33 Rear Axle

Rear Axle

SPECIFICATIONS

Model			320 i	320 i A
Final Drive				
Design			short neck	
Tooth pattern			Klingelnberg or Gleason	
Identification on case			at side of final drive case; ratio and similar data stamped on rear case cover; stripe of paint	
Color code			green	
Pinion and Ring Gear				
Identification	Klingelnberg		K 9	
	Gleason		H 9	
Number of teeth	Klingelnberg		40 : 11	
	Gleason		40 : 11	
Ratio	Klingelnberg		3.64 : 1	
	Gleason		3.64 : 1	
Oil Grades			brand-name hypoid gear lubes SAE 90 (see table on Page 33-0/10)	
Quantity	Initial fillings	ltr (pts.)	1.1 (2.3)	
	Oil changes	ltr (pts.)	0.95 (2) or until oil overflows at oil filler opening	
Pinion/ring gear backlash		mm (in.)	0.06 ... 0.11 (0.002 ... 0.004)	
Play betw. ring gear shim and differential side gear		mm (in.)	0.03 ... 0.1 (0.001 ... 0.003)	
Drive pinion bearing preload		N/kp (lbs.)	4910 / 500 (1100)	
Drive pinion bearing friction moment[1)]				
without shaft seal		Ncm/kpcm(in lbs)	max. 290 / 30 (26)	
with shaft seal		Ncm/kpcm(in lbs)	max. 310 / 32 (28)	

1) Collared nut for drive pinion flange tightened to at least 150 Nm / 15 kpm (108 ft. lbs.).

SPECIFICATIONS

Model			320 i	320 i A
Max. total friction moment (pinion and ring gear bearings) with shaft seal		Ncm/kpcm(in lbs)		420 ± 30 / 42 ± 3 (36 ± 2.5)
Differential case bearing friction moment without shaft seal		Ncm/kpcm(in lbs)		200 ... 280/ 20 ... 28 (17 ... 24)
Ring gear installing temperature		°C (° F)		80 ... 100 (175 ... 210)
Taper roller bearing installing temperature				cold
Max. drive pinion runout		mm (in.)		0.03 (0.001)
Drive pinion head height				
	Klingelnberg	mm (in.)		32.5 ± 0.0195 (1.2795 ± 0.0007)
	Gleason	mm (in.)		32.5 ± 0.0195 (1.2795 ± 0.0007)
Track Width (at max. axle load)		mm (in.)		1399 (55.078)
Wheel bump travel		mm (in.)		100.5 (3.956)
Wheel rebound travel		mm (in.)		121.5 (4.783)
Wheel Bearings				
Inside grooved ball bearing				62/30 C 3
Outside grooved ball bearing8				62/30 C 3
Axial wheel bearing play		mm (in.)		0.05 ... 0.1 (0.002 ... 0.004)
Wheel bearing grease per wheel	(bearing)	grams		39 Shell Retinax A
	(seal)	grams		4 Shell Retinax A
Output Shafts				
Design				constant velocity universal joint

Rear Axle

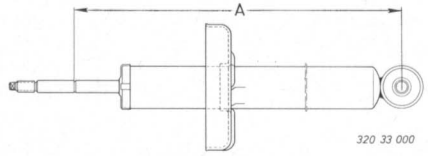
SPECIFICATIONS

Model			320 i	320 i A
Continuation of Output Shafts				
Max. bending angle		o		18
Max. displacement per joint		mm (in.)		± 6 (0.236)
Max. displacement per propeller shaft		mm (in.)		± 12 (0.472)
Max. backlash betw. joints A and B at radius of 25 mm (1")		mm (in.)		0.08 (0.003)
Torsional moment		Nm/kpm(ft lbs)		approx. 10 / 1.0 (7)
Grease pre joint		grams		80 Shell Retinax AM
Dust bellows adhesive				Bostik 475
Contact surface sealant for both joints				Curil
Coil Springs 1)				
Relaxed length		mm (in.)		min. 322 (12.677)
Installed length		mm (in.)		185.5 (7.303)
Color code				2 orange stripes on 3 turns; also red or white stripe over entire length of spring depending on force of coil spring
Coil spring force	Color code red	N/kp (lbs.)		2472 ... 2536 /252 ... 258 (555 ... 568)
	Color code white	N/kp (lbs.)		2537 ... 2614 /259 ... 266 (571 ... 586)
Wire gage diameter		mm (in.)		11.15 (0.439)
Number of turns				10
Spring-action turns				8.5
Outside coil diameter		mm (in.)		101.15 (3.982)

1) Use coil springs of same coil spring force on any one axle and springs with same color code on front and rear axles (max. difference in force between front and rear axles is only 1 force class).

SPECIFICATIONS

Model		320 i	320 i A
Continuation of Coil Springs			
Inside coil diameter	mm (in.)	78.85 (3.104)	
Upper and lower coil spring damper ring, height	mm (in.)	20 (0.787)	
Auxiliary Springs			
Auxiliary spring length	mm (in.)	80 (3.150)	
Shock Absorbers			
Type or make		double-action, hydraulic, double-tube, telescopic shock absorbers from Fichtel & Sachs	
Max. length A (at pad stop)	mm (in.)	$550\ {}_{-4}\ (21.653\ {}_{-0.157})$	
Min. length A (at 11.5 mm/0.453" reserve)	mm (in.)	360 ± 2 (14.173 $\pm$ 0.079)	
Travel limit		in traction stage	



Shock Absorber Test						
Test stroke	mm (in.)	100 (3.937)	100 (3.937)	100 (3.937)	100 (3.937)	100 (3.937)
Speed	rpm	10	25	50	75	100
Traction stage	N/kp (lbs.)	90/9.2 (20)	300/30.6 (67)	650/66.3 (146)	850/86.7 (191)	1000/102 (225)
Compression stage	N/kp (lbs.)	40/4.1 (9)	90/9.2 (20)	240/24.5 (54)	440/44.9 (99)	670/68.3 (150)

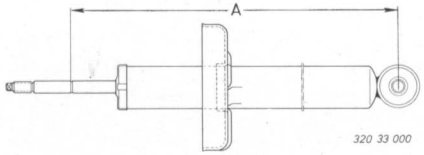
Rear Axle — SPECIFICATIONS

Model		320 i	320 i A
Special Versions			
Multi-disc Self-locking Differential			ZF DL - 175
Locking value (with preload; inner discs lined with molybdenum)	%		40
Nominal torque	Nm/kpm(ft lbs)		1750 / 175 (1265)
Max. torque	Nm/kpm(ft lbs)		2100 / 210 (1519)
Identification on final drive case		at side of final drive case; ratio, "S" (self-locking differential) and other data stamped on rear case cover; stripe of paint	
Color code			green
Locking value code on multi-disc self-locking differential			"S 40" (located along side)
Oil Grades		brand-name hypoid gear lubes SAE 90 (see table on Page 33-0/10)	
Quantity for initial fillings	ltr. (pts.)		1.1 (2.3)
oil changes	ltr. (pts.)		0.95 (2) or until oil overflows at filler opening
Coil Springs[1] and Shock Absorbers			
- For built-in trailer suspension -			
Coil Springs			
Relaxed length	mm (in.)		$347 \,^{+\,18}_{-\,10}$ ($13.661 \,^{+\,0.709}_{-\,0.394}$)
Wire gage diameter	mm (in.)		11.3 (0.445)
Outside coil diameter	mm (in.)		101.3 ± 1.5 (3.988 ± 0.059)

1) Use coil springs of same coil spring force on any one axle and springs with same color code on front and rear axles (max. difference in force between front and rear axles is only 1 force class).

SPECIFICATIONS

Model			320 i	320 i A
Continuation of Coil Springs				
Relaxed pitch		mm (in.)	37 (1.457)	
Color code			Blue stripe as well as red, white or green depending on coil spring force along entire length of spring	
Coil spring force, Color code	red	N/kp (lbs.)	2726 ... 2804 / 278 ... 285 (613 ... 628)	
	white	N/kp (lbs.)	2805 ... 2863 / 286 ... 294 (630 ... 648)	
	green	N/kp (lbs.)	2884 ... 2962 / 295 ... 302 (650 ... 666)	
Shock Absorbers				
Type or make			Fichtel & Sachs	
Max. length A (at stop pad)		mm (in.)	$566\ {}^{}_{-4}\ (22.283\ {}^{}_{-0.157})$	
Min. length A (at 11.5 mm/0.453" reserve)		mm (in.)	360 ± 2 (14.173 $\pm$ 0.079)	
Travel limit			in traction stage	



Shock Absorber Test						
Test stroke	mm (in.)	100 (3.937)	100 (3.937)	100 (3.937)	100 (3.937)	100 (3.937)
Speed	rpm	10	25	50	75	100
Traction stage	N	110	$400\ {}^{+50}_{+30}$	730	900	1040 ± 60
	kp (lbs.)	11.2 (25)	$40.8\ {}^{+5.1}_{+3.1}$ ($90\ {}^{+11}_{+7}$)	74 (163)	91.7 (202)	106 $\pm$ 6.1 (234 $\pm$ 13)
Compressing stage	N	60	160 ± 30	290	490	720 ± 50
	kp (lbs.)	6.1 (13)	16.3 $\pm$ 3.1 (36 $\pm$ 7)	29.6 (65)	50 (110)	73.4 $\pm$ 5.1 (162 $\pm$ 11)

Model	320 i	320 i A

Torque Specifications in Nm / kpm (ft. lbs.)

Rear case cover M 10 x 45	43 ... 48 / 4.3 ... 4.8	(31 ... 35)
Ring gear to differential case (with red Loctite No. 41)	85 ... 100 / 8.5 ... 10	(62 ... 72)
Side cover to final drive M 8 x 25	20 ... 24 / 2.0 ... 2.4	(15 ... 17)
Min. flange to drive pinion	150 / 15	(108)
Lower spring strut shock absorber [1] M 10	49 ... 54 / 4.9 ... 5.4	(36 ... 39)
Upper spring strut shock absorber to wheelhouse M 8	25 ... 28 / 2.5 ... 2.8	(18 ... 20)
Upper spring strut shock absorber M 10 x 1	10 ... 12 / 1.0 ... 1.2	(7 ... 9)
Rear axle shaft to drive flange (rear axle shaft mounting nut)	400 ... 470 / 40 ... 47	(290 ... 340)
Output shaft to drive flange	30 ... 33 / 3.0 ... 3.3	(22 ... 24)
Output shaft to final drive	30 ... 33 / 3.0 ... 3.3	(22 ... 24)
Rear axle support with rubber mount to body M 14 x 1.5	140 ... 155 / 14 ... 15.5	(101 ... 112) [2]
Rubber mount to rear axle support (M 10 fillister head screw)	68 ... 76 / 6.8 ... 7.6	(49 ... 55)
Final drive to rear axle support M 12 x 1.5	81 ... 90 / 8.1 ... 9.0	(58 ... 65)
Self-aligning support to final drive M 12 x 1.5	81 ... 90 / 8.1 ... 9.0	(58 ... 65)
Final drive with self-aligning support to body M 12 x 1.5	81 ... 90 / 8.1 ... 9.0	(58 ... 65)
Trailing arm 1) to rear axle support M 12 x 1.5	81 ... 90 / 8.1 ... 9.0	(58 .... 65)
Brake anchor plate to trailing arm M 10 (with Loctite AVV)	60 ... 67 / 6.0 ... 6.7	(43 ... 48)
Support to body (M 8 fillister head screw)	22 ... 24 / 2.2 ... 2.4	(16 ... 17)
Propeller shaft to final drive	68 ... 76 / 6.8 ... 7.6	(49 ... 55)

1) In normal load position (see Page 32-0/3).

2) Was 180 ... 200 Nm / 18 ... 20 kpm (130 ... 144 ft. lbs.).

Model	320 i	320 i A

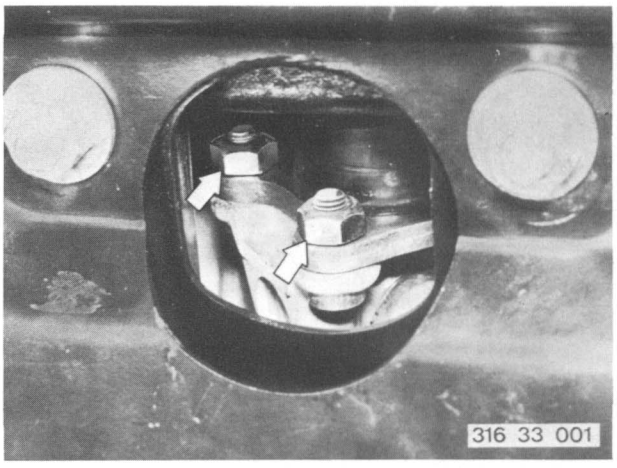
Brand-name Hypoid Gear Lubes SAE 90 (Breaking-in and Regular Operation Final Drive Hypoid Oils)

Company and Product Designation	Company and Product Designation	Company and Product Designation
A. B. NYNAS Hypoidolja 90 MP	DEA Multigear Lub EP SAE 90 (Deapoid 90 EP)	Motul Getriebeöl HD 90
Agip F 1 Rotra MP	Divinol Einlauf-Hypoid-Getriebeöl SAE 90	Oest Mehrzweck-Getriebeöl Spezial SAE 80 and SAE 90
Amoco EP Gear Lubricant SAE 90	Ecubsol-Hypoidgetriebeöl DB 90	Optimol Unigear SAE 80 and 90
Antar Gmo SAE 90	Esso Einlauf SAE 90	Petrolexport EB SAE 90
Antar E. P. 90 R	Esso LSA 90	Sacor EP 90
Aral Hyp. 90	Esso GX 90	Shell Spirax HD 90
Aral Getriebeöl EH	Fina Pontonic MP 90	Shell 417/69 SAE 80
Avia Getriebeöl Hypoid 90 EP	Frisa Hypoid-Getriebeöl Mil-L-2105 B	Sunoco MP GL - 5 SAE 90
Avia Hyp. 90 M	Fuchs Einlauf Hyp.	Tor 2431 Super MP Gear Oil SAE 90
BP PZG 90	Fuchs Einlauf Hyp. SAE 90	Total EP-B SAE 90
BP Mehrzweck EP - SAE 90	Fuchs Renogear H 90	Valvoline High Performance Gear Lube SAE 90
Castrol Hypoy ELH	Gasolin Hyp. SAE 90	Valvoline Magnet S 90
Castrol Hypoid B SAE 90	Gulf Multi-purpose Gear Lubricant SAE 90	Veedol Multig. HD SAE 90
Castrol Hypoy 80/90	Irokal EL 90	Veedol Multigear AX
Castrol Hypoy G 728	Mobil Hinterachsgetriebeöl BM	Westfalen Einlauf Getriebeöl Hypoid Mil-L-2105 B
Castrol Hypoy H	Mobil D 90	Zepf Getriebeöl HT 90 EP Universal
Chevron Universal Gear Lubricant SAE 90	Mobil EXD 55/32 (tradename: Mobilube HD 90)	
For Heavy Duty Applications		
only: Aral Getriebeöl EH	Mobil Hinterachsgetriebeöl BM	Veedol Multigear AX
Castrol Hypoy G 728	Motul Getriebeöl HD 90	Zepf Getriebeöl HT 90 EP Universal
Fuchs Renogear H 90	Valvoline Magnet S 90	

33 10 010 REMOVING AND INSTALLING FINAL DRIVE

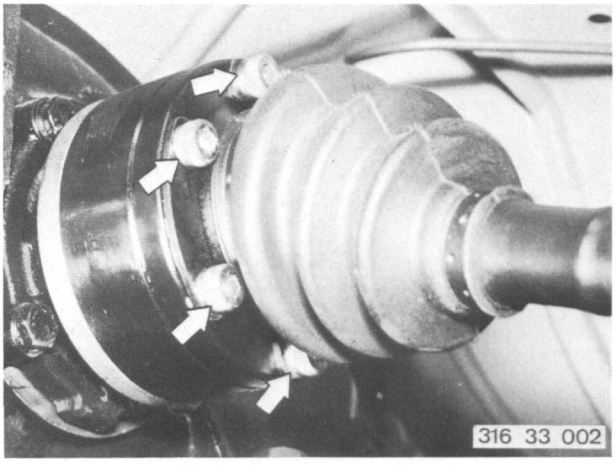
Detach propeller shaft.

Installation Note! Tighten to specified torque[1].



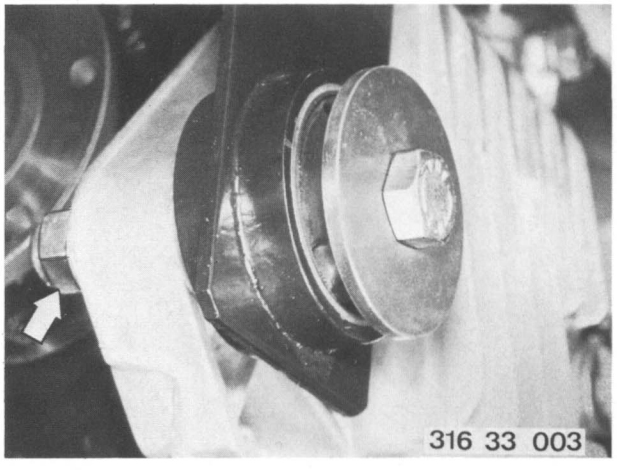
Detach output shafts and suspend from wire.

Installation Note! Tighten to specified torque[1].



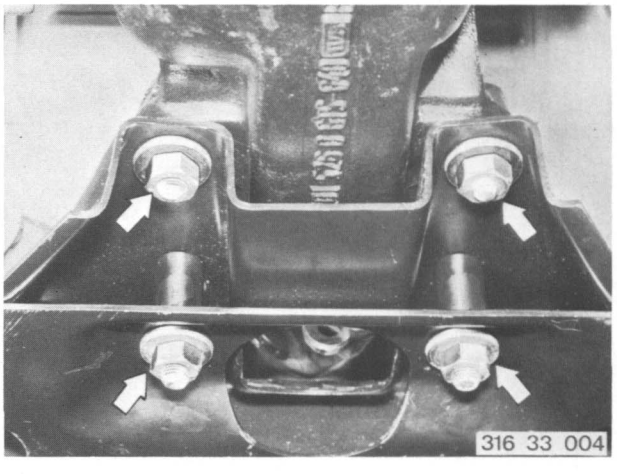
Detach self-aligning support at final drive.

Installation Note! Tighten to specified torque[1].
Replace self-locking nuts.



Detach final drive at rear axle support and remove.

Installation Note! Tighten to specified torque[1].
Install final drive without tension.

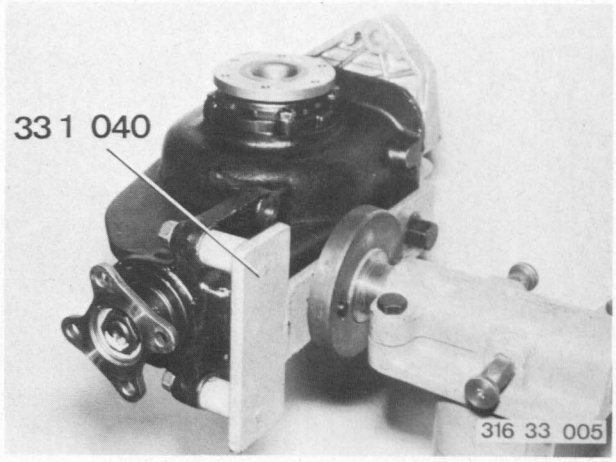


1) See Specifications

33 11 011 REPLACING FINAL DRIVE INPUT FLANGE SHAFT SEAL

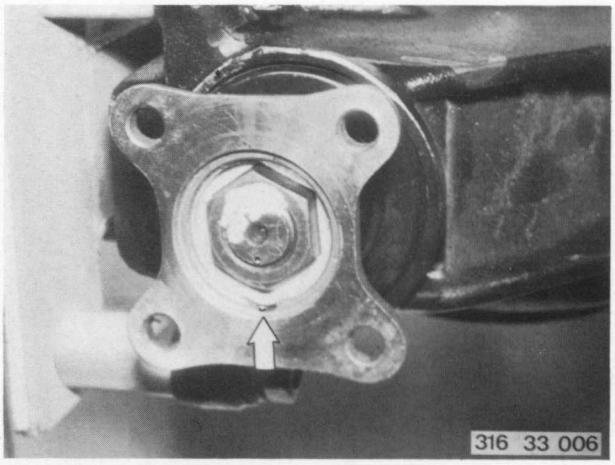
- With Removal and Installation of Drive Pinion -

Remove and install final drive - 33 10 010.
Drain oil.
Mount final drive on Special Tool 33 1 040.

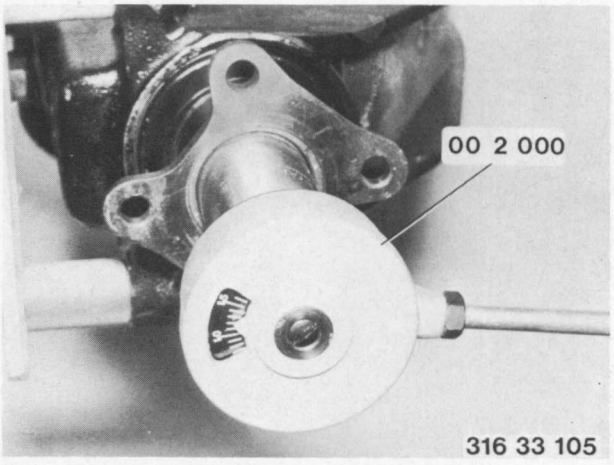


Remove and install differential case - 33 13 510.
Mark position of input flange.
Remove lockplate.

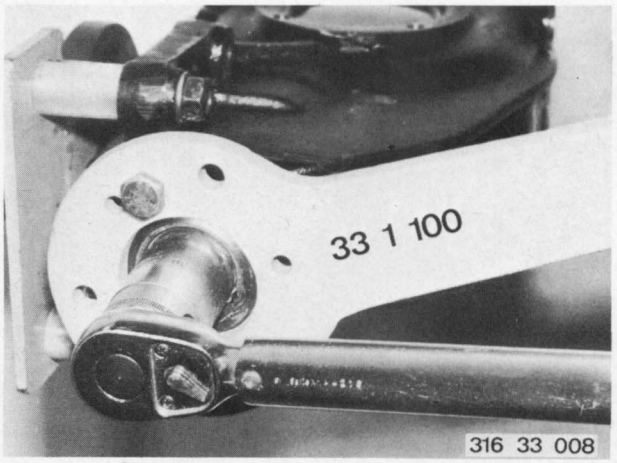
Installation Note! Lock collared nut in groove of input flange.

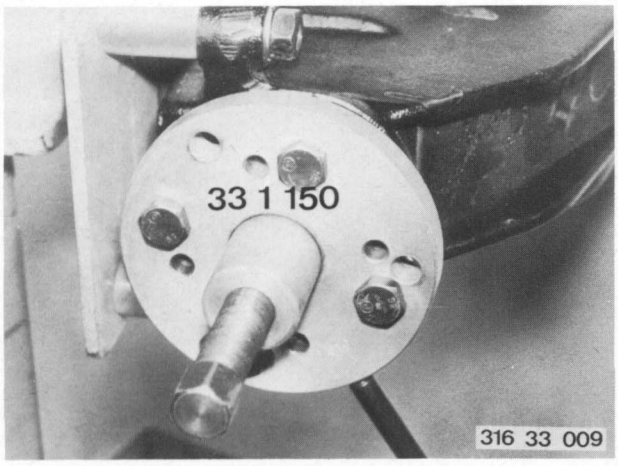


Check friction value with Special Tool 00 2 000 and note value, e.g. 120 Ncm / 12 kpcm (10 in. lbs.).

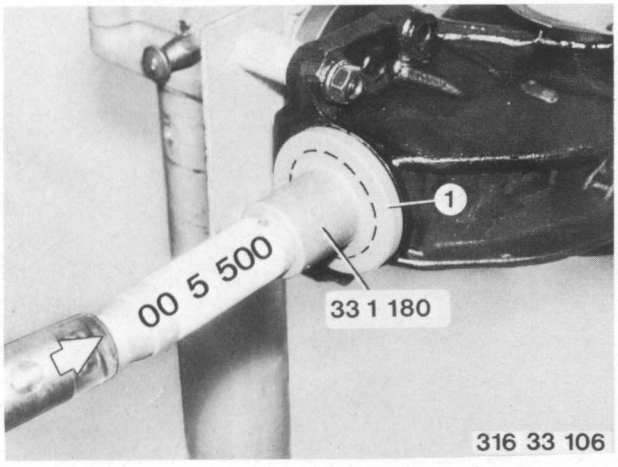


Counterhold input flange with Special Tool 33 1 100 and unscrew collared nut.



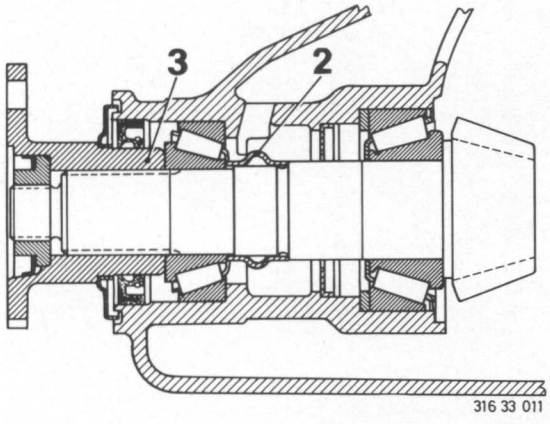


Pull off input flange with Special Tool 33 1 150.
Drive out pinion toward inside.

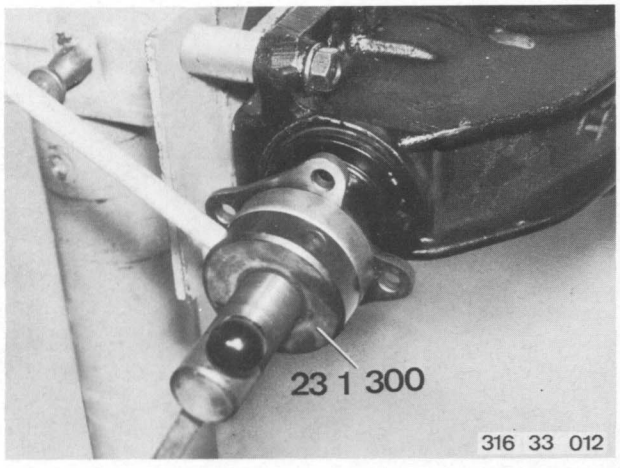


Remove shaft seal (11).

Installation Note! Fill groove between both sealing lips with grease.
Drive shaft seal into case with Special Tools 33 1 180 and 00 5 500 until flush.



Guide pinion with new bushing (2) into case.
Replace an input flange (3) with a seriously scored bearing surface.



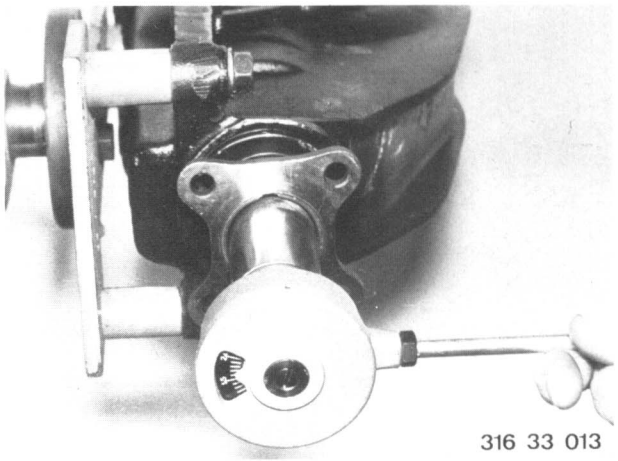
Press input flange onto drive pinion with Special Tool 23 1 300.

Adjust drive pinion to the friction value determined before disassembly and add 40 Ncm / 4 kpcm (4 in. lbs.) for new shaft seal.

Caution! Collared nut torque must be at least 150 Nm / 15 kpm (108 ft. lbs.). If 150 Nm / 15 kpm (108 ft. lbs.) are not reached or the friction value is exceeded, replace bushing and repeat check.

Example:
120 Ncm/12 kpcm (10 in lbs) friction value before dis.
+ 40 Ncm/ 4 kpcm (4 in lbs) new shaft seal

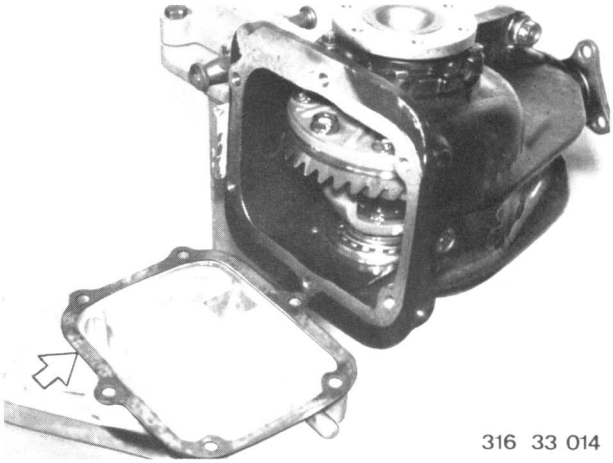
160 Ncm/16 kpcm (14 in lbs) adjustment


316 33 013

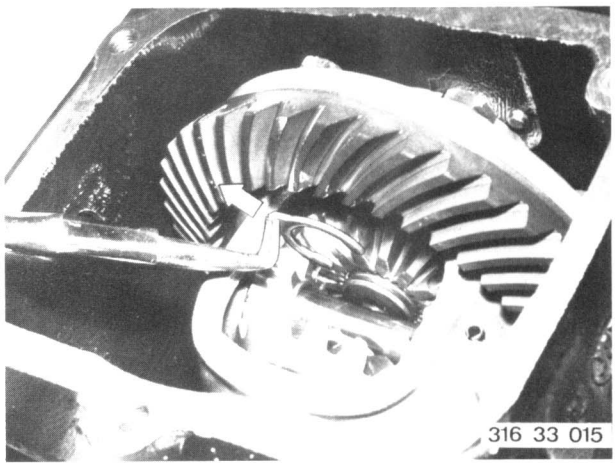
33 11 060 REMOVING AND INSTALLING DRIVE FLANGE

Remove and install final drive - 33 10 010.
Drain oil.
Mount final drive on Special Tool 33 1 040.
Remove case cover.

Installation Note! Replace gasket.


316 33 014

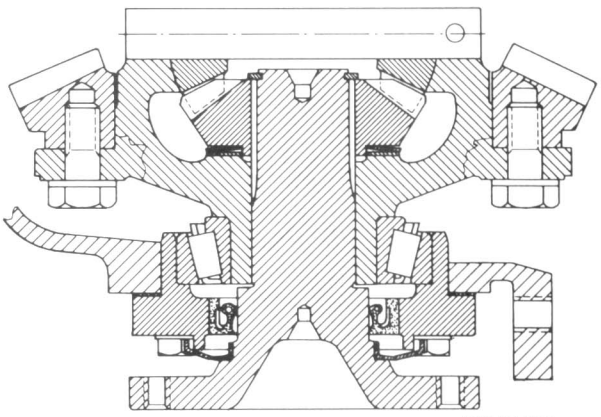
Remove drive flange circlips with bent circlip pliers.
Remove drive flange.


316 33 015

33 11 151 REPLACING DRIVE FLANGE SHAFT SEAL

Remove and install drive flange - 33 11 060.
Remove shaft seal.

Installation Note! Fill groove between both sealing lips with grease.
Drive in shaft seal with a 54 mm (2.126") diameter pipe or similar tool until fit is tight.
Replace a drive flange with a seriously scored bearing surface.

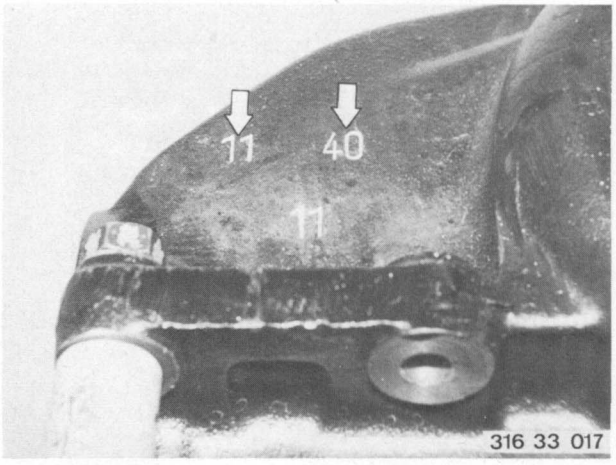

316 33 016

33 12 510 REMOVING AND INSTALLING DRIVE PINION
- Final Drive Removed -

This work is identical with that for replacing an input flange shaft seal - 33 11 011.

33 12 551 REPLACING PINION WITH RING GEAR
- Final Drive Removed -

Remove and install differential case - 33 13 510.
Remove and install drive pinion - 33 12 510.
The number of pinion and ring gear teeth is stamped on case.

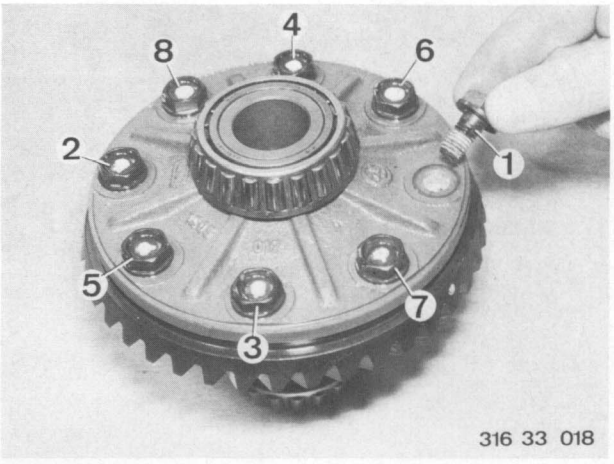


316 33 017

Take off ring gear (cold).

Installation Note! Clean threads thoroughly. Insert screws with Loctite 1) and tighten in sequence 1 ... 8. Tighten to specified torque 1).

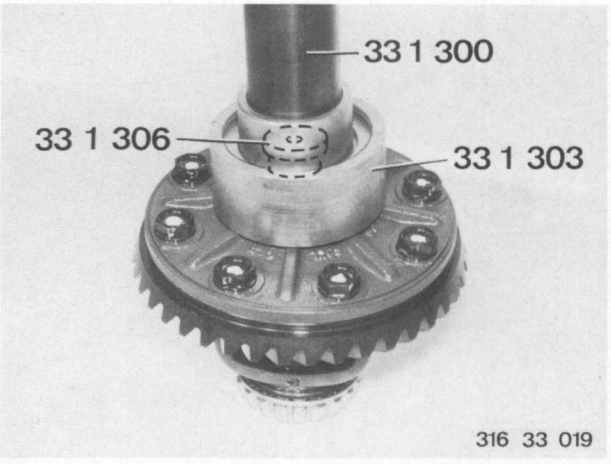
Caution! Only use M 10 x 22 stretch bolts.



316 33 018

If pinion and ring gear are defective, it can be assumed that the taper roller bearings are also damaged.
Extract taper roller bearings with Rollex 33 1 300. Also apply Special Tools 33 1 303 and 33 1 306.

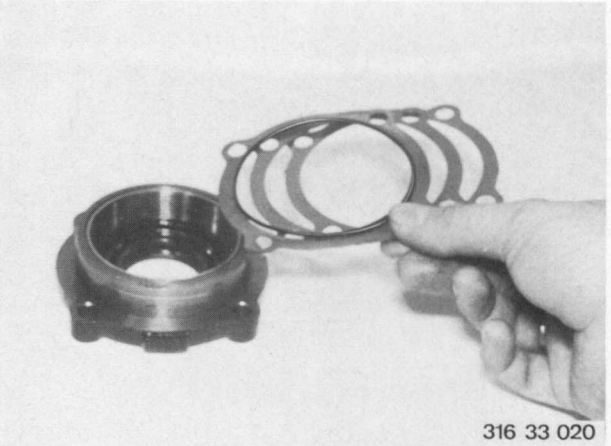
Installation Note! Press on cold taper roller bearings.



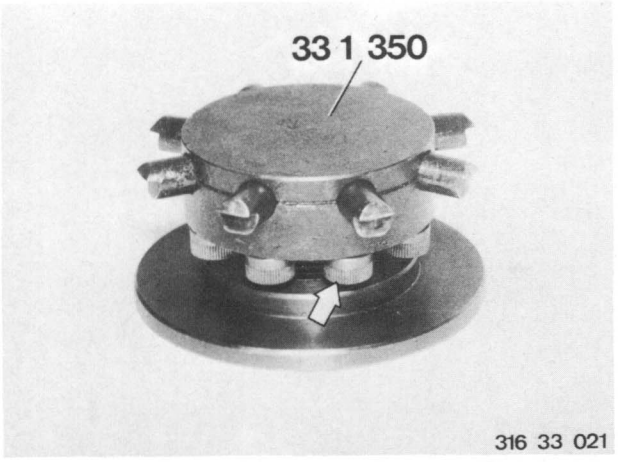
316 33 019

Use o-ring and shims from old bearing caps.
Check whether shaft seals can be reused.

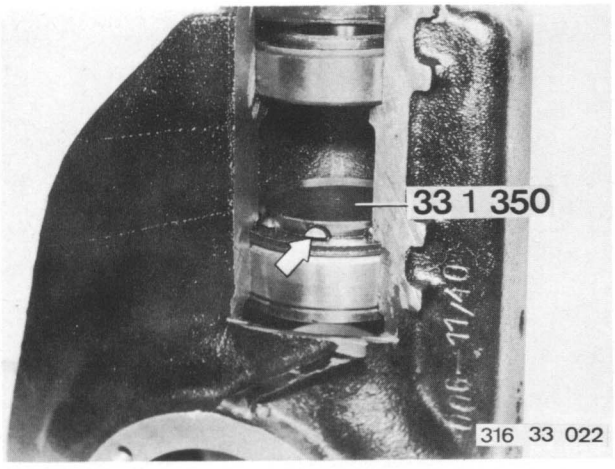
Installation Note! Use complete taper roller bearings with bearing caps. Fill groove between sealing lips with grease. Drive seal into new bearing cap with a 54 mm (2.126") diameter pipe or similar tool until fit is tight.


316 33 020

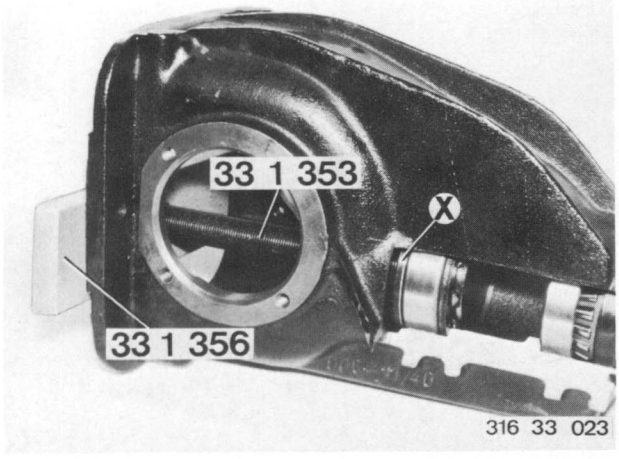
1) See Specifications



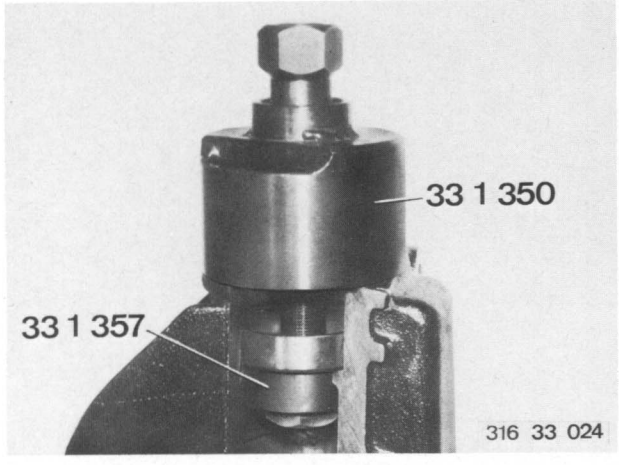
Place stop disc on extractor spider with collar facing bolt heads.
Extractor spider and stop disc belong to Special Tool 33 1 350.



Press extractor spider 33 1 350 up to stop in bearing outer race.

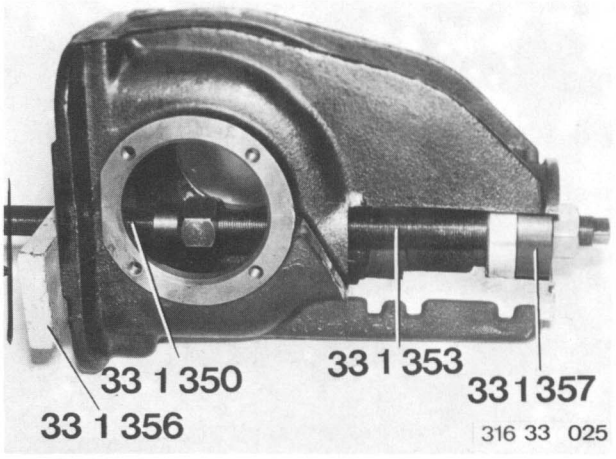


Pull bearing outer race with shim (X) out of case with Special Tools 33 1 356 and 33 1 353.

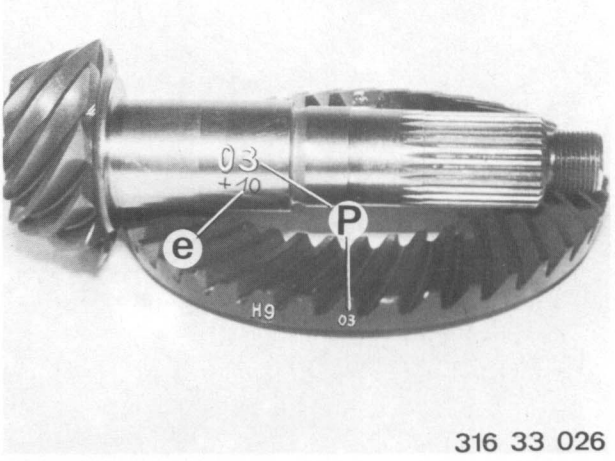


Pull out front bearing outer race with Special Tools 33 1 350 and 33 1 357.

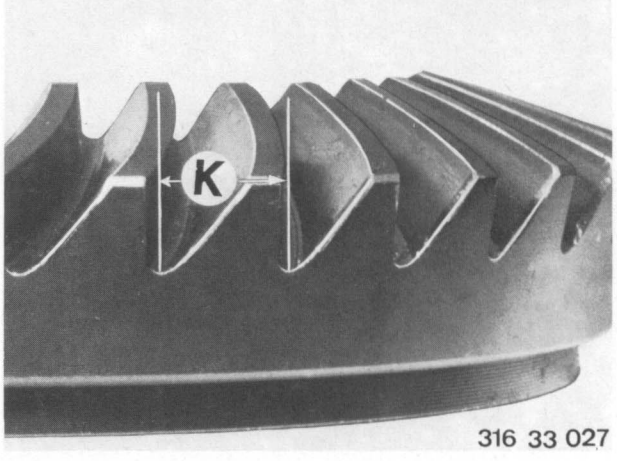
Installation Note! Pull in front bearing outer race with Special Tools 33 1 356, 33 1 353, 33 1 350 and 33 1 357.



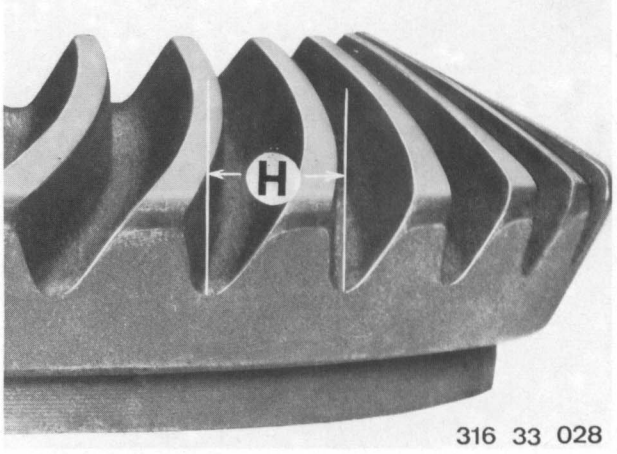
Special machines pair pinions and ring gears for optimal smooth running. The paired number (P) is electrically engraved on pinion and ring gear.
Never install pinions and ring gears with two different paired numbers.
The number(s) preceded by a + or - is the amount of deviation from basic adjustment (D) in hundreths of millimeters and is required to determine thickness of shim X.
Add + e to D. Subtract - e from D.
Stamped letters H, F or K indicate tooth patterns.
H or F = Gleason teeth
K = Klingelnberg teeth

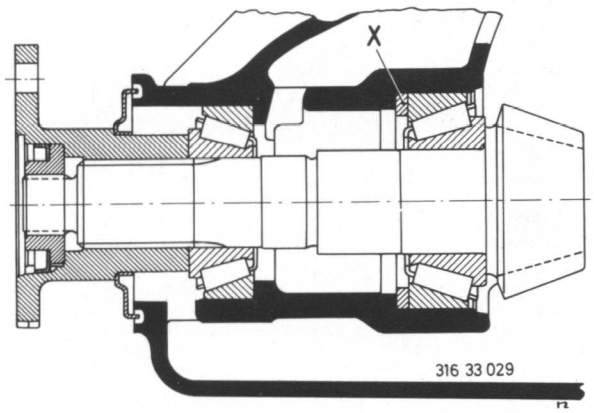


Pinions and ring gears, of which the tooth pattern is not indicated by a letter, can be identified by the tooth's shape.
Klingelnberg teeth:
Tooth back and height are constant.
When checking with a piece of 2 mm (0.079") dia. welding wire, distance K will be the same on inside and outside diameters.

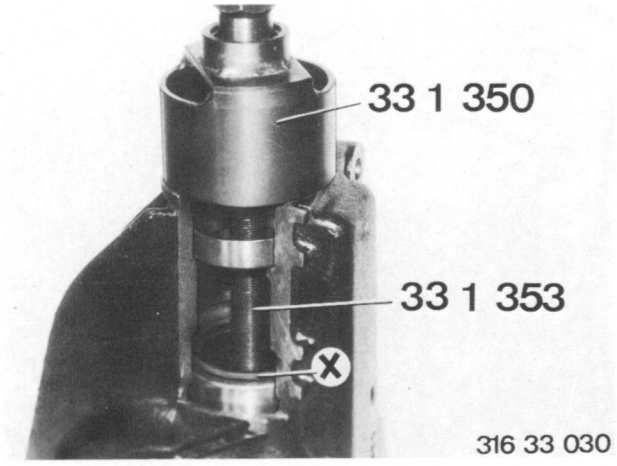


Gleason teeth:
Tooth back is higher and wider on outside than on inside.
When checking with a piece of bent 2 mm (0.079") dia. welding wire, distance H will be larger on outside diameter than on inside diameter.

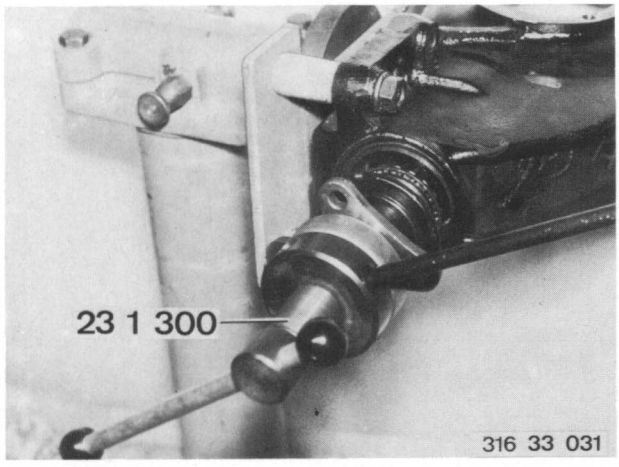




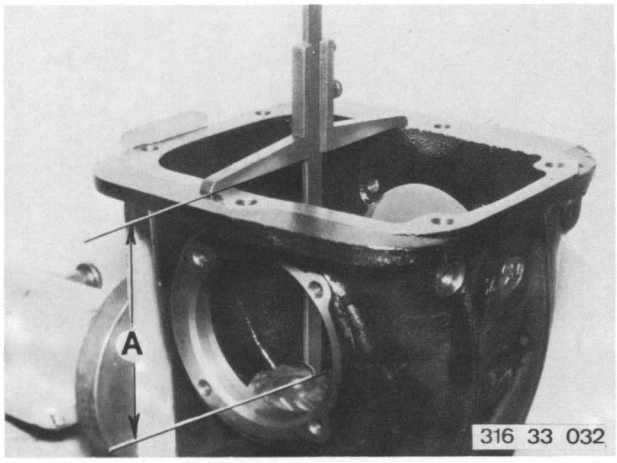
To facilitate finding the ring gear/pinion setting more quickly, install removed shim (X) with new bearing outer race and drive pinion (with new taper roller bearing) without bushing.



Installation Note! Pull new bearing outer race and shim (X) into case with Special Tools 33 1 350 and 33 1 353.



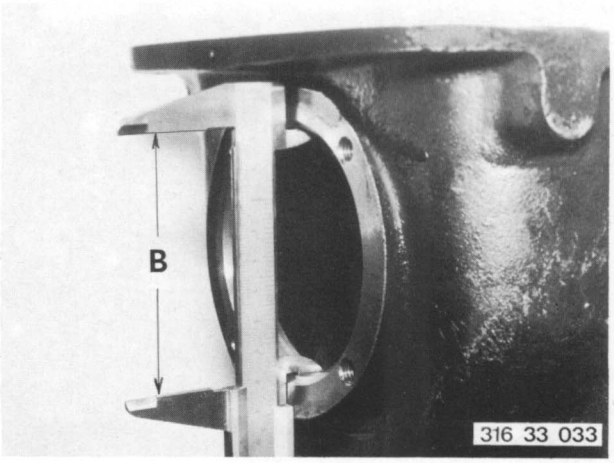
Press input flange onto drive pinion with Special Tool 23 1 300.
Adjust friction moment[1] of taper roller bearing by tightening collared nut.



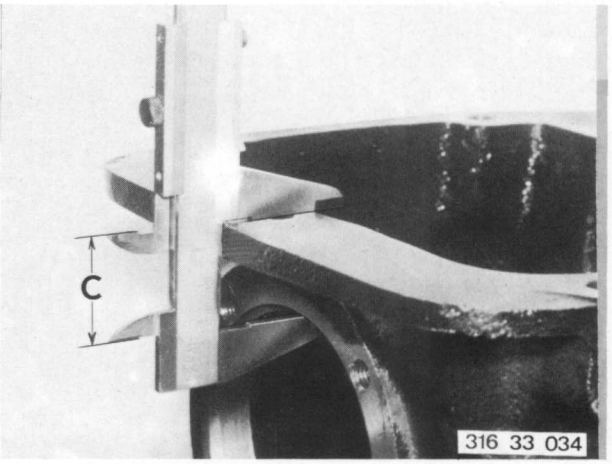
Determine distance (A) from case sealing surface to face of drive pinion.
For example, 123.9 mm (4.878").

1) See Specifications

Determine bore diameter (B) to take side bearing cap. Divide the value obtained by two.
For example, 83.0 mm (3.268") divided by 2 is
41.50 mm (1.624").



Measure tightest point (C) between side bore and case sealing surface.
Should there be a difference between left and right sides, add both distances together and divide by 2.
E.G., 29.8 mm (1.173") right side
+ 30.0 mm (1.181") left side
59.8 mm (2.354") divided by 2 =
29.9 mm (1.177")



Determine thickness of shim X in consideration for basic setting D. Basic setting D for Gleason and Klingelnberg teeth is 52.52 mm (2.068").
Example I:

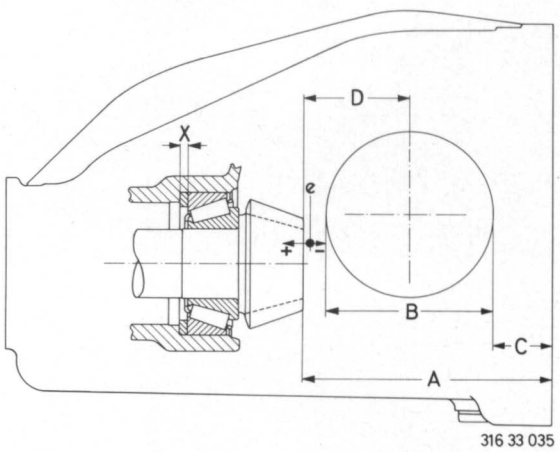
1.B:2	41.50 mm(1.634")	3.D	52.52 mm (2.068")
+ C	29.90 mm(1.177")	- e	0.18 mm (0.007")
y	71.40 mm(2.811")	D_n	52.34 mm (2.061")
2.A	123.90 mm(4.878")	4.D_a	52.50 mm (2.067")
- y	71.40 mm(2.811")	D_n	-52.34 mm (2.061")
D_a	52.50 mm(2.067")	X+	0.16 mm (0.006")

In this example installed shim X must be exchanged against a 0.16 mm (0.006") thicker shim.

Example II:

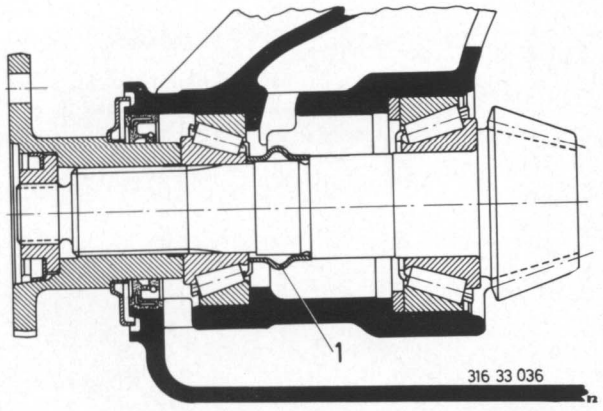
1.B:2	41.50 mm (1.634")	3.D	52.52 mm (2.067")
+ C	29.90 mm (1.177")	+ e	0.25 mm (0.010")
y	71.40 mm (2.811")	Dn	52.77 mm (2.077")
2.A	123.90 mm (4.878")	4.D_n	52.77 mm (2.077")
- y	71.40 mm (2.811")	D_a	52.50 mm (2.067")
D_a	52.50 mm (2.067")	X-	0.27 mm (0.010")

This case requires that installed shim X be replaced by a 0.27 mm (0.010") thinner shim.



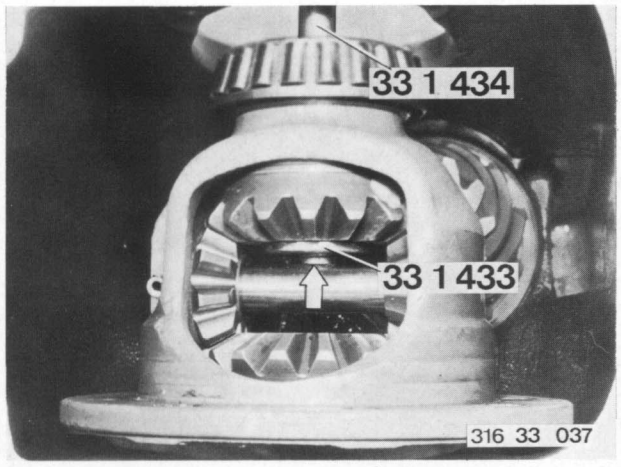
As a general rule, if D nominal is larger than D actual, amount X must be subtracted from thickness of shim X.

If D nominal is smaller than D actual, amount X must be added to thickness of shim X.

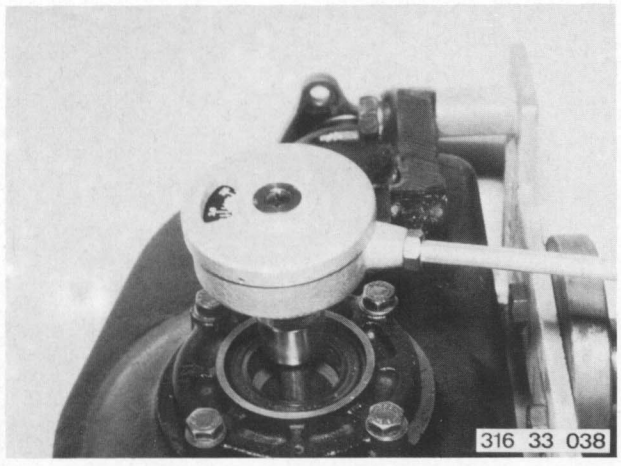


Remove drive pinion.
Install shim of determined thickness (X).
Insert drive pinion with new bushing and press front taper roller bearing onto drive pinion. Drive in shaft seal and mount input flange. Adjust friction moment 1) of input end taper roller bearing.
Lock collared nut.

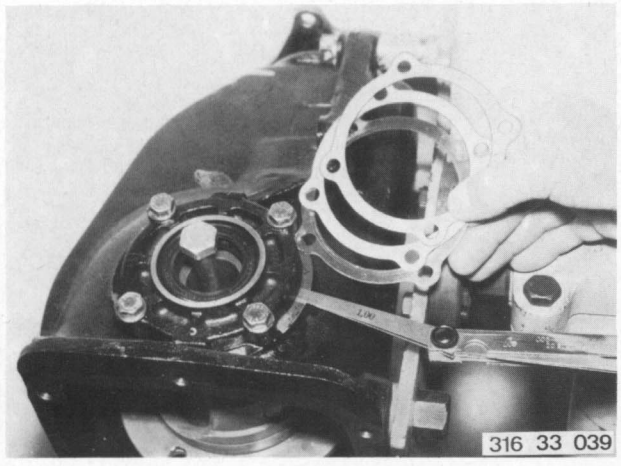
Caution! If friction moment is exceeded, replace bushing and repeat measurement.



Install differential case without ring gear.
Mount bolt 33 1 434 and threaded plate 33 1 433 in differential case that the bolt presses against differential pinion shaft.



Mount one bearing cap without shims on case. Install opposite bearing cap without shims.
Tighten bearing cap bolts evenly until the friction moment is 200 ... 280 Ncm / 20 ... 28 kpcm (17 ... 24 in. lbs.)



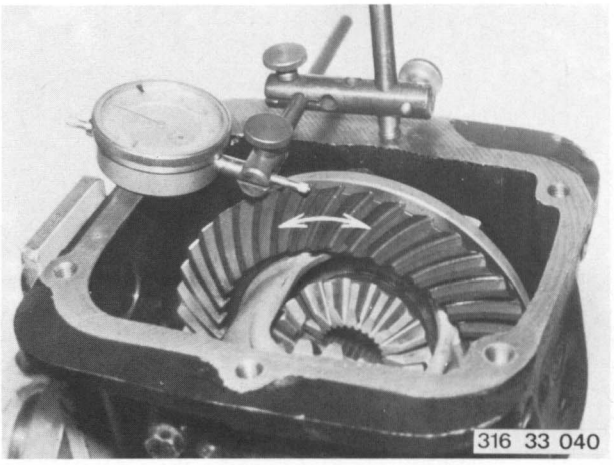
Measure distance between bearing cap and case with a depth gage and take up gap with shims.

Caution! First distribute shims evenly on both ends.
For example: If measured distance is 1.8 mm (.071"), place 0.9 mm (0.035") shims in front of each bearing cap.

1) See Specifications

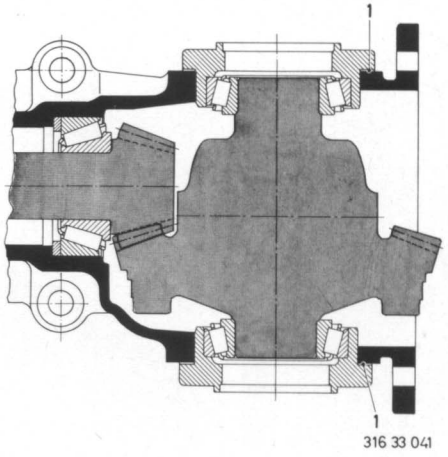
Install ring gear.
Install differential case.
Check amount of backlash.
Hold input flange with Special Tool 33 1 100.

Caution! Correct tooth contact patterns are always of primary importance. Refer to general information on tooth contact pattern adjustments.



Correct backlash and tooth contact pattern by moving shims (1) from one end to the other.

Caution! Never change the overall thickness of the shims.



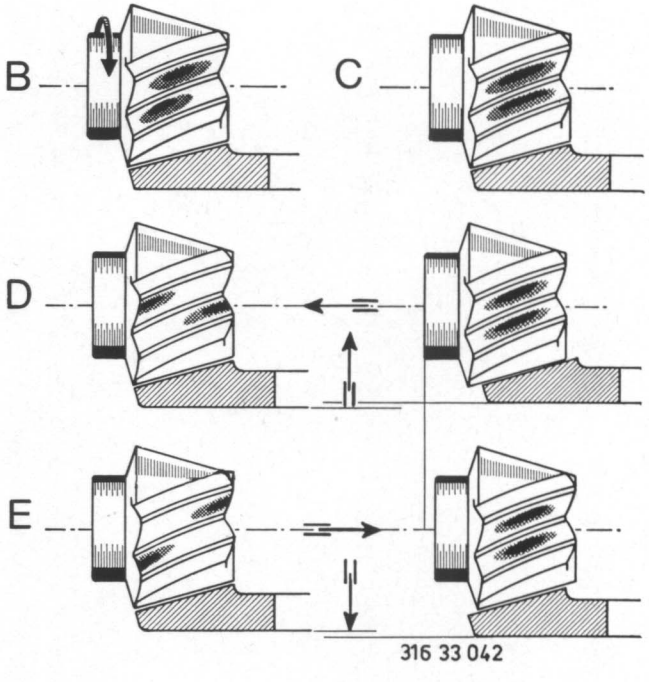
GENERAL INFORMATION ON TOOTH CONTACT PATTERN ADJUSTMENTS

Klingelnberg Teeth:

Tooth contact pattern on forward and reverse flanks of drive pinion should be at approximately center of tooth length and tooth height.

B Tooth contact pattern off load.
C Tooth contact pattern under load.
D By installing a thicker shim "X" behind drive pinion the contact pattern of forward flank will shift toward the large drive pinion diameter, while on the reverse flank it will move closer to the small drive pinion diameter.

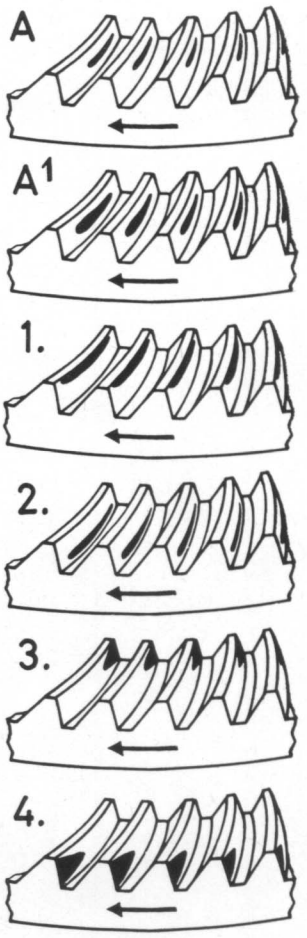
For other possible changes refer to drawing E.



Gleason Teeth:

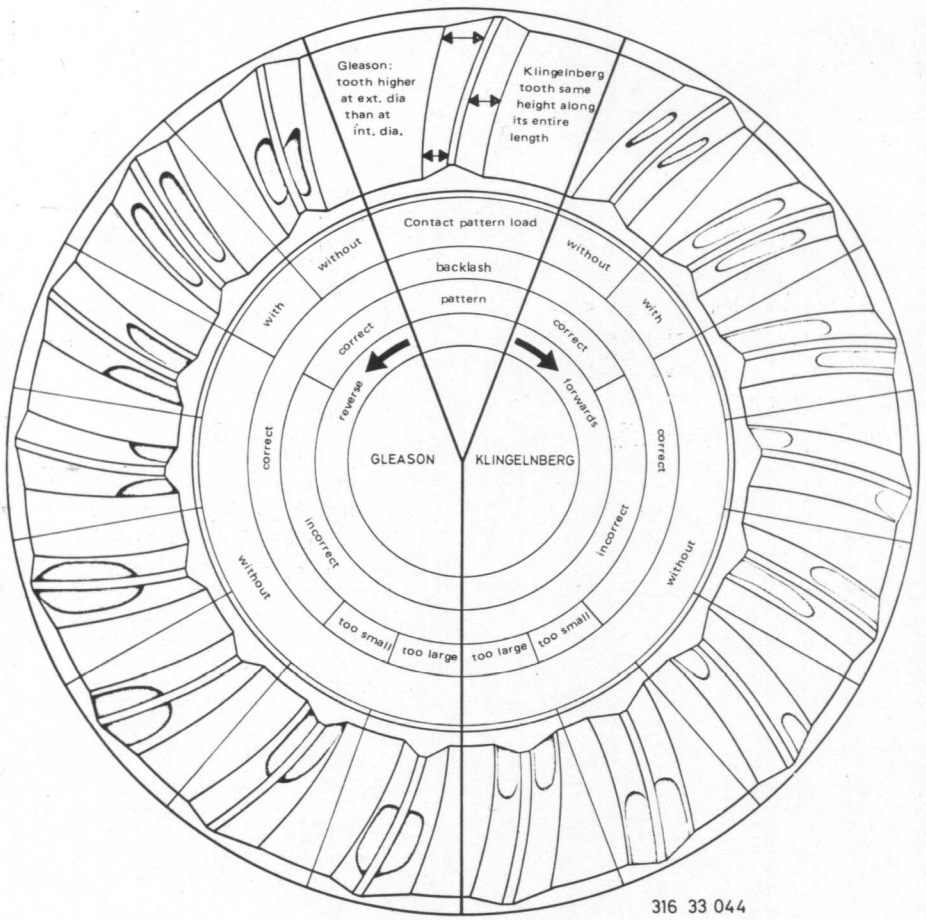
A Correct tooth contact pattern without load.
A1 Loads will shift tooth contact pattern outward slightly.
Moving the ring gear will mainly change the backlash, but will also displace the contact pattern in longitudinal direction of the teeth.
Moving the drive pinion will displace the contact pattern in favor of tooth height, but the backlash will be altered just very slightly.
Here are the four basically incorrect contact patterns, which usually appear in combination. Knowing these patterns will facilitate making adjustments.

1. High, narrow contact pattern (tip contact) on ring gear. Move drive pinion toward ring gear shaft and perhaps correct backlash by backing ring gear off of drive pinion.
2. Deep, narrow contact pattern (root contact) on ring gear. Move drive pinion away from ring gear shaft and perhaps correct backlash by moving in ring gear.
3. Short contact pattern on small tooth end (toe contact) of ring gear. Move ring gear away from drive pinion. Maybe move drive pinion closer to to ring gear shaft.
4. Short contact pattern on large tooth end (heel contact) of ring gear. Move ring gear toward drive pinion. Perhaps back drive pinion away from ring gear shaft.



316 33 043

ADJUSTING CONTACT PATTERNS



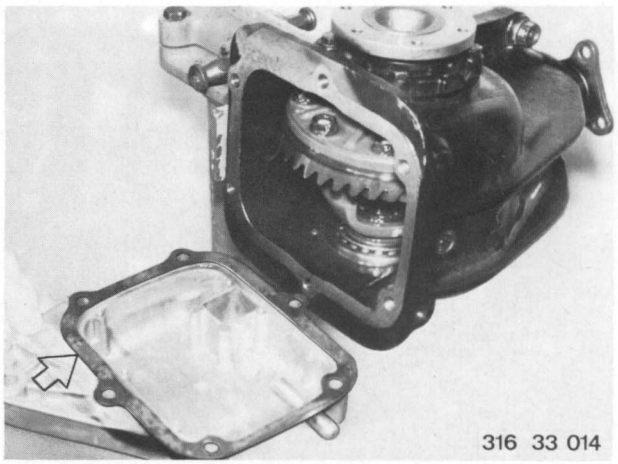
316 33 044

33 13 510 REMOVING AND INSTALLING DIFFERENTIAL CASE

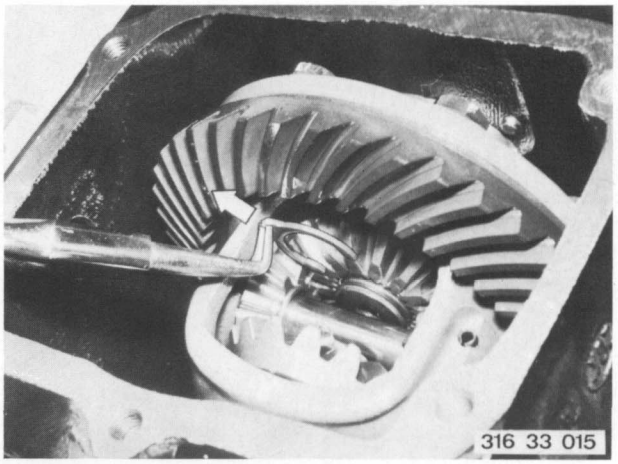
- Final Drive Removed -

Drain oil.
Mount final drive on Special Tool 33 1 040.
Remove case cover.

Installation Note! Tighten to specified torque[1].
Replace gasket.



Pull out drive flange circlips with a bent circlip pliers.
Remove drive flange.

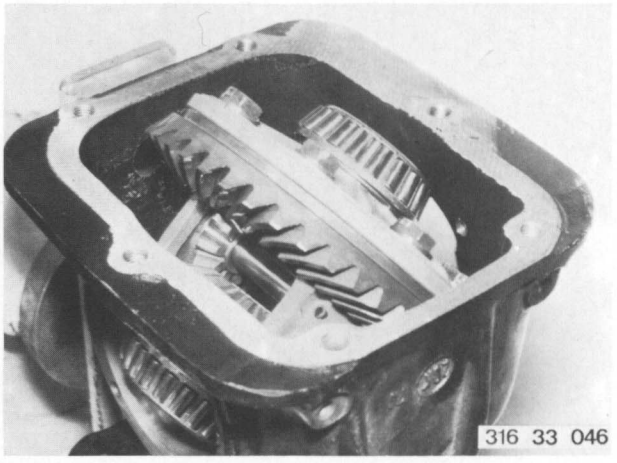


Remove both bearing caps.

Caution! Mark location of bearing caps.
The shims adjust the differential case location and backlash.
Check o-ring, replace if necessary.

Installation Note! Tighten to specified torque[1].

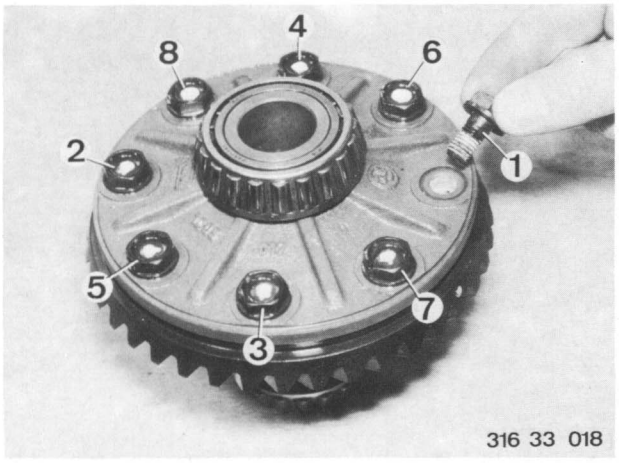
Position open end of differential case parallel to case mating surface.
Insert bearings as far as possible through bearing cap bore and remove differential case upward.



1) See Specifications

33 13 591 REPLACING DIFFERENTIAL BEVEL PINIONS

- Differential Case Removed -

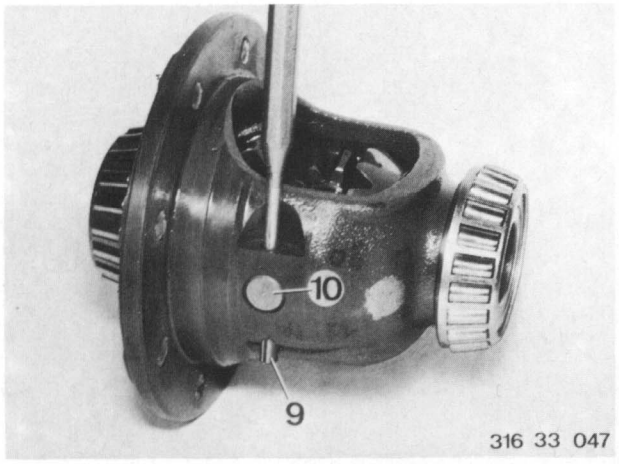


316 33 018

Remove (cold) ring gear.

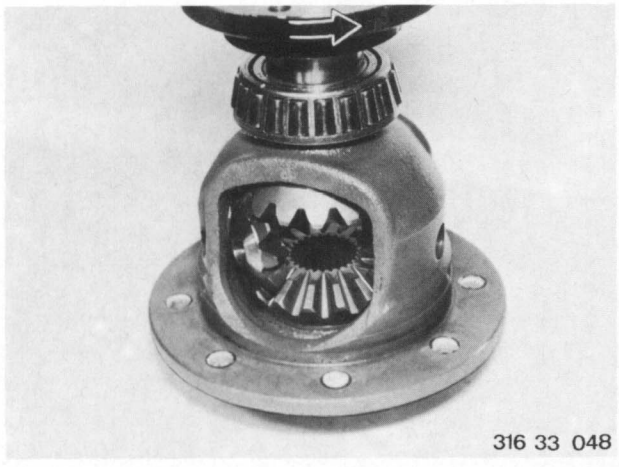
Installation Note! Clean threads thoroughly. Install bolts with Loctite 1) and tighten in sequence (1 ... 8).

Installation Note! Tighten to specified torque[1].

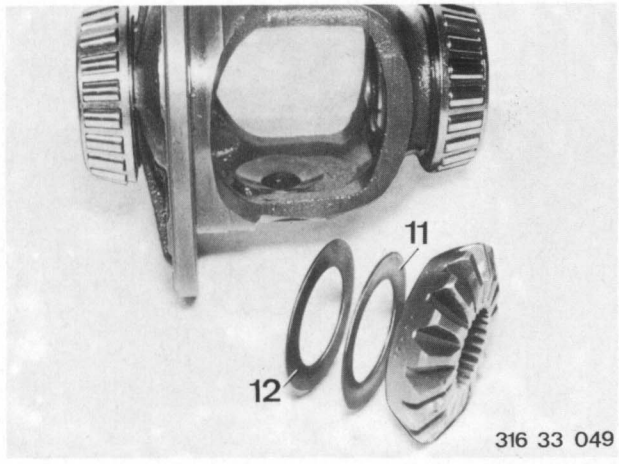


316 33 047

Drive out sleeve (9) and differential pinion shaft (10).


316 33 048

Unscrew differential bevel pinions with drive flange.

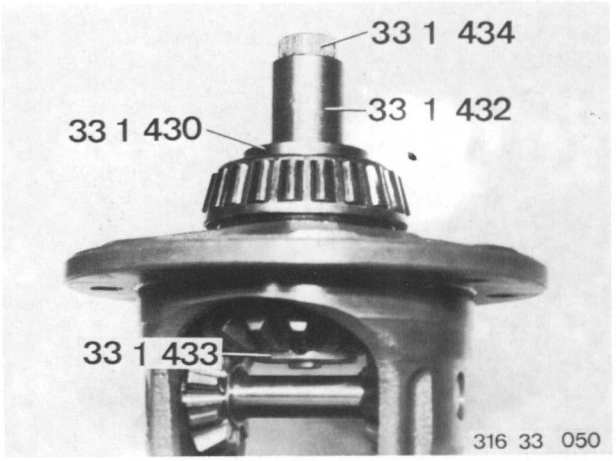


316 33 049

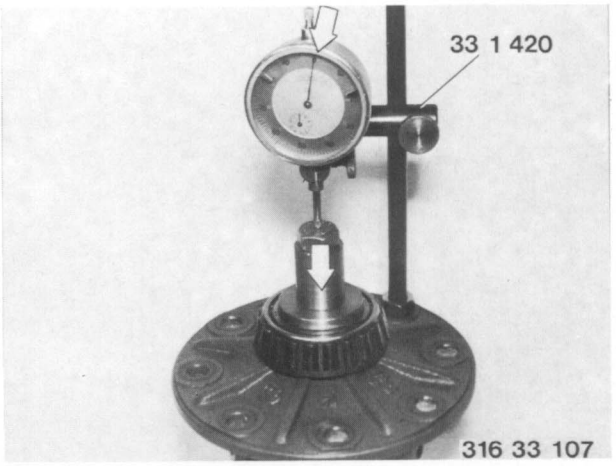
Remove both differential side gears with cup springs (11) and shims (12).

1) -See Specifications

Installation Note! Install one differential side gear (without cup spring or shim) with bevel pinions and differential bevel pinion shaft.
Mount Special Tools 33 1 430, 33 1 432, 33 1 434 and 33 1 433 on differential side gear.



Mount dial gage on differential case with holder 33 1 420. Move differential side gear back and forth firmly and set dial gage at zero.

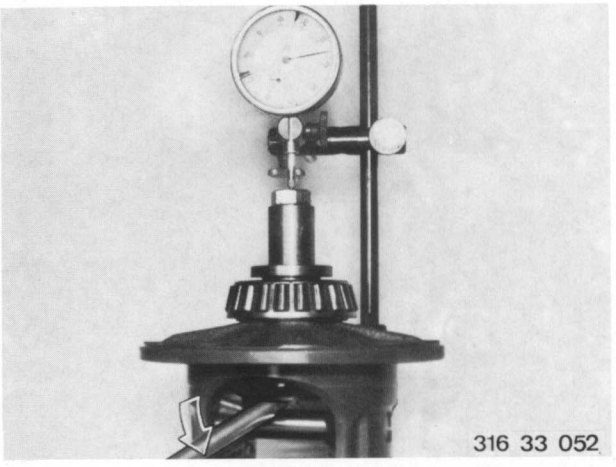


Press up differential side gear firmly and read dial gage, e.g. 2.35 mm (0.092").
The value obtained in this manner less 0.05 mm (0.002") is the thickness of shims and cup springs.

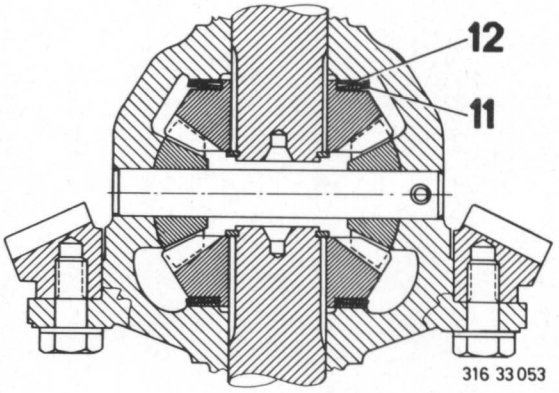
Example: 2.35 mm (0.092")
- 0.05 mm (0.002")

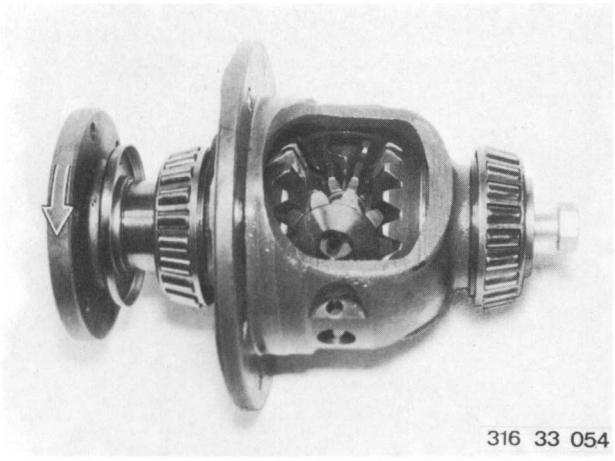
2.30 mm (0.090")

The 0.05 mm (0.002") are necessary so that cup spring will not be preloaded against block.



The opposite end is calculated in the same manner.
Remove differential pinion shaft and differential bevel pinions.
Install cup spring (11) and shim (12).
Convex side of cup spring (11) faces differential side gear.





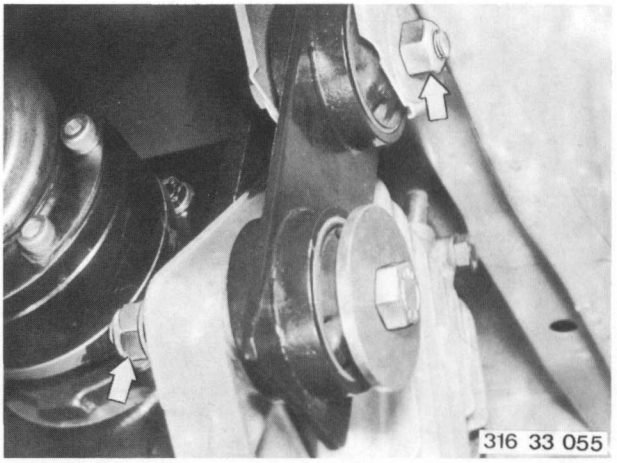
316 33 054

Insert drive flange into differential side gear and install circlip.
Install Special Tools 33 1 430, 33 1 434 and 33 1 433 on opposite end. Use bolt to press both differential side gears so far apart, that the differential bevel pinions with drive flange can be screwed in.
Install differential bevel pinion shaft and sleeve.
Remove drive flange.

33 17 030 REPLACING SELF-ALIGNING SUPPORT

Support final drive.
Unscrew stop nuts and remove bolts.
Remove self-aligning support.

Installation Note! Replace self-locking nuts.
Tighten to specified torque. 1)

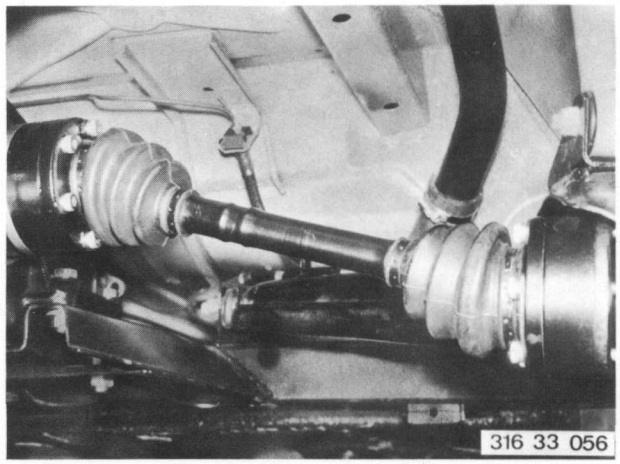


1) See Specifications

33 21 000 REMOVING AND INSTALLING OUTPUT SHAFT

Unscrew bolts.
Remove output shaft.

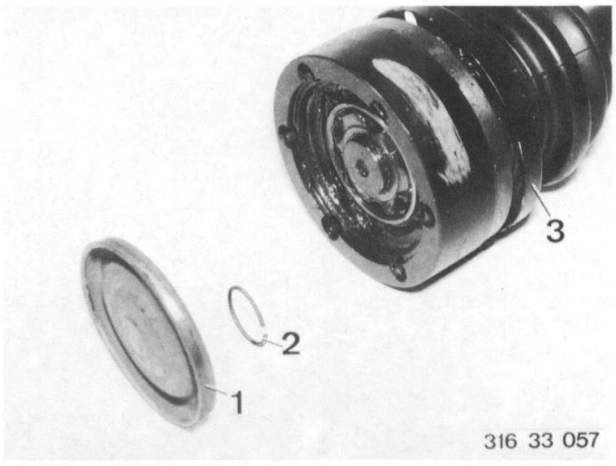
Installation Note! Tighten to specified torque[1].



33 21 551 REPLACING BELLOWS

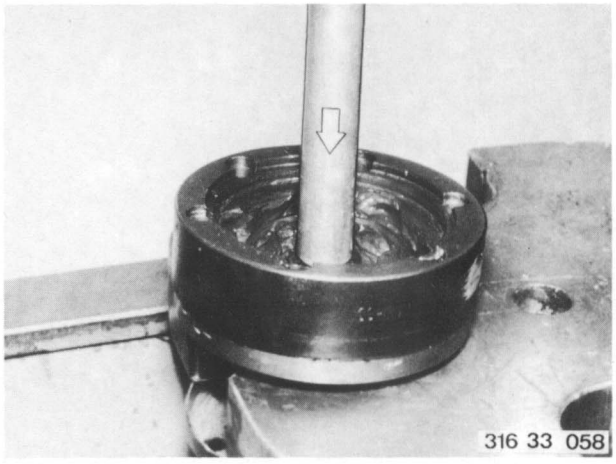
- Output Shaft Removed -

Remove sealing cover (1).
Remove circlip (2).
Slide back cover (3).

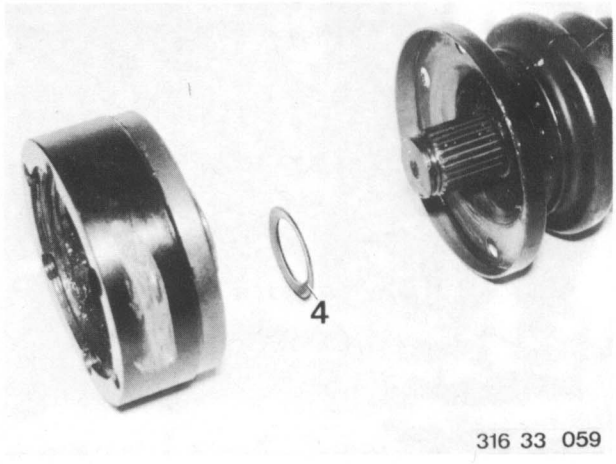


Support joint and press out shaft.

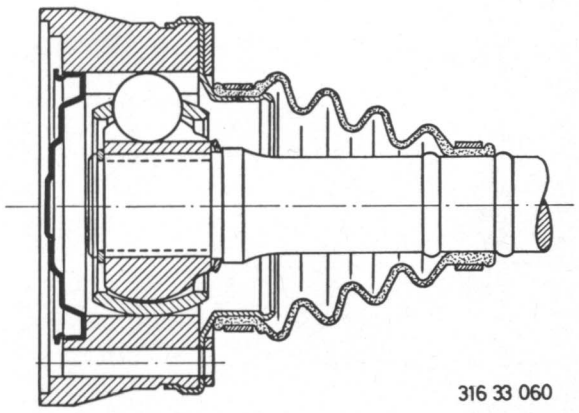
Installation Note! Installing pressure is 1000 ... 5000 N / 100 ... 500 kp (220 ... 1100 lbs).



Installation Note! Concave side of axial clamping ring (4) faces joint.



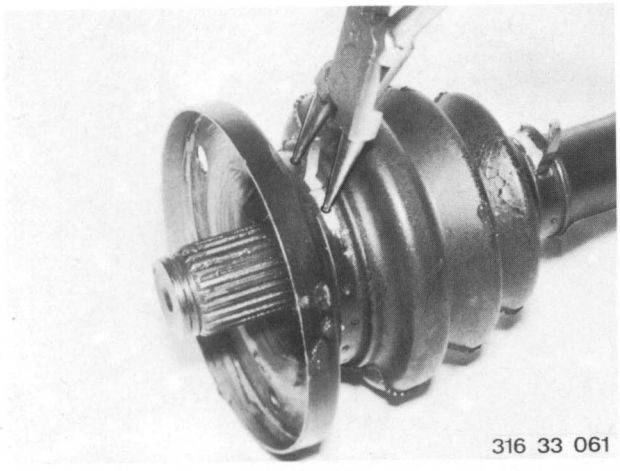
1) See Specifications



316 33 060

Take off clip and remove bellows.

Installation Note! Clean bellows mating surface to remove any grease.
Apply coat of adhesive [1] to bellows.
Fill joint and bellows with grease.



316 33 061

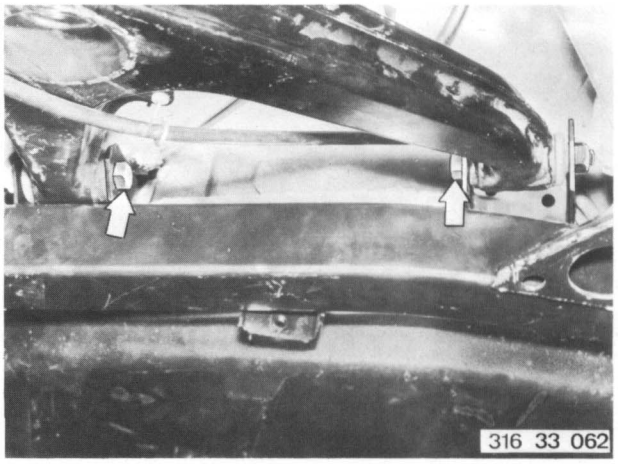
To facilitate tightening, drill two 2 mm (0.079") diameter holes in clips.

1) See Specifications

33 31 011 REPLACING REAR AXLE SUPPORT

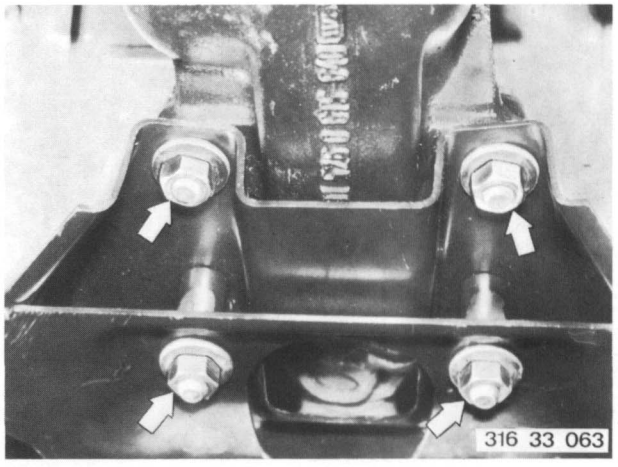
Remove trailing arm bolts.

Installation Note! Tighten to specified torque[1].
Replace self-locking nuts.



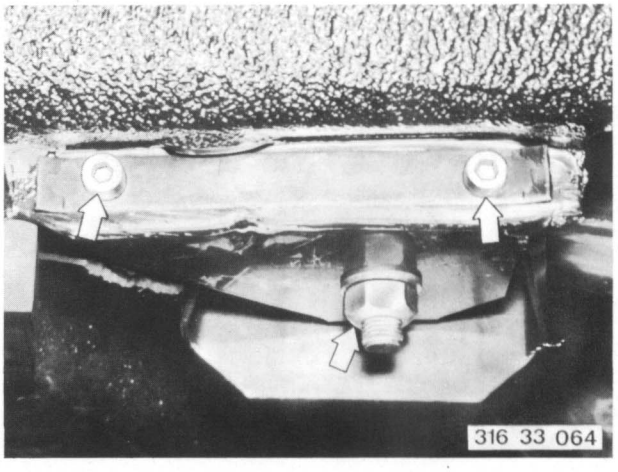
Detach final drive at rear axle carrier.

Installation Note! Tighten to specified torque[1].



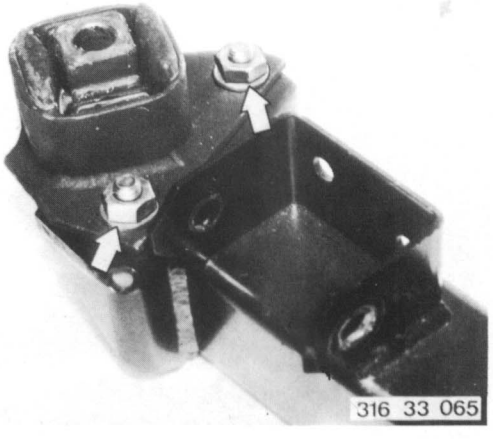
Remove support bolts and unscrew rubber mount nuts.

Installation Note! Tighten to specified torque[1].
Replace self-locking nuts.

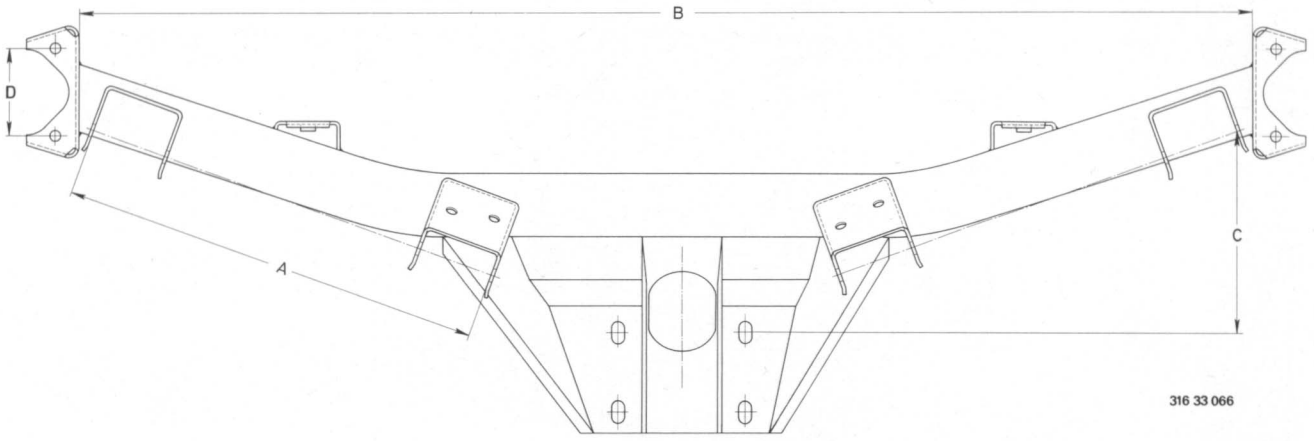


Remove rear axle support.
Unscrew rubber mount.

Installation Note! Tighten to specified torque.[1]
Check rubber mount, replace if necessary.
Check knurled head bolts.
Replace self-locking nuts.



1) See Specifications



Check rear axle support.

A = 371.8 mm (14.638")

B = $1099.4^{\ }_{-\ 0.8}$ mm ($43.283^{\ }_{-\ 0.031}$")

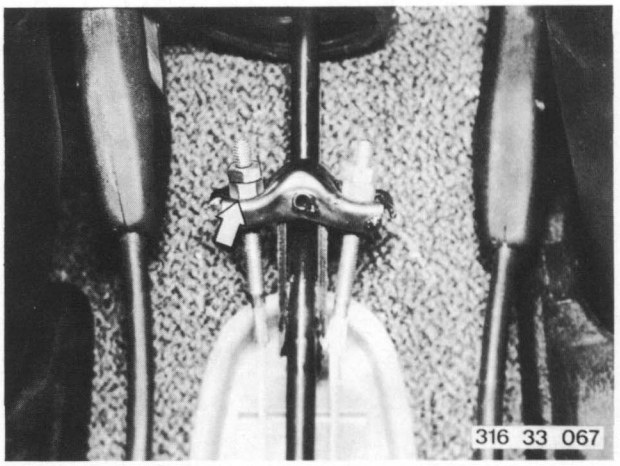
C = 185.9 $\pm$ 1 mm (7.319 $\pm$ 0.040")

D = 82 mm (3.228")

33 32 000 REMOVING AND INSTALLING TRAILING ARM

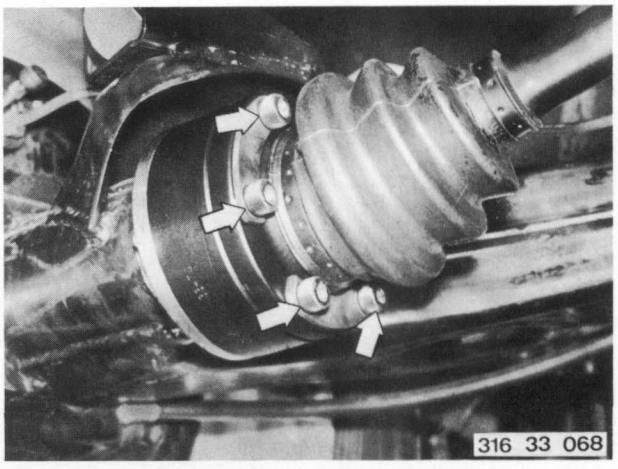
Detach parking brake cable at parking brake lever.

Installation Note! Adjust parking brake - 34 10 014.



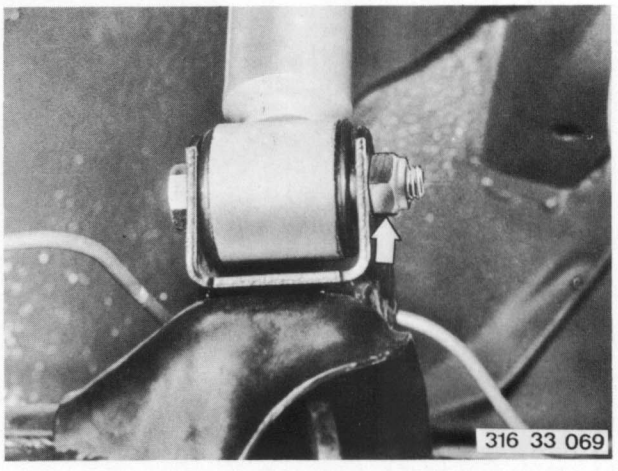
Detach output shaft at rear axle shaft.
Remove wheel.

Installation Note! Tighten to specified torque[1].



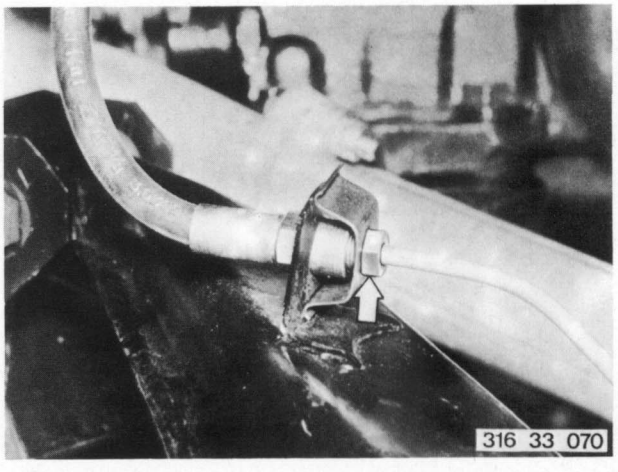
Detach coil spring/shock absorber strut at trailing arm.
Support trailing arm.

Installation Note! Tighten to specified torque[1].
Replace self-locking nuts.

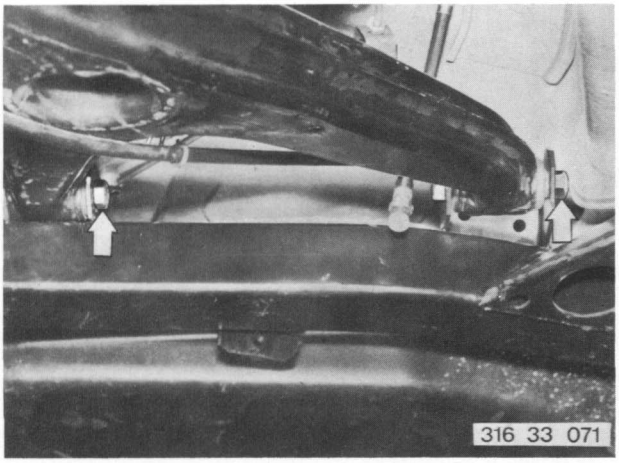


Detach brake hose at pipe.
Plug end of hose with Ate cap to prevent dirt from entering.

Installation Note! Bleed brakes.
Don't twist brake hose.
Tighten to specified torque[1].

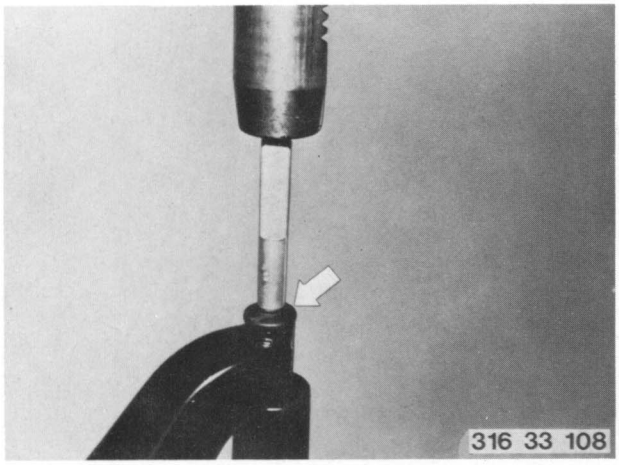


1) See Specifications



Detach stabilizer at trailing arm.
Unscrew both trailing arm mounting bolts.

Installation Note! Tighten mounting bolts to specified torque 1) in car's normal load position. 1)
Replace self-locking nuts.
Pull out parking brake cable.
Remove trailing arm.

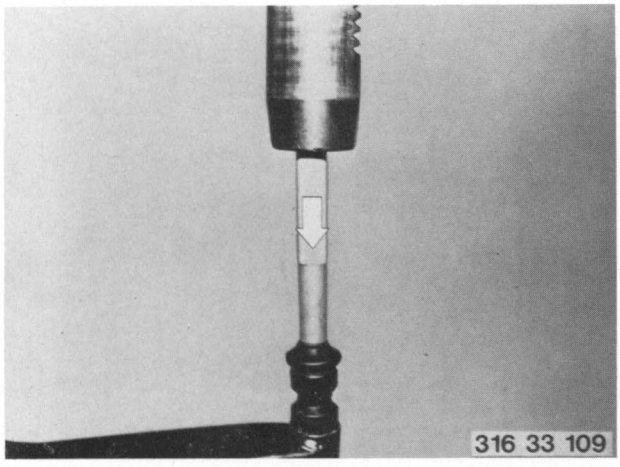


33 32 021 REPLACING TRAILING ARM

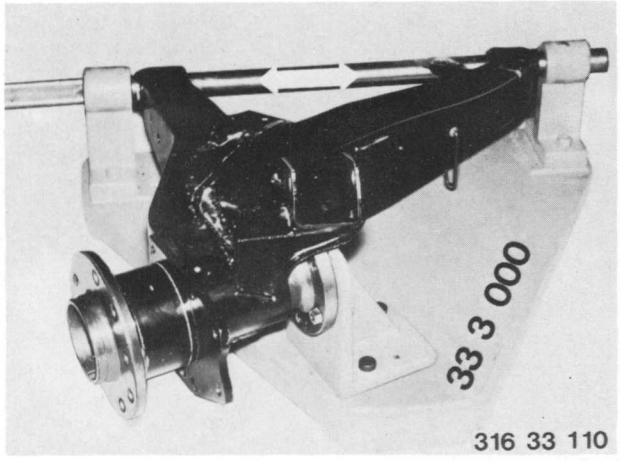
Remove and install trailing arm - 33 32 000.
Replace flange blocks - 33 32 561.
Replace wheel bearings and shaft seal - 33 41 601.
Transfer guard.

33 32 561 REPLACING BOTH FLANGE BLOCKS
- Trailing Arm Removed -

If necessary, cut through collar end with a knife.
Press out flange blocks with an appropriate mandrel and a hydraulic press.



Installation Note! Coat flange blocks with a rubber slip compound such as diluted Cresta, sliding oil II or low surface tension water.
Collar end faces out.
Press in flange blocks with an appropriate mandrel and hydraulic press until flush.



33 32 609 CHECKING TRAILING ARM ALIGNMENT
- Trailing Arm Removed -

Press out flange blocks.
Mount drive flange on Special Tool 33 3 000.
Test mandrel must slide through take-up bore easily.

Caution! Trailing arms may only be straightened, if no cracks or other damage can be seen.

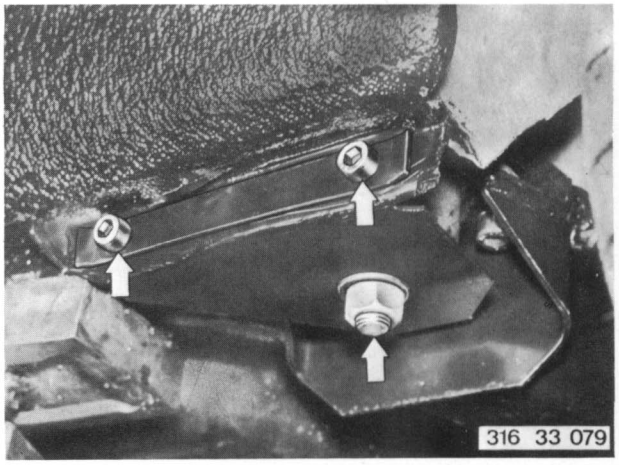
Installation Note! Coat new flange blocks with diluted Cresta, sliding oil II or low surface tension water and press in until flush. Collar faces out.

1) See Specifications

33 33 071 REPLACING REAR AXLE SUPPORT RUBBER MOUNT

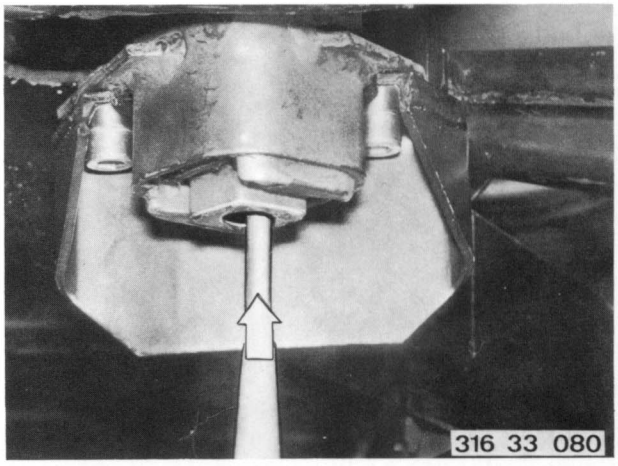
Unscrew socket head cap screws for reinforcement and stop nuts on knurled head bolts.

Installation Note! Tighten to specified torque[1].
Replace self-locking nuts.



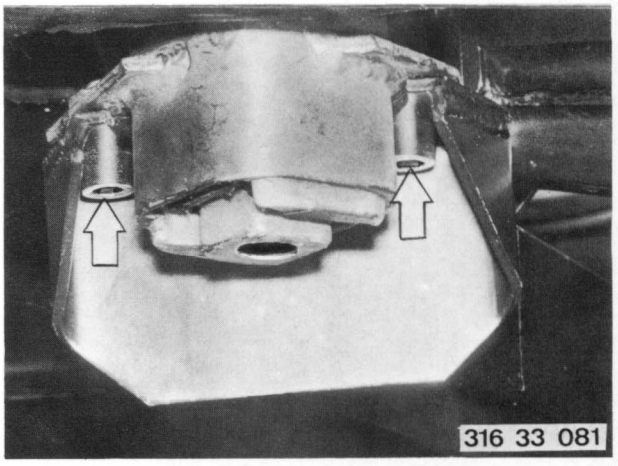
Remove rear seat cushion.
Drive out knurled head bolts from above.

Installation Note! Check knurled head bolts, and replace if necessary.

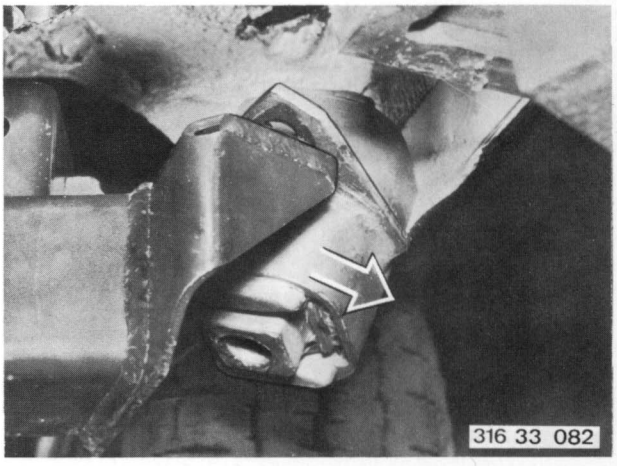


Unscrew rubber mount mounting bolts.

Installation Note! Tighten to specified torque[1].



Remove rubber mount.

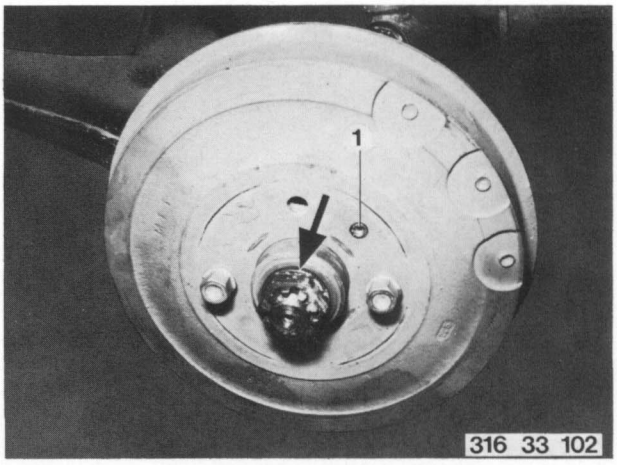


1) See Specifications

33 41 000 REMOVING AND INSTALLING REAR AXLE SHAFT DRIVE FLANGE

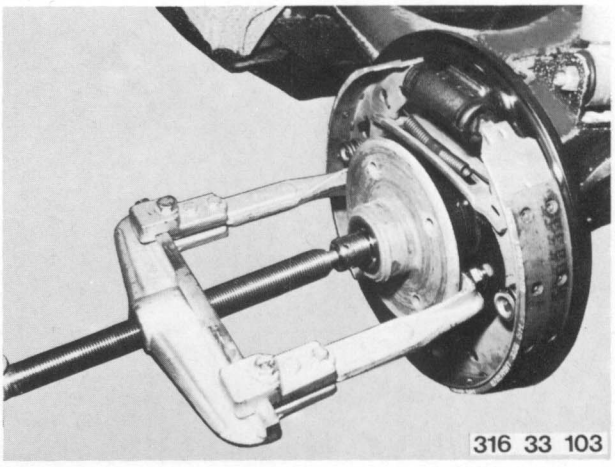
Remove and install rear wheel - 36 10 320.
Take cotter pin out of castle nut.
Apply parking brake and hold brake drum against drive flange additionally with two screwdrivers.
Unscrew castle nut.
Release parking brake.
Remove screw (11) and wheel bolts.
Remove brake drum.

Installation Note! Tighten to specified torque[1].



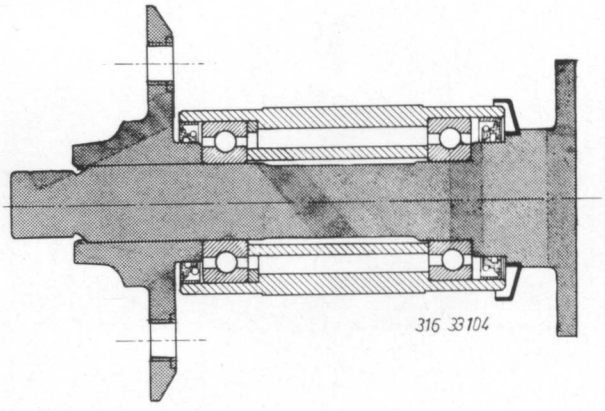
Apply Kukko extractor and pull off drive flange.

Installation Note! Check bearing surfaces for shaft seal on drive flange and shaft seal.



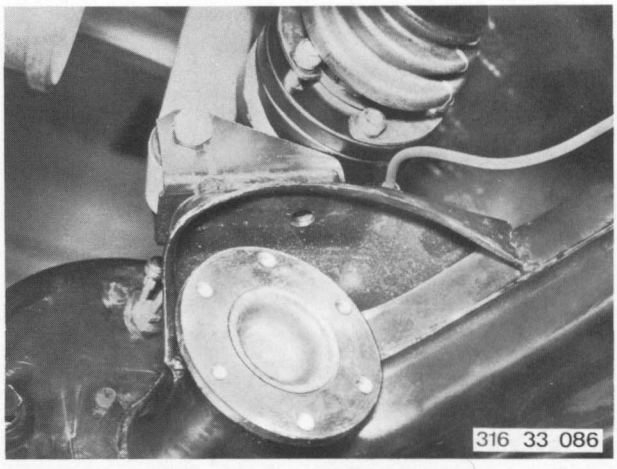
33 41 100 REMOVING AND INSTALLING REAR AXLE SHAFT

Remove and install drive flange - 33 41 000.

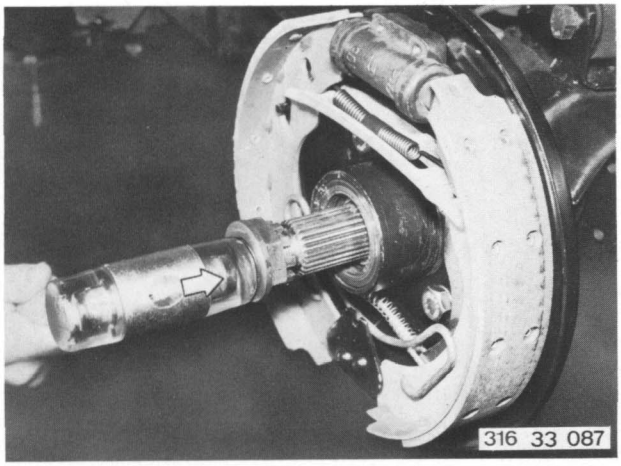


Detach output shaft and tie up.

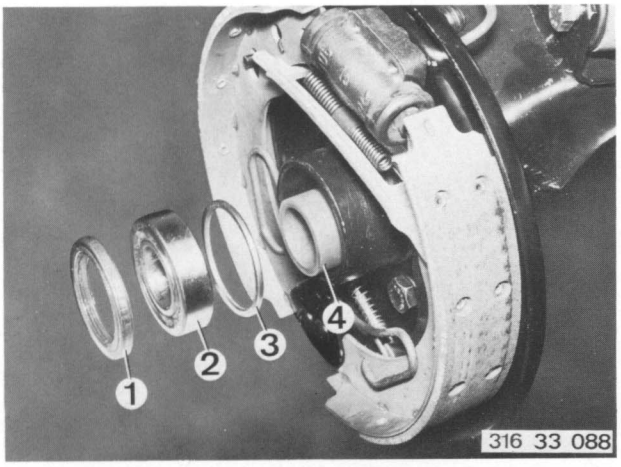
Installation Note! Tighten to specified torque[1].



1) See Specifications



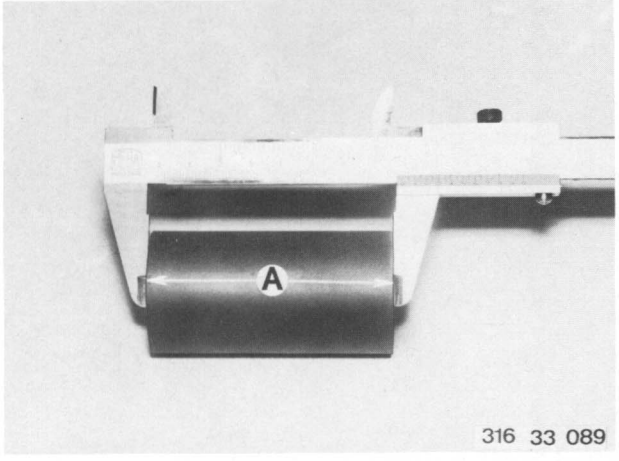
Drive out rear axle shaft with a plastic hammer.
Install castle nut to protect axle shaft.



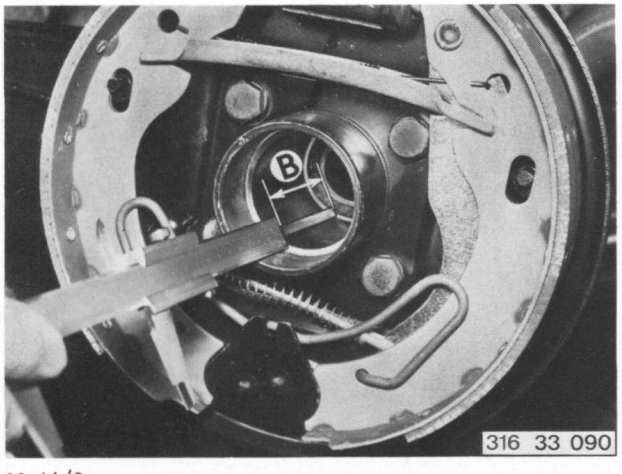
33 41 151 REPLACING REAR AXLE SHAFT WHEEL BEARINGS AND SHAFT SEALS

Remove and install rear axle shaft - 33 41 100.
Drive out ball bearing (2) and shaft seal (1) together with a punch.
Remove spacer (4) and locating ring (3).

Installation Note! Fill cavity between sealing lips with graphite grease.
Fill hub with grease 1).



Installation Note! Adjust wheel bearing play[1].
Measure length of spacer (A), e.g. 78.9 mm (3.106").



Install inner ball bearing.
Measure distance (B) from bearing surface of outer ball bearing in hub to inner ball bearing outer race.
E.g. 75.8 mm (2.984").

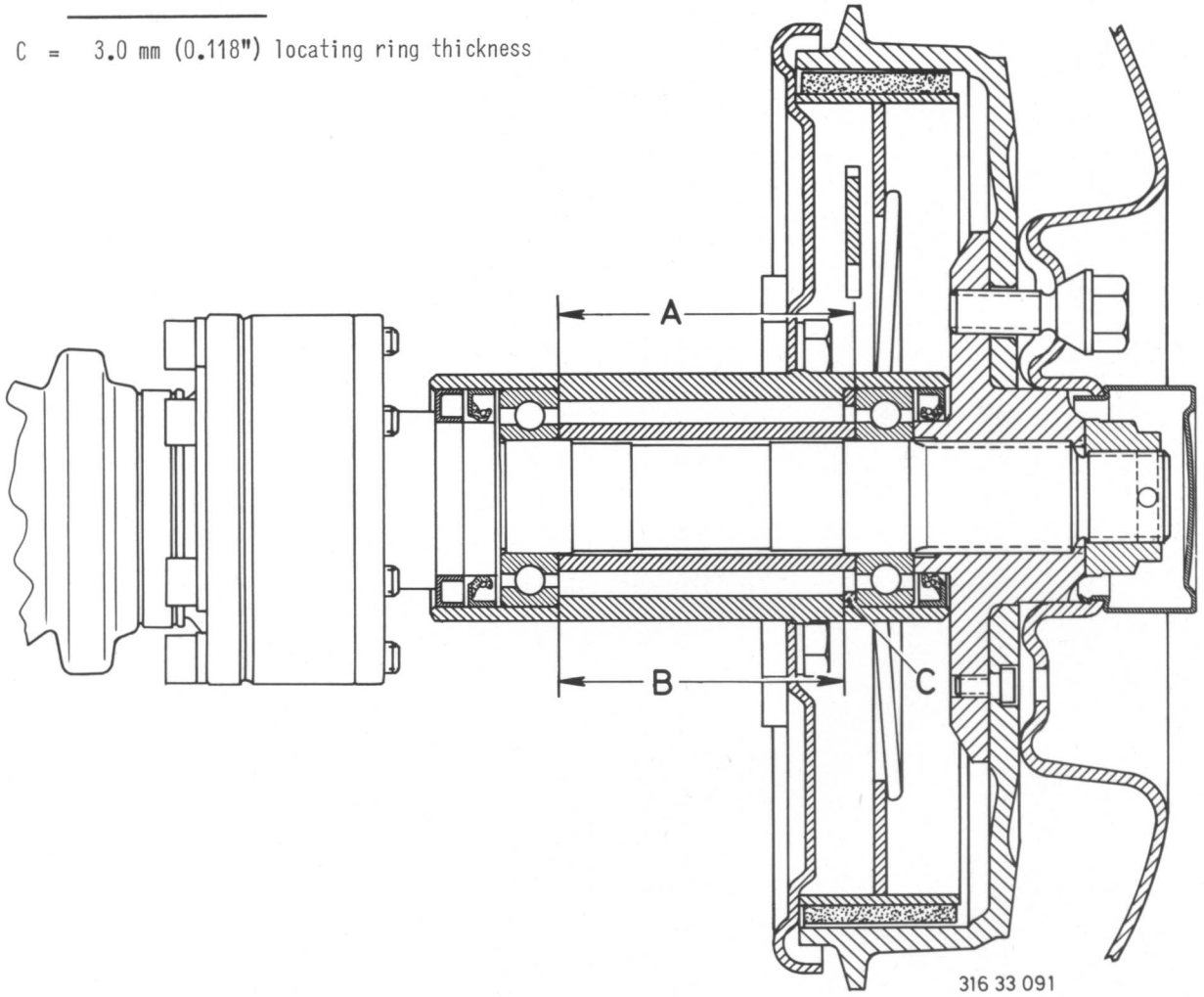
1) See Specifications

Determine installed clearance as follows:

A = 78.9 mm (3.106")
- B = 75.8 mm (2.984")

3.1 mm (0.122")
- 0.1 mm (0.004") play

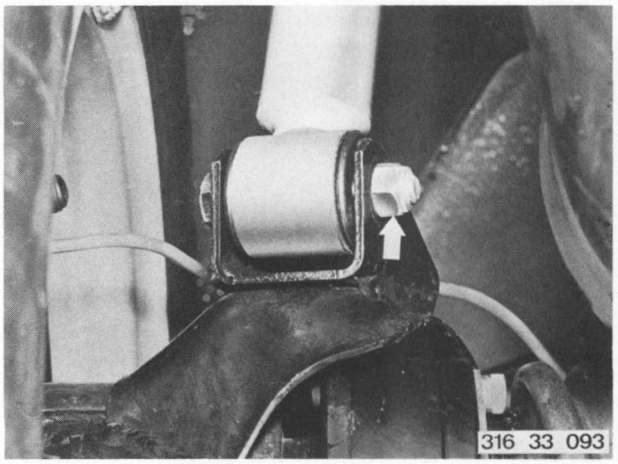
C = 3.0 mm (0.118") locating ring thickness



33 52 100 REMOVING AND INSTALLING COIL SPRING/ SHOCK ABSORBER STRUT ASSEMBLY

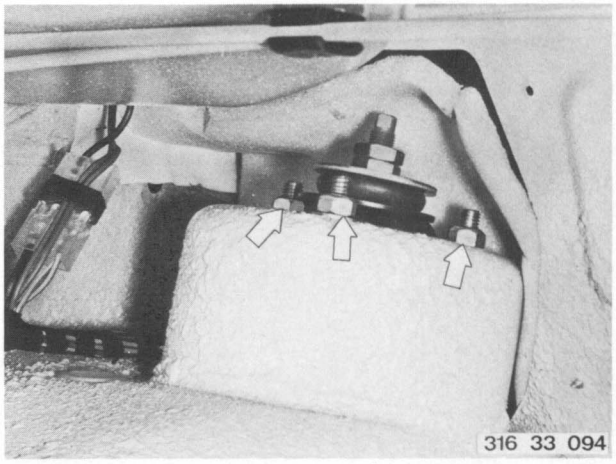
Caution! Spring strut shock absorber catches any rebound action. Bending angle of output shaft is 18°. Always support trailing arm when removing spring strut shock absorber. Unscrew mounting bolts.

Installation Note! Tighten mounting bolts to specified torque in car's normal load position 1). Replace self-locking nuts.



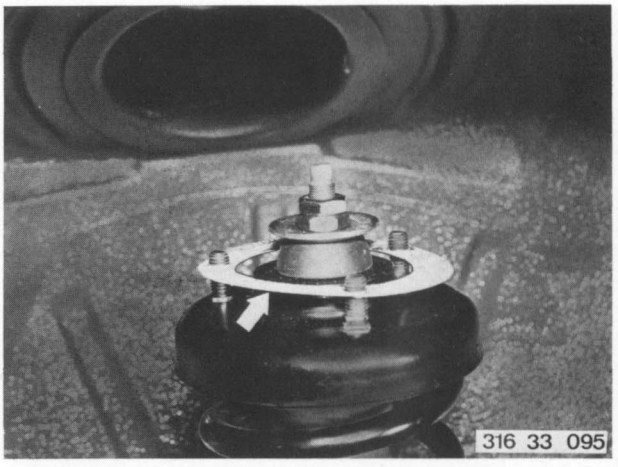
Detach centering cup at wheelhouse.

Installation Note! Tighten to specified torque 1).



Remove spring strut shock absorber.

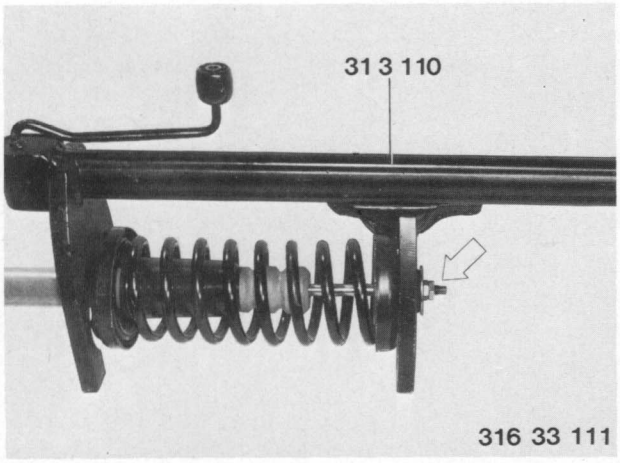
Caution! Gasket.



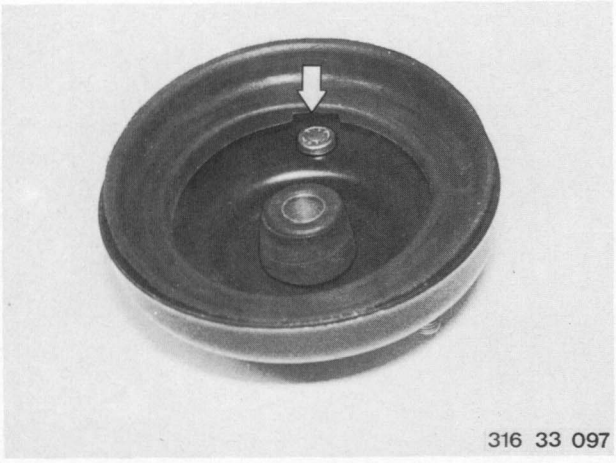
33 52 131 REPLACING SPRING STRUT SHOCK ABSORBER

When replacing just one shock absorber, always use one of same make. 1)
An exact method of testing shock absorbers to check whether replacement is called for is with a shock absorber tester or similar device for installed absorbers, or inspection of removed absorbers in a shock absorber test bench. 1)
Generally it can be said that shock absorbers will only have about 50 % of their original damping effect after going through two sets of tires. In this case an inspection would be called for and replacement of absorbers of any one axle, if applicable.
Remove and install coil spring - 33 53 000.
Note information in Specifications for conversion to heavy duty applications.
1) See Specifications

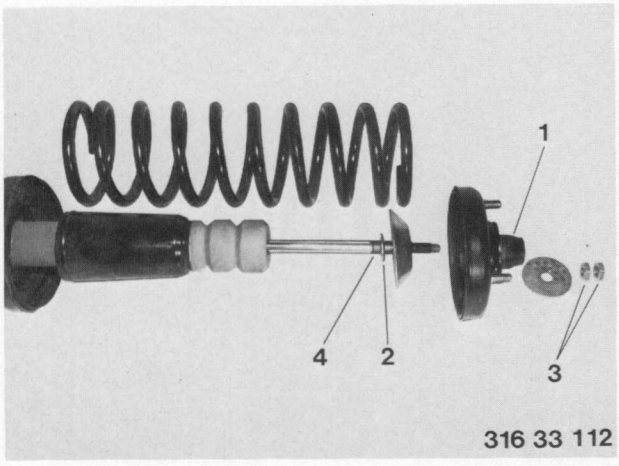
33 52 200 REMOVING AND INSTALLING CENTERING CUP



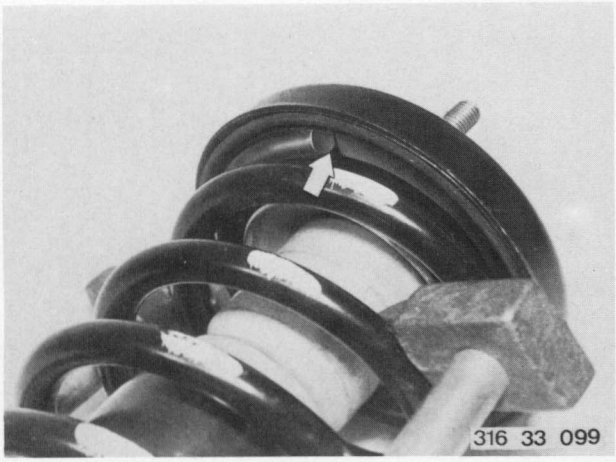
Remove and install spring strut shock absorber - 33 52 100.
Compress coil spring with Special Tool 31 3 110 far enough until centering cup can be detached.
Release coil spring and remove centering cup.



Installation Note! Note position.
Knurled head bolts in openings of rubber liner.
Check damper rings on spring retainer and in centering cup, and replace if necessary.



Installation Note! Check rubber mount (1), and replace if necessary.
Collar of disc (2) faces circlip (4).
Tighten nut (3) until it fits tight. 1)

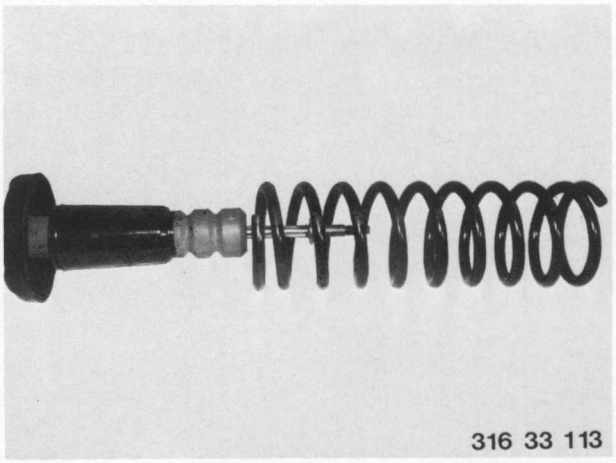


Installation Note! Align coil spring before compressing.

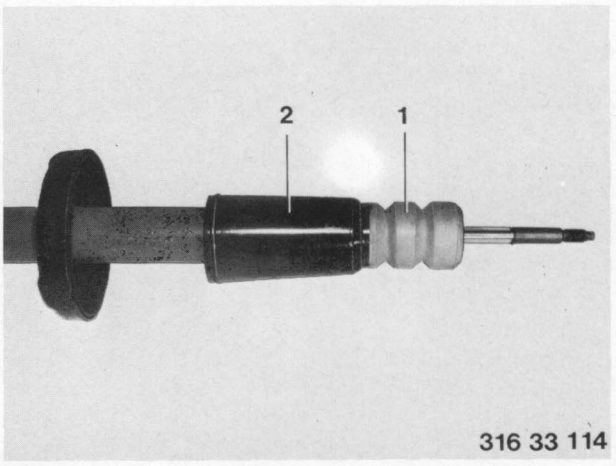
1) See Specifications

33 53 000 REMOVING AND INSTALLING COIL SPRING

Remove and install centering cup - 33 52 000.
Take coil spring off of shock absorber.


316 33 113

Check auxiliary spring (1) and outer tube (2), and replace if necessary.



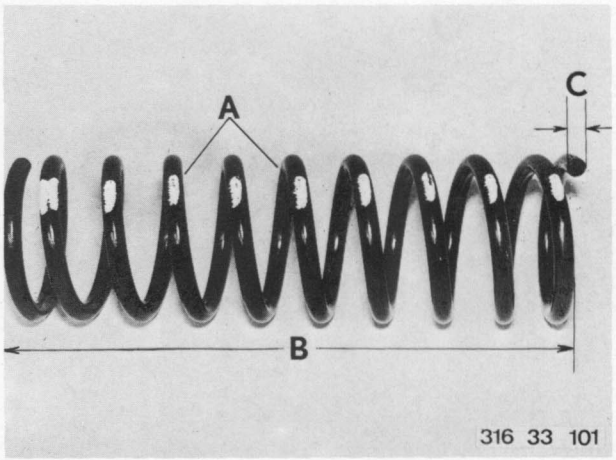
316 33 114

33 53 001 REPLACING COIL SPRING

Remove and install coil spring - 33 53 000.

Spring force color code A[1)], spring length B[1)] and wire gage diameter C[1)] must be the same on left and right-hand sides.

Note information in Specifications on coversions to heavy duty applications.



316 33 101

1) See Specifications

TROUBLESHOOTING REAR AXLE

Condition	Cause	Correction
Knock when moving off	a) Drive flange loose in keyway	a) Install drive flange with Loctite for keyways - 33 11 060
Knock from load shifts	a) Excessive backlash b) Drive flange loose in keyway c) Output shaft defective d) Play in slide of propeller shaft	a) Adjust backlash - 33 12 551 b) See knock when moving off c) Replace output shaft - 33 21000 d) Install slide with green Loctite No. 75 for joints
Traction or compression noise	a) Backlash too large or too small	a) Adjust backlash - 33 12 551
Drumming	a) Propeller shaft b) Rear axle support rubber mount defective	a) See Troubleshooting Propeller Shaft b) Replace rubber mount - 33 33071
Loss of oil	a) Radial oil seals leak b) Vent plugged c) Incorrect oil grade 1)	a) Replace radial oil seals b) Clean vent c) Replace final drive oil
Vibration	a) Unbalanced wheels b) Output shaft defective c) Propeller shaft	a) Balance wheels, replace rims if necessary b) Replace output shaft - 33 21000 c) See Troubleshooting Propeller Shaft
Rattling noise	a) Shock absorber damping force insufficient b) Upper absorber rubber mount shot c) Lower absorber rubber mount shot d) Rear axle support rubber mount shot	a) Replace absorber - 33 52 100 b) Replace rubber mount - 33 52200 c) Replace absorber - 33 52 100 d) Replace rubber mount 33 33 071
Grinding noise only when driving in curves	a) Wheel bearings defective	a) Replace wheel bearings - 33 41 151

1) See Specifications