

SECTION F

43-44-45000 STANDARD DIFFERENTIAL

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DIVISION I SPECIFICATIONS AND ADJUSTMENTS

40-21 DIFFERENTIAL SPECIFICATIONS

a. Tightening Specifications

Use a reliable torque wrench to tighten the parts listed, to insure proper tightening without straining or distorting parts. These specifications are for clean and lightly lubricated threads only; dry or dirty threads produce increased friction which prevents accurate measurement of tightness.

Part	Location	Thread Size	Torque Lbs. Ft.
Nut	Rear Universal Joint to Pinion Flange	5/16-18	15-18
Bolt	Differential Pinion Shaft Locking Bolt	5/16 (Special)	20-28
Bolt	Rear Axle Housing Cover to Carrier	5/16-18	25-35
Nut	Brake Assembly to Rear Axle Housing	3/8 -16	45-60
Bolt	Ring Gear to Differential Case	3/8 -24	50-60
Bolt	Bearing Cap to Carrier	7/16-14	45-60
Nut	Rear Wheel to Axle Shaft	7/16-20	65-85
Bolt & Nut	Lower Control Arm to Frame Bracket and Axle Bracket	1/2 -13	65-85
Bolt & Nut	Upper Control Arm to Frame or Bracket and Differential Housing . .	1/2 -13	65-85
Nut	Lower End of Shock Absorber to Lower Control Arm Axle Bracket .	1/2 -20	30-60

b. General Specifications

Rear Axle Type	Semi-Floating Hypoid
Drive and Torque	Through 4 Arms
Rear Axle Oil Capacity	2-3/4 pints
Ring and Pinion Gear Set Type	Hypoid

c. Limits for Fitting and Adjusting

Pinion Bearing Preload

New Bearings 20-30 inch lbs. torque
with new seal
Reused Bearings 12-20 inch lbs. torque
with new seal
Ring Gear Position007", .008", .009" Backlash

Ring Gear Preload

New Bearings 30-40 inch lbs. torque
at ring gear
with pinion
Reused Bearings 20-30 inch lbs. torque
at ring gear
with pinion

d. Differential Gear Ratios

Gear ratios are indicated by letters stamped on the bottom of the right axle tube. The produc-

tion date is also indicated by a stamped number which represents the day of the year starting with "1" for January 1. See Figure 40-102.

e. Speedometer Gears

Speedometer gears must correspond with axle ratios and tire sizes in order to have correct speedometer and odometer readings.

**DIVISION II
DESCRIPTION
AND OPERATION**

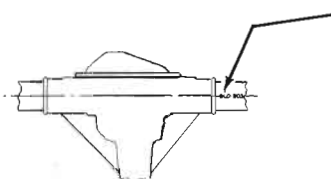
**40-22 DESCRIPTION AND OPERATION
OF STANDARD DIFFERENTIAL**

The rear axle assembly is of the semi-floating type in which the car weight is carried on the axle shafts through ball bearings enclosed in the outer axle housing tubes. The rear axle is designed for use with an open drive line and coil springs. Drive from the axle housing is transmitted to frame members through two lower and two upper control arms. Large rubber bushings at either end of these control arms are designed to absorb vibration and noise. The upper control arms are angle mounted to also hold the frame in sidewise alignment with the rear axle assembly. The final drive has a hypoid type ring gear and pinion with the centerline of the pinion below the centerline of the ring gear. See Figures 40-103 and 40-104.

The drive pinion is mounted in two tapered roller bearings which are preloaded by a collapsible spacer during assembly. The pinion is positioned by shims located between a shoulder on the drive pinion and the rear bearing. The front bearing is held in place by a large nut.

AXLE RATIO	SERIES							
	43300,43400, 43500,43600, 44300 44407-17-39-67		44200 44455-65		44600		45000	
	STD. AXLE	P.T. AXLE	STD. AXLE	P.T. AXLE	STD. AXLE	P.T. AXLE	STD. AXLE	P.T. AXLE
2.56	LK	LV	—	—	—	—	—	—
2.78	LA	LN	—	—	OA	OP	NL	NY
2.93	OB	OW	MJ	MZ	OE	OX	NJ	NZ
3.08	LB	LO	—	—	—	—	NK	NT
3.23	LC	LP	MG	MT	—	—	NF	NW
3.36	LD	LR	MA	MN	LJ	LX	NG	NU
3.55	—	ON	—	MW	—	OR	—	NS
3.90	—	OO	—	MX	—	OS	—	NX
4.30	—	—	—	—	—	OT	—	—

(FIELD IDENTIFICATION)



FOR FIELD IDENTIFICATION, ALL AXLE ASSEMBLIES TO BE STAMPED WITH LETTERS 1/4" HIGH ON BOTTOM OF AXLE TUBE AS INDICATED FROM CHART. SAMPLE MARKING FOR 3.08 RATIO, (FOR 433 MODEL), DATE JULY 22, (DAY IN THE YEAR MFG'D.) WOULD BE..... STANDARD AXLES LB-203; POSITIVE TRACTION AXLES ⊗LO-203. 40-141 40-102

Figure 40-102—Differential Identification

40-103

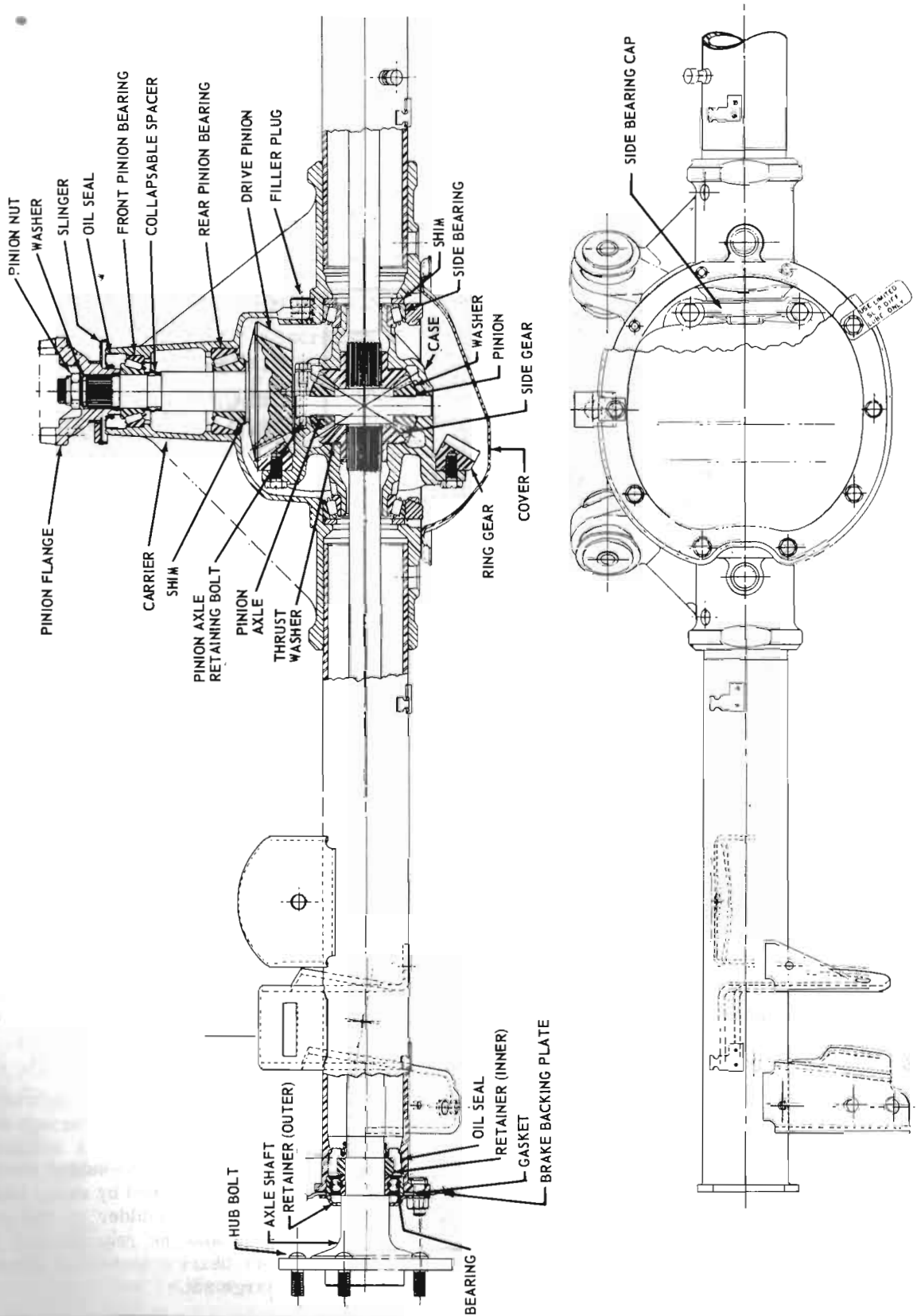


Figure 40-103 43-44000 Differential Assembly

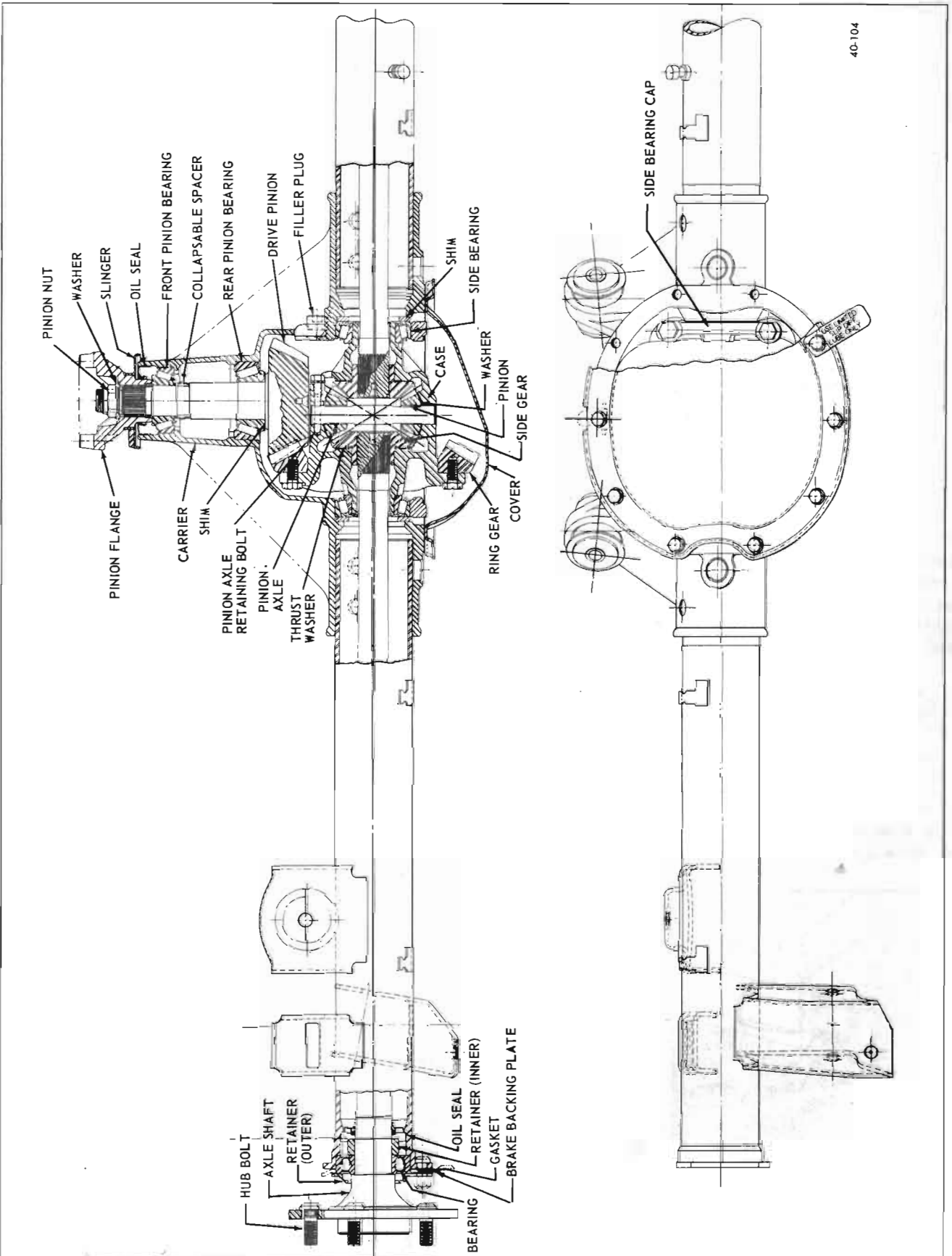


Figure 40-104 45000 Differential Assembly

The differential is supported in the carrier by two tapered roller side bearings. These are pre-loaded by inserting shims between the bearings and the pedestals. The differential assembly is positioned for proper gear and pinion backlash by varying these shims. The ring gear is bolted to the case. The case houses two side gears in mesh with two pinions mounted on a pinion axle which is anchored in the case by a bolt. The pinions and side gears are backed by thrust washers.

The axle shaft inner splines engage the differential side gears with a floating fit. The outer ends are supported in the axle housing by thrust type ball bearings which are factory packed for the life of the bearing and sealed on both sides. The axle shaft oil seals are located inboard of the bearings. The bearings are secured against shoulders on the shafts by press fit retainer rings. Retainer plates hold the bearings against shoulders in the housing. Wheel side thrust is taken at the wheel bearings, so an axle shaft may be removed simply by removing the bolts holding the retainer to the brake backing plate and axle housing flange. See Figure 40-105.

The differential carrier is a malleable iron casting with tubular axle housings pressed into the

sides to form a complete assembly. A removable, heavy steel cover is bolted on the rear of the carrier to permit service of the differential without removing the rear axle from the car. A seal in the front of the carrier bears against the pinion flange. See Figures 40-103 and 40-104.

Brackets welded to the tubular axle housings and upper brackets integral with main carrier casting, form means of attaching the rear axle to the body. An oil feed passage to the pinion bearings and an oil return hole are provided in the carrier casting to allow lubricant to circulate.

The rear axle filler plug is located on the right side of the carrier casting just ahead of and below the axle housing.

The rear brake drum is mounted directly against the axle flange on hub bolts pressed through the back of the axle flange.

DIVISION III

SERVICE PROCEDURES

40-23 REMOVAL AND INSTALLATION OF DIFFERENTIAL ASSEMBLY

It is not necessary to remove the rear axle assembly for any normal repairs. However, if the housing is damaged, the rear axle assembly may be removed and installed using the following procedure.

a. Removal of Rear Axle Assembly

1. Raise rear of car high enough to permit working underneath. Place a floor jack under center of axle housing so it just starts to raise rear axle assembly. Place car stands solidly under frame members on both sides.

2. Disconnect rear universal joint from pinion flange by removing two U-bolts. Wire propeller shaft to exhaust pipe to support it out of the way.

3. Disconnect parking brake cables by removing adjusting nuts at equalizer. Slide center cable rearward and disconnect two rear cables at connectors to free from body.

4. Disconnect rear brake hose at floor pan. Cover brake hose and pipe openings to prevent entrance of dirt.

5. Disconnect shock absorbers at lower end. Lower jack under housing until rear springs can be removed.

6. Disconnect upper control arms at axle ends.

7. Disconnect lower control arms at differential housing and roll assembly out from under car.

b. Installation of Rear Axle Assembly

1. Rest car solidly on stands placed under frame members, with rear end of car high enough to permit working underneath. Roll rear axle assembly under car.

2. Connect lower control arms to housing.

NOTE: Control arm bushing bolts and shock absorbers to be tightened with suspension in normal load position.

3. Connect upper control arms to housing.

4. Place rear springs in position and jack axle housing upward until shock absorbers will reach.

5. Connect shock absorbers and tighten nuts to 30-60 lb. ft. Connect lower control arms and tighten pivot bolts to 65-86 lb. ft. Connect upper control arm bolts and tighten to 65-85 lb. ft.

6. Connect and adjust parking brake cable.

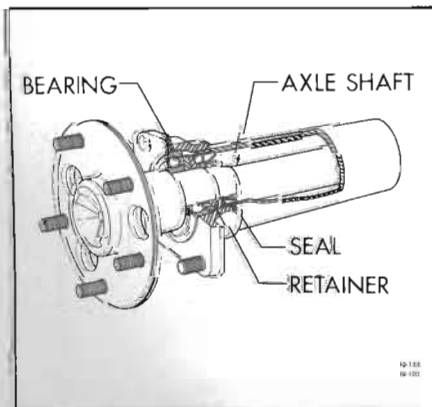


Figure 40-105—Rear Axle Shaft Bearing and Seal

7. Connect rear universal joint to pinion flange. Tighten nuts evenly to 15-18 lb. ft.

CAUTION: U-bolt nuts must be torqued as specified as over-tightening will distort bearings and cause early failure.

8. Connect rear brake hose at floor pan. Bleed both rear brakes and refill master cylinder.

9. Fill rear axle with specified gear lubricant. If axle housing or any rear suspension parts were replaced due to damage, rear universal joint angle must be checked and adjusted if necessary.

40-24 REMOVAL AND INSTALLATION OF AXLE SHAFT, WHEEL BEARING OR OIL SEAL

Most rear axle service repairs can be made with the rear axle assembly in the car by raising the rear end of the car with the rear axle hanging on the shock absorbers. See Figure 40-106. Rear axle lubricant may be drained by backing-out all cover bolts and breaking cover loose at the bottom.

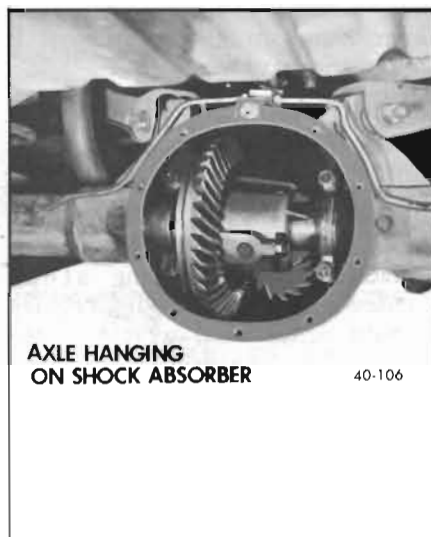


Figure 40-106—Differential Assembly In Position For Repair

a. Remove Axle Shaft Assemblies

Design allows for axle shaft end play up to .042" loose. This end play can be checked with the wheel and brake drum removed by measuring the difference between the end of the housing and the axle shaft flange while moving the axle shaft in and out by hand.

End play over .042" is excessive. Compensating for all of the end play by inserting a shim inboard of the bearing in the housing is not recommended since it ignores the end play of the bearing itself, and may result in improper seating of the gasket or backing plate against the housing. If the end play is excessive, the axle shaft and bearing assembly should be removed and the cause of the excessive end play determined and corrected.

1. Remove wheels. Both right and left wheels have right hand threads.
2. Remove brake drums.
3. Remove nuts holding retainer plates to brake backing plates. Pull retainers clear of bolts, and reinstall two lower nuts finger tight to hold brake backing plate in position.
4. Pull out axle shaft assemblies using Puller J-21579 with a slide hammer. See Figure 40-107.

CAUTION: While pulling axle shaft out through oil seal, support shaft carefully in center of seal to avoid cutting seal lip.

b. Remove and Install Axle Shaft Bearing

1. Nick bearing retainer in 3 or 4 places with a chisel deep enough to spread ring. Retainer will then slip off. See Figure 40-108.
2. Press axle shaft bearing off using Puller Plate J-8621 with Remover J-6525. An arbor press may be used or a set-up may be made using Ram and Yoke

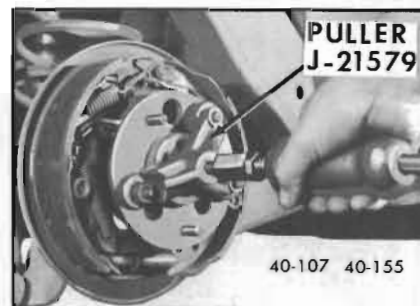


Figure 40-107—Removing Rear Axle Shaft

Assembly with Adapter J-6258 and puller J-21579. See Figure 40-109.

3. Press new axle shaft bearing against shoulder on axle shaft using Installer J-8853 with Holder J-6407. See Figure 40-111.

CAUTION: Retainer plate which retains bearing in housing must be on axle shaft before bearing is installed; retainer gasket can be installed after bearing.

4. Press new retainer ring against bearing using Installer J-8853.

c. Remove and Install Rear Wheel Bolt

1. To remove and install a rear

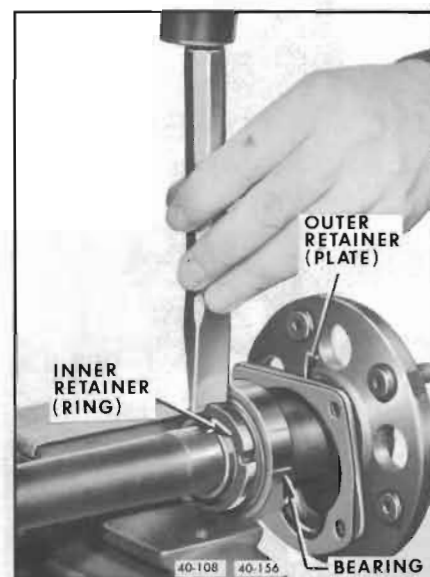


Figure 40-108—Removing Axle Shaft Bearing Retainer

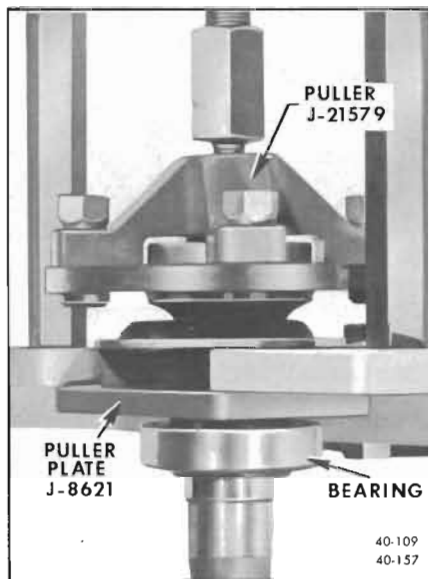


Figure 40-109—Removing Axle Shaft Bearing

wheel bolt, axle shaft assembly must be out of car. Remove rear wheel bolt by pressing from axle flange.

2. Install new rear wheel bolt by pressing through axle flange.

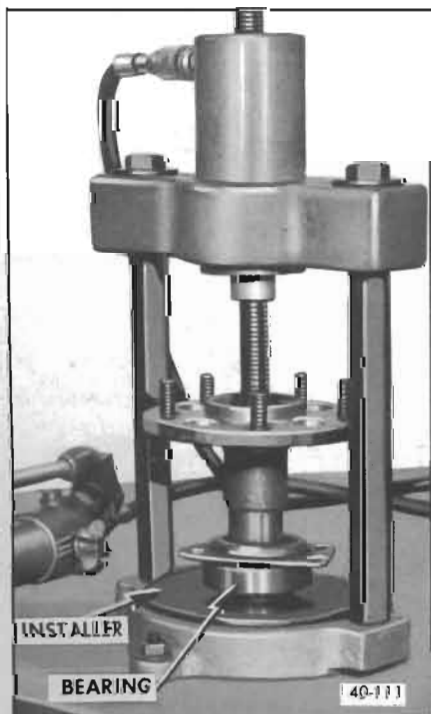


Figure 40-111—Installing Axle Shaft Bearing



Figure 40-112—Removing Axle Shaft Seal

Check new bolt for looseness; if bolt is loose, axle shaft must be replaced.

d. Remove and Install Axle Shaft Seal

1. Insert axle shaft so that splined end is just through seal.

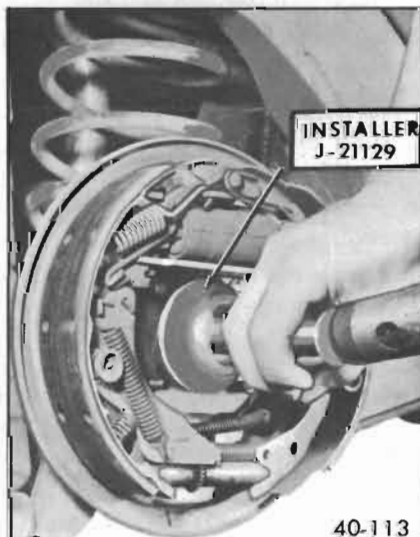


Figure 40-113—Installing Axle Shaft Seal

2. Using axle shaft as a lever, push down on shaft until seal is pried from housing. Remover J-8119 or J-6199 can also be used. See Figure 40-112.

3. Apply sealer to O.D. of new seal.

4. Position seal over Installer J-21129 and drive seal straight into axle housing until fully seated. See Figure 40-113.

40-25 REMOVAL AND DISASSEMBLY OF DIFFERENTIAL CASE ASSEMBLY

a. Removal of Differential Case Assembly—Differential in Car

1. Raise rear of car and support securely under rear of frame.

2. Loosen parking brake cables so that brake is not applied when axle assembly is lowered.

3. Mark rear universal joint and pinion flange for proper alignment at reassembly. Disconnect rear universal joint by removing two U-bolts. Push rear propeller shaft forward as far as possible and wire it to the upper control arm frame bracket to support it out of the way.

4. Disconnect lower ends of both rear shock absorbers and lower differential assembly just far enough to clear lower portion of fuel tank.

NOTE: The following steps also apply when making repairs with differential assembly removed from car.

5. Remove 10 bolts securing cover to housing to drain lubricant.

6. While lubricant is draining, remove rear wheels and drums.

7. Remove rear axle shafts as described in paragraph 40-24.

NOTE: Before proceeding with following steps, it is advisable to check the existing ring gear to pinion backlash as described in paragraph 40-26, subparagraph f. This will indicate gear or bearing wear or an error in backlash or preload setting which will help in determining cause of axle noise. Backlash should be recorded so that if same gears are reused, they may be reinstalled at original lash to avoid changing gear tooth contact.

8. Mark side bearing caps for proper installation at reassembly. Remove bolts holding differential side bearing caps to housing.

9. Remove two ring gear retaining bolts from differential case and install Ring Gear and Case Remover J-21322 with slide hammer as shown in Figure 40-114. Remove case assembly and place right and left bearing outer races and shims in sets with marked bearing caps so that they can be reinstalled in their original positions.

CAUTION: Do not allow case assembly to drop as this may cause injury or damage parts.

b. Disassemble Differential Case Assembly

1. If differential side bearings are to be replaced, insert Remover Adapter J-2241-8 in center hole and pull bearing using Puller J-2241 or Hydraulic Puller J-9005. See Figure 40-115.

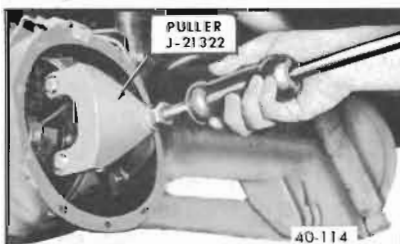


Figure 40-114—Removing Differential Case Assembly

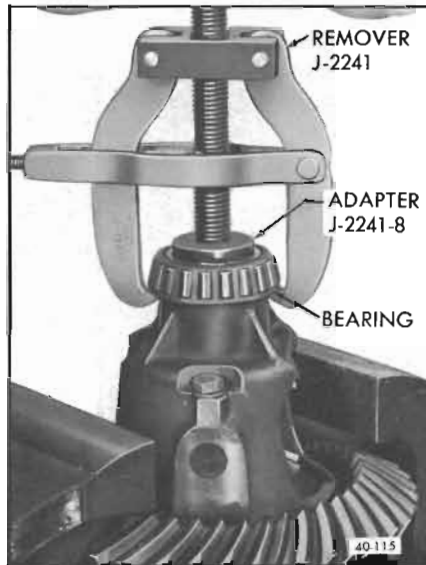


Figure 40-115—Removing Differential Side Bearings

2. Remove bolt that retains differential pinion axle. See Figure 40-116. Remove differential pinions, side gears and thrust washers from case.

3. If ring gear is to be replaced and it is tight on case after removing bolts, tap it off using a soft hammer; do not pry between ring gear and case.



Figure 40-116—Removing Pinion Axle Retaining Bolt

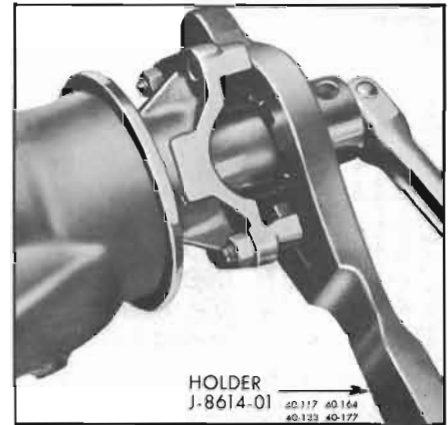


Figure 40-117—Removing Pinion Nut

c. Removal of Pinion and Bearings

1. Check pinion bearing preload as described in paragraph 40-26, subparagraph c.

If there is no preload reading, check for looseness of pinion assembly by shaking. Looseness indicates need for bearing replacement. If assembly is run long with very loose bearings, ring and pinion will also require replacement.

2. Install Holder J-8614-01 on pinion flange by using two 5/16-18 x 2 bolts with flat washers. Remove pinion nut and washer. See Figure 40-117.

3. Pull pinion flange from pinion using Puller J-8614-02 in Holder J-8614-01. To install puller, back out puller screw, insert puller

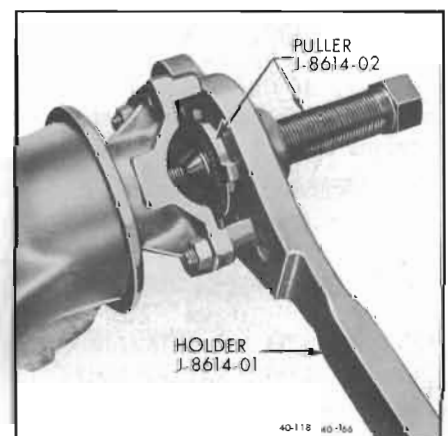


Figure 40-118—Removing Pinion Flange

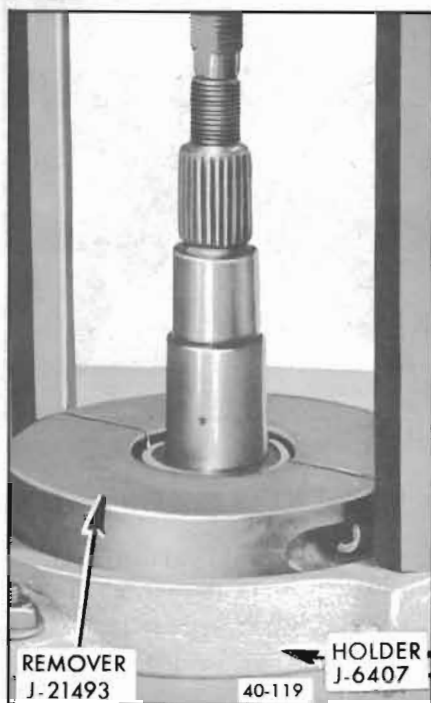


Figure 40-119—Removing Rear Pinion Bearing

through holder, and rotate 1/8 turn. See Figure 40-118.

4. Remove pinion assembly. If necessary, tap pinion out with soft hammer, while being careful to guide pinion with hand to avoid damage to bearing outer races.

5. If rear pinion bearing is to be replaced, remove rear pinion bearing from pinion shaft using Remover J-21493 with Holder J-6407. See Figure 40-119.

6. Pry pinion oil seal from carrier and remove front pinion bearing. If this bearing is to be replaced, drive outer race from carrier using a drift.

7. If rear pinion bearing is to be replaced, drive outer race from carrier using a drift in slots provided for this purpose.

40-26 ASSEMBLY AND INSTALLATION OF DIFFERENTIAL CASE ASSEMBLY

Before installation of any parts, examine the wearing surfaces of all parts for scoring or unusual



Figure 40-121—Installing Rear Pinion Bearing Outer Race

wear. Make certain that the interior of the carrier housing is absolutely clean and dry. Also make certain that the parts to be assembled are absolutely clean and that there are no burred edges. Lubricate all parts with the specified rear axle lubricant just before assembly.

NOTE: If the Buick is equipped with a Positive Traction Differential, only Positive Traction Lube should be used.

CAUTION: If the ring gear and pinion are changed, only factory hypoid lubricant should be used for filling because of its special anti-scoring properties. For this reason the proper lubricant is included in the carton with the replacement gears as

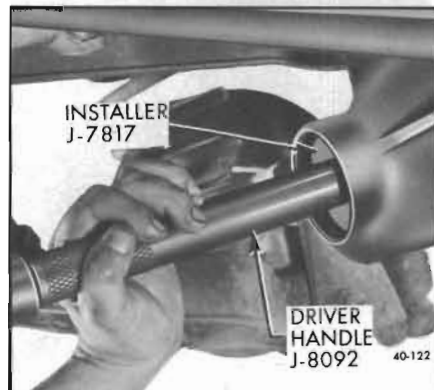


Figure 40-122—Installing Front Pinion Bearing Outer Race

received from the Buick warehouses.

a. Install Pinion Bearing Outer Races in Carrier

1. If rear pinion bearing is to be replaced, install new outer race using Installer J-6197 with Driver Handle J-8092. See Figure 40-121.

2. If front pinion bearing is to be replaced, install new outer race using Installer J-7817 with Driver Handle J-8092. See Figure 40-122.

b. Set Pinion Depth

Ring and pinion gear sets are matched in a special test machine which permits adjustment of pinion depth in ring gear until a point is reached where best operation and proper tooth contact under load is obtained. At this point, the setting of the pinion with reference to the centerline of the ring gear is indicated by the machine. This setting may vary slightly from the design or "nominal" setting due to allowable variation in machining the parts. However, most production pinions and all pinions used for service replacement are zero or nominal pinions.

If during repair, a pinion is found having a plus or minus reading recorded in thousandths on the rear face of the pinion, this indicates that the pinion during testing was found to have best tooth contact at a position varying from design or nominal depth.

In order to compensate for all of the allowable machining variables, a procedure of gaging the carrier and shimming the pinion has been developed. After gaging a carrier, the assembler is able to install a shim between the front face of the pinion and its bearing so that pinion depth can be adjusted to an exact required specification for best tooth contact in each axle assembly.

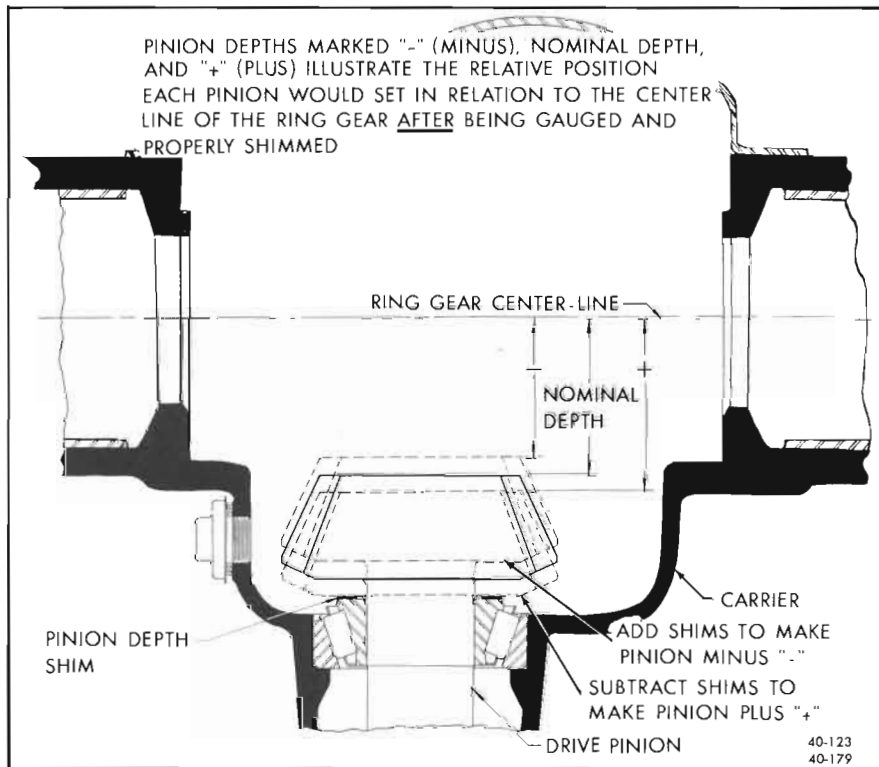


Figure 40-123—Nominal Pinion Setting Depth

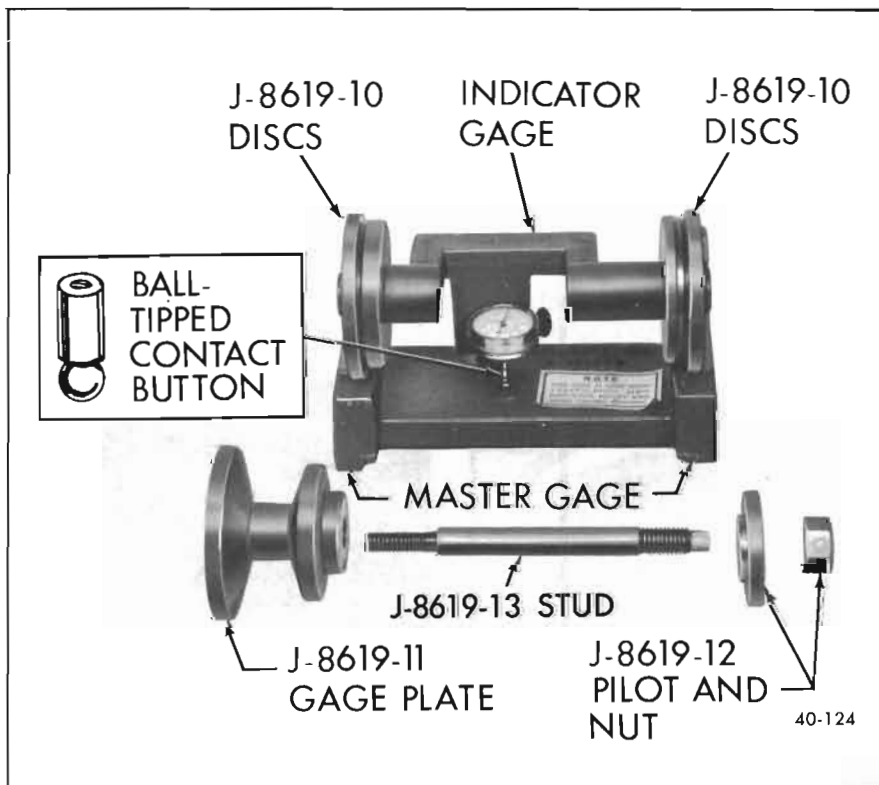


Figure 40-124—Pinion Setting Gauge

Pinion depth is set with Pinion Setting Gauge J-8619 which consists of the following: (1) master gage, (1) indicator gage with dial indicator, (2) J-8619-10 Discs, (1) J-8619-11 Gage Plate, J-8619-12 Pilot and Nut with J-8619-13 Stud. See Figure 40-124. Although production pinions are marked, neither production nor service pinions have a gaging tooth. The pinion setting gauge provides in effect a nominal or zero pinion as a reference.

Set up pinion setting gage as follows:

1. Make certain all of the gage parts clean, particularly the discs and center of the indicator gage; also check the centering hole and disc pads on the master gage.

2. Install the J-8619-10 Discs on the indicator gage. Install the small ball-tipped contact button on the stem of the dial indicator and mount the dial indicator on the indicator gage. See Figure 40-124.

NOTE: When gaging for pinion depth, the ball-tipped contact button must be used on dial indicator in order to reach Gage Plate J-8619-11 in carrier.

3. Place the indicator gage on the master gage, as shown in Figure 40-125 so that the spring loaded center is engaged in the centering hole, and the inner, large diameter portion of each disc contacts the master gage pads.

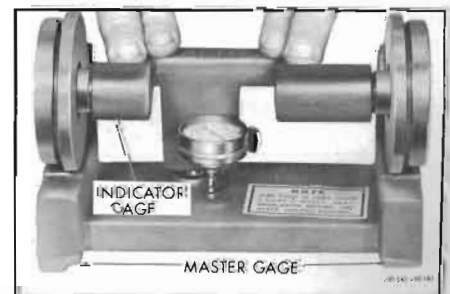


Figure 40-125—Zeroing Pinion Setting Gauge

4. Center the indicator contact button on the indicator pad and lock the indicator by tightening the thumb screw.

5. Hold yoke down firmly, with both discs contacting the horizontal and vertical pads on master gage, and set master gage at zero.

6. Lubricate front and rear pinion bearings; then position them in their respective races in the carrier. While holding bearings in place, install Gage Plate J-8619-11 in carrier on rear pinion bearing inner race as shown in Figure 40-126 and place Pilot J-8619-12 on surface of front pinion bearing. Insert Stud J-8619-13 through pilot, front and rear bearings, and thread it into gage plate.

7. Install nut on Stud J-8619-13. Hold stud stationary with wrench positioned over flats on ends of stud and tighten nut until a reading of 15-20 inch pounds is obtained when rotating gage plate assembly with an inch pound torque wrench.

8. Make certain differential bearing support bores are free of burrs. Install indicator gage in carrier so that small diameter

outer portion of discs rest in differential bearing pedestal support bores. Spring-loaded center of gage must be located in centering hole of gage plate, and ball-tipped contact button of dial indicator must be positioned in bear against outer edge of gage plate top surface. See Figure 40-127.

9. Press gage yoke down firmly toward gaging plate; record the number of thousandths the dial moves from zero. Remove indicator gage and recheck "zero setting" on master gage to make sure this setting was not disturbed by handling.

10. If zero setting is still correct, remove gaging set up and both bearings from the carrier. Then subtract reading recorded in previous step from 100. For example, a typical reading of 70 should be subtracted from 100; this answer (30) indicates the thickness of the shims to be selected as further qualified in Step 12 following.

NOTE: An average dial indicator reading will range from 65 to 75 thousandths with a corresponding shim thickness range of 35-25 thousandths.

11. Examine the ring gear for nicks, burrs or scoring. Any of these conditions will require replacement of the gear set.

12. Select the correct pinion shim to be used during pinion reassembly on the following basis:

(a) If the production (marked) pinion is being reused and the pinion is marked "+" (plus), subtract the amount specified on the pinion from the shim thickness as determined in Step 9.

(b) If the production (marked) pinion is being reused and the pinion is marked "-" (minus), add the amount specified on the pinion to the shim thickness as determined in Step 9.

(c) If a service pinion is being used (no marking), shim pinion using shim thickness directly as determined in Step 9.

NOTE: Frequently production pinions are nominal or zero pinions (no marking). When reusing a nominal production pinion, shim as with service pinion using shim thickness directly as determined in Step 9.

13. Position correct shim on pinion shaft and install rear pinion bearing. Use Installer J-21022 as shown in Figure 40-128.

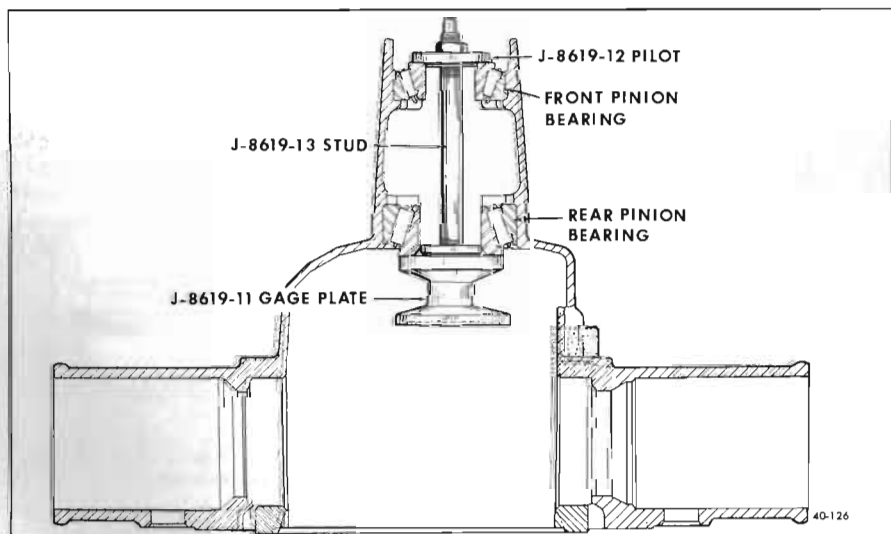


Figure 40-126—Pinion Gage Plate Installed in Carrier

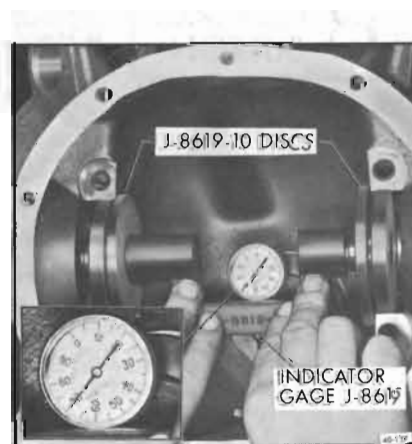


Figure 40-127—Checking Pinion Depth

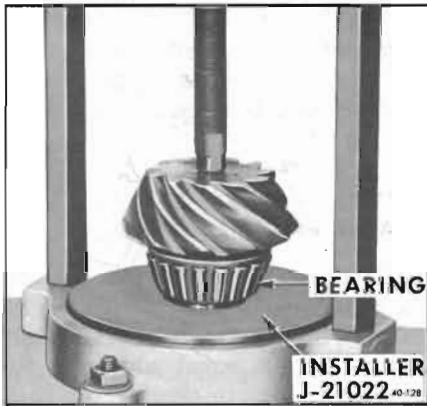


Figure 40-128—Installing Rear Pinion Bearing

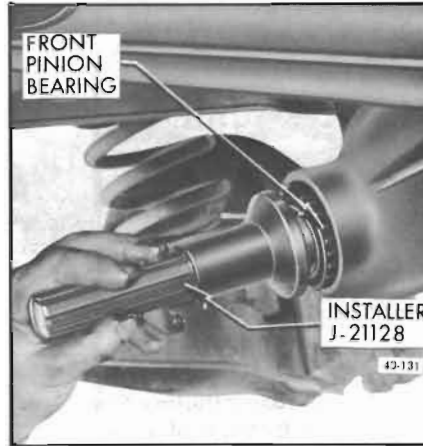


Figure 40-131—Installing Front Pinion Bearing

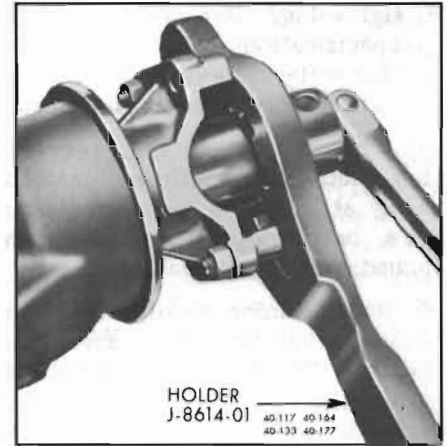


Figure 40-133—Installing Pinion Nut

c. Install Pinion Assembly and Adjust Pinion Preload

1. Position pinion assembly in carrier and install collapsible spacer as shown in Figure 40-129.

2. Place front pinion bearing in position on pinion. Hold pinion fully forward and drive bearing over pinion until seated. Use Installer J-21128. See Figure 40-131.

3. Install "O" ring on pinion in spline undercut.

4. Install pinion oil seal in carrier. Coat O.D. of seal with sealing compound. Install seal by using Installer J-21128. See Figure 40-132.

5. Coat lips of pinion oil seal and seal surface of pinion flange with gear lube. Install pinion flange on pinion by tapping with a soft hammer until a few pinion threads project through flange.

6. Install pinion washer and nut. Hold companion flange with Holder J-8614-01. While intermittently rotating pinion to seat bearings, tighten pinion nut until end play begins to be taken up. See Figure 40-133.

CAUTION: When no further end play is detectable, and when Holder J-8614 will no longer pivot freely as pinion is rotated preload specifications are being neared. Further tightening

should be done only after preload has been checked.

7. Check preload by using an inch pound torque wrench as shown in Figure 40-134.

CAUTION: After preload has been checked, final tightening should be done very cautiously. For example, if when checking, preload was found to be 5 inch pounds, additional tightening of the pinion nut as little as 1/8 turn can add 5 additional inch pounds drag. Therefore, the pinion nut should be further tightened only a little at a time and preload should be checked after each slight amount of



Figure 40-129—Installing Collapsible Spacer



Figure 40-132—Installing Pinion Oil Seal



Figure 40-134—Checking Pinion Bearing Preload

tightening. Exceeding preload specifications will compress the collapsible spacer too far and requires its replacement.

8. While observing the preceding caution, carefully set preload drag at 20 to 30 inch pounds on new bearings or 15 to 20 inch pounds on reused bearings.

9. Rotate pinion several times to assure that bearings have been seated. Check preload again. If drag has been reduced by rotating pinion, re-set preload to specification.

d. Assemble Differential Case Assembly

Before assembling the differential, examine the wearing surfaces of all parts for scoring or unusual wear. Also make certain that all parts are absolutely clean. Lubricate parts with rear axle lubricant just before assembly.

1. Place side gear thrust washers over side gear hubs and install side gears in case. If same parts are reused, replace in original sides.

2. Position one pinion (without washer) between side gears and rotate gears until pinion is directly opposite from loading opening in case. Place other pinion between side gears so that pinion axle holes are in line, then rotate gears to make sure holes in pinions will line up with holes in case.

3. If holes line up, rotate pinions back toward loading opening just enough to permit sliding in pinion thrust washers.

4. Install pinion axle. Install pinion axle retaining bolt. Torque to 20-28 lb. ft.

5. After making certain that mating surfaces of case and ring gear are clean and free of burrs, thread two 3/8-24 x 2 studs into

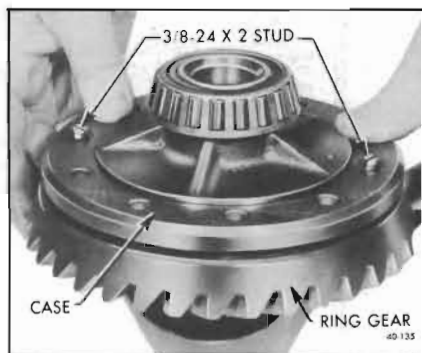


Figure 40-135—Installing Ring Gear On Differential Case

opposite sides of ring gear, then install ring gear on case. See Figure 40-135. Install ring gear attaching bolts just snug. Torque bolts alternately in progressive stages to 50-60 lb. ft.



Figure 40-136—Installing Differential Side Bearings

6. If differential side bearings were removed, install new bearings using Installer J-9537 with Driver Handle J-8092. See Figure 40-136.

e. Install Differential Case and Adjust Side Bearing Preload

Differential side bearing preload is adjusted by changing the thickness of both the right and left shims by an equal amount. By changing the thickness of both shims equally, the original backlash will be maintained. All differential side bearing preload shims used in production are cast. Shims used during service repairs of the differential are of a stamped steel design and are used along with a production type, .140" thick, cast shim. Stamped steel service shims must be used when differential repairs are made that require changing side bearing preload. Service, steel, adjusting shims are available in thicknesses ranging from .040" to .082" in increments of .002".

1. Before installation of case assembly, make sure that side bearing surfaces in carrier are clean and free of burrs. Side bearings must be oiled with gear lube and if same bearings are being reused, they must have original outer races in place.

2. Place differential case and bearing assembly in position in carrier. If old side bearings were installed, use original adjusting shims; if new bearings are to be used, select new right and left adjusting shims each .002" thicker than original shims. Slip left shims in position at left bearing with steel shim next to bearing, then place .140" shim for right side in position and drive steel shim carefully into position between bearing and cast shim using a soft hammer. See Figure 40-137.

Install side bearing caps, as previously marked, and tighten bolts

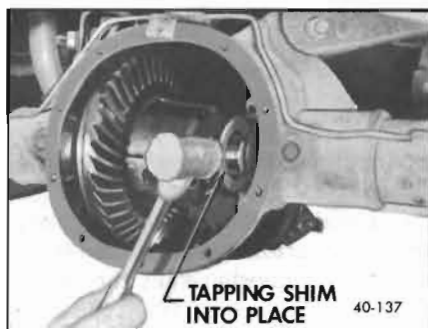


Figure 40-137—Installing Differential Adjusting Shims

to 45-60 lb. ft. before checking side bearing preload or backlash.

3. As a safety precaution, install bearing caps using four 7/16-14 x 4-1/4 bolts.

4. Rotate differential case several complete turns to seat bearings. Check bearing preload using an inch pound torque wrench connected at ring gear attaching bolt. With wrench projecting approximately straight out, bearing preload should read 30 to 40 in. lbs. with new bearings, or 15 to 25 in. lbs. with reused bearings. See Figure 40-138. If preload is not according to these specifications, increase shim thickness on each side .002" for each additional 10 in. lbs. preload



Figure 40-138—Checking Differential Case Preload

desired, or decrease shim thickness .002" on each side for each 10 in. lbs. preload to be subtracted.

5. When preload is correctly adjusted, leave four safety head bolts and caps in position as a safety precaution while performing following backlash checking operation.

f. Adjust Differential Backlash

1. Rotate differential case several times to seat bearings, then mount dial indicator as shown in Figure 40-139. Use a small button on indicator stem so that contact can be made near heel end of tooth. Set dial indicator so that stem is as nearly as possible in line with gear rotation and perpendicular to tooth angle for accurate backlash reading.

2. With pinion locked to carrier, check gear lash at 3 or 4 points around ring gear. Lash must not vary over .001" around ring gear.

If variation is over .001" check for burrs, uneven bolting conditions or distorted case flange and make corrections as necessary.

3. Gear lash at the point of minimum lash should be .007" to .009" for all new gears. If adjustment is necessary, adjust to .008".



Figure 40-139—Checking Ring Gear To Pinion Backlash

If original gear set having a wear pattern is being reinstalled, original gear lash should be maintained within $\pm .001$ ".

4. If gear backlash is not within specifications, correct by increasing thickness of one differential shim and decreasing thickness of other shim the same amount. In this way, correct differential bearing preload will be maintained.

Shift .002" in shim thickness for each .001" change in backlash desired. If backlash is .001" too much, decrease thickness of right shim .002" and increase thickness of left shim .002". If backlash is .001" too little, increase thickness of right shim .002" and decrease thickness of left shim .002".

5. When gear backlash is correctly adjusted, remove 4 safety head bolts and install bearing caps according to markings. Torque bearing cap bolts to 40-60 lb. ft.

6. Install new gasket in housing using heavy grease to retain it in place. Install cover. Torque cover bolts to 25-35 lb. ft. Wait 20 minutes and retorque cover bolts to specification.

g. Install Axle Shaft Assemblies

1. Apply a coat of wheel bearing grease in bearing recesses of housing. Install new outer retainer gaskets. Apply a thin coating of Permatex #2 or equivalent to outer diameter of seal if replaced. To help prevent damage to the lip of the wheel seal when installing axle shaft and to ensure lubricant on the seal lip during the first few miles of operation, the axle shaft should be lightly lubricated with axle lubricant from the sealing surface to approximately 6 inches inboard of the shaft. Insert axle shaft assemblies carefully until

shaft splines engage in differential to avoid damage to seals.

2. Drive axle shaft assemblies into position.
3. Place gasket and retainer over studs and install nuts. Torque nuts to 50 lb. ft.
4. Install brake drums over wheel bolts.
5. Install wheels and tighten wheel nuts to 75 lb. ft.

h. Install Pinion Oil Seal with Differential Installed in Car

In case of pinion oil seal failure, remove old oil seal and install new one (with differential remaining in car) as follows:

1. Mark propeller shaft and companion flange to permit proper alignment at reinstallation. Disconnect propeller shaft from companion flange and support shaft out of way. If U-joint bearings are not held by a retainer strap, use a piece of wire or tape to retain bearings in their journals.
2. Remove wheels and brake drums. Install an inch pound torque wrench on pinion nut, and record torque required to rotate pinion freely.
3. Mark position of companion flange, pinion shaft threads, and pinion nut so that they can be reinstalled in the same position.
4. Remove companion flange nut and washer using Holder J-6814-01 to hold flange.
5. Pry oil seal out of carrier.
6. Examine oil seal surface of companion flange for nicks or damaged surface. If damaged, replace flange.
7. Examine carrier bore and remove any burrs that might cause leaks around O.D. of seal.
8. Coat O.D. of new pinion oil seal with sealing compound

and install seal using Installer J-21128.

9. Apply seal lubricant to O.D. of companion flange.
10. While holding companion flange with Holder J-8614-01, install companion flange nut and tighten to same position as marked in Step 3 above. Tighten nut 1/8 turn beyond alignment marks on pinion shaft threads in order to preload collapsible spacer. Check preload using an inch pound torque wrench; torque reading should be equal to or five inch pounds above that recorded in Step 2 preceding.
11. Connect propeller shaft to companion flange using alignment marks. Torque the four (4) nuts to 15-18 lb. ft.

DIVISION IV TROUBLE DIAGNOSIS

40-27 DIFFERENTIAL TROUBLE DIAGNOSIS

a. Elimination of External Noises

When a rear axle is suspected of being noisy it is advisable to make a thorough test to determine whether the noise originates in the tires, road surface, front wheel bearings, engine, transmission, or rear axle assembly. Noise which originates in other places cannot be corrected by adjustment or replacement of parts in the rear axle assembly.

(1) Road Noise. Some road surfaces, such as brick or rough surfaced concrete, cause noise which may be mistaken for tire or rear axle noise. Driving on a different type of road, such as smooth asphalt or dirt, will quickly show whether the road surface is the cause of noise. Road noise usually is the same on drive or coast.

(2) Tire Noise. Tire noise may easily be mistaken for rear axle noise even though the noisy tires may be located on the front wheels. Tires worn unevenly or having surfaces of non-skid divisions worn in saw-tooth fashion are usually noisy, and may produce vibrations which seem to originate elsewhere in the vehicle. This is particularly true with low tire pressure. Some designs of non-skid treads may be more noisy than others, even when tires are new.

(3) Test for Tire Noise. Tire noise changes with different road surfaces, but rear axle noise does not. Temporarily inflating all tires to approximately 50 pounds pressure, for test purposes only, will materially alter noise caused by tires, but will not affect noise caused by rear axle. Rear axle noise usually ceases when coasting at speeds under 30 miles per hour; however, tire noise continues but with lower tone as car speed is reduced. Rear axle noise usually changes when comparing "pull" and "coast," but tire noise remains about the same.

(4) Front Wheel Bearing Noise. Loose or rough front wheel bearings will cause noise which may be confused with rear axle noises; however, front wheel bearing noise does not change when comparing "pull" and "coast". Light application of brake while holding car speed steadily will often cause wheel bearing noise to diminish as this takes some weight off the bearing. Front wheel bearings may be easily checked for noise by jacking up the wheels and spinning them, also by shaking wheels to determine if bearings are loose.

(5) Engine and Transmission Noises. Sometimes a noise which seems to originate in the rear axle is actually caused by the

engine or transmission. To determine which unit is actually causing the noise, observe approximate car speeds and conditions under which the noise is most pronounced; then stop car in a quiet place to avoid interfering noises. With transmission in neutral, run engine slowly up and down through engine speeds corresponding to car speed at which the noise was most pronounced. If a similar noise is produced with car standing, it is caused by the engine or transmission, and not the rear axle.

b. Rear Axle Noises

If a careful test of car shows that noise is not caused by external items as described in subparagraph a, it is then reasonable to assume that noise is caused by rear axle assembly. The rear axle should be tested on a smooth level road to avoid road noise. It is not advisable to test rear axle for noise by running with rear wheels jacked up.

Noises in rear axle assembly may be caused by a faulty propeller shaft, faulty rear wheel bearings, faulty differential or pinion shaft bearings, misalignment between two U-joints, or worn differential side gears and pinions; noises may also be caused by mismatched, improperly adjusted, or scored ring and pinion gear set.

(1) Rear Wheel Bearing Noise. A rough rear wheel bearing produces a vibration or growl which continues with car coasting and transmission in neutral. A brinelled rear wheel bearing causes a knock or click approximately every two revolutions of rear wheel, since the bearing rollers do not travel at the same speed as the rear axle and wheel. With rear wheels jacked up, spin rear wheels by hand while listening at hubs for evidence of rough or brinelled wheel bearing.

(2) Differential Side Gear and Pinion Noise. Differential side gears and pinions seldom cause noise since their movement is relatively slight on straight ahead driving. Noise produced by these gears will be most pronounced on turns.

(3) Pinion Bearing Noise. Rough or brinelled pinion bearings produce a continuous low pitch whirring or scraping noise starting at relatively low speed.

(4) Ring and Pinion Gear Noise. Noise produced by the ring and pinion gear set generally shows up as drive noise, coast noise, or float noise.

(a) Drive noise is noise produced during vehicle acceleration.

(b) Coast noise is noise produced while allowing car to coast with throttle closed.

(c) Float noise is noise occurring while just maintaining constant car speed at light throttle on a level road.

(d) Drive, coast and float noises will vary in tone with speed, and will be very rough and irregular if the differential or pinion shaft bearings are rough, worn, or loose.

c. Body Boom Noise or Vibration

Objectional "body boom" noise or vibration at 55-65 MPH can be caused by an unbalanced propeller shaft. Excessive looseness at the spline can contribute to this unbalance.

Other items that may also contribute to the noise problem are as follows:

1. Undercoating or mud on the shaft causing unbalance.
2. Shaft balance weights missing.
3. Shaft damage such as bending, dents or nicks.

4. Tire-type roughness. Switch tires from a known good car to determine tire fault.

d. Check for Propeller Shaft Vibration

Objectionable vibrations at high speed (65 MPH or higher) may be caused by a propeller shaft that is out of balance. Out of balance may be due to a bent shaft.

To determine whether propeller shaft is causing vibration, drive car through speed range and note speed at which vibration is most pronounced. Shift transmission into lower gear range and drive car at same engine speed as when vibration was most pronounced in direct drive. Note effect on vibration.

To determine engine speed, divide vehicle speed by the following transmission gear ratios as listed below:

EXAMPLE: If vibration is most pronounced in direct drive at 65 MPH, the same engine speed would be produced in second gear (V-6, three speed manual) at $65/1.68 = 39$ MPH; in low range (S.T. 300) at $65/1.76 = 37$ MPH.

If the vibration is still present at the same engine speed whether in direct drive or in the lower gear, since the propeller shaft speed varies, this cannot be the fault. If the vibration decreases or is eliminated in the lower gear, then the propeller shaft is out of balance and should be rebalanced. See Section D for balancing procedure and more complete trouble diagnosis.

e. Oil Leaks

It is difficult to determine the source of some oil leaks. When there is evidence of an oil leak determine source as follows:

(1) Oil coming from the drain hole under the axle housing at the brake backing plate is caused by a leaking axle shaft seal or a leaking wheel bearing inner gasket.

(2) Oil coming from between the

rear pinion flange slinger and the carrier is caused by a leaking pinion seal.

Even after the point of leakage has been determined, it is hard to tell whether the oil is leaking

past the lip of the seal or past the O.D. of the seal. Therefore it is a good idea to make sure the leak is stopped by using a nonhardening sealing compound around the O.D. of the new seal.