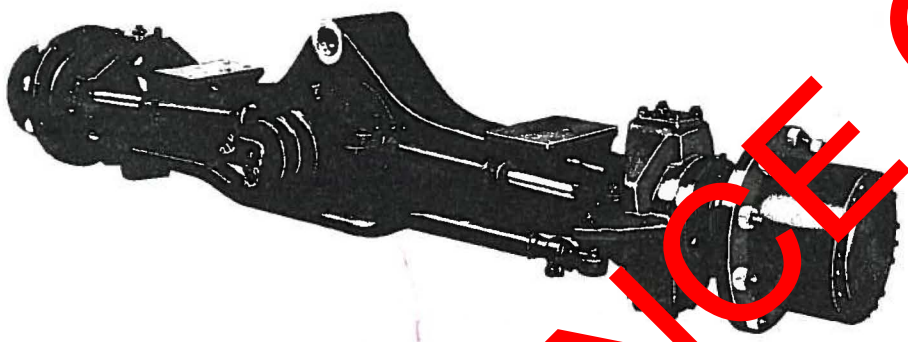
Maintenance Manual
Models PS/PR 7036

236512



SPICER OFF-HIGHWAY COMPONENTS

DANA

MAINTENANCE MANUAL
Models PS/PR-7036

CONTENTS

SECTION 1
GENERAL INFORMATION

IMPORTANT SAFETY NOTICE

Should an axle assembly require component parts replacement, it is recommended that "Original Equipment" replacement parts be used. They may be obtained through your local service dealer or other original equipment manufacturer parts supplier. **CAUTION: THE USE OF NON-ORIGINAL EQUIPMENT REPLACEMENT PARTS IS NOT RECOMMENDED AS THEIR USE MAY CAUSE UNIT FAILURE AND/OR AFFECT VEHICLE SAFETY.**

Proper service and repair is important to the safe, reliable operation of all motor vehicles or driving axles whether they be front or rear. The service procedures recommended and described in this service manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. The special tool should be used when and as recommended.

CAUTION: EXTREME CARE SHOULD BE EXERCISED WHEN WORKING ON COMPONENTS UTILIZING SNAP RINGS OR SPRING LOADED RETENTION DEVICES. FOR PERSONAL SAFETY, IT IS RECOMMENDED THAT INDUSTRIAL STRENGTH SAFETY GOGGLES OR GLASSES BE WORN WHENEVER REPAIR WORK IS BEING DONE ON ANY VEHICLE OR VEHICLE COMPONENTS.

It is impossible to know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Accordingly, anyone who uses a service procedure or tool which is not recommended must first satisfy himself thoroughly that neither his safety or vehicle safety will be jeopardized by the service methods he selects.

WARNING

Some vehicle manufacturers may require the assembly of brake components on Dana axles that utilize materials containing asbestos fibers.

BREATHING ASBESTOS DUST MAY BE HAZARDOUS TO YOUR HEALTH AND MAY CAUSE SERIOUS RESPIRATORY OR OTHER BODILY HARM.

Follow O.S.H.A. standards for proper protective devices to be used when working with asbestos materials.

SILICONE RUBBER SEALANT (RTV) AND LUBRICATING GREASE AND OILS

Silicone rubber sealant is used as a gasket material on some Dana axles, as well as various lubricants and other materials. Before using any of these materials, one should become familiar with and follow all safety precautions as recommended by the product manufacturer/supplier. All personnel involved with these materials should follow good industrial hygiene practices (e.g. before eating, hand and face should be thoroughly washed. Eating, drinking and smoking should be prohibited in areas where there is potential for significant exposure to these materials).

When discarding any of the materials, observe all local, state, and federal laws and regulations for proper disposal procedures.

Safety Precautions

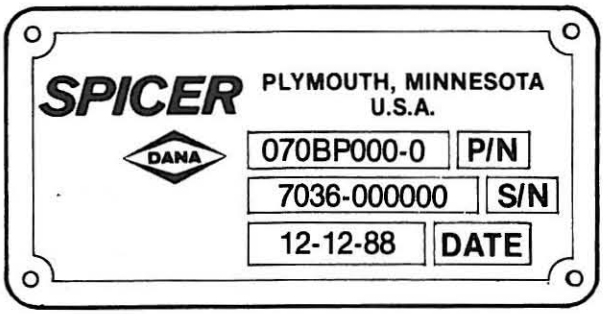
This symbol warns of possible personal injury.

A serious or fatal injury can occur ...

- if you lack proper training
- if you fail to follow proper procedures
- if you do not use proper tools and safety equipment
- if you assemble components improperly
- if you use incompatible components
- if you use worn-out or damaged components
- if you use components in a non-approved application

SAFETY GLASSES SHOULD BE WORN AT ALL TIMES WHEN WORKING ON VEHICLES OR VEHICLE COMPONENTS.

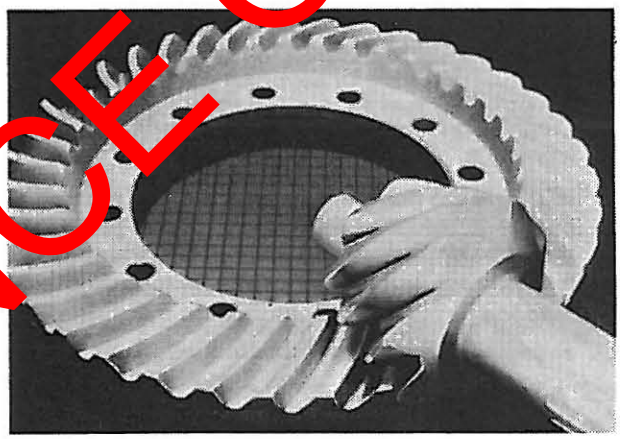
Axle Identification

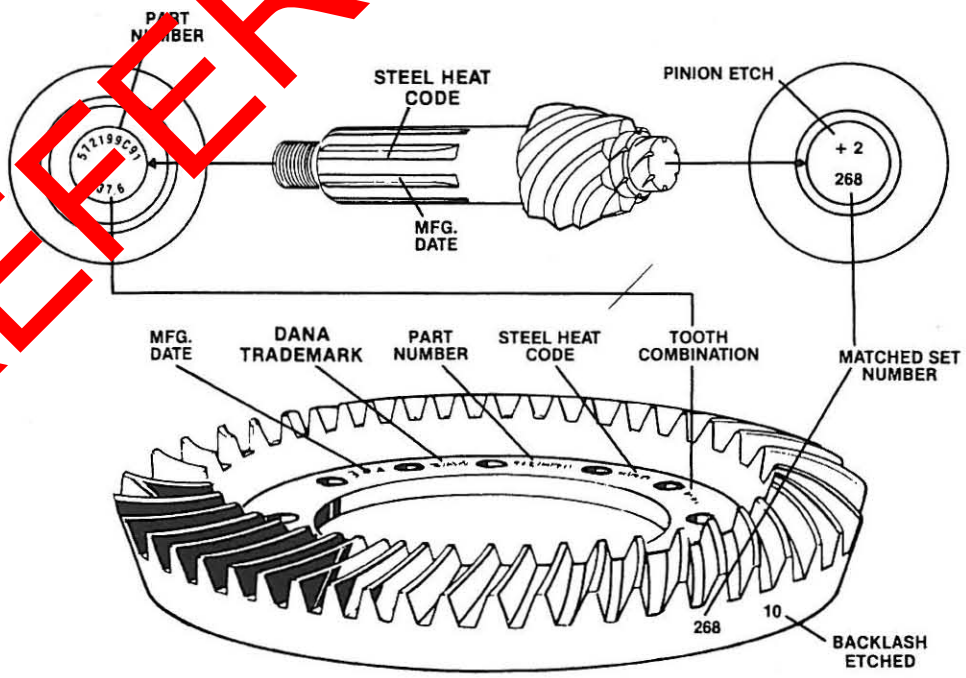


The identification tag located on the rear of the axle housing contains the axle assembly number, the serial number and the build date. It is recommended when referring to components of the axle assembly that all the information recorded on this tag be obtained to aid in the correct identification.

Gear Set Identification

Manufacturer's date—date gear set was made.
Dana—Dana name—and location of manufacturing.
572199C91—part number of ring gear. (Typical)
Tooth combination (i.e. 37-6)—indicates the pinion has 6 teeth and the ring gear 37 teeth which results in a 6.17:1 ratio.
Matched set number—Spicer ring and pinions are manufactured as a matched set. Both pieces are marked with a corresponding number (i.e. 268) which indentifies them as a matched set.
A gear set that does not have the same matching numbers should not be run together. If either ring gear or pinion require replacement **they must be replaced as a matched set.**





Servicing Components Not Covered In This Manual

Service procedures for some components may not be covered in this manual because they are unique to the vehicle application. Refer to the vehicle manufacturer's service manual for servicing those components.

Vehicle Storage Or Prolonged Inoperation

If the vehicle has not been operated on a regular daily basis, it is recommended that the vehicle be operated at least once every two weeks. The vehicle should be moved far enough to cause the drivetrain components to make several complete revolutions. This procedure will help assure that all internal components receive adequate amount of lubrication to help reduce component deterioration caused by an undesirable environment (e.g. high humidity).

Submersion Or Deep Water Fording

If the vehicle is exposed to water deep enough to cover the hubs, it is recommended that the wheel ends be disassembled and inspected for water damage and/or contamination.

In the event the carrier housing should become submerged in water, particularly if over the breather, it is recommended that the hypoid gear lubricant be drained and internal parts be inspected for water damage and/or contamination.

Clean, examine, and replace damaged parts if necessary, prior to assembling and refilling with the specified lubricants.

NOTE: If the hubs are exposed to deep water, it is possible on steering axles that the water could enter the carrier at the point the inner axle shaft enters the axle housing. This could also necessitate the draining of the hypoid lubricant as described above.

It is recommended that whenever bearings are removed, they be replaced with new ones, regardless of mileage.

Axle Lubricant Change Schedule

The following schedule is a suggested lubricant change schedule. Lubricant in your vehicle may require more frequent changes depending on the environment in which it is operated. Contact your local authorized service dealer or refer to your owner's manual for obtaining the proper lubricant change schedule for your vehicle.

BREAK IN

After 100 hours of operation, the lubricant should be drained and replaced with fresh lubricant to the correct level and of the type specified.

SERVICE

It is recommended that the lubricant be changed at 2500 hours of operation. When yearly usage is less than 4000 hours, the lubricant should be changed twice yearly.

AFTER OVERHAUL

When refilling the axle assembly or planetary hub assembly after it has been disassembled for service, the lubricant should be filled to the bottom of the fill hole located in the bowl of the axle housing or the planetary drive flange. After 24 hours of operation recheck the lubricant level and bring it up to the bottom of the fill hole again, if necessary. This procedure is recommended to replenish the small amount of lubricant that is retained in the differential support case or planetary gearing during initial operation of the axle immediately following an overhaul.

General Precautions for Assembly and Disassembly

IMPORTANT

READ THIS SECTION BEFORE STARTING THE DETAILED ASSEMBLY OR DISASSEMBLY PROCEDURES.

USE ONLY GENUINE REPLACEMENT PARTS FOR SATISFACTORY SERVICE.

NOTE: The photos or pictures contained herein are for illustrative and instructional purposes only. The appearance of your axle assembly and/or components may vary from that shown. However, the service procedures described will apply.

If it becomes necessary to disassemble any parts inside the carrier, it is suggested that the entire axle be removed from the vehicle and held tight in a stand or rack.

All dimensions are in inches unless otherwise stated.

WARNING: When removing axle assembly, make sure vehicle is properly supported. Improperly supported vehicle can cau serious injury or death. Follow vehicle manufacturers recommendation for prope axle assembly removal proce res.

Safety Glasses should be worn at all times when assembling or disassembling.

CLEANLINESS

The axle assembly should be steam cleaned prior to disassembly. Seal all openings before steam cleaning to prevent entry of dirt and water which can damage serviceable parts.

Thoroughly clean all parts just prior to assembly.

REBUILD FACILITIES

If the axle assembly is removed from the vehicle, it must be safely supported at three points on the housing. If the axle is to remain in the vehicle, use the OEM recommended support method.

A suitable holding fixture should be used rebuilding the carrier assembly. A lifting device should be used to relocate the carrier assembly and to install or remove the ring gear and support case assembly.

END YOKES AND FLANGES

CAUTION: Hammering on end yokes or flanges to remove or install them is not only destructive to the yoke or flange itself, it can also cause serious internal damage. Hammering on end yokes can close in the bearing bores or misalign yoke lugs and result in early failures of journal needle bearings or other driveline components. Serious damage can also be done internally to the ring and pinion set or pinion bearings by hammering on external parts. End yokes or flanges should be removed or installed using a recommended method such as that described herein.

BEARINGS

Use suitable pullers for bearing removal. Clean, inspect, and lubricate all bearings just prior to reassembly.

NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.

NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.

OIL OR GREASE SEALS

Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.

CLEANING

Parts with machined or ground surfaces such as gears, bearings, and shafts should be cleaned with emulsion cleaners or petroleum based cleaners.

Steam cleaning of internal components and the interior of the planetary hub and axle housing is not recommended. Water can cause corrosion of critical parts. Rust contamination in the lubricant can cause gear and bearing failure.

Clean all surfaces of old gasket material.

DRYING

Use clean lintless towels to dry components after cleaning. DO NOT dry bearings by spinning with compressed air. This can damage mating surfaces due to lack of lubrication.

After drying, components should be lightly coated with oil or rust preventive to protect them from corrosion. If components are to be stored for a prolonged period they should be wrapped in wax paper.

INSPECTION

Prior to reassembly, inspect parts for signs of wear or damage.

Bearing surfaces should be inspected for pitting, wear, or overheating.

Inspect, all bearings, cups, and cones, and replace if worn, pitted or damaged. When replacing bearings, use a suitable puller or pressing fixture to remove them. Avoid using drifts and hammers which may mutilate or distort component parts.

Inspect planetary and carrier components for wear or damage. Replace if the following conditions are found.

- Worn, chipped, pitted or scored gears.
- Worn, pitted, or scored thrust washers.
- Worn or scored planet gear or differential pinion gear shafts.
- Axle shafts or worn splines, bends, cracks, or for torsional fractures or other indications of impending failure.

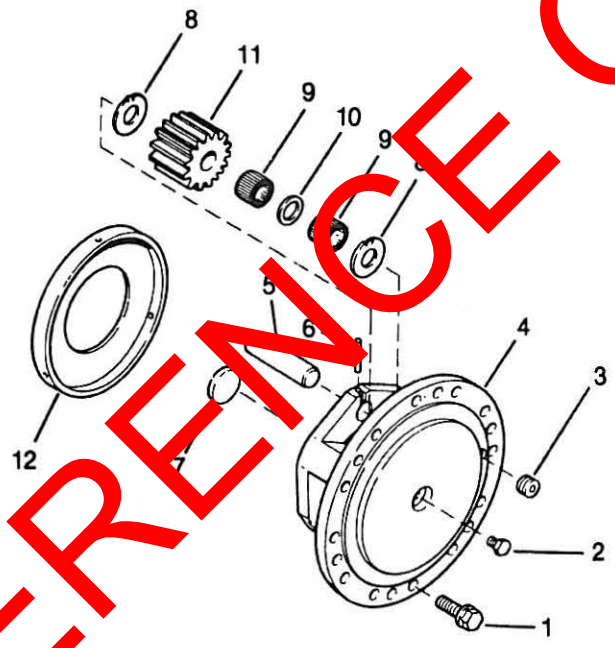
- **BOLTS:** Make sure all bolts are torqued to the recommended specifications.
- **LUBRICATION:** Coat bearings, seals and splines with lubricant to provide initial lubrication and prevent damage during assembly.
- **BEARINGS:** Bearing drivers which apply equal forces to both races of the bearing are recommended. If another type of driver is used, it is important that the driving force not be transmitted through the rollers.

USE A PRESS WHERE POSSIBLE WHEN ASSEMBLING COMPONENT PARTS WHICH REQUIRE AN INTERFERENCE FIT.

Dana Corporation, Spicer Off-Highway Axle Division, reserves the right to make changes from time to time, without notice or obligations, in specifications, descriptions, and illustrations, and to discontinue models or revise designs.

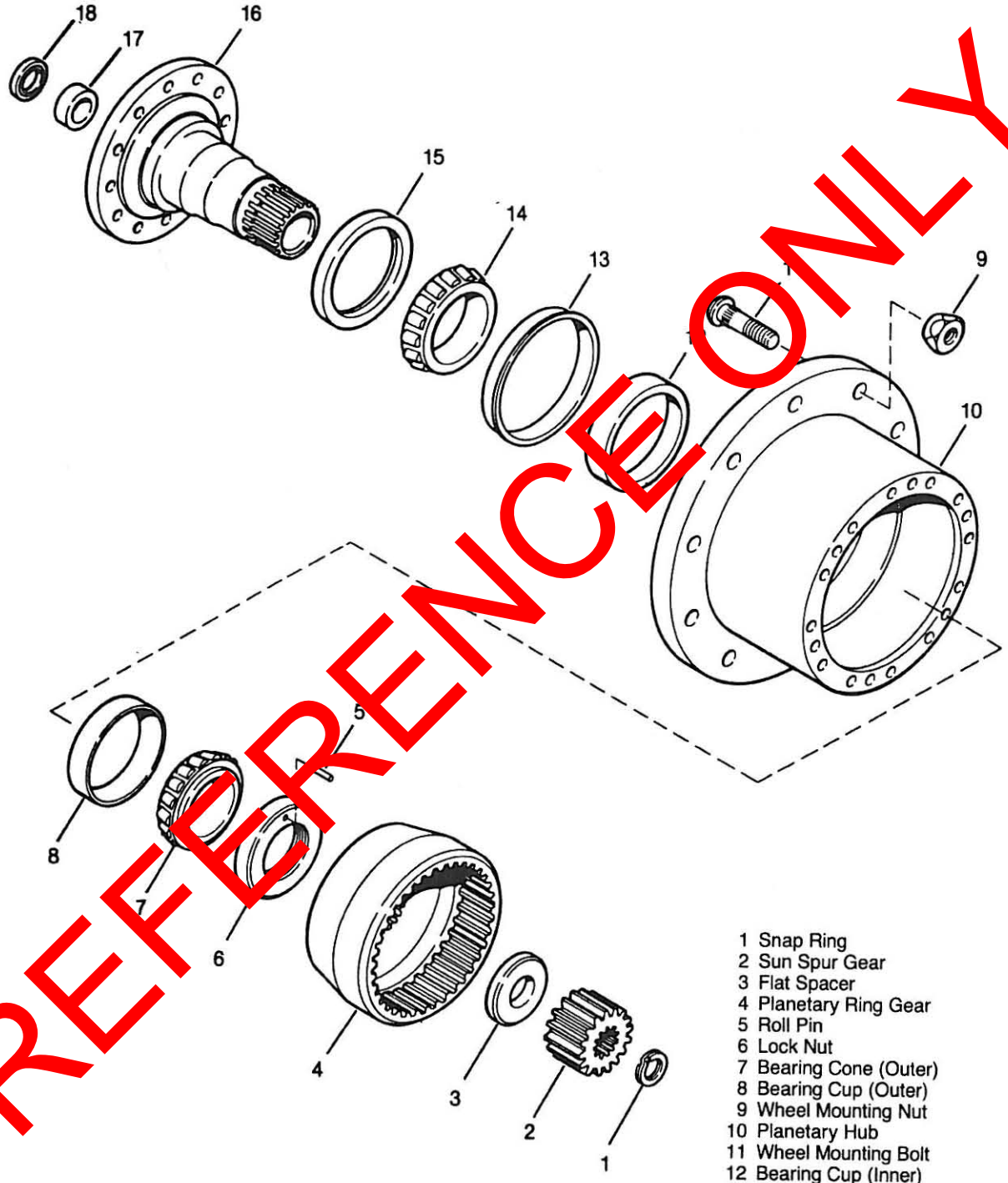
SECTION 2
Planetary Wheel End, Wheel End Brakes, Axle Shaft, Steering Knuckle Steering Cylinder, Tie Rod

3.650 Drive Flange



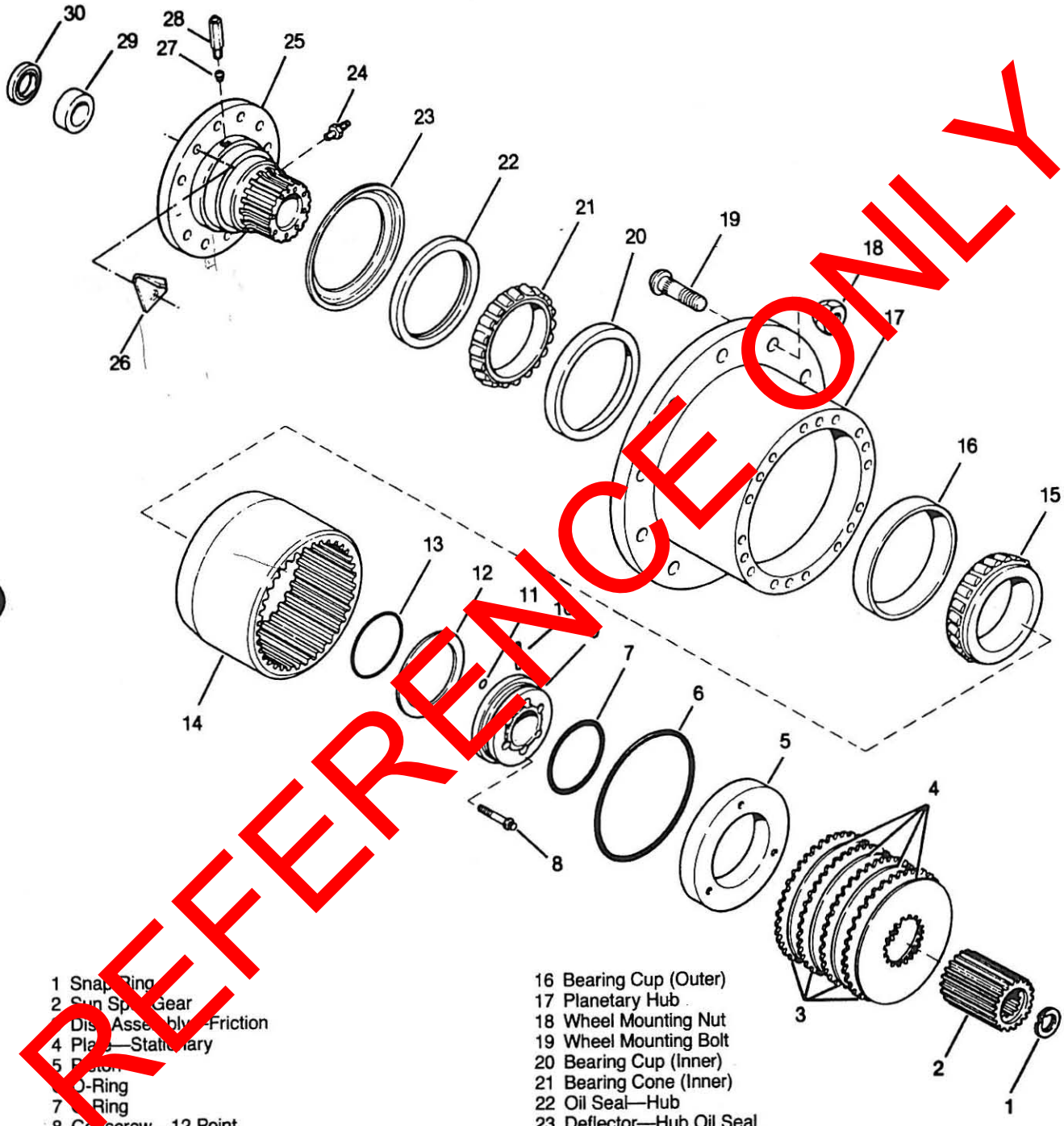
1 Capscrew—Self Locking Flange Mounting
2 Pipe Plug or Vent
3 Recessed Drive Pipe Plug (Magnetic)
4 Planetary Drive Flange
5 Planetary Gear Shaft
6 Roll Pin
7 Drive Flange Washer (Thrust Washer)
8 Flat Spacer (Thrust Washer)
9 Needle Roller Bearing
10 Spacer Ring—Bearing
11 Planetary Spur Gear
12 Plate—Lining Stop (Wheel End Wet Disc Brake Use Only)

Wheel End 3.65 Reduction



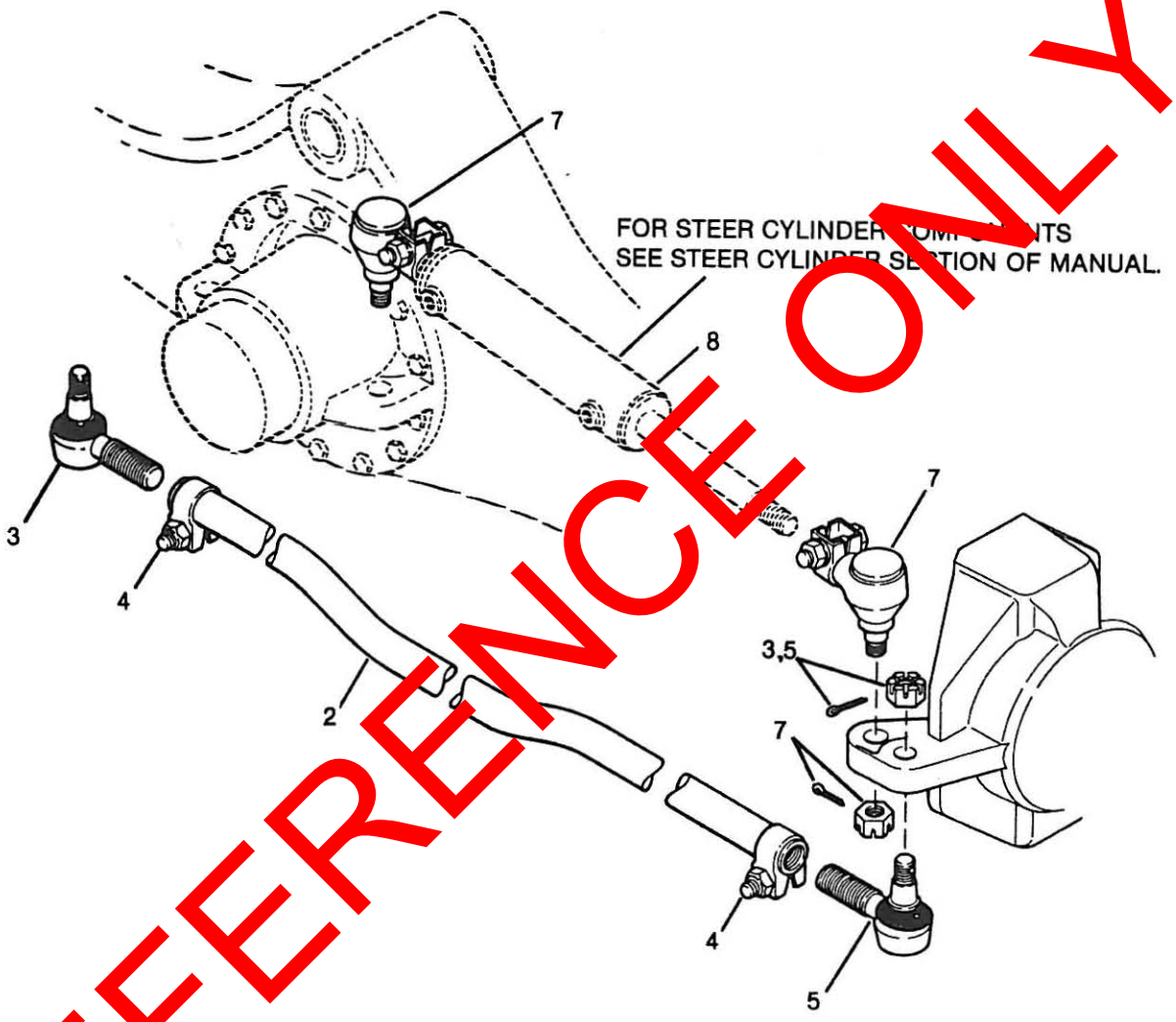
1 Snap Ring
2 Sun Spur Gear
3 Flat Spacer
4 Planetary Ring Gear
5 Roll Pin
6 Lock Nut
7 Bearing Cone (Outer)
8 Bearing Cup (Outer)
9 Wheel Mounting Nut
10 Planetary Hub
11 Wheel Mounting Bolt
12 Bearing Cup (Inner)
13 Hub Slinger (For Axles Without Wheel End Brakes Only)
14 Bearing Cone Inner
15 Oil Seal—Hub
16 Spindle
17 Bushing—Outer Shaft
18 Oil Seal—Outer Shaft

Wet Disc Brake Wheel End 3.65 Reduction



1 Snap Ring
2 Sun Spur Gear
3 Disc Assembly—Friction
4 Plate—Stationary
5 Piston
6 O-Ring
7 O-Ring
8 Capscrew—12 Point
9 Retainer—Bearing Adjusting
10 Tube—Brake Bleeding
11 O-Ring
12 Shim–Adjusting (.010, .011, .012, .013, .014, .015, .020, .030 Thick)
13 O-Ring
14 Planetary Ring Gear
15 Bearing Cone (Outer)
16 Bearing Cup (Outer)
17 Planetary Hub
18 Wheel Mounting Nut
19 Wheel Mounting Bolt
20 Bearing Cup (Inner)
21 Bearing Cone (Inner)
22 Oil Seal—Hub
23 Deflector—Hub Oil Seal
24 Fitting Brake Inlet
25 Spindle
26 Guard—Fitting/Bleeder
27 Seat—Insert
28 Bleeder
29 Bushing—Outer Shaft
30 Oil Seal—Outer Shaft

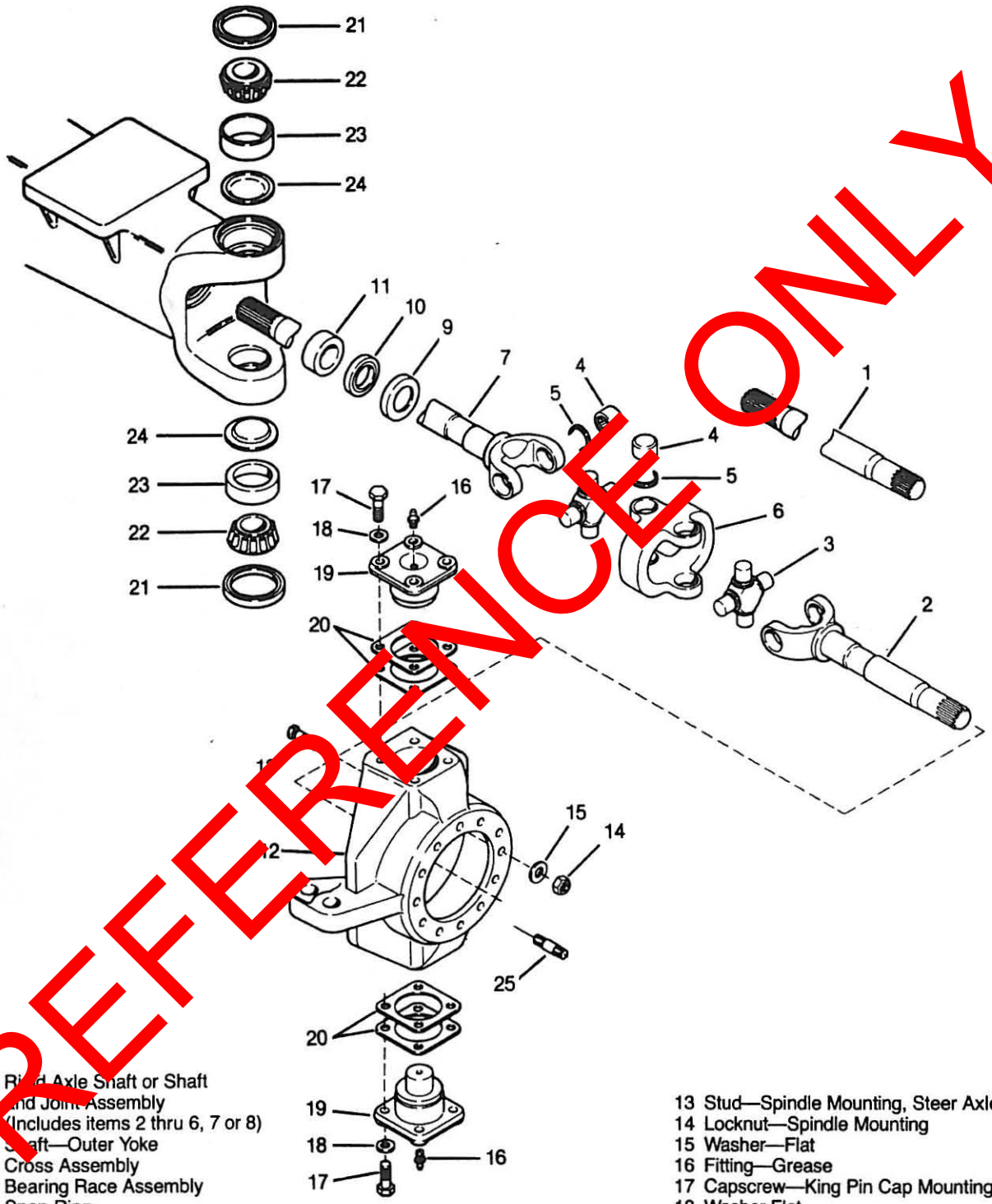
Tie Rod & Steering Cylinder Mounting



FOR STEER CYLINDER COMPONENTS
SEE STEER CYLINDER SECTION OF MANUAL.

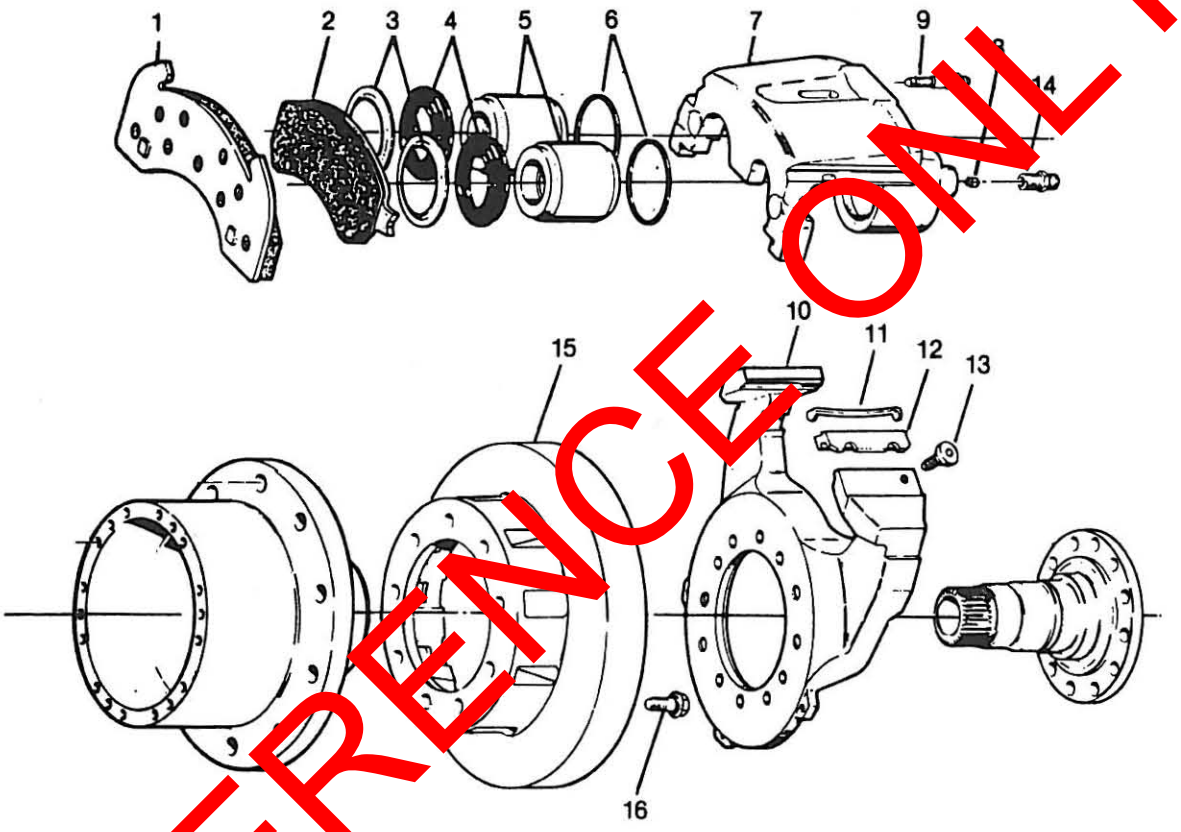
1 Tie Rod Assembly (Items 2 thru 5)
2 Tie Rod
3 Vertical Socket Assembly
4 Clamp Assembly—Tie Rod
5 Vertical Socket Assembly
6 Steer Cylinder/Vertical Socket Assembly (Items 7 and 8)
7 Vertical Socket Assembly
8 Steer Cylinder

Axle Steering Joints



1 Rigid Axle Shaft or Shaft
and Joint Assembly
(Includes items 2 thru 6, 7 or 8)
2 Shaft—Outer Yoke
3 Cross Assembly
4 Bearing Race Assembly
5 Snap Ring
6 Center Yoke
7 Shaft—Inner Yoke (Short)
8 Shaft—Inner Yoke (Long)
9 Deflector—Inner Shaft Seals
10 Oil Seal—Inner Shaft
11 Bushing—Inner Shaft
12 Steering Knuckle
13 Stud—Spindle Mounting, Steer Axle
14 Locknut—Spindle Mounting
15 Washer—Flat
16 Fitting—Grease
17 Capscrew—King Pin Cap Mounting
18 Washer-Flat
19 Cap—King Pin
20 Shim—King Pin Bearing Adjusting
21 Seal—King Pin Bearing
22 Bearing Cone—King Pin
23 Bearing Cup—King Pin
24 Retainer—Grease
25 Stud-Spindle Mounting, Rigid Axle

Wheel End Disc Brake

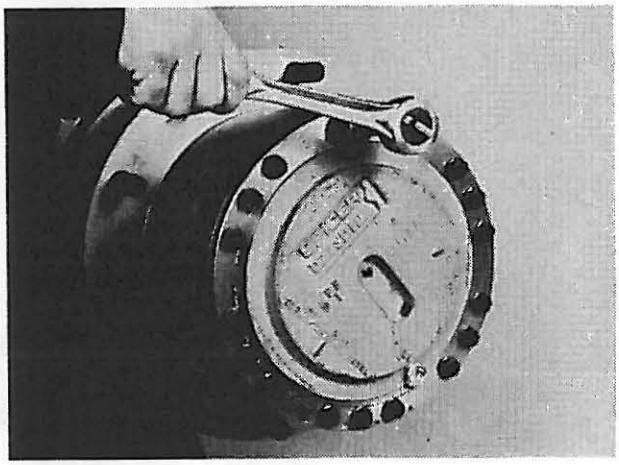


1 Brake Lining (Outer Pad)
2 Brake Lining (Inner Pad)
3 Dust Boot Shield
4 Dust Boot
5 Piston
6 Piston Seal
7 Caliper Housing
8 Bleeder Screw
9 Bleeder Screw
10 Caliper Bracket
11 Compression Spring (Caliper Support)
12 Caliper Support Key
13 Socket Head Screw (Caliper Support)
14 Hydraulic Fluid Fitting
15 Disc (Rotor)
16 Hex Bolt

Removal of Planetary Drive Flange Assembly

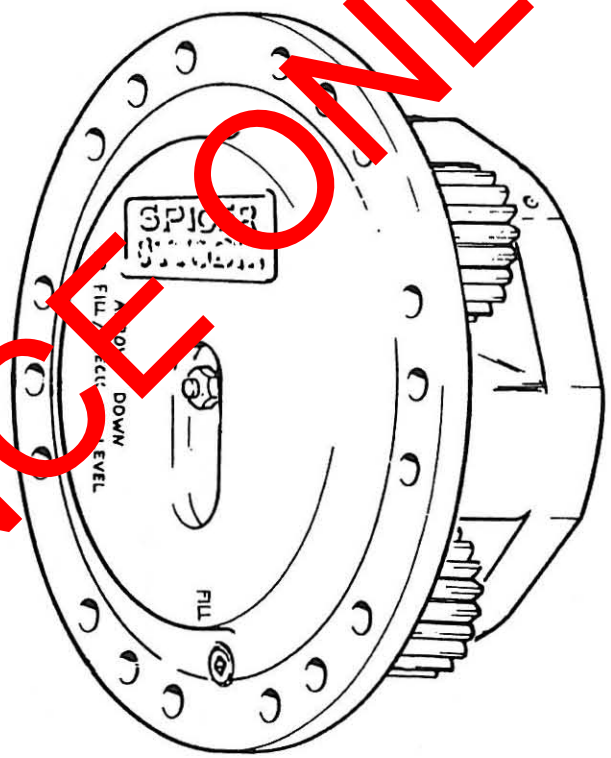
NOTE: The following procedures are the same for both rigid and steer axles.

1. Rotate hub so drain plug is down. Remove plug and drain oil.

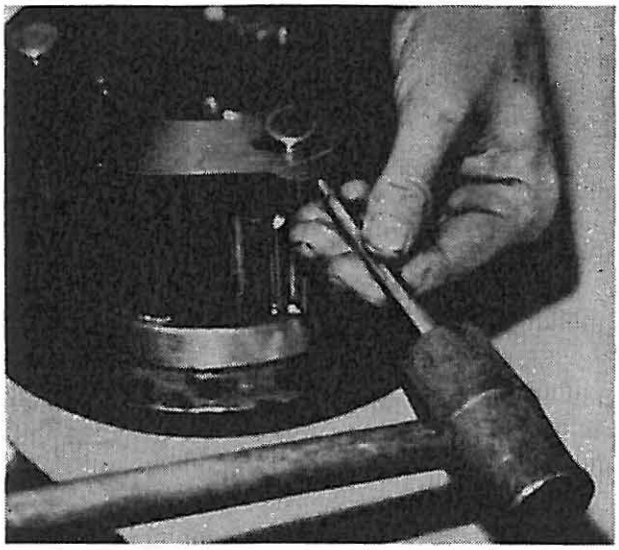


2. Remove capscrews from drive flange.

3. Tap drive flange with soft faced hammer to break loose from hub. Remove drive flange from hub.



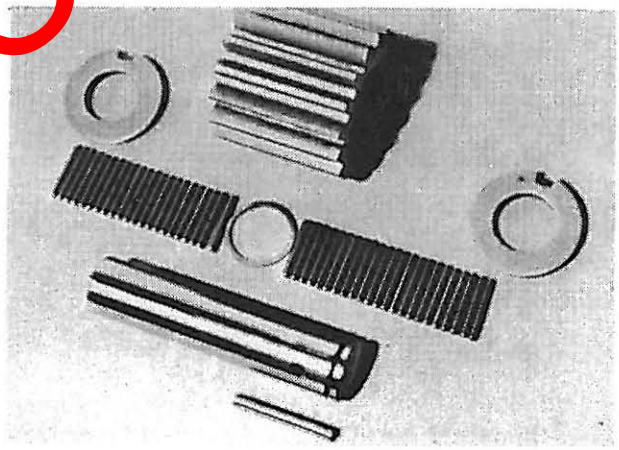
Disassembly of 3.650 Drive Flange



1. Using a hammer and punch, drive roll pins out of planet gear shafts. Remove lining stop plate for wheel end wet disc brake if used.

3. Remove planet gears and thrust washers.

2. Insert pry bar into groove in planet gear shaft and remove gear shaft.



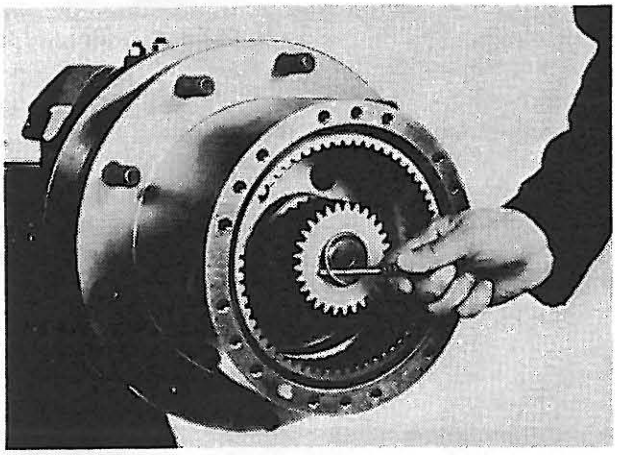
4. The planet gears are supported on the planet shafts by two rows of needle bearings divided by a spacer ring and a thrust washer on each end.

5. Inspect the thrust button located in the center of the drive flange. If worn, replace.

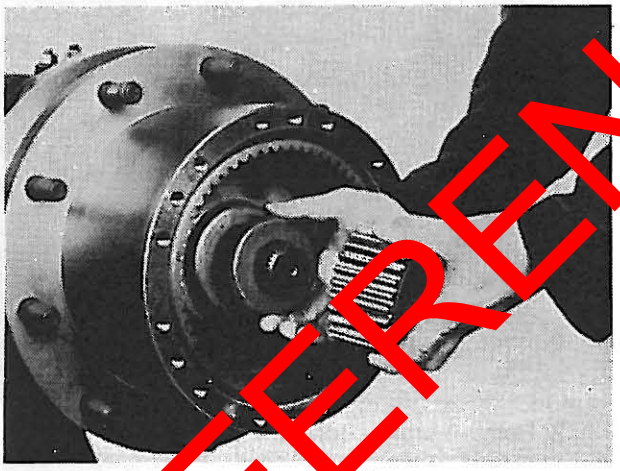
WARNING: Keep the groove under the thrust button open. It is the access to the air vent if used.

Disassembly of Wheel End Hub

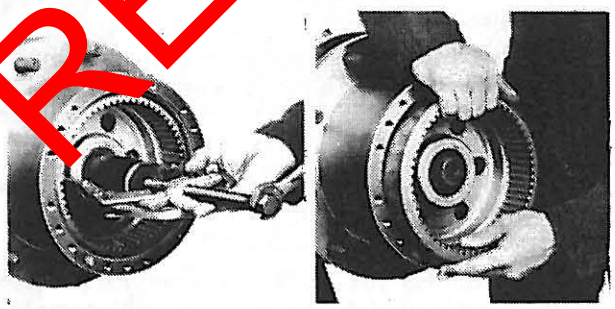
NOTE: the following procedure is the same for both rigid and steer axles.



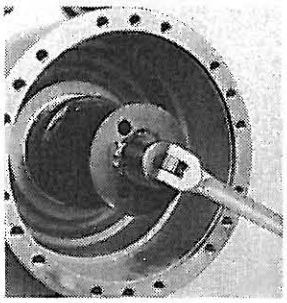
1. Insert small screwdriver under end and remove locking ring from end of axle shaft by rotating around shaft.

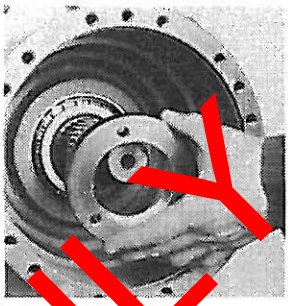


2. Remove sun gear and spacer from axle shaft.

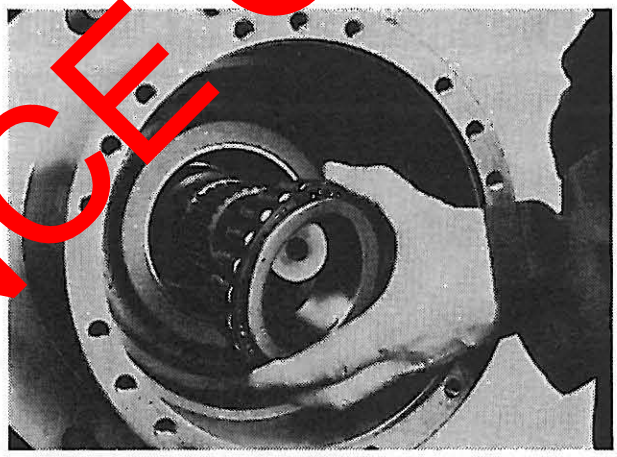


3. Remove ring gear. Use a suitable puller if necessary.
NOTE: DO NOT pilot puller on axle shaft. This may damage the inboard axle seal.

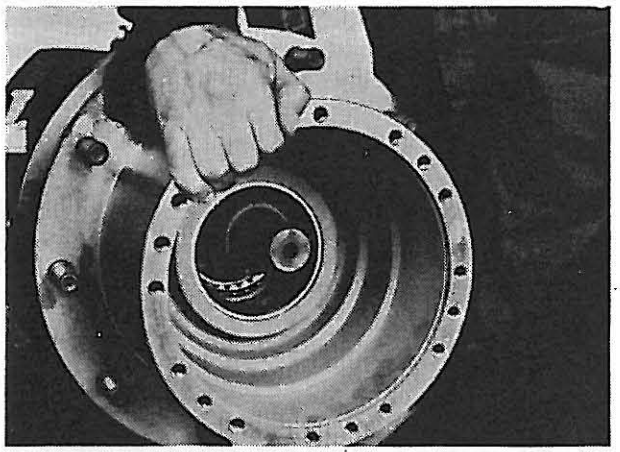




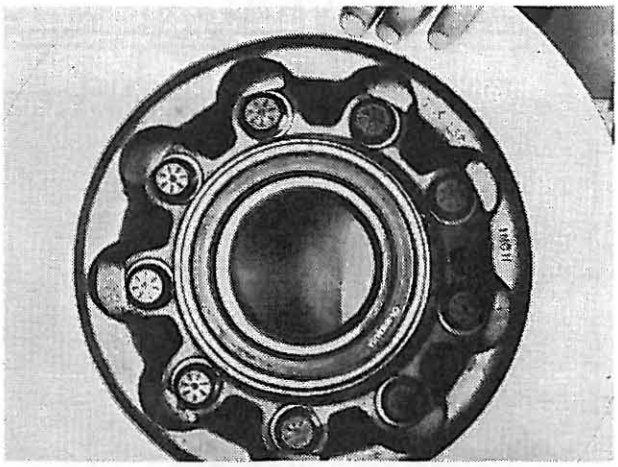
4. Remove the wheel bearing adjusting nut using a three pin spanner wrench. (Varco tool #451125)
NOTE: If axle is equipped with wheel and disc brakes, remove the caliper assembly at this time as outlined in the disc brake section of this manual.



5. Remove the outer wheel bearing while supporting the hub assembly.



6. With the hub supported, carefully remove it from the spindle.
NOTE: A lifting device is recommended for assemblies having a rotor attached.



7. If the axle is equipped with disc brakes the rotor can be removed at this time.

8. Rest hub on drive flange mounting face and remove the hub seal and inner wheel bearing.

9. Inspect wheel bearings and cups and replace if necessary. Remove cups with a suitable puller.

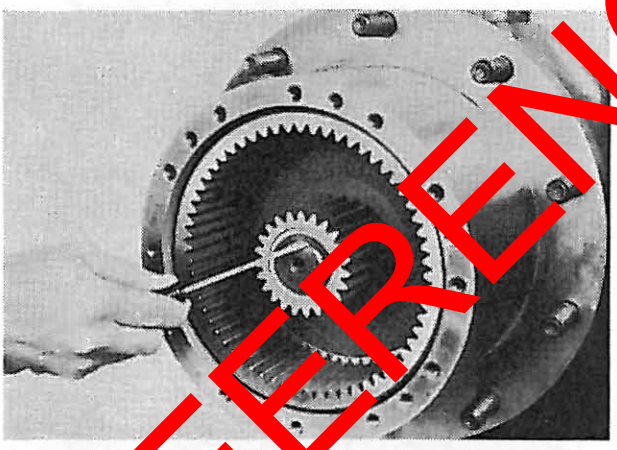
NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.

NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.

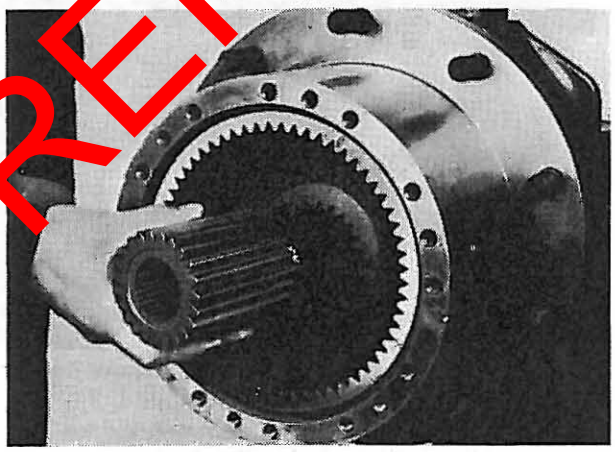
NOTE: Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.

Disassembly of Wet Disc Brake Wheel End

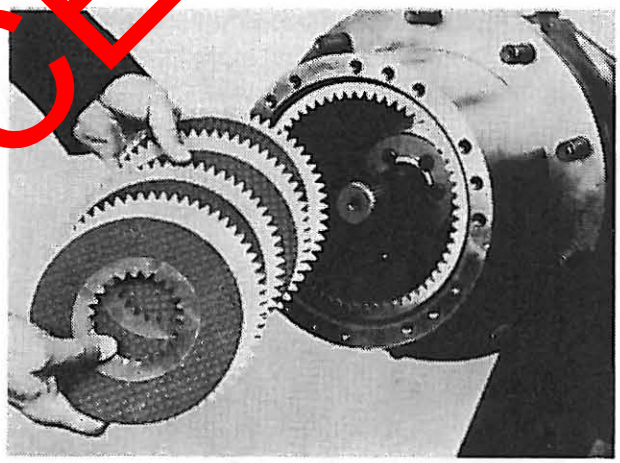
NOTE: the following procedure is the same for both rigid and steer axles.



1. Insert small screwdriver under locking ring on axle shaft and remove by rotating around shaft.



2. Remove sun gear from axle shaft.



3. Remove brake plates and discs. Check friction material thickness on discs. If groove depth is less than .005" they must be replaced.

Inspect stationary plates for warpage with a straight edge. If warpage is observed they must be replaced.

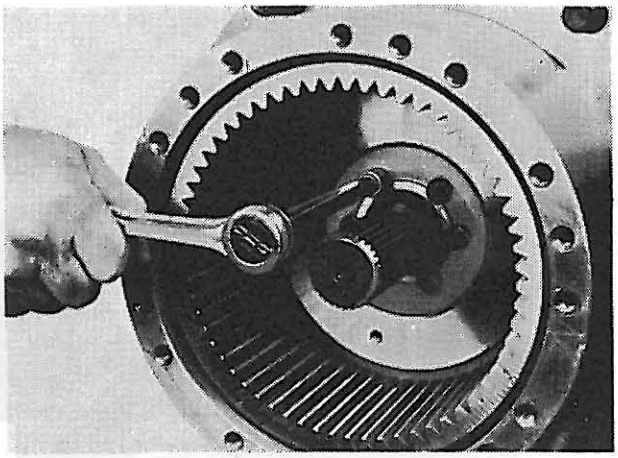
Inspect all plates and discs for heat damage. Replace if necessary.

NOTE: If any of the above conditions exist it is necessary to replace all discs and plates together as a set. Piston O-rings should also be replaced at this time.

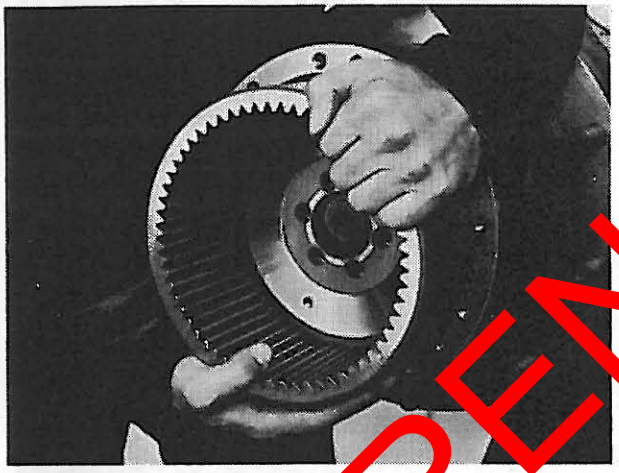
If brake discs and plates are within specifications and brake was operating properly it is not necessary to remove brake piston or replace piston O-rings.

SPECIAL SERVICE NOTE: If the service procedure being performed does not require replacement of piston or wheel retainer O-rings the hub assembly may be removed using the following steps.

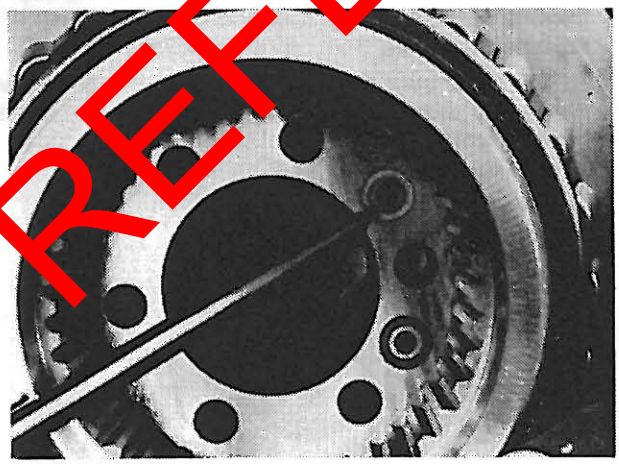
A. Safely support hub assembly with lifting device.



B. Remove wheel retainer cap-screws.

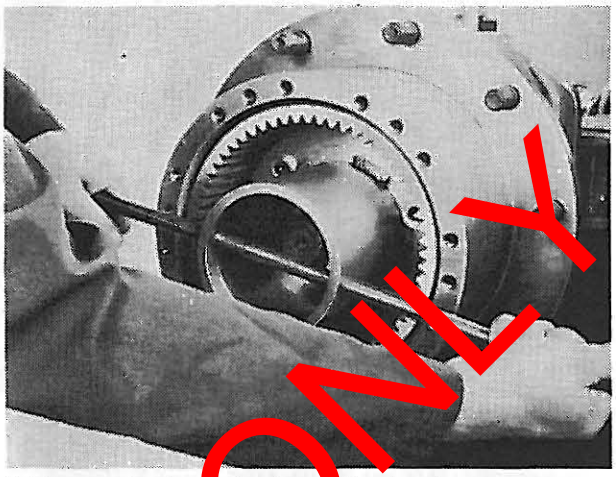


C. Remove planetary ring gear, brake piston and wheel retainer as one unit.

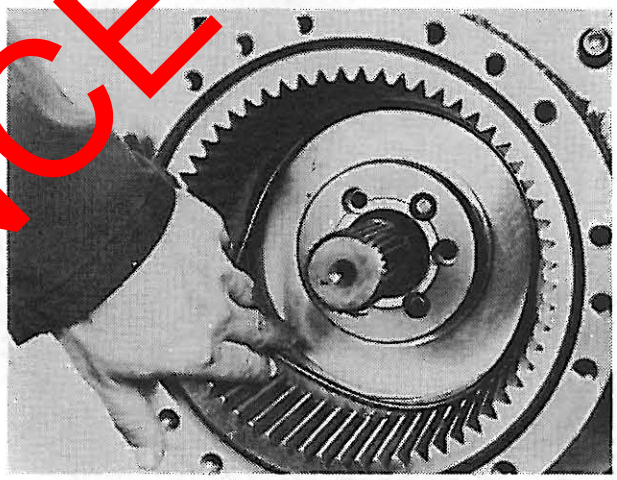


D. Remove oil passage O-rings from grooves on inboard face of wheel retainer. If damaged, replace. If ok, save for re-assembly.

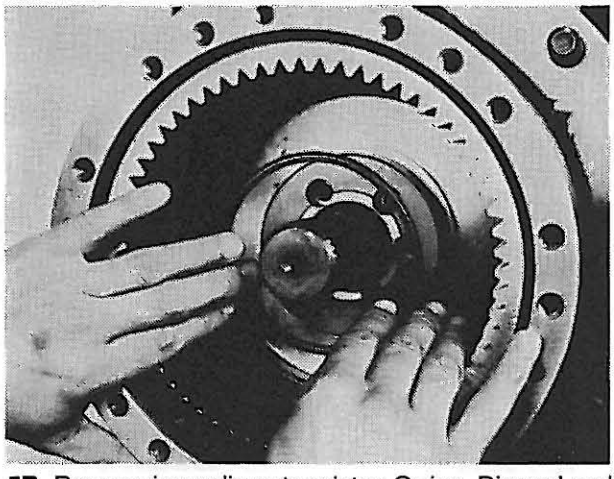
E. Skip following steps #4 thru #9. Continue disassembly with step #10.



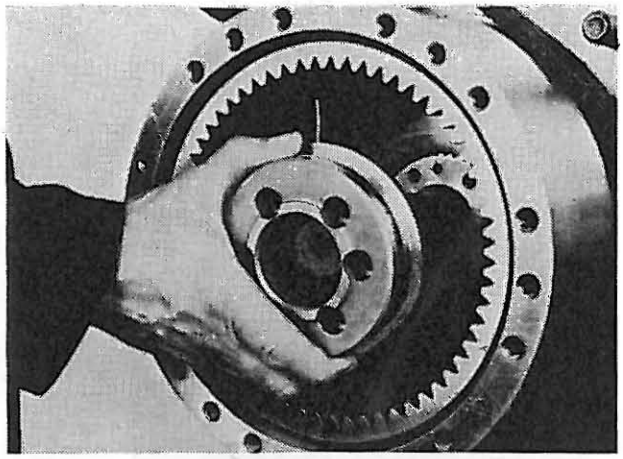
4. Remove brake piston from wheel end.
NOTE: Use of a special piston remover/installer tool, (Dana tool #45116), is recommended to prevent damage to the piston.



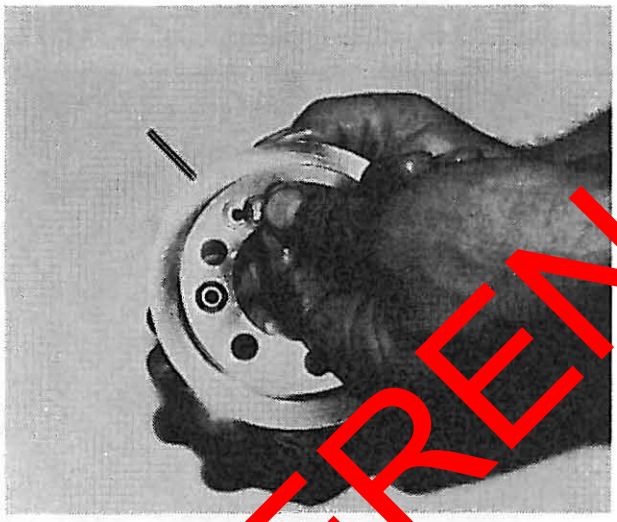
5A. Remove outer diameter piston O-ring. Discard and replace with new.



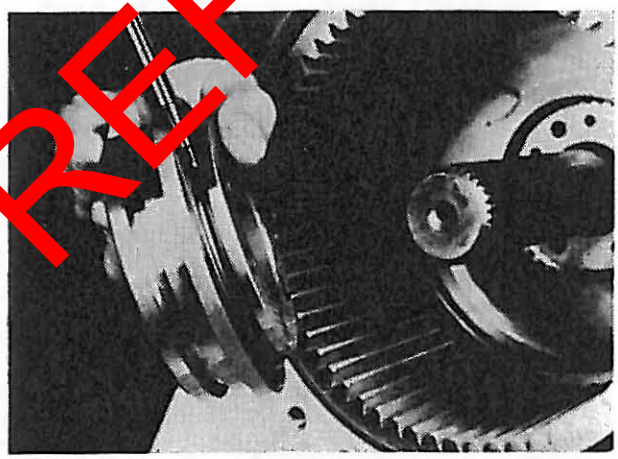
5B. Remove inner diameter piston O-ring. Discard and replace with new.



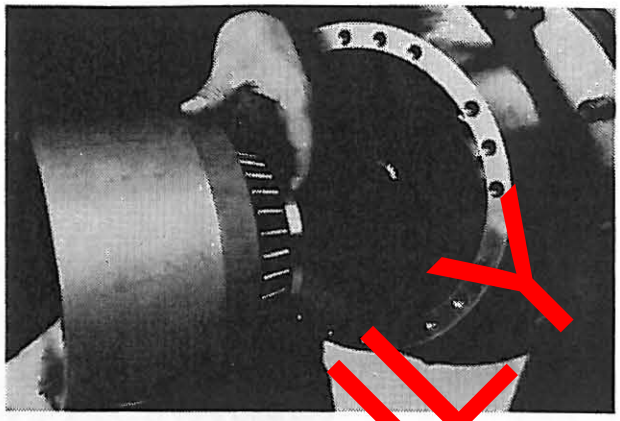
6. Safely support hub assembly with a lifting device. Remove wheel retainer capscrews. Remove wheel retainer and preload shims. Wire shims to retainer to facilitate re-assembly.



7. Remove oil passage O-rings from groove on inboard face of wheel retainer. If damaged, replace, If ok, save for re-assembly.

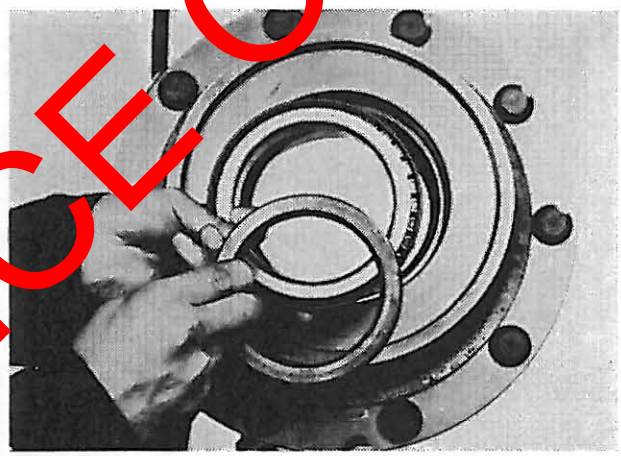


8. Remove and inspect outer diameter O-ring on inboard side of wheel retainer. Replace if necessary.



9. Remove planetary ring gear from wheel end. Inspect outboard wheel bearing. Replace if necessary.

10. With hub supported, carefully remove it from the spindle.



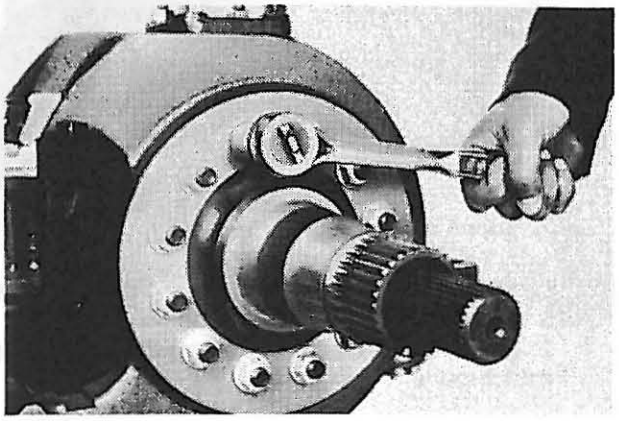
11. Inspect wheel bearings, cups and seal. Replace if necessary.

NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.

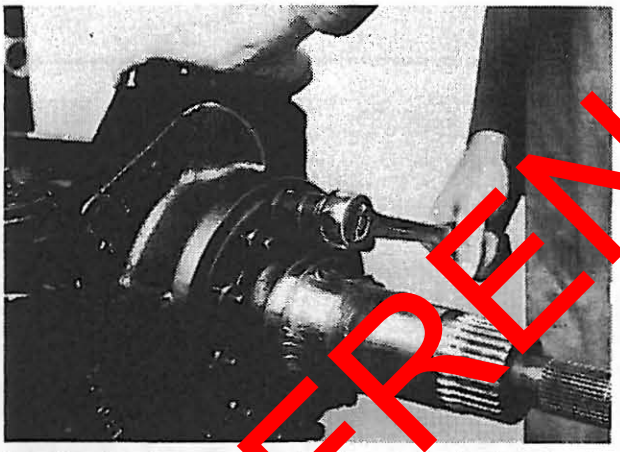
NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.

NOTE: Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.

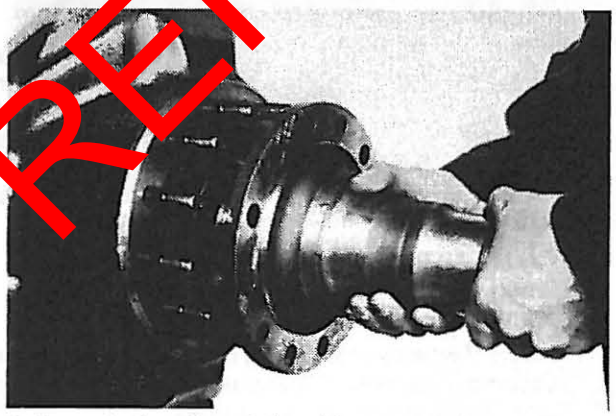
Removal and Disassembly of Spindle and Axle Shaft



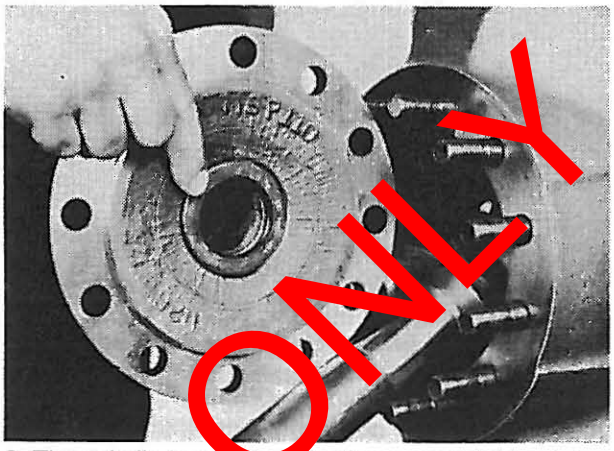
1A. Remove spindle mounting nuts and flat washers. On planetary equipped with disc brake, the caliper mounting bracket can be removed when the spindle mounting nuts are removed.



1B. On planetary equipped with wet disc brake wheel ends remove brake inlet fitting and bleeder screw. Remove spindle mounting nuts, washers, and (if used) the fitting/bleeder guards.



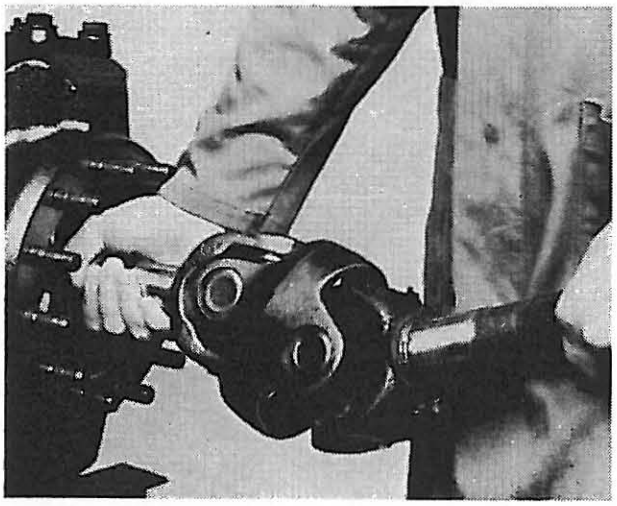
2. Tap spindle with soft faced hammer to loosen from steering knuckle or housing flange. Remove spindle.



3. The spindle in many applications, contains an outer shaft oil seal and bronze bushing in the spindle bore. These should be replaced if necessary.

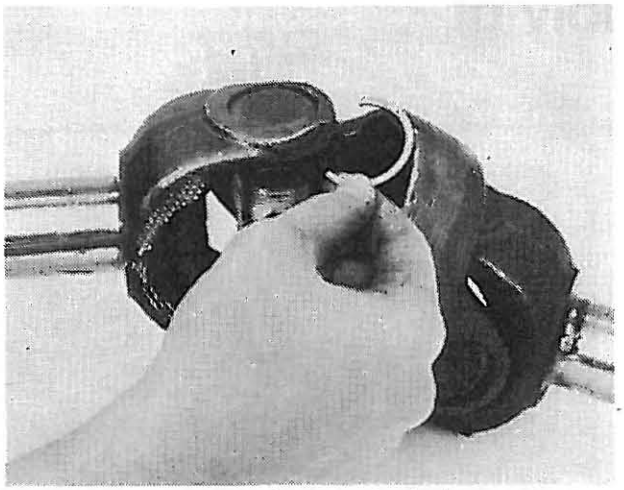
NOTE: Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.

NOTE: Inspect the spindle mounting studs in steer knuckle or axle housing (rigid axle) for damage and replace if necessary.

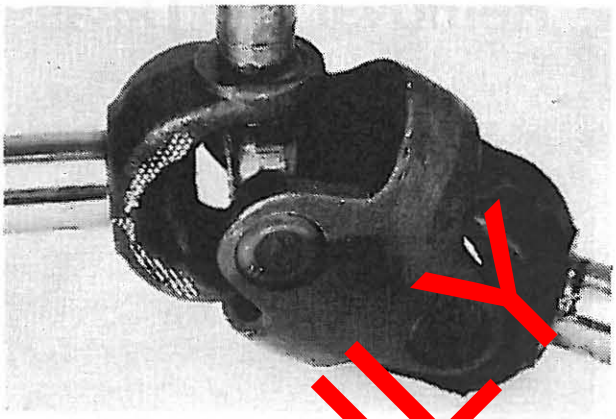


4. To remove axle shaft assembly on the steering axle, hold shaft level and pull straight out to avoid damaging inner shaft oil seal.

NOTE: To remove axle shaft on rigid axles, pull shaft straight out.



5. To separate inner and outer axle shafts, on steering axle, first remove all bearing cap retaining rings.



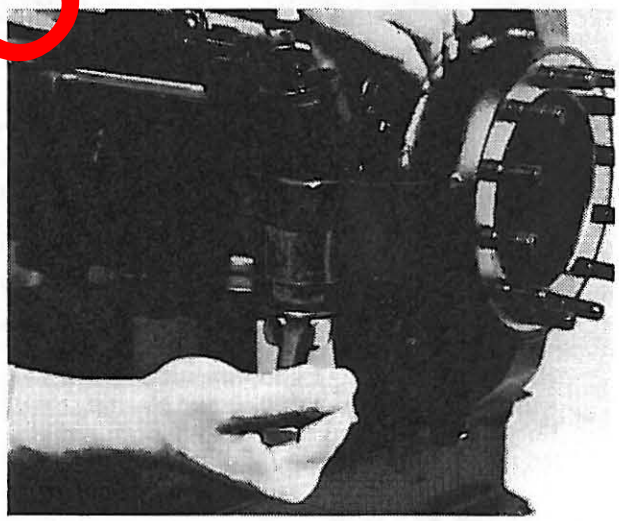
6. Next, press out u-joint bearing caps and remove cross.

7. Inspect u-joint bearing caps and cross and replace if necessary.

Removal of Steering Cylinder and Tie Rod Assemblies

1. Disconnect the hydraulic hoses to the steering cylinders. Plug the open fittings.

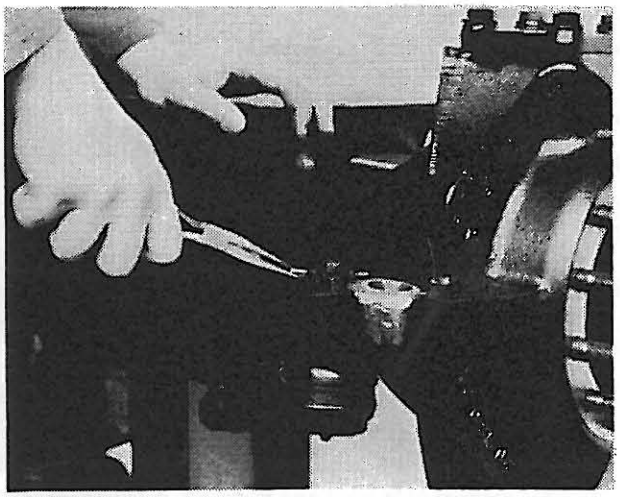
2. Remove the cotter pins from the steering cylinder socket assemblies.



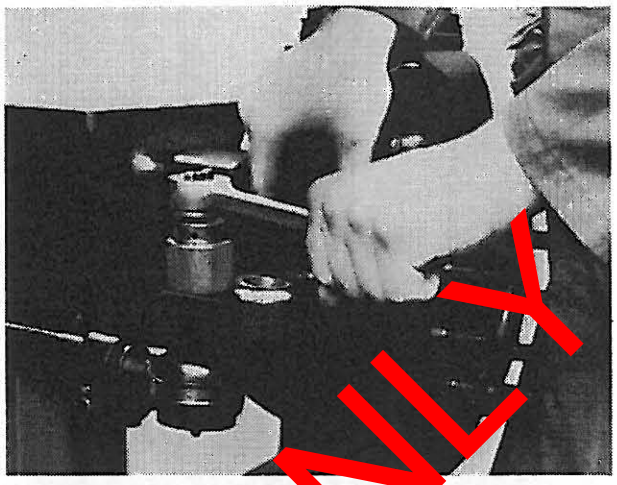
3. Remove the slotted hex nuts that fasten the cylinder socket assemblies to the anchor points on the carrier and steering knuckle. Tap the threaded end of socket assembly lightly with a soft faced hammer to unseat them. Carefully remove steering cylinder assemblies. Mark cylinder assemblies "rightside" "leftside" to aid reassembly.

CAUTION: Protect chrome finish on rod at all times. Damage to surface of rod can cause premature seal failure.

NOTE: Refer to steering cylinder disassembly and assembly section of manual if further disassembly of cylinder assembly is required.



4. Remove the cotter pins from the tie rod socket assemblies.



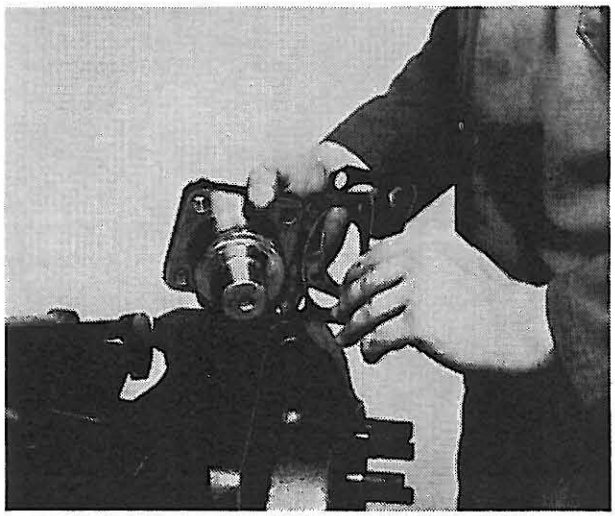
5. Remove the slotted hex nuts that fasten the tie rod socket assemblies to the steering knuckle anchor points. Tap the threaded end of the socket assembly lightly with a soft faced hammer to unseat them. Remove the tie rod assembly. Match marked tie rod end and steering knuckle to aid in reassembly.

NOTE: Do not alter the tie rod adjustment unless further repair is required to tie rod components. If repair is required or tie rod adjustment is inadvertently changed it will require the resetting of this adjustment for proper "toe-in".

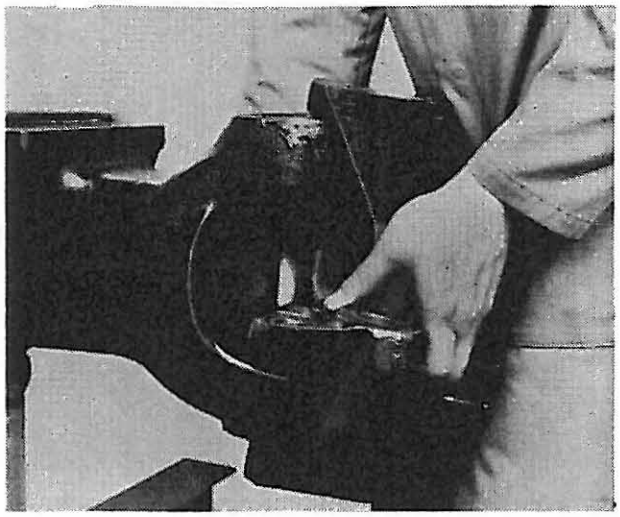
Disassembly of Steering Knuckles

1. Remove the wheel end components, spindle, axle shaft, steer cylinder, and tie rod prior to disassembly of steer knuckle components.

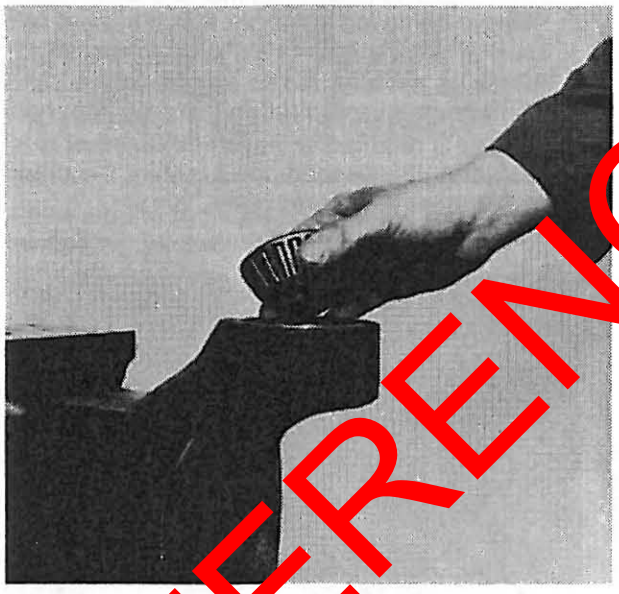
2. Remove bearing cap bolts and washers from both upper and lower bearing caps.



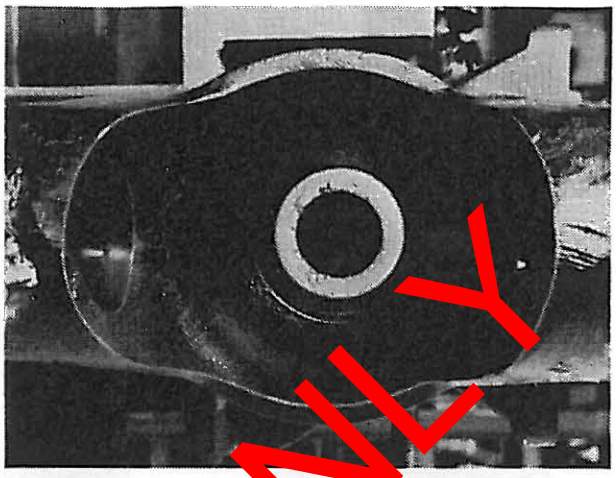
3. Remove both upper and lower bearing caps and shims. Wire shims together with their respective bearing caps to facilitate reassembly.



4. Tip the steering knuckle slightly and remove from housing yoke.



5. Inspect bearing cone and replace if necessary.



6. Inspect axle seal and bushing. If replacement is necessary, remove with suitable puller.

7. Inspect bearing cup and seal; replace if necessary.

NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.

NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.

NOTE: Whenever it becomes necessary to remove an oil or grease seal to gain access to an adjacent component for replacement or repair, that seal is to be discarded because of possible damage.

Assembly of Steering Knuckles

1. Install inner axle shaft bushing and seal into housing yoke bore.

2. Apply #2 Permatex to grease retainers. Install grease retainers and king pin bearing cups into housing yoke.

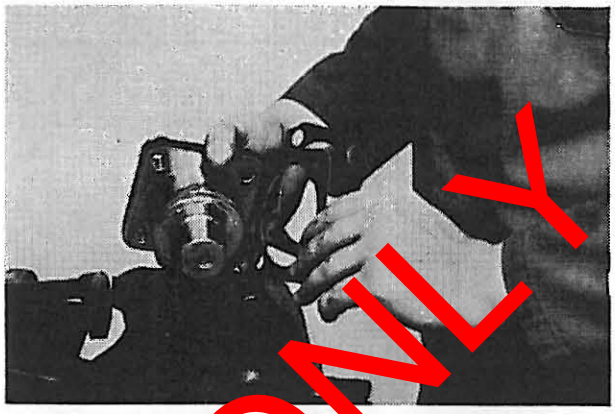
NOTE: The grease retainer must be installed with its "dished" portion positioned toward the inside of the axle housing yoke. Installed opposite, the retainer would restrict the bearing cup from seating properly in the housing bore and clamp against the bearing cone cage restricting movement.

3. Install pregreased king pin bearing cones in bearing cups.

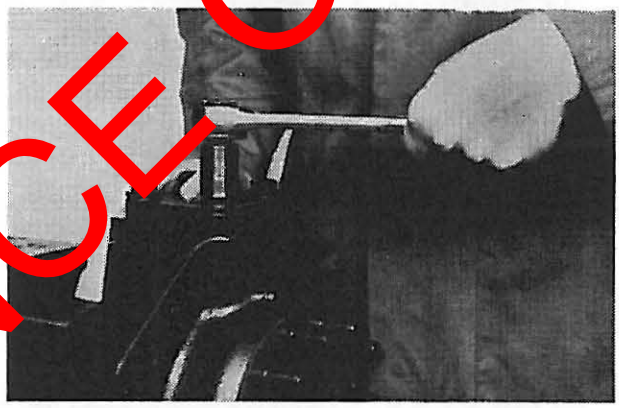
4. Install king pin seals.

NOTE: Inspect the spindle mounting studs in steer knuckle for damage and replace if necessary.

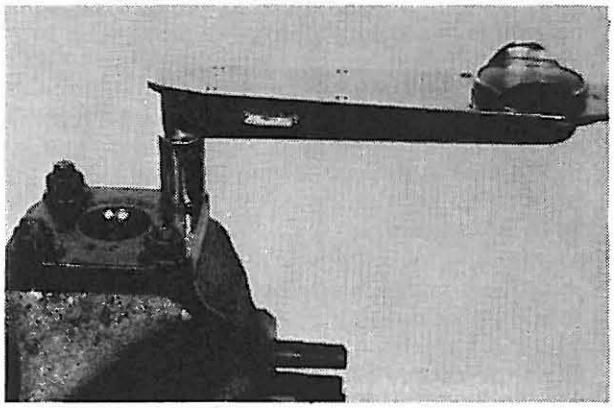
5. Place knuckle in position over housing yoke.



6. Place original shims in position on knuckle or king pin cap.



7. Install bearing caps, washers, and bolts. Torque to 80-90 ft. lbs.



8. To check king pin bearing preload, turn knuckle all the way to the right. Place torque wrench on one of the king pin cap bolts. Rotate knuckle through complete turn angle. Torque reading should be 8-15 ft. lbs. Measurement is made less hub components, axle shaft, tie rod, and steering cylinder.

To increase preload, remove shims from top or bottom king pin bearing. To decrease preload, add shims to top or bottom king pin bearing. Keep top and bottom shim packs as equal as possible.

Installation of Tie Rod and Steering Cylinder Assemblies

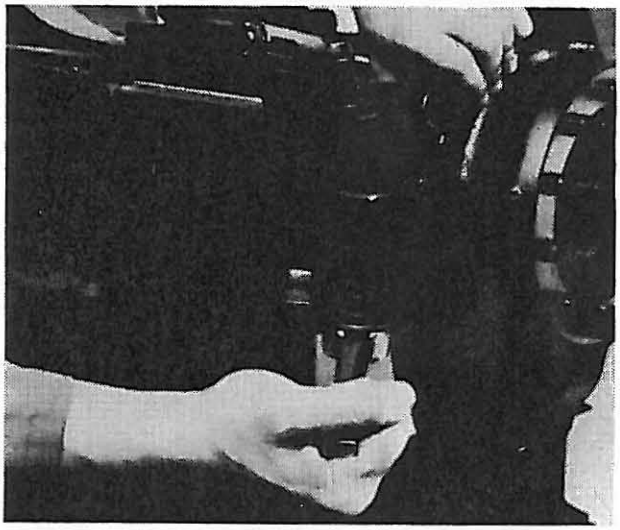
NOTE: The carrier assembly and steering knuckles are to be installed prior to proceeding with the installation of these components.

1. Connect the tie rod assembly to the steering knuckle anchor points. Torque the socket assembly slotted nuts to 140 ft. lbs. minimum. Check to make sure the position of the offset in the tie rod clears the carrier assembly in full turn position (both directions). The tie rod assembly should be switched around end for end if full turn clearance is not found and the slotted nuts retorqued.

NOTE: If the tie rod adjustment (toe-in) has been changed it will be necessary to readjust it. Loosen the tie rod clamp assembly bolt and nut. Position the steering knuckles in a straight ahead (0° turn angle) position. Position measuring bars on the spindle mounting face of the steering knuckles. Measure across them on the carrier side and cover side of the axle housing and compare readings. Remove tie rod, adjust the overall socket to socket length (in or out), reinstall the tie rod assembly and remeasure. Repeat this procedure until equal measurements are attained (zero toe-in) or the toe-in specified by the vehicle manufacturer is attained. Retorque slotted nuts to 140 ft. lbs. minimum. Torque the tie rod clamp assembly bolts and nuts to 60-70 ft. lbs.

2. Install cotter pins and bend the pin over to lock it in place.

NOTE: If cotter pin cannot be installed after minimum torque is attained, the nut must be advanced until the cotter pin can be installed.



3. Connect the steering cylinder assemblies to the carrier and steer knuckle anchor points. Torque the socket assembly slotted nuts to 140 ft. lbs. minimum.

NOTE: If repairs were made to or the retracted length of the steering cylinder assembly was inadvertently changed the retracted length of the assembly will require resetting as follows:

A. Remove slotted nuts from and remove rod end socket assemblies from steer knuckles. Push in or use air pressure retract the rod into the barrel assembly of both cylinders.

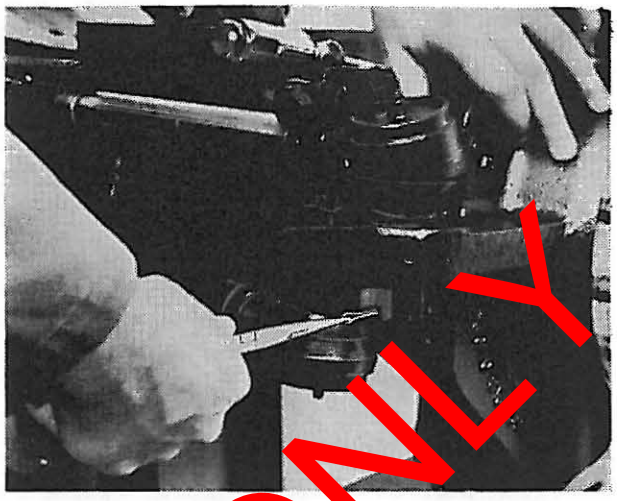
B. Turn steering knuckle to full inside turn position on either the right or left hand side.

C. Adjust the socket assembly position in or out on the rod end and also barrell end, if required, such that its retracted length matches the length required for assembly to its steer knuckle.

CAUTION: Protect the rod from damage while adjusting socket position.

Reconnect the cylinder assembly as noted in step #3. Torque the cylinder socket clamp bolts and nuts to 60-70 ft. lbs.

D. Turn the other steer knuckle to its full inside turn position. Adjust its steer cylinder retracted length as noted in step C.



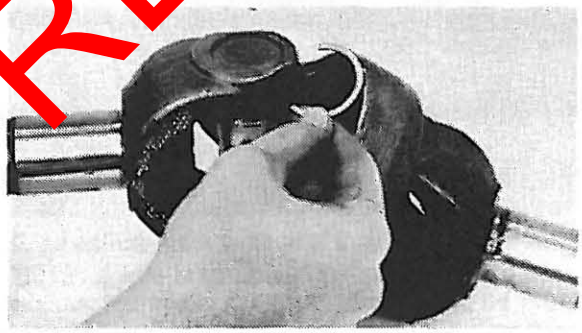
4. Install cotter pin and bend the pin over to lock it in place.

NOTE: If cotter pin cannot be installed after minimum torque is attained, the nut must be advanced until the cotter pin can be installed.

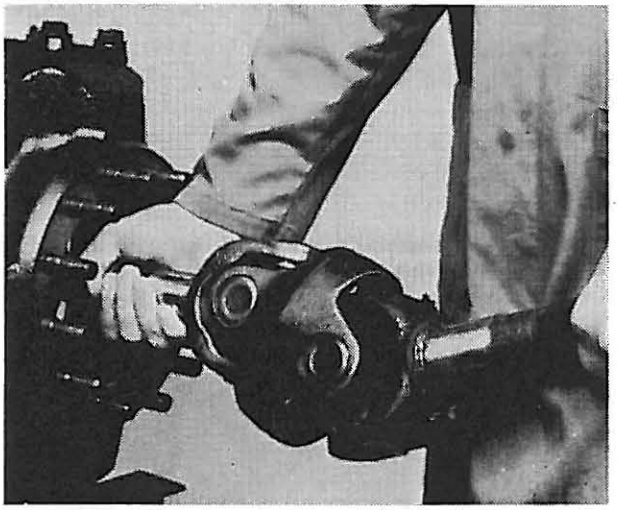
5. Connect the hydraulic hoses to the steering cylinders and "bleed" the system.

Assembly and Installation of Axle Shaft and Spindle

1. To assemble inner and outer axle shafts, insert u-joint cross into yoke of outer shaft and press in bearing cups. Repeat with center yoke and inner shaft.

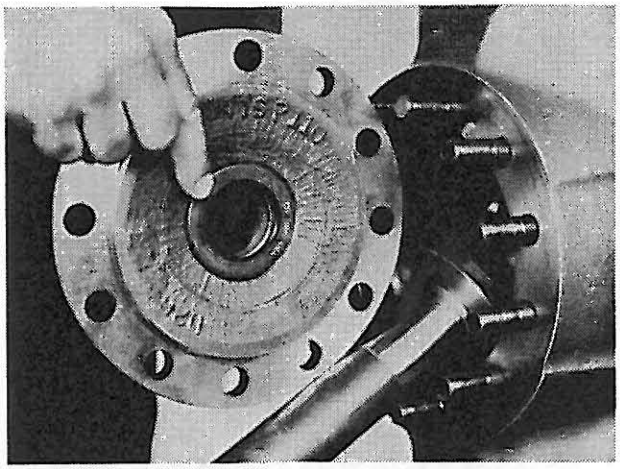


2. Install all bearing cap retaining rings. Grease u-joint.

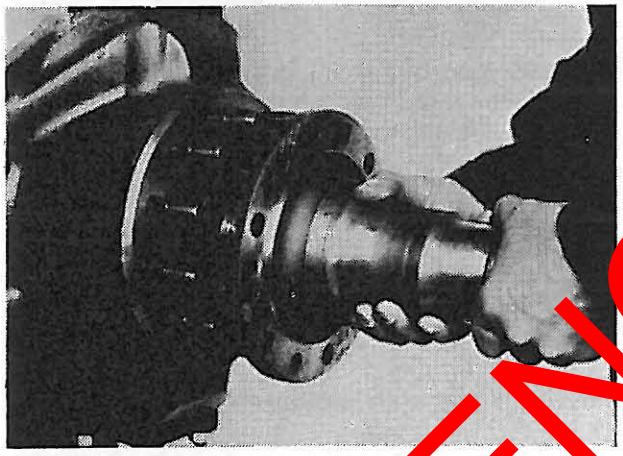


3. Support shaft assembly and slide into axle housing and engage in differential side gear. Care should be taken when installing shaft as not to damage axle shaft oil seal.

NOTE: On rigid axles, install the axle shaft into the axle housing until it engages the differential side gear.



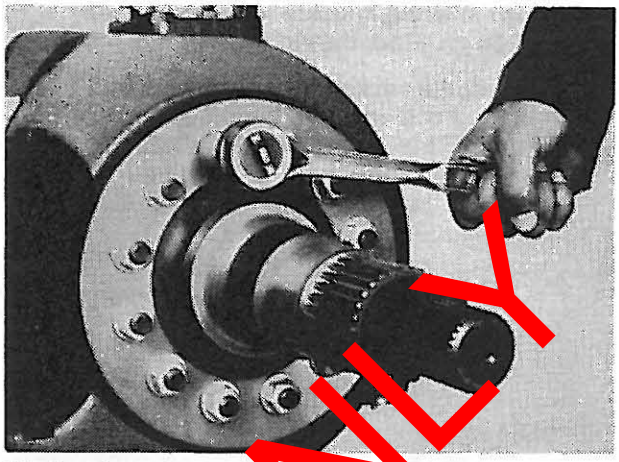
4. Install new bushing and seal in spindle if required.



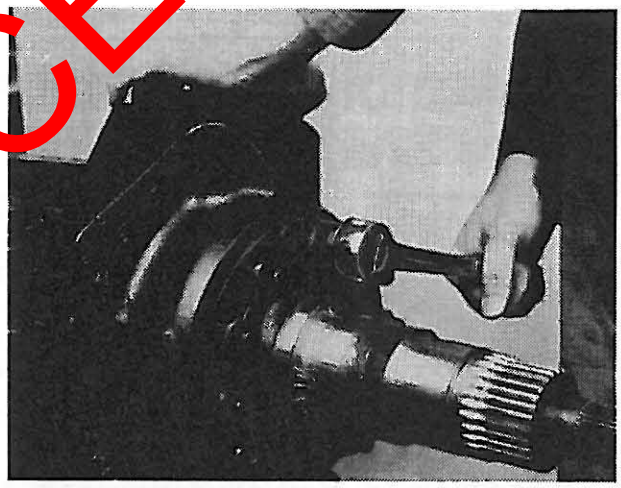
5. Install spindle over the axle shaft and onto knuckle or housing flange studs.

NOTE: Care should be taken when sliding the spindle over the end of the axle shaft so as not to damage the outer shaft seal and bushing if so equipped.

NOTE: On planetary equipped with wet disc brake wheel ends the spindle is to be assembled to the mounting studs with the bleeder port positioned at the top (12 o'clock position) and the brake inlet port on the carrier side of the axle housing.



6A. On planetary equipped with disc brake, install the caliper mounting bracket on the mounting studs. The bracket is to be positioned such that when the brake caliper assembly is installed it will be on the cover side of the axle housing (3 or 9 o'clock position). Also, the support key and spacer leg of the bracket is to be on the top side. Install the mounting washers and nuts and torque to 80-100 ft. lbs.



6B. On planetary equipped with wet disc brake wheel ends proceed as follows:

1) Install the fitting/bleeder guards, if used, on the mounting studs. Guards are not to be installed in the area between the bleeder and inlet ports but just outside of that area and such that they will not interfere with the installation of the bleeder screw and inlet fitting.

2) Install the mounting washers and nuts and torque to 80-100 ft. lbs.

3) Install the bleeder screw in the top port and tighten until it is seated properly.

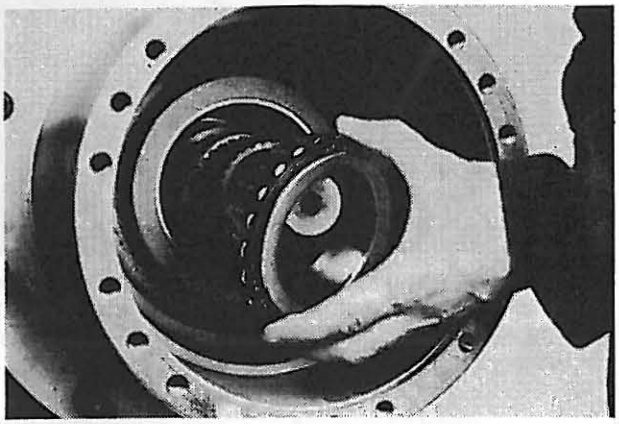
4) Install the brake inlet fitting in the other port and tighten until it is seated properly.

Assembly of Wheel End Hub

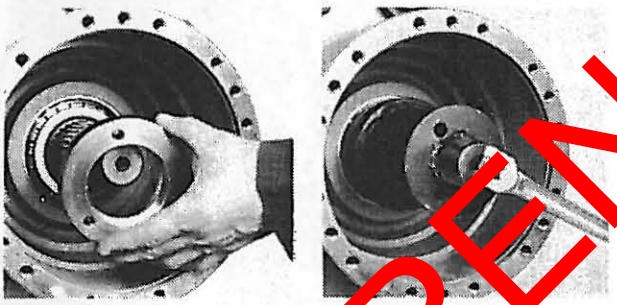
1. Install inner and outer bearing cups into hub. Install inboard bearing and hub seal.

2. Install hub onto spindle.

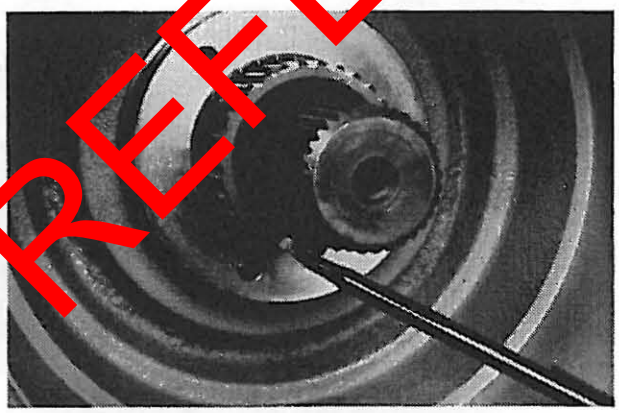
NOTE: A lifting device is recommended for assemblies having a rotor attached.



3. Install outer bearing cone.

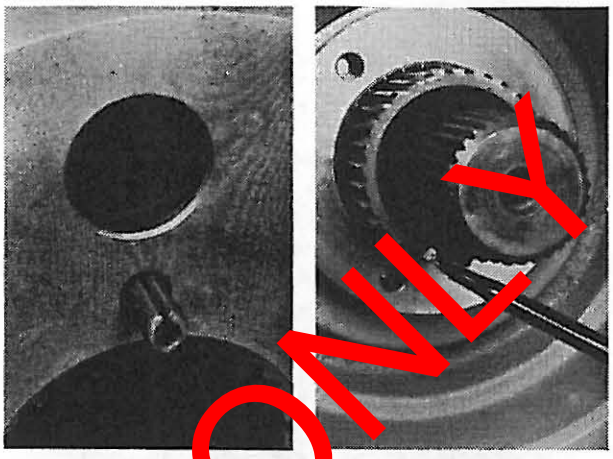


4. Install bearing adjusting nut. Torque to 200-250 ft.lbs. Back nut off 1/8 turn and align any hole in nut with a major spline on the spindle. Make sure hub rotates freely. (Use Dana Tool #45112)

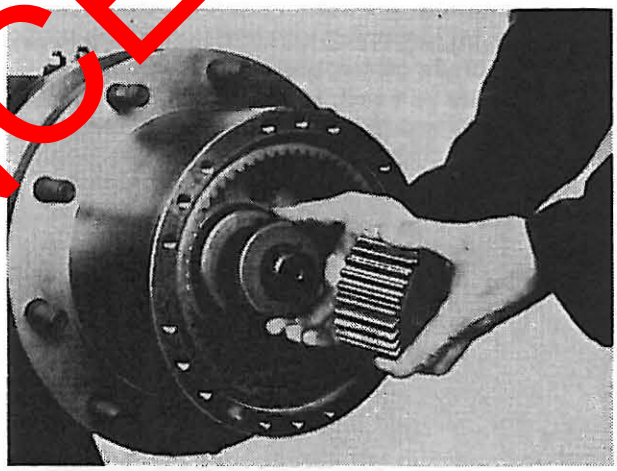


5. As an aid, mark the end of the aligned spline.

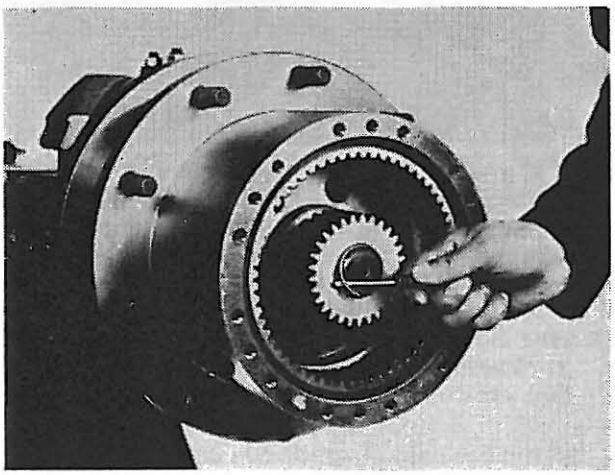
NOTE: If axle is equipped with wheel end disc brakes, the brake caliper assembly can be installed at this time as outlined in the disc brake section of the manual.



6. Install ring gear. The roll pin on the back face of the ring gear must be located into the bearing adjusting nut hole. Use punch mark on front of ring gear as an alignment aid.

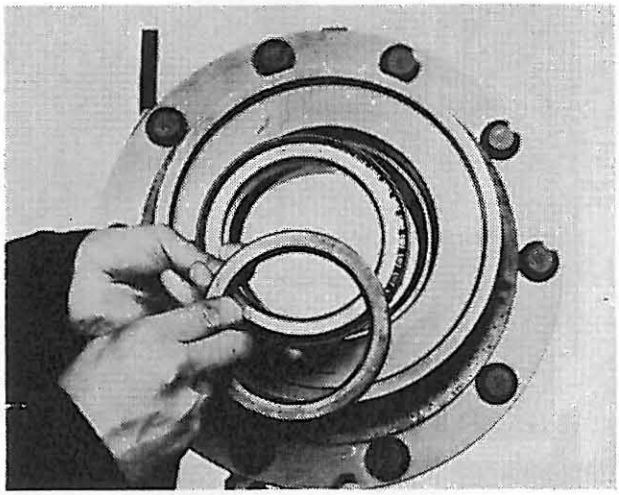


7. Install spacer and sun gear on shaft.



8. Install snap ring onto axle shaft.

Assembly of Wet Disc Brake Wheel End

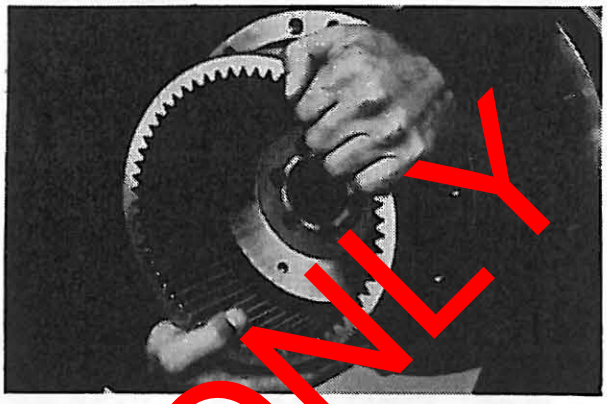


1. Install inner and outer bearing cups into hub. Install inboard bearing and seal and deflector.

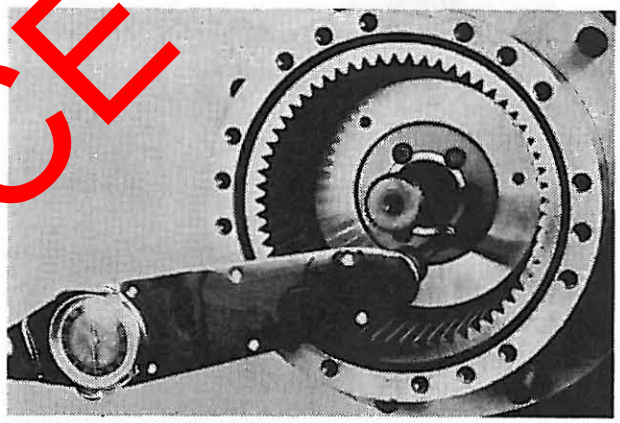
2. Using a suitable lifting device, install hub assembly onto spindle.

SPECIAL SERVICE NOTE: If the planetary ring gear, brake piston, and wheel retainer were removed as a unit, (described in disassembly section), and it was not necessary to replace wheel bearings or cups, use the following lettered steps for reassembly. Otherwise proceed with steps #3.

A. Insert both oil passage O-rings into grooves on inboard face of wheel retainer using a small amount of petroleum jelly to hold them in place and facilitate assembly.

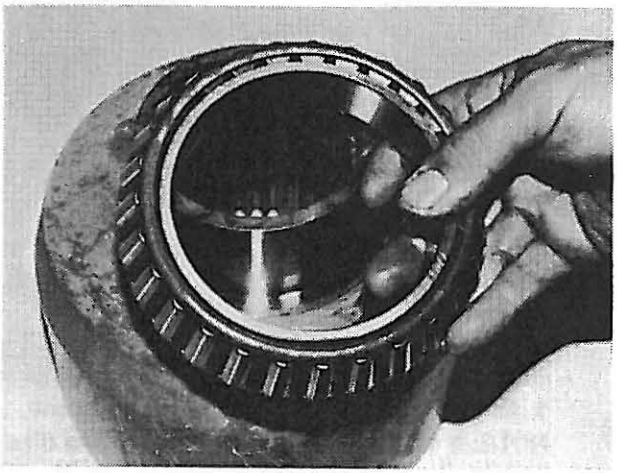


B. Install ring gear/piston assembly onto spindle spline making sure oil passage hole in ring gear is to bottom of axle at 6 o'clock position. Mounting holes in wheel retainer will align only one way.

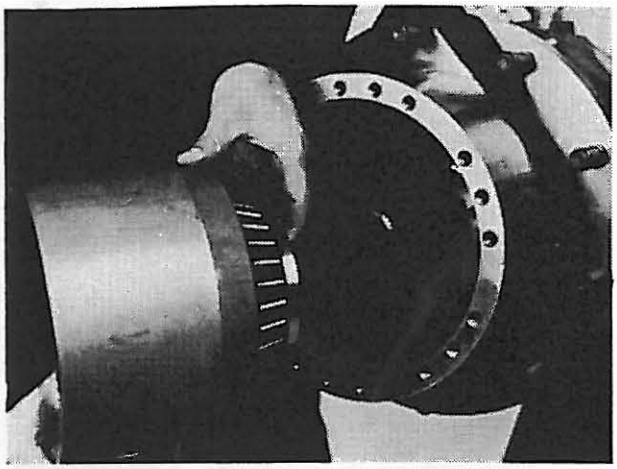


C. Install wheel retainer capscrews with Loctite® 271 compound applied to the threads and torque to 45 ft. lbs.

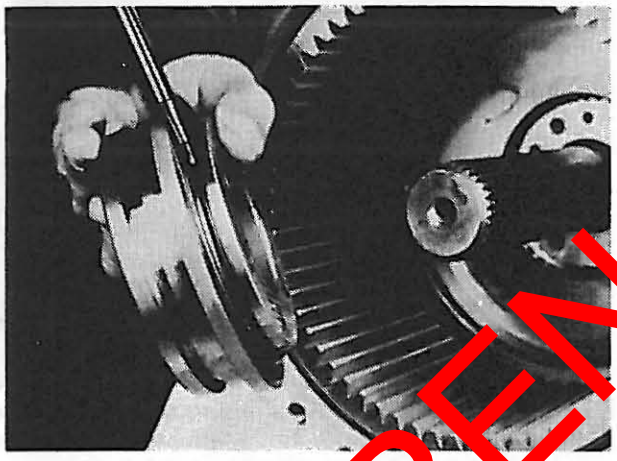
D. Skip following steps 3 thru 10 and continue assembly with step 11.



3. Install outboard wheel bearing onto planetary ring gear.



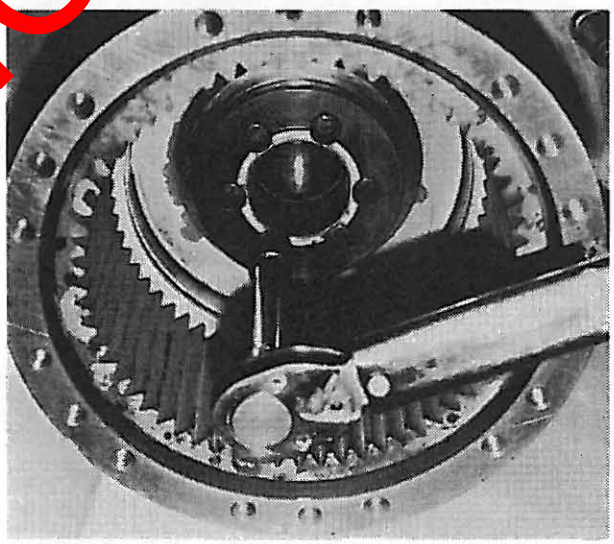
4. Install planetary ring gear onto spindle spline making sure oil passage hole in ring gear is to bottom of axle at 6 o'clock position.



5. Lubricate and install outer diameter O-ring into groove around inboard side of wheel retainer.

6. Insert both oil passage O-rings into grooves on inboard face of wheel retainer. Use a small amount of petroleum jelly to hold them in place and facilitate assembly.

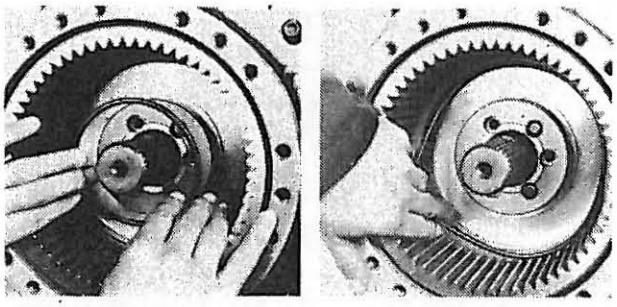
7. Place original wheel pre-load shims onto inboard side of wheel retainer and install into planetary ring gear. Make sure bleeder tube in retainer is to top of axle at 12 o'clock position.



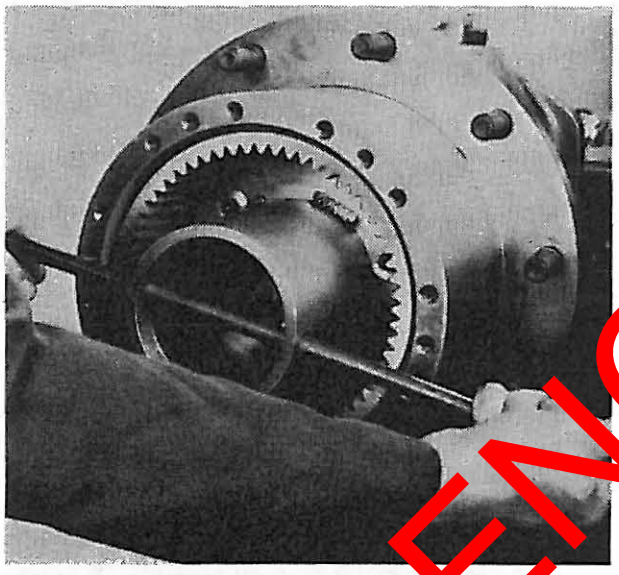
8. Install wheel retainer capscrews with Loctite® 271 compound applied to the threads. Gradually increase torque value on capscrews using a crossing pattern until 45 ft. lbs. is achieved on each capscrew.

NOTE: At this point check wheel bearing preload. Torque to rotate wheel should be 50-80 in. lbs. when measured with a torque wrench from the center of the hub. If a spring scale is used, wrap a cord around the wheel pilot diameter. Readings taken with this method should be 10-15 lbs. Pull while the hub is rotating.

To increase preload add shims. To decrease preload subtract shims.

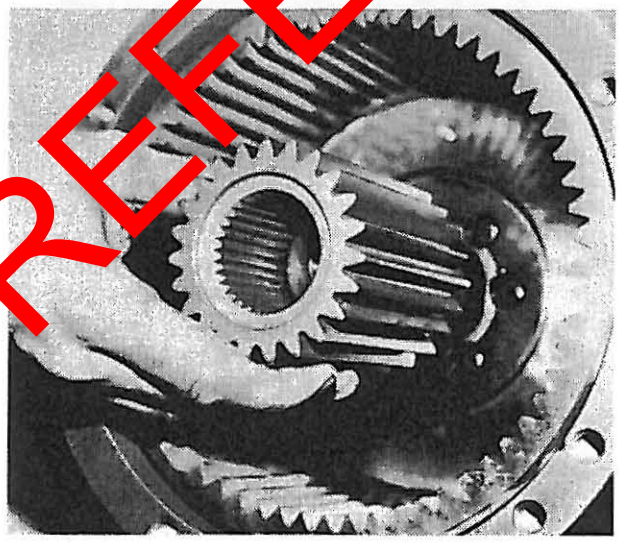


9. Lubricate and install outer and inner diameter piston O-rings.

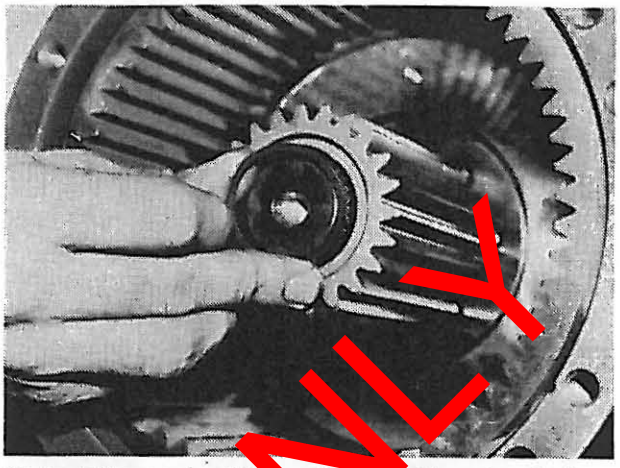


10. Install brake piston.

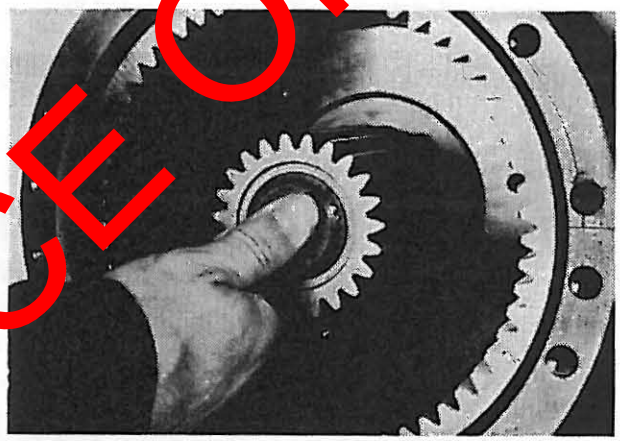
NOTE: Use of a special piston remover/installer tool, (Dana tool #451164), is recommended to prevent damage to the piston.



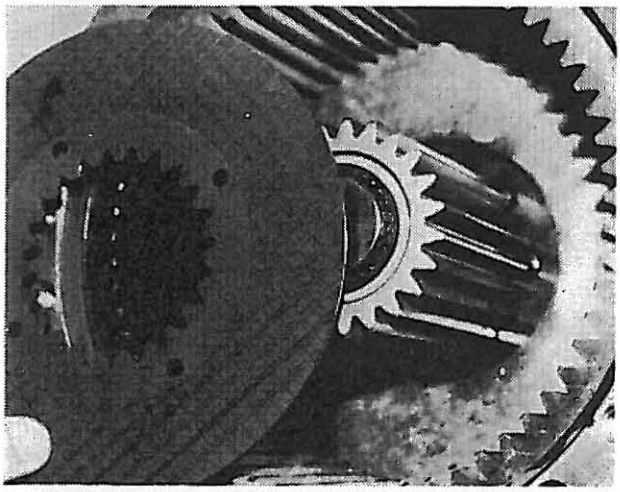
11. Install sun gear onto outer axle shaft.



12. Install snap ring into groove on outboard end of outer shaft.



13. Push inward on end of axle shaft to seat sun gear against wheel retainer. This will prevent rotating disc from dropping behind gear during installation.

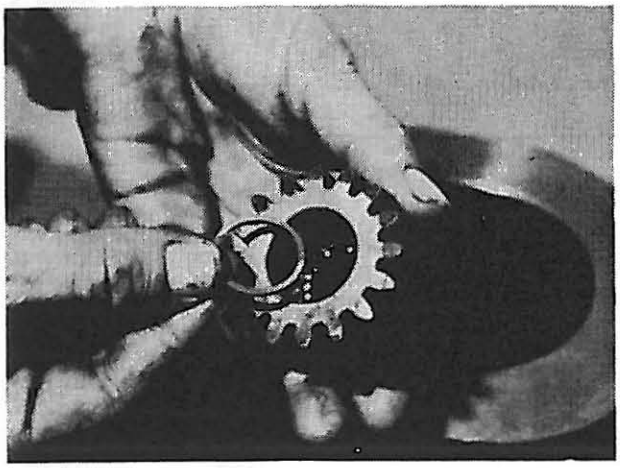


14. Install brake plates and discs into wheel end (4 each). Start with a steel stationary plate first, then a grooved friction disc (shown) second. Alternate until 4 of each are in place.

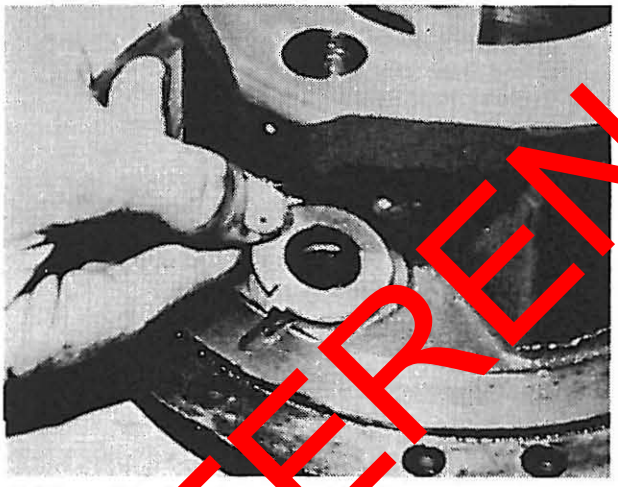
NOTE: If new discs are installed, presoak in the correct lubricant as recommended by the vehicle manufacturer for a minimum of 15 minutes prior to assembly.

Assembly of 3.650 Drive Flange

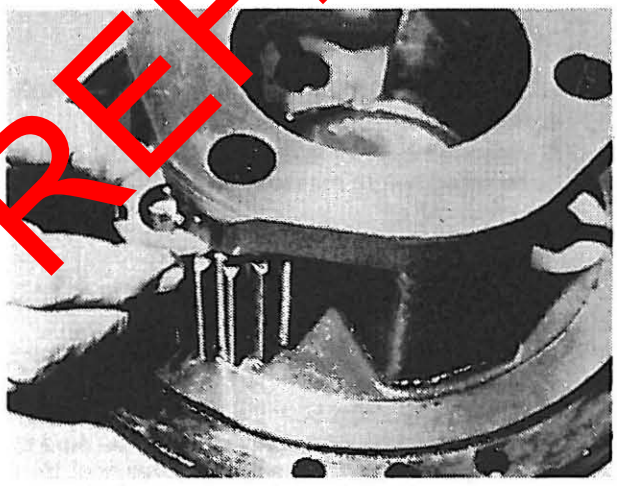
1. Install thrust button and vent into drive flange.



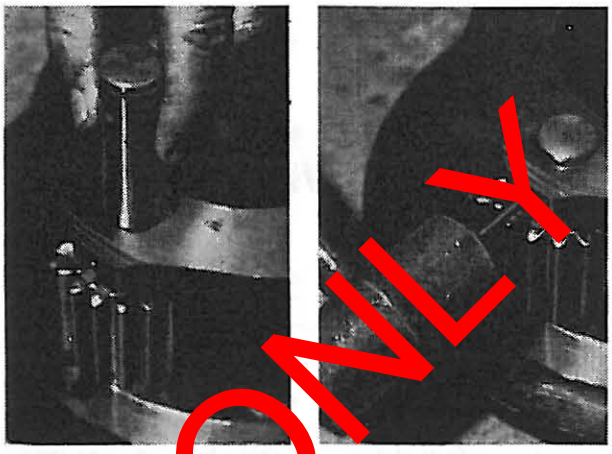
2. Grease inside of planet gear. Install two rows of needle bearings (25 per row) separated by spacer ring.



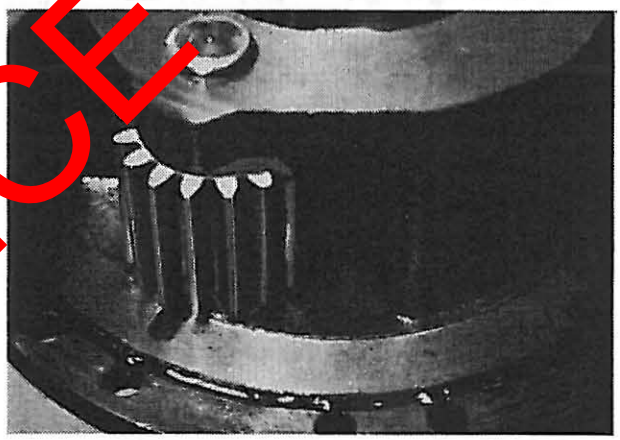
3. Place thrust washer on drive flange.



4. Install planet gear and remaining thrust washer.

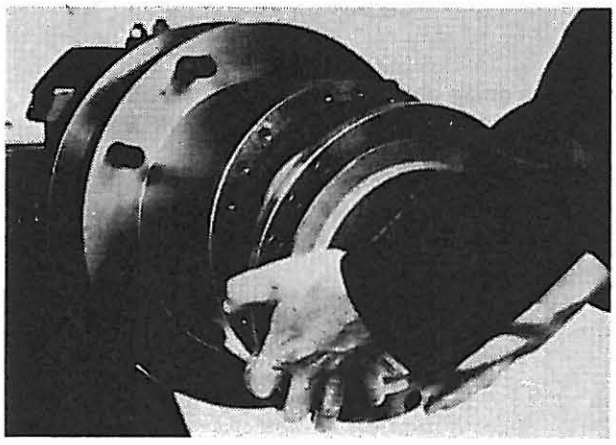


5. Install planet gear shaft into drive flange. If equipped with wet disc brakes install lining stop plate. Align holes and install roll pins.



6. Apply small bead of Permatex #2 gasket sealer around drive flange.

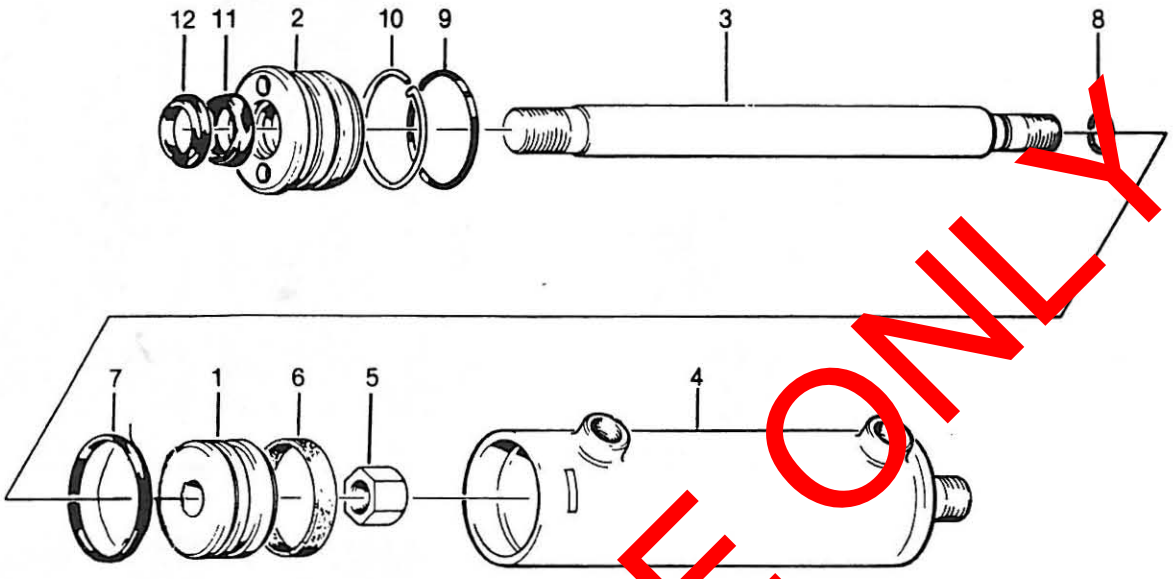
NOTE: DO NOT use silicone sealer on drive flange. It can cause flange to loosen.



7. Align gears and install drive flange into hub. Rotate hub to align bolt holes.

8. Install and torque bolts 90-100 ft. lbs.

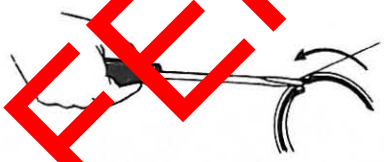
Steering Cylinder Disassembly and Assembly



1 Piston
2 Gland
3 Rod
4 Barrel Assem
5 Locknut
6 Wear
7 Pist Seal
8 od Static Seal
9 and Static Seal
10 Lockwire
11 Rod Seal U-Cup
12 Rod Wiper

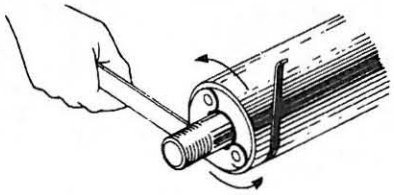
NOTE: Prior to disassembly of ste cylinder assembly loosen the socket ass bly amp bolt and nut and remove the socket ass blies om the steering cylinder.

DISASSEMBLY



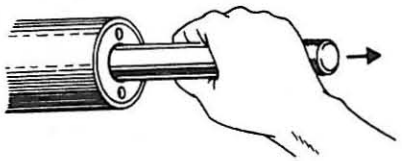
1. A sharp object, such as a screwdriver, must be use to get under the lockwire to start it out of the cy nder.

NOTE: D ction of rotation for lockwire removal nds on prior installation. Check lockwire position for correct rotation.



2. Locate spanner wrench in drilled holes in gland and rotate 360° in proper direction to remove lockwire.

CAUTION: Protect chrome finish on rod at all times. Damage to surface of rod can cause premature seal failure.



3. Pull on the rod to remove the piston and gland.

4. Remove the nut from the end of the rod.

5. When the cylinder is disassembled, all seals should be replaced before reassembling.

CLEANING AND INSPECTION

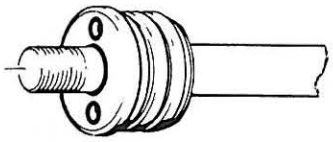
1. Check rod and cylinder bore for nicks, burrs, scratches or rust. Slight defects may be removed with fine sand paper.

2. All parts removed from the cylinder that are to be reused should be thoroughly cleaned. Be sure to carefully clean all cavities and grooves prior to replacing parts.

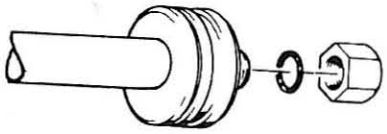
ASSEMBLY

1. Install all seals. Do not over stretch seals to facilitate easier installation.

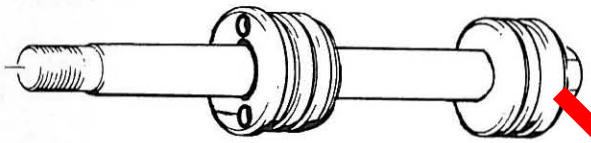
2. Make sure all seals are not twisted or distorted in grooves.



3. Install gland on rod with inner seal facing exposed section of rod.



4. Install piston on rod turn down.



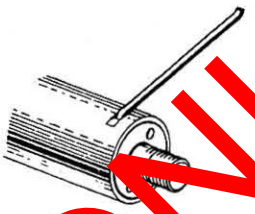
5. Install locknut and torque to 90-100 ft. lbs.

NOTE: Two (2) jam nuts can be used on opposite end of shaft to hold while torquing.

6. Lubricate all parts and inside of cylinder with hydraulic oil.

7. Push the piston into the cylinder bore with a steady, even pressure.

8. Push gland bore until shoulder of gland bushes up to the barrel.

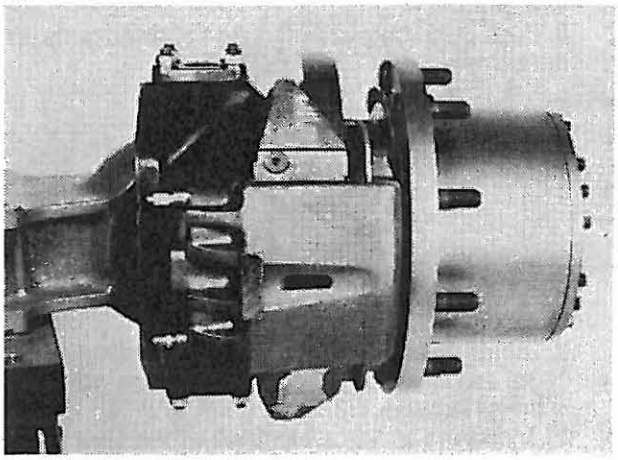


9. Locate drilled hole in gland through milled slot in the barrel and insert lockwire, then rotate the gland 360° to install lockwire.

10. Install the socket assemblies on the steering cylinder. Install the socket clamp bolt and nut (finger tight only).

NOTE: The final socket to steer cylinder adjustments will be made when steering cylinder assemblies are installed on the axle assembly.

Disassembly and Assembly of Wheel End Disc Brake



MAINTENANCE
GENERAL

It is difficult to determine an exact maintenance interval (time and mileage), since vehicles will be used in a wide variety of applications and conditions.

A regular schedule for periodic inspection should be established based on past experience and type of operation.

Disc brakes do not require adjustment since the pad clearance is maintained by movement of the caliper and piston.

BRAKE PADS

To inspect brake pads for wear, raise vehicle onto floor stands and remove wheel. Visually inspect pad linings at each visible end and through opening in caliper assembly. Replace pads if the thinnest point is less than 3/16" (4.76 mm).

It is recommended that all brake pads be replaced at the same time to maintain balanced braking of the axle.

Moderate erosion or pitting is a normal characteristic of semi-metallic pad lining material which does not require replacement. Should erosion reduce the polished contact area to less than 20% of total surface area, replace pads.

CALIPERS

Visually inspect calipers for defects or brake fluid leakage. If necessary, follow repair procedures in the Pad and Caliper portion of this section.

BRAKE FLUIDS

The Bendix disc brake is designed to use either a standard brake fluid or petroleum base mineral oil.

1. If brake fluid is used the brake must have black colored seals and dust boots. Brake fluid must meet SAE 1703 or Super Heavy Duty DOT-3 brake fluid specifications.

2. If petroleum based mineral oil is used the brake must have green colored seals and dust boots. Petroleum based mineral oil must meet Mil Spec Mil-H-5606 requirements.

SERVICE PRECAUTIONS

1. When the vehicle is raised for inspection or servicing use floor stands for additional support.

2. Check fluid level in the fluid reservoir prior to servicing the brakes. If the reservoir is full when the caliper pistons are retracted, fluid will overflow. Remove any potentially excess fluid from the reservoir with a siphon and discard.

CAUTION: Avoid contaminating the caliper and other brake parts while servicing the brake. Handle parts carefully to prevent damage.

3. The caliper assembly must be removed before removing the hub and disc assembly.

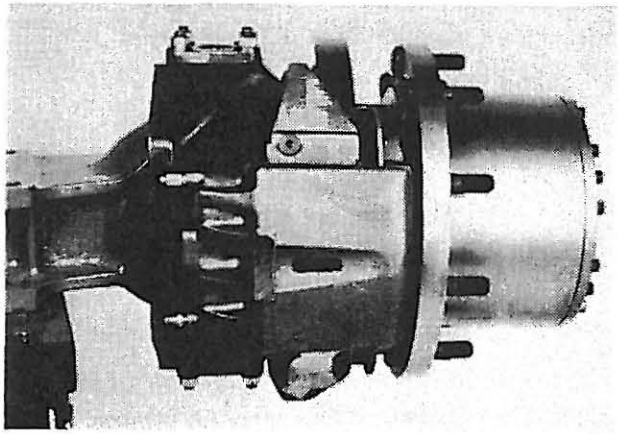
4. Replace worn or damaged caliper dust boots and piston seals.

5. If the original brake pads are to be reused, mark them in some manner so they can be installed in the same location.

6. After any brake service, be sure to test brakes prior to returning vehicle to service. A firm pedal should be felt during brake application.

CAUTION: DO NOT move vehicle until a firm brake pedal is obtained.

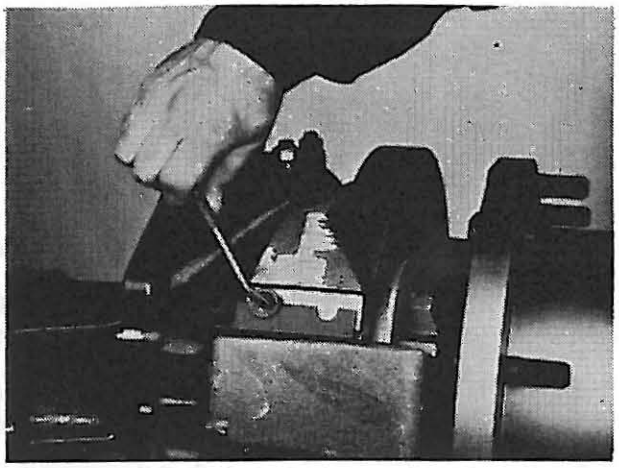
SERVICE PROCEDURES
CALIPER AND PADS REMOVAL



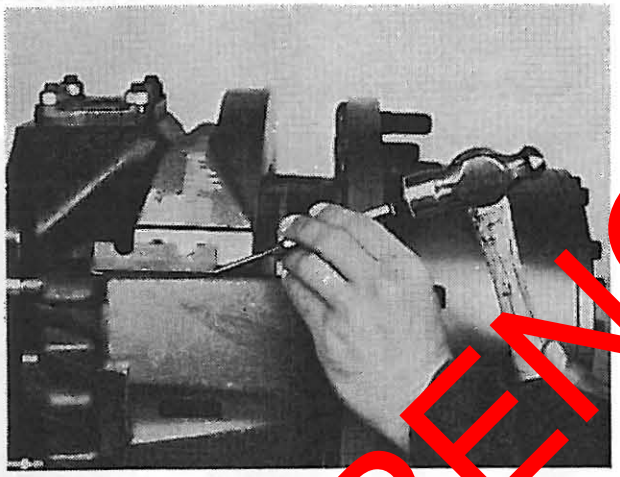
1. Position vehicle on floor stands and remove wheel.

2. Inspect master cylinder fluid level and remove fluid if necessary.

3. Pry the caliper outboard retracting the caliper pistons into the cylinder bore.

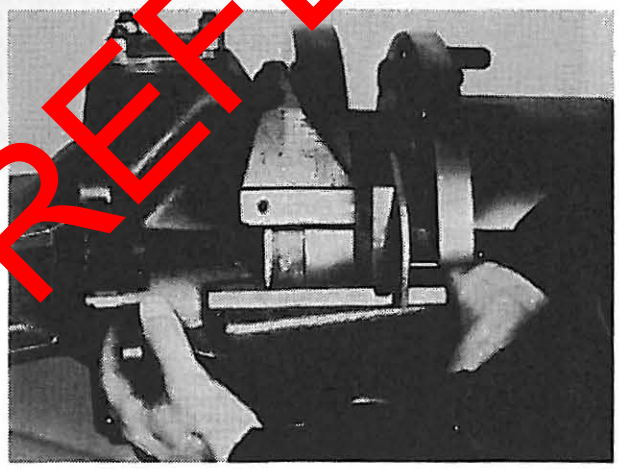


4. Remove support key retaining screw.

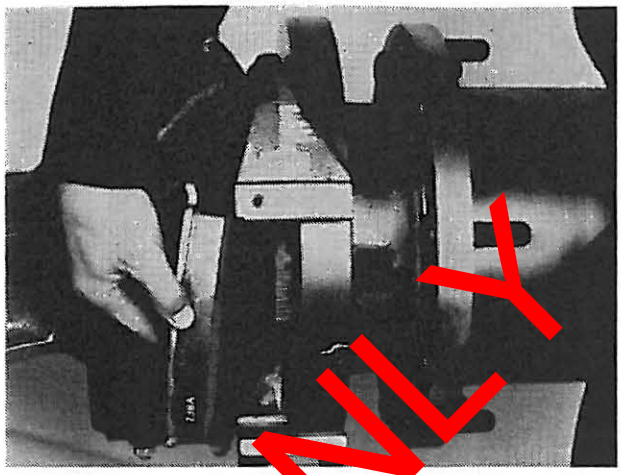


5. Using a hammer and drift, drive out caliper support key and spring.

6. Disconnect hydraulic hose if removing caliper to service other than brake pads.



7. Remove caliper from mounting bracket. Do not let caliper hang on brake hose.



8. Remove inboard pad from caliper mounting bracket. Inspect caliper for leakage. Rebuild if necessary.

NOTE: If the caliper does not require rebuilding, retract the pistons into the caliper to obtain necessary clearance for reassembly over the rotor. Position a metal bar over both pistons, then use a "C" clamp to force both pistons into the caliper.

CALIPER DISASSEMBLY

1. Disconnect brake hose from caliper inlet. Cap the hose and inlet to prevent brake fluid leakage. Avoid getting grease or brake fluid on brake pads.

2. Clean exterior of caliper in denatured alcohol.

3. Remove pistons from caliper.

NOTE: It may be necessary to use compressed air to aid in removal of pistons.

CAUTION: Use no more than 15 PSI air pressure to ease pistons from bore. Stay clear of area between piston and caliper housing to avoid personal injury. Avoid spray of brake fluid as pistons are dislodged from bores. Use shop towels to restrict piston travel and prevent damage to the pistons.

NOTE: If the piston becomes seized or cocked, release the air pressure and realign the piston, tapping with a soft faced hammer. Reapply air pressure to remove the piston.

4. Remove boot from piston and seal from caliper bore. Discard boot and seal.

CLEAN AND INSPECT CALIPER COMPONENTS

1. Remove any rust or corrosion from the external machined surfaces of the caliper housing. DO NOT use any abrasive material in the piston bores.

2. Remove any rust or corrosion from the machined surfaces on the caliper mounting bracket.

3. Clean the caliper housing and piston bores using denatured alcohol. Use dry compressed air to clean and dry all grooves and passages.

NOTE: Make sure all alcohol is completely removed before reassembly.

4. Inspect the piston bore, boot groove, seal groove, and piston for damage for excessive wear. Replace piston if it is pitted, scored or worn. Remove any corrosion that may be present in the piston bores and grooves with a fiber brush.

5. Inspect caliper support spring and key. Replace if necessary.

CALIPER REASSEMBLY

1. Lubricate piston seal and piston bore with brake fluid (Refer to BRAKE FLUID SECTION), and install seal in groove in piston bore. Be sure seal is fully seated and not twisted.

2. Coat outside of piston and dust boot lips with brake fluid. Slide dust boot over the piston and position it at bottom (closed end) of piston.

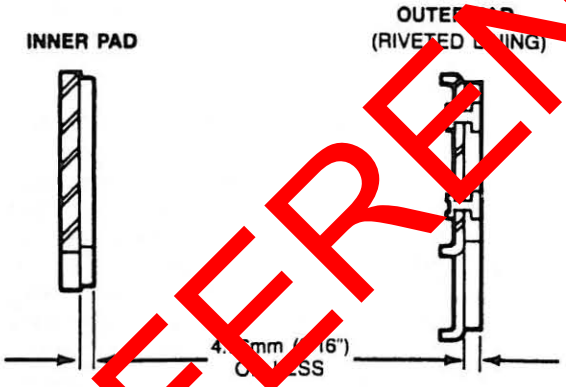
3. Position piston and boot over piston bore and install lip of boot into groove near top of bore. Be sure boot lip is fully seated.

4. Press straight in on piston until it bottoms in bore.

5. Assemble other parts on caliper and install as outlined in the Pad and Caliper Installation section.

CLEANING AND INSPECTION OF ROTOR AND PARTS

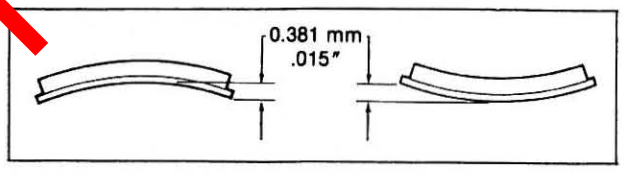
1. Measure lining thickness. If any point is less than 3/16" (4.76 mm), new pads should be installed on both wheels of that axle.



If lining material shows sign of excessive cracking, the pads must be replaced.

Replace brake pads as a set on an axle. Never replace pads one wheel at a time.

Replace brake pads contaminated with oil, grease, or any material not easily removed with a clean rag.



Examine the pads for flatness of the control surface. Any shoe found with a concave or convex bend more than 0.015" (0.381 mm), should be replaced.

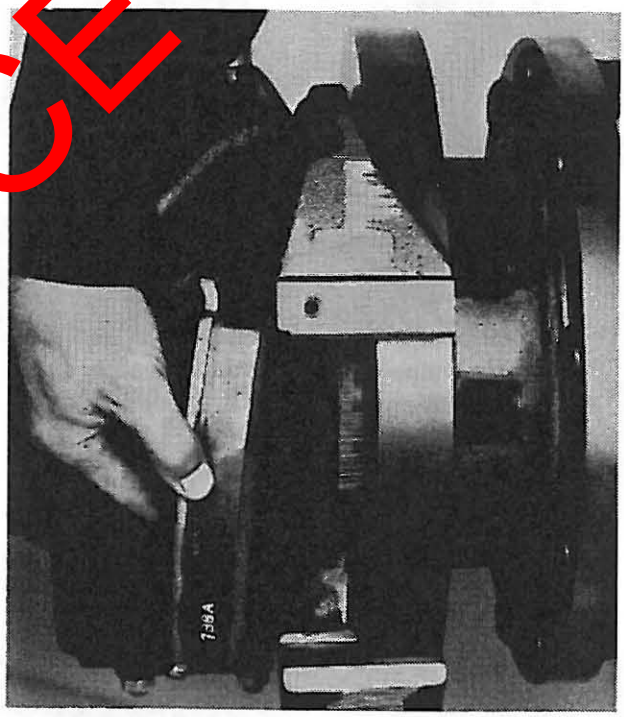
2. Inspect rotors. While rotors are mounted on wheel end, use dial indicator to check for warpage of braking surface. If surface varies more than .003 (.076 mm), it will be necessary to machine rotor to acceptable tolerance (Use standard automotive procedures). Rotors with cracks or burnt spots must be replaced.

NOTE: The minimum allowable thickness of the rotor braking surfaces is 1.320 inch (This value is cast on the rotor). If the amount of cleanup machining to eliminate warpage decreases or will decrease the thickness to less than the minimum specified, the rotor must be replaced.

Before reassembling the reworked or new rotor on the hub make sure the rotor and the hub mounting surface and pilot diameter for hare clean. Position the rotor on the hub, install all the mounting bolts and torque them to 174-191 ft. lbs.

Recheck the braking surface runout to make sure it is acceptable.

PADS AND CALIPER INSTALLATION

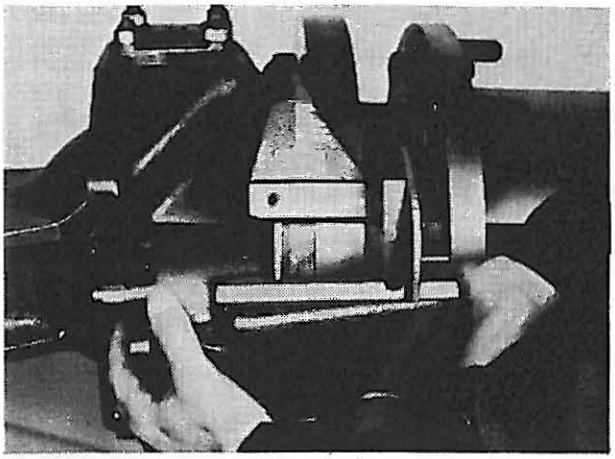


1. Position the inboard (smaller) pad into the caliper mounting bracket with lining towards rotor.

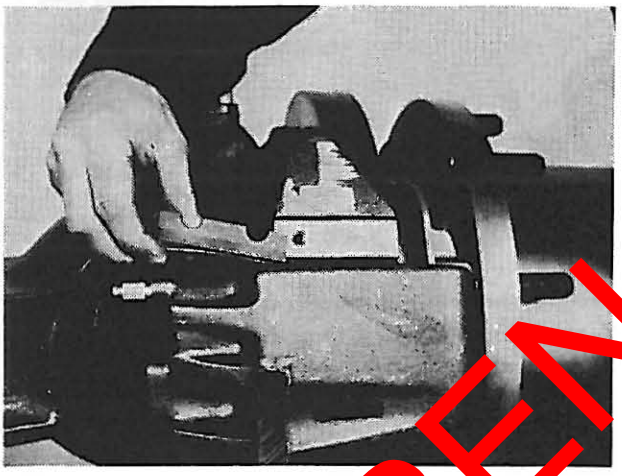
2. Be sure the caliper piston is fully bottomed in the piston bore.

3. Position outboard pad on caliper.

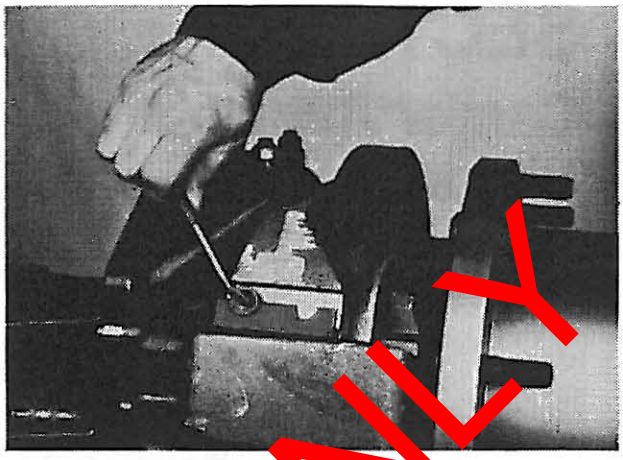
4. Apply a small amount of special lubricant (NLG-2 extreme temperature lithium grease), to the machined surfaces of the caliper vee-way grooves and caliper mounting bracket rails which are in contact during the sliding action of the caliper.



5. Position caliper into caliper mounting bracket. Avoid cutting piston dust boots.



6. Hold caliper in position and install support and support key between caliper and bracket. Use a soft faced hammer to drive the key and spring assembly into position.



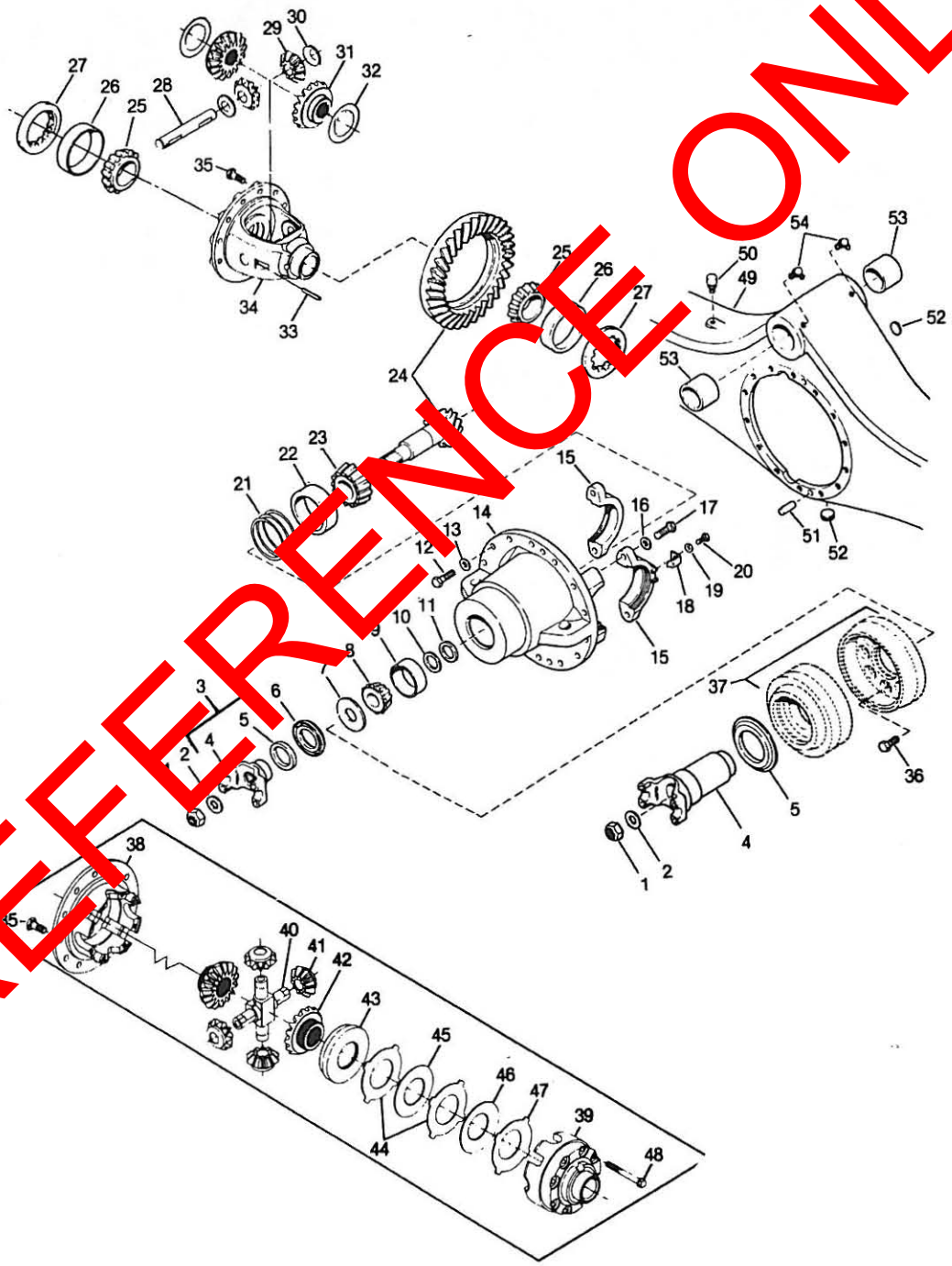
7. Install key retaining screw and torque to 12-18 ft. lbs.
8. Install line fitting in bottom port and bleeder fitting in top port.
9. Connect brake line hose removed.

BLEEDING INSTRUCTION
Refer to VEHICLE SERVICE MANUAL
CAUTION: OBTAIN FIRM PEDAL BEFORE MOVING VEHICLE.

SECTION 3

Carrier Assembly, Limited Slip Differential, Pinion Mounted Dry Disc Parking Brake

Carrier Assembly



1 Nut—Pinion
2 Washer—Pinion Nut
3 Pinion End Yoke Assembly (Includes Item 4 and 5)
4 End Yoke or Companion Flange
5 Deflector
6 Oil Seal—Pinion
7 Washer—Bearing Thrust
8 Outer Bearing Cone
9 Outer Bearing Cup
10 Shim—Pinion Bearing Preload Adjusting
11 Spacer—Flat
12 Capscrew—Carrier Mounting
13 Washer—Flat
14 Carrier
15 Cap—Differential Carrier
16 Washer—Flat
17 Capscrew—Bearing Cap Mounting
18 Lock—Bearing Adjusting Nut
19 Washer—Flat
20 Capscrew—Lock Mounting
21 Shim—Pinion Position (.003, .005, .010 Thick)
22 Inner Bearing Cup
23 Inner Bearing Cone
24 Gear and Pinion (Matched Set)
25 Side Bearing Cone
26 Side Bearing Cup
27 Adjusting Nut—Differential Side Bearings
28 Shaft—Differential
29 Pinion—Differential
30 Thrustwasher—Differential Pinion
31 Side Gear—Differential
32 Thrustwasher—Differential Side Gear
33 Lock—Differential Shaft
34 Case—Differential (Standard)
35 Capscrew—Drive Gear Mounting
36 Capscrew—Brake Mounting (Optional)
37 Parking Brake (Optional)
38 Flange Half—Limited Slip Differential Case
39 Cap Half—Limited Slip Differential Case
40 Shaft—Differential
41 Pinion—Differential
42 Side Gear—Differential
43 Ring—Differential Side Gear
44 Plate—Differential
45 Disc—Differential
46 Disc—Differential (Dished)
47 Plate—Differential (Dished)
48 Capscrew—Differential Case Mounting
49 Housing—Axle (Housing Configurations May Vary from Steer to Rigid)
50 Vent
51 Pin—Dowel
52 Plug—Pipe (Drain and Fill/Level)
53 Bushing—Axle Pivot
54 Fitting—Grease

Removal of Carrier from Axle Housing

NOTE: Use of safety glasses during disassembly/assembly procedures is recommended.

1. If it becomes necessary to disassemble any part inside the carrier, it is suggested that the entire axle be removed from the vehicle and held tight in a stand or rack.

WARNING: When removing axle assembly, make sure vehicle is properly supported. Improperly supported vehicle can cause serious injury or death. Follow vehicle manufacturer's recommendations for proper axle assembly removal procedures.

2. Remove drain plugs and drain lubricant from planetaries and carrier housing.

3. At this time remove wheel ends, and axle shafts. Follow procedures outlined in Wheel-End section of manual.

NOTE: If non-steering axle skip steps #4 and #5 and proceed with step #6.

4. Disconnect hydraulic lines to and remove steering cylinder assemblies from the steer knuckle and carrier anchor points.

5. Remove the tie rod assembly from the steer knuckle anchor points.

NOTE: Do not alter the tie rod adjustment.

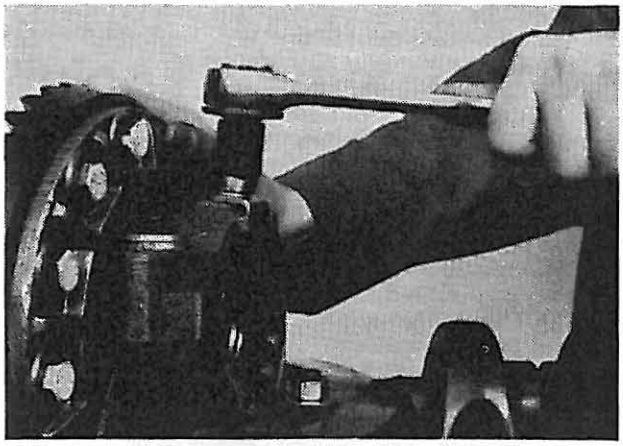
NOTE: If axle assembly is still in vehicle, be sure carrier assembly is securely supported before it is separated from housing.

If axle assembly has been removed from vehicle, be sure it is set securely in support stands with carrier pinion positioned up.

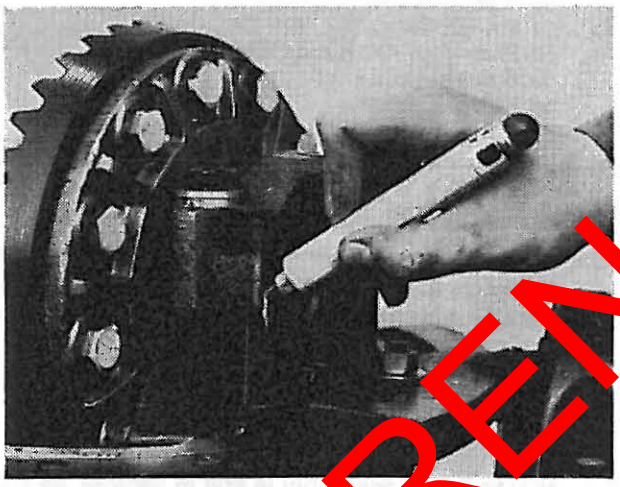
6. Remove mounting bolts and washers from carrier flange. Carrier assembly and axle housing is aligned with dowel pins.

7. Remove carrier assembly from housing and mount in suitable holding fixture such as a carrier repair stand.

Removal of Differential from Carrier



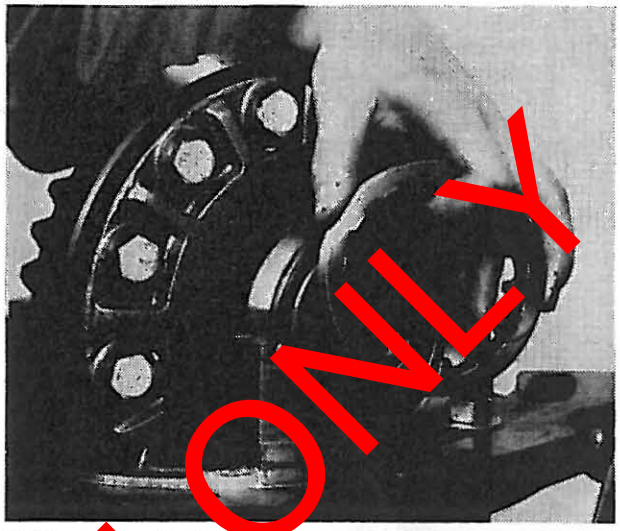
1. Remove adjusting nut lock from bearing caps.



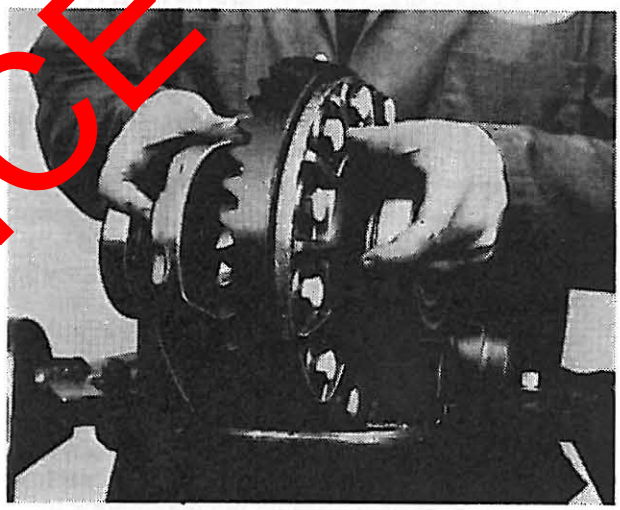
2. Match mark one differential bearing cap and leg of carrier with center punch or chisel for correct reassembly.

3. Remove bearing cap retaining bolts.

4. Remove bearing caps.



5. Remove adjusting nuts.



6. Carefully lift the ring gear and differential sub-assembly out of carrier.

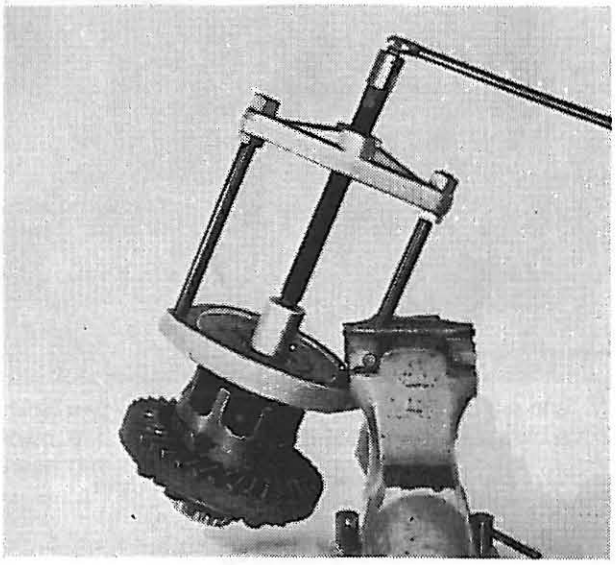
NOTE: Prevent bearing cups from falling as you remove differential.

Use care to avoid damage to ring and pinion gears. If either is damaged, it must be replaced as part of a matched set.

NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.

Differential Disassembly

A. Ring Gear and/or Differential Side Bearing Cones



1. If replacement of differential bearings is required, remove differential bearings with a puller as shown.

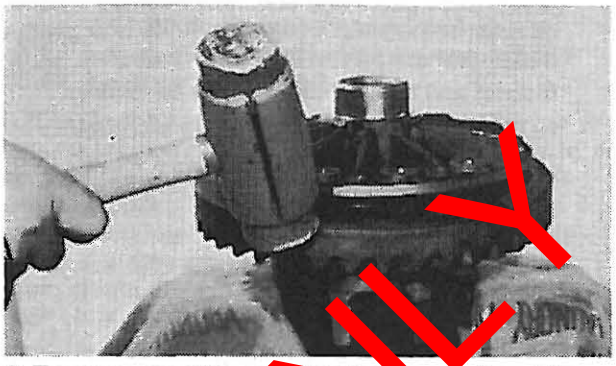
NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.

NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.

2. If removal of ring gear from case is required, place a few shop towels over the vise to prevent the ring gear teeth from being nicked after it is free from the case.

Place case in vise. Remove ring gear screws and discard them.

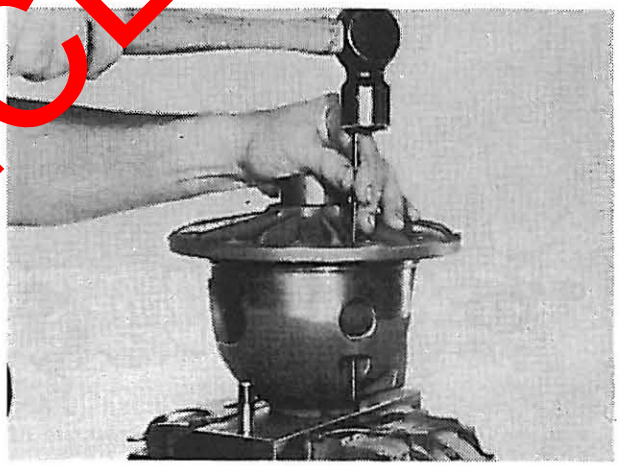
Ring gear screws are to be replaced with new ones at time of reassembly.



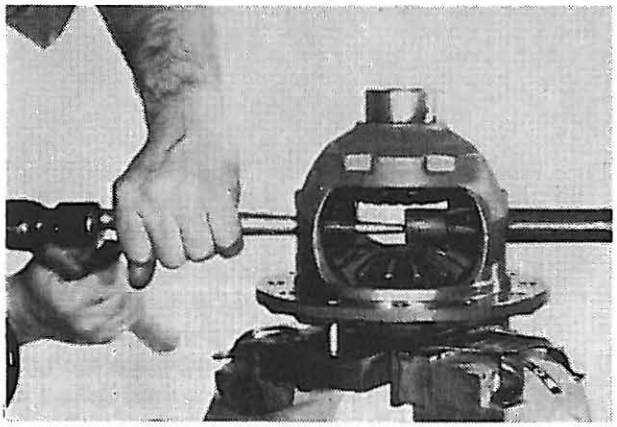
3. Tap ring gear with a rubber hammer to free it from the case. Remove case and ring gear from vise.

NOTE: If ring gear and/or pinion shaft needs to be replaced, ring gear and pinion shaft must be replaced as a matched set.

B. Standard Differential (One-Piece Case)



1. Place holding fixture into vise. Place case onto holding fixture as shown. Drive out lock pin.

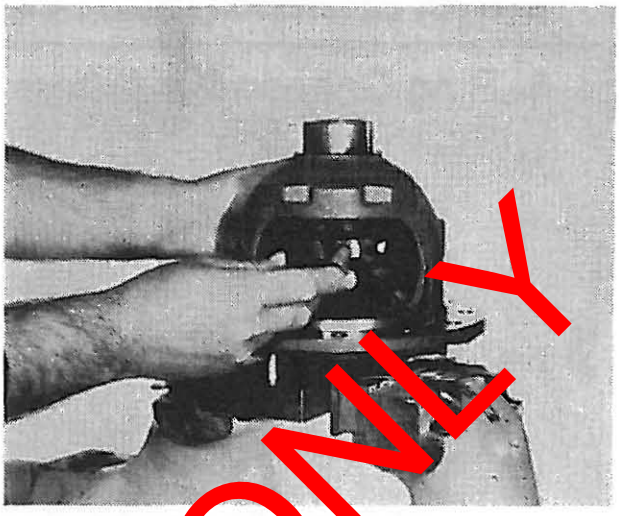


2. Reposition case on holding fixture as shown. Drive out cross pin using a drift and hammer.

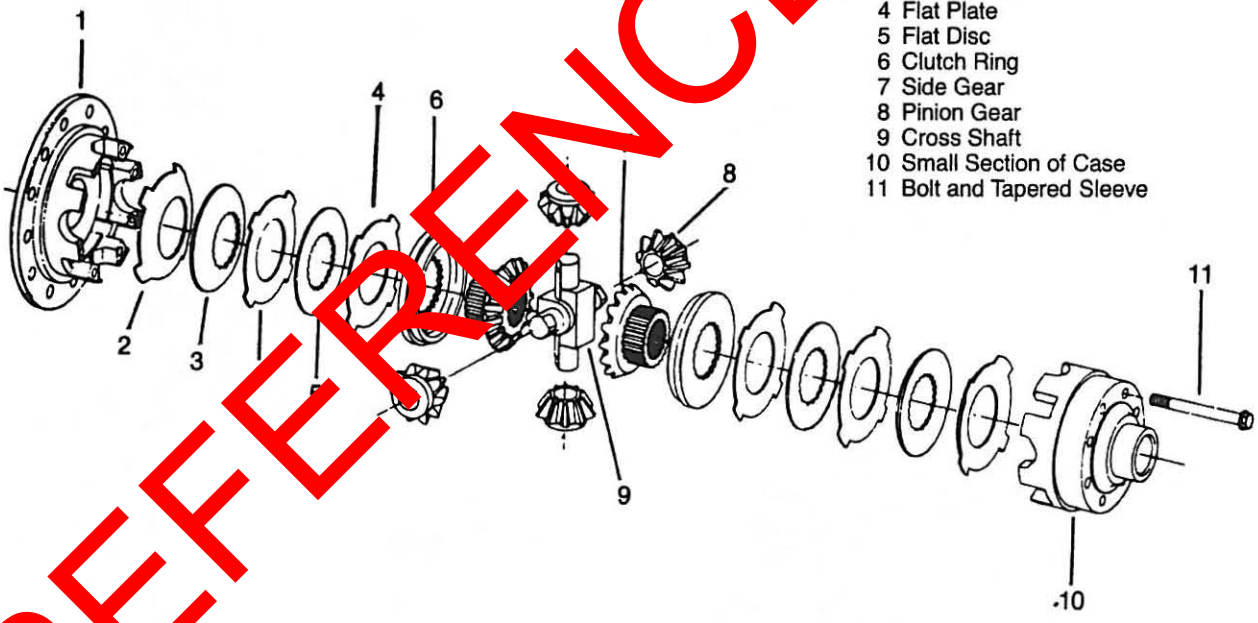
3. Rotate gears until the pinion mate gears (small gears) enter the large opening of the case. Remove pinion mate gears and spherical washers. After removal of the pinion mate gears, the side gears and thrust washers can be easily removed.

Inspect and replace components as required.

NOTE: Always replace gears as a complete set. Do not mix new gears with old gears, as this may cause uneven wear and short gear life.



C. Limited Slip Differential



1 Large Section of Case
2 Dished Plate
3 Dished Disc
4 Flat Plate
5 Flat Disc
6 Clutch Ring
7 Side Gear
8 Pinion Gear
9 Cross Shaft
10 Small Section of Case
11 Bolt and Tapered Sleeve

1. Punch mark both sections of differential case to assure proper reassembly. Also mark end of the cross shaft nearest the differential case punch marks.

2. Remove the small section of differential case, side gear, clutch ring, plates, and discs.

3. Remove pinion gears, cross shafts, side gear, clutch ring, plates, and discs from large section of differential case.

NOTE: The differential has a serial number stamped on the small case section. When ordering parts, always include the complete part number.

NOTE: If any plates or discs are scored or worn, entire set must be replaced on both sides.

NOTE: Clutch rings must be replaced in sets.

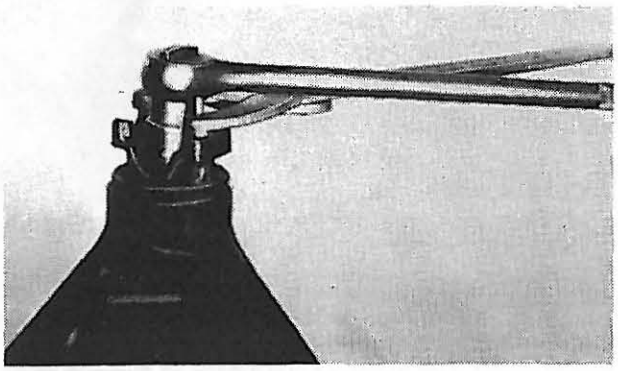
NOTE: Side gears or pinion gears showing wear must be replaced in sets.

NOTE: If cross shaft shows signs of wear, replace in sets.

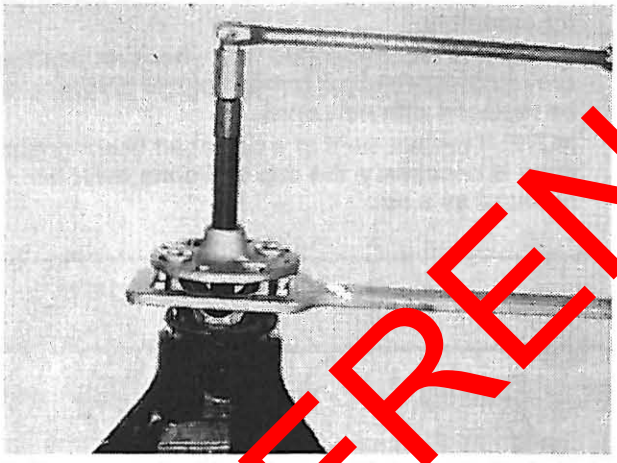
NOTE: If wear is evident at "V" notch for the cross shaft on either small or large case section, replace as a set.

Pinion Disassembly

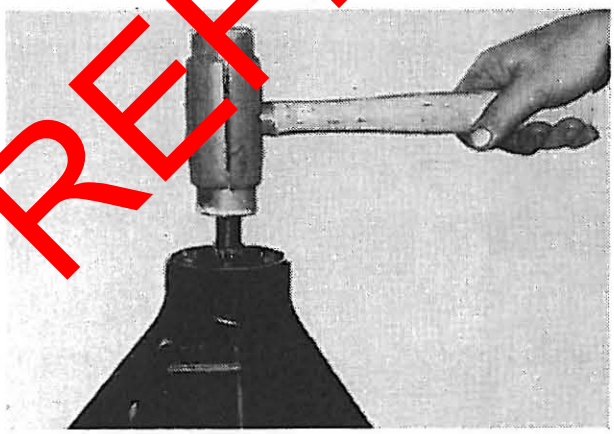
NOTE: If carrier has optional pinion mounted parking brake refer to pinion parking brake section of manual for removal of brake assembly from carrier.



1. Hold end yoke or flange with tool similar to the one shown, and remove pinion nut and washer. Discard nut as new one should be used at reassembly.



2. Remove end yoke or flange with tools similar to that shown. If yoke or flange shows wear in the area of the seal contact, it should be replaced.



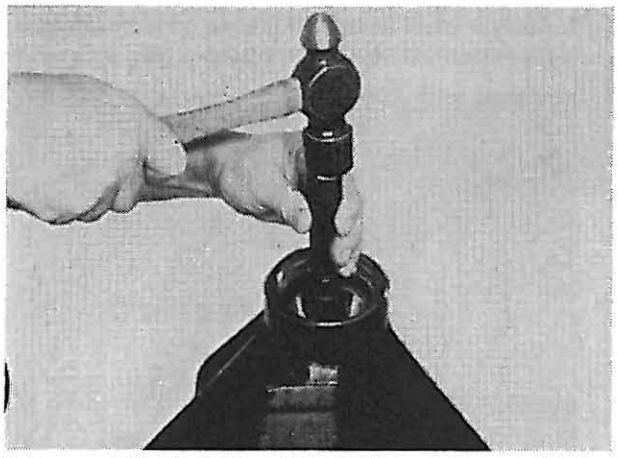
3. Remove pinion by tapping with a rawhide hammer. Catch the pinion with your hand to prevent it from falling to the ground and being damaged.

WARNING: Gear teeth may have sharp edges. When handling gears, use care to avoid personal injury.

NOTE: On the spline end of the pinion, there are bearing preload shims. These shims may stick to the bearing—pinion—or even fall out. The shims are to be collected and kept together so they will be used later in assembly. Try not to mutilate shims. If shims are mutilated, replace with new ones; shims are available in thicknesses of .003", .005", .010". and .030".

NOTE: If ring gear and/or pinion shaft needs to be replaced, ring gear and pinion must be replaced as a matched set.

4. Pull out pinion seal with puller as shown. **DISCARD SEAL.** Replace with new seal at time of assembly. Remove bearing cone and outer pinion oil slinger.



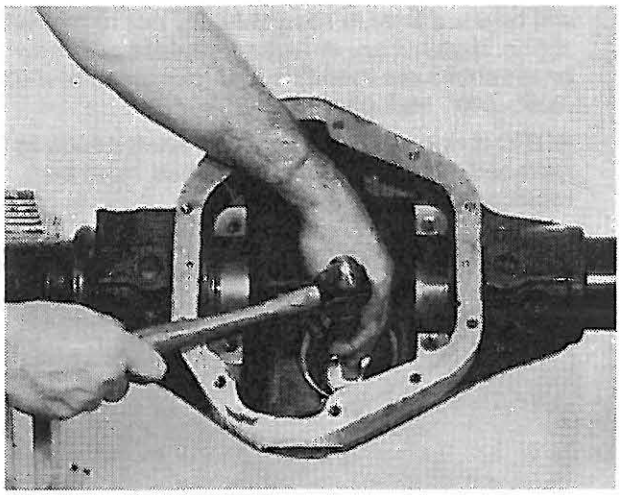
5. Remove the inner bearing cup, if necessary, with tools as shown.

NOTE: Shims are located between the bearing cup and carrier bore and may also include an oil baffle, depending upon the application. If shims and baffle are bent or nicked, they should be replaced at time of assembly. Wire the stacks together and

measure each. If stack has to be replaced, replace with the same thickness.

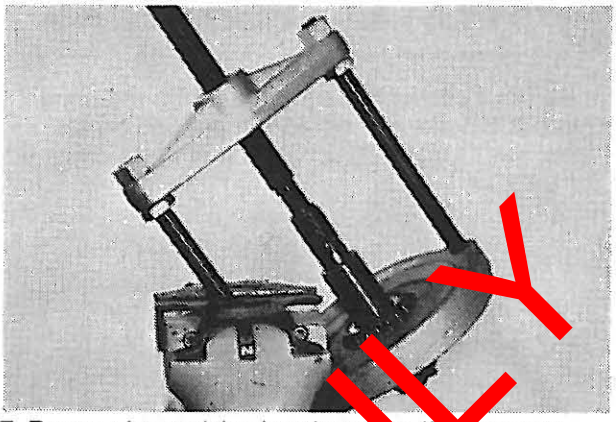
NOTE: The front and rear axle carrier section may vary in pinion bore depth due to the possibility of the need for either a baffle or slinger or both.

The baffle serves the same purpose of assisting the lube to flow up through the oil channels to lubricate the pinion bearings. If used, they are part of the pinion setting adjustment.



6. Turn nose of carrier down. Remove outer pinion bearing cup as shown. Locate driver on back edge of cup; drive cup out of carrier if necessary.

CAUTION: Do not nick carrier bore.



7. Remove inner pinion bearing cone, if necessary, with tools as shown.

WARNING: Do not allow gear to fall. It can strike legs or feet and may cause serious injury. Gear teeth may have sharp edges. When handling, use care to avoid cutting hands.

NOTE: Both baffle and slinger are part of the pinion adjustment shims and are to be kept intact for assembly.

NOTE: It is recommended that whenever bearings are removed, they are (regardless of mileage) to be replaced with new ones.

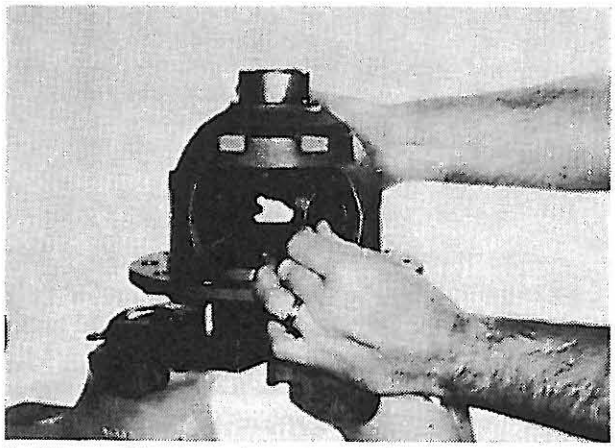
NOTE: If replacement of a damaged bearing cup or cone is necessary, the cup and cone must be replaced as a set.

Differential Assembly

A. Standard Differential (One-Piece Case)

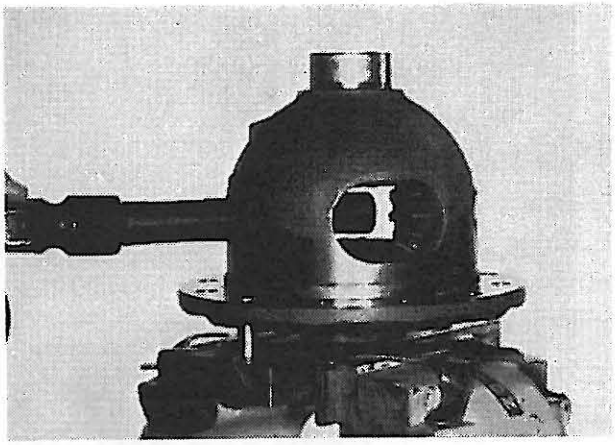
1. Apply a small amount of grease on both side gear hubs. Assemble new thrust washers onto side gears.

2. Assemble both side gears into case. Hold top side gear up with your fingers. Assemble one pinion mate gear. Rotate gears until pinion mate gear is directly in the center of the small opening of the case. Line up the other pinion mate gear with the gear which has just been assembled. Rotate gears until the holes of pinion mate gears are in direct line with the holes of the differential case.

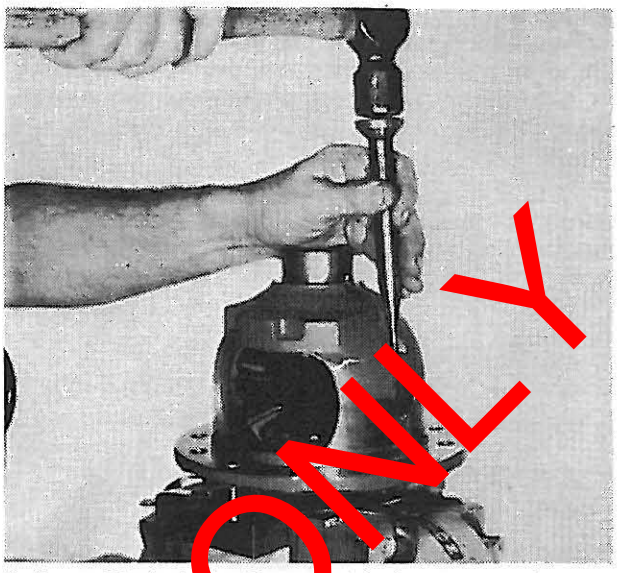


3. After making sure the gears are in alignment, apply a small amount of grease to the new spherical

washers. Assemble washers between the gears and case. Also line up the holes of the washers with those of the gears and case.



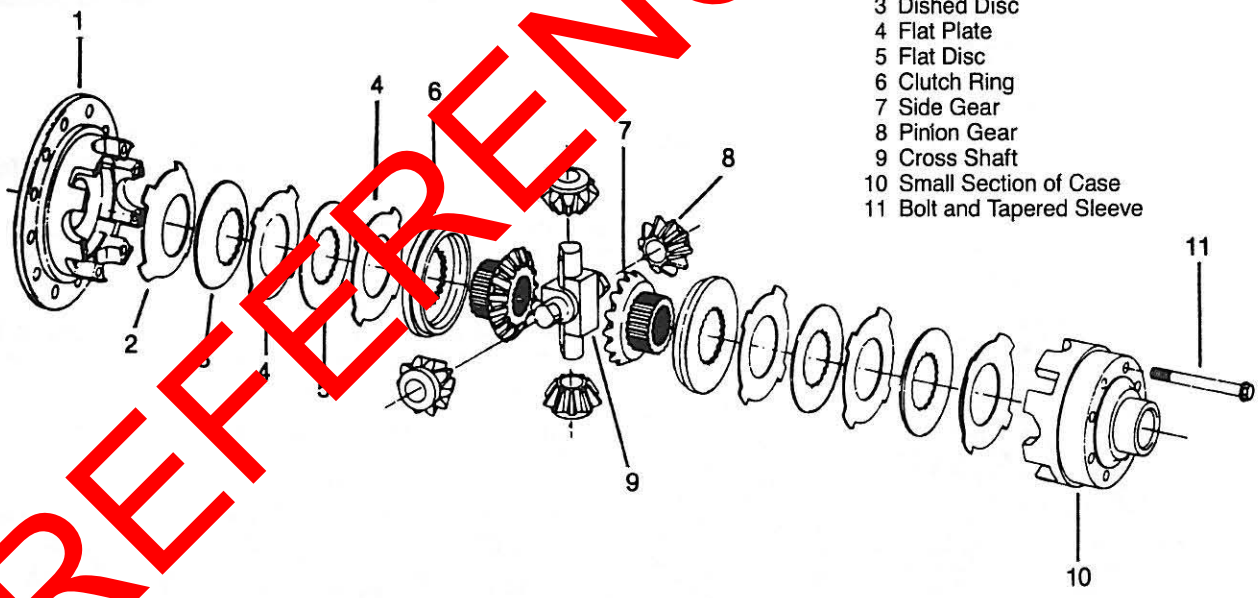
4. Assemble cross pin. Make sure lock pin hole of the cross pin is in a vertical position and lined up with the lock pin hole of the case. Drive cross pin into case with a hammer until the cross pin hole is in alignment with the hole of the case.



5. Assemble lock pin. Peen metal of case over pin to lock in place.

B. Limited Slip Differential

1 Large Section of Case
2 Dished Plate
3 Dished Disc
4 Flat Plate
5 Flat Disc
6 Clutch Ring
7 Side Gear
8 Pinion Gear
9 Cross Shaft
10 Small Section of Case
11 Bolt and Tapered Sleeve



1. Lubricate all internal parts with axle lubricant before assembly.

2. Alternately install plates and discs into large section of case as illustrated.

NOTE: Install dished plate and disc with concave surface toward case section.

3. Install clutch ring and side gear. Engage splines of discs and clutch ring on side gear.

4. Assemble pinion gears on cross shafts. Assemble cross shafts together.

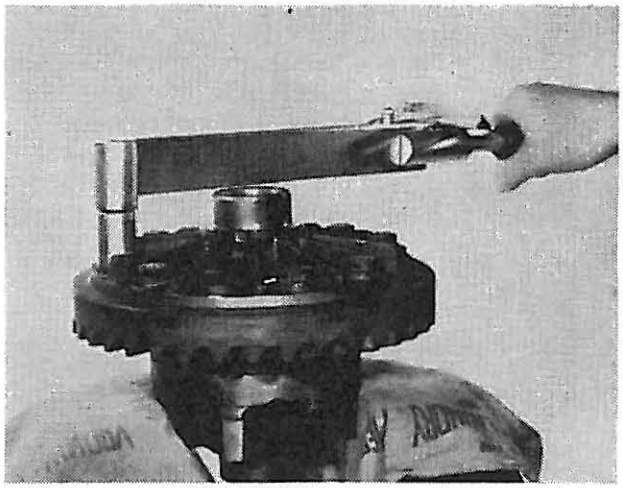
5. Install cross shafts to large section of case so "V" portion of cross shaft mates with "V" cut out in case.

6. Assemble side gear, clutch ring and clutch discs for small case section on spider assembly as it sits on work bench. Install case section being sure it seats fully.

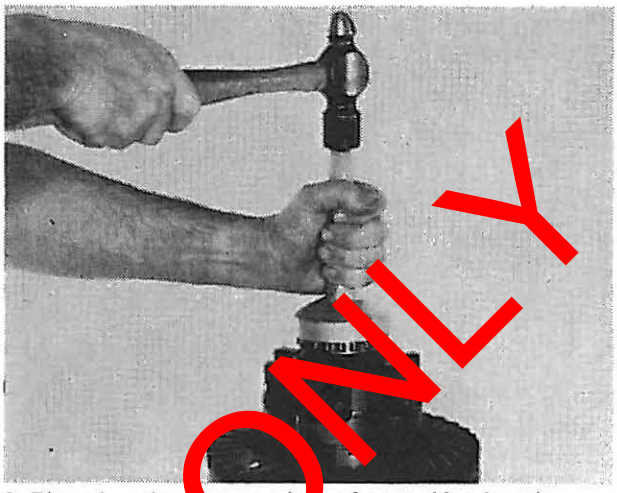
7. Tighten case section bolts to 95-100 ft. lbs.

NOTE: Match case halves together by punch marks.

C. Ring Gear and/or Differential Side Bearing Cones



1. Place case assembly in a vise. Be sure flange face of the case is free of nicks or burrs. Assemble ring gear to case. Line up holes of the ring gear with those of the case. Use new ring gear screws. Draw up screws alternately and evenly. Torque ring gear screws to 120-140 ft. lbs.



2. Place bearing cone on hub of case. Use bearing installer to seat bearing cone as shown.

Be sure they are fully seated.

NOTE: Be sure bearing cone and case bearing journal are clean prior to assembly.

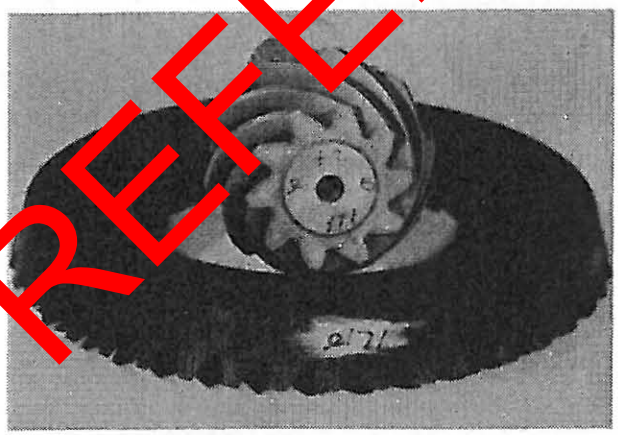
Pinion Position and Assembly

A. Pinion Position

RING GEAR & PINION TOOTH PATTERN INTERPRETATION

When setting the pinion position, many of the service manuals required a final pinion position check by using gauges that verified the dimension from the center line of the differential carrier (center line of ring gear) to the face of the pinion (button).

This surface (button) is not used on all current gears for verifying the pinion position. The service tools will be used to establish the proper amount of shims required prior to installing the pinion gear. The final pinion position will be verified by using the GEAR CONTACT PATTERN METHOD, as described in this manual.



View of ring and pinion set.

Ring gears and pinions are supplied in matched sets only. Matching numbers on both the pinion and ring gear are etched for verification. If a new gear set is being used, verify the numbers of each pinion and ring before proceeding with assembly.

The distance from the centerline of the ring gear to the button end of the pinion for the Model 70 (Front and Rear) axle is 3.500 inches approx.

On the button end of each pinion there is etched a plus (+) number, a minus (−) number, or a zero (0) number, which indicates the best running position for each particular gear set. This dimension is controlled by the shimming behind the inner bearing cup.

For example: If a pinion is etched +3, this pinion would require .003″ less shims than a pinion etched "0". This means by removing shims, the mounting distance of the pinion is increased to 3.503″ which is just what a +3 indicates. Or if a pinion is etched −3, we would want to add .003″ more shims than would be required if the pinion were etched "0". By adding .003 shims the mounting distance of the pinion was decreased to 3.497″ which is just what a −3 etching indicated.

If the old ring and pinion set is to be reused, measure the old shim pack and build a new shim pack to this

same dimension. If a baffle is in the axle assembly, it is considered as part of the shim pack.

To change the pinion adjustment, shims are available in thicknesses of .003", .005", and .010".

NOTE: If baffle or slinger is bent or mutilated, it should be replaced.

Measure each shim separately with a micrometer and add together to get total shim pack thickness from original build up.

If a new gear set is being used, notice the (+) or (−) etching on both the old and new pinion and adjust the thickness of the new shim pack to compensate for the difference of these two figures.

For example: If the old pinion reads (+) 2 and the new pinion is (−) 2, add .004" shims to the original shim pack.

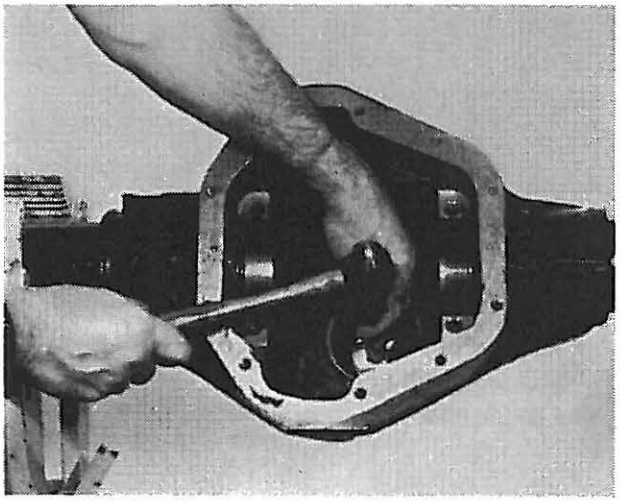
The above procedures also apply to pinion adjustment on the front axle which includes the oil slinger between the inner bearing cone and pinion, and baffle between the inner bearing and carrier.

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

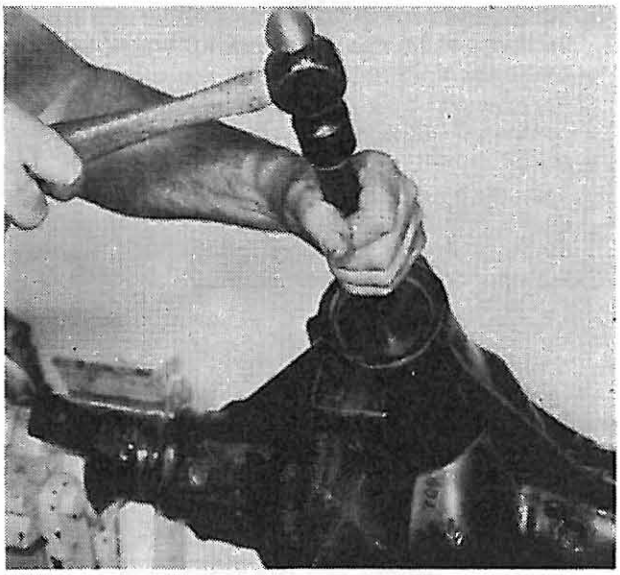
Pinion setting chart shown. Use this chart as a guideline to set pinion.

B. Pinion Assembly

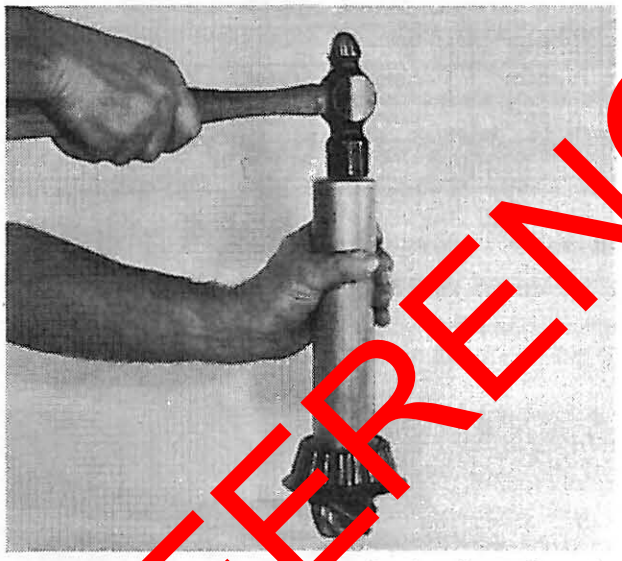
1. Measure each shim separately with a micrometer and add together to get total shim pack thickness. If baffle is required, it is to be included in the shim pack. If slinger is used between the inner bearing cone and thrust face of pinion, the slinger is also to be measured and included as a part of the total shim pack.



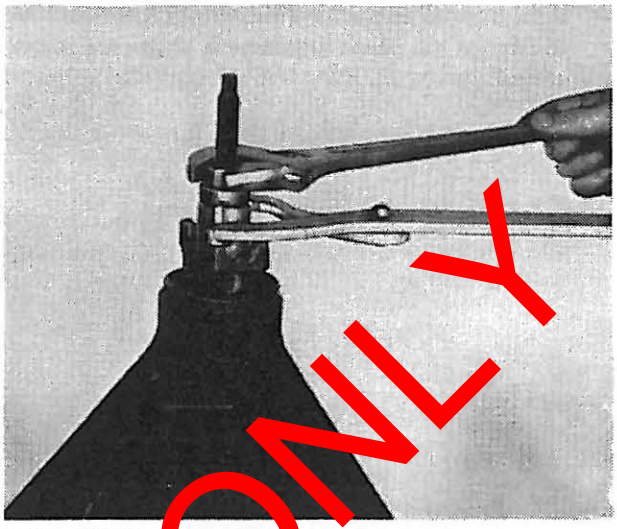
2. Place the required amount of shims (and baffle if used) in the inner bearing bore; drive the inner bearing cup into carrier with tools as shown.



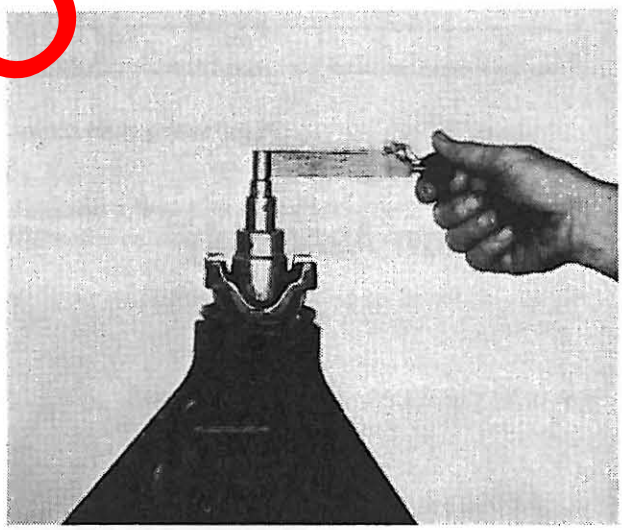
3. Assemble the outer pinion bearing cup into carrier as shown.



4. Assemble inner bearing cone (and a slinger if used) on pinion, place bearing installer over pinion shaft as shown. Drive bearing on shaft until it is completely seated.



5. Install pinion into carrier.
Assemble outer pinion bearing cone, (slinger if used) and end yoke onto pinion spline.
NOTE: Do not assemble preload shims or pinion oil seal at this time
Use yoke installer (as shown) to assemble end yoke onto spline of pinion.

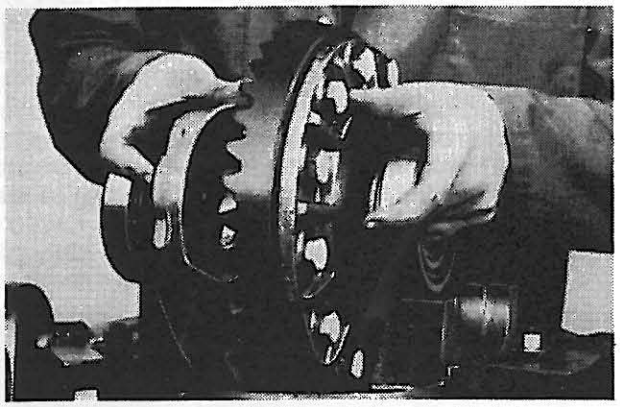


6. Assemble washer and pinion nut. Torque nut until it requires 10 lbs. inch to rotate pinion. Rotate pinion several times before checking pinion position. This is to seat the bearings and assure a more accurate indication of the pinion position.

NOTE: The reason for not assembling preload shims and new pinion oil seal at this time is due to the possibility of having to adjust pinion preload or pinion adjustment. It would be necessary to again remove the seal, and as mentioned, whenever seals are removed, they are to be discarded because of possible damage.

7. Install the differential assembly into the carrier. Refer to the ring gear/pinion tooth contact pattern and differential installation sections of manual to properly set the pinion position and backlash.

Differential Installation

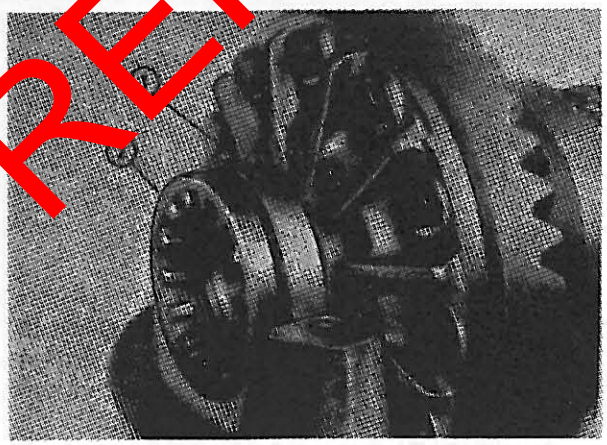


1. Install ring gear and differential assembly into carrier housing.

CAUTION: Care should be used when installing ring gear and differential into carrier housing so damage to ring gear, pinion, bearings, or bearing bores do not occur.

2. Install adjusting nuts in place. Thread in adjusting nuts until all slack is removed between bearing cups and bearings.

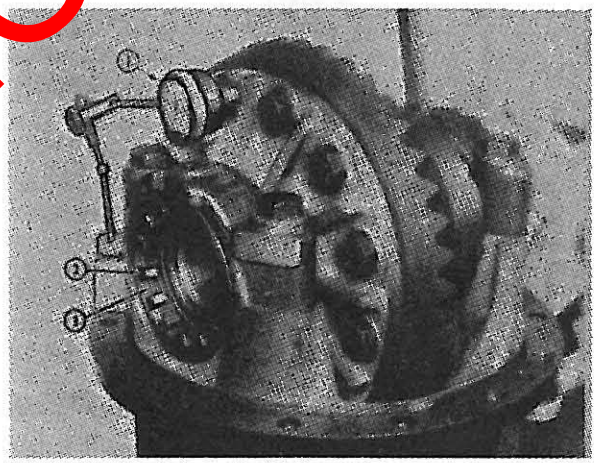
NOTE: Adjusting nuts must be installed with side of nut having the deeper recess facing the bearing. Installed opposite, the adjusting nut would clamp against the bearing cage restricting movement.



1. Bearing Cup 2. Adjusting Nut

3. Be sure bearing cups are seated on bearing cones and assemble differential bearing caps. Install bearing cap bolts (finger tight only) so adjusting nuts can still be turned.

NOTE: Make sure the "match marked" bearing cap and leg of the carrier are on the same side for correct reassembly.



1. Dial Indicator 2. Adjusting Nut 3. Notch

4. Position a dial indicator on housing lip and index indicator dial to back face of the ring gear. Zero the indicator.

Turn adjusting nut on the backside of the ring gear in until the indicator stops moving.

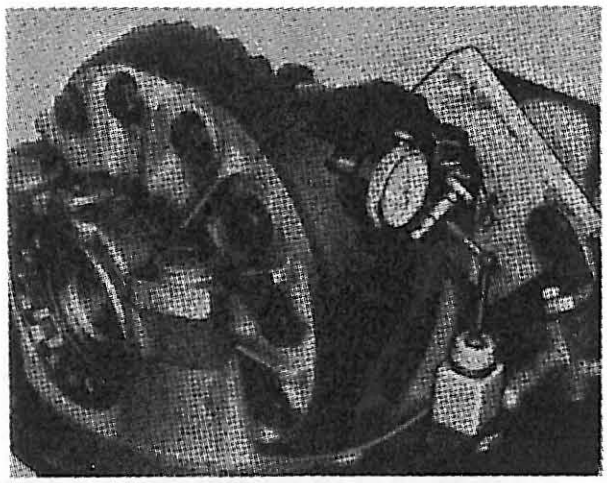
5. Next tighten adjusting nut on tooth side of ring gear until bearing cup is seated.

Checking backlash

6. Position dial indicator on lip of differential housing and indicate to side of one tooth on ring gear.

7. Move ring gear as far as it will go in one direction before it moves the pinion.

8. '0' the dial on the indicator face.



9. Force the ring gear in the opposite direction until it contacts the pinion gear and observe the dial face. This figure is your backlash setting. Backlash should be .005-.009-inch with no more variation around gear than .003 inch.

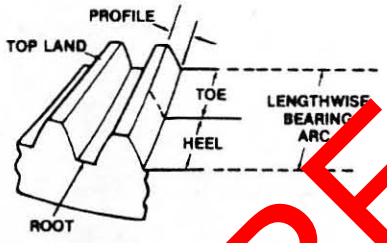
A reading larger than .009 in. is corrected by moving ring gear closer to pinion. A reading smaller than .005 in. is corrected by moving ring gear away from pinion. Move the ring gear by tightening and loosening the adjusting nuts. Both adjusting nuts must be moved the same amount. A ¼ turn 'in' with one nut should be accompanied by a ¼ turn 'out' for the opposite nut.

10. When backlash is adjusted properly, rotating torque at the pinion shaft nut should be 5-10 inch lb. higher than the torque you had when setting pinion shaft bearing preload.

Tighten adjusting nuts until adjusting nut locks can be installed.

11. Torque the bearing cap bolts to 180-200 ft. lbs.

Ring Gear and Pinion Tooth Contact Pattern

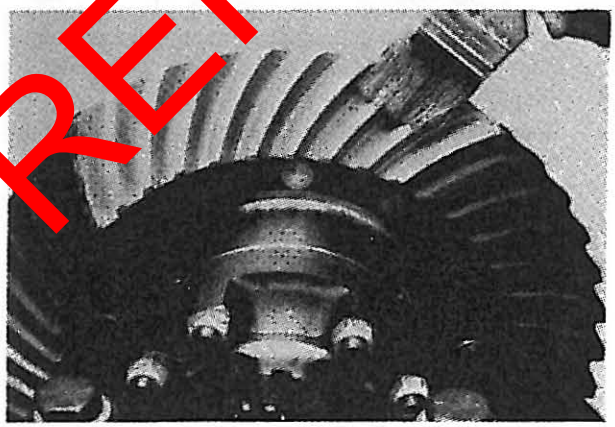


Gear tooth nomenclature

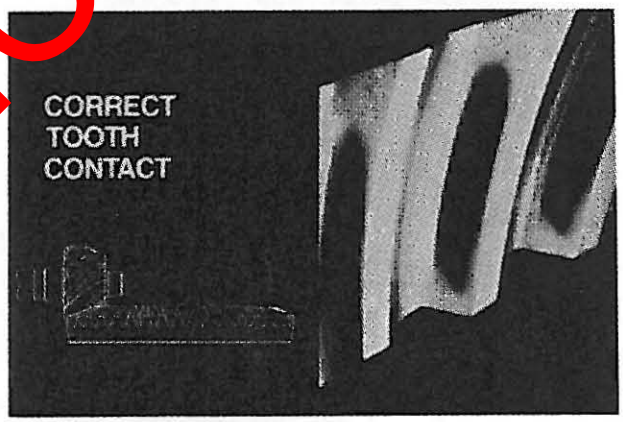
The **toe** of the gear tooth is the portion of the tooth surface at the end towards the center.

The **heel** of the gear tooth is the portion of the tooth surface at the outer end.

The **top land** of a gear tooth is the surface of the top of the tooth.



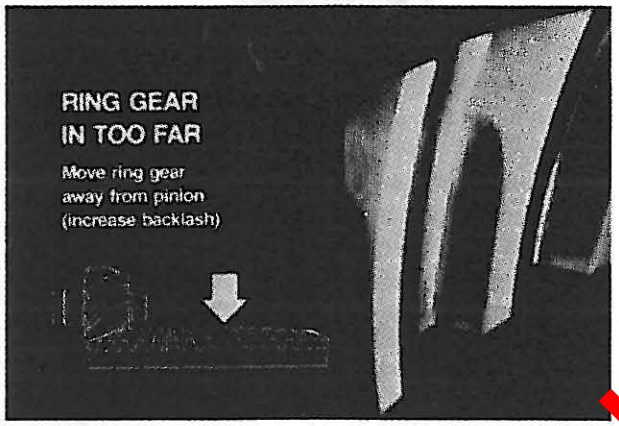
1. Paint ring gear teeth with marking compound and rotate with pinion to obtain contact pattern.



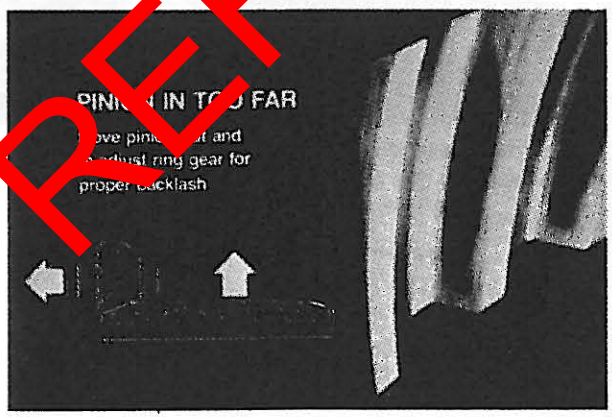
2. The tooth contact patterns should have the same general shape and position as the ring gear teeth shown above.

3. If the pattern is concentrated more toward the heel (as shown above), backlash must be reduced.

Recheck backlash as described in differential installation section of manual. To reduce backlash, loosen the right side adjusting ring until the measured backlash is within specification. The tooth contact pattern should now have the same general shape and location as shown in step 2. If the contact pattern still does not conform, less backlash than normal is required. To avoid reducing differential bearing preload excessively, further loosening of the right hand adjusting ring should be accompanied by equal tightening of the left hand adjusting ring. Place a dial indicator directly on each adjusting ring to measure the exact amount of additional adjustment. Decreasing backlash moves the ring gear toward the pinion.



4. If the pattern is concentrated at the toe (as shown above), more backlash is required. Recheck backlash. To increase backlash, tighten the right side adjusting ring further until the measured backlash is within specification. The tooth contact pattern should now spread across the ring gear tooth as in step 2. If the contact pattern still does not conform, more backlash than normal is required. To avoid increasing differential bearing preload excessively, further tightening of the right hand adjusting ring should be accompanied by equal loosening of the left hand adjusting ring. Place a dial indicator directly on each adjusting ring to measure the exact amount of the additional adjustment. Increasing backlash moves the ring gear away from the pinion.



5. If a pattern is concentrated at the ring gear tooth root as shown above, the pinion is too close to the ring gear. It must be moved out and away to establish its proper mounting distance and contact pattern as shown in step 2. This is accomplished by decreasing the thickness of the inner pinion bearing shim pack as described in the pinion assembly and position sections of manual. Readjust pinion-to-ring gear backlash, as required, once proper pinion mounting distance has been established.

6. If pattern is concentrated at the tooth top land (as shown above), the pinion is too far away from the ring gear and must be moved closer to the ring gear to establish the proper mounting distance and tooth contact pattern. This is accomplished by increasing the thickness of the inner pinion bearing shim pack as described in the pinion assembly and position sections of manual. Readjust pinion-to-ring gear backlash as required once proper mounting distance has been established.

NOTE: When making changes, note that two variables are involved. Example: If you have the backlash set correctly to specifications and you change the pinion position shim, you may have to readjust the backlash to the correct specification before checking the pattern. Refer to patterns as shown.

PATTERN MOVEMENTS SUMMARIZED

(1) Decreasing backlash moves the ring gear closer to the pinion.
Drive pattern (convex side of gear) moves slightly lower and toward the toe.
Coast pattern (concave side of gear) moves lower and toward the toe.

(2) Increasing backlash moves the ring gear away from the pinion.
Drive pattern moves slightly higher and toward the heel.
Coast pattern moves higher and towards the heel.

(3) Thicker pinion position shim with the backlash constant moves the pinion closer to the ring gear.
Drive pattern moves deeper on the tooth (flank contact) and slightly toward the toe.
Coast pattern moves deeper on the tooth and toward the heel.

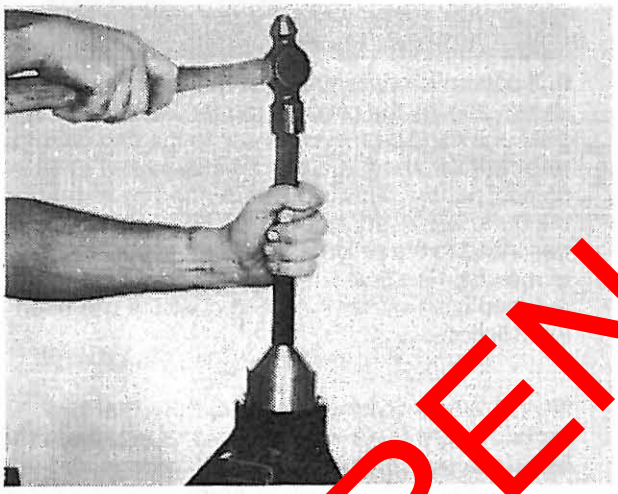
(4) Thinner pinion position shim with the backlash constant moves the pinion further from the ring gear.

Drive pattern moves toward the top of the tooth (face contact) and toward the heel.
Coast pattern moves toward the top of the tooth and slightly toward the toe.

7. After the proper pinion position is determined, temporarily remove the differential assembly from the carrier for the proper setting of pinion bearing preload.

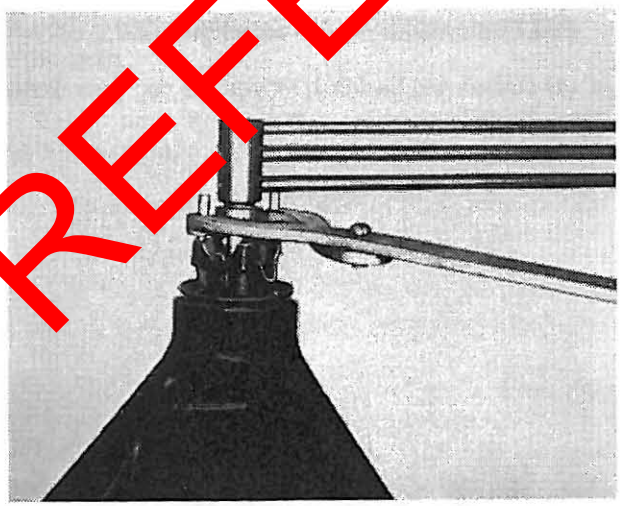
8. Remove pinion nut, washer, end yoke, slinger, and bearing cone. Assemble preload shims (which were removed during disassembly) onto pinion. Assemble bearing cone, slinger.

NOTE: If carrier has optional pinion mounted parking brake refer to pinion parking brake section of manual for installation of brake assembly, pinion input yoke, washer, and nut to the carrier.

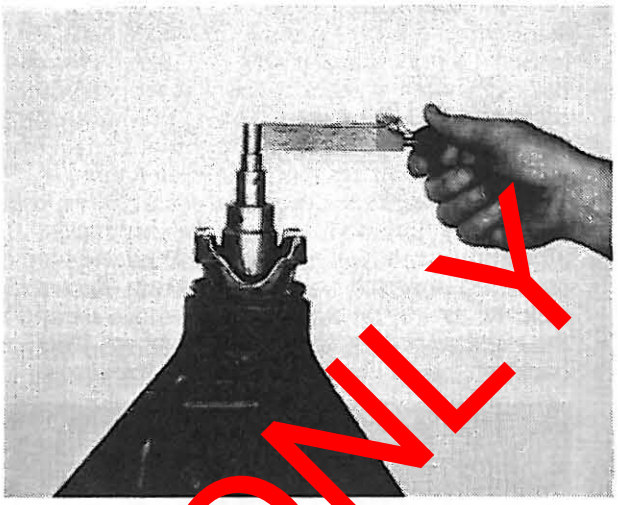


9a. Apply a light coat of hypoid lubricant to the lip of the pinion seal and assemble into housing.

9b. If pinion parking brake is used, install brake cover plate and inner pinion seal at this time.



10. Assemble end yoke, washer, and new pinion nut. Torque nut to 240-300 lbs. ft.

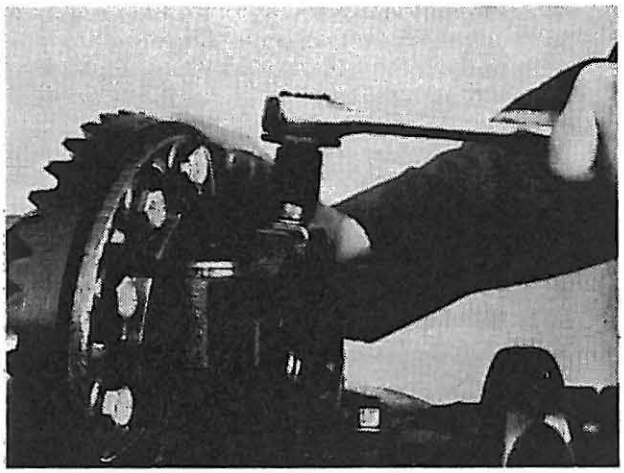


11. Using an inch lb. torque wrench as shown, rotate pinion. Torque of pinion should read between 20-40 lbs. inch (with new bearings).

To increase preload, remove shims; to decrease preload, add shims.

12. If pinion parking brake is used remove pinion nut, washer and yoke. Refer to parking brake section of manual to complete the installation of the brake assembly to the carrier.

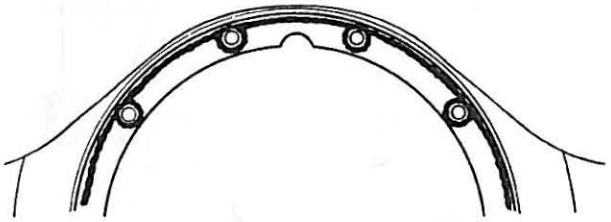
13. Reinstall the differential assembly into the carrier. Refer to the differential installation section of manual to properly set the ring gear/pinion backlash. Torque the differential bearing cap bolts to 180-200 ft. lbs.



14. Install adjusting nut locks, mounting bolts, and washers. Torque mounting bolts to 15-17 ft. lbs.

Installation of Carrier Assembly into Axle Housing

1. Thoroughly clean inside of axle housing. Stone the housing mounting surface if necessary to remove burrs or nicks.



2. Apply Permatex #2 gasket sealer to axle housing at carrier mounting flange. A 1/4 inch bead around the outside of all carrier mounting dowels and each bolt hole is required.

3. Install carrier assembly into axle housing. Install washers. Torque bolts to 100-115 ft. lbs. Bolts must be cleaned and threads coated with Loctite #271, or its equivalent.

4. Assemble axle shafts and wheel end components at this time following procedures outlined in the wheel end section of manual.

5. Clean Drain plugs and install in planetaries and carrier housing. Fill with proper lubricant and to required levels for planetaries, wheel ends and carrier housing. Inspect wheel ends and housing for oil leaks. Take corrective action if leaks are incountered.

NOTE: If steering axle, at this time install tie rod and steering cylinder assemblies following procedures outline in those specific sections of the manual for them.

Pinion Mounted Dry Disc Parking Brake

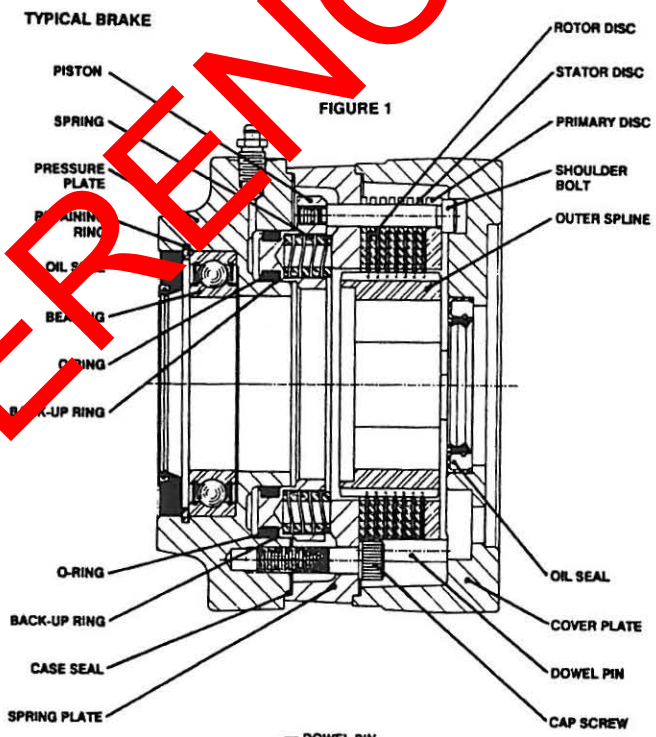
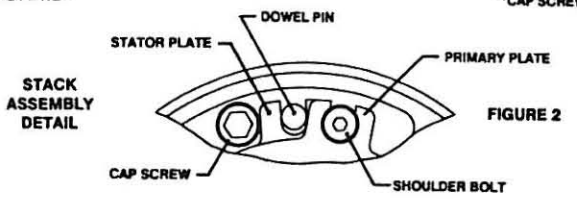


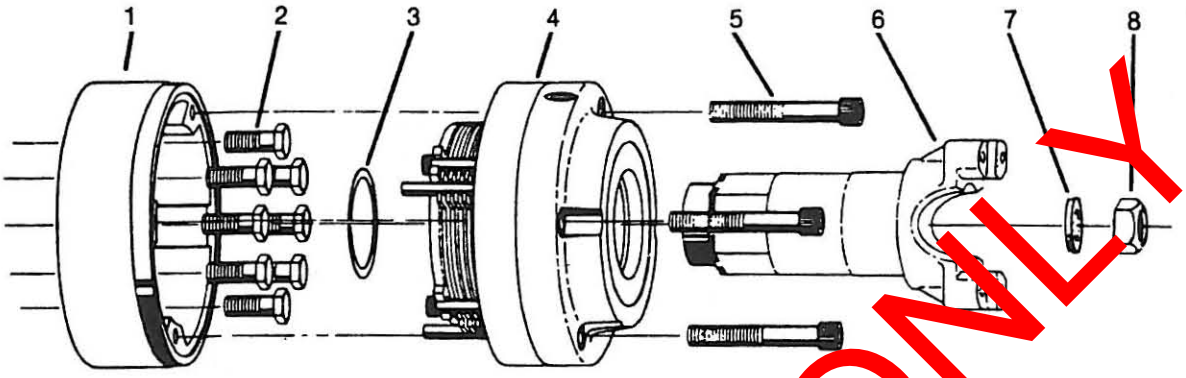
FIGURE 1



STACK ASSEMBLY DETAIL

FIGURE 2

Parking Brake—Removal/Installation



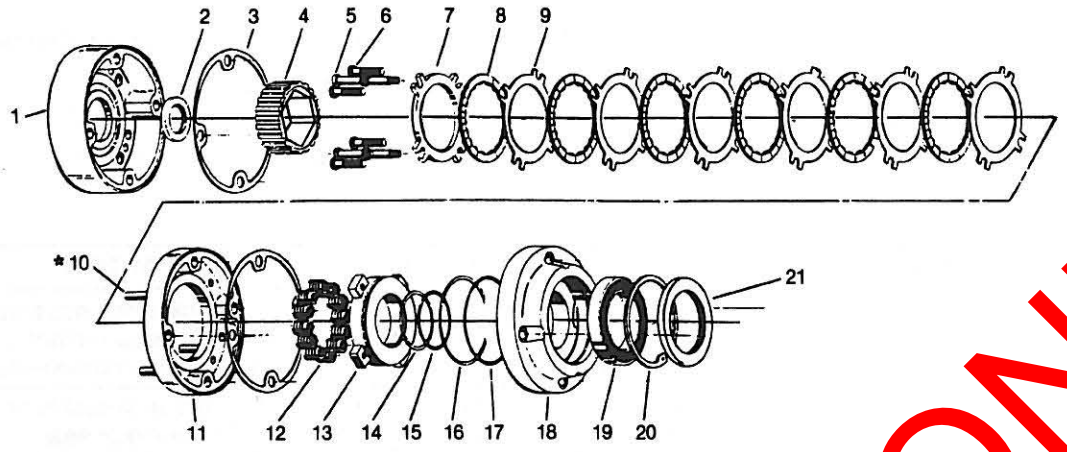
REMOVAL INSTRUCTIONS

1. Disconnect driveline from yoke shaft (6) and position away from brake.
2. Disconnect hydraulic pressure line used for releasing brake.
3. Remove nut (8) and washer (7) which retains yoke shaft (6) to splined pinion shaft on axle. Discard nut (8).
4. Remove four 1/2-13 UNC socket head cap screws (5) which attaches brake module (4) to cover plate (1).
5. Pull brake module (4) and yoke shaft (6) assembly away from cover plate (1).
6. Remove snap ring (3) from yoke shaft (6) and remove yoke shaft (6) from brake module (4).
7. Remove eight 9/16-18 UNF hex bolts (2) which attach cover plate (1) to carrier pinion input flange. Remove cover plate (1) from axle.

INSTALLATION INSTRUCTIONS

1. Insert yoke shaft (6) into brake module (4) thru seal, bearing, and internal hex of spline ring.
2. Attach snap ring (3) in groove on yoke shaft (6) to retain spline ring.
3. Install cover plate (1) on carrier pinion input flange. Apply sealant between flange and cover plate surfaces.
4. Attach cover plate (1) to axle with eight 9/16-18 UNF hex bolts (grade 5) and torque evenly to 90-100 ft. lbs.
5. Install brake module (4) and yoke shaft (6) assembly into cover (1) engaging internal yoke shaft spline with pinion spline. Orient brake module such that mounting bolt holes are in alignment and brake module seats properly on cover flange. Be sure pressure and bleeder ports are facing up.
6. Insert four 1/2-13 UNC socket head cap screws (5) thru brake module (4) and into cover plate (1). Torque screws evenly to 85 ft. lbs.
7. Install washer (7) and new nut (8) on threaded end of spline shaft which engages yoke shaft (6). Torque nut (8) to 240-300 ft. lbs.
8. Reattach driveline on yoke shaft (6).
9. Connect pressure line to brake, bleed system, and test operation of brake on vehicle.

Parking Brake—Disassembly/Assembly



1 Cover Plate
2 Oil Seal
3 Case Seal (2)
4 Outer Spline
5 Shoulder Bolt (4)
6 Cap Scre (4)
7 Primary D sc
8 Rotor Disc 7)
9 Stator Di 7)
10 Dowel Pin (4)
11 Spring Plate
Springs (12)
13 iston
Ba p Ring
O-Ring
ack-up Ring
17 O-Ring
18 Pressure Plate
19 Bearing
20 Retaining Ring
21 Oil Seal

*** NOTE: Earlier brakes do not have additional dowe pins (10) installed. The plate stack (7, 8 & 9) is retai d only by shoulder bolts (5).**

DISASSEMBLY

1. Remove case gasket (3) from cover (1).

2. Press out oil seal (2) from cover (1) if replacement required.

3. Remove outer spline (4) from brake module.

4. Remove four socket head shoulder bolts (5). A suitable holding fixture is useful to hold brake in position.

CAUTION: Do not remove shoulder bolts without pressurization of brake (approx. 300 psi) or damage may result.

5. Remove primary disc (7), seven rotor discs (8) and sev stator discs (9).

NOTE: Primary disc (7) is offset from othe stato discs (9). Reinstall new plates in same sequence.

6. Remove four (4) socket head cap s rews 6) wh h a ach spring plate (11) to pressure plate (3).

7. Remove spring plate (11) from pr su plate (3).

8. Remove case gasket (3) fr m spring ate (11).

9. Remove springs (12) fr m pisto (13).

10. Remove piston (13) by c refully exe ting hydraulic pressure through br ke relea port o pressure plate (18).

11. Remove o-rin s (15 & 17) an ack-up rings (14 & 16) from piston (13).

CAUTION: Care mus e taken so as not to scratch or mar pist n.

12. Rem e o seal (21) from pressure plate (18).

13. ove nap ri g (20) and press bearing (19) from ressu plate 18).

NOTE: A special removal tool with a diameter tolerance of 2.990/2.980 is required to press bearing from bore. Therefore the bearing should be removed only if replacement is required.

ASSEMBLY

LUBRICATE ALL RUBBER COMPONENTS FROM REPAIR KIT WITH CLEAN TYPE FLUID USED IN THE SYSTEM.

1. Clean all parts thoroughly before assembling.

2. If removed, press new bearing (19) in pressure plate bore (18). Insert snap ring (20).

3. Press seal (21) into pressure plate (18) until flush with end of pressure plate.

4. Inst ll bac -up rings (14 & 16) on piston (13) toward spring p ets.

5. Install o- gs (15 & 17) on piston (13). Be sure o-rings are flat a d all twists removed.

CAUTIO Care must be taken so as not to scratch or ar pis n.

6. Lubricate pressure plate piston bore (18) with type fluid sed in system. Carefully press piston (13) into pressure plate (18). Be sure piston is oriented such that threaded holes in piston are in alignment with thru holes in spring plate (11) when installed. Press piston until it bottoms on pressure plate (18).

7. Install twelve springs (12) in piston (13).

8. Install case gasket (3) on spring plate (11).

9. Install spring plate (11) on pressure plate (18). Compress springs (12) until spring plate bottoms on pressure plate.

10. Install four socket head cap screws (6). **SEE NOTE BELOW.** Torque bolts to 55 ft. lbs. A suitable holding fixture is useful to hold brake in position.

11. Install stator discs (9) and rotor discs (8). Begin with a stator disc (9) and alternate with rotor discs (8).

CAUTION: Slots in stator discs (9) should engage with fixed dowel pins (10) in spring plate (11).

12. Install primary disc (7) offset from other stator discs (9).

13. Align tabs on primary disc (7) with thru holes in spring plate (11) and partially screw in four socket head shoulder bolts (5) into piston (13). **SEE NOTE BELOW.**

14. Using outer spline (4) align and center rotor discs (8) in brake module. Be certain outer spline (4) is installed with counterbored end towards bearing in brake.

15. Pressurize brake release port (approx. 300 psi) to completely release discs. Torque shoulder bolts to 18 ft. lbs. and release pressure. A suitable holding fixture is useful to hold brake in position.

16. Press oil seal (2) into cover (1). Note direction of seal during installation.

17. Install case gasket (3) in cover (1).

NOTE: Bolts should have Loctite applied. Place one or two drops of Loctite to the threads.

Parking Brake — Bleeding / Trouble Shooting

BLEEDING

1. Install brake in system and connect pressure lines.

2. Bleed pressure release section of brake by pressurizing side inlet port and allowing air to escape from top port. Pressure should not exceed 100 psi during bleeding.

3. Apply sufficent pressure to release brake and check for proper operation in system.

SERVICE DIAGNOSIS

PROBLEM	CAUSE	EXPLANATION	ACTION
Brake slips	A. Excessive pressure in hydraulic system	If there is back pressure in the brakes actuation line, the holding torque of the brakes is reduced.	Check filters, hose size, restriction in other hydraulic components.
	B. Oil in brake if designed for dry use	Dry linings generate 50% more torque than linings saturated with oil. If the brake has oil in it, check the type of oil hydraulic or gearbox. 1. Gearbox oil 2. Hydraulic oil	Replace oil seal in brake Check motor seal Check piston seals Note: Internal components will need to be inspected, cleaned and replaced as required.
	C. Disc plates worn	The thickness of the disc stack set the torque level. A thin stack reduces torque.	Check disc thickness
	D. Springs broken or have taken a permanent set.	Broken or set springs can cause reduced torque — a rare occurence.	Check release pressure
Brake drags or runs hot	A. Low actuation pressure	The brake should be pressurized to a minimum of 20 psi over the specified release pressure under normal operating conditions. Lower pressures will cause the brake to drag thus generating heat.	Place pressure gauge in bleed port & check pressure with system on
	B. Bearing failure	If the bearing should fail, a large amount of drag can be generated.	Replace bearing
Brake will not release	A. Stuck valve or clogged	Brakes are designerd to come on when system pressure drops below stated release pressure. If pressure cannot get to brake, the brake will not release.	Place pressure gauge in bleed port — check for adequate pressure — Replace defective line or component
	B. Bad o-rings	If release piston will not hold pressure, brake will not release.	Replace o-rings
	C. Discs frozen	Brakes are designed for only limited dynamic braking. A severe emergency stop or prolonged reduced release pressure operation may result in this type of damage.	Replace disk stack

Inspection and Failure Analysis

This section is intended to serve as a guide for describing and explaining commonly encountered axle problems or failures, and for recommending appropriate repair procedures.

FAILURE MODE	PROBABLE CAUSE	RECOMMENDED REPAIR
Fracture of ring gear teeth at the tooth heel.	1. Excessive loading of the gear beyond design intent. 2. Incorrect gear adjustment (excessive backlash).	Replace ring gear and pinion as matched set. Carefully follow the recommended procedures for adjusting ring gear and pinion backlash and tooth pattern.
Fracture of ring gear teeth at the tooth toe.	1. Shock impact loading. 2. Incorrect gear adjustment (insufficient backlash).	Replace ring gear and pinion as matched set. Carefully follow the recommended procedures for adjusting ring gear and pinion backlash and tooth pattern.
Scored and/or scuffed ring and pinion gear teeth.	1. Insufficient lubrication. 2. Contaminated lubricant. 3. Wrong lubricant or lubricant with depleted additives. 4. Worn pinion bearings which result in pinion end play and incorrect ring and pinion tooth contact.	Replace ring gear and pinion as a matched set. Replace pinion bearings taking care to set ring and pinion position and bearing preloads properly. Use correct lubricant, fill to proper level and change at recommended intervals.
Overheated ring and pinion gear teeth. Look for discoloration of the gear teeth.	1. Prolonged operation at excessive temperatures. 2. Incorrect lubricant 3. Low oil level. 4. Contaminated lubricant. All of the above can result in inadequate lubricant film between tooth surfaces which causes surfaces to overheat due to excessive friction.	Replace ring and pinion as a matched set. Use correct lubricant, fill to specified level and change at recommended intervals.
Pitted drive pinion teeth.	1. Extremely severe service. 2. Insufficient lubrication.	Replace ring gear and pinion as a matched set. Use correct lubricant, fill to proper level and change at recommended intervals.
Bent axle housing.	1. Vehicle overloading. 2. Vehicle accident. 3. Shock loading.	Replace axle housing.
Worn or pitted bearing.	1. Insufficient lubrication. 2. Contaminated lubricant. 3. Very severe service. 4. Normal wear.	Replace bearing cups and cones in matched sets. Check roller ends for excessive wear by comparing used rollers with a new bearing. Use correct lubricant, fill to proper level and change at recommended levels.
Leaking oil seal.	1. Prolonged operation at excessive oil temperatures. 2. Scored or dented yoke wear surface. 3. Improperly installed oil seal. 4. Nicked or cut seal lip. 5. Contaminated lubricant.	Replace the oil seal and mating surface if damaged. Use correct lubricant, fill to proper level and change at the recommended intervals.

FAILURE MODE	PROBABLE CAUSE	RECOMMENDED REPAIR
Excessive end yoke spline looseness.	1. Severe service. 2. Loose pinion nut. 3. Pinion endplay.	Replace the end yoke. Check the pinion spline for excessive wear. Replace the ring gear and pinion as a matched set if necessary.
Fatigue fracture of the pinion gear teeth. Look for clear-cut, wavy fracture lines (beachmarks).	Severe service	Replace the ring gear and pinion as a matched set.
Fracture of differential side gears and pinion mates.	Shock loading of differential components.	Replace differential side gears, pinion mates and cross shaft as a set.
Scoring and/or seizure of cross shaft arms and pinion mate gears.	1. Excessive wheel spinning. 2. Inadequate lubrication. 3. Extremely severe service. 4. Unequal tire pressures.	Replace differential side gears, pinion mates, cross shaft and thrust washers as a set. Use correct lubricant, fill to proper level and change at recommended intervals.
Worn side gear splines. (Excessive backlash).	Severe service.	Replace differential side gears and pinion mates as a set. Replace worn axle shafts.
Scored or worn thrust washer surfaces.	1. Insufficient lubrication. 2. Improper lubrication. 3. Contaminated lubricant.	Replace any scored washer and any washer that is .005 inch thinner than a new one. Use correct lubricant, fill to proper level and change at recommended intervals.
Worn pinion roller bearing retainer bore.	1. Severe service. 2. Excessive pinion end play. 3. Inadequate lubrication. Contaminated lubricant.	Replace carrier housing. Check pinion for excessive endplay. Use correct lubricant, fill to proper level and change at recommended intervals.
Twisted or broken axle shaft.	Severe vehicle operation.	Replace the shaft.
Fractured axle shaft at the flange.	1. Loose wheel bearing. 2. Bent axle housing. 3. Loose shaft to wheel hub bolts.	Replace the shaft. Check housing distortion. Make certain that wheel bearings are not worn or misadjusted.
Noise on Drive	1. Excessive pinion to ring gear backlash. 2. Worn pinion and ring gear. 3. Worn pinion bearings. 4. Loose pinion bearings. 5. Excessive pinion end play. 6. Worn differential bearings. 7. Loose differential bearings. 8. Excessive ring gear run-out. 9. Low lubricant level. 10. Wrong or poor grade lubricant. 11. Bent axle housing.	1. Adjust 2. Replace 3. Replace 4. Adjust 5. Adjust 6. Replace 7. Adjust 8. Replace 9. Replenish 10. Replace 11. Replace
Noise on Coast	1. Axle noises heard on drive will usually be heard on coast, although not as load. 2. Pinion and ring gear too tight (audible when decelerating and disappears when driving.	1. Adjust or replace (See above) 2. Adjsut

FAILURE MODE	PROBABLE CAUSE	RECOMMENDED REPAIR
Intermittent Noise	1. Warped ring gear. 2. Loose differential case bolts.	1. Replace 2. Tighten
Contant Noise	1. Flat spot on pinion or ring gear teeth. 2. Flat spot on bearings. 3. Worn pinion splines. 4. Bent axle shaft.	1. Replace 2. Replace 3. Replace 4. Replace
Noisy on Turns	1. Worn differential side gears and pinions. 2. Worn differential spider. 3. Worn differential thrust washers. 4. Worn axle shaft splines.	1. Replace 2. Replace 3. Replace 4. Replace

SECTION 4
Specifications

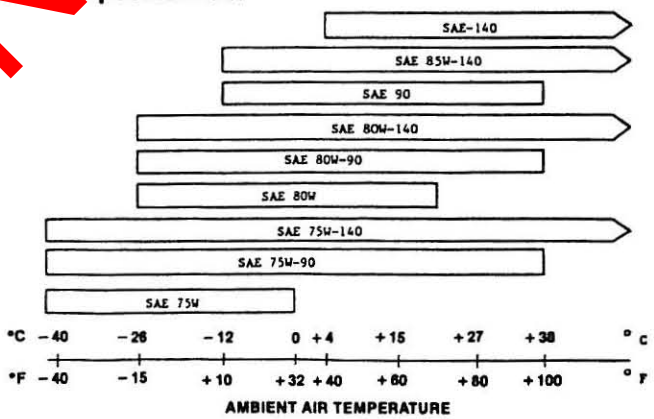
Spicer Axle Lubricant Recommendations

IMPORTANT: Motor vehicles are operated under various requirements, conditions, and environments. This manual specifies the minimum requirements that the lubricants should meet. However, it is recommended that the lubricants specified by the vehicle manufacturer be used. They may provide additional lubricating characteristics which may be required for your vehicle's operation. Contact your local service dealer or refer to your owner's manual for obtaining proper lubricant specification.

To ensure proper lubrication and operating temperature in Spicer Axles, it is important that proper lubricants be used and correct lubricant level be maintained.

RECOMMENDED LUBRICANTS

Multi-purpose gear lubricants meeting MIL Spec L-2105C and suitable for API service classification GL-5 are suggested as a minimum requirement for Spicer Industrial axles. Refer to the chart below for SAE viscosity grade versus ambient air temperature range recommendations.



LIMITED SLIP DIFFERENTIAL LUBRICATION

Limited Slip differentials impose additional requirements on lubricants which may not be covered by the above specifications. Many vehicle manufacturers find it necessary to specify a special lubricant or limited slip additive for use with Limited Slip Differentials. If required, these special lubricants are normally available through the original equipment manufacturer.

KING PIN BEARING LUBRICATION

King pin bearings are lubricated by packing with grease. For grease packing it is recommended that a No. 2 lithium EP grease suitable for automotive wheel bearings be used. Contact your local vehicle service dealer or refer to your owner's manual for obtaining the proper lubricant specification, and maintenance schedule.

WHEEL END WET DISC BRAKE LUBRICATION

Wheel end wet disc brakes impose additional requirements on lubricants which may not be covered by the above specifications. Many vehicle manufacturers find it necessary to specify a special lubricant or additive for use with them. Contact your local vehicle service dealer or refer to your owner's manual for obtaining the proper lubricant specification.

FASTENER STRENGTH IDENTIFICATION

IMPORTANT: Whenever fasteners are replaced, it is very important that the fastener be replaced with one of equal or higher grade and quality. Fasteners should be torqued as recommended or specified for the application.

WARNING: If fasteners of a lower grade or class are torqued to the requirements of a higher grade or class fastener, it may result in component failure. (e.g. Grade 5 fastener torqued to the requirements of a grade 8 fastener).

GRADE 5 | GRADE 7 | GRADE 8 | SPECIAL GRADE (High Strength Applications)

Customary (Inch) Bolts - Identification marks correspond to bolt strength - Increasing numbers represent increasing strength.

Inch grade fasteners can be identified by the radial lines embossed upon the head of the fastener and will correspond to the fastener strength by two-lines less than actual grade (i.e. grade 5 fastener will display 6 radial lines on the head).

NOTE: Male and female threads should be dry and unlubricated (unless purchased new as such), clean and free from scale and dirt.

WRENCH TIGHTENING TORQUE SPECIFICATIONS

POSITION	WRENCH TORQUE (FT. LBS.)
Drive Pinion Nut	240-300
Differential Bearing Cap Capscrews	180-200
Ring Gear Capscrews	120-140
Limited Slip Differential Capscrews	95-110
Carrier Assembly Mounting Capscrews	100-115
Pinion Parking Brake Cover Plate Capscrews	90-100
Pinion Parking Brake Module Capscrews	85
King Pin Cap Capscrews	80-90
Tie Rod and Steer Cylinder Socket Assembly Stud Nuts	140 Min. **(Note A)**
Tie Rod and Steer Cylinder Socket Assembly Clamp Nuts	60-70
Spindle Mounting Nuts	80-100
Brake Rotor Mounting Capscrews	174-191
Wet Disc Brake Wheel Retainer Capscrews	45
Drive Flange Mounting Capscrews	90-100

A) If cotter pin cannot be installed after minimum torque is attained, the nut must be advanced until cotter pin can be installed.

BEARING PRELOAD SPECIFICATIONS

Pinion Torque to Rotate (New Bearings Only)	20-40 in. lbs.
Additional Torque to Rotate Required or Differential Bearing Preload (New Bearings Only)	5-10in. lbs. higher than required for Pinion Bearing Preload Setting.
King Pin Bearing Torque to Rotate Knuckle	8-15 ft. lbs.

Measurement is made less hub components, axle shaft, tie rod, and steering cylinder.

BACKLASH SPECIFICATIONS

Drive Pinion Ring Gear	.005-.009 in.

APPLICATION POLICY

Capability ratings, features and specifications vary depending upon the model type of service. Applications approvals must be obtained from Spicer Off-Highway Products Division. We reserve the right to change or modify our product specifications, configurations, or designs at any time without notice.

DANA

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