

# Workshop manual

# 911

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STUTT GART-ZUFFENHAUSEN**

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by Dr. -Ing. h. c. Ferdinand Porsche KG  
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## PORSCHE WORKSHOP MANUAL 911 - FROM MODEL 1972 ON

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The Workshop Manual 911 - from model 1972 on - is subdivided into 10 Assembly Groups, delivered in supplements to volume I and II.

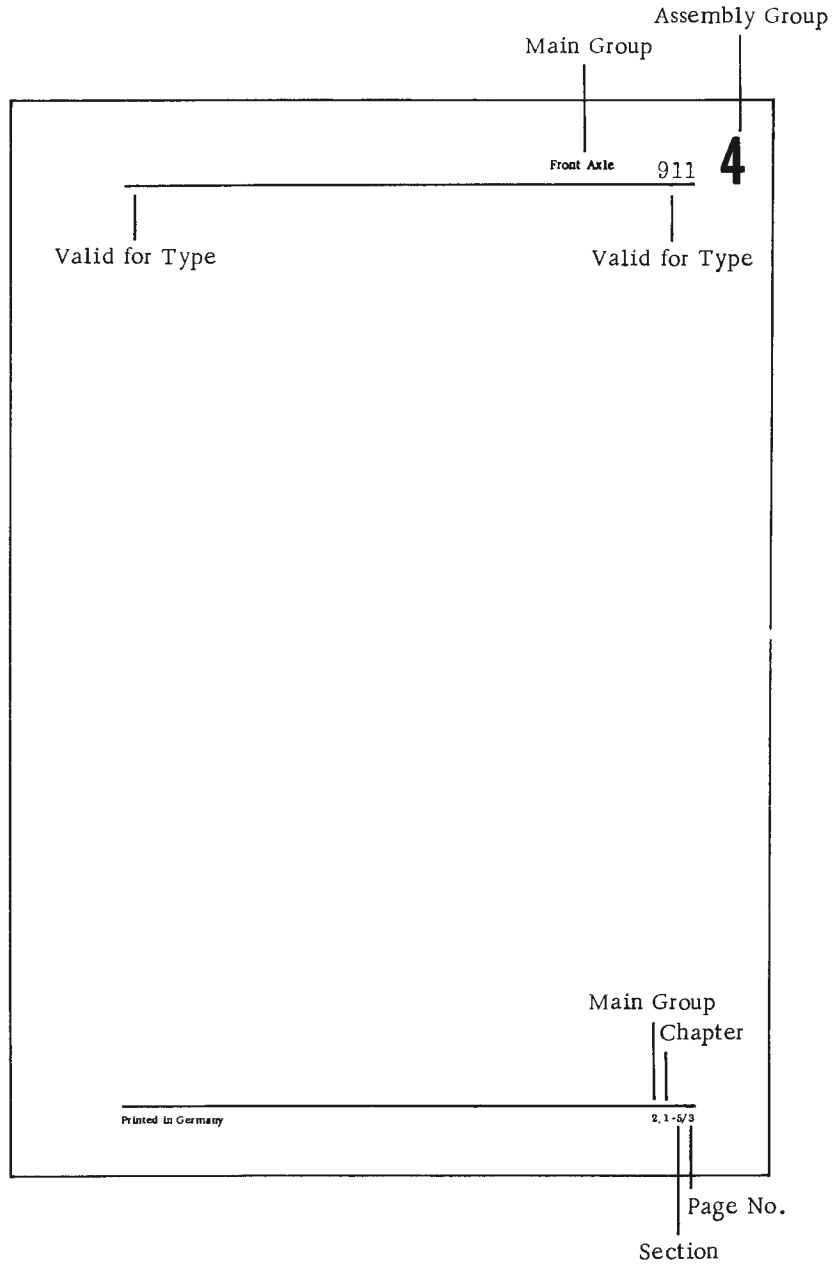
### Survey of the individual Assembly Groups:

Engine and Clutch	Code No. 1
Fuel System	Code No. 2
Transmission	Code No. 3
Front Axle	Code No. 4
Rear Axle	Code No. 5
Brakes, Wheels, Tires	Code No. 6
Pedal Controls and Manual Controls	Code No. 7
Maintenance Jobs, Technical Data	Code No. 0
Body	Code No. 8
Electrical System	Code No. 9

For identification of the volumes, the back of the folders is provided with a transparent pocket at the top for insertion of the pertinent type.

To find the individual repair steps quickly, each Assembly Group of this Workshop Manual is subdivided into "Main Groups", "Chapters" and "Sections" and provided with a very detailed list of contents; refer to example on next page.

The Technical Informations are designed to be filed at the beginning of each Assembly Group. The contents of the Technical Informations will be incorporated into the Workshop Manual at suitable intervals. The List of Contents will be edited whenever extensions and supplements are published.



## FOREWORD

This Workshop Manual is issued by Porsche KG for use in repairing and overhauling  
PORSCHE automobiles.

All information, illustrations and specifications contained in this MANUAL are based  
on the latest product information available at the time of publication. However,  
Porsche KG reserves the right to make changes at any time in service and repair  
procedures or to alter product specifications without notice to users of this Manual.

DR.-ING. h.c.F. PORSCHE K.-G.  
STUTTGART - ZUFFENHAUSEN



## ENGINE CHANGES - BEGINNING WITH 1972 MODELS

## General Information

Beginning with 1972 models, Type 911 engines have a cubic displacement of 2.4 liters (2341 c/142.8 cu.in.)



Individual changes and changed service operations are described on the pages that follow.

Summary of Changes:

1. Technical Data
2. Crankcase
3. Crankshaft
4. Connecting rods and bearings
5. Pistons
6. Location of oil tank and oil lines
7. Clutch pressure plate, throwout bearing, and clutch disc
8. Ignition - see Group 9 (Electrical System)
9. Fuel system - see Group 2



## OIL TANK CHANGES - BEGINNING WITH 1972 MODELS

## General Information

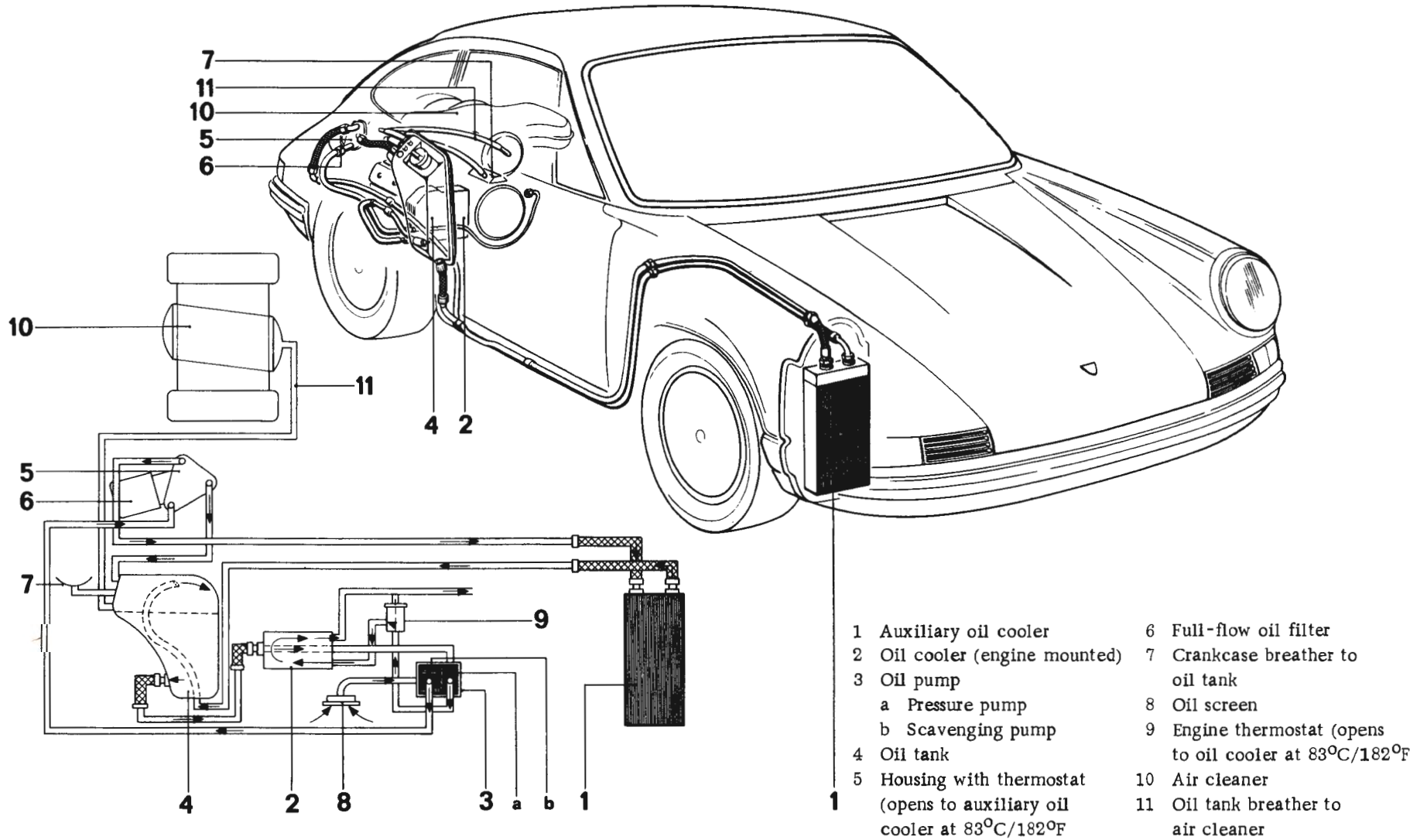
Beginning with 1972 models, the oil tank is located in right rear wheelhousing in front of the rear axle. The oil filler neck is now accessible from the outside. It is located under a hinged lid in the right rear fender. The oil filter housing is separated from the tank and mounted on the right engine compartment wall.

The auxiliary oil cooler under the right front fender continues to be standard equipment in Type 911S vehicles.



# OIL COOLING SYSTEM AND OIL CIRCUIT SCHEMATIC

TYPE 911 S VEHICLES (FROM 72-MODELS)



TECHNICAL DATA - TYPE 911 VEHICLES BEGINNING WITH 1972 MODELS

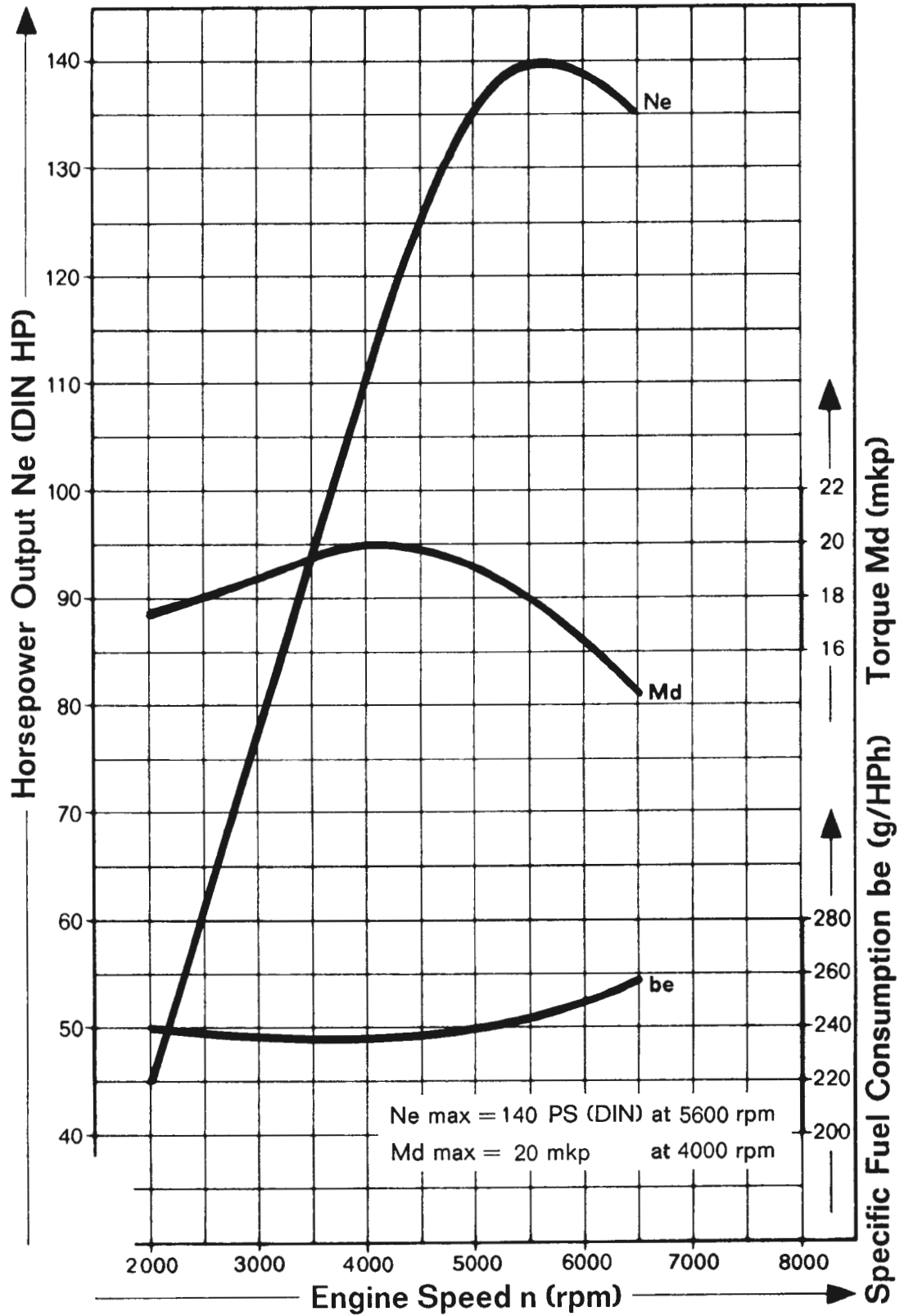
	911 T	911 E	911 S
ENGINE			
Type	four-stroke gasoline engine with two opposing cylinder banks		
Number of cylinders	6	6	6
Cylinder arrangement		horizontal, three cylinders per bank	
Bore	84 mm (3.31 in.)	84 mm (3.31 in.)	84 mm (3.31 in.)
Stroke	70.4 mm (2.77 in.)	70.4 mm (2.77 in.)	70.4 mm (2.77 in.)
Engine displacement	2341 cc (142.8 cu. in.)	2341 cc (142.8 cu. in.)	2341 cc (142.8 cu. in.)
Compression ratio	7.5 : 1	8.0 : 1	8.5 : 1
Horsepower rating (DIN)	140	165	190
(SAE Net)	137	157	181
Maximum torque (DIN)	20 mkp	21 mkp	22 mkp
(SAE)	166 ft/lb	174 ft/lb	181 ft/lb
@ engine speed	4000 rpm	4500 rpm	5200 rpm

	911 T	911 E	911 S	
Specific power output per liter	(DIN HP)	60	70	81
	(SAE Net HP)	67	79	90
Nominal piston speed @ maximum power	13.1 m/sec	14.5 m/sec	15.2 m/sec	
Maximum engine revolutions	6500 rpm	7100 rpm	7300 rpm	
Required fuel rating	91 octane	91 octane	91 octane	
Cooling	air cooled by fan on alternator shaft	air cooled by fan on alternator shaft	air cooled by fan on alternator shaft	
Cooling fan drive	by V-belt from crankshaft	by V-belt from crankshaft	by V-belt from crankshaft	
Crankshaft/blower ratio	1 : 1.3	1 : 1.3	1 : 1.3	
Air flow rate	approx. 1230 ltr/sec @ 5800 rpm	approx. 1380 ltr/sec @ 6500 rpm	approx. 1380 ltr/sec @ 6500 rpm	

	911 T	911 E	911 S
Lubrication	dry sump	dry sump	dry sump
Oil cooling	oil cooler on crankcase in fan air stream	oil cooler on crankcase in fan air stream	oil cooler on crankcase in fan air stream; auxiliary cooler in front of vehicle
Oil filter	full flow	full flow	full flow
Oil consumption	1,5 - 2 ltr/1000 km 1,5 - 2 US qts/600 mi	1,5 - 2 ltr/1000 km 1,5 - 2 US qts/600 mi	1,5 - 2 ltr/1000 km 1,5 - 2 US qts/600 mi
Crankcase	two-piece pressure casting of aluminum/magnesium alloy	two-piece pressure casting of aluminum/magnesium alloy	two-piece pressure casting of aluminum/magnesium alloy
Crankshaft	forged, surface-hardened	forged, surface-hardened	forged, surface-hardened
Intermediate shaft bearings	two, plain-journal	two, plain-journal	two, plain-journal
Crankshaft bearings	eight, plain-journal	eight, plain-journal	eight, plain-journal
Main bearings 1-7	split inserts, 3-layer	split inserts, 3-layer	split inserts, 3-layer
Main bearing 1	thrust bearing	thrust bearing	thrust bearing
Main bearing 8	one-piece bushing, hard-lead lined	one-piece bushing, hard-lead lined	one-piece bushing, hard-lead lined

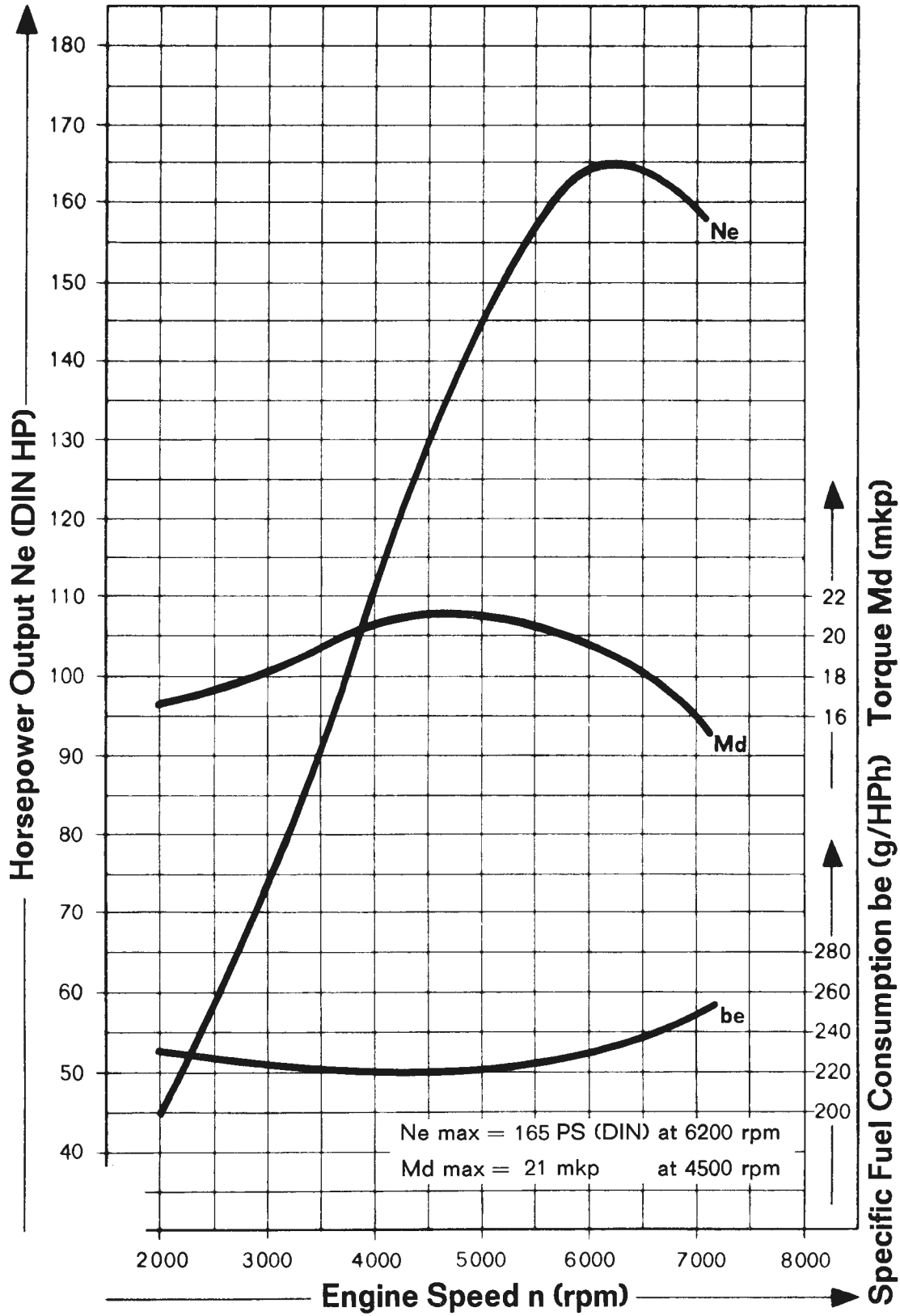
	911 T	911 E	911 S
Connecting rods	forged steel	forged steel	forged steel, surface-hardened (Tenifer)
Connecting rod bearings	split inserts, 3-layer	split inserts, 3-layer	split inserts, 3-layer
Piston pin bushings	bronze, pressed-in	bronze, pressed-in	bronze, pressed-in
Pistons	light alloy, die-cast	light alloy, die-cast	light alloy, forged
Piston pins	floating, with circlips	floating, with circlips	floating, with circlips
Piston rings	two compression rings one oil scraper	two compression rings one oil scraper	two compression rings one oil scraper
Cylinders	individual, grey cast iron with integral cooling fins	individual, grey cast iron sleeve with finned light alloy jacket	individual, grey cast iron sleeve with finned light alloy jacket
Cylinder heads	light alloy, finned individual castings for each cylinder	light alloy, finned individual castings for each cylinder	light alloy (Y-alloy), finned individual castings for each cylinder
Valve seat inserts	shrunk-in, grey-cast iron	shrunk-in, grey-cast iron	shrunk-in, grey-cast iron
Valve guides	shrunk-in, special bronze	shrunk-in, special bronze	shrunk-in, special bronze

**Full-power Performance Type 911 TUSA**



# Full-power Performance

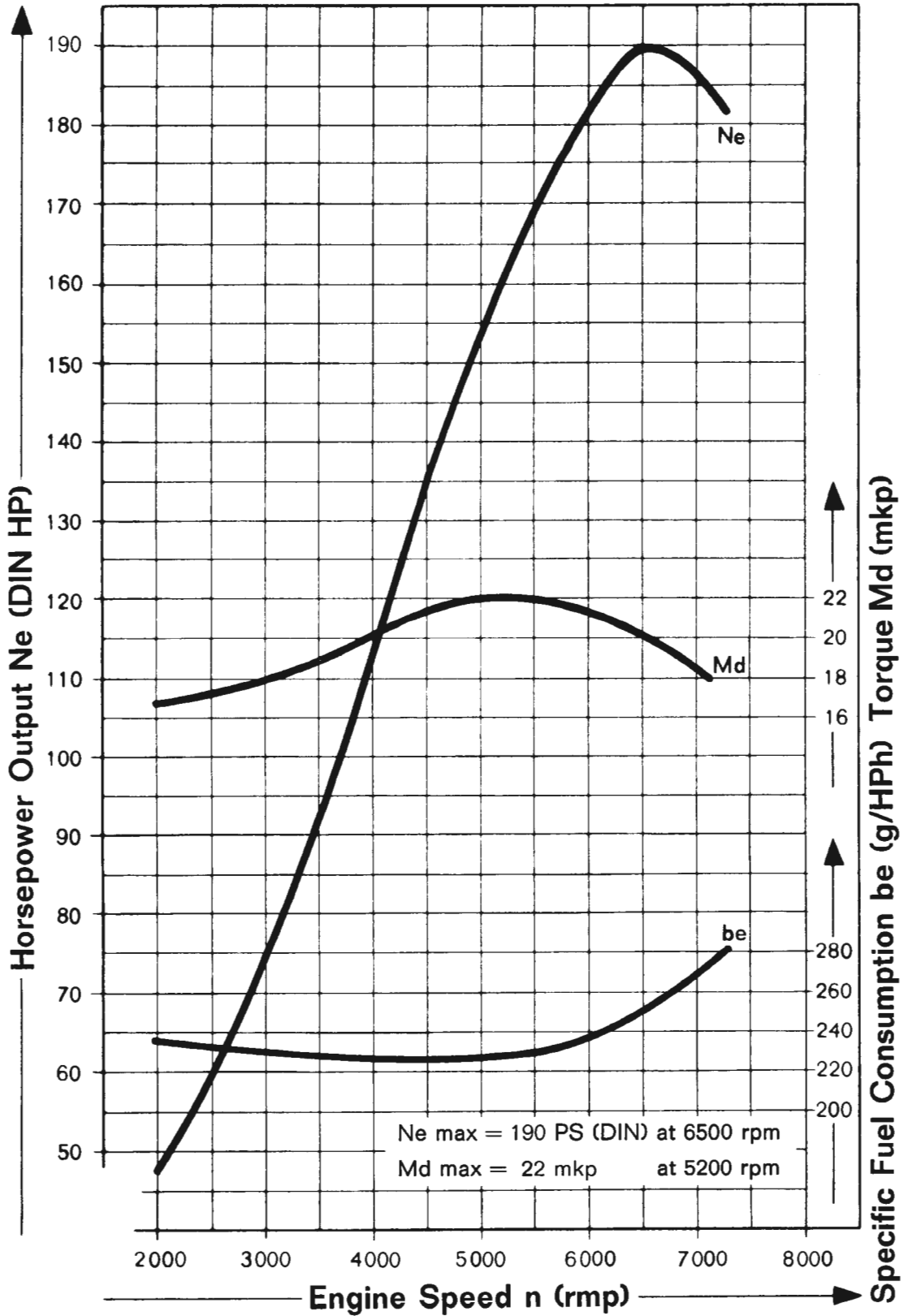
# Type 911 E





### Full-power Performance

### Type 911 S





## REMOVING AND INSTALLING OIL TANK

1. Remove right rear wheel.

**Caution**

Cover brake disc to prevent oil spillage during removal of tank.

2. Drain oil from tank.

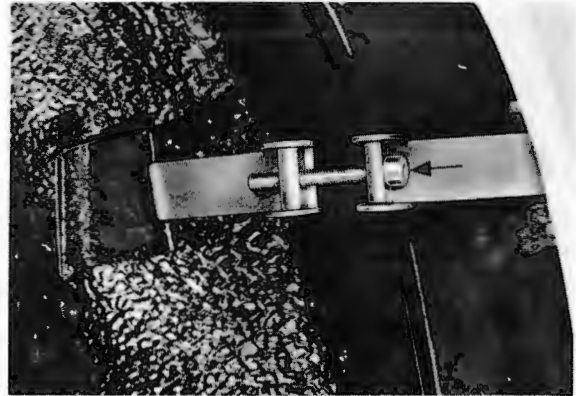
3. Loosen hose clamps and retaining clamp of return line.



4. Detach return hose from oil tank.

5. In Type 911 S also detach the oil hose from bottom of tank.

6. Loosen retaining strap.



7. Pull tank partially out of the wheelhousing and remove oil line, breather hoses, and oil level gauge wires. Remove tank.



Make sure during installation that plastic caps between tank and body, and retaining strap liner are correctly seated.

Coat oil hose connections with Molykote or similar lubricant when assembling.



## PISTON CHANGES - BEGINNING WITH 1972 MODELS

## 1. New pistons with flatter piston tops to reduce compression

ratio:

911 T = 7.5 : 1

911 E = 8.0 : 1

911 S = 8.5 : 1

Required fuel octane rating = 91

## 2. Changed piston ring.

## 3. New table of dimensions for pistons and cylinders beginning with 1972 models.

PISTON AND CYLINDER DIMENSIONS - BEGINNING WITH 1972 MODELS

Type 911 S Pistons



Cylinder marking	Cylinder diameter	Piston diameter D1	Tolerance
Standard			$\pm 0.005$ mm
0	84.000-84.010 mm	83.950 mm	
1	84.010-84.020 mm	83.960 mm	
2	84.020-84.030 mm	83.970 mm	
Oversize			
0 KD 1	84.250-84.260 mm	84.200 mm	
1 KD 1	84.260-84.270 mm	84.210 mm	
2 KD 1	84.270-84.280 mm	84.220 mm	

Cylinder/piston clearance: 0.045-0.065 mm  
Piston weight: 354  $\pm$  3 g

Type 911 E Pistons



Cylinder marking	Cylinder diameter	Piston diameter D1	Tolerance
Standard			$\pm 0.005$ mm
0	84.000-84.010 mm	83.970 mm	
1	84.010-84.020 mm	83.980 mm	
2	84.020-84.030 mm	83.990 mm	
Oversize			
0 KD 1	84.250-84.260 mm	84.220 mm	
1 KD 1	84.260-84.270 mm	84.230 mm	
2 KD 1	84.270-84.280 mm	84.240 mm	

Cylinder/piston clearance: 0.025-0.045 mm  
Piston weight: 371  $\pm$  3 g

Type 911 T Pistons



Cylinder marking	Cylinder diameter	Piston diameter D1	Tolerance
Standard (MAHLE)			$\pm 0.005$ mm
0	84.000-84.010 mm	83.970 mm	
1	84.010-84.020 mm	83.980 mm	
2	84.020-84.030 mm	83.990 mm	
Oversize			
0 KD 1	84.250-84.260 mm	83.220 mm	
1 KD 1	84.260-84.270 mm	83.230 mm	
2 KD 1	84.270-84.280 mm	83.240 mm	

Cylinder/piston clearance: 0.025-0.045 mm  
Piston weight: 376  $\pm$  3 g

Cylinder  
marking



## Type 911 T Pistons



Standard (SCHMIDT)		Tol.
0	84.00-84.01 mm	+0.007 -0.008
1	84.01-84.02 mm	83.97 mm
2	84.02-84.03 mm	83.98 mm
Oversize		
0 KD 1	84.25-84.26 mm	83.99 mm
1 KD 1	84.26-84.27 mm	84.22 mm
2 KD 1	84.27-84.28 mm	84.23 mm
Cylinder/piston clearance:		0.023-0.048 mm
Piston weight:		375 ± 4 g

For piston and cylinder wear limits see page SE 45.

## CYLINDER HEIGHT TOLERANCE GROUPE (2.4 LITER, 1972 MODELS)

Cylinder Installation Height	Identification Mark			
		85.400 - 85.425 mm		Standard cylinder height
		85.425 - 85.450 mm		
	R 5	85.150 - 85.175 mm		Reconditioned cylinder height
R 6	85.175 - 85.200 mm			





## CRANKCASE CHANGES - BEGINNING WITH 1972 MODELS

Distributor mounting flange.



## CHANGED CRANKSHAFT - BEGINNING WITH 1972 MODELS

Stroke = 70.4 mm

Crankpin diameter = 51.990 - 51.971

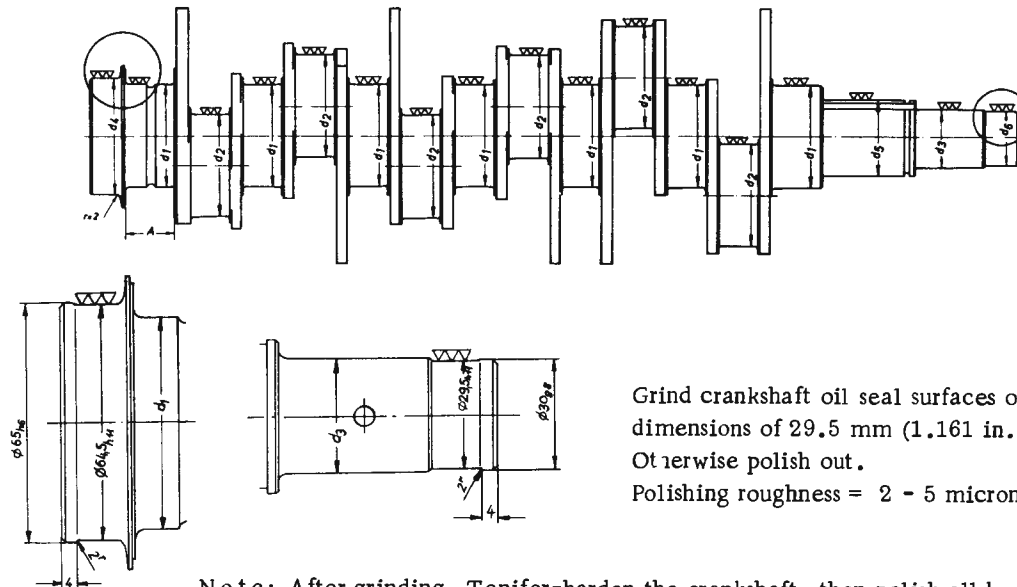
Crankpin width = 24 mm

Beginning with 1972 models, all crankshafts have counterweights.

See next page for crankshaft dimensions.

CRANKSHAFT DIMENSIONS - STANDARD AND RECONDITIONED

Step	Crankshaft diameter Bearings 1-8	All main bearings d 1	Connecting rod bearings d 2	Main bearing diameter d 3 on crankshaft Bearing 8	Shoulder diameter d 4	Timing gear seat diameter d 5	Crankshaft pulley seat diameter d 6	Thrust bearing Width A
Standard	Standard 62.000-62.019 mm (2.4409-2.4417 in.)	mm 56.990-56.971 in. (2.2437-2.2429)	51.990-51.971 (2.0468-2.0461)	30.993-30.980 (1.2202-1.2197)	65.000-64.981 (2.5591-2.5583)	42.013-42.002 (1.6541-1.6536)	29.993-29.960 (1.1808-1.1795)	28.000-28.06 (1.1024-1.1047)
-0.25 mm (-0.0098)		mm 56.740-56.721 in. (2.2339-2.2331)	51.740-51.721 (2.0382-2.0363)	30.743-30.730 (1.2104-1.2098)				
-0.50 mm (-0.0197)	Oversize 62.269-62.250 mm (2.4515-2.4508 in.)	mm 56.490-56.471 in. (2.2240-2.2233)	51.490-51.471 (2.0272-2.0264)	30.493-30.480 (1.2005-1.2000)	64.500-64.310 (2.5394-2.5319)		29.500-29.370 (1.1614-1.1563)	
-0.75 mm (-0.0295)		mm 56.240-56.221 in. (2.2142-2.2134)	51.240-51.221 (2.0173-2.0166)	30.243-30.230 (1.1907-1.1902)				

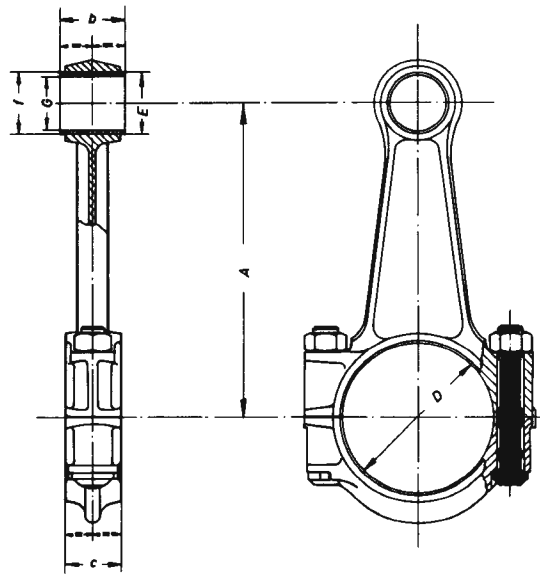


Grind crankshaft oil seal surfaces only when deeply scored. Grind to dimensions of 29.5 mm (1.161 in.) and 64.5 mm (2.539 in.)  
 Otherwise polish out.  
 Polishing roughness = 2 - 5 microns

Note: After grinding, Tenifer-harden the crankshaft, then polish all bearing journals and thrust surface A. Magnaflux to check for cracks.

Maximum vertical runout = 0.04 mm (0.002 in.), measured at Bearing 4 and 8, with Bearing 1 and 7 on V-blocks.  
 Maximum crankshaft unbalance = 10 cmg.

## CONNECTING ROD CHANGES - BEGINNING WITH 1972 MODELS



A	Distance between centers	127.8 - 0.05 mm (5.03) - (0.002 in.)
b	Width of piston pin bushing	26.0 - 0.2 mm (1.02) - (0.008 in.)
c	Big end width	23.8 - 0.1 mm (0.9370) - (0.004 in.)
D	Big end diameter (without bearing insert)	56.019 - 56.000 mm (2.2055) - (2.2047 in.)
E	Small end diameter	25.021 - 25.000 mm (0.9851) - (0.9843 in.)
f	Piston pin bushing dia. (before installation)	25.035 - 25.055 mm (0.9856) - (0.9864 in.)
	(Press-fit interference in rod)	0.014 - 0.055 mm (0.0006) - (0.0022 in.)
G	Inside diameter of installed piston pin bushing (finished)	22.033 - 22.020 mm (0.8674) - (0.8669 in.)
	Piston pin clearance in bushing	0.020 - 0.039 mm (0.0008) - (0.0015 in.)
	Wear limit	0,055 (.0022)

## CONNECTING ROD WEIGHT GROUPS

Connecting rods are assigned to weight groups.

The pertinent weight group can be identified in spare part end numbers.

The end number is stamped into connecting rods furnished as spare parts.

Weight more than   up to grams   grams		Weight group for KD	KD connecting rod spare part number	Identification in connecting rod
645	654	1	911.103.015.31	31
654	663	2	911.103.015.32	32
663	672	3	911.103.015.33	33
672	681	4	911.103.015.34	34
681	690	5	911.103.015.35	35
690	699	6	911.103.015.36	36
699	708	7	911.103.015.37	37
708	717	8	911.103.015.38	38

Weight variation between connecting rods in any engine may not exceed 9 g.

To determine weight group, weigh complete connecting rod without big end inserts.

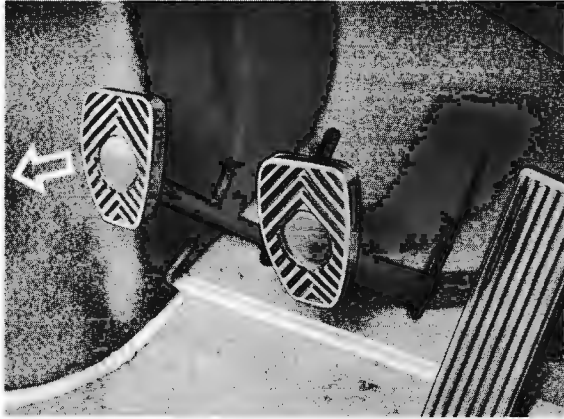
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CLUTCH CHANGES - BEGINNING WITH 1972 MODELS

1. Clutch operating system has been redesigned. The throw-out fork and clutch lever are mounted and secured with lock rings on a shaft which is splined on both ends and located in the transmission housing. The clutch lever is now pulled by the clutch cable instead of the cable housing.
2. Pressure of the pressure plate (MFZ 225 KL) has been increased to a range of 650-720 kp (1430-1584 lbs.)
3. Clutch disc splines have been changed from 24 to 20 (an SAE designation).

## ADJUSTING CLUTCH

1. Turn self-locking adjusting nut until clutch pedal free travel is 20 - 25 mm (0.8 - 1.0 in.).



2. When checking, pull pedal in direction of arrow.



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FUEL INJECTION PUMP CHANGES - BEGINNING WITH 1972 MODELS

The 2,4 liter engines are equipped with changed injection pumps. The changes consist of a wider contoured cam and modified centrifugal weights and springs.

Pump designation (BOSCH number on data plate):

911 T = 0408 126015

911 E = 0408 126014

911 S - 0408 126013



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#### CHANGES IN THROTTLE VALVE HOUSINGS AND INTAKE MANIFOLDS

Beginning with the 1972 models, throttle valve stops in the throttle valve housing are relocated to the lever side. The new levers require the use of modified protractors, special tool P 228 c.

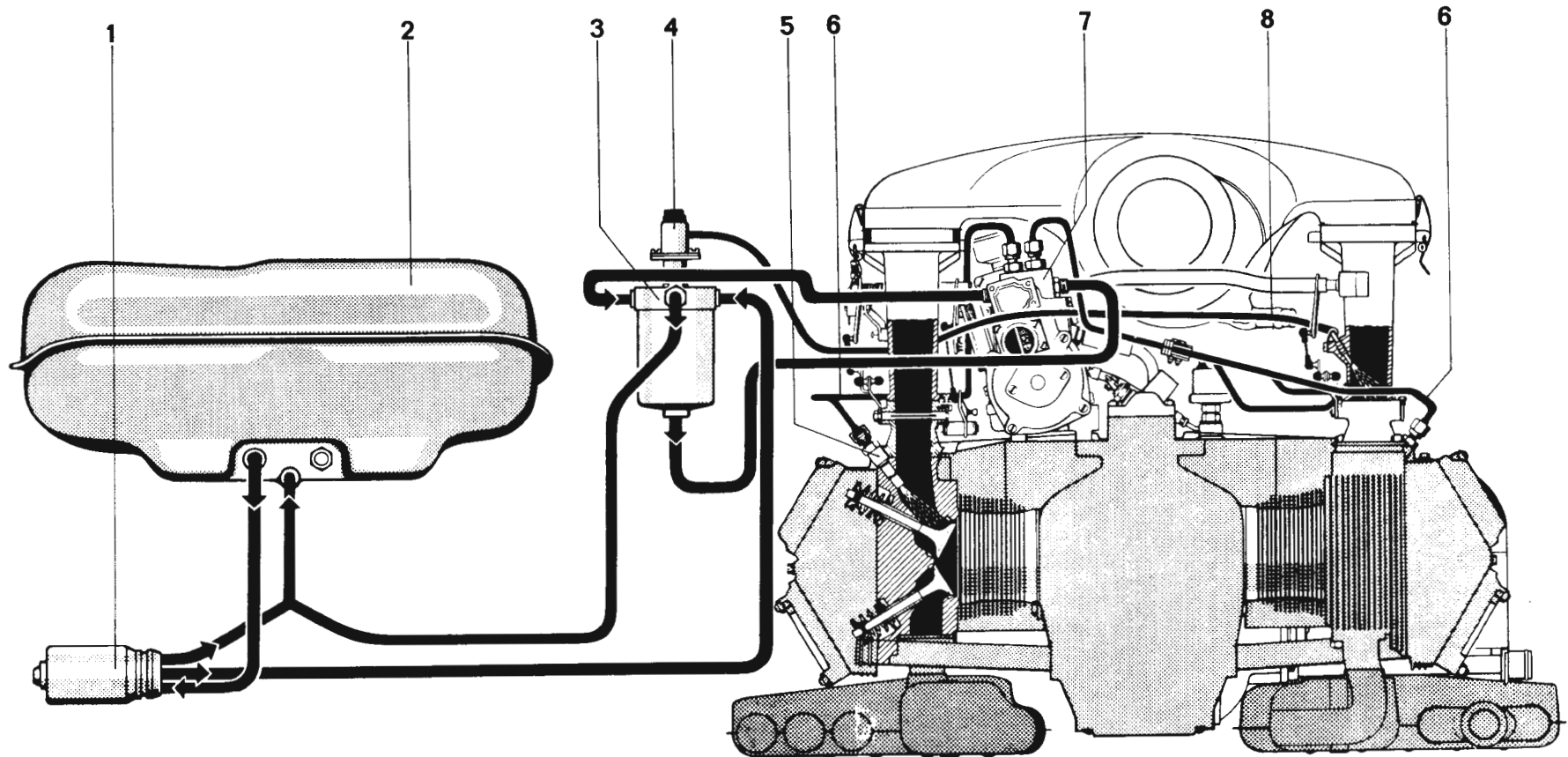
The protractor on the injection pump control lever has not been changed. The correlation checkout procedure remains same (see page SF 22).

The intake velocity stacks are made of plastic. They form a single unit together with the lower air assembly.

#### COLD START ENRICHMENT SYSTEM CHANGES

Fuel for cold start enrichment now is fed directly into each individual velocity stack. The discharge nozzles are bonded and can not be exchanged.

SCHEMATIC VIEW OF THE PORSCHE FUEL INJECTION SYSTEM



1 Fuel pump  
2 Fuel tank  
3 Fuel filter

4 Cold start enrichment solenoid  
5 Injection valve(nozzle)  
6 Injection line

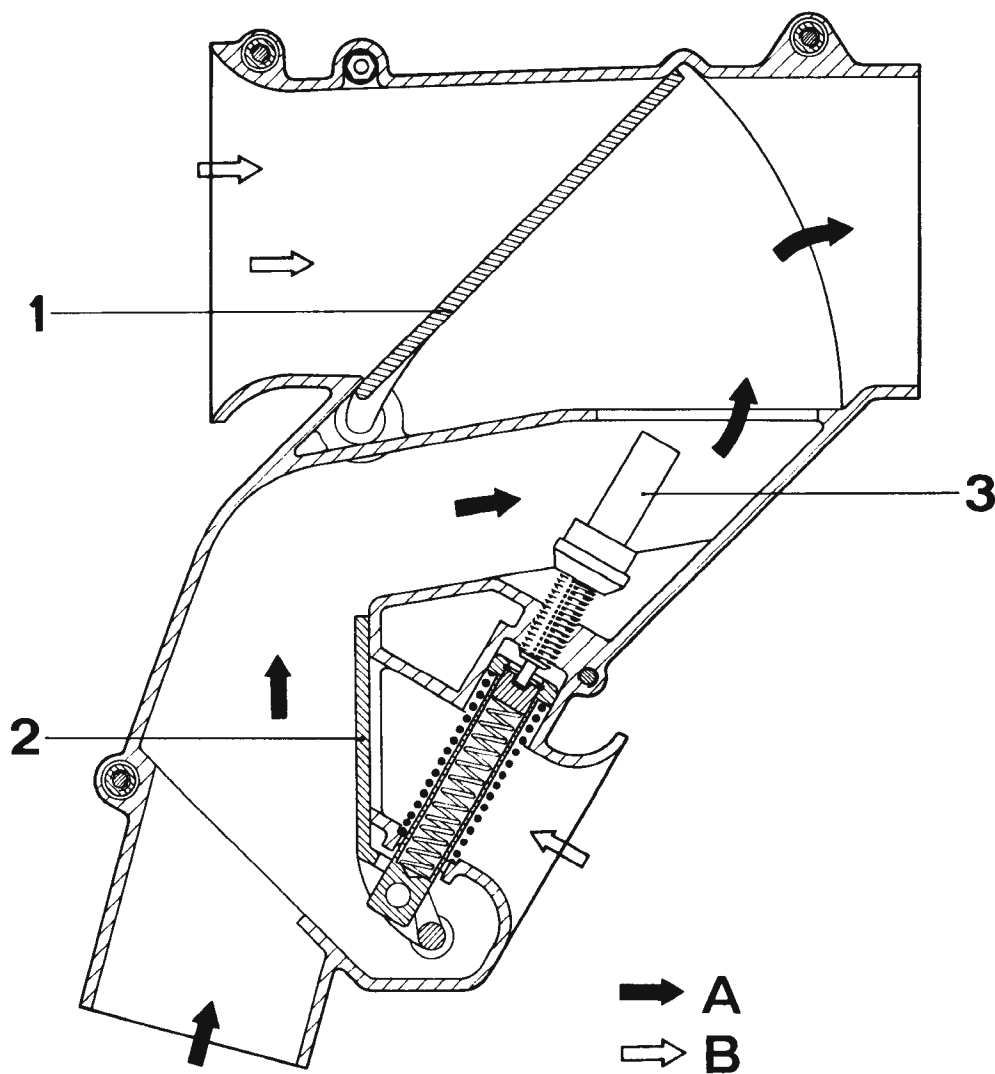
7 Injection pump  
8 Cold start enrichment hose

## INDUCTION AIR PREHEATING - BEGINNING WITH 1972 MODELS

## General Information

Beginning with the 1972 models, all 2.4 liter fuel injection engines are equipped with an induction air preheating system.

Induction air preheating provides even induction air temperatures in lower engine speed ranges resulting in improved performance, as well as lower exhaust emission values.



1 = Fresh air flap

2 = Hot air flap

3 = Thermostat

A = Hot air

B = Fresh air

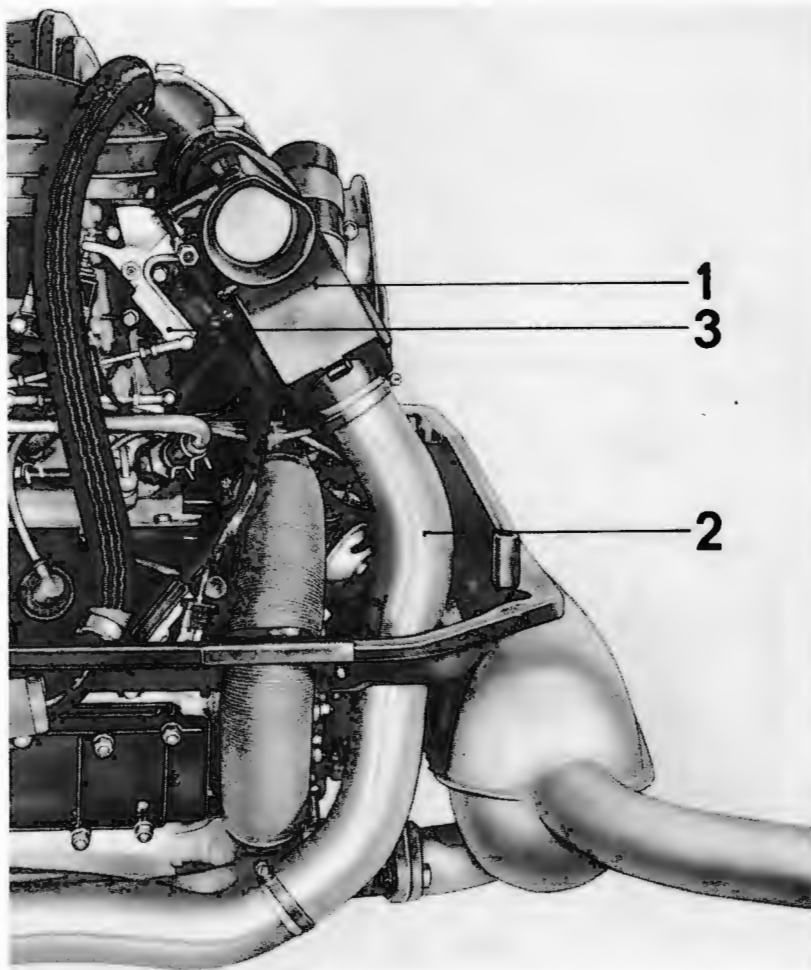
**Design**

The induction air preheating system consists of:

1. A regulator housing which is attached to the left velocity stack by three 6 mm bolts. It contains two flaps and a thermostat.

One of the flaps (the fresh air flap) is controlled by the throttle linkage. The other flap (hot air flap) is controlled by the thermostat.

2. A hose which feeds heated air from the left heat exchange.
3. A cam on the left throttle valve lever which controls the fresh air flap.



- 1 Control box
- 2 Hot air supply duct
- 3 Control lever

**Function** A thermostat-controlled hot air flap maintains induction air temperature at 45°C (112°F). A second flap stops the flow of hot air from throttle valve position of about 20° and engine draws only fresh outside air at wide open throttle.

Engine started, cold (below 45°C (112°F))

Throttle at idle position (fresh air flap closed)

Hot air flap open, engine draws hot air from heat exchanger.

Engine cold (below 45°C (112°F)) - throttle in partial load position

Hot air flap open. It opens according to position of cam. Fresh outside air is added.

Fresh air flap is fully open in full throttle position.

Air temperature rises to 45-50°C (112°F - 122°F)

Thermostat begins to close hot air flap at 45°C (112°F). It is fully closed at 50°C (122°F) and engine draws only fresh outside air.

A bypass duct, closed by the hot air flap when cold, feeds additional air with increasing temperatures.





## REMOVING AND INSTALLING REGULATOR HOUSING

## Removing

1. Detach hot air hose between left heat exchanger and regulator housing, then remove hose between regulator housing and air cleaner intake.
2. Remove 3 retaining bolts from left velocity stack and remove regulator housing.



## Installing

Adjust fresh air flap (see page 2.1-1/2).

## CHECKING OPERATION OF INDUCTION AIR PREHEATING SYSTEM

1. Hot air flap must be open when engine is cold. This can be checked through the bypass hole in the regulator housing. The hot air flap closes the bypass duct and stays in place under spring tension.



2. Warm up engine at about 2500 rpm. The hot air flap must close after about 3-4 minutes. Check flap position through bypass hole.

3. If the hot air flap, which is controlled by a thermostat, does not work, replace the regulator housing.

Note: The thermostat in the regulator housing can not be replaced. Replace the entire control box.

#### ADJUSTING FRESH AIR FLAP

1. Adjust fresh air flap with throttle valve linkage set in idle position.

2. Adjust roller for fresh air flap lever with both nuts so that the roller touches the control lever without play. Lock the nut.

#### Note:

After adjusting, check that the fresh air flap begins to open with throttle valves set at 20°.



REPLACING FRESH AIR FLAP LEVER

**Caution**

Prevent nut from falling into regulator housing by holding nut of retaining bolt during removal.

1. Remove bolt and lever.

**Note:**

Hold lock nut with punch or scriber. The nut can fall into the control box.



1 Nut  
2 Spring washer

3 Washer  
4 Lever

5 Control box  
6 Nut

## INSTALLING HOSE CLAMPS FOR COLD START ENRICHMENT

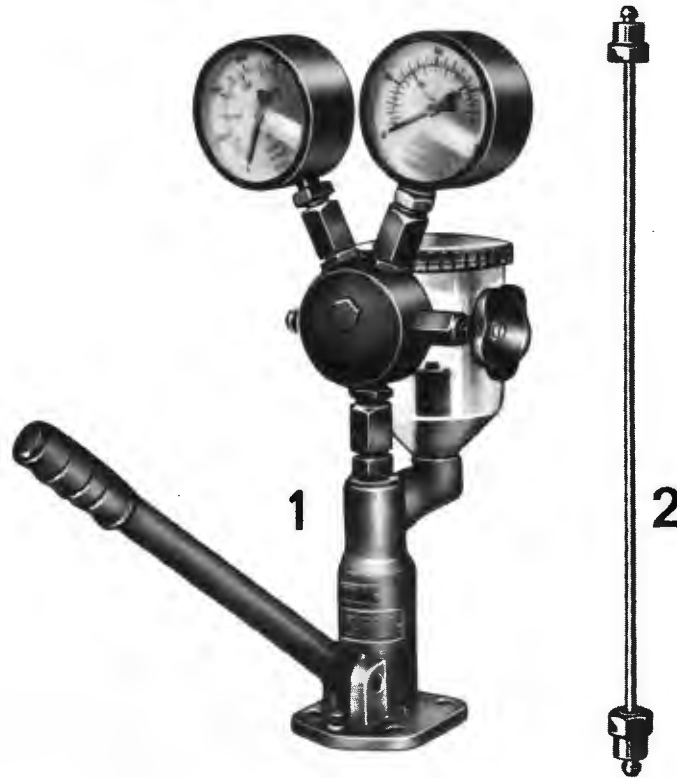
Tighten hose clamps with VW special tool  
Nr. ASE 000 049.

Note:  
The hose clamps can be used only once.



FUEL INJECTION

TOOLS



Nr.	Description	Special Tool	Remarks
1	Injection nozzle tester with two pressure gauges		Use Bosch or similar injection nozzle tester. Pressure gauge range: 0-25 kg/cm <sup>2</sup> (0-355 psi)
2	Line with fittings		Use Bosch EF 8040/30 or similar

## CHECKING FUEL INJECTION NOZZLES

### General

The injection nozzle tester is used for checking nozzle leakage, opening pressure and spray pattern.

### Caution

Fill container of tester with Bosch Testing Oil 61 v 11 or similar before testing the nozzles. Do not use gasoline.

### Bleeding the Tester

1. Open bleeder screw.

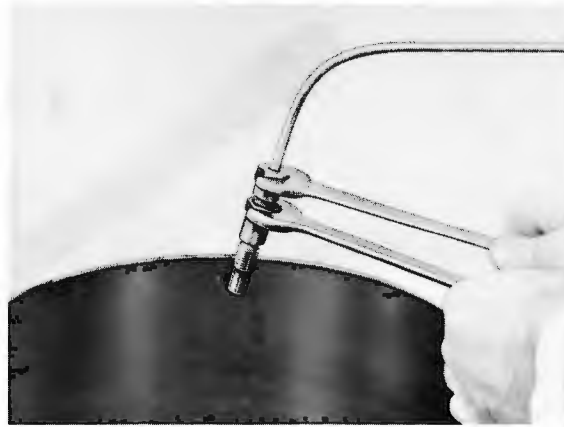


2. Actuate lever until testing oil comes out of the bleeder without air bubbles.

3. Tighten bleeder screw.

4. Connect nozzle to pressure line but do not tighten nozzle to line. Actuate hand lever until no more bubbles come out at the coupling nut.

5. Tighten nozzle to line.



### Checking nozzle

#### Note

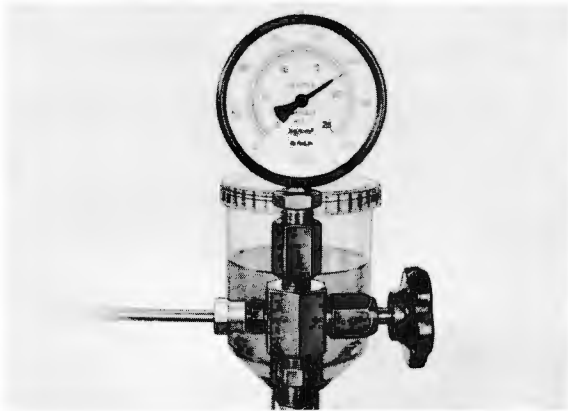
Injection nozzles can be replaced individually. Faulty nozzles cannot be repaired and must be replaced.

### Checking Opening Pressure

1. Pump tester lever quickly in succession with pressure gauge shut off (knob turned fully to right).
2. Turn pressure gauge on (knob turned fully to left) and push down tester lever slowly until the nozzle sprays. Read opening pressure on gauge. Opening pressure should be between 16-18  $\text{kp}/\text{cm}^2$  (228-256 psi).



2. The spray pattern should be "tight" and well atomized. Nozzles which spray to the sides must be replaced.



### Caution

When the pressure gauge is turned on, increase pressure slowly since otherwise the gauge can be damaged.

### Checking Spray Pattern

1. This test should be made only with the pressure gauge turned off. The spray pattern can be analyzed only when the lever is pumped quickly.

### Checking Leakage

Pump up pressure to 15  $\text{kp}/\text{cm}^2$  (213 psi). No test oil should drip from nozzle within 25 seconds. Replace if necessary.





## ADJUSTING FUEL INJECTION PUMP WITH EMISSION TESTER

## Special Tools

P 228 c Protractors

1. Bring engine to operating temperature (about 80°C/175°F).
2. Connect emission tester according to the manufacturer's instructions.
3. Attach protractor, special tool P 228 c, to the right throttle valve housing (if equipped with air conditioner, attach to left throttle valve housing). Adjust pointer to 0°.

## Note

Hand throttle lever must be all the way off.



4. Using hand throttle or locally manufactured tool, open throttle 9°; actuate gas pedal a few times to take strain off linkage.
5. Determine exhaust emissions by road test or dynamometer test. Under partial load the 2400 rpm with a 9° throttle opening the exhaust emissions (CO%) should be:
 

911 T	1.5 - 2.0 % CO
911 E and S	2.0 - 2.5 % CO (Europe 2, 0-3, 0)
At idle (900 ± 50 rpm)	2.5 ± 0.5 % CO

For typical road test see page SF 35.

Adjustment instructions for injection pump are shown on page SF 36.

## Note

The intake air preheating system eliminates the necessity for monitoring intake air temperature.

## ADJUSTING ENGINE IDLE

### Special tools

P 230 c Socket (8 mm)

1. Bring engine to operating temperature.
2. Check idle speed. If idle speed is too high or too low, readjust air correction screws on throttle valve housings as needed. Turning screws in, lowers idle. Turning out, increases idle. Check air flow of individual cylinders at 2000 - 2400 rpm synchronometer, special tool P 235. See page SF 40 for adjusting instructions.



### Note

If resetting the air correction screws shows no reaction on the synchronometer, then the idle passages in the throttle valve housings are carboned up and must be cleaned.

3. Connect emission tester and check CO emissions. If CO value is not within the prescribed limit, shut off engine and readjust idle speed injection quantity on pump.

### Caution

Do not start engine while adjusting idle speed injection quantity.

4. The idle adjusting screw can be reached with special tool P 230 c through a hole which is covered by a plastic cap in the cooling air upper shroud.

5. Remove cap.

6. Depress the spring-loaded idle adjusting screw with special tool P 230 c until you can feel it engage with the slot of the centrifugal governor.



CO emissions: 2,0 - 3,0 %  
(Europe 2,5 - 3,5)



lean



rich

8. Idle speed can change after CO emissions have been adjusted at idle speed (900  $\pm$  50 rpm).



9. Adjust idle speed by turning the air correction screws. Recheck with synchrometer.

7. Turn adjusting screw counter-clockwise for a leaner mixture and clockwise for a richer mixture.

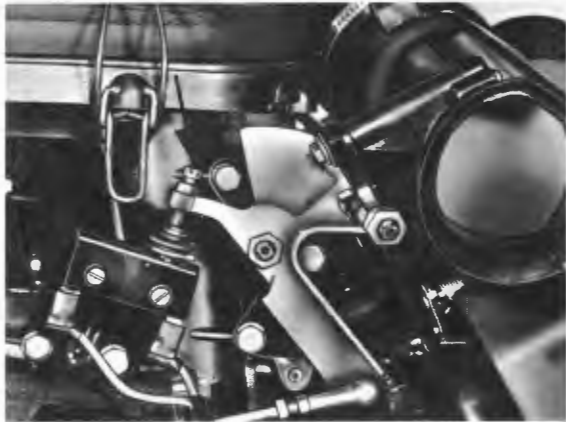
Do not adjust by more than 1 notch at a time. A maximum of three notches is allowed to either the right or left of the basic adjustment.

#### Note

Adjustments at idle speed and under partial load should be made as quick as possible so that the velocity stack area does not heat up. Drive the car a short distance or run engine slightly faster (about 3000 rpm) before making another CO test on road or dynamometer. This will cool off the velocity stack area.

ADJUSTING MICRO SWITCH - BEGINNING WITH 1972 MODELS -

1. Loosen lock nut and back off adjusting screw until the micro switch is not closed in idle position.



2. Turn the adjusting screw from this position until the micro switch closes (listen for click sound).

3. Turn adjusting screw 1/4 turn farther in. Tighten lock nut.

Note

The micro switch must be readjusted whenever the throttle valve linkage or injection pump linkage has been reset.

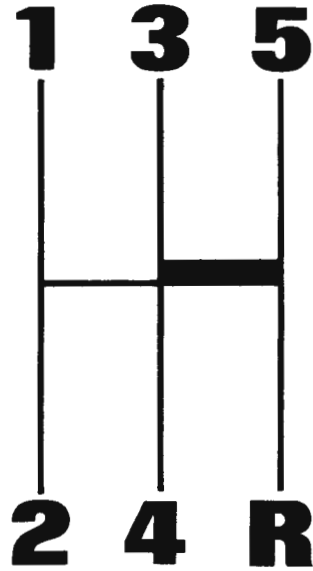
## FOUR AND FIVE SPEED TRANSMISSION (TYPE 915)



Beginning with 1972 models, all Type 911 vehicles are equipped with the new, reinforced 4-speed transmission. The 5-speed transmission is optional.

## DESIGN AND FUNCTION

The five forward speeds and reverse are arranged in a double "H" shift pattern.



1st speed: left forward

2nd speed: left back

3rd speed: straight forward

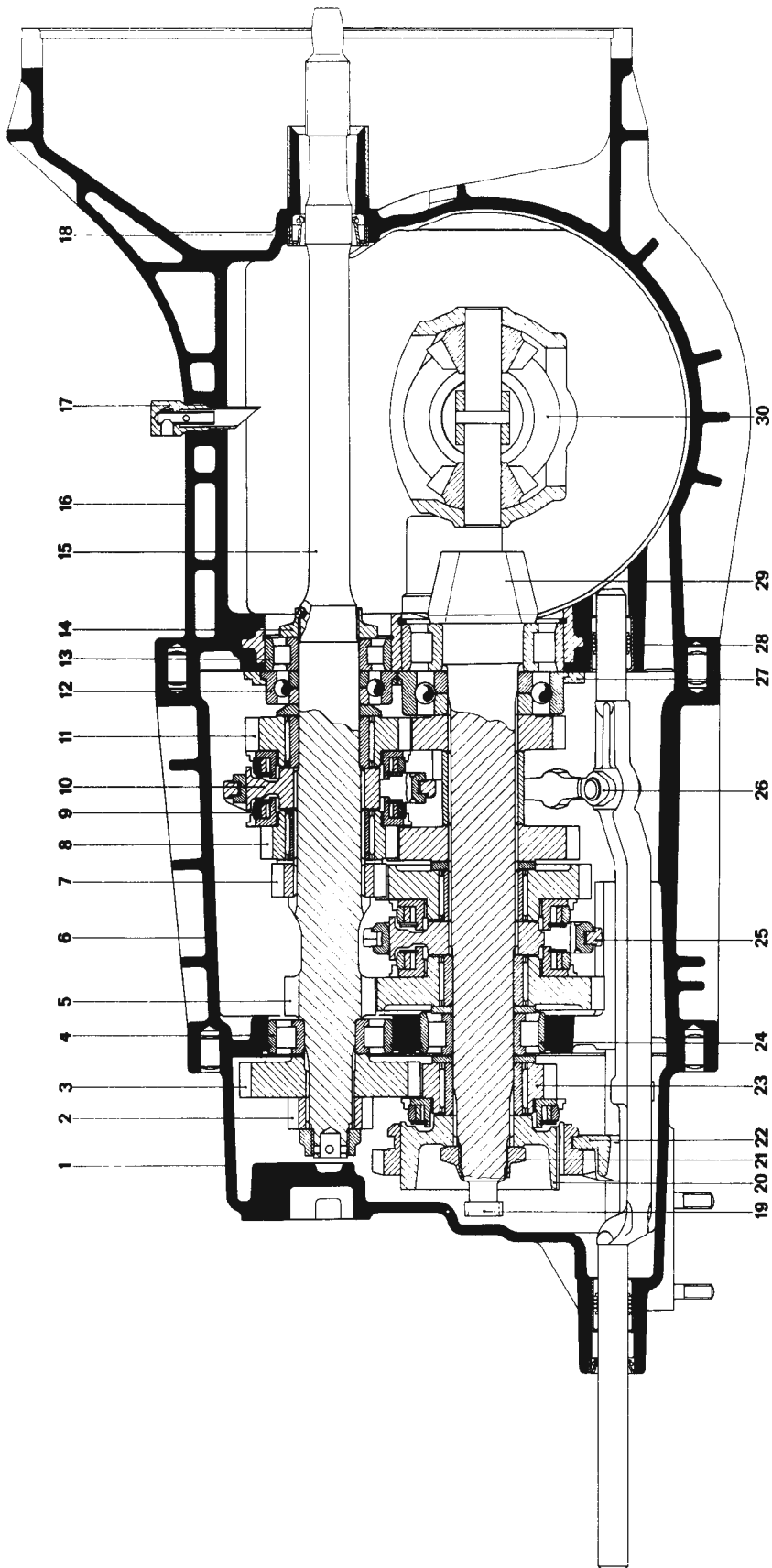
4th speed: straight back

5th speed: press right overcoming spring detent, then straight forward

Reserve: press right overcoming spring detent, then straight back

Clutch pedal must be fully depressed and selected gear fully engaged.







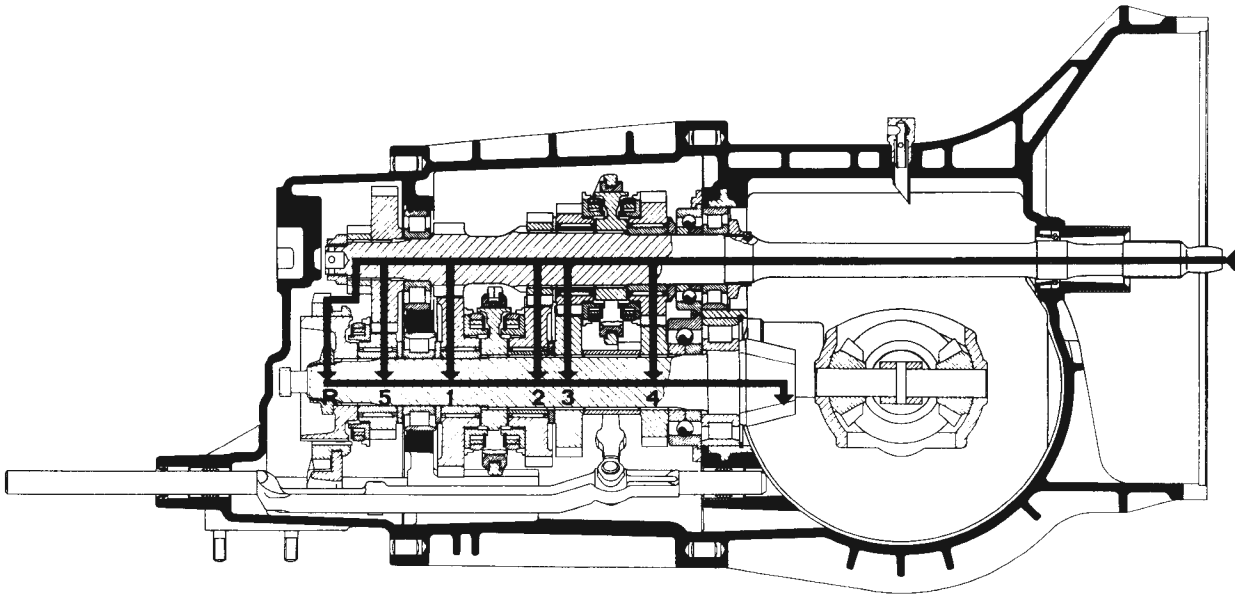
- 
- |                                |   |
|--------------------------------|---|
| 1 - Transmission front cover   | 16 - Transmission housing               |
| 2 - Reverse, Gear I            | 17 - Breather                           |
| 3 - 5th speed, Gear I, fixed   | 18 - Seal                               |
| 4 - Roller bearing             | 19 - Speedometer drive, Gear I          |
| 5 - 1st speed, Gear I, fixed   | 20 - Spider, 5th and reverse speeds     |
| 6 - Gear housing               | 21 - Flange nut                         |
| 7 - 2nd speed, Gear I, fixed   | 22 - Shift fork, 5th and reverse speeds |
| 8 - 3rd speed, Gear I, free    | 23 - 5th speed, Gear II, free           |
| 9 - Synchronizing ring         | 24 - Roller bearing                     |
| 10 - Spider (Synchro hub)      | 25 - Shift fork, 1st and 2nd speeds     |
| 11 - 4th speed, Gear I, free   | 26 - Selector shaft                     |
| 12 - Pinion shaft ball bearing | 27 - Bearing retaining plate            |
| 13 - Roller bearing            | 28 - Ball sleeve                        |
| 14 - Flange nut                | 29 - Pinion shaft                       |
| 15 - Input shaft               | 30 - Differential                       |

## POWER FLOW

In all gears, power flow is from the input shaft to the pinion shaft through the respectively engaged gear pair. The engaging and synchronizing parts for 1st, 2nd, and 5th gears are on the pinion shaft, and those for the 3rd and 4th gear are on the input shaft.

Torque transfer occurs only through the respective gear pair. Engagement of the 1st, 2nd, and 5th gears is made by repositioning the shifting sleeve or sliding gear located on the pinion shaft, and that of 3rd and 4th gears by one located on the input shaft.

Power flow in reverse gear is from the input shaft through the reverse idler gear, the sliding gear, to the pinion shaft.

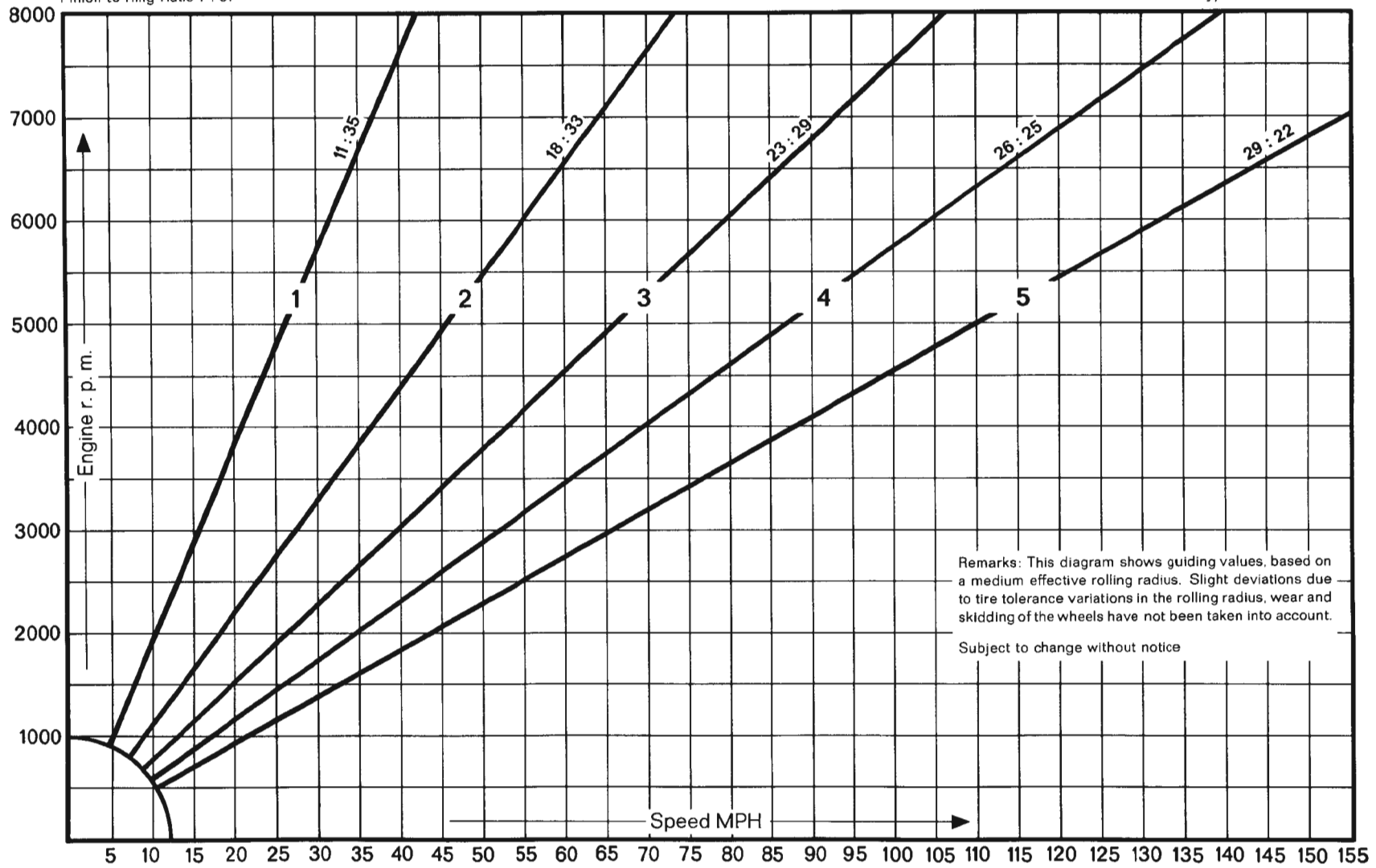


# Transmission Diagram

# 5-speed-transmission

Pinion to Ring Ratio 7 : 31

Type 915 Transmission

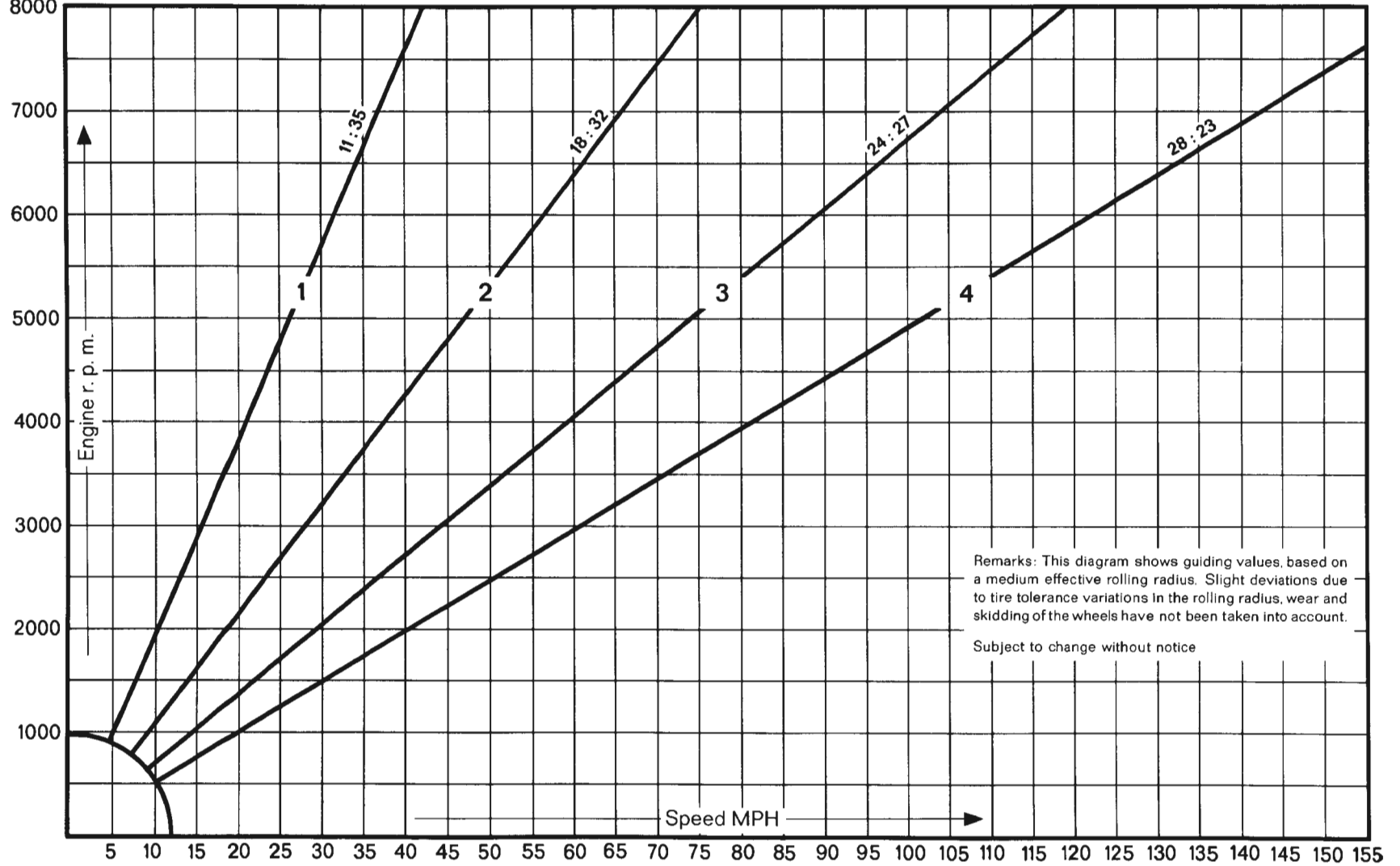


# Transmission Diagram

# 4-speed-transmission

Pinion to Ring Ratio 7 : 31

Type 915 Transmission



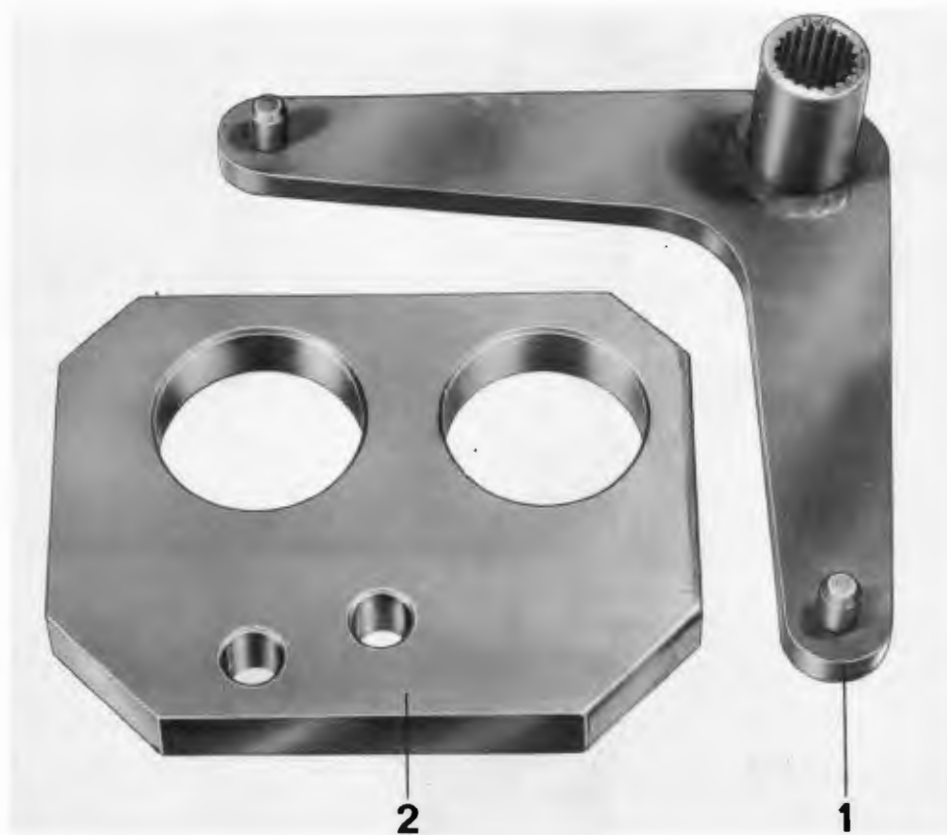
TIGHTENING TORQUES

Location	Description	Thread	Grade	mkp	ft. lbs.
Transmission housing (oil drain)	Magnetic plug	M 24 Tapered	St 37	2.0 - 2.5	14.5 - 18.1
Transmission housing (oil filler)	Oil filler plug	M 24 Tapered	St 37	2.0 - 2.5	14.5 - 18.1
Transmission housing - side and front cover, guide fork cover	Nut, center lock type	M 8 x 1.25	x 12 Cr Ni 18-8	2.2 - 2.5	15.9 - 18.1
Front cover	Backup light switch	M 18 x 1.5	Ms	3.5 - 4.0	25.3 - 28.9
Input shaft	Flange nut	M 30 x 1.5	8.8	16.0 - 18.0	115.7 - 130.2
Input shaft	Castellated nut	M 18 x 1.5	6.8	12.0 - 14.0	86.8 - 101.3
Retaining plate and transmission support attachment	Nut	M 8 x 1.25	8	2.1 - 2.3	15.2 - 16.6
Pinion shaft	Flange nut	M 24 x 1.5	8	14.0 - 16.0	101.3 - 115.7
Guide fork, shifting	Nut	M 6 x 1.0	8	0.8 - 0.9	5.8 - 6.5
Shift detent, transmission housing	Nut	M 10 x 1.5	8.8	1.5 - 1.8	10.8 - 13.0
Transmission housing	Breather	M 16 x 1.5	9 S 20 K	2.0 - 3.0	14.5 - 21.7
Shift forks	Nut	M 8 x 1.25	8.8	2.4 - 2.6	17.4 - 18.8
Ring gear (differential)	Bolt	M 12 x 1.25	11.9	11.5 - 12.0	83.2 - 86.8
Axle flange	Expansion bolt	M 10 x 1.5	8.8	2.6 - 3.0	18.8 - 21.7
Starter attachment	Nut	M 10 x 1.5	8	4.6 - 4.8	33.3 - 34.7

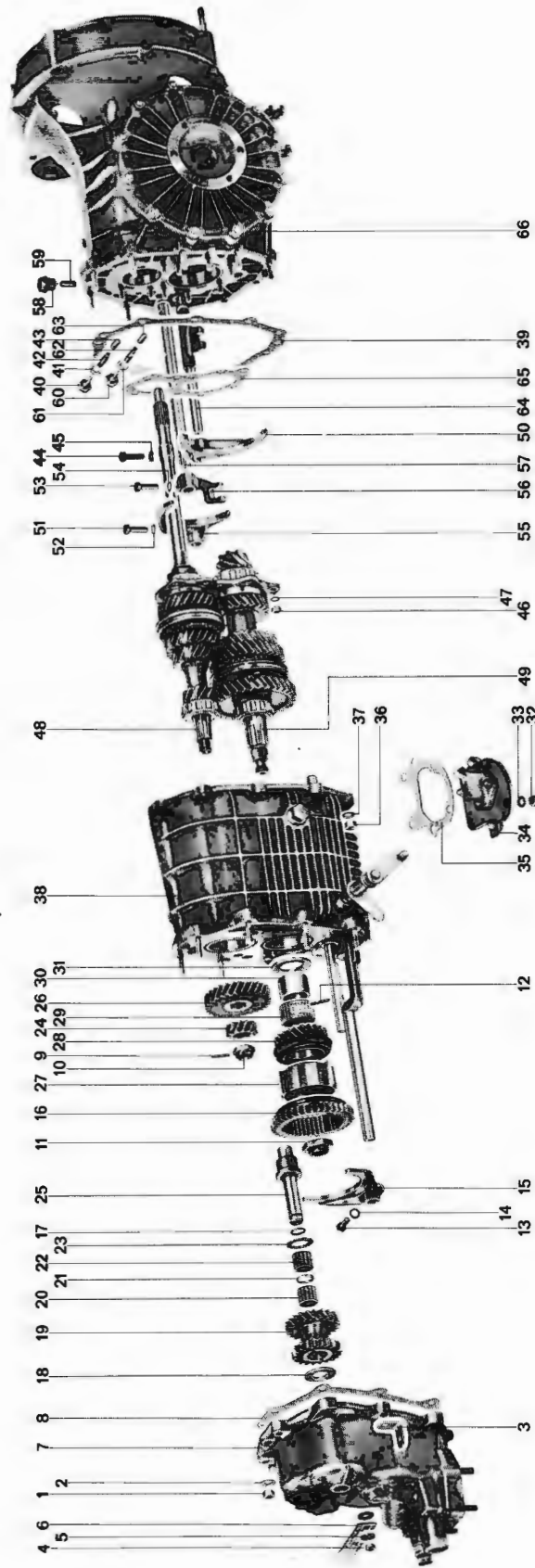


## DISASSEMBLING AND ASSEMBLING MANUAL TRANSMISSION

## TOOLS



Nr.	Description	Special Tool	Remarks
1	Input shaft holder	P 37a	
2	Shift rod holder	P 260a	





Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Self-locking nut	8		Replace if necessary, torque to specification.	
2	Washer	7			
3	Clutch cable bracket	1			
4	Self-locking nut	1		Replace if necessary, torque to specification.	
5	Washer	2		Place one on each side of ground strap.	
6	Ground strap	1			
7	Front transmission cover	1			
8	Gear housing gasket	1		Replace.	
9	Roll pin	1	Drive out.	Replace if necessary.	
10	Castellated nut	1		Torque to specification.	3.1-1/13
11	Flange nut	1		Replace, torque to specification.	3.1-1/13
12	Roll pin	1	Drive out.	Replace if necessary.	
13	Bolt	1		Torque to specification.	
14	Spring washer	1		Replace if necessary.	
15	Shift fork, 5th and reverse gear	1		Readjust.	3.1-2/2

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
16	Sliding gear, 5th and reverse gear	1		Check for wear.	
17	O-ring	1		Replace, oil lightly.	
18	Thrust washer	1			
19	5th and Reverse idler gear	1		Check for wear.	
20	Needle bearing cage	1		Check for wear.	
21	Intermediate ring	1			
22	Needle bearing cage	1		Check for wear.	
23	Thrust needle bearing cage	1		Check for wear.	
24	Reverse speed, Gear I	1		Replace in pairs only.	
25	Shaft for 5th and Reverse idler gear	1	Remove together with fixed Gear I of 5th speed.	Install together with fixed Gear I of 5th speed.	
26	Gear I, fixed, 5th speed	1		Small flange faces gear housing. Replace in pairs only.	
27	Guide sleeve	1		Check for wear.	
28	Gear II, free, 5th speed	1		Check synchronization. Replace in pairs only.	3.1-8/4
29	Needle bearing cage	1	Mark position for installation.	Install with same gear.	
30	Bushing	1	Mark position for installation.	Install with same gear.	

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
31	Thrust washer	1			
32	Self-locking nut	4		Replace if necessary, torque to specification.	
33	Washer	4			
34	Cover with guide fork	1			
35	Gasket	1		Replace.	
36	Self-locking nut	10		Replace if necessary, torque to specification.	
37	Washer	10			
38	Gear housing	1	Move selector fork rod for 5th speed and reverse into neutral and remove.		
39	Gasket	1		Replace.	
40	Nut	1		Torque to specification.	
41	Seal	1		Replace.	
42	Spring	1			
43	Short detent	1		Check for free move- ment.	
44	Nut	1		Torque to specification.	
45	Spring washer	1		Replace if necessary.	
46	Nut	10		Torque to specification.	
47	Lock washer	10		Replace.	

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
48	Input shaft	1	Remove together with pinion shaft, 1st and 2nd speed selector fork, and complete 3rd and 4th speed shift rod.		3.1-1/10
49	Pinion shaft	1			
50	1st and 2nd speed selector fork	1		Check for wear, readjust.	3.1-2/1
51	Bolt	1		Torque to specification.	
52	Spring washer	1		Replace if necessary.	
53	Bolt	1		Torque to specification.	
54	Spring washer	1		Replace if necessary.	
55	3rd and 4th speed selector fork	1		Check for wear, readjust.	
56	Shift guide	1		Check for wear, readjust.	
57	3rd and 4th speed shift rod	1			
58	Plug	1		Torque to specification.	
59	Short detent	1		Check for free movement.	
60	Bolt	1		Torque to specification.	

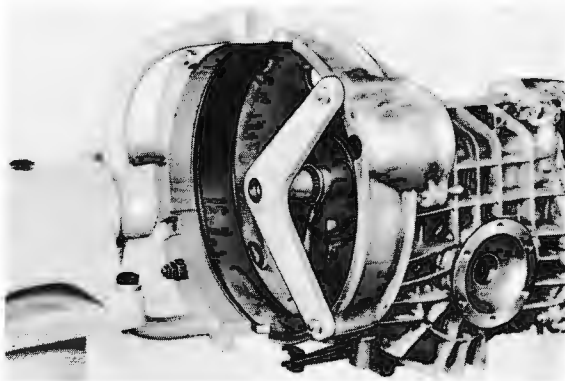
Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
61	Seal	1		Replace.	
62	Spring	1			
63	Short detent	1		Check for free movement.	
64	1st and 2nd speed selector fork rod	1			
65	Shim	X	Note thickness and quantity.	Recompute if necessary.	
66	Transmission housing	1			



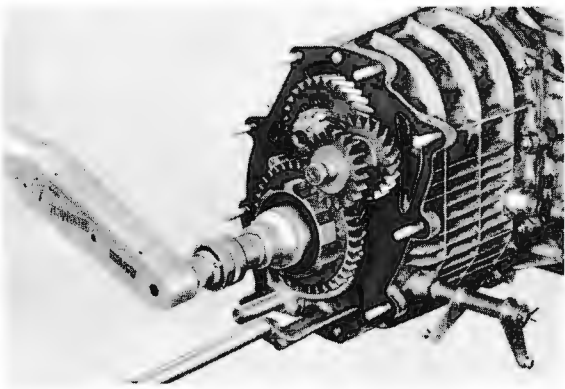
## DISASSEMBLING AND ASSEMBLING MANUAL TRANSMISSION

## Disassembling

1. Block input shaft with special tool P 37a, engage 5th gear.

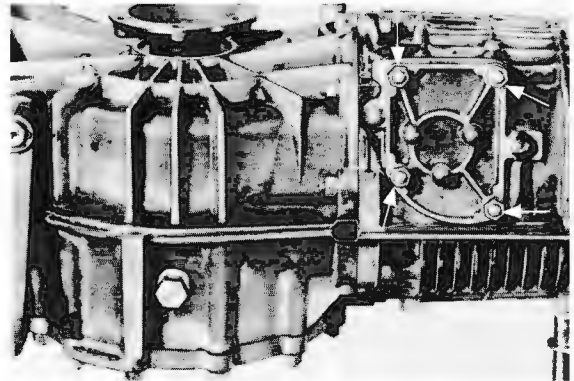


2. Remove castellated nut from input shaft, and flange nut from pinion shaft.



3. Mark needle bearing of 5th speed free gear; it must be reassembled with same gear.

4. Remove guide fork cover with gasket.



5. Remove nuts from gear housing. Pull housing and selector fork rod (5th and reverse speed), and selector fork rod with selector shaft off the studs (tap lightly with a plastic mallet, if necessary).

## Note

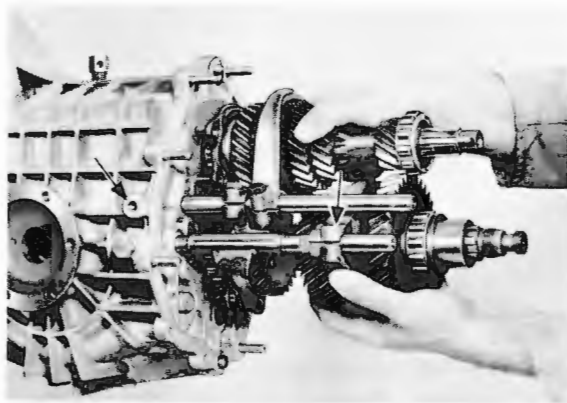
Selector fork rod for 5th and reverse speed must be in neutral. Otherwise the gear housing will bind against the rod and cannot be removed.

6. Remove shift detent plug (3rd and 4th gear).  
Take out spring and detent.

7. Remove bolt from selector fork of 1st and  
2nd gear, gently spread clamping piece with  
screwdriver.

8. Remove retaining plates for input and  
pinion shafts.

9. Take input and pinion shafts with complete  
selector fork rod (3rd and 4th speed) and  
selector fork (1st and 2nd gear) out of their  
seats.



10. Remove detent.

11. Remove plug from shift detent (1st and  
2nd gear) and take out spring and detent.

12. Take out selector fork rod 1st and 2nd  
gear.

13. Note the number and thickness of shims  
between transmission housing and retaining  
plates for reinstallation.



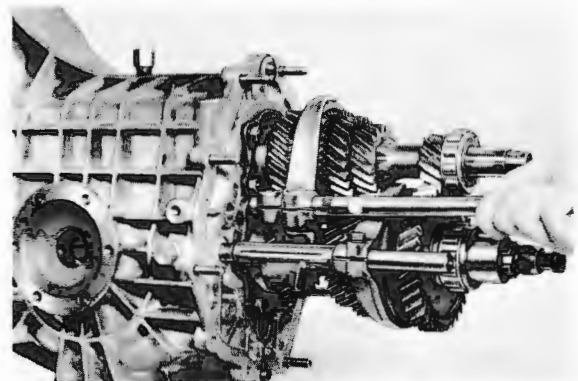
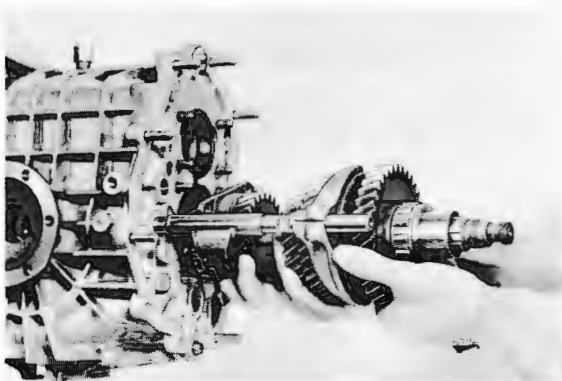
### Assembling

1. Place the same number and thickness of shims on the transmission housing studs as noted during disassembly or as determined while adjusting the pinion.
2. Insert 1st and 2nd speed selector fork rod.
3. Insert 1st and 2nd speed shift detent and spring.
4. Torque bolt to specification.
5. Insert pinion shaft with 1st and 2nd speed selector fork so that the pinion comes barely to rest in the bearing race of the transmission housing.

### Note

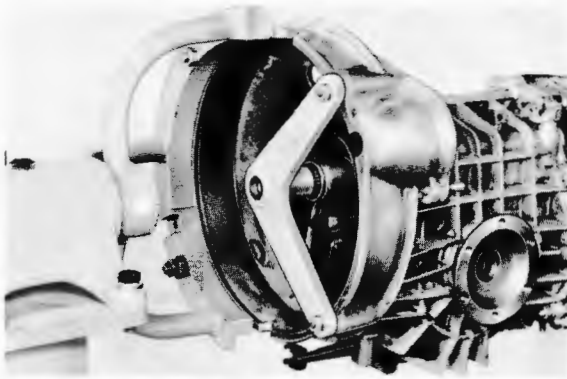
To keep the selector fork from binding on the selector fork rod, slightly open the selector fork clamping piece with a screwdriver.

6. Insert input shaft and push into place together with the pinion shaft.
7. Torque clamping plate nuts to specification.
8. Lightly tighten selector fork bolt (1st and 2nd speed).
9. Insert detent from the top.
10. Unscrew bolts for 3rd and 4th speed selector fork and fork clamping piece. Push fork and clamping plate back so that the selector fork and rod can be installed.



11. Lightly tighten selector fork and fork piece bolts.
12. Insert shift detent and spring, torque plug to specification.
13. Adjust selector forks (see 3.1-2/1).
14. Place transmission housing gasket on the studs.
15. Install gear housing together with selector fork rod (5th speed and reverse) and selector shaft. Tighten to correct torque.
16. Push selector fork rod in the ball sleeve, and selector shaft into the shift pawl guides.
17. Install guide fork cover and gasket. Tighten to correct torque.
18. Install idler gear shaft turning the shaft until the pin in the gear housing prevents it from turning.
19. Install reverse speed Gear I and start castellated nut on threads.
20. Install thrust washer for 5th speed free gear.
21. Install needle bearing with 5th speed free gear.
22. Install guide sleeve for 5th and reverse speed, start flange nut on threads.
23. Install thrust needle bearing cage, idler gear with needle bearing cages and intermediate piece and thrust washer on the idler shaft.
24. Slide 5th speed and reverse sliding gear with selector fork on guide sleeve and selector fork rod. Slightly open the selector fork clamping piece for easier assembly.
25. Lightly tighten selector fork bolt.
26. Apply light coat of oil to the O-ring and install.

27. Block input shaft with special tool P 37a, and engage 5th gear. Tighten input shaft castellated nut and pinion shaft flange nut to correct torque.



28. Adjust 5th and reverse speed selector fork (see page 3.1-2/2).
29. Secure castellated nut with roll pin; and flange nut by notching.
30. Insert actuating pin for backup light switch with recessed end toward switch.
31. Place gear housing gasket on studs. Install front transmission cover, and tighten nuts to correct torque.

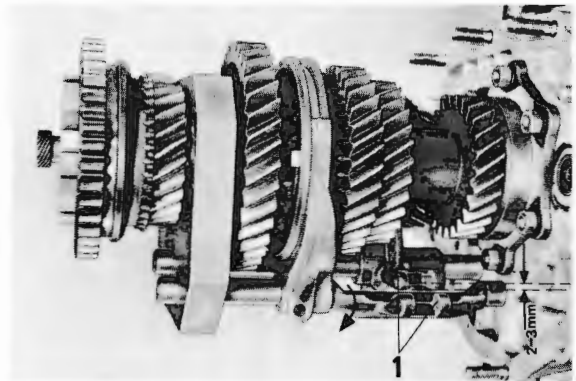


## ADJUSTING SELECTOR FORKS

**Note**

Tighten input shaft flange nut to correct torque before adjusting selector forks.

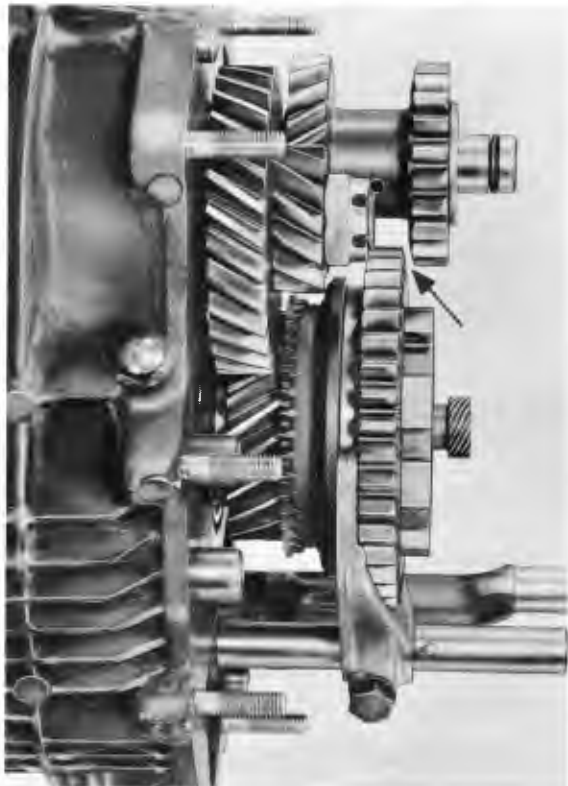
1. Install mounting plate P 260a. Install 5th speed synchro hub and 5th and reverse speed sliding gear.
2. Block input shaft with P 37a and engage 5th speed. Tighten input shaft flange nut to correct torque.
3. Turn selector fork rod of 1st and 2nd speed left (in driving direction) to stop, then turn slightly back until the unmachined flat inner surface is almost vertical. Do not turn it back beyond the middle point or all the way to the right stop.
4. Position the 1st and 2nd speed selector fork so that the shift sleeve is exactly in the middle between the synchronizing rings. Tighten bolt to correct torque.
5. Adjust 3rd and 4th speed selector fork in the same way as 1st and 2nd speed. Tighten bolt to correct torque.
6. Position 3rd and 4th speed shift guide flush with the selector fork. Make sure there is 2-3 mm (0.8-0.12 in.) clearance between the 3rd and 4th speed shift guide and the 1st and 2nd speed shift guide. They must not touch. (see illustration).
7. To ensure proper synchronization, check ease of shifting. Readjust if necessary.



1 - Install flush

## Adjusting 5th and Reverse Speed Selector Fork

1. Push the idler gear on shaft against fixed gear I of 5th speed. Adjust clearance between idler gear and sliding gear in neutral position. Clearance should be 1 mm (0.04 in.).



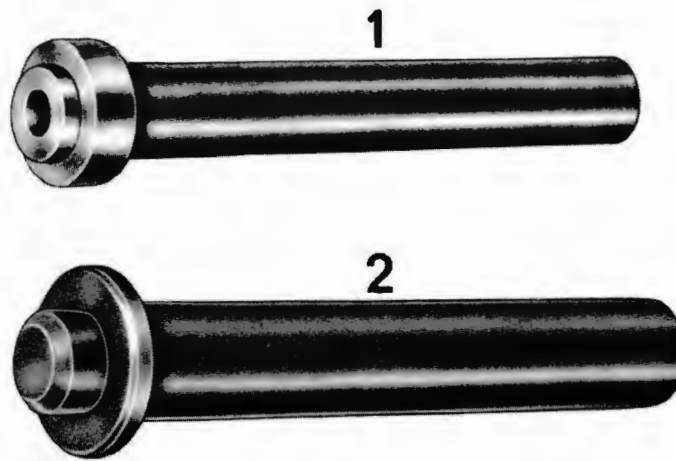
### Caution

Push the idler gear gently in direction of travel; there should be no play between the shift fork and the sliding gear groove. This eliminates the possibility of the sliding gear hitting the idler gear in cases of tolerance build-up.

2. Tighten selector fork bolt to correct torque.

## DISASSEMBLING AND ASSEMBLING FRONT COVER

## TOOLS



Nr.	Description	Special Tool	Remarks
1	Mandrel	P 374	
2	Mandrel	P 369	

Disassembling and Assembling Front Cover





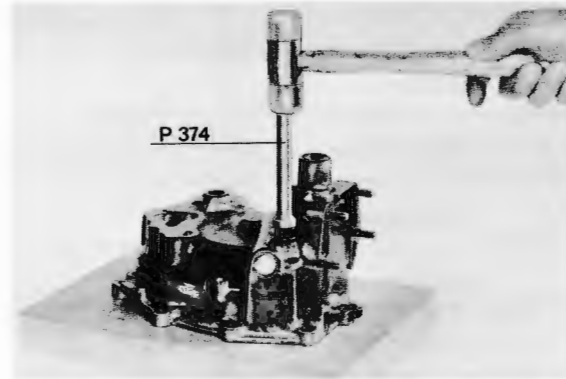
Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Backup light switch	1		Torque to specification.	
2	Actuating pin	1		Position properly.	3.1-1/13
3	Seal	1	Press out with small screwdriver.	Drive fully into seat with P 374.	3.1-3/4
4	Retainer	1		Replace if necessary.	
5	Thrust washer	1			
6	Speedometer drive	1			
7	Retainer	1		Seat properly.	
8	O-ring	1		Oil lightly.	
9	Positioning piece	1			
10	Worm shaft	1			
11	Seal	1	Pry out with screwdriver.	Drive in with P 369 until fully seated.	3.1-3/4
12	Shift rod bushing	1		Replace.	
13	Bushing	1	Heat the cover to approx. 120°C (250°F) on hot plate then pull out; drill out if necessary.	Heat the cover to approx. 120°C (250°F) on hot plate. Drive on with suitable mandrel.	
14	Transmission front cover	1			

## DISASSEMBLING AND ASSEMBLING

### Disassembling

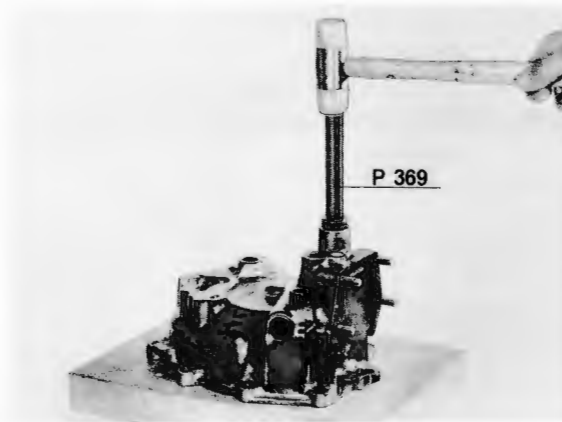
1. Heat transmission cover to approximately 120°C (250°F) and pull speedometer gear shaft bushing out; drill out, if necessary.

3. Drive on seal for speedometer drive with special tool P 374.



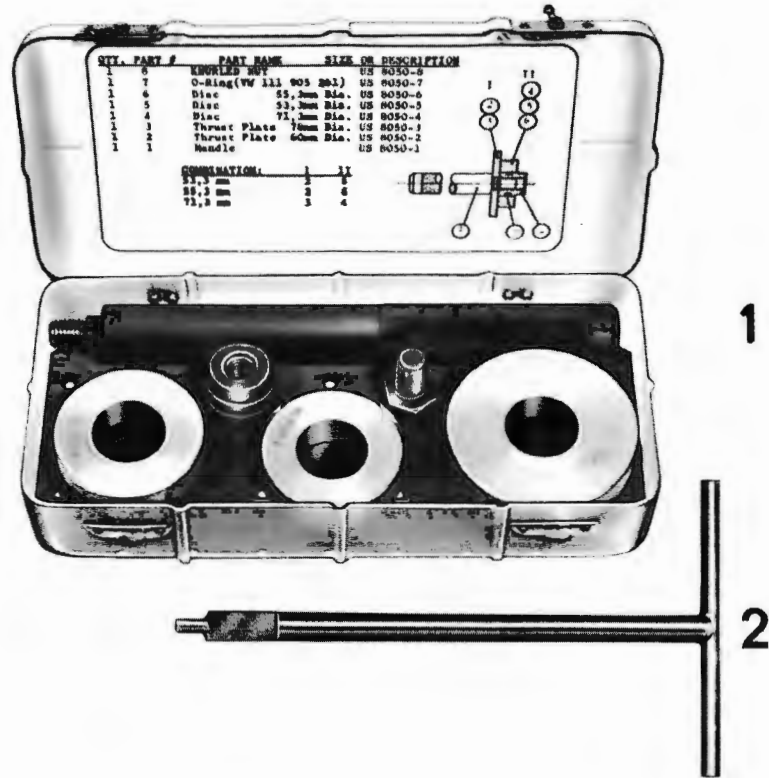
### Assembling

1. Heat transmission cover to approximately 120°C (250°F) and drive gear shaft bushing in with a suitable mandrel.
2. Drive on seal for shift rod with special tool P 369.



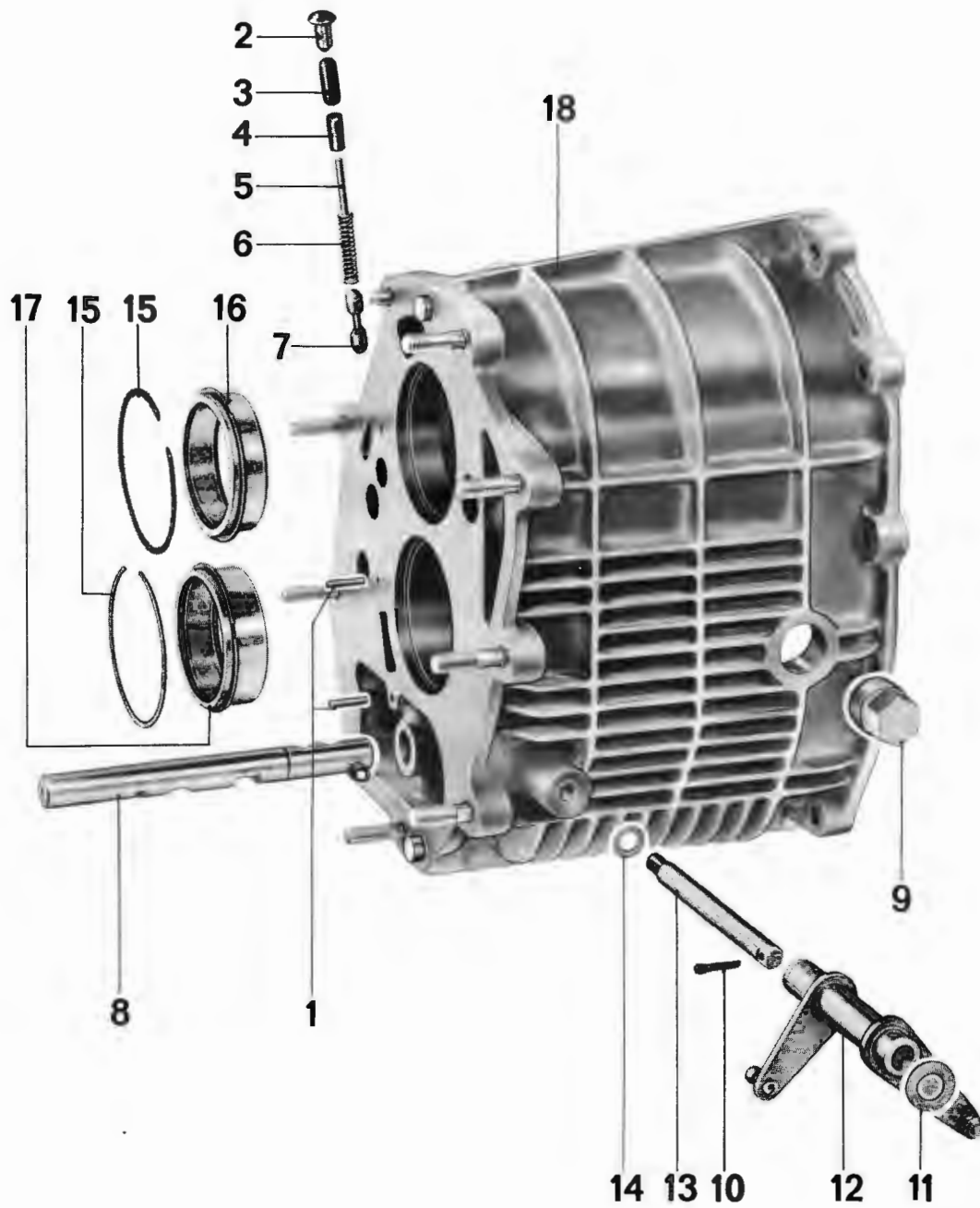
## DISASSEMBLING AND ASSEMBLING TRANSMISSION HOUSING

## TOOLS



Nr.	Description	Special Tool	Remarks
1	Driver Set	US 8050	
2	T-handle	P 366	

Disassembling and Assembling Transmission Housing



Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Roll pin	2	Drive out.	Tension spring with P 366 and drive in.	3.1-4/5
2	Plug	1	Drive out with flat chisel.	Replace if necessary.	
3	Short detent	1			3.1-4/5
4	Sleeve	1			
5	Pin	1			
6	Spring	1			
7	Long detent	1			
8	5th and reverse speed selector (shift) rod	1			
9	Plug	1		Torque to specification.	
10	Cotter pin	1		Replace.	
11	Washer	1			
12	Bellcrank for accelerator linkage	1			
13	Shaft	1			
14	Washer	1			
15	Retainer ring	2	Take out with small screwdriver.		
16	Bearing outer race	1	Heat gear housing to approx. 120°C (250°F) and drive out with special tool US 8050.	Heat gear housing to approx. 120°C (250°F) and drive in with special tool US 8050.	
17	Bearing outer race	1	Heat gear housing to approx. 120°C (250°F) and drive out with special tool US 8050	Heat gear housing to approx. 120°C (250°F) and drive in with special tool US 8050	
18	Gear housing	1			

## DISASSEMBLING AND ASSEMBLING

### Disassembling

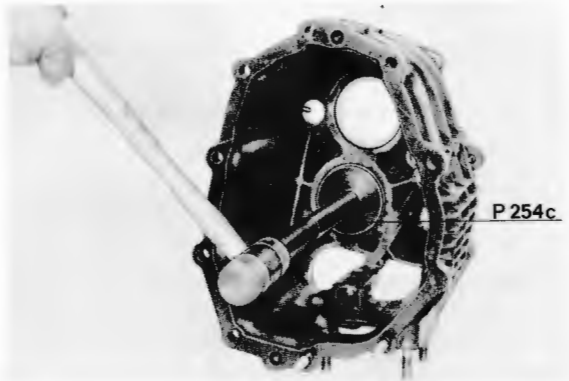
1. Drive shift detent securing roll pins out.

2. Drive half-round dowel pin out.

#### Note

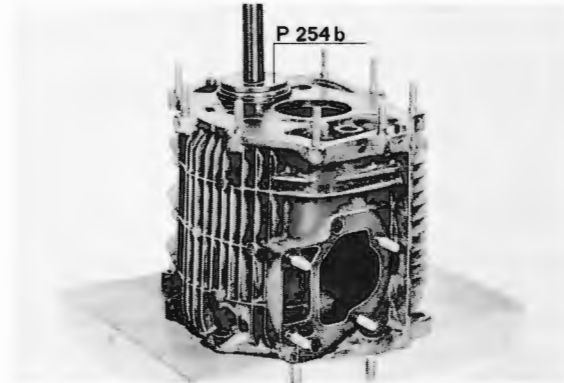
Detent components are under spring tension. Therefore, always remove the roll pin first, then the half-round dowel pin.

3. Heat gear housing to approximately 120°C (250°F) and drive bearing outer races out using special tool US 8050.



### Assembling

1. Heat housing to approximately 120°C (250°F) and drive bearing outer races in with special tool US 8050.



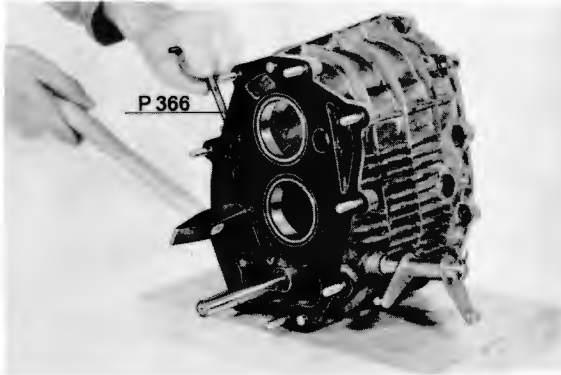
#### Caution

The bearing outer races differ in inside diameter. The race with the larger inside diameter belongs to the pinion shaft (lower shaft).

2. Install 5th and reverse speed shift rod.

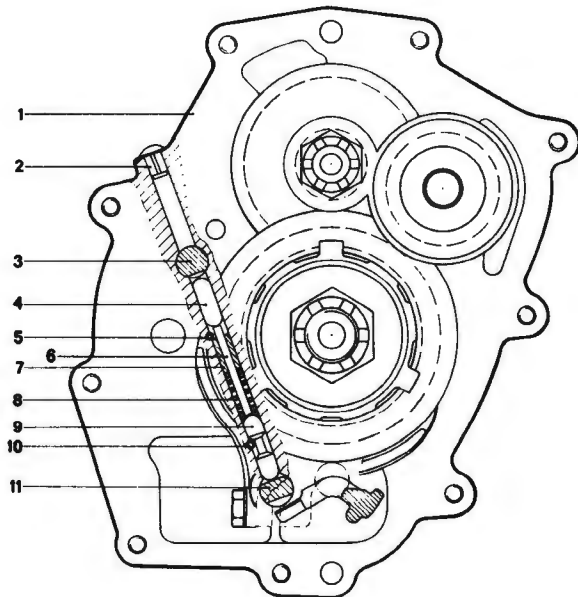
3. Insert long detent and drive roll pin in.

4. Install spring and sleeve, tension both with special tool P 366, and drive roll pin in.



- 1 - Gear housing
- 2 - Half-round dowel pin
- 3 - 3rd and 4th speed selector fork(shift) rod
- 4 - Short detent
- 5 - Roll pin
- 6 - Pin
- 7 - Sleeve
- 8 - Spring
- 9 - Long detent
- 10 - Roll pin
- 11 - 5th and reverse speed selector fork (shift) rod

5. Insert pin and detent (short), then drive the plug in.

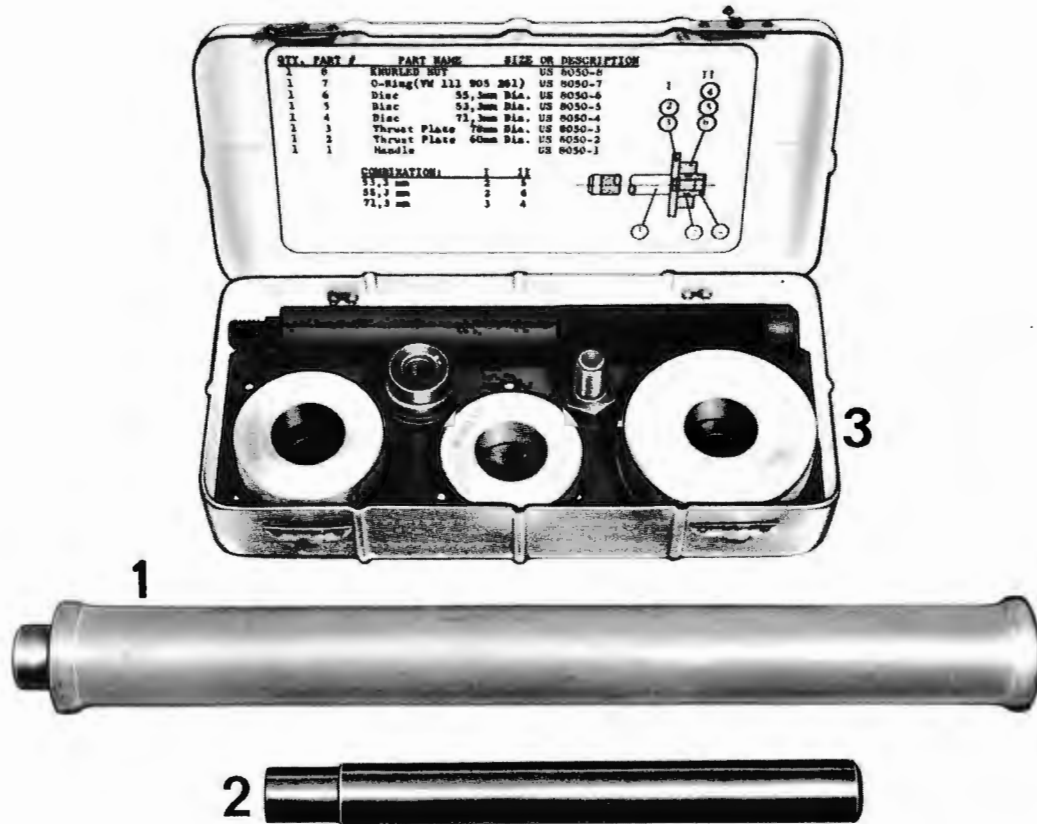




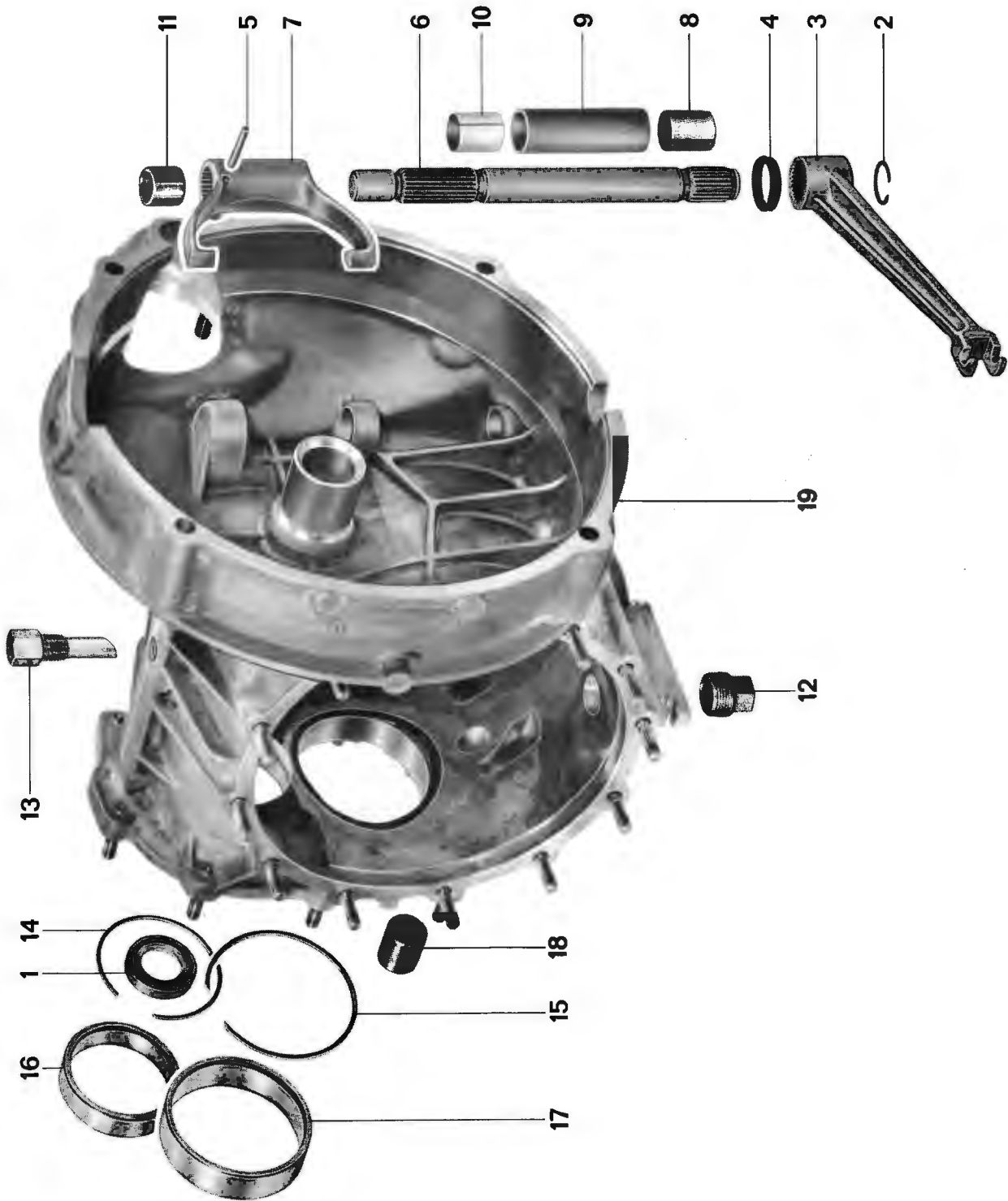


FINAL DRIVE HOUSING

TOOLS



Nr.	Description	Special Tool	Remarks
1	Mandrel	P 360a	
2	Mandrel	P 375	
3	Driver Set	US 8050	



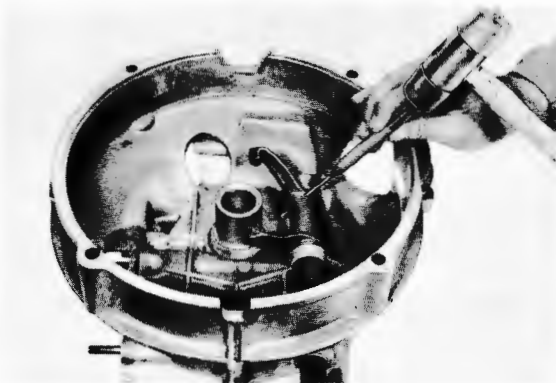
Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Input shaft oil seal	1	Drive out in direction of bell housing with an appropriate punch.	Install with P 360a. Sealing lip faces bell housing.	3.1-5/7
2	Snap ring	1		Replace.	
3	Throwout lever	1	Mark lever position on shaft to ensure proper reinstallation.	Readjust if necessary.	3.1-5/7
4	Seal	1		Replace if necessary.	
5	Roll pin	1	Drive out.	Replace if necessary.	
6	Lever shaft	1		Coat with multipurpose.	
7	Throwout fork	1		Readjust.	
8	Bushing	1	Drive out with P 375.	Drive in with P 375.	3.1-5/7
9	Cover tube	1			
10	Bushing	1	Drive out with P 375.	Drive in with P 375.	
11	Bushing	1			
12	Plug	1		Clean and torque to specification.	
13	Breather	1		Position properly, torque to specification.	3.1-5/6
14	Snap ring	1		Make sure it is properly seated.	

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
15	Snap ring	1		Note proper seating.	3.1-5/6
16	Bearing outer race	1	Heat transmission housing to 120°C (250°F) on a hot-plate and drive out with US 8050.	Heat transmission housing to 120°C (250°F) on hotplate and drive in with US 8050.	
17	Bearing outer race	1	Heat transmission housing to 120°C (250°F) on hotplate and drive out with US 8050.	Heat transmission housing to 120°C (250°F) on hotplate and drive in with US 8050.	
18	Needle bearing/ bushing	1	Drive out with appropriate mandrel.	Drive in with appropriate mandrel.	
19	Transmission housing	1			

## DISASSEMBLING AND ASSEMBLING FINAL DRIVE HOUSING

## Disassembling

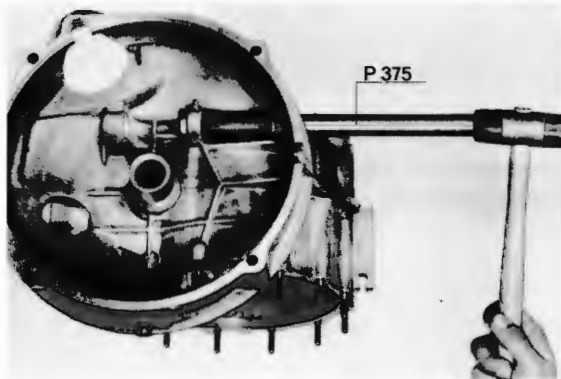
1. Drive out input shaft seal in direction of bell housing with an appropriate mandrel.
2. Drive roll pin out.



## Caution

Mark throwout lever and shaft to ensure proper position when installing.

3. Drive out lever shaft bushings with special tool P 375.



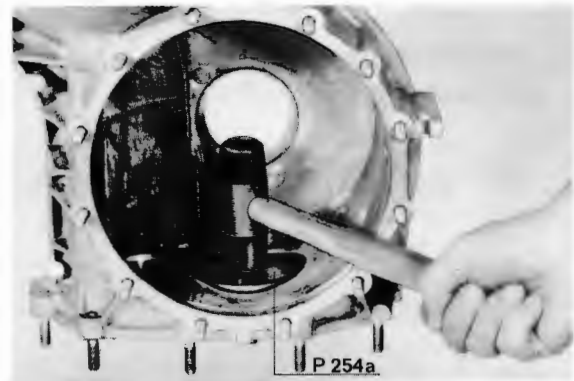
4. Remove bushing.

5. Using a small screwdriver, remove both snap rings from the housing for input shaft and pinion shaft bearings.

## Note

The retaining rings are pressed against the housing by the bearing outer races. For this reason, first loosen the bearing racer from the snap rings with a punch.

6. Heat housing to approximately 120°C (250°F) on a hotplate and drive out both bearing outer races with special tool US 8050.



7. Drive out shift rod needle bearing/bushing from inside of housing using an appropriate mandrel.

## Assembling

### Caution

When cleaning the final drive housing, do not use corrosive cleaning materials as they will damage the magnesium alloy.

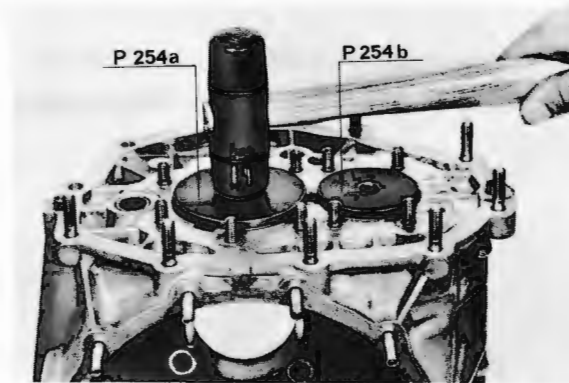
1. Clean housing and check for wear, external damage, and cracks. If repair is due to broken pinion shaft of ring gear, check for damage in center web bearing bores. Replace the housing if necessary.

2. Install bearing outer race snap rings in housing grooves.

### Note

Position the large snap ring so that its gap will rest in the groove in the housing. In no case should the snap ring gap appear at the sides where the groove is interrupted by a machined cut.

3. Heat housing to approximately 120°C (250°F) on a hotplate and drive both bearing outer races in with special tool US 8050.



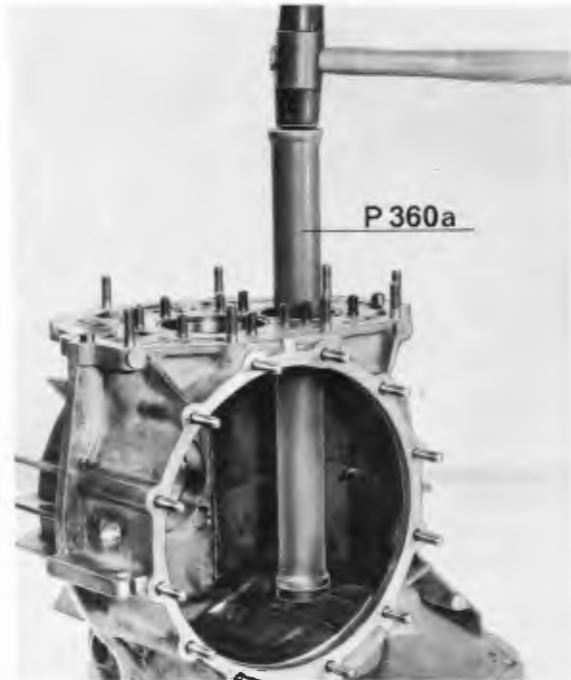
4. Install breather and torque to specification.



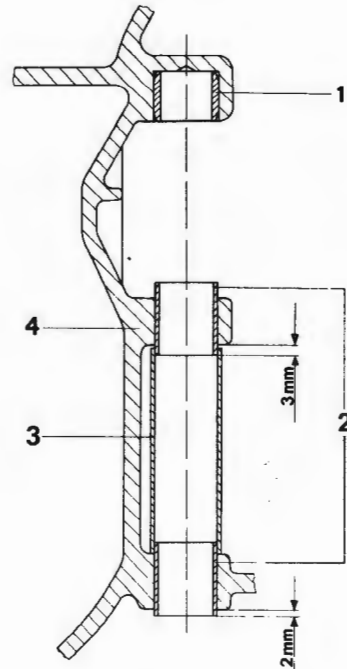
### Note

The opening in the hex part of the breather must face forward in direction of travel (toward transmission front cover).

5. Install input shaft seal with P 360a. Sealing lip faces bell housing.



6. Install lever shaft bushings with special tool P 375 (see sketch).



- 1 - Bushing  
 2 - Lever shaft bushing  
 3 - Cover tube  
 4 - Transmission housing

7. Assemble clutch controls.

#### Note

Throwout fork and throwout lever must be adjusted on the lever shaft splines in order to attain proper lever travel.

#### Important

8. After making repairs to transmission, apply new protective undercoating to the entire outside of the housing.

The adjustment dimensions are:  
From top edge of the bell housing to the tip of  
the throwout fork = 70 mm



From top edge of bell housing to the bottom  
throwout lever cut-out = 79 mm





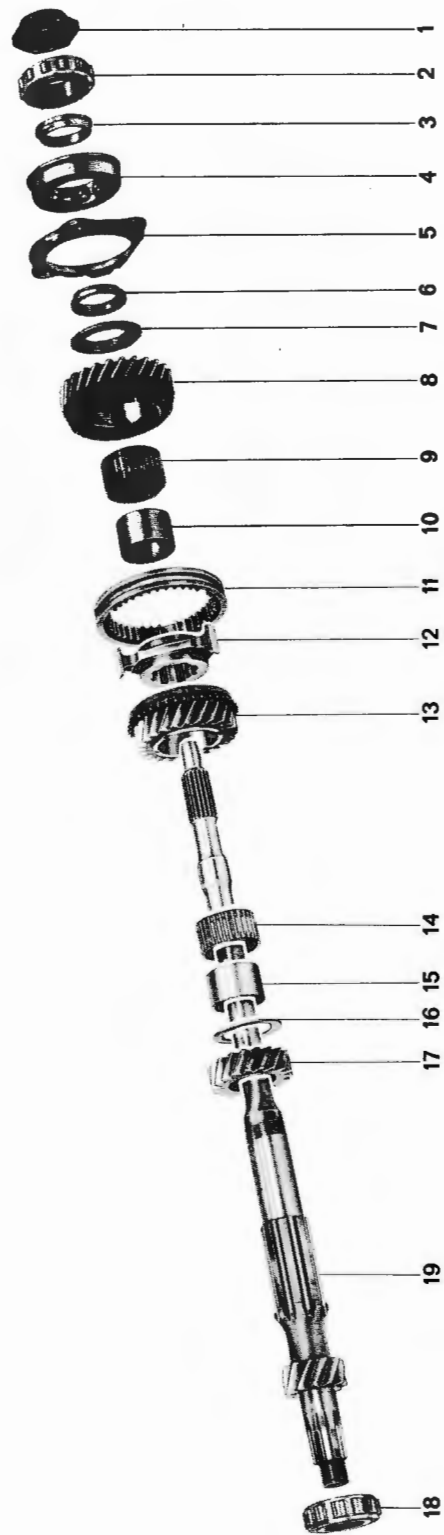
## DISASSEMBLING AND ASSEMBLING INPUT SHAFT

## TOOLS



Nr.	Description	Special Tool	Remarks
1	Support plate	P 355a	
2	Socket	P 252a	
3	Thrust plate	VW 401	
4	Thrust plate	VW 402	
5	Thrust disc	VW 412	
6	Thrust tube	VW 415a	
7	Press punch	VW 407	
8	Thrust tube	VW 416b	
9	Press punch	VW 405	
10	V-blocks	VW 406	Two each
11	Thrust tube	VW 454	

Disassembling and Assembling Input Shaft



Nr.	Description	Qty.	Note when		Special instructions see
			Removing	Installing	
1	Flange nut	1	Remove with P 252a	Torque to specification, secure with center punch.	3.1-6/6
2	Roller bearing	1	Press off with VW 401, VW 402, and VW 412.	Press in with VW 401, VW 454, and VW 407.	
3	Bearing inner race	1	Keep together with bearing to ensure correct installation position.	Install as a matched set only. Heat to approx. 120°C (250°F) and drive on.	
4	Four-point bearing	1			
5	Bearing clamping plate	1			
6	Bearing inner race	1		Install as a matched set only. Heat to approx. 120°C (250°F) and drive on.	
7	Thrust washer	1			
8	4th speed	1		Check synchronization. Replace in pairs only.	3.1-8/4
9	Needle bearing	1	Fasten to respective gear and race with mechanic's wire.	Make sure bearings have not been interchanged.	
10	Needle bearing race	1	Fasten to respective gear and bearing with mechanic's wire.	Make sure races have not be interchanged.	
11	Shifting sleeve	1		Check for wear.	
12	Spider	1		Check for wear.	
13	3rd speed	1		Check synchronization. Replace in pairs only.	3.1-8/4

Nr.	Description	Qty.	Note when		Special instructions see
			Removing	Installing	
14	Needle bearing	1	Fasten to respective gear and race with mechanic's wire.	Make sure bearings have not been interchanged.	
15	Needle bearing race	1	Fasten to respective gear and bearing with mechanic's wire.	Make sure races have not been interchanged.	
16	Thrust washer	1			
17	2nd speed	1		Check for wear. Replace in pairs only.	
18	Roller bearing	1	Press off with VW 415a and VW 407	Press on with VW 416b and VW 412	
19	Input shaft	1		Check for runout.	3.1-6/7

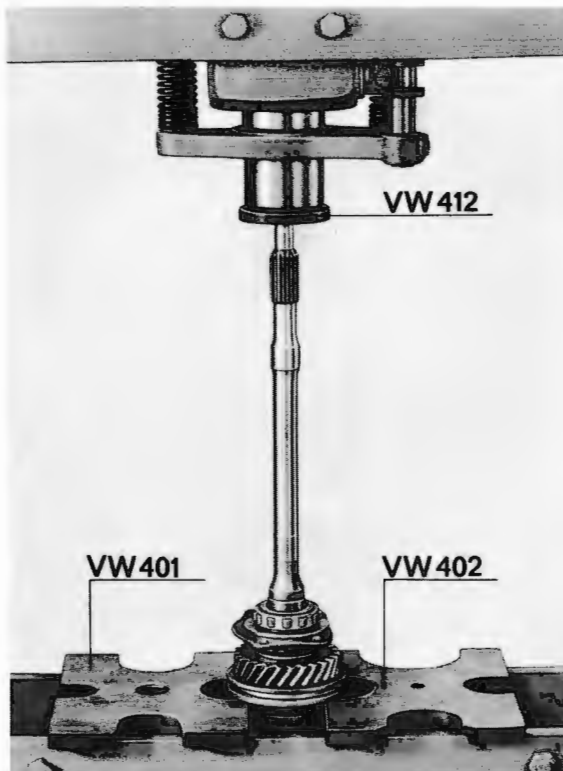
## DISASSEMBLING AND ASSEMBLING INPUT SHAFT

## Disassembling

1. Mount support plate P 355a in a vise. Insert input shaft and remove flange nut with special tool P 252a.

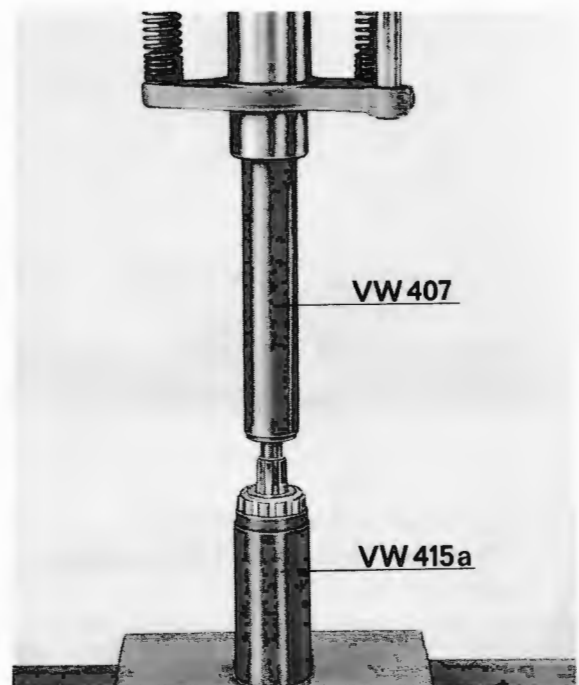


2. Press roller bearing off input shaft with thrust plates VW 401 and VW 402, and thrust disc VW 412.



3. When removing other parts, wire needle bearings races, and respective gears together for correct reinstallation.

4. Press roller bearing off input shaft with thrust tube VW 415a and press punch VW 407.

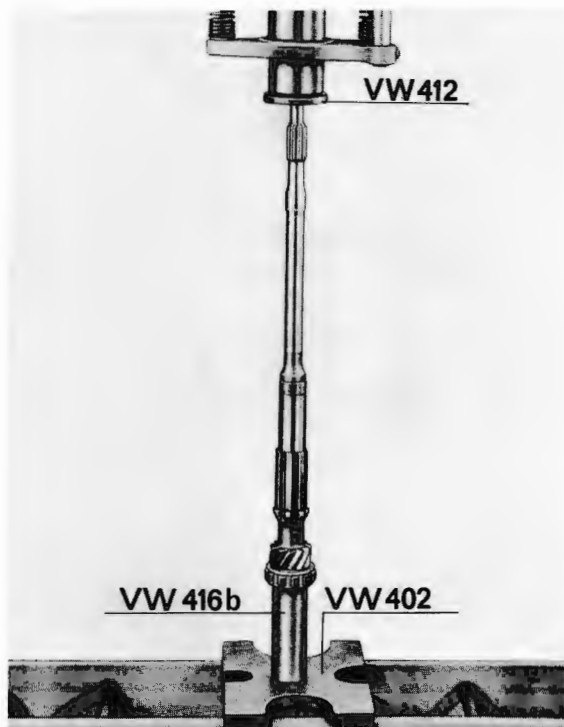


## Assembling

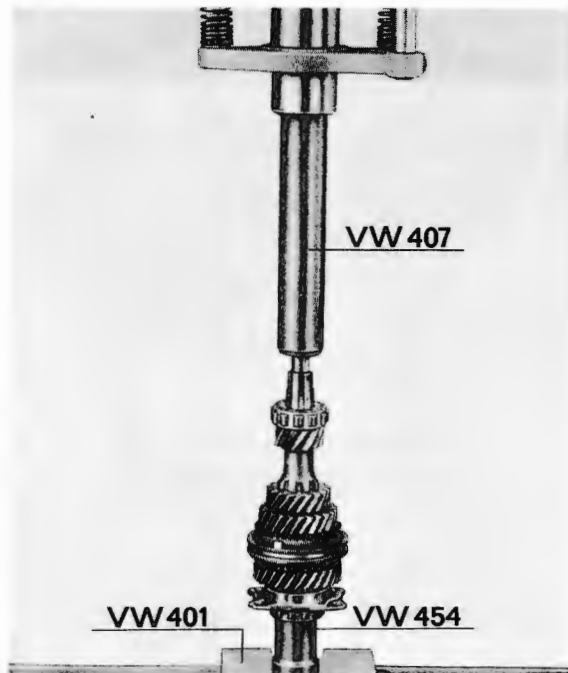
## Caution

Assemble all input shaft parts dry. Make sure oil does not enter between the contact surfaces.

1. Press roller bearing on with thrust disc VW 412 and press thrust tube VW 416b.



2. Press roller bearing on with thrust plate VW 401 and thrust tube VW 454 and press punch VW 407.



#### Caution

When reinstalling needle bearings and races, make sure they are not interchanged with those of another gear.

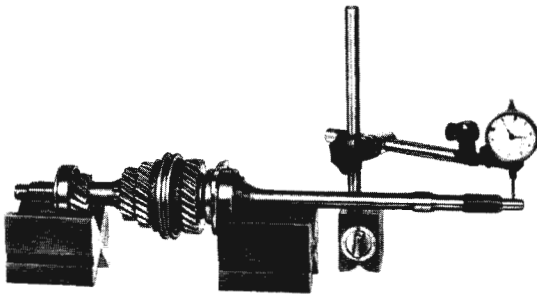
3. Torque flange nut to specification with special tool P 355a and P 252a.

4. Rock flange nut in place with center punch.



Always check input shaft for runout when it is fully assembled and the flange nut torqued to proper specification.

1. Remove the input shaft outer bearing races from the transmission and final drive housings and place them on the pinion shaft (substitute bearings can be used).



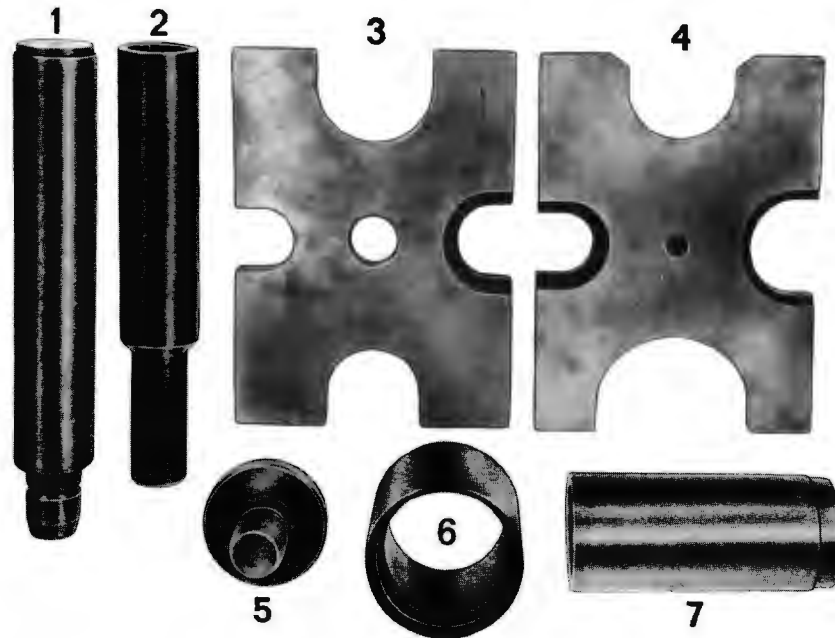
2. Place assembled pinion shaft with bearing outer races on V-blocks VW 406. Check for runout as shown in illustration. Maximum runout = 0.1 mm (0.004 in.).
3. The input shaft can be straightened while cold if the runout does not exceed 0.3 mm (0.012 in.). Use press with V-blocks VW 406 and press punch VW 405.





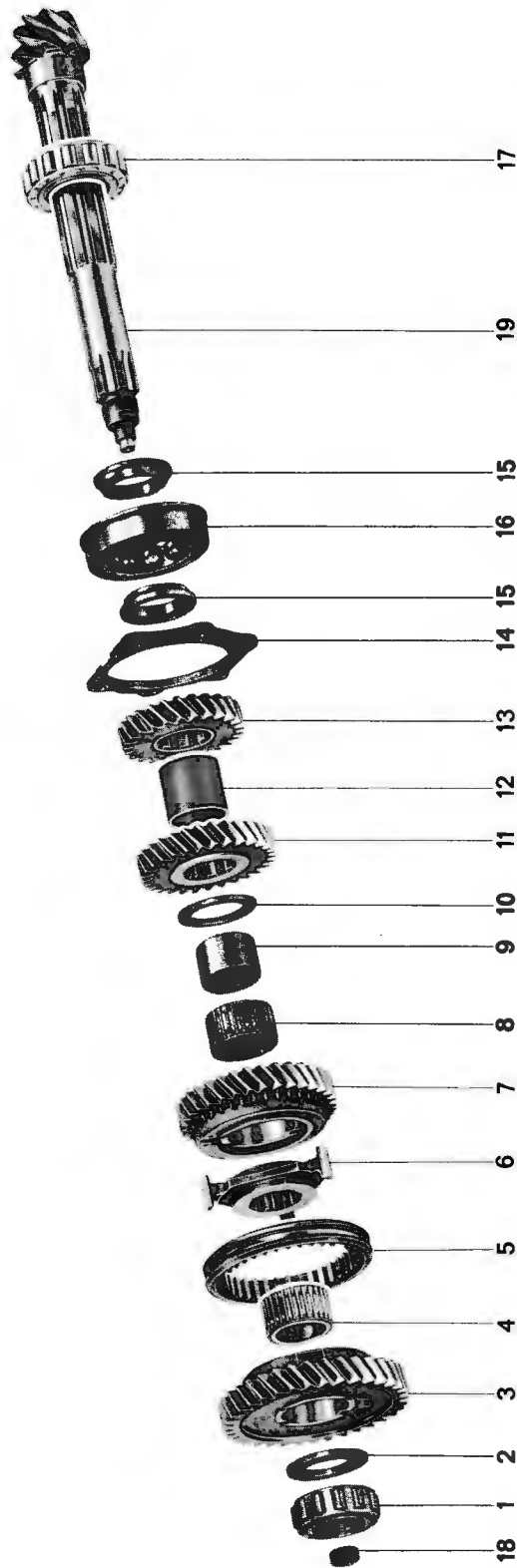
## DISASSEMBLING AND ASSEMBLING PINION SHAFT

## TOOLS



Nr.	Description	Special Tool	Remarks
1	Press punch	VW 407	
2	Thrust sleeve	VW 244b	
3	Thrust plate	VW 401	
4	Thrust plate	VW 402	
5	Thrust disc	VW 412	
6	Thrust tube	P 255a	
7	Thrust tube	VW 415a	

Disassembling and Assembling Pinion Shaft



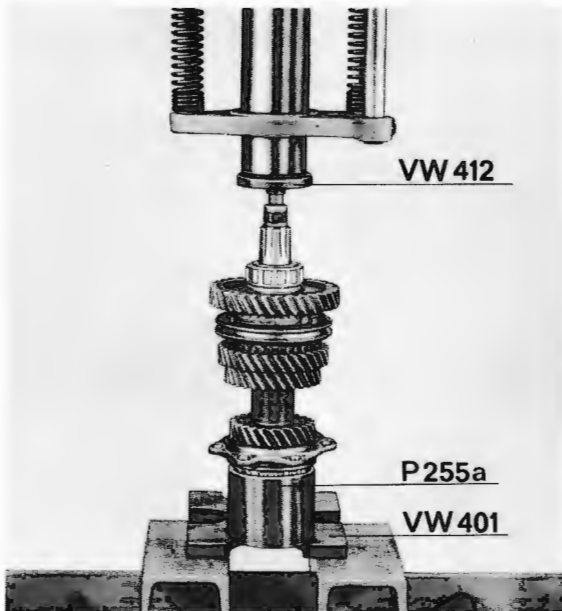
Nr.	Description	Qty.	Note when		Special instructions see
			Removing	Installing	
1	Roller bearing	1	Press off pinion shaft with VW 401, VW 412, and P 255a.	Press on with VW 407 and VW 415 a.	
2	Thrust washer	1			
3	1st speed	1		Check synchronization. Replace only in pairs.	3.1-8/4
4	Needle bearing	1	Fasten to respective gear with mechanic's wire.	Make sure bearings have not been interchanged.	
5	Shift sleeve	1		Check for wear.	
6	Synchro hub	1		Check for wear.	
7	2nd speed	1		Check synchronization. Replace only in pairs.	3.1-8/4
8	Needle bearing	1	Fasten to respective gear and race with mechanic's wire.	Make sure bearings have not been interchanged.	
9	Needle bearing race	1	Fasten to respective gear and bearing with mechanic's wire.	Make sure races have not been interchanged.	
10	Thrust washer	1			
11	3rd speed	1		Large, smooth surface must face thrust washer. Replace only in pairs.	
12	Spacer bushing	1			

Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
13	4th speed	1		Large, smoothly ground surface faces four-point bearing. Replace only in pairs.	
14	Clamping plate	1			
15	Bearing inner race	2	Press off with VW 401, VW 412, and P 255a.	Heat to approx. 120°C (250°F) and drive on.	
16	Four-point bearing	1		Check for wear.	
17	Roller bearing	1	Press off with VW 401, VW 412, and P 255a.	Press on with VW 407 and VW 415a.	3.1-7/5
18	Speedometer drive, Gear I	1	Remove with puller.	Heat to approx. 120°C (250°F) and drive on.	3.1-7/5
19	Pinion shaft	1		Readjust if necessary.	5.1-4/1

## DISASSEMBLING AND ASSEMBLING PINION SHAFT

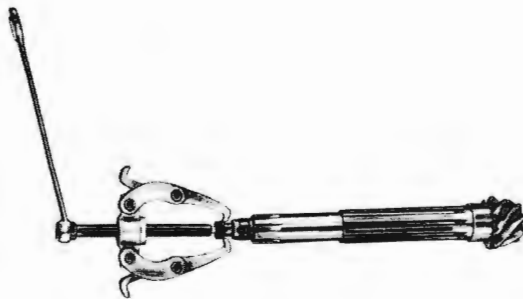
## Disassembling

1. Press roller bearing off pinion shaft with thrust plate VW 401, disc VW 412, and tube P 255a.



2. Remove components from pinion shaft. Wire needle bearings and races to respective gears to prevent interchanging of parts during re-assembly.

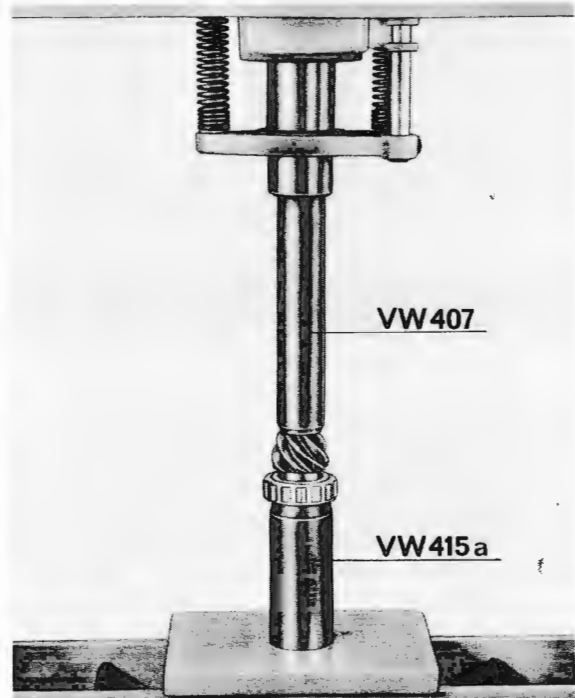
3. Remove speedometer drive Gear I.



## Assembling

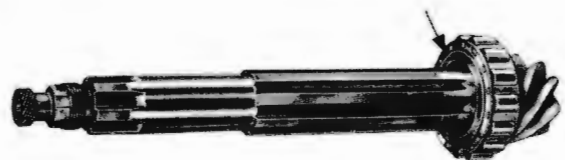
Assemble all pinion shaft parts dry. Make sure that no oil enters between the contact surfaces. Pinion shaft and ring gear are marked with paired numbers. Check that these numbers match before assembling.

1. Press roller bearing on with press punch VW 407 and tube 415a.

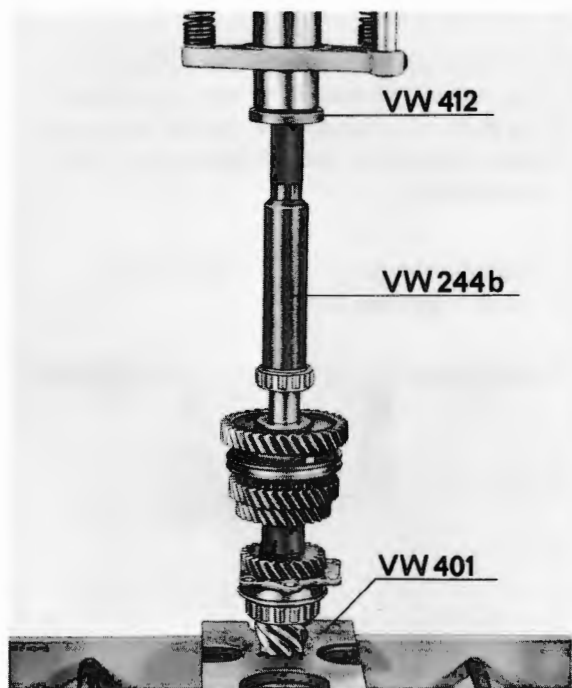


## Note

Install bearing so that the ring of the two part roller cage faces the gears.



2. Press small roller bearing on pinion shaft using thrust disc VW 412 and thrust sleeve VW 244b.



3. Heat speedometer drive gear I to 120°C (250°F) and drive on.

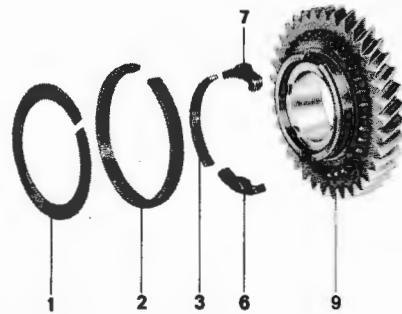
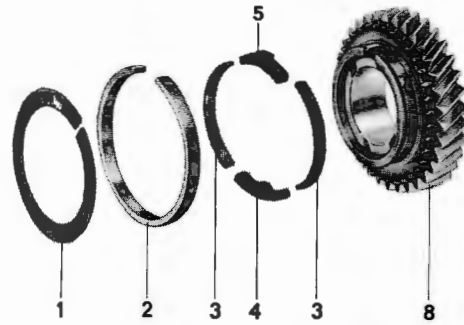
## DISASSEMBLING AND ASSEMBLING SYNCHRONIZERS

## TOOLS



Nr.	Description	Special Tool	Remarks
	Micrometer	-	Size: 75-100 mm

# Disassembling and Assembling Synchronizers



Nr.	Description	Qty	Note when		Special instructions see
			Removing	Installing	
1	Circlip	1	Remove with pliers.	Install with pliers.	
2	Synchronizing ring	1		Check for wear.	
3	Brake band, only 1 for 1st speed	2		Place on proper side in 1st speed.	3.1-8/3
4	Brake band anchor block, 2nd speed	1			
5	Thrust block, 2nd speed	1			
6	Brake band anchor block, 1st speed	1		Position properly.	3.1-8/3
7	Thrust block, 1st speed	1		Position properly.	3.1-8/3
8	Gear, 2nd speed	1			
9	Gear, 1st speed	1			



## DISASSEMBLING AND ASSEMBLING SYNCHRONIZERS

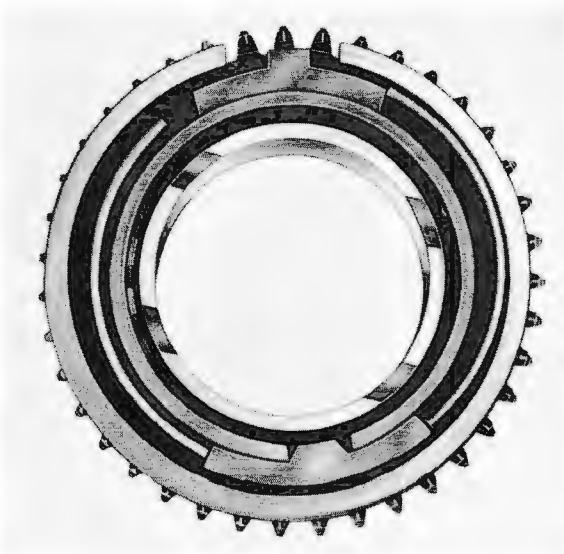
## Disassembling

1. Remove the circlip from the gear. Check all parts for wear and damage and replace as necessary.
2. When assembling the 1st gear synchronizer, make sure to install only one brake band (see illustration).



## Assembling

1. Place synchronizing ring on clutch carrier. Make sure rough ring surface faces the shift sleeve. Insert thrust block, anchor block, and brake band(s).

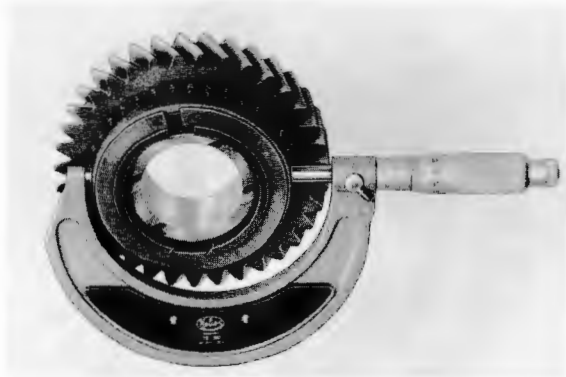


**Note**  
Clutch carrier and brake band energizer have matching contour and must be installed in such positions (see arrow).

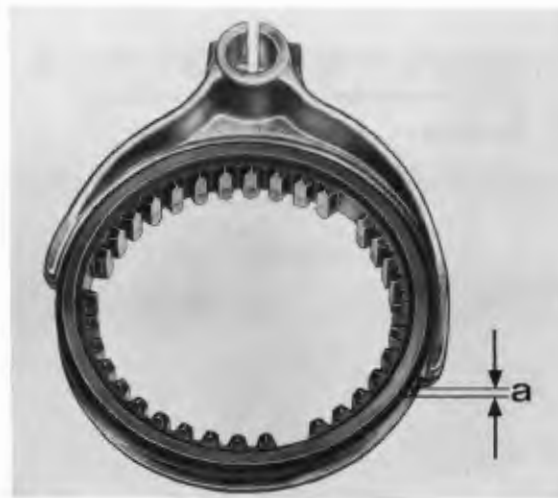
3. Install retaining ring with retaining ring plier.

## Checking

1. Using a micrometer, check diameter of installed synchronizing ring. Place micrometer at the highest point of the synchronizing ring.



2. Maximum clearance between selector fork and shifting sleeve of 1st through 5th speed:  
Dimension a = 0,5 mm (0.02 in.).



### Diameter:

3rd, 4th, and 5th speed =  $76.3 \pm 0.18$  mm  
1st and 2nd speed =  $86.37 \pm 0.17$  mm

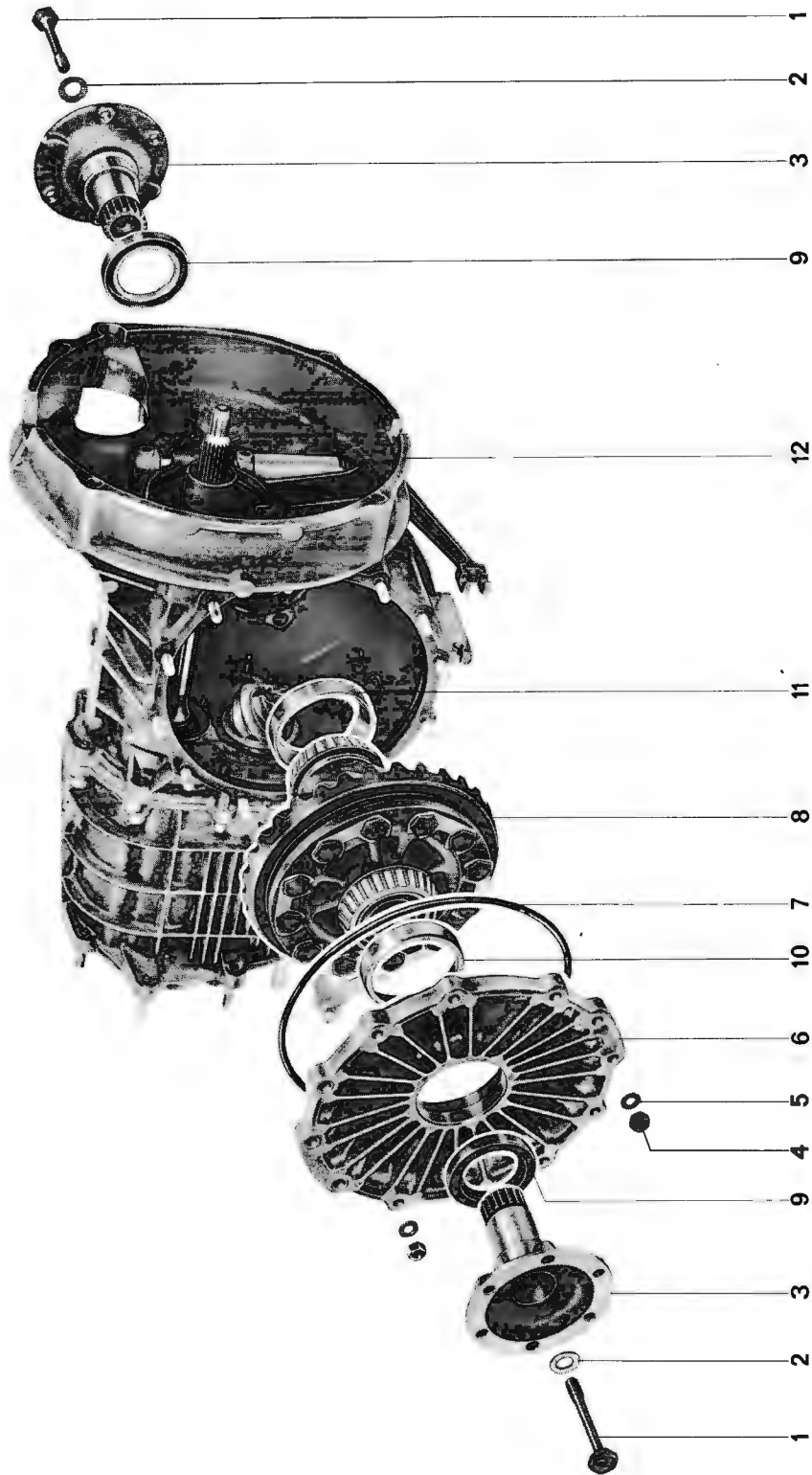
## REMOVING AND INSTALLING FINAL DRIVE

## 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			
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
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			

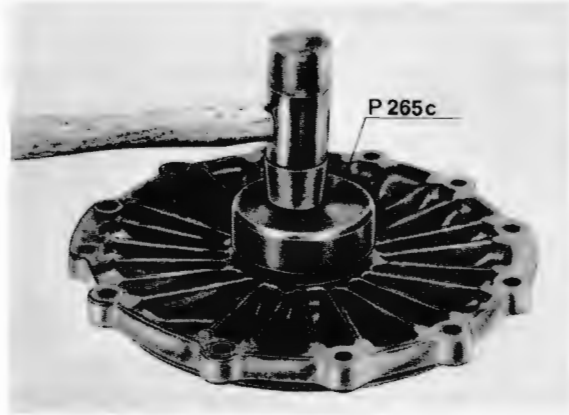
## REMOVING AND INSTALLING

### Removing

1. Remove expansion bolt and withdraw flange shaft.



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



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

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

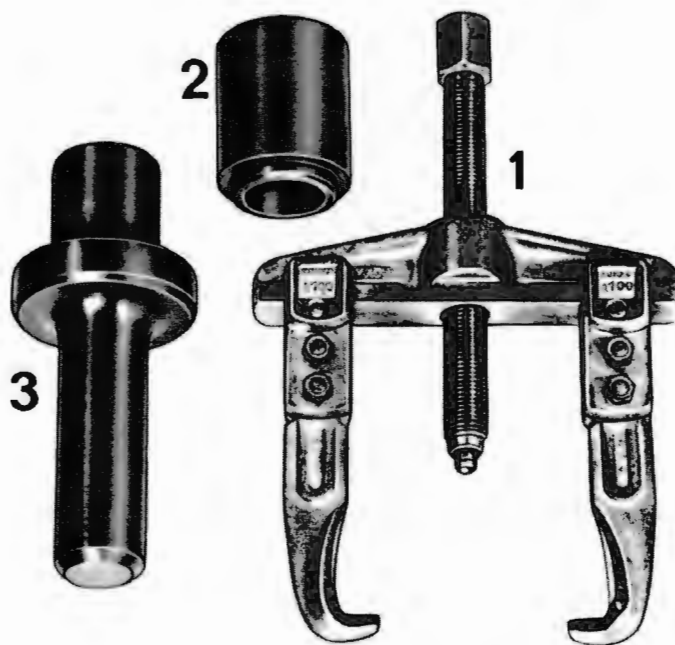
### Installing

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



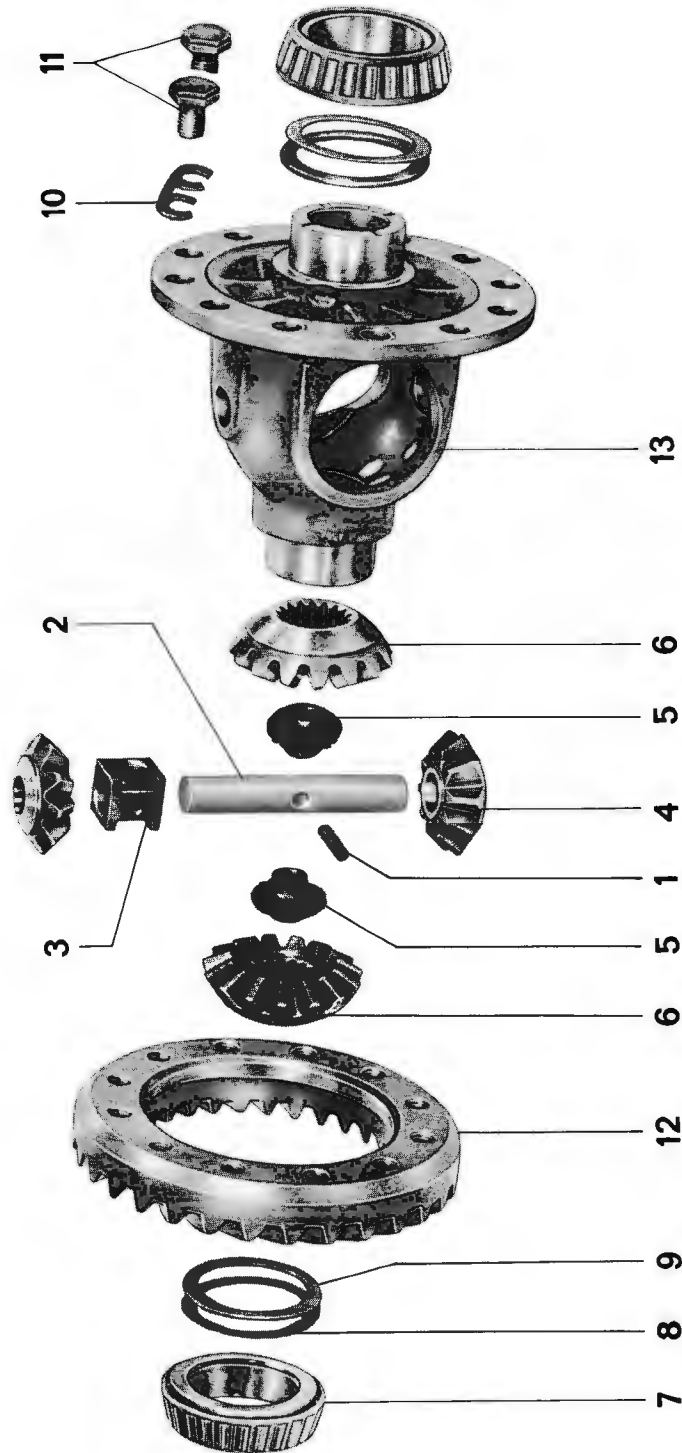
## DISASSEMBLING AND ASSEMBLING DIFFERENTIAL

## 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



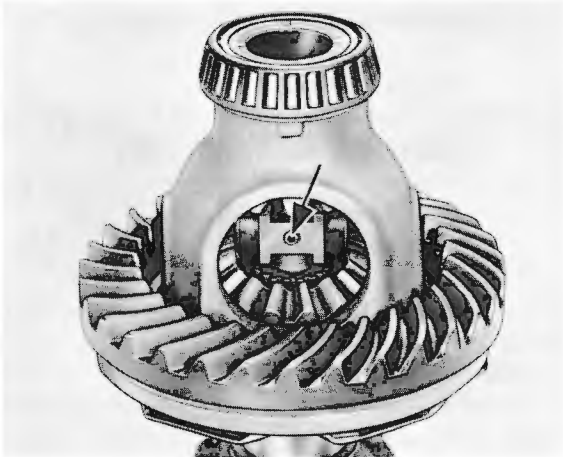


Nr.	Description	Qty	Note when		Special instruc. see
			Removing	Installing	
1	Roll pin	1	Drive out.	Replace if necessary	
2	Shaft	1	Drive out.	Note location of roll pin bore.	
3	Anchor piece	1			
4	Small differential pinion (spider gear)	1		Coat thrust areas with Molykote or similar lubricant.	3.1-2/4
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			

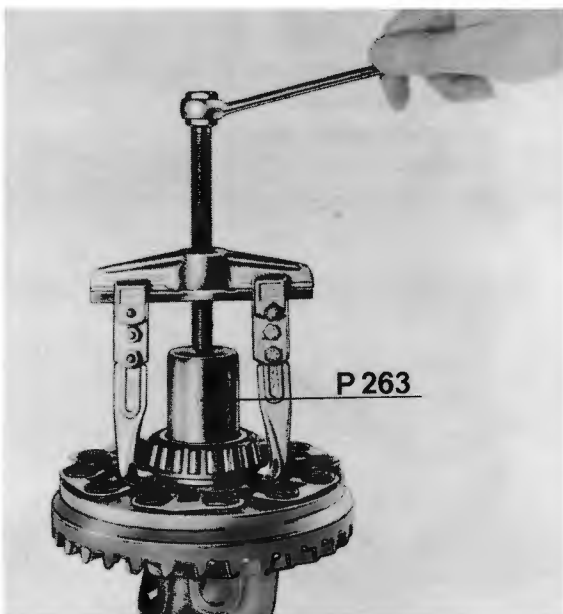
## DISASSEMBLING AND ASSEMBLING DIFFERENTIAL

### 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.

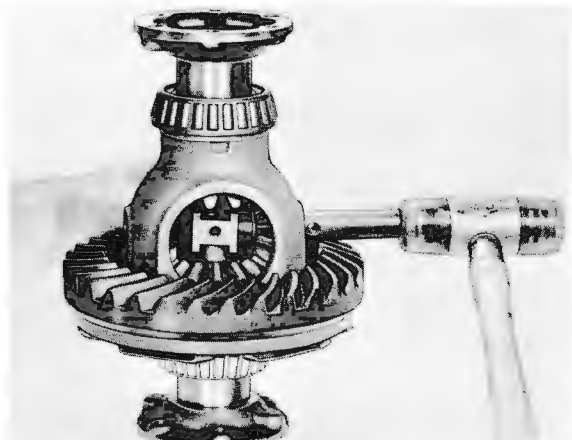
4. Insert threaded retainers with lock rings into the large differential pinions (side gears) and slide the anchor piece between the threaded retainers (see illustration).



**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".



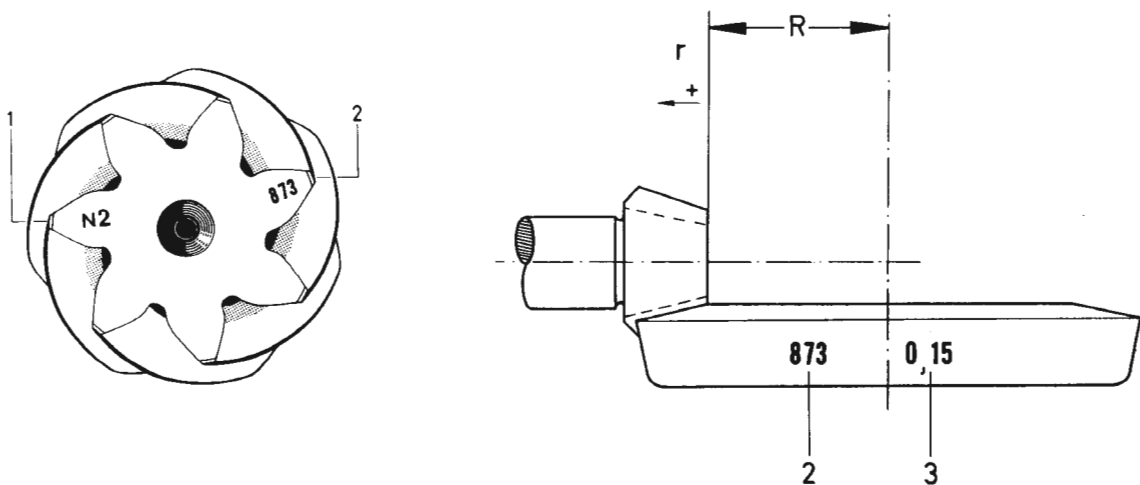
## ADJUSTING RING GEAR AND PINION

## General

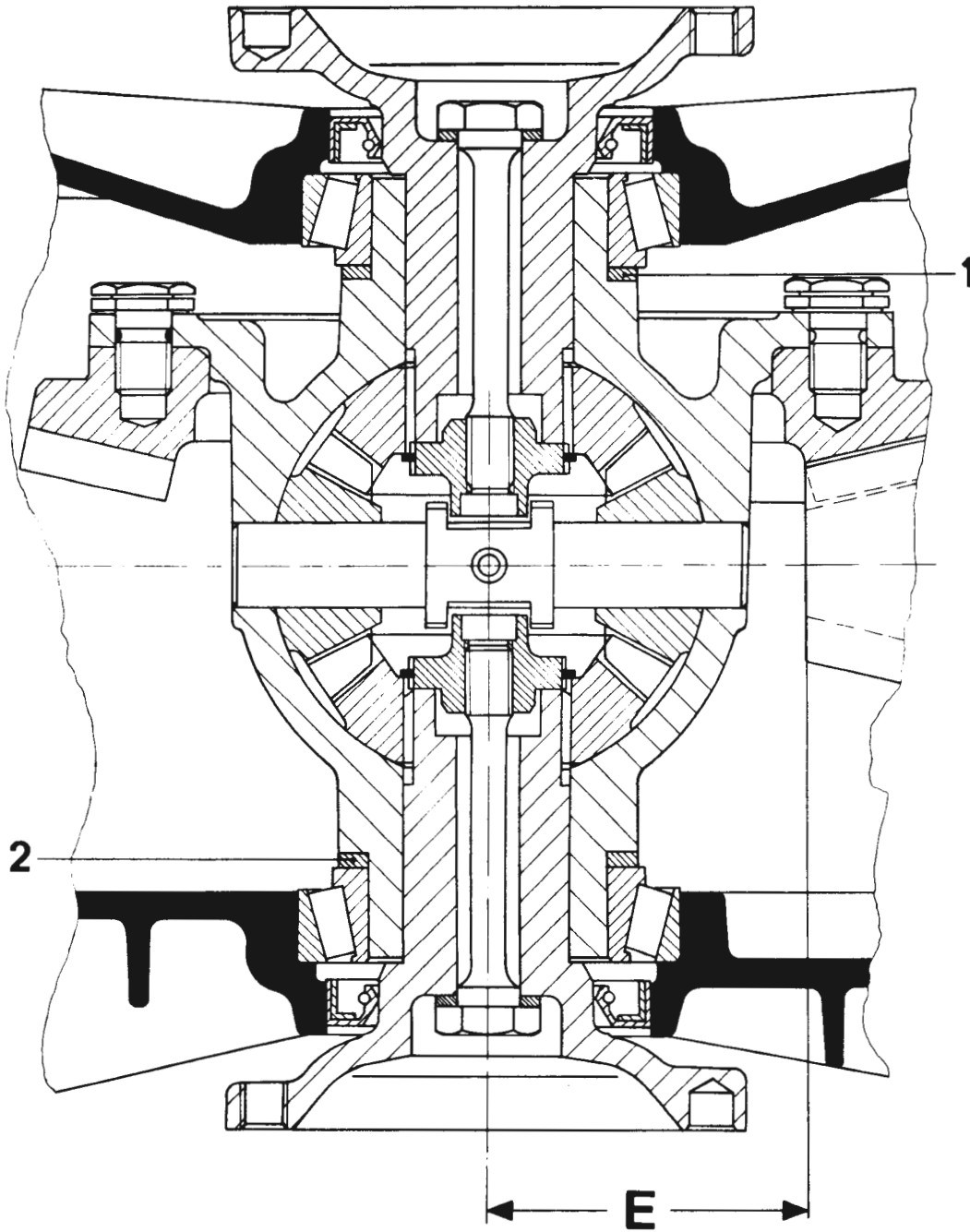
Adjustment of the ring gear and pinion is important for quiet operation of the rear axle assembly. For this reason the pinion shaft and ring gear is already matched as a pair during production. They are checked on testing machines for correct contact pattern and low noise level in both directions of 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

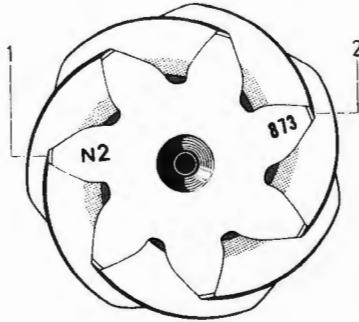
## TOOLS



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

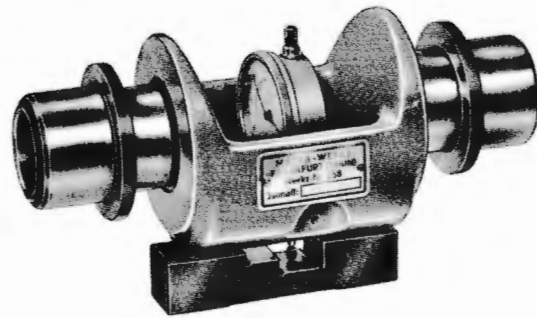
1. After finding the "Adjusting dimension E", attach input and pinion shafts, without shims, to final drive housing with clamping plates.

### 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
+ <u>Gauge block dimension</u>	+	<u>12.595 mm</u>
Actual adjusting dimension		<u>66.610 mm</u>

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
- <u>Dial indicator reading</u>	-	<u>0.39 mm</u>
Distance from ring gear center to face of pinion		<u>66.22 mm</u>

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
- <u>Distance from ring gear center to face of pinion</u>	-	<u>66.22 mm</u>
Shim thickness		<u>0.10 mm</u>

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  $\pm 0.03$  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.
5. If the nominal value of 0.15 mm is not reached, replace the (S1) spacer (ring gear side) with an appropriate spacer.

2. Install a 3.5 mm spacer (S1) on the ring gear side beneath the side bearing. Install a 3.0 mm spacer (S2) on the opposite side beneath the other bearing.

3. Install differential with side bearings in housing and install side cover with oil seal but without gasket. 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 approx. 0.15 mm.

## Example:

Feeler gauge measurement		0.40 mm
- Nominal value for side bearing preload	-	<u>0.15 mm</u>
		0.25 mm
		=====

The installed spacer S1 (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	=	25 - 35 cmkp (22 -30 in. lbs.)
FAG-bearings	=	40 - 65 cmkp (35-57 in. lbs.)



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 S1 should be 0.1 mm (0.004 in.) thinner than one half of the sum of spacers S1 and S2. The spacer S2 should be 0.1 mm (0.004 in.) thicker than one half of the sum of spacers S1 and S2.

**Example:**

Total thickness of spacers (S1 + S2) ... 6.25 mm

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

$$\text{Thickness of spacer S1} = \frac{0.10 \text{ mm}}{\text{=====}} = 3.025 \text{ mm}$$

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

$$\text{Thickness of spacer S2} = \frac{0.10 \text{ mm}}{\text{=====}} = 3.225 \text{ mm}$$

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.

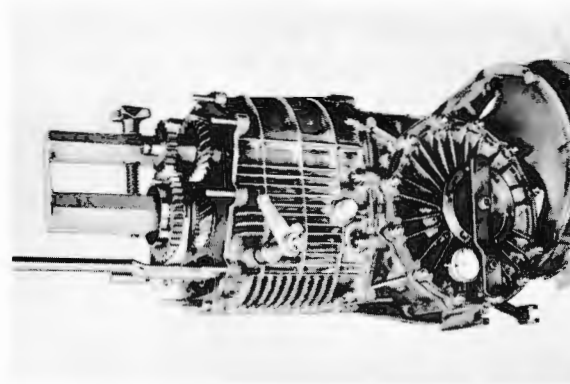
4. Block pinion shaft with holder P 259a.

### Caution

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

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.

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.

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.





## 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.

## Note

KONI shockabsorber or suspension struts cannot be used in Targa vehicles.

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.



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.)
<b>Nominal Adjustment Values and Wear Tolerance (at DIN curb weight)</b>	
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 $20^\circ$	$0^\circ$ to $30'$
Front axle height adjustment (wheel center above torsion bar center)	108 mm $\pm$ 5 mm (4.25 $\pm$ 0.20 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.)



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 transverse arm	Notched nut	M 45 x 1.5	8,8	15	108.5
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

MEASURING FRONT AXLE

General Information

Beginning with 1972 models, caster and camber specifications for the front axle have been changed. The new adjustment values have been indicated on the new wheel alignment chart by small triangles. This acts as a quick reference for evaluating the alignment data.

SAMPLE  
WHEEL ALIGNMENT DATA CHART

Name: \_\_\_\_\_ Vehicle: Porsche type 911 - from model 72 on  
 Chassis N°: \_\_\_\_\_ License plate No: \_\_\_\_\_ miles: \_\_\_\_\_  
 Date: \_\_\_\_\_ measured by: \_\_\_\_\_

Tires: \_\_\_\_\_  
 Make: \_\_\_\_\_  
 Condition: \_\_\_\_\_

**MEASURING CHART**

Difference angle at 20° turning radius

Please note:

15" rim:

10' = 0.473"

1° = .284

Vehicle:

Empty weight according to DIN 70020

shock absorber strut adjustment value: 1 mm = 6'

max. camber-difference left to right = 10'

max. caster-difference left to right = 30'

toe-in (pressed with 15 kp)

+

0 1 2

-

max. camber-difference left to right = 10'

max. camber-difference left to right = 10'

Caster results from total-camber difference at 20° left turning radius and 20° right turning radius times 1,5

max. camber-difference left to right = 10'

Rear-wheel adjustment

toe-in

1 0 1

Torsion-bar adjustment

1 0 1

max. camber-difference left to right = 10'

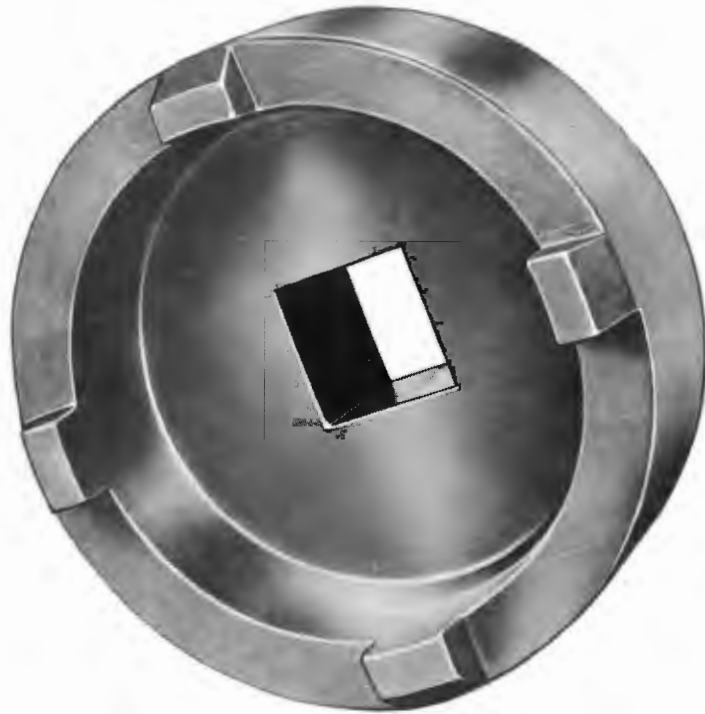
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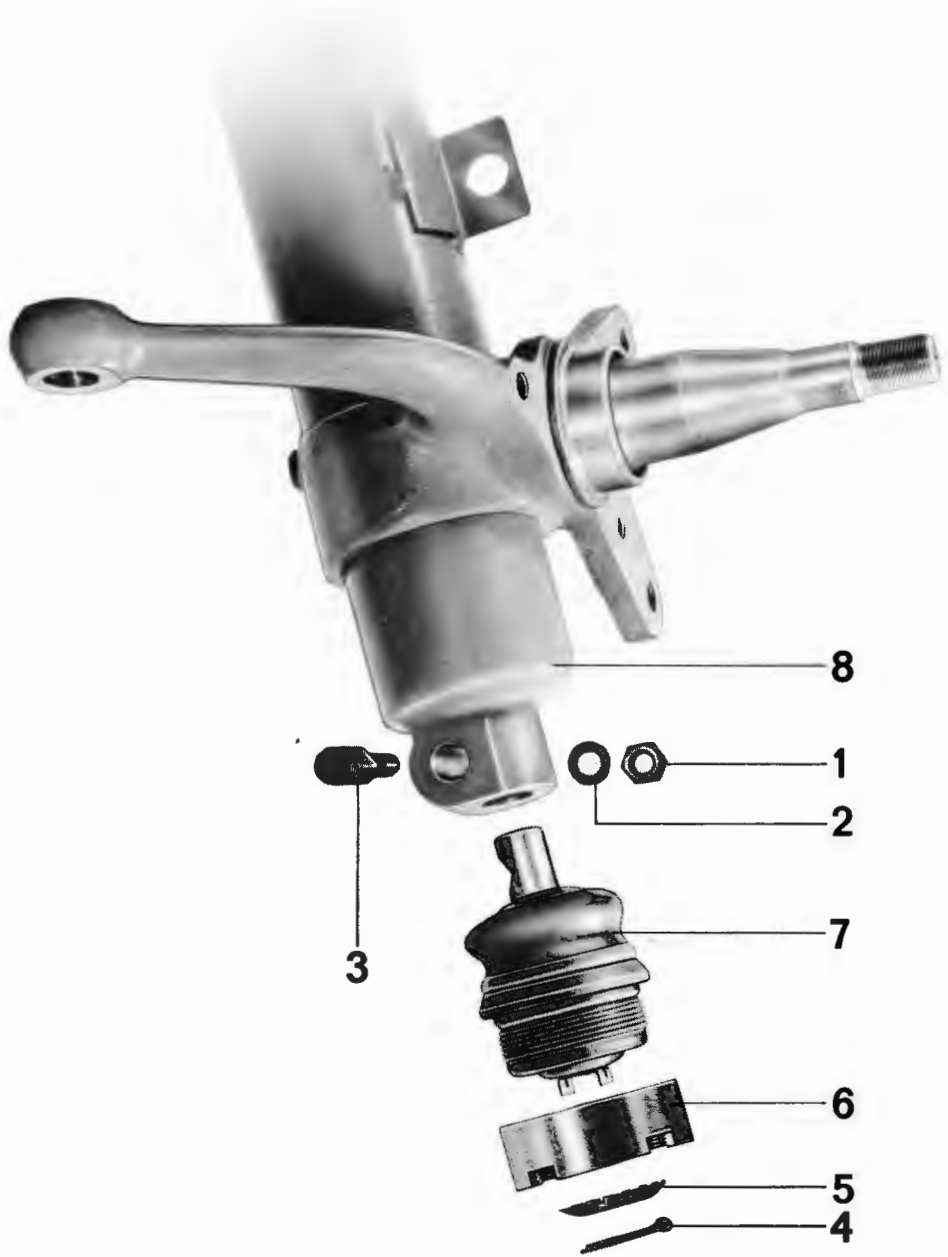
## REMOVING AND INSTALLING FRONT AXLE BALL JOINT

## 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.

## 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.

## Caution

KONI shockabsorbers cannot be used on Targa vehicles.

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° + 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 14 x 1.5	10 K	9,0	65,1
Radius arm to spring plate	Eccenter	M 12 x 1.5	8,8	6,0	43,4
Radius arm to spring plate	Bolt	M 12 x 1.5	10 K	9,5	68,7
Brake caliper to arm	Bolt	M 12 x 1.5	8,8	6,0	43,4
Shockabsorber to arm	Bolt	M 14 x 1.5	8,8	12,5	90,4
Shockabsorber to body	Nut	M 10 x 1	8	2,5	18,1
Brake hose to brake lines	Brake hose	M 10 x 1		1,7	12,3
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
Parking brake assembly to arm	Bolt	M 8	8,8	2,5	18,1
Wheel to hub	Wheel lug	M 14 x 1.5		13	94,0
Wheel hub to axle	Castellated nut	M 20 x 1.5	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.)

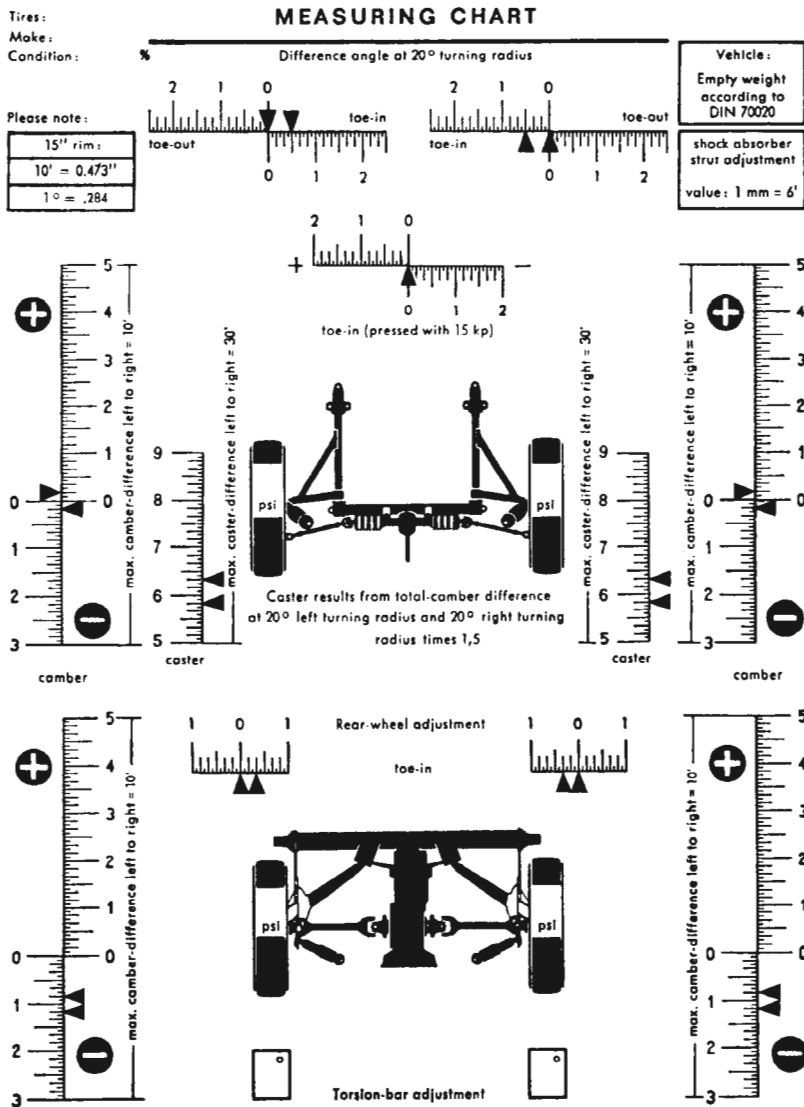


MEASURING REAR AXLE

General Information

Beginning with 1972 models, rear axle camber specifications have been changed. The specifications are listed on the new wheel alignment data chart by small triangles. This provides a quick reference for evaluating the alignment data.

Name: \_\_\_\_\_ Vehicle: Porsche type 911 - from model 72 on  
 Chassis N°: \_\_\_\_\_ License plate No: \_\_\_\_\_ miles: \_\_\_\_\_  
 Date: \_\_\_\_\_ measured by: \_\_\_\_\_



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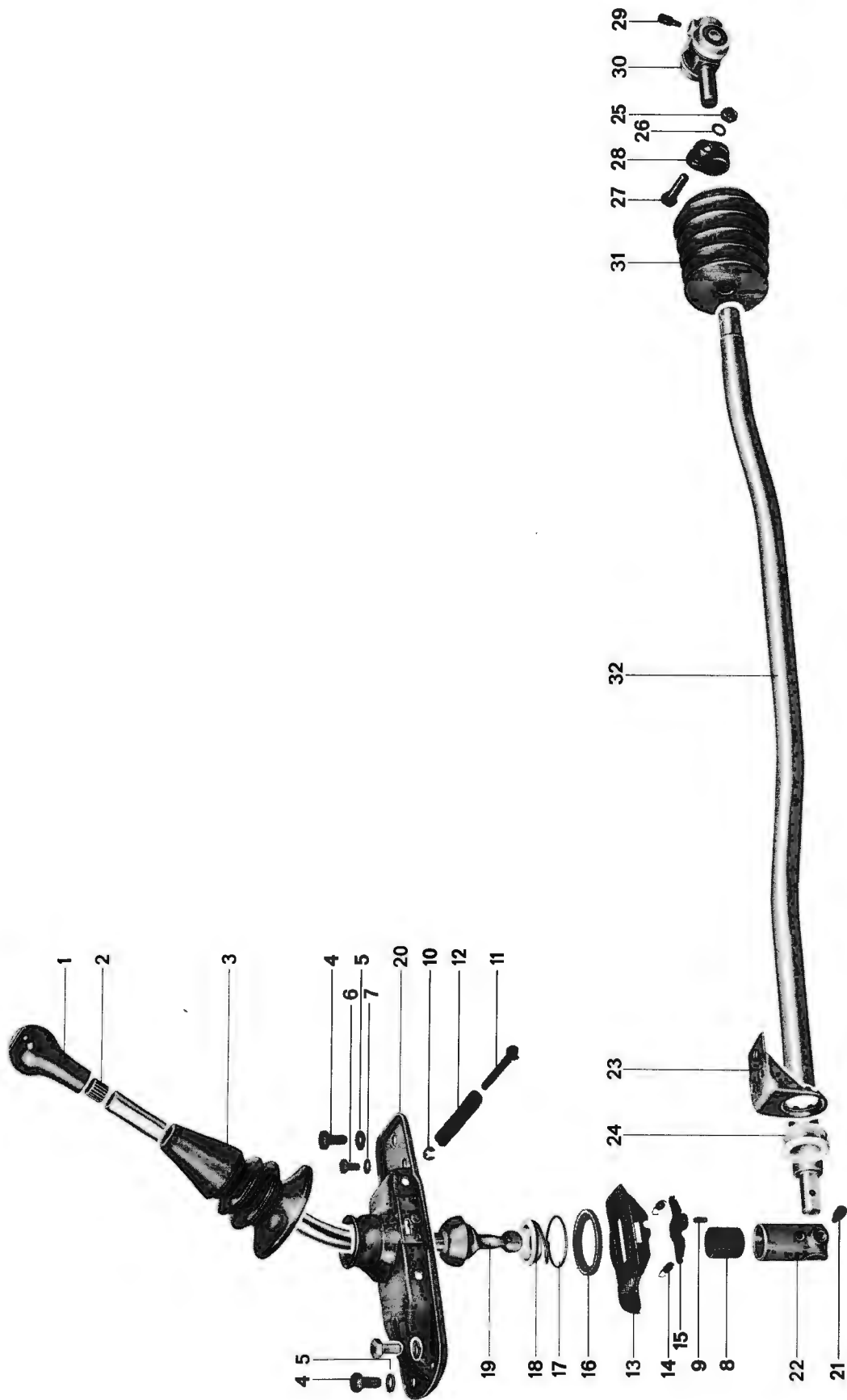
## DISASSEMBLING AND ASSEMBLING SHIFT LEVER ASSEMBLY

## 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.	

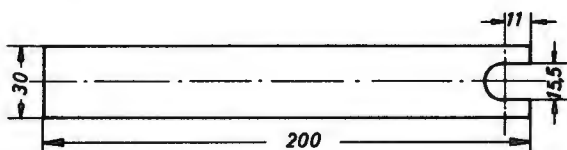


## DISASSEMBLING AND ASSEMBLING SHIFT LEVER ASSEMBLY

## 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



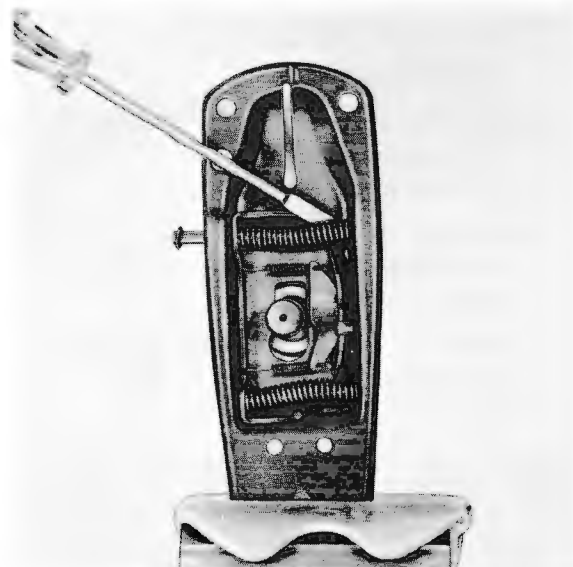
1/4 inch flat stock, all edges rounded off.

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.

**Caution**

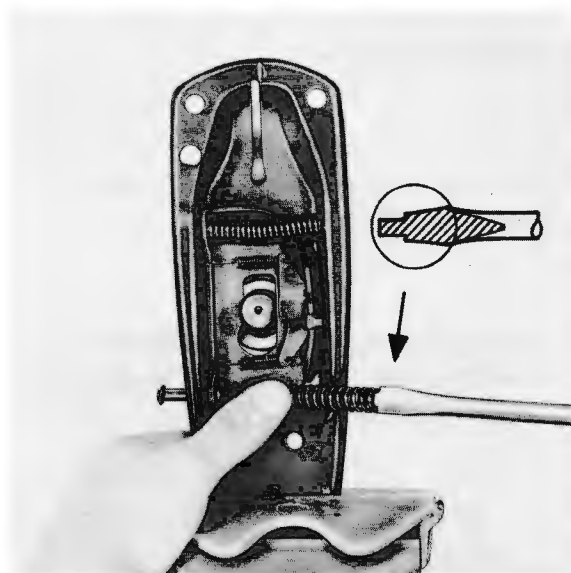
Use care when removing the guide pin springs. They are under tension and may fly out. Cover the springs with a rag. Remove the guide pin snap springs. Remove the guide pin springs one at a time.

5. Remove remaining parts.

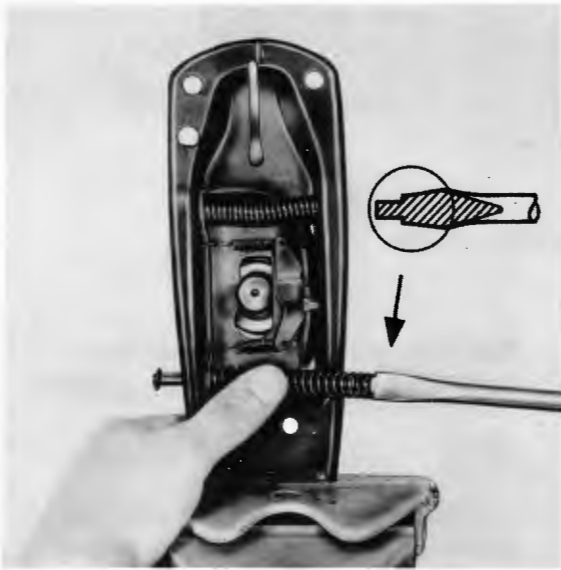


## Assembling

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.



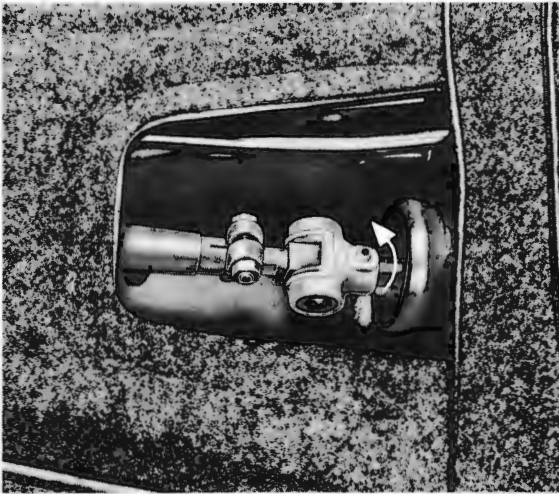
3. To install the guide pin springs:
  - a. Position the stop plate to the shift bracket of the guide pins.
  - b. Insert the second guide pin with snap ring at an angle.  
Slip the spring over the pin.
  - c. Carefully push one end of the spring into the cutout. Align the spring and push the pin in 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.

## ADJUSTING GEARSHIFT LINKAGE

1. Move shift lever into neutral.
2. Loosen shift rod clamp. Move shift rod transmission all the way to the right stop (see arrow).
3. With the gearshift lever in neutral the lower part of the lever should be in the vertical position when seen from the side. The lever should also rest against the lever stop.
4. Torque shift rod clamp to 2.5 mkp (18.1 ft. lbs.). Use new lock washer under clamp bolt nut.



3. With the gearshift lever in neutral the lower part of the lever should be in the vertical position when seen from the side. The lever should also rest against the lever stop.

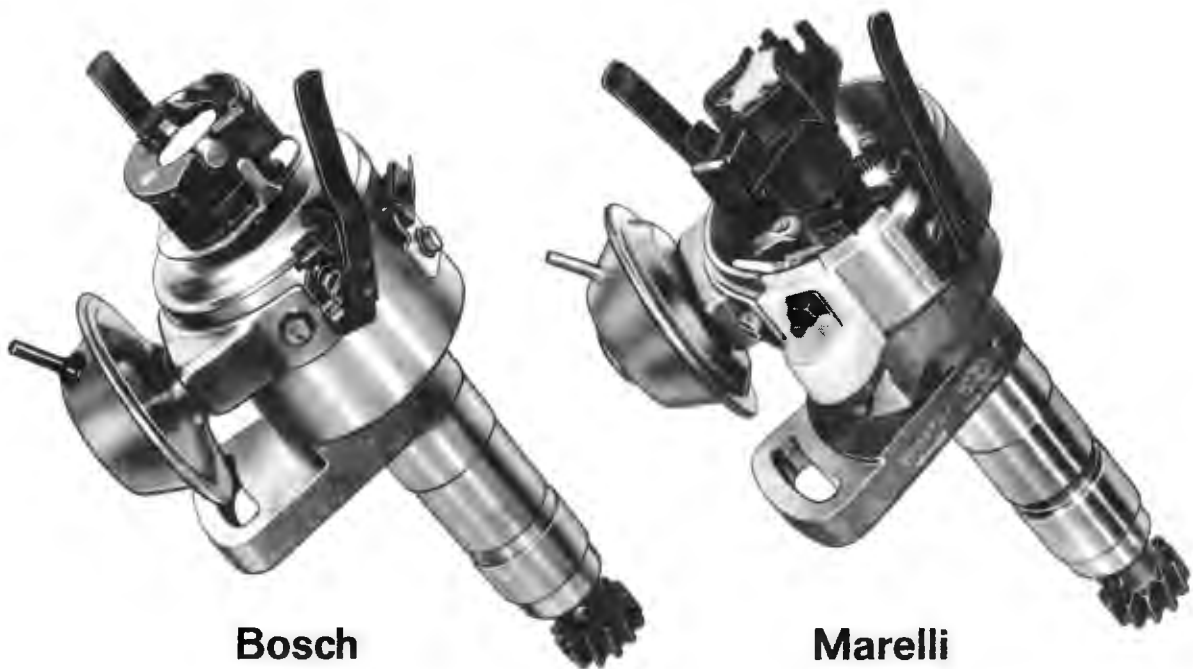




IGNITION DISTRIBUTOR FOR 2.4 LITER ENGINES -  
BEGINNING WITH 1972 MODELS

General Information

Beginning with the 1972-model year, all Type 911 vehicles are equipped with either BOSCH or MARELLI distributors described below.



In the new distributors, engine timing is changed by:

- 1 - Centrifugal weights (responding to engine speed)
- 2 - Vacuum control (responding to throttle valve position)

Speed limiters (engine governors) continue to be used in the distributors. A centrifugal weight built into the rotor of each distributor short-circuits the secondary side of the ignition system at a predetermined cut-off speed. This prevents exceeding maximum engine speed. The distributors for the Type 911 T, E, and S 2.4 liter engines are identical with the exception of the rotors which have different cut-off speeds.

The vacuum control unit retards the ignition timing during idle and low speed ranges. The ignition then fires 5° ATDC. This results in cleaner combustion, reducing the emission of harmful exhaust pollutants. When the throttle opens, vacuum is reduced and the ignition timing is advanced by 10°.

Vehicle Type	BOSCH Distributor	MARELLI Distributor
911 T	0 231 169 003	5 010 974 - 1
911 E	0 231 169 004	5 010 974 - 2
911 S	0 231 169 005	5 010 974 - 3

## STARTER

## General Information

Beginning with 1972 models, starter power output is increased from 0.8 HP to 1.5 HP. Both starter types are basically of the same design.

Specifications for GB 12 V 1.5 HP (BOSCH :: 0 001 312 100)

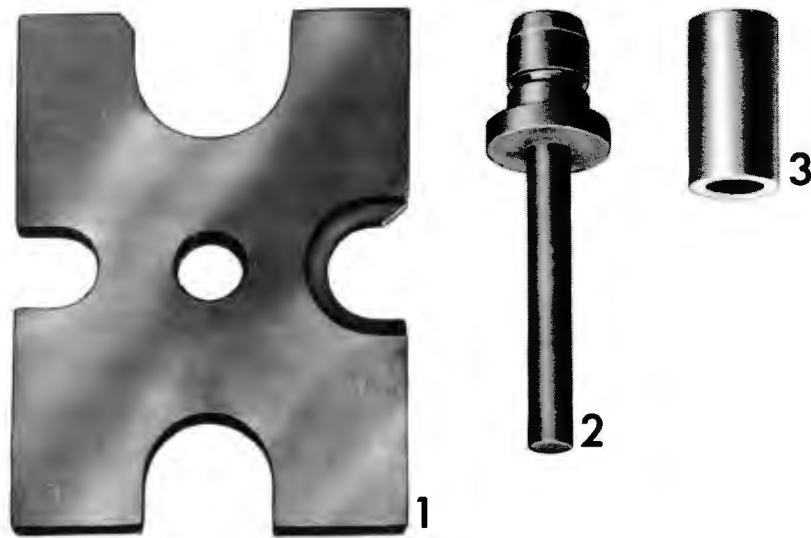
Voltage	12 V
Power rating	1.5 HP
No-load current draw @ 11.5 volts	50 - 80 amps
No-load speed	7300 - 9300 rpm
Stall torque current draw @ 6 volts	690 - 780 amps
Minimum voltage for solenoid draw-in	7.5 volts
Brush pressure	800 - 900 grams
Armature end-play	0.1 - 0.3 mm





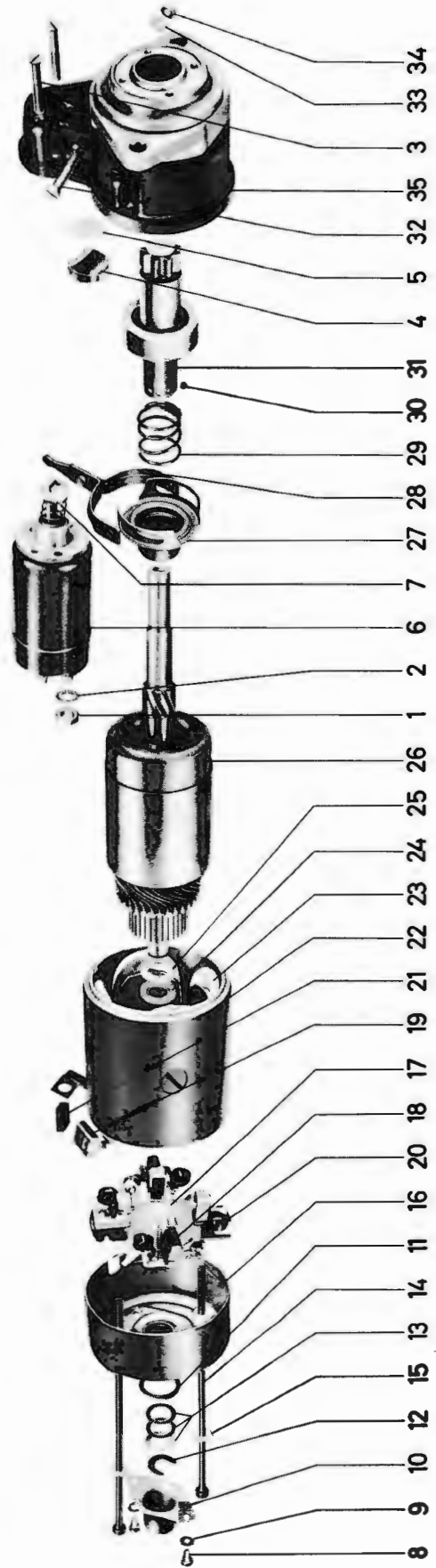
## DISASSEMBLING AND ASSEMBLING STARTER

## TOOLS



Nr.	Description	Special Tool	Remarks
1	Press plate	VW 401	
2	Press block	VW 411	
3	Press pipe	VW 418a	31.5 mm dia.

Disassembling and Assembling  
Starter



Nr.	Description	Qty	Note when		Special instructions see
			removing	installing	
1	Nut	1			
2	Lock washer	1			
3	Retaining screw	2			
4	Rubber block	1		Position rubber block tip in field frame recess.	
5	Disc	1			
6	Solenoid	1	Pull pinion engagement assembly forward.	Check solenoid current draw and free movement of core. Seal, lubricate lightly.	
7	Disengagement spring	1			
8	Fillister screw	2			
9	Washer	2			
10	Dust cap	1		Seal.	
11	O-ring	1	Replace if damaged.		
12	Retainer	1			
13	Shim		Note number of shims. Adjust armature endplay to 0,1 - 0,3 mm (0,004 - 0,012 in.)		
14	Bolt	2		Seal with paste.	
15	Washer	2			
16	Brush-end cover	1	Check bearing bushing, replace if necessary (remove with VW 401, VW 411, and VW 418a).	Ground-connecting surface to field frame must be free of paint or grease. Upon assembling, seal and lubricate lightly.	
17	Brush carrier plate	1		Check position of rotation detent for proper ground to field frame.	

Nr.	Description	Qty	Note when		Special instructions see
			removing	installing	
18	Negative brush	2	Check for cracks, dirt, and tight connection.	Brushes must move freely in holder. Replace in sets only.	
19	Positive brush				
20	Brush spring	4	Lift with wire hook.	Brush pressure ca. 800 - 900 grams (28-32 oz.).	
21	Rubber grommet	1		Check for proper sealing.	
22	Field frame	1		Check for proper ground between brush end cover and drive housing.	
23	Field coil			Check continuity. Replace coil if burned.	
24	Insulating washer	1		Locate against brush carrier plate.	
25	Thrust washer	1		Locate against commutator.	
26	Armature	1	Vertical runout 0.03 mm; minimum diameter 33.3 mm; if necessary, undercut segment insulation 0.8 mm deep.	Check for grounding. Check soldered points between segments and soldered tabs. Install armature together with actuating lever.	
27	Actuating sleeve	1			
28	Actuating lever	1		Replace if bent.	
29	Engagement spring	1		Coat heavily with Ft 2-v-3 grease or similar.	
30	Detent balls	10		Install packed in lithium grease.	
31	Overrun clutch	1			
32	Pivot bolt	1		Grease lightly.	
33	Lock washer	1			
34	Nut	1			
35	Drive housing	1		Seal joining surfaces between solenoid and drive housing, and field frame and drive housing. Coat lightly with oil.	

## IGNITION LEADS

Beginning with 1972 models, ignition lead lengths are as follows:

From distributor to:	Cylinder 1 = 330 mm (13 in.)
	Cylinder 2 = 390 mm (15-11/32 in.)
	Cylinder 3 = 510 mm (20- 5/64 in.)
	Cylinder 4 = 880 mm (34-21/32 in.)
	Cylinder 5 = 900 mm (35- 7/16 in.)
	Cylinder 6 = 990 mm (38-63/64 in.)

These lengths must be maintained for proper radio noise suppression.



## SPARK PLUGS

Beginning with the 1972 models, the following spark plugs can be used in the 2.4 liter engines:

Vehicle Type	Spark Plug Type	Electrode Gap
911 T USA	BOSCH W 235 P 21	0.55 mm
	BERU 235/14/3P or similar	0.55 mm
911 E and 911 S	BOSCH W 265 P 21,	0.55 mm
	BERU 265/14/3 P or similar	0.55 mm

Coat spark plug threads with a molybdenum paste (such as MOLYKOTE HTP-White or similar) before installing.

Torque spark plugs to 2.5 - 3 mkp (18.1 - 21.7 ft. lbs.).





## ADJUSTING AND CHECKING DISTRIBUTOR

## Adjusting Ignition Breaker Points

1. Remove distributor cap, rotor, and dust cover (BOSCH only). In MARELLI distributors, loosen retaining screw in rotor.
2. Turn crankshaft pulley until a distributor cam lifts the breaker arm to its highest point.
3. Adjust gap with feeler gauge (basic setting):

BOSCH	0.35 mm
MARELLI	0.40 mm

4. Check dwell angle with an appropriate tester and adjust, if necessary, by changing breaker point gap:

BOSCH	$38^{\circ} \pm 3^{\circ}$
MARELLI	$40^{\circ} \pm 3^{\circ}$

Large breaker point gap	=	small dwell angle
Small breaker point gap	=	large dwell angle

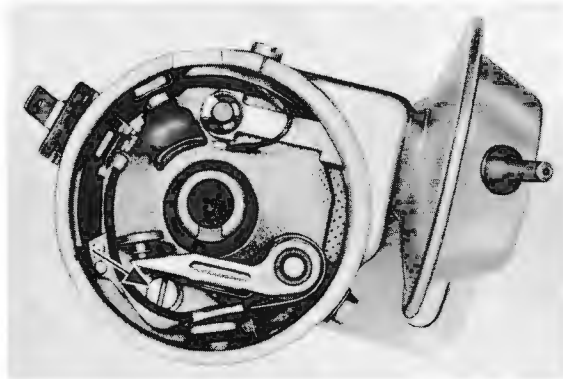
5. Tighten breaker point plate retaining screw.

## Note

Always check ignition timing after adjusting dwell angle since dwell angle changes affect timing.



### Changing Breaker Points



1. Remove distributor cap, rotor, and dust cover.
2. Remove slotted screws and disconnect wire from Terminal 1. (In MARELLI distributor loosen nut at Terminal 1.)
3. Remove breaker points.



Install in reversed order. Lightly coat the cam with distributor cam lubricant. Keep lubricant off breaker points.

## Adjusting Ignition Timing

Check dwell angle before adjusting ignition timing, correct if necessary.

### Warning

Keep fingers, loose clothing, tools and test instruments clear of fan and belt when making adjustments on running engine.

1. Run engine until engine oil is warm ( $80^{\circ}\text{C}/175^{\circ}\text{F}$ ).
2. Check ignition timing with stroboscope timing light. At  $900 \pm 50$  rpm, the mark on the left side of the Z 1 mark ( $5^{\circ}$  ATDC) on the crankshaft pulley must line up with the mark on the fan housing (vacuum hose connected to distributor). Change timing by loosening nut and turning distributor.

Maximum advance is checked only after the idle speed timing adjustment has been made. At 6000 rpm, maximum advance must be between  $32^{\circ}$  and  $35^{\circ}$  BTDC with the vacuum hose disconnected.

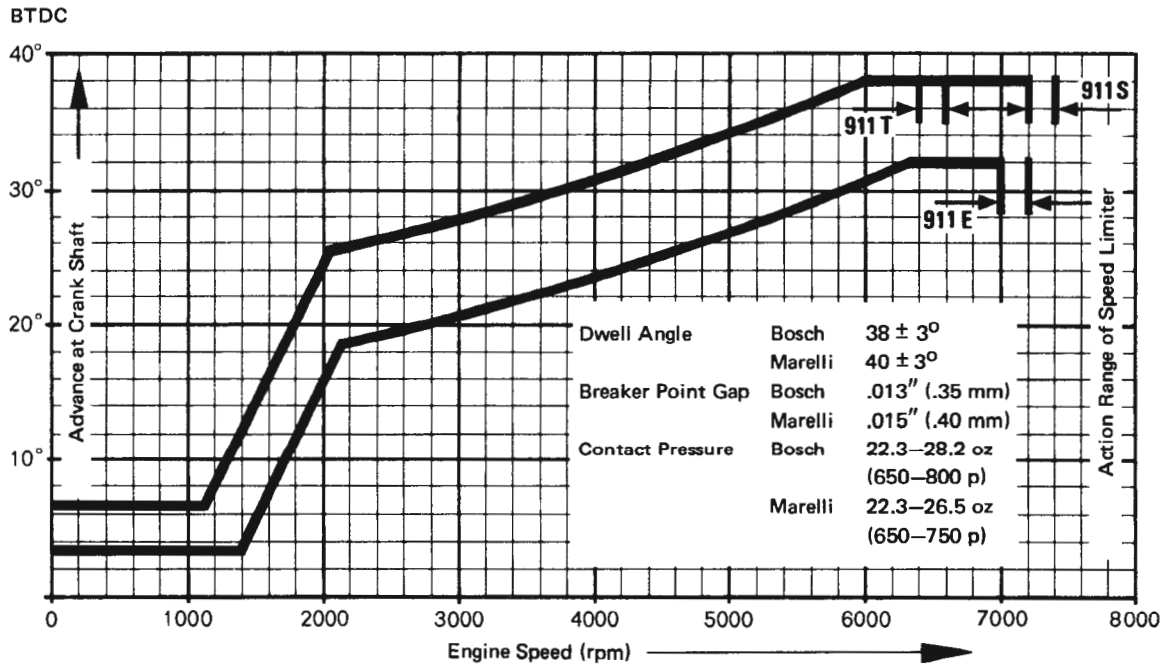




Checking Timing Advance Curve

1. Remove vacuum hose and compare advance curve with chart below at 1000 - 1500 - 2000 - 4000 - 6000 rpm. The readings must be within the two lines on the chart.

Ignition Advance Curve for Distributor for 2.4 Liter Engines Bosch and Marelli



## Checking Distributor Advance Curve on Test Stand

The advance curves may be checked only on a test stand equipped with CDS hookup.

### Centrifugal Advance

1. Remove distributor and mount in test stand.
2. Remove distributor cap and connect according to test stand manufacturer. Terminal 4 of the ignition transformer must be connected to the test stand spark display unit by an ignition wire.
3. Position the test stand selector lever to "auxiliary ignition coil"; the CDS unit will then be switched on.
4. Move distributor and bridge so that one of the light-markers will stop at  $0^{\circ}$ .



**Note**

The vacuum hose must be disconnected and speed reduction avoided during this test.

- Increase speed and compare rpm with the degrees of advance (BTDC) with the chart below.

**Contact Bounce**

The light marker must not deviate by more than 1° at 300 rpm, or 2° at 3500 rpm.

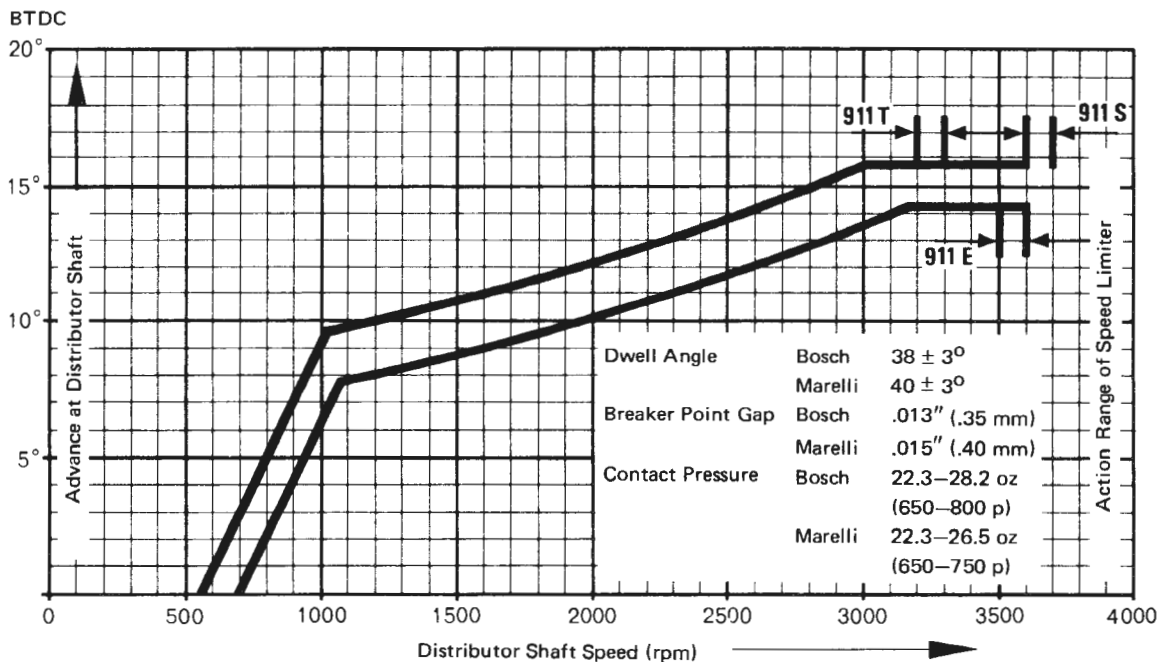
Degrees Advance	Distributor Shaft RPM
1°	600 - 750 rpm
7°	900 - 1050 rpm
9°	1000 - 1650 rpm
12°	1950 - 2550 rpm
14°	2550 - 3050 rpm

**Measurement Errors (cam displacement)**

Run distributor at 300 rpm. The 6 visible light markers on the protractor must be spaced at 60° intervals ( $\pm 1^\circ$  deviation per cam).

At 3500 rpm, the advance must be between 14.3° and 15.7°.

**Centrifugal Advance Curve for Distributor for 2.4 Liter Engines Bosch and Marelli**

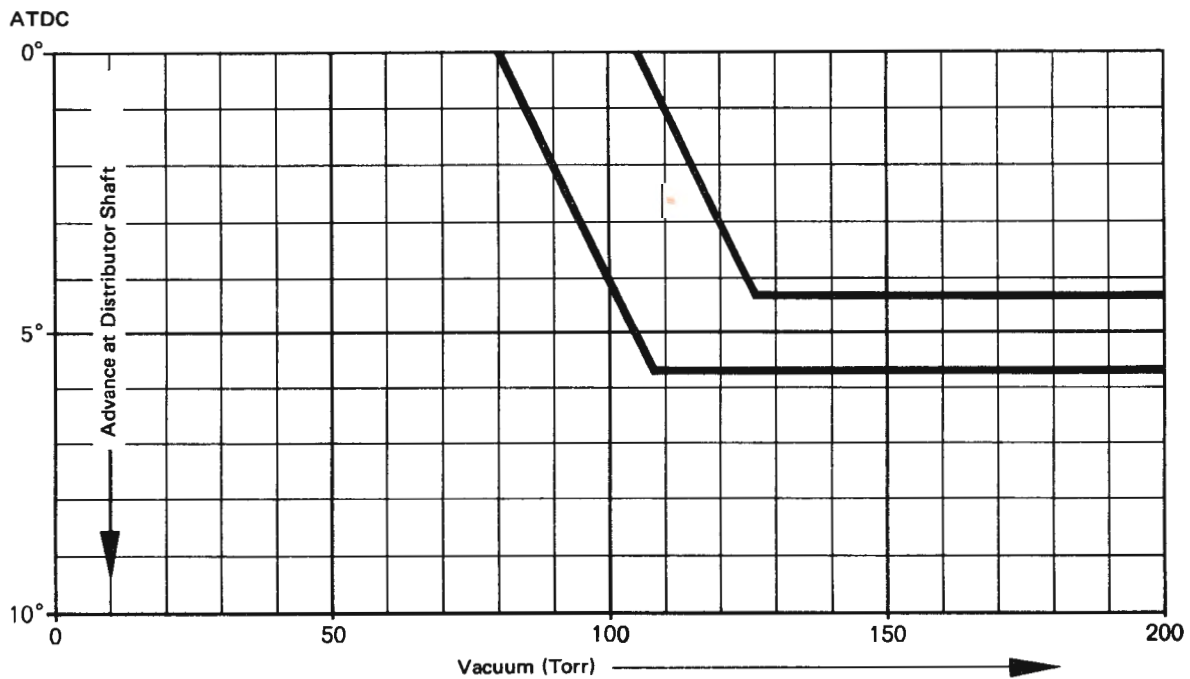


## Vacuum

1. Connect vacuum line of test stand to distributor vacuum chamber.
2. Set speed to 300 rpm and do not change during the test.
3. Check vacuum at the indicated degrees advance (ATDC):

Degrees Advance	Vacuum
1°	85 - 110 Torr (3.3 - 4.3 in.)
4°	100 - 125 Torr (3.9 - 4.9 in.)

### Vacuum Advance Curve for Distributor for 2.4 Liter Engines Bosch and Marelli





## Speed Limiter

1. Mount cap on distributor and connect according to test stand manufacturer. The ignition lead must be removed from the spark display unit and connected to the distributor cap so that connection is made between ignition transformer and distributor.
2. Adjust spark display to 5 mm distance.
3. Increase speed until sparks stop. The sparks must stop at the following speeds:

Distributor for Vehicle Type	Cut-off RPM
911 T	3250 $\pm$ 50 rpm
911 E	3550 $\pm$ 50 rpm
911 S	3650 $\pm$ 50 rpm

## Dwell Angle

1. Connect standard ignition condenser between Terminal 1 of the distributor and the ground.
2. Position test stand selector lever to the "Dwell Angle" position.
3. Attach test stand connecting wire to Terminal 1 of the distributor.
4. Adjust speed to 300 rpm and turn bridge so that the end of a light marker lines up with the 0° mark on the protractor. The length of the light marker indicates dwell angle.

Remove the ignition condenser after completing the test. Connect vacuum hose and adjust ignition timing after reinstalling the distributor in the vehicle.



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## 0.0 Information

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## 2 - MAINTENANCE

## 2.1 Service Schedule

Service Schedule	2.1-1/1
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## 2.2 Lubrication Schedule

Lubrication Schedule	2.2-1/1
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TYPE 911 SPECIFICATIONS - BEGINNING WITH 1972 MODELS

MOTOR	911 T	911 E	911 S
Type	four-stroke gasoline engine with two opposing cylinder banks		
Number of cylinders	6	6	6
Cylinder arrangement	horizontal, three cylinders per bank	horizontal, three cylinders per bank	horizontal, three cylinders per bank
Bore	84 mm (3.31 in.)	84 mm (3.31 in.)	84 mm (3.31 in.)
Stroke	70.4 mm (2.77 in.)	70.4 mm (2.77 in.)	70.4 mm (2.77 in.)
Engine displacement	2341 cc (142.8 cu. in.)	2341 cc (142.8 cu. in.)	2341 cc (142.8 cu. in.)
Compression ratio	7.5 : 1	8.0 : 1	8.5 : 1
Cylinder pressure	maximum difference in compression between cylinders = 1.5 kp/cm <sup>2</sup> (21.3 psi), with engine oil warmed to at least 60°C (140°F).		
Horsepower rating (DIN)	140 HP	165 HP	190 HP
(SAE NET)	133 HP	157 HP	181 HP
at engine speed of	5600 rpm	6200 rpm	6500 rpm
Maximum torque (DIN)	20 mkp	21 mkp	22 mkp
(SAE)	166 ft. lbs.	174 ft. lbs.	181 ft. lbs.
at engine speed of	4000 rpm	4500 rpm	5200 rpm
Specific power output (DIN)	60 HP/ltr	70 HP/ltr	81 HP/ltr
	55 HP/ltr	65 HP/ltr	75 HP/ltr
	.93 HP/cu. in.	1.09 HP/cu. in.	1.26 HP/cu. in.
Maximum engine speed	6500 rpm	7100 rpm	7300 rpm

	911 T	911 E	911 S
Cut off speed of ignition distributor speed limiter	6500 $\pm$ 100 rpm	7100 $\pm$ 100 rpm	7300 $\pm$ 100 rpm
Fuel octane requirement	91	91	91
Engine weight	approx. 183 kp (404 lbs)	approx. 182 kp (402 lbs)	approx. 182 kp (402 lbs)
Nominal fuel consumption	9.0 ltr/100 km 26.1 mpg	9.5 ltr/100 km 24.7 mpg	10.2 ltr/100 km 23.0 mpg
Cooling system	air cooled by axial fan on alternator shaft	air cooled by axial fan on alternator shaft	air cooled by axial fan on alternator shaft
Air fan drive	by V-belt off crankshaft	by V-belt off crankshaft	by V-belt off crankshaft
Crankshaft to fan ratio	approx. 1 : 1.3	approx. 1 : 1.3	approx. 1 : 1.3
Air flow rate	approx. 1230 ltr/sec @ 5800 rpm	approx. 1380 ltr/sec @ 6500 rpm	approx. 1380 ltr/sec @ 6500 rpm
Lubrication system	dry sump	dry sump	dry sump
Oil cooling system	oil cooler on crankcase in air stream of fan	oil cooler on crankcase in air stream of fan	oil cooler on crankcase in air stream of fan plus auxiliary oil cooler in front of vehicle
Oil pressure indication	by warning light	by warning light	by gauge in kp/cm <sup>2</sup>
Oil pressure: engine warm 80°C (175°F) at 5500 rpm	5.5-7 kp/cm <sup>2</sup> (78-99 psi)	5.5-7 kp/cm <sup>2</sup> (78-99 psi)	5.5-7 kp/cm <sup>2</sup> (78-99 psi)
Max. oil temperature	130°C (265°F)	130°C (265°F)	130°C (265°F)
Oil filter type	full flow	full flow	full flow

	911 T	911 E	911 S
Oil consumption	1 1/2 - 2 ltr/100 km 1 1/2 - 2 US qts/600 mi	1 1/2 - 2 ltr/100 km 1 1/2 - 2 US qts/600 mi	1 1/2 - 2 ltr/100 km 1 1/2 - 2 US qts/600 mi
Crankcase	two-piece pressure casting of aluminum/magnesium alloy	two-piece pressure casting of aluminum/magnesium alloy	two-piece pressure casting of aluminum/magnesium alloy
Crankshaft	forged, surface-hardened	forged, surface-hardened	forged, surface-hardened
Crankshaft bearings	eight, plain journal	eight, plain journal	eight, plain journal
Main bearings 1-7	split shell, tri-metal inserts	split shell, tri-metal inserts	split shell, tri-metal inserts
Main bearing 1	thrust bearing	thrust bearing	thrust bearing
Main bearing 8	one-piece bushing, hard-lead lined	one-piece bushing, hard-lead lined	one-piece bushing, hard-lead lined
Connecting rods	forged steel	forged steel	forged steel surface-hardened
Connecting rod bearings	split shell, tri-metal inserts	split shell, tri-metal inserts	split shell, tri-metal inserts
Piston pin bushings	bronze, pressed-in	bronze, pressed-in	bronze, pressed-in
Intermediate shaft bearings	two, plain journal	two, plain journal	two, plain journal
Pistons	light-alloy, die-cast	light-alloy, die-cast	light-alloy, die-cast box-shaped
Piston pins	floating, secured with circlips	floating, secured with circlips	floating, secured with circlips
Piston rings	two compression rings, one oil scraper	two compression rings, one oil scraper	two compression rings, one oil scraper

	911 T	911 E	911 S
Cylinders	individual, grey-cast iron with integral cooling fins	individual, grey-cast iron sleeve with finned light alloy jacket	individual, grey-cast iron sleeve with finned light alloy jacket
Cylinder heads	light alloy, finned individual castings for each cylinder	light alloy, finned individual castings for each cylinder	light alloy (Y-alloy) finned individual castings for each cylinder
Valve seat inserts	shrunk-in, grey-cast iron alloy	shrunk-in, grey-cast iron alloy	shrunk-in, grey-cast iron alloy
Valve guides	shrunk-in, special bronze	shrunk-in, special bronze	shrunk-in, special bronze
Spark plug threads	14 x 1.25, machined into cylinder heads	14 x 1.25, machined into cylinder heads	14 x 1.25, machined into cylinder heads
Valves	1 intake and 1 exhaust valve per cylinder	1 intake and 1 exhaust valve per cylinder	1 intake and 1 exhaust valve per cylinder
Valve arrangement	overhead in "V"	overhead in "V"	overhead in "V"
Exhaust valves	sodium cooled, with reinforced seat	sodium cooled, with reinforced seat	sodium cooled, with reinforced seat
Valve springs	2 coil springs per valve	2 coil springs per valve	2 coil springs per valve
Valve timing	OHC, 1 camshaft per cylinder bank	OHC, 1 camshaft per cylinder bank	OHC, 1 camshaft per cylinder bank
Camshafts	cast steel, in three plain journal bearings in camshaft housing	cast steel, in three plain journal bearings in camshaft housing	cast steel, in three plain journal bearings in camshaft housing
Camshaft drive	by chain	by chain	by chain



911 T

911 E

911 S

Valve timing with 1 mm  
(0.039 in.) valve clearance

inlet opens 15° BTDC  
inlet closes 29° ATDC  
exhaust opens 41° BTDC  
exhaust closes 5° BTDC

18° BTDC  
36° ATDC  
38° BTDC  
8° ATDC

38° BTDC  
50° ATDC  
40° BTDC  
20° ATDC

Intake valve lift at overlap TC with  
0.1 mm (0.004 in.) valve clearance

2.3 - 2.7 mm (0.091 - 0.106 in.)

2.7 - 3.1 mm (0.106 - 0.122 in.)

5.0 - 5.4 mm (0.197 - 0.213 in.)

Valve clearance, cold,  
intake and exhaust

0.10 mm (0.004 in.) measured  
between valve stem and rocker arm0.10 mm (0.004 in.) measured  
between valve stem and rocker arm0.10 mm (0.004 in.) measured  
between valve stem and rocker arm

Clutch

single plate, dry, pull-actuated

single plate, dry, pull-actuated

single plate, dry, pull actuated

Pressure plate type

MFZ 225 KL, Fichtel &amp; Sachs

MFZ 225 KL, Fichtel &amp; Sachs

MFZ 225 KL, Fichtel &amp; Sachs

Plate pressure

650 - 720 kp (143 - 159 lbs.)

650 - 720 kp (143 - 159 lbs.)

650 - 720 kp (143 - 159 lbs.)

## FUEL SYSTEM

BOSCH intake manifold fuel injection  
with double row six-plunger,  
injection pumpBOSCH intake manifold fuel injection  
with double row six-plunger,  
injection pumpBOSCH intake manifold fuel injection  
with double row six-plunger,  
injection pump

Air cleaner

induction air silencer with cartridge  
filter and induction air preheating  
systeminduction air silencer with cartridge  
filter and induction air preheating  
systeminduction air silencer with cartridge  
filter and induction air preheating  
system

	911 T	911 E	911 S
Fuel pump	1 electric roll-cell pump	1 electric roll-cell pump	1 electric roll-cell pump
Transfer rate	125 ltr/h (128 qts/h)	125 ltr/h (128 qts/h)	125 ltr/h (128 qts/h)
Operating pressure	1 kp/cm <sup>2</sup> (14.2 psi)	1 kp/cm <sup>2</sup> (14.2 psi)	1 kp/cm <sup>2</sup> (14.2 psi)
Pressure relief valve opens at	approx. 2 kp/cm <sup>2</sup> (28.4 psi)	approx. 2 kp/cm <sup>2</sup> (28.4 psi)	approx. 2 kp/cm <sup>2</sup> (28.4 psi)
Fuel filter	fuel screen ahead of fuel injection pump with built-in restrictor valve	fuel screen ahead of fuel injection pump with built-in restrictor valve	fuel screen ahead of fuel injection pump with built-in restrictor valve
ELECTRICAL SYSTEM			
Operating voltage	12 volts	12 volts	12 volts
Battery capacity	2 x 36 Ah	2 x 36 Ah	2 x 36 Ah
Generator	AC, 770 watts	AC, 770 watts	AC, 770 watts
Voltage regulator	same make as generator	same make as generator	same make as generator
Ignition type	capacitive discharge system (CDS)	capacitive discharge system (CDS)	capacitive discharge system (CDS)
Firing order	1 - 6 - 2 - 4 - 3 - 5	1 - 6 - 2 - 4 - 3 - 5	1 - 6 - 2 - 4 - 3 - 5
Ignition transformer	BOSCH	BOSCH	BOSCH
Distributor (either kind)	MARELLI 50.10.974.1 BOSCH JFUDR6 0231169003	MARELLI 50.10.974.2 BOSCH JFUDR6 0231169004	MARELLI 50.10.974.3 BOSCH JFUDR6 0231169005
Spark advance	centrifugal and vacuum	centrifugal and vacuum	centrifugal and vacuum
Basic ignition timing	5° ATDC @ 900 rpm	5° ATDC @ 900 rpm	5° ATDC @ 900 rpm
Dwell angle	BOSCH 38° ± 3° MARELLI 40° ± 3°	BOSCH 38° ± 3° MARELLI 40° ± 3°	BOSCH 38° ± 3° MARELLI 40° ± 3°

	911 T	911 E	911 S
Spark plugs (either kind)	BOSCH W 235 P 21 or similar	BOSCH W 265 P 21 BERU 265/14/3 P or similar	BOSCH W 265 P 21 BERU 265/14/3 P or similar
Electrode gap	0.5 - 0.6 mm	0.5 - 0.6 mm	0.5 - 0.6 mm
Starter	BOSCH 12 V, 1.5 HP	BOSCH 12 V, 1.5 HP	BOSCH 12 V, 1.5 HP
Bulb List (12 V)			
Headlamps (Halogen) H 1	(see USA table)	55 W, 2 each lamp	55 W, 2 each lamp
Driving lamps (Halogen) H 1 and H 3	(see USA table)	55 W	55 W
Fog lamps	35 W	55 W	55 W
Stop lamp/tail lamp	(see USA table)	21/5 W	21/5 W
Directional signals	(see USA table)	21 W	21 W
Backup lamp	(see USA table)	15 W	15 W
Fog tail lamp	(not for USA)	18 W	18 W
Interior lamp, luggage compart- ment lamp, glove compartment lamp	10 W	10 W	10 W
Parking lamp, license plate lamp	(see USA table)	4 W	4 W
Instrument lamps, control lamps, ashtray lamp	2 W	2 W	2 W
Control lamp for ventilator and auxiliary heater	1.2 W	1.2 W	1.2 W

Bulb List	911 T	911 E	911 S
Sealed beam headlamps	50/40 W (6012)	50/40 W (6012)	50/40 W (6012)
Fog lamps	35 W	35 W	35 W
Stop/tail lamp	32/3 cp (1034)	32/3 cp (1034)	32/3 cp (1034)
Front turn signal/parking lamps	32/3 cp (1034)	32.3 cp (1034)	32/3 cp (1034)
Rear turn signal	32 cp (1073)	32 cp (1073)	32 cp (1073)
Backup lamp	15 cp (1003)	15 cp (1003)	15 cp (1003)
Sidemarkers lamp	2 cp (1889)	2 cp (1889)	2 cp (1889)
Interior lamp, luggage compartment lamp, glove compartment lamp	10 W	10 W	10 W
License plate lamp	4 W	4 W	4 W
Instrument lamps, control lamps, ashtray lamp	2 W	2 W	2 W
Control lamp for ventilator and auxiliary heater	1.2 W	1.2 W	1.2 W
Fuses			
Fuse Box I			
1 - Interior lamp, luggage compartment lamp, glove compartment lamp, clock	5 A	5 A	5 A
2 - Emergency flasher	16 A	16 A	16 A
3 - Power windows	25 A	25 A	25 A
4 - Cigarette lighter (auxiliary heater)	16 A (25 A)	16 A (25 A)	16 A (25 A)
5 - Sun roof, rear window wiper	16 A	16 A	16 A
6 - Windshield wipers, windshield washer	25 A	25 A	25 A
7 - Fresh air fan, rear window defroster	25 A	25 A	25 A

	911 T	911 E	911 S
8 - Stop, rear turn signal, and backup lamps	16 A	16 A	16 A
9 - Left front turn signal lamp	5 A	5 A	5 A
10 - Right front turn signal lamp	5 A	5 A	5 A
Fuse Box II			
1 - High beam, left	8 A	8 A	8 A
2 - High beam, right	8 A	8 A	8 A
3 - Low beam, left	8 A	8 A	8 A
4 - Low beam, right	8 A	8 A	8 A
5 - Parking lamp, left	5 A	5 A	5 A
6 - Parking lamp, right	5 A	5 A	5 A
7 - License plate lamp	5 A	5 A	5 A
8 - Fog lamp	16 A	16 A	16 A
TRANSMISSION AND FINAL DRIVE			
Type	Transmission and differential unitized in one assembly	Transmission and differential unitized in one assembly	Transmission and differential unitized in one assembly
Transmission	4 forward speeds, one reverse, with Porsche synchronization (5 speeds optional)	4 forward speeds, one reverse, with Porsche synchronization (5 speeds optional)	4 forward speeds, one reverse, with Porsche synchronization (5 speeds optional)

	911 T	911 E	911 S
Gear ratio, reverse speed	3.325 : 1	3.325 : 1	3.325 : 1
Gear shift system	shift linkage with floor mounted gearshift lever	shift linkage with floor mounted gearshift lever	shift linkage with floor mounted gearshift lever
Rear axle drive	spiral bevel gears, differential unit	spiral bevel gears, differential unit	spiral bevel gears, differential unit
Rear axle ratio	7/31, 4.429 : 1	7/31, 4.429 : 1	7/31, 4.429 : 1
Power transfer	to rear wheels by drive shafts with two CV joints per shaft	to rear wheels by drive shafts with two CV joints per shaft	to rear wheels by drive shafts with two CV joints per shaft
Gearbox weight	approx. 49 kp (108 lbs), ready for installation including oil supply but without starter.	approx. 49 kp (108 lbs), ready for installation including oil supply but without starter.	approx. 49 kp (108 lbs), ready for installation including oil supply but without starter.
Limited slip differential	ZF limited slip differential optional with manual transmissions	ZF limited slip differential optional with manual transmissions	ZF limited slip differential optional with manual transmissions
Sportomatic Transmission Type	925/00	925/00	925/01
Clutch (190 mm dia)	hydraulic torque converter and vacuum actuated single plate, dry clutch MFZ 190K	hydraulic torque converter and vacuum actuated single plate, dry clutch MFZ 190K	hydraulic torque converter and vacuum actuated single plate, dry clutch MFZ 190K
Number of gears	4 forward, 1 reverse, and parking lock	4 forward, 1 reverse, and parking lock	4 forward, 1 reverse, and parking lock
Selector lever location	floor mounted on center tunnel	floor mounted on center tunnel	floor mounted on center tunnel
Torque converter ratio	2.19 : 1	2.19 : 1	2.10 : 1
Rear axle ratio	7/27, 3.857 : 1	7/27, 3.857 : 1	7/27, 3.857 : 1

	911 T	911 E	911 S
Tow-start speed in "L"	35 kmh (21 mph)	35 kmh (21 mph)	35 kmh (21 mph)
Stallspeed	approx. 2500 - 2700 rpm	approx. 2500 - 2700 rpm	approx. 2900 - 3100 rpm
Clutch speed	approx. 3000 rpm	approx. 3000 rpm	approx. 3000 rpm
<b>CHASSIS</b>			
Body characteristics	welded assembly, sheet metal box section, unitized with body	welded assembly, sheet metal box section, unitized with body	welded assembly, sheet metal box section, unitized with body
Wheel suspension, front	independent, with shockabsorber struts and transverse control arms	independent, with shockabsorber struts and transverse control arms	independent, with shockabsorber struts and transverse control arms
rear	independent, with triangulated control arms	independent, with triangulated control arms	independent, with triangulated control arms
Springing, front	1 round longitudinal torsion bar per wheel	1 round longitudinal torsion bar per wheel	1 round longitudinal torsion bar per wheel
rear	1 round transverse torsion bar per wheel	1 round transverse torsion bar per wheel	1 round transverse torsion bar per wheel
Rear control arm adjustment (spring plate inclination)	36° 30' to 37°	36° 30' to 37°	36° 30' to 37°

		911 T	911 E	911 S
Shockabsorbers	front	double-action hydraulic shockabsorber strub	double-action hydraulic shockabsorber strub	double-action hydraulic shockabsorber strub
	rear	double-action hydraulic shockabsorber	double-action hydraulic shockabsorber	double-action hydraulic shockabsorber
Stabilizers				transverse, 15 mm (0,59 in.) dia
Steering		rack-steering ZF	rack-steering ZF	rack-steering ZF
Mean steering ratio		17,78 : 1	17,78 : 1	17,78 : 1
Steering wheel turns, lock-to-lock		approx. 3,1	approx. 3,1	approx. 3,1
Smallest turning circle		approx. 10,7 m (35,1 ft.)	approx. 10,7 m (35,1 ft.)	approx. 10,7 m (35,1 ft.)
Toe-in.	front	$\pm 0'$	$\pm 0'$	$\pm 0'$
	rear	$0^{\circ}$ to $+ 20'$ per wheel	$0^{\circ}$ to $+ 20'$ per wheel	$0^{\circ}$ to $+ 20'$ per wheel
Chamber	front	$0^{\circ} \pm 10'$	$0^{\circ} \pm 10'$	$0^{\circ} \pm 10'$
	rear	$- 1^{\circ} \pm 10'$	$- 1^{\circ} \pm 10'$	$- 1^{\circ} \pm 10'$
Caster		$6^{\circ} 5' \pm 15'$	$6^{\circ} 5' \pm 15'$	$6^{\circ} 5' \pm 15'$
Inclination		$10^{\circ} 55'$	$10^{\circ} 55'$	$10^{\circ} 55'$
Difference angle, front wheels turned $20^{\circ}$		0 to $30'$	0 to $30'$	0 to $30'$



	911 T	911 E	911 S
Wheels	steel, 5 1/2J x 15, optional 6J x 15 steel or light alloy	steel, 6J x 15 or optional light alloy	6J x 15 light-alloy
Tires	165 HR 15	185/70 VR 15	185/70 VR 15
Tire pressures (cold)			
front	1.8 atm (26 psi)	1.8 atm (26 psi)	1.8 atm (26 psi)
rear	2.0 atm (29 psi)	2.0 atm (29 psi)	2.0 atm (29 psi)
for speeds above 200 kmh (125 mph)			
front	2.2 atm (32 psi)	2.2 atm (32 psi)	2.2 atm (32 psi)
rear	2.4 atm (35 psi)	2.4 atm (35 psi)	2.4 atm (35 psi)
for snow tires			
front	2.0 atm (29 psi)	2.0 atm (29 psi)	2.0 atm (29 psi)
rear	2.2 atm (32 psi)	2.2 atm (32 psi)	2.2 atm (32 psi)
Service brake	hydraulic, dual-circuit, vented - disc brakes on all four wheels	hydraulic, dual-circuit, vented - disc brakes on all four wheels	hydraulic, dual-circuit, vented - disc brakes on all four wheels
Total effective braking surface (foot brake)	210 cm <sup>2</sup> (32.55 sq.in.)	210 cm <sup>2</sup> (32.55 sq.in.)	257 cm <sup>2</sup> (39.84 sq. in.)
Effective brake disc diameter			
front	235 mm (9.25 in.)	235 mm (9.25 in.)	228 mm (8.98 in.)
rear	244 mm (9.61 in.)	244 mm (9.61 in.)	244 mm (9.61 in.)
Parking brake	mechanical, to rear wheels	mechanical, to rear wheels	mechanical, to rear wheels
<b>BODY</b>			
Type	all-steel body, unitized with underbody, sloping front, fastback rear in Coupe	all-steel body, unitized with underbody, sloping front, fastback rear in Coupe	all-steel body, unitized with underbody, sloping front, fastback rear in Coupe
Doors	2 doors attached to the body A-pillars	2 doors attached to the body A-pillars	2 doors attached to the body A-pillars

	911 T	911 E	911 S
Door opening angle	approx. 70°	approx. 70°	approx. 70°
Windows			
Windshield	one-piece, constant radius, convex contour, laminated safety glass	one-piece, constant radius, convex contour, laminated safety glass	one-piece, constant radius, convex contour, laminated safety glass
Door windows	crankdown windows	crankdown windows	crankdown windows
Rear side windows	open and lock in position	open and lock in position	open and lock in position
Rear window	one-piece, convex contour, electrically heated	one-piece, convex contour, electrically heated	one-piece, convex contour, electrically heated
Windshield wipers	electric, 2 parallel wiping arms, 3 speeds	electric, 2 parallel wiping arms, 3 speeds	electric, 2 parallel wiping arms, 3 speeds
Front hood	opens from front of vehicle, with hydraulic stays, hood release under instrument panel	opens from front of vehicle, with hydraulic stays, hood release under instrument panel	opens from front of vehicle, with hydraulic stays, hood release under instrument panel
Engine compartment lid	opens from rear of vehicle, with hydraulic stays, lid release in left rear door post	opens from rear of vehicle, with hydraulic stays, lid release in left rear door post	open from rear of vehicle, with hydraulic stays, lid release in left rear door post
Heating	hot air heating with remote control; hot air mixable with outside air; 2 defroster outlets at the windshield, and 2 hot air outlets into passenger compartment leg area	hot air heating with remote control; hot air mixable with outside air; 2 defroster outlets at the windshield, and 2 hot air outlets into passenger compartment leg area	hot air heating with remote control; hot air mixable with outside air; 2 defroster outlets at the windshield, and 2 hot air outlets into passenger compartment leg area

911 T

911 E

911 S

Ventilation	flap-controlled fresh air chamber, 3-speed fan, air distributor system, centralized control unit	flap-controlled fresh air chamber, 3-speed fan, air distributor system, centralized control unit	flap-controlled fresh air chamber, 3-speed fan, air distributor system, centralized control unit
<b>CAPACITIES</b>			
Engine	approx. 8 ltr (8.5 US qts) premium quality HD oil according to API classification SD or SE; summer SAE 30, winter SAE 20, below -15°C (+5°F) SAE 10 W	approx. 8 ltr (8.5 US qts) premium quality HD oil according to API classification SD or SE; summer SAE 30, winter SAE 20, below -15°C (+5°F) SAE 10 W	approx. 8 ltr (8.5 US qts) premium quality HD oil according to API classification SD or SE; summer SAE 30, winter SAE 20, below -15°C (+5°F) SAE 10 W first filling approx. 9 ltr (9.5 US qts) with oil cooler
Engine together with Sportomatic (torque converter in engine oil circuit)	approx. 10 ltr (10.5 US qts)	approx. 10 ltr (10.5 US qts)	approx. 11 ltr (11.5 US qts) with oil cooler
Transmission and differential	approx. 3.0 ltr (3 US qts) SAE 30 transmission oil, specification MIL-L 2105 or MIL-L 2105 B	approx. 3.0 ltr (3 US qts) SAE 30 transmission oil, specification MIL-L 2105 or MIL-L 2105 B	approx. 3.0 ltr (3 US qts) SAE 30 transmission oil, specification MIL-L 2105 or MIL-L 2105 B
Fuel tank	approx. 62 ltrs (16.4 US gals) including 6 ltrs (1.6 US gals) reserve Fuel requirement: 91 octane (RON)	approx. 62 ltrs (16.4 US gals) including 6 ltrs (1.6 US gals) reserve Fuel requirement: 91 octane (RON)	approx. 62 ltrs (16.4 US gals) including 6 ltrs (1.6 US gals) reserve Fuel requirement: 91 octane (RON)
Brake fluid reservoir	approx. 0.2 ltr (0.42 US pints)	approx. 0.2 ltr (0.42 US pints)	approx. 0.2 ltr (0.42 US pints)
Windshield washer reservoir	approx. 2.0 ltr (2 US qts)	approx. 2.0 ltr (2 US qts)	approx. 2.0 ltr (2 US qts)
<b>DIMENSIONS</b>			
Vehicle empty according to DIN			
Wheelbase	2271 mm (89.4 in.)	2271 mm (89.4 in.)	2271 mm (89.4 in.)
Track, front (wheel center 108 mm above torsion bar center)	1360 mm (53.54 in.)	1372 mm (54.0 in.)	1372 mm (54.0 in.)
Track, rear (wheel center 12 mm below transverse tube center)	1342 mm (52.82 in.)	1354 mm (53.34 in.)	1354 mm (53.34 in.)

1.1-1/16  
(USA only)

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	911 T	911 E	911 S
Length, USA and Canada only	4163 mm (163.9 in.)	4163 mm (163.9 in.)	4163 mm (163.9 in.)
Width	1610 mm (63.39 in.)	1610 mm (63.39 in.)	1610 mm (63.39 in.)
Height (unladen)	1320 mm (51.97 in.)	1320 mm (51.97 in.)	1320 mm (51.93 in.)
Ground clearance	150 mm (5.91 in.)	150 mm (5.91 in.)	150 mm (5.91 in.)
<b>WEIGHTS</b>			
Unladen weight	1061 kp (2340 lbs)	1061 kp (2340 lbs)	1061 kp (2340 lbs)
Maximum load capacity	280 kp (617 lbs)	280 kp (617 lbs)	280 kp (617 lbs)
Total permissible weight	1400 kp (3086 lbs)	1400 kp (3086 lbs)	1400 kp (3086 lbs)
Maximum axle load, front	600 kp (1320 lbs)	600 kp (1320 lbs)	600 kp (1320 lbs)
rear	840 kp (1852 lbs)	840 kp (1852 lbs)	840 kp (1852 lbs)
Permissible trailer weight,			
without brakes	480 kp (1058 lbs)	480 kp (1058 lbs)	480 kp (1058 lbs)
with brakes	600 kp (1320 lbs)	600 kp (1320 lbs)	600 kp (1320 lbs)

	911 T	911 E	911 S
<b>PERFORMANCE DATA</b>			
Max. speed (with 4 or 5 speed transmission)	208 kmh 129 mph	220 kmh 137 mph	230 kmh 143 mph
	with Sportomatic transmission ca. 5 kmh (3 mph) slower than shown above		
1 km with standing start at DIN empty weight + 1/2 loading capacity	30.0 sec	28.5 sec	27.5 sec
Weight-to-power ration DIN	7.5 kp/HP	6.37 kp/HP	5.52 kp/HP
Nominal fuel consumption	9.0 ltr/100 km 26.1 mpg(US)	9.5 ltr/100 km 24.7 mpg (US)	10.2 ltr/100 km 23.0 mpg (US)
Engine oil consumption	1.5 - 2.0 ltr (1.5 - 2.0 US qts per 600 miles)	1.5 - 2.0 ltr (1.5 - 2.0 US qts per 600 miles)	1.5 - 2.0 ltr (1.5 - 2.0 US qts per 600 miles)



Service Schedule, Type 911 T, 911 E, and 911 S (beginning with 1972 models)

at 1000 miles	Maintenance required	then at and every 10 000 miles
—	<b>A. Before Road or Dynamometer Test</b>	
	1. Front wheel bearing play : Check.	
	2. Steering : Check all connections and rubber boots for tightness and for leaks.	—
—	3. V-belt and injection pump spur belt : Check.	—
—	4. Valve adjustment (rocker arm shafts for tightness)* : Check.	—
—	5. Ignition points and timing : Check (engine at operating temperature.)	—
	6. Fuel and air filter cartridges : Replace.	—
	7. Flame trap cartridge : Clean.	—
—	8. Clutch pedal free play : Check.	—
	9. Complete brake system (incl. wear and leaks) : Check.	—
—	10. Reflectors and operation of lights : Check.	—
—	11. Horn, wipers and washer : Check.	—
—	12. Battery electrolyte level : Check.	—
—	<b>B. During Road or Dynamometer Test</b>	
—	1. Test engine performance, foot and parking brakes, clutch operation and gear shifting.	—
—	2. All instruments, control and warning lights : Check.	—
—	<b>C. After Road or Dynamometer Test</b>	
—	1. Engine idle and exhaust emission : Check.	—

**Note:** The recommended service intervals apply under normal driving conditions. The condition of tires, brakes and clutch lining depends greatly on the amount of driving and on driving habits and should possibly be checked at shorter intervals. A complete maintenance service as well as protection against corrosion should be carried out at least once a year, preferably before the winter.

\* Necessary at first maintenance only.





Lubrication Schedule for Type 911 T, 911 E, and 911 S (beginning with 1972 models)

at 1000 miles	Service required	then at and every 10 000 miles
█	<b>Engine</b> Engine oil : Change (oil at operating temperature), at least twice a year, preferably once before summer and once before winter.	█
█	Oil strainer and magnetic drain plugs : Clean.	█
█	Oil filter : Replace.	█
	Lubricate : Accelerator linkage.	█
█	<b>Transmission</b> Transmission oil : Change (oil at operating temperature.)	█
█	Magnetic drain plug : Clean.	█
	<b>Miscellaneous</b> Lubricate : Door and hood hinges and locks.	█

**Note :** The recommended service intervals apply under normal driving conditions. The condition of oil, and wear and tear items depends greatly on the amount of driving and on driving habits. Therefore, oil, and wear and tear items should be checked more frequently and possibly changed at shorter intervals. A complete lubrication and maintenance service should be carried out at least once a year, preferably before the winter. The same applies to protective undercoating for the vehicle.

