

# AXLES - FRONT HUBS

# 2F

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## AXLE TESTING AND DIAGNOSIS

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### GENERAL

When diagnosing an axle or front drive hub noise condition, obtain a complete description of the noise and driving conditions when the noise occurred. A preliminary road test with the owner demonstrating the complaint condition is recommended.

The action of transmitting engine torque to the wheels will produce some noise in all axles. Slight axle noises confined to a brief speed range or specific period are considered normal.

Noises produced by the engine, transfer case, transmission, tires, wheel bearings, exhaust system, propeller shaft, or the action of wind on the body or grille may be incorrectly diagnosed as axle noise. It is important to test the vehicle thoroughly in order to isolate the problem component and avoid unnecessary repair.

During the road test, stop the vehicle, shift the transmission into neutral, and operate the engine at various speeds. If the noise is heard during this test, the noise is being produced by the engine, exhaust system, clutch, transmission, transfer case, or by engine driven accessory equipment.

Before road testing, check and correct the tire inflation pressures and axle lubricant levels.

### TIRE NOISE DIAGNOSIS

Because certain types of tire tread wear or tread patterns may produce objectionable noises, drive the vehicle on various types of road surfaces and listen for a change in the noise. If the noise varies with the type of road surface, the tires may be causing the noise.

### WHEEL BEARING DIAGNOSIS

Worn, loose, or damaged wheel bearings can be confused with axle noises. Wheel bearing noise is usually more noticeable when coasting at lower vehicle speeds. Applying the brakes gently while the vehicle is moving will usually change wheel bearing noise. Another test involves turning the vehicle alternately left and right while moving straight ahead at relatively low speed. This maneuver side-loads the bearings and should cause the problem bearing to become noisier.

### AXLE TEST AND DIAGNOSIS

Before testing the axle, drive the vehicle a distance sufficient to warm the axles and axle lubricant. During the test, operate the transmission and transfer case in every gear combination.

Axle noises are usually related to vehicle speed rather than engine rpm or transmission gear range.

Axle noises may be classified into two types: gear noise and bearing noise.

Gear noise is often described as a whine or high-pitched resonating sound. It is usually more pronounced at certain vehicle speeds and within a narrow speed range under a drive (accelerating load), coast (decelerating load), or float (constant speed) condition.

Axle bearing noise is usually constant and the pitch is related to vehicle speed.

Since the pinion gear rotates faster than the ring gear, the pinion bearings produce a higher pitch sound than the differential bearings. The pinion bearings are usually heard at lower vehicle speeds of 20 to 30 mph (32 to 48 km/h).

Differential bearings produce a lower pitch sound because they are rotating at the same speed as the wheels. Differential bearing noise will not vary when the vehicle is turned alternately left and right or when the brakes are gently applied.

### Axle Noisy On Pull and Coast

- Excessive ring and pinion backlash.
- Excessive pinion end play.
- Worn pinion bearings.
- Incorrect pinion depth adjustment.
- Incorrect lubricant (Trac-Lok differential).

### Axle Noisy On Pull

- Incorrect ring and pinion backlash or depth adjustment.
- Damaged or worn pinion bearings.
- Incorrect pinion bearing preload.

### AXLE NOISY ON COAST

- Excessive ring and pinion backlash.
- Excessive pinion end play.
- Worn or damaged pinion or differential bearings.
- Excessive differential bearing preload.

### Backlash

Excessive driveline backlash may be the result of backlash in the transmission, transfer case, propeller shaft yokes or slip joint splines, universal joints, ring and pinion gears, differential gears, front axle shaft splines or universal joints, or rear axle shaft splines.

### Chatter—Trac-Lok Differential

Trac-Lok chatter is usually caused by using non-recommended lubricants. If chatter occurs, drain and refill the axle with Jeep Axle lubricant or equivalent only.

### Other Axle Conditions

A knocking noise heard at low speed or when coasting may be caused by loose fitting differential side gears. If this condition is encountered, operate the vehicle at the speed where noise is loudest and apply the brakes lightly. If loose fitting gears are causing the problem, the noise level will usually decrease when the brakes are applied.

Differential gear noise is considered normal when spinning a wheel with an on-the-vehicle wheel balancer, or when the wheels are spinning on icy or other types of low traction surface.

Whenever axle noise is caused by worn or damaged bearings, do not replace the gears unless they are also worn or damaged. Similarly, if axle gears are causing noise, do not replace the bearings unless they are worn or damaged.

## FRONT AXLE

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### GENERAL

A drive-type front axle with steering knuckles and hypoid differential gears is used on all Jeep models.

Engine torque is transmitted to the wheels through full floating, two-piece axle shafts which have connecting universal joints (fig. 2F-1). The axle shafts revolve within and are supported by the steering knuckles. Open

end steering knuckles which pivot on ball studs are used on all Jeep front axles.

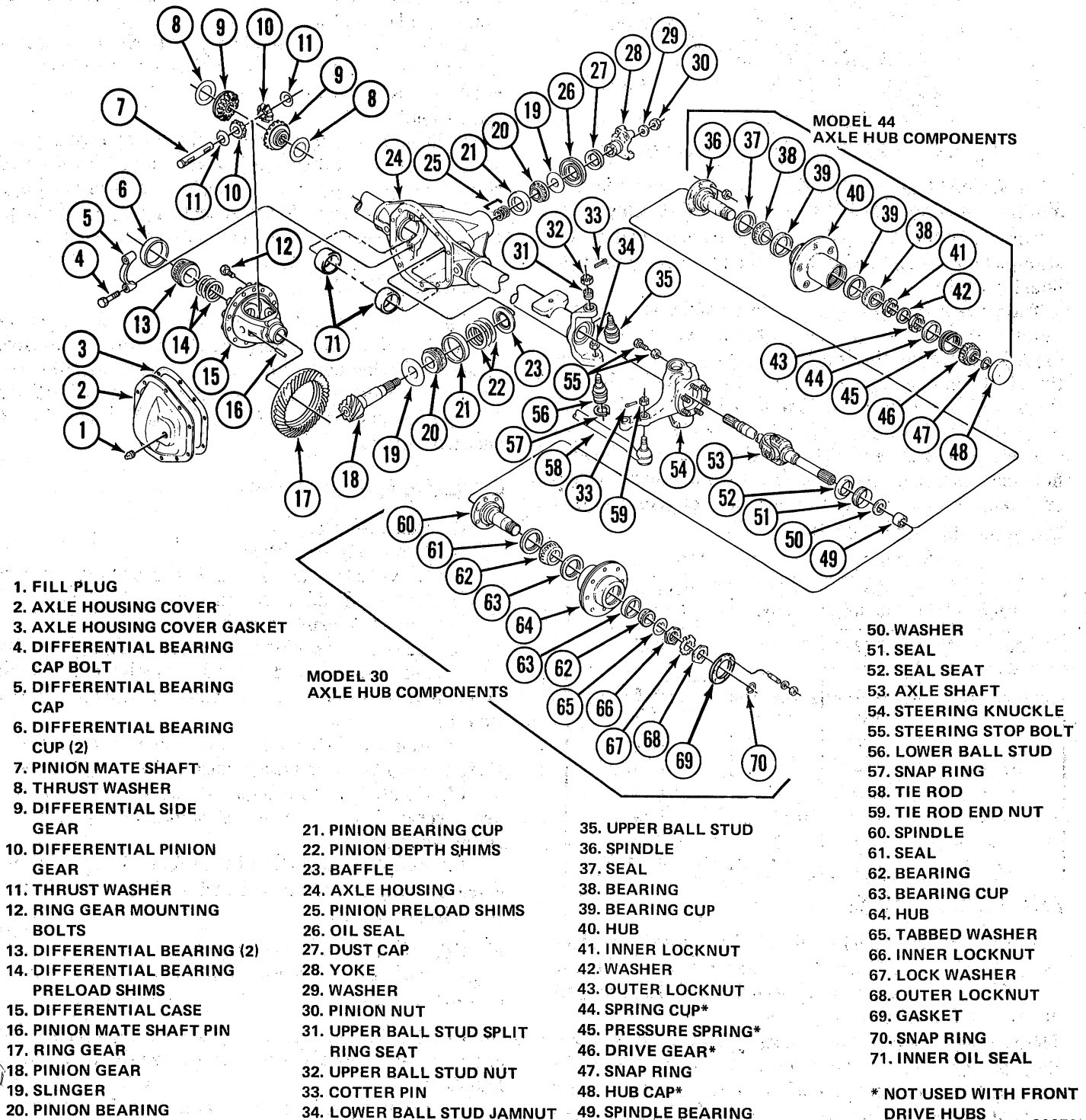
The Model 30 front axle is used on all CJ and Scrambler models. The Model 44 front axle is used on all Cherokee, Wagoneer and Truck models. Service procedures for the two axle models are the same.

On all front axles, toe-in and caster are the only adjustable alignment angles. Camber is built into the axle

and cannot be adjusted. Refer to Front End Alignment for adjustment methods.

**AXLE IDENTIFICATION**

On Model 44 front axles, the axle code number is cast into the upper surface of the reinforcing rib at the left side of the axle housing (fig. 2F-2).



- 1. FILL PLUG
- 2. AXLE HOUSING COVER
- 3. AXLE HOUSING COVER GASKET
- 4. DIFFERENTIAL BEARING CAP BOLT
- 5. DIFFERENTIAL BEARING CAP
- 6. DIFFERENTIAL BEARING CUP (2)
- 7. PINION MATE SHAFT
- 8. THRUST WASHER
- 9. DIFFERENTIAL SIDE GEAR
- 10. DIFFERENTIAL PINION GEAR
- 11. THRUST WASHER
- 12. RING GEAR MOUNTING BOLTS
- 13. DIFFERENTIAL BEARING (2)
- 14. DIFFERENTIAL BEARING PRELOAD SHIMS
- 15. DIFFERENTIAL CASE
- 16. PINION MATE SHAFT PIN
- 17. RING GEAR
- 18. PINION GEAR
- 19. SLINGER
- 20. PINION BEARING

- MODEL 30 AXLE HUB COMPONENTS**
- 21. PINION BEARING CUP
  - 22. PINION DEPTH SHIMS
  - 23. BAFFLE
  - 24. AXLE HOUSING
  - 25. PINION PRELOAD SHIMS
  - 26. OIL SEAL
  - 27. DUST CAP
  - 28. YOKE
  - 29. WASHER
  - 30. PINION NUT
  - 31. UPPER BALL STUD SPLIT RING SEAT
  - 32. UPPER BALL STUD NUT
  - 33. COTTER PIN
  - 34. LOWER BALL STUD JAMNUT

- 35. UPPER BALL STUD
- 36. SPINDLE
- 37. SEAL
- 38. BEARING
- 39. BEARING CUP
- 40. HUB
- 41. INNER LOCKNUT
- 42. WASHER
- 43. OUTER LOCKNUT
- 44. SPRING CUP\*
- 45. PRESSURE SPRING\*
- 46. DRIVE GEAR\*
- 47. SNAP RING
- 48. HUB CAP\*
- 49. SPINDLE BEARING

- 50. WASHER
  - 51. SEAL
  - 52. SEAL SEAT
  - 53. AXLE SHAFT
  - 54. STEERING KNUCKLE
  - 55. STEERING STOP BOLT
  - 56. LOWER BALL STUD
  - 57. SNAP RING
  - 58. TIE ROD
  - 59. TIE ROD END NUT
  - 60. SPINDLE
  - 61. SEAL
  - 62. BEARING
  - 63. BEARING CUP
  - 64. HUB
  - 65. TABBED WASHER
  - 66. INNER LOCKNUT
  - 67. LOCK WASHER
  - 68. OUTER LOCKNUT
  - 69. GASKET
  - 70. SNAP RING
  - 71. INNER OIL SEAL
- \* NOT USED WITH FRONT DRIVE HUBS

Fig. 2F-1 Front Axle Assembly

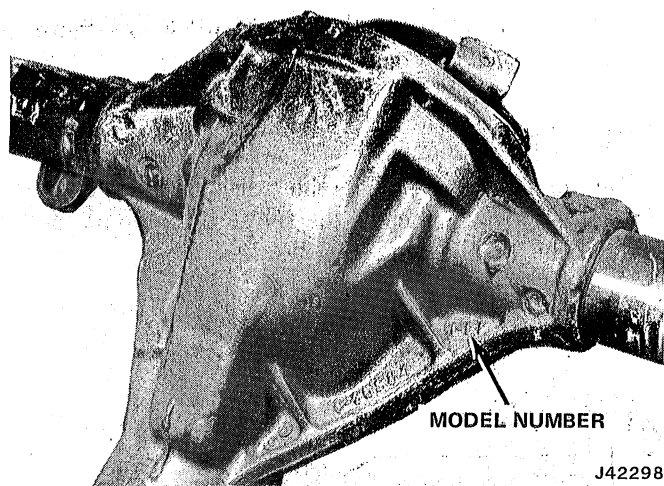


Fig. 2F-2 Model 44 Front Axle Code Number Location

On Model 30 front axles, the axle code number is cast into the bottom surface of the differential housing.

The axle build date and manufacturers build date are stamped on the right-side axle tube adjacent to the axle housing cover.

The axle build date is decoded as follows: The first number represents the month, the second number the day of the month, the third number the year, the letter the shift, and the last number is the assembly line. If there are two build dates, the latter date will indicate when the brake components were installed.

The gear ratio tag attached to the left side of the axle housing cover indicates the Jeep manufacturing reference part number and the numerical tooth combination of the ring and pinion gears.

**Axle Ratio and Code Letter Chart**

Differential Type	Gear Ratio	Code Letter	Pinion-to-Drive Gear Teeth
Standard	2.73	D	15/41
Trac-Lok	2.73	DD	15/41
Standard	3.31	B	13/43
Trac-Lok	3.31	CC	13/43
Standard	3.54	A	11/39
Trac-Lok	3.54	AA	11/39
Standard	3.73	GG	11/41
Trac-Lok	3.73	Q	11/41
Standard	4.10	C	10/41
Trac-Lok	4.10	CC	10/41

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**AXLE HOUSING SERVICE**

The front axle housing should be inspected periodically for weld cracks or other damage that could cause loss of lubricant, affect driving characteristics, or result in front end misalignment.

**NOTE:** *If the vehicle is driven through water that is deep enough to cover the front hubs, steering knuckles and brake components should be disassembled and inspected for water-dirt contamination and water damage. All components should be cleaned thoroughly,*

*examined carefully, and lubricated as necessary before assembly. During the inspection, pay particular attention to the axle bearings, spindle bearings and brake components. Damaged or contaminated parts should be replaced.*

**FRONT WHEEL ALIGNMENT**

Toe-in and caster are the only adjustable front alignment angles. Camber is built into the axle during manufacture and cannot be adjusted.

An alignment rack should be used to check the alignment angles. The use of a rack will ensure more accurate readings and avoid the possibility of incorrect adjustments.

Toe-in is adjusted by lengthening or shortening the steering tie rod. Caster is adjusted by installing tapered shims between the front axle spring mounting pad and front spring. Refer to Front Wheel Alignment in Chapter 2M for measurement and adjustment procedures.

**HIGH STEERING EFFORT**

High steering effort or slow return of the steering mechanism after turns may be the result of excessive steering knuckle ball stud preload. If this condition occurs and all other items affecting steering effort are functioning normally, ball stud preload should be checked as follows:

**Ball Stud Preload Measurement**

- (1) Raise vehicle.
- (2) Remove front wheels.
- (3) If vehicle has steering damper, disconnect damper at tie rod and move damper aside.
- (4) Unlock steering column.
- (5) Disconnect steering connecting rod. On CJ models, disconnect rod at right-side steering knuckle. On all other models, disconnect connecting rod at right-side of tie rod.
- (6) Remove cotter pin and retaining nut attaching tie rod to right-side steering knuckle. Discard cotter pin.
- (7) Rotate both steering knuckles through complete arc several times. Work from right-side of vehicle to rotate knuckles.
- (8) Assemble socket and 0-50 foot-pound (68 N•m) capacity torque wrench and install wrench on tie rod retaining nut.

**NOTE:** *The torque wrench must be positioned at a 90 degree angle to the steering knuckle arm to obtain an accurate reading.*

(9) Rotate knuckles slowly and steadily through a complete arc and measure torque required to rotate knuckles.

(a) If reading is less than 25 foot-pounds (34 N•m), turning effort is within specifications and fault is

not in steering knuckle. Check steering gear, pump and column.

(b) If reading is more than 25 foot-pounds (34 N•m), turning effort is excessive. Proceed to next step.

(10) Disconnect tie rod from both steering knuckles.

(11) Install 1/2 x 1 inch bolt, flat washer, and nut in tie rod stud mounting hole in one steering knuckle. Tighten bolt and nut securely.

(12) Assemble and install socket and 0-50 foot-pound (68 N•m) capacity torque wrench on bolt previously installed in steering knuckle.

**NOTE:** *The torque wrench must be positioned at a 90 degree angle to the steering knuckle arm.*

(13) Rotate steering knuckle slowly and steadily through complete arc and measure torque required to turn knuckle.

(14) Install bolt, flat washer, nut, torque wrench and socket on opposite steering knuckle and measure torque required to rotate knuckle.

(a) If reading is less than 10 foot-pounds (14 N•m), steering effort is within specifications and fault is not in knuckle ball studs. Check for tight or damaged tie rod ends, lubricate or replace as necessary, and proceed to next step.

(b) If torque reading is more than 10 foot-pounds (14 N•m), turning effort is excessive. Proceed to Ball Stud Preload Correction procedure.

(15) Install tie rod. Tighten tie retaining nuts to 35 foot-pounds (47 N•m) torque and install replacement cotter pins.

(16) Install connecting rod. Tighten connecting rod retaining nuts to 60 foot-pounds (81 N•m) torque on CJ and Scrambler models and 75 foot-pounds (102 N•m) torque on all other models. Install replacement cotter pins.

(17) Install front wheels.

(18) Lower vehicle.

### Ball Stud Preload Correction

(1) Remove front axle shafts as outlined in this chapter.

(2) Loosen lower ball stud jamnut.

(3) Remove cotter pin and slotted nut from upper ball stud.

(4) Unseat upper and lower ball studs by striking studs with lead hammer.

(5) Remove upper ball stud split ring seat using Tool J-23447. Discard seat after removal.

(6) Remove lower ball stud jamnut and remove steering knuckle. Discard jamnut after removal.

(7) Clean upper ball stud split ring seat threads, lower ball stud taper in steering knuckle, threads and tapered surfaces of ball studs, and upper ball stud retaining nut threads.

(8) Position steering knuckle on axle and install replacement lower ball stud jamnut finger-tight (only).

(9) Install and tighten upper ball stud slotted nut to 10 to 20 foot-pounds (13 to 27 N•m) torque to draw lower ball stud into tapered hole in axle yoke. Do not install upper ball stud split ring seat at this time.

(10) Tighten replacement lower ball stud jamnut to 80 foot-pounds (108 N•m) torque.

(11) Remove upper ball stud slotted nut and install replacement split ring seat using Tool J-23447. Tighten seat to 50 foot-pounds (68 N•m) torque.

(12) Install slotted nut on upper ball stud. Tighten nut to 100 foot-pounds (136 N•m) torque. Align and install cotter pin without loosening slotted nut.

**NOTE:** *If the cotter pin holes in the nut and stud are not aligned, tighten the nut (only) to align the holes. Never loosen the nut to align the holes.*

(13) Install front axle shafts and steering spindles loosely and measure turning effort of each steering knuckle as described in Ball Stud Preload Measurement.

(a) If turning effort is less than 10 foot-pounds (14 N•m) torque, proceed to next step.

(b) If turning effort is more than 10 foot-pounds (14 N•m) torque, replace upper and lower ball studs and repeat Ball Stud Preload Correction procedure.

**NOTE:** *If the Ball Stud Preload Correction Procedure is repeated, tighten split ring seat to 50 foot-pounds (68 N•m) torque. Also, tighten the slotted nut on the upper ball stud to 80 foot-pounds (108 N•m) torque.*

(14) Install front axle shafts.

(15) Connect tie rod to steering knuckle arms. Tighten tie rod end retaining nuts to 45 foot-pounds (61 N•m) torque and install replacement cotter pins.

(16) Attach connecting rod to tie rod. Tighten connecting rod end retaining nut to 60 foot-pounds (81 N•m) torque on CJ and Scrambler models and 75 foot-pounds (102 N•m) torque on all other models.

(17) Connect steering damper to tie rod, if equipped.

(18) Install front wheels. Tighten wheel retaining nuts to 80 foot-pounds (108 N•m) torque.

(19) Lower vehicle.

### PINION SEAL AND YOKE

#### Removal

(1) Raise vehicle.

(2) Mark propeller shaft and yoke for assembly alignment reference and disconnect propeller shaft from yoke.

(3) Remove pinion nut and washer using socket, breaker bar, and Tool J-8614-01 (fig. 2F-3).

(4) Remove yoke using Tools J-8614-01, -02, -03 (fig. 2F-4).

(5) Remove pinion seal using Tool J-25180.

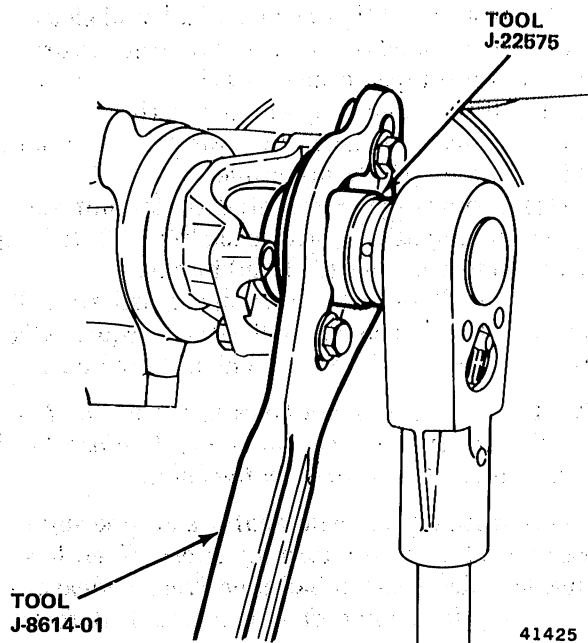


Fig. 2F-3 Pinion Nut Removal

### Installation

- (1) Install replacement seal using Tool J-25104.
- (2) Install yoke.
- (3) Install pinion washer and nut. Tighten nut to 210 foot-pounds torque.
- (4) Align reference marks on propeller shaft and yoke and connect shaft to yoke. Tighten shaft-to-yoke attaching bolts or nuts to 16 foot-pounds (22 N•m) torque.
- (5) Lower vehicle.

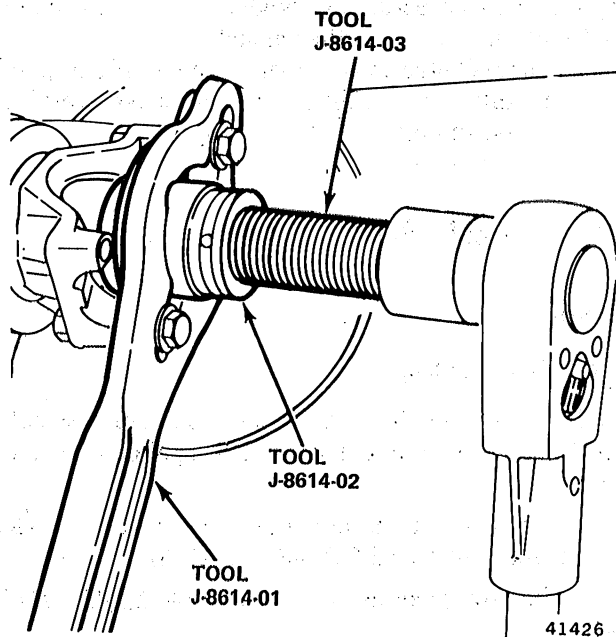


Fig. 2F-4 Pinion Yoke Removal

### AXLE SHAFT

#### Removal—CJ and Scrambler Models

- (1) Raise vehicle.
- (2) Remove disc brake caliper. Refer to Chapter 2G.
- (3) Remove bolts attaching front hub to axle and remove hub body and gasket.
- (4) Remove retaining ring from axle shaft.
- (5) Remove hub clutch and bearing assembly from axle.
- (6) Straighten lip of lock washer.
- (7) Remove outer locknut, lock washer, inner locknut, and tabbed washer. Use Tool J-25103 to remove locknuts.
- (8) Remove outer bearing and remove disc brake rotor.
- (9) Remove disc brake caliper adapter and splash shield.
- (10) Remove axle spindle.
- (11) Remove axle shaft and universal joint assembly.

#### Installation—CJ and Scrambler Models

- (1) Clean all parts thoroughly.
- (2) Install axle shaft and universal joint assembly. Insert splined end of axle shaft into differential side gear and push shaft into place.
- (3) Install axle spindle.
- (4) Install splash shield and disc brake caliper adapter.
- (5) Lubricate and install outer bearing in disc brake rotor.
- (6) Install disc brake rotor on spindle.
- (7) Install tabbed washer and inner locknut. Tighten locknut to 50 foot-pounds (68 N•m) torque; then back off locknut 1/6 turn (45°-65°). Rotate wheel while tightening inner locknut to seat bearings evenly. Use Tool J-25103 to tighten locknut.
- (8) Install lock washer and outer locknut. Tighten locknut to 50 foot-pounds (68 N•m) torque and bend lip of lock washer over nut.
- (9) Install hub clutch and bearing assembly on axle shaft.
- (10) Install retaining ring on axle shaft.
- (11) Install gasket and hub body on axle and install hub attaching bolts. Tighten bolts to 30 foot-pounds (41 N•m) torque. Tighten bolts alternately and evenly.
- (12) Install disc brake caliper. Refer to Chapter 2G.
- (13) Lower vehicle.

#### Removal—Cherokee-Wagoneer-Truck

- (1) Raise vehicle.
- (2) Remove disc brake caliper. Refer to Chapter 2G.
- (3) On models without front hubs:
  - (a) Remove rotor hub cap.
  - (b) Remove axle shaft snap ring, drive gear, pressure spring, and spring retainer.

- (4) On models with front hubs:
  - (a) Remove socket head screws from hub body and remove body and large retaining ring.
  - (b) Remove small retaining ring from axle shaft.
  - (c) Remove hub clutch assembly from axle.
- (5) Remove outer locknut, washer, and inner locknut using Tool J-6893.
- (6) Remove rotor. Spring retainer and outer bearing are removed with rotor.
- (7) Remove nuts and bolts attaching spindle and support shield and remove spindle and shield. If necessary, tap spindle with rawhide mallet to remove it from knuckle (fig. 2F-5).
- (8) Remove axle shaft.

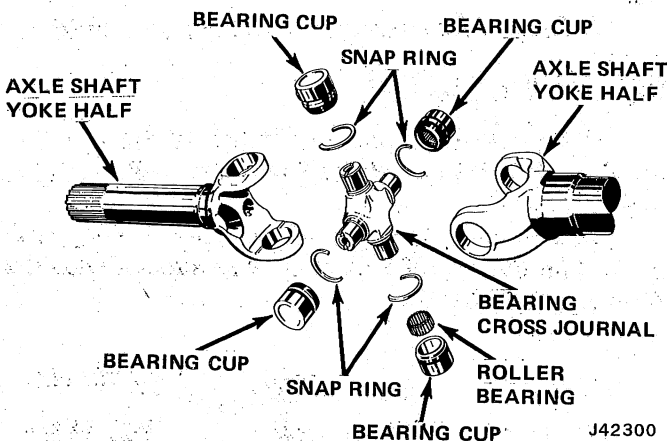


Fig. 2F-5 Axle Shaft Universal Joint

### Installation—Cherokee-Wagoneer-Truck

- (1) Install axle shaft. Insert splined end of axle shaft in differential side gear and push shaft into place.
- (2) Install spindle.
- (3) Install support shield and rotor.
- (4) Install inner wheel bearing locknut (nut has peg on one side). Tighten locknut just enough to remove end play.
- (5) Install wheel and tire but do not tighten wheel nuts completely.
- (6) Tighten inner locknut to 50 foot-pounds (68 N•m) torque; then back off locknut 1/6-turn (45°-65°). Rotate wheel while tightening locknut to seat bearings evenly.
- (7) Install washer so inner tab is aligned with spindle keyway. Also be sure peg on inner locknut engages in nearest hole in washer.
- (8) Install and tighten outer locknut to minimum of 50 foot-pounds (68 N•m) torque.
- (9) Remove wheel and tire.
- (10) On models without front hubs:
  - (a) Install spring retainer, pressure spring, and drive gear.

**CAUTION:** Install the spring retainer with the cupped side of the retainer facing toward the center of the vehicle.

- (b) Push drive gear inward to provide clearance for axle shaft snap ring and install snap ring.
- (c) Coat rotor hub cap rim with Permatex Adhesive-Sealant number 3, or equivalent, and install hub cap in rotor.
- (11) On models with front hubs:
  - (a) Install hub clutch assembly in axle.
  - (b) Install small retaining ring on axle shaft. Install large retaining ring in axle hubs.
  - (c) Install replacement O-ring on hub body, if necessary.
  - (d) Install hub body. Install and tighten socket head screws to 30 inch-pounds (3 N•m) torque.
- (12) Install disc brake caliper. Refer to Chapter 2G.
- (13) Install wheel and tire.
- (14) Lower vehicle.

### AXLE SHAFT UNIVERSAL JOINT

#### Replacement

- (1) Remove axle shaft.
- (2) Remove snap rings from universal joint bearing cups (fig. 2F-5).
- (3) Press on end of one bearing cup to press opposite bearing from yoke half.
- (4) Turn yoke over and press remaining bearing cup out of yoke by pressing on exposed end of bearing cross journal.

**CAUTION:** To avoid damaging the bearing, remove the bearing using a brass drift having a flat face that is approximately 1/32-inch smaller in diameter than the hole in the axle shaft yoke.

- (5) Repeat above step to remove remaining bearing cups. Remove bearing cross journal by sliding it to one side and lifting out.
- (6) Clean parts in solvent. Inspect parts after cleaning. Replace any part that exhibits excessive wear or damage.
- (7) Pack bearing cups 1/3 full of bearing lubricant and install bearing rollers.
- (8) Install bearing cross journal. Hold bearing cups in vertical position to prevent bearings from dropping out.
- (9) Install bearing cups in axle shaft yoke halves and seat them firmly against bearing shoulders.
- (10) Press bearing cups on journal from opposite side until firmly seated.
- (11) Repeat previous steps to install opposite bearing cups on cross journal.
- (12) Install snap rings on bearing cups.

**NOTE:** If the universal joint binds when assembled, tap the yoke lightly to relieve any pressure on the bearings at each end of the journal.

- (13) Install axle shaft.

### STEERING KNUCKLE REMOVAL

**NOTE:** The open-end steering knuckle pivots on ball studs. Ball stud replacement requires removal of the axle shaft and steering knuckle (fig. 2F-6).

- (1) Remove axle shaft.
- (2) Disconnect tie-rod end at steering knuckle arm.
- (3) Remove and discard lower ball stud jamnut (fig. 2F-7).
- (4) Remove cotter pin from upper ball stud and loosen stud nut until top edge of nut is flush with top of stud.
- (5) Unseat upper and lower ball studs using lead hammer.
- (6) Remove upper ball stud nut and steering knuckle.
- (7) Remove upper ball stud split ring seat using Tool J-25158.

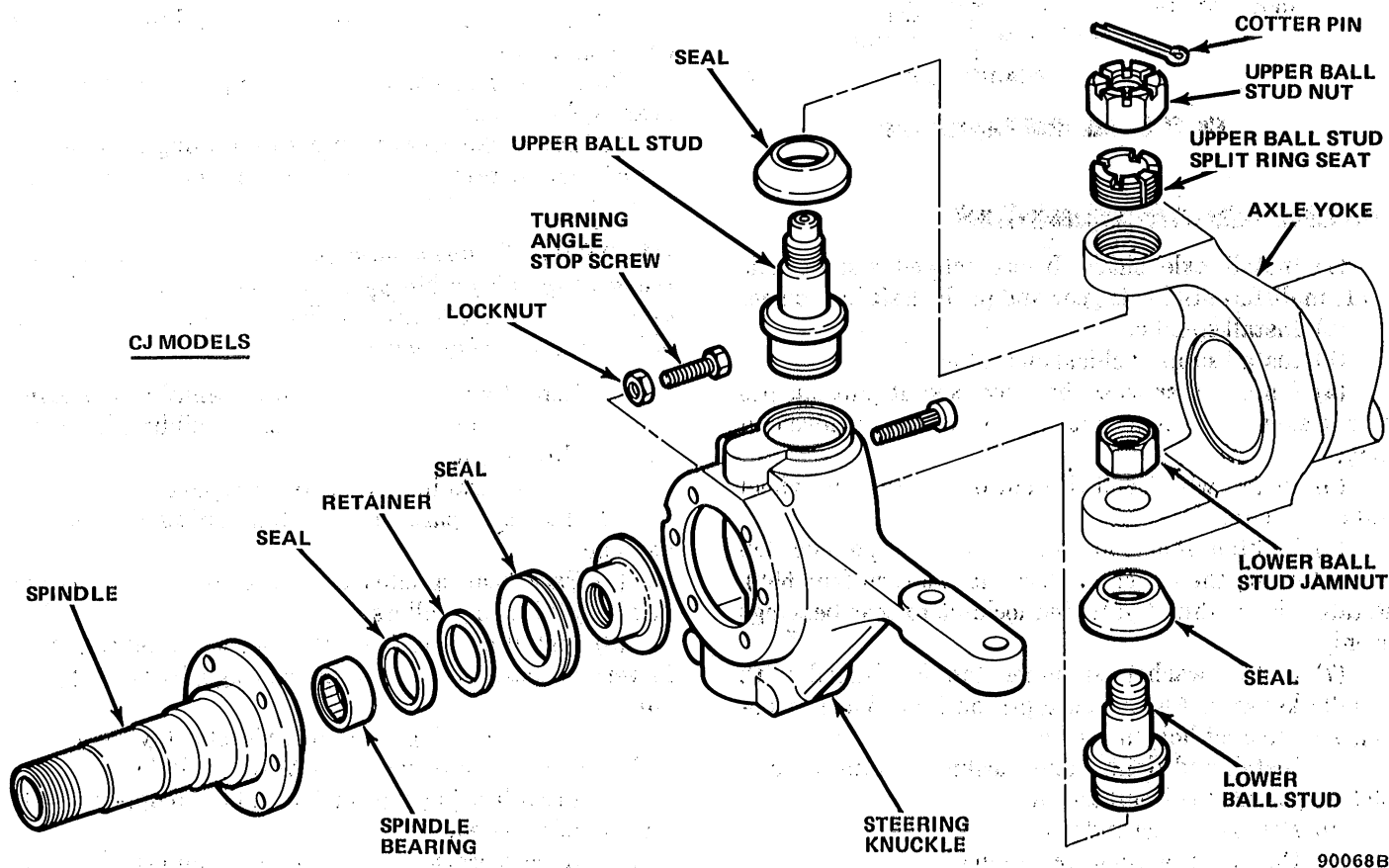
### STEERING KNUCKLE BALL STUDS

#### Lower Ball Stud Removal

- (1) Remove lower ball stud snap ring.
- (2) Clamp knuckle assembly securely in vise with upper ball stud pointing downward (fig. 2F-8).
- (3) Attach Plate J-25211-1 to spindle mating surface of knuckle assembly (fig. 2F-8).
- (4) Position Button J-25211-3 on lower ball stud (fig. 2F-8).
- (5) Assemble and install Puller J-25215 on steering knuckle (fig. 2F-8). Hook one puller arm in Plate J-25211-1 and hook opposite arm in knuckle.
- (6) Tighten puller screw to press lower stud out of knuckle.
- (7) Remove tools used to press stud from knuckle.

#### Upper Ball Stud—Removal

- (1) Remove both arms from Puller J-25215.
- (2) Place Button J-25211-3 on upper ball stud (fig. 2F-9).
- (3) On CJ and Scrambler models, install Adapter J-25211-4 on nut-end of puller screw so adapter shoulder faces nut-end of screw.



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Fig. 2F-6 Steering Knuckle Components



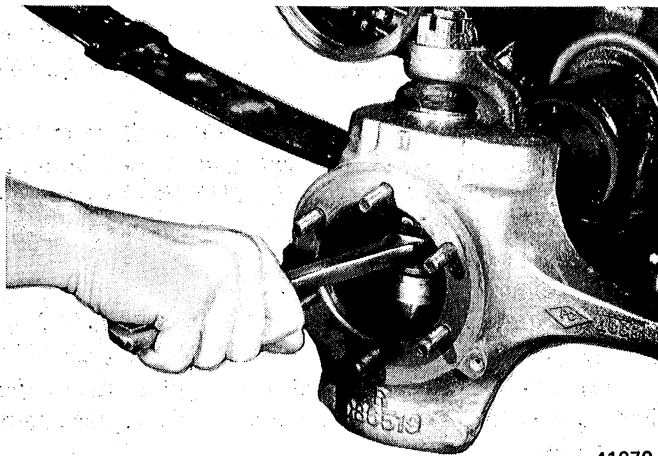


Fig. 2F-7 Lower Ball Stud Jamnut Removal

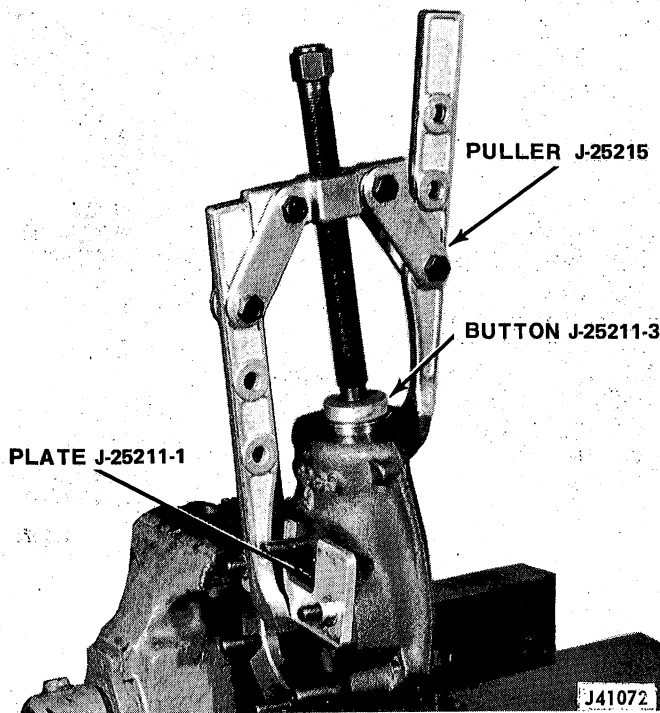


Fig. 2F-8 Lower Ball Stud Removal

(4) On all models, thread puller frame halfway onto puller screw. Insert nut-end of screw through lower ball stud hole in steering knuckle. Position puller frame against knuckle and puller screw against Button J-25211-3 (fig. 2F-9). On CJ and Scrambler models, be sure Adapter J-25211-4 is positioned between puller frame and steering knuckle.

(5) Tighten puller screw to press upper ball stud out of knuckle.

(6) Remove tools used to press upper ball stud from knuckle. Do not disassemble screw and frame of Puller J-25215 at this time. Tools will be used, as assembled, to install lower ball stud.

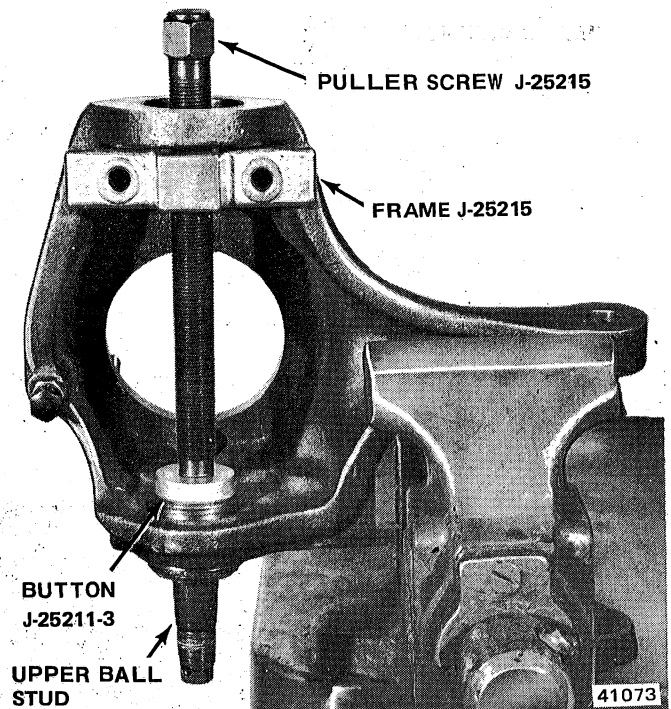


Fig. 2F-9 Upper Ball Stud Removal

### Lower Ball Stud—Installation

- (1) Invert steering knuckle in vise.
- (2) Position replacement lower ball stud in steering knuckle.
- (3) Place Adapter J-25211-4 over nut-end of puller screw and against puller frame (fig. 2F-10).
- (4) Insert nut-end of puller screw through upper ball stud hole in knuckle and hold adapter and frame against knuckle (fig. 2F-10).
- (5) Place Installer Cup J-25211-2 on ball stud (fig. 2F-10).
- (6) Tighten puller screw to press lower ball stud into steering knuckle (fig. 2F-10).
- (7) Install replacement lower ball stud retaining snap ring.
- (8) Remove tools used to install lower ball stud.

### Upper Ball Stud Installation

- (1) Install both arms on Puller J-25215 (fig. 2F-11).
- (2) Position replacement upper ball stud in steering knuckle.
- (3) Install Plate J-25211-1 on spindle mounting studs (fig. 2F-11).
- (4) Position Installer Cup J-25211-2 on upper ball stud (fig. 2F-11).
- (5) Install assembled Puller J-25215 on steering knuckle. Hook one puller arm in plate and hook opposite arm in knuckle (fig. 2F-11). Be sure puller screw is centered on installer cup.

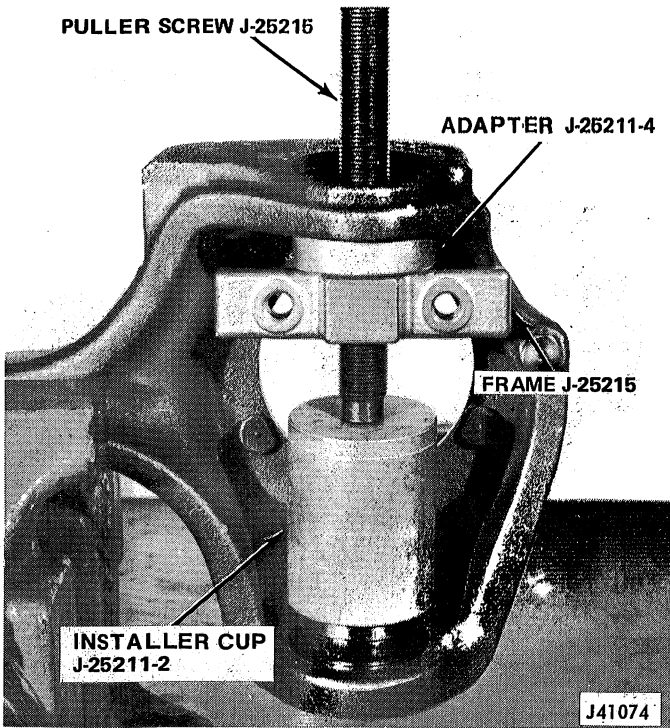


Fig. 2F-10 Lower Ball Stud Installation

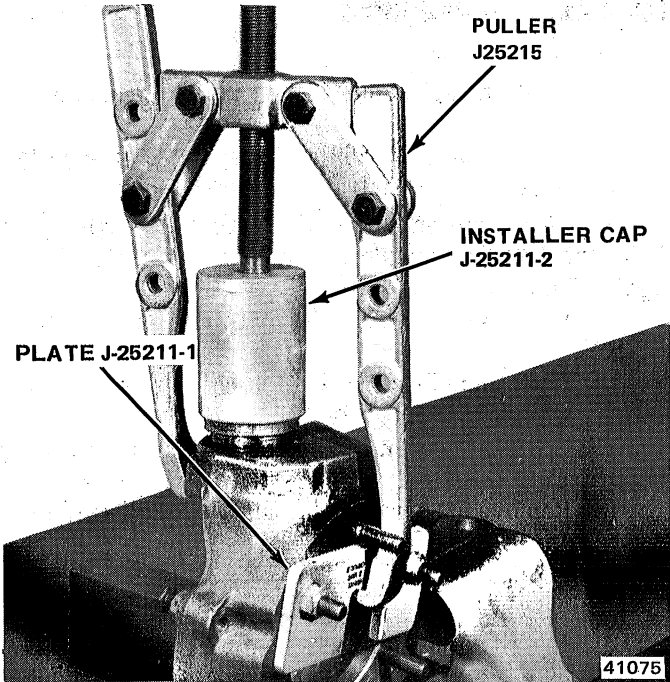


Fig. 2F-11 Upper Ball Stud Installation

- (6) Tighten puller screw to press ball stud into steering knuckle (fig. 2F-11).
- (7) Remove upper ball stud installation tools.

**STEERING KNUCKLE INSTALLATION**

- (1) Install upper ball stud split ring seat in axle yoke. Top of seat should be flush with top of yoke.
- (2) Install steering knuckle on axle yoke and install lower ball stud stud jamnut finger-tight only.

- (3) Position and align Nut Wrench J-23447, Button J-25211-3, Plate J-25211-1, and Puller J-25212 (fig. 2F-12).

- (4) Tighten screw of Puller J-25212 until lower ball stud is held firmly in its seat and install jamnut. Tighten jamnut to 85 foot-pounds (115 N•m) torque on CJ and Scrambler models and 75 foot-pounds (102 N•m) torque on all other models.

- (5) Remove puller and plate.

- (6) Tighten upper ball stud split ring seat to 50 foot-pounds (68 N•m) torque using Tool J-23447 (fig. 2F-13).

- (7) Install upper ball stud nut. Tighten nut to 100 foot-pounds (136 N•m) torque and install replacement cotter pin.

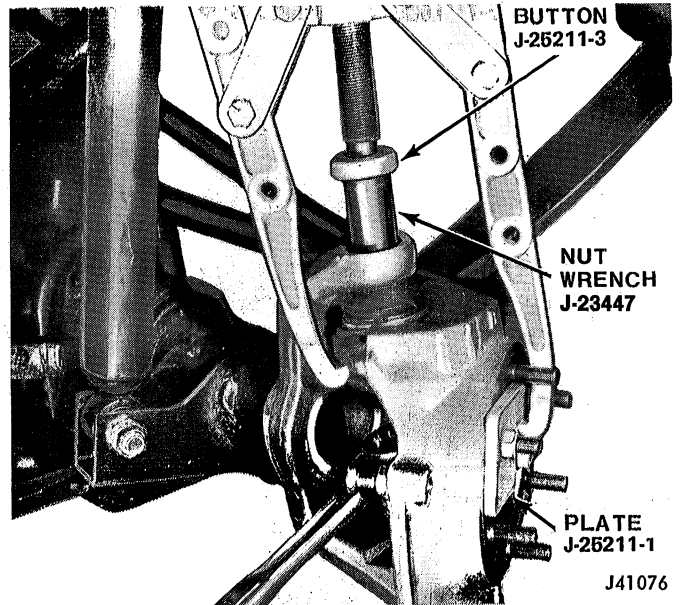


Fig. 2F-12 Steering Knuckle Installation

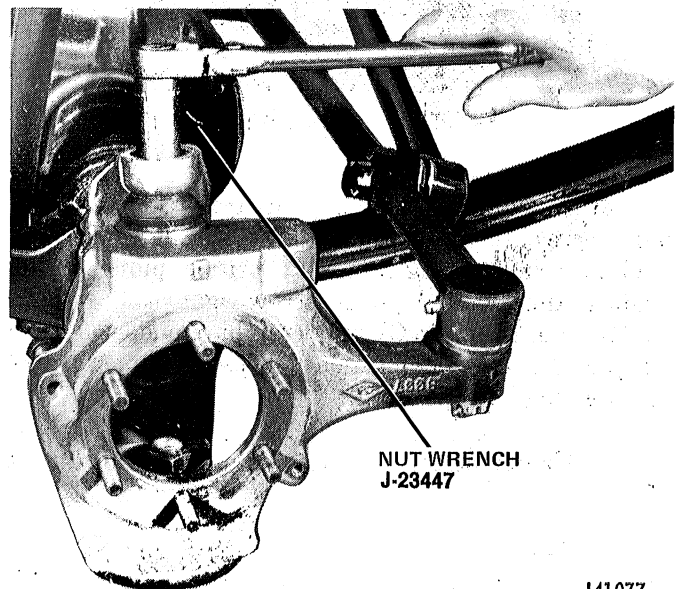


Fig. 2F-13 Tightening Upper Ball Stud Seat

**NOTE:** If the cotter pin holes do not align, tighten the nut until the holes are aligned. Never loosen the nut to align the holes.

(8) Connect steering tie rod. Tighten tie rod endnuts to 50 foot-pounds (68 N•m) torque and install replacement cotter pins.

(9) Check and correct front axle turning angle as necessary. Refer to Turning Angle Adjustment.

## AXLE SHAFT SEAL

### Replacement

(1) Remove axle shaft. Refer to Axle Shaft-Removal procedure.

(2) Remove seal from axle shaft (fig. 2F-14).

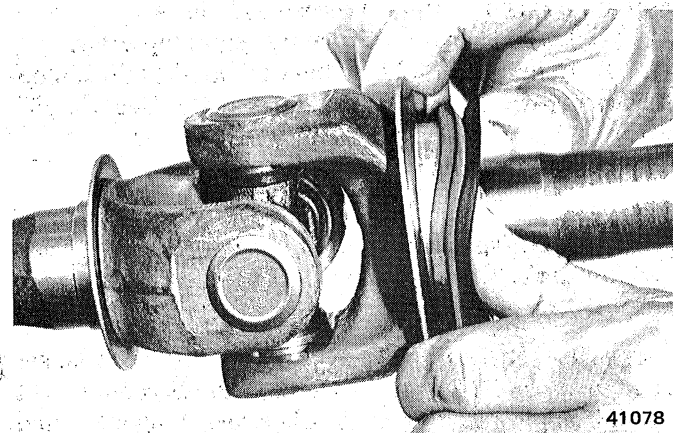


Fig. 2F-14 Axle Shaft Seal Installation

(3) Remove bronze thrust washer. If washer is worn, replace it.

(4) Clean dirt and foreign matter from seal area.

(5) Install bronze washer with chamfered side toward axle shaft seal.

(6) Install replacement seal with seal lip facing spindle (fig. 2F-14).

(7) Pack wheel bearing lubricant around thrust face of shaft and seal and fill seal area of spindle with wheel bearing lubricant also.

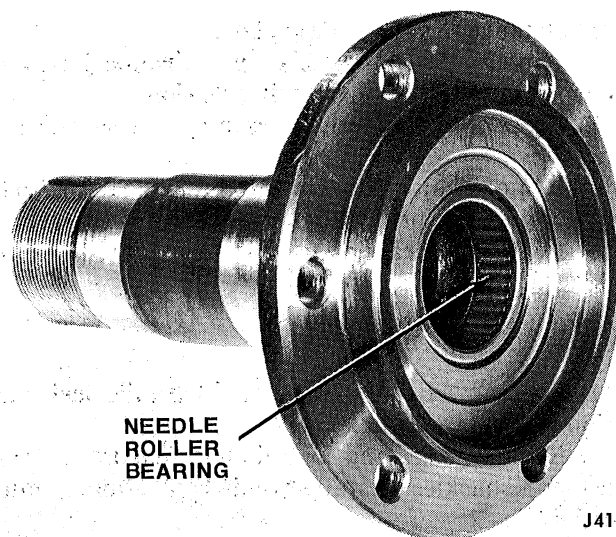
(8) Install axle shaft. Refer to Axle Shaft-Installation procedure.

## SPINDLE BEARING

### Replacement

**NOTE:** Front axle spindles are equipped with a needle roller bearing that is located in the spindle flange bore (fig. 2F-15).

(1) Wrap machined surfaces of spindle with tape and mount spindle in vise. Do not clamp spindle in vise until protective tape is applied to spindle surfaces.



NEEDLE  
ROLLER  
BEARING

Fig. 2F-15 Spindle Bearing Location

(2) Remove needle bearing using internal-type puller.

(3) Clean dirt and foreign matter from spindle bearing surface.

(4) Install replacement bearing using bearing driver.

(5) Pack needle bearing with wheel bearing lubricant.

## AXLE HOUSING INNER OIL SEAL

Model 30 and 44 front axles have inner oil seals that are located inside the housing. The seals are installed in counterbores machined into the shaft bores in the housing center section.

The axle housing inner seals are serviceable items but require differential removal in order to replace them. Refer to Differential Overhaul—Model 30-44-60 Axle in the Standard Differential section for removal/installation procedures.

## AXLE REMOVAL

(1) Raise and support front end. Position frame stands under frame rails at rear of front springs.

(2) Remove wheels.

(3) Mark propeller shaft and axle yoke for assembly alignment reference.

(4) Disconnect propeller shaft at axle yoke. Secure shaft to frame rail using wire.

(5) Disconnect connecting rod at steering knuckles.

(6) Disconnect shock absorbers at axle housing.

(7) On vehicles equipped with stabilizer bar, remove nuts attaching stabilizer bar connecting links to spring tie plates.

(8) Disconnect breather tube at axle housing.

(9) Disconnect stabilizer bar link bolts at spring clips.

(10) Remove disc brake calipers, rotors, and brake shields. Refer to Chapter 2G.

- (11) Remove U-bolts and tie plates.
- (12) Support axle assembly on hydraulic jack and raise jack slightly to relieve spring tension.
- (13) Loosen nuts attaching rear spring shackles to springs.
- (14) Remove bolts attaching front spring shackles to springs and lower springs to floor.
- (15) Remove hydraulic jack and axle assembly from underneath vehicle.

**AXLE INSTALLATION**

- (1) Support axle assembly on hydraulic jack and position axle under vehicle.
- (2) Raise springs and install shackle bolts in front springs and shackles. Install shackle bolt retaining nuts hand-tight.
- (3) Lower hydraulic jack until axle is supported by front springs and rotate axle into position on springs.
- (4) Install spring U-bolts and tie plates.
- (5) On vehicles equipped with sway bar, mount sway bar connecting links on tie plates.
- (6) Tighten spring shackle bolts to 24 foot-pounds (33 N•m) torque on CJ and Scrambler models and 100 foot-pounds (136 N•m) torque on all other models.
- (7) On vehicles equipped with stabilizer bar, install nuts attaching stabilizer bar connecting links to tie plates.
- (8) Tighten spring pivot bolts to 100 foot-pounds (136 N•m) torque on all models.
- (9) Install brake shields, rotors, and brake calipers. Refer to Chapter 2G.

- (10) Connect breather tube.
- (11) Connect shock absorbers.
- (12) Connect steering connecting rod at steering knuckles. Use replacement cotter pins to secure nuts.
- (13) Connect propeller shaft to yoke. Align shaft and yoke using alignment marks made during removal.
- (14) Install wheels.
- (15) Remove support stands and lower vehicle.
- (16) Tighten wheel retaining nuts and install wheel covers.
- (17) Check front wheel alignment.
- (18) Check turning angle.

**TURNING ANGLE ADJUSTMENT**

The turning angle stopscrews are located at the rear of the steering knuckle just above the axle centerline. If adjustment is necessary, proceed as follows.

- (1) Loosen locknut on turning angle stopscrew.
- (2) Using a turntable to measure angle, adjust stopscrew to obtain proper turning angle (see Specifications).
- (3) Tighten stopscrew locknut.

**NOTE:** *Turning adjusting screw inward increases turning angle. Turning screw outward decreases turning angle.*

**Turning Angle Specifications:** On CJ-5 models, set turning angle at 29 degrees. On CJ-7 and Scrambler, set turning angle at 32 degrees. Cherokee, Wagoneer and Truck models, set the turning angle at 36 to 37 degrees.

**SPECIFICATIONS**

**Front Axle Specifications**

Axle Type:	
Model 30/44 .....	Drive-type, full-floating axle with open end steering knuckles mounted on ball studs.
Axle Application:	
Model 30 Front Axle .....	CJ-5, CJ-7, Scrambler
Model 44 Front Axle .....	Cherokee, Wagoneer, Truck
Axle Ring Gear Diameter:	
Model 30 .....	7.125-inches (18.09 cm)
Model 44 .....	8.500-inches (21.59 cm)
Front Axle Lubricants:	
	Jeep Axle Lubricant or equivalent of SAE 85W-90, A.P.I. Grade GL-5 quality, Grade MIL-L-2105C.
Lubricant Capacity:	
Model 30 .....	2.5 Pints (1.18 liters)
Model 44 .....	3.0 Pints (1.41 liters)
Turning Angle:	
CJ-5 .....	24 degrees
CJ-7, Scrambler .....	32 degrees
Cherokee, Wagoneer, Truck .....	36-37 degrees

**Torque Specifications**

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-tightened item.

	USA (ft-lbs)		Metric (N·m)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Axle Housing Cover Bolts	20	15-25	27	20-34
Connecting Rod-End Nut:				
CJ - Scrambler	40 min.	—	54 min.	—
Cherokee-Wagoneer-Truck	70 min.	—	95 min.	—
Lower Ball Stud Jam Nut:				
CJ - Scrambler	85	—	115 min.	—
Cherokee-Wagoneer-Truck	75	—	102 min.	—
Tie Rod-End Nut:				
CJ - Scrambler	40 min.	—	54 min.	—
Cherokee-Wagoneer-Truck	60 min.	—	81 min.	—
Shock Absorber Lower Mounting Stud Nut	45	35-50	61	48-68
Spring Pivot Bolts	100	80-120	136	109-163
Spring Shackle Bolts/Nuts:				
CJ - Scrambler	24	18-30	33	24-41
Cherokee-Wagoneer-Truck	100	80-120	136	109-163
Spring Clip U-Bolt Nuts:				
9/16-18	100	85-105	163	115-142
1/2-20	55	45-65	75	61-81
Upper Ball Stud Split Ring Seat	50	—	68	—
Upper Ball Stud Retaining Nut	100	—	136	—
Universal Joint Strap Bolt	16	15-19	22	20-26
Wheel Retaining Nuts	80	65-90	109	88-122

All torque values given in foot-pounds and newton-meters with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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**REAR AXLE**

	Page		Page
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Axle Hub—CJ and Scrambler	2F-14	Wagoneer-J-10 Truck	2F-18
Axle Shaft and Bearing—Cherokee-Wagoneer-J-10 Truck	2F-17	Pinion Seal and Yoke—Model 44 and 60 Axle	2F-19
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**GENERAL**

CJ and Scrambler models are equipped with the AMC/Jeep semi-floating rear axle with tapered axle shafts. This axle has an 8-7/8 inch (23 cm) diameter ring gear.

Cherokee, Wagoneer, and J-10 Truck models use an AMC/Jeep semi-floating rear axle which has flanged axle shafts. This axle has an 8-7/8 (23 cm) diameter ring gear. J-20 Truck models use the Model 60 full-floating rear axle.

**IDENTIFICATION**

On AMC/Jeep rear axles, the axle code letters are stamped on the right-side axle housing tube boss (fig. 2F-16). On Dana model 60 rear axles, the axle ratio is

stamped on an I.D. tag attached to the axle housing cover. In addition to the ratios listed in the ratio and letter code chart, J-20 Truck models are also available with 3.73 ratio axles. The ring and pinion tooth combination for this ratio is 11/41.

**J-20 Truck Axle**

On the Model 60 rear axle, the model number is cast into a boss on the lower right side of the housing, adjacent to the housing cover.

The axle build date and manufacturer's part numbers are stamped on the right-hand axle tube, adjacent to the cover (fig. 2F-17). The build date of the axle is as follows. First number is the month, second number is the day of the month, third number is the year, the alpha-letter is the shift and the last number is the assembly line. If

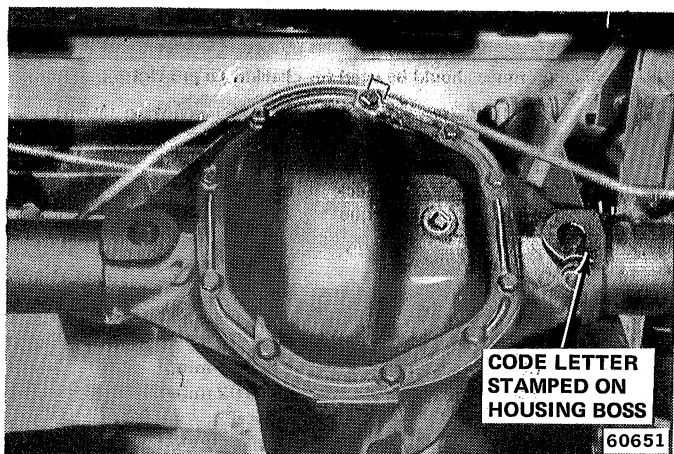


Fig. 2F-16 Axle Ratio Code Location—AMC/Jeep Axle

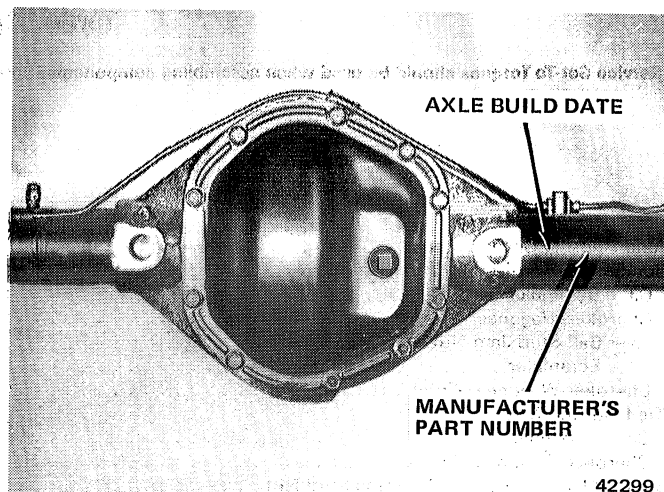


Fig. 2F-17 Axle Part Number and Build Date Code Location—Model 60 Axle

there are two build dates, the latter will be the date on which the brake components were installed.

**AXLE HOUSING**

The rear axle housing should be checked periodically for weld cracks and other damage that may cause loss of lubricant or affect driving characteristics.

If the vehicle is driven through water deep enough to cover the hubs, the wheel ends should be disassembled and inspected for water damage or contamination.

Examine, clean, and replace damaged parts before lubricating and assembling the wheel end components. Pay particular attention to the axle bearings, front spindle bearings and brake components.

**AXLE HUB—CJ AND SCRAMBLER MODELS**

**Removal**

- (1) Remove axle shaft dust cap.
- (2) Remove axle shaft nut and washer.
- (3) Raise and support vehicle.
- (4) Remove wheel and tire.
- (5) Remove screws attaching brake drum to rear hub and remove drum.
- (6) Install Puller Tool J-25109-01 on axle hub and remove hub (fig. 2F-18).

**CAUTION:** Do not use a knockout or slide hammer-type puller to remove the hub. This type of puller may damage axle bearings, axle shaft, or differential thrust block.

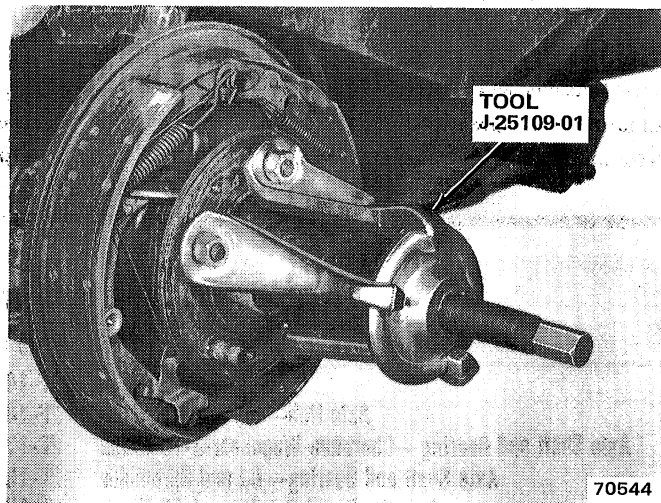


Fig. 2F-18 Axle Hub Removal—CJ and Scrambler Axle

**Inspection**

Inspect the hub for loose or distorted wheel lug studs. Inspect the keyway and tapered center bore for wear, damaged serrations, or cracks. Replace the hub if worn or damaged.

**Installation**

**NOTE:** The procedures for installing an original hub and for installing a replacement hub are different. The installation procedures for both hub-types are as follows:

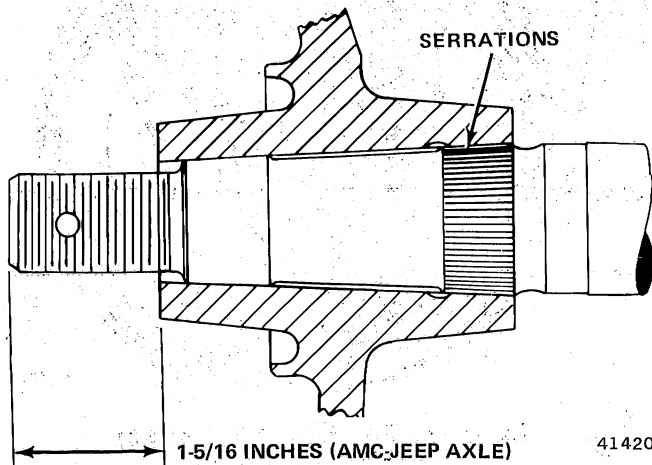
**Original Hub Installation**

- (1) Align keyway in hub with axle shaft key.
- (2) Slide hub onto axle shaft as far as possible.
- (3) Install axle shaft nut and washer.
- (4) Install drum, drum retaining screws, and road wheel.
- (5) Lower vehicle onto wheels.
- (6) Tighten axle shaft nut to 250 foot-pounds (339 N•m) torque. If cotter pin hole is not aligned, tighten nut to the next castellation and install cotter pin. Do not loosen nut to align cotter pin hole.

**NOTE:** When a replacement axle shaft is installed, a replacement hub must also be installed. However, a replacement hub may be installed on an original axle shaft if the serrations on the shaft are not worn or damaged.

**Replacement Hub Installation**

- (1) Align keyway in hub with axle shaft key.
- (2) Lubricate two thrust washers with liberal amount of chassis lubricant and install washers on axle shaft.
- (3) Install axle shaft nut.
- (4) Install brake drum, drum retaining screws, and wheel.
- (5) Lower vehicle onto wheels. Tighten axle shaft nut until distance from hub outer face to axle shaft outer end is 1-5/16 inches (33 mm) (fig. 2F-19).



**Fig. 2F-19 Replacement Hub Installation Measurement —CJ and Scrambler Axle**

**NOTE:** The hub must be pressed onto the axle shaft to the specified dimension in order to form the hub serrations properly.

- (6) Remove axle shaft nut and one thrust washer.
- (7) Install axle shaft nut and tighten to 250 foot-pounds (339 N•m) torque. If cotter pin hole is not aligned, tighten nut to next castellation and install cotter pin. Do not loosen nut to align cotter pin hole.

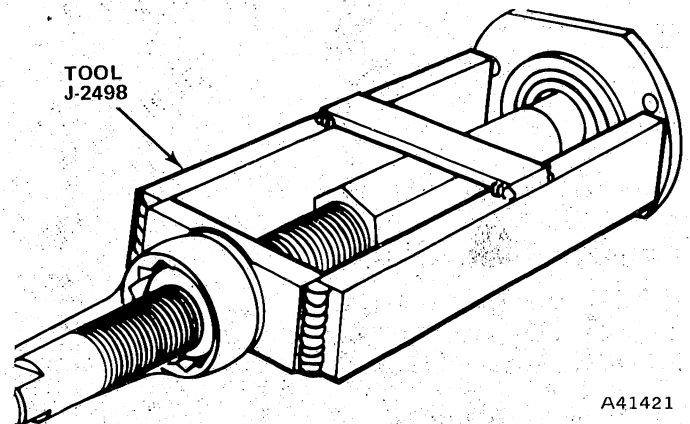
**AXLE SHAFT AND BEARING—CJ AND SCRAMBLER AXLE**

**Removal**

- (1) Remove rear wheel, drum, and hub as outlined under Axle Hub—CJ and Scrambler Models.
- (2) Disconnect parking brake cable at equalizer.
- (3) Disconnect brake line at wheel cylinder and remove brake support plate assembly, oil seal, and shims from axle shaft.

**NOTE:** If both axle shafts are removed, keep the shims separated. Axle shaft end play is adjusted on the left side only.

- (4) Remove axle shaft and bearing using Tool J-2498 (fig. 2F-20).



**Fig. 2F-20 Axle Shaft Removal—CJ and Scrambler Models**

**CAUTION:** On models equipped with a Trac-Lok differential, do not rotate the differential gears unless both axle shafts are in place. If one shaft is removed and remaining shaft is rotated, the side gear splines will become misaligned and prevent installation of the replacement shaft.

- (5) Remove and discard axle shaft inner oil seal.
- (6) Remove axle shaft bearing if bearing is worn or damaged.

**NOTE:** The bearing is a press-fit on the axle shaft and must be removed using an arbor press only (fig. 2F-21). Do not attempt to remove the bearing by any other method.

**Installation**

**NOTE:** Tapered shaft axle bearings do not have any provision for lubrication after assembly and must be packed with a high quality wheel bearing lubricant before installation.

- (1) If axle shaft bearing is to be replaced, pack bearing with generous amount of wheel bearing lubricant

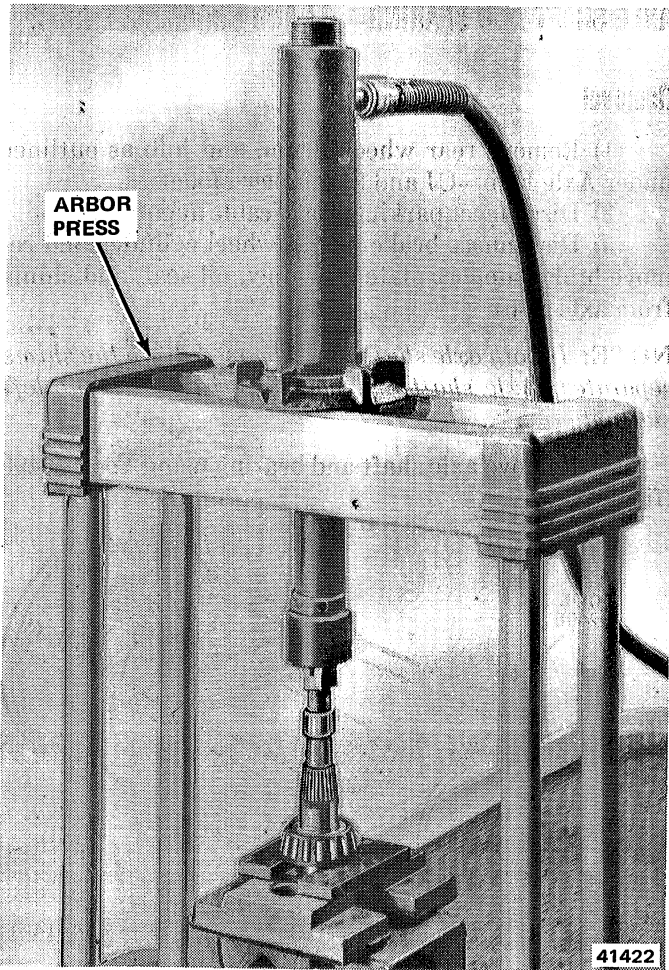


Fig. 2F-21 Axle Shaft Bearing Removal—CJ and Scrambler Models

and press bearing onto shaft. Small diameter of bearing must face toward outer tapered end of shaft.

- (2) Coat inner seal with oil.
- (3) Coat outer surface of seal metal retainer with nonhardening sealer.
- (4) Install inner oil seal using Seal Installer J-21788 (fig. 2F-22).

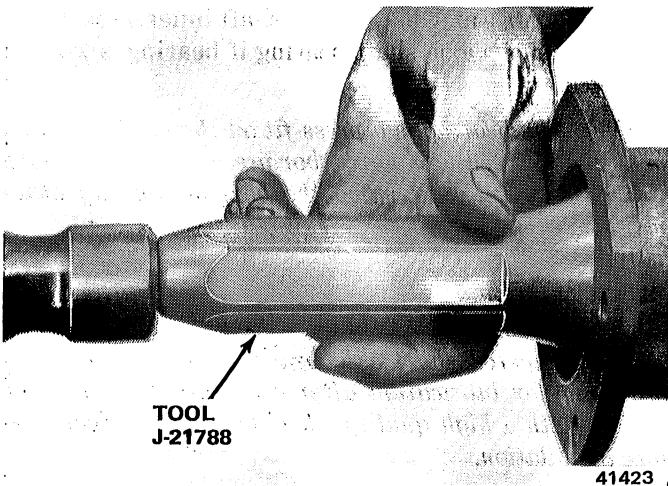


Fig. 2F-22 Inner Oil Seal Installation—CJ and Scrambler Models

(5) Install axle shaft. Align shaft splines with differential side gear splines and insert shaft into gear.

(6) Install outer bearing cup.

(7) Inspect brake support plate for elongated bolt holes. Replace support plate if necessary.

**NOTE:** During assembly, apply a silicone-type sealer to the axle tube flange and brake support plate mounting area to prevent entry of dust and water.

(8) Install original axle end play shims, oil seal assembly, and brake support plate. Tighten attaching bolts to 35 foot-pounds (47 N•m) torque.

**NOTE:** The oil seal and retainer are located on the outside of the brake support plate.

### End Play Adjustment—CJ and Scrambler Axle Shaft

Axle shaft end play is adjusted at the left side axle shaft only.

(1) Strike end of each axle shaft with lead hammer to seat bearing cups against support plate.

(2) Attach Axle Shaft End Play Tool J-2092 to end of left side axle shaft. Mount dial indicator on support plate or tool, and check end play while pushing and pulling on axle shaft (fig. 2F-23).

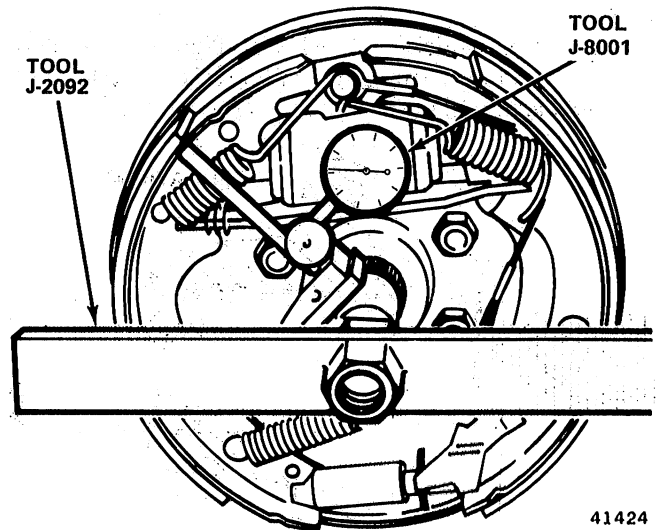


Fig. 2F-23 Measuring Axle Shaft End Play—CJ and Scrambler Models

(3) End play should be 0.004 to 0.008 inch (0.10 to 0.20 mm), 0.006 inch (0.15 mm) is desired.

(4) Add shims to increase end play, or remove shims to decrease end play.

(5) Install axle hub and brakedrum as outlined under Rear Axle Hub—Installation.

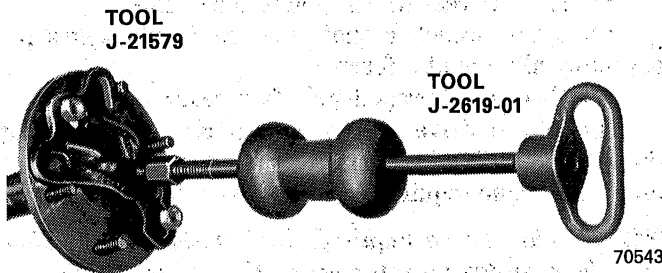
(6) After axle shaft end play is checked and corrected, adjust brakes. Refer to Chapter 2G.



**AXLE SHAFT AND BEARING—CHEROKEE-WAGONEER-TRUCK AXLES**

**Removal—Cherokee-Wagoneer-J-10 Truck**

- (1) Raise and support vehicle and remove wheels.
- (2) Remove brakedrum.
- (3) Remove nuts attaching support plate and retainer to axle tube flange using access hole in axle shaft flange.
- (4) Assemble Adapter Tool J-21579 and Slide Hammer J-2619-01, install tools on axle shaft flange, and remove axle shaft (fig. 2F-24).



**Fig. 2F-24 Axle Shaft Removal—Cherokee-Wagoneer-J-10 Truck**

- (5) If cup portion of wheel bearing assembly remains in axle housing after axle shaft is removed, remove bearing cups using Tools J-2619-01 and J-26941.
- (6) Remove axle shaft oil seal from axle housing tube.

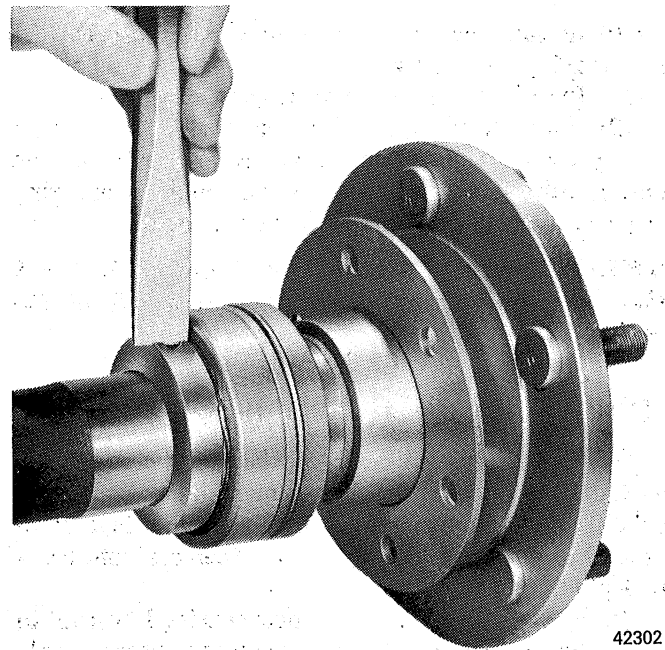
**Axle Shaft Bearing Replacement**

**CAUTION:** Under no circumstances should the axle shaft retaining ring or bearing be removed using a torch. Heat will transfer into the axle shaft bearing journal and weaken it.

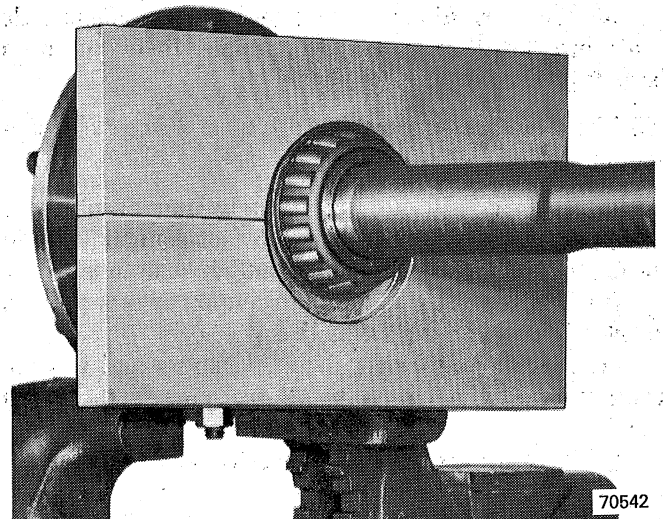
- (1) Mount axle shaft in vise. Use protective jaws on vise to prevent scratching or damaging shaft.
- (2) Drill 1/4 inch (6 mm) diameter hole in retaining ring. Hole depth should be approximately 3/4 of ring thickness.

**CAUTION:** Do not allow drill to contact axle shaft.

- (3) Position chisel over drilled hole in retaining ring. Cut deep groove in retaining ring using chisel. This will enlarge ring, or split it, allowing ring to be removed from axle shaft (fig. 2F-25).
- (4) Slide retaining plate and oil seal toward axle shaft. This provides room for bearing removal tool between seal and bearing.
- (5) Remove axle shaft bearing using arbor press and Tool J-22912-01 or J-23674 (fig. 2F-26).
- (6) Inspect axle shaft bearing and seal surfaces for scratches. Remove scratches using crocus cloth.



**Fig. 2F-25 Notching Bearing Retaining Ring—Cherokee-Wagoneer-J-10 Truck Axle**



**Fig. 2F-26 Axle Shaft Bearing Removal—Cherokee-Wagoneer-J-10 Truck Axle**

- (7) Install retainer plate on axle shaft.
- (8) Pack wheel bearing lubricant in oil seal cavity and between seal lips and install seal on axle shaft seal seat. Outer face of seal must face axle flange.

**NOTE:** Prevent damage to the seal by lubricating seal lips before installation. The seal lips, when seal is installed, must contact the machined portion of the axle shaft only.

- (9) Pack replacement bearing with wheel bearing lubricant. Force lubricant through cup rib ring end until it appears at opposite end, around bearing.

- (10) Install bearing on axle shaft. Be sure cup rib ring is facing axle flange.
- (11) Install bearing retainer ring on axle shaft.
- (12) Using Tool J-22912-01 or J-23674 and arbor press, press axle shaft bearing and retainer ring on axle shaft simultaneously. Be sure bearing and retainer ring are properly seated against axle shaft shoulder.

**NOTE:** When the seal and bearing seat against each other, some lubricant should be forced out of the bearing.

**Installation—Cherokee-Wagoneer-J-10 Truck**

- (1) Clean inner oil seal and bearing bores in axle housing tube and install replacement inner seal using Tool J-25135-01. Next, apply wheel bearing lubricant to seal and to bottom 1/3 of cavity between seal and bearing bore shoulder.

- (2) Apply thin coating of wheel bearing lubricant to outside diameter of wheel bearing cup and outer oil seal.

**CAUTION:** Take care to avoid damaging the oil seal when installing the shaft.

- (3) Insert splined end of shaft into differential side gears and start cup rib rings and seals into axle tube.

- (4) Align retainer plate and bolts and push axle shaft into housing as far as possible. Install nuts on bolts finger-tight only.

**NOTE:** The outer oil seal must be squarely seated against the bearing.

- (5) Tighten all nuts alternately and evenly in a cross pattern to approximately 15 foot-pounds (20 Nm) torque to seal the cup rib ring evenly in axle tube.

- (6) Tighten nuts to final torque of 50 foot-pounds (68 N•m) torque in a cross pattern.

- (7) Install rear brake drum, locknuts and wheels. Tighten rear wheel nuts to 72 foot-pounds (98 N•m) torque.

- (8) Remove supports and lower vehicle.

**Removal—J-20 Truck**

**NOTE:** It is not necessary to raise the wheels in order to remove the axle shafts on Model 60 full-floating rear axles.

- (1) Remove axle flange nuts, lockwashers, and split washers retaining axle shaft flange.
- (2) Remove axle shaft from housing.

**Installation—J-20 Truck**

- (1) Be sure axle flange mating area on hub and axle are clean and free of old gasket material.
- (2) Install replacement flange gasket on hub studs.
- (3) Insert axle shaft into housing.

**NOTE:** It will be necessary to rotate the axle shaft to simultaneously align the shaft splines with the differential gear splines and the flange attaching holes with the hub studs.

- (4) Install split washers, lockwashers, and flange bolts. Tighten bolts.

**PINION SEAL AND YOKE—CJ-SCRAMBLER-CHEROKEE-WAGONEER-J-10 TRUCK**

**Removal**

- (1) Raise and support vehicle.
- (2) Remove rear wheels and brake drums.
- (3) Mark propeller shaft and rear axle yokes for assembly alignment reference.
- (4) Disconnect propeller shaft at rear axle yoke.
- (5) Rotate drive pinion several revolutions using Socket Tool J-22575 and inch-pound torque wrench to measure torque required to turn drive pinion.

**NOTE:** The torque required to turn the drive pinion must be recorded for reference at time of assembly.

- (6) Remove pinion nut using Tool J-8614-01 (fig. 2F-3). Discard pinion nut.
- (7) Mark yoke and pinion for alignment reference at time of assembly.
- (8) Remove yoke using Tools J-8614-01, -02, -03 (fig. 2F-4).
- (9) Inspect seal surface of yoke. If surface is damaged or grooved, replace yoke.
- (10) Remove pinion seal using Tool J-9233 (fig. 2F-27).

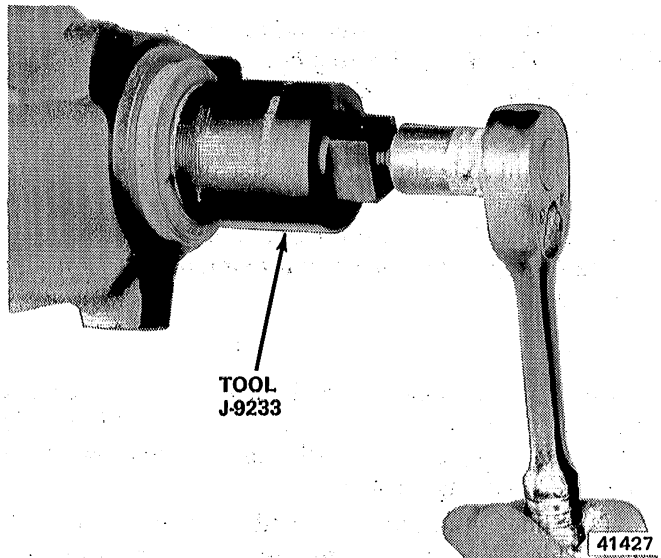


Fig. 2F-27 Pinion Seal Removal

- (11) Before installing replacement seal, coat seal lip with rear axle lubricant.
- (12) Install seal using Tool J-22661 (fig. 2F-28).

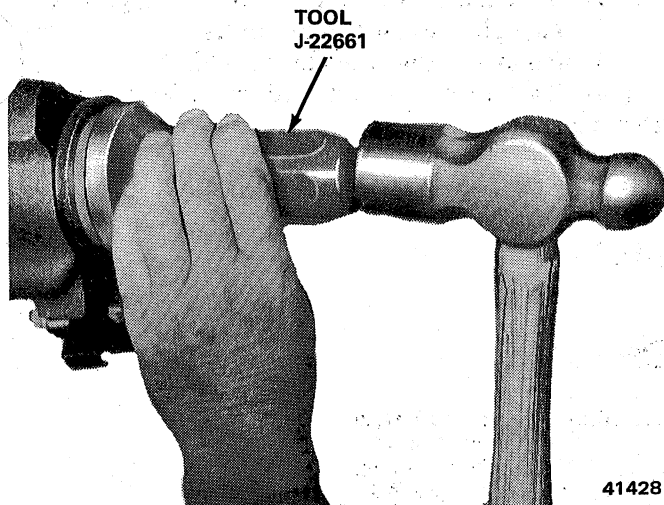


Fig. 2F-28 Pinion Seal Installation

- (13) Install yoke on pinion. Note alignment marks.
- (14) Install replacement pinion nut. Tighten nut using Tools J-8614-01 and J-22575 to remove pinion bearing end play only. **Do not overtighten nut.**
- (15) Check torque required to turn pinion gear. Pinion gear must be turned several revolutions to obtain accurate torque reading. Refer to torque reading recorded during disassembly and add 5 inch-pounds (0.56 N•m) more torque to this amount for correct preload torque.
- (16) If preload torque is less than desired amount, which should equal disassembly torque reading plus 5 inch-pounds (0.56 N•m), tighten pinion nut slightly and recheck torque.
- (17) Repeat gradual tightening procedure until desired torque is attained. **Do not loosen and retighten nut.**

**CAUTION:** Do not overtighten the pinion nut. If the desired torque is exceeded, a replacement collapsible pinion spacer sleeve must be installed and the pinion gear preload reset. Refer to Differential Overhaul.

- (18) Install propeller shaft. Align index marks made at disassembly
- (19) Install rear brake drums and wheels.
- (20) Remove supports and lower vehicle.

## PINION SEAL AND YOKE—MODEL 44 AND 60 AXLE

### Removal

- (1) Raise and support vehicle.
- (2) Index propeller shaft to front yoke for assembly reference and disconnect shaft at yoke.
- (3) Remove pinion nut and washer using Tool J-8614-01 (fig. 2F-3).
- (4) Remove yoke using Tools J-8614-01, -02, -03 (fig. 2F-4).

- (5) Remove pinion seal using Tool J-25180 on Model 44 axle or Tool J-25144 on Model 60 axle.

### Installation

- (1) Install replacement pinion seal using Tool J-25104.
- (2) Install yoke on pinion.
- (3) Install pinion washer and nut. Tighten nut to 210 foot-pounds (285 N•m) torque on Model 44 axle and 260 foot-pounds (352 N•m) torque on Model 60 axle.
- (4) Align index marks on propeller shaft and yoke and install shaft. Tighten strip clamp bolts to 16 foot-pounds (22 N•m) torque or tighten flange bolts to 35 foot-pounds (47 N•m) torque.
- (5) Remove supports and lower vehicle.

### REAR AXLE REMOVAL

- (1) Raise vehicle and position support stands under frame rails just forward of rear springs.
- (2) Remove wheels.
- (3) Mark propeller shaft and axle for assembly alignment reference.
- (4) Disconnect propeller shaft at rear axle yoke.
- (5) Disconnect shock absorbers at axle tubes.
- (6) Disconnect brake hydraulic hose at rear axle tee fitting. Tape ends of hose and fitting to prevent dirt entry.
- (7) Disconnect parking brake cable at equalizer.
- (8) Support axle using hydraulic jack.
- (9) Remove U-bolts. On vehicle with spring-mounted above axle, disconnect spring at rear shackle.
- (10) Slide axle from under vehicle.

### REAR AXLE INSTALLATION

**NOTE:** All service replacement axle assemblies are shipped from the factory without lubricant in the differential. Lubricant must be added to the differential before the axle is installed. Use Jeep Axle Lubricant, or equivalent, marked SAE 85W-90 gear lubricant, grade API GL-5.

When adding differential lubricant, be sure the pinion bearings receive lubricant. Suspend the axle so the axle shafts are in a horizontal position and the yoke end of the pinion housing is facing downward. Then, turn the pinion gear several times so lubricant will reach the pinion bearings.

- (1) Support axle assembly on hydraulic jack and position assembly under vehicle.
- (2) Align springs with axle spring pads, and install U-bolts and nuts. On vehicles with spring mounted above axle, position spring on shackles and install bolts but do not tighten bolts completely.
- (3) Attach brake line hose at tee fitting on top of housing.

- (4) Connect parking brake cables.
- (5) Connect shock absorbers to axle tubes.
- (6) Install propeller shaft. Align reference marks made during removal.
- (7) Bleed and adjust brakes. Refer to Chapter 2G.
- (8) Install brake drums and wheels.
- (9) Remove supports and lower vehicle.
- (10) Check axle lubricant level and add lubricant as necessary.

**SPECIFICATIONS**

**Rear Axle Specifications**

<b>Axle Type:</b>	
Model 60 .....	Drive-type, full-floating axle with flange-type axle.
AMC/Jeep .....	Drive-type, semi-floating axle with tapered axle shaft.
<b>Axle Application:</b>	
Model 60 Rear Axle .....	J-20 Truck
AMC/Jeep Rear Axle .....	CJ, Cherokee, Wagoneer and J-10 Truck
<b>Axle Ring Gear Diameter:</b>	
Model 60 .....	9.750-inches (24.38 cm)
AMC/Jeep .....	8.875-inches (22.19 cm)
<b>Rear Axle Lubricants:</b>	
	Jeep Axle Lubricant or equivalent of SAE 85W-90 A.P.I. Grade GL-5 quality, or axle lubricant grade MIL-L-2105 C
<b>Lubricant Capacity:</b>	
Model 60 .....	6.0 Pints (2.84 liters)
AMC/Jeep .....	4.75 Pints (2.25 liters)

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**Torque Specifications**

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-tightened item.

	USA (ft-lbs)		Metric (N·m)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Axle Hub-To-Shaft Nut (AMC-Jeep Axle)-CJ - Scrambler .....	205 min.	—	278 min.	—
Axle Housing Cover Bolts .....	20	15-25	27	20-34
<b>Brake Support Plate Bolts:</b>				
AMC/Jeep-Cherokee, Wagoneer and J-10 Truck .....	30	25-35	41	34-47
Model 60 .....	50	45-55	68	61-75
AMC/Jeep .....	32	25-40	43	34-47
<b>Pinion Nut:</b>				
Model 60 .....	260	250-270	353	339-366
AMC/Jeep .....	17-25 in-lbs	—	2-3	—
Shock Absorber Lower Stud Nut .....	45	35-50	61	47-68
<b>Spring Clip U-Bolt Nut:</b>				
9/16-18 .....	100	85-105	136	115-142
1/2-20 .....	55	45-65	75	61-88
<b>Spring Shackle Bolt/Nuts:</b>				
CJ-Scrambler .....	24	18-30	33	24-41
Cherokee-Wagoneer-Truck .....	100	80-120	136	115-163
Spring Pivot Bolts/Nuts (All) .....	100	80-120	136	115-163
Styled Wheel Hub Cap .....	32 in-lbs	24-40 in-lbs	4	3-5
Universal Joint Clamp Strap Bolts .....	16	15-19	22	20-26
Universal Joint Flange Bolts/Nuts .....	35	25-45	47	34-61
<b>Wheel Retaining Nuts:</b>				
Model 60 .....	120	110-150	163	149-203
AMC/Jeep .....	80	65-90	108	88-108

All Torque values given in foot-pounds and newton-meters with dry fits unless otherwise specified.

# STANDARD DIFFERENTIAL

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Differential Overhaul—Model 30-44-60 Front/Rear Axles	2F-30

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## GENERAL

CJ and Scrambler models use the Model 30 front axle and an AMC/Jeep rear axle which has tapered axle shafts.

Cherokee, Wagoneer, and J-10 Truck models use the Model 44F front axle and an AMC/Jeep rear axle with flanged axle shafts. Truck models rated at 6800 GVWR (3084 kg) and up use the Model 44F front axle and the Model 60 rear axle with full-floating axle shafts.

The AMC/Jeep rear axles are semi-floating type axles. Only the Model 60 is a full-floating type unit.

## DIFFERENTIAL OPERATION

The differential gear system divides incoming torque between the axle shafts allowing them to rotate at different speeds when turning corners.

Each differential side gear is splined to an axle shaft. The pinion gears are mounted on a pinion mate shaft and are free to rotate on the shaft. The pinion gear is fitted in a bore in the differential case and is positioned at a right angle to the axle shafts.

In operation, power flow occurs as follows: The pinion gear rotates the ring gear. The ring gear, which is bolted to the differential case, rotates the case. The differential pinion gears, which are mounted on the pinion mate shaft, which is fitted in the case, rotate the side gears. The side gears, which are splined to the axle shafts, rotate the shafts.

During straight-ahead driving, the differential pinion gears do not rotate on the pinion mate shaft. This occurs because input torque applied to the gears is divided and distributed equally between the two side gears. As a result, the pinion gears revolve with the pinion mate shaft but do not rotate around it (fig. 2F-29).

When turning corners, the outside wheel must travel a greater distance than the inside wheel in order to complete the turn. This difference must be compensated for in order to prevent the wheels from scuffing and sliding through the turn. To accomplish this, the differential becomes effective allowing the axle shafts to rotate at unequal speeds (fig. 2F-30). In this instance, the input torque applied to the pinion gears is not divided equally. The pinion gears now rotate around the pinion mate shaft in opposite directions. This allows the side gear and axle shaft attached to the outside wheel to rotate at a faster speed.

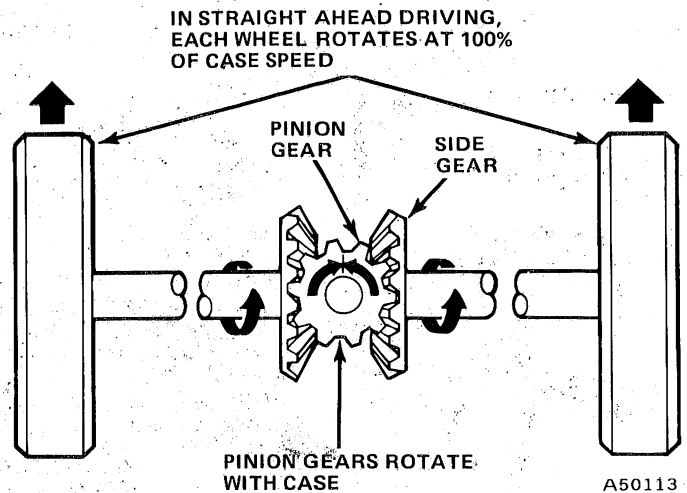


Fig. 2F-29 Differential Operation—Straight Ahead Driving

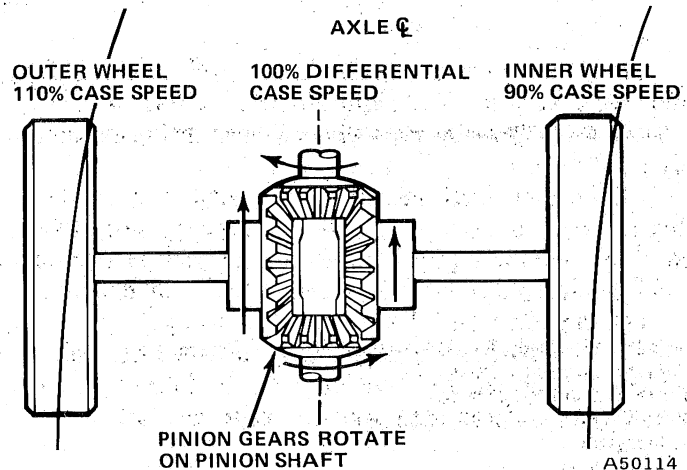


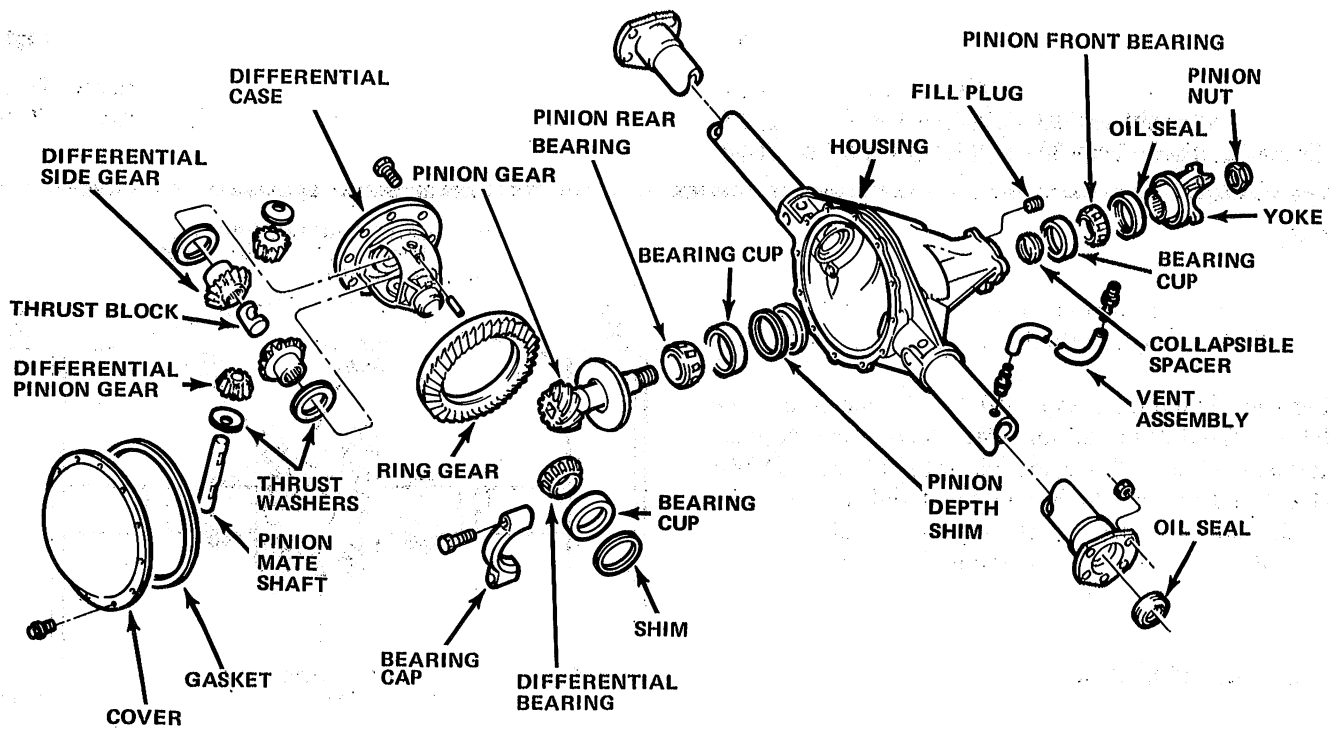
Fig. 2F-30 Differential Operation—On Turns

## DIFFERENTIAL OVERHAUL—AMC/JEEP REAR AXLES

### Differential Disassembly

**NOTE:** It is not necessary to remove the rear axle assembly in order to overhaul the differential. Refer to figure 2F-31 for parts nomenclature during overhaul.

- (1) Remove axle shaft dust caps and retaining nuts.
- (2) Raise and support vehicle.
- (3) Remove axle housing cover and drain lubricant.



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Fig. 2F-31 AMC/Jeep Rear Axle

- (4) Remove wheels, brake drums, hubs, axle shafts, and seals. Keep left and right-side axle parts separated.
- (5) Mark bearing caps with center punch for assembly reference.
- (6) Loosen bearing cap bolts until only several threads are engaged, then pull bearing caps away from bearings. This will prevent differential from falling out and sustaining damage when pried from axle housing.
- (7) Pry differential loose in axle housing.
- (8) Remove bearing caps and remove differential.
- (9) Tie differential bearing shims to their respective bearing caps and cups to prevent misplacement.

**Differential Bearing Removal**

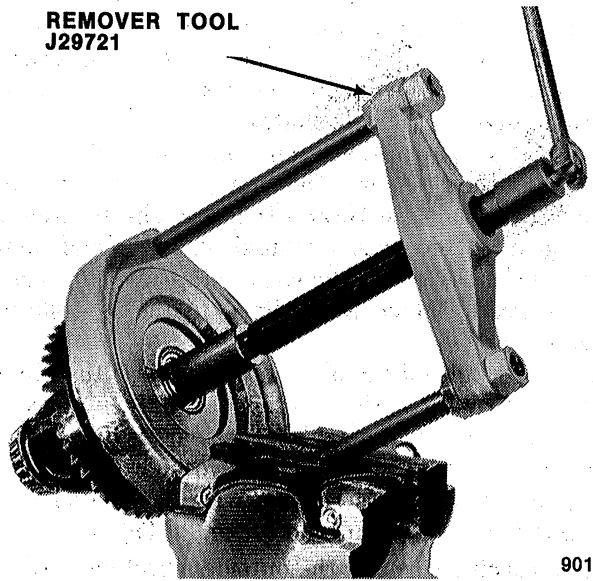
Use Puller J-29721 and adapters to remove the differential bearings (fig. 2F-32). When using this tool, be sure the differential case is secure. When the bearing is removed the differential case can drop if not supported.

**Ring Gear Removal**

- (1) Remove ring gear-to-differential case bolts.
- (2) Remove ring gear from case. Use brass drift and hammer to tap ring gear from case. Do not nick ring gear face of differential case or drop gear.

**CAUTION:** Do not chisel or wedge the gear from the case.

REMOVER TOOL J29721



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Fig. 2F-32 Differential Bearing Removal

**Pinion Mate Shaft Removal**

- (1) Remove pinion mate shaft lockpin using 3/16-inch (5 mm) diameter drift at least 3 inches (8 cm) long (fig. 2F-33).
- (2) Remove pinion mate shaft and remove thrust block (fig. 2F-34).

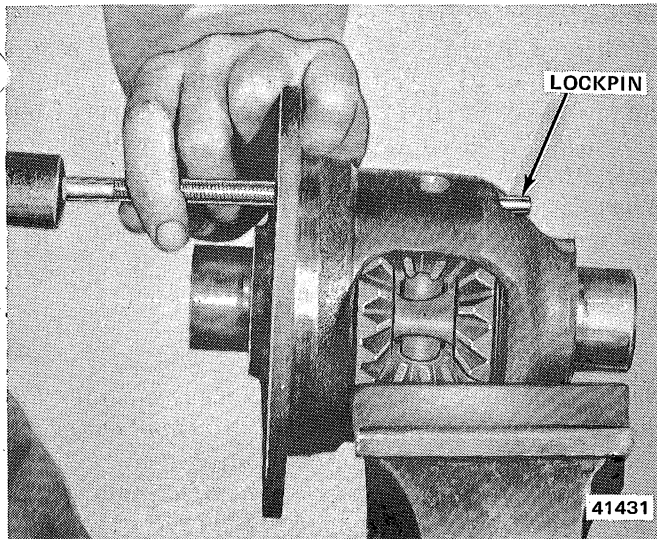


Fig. 2F-33 Pinion Mate Shaft Lockpin Removal

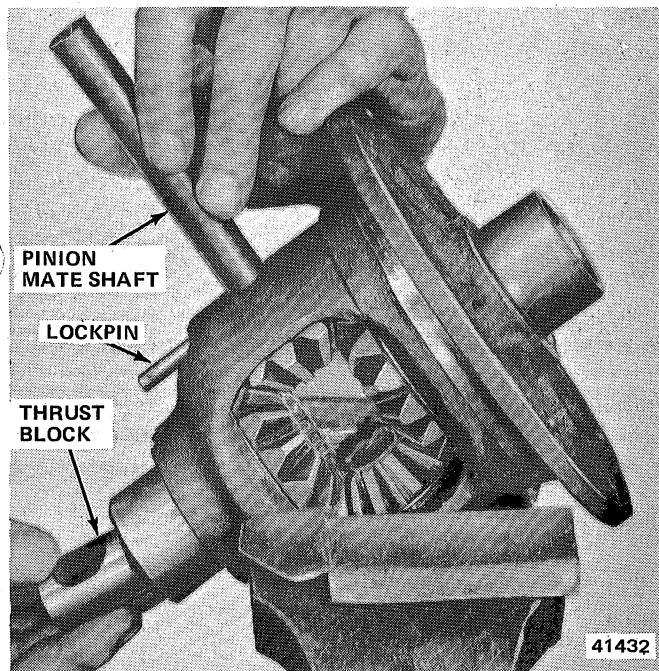


Fig. 2F-34 Pinion Mate Shaft and Thrust Block Removal

(3) Rotate pinion gears on side gears until pinion gears are aligned with case opening. Remove pinion gears and thrust washers and remove side gears and thrust washers.

#### Pinion Gear Removal

- (1) Remove pinion nut using Tool J-8614-01 (fig. 2F-3).
- (2) Remove yoke using Tools J-8614-01, -02, -03 (fig. 2F-4).
- (3) Reinstall axle housing cover to prevent pinion gear from falling out when gear is driven out of bearings and housing. Loosely attach cover using two bolts.

- (4) Remove pinion seal.
- (5) Tap end of pinion gear with rawhide mallet to drive pinion gear out of front bearing. Remove front bearing and collapsible spacer. Discard spacer.

**CAUTION:** The collapsible spacer is used to control pinion bearing preload. Discard this spacer after removal, it is not reusable.

- (6) Remove axle housing cover and remove pinion gear and rear bearing from housing.

#### Pinion Bearing Cup Removal

- (1) Remove rear bearing cup using Tools J-8092 and J-21786.

**NOTE:** The pinion gear depth adjustment shims are located under the rear bearing cup. Tag these shims for assembly reference.

- (2) Remove front bearing cup using Tools J-8092 and J-21787.

**CAUTION:** Keep the bearing cup remover tool seated squarely on the cup to prevent damaging the cup bores during removal.

#### Cleaning and Inspection

Clean all parts in solvent. Allow bearings to air dry. Dry other parts with compressed air.

Inspect the differential bearing cones, cups, and rollers for pitting, galling, flat spots, or cracks.

Inspect the differential case for an elongated or enlarged pinion mate shaft hole. The machined thrust washer surface areas and counterbores must be smooth and free of nicks, gouges, cracks, or burrs. Inspect the differential case for cracks or other visible damage which would necessitate replacement.

Inspect the pinion mate shaft for excessive wear in the contact area of the differential pinions. The shaft should be smooth and concentric and not scored or galled.

Inspect the differential side gears and pinions; they should have smooth teeth with a uniform contact pattern but not display excessive wear or broken surfaces. The side gear and pinion thrust washers should be smooth and free from any scoring or metal pickup.

Inspect the pinion mate shaft lockpin for damage or looseness in the case. Replace the pin or case as necessary.

Inspect the ring and pinion gears for worn or chipped teeth or damaged attaching bolt threads. If replacement is necessary, replace the ring gear and pinion as a matched set only.

Inspect the pinion bearing cones, cups, and rollers for pitting, galling, excessive wear, or other visible damage. Replace any part that exhibits any of these conditions.

Inspect the axle housing for cracks, porosity, bent or loose tubes, or other damage. In addition, if raised metal was created on the pinion bearing cup bore shoulders during cup removal, flatten it using a blunt punch.

Inspect the pinion gear for damaged bearing journals, damaged shim surfaces, or excessively worn splines. If pinion replacement is necessary, replace both the pinion gear and ring gear as a matched set only.

Inspect the pinion yoke for cracks, worn splines, and a pitted, rough, or corroded oil seal contact surface. Repair or replace the yoke as necessary.

Inspect the pinion gear depth adjustment shims for being broken, damaged, or distorted. Replace the shims as necessary before adjusting pinion gear depth.

### Differential Assembly

#### Pinion Gear Installation and Depth Adjustment

Pinion gear depth is the distance (measured in inches) from the end (bottom) face of the pinion gear to the centerline of the axle shafts (fig. 2F-35). This dimension is controlled by shims installed between the pinion gear rear bearing cup and axle housing (fig. 2F-35).

Ring and pinion sets are factory tested to detect machining variances. Tests are started at a standard setting which is then varied to obtain the most desirable tooth contact pattern and quiet operation. When this setting is determined, the ring and pinion gear are etched with identifying numbers (fig. 2F-36).

The ring gear receives one number. The pinion gear receives two numbers which are separated by a plus (+) or minus (-) sign.

The second number on the pinion gear indicates pinion position, in relation to the centerline of the axle shafts, where tooth contact was best and gear operation was quietest. This number represents pinion depth variance and indicates the amount, in thousandths of an inch, that the gear set varied from the standard setting. The number on the ring gear and first number on the pinion gear identify the gears as a matched set. Do not attempt to use a ring and pinion set having differing numbers. This is not a matched set.

The standard setting for AMC/Jeep axles is 2.547 inches (6.46 cm). If the pinion is marked +2, the gear set varied from standard by +0.002 inches (0.05 mm) and will require 0.002 inch (0.05 mm) less shims than a gear

set marked zero (0). When a gear set is marked plus (+), the distance from the pinion end face to the axle shaft centerline must be more than the standard setting. If the pinion gear is marked -3, the gear set varied from standard by 0.003 inches (0.07 mm) and will require 0.003 (0.07 mm) more shims than a set marked zero (0). When a set is marked minus (-), the distance from the pinion end face to the axle shaft centerline must be less than the standard setting. Refer to figure 2F-35 for an illustration of the standard setting dimension.

**NOTE:** On some factory installed gear sets, an additional 0.010 or 0.020 inches (0.25 or 0.50 mm) may have been machined off the pinion gear bottom face. This does not affect gear operation but does affect pinion gear marking and depth measurement. Pinion gears machined in this fashion have different identifying numbers. For example, if the pinion is marked +23, the number 2 indicates that 0.020 (0.050 mm) was removed from the pinion bottom face and the number 3 indicates that variance from the standard setting is +0.003 (0.07 mm). If the pinion is marked +16, the number 1 indicates that 0.010 (0.25 mm) was removed from the pinion bottom face and the number 6 indicates that variance from the standard setting is +0.006 (0.15 mm). Gear sets with additional amounts machined off the pinion bottom face are factory installed items exclusively. All service replacement gear sets will be machined to standard settings only. In addition, replacement gear sets marked + or -0.009 (0.22 mm) or more, or sets with mismatched identifying numbers must be returned to the parts distribution center. Do not attempt to install these gear sets.

#### Pinion Variance Chart

This chart will help to determine the approximate "starter shim" thickness needed for initial pinion depth measurement. However, the chart will not provide the exact shim thickness required for final adjustment and must not be used as a substitute for an actual pinion depth measurement.

To use the chart, proceed as follows:

(a) Measure thickness of original pinion depth shim.

(b) Note pinion depth variance numbers marked on old and new pinion gears.

(c) Refer to Old and New Pinion Marking columns in chart. Chart box where old and new pinion depth variances intersect will provide approximate amount of change required to achieve desired starter shim thickness.



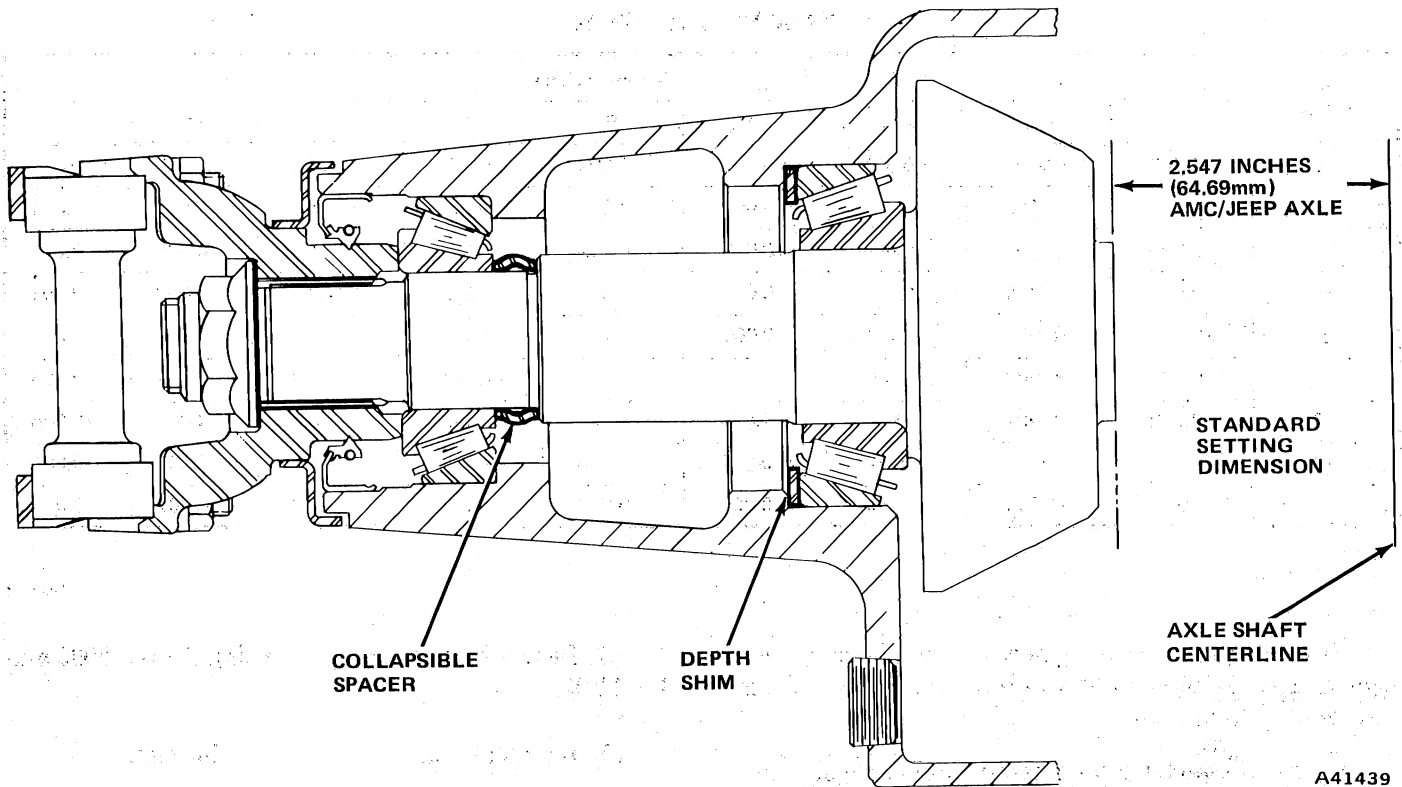


Fig. 2F-35 Standard Setting Dimension and Pinion Depth Shim Location—AMC/Jeep Axle

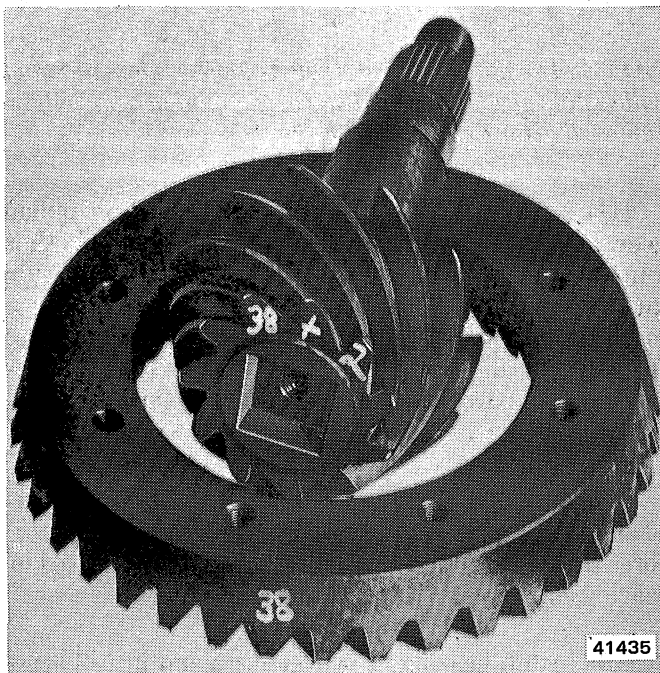


Fig. 2F-36 Ring and Pinion Gear Markings

For example, if the old pinion is marked -3 and the new pinion +2, chart procedure would be as follows: Refer to Old Pinion Marking column at left side of chart and locate -3 figure in this column. Then read to right,

across chart, until under +2 figure in New Pinion Marking column. Box where two columns intersect is amount of shim thickness change required. In this case, the number in the intersecting box is -0.005 (0.12 mm) which represents the amount to be subtracted from the old shim thickness. If the box number had been a + figure, this amount would be added to the old shim thickness.

- (1) Measure thickness of pinion depth shim removed during disassembly.
- (2) Note pinion depth variance numbers marked on old and new pinion gears.
- (3) Refer to Pinion Variance Chart and determine amount to be added or subtracted from original shim for desired starter shim thickness.

**NOTE:** Do not use the starter shim thickness determined by the pinion variance chart as the final shim setting. The actual pinion depth measurement must be performed and final shim thickness adjusted as necessary.

- (4) Install rear bearing on pinion gear with large diameter of bearing cage facing gear end of pinion. Press bearing against rear face of gear.

## Pinion Variance Chart

Old Pinion Marking	New Pinion Marking								
	-4	-3	-2	-1	0	+1	+2	+3	+4
+4	+0.008	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0
+3	+0.007	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001
+2	+0.006	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002
+1	+0.005	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003
0	+0.004	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004
-1	+0.003	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005
-2	+0.002	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006
-3	+0.001	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007
-4	0	-0.001	-0.002	-0.003	-0.004	-0.005	-0.006	-0.007	-0.008

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(5) Clean pinion bearing bores in axle housing thoroughly. This is important to obtaining correct pinion gear depth adjustment.

(6) Install starter pinion depth shim in housing rear bearing cup bore. Be sure shim is centered in bearing cup bore.

**NOTE:** *If the shim is chamfered, be sure the chamfered side faces the bottom of the bearing cup bore.*

(7) Install rear bearing cup using Tools J-8092 and J-8608 (fig. 2F-37).

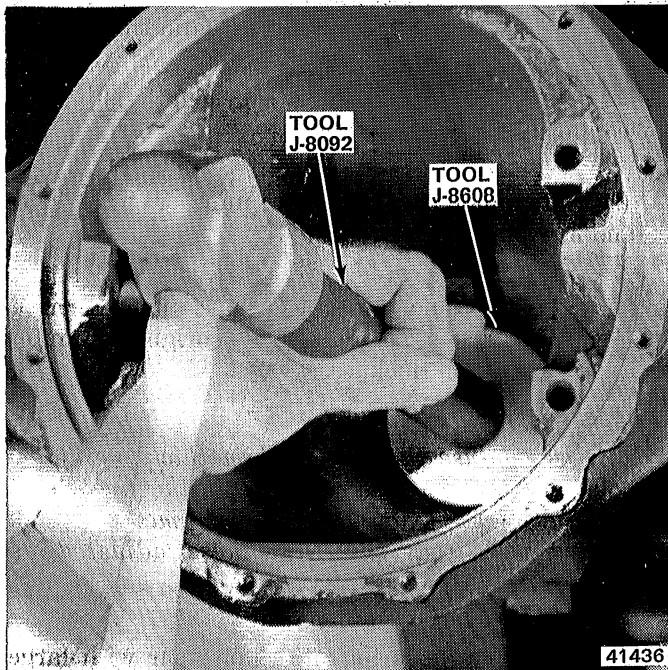


Fig. 2F-37 Pinion Rear Bearing Cup Installation

(8) Install front bearing cup using Tools J-8092 and J-8611-01.

(9) Install pinion gear in rear bearing cup.

(10) Install front bearing, rear universal joint yoke, and original pinion nut on pinion gear. **Tighten pinion nut only enough to remove bearing end play.**

**NOTE:** *Do not install a replacement pinion nut and collapsible spacer at this time as the pinion gear will be removed after depth measurement.*

(11) Note pinion depth variance marked on pinion gear. If number is preceded by a plus (+) sign, add that amount (in thousands) to standard setting for axle model being overhauled. If number is preceded by a minus (-) sign, subtract that amount (in thousandths) from standard setting. Result of this addition or subtraction is **desired pinion depth**. Record this figure for future reference.

(12) Assemble Arbor Tool J-5223-4 and Discs J-5223-23 and install assembled tools in differential bearing cup bores (fig. 2F-38). Be sure discs are completely seated in bearing cup bores.

(13) Install bearing caps over discs and install bearing cap bolts (fig. 2F-38). Tighten bearing cap bolts securely, but not to specified torque.

(14) Position Gauge Block J-5223-20 on end face of pinion gear with anvil end of gauge block seated on gear and gauge plunger underneath Arbor Tool J-5223-4 (fig. 2F-39).

(15) Assemble and mount Clamp J-5223-14 and Bolt J-5223-24 on axle housing (fig. 2F-38). Use axle housing cover bolt to attach clamp to housing.

(16) Extend clamp bolt until it presses against gauge block with enough force to prevent gauge block from moving.

(17) Loosen gauge block thumbscrew to release gauge block plunger. When plunger contacts arbor tool, tighten thumbscrew to lock plunger in position. Do not disturb plunger position.

(18) Remove clamp and bolt assembly from axle housing.

(19) Remove gauge block and measure distance from end of anvil to end of plunger using a 2 to 3 inch (5 to 8 cm) micrometer (fig. 2F-39). This dimension represents the **measured pinion depth**. Record this dimension for assembly reference.

(20) Remove bearing caps and remove arbor tool and discs from axle housing.

(21) Remove pinion gear, rear bearing cup, and pinion depth shim from axle housing.

(22) Measure thickness of depth shim used in step (10). Add this dimension to measured pinion depth obtained in step (8). From this total, subtract desired pinion depth. Result represents correct shim thickness required.

**NOTE:** *The desired pinion depth is the standard setting plus or minus the pinion depth variance.*

(23) Following examples will illustrate procedure for determining correct shim thickness.

**Example I—Pinion Depth Variance is Plus (+)**

**Step 1—Determine desired pinion depth**

Add pinion depth variance (marked on pinion gear) to standard setting. Result is desired pinion depth.

<i>Standard Setting</i> . . . . .	2.547 (6.46 cm)
<i>Pinion Depth Variance</i> . . . . .	+0.007 (0.17 mm)
<i>Desired Pinion Depth</i> =	<u>2.554 (6.48 cm)</u>

**Step 2—Determine total measured pinion depth**

Add measured pinion depth to measured shim thickness. Result is total measured pinion depth.

<i>Measured Pinion Depth</i> . . . . .	2.550 (6.47 cm)
<i>Starter Shim Thickness</i> . . . . .	+0.098 (2.48 mm)
<i>Total Measured Pinion Depth</i> =	<u>2.648 (6.72 cm)</u>

**Step 3—Determine correct shim thickness**

Subtract desired pinion depth from total measured pinion depth. Result is correct shim thickness.

<i>Total Measured Pinion Depth</i> . . . . .	2.648 (6.72 cm)
<i>Desired Pinion Depth</i> . . . . .	-2.554 (6.48 cm)
<i>Correct Shim Thickness</i> =	<u>0.094 (2.38 mm)</u>

**Example II—Pinion Depth Variance is Minus (-)**

**Step 1—Obtain desired pinion depth**

Subtract pinion depth variance (marked on pinion gear) from standard setting. Result is desired pinion depth.

<i>Standard Setting</i> . . . . .	2.547 (6.46 cm)
<i>Pinion Depth Variance</i> . . . . .	-0.003 (0.07 mm)
<i>Desired Pinion Depth</i> =	<u>2.544 (6.46 cm)</u>

**Step 2—Determine total measured pinion depth**

Add measured pinion depth to measured shim thickness. Result equals total measured pinion depth.

<i>Measured Pinion Depth</i> . . . . .	2.542 (6.45 cm)
<i>Starter Shim Thickness</i> . . . . .	+0.096 (2.43 mm)
<i>Total Measured Pinion Depth</i> =	<u>2.638 (6.70 cm)</u>

**Step 3—Determine correct shim thickness**

Subtract desired pinion depth from total measured pinion depth. Result is correct shim thickness.

<i>Total Measured Pinion Depth</i> . . . . .	2.638 (6.70 cm)
<i>Desired Pinion Depth</i> . . . . .	-2.544 (6.46 cm)
<i>Correct Shim Thickness</i> =	<u>0.094 (2.38 mm)</u>

**Pinion Gear Bearing Preload Adjustment**

- (1) Install correct thickness pinion depth shim(s) in axle housing bearing cup bore.
- (2) Install rear bearing cup and pinion gear.
- (3) Install replacement collapsible spacer and front bearing on pinion gear.

**CAUTION:** *The collapsible spacer controls pinion bearing preload. Do not reuse the old spacer. Use a replacement spacer only.*

(4) Install pinion oil seal using tool J-22661 (fig. 2F-28).

(5) Install pinion yoke and replacement pinion nut. **Tighten pinion nut finger-tight only.**

(6) Tighten pinion nut **only enough to remove end play and seat pinion bearings**. Use tool J-22575 to tighten nut and use tool J-8614-01 to hold yoke while tightening nut. Rotate pinion while tightening nut to seat bearings evenly.

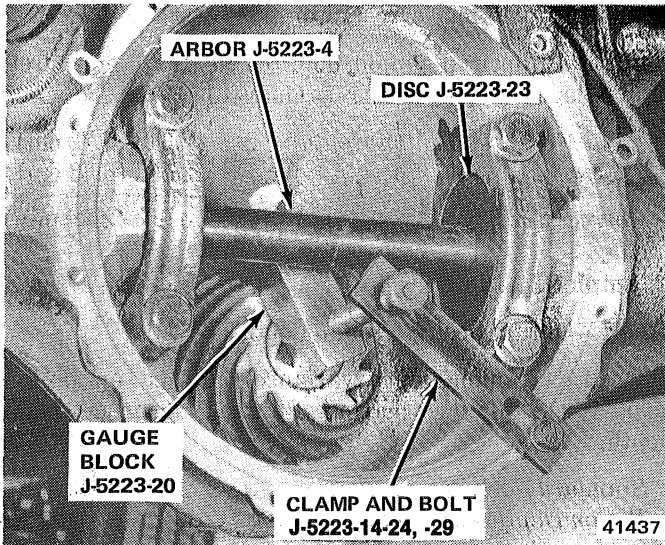


Fig. 2F-38 Installing Pinion Depth Gauge Tools

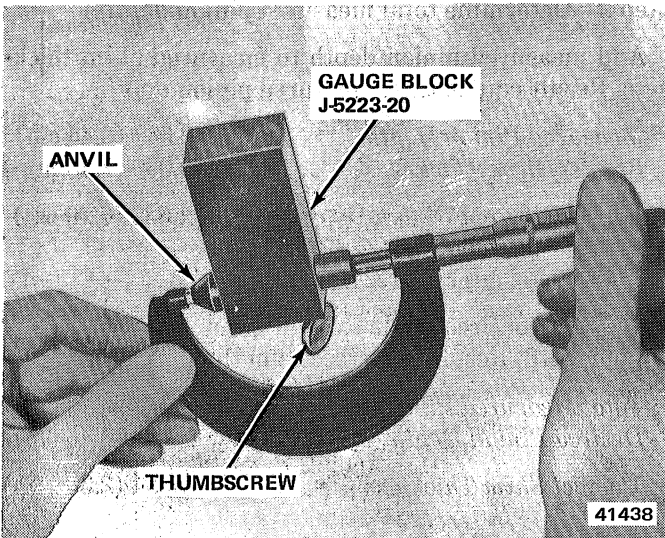


Fig. 2F-39 Measuring Gauge Block

(7) Remove Tools J-8614-01 and J-22575.

(8) Measure torque required to turn pinion gear using an inch-pound torque wrench and Tool J-22575. Correct pinion bearing preload torque is 17 to 25 inch-pounds (2 to 3 N•m) torque. Continue tightening pinion nut until required preload torque is obtained.

**CAUTION:** Do not exceed the specified preload torque and do not loosen the nut to reduce preload torque if the specified torque is exceeded.

(9) If pinion bearing preload torque is exceeded, remove pinion gear, replace collapsible spacer and pinion nut, and adjust preload again.

#### Differential Case Assembly

(1) Install differential bearings on case using Tools J-21784 and J-8092 (fig. 2F-40).

(2) Install thrust washers on differential side gears and install gears in differential case.

(3) Install differential pinion gears in case. Install thrust washers behind pinion gears and align pinion gear bores.

(4) Rotate differential side and pinion gears until pinion mate shaft bores in pinion gears are aligned with shaft bores in case.

(5) Install thrust block in case. Insert block through side gear bore. Align bore in block with pinion mate shaft bores in pinion gears and case.

(6) Install pinion mate shaft. Align lockpin bore in shaft with bore in case and install shaft lockpin.

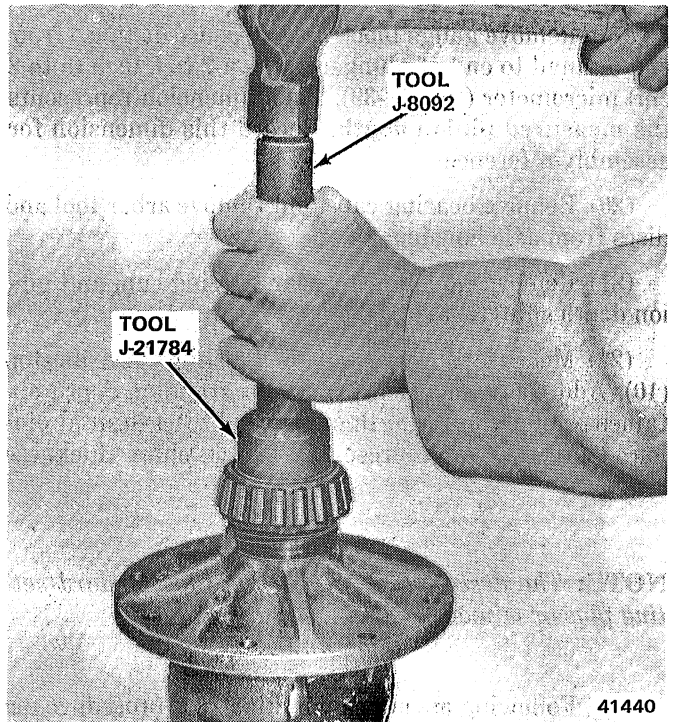


Fig. 2F-40 Differential Bearing Installation

#### Differential Bearing Adjustment

(1) Place bearing cup over each differential bearing and install differential case assembly in axle housing.

(2) Install shim on each side between bearing cup and housing. Use 0.080 inch (2 mm) shims as starting point (fig. 2F-41).

(3) Install bearing caps and tighten bolts finger-tight. Mount Dial Indicator J-8001 on housing (fig. 2F-42).

(4) Using two screwdrivers, pry between shims and housing. Pry assembly to one side and zero indicator then pry assembly to opposite side and read indicator.

**NOTE:** Do not zero or read indicator while prying.

(5) Amount read on indicator is shim thickness that should be added to arrive at zero preload and zero end play. Repeat procedure to ensure accuracy and adjust if necessary.

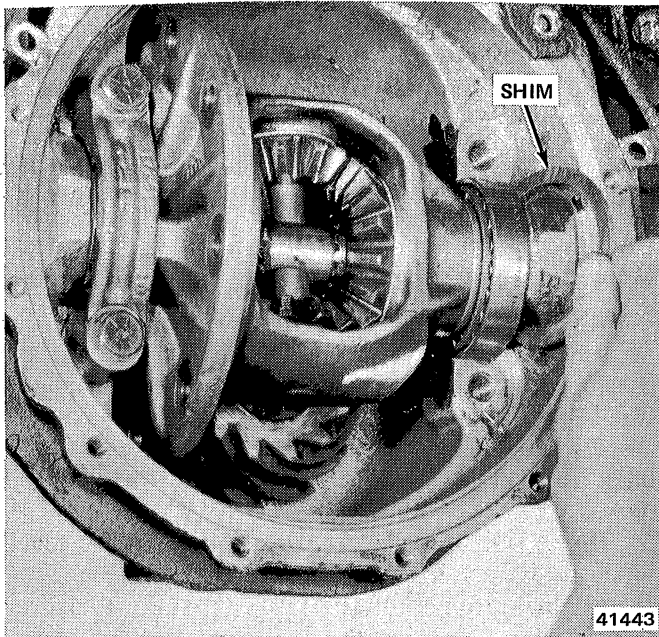


Fig. 2F-41 Adjusting Sideplay

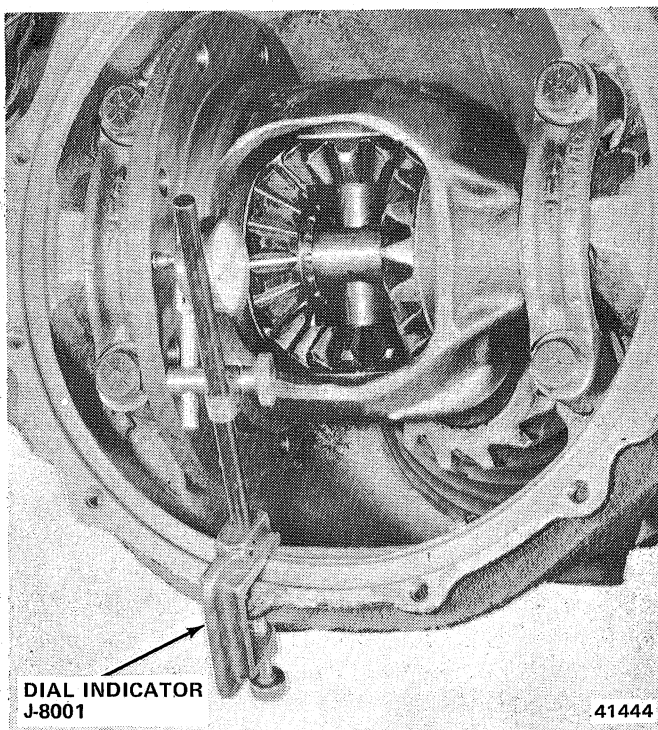


Fig. 2F-42 Checking Ring Gear Mounting Surface of Case for Runout

(6) Shims are available in thicknesses from 0.080 to 0.110 inch (0.25 mm) in 0.002 inch (0.05 mm) increments.

(7) When sideplay is eliminated, a slight bearing drag will be noticed. Install bearing caps and tighten bearing cap bolts to 87 foot-pounds (118 N•m) torque.

(8) Attach dial indicator to axle housing and check ring gear mounting face of differential case for runout (fig. 2F-42). Runout should not exceed 0.002 inch (0.05 mm).

(9) Remove case from housing. Retain shims used to adjust sideplay.

### Ring Gear Installation

(1) Position ring gear on differential case.

(2) Install two ring gear bolts in opposite holes and tighten bolts to pull gear into position.

(3) Install remaining ring gear attaching bolts. Tighten bolts to 55 foot-pounds (75 N•m) torque.

### Ring and Pinion Gear Backlash Adjustment

(1) Position shims previously selected to remove differential bearing sideplay on bearing cups and install differential assembly in axle housing.

(2) Install bearing cap bolts and tighten bolts to 87 foot-pounds (118 N•m) torque.

(3) Attach dial indicator to housing. Position indicator so indicator stylus contacts drive side of a ring gear tooth and at right angle to tooth (fig. 2F-43).

(4) Move ring gear back and forth and note movement registered on dial indicator. Ring gear backlash should be 0.005 to 0.009 inch (0.12 to 0.22 mm), with 0.008 inch (0.20 mm) desired.

(5) Adjust backlash as follows: to increase backlash, install thinner shim on ring gear side and thicker shim on opposite side. To decrease backlash, reverse procedure, however, do not change total thickness of shims.

**Example:** Sideplay was removed using 0.090 inch (2.28 mm) shims on each side totaling 0.180 inch (4.57 mm).

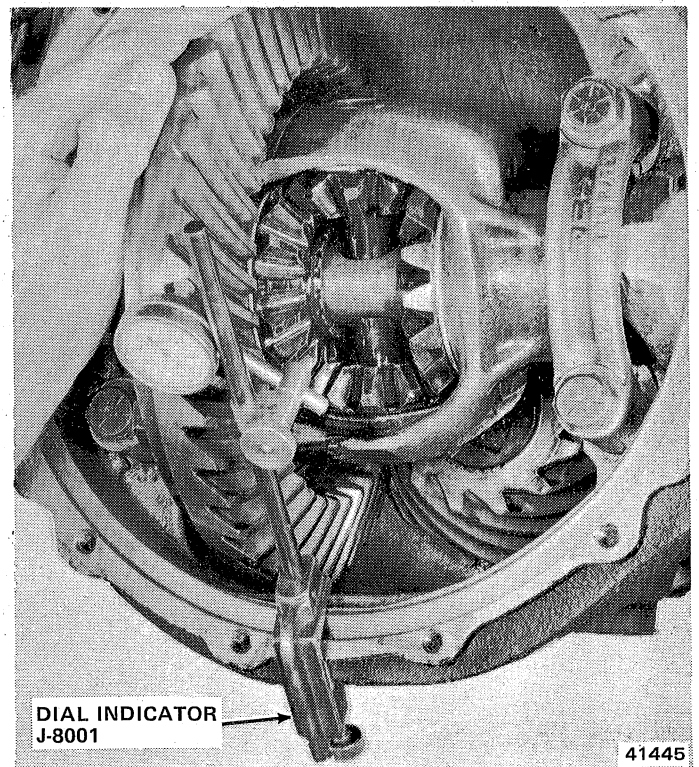


Fig. 2F-43 Checking Backlash

Backlash is checked and found to be 0.011 inch (0.27 mm). To correct backlash, add 0.004 inch (0.10 mm) to shim on ring gear side and subtract 0.004 inch (0.10 mm) from shim on opposite side. This will result in 0.094 inch (2.38 mm) shim on ring gear side and 0.086 inch (2.18 mm) shim on other side. Backlash will be approximately 0.007 to 0.008 inch (0.17 to 0.20 mm). Total shim thickness remains 0.180 inch (4.57 mm).

### Differential Bearing Preload Adjustment

**NOTE:** Differential bearings must be preloaded to compensate for heat and loads during operation. The differential bearings are preloaded by increasing shim pack thickness at each side of the differential by 0.004 inch (0.10 mm) for a total of 0.008 inch (0.20 mm).

(1) Remove differential assembly from housing. Be sure to keep differential bearing shim packs together for proper assembly.

(2) Reinstall differential bearing shims in axle housing bearing bores.

(3) Install differential bearing cups on differential bearings. Cups should cover differential bearing rollers completely.

(4) Position differential assembly in housing so bearings just start into housing bearing bores (fig. 2F-44).

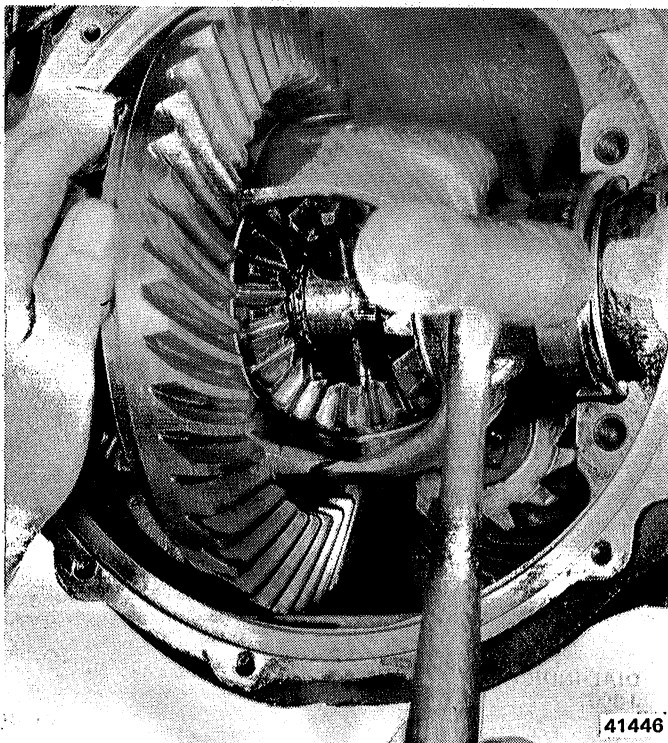


Fig. 2F-44 Differential Installation

**NOTE:** Slightly tipping the bearing cups will ease starting them into the bores. Also keep the differential assembly square in the housing during installation and push it in as far as possible.

(5) Tap outer edge of bearing cups until differential is seated in housing.

**CAUTION:** Do not distort the shims by hammering them into the housing.

(6) Install differential bearing caps. Position caps according to alignment punch marks made at disassembly. Tighten bearing cap bolts to 87 foot-pounds (118 N•m) torque.

(7) Preloading differential bearings may change backlash setting. Check and correct backlash if necessary.

(8) Install propeller shaft, aligning index marks made at disassembly.

(9) Install axle shafts, bearings, seals, and brake support plates.

(10) Fill rear axle with Jeep Axle lubricant or equivalent marked SAE 85W-90, grade API GL-5.

(11) Check and adjust axle shaft end play if necessary. Adjust end play at left side of axle shaft only.

(12) Install hubs, drums, and wheels.

(13) Lower vehicle.

## DIFFERENTIAL OVERHAUL—MODEL 30-44-60 FRONT/REAR AXLES

### Disassembly

**NOTE:** It is not necessary to remove the axle assembly to overhaul the differential. Refer to figures 2F-45 and 2F-46 for parts nomenclature during overhaul.

(1) Raise vehicle, drain lubricant and remove axle shafts.

**NOTE:** On CJ and Scrambler models lower right spring. On Cherokee, Wagoneer and Truck models, lower left spring at front shackle only so spreader tool can be installed.

(2) Remove front shock absorber at tie plate only.

(3) Remove stabilizer bar connecting link to tie plate attaching nut.

(4) Remove U-bolts and tie plate.

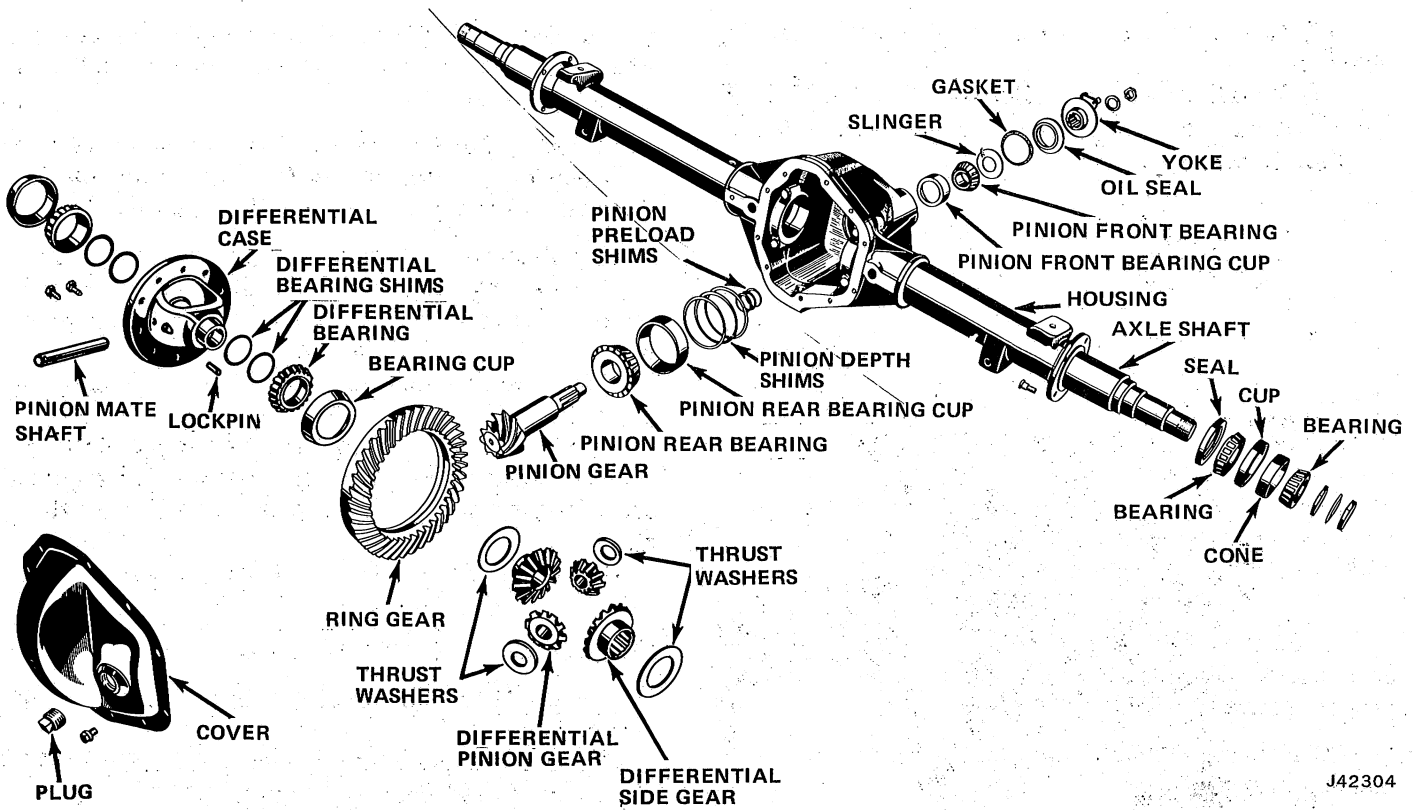
(5) Loosen nuts attaching rear spring shackle to spring.

(6) Support axle housing with jackstand.

(7) Remove bolts attaching spring shackle to spring and lower spring.

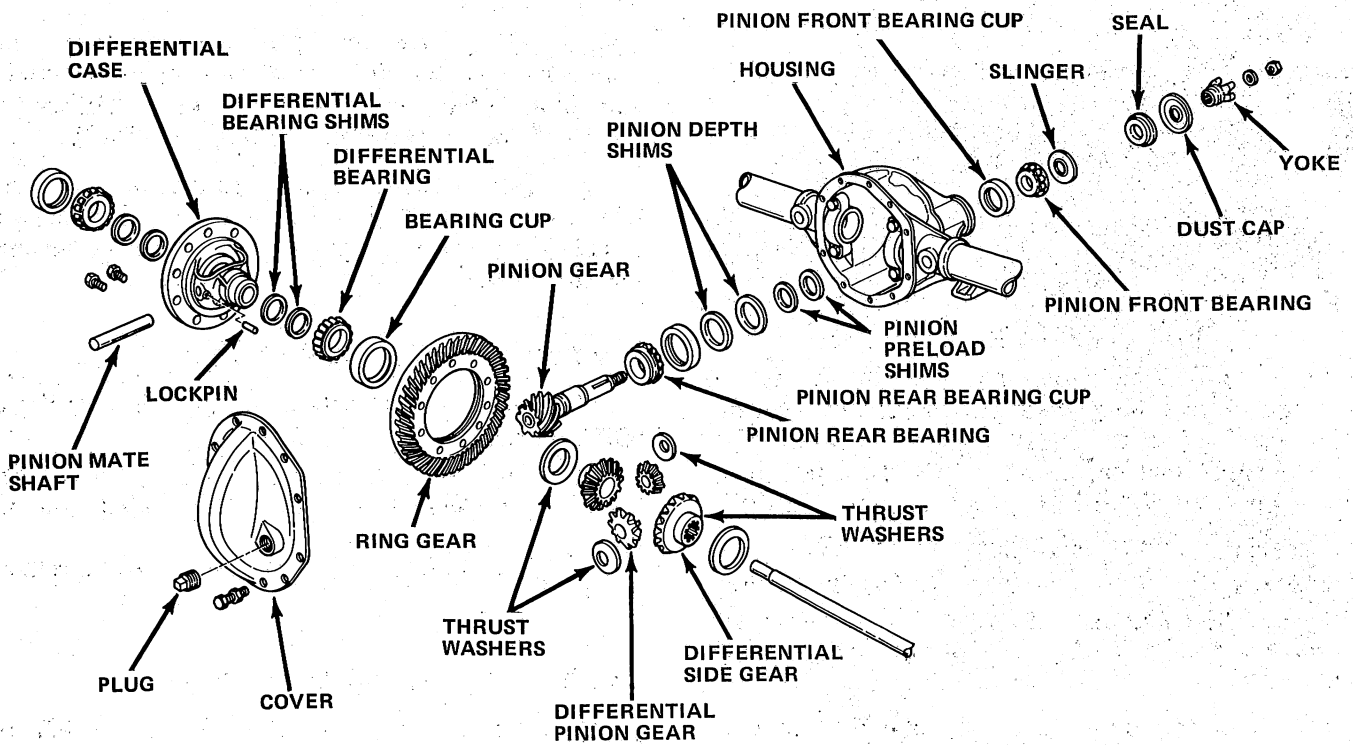
(8) Remove axle housing cover.

(9) Mark differential bearing caps for assembly alignment reference. Use centerpunch to mark caps.



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Fig. 2F-45 Model 60 Rear Axle



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Fig. 2F-46 Model 44 Front Axle

(10) Loosen but do not remove differential bearing cap bolts.

(11) Install Axle Housing Spreader Tool 24385-01. Be sure to install holddown clamps to keep spreader tool in position (fig. 2F-47).

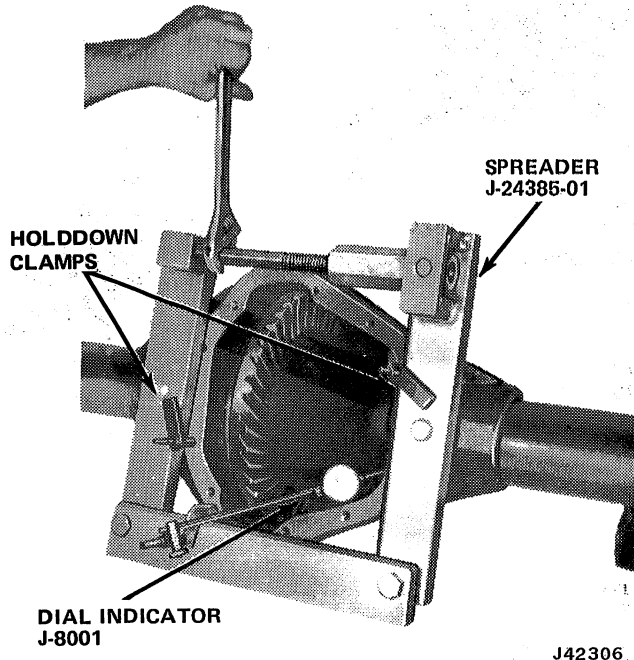


Fig. 2F-47 Spreading Axle Housing

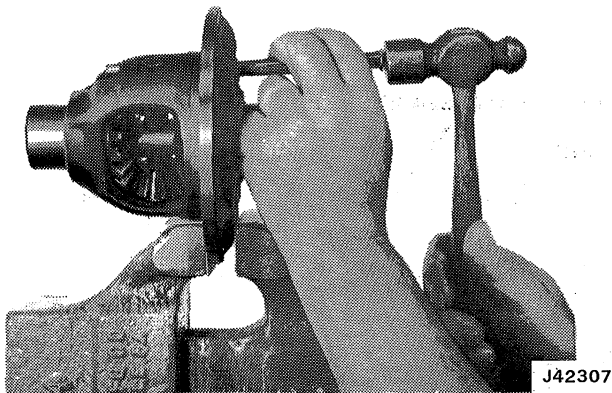


Fig. 2F-48 Pinion Mate Shaft Lockpin Removal

(12) Mount dial indicator on axle housing (fig. 2F-47). Zero indicator and be sure indicator stylus contacts one side of opening in housing.

(13) Spread housing no more than 0.020 inch (0.50 mm) using Tool J-25102. Measure amount housing is spread using dial indicator mounted previously.

**CAUTION:** Do not exceed the specified 0.020 inch (0.50 mm) when spreading the housing. If the housing is over-spread, it could be distorted or damaged necessitating replacement.

(14) When housing has been spread 0.020 inch (0.50 mm), remove dial indicator.

(15) Remove differential bearing caps. Tag caps for assembly reference.

(16) Remove differential assembly using pry bars. Position pry bars under ring gear bolt head and under differential case.

**CAUTION:** Remove the spreader tool immediately after removing the differential to avoid the possibility of distorting the housing or causing it to take a set.

(17) Remove and discard ring gear attaching bolts.

(18) Remove ring gear from differential case using brass drift and hammer. Do not attempt to wedge gear off case as case will be damaged in process.

(19) Remove pinion mate shaft lockpin using small punch (fig. 2F-48).

(20) Remove pinion mate shaft and thrust block.

(21) Rotate pinion gears until gears are aligned with case opening and remove pinion gears and thrust washers.

(22) Remove side gears and thrust washers.

#### Pinion Gear Removal—Model 30-44-60 Axle

(1) Mark propeller shaft for assembly reference and remove shaft.

(2) Remove and discard pinion nut. Use Tool J-8614-01 to hold yoke while removing nut.

(3) Remove pinion yoke using Tools J-8614-01, -02, and -03 (fig. 2F-4).

(4) Remove dust cap from pinion gear.

(5) Remove pinion gear. Strike end of gear using rawhide hammer to force pinion out of pinion rear bearing and housing.

**NOTE:** The pinion bearing preload adjusting shims may remain on the pinion shaft, or stick to the bearing remaining in the housing, or it may fall out. Collect, tag, and retain these shims for assembly (fig. 2F-46).

(6) Remove pinion front bearing, slinger, and seal (fig. 2F-46). Use 2 x 2 (5 x 5 cm) piece of wood or length of pipe to drive bearing, slinger, and seal out of housing. Discard seal after removal.

#### Pinion Rear Bearing Removal—Model 30-44 Axle

(1) Assemble and install Bearing Remover Set J-29721 on bearing and gear (fig. 2F-49).

(2) Insert bearing remover adaptors into remover base from top and position adaptors 180° apart (fig. 2F-49).

(3) Tighten remover tool forcing screw and remove bearing.

#### Pinion Rear Bearing Removal—Model 60 Axle

(1) Install Bearing Remover Tool J-22912-01 on bearing and gear (fig. 2F-50).

(2) Position chamfered edges of remover tool between bearing inner race and pinion head.



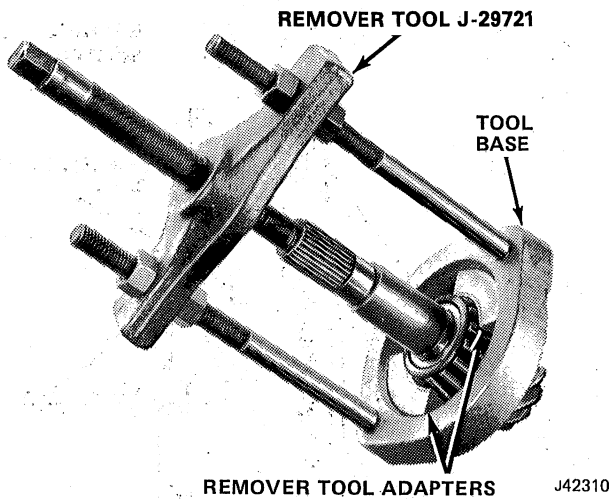
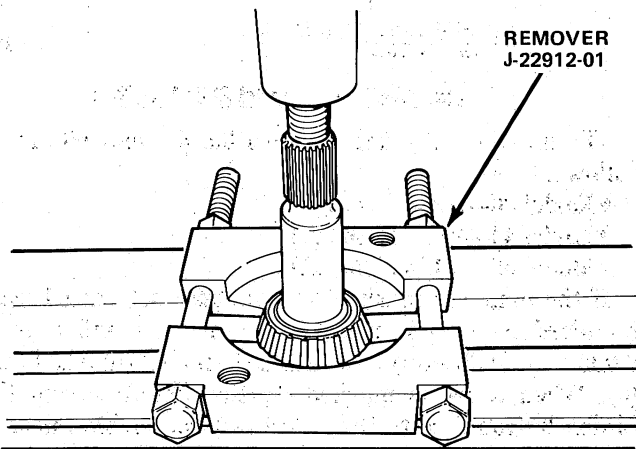


Fig. 2F-49 Pinion Rear Bearing Removal—Model 30-44 Axle



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Fig. 2F-50 Pinion Rear Bearing Removal—Model 60 Axle

(3) Tighten remover tool bolts until chamfered edges of tool are well under bearing race.

(4) Position pinion gear and remover tool in arbor press and press pinion out of bearing.

#### Differential Bearing Removal

(1) Install Bearing Remover Tool J-29721 and adapters on case and bearing (fig. 2F-51).

**NOTE:** Use Remover Tool Adapters J-29721-9 for Model 30, J-29721-8 for Model 44, and J-29721-5 for Model 60.

(2) Position chamfered edge of remover tool adapters between bearing race and case.

(3) Tighten remover tool bolt until chamfered edge of adapters are well under bearing race.

(4) Tighten remover tool forcing screw and remove bearing.

(5) Repeat operations to remove opposite bearing.

**NOTE:** When using this tool, be sure the differential case is secure. When the bearing is removed the differential case can drop if not supported.

#### REMOVER TOOL J-29721

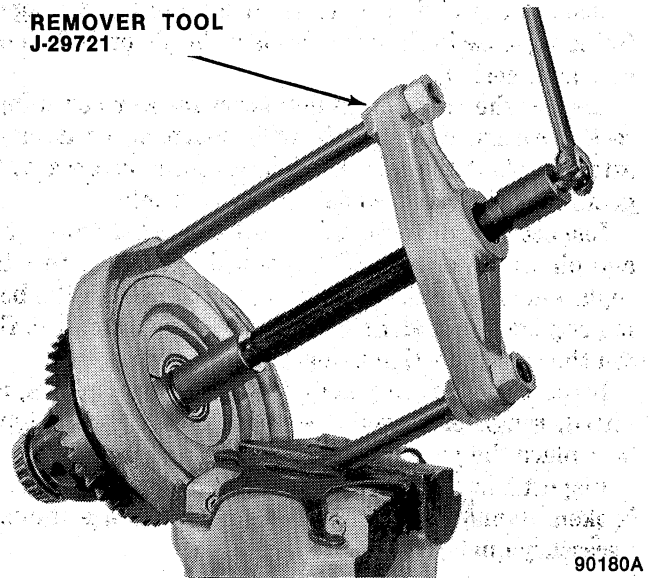


Fig. 2F-51 Differential Bearing Removal—Model 60 Axle

#### Pinion Bearing Cup Removal—Model 30-44-60 Axle

(1) Remove pinion rear bearing cup. Use brass drift and hammer to tap cup out of housing.

(2) Remove pinion depth shims from rear bearing cup bore in housing. Retain shims for assembly reference even if bent or distorted.

(3) Remove pinion front bearing cup. Use brass drift and hammer to tap cup out of housing.

#### Cleaning and Inspection

Clean all parts in solvent. Allow bearings to air dry. Dry other parts with compressed air.

Inspect all bearings and cups for pitting, galling, flat spots, or cracks. Replace any bearing or cup that exhibits any of these conditions.

Inspect the differential case for an elongated, or enlarged pinion mate shaft bore. The machined thrust washer surface areas and counterbores must be smooth and free of nicks, gouges, cracks, or burrs. Inspect the case for cracks or other visible damage. Replace the case if it exhibits any of these conditions.

Inspect the pinion mate shaft for excessive wear, scoring, or galling. The shaft must be smooth and concentric. Replace the shaft if worn or damaged.

Inspect the side gears and pinion gears. All gear teeth must display a uniform contact pattern. Inspect the gears and gear teeth for cracks, scoring, excessive wear, or galling. Replace all the gears if any gear exhibits these conditions. Inspect the side gear and pinion gear thrust washers for wear, scoring, galling, or distortion. Replace the washers if they exhibit any of these conditions.

Inspect the pinion mate shaft lockpin for damage or for being loose in the case. Replace the pin or differential case as necessary.

Inspect the ring and pinion gears for worn or chipped teeth, cracks, damaged bearing journals, or damaged attaching bolt threads. If replacement is necessary, the gears must be replaced as matched set only.

Inspect the differential case for cracks, worn shaft and pin bores, or other damage which might necessitate replacement. If raised metal was produced on the bearing cup bore shoulders during bearing cup removal, flatten the raised portion using a blunt punch.

Inspect the pinion yoke for cracks, worn splines, and pitted, rough or corroded seal contact surfaces. Repair or replace the yoke as necessary.

Inspect the pinion differential bearing shim packs for broken, damaged, or distorted shims. Replace shims as necessary during assembly.

## Differential Assembly

### Pinion Gear Installation and Depth Adjustment

Pinion gear depth is the distance, measured in inches, from the end face of the pinion gear to the axle shaft centerline (fig. 2F-35). This dimension is controlled by shims installed between the pinion rear bearing and axle housing (fig. 2F-52).

Ring and pinion gear sets are factory tested to detect machining variances. Tests are started at a standard setting which is then varied to obtain the most desirable tooth contact pattern and quietest operation. When this setting is determined, identifying numbers are etched on the the ring and pinion (fig. 2F-36).

The ring gear receives one number. The pinion gear receives two numbers which are separated by a + or - sign. The ring gear number and first number on the pinion gear identify the gears as a matched set. Do not attempt to use a set with differing numbers. This is not a matched set.

The second number on the pinion indicates pinion position in relation to the centerline of the axle shafts where tooth contact was best and operation quietest. This number represents pinion depth variance and is the amount, in thousandths of an inch, that the set varied from the standard setting.

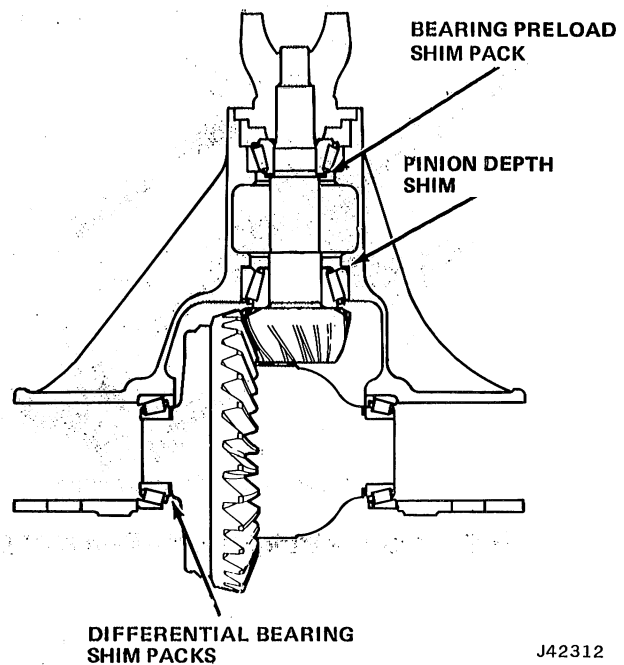


Fig. 2F-52 Differential Shim Locations

The standard for axle Models 30, 44, and 60 are as follows:

- Model 30—2.250 (5.71 cm)
- Model 44—2.625 (6.66 cm)
- Model 60—3.125 (7.93 cm)

If the pinion is marked +2, the gear set varied from standard by +0.002 inch (0.05 mm) and will require 0.002 inch (0.05 mm) less shims than a set marked zero (0). When a set is marked +, the distance from the pinion button face to the axle shaft centerline must be more than the standard setting. If the pinion is marked -3, the set varied from standard by -0.003 inch (0.07 mm) and will require 0.003 (0.07 mm) more shims than a set marked zero. When a set is marked zero, the distance from the pinion button face to the axle shaft centerline must be less than the standard setting. Refer to figure 2F-35 for an illustration of the standard setting dimension.

### Pinion Variance Chart

This chart will help determine the approximate starter shim thickness needed for initial pinion depth measurement. However, the chart will not provide the exact shim thickness required for final adjustment and must not be used as a substitute for an actual pinion depth measurement.

To use the chart, proceed as follows:

- (a) Measure thickness of original pinion depth shim.
- (b) Note pinion depth variance numbers marked on old and new pinion gears.
- (c) Refer to Old and New Pinion Marking columns in chart. Chart box where old and new pinion depth columns intersect is approximate amount of

change required to obtain desired starter shim thickness.

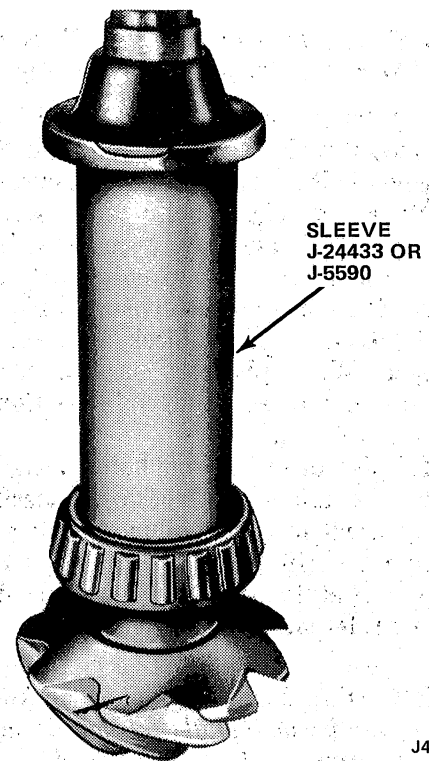
For example, if the old pinion is marked -3 and the new pinion +2, chart procedure would be as follows: Refer to Old Pinion Marking column at left side of chart and locate -3 figure in this column. Then read to right, across chart, until under +2 figure in New Pinion Marking column. Box where the two columns intersect will provide amount of shim thickness required. In this case, the number in the intersecting box is -0.005 (0.12mm) which represents the amount to be subtracted from the original shim thickness. If the box number had been a + figure, this amount would be added to the original shim thickness.

**CAUTION:** *Front axle differentials use an oil slinger between the pinion rear bearing and the pinion head (fig. 2F-1). This slinger must be installed in order to measure and adjust pinion depth correctly.*

- (1) Measure thickness of pinion depth shim removed during disassembly.
- (2) Note pinion depth variance numbers on old and new pinion gears.
- (3) Refer to pinion variance chart and determine amount to be added to or subtracted from original shim to arrive at starter shim thickness.

**CAUTION:** *Do not use or assume that the starter shim thickness will be the final shim setting. An actual pinion depth measurement must be performed and the final shim thickness adjusted as necessary.*

- (4) Install pinion front bearing cup in housing bore using Driver Handle J-7079-02 and Installer J-25101.
- (5) Install starter shim in rear bearing bore of housing. Be sure shim is centered in cup bore. If shim is chamfered, chamfer must face toward housing bore—not toward pinion head.
- (6) Install pinion rear bearing cup in housing bore. On Model 30 axles, install cup using Driver Handle J-7079-02 and Installer J-25101. On Model 44 and 60 axles, install cup using Driver Handle J-25122 and Installer J-25157.
- (7) On front axle differentials, install oil slinger on pinion gear. Be sure slinger is seated on pinion head before installing rear bearing.
- (8) Install rear bearing on pinion. On Model 30 axles install cup using Installer Sleeve J-5590 (fig. 2F-53). On Model 44 and 60 axles, install bearing using Installer Sleeve J-24433 (fig. 2F-53).
- (9) Install pinion gear in axle housing.
- (10) Install pinion front bearing, pinion yoke, washer, and original pinion nut on pinion. Tighten nut only enough to remove end play and provide 10 to 15 inch-pounds (1 to 2 N•m) of drag torque when pinion is rotated.



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**Fig. 2F-53 Pinion Bearing Installation**

**NOTE:** *Do not install the pinion seal, slinger, or dust cap at this time. The pinion will be removed after measuring and adjusting pinion depth.*

(11) Note pinion depth variance marked on pinion gear. If number is preceded by a plus (+) sign, add that amount (in thousands or millimeters) to standard setting for axle model being overhauled. If number is preceded by a minus (-) sign, subtract that amount (in thousands or millimeters) from standard setting. Result of addition or subtraction is desired pinion depth. Record this figure for further reference.

**NOTE:** *If the gear is marked 0 (zero), use the standard setting.*

(12) Assemble Gauge Arbor J-5223-4 and Discs. On Model 30 axles, use Discs J-5223-26. On Model 44 and 60 axles, use Discs J-5223-25.

(13) Install assembled arbor and discs in differential bearing cup bores (fig. 2F-54). Be sure discs are firmly seated in bearing cup bores.

(14) Install differential bearing caps over discs and tighten cap bolts securely, but not to specified torque.

(15) Remove standard plunger from Gauge Block J-5223-20 and install Plunger J-5223-27.

(16) Compress plunger completely and tighten gauge block thumbscrew securely.

(17) Install Gauge Block J-5223-20. Position block so plunger is directly under Arbor J-5223-4 and flat surface on anvil side of block is seated on end face of pinion (fig. 2F-54).

**CAUTION:** To avoid false readings, do not allow the anvil to contact the pinion gear at any point.

(18) Assemble Bolt J-5223-29 and Clamp J-5223-24 and mount tools on axle housing (fig. 2F-54). Use housing cover bolt to attach clamp to housing.

(19) Extend clamp bolt until it presses against gauge block. Align gauge block plunger with center of gauge arbor and tighten clamp bolt until it presses against block with enough force to prevent block from moving.

(20) Loosen gauge block thumbscrew and release plunger. When plunger contacts arbor tool, tighten thumbscrew to lock plunger in position. Do not disturb plunger position.

(21) Remove clamp and bolt from axle housing.

(22) Remove gauge block and measure distance from end of anvil to end of plunger using 3-inch (7.62 cm) micrometer (fig. 2F-55). This dimension represents **measured pinion depth**. Record this dimension for assembly reference.

**NOTE:** If the measured pinion depth equals the desired pinion depth, the installed shim thickness is correct and further adjustment is not required.

(23) Remove bearing caps and remove arbor tool and discs.

(24) Remove pinion gear, rear bearing cup, and depth shim from axle housing.

(25) Measure thickness of depth shim just removed from housing and add this dimension to measured pinion depth obtained in previous step. From this total, subtract desired pinion depth. Result represents shim thickness required to adjust pinion depth.

**NOTE:** The desired pinion depth is the standard setting plus or minus the pinion depth variance.

(26) Following examples illustrate procedure for determining correct shim thickness.

**Example I—Pinion Depth Variance is Plus (+) Model 44 Axle**

Step 1—Determine desired pinion depth.

Add pinion depth variance (marked on pinion gear) to standard setting. Result is desired pinion depth.

Standard Setting . . . . .	2.625 (66.6 mm)
Pinion Depth Variance . . . . .	+0.004 (0.10 mm)
Desired Pinion Depth =	<u>2.629 (66.7 mm)</u>

Step 2—Determine total measured pinion depth.

Add measured pinion depth to measure shim thickness. Result is total measured pinion depth.

Measured Pinion Depth . . . . .	2.601 (66.0 mm)
Starter Shim Thickness . . . . .	+0.107 (2.71 mm)
Total Measured Pinion Depth =	<u>2.708 (68.7 mm)</u>

Step 3—Determine correct shim thickness.

Subtract desired pinion depth from total measured pinion depth. Result is correct shim thickness.

Total Measured Pinion Depth . . . . .	2.708 (68.7 mm)
Desired Pinion Depth . . . . .	<u>-2.629 (66.7 mm)</u>
Correct Shim Thickness =	0.079 (2.00 mm)

**Example II—Pinion Depth Variance is Minus (-) Model 60 Axle**

Step 1—Obtain desired pinion depth.

Subtract pinion depth variance (marked on pinion gear) from standard setting. Result is desired pinion depth.

Standard Setting . . . . .	3.125 (79.3 mm)
Pinion Depth Variance . . . . .	<u>-0.002 (0.05 mm)</u>
Desired Pinion Depth =	3.123 (79.35 mm)

Step 2—Determine total measured pinion depth.

Add measured pinion depth to measured shim thickness. Result equals total measured pinion depth.

Measured Pinion Depth . . . . .	3.120 (79.2 mm)
Starter Shim Thickness . . . . .	<u>+0.100 (2.54 mm)</u>
Total Measured Pinion Depth =	3.220 (81.7 mm)

Step 3—Determine correct shim thickness.

Subtract desired pinion depth from total measured pinion depth. Result is correct shim thickness.

Total Measured Pinion Depth . . . . .	3.220 (81.7 mm)
Desired Pinion Depth . . . . .	<u>-3.123 (79.3 mm)</u>
Correct Shim Thickness =	0.097 (2.46 mm)

(27) Remove pinion gear, rear bearing cup, and starter shim.

(28) Install correct thickness pinion depth shim in housing bearing cup bore and reinstall rear bearing cup.

**Pinion Bearing Preload Adjustment**

(1) Install pinion bearing preload shims.

(2) Install pinion gear, front bearing, oil slinger, if equipped, yoke, washer, and old pinion nut. Tighten nut to 260 foot-pounds (352 N•m) torque.

(3) Measure torque required to rotate pinion gear using 0-50 inch-pound torque wrench. Rotating torque should be 20-40 inch-pounds with new bearings, or 10-20 inch-pounds (1-2 N•m) with original bearings. Add shims to decrease preload or subtract shims to increase preload.

(4) Remove pinion nut, washer, and yoke when pinion bearing preload is adjusted.

(5) Install new pinion oil seal using Tool J-25104 on Model 30 and 44 axles, or Tool J-24384 on Model 60 axles.

(6) Install yoke and pinion washer.

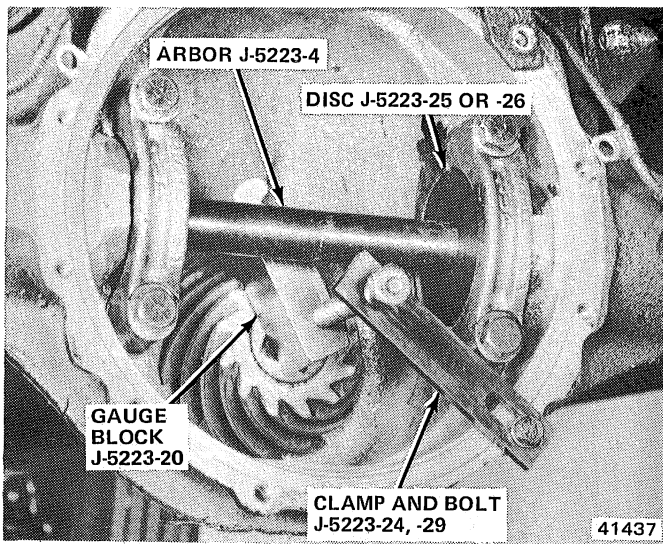


Fig. 2F-54 Installing Pinion Depth Gauge Tools

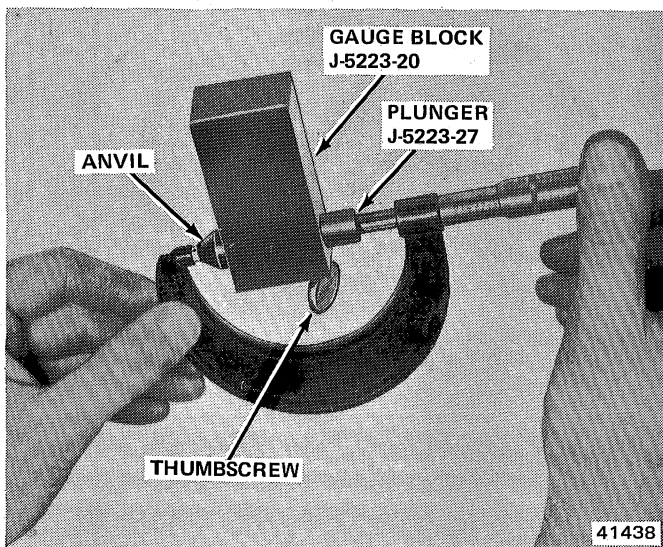


Fig. 2F-55 Measuring Gauge Block

(7) Install new pinion nut. Tighten nut to 210 foot-pounds (285 N•m) torque on Model 30 and 44 axles, and 260 foot-pounds (352 N•m) torque on Model 60 axles.

#### Differential Side Gear Adjustment

- (1) Install thrust washers on side gears and install gears in case.
- (2) Install thrust washers on differential pinion gears and install gears in case.
- (3) Install thrust block and pinion mate shaft pin in case.
- (4) Position differential case on end.
- (5) Tap differential case lightly on flat surface to settle gears into position in case.
- (6) Measure clearance between case and side gears using feeler gauges (fig. 2F-56). Clearance between gears and case must be 0.000 to 0.006 inch (0.00 to 0.15 mm).

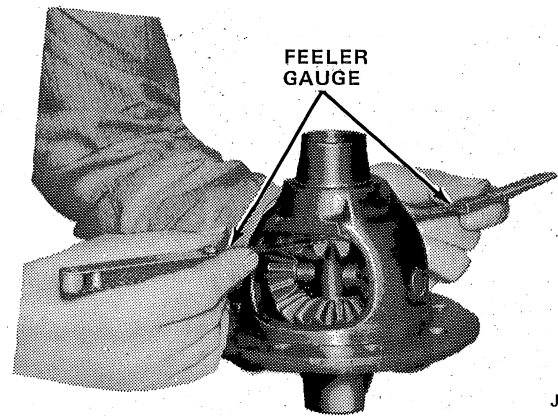


Fig. 2F-56 Checking Side Gear Clearance

(7) If clearance between gears and case exceeds 0.006 inch, replace complete differential case.

**NOTE:** Shims are no longer available.

(8) If differential case is replaced, check side gear clearance again.

(9) Install ring gear on differential case and start two bolts in holes 180 degrees apart. Tighten bolts evenly to seat ring gear.

(10) Install remaining bolts and tighten to 55 foot-pounds (74 N•m) torque.

#### Differential Bearing Preload and Ring Gear Backlash Adjustment

**NOTE:** Differential bearing preload is controlled by shims located between the differential case and bearings.

(1) Remove old differential bearing shims if not removed previously.

(2) Install differential bearings. On Model 30 and 44 axles, install bearings using Driver Handle J-7079-02 and Installer J-22175 (fig. 2F-57). On Model 60 axles, install bearings using Driver Handle and Installer J-24430.

(3) Install bearing cups on differential bearings.

(4) Install differential in axle housing.

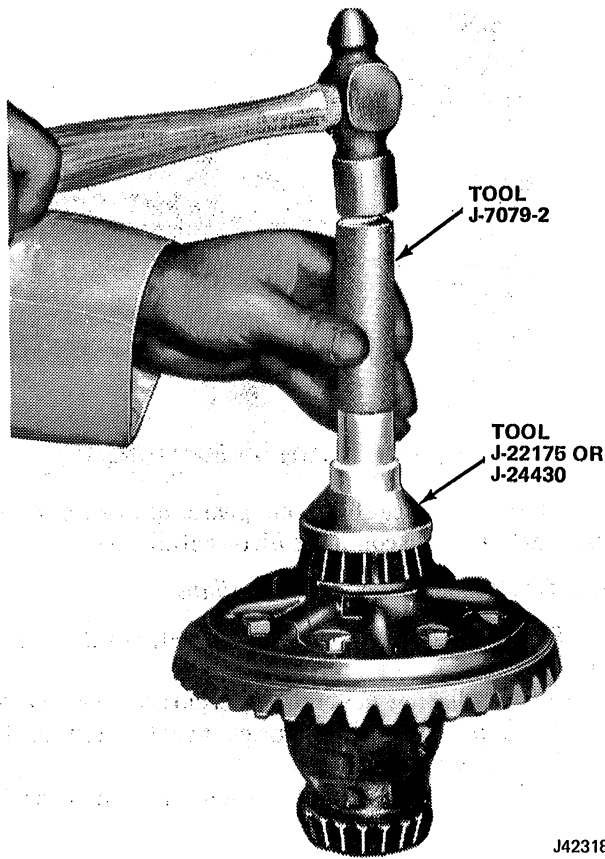
(5) Install bearing caps and tighten cap bolts securely but not to specified torque.

(6) Hold ring gear in contact with pinion gear and pry differential bearing cups toward center of case using screwdriver.

(7) Insert various thickness feeler gauges between each bearing cup and axle housing until ring gear backlash is 0.001 to 0.002 inch (0.02 to 0.05 mm) with feeler gauges installed. Feeler gauges must be installed at both sides of differential and at same time to obtain accurate measurement.

(8) Assemble shim pack that will provide desired backlash. Check backlash again. If OK, tag and retain shims for assembly.

(9) Remove differential case.



J42318

**Fig. 2F-57 Differential Bearing Installation**

(10) Add additional 0.015 inch (0.38 mm) thickness shim to shim pack to be installed on tooth side of ring gear.

(11) Remove differential bearings. Refer to removal procedures outlined in Differential Assembly.

(12) Install shim packs on appropriate sides of differential case and reinstall differential bearings. On Model 30 and 44 axles, install bearings using Tools J-7079-2 and J-22175. On Model 60 axles, install bearings using Tool J-24430 (fig. 2F-57).

**NOTE:** When overhauling a front axle differential, check the axle housing inner oil seals. If seal replacement is required, install replacement seals using Tool J-28648 (fig. 2F-58).

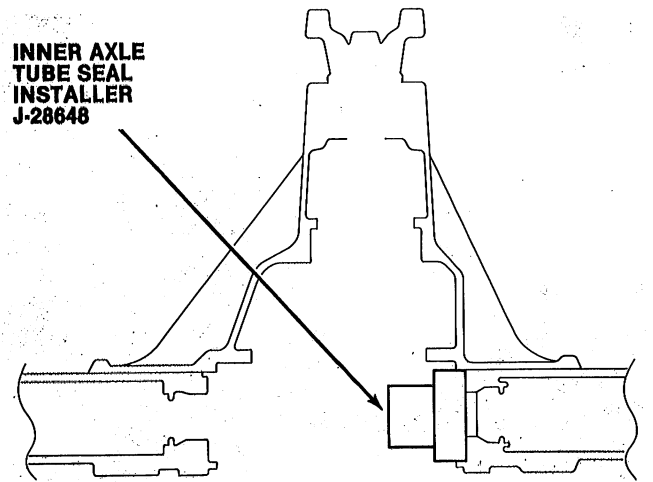
(13) Mount Spreader Tool J-25102 and Dial Indicator J-8001 on housing. Spread housing no more than 0.020 inch (0.50 mm) (fig 2F-47). Do not exceed 0.020 inch (0.50 mm) to avoid damaging housing.

(14) Remove dial indicator when housing has been spread desired amount.

(15) Lubricate differential bearings with axle lubricant and install differential bearing cups on bearings.

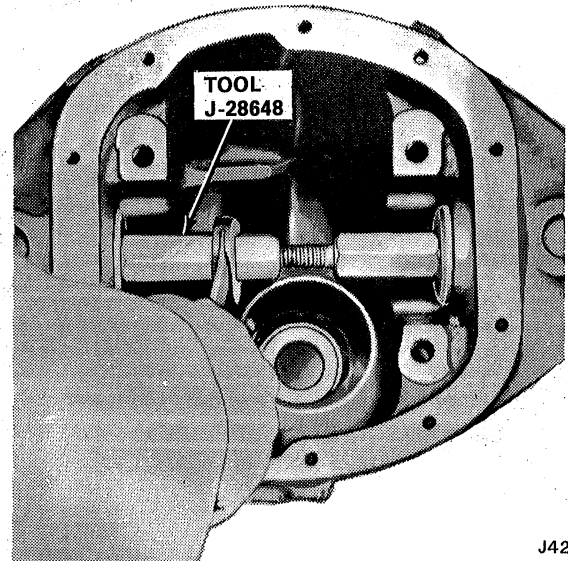
(16) Install differential in housing. Use rawhide mallet to seat differential. Be sure ring and pinion gear teeth mesh completely.

(17) Remove axle housing spreader tool.



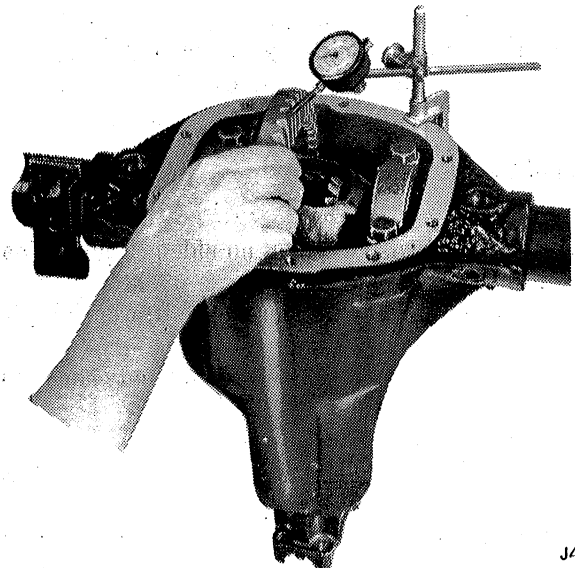
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**Inner Axle Tube Seal Installer - Models 44 and 60**



J42319

**Fig. 2F-58 Front Axle Housing Inner Oil Seal Installation**



J42320

**Fig. 2F-59 Measuring Ring Gear Backlash**

(18) Apply sealing compound to bearing cap bolt threads and install bolts. Tighten bolts to 40 foot-pounds (54 N•m) torque on Model 30 axle, or to 80 foot-pounds (108 N•m) torque on Model 44 and 60 axles.

(19) Remount Dial Indicator J-8001 on housing and measure ring gear backlash (fig. 2F-59). Measure backlash at two points. Backlash should be 0.005 to 0.010 inch (0.12 to 0.25 mm). If backlash is incorrect, add or subtract shims from differential bearing shim packs until correct backlash is obtained.

**NOTE:** Changing the position of a 0.005 inch (0.12 mm) shim from one side to the other will change the amount of backlash approximately 0.003 inch (0.07 mm).

(20) Measure ring gear runout. If runout exceeds 0.006 inch (0.15 mm), case may be distorted, or there is dirt between case and gear, or ring gear bolts are loose. Check and correct as necessary.

(21) Raise spring and install front spring shackle to spring attaching bolts.

(22) Remove jack stand.

(23) Install tie plate and U-bolts. Tighten U-bolt nuts as follows:

1/2-20—55 foot-pounds (75 N•m)

9/16-18—100 foot-pounds (136 N•m)

(24) Tighten spring shackle to spring attaching bolts on CJ and Scrambler models to 24 foot-pounds (33 N•m) torque. Cherokee, Wagoneer and Truck model bolts should be tightened to 100 foot-pounds (136 N•m) torque.

(25) Install stabilizer bar link to tie plate attaching nut.

(26) Install shock absorber. Tighten shock absorber to tie plate retaining nut to 45 foot-pounds (61 N•m) torque.

(27) Install axle shafts.

(28) Install axle housing cover. On Model 44 and 60 axles, clean cover and housing mating surfaces and apply thin bead of Jeep Gasket-In-A-Tube, or equivalent, silicone sealer to housing and cover before installation.

## SPECIFICATIONS

### Differential Specifications

	USA	Metric
<b>Model 30 Front Axle</b>		
Differential Bearing Preload . . . . .	.015 in	0.38 mm
Differential Side Gear-to-Case Clearance . . . . .	.000-.006 in	0.000-0.15 mm
Ring Gear . . . . .	.005-.009 in	0.12-0.22 mm
Pinion Bearing Break-Away Preload		
Original Bearings . . . . .	15-25 in-lbs.	2-3 N•m
New Bearings . . . . .	20-40 in-lbs.	2-5 N•m
<b>Model 44 Axle</b>		
Differential Bearing Preload . . . . .	0.15 in	0.38 mm
Differential Side Gear-to-Case Clearance . . . . .	.000-.006 in	0.000-0.15 mm
Ring Gear Backlash . . . . .	.005-.010 in	0.12-0.25 mm
Pinion Bearing Break-Away Preload		
Original Bearings . . . . .	10-20 in-lbs.	1-2 N•m
New Bearings . . . . .	20-40 in-lbs.	2-5 N•m
<b>Model 60 Axle</b>		
Differential Bearing Preload . . . . .	.015 in	0.38 mm
Differential Side Gear-to-Case Clearance . . . . .	.000-.006 in	0.000-0.15 mm
Drive Gear-to-Pinion Backlash . . . . .	.005-.009 in	0.12-0.15 mm
Drive Pinion Bearing Break-Away		
Original Bearings . . . . .	10-20 in-lbs.	1-2 N•m
New Bearings . . . . .	20-40 in-lbs.	2-5 N•m
<b>AMC/Jeep Axle</b>		
Axle Shaft End Play (Shims — Left Side Only) - CJ - Scrambler . . . . .	.004-.008 in (.006 in desired)	0.10-0.20 mm (0.15 mm desired)
Pinion Bearing Preload (Collapsible Sleeve) . . . . .	17-25 in-lbs.	2-3 N•m
Differential Bearing Preload (Shims) . . . . .	.008 in	0.20 mm
Differential Case Flange Runout (Inspection only — no adjustment) . . . . .	.002 in max.	0.05 mm max.
Ring Gear Backlash (Shims) . . . . .	.005-.009 in (.008 in desired)	0.12-0.15 mm (0.20 mm desired)
Pinion Gear Standard Setting (Shims) . . . . .	2.547 in	64-69 mm

**Differential Torque Specifications**

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-tightened item.

	USA (ft-lbs)		Metric (N·m)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
<b>Model 30 Front Axle</b>				
Axle Housing Cover Bolts	20	15-25	27	20-34
Differential Bearing Cap Bolts	40	35-50	54	47-68
Ring Gear-to-Case Bolts	55	45-65	75	61-88
Lower Ball Stud Nut	80 min.	—	108 min.	—
Pinion Nut	210	200-220	271	285-298
Universal Joint U-Bolts	15	13-18	20	18-24
Upper Ball Stud Nut	100 min.	—	136 min.	—
Upper Ball Stud Seat	50 min.	—	68 min.	—
Wheel-to-Hub Nuts	80	65-90	108	88-122
<b>Model 60 Axle</b>				
Axle Housing Cover Bolts	20	15-25	27	20-34
Support Plate Bolts/Nuts	50	45-55	68	61-75
Differential Bearing Cap Bolts	80	70-90	108	95-122
Ring Gear-to-Case Bolts	106	100-110	142	135-149
Pinion Nut	260	250-270	352	339-366
Universal Joint Strap Bolts	15	13-18	20	18-24
Wheel-to-Hub Nuts	120	110-125	163	149-169
<b>AMC/Jeep Axle</b>				
Axle Housing Cover Bolts	170 in-lbs	150-190 in-lbs	19	17-21
Brake Tube-to-Rear Wheel Cylinder	97 in-lbs	90-105 in-lbs	11	10-12
Differential Bearing Cap Bolts	87	80-95	10	9-11
Ring Gear-to-Case Bolt	105	95-115	142	135-149
Rear Brake Support Plate Bolts	32	25-40	43	34-54
Axle Shaft-to-Hub Nuts-CJ	250 min.	250 min.	339 min.	—
Clamp Strap Bolts	16	15-19	18	14-24

All Torque values given in foot-pounds and newton-meters with dry fits unless otherwise specified.

60657A

# TRAC-LOK DIFFERENTIAL

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## GENERAL

The Trac-Lok limited slip differential is available as an option on Jeep vehicles equipped with the Model 208 or 300 transfer case only. Trac-Lok is used in rear axles only and is not available on vehicles equipped with Quadra-Trac. Two Trac-Lok units are used. Model 60 axles use a slightly different unit than is used in AMC/Jeep rear axles. Refer to the Overhaul section for servicing procedures.

## OPERATION

In a conventional differential, torque applied to the ring gear is transmitted to the axle shafts through the differential gears. During normal operation, torque transmitted to each axle shaft is equal at all times. However, if one wheel slips, the opposite wheel will generate only as much torque as the slipping wheel.

With Trac-Lok, part of the ring gear torque is transmitted through clutch packs located between the differential side gears and case. The clutch packs contain multiple disc clutches which have radial grooves on the plates and concentric grooves on the discs.



In operation, the Trac-Lok clutches are engaged by two concurrent forces. The first being preload force exerted through Belleville springs contained within the clutch packs and the second is from separating forces generated by the side gears as torque is applied through the ring gear.

The Trac-Lok design provides the normal differential action needed for turning corners and for the transmittal of equal torque to both wheels when driving straight ahead. However, when one wheel loses traction and spins, the clutch packs transfer additional torque to the wheel having the most traction. Trac-Lok differentials resist wheel spin on bumpy roads and provide more pulling power when one wheel loses traction. Pulling power is provided continuously until both wheels lose traction. If both wheels slip due to unequal traction, Trac-Lok operation is normal. In extreme cases of differences in traction, the wheel with the least traction may spin after the Trac-Lok has transferred as much torque as possible to the nonslipping wheel.

## LUBRICATION

Use Jeep axle lubricant, or equivalent marked SAE 85W-90, grade GL-5 in Trac-Lok axles. In addition, the only acceptable method for cleaning the Trac-Lok differential is by disassembling the unit and wiping it clean using shop towels.

**NOTE:** *The Trac-Lok differential is serviced at the same time intervals as the standard differential.*

## Trac-Lok Lubricant Change

(1) Warm axle lubricant. Operate vehicle in gear, on hoist, with wheels off floor for minimum of 5 minutes at 30 mph.

**WARNING:** *Never attempt to operate a Trac-Lok equipped vehicle in gear with only one wheel raised. The vehicle could propel itself off the jack and cause damage or personal injury.*

(2) Stop engine and raise vehicle on hoist.

(3) Remove axle housing cover drain plug or cover and drain lubricant while it is warm. If cover is removed, discard cover gasket.

(4) Remove any residual lubricant from axle housing using shop cloths.

(5) Install drain plug. If axle housing cover was removed, clean cover and housing mating surfaces and apply Jeep Gasket-In-A-Tube, or equivalent sealer to cover and housing mating surfaces. Install cover and cover bolts. Tighten cover bolts to 20 foot-pounds (27 N•m) torque.

(6) Refill axle housing with specified lubricant only. Refer to Specifications for lubricant capacities of various axle models.

(7) Operate vehicle on road for approximately ten miles (16 km). Make at least ten figure eight turns to flush old lubricant out of clutch packs.

(8) Return vehicle to shop and raise vehicle on hoist.

(9) Drain and replace axle lubricant again. If axle housing cover is removed, be sure to clean cover and housing mating surfaces and reapply Jeep Gasket-In-A-Tube, or equivalent sealer to mating surfaces before reinstalling cover.

(10) Lower vehicle.

(11) Road test vehicle and verify proper Trac-Lok operation.

**NOTE:** *If a slight chatter occurs after flushing and refilling the Trac-Lok differential, drive the vehicle an additional ten to twenty miles (16 to 32 km) or until chatter stops. If the chatter persists after twenty (32 km) or more miles of driving, an overhaul may be necessary.*

## DIAGNOSIS

If noisy or rough operation such as chatter occurs when turning corners, the most probable cause is incorrect or contaminated lubricant. Before removing the Trac-Lok unit for repair, drain, flush, and refill the axle with the specified lubricant. Refer to the lubricant change procedure under Lubrication. A complete lubricant drain and refill with the specified lubricant will usually correct chatter.

## Trac-Lok Operational Test

Trac-Lok operation can be checked quickly using the following test.

(1) Position one wheel on solid, dry pavement and opposite wheel on ice, mud, grease, or similiar low traction surface.

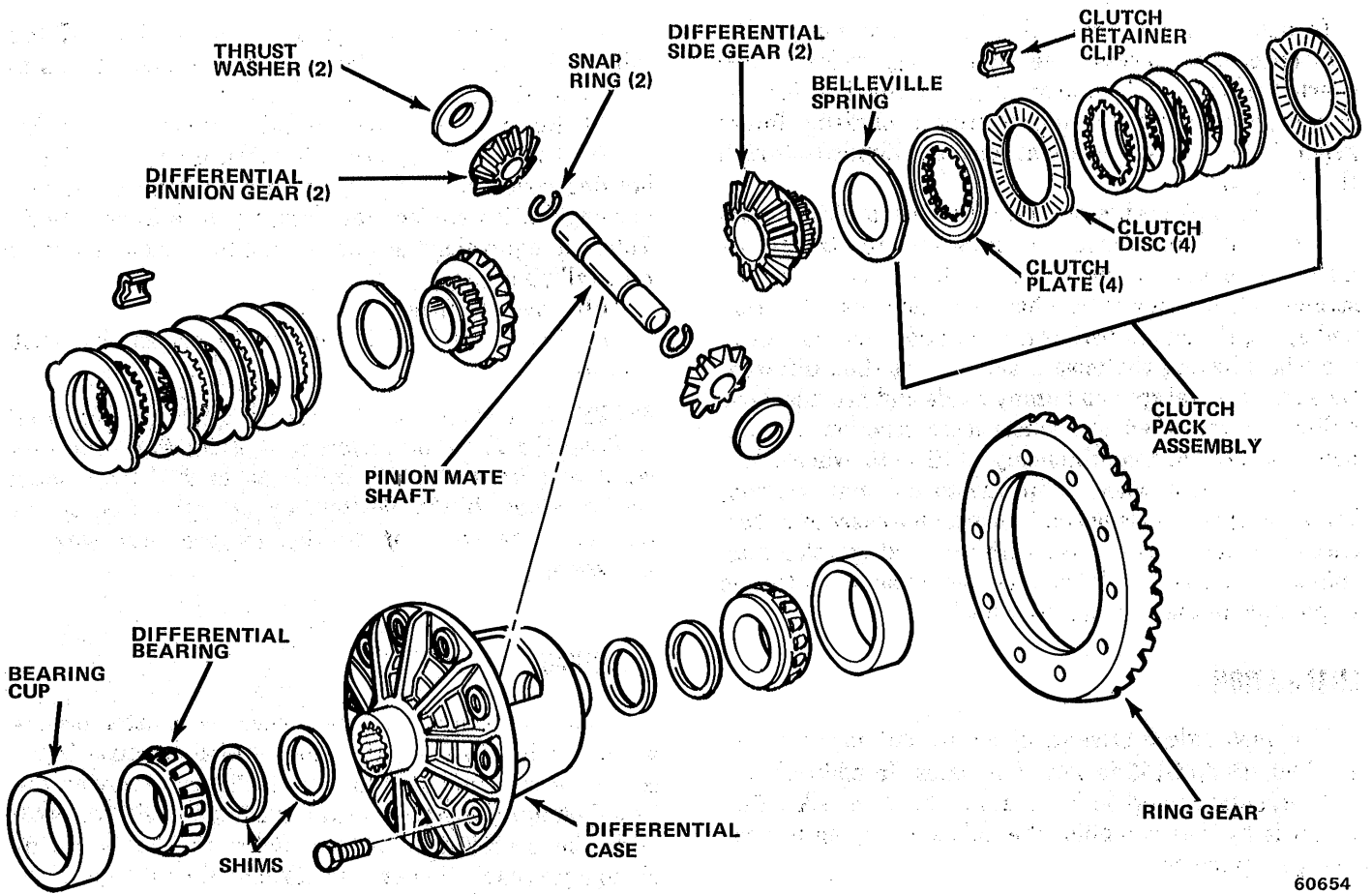
(2) Increase engine rpm gradually to obtain maximum traction prior to breakaway. Ability to move vehicle effectively will demonstrate proper performance.

**NOTE:** *If the test is performed on extremely slick surfaces such as ice or grease coated surfaces, some question may exist as to proper performance. In these extreme cases, a properly performing Trac-Lok will provide greater pulling power by lightly applying the parking brake.*

## OVERHAUL

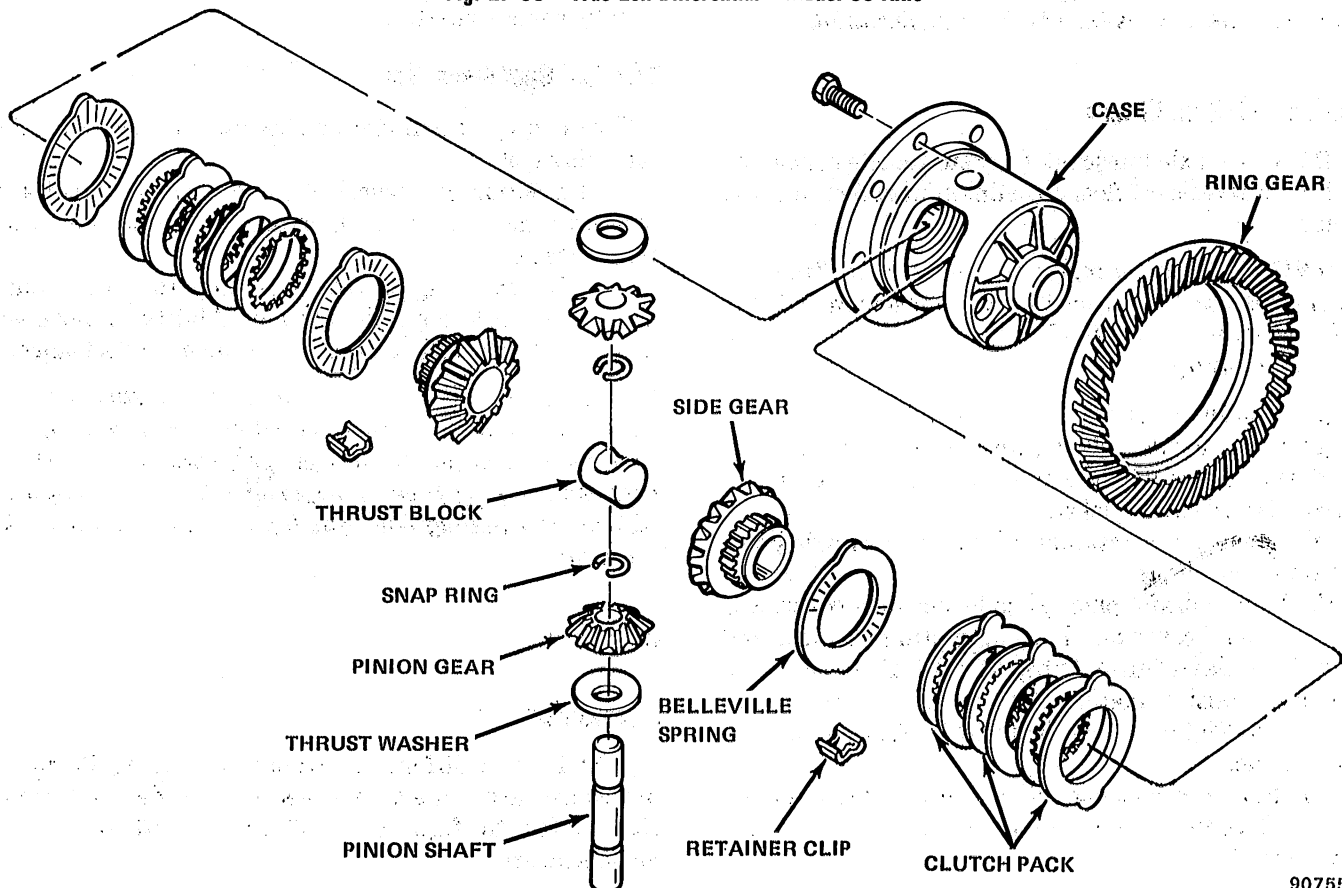
### Disassembly

(1) Remove differential from axle housing. Removal procedures are same as outlined for standard differential. Refer to figures 2F-60 and 2F-61 for parts nomenclature.



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Fig. 2F-60 Trac-Lok Differential—Model 60 Axle



90755

Fig. 2F-61 Trac-Lok Differential—AMC/Jeep Axle

(2) Install one axle shaft in vise with spline end facing upward and tighten vise. Do not allow more than 2-3/4 inch (7 cm) of shaft to extend above top of vise (fig. 2F-62). This prevents shaft from fully entering side gear, causing interference with step plate tool used to remove differential gears.

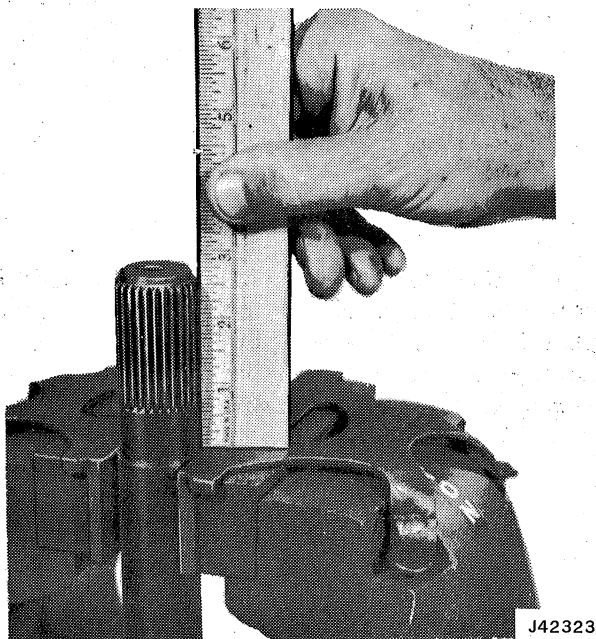


Fig. 2F-62 Axle Shaft Positioned in Vise

(3) Mount differential case on axle shaft with ring gear bolt heads facing upward (fig. 2F-63).

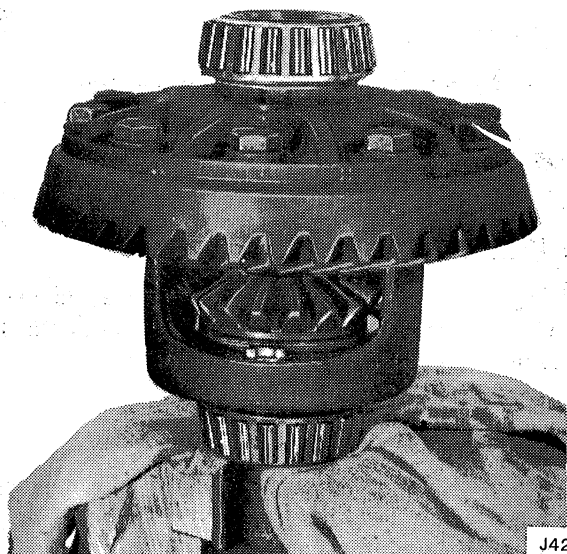


Fig. 2F-63 Differential Mounted on Axle Shaft

(4) Remove and discard ring gear bolts.  
 (5) Place shop towels under ring gear to protect gear when it is removed from case (fig. 2F-63).  
 (6) Remove ring gear from case using rawhide hammer.

(7) Remove differential case from axle shaft and remove ring gear.

(8) Remount differential case on axle shaft.

(9) Remove snap rings from pinion mate shaft (fig. 2F-64). Use two screwdrivers to disengage snap rings. Place shop towel on opposite opening of case to prevent snap rings from flying out of case.

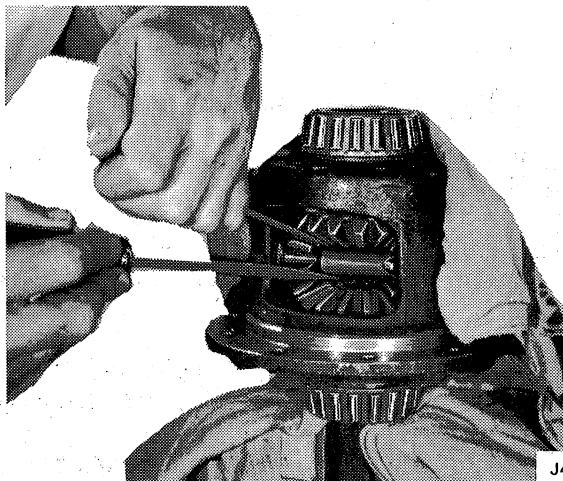


Fig. 2F-64 Pinion Mate Shaft Snap Ring Removal

**NOTE:** On the Model 60 Trac-Lok, the pinion mate shaft is retained in the case by a roll pin. Use a 3/16 inch (5 mm) diameter pin punch to remove this pin.

(10) Remove pinion mate shaft using hammer and brass drift.

**NOTE:** Gear Rotating Tool J-23781 is required to perform the following steps. The tool consists of three parts: gear rotating tool, forcing screw, and step plate.

(11) Install step plate in lower differential side gear (fig. 2F-65).

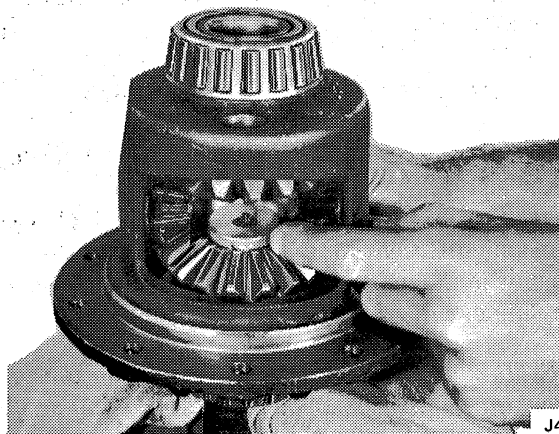


Fig. 2F-65 Step Plate Installation

(12) Position pawl end of gear rotating tool on step plate (fig. 2F-66).

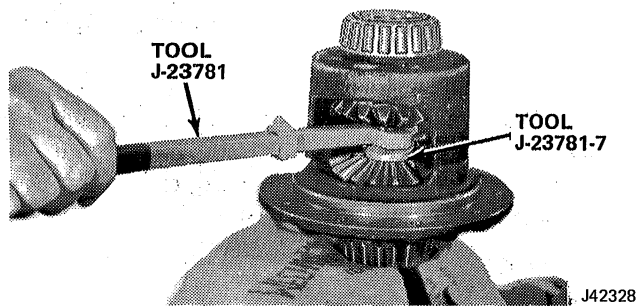


Fig. 2F-66 Gear Rotating Tool Installation

(13) Insert forcing screw through top of case and thread into gear rotating tool.

**NOTE:** Before using forcing screw, apply dab of grease to centering hole in step plate and oil threads of forcing screw.

(14) Center forcing screw in step plate and tighten screw to move differential side gears away from differential pinion gears.

(15) Remove differential pinion gear thrust washers using feeler gauge or shim stock of 0.030 inch thickness (0.76 mm). Insert shim stock or gauge between washer and case and withdraw shim stock and thrust washer (fig. 2F-67).

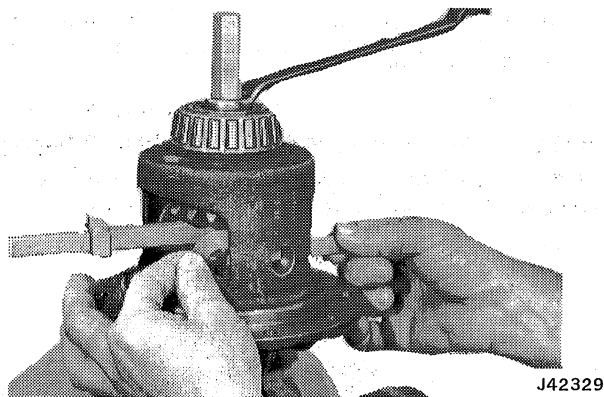


Fig. 2F-67 Pinion Thrust Washer Removal

(16) Tighten forcing screw until a slight movement of differential pinion gears is observed.

(17) Insert pawl end of gear rotating tool between teeth of one differential side gear. Pull handle of tool to rotate side gears and pinion gears. Remove pinion gears as they appear in case opening (fig. 2F-68).

**NOTE:** It may be necessary to adjust the tension applied on the Belleville springs by the forcing screw before the gears can be rotated in the case.

(18) Retain upper side gear and clutch pack in case by holding hand on bottom of rotating tool while removing forcing screw. Remove rotating tool, upper side gear, and clutch pack.

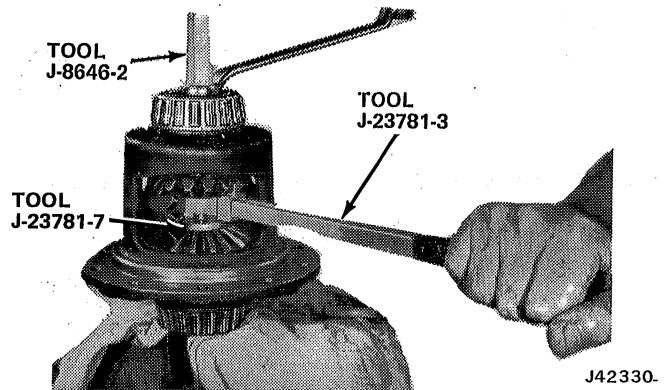


Fig. 2F-68 Pinion Gear Removal

(19) Remove differential case from axle shaft. Invert case with flange or ring gear side up and remove step plate tool, lower side gear, and clutch pack from case. Remove retainer clips from both clutch packs to allow separation of plates and discs (fig. 2F-69).

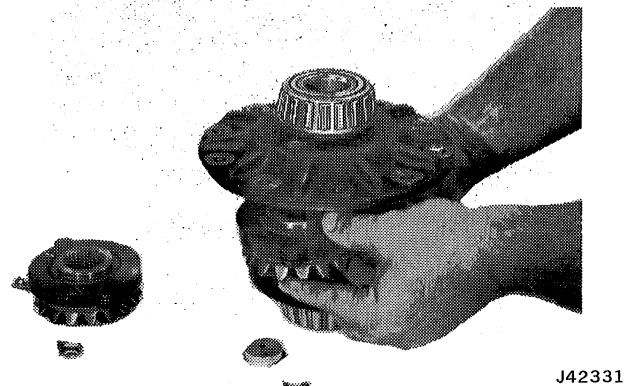


Fig. 2F-69 Side Gear and Clutch Pack Removal

## Inspection

### Clutch Plates and Disc

If any one member of either clutch pack shows evidence of excessive wear or scoring, the complete clutch pack must be replaced on both sides.

### Differential Side and Pinion Gears

The gear teeth should be checked for extreme wear or possible cracks. The external teeth of the side gear which holds the clutch pack also should be checked for wear or cracks. If replacement of one gear is required due to wear, both side gears, pinion gears, and thrust washers must be replaced.

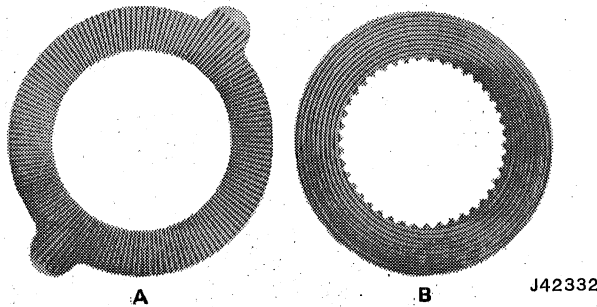
### Pinion Mate Shaft

If excessive wear is evident on any one of the retainer clips, all clips should be replaced.

**Differential Case**

If scoring, wear, or metal pickup is evident on the machined surfaces, then replacement of the case is necessary.

Examples of radial groove clutch plate (A) and the concentric groove disc (B) are shown in figure 2F-70.



**Fig. 2F-70 Clutch Plate and Disc Identification**

**ASSEMBLY**

(1) Lubricate all differential components with Jeep axle lubricant or equivalent marked SAE 85W-90, GL-5.

(2) Assemble clutch packs. Install plates and discs in same position as when removed regardless of whether they are replacement or original parts.

(3) Install clutch retainer clips on ears of clutch plates. Be sure clutch packs are completely assembled and seated on ears of plates.

(4) Install clutch packs on differential side gears and install assembly in case.

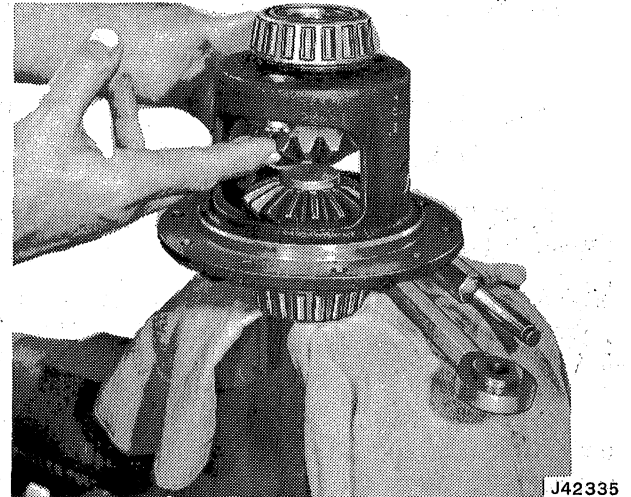
**NOTE:** Be sure clutch pack stays assembled on side gear splines and that retainer clips are completely seated in case pockets. To prevent pack from falling out of case, it will be necessary to hold them in place by hand while mounting case on axle shaft (fig. 2F-71).



**Fig. 2F-71 Mounting Differential Case on Axle Shaft**

(5) Mount case assembly on axle shaft (fig. 2F-72).

**CAUTION:** When installing differential case on axle shaft, be sure that splines of side gears are aligned with those of axle shaft. Be sure clutch pack is still properly assembled in case after installing case on axle shaft.



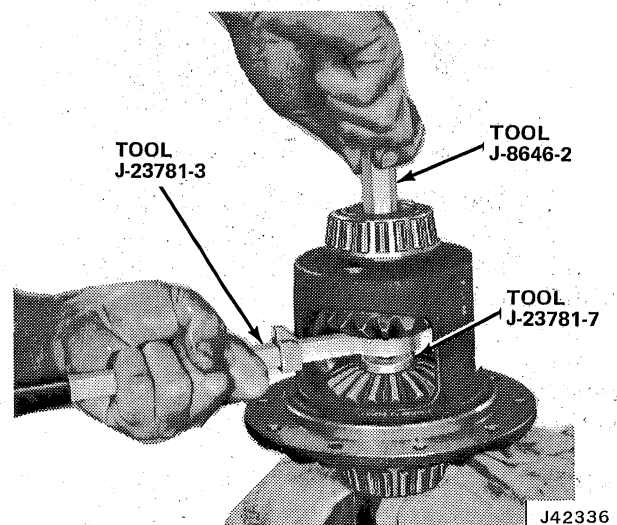
**Fig. 2F-72 Clutch Pack and Side Gear Installation**

(6) Install step plate tool in side gear. Apply small daub of grease in centering hole of step plate.

(7) Install remaining clutch pack and side gear. Be sure clutch pack stays assembled on side gear splines and that retainer clips are completely seated in pockets of case (fig. 2F-72).

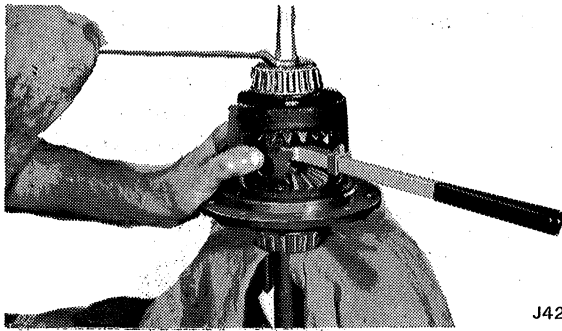
(8) Position gear rotating tool in upper side gear.

(9) Keep side gear and rotating tool in position by holding with hand. Insert forcing screw through top of case and thread into rotating tool (fig. 2F-73).



**Fig. 2F-73 Threading Forcing Screw into Rotating Tool**

(10) Install both differential pinion gears in case. Be sure bores of gears are aligned. Hold gears in place by hand (fig. 2F-74).



J42337

Fig. 2F-74 Pinion Gear Installation

(11) Tighten forcing screw to compress Belleville springs and provide clearance between teeth of pinion gears and side gears.

(12) Position pinion gears in case and insert rotating tool pawl between side gear teeth. Rotate side gears by pulling on tool handle and install pinion gears.

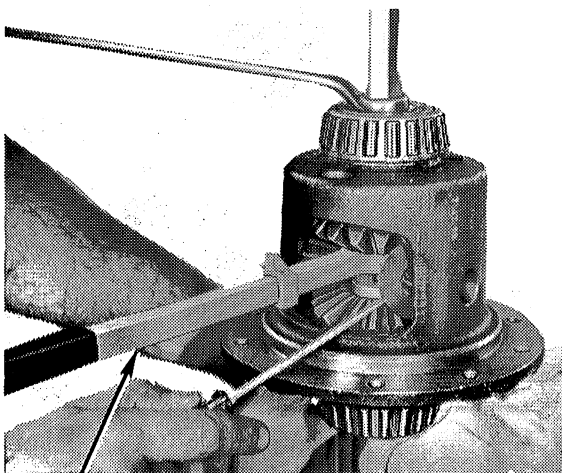
**NOTE:** If the side gears will not rotate, Belleville spring load will have to be adjusted. If adjustment is necessary, loosen or tighten the forcing screw slightly until the gears will rotate.

(13) Continue rotating side gears using rotating tool handle until shaft bores in both pinion gears are aligned with case bores.

(14) Lubricate both sides of pinion gear thrust washers.

(15) Tighten or loosen forcing screw to permit thrust washer installation.

(16) Install thrust washers. Use small screwdriver to guide washers into position (fig. 2F-75).



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J42338

Fig. 2F-75 Pinion Gear Thrust Washer Installation

**CAUTION:** Be sure the shaft bores in the washers and gears are aligned with the case bores.

(17) Remove forcing screw, rotating tool, and step plate.

(18) Lubricate pinion mate shaft and seat shaft in case. Be sure snap ring grooves in shaft are exposed to allow snap ring installation (fig. 2F-76).



J42339

Fig. 2F-76 Pinion Mate Shaft Installation

(19) Install pinion mate shaft snap rings.

**NOTE:** On Model 60 Trac-Lok, align the shaft and shaft retaining pin bore and case pin bore. Tap the shaft into position and install the retaining pin. If the case is mounted in a vise with the machined side of the ring gear flange facing upward, use a 5/16 inch (8 mm) diameter punch to install the retaining pin. Seat the pin until the punch bottoms in the case bore. If the case is mounted in a vise with the machined side of the ring gear flange facing downward, wrap a length of tape around a 3/16 inch (5 mm) diameter punch approximately 1-3/4 inch (4 cm) from the end of the punch. Install the retaining pin until the edge of the tape is flush with the pin bore.

(20) Remove case from axle shaft.

(21) Install ring gear on case.

**NOTE:** Use replacement ring gear bolts only. Do not reuse original bolts.

(22) Align ring gear and case bolt holes and install ring gear bolts finger-tight only.

(23) Remount case on axle shaft and tighten bolts evenly to specified torque. Refer to Specifications.

(24) Install Trac-Lok differential assembly in axle housing. Follow service procedures previously outlined for conventional axles to complete differential and axle assembly servicing.

**SERVICE REPLACEMENT**

If the Trac-Lok unit must be replaced as an assembly, replace the unit as follows:

- (1) Remove differential bearings and shims. Mark or tag each bearing and shim pack for assembly reference.
- (2) Remove ring gear from case.
- (3) Install original ring gear on replacement differential assembly. Be sure gear flange on replacement case is free of nicks or burrs.
- (4) Inspect shims and bearings which were removed. If shims and bearings are worn or damaged,

replace them. Be sure shims and bearings are used on same sides of replacement case as on old case.

(5) Install shims and differential bearings. Use step plate on bottom bearing to protect bearing from damage during installation of upper bearing. Seat bearings, using bearing driver tool.

(6) Lubricate differential bearings with 85W-90 gear lubricant and install differential assembly in axle housing.

(7) Follow service procedures previously outlined for conventional axles to complete differential and axle assembly servicing.

**SPECIFICATIONS**

**Axle Specifications**

	USA	Metric
<b>Model 44 Axle</b>		
Differential Bearing Preload . . . . .	0.15 in	0.38 mm
Differential Side Gear-to-Case Clearance . . . . .	.000-.006 in	0.000-0.15 mm
Ring Gear Backlash . . . . .	.005-.010 in	0.12-0.25 mm
Pinion Bearing Break-Away Preload		
Original Bearings . . . . .	10-20 in-lbs.	1-2 N-m
New Bearings . . . . .	20-40 in-lbs.	2-5 N-m
<b>Model 60 Axle</b>		
Differential Bearing Preload . . . . .	.015 in	0.38 mm
Differential Side Gear-to-Case Clearance . . . . .	.000-.006 in	0.000-0.15 mm
Drive Gear-to-Pinion Backlash . . . . .	.005-.009 in	0.12-0.15 mm
Drive Pinion Bearing Break-Away		
Original Bearings . . . . .	10-20 in-lbs.	1-2 N-m
New Bearings . . . . .	20-40 in-lbs.	2-5 N-m
<b>AMC/Jeep Axle</b>		
Axle Shaft End Play (Shims — Left Side Only) . . . . .	.004-.008 in (.006 in desired)	0.10-0.20 mm (0.15 mm desired)
Pinion Bearing Preload (Collapsible Sleeve) . . . . .	17-25 in-lbs.	2-3 N-m
Differential Bearing Preload (Shims) . . . . .	.008 in	0.20 mm
Differential Case Flange Runout (Inspection only — no adjustment) . . . . .	.002 in max.	0.05 mm max.
Ring Gear Backlash (Shims) . . . . .	.005-.009 in (.008 in desired)	0.12-0.15 mm (0.20 mm desired)
Pinion Gear Standard Setting (Shims) . . . . .	2.547 in	64-69 mm

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**Torque Specifications**

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-tightened item.

	USA (ft. lbs.)		Metric (N-m)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
<b>Model 30 Front Axle</b>				
Axle Housing Cover Bolts . . . . .	20	15-25	27	20-34
Differential Bearing Cap Bolts . . . . .	40	35-50	54	47-68
Ring Gear-to-Case Bolts . . . . .	55	45-65	75	61-88
Lower Ball Stud Nut . . . . .	80 min.	—	108 min.	—
Pinion Nut . . . . .	210	200-220	271	285-298
Universal Joint U-Bolts . . . . .	15	13-18	20	18-24
Upper Ball Stud Nut . . . . .	100 min.	—	136 min.	—
Upper Ball Stud Seat . . . . .	50 min.	—	68 min.	—
Wheel-to-Hub Nuts . . . . .	80	65-90	108	88-122

**Torque Specifications**

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-tightened item.

	USA (ft-lbs)		Metric (N·m)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
<b>Model 44 Front Axle</b>				
Axle Housing Cover Bolts	20	15-25	27	20-34
Support Plate Bolts/Nuts	30	25-35	41	34-47
Differential Bearing Cap Bolts	80	70-90	108	95-122
Disc Brake Shield Bolt	8	5-10	11	7-14
Disc Brake Shield Nuts	35	30-40	47	41-54
Ring Gear-to-Case Bolts	55	45-65	75	61-81
Lower Ball Stud Nut	80 min.	—	108 min.	—
Pinion Nut	210	200-220	271	285-298
Upper Ball Stud Nut	100 min.	—	136 min.	—
Upper Ball Stud Seat	50 min.	—	68 min.	—
Universal Joint Flange Bolts	35	25-45	47	34-61
Universal Joint Strap Bolts	16	15-19	22	20-26
Wheel-to-Hub Nuts	80	65-90	108	88-122

**Model 60 Axle**

Axle Housing Cover Bolts	20	15-25	27	20-34
Support Plate Bolts/ Nut	50	45-55	68	61-75
Differential Bearing Cap Bolts	80	70-90	108	95-122
Ring Gear-to-Case Bolts	105	100-110	142	135-149
Pinion Nut	260	250-270	352	339-366
Universal Joint Strap Bolts	16	15-19	22	20-26
Wheel-to-Hub Nuts	120	110-125	163	149-169

**AMC / Jeep Axle**

Axle Housing Cover Bolts	170 in-lbs	150-190 in-lbs	19	17-21
Brake Tube-to-Rear Wheel Cylinder	97 in-lbs	90-105 in-lbs	11	10-12
Differential Bearing Cap Bolts	87	80-95	10	9-11
Ring Gear-to-Case Bolt	105	95-115	142	135-149
Rear Brake Support Plate Bolts	32	25-40	43	34-54
Axle Shaft-to-Hub Nuts	250 min.	250 min.	339 min.	—
Clamp Strap Bolts	16	15-19	22	15-19

All torque values given in foot-pounds and newton-meters with dry fits unless otherwise specified.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above. 60867A

**FRONT DRIVE HUBS**

	Page		Page
Front Drive Hub Diagnosis	2F-51	Hub Service	2F-51
General	2F-48	Lubrication	2F-51
Hub Removal—Installation	2F-51	Specifications	2F-53

**GENERAL**

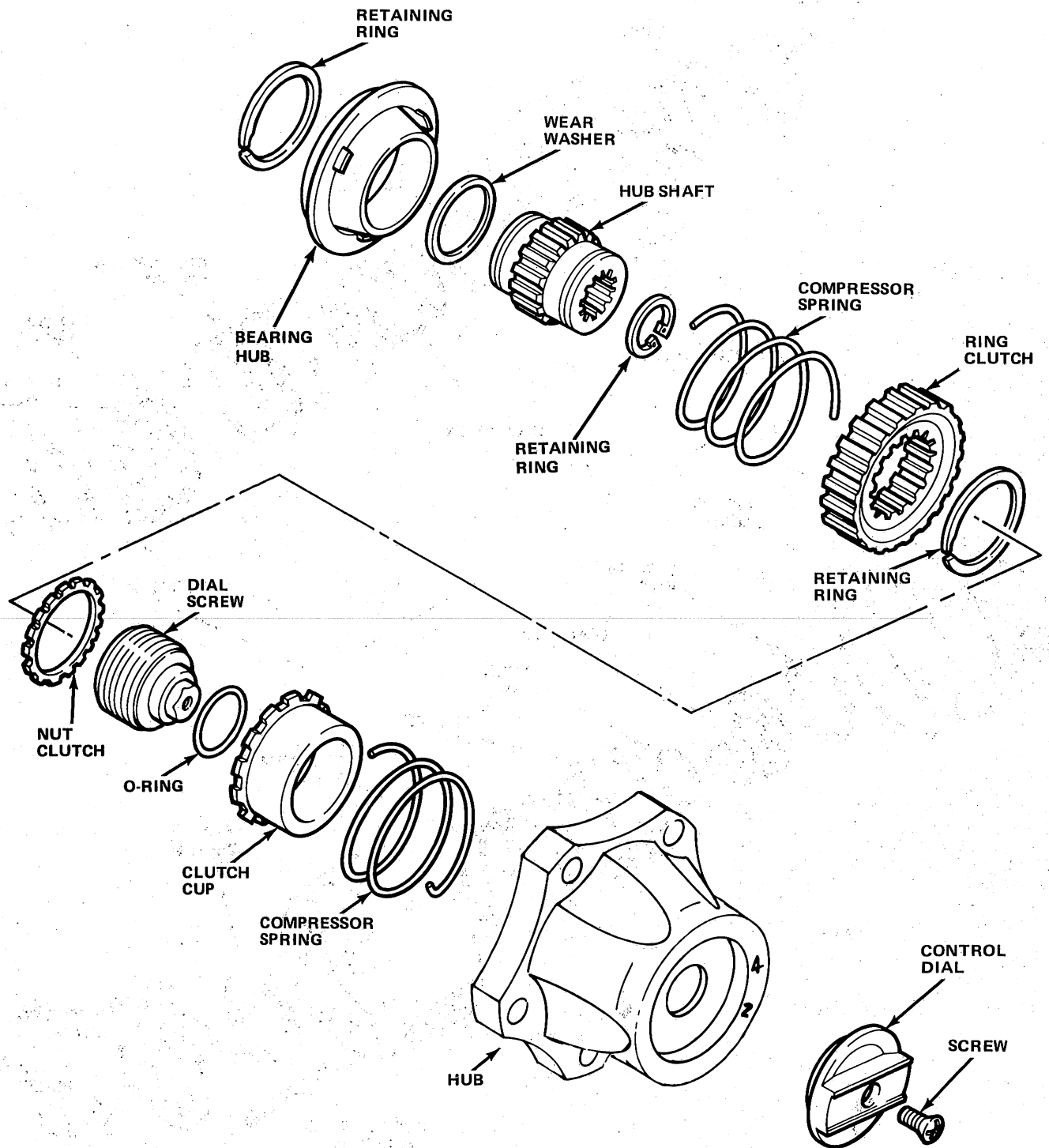
Manual front drive hubs are standard equipment on Jeep vehicles equipped with a Model 208 or 300 part-time four-wheel drive transfer case only.

**NOTE:** Front drive hubs are not available nor recommended on Jeep vehicles equipped with the Model 219,

*Quadra-Trac, full-time four-wheel drive transfer case.*

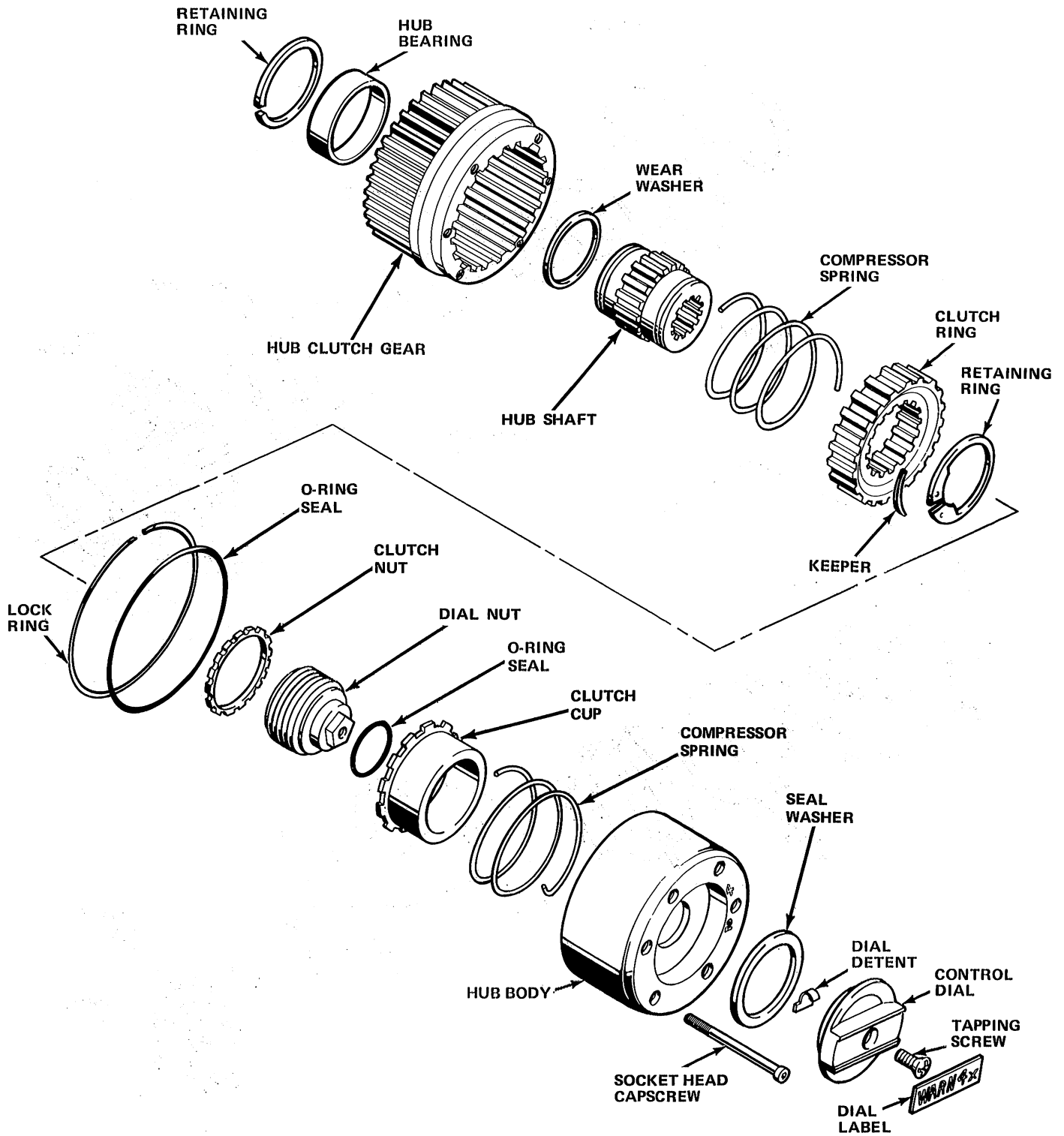
Two different front drive hub models are used. Hub model M243 is used on CJ and Scrambler models (fig. 2F-77) and hub model 247 is used on Cherokee, Wagoneer and Truck models (fig. 2F-78). Both hub models are manually locked or unlocked.





90306

Fig. 2F-77 Model M253 Front Drive Hub—CJ and Scrambler Models



90304

Fig. 2F-78 Model M247 Front Drive Hub—Cherokee-Wagoneer-Truck Models

## LUBRICATION

Use Jeep all purpose chassis lubricant, or equivalent lithium base, waterproof, EP-type chassis lubricant. When servicing front drive hubs, apply a light coating of chassis lubricant to the hub internal components. Do not pack the hubs full of lubricant, apply a light coating only.

After operation in dusty areas or if the hubs become immersed in water, the hubs, as well as the wheel end components, should be removed, cleaned, and lubricated. This should avoid the possibility of premature wear or damage caused by foreign material in the hubs or by lubricant washout.

## FRONT DRIVE HUB DIAGNOSIS

The manual front drive hubs used on Jeep vehicles should provide efficient and satisfactory operation when used and maintained properly. However, if a problem should occur, refer to the following diagnosis and repair procedures.

### Control Dials Hard to Turn or Will Not Engage Completely

If the control dials become hard to turn or will not engage completely, the problem is usually due to a lack of lubricant, or dirt, water or foreign material in the hub cavity or in the dials themselves. In these cases, repair involves removing, cleaning and lubricating the hubs. However, in some cases, this condition may simply be the result of driveline torque load on the hub clutch. This situation is remedied by raising the vehicle front end and turning the front wheels forward or reverse to relieve the load.

If the problem is the result of internal damage to the hub body or clutch, the damaged component will have to be replaced to restore proper operation. Refer to Hub Service.

### Noisy Operation

Chatter, clicking, grating, or similar type noises from the hubs may be the result of dirt, water or foreign material in the hub. This condition can be caused by a lack of hub maintenance, loose attaching bolts or screws, or damaged hub gaskets. Noise can become especially prevalent after fording streams or after operation in sandy areas. Service correction involves cleaning and lubricating the hubs.

However, if inspection indicates the problem is the result of damaged internal components, the damaged

components will have to be replaced to restore proper operation. Refer to Hub Service.

### Lubricant Leaks

Generally, lubricant leaks are caused by loose hub attaching bolts or screws, damaged hub gaskets or a damaged hub body or clutch assembly. Leakage may also be caused by over lubricating during service or normal maintenance operations. In each case, the hub should be removed, inspected and repaired as necessary.

### Hub Internal Damage

Axle or hub clutch or hub body component damage may be the result of improper hub usage or maintenance. The vehicle should never be moved unless the hub control dials are fully engaged. In addition, on vehicles equipped with manual hubs, the vehicle should not be operated with the transfer case in low range and the hubs in the 4 x 2 or Free position. This places high torque loads on the rear axle.

If the hubs are not maintained properly, full engagement of the control dials may not occur. This can lead to accelerated wear or damage to hub internal components. If the vehicle is driven through water deep enough to cover the hubs or in sandy, dusty areas, the hubs should be cleaned and lubricated thoroughly.

## HUB SERVICE

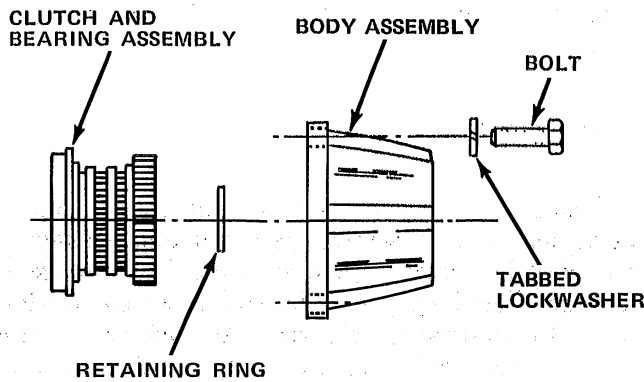
Model M253 and M247 front drive hubs are serviced as either a complete assembly or sub assembly such as the hub body or hub clutch assembly only. Do not attempt to disassemble these units. If the entire hub or a sub assembly has malfunctioned, replace the hub assembly or the problem sub assembly as a unit only.

Although the front drive hubs are serviced as assemblies or sub assemblies only, the hubs may be removed for cleaning inspection and lubrication purposes. Refer to the Hub Removal/Installation procedures for details.

## HUB REMOVAL/INSTALLATION

### Removal—Model M253

- (1) Remove bolts and tabbed lockwashers attaching hub body to axle hub (fig. 2F-79). Retain bolts and washer.
- (2) Remove hub body and gasket. Discard gasket.



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Fig. 2F-79 M253 Hub Removal/Installation

**CAUTION:** Do not turn the hub control dial after removing the hub body.

- (3) Remove retaining ring from axle shaft (fig. 2F-78).
- (4) Remove hub clutch and bearing assembly.
- (5) Clean hub components in solvent. Dry them using compressed air, clean shop towels, or air dry. Be sure old lubricant, dirt, water or other foreign materials are flushed out.
- (6) Inspect hub components for signs of wear or damage. Service components as necessary.

### Installation—Model M253

**CAUTION:** Do not turn the hub control dial until after the hub has been installed. The hub clutch nut and cup can be damaged severely if the dial is rotated while the hub is off the vehicle.

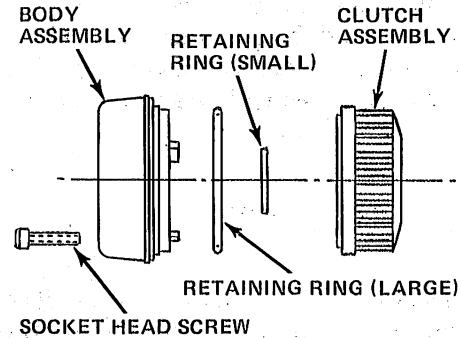
- (1) Lubricate hub components with Jeep all purpose chassis lubricant or equivalent. Refer to Lubrication section. Apply light coat of lubricant only. Do not pack hub with lubricant.
- (2) Install hub clutch and bearing assembly on axle shaft.
- (3) Install retaining ring on axle shaft.
- (4) Position new gasket on hub body and install hub body and gasket.
- (5) Align bolt holes in axle and hub body and install bolts and tabbed lockwashers. Tighten bolts to 30 foot-pounds (41 N•m) torque.
- (6) Raise vehicle front end.
- (7) Turn hub control dials to 4 x 2 position and rotate wheels. Wheels should rotate freely. If wheels

drag, check hub installation. Also, be sure control dials are fully engaged in 4 x 2 position.

- (8) Lower vehicle.

### Removal—Model M247

- (1) Remove socket head screws from hub body assembly (fig. 2F-80).



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Fig. 2F-80 M247 Hub Removal/Installation

- (2) Remove large retaining ring from axle hub. Remove small retaining ring from axle shaft.
- (3) Remove hub clutch assembly.
- (4) Clean hub components in solvent. Dry them using compressed air, clean shop towels, or air dry. Be sure old lubricant, dirt, water, or other foreign materials are flushed out.
- (5) Inspect hub components for signs of wear or damage. Service components as necessary.

### Installation—Model M247

- (1) Lubricate hub components with Jeep all purpose chassis lubricant, or equivalent. Refer to Lubrication section. Apply light coat of lubricant only. Do not pack hub with lubricant.
- (2) Install hub clutch assembly.
- (3) Install small retaining ring on axle shaft. Install large retaining ring in axle hub.
- (4) Install new O-ring or hub body if O-ring is being replaced.
- (5) Position hub body in clutch. Align screw holes in clutch and body assemblies and install socket head screws. Tighten screws to 30 inch-pounds (3 N•m) torque.
- (6) Raise vehicle front end.
- (7) Turn both control dials to Free Position and rotate wheels. Wheels must rotate freely. If wheels drag, check hub installation. Also be sure control dials are fully engaged in position.
- (8) Lower vehicle.

**SPECIFICATIONS**

**Front Drive Hub Specifications**

Hub Application  
 M253 ..... CJ, Scrambler Models  
 M247 ..... Cherokee, Wagoneer, Truck  
 Hub Type: ..... 2-position, manually operated locking hub  
 Lubricant ..... Use Jeep All-purpose Chassis Lubricant or equivalent lithium base, waterproof EP-type chassis lubricant

Torque Values:  
 Socket Head Screws (M247) ..... 30 in-pounds (3 N.m)  
 Hub Bolts (M253) ..... 30 foot-pounds (41 N.m)

Hub Control Dial Positions:  
 M247 ..... Lock (4 WD)-Free (2 WD)  
 M253 ..... 4 x 4 (4 WD)-4 x 2 (2 WD)

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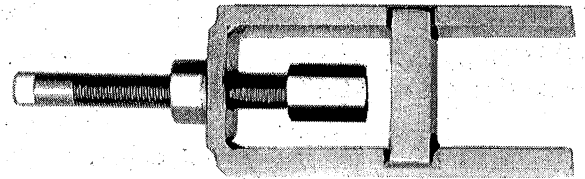
**Tools**



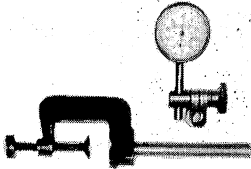
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PINION NUT SOCKET



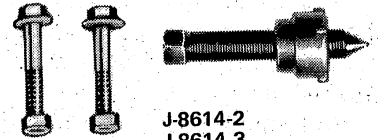
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J-22661  
REAR PINION OIL  
SEAL INSTALLERS



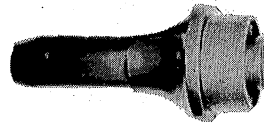
J-2498  
AXLE SHAFT REMOVER



J-8001  
DIAL INDICATOR SET



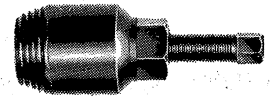
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J-8614-3  
YOKE REMOVER  
TOOLS



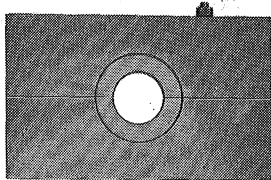
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SEAL INSTALLER



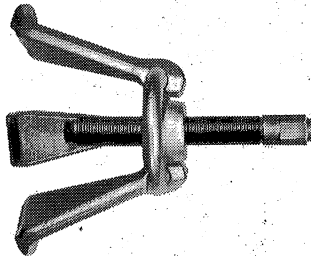
J-2092 AXLE END  
PLAY CHECKING TOOL



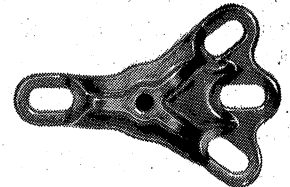
J-9233  
PINION OIL SEAL REMOVER



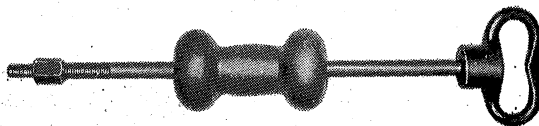
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AXLE SHAFT BEARING  
REMOVER-INSTALLER



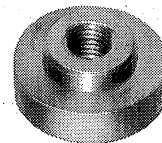
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AXLE HUB PULLER



J-21579  
AXLE SHAFT PULLER



J-2619-01 SLIDE HAMMER



J-25135-01

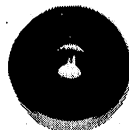
Tools (Continued)



J-21787  
PINION FRONT  
BEARING CUP  
REMOVER



J-21786  
PINION REAR  
BEARING REMOVER



J-8608  
PINION REAR BEARING  
CUP INSTALLER



J-8611-01  
PINION FRONT  
BEARING CUP  
INSTALLER



J-5223-24  
CLAMP



J-5223-29  
BOLT



J-5223-20  
GAUGE BLOCK  
AND PLUNGER



J-5223-25 OR -26  
DISCS



J-24433  
PINION BEARING  
INSTALLER SLEEVE

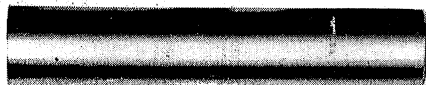


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DIFFERENTIAL  
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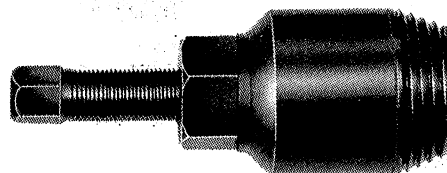


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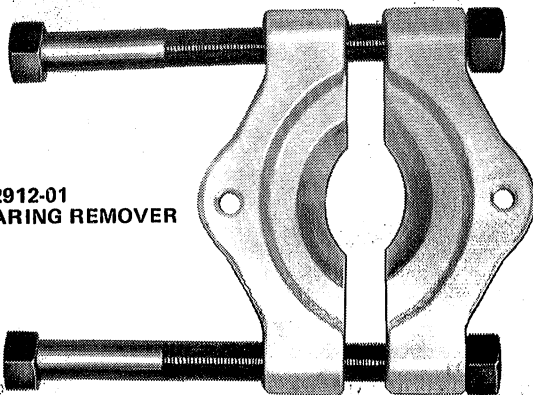
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PINION DEPTH SETTING GAUGE SET



J-22697 PINION REAR  
BEARING INSTALLER



J-9233  
PINION SEAL REMOVER



J-22912-01  
BEARING REMOVER



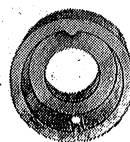
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INSTALLER



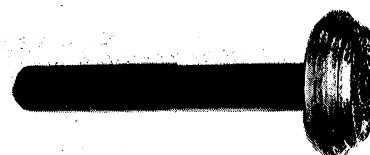
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PINION BEARING  
INSTALLER SLEEVE



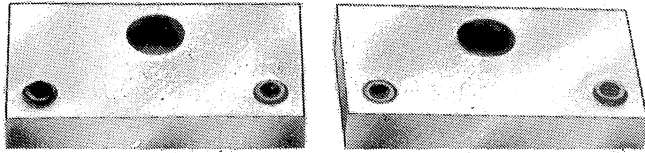
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SEAL INSTALLER  
MODELS 44-60



J-25131 SEAL INSTALLER



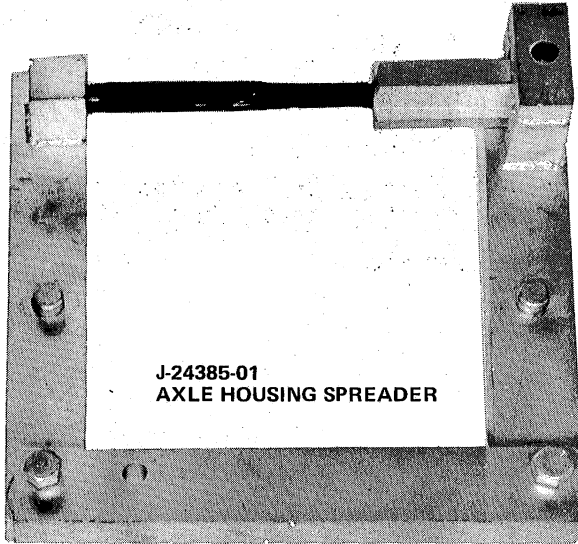
Tools (continued)



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ADAPTER



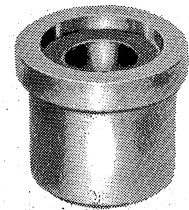
J-7079-2  
DRIVER HANDLE (NON-THREADED)



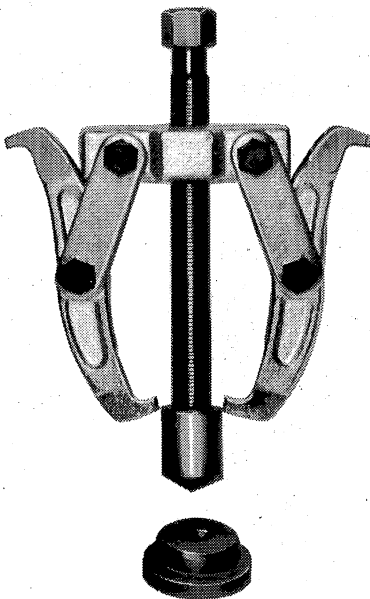
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AXLE HOUSING SPREADER



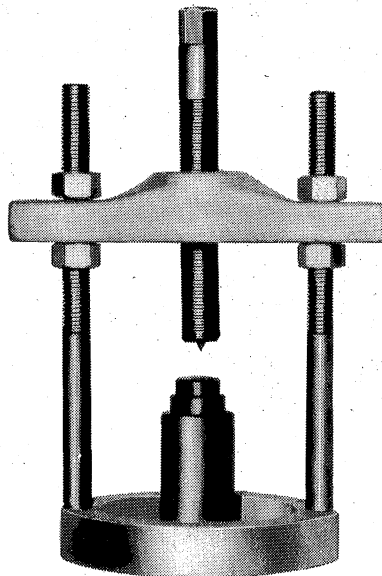
J-8092  
DRIVER HANDLE (THREADED)



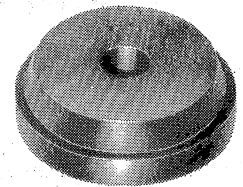
J-25104  
BEARING INSTALLER



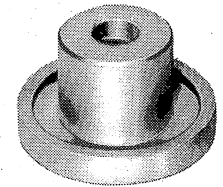
J-22888  
BEARING PULLER SET



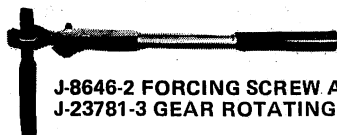
J-29721 DIFFERENTIAL  
BEARING REMOVER TOOL SET



J-25101  
BEARING CUP INSTALLER



J-24430  
BEARING INSTALLER



J-8646-2 FORCING SCREW AND  
J-23781-3 GEAR ROTATING TOOL

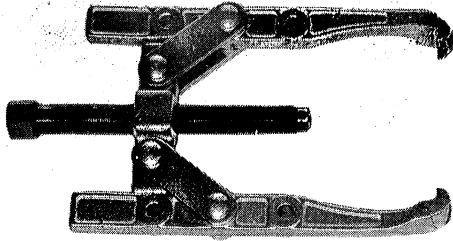


J-23781-7  
STEP PLATE

80327B

80328

Tools (Continued)



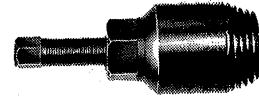
J-25215 PULLER



J-25211-3 BUTTON



J-25133 PULLER



J-25180 PULLER



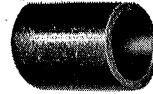
J-8614-2, J-8614-3  
YOKE REMOVER TOOLS



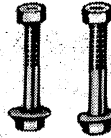
J-25211-1 PLATE



J-23447 WRENCH NUT



J-25211-2 CUP



J-25211-4 ADAPTER



J-8614-01 YOKE HOLDING TOOL