

33 Rear Axle

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33 Rear Axle

Transmission Type K = Side Cover with Four Bolts

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33 Rear Axle

Transmission Type K = Side Cover with Four Bolts

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33 Rear Axle

Transmission Type M = Side Cover with Six Bolts

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33 Rear Axle

Transmission Type M = Side Cover with Six Bolts

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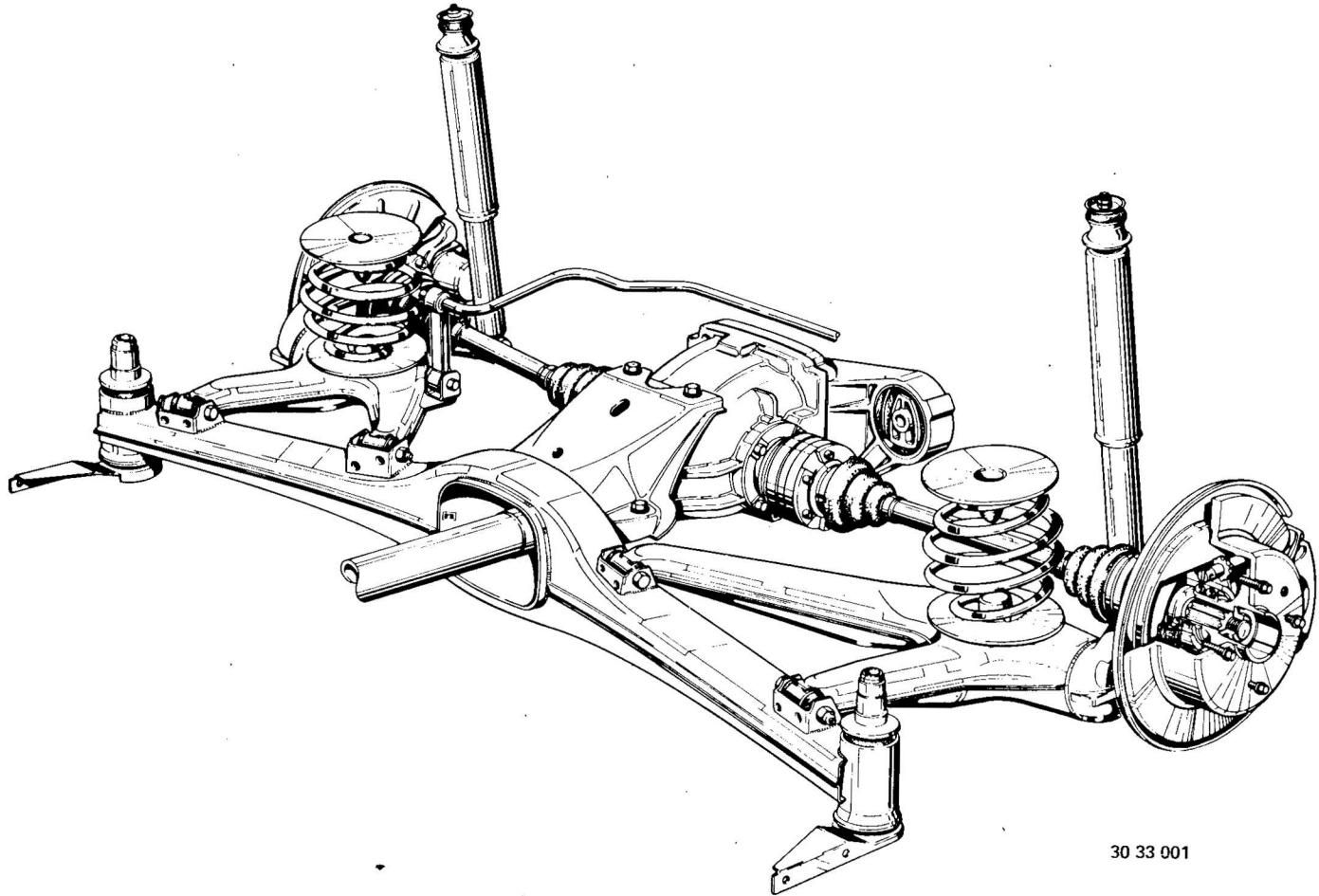
33 Rear Axle

Transmission Type M = Side Cover with Six Bolts

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REAR AXLE LAYOUT DRAWING
15° TRAIL AXLE



30 33 001

BMW 325 IX - Checking Visco Rear Axle Lock in Car:

The condition of visco locks can be determined on a brake test stand together with a BMW Service Tester.

Caution!

If only one wheel turns while testing on a brake test stand, this will subject the visco lock to excessive loads and in turn to its destruction due to excessive heat.

The total running time = warm-up time + test time on the brake test stand must not exceed 40 sec..

There must be a break of at least 30 minutes between tests. This is applicable for cold and warm cars.

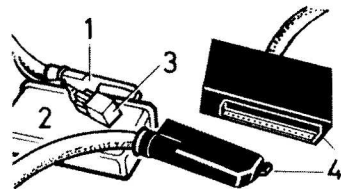
The cylinder speed of the brake test stand must not exceed 7.5 km/h (4.5 mph).

If the cylinder speed is not known, it can be determined with the method described in the test plan, using a 3 Series car with ABS and without four wheel drive. The warming-up phase and brake force test are omitted.



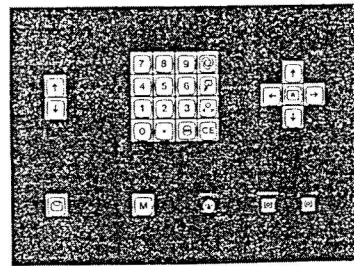
30 27 002

Check tire pressure and tire size.
Brake test stand not set to automatic.
Rear wheels of car on test stand cylinders.
Ignition turned off.
Front wheels on floor.
Shift lever in 1st gear.



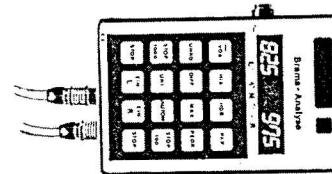
30 27 003

To determine the test stand speed (wheel speed) under load, the car must be connected on a BMW Service Tester. Switch off electric equipment and turn off the Ignition.
Connect T-plug (4) between ABS control unit (2) and ABS wire harness (1).



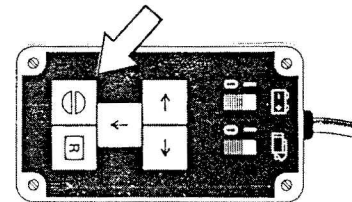
30 27 004

Select test program 03 ABS on the BMW Service Tester.
Select ABS Test Step 03.



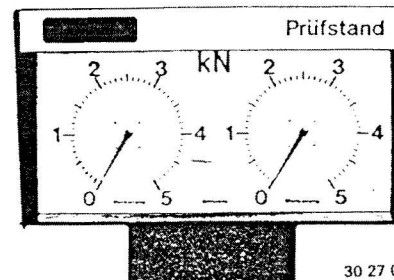
30 27 005

Switch on one brake test stand cylinder and let it run about 30 seconds (warm-up phase).



30 27 008

Press acknowledgement button on the BMW Service Tester after the warm-up time.
The value in ms now appearing for left or right rear is equal to the cylinder speed.
See diagram.



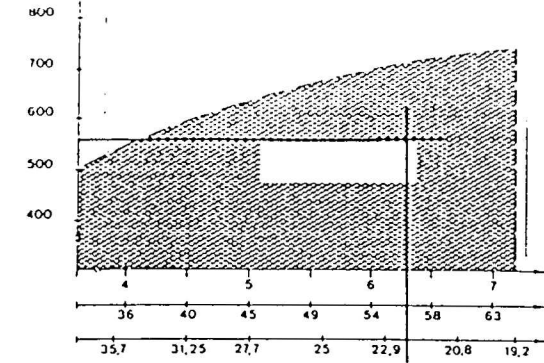
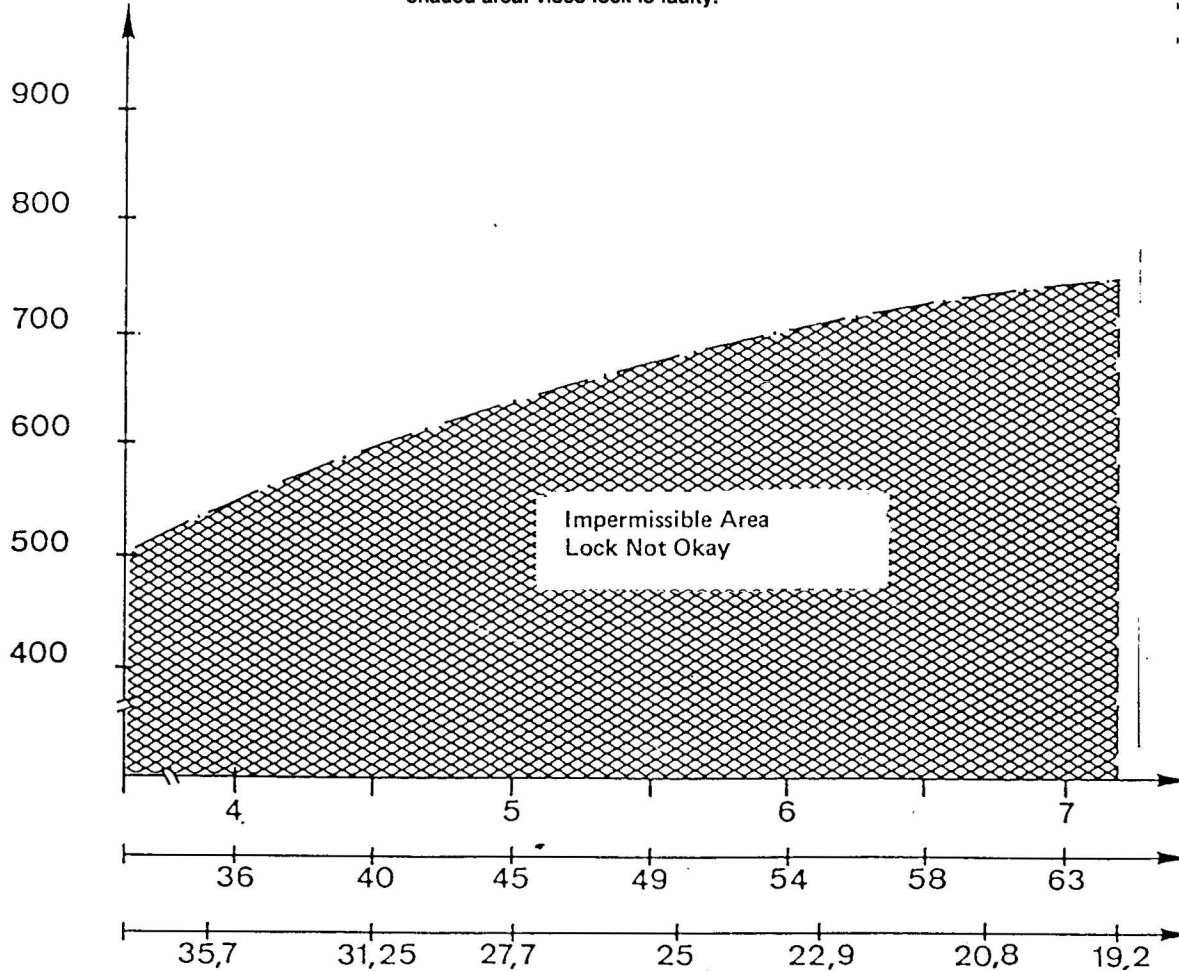
30 27 006

Read brake force of left or right wheel on the brake test stand.

Important!
Total running time = max. 40 seconds.

33-0/2

Enter period of time (ms) in diagram.
 Enter braking force (on brake test stand) in diagram.
 Condition of visco lock is seen at point of intersection of both lines.
 Example:
 Period of time for pulse wheel: 22 ms.
 Braking force of left or right wheel: 121 lbs..
 Intersection point of both lines in shaded area: visco lock is faulty.



No. of pulse wheel teeth: 48
 Rear wheels in brake stand rollers
 Front wheels on floor
 Ignition off
 1st gear
 Only one rear wheel driven
 Warm-up time approx. 30 sec.
 Testing time max. 10 sec.
 Total testing time 40 sec.
 Tested immediately after warm-up time
 Thirty minutes between two tests

33 10 010 REMOVING AND INSTALLING OR REPLACING FINAL DRIVE

Unscrew propeller shaft bolts.

Installation:
Replace self-locking nuts.
Tightening torque*.

Unscrew output shafts and suspend from car on pieces of wire.

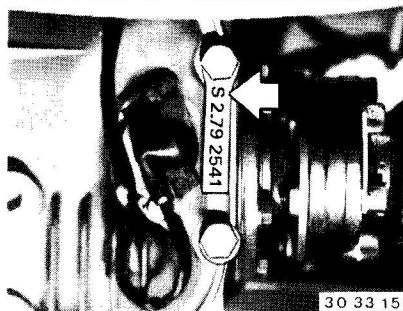
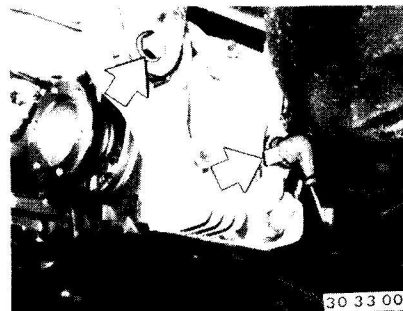
Installation:
Tightening torque*.

Unscrew bolts at top.

Installation:
First locate final drive on rear axle carrier with the top bolts.
Tightening torque*.

Support final drive with a garage jack. Unscrew front bolts on left and right sides.

Installation:
Tightening torque*



Pull off electric leads on speedometer pulse sender.
Unscrew rubber mount bolt and lower the final drive.

Installation:
Replace self-locking nut.
Tightening torque*.
Check oil level, correcting only with approved final drive gear lube - see Group 33 in Operating Fluids.
Amount of oil*.

Installation:
When replacing, check final drive ratio* and final drive version.
Ratio digits are stamped on data plate (1).

BREAKING-IN PROCEDURES AFTER REPLACING OR REPAIRING FINAL DRIVE

Strict conformance with these breaking-in procedures is required for preloading the tapered roller bearings.

During the first 1,000 km (600 miles) the car must be driven at different engine speeds and road speeds, but never faster than 2/3rds of the max. permissible speed in 4th gear (direct). For cars with a five speed manual transmission (with overdrive) 2/3rds of the max. permissible speed in 4th gear will be applicable to 5th gear.

If there is no conformance with these breaking-in procedures, there could be seizure between the tapered rollers and inner race guide band, which in turn will cause a continuous noise, overheating and oil leakage.

Install tag or label for next oil change in view of the driver.

* See Specifications

* See Specifications

31 11 151 REPLACING SHAFT SEAL FOR DRIVE FLANGE

Unscrew output shaft on drive flange and suspend it on a piece of wire.

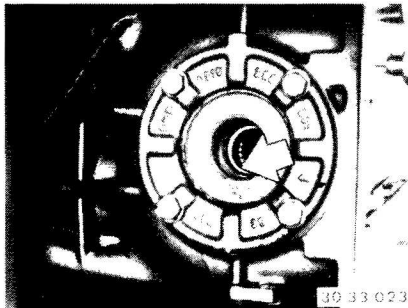
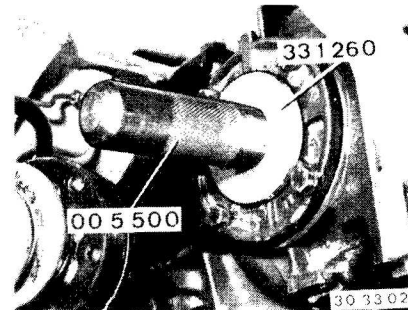
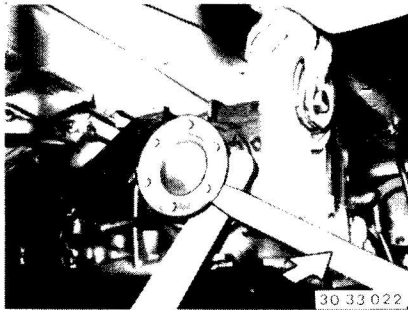
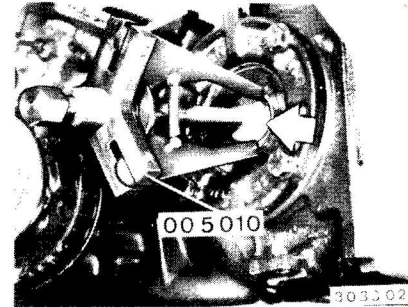
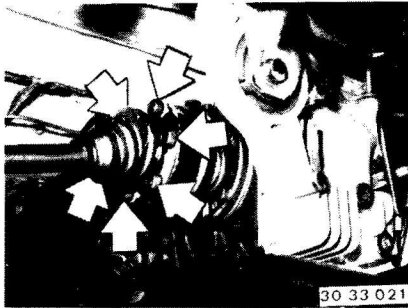
Installation:
Use washers.
Tightening torque*.

Press off drive flange with a tire iron.

Installation:
Place round wire snap ring in groove of the differential case in such a manner prior to installation of the drive flange that both ends of the snap ring are recessed in the groove. This prevents lateral bending of the ring.
Press in the drive flange by hand and also be turning slightly, until the snap ring is heard to engage.
Replace stretched snap rings.

Pull out the shaft seal with Special Tool 0 5 010 used together with a pressure piece.

Installation:
Dip the shaft seal in final drive gear lube.
Drive in shaft seal against stop with Special Tools 33 1 260 or 33 1 230 and 00 5 500.
Replace a drive flange with a seriously scored bearing surface.



33 17 001 REPLACING RUBBER MOUNT FOR FINAL DRIVE

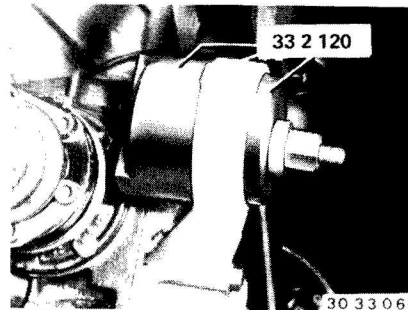
Loosen nuts on rear axle carrier.
Support final drive.

Installation:
Replace self-locking nuts.
Tightening torque*.

Pull off wires on speed pulse sender.
Remove rubber mount mounting bolt.

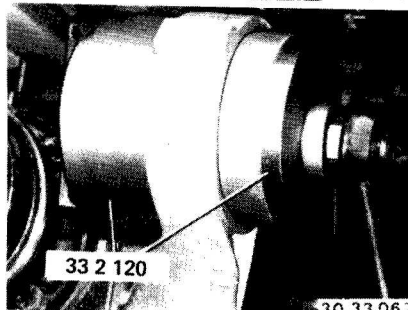
Installation:
Replace self-locking nut.
Tightening torque*.

Lower final drive.

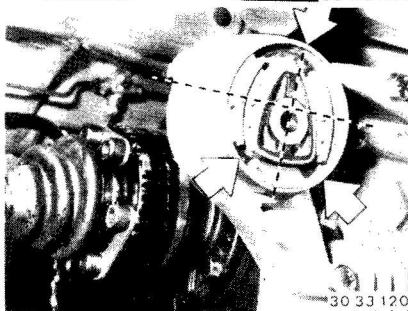


Press out rubber mount with Special Tool 33 2 120.

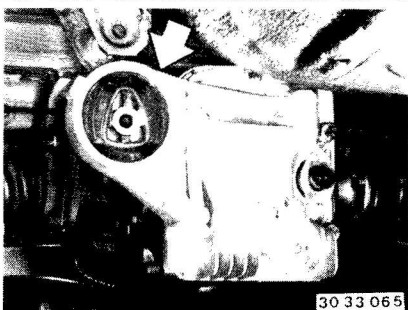
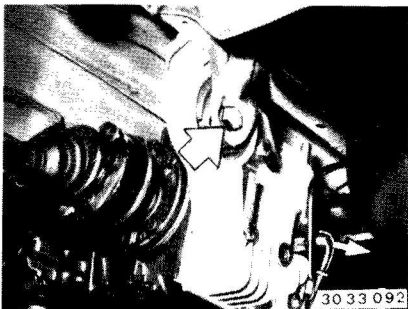
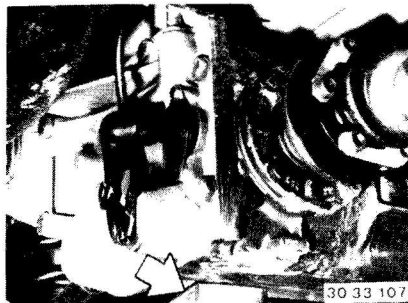
Note:
Rubber mount is eccentric.
Make sure special tool is applied correctly.



Pull in rubber mount with Special Tool 33 2 120.



Important!
Check installed position of rubber mount.



* See Specifications

33 21 000 REMOVING AND INSTALLING OUTPUT SHAFT

Remove wheel – see Group 36.
Lift out lockplate (1).
Unscrew nut (2).

Installation:
Lubricate bearing surface of nut with oil.
Tightening torque*.
Replace lockplate.

Disconnect output shaft on final drive and suspend with a piece of wire.

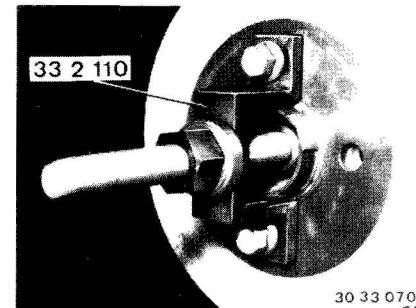
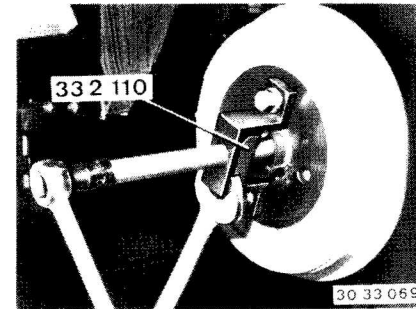
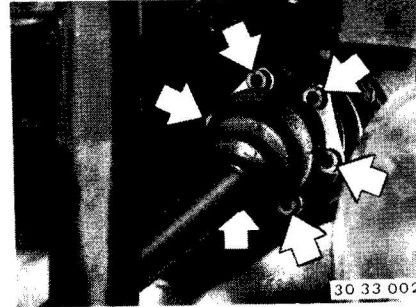
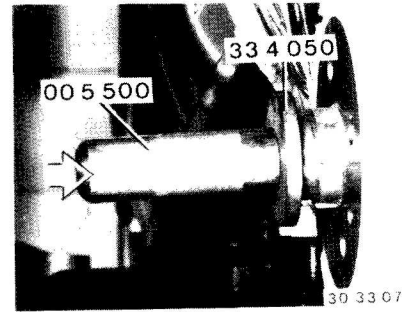
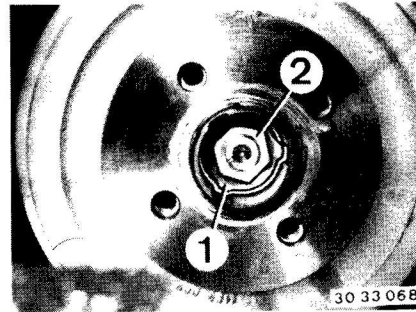
Installation:
Tightening torque*.

Press out output shaft with Special Tool 33 2 110.
(Use spindle 33 2 111, bridge 33 2 112 – deleted and replaced by 33 2 116, threaded element 33 2 113 – deleted and replaced by 33 2 117, and wheel bolts.)

Pull in output shaft with Special Tool 33 2 110, by first screwing in spindle 33 2 114 completely; using bridge 33 2 112 and nut 33 4 042.

* See Specifications

Knock in lockplate with Special Tools 33 4 050 and 00 5 000.



33 21 031 REPLACING DUST COVER

Remove output shaft – see 33 21 000.

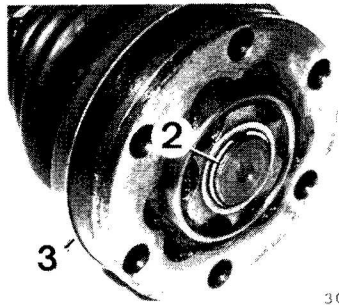
Important!
Stronger output shafts and joints are used in 325 IX models – don't mix them up.

Press off sealing cover (1).
Loosen retaining straps.



30 33 072

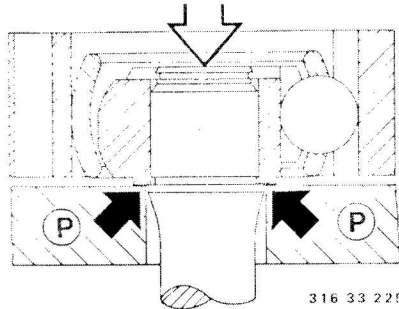
Remove circlip (2).
Press off cover (3) with dust cover.



30 33 073

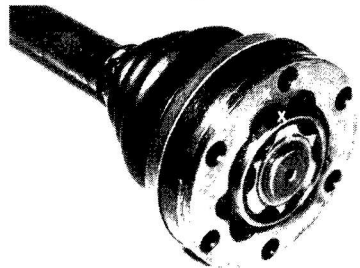
Press output shaft out of constant velocity joint.

Important!
Ball bearing hub must rest on counter-pressure plate (P).
Do not disassemble joint if not absolutely necessary.
Check joint for dirt or damage.

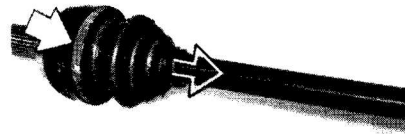


316 33 225

If joint has to be disassembled (dirt), mark position of ball bearing hub, cage and joint to each other on face end with an electric inscriber.
Cleanliness is essential when assembling.



30 33 074



30 33 075

Pull wheel end dust cover off of the output shaft.
Slide transmission end dust cover over splines of shaft.

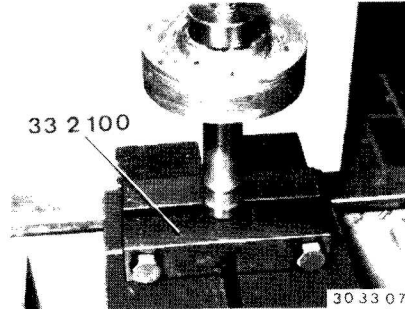
Important!
Be careful not to damage the new dust cover.
Use a suitable sleeve for protection on the sharp edges of the splined shaft.
Use repair kit.

Clean splines of joint to remove grease.
Coat splines with Loctite No. 270.

Important!
Keep Loctite out of ball passages.



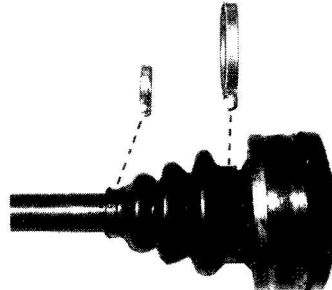
30 33 076



30 33 077

Press on joint with cap (3) while holding output shaft with Special Tool 33 2 100.
Insert circlip.

Pack joint and dust cover with grease*.
Clean sealing surfaces for dust cover to remove grease.
Coat large diameter end of dust cover with adhesive* and mount with new clamps.
Seal sealing cover with Curil and install.



30 33 051

* See Specifications

33 31 000 REMOVING AND INSTALLING REAR AXLE CARRIER ASSY.

Remove primary and final mufflers – see 18 12 000.
Remove heat shield.
Unscrew propeller shaft and center mount – see 26 11 000.

Installation:
Replace self-locking nuts.
Tightening torque*.

Remove parking brake lever.
Draw off brake fluid with a syringe used exclusively with brake fluids.
Disconnect brake pipes on left and right sides.

Installation:
Tightening torque*.
Fill brake system with brake fluid* and bleed.

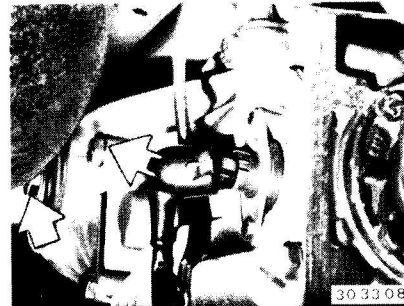
Support rear axle.
Unscrew thrust strut on left and right sides.

Installation:
Replace self-locking nuts.
Tightening torque*.

Note:
Remove rear seat cushion (52 20 000) when replacing staybolts.
Remove rear side trim panel (51 43 000) for convertibles.

If necessary, loosen clamp on rear axle carrier.

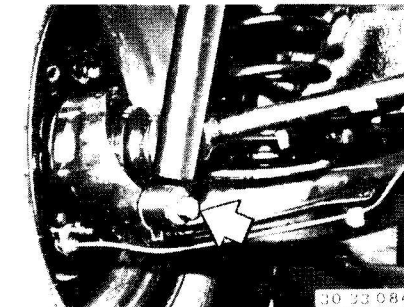
* See Specifications



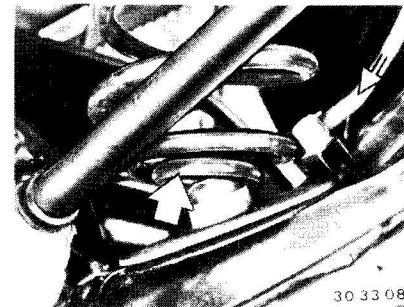
30 33 082



30 33 083



30 33 084



30 33 085

Pull off wires on speed pulse sender.
Unscrew mounting bolt on rubber mount.

Installation:
Replace self-locking nut.
Tightening torque*.

Cars with Rear Disc Brakes:
Disconnect plug for pad wear indicator.
If applicable, unscrew stabilizer on left and right sides.
Support both trailing arms, having wheels rest on floor if necessary.

Unscrew left and right shock absorbers on trailing arms.

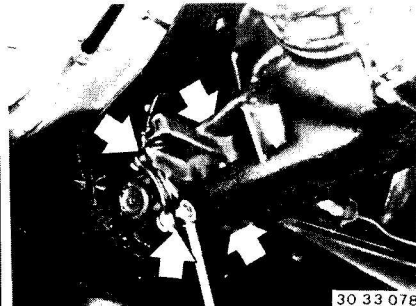
Caution!
Shock absorbers act as retaining straps.

Installation:
Tighten mounting bolts after lowering car that it rests on its wheels.
Tightening torque*.

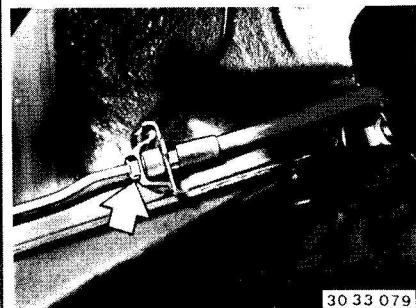
Lower rear axle carrier.
Pull parking brake cables out of the protective tube.

Caution!
This will release the rear axle coil springs.

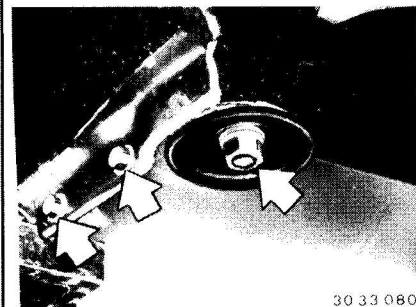
* See Specifications



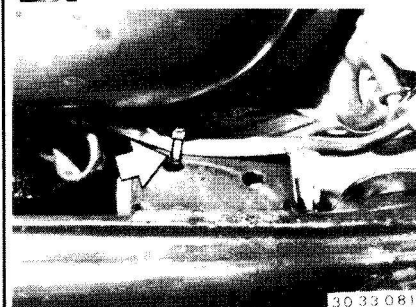
30 33 078



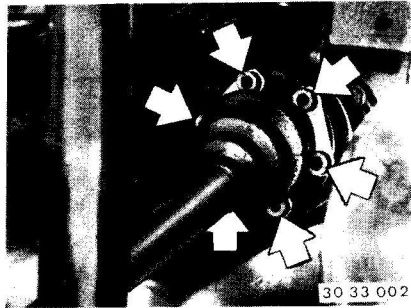
30 33 079



30 33 080



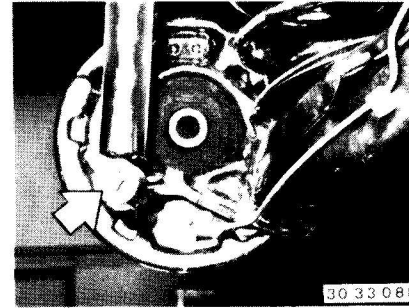
30 33 081



33 32 000 REMOVING AND INSTALLING TRAILING ARM ASSEMBLY

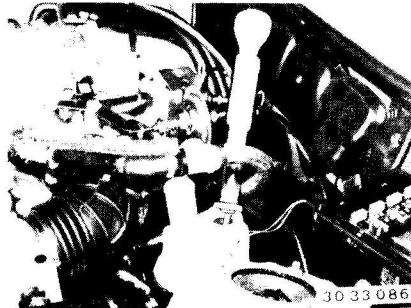
Remove rear wheel – see 36 10 300.
Apply parking brake and remove output shaft assembly – see 33 21 000.

Installation:
Tightening torque*.



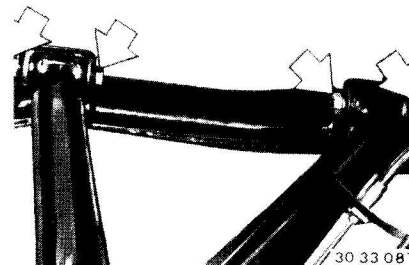
Support trailing arm.
Unscrew shock absorber and lower the trailing arm.

Installation:
Tightening torque*.



Remove parking brake lever – see 34 41 000.
Draw off brake fluid in tank with a syringe used exclusively with brake fluid.
Remove filter sleeve.

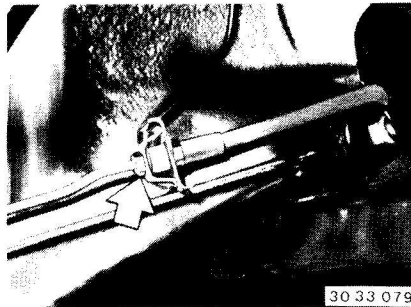
Installation:
Fill brake system with brake fluid* and bleed.



Unscrew trailing arm on rear axle carrier.

Installation:
Guide in bolt on inner console first.

Important!
Tighten bolts with car in normal position**.
Tightening torque*.

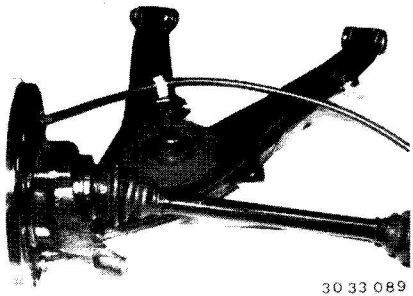


Disconnect brake pipe.

Installation:
Tightening torque*.

* See Specifications

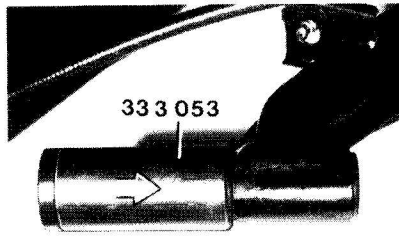
* See Specifications
** See Specifications of Gr. 32



30 33 089

33 32 021 REPLACING TRAILING ARM

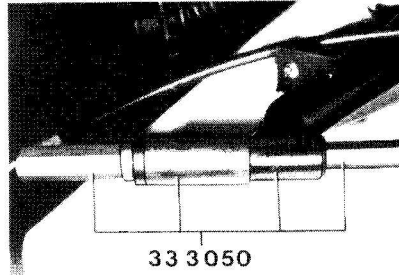
Remove trailing arm – see 33 32 000.
 Replace wheel bearings and shaft seals – see 33 41 151.
 Transfer guard.



33 3 053

33 32 561 REPLACING BOTH SILENT BLOCKS – Trailing Arm Removed –

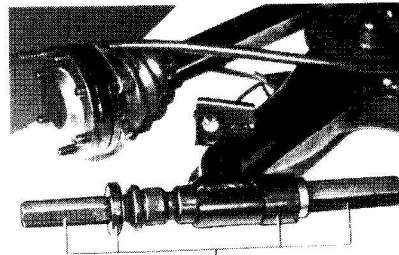
Coat collar in Special Tool 33 3 053 with water and slide over bead of silent block.



30 33 090

33 3 050

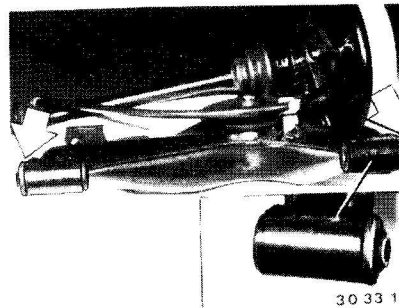
Pull out silent block with Special Tool 33 3 050.



30 33 091

33 3 050

Give new silent blocks a thin coat of Cresta, lubricating oil II or relaxed water.
 Pull in silent blocks with Special Tool 33 3 050, using thrust washer (1) and bushing (2) with two tabs.



30 33 118

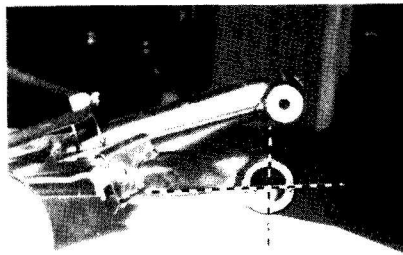
Installation:
 Collar end of silent blocks always faces out.

30 33 119

Eccentric silent blocks could be installed to correct the rear axle toe deviation caused by summation of unfavorable tolerances.

Important!

Changes in alignment geometry caused by damage in an accident may never be "eliminated" with this measure.



30 33 034

Mark horizontal position of trailing arm to trailing arm eye.

Check rear wheel alignment with optical tester – see 32 00 . . .

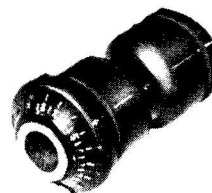
Determine correction value.

Example:

Actual value, left rear + 2.5 mm (0.098")

Nom. value, left rear + 2.0 mm (0.079")

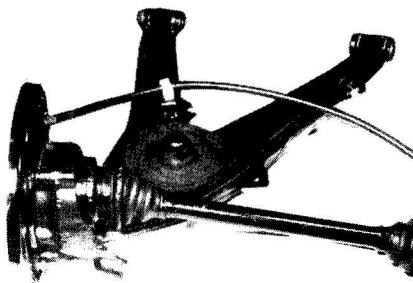
Correction value - 0.5 mm (0.019")



730 33 181

Use pertinent angle displacement from following diagram.

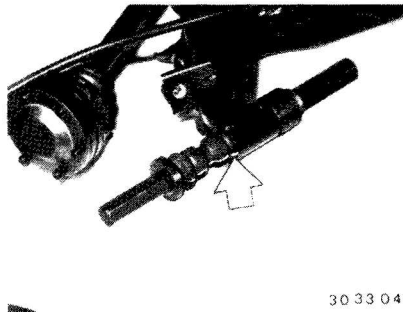
Connect numbers for toe correction on both sides of silent block with lines.



30 33 089

Remove rear wheel – see 36 10 300.

Remove trailing arm – see 33 32 000.

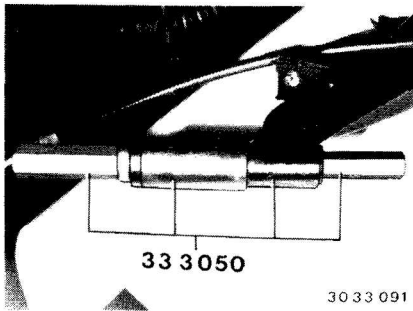


30 33 040

Coat silent block with diluted Cresta, lubricating oil II or relaxed water.

Apply silent block on trailing arm that drawn line aligns with mark on trailing arm and pull in with Special Tool 33 3 050.

Mount trailing arm and check rear wheel toe.



33 3 050

30 33 091

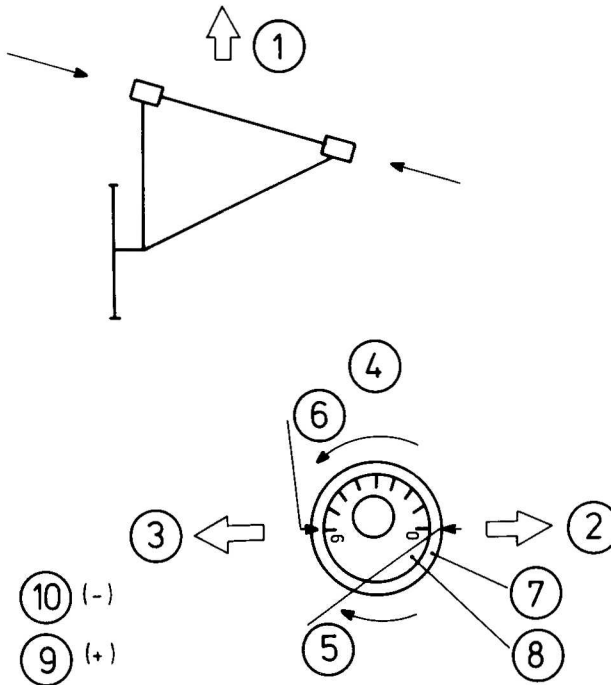
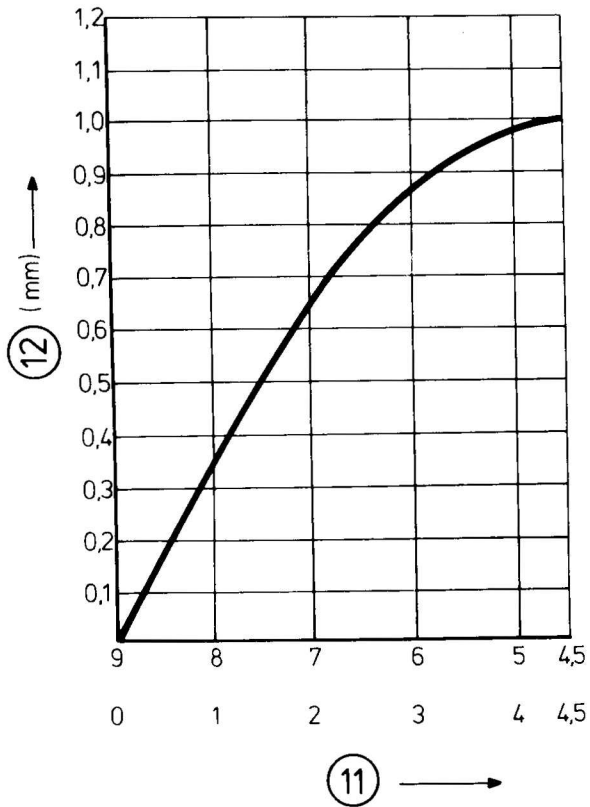
Pull out silent block with Special Tool 33 3 050.

If the adjustment on the outer silent block is not sufficient, an eccentric silent block could also be installed on the inside.

33-10

CHANGING TOE ON "LEFT" WHEEL

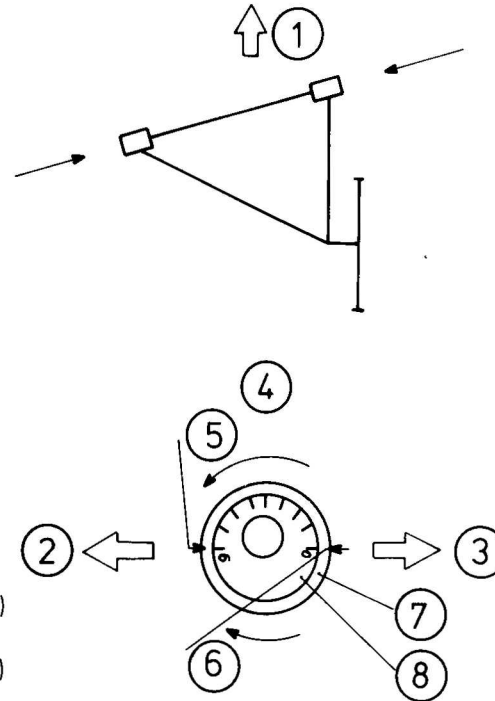
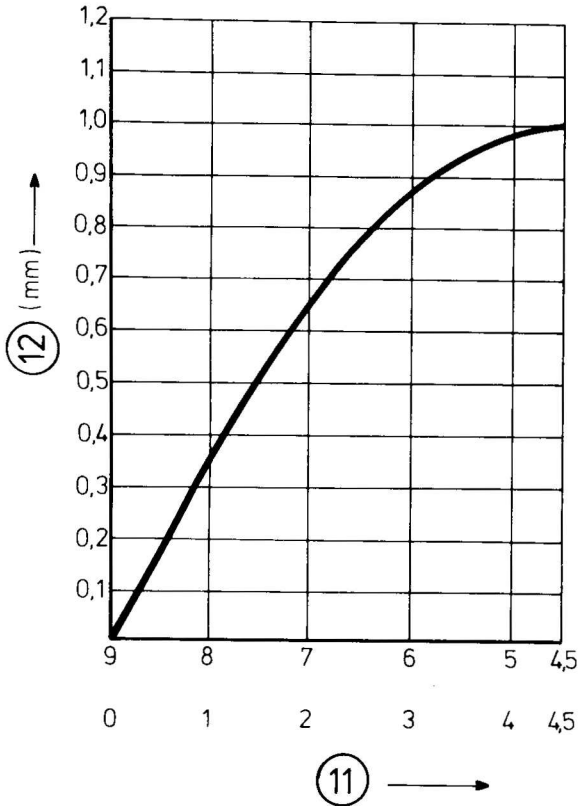
- 1 Forward direction
- 2 Forward direction - inner silent block
- 3 Forward direction - outer silent block
- 4 Pressing-in note
- 5 Reading point - toe increase
- 6 Reading point - toe decrease
- 7 Trailing arm eye
- 8 Silent block
- 9 Toe Increase
- 10 Toe decrease
- 11 Displacement angle
- 12 Toe change



33-11

CHANGING TOE ON "RIGHT" WHEEL

- 1 Forward direction
- 2 Forward direction-Inner silent block
- 3 Forward direction-outer silent block
- 4 Pressing-in note
- 5 Reading point - toe increase
- 6 Reading point - toe decrease
- 7 Trailing arm eye
- 8 Silent block
- 9 Toe increase
- 10 Toe decrease
- 11 Displacement angle
- 12 Toe change



33 33 071 REPLACING RUBBER MOUNT FOR REAR AXLE CARRIER

Remove rear seat cushion – 52 20 000.
 Convertibles:
 Remove rear side trim panel – see 51 43 000.
 Support trailing arm.
 Unscrew thrust strut.

Installation:
 Replace self-locking nuts.
 Use washers.
 Tightening torque*.

Drive out threaded pin upwards.

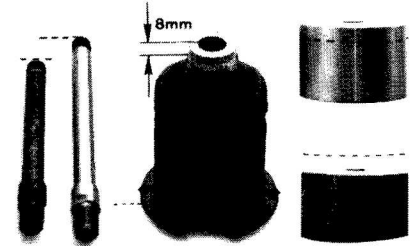
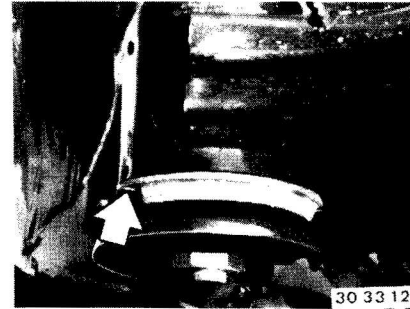
Important!
 Be careful not to damage threads.
 If applicable, cut off protruding rubber in openings.

Place Special Tool 33 3 111 between body and rear axle carrier on rubber mount and screw in Special Tool 33 3 101.

Important!
 Flat sides of Special Tool 33 3 111 must face in direction of openings.
 Apply Special Tool 00 8 550 with claws in openings, bolt down with Special Tool 33 3 101 and pull out rubber mount.

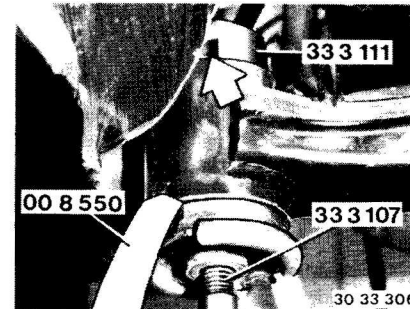
Place Special Tool 33 3 113 between body and rear axle carrier on edge of bushing and screw in Special Tool 33 3 103.
 Coat rubber mount with diluted Cresta, lubricating oil II or relaxed water and apply on rear axle carrier.
 Pull in rubber mount with Special Tools 33 3 112 and 33 3 104.

* See Specifications

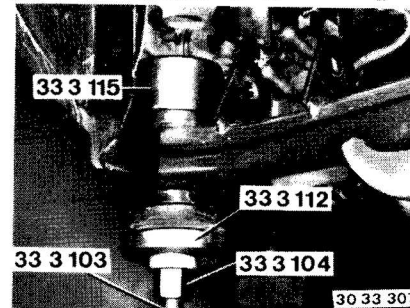


Installation:
 Check installed position of rubber mount opening in rear axle carrier.

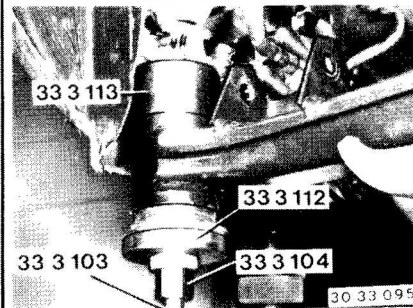
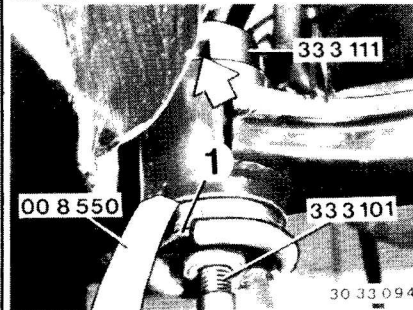
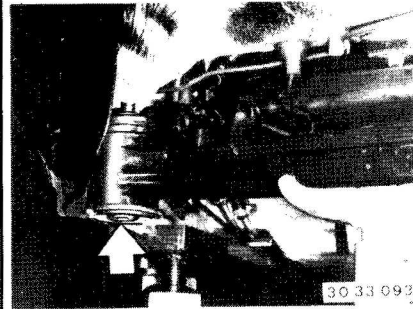
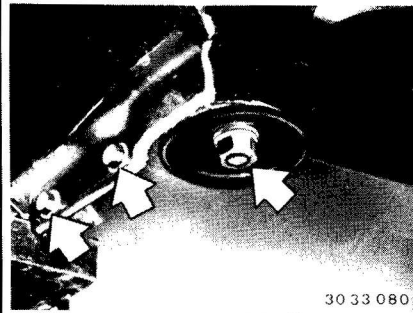
BMW 325 iX:
 The rubber mount is 8 mm (0.315") higher.



Special Tool 33 3 107 with a longer threaded spindle is required together with Special Tools 33 3 111 and 00 8 550 for pulling out.



New Special Tool 33 3 115 is required together with Special Tool 33 3 103 of Special Tool 33 3 112 and Special Tool 33 3 104 for pulling in the rubber mount.

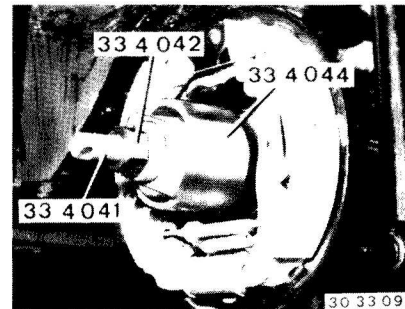


33-14

33 41 151 REPLACING WHEEL BEARINGS AND SHAFT SEAL

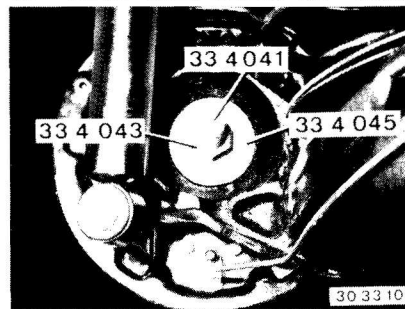
Remove output shaft assembly – see 33 21 000.
Remove brake drum.

323 i, 325 e/i and Cars with ABS:
Remove brake disc.
Loosen exhaust assembly.



Pull out wheel bearings with Special Tool 33 4 040.

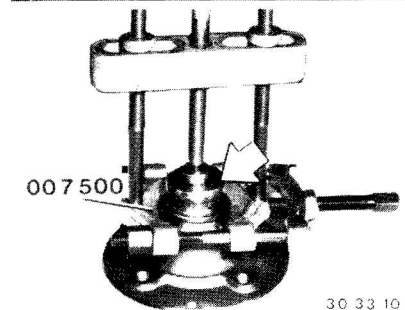
323 i, 325 e/i and Cars with ABS:
Use Special Tool 33 4 031 beginning with 1986 models.



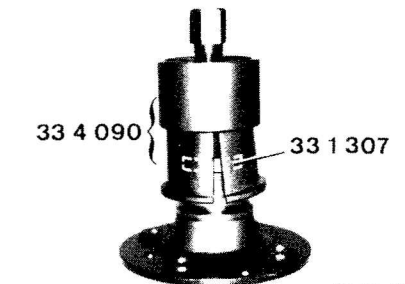
Use Special Tool 33 4 045.

Drive out stub shaft with Special Tool 33 4 010.

Lift out circlip.

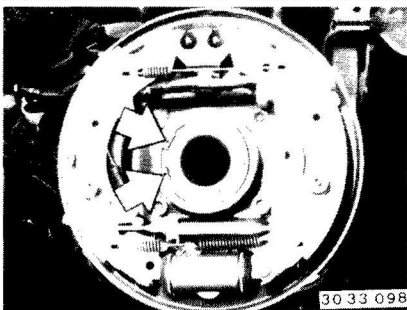
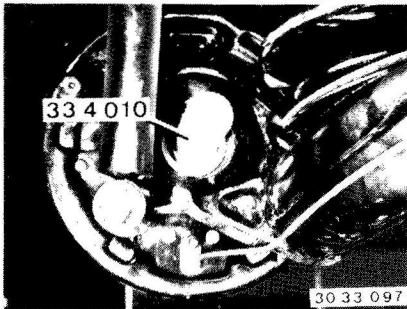
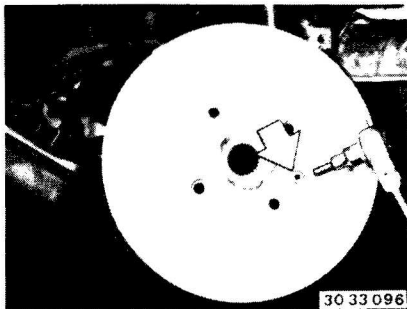


If applicable, pull inner bearing shell off of stub axle with Special Tool 00 7 500 and a thrust piece.



323 i, 325 e/i and Cars with ABS beginning with 1986 Models:
Use Special Tools 33 4 090 and 33 1 307.

30 33 161



Pull in wheel bearing assembly with Special Tool 33 4 040.

323 I, 325 e/I and Cars with ABS beginning with 1986 Models:
Use Special Tool 33 4 049.

Apply Special Tool 33 4 047.

Insert circlip.

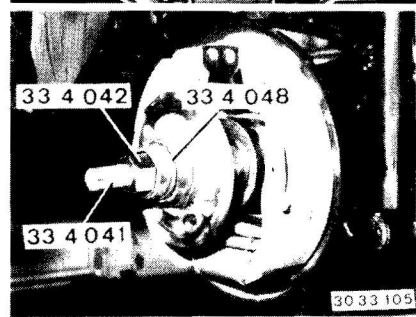
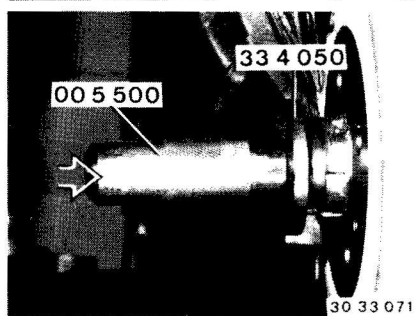
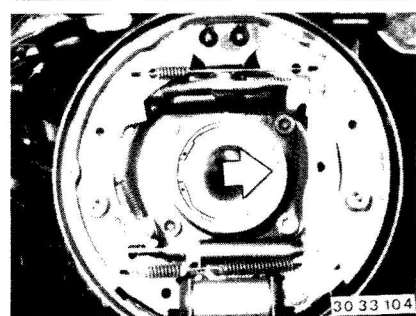
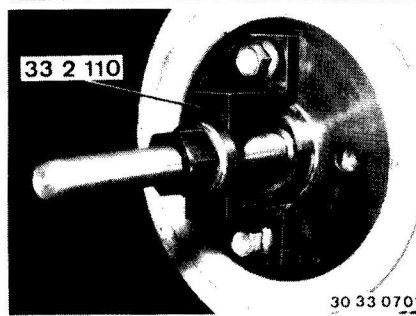
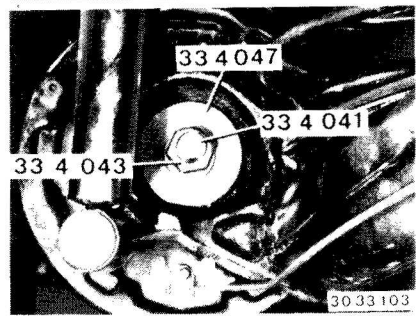
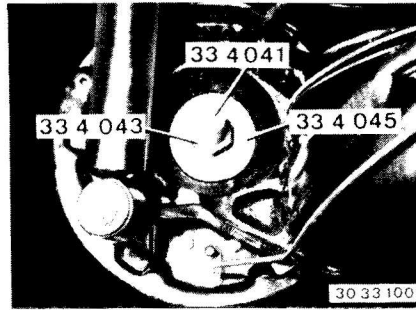
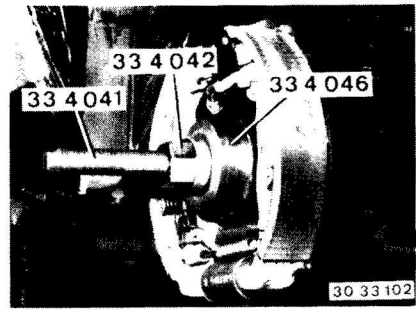
Pull in rear axle shaft with Special Tools 33 4 040 and 33 4 048.

Use Special Tool 33 4 045.

Install output shaft, pulling in with Special Tool 33 2 110.
Tightening torque*.

Drive in lockplate with Special Tools 33 4 050 and 00 5 000.

* See Specifications



33 52 000 REMOVING AND INSTALLING REAR SHOCK ABSORBERS

Support semi-trailing arm (or have road wheel rest on floor).
Unscrew shock absorber on semi-trailing arm.

Caution!

Shock absorber acts as a retaining strap. Do not remove the support or lift the car, to avoid damage on constant velocity joints.

Installation:

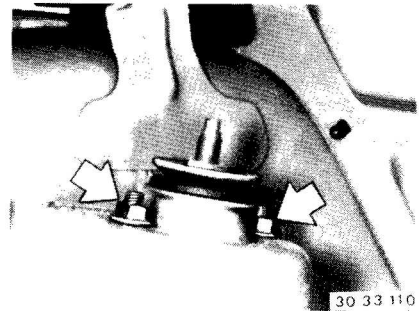
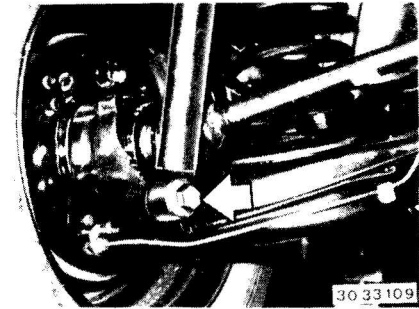
Tighten shock absorbers with car loaded down to normal position**.
Tightening torque*.

Important!

Always store shock absorbers standing upright. If shock absorbers are stored laying down with their piston rods run in, they will cause knocking noise when used in car.

Remedy:

Store shock absorbers with run out piston rods standing upright at room temperature for at least 24 hours.



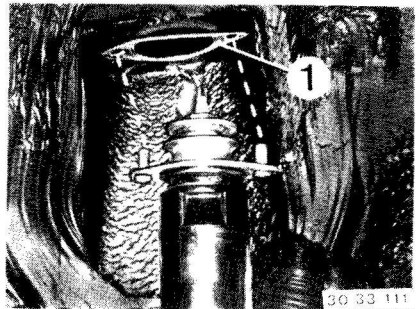
Remove trunk trim panel partially - see Group 51.

Additional for Touring Models:

Remove side backrest - see Gr. 52.
Remove seat belt reels - see Gr. 72.
Unscrew centering shell on wheel house.

Installation:

Replace self-locking nut.
Tightening torque*.



Remove shock absorber.

Important!

Replace gasket (1).

* See Specifications

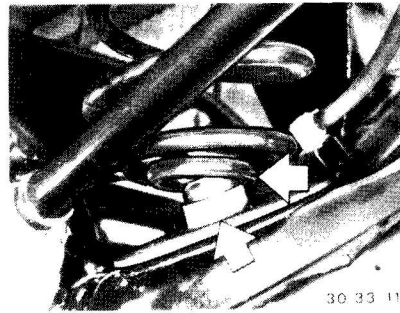
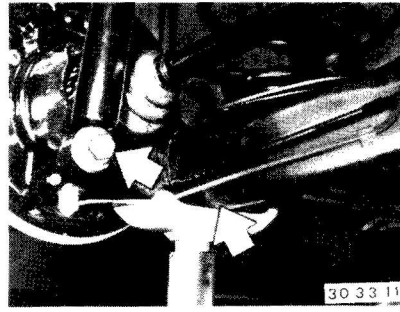
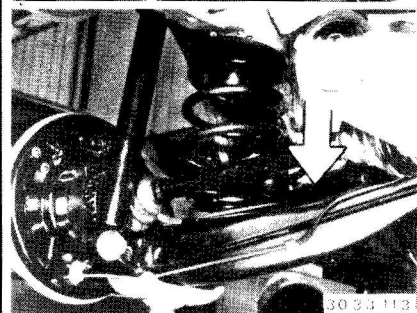
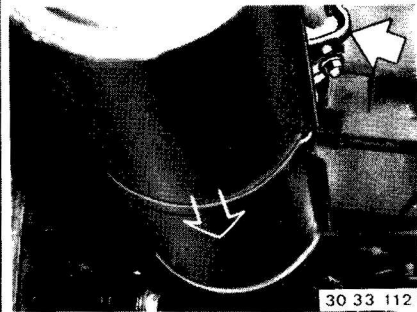
** See Specifications of Gr. 32

**33 53 000 REMOVING AND INSTALLING
OR REPLACING LEFT OR
RIGHT REAR COIL SPRING**

Disconnect and suspend exhaust
assembly with a piece of wire.

Unscrew final drive rubber mount and
push down.
Hold down with a wedge of wood or
similar item.

If applicable, unscrew stabilizer.



Support trailing arm.

Important!
Don't damage the brake pipe.

Unscrew shock absorber on trailing
arm.

Important!
Only lower trailing arm enough to be
able to remove the coil spring.
The output shaft joints could be da-
maged when lowered too far.

Installation:
Check installed position of coil spring.

Important!
Check surface of springs for damage.
Replace damaged springs.

Only install coil springs with the same
BMW number*, same color code* and
correct rubber ring*.

TROUBLESHOOTING REAR AXLE

Condition	Cause	Correction
Load change knock	Backlash excessive. Output shaft faulty. Play in propeller shaft slide.	Adjust backlash – see 33 12 551. Replace output shaft – see 33 21 000. Install slide with Loctite No. 75 for joints.
Noise when accelerating or decelerating	Backlash excessive or insufficient.	Adjust backlash – see 33 12 551.
Drumming	Propeller shaft. Rubber mount on rear axle carrier faulty.	See "Troubleshooting Propeller Shaft". Replace rubber mount – see 33 33 071.
Oil loss	Radial oil seals leak. Vent clogged. Oil grade* incorrect.	Replace radial oil seals. Clean vent, see Service Information of Group 33. Replace final drive gear lube.
Vibration	Wheels unbalanced. Output shaft faulty. Propeller shaft.	Balance wheels; replace wheel rims when necessary. Replace output shaft – see 33 21 000. See "Troubleshooting Propeller Shaft".
Rattling noise	Shock absorber mounting parts loose. Upper shock absorber mount faulty. Lower shock absorber rubber mount faulty. Rubber mount on rear axle carrier faulty. Shock absorber faulty or worn.	Tighten shock absorbers. Replace rubber mount. Replace shock absorber – see 33 52 100. Replace rubber mount – see 33 33 071. Test shock absorbers – see Service Information of Group 37. If applicable, replace shock absorbers – see 33 52 000.
Grinding noise only when driving in curves	Wheel bearings faulty.	Replace wheel bearings – see 33 41 141.
* See Specifications		

33 11 511 REPLACING SHAFT SEAL AND INPUT FLANGE - Final Drive Removed -

Mount final drive on Special Tool 33 1 010.
 Drain oil.
 Unscrew case cover.
Installation:
 Replace gasket.
 Tightening torque*
 Pour in correct volume* of oil – see Group 33 in Operating Fluids.

Press off drive flange with a tire iron.

Mark both bearing covers with punch marks.
 Unscrew both bearing covers.

Important!
 Don't mix up bearing covers and shims.
 Secure shims on bearing cover with a piece of wire, if necessary.

Installation:
 Tightening torque*.

The differential bearing and backlash are adjusted with shims (1).
 Check O-ring (2), replacing if necessary.

* See Specifications

Remove the complete differential.

Important!
 Don't bend the pulse spider.

Lift out lockplate.

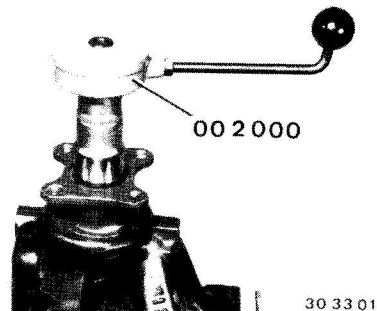
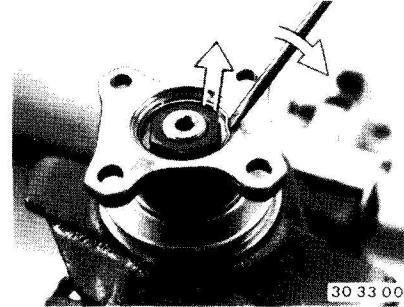
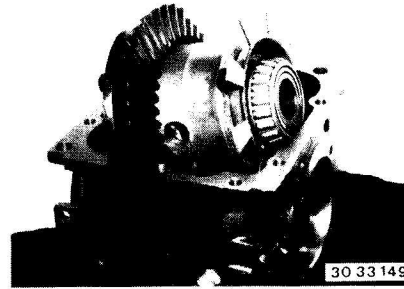
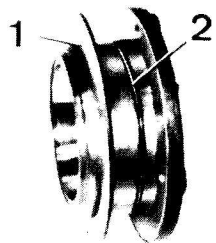
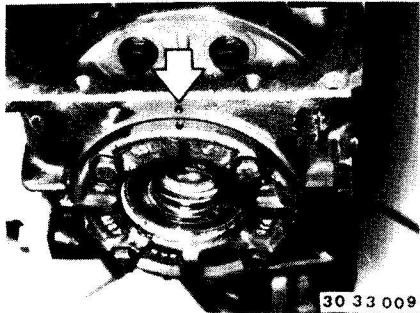
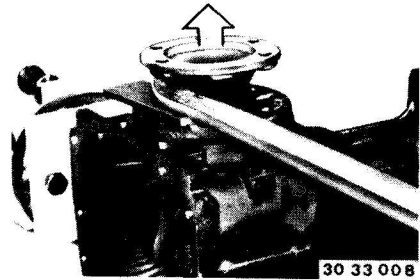
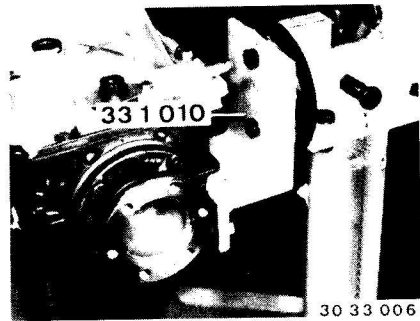
Check friction torque with Special Tool 00 2 000 and note the value.

Important!
 The measured friction torque + friction torque for the new shaft seal = 20 Ncm (17 in. lbs.) must be reached during installation, but not exceeded.

Hold the drive flange with Special Tool 23 0 020 and unscrew the collar nut.

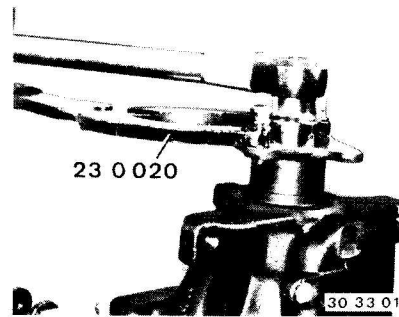
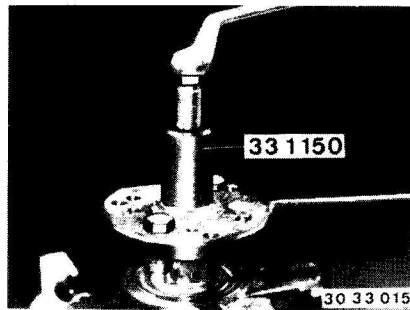
Installation:
 Tightening torque*.

* See Specifications



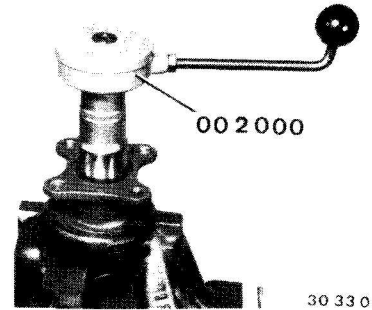
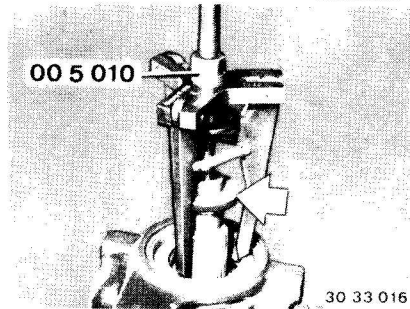
33-102

Pull off input flange with Special Tool 33 1 150.



Tighten input flange with the collar nut in steps, measuring the friction torque between steps.

Pull out shaft seal with Special Tool 00 5 010 and a thrust piece.

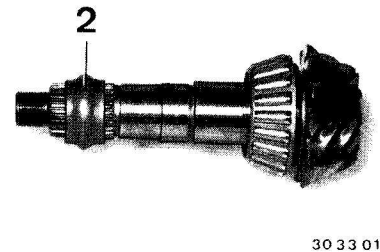
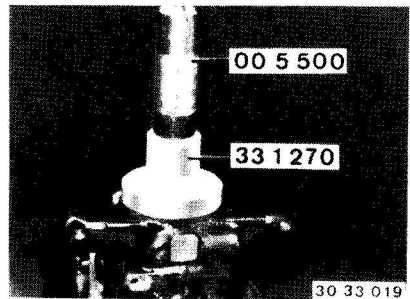


Adjust drive pinion bearing to friction torque value measured prior to disassembling and add 20 Ncm (1.7 in. lbs.) for a new shaft seal.

Example:

Measured torque	60 Ncm (5.2 in. lbs.)
New shaft seal	+ 20 Ncm (1.7 in. lbs.)
Pinion bearing adjusted to	80 Ncm (6.9 in. lbs.)

Dip shaft seal in final drive gear lube and drive in seal flush with Special Tools 33 1 270 and 00 5 500.

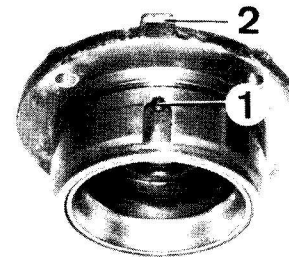
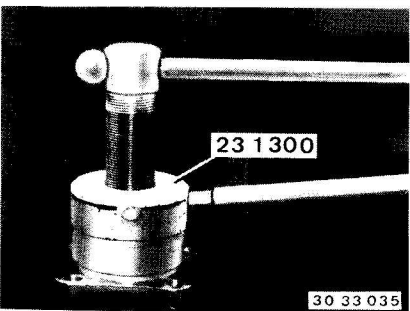


If the friction torque value (see example) is exceeded, replace bushing (2) and repeat the measuring procedures. This requires removing and installing the drive pinion - see 33 12 551.

Installation:

Drive in new lockplate with Special Tools 33 4 050 and 00 5 500.

Press new input flange on to the input shaft with Special Tool 23 1 300, but do not tighten. The bushing does not have to be replaced when replacing the input flange.



Installation:

Install the complete differential again, checking for correct installation of bearing caps.

The differential bores (1) always face up when the differential is installed correctly and this can be seen on the outside by way of tab (2). If applicable, check backlash and tooth contact pattern. See 33 12 551 for additional information.

33 11 512 REPLACING SHAFT SEAL FOR INPUT FLANGE - Final Drive Removed -

Mount final drive on Special Tool 33 1 010.
Drain oil.

Installation:
Pour in correct volume* of oil - see Group 33 in Operating Fluids.

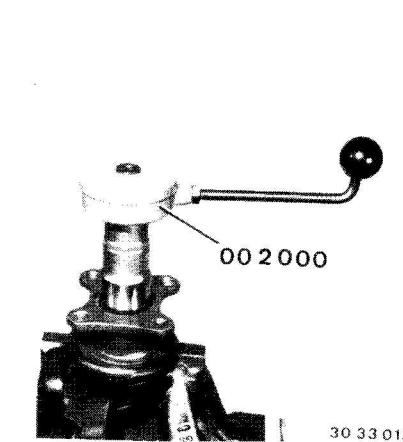
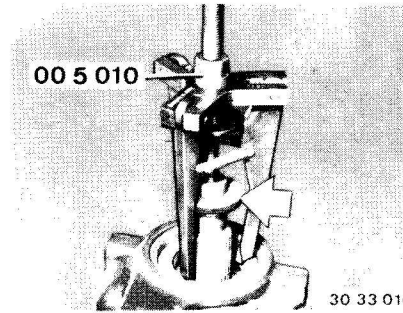
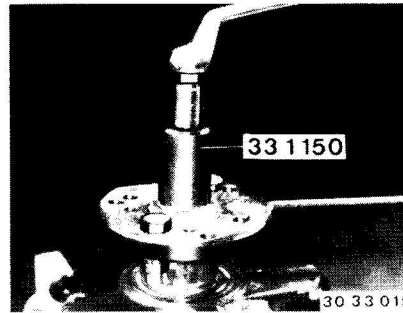
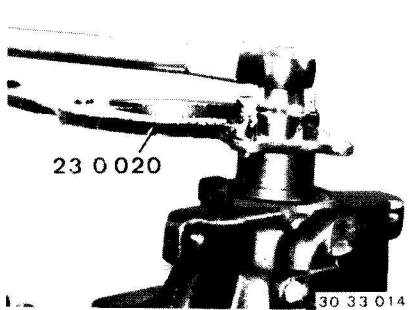
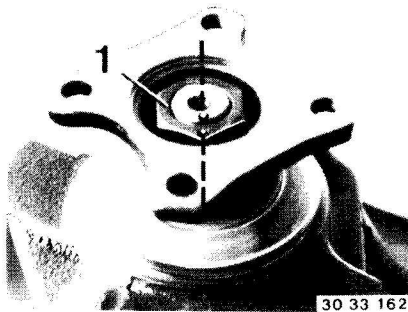
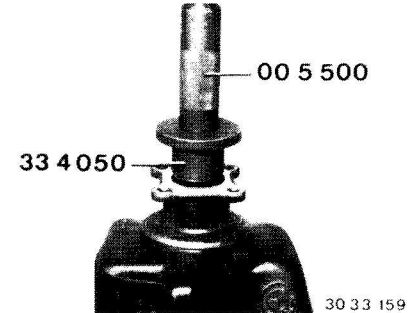
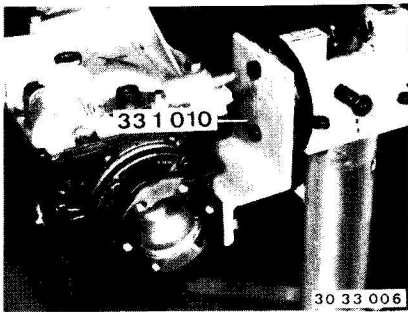
Lift out lockplate.

Installation:
Drive in new lockplate with Special Tools 33 4 050 and 00 5 500.

Punch mark position of nut (1) to the input shaft.

Unscrew nut (1), counterholding on the flange with Special Tool 23 0 020.

* See Specifications



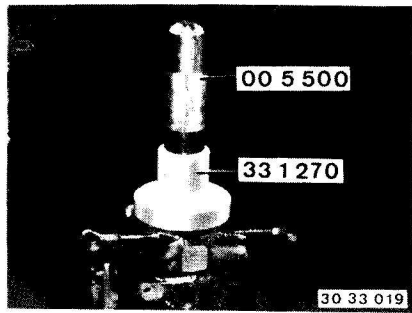
Pull off input flange with Special Tool 33 1 150.

Pull out shaft seal with Special Tool 00 5 010 and a suitable thrust piece.

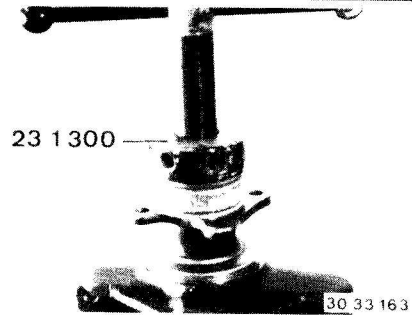
Installation:
If the bearing surface on the input flange is scored seriously, replace the input flange.

Important!
If the input flange has to be replaced, measure the friction torque with the old input flange. If applicable, tighten nut to the punch mark, measure and note the friction torque value - see 33 11 011. The old shaft seal does not have to be installed for measuring.

Dip new shaft seal in final drive gear lube** and drive in seal flush with Special Tools 33 1 270 and 00 5 500.



Press on input flange, if necessary with Special Tool 23 1 300; do not tighten.



Tighten input flange with collar nut (1) and then turn nut further until punch marks are aligned precisely.

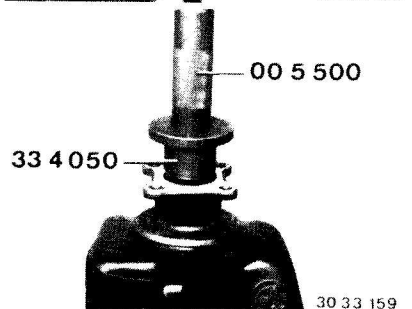
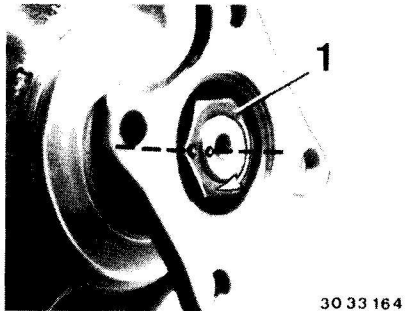
Caution!

Never tighten collar nut past the punch marks and then back again, since then the bushing will have to be replaced - see 33 12 551.

Installation:

Replace lockplate.

Fill final drive with gear lube**.



** See Gr. 33 in Operating Fluids

33-105

33 11 621 REPLACING SHAFT SEAL FOR DRIVE FLANGE - Final Drive Removed -

Mount final drive on Special Tool 33 1 010.

Press off drive flange with tire irons.

Installation:

Prior to installation of the drive flange, place wire snap ring (1) in groove of the differential case that both ends of the wire snap ring are recessed in the groove.

This will prevent lateral bending of the ring.

Press in drive flange by hand and turn slightly until the wire snap ring is heard to engage.

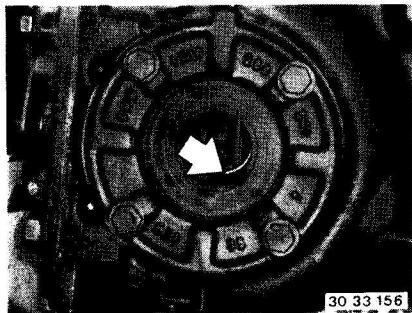
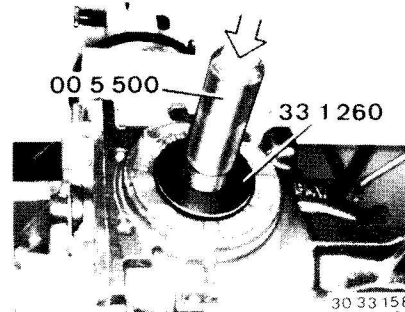
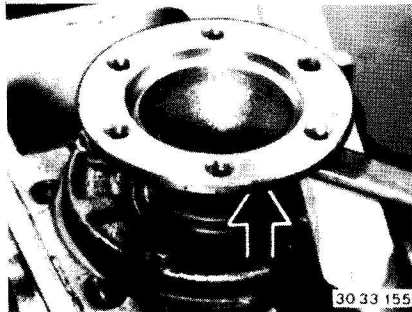
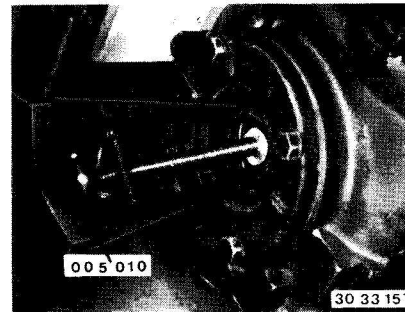
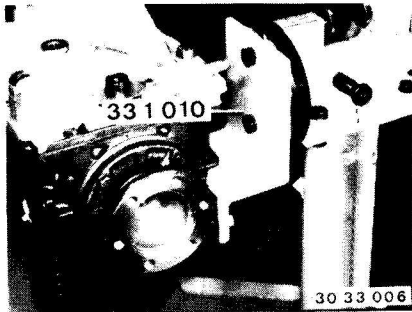
Replace stretched snap rings.

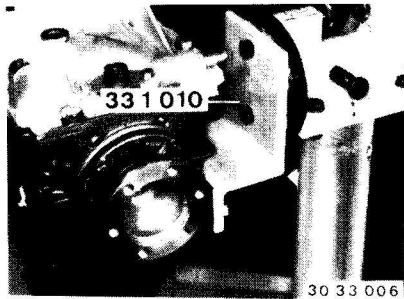
Pull out shaft seal with Special Tool 00 5 010 in conjunction with a thrust piece.

Installation:

Dip shaft seal in final drive gear lube. Drive in shaft seal against the stop with Special Tools 33 1 260 and 00 5 500.

Replace a drive flange with a seriously scored bearing surface.

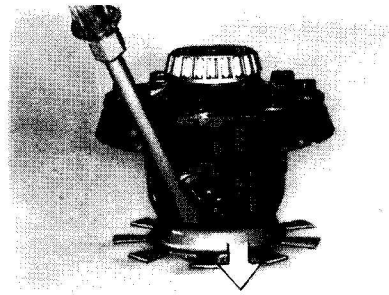




30 33 006

33 11 731 REPLACING BOTH BEARINGS FOR DIFFERENTIAL CASE - Final Drive Removed -

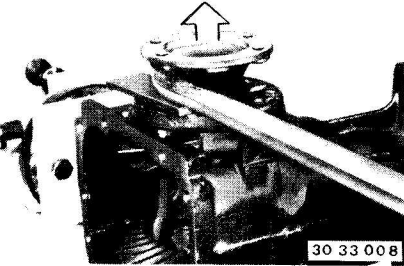
Mount final drive on Special Tool 33 1 010.
Drain oil.
Unscrew case cover.



30 33 011

Press pulse spider off of differential case.

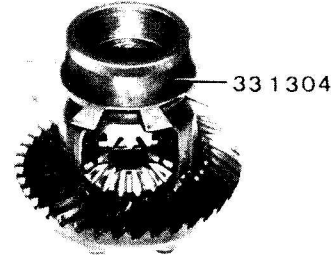
Important!
Don't bend the pulse spider.



30 33 008

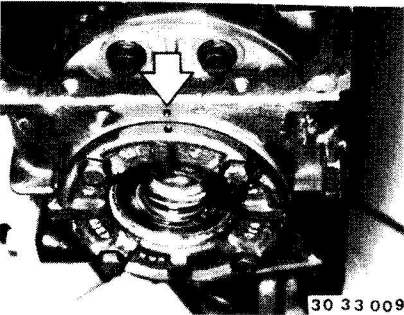
Installation:
Replace gasket.
Tightening torque*.
Pour in correct amount* of gear lube - see Gr. 33 in Operating Fluids.

Remove the complete differential - see 33 13 010.
Pry off drive flanges with a tire iron for this purpose.



30 33 012

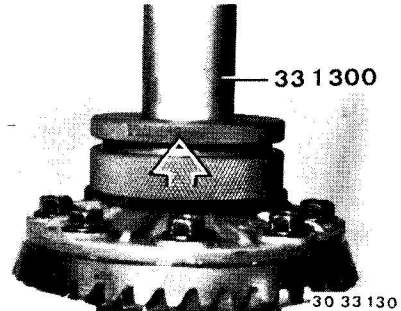
Installation:
Press on pulse spider with Special Tool 33 1 304.



30 33 009

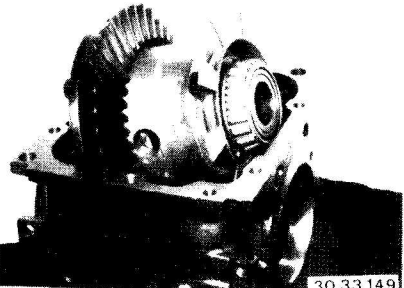
Punch mark bearing caps and remove them.

Important!
Don't mix up bearing caps and shims to make determination of the friction torque easier.



30 33 130

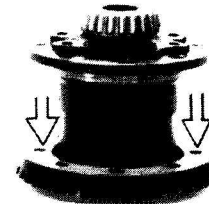
Pull off tapered roller bearing on differential case with Special Tool 33 1 300.



30 33 149

Remove complete differential case.

Important!
Don't bend the pulse spider.



30 33 309

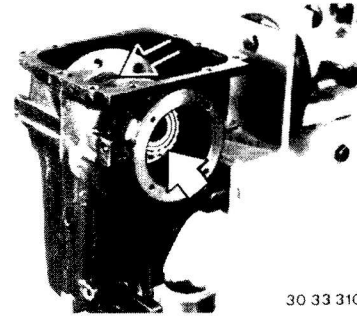
Remove ring gear (cold).

* See Specifications

33-107

Installation:
Press on new tapered roller bearings cold with Special Tool 33 1 020.

Important!
Always only install both bearings of same make.

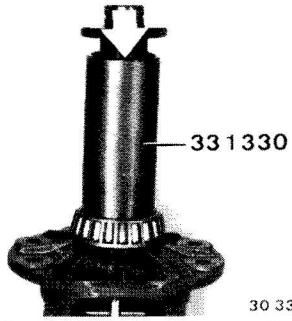


30 33 310

If only differential bearings are being replaced, the drive pinion can remain installed and the differential case is installed without the ring gear to determine the thickness of shims.

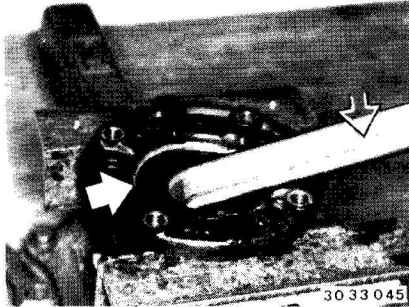
Important!
Note make of bearings - needed for friction torque determination.

Lubricate new bearings with approved final drive gear lube** thoroughly and let them drip dry.



30 33 044

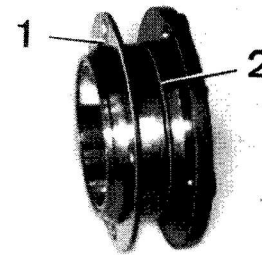
Lift shaft seals out of both bearing caps.



30 33 045

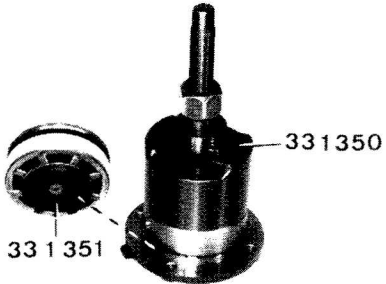
Press out bearing outer races with Special Tools 33 1 350 and 33 1 351.

Important!
Puller must engage in the bearing outer race.



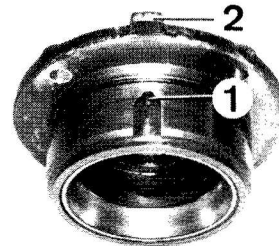
30 33 048

Install side bearing caps as marked with corresponding shims (1), but without O-rings (2) at first. Tighten bolts of bearing cap opposite the ring gear end uniformly. Tightening torque*.



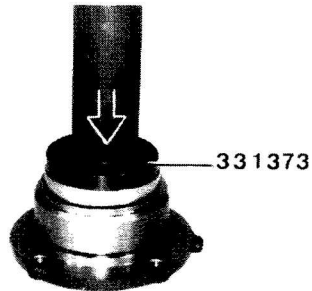
30 33 046

Installation:
Press in new bearing outer races with Special Tool 33 1 373.



30 33 148

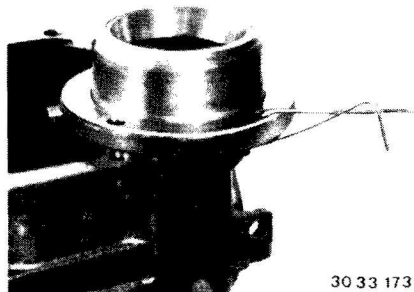
Compensating bores (1), recognized on the outside by tab (2), always face up in the installed position of the transmission.



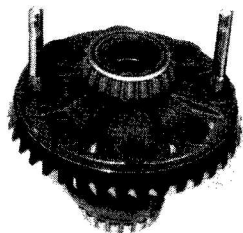
30 33 047

* See Specifications
** See Gr. 33 in Operating Fluids

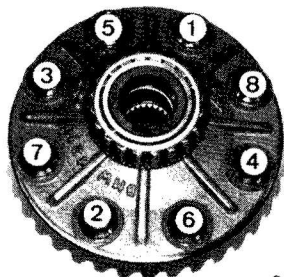
Remove differential case.
Arrange side covers and shims of determined thickness and don't mix them up.



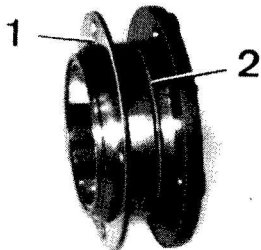
30 33 173



30 33 041



30 33 042



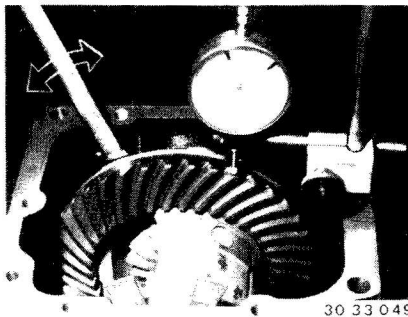
30 33 048

Installation:
Clean tapped bores thoroughly (with taper).
Heat ring gear to max. 100° C (212° F), checking temperature with a thermocolor pencil.
Mount ring gear with two locally manufactured staybolts for guiding.

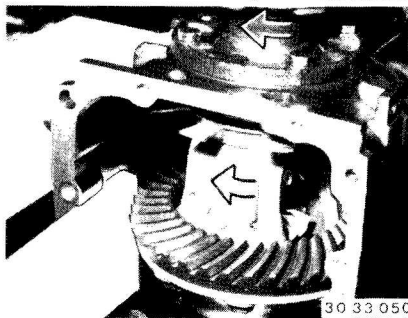
Install new bolts with Loctite No. 270.
Tighten bolts in order of 1 ... 8.
Tightening torque*.
Then tighten bolts with torque angle*.

Install differential with ring gear and pulse gear.
Install side covers as marked with corresponding washers (1) and new O-rings (2).
Tightening torque*.

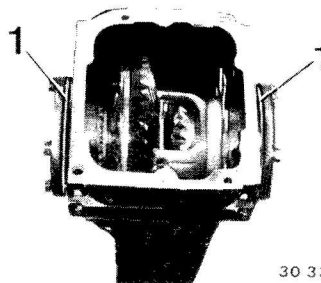
* See Specifications



30 33 049



30 33 050



30 33 052

Backlash/Tooth Contact Pattern Adjustments:
Mount Special Tool 00 2 500 and measure the backlash*.

Important!

The tooth contact pattern is always most important for a perfectly adjusted pinion/ring gear set.
See "Replacing Drive Pinion and Ring Gear" in 33 12 551 for general instructions on tooth contact pattern adjustments.

To check the tooth contact pattern, coat the ring gear teeth with printer's ink, turn in both directions several times and stop the ring gear abruptly with a piece of hard wood.

Correct backlash* and tooth contact pattern by changing the thickness of both shims (1).

If backlash is excessive, use a thinner shim on the ring gear end.

If backlash is insufficient, use a thicker shim on the ring gear end.

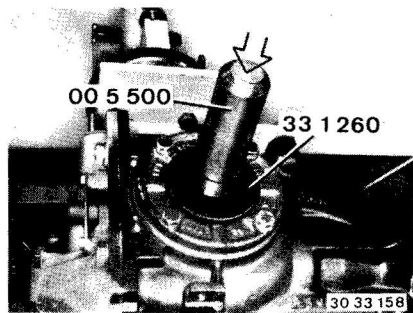
An axial displacement of the ring gear by 0.01 mm (0.0004") will cause a change in backlash of 0.0076 mm (0.0003").

Important!

The total thickness of both shims must not be changed.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.

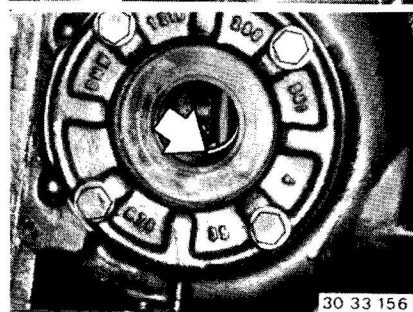
* See Specifications



Installation:

Dip shaft seal in final drive gear lube.
Drive in shaft seal against the stop
with Special Tools 33 1 260 and
00 5 500.

Replace a drive flange with seriously
scored bearing surfaces.



Installation:

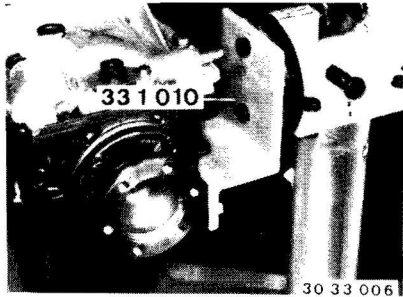
Place round wire snap ring (1) in
groove of the differential case prior to
installation of the drive flange in such
a manner, that both ends of the snap
ring are recessed in the groove.

This prevents lateral bending of the
ring.

Press in drive flange by hand and turn
slightly until the snap ring is heard to
engage.

Replace a stretched snap ring.

33-111



33 12 526 REPLACING BEARINGS FOR DRIVE PINION - Final Drive Removed -

Mount final drive on Special Tool 33 1 010.

Drain oil.

Unscrew case cover.

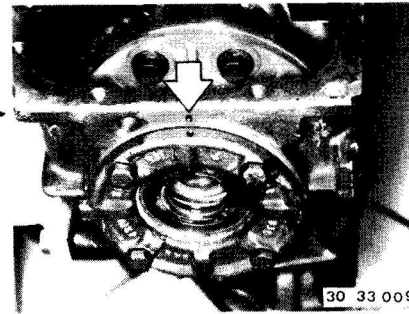
Installation:

Replace gasket.

Tightening torque*.

Pour in correct volume* of oil - see Group 33 in Operating Fluids.

30 33 006



Punch mark both bearing caps. Unscrew bolts of both bearing caps and take off bearing caps (turn if necessary, since seals suck tight).

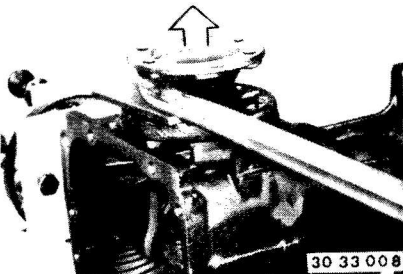
Important!

Don't mix up bearing caps and shims. If necessary, attach shims on bearing caps with pieces of wire.

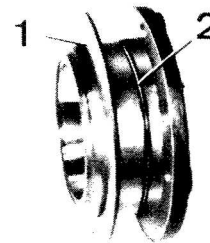
Installation:

Tightening torque*.

30 33 009

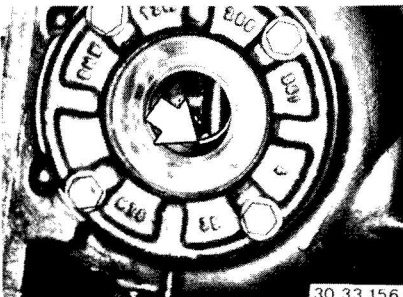


Pry off drive flanges with a tire iron.



Axial preload force (4000 N = 882 lbs.) of differential bearings and backlash of ring gear/pinion are adjusted with shims (1).

30 33 010



Installation:

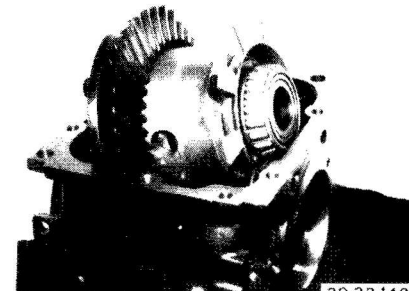
Place round wire snap ring (1) in groove of the differential case prior to installation of the drive flange in such a manner, that both ends of the snap ring are recessed in the groove. This prevents lateral bending of the snap ring.

Press in drive flange by hand and turn slightly, until the snap ring is heard to engage.

Replace a stretched snap ring.

* See Specifications

30 33 156



Remove the complete differential.

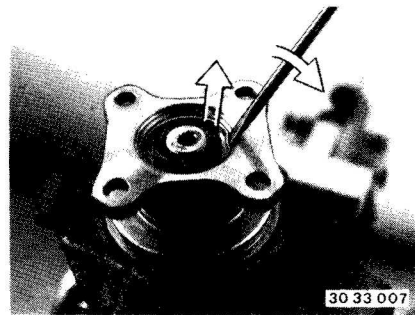
Important!

Don't bend the pulse spider.

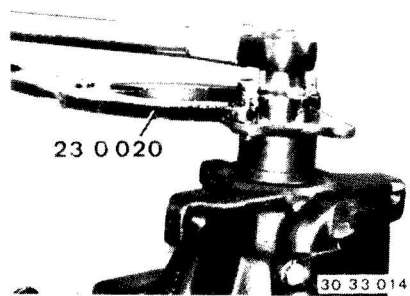
* See Specifications

30 33 149

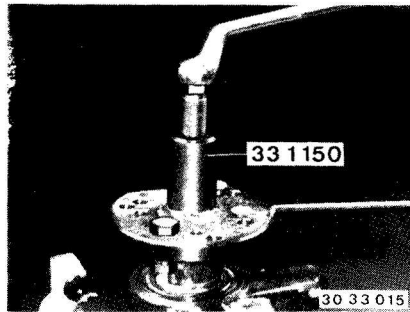
Lift out lockplate.



Hold input flange with Special Tool 23 0 020 and unscrew the collar nut.

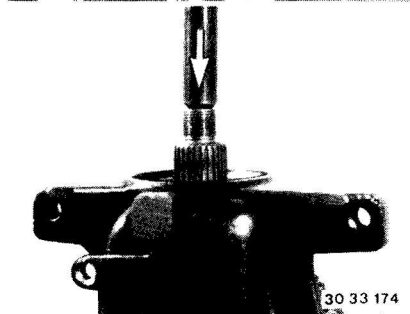


Pull off input flange with Special Tool 33 1 150. The specified friction torque* is given for new bearings and friction torque of old bearings does not have to be measured.

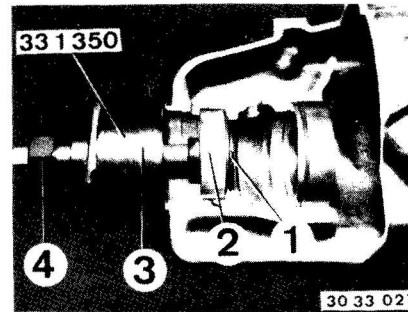


Press out drive pinion.

Caution!
Be careful not to damage the threads.



* See Specifications



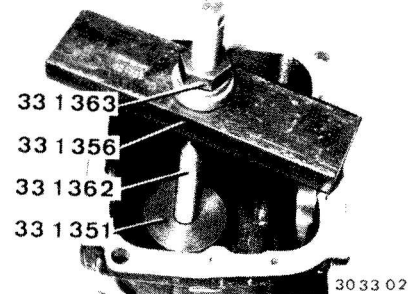
Pull out front bearing outer race with Special Tool 33 1 350.

- 1 Spreader
- 2 Front bearing outer race
- 3 Pull bell housing
- 4 Pressure bolt

Pull out rear bearing outer race with Special Tool 33 1 360, consisting of:

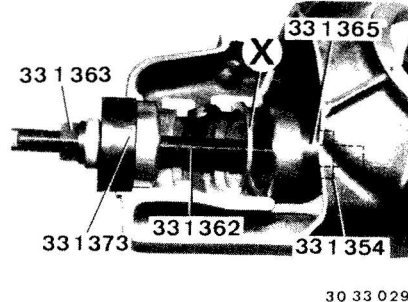
- | | |
|------------------|----------|
| Puller head | 33 1 361 |
| Threaded spindle | 33 1 362 |
| Bearing bridge | 33 1 356 |
| Pressure nut | 33 1 363 |

Important!
Shim (X) is located underneath the rear bearing outer race. It will be needed again for adjustment of the block distance.



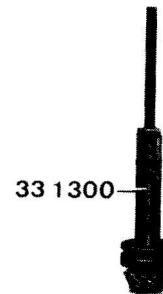
Install old shim (X) in front of the rear bearing outer race.

- Pull in bearing outer races with Special Tool 33 1 360, consisting of:
- | | |
|---------------------------|----------|
| Disc for front outer race | 33 1 373 |
| Disc for rear outer race | 33 1 365 |
| Threaded spindle | 33 1 362 |
| Pressure nut | 33 1 363 |
| Nut | 33 1 354 |

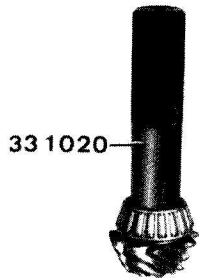


Pull tapered roller bearing off of drive pinion with Special Tool 33 1 300.

Caution!
Be careful not to damage the pinion - use soft aluminum jaws or pieces of wood.

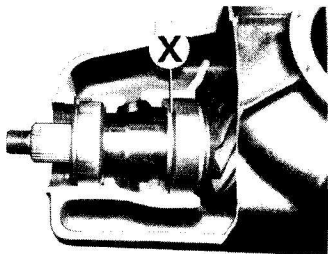


* See Specifications



33 1 020

30 33 030



30 33 033

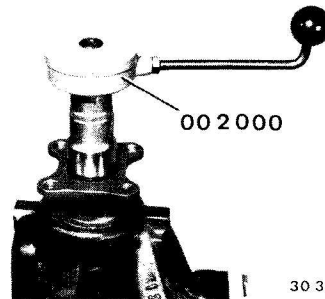
Press new tapered roller bearing on to drive pinion with Special Tool 33 1 020.

Important!
Always only use both bearings of the same make.

The drive pinion is installed with new tapered roller bearings, but without clamping sleeve, to determine correct thickness of shim (X).

Install drive pinion in rear bearing outer race.
Pull front tapered roller bearing on to drive pinion with Special Tool 23 1 300 in conjunction with a spacing sleeve.

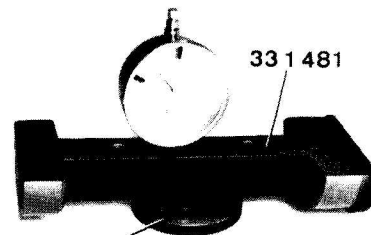
Mount input flange.
Adjust the friction torque of the drive pinion bearings to 250 Ncm (22 in. lbs.) by tightening the collar nut carefully.



00 2 000

30 33 013

Important!
Measure friction torque at intervals during the tightening procedures with Special Tool 00 2 000.

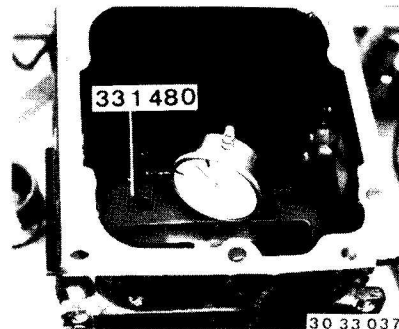


33 1 481

33 1 482

30 33 036

Block Distance of Drive Pinion:
Mount dial gage in Special Tool 33 1 481.
Place Special Tool 33 1 481 with dial gage on Special Tool 33 1 482 and set the dial gage to 0 (zero) with preload.

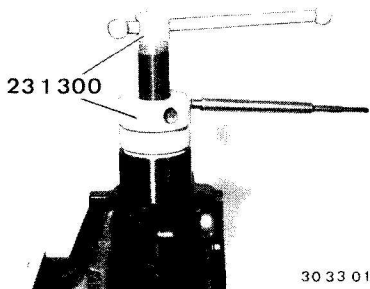


33 1 480

30 33 037

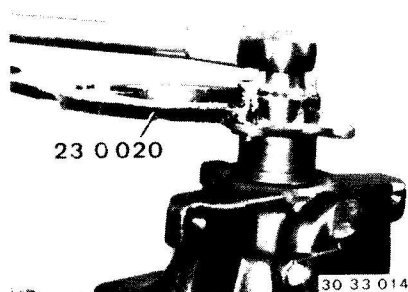
Place Special Tool 33 1 482 on the drive pinion.
Place Special Tool 33 1 481 in case.

Determine value Y:
Basic distance C = 9.02 mm (0.362")
Gage thickness B = 7.00 mm (0.275")



23 1 300

30 33 018



23 0 020

30 33 014

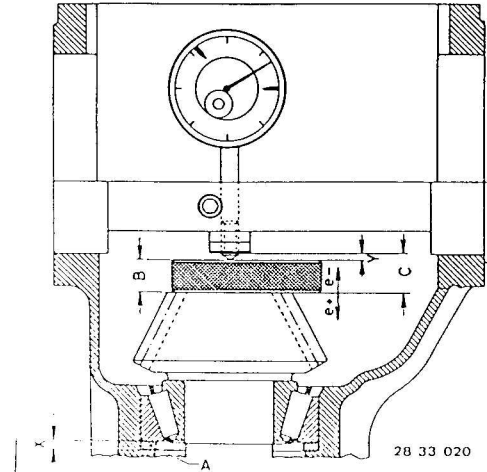
EXAMPLES FOR DETERMINATION OF CORRECT SHIM THICKNESS (X)

Example I		Example II	
C	9.02 mm (0.355")	C	9.02 mm (0.355")
e +	0.10 mm (0.004")	e -	0.10 mm (0.004")
<hr/>		<hr/>	
C nominal	9.12 mm (0.359")	C nominal	8.92 mm (0.351")
<hr/>		<hr/>	
Y on dial gage + gage thickness	1.92 mm (0.076") 7.00 (0.275")	Y on dial gage + gage thickness	2.12 mm (0.084") 7.00 mm (0.275")
<hr/>		<hr/>	
C actual	8.92 mm (0.351")	C actual	9.12 mm (0.359")
<hr/>		<hr/>	
C nominal	9.12 mm (0.359")	C actual	9.12 mm (0.359")
C actual -	8.92 mm (0.351")	C nominal -	8.92 mm (0.351")
<hr/>		<hr/>	
a	0.20 mm (0.008")	a	0.20 mm (0.008")
<hr/>		<hr/>	
Gage thickness A	4.10 mm (0.161")	Gage thickness A	3.90 mm (0.513")
- a	0.20 mm (0.008")	+ a	0.20 mm (0.008")
<hr/>		<hr/>	
Shim thickness (X)	3.90 mm (0.153")	Shim thickness (X)	4.10 mm (0.161")

If C nominal is larger than C Actual,
"a" is subtracted (-) from shim thick-
ness X.

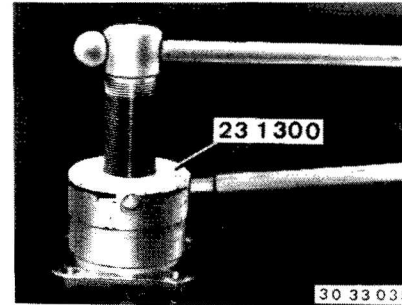
If C nominal is smaller than C actual,
"a" is added (+) to shim thickness X.

The permissible tolerances for distance (X) result from the tolerances for shim
thicknesses which are available in steps from 0.01 to 0.03 mm (0.0004 to 0.0012").

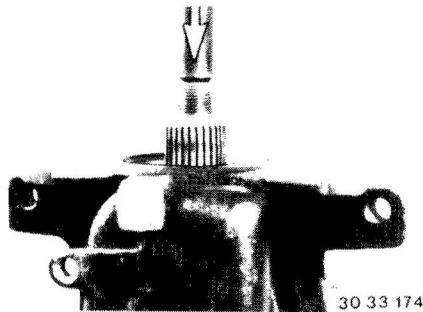


Remove drive pinion after determining the thickness of shim (X).

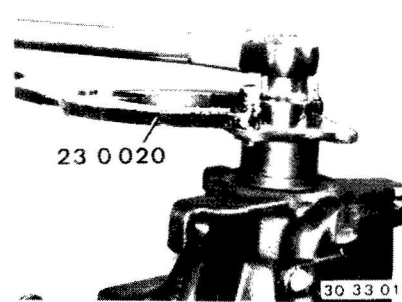
Important!
Note make of bearings - this is required for determination of friction torque.



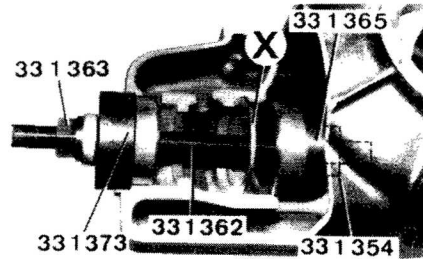
Press (don't pull) input flange on to the input shaft with Special Tool 23 1 300. Axial preload force (5000 N = 1102 lbs.) of drive pinion bearings can be determined with help of the friction torque.



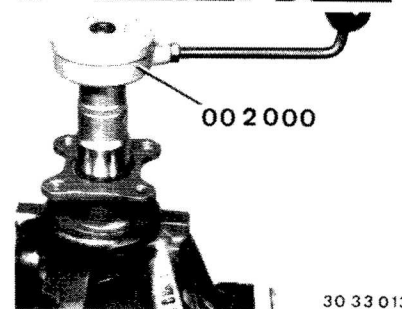
Remove rear bearing outer race and install it again with shim (X) of determined thickness.



Tighten input flange with the collar nut in steps, measuring the friction torque after each step (see below).



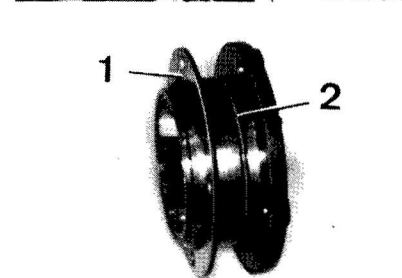
Install drive pinion with a new clamping sleeve (2).



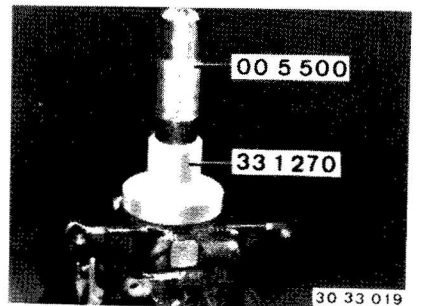
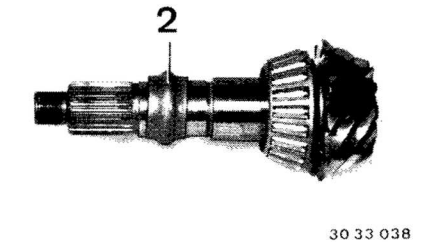
Measure friction torque* with Special Tool 00 2 000 and a suitable wrench socket.

Important!
The relation between friction torque and preload force differs depending on the make of bearings. Take the specified friction torque from the pinion bearing table* and add 20 Ncm (2 in. lbs.) for the new shaft seal.

Dip shaft seal in final drive gear lube and drive in flush with Special Tools 33 1 270 and 00 5 500.



Install differential. Install side covers as marked with corresponding washers (1) and new O-rings (2). Tighten bolts uniformly. Tightening torque*.

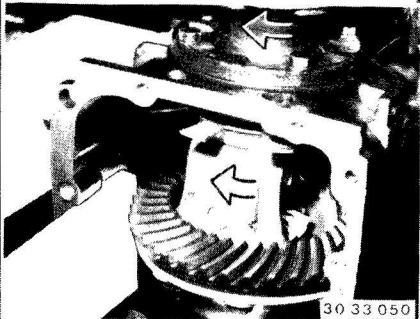
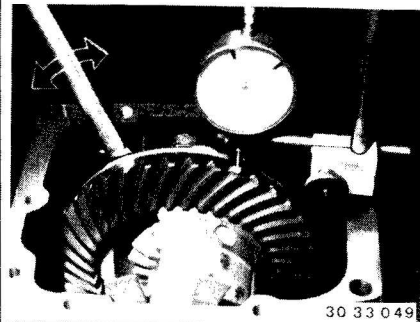


Adjusting Backlash/Tooth Contact Pattern:

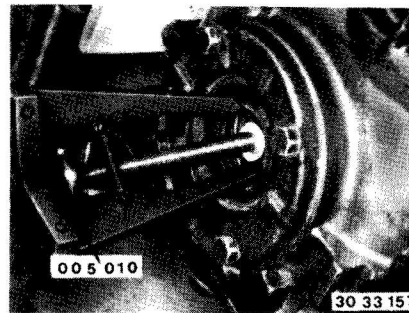
Mount Special Tool 00 2 500 and measure backlash* with a dial gage.

Important!

The tooth contact pattern is always most important for a perfectly adjusted pinion/ring gear set.



To check the tooth contact pattern, coat the ring gear teeth with printer's ink, turn in both directions several times and stop the ring gear abruptly with a piece of hard wood.



Pull out old shaft seals with Special Tool 00 5 010 together with a thrust piece.

Correct backlash* and tooth contact pattern by changing the thickness of both shims (1).

If backlash is excessive, use a thinner shim on the ring gear end.

If backlash is insufficient, use a thicker shim on the ring gear end.

An axial displacement of the ring gear by 0.01 mm (0.0004") will cause a change in backlash of 0.0076 mm (0.0003").

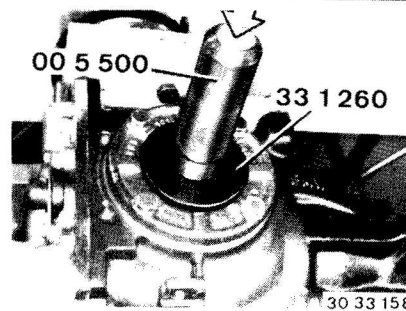
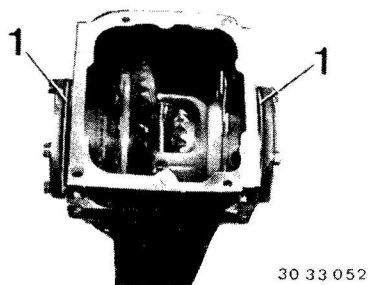
Important!

The total thickness of both shims must not be changed.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.

See "Replacing Differential Bearings" in 33 11 731 for information on determining friction torque of differential bearings.

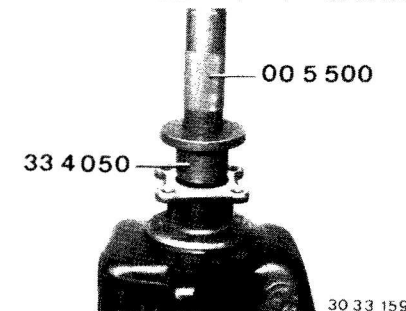
* See Specifications

**Installation:**

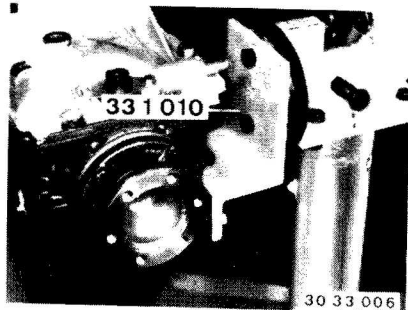
Dip new shaft seals in final drive gear lube.

Drive in shaft seals against the stop with Special Tools 33 1 260 and 00 5 500.

Replace a drive flange with seriously scored bearing surfaces.



Drive in new lockplate with Special Tools 33 4 050 and 00 5 500.



30 33 006

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

Mount final drive on Special Tool 33 1 010.

Drain oil.

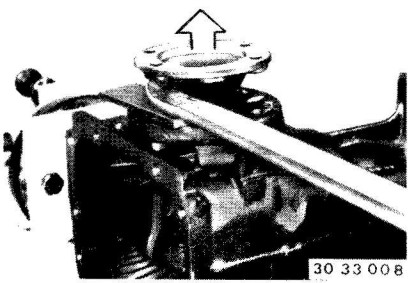
Unscrew case cover.

Installation:

Replace gasket.

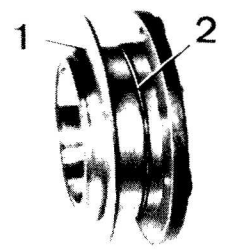
Tightening torque*.

Pour in correct volume* of oil - see Group 33 in Operating Fluids.



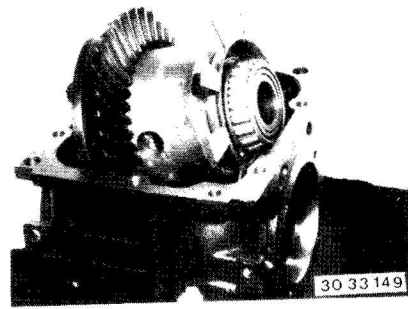
30 33 008

Pry off both drive flanges with a tire iron.



30 33 010

Differential case bearings and back-lash are adjusted with shims (1). Check O-ring (2), replacing if necessary.

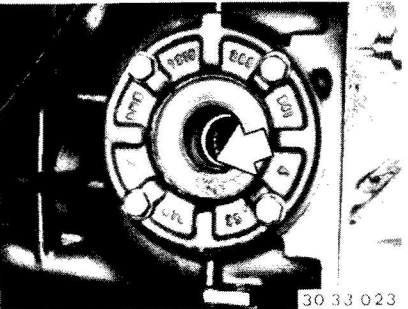


30 33 149

Remove complete differential case.

Important!

Don't bend the pulse spider.



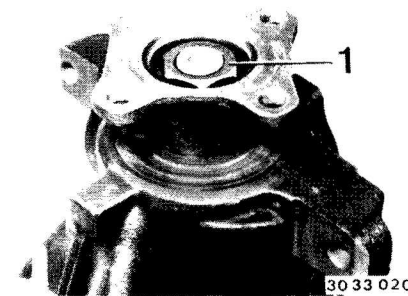
30 33 023

Installation:

Place round wire snap ring (1) in the groove of the differential case prior to installation of the drive flange in such a manner, that both ends of the snap ring are recessed in the groove. This prevents lateral bending of the ring.

Press in drive flange by hand and turn slightly until snap ring is heard to engage.

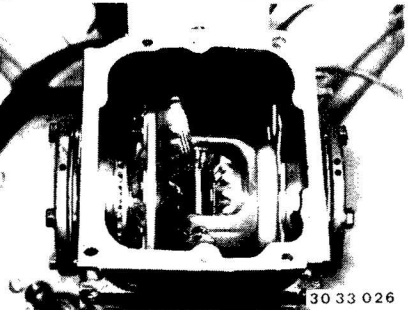
Replace a stretched snap ring.



30 33 020

Lift out lockplate.

Hold with Special Tool 23 0 020 and unscrew nut (1).



30 33 026

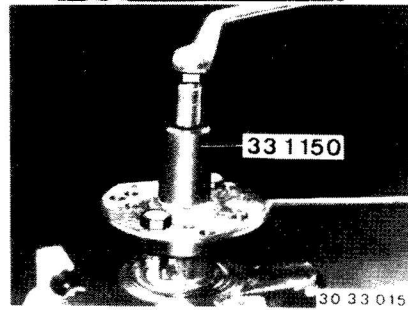
Punch mark both bearing caps. Remove both bearing caps.

Important!

Don't mix up bearing caps and shims. Attach shims on bearing caps with pieces of wire, if necessary.

Installation:

Tightening torque*.



30 33 015

Pull off input flange with Special Tool 33 1 150.

The specified friction torque* is given for new drive pinion bearings and the friction torque of old bearings does not have to be determined.

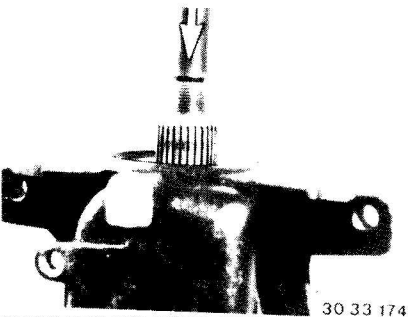
* See Specifications

* See Specifications

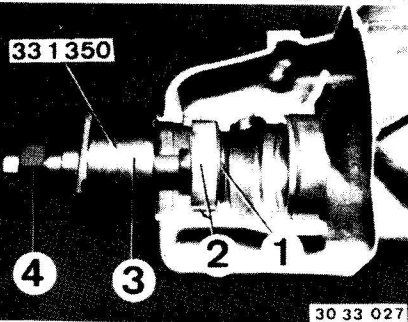
33-118

Press out drive pinion.

Important!
Replace both drive pinion bearings, using only one make.



30 33 174



33 1350

4

3

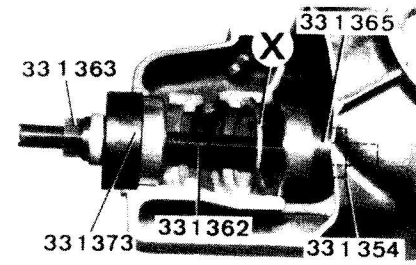
2

1

30 33 027

Pull out front bearing outer race with Special Tool 33 1 350.

- 1 Spreader
- 2 Front bearing outer race
- 3 Puller bell housing
- 4 Pressure bolt



33 1363

33 1365

33 1362

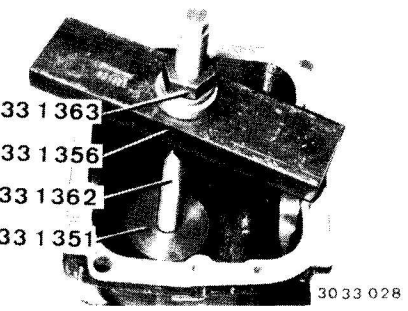
33 1373

33 1354

30 33 029

Install old shim (X) in front of the rear bearing outer race.
Pull in bearing outer races with Special Tool 33 1 360, consisting of:

pulling disc for front outer race	33 1 373,
pulling disc for rear outer race	33 1 365,
threaded spindle	33 1 362,
pressure nut	33 1 363 and
nut	33 1 354.



33 1363

33 1356

33 1362

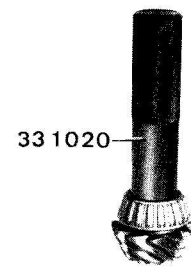
33 1351

30 33 028

Pull out rear bearing outer race with Special Tool 33 1 360, consisting of:

puller head	33 1 361,
threaded spindle	33 1 362,
bearing bridge	33 1 356 and
pressure nut	33 1 363.

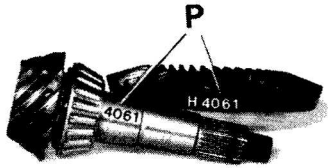
Important!
Shim (X) is located underneath the rear bearing outer race.
It will be needed again for pinion/ring gear adjustments.



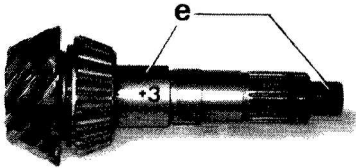
33 1020

30 33 030

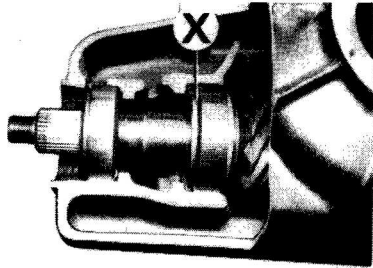
Press new tapered roller bearing inner race on to new drive pinion with Special Tool 33 1 020.



30 33 031



30 33 032



30 33 033

Important!

Drive pinions and ring gears are paired for optimal smooth running in special machines.

The pairing code (P) is inscribed electrically on the drive pinion and ring gear.

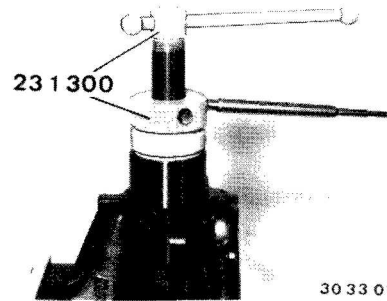
Never install a ring gear and drive pinion with different pairing codes (P) together.

H Gleason hypoid teeth (helical shape)

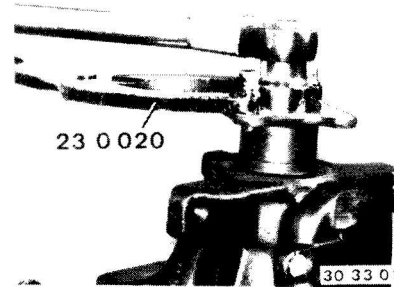
The number inscribed together with "+" or "-" is the deviation from basic distance C in hundredths of millimeter and is required for adjustment of the tooth contact pattern with shims.

+ e is added to C.
- e is subtracted from C.

To determine the thickness of shim (X), install drive pinion with new tapered roller bearings, but without bush.



30 33 018



30 33 014

Install drive pinion in rear bearing outer race.

Press (don't pull) front tapered roller bearing on to the drive pinion with Special Tool 23 1 300 together with a spacing sleeve.

Mount input flange.

Tighten collar nut in steps and measure the friction torque after each step with Special Tool 00 2 000, adjusting it to 250 Ncm (22 in. lbs.) with the collar nut.

Drive Pinion Block Distance:
Mount dial gage in Special Tool 33 1 481.

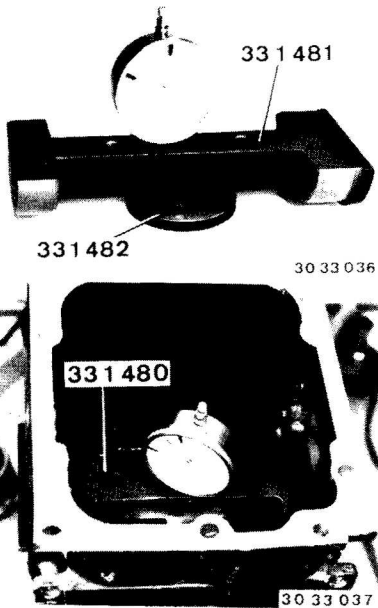
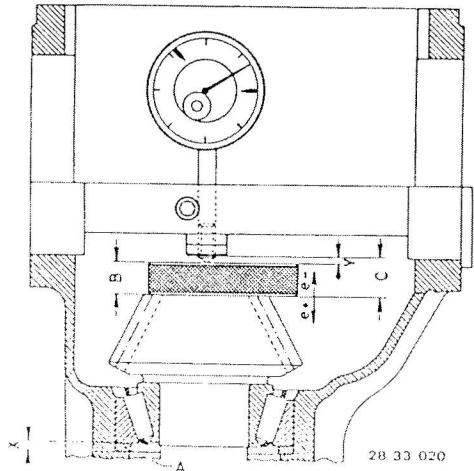
Place Special Tool 33 1 481 with dial gage on Special Tool 33 1 482 and set the dial gage to 0 (zero) with preload.

Place Special Tool 33 1 482 on drive pinion.

Insert Special Tool 33 1 481 in case. Determine value Y.

Basic distance C = 9.02 mm (0.355")

Gage thickness B = 7.00 mm (0.275")



Example I:

C	9.02 mm (0.355")
e +	0.10 mm (0.004")
C nominal	9.12 mm (0.359")

Y on dial gage	1.92 mm (0.076")
+ gage thickness B	7.00 mm (0.275")
C actual	8.92 mm (0.351")

C nominal	9.12 mm (0.359")
C actual (-)	8.92 mm (0.351")
a	0.20 mm (0.008")

Test shim A	4.10 mm (0.161")
- a	0.20 mm (0.008")
Shim thickness X	3.90 mm (0.153")

If C nom. is larger than C actual, "a" is subtracted (-) from shim thickness X.

Example II:

C	9.02 mm (0.355")
e -	0.10 mm (0.004")
C nominal	8.92 mm (0.351")

Y on dial gage	2.12 mm (0.084")
+ gage thickness B	7.00 mm (0.275")
C actual	9.12 mm (0.359")

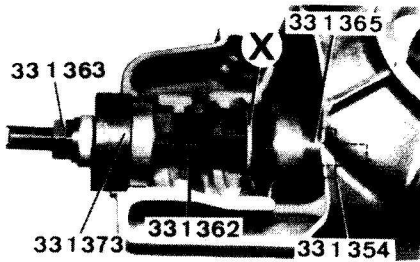
C actual	9.12 mm (0.359")
C nominal (-)	8.92 mm (0.351")
a	0.20 mm (0.008")

Test shim A	3.90 mm (0.153")
+ a	0.20 mm (0.008")
Shim thickness X	4.10 mm (0.161")

If C nominal is smaller than C actual, "a" is added (+) to shim thickness X.

The permissible tolerances for distance (X) result from the tolerances for shim thicknesses in steps of 0.01 to 0.03 mm (0.0004 to 0.0012").

33-121



30 33 029

Remove drive pinion and rear bearing outer race.
Press in shim (X) of determined thickness and bearing outer race.

Important!

Do not install the drive pinion at this point, since it is first necessary to measure and adjust the friction torque of the new differential case bearing.

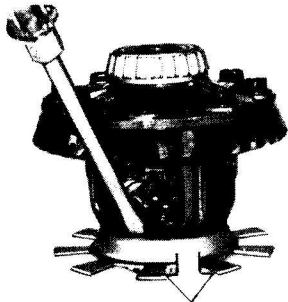
Press pulse spider off of the differential case.

Caution!

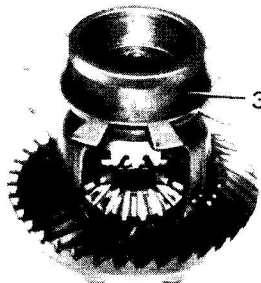
Be careful not to bend the pulse spider.

Installation:

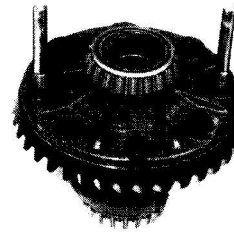
Press on pulse spider with Special Tool 33 1 304.



30 33 011



30 33 012

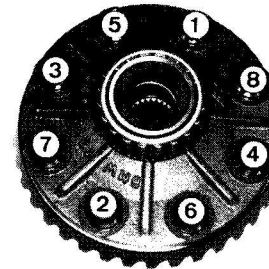


30 33 041

Remove ring gear (cold).

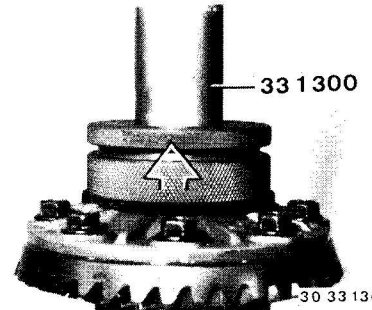
Installation:

Heat new ring gear to max. 100° C (212° F), checking the temperature with a thermochrome pencil.
Mount ring gear with two locally made staybolts as guides.



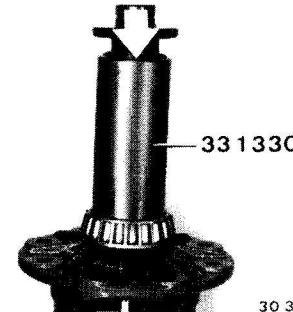
30 33 042

Install new bolts with Loctite No. 270 and tighten in order of (1 ... 8). Tightening torque*.
Tighten bolts to torque angle*.



30 33 130

Pull off tapered roller bearing on the differential case with Special Tool 33 1 300.



30 33 044

Installation:

Press on new tapered roller bearing inner races cold with Special Tool 33 1 330.

* See Specifications

33-122

Lift shaft seals out of both bearing caps.

The following 12 steps can only be omitted, if the differential case bearings were not replaced.

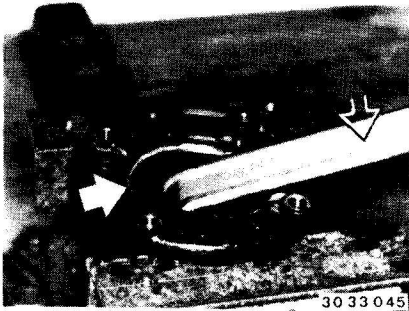
Install differential case with new ring gear and new bearings.
Lubricate bearings thoroughly with approved final drive gear lube** and let them drip dry.

Install side bearing caps as marked with corresponding shims (1) but without O-rings (2) at first. Tighten bearing cap bolts on the side opposite the ring gear uniformly. Tightening torque*.

The compensating bore (1), which is recognized on the outside by tab (2), always faces up in the installed position of the transmission.

* See Specifications

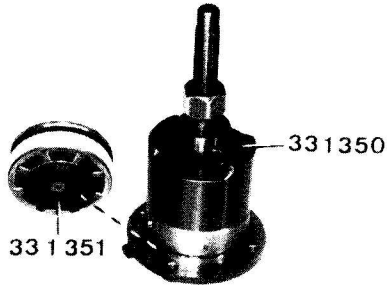
** See Gr. 33 In Operating Fluids



30 33 045

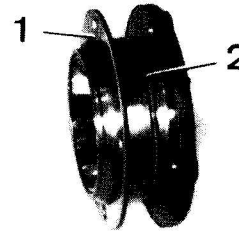
Press out bearing outer race with Special Tools 33 1 350 and 33 1 351.

Important!
Special Tool 33 1 351 must engage in the bearing outer race.

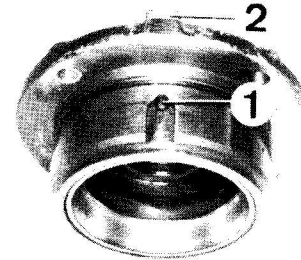


30 33 046

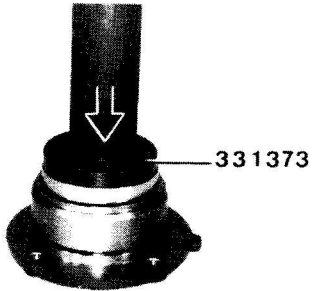
Installation:
Press in new bearing outer races with Special Tool 33 1 373.



30 33 048



30 33 148



30 33 047

Determining Friction Torque of New Differential Case Bearings:
Axial preload force (4000 N = 882 lbs.) of differential case bearings can be determined with help of the friction torque*.

Tighten bolts of second bearing cap uniformly only enough, that the differential can still be turned easily.

Install an output flange on the end opposite the ring gear and determine the friction torque with a locally made holder with welded nut and Special Tool 00 2 000.

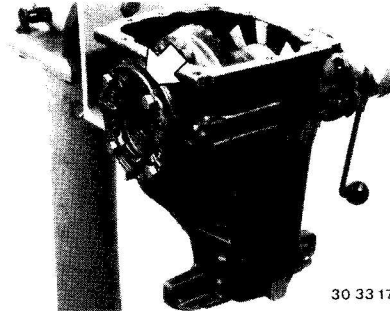
Turn the friction torque tester at approx. 50 rpm.

The friction torque* specified in the differential case bearing table* should be reached, but not exceeded.

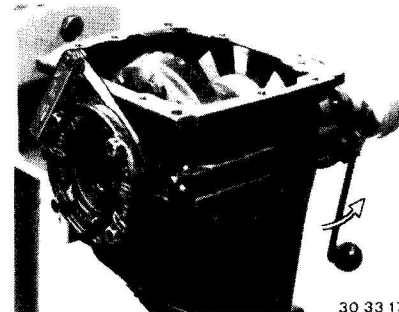
If new shaft seals had already been installed, add 20 Ncm (2 in. lbs.) for each seal in which an output shaft runs while measuring.

If the given friction torque is not reached, even though both bearing caps are tightened to the correct tightening torque*, install a thinner shim opposite the ring gear and repeat the measuring procedures.

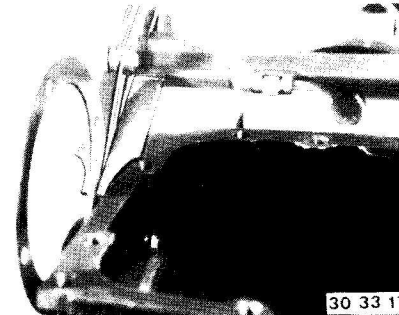
* See Specifications



30 33 170



30 33 172



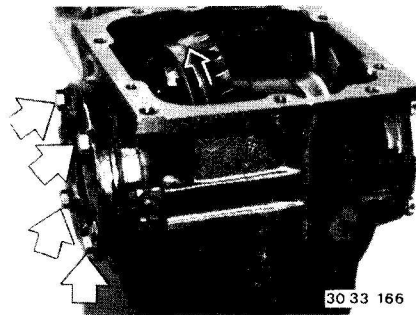
30 33 171

If the friction torque is reached, even though the second bearing cap has not yet been tightened to the correct tightening torque*, a thicker shim must be used on the ring gear end and the measuring procedures repeated.

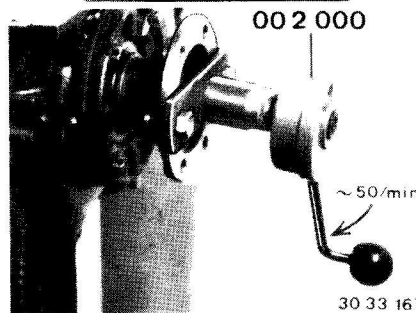
To make finding the shim thickness easier, the distance between the shim and case can be measured with a feeler gage blade and added to the thickness of the used shim.

Example:
Second bearing cap not tightened fully (bolts screwed in uniformly).
Specified friction torque* (e.g. 190 Ncm = 16.5 in. lbs.) is reached and shaft seals are not yet installed.
Gap measured with blade of feeler gage 0.20 mm (0.008")
Used shim thickness 1.40 mm (0.055")
Install shim of thickness 1.60 mm (0.063") and measure again.

* See Specifications



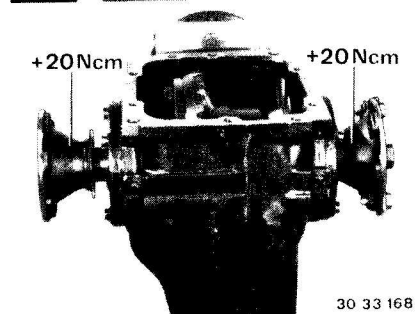
30 33 166



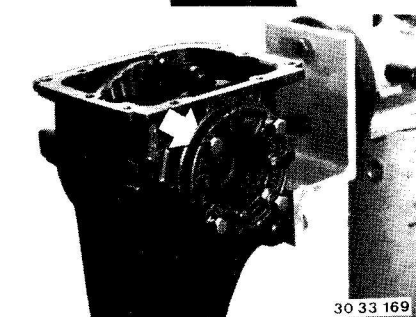
00 2 000

~ 50/min

30 33 167



30 33 168



30 33 169

33-124

Remove differential for installation of the drive pinion.
(If differential case bearings were not replaced, procedures are continued from this point on.)

Important!
Arrange side covers and shims of determined thickness; don't mix them up.

Install drive pinion with a new clamping sleeve (2).

Dip shaft seal in final drive gear lube and drive it in flush with Special Tools 33 1 270 and 00 5 500.

Press (don't pull) input flange on to the input shaft with Special Tool 23 1 300. Axial preload force (5000 N = 1102 lbs.) of drive pinion bearings can be determined with help of the friction torque.

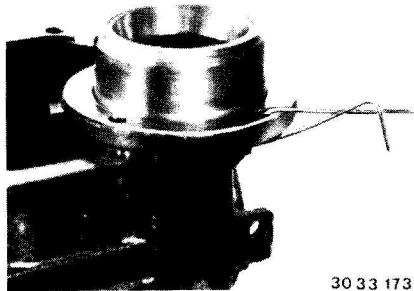
Tighten input flange with the collar nut in steps, measuring the friction torque after each step (see below).

Measure friction torque* with Special Tool 00 2 000 and a suitable wrench socket.

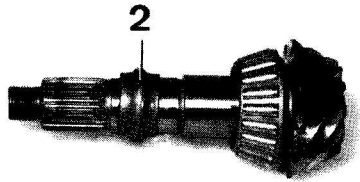
Important!
The relation between friction torque and preload force differs depending on the make of bearings.
Take specified friction torque from the pinion bearing table* and add 20 Ncm (2 in. lbs.) for the new shaft seal.

Install differential.
Install side covers as marked with corresponding washers (1) and new O-rings (2).
Tighten bolts uniformly.
Tightening torque*.

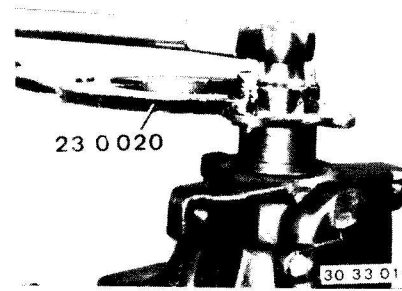
* See Specifications



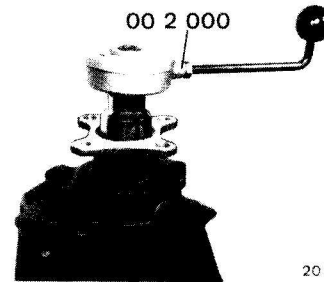
30 33 173



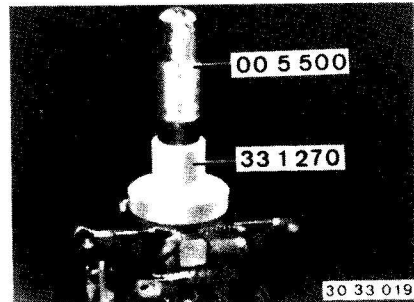
30 33 038



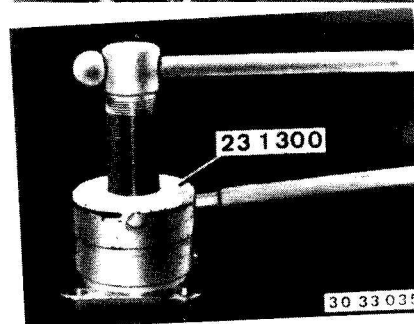
30 33 014



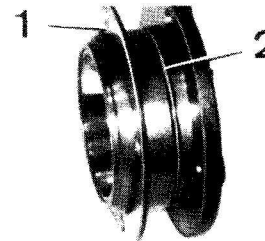
20 33 072



30 33 019



30 33 035



30 33 048

Adjusting Backlash/Tooth Contact Pattern:

Mount Special Tool 00 2 500 and measure backlash* with a dial gage.

Important!

The tooth contact pattern is always most important for a perfectly adjusted pinion/ring gear set.

To check the tooth contact pattern, coat the ring gear teeth with printer's ink, turn in both directions several times and stop ring gear suddenly with a piece of hard wood.

Correct the backlash* and tooth contact pattern by changing the thickness of both shims (1).

If backlash is excessive, use a thinner shim on the ring gear end.

If backlash is insufficient, use a thicker shim on the ring gear end.

An axial displacement of the ring gear by 0.01 mm (0.0004") will cause a change in backlash of 0.0076 mm (0.0003").

Important!

The total thickness of both shims must not be changed.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.

* See Specifications

Refer to following pages for general information on tooth contact pattern adjustments.

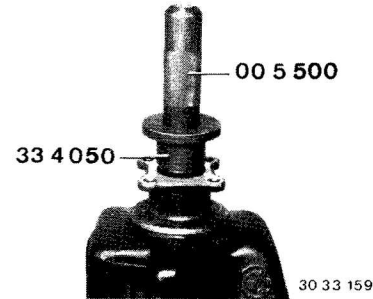
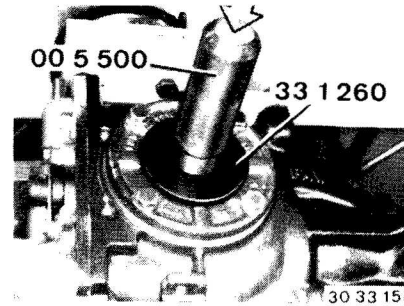
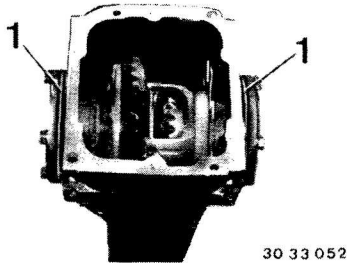
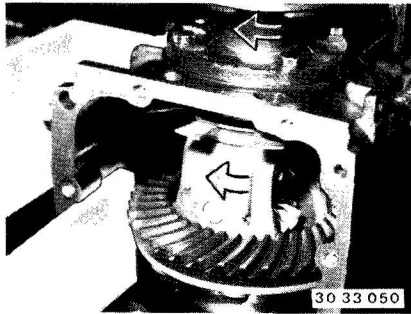
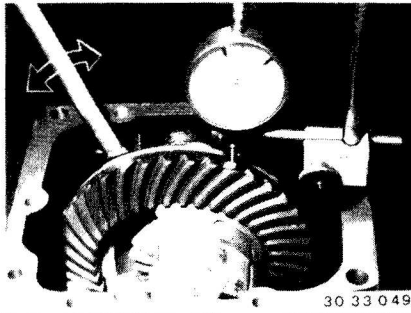
Installation:

Dip new shaft seals in final drive gear lube.

Drive in shaft seals against the stop with Special Tools 33 1 260 and 00 5 500.

Replace a drive flange with seriously scored bearing surfaces.

Drive in new lockplate with Special Tools 33 4 050 and 00 5 500.



GENERAL INFORMATION ON TOOTH CONTACT PATTERN ADJUSTMENTS

Gleason Teeth

A Correct tooth contact pattern without load.

A1 Loads will shift the tooth contact pattern outward slightly.

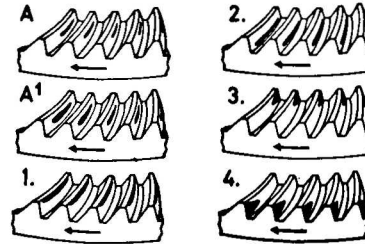
Moving the ring gear will mainly change the backlash, but will also displace the contact pattern in longitudinal direction of the teeth.

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 tooth contact patterns, which usually occur in combination.

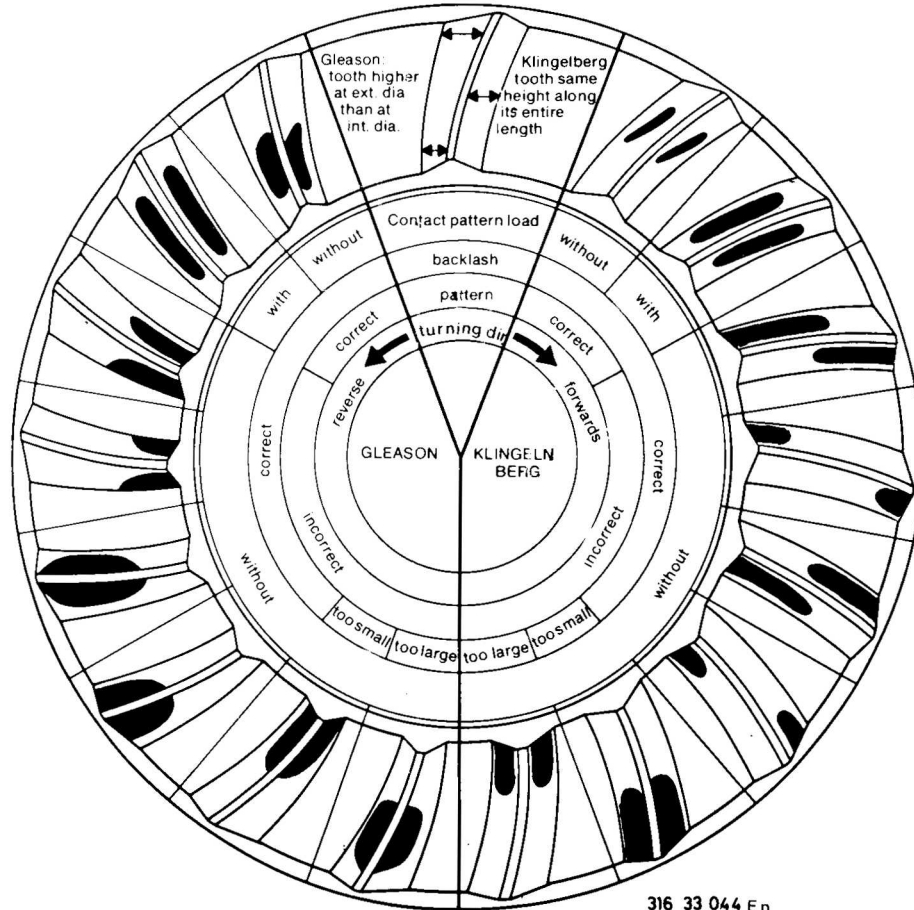
Knowing these patterns will facilitate making adjustments.

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



28 33 030

Adjustment of contact pattern



33 13 611 REPLACING DIFFERENTIAL GEARS

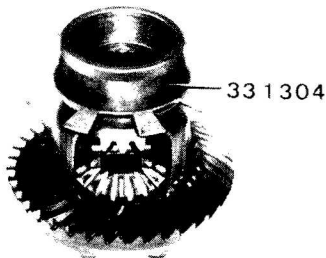
- Differential Removed -

See "Replacing Drive Pinion with Ring Gear" in 33 11 731.

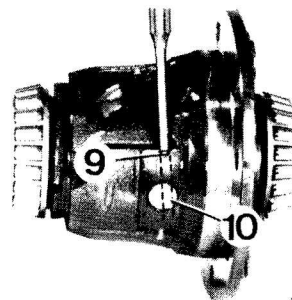
Press off pulse spider.

Installation:

Press on pulse spider with Special Tool 33 1 304.



30 33 012



30 33 053

Drive out dowel sleeve (9) and differential gear shaft (10).

Installation:

The bore in differential gear shaft (10) is countersunk on one end. Drive in dowel sleeve (9) from this end.

Remove ring gear (cold).

Important!

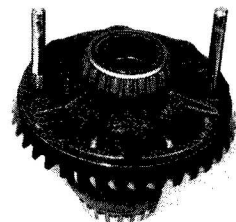
If bearings also have to be replaced, install ring gear only after determination of the friction torque - see "Replacing Bearings for Differential Case" in 33 11 724.

Installation:

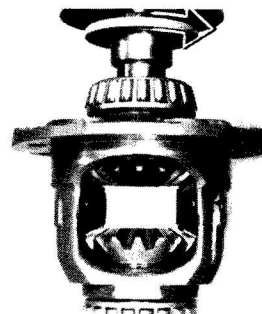
Clean threads thoroughly (tapper). Heat ring gear to max. 100° C (212° F) and check the temperature with a thermochrome pencil. Install ring gear with two locally made staybolts as guides.

Important!

Use new ring gear bolts.



30 33 041



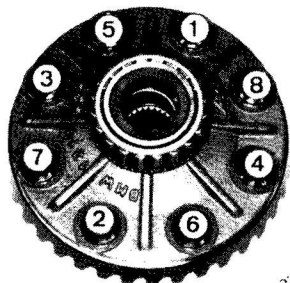
30 33 054

Turn out differential bevel gears with drive flange.

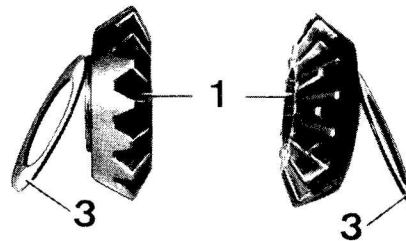
Remove differential side gears with shims (2).

Installation:

Install new bolts with Loctite No. 270 and tighten in order of 1 through 8. Tightening torque*. Tighten bolts to torque angle*.



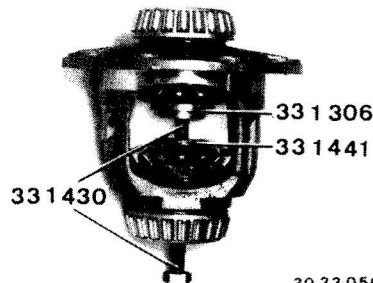
30 33 042



30 33 108

Install both new differential side gears (1) with diaphragm springs (3) (Part No. 33 13 1 201 538) without shims (2). Center differential side gears with the drive flange.

(See measuring procedures on page 228 if two diaphragm springs and two shims are installed in this transmission as an exception.)



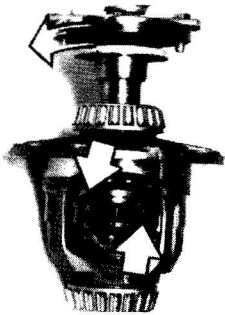
30 33 056

Insert Special Tool 33 1 306 on one side.

Screw in Special Tool 33 1 441 with Special Tool 33 1 431.

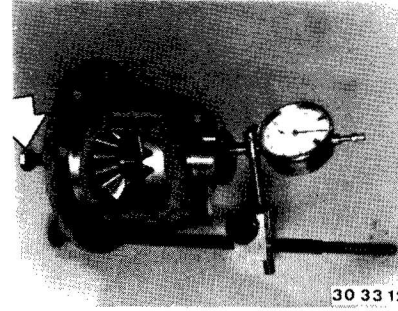
Tighten special tool bolt to spread the differential side gears apart far enough, that the drive flange can just barely be turned.

* See Specifications



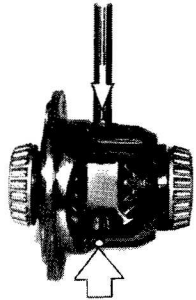
30 33 057

Insert new differential gears opposite each other precisely.
Move differential gears into installed position by turning the drive flange. Remove thrust piece, threaded plate and spindle.



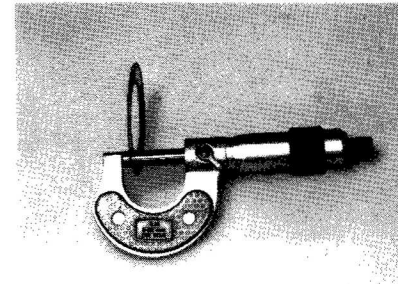
30 33 122

Loosen Special Tool 33 1 431. Read dial gage and note the value. Also note the end, e.g. ring gear end. 0.36 mm (0.014"). Repeat measurement on the opposite shaft gear and note the value, for example: 0.28 mm (0.011").



30 33 058

Drive in differential gear shaft. Turn the differential side gears with the drive flange and leave them at the highest point of meshing (hardest turning).



30 33 123

Remove differential side gears and diaphragm springs.

Important!

Don't mix up differential side gears and diaphragm springs. Measure diaphragm springs with a micrometer, note values and locations, e.g. 1.16 mm for ring gear end and 1.18 mm for other end. Determine correct shim thickness with consideration for a play of 0.02 to 0.07 mm (0.001 to 0.003").

Example:

Ring gear end:

Diaphragm spring	1.16 mm (0.045")
+ measured value	0.36 mm (0.014")
<hr/>	
	1.52 mm (0.059")
- play	0.02 mm (0.001")
<hr/>	
	1.50 mm (0.058")

Opposite end:

Diaphragm spring	1.18 mm (0.046")
+ measured value	0.28 mm (0.011")
<hr/>	
	1.46 mm (0.057")
- play	0.02 mm (0.001")
<hr/>	
	1.44 mm (0.056")

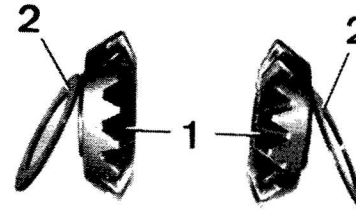
Thickness of Shims:

1.50 mm (0.058") and 1.45 mm (0.057").

Shims (2) are available in steps of 0.05 mm (0.002").

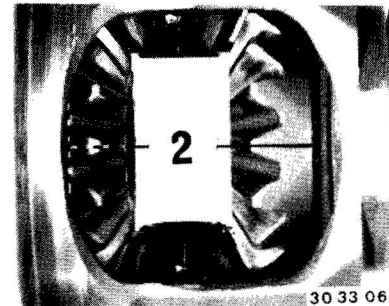
Install shims (2) of determined thickness.

Install Special Tools 33 1 441 and 33 1 431 for measuring. If applicable, machine a small amount away from Special Tool 33 1 441 to make application of the dial gage easier. Screw in the bolt until the shaft gear is "blocked".

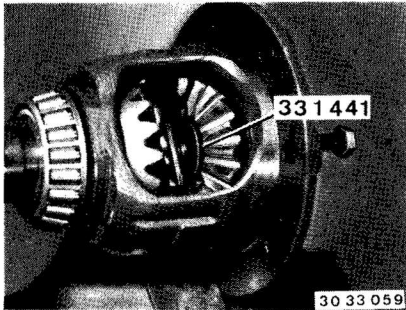


30 33 055

Mount holder with dial gage, consisting of Special Tools 33 1 420, 00 2 505 and 00 2 506, on the differential case. Set dial gage to zero on the blocked shaft gear with preload.

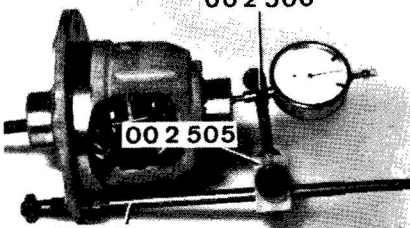


30 33 063



30 33 059

00 2 506



33 1420

30 33 121

LIMITED SLIP DIFFERENTIAL WITH 25 % LOCKING RATIO

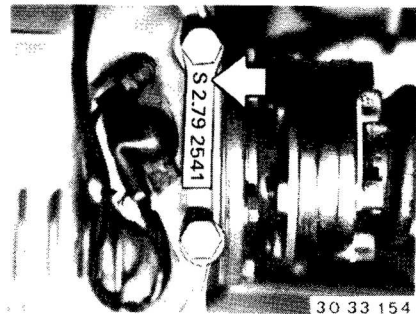
The limited slip differential is marked with a "S" on the case or data plate. A limited slip differential has the following advantages.

- Prevention of wheel slip when driving on rough road surfaces.
- Prevention of wheel slip when moving off with different traction underneath left and right sides of car wheels.
- Prevention of wheel slip when driving fast on wet roads.
- Prevention of wheel slip on inside of curve when driving fast in curves.
- Prevention of slip when driving fast on roads with different traction between left and right.

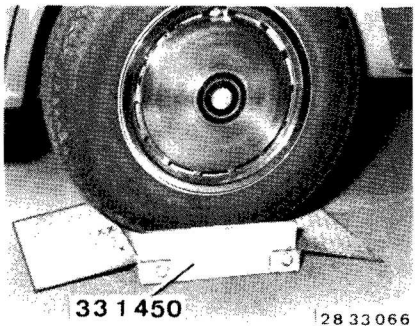
Checking Function Without Removing:

- Level workshop floor.
- Drive car's left wheel on Special Tool 33 1 450.
- Release parking brake completely.
- Engage 1st gear and accelerate engine.
- Function of limited slip differential is okay, if the car can be driven off of Special Tool 33 1 450.

Important!
Drive off of fixture slowly.

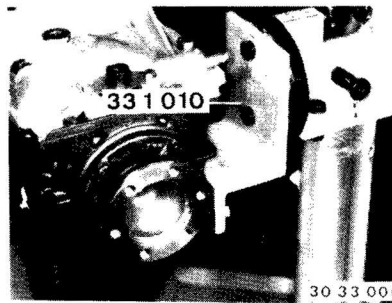


30 33 154

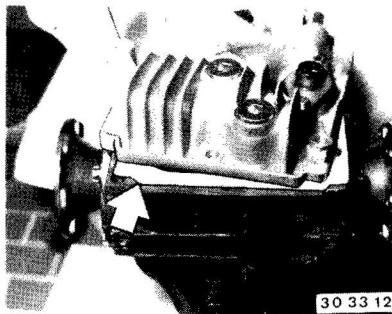


33 1 450

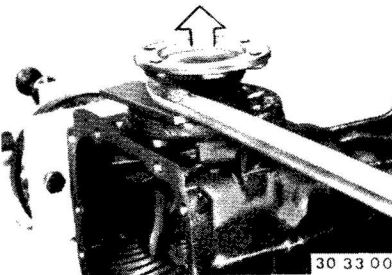
128 33 066



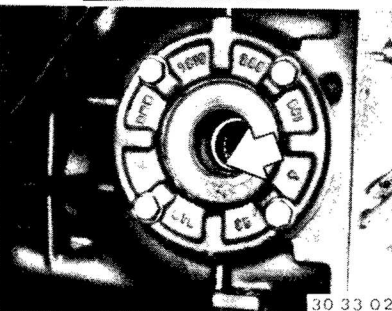
30 33 006



30 33 125



30 33 008



30 33 023

33 14 520 REPLACING LIMITED SLIP DIFFERENTIAL ASSEMBLY - Final Drive Removed -

Remove final drive – see 33 10 010.
Drain oil.
Mount final drive on Special Tool 33 1 010.

Installation:

Pour in correct volume* of oil - see Group 33 in Operating Fluids.

Unscrew case cover.

Installation:

Replace gasket.
Tightening torque*.

Pry off both drive flanges with a tire iron.

Installation:

Before installation of the drive flange, place round wire snap ring (1) in groove of the differential case that both ends are recessed in the groove. This prevents lateral bending of the ring.
Push in and turn drive flange slightly by hand until round wire snap ring is heard to engage.
Replace a stretched snap ring.

* See Specifications

33-131

Unscrew both bearing caps.

Important!
Mark bearing caps.
Don't mix up bearing caps and shims.

Installation:
Tightening torque*.

Differential case bearings and backlash are adjusted with shims (1). Check O-ring (2), replacing if necessary.

Important!
Changing the total thickness of shims (1) will change the friction torque value. After adjusting the friction torque, the backlash and tooth contact pattern will have to be adjusted again - see 33 12 551.

Remove complete limited slip differential.

Important!
Don't bend the pulse spider.

Press off pulse spider.

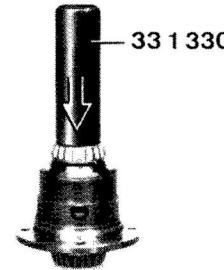
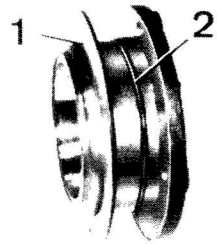
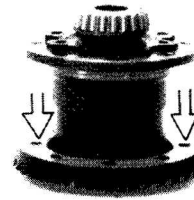
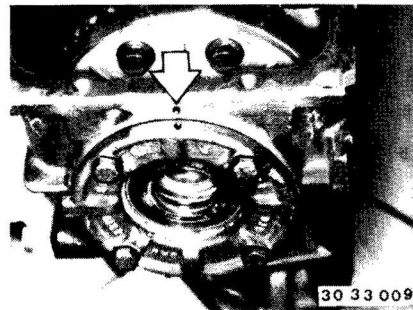
Installation:
Press on pulse spider with Special Tool 33 1 304.

* See Specifications

Remove ring gear (cold).

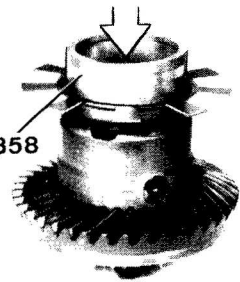
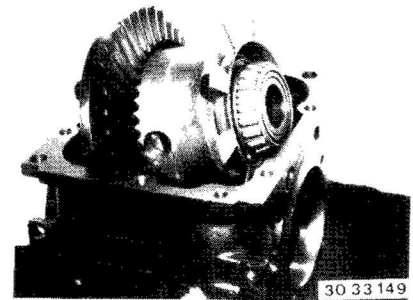
Press new tapered roller bearings on to new limited slip differential case cold with Special Tool 33 1 330.

Important!
Only use the same make for both bearings.
Note make - this information is needed later to determine the friction torque.



30 33 010

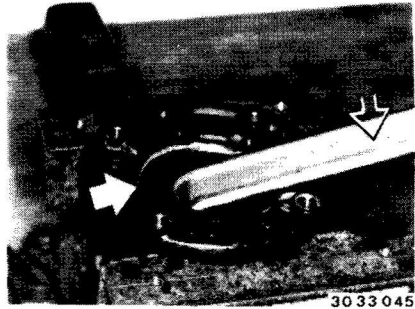
30 33 318



30 33 150

33-132

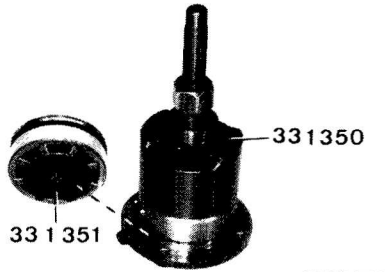
Lift shaft seals out of both bearing caps.



30 33 045

Press out bearing outer race with Special Tools 33 1 350 and 33 1 351.

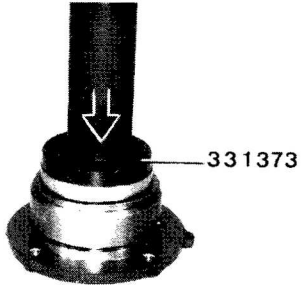
Important!
Special Tool 33 1 351 must engage in bearing outer race.



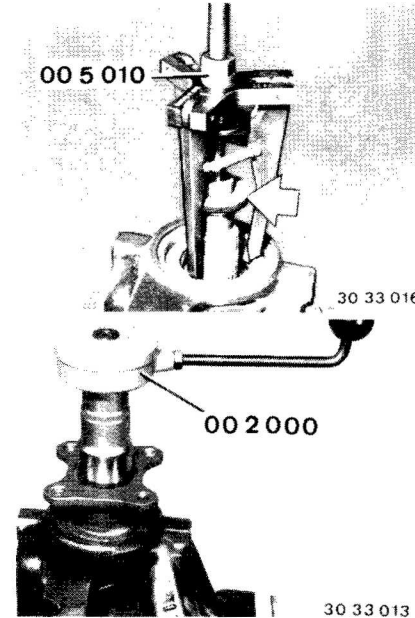
30 33 046

Installation:
Press in new bearing outer races with Special Tool 33 1 373.

Important!
Use both bearings from only one manufacturer.



30 33 047

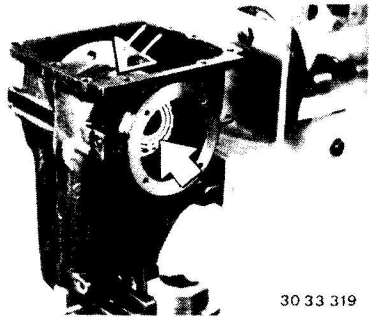


30 33 013

If applicable, replace shaft seal for input flange - see 33 11 512.

If applicable, replace drive pinion - see 33 12 551.

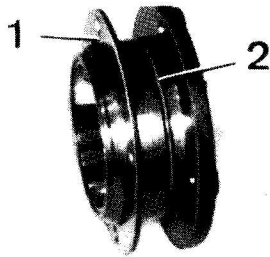
33-133



30 33 319

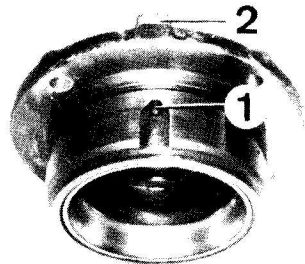
Install new limited slip differential with new bearings. Only use same make for both bearings. Note make.

Lubricate new bearings thoroughly with approved final drive gear lube** and let them drip dry.



30 33 048

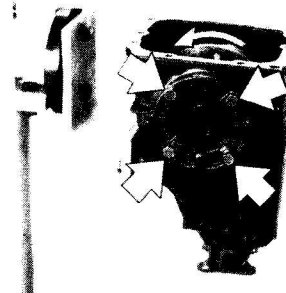
Install side bearing caps as marked with corresponding shims (1), but without O-rings (2) at first. Tighten bearing cap bolts opposite the ring gear end uniformly with correct tightening torque*.



30 33 148

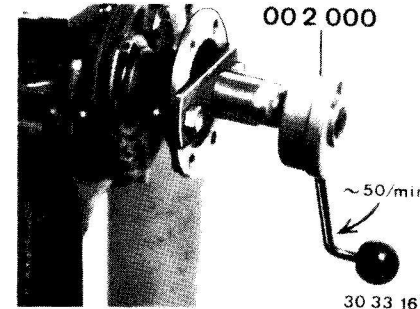
The compensating bore (1), recognized on the outside by tab (2), always faces up in the installed position of the transmission.

* See Specifications
** See Gr. 33 in Operating Fluids



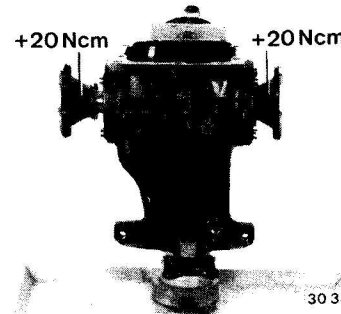
30 33 311

Axial preload force (4000 N = 882 lbs.) of differential case bearings can be determined with help of the friction torque*. Tighten bolts of the second bearing cap uniformly only enough, that the differential is still easy to turn.



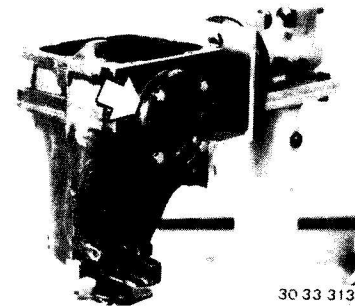
30 33 167

Install an output flange on the end opposite the ring gear and measure the friction torque with a locally made holder with welded nut and friction torque tester, Special Tool 00 2 000. Turn the friction torque tester at approx. 50 rpm.



30 33 312

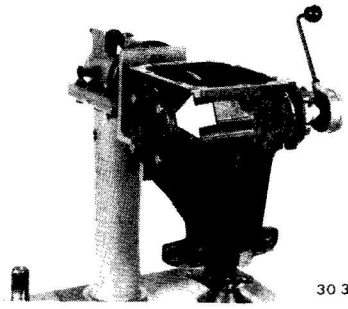
The friction torque* specified in the differential case bearing table* should be reached, but not exceeded. If new shaft seals had already been installed, add 20 Ncm (2 in. lbs.) for each seal in which an output shaft runs while measuring.



30 33 313

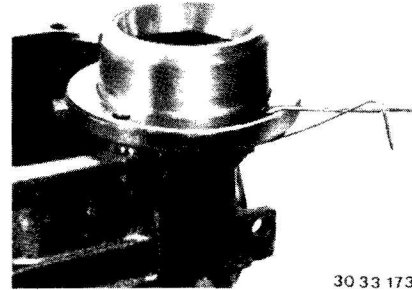
If the given friction torque is not reached, even though both bearing caps are tightened to the correct tightening torque*, a thinner shim must be used on the end opposite the ring gear and the measuring procedures repeated.

* See Specifications



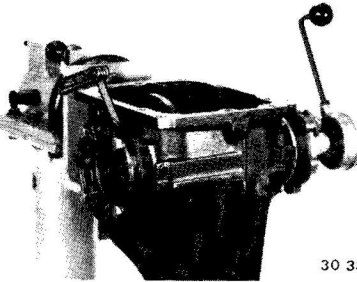
30 33 314

If the friction torque is reached, even though the second bearing cap is not yet tightened to correct tightening torque*, use a thicker shim on the ring gear and repeat the measuring procedures.



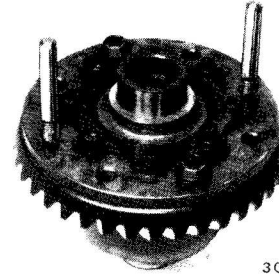
30 33 173

Remove differential case.
Arrange side covers and shims; don't mix them up.



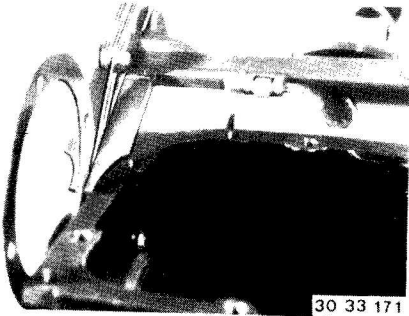
30 33 315

To make finding the thickness of shims easier, the distance between the shim and case can be measured with a feeler gage blade and this value is then added to the thickness of the used shims.



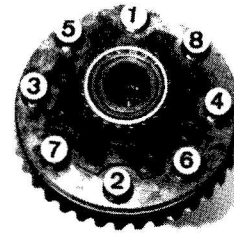
30 33 126

Installation:
Clean tapped bores thoroughly (with a taper).
Heat ring gear to max. 100° C (212° F), checking the temperature with a thermocolor pencil.
Mount ring gear with two locally made staybolts as guides.



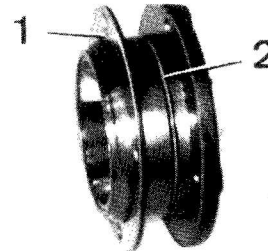
30 33 171

Example:
Second bearing cap not tightened fully (bolts screwed in uniformly).
Specified friction torque* (e.g. 190 Ncm = 16.5 in. lbs.) is reached and shaft seals are not yet installed.
Gap measured with blade of feeler gage 0.20 mm (0.008")
Used shim thickness 1.40 mm (0.055")
Install shim of thickness 1.60 mm (0.063") and measure again.



30 33 127

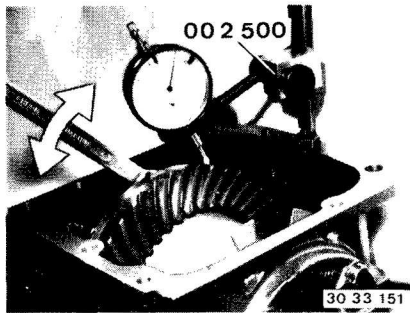
Install new bolts with Loctite No. 270 and tighten in order of 1 through 8. Tightening torque*.
Tighten bolts with torque angle*.



30 33 048

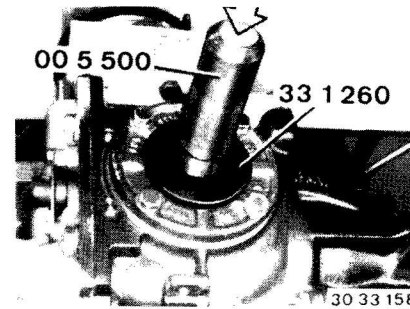
Install differential with ring gear and pulse wheel.
Install side covers as marked with corresponding washers (1) and new O-rings (2).
Tightening torque*.

33-135

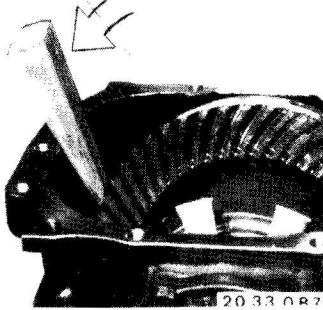


Adjusting Backlash/Tooth Contact Pattern:
Mount Special Tool 00 2 500 and measure the backlash* with a dial gage.

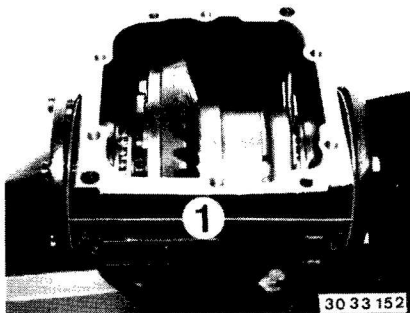
Important!
The tooth contact pattern is always most important for a perfectly adjusted pinion/ring gear set.
See 33 12 551 for general information on adjusting the tooth contact pattern.



Installation:
Dip shaft seal in final drive gear lube.
Drive in shaft seal against the stop with Special Tools 33 1 260 and 00 5 500.
Replace a drive flange with a seriously scored bearing surface.



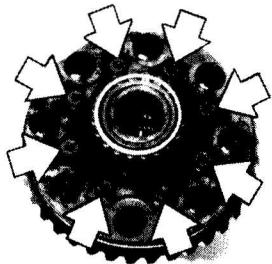
To check the tooth contact pattern, coat ring gear with printer's ink, turn several times in both directions and then stop the ring gear abruptly with a piece of hard wood.



The backlash* and tooth contact pattern are corrected by changing the thickness of both shims (1).
If the backlash is too large, install a thinner shim on the ring gear end.
If the backlash is too small, install a thicker shim on the ring gear end.
An axial displacement of the ring gear by 0.01 mm (0.0004") will change the backlash by 0.0076 mm (0.0003").

Important!
The total thickness of both shims may no longer be changed.
If a thicker or thinner shim was needed to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of the bearings would be changed again.

* See Specifications



30 33 131

33 14 593 DISASSEMBLING AND ASSEMBLING LIMITED SLIP DIFFERENTIAL

- Final Drive Removed -

Remove limited slip differential - see 33 14 520.

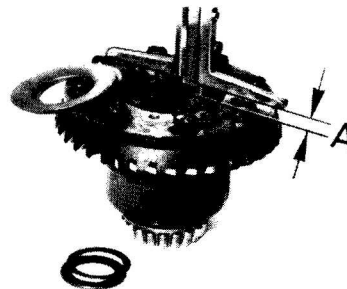
Unscrew case cover mounting bolts. Take off case cover.

Turn case upside down to let the parts slide out.

Installed Order:

(1) case cover, (2) diaphragm spring, (3) thrust washer, (4) diaphragm spring, (5) outer plate, (6) inner plate, (7) thrust ring, (8) differential side gear, (9) differential gears with differential shafts and (10) differential case.

30 33 132



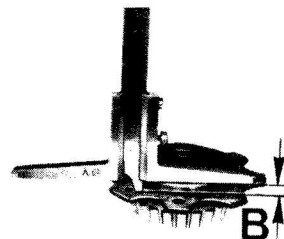
30 33 134

Install the following parts in correct order to measure the preload.

Outer plates (5), inner plates (6), thrust rings (7), differential side gears (8) and differential gears with differential shafts (9).

Measure distance A from case edge to outer plate, e.g. A = 10.8 mm (0.425").

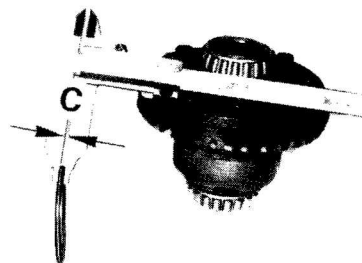
Measure distance B on cover, e.g. B = 6.8 mm (0.268").



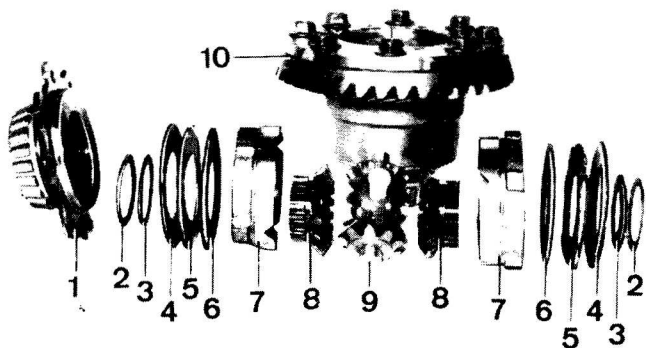
30 33 135

Place both diaphragm spring curved surfaces together.

Measure distance C on diaphragm springs, e.g. C = 3.6 mm (0.142").



30 33 136



30 33 133

Check all parts for wear, e.g. molybdenum coat, splines, etc..

Installation:

Lubricate all parts with approved final drive gear lube before assembling.

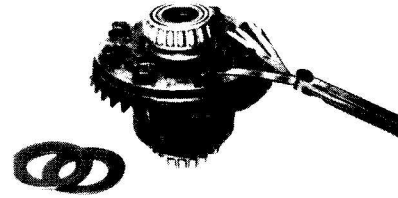
33-137

An installed play of 0.1 to 0.4 mm (0.004 to 0.016") is required to prevent pressing the diaphragm springs flat.

Example:

B (cover)	6.8 mm (0.268")
C (diaphr. springs)	3.6 mm (0.142")
A (case)	10.8 mm (0.425")
Sum of B + C	10.4 mm (0.409")
Installed play D	0.4 mm (0.016")

Correct any deviation in installed play D by installing outer plates of correct thickness.

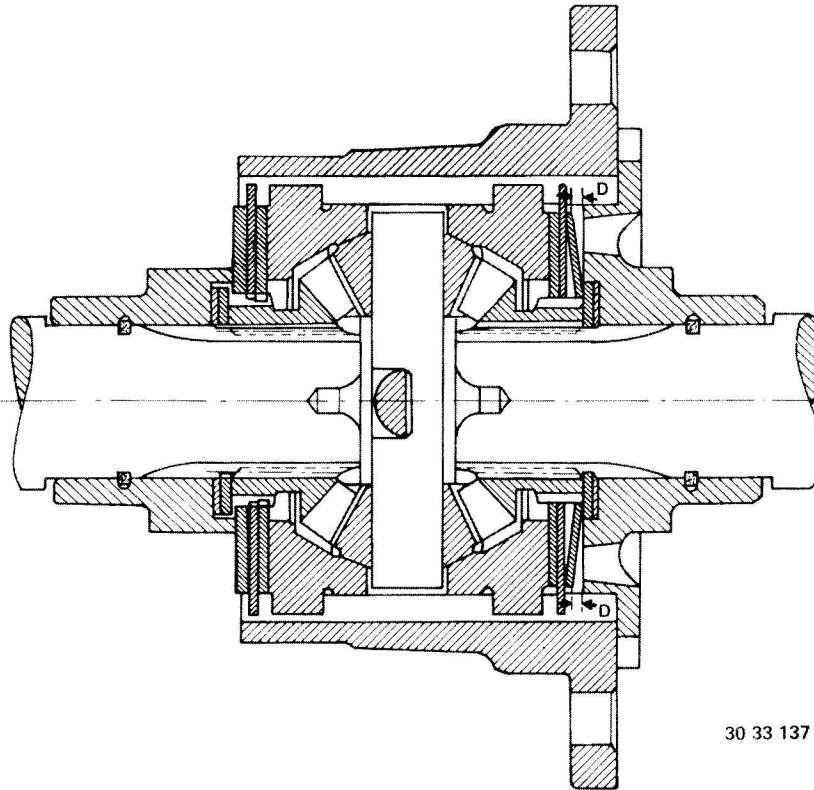


30 33 138

Remove all parts from case and insert with the additional parts, thrust washers (2), diaphragm springs (3) and stepped washers (4). Mount and press on case cover (12) firmly (don't bolt).

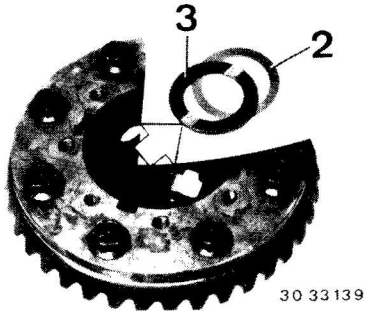
The pre-load of small diaphragm springs (2) should produce an uniform gap all around (check with a feeler gage blade).

If there is no clearance between cover and case, check diaphragm springs (2) and thrust washers (3).



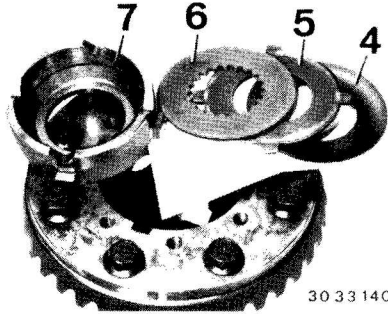
30 33 137

Installed Order:
 Install diaphragm spring (2) with concave surface facing up to the differential shaft.
 Install thrust washer (3) with the oil pockets facing up to the differential shaft.



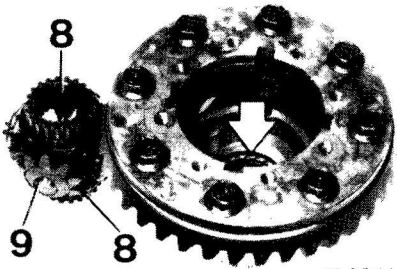
30 33 139

Install diaphragm spring (4) with concave surface facing the differential shaft, outer plate (5) with four tabs, molybdenum-coated inner plate (6) and thrust ring (7).



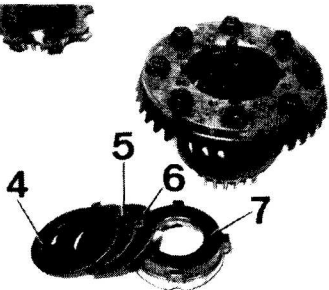
30 33 140

Insert differential side gear (8) in guides or splines of the inner plate by turning.
 Install differential gears with shafts (9) and second differential side gear (8).

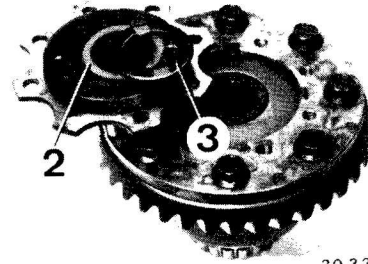


30 33 141

Install thrust ring (7), molybdenum-coated inner plate (6) and outer plate (5) as well as diaphragm spring (4) with the concave surface facing down to the differential shaft.

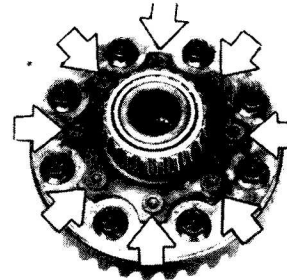


30 33 142



30 33 143

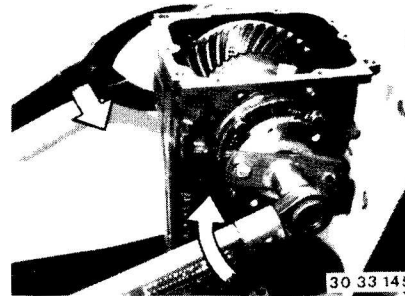
Install diaphragm spring (2) with the concave surface facing up and thrust washer (3) with the oil pockets facing up in the case cover with grease.



30 33 144

Mount the case cover with washers (make sure washers do not slide out). Install bolts with Loctite No. 270 and tighten the cover uniformly.

Installation:
 Tightening torque*.



30 33 145

Check the slip torque* of the differential lock with one each differential side gear held tight and driven. Weld a nut on a no longer required drive flange to produce a special tool for this purpose.

* See Specifications

Remove the complete differential.

Important!
Don't bend the pulse spider.

33 11 511 REPLACING SHAFT SEAL AND INPUT FLANGE - Final Drive Removed -

Mount final drive on Special Tool 33 1 010.
See Special Tool Service Information for new special tool to take final drive with 3-point (DEHAZ) suspension. Drain oil.
Unscrew case cover.

Installation:
Replace gasket.
Tightening torque*
Pour in correct volume* of oil – see Group 33 in Operating Fluids.

Press off drive flange with a tire iron.

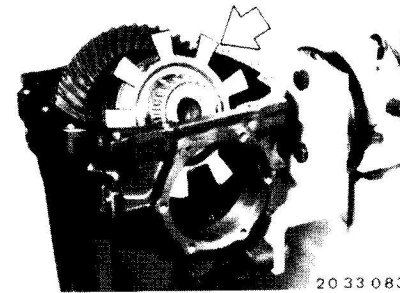
Mark both bearing covers with punch marks.
Unscrew both bearing covers.

Important!
Don't mix up bearing covers and shims. Secure shims on bearing cover with a piece of wire, if necessary.

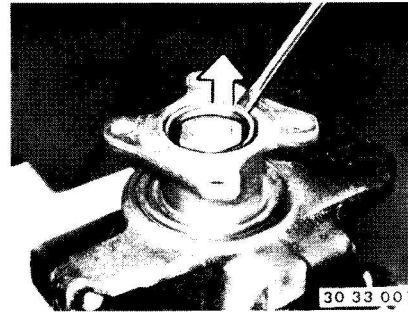
Installation:
Tightening torque*.

The differential bearing and backlash are adjusted with shims (1). Check O-ring (2), replacing if necessary.

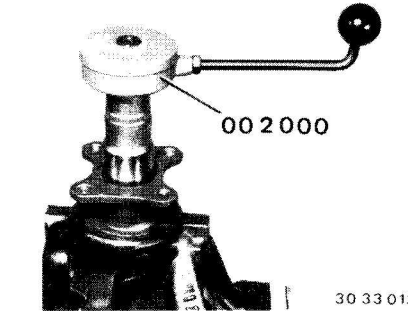
* See Specifications



20 33 006



30 33 007



30 33 013

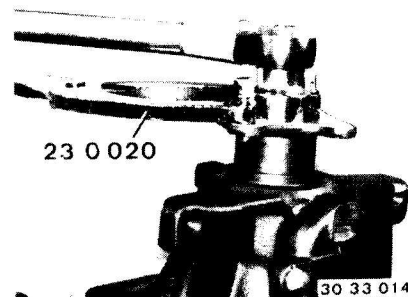
Check friction torque with Special Tool 00 2 000 and note the value.

Important!
The measured friction torque + friction torque for the new shaft seal = 20 Ncm (17 in. lbs.) must be reached during installation, but not exceeded.

Hold the drive flange with Special Tool 23 0 020 and unscrew the collar nut.

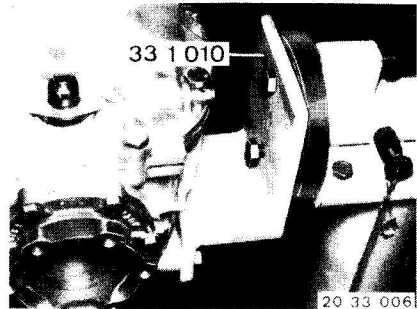
Installation:
Tightening torque*.

* See Specifications



30 33 014

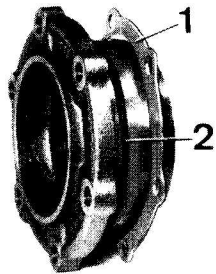
23 0 020



20 33 006



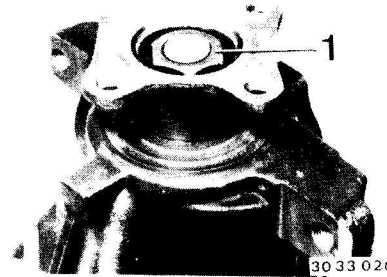
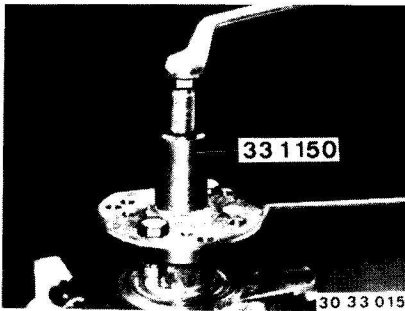
20 33 009



20 33 010

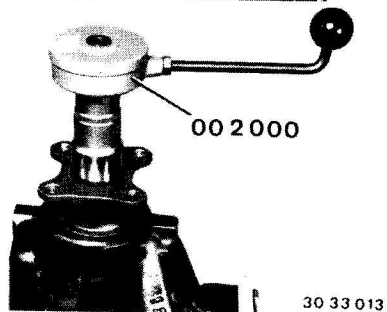
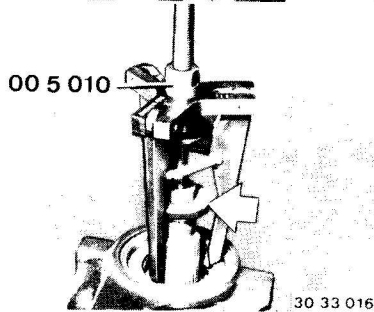
Pull off input flange with Special Tool 33 1 150.

Tighten input flange with the collar nut in steps, measuring the friction torque between steps.



Pull out shaft seal with Special Tool 00 5 010 and a thrust piece.

Adjust drive pinion bearing to friction torque value measured prior to dis-assembly and add 20 Ncm (2 in. lbs.) for a new shaft seal.

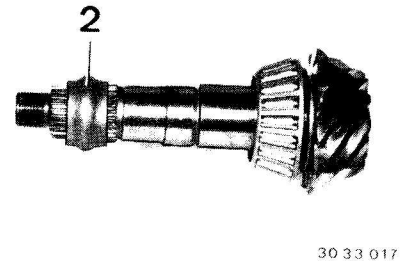
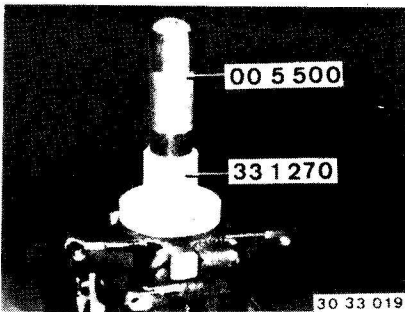


Example:

Measured torque	160 Ncm (14 in. lbs.)
New shaft seal	+ 20 Ncm (2 in. lbs.)
Pinion bearing adjusted to	180 Ncm (16 in. lbs.)

Dip shaft seal in final drive gear lube and drive in seal flush with Special Tools 33 1 270 and 00 5 500.

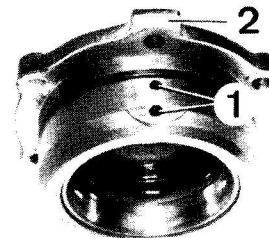
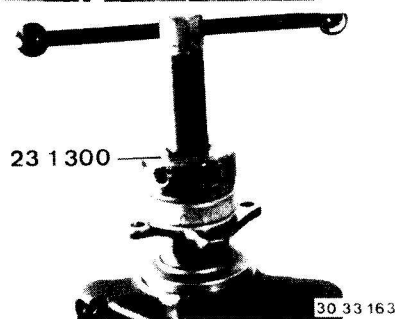
If the friction torque value (see example) is exceeded, replace bushing (2) and repeat the measuring procedures. This requires removing and installing the drive pinion - see 33 12 551.

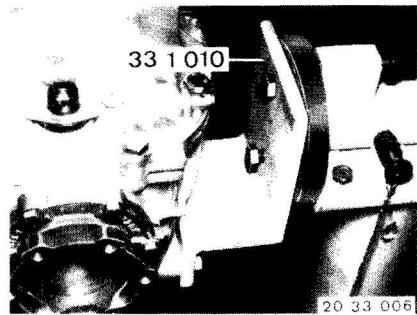


Installation:
Drive in new lockplate with Special Tools 33 4 050 and 00 5 500.

Press new input flange on to the input shaft with Special Tool 23 1 300, but do not tighten. The bushing does not have to be replaced when replacing the input flange.

Installation:
Install the complete differential again, checking for correct installation of bearing caps. The differential bores (1) always face up when the differential is installed correctly and this can be seen on the outside by way of tab (2). If applicable, check backlash and tooth contact pattern. See 33 12 551 for additional information.

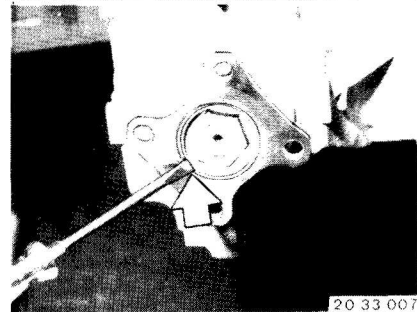




33 11 512 REPLACING SHAFT SEAL FOR INPUT FLANGE - Final Drive Removed -

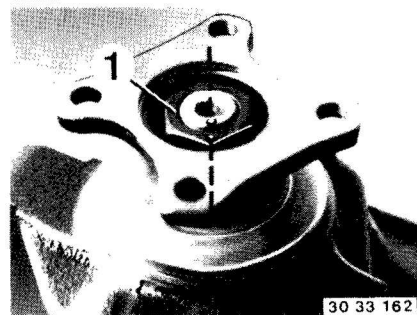
Mount final drive on Special Tool 33 1 010.
Drain oil.

Installation:
Pour in correct volume* of oil - see Group 33 in Operating Fluids.

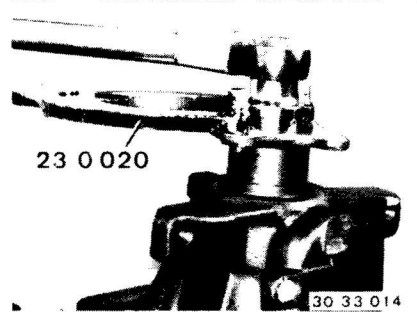


Lift out lockplate.

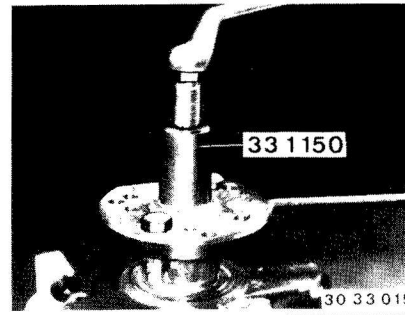
Installation:
Drive in new lockplate with Special Tools 33 4 050 and 00 5 010.



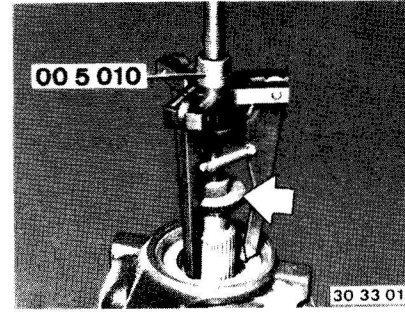
Punch mark position of nut (1) to the input shaft.



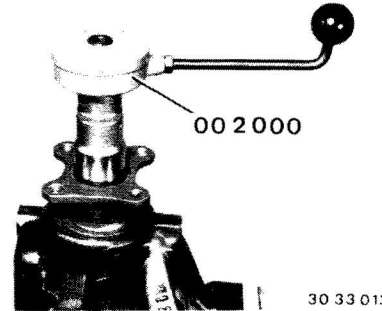
Unscrew nut (1), counterholding on the flange with Special Tool 23 0 020.



Pull off input flange with Special Tool 33 1 150.



Pull out shaft seal with Special Tool 00 5 010 and a suitable thrust piece.



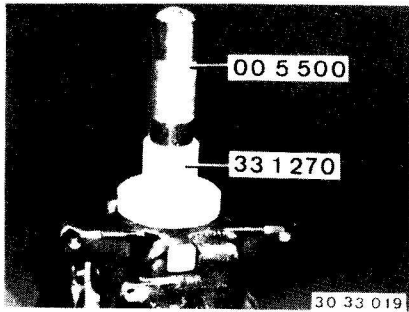
Installation:
If the bearing surface on the input flange is scored seriously, replace the input flange.

Important!
If the input flange has to be replaced, measure the friction torque with the old input flange.
If applicable, tighten nut to the punch mark, measure and note the friction torque value - see 33 11 011.
The old shaft seal does not have to be installed for measuring.

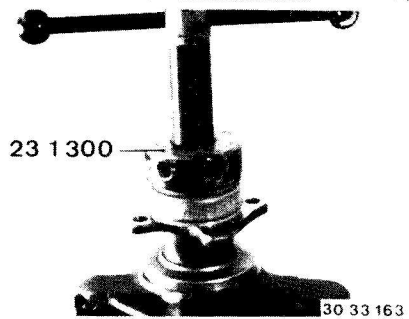
* See Specifications

33-204

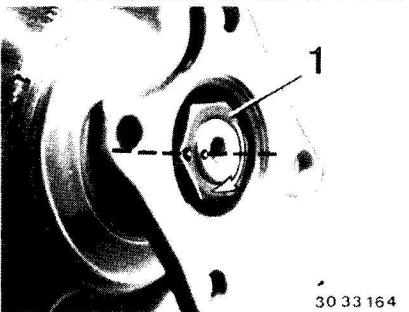
Dip new shaft seal in final drive gear lube** and drive in seal flush with Special Tools 33 1 270 and 00 5 500.



Press on input flange, if necessary with Special Tool 23 1 300; do not tighten.



Tighten input flange with collar nut (1) and then turn nut further until punch marks are aligned precisely.

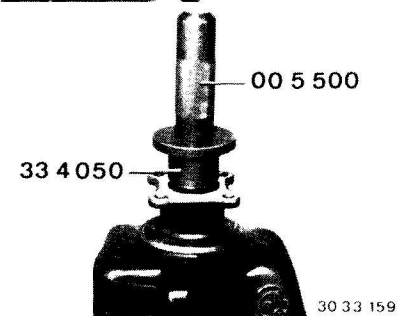


Caution!

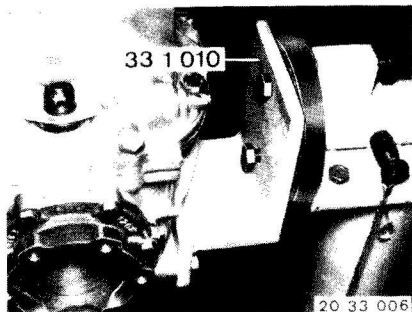
Never tighten collar nut past the punch marks and then back again, since then the bushing will have to be replaced - see 33 12 551.

Installation:

Replace lockplate.
Fill final drive with gear lube**.

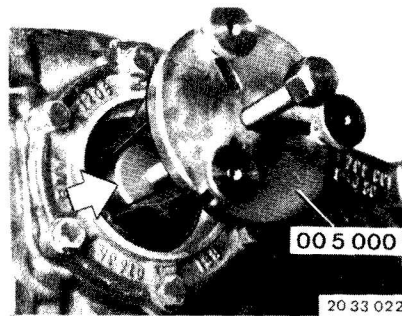


** See Gr. 33 in Operating Fluids

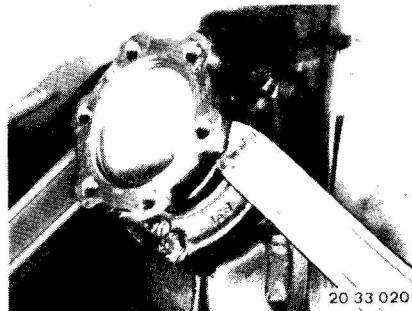


33 11 621 REPLACING SHAFT SEAL FOR DRIVE FLANGE - Final Drive Removed -

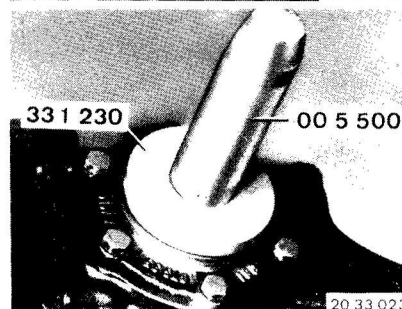
Mount final drive on Special Tool 33 1 010.



Pull out shaft seal with Special Tool 00 5 000 or 00 5 010 in conjunction with a thrust piece.

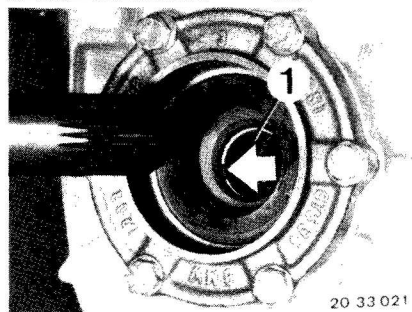


Press off drive flange with tire irons.



Installation:
Dip shaft seal in final drive gear lube. Drive in shaft seal against the stop with Special Tools 33 1 230 and 00 5 500. Replace a drive flange with a seriously scored bearing surface.

Note:
It might be necessary to machine Special Tool 33 1 230 because of the side cover casting tolerances.



Installation:
Prior to installation of the drive flange, place wire snap ring (1) in groove of the differential case that both ends of the wire snap ring are recessed in the groove. This will prevent lateral bending of the ring. Press in drive flange by hand and turn slightly until the wire snap ring is heard to engage. Replace stretched snap rings.

33-206

33 11 731 REPLACING BOTH BEARINGS FOR DIFFERENTIAL CASE - Final Drive Removed -

Mount final drive on Special Tool 33 1 010.
Drain oil.
Unscrew case cover.

Installation:

Replace gasket.
Tightening torque*.
Pour in correct amount* of gear lube - see Gr. 33 in Operating Fluids.

Pry off drive flanges with a tire iron for this purpose.

Punch mark bearing caps and remove them.

Important!

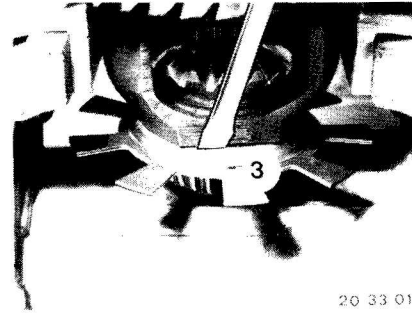
Don't mix up bearing caps and shims to make determination of the friction torque easier.

Remove complete differential case.

Important!

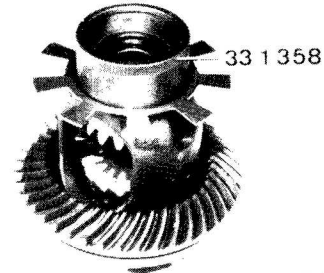
Don't bend the pulse spider.

* See Specifications

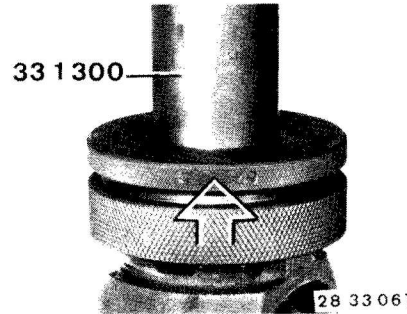


Press pulse spider off of differential case.

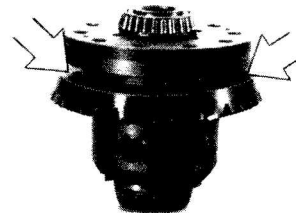
Important!
Don't bend the pulse spider.



Installation:
Press on pulse spider with Special Tool 33 1 304.

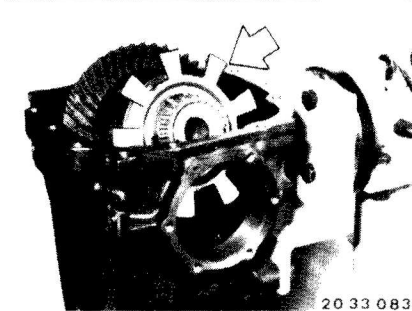
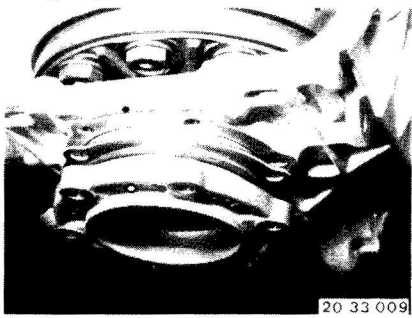
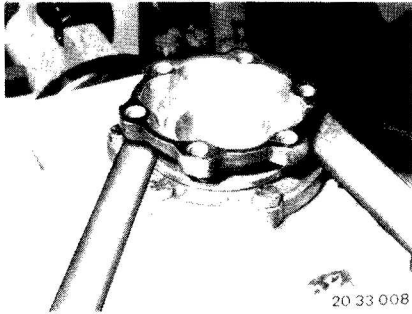
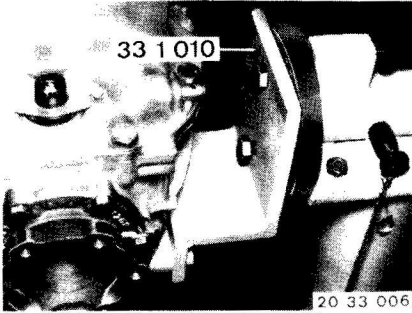


Pull off tapered roller bearing on differential case with Special Tool 33 1 300.



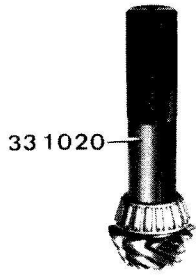
Remove ring gear (cold).

28 33 075



20 33 083

33-207

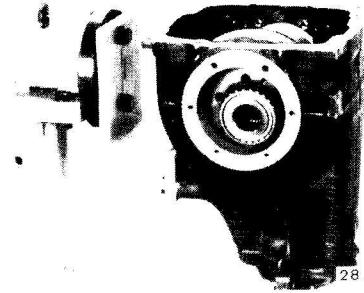


33 1 020

30 33 030

Installation:
Press on new tapered roller bearings cold with Special Tool 33 1 020.

Important!
Always only install both bearings of same make.



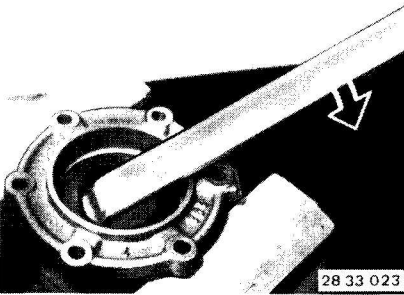
28 33 094

If only differential bearings are being replaced, the drive pinion can remain installed and the differential case is installed without the ring gear to determine the thickness of shims.

Important!
Note make of bearings - needed for friction torque determination.

Lift shaft seals out of both bearing caps.

Lubricate new bearings with approved final drive gear lube** thoroughly and let them drip dry.

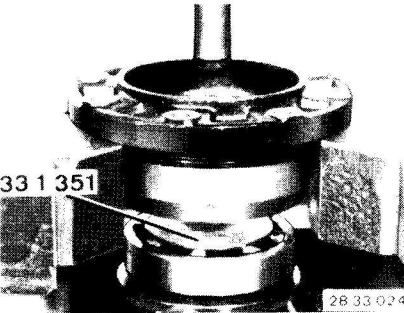


28 33 023

Press out bearing outer races with Special Tools 33 1 350 and 33 1 351.

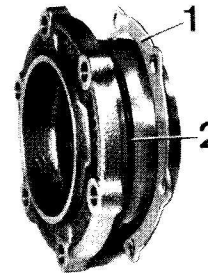
Important!
Puller must engage in the bearing outer race.

Install side bearing caps as marked with corresponding shims (1), but without O-rings (2) at first. Tighten bolts of bearing cap opposite the ring gear end uniformly. Tightening torque*.



33 1 351

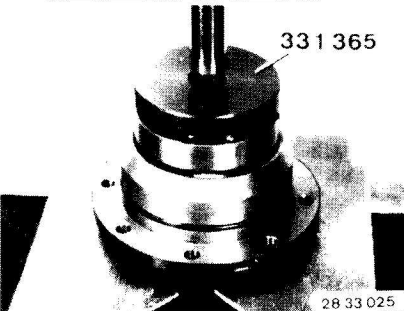
28 33 024



20 33 010

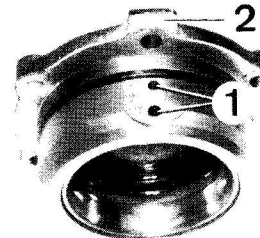
Installation:
Press in new bearing outer races with Special Tool 33 1 365.

Compensating bores (1), recognized on the outside by tab (2), always face up in the installed position of the transmission.



33 1 365

28 33 025



28 33 072

* See Specifications
** See Gr. 33 in Operating Fluids

Axial preload force of differential case bearings (4000 N = 882 lbs.) can be determined with help of the friction torque*.

Tighten bolts of the second bearing cap uniformly only enough, that the differential can still be turned easily.

Apply an output flange on the side tightened to the tightening torque and measure the friction torque with a locally made clamp with a welded nut and friction torque meter, Special Tool 00 2 000.

Turn the friction torque meter at a speed of approx. 50 rpm.

The friction torque* specified in the differential case bearing table* should be reached, but not exceeded. If new shaft seals have already been installed, 20 Ncm (2 in. lbs.) must be added for each seal in which an output shaft runs while measuring.

If the specified friction torque is not reached, even though both bearing caps are bolted with the specified tightening torque*, a thinner shim must be installed on the end opposite the ring gear and measuring repeated.

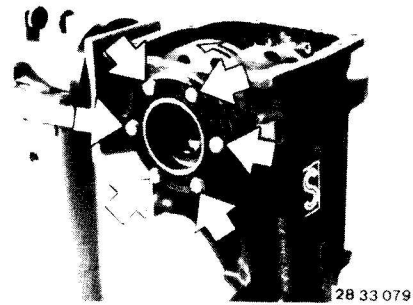
* See Specifications

If the friction torque is reached, even though the second bearing cap has not yet been tightened to the correct tightening torque*, a thicker shim must be used on the ring gear end and measuring procedures repeated.

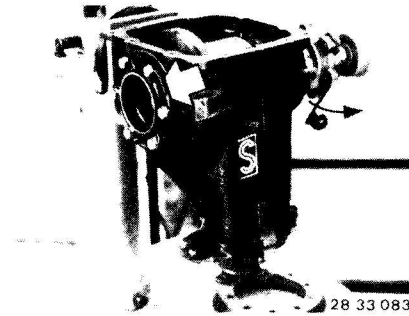
To make finding the shim thickness easier, the distance between the shim and case can be measured with a feeler gage blade and added to the thickness of the used shim.

Example:
 Second bearing cap not tightened fully (bolts screwed in uniformly).
 Specified friction torque* (e.g. 190 Ncm = 16.5 in. lbs.) is reached, but without shaft seals.
 Gap measured with blade of feeler gage 0.20 mm (0.008")
 Used shim thickness 1.40 mm (0.055")
 Install shim of thickness 1.60 mm (0.063") and measure again.

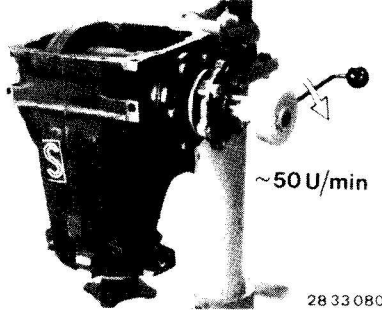
* See Specifications



28 33 079

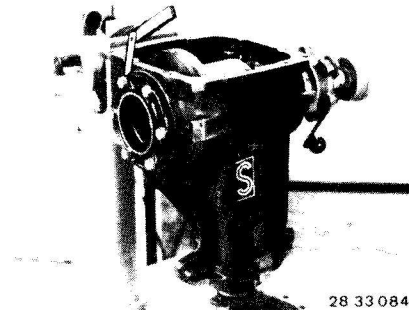


28 33 083

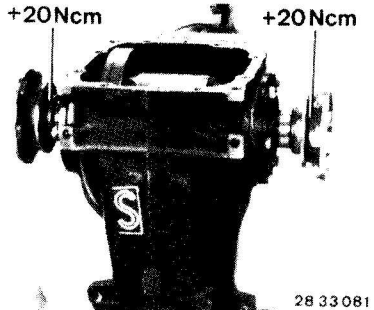


~50 U/min

28 33 080



28 33 084



28 33 081

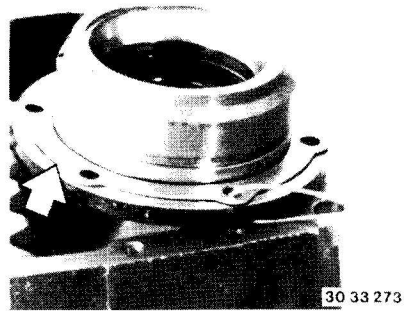


28 33 085



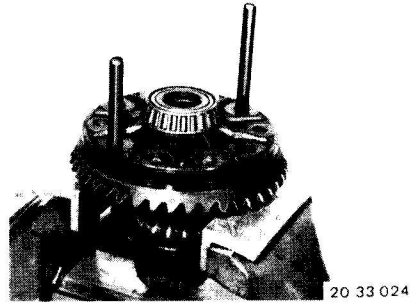
28 33 082

Remove differential case.
Arrange side covers and shims of
determined thickness and don't mix
them up.



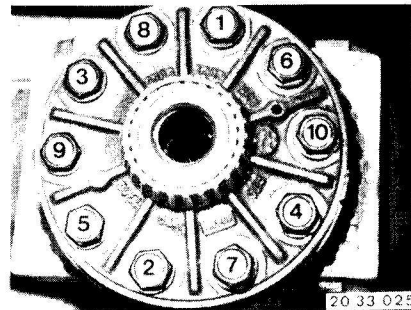
30 33 273

Installation:
Clean tapped bores thoroughly (with
tapper).
Heat ring gear to max. 100° C (212° F),
checking temperature with a thermo-
color pencil.
Mount ring gear with two locally
manufactured staybolts for guiding.



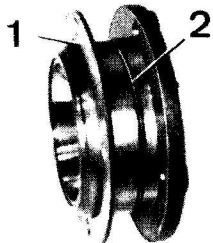
20 33 024

Install new bolts with Loctite No. 270.
Tighten bolts in order of 1 ... 10.
Tightening torque*.
Then tighten bolts with torque angle*.



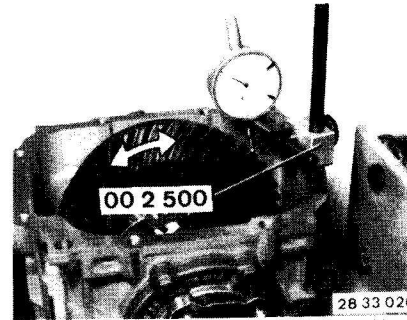
20 33 025

Install differential with ring gear and
pulse gear.
Install side covers as marked with
corresponding washers (1) and new
O-rings (2).
Tightening torque*.

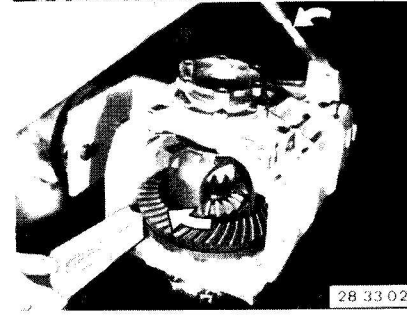


30 33 010

* See Specifications



28 33 026



28 33 027

Backlash/Tooth Contact Pattern
Adjustments:
Mount Special Tool 00 2 500 and
measure the backlash*.

Important!

The tooth contact pattern is always
most important for a perfectly adjusted
pinion/ring gear set.
See "Replacing Drive Pinion and Ring
Gear" in 33 12 551 for general instruc-
tions on tooth contact pattern adjust-
ments.

To check the tooth contact pattern,
coat the ring gear teeth with printer's
ink, turn in both directions several
times and stop the ring gear abruptly
with a piece of hard wood.

Correct backlash* and tooth contact
pattern by changing the thickness of
both shims (1).

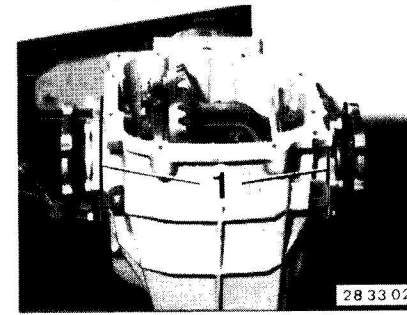
If backlash is excessive, use a thinner
shim on the ring gear end.
If backlash is insufficient, use a thicker
shim on the ring gear end.

An axial displacement of the ring gear
by 0.01 mm (0.0004") will cause a
change in backlash of 0.0076 mm
(0.0003").

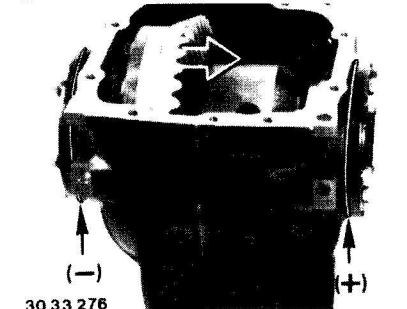
Important!

The total thickness of both shims must
not be changed.

If a thinner or thicker shim is required
to correct the tooth contact pattern,
the total thickness must be corrected
with the second shim, since otherwise
the friction torque of bearings would
be changed again.



28 33 029



30 33 276

* See Specifications

Installation:

Dip shaft seal in final drive gear lube.
 Drive in shaft seal against the stop
 with Special Tools 33 1 230 and
 00 5 500.

Replace a drive flange with seriously
 scored bearing surfaces.

Note:

It might be necessary to machine
 Special Tool 33 1 230 because of the
 side cover casting tolerances.

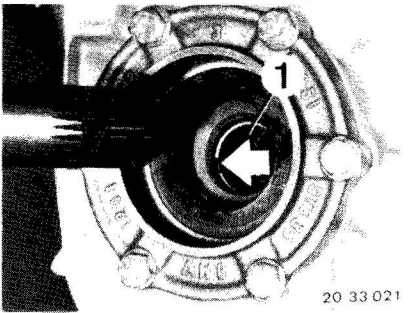
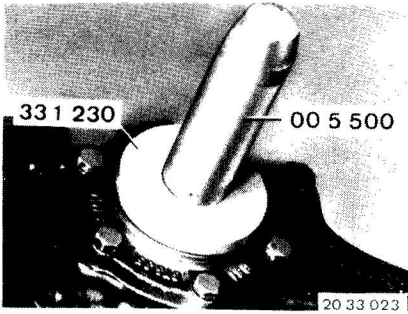
Installation:

Place round wire snap ring (1) in
 groove of the differential case prior to
 installation of the drive flange in such
 a manner, that both ends of the snap
 ring are recessed in the groove.

This prevents lateral bending of the
 ring.

Press in drive flange by hand and turn
 slightly until the snap ring is heard to
 engage.

Replace a stretched snap ring.



33-211

33 12 526 REPLACING BEARINGS FOR DRIVE PINION - Final Drive Removed -

Mount final drive on Special Tool 33 1 010.

Drain oil.

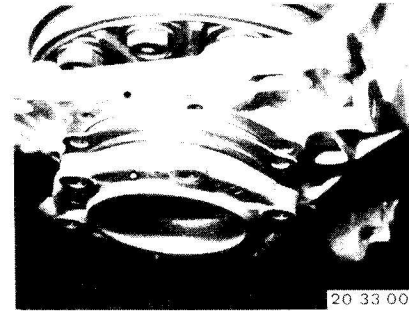
Unscrew case cover.

Installation:

Replace gasket.

Tightening torque*.

Pour in correct volume* of oil - see Group 33 in Operating Fluids.



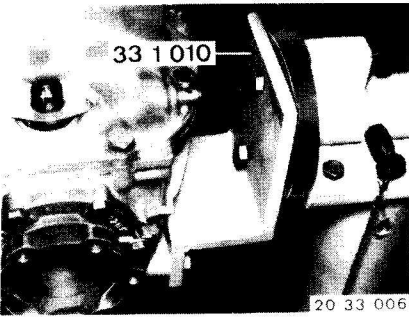
Punch mark both bearing caps. Unscrew bolts of both bearing caps and take off bearing caps (turn if necessary, since seals suck tight).

Important!

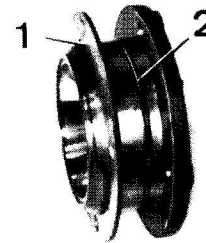
Don't mix up bearing caps and shims. If necessary, attach shims on bearing caps with pieces of wire.

Installation:

Tightening torque*.



Pry off drive flanges with a tire iron.



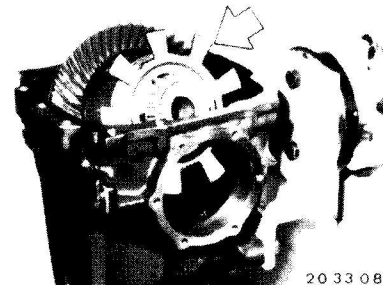
Axial preload force (4000 N = 882 lbs.) of differential bearings and backlash of ring gear/pinion are adjusted with shims (1).

Installation:

Place round wire snap ring (1) in groove of the differential case prior to installation of the drive flange in such a manner, that both ends of the snap ring are recessed in the groove. This prevents lateral bending of the snap ring.

Press in drive flange by hand and turn slightly, until the snap ring is heard to engage.

Replace a stretched snap ring.



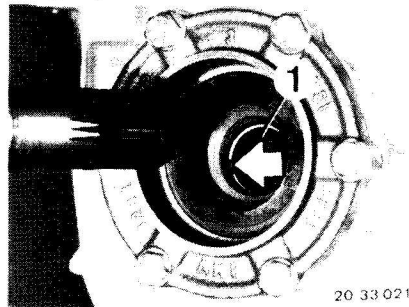
Remove the complete differential.

Important!

Don't bend the pulse spider.

* See Specifications

* See Specifications

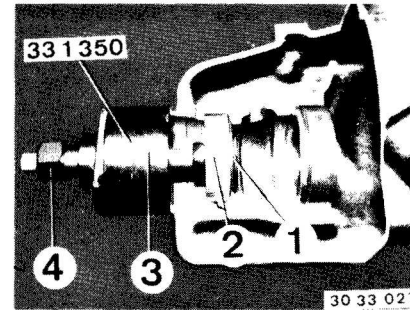


Lift out lockplate.

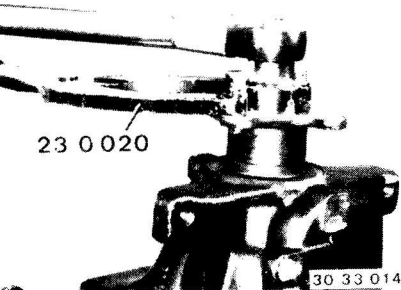


Pull out front bearing outer race with Special Tool 33 1 350.

- 1 Spreader
- 2 Front bearing outer race
- 3 Pull bell housing
- 4 Pressure bolt



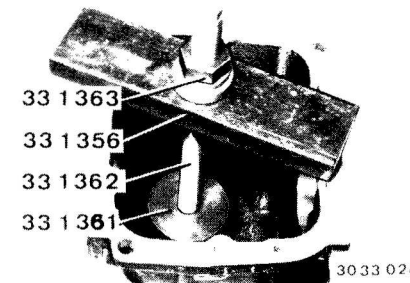
Hold input flange with Special Tool 23 0 020 and unscrew the collar nut.



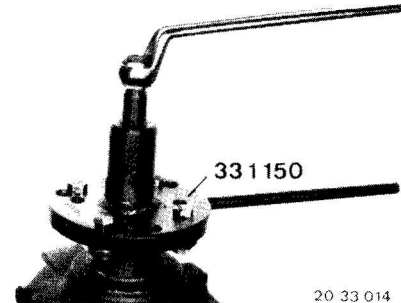
Pull out rear bearing outer race with Special Tool 33 1 360, consisting of:

Puller head	33 1 361
Threaded spindle	33 1 362
Bearing bridge	33 1 356
Pressure nut	33 1 363

Important!
Shim (X) is located underneath the rear bearing outer race. It will be needed again for adjustment of the block distance.

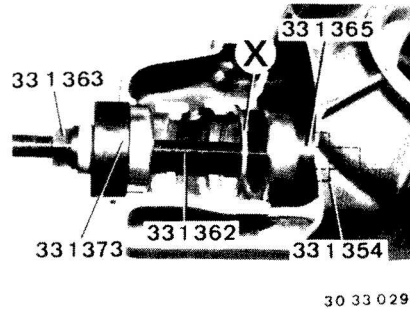


Pull off input flange with Special Tool 33 1 150.
The specified friction torque* is given for new bearings and friction torque of old bearings does not have to be measured.



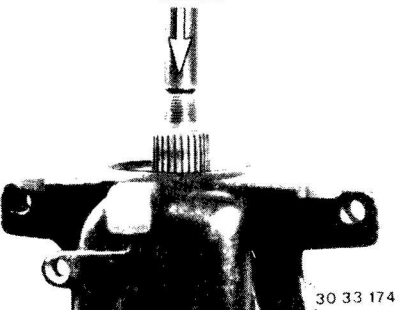
Install old shim (X) in front of the rear bearing outer race.
Pull in bearing outer races with Special Tool 33 1 360, consisting of:

Disc for front outer race	33 1 373
Disc for rear outer race	33 1 365
Threaded spindle	33 1 362
Pressure nut	33 1 363
Nut	33 1 354



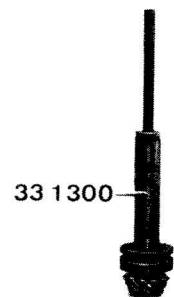
Press out drive pinion.

Caution!
Be careful not to damage the threads.



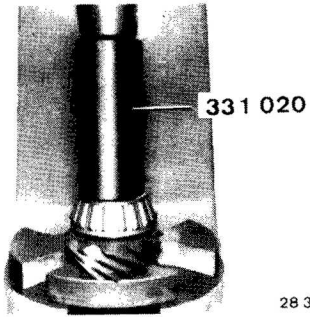
Pull tapered roller bearing off of drive pinion with Special Tool 33 1 300.

Caution!
Be careful not to damage the pinion - use soft aluminum jaws or pieces of wood.



* See Specifications

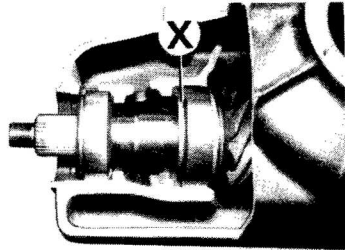
* See Specifications



28 33 015

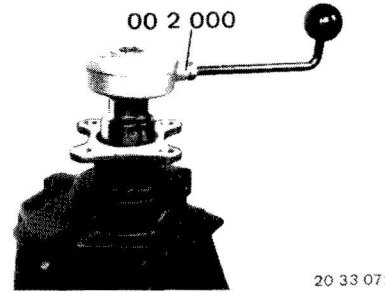
Press new tapered roller bearing on to drive pinion with Special Tool 33 1 020.

Important!
Always only use both bearings of the same make.



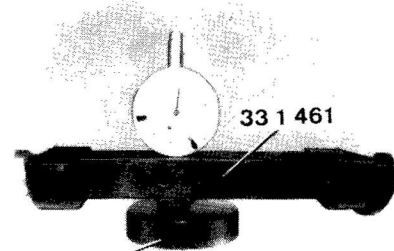
30 33 033

The drive pinion is installed with new tapered roller bearings, but without clamping sleeve, to determine correct thickness of shim (X).



20 33 072

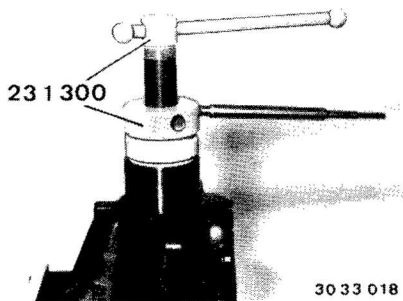
Important!
Measure friction torque at intervals during the tightening procedures with Special Tool 00 2 000.



33 1 462

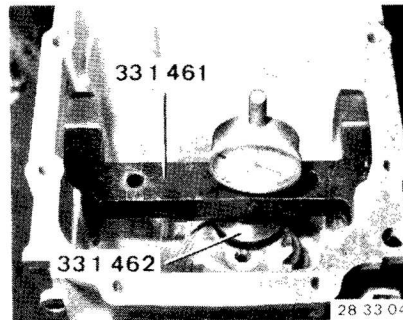
28 33 019

Block Distance of Drive Pinion:
Mount dial gage in Special Tool 33 1 461.
Place Special Tool 33 1 461 with dial gage on Special Tool 33 1 462 and set the dial gage to 0 (zero) with preload.



30 33 018

Install drive pinion in rear bearing outer race.
Pull front tapered roller bearing on to drive pinion with Special Tool 23 1 300 in conjunction with a spacing sleeve.

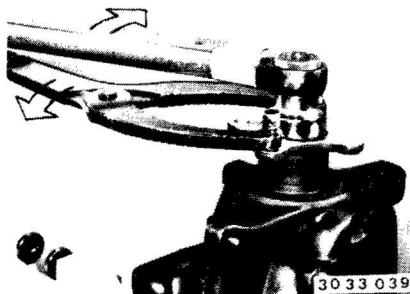


28 33 043

Place Special Tool 33 1 462 on the drive pinion.
Place Special Tool 33 1 461 in case.

Determine value Y:
Basic distance C = 11.50 mm (0.453")
Gage thickness B = 9.50 mm (0.374")

Mount input flange.
Adjust the friction torque of the drive pinion bearings to 250 Ncm (22 in. lbs.) by tightening the collar nut carefully.



30 33 039

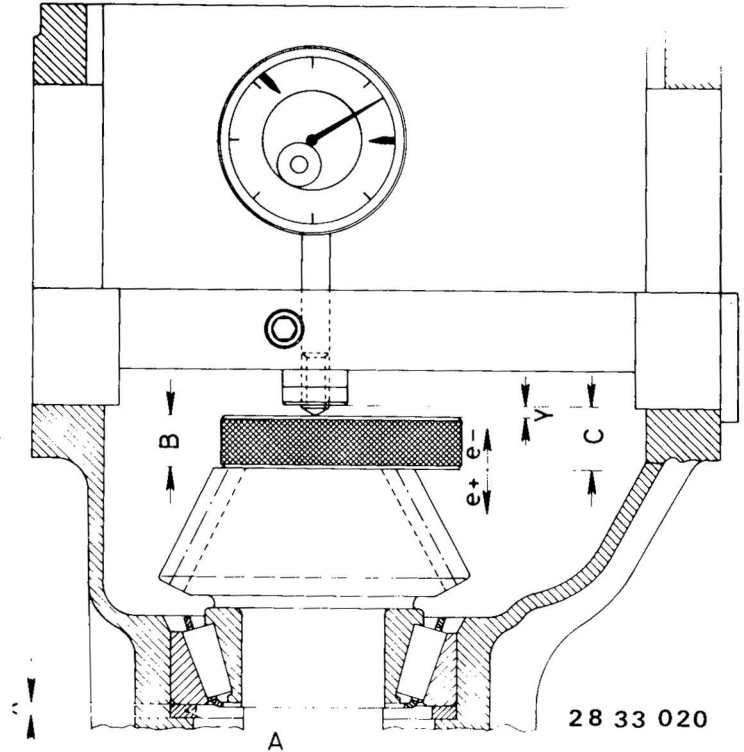
EXAMPLES FOR DETERMINATION OF CORRECT SHIM THICKNESS (X)

Example I		Example II	
C	11.50 mm (0.453")	C	11.50 mm (0.453")
e +	0.10 mm (0.004")	e -	0.10 mm (0.004")
C nominal		C nominal	
	11.60 mm (0.457")		11.40 mm (0.449")
Y on dial gage + gage thickness		Y on dial gage + gage thickness	
	1.90 mm (0.075") 9.50 mm (0.374")		2.20 mm (0.087") 9.50 mm (0.374")
C actual		C actual	
	11.40 mm (0.449")		11.70 mm (0.461")
C nominal		C actual	
	11.60 mm (0.457")		11.70 mm (0.461")
C actual		C nominal	
	11.40 mm (0.449")		11.50 mm (0.453")
a		a	
	0.20 mm (0.008")		0.20 mm (0.008")
Gage thickness A		Gage thickness A	
	4.10 mm (0.161")		3.90 mm (0.513")
- a		+ a	
	0.20 mm (0.008")		0.20 mm (0.008")
Shim thickness (X)		Shim thickness (X)	
	3.90 mm (0.153")		4.10 mm (0.161")

If C nominal is larger than C Actual, "a" is subtracted (-) from shim thickness X.

If C nominal is smaller than C actual, "a" is added (+) to shim thickness X.

The permissible tolerances for distance (X) result from the tolerances for shim thicknesses which are available in steps from 0.01 to 0.03 mm (0.0004 to 0.0012").



33-215

Remove drive pinion after determining the thickness of shim (X).

Important!
Note make of bearings - this is required for determination of friction torque.

Remove rear bearing outer race and install it again with shim (X) of determined thickness.

Install drive pinion with a new clamping sleeve (2).

Dip shaft seal in final drive gear lube and drive in flush with Special Tools 33 1 270 and 00 5 500.

Press (don't pull) input flange on to the input shaft with Special Tool 23 1 300.
Axial preload force (5000 N = 1102 lbs.) of drive pinion bearings can be determined with help of the friction torque.

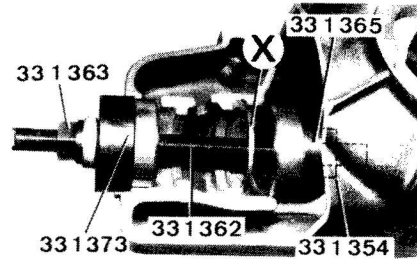
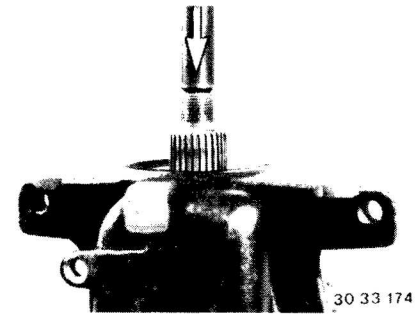
Tighten input flange with the collar nut in steps, measuring the friction torque after each step (see below).

Measure friction torque* with Special Tool 00 2 000 and a suitable wrench socket.

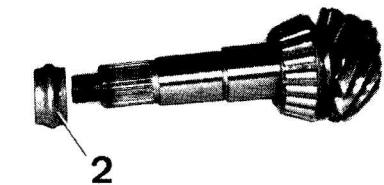
Important!
The relation between friction torque and preload force differs depending on the make of bearings. Take the specified friction torque from the pinion bearing table* and add 20 Ncm (2 in. lbs.) for the new shaft seal.

Install differential. Install side covers as marked with corresponding washers (1) and new O-rings (2). Tighten bolts uniformly. Tightening torque*.

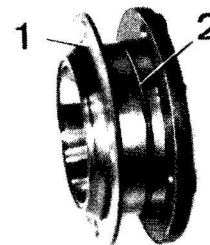
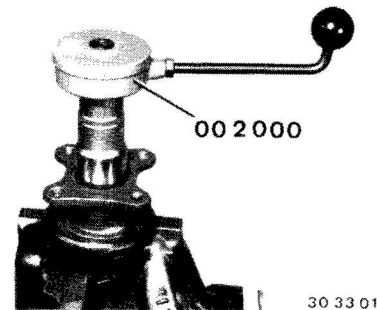
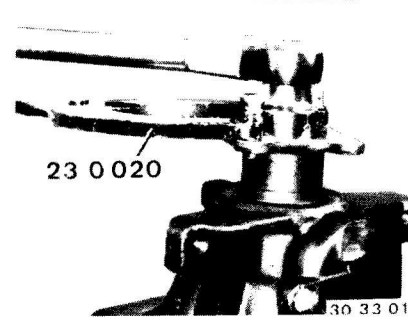
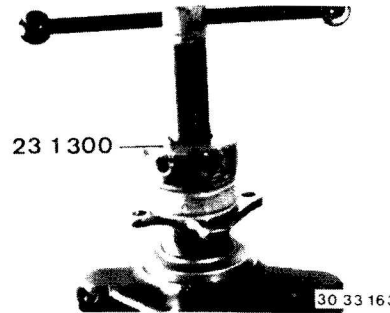
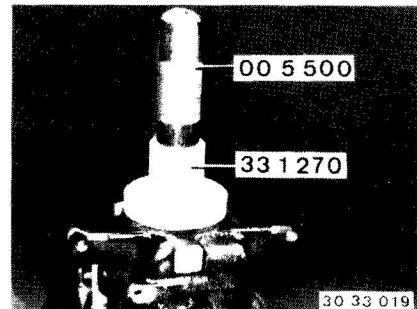
* See Specifications



28 33 014



20 33 016



30 33 010

Adjusting Backlash/Tooth Contact

Pattern:

Mount Special Tool 00 2 500 and measure backlash* with a dial gage.

Important!

The tooth contact pattern is always most important for a perfectly adjusted pinion/ring gear set.

To check the tooth contact pattern, coat the ring gear teeth with printer's ink, turn in both directions several times and stop the ring gear abruptly with a piece of hard wood.

Correct backlash* and tooth contact pattern by changing the thickness of both shims (1).

If backlash is excessive, use a thinner shim on the ring gear end.

If backlash is insufficient, use a thicker shim on the ring gear end.

An axial displacement of the ring gear by 0.01 mm (0.0004") will cause a change in backlash of 0.0076 mm (0.0003").

Important!

The total thickness of both shims must not be changed.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.

See "Replacing Differential Bearings" in 33 11 731 for information on determining friction torque of differential bearings.

* See Specifications

See "Replacing Drive Pinion and Ring Gear" in 33 12 551 for general information on tooth contact pattern adjustments.

Pull out old shaft seals with Special Tool 00 5 000 or 00 5 010 together with a thrust piece.

Installation:

Dip new shaft seals in final drive gear lube.

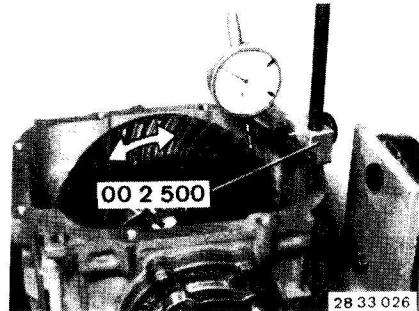
Drive in shaft seals against the stop with Special Tools 33 1 230 and 00 5 500.

Replace a drive flange with seriously scored bearing surfaces.

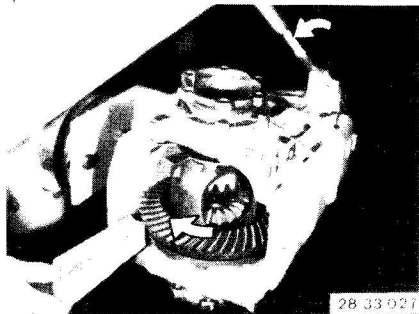
Note:

It could be necessary to machine Special Tool 33 1 230 because of the side cover casting tolerances.

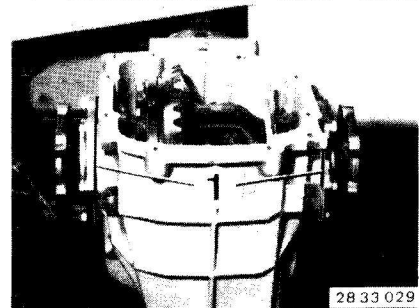
Drive in new lockplate with Special Tools 33 4 050 and 00 5 500.



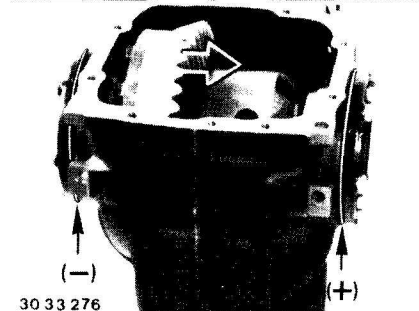
28 33 026



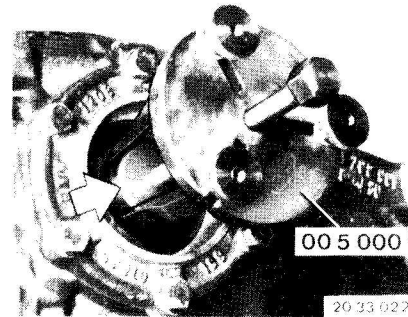
28 33 027



28 33 029

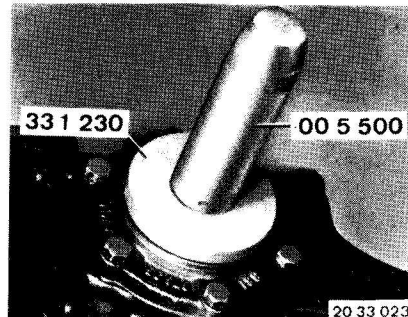


30 33 276



00 5 000

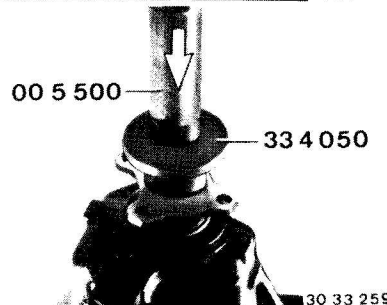
20 33 022



33 1 230

00 5 500

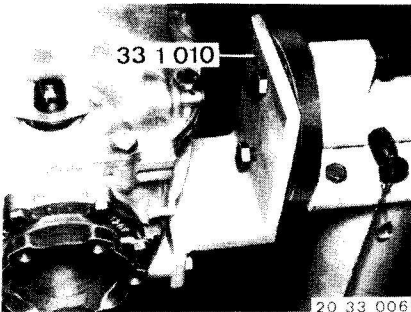
20 33 023



00 5 500

33 4 050

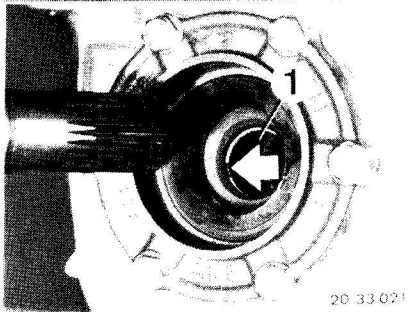
30 33 259



20 33 006



20 33 008



20 33 021



20 33 009

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

Mount final drive on Special Tool 33 1 010.

Drain oil.

Unscrew case cover.

Installation:

Replace gasket.

Tightening torque*.

Pour in correct volume* of oil - see Group 33 in Operating Fluids.

Pry off both drive flanges with a tire iron.

Installation:

Place round wire snap ring (1) in the groove of the differential case prior to installation of the drive flange in such a manner, that both ends of the snap ring are recessed in the groove. This prevents lateral bending of the ring.

Press in drive flange by hand and turn slightly until snap ring is heard to engage.

Replace a stretched snap ring.

Punch mark both bearing caps. Remove both bearing caps.

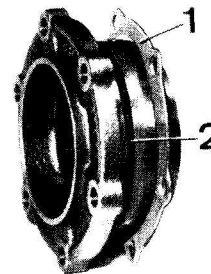
Important!

Don't mix up bearing caps and shims. Attach shims on bearing caps with pieces of wire, if necessary.

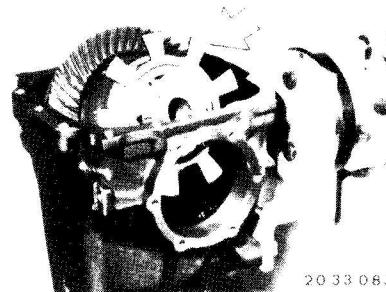
Installation:

Tightening torque*.

* See Specifications



20 33 010



20 33 083

Differential case bearings and backlash are adjusted with shims (1). Check O-ring (2), replacing if necessary.

Remove complete differential case.

Important!

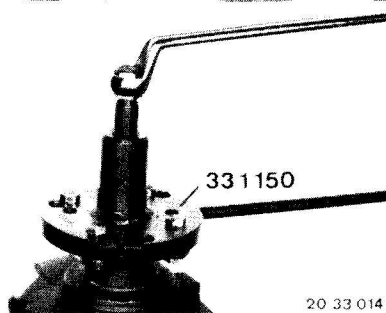
Don't bend the pulse spider.



20 33 073

Lift out lockplate.

Hold with Special Tool 23 0 020 and unscrew nut (1).



20 33 014

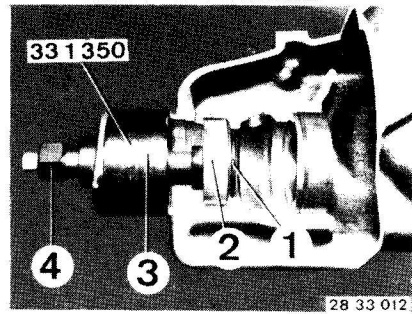
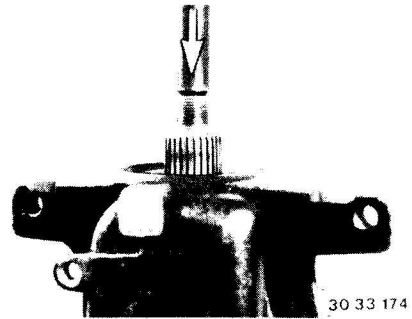
Pull off input flange with Special Tool 33 1 150.

The specified friction torque* is given for new drive pinion bearings and the friction torque of old bearings does not have to be determined.

* See Specifications

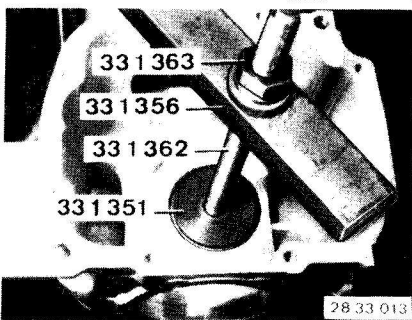
Press out drive pinion.

Important!
Replace both drive pinion bearings, using only one make.



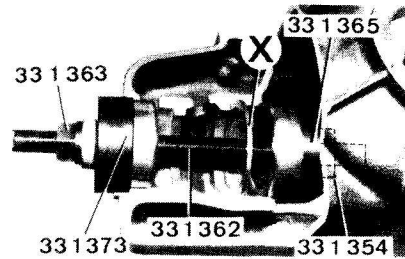
Pull out front bearing outer race with Special Tool 33 1 350.

- 1 Spreader
- 2 Front bearing outer race
- 3 Puller bell housing
- 4 Pressure bolt

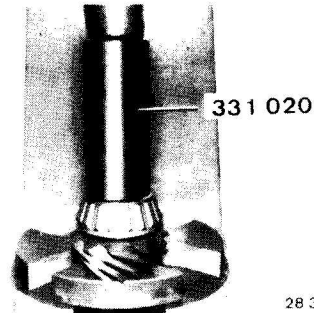


Pull out rear bearing outer race with Special Tool 33 1 360, consisting of:
puller head 33 1 361,
threaded spindle 33 1 362,
bearing bridge 33 1 356 and
pressure nut 33 1 363.

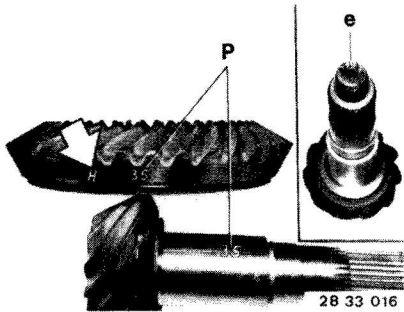
Important!
Shim (X) is located underneath the rear bearing outer race. It will be needed again for pinion/ring gear adjustments.



Install old shim (X) in front of the rear bearing outer race.
Pull in bearing outer races with Special Tool 33 1 360, consisting of:
pulling disc for front outer race 33 1 373,
pulling disc for rear outer race 33 1 365,
threaded spindle 33 1 362,
pressure nut 33 1 363 and
nut 33 1 354.



Press new tapered roller bearing inner race on to new drive pinion with Special Tool 33 1 020.

**Important!**

Drive pinions and ring gears are paired for optimal smooth running in special machines.

The pairing code (P) is inscribed electrically on the drive pinion and ring gear.

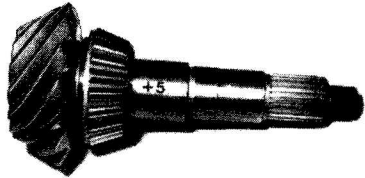
Never install a ring gear and drive pinion with different pairing codes (P) together.

H Gleason hypoid teeth
(helical shape)

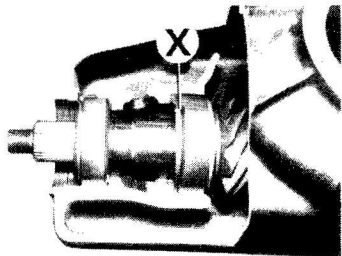
The number inscribed together with "+" or "-" is the deviation from basic distance C in hundredths of millimeter and is required for adjustment of the tooth contact pattern with shims.

+ e is added to C.

- e is subtracted from C.

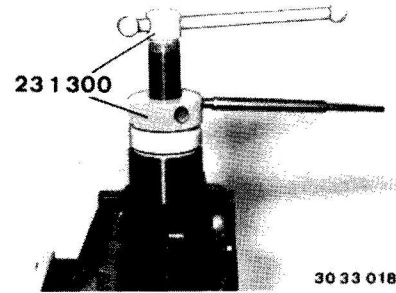


28 33 017



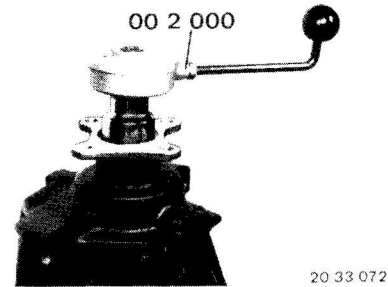
26 33 018

To determine the thickness of shim (X), install drive pinion with new tapered roller bearings, but without bush.



Install drive pinion in rear bearing outer race.

Press (don't pull) front tapered roller bearing on to the drive pinion with Special Tool 23 1 300 together with a spacing sleeve.



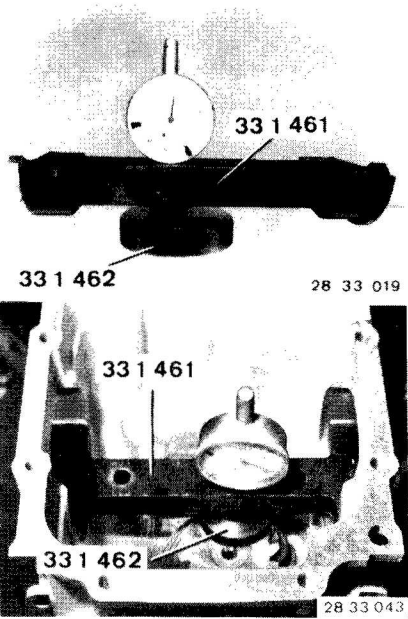
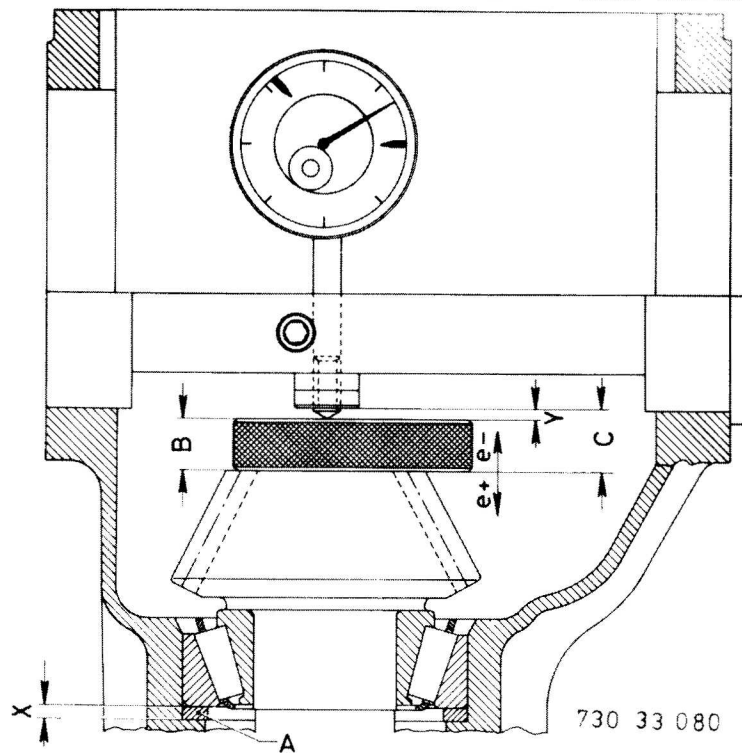
Mount input flange.

Tighten collar nut in steps and measure the friction torque after each step with Special Tool 00 2 000, adjusting it to 250 Ncm (22 in. lbs.) with the collar nut.

33-220

Drive Pinion Block Distance:
 Mount dial gage in Special Tool
 33 1 481.
 Place Special Tool 33 1 482 with dial
 gage on Special Tool 33 1 482 and set
 the dial gage to 0 (zero) with preload.

Place Special Tool 33 1 482 on drive
 pinion.
 Insert Special Tool 33 1 481 in case.
 Determine value Y.
 Basic distance C = 11.50 mm (0.453")
 Gage thickness B = 9.50 mm (0.374")



Example I:

C	11.50 mm (0.453")
e +	0.10 mm (0.004")
C nominal	11.60 mm (0.457")
Y on dial gage	1.90 mm (0.075")
+ gage thickness B	9.50 mm (0.374")
C actual	11.40 mm (0.449")
C nominal	11.60 mm (0.457")
C actual (-)	11.40 mm (0.449")
a	0.20 mm (0.008")
Test shim A	4.10 mm (0.161")
- a	0.20 mm (0.008")
Shim thickness X	3.90 mm (0.153")

If C nom. is larger than C actual, "a" is subtracted (-) from shim thickness X.

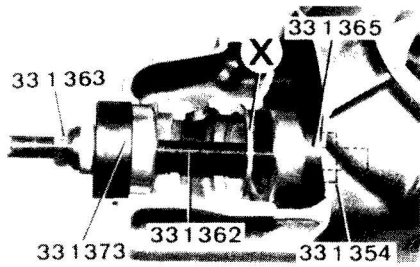
Example II:

C	11.50 mm (0.453")
e -	0.10 mm (0.004")
C nominal	11.40 mm (0.449")
Y on dial gage	2.20 mm (0.087")
+ gage thickness B	9.50 mm (0.374")
C actual	11.70 mm (0.461")
C actual	11.70 mm (0.461")
C nominal (-)	11.50 mm (0.453")
a	0.20 mm (0.008")
Test shim A	3.90 mm (0.153")
+ a	0.20 mm (0.008")
Shim thickness X	4.10 mm (0.161")

If C nominal is smaller than C actual, "a" is added (+) to shim thickness X.

The permissible tolerances for distance (X) result from the tolerances for shim thicknesses in steps of 0.01 to 0.03 mm (0.0004 to 0.0012").

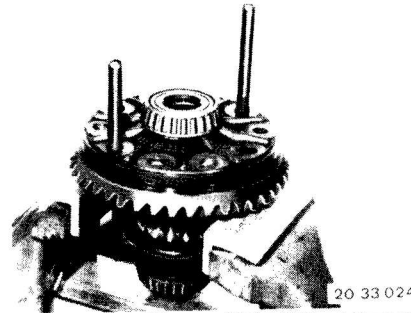
33-221



28 33 014

Remove drive pinion and rear bearing outer race.
Press in shim (X) of determined thickness and bearing outer race.

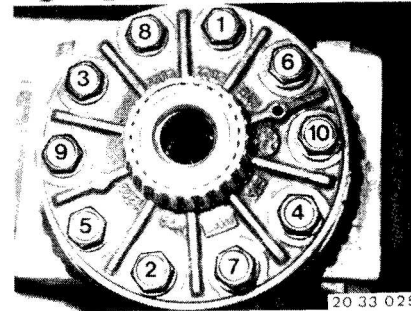
Important!
Do not install the drive pinion at this point, since it is first necessary to measure and adjust the friction torque of the new differential case bearing.



20 33 024

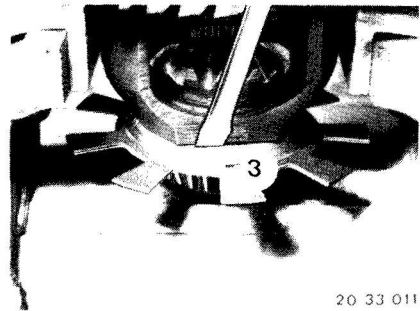
Remove ring gear (cold).

Installation:
Clean threads thoroughly (with a tapper).
Heat ring gear to max. 100° C (212° F), checking the temperature with a thermochrome pencil.
Mount ring gear with two locally made staybolts as guides.



20 33 025

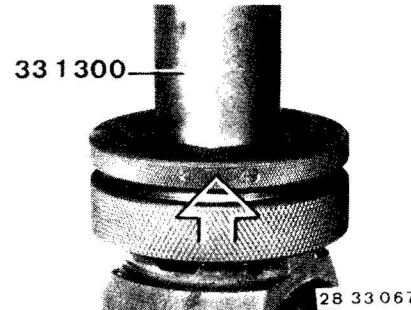
Install new bolts with Loctite No. 270 and tighten in order of (1 ... 10).
Tightening torque*.
Tighten bolts to torque angle*.



20 33 011

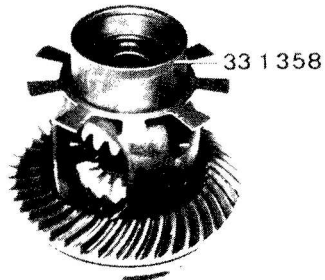
Press pulse spider off of the differential case.

Caution!
Be careful not to bend the pulse spider.



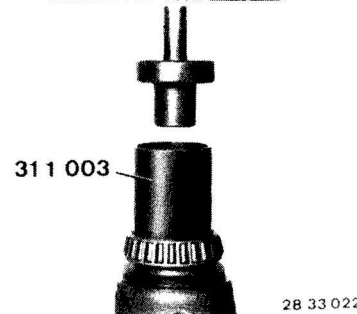
28 33 067

Pull off tapered roller bearing on the differential case with Special Tool 33 1300.



20 33 012

Installation:
Press on pulse spider with Special Tool 33 1304.



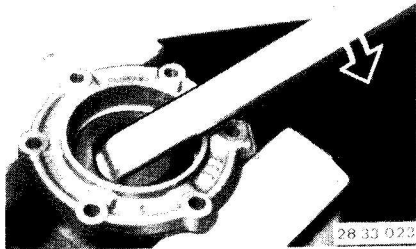
28 33 022

Installation:
Press on new tapered roller bearing inner races cold with Special Tool 33 1003.

* See Specifications

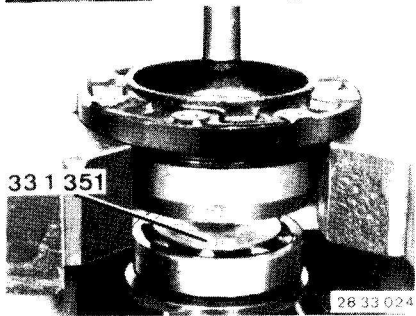
33-222

Lift shaft seals out of both bearing caps.

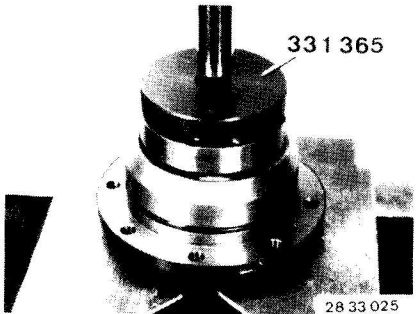


Press out bearing outer race with Special Tools 33 1 350 and 33 1 351.

Important!
Special Tool 33 1 351 must engage in the bearing outer race.



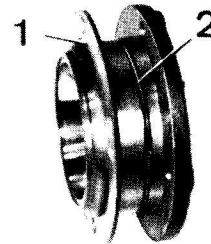
Installation:
Press in new bearing outer races with Special Tool 33 1 365.



The following 12 steps can only be omitted, if the differential case bearings were not replaced.

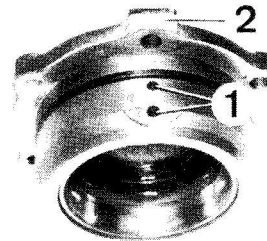
Install differential case with new ring gear and new bearings.
Lubricate bearings thoroughly with approved final drive gear lube** and let them drip dry.

Install side bearing caps as marked with corresponding shims (1) but without O-rings (2) at first.
Tighten bearing cap bolts on the side opposite the ring gear uniformly.
Tightening torque*.



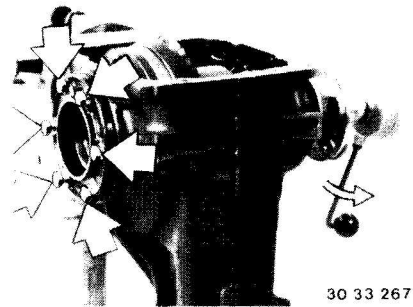
30 33 010

The compensating bore (1), which is recognized on the outside by tab (2), always faces up in the installed position of the transmission.

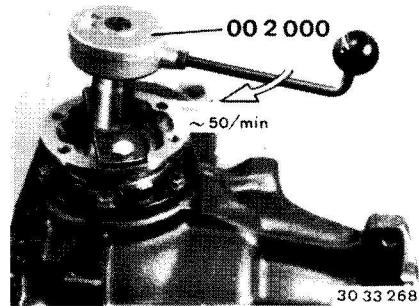


28 33 072

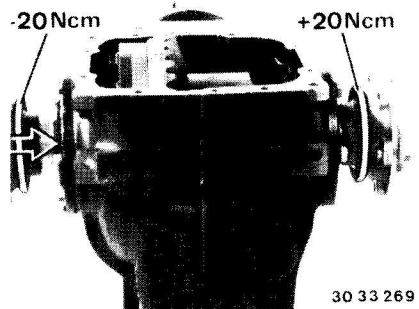
* See Specifications
** See Gr. 33 in Operating Fluids



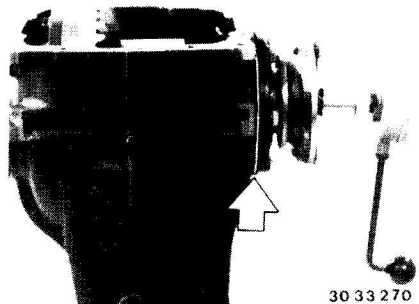
30 33 267



30 33 268



30 33 269



30 33 270

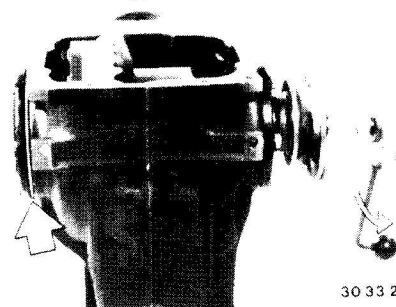
Determining Friction Torque of New Differential Case Bearings:
Axial preload force (4000 N = 882 lbs.) of differential case bearings can be determined with help of the friction torque*.
Tighten bolts of second bearing cap uniformly only enough, that the differential can still be turned easily.

Install an output flange on the end opposite the ring gear and determine the friction torque with a locally made holder with welded nut and Special Tool 00 2 000.
Turn the friction torque tester at approx. 50 rpm.

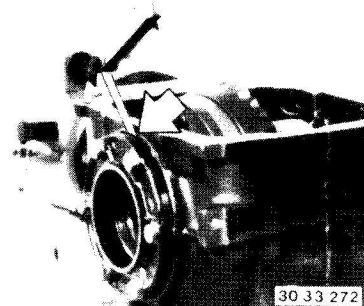
The friction torque* specified in the differential case bearing table* should be reached, but not exceeded.
If new shaft seals had already been installed, add 20 Ncm (2 in. lbs.) for each seal in which an output shaft runs while measuring.

If the given friction torque is not reached, even though both bearing caps are tightened to the correct tightening torque*, install a thinner shim opposite the ring gear and repeat the measuring procedures.

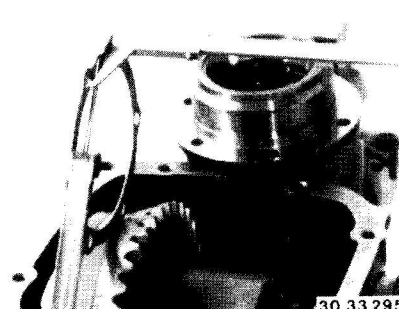
* See Specifications



30 33 271



30 33 272



30 33 295

If the friction torque is reached, even though the second bearing cap has not yet been tightened to the correct tightening torque*, a thicker shim must be used on the ring gear end and the measuring procedures repeated.

To make finding the shim thickness easier, the distance between the shim and case can be measured with a feeler gage blade and added to the thickness of the used shim.

Example:
Second bearing cap not tightened fully (bolts screwed in uniformly).
Specified friction torque* (e.g. 190 Ncm = 16.5 in. lbs.) is reached and shaft seals are not yet installed.
Gap measured with blade of feeler gage 0.20 mm (0.008")
Used shim thickness 1.40 mm (0.055")
Install shim of thickness 1.60 mm (0.063") and measure again.

* See Specifications

33-224

Remove differential for installation of the drive pinion.
(If differential case bearings were not replaced, procedures are continued from this point on.)

Important!
Arrange side covers and shims of determined thickness; don't mix them up.

Install drive pinion with a new clamping sleeve (2).

Dip shaft seal in final drive gear lube and drive it in flush with Special Tools 33 1 270 and 00 5 500.

Press (don't pull) input flange on to the input shaft with Special Tool 23 1 300. Axial preload force (5000 N = 1102 lbs.) of drive pinion bearings can be determined with help of the friction torque.

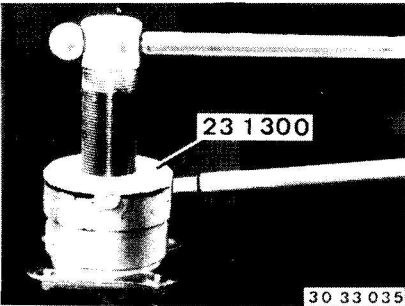
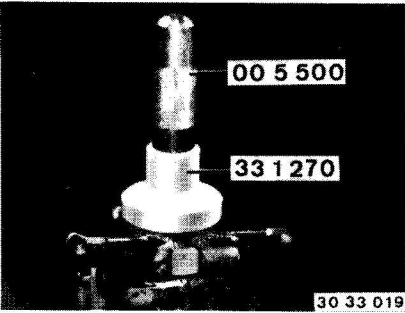
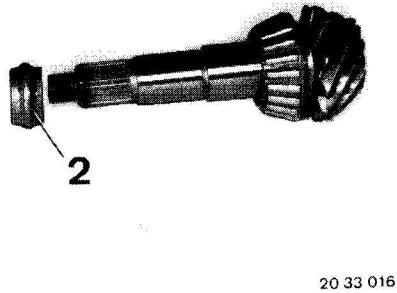
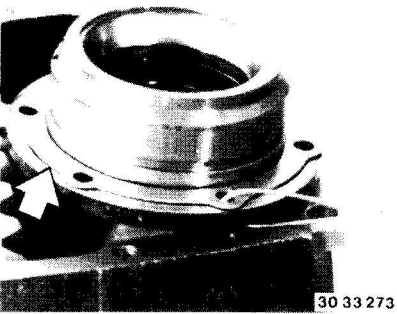
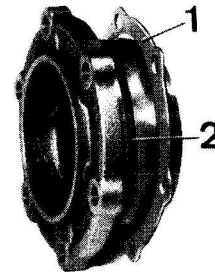
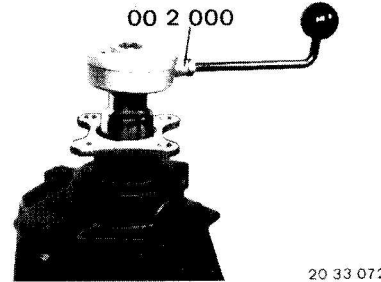
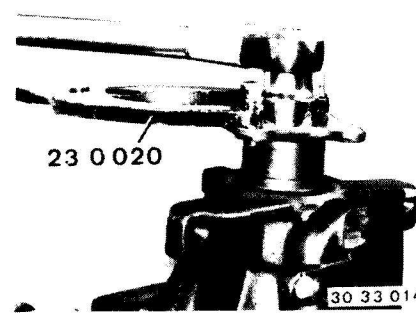
Tighten input flange with the collar nut in steps, measuring the friction torque after each step (see below).

Measure friction torque* with Special Tool 00 2 000 and a suitable wrench socket.

Important!
The relation between friction torque and preload force differs depending on the make of bearings. Take specified friction torque from the pinion bearing table* and add 20 Ncm (2 in. lbs.) for the new shaft seal.

Install differential.
Install side covers as marked with corresponding washers (1) and new O-rings (2).
Tighten bolts uniformly.
Tightening torque*.

* See Specifications



Adjusting Backlash/Tooth Contact Pattern:

Mount Special Tool 00 2 500 and measure backlash* with a dial gage.

Important!

The tooth contact pattern is always most important for a perfectly adjusted pinion/ring gear set.

To check the tooth contact pattern, coat the ring gear teeth with printer's ink, turn in both directions several times and stop ring gear suddenly with a piece of hard wood.

Correct the backlash* and tooth contact pattern by changing the thickness of both shims (1).

If backlash is excessive, use a thinner shim on the ring gear end.

If backlash is insufficient, use a thicker shim on the ring gear end.

An axial displacement of the ring gear by 0.01 mm (0.0004") will cause a change in backlash of 0.0076 mm (0.0003").

Important!

The total thickness of both shims must not be changed.

If a thinner or thicker shim is required to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of bearings would be changed again.

* See Specifications

Refer to following pages for general information on tooth contact pattern adjustments.

Installation:

Dip new shaft seals in final drive gear lube.

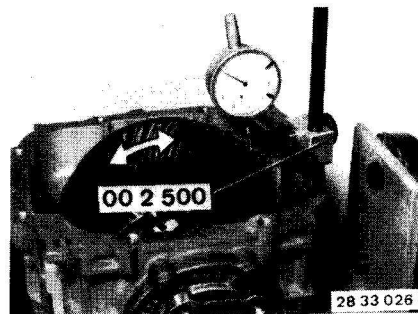
Drive in shaft seals against the stop with Special Tools 33 1 230 and 00 5 500.

Replace a drive flange with seriously scored bearing surfaces.

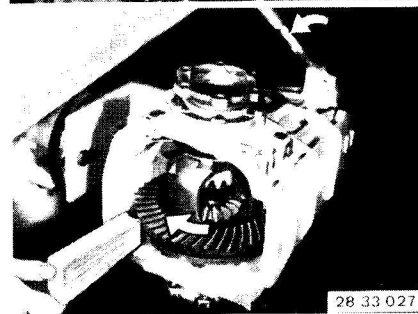
Note:

It might be necessary to machine Special Tool 33 1 230 because of the side cover casting tolerances.

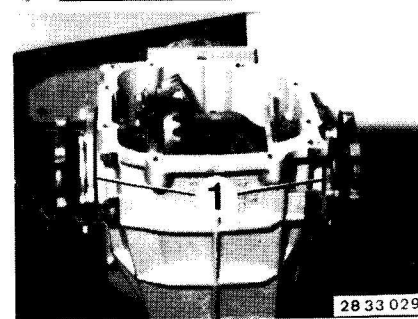
Drive in new lockplate with Special Tools 33 4 050 and 00 5 500.



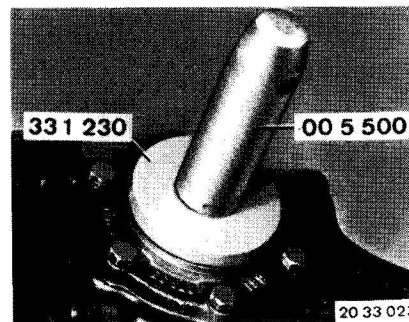
28 33 026



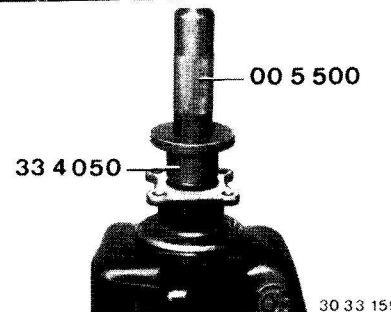
28 33 027



28 33 029



20 33 023



30 33 159

GENERAL INFORMATION ON TOOTH CONTACT PATTERN ADJUSTMENTS

*Gleason Teeth***A** Correct tooth contact pattern without load.**A1** Loads will shift the tooth contact pattern outward slightly.

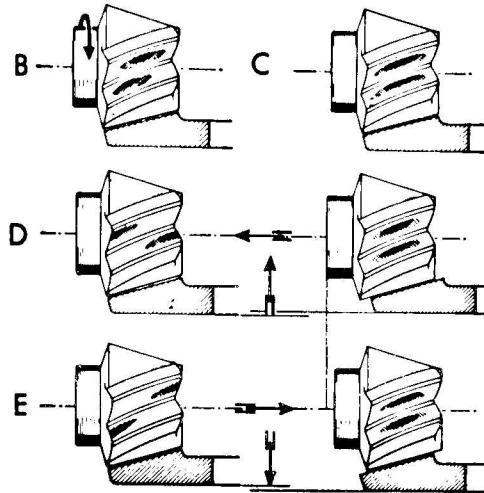
Moving the ring gear will mainly change the backlash, but will also displace the contact pattern in longitudinal direction of the teeth.

Moving the drive pinion will displace the contact pattern in favor of tooth height, but the backlash will be altered just very slightly.

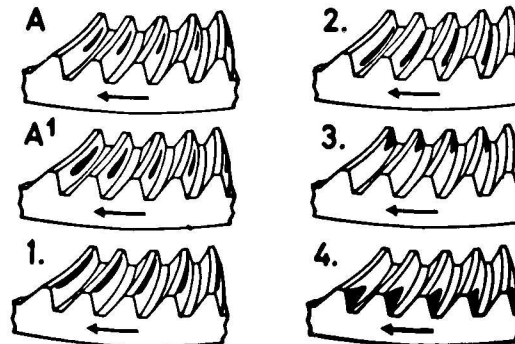
Here are the four basically incorrect tooth contact patterns, which usually occur in combination.

Knowing these patterns will facilitate making adjustments.

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

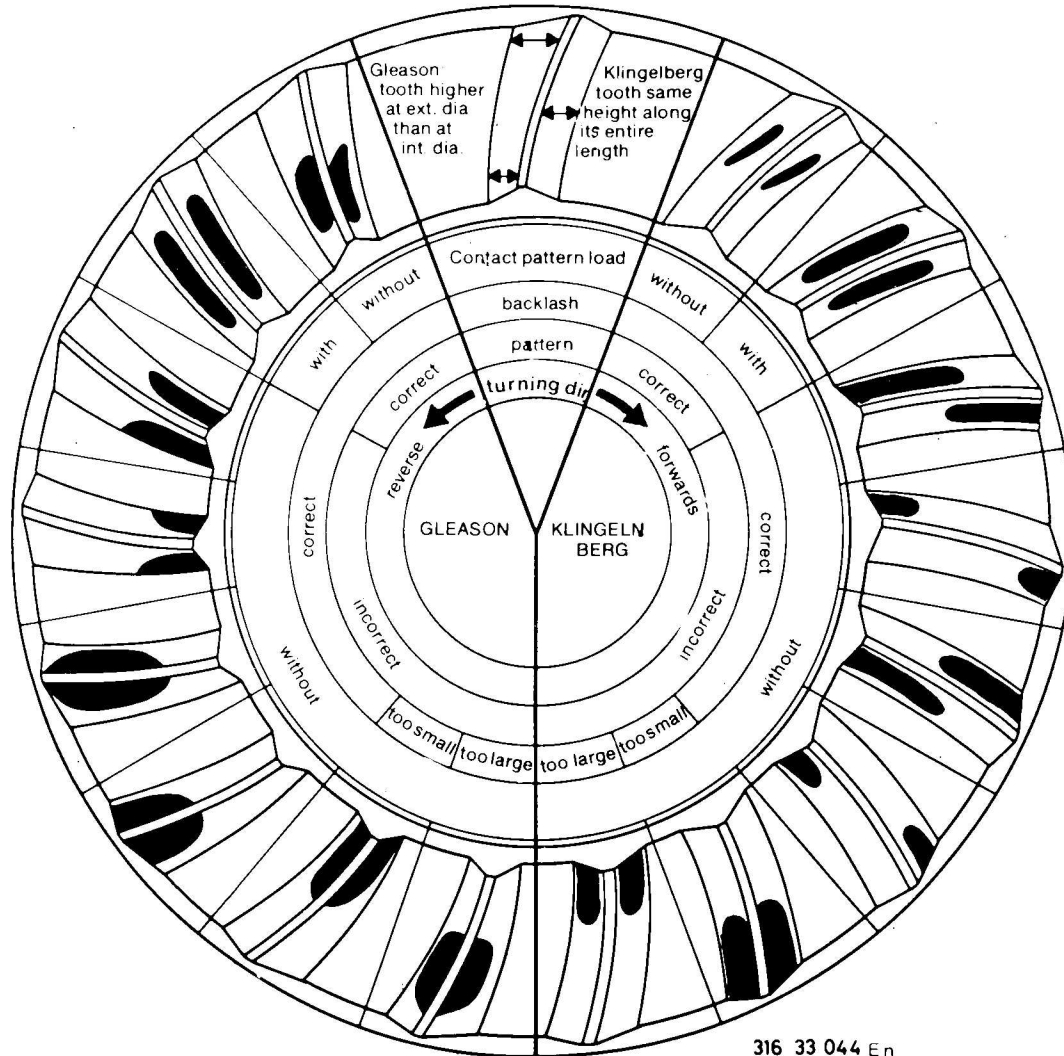


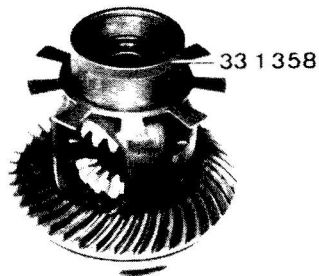
28 33 031



28 33 030

Adjustment of contact pattern





20 33 012

33 13 611 REPLACING DIFFERENTIAL GEARS - Differential Removed -

See "Replacing Drive Pinion with Ring Gear" in 33 12 551 for information on removing the differential. Press off the pulse spider.

Installation:
Press on pulse spider with Special Tool 33 1 358.

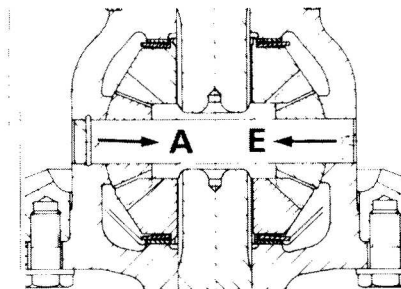
Remove ring gear (cold).

Important!
If bearings also have to be replaced, install ring gear only after determination of the friction torque - see "Replacing Bearings for Differential Case" in 33 11 724.

Installation:
Clean threads thoroughly (tapper). Heat ring gear to max. 100° C (212° F) and check the temperature with a thermochrome pencil. Install ring gear with two locally made staybolts as guides.

Install new bolts with Loctite No. 270 and tighten in order of 1 through 10. Tightening torque*. Tighten bolts to torque angle*.

* See Specifications



20 33 026

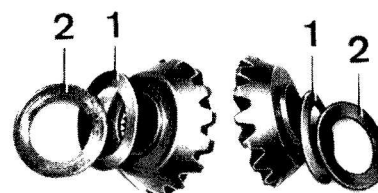
Press out differential shaft from the countersunk end with Special Tool 33 1 470.

A = Pressing out direction
E = Pressing in direction



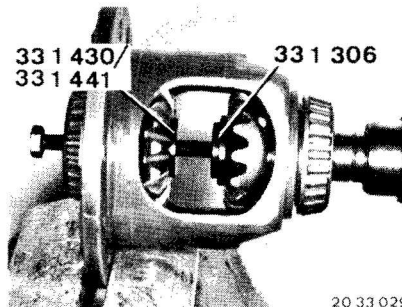
20 33 027

Turn out differential bevel gears with drive flange. Remove differential side gears with diaphragm springs and shims.



20 33 028

Install both differential side gears with diaphragm springs (1) and shims (2). Curved surface of diaphragm springs (1) faces the differential case. Center differential side gears with the drive flange.

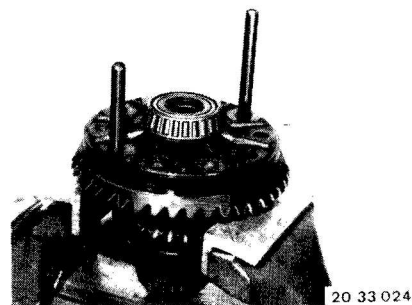


33 1 430/
33 1 441

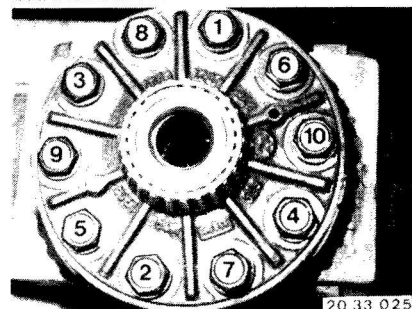
33 1 306

20 33 029

Insert Special Tool 33 1 306 on one side. Screw in Special Tool 33 1 441 with Special Tool 33 1 430. Tighten special tool bolt to spread the differential side gears apart far enough, that the drive flange can just barely be turned.



20 33 024



20 33 025

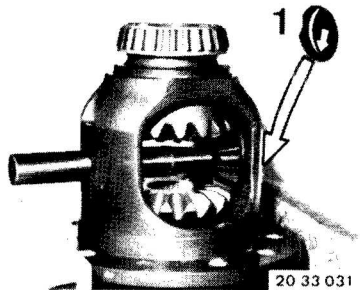
Install differential bevel gears exactly opposite each other. Move differential gears to installed position by turning the drive flange. Remove special tools.



20 33 030

Procedures with Hydraulic Press:

Check that circlip (1) is in correct installed position. Slide in feed mandrel from the side without a circlip.

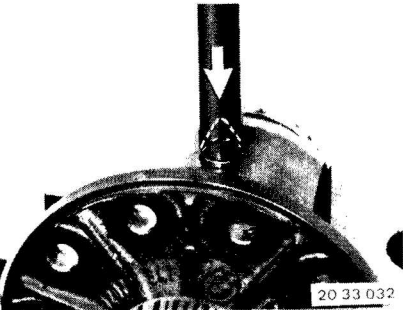


20 33 031

Place differential shaft with large opening on the feed mandrel and press it in. The pressing-in force will increase strongly, when the circlip has engaged.

Caution!

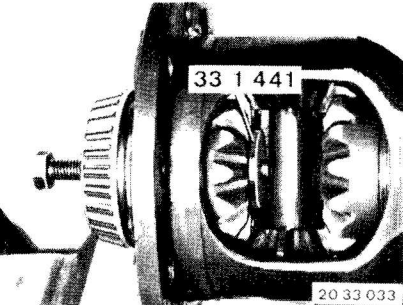
Stop the pressing-in step as soon as the force increases - danger of shearing off the circlip. Do not push back the differential shaft after installation.



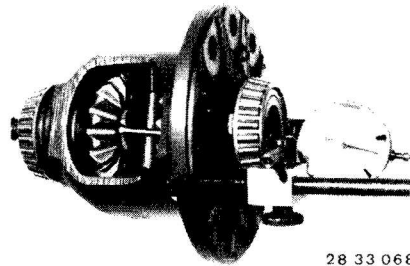
20 33 032

Measuring Preload of Diaphragm Springs:

Install Special Tools 33 1 441 and 33 1 431. Tighten the bolt by hand.

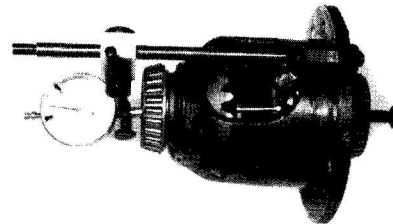


20 33 033



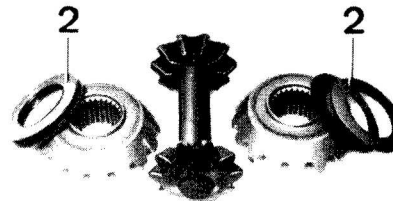
28 33 068

Mount dial gage with holder, consisting of Special Tools 33 1 420, 00 2 505 and 00 2 506, on the differential case. Set the dial gage to zero with preload on the blocked shaft gear.



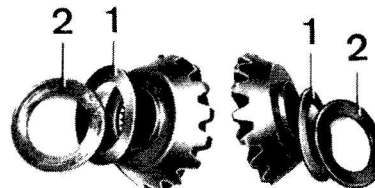
28 33 069

Tighten spindle until diaphragm springs are pressed flat. Read dial gage. Loosen spindle. Turn shaft gear and measure again at several points. A play of 0.03 to 0.1 mm (0.0012 to 0.0039") is required to avoid pressing the diaphragm springs flat. The lower value would be ideal. Repeat measurements on the opposite shaft gear.



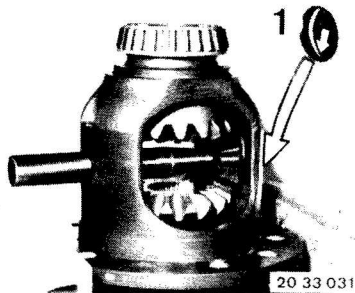
28 33 036

Excessive Clearance: Install thicker shim.
Insufficient Clearance: Install thinner shim. Shims (2) are available in 0.05 mm (0.0020") thickness steps. The opposite end is determined in the same manner.



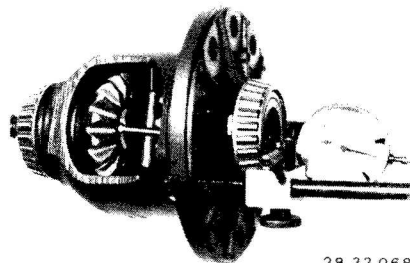
20 33 028

Install shims (2) of determined thickness and diaphragm springs (1). Inside curved surfaces of diaphragm springs (1) face the differential case.

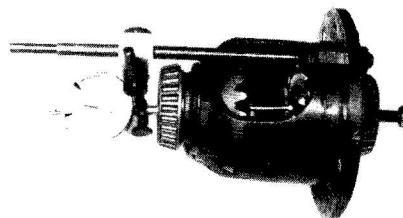


Procedures with Special Tool 00 8 500:

Check that circlip (1) is in correct installed position.
Slide in Special Tool 33 1 470 from the side without a circlip.



Place differential gear shaft with large opening on special tool and press it in until 1 to 2 cm (3/8 to 3/4") of the shaft is visible.

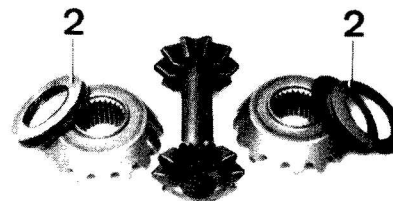


Mount holder with dial gage.
Set the dial gage to zero with preload.

Tighten the spindle until diaphragm springs are pressed flat.
Read dial gage.
Loosen spindle.
Turn shaft gear and repeat measurement at several points.
A play of 0.03 to 0.1 mm (0.0012 to 0.0039") is required to prevent pressing the diaphragm springs flat.
Lowest value would be ideal.
Repeat measurements on the opposite shaft gear.

20 33 069

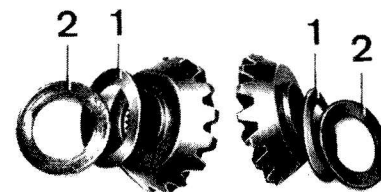
Apply Special Tool 00 8 500 on the differential cage and pull in the differential gear shaft with a torque breaking wrench.
Torque Adjusting Value:
18 mm spindle dia. = 22 Nm (16 ft. lbs.)
20 mm spindle dia. = 22 Nm (16 ft. lbs.)



Excessive Clearance:
Install thicker shim.
Insufficient Clearance:
Install thinner shim.
Shims (2) are available in 0.05 mm (0.0020") thickness steps.
Determine the opposite end in the same manner.

20 33 036

Important!
Lubricate center on differential gear shaft with oil before application of the special tool.
Differential gear shaft must no longer be pushed back after installation.
Make sure that last fourth of torque (from about 17 Nm / 12 ft. lbs.) is applied at constant speed (not suddenly).



Measuring Preload of Diaphragm Springs:
Install Special Tool 33 1 441 and a spindle.
Tighten the spindle by hand.

Install shims (2) of determined thickness and diaphragm springs (1).
Inside curved surfaces of diaphragm springs (1) face the differential case.

20 33 028

LIMITED SLIP DIFFERENTIAL WITH 25 % LOCKING RATIO

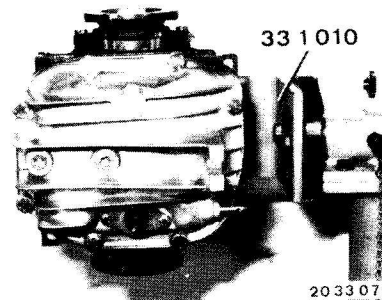
The limited slip differential is marked with a "S" on the case or data plate. A limited slip differential has the following advantages.

- Prevention of wheel slip when driving on rough road surfaces.
- Prevention of wheel slip when moving off with different traction underneath left and right sides of car wheels.
- Prevention of wheel slip when driving fast on wet roads.
- Prevention of wheel slip on inside of curve when driving fast in curves.
- Prevention of slip when driving fast on roads with different traction between left and right.

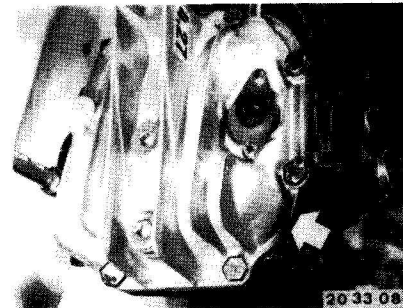
Checking Function Without Removing:

- Level workshop floor.
- Drive car's left wheel on Special Tool 33 1 450.
- Release parking brake completely.
- Engage 1st gear and accelerate engine.
- Function of limited slip differential is okay, if the car can be driven off of Special Tool 33 1 450.

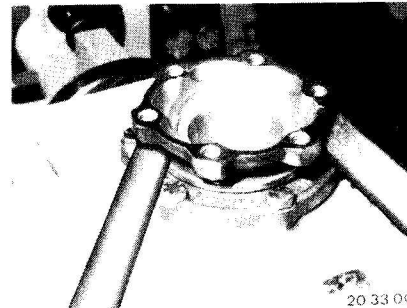
Important!
Drive off of fixture slowly.



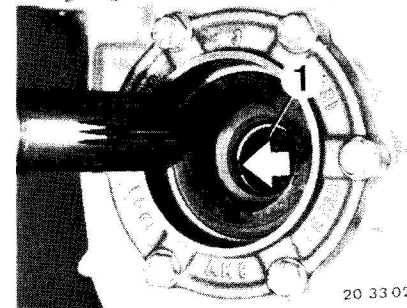
20 33 078



20 33 080



20 33 008



20 33 021

33 14 520 REPLACING LIMITED SLIP DIFFERENTIAL ASSEMBLY - Final Drive Removed -

Remove final drive – see 33 10 010.
Drain oil.
Mount final drive on Special Tool 33 1 010.

Installation:
Pour in correct volume* of oil - see Group 33 in Operating Fluids.

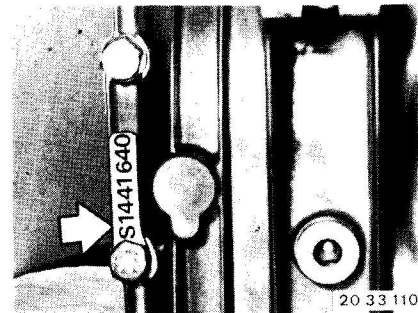
Unscrew case cover.

Installation:
Replace gasket.
Tightening torque*.

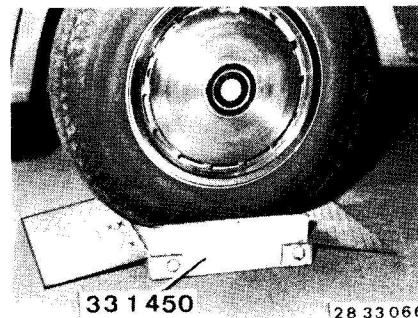
Pry off both drive flanges with a tire iron.

Installation:
Before installation of the drive flange, place round wire snap ring (1) in groove of the differential case that both ends are recessed in the groove. This prevents lateral bending of the ring.
Push in and turn drive flange slightly by hand until round wire snap ring is heard to engage.
Replace a stretched snap ring.

* See Specifications



20 33 110



33 1 450

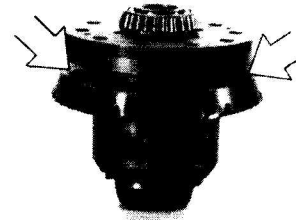
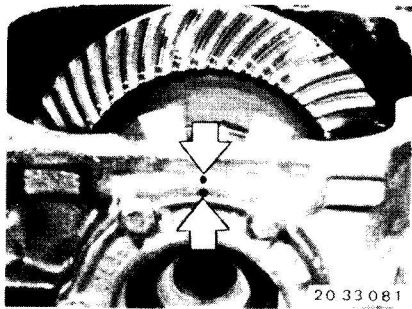
28 33 066

33-232

Unscrew both bearing caps.

Important!
Mark bearing caps and don't mix them up.

Installation:
Tightening torque*.



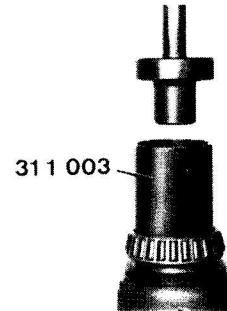
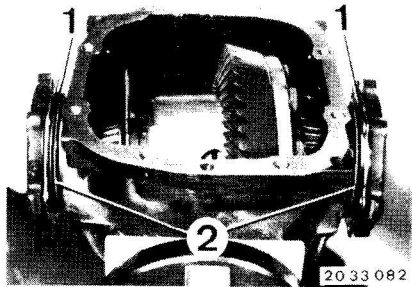
Remove ring gear (cold).

Differential case bearings and backlash are adjusted with shims (1). Check O-ring (2), replacing if necessary.

Important!
Changing the total thickness of shims (1) will change the friction torque value. After adjusting the friction torque, the backlash and tooth contact pattern will have to be adjusted again - see 33 12 551.

Press new tapered roller bearings on to new limited slip differential case cold with Special Tool 33 1 003.

Important!
Only use the same make for both bearings.
Note make - this information is needed later to determine the friction torque.

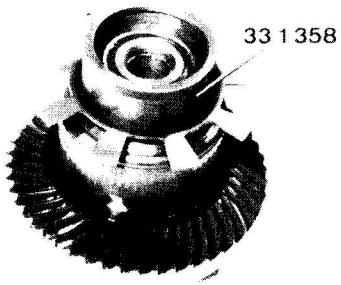
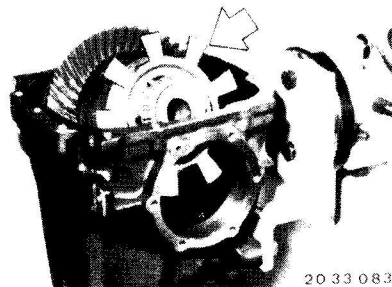


Remove complete limited slip differential.

Important!
Don't bend the pulse spider.

Press off pulse spider.

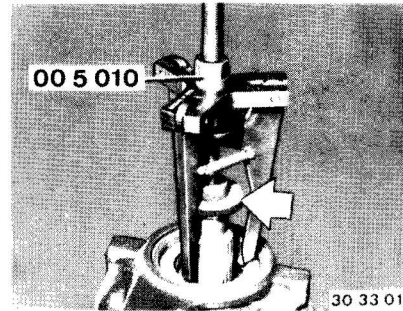
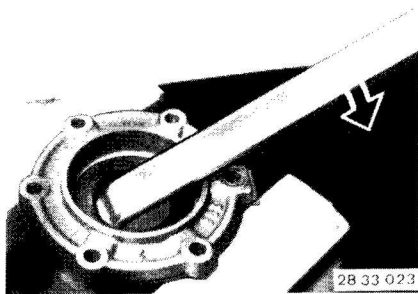
Installation:
Press on pulse spider with Special Tool 33 1 358.



* See Specifications

33-233

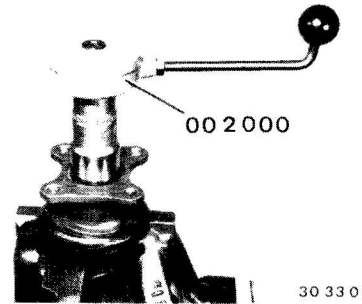
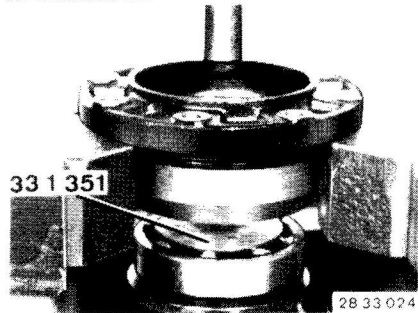
Lift shaft seals out of both bearing caps.



If applicable, replace shaft seal for input flange - see 33 11 512.

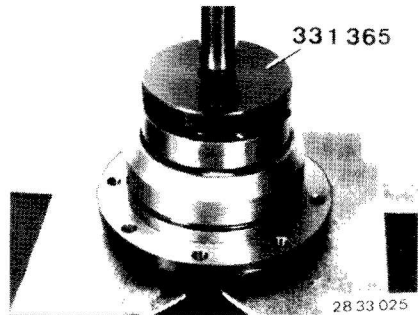
Press out bearing outer race with Special Tools 33 1 350 and 33 1 351.

Important!
Special Tool 33 1 351 must engage in bearing outer race.



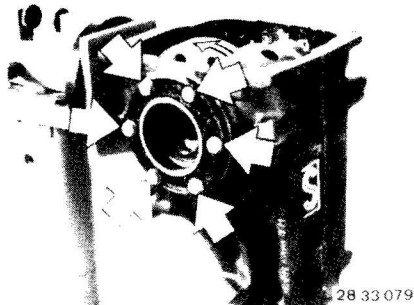
If applicable, replace drive pinion - see 33 12 551.

Installation:
Press in new bearing outer races with Special Tool 33 1 365.



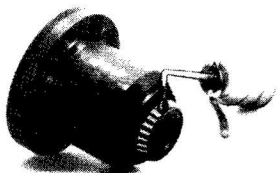
33-234

Install new limited slip differential with new bearings. Only use same make for both bearings. Note make.



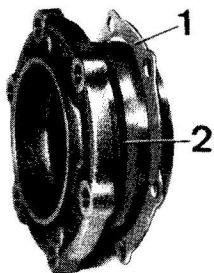
28 33 077

Lubricate new bearings thoroughly with approved final drive gear lube** and let them drip dry.



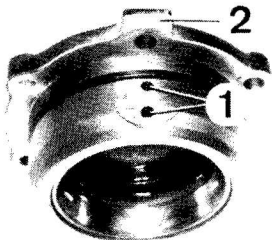
28 33 078

Install side bearing caps as marked with corresponding shims (1), but without O-rings (2) at first. Tighten bearing cap bolts opposite the ring gear end uniformly with correct tightening torque*.



20 33 010

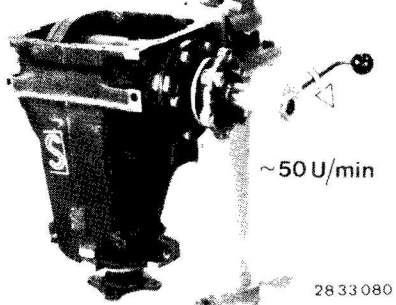
The compensating bore (1), recognized on the outside by tab (2), always faces up in the installed position of the transmission.



28 33 072

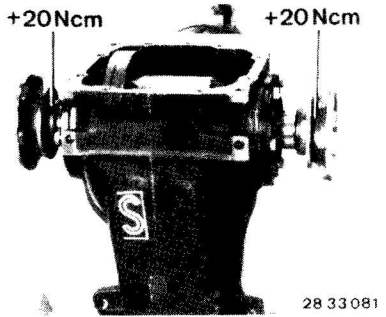
* See Specifications
** See Gr. 33 In Operating Fluids

Axial preload force (4000 N = 882 lbs.) of differential case bearings can be determined with help of the friction torque*.
Tighten bolts of the second bearing cap uniformly only enough, that the differential is still easy to turn.



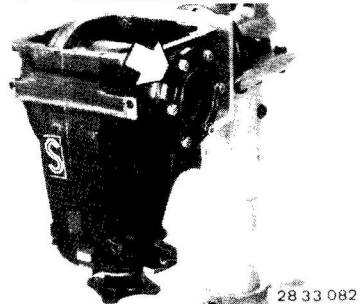
28 33 080

Install an output flange on the end opposite the ring gear and measure the friction torque with a locally made holder with welded nut and friction torque tester, Special Tool 00 2 000. Turn the friction torque tester at approx. 50 rpm.



28 33 081

The friction torque* specified in the differential case bearing table* should be reached, but not exceeded. If new shaft seals had already been installed, add 20 Ncm (2 in. lbs.) for each seal in which an output shaft runs while measuring.



28 33 082

If the given friction torque is not reached, even though both bearing caps are tightened to the correct tightening torque*, a thinner shim must be used on the end opposite the ring gear and the measuring procedures repeated.

* See Specifications

If the friction torque is reached, even though the second bearing cap is not yet tightened to correct tightening torque*, use a thicker shim on the ring gear and repeat the measuring procedures.

To make finding the thickness of shims easier, the distance between the shim and case can be measured with a feeler gage blade and this value is then added to the thickness of the used shims.

Example:
 Second bearing cap not tightened fully (bolts screwed in uniformly).
 Specified friction torque* (e.g. 190 Ncm = 16.5 In. lbs.) is reached and shaft seals are not yet installed.
 Gap measured with blade of feeler gage 0.20 mm (0.008")
 Used shim thickness 1.40 mm (0.055")
 Install shim of thickness 1.60 mm (0.063") and measure again.

* See Specifications

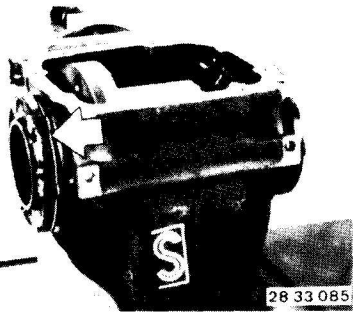
Remove differential case. Arrange side covers and shims; don't mix them up.

Installation:
 Clean tapped bores thoroughly (with a taper). Heat ring gear to max. 100° C (212° F), checking the temperature with a thermocolor pencil.

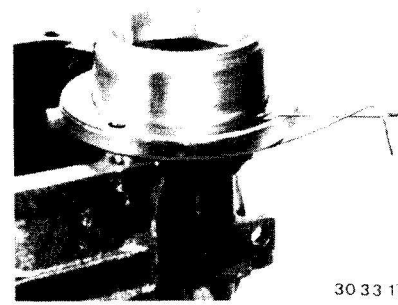
Mount ring gear with two locally made staybolts as guides.

Install new bolts with Loctite No. 270 and tighten in order of 1 through 10. Tightening torque*. Tighten bolts with torque angle*.

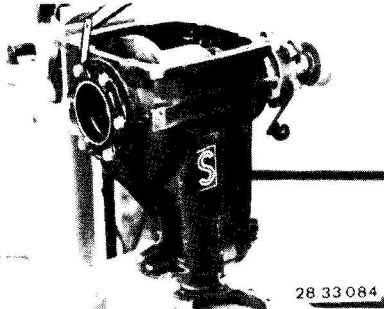
* See Specifications



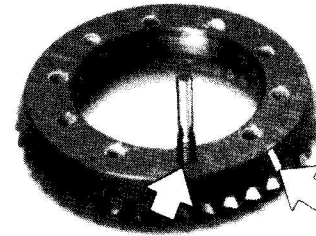
28 33 085



30 33 173



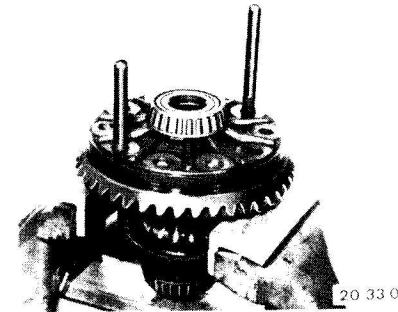
28 33 084



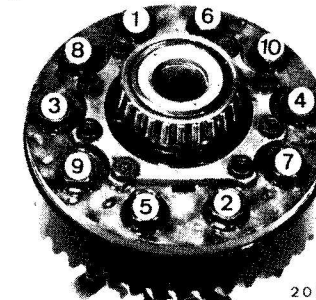
30 33 262



30 33 321

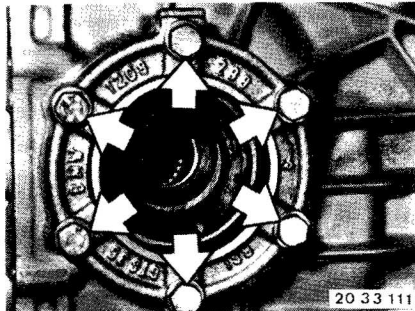


20 33 024

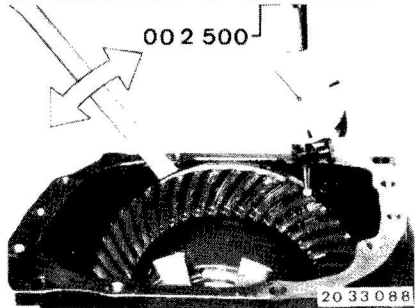


20 33 085

33-236



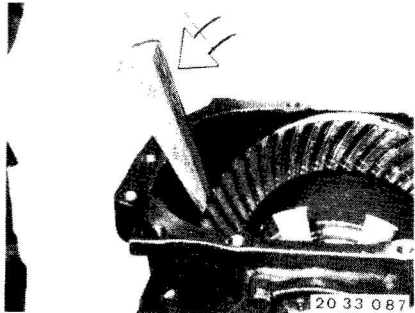
Install new limited slip differential with ring gear and pulse spider. Install marked side bearing caps with corresponding shims and new O-rings. Tighten bearing cap bolts uniformly. Tightening torque*.



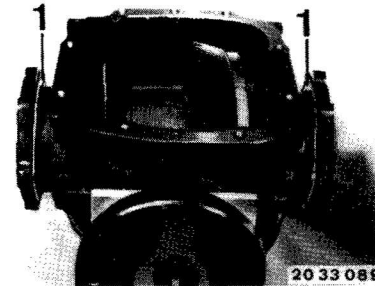
Mount Special Tool 00 2 500 and measure the backlash* with a dial gage.

Important!

The tooth contact pattern is always most important for a perfectly adjusted pinion/ring gear set - see pages 33 - 111/112.



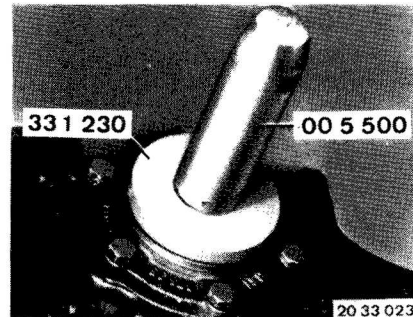
To check the tooth contact pattern, coat ring gear with printer's ink, turn several times in both directions and then stop the ring gear abruptly with a piece of hard wood.



The backlash* and tooth contact pattern are corrected by changing the thickness of both shims (1). If the backlash is too large, install a thinner shim on the ring gear end. If the backlash is too small, install a thicker shim on the ring gear end. An axial displacement of the ring gear by 0.01 mm (0.0004") will change the backlash by 0.076 mm (0.0003").

Important!

The total thickness of both shims may no longer be changed. If a thicker or thinner shim was needed to correct the tooth contact pattern, the total thickness must be corrected with the second shim, since otherwise the friction torque of the bearings would be changed again.



Installation:

Dip new shaft seals in final drive gear lube. Drive in shaft seals against the stop with Special Tools 33 1 230 and 00 5 500.

Note:

It might be necessary to machine Special Tool 33 1 230 because of the side cover casting tolerances.

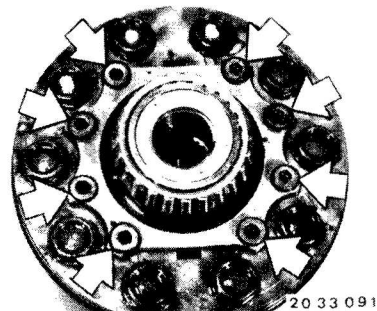
33 14 593 DISASSEMBLING AND ASSEMBLING LIMITED SLIP DIFFERENTIAL - Final Drive Removed -

Remove limited slip differential - see 33 14 520.
Unscrew case cover mounting bolts.
Take off case cover.

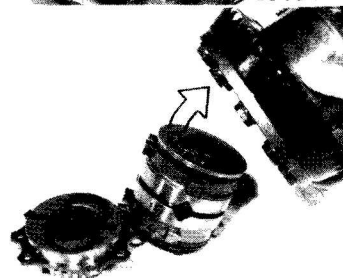
Turn case upside down to let the parts slide out.

Installed Order:

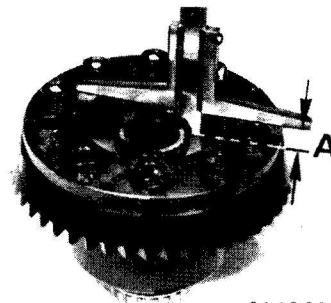
(1) case cover, (2) thrust washer, (3) diaphragm spring, (4) stepped washer, (5) spacer, (6) diaphragm spring, (7) outer plate, (8) inner plate, (9) thrust ring, (10) differential side gear, (11) differential gears with differential shafts and (12) differential case.



20 33 091

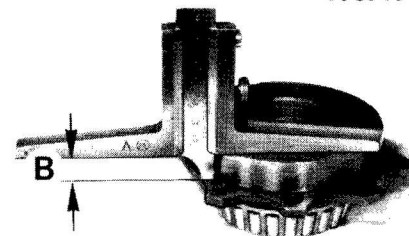


20 33 092



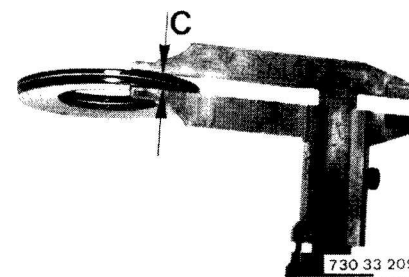
20 33 094

Install the following parts in correct order to measure the preload. Spacer (5), outer plates (7), inner plates (8), thrust rings (9), differential side gears (10) and differential gears with differential shafts (11). Measure distance A from case edge to outer plate, e.g. A = 19.5 mm (0.768").



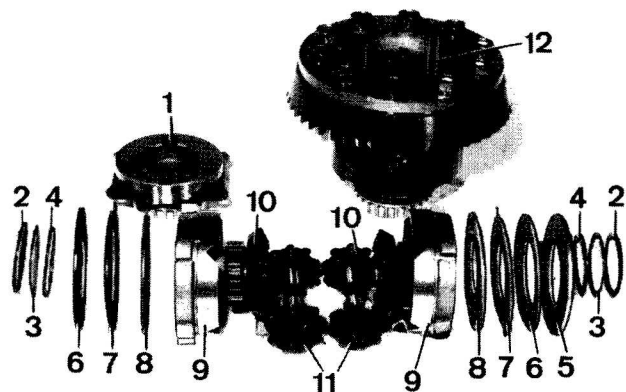
20 33 095

Measure distance B on cover, e.g. B = 14.4 mm (0.567").



730 33 209

Place both diaphragm spring curved surfaces together. Measure distance C on diaphragm springs, e.g. C = 4.8 mm (0.189").



20 33 093

Check all parts for wear, e.g. molybdenum coat, splines, etc..
Installation:
Lubricate all parts with approved final drive gear lube before assembling.

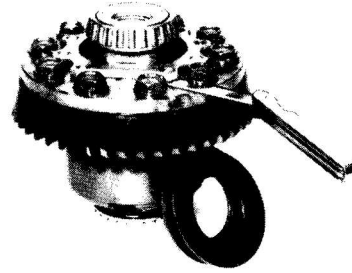
33-238

An installed play of 0.1 to 0.4 mm (0.004 to 0.016") is required to prevent pressing the diaphragm springs flat.

Example:

B (cover)	14.4 mm (0.567")
C (diaphr. springs)	4.8 mm (0.189")
A (case)	19.5 mm (0.768")
Sum of B + C	19.2 mm (0.756")
Installed play D	0.3 mm (0.012")

Correct any deviation in installed play D by installing outer plates of correct thickness.



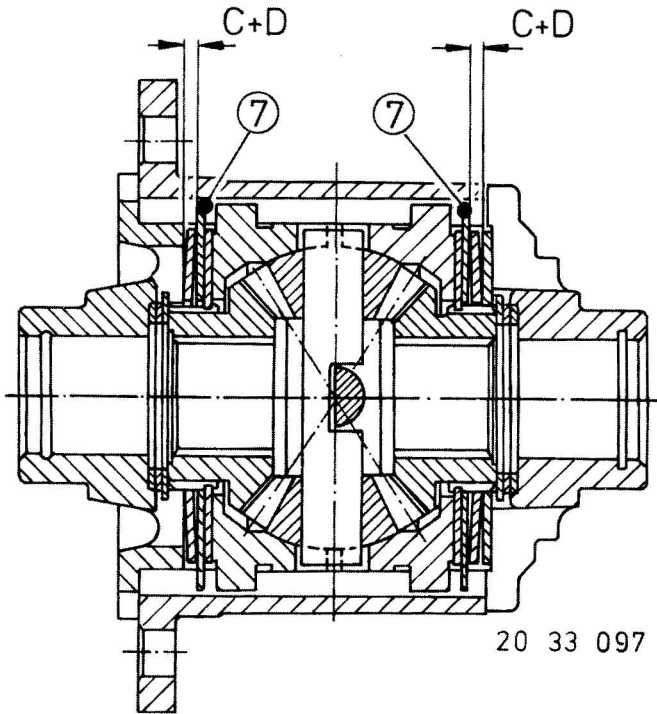
20 33 098

Remove all parts from case and insert with the additional parts, thrust washers (2), diaphragm springs (3) and stepped washers (4).

Mount and press on case cover (12) firmly (don't bolt).

The pre-load of small diaphragm springs (3) should produce an uniform gap all around (check with a feeler gage blade).

If there is no clearance between cover and case, check diaphragm springs (3), thrust washers (2) and stepped washers (4).

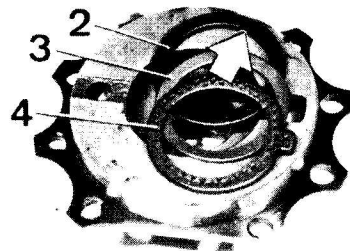


20 33 097

33-239

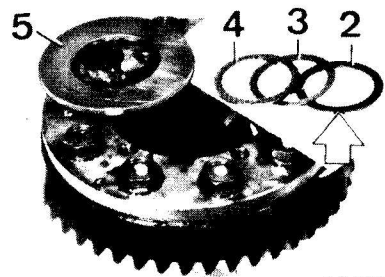
Installed Order:

Thrust washer (2) with oil pockets facing case (down), diaphragm spring (3) with inside curved surface facing differential shaft (up), stepped washer (4) with smooth side facing diaphragm spring (down) and tab engaging in guide in case.



20 33 103

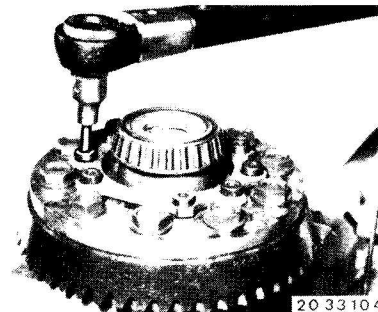
Insert thrust washer (2) with oil pockets facing cover, diaphragm spring (3) with inside curved surface facing out and stepped washer (4) with smooth side facing diaphragm spring and with tab in case cover groove in case with grease.



20 33 099

Install spacer (5), diaphragm spring (6) with inside curved surface facing differential shaft and outer plate (7) with four tabs.

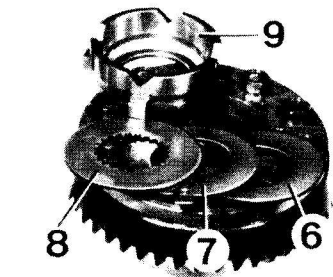
Install molybdenum coated inner plate (8).



20 33 104

Mount case cover with washers (don't let stepped washer slide out of groove). Install bolts with Loctite No. 270 and tighten cover uniformly.

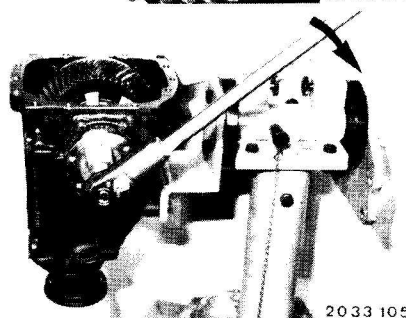
Installation:
Tightening torque*.



20 33 100

Install thrust ring (9) and differential side gear (10) by turning in guides or spline of inner plate.

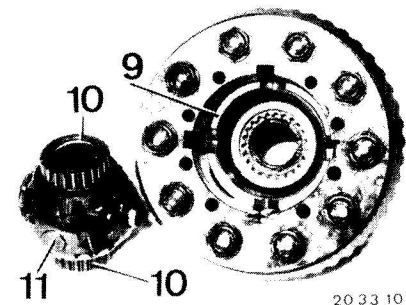
Install differential gears with shafts (11), second differential side gear (10) and thrust ring (9).



20 33 105

Check slip torque* of differential lock by holding one and driving the other differential side gear.

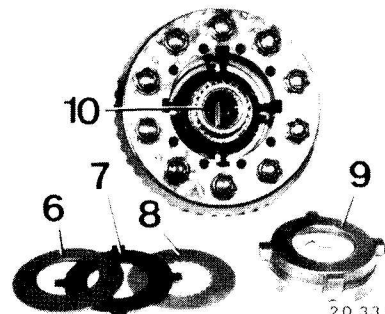
Make up tool locally for this purpose by, for example, welding a nut on a drive flange which is no longer required.



20 33 101

Install molybdenum coated inner plate (8) and outer plate (7).

Insert diaphragm spring (6) with inside curved surface facing differential shaft (down).



20 33 102

* See Specifications

Visco Limited Slip Differential

Visco Locks

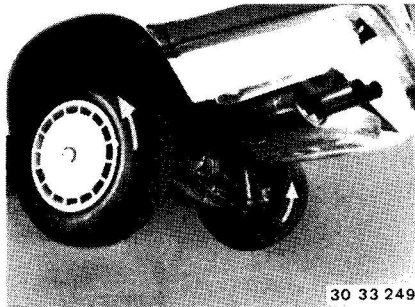
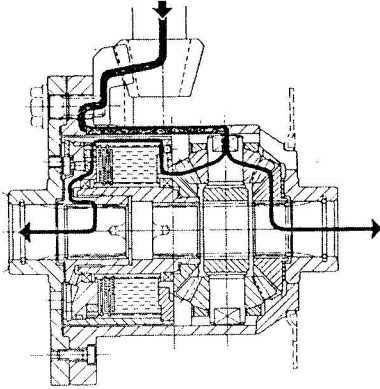
The visco clutch is located in a capsule which in turn is pushed into the differential case.

Outer and inner plates as well as a special oil mixture on the basis of silicone are located inside.

Outer plates are connected via splines with the left differential side gear and inner plates via the plate carrier and splines of the right output flange with the right differential side gear.

Plates can be moved axially, but can not touch each other because this is prevented by approx. 0.1 mm (0.004") thick spacers.

Oil, which is similar to stiff honey and transmits the power, is used between the plates.

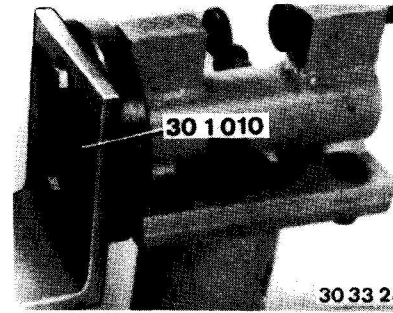


30 33 249

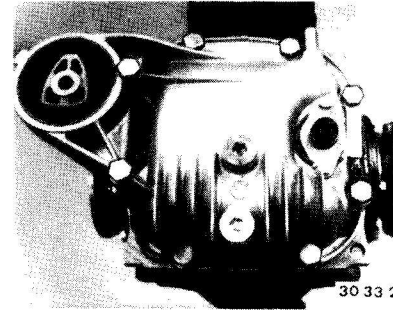
Checking in Car:

Lift car with 1st gear engaged. Turn one rear wheel in forward direction by hand firmly and suddenly. Considerable resistance should be felt through the function of visco locks. The visco lock is not working, if it is possible to drive the other rear wheel in opposite direction with strong turning of the first rear wheel without noticeable resistance.

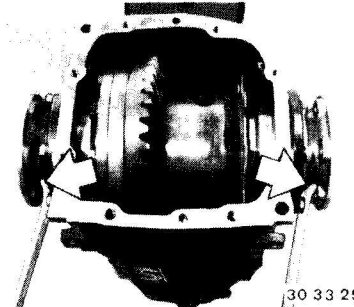
A brake test stand is necessary for precise testing of the locking effect.



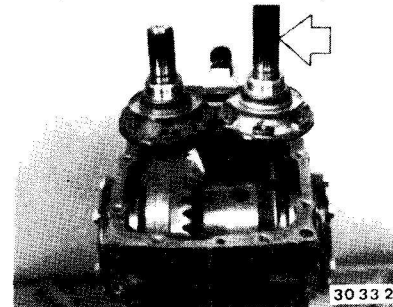
30 33 250



30 33 251



30 33 252



30 33 253

33 14 520 REPLACING COMPLETE VISCO LIMITED SLIP DIFFERENTIAL

– Final Drive Removed –

Drain oil.
Mount final drive on Special Tool 33 1 010.

Installation:
Pour in correct amount* of specified oil – see Group 33 in Operating Fluids.

Unscrew case cover.

Installation:
Replace gasket.
Tightening torque*.

Pry off both drive flanges with a tire iron.

The drive flange with the long spline section is on the right-hand side of the differential in installed position.

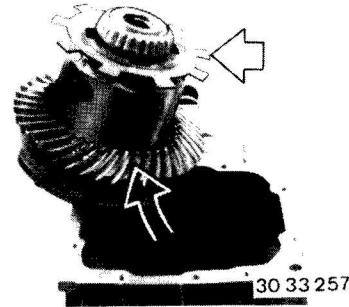
* See Specifications

Installation:

Place round wire snap ring (1) in groove of the differential case to have both ends recessed in the groove prior to installation of the drive flange. This prevents lateral bending of the ring.

Press in and turn the drive flange by hand until the snap ring is heard to engage.

Replace stretched snap rings.



Remove complete limited slip differential.

Installation:

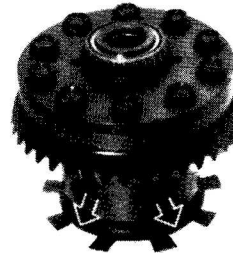
Don't bend the pulse spider.

Remove both bearing cap by turning slightly while pressing them off, since the O-ring has a suction effect.

Important!

Mark both bearing caps – don't mix them up.

Don't mix up shims; secure them on pertinent bearing cap with wire if necessary.



Press off pulse spider.

Installation:

Differential case bearing and backlash are adjusted with shims (1).

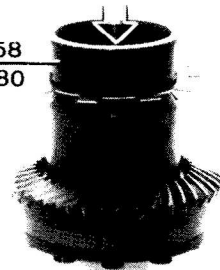
Check O-ring (2), replacing if necessary.

Important!

Changing the total thickness of shims (1) will change the friction torque.

The backlash and tooth contact pattern must be readjusted after adjusting the friction torque.

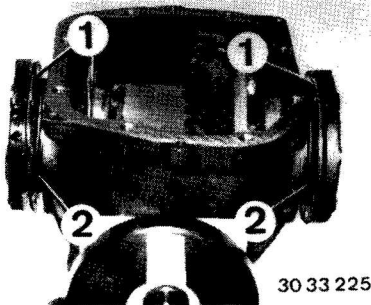
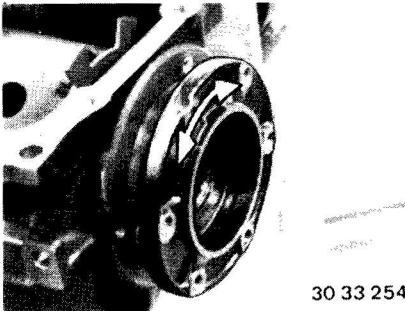
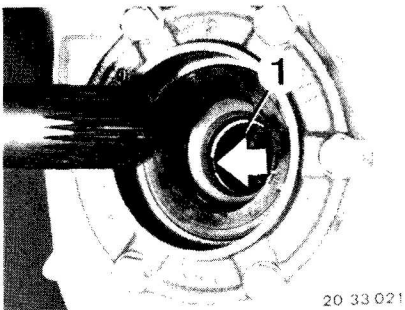
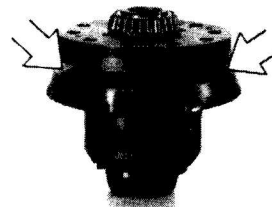
33 1358
24 2180



Installation:

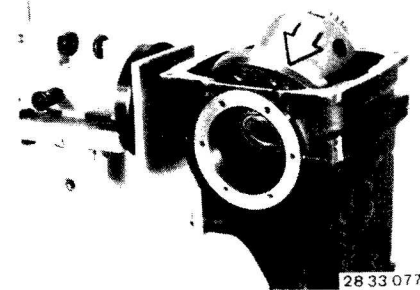
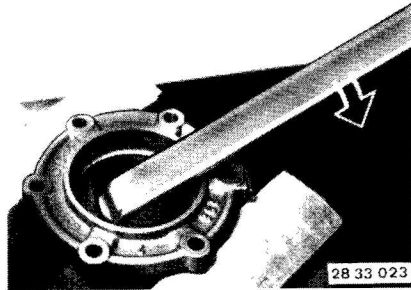
Press on pulse spider with Special Tool 33 1358.

Remove ring gear (cold).



33-242

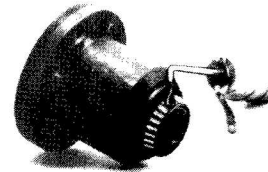
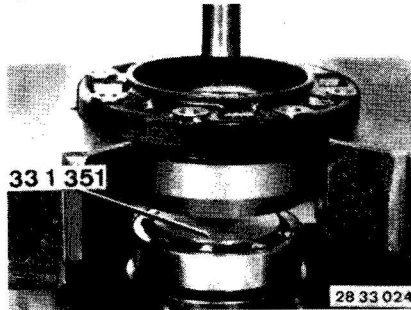
Lift out shaft seals in both bearing caps.



Install new limited slip differential with new bearings, but without the ring gear.

Press out bearing outer race with Special Tools 33 1 350 and 33 1 351.

Important!
Special Tool 33 1 351 must grab hold of the bearing outer race.

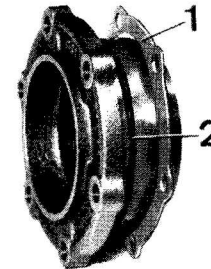
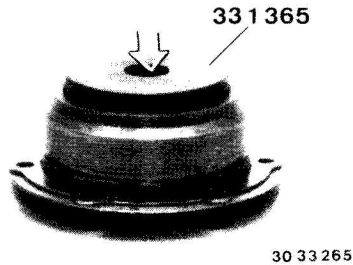


Lubricate new bearings with approved final drive gear lube** thoroughly and let them drip dry.

28 33 078

Installation:
Press in new bearing outer races with Special Tool 33 1 365.

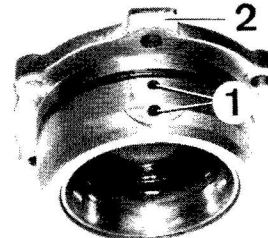
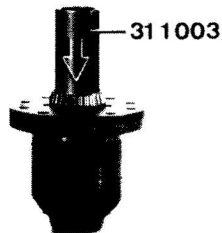
Important!
Use both new bearings of same make from one manufacturer.
Note make, which is required for determination of the friction torque.



Install side bearing caps as marked with corresponding shims (1), but at first without O-rings (2).
Tighten bearing cap bolts on end opposite the ring gear end uniformly with correct tightening torque*.

20 33 010

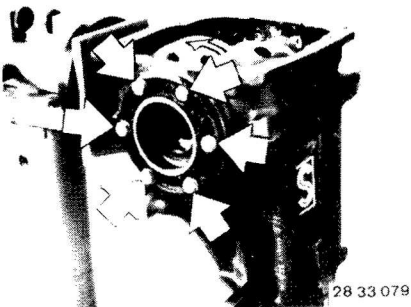
Press new tapered roller bearing on visco limited slip differential cold with Special Tool 33 1 003.



Installation:
Compensation bores (1) face up with the differential in installed position, which can be checked on the outside on tab (2).

28 33 072

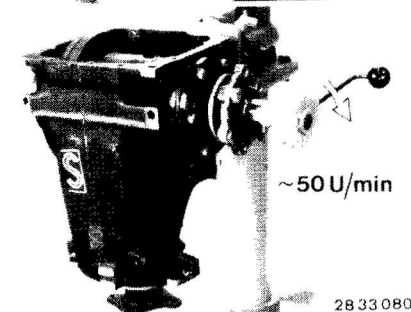
* See Specifications
** See Gr. 33 in Operating Fluids



28 33 079

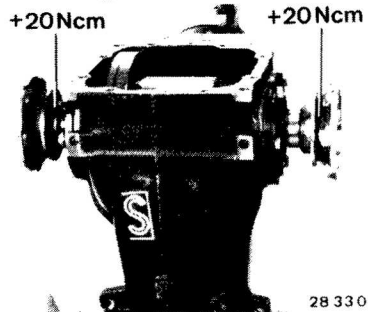
Axial preload force of differential case bearings (4000 N = 882 lbs.) can be determined with help of the friction torque*.

Tighten bolts of the second bearing cap uniformly only enough, that the differential can still be turned easily.



~50 U/min

28 33 080



+20Ncm

+20Ncm

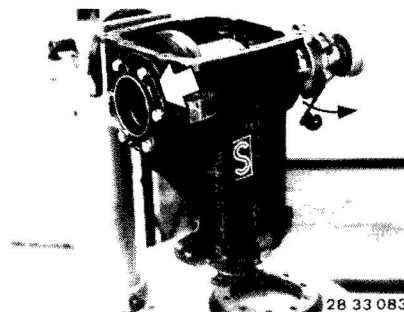
28 33 081

Apply an output flange on the end opposite the ring gear and measure the friction torque with a locally made clamp with a welded nut and friction torque meter, Special Tool 00 2 000. Turn the friction torque meter at a speed of approx. 50 rpm.

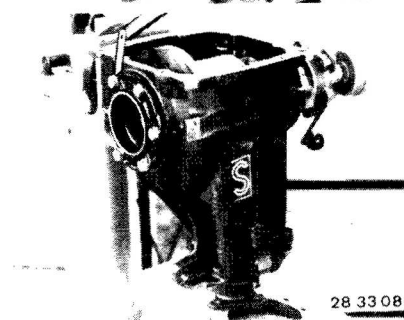
The friction torque* specified in the differential case bearing table* should be reached, but not exceeded. If new shaft seals have already been installed, 20 Ncm (2 in. lbs.) must be added for each seal in which an output shaft runs while measuring.

If the specified friction torque is not reached, even though both bearing caps are bolted with the specified tightening torque*, a thinner shim must be installed on the end opposite the ring gear and measuring repeated.

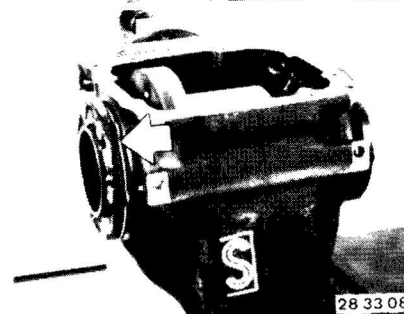
* See Specifications



28 33 083



28 33 084



28 33 085

If the friction torque is reached, even though the second bearing cap has not yet been tightened to the correct tightening torque*, a thicker shim must be used on the ring gear end and measuring procedures repeated.

To make finding the shim thickness easier, the distance between the shim and case can be measured with a feeler gage blade and added to the thickness of the used shim.

Example:

Second bearing cap not tightened fully (bolts screwed in uniformly). Specified friction torque* (e.g. 190 Ncm = 16.5 in. lbs.) is reached, but without shaft seals.

Gap measured with blade of feeler gage	0.20 mm (0.008")
Used shim thickness	1.40 mm (0.055")
Install shim of thickness	1.60 mm (0.063")

and measure again.

* See Specifications

Remove differential case for installation of the ring gear.
 Pair side covers and shims of determined thickness; don't mix them up.

Mount Special Tool 00 2 500 and measure backlash* with the dial gage.

Important!
 The tooth contact pattern is always very important for a correctly adjusted pinion/ring gear – see pages 33-226 and 33-227.

Check the tooth contact pattern by coating the ring gear with printer's ink, turning the ring gear several times in both directions and stopping it abruptly with a piece of hard wood.

Correct the backlash* and tooth contact pattern by exchanging shims (1). Displacing the ring gear axially by 0.01 mm (0.0004") will change the backlash by 0.076 mm (0.003").

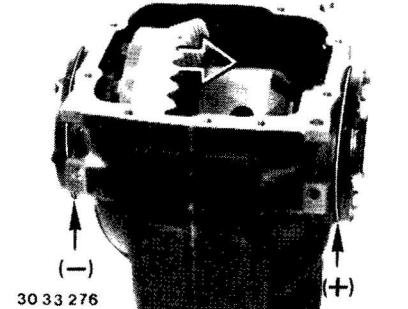
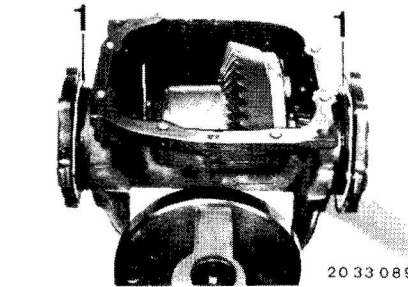
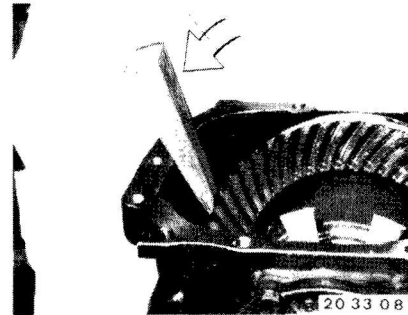
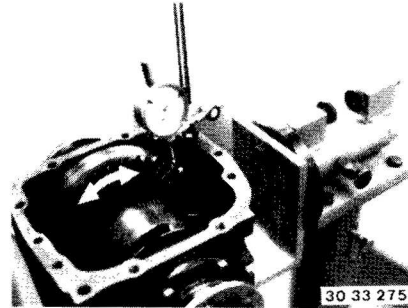
Important!
 The sum of both shim thicknesses may no longer be changed. If a shim is replaced by a thicker or thinner shim, the total thickness must be restored by replacing the second shim accordingly.

Installation:
 Clean tapped bores thoroughly (with a taper).
 Heat ring gear to max. 100° C (210° F), checking the temperature with a thermocolor crayon.
 Mount ring gear with two locally made staybolts for guiding.

Install new bolts with Loctite No. 270 and tighten in order of 1 through 10. Tightening torque*. Then tighten bolts with torque angle*.

Install differential case.
 Pull on O-rings (1).
 Tighten side covers.
 Tightening torque*.

* See Specifications

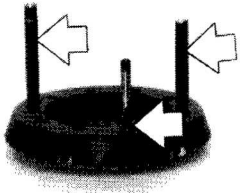


30 33 276

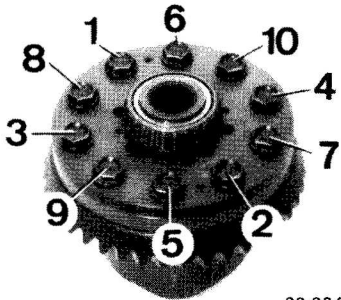
* See Specifications



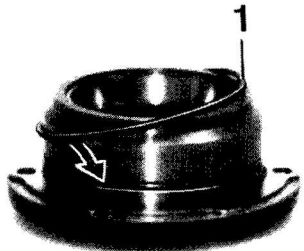
30 33 273



30 33 323



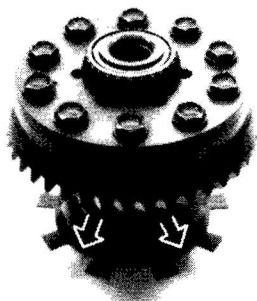
30 33 324



30 33 274

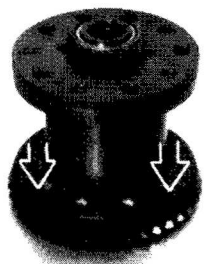
33 14 631 REPLACING VISCO LOCK AND DIFFERENTIAL GEARS - Rear Axle Removed -

Remove differential case - see 33 11 731.



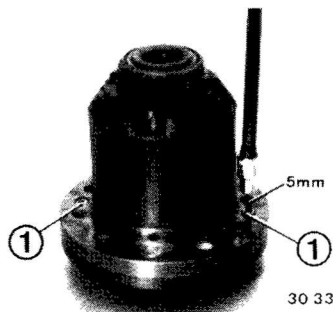
30 33 277

Remove ring gear - see 33 11 731.



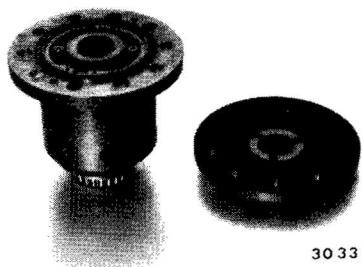
30 33 256

Unscrew bolts (1) with a 5 mm socket key.

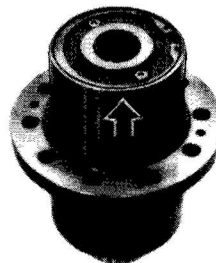


30 33 278

Separate differential case with light knocks from a plastic hammer.

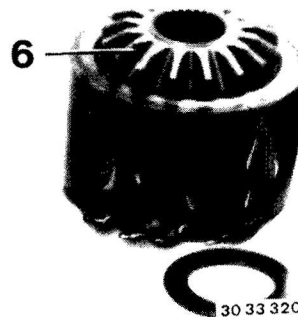


30 33 279

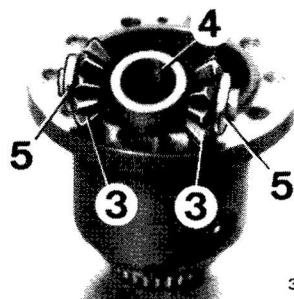


30 33 280

Pull out complete visco lock; don't disassemble. The amount of oil in the visco lock housing is precise and can not be weighed with sufficient precision in a workshop.

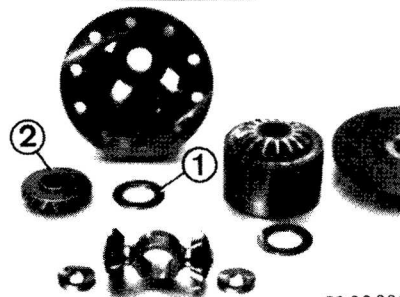


If the visco lock is faulty, i.e. not working, leaking or heated excessively (recognized on strong discoloration of the entire housing), it must be replaced as a complete unit. The differential side gear (6) can only be replaced together with the visco lock unit.



30 33 301

Pull out differential gears (3) with differential shaft (4) and washers (5).

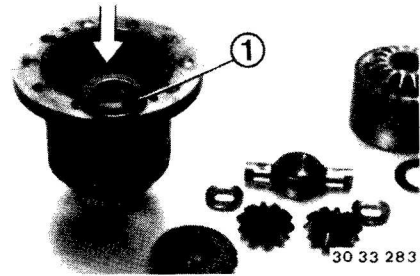


30 33 302

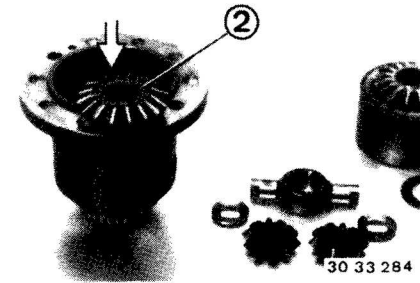
Let differential side gear (2) and shim (1) slide out. Inspect parts, replacing if necessary.

Assembling:

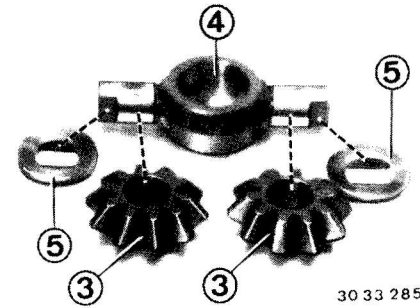
Install shim (1).



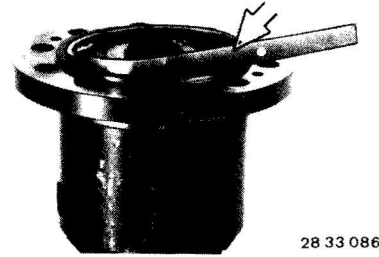
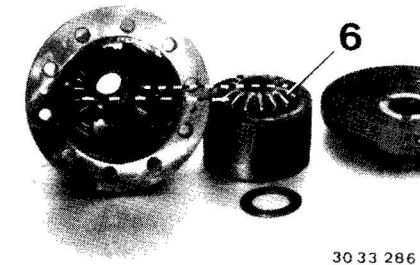
Install differential side gear (2).



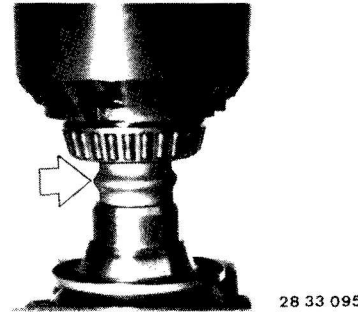
Install differential gears (3) with differential shaft (4) and washers (5), and mesh.



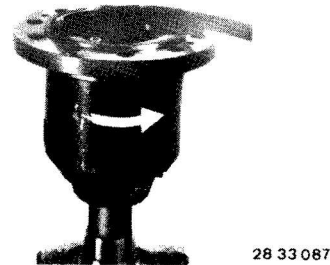
Install visco lock.
Mesh differential side gear (6).



Place feeler gage blades around the visco lock in such a manner that no lateral play is noticed, but that the lock is still easy to turn in the differential case.



Clamp a drive flange which may no longer be used.
Install a suitable 2 to 3 cm (0.787 to 1.181") high sleeve (if applicable, old clamping sleeve for the drive pinion).

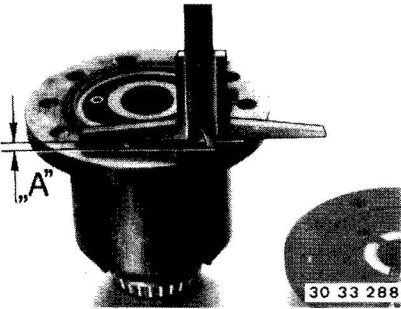


Slide differential case on drive flange shaft up to the sleeve.



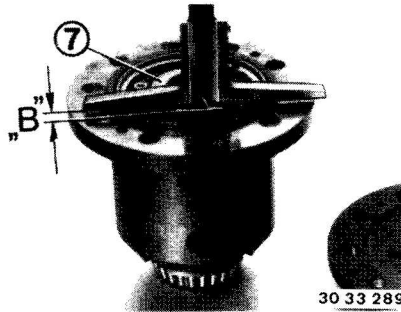
Clamp on a micrometer and find the highest point by turning the differential case.
Press visco lock into splines firmly while turning.
Stop the differential case at the highest point.

Determine the shim thickness.
Measure distance "A" on the differential case and note this value.



30 33 288

Measure distance "B" from edge of differential case to bearing surface of the shim, without washer (7), and note this value.



30 33 289

Measure distance "C" on upper section of the differential case and note this value.

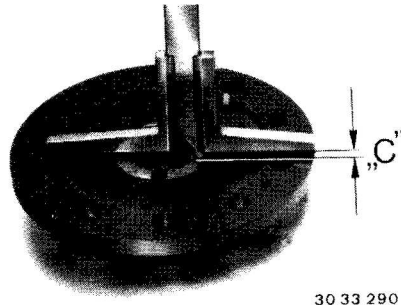
Subtract distance "B" from distance "A". Subtract the difference as well as 0.05 mm (0.002") play from distance "C" to determine the shim thickness.

Example:

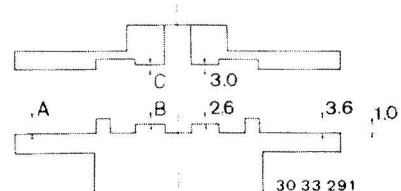
Distance A	3.6 mm (0.142")
- Distance B	2.6 mm (0.102")
Difference	1.0 mm (0.040")

Distance C	3.00 mm (0.118")
- Difference	1.00 mm (0.040")
- Play	0.05 mm (0.002")
Shim thickness	1.95 mm (0.076")

Shims are available in steps of 0.05 mm (0.002").

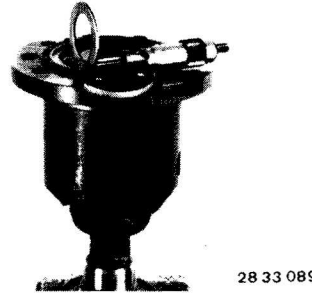


30 33 290



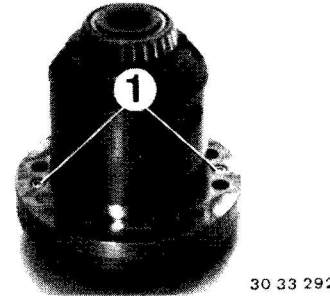
30 33 291

Install shim (7) of determined thickness.



28 33 089

Mount upper section of differential case and tighten the 5 mm socket head screws (1).



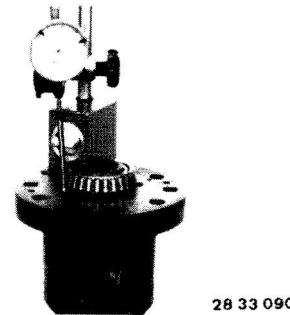
30 33 292

Mount a dial gage with a magnetic holder or dial gage holder (Special Tool 00 2 500).

Use extension on housing of visco lock and set dial gage to zero with 2 mm (0.079") preload.

Important!

Do not measure on the bolt head or circlip of the visco lock.



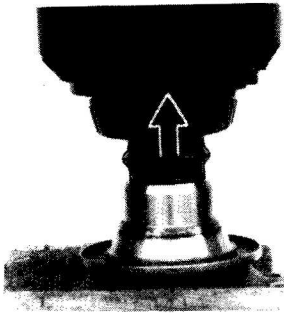
28 33 090

Pull differential case off of the drive flange shaft carefully.



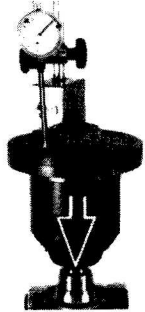
28 33 091

Pull sleeve off of drive flange shaft.



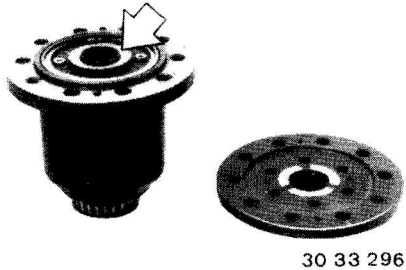
28 33 096

Push on differential case again carefully.
Read amount of play on the dial gage.



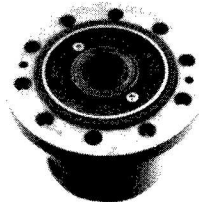
28 33 092

If the play* between the shims and differential side gears is not as specified, measuring must be repeated with a thicker or thinner shim accordingly.



30 33 296

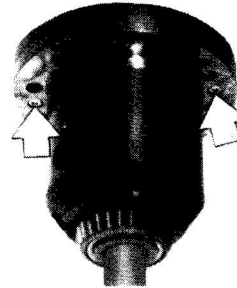
Use a thicker shim for excessive play or thinner shim for insufficient play.



28 33 097

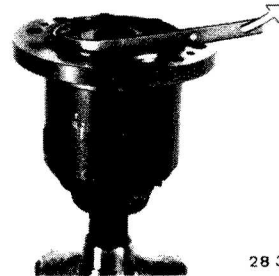
* See Specifications

If the play* is as specified, take off the upper section of the differential case.



28 33 098

Remove the feeler gage blades by turning and lifting the visco lock slightly.



28 33 093

Assemble the differential case.
Tighten socket head screws.



28 33 099

* See Specifications