The function of a propeller shaft is to transmit power from one point to another. The shaft is designed to send torque from the transmission and transfer case to the drive axles (Fig. 1). The propeller shaft must operate through constantly changing relative angles between the transmission and axle. It must also be capable of changing length while transmitting torque. The axle rides suspended by springs in a floating motion. The propeller shaft must be able to change operating angles when going over various road surfaces. This is done through universal joints, which permit the propeller shaft to operate at different angles. The slip joints (or yokes) permit contraction or expansion (Fig. 1).

Tubular propeller shafts are balanced by the manufacturer with weights spot welded to the tube. The propeller shaft is designed and built with the yoke lugs in line with each other which is called zero phasing. This design produces the smoothest running condition, an out-of-phase shaft can cause a vibration.

Before undercoating a vehicle, the propeller shaft and the U-joints should be covered to prevent an out-of-balance condition and driveline vibration.

CAUTION: Use original equipment replacement parts for attaching the propeller shafts. The specified torque must always be applied when tightening the fasteners.

Two different types of propeller shaft joints are used in TJ vehicles (Fig. 2) and (Fig. 3). None of the joints are servicable. If worn or damaged, they must be replaced as a complete assembly.
PROPELLER SHAFT JOINT ANGLE

When two shafts come together at a common joint, the bend that is formed is called the operating angle. The larger the angle, the larger the amount of angular acceleration and deceleration of the joint. This speeding up and slowing down of the joint must be cancelled to produce a smooth power flow. This is done through the phasing of a propeller shaft and ensuring that the proper propeller shaft joint working angles are maintained.

A propeller shaft is properly phased when the yoke ends are in the same plane, or in line. A twisted shaft will make the yokes out of phase and cause a noticeable vibration.

When taking propeller shaft joint angle measurements, or checking the phasing, of two piece shafts, consider each shaft separately.

Ideally the driveline system should have;
- Angles that are equal or opposite within 1 degree of each other.
- Have a 3 degree maximum operating angle.
- Have at least a 1/2 degree continuous operating (propeller shaft) angle.

Engine speed (rpm) is the main factor in determining the maximum allowable operating angle. As a guide to the maximum normal operating angles refer to (Fig. 4).

LUBRICATION

The factory installed universal joints are lubricated for the life of the vehicle and do not need lubrication. All universal joints should be inspected for leakage and damage each time the vehicle is serviced. If seal leakage or damage exists, the universal joint should be replaced.
PRECAUTIONS

Use the exact replacement parts when installing the propeller shafts. The use of the correct replacement parts helps to ensure safe operation. All fasteners must be torqued to the specified values for safe operation.

Also make alignment reference marks (Fig. 5) on the propeller shaft yoke and axle, or transmission, yoke prior to servicing. This helps to eliminate possible vibration.

CAUTION: Do not allow the propeller shaft to drop or hang from any propeller shaft joint during removal. Attach the propeller shaft to the vehicle underside with wire to prevent damage to the joints.

VIBRATION

Tires that are out-of-round, or wheels that are unbalanced, will cause a low frequency vibration. Refer to Group 22, Tires and Wheels, for additional information.

Brake drums that are unbalanced will cause a harsh, low frequency vibration. Refer to Group 5, Brakes, for additional information.
Driveline vibration can also result from loose or damaged engine mounts. Refer to Group 9, Engines, for additional information.

Propeller shaft vibration increases as the vehicle speed is increased. A vibration that occurs within a specific speed range is not usually caused by a propeller shaft being unbalanced. Defective universal joints, or an incorrect propeller shaft angle, are usually the cause of such a vibration.

### DRIVELINE VIBRATION

<table>
<thead>
<tr>
<th>Drive Condition</th>
<th>Possible Cause</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propeller Shaft Noise</td>
<td>1) Undercoating or other foreign material on shaft.</td>
<td>1) Clean exterior of shaft and wash with solvent.</td>
</tr>
<tr>
<td></td>
<td>2) Loose U-joint clamp screws.</td>
<td>2) Install new clamps and screws and tighten to proper torque.</td>
</tr>
<tr>
<td></td>
<td>3) Loose or bent U-joint yoke or excessive runout.</td>
<td>3) Install new yoke.</td>
</tr>
<tr>
<td></td>
<td>4) Incorrect driveline angularity.</td>
<td>4) Measure and correct driveline angles.</td>
</tr>
<tr>
<td></td>
<td>5) Rear spring center bolt not in seat.</td>
<td>5) Loosen spring u-bolts and seat center bolt.</td>
</tr>
<tr>
<td></td>
<td>6) Worn U-joint bearings.</td>
<td>6) Install new U-joint.</td>
</tr>
<tr>
<td></td>
<td>7) Propeller shaft damaged or out of balance.</td>
<td>7) Install new propeller shaft.</td>
</tr>
<tr>
<td></td>
<td>8) Broken rear spring.</td>
<td>8) Install new rear spring.</td>
</tr>
<tr>
<td></td>
<td>9) Excessive runout or unbalanced condition.</td>
<td>9) Re-index propeller shaft 180°, test, and evaluate.</td>
</tr>
<tr>
<td></td>
<td>10) Excessive drive pinion gear shaft runout.</td>
<td>10) Re-index propeller shaft 180° and evaluate.</td>
</tr>
<tr>
<td></td>
<td>11) Excessive axle yoke deflection.</td>
<td>11) Inspect and replace yoke if necessary.</td>
</tr>
<tr>
<td></td>
<td>12) Excessive transfer case runout.</td>
<td>12) Inspect and repair as necessary.</td>
</tr>
<tr>
<td>Universal Joint Noise</td>
<td>1) Loose U-joint clamp screws.</td>
<td>1) Install new clamps and screws and tighten to proper torque.</td>
</tr>
<tr>
<td></td>
<td>2) Lack of lubrication.</td>
<td>2) Lubricate U-joint and evaluate.</td>
</tr>
</tbody>
</table>

### UNBALANCE

**NOTE:** Removing and re-indexing the propeller shaft 180° relative to the yoke may eliminate some vibrations.

If propeller shaft is suspected of being unbalanced, it can be verified with the following procedure:

1. Raise the vehicle.
2. Clean all the foreign material from the propeller shaft and the universal joints.
3. Inspect the propeller shaft for missing balance weights, broken welds, and bent areas. **If the propeller shaft is bent, it must be replaced.**
4. Inspect the universal joints to ensure that they are not worn, are properly installed, and are correctly aligned with the shaft.
5. Check the universal joint clamp screws torque.
6. Remove the wheels and tires. Install the wheel lug nuts to retain the brake drums or rotors.
7. Mark and number the shaft six inches from the yoke end at four positions 90° apart.
8. Run and accelerate the vehicle until vibration occurs. Note the intensity and speed the vibration occurred. Stop the engine.
9. Install a screw clamp at position 1 (Fig. 6).
10. Start the engine and re-check for vibration. If there is little or no change in vibration, move the...
clamp to one of the other three positions. Repeat the vibration test.

(11) If there is no difference in vibration at the other positions, the source of the vibration may not be propeller shaft.

(12) If the vibration decreased, install a second clamp (Fig. 7) and repeat the test.

(13) If the additional clamp causes an additional vibration, separate the clamps (1/4 inch above and below the mark). Repeat the vibration test (Fig. 8).

(14) Increase distance between the clamp screws and repeat the test until the amount of vibration is at the lowest level. Bend the slack end of the clamps so the screws will not loosen.

(15) If the vibration remains unacceptable, apply the same steps to the front end of the propeller shaft.

(16) Install the wheel and tires. Lower the vehicle.

RUNOUT

(1) Remove dirt, rust, paint, and undercoating from the propeller shaft surface where the dial indicator will contact the shaft.

(2) The dial indicator must be installed perpendicular to the shaft surface.

(3) Measure runout at the center and ends of the shaft sufficiently far away from weld areas to ensure that the effects of the weld process will not enter into the measurements.

(4) Refer to Runout Specifications chart.

(5) If the propeller shaft runout is out of specification, remove the propeller shaft, index the shaft 180°, and re-install the propeller shaft. Measure shaft runout again.

(6) If the propeller shaft runout is now within specifications, mark the shaft and yokes for proper orientation.

(7) If the propeller shaft runout is not within specifications, verify that the runout of the transmission/transfer case and axle are within specifications. Correct as necessary and re-measure propeller shaft runout.

(8) Replace the propeller shaft if the runout still exceeds the limits.

RUNOUT SPECIFICATIONS

<table>
<thead>
<tr>
<th>Location</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front of Shaft</td>
<td>0.020 in. (0.50 mm)</td>
</tr>
<tr>
<td>Center of Shaft</td>
<td>0.025 in. (0.63 mm)</td>
</tr>
<tr>
<td>Rear of Shaft</td>
<td>0.020 in. (0.50 mm)</td>
</tr>
</tbody>
</table>

Measure front/rear runout approximately 3 inches (76 mm) from the weld seam at each end of the shaft tube for tube lengths over 30 inches. For tube lengths under 30 inches, the maximum allowed runout is 0.020 in. (0.50 mm) for the full length of the tube.
SERVICE PROCEDURES

DRIVELINE ANGLE MEASUREMENT
PREPARATION
Before measuring universal joint angles, the following must be done;
- Inflate all tires to correct pressure.
- Check the angles in the same loaded or unloaded condition as when the vibration occurred. Propeller shaft angles change according to the amount of load in the vehicle.
- Check the condition of all suspension components and verify all fasteners are torqued to specifications.
- Check the condition of the engine and transmission mounts and verify all fasteners are torqued to specifications.

PROPELLER SHAFT ANGLE MEASUREMENT
To accurately check driveline alignment, raise and support the vehicle at the axles as level as possible. Allow the wheels and propeller shaft to turn.
(1) Remove any external bearing snap rings, if equipped, from universal joint so protractor base sits flat.
(2) Rotate the shaft until transmission/transfer case output yoke bearing is facing downward.
Always make measurements from front to rear. Also, be sure to take all measurements while working from the same side of the vehicle.
(3) Place Inclinometer on yoke bearing (A) parallel to the shaft (Fig. 9). Center bubble in sight glass and record measurement.
This measurement will give you the transmission or Output Yoke Angle (A).
(4) Rotate propeller shaft 90 degrees and place Inclinometer on yoke bearing parallel to the shaft (Fig. 10). Center bubble in sight glass and record measurement. This measurement can also be taken at the rear end of the shaft.
This measurement will give you the Propeller Shaft Angle (C).
(5) Subtract smaller figure from larger (C minus A) to obtain Transmission Output Operating Angle.
(6) Rotate propeller shaft 90 degrees and place Inclinometer on pinion yoke bearing parallel to the shaft (Fig. 11). Center bubble in sight glass and record measurement.
This measurement will give you the pinion shaft or Input Yoke Angle (B).
(7) Subtract smaller figure from larger (C minus B) to obtain axle Input Operating Angle.
Refer to rules given below and the example in (Fig. 12) for additional information.
- Good cancellation of U-joint operating angles (within 1°).
- Operating angles less than 3°.
- At least 1/2 of one degree continuous operating (propeller shaft) angle.
Fig. 11 Rear (Input) Angle Measurement (B)

<table>
<thead>
<tr>
<th></th>
<th>(A) Output Yoke</th>
<th>3.0°</th>
<th>4.9°</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(C) Prop. Shaft</td>
<td>4.9° or -3.0°</td>
<td></td>
</tr>
<tr>
<td>Transmission Output Operating Angle</td>
<td>1.9°</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>(B) Axle Input Yoke</th>
<th>3.2°</th>
<th>4.9°</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(C) Prop. Shaft</td>
<td>4.9° or -3.2°</td>
<td></td>
</tr>
<tr>
<td>Axle Input Operating Angle</td>
<td>1.7°</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Trans. Output Operating Angle 1.9°
Axle Input Operating Angle -1.7°

Amount of U-Joint Cancellation 0.2°

Fig. 12 Universal Joint Angle Example
REMOVAL AND INSTALLATION
FRONT PROPELLER SHAFT

REMOVAL

1. Hoist and support vehicle on safety stands.
2. Shift the transmission and transfer case, if necessary, into the Neutral position.
3. Using a suitable marker, mark a line across the yoke at the transfer case, the link yoke, and propeller shaft yoke at the rear of the front propeller shaft for installation reference (Fig. 14).
4. Mark a line across the propeller shaft yoke and the pinion shaft yoke for installation reference.
5. Remove the U-joint strap bolts at the pinion shaft yoke.
6. Remove bolts holding rear universal joint to the transfer case yoke.
7. Separate the rear universal joint from the transfer case yoke.
8. Push rear of propeller shaft upward to clear transfer case yoke.
10. Separate propeller shaft from vehicle.

INSTALLATION

1. Position front propeller shaft under vehicle with rear universal joint over the transfer case yoke.
2. Place front universal joint into the axle pinion yoke.
3. Align mark on the rear link yoke and universal joint to the mark on the transfer case yoke (Fig. 14).
4. Loosely install bolts to hold universal joint to transfer case yoke.
5. Align mark on front universal joint to the mark on the axle pinion yoke.
6. Tighten the U-joint strap/clamp bolts at the axle yoke to 19 N·m (14 ft. lbs.) torque.

REAR PROPELLER SHAFT

REMOVAL

1. Shift the transmission and transfer case into Neutral.
2. Hoist and support vehicle on safety stands.
3. Scribe alignment marks at the pinion shaft and at each end of the propeller shaft. These marks will be used for installation reference.
4. Remove the U-joint strap bolts at the pinion shaft yoke.
5. Pry open clamp holding the dust boot to propeller shaft yoke (Fig. 15).
6. Slide the slip yoke off of the transmission/transfer case output shaft and remove the propeller shaft (Fig. 16).
7. Tighten the universal joint to transfer case bolts to 27 N·m (20 ft. lbs.) torque.
8. Lower the vehicle.

INSTALLATION

1. Position front propeller shaft under vehicle with rear universal joint over the transfer case yoke.
2. Place front universal joint into the axle pinion yoke.
3. Align mark on the rear link yoke and universal joint to the mark on the transfer case yoke (Fig. 14).
4. Loosely install bolts to hold universal joint to transfer case yoke.
5. Align mark on front universal joint to the mark on the axle pinion yoke.
6. Tighten the U-joint strap/clamp bolts at the axle yoke to 19 N·m (14 ft. lbs.) torque.
REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Slide the slip yoke on the transmission/transfer case output shaft. Align the installation reference marks at the axle yoke and install the propeller shaft (Fig. 16).

(2) Tighten the U-joint strap/clamp bolts at the axle yoke to 19 N·m (14 ft. lbs.) torque.

(3) Crimp clamp to hold dust boot to propeller shaft yoke (Fig. 17).

(4) Lower the vehicle.

DISASSEMBLY AND ASSEMBLY

SINGLE CARDAN UNIVERSAL JOINT

DISASSEMBLY

Individual components of cardan universal joints are not serviceable. If worn or leaking, they must be replaced as an assembly.

(1) Remove the propeller shaft.

(2) Using a soft drift, tap the outside of the bearing cap assembly to loosen snap ring.

(3) Remove snap rings from both sides of yoke (Fig. 18).

(4) Set the yoke in an arbor press or vise with a socket whose inside diameter is large enough to receive the bearing cap positioned beneath the yoke.

(5) Position the yoke with the grease fitting, if equipped, pointing up.

(6) Place a socket with an outside diameter smaller than the upper bearing cap on the upper bearing cap and press the cap through the yoke to release the lower bearing cap (Fig. 19).
DISASSEMBLY AND ASSEMBLY (Continued)

(7) If the bearing cap will not pull out of the yoke by hand after pressing, tap the yoke ear near the bearing cap to dislodge the cap.

(8) To remove the opposite bearing cap, turn the yoke over and straighten the cross in the open hole. Then, carefully press the end of the cross until the remaining bearing cap can be removed (Fig. 20).

CAUTION: If the cross or bearing cap are not straight during installation, the bearing cap will score the walls of the yoke bore and damage can occur.

ASSEMBLY

(1) Apply extreme pressure (EP) N.L.G.I. Grade 1 or 2 grease to inside of yoke bores to aid in installation.

(2) Position the cross in the yoke with its lube fitting, if equipped, pointing up (Fig. 21).

(3) Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 22). Keep the needle bearings upright in the bearing assembly. A needle bearing lying at the bottom of the cap will prevent proper assembly.

(4) Press the bearing cap into the yoke bore enough to install a snap ring.

(5) Install a snap ring.

(6) Repeat Step 3 and Step 4 to install the opposite bearing cap. If the joint is stiff or binding, strike the yoke with a soft hammer to seat the needle bearings.

(7) Add grease to lube fitting, if equipped.

(8) Install the propeller shaft.

DOUBLE CARDAN JOINT

DISASSEMBLY

Individual components of cardan universal joints are not serviceable. If worn or leaking, they must be replaced as an assembly.

(1) Remove the propeller shaft.

(2) Using a soft drift, tap the outside of the bearing cap assembly to loosen snap ring.
DISASSEMBLY AND ASSEMBLY (Continued)

(3) Remove all the bearing cap snap rings (Fig. 23).

(4) Set the joint in an arbor press or vise with a socket whose inside diameter is large enough to receive the bearing cap positioned beneath the link yoke.

(5) Place a socket with an outside diameter smaller than the upper bearing cap on the upper bearing cap and partially press one bearing cap from the outboard side of the link yoke enough to grasp the bearing cap with vise jaws (Fig. 24). Be sure to remove grease fittings that interfere with removal.

(6) Grasp the protruding bearing by vise jaws. Tap the link yoke with a mallet and drift to dislodge the bearing cap from the yoke (Fig. 25).

(7) Flip assembly and repeat Step 4, Step 5, and Step 6 to remove the opposite bearing cap. This will then allow removal of the cross centering kit assembly and spring (Fig. 26).

(8) Press the remaining bearing caps out the other end of the link yoke as described above to complete the disassembly.
ASSEMBLY

During assembly, ensure that the alignment marks on the link yoke and propeller shaft yoke are aligned.

1. Apply extreme pressure (EP) N.L.G.I. Grade 1 or 2 grease to inside of yoke bores to aid in installation.
2. Fit a cross into the propeller shaft yoke (Fig. 27).
3. Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 28). Keep the needle bearings upright in the bearing assembly. A needle bearing lying at the bottom of the cap will prevent proper assembly.
4. Press the bearing cap into the yoke bore enough to install a snap ring (Fig. 29).
5. Install a snap ring.
6. Flip the propeller shaft yoke and install the bearing cap onto the opposite trunnion. Install a snap ring (Fig. 30).
7. Fit the link yoke on the remaining two trunnions and press both bearing caps into place (Fig. 31).
8. Install snap rings.
DISASSEMBLY AND ASSEMBLY (Continued)

(9) Install the centering kit assembly inside the link yoke making sure the spring is properly positioned (Fig. 32).

(10) Place two bearing caps on opposite trunnions of the remaining cross. Fit the open trunnions into the link yoke bores and the bearing caps into the centering kit (Fig. 33).

(11) Press the remaining two bearing caps into place and install snap rings (Fig. 34).

(12) Tap the snap rings to allow them to seat into the grooves (Fig. 35).

(13) Check for proper assembly. Flex the joint beyond center, it should snap over-center in both directions when correctly assembled (Fig. 36).

(14) Install the propeller shaft.

CLEANING AND INSPECTION

SINGLE AND DOUBLE CARDAN JOINT

(1) Clean all the universal joint yoke bores with cleaning solvent and a wire brush.

(2) Inspect the yokes for distortion, cracks, and worn bearing cap bores.

ADJUSTMENTS

AXLE PINION ANGLE ADJUSTMENT

The pinion angle of the front axle can be adjusted by the use of adjustment cams in the lower suspension arms (Fig. 37). The primary function for the
ADJUSTMENTS (Continued)

cams is to adjust the caster angle for the alignment of the front suspension. When using the cams to adjust the pinion angle, make sure that both cams are moved equally. After the pinion angle is adjusted, the front suspension alignment should be checked to ensure that side-to-side caster angles variance is within the acceptable range. Having the correct pinion angle does have priority over having the preferred caster angle.

A cam kit is available to be installed in the rear axle lower suspension arms in order to provide adjustability of the pinion angle. Follow the procedures supplied with the kit in order to ensure a safe installation.

### SPECIFICATIONS

#### TORQUE

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>TORQUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front Propeller Shaft Bolts, Rear Yoke</td>
<td>27 N·m (20 ft. lbs.)</td>
</tr>
<tr>
<td>Bolts, Front Yoke</td>
<td>41 N·m (30 ft. lbs.)</td>
</tr>
<tr>
<td>Rear Propeller Shaft Bolts, Rear Yoke</td>
<td>19 N·m (14 ft. lbs.)</td>
</tr>
</tbody>
</table>

#### SPECIAL TOOLS

**PROPELLER SHAFT**

- Inclinometer—7663
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GENERAL INFORMATION

181 FBI AXLE

The 181 Front Beam-design Iron (FBI) axle consists of a cast iron differential housing with axle shaft tubes extending from either side. The tubes are pressed into the differential housing and welded. The integral type housing, hypoid gear design has the centerline of the pinion set below the centerline of the ring gear.

The axle has a fitting for a vent hose used to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts, meaning that loads are supported by the hub bearings. The axle shafts are retained by nuts at the hub bearings. The hub bearings are bolted to the steering knuckle at the outboard end of the axle tube yoke. The hub bearings are serviced as an assembly.

For vehicles with ABS brakes, the ABS wheel speed sensors are attached to the knuckle assemblies. The tone rings for the ABS system are pressed onto the axle shaft. Do not damage ABS tone wheel or the sensor when removing axle shafts.

LUBRICANT SPECIFICATIONS

A multi-purpose, hypoid gear lubricant which conforms to the following specifications should be used. Mopar® Hypoid Gear Lubricant conforms to all of these specifications.

- The lubricant should have MIL-L-2105C and API GL 5 quality specifications.
- Lubricant is a thermally stable SAE 80W-90 gear lubricant.
GENERAL INFORMATION (Continued)

- Lubricant for axles intended for heavy-duty or trailer tow use is SAE 75W-140 SYNTHETIC gear lubricant.

  The 181 FBI axle lubricant capacity is 1.2 L (2.5 pts.).

CAUTION: If axle is submerged in water, lubricant must be replaced immediately to avoid possible premature axle failure.

DESCRIPTION AND OPERATION

STANDARD DIFFERENTIAL

The differential gear system divides the torque between the axle shafts. It allows the axle shafts 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 (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft) rotate the side gears
- The side gears (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. 1).

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 2). 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.

DIAGNOSIS AND TESTING

GENERAL INFORMATION

Axle bearing problem conditions are usually caused by:
- Insufficient or incorrect lubricant.
- Foreign matter/water contamination.
- Incorrect bearing preload torque adjustment.
- Incorrect backlash.

Axle gear problem conditions are usually the result of:
- Insufficient lubrication.
- Incorrect or contaminated lubricant.
- Overloading (excessive engine torque) or exceeding vehicle weight capacity.
- Incorrect clearance or backlash adjustment.

Axle component breakage is most often the result of:
- Severe overloading.
- Insufficient lubricant.
- Incorrect lubricant.
- Improperly tightened components.

GEAR NOISE

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, or worn/damaged gears.

Gear noise usually happens at a specific speed range. The range is 30 to 40 mph, or above 50 mph.
The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly:

- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side and pinion gears can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion gear mate shaft can also cause a snapping or a knocking noise.

**BEARING NOISE**

The axle shaft, differential and pinion gear bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion gear bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

**LOW SPEED KNOCK**

Low speed knock is generally caused by a worn U-joint or by worn side-gear thrust washers. A worn pinion gear shaft bore will also cause low speed knock.

**VIBRATION**

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out-of-balance wheels.
- Loose wheel lug nuts.
- Worn U-joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be a rear-end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

Refer to Group 22, Wheels and Tires, for additional vibration information.

**DRIVELINE SNAP**

A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed
- Loose engine/transmission/transfer case mounts
- Worn U-joints
- Loose spring mounts
- Loose pinion gear nut and yoke
- Excessive ring gear backlash
- Excessive side gear/case clearance

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.
## FRONT AXLES

### DIAGNOSIS

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEEL NOISE</td>
<td>1. Wheel loose. 2. Faulty, brinelled wheel bearing.</td>
<td>1. Tighten loose nuts. 2. Faulty or brinelled bearings must be replaced.</td>
</tr>
<tr>
<td>AXLE SHAFT NOISE</td>
<td>1. Misaligned axle shaft tube. 2. Bent or sprung axle shaft. 3. End play in drive pinion bearings. 4. Excessive gear backlash between ring gear and pinion gear. 5. Improper adjustment of drive pinion gear shaft bearings. 6. Loose drive pinion gear shaft yoke nut. 7. Improper wheel bearing adjustment. 8. Scuffed gear tooth contact surfaces.</td>
<td>1. Inspect axle shaft tube alignment. Correct as necessary. 2. Replace bent or sprung axle shaft. 3. Refer to Drive Pinion Bearing Pre-Load Adjustment. 4. Check adjustment of ring gear backlash and pinion gear. Correct as necessary. 5. Adjust drive pinion shaft bearings. 6. Tighten drive pinion gear shaft yoke nut with specified torque. 7. Readjust as necessary. 8. If necessary, replace scuffed gears.</td>
</tr>
<tr>
<td>AXLE SHAFT BROKE</td>
<td>1. Misaligned axle shaft tube. 2. Vehicle overloaded. 3. Erratic clutch operation. 4. Grabbing clutch.</td>
<td>1. Replace broken axle shaft after correcting axle shaft tube alignment. 2. Replace broken axle shaft. Avoid excessive weight on vehicle. 3. Replace broken axle shaft after inspecting for other possible causes. Avoid erratic use of clutch. 4. Replace broken axle shaft. Inspect clutch and make necessary repairs or adjustments.</td>
</tr>
<tr>
<td>DIFFERENTIAL CASE CRACKED</td>
<td>1. Improper adjustment of differential bearings. 2. Excessive ring gear backlash. 3. Vehicle overloaded. 4. Erratic clutch operation.</td>
<td>1. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings properly. 2. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust ring gear backlash properly. 3. Replace cracked case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. 4. Replace cracked case. After inspecting for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.</td>
</tr>
<tr>
<td>DIFFERENTIAL GEARS SCORED</td>
<td>1. Insufficient lubrication. 2. Improper grade of lubricant. 3. Excessive spinning of one wheel/tire.</td>
<td>1. Replace scored gears. Scoring marks on the drive face of gear teeth or in the bore are caused by instantaneous fusing of the mating surfaces. Scored gears should be replaced. Fill rear differential housing to required capacity with proper lubricant. Refer to Specifications. 2. Replace scored gears. Inspect all gears and bearings for possible damage. Clean and refill differential housing to required capacity with proper lubricant. 3. Replace scored gears. Inspect all gears, pinion bores and shaft for damage. Service as necessary.</td>
</tr>
<tr>
<td>LOSS OF LUBRICANT</td>
<td>1. Lubricant level too high.</td>
<td>1. Drain excess lubricant by removing fill plug and allow lubricant to level at lower edge of fill plug hole.</td>
</tr>
</tbody>
</table>
## CONTINUED

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
</table>
| LOSS OF LUBRICANT          | 2. Worn axle shaft seals.  
3. Cracked differential housing.  
4. Worn drive pinion gear shaft seal.  
5. Scored and worn yoke.  
6. Axle cover not properly sealed. | 2. Replace worn seals.  
3. Repair or replace housing as necessary.  
4. Replace worn drive pinion gear shaft seal.  
5. Replace worn or scored yoke and seal.  
6. Remove cover and clean flange and reseal. |
| AXLE OVERHEATING           | 1. Lubricant level too low.  
2. Incorrect grade of lubricant.  
4. Excessive gear wear.  
5. Insufficient ring gear backlash. | 1. Refill differential housing.  
2. Drain, flush and refill with correct amount of the correct lubricant.  
3. Readjust bearings.  
4. Inspect gears for excessive wear or scoring. Replace as necessary.  
5. Readjust ring gear backlash and inspect gears for possible scoring. |
| GEAR TEETH BROKE (RING GEAR AND PINION) | 1. Overloading.  
2. Erratic clutch operation.  
3. Ice-spotted pavements.  
4. Improper adjustments. | 1. Replace gears. Examine other gears and bearings for possible damage.  
2. Replace gears and examine the remaining parts for possible damage. Avoid erratic clutch operation.  
3. Replace gears. Examine the remaining parts for possible damage. Replace parts as required.  
4. Replace gears. Examine other parts for possible damage. Ensure ring gear backlash is correct. |
| AXLE NOISE                 | 1. Insufficient lubricant.  
2. Improper ring gear and drive pinion gear adjustment.  
3. Unmatched ring gear and drive pinion gear.  
4. Worn teeth on ring gear or drive pinion gear.  
5. Loose drive pinion gear shaft bearings.  
7. Misaligned or sprung ring gear.  
8. Loose differential bearing cap bolts | 1. Refill axle with correct amount of the proper lubricant. Also inspect for leaks and correct as necessary.  
2. Check ring gear and pinion gear teeth contact pattern.  
3. Remove unmatched ring gear and drive pinion gear. Replace with matched gear and drive pinion gear set.  
4. Check teeth on ring gear and drive pinion gear for correct contact. If necessary, replace with new matched set.  
5. Adjust drive pinion gearshaft bearing preload torque.  
6. Adjust differential bearing preload torque.  
7. Measure ring gear runout.  
8. Tighten with specified torque |
SERVICE PROCEDURES

LUBRICANT CHANGE

(1) Raise and support the vehicle.
(2) Remove the lubricant fill hole plug from the differential housing cover.
(3) Remove the differential housing cover and drain the lubricant from the housing.
(4) Clean the housing cavity with a flushing oil, light engine oil or lint free cloth. **Do not use water, steam, kerosene or gasoline for cleaning.**
(5) Remove the sealant from the housing and cover surfaces. Use solvent to clean the mating surfaces.
(6) Apply a bead of Mopar Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 3).
   - Install the housing cover within 5 minutes after applying the sealant.
(7) Install the cover and any identification tag. Tighten the cover bolts in a criss-cross pattern to 41 N-m (30 ft. lbs.) torque.
(8) Refill the differential with Mopar Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications in this group for the quantity necessary.
(9) Install the fill hole plug and lower the vehicle. Tighten fill plug to 34 N-m (25 ft. lbs.).

REMOVAL AND INSTALLATION

DRIVE AXLE ASSEMBLY

REMOVAL

(1) Raise and support the vehicle.
(2) Position a suitable lifting device under the axle.
(3) Secure axle to device.
(4) Remove the wheels and tires.
(5) Remove the brake rotors and calipers from the axle. Refer to Group 5, Brakes, for proper procedures.
(6) Disconnect the wheel sensor wiring harness from the vehicle wiring harness, if necessary.
(7) Disconnect the vent hose from the axle shaft tube.
(8) Mark the propeller shaft and yoke for installation alignment reference.
(9) Remove propeller shaft.
(10) Disconnect stabilizer bar links at the axle.
(11) Disconnect shock absorbers from axle brackets.
(12) Disconnect track bar.
(13) Disconnect the tie rod and drag link from the steering knuckle. Refer to Group 2, Suspension, for proper procedures.
(14) Disconnect the steering damper from the axle bracket.
(15) Disconnect the upper and lower suspension arms from the axle brackets.
(16) Lower the lifting device enough to remove the axle. The coil springs will drop with the axle.
(17) Remove the coil springs from the axle.

INSTALLATION

**CAUTION:** The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. If the springs are not at their normal ride position, ride height and handling could be affected.

(1) Install the springs and retainer clips. Tighten the retainer bolts to 21 N-m (16 ft. lbs.) torque.
(2) Support the axle on a suitable lifting device and position axle under the vehicle.
(3) Raise the axle and align it with the spring pads.
(4) Position the upper and lower suspension arms in the axle brackets. Loosely install bolts and nuts to hold suspension arms to the axle brackets.
(5) Connect the vent hose to the axle shaft tube.
(6) Connect the track bar to the axle bracket. Loosely install the bolt to hold the track bar to the axle bracket.


REMOVAL AND INSTALLATION (Continued)

(7) Install the shock absorbers and tighten the bolts to 23 N·m (17 ft. lbs.) torque.

(8) Install the stabilizer bar links to the axle brackets. Tighten the nut to 95 N·m (70 ft. lbs.) torque.

(9) Install the drag link and tie rod to the steering knuckles. Refer to Group 2, Suspension, for proper procedures.

(10) Install the steering damper to the axle bracket and tighten the nut to 75 N·m (55 ft. lbs.) torque.

(11) Install the brake rotors and calipers. Refer to Group 5, Brakes, for the proper procedures.

(12) Connect the wheel speed sensor wiring harness to the vehicle wiring harness, if necessary.

(13) Align the previously made marks on the propeller shaft and the yoke.

(14) Install the straps and bolts to hold the propeller shaft to the yoke.

(15) Check and fill axle lubricant. Refer to the Lubricant Specifications in this group for the quantity necessary.

(16) Install the wheel and tire assemblies.

(17) Remove the lifting device from the axle and lower the vehicle.

(18) Tighten the upper suspension arm nuts to 75 N·m (55 ft. lbs.) torque. Tighten the lower suspension arm nuts to 115 N·m (85 ft. lbs.) torque.

(19) Tighten the track bar bolt at the axle bracket to 100 N·m (74 ft. lbs.) torque.

(20) Check the front wheel alignment.

AXLE SHAFT—CARDAN U-JOINT

Single cardan U–joint components are not serviceable. If defective, they must be replaced as a unit. If the bearings, seals, spider, or bearing caps are damaged or worn, replace the complete U–joint.

REMOVAL

CAUTION: Clamp only the narrow forged portion of the yoke in the vise. Also, to avoid distorting the yoke, do not over tighten the vise jaws.

(1) Remove axle shaft.

(2) Remove the bearing cap retaining snap rings (Fig. 4).

It can be helpful to saturate the bearing caps with penetrating oil prior to removal.

(3) Locate a socket where the inside diameter is larger in diameter than the bearing cap. Place the socket (receiver) against the yoke and around the perimeter of the bearing cap to be removed.

(4) Locate a socket where the outside diameter is smaller in diameter than the bearing cap. Place the socket (driver) against the opposite bearing cap.

(5) Position the yoke with the sockets in a vise (Fig. 5).

(6) Compress the vise jaws to force the bearing cap into the larger socket (receiver).

(7) Release the vise jaws. Remove the sockets and bearing cap that was partially forced out of the yoke.

(8) Repeat the above procedure for the remaining bearing cap.

(9) Remove the remaining bearing cap, bearings, seals and spider from the propeller shaft yoke.
REMOVAL AND INSTALLATION (Continued)

INSTALLATION

1. Pack the bearing caps 1/3 full of wheel bearing lubricant. Apply extreme pressure (EP), lithium–base lubricant to aid in installation.
2. Position the spider in the yoke. Insert the seals and bearings. Tap the bearing caps into the yoke bores far enough to hold the spider in position.
3. Place the socket (driver) against one bearing cap. Position the yoke with the socket wrench in a vise.
4. Compress the vise to force the bearing caps into the yoke. Force the caps enough to install the retaining clips.
5. Install the bearing cap retaining clips.
6. Install axle shaft.

PINION SHAFT SEAL

REMOVAL

1. Raise and support the vehicle.
2. Remove wheel and tire assemblies.
3. Remove brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.
4. Mark the propeller shaft and pinion yoke for installation reference.
5. Remove the propeller shaft from the yoke.
6. Rotate the pinion gear three or four times.
7. Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.
8. Using Holder 6958 to hold the pinion yoke, remove the pinion nut and washer.
9. Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 6).
10. Use a suitable pry tool or a slide hammer mounted screw to remove the pinion seal.

INSTALLATION

1. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 7).

Fig. 7 Pinion Seal Installation

2. Install yoke on the pinion gear with Installer W-162–D, Cup 8109, and Holder 6958 (Fig. 8).

Fig. 8 Pinion Yoke Installation

CAUTION: Do not exceed the minimum tightening torque when installing the pinion yoke retaining nut at this point. Damage to collapsible spacer or bearings may result.

3. Install the pinion washer and a new nut on the pinion gear. Tighten the nut only enough to remove the shaft end play.
4. Rotate the pinion shaft using a (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.) (Fig. 9).
5. If the rotating torque is low, use Holder 6958 to hold the pinion yoke (Fig. 10), and tighten the pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.
REMOVAL AND INSTALLATION (Continued)

CAUTION: If the maximum tightening torque is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Replace the collapsible spacer.

(6) Align the installation reference marks on the propeller shaft and yoke and install the propeller shaft.

(7) Check and fill the gear lubricant. Refer to the Lubricant Specifications for gear lubricant requirements.

(8) Install the brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(9) Install wheel and tire assemblies.

(10) Lower the vehicle.

COLLAPSIBLE SPACER

REMOVAL W/PINION INSTALLED

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(4) Mark the propeller shaft and pinion yoke for installation reference.

(5) Remove the propeller shaft from the yoke.

(6) Rotate the pinion gear three or four times.

(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

(8) Using Holder 6958 to hold the pinion yoke, remove the pinion nut and washer.

(9) Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 11).

(10) Use a suitable pry tool or a slide hammer mounted screw, remove the pinion seal.

(11) Remove the front pinion bearing using a pair of suitable pick tools to pull the bearing straight off the pinion gear shaft. It may be necessary to lightly tap the end of the pinion gear with a rawhide or rubber mallet if the bearing becomes bound on the pinion shaft.

(12) Remove the collapsible spacer.
REMOVAL AND INSTALLATION (Continued)

REMOVAL W/PINION REMOVED
(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.
(4) Mark the propeller shaft and pinion yoke for installation reference.
(5) Remove the propeller shaft from the yoke.
(6) Rotate the pinion gear three or four times.
(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.
(8) Remove differential assembly from axle housing.
(9) Using Holder 6958 to hold yoke, remove the pinion nut and washer.
(10) Using Remover C-452 and Wrench C-3281, remove the pinion yoke from pinion shaft (Fig. 11).
(11) Remove the pinion gear from housing (Fig. 12). Catch the pinion with your hand to prevent it from falling and being damaged.
(12) Remove collapsible spacer from pinion shaft.

INSTALLATION
(1) Install a new collapsible preload spacer on pinion shaft (Fig. 13).
(2) If pinion gear was removed, install pinion gear in housing.
(3) Install pinion front bearing, if necessary.
(4) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 14), if necessary.
(5) Install yoke with Installer W-162-D, Cup 8109, and holder 6958 (Fig. 15).
(6) If the original pinion bearings are being used, install differential assembly and axle shafts, if necessary.

NOTE: If new pinion bearings were installed, do not install the differential assembly and axle shafts until after the pinion bearing preload and rotating torque are set.

(7) Install the pinion washer and a new nut on the pinion gear. Tighten the nut to 217 N·m (160 ft. lbs.) minimum. Do not over-tighten. Maximum torque is 353 N·m (260 ft. lbs.).
CAUTION: Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload torque. If preload torque is exceeded, a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(8) Using yoke holder 6958 and a torque wrench set at 353 N·m (260 ft. lbs.), crush collapsible spacer until bearing end play is taken up (Fig. 16).

(9) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 17).

(10) Check rotating torque with an inch pound torque wrench (Fig. 17). The torque necessary to rotate the pinion gear should be:
- Original Bearings — The reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

Fig. 17 Check Pinion Gear Rotation Torque—Typical

(11) Install differential assembly and axle shafts, if necessary.

(12) Align marks made previously on yoke and propeller shaft and install propeller shaft.

(13) Install brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(14) Add gear lubricant, if necessary. Refer to Lubricant Specifications of this section for lubricant requirements.

(15) Install wheel and tire assemblies.

(16) Lower vehicle.

HUB BEARING AND AXLE SHAFT

If the axle shaft and hub bearing are being removed in order to service another component, the axle shaft and hub bearing can be removed as an assembly.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the wheel and tire assembly.

(3) Remove the brake caliper and rotor. Refer to Group 5, Brakes, for proper procedures.

(4) Remove ABS wheel speed sensor, if necessary. Refer to Group 5, Brakes, for proper procedures.

(5) Remove the cotter pin, nut retainer, and axle hub nut (Fig. 18), if necessary.
(6) Remove the hub to knuckle bolts (Fig. 19).

(7) Remove the hub from the steering knuckle and axle shaft, if necessary.

(8) Remove hub bearing and axle shaft assembly (Fig. 20), or axle shaft from axle. **Avoid damaging the axle shaft oil seals in the axle housing.**

**INSTALLATION**

(1) Thoroughly clean the axle shaft (Fig. 18) and apply a thin film of Mopar® Wheel Bearing Grease, or equivalent, to the shaft splines, seal contact surface, and hub bore.

(2) Install the brake rotor shield to the knuckle.

(3) Install the hub bearing and axle shaft assembly, or axle shaft, into the housing and differential side gears. **Avoid damaging the axle shaft oil seals in the axle housing.**

(4) Install the hub bearing, if necessary.

(5) Install the hub to knuckle bolts and tighten to 102 N·m (75 ft. lbs.) torque.

(6) Install the hub washer and nut, if necessary. Tighten the hub nut to 237 N·m (175 ft. lbs.) torque. Install the nut retainer and a new cotter pin (Fig. 18).

(7) Install ABS wheel speed sensor, if necessary. Refer to Group 5, Brakes, for proper procedures.

(8) Install the brake rotor and caliper. Refer to Group 5, Brakes, for proper procedures.

(9) Install the wheel and tire assembly.

(10) Remove support and lower the vehicle.
REMOVAL AND INSTALLATION (Continued)

STEERING KNUCKLE AND BALL STUDS

Ball stud service procedures below require removal of the hub bearing and axle shaft. Removal and installation of upper and lower ball studs require the use of Tool Kit 6289.

KNUCKLE REMOVAL

(1) Remove hub bearing and axle shaft.
(2) Disconnect the tie-rod or drag link from the steering knuckle arm. Refer to Group 2, Suspension, for proper procedures.
(3) Remove the cotter pins from the upper and lower ball studs.
(4) Remove the upper and lower ball stud nuts.
(5) Strike the steering knuckle with a brass hammer to loosen knuckle from the ball studs. Remove knuckle from ball studs (Fig. 21).

UPPER BALL STUD REPLACEMENT

(1) Position tools as shown to remove and install ball stud (Fig. 22).

LOWER BALL STUD REPLACEMENT

(1) Position tools as shown to remove and install ball stud (Fig. 23).

KNUCKLE INSTALLATION

(1) Position the steering knuckle on the ball studs.
(2) Install and tighten the bottom retaining nut to 109 N·m (80 ft. lbs.) torque. Install new cotter pin.
(3) Install and tighten the top retaining nut to 101 N·m (75 ft. lbs.) torque. Install new cotter pin.
(4) Install the hub bearing and axle shaft.

(5) Connect the tie-rod or drag link end to the steering knuckle arm. Refer to Group 2, Suspension, for proper procedures.

AXLE BUSHING REPLACEMENT

Refer to Group 2, Suspension, for the proper axle bushing procedures.

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.
(2) Remove the lubricant fill hole plug from the differential housing cover.
(3) Remove the differential housing cover and allow fluid to drain.
(4) Remove hub bearings and axle shafts.
(5) Note the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 24).
(6) Loosen the differential bearing cap bolts.
(7) Position Spreader W-129-B, utilizing some items from Adapter Kit 6987, with the tool dowel pins seated in the locating holes (Fig. 25). Install the holddown clamps and tighten the tool turnbuckle finger–tight.
(8) Install a Guide Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to guide pin. Load the lever adapter against the opposite side of the housing (Fig. 26) and zero the indicator.

CAUTION: Do not spread over 0.50 mm (0.020 in). If the housing is over-spread, it could be distorted or damaged.

(9) Spread the housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 27).
(10) Remove the dial indicator.
(11) While holding the differential case in position, remove the differential bearing cap bolts and caps.
(12) Remove the differential from the housing. Ensure that the differential bearing cups remain in position on the differential bearings (Fig. 28).
(13) Mark or tag the differential bearing cups to indicate which side of the differential they were removed from.
(14) Remove spreader from housing.

INSTALLATION

If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.
Fig. 22 Upper Ball Stud Remove/Install

Fig. 23 Lower Ball Stud Remove/Install
(1) Position Spreader W-129-B, utilizing some items from Adapter Kit 6987, with the tool dowel pins seated in the locating holes (Fig. 29). Install the holddown clamps and tighten the tool turnbuckle finger-tight.

(2) Install a Guide Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to guide pin. Load the lever adapter against the opposite side of the housing (Fig. 26) and zero the indicator.

CAUTION: Do not spread over 0.50 mm (0.020 in). If the housing is over-spread, it could be distorted or damaged.

(3) Spread the housing enough to install the case in the housing. Measure the distance with the dial indicator (Fig. 27).

(4) Remove the dial indicator.

(5) Install differential case in the housing. Ensure that the differential bearing cups remain in position on the differential bearings. Tap the differential case to ensure the bearings cups are fully seated in the housing.

(6) Install the bearing caps at their original locations (Fig. 30).

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

(9) Tighten the bearing cap bolts to 61 N·m (45 ft. lbs.) torque.

(10) Install the hub bearings and axle shafts.
DIFFERENTIAL SIDE BEARINGS

REMOVAL
(1) Remove differential case from axle housing.
(2) Remove the bearings from the differential case with Puller/Press C-293-PA, C-293-39 Adapter Blocks, and Plug SP-3289 (Fig. 31).

INSTALLATION
If replacement differential side bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Install differential side bearing shims onto differential case hubs.
(2) Using Installer C-3716-A and Handle C-4171, install differential side bearings (Fig. 32).
(3) Install differential in axle housing.
REMOVAL AND INSTALLATION (Continued)

AXLE SHAFT OIL SEAL

REMOVAL
(1) Raise and support vehicle.
(2) Remove differential assembly.
(3) Remove the inner axle shaft seals with a pry bay.

INSTALLATION
(1) Remove any sealer remaining from original seals.
(2) Remove sealer from axle tube to housing junction, if necessary.
(3) Install oil seals with Discs 8110 and Turnbuckle 6797 (Fig. 33). Tighten tool until disc bottoms in housing.
(4) Install differential assembly.

RING GEAR
The ring and pinion gears are service in a matched set. Do not replace the ring gear without replacing the pinion gear.

REMOVAL
(1) Remove differential from axle housing.
(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 34)
(3) Remove bolts holding ring gear to differential case.
(4) Using a soft hammer, drive ring gear from differential case (Fig. 34).

INSTALLATION
CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

(1) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.
(2) Invert the differential case in the vise.
(3) Install new ring gear bolts and alternately tighten to 95-122 N·m (70-90 ft. lbs.) torque (Fig. 35).
(4) Install differential in axle housing and verify gear mesh and contact pattern.
PINION GEAR

The ring and pinion gears are serviced as a matched set. Do not replace the pinion gear without replacing the ring gear.

REMOVAL

(1) Remove differential assembly from axle housing.
(2) Mark pinion yoke and propeller shaft for installation alignment.
(3) Disconnect propeller shaft from pinion yoke. Using suitable wire, tie propeller shaft to underbody.
(4) Using Holder 6958 to the hold yoke, remove the pinion nut and washer (Fig. 36).
(5) Using Remover C-452 and Holder C-3281, remove the pinion yoke from pinion shaft (Fig. 37).
(6) Remove the pinion gear and collapsible spacer from housing (Fig. 38). Catch the pinion with your hand to prevent it from falling and being damaged.
(7) Remove the front pinion bearing cup, bearing, oil slinger, if equipped, and pinion seal with Remover C-4345 and Handle C-4171 (Fig. 39).
(8) Remove the rear pinion bearing cup from axle housing (Fig. 40). Use Remover D-149 and Handle C-4171.
(9) Remove the depth shims from rear pinion bearing cup bore in axle housing. Record the thickness of the depth shims.
REMOVAL AND INSTALLATION (Continued)

NOTE: The pinion depth shims can be very thin. Verify that all shims have been removed before proceeding.

(10) Remove the collapsible preload spacer from pinion gear (Fig. 41).

(11) Remove the rear pinion bearing from the pinion with Puller/Press C–293-PA and Adapters C–293–39 (Fig. 42).

Place 4 adapter blocks so they do not damage the bearing cage.

Fig. 39 Front Bearing Cup Removal

Fig. 41 Collapsible Spacer

Fig. 40 Rear Bearing Cup Removal

Fig. 42 Inner Bearing Removal

INSTALLATION

NOTE: Pinion depth shims are placed between the rear pinion bearing cup and axle housing to achieve proper ring and pinion gear mesh. If the factory installed ring and pinion gears are reused, the pinion depth shim should not require replacement. Refer to Pinion Gear Depth to select the proper thickness shim before installing pinion gear.
(1) Place proper thickness depth shim in rear pinion bearing cup bore in the axle housing.

(2) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of rear pinion bearing cup. Install the bearing cup with Installer D-146 and Driver Handle C-4171 (Fig. 43). Verify cup is correctly seated.

(3) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of front pinion bearing cup. Install the bearing cup with Installer D-130 and Handle C-4171 (Fig. 44).

(4) Install front pinion bearing, and oil slinger, if equipped.

(5) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 45).

(6) Install the rear pinion bearing and oil slinger, if equipped, on the pinion gear with Installer W-262 and a shop press (Fig. 46).

(7) Install a new collapsible preload spacer on pinion shaft and install pinion gear in housing (Fig. 47).

(8) Install yoke with Installer W-162-B, Cup 8109, and Holder 6958 (Fig. 48).

(9) Install the pinion washer and a new nut on the pinion gear. Tighten the nut to 216 N·m (160 ft. lbs.) minimum. Do not over-tighten. Maximum torque is 352 N·m (260 ft. lbs.).
CAUTION: Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload torque. If preload torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(10) Using Holder 6958 and torque wrench (set at 352 N·m (260 ft. lbs.)), crush collapsible spacer until bearing end play is taken up (Fig. 49).

(11) Slowly tighten the nut in 6.8 N·m (5 ft. lb.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 50).

(12) Check bearing rotating torque with an inch pound torque wrench (Fig. 50). The torque necessary to rotate the pinion gear should be:
- Original Bearings — 1 to 3 N·m (10 to 20 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

(13) Install differential assembly.
DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove the ring gear.
(2) Using a suitable roll pin punch, drive out the roll pin holding pinion gear mate shaft in the differential case (Fig. 51).

(3) Remove the pinion gear mate shaft from the differential case and the pinion mate gears.
(4) Rotate differential side gears and remove the pinion mate gears and thrust washers (Fig. 52).
(5) Remove the differential side gears and thrust washers.

ASSEMBLY

(1) Install the differential side gears and thrust washers.
(2) Install the pinion mate gears and thrust washers.
(3) Install the pinion gear mate shaft. Align the roll pin holes in shaft and the differential case.
(4) Install the roll pin to hold the pinion mate shaft in the differential case (Fig. 53).
(5) Install the ring gear.
(6) Lubricate all differential components with hypoid gear lubricant.

FINAL ASSEMBLY

(1) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces with mineral spirits. Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, on the housing cover (Fig. 54).

Install the housing cover within 5 minutes after applying the sealant.

(2) Install the cover on the differential with the attaching bolts. Install the identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.
CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

CLEANING AND INSPECTION

CARDAN U-JOINT

Clean all the U–joint yoke bores with cleaning solvent and a wire brush. Ensure that all the rust and foreign matter are removed from the bores.

Inspect the yokes for distortion, cracks and worn bearing cap bores.

Replace the complete U–joint if any of the components are defective.

AXLE COMPONENTS

Wash differential components with cleaning solvent and dry with compressed air. Do not steam clean the differential components.

Wash bearings with solvent and towel dry, or dry with compressed air. DO NOT spin bearings with compressed air. Cup and bearing must be replaced as matched sets only.

Clean axle shaft tubes and oil channels in housing.

Inspect for:

- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces.
- Bearing cups must not be distorted or cracked.
- Machined surfaces should be smooth and without any raised edges.
- Raised metal on shoulders of cup bores should be removed with a hand stone.
- Wear and damage to pinion gear mate shaft, pinion gears, side gears and thrust washers. Replace as a matched set only.
- Ring and pinion gear for worn and chipped teeth.
- Ring gear for damaged bolt threads. Replaced as a matched set only.
- Pinion yoke for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
- Preload shims for damage and distortion. Install new shims, if necessary.

ADJUSTMENTS

PINION GEAR DEPTH

GENERAL INFORMATION

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 55). A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard setting from the center line of the ring gear to the back face of the pinion is 92.08 mm (3.625 in.). The standard depth provides the best gear tooth contact pattern. Refer to Backlash and Contact Pattern Analysis paragraph in this section for additional information.
Compensation for pinion depth variance is achieved with select shims. The shims are placed behind the rear pinion bearing cup (Fig. 56).

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion gear. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance chart.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus the amount needed.

Note the etched number on the face of the drive pinion gear (−1, −2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shims. If the number is positive, subtract that value from the thickness of the depth shim. If the number is 0 no change is necessary.

**PINION DEPTH MEASUREMENT AND ADJUSTMENT**

Measurements are taken with pinion bearing cups and pinion bearings installed in the axle housing without any shims placed behind the rear pinion bearing cup. Take measurements with Pinion Gauge Set 6774 and Dial Indicator C-3339 (Fig. 57).

1. Assemble Pinion Height Block 6739, Pinion Block 6733, and rear pinion bearing onto Screw 6741 (Fig. 57).
2. Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups (Fig. 58).
3. Install front pinion bearing and Cone-nut 6740 hand tight (Fig. 57).
4. Place Arbor Disc 6732 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 59). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

**NOTE:** Arbor Discs 6732 has different step diameters to fit other axles. Choose proper step for axle being serviced.

5. Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.
6. Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block (Fig. 57). Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.
7. With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block.
8. Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 60). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator cannot achieve a zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.
9. Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number etched in the face of the pinion gear (Fig. 55). For example, if the depth variance is −2, add +0.002 in. to the dial indicator reading.

**NOTE:** If an oil slinger is used behind the inner pinion bearing, deduct the thickness of the slinger from the dial indicator reading and use that total for shim selection.

**DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH**

**INTRODUCTION**

Differential side bearing preload and gear backlash is achieved by selective shims positioned behind the differential side bearing cones. The proper shim thickness can be determined using slip-fit dummy bearings D-348 in place of the differential side bearings and a dial indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth...
and prepare the pinion gear for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion gear is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 61). Differential shim measurements are performed with axle spreader W-129-B removed.

**SHIM SELECTION**

NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.
(1) Remove differential side bearings from differential case.
(2) Remove factory installed shims from differential case.
(3) Install ring gear on differential case and tighten bolts to specification.
(4) Install dummy side bearings D-348 on differential case.
(5) Install differential case in axle housing.
(6) Install the marked bearing caps in their correct positions. Install and snug the bolts (Fig. 62).

(7) Using a dead-blow type mallet, seat the differential dummy bearings to each side of the axle housing (Fig. 63) and (Fig. 64).

(8) Thread guide stud C-3288-B into rear cover bolt hole below ring gear (Fig. 65).
(9) Attach a dial indicator C-3339 to guide stud. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 65).
(10) Push and hold differential case to pinion gear side of axle housing (Fig. 66).

(11) Zero dial indicator face to pointer (Fig. 66).

(12) Push and hold differential case to ring gear side of the axle housing (Fig. 67).

(13) Record dial indicator reading (Fig. 67).

(14) Add 0.008 in. (0.2 mm) to the zero end play total. This new total represents the thickness of shims to compress, or preload the new bearings when the differential is installed.

(15) Rotate dial indicator out of the way on the guide stud.

(16) Remove differential case and dummy bearings from axle housing.

(17) Install the pinion gear in axle housing. Install the pinion yoke and establish the correct pinion rotating torque.

(18) Install differential case and dummy bearings D-348 in axle housing (without shims), install bearing caps and tighten bolts snug.

(19) Seat ring gear side dummy bearing (Fig. 64).

(20) Position the dial indicator plunger on a flat surface between the ring gear bolt heads. (Fig. 65).

(21) Push and hold differential case toward pinion gear (Fig. 68).

(22) Zero dial indicator face to pointer (Fig. 68).

(23) Push and hold differential case to ring gear side of the axle housing (Fig. 69).

(24) Record dial indicator reading (Fig. 69).

(25) Subtract 0.002 in. (0.05 mm) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness shim required to achieve proper backlash.
(26) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the axle housing.

(27) Rotate dial indicator out of the way on guide stud.

(28) Remove differential case and dummy bearings from axle housing.

(29) Install side bearing shims on differential case hubs.

(30) Install side bearings and cups on differential case.

(31) Install spreader W-129-B, utilizing some items from Adapter Set 6987, on axle housing and spread axle opening enough to receive differential case.

(32) Install differential case in axle housing.

(33) Remove spreader from axle housing.

(34) Rotate the differential case several times to seat the side bearings.

(35) Position the indicator plunger against a ring gear tooth (Fig. 70).

(36) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(37) Zero dial indicator face to pointer.

(38) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the axle housing to the other (Fig. 71).

(39) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at several locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

After the proper backlash is achieved, perform Gear Contact Pattern Analysis procedure.
GEAR CONTACT PATTERN ANALYSIS

The ring and pinion gear teeth contact patterns will show if the pinion gear depth is correct in the axle housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

1. Apply a thin coat of hydrated ferric oxide, or equivalent, to the drive and coast side of the ring gear teeth.

2. Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion gear. This will provide a more distinct contact pattern.

3. Using a boxed end wrench on a ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion gear teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 72) and adjust pinion depth and gear backlash as necessary.

Fig. 71 Backlash Shim Adjustment

The ring and pinion gear teeth contact patterns will show if the pinion gear depth is correct in the axle housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.
**Fig. 72 Gear Tooth Contact Patterns**

<table>
<thead>
<tr>
<th>Drive Side of Ring Gear Teeth</th>
<th>Coast Side of Ring Gear Teeth</th>
<th>Desirable Contact Pattern. Pattern should be centered on the drive side of tooth. Pattern should be centered on the coast side of tooth, but may be slightly toward the toe. There should always be some clearance between contact pattern and top of the tooth.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toe</td>
<td>Toe</td>
<td>Ring Gear Backlash Correct. <strong>Thinner</strong> Pinion Gear Depth Shim Required.</td>
</tr>
<tr>
<td>Heel</td>
<td>Heel</td>
<td>Ring Gear Backlash Correct. <strong>Thicker</strong> Pinion Gear Depth Shim Required.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pinion Gear Depth Shim Correct. <strong>Decrease</strong> Ring Gear Backlash.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pinion Gear Depth Shim Correct. <strong>Increase</strong> Ring Gear Backlash.</td>
</tr>
</tbody>
</table>
SPECIFICATIONS

181 FBI AXLE

Axle Type .................................. Hypoid
Lubricant ............................. SAE Thermally Stable 80W–90
Lube Capacity ........................... 1.2 L (2.5 pts.)
Axle Ratio ..................... 3.07, 3.55, 3.73, 4.10
Differential Side Gear Clearance ... 0.12–0.20 mm
  (0.005–0.008 in.)
Ring Gear Diameter .......... 18.09 cm (7.125 in.)
Backlash ................. 0–0.15 mm (0.005–0.008 in.)
Pinion Std. Depth .......... 92.1 mm (3.625 in.)
Pinion Bearing Rotating Torque ..............
  Original Bearings ........1 – 2 N·m (10–20 in. lbs.)
  New Bearings .......... 1.5–4 N·m (15–35 in. lbs.)

181 FBI AXLE

DESCRIPTION TORQUE
Fill Hole Plug ............... 34 N·m (25 ft. lbs.)
Diff. Cover Bolt ............ 41 N·m (30 ft. lbs.)
Bearing Cap Bolt .......... 61 N·m (45 ft. lbs.)
Ring Gear Bolt .......... 95–122 N·m (70–90 ft. lbs.)
Axle Nut ................. 237 N·m (175 ft. lbs.)
Hub Brg. Bolt ............. 102 N·m (75 ft. lbs.)
Lower Ball Stud ............ 108 N·m (80 ft. lbs.)
Upper Ball Stud ............ 101 N·m (75 ft. lbs.)

SPECIAL TOOLS

181 FBI AXLE

Puller—C-293-PA
Plug—SP-3289
Adapter—C-293-39
Puller—C-452
Wrench—C-3281
SPECIAL TOOLS (Continued)

- **Dial Indicator**—C-3339
- **Driver**—C-3716-A
- **Handle**—C-4171
- **Installer**—D-146
- **Remover**—D-149
- **Installer**—W-162-D
- **Cup**—8109
- **Remover/Installer**—6289
SPECIAL TOOLS (Continued)

Installers
- 6761
- 6752
- 6774

Installer Discs—8110

Tool Set, Pinion Depth—6774

Gauge Block—6733

Spanner—6958

Turnbuckle—6797

Installer—C-3972-A
SPECIAL TOOLS (Continued)

**Spreader—W-129-B**

**Adapter Kit—6987**

**Pilot Stud—C-3288-B**

**Remover—C-4345**

**Installer—D-130**

**Installer—W-262**
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GENERAL INFORMATION

194 RBI AXLE

The 194 Rear Beam-design Iron (RBI) axle housing has an iron center casting (differential housing) with axle shaft tubes extending from either side. The tubes are pressed into and welded to the differential housing to form a one-piece axle housing.

The integral type, hypoid gear design, housing has the centerline of the pinion set below the centerline of the ring gear.

The axle has a vent hose to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts, meaning that loads are supported by the axle shaft and bearings. The axle shafts are retained by C-clips in the differential side gears.

The cover provides a means for servicing the differential without removing the axle.

For vehicles equipped with ABS brakes, the axles have a tone ring pressed onto the axle shaft. Use care when removing axle shafts to ensure that the tone wheel or the wheel speed sensor are not damaged.

LUBRICANT SPECIFICATIONS

A multi-purpose, hypoid gear lubricant which conforms to the following specifications should be used. Mopar® Hypoid Gear Lubricant conforms to all of these specifications.

- The lubricant should have MIL-L-2105C and API GL 5 quality specifications.
- Lubricant is a thermally stable SAE 80W–90 gear lubricant.
- Lubricant for axles intended for heavy-duty or trailer tow use is SAE 75W–140 SYNTHETIC gear lubricant.

Trac-loc differentials require the addition of 4 oz. of friction modifier to the axle lubricant. The 194 RBI
axle lubricant capacity is 1.66L (3.50 pts.) total, including the friction modifier if necessary.

CAUTION: If axle is submerged in water, lubricant must be replaced immediately to avoid possible premature axle failure.

DESCRIPTION AND OPERATION

STANDARD DIFFERENTIAL

The differential gear system divides the torque between the axle shafts. It allows the axle shafts 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 (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The side gears (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. 2).

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential

TRAC-LOK OPERATION

In a conventional differential, if one wheel spins, the opposite wheel will generate only as much torque as the spinning wheel.

In the Trac-loc differential, part of the ring gear torque is transmitted through clutch packs which contain multiple discs. The clutches will have radial grooves on the plates, and concentric grooves on the discs or bonded fiber material that is smooth in appearance.

In operation, the Trac-loc clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating
forces generated by the side gears as torque is applied through the ring gear (Fig. 4).

The Trac-lok design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel loses traction, 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 loose traction. If both wheels slip due to unequal traction, Trac-lok operation is normal. In extreme cases of differences of traction, the wheel with the least traction may spin.

**DIAGNOSIS AND TESTING**

**GENERAL INFORMATION**

Axle bearing problem conditions are usually caused by:
- Insufficient lubrication.
- Incorrect or contaminated lubricant.
- Overloading (excessive engine torque) or exceeding vehicle weight capacity.
- Incorrect clearance or backlash adjustment.
Axle component breakage is most often the result of:
- Severe overloading.
- Insufficient lubricant.
- Incorrect lubricant.
- Improperly tightened components.

**GEAR NOISE**

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, or worn/damaged gears.

Gear noise usually happens at a specific speed range. The range is 30 to 40 mph, or above 50 mph. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak–noise range. If the noise stops or changes greatly:
- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side and pinion gears can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion gear mate shaft can also cause a snapping or a knocking noise.

**BEARING NOISE**

The axle shaft, differential and pinion gear bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion gear bearings have a constant–pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differential bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle.
Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK
Low speed knock is generally caused by a worn U-joint or by worn side-gear thrust washers. A worn pinion gear shaft bore will also cause low speed knock.

VIBRATION
Vibration at the rear of the vehicle is usually caused by:
- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out-of-balance wheels.
- Loose wheel lug nuts.
- Worn U-joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components contribute to what appears to be a rear-end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.
Refer to Group 22, Wheels and Tires, for additional vibration information.

DRIVELINE SNAP
A snap or clunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:
- High engine idle speed
- Loose engine/transmission/transfer case mounts
- Worn U-joints
- Loose spring mounts
- Loose pinion gear nut and yoke
- Excessive ring gear backlash
- Excessive side gear/case clearance

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

TRAC-LOK DIFFERENTIAL NOISE
The most common problem is a chatter noise when turning corners. Before removing a Trac-loc unit for repair, drain, flush and refill the axle with the specified lubricant. Refer to Lubricant change in this Group.

A container of Mopar® Trac-loc Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

TRAC-LOK TEST
WARNING: WHEN SERVICING VEHICLES WITH A TRAC-LOK DIFFERENTIAL DO NOT USE THE ENGINE TO TURN THE AXLE AND WHEELS. BOTH REAR WHEELS MUST BE RAISED AND THE VEHICLE SUPPORTED. A TRAC-LOK AXLE CAN EXERT ENOUGH FORCE IF ONE WHEEL IS IN CONTACT WITH A SURFACE TO CAUSE THE VEHICLE TO MOVE.

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

1. Place blocks in front and rear of both front wheels.
2. Raise one rear wheel until it is completely off the ground.
3. Engine off, transmission in neutral, and parking brake off.
4. Remove wheel and bolt Special Tool 6790 to studs.
5. Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 5).
6. If rotating torque is less than 22 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be serviced.
## DIAGNOSIS AND TESTING (Continued)

### DIAGNOSIS CHART

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEEL NOISE</td>
<td>1. Wheel loose. 2. Faulty, brinelled wheel bearing.</td>
<td>1. Tighten loose nuts. 2. Faulty or brinelled bearings must be replaced.</td>
</tr>
<tr>
<td>AXLE SHAFT NOISE</td>
<td>1. Misaligned axle shaft tube. 2. Bent or sprung axle shaft. 3. End play in drive pinion bearings. 4. Excessive gear backlash between ring gear and pinion gear. 5. Improper adjustment of drive pinion gear shaft bearings. 6. Loose drive pinion gear shaft yoke nut. 7. Improper wheel bearing adjustment. 8. Scuffed gear tooth contact surfaces.</td>
<td>1. Inspect axle shaft tube alignment. Correct as necessary. 2. Replace bent or sprung axle shaft. 3. Refer to Drive Pinion Bearing Pre-Load Adjustment. 4. Check adjustment of ring gear backlash and pinion gear. Correct as necessary. 5. Adjust drive pinion shaft bearings. 6. Tighten drive pinion gear shaft yoke nut with specified torque. 7. Readjust as necessary. 8. If necessary, replace scuffed gears.</td>
</tr>
<tr>
<td>AXLE SHAFT BROKE</td>
<td>1. Misaligned axle shaft tube. 2. Vehicle overloaded. 3. Erratic clutch operation. 4. Grabbing clutch.</td>
<td>1. Replace broken axle shaft after correcting axle shaft tube alignment. 2. Replace broken axle shaft. Avoid excessive weight on vehicle. 3. Replace broken axle shaft after inspecting for other possible causes. Avoid erratic use of clutch. 4. Replace broken axle shaft. Inspect clutch and make necessary repairs or adjustments.</td>
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<tr>
<td>DIFFERENTIAL CASE CRACKED</td>
<td>1. Improper adjustment of differential bearings. 2. Excessive ring gear backlash. 3. Vehicle overloaded. 4. Erratic clutch operation.</td>
<td>1. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings properly. 2. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust ring gear backlash properly. 3. Replace cracked case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. 4. Replace cracked case. After inspecting for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.</td>
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<tr>
<td>DIFFERENTIAL GEARS SCORED</td>
<td>1. Insufficient lubrication. 2. Improper grade of lubricant. 3. Excessive spinning of one wheel.</td>
<td>1. Replace scored gears. Scoring marks on the drive face of gear teeth or in the bore are caused by instantaneous fusing of the mating surfaces. Scored gears should be replaced. Fill rear differential housing to required capacity with proper lubricant. Refer to Specifications. 2. Replace scored gears. Inspect all gears and bearings for possible damage. Clean and refill differential housing to required capacity with proper lubricant. 3. Replace scored gears. Inspect all gears, pinion bores and shaft for damage. Service as necessary.</td>
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<td>3. Replace gears. Examine the remaining parts for possible damage.</td>
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<td>4. Replace gears. Examine other parts for possible damage. Ensure ring gear backlash is correct.</td>
</tr>
<tr>
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LUBRICANT CHANGE

1. Raise and support the vehicle.
2. Remove the lubricant fill hole plug from the differential housing cover.
3. Remove the differential housing cover and drain the lubricant from the housing.
4. Clean the housing cavity with a flushing oil, light engine oil, or lint free cloth. Do not use water, steam, kerosene, or gasoline for cleaning.
5. Remove the original sealant from the housing and cover surfaces.
6. Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 6).
7. Install the housing cover within 5 minutes after applying the sealant.
8. For Trac-lok differentials, a quantity of Mopar® Trac-lok lubricant (friction modifier), or equivalent, must be added after repair service or a lubricant change. Refer to the Lubricant Specifications section of this group for the quantity necessary.
9. Fill differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications section of this group for the quantity necessary.
10. CAUTION: Overfilling the differential can result in lubricant foaming and overheating.
11. Install the fill hole plug and lower the vehicle.
12. Trac-lok differential equipped vehicles should be road tested by making 10 to 12 slow figure-eight turns. This maneuver will pump the lubricant through the clutch discs to eliminate a possible chatter noise complaint.

REMOVAL AND INSTALLATION

REAR AXLE

REMOVAL

1. Raise and support the vehicle.
2. Position a suitable lifting device under the axle.
3. Secure axle to device.
4. Remove the wheels and tires.
5. Remove the brake drums from the axle. Refer to Group 5, Brakes, for proper procedures.
6. Disconnect parking brake cables from brackets and lever.
7. Remove wheel speed sensors, if necessary. Refer to Group 5, Brakes, for proper procedures.
8. Disconnect the brake hose at the axle junction block. Do not disconnect the brake hydraulic lines at the wheel cylinders. Refer to Group 5, Brakes, for proper procedures.
9. Disconnect the vent hose from the axle shaft tube.
10. Mark the propeller shaft and yokes for installation alignment reference.
11. Remove propeller shaft.
12. Disconnect stabilizer bar links.
13. Disconnect shock absorbers from axle.
15. Disconnect upper and lower suspension arms from the axle brackets.
16. Separate the axle from the vehicle.
REMOVAL AND INSTALLATION (Continued)

INSTALLATION

NOTE: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. If the springs are not at their normal ride position, vehicle ride height and handling could be affected.

(1) Raise the axle with lifting device and align coil springs.
(2) Position the upper and lower suspension arms on the axle brackets. Install nuts and bolts, do not tighten bolts at this time.
(3) Install track bar and attachment bolts, do not tighten bolts at this time.
(4) Install shock absorbers and tighten nuts to 100 N·m (74 ft. lbs.) torque.
(5) Install stabilizer bar links and tighten nuts to 54 N·m (40 ft. lbs.) torque.
(6) Install the wheel speed sensors, if necessary. Refer to Group 5, Brakes, for proper procedures.
(7) Connect parking brake cable to brackets and lever.
(8) Install the brake drums. Refer to Group 5, Brakes, for proper procedures.
(9) Connect the brake hose to the axle junction block. Refer to Group 5, Brakes, for proper procedures.
(10) Install axle vent hose.
(11) Align propeller shaft and pinion yoke reference marks. Install U-joint straps and bolts. Tighten to 19 N·m (14 ft. lbs.) torque.
(12) Install the wheels and tires.
(13) Add gear lubricant, if necessary. Refer to Lubricant Specifications in this section for lubricant requirements.
(14) Remove lifting device from axle and lower the vehicle.
(15) Tighten lower suspension arm bolts to 177 N·m (130 ft. lbs.) torque.
(16) Tighten upper suspension arm bolts to 75 N·m (55 ft. lbs.) torque.
(17) Tighten track bar bolts to 100 N·m (74 ft. lbs.) torque.

PINION SHAFT SEAL

REMOVAL
(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove the brake drums. Refer to Group 5, Brakes, for proper procedures.
(4) Mark the propeller shaft and pinion yoke for installation alignment reference.
(5) Remove the propeller shaft from the yoke.
(6) Rotate the pinion gear three or four times.
(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.
(8) Using Holder 6958 to hold the pinion yoke, remove the pinion nut and washer.
(9) Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 7).

INSTALLATION
(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 8).
(2) Install yoke on the pinion gear with Screw 8112, Cup 8109, and Holder 6958 (Fig. 9).
REMOVAL AND INSTALLATION (Continued)

CAUTION: Do not exceed the minimum tightening torque when installing the pinion yoke at this point. Damage to the collapsible spacer or bearings may result.

(3) Install the yoke washer and a new nut on the pinion gear and tighten the pinion nut until there is zero bearing end-play.
(4) Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(5) Rotate the pinion shaft using a (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.) (Fig. 10).
(6) If the rotating torque is low, use Holder 6958 to hold the pinion yoke (Fig. 11), and tighten the pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until the proper rotating torque is achieved.

CAUTION: If the maximum tightening torque is reached prior to reaching the required rotating torque, the collapsible spacer may have been damaged. Replace the collapsible spacer.

(7) Align the installation reference marks on the propeller shaft and yoke and install the propeller shaft.
(8) Add gear lubricant to the differential housing, if necessary. Refer to the Lubricant Specifications for gear lubricant requirements.
(9) Install the brake drums. Refer to Group 5, Brakes, for proper procedures.
(10) Install wheel and tire assemblies.
(11) Lower the vehicle.

COLLAPSIBLE SPACER

REMOVAL W/PINION INSTALLED
(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove rear brake drums. Refer to Group 5, Brakes, for proper procedures.
(4) Mark the propeller shaft and pinion yoke for installation reference.
(5) Remove the propeller shaft from the yoke.
(6) Rotate the pinion gear three or four times.
(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.
REMOVAL AND INSTALLATION (Continued)

(8) Using Holder 6958 to hold the pinion yoke, remove the pinion nut and washer.
(9) Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 12).
(10) Use a suitable pry tool or a slide hammer mounted screw to remove the pinion shaft seal.
(11) Remove the front pinion bearing using a pair of suitable pick tools to pull the bearing straight off the pinion gear shaft. It may be necessary to lightly tap the end of the pinion gear with a rawhide or rubber mallet if the bearing becomes bound on the pinion shaft.
(12) Remove the collapsible spacer.

Removal W/Pinion Removed

(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove rear brake drums. Refer to Group 5, Brakes, for proper procedures.
(4) Mark the propeller shaft and pinion yoke for installation reference.
(5) Remove the propeller shaft from the yoke.
(6) Rotate the pinion gear three or four times.
(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.
(8) Remove differential assembly from axle housing.
(9) Using Holder 6958 to hold yoke, remove the pinion yoke nut and washer.
(10) Using Remover C-452 and Wrench C-3281, remove the pinion yoke from pinion shaft (Fig. 12).
(11) Remove the pinion gear from housing (Fig. 13). Catch the pinion with your hand to prevent it from falling and being damaged.
(12) Remove collapsible spacer from pinion shaft.

Installation

(1) Install a new collapsible preload spacer on pinion shaft (Fig. 14).
(2) If pinion gear was removed, install pinion gear in housing.
(3) Install pinion front bearing, if necessary.
(4) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 15).
REMOVAL AND INSTALLATION (Continued)

(5) Install yoke with Screw 8112, Cup 8109, and Holder 6958 (Fig. 16).

(6) If the original pinion bearings are being used, install differential assembly and axle shafts, if necessary.

NOTE: If new pinion bearings were installed, do not install the differential assembly and axle shafts until after the pinion bearing preload and rotating torque are set.

(7) Install the yoke washer and a new nut on the pinion gear. Tighten the pinion nut until there is zero bearing end-play.

(8) Tighten the nut to 271 N·m (200 ft. lbs.).

CAUTION: Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(9) Using yoke holder 6958 and a torque wrench set at 474 N·m (350 ft. lbs.), crush collapsible spacer until bearing end play is taken up (Fig. 17).

NOTE: If more than 474 N·m (350 ft. lbs.) of torque is necessary to remove the bearing end play, the collapsible spacer is defective and must be replaced.

(10) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 18).

(11) Check rotating torque with a (in. lbs.) torque wrench (Fig. 18). The torque necessary to rotate the pinion gear should be:
   - Original Bearings — The reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.).
   - New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

(12) Install differential assembly and axle shafts, if necessary.

(13) Align marks made previously on yoke and propeller shaft and install propeller shaft.

(14) Install rear brake drums. Refer to Group 5, Brakes, for proper procedures.

(15) Add gear lubricant, if necessary. Refer to Lubricant Specifications of this section for lubricant requirements.

(16) Install wheel and tire assemblies.

(17) Lower vehicle.

AXLE SHAFT

REMOVAL

(1) Raise and support vehicle. Ensure that the transmission is in neutral.

(2) Remove wheel and tire assembly.

(3) Remove brake drum. Refer to Group 5, Brakes, for proper procedure.
(4) Clean all foreign material from housing cover area.
(5) Loosen housing cover bolts. Drain lubricant from the housing and axle shaft tubes. Remove housing cover.
(6) Rotate differential case so that pinion mate gear shaft lock screw is accessible. Remove lock screw and pinion mate gear shaft from differential case (Fig. 19).

(7) Push axle shaft inward and remove axle shaft C–clip lock from the axle shaft (Fig. 20).
(8) Remove axle shaft. Use care to prevent damage to axle shaft bearing and seal, which will remain in axle shaft tube. Also, exercise care not to damage the wheel speed sensor on vehicles equipped with ABS brakes.

(9) Inspect axle shaft seal for leakage or damage.
(10) Inspect roller bearing contact surface on axle shaft for signs of brinelling, galling and pitting. If any of these conditions exist, the axle shaft and/or bearing and seal must be replaced.

INSTALLATION
(1) Lubricate bearing bore and seal lip with gear lubricant. Insert axle shaft through seal, bearing, and engage it into side gear splines.

NOTE: Use care to prevent shaft splines from damaging axle shaft seal lip. Also, exercise care not to damage the wheel speed sensor on vehicles equipped with ABS brakes.

(2) Insert C–clip lock in end of axle shaft. Push axle shaft outward to seat C–clip lock in side gear.
(3) Insert pinion mate shaft into differential case and through thrust washers and pinion gears.
(4) Align hole in shaft with hole in the differential case and install lock screw with Loctite® on the threads. Tighten lock screw to 19 N·m (14 ft. lbs.) torque.
(5) Install cover and add fluid. Refer to Lubricant Change procedure in this section for procedure and lubricant requirements.
(6) Install brake drum. Refer to Group 5, Brakes, for proper procedures.
(7) Install wheel and tire.
(8) Lower vehicle.

AXLE SHAFT SEAL AND BEARING REMOVAL
(1) Remove the axle shaft.
(2) Remove the axle shaft seal from the end of the axle shaft tube with a small pry bar.
REMOVAL AND INSTALLATION (Continued)

NOTE: The seal and bearing can be removed at the same time with the bearing removal tool.

(3) Remove the axle shaft bearing from the axle tube with Bearing Removal Tool Set 6310 using Adapter Foot 6310-5 (Fig. 21).

(4) Install the new axle shaft seal with Installer 6437 and Handle C–4171 (Fig. 22).

INSTALLATION

Do not install the original axle shaft seal. Always install a new seal.

(1) Wipe the axle shaft tube bore clean.

(2) Install axle shaft bearing with Installer 6436 and Handle C–4171. Ensure that the part number on the bearing is against the installer.

(3) Install the new axle shaft seal with Installer 6437 and Handle C–4171 (Fig. 22).

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.

(2) Remove the lubricant fill hole plug from the differential housing cover.

(3) Remove the differential housing cover and allow fluid to drain.

(4) Remove axle shafts.

(5) Note the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 23).

(6) Loosen the differential bearing cap bolts.

CAUTION: Do not spread over 0.38 mm (0.015 in). If the housing is over–spread, it could be distorted or damaged.

(9) Spread the housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 26).

(10) Remove the dial indicator.

(11) While holding the differential case in position, remove the differential bearing cap bolts and caps.

(7) Position Spreader W–129–B, utilizing some items from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 24). Install the hold-down clamps and tighten the tool turnbuckle finger–tight.

(8) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 25) and zero the indicator.
(12) Remove the differential from the housing. Ensure that the differential bearing cups remain in position on the differential bearings (Fig. 27).

(13) Mark or tag the differential bearing cups to indicate which side of the differential they were removed from.

(14) Retrieve differential case preload shims from axle housing. Mark or tag the differential case preload shims to indicate which side of the differential they were removed from.

(15) Remove spreader from housing.

**INSTALLATION**

If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Position Spreader W-129-B, utilizing some items from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 28). Install the hold-down clamps and tighten the tool turnbuckle finger-tight.

(2) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 25) and zero the indicator.
REMOVAL AND INSTALLATION (Continued)

CAUTION: Do not spread over 0.38 mm (0.015 in). If the housing is over-spread, it could be distorted or damaged.

(3) Spread the housing enough to install the case in the housing. Measure the distance with the dial indicator (Fig. 26).

(4) Remove the dial indicator.

(5) Install differential case in the housing. Ensure that the differential bearing cups remain in position on the differential bearings and that the preload shims remain between the face of the bearing cup and the housing. Tap the differential case to ensure the bearings cups and shims are fully seated in the housing.

(6) Install the bearing caps at their original locations (Fig. 29).

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

(9) Tighten the bearing cap bolts to 77 N·m (57 ft. lbs.) torque.

(10) Install the axle shafts.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential from axle housing.

(2) Remove the bearings from the differential case with Puller/Press C-293-PA, C-293-39 Blocks, and Plug SP-3289 (Fig. 30).

INSTALLATION

(1) Using tool C-3716-A with handle C-4171, install differential side bearings (Fig. 31).

(2) Install differential in axle housing.

RING GEAR

The ring and pinion gears are service in a matched set. Do not replace the ring gear without replacing the pinion gear.
REMOVAL AND INSTALLATION (Continued)

REMOVAL

1. Remove differential from axle housing.
2. Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 32)
3. Remove bolts holding ring gear to differential case.
4. Using a soft hammer, drive ring gear from differential case (Fig. 32).

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

1. Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.
2. Invert the differential case in the vise.
3. Install new ring gear bolts and alternately tighten to 95-122 N·m (70-90 ft. lbs.) torque (Fig. 33).
4. Install differential in axle housing and verify gear mesh and contact pattern.

PINION GEAR

The ring and pinion gears are serviced in a matched set. Do not replace the pinion gear without replacing the ring gear.

REMOVAL

1. Remove differential from the axle housing.
2. Mark pinion yoke and propeller shaft for installation alignment.
3. Disconnect propeller shaft from pinion yoke. Using suitable wire, tie propeller shaft to underbody.
4. Using Holder 6958 to hold yoke, remove the pinion yoke nut and washer.
5. Using Remover C-452 and Wrench C-3281, remove the pinion yoke from pinion shaft (Fig. 34).
6. Remove the pinion gear from housing (Fig. 35).
7. Catch the pinion with your hand to prevent it from falling and being damaged.
8. Remove oil slinger, if equipped, and front pinion bearing.
9. Remove the front pinion bearing cup with Remover C-4345 and Handle C-4171 (Fig. 36).
10. Remove the rear bearing cup from housing (Fig. 37). Use Remover D-149 and Handle C–4171.
11. Remove the collapsible preload spacer (Fig. 38).
12. Remove the rear bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-40 (Fig. 39).
   Place 4 adapter blocks so they do not damage the bearing cage.
13. Remove the depth shims from the pinion gear shaft. Record the thickness of the depth shims.

**INSTALLATION**
1. Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.
2. Install the pinion rear bearing cup with Installer D-146 and Driver Handle C–4171 (Fig. 40). Ensure cup is correctly seated.
3. Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.
4. Install the pinion front bearing cup with Installer D–130 and Handle C–4171 (Fig. 41).
5. Install pinion front bearing, and oil slinger, if equipped.
6. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C–4171 (Fig. 42).
NOTE: Pinion depth shims are placed between the rear pinion bearing cone and pinion gear to achieve proper ring and pinion gear mesh. If the factory installed ring and pinion gears are reused, the pinion depth shim should not require replacement. If required, refer to Pinion Gear Depth to select the proper thickness shim before installing rear pinion bearing.

(7) Place the proper thickness depth shim on the pinion gear.
(8) Install the rear bearing and slinger, if equipped, on the pinion gear with Installer W-262 (Fig. 43).
(9) Install a new collapsible preload spacer on pinion shaft and install pinion gear in housing (Fig. 44).
(10) Install pinion gear in housing.
(11) Install yoke with Installer Screw 8112, Cup 8109, and holder 6958 (Fig. 45).
(12) Install the yoke washer and a new nut on the pinion gear and tighten the pinion nut until there is zero bearing end-play.
(13) Tighten the nut to 271 N·m (200 ft. lbs.).
CAUTION: Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload torque. If preload torque or rotating torque is exceeded a new collapsible spacer must be installed. The torque sequence will then have to be repeated.

(14) Using yoke holder 6958 and a torque wrench set at 474 N·m (350 ft. lbs.), crush collapsible spacer until bearing end play is taken up (Fig. 46).

NOTE: If the spacer requires more than 474 N·m (350 ft. lbs.) torque to crush, the collapsible spacer is defective and must be replaced.

(15) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 47).

(16) Check bearing rotating torque with a (in. lbs.) torque wrench (Fig. 47). The torque necessary to rotate the pinion gear should be:
- Original Bearings — 1 to 3 N·m (10 to 20 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

(17) Install differential in housing.

**FINAL ASSEMBLY**

(1) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces
with mineral spirits. Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, on the housing cover (Fig. 48).

Install the housing cover within 5 minutes after applying the sealant.

(2) Install the cover on the differential with the attaching bolts. Install the identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove pinion gear mate shaft lock screw (Fig. 49).
(2) Remove pinion gear mate shaft.
(3) Rotate the differential side gears and remove the pinion mate gears and thrust washers (Fig. 50).
DISASSEMBLY AND ASSEMBLY (Continued)

(4) Align the hole in the pinion gear mate shaft with the hole in the differential case and install the pinion gear mate shaft lock screw.
(5) Lubricate all differential components with hypoid gear lubricant.

TRAC-LOK DIFFERENTIAL
The Trac-lok differential components are illustrated in (Fig. 51). Refer to this illustration during repair service.

DISASSEMBLY
(1) Clamp Side Gear Holding Tool 6965 in a vise.
(2) Position the differential case on Side Gear Holding Tool 6965 (Fig. 52).
(3) Remove ring gear, if necessary. Ring gear removal is necessary only if the ring gear is to be replaced. The Trac-lok differential can be serviced with the ring gear installed.
(4) Remove the pinion gear mate shaft lock screw (Fig. 53).
(5) Remove the pinion gear mate shaft. If necessary, use a drift and hammer (Fig. 54).
(6) Install and lubricate Step Plate C-6960-3 (Fig. 55).
(7) Assemble Threaded Adapter C-6960-1 into top side gear. Thread Forcing Screw C-6960-4 into adapter until it becomes centered in adapter plate.
(8) Position a small screw driver in slot of Threaded Adapter C-6960-1 (Fig. 56) to prevent adapter from turning.

Fig. 50 Pinion Mate Gear Removal

ASSEMBLY
(1) Install the differential side gears and thrust washers.
(2) Install the pinion mate gears and thrust washers.
(3) Install the pinion gear mate shaft.

Fig. 51 Trac–lok Differential Components
(9) Tighten forcing screw tool 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 57).

(10) Using an appropriate size feeler gauge, remove thrust washers from behind the pinion gears (Fig. 58).

(11) Insert Turning Bar C-6960-2 in case (Fig. 59).

(12) Loosen the Forcing Screw C-6960-4 in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar C-6960-2.

(13) Rotate differential case until the pinion gears can be removed.

(14) Remove pinion gears from differential case.

(15) Remove Forcing Screw C-6960-4, Step Plate C-6960-3, and Threaded Adapter C-6960-1.

(16) Remove top side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal (Fig. 60).


ASSEMBLY

NOTE: The clutch discs are replaceable as complete sets only. If one clutch disc pack is damaged, both packs must be replaced.
Lubricate each component with gear lubricant before assembly.

1. Assemble the clutch discs into packs and secure disc packs with retaining clips (Fig. 61).
2. Position assembled clutch disc packs on the side gear hubs.
3. Install clutch pack and side gear in the ring gear side of the differential case (Fig. 62). Be sure clutch pack retaining clips remain in position and are seated in the case pockets.
4. Position the differential case on Side Gear Holding Tool 6965.
5. Install lubricated Step Plate C-6960-3 in lower side gear (Fig. 63).
6. Install the upper side gear and clutch disc pack (Fig. 63).
8. Insert Forcing Screw C-6960-4.
9. Tighten forcing screw tool to slightly compress clutch discs.
10. Place pinion gears in position in side gears and verify that the pinion mate shaft hole is aligned.
11. Rotate case with Turning Bar C-6960-2 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.
12. Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.
13. Lubricate and install thrust washers behind pinion gears and align washers with a small screw.
driver. Insert mate shaft into each pinion gear to verify alignment.

14) Remove Forcing Screw C-6960-4, Step Plate C-6960-3, and Threaded Adapter C-6960-1.

15) Install pinion gear mate shaft and align holes in shaft and case.

16) Install the pinion mate shaft lock screw finger tight to hold shaft during differential installation.

If replacement gears and thrust washers were installed, it is not necessary to measure the gear backlash. Correct fit is due to close machining tolerances during manufacture.

17) Lubricate all differential components with hypoid gear lubricant.

Fig. 60 Side Gear & Clutch Disc Removal

Fig. 61 Clutch Disc Pack

Fig. 62 Clutch Discs & Lower Side Gear Installation

Fig. 63 Upper Side Gear & Clutch Disc Pack Installation
CLEANING AND INSPECTION

AXLE COMPONENTS

Wash differential components with cleaning solvent and dry with compressed air. **Do not steam clean the differential components.**

Wash bearings with solvent and towel dry, or dry with compressed air. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

Clean axle shaft tubes and oil channels in housing. Inspect for:

- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces.
- Bearing cups must not be distorted or cracked.
- Machined surfaces should be smooth and without any raised edges.
- Raised metal on shoulders of cup bores should be removed with a hand stone.
- Wear and damage to pinion gear mate shaft, pinion gears, side gears and thrust washers. Replace as a matched set only.
- Ring and pinion gear for worn and chipped teeth.
- Ring gear for damaged bolt threads. Replaced as a matched set only.
- Pinion yoke for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
- Preload shims for damage and distortion. Install new shims, if necessary.

TRAC-LOK

Clean all components in cleaning solvent. Dry components with compressed air. Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged. Inspect side and pinion gears. Replace any gear that is worn, cracked, chipped or damaged. Inspect differential case and pinion shaft. Replace if worn or damaged.

PRESOAK PLATES AND DISC

Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

ADJUSTMENTS

PINION GEAR DEPTH

GENERAL INFORMATION

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 64). A plus (+) number, minus (−) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard setting from the center line of the ring gear to the back face of the pinion is 96.850 mm (3.813 in.). The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

[Fig. 64 Pinion Gear ID Numbers]

Compensation for pinion depth variance is achieved with select shims. The shims are placed under the inner pinion bearing cone (Fig. 65).

[Fig. 65 Shim Locations]
If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion gear. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance charts.

Note where Old and New Pinion Marking columns intersect. Intersecting figure represents plus or minus amount needed.

Note the etched number on the face of the drive pinion gear (−1, −2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shim(s). If the number is positive, subtract that value from the thickness of the depth shim(s). If the number is 0 no change is necessary. Refer to the Pinion Gear Depth Variance Chart.

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with a Pinion Gauge Set, Pinion Block 6735, Arbor Discs 6732, and Dial Indicator C-3339 (Fig. 66).

1) Assemble Pinion Height Block 6739, Pinion Block 6735, and rear pinion bearing onto Screw 6741 (Fig. 66).

2) Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups (Fig. 67).

3) Install front pinion bearing and Cone 6740 hand tight (Fig. 66).

4) Place Arbor Disc 6732 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 68). Install differential bearing caps on Arbor Discs and tighten cap bolts. Refer to the Torque Specifications in this section.

NOTE: Arbor Discs 6732 have different step diameters to fit other axle sizes. Pick correct size step for axle being serviced.

---

**PINION GEAR DEPTH VARIANCE**

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</table>
ADJUSTMENTS (Continued)

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the surface of the pinion height block. Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block. Observe how many revolutions counterclockwise the dial pointer travels (approximately 0.125 in.) to the out-stop of the dial indicator.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 69). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number etched in the face of the pinion gear (Fig. 64) using the opposite sign on the variance number. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

(10) Remove the pinion depth gauge components from the axle housing.

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

Differential side bearing preload and gear backlash is achieved by selective shims inserted between the bearing cup and the axle housing. The proper shim thickness can be determined using slip-fit dummy bearings D-348 in place of the differential side bearings and a dial indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion gear for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion gear is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading, starting point shim thickness, and the preload specification added together.

The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 70).
SHIM SELECTION

NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.

1. Remove side bearings from differential case.
2. Install ring gear, if necessary, on differential case and tighten bolts to specification.
3. Install dummy side bearings D-348 on differential case.
4. Install differential case in axle housing.
5. Insert Dummy Shims 8107 (0.118 in. (3.0 mm)) starting point shims between the dummy bearing and the axle housing (Fig. 71).
6. Install the marked bearing caps in their correct positions. Install and tighten the bolts.
7. Thread guide stud C-3288-B into rear cover bolt hole below ring gear (Fig. 72).
8. Attach dial indicator C-3339 to guide stud. Position the dial indicator plunger on a flat surface on a ring gear bolt head (Fig. 72).
9. Push firmly and hold differential case to pinion gear side of axle housing.
10. Zero dial indicator face to pointer.
11. Push firmly and hold differential case to ring gear side of the axle housing.
12. Record dial indicator reading.
13. Add the dial indicator reading to the starting point shim thickness to determine total shim thickness to achieve zero differential end play.
14. Add 0.008 in. (0.2 mm) to the zero end play total. This new total represents the thickness of shims to compress, or preload the new bearings when the differential is installed.
15. Rotate dial indicator out of the way on guide stud.
16. Remove differential case, dummy bearings, and starting point shims from axle housing.
17. Install pinion gear in axle housing. Install the yoke and establish the correct pinion rotating torque.
18. Install differential case and dummy bearings in axle housing (without shims) and tighten retaining cap bolts.
19. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 72).
20. Push and hold differential case toward pinion gear.
22. Push and hold differential case to ring gear side of the axle housing.
(23) Record dial indicator reading.
(24) Subtract 0.002 in. (0.05 mm) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness of shim required to achieve proper backlash.
(25) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the axle housing.
(26) Rotate dial indicator out of the way on guide stud.
(27) Remove differential case and dummy bearings from axle housing.
(28) Install new side bearing cones and cups on differential case.
(29) Install spreader W-129-B, utilizing some components of Adapter Set 6987, on axle housing and spread axle opening enough to receive differential case.
(30) Place side bearing shims in axle housing against axle tubes.
(31) Install differential case in axle housing.
(32) Rotate the differential case several times to seat the side bearings.
(33) Position the indicator plunger against a ring gear tooth (Fig. 73).
(34) Push and hold ring gear upward while not allowing the pinion gear to rotate.
(35) Zero dial indicator face to pointer.
(36) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the differential housing to the other (Fig. 74).
(37) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at several locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

After the proper backlash is achieved, perform the Gear Contact Pattern Analysis procedure.

GEAR CONTACT PATTERN ANALYSIS

The ring and pinion gear teeth contact patterns will show if the pinion gear depth is correct in the axle housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

(1) Apply a thin coat of hydrated ferric oxide, or equivalent, to the drive and coast side of the ring gear teeth.

Fig. 73 Ring Gear Backlash Measurement

Fig. 74 Backlash Shim Adjustment

(2) Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion gear. This will provide a more distinct contact pattern.
(3) Using a boxed end wrench on a ring gear bolt, Rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion gear teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 75) and adjust pinion depth and gear backlash as necessary.
ADJUSTMENTS (Continued)

**DRIVE SIDE OF RING GEAR TEETH**

- **HEEL**
- **TOE**

**COAST SIDE OF RING GEAR TEETH**

- **TOE**
- **HEEL**

**Fig. 75 Gear Tooth Contact Patterns**

Desirable contact pattern. Pattern should be centered on the drive side of tooth. Pattern should be centered on the coast side of tooth, but may be slightly toward the toe. There should always be some clearance between contact pattern and top of the tooth.

**Ring Gear Backlash Correct. Thinner Pinion Gear Depth Shim Required.**

**Ring Gear Backlash Correct. Thicker Pinion Gear Depth Shim Required.**

**Pinion Gear Depth Shim Correct. Decrease Ring Gear Backlash.**

**Pinion Gear Depth Shim Correct. Increase Ring Gear Backlash.**
SPECIFICATIONS

194 RBI AXLE

DESCRIPTION
Axle Type ................... Semi-Floating Hypoid
Lubricant ................. SAE Thermally Stable 80W–90
Lubricant Trailer Tow ...... Synthetic 75W–140
Lube Capacity ............. 1.66 L (3.50 pts.)
Axle Ratios ............... 3.07, 3.55, 3.73, 4.10
Differential Bearing Preload .... 0.1 mm (0.004 in.)
Differential Side Gear Clearance ...... 0–0.15 mm (0–0.006 in.)
Ring Gear Diameter .......... 19.2 cm (7.562 in.)
Ring Gear Backlash . . . 0–0.15 mm (0.005–0.008 in.)
Pinion Std. Depth .......... 92.08 mm (3.625 in.)
Ring Gear Backlash .......... 0–0.15 mm (0.005–0.008 in.)
Pinion Bearing Preload-Original Bearings . 1–2 N·m (10–20 in. lbs.)
Pinion Bearing Preload-New Bearings . . . 1.5–4 N·m (15–35 in. lbs.)
Maximum Carrier Spread . . . 0.51 mm (0.020 in.)

TORQUE
Bolt, Diff. Cover ............. 41 N·m (30 ft. lbs.)
Bolt, Bearing Cap ............ 77 N·m (57 ft. lbs.)
Nut, Pinion ................. 271–474 N·m (200–350 ft. lbs.)
Screw, Pinion Mate Shaft Lock ....... 16.25 N·m (12 ft. lbs.)
Bolt, Ring Gear ....... 95–122 N·m (70–90 ft. lbs.)
Bolt, ABS Sensor ............. 8 N·m (70 in. lbs.)
SPECIAL TOOLS (Continued)

Installer—D-146

Remover—C-4345

Remover—D-149

Installer—W-262

Installer—6436

Installer—6437

Disc, Axle Arbor—6732

Gauge Block—6735
SPECIAL TOOLS (Continued)

- Tool Set, Pinion Depth—6774
- Trac-lok Tool Set—6960
- Holder—6965
- Starting Point Shim—8107

Spreader—W-129-B

Adapter Kit—6987

Guide Pin—C-3288-B

Bearing Remover Tool Set—6310
SPECIAL TOOLS (Continued)

Hub Puller—6790
Dial Indicator—C-3339
216 RBI REAR AXLE

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GENERAL INFORMATION

216 RBI AXLE

The 216 Rear Beam-design Iron (RBI) axle housing has an iron center casting (differential housing) with axle shaft tubes extending from either side. The tubes are pressed and welded into the differential housing to form a one-piece axle housing.

The integral type housing, hypoid gear design has the center line of the pinion set below the center line of the ring gear.

The axle has a vent hose to relieve internal pressure caused by lubricant vaporization and internal expansion.

The axles are equipped with semi-floating axle shafts. The vehicle weight is supported by the axle shaft and bearings. The axle shafts are retained by plates bolted to the end flanges of the axle tubes.

The cover provides a means for servicing the differential without removing the axle housing.

For vehicles equipped with ABS brakes, the axles have a tone ring pressed onto the axle shaft. Use care when removing axle shafts to ensure that the tone ring or the wheel speed sensor are not damaged.

The 216 RBI axle has the assembly part number and gear ratio listed on a tag. The tag is attached to the differential housing by a cover bolt. Build date identification codes are stamped on the cover side of an axle shaft tube.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a roll-pin. Differential side bearing preload and ring gear backlash is adjusted by shims positioned between the side bearing cone and differential case. Pinion gear depth is adjusted by shims positioned between the axle housing and the inner pinion bearing cup. Pinion bearing preload is maintained by shims positioned between the pinion gear shaft shoulder and the outer bearing cone. (Fig. 1)

LUBRICANT SPECIFICATIONS

A multi-purpose, hypoid gear lubricant which conforms to the following specifications should be used. Mopar® Hypoid Gear Lubricant conforms to all of these specifications.

- The lubricant should have MIL-L-2105C and API GL 5 quality specifications.
- Lubricant is a thermally stable SAE 80W-90 gear lubricant.

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Lubricant for axles intended for heavy-duty or trailer tow use is SAE 75W–140 SYNTHETIC gear lubricant.

Trac-lok differentials require the addition of 4 oz. of friction modifier to the axle lubricant. The 216 RBI axle lubricant capacity is 1.89 L (4.0 pts.) total, including the friction modifier if necessary.

**CAUTION:** If axle is submerged in water, lubricant must be replaced immediately to avoid possible premature axle failure.

**DESCRIPTION AND OPERATION**

**STANDARD DIFFERENTIAL**

The differential gear system divides the torque between the axle shafts. It allows the axle shafts 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 (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The side gears (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. 2).

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 3). 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.

**TRAC-LOK OPERATION**

In a conventional differential, if one wheel spins, the opposite wheel will generate only as much torque as the spinning wheel.

In the Trac-lok differential, part of the ring gear torque is transmitted through clutch packs which contain multiple discs. The clutches will have radial grooves on the plates, and concentric grooves on the discs or bonded fiber material that is smooth in appearance.
In operation, the Trac-lok clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 4).

The Trac-lok design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. When one wheel loses traction, 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 of traction, the wheel with the least traction may spin.

**DIAGNOSIS AND TESTING**

**GENERAL INFORMATION**

Axle bearing problem conditions are usually caused by:
- Insufficient or incorrect lubricant.
- Foreign matter/water contamination.

**GEAR NOISE**

Axle gear noise can be caused by insufficient lubricant, incorrect backlash, tooth contact, or worn/damaged gears.

Gear noise usually happens at a specific speed range. The range is 30 to 40 mph, or above 50 mph. The noise can also occur during a specific type of driving condition. These conditions are acceleration, deceleration, coast, or constant load.

When road testing, accelerate the vehicle to the speed range where the noise is the greatest. Shift out-of-gear and coast through the peak-noise range. If the noise stops or changes greatly:
- Check for insufficient lubricant.
- Incorrect ring gear backlash.
- Gear damage.

Differential side and pinion gears can be checked by turning the vehicle. They usually do not cause noise during straight-ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. A worn pinion gear mate shaft can also cause a snapping or a knocking noise.

**BEARING NOISE**

The axle shaft, differential and pinion gear bearings can all produce noise when worn or damaged. Bearing noise can be either a whining, or a growling sound.

Pinion gear bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher because it rotates at a faster rate. Drive the vehicle and load the differential. If bearing noise occurs, the rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. The pitch of differen-
DIAGNOSIS AND TESTING (Continued)

tial bearing noise is also constant and varies only with vehicle speed.

Axle shaft bearings produce noise and vibration when worn or damaged. The noise generally changes when the bearings are loaded. Road test the vehicle. Turn the vehicle sharply to the left and to the right. This will load the bearings and change the noise level. Where axle bearing damage is slight, the noise is usually not noticeable at speeds above 30 mph.

LOW SPEED KNOCK

Low speed knock is generally caused by a worn U-joint or by worn side-gear thrust washers. A worn pinion gear shaft bore will also cause low speed knock.

VIBRATION

Vibration at the rear of the vehicle is usually caused by a:

- Damaged drive shaft.
- Missing drive shaft balance weight(s).
- Worn or out-of-balance wheels.
- Loose wheel lug nuts.
- Worn U-joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

Check for loose or damaged front-end components or engine/transmission mounts. These components can contribute to what appears to be a rear-end vibration. Do not overlook engine accessories, brackets and drive belts.

All driveline components should be examined before starting any repair.

Refer to Group 22, Wheels and Tires, for additional vibration information.

DRIVELINE SNAP

A snap or dunk noise when the vehicle is shifted into gear (or the clutch engaged), can be caused by:

- High engine idle speed
- Loose engine/transmission/transfer case mounts
- Worn U-joints
- Loose spring mounts
- Loose pinion gear nut and yoke
- Excessive ring gear backlash
- Excessive side gear/case clearance

The source of a snap or a clunk noise can be determined with the assistance of a helper. Raise the vehicle on a hoist with the wheels free to rotate. Instruct the helper to shift the transmission into gear. Listen for the noise, a mechanics stethoscope is helpful in isolating the source of a noise.

TRAC–LOK DIFFERENTIAL NOISE

The most common problem is a chatter noise when turning corners. Before removing a Trac-lok unit for repair, drain, flush and refill the axle with the specified lubricant. Refer to Lubricant change in this Group.

A container of Mopar® Trac-lok Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

TRAC–LOK TEST

WARNING: WHEN SERVICING VEHICLES WITH A TRAC–LOK DIFFERENTIAL DO NOT USE THE ENGINE TO TURN THE AXLE AND WHEELS. BOTH REAR WHEELS MUST BE RAISED AND THE VEHICLE SUPPORTED. A TRAC–LOK AXLE CAN EXERT ENOUGH FORCE IF ONE WHEEL IS IN CONTACT WITH A SURFACE TO CAUSE THE VEHICLE TO MOVE.

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

1. Place blocks in front and rear of both front wheels.
2. Raise one rear wheel until it is completely off the ground.
3. Engine off, transmission in neutral, and parking brake off.
4. Remove wheel and bolt Special Tool 6790 to studs.
5. Use torque wrench on special tool to rotate wheel and read rotating torque (Fig. 5).
6. If rotating torque is less than 22 N·m (30 ft. lbs.) or more than 271 N·m (200 ft. lbs.) on either wheel the unit should be serviced.
<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHEEL NOISE</td>
<td>1. Wheel loose. 2. Faulty, brinelled wheel bearing.</td>
<td>1. Tighten loose nuts. 2. Faulty or brinelled bearings must be replaced.</td>
</tr>
<tr>
<td>AXLE SHAFT NOISE</td>
<td>1. Misaligned axle shaft tube. 2. Bent or sprung axle shaft. 3. End play in drive pinion bearings. 4. Excessive gear backlash between ring gear and pinion gear. 5. Improper adjustment of drive pinion gear shaft bearings. 6. Loose drive pinion gear shaft yoke nut. 7. Improper wheel bearing adjustment. 8. Scuffed gear tooth contact surfaces.</td>
<td>1. Inspect axle shaft tube alignment. Correct as necessary. 2. Replace bent or sprung axle shaft. 3. Refer to Drive Pinion Bearing Pre-Load Adjustment. 4. Check adjustment of ring gear backlash and pinion gear. Correct as necessary. 5. Adjust drive pinion shaft bearings. 6. Tighten drive pinion gear shaft yoke nut with specified torque. 7. Readjust as necessary. 8. If necessary, replace scuffed gears.</td>
</tr>
<tr>
<td>AXLE SHAFT BROKE</td>
<td>1. Misaligned axle shaft tube. 2. Vehicle overloaded. 3. Erratic clutch operation. 4. Grabbing clutch.</td>
<td>1. Replace broken axle shaft after correcting axle shaft tube alignment. 2. Replace broken axle shaft. Avoid excessive weight on vehicle. 3. Replace broken axle shaft after inspecting for other possible causes. Avoid erratic use of clutch. 4. Replace broken axle shaft. Inspect clutch and make necessary repairs or adjustments.</td>
</tr>
<tr>
<td>DIFFERENTIAL CASE CRACKED</td>
<td>1. Improper adjustment of differential bearings. 2. Excessive ring gear backlash. 3. Vehicle overloaded. 4. Erratic clutch operation.</td>
<td>1. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings properly. 2. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust ring gear backlash properly. 3. Replace cracked case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. 4. Replace cracked case. After inspecting for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.</td>
</tr>
<tr>
<td>DIFFERENTIAL GEARS SCORED</td>
<td>1. Insufficient lubrication. 2. Improper grade of lubricant. 3. Excessive spinning of one wheel/shaft.</td>
<td>1. Replace scored gears. Scoring marks on the drive face of gear teeth or in the bore are caused by instantaneous fusing of the mating surfaces. Scored gears should be replaced. Fill rear differential housing to required capacity with proper lubricant. Refer to Specifications. 2. Replace scored gears. Inspect all gears and bearings for possible damage. Clean and refill differential housing to required capacity with proper lubricant. 3. Replace scored gears. Inspect all gears, pinion bores and shaft for damage. Service as necessary.</td>
</tr>
<tr>
<td>LOSS OF LUBRICANT</td>
<td>1. Lubricant level too high.</td>
<td>1. Drain excess lubricant by removing fill plug and allow lubricant to level at lower edge of fill plug hole.</td>
</tr>
</tbody>
</table>
## DIAGNOSIS AND TESTING (Continued)

### DIAGNOSIS CHART — CONTINUED

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>POSSIBLE CAUSES</th>
<th>CORRECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOSS OF LUBRICANT</td>
<td>2. Worn axle shaft seals.</td>
<td>2. Replace worn seals.</td>
</tr>
<tr>
<td></td>
<td>3. Cracked differential housing.</td>
<td>3. Repair or replace housing as necessary.</td>
</tr>
<tr>
<td></td>
<td>4. Worn drive pinion gear shaft seal.</td>
<td>4. Replace worn drive pinion gear shaft seal.</td>
</tr>
<tr>
<td></td>
<td>5. Scored and worn yoke.</td>
<td>5. Replace worn or scored yoke and seal.</td>
</tr>
<tr>
<td></td>
<td>6. Axle cover not properly sealed.</td>
<td>6. Remove cover and clean flange and reseal.</td>
</tr>
<tr>
<td>AXLE OVERHEATING</td>
<td>1. Lubricant level too low.</td>
<td>1. Refill differential housing.</td>
</tr>
<tr>
<td></td>
<td>2. Incorrect grade of lubricant.</td>
<td>2. Drain, flush and refill with correct amount of the correct lubricant.</td>
</tr>
<tr>
<td></td>
<td>4. Excessive gear wear.</td>
<td>4. Inspect gears for excessive wear or scoring. Replace as necessary.</td>
</tr>
<tr>
<td></td>
<td>5. Insufficient ring gear backlash.</td>
<td>5. Readjust ring gear backlash and inspect gears for possible scoring.</td>
</tr>
<tr>
<td>GEAR TEETH BROKE (RING GEAR AND PINION)</td>
<td>1. Overloading.</td>
<td>1. Replace gears. Examine other gears and bearings for possible damage.</td>
</tr>
<tr>
<td></td>
<td>2. Erratic clutch operation.</td>
<td>2. Replace gears and examine the remaining parts for possible damage. Avoid erratic clutch operation.</td>
</tr>
<tr>
<td></td>
<td>3. Ice-spotted pavements.</td>
<td>3. Replace gears. Examine the remaining parts for possible damage. Replace parts as required.</td>
</tr>
<tr>
<td></td>
<td>4. Improper adjustments.</td>
<td>4. Replace gears. Examine other parts for possible damage. Ensure ring gear backlash is correct.</td>
</tr>
<tr>
<td>AXLE NOISE</td>
<td>1. Insufficient lubricant.</td>
<td>1. Refill axle with correct amount of the proper lubricant. Also inspect for leaks and correct as necessary.</td>
</tr>
<tr>
<td></td>
<td>2. Improper ring gear and drive pinion gear adjustment.</td>
<td>2. Check ring gear and pinion gear teeth contact pattern.</td>
</tr>
<tr>
<td></td>
<td>4. Worn teeth on ring gear or drive pinion gear.</td>
<td>4. Check teeth on ring gear and drive pinion gear for correct contact. If necessary, replace with new matched set.</td>
</tr>
<tr>
<td></td>
<td>5. Loose drive pinion gear shaft bearings.</td>
<td>5. Adjust drive pinion gearshaft bearing preload torque.</td>
</tr>
<tr>
<td></td>
<td>7. Misaligned or sprung ring gear.</td>
<td>7. Measure ring gear runout.</td>
</tr>
<tr>
<td></td>
<td>8. Loose differential bearing cap bolts</td>
<td>8. Tighten with specified torque.</td>
</tr>
</tbody>
</table>
SERVICE PROCEDURES

LUBRICANT CHANGE

(1) Raise and support the vehicle.
(2) Remove the lubricant fill hole plug from the differential housing cover.
(3) Remove the differential housing cover and drain the lubricant from the housing.
(4) Clean the housing cavity with a flushing oil, light engine oil, or lint free cloth. Do not use water, steam, kerosene, or gasoline for cleaning.
(5) Remove the original sealant from the housing and cover surfaces.
(6) Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 6).

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(7) Install the fill hole plug and lower the vehicle.
(8) For Trac-lok differentials, a quantity of Mopar® Trac-lok lubricant (friction modifier), or equivalent, must be added after repair service or a lubricant change. Refer to the Lubricant Specifications section of this group for the quantity necessary.
(9) Fill differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications section of this group for the quantity necessary.

REMOVAL AND INSTALLATION

REAR AXLE

REMOVAL

(1) Raise and support the vehicle.
(2) Position a suitable lifting device under the axle.
(3) Secure axle to device.
(4) Remove the wheels and tires.
(5) Remove the brake drums from the axle. Refer to Group 5, Brakes, for proper procedures.
(6) Disconnect parking brake cables from brackets and lever.
(7) Remove wheel speed sensors, if necessary. Refer to Group 5, Brakes, for proper procedures.
(8) Disconnect the brake hose at the axle junction block. Do not disconnect the brake hydraulic lines at the wheel cylinders. Refer to Group 5, Brakes, for proper procedures.
(9) Disconnect the vent hose from the axle shaft tube.
(10) Mark the propeller shaft and yokes for installation alignment reference.
(11) Remove propeller shaft.
(12) Disconnect stabilizer bar links.
(13) Disconnect shock absorbers from axle.
(14) Disconnect track bar.
(15) Disconnect upper and lower suspension arms from the axle brackets.
(16) Separate the axle from the vehicle.

Fig. 5 Trac-lok Test —Typical

Fig. 6 Apply Sealant

Install the housing cover within 5 minutes after applying the sealant.

(7) Install the cover and any identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.
REMOVAL AND INSTALLATION (Continued)

INSTALLATION

NOTE: The weight of the vehicle must be supported by the springs before suspension arms and track bar fasteners can be tightened. If the springs are not at their normal ride position, vehicle ride height and handling could be affected.

(1) Raise the axle with lifting device and align coil springs.
(2) Position the upper and lower suspension arms on the axle brackets. Install nuts and bolts, do not tighten bolts at this time.
(3) Install track bar and attachment bolts, do not tighten bolts at this time.
(4) Install shock absorbers and tighten nuts to 100 N·m (74 ft. lbs.) torque.
(5) Install stabilizer bar links and tighten nuts to 54 N·m (40 ft. lbs.) torque.
(6) Install the wheel speed sensors, if necessary. Refer to Group 5, Brakes, for proper procedures.
(7) Connect parking brake cable to brackets and lever.
(8) Install the brake drums. Refer to Group 5, Brakes, for proper procedures.
(9) Connect the brake hose to the axle junction block. Refer to Group 5, Brakes, for proper procedures.
(10) Install axle vent hose.
(11) Align propeller shaft and pinion yoke reference marks. Install U-joint straps and bolts. Tighten to 19 N·m (14 ft. lbs.) torque.
(12) Install the wheels and tires.
(13) Add gear lubricant, if necessary. Refer to Lubricant Specifications in this section for lubricant requirements.
(14) Remove lifting device from axle and lower the vehicle.
(15) Tighten lower suspension arm bolts to 177 N·m (130 ft. lbs.) torque.
(16) Tighten upper suspension arm bolts to 75 N·m (55 ft. lbs.) torque.
(17) Tighten track bar bolts to 100 N·m (74 ft. lbs.) torque.

PINION SHAFT SEAL

REMOVAL
(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove brake drums. Refer to Group 5, Brakes, for proper procedures.
(4) Mark the propeller shaft and pinion yoke for installation reference.
(5) Remove the propeller shaft from the yoke.
(6) Rotate the pinion gear three or four times.
(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.
(8) Using Holder 6958 to hold the pinion yoke, remove the pinion nut and washer.
(9) Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 7).

INSTALLATION
(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 8).
(2) Install yoke on the pinion gear with Installer W-162-D, Cup 8109, and Holder 6958 (Fig. 9).
REMOVAL AND INSTALLATION (Continued)

CAUTION: Do not exceed the minimum tightening torque when installing the pinion yoke retaining nut at this point. Damage to the pinion bearings may result.

(3) Install the pinion washer and a new nut on the pinion gear. **Tighten the nut only enough to remove the shaft end play.**

(4) Tighten pinion nut to 217 N·m (160 ft. lbs.).
(5) Rotate the pinion shaft using a (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.) (Fig. 10).

(6) If the rotating torque is low, use Holder 6958 to hold the pinion yoke, and tighten the pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.
(7) Align the installation reference marks on the propeller shaft and yoke, and install the propeller shaft.
(8) Check and fill the gear lubricant. Refer to the Lubricant Specifications for gear lubricant requirements.
(9) Install the brake drums. Refer to Group 5, Brakes, for proper procedures.
(10) Install wheel and tire assemblies.
(11) Lower the vehicle.

**AXLE SHAFT**

**REMOVAL**

(1) Hoist and support vehicle on safety stands.
(2) Remove wheel from vehicle.
(3) Remove brake drum. Refer to Group 5, Brakes, for proper procedure.
(4) Through access hole in axle flange, remove nuts holding axle retainer plate to axle tube.
(5) Using Slide Hammer 7420, Adapter 6790, and suitable lug nuts, pull axle shaft from vehicle (Fig. 11).

**INSTALLATION**

**WARNING:** Do not reuse the bolts and nuts that retained the axle shaft to axle tube flange. Used prevailing torque nuts can loosen, causing a dangerous condition.

(1) Insert axle into opening at end of axle tube.
(2) Align flat area on axle shaft retaining plate upward.
(3) Insert the retaining bolts into the axle tube flange and through the holes in the brake backing and axle shaft retaining plates.
REMOVAL AND INSTALLATION (Continued)

(4) Install nuts to hold axle retaining plate to axle tube.
(5) Through access hole in axle flange, tighten nuts to 61 N·m (45 ft. lbs.).
(6) Install brake drum.
(7) Install wheel and tire assembly.
(8) Check and fill the gear lubricant. Refer to the Lubricant Specifications for gear lubricant requirements.
(9) Lower vehicle and road test to verify repair.

AXLE BEARING AND SEAL

REMOVAL
(1) Remove axle shaft from vehicle.
(2) Using a 3/8 in. dia. drill bit, drill a shallow hole into soft steel axle bearing retaining ring (Fig. 12). If possible, use a drill depth stop to avoid marking axle.
(3) Using a suitable cold chisel, cut retaining ring across drilled hole (Fig. 13).
(4) Slide retaining ring from axle shaft.
(5) Using Splitter 1130 placed between the seal and bearing and a suitable Arbor Press, press unit bearing from axle shaft (Fig. 14).
(6) Slide seal from axle.
(7) Slide retaining plate from axle shaft.

INSTALLATION
(1) Using a suitable straight edge, verify flatness of axle shaft retaining plate. Replace plate if warped.
(2) Install retaining plate on axle (Fig. 15).
(3) Apply a coat of multi-purpose grease on sealing surface of axle seal.
(4) Install seal on axle with cavity away from retaining plate (Fig. 15).
(5) Lubricate bearing with Mopar® Wheel Bearing Grease, or equivalent. Wipe excess grease from outside of bearing.
(6) Slide bearing onto axle shaft with groove in outer surface toward seal (Fig. 15).
(7) Using Installer 7913 and shop press, press bearing onto axle shaft (Fig. 16).
(8) Using Installer 7913 and shop press, press soft metal retaining ring onto axle shaft (Fig. 17).
(9) Install axle in vehicle.
DIFFERENTIAL

REMOVAL

(1) Remove axle shafts.
(2) Note the orientation of the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 18).
(3) Remove the differential bearing caps.
(4) Position Spreader W–129–B with the tool dowel pins seated in the locating holes (Fig. 19).
(5) Install the hold down clamps and tighten the tool turnbuckle finger-tight.
(6) Install a Guide Pin C-3288-B at the left side of the differential housing. Attach dial indicator to housing pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 19) and zero the indicator.
(7) Spread the housing enough to remove the case from the housing. Measure the distance with the dial indicator (Fig. 19).

CAUTION: Do not spread over 0.50 mm (0.020 in). If the housing is over-spread, it could be distorted or damaged.

(8) Remove the dial indicator.
(9) Pry the differential case loose from the housing. To prevent damage, pivot on housing with the end of the pry bar against spreader (Fig. 20).
REMOVAL AND INSTALLATION (Continued)

(10) Remove the case from housing. Mark or tag bearing cups to indicate which side they were removed from.

INSTALLATION

(1) Position Spreader W-129-B with the tool dowel pins seated in the locating holes (Fig. 19). Install the hold down clamps and tighten the tool turnbuckle finger-tight.

(2) Install a Guide Pin C-3288-B at the left side of the differential housing. Attach dial indicator to housing pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 19) and zero the indicator.

(3) Spread the housing enough to install the case in the housing. Measure the distance with the dial indicator (Fig. 19).

CAUTION: Do not spread over 0.50 mm (0.020 in). If the housing is over-spread, it could be distorted or damaged.

(4) Remove the dial indicator.

(5) Install differential in housing.

(6) Install case in the housing. Tap the differential case with a rawhide or rubber mallet to ensure the bearings are fully seated in the differential housing (Fig. 21).

(7) Remove the spreader.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove the bearings from the differential case with Puller/Press C-293-PA, Adapters C-293-18, and Adapter C-293-3 (Fig. 23).

(3) Remove differential preload shims from differential case hubs. Tag the shims to identify which side of the differential they came from.
If ring and pinion gears have been replaced, verify differential side bearing preload and gear mesh backlash.

(1) Install differential preload shims on differential case hubs.
(2) Using tool D-156 with handle C-4171, install differential side bearings (Fig. 24).
(3) Install differential in axle housing.

RING GEAR

The ring and pinion gears are service in a matched set. Do not replace the ring gear without replacing the pinion gear.

REMOVAL

(1) Remove differential from axle housing.
(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 25)
(3) Remove bolts holding ring gear to differential case.
(4) Using a soft hammer, drive ring gear from differential case (Fig. 25).
REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

1) Invert the differential case and start two ring gear bolts. This will provide case-to-ring gear bolt hole alignment.
2) Invert the differential case in the vise.
3) Install new ring gear bolts and alternately tighten to 95–122 N·m (70–90 ft. lbs.) torque (Fig. 26).
4) Install differential in axle housing and verify gear mesh and contact pattern.

PINION GEAR

The ring and pinion gears are serviced as a matched set. Do not replace the pinion gear without replacing the ring gear.

REMOVAL

1) Remove differential assembly from axle housing.
2) Mark pinion yoke and propeller shaft for installation alignment.
3) Disconnect propeller shaft from pinion yoke. Using suitable wire, tie propeller shaft to underbody.
4) Using Holder 6958 to hold yoke, remove the pinion nut and washer (Fig. 27).
5) Using Remover C-452 and Holder C-3281, remove the pinion yoke from pinion shaft (Fig. 28).
6) Remove the pinion gear and preload shims from housing (Fig. 29). Catch the pinion with your hand to prevent it from falling and being damaged.
7) Remove the front pinion bearing cup, bearing, oil slinger, if equipped, and pinion seal with Remover D-147 and Handle C-4171 (Fig. 30).
8) Remove the rear pinion bearing cup from axle housing (Fig. 31). Use Remover D-148 and Handle C-4171.
9) Remove the depth shims from rear pinion bearing cup bore in axle housing. Record the thickness of the depth shims.

NOTE: The pinion depth shims can be very thin. Verify that all shims have been removed before proceeding.

10) Remove the rear pinion bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-48 (Fig. 32).

Place 4 adapter blocks so they do not damage the bearing cage.
INSTALLATION

NOTE: Pinion depth shims are placed between the rear pinion bearing cup and axle housing to achieve proper ring and pinion gear mesh. If the factory installed ring and pinion gears are reused, the pinion depth shim should not require replacement. Refer to Pinion Gear Depth to select the proper thickness shim before installing pinion gear.

(1) Place proper thickness depth shim in rear pinion bearing cup bore in the axle housing.
(2) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of rear pinion bearing cup. Install the bearing cup with Installer D-145 and Handle C–4171 (Fig. 33). Verify cup is correctly seated.
(3) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of front pinion bearing cup. Install the bearing cup with Installer D-144 and Handle C–4171 (Fig. 34).
(4) Install front pinion bearing, and oil slinger, if equipped.

(5) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C–4171 (Fig. 35).

(6) Install the rear pinion bearing and oil slinger, if equipped, on the pinion gear with Installer W-262 and a shop press (Fig. 36).

(7) Install pinion bearing preload shims onto the pinion gear (Fig. 37).

(8) Install pinion gear in housing.

(9) Install yoke with Installer W-162-B, Cup 8109, and Holder 6958 (Fig. 38).

(10) Install the pinion washer and a new nut on the pinion gear. Tighten the nut to 217 N·m (160 ft. lbs.) (Fig. 39).

CAUTION: Never loosen pinion gear nut to decrease pinion gear bearing rotating torque and never exceed specified preload rotating torque.

(11) Check bearing preload torque with an inch pound torque wrench (Fig. 40). The torque necessary to rotate the pinion gear should be:
- Original Bearings—1 to 3 N·m (10 to 20 in. lbs.).
- New Bearings—2 to 5 N·m (15 to 35 in. lbs.).

(12) If rotating torque is above the desired amount, remove the pinion yoke and increase the preload shim pack thickness. Increasing the shim pack thickness 0.025 mm (0.001 in.) will decrease the rotating torque approximately 0.9 N·m (8 in. lbs.).
Tighten pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until the maximum tightening or desired rotating torque is reached.

If the maximum tightening torque is reached prior to achieving the desired rotating torque, remove the pinion yoke and decrease the thickness of the preload shim pack. Decreasing the shim pack thickness 0.025 mm (0.001 in.) will increase the rotating torque approximately 0.9 N·m (8 in. lbs.).

Install differential assembly.

(13) Tighten pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until the maximum tightening or desired rotating torque is reached.

(14) If the maximum tightening torque is reached prior to achieving the desired rotating torque, remove the pinion yoke and decrease the thickness of the preload shim pack. Decreasing the shim pack thickness 0.025 mm (0.001 in.) will increase the rotating torque approximately 0.9 N·m (8 in. lbs.).

(15) Install differential assembly.

**FINAL ASSEMBLY**

(1) Scrape the residual sealant from the housing and cover mating surfaces. Clean the mating surfaces with mineral spirits. Apply a bead of Mopar® Silicone.
Rubber Sealant, or equivalent, on the housing cover (Fig. 41).

Install the housing cover within 5 minutes after applying the sealant.

CAUTION: Overfilling the differential can result in lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove pinion gear mate shaft lock screw (Fig. 42).

(2) Remove pinion gear mate shaft.

(3) Rotate the differential side gears and remove the pinion mate gears and thrust washers (Fig. 43).

ASSEMBLY

(1) Install the differential side gears and thrust washers.

(2) Install the pinion mate gears and thrust washers.

(3) Install the pinion gear mate shaft.

(4) Align the hole in the pinion gear mate shaft with the hole in the differential case and install the pinion gear mate shaft lock screw.

(5) Lubricate all differential components with hypoid gear lubricant.

TRAC-LOK DIFFERENTIAL

The Trac-Lok differential components are illustrated in (Fig. 44). Refer to this illustration during repair service.
DISASSEMBLY

1. Clamp Side Gear Holding Tool 6963–A in a vise.
2. Position the differential case on Side Gear Holding Tool 6963–A (Fig. 45).
3. Remove ring gear, if necessary. Ring gear removal is necessary only if the ring gear is to be replaced. The Trac-Lok differential can be serviced with the ring gear installed.
4. Remove the pinion gear mate shaft lock screw (Fig. 46).
(5) Remove the pinion gear mate shaft. If necessary, use a drift and hammer (Fig. 47).

(6) Install and lubricate Step Plate C-4487-1 (Fig. 48).

(7) Assemble Threaded Adapter C-4487-3 into top side gear. Thread Forcing Screw C-4487-2 into adapter until it becomes centered in adapter plate.

(8) Position a small screw driver in slot of Threaded Adapter C-4487-3 (Fig. 49) to prevent adapter from turning.

(9) Tighten forcing screw tool 122 N·m (90 ft. lbs.) (maximum) to compress Belleville springs in clutch packs (Fig. 50).

(10) Using an appropriate size feeler gauge, remove thrust washers from behind the pinion gears (Fig. 51).

(11) Insert Turning Bar C-4487-4 in case (Fig. 52).

(12) Loosen the Forcing Screw C-4487-2 in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar C-4487-4.

(13) Rotate differential case until the pinion gears can be removed.

(14) Remove pinion gears from differential case.

(15) Remove Forcing Screw C-4487-2, Step Plate C-4487-1, and Threaded Adapter C-4487-3.

(16) Remove top side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal (Fig. 53).

**ASSEMBLY**

NOTE: The clutch discs are replaceable as complete sets only. If one clutch disc pack is damaged, both packs must be replaced.

Lubricate each component with gear lubricant before assembly.

1. Assemble the clutch discs into packs and secure disc packs with retaining clips (Fig. 54).
2. Position assembled clutch disc packs on the side gear hubs.
3. Install clutch pack and side gear in the ring gear side of the differential case (Fig. 55). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**
4. Position the differential case on Side Gear Holding Tool 6963-A.
5. Install lubricated Step Plate C–4487–1 on side gear (Fig. 56).
6. Install the upper side gear and clutch disc pack (Fig. 56).
9. Tighten forcing screw tool to slightly compress clutch discs.
10. Place pinion gears in position in side gears and verify that the pinion mate shaft hole is aligned.
DISASSEMBLY AND ASSEMBLY (Continued)

(11) Rotate case with Turning Bar C–4487–4 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove forcing screw, threaded adapter, and step plate.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install the pinion mate shaft lock screw finger tight to hold shaft during differential installation. If replacement side and/or pinion gears and thrust washers were installed, it is not necessary to measure the side gear backlash. Correct fit is due to close machining tolerances during manufacture.

(17) Lubricate all differential components with hypoid gear lubricant.

CLEANING AND INSPECTION

AXLE COMPONENTS

Wash differential components with cleaning solvent and dry with compressed air. Do not steam clean the differential components.

Wash bearings with solvent and towel dry, or dry with compressed air. DO NOT spin bearings with compressed air. Cup and bearing must be replaced as matched sets only.

Clean axle shaft tubes and oil channels in housing. Inspect for:
- Smooth appearance with no broken/dented surfaces on the bearing rollers or the roller contact surfaces.
- Bearing cups must not be distorted or cracked.
- Machined surfaces should be smooth and without any raised edges.
- Raised metal on shoulders of cup bores should be removed with a hand stone.
CLEANING AND INSPECTION (Continued)

- Wear and damage to pinion gear mate shaft, pinion gears, side gears and thrust washers. Replace as a matched set only.
- Ring and pinion gear for worn and chipped teeth.
- Ring gear for damaged bolt threads. Replaced as a matched set only.
- Pinion yoke for cracks, worn splines, pitted areas, and a rough/corroded seal contact surface. Repair or replace as necessary.
- Preload shims for damage and distortion. Install new shims, if necessary.

TRAC-LOK

Clean all components in cleaning solvent. Dry components with compressed air. Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged. Inspect side and pinion gears. Replace any gear that is worn, cracked, chipped or damaged. Inspect differential case and pinion shaft. Replace if worn or damaged.

PRESOAK PLATES AND DISC

Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

ADJUSTMENTS

PINION GEAR DEPTH

GENERAL INFORMATION

Ring and pinion gears are supplied as matched sets only. The identifying numbers for the ring and pinion gear are etched into the face of each gear (Fig. 57). A plus (+) number, minus (–) number or zero (0) is etched into the face of the pinion gear. This number is the amount (in thousandths of an inch) the depth varies from the standard depth setting of a pinion etched with a (0). The standard setting from the center line of the ring gear to the back face of the pinion is 109.52 mm (4.312 in.). The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed under the inner pinion bearing cup in the axle housing bore (Fig. 58).

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion gear. Add or subtract the thickness of the original depth shims to compensate for the difference in the depth variances. Refer to the Depth Variance charts.

Note where Old and New Pinion Marking columns intersect. The intersecting figure represents plus or minus the amount needed.

Note the etched number on the face of the drive pinion gear (−1, −2, 0, +1, +2, etc.). The numbers represent thousands of an inch deviation from the standard. If the number is negative, add that value to the required thickness of the depth shim(s). If the number is positive, subtract that value from the thickness of the depth shim(s). If the number is 0 no change is necessary. Refer to the Pinion Gear Depth Variance Chart.


**PINION DEPTH MEASUREMENT AND ADJUSTMENT**

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with Pinion Gauge Set 6730 and Dial Indicator C-3339 (Fig. 59).

(1) Assemble Pinion Height Block 6739, Pinion Block 6734, and rear pinion bearing onto Screw 6741 (Fig. 59).

(2) Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups (Fig. 60).

(3) Install front pinion bearing and Cone 6740 hand tight.

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 61). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

**NOTE:** Arbor Discs 6732 have different step diameters to fit other axle sizes. Pick correct size step for axle being serviced.

---

**PINION GEAR DEPTH VARIANCE**

<table>
<thead>
<tr>
<th>Original Pinion Gear Depth Variance</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>+1</th>
<th>+2</th>
<th>+3</th>
<th>+4</th>
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<tbody>
<tr>
<td>+4</td>
<td>+0.008</td>
<td>+0.007</td>
<td>+0.006</td>
<td>+0.005</td>
<td>+0.004</td>
<td>+0.003</td>
<td>+0.002</td>
<td>+0.001</td>
<td>0</td>
</tr>
<tr>
<td>+3</td>
<td>+0.007</td>
<td>+0.006</td>
<td>+0.005</td>
<td>+0.004</td>
<td>+0.003</td>
<td>+0.002</td>
<td>+0.001</td>
<td>0</td>
<td>-0.001</td>
</tr>
<tr>
<td>+2</td>
<td>+0.006</td>
<td>+0.005</td>
<td>+0.004</td>
<td>+0.003</td>
<td>+0.002</td>
<td>+0.001</td>
<td>0</td>
<td>-0.001</td>
<td>-0.002</td>
</tr>
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<td>+1</td>
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<td>+0.004</td>
<td>+0.003</td>
<td>+0.002</td>
<td>+0.001</td>
<td>0</td>
<td>-0.001</td>
<td>-0.002</td>
<td>-0.003</td>
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<tr>
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<td>+0.004</td>
<td>+0.003</td>
<td>+0.002</td>
<td>+0.001</td>
<td>0</td>
<td>-0.001</td>
<td>-0.002</td>
<td>-0.003</td>
<td>-0.004</td>
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<tr>
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<td>+0.001</td>
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<td>-0.005</td>
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<td>-0.001</td>
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<td>-0.003</td>
<td>-0.004</td>
<td>-0.005</td>
<td>-0.006</td>
</tr>
<tr>
<td>-3</td>
<td>+0.001</td>
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<td>-0.001</td>
<td>-0.002</td>
<td>-0.003</td>
<td>-0.004</td>
<td>-0.005</td>
<td>-0.006</td>
<td>-0.007</td>
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</tbody>
</table>

---

**Fig. 59 Pinion Gear Depth Gauge Tools—Typical**

(1) Assemble Pinion Height Block 6739, Pinion Block 6734, and rear pinion bearing onto Screw 6741 (Fig. 59).

**Fig. 60 Pinion Height Block—Typical**

(2) Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups (Fig. 60).

(3) Install front pinion bearing and Cone 6740 hand tight.

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 61). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

**NOTE:** Arbor Discs 6732 have different step diameters to fit other axle sizes. Pick correct size step for axle being serviced.
ADJUSTMENTS (Continued)

(5) Assemble Dial Indicator C-3339 into Scooter Block D-115-2 and secure set screw.

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block. Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block. Observe how many revolutions counterclockwise the dial pointer travels (approximately 0.125 in.) to the out-stop of the dial indicator.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 62). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the thickest dial indicator reading plus or minus the drive pinion gear depth variance number etched in the face of the pinion gear (Fig. 57).

(10) Remove the pinion depth gauge components from the axle housing.

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

Differential side bearing preload and gear backlash is achieved by selective shims inserted between the bearing cup and the axle housing. The proper shim thickness can be determined using slip-fit dummy bearings D-345 in place of the differential side bear-
ADJUSTMENTS (Continued)

Differential Preload and Gear Backlash Shim Selection

NOTE: It is difficult to salvage the differential side bearings during the removal procedure. Install replacement bearings if necessary.

1. Remove differential side bearings from differential case.
2. Remove factory installed shims from differential case.
3. Install ring gear on differential case and tighten bolts to specification.
4. Install dummy side bearings D-345 on differential case.
5. Install differential case in axle housing (Fig. 64).
6. Install the marked bearing caps in their correct positions. Install and snug the bolts (Fig. 65).

(7) Using a dead-blow type mallet, seat the differential dummy bearings to each side of the axle housing (Fig. 66) and (Fig. 67).

8. Thread guide stud C-3288-B into rear cover bolt hole below ring gear (Fig. 68).
9. Attach a dial indicator C-3339 to Guide Stud C-3288-B. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 68).
10. Push and hold differential case to pinion gear side of axle housing (Fig. 69).
11. Zero dial indicator face to pointer (Fig. 69).
12. Push and hold differential case to ring gear side of the axle housing (Fig. 70).
13. Record dial indicator reading (Fig. 70).
14. Add the dial indicator reading to the starting point shim thickness to determine total shim thickness to achieve zero differential end play.
15. Add 0.008 in. (0.2 mm) to the zero end play total. This new total represents the thickness of shims to compress, or preload the new bearings when the differential is installed.
(16) Rotate dial indicator out of the way on guide stud.
(17) Remove differential case and dummy bearings from axle housing.
(18) Install pinion gear in axle housing. Install the pinion yoke and establish the correct pinion rotating torque.
(19) Install differential case and dummy bearings D-345 in axle housing (without shims), install bearing caps and tighten bolts snug.
(20) Seat ring gear side dummy bearing (Fig. 67).
(21) Position the dial indicator plunger on a flat surface between the ring gear bolt heads. (Fig. 68).
(22) Push and hold differential case toward pinion gear (Fig. 71).
(23) Zero dial indicator face to pointer (Fig. 71).
(24) Push and hold differential case to ring gear side of the axle housing (Fig. 72).
(25) Record dial indicator reading (Fig. 72).
ADJUSTMENTS (Continued)

(26) Subtract 0.002 in. (0.05 mm) from the dial indicator reading to compensate for backlash between ring and pinion gears. This total is the thickness shim required to achieve proper backlash.

(27) Subtract the backlash shim thickness from the total preload shim thickness. The remainder is the shim thickness required on the pinion side of the axle housing.

(28) Rotate dial indicator out of the way on guide stud.

(29) Remove differential case and dummy bearings from axle housing.

(30) Install side bearing shims on differential case hubs.

(31) Install new side bearing cones and cups on differential case.

(32) Install spreader W-129-B on axle housing and spread axle opening enough to receive differential case.

(33) Install differential case in axle housing. Refer to Differential Removal and Installation paragraph.

(34) Remove spreader from axle housing.

(35) Rotate the differential case several times to seat the side bearings.

(36) Position the indicator plunger against a ring gear tooth (Fig. 73).

(37) Push and hold ring gear upward while not allowing the pinion gear to rotate.

(38) Zero dial indicator face to pointer.

(39) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the axle housing to the other (Fig. 74).

(40) Verify differential case and ring gear runout by measuring ring to pinion gear backlash at several locations around the ring gear. Readings should not vary more than 0.05 mm (0.002 in.). If readings vary more than specified, the ring gear or the differential case is defective.

After the proper backlash is achieved, perform Gear Contact Pattern Analysis procedure.

GEAR CONTACT PATTERN ANALYSIS

The ring and pinion gear teeth contact patterns will show if the pinion gear depth is correct in the axle housing. It will also show if the ring gear backlash has been adjusted correctly. The backlash can be adjusted within specifications to achieve desired tooth contact patterns.

(1) Apply a thin coat of hydrated ferric oxide, or equivalent, to the drive and coast side of the ring gear teeth.

(2) Wrap, twist, and hold a shop towel around the pinion yoke to increase the turning resistance of the pinion gear. This will provide a more distinct contact pattern.

(3) Using a boxed end wrench on a ring gear bolt, rotate the differential case one complete revolution in both directions while a load is being applied from shop towel.

The areas on the ring gear teeth with the greatest degree of contact against the pinion gear teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 75) and adjust pinion depth and gear backlash as necessary.
### Gear Tooth Contact Patterns

<table>
<thead>
<tr>
<th>Drive Side of Ring Gear Teeth</th>
<th>Coast Side of Ring Gear Teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heel</strong></td>
<td><strong>Toe</strong></td>
</tr>
</tbody>
</table>

**Desirable Contact Pattern:**
- Pattern should be centered on the drive side of tooth.
- Pattern should be centered on the coast side of tooth, but may be slightly toward the toe.
- There should always be some clearance between contact pattern and top of the tooth.

**Ring Gear Backlash Correct:**
- **Thinner** Pinion Gear Depth Shim Required.

**Ring Gear Backlash Correct:**
- **Thicker** Pinion Gear Depth Shim Required.

**Pinion Gear Depth Shim Correct:**
- **Decrease** Ring Gear Backlash.

**Pinion Gear Depth Shim Correct:**
- **Increase** Ring Gear Backlash.

*Fig. 75 Gear Tooth Contact Patterns*
## SPECIFICATIONS

### 216 RBI AXLE

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axle Type</td>
<td>Semi-floating Hypoid</td>
</tr>
<tr>
<td>Lubricant</td>
<td>SAE Thermally Stable 80W–90</td>
</tr>
<tr>
<td>Lubricant–Trailer Tow</td>
<td>Synthetic 75W–140</td>
</tr>
<tr>
<td>Lubricant Capacity</td>
<td>1.89 L (4.0 pts.)</td>
</tr>
<tr>
<td>Axle Ratios</td>
<td>3.07, 3.55, 4.10</td>
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<tr>
<td>Differential Bearing Preload</td>
<td>0.1 mm (0.004 in.)</td>
</tr>
<tr>
<td>Differential Side Gear Clearance</td>
<td>0–0.15 mm (0–0.006 in.)</td>
</tr>
<tr>
<td>Ring Gear Diameter</td>
<td>216 mm (8.5 in.)</td>
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<tr>
<td>Ring Gear Backlash</td>
<td>0.13–0.20 mm (0.005–0.008 in.)</td>
</tr>
<tr>
<td>Pinion Depth</td>
<td>109.52 mm (4.312 in.)</td>
</tr>
<tr>
<td>Brg. Preload, Pinion (New)</td>
<td>2.26–4.52 N·m (20–40 in. lbs.)</td>
</tr>
<tr>
<td>Brg. Preload, Pinion (Original)</td>
<td>1–3 N·m (10–20 in. lbs.)</td>
</tr>
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</table>

### 216 RBI TORQUE

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<th>DESCRIPTION</th>
<th>TORQUE</th>
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</thead>
<tbody>
<tr>
<td>Plug, Fill</td>
<td>34 N·m (25 ft. lbs.)</td>
</tr>
<tr>
<td>Bolts, Diff. Cover</td>
<td>41 N·m (30 ft. lbs.)</td>
</tr>
<tr>
<td>Bolts, Diff. Bearing Cap</td>
<td>108 N·m (80 ft. lbs.)</td>
</tr>
<tr>
<td>Bolts, Ring Gear</td>
<td>108 N·m (80 ft. lbs.)</td>
</tr>
<tr>
<td>Nuts, Brake Backing Plate</td>
<td>61 N·m (45 ft. lbs.)</td>
</tr>
<tr>
<td>Nut, Pinion Gear—Minimum</td>
<td>217 N·m (160 ft. lbs.)</td>
</tr>
</tbody>
</table>

## SPECIAL TOOLS

### 216 RBI AXLE

- Puller Set—C-293-M
- Adapters—C-293-18
- Adapters—C-293-48
- Extension—C-293-3
- Remover—C-452
SPECIAL TOOLS (Continued)

- **Handle**—C-4171
- **Installer**—D-156
- **Pilot**—C-3288-B
- **Dial Indicator**—C-3339
- **Trac-lok Tool Set**—C-4487
- **Installer**—C-3972-A
- **Installer**—D-144
- **Installer**—D-145
SPECIAL TOOLS (Continued)

Remover—D-147

Cup—8109

Remover—D-148

Splitter—1130

Spreader—W-129-B

Installer—W-262

Installer—W-162–D

Pinion Depth Set—6730