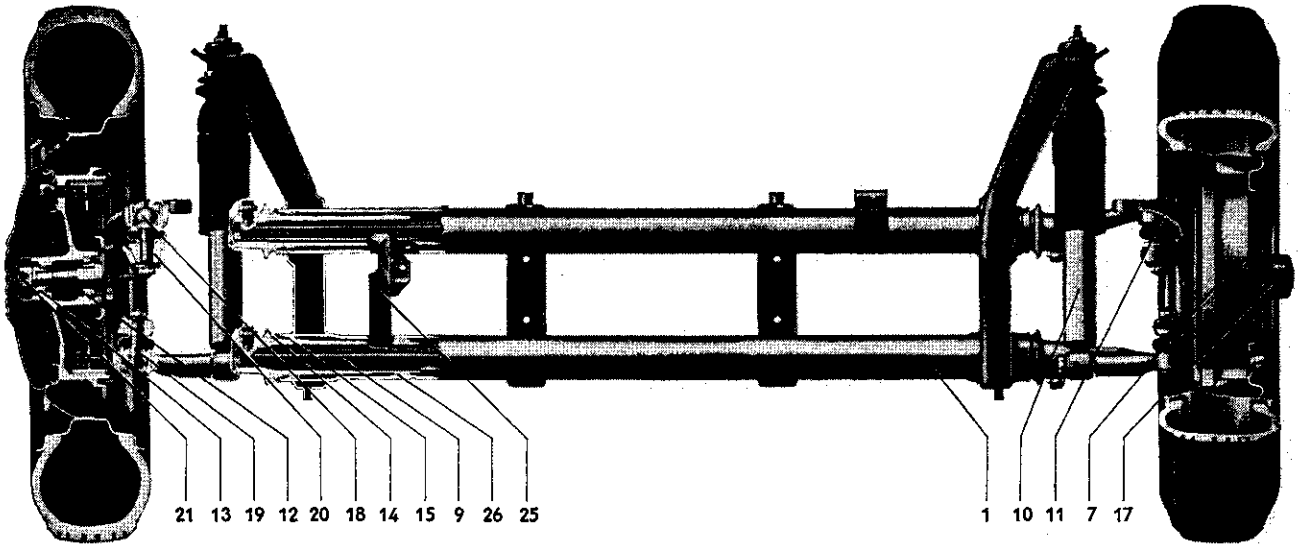
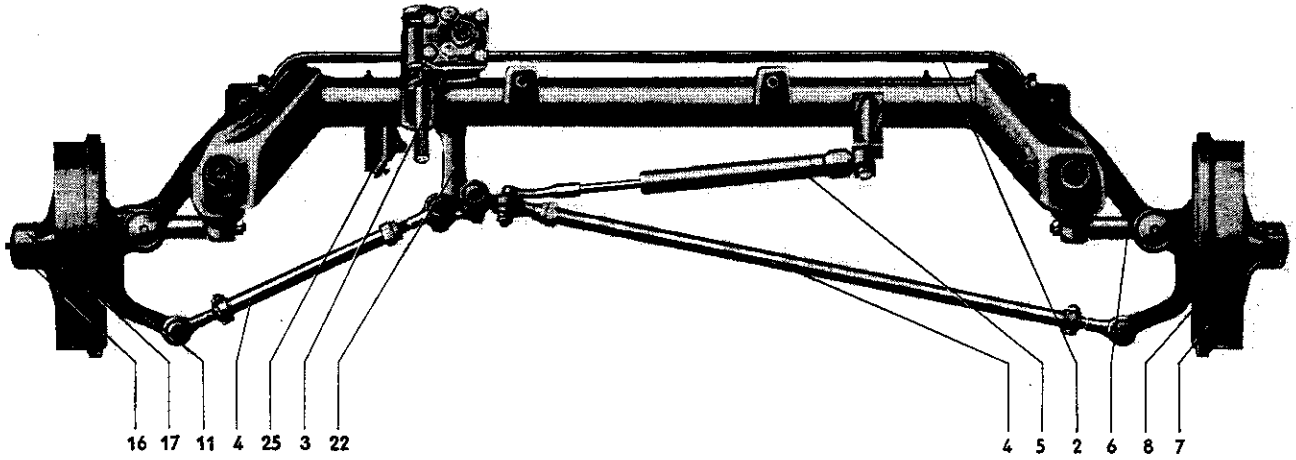
Section V

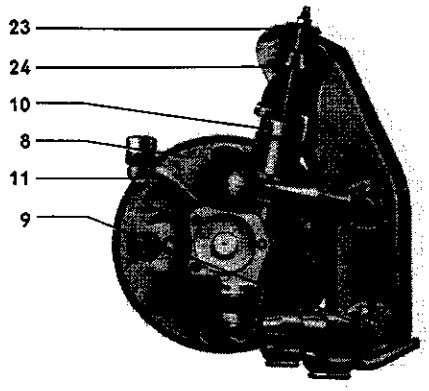
Front Suspension and Steering

1.1 Front Suspension Description
1.2 Steering Description
1.4 Technical Data
4.1 Disassembling, Assembling Front Suspension
6.1 Tie Rods, Steering Damper
7.1 Steering Column
8.1 Steering Box





1 - Front axle beam
2 - Stabilizer bar
3 - Steering gear
4 - Tie-rods
5 - Steering damper
6 - Torsion arm
7 - Brake drum
8 - Brake backing plate
9 - Torsion bar
10 - Shock absorber
11 - Steering knuckle
12 - Inner wheel bearing
13 - Outer wheel bearing
14 - Torsion arm seal
15 - Torsion arm needle bearing
16 - Speedometer cable
17 - Dust cap
18 - Upper ball joint
19 - Lower ball joint
20 - Eccentric bush for camber adjustment
21 - Clamp nut for wheel bearing adjustment
22 - Steering drop arm
23 - Damper ring
24 - Rubber stop
25 - Wheel lock stop
26 - Plastic seating and metal bushing



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The main design features of the front axles on Type 1 and 2 vehicles are the same. The basic construction described therefore, is of the Type 1 axle.

Both front axles can be replaced as complete units and are readily detachable from the frame head or side members. The wheels are individually suspended and thus independently sprung.

Front axle beam

The front axle beam consists of two tubes which are rigidly joined together by welded-on end plates and house the torsion bars. When damaged, the axle beam should be replaced complete. Do not attempt to repair any damage by straightening or welding.

Springing and wheel suspension

In each axle tube is a torsion bar consisting of a pack of separate leaves (Type 1: 10 leaves, Type 2: 9 leaves). The torsion bars are located in an anchor bush in the center and secured with a headless setscrew. The torsion arms are pushed onto the ends of the torsion bars and are also secured with headless setscrews.

A stabilizer bar is attached to the lower torsion arms with rubber blocks and clamps.

Progressively acting, hydraulic, telescopic shock absorbers prevent the vehicle from bouncing and pitching when driving over poor roads. The shock absorbers are designed to match the vehicle suspension characteristics so only shock absorbers of the specified type may be installed. They are attached to the axle end plate at the top and to a pin in the torsion arm at the bottom.

Maintenance-free ball joints connect the torsion arms to the steering knuckle. The ball joints are pressed into the torsion arm (additionally peened on Type 2). They are joined to the steering knuckle by a tapered stud and a nut. The stud points upwards on the lower ball joint of the Type 1 and downward on the Type 2. The ball heads of the joints are fitted in wear-resistant plastic shells and lubricated with a special grease to assure ease of movement and long service life. Sturdy rubber boots secured to the joint body or stud with steel clips protect the joints against moisture and dirt.

The brake drums (Types 1 and 2) or the brake discs/wheel hub (Karmann Ghia only) are cast in one piece and the wheel bearings are of the taper roller type.

Front axle with ball joints, Types 1 and 2

The main design features of the front axles on Types 1 and 2 vehicles are the same. The basic construction is therefore described for the Type 1 axle.

Both front axles can be replaced as complete units and are readily detachable from the frame head or side members.

Front axle beam

The front axle beam consists of two tubes which are rigidly joined together by welded end plates and house the torsion bars. When damaged, the axle beam should be replaced complete. Do not attempt to repair any damage by straightening or welding.

Springing and wheel suspension

In each axle tube there is a laminated torsion bar consisting of flat steel leaves (Type 1:10 leaves, Type 2: 9 leaves). The torsion bars are located in an anchor bushing in the center and secured with a setscrew. The torsion arms are pushed on to the ends of the torsion bars and also secured with setscrews.

A torsion bar stabilizer is attached to the lower torsion arm with rubber mounting blocks and retaining clips.

Progressive acting, hydraulic, telescopic shock absorbers prevent the vehicle from bouncing and pitching when driving over uneven road surfaces. The shock absorbers are designed to match the vehicle suspension characteristics so only shock absorbers of the specified type may be installed. They are attached to the axle end plate at the top and to a stud in the torsion arm at the bottom.

Maintenance-free ball joints connect the torsion arms to the steering knuckle. The ball joints are pressed into the torsion arm (peened as well on Type 2) and are joined to the steering knuckle by a tapered stud and a nut. The stud points upward on the lower ball joint of the Type 1 and downward on the Type 2. The ball-shaped heads of the joints are located in wear-resistant plastic shells and lubricated with a special grease to give ease of movement and long service life. Sturdy rubber boots secured to the joint body or stud with steel retaining rings protect the joints against moisture and dirt.

The brake drums or the brake discs and wheel hub on Type 1 vehicles are cast in one piece and the wheel bearings are the tapered roller type.

Front axle with ball joints Type 1, Model 181

The front axle of the Type 1, Model 181 is basically the same as the axle of the Type 1/Sedan 111. The Type 1, Model 181 has modified steering knuckles, a greater ground clearance, lower steering ball joints with studs facing downward, stronger torsion arms and end plates. The front axle of the Type 1, Model 181 is also provided with additional supports attached to the frame.

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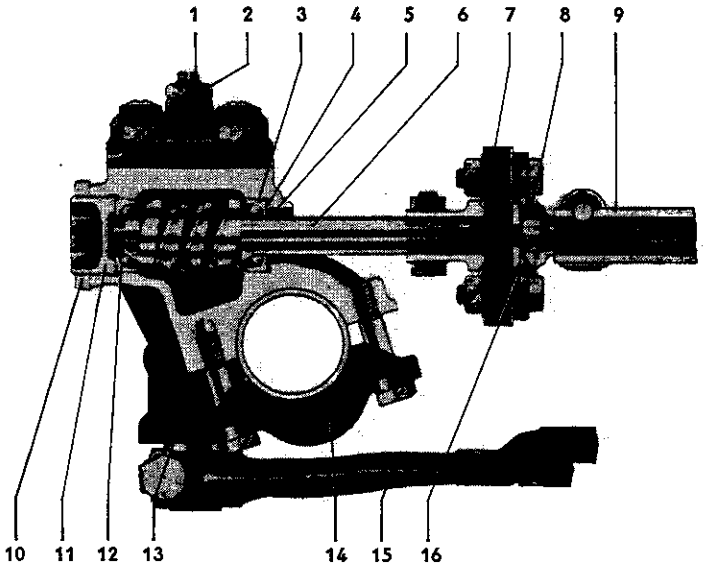
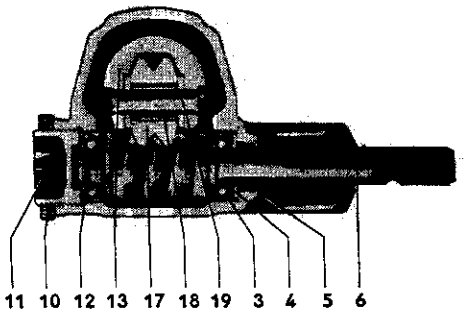
All Type 1 and 3 vehicles are fitted with a roller type steering gear. The steering column is mounted inside a column tube attached to the body. The column is connected to the steering gear by means of coupling with a rubber/fabric disc. The steering case is secured to the axle tube with a mounting clamp. Adjustable, maintenance-free tie-rods located behind the axle beam transmit the steering movements to the road wheels. A hydraulic steering damper helps to reduce road shocks.

The steering housing contains a shaft to which a roller, fitted in a needle bearing, is mounted. This roller engages in an adjustable steering worm spindle. The steering worm spindle is mounted in two thrust ball bearings. The roller is held in bronze bushings in the housing on one side, in the housing cover on the other. The spindle is adjusted axially by a washer fitted under the upper bearing. The steering roller shaft and thus the depth of engagement of the roller in the worm is adjusted with a screw in the housing cover.

Due to a design feature, the roller steering is only free of play in a certain range in the central position. When the steering is moved with the vehicle stationary, the play between spindle and roller increases steadily. The play is not noticed when the vehicle is in motion because of the self-centering action of the wheels.



1 - Roller shaft adjustment screw
2 - Lock nut
3 - Upper worm bearing
4 - Adjusting shim for worm
5 - Oil seal for worm
6 - Steering worm
7 - Coupling disc
8 - Flange for coupling disc
9 - Steering column
10 - Lock nut
11 - Worm adjusting screw
12 - Lower worm bearing
13 - Steering roller shaft
14 - Mounting clamp
15 - Drop arm
16 - Ground connection terminal
17 - Steering roller
18 - Roller needle bearings
19 - Roller support pin



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Steering linkage, Type 1/Sedan 111 and Type 3

Type 1 / Sedan 111 and Type 3 vehicles have two maintenance-free tie rods which are located in a protected area behind the front axle. Both tie rods are adjustable. The movements of the drop arm are transmitted to the wheels by the tie rods. Road shocks are damped by a hydraulic steering damper. The damper is attached to the front axle beam and the tie rod or, on the Type 3, to the drop arm.

Steering linkage, Type 1 / Sedan 113 and Type 4

The Type 1 / Sedan 113 and Type 4 vehicles have three maintenance-free tie rods. The center tie rod is fixed in length and the two outer ones are ajustable.

The movements of the drop arm are transmitted by the center tie rod to the idler arm which is mounted in bonded rubber bushings in the idler arm bracket.

Two adjusting bolts in the bracket limit the movement of the idler arm and thus the wheel lock to left and right. The idler arm bracket is attached to the side member with three bolts.

The hydraulic steering damper is attached to the front axle carrier and the center tie rod.

Steering linkage, Type 2

On the Transporter, the drop arm transmits the movements via an adjustable draglink to the swing lever and two maintenance-free tie rods to the wheels. One tie rod is adjustable and the other is fixed in length. The hydraulic steering damper is attached to the front axle beam and the swing lever.

539.307.23 V 7th Supplement Printed in Germany 5. 71

Torque specifications for front axle and steering Type 1 / Sedan 111 and Model 181

Location	Description	Thread	Quality grade	Tensile class	mkg	lb ft
Front axle to frame	bolt	M 12×1.5	8 G	8.8	5.0	36
Steering damper to axle	bolt	M 10	8 G	8.8	4.0—4.5	29—32
Steering damper to tie rod	nut	M 10×1	6 G	8	2.5	18
Shock absorber to axle beam side plate	nut	M 10 M 12×1.5	6 G 10 K	6 10.9	2.0 3.0—3.5	14 22—25
Shock absorber to lower torsion arm	nut	M 10	6 G	8	3.0—3.5	22—25
Tie rod to steering knuckle and drop arm	slotted nut	M 12×1.5 M 10×1	8 G	10 8	3.0[1]) 2.5[1])	22[1]) 18[1])
Setscrew for torsion bar	socket hd. screw	M 14×1.5	CK 15 Kv		4.0—5.0	29—36
Locknut for setscrew	nut	M 14×1.5	6 G		4.0—5.0	29—36
Steering ball joint to steering knuckle	self-locking nut	M 12×1.5	6 S	8	5.0—7.0	36—50
Screw for wheel bearing clamp nut	socket hd. screw	M 7	10 K	10.9	1.0—1.3	7—10
Caliper to steering knuckle	bolt	M 10	10 K	10.9	4.0	29
Steering gear to front axle	bolt	M 10	8 G	8.8	2.5—3.0	18—22
Worm shaft to steering coupling	bolt	M 8	10 K	10.9	2.0—2.5	14—18
Steering wheel to column	nut	M 18×1.5	6 G		5.0	36
Drop arm to roller shaft	bolt	M 12×1.5	8 G	8.8	7.0	50
Cancelling ring to steering wheel	fillister hd. screw	AM 3.5	8 G	8.8	0.5	3.5
Lock nut for tapered ring on tie rod	nut	M 14×1.5	6 G		2.5	18
Bolt in clamp for tie rod	bolt	M 8×1	8 G	8.8	1.5	11
Steering column tube mounting plate to instrument panel	bolt with groove	M 8	8 G	8.8	1.5	11
Steering coupling flange to disc	nut	M 8	6 G	8	1.5	11
Cover for steering gear housing	bolt	M 8×1.25	8 G		2.0—2.5	14—18
Locknut for drop arm shaft adjusting screw	nut	M 10×1	5 S		2.5	18
Locknut for worm spindle adjusting screw	nut	M 35×1.5	9 S K 20		5.0—6.0	36—43
Column to coupling flange	bolt	M 8	10 K	10.9	1.5	11
Bracket to front axle (Model 181)	nut	M 12×1.5	10 K	10.9	5.5—6.0	40—43
Front axle bracket to frame (Model 181)	nut	M 10	8 G	8.8	5.5—6.0	40—43

[1]) and turn further to cotter pin hole

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Most front axle repairs can be performed with the axle on the vehicle.

When the axle is taken off, it should be mounted in the repair stand with VW 309 and VW 309c.

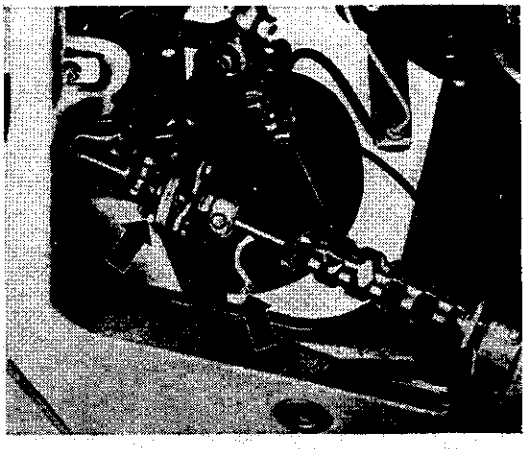
If it is suspected that the axle is bent or distorted due to accident damage, the axle tubes can be checked with a straight edge. Do not attempt to straighten the axle beam.

Removing

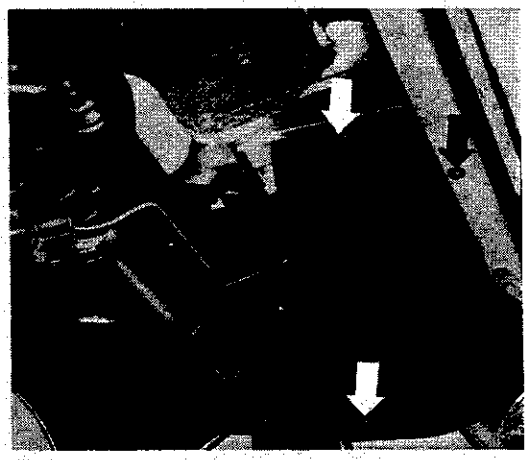
1 - Pull off fuel hose and plug it.

2 - Remove fuel tank.

3 - Disconnect horn ground wire and remove screws holding steering column coupling (arrows).



4 - Remove deflector plate if necessary (arrows).



5 - Remove bolts (arrows) attaching reinforcement plates to axle and frame and take reinforcement plates off.

6 - Take cotter pin out of speedometer cable in left wheel and pull cable out of steering knuckle.

7 - Detach brake hoses at brackets and seal lines with dust caps from bleeder valves.

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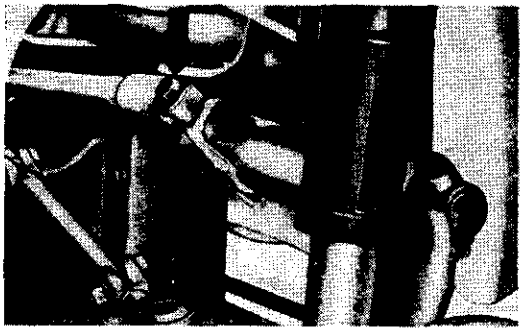
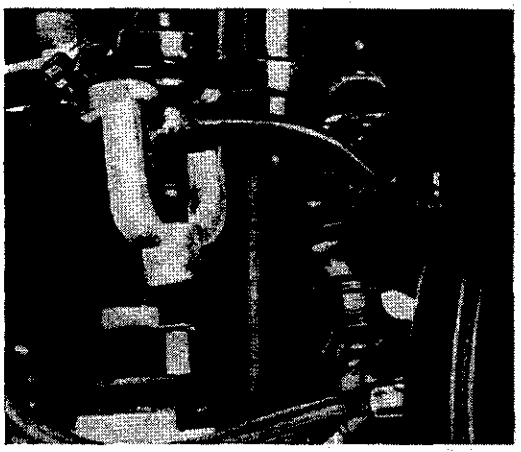
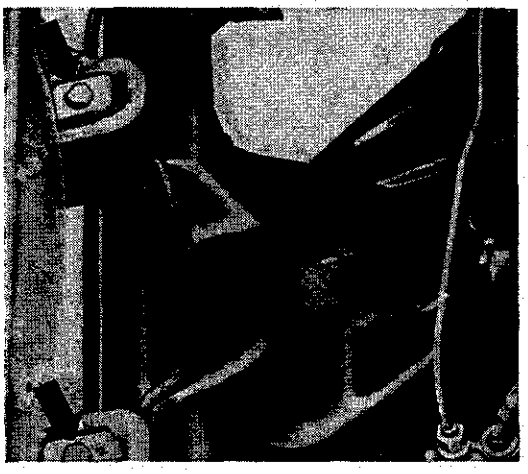


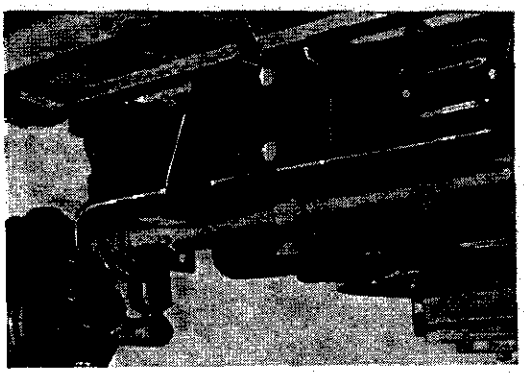
8 - Remove steering damper from bracket on front axle beam (arrow).



9 - Remove cotter pins and nuts holding tierod ends on long tierod and press ends out with VW 266h and remove tierod together with steering damper.



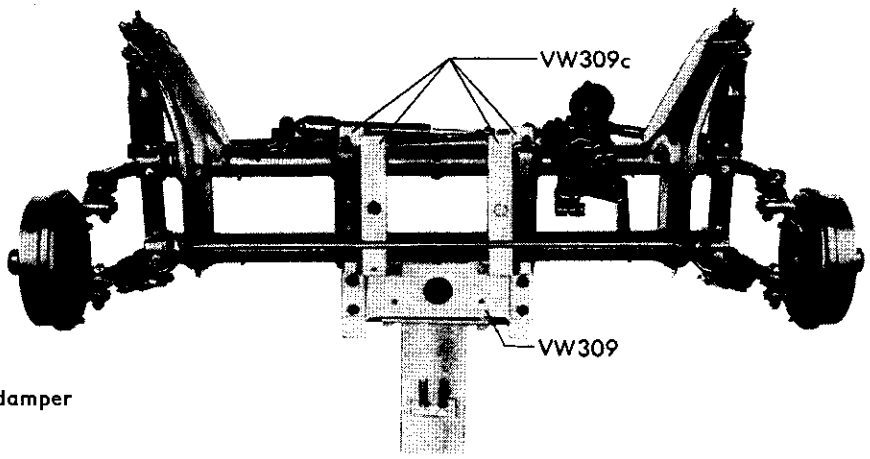
10 - Remove two body mounting bolts (arrows).



11 - Loosen four bolts securing front axle to frame head.

12 - Position floor jack with adaptor, take bolts out and remove axle.

It is advisable to disassemble the axle in the following sequence:



Remove:
1 - tierods and steering damper
2 - steering gear box
3 - brake drums
4 - backing plates
5 - shock absorbers
6 - steering knuckles
7 - stabilizer bar
8 - torsion arms complete with ball joints
9 - torsion bars
10 - needle bearings
11 - metal bushings for torsion arms

Instructions on the assembly of the axle are given in the following sections.

Installing

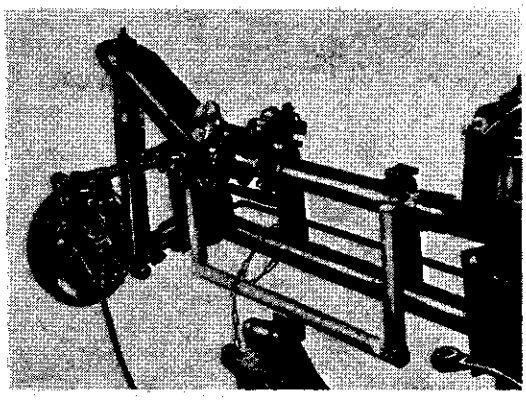
Note the following points:

1 - Place axle in adaptor and position it at the correct angle for installation with the aid of the chain. Place rubber paddings on each of the threaded bushings.

2 - Use new lockwashers on axle bolts.

3 - Tighten axle securing bolts to the correct torque.

Do not forget bracket for deflector plate.



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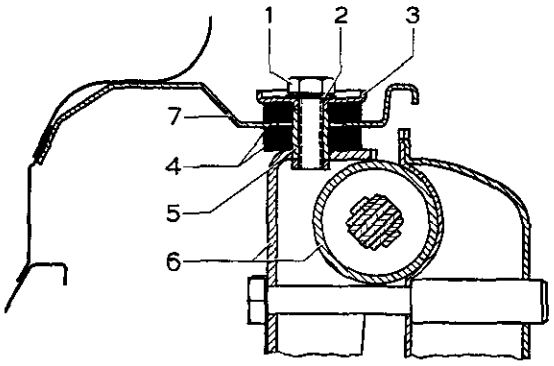
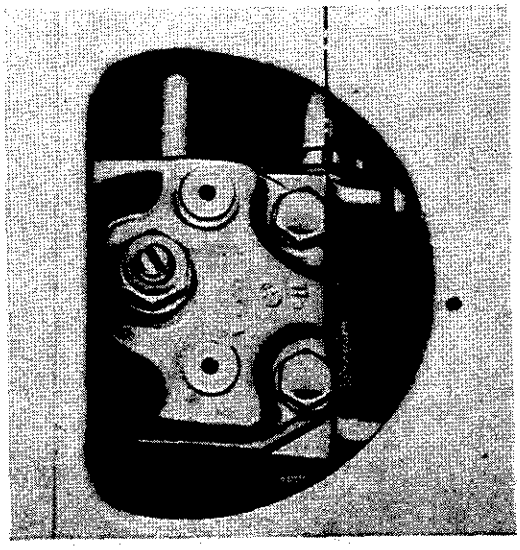


1 - Bolt
2 - Spring washer
3 - Washer
4 - Rubber pad
5 - Threaded bushing
6 - Front axle
7 - Body

4 - Tighten body to axle bolts to correct torque. Do not forget rubber pads, washers and lock-washers.

5 - Tighten tierod end nuts to correct torque and install cotter pins.

6 - Install steering damper bolt in bracket on front axle with a new locking plate, tighten bolt to correct torque and lock it. The locking plate should be fitted so that the open end of the U shaped faces forward and the narrow angled part contacts the bracket.



7 - Set steering to center position with the marking ring and connect column to the steering coupling so that the spokes are horizontal.

8 - Install reinforcement plates and tighten bolts to correct torque.

9 - Install brake hoses. Make sure they hang down and are not twisted.

Check position of hoses over entire steering sweep.

10 - Bleed hydraulic system and adjust brakes.

11 - Check wheel alignment.

12 - Install deflector plate if necessary.

Tools

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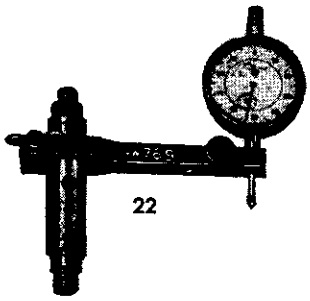
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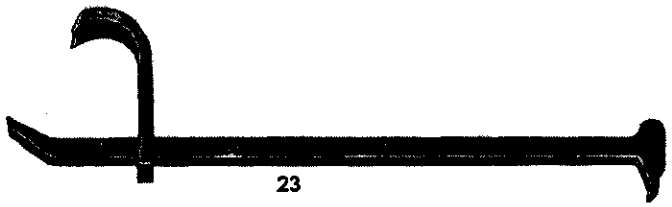
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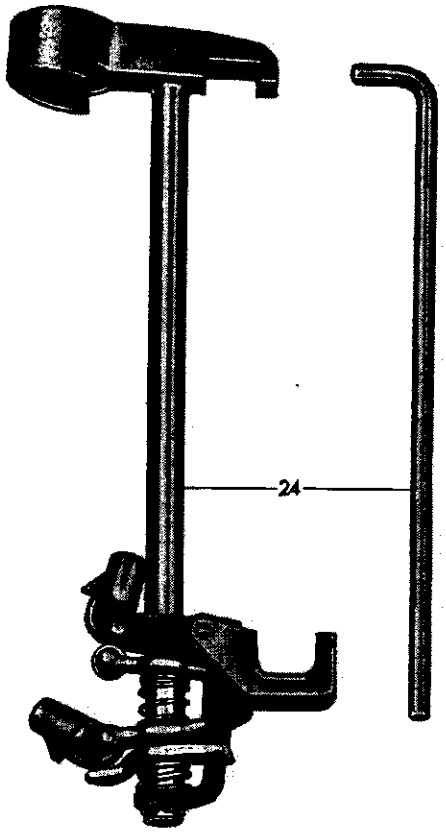
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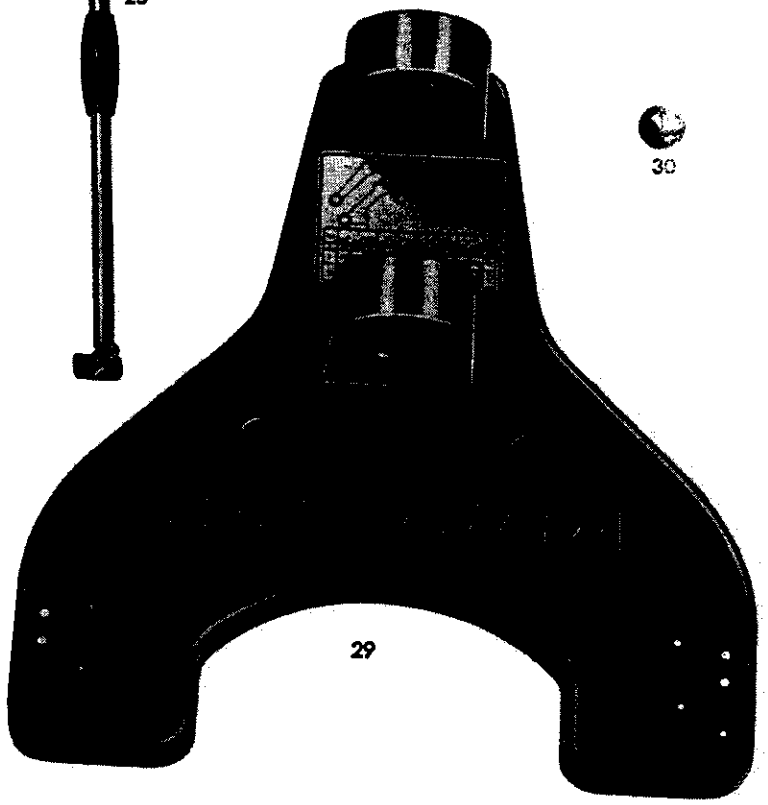
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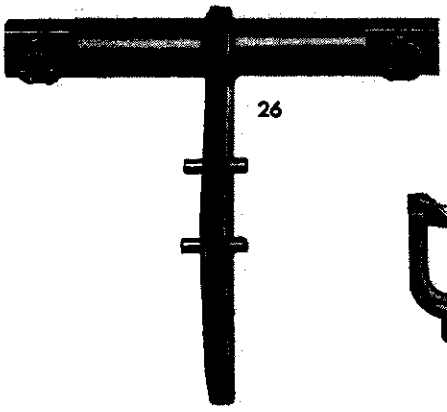
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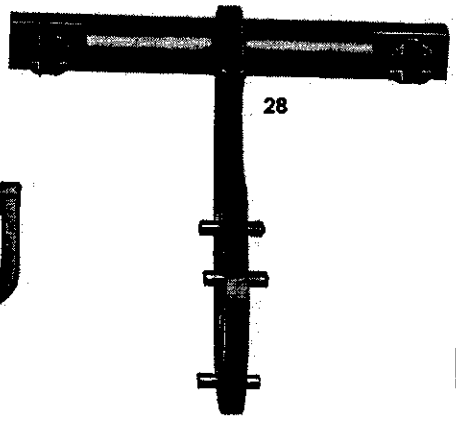
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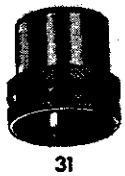
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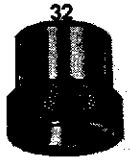
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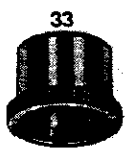
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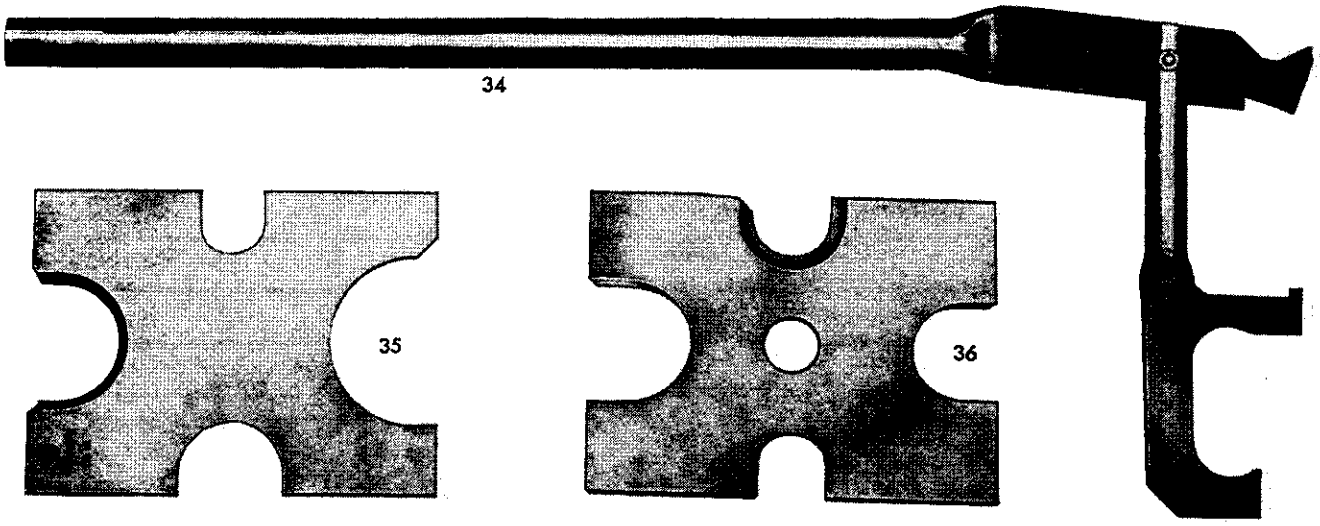

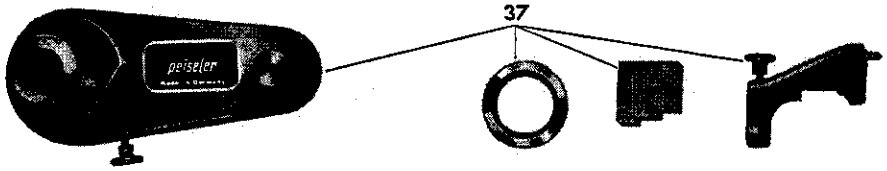

No.	Description	Tool	Explanation
1	Special wrench 36 mm	VW 179	
2	Press tool	VW 432	
3	Ring	VW 440	
4	Ring	VW 429	
5	Multi-purpose tool	VW 771	
6	Washer	VW 771—21/7	for lower needle bearing
7	Washer	VW 771—21/6	for upper and lower metal bushings
8	Washer	VW 771—21/3	for upper needle bearing
9	Press tool	VW 431	
10	Drift	VW 767	
11	Press tool	VW 407	
12	Drift	VW 768	
13	Fitting sleeve	VW 778	

539.301.23 Printed in Germany 4. 69

No.	Description	Tool	Explanation
14	Press tool	VW 408a	
15	Press tool	VW 412	
16	Press tool	VW 433	
17	Tube	VW 418a	
18	Ball joint removing tool	VW 267a	
19	Tube	VW 415a	
20	Fitting sleeve	VW 780-1	for steel retaining ring (lower ball joint)
21	Fitting sleeve	VW 780-2	for steel retaining ring (upper ball joint)
22	Dial gauge bracket and dial gauge	VW 769	for bearing adjustment
23	Hub cap puller	VW 637/2	
24	Clamping device	VW 655/3	
25	Inside measuring gauge		standard type, range 24—60 mm for metal bushings and needle bearing seats
26	Steering knuckle gauge	VW 258 mm	
27	Tie-rod end extractor		commercial type
28	Steering knuckle gauge	VW 258h	
29	Torsion arm test plate	VW 282d	
30	Test point for plate	VW 282d	
31	Bushing	VW 282d/14	
32	Bushing	VW 282d/15	
33	Bushing	VW 282d/13	
34	Lever	VW 281a	for testing ball joint play
35	Plate	VW 402	
36	Plate	VW 401	
37	Measuring bracket	VW 258k or 258p	

No.	Description	Qty.	Note when disassembling	Note when assembling	Special instructions see
72	Metal bushing for torsion arms	4	wear limit 37.38 mm (1.47 in.) knock out with VW 771—21/6	knock new upper bushing in with VW 768 and lower bushing with VW 767	V 4.1/9
73	Grease fitting	4	clean before greasing	turn in, do not knock in	
74	Axle beam	1		replace if bent, do not attempt to straighten	
75	Bolt M 8×25	2		turn in so far that there is a gap of 10±1 mm (0.4±0.004 in.) between upper torsion arm and tire. Steering must be in full lock position and front end fully raised	
76	Nut M 8	2			

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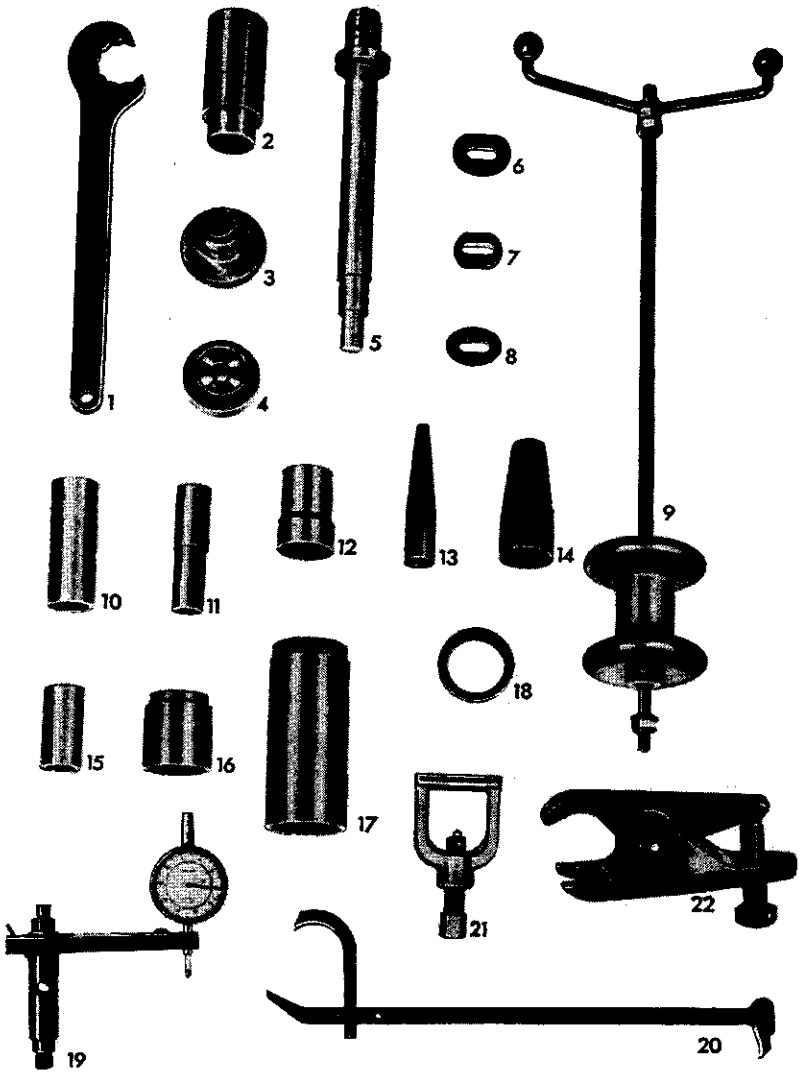
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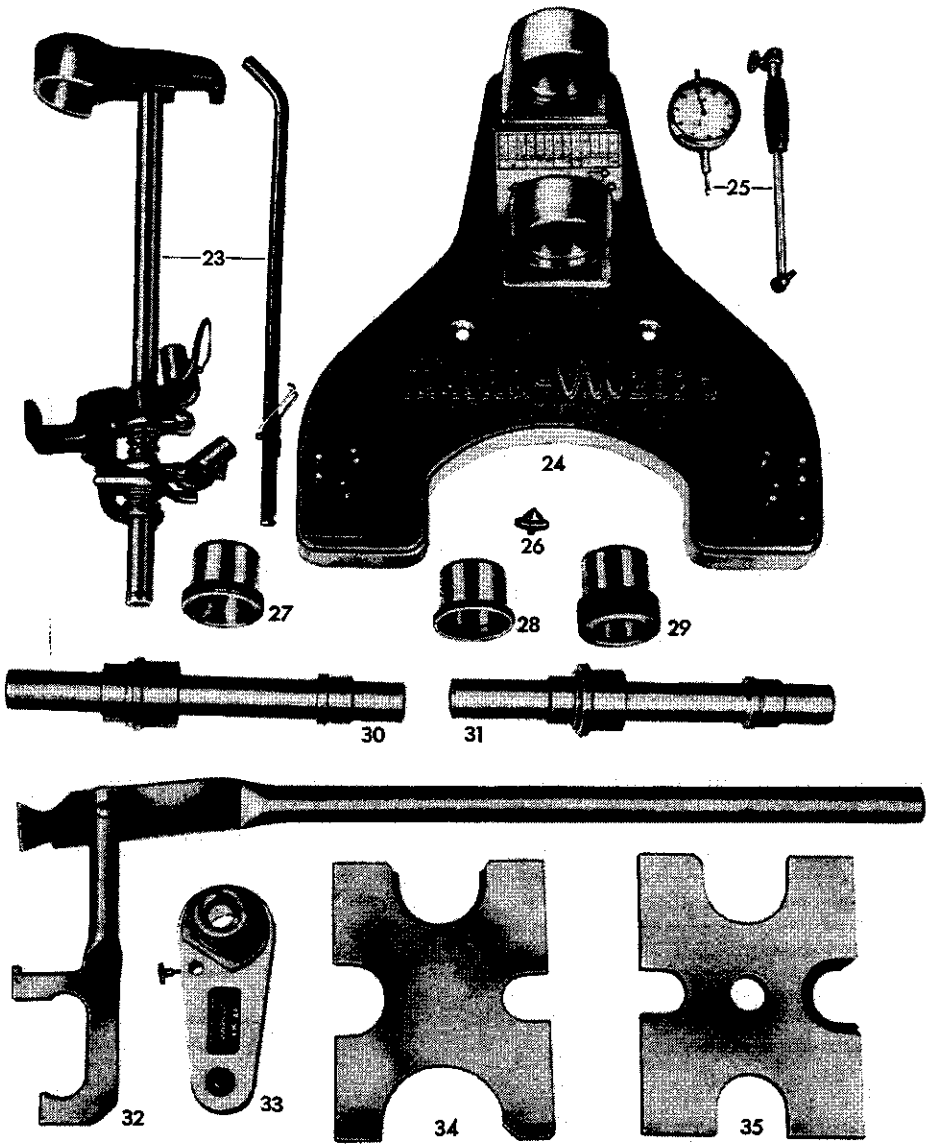


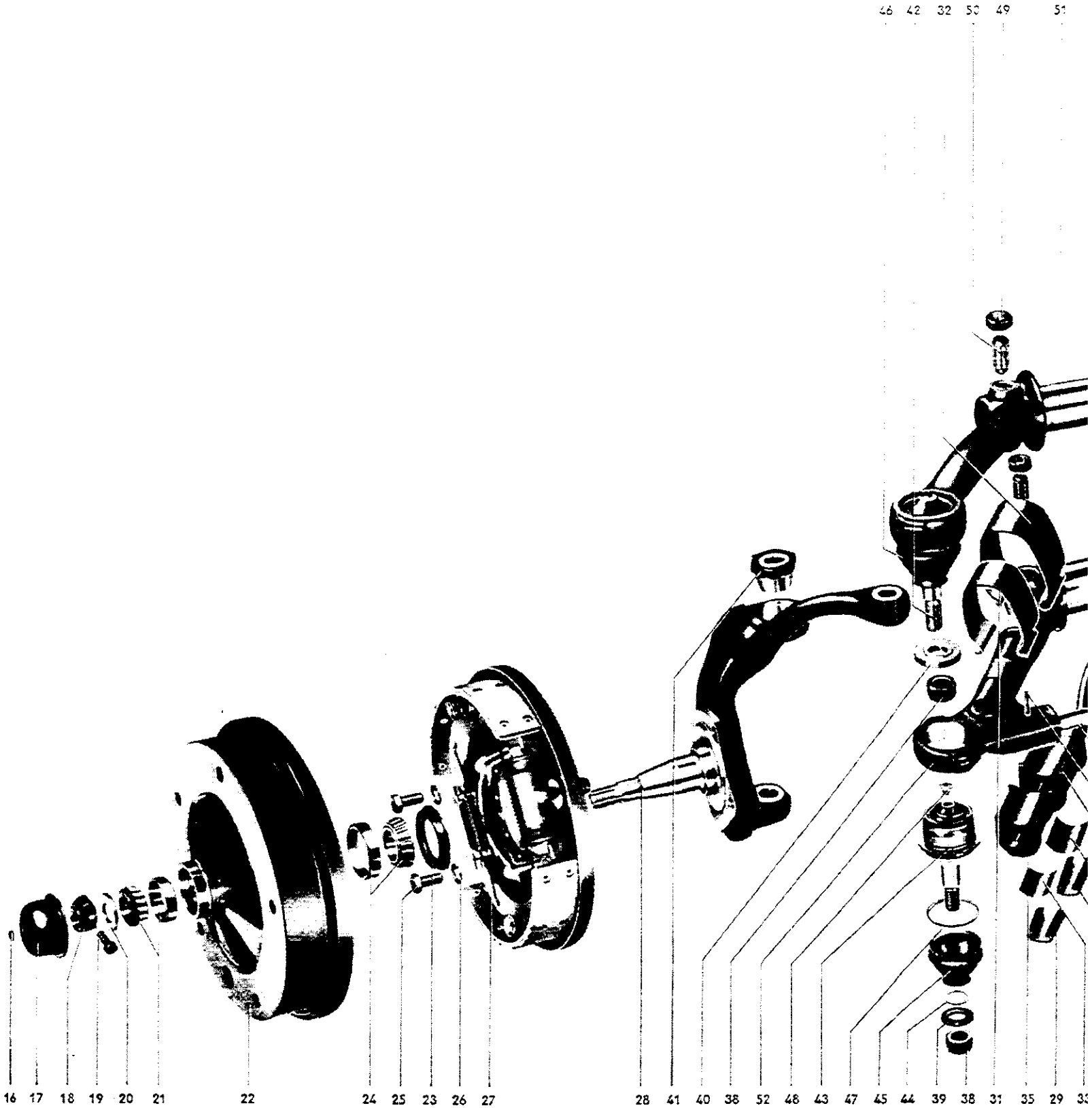
V 8th Supplement — USA — Printed in Germany 3. 73

No.	Description	Tool	Explanation
1	Special wrench 36 mm	VW 179	
2	Press tool	VW 432	
3	Press tool	VW 412	
4	Press tool	VW 433	
5	Press tool	VW 408a	
6	Washer	VW 771—21/7	for lower needle bearing
7	Washer	VW 771—21/6	for upper and lower needle bearings
8	Washer	VW 771—21/3	for upper needle bearing
9	Multi-purpose tool	VW 771	
10	Tube	VW 416b	
11	Tube	VW 421	
12	Press tool	VW 454	
13	Fitting sleeve	VW 778	
14	Fitting sleeve	VW 780	marked "oben"
15	Tube	VW 418a	
16	Fitting sleeve	VW 455	
17	Tube	VW 415a	
18	Ring	VW 429	
19	Dial gauge bracket and dial gauge	VW 769	
20	Dust cap puller	VW 637/2	
21	Tie rod end extractor		local purchase item
22	Ball joint removing tool	VW 267a	
23	Clamping device	VW 655/3	
24	Torsion arm test plate	VW 282d	
25	Inside measuring gauge		local purchase item, range 25—60 mm (0.984—2.362 in.) for metal bushings and needle bearing seats
26	Test point for plate (part of VW 282d)		
27	Bushing	VW 282d/15	
28	Bushing	VW 282d/13	
29	Bushing	VW 282d/12	
30	Drift	VW 767	
31	Drift	VW 768	
32	Lever	VW 281a	for testing ball joint play
33	Measuring bracket	VW 258p	
34	Plate	VW 402	
35	Plate	VW 401	

No.	Description	Qty.	Note when disassembling	Note when assembling	Special instructions see
30	Retainer, large	2	as for point 29	as for point 29	
31	Clip, small	2		hold clip with waterpump pliers to install retainer	V 4.2/5
32	Clip, large	2		as for point 31	V 4.2/5
33	Plate, small	2			
34	Plate, large	2			
35	Rubber mounting, small	2			
36	Rubber mounting, large	2			
37	Stabilizer bar	1			
38	Self-locking nut M 16×1.5	4		always use new nuts tighten to 5—7 mkg (36—50 lb ft)	V 4.1/4
39	Washer, small	2			
40	Washer, large	2			
41	Eccentric bushing for camber adjustment	2	press off upper ball joint with VW 267a	insert in knuckle lightly greased, **no grease in hole for ball joint stud.** In basic position, notch should point forward	V 4.1/4
42	Upper ball joint	2	press out of knuckle with VW 267a, out of torsion arm with VW 412, VW 415a, VW 416b and VW 401	press in with VW 412, VW 432, VW 433, VW 415a, VW 429, VW 402 and VW 401. Notch in joint must be aligned with notch in arm **Note** Check for oversize marking on torsion arm ("B")	V 4.1/4
43	Lower ball joint	2	press out of knuckle with VW 267a, out of torsion arm with VW 412, VW 418a, VW 415a, VW 421 and VW 401	press in with VW 412, VW 454, VW 455, VW 429, VW 415a, VW 402 and VW 401 as for No. 42	V 4.1/6
44	Ring for rubber boot	4		fit with VW 778, do not twist ring	V 4.1/6
45	Boot for lower joint	2		if boot is damaged, clean joint carefully and grease well with multi-purpose grease	V 4.1/6
46	Boot for upper joint	2		as for No. 45	
47	Ring for rubber boot	4		fit with sleeve VW 780 (marked "oben"), ring ends must be offset 60° from ball stud pivot direction	V 4.1/6
48	Plug	4		**always use new plugs,** screw them in, do not knock in	
49	Locknut	4		tighten to 4—5 mkg (28—36 lb ft)	
50	Setscrew for torsion bar	4		tighten to 4—5 mkg (28—36 lb ft)	
51	Torsion arm, upper	2	remove steering knuckle with drum	check for distortion with VW 282d	V 4.1/6
52	Torsion arm, lower	2	remove steering knuckle with drum and stabilizer	as for No. 51	

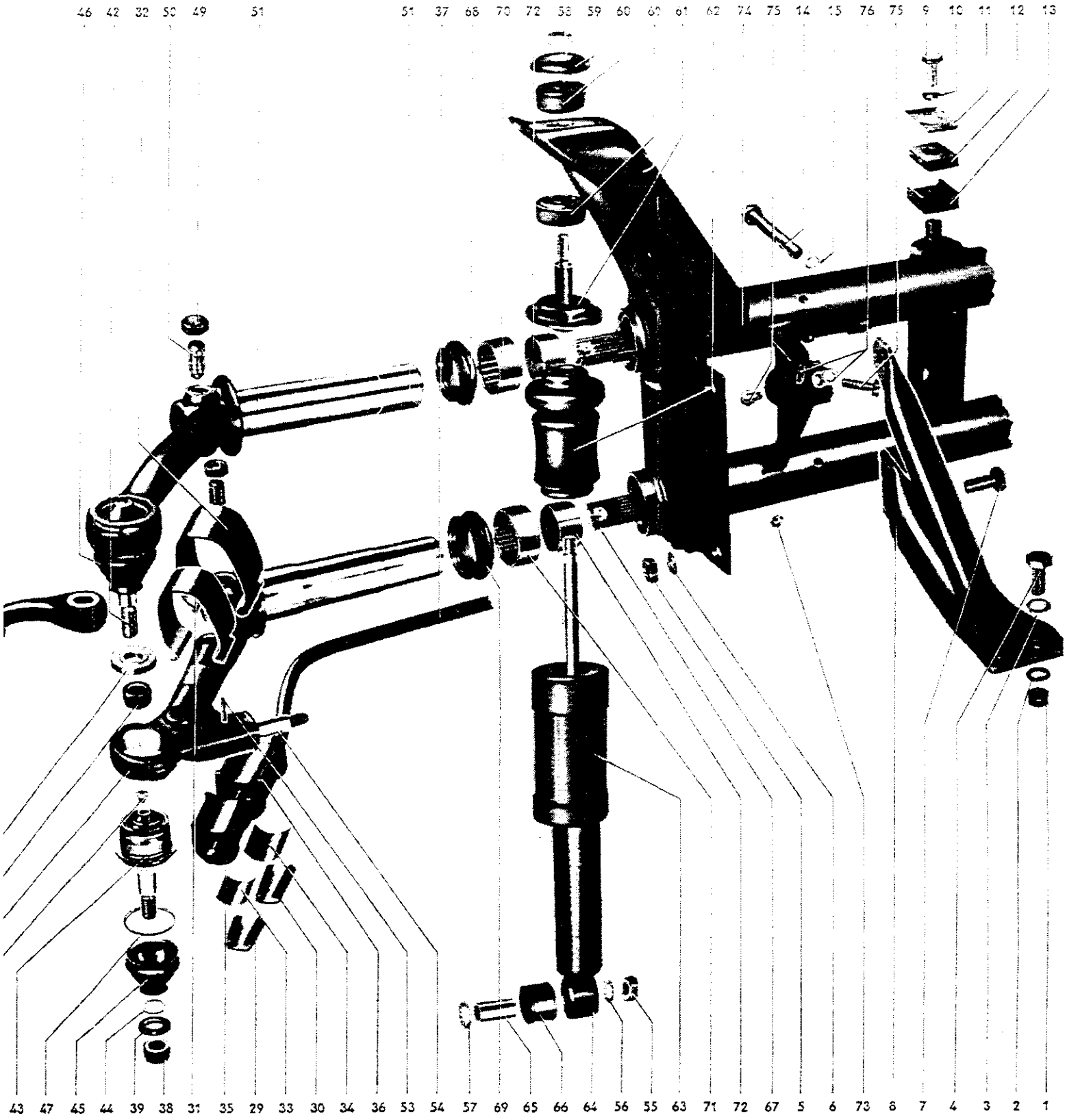
V 8th Supplement — USA — Printed in Germany 3. 73

No.	Description	Qty.	Note when disassembling	assembling	Special instructions see
53	Pin	2			
54	Pin for shock absorber	2	drill broken pins out and ream hole	install oversize pin	V 4.2/6
55	Nut M 12×1.5	2		tighten to 4.0 mkg (28 lb ft)	
56	Lock washer 10.5	2			
57	Lock washer 12.5	2			
58	Nut M 10	2	tension upper torsion arm lightly with VW 655/3	tighten as far as possible	V 4.1/10
59	Plate for damper bushing	2			
60	Damper bushing	4			V 4.1/10
61	Pin for buffer	2			
62	Buffer	2			
63	Tube	2			
64	Shock absorber	2	tension upper torsion arm lightly with VW 655/3. Hold lower end of pin (No. 61) with water-pump pliers and remove nut	check shock absorber	V 4.1/10 V 4.2/9
65	Sleeve for rubber bushing	2	press out with VW 408a, VW 402 and VW 401	press in with VW 436a, VW 411, VW 416b, VW 402, VW 401. Coat VW 436a and sleeve lightly with glycerine	V 4.2/9
66	Rubber bushing	2	as for point 65	coat with talcum and press in flush in vise	
67	Torsion bar — 10 leaf	2		check for damage. Note number of leaves and arrangement, bind end with adhesive tape when installing	
68	Seal for upper torsion arm	2		replace if necessary	
69	Seal for lower torsion arm	2		replace if necessary	
70	Needle bearing, upper Standard size: 46.0 mm (1.574 in.) outside diameter Oversize: 46.2 mm (1.819 in.) outside diameter	2	knock out with VW 771 and washer VW 771—21/3	knock in with drift VW 768 until shoulder of drift makes contact. Note bearing dia., oversize is 0.2 mm (0.0078 in.) larger	V 4.1/9
71	Needle bearing, lower Standard size: 50.0 mm (1.968 in.) outside diameter Oversize: 50.2 mm (1.976 in.) outside diameter	2	knock out with VW 771 and washer VW 771—21/7	knock in with drift VW 767 until shoulder of drift makes contact. Note bearing dia., oversize is 0.2 mm (0.0078 in.) larger	V 4.1/9
72	Metal bushing for torsion arms	4	wear limit 37.38 mm (1.47 in.), knock out with VW 771 and washer VW 771—21/6	knock new upper bushing in with VW 768 and lower bushing with VW 767	V 4.1/9
73	Grea e fitting	4	clean before greasing	turn in, do not knock in	
74	Axle beam	1			
75	Bolt M 8×25	2		turn in so far that there is a gap of 10±1 mm (0.393± 0.039 in.) between upper torsion arm and tire when wheel is locked hard over and on full rebound	V 8.1/6
76	Nut M 8	2		tighten so 1.5 mkg (11 lb ft)	



V 8th Supplement — USA — Printed in Germany 3.73

V4.1


46 42 32 50 49 51
51 37 68 70 72 58 59 60 60 61 62 74 75 14 15 76 75 9 10 11 12 13
43 47 45 44 39 38 31 35 29 33 30 34 36 53 54 57 69 65 66 64 56 55 63 71 72 67 5 6 73 8 7 4 3 2 1

V 4.1 Front Axle with Ball Joints

No.	Description	Qty.	Note when disassembling	Note when assembling	Special instructions see
1	Nut M 10	4		tighten to 5.5—6.0 mkg (40—43 lb ft)	
2	Spring washer	4			
3	Washer	4			
4	Bolt M 10 × 25	4			
5	Nut M 12 × 1.5	2		tighten to 5.5—6.0 mkg (40—43 lb ft)	
6	Spring washer	2			
7	Bolt M 12 × 1.5 × 25	2			
8	Support for axle	2			
9	Bolt M 10 × 25	2		tighten to 2.0 mkg (14 lb ft)	
10	Spring washer	2			
11	Plate	2			
12	Rubber packing, upper	2			
13	Rubber packing, lower	2			
14	Bolt M 12 × 1.5 × 90	2		tighten to 5.0 mkg (36 lb ft)	
15	Spring washer	2			
16	Lock washer	1			
17	Dust cap	2	pull off with VW 637/2	must be free of grease, seal speedo cable hole	V 4.2/3
18	Clamp nut for wheel bearing	2	lefthand thread on left steering knuckle	adjust as specified	V 4.2/3
19	Socket hd. screw for clamp nut M 7 × 18	2		after adjusting wheel bearing play to 0.03—0.12 mm (0.001—0.004 in.) with VW 769, tighten screw to 1.0—1.3 mkg (7—9 lb ft)	V 4.2/3
20	Thrust washer	2		do not tilt as this will affect adjustment	
21	Outer tapered roller bearing Outside dia. 40 mm (1.574 in.)	2	knock outer race out with brass drift	lubricate with multi-purpose grease of correct specification. Press grease into cage	
22	Brake drum	2		clean carefully, check dimensions, damaged threads for wheel bolts, friction surface condition. Amount of grease per side approx. 50 grams	
23	Oil seal	2		knock in carefully with a rubber hammer	
24	Inner tapered roller bearing Outside dia. 50 mm (1.968 in.)	2	as for point 21	as for point 21	
25	Bolt M 10 × 18	3		tighten to 5.0 mkg (36 lb ft)	
26	Spring washer	3			
27	Front wheel brake and backing plate	2	detach brake hose at bracket	bleed brakes	
28	Steering knuckle	2	press off ball joints with VW 267a	check bearing seats for wear, check for distortion with VW 258p	V 4.1/4
29	Retainer, small	2	knock off	bend lugs down after installing stabilizer	V 4.2/5

When removing a steering knuckle, the brake parts need only be taken off if the steering knuckle itself has to be replaced.

Removing

1 - Detach brake hose at bracket and seal brake seal with dust cap from bleeder valve.

2 - Press outer tie rod end out.

3 - Remove brake drum and backing plate.

4 - Take self-locking nut off lower ball joint and press ball joint out of steering knuckle with VW 267a. Screw cap nut (M 12×1.5) from VW 267a on to ball joint stud to prevent damage to the thread.

Caution

The upper edges of the fork on the appliance which contact the rubber boot when pressing the joint out must be free of burrs to avoid damaging the boot. Position the appliance carefully.

The nut should be screwed on as far as it will go to ensure that the thrust is taken mainly at the base of the nut as well as on the thread flanks. The nut must not be screwed on too tightly otherwise the stud will turn as well and make the nut difficult to remove after the joint has been pressed out.

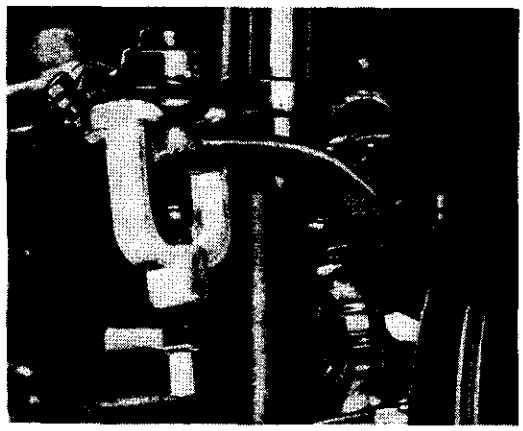
Very tight ball joints can be loosened by tapping the steering knuckle eye with the appliance tensioned.

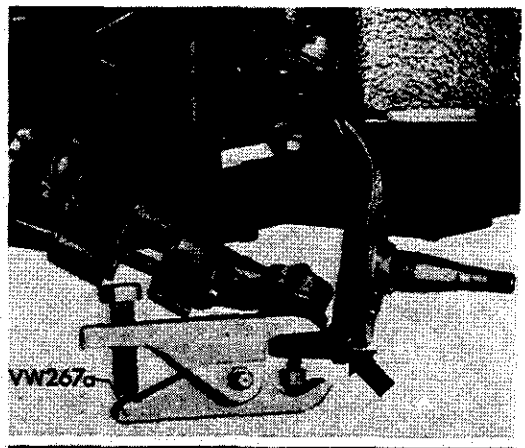
5 - Remove self-locking nut from upper ball joint and loosen eccentric bushing for camber adjustment with VW 179.

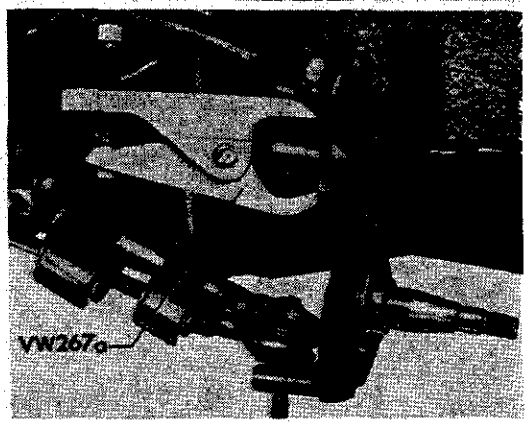
Note

If the upper ball joint is to be repaired or replaced it should be pressed out of eccentric bushing with VW 267a. If the steering knuckle is to be removed, the bushing should be loosened with VW 179 and the bushing left on the ball joint stud.

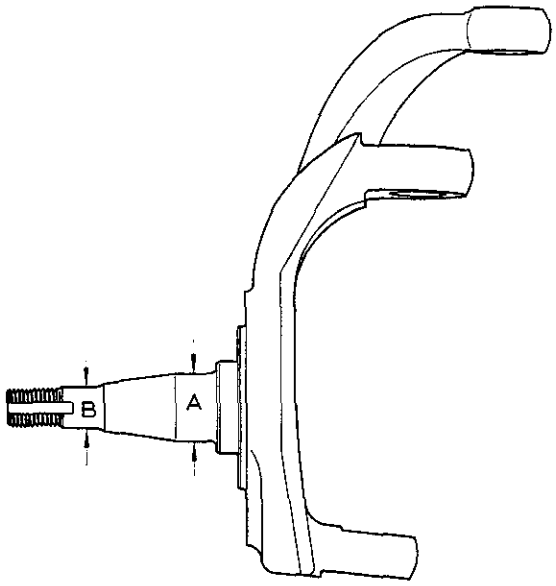
6 - Take steering knuckle off.







V 8th Supplement — USA — Printed in Germany 3.73



Checking steering knuckle

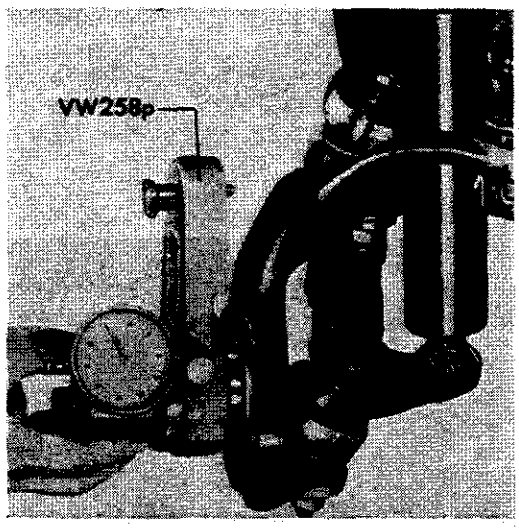
The steering knuckle can be checked on or off the vehicle.

a - On vehicle

1 - Checking bearing seats for wear and size.

Inner bearing seat A =
28.98—29.0 mm dia. (1.1409—1.1417 in.)

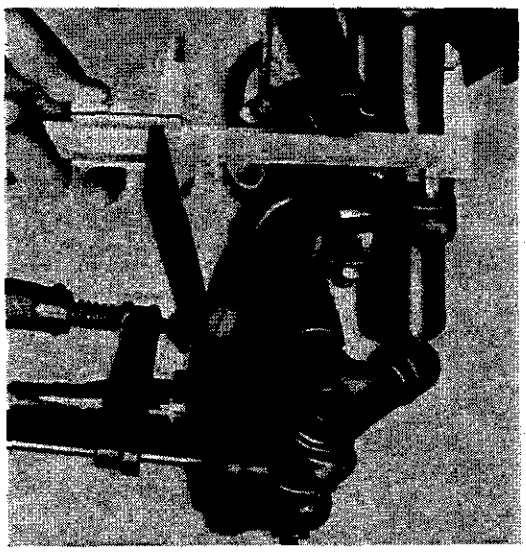
Outer bearing seat B =
17.45—17.46 mm dia. (0.6869—0.6874 in.)



2 - Checking stub axle for bend

Place measuring appliance VW 258p on the stub axle and press it firmly against shoulder for inner bearing. Set dial gauge to zero and check stub axle by turning appliance one complete turn.

The deflection on the dial gauge needle must not exceed 0.15 mm (0.0059 in.).



3 - Checking steering arm for bend

The steering arm on the steering knuckle can be checked for bend with a straight edge and a vernier caliper. The dimension from backing plate flange to the outer edge of the tie rod hole should be 117.75 to 118.25 mm (4.6357 to 4.6554 in.).

Warning

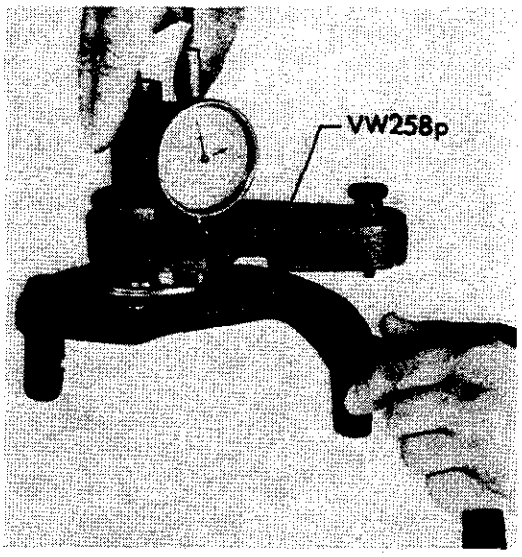
Do not attempt to straighten bent steering knuckles. Install new parts.

b - Removed

1 - Checking stub axle for bend

Place appliance VW 258p on the stub axle and press it firmly against the shoulder for inner bearing. Set dial gauge to zero and check stub axle by turning appliance one complete turn.

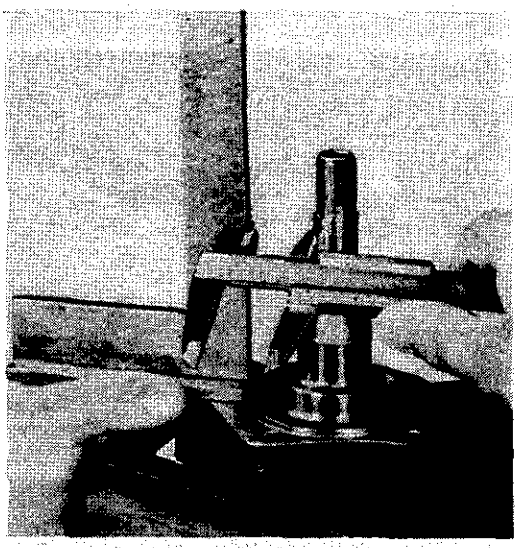
The deflection of the gauge needle must not exceed 0.15 mm (0.0059 in.).



2 - Checking stub axle with square and vernier caliper

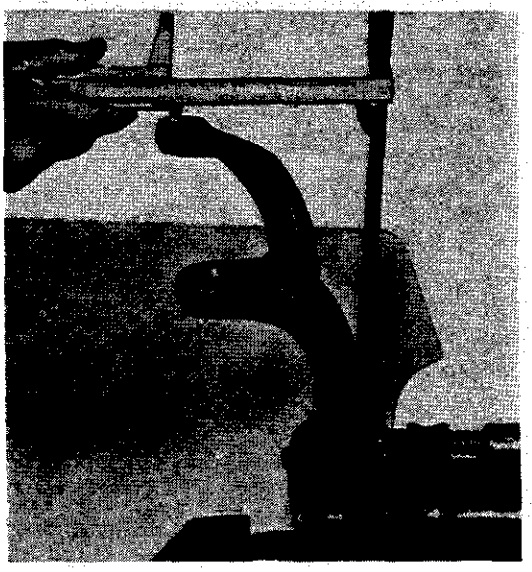
Measure as shown in illustration at least three points around the stub axle.

The difference between the measurements must not exceed 0.25 mm (0.0098 in.).



3 - Checking steering arm for bend

The steering arm on the steering knuckle can be checked with a straight edge and a vernier caliper. The dimension from the backing plate flange to the outer edge of the tie rod hole should be 117.75 to 118.25 mm (4.6357 to 4.6554 in.).



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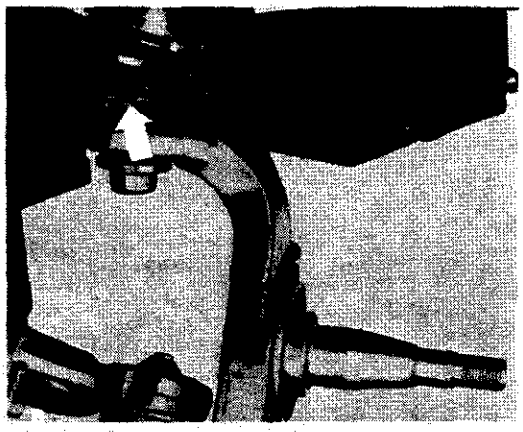
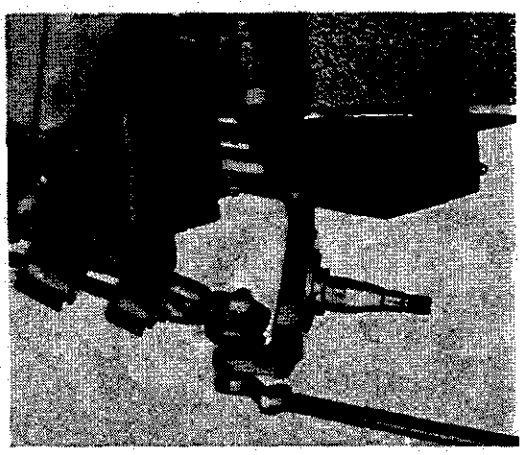




Installing

1 - Install steering knuckle on lower ball joint but do not fully tighten the nut. **Always use new self-locking nuts.**

2 - Lift upper torsion arm with the tensioner VW 655/3 until the steering knuckle can be attached to the upper ball joint.

3 - Set the camber adjusting bushing so that the notch is pointing forward (arrow).

4 - Tighten the self-locking nuts on the ball joints to the correct torque.

Caution

Use only self-locking nuts.

5 - Tighten tie rod end nuts to the correct torque, turn on to align cotter pin holes and fit cotter pins.

6 - Install backing plates and brake drums and tighten backing plate bolts to correct torque.

7 - Adjust wheel bearings correctly. See the instructions on "Checking and adjusting wheel bearings" on page V 4.2/3.

8 - Install brake hoses without twist so that they hang down. Check position of brake hose over full range of steering movement.

9 - Bleed brake system and adjust brakes.

10 - Adjust wheel alignment.

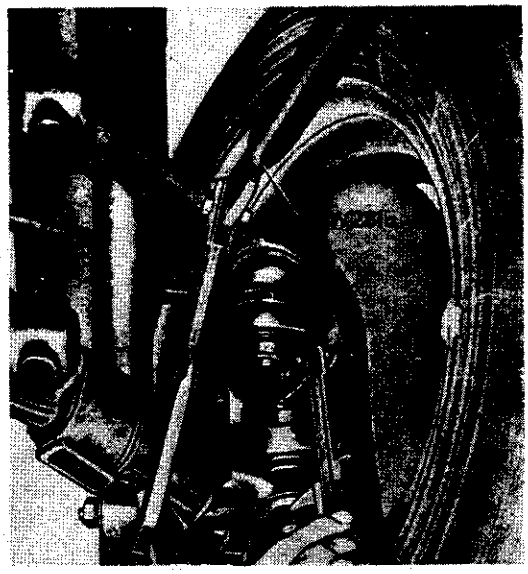
Checking ball joints (installed)

The axial play of the ball joint can be checked with special tool VW 281 a.

1 - Raise vehicle and turn wheels to one side.

2 - Position tool VW 281 a between upper and lower torsion arms as shown in illustration.

3 - Place vernier caliper on the ball joint with one jaw on the torsion arm and the other jaw on the steering knuckle and read the measurement. Without removing the vernier caliper, pull down checking lever to expand torsion arms and obtain second reading. Subtract first reading from second reading to obtain play of ball joint.



All Type 1 / Sedan 111

	Type 1, except 181	Model 181
Maximum play, new	0.5 mm (0.019 in.)	0.3 mm (0.011 in.)
Wear limit:		
Upper ball joint	2.0 mm (0.08 in.)	2.0 mm (0.08 in.)
Lower ball joint	1.0 mm (0.04 in.)	2.0 mm (0.08 in.)

Worn ball joints must be replaced with new ones.

Model 181

Removing torsion arms

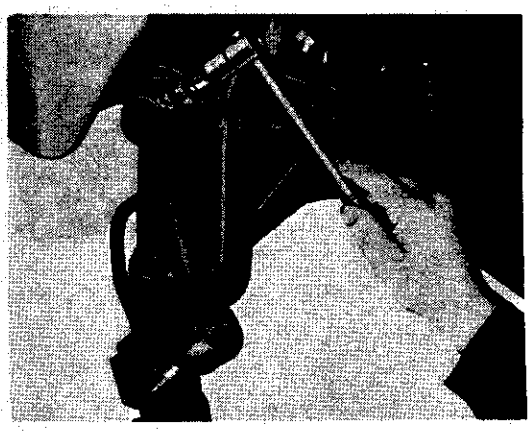
1 - Remove steering knuckle complete with brake drum.

2 - If the lower torsion arm is to be removed, disconnect stabilizer.

3 - Loosen lock nuts on torsion arm securing pins and remove pins.

4 - Remove torsion arms from axle tubes.

5 - If necessary, remove seals from axle tubes.



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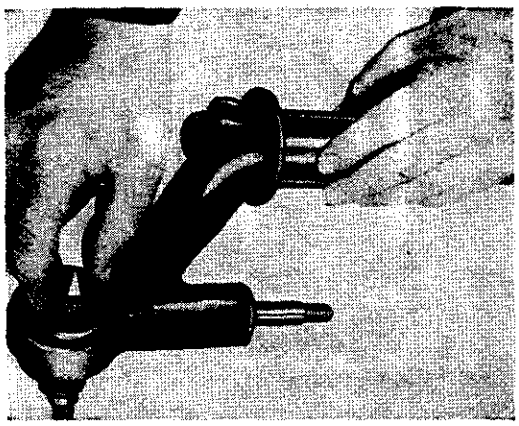
Checking torsion arms

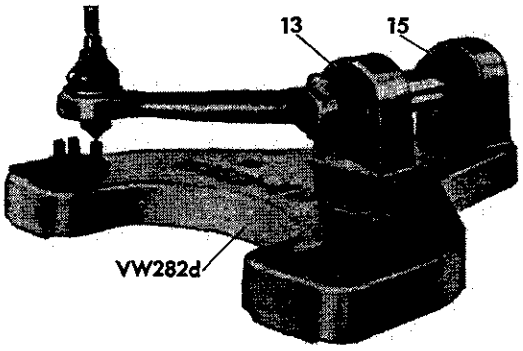
1 - Carefully clean torsion arms and ball joints.

2 - Check bearing seats on torsion arms for wear.

3 - Remove plastic plugs from bottom of ball joint and insert tip of test appliance VW 282d.



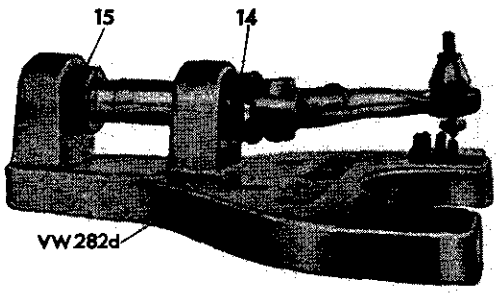
Torsion arm upper



4 - Locate torsion arm bushings in test plate VW 282d.

	Sedan 111		Model 181	
	Bushing No.		Bushing No.	
	inner	outer	inner	outer
Upper arm	15	13	15	13
Lower arm	15	14	13	12

Torsion arm lower



5 - Place torsion arm in test plate.

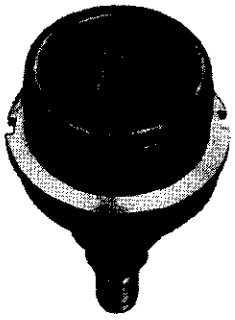
The tip must contact the small boss on the plate. If it does not do so, the torsion arm is bent.

Replacing

For manufacturing reasons standard size ball joints as well as oversize ball joints (0.4 mm = 0.016 in.) are installed in corresponding torsion arms.

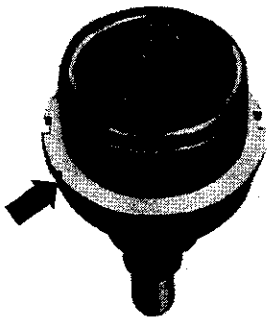
Standard size

Two grooves 180° apart to show fitting position.



Oversize

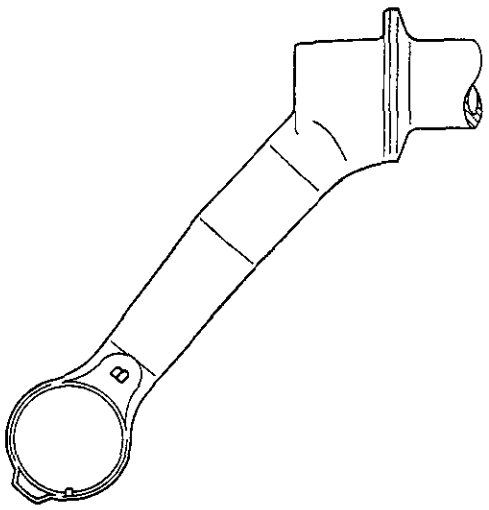
Two notches (arrow) 45° from the grooves showing fitting position.



Caution

When replacing the ball joints, it is essential to check these marks so that the proper ball joint is pressed in. The torsion arm itself has no marks to show which ball joint is to be used.

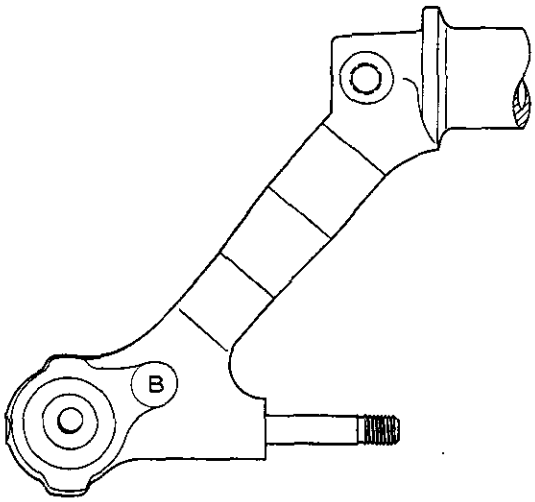
V 8th Supplement — USA — Printed in Germany 3. 73



Model 181

The torsion arms with oversize holes for the ball joints (also 0.4 mm = 0.016 in. larger) are marked with a "B" as shown.

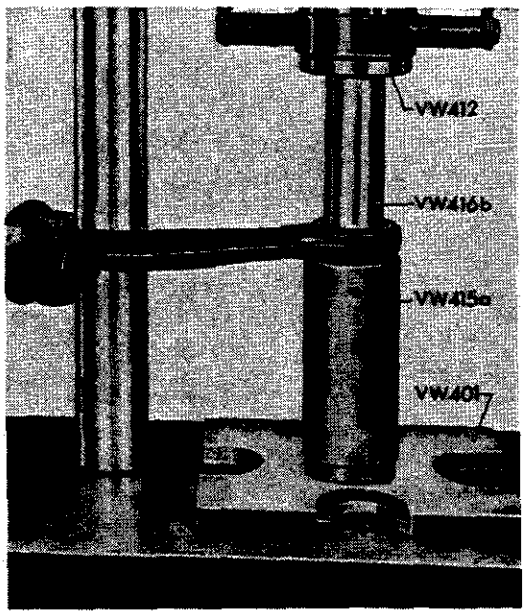
When replacing the ball joints, it is essential to check the marks on the ball joint or torsion arm in order to ensure that the correct joint is pressed in.



Note

The upper ball joint spigot has been increased in diameter from 16 to 18 mm (0.629 to 0.708 in.), and the ball joint spigot thread has been increased in length by 2 mm (0.078 in.). In connection with this, the tapered drilling in the eccentric bushing for camber adjustment has also been increased to 18 mm (0.708 in.) dia., the washer between the steering knuckle and the self-locking nut has been increased in thickness from 5 to 7 mm (0.196 to 0.275 in.), and in diameter from 34 to 38 mm (1.338 to 1.496 in.).

The new ball joints can be service installed without difficulty, but the other new parts, i.e. eccentric bushing and washer, must however also be installed.



Upper ball joint

1 - Press joint out with press tools VW 412, VW 416b, VW 415a and VW 401.

Installing torsion arms

Note the following points:

1 - Check condition of torsion arm sealing rings and install new parts where necessary.

2 - Install torsion arm on torsion bar. Install retaining screws and tighten to correct torque.

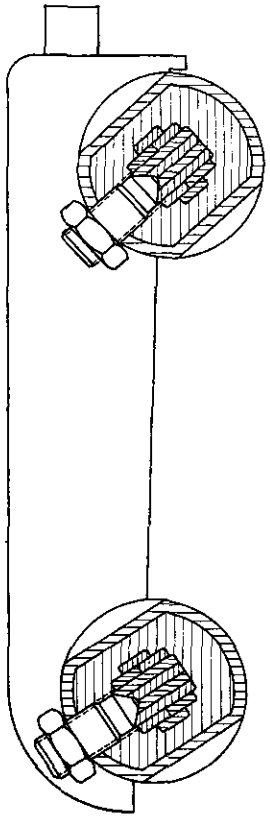
3 - Install all other parts. Grease front axle thoroughly with multi-purpose grease.

4 - Check wheel alignment.

V 8th Supplement — USA — Printed in Germany 3. 73

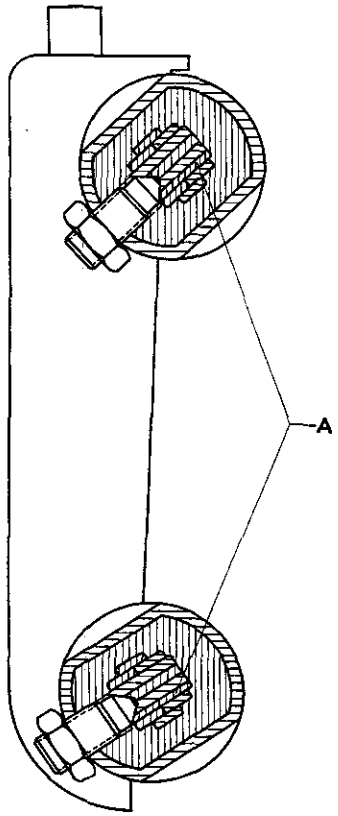
The front axle torsion bars are made up of 10 spring steel leaves. There are two versions which differ as follows:

Type 1 all (except Model 181)



Model 181

A = thinner leaf must be at bottom



V 8th Supplement — USA — Printed in Germany 3.73

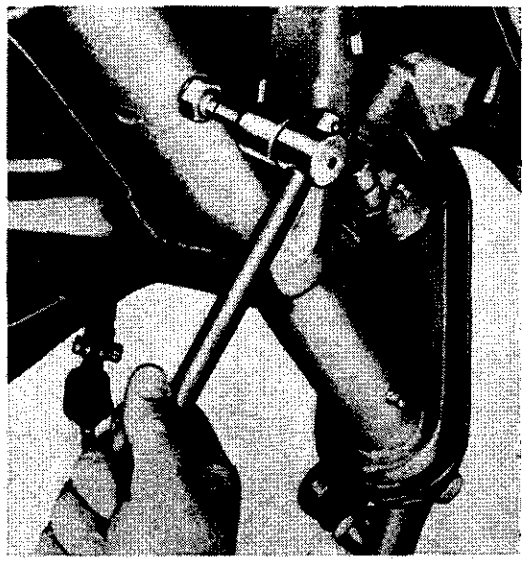
Removing

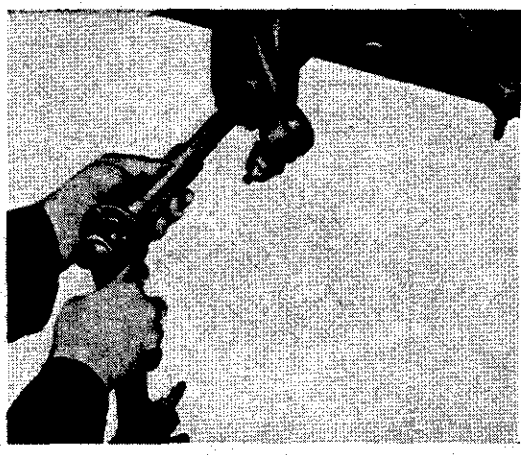
1 - Remove both steering knuckles.

2 - Remove torsion arms on one side.

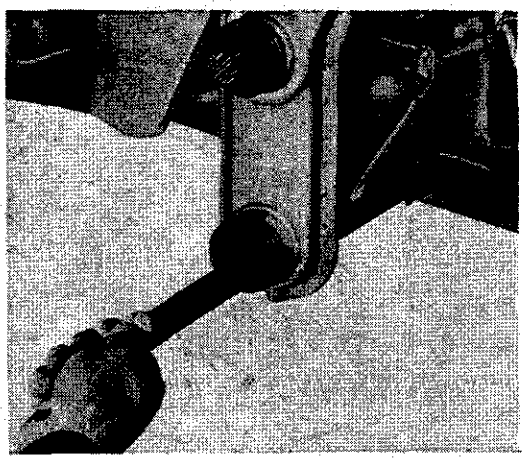
3 - Loosen the locknut on the headless setscrew.

4 - Remove the setscrew.





5 - Pull torsion arm and bar out.



Installing

Note the following points:

1 - Clean the torsion bars and examine them for cracks and breakage. Install new bars if necessary.

2 - Check torsion arms, needle bearing and bushings and replace as necessary.

3 - Coat bars liberally with multi-purpose grease before installing.

4 - When inserting the torsion bars, note the number of leaves and the position of the countersunk marks for the torsion arm attaching pins.

5 - Align the countersunk mark in the center of the bar with the hole for the setscrew. Tighten center setscrew to correct torque and secure with the locknut.

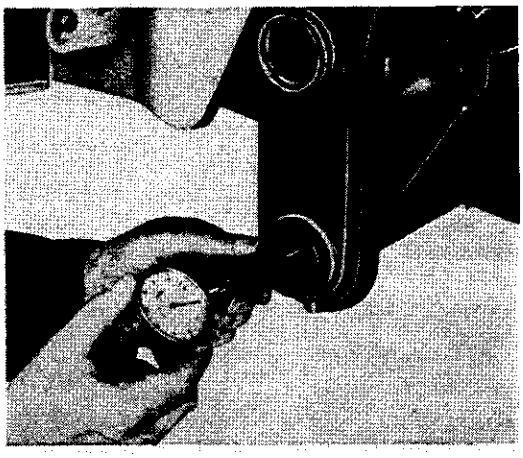
6 - Reinstall all removed parts and lubricate front axle with multi-purpose grease.

The metal bushes are subject to very little wear and do not usually need replacement. However, if wear is noted on the torsion arm bearing surface, the metal bush should be replaced as well as the torsion arm.

Removing

1 - Remove both steering knuckles complete with drums, take out torsion arms and torsion bars.

2 - Measure metal bush wear with an internal measuring gauge. The wear limit for upper and lower bushes is 37.38 mm (1.47 in.).

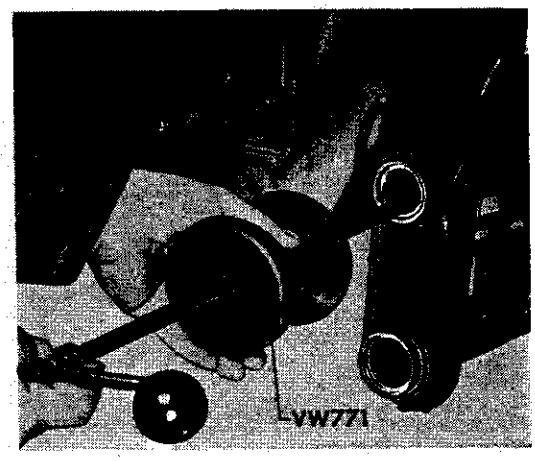


Removing needle bearings and metal bushes

Upper and lower needle bearings

a - Attach washers VW 771—21/3 for **upper needle bearing** or washer VW 771—21/7 for **lower needle bearing** to extractor VW 771. Insert tool into axle tube and locate washer against shoulder of needle bearing.

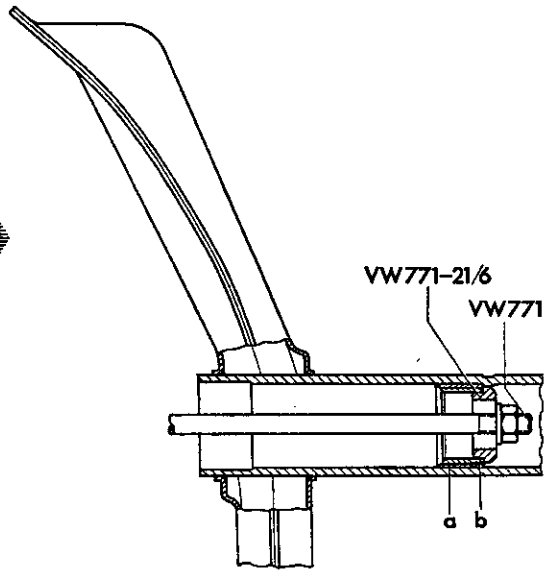
b - Pull bearing out.



Upper and lower metal bushings

a - Insert extractor VW 771 into axle tube with washer VW 771—21/6 attached and locate washer against bushing.

b - Pull metal bushing out.

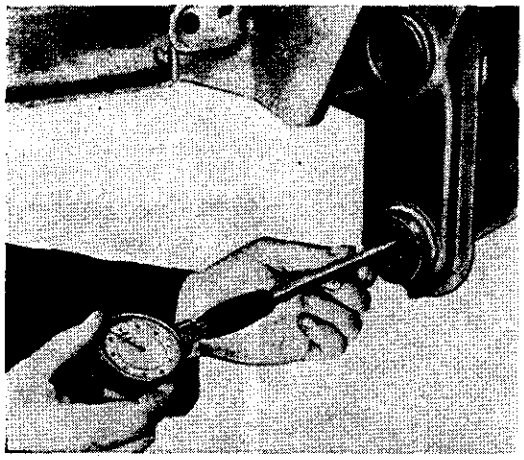


a - Plastic sleeve
b - Metal bushing

Important

The plastic sleeves for the bushings do not wear and remain in the axle tube. Exercise extreme care when driving out bushings to avoid damaging plastic sleeves.

539.301.23 Printed in Germany 4. 69



Installing

1 - Clean axle tubes particularly at the needle bearing and bushing seats.

2 - Check condition and dimensions of needle bearing seats in axle tube.

Note:

Since oversize needle bearings are also used, it is essential to check the size of the axle tubes when fitting a new needle bearing. The inside diameters of the bores are:

	Standard	Oversize
Upper:	45.99—45.97 mm 1.81— 1.80 in.	46.19—46.17 mm 1.82— 1.81 in.
Lower:	49.99—49.97 mm 1.97— 1.96 in.	50.19—50.17 mm 1.96— 1.95 in.

The bearings to match are:

	Standard	Oversize
Upper needle bearing:	46 mm 1.811 in.	46.2 mm 1.818 in.
Lower needle bearing:	50 mm 1.969 in.	50.2 mm 1.976 in.

If the seats in the axle tubes are no longer within tolerance, a new axle beam must be fitted as it is not possible to machine the seats.

3 - Drive in new upper metal bushing and upper needle bearing with VW 768. The bushings should be driven in until the shoulder on the drift contacts the axle tube.

Important

When installing the metal bushings be careful not to damage the plastic sleeves. Damaged plastic sleeves cannot be replaced. Clean needle bearings carefully, check for diameter of bearings and bushings.

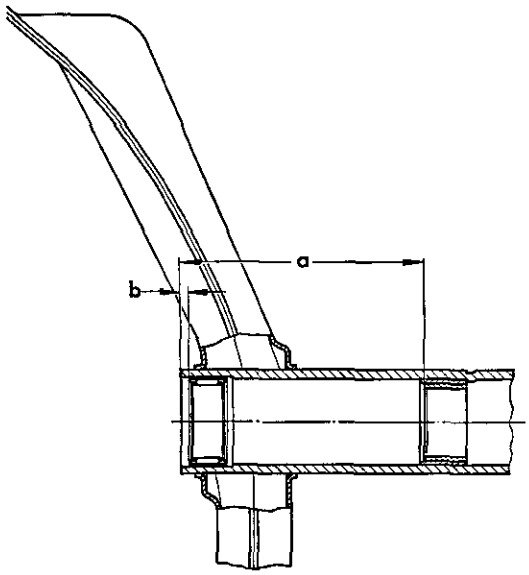
Lubricate needle bearing seats lightly with universal grease. The needle bearings should be installed so that the marking on the shoulder is facing outward.

4 - Drive new lower metal bushing and lower needle bearing in with VW 767 until shoulder on drift contacts the axle tube.

5 - Install all parts removed and lubricate axle thoroughly with multi-purpose grease.

Note:

In cases where the drifts 767 and 768 are not available, drive metal bushings and needle bearings into axle beam to the dimensions given in sketch.



a - metal bushings:

upper 122+2 mm
4.80+.08 in.

lower 132+2 mm
5.20+.08 in.

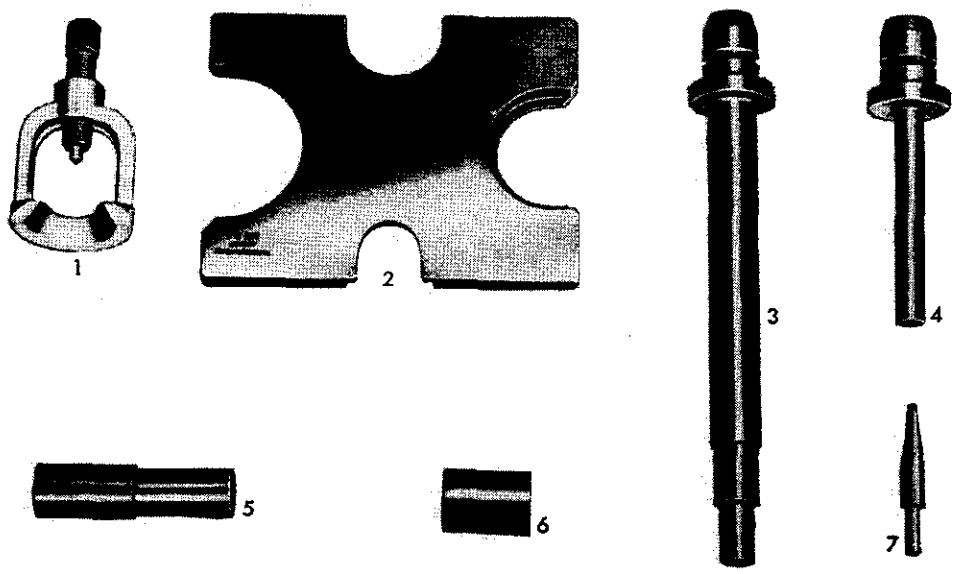
b - needle bearings:

upper 3.5+0.2 mm
.0137+.008 in.

lower 5.0+0.2 mm
.0197+.008 in.

539.301.23 Printed in Germany 4. 69

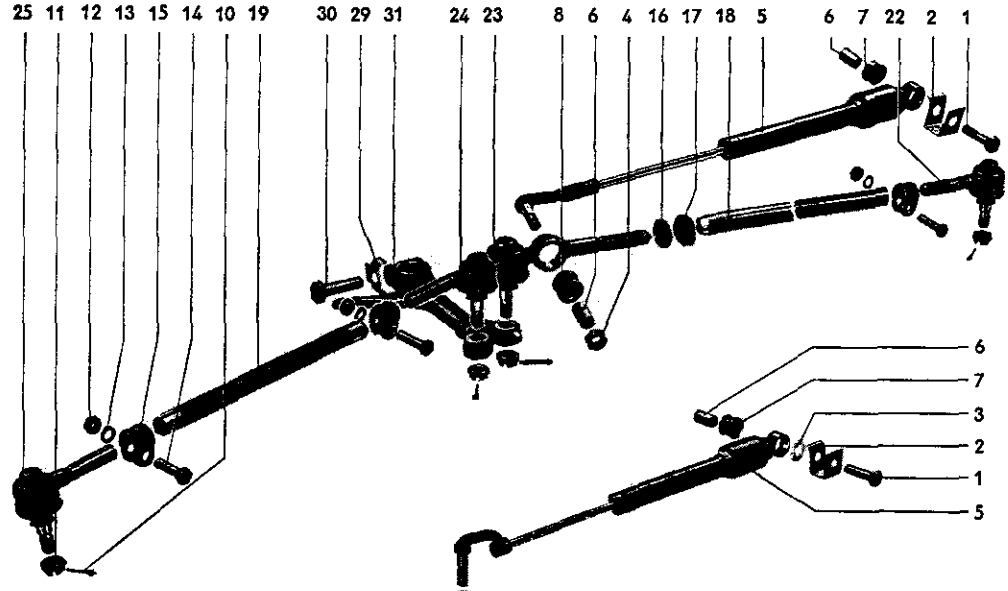
Tools



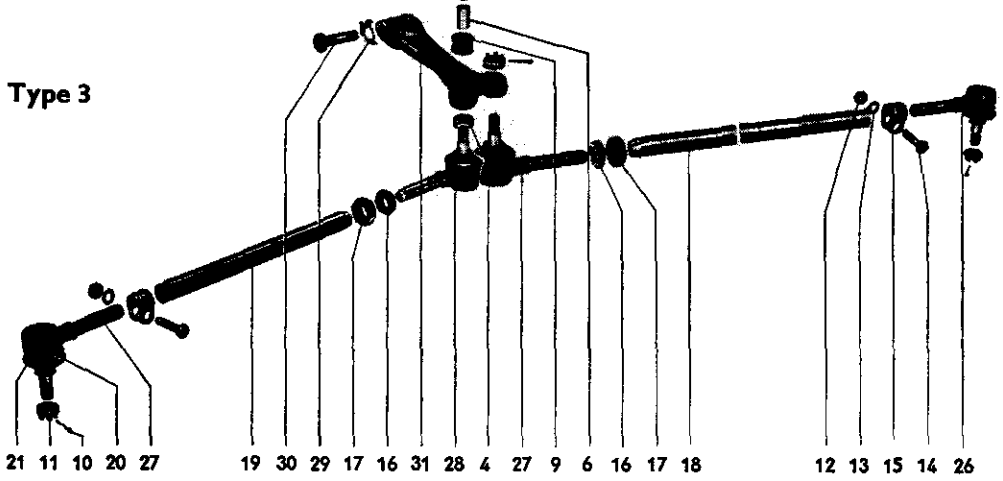
No.	Description	Special Tool	Remarks
1	Tie-rod end extractor	VW 266h	
2	Plate	VW 402	
3	Press tool	VW 408	
4	Press tool	VW 411	
5	Tube	VW 421	
6	Tube	VW 426	
7	Tapered pilot	VW 437a	

539.302.2$_{69}$ Printed in Germany 6. 69

Type 1



Type 3



No.	Description	Qty.	Note when removing	Note when installing	Remarks
1	Bolt M 10×40	1		tighten to 4.0 to 4.5 mkg (29—32 lbs. ft.)	
2	Lockplate	1		use new plate	
3	Washer	1		only on Type 3	
4	Self-locking nut M 10×1	1		always use new nut	
5	Steering damper	1		check by extending and compressing	V 6.1/2-1

No.	Description	Qty.	Note when removing	Note when installing	Remarks
6	Sleeve for rubber bushing	2		coat with glycerine, when pressing into bushing	V 6.1/2
7	Bushing for steering damper	1		coat with talcum and press in flush	V 6.1/2
8	Bushing for tie rod end	1		as No. 7	
9	Bushing for drop arm	1		as No. 7	
10	Cotter pin	4		always use new pins, note size of hole in tie rod end	
11	Slotted nut	4		tighten to 3.0 mkg (22 lb. ft.) then turn on until cotter hole is aligned	
12	Nut M 8 on Type 1 on Type 3	3 2		tighten to 1.5 mkg (11 lb. ft.) after adjusting wheel toe	
13	Spring washer on Type 1 on Type 3	3 2			
14	Bolt M 8×1×30 on Tyep 1 on Type 3	3 2			
15	Clamp on Type 1 on Type 3	3 2			
16	Nut for tapered ring M 14×1.5 on Type 1 on Type 3	1 2		tighten to 2—2.5 mkg (14—18 lb. ft.) after adjusting wheel toe	
17	Tapered ring on Type 1 on Type 3	1 2			
18	Tie rod (long)	1			
19	Tie rod (short)	1			
20	Retaining ring for dust seal	4			
21	Dust seal	4		check for damage	

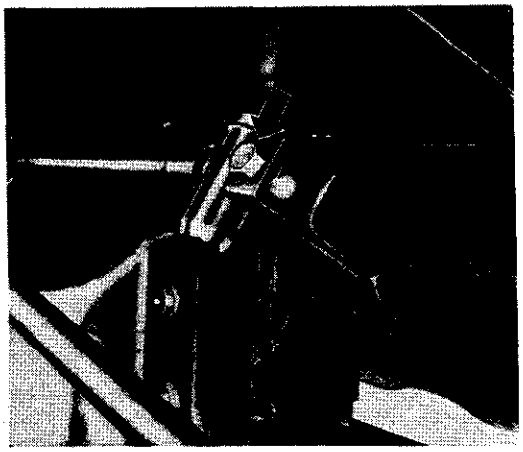
539.307.23 V 7th Supplement Printed in Germany 5.71

No.	Description	Qty.	Note when removing	Note when installing	Remarks
22	Tie rod end, straight, RH thread	1		**Do not use** the tie rod ends of the Sedan 113	V 6.1/3 V 6.1/6
23	Tie rod end, for steering damper	1			
24	Tie rod end, offset RH thread	1			
25	Tie rod end, straight, LH thread	1		as No. 22	
26	Tie rod end, straight, RH thread	1		as No. 22	
27	Tie rod end, straight, LH thread	2		as No. 22	
28	Tie rod, offset	1		as No. 22	
29	Lockplate	1		use new plate	
30	Bolt M 12×1.5	1		tighten tp 5.0—7.0 mkg (36—50 lb. ft.) and lock with lock plate	
31	Drop arm	1			

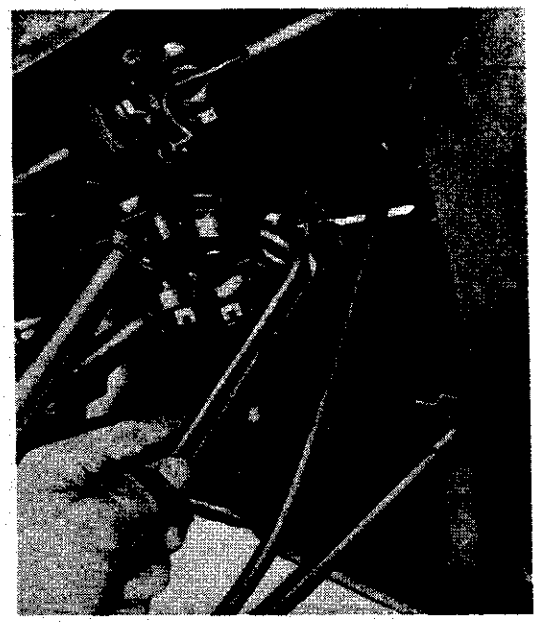
Removing and checking steering damper

Removing

1 - Release lockplate and remove bolt from bracket on axle beam.



2 - Remove nut at tie-rod eye (at drop arm on Type 3) and take damper out.



Checking

Check damper by extending and compressing it. The damper resistance must be uniformly firm and free of jerks over the complete stroke. When in doubt compare with a new damper.

The damping action in both directions must be clearly felt to the end of the stroke.

Two steering dampers which differ in length and stroke are available as replacement parts for type 1 vehicles.

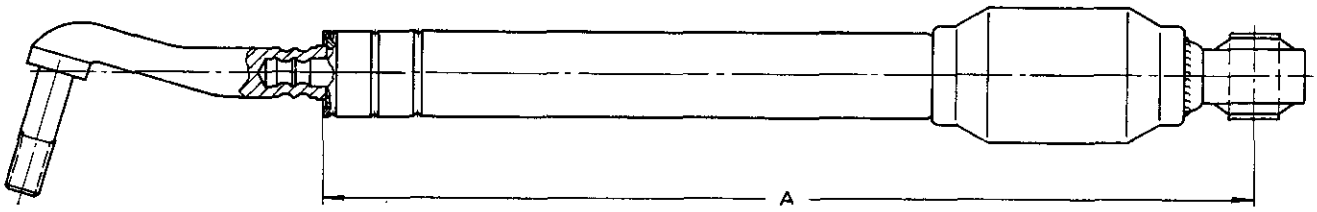
To avoid trouble with the steering due to premature failure of the steering damper ensure, when replacing a damper, that the one installed is the correct type for the vehicle concerned.

Check the rubber bushings and sleeves in damper for wear and damage and replace it necessary.

539.306.23 6th Supplement Printed in Germany 2. 71

Replacing

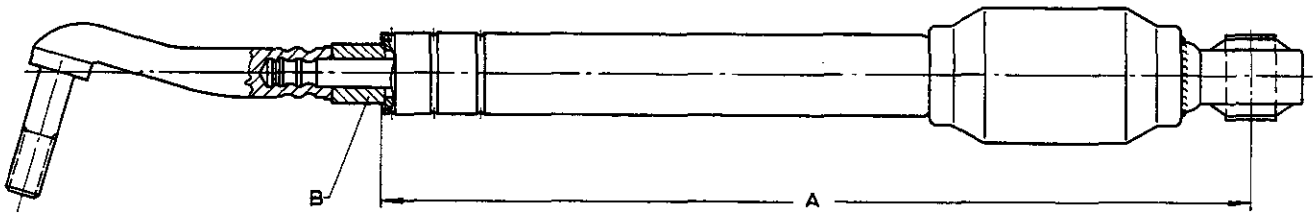
Steering damper without spacer



A = appr. 260 mm (10¹/₄")

Model	Chassis No.
113, 117, 141, 143, 151	from 116 000 001
141, 143	from 2 921 252 to 115 999 000

Steering damper with spacer



A = approx. 243 mm (9⁹/₁₆")

B = Plastic spacer

Model	Chassis No.
113, 117, 151	from 2 921 252 to 115 999 000

Installing

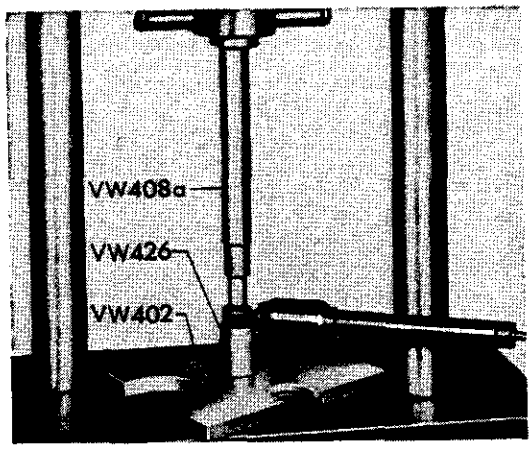
1 - Attach steering damper to tie-rod or the drop arm on Type 3 vehicles. Tighten the **new self-locking nut** to correct torque.

2 - Attach steering damper to bracket on axle tube, using a **new lockplate.** Tighten bolt to correct torque and lock.

Replacing steering damper bushing and sleeve

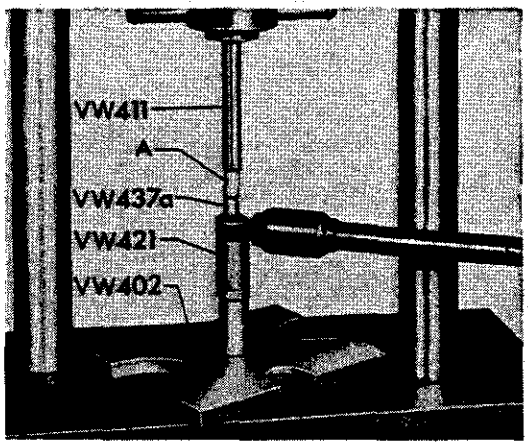
1 - Press bushing and sleeve out with VW 408a, 426 and 402.

2 - Press new bushing into damper eye.



3 - Press sleeve into bushing using VW 411, 437a, 421 and 402.

A = Sleeve for bushing



539.306.23 6th Supplement Printed in Germany 2. 71

Removing

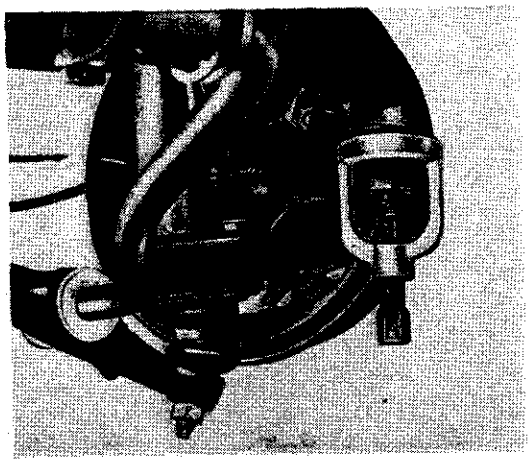
1 - Remove cotter pins and nuts from tie rod ends.

2 - Detach steering damper from tie rod end.

3 - Press tie rod ends out, using VW 266h.

Caution

Do not damage the rubber seals when removing tie rod ends. Take care not to squeeze grease out of the seals when working on the steering linkage. The service life of the joints is satisfactory only when they are packed with the correct amount of grease. Damaged rubber seals must be replaced.



Installing

1 - Check tie rods for damage.

Important

Bent tie rods must be replaced, not straightened.

2 - Check tie rod ends for wear and tighten. If there is any play or if the stud cannot be moved by hand, the tie rod end must be replaced. The thread on the stud must be undamaged.

3 - Check dust seals for damage. The seals may be replaced only if it is known that no dirt has entered the joint. If in doubt, replace the joint.

4 - On Type 1 vehicles, check the steering damper bushing for wear and replace if necessary.

5 - Install both tie rods so that the left-hand thread is on the left.

Caution

Do not confuse the tie rod ends of the link pin or ball joint type axles with those of the suspension strut type axle. Tie rod ends of the suspension strut axle have a greater movement. Under no circumstances are they to be installed on a vehicle with either ball joint or link pin axles. Otherwise the driving and steering characteristics of the vehicle will be seriously impaired.

The tie rod ends of the suspension strut type axle are identified by either a protusion or indentation on the housing as shown at point "A".

6 - Tighten slotted nuts on tie rod ends to correct torque and lock.

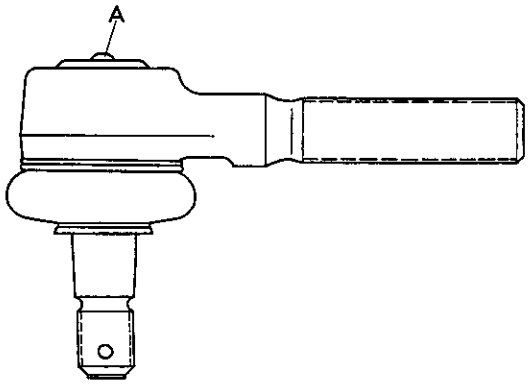
7 - Loosen nuts for tapered rings or clamps.

8 - Turn both ends on each rod in one direction to front or rear as far as possible so that the ends are properly aligned with one another.

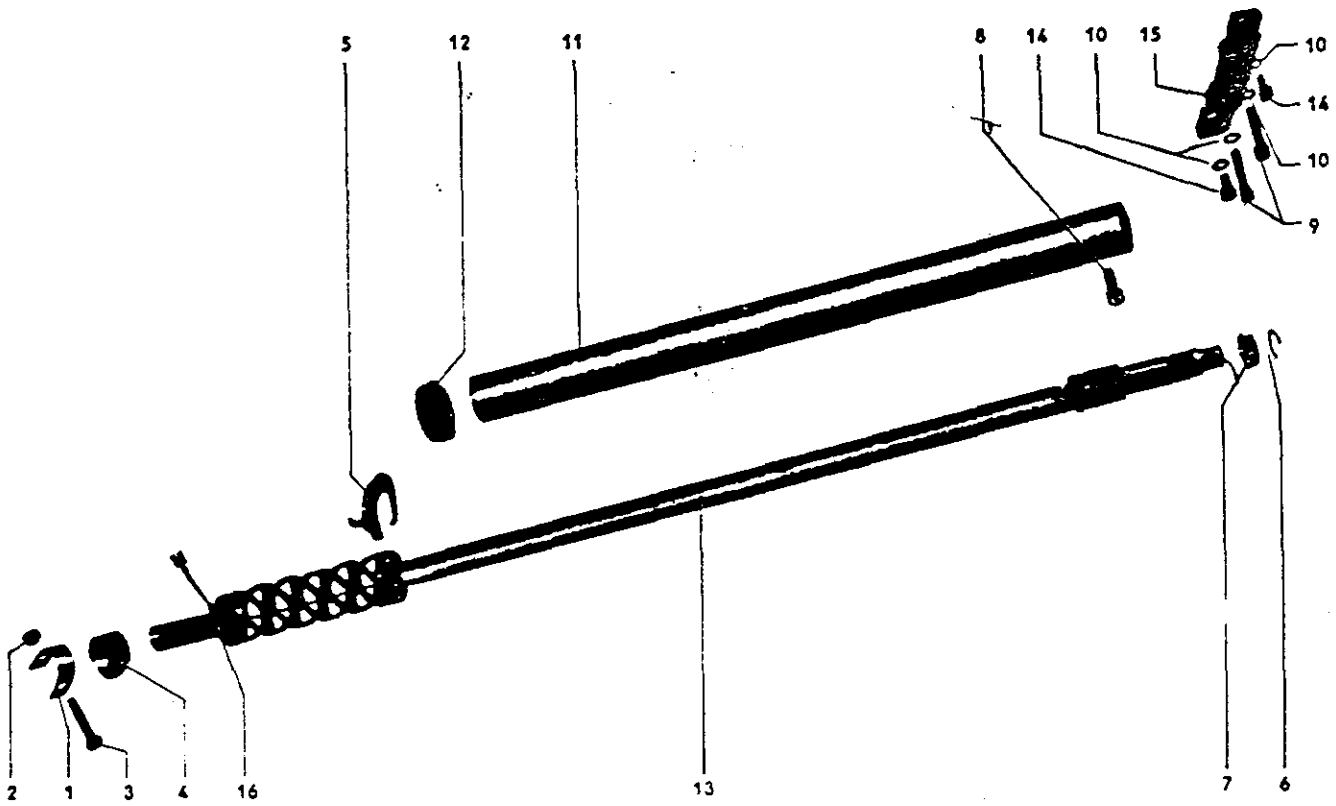
9 - In this position tighten nuts for tapered rings or clamps to correct torque.

10 - On Type 1 vehicles, attach steering damper to tie rod.

11 - Adjust wheel toe.



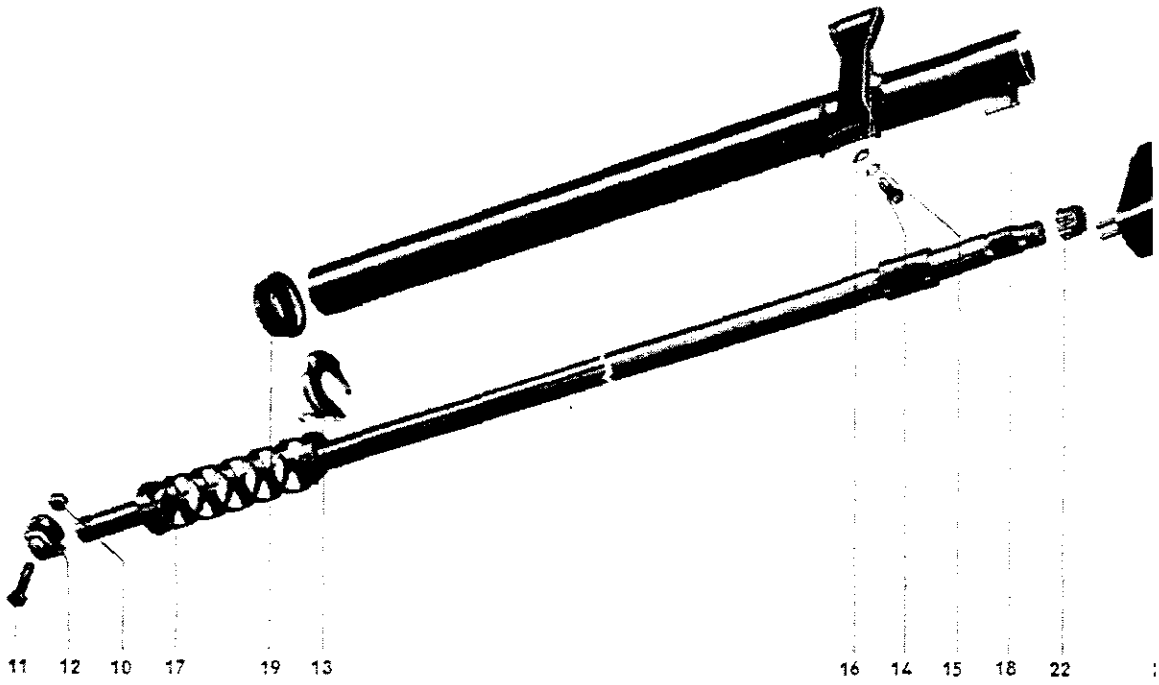
539.307.23 V 7th Supplement Printed in Germany 5.71



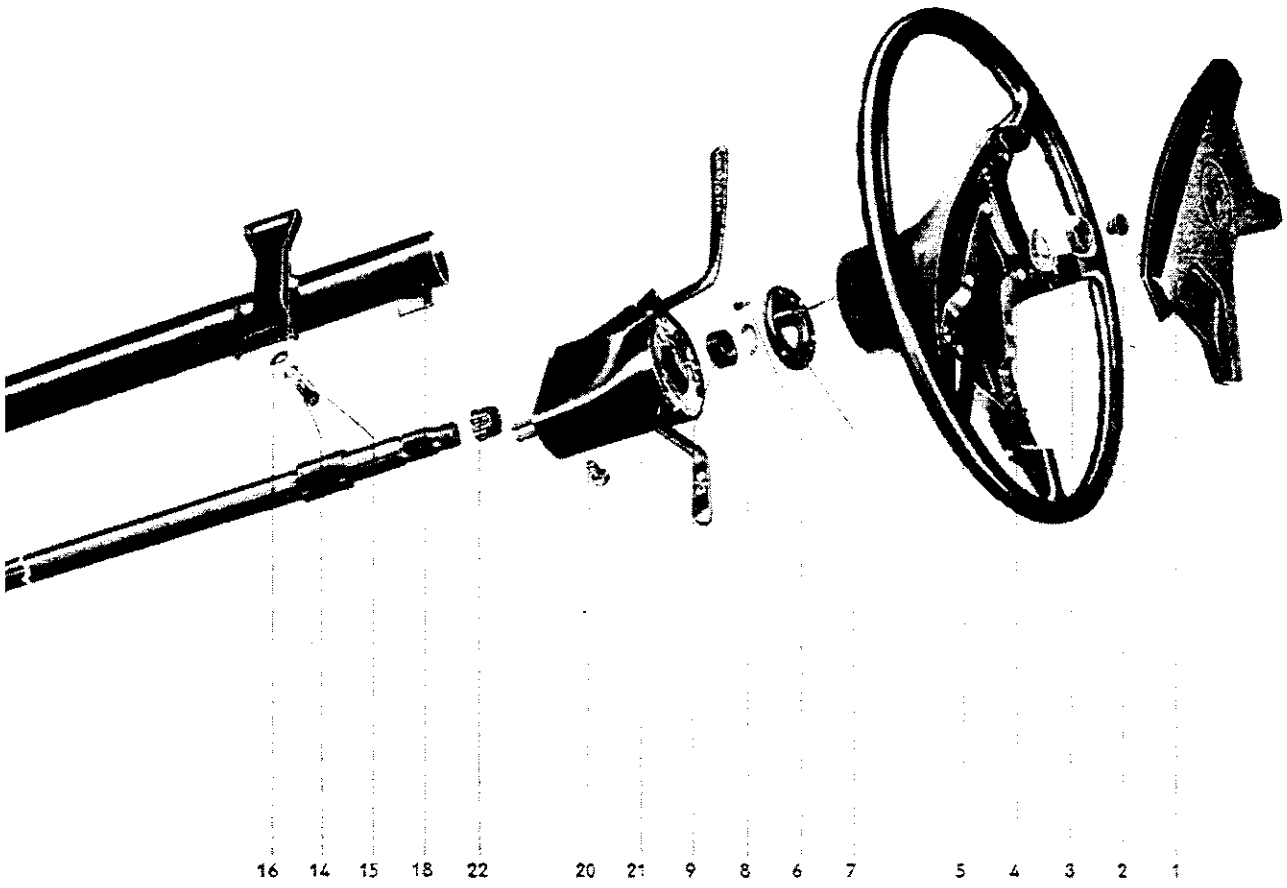
No.	Description	Qty.	Note when removing	Note when installing	Remarks
1	Lockplate	1	bend up	use new plate, lock nut and bolt by bending plate	V 7.1 2-1
2	Hex nut	1		tighten to 2—2.5 mkg (14—18 lb. ft.) and lock	
3	Bolt	1		lock	
4	Clamp for column	1			
5	Support for column	1	bend tabs up	bend tabs down	V 7.1 2-1
6	Circlip for column	1	pry off with two screwdrivers		
7	Contact ring	1		place in bearing in column switch from underneath	
8	Allen head bolt (M 8 x 22, secures column switch to column tube)	1		tighten to 0.5—1.0 mkg (4—7 lb. ft.)	

539 902.23 Printed in Germany 6.69

No.	Description	Qty.	Note when disassembling	assembling	Special instructions see
1	Padded cap	1	remove from steering wheel		
2	Plug	1			
3	Nut M 18x1.5	1		tighten to 5 mkg (36 lb ft)	
4	Circlip				
5	Steering wheel	1		install with wheels in straight-ahead position	
6	Screw with lock washer	3			
7	Cancelling ring	1		the cancelling lug points to the right	
8	Circlip for column	1			
9	Sealing ring	1			
10	Nut M 8 self locking	1		tighten to 2.5 mkg (18 lb ft)	
11	Bolt M 8x40	1			
12	Clamp	1			
13	Support ring for column tube	1	open tabs	close tabs	
14	Bolt with groove M 8x18	2		tighten to 2 mkg (14 lb ft)	
15	Spring washer	2			
16	Washer	2			
17	Steering column	1			
18	Column tube	1			
19	Sealing ring	1			
20	Screw M 8x16	1		tighten to 0.5—1 mkg (3.5—7 lb ft)	
21	Steering column switch	1			
22	Contact ring	1			



Disassembling and assembling steering Type 1 / Model 181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1

No.	Description	Qty.	Note when disassembling	assembling	Special instructions see
1	Padded cap	1	remove from steering wheel		
2	Plug	1			
3	Nut M 18×1.5	1		tighten to 5 mkg (36 lb ft)	
4	Circlip				
5	Steering wheel	1		install with wheels in straight-ahead position	
6	Screw with lock washer	3			
7	Cancelling ring	1		the cancelling lug points to the right	
8	Circlip for column	1			
9	Sealing ring	1			
10	Nut M 8 self locking	1		tighten to 2.5 mkg (18 lb ft)	
11	Bolt M 8×40	1			
12	Clamp	1			
13	Support ring for column tube	1	open tabs	close tabs	
14	Bolt with groove M 8×18	2		tighten to 2 mkg (14 lb ft)	
15	Spring washer	2			
16	Washer	2			
17	Steering column	1			
18	Column tube	1			
19	Sealing ring	1			
20	Screw M 8×16	1		tighten to 0.5—1 mkg (3.5—7 lb ft)	
21	Steering column switch	1			
22	Contact ring	1			

Removing

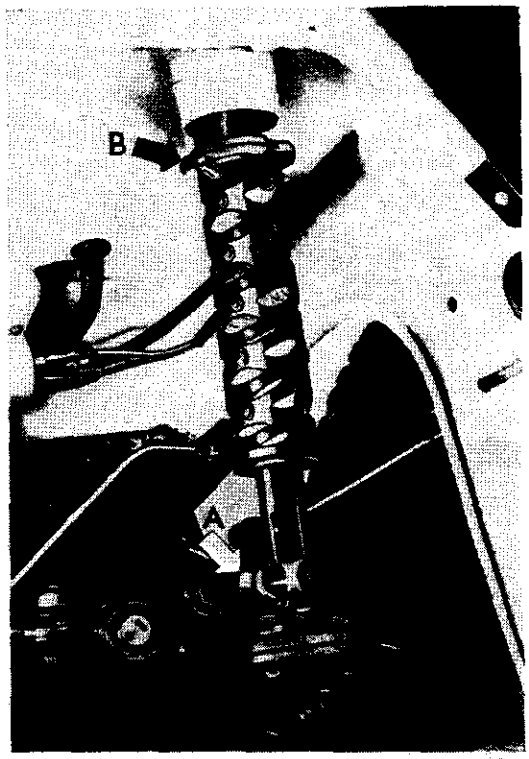
1 - Disconnect battery ground strap.

2 - Remove fuel tank.

3 - Remove nut from bolt in column securing clamp (arrow A). Bend up tab on column support ring and take ring off (arrow B).

4 - Remove steering wheel and column circlip. Turn ignition key to "on" position.

5 - Disconnect all wiring from column switch. Release pressure before disconnecting hoses for windshield washers from the steering column switch.

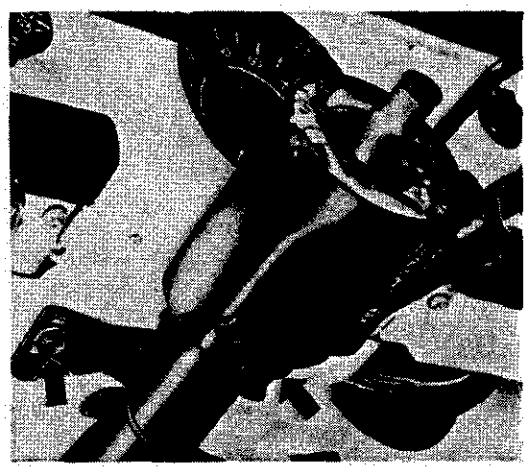


6 - Remove two bolts (arrows) attaching column tube to mounting plate.

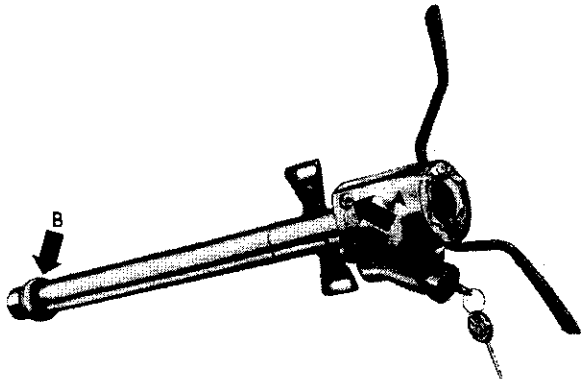
7 - Pull column tube back into passenger compartment complete with column and switch.

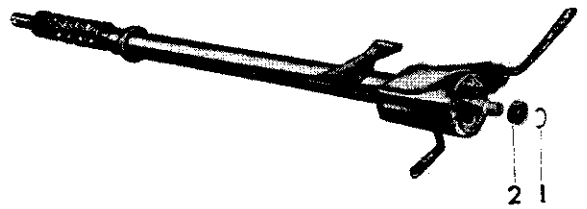
8 - Remove bolt holding switch to column tube and take switch off.

9 - Pull column tube off column.



V 8th Supplement — USA — Printed in Germany 3. 73





1 = Circlip

2 = Sealing ring

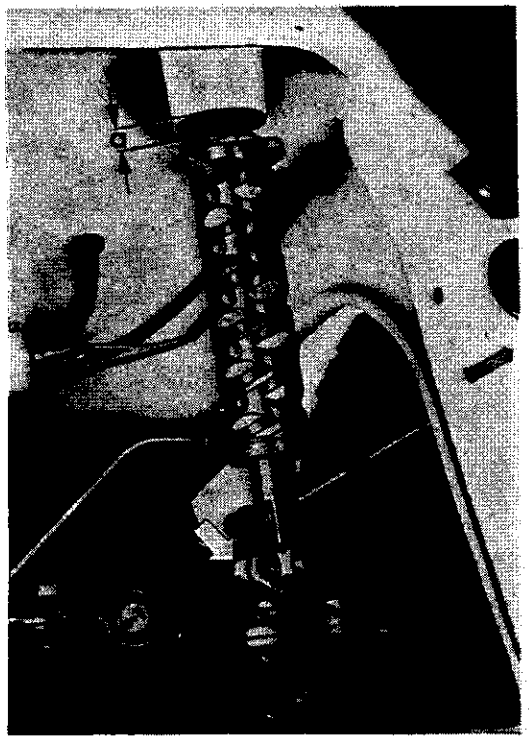
Installing

1 - Install switch on column tube and tighten socket head bolt (arrow A) to correct torque. Fit sealing ring on column tube (arrow B).

2 - Place contact ring and seat on the column, insert column into column tube and secure with circlip.

3 - Install the assembly in the vehicle and push column on to column coupling after installing the clamp. Insert bolt through clamp and tighten new self-locking nut lightly.

4 - Install column support ring and secure by bending down the tab.

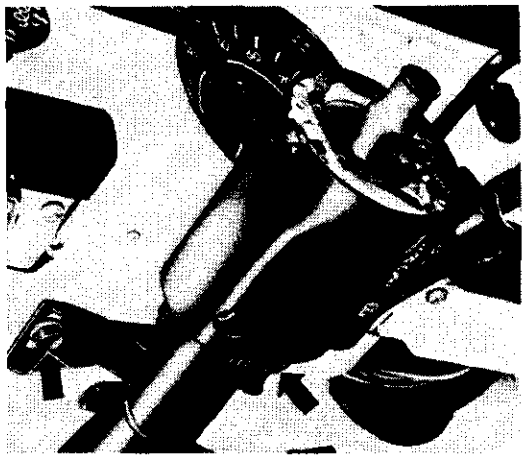


5 - Move steering column far enough that the distance between the support ring and tube in the cross panel is (a) 6—8 mm (0.24—0.31 in.) Then tighten self-locking nut (arrow) to correct torque.

6 - Tighten bolts (arrows) for column tube lightly.

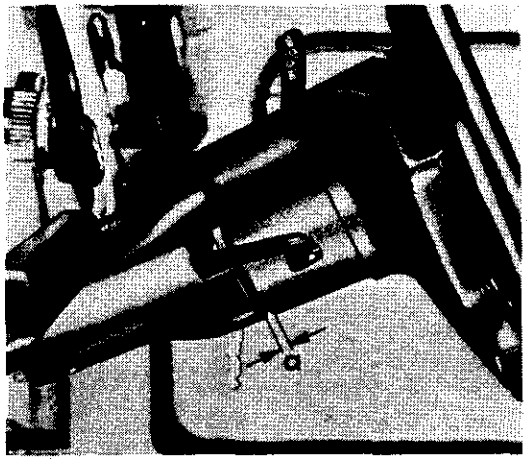
7 - Install steering wheel on column with wheels in straight-ahead position (marking ring on worm spindle in line with casting seam in housing, steering wheel spokes horizontal). Make sure that turn signal lever is in the central position as otherwise the canceling cams will be damaged by the lug on the canceling ring when the steering wheel is installed.

8 - Tighten steering wheel nut to correct torque.



9 - Adjust gap between steering wheel hub and column switch to 2—4 mm (0.08—0.16 in.) (a) by moving the column tube. Tighten bolts to correct torque.

10 - Connect all wires and water hoses for windshield washer to column switch.



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Troubleshooting Chart

Symptom	Cause	Remedy
Hard Steering		
Steering is equally stiff from lock to lock, jams or does not automatically self center	a - Front axle inadequately lubricated	a - Jack up front end af car thoroughly lubricate front axle
	b - Steering gear not properly adjusted	b ; Check steering gear adjustment
Front wheel do not self center although there is no tightness in the steering system	a - Front wheel alignment improperly adjusted	a - Check and adjust front wheel alignment (caster, camber and toe-in)
Play in Steering		
Play in steering gear	a - Steering gear not properly adjusted	a - Sheck steering gear adjustments
	b - Steering gear set worn	b - Install new steering gear set
Excessive play in tie rod ends	Tie rod ends aorn	Install new tie rod ends
Excessive play in front wheel suspension	Worn bearing points (torsion arms stub axle, and front wheel bearings)	Check adjustment of torsion arms and front wheel bearings. Adjust parts with excessive play or replace if necessary
Vehicle pulls to one side	a - Tire pressures uneven. The vehicle pulls to the side with low pressure	a - Check pressures and rectify
	b - Tires unevenly worn. The vehicle pulls to the side on which the tires are most worn	b - Rotate or install new tires
	c - Toe-in out of adjustment	c - Adjust toe-in
	d - Steering damper defective	d - Install new damper
	e - Difference between front wheel comber excessive. The vehicle pulls to one side if the camber differs more than 20′ between sides	e - Check camber
Front wheel wobble	a - Wheels are not balanced	a - Balance wheels (see section B)
	b - Steering out of adjustment	b - Adjust steering
	c - Steering damper defective	c - Install new damper
	d - Shock absorber defective	d - Install new shock absorber
	e - Front axle worn	e - Overhaul axle
	f - Wheel alignment out of adjustment	f - Correct wheel alignment

539.307.23 V 7th Supplement Printed in Germany 5.71

Checking the steering gear of accident vehicles

Whenever repairs are performed to the front end of a vehicle that has been involved in an accident the steering must be very carefully checked as follows:

1 - The steering gear and all component parts must be checked for fractures, cracks, distortion and also for security of mountings etc.

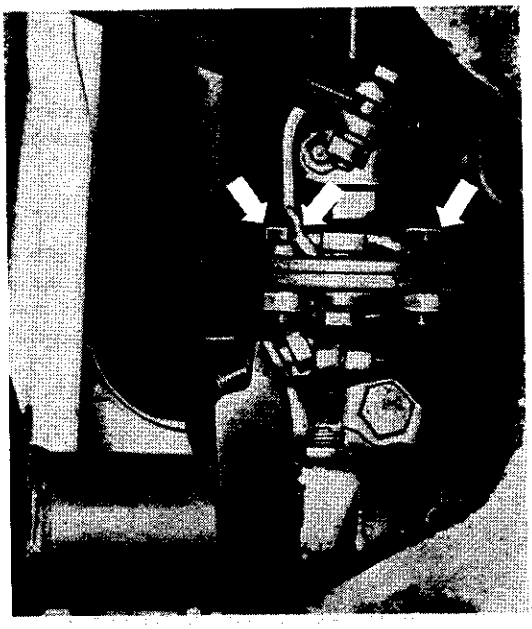
2 - In addition the steering must be checked, both with the vehicle standing on its wheels and with the front end jacked up, by turning the steering wheel repeatedly to both full lock positions and checking for excessive play, noises, jamming, sticking, grinding and uneven movement.

Where such defects are noted, the steering gear must either be repaired or replaced.

Removing

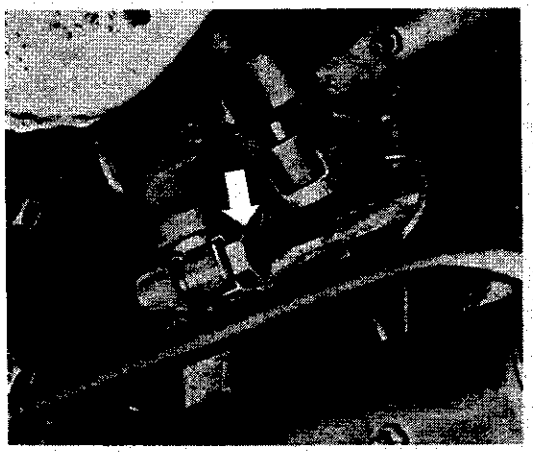
When removing the steering gear, it is advisable to pull the drop arm off the shaft. The tie-rods need not be taken off the drop arm. The arm remains on the vehicle.

1 - Pull horn ground cable off. Remove bolts from upper flange of column coupling.



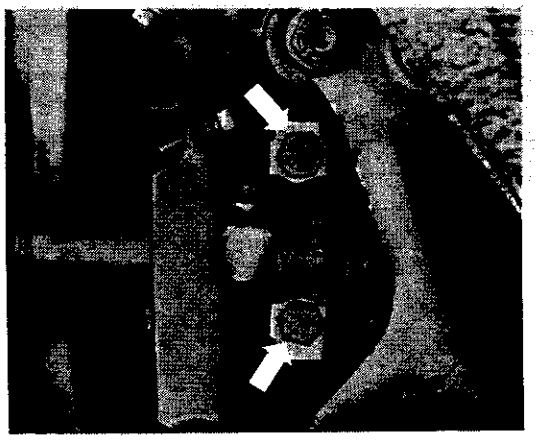
2 - Bend lock plate for the drop arm securing bolt and remove bolt.

3 - Pull drop arm off shaft. Turn wheels to a suitable angle.



4 - Bend lock plate for steering gear mounting clamp bolt. Remove bolts.

5 - Remove steering gear.

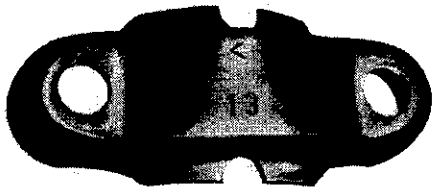


539.301.23 Printed in Germany 4. 69

Installing

The position of the steering gear on the upper tube is controlled by two stops welded to the tube as well as cutouts in the mounting clamp.

1 - Install steering gear on the axle tube with the appropriate cutout in the clamp on the left and the arrow pointing forward. Install a new lock plate, tighten bolts to correct torque and lock.



13 = for 113 and 151

14 = for Karmann Ghia

2 - Place drop arm on shaft, install bolt with new lock plate, tighten to correct torque and lock.

3 - Attach upper flange on column to coupling and tighten nuts to correct torque. **Use new self-locking nuts.**

4 - Connect horn ground cable.

5 - Check toe-in and adjust if necessary.

Tightening torques

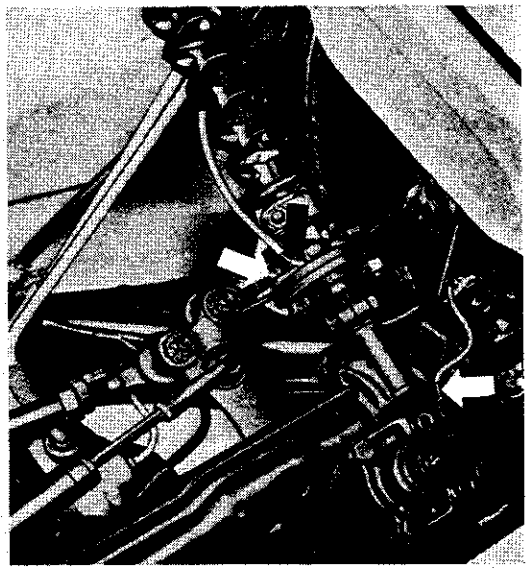
Location	Description	Thread	Quality grade	Tensile class	mkg	lb. ft.
Steering gear to front axle	bolt	M 10	8 G	8.8	2.5—3	18—22
Drop arm to shaft	nut	M 12×1.5	8 G	8.8	7.0	51
Coupling flange to disc	nut	M 8	6 G	8	1.5	11

Removing

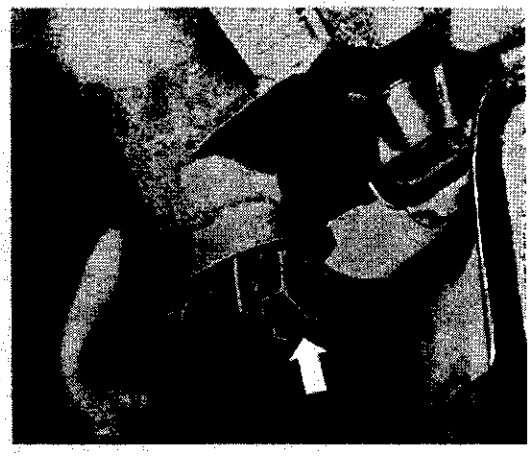
To remove the steering gear, it is necessary to remove the spare wheel well and the fuel tank. The drop arm can now be pulled off the shaft.

1 - Take spare wheel well and fuel tank out.

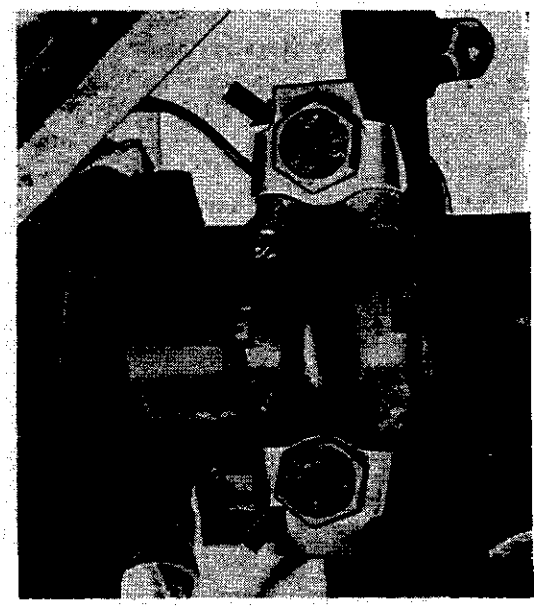
2 - Pull horn ground cable off the connector on the steering column coupling (arrow A), remove bolts holding upper part of flange (arrow B) and bolt holding the ground connection from steering gear to axle retainer (arrow C).



3 - Bend lock plate for drop arm securing bolt and remove bolt.



4 - Bend lock plate for the bolts holding the steering gear clamp. Remove bolts.



5 - Take steering gear.

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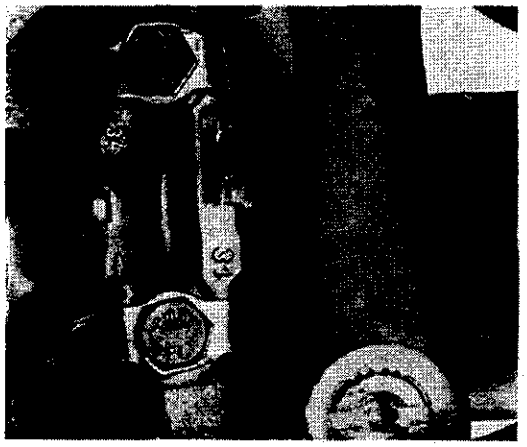
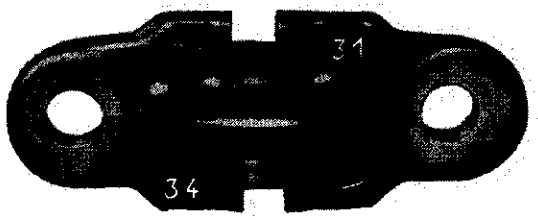




LHD:

Cutout "31" for Sedan and Squareback
Cutout "34" for Karmann Ghia, Type 3

Installing

The position of the steering gear on the axle tube is controlled by a stop.

1 - Install steering gear and fit drop arm on shaft.

2 - Install retaining clamp with new lockplates. The clamp should be placed on the axle tube with the appropriate cutout engaged in the stop on the axle.

3 - Tighten clamp securing bolt to correct torque and lock.

4 - Tighten drop arm securing bolt to correct torque and lock. Always use a new locking plate.

5 - Insert bolts for upper column flange, install **new self-locking nuts** and tighten to correct torque.

6 - Connect horn ground cable to the column coupling and attach steering gear ground cable.

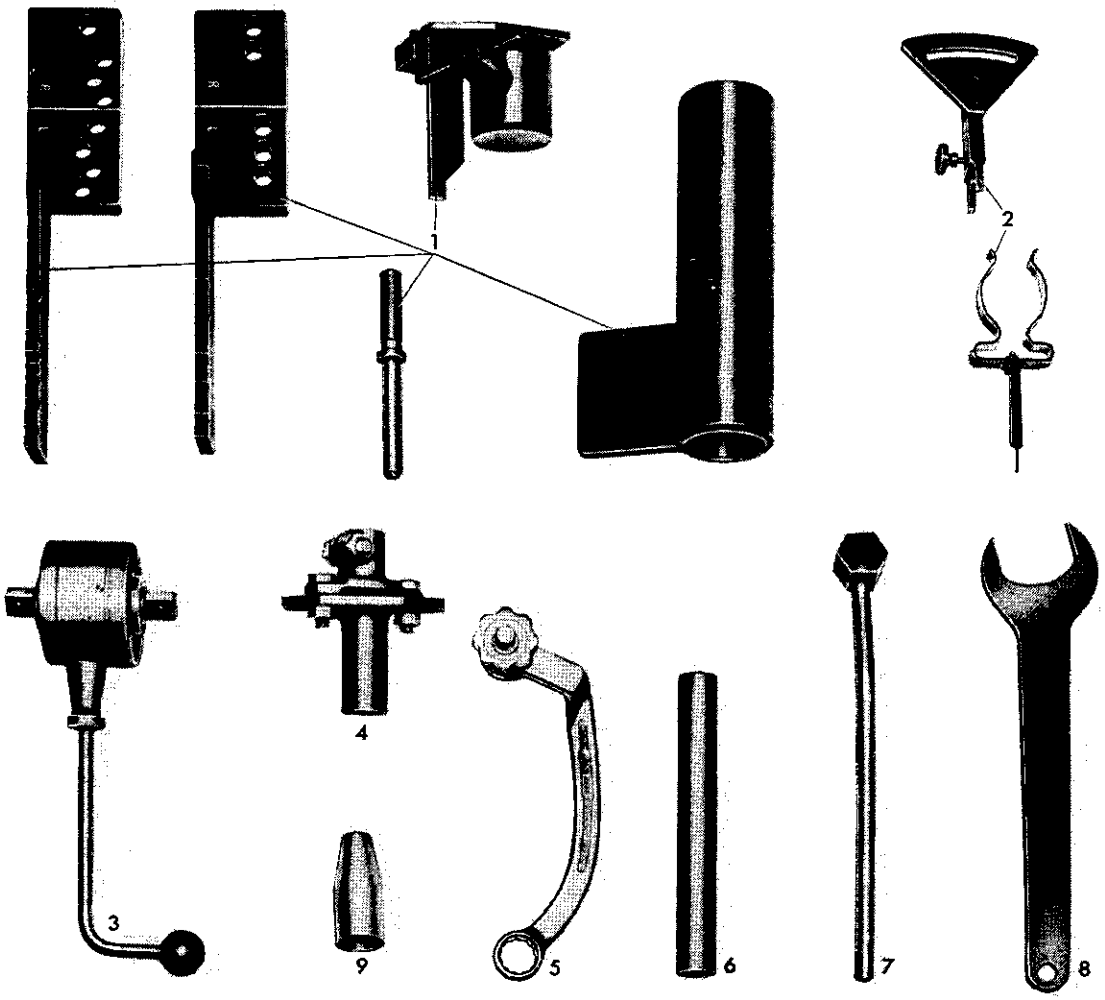
7 - Install fuel tank and spare wheel well.

8 - Check toe-in and adjust if necessary.

Tightening torques

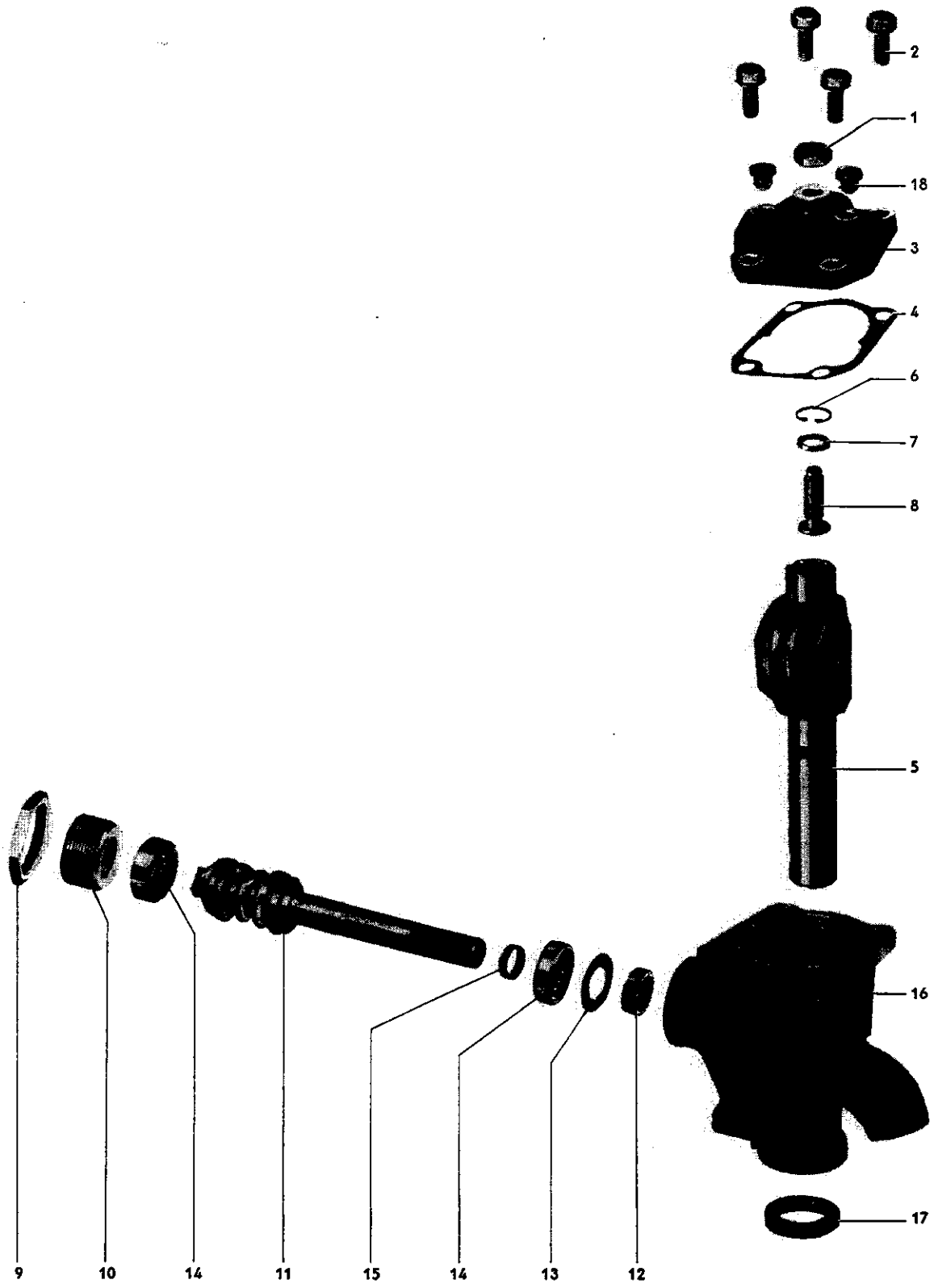
Location	Description	Thread	Quality grade	Tensile class	mkg	lb. ft.
Steering gear to front axle	Bolt	M 10	8 G	8.8	2.5—3.0	18—22
Drop arm to shaft	Bolt	M 12×1.5	8 G	8.8	7.0	51
Coupling flange to disc	nut	M 8	6 G	8	1.5	11

Tools



No.	Description	Tool No.	Explanation
1	Repair and checking tools	VW 280	
2	Setting devices	VW 279	
3	Torque gauge		standard type, from 0—30 cmkg
4	Adaptor	VW 758/1	
5	Special wrench	2569	17 mm
6	Tube	VW 423	
7	Spindle adjusting wrench	VW 278a	
8	Open-end wrench	VW 277	

539.301.23 Printed in Germany 4. 69


2
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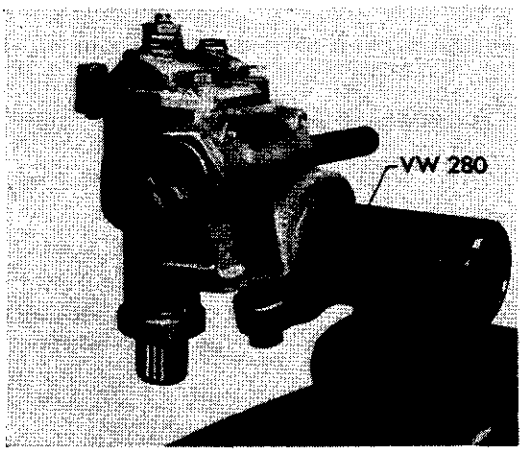
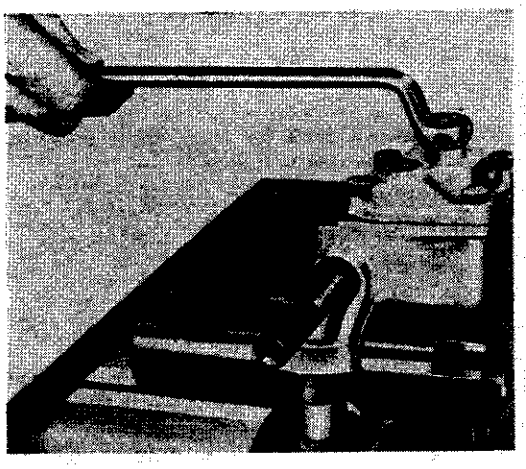
No.	Description	Qty.	Note when disassembling	assembling	Special instructions see
1	Locknut for adjusting bolt	1			V 8.1/4
2	Bolt M 8×20 and spring washer M 8×15	4 of each		tighten to correct torque	V 8.1/4
3	Housing cover	1	detach by turning adjusting screw (No. 8) and remove	fill housing with liquid transmission grease. Install cover. Before tightening bolts, move cover to side opposite that of spindle if the modified cover marked "KD" is installed use longer bolts.	V 8.1/4
4	Gasket for cover	1		always install new gasket	
5	Drop arm shaft	1	turn spindle to center position, push oil seal protection sleeve VW 649 over splines, press shaft out upward with a punch	check shaft and adjusting screw for damage. Turn screw through the cover	V 8.1/4
6	Circlip 17×1	1		must fit properly in groove in shaft all around	
7	Adjusting washer	x		select as detailed	V 8.1/4
8	Adjusting screw	1		if washer has been selected properly, it should just be possible to turn screw in shaft with thumb and fore-finger, without lateral play	V 8.1/4
9	Lock nut for adjuster	1	loosen with wrench VW 277	tighten to correct torque after adjusting spindle axial play	V 8.1/4
10	Adjuster	1	screw out with VW 278	use sealing compound when installing, tighten, back off and tighten again until spindle turning torque is obtained: 1.5—2.5 cmkg (1.3—2.2 in. lb) 2.0—3.0 cmkg (1.7—2.6 in. lb) with seal installed (No. 12)	V 8.1/4 V 8.1/5
11	Worm spindle	1	knock out with rubber hammer	install with upper bearing and medium thickness washer 0.35 mm (1.378 in.) No 13. Adjust axial play, see turning torque under No. 10	V 8.1/4
12	Seal for spindle	1	knock inward together with washer and upper bearing, using tube VW 423	after adjusting, press seal in with VW 423	V 8.1/4
13	Adjusting washer	x		when installing spindle, use a medium washer 0.35 mm (1.378 in.). If free-of-play movement to left is larger than 11°±2°, use thicker washer; if free-of-play movement to left is less than 11°±2°, use thinner washer	V 8.1/4
14	Ball thrust bearing	2			
15	Marking ring	1		mark center position with ring and secure with paint	
16	Housing	1		fill with 160 cc (5.4 oz.) of transmission grease	
17	Oil seal for shaft	1			
18	Plug for cover	2			

V 8th Supplement — USA — Printed in Germany 3.73

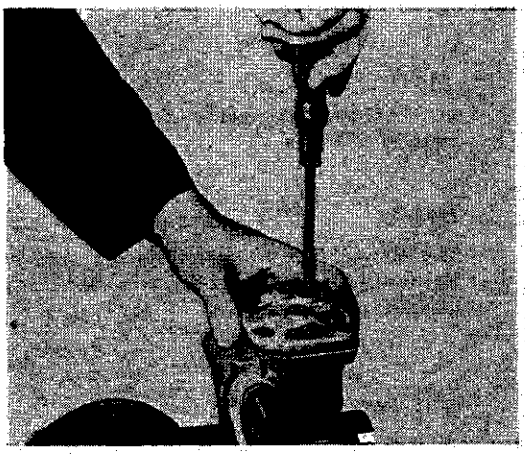
1 - Bolt steering gear onto mounting tube VW 280. The exact position is controlled by a stop on the tube.



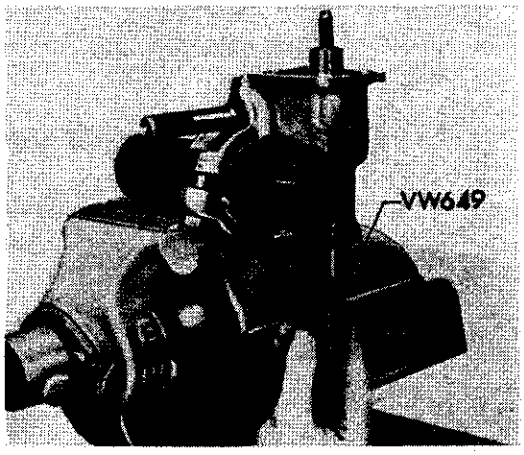
2 - Remove lock nut on drop arm shaft adjusting screw. Remove four cover securing bolts.



3 - Detach cover from shaft by turning the adjusting screw and take cover off.



4 - Slide oil seal protective sleeve VW 649 over splines on drop arm shaft as far as it will go.



5 - Turn steering worm to center position: push drop arm out upwards with a drift.

6 - Remove grease from housing.

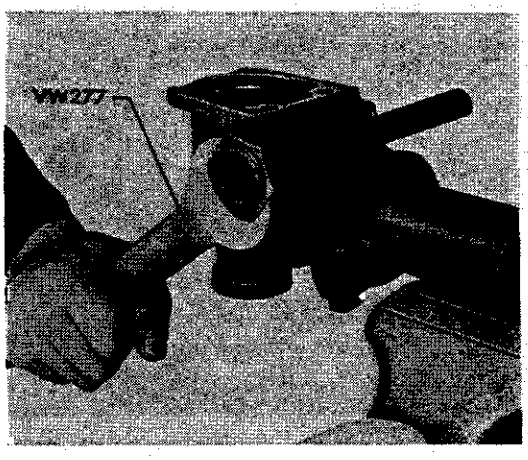
7 - Take circlip for drop arm shaft adjustment out.

8 - Take adjusting screw and shim out of the drop arm shaft.

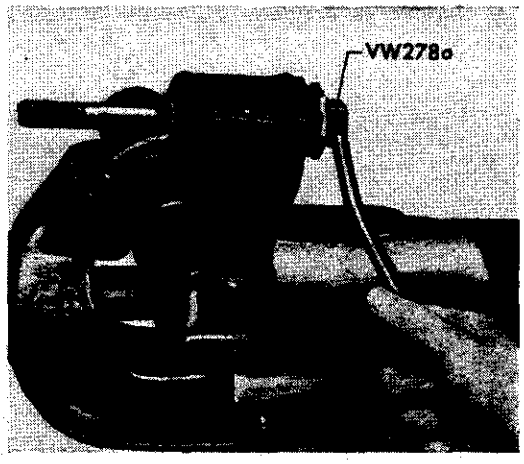
Note:

The drop arm shaft cannot be dismantled any further.

9 - Loosen the lock nut on the worm spindle adjuster with open-end wrench VW 277.



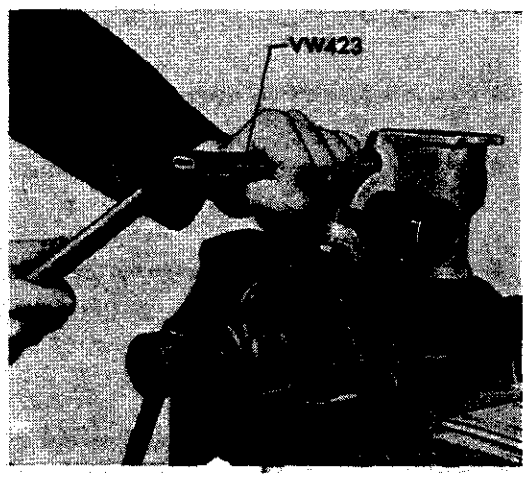
539.301.23 Printed in Germany 4. 69



10 - Screw adjuster out with wrench VW 278a.

11 - Take marking ring off.

12 - Remove worm spindle and lower ball bearing by tapping lightly with a rubber hammer.



13 - Drive oil seal, shim and upper bearing inwards with tube VW 423.

14 - Check all parts for wear and damage and replace where necessary.

Assembling

When assembling the steering gear, the worm and roller must be adjusted in a way that the free-of-play movement is approximately the same in both directions by selecting a shim of the correct thickness. It is advisable to install a shim of medium thickness (0.35 mm/.0138 in.) first.

The correct shim is then determined with the appliances VW 279 and VW 280.

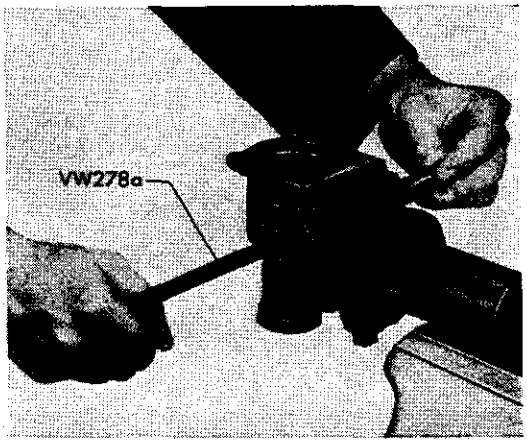
1 - Insert worm spindle into housing with the upper bearing and shim.

Note:

The oil seal for the worm spindle must not be installed until the steering has been assembled and adjusted.

2 - Install lower bearing.

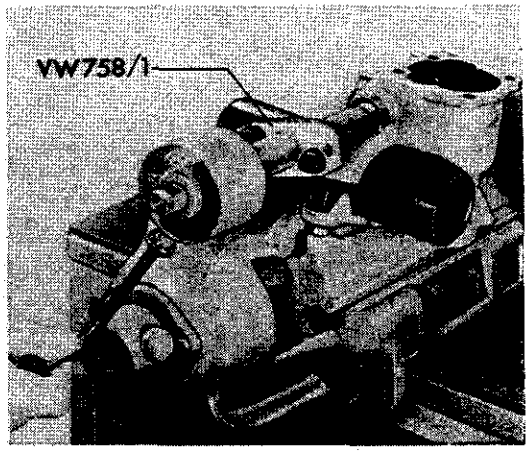
3 - Install worm adjuster with sealing compound and tighten lightly with VW 278a to press the bearings onto their seats.



4 - Loosen adjuster and tighten again until the worm feels rough when turned.

The torque required to turn the worm spindle should be 1.5 to 2.6 cmkg (1.3 to 2.2 in. lb). 2.0 to 3 cmkg (1.7 to 2.5 in. lb) with oil seal installed. A special torque wrench is required for this purpose.

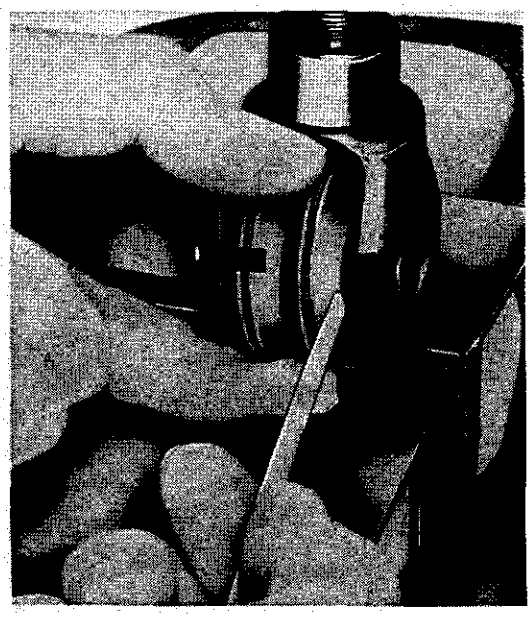
5 - Tighten the adjuster locknut and check the spindle adjustment again.



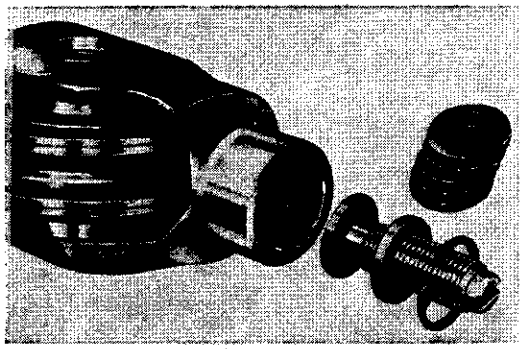
6 - Assemble drop arm shaft:

a - Check axial play of roller. The play must not exceed 0.04 mm (0.001 in.). It is checked between roller and washer with a 0.05 mm (0.002 in.) feeler blade. If the blade can be pushed between roller and washer, a new shaft must be installed.

b - Check adjusting screw. If the threads or the thrust surface are damaged, a new screw must be used.



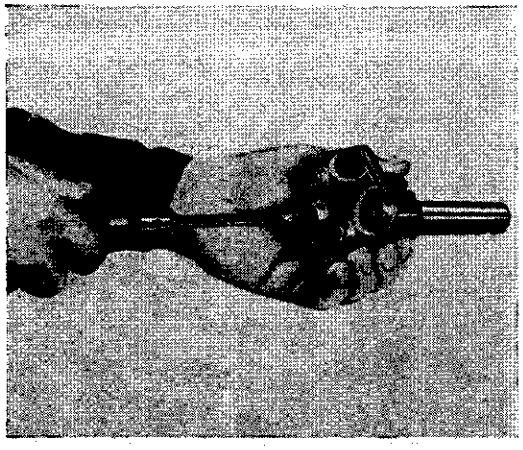
V 8th Supplement — USA — Printed in Germany 3.73



c - Place adjusting screw and shim in the end of the shaft and secure with circlip. The thickness of the shim should be selected so that the screw can just be turned with thumb and forefinger without lateral play. The shims are available in thicknesses from 2.0 mm (0.08 in.) to 2.5 mm (0.098 in.) in 0.05 mm (0.002 in.) steps.

Caution

The circlip must seat properly in the groove all the way around.



7 - Attach drop arm shaft to housing cover by inserting the adjusting screw through the cover as far as it will go.

Modification
Type 1 from Chassis No. 111 2517 788, Jan. 71
Type 3 from Chassis No. 311 2131 806, Febr. 1971

The material for the steering gear cover has been changed to an aluminium alloy (previously magnesium alloy).

Also a new gasket between the housing and cover as well as longer bolts (M 8×25) are installed.

To identify this modified cover the letters "KD" are stamped on it in addition to the Part Number. When this cover is used as a spare part make sure that the longer bolts (M 8×25) are also used.

8 - Insert oil seal protection sleeve VW 649 into housing.

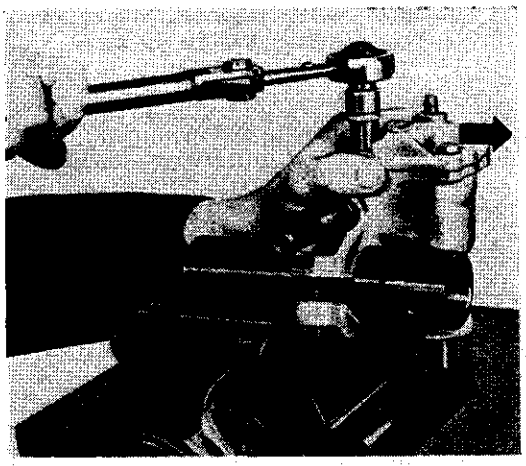
9 - Install drop arm shaft in housing with the roller at right angle to the worm.

Note

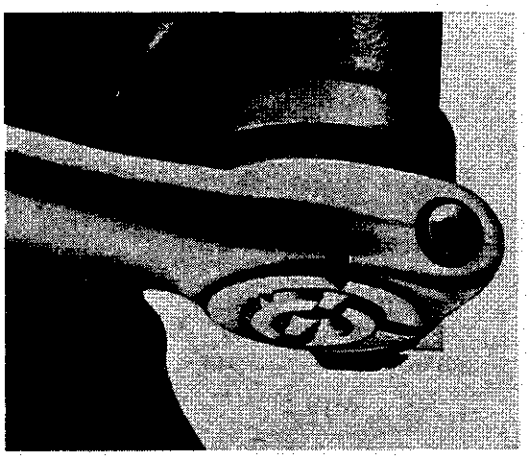
Do not put grease into housing until steering gear has been adjusted.

10 - Tighten cover bolts to 2.0—2.5 mkg (15—18 lb. ft.). While doing this, press the cover against the housing on side opposite to worm as shown by arrow. This will prevent the cover from moving and causing premature play in the steering.

To adjust the steering gear, fit the appropriate drop arm on the shaft.



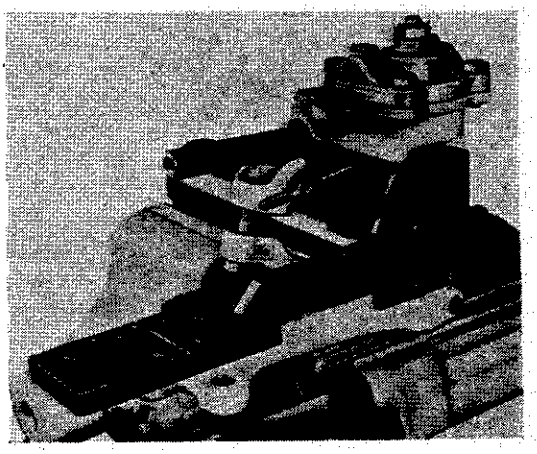
11 - Push drop arm on until upper edge is level with the chamfer on shaft. Tighten securing bolt to 7.0 mkg (51 lb. ft.) and lock.



12 - Check operation of steering by moving drop arm back and forth several times.

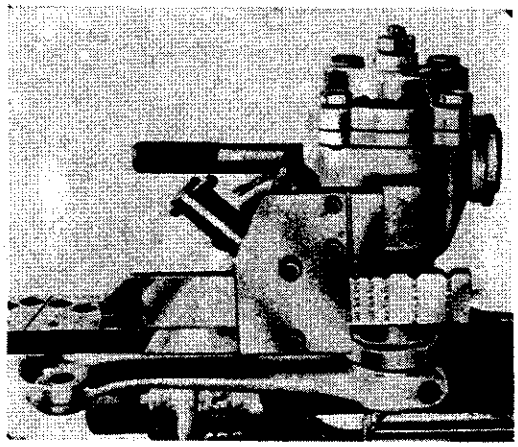
Adjusting

1 - Place measuring head of appliance VW 280 in the mounting tube and clamp in position. Ensure that the feeler plate on the head contacts the worm spindle.



539.301.23 Printed in Germany 4. 69

2 - Move the setting plate until the appropriate drop arm number is under the mark:



Typ 1

L = Left hand drive
up to August 1965

113 415 371 — 113 - 117 - 151
141 415 371 a — 141 - 143

from August 1965

131 415 371 — 113 - 117 - 151
141 415 371 B — 141 - 143

Type 3

L = Left hand drive

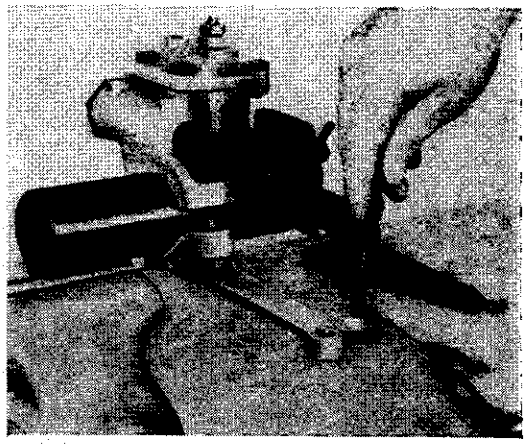
311 415 371 — 311 - 361

3 - Move drop arm to center position:

a - Align right hand hole in drop arm roughly under the appropriate hole in plate.

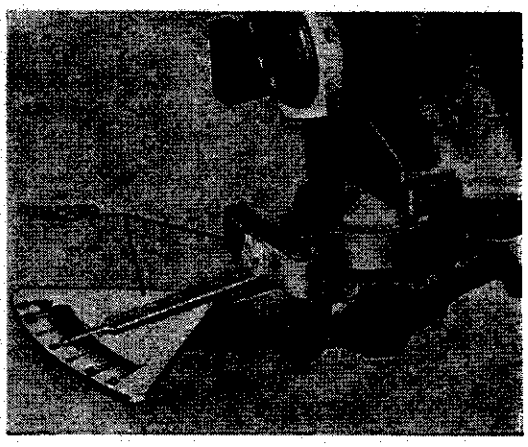
b - Insert pilot into correct hole in plate.

c - Move drop arm and plate slightly until the pilot fits the hole in the drop arm.



4 - Insert scale of setting device VW 279 into slot in drop arm and clamp in position.

5 - Install finger of VW 279 on housing and set to zero.



6 - Pull pilot out.

7 - Turn drop arm 11° to left or right.

Important

The angle of 11°±2° is only applicable when drop arm shaft and worm spindle or one of these parts has been replaced. Otherwise the steering should be set to 5°.

8 - Turn drop arm shaft adjusting screw in until no further play can be felt. While doing this, move the drop arm slightly and hold the worm spindle with other hand. The column coupling flange should be fitted on the worm spindle to enable it to be held properly.

9 - Tighten the lock nut of adjusting screw to correct torque.

10 - Check the no-play range on the other lock. It should be possible to turn the worm through the center position with a torque of 9—12 cmkg.

At 11°±2° there should be no detectable play at the drop arm. If play can be felt at this angle, dismantle the steering gear again and correct the setting of the worm to the roller by installing a different shim:

a - No-play angle to left side of scale is larger than 11°±2°.

Fit a thicker shim.

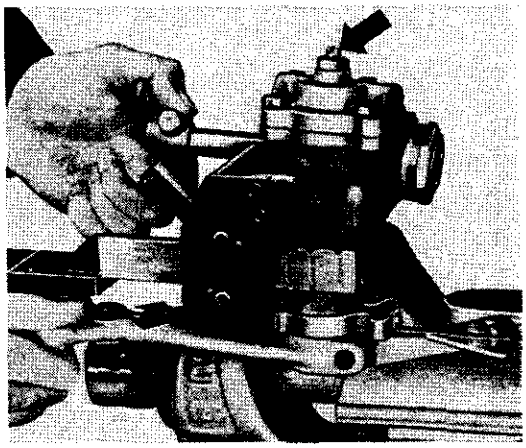
b - No-play angle to left side of scale is smaller than 11°±2°.

Fit a thinner shim.

The adjustment should be repeated until the necessary degree of accuracy is obtained. Shims are available in thickness from 0.20 mm (.008 in.) to 0.50 mm (.02 in.) in 0.05 mm (.002 in.) steps.

11 - When adjustment is completed, press the worm spindle oil seal in with 21.5 mm (.846 in.) diameter tube VW 423.

12 - Take lock nut off drop arm shaft adjusting screw.



13 - Remove four cover securing bolts.

14 - Loosen cover by turning adjusting screw and take cover off.

15 - Fill housing with transmission grease (approx. 160 cc/5.4 oz.). Move the drop arm shaft about slightly while putting the grease in so that all air escapes and the proper quantity can be put in.

16 - Fill the adjusting screw hole in the drop arm shaft with transmission grease.

17 - Install new plastic plugs in housing cover.

18 - Install cover with a new gasket and insert bolts. Press the cover away from the steering worm and tighten the screws to the correct torque (see V 8.1/4-9).

19 - Adjust drop arm shaft again as described at points 7 to 9.

20 - Mark center position with a new marking ring and secure with paint.

539.301.23 Printed in Germany 4. 69

Checking and Adjusting Steering Gear (Installed)

A - **Checking** (steering gear installed)

The vehicle must not be lifted when checking the roller steering.

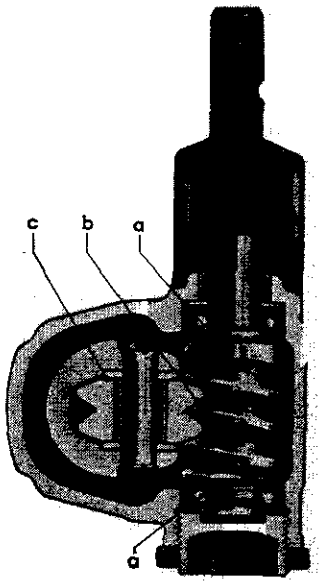
1 - Set the front wheels to straightahead position.

2 - Move the steering wheel lightly, holding outer end of spoke, until resistance is felt in both directions. This movement at the center position is determined by the steering adjustment and by the linkage (tie rods and coupling disc). It must not exceed max. 25 mm (1.0 in.), measured on the circumference of the steering wheel.

B - **Adjusting**

Excessive play at the center position can be caused by three things. These points should be checked in the following order:

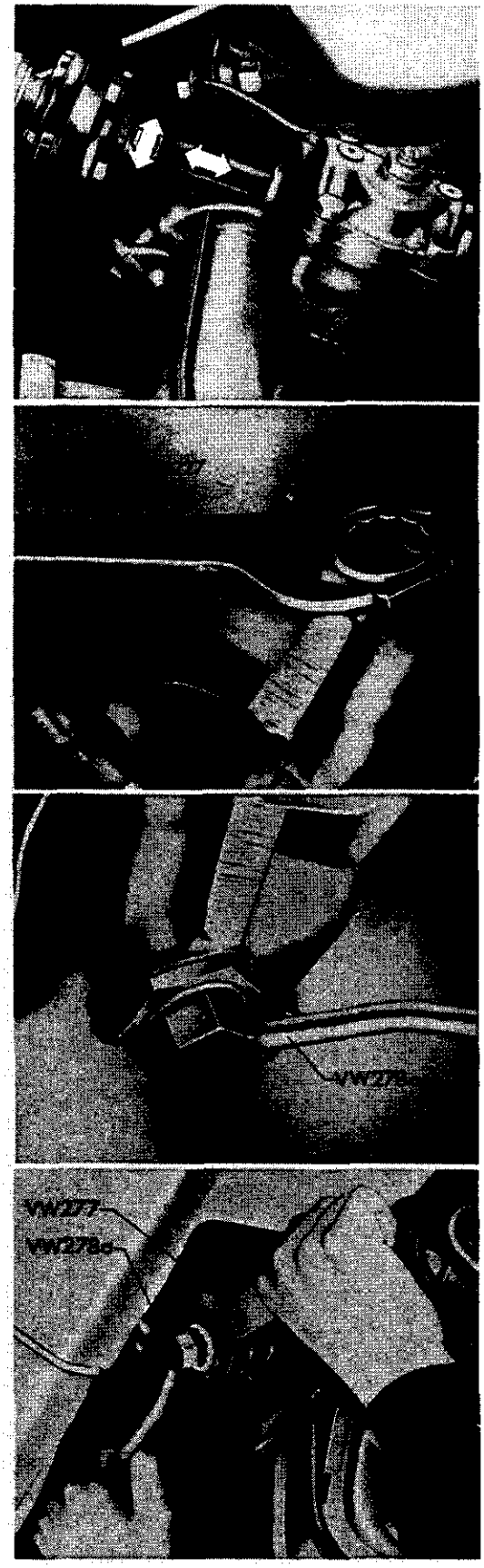
a = Axial play of worm spindle
b = Play between roller and worm
c = Axial play of roller



Note

Before adjusting the steering gear, the cesurity of the steering gear housing cover bolts and the steering gear mounting bolts must be checked. Loose bolts must be tightened to the specified torque.

539.307.23 V 7th Supplement Printed in Germany 5.71



a - Axial play of worm spindle

The worm spindle axial play is determined by turning the spindle at the steering coupling with the vehicle lifted. If there is play it can be eliminated as follows:

1 - Turn steering fully to left ro right.

2 - Loosen locknut on worm spindle adjuster with special wrench VW 277.

3 - Turn worm spindle and tighten the adjuster with special wrench VW 278a at the same time until play can no longer be felt.

4 - Hold adjuster and tighten lock nut with special wrench VW 277.

5 - Turn worm spindle from lock to lock. There should be no tight spots. Should there be any, the adjuster has been moved in too far and the adjustment has to be rectified.

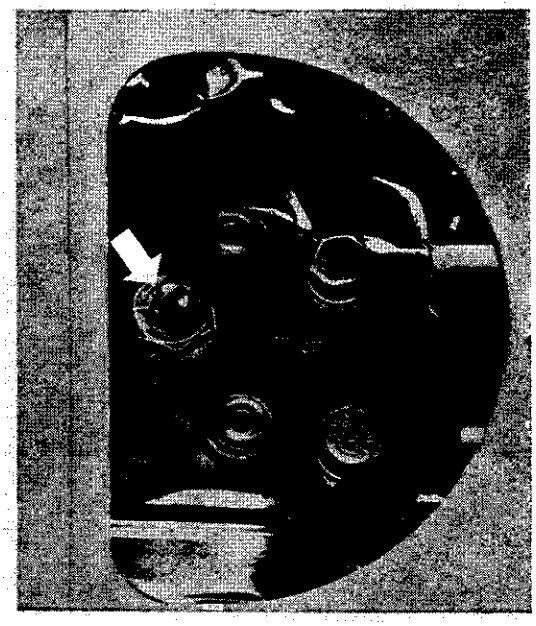
b - Play between roller and worm

If play in the steering gear cannot be eliminated by adjusting the worm spindle, the roller to worm setting must be adjusted. There should be no play between roller and worm with the steering gear in the center position. The roller to worm adjustment can be made with the vehicle lifted. To check the adjustment, however, the vehicle must be standing on the ground.

1 - Turn steering wheel 90° to left or right.

2 - Loosen locknut on drop arm shaft adjusting screw and turn adjusting screw out about one turn.

3 - On **Type 1** / Sedan 111 vehicles, the adjusting screw (arrow) is accessible through the hole in the luggage pan.



On **Type 3** vehicles, the spare wheel well must be taken out. The steering gear is then adjusted with the special roller steering wrench.

4 - Turn adjusting screw in until roller can be felt contacting the worm.

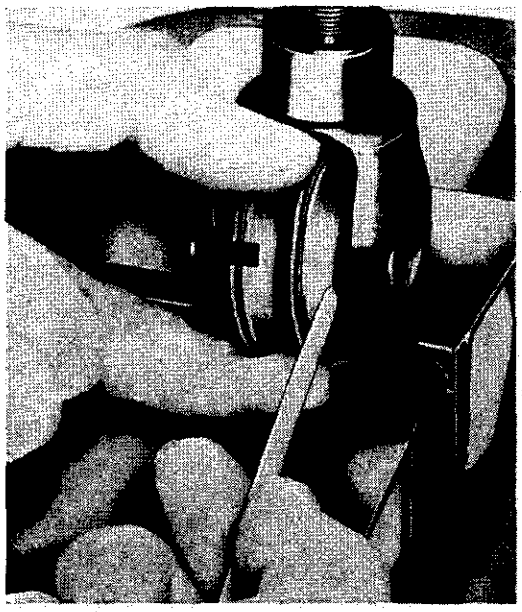
5 - Hold screw and tighten lock nut.

6 - With vehicle standing on wheels, turn steering wheel 90° to each side and check adjustment. The play at this point must not exceed 25 mm (1 in.), measured at the circumference of the steering wheel. If there is more play on one side, the adjustment of the roller to worm must be repeated on this side at 90°.

7 - Check toe-in and rectify if necessary.

8 - Road test the vehicle. If the steering does not return to about 45° from the center position after taking a corner at 10—12 mph, the roller setting is too tight. The adjustment should then be repeated, otherwise the worm and roller will be damaged.

539.307.23 V 7th Supplement Printed in Germany 5.71



c - Axial play of roller

If the steering cannot be adjusted properly by carrying out the adjustments described so far, the steering gear must be removed, disassembled and the axial play of the roller checked.

1 - Check roller axial play. The play must not exceed 0.04 mm (.0016 in.).

Measure the clearance between roller and washer (arrow) with a 0.05 mm (.002 in.) feeler gauge. If the feeler blade can be pushed between roller and washer, the complete drop arm shaft must be replaced.

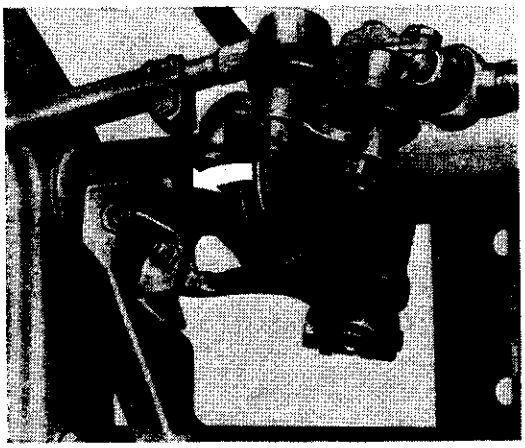
2 - Assemble steering gear, adjust and install

3 - Check toe-in, rectify if necessary.

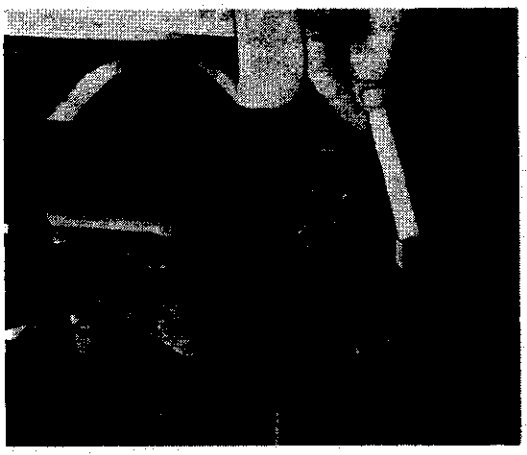
4 - Road test vehicle.

Type 1

The wheel lock to left and right is limited by two adjustable stops on the axle beam which contact the drop arm.



When correcting the wheel lock, the bolts in the steering stops on the axle beam must be set so that there is always a gap of 10 mm ± 1 mm (.4 ± .04 in.) between upper torsion arm and tire. This dimension, which is measured with the vehicle lifted with the wheels fully extended and on full lock, ensures that there is adequate clearance between wheel housing and wheels under all load conditions.



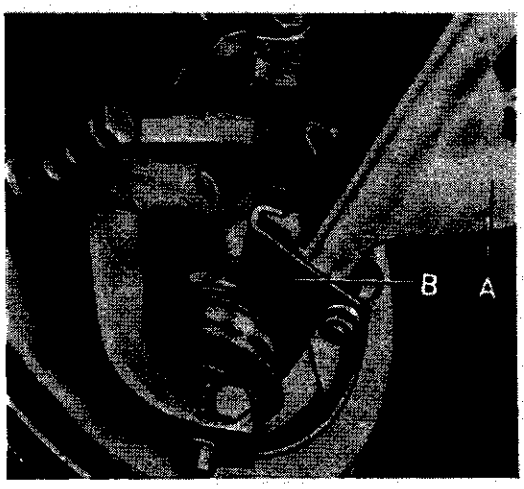
Type 3

If the steering lock on a vehicle is too great the front tires will tend to rub on the wheel housings.

This can be eliminated by installing clips on the torsion arms.

The clip is pushed over the torsion arm and secured with a bolt M 8 × 35, a washer 8.1, a spring washer B 8 and a nut M 8.

If this makes the diameter of the turning circle too large, the clips should be removed again and the lugs on the torsion arms ground down slightly. When grinding the lugs, however, take care not to reduce the clearance between tire and wheel housing to less than 35 mm (1.37 in.) with the clip installed. The vehicle must be empty and should not be lifted or supported when measuring.



a = Lower torsion arm
b = Clip

539.301.23 Printed in Germany 4. 69

Workshop Bulletin

No. F

(Supersedes W. B. F of 15 February 1973) of 4 June 1974

Subject:	Type/Model:
Adjusting overheating switch on BN 4 heater in Type 1/Model 181 and Type 2	1 / Model 181 2

see workshop manual

The overheating switch can be adjusted only when installed. Adjustment is necessary when a new switch is installed or when the setting is not correct. The switch cannot be set to temperature readings but to the upper cut-off value of the temperature regulating switch.

These instructions do not apply to the BN 2 heater.

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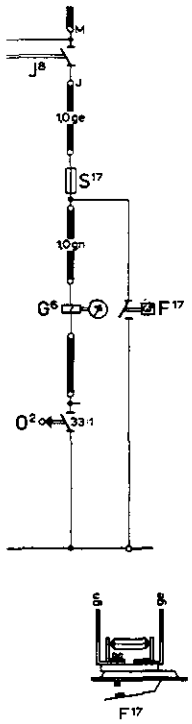
see workshop manual

Adjusting instructions

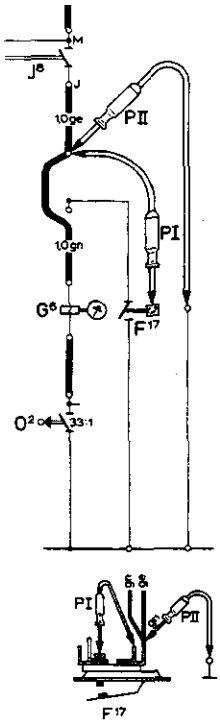
When adjusting the switch on Type 1 Model 181, use a new temperature regulating switch.

1 - Connect wires and test lights to overheating switch as shown in wiring diagram and illustrations. Take overheating fuse out.

Standard wiring layout



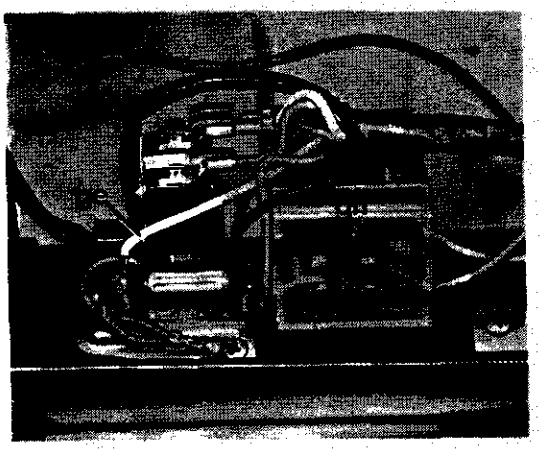
Test wiring layout

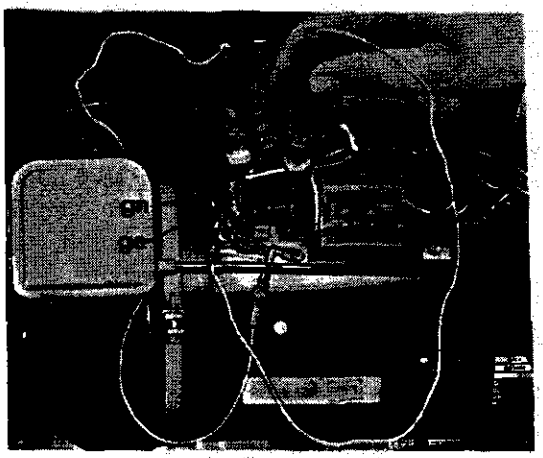


gn = green

ge = yellow

J 8 = Relay (controlled by temperature regulating switch)
S 17 = Overheating fuse
G 6 = Metering pump
F 17 = Overheating switch
P = Test light
O 2 = Breaker contacts in combustion air blower





see workshop manual

2 - Start engine.

3 - Switch heater on.

4 - Set to maximum output: Pull Bowden cable out all the way. Type 1/Model 181: Move lever on warm air outlet up so that warm air is directed to the windshield.

5 - Close vehicle doors.

6 - Wait until heater has regulated four times (Heater goes out, test light II goes out).

7 - Remove green paint from adjusting screw of overheating switch and turn adjusting screw in as far as it will go.

8 - When heater starts again (test light I and II light up) turn adjusting screw out slowly until test light I just goes out.

C a u t i o n

If the test light II goes out, do not turn adjusting screw further. Continue adjustment after test light II has come on again.

9 - Switch heater off.

10 - Take test lights off.

11 - Turn adjusting screw of overheating switch out as follows:

Type 1/Model 181	- 1 turn
Type 2 Delivery Van, Combi, Station wagon	- 3 turns
Type 2 Pick-up	- 2 turns

12 - Seal adjusting screw with a different colored paint.

13 - Connect green wire to the appropriate connector on the overheating switch.

14 - Install overheating fuse (8 amp.).

15 - Type 1/Model 181: Install old temperature regulating switch.

(If the overheating switch fuse blows during the test run, the temperature regulating switch should be replaced. Before doing this, however, check that the air circulation duct is not blocked).

Workshop Bulletin

No. H

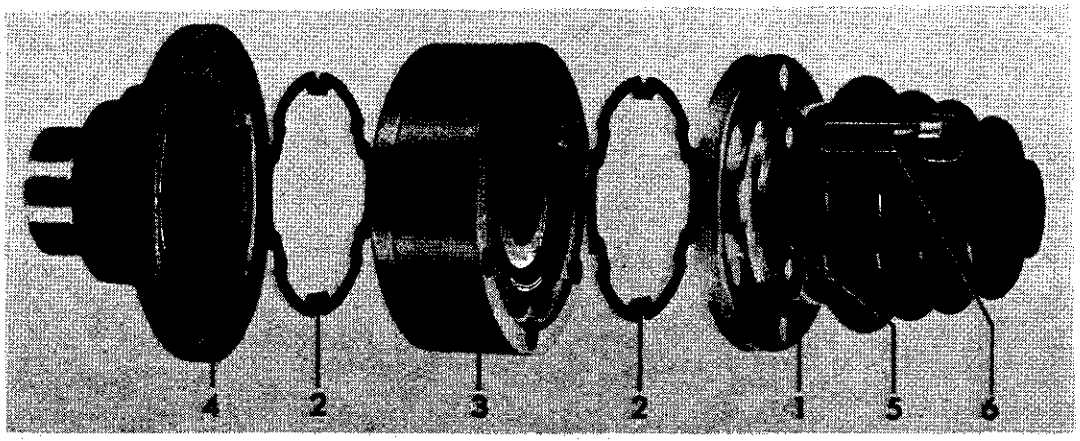
(Supersedes W.B. H of 15 February 1974)

of 5 June 1974

Subject:	Type/Model:
Constant Velocity Joints	1/Model 181 4

see workshop manual

To improve sealing of C.V. joints, a gasket was installed on both sides of the joint. Both drive flange and joint have a recess for the gasket.



1 - Gap and boot
2 - Gasket
3 - Joint
4 - Flange
5 - Plate
6 - Socket head screw

Repair instructions

During repairs, joints and flanges should be checked whether they have a recess for the gaskets.

Parts with recess - Install gasket

Parts without recess - Do not install gasket

When installing shafts, be sure to position gasket in recess. If necessary hold them in place with some grease when assembling joints. Gaskets which are not properly positioned will cause socket head bolts to become loose. The tightening torque for socket head bolts remains unchanged (4.5 mkg / 32 ft lb). If gaskets are not available, drive flanges and joints without recess for gasket (Type 181) should be installed as otherwise grease will leak from joints.

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SERVICE

Workshop Bulletin

No. V

(Supersedes Workshop Bulletin V of 16 June 1972) of 29 Sept. 1973

Subject:	Type/Model:
Values for wheel alignment checks	1, 2, 3 and 4

see workshop manual

This bulletin contains the current alignment specifications for front and rear axle of all models. Previous bulletins pertaining to alignment are herewith superseded.

Workshop Bulletin "Torsion bar adjustment" contains all the necessary dimensions and specifications for their adjustment.

Make adjustments as close as possible to values given. Avoid using the tolerances to their fullest extent.

All measurements are made with vehicle unladen, fuel tank full, tires inflated to pressures for maximum vehicle weight, with vehicle properly aligned and suspension bounced.

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see workshop manual

Type 1

Link pin and ball joint front axles

Total toe, wheels not pressed		+30' ± 15'
Total toe, wheels pressed		+5' ± 15'
Applied pressure		22 ± 4 lbs. (10 ± 2 kg)
Maximum permissible difference between total toe with wheels pressed and not pressed		25'
Camber in straight-ahead position		
from Chassis No. 116 000 001		30' ± 20'
up to Chassis No. 115 979 202		40' ± 30'
Maximum permissible difference between sides		30'
Toe angle difference at 20° lock to left and right (not pressed)		
a - from Chassis No. 116 000 001	to left	-1°20' ± 30'
	to right	-2°10' ± 30'
b - up to Chassis No. 115 979 202		-2° ± 30'
c - De Luxe Sedan and Convertible		
up to Chassis No. 1 430 497	to left	-1°40' ± 30'
	to right	-2°30' ± 30'
Maximum permissible difference between sides		1°
d - Karmann Ghia		
up to Chassis No. 1 644 421		-2° ± 1°
Offset between stub-axles in direction of motion		max. 8 mm
Caster angle of a wheel		3°20' ± 1°
Corresponds to camber difference of a wheel on a lock from 20° left 20° right		2°15' ± 40'

Strut front axle

Total toe, wheels not pressed		+30' ± 15'
Total toe, wheels pressed		+10' ± 15'
Applied pressure		22 ± 4 lbs. (10 ± 2 kg)
Maximum permissible difference between total toe with wheels pressed and not pressed		max. 25'
Camber in straight-ahead position		1° + 20' ± 40'
Maximum permissible difference between sides		30'

see workshop manual

Toe angle difference at 20° lock to left and right (not pressed) all models	-30' ± 30'
Offset between stub axles in direction of motion	max. 11 mm
Caster angle of a wheel (measured with the vehicle standing horizontally)	2° ± 35'
Corresponds to camber difference of a wheel on a lock from 20° left to 20° right	1°20' ± 25'

Rear axle

Camber with spring plates correctly set (after at least 300 miles in use)	
a - All models with double joint rear axle *)	-1° ± 40'
Model 181	+20' ± 40'
b - Vehicles with swing axle	
Model 11 from Chassis No. 117 000 001	+1° ± 1°
permissible minimum camber	-1°
Model 14 from Chassis No. 147 000 003	+15' ± 1°
Model 15 up to Chassis No.157 000 002	
permissible minimum camber	-1°30'
all models up to Chassis No.116 1 021 298	+2°30' ± 1°
permissible minimum camber	0°
all models up to Chassis No. 2 528 668	+3° ± 30'
permissible minimum camber	+2°
Maximum permissible difference between sides	
All models with double joint rear axle	45'
All models with swing axle	20'
Total rear wheel toe with camber correctly set	
All models with double joint rear axle	0° ± 15'
All models with swing axle	-5' ± 10'
Maximum permissible deviation in wheel alignment	max. 10'

*)

Note:

When checking the rear wheels with an optical measuring device and the camber values have exceeded the limit in a negative direction, (settling after considerable mileage), the camber can be corrected within specific limits as follows:

1 - With the vehicle standing on its wheels loosen the bolts connecting the spring plate and diagonal arm flange. The diagonal arm will be lifted thereby, and the camber altered in the positive direction (approx. 45').

2 - With the diagonal arm in this position retighten the bolts to the prescribed torque.

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Type 2

Front axle

Total toe, wheels not pressed	
from Chassis No. 218 000 001	+15' ± 15'
up to Chassis No. 217 148 459	+ 5' ± 10'
Total toe, wheels pressed	
from Chassis No. 218 000 001	+ 5' ± 15'
up to Chassis No. 217 148 459	- 5' ± 10'
Applied pressure	33 ± 6 lbs. (15 ± 3 kg)
Maximum permissible difference between total toe with wheels pressed and not pressed	25'
Camber in straight-ahead position	
from Chassis No. 218 000 001	+40' ± 20'
up to Chassis No. 217 148 459	+40' ± 30'
Maximum permissible difference between sides	30'
Toe angle difference at 20° lock to left and right(not pressed)	-2°30' ± 30'
Offset between stub axles in direction of motion	max. 8 mm
Caster angle of a wheel	
from Chassis No. 218 000 001	3° ± 40'
up to Chassis No. 217 148 459	max. 1°
Corresponds to camber difference of a wheel on a lock from 20° left to 20° right	
from Chassis No. 218 000 001	2° ± 25'
up to Chassis No. 217 148 459	max. 40'