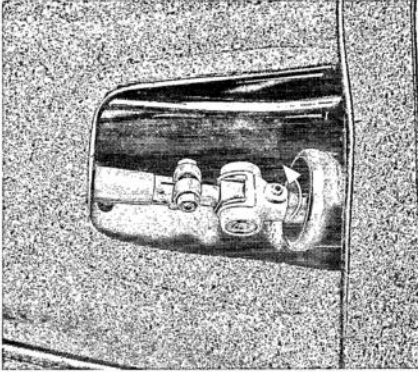
3. When installing the lock pawl carrier plate, place the lower part of the shift lever in the vise.
Use vise jaw covers.
4. Firmly press the lock pawl carrier plate down onto the shift lever base and tighten the M 6 retaining nuts.

Caution:

The springs are under heavy pressure and can cause the lock pawl carrier plate to snap out.

ADJUSTING GEARSHIFT LINKAGE

1. Loosen shift rod clamp. Turn shift rod for selector shaft to the right in neutral position (seen in direction of driving).



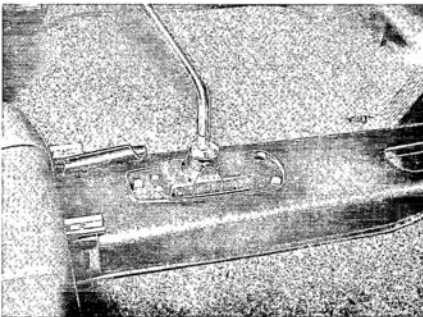
3. Lightly tighten the shift rod clamp.

4. Check if equally long travel is evident in gears 1 thru 4, and 5th and reverse gears can be easily engaged. Correct the adjustment if necessary.

5. Torque clamp nut to specification.

6. Shift into 5th gear. With the dust boot at the shift rod coupling pushed back, check selector shaft for rotational play. A definite amount of play must be in evidence.

2. Move gearshift lever in neutral to the point where the lower part of the shift lever is positioned vertically and touching the left stop.

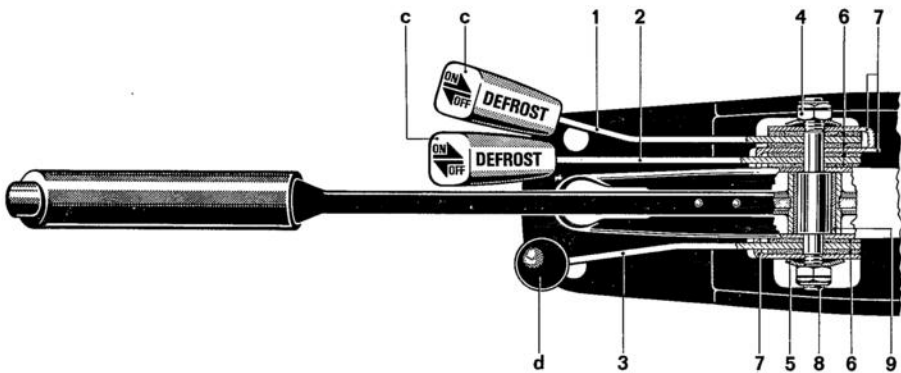


DISMANTLING AND ASSEMBLING HEATER AND HAND THROTTLE CONTROLS (from 1975 Models)

General Notes

The hand throttle and heater controls are located on the parking brake holder.
The heater is regulated by two control levers infinitely, on the left and right sides of the vehicle.

DISMANTLING AND ASSEMBLING



- 1 Heater control lever, right
- 2 Heater control lever, left
- 3 Hand throttle control lever
- 4 Nut, self-locking
- 5 Spring disc

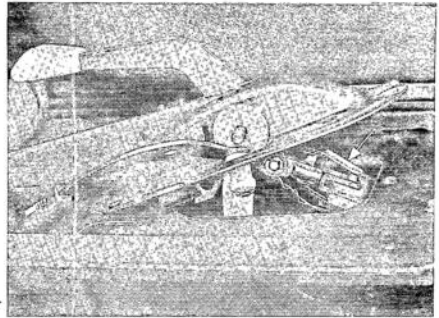
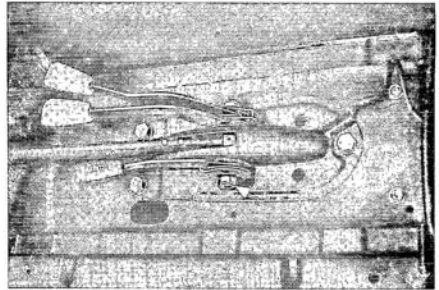
- 6 Friction disc
- 7 Disc
- 8 Shaft
- 9 Spacer

- a Release pressure for heater control friction clutch: 10 kp
- b Release pressure for hand throttle control friction clutch: 6 kp
- c Heater control knob (press fit)
- d Hand throttle control knob (press fit)

REMOVING AND INSTALLING HEATER AND HAND THROTTLE CONTROLS

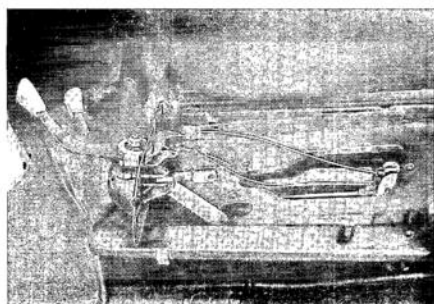
Removing

1. Disconnect heater cables at rotary valves of heater body (underneath vehicle).
2. Remove tunnel cover and parking brake boot.
3. Remove parking brake base screws.
4. Remove hand throttle lever self-locking nut. Remove friction disc and discs. Disconnect hand throttle lever.
5. Lift parking brake base to unlock and pull out cable pin.
6. Disconnect wire connector at operating segment of parking brake indicator lamp. Remove parking brake base with heater cables.



Caution

If the parking brake base cannot be lifted high enough to disconnect cable, disconnect the parking brake compensator.

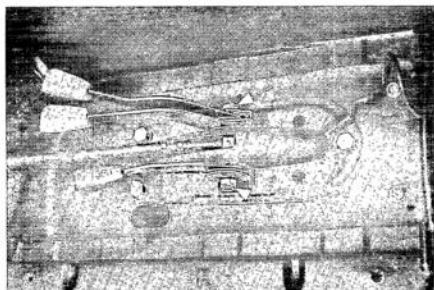


Installing

1. Pull heater cables into heater control lever. The longer heater cable is connected to left heater control lever.
2. Slide heater flap cables into guide tubes. Lubricate cables at the same time with a multi-purpose grease. Make sure that heater flap cables do not tangle.
3. Install and lock parking brake compensator (apply multi-purpose grease).

Caution

Make sure that parking brake cables are located properly.



4. Connect wire connector to operating segment of parking brake indicator lamp.
5. Connect hand throttle lever at parking brake base and throttle linkage. Install parking brake base on center tunnel.
6. Secure hand throttle lever. Tighten self-locking nut until hand throttle lever will not return on its own when throttle is fully pulled out.

7. Check hand throttle position (refer to page 1.2 - 1/7).
8. Connect heater cables to rotary valves at heater body. Install grommets on guide tubes.
9. Check heater flap settings (refer to page 1.2 - 1/6).

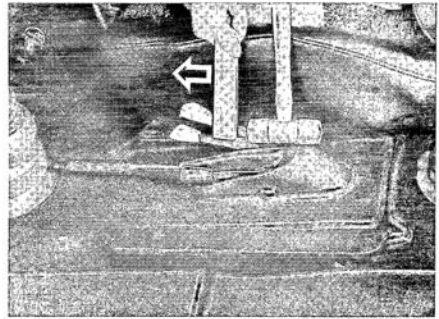
Replacing heater and hand throttle control knobs

Drive knobs off heater and hand throttle control levers with a piece of wood, or similar.

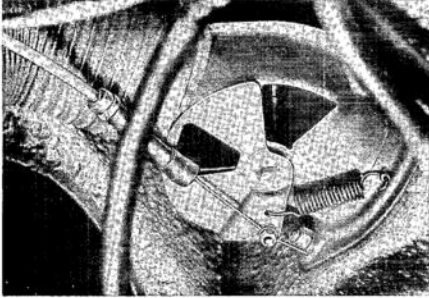
Drive knobs on with a plastic hammer.

Caution

Do not damage knobs.



ADJUSTING HEATER CONTROLS



1. Move both heater control levers to front stop, slide to "off" position and tighten left and right heater cables to rotary valves underneath vehicle.

2. Heater flap valves must be fully open.

3. Check function of heater flaps. Heater flaps and rotary valves must open and close completely when operated.

4. Tighten self-locking nut of heater controls so that lever does not return on its own when heater is on. On the other hand, the levers should not be too hard to move.

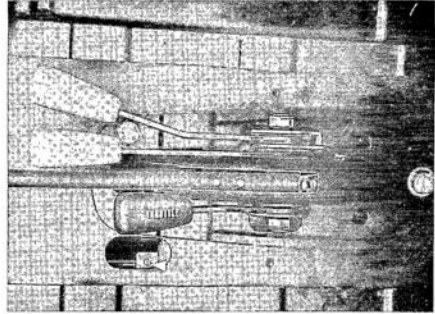
ADJUSTING HAND THROTTLE CONTROL

1. Remove tunnel cover and parking brake base cuff.
2. With a warm engine (approx. 80° C) and the hand throttle control lever pulled out completely, the engine speed must be between 3500 and 3800 rpm.

Caution

Do not race engine.

3. The hand throttle control adjustment can be corrected on the accelerator linkage nipple in the vehicle's tunnel.



PEDAL CONTROLS

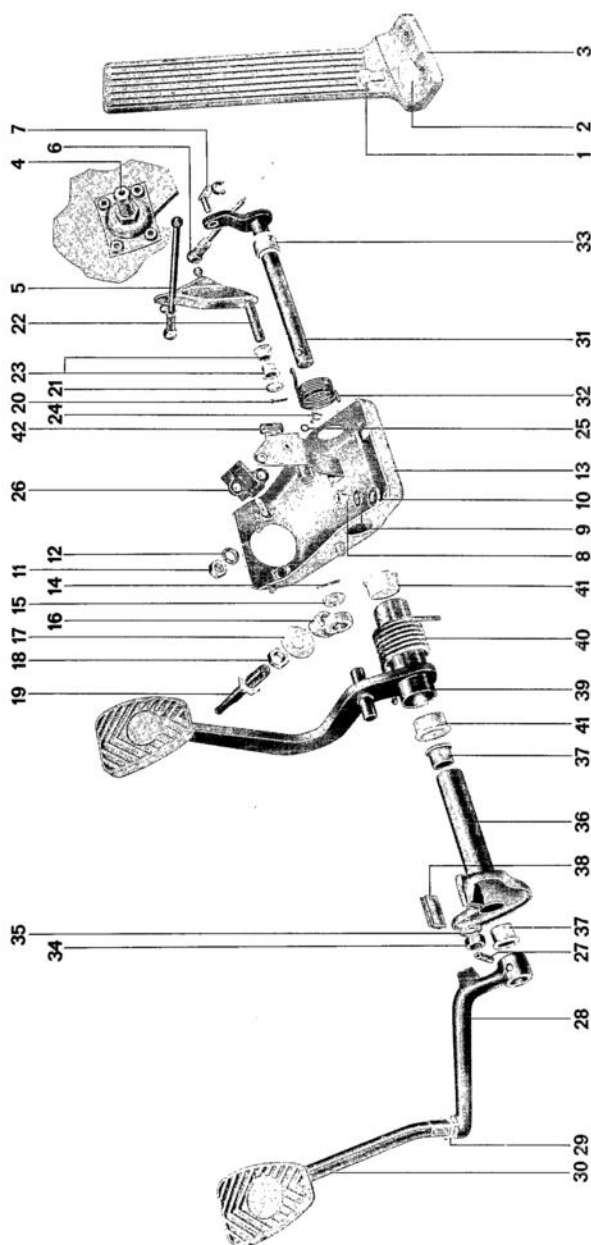
General

The clutch and brake pedals are mounted on a common clutch pedal shaft which is attached to the support fixture.

The support fixture is bolted to the floor and brake master cylinder attachment to the brake master cylinder is by two studs which extend through the transverse panel.

The throttle pedal cross-shaft rides in bushings mounted in the support fixture. The throttle pedal is fastened to the floor by two M 6 bolts.

DISASSEMBLING AND REASSEMBLING



Nr.	Description	Qty	Note when		Special instructions see
			removing	installing	
1	Bolt, M 6 x 25	2			
2	Washer	2			
3	Throttle pedal	1	Pull back to remove.		
4	Throttle pedal stop	1		Adjust.	
5	Throttle pedal pressure rod	1	Detach.	Lubricate ball socket with multipurpose grease.	
6	Throttle rod		Detach.	Install with some multipurpose grease, adjust if necessary.	
7	Clevis pin	1			
8	Nut, M 8	2			
9	Spring washer	2		Use new spring washers.	
10	Washer	2			
11	Nut, M 8	2	Remove frontshroud of steering and dual master cylinder.	Torque to 2.5 mkp.	
12	Spring washer	2		Use new spring washers.	
13	Support fixture		Remove together with pedals.	Install in assembled condition.	
14	Cotter pin for actuating rod	1		Use new cotter pin.	
15	Washer	1			
16	Intermediate piece	1			
17	Stop light actuating washer	1			
18	Nut, M 10	1			

Nr.	Description	Qty	Note when		Special instructions see
			removing	installing	
19	Master cylinder rod	1		Assemble and install rod prior to the installation of the pedal assembly. Adjust free play between rod and piston in the brake master cylinder.	
20	Cross-shaft cotter pin	1		Use new cotter pin.	
21	Washer	1			
22	Cross-shaft	1	Check for wear.	Install with multipurpose grease.	
23	Bushing	2	Check for wear.	Press in.	
24	Fillister head screw M 4 x 10	2			
25	Lock washer	2			
26	Stop light switch	1	Detach flat connector.	Adjust switch, if necessary.	
27	Roll pin	1	Drive out.	Use new roll pin.	
28	Clutch pedal lower part	1			
29	Nut, M 14 x 1.5	1			
30	Clutch pedal upper part	1		Adjust length, if necessary.	
31	Clutch pedal shaft	1	Check for wear.	Install with multipurpose grease.	
32	Spring for clutch pedal shaft	1			
33	Bushing	1	Check for wear.	Lubricate with multipurpose grease.	
34	Nut, M 8	1			

Nr.	Description	Qty	Note when		Special instructions see
			removing	installing	
35	Spring washer	1		Use new spring washer.	
36	Support tube	1		Install with multipurpose grease.	
37	Bushing	2	Check for wear.	Press in.	
38	Rubber cushion	1	Check for wear or damage.	Replace if necessary.	
39	Brake pedal	1			
40	Return spring	1			
41	Bushing	2	Check for wear.	Press in.	
42	Rubber cushion	1	Check for wear or damage.	Replace if necessary.	

INSTRUCTIONS FOR REMOVAL AND INSTALLATION

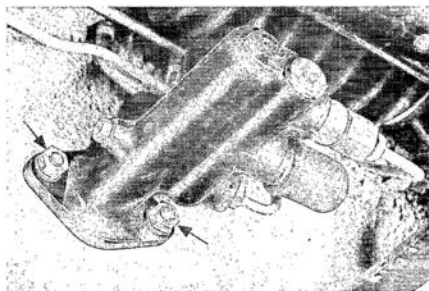
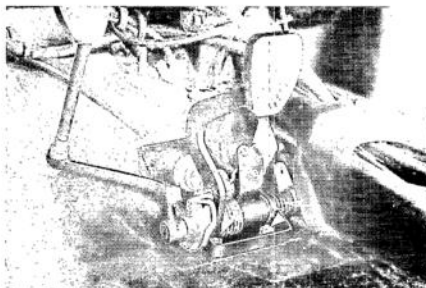
Removing

1. Remove shroud covering steering and brake master cylinder under the car.

2. Remove both M 8 retaining nuts from brake master cylinder.

Note:

Do not detach brake lines or remove the brake master cylinder. Remember to install the master cylinder rod prior to installing the pedal assembly.



3. Remove M 8 retaining nuts from support fixture and remove pedal assembly (first remove clevis pin from clutch pedal shaft, and detach throttle rod).

Installing

1. Clean the parts, check for wear or damage, and replace if necessary.
2. Press bushing in, lubricate bearing surface and pedal shaft.

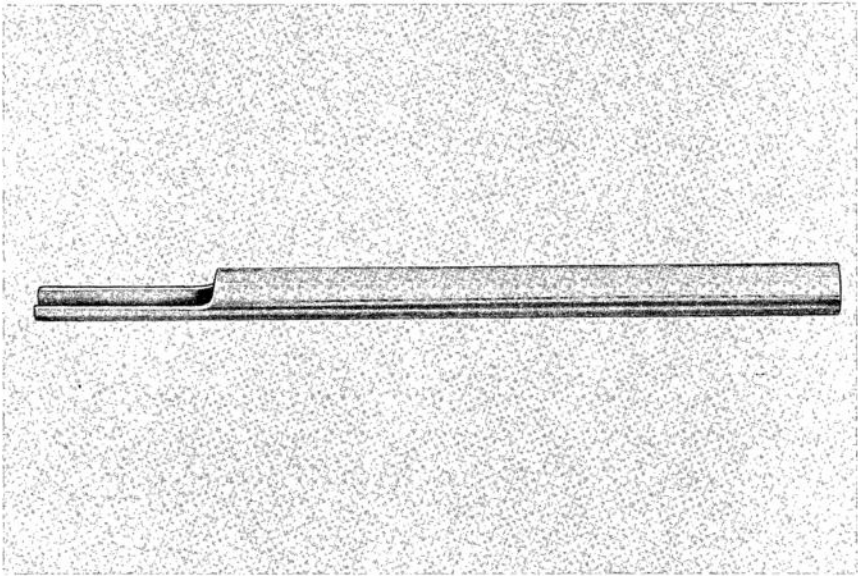
PEDAL CONTROLS

General

Beginning with the 1974 models, all Type 911 vehicles are furnished with a supplemental clutch pedal spring to reduce the necessary pedal force. The pedal force decreases progressively as the clutch pedal is pushed in.

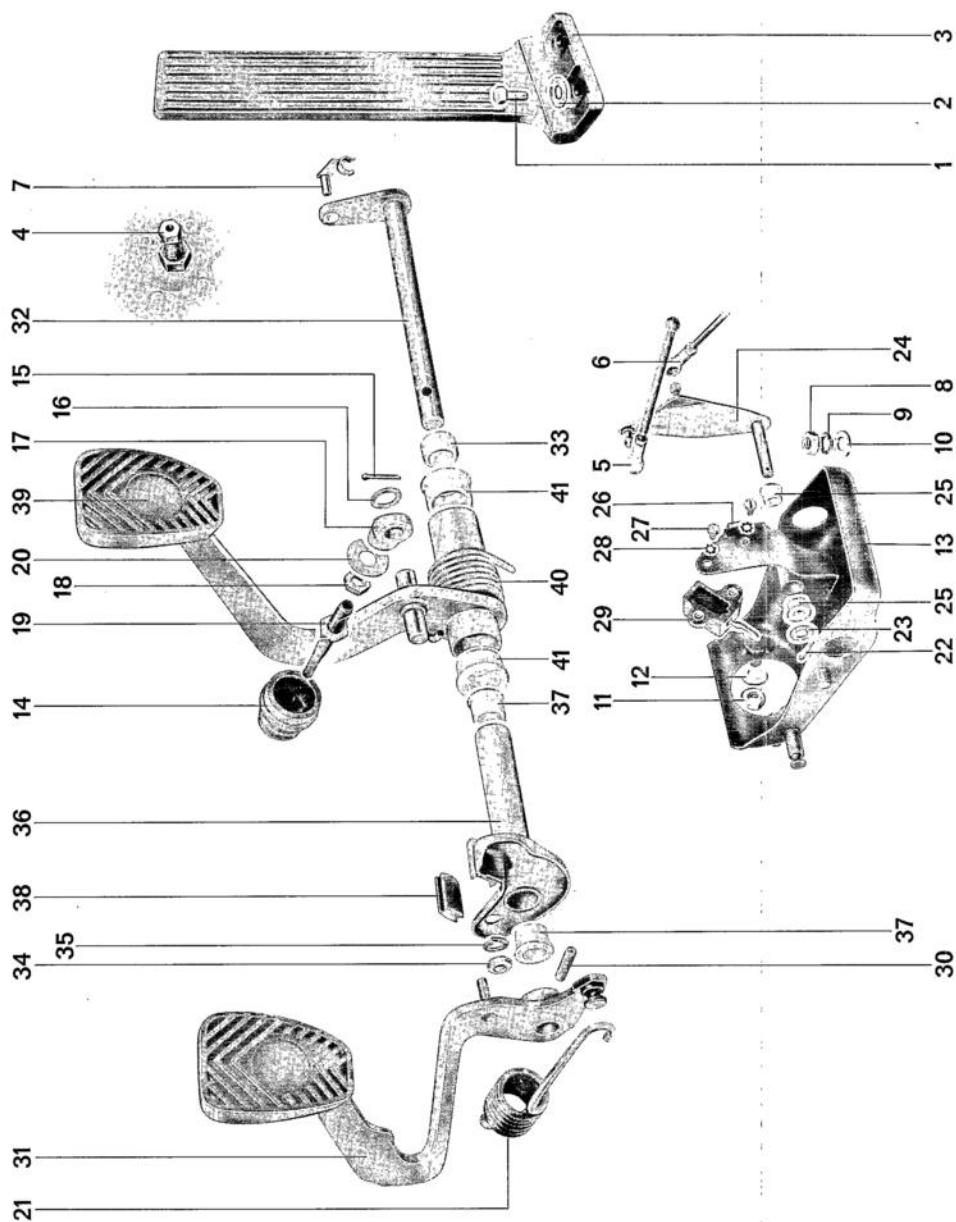
In addition, the cars are equipped with a longer brake pedal. The pedal lever length is 250 mm, the ratio 5.8:1.

TOOLS



No.	Description	Special Tool	References
1	Installer	---	Local manufacture

DISASSEMBLY AND REASSEMBLY



No.	Description	Qty	Note during removal installation	References
1	Bolt M 6 x 25	2	Tighten to specified torque	
2	Washer	2		
3	Throttle pedal	1	Pull off rearward	
4	Throttle pedal stop	1	Adjust	
5	Throttle control link	1	Detach Grease ball socket with multi-purpose grease	
6	Throttle control rod		Detach Install with multipurpose grease, adjust if necessary	
7	Clevis pin	1		
8	Nut M 8	2	Tighten to specified torque	
9	Lock washer	2	Replace	
10	Washer	2		
11	Nut M 8	2	Remove steering and brake master cylinder stone guard first Tighten to specified torque	
12	Lock washer	2	Replace	
13	Support	1	Remove together with pedals Install assembled	
14	Dust boot	1		
15	Cotter pin for actuating rod	1	Use new cotter pin	
16	Washer	1		
17	Intermediate piece	1		
18	Nut M 10	1		

No.	Description	Qty	Note during removal installation		References
19	Actuating rod	1		Assemble and insert the actuating rod prior to the installation of the pedal assembly. Adjust clearance between the actuating rod and piston in brake master cylinder	
20	Stoplight switch actuating washer	1			
21	Spring	1	Detach with the aid of a screwdriver	Use locally-manufactured tool	2.1-1/2
22	Cotter pin for bell crank	1		Use new cotter pin	
23	Washer	1			
24	Bell crank	1	Check for wear	Grease with multipurpose grease prior to installation	
25	Bushing	2	Check for wear	Press in	
26	Rubber stop	1		Replace if necessary	
27	Slotted screw M 4 x 10	2			
28	External tooth lock washer	2			
29	Stoplight switch	1	Detach tab connector	Adjust if necessary	
30	Rollpin	1	Drive it out	Use new rollpin	
31	Clutch pedal	1			
32	Clutch pedal shaft	1	Check for wear	Use multipurpose grease	
33	Bushing	1		Use multipurpose grease	
34	Nut M 8	1			
35	Lock washer	1		Replace	

No.	Description	Qty	Note during		References
			removal	installation	
36	Support tube	1		Use multipurpose grease	
37	Bushing	2	Check for wear	Press in	
38	Rubber stop	1	Check for wear and damage	Replace if necessary	
39	Brake pedal	1			
40	Return spring	1			
41	Bushing	2	Check for wear	Press in	

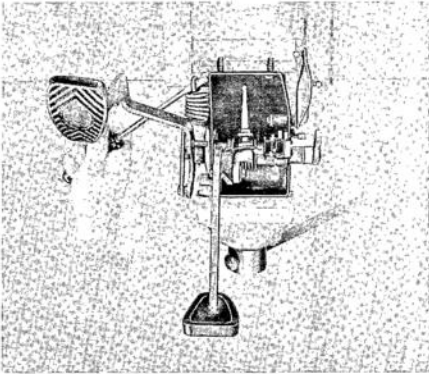
INSTRUCTIONS FOR DISASSEMBLY AND REASSEMBLY

Disassembly

1. Mount pedal support in a vise.
2. Unhook the clutch pedal supplemental spring from pedal support with the aid of a screwdriver while depressing the clutch pedal.

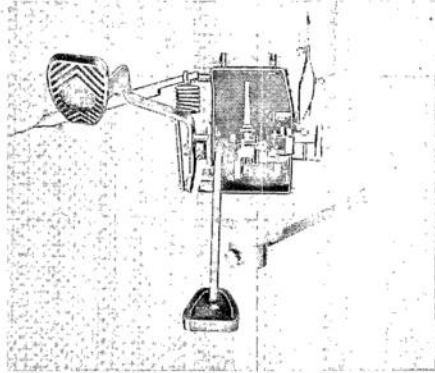
Caution

The spring is under tension and can jump out.

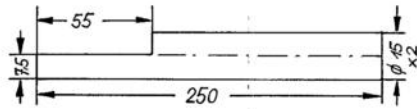


Reassembly

1. Grease both spring attachment studs (in the pedal and pedal support) with MoS₂ multi-purpose grease.
2. Attach spring to pedal support with the aid of the installer (see sketch for local manufacture of tool).



Sketch for local Manufacture of Tool



Material:

Steel pipe , 15 mm dia., wall thickness 2 mm

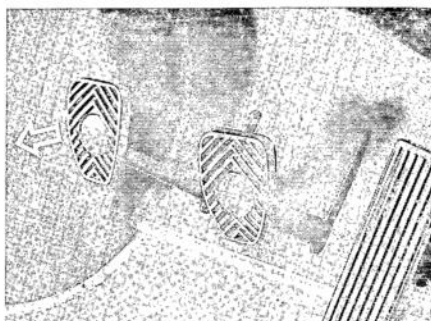
ADJUSTING CLUTCH

Checking Clutch Free Play

The clutch pedal free play is 15 - 20 mm. It is determined by pulling the clutch pedal out in the direction of the arrow.

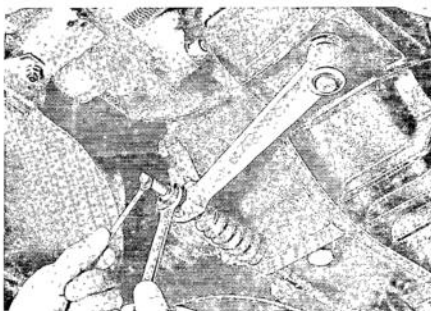
NOTE:

The clutch free play of 20 mm must not be exceeded since otherwise the clutch pedal supplemental spring will become active without actuation of the clutch pedal.



Adjusting Play

Use screwdriver to press release lever in direction of engine against stop. Measure distance between lever and transmission case. Release lever again. Turn adjusting nut on end of cable (underneath car) until lever travel is 4 mm (5/32 in.). Now check clutch play at pedal and correct again, if necessary.

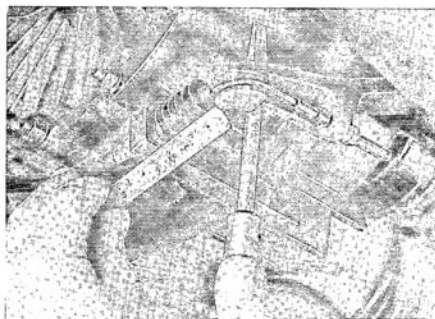


Note

A new clutch lever is installed on all 1975 models.

Checking Clutch Pedal Travel

The test should be accomplished when the transmission is warm. Depress clutch pedal fully to the stop. With clutch pedal in this position, the reverse gear should still engage clash-free.



Adjusting Clutch Pedal Travel

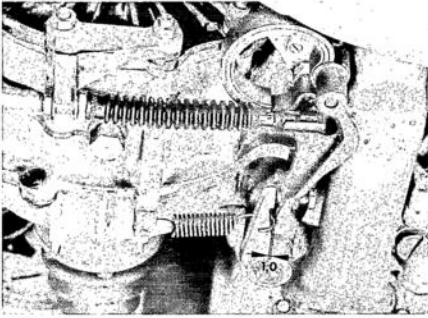
1. Detach floor mat and remove.
2. Loosen both travel stop retaining screws.
3. Push the travel stop plate up or down, as required, until the adjustment is such that the reverse gear can still be engaged clash-free.
4. Tighten the retaining screws, recheck clutch pedal travel, and install floor mat.

ADJUSTING CLUTCH ON MODELS WITH AUXILIARY CLUTCH SPRING

Checking Clutch Play

Because of the auxiliary clutch spring the clutch play cannot be measured exactly at the clutch pedal. This is why the clutch play of models with a auxiliary clutch spring is checked at the transmission adjusting lever.

1. Check whether clutch cable is tight.
2. If cable has sufficient tightness, check clutch play with a feeler gauge and, if applicable, adjust it to 1.0 ± 0.1 mm with the adjusting screw.

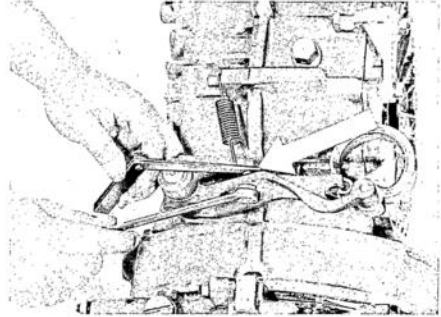


Note

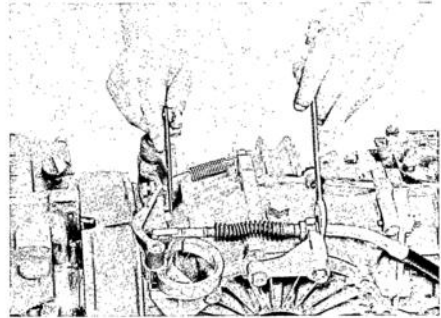
Make basic adjustment if cable is loose (stretching process).

Basic Adjustment

1. Detach clutch cable or loosen completely at holder.
2. Adjust clutch play to 1.2 mm with a feeler gauge and lock adjusting screw.



3. Detach clutch cable.
4. Tighten clutch cable until clutch play is 1.0 mm.



Note

If there is not enough room for adjustment at the clutch cable holder, adjustments must also be made up front at the pedal assembly. Adjust stop on floor plate until the release travel at the release lever is $25 \pm 0,5$ mm (Turbo $27 \pm 0,5$ mm).

5. Measure release travel distance.

- a) Insert calipers as shown in the photo and read distance I (e.g. 95.3 mm).
- b) Depress clutch pedal and measure distance II with calipers as shown in the photo (e.g. 69.9 mm).
- c) Distance I minus distance II (e.g. 95.3 minus $69.9 = 25.4$ mm) equals release travel distance.

