

GROUP 6 REAR AXLE ASSEMBLY

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SECTION 6-A

REAR AXLE SPECIFICATIONS, DESCRIPTION, TROUBLE DIAGNOSIS

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6-1 REAR AXLE SPECIFICATIONS

a. Tightening Specifications

Use a reliable torque wrench to tighten the parts listed, to insure proper tightening with-

out 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 Ft. lbs.
Nut	Differential Carrier to Housing	$\frac{3}{8}$ -24	45-55
Nut	Spring, Upper End to Frame	$\frac{3}{8}$ -24	15-20
Bolt & Nut	Track Bar Support to Frame Bracket	$\frac{3}{8}$ -16	25-35
Bolt	Torque Ball Retainers to Transmission	$\frac{3}{8}$ -16	30-35
Bolt	Front Torque Tube to Torque Ball	$\frac{3}{8}$ -16	45-55
Bolt	Rear Torque Tube to Carrier	$\frac{3}{8}$ -16	50-60
Nut	Front Torque Tube to Rear Torque Tube	$\frac{7}{16}$ -20	65-75
Bolt & Nut	Rear Shock, Lower End to Axle Bracket	$\frac{7}{16}$ -20	60-80
Bolt	Ring Gear to Case	$\frac{7}{16}$ -20	65-75
Nut	Wheel Bearing Retainer and Brake Assembly to Housing	$\frac{7}{16}$ -20	65-75
Bolt & Nut	Differential Bearing Support Clamping	$\frac{1}{2}$ -20	40-50
Nut	Spring, Lower End to Axle	$\frac{1}{2}$ -20	20-30
Plug	Housing Cover	$\frac{1}{2}$ pipe	20-30
Bolt & Nut	Strut Rod, Front End to Torque Tube Bracket	$\frac{9}{16}$ -18	70-80
Nut	Strut Rod, Rear End to Axle Pracket	$\frac{9}{16}$ -18	90-100
Bolt	Wheel to Rear Axle Shaft	$\frac{9}{16}$ -18	65-75
Bolt & Nut	Track Bar to Axle or Frame Bracket	$\frac{5}{8}$ -18	90-105
Nut	Pinion Bearing Lock	$1\frac{5}{16}$ -16	200-300

b. General Specifications

Items	All Series
Rear Axle Type	Semi-Floating Hypoid
Drive and Torque	Through Torque Tube
Rear Axle Oil Capacity	6 $\frac{1}{2}$ pints
Ring and Pinion Gear Set Type	Hypoid
Bolted Ring Gear	12 Bolts— $\frac{7}{16}$ Alloy
Pinion Position Adjustment	Shims
Pinion Bearing Pre-load Adjustment	Spacers
Ring Gear Position and Pre-load Adjustment	Shims
Wheel Bearing Retainer Positioning	Shims

b. General Specifications (Cont.)

Items	All Series
Differential Cover.....	Welded to Housing
Propeller Shaft.....	2 Piece—2 U. Joints
Torque Tube.....	2 Piece—Depressed

Series	Synchromesh	Twin Turbine
4400	3.91	3.07
4400 Power Pack—4600-4700-4800	—	3.23

c. Limits for Fitting and Adjusting

Pinion Position.....	±.0015 from Marking on Pinion
Pinion Bearing Pre-Load.....	10-30 Inch Lbs. Torque on Pinion without Seal
Ring Gear Position.....	.007-.009 Backlash
Ring Gear Pre-Load.....	.004 Compression (.002 per side)
Wheel Bearing Retainer.....	.005-.020 Crush on Bearing Outer Race

e. Rear Axle Gear Ratios (Export)

Series	Synchromesh	Twin Turbine
4400	3.91	3.36
4600-4700-4800	—	3.36

f. Speedometer Gears

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

d. Rear Axle Gear Ratios (Domestic)

Gear ratios are indicated by numbers stamped on the bottom of the axle housing.

Axle Ratio	Speedo Worm	Driven Gear (7.60 Tires)	Driven Gear (8.00 Tires)
3.07	9T	19T	—
3.23	9T	20T	19T
3.36	9T	21T	20T
3.91	8T	21T	—

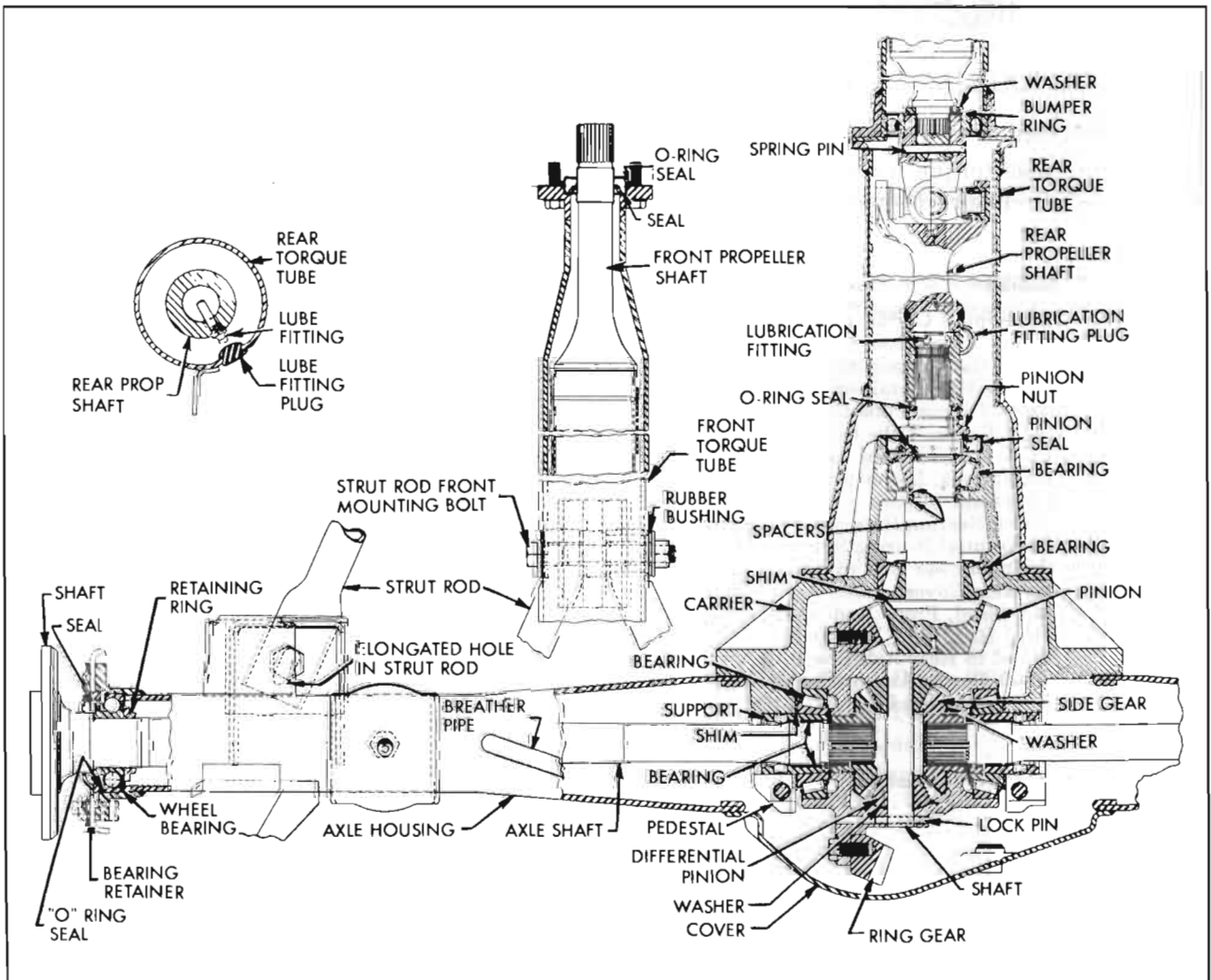


Figure 6-1—Rear Axle Assembly

6-2 DESCRIPTION OF REAR AXLE

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. It has a full torque tube drive and coil springing. Its final drive is a hypoid type ring gear and pinion with the centerline of the pinion below the centerline of the ring gear. See figure 6-1.

The drive pinion is mounted in two tapered roller bearings which are pre-loaded by two selected spacers at 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 staked lock nut. The differential carrier casting has an oil feed passage to the pinion bearings and an oil return hole so that the oil will circulate and cool.

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 back-lash by varying these shims. The bearings are centered on the cross axis by lock taper cones secured in the pedestal bores by clamp bolts. 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 spring pin. The pinions and side gears are backed by bronze 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 also contain oil seals. The bearings are secured against a shoulder on the shaft by a press fit retainer ring. A retainer plate holds 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.

The torque tube has an enlarged section at the rear which is bolted to the carrier behind the pinion bearings. This design prevents loads due to driving and braking forces from causing a deflection resulting in a bind between the pinion bearings.

There are two propeller shafts making a second (rear) universal joint necessary. The front propeller shaft has a splined stub at each end with the front spline sliding in the front universal joint in the torque ball, and the rear spline pinned in the rear universal joint. See figure 6-1.

The rear propeller shaft assembly has an internal spline at each end with the front spline pinned to the front propeller shaft and the rear spline sliding over the pinion shaft. The rear universal joint is welded to the front end of the rear propeller shaft and is supported in the torque tube by a sealed ball bearing. This bearing requires no additional lubrication, but the coupling at the rear end must be packed with a good grade of chassis grease before installing the rear propeller shaft assembly on the pinion. The splines must also be lubricated with chassis lube every 5000 miles through a special fitting. See figure 6-1.

The rear universal joint is of the needle roller bearing type. It transmits motion through a constant angle—the slight angle between the front and rear torque tubes.

The torque ball outer retainer has a bonded rubber compression ring which acts as a rubber cushion between the ball and the outer retainer. This rubber ring also functions as an oil tight seal. See Figure 4-13.

The strut rods are bolted to the torque tube bracket through rubber compression bushings to eliminate metal to metal contact.

All axle and propeller shaft splines are of the fine pitch type. This tooth design reduces sliding friction and permits limited angular deflection without bind.

A seal mounted between the rear flange of the torque ball and the front flange of the front torque tube bears against a ground seal surface on the front end of the propeller shaft to prevent transmission oil from passing into the torque tube. An O-ring around the O.D. of this seal prevents oil from by-passing around the seal. Each wheel bearing has a built-in oil seal which allows gear oil to lubricate the bearing but prevents oil passage into the brake.

A seal in the front of the carrier bears against the pinion bearing nut to prevent differential gear oil from passing into the torque tube. An O-ring seal in a counterbore of the pinion nut seals the threads between the drive pinion and the pinion nut. See figure 6-2.

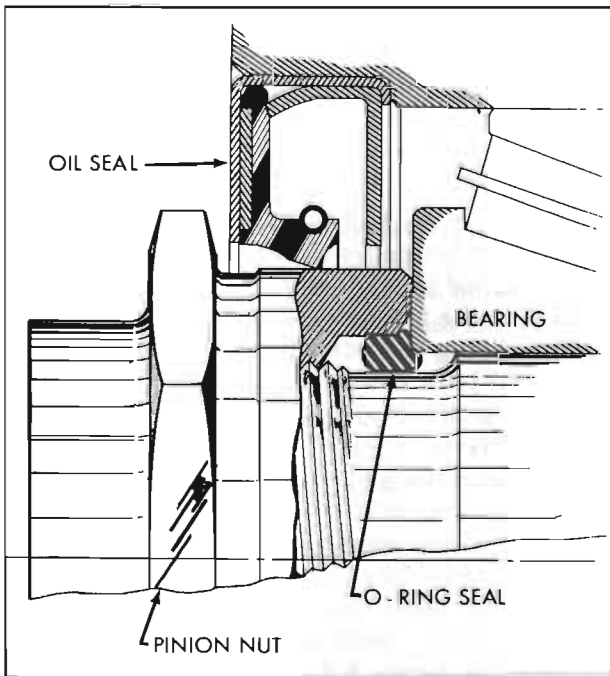


Figure 6-2—Pinion Nut Seals

6-3 REAR AXLE 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 which have the surfaces of the 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 40 pounds pressure, for test purposes only, will materially alter noise caused by tires, but will not affect noise caused by the 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 steady 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 the car shows that the noise is not caused by external items as described in subparagraph *a*, it is then reasonable to assume that the noise is caused by the 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 the rear axle assembly may be caused by faulty propeller shaft or rear wheel bearings, faulty differential or pinion shaft bearings, dry or misaligned shaft splines, misalignment between two U-joints, differential side gears and pinions worn, or by a 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 with transmission in neutral. A brinnelled 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 brinnelled 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 brinnelled 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 most evident on constant acceleration through the speed range.

(b) *Coast noise* is most evident when car is allowed to coast through the speed range with throttle closed.

(c) *Float noise* is most evident while just barely holding the car speed constant on a level road at any speed.

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

c. Check for Propeller Shaft Vibration

Objectionable vibrations at high speed (65 m.p.h. or higher) may be caused by a propeller shaft that is out of balance. Out of balance may be due to a bent shaft. For the method used for insuring joint alignment, see figure 4-14 in paragraph 4-12.

To determine whether the propeller shaft is causing vibration, drive car through the speed range and note car speed at which vibration is most pronounced. Shift transmission into second gear (synchromesh) or low range (automatic) and drive car at same engine speed as when vibration was most pronounced in direct drive, and note the effect on vibration.

To determine the required engine speed, divide car speed by the transmission gear ratio, using 1.4 for synchromesh or 1.8 for automatic. Example: If vibration is most pronounced at 65 m.p.h. in direct drive, the same engine speed would be produced in

second gear (synchromesh) at $\frac{65}{1.4} = 46$ m.p.h.

or in low range (automatic) at $\frac{65}{1.8} = 36$ m.p.h.

If the vibration is still present at the same engine speed whether in direct drive or in the lower gear, then the propeller shaft is *not out of balance*. If the vibration decreases or is eliminated in the lower gear then the propeller shaft is out of balance and should be removed for correction.

d. Oil Leaks

It is difficult to determine the source of some oil leaks. When there is evidence of an oil leak at these locations, the probable cause is as follows:

(1) Oil coming from the drain hole shield under the axle housing at the brake backing plate is caused by either a leaking wheel bearing seal or a leaking wheel bearing inner gasket. A leaking inner gasket is generally the result of end-play of the wheel bearing in the axle housing. The wheel bearing must be held tight against the inner gasket to keep oil from leaking out between the bearing outer race and axle housing. See paragraphs 6-6, (c) for correct adjustment. An O-ring in a groove around the OD of the bearing functions as a second or safety seal.

(2) Oil coming from between the rear flange of the torque tube and the carrier is caused by either a leaking pinion seal or a leaking propeller shaft seal. The torque tube is normally dry so no gasket is used between the rear flange and the carrier. In an automatic transmission equipped car, leakage of light oil at this point is caused by a defective propeller shaft seal; leakage of heavy oil is caused by a defective pinion seal or a defective O-ring seal between pinion and pinion nut.

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 OD of the seal. Therefore it is a good idea to make sure the leak is stopped by using a non-hardening sealing compound around the OD of the new seal.