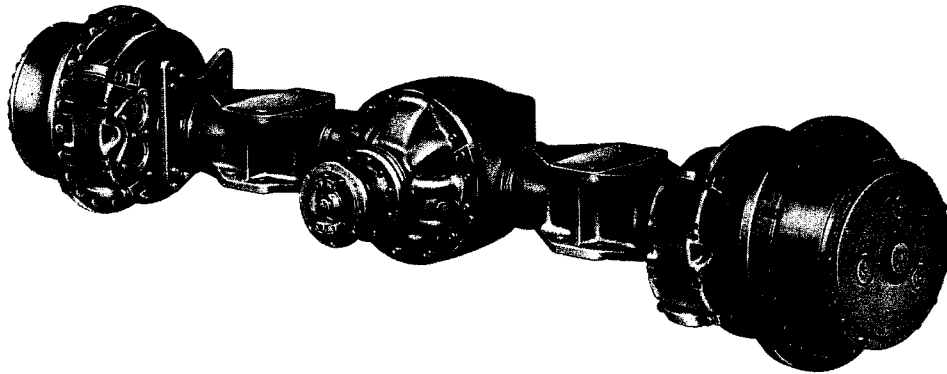


Field Maintenance Manual No. 9

# Planetary Axle Wheel Ends



Steering and Rigid Models



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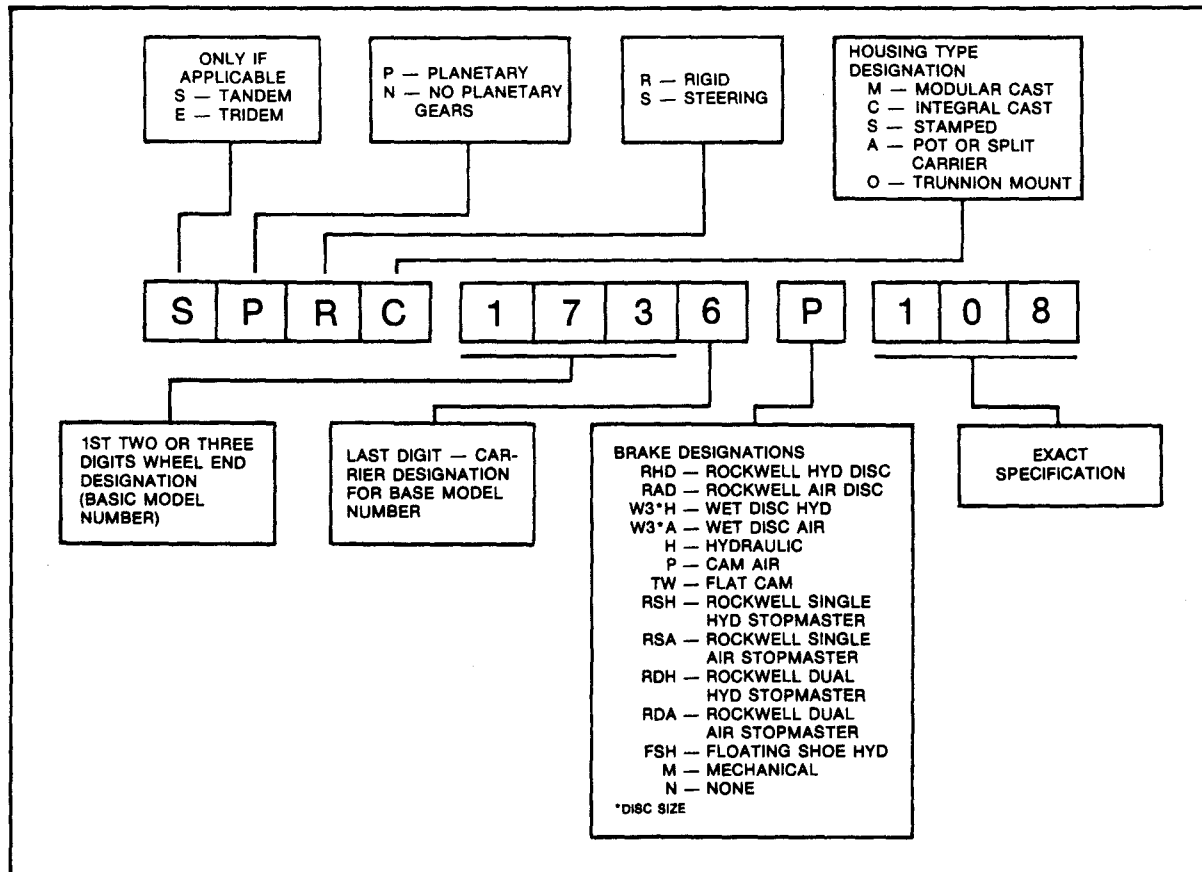
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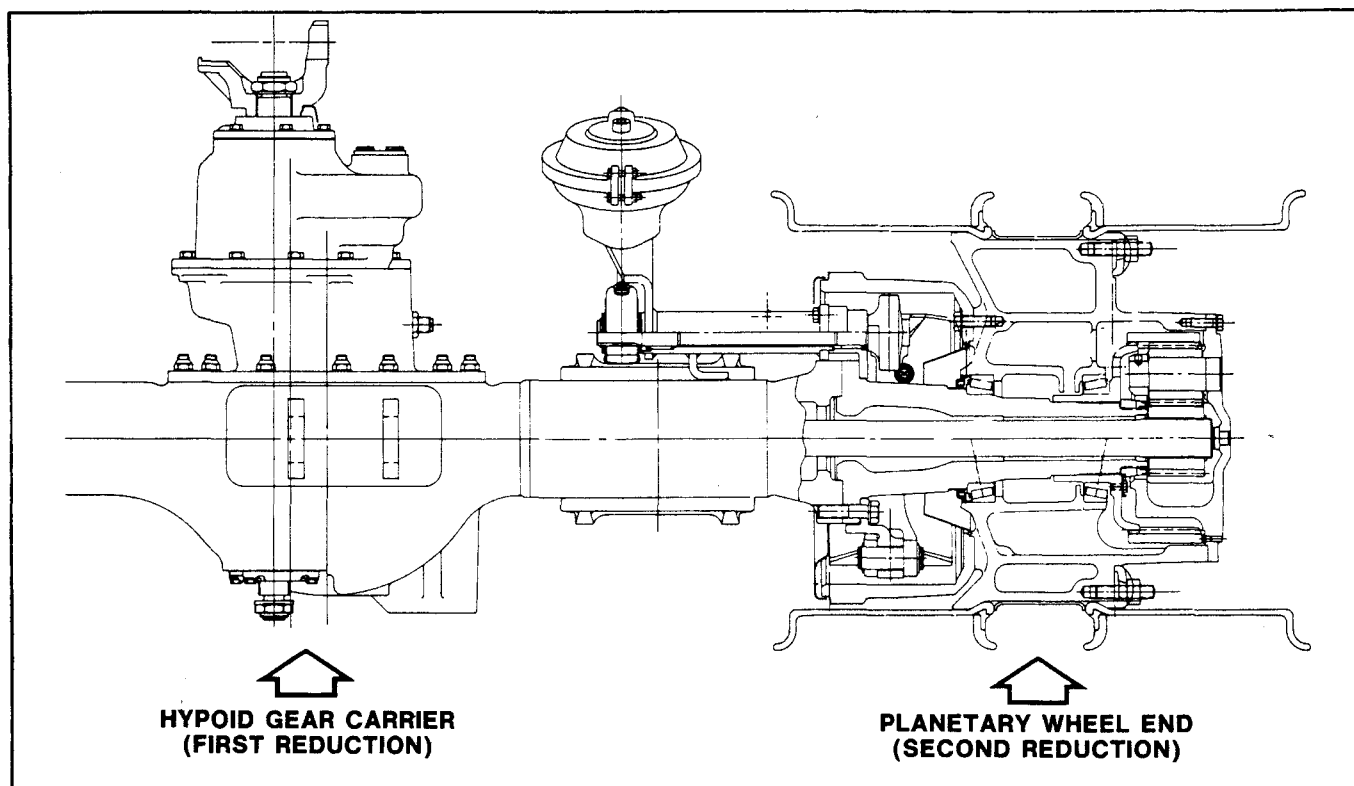
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### IMPORTANT

Follow all CAUTION and IMPORTANT Notes used throughout this manual to prevent personal injury and ensure mechanical integrity of components being serviced. The wearing of appropriate and safe eye protection is suggested while servicing and repairing components to prevent personal injury from chips or splinters.

## ROCKWELL PLANETARY AXLE DESIGNATIONS





## DOUBLE-REDUCTION PLANETARY AXLES

Rockwell double-reduction planetary axles incorporate a single reduction carrier with hypoid or spiral bevel gearing mounted in the axle center. The second reduction is of planetary design spur gearing built into the wheel hubs.

There are three types of housings, cast, stamped and modular.

Rockwell Planetary Axles permit the bevel gearing of the carrier, and the axle shafts to carry nominal torsional load while providing the highest practical numerical gear reduction at the wheels.

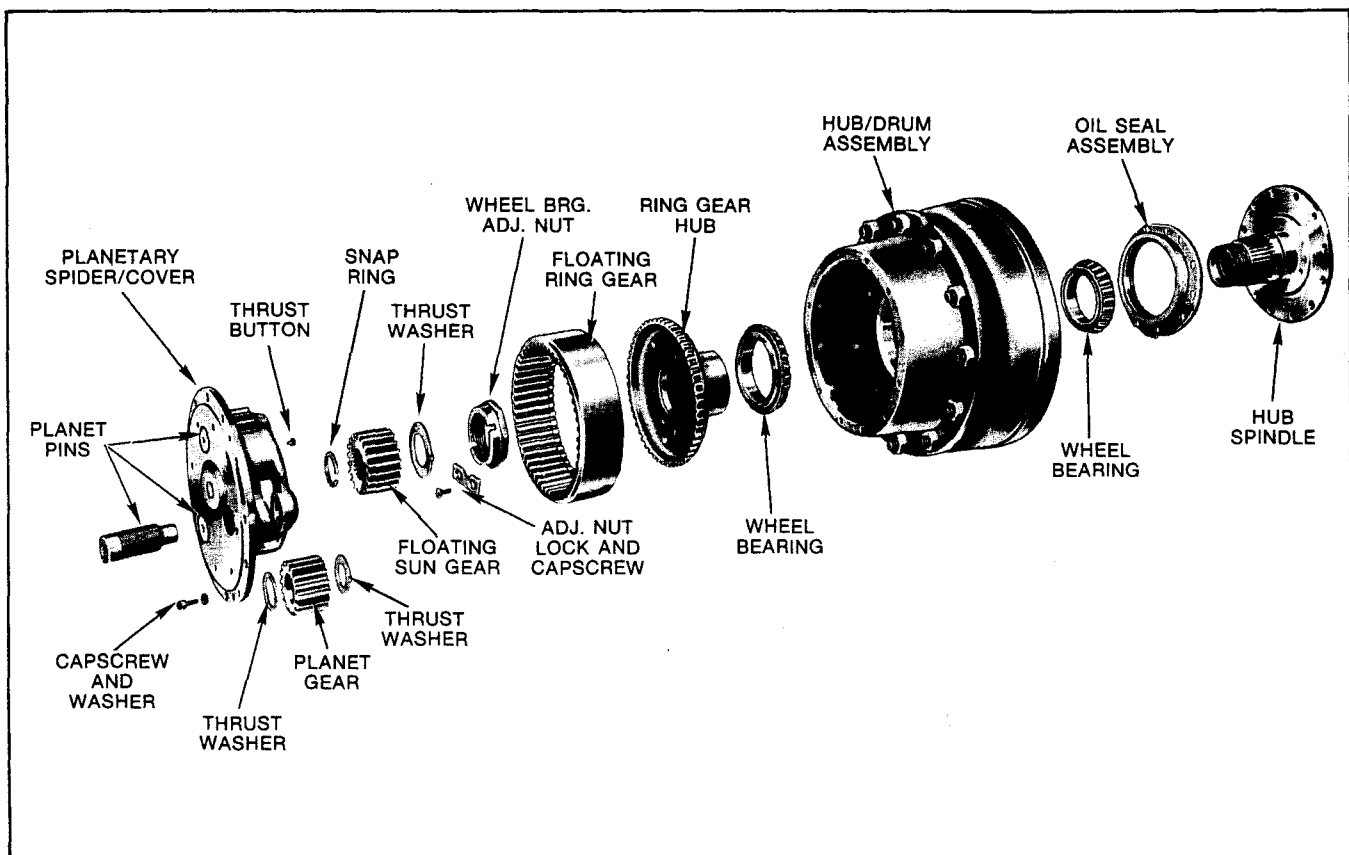
The hypoid or spiral pinion and differential assembly of the first reduction are supported by tapered roller bearings. The pinion bearing preload is adjusted and maintained by a hardened precision spacer between the inner and outer bearings. The differential tapered bearing preload is adjusted and maintained by the positioning of the threaded adjusting rings in the carrier leg and cap bores.

The spur teeth of the sun gear (which floats) mesh with teeth of the planet spur gears. The planet spur gears rotate on planet pins which are mounted in a spider. The planet spur gear teeth in turn mesh with teeth of the floating ring gear.

Power is transmitted by the first reduction bevel gear set in the carrier to the axle shafts and the sun gear of the planetary second reduction, through the revolving planet gears, and into the planetary spider which drives the wheel hub.

This manual covers the disassembly, inspection, reassembly and adjustment procedures of the planetary wheel end, steering joint and knuckle assembly.

**NOTE:** The servicing of the standard first reduction gear carrier assembly mounted in the axle center is thoroughly covered in our Field Maintenance Manual No. 5 (and 5C if drive unit is the through-drive tandem axle type).



## DISASSEMBLY OF PLANETARY WHEEL ENDS

### PREPARE FOR DISASSEMBLY

**NOTE:** Unless service is planned for brakes and/or steering knuckles, it will not be necessary to remove the tire and rim from the planetary wheel end to service the planetary gearing.

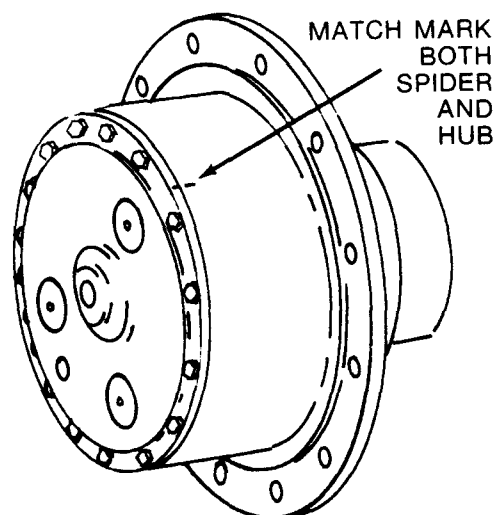
Before starting the disassembly of the planetary wheel end the following procedure and precautions should be taken:

- Jack up wheel end of vehicle just enough so the tire clears the ground.
- Block up the axle in this position under the spring seat using a jack stand or other suitable fixture. After blocking up the vehicle remove the jacks.

**CAUTION:** Do not attempt to perform any type of service on the wheel end with the vehicle supported by jacks only.

- Rotate the hub assembly so that the oil drain plug in the spider/cover is at the bottom. Remove the drain plug and drain the lubricant.

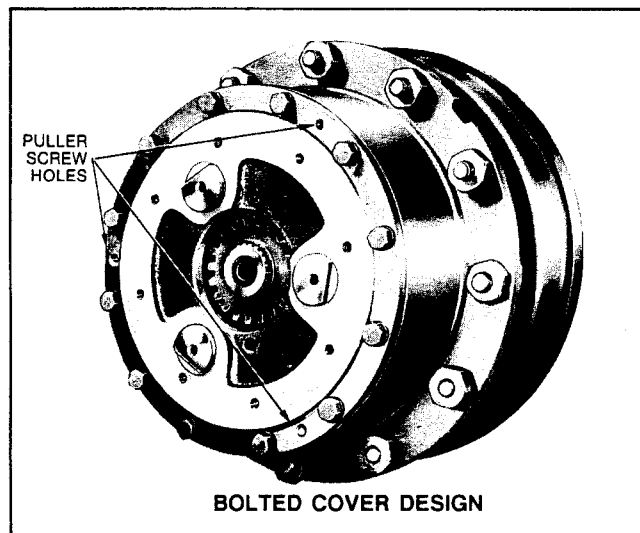
### REMOVE PLANETARY SPIDER ASSEMBLY



**NOTE:** Before disassembly match mark both the spider and wheel hub for identification of correct alignment when reassembling the unit.

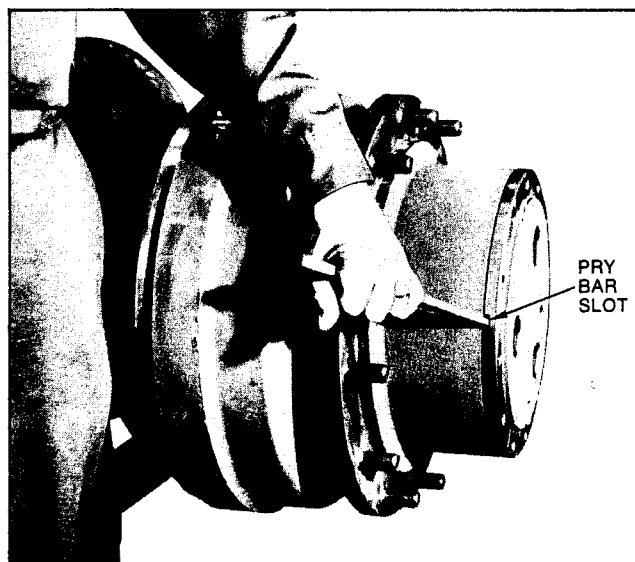
## DISASSEMBLY

- A. If wheel ends have a separate planetary spider and cover remove the spider cover capscrews and cover.
- B. Remove the planetary spider to hub stud nuts or capscrews and washers.



- C. Separate and remove planetary spider assembly from wheel hub assembly; use puller screws in threaded holes when provided in the spider flange.

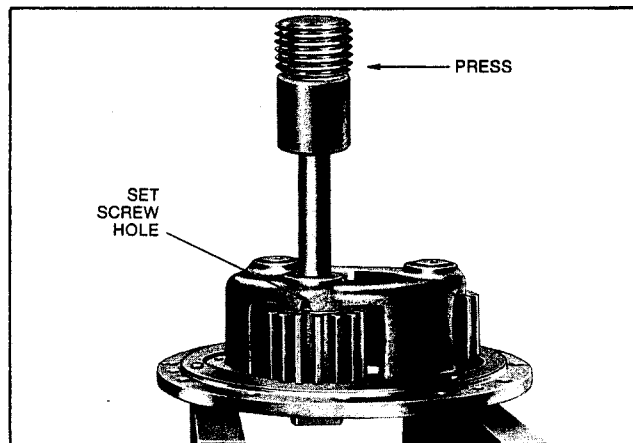
**CAUTION:** Rockwell planetary axles employ a floating ring gear. Care should be taken to prevent this gear from accidentally falling out when planetary spider is removed.



**NOTE:** The adhesive effect of the liquid gasket material may necessitate the use of the pry bar slots provided in some models to assist in loosening the spider. If there are no pry bar slots break the spider loose from the hub by striking it with a rawhide, plastic or rubber mallet.

## DISASSEMBLE PLANETARY SPIDER ASSEMBLY

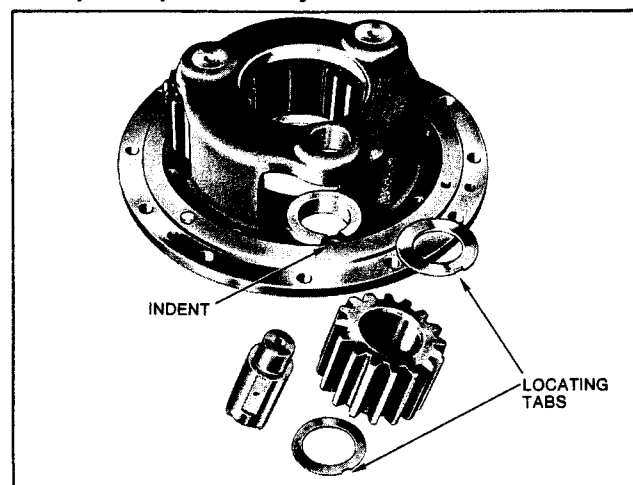
Planetary spur gears rotate on planet pins. Each gear rotates between hardened thrust washers.



- A. Remove set screws (if used) holding the planet pins in the spider. Set screws are located at the small diameter ends of the planet pins.
- B. Support the spider assembly in a press, flange side down. Block up as required. To avoid damaging the pins place a block of wood under the press to cushion the pins as they are pressed out. Press the planet pins out through the spider and planet gears. (It is possible/acceptable to encounter a non-press fit condition on the bolted cover design).

**NOTE:** If a press is not available use a brass drift and mallet to tap out the pins.

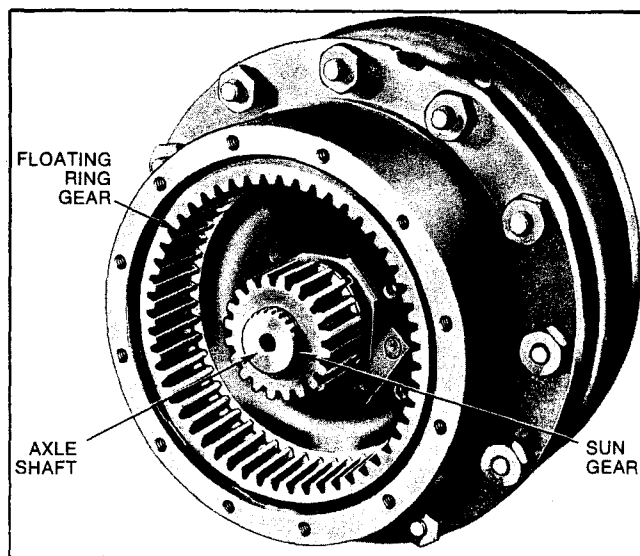
**CAUTION:** Do not strike planet pins directly with a steel hammer. Personal injury from chips or splinters may result.



- C. Remove the planet gears and their respective thrust washer.

**NOTE:** Thrust washers are designed for opposite sides of planet gears and can only be installed in their correct locations.

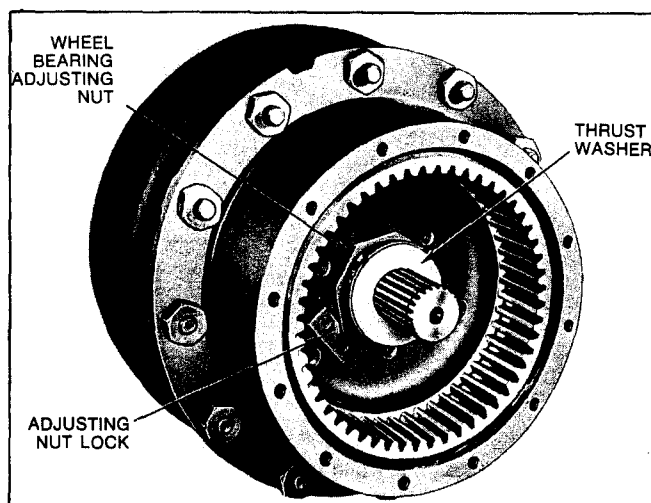
## REMOVE THE FLOATING RING GEAR ASSEMBLY



### Steering and Smaller Rigid Models

- A. Remove floating ring gear (on models where gear is not secured to ring gear hub).
- B. Remove the snap ring from end of axle shaft.
- C. Remove the axle shaft sun gear.

**NOTE:** On some of the larger rigid models the axle shaft and sun gear are integral. On these models remove the complete axle shaft, exercising care not to damage the oil seal. The sun gear thrust washer may then be removed from the axle shaft.

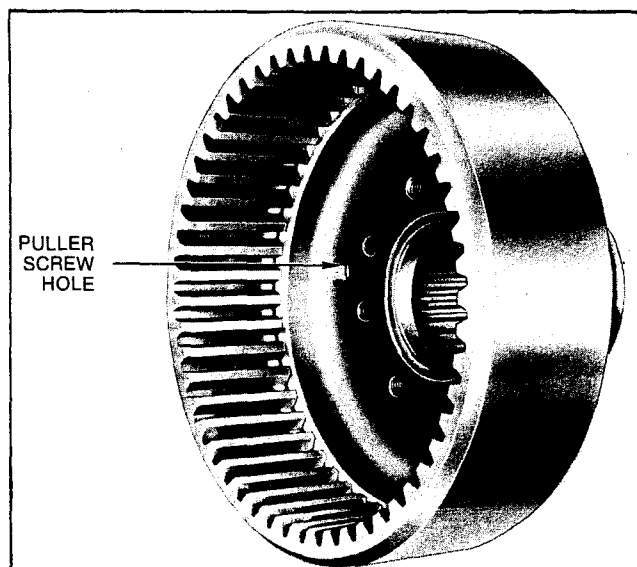


- D. Remove the sun gear thrust washer.
- E. Remove the axle shaft on rigid models that do not employ the integral sun gear.
- F. Remove the wheel bearing adjusting nut lock. (Wheel bearing adjusting nuts can be of either single or double nut construction and may be locked

to the hub spindle in different methods, depending upon the model.)

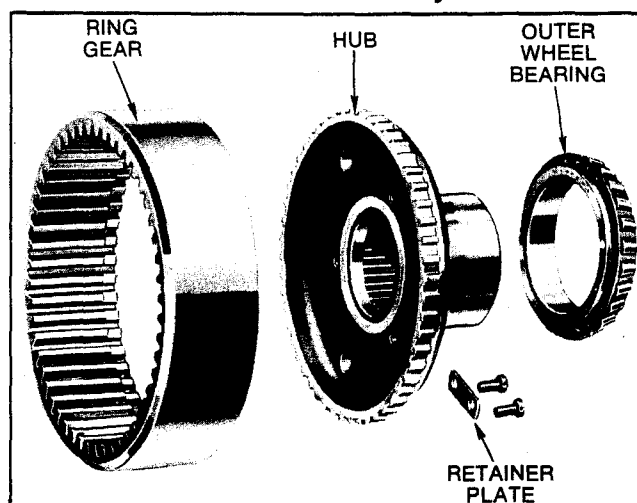
- G. Remove the wheel bearing adjusting nut. Where double nuts are employed remove the jam nut, locking washer and the adjusting nut.

**CAUTION:** Before removal of ring gear hub assembly, be sure to provide a sling support for the wheel hub.



- H. Remove the ring gear hub. Puller screw holes are provided on the larger models in the ring gear hub flange to aid in the removal of the hub.

**NOTE:** Some models may secure the ring gear to the ring gear hub with capscrews and plates on the back side of the assembly.



The outer wheel bearing is mounted on the ring gear hub.

- J. Remove outer wheel bearing from ring gear hub.

**NOTE:** In some models the ring gear hub assembly is made up of the hub and a ring sleeve insert. These parts are not serviced separately.

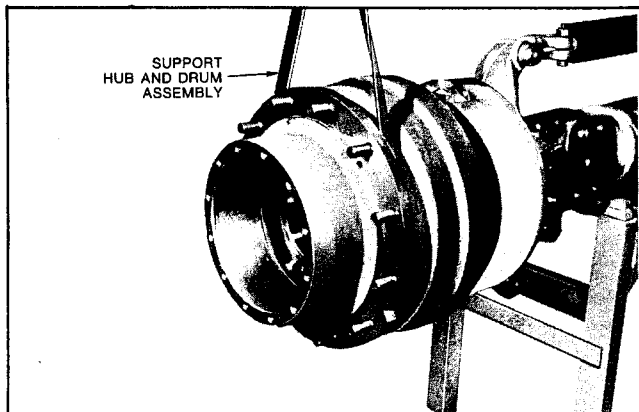
## Larger Rigid Models

Larger rigid models are provided with threaded puller screw holes in the ring gear hub flange. There are also threaded holes of a smaller size in the wheel hub behind the ring gear hub.

- Turn the complete hub assembly so that the puller screw holes in the ring gear hub flange entirely miss the smaller holes of the wheel hub in back.
- Install puller screws and turn in until they butt against the flat surface of the wheel hub.
- Tighten puller screws alternately to pull ring gear assembly out.

## REMOVE THE WHEEL HUB AND DRUM ASSEMBLY

- Lift the hub and drum slightly to relieve the hub weight and drum to brake shoe drag and remove the assembly from the hub spindle.



**CAUTION:** Removal of hub and drum assemblies from larger model axles will require use of a chain fall.

- If wheel bearings are to be replaced, remove wheel bearing cups with a suitable puller.

### BRAKES

**NOTE:** In most cases, complete disassembly of the brake is not necessary for the removal of the hub spindle. Adequate working clearance is provided by removing the brake shoe return springs. If brakes are to be disassembled for service or inspection, refer to one of the following Rockwell Field Maintenance Manuals:

Hydraulic Brakes	— FMM#4
Cam Brakes	— FMM#4
Stopmaster Brakes (17"-36")	— FMM#4P
Stopmaster Brakes (15")	— FMM#4R

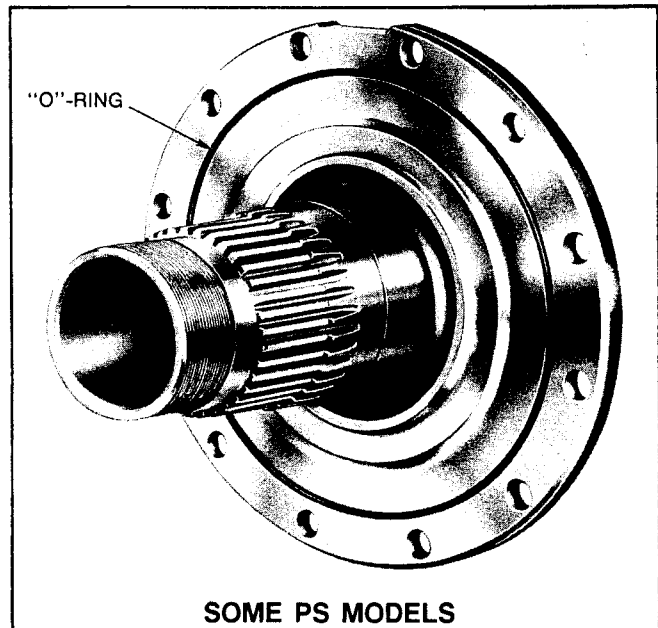
Dura-Disc Wet Disc Brakes	— FMM#4L
Dura-Master Air Disc Brakes	— FMM#4M

## DISASSEMBLE HUB SPINDLE ASSEMBLY

- Remove brake shoe return spring and push brake shoes aside to permit access to the hub spindle fasteners.
- Remove the inner wheel bearing.
- Remove the spindle stud nuts, bolts, and washers.

**NOTE:** You must remove the brake spider to allow removal of the spindle on certain models.

All modular housing models have welded on spindles. Also, some rigid models utilizing a stamped axle housing have welded on spindles.

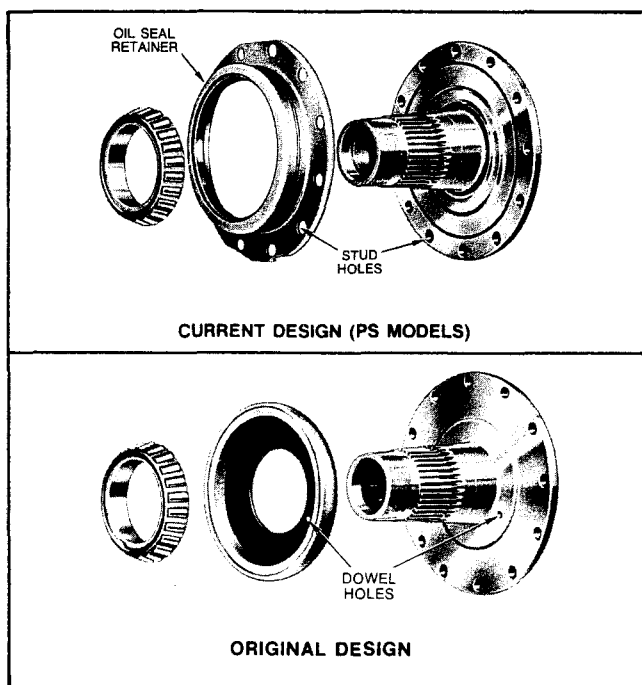


- Remove the spindle. Care must be taken on some steering models not to damage the inner oil seal, in bore of spindle, while sliding past axle shaft splines.

**NOTE:** The wheel hub oil seal/retainer may adhere to the spindle flange due to liquid gasket in the joint on some PS models.

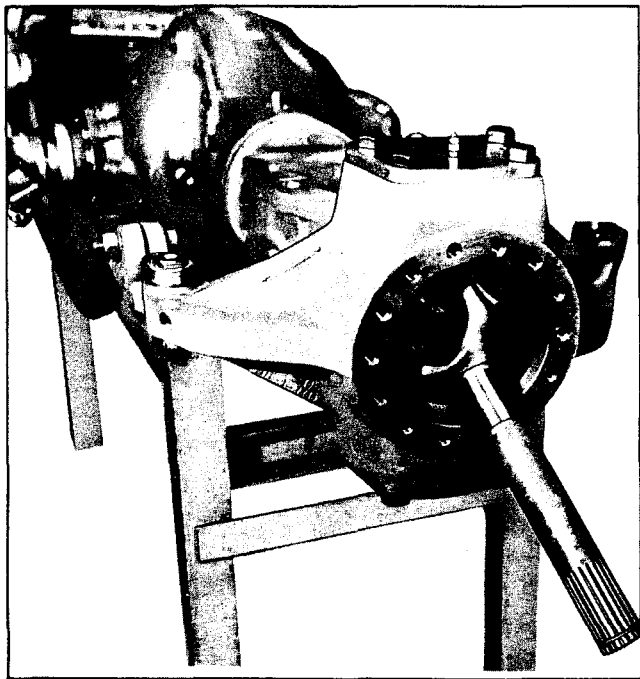
- Remove the oil seal assembly. Original design models use a retainer held in position against the spindle flange by a dowel.
- On all rigid and some steering models the oil seal and retainer assembly is located in the hub outside the hub rear bearing and wipes the hub spin-





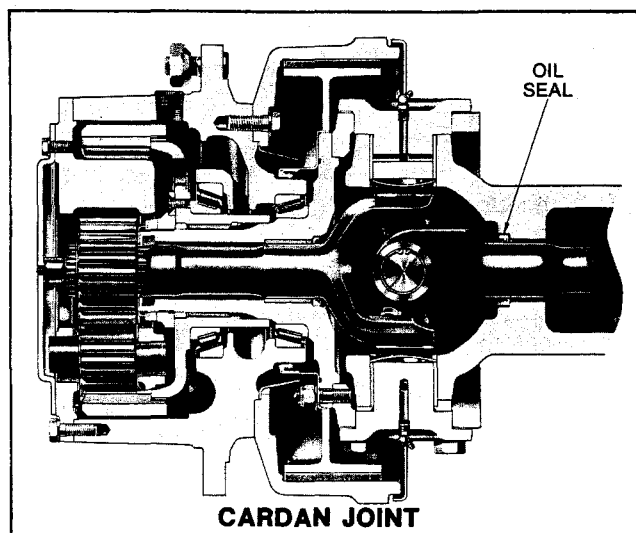
dle. Remove the retainer and seal assembly from hub with a suitable puller. Remove bearing.

**NOTE:** Do not remove the oil seal from the retainer unless replacement is necessary.



## DISASSEMBLE "CARDAN" STEERING JOINT

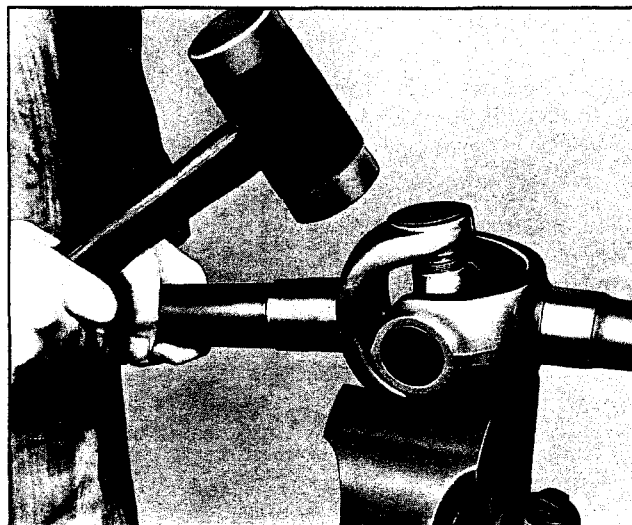
Shown here is the standard "Cardan" steering joint. For service instructions on the "Rzeppa" or "constant velocity" joint move ahead to the Rzeppa Steering Joint section on page 10.



A. Remove the axle shaft and universal joint assembly from the housing assembly. Care must be exercised not to damage the oil seal in the housing.

B. If universal joints are disassembled for the purpose of cleaning, inspecting or replacing of individual components, use the following procedure.

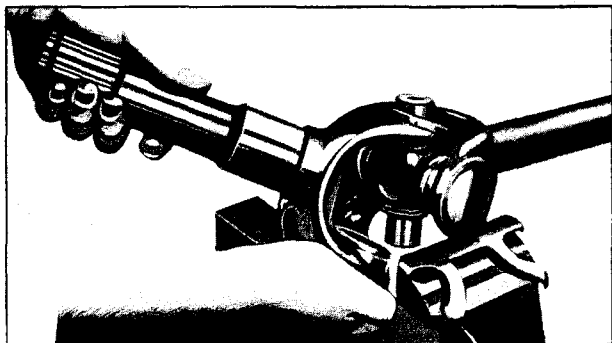
1. Remove the snap rings from the two ears in each yoke, with a suitable tool.
2. Position the joint assembly in an open vise with one yoke "horizontal" and resting on top of the vise jaws (do not tighten the vise).



3. With a suitable soft mallet, tap the upper ear of the "vertical" yoke several times. This will drive the vertical yoke down and push out the upper needle bearing and cap (Bearing cap has a highly polished surface and care should be exercised not to mar or scratch surface during removal operation).

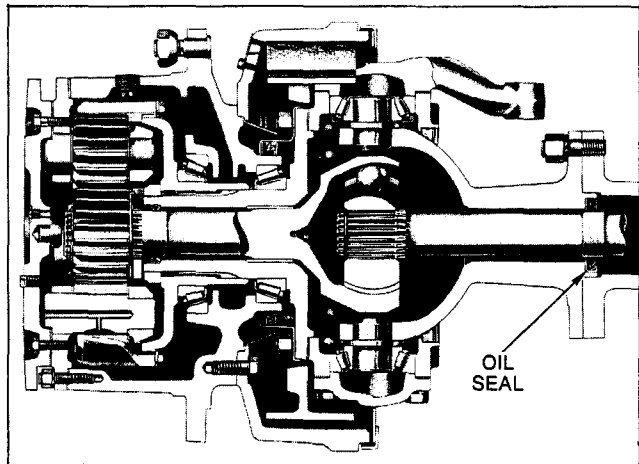
## DISASSEMBLY

4. If the metal retainers have worked free from the bearing caps, remove from the arms of the cross through the hole in the yokes.
5. Turn the "vertical" yoke upside down and remove the needle bearing and retainer on the opposite side following procedure outlined in items 3 and 4.

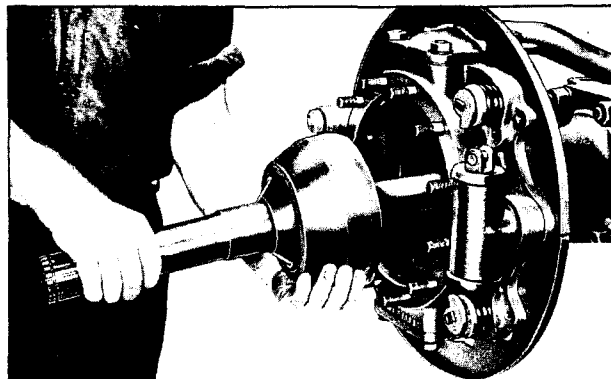


6. Remove "vertical" yoke by gently working yoke off arms of the cross.
7. To complete the disassembly, hold the remaining yoke in a "vertical" position and rest the cross arms on top of the open vise. Repeat steps 3, 4 and 5.
8. Remove cross from yoke by gently working cross free.
9. Clean and inspect all parts. When inspecting bearings, keep needles, caps and retainers together.
10. Replace parts that show excessive wear or damage. If it is necessary to use a new cross, the needle bearings should also be replaced. Do *not* mix new and used bearings together. Replacement should be made in sets of four.

## DISASSEMBLE "RZEPPA" STEERING JOINT

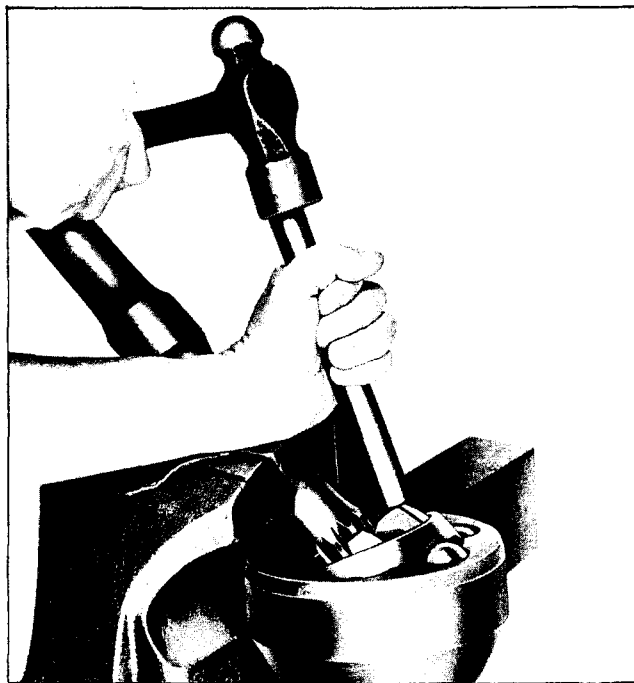


## REMOVE AXLE SHAFTS



Remove the axle shaft and ball joint assembly from the housing assembly. Care must be exercised not to damage the oil seal in the housing.

- A. Clamp the inner shaft into a bronze jawed vise with outer race bell in downward position.



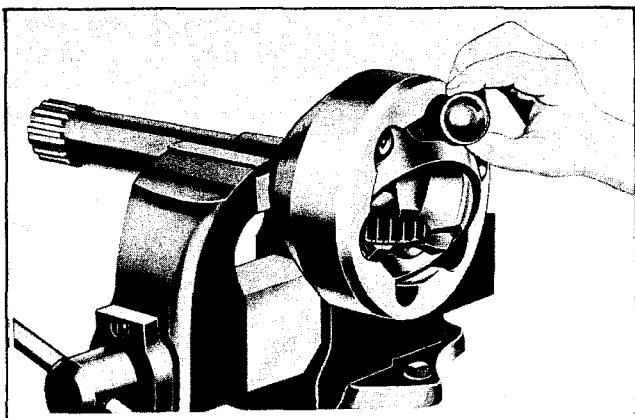
- B. Drive off the shaft, bell, bearing and cage assembly by use of a bronze drift against end of inner race.

**CAUTION:** Do not strike these hardened steel pieces directly with a steel hammer. Personal injury from chips or splinters may result.

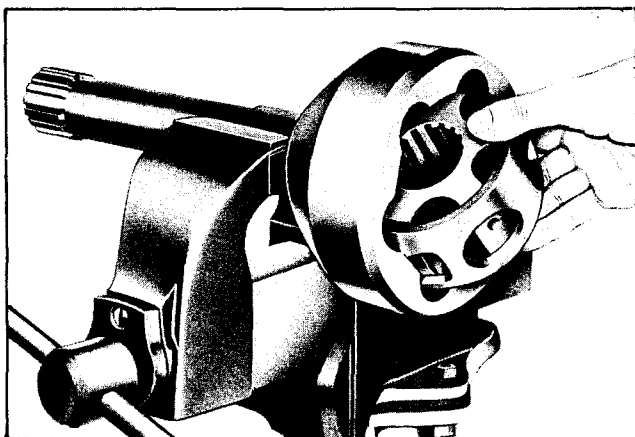
- C. Remove the lock ring and discard. When shaft is reinstalled, a new lock ring should always be used.

## UNIVERSAL JOINT DISASSEMBLY

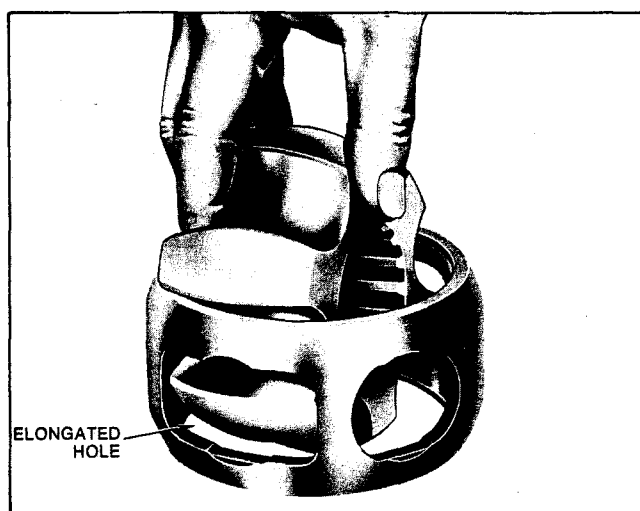
If universal joints are disassembled for the purpose of cleaning, inspecting or replacing of individual components, use the following procedure:



A. Tilt the inner race in the outer race bell until one joint ball can be lifted out. Then tilt the inner race until the next ball can be lifted out, continue until all the balls are removed.



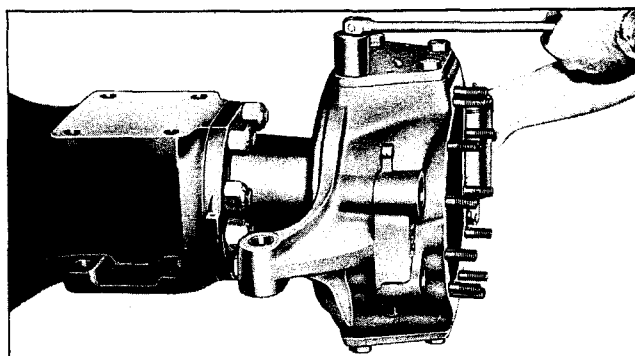
B. Roll the cage and inner race at right angles to the outer race bell with the two elongated openings in cage aligned with opposite teeth of bell. Then lift cage and inner race from the outer race bell.



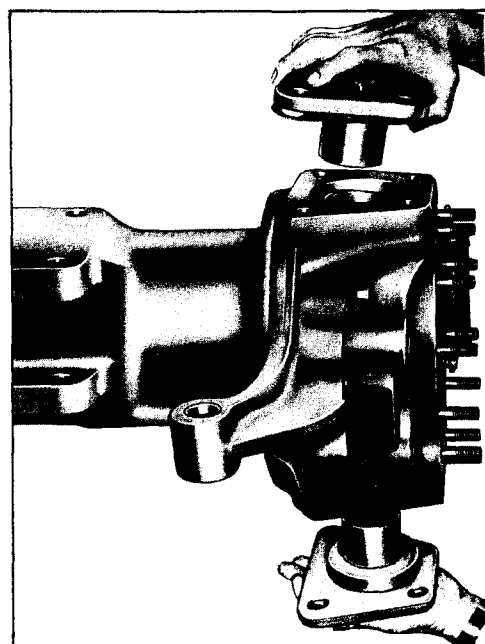
C. To separate the inner race from the cage, turn race at right angle to cage, align tooth on race with elongated hole in cage and roll inner race from cage.

## REMOVE STEERING KNUCKLE ASSEMBLY One Piece Construction

- A. Disconnect the steering arm linkage.
- B. Disconnect the tie rod ends at clevis joint.
- C. Remove dust shields where used.
- D. Remove brake line from wheel cylinder inlet fitting.



E. Remove the steering arm cap and or knuckle pin capscrews.



F. Remove the lower knuckle pin cap, shims and thrust washer. Then remove the upper knuckle pin cap and shims. Keep the shims together for reassembly. (Do not mix the upper and lower shim packs).

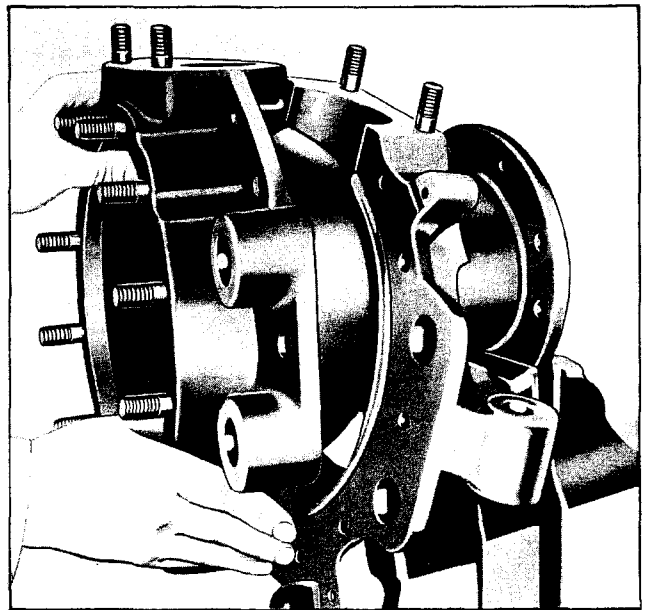
G. Loosen the outer boot clamp wire and fold back the boot (where used).

H. Remove the steering knuckle from the socket. The knuckle can be tipped to clear the socket.

### REMOVE TRUNNION SOCKET ASSEMBLY

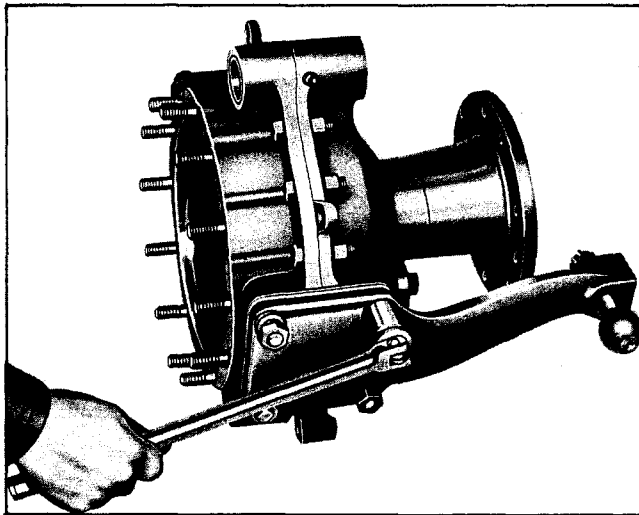
#### Bolted Type Construction

- A. Disconnect the steering arm linkage.
- B. Disconnect the tie rod ends at clevis joint.
- C. Remove dust shields where employed.
- D. Remove the stud nuts and lock washers from the socket to axle housing flange.
- E. Separate the trunnion socket assembly from the axle housing.
- F. The trunnion socket assembly can be placed in a bronze jawed vise for further disassembly.



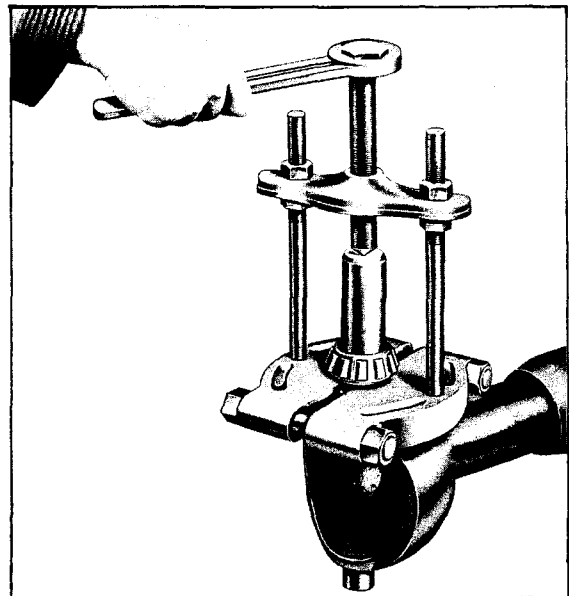
### DISASSEMBLE THE SPLIT TYPE KNUCKLE ASSEMBLY

#### Tapered Bearing Type



- A. Remove the steering arm stud nuts and lock washers.
- B. Remove the steering arm and shim pack. Shim pack should be wired together to keep intact to facilitate adjustment on reassembling.
- C. Remove the lower bearing cap stud nuts and lock washers.
- D. Remove the lower bearing cap and shim pack. Wire shim pack together to keep intact to facilitate adjustment on reassembling.
- E. Remove fasteners holding knuckle halves together.

- F. Remove the bearing cups and separate the knuckle flange assembly. The inner half of knuckle flange may be tipped at an angle to clear inner connecting flange.



- G. If bearings are to be replaced, remove the bearings with a suitable puller.
- H. Remove the oil seal from the oil seal recess in the housing at connecting flange.
- I. Remove the knuckle flange socket felt or oil seal. New felts or seals should always be used in knuckle rebuild.

**NOTE:** Some models may also have a hardened cover guide plate in front of the oil seal as a seal element protector during the installation and removal of the axle shafts. These guide plates

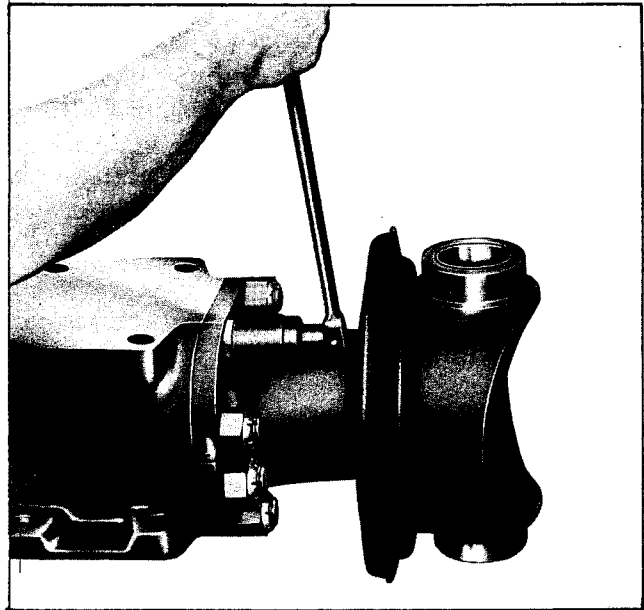
are machined with an interference fit to the housing seal bore. To remove seals on axles that employ these guide plates, it is necessary to drive the plates out by means of a long bar from the opposite end of housing.

## DISASSEMBLE THE TRUNNION SOCKET ASSEMBLY

### Bronze Bushing Type

- A. Remove the steering knuckle from the socket. The knuckle can be tipped to clear the socket.
- B. Remove the stud nuts at the connecting flange and separate the trunnion socket from the axle housing.
- C. Loosen inner boot clamp wire and remove boot.

**NOTE: FLUSH TOTAL AXLE BEFORE REASSEMBLY.** Most current rigid axles (PRC, PRM and PRS) do not utilize axle shaft oil seals; the lube is common to the wheel ends and the center section. Contamination from either wheel end or



the carrier can spread to all other areas of the axle. Therefore the entire axle (both wheel ends and center section) should be thoroughly drained and flushed.

## PREPARE FOR REASSEMBLY— CLEAN, INSPECT AND REPAIR

### CLEAN

Parts having ground and polished surfaces, such as gears, bearings, shafts and collars, should be cleaned in a suitable solvent, such as kerosene or diesel fuel oil.

Clean all mating surfaces where fiber or liquid gasket material is used. It may be necessary to use a scraper to completely remove gasket materials. Be careful not to damage mating surfaces.

**CAUTION:** Exercise care to avoid skin rashes, fire hazards and inhalation of vapors when using solvent type cleaners.

### GASOLINE SHOULD NOT BE USED AS A SOLVENT

DO NOT clean these parts in a hot solution tank or with water and alkaline solutions, such as sodium hydroxide, orthosilicates or phosphates.

DO NOT steam clean assembled drive units after they have been removed from the housing. When this method of cleaning is used, water is trapped in the cored passage of the castings and in the close clearances between parts as well as on the parts. This can lead to corrosion (rust) of critical parts of the assembly and the possibility of circulating rust particles in the lubricant.

Premature failure of bearings, gears and other parts can be caused by this practice. Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. Complete drive unit disassembly is a necessary requisite to thorough cleaning.

### Rough Parts

Rough parts, such as differential carrier castings, cast brackets and some brake parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts are not ground or polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. The parts should be thoroughly rinsed after cleaning to remove all traces of alkali.

**CAUTION:** Exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

### Complete Assemblies

Completely assembled axles may be steam cleaned on the outside only to facilitate initial removal and disassembly, providing all openings are closed. Breathers, vented shift units, and all other openings should be tightly covered or closed to prevent the possibility of water entering the assembly.

## PREPARE FOR REASSEMBLY

### Drying

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless absorbent paper towels or wiping rags free of abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

### Corrosion Prevention

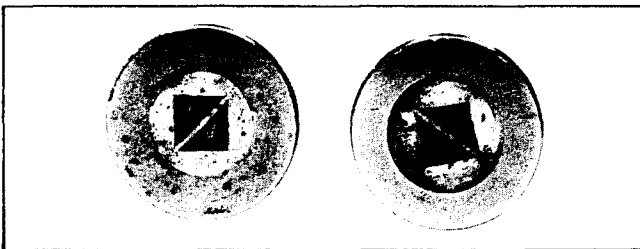
Parts that have been cleaned, dried, inspected and are to be immediately reassembled should be coated with light oil to prevent corrosion. If these parts are to be stored for any length of time, they should be treated with a good *rust preventive* and wrapped in special paper or other material designed to prevent corrosion.

### INSPECT

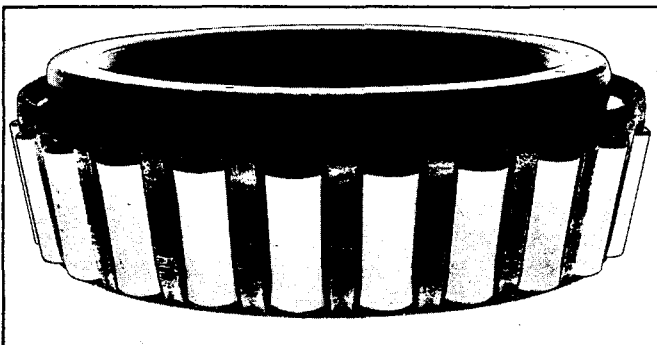
It is impossible to overstress the importance of careful and thorough inspection of parts prior to reassembly. Thorough visual inspection for indications of wear or stress, and the replacement of such parts as are necessary will eliminate costly and avoidable failure.

A. Inspect all bearings, cups and cones, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers. They may easily mutilate or distort component parts.

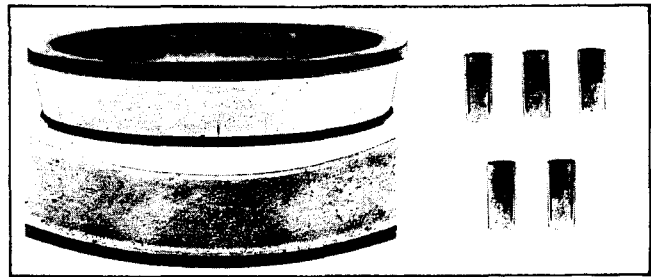
If any of the following bearing conditions exist, bearings must be replaced:



1. Large ends of rollers worn flush to recess or radii at large ends of rollers worn flat.



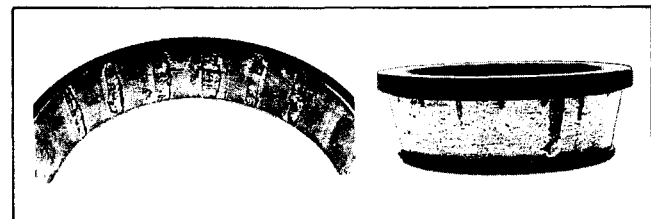
2. Bright rubbing marks on the dark phosphate surfaces of the bearing cage.



3. (a) Visible step wear, particularly at the small end of the roller track.  
(b) Deep indentations, cracks or breaks in bearing cup and/or cone surfaces.



4. Etching or pitting on functioning surfaces.



5. Spalling or flaking on bearing cup and/or cone surfaces.

B. Inspect the planetary reduction, planet gears, sun gear and ring gear assembly for wear or damage. Gears, shafts or thrust washers which are scored, pitted, ridged, chipped or worn should be replaced.

C. Inspect axle shafts for signs of torsional fractures or other indications of impending failure.

D. Inspect seals on tie rod ends for any indications of damage. Also check to make sure seal is securely seated on socket. If tie rod end has a grease fitting, replace damaged seals. Tie rod ends not having a greasing provision should be replaced if seals are damaged or loose.

**IMPORTANT: Rockwell *does not* recommend attempts to salvage damaged ends by repacking and replacing the boot seal on nongreasable ends.**

Check the turning torque value between the tie rod end assembly stud and the ball cavity. If torque value is less than five (5) inch pounds, the tie rod end assembly should be replaced. This is not to say the end assembly will fail at this point, but it can no longer provide the type of steering

control designed into it once lateral movement develops between the stud and the ball cavity.

- E. Inspect axle housing for cracks, loose studs and nicks or burrs at machined surfaces. Make all necessary repair or parts replacement.

## REPAIR

- A. Replace all worn or damaged parts. Trunnion sockets if scratched. Replace all hex nuts with rounded corners, distorted washers and snap rings, oil seals, gaskets and socket felts at time of overhaul.

**IMPORTANT:** Use only genuine Rockwell parts for satisfactory service. For example, using gaskets of improper material generally leads to mechanical trouble due to variations in thickness and the inability of certain materials to withstand compression, oil, and temperature extremes.

- B. Remove nicks, mars and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. A fine mill file or India stone is suitable for this purpose. Studs must be tight prior to reassembling the parts.

- C. Tighten all the nuts and capscrews to the correct torque. (See torque limits on page 27).

## USE OF DRI-LOC FASTENERS AND ROCKWELL LIQUID ADHESIVE 2297-C-3747 (LOCTITE #277)

### Using New Dri-Loc Fasteners

1. Wipe excess oil and any residue from the threaded holes. The holes should be relatively oil free, however, no special cleaning is required.
2. Assemble the components using Dri-Loc fasteners. DO NOT APPLY ROCKWELL LIQUID ADHESIVE OR ANY OTHER TYPE OF FASTENER RETAINER MATERIAL, SEALANT OR ADHESIVE ON DRI-LOC FASTENERS OR IN THE THREADED HOLES.
3. Tighten the Dri-Loc fasteners to the specified torque value. Refer to Fastener Torque Chart at end of manual.

**NOTE:** No cure time is required for Dri-Loc fasteners prior to rebuilding the axle and returning it to service.

## Reusing Dri-Loc Fasteners and Rockwell Liquid Adhesive 2297-C-3747 (Loctite #277) Application

1. Wipe excess oil residue from the fasteners and threaded holes. The fasteners and holes should be relatively oil free, however, no special cleaning is required. When reusing Dri-Loc fasteners, it is not necessary to remove the Dri-Loc residue from threads.

2. Apply Rockwell Liquid Adhesive to the threaded holes only, by letting four or five drops run down the side of each hole. Before threading in the fasteners, visually check to make sure that the adhesive has contacted the threads.

**IMPORTANT:** Do not apply adhesive to the fastener, since trapped air in the hole will create back pressure and "blow out" the adhesive as the fastener advances.

3. Tighten the fasteners to the specific torque value recommended for that size fastener. Rockwell Liquid Adhesive will not alter the torque requirement. Refer to the Fastener Torque Charts on page 28.

**NOTE:** No cure time is required for Rockwell Liquid Adhesive prior to rebuilding the axle and returning it to service.

**IMPORTANT:** When servicing drive units assembled with Dri-Loc fasteners or with Rockwell Liquid Adhesive in Threaded holes where the fasteners do not require removal:

—Check each fastener for tightness by applying the minimum amount of torque specified for that size fastener. If the fastener does not rotate, it is satisfactory. If the fastener rotates to any degree, it must be removed from the component and adhesive must be applied to the threaded hole. Use the procedures under "Reuse of Dri-Loc Fasteners and Rockwell Liquid Adhesive 2297-C-3747 (Loctite #277) Application."

Further, if fastener removal becomes difficult due to worn heads or unusually high breakaway torques, the locking strength of either Rockwell Liquid Adhesive or Dri-Loc can be reduced by heating. Heat the fastener for only a few seconds at a time while trying to loosen it.

**DO NOT EXCEED 177°C (350°F) maximum.** Heating should be done slowly to avoid thermal stresses in other components. Application of heat reduces the strength of the adhesive and Dri-Loc below recommended installation torque.

Rockwell does not recommend removing fasteners with an impact wrench or by striking with a hammer. Damage to fastener heads can result.

## REASSEMBLE PLANETARY WHEEL END

### INSTALL OIL SEAL IN HOUSING

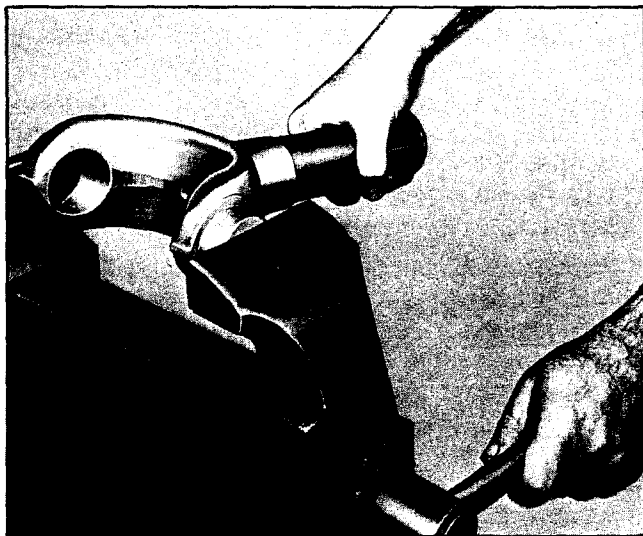
- A. Install oil seal in axle housing at the outer end with a suitable driver. Care must be exercised to locate the seal squarely against the seal recessed shoulder or shaft guide.
- B. On units incorporating the axle shaft guide plate, start the plate into the end bore evenly with a mallet. Once plate is started square, drive the plate into position with a suitable driver.

**CAUTION:** Do not strike hardened steel parts directly with a hammer. Personal injury from chips or splinters may result.

For steering axle models continue on for reassembling steering joints and knuckle assemblies. For rigid axle models proceed to "Install Hub Spindle Assembly" on page 20.

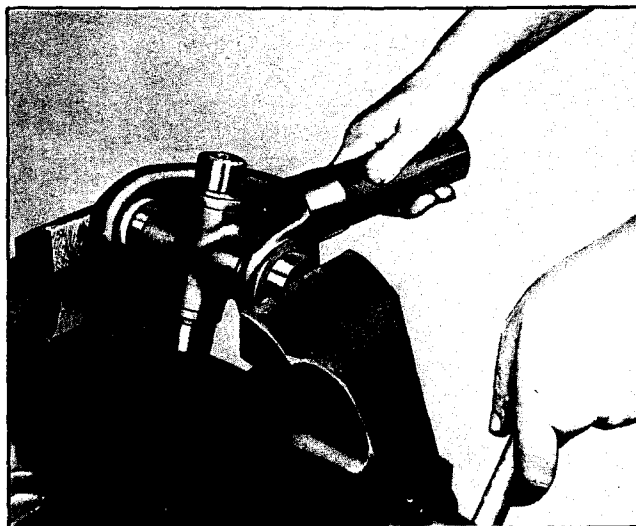
### REASSEMBLY OF CARDAN JOINT

- A. Insert needle bearing cap into ear of yoke.
- B. Place yoke in vise and press needle bearing cap into the proper position. Bearing cap has a highly polished surface and care should be exercised not to mar or scratch surface during installation operation.



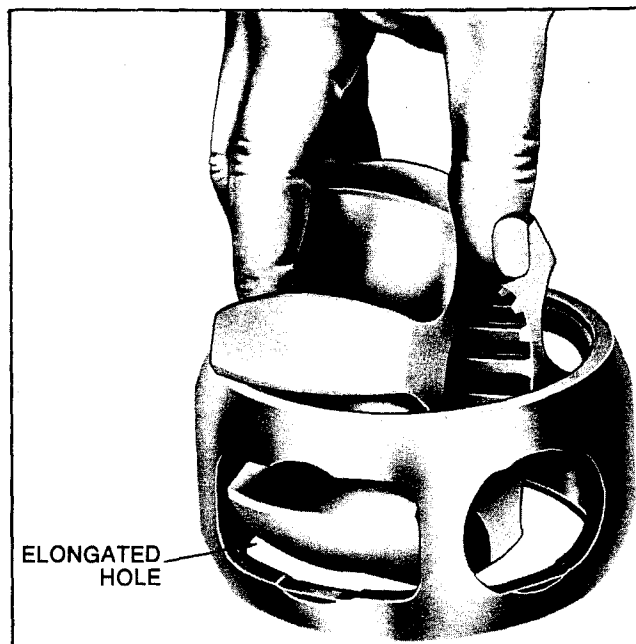
- C. Remove yoke from vise and gently work one arm of cross into the yoke and bearing cap.
- D. Install opposite bearing cap by hand and line up cross arm.
- E. Place yoke in vise and press needle bearing cap into the yoke and onto the arm of the cross.

(Cross must move freely in both caps; if cross should bind, remove cap and check for upset needles).



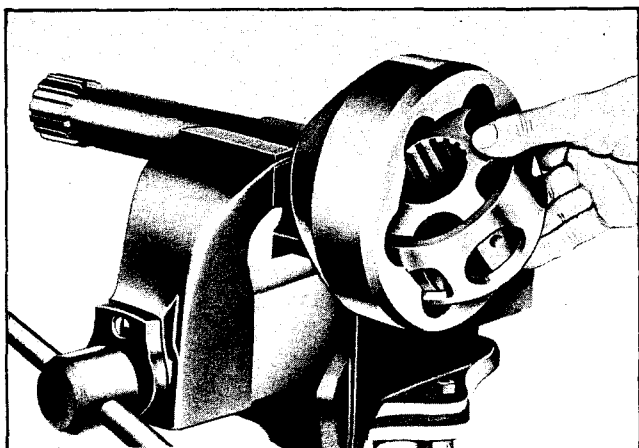
- F. With the aid of a short plug, move bearing caps past snap ring groove. Insert snap rings in grooves, one with each bearing cap.
- G. Repeat procedure as outlined in items A thru F for installing remaining caps and yoke.

### REASSEMBLE "RZEPPA" STEERING JOINT

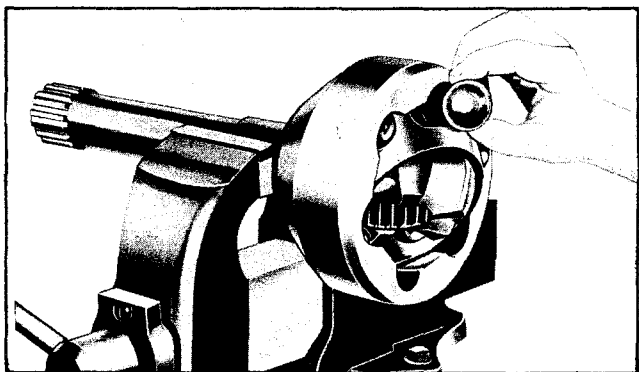


- A. Install the inner bearing race into cage at right angle and align race teeth with elongated cage hole. Turn race within cage to position parallel with cage.





B. Insert the race and cage into the universal bell at right angle and tilt into position while at the same time aligning bell teeth with elongated openings.



C. Tilt, in the bell, the inner race and cage until one joint ball can be inserted. Then tilt race and cage with aligning bell teeth until the next joint ball can be inserted. Continue until all the joint balls are in place.

D. Clamp the outer end of bell shaft in a bronze jawed vise or holding fixture with inner race splines parallel with the bell face.

E. Install a new locking ring in the inner shaft lock ring groove.

F. Align the splines of inner shaft with splines of the inner race, holding shaft in a vertical position so that lock ring rests in inner race entering chamfer.

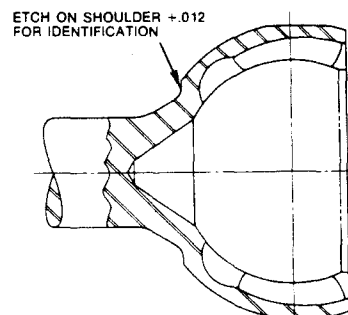
G. Tap the end of shaft with a rawhide mallet to collapse the lock ring.

H. Drive the shaft through the inner race until lock ring clears splines and opens, thus locking the shaft in place.

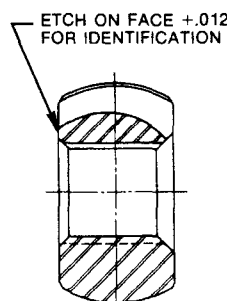
**CAUTION:** Do not strike these hardened steel pieces directly with a steel hammer. Personal injury from chips or splinters may result.

## REPLACEMENT OF INDIVIDUAL COMPONENTS IN RZEPPA BALL JOINTS

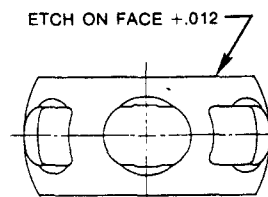
This will acquaint you with the fact that approximately 10% of original Rzeppa universal joints are made with .012" oversize balls, raceways and cages. All original joints that employ oversize components are marked on the individual pieces aside from the balls in the places noted on the following figures:



OUTER RACE BELL



INNER RACE



CAGE

When disassembling these universal joints for the purpose of cleaning, inspecting or replacing individual components, it is advisable to rework them one at a time and thus avoid a chance of mixing parts from standard and oversize assemblies.

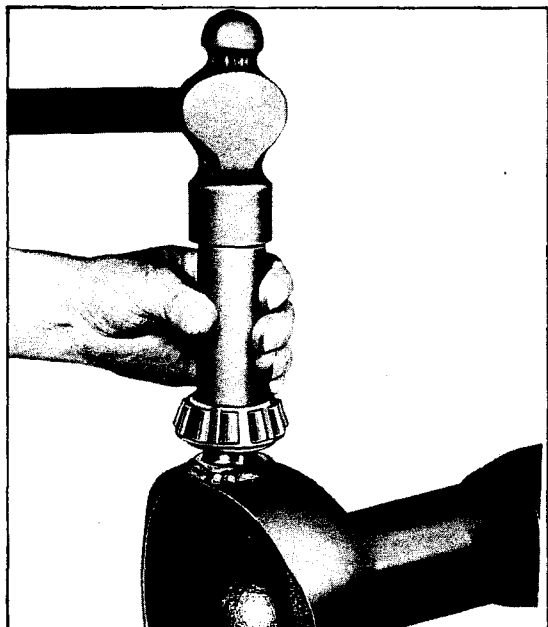
If a considerable number of joints are to be reworked at one time, it will be necessary to segregate the components from standard and oversize joints.

It should be noted further that only standard size components are furnished for service replacement. The standard size parts are to be used for replacement of either standard or oversize parts in the original assemblies. It should be noted, however, that if the outer race, the inner race or the cage in an original oversize joint is replaced, it will also be necessary to replace all the balls at the same time. If the original oversize balls were to be re-used, the resulting assembly would be too tight and would lead to hard steering and short life.

The use of standard size replacement balls in a joint having one or more of the other components oversize, will in no way affect performance or life though there will be slightly more backlash.

## INSTALL TRUNNION SOCKET PIN BEARINGS OR BUSHINGS

- A. If trunnion socket pin bearings have been removed, place knuckle pin end of housing in a bronze jawed vise or other suitable fixture.

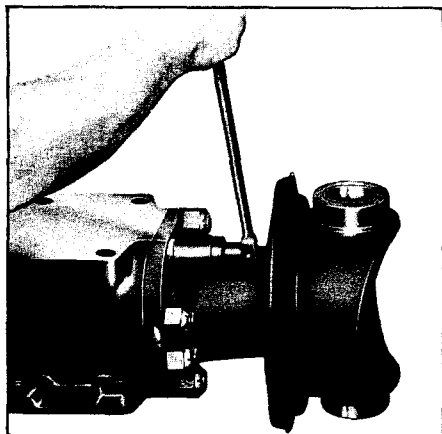


- B. Install the bearing on the knuckle pin by use of a sleeve driver that bears against the bearing inner race, or . . .
- C. Install bronze bushings with a suitable driver. Check fit of the knuckle pin caps in new bushings and ream if necessary.

## MOUNT TRUNNION SOCKET ASSEMBLY TO HOUSING

### Bronze Bushing Type

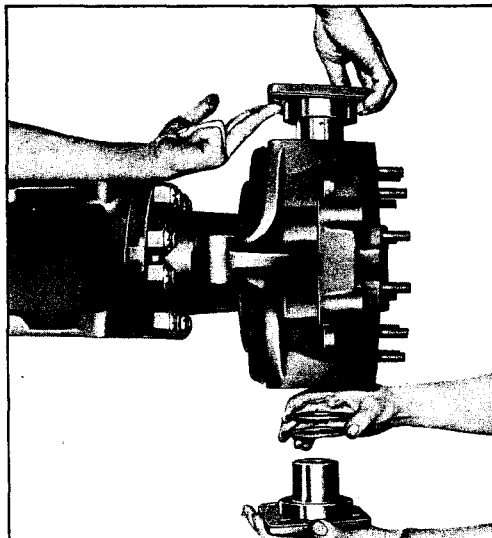
- A. Slip the boot over the connecting flange of the trunnion socket.



- B. Mount the trunnion socket on the axle housing studs and install the stud nuts. Tighten the nuts to specified torque.

- C. Install the inner boot clamp wire in the trunnion socket groove.

## ASSEMBLE STEERING KNUCKLE ASSEMBLY



- A. Lubricate king pin bushing bores with grease (Rockwell 0-617-A or 0-617-B Spec.).
- B. Install knuckle over trunnion socket.
- C. Install upper king pin cap with original shim pack. It may be necessary to drive the cap into the knuckle by tightening the king pin capscrews alternately in small increments, keeping the king pin cap straight with respect to the knuckle bore.
- D. Install lower king pin cap with original shim pack. The thrust washer must have tangs facing the trunnion socket.
- NOTE: Apply grease to the grooved face of the thrust washer prior to installation on the king pin cap.**
- E. Make sure that the thrust washer tangs engage the slots in the trunnion socket boss before final tightening of the lower king pin cap fasteners.

## ADJUST STEERING KNUCKLE

Steering knuckle adjustment is accomplished by use of shims located under the upper and lower king pin caps. The knuckle vertical end play specification is .005 to .013 inch.

- A. Measure the vertical end play of the steering knuckle and *record*. This may be determined by using a feeler gauge to measure the gap between the upper king pin cap shoulder and the top surface of the trunnion socket king pin boss while

the wheels are on the ground — or — if wheels are removed (axle supported on blocks) measure the gap with the knuckle assembly forced maximum upward (with hydraulic jack or pry bar), or check maximum vertical movement of knuckle with a dial indicator.

- B. (1) If end play is .013 inch or less; no readjustment is necessary.
- (2) If current end play exceeds .013 inch; continue the following steps.
- C. Remove lower and upper king pin caps and measure the *total* current shim pack thickness (upper pack *plus* lower pack).
- D. Subtract actual end play (value from step A) from the total shim pack thickness (value from step C) and divide this result by two.
- E. Make the "new" *lower* shim pack thickness the same as the value from the step D calculation. If this thickness cannot be met exactly, choose the nearest thicker pack.
- F. Make the "new" *upper* shim pack thickness the same as the value from the step D calculation *plus* .005 inch. If this result cannot be met exactly, choose the nearest thicker pack.

### EXAMPLE:

- Step A. Current end play = .020 inch
- Step B. Conclude readjustment necessary
- Step C. Current *total* pack thickness = .066 inch
- Step D.  $.066 - .020$  divided by 2 = .023  
( $.046$  divided by 2 = .023)
- Step E. New *lower* pack = .023 inch
- Step F. New *upper* pack =  $.023 + .005 = .028$  inch.

### ASSEMBLE SPLIT TYPE KNUCKLE AND TRUNNION SOCKET

- A. Install the inner half of the knuckle flange by tilting and sliding it over the trunnion socket flange end.
- B. Mount the trunnion socket onto housing studs and install washers and nuts.
- C. Tighten nuts to correct specifications as listed on torque chart following service instructions.
- D. Align mating outer knuckle flange with inner knuckle flange.

- E. Join the two flanges together by installing the knuckle flange bolts, lock washers and nuts.
- F. Tighten the knuckle flange nuts to correct torque.
- G. Install the upper and lower bearing cups.

### ADJUST STEERING KNUCKLE BEARINGS

#### Split Type Knuckle

- A. Install the original shim packs between steering arm cap and lower bearing cap.
- B. Install the caps, lock washers and nuts.
- C. Tighten the nuts to correct torque and check for end play and oscillating freeness.
- D. The knuckle should be adjusted by adding or removing shims as required.
- E. After zero end play with oscillation has been established, remove a .005" shim from each shim pack.
- F. Replace the caps, lock washers and nuts. Tighten nuts to correct torque. After this is done a small amount of drag in rotating the steering knuckle should be felt, but it should not bind.
- G. The size of the shim pack at the top and the bottom should be nearly the same so as to center the joint assembly for proper shaft alignment.
- H. Install the dust shields where used.

### ATTACH COMPONENTS

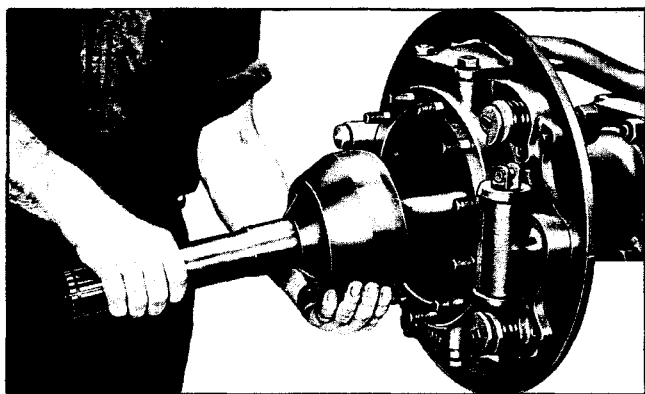
#### All Knuckle Styles

- A. Install brake line to wheel cylinder inlet fitting.
- B. Attach power steer cylinder to knuckle arm.
- C. Attach tie rod to knuckle, use correct specifications as listed in torque chart following service instructions.
- D. Install brake dust shields.

### INSTALL AXLE SHAFT AND UNIVERSAL JOINT ASSEMBLY

- A. Hand pack universal joint assembly by forcing grease into bell and race cavities. (Rzeppa only)
- B. Hand pack inner walls of flange socket. (Rzeppa only)

## REASSEMBLY.



- C. Insert axle shaft through housing and into side gear of carrier using care not to damage oil seal in housing end.

**IMPORTANT:** First apply a film of waterproof grease to housing oil seal lips, bronze bushing bore and oil seal journal on axle shaft long end.

### INSTALL HUB SPINDLE ASSEMBLY

#### PS Models

- A. If replacement of the spindle inner oil seal is necessary, install new seal from inner end with a suitable driver.

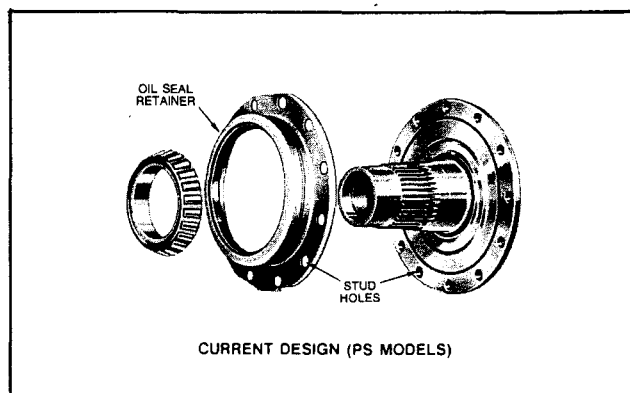
**NOTE:** Oil seal replacement should be made at regular maintenance intervals.

- B. For models that *do not* have oil seal installed in wheel hub inner bearing bore, install the inner wheel bearing cone on the hub spindle and apply lube to bearing rollers.
- C. Apply a film of waterproof grease to lips of oil seal in the spindle bore, the bore of the bronze bushing in the spindle and to the oil seal journal on the axle shaft short end. Then install the spindle by carefully sliding it over the end of the axle shaft.

**NOTE:** Care must be exercised to avoid damage to seals.

(Steps D Through F For PS-166, 334, 824, 826 And 1044 Models Only)

- D. Assemble O-ring, if used, in spindle face groove.
- E. Where O-ring is not incorporated, apply a bead of liquid gasket (approximately .09 inch diameter) to the mounting face of the wheel hub oil seal retainers. The bead must go around the inner side of the bolt holes.
- F. Place the oil seal and retainer assembly over the studs and install flat washers and nuts (where bolted type oil seal is used).



Older models use oil seal and retainer assembly which is held in place against the spindle by means of a dowel.

- G. On models with bolted brake spiders install brake spider to the spindle while supporting the spindle. Then install and tighten mounting fasteners.

#### Rigid Axle Models

- H. On cast or stamped housing models mount spindle, "O"-ring and brake spider or backing plate to housing flange with bolts, washers, and nuts, if used (or with capscrews and washers where employed). Tighten nuts or capscrews to specified torque.

**NOTE:** On recent models liquid gasket is used in place of "O"-ring. Apply a continuous bead (approx. .09 in dia.) of liquid gasket around spindle flange between the mounting pilot and the bolt holes.

On modular models when the spindle is welded to the housing, mount brake spider to the flange on spindle or housing.

### INSTALL BRAKE ASSEMBLIES

For brake installation details refer to the pertaining Rockwell Field Maintenance Manual. (See page 8).

### ASSEMBLE RING GEAR HUB ASSEMBLY

- A. On those models incorporating a planetary ring gear with tapped holes, lock plates and capscrews, the ring gear must be assembled to the ring gear hub at this time.

**NOTE:** Most models incorporate an axially floating ring gear (does not have tapped holes) which can be assembled later, just prior to assembly of the planetary spider.

- B. Install the outer wheel bearing cone on ring gear hub journal squarely against hub shoulder and

apply lubricant. The inner race of bearing is a slip fit over the spindle journal.

**NOTE: Do not assemble onto spindle at this time.**

## ASSEMBLE AXLE SHAFT IN RIGID AXLES

On rigid planetary axles it is more convenient to assemble the axle shaft before the wheel hub assembly is installed. Insert axle shaft through spindle and housing and into side gear of carrier.

## ASSEMBLE HUB, BEARINGS, OIL SEAL AND DRUM

- If hub bearing cups have been removed for replacement, install new cups with a suitable driving sleeve.
- Most models then require installation of the inner bearing cone prior to installation of wheel hub oil seal in bore of wheel hub. Apply lubricant to bearing rollers before installation.
- Install new wheel hub oil seal with proper driver. Drive seal to same location as the original, this may be to bottom of bore in hub or flush with the bottom end face of hub. New wear sleeves are to be installed on the spindle where employed. Use extreme care to avoid any nicks on the sleeve end which can damage the seal lip during wheel hub installation.
- Apply lubricant to lips of oil seal, or to inside diameter of unitized type of oil seal, or to interface area of metal rings of face seals. *Do not* lubricate any other part of face seals. Also apply a film of lubricant to the oil seal journal surface of the spindle (or wheel hub journal surface on certain PS models).
- Install brake drum and oil slinger where applicable. If slinger fit is not tight between hub and drum, a bead of liquid gasket can be applied to prevent rattle. Install drum mounting capscrews and washers and tighten to proper torque.

**NOTE: On dual tire models make sure the air valve clearance notch in drum O.D. aligns with notch in wheel hub.**

## Smaller Models

- Lift the hub and drum assembly onto the hub spindle and position so that the inner cup rests on the inner bearing rollers.

**NOTE: Alignment must be maintained during installation to prevent damage to hub oil seal.**

- Install the ring gear hub assembly, while at the same time lifting the weight of the hub and drum assembly to allow the outer bearing to mate with outer hub bearing cup.

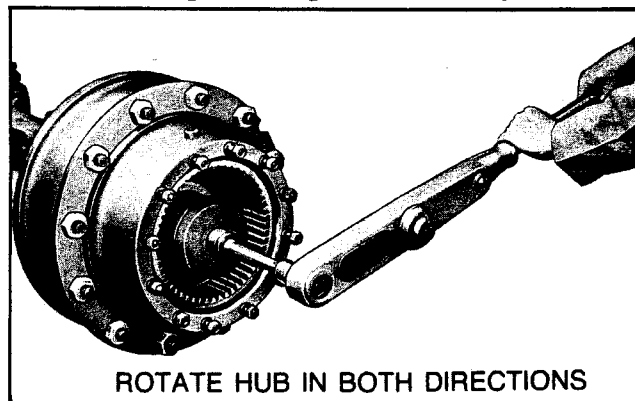
- Install the wheel bearing adjusting nut.

## Larger Models

On larger models the ring gear hub assembly and bearing may be temporarily mounted to the wheel hub assembly by capscrews through the puller holes of ring gear hub flange, into the smaller threaded holes of the wheel hub.

- Place hub and drum assembly on floor or bench vertically with brake drum up.
- Install rear bearing in cup (with lube on rollers).
- Install seal and retainer with suitable driver.
- Invert the hub and drum assembly.
- Install the ring gear hub assembly and outer bearing (with lube on rollers).
- Align ring gear hub puller holes with hub threaded holes.
- Install capscrews to temporarily hold the assemblies together.
- Supporting the weight by use of chain falls, locate the combined assembly on the spindle splines.
- Install the wheel bearing nut and draw assembly into position.
- Remove the temporary capscrews from the ring gear hub.

## WHEEL BEARING ADJUSTMENT New Bearings - Single Nut Design



- Seat the bearings and related components by tightening the adjusting nut to 400 lb. ft. *while hub is rotated in both directions.* Rap the hub

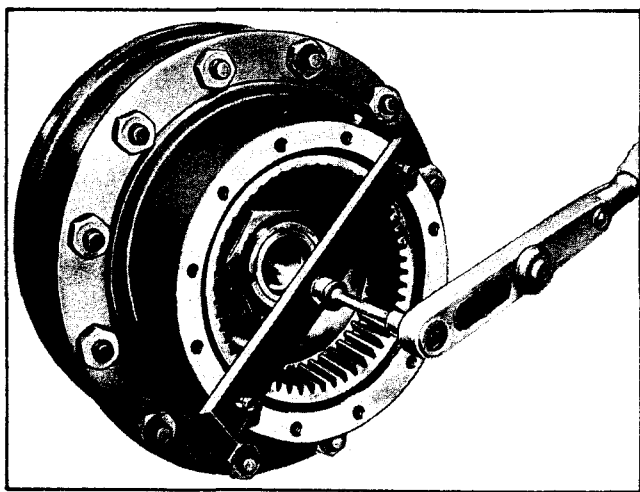
## REASSEMBLY

several times with a brass or plastic mallet, then re-torque to 400 lb. ft. Repeat procedure until nut will not advance with application of 400 lb. ft.

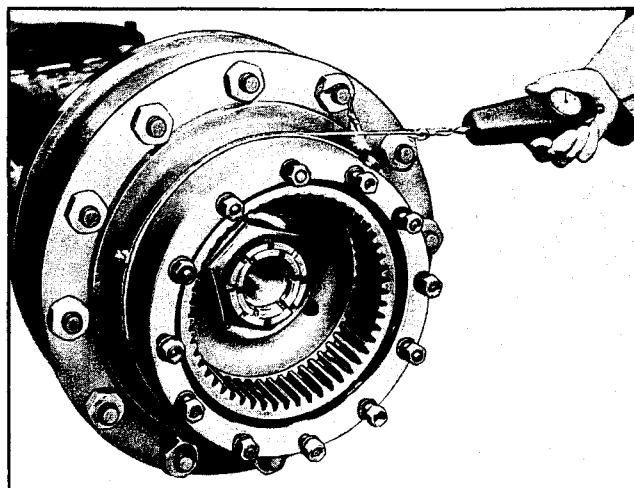
**EXCEPTION:** Seating torque on adjusting to be 100 lb. ft. for following models:

**PRA/PRS/PRLC-130 through 265 (PR-35 through 68) and PSC/PSS-165 through 200 (PS-50 through 60).**

- B. Back off adjusting nut to relieve preload on bearings. Torque on nut should be 0 lb. ft.

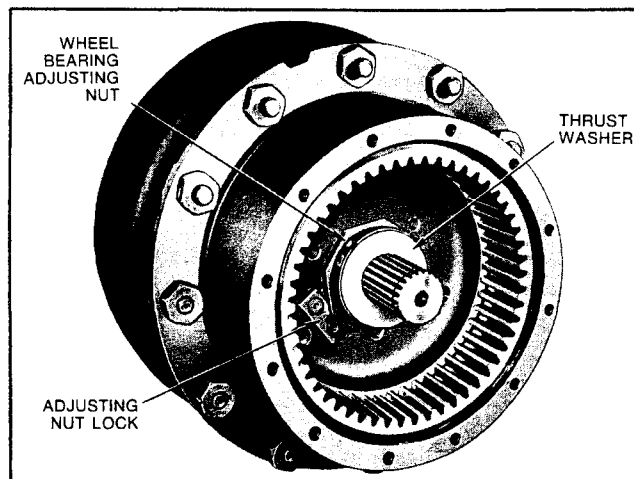


- C. Determine the wheel hub rolling torque. Torque value must be obtained while hub is rotated at a *steady* rate (not starting torque). Rockwell recommends the use of a flat bar, with a welded nut in the center, attached to the planetary mounting face of the wheel hub; and a torque wrench to obtain rotation and the torque reading (see illustration above).



An alternate method for determining wheel hub rolling torque is to wrap a cord around hub barrel, attach a spring scale and pull straight out at a steady rate. Torque in units of lb. ft. = (lb. pull × inches of hub barrel radius) ÷ 12.

- D. Tighten adjusting nut and re-check the hub rolling torque. The increase in rolling torque from that determined in step "C" (no preload position) should be as indicated in the chart below.



ORIGINAL AXLE MODEL	CURRENT AXLE MODEL	HUB ROLLING TORQUE INCREASE
PR-35 thru 68, PS-50 & 60	PR-130 thru 265, PS-165 thru 200	3 to 5 lb. ft.
PR-100, PS-100	PR-344 thru 614, PS-334	4 to 8 lb. ft.
PR-150 thru 200, PS-150 thru 200	PR-672 thru 677, PS-614 thru 825	5 to 9 lb. ft.
PR-250, PS-250 thru 270	PR-863 thru 1757, PS-826 thru 1614	6 to 10 lb. ft.
PR-300 thru 440, PS-350	PR-1923 thru 4025, PS-1874 & 1875	8 to 12 lb. ft.
PR-500, PS-500	PR-4264 thru 4807, PS-4564	10 to 14 lb. ft.
PR-700	PR-7314	14 to 18 lb. ft.

**IMPORTANT:** The final nut setting must result in a hub rolling torque which is the *sum* of the "initial" value from step "C" plus the "increase" from above chart.

- E. Install nut lockplate and capscrews. Tighten to grade 8 value (see page 27). There are several types of nut locks/lockplates used among the various axle series. The V-notch lockplates will allow use of the plate flat toward flat of nut if the V-notch does not properly engage a nut corner.

**IMPORTANT: The lockplate assembly method chosen *must* prevent nut rotation.**

If new screws (with pre-applied locking agent) are not used, then several drops of Loctite #277 must be applied to the internal threads in the planetary ring gear hub.

Flat head screws *must* be used in lockplates incorporating counter sunk holes.

**NOTE:** For models PR-130 through 265 and PS-165 through 200 ("original" models PR-35 through 68 and PS-50 through 60). Locking method is engagement of nut dowel pin into a hole in the planetary ring gear/hub which is installed *after* the final nut/bearing adjustment is made. The final nut position must orient the dowel pin with respect to a spindle spline same as "hole to spline" in the ring gear hub.

**EXAMPLE:**

Axle is PR-672 series.

Initial hub rolling torque from step C with zero adjusting nut torque = 8 lb. ft.

Final hub rotating torque after nut adjustment:

$$\text{Min} = 8 + 5 = 13 \text{ lb. ft.}$$

$$\text{Max} = 8 + 9 = 17 \text{ lb. ft.}$$

## New Bearings — Double Nut Design

- A. Seat the bearings and related components by installing the wheel bearing adjusting nut with the locking protrusion facing *outward*. Tighten the nut to 400 lb. ft. *while hub is rotated in both directions*. Rap the hub several times with a brass or plastic mallet, then re-torque to 400 lb. ft.
- B. Back off adjusting nut to relieve preload on bearings. Torque on nut should be 0 lb. ft.
- C. Determine the wheel hub rolling torque. Torque value must be obtained while the hub is rotated at a *steady* rate (not starting torque). See recommended procedure in step "C" under "Single Nut Design."

- D. Tighten adjusting nut slightly (approximately 25 lb. ft.). Install the nut lock ring washer with the washer tang into the slot on the spindle and with a washer hole engaging the protrusion of the adjusting nut.

- E. Install the jam nut and tighten to 800 lb. ft.

- F. Re-check the wheel hub rolling torque. The "increase" from step "C" (no preload position) should be 5 to 9 lb. ft. If "increase" is out of this range, remove the jam nut and lock ring washer and readjust the inner adjusting nut in the appropriate direction. Repeat above procedure.

**NOTE:** The rolling torque check for "increase" *must* be performed *after* the jam nut is tightened since the bearing preload *is* increased by the jam nut tightening.

## Reused Wheel Bearings

For both single nut and double nut designs the procedure is the same as for new bearings (pages 21 thru 23) *except* the "INCREASE" in hub rolling torque should be 1/2 the value specified for new bearings.

**EXAMPLE:**

Axle is PS-1614 series.

Initial hub rolling torque (step C pg. 22) = 2 lb. ft.

Final hub rotating torque after nut adjustment:

$$\text{Min.} = 2 + (6 \div 2) = 5 \text{ lb. ft.}$$

$$\text{Max.} = 2 + (10 \div 2) = 7 \text{ lb. ft.}$$

## Wheel Bearing Adjustment For Axles With Wet Disc Brakes

Refer to Rockwell Field Maintenance Manual No. 4L.

## INSTALL PLANETARY RING AND SUN GEARS

- A. Install sun gear thrust washer, sun gear and axle shaft snap ring. Thrust washer tangs must engage slots in spindle or nut. Apply grease to washer for temporary retention, then push sun gear against the washer.
- B. Install planetary ring gear onto ring gear hub (floating ring gear design).

## ASSEMBLE PLANETARY SPIDER

**NOTE:** Later axle models incorporate nylon coated steel planet pins. These pins are also used for service replacement of early model bronze planet pins. Utilize the following recommendations to obtain satisfactory component life and performance:

- A. Carefully inspect bores of planet gears. Do not re-use planet gears with bore surface roughness from previous use. A smooth bore surface is essential for proper function.
- B. When servicing an early axle model (bronze pin design) with new nylon coated planet pins, all three pins in the planetary spider should be changed. *Do not* mix bronze and nylon coated pins in the same spider. For optimum planet pin life, it is strongly recommended that *both* wheel ends are changed to the nylon coated pins simultaneously.

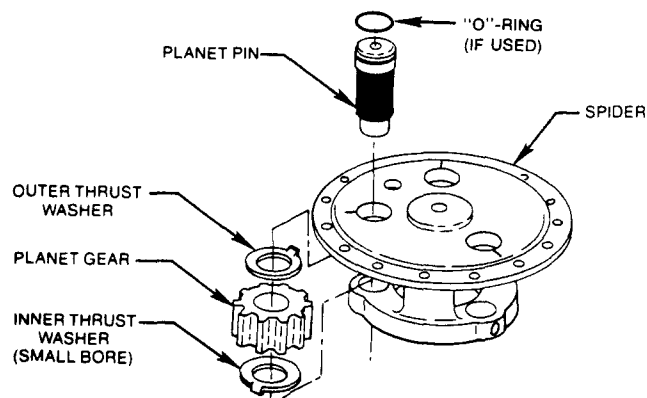
**IMPORTANT:** Debris from wear or failure *must* be thoroughly flushed from the wheel end (or from entire axle if common lube system is employed) as stated in previous section on "axle flush."

- C. Use of nylon coated planet pins in early axle models (which utilized bronze pins) requires new outer thrust washers which are included in kits along with detailed instructions. The planetary spider requires minor re-work to provide a recess for the tangs of the new thrust washers.

If planet pins do not have "O"-ring grooves disregard step D.

- D. Install the proper "O"-ring in the planet ring groove making sure that the "O"-ring is not twisted.

**IMPORTANT:** Chamfers on large bores must be smooth. Use an emery cloth to avoid damaging O-ring and/or nylon coating on planet pin during installation.



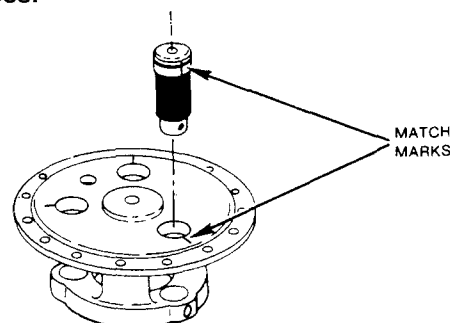
- E. Place the spider in a press with the flange side up. Block up as required.

- F. Install inner thrust washer with the washer tab engaged in the spider indent and the washer bore aligned with the spider bore.

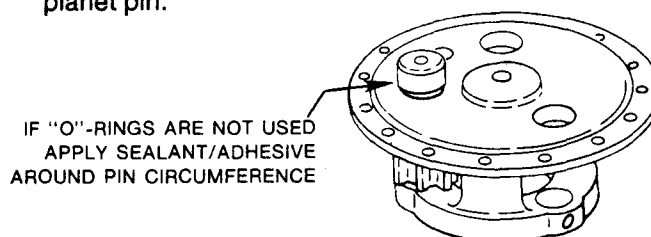
- G. Coat the bore of the planet gear with a film of the same GL-5 gear lube used in the wheel end. Slide planet gear and outer thrust washer into the spider. Align the bores of the parts and engage the outer thrust washer tab in the spider indent.

- H. Install the planet pin into the spider and through the planet gear and thrust washers by hand. The large end of the planet pin will bind in the spider bore due to an interference fit.

- I. On axle models with one-piece integral spider and cover align the match mark on the large diameter of the pin with the match mark on the spider. These match marks provide proper alignment of the set screw hole in the small end of the pin and the tapped set screw hole in the spider boss.



- J. Apply a film of non-hardening sealant (Permatex 51 or equivalent) to "O"-ring and large end of planet pin.



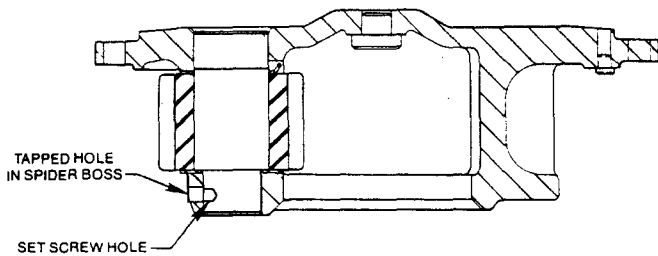
- K. If "O"-rings are not used, brush Loctite 271 (Rockwell Part No. 1199-B-3720) sealant/ adhesive on the planet pin O.D. protruding from the spider.

- L. Being careful to keep planet pin aligned, press pin into spider until the shoulder of the pin bottoms against the inner thrust washer.

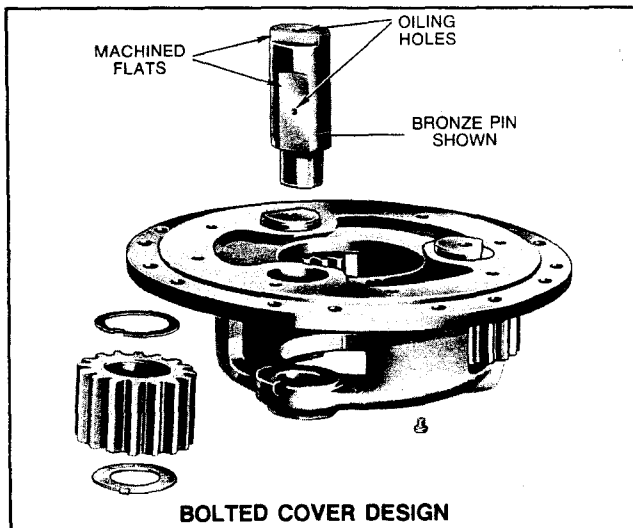
**NOTE:** If a press is not available use a brass drift and mallet to tap the pin through the spider and planet gear.



**CAUTION:** Do not strike planet pins directly with a steel hammer. Personal injury from chips or splinters may result.



M. Install set screws (if used) into spider and planet pin. New set screws have a pre-applied locking agent on the threads. If original set screws are used, apply one or two drops of Loctite 277 (Rockwell Part No. 2297-C-3747) to threads of spider before installing. Tighten set screw to 15-25 lb. ft. torque.



On axle models equipped with planet pins with machined flats, the pin must be installed so the "flat" is facing the outside of the hub circle. This allows cover clearance and properly locates the pin oiling holes.

**NOTE:** Nylon coated replacement pins do not have flats nor oiling holes in the area of planet gear contact.

N. Repeat the reassembly procedures to install the second and third sets of planetary pins, gears and washers.

## INSTALL SPIDER ASSEMBLY

A. Apply silicone RTV gasket material to spider flange at hub mounting face. Use silicone RTV gasket application procedures as follows:

## SILICONE (RTV) GASKET APPLICATION

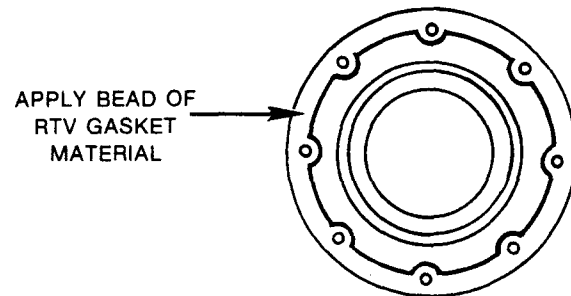
**NOTE:** Where silicone RTV gasket material is used, Dow Silastic No. RTV-732 Black and General Electric No. RTV-1473 Black meet our requirements. However, silicone RTV is also available in bulk under Rockwell part number 1199-Q-2981; in 10 oz. tubes, part number 1250-X-388, or in 3 oz. tubes, part number 1199-T-3842.

## Service

Removal of all gaskets including silicone RTV is accomplished by peeling or scraping the used gasket off both mating surfaces.

Application of silicone RTV gasket material is as follows:

1. Remove dirt, grease or moisture from both mating surfaces.
2. Dry both surfaces.



3. Apply a continuous thin bead, approximately  $\frac{1}{8}$ " diameter completely around one mating surface and around the inner edge of all fastener holes to assure complete sealing and prevent leakage.

**CAUTION:** Minor concentrations of acetic acid vapor may be produced during application of silicone RTV. Adequate ventilation should be provided when silicone RTV is applied in confined areas.

Further, eye contact with these silicone RTV gasket materials may cause irritation; if eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.

4. Assemble the components immediately to permit silicone RTV gasket material to spread evenly.

When rebuilding any assembly, always use torque values on fasteners as specified by either Rockwell or the vehicle manufacturer.

**NOTE:** Failure to use appropriate gasket material will cause axle to leak.

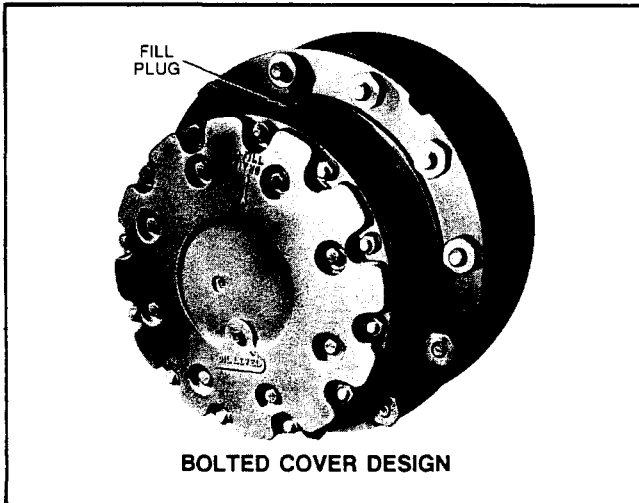
- B. Start the spider and pinion assembly, aligning teeth of planet gears with sun gear and ring gear teeth.

Align the match marks on the spider flange and the wheel hub as previously marked at disassembly.

- C. Align hub studs or holes with spider holes and push spider assembly against hub.
- D. Install spider washers and nuts or washers and capscrews.
- E. Tighten nuts or capscrews to specified torque.

## INSTALL PLANETARY SPIDER COVER (Where applicable)

- A. Apply silicone RTV gasket material to cover flange at spider mounting face. Use Silicone RTV gasket application procedure (see above).



- B. Install the spider cover and capscrews. Fill arrow must be in line with hub fill plug.
- C. Tighten cover capscrews to correct torque. (See page 28.)

## LUBRICATION

**NOTE: Correct types of lubrication and proper lubrication practices are specified in the Rockwell Field Maintenance Manual No. 1 on lubrication.**

New planetary axles should be drained of initial lubricant after 75 to 100 hours of operation. Drain while the axle is still warm.

The regular change interval should be whenever seals are replaced, brakes are relined, every 1,000 to 1,500 hours of operation or twice a year (spring and fall).

## FILL PROCEDURE

- A. Rotate the wheel end to position the lube level hole at the horizontal centerline of the axle. Lower the vehicle to the ground.

- B. For bolted cover design:  
Remove "fill/drain" plug from barrel of wheel hub (should be at top position) and the "oil level" plug from the planetary cover.

For one piece spider/cover design:

Remove the "drain/level/fill" plug from the planetary spider (one plug serves all purposes). The level mark should be in horizontal position.

For all axle models:

Also remove the "fill/level" plug in the axle housing bowl or bowl area.

- C. Make sure all magnetic plugs have been cleaned of metal particles and are securely re-installed.

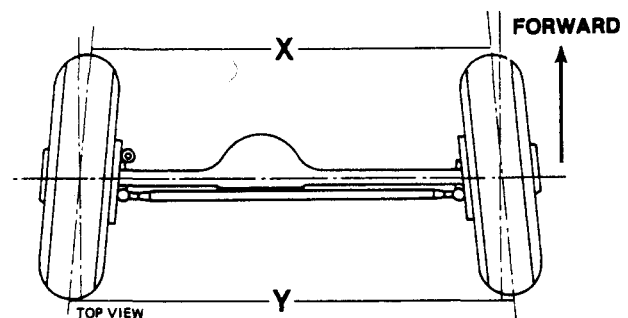
**NOTE: Only certain special applications approved by Rockwell International employ the carrier fill/level plug.**

- D. Fill wheel ends and housing bowl with the recommended GL-5 gear lubricant to the bottom of the level/fill hole. Wait for lube to evenly distribute throughout the wheel end. Check lube levels and add more lube if necessary. Replace all plugs and tighten securely.

Most rigid axles have common wheel end/housing bowl oil and oil level (no axle shaft oil seals are employed). To assure proper oil level, oil should be added at each wheel end and to the bowl. Do not fill through bowl only.

- E. For axles with separate housing bowl and wheel end lubricant (with axle shaft oil seals), fill each until lubricant appears at the level hole. Replace all plugs and tighten securely. For lubricant capacities refer to Rockwell Field Maintenance Manual #1 on Lubrication.

## STEERING ALIGNMENT



**Y MINUS X EQUALS TOE-IN**

Toe-in should be checked and adjusted on all front steering axles after being installed in a vehicle. Toe-in adjustment made by Rockwell on the assembly line is a single average setting. This will not be correct for all tire sizes and axle loadings. It is the OEM's responsibility to make the final setting.

Rockwell's practice for off-highway steer axles is  $1/16" \pm 1/16"$  toe-in based on a 24" radius (theoretical tire of 48" outside diameter).

Toe-in setting of new axles is performed with the axle in the unloaded condition.

## TANDEM/TRIDEM AXLE TIRE MATCHING

Unmatched tires on either Tandem Drive Units or Tridem Drive Units will cause tire wear and scuffing and possible damage to the drive units. Consequently we recommend the tires be matched to within  $1/8"$  of the same rolling radius,  $3/4"$  of the same rolling circumference.

### Tandem Units:

**IMPORTANT: The four largest tires should never be installed on one driving axle or the four smallest tires on the other driving axle. Such tire mounting will cause an inter-axle "fight," unusually high axle lubricant temperatures that result in premature lubricant breakdown and possible costly axle service.**

In addition to matching individual tire rolling radii or rolling circumference, we recommend matching, as nearly as possible, the total tire circumference of one driving axle to the tire circumference of the other driving axle. This will usually result in satisfactory tandem axle lubricant temperatures that lengthen drive unit service with higher tire mileage.

### Tridem Units:

When three driving axles are "hooked" together in a Tridem Series, unmatched tires will compound the problems described in the preceding paragraphs.

Therefore, we recommend matching, as nearly as possible, the total tire circumference of each of the three driving axles.

## HOW TO MATCH TIRES

### Tandem Units:

The vehicle should be on a level floor, carrying a correctly distributed rated capacity load. Be sure all tires are the same size.\*

1. Inflate all tires to the same pressure.
2. Carefully measure the rolling circumference of each tire with a steel tape.
3. Mark the size on each tire with chalk and arrange them in order of size, largest to smallest.
4. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.
5. Mount the four other tires on the other axle in the same manner.
6. Test run the vehicle to get accurate rear axle lubricant temperature readings on the two axle lubricant temperature gauges.
7. Vary tire air pressure, within the tire manufacturer's recommended range, so the lubricant temperature of both axles is within 30°F of each other and not in excess of 200°F. This will usually result in uniform tire loading and good tire life.

### Tridem Units:

Follow the same procedure (Items #1 through #7) for matching tires on a Tridem Unit. Arrange the tires in order of size. The two largest and two smallest go on one axle, the next two largest and smallest on the second axle, and the remaining four on the third axle.

\*Measure new tires to be sure they will be correctly matched.

## TORQUE VALUES

### TORQUE VALUES FOR CURRENT DESIGN PLANETARY AXLES (Axles Built Since 1978)

#### A. For select fasteners:

<u>FASTENER</u>	<u>THREAD SIZE</u>	<u>TORQUE (LB. FT.)</u> <u>MIN./MAX.</u>
Tie Rod Yoke Lock Nut	1" - 16	165 to 200
Tie Rod Yoke Lock Nut	1 3/4" - 16	165 to 200
Tie Rod Yoke Lock Nut	2" - 16	165 to 200
Tie Rod Clamp Bolt (Ball Joint End)	5/8" - 18	50 to 65
Tie Rod Yoke Clamp Bolt Nut	1/2" - 20	100 to 130
Tie Rod Yoke Clamp Bolt Nut	3/4" - 16	125 to 175
*Tie Rod Yoke Bolt Nut	7/8" - 14	0 to 5
*Tie Rod Ball Stud Nut	5/8" - 18	60 to 85
*Tie Rod Ball Stud Nut	7/8" - 14	150 to 200
*Tie Rod Ball Stud Nut	1 1/4" - 12	400 to 550
*Steer Arm Ball Stud Nut	5/8" - 11	60 to 85
*Steer Arm Ball Stud Nut	3/4" - 16	90 to 125
*Steer Arm Ball Stud Nut	1" - 12	250 to 350
*Steer Arm Ball Stud Nut	1 1/8" - 12	350 to 490
*Steer Arm Ball Stud Nut	1 1/4" - 12	400 to 550
Wheel Bearing Nut Lock Screw	3/8" - 16	35 to 50
Wheel Bearing Nut Lock Screw	7/16" - 14	60 to 75
Steer Stop Bolt Jam Nut	7/8" - 14	150 to 190
Steer Stop Bolt Jam Nut	5/8" - 11	60 to 75
Steer Stop Bolt Jam Nut	1/2" - 13	50 to 65

\*Use wrench torque shown and as much more as necessary to line up the next cotter pin hole. *Do not back off.*

#### B. For all other fasteners (except carrier components — see appropriate Field Maintenance Manual on carriers): Use appropriate GRADE 8 torque.

- Since 1978 all fasteners have been GRADE 8. See following torque chart for proper torque value based on thread size and type of fastener.
- Nuts used on double end studs should be tightened to the appropriate *coarse* thread torque. If nut is a locknut type, use coarse thread torque value under "locknut" heading.

## ROCKWELL TORQUE SPECIFICATIONS—STANDARD FASTENERS

Size	Series	Grade 5		Grade 6 and 7		Grade 8	
		Locknuts	Plain Nuts And Screws	Locknuts	Plain Nuts And Screws	Locknuts	Plain Nuts And Screws
1/4-20	UNC	75-100 Lbs.-In.	85-115 Lbs.-In.	85-115 Lbs.-In.	105-135 Lbs.-In.	105-135 Lbs.-In.	120-160 Lbs.-In.
1/4-28	UNF	85-115 Lbs.-In.	105-135 Lbs.-In.	105-135 Lbs.-In.	120-160 Lbs.-In.	120-160 Lbs.-In.	12-16 Lbs.-In.
5/16-18	UNC	12-16 Lbs.-Ft.	15-20 Lbs.-Ft.	15-20 Lbs.-Ft.	18-24 Lbs.-Ft.	18-24 Lbs.-Ft.	20-30 Lbs.-Ft.
5/16-24	UNF	15-20 Lbs.-Ft.	18-24 Lbs.-Ft.	18-24 Lbs.-Ft.	20-30 Lbs.-Ft.	20-30 Lbs.-Ft.	20-30 Lbs.-Ft.
3/8-16	UNC	20-30 Lbs.-Ft.	25-35 Lbs.-Ft.	25-35 Lbs.-Ft.	30-40 Lbs.-Ft.	30-40 Lbs.-Ft.	35-50 Lbs.-Ft.
3/8-24	UNF	25-35 Lbs.-Ft.	30-40 Lbs.-Ft.	30-40 Lbs.-Ft.	35-50 Lbs.-Ft.	35-50 Lbs.-Ft.	40-55 Lbs.-Ft.
7/16-14	UNC	35-50 Lbs.-Ft.	40-55 Lbs.-Ft.	40-55 Lbs.-Ft.	50-65 Lbs.-Ft.	50-65 Lbs.-Ft.	60-75 Lbs.-Ft.
7/16-20	UNF	40-55 Lbs.-Ft.	50-65 Lbs.-Ft.	50-65 Lbs.-Ft.	60-75 Lbs.-Ft.	60-75 Lbs.-Ft.	65-85 Lbs.-Ft.
1/2-13	UNC	60-75 Lbs.-Ft.	65-85 Lbs.-Ft.	65-85 Lbs.-Ft.	75-100 Lbs.-Ft.	75-100 Lbs.-Ft.	85-115 Lbs.-Ft.
1/2-20	UNF	65-85 Lbs.-Ft.	75-100 Lbs.-Ft.	75-100 Lbs.-Ft.	85-115 Lbs.-Ft.	85-115 Lbs.-Ft.	100-130 Lbs.-Ft.
9/16-12	UNC	75-100 Lbs.-Ft.	85-115 Lbs.-Ft.	100-130 Lbs.-Ft.	110-145 Lbs.-Ft.	110-145 Lbs.-Ft.	130-165 Lbs.-Ft.
9/16-18	UNF	85-115 Lbs.-Ft.	100-130 Lbs.-Ft.	110-145 Lbs.-Ft.	130-165 Lbs.-Ft.	130-165 Lbs.-Ft.	150-190 Lbs.-Ft.
5/8-11	UNC	110-145 Lbs.-Ft.	130-165 Lbs.-Ft.	130-165 Lbs.-Ft.	150-190 Lbs.-Ft.	150-190 Lbs.-Ft.	180-230 Lbs.-Ft.
5/8-18	UNF	130-165 Lbs.-Ft.	150-190 Lbs.-Ft.	150-190 Lbs.-Ft.	180-230 Lbs.-Ft.	180-230 Lbs.-Ft.	210-270 Lbs.-Ft.
3/4-10	UNC	180-230 Lbs.-Ft.	230-300 Lbs.-Ft.	230-300 Lbs.-Ft.	270-350 Lbs.-Ft.	270-350 Lbs.-Ft.	310-400 Lbs.-Ft.
3/4-16	UNF	210-270 Lbs.-Ft.	270-350 Lbs.-Ft.	270-350 Lbs.-Ft.	310-400 Lbs.-Ft.	310-400 Lbs.-Ft.	360-470 Lbs.-Ft.
7/8-9	UNC	310-400 Lbs.-Ft.	360-470 Lbs.-Ft.	360-470 Lbs.-Ft.	440-580 Lbs.-Ft.	440-580 Lbs.-Ft.	500-650 Lbs.-Ft.
7/8-14	UNF	360-470 Lbs.-Ft.	440-580 Lbs.-Ft.	440-580 Lbs.-Ft.	500-650 Lbs.-Ft.	500-650 Lbs.-Ft.	575-750 Lbs.-Ft.
1.0-8	UNC	440-580 Lbs.-Ft.	500-650 Lbs.-Ft.	575-750 Lbs.-Ft.	650-875 Lbs.-Ft.	650-875 Lbs.-Ft.	775-1000 Lbs.-Ft.
1.0-12	UNF	500-650 Lbs.-Ft.	575-750 Lbs.-Ft.	650-875 Lbs.-Ft.	725-950 Lbs.-Ft.	725-950 Lbs.-Ft.	850-1100 Lbs.-Ft.
1.0-14	UN	500-650 Lbs.-Ft.	575-750 Lbs.-Ft.	650-875 Lbs.-Ft.	725-950 Lbs.-Ft.	725-950 Lbs.-Ft.	850-1100 Lbs.-Ft.

Torques given apply to parts lightly covered with rust preventing oil, unplated and uncoated. For dry parts, increase torques 10%. For parts coated with multi-purpose gear oil, decrease torques 10%. Nuts used on double end studs require the appropriate coarse thread torque. Locknuts are normally coated with a lubricant (dry to the touch) which reduces friction, therefore less torque is required to produce the clamping load.

**TORQUE VALUES FOR ORIGINAL DESIGN PLANETARY AXLES  
(Axles Built Prior to 1978)**

**A. For Tie Rod Yoke and/or Ball Joint Fasteners**

Steer Arm Ball Stud Nuts

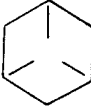



Steer Stop Bolt Jam Nuts

Wheel Bearing Nut Lock Screws

Use same torque as shown in part "A" of "Current Design Torque Values."

**B. For all other fasteners (except carrier components — see appropriate Field Maintenance Manual on carriers) use appropriate torques for *size*, *grade* and type as shown on preceeding chart (page 28).**

- Fastener Grade — the majority of threaded fasteners are grade 8, however, some grade 5 capscrews/bolts and grade 6 studs (double ended) were used.

GRADE IDENTIFICATION			
FASTENER	GRADE 5	GRADE 6	GRADE 8
CAPSCREW OR BOLT HEAD		NOT USED	
STUDS	NOT USED	 PLAIN END	 FIGURE 8 STAMPED

- Locations of GRADE 5 capscrews/bolts:
  - Brake dust shield mounting
  - Brake cylinder and actuator mounting
  - Brake camshaft collar
  - Housing flange half joint (PR-35 series)
- Locations of GRADE 6 studs (some axles):
  - Carrier to axle housing mounting studs
  - Brake camshaft support bracket mounting studs
  - Hydraulic motor mounting studs
  - Steer arm mounting studs
  - Planetary spider to wheel hub mounting studs (PR-75 through PR-120).
- Proper nut torque is based on:
  - Grade of stud or bolt
  - Thread size (where used on double ended studs tighten to the appropriat coarse thread torque value).
  - Type of nut (plain or self-locking type)
- Proper capscrew torque is based on:
  - Grade of capscrew
  - Thread size

## PLANETARY AXLE MODEL CROSS-REFERENCE CHART

Old	New	Old	New	Old	New
PR-30	PRA-104	PR-190	PRM-855	PS-50	PSS-165
PR-35	PRA-134 <sup>1</sup>	PR-204	PRM-676, 7	PS-60	PSS-165
PR-35	PRA-164 <sup>2</sup>	PR-205	PRM-676, 7	PS-61	PSS-165
PR-37	PRA-174	PR-207	PRM-676, 7	PS-101	PSS-334
PR-54	PRLC-176	PR-208	PRM-676, 7	PS-114	PSS-334
PR-60	PRS-165	PR-209	PRLC-675	PS-151	PSC-614
PR-62	PRC-184	PR-223	PRLC-1355	PS-157	PSM-824, 5
PR-65	PRS-204, 5	PR-235	PRC-1755	PS-201	PSC-616
PR-66	PRS-204, 5	PR-250	PRM-1756, 7	PS-205	PSC-616
PR-68	PRS-204, 5	PR-251	PRM-1756, 7	PS-210	PSC-826
PR-75	PRS-624, 5	PR-253	PRLC-1756, 7	PS-250	PSM-826
PR-76	PRS-624, 5	PR-256	PRM-1314, 5	PS-251	PSM-826
PR-78	PRC-574, 5	PR-256	PRM-1615 <sup>4</sup>	PS-254	PSC-1045
PR-80	PRS-594	PR-258	PRM-1724, 5	PS-256	PSM-826
PR-106	PRS-344	PR-270	PRLC-823	PS-260	PSM-1044, 5
PR-107	PRS-344	PR-273	PRLC-1374	PS-261	PSM-1044, 5
PR-108	PRLC-614	PR-275	PRLC-824	PS-270	PSM-1614
PR-108	PRLC-794	PR-305	PRC-1935	PS-350	PSC-1874, 5
PR-112	PRLC-344	PR-311	PRLC-1935	PS-500	PSC-4564
PR-112	PRLC-596 <sup>3</sup>	PR-313	PRLC-1935		
PR-114	PRC-345	PR-350	PRC-3795, 6		
PR-115	PRS-626	PR-351	PRC-3796	SPR-150	SPRC-671
PR-118	PRC-672	PR-352	PRC-4025	SPR-200	SPRC-1357
PR-120	PRS-596	PR-400	PRC-1925	SPR-250	SPRC-1734
PR-130	PRC-694	PR-408	PRC-1925	SPR-270	SPRC-1736
PR-150	PRM-672, 3	PR-502	PRC-4805	SPR-400	SPRC-1923
PR-151	PRM-672, 3	PR-503	PRC-4805	SPR-570	SPRC-4806
PR-153	PRM-672, 3	PR-504	PRC-4807		
PR-154	PRC-654, 5	PR-705	PRC-7314		
PR-158	PRC-863, 4				

<sup>1</sup>With welded spindle    <sup>3</sup>PR-80 wheel end  
<sup>2</sup>With bolted spindle    <sup>4</sup>Wide planetary gearing



## **Rockwell International**

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**FMM-9 (Revised 5-84)**  
**Supersedes FMM-9A and all**  
**previous FMM-9 manuals**

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