

## MERCEDES-BENZ INTEGRAL CARRIER

240D  
280 Series  
300 Series  
450 Series

### DESCRIPTION

Axle assembly is of integral carrier housing, hypoid gear type in which centerline of drive pinion is mounted below centerline of ring gear. Removable rear housing cover permits inspection and service of differential. Some models may also be equipped with limited slip differential. All adjustments, except pinion bearing preload, are performed using shims. Pinion bearing preload is set using a collapsible spacer.

### AXLE RATIO & IDENTIFICATION

All of the above mentioned Mercedes-Benz models use the integral carrier rear axle with semi-trailing arm rear suspension. Some models also have limited slip differentials. To determine axle ratio, divide number of ring gear teeth by number of pinion gear teeth. Two different size center housings are also used. The small center housing, generally used on smaller vehicles, has breather mounted on end cover and side covers are secured with six bolts. The large center housing, generally used on larger vehicles, has breather located on right side of housing and side covers are secured with eight bolts.

### REMOVAL & INSTALLATION

#### AXLE DRIVE SHAFTS

**Removal** – 1) Drain lubricant from rear axle. Remove brake caliper and suspend on piece of wire. Remove bolt attaching axle drive shaft to axle shaft. Force axle drive shaft out of axle shaft. If required to aid axle drive shaft removal, loosen upper shock absorber mount and lower suspension arm to stop.

2) Support axle housing and remove rubber mount from body. Lower axle housing slightly. Clean housing and remove rear cover plate. Remove "C" lock holding axle drive shaft to differential side gear. Pull shaft from gear along with spacer ring.

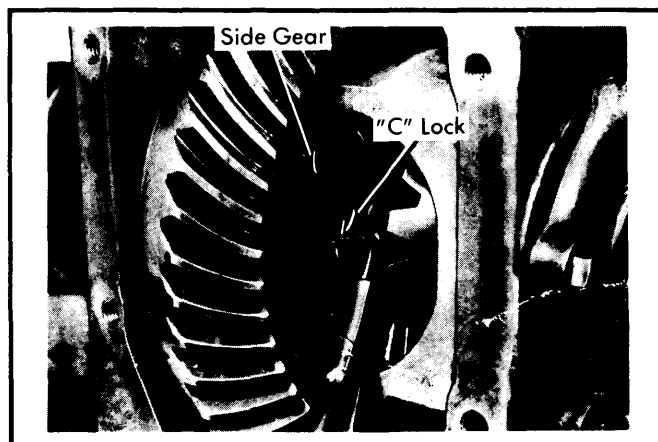


Fig. 1 Removing "C" Lock for Axle Shaft Removal

**Installation** – 1) Face of universal joint spider carries a stamped "R" for right or "L" for left. Make sure correct axle is used on correct side. Place old spacer ring on inner constant velocity joint. Slide axle drive shaft into differential side gear and install new "C" lock into shaft. Check end play between inner universal joint and axle housing. There should be no perceptible end play. In addition, lock ring should still turn in groove. If necessary, install a thicker or thinner lock ring to achieve desired results.

2) Completely telescope axle drive shaft and install axle shaft. Tighten securing nut. Mount end cover with suitable sealing compound and tighten bolts. Raise axle housing, install rubber mount and attach to body. Attach brake caliper using new lock washer and fill axle with lubricant.

#### AXLE DRIVE SHAFT RUBBER SLEEVES

**Removal** – Remove axle drive shaft. Cut stop sleeve of constant velocity joint on beaded edge and pull sleeve from spider. Remove spider from hub along with six balls. Remove lock ring from groove in axle drive shaft and press spider from shaft. Pull stop sleeve and rubber sleeve from shaft. Loosen hose clamps and pull second rubber sleeve across disassembled end of axle drive shaft. Carefully clean joints and check balls and other parts for wear or damage.

**Installation** – 1) Slide new rubber sleeve on shaft up to bead. Place suitable assembly bushing (115 589 01 63 000) on splines to protect against damage. Place new stop sleeve on shaft and press spider on axle drive shaft. Install locking ring. Assemble universal spider and 6 balls using suitable magnetic ball holders for assistance.

2) Place new sealing rings on universal spider and attach new protective sleeve. Insert complete drive axle into suitable beading tool (115 589 00 63 00) and install split supporting ring. Attach beading ring and bead edge of sleeve while tightening nuts against stop of beading tool. Remove axle from tool and fill constant velocity joint with 8.5 ozs. (241 grams) of suitable CV joint oil. Attach rubber sleeve on stop sleeve and on axle shaft with new hose clamps.

#### AXLE SHAFT & BEARING

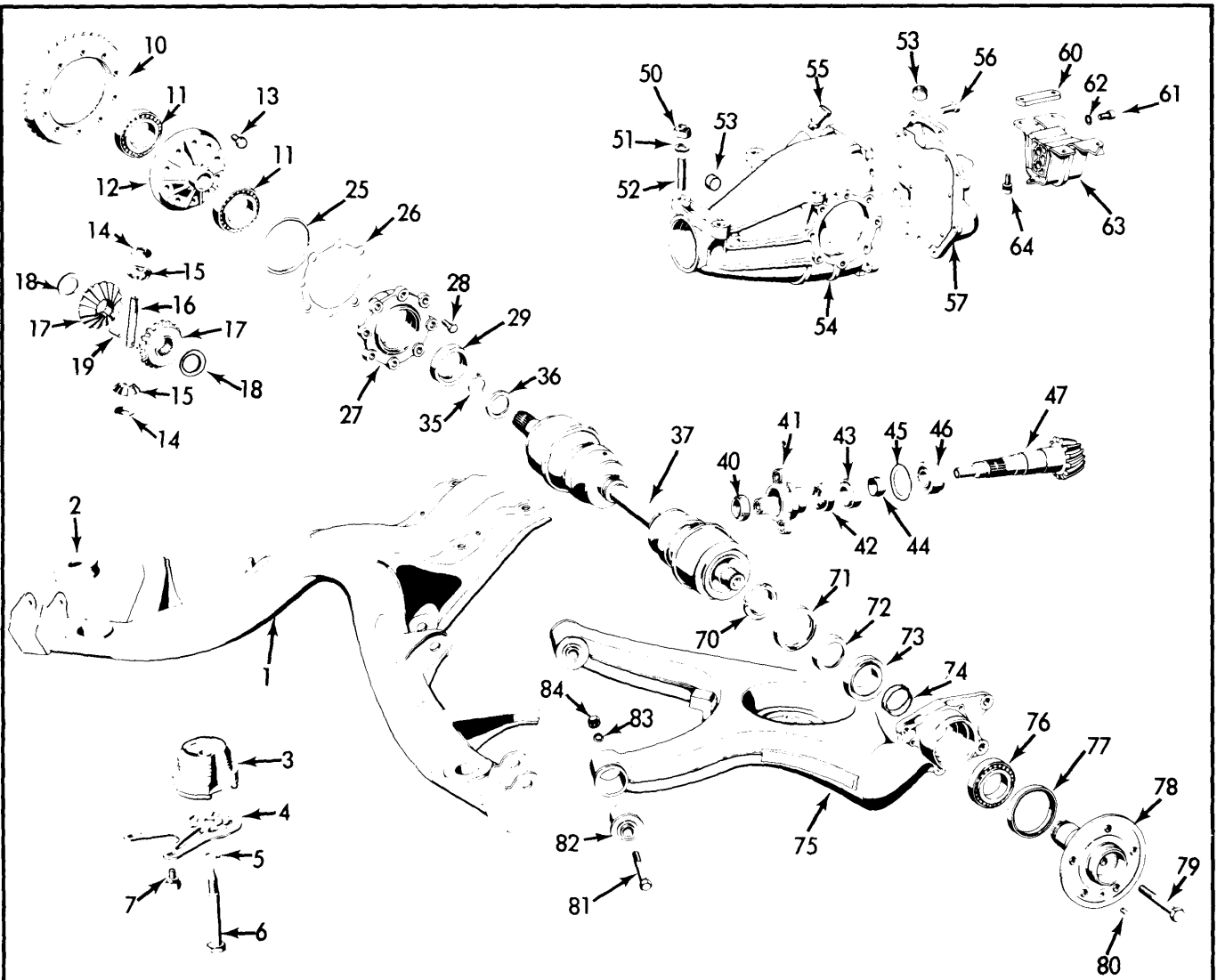
**Removal** – 1) Unscrew bolt and force axle drive shaft out of axle shaft, tie axle drive shaft up out of way. Do not allow axle drive shaft to hang freely. Remove brake caliper and rotor and if necessary, parking brake shoes. Using suitable wrench, remove slotted nut from axle shaft while holding shaft with suitable tool (136 589 05 31 00). Remove sealing rings from support housing using screwdriver.

2) Knock axle shaft out of support housing and remove bearing inner race along with spacer sleeve. Force outer sealing ring from support housing and pull outer bearing race out of outer bearing from wheel bearing. Knock outer bearing race of inner bearing from support housing. Force outer bearing inner race from axle shaft.

**Installation** – 1) For identification, axle shafts have a stamped "R" for right or "L" for left. Insure that axle shafts are installed in correct sides. Press inner race of outer bearing onto axle shaft and install both bearing outer races in support housing. Coat seat for outer sealing ring on support housing with sealing compound and install seal making sure that seal rests straight against chamfer at bottom of housing. Fill cavity between two bearing races in support housing with 1.8 ozs. (50 grams) multi-purpose grease.

# Drive Axles

## MERCEDES-BENZ INTEGRAL CARRIER (Cont.)



- |                          |                            |                        |
|--------------------------|----------------------------|------------------------|
| 1 - Axle Carrier         | 29 - Seal                  | 61 - Allen Bolt        |
| 2 - Rubber stop          | 35 - Lock Ring             | 62 - Circlip           |
| 3 - Rubber Mounting      | 36 - Shim                  | 63 - Rubber Mounting   |
| 4 - Support Plate        | 37 - Axle Drive Shaft      | 64 - Bolt              |
| 5 - Snap Ring            | 40 - Self-Locking Slot Nut | 70 - Slot Nut          |
| 6 - Bolt                 | 41 - Flange                | 71 - Seal              |
| 7 - Bolt                 | 42 - Seal                  | 72 - Thrust Ring       |
| 10 - Ring Gear           | 43 - Bearing               | 73 - Bearing           |
| 11 - Bearing             | 44 - Collapsible Spacer    | 74 - Sleeve            |
| 12 - Differential Case   | 45 - Shim                  | 75 - Semi-Trailing Arm |
| 13 - Bolt                | 46 - Bearing               | 76 - Bearing           |
| 14 - Spherical Washer    | 47 - Drive Pinion          | 77 - Seal              |
| 15 - Differential Pinion | 50 - Lock Nut              | 78 - Axle Shaft        |
| 16 - Pinion Shaft        | 51 - Washer                | 79 - Bolt              |
| 17 - Side Gear           | 52 - Stud                  | 80 - Notched Pin       |
| 18 - Thrust Washer       | 53 - Plug                  | 81 - Bolt              |
| 19 - Pin                 | 54 - Axle Housing          | 82 - Rubber Mounting   |
| 25 - Seal                | 55 - Breather              | 83 - Circlip           |
| 26 - Gasket              | 56 - Bolt                  | 84 - Nut               |
| 27 - Bearing Cover       | 57 - Rear Cover            |                        |
| 28 - Bolt                | 60 - Threaded Plate        |                        |

Fig. 2 Exploded View of Mercedes-Benz Drive Axle Assembly

## MERCEDES-BENZ INTEGRAL CARRIER (Cont.)

2) Attach new spacer sleeve to axle shaft and install into carrier housing. Attach bearing inner race for inner bearing to axle shaft. Fill new sealing ring between lips with anti-friction bearing grease and coat with sealing compound on outside diameter. Press bearing inner race and sealing ring into housing. Install seal running ring and screw on new slotted nut.

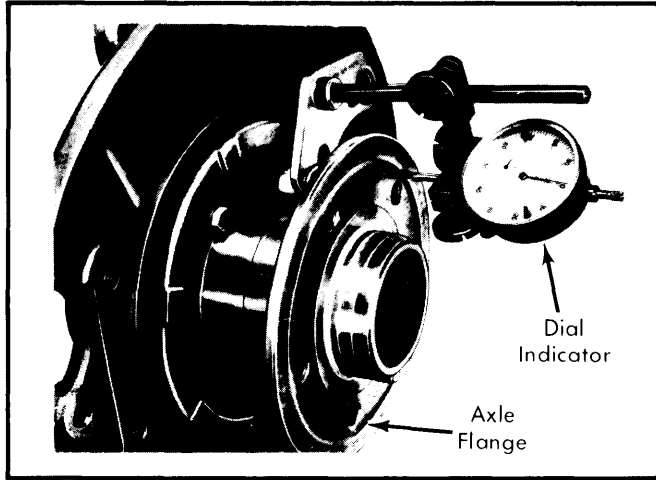


Fig. 3 Checking Axle Shaft End Play

3) Attach dial indicator holder to support housing and check end play of axle shaft while tightening slotted nut and rotating axle shaft back and forth. End play should be .0016-.0024" (.04-.06 mm). If slot nut is overtightened, reducing end play to zero, install a new spacer sleeve and retighten slot nut. Lock slot nut by bending into grooves in axle shaft at two points. Install axle drive shaft, brake components and bleed brake system.

### PINION FLANGE & SEAL

**Removal** – 1) Remove exhaust system and shielding plate, if necessary. Loosen clamping nut and unscrew propeller shaft intermediate bearing from frame. On three-piece propeller shaft, loosen front clamping nut only. Unflange propeller shaft from axle and push forward out of centering alignment.

2) Make sure axle drive shafts are horizontal and that brakes are not dragging and check and record torque required to rotate entire rear axle assembly. Attach holding wrench to flange and loosen slotted nut with suitable wrench (115 589 01 07 00). Pull flange from pinion using puller if required. Force seal out of housing using a screwdriver. Check running surface for seal on flange and replace flange if surface is worn.

**Installation** – 1) Coat new seal on outside diameter with sealing compound and knock in against stop in axle housing using suitable driver (116 589 12 61 00). Attach flange and carefully tighten slotted nut until turning torque for rear axle is equal to torque measured previously. Do not overtighten or a new collapsible spacer will have to be installed on pinion.

2) Reconnect propeller shaft and lightly tighten propeller shaft intermediate bearing. Fill axle housing with oil, lower vehicle and move back and forth several times. Tighten clamping nut on universal and propeller shaft intermediate bearing. Reinstall shielding plate and exhaust system, if necessary.

### AXLE ASSEMBLY

**Removal** – 1) Drain oil from rear axle. On vehicles without starting torque compensation, unscrew brake caliper at right and suspend out of way. On vehicles with starting torque compensation, disconnect brake cable control, unscrew holding bracket on support housing, remove rubber sleeve and push cover back. On all models, disconnect axle drive shafts from axle shaft on both sides and force axle drive shafts out of axle shafts.

2) If necessary, remove exhaust system and shielding plate. Loosen clamping nut and unscrew propeller shaft intermediate bearing on frame. On three-piece propeller shaft, loosen front clamping nut only. Disconnect propeller shaft and push forward out of way. Support axle assembly with jack and suitable holding fixture (115 589 35 63 00 for small center housing, 116 589 02 63 00 for large center housing).

3) Unscrew rear rubber mounting on frame floor, or unscrew socket bolt for rubber mounting on cover of axle housing. On 240D and 280 Series, fold back rubber mat in trunk and remove rubber plugs. Unscrew axle housing from rear axle carrier. On all models, lower rear axle and remove along with axle drive shafts. Use care not to let axle drive shafts droop. Unscrew rubber mounting from housing and replace if worn or damaged.

**Installation** – 1) Attach rubber mounting to axle housing and place on jack and holding fixture. Move axle up under vehicle. Mount axle housing to rear axle carrier and tighten nuts. On 240D and 280 Series, install rubber plugs and replace trunk floor mat. Install both axle drive shafts into axle shafts and tighten bolts.

2) Lift axle housing up to frame floor and attach rubber mounting to frame. Reconnect propeller shaft and lightly attach propeller shaft intermediate bearing. On vehicles without starting torque compensation, mount brake caliper using new lock washers. On vehicles with starting torque compensation, mount holding bracket for brake cable control to support housing, slide on cover and rubber sleeve, attach cable control and adjust parking brake.

3) Fill axle with oil to level of filler hole, lower vehicle. Rock back and forth several times, then tighten clamping nut on propeller shaft and tighten propeller shaft intermediate bearing. Install exhaust system and shielding plate if removed.

## OVERHAUL

### DISASSEMBLY

1) Clamp axle housing in suitable support so that axle drive shafts are fully supported. Remove rear cover from housing and axle drive shafts from side gears (see "Axle Drive Shafts" under REMOVAL & INSTALLATION). Remove bolts and push side bearing covers out of housing along with seal rings and shims, mark all parts for correct right and left side reassembly.

2) Tilt differential case slightly and remove from housing. Mark relative position of ring gear to differential case, remove bolts and carefully force gear from case. To disassemble case, pull roller bearings from case using suitable puller (187 589 05 33 00). Knock holding pin for pinion shaft out of case and remove pinion shaft.

## MERCEDES-BENZ INTEGRAL CARRIER (Cont.)

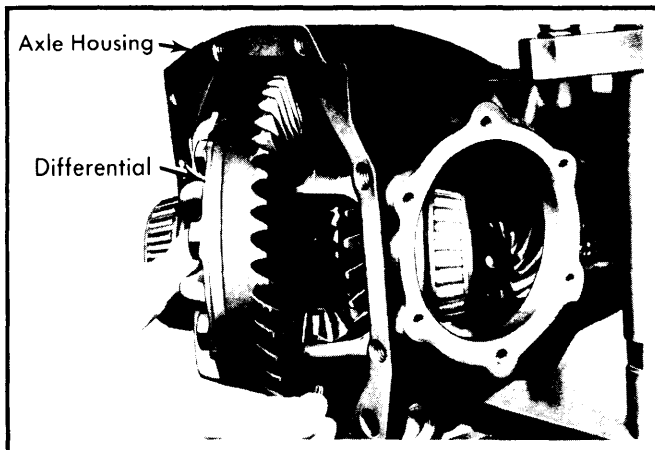


Fig. 4 Removing Differential Assembly from Housing

3) On limited slip differentials, insert suitable assembly mandrels (116 589 18 61 00) through case and side gears. Remove pinions with spherical washers, then remove right side gear with friction discs, then repeat procedure for left side. On standard differentials, lift out side gears, thrust washers and spherical washers.

4) To remove drive pinion, remove flange nut and flange. Force pinion out of housing using tool (115 589 00 59 00). Pry seal out of housing with screwdriver. Screw suitable fixture (115 589 01 61 00) to housing and using suitable mandrel (115 589 01 61 06), press front bearing outer race out of housing. Now pull rear bearing outer race out of housing using suitable adapter (116 589 12 61 00 part 7 for small center housing or part 18 for large center housing). Press roller bearing inner race from pinion using suitable press plate (108 589 00 33 00).

## REASSEMBLY &amp; ADJUSTMENT

**Case Assembly (Standard Differential)** – 1) Place thrust washers on side gears and insert in case. Insert assembly mandrels (116 589 18 61 00) into side gears and mount both pinions along with spherical washers. Insert dummy pinion shaft (115 589 03 61 00 for small center housing or 116 589 07 61 00 for large center housing) into case to locate pinion gears and spherical washers.

2) Check torque required to rotate side gears. Specified torque is 130-174 INCH lbs. (150-200 cmkg) with spot binding up to 304 INCH lbs. (350 cmkg) permitted with no end play. If necessary, change side gear thrust washers as necessary to achieve this torque value. When side gear preload is correct, insert pinion shaft in place of mandrel, install new clamping sleeve and press bearing inner races on case using suitable mandrel (115 589 04 61 00 for small center housing or 116 589 08 61 00 for large center housing).

**Case Assembly (Limited Slip Differential)** – 1) Mount friction discs on side gears in correct sequence (see illustration). Install left side gear (ring gear side) with discs and insert assembly mandrel (116 589 18 61 00). Make sure disc lugs align properly in case. Repeat procedure for right side gear. Install pinions with new spherical washers.

2) Insert dummy pinion shaft (116 589 07 61 00) through case, pinions and spherical washers. Check torque required to rotate side gears. Specified torque is 217-304 INCH lbs. (250-350 cmkg) with no end play. If necessary, change side gear

thrust washers as necessary to achieve this torque value. When side gear preload is correct, insert pinion shaft in place of mandrel, install new clamping sleeve and press bearing inner races on case using suitable mandrel (116 589 08 61 00).

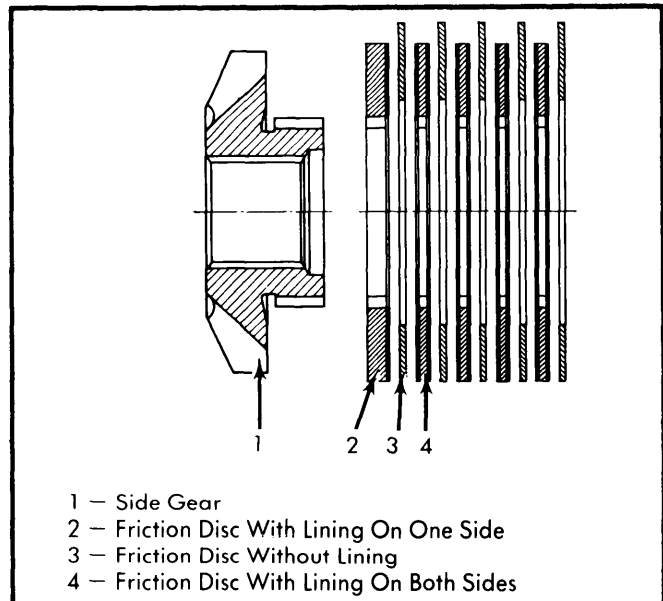


Fig. 5 Friction Disc Installation Sequence

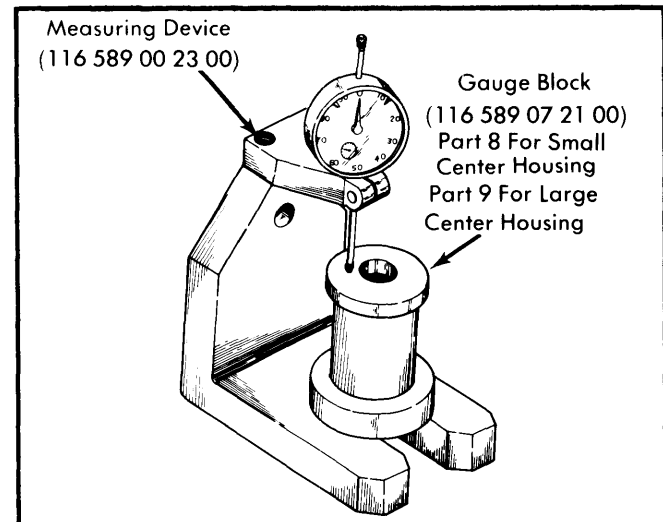
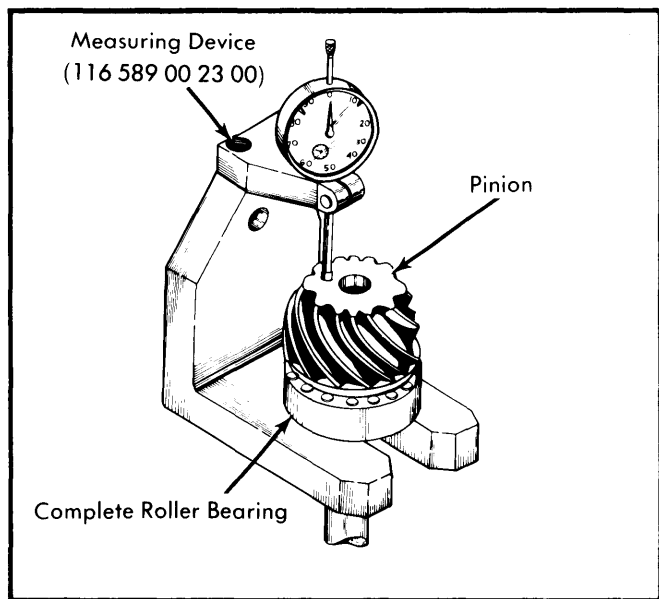


Fig. 6 Zeroing Dial Indicator for Pinion Depth Adjustment

**Drive Pinion Depth** – 1) With dial indicator depressed about .12" (3 mm) by gauge block (116 589 07 21 00 part 8 for small center housing or part 9 for large center housing), zero dial indicator. Press inner tapered roller bearing on drive pinion and place bearing outer race on roller cage of bearing. Insert pinion assembly into measuring device. On pinions from large center housings, place magnetic plate (116 589 01 21 00 part 4) on top of pinion. Place indicator stem on head of pinion or plate and note reading (example: 1.50 mm).

**NOTE** – On all 450 Series, the height of the pinion gear head has been increased from 1.477" (37.5 mm) to 1.535" (39 mm). This must be considered when selecting pinion depth adjusting shims. This change was made as of chassis end numbers: 0066963 (450 SLC); 017787 (450 SL); and 023515 (450 SE/SEL).

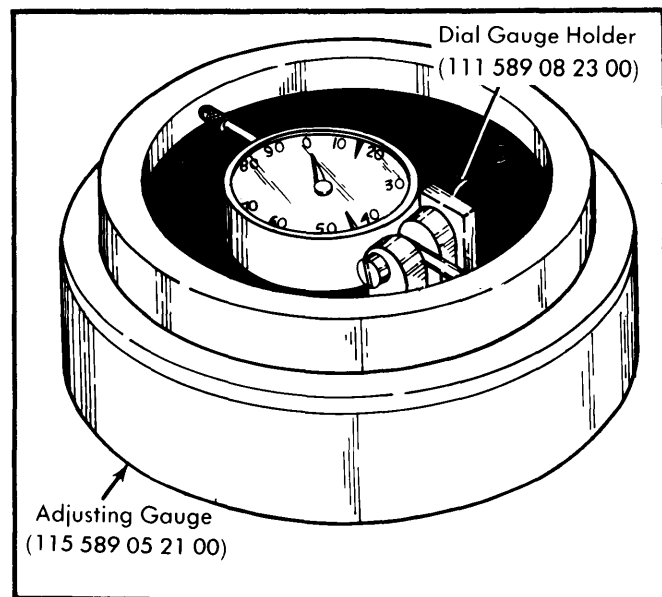
## MERCEDES-BENZ INTEGRAL CARRIER (Cont.)



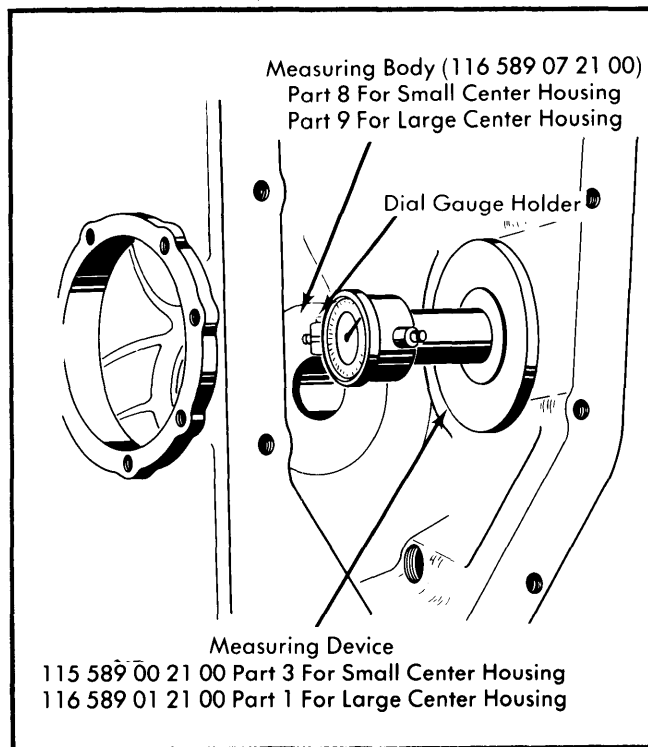
**Fig. 7 Reading Pinion Height**

2) Now note adjustment value engraved on pinion shaft in tenths of millimeters (example: +20 = +.20 mm). From value measured above, add adjustment value if plus and subtract value if minus. (example: 1.50 + .20 = 1.70 mm). Insert gauge block holder into axle housing and screw on appropriate gauge block. Insert dial gauge holder (111 589 08 23 00) into adjusting gauge (115 589 05 21 00) and zero indicator with stem depressed about .12" (3 mm).

3) Insert measuring device (115 589 00 21 00 part 3 for small center housing or 116 589 01 21 00 part 1 for large center housing) together with dial gauge holder into right bore of housing and screw down. Read indicator reading difference between adjusting gauge and gauge block face end. If value is plus, it must be subtracted from result obtained in step 2) and if minus, must be added to above result (example: If measured deviation is +.16 mm, subtract this value from 1.70 mm to obtain 1.54 mm). This result is thickness of required shim.



**Fig. 8 Zeroing Dial Indicator**



**Fig. 9 Measuring Housing Depth**

4) Remove all tools from axle housing. Insert shim of calculated thickness into axle housing. If necessary, a thicker washer may be ground down to required thickness. Install outer races of bearings in housing using suitable installation tool (116 589 11 61 00). Lubricate bearings on drive pinion with hypoid gear oil and insert pinion and new collapsible spacer into housing.

5) Install front bearing inner race using suitable tools. Coat new seal on circumference with sealing compound and press into cover using suitable mandrel. Coat running surface of pinion flange with molybdenum disulphide paste and slide flange on drive pinion, making sure alignment marks are lined up.

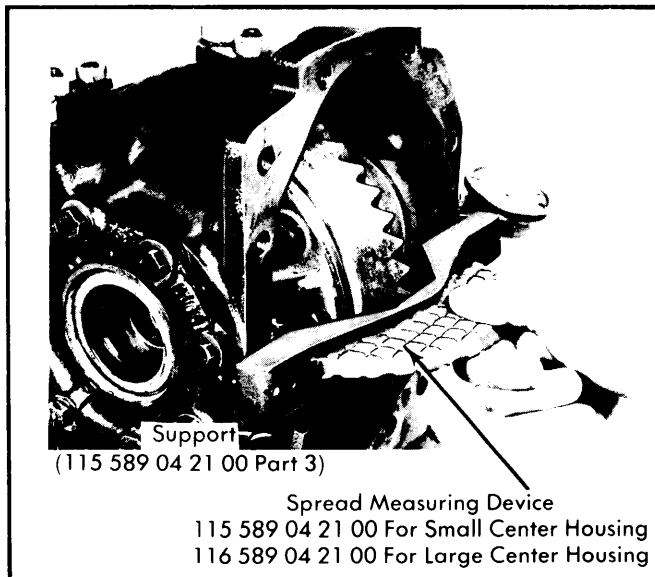
**Pinion Bearing Preload — 1)** Check that runout of pinion flange does not exceed .001" (.03 mm). If runout is excessive, reposition flange. Attach suitable holding wrench to flange and screw on new locking slot nut. Gradually tighten slot nut while turning pinion and applying light hammer blows to axle housing. Continue tightening nut until torque required to rotate pinion is 10.4-12.2 INCH lbs. (12-14 cmkg) with new bearings or 4.3-8.7 INCH lbs. (5-10 cmkg) with used bearings.

2) Use care not to exceed specified preload. If preload is exceeded, remove pinion from housing and replace collapsible spacer. Again insert measuring device together with dial gauge holder into right bore of housing and place magnetic measuring plate (116 589 01 21 00 part 4) on head of pinion. Dial indicator should read value engraved on pinion shaft. Maximum error is -.0008" (.02 mm). If error is higher, disassemble pinion and install correct shim.

## MERCEDES-BENZ INTEGRAL CARRIER (Cont.)

**Backlash & Side Bearing Preload** – 1) On small center housing axles, press out sealing rings and outer bearing bores from side covers using a mandrel. On large center housing axles remove sealing rings from covers using a suitable tool, then remove bearing outer race. On all axles, press in new outer races with suitable sleeve (116 589 04 43 00 part 5) and, on small center housing only, disc (115 589 00 61 00).

2) Coat new seals on outside diameter with sealing compound and press into bearing covers with a suitable punch. Place previously used shims on bearing covers and install new sealing rings in grooves of covers. Carefully clean bore of ring gear and seat on differential case as ring gear is removed from case. Heat ring gear to about 140-158°F (60-70°C) and install gear on case making sure installation markings are lined up if old ring gear and case is being used. If necessary, tap gear on case using rubber hammer. Tighten ring gear bolts uniformly and in a crosswise pattern.



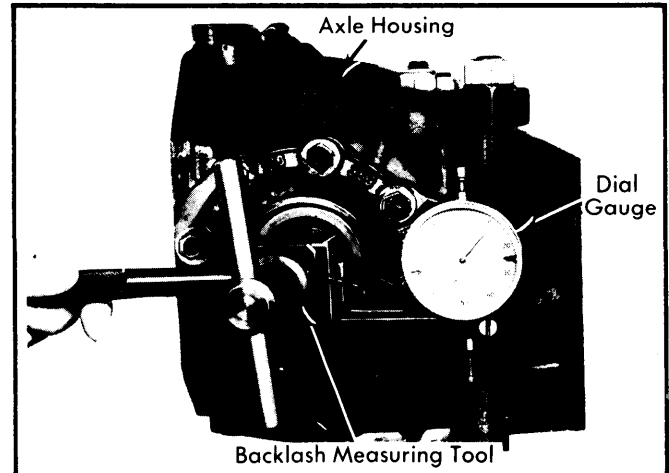
**Fig. 10 Measuring Housing Spread**

3) Place differential case into housing. Place suitable assembly fixture (116 589 06 61 00) into housing. Place both bearing covers with shims on centering surface of fixture and slide into housing on same side from which they were removed. Turn both covers so that marking "bottom" ("unten") faces downwards. Remove assembly fixture and screw in bearing cover bolts but do not tighten. Mount suitable case spread measuring device (115 589 04 21 00 for small center housing or 116 589 04 21 00 for large center housing) and support (115 589 04 21 00 part 3) on housing and zero dial indicator.

4) Tighten bolts on bearing covers, crosswise, to a torque of 14.5 ft. lbs. (2 mkg). Place spread measuring device on support blocks and measure spread of axle housing. Spread should be .004-.006" (.10-.15 mm) for small center housing or .006-.008" (.15-.20 mm) for large center housing. Adjust size of shims as necessary to achieve specified case spread. Install suitable backlash measuring device (115 589 03 23 00) into right side bearing bore and clamp down.

5) Measure backlash at four points on ring gear. The lowest measured value of backlash should be .003-.0055" (.08-.14

mm). Adjust shims from side to side as necessary to achieve specified backlash. When preload and backlash is correct, install both axle drive shafts with new "C" lock rings. Clean sealing surface on end cover and axle housing and coat with sealing compound. Install cover and tighten bolts.



**Fig. 11 Measuring Ring-to-Pinion Gear Backlash**

### AXLE ASSEMBLY SPECIFICATIONS

Application	Specification
Flange Runout	.0047" (.12 mm) Max.
Wheel Bearing End Play	0-.0015" (0-.04 mm)
Axle Shaft End Play	.0016-.0024" (.04-.06 mm)
Ring Gear Runout	.0008" (.02 mm) Max.
Side Gear Turning Torque	
Standard Diff.	130-174 INCH lbs. (150-200 cmkg)
Limited Slip Diff.	217-303 INCH lbs. (250-350 cmkg)
Pinion Turning Torque	
New Bearings	10-12 INCH lbs. (12-14 cmkg)
Old Bearings	4-9 INCH lbs. (5-10 cmkg)
Ring & Pinion Backlash	.003-.0055" (.08-.14 mm)
Housing Spread	
Small Center Housing	.004-.006" (.10-.15 mm)
Large Center Housing	.006-.008" (.15-.20 mm)

### TIGHTENING SPECIFICATIONS

Application	Ft. Lbs. (mkg)
Rubber Mount-to-Axle Housing	87 (12)
Rear Rubber Mount-to-Frame	18 (2.5)
Front Rubber Mount-to-Frame	87 (12)
Propeller Shaft Clamping Nut	
Two Piece Shaft	22-29 (3-4)
Three Piece Shaft	
Front	22-29 (3-4)
Rear	145 (20)
Housing-to-Rear Axle Carrier	72 (10)
Axle Drive Shaft-to-Axle Shaft	
Early (M 12)	69 (9.5)
Late (M 8)	22 (3)
Housing Rear Cover	33 (4.5)
Brake Caliper Carrier Bolt	18 (2.5)
Bearing Cover-to-Axle Housing	14 (2)
Ring Gear Bolts	
Small Center Housing	58 (8)
Large Center Housing	87 (12)