Tandem Axle Forward Rear Drive Units

Maintenance Manual No. 6B

Double Reduction
- STD
- STDD
- SUD
- SUDD
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Top-mounted double-reduction drive units in the SUD and STD series made by Meritor Automotive incorporate hypoid first reduction gears and helical spur gears in the second reduction.

The thru-shafts of the hypoid gear drive units are supported at the forward end by tapered roller bearings in a cage and at the rear end by a ball bearing. Pinion bearing preload is adjusted and maintained by a hardened precision spacer between the inner and outer tapered bearings which are held in place on the pinion journal by large nuts. Yokes and flanges are held in place on the thru-shaft by separate thru-shaft nuts.

The inter-axle differential may be either engaged or disengaged by a power shift unit which moves a sliding collar on the pinion quill assembly.

The shift unit is controlled by a selector switch or lever within the cab of the vehicle and may be engaged or disengaged under any normal operating conditions. The inter-axle differential when engaged (unlocked) divides the engine torque between the forward and rear axles, when disengaged (locked) converts the two axles to a through drive type tandem. The following Schematic Drawing illustrates the action of the inter-axle differential assembly.

The single gray tone shows the differential “locked-up,” inoperative, with the tandem functioning as a thru-drive assembly.

The double gray tone illustrates the differential operating under normal conditions, distributing equal amounts of torque to the axles.
The rear side gear of the inter-axle differential has splines on the I.D. and engages mating splines of the pinion and quill assembly, driving the forward axle. The front side gear of the differential also has splines on the I.D. and engages the mating splines of the thru-shaft that extends through the pinion and quill assembly and drives the rear axle.

Hypoid drive units of the thru-drive type have pinions that are separable from the thru-shafts and are serviced with the mating gears as matched sets. We assume no responsibility for gears of these types serviced in any manner other than matched sets. The pinion and quill assembly used with the inter-axle differential of the forward hypoid gear top-mounted drive units is serviced as an assembly with matched hypoid gears.

**REMOVE AND DISASSEMBLE DRIVE UNIT**

**REMOVE DRIVE UNIT FROM HOUSING**

A. Remove plug from bottom of axle housing and drain lubricant.

B. Remove the axle shaft stud nuts, lockwashers and tapered dowels

**IMPORTANT:** To loosen the dowels, hold a 1½ inch diameter brass drift against the center of the axle shaft head, INSIDE THE CIRCULAR DRIVING LUGS. Strike the drift a sharp blow with a 5 to 6 pound hammer or sledge. A 1½ inch diameter brass hammer is an excellent and safe drift.

**CAUTION:** Do not hit the circular driving lugs on the shaft head – this may cause the lugs to shatter and splinter. Do not use chisels or wedges to loosen the shaft or dowels – this will damage the hub, shaft and oil seal

C. Remove the axle shaft from the drive unit and housing.

D. Disconnect the forward and rear propeller shafts.

E. Remove carrier to housing stud nuts and washers.

F. Break carrier loose from housing with rawhide mallet and remove tapered dowels. Dowels must be removed. If necessary back out studs.

G. Pull carrier straight out of housing with chain fall, boom or “A” frame.

A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange.

**REMOVE AND DISASSEMBLE DIFFERENTIAL**

A. Mount drive unit in suitable repair stand and cut lock wire. Remove cap screws and adjusting nut locks.

B. Center-punch one differential carrier leg and bearing cap to correctly identify for proper reassembly.

C. Remove bearing cap stud nuts or cap screws, bearing caps and adjusting nuts, split rings (if used), and bearing cups.

D. Lift out differential and gear assembly.
E. If original identification marks are not clear, center-punch case halves for correct alignment during reassembly.

G. Insert short sleeve in case axle shaft bore and separate assembly by striking sleeve as illustrated.

H. When the case assembly is held together with rivets, remove the rivets by drilling out rivet body as illustrated below:

1. Carefully center punch rivets in center of head.
2. Use drill 1/32" smaller than body of rivet to drill through head.
3. Press out rivets.

NOTE: Differential may be held together with bolts and nuts or rivets.

F. When bolts are used, cut lock wire or cotter pins and remove nuts. Drive bolts from case assembly with convenient drift.

CAUTION: Do not strike these hardened steel pieces directly with a steel hammer.

Note elongated differential case and gear rivet holes that result from cutting rivets with chisel.
I. Remove side gears, spider and pinion assembly and thrust washers.

J. Remove differential bearings from case halves with suitable puller.

DISASSEMBLE INTER-AXLE (3rd) DIFFERENTIAL ASSEMBLY

A. Remove input shaft cotter key using a suitable holder for flange or yoke. Loosen nut, but do not remove at this time.

B. Remove the inter-axle differential cover cap screws and lock washers and lift the assembly from the carrier.

C. Remove input shaft nut and washer.

NOTE: Inner bearing cone and spacer will remain on input shaft. Retain spacer for rebuild.

IMPORTANT: Oil seal assembly and outer bearing will remain in inter-axle differential cover. Do not remove unless necessary.

E. If original identification marks are not clear, mark the differential case sections with a punch or chisel for correct alignment during reassembly.
F. Disassemble case sections and remove spider, pinions, side gears and thrust washers. Do not remove the bearing from the case unless replacement is necessary.

G. If it is necessary to replace the outer bearing in the cover, drive the oil seal from the cover and remove bearing.

**REMOVE AND DISASSEMBLE HYPOID PINION AND QUILL, BEARING AND HOUSING ASSEMBLY**

A. Remove shift shaft housing cap screws and lock washers. Remove shift shaft housing assembly.

B. Disassemble and remove shift lever attaching nut, button, lever, cup and spring. Body fit bolt should not be removed.

*NOTE: Shift unit may be single or double line vacuum, air or electric.*

C. Remove inter-axle differential shift collar from pinion quill assembly.

D. Cut housing cap screw or stud nut lock wire. Remove cap screws or stud nuts. Also remove cross shaft cover and carrier inspection cover.

E. Lightly tap on the top edge of housing with a rawhide hammer to loosen it from carrier.

F. Remove housing and pinion quill assembly. Wire shim pack to carrier to aid reassembly.

G. Clamp the pinion and quill assembly in a copper-jawed vise and straighten pinion bearing outer (jam) nut lock washer.

H. Remove the pinion bearing outer nut and lock washer, inner adjusting nut lock and inner adjusting nut. A hard wood wedge inserted between the teeth of the hypoid pinion and hypoid gear will prevent the gears from turning while loosening and tightening the bearing adjusting and jam nuts when the gears are assembled in the carrier.
J. Remove housing and outer bearing from the pinion and quill assembly.

K. Remove the pinion bearing spacer. Note O.D. chamfer is toward outer bearing.

L. Remove the rear pinion bearing using a suitable puller or other tool in press.

M. Remove pinion quill rear bearing inner race outer snapring.

N. Remove the pinion quill rear bearing inner race using a suitable puller or press. Exercise care not to damage inner snapring.
**REMOVE AND DISASSEMBLE THRU-SHAFT ASSEMBLY**

**A.** Remove the thru-shaft bearing cage, cover and seal assembly capscrews.

**B.** Remove the thru-shaft assembly by lightly tapping on the forward end with a rawhide hammer.

**C.** Remove the pinion quill rear bearing from carrier with suitable puller.

**D.** Remove snapring and tap thru-shaft ball bearing cage from bearing with sleeve.

**E.** Remove thru-shaft ball bearing with puller having long fingers that pull against bearing inner race.
DISASSEMBLE CROSS SHAFT ASSEMBLY

A. Remove cross shaft cover capscrews, lock washers and cover. Attach shim pack, which controls cross shaft bearing preload, to cover. This will facilitate preload adjustment when reassembling drive unit.

B. Cut lock wire from bearing retainer plate cap screws and remove screws and plate.

C. Insert hard wood block between end of cross shaft and outer thru-shaft chamber wall. Remove bearing cage and tapered bearings with suitable puller, using 3/8”-16 puller screws in cage flange tapped holes. Attach shim pack, which controls gear backlash to cage. This will facilitate adjustment when reassembling drive unit.

D. Tap cross shaft and gear assembly toward thru-shaft chamber in carrier, so semi-circular blocks can be inserted between back of gear and inner thru-shaft chamber wall.

E. Position drive unit in press, thru-shaft chamber up, with blocks under gear and press cross shaft from gear.

Provide a rigid support on the press bed for the drive unit during this operation. A sleeve with a ¾” or 1” wall and I.D. approximately the size of the cross shaft cage O.D. is suitable; or, the drive unit may be supported by a horizontal flat plate 10” x 10” x 1” with a bored hole about the same size as the cross shaft cage O.D. Support the horizontal plate on heavy vertical plates of a convenient size.

NOTE: Two pieces of ¾” steel square bar stock, approximately 10” long, bent to form segments of an 18” diameter circle, will facilitate cross shaft removal.
F. Lift or tap out radial bearing and gear assembly from drive unit; do not lose gear washer. Remove bearing from gear with pry bars or suitable puller.

H. Remove cross shaft tapered bearing inner and outer cones and outer cup from cage with suitable puller or with sleeve in press.

Exploded view of components of cross shaft assembly showing gear, radial bearing, washer, and cross shaft.

J. Remove cage inner cup with suitable puller or with sleeve in press.

G. Do not remove radial bearing sleeve from drive unit unless replacement of sleeve is necessary.
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.

GASOLINE SHOULD BE AVOIDED.

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

We do NOT recommend steam cleaning 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.

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 overstate the importance of careful and thorough inspection of drive unit 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 drive unit failure.

A. Inspect all bearings, cups and cones, including those not removed from parts of the drive unit and replace if rollers or cups are 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.

B. Inspect first reduction bevel or hypoid and second reduction spur gears for wear or damage. Gears which are pitted, galled or worn or broken through case hardening should be replaced.

When necessary to replace the pinion or gear of a spiral bevel or hypoid gear set, the entire gear set should be replaced. We assume no responsibility for gears of these types when replaced in any other manner.

C. Inspect the differential assembly for the following:

1. Pitted, scored or worn thrust surfaces of differential case halves, thrust washers, spider trunnions and differential gears.

   Thrust washers must be replaced in sets. The use of a combination of old and new washers will result in premature failure.

2. Wear or damage to the differential pinion and side gear teeth.

   Always replace differential pinions and side gears in sets.
D. Spur pinions for wear or damage to teeth.

E. Check end of pinion for indications of brinelling caused by worn splines. Replace the parts if the splines of the pinion and/or thru-shaft are worn, permitting movement of the pinion on the thru-shaft.

F. Axle shafts for indications of torsional fractures and runout. Axle shafts should be inspected between centers to ascertain the amount of runout of the ground surfaces. Runout at the shaft flange and splines should not exceed .005" total indicator reading.

**REPAIR**

A. Replace all worn or damaged parts. Hex nuts with rounded corners, all lock washers, oil seals and gaskets should be replaced at the time of overhaul.

Use only genuine Meritor parts for satisfactory service. For example, using gaskets of foreign material generally leads to mechanical trouble due to variations in thickness and the inability of certain materials to withstand compression, oil, etc.

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 parts.

C. All Meritor bronze bushed axle differential and inter-axle differential pinions should be ball burnished after bushing installation. Install the bushing with a small stepped drift. The small O.D. should be .010" smaller than the bushing burnished I.D. and 1-1/2 times bushing length. Always install bushings so end is even with the I.D. chamfer or about 1-1/2 16" below the machined surface.

D. When assembling component parts use a press where necessary. Avoid hammering.

E. Tighten all nuts to specified torque. See torque limits following service instructions.

Lock wire must not be brittle; use soft iron wire to prevent possibility of wire breakage.

F. The burrs, caused by lock washers, at the spot face of stud holes of cages and covers should be removed to assure easy reassembly of these parts. The stud holes are standard sizes (fractions of an inch) and may be reamed with standard size reamers. Start the reamer or drill on side of flange opposite spot face so the tool will have from 3/8" to 1/2" pilot as it cuts the burr from the hole.

**REASSEMBLE AND INSTALL DRIVE UNIT**

The cross shaft assembly must be installed in the carrier first so cross shaft bearing preload can be established without interference of the thru-shaft and pinion assembly. The thru-shaft, pinion, bearing and cage may be assembled at the bench and then installed in the carrier.
A. Check sleeve I.D. and radial bearing O.D. Replace sleeve and/or bearing if the parts are damaged, or if there is more than .006" clearance between the sleeve and bearing. When these parts are new the sleeve I.D. should be .0024" to .004" larger than the bearing O.D. The radial bearing must be free to float in the sleeve.

Carefully check the I.D. of the bearing bore of older drive units that do not have replaceable sleeves. If the I.D. is more than .006" larger than the bearing O.D., replace the carrier and cap assembly with the newer type carrier and cap assembly that incorporates replaceable sleeves.

B. If radial bearing sleeve is to be replaced, press new sleeve firmly against housing shoulder. Drill hole for lock screw and remove burrs from sleeve. Install lock screw and tighten securely or install pin and stake in place.

C. Assemble radial bearing on gear hub, large radius of bearing inner race toward back of gear.

D. Install bearing washer on cross shaft with chamfer of spacer away from radial bearing. A large flat washer is used at this location when the O.D. of the pinion teeth is smaller than the I.D. of the radial bearing. (see photo)

E. Coat I.D. or gear with heavy grease such as Meritor Spec. O-616A. Install gear, and bearing assembly in drive unit sleeve and block up to hold in place.

F. Inspect entering end of cross shaft and remove any nicks or burrs. Coat O.D. of shaft with a heavy grease such as Meritor Spec. O-616A.

G. Position housing in press, thru-shaft chamber down with gear supported on suitable sleeve.

H. Align key in cross shaft (do not drop bearing washer) with keyway in gear and press shaft firmly into gear and bearing. Continue pressing operation, exert 10 to 20 tons pressure in excess of that required for secure assembly.

Begin the assembly operation in the press, making sure the parts are properly aligned. Press the parts together about ¼" to 3/8", then relieve the press pressure to permit them to re-align themselves to prevent distortion and damage. Continue the pressing operation until the parts are correctly assembled.

NOTE: If inner tapered bearing cup has been removed from cross shaft cage, re-assemble in press using sleeve or other suitable installation tool. Press cup firmly against cage shoulder.
I. Install original shim pack (which controls gear back lash) over cross shaft opening in carrier. Apply colloidal graphite lubricant to cross shaft bearing journal. Place cage in carrier over shim pack, carefully aligning oil holes in cage with oil holes in drive unit. Press bearing cage partway into carrier.

J. Press inner bearing part-way onto cross shaft, then install outer bearing and cup onto cross shaft. Use a suitable sleeve and press bearings and cage completely into carrier.

K. Assemble bearing retainer plate with 2 capscrews. Tighten capscrews to specified torque and lock with soft iron wire.

L. Install bearing cage cover original shim pack (which controls tapered bearing preload).

M. Assemble bearing cage cover, lock washers and capscrews. Tighten to specified torque.

N. Measure cross shaft bearing preload torque. Wrap strong cord around spur pinion and pull on horizontal line with pound scale.

The preload torque specification for tapered roller bearings mounted close together in the bearing cage is 5 to 15 pound inches (new and serviceable used bearings).

Example: Assume spur pinion diameter is 4", the radius is 2", and with 5 pounds pull on the scale, preload torque is 10 pound inches.

Read rotating pounds pull, not starting pounds pull. If preload torque is not within 5 to 15 pound inches, add shims between cover and cage to decrease, or remove shims to increase cross shaft bearing preload torque.

If the pinion, quill and through shaft assembly was not disassembled disregard reassembly section Pages 18, and 19 and temporarily install the pinion, quill and through shaft into carrier (Page 19, Item H) for tooth contact and backlash check. See backlash and tooth contact section, Pages 21 and 22. Continue reassembly by installing the shift unit, Page 19. If the pinion, quill and through shaft assembly was disassembled, continue with Item “A” Page 18.
RESASSEMBLE AND INSTALL HYPOID PINION AND QUILL, BEARING AND HOUSING ASSEMBLY


*Begin the assembly operation in the press, making sure the parts are properly aligned. Press the parts together about 1/4" to 3/8", then relieve the pressure to permit them to realign themselves to prevent distortion and damage. Continue the pressing operation until the parts are correctly assembled.*

B. Lubricate all bearing journals only with a few drops of engine oil and firmly press inner bearing on pinion and quill assembly.

C. Install original spacer on inner bearing. O.D. chamfer of spacer must be toward outer (forward) bearing.

D. Position housing and cup assembly on pinion. Press bearing firmly against selective spacer with suitable sleeve, rotating housing assembly to assure normal bearing contact.

E. Measure pinion bearing preload torque while in press under 9 tons pressure. Wrap strong cord around housing pilot and pull on horizontal line with a pound scale. If a press is not available, the pinion bearing nut may be tightened to the torque noted in “Tabulation of Torque Limits” (back of Manual) and preload torque checked.

The preload torque specification for tapered roller bearings mounted close together in the bearing cage is 5 to 15 pound inches (new and serviceable used bearings).

*Example: Assume the housing pilot diameter is 6", the radius is 3" and with 3 pounds pull on the scale, preload torque is 9 pound inches.*

Read rotating pounds pull on scale, not starting pounds pull. If rotating torque is not within 5 to 15 pound inches, use a thinner spacer to increase or a thicker spacer to decrease preload torque.

F. Assemble bearing adjusting nut onto pinion and tighten nut to specified torque. Recheck bearing preload. Install nut lock, flat washer and lock (jam) nut. Bend flat washer over nut flat.
(A hardwood wedge inserted between the teeth of the hypoid pinion and hypoid gear will prevent the gears from turning while loosening and tightening the bearing adjusting and jam nuts when the gears are assembled in the carrier.)

H. Loosely install two guide studs in carrier if cap screws are used to hold housing assembly in place. Position original shim pack over studs so oil holes are in correct alignment.

I. Carefully tap pinion, housing and gear assembly in place.

G. Install pinion quill rear bearing in carrier with suitable sleeve. Check location with thru-shaft ball bearing retainer.

A. Install thru-shaft ball bearing firmly against shaft shoulder and assemble shaft and bearing assembly in retainer.

B. Position gasket over bearing retainer and install shaft, bearing and retainer assembly into carrier.

C. Alternately tighten six evenly spaced capscrews to draw assembly in place. Tighten capscrews to correct torque.

D. Coat seal body and seat with non-hardening sealing compound and install in cover with suitable sleeve. Lubricate sealing element.

E. Install thru-shaft yoke or flange, washer and nut. Tighten nut to specified torque and cotter in place.

**SHIFT UNIT INSTALLATION**

A. Slide inter-axle differential shift collar onto pinion quill assembly (Dog teeth facing out).

NOTE: Before installing shift unit into carrier, adjust shift fork as follows:

1. Hold shift fork in the “unlocked” position.
REASSEMBLE INTER-AXLE DIFFERENTIAL

2. Turn adjusting screw (at front of unit) in, to contact shift fork.

3. After contact with fork has been made, turn adjusting screw in, 3/4 of a turn.

4. Lock adjusting screw in position with jam nut.

B. Install shift unit into carrier engaging shift collar on pinion quill assembly with shift fork.

C. Assemble shift lever attaching nut, button, lever, cup and spring.

D. Install shift shaft housing assembly, lockwashers and capscrews.

NOTE: Do not adjust shaft until inter-axle differential has been installed.

ASSEMBLE INTER-AXLE DIFFERENTIAL

A. Lubricate differential case walls and all component parts with axle lubricant.

B. Position thrust washer and rear side gear into rear case section and assemble intermediate case section over real case and side gear.

C. Place spider with pinions and thrust washers in position.

D. Install forward side gear and thrust washer.

NOTE: If inner bearing was removed from forward case (Input shaft), position bearing on shaft and press into position using suitable sleeve. Press bearing flush against case half.

E. Align mating marks, of the three case sections.

F. Install the case cap screws, tighten to correct torque and lock wire.

G. Check for free rotation of gears and correct if necessary.

COVER BUILD-UP

A. If the cover assembly was disassembled, install the forward and read bearing cups.

B. Install the spacer on the input shaft.

C. Place unit in press and position the cover assembly over the input shaft and press outer bearing in cover until the bearing seats against the spacer.

D. Install the cover oil seal with a suitable driver.

BEARING END PLAY CHECK

NOTE: Bearing must be adjusted to .003 to .005 end play which is controlled by the hardened spacer between the bearings. Use the following method:

A. Install gasket and position inter-axle differential and cover assembly onto drive unit. Line-up splines of through shaft and pinion with splines of side gears.

B. Install inter-axle differential cover to housing capscrews and lockwashers. Tighten capscrew to recommended torque value.

C. Install yoke or flange and hand tighten nut.

D. With rawhide mallet tap input shaft to be certain bearings are properly seated.

ADJUSTMENT:

1. Use a dial indicator with a magnetic base and mount base against cover.

2. Place stem of indicator against end of input shaft.
3. While watching the indicator push inward on the flange or yoke and roll it back and forth until the indicator stops changing. Make a note of this reading. In a similar manner, pull outward and roll the flange or yoke until the indicator again stops changing. The difference between this reading and the inward reading is the adjustment condition.

4. Correct to .003 to .005 end play if necessary by using thicker or thinner spacer.

E. Remove yoke or flange and input nut.

F. Install oil slinger if used, reinstall yoke or flange, input washer and nut. Tighten nut to recommended torque value.

SHIFT SHAFT ADJUSTMENT

1. Apply air or vacuum to move shaft to its full travel to “lock” inter-axle differential.
2. Turn adjusting screw (in rear of unit) to contact shift shaft.
3. After contact with shaft has been made turn adjusting screw in 3/4 of a turn.
4. Lock adjusting screw in position with jam nut.

ESTABLISH TOOTH CONTACT AND GEAR BACKLASH

Hypoid gear first-reduction units have a single shim pack between the pinion cage and carrier or inter-axle differential housing and carrier to control pinion position. A shim pack between the cross shaft bearing cage flange and the carrier controls the position of the first-reduction hypoid gear in all top-mounted double reduction drive units.

(NEW GEARS)

Tooth contact may be checked by applying a thin even coat of lightly oiled red lead with a small brush to both drive and coast sides of a dozen teeth of the gear. When the pinion is rotated the red lead is squeezed from the gear teeth by pressure of the pinion teeth leaving areas the exact size, shape and location of the contacts. Sharper, better defined areas of contact can be obtained by applying rolling resistance to the gear providing the gear is not forced out of location during the checking operation.

Use the smallest amount of the lead and oil mixture that will render good impressions. The drier the mixture the better the impressions. Clean the material from the gear and pinion teeth when the operation is complete. Always judge tooth contact by noting pattern on the drive side of the gear teeth. The coast side pattern should be correct when the drive side pattern is correct.

IMPORTANT: When backlash amount is not specified, set backlash to the following:

STDD
Forward Rear - .005 to .015
Rear Rear - .005 to .015

SUDD
Forward Rear - .005 to .015
Rear Rear - .020 to .026, however, .010 should be used for establishing tooth contact pattern, than opened to .020 to .026.

RE-CHECK BACKLASH (USED GEAR SETS)

Generally, if original gears are being re-installed in assembly, red leading of teeth will not indicate the same contact as new gears and can be misleading. Gears that have been in service for long periods form running contacts due to wear of teeth. Therefore, the thickness of the original shim pack plus approximately .015” additional shim stock should be maintained to check gear lash. In the event that gear lash is in excess of maximum tolerance, as stated under gear adjustment, reduce gear lash only in the amount that will avoid overlap of the worn tooth section.

Gear lash can only be reduced to a point of maintaining smooth rotation of bevel gears.

Smoothness or roughness can be noted by rotating bevel gear. If a slight overlap, as illustrated, takes place at worn tooth section, rotation will be rough. Generally with the original gears, tone should be satisfactory.
The actual back lash changes approximately .008" for each .010" movement of the gear.

**CORRECT TOOTH CONTACT ASSURES LONGER GEAR LIFE**

With adjustments properly made (pinion at correct depth and backlash set at .010") the following contacts will be procured. The area of contact favors the toe and is centered between the top and bottom of the tooth.

**SATISFACTORY TOOTH CONTACT (GEARS UNLOADED)**

The hand rolled pattern shown above (gears unloaded) will result in a pattern centered in the length of the tooth when the gears are under load. The loaded pattern will be almost full length and the top of pattern will approach the top of the gear. (Shown Below)

**SATISFACTORY TOOTH CONTACT (GEARS LOADED)**

The pattern of the coast side of teeth will appear the same width as the drive side shown above; however, the over-all length will be centered between the toe and heel of gear tooth.

A high contact indicates pinion is too far out. Set the pinion to the correct depth by removing shims under the pinion cage. Slight outward movement of hypoid gear may be necessary to maintain correct backlash.

A low contact indicates pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the hypoid gear may be necessary to maintain correct backlash.

A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.†

†For further detailed information refer to SAE Paper SP-228, Section 2 by W. A. Johnson and R. F. Cornish.
ASSEMBLE AND INSTALL AXLE DIFFERENTIAL

A. Press differential bearings firmly against case shoulders. Coat inside of case and all differential parts with specified rear axle lubricant.

B. Assemble differential case half and gear. Install side gear thrust washers, side gears and differential pinion gears, thrust washers and spider.

C. Note cast alignment marks and assemble opposite case half. Hold assembly together with 4 bolts and nuts and check for free rotation of parts.

D. Install remaining differential case bolts so heads are locked by machined relief in case half. Be sure case halves are assembled to gear so there is adequate nut clearance. Check clearance in carrier before completing assembly.

When a new gear or a new differential case is installed the case holes must be line reamed with the gear in order to assemble the parts using the correct size rivets or bolts. Align the case halves and hold case and gear assembly together with 4 bolts and nuts. Line ream the holes. Thoroughly clean the parts before assembly.

Hold differential case assembly together with 4 bolts when riveting the parts together. Use a rivet set that will shape the formed head 1/8” larger in diameter than the rivet hole. The formed head height should not be more than 1/16” lower than the preformed head. A lower formed head indicates high riveting pressures that may distort the case and cause gear eccentricity.

E. Tighten bolt nuts to specified torque and lock wire or cotter in place.
INSTALLATION OF BEARING CUPS IN CARRIER LEG BORES

A. Temporarily install the bearing cups, threaded adjusting rings where employed and bearing caps. Tighten the cap screws to the proper torque.

B. The bearing cups must be of a hand push fit in the bores, otherwise the bores must be reworked with a scraper or some emery cloth until a hand push fit is obtained. Use a blued bearing cup as a gauge and check the fits as work progresses.

This applies to all types of carrier leg bores.

USE THE FOLLOWING PROCEDURE FOR ADJUSTING DIFFERENTIAL BEARINGS ON UNITS EMPLOYING TWO THREADED RINGS:

A. Inspect carrier legs and bearing caps to be sure they are properly relieved at I.D. parting line.

B. Apply Specified axle lubricant to bearing cups and cones. Position cups over cones and install assembly in carrier.

C. Insert differential bearing adjusting nuts and turn hand tight against bearing cups.

D. Position Bearing caps in place over bearing cups and adjusting nuts, making sure they are properly aligned.

Caution: If bearing caps do not seat easily and correctly, the adjusting nuts may be cross threaded. Forcing caps in place will result in irreparable damage to the differential carrier and caps.

E. Install and tighten the stud nuts or cap screws to specified torque noted in “Tabulation of Torque Limits” at back of Manual.

F. Alternately loosen one adjusting nut and tighten the opposite adjusting nut while turning the differential assembly to assure normal bearing contact and to keep bearing cups straight in the bores.

G. Either of the following procedures will result in proper differential bearing preload:

1. Establish a zero end play; no-preload condition with a dial indicator. Tighten the adjusting nuts 1¾ to 2¾ notches (total for both nuts) tight to correctly preload the bearings; or:

2. Tighten adjusting nuts to spread the differential bearing legs .006"-.010" (total for both legs) as determined by a crescent shaped micrometer held at the level of the leg pilot surfaces and parallel to the carrier mounting flange.

H. Install adjusting nut locks and cap screws. Tighten to specified torque.

I. Lock all parts in place with soft iron wire.

USE THE FOLLOWING PROCEDURE FOR ADJUSTING DIFFERENTIAL BEARINGS ON UNITS employing TWO SPLIT RINGS:

A. Temporarily install differential with bearings and cups in carrier housing and center between carrier leg grooves.

B. Insert thin split rings making certain that there is clearance between bearing cup faces and rings. (Do not install bearing caps.)

C. By means of a dial indicator measure end play of differential assembly by shifting the assembly back and forth between the rings with a small pair of pinch bars placed between the carrier legs and the spur gears.

D. Remove and measure the thickness of the rings. To obtain the total thickness of the two thinner rings the end play figure plus another .017" to .022" to obtain the total thickness of the two thicker rings required to obtain proper bearing preload.

E. NOTE: Hardened split rings are ground in increments of .005".
For Example:

If temporary thin rings used to measure end play were .290” each for a total of .580” and the end play is .005”, then .580” plus .005” end play equals .585” (or zero end play).

Here an additional .020” (interference) would be required to preload the bearings or a total of .605” thicker split rings. The total of .605” may be divided between the two rings such as .300” and .305”.

F. It should be understood that the .017” to .022” interference of which we speak is not bearing preload torque but that it is the amount of interference required to establish bearing preload torque within the desirable limits.

COMPLETE ASSEMBLY AS FOLLOWS:

A. Insert one split ring in carrier leg groove. Move differential assembly over so that face of bearing cup is held tightly against inserted ring. Rings should be positioned in carrier leg grooves so that split portion will locate in center of cap.

B. Install opposite split ring by tapping it into the carrier leg groove by use of a blunt end drift, tapping on the I.D. of ring opposite the split portion.

C. Position the differential bearing caps in place making sure they are properly aligned.

D. Install carrier leg capscrews and tighten to specified torque.

A. Apply non-hardening sealer to gaskets under stamped cover and threaded inspection hole plug. Apply sealer to threads of all plugs. Install plugs and tighten securely. Lock thru-shaft chamber plug with soft iron wire.

B. Assemble yokes and flanges, tighten nuts to specified torque.

C. Check flange runout. If runout exceeds .005” total indicator reading, replace flange.
LUBRICATION

Proper lubrication of the drive units is extremely important. Our “Standard” recommended lubricant is Meritor Specification 0-65, SAE 140 viscosity, multipurpose gear lubricant. Unusual operating conditions such as extremes in climatic temperatures may require lubricants of “Optional” viscosities. Refer to Field Maintenance Manual No. 1, “Lubrication”, for detailed information.

Since Meritor lubricant specifications are periodically revised, always refer to Field Maintenance Manual No. 1 for current complete lubricant specifications and applications.

NEW AND RECONDITIONED AXLE SERVICE

The original rear axle lubricant should be drained at the end of the driveway prior to putting the vehicle in regular service, or before the maximum of 3,000 miles. Drain the lubricant initially used in the assembly following reconditioning at the same interval. Completely drain the lubricant while the unit is warm. Flush well with clean flushing oil and thoroughly drain.

Fill axle housings to bottom of level hole with specified lubricant with the vehicle level. Put an additional 2 U.S. pints of specified lubricant in the inter-axle differential housing.

REGULAR AXLE SERVICE

Refer to Field Maintenance Manual No. 1, “Lubrication,” for recommended service interval. Service the inter-axle differential housing at the same time and in the same manner as the axle housings. Completely drain the lubricant while the unit is warm. Flush well with clean flushing oil and thoroughly drain. Whenever the inter-axle differential housing has been drained, always add an additional 2 U.S. pints of specified lubricant directly to the inter-axle differential housing.

Some newer model axles have a smaller tapped and plugged hole located near and below the housing lubricant level hole. This smaller hole has been provided for the use of a lubricant temperature indicator only and should not be used as a fill or level hole.

Jack up all four wheels of the assembly and run at 25 M.P.H. in high transmission gear for five minutes to thoroughly circulate the lubricant throughout the assembly. Be sure brakes are fully released.

TIRES

Measure the rolling radii of all tires. The tires of all wheels must be matched to within 1/8" of the same rolling radius (3") of the same rolling circumference. The 4 largest tires should not be installed on one driving axle and the four smallest tires on the other driving axle of thru-drive type tandems. Such tire mounting will cause inter-axle “fright,” 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 total 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.

HOW TO MATCH TANDEM TIRES

The vehicle should be on a level floor, carrying a correctly distributed rated capacity load. Be sure all tires are the same size. Measure new tires to be sure they will be correctly matched.

A. Inflate all tires to the same pressure.
B. Carefully measure the rolling circumference of each tire with a steel tape.
C. Mark the size on each tire with chalk and arrange them in order of size, largest to smallest.
D. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.
E. Mount the four other tires on the other axle in the same manner.
F. Test run the vehicle to get accurate rear axle lubricant temperature readings on the two axle lubricant temperature guages.
G. Vary tire air pressure within the tire manufacturer’s recommended range, so the lubricant temperatures of both axles are within 30°F of each other and not in excess of 220°F. This will usually result in uniform tire loading and good tire life.

Refer to Field Maintenance Manual No. 11, “Tandem Hook-ups,” for additional information which applies to tandem assemblies.