

Maintenance Instruction

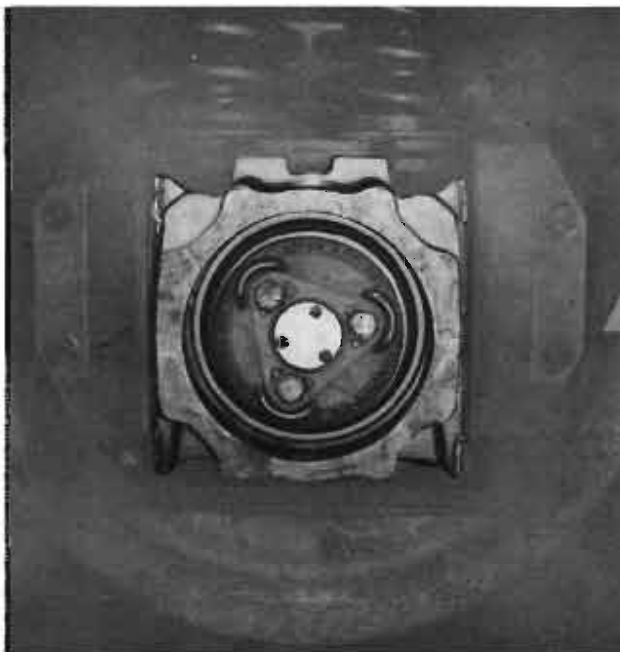


Service Department

GREASE LUBRICATED, CARTRIDGE-TYPE JOURNAL BEARINGS

DESCRIPTION

Grease lubricated, cartridge-type journal bearings, Fig. 1, are available for domestic and export locomotives. The journal bearings are self-contained, preassembled, preadjusted, prelubricated, and completely sealed. The bearings are applied to the axle and removed from the axle without exposing the bearing elements, seals, or lubricant to contamination or damage. The bearing sizes available are listed in Table 1.



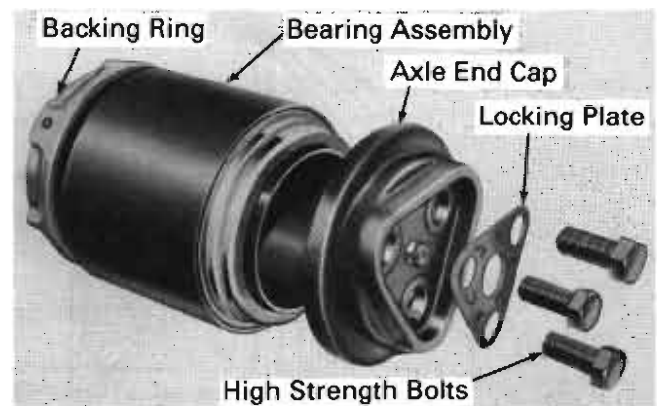
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Fig. 1 - Grease Lubricated Cartridge-Type
Journal Bearing

Class	Size	
	(inch)	mm
E	6 x 11	152 x 279
F	6-1/2 x 12	165 x 305
G	7 x 12	178 x 305
GG	6-7/8	175

Table 1 - Bearing Sizes

The preassembled bearing unit is applied to the axle in three basic parts as shown in Fig. 2.

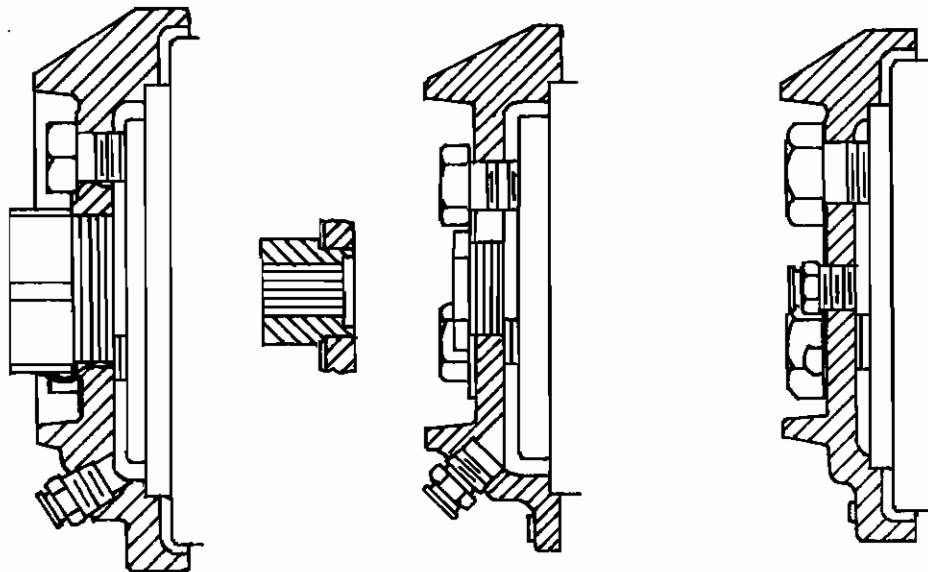
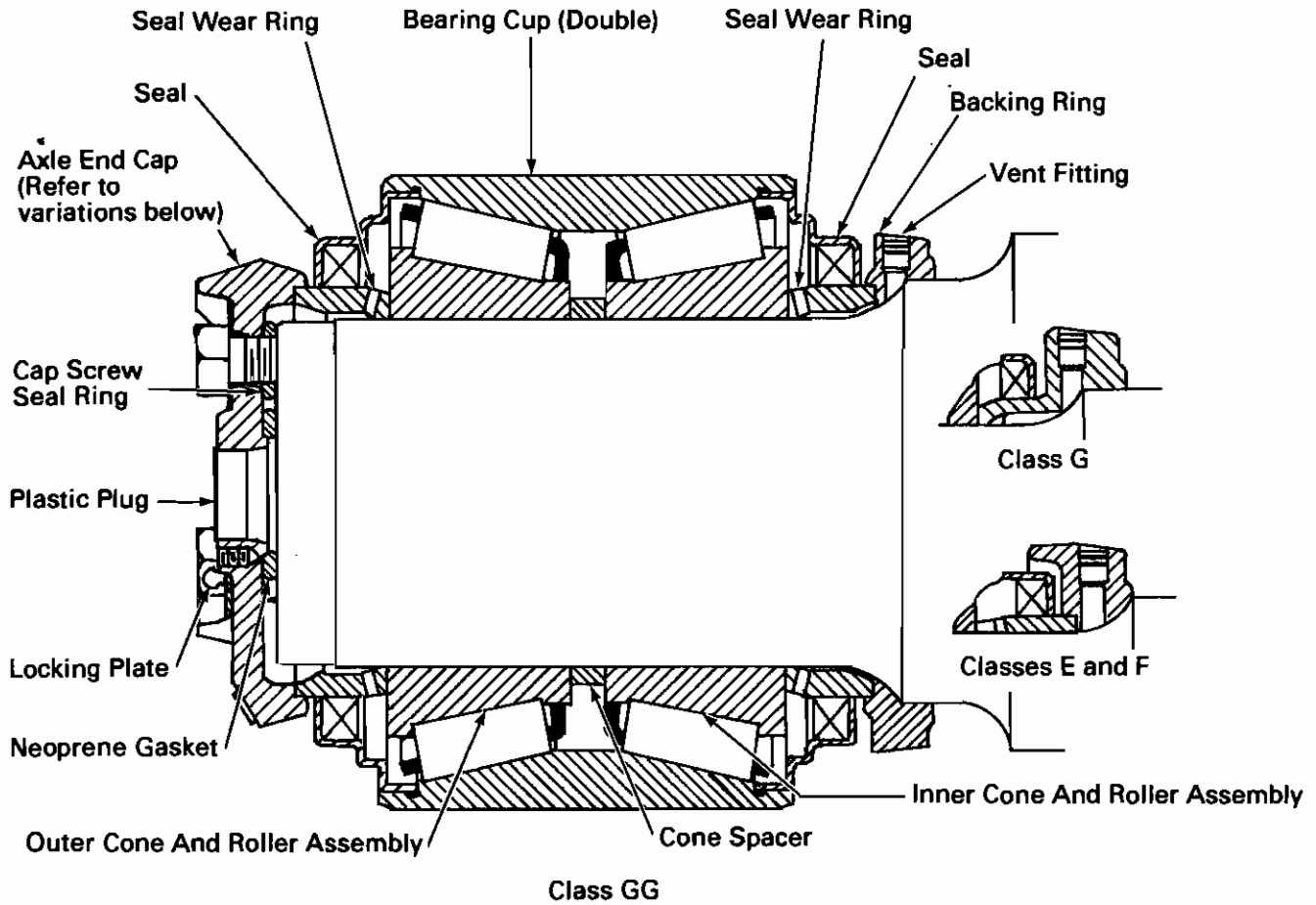


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Fig. 2 - Journal Bearing Partial
Exploded View

The bearing assembly is pressed on the axle as a completely sealed unit. It is retained on the axle by one end cap which is secured to the axle by three cap screws and a locking plate. Refer to Fig. 3 for nomenclature of the parts contained in the bearing assembly.

*Extensively revised and completely retyped. Supersedes previous issue of this number.



Typical Axle End Cap Variations

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Fig.3 - Bearing Nomenclature

A bearing adapter is used to fit the bearing assembly between the pedestal jaws of the truck frame. Bearing adapters must be clean and free of dust, dirt, metal chips, and foreign material which can prevent the proper seating of the bearing in the adapter.

The bearing adapters for Classes E and F bearings have driving wear plates welded to the sides and rear lugs as shown in Fig. 4. Bearing adapters for Classes G and GG bearings have driving wear plates welded to the sides and wear plates mounted on resilient rubber pads bolted to the rear lugs as shown in Fig. 5.

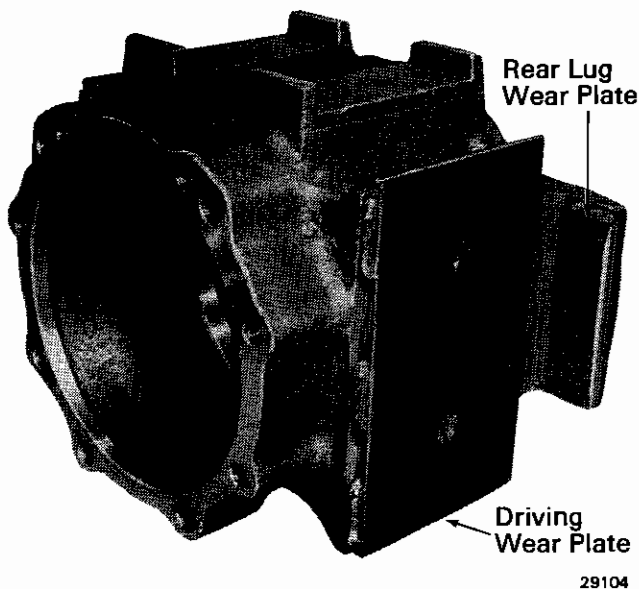


Fig. 4 - Classes E And F Journal Bearing Adapter

AXLE JOURNAL

Axle journal bearing dimensions should be checked to ensure journal bearings can be properly applied.

The axle journal bearing diameter and radii should be smooth machined or ground to a finish not to exceed 1.3 microns (50 micro-inch). The surface must be free of nicks, burrs, tool marks, scratches, or corrosion.

Micrometer and axle diameters should be at the same temperature. Axle diameters should not be checked while axle is heated due to machining. Ensure accuracy of micrometer by checking with a master/standard gauge.

Axle bearing diameters should be checked to ensure diameters are within tolerance. Check water guard diameter on axles used with Classes G and GG

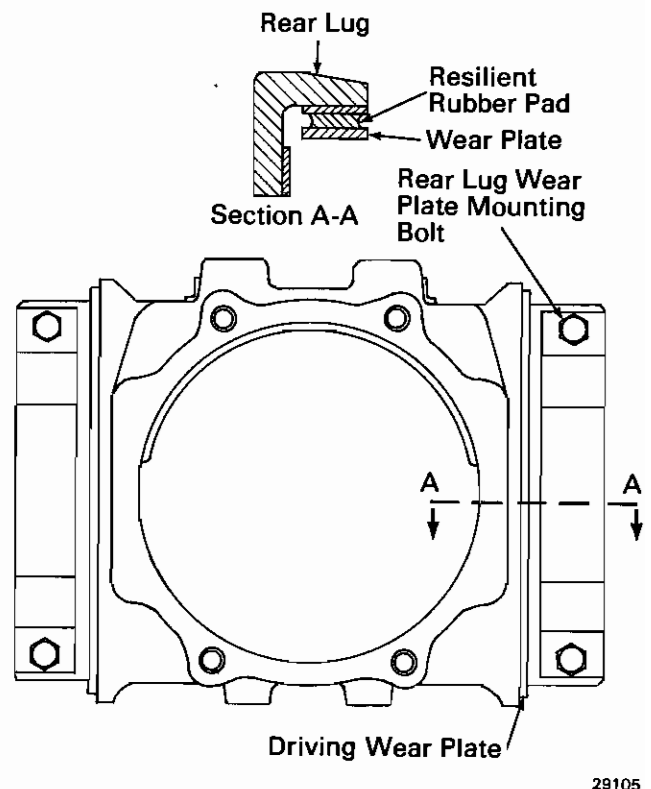


Fig. 5 - Classes G And GG Journal Bearing Adapter

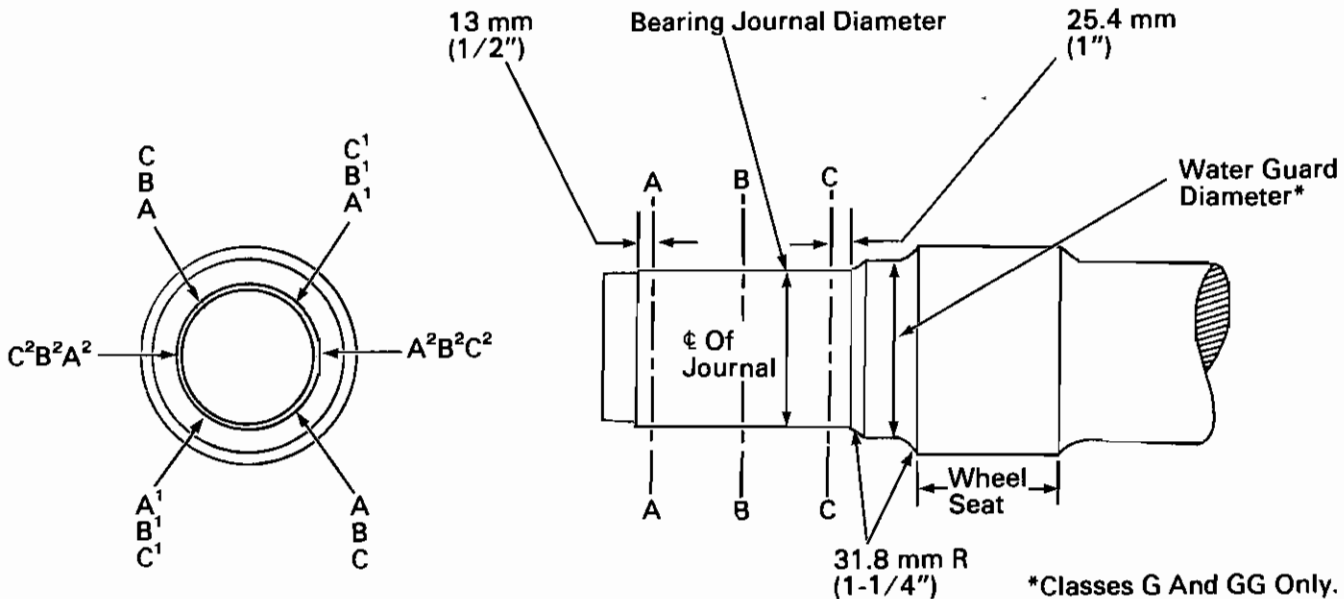
bearings. Refer to Fig. 6. The axle bearing and water guard diameters should be concentric with the wheel seat diameter.

When measuring the axle journal, a total of nine micrometer readings must be taken; three readings at position A, three readings at position B, and three readings at position C, as shown in Fig. 6. Average the three readings taken at position A. Average the three readings taken at position B. Average the three readings taken at position C. **DO NOT AVERAGE ALL NINE READINGS.** The three averages must each be within the limits of Fig. 6. Journal diameter tolerance can be a positive taper only. The dimension at position C can be greater than the dimension at position A.

The 7/8"-9 UNC-2B threaded holes in the ends of the axles should be checked with a thread checking gauge.

All steel chips, dirt, and white lead must be cleaned out of the lathe center holes and cap screw holes in the ends of the axles prior to bearing application.

Axles that have become magnetized must be demagnetized before bearings are applied.



Bearing Class	Journal Diameter				Water Guard Diameter			
	Maximum		Minimum		Maximum		Minimum	
	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
E	144.564	5.6915	144.539	5.6905	-	-	-	-
F	157.264	6.1915	157.239	6.1905	-	-	-	-
G	177.90	7.004	177.88	7.003	200.02	7.875	199.90	7.870
GG	174.73	6.879	174.70	6.878	200.02	7.875	199.90	7.870

NOTE
Only a positive taper allowed in journal tolerance ranges. The dimension at position C can be greater than the dimension at position A.

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Fig.6 - Axle Journal Dimensions

HYATT JOURNAL BEARING TO TIMKEN JOURNAL BEARING MODIFICATION

An axle with a 174.73 mm (6.879") journal bearing diameter which had been equipped with a Group 1, 165 mm x 305 mm (6-1/2" x 12") Hyatt journal bearing, may be modified to use a 175 mm (6-7/8") Class GG Timken journal bearing as follows:

1. Apply an induction heater to Hyatt journal bearing inner race, Fig. 7, and heat inner race and remove. Refer to Service Data for induction heater part number.
2. Use a torch and remove the water guard, Fig. 7, from axle.

CAUTION

Ensure axle journal bearing seat is not hot and is the same temperature as the micrometer when checking axle diameter.

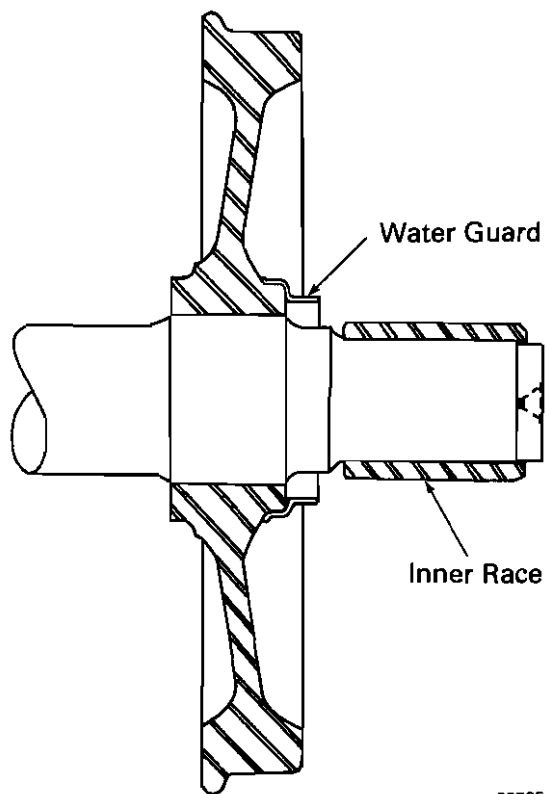
3. Refer to Axle Journal paragraphs and Fig. 6 and check axle journal bearing and water guard diameters and condition.
4. Drill three 19.5 mm (49/64") diameter holes in each end of the axle as shown in Fig. 8. Countersink holes and tap 7/8"-9 UNC-2B threads, 38 mm (1-1/2") deep.

APPLYING BEARINGS TO AXLE

PREPARATION

Roller bearing work should be confined to a specific area. Only machines and tools designed for roller bearing installation and removal should be used.

If other than new bearings are to be installed, the bearings should either be requalified at an approved Service Center or disassembled, cleaned, inspected, and if within specifications, lubricated, and reassembled.



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Fig.7 - Hyatt Journal Bearing Inner Race And Water Guard

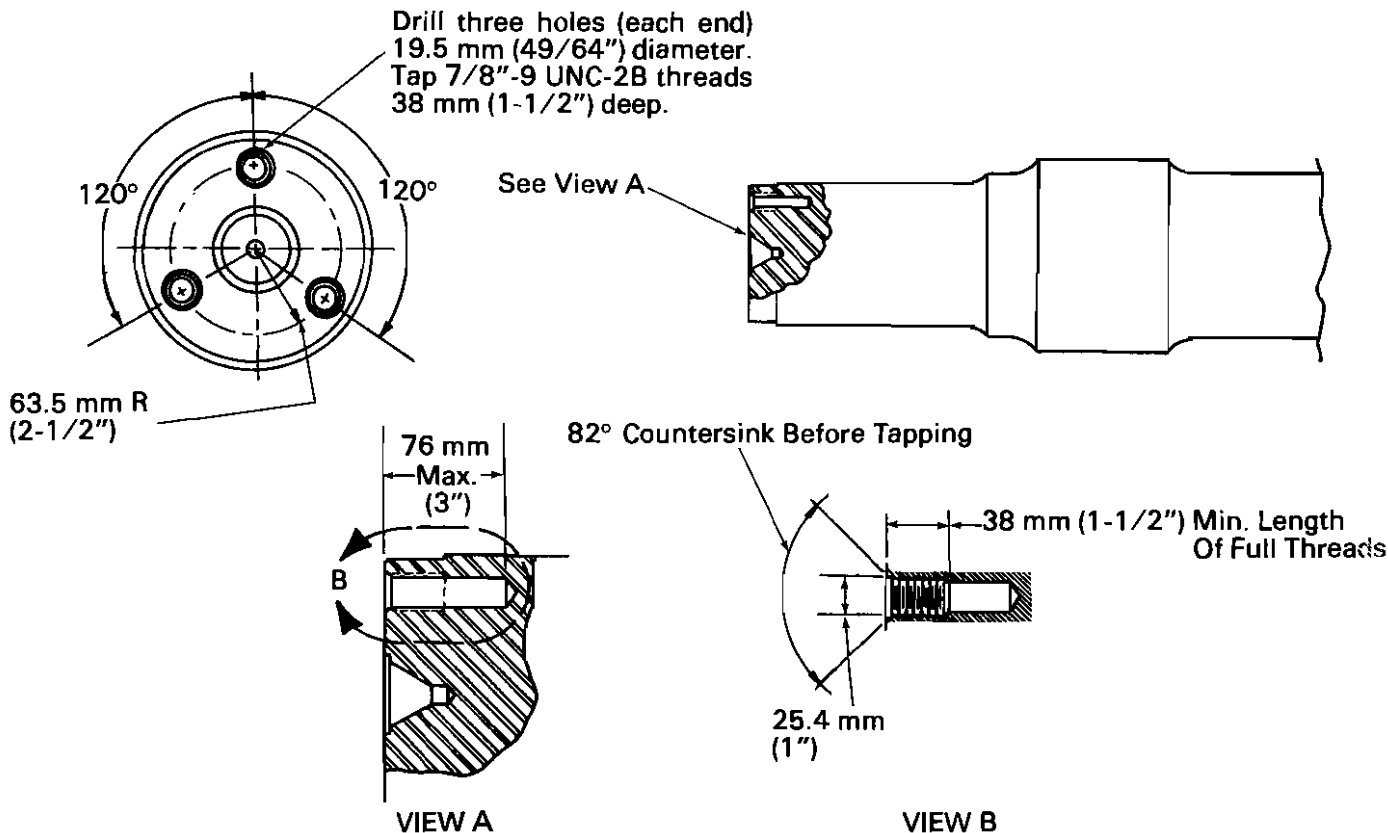
Bearing assemblies should be stored in a clean dry place and should be protected from moisture and kept dry until they are installed on the axle. New bearing assemblies should not be removed from the shipping package nor should the protective wrapping be removed until time of application.

The cardboard insert should not be removed from the bore of the new bearing assembly. This cardboard insert is required to hold the cone spacer in alignment with the bearing cones when installing the bearing assembly.

New bearing assemblies are shipped with a protective coating of grease over the vent fitting. Care should be taken to see that the grease is not wiped off when the bearings are applied to the axles.

Grease lubricated cartridge-type journal bearings must be pressed on the axle. Heat must not be applied to the bearing cone assemblies to facilitate installation. The bore of the bearing cones should be checked to ensure the proper interference fit.

All new bearings require an interference fit with the axle of between 0.064 mm to 0.114 mm (.0025" to .0045").



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Fig.8 - Drilling Axle For Timken Bearing

All bearings with previous service require an interference fit with the axle of not less than 0.038 mm (.0015").

A thin coating of lead-free rust preventive must be applied to the axle bearing journal fillet and the portion of the axle between the wheel seat and bearing journal fillet. The coating must be uniform and must not be applied more than 30 minutes before the bearings are applied to the axle.

As a lubricant for bearing application, coat the bearing seats of the axle with caster oil, heavy mineral oil, or a molybdenum-disulphide and oil mixture.

CAUTION

DO NOT USE WHITE LEAD. Lead compounds may be detrimental to lubricating greases by acting as an oxidation catalyst.

PROCEDURE

NOTE

Refer to Service Data for information on installation and removal equipment.

A bearing handling device such as a small lift may be used for handling the bearing.

When the bearing assembly is slipped onto the pilot sleeve and the cardboard insert is ejected, the outer seal wear ring should be held in place to prevent it from riding out of the enclosure seal. If the outer seal wear ring does slip out of the assembly, it must be inserted into the enclosure seal correctly and carefully, chamfered end first, so that the outer lip of the seal does not turn under when the seal lips are expanded over the seal wear ring.

CAUTION

DO NOT INSERT ANY TOOL OR OTHER INSTRUMENT BETWEEN THE SEAL ELEMENT LIPS AND SEAL WEAR RING. This may damage the seal element lips or scratch the seal wear ring, resulting in bearing lubricant leakage.

An assembly sleeve which contacts the seal wear ring outer face and telescopes over the pilot sleeve is used to press the bearing on the axle. To make sure that the bearings are firmly seated against the axle fillet, the pressures shown in Fig. 9 must be applied to the bearings after the surge of the pressure gauge indicates that the bearings have contacted the axle fillet.

Class	Size (inch)	Pressure		
		mm	(tons)	tonnes
E	6 x 11	152 x 279	40-50	36-45
F	6-1/2 x 12	165 x 305	50-60	45-54
G	7 x 12	178 x 305	60-70	54-63
G-G	6-7/8	175	60-70	54-63

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Fig. 9 - Bearing Seat Tonnage

For Classes E and F bearings or any bearing with nonfitted backing rings or rings manufactured without a counterbore for fitted application to the axle dust guard, a check to ensure bearing is properly seated can be made by attempting to insert a 0.05 mm (.002") feeler gauge between the bearing backing ring and axle fillet, Fig. 10. Slide the feeler gauge around the entire axle fillet.

If the feeler gauge can be inserted more than 3 mm (1/8"), apply the recommended seating pressure to the bearing a second time. If the feeler gauge can still be inserted more than 3 mm (1/8"), the bearing should be removed from the axle and the cause determined.

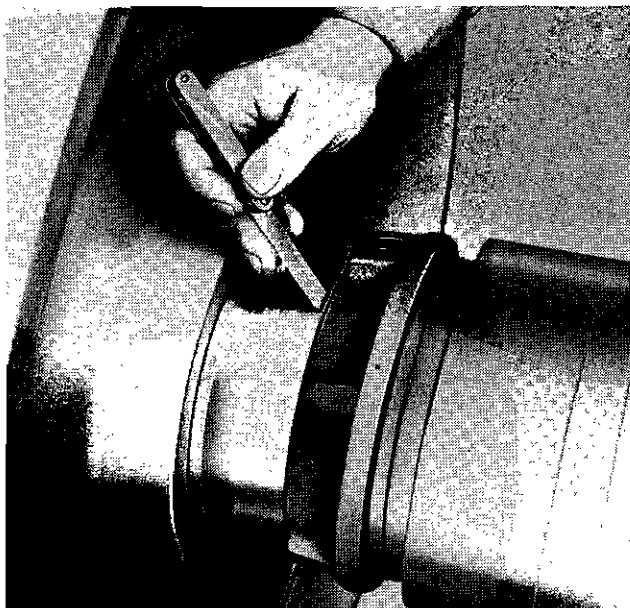
A feeler gauge cannot be used to check Class G and Class GG bearings or any bearing assembly containing backing rings with an additional counterbore for fitted application on the axle dust guard. These bearings require an increase in pressure to be seated. Refer to Fig. 9.

Rotate the bearing assembly to make sure that it will turn. Due to the rubbing type seals, the bearing assembly will not rotate freely at initial application. New bearing assemblies are preadjusted at the factory. No adjustment is necessary at the time of application to the axle.

APPLYING AXLE END CAPS

The axle end cap, locking plate, and cap screws should be applied to the axle as a unit. The cap screws should be tightened with a torque wrench to the specified torque as given in the Service Data. Recheck each cap screw several times until the cap screw does not turn when the specified torque is applied.

Lock the cap screws by bending all tabs of the locking plate flat against the sides of the cap screw heads, using adjustable rib joint pliers. Do not tighten or loosen a cap screw after the specified torque has been obtained in order to position the cap screw head flats relative to the locking plate tabs.



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Fig.10 – Checking Between Classes E And F Bearing Backing Ring And Axle Fillet With Feeler Gauge

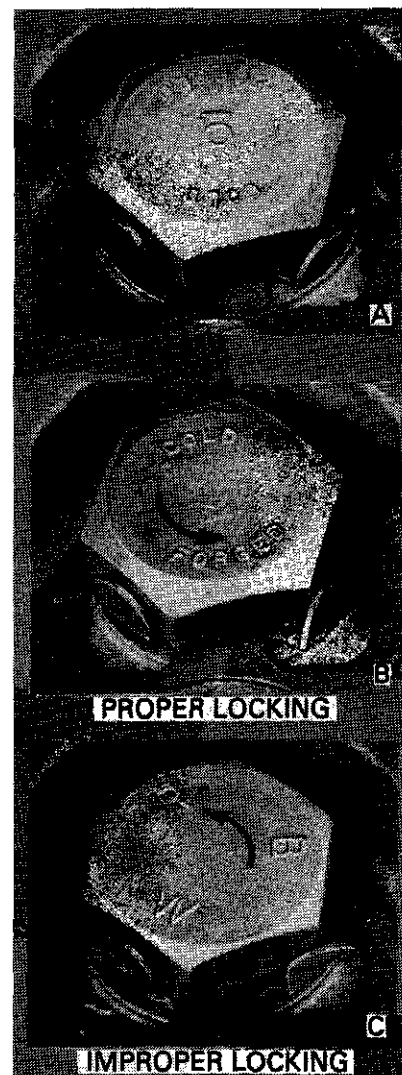
A cap screw tightened to the specified torque may have a corner of the cap screw head centered on one of the locking plate tabs. Fig. 11A. Bend that tab against the cap screw head flat, Fig. 11B, so that the tab will resist loosening of the cap screw. (Arrow indicates loosening direction.) If the tab is bent against the opposite flat, Fig. 11C, it will not resist loosening of the screw.

CHECKING BEARING RUNNING LATERAL PLAY

Check the bearing running lateral play with a dial indicator mounted on a magnetic base. Rotate the bearing a few times while forcing the bearing cup laterally toward the wheel hub. Place the magnetic base on the outside surface of the bearing cup and position the indicator stem against the surface of a cap screw head or on the lubricant fitting, Fig. 12. Oscillate the cup slightly while forcing the cup toward the wheel hub and then pull the cup away from the wheel hub while oscillating. If the bearing lateral play as indicated by the dial indicator is less than 0.02 mm (.001") or more than 0.51 mm (.020") remove the bearing assembly from the axle.

The bearing lateral may be corrected so as to fall within the specified limits by one of the following methods:

1. Check the bearing seat on the axle for size and condition. If the size or condition of the axle is



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Fig.11 – Proper Method Of Applying Locking Tabs

not according to specification, correct any undesirable condition found and reapply the bearing. If a bearing was applied to an oversized axle, check the size of the cone bores before reapplying the bearing.

2. If the size and condition of the axle are satisfactory, but the lateral indicated was less than 0.02 mm (.001"), apply the bearing to an axle having a bearing seat diameter nearer the minimum dimensions but within the specified tolerance.
3. If the size and condition of the axle are satisfactory, but the lateral indicated was more than 0.51 mm (.020"), apply the bearing to an axle having a bearing seat diameter nearer the maximum dimension but within the specified tolerance.



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Fig.12 – Checking Bearing Running Lateral Play

If the bearing running lateral play is still not within the limits of 0.02 mm to 0.51 mm (.001" to .020") the bearing should be removed from the axle and disassembled. The bench lateral play and the bore of both cone assemblies should be rechecked. Also, the bearing seat diameter of the axle from which the bearing was removed should be checked for size.

VENT FITTINGS

On new bearings a protective coating of grease is applied to the vent fittings to prevent the vent from becoming clogged when the bearing is painted. Do not remove this protective coating when the bearings are applied to the axle.

A protective coating of grease should also be applied to the vent fittings of reassembled bearings to protect the vent through the painting operation.

It is not necessary to wipe the grease off the vent fitting before the locomotive is released for service. The grease will be disposed of by centrifugal force during the course of normal locomotive service.

LUBRICANT FITTINGS

Some new bearings are equipped with a lubricant fitting and will have a protective plastic cap over the fitting. This cap should not be removed until after the bearing is painted. The protective plastic cap may be left on the lubricant fitting after painting in order to protect the fitting from the accumulation of road dirt.

BEARING REMOVAL FROM AXLE

NOTE

Refer to Service Data for information on installation and removal equipment.

PREPARATION

Bearings are normally removed from the axle only when wheels are removed. Whenever bearing assemblies that have been in service are removed from the axles, the bearings must be requalified at an approved Service Center or must be disassembled, cleaned, inspected, and repairs made as necessary in accordance with instructions given later in this M.I.

The bearing assemblies may be removed with a bearing press, wheel press, or with portable fixtures. Forty to sixty tons pressure is normally required to break the bearing fit.

If bearings are to be removed simultaneously with the wheels, a suitable shoe must be used to make contact between the wheel hub and bearing backing ring so as not to load through the outer race and rollers.

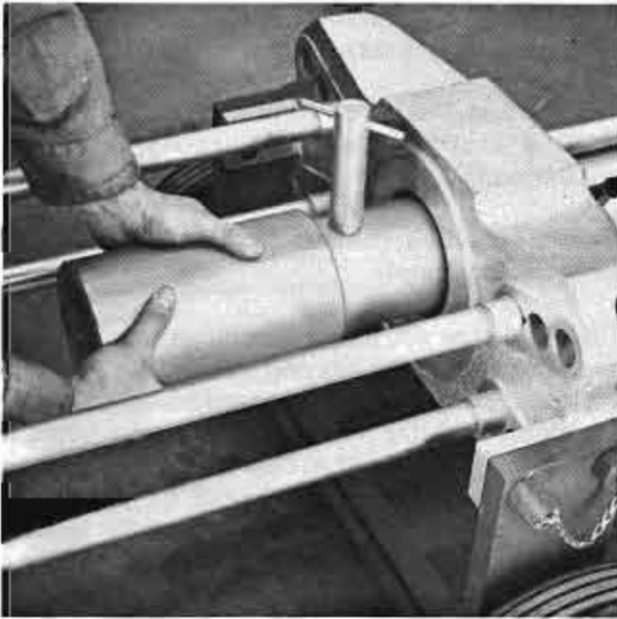
When bearings are removed from the axle, a pilot sleeve or guide tube should be fastened to the end of the axle or to the press ram to keep the bearing parts together and protect them from damage. Do not drop the bearing when removing it from the pilot sleeve.

PROCEDURE

Bend the tabs of the locking plate away from the cap screw heads. Remove the cap screws, locking plate, and axle end cap. It may be necessary to tap the end cap lightly for removal. If more than one bearing assembly is to be removed, the guide tube should be fastened to the hydraulic ram, if possible. A guide tube slightly smaller than the axle diameter should be used to eliminate alignment problems.

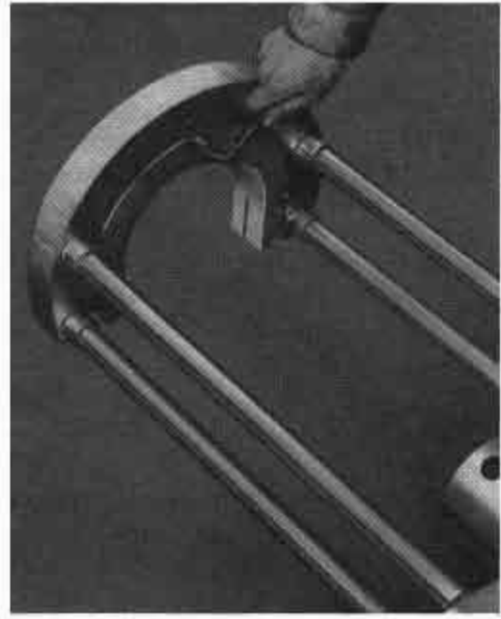
If portable machines are used, be sure to tighten the guide tube against the ram head so that the pressure required to remove the bearing will not shear or bend the connector pin, Fig. 13.

When portable machines are used and only one bearing is to be removed from an axle, and a bearing is to be immediately applied, fasten the guide tube of the proper size to the axle, Fig. 14. It will then be in place when installing the bearing.



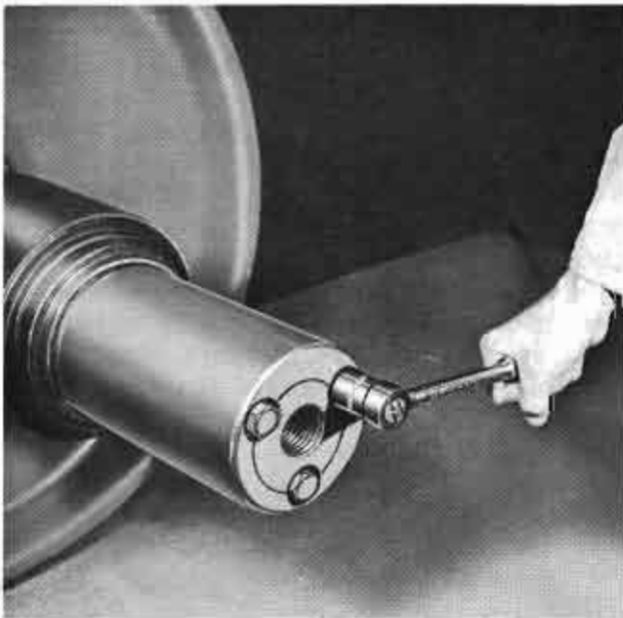
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Fig.13 - Tightening Guide Tube



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Fig.15 - Pulling Shoe

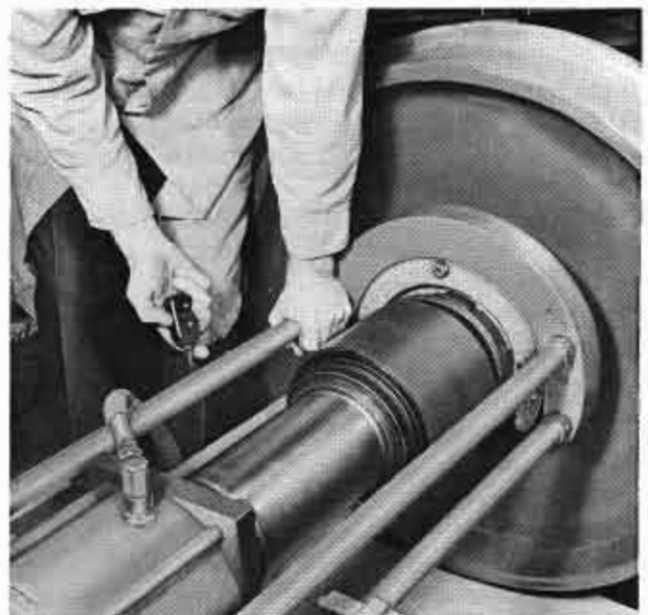


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Fig.14 - Fastening Guide Tube

A pulling shoe, Fig. 15, which fits behind the backing ring, is used to remove the bearings when it is desirable to remove the bearings without removing the wheels. The pulling shoe should be the correct size for the bearing being removed. Puller alignment and proper contact with the backing ring are necessary for efficient bearing removal.

Position the pulling shoe behind the backing ring. The pulling shoe contact surface of the backing ring is very narrow. Therefore, to ensure proper contact with the backing ring and prevent distorting or bending the backing ring it is necessary to hold the pulling shoe down in position behind the backing ring, Fig. 16, until the initial pressure has been applied. Extend the ram to remove the bearing from the axle.



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Fig.16 - Positioning Pulling Shoe

After the bearing assembly is removed from the pilot sleeve, a cardboard insert or a similar device should be inserted in the bore of the bearing assembly to hold the internal bearing parts in place. Particular attention should be given to keeping the seal wear rings in place in the enclosure seals.

TERMINAL INSPECTION

GENERAL

Roller bearings should be given a visual inspection for overheating; excessive lubricant leakage; broken, loose, or missing parts such as loose cap screws; loose or defective seals; cracked or broken cups, end caps, or adapters. If a seal can be moved with a suitable probe, the bearing must be removed from the axle for inspection and repair.

LOOSE OR MISSING CAP SCREWS

If one or more cap screws are found loose or missing from the bearing, the wheel, gear, axle, and journal box assembly should be removed from the truck. The bearing should be removed from the axle, and a full inspection made to determine the cause and possible resultant damage.

BEARING RUNNING TEMPERATURE

Running temperatures up to 56° C (100° F) above ambient may be expected under normal operating conditions. The running temperature may be checked by placing the bare hand on the adapter.

If the bare hand cannot be held on the adapter for a few seconds, and the bearing is noticeably warmer than other bearings on the locomotive, the bearing should be checked with a temperature-indicating crayon 93° C (200° F) or a direct reading pyrometer, on the outside face of the adapter. If the bearing temperature is in excess of 93° C (200° F), the bearing should be removed from service for further examination.

GREASE LEAKAGE

A small amount of grease leakage around the seals may be expected during the initial run-in period. This leakage will reduce to normal "weeping."

When grease is added to a bearing assembly at relubrication intervals, the space between the axle end cap and the end of the axle and the space between the seal and cone assembly are filled with grease.

In service, centrifugal force due to bearing rotation will move some grease out from between the end cap and axle into the bearing. When the space between the cone and seal is full of grease this action may cause a seal to leak temporarily following lubrication.

When a bearing appears to be leaking excessively, check for loose seals.

If the seals are not loose, consideration should be given to the date the bearing was installed and the last lubrication. If grease had been added within the last six months, the leakage could be attributed to the lubrication. If grease had been added two or more times, the leakage could be caused by excessive grease in the bearing. Wipe the bearing clean. Subsequent inspections will determine if further attention is required.

Over-lubrication should be avoided. Over-lubrication can cause the bearing running temperature to increase. This increased running temperature along with increased churning action will break down and deteriorate the grease.

LUBRICANT CONTAMINATION

Lubricant containing water is destructive to roller bearings, causing rapid wear. All possible precautions should be taken to prevent water from entering the bearing assembly.

If the equipment has been submerged in water or operated through water of such depth that the water could have entered the bearings, the bearing assemblies must be removed from the axles, disassembled, cleaned, inspected, and repairs or replacement made as required.

Drain pipes or holes in the locomotive carbody must be located so that drainage will not be directed at the bearing assemblies.

When cleaning the exterior of the locomotive, the stream of water should not be directed at the bearing enclosure seals.

When sandblasting or shotblast cleaning for repainting or for any reason, a shield should be used to protect both the front and rear of the bearing assemblies from sand or shot.

Sandblasting or shotblast cleaning of roller bearing equipped axle assemblies is not recommended. Sand or shot may damage the seal elements or seal wear rings.

If the plug in the axle end cap is to be removed for any reason, the area around the plug must be cleaned before the plug is removed.

Grease for roller bearing lubrication must be kept covered and in the container in which it was shipped to prevent contamination. Pumping devices must be used to dispense the grease directly from the shipping container into the bearing assemblies.

ACCIDENTAL DAMAGE

Roller bearings on locomotives involved in derailment or collision, or subjected to damage by fire, floods, or other cause, should be returned to the shop for inspection before being returned to service. Bearings should be removed from axles, cleaned, and thoroughly inspected for damage.

After removal of the bearings, axles should be checked to make sure they are not bent. A bent axle can cause premature bearing failure due to the oscillation movement and uneven load distribution in the bearing.

Bearing adapters should be inspected for distortion or other damage before being returned to service. If a damaged adapter is returned to service, it could cause a road failure of the replacement bearing due to concentration of load.

Truck frames should also be inspected to see that they are not bent or distorted. Frames and/or pedestal jaws which are bent or distorted can impose undesirable loads on the bearing assembly which can cause premature bearing failure.

SHOP PRACTICE

BEARING INSPECTION AT TRUCK DISASSEMBLY

Clean the outside surfaces of the bearing assemblies after removal of the wheels, gear, axle, and bearings as an assembly from the truck.

Rotate the bearing assembly to detect any abnormal condition and visually check the outside of the bearing assembly for broken, loose, or missing parts.

Mount a magnetic base dial indicator to check the bearing running lateral play. Place the magnetic base on the outside surface of the bearing cup with the stem of the indicator against a surface near the center of the bearing as shown in Fig. 17.



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Fig. 17 – Checking Bearing Running Lateral Play

Check the bearing running lateral play by forcing the bearing cup laterally toward the wheel hub and then pulling the cup away from the wheel hub while oscillating the bearing.

If the bearing lateral play is 0.76 mm (.030") or more, or if any roughness is detected when rotating, the bearing assembly should be removed from the axle, disassembled, cleaned, inspected and re-assembled in accordance with previous instructions.

WHEEL TURNING

Wheel turning lathes or wheel truing machines may be used for turning wheels. When wheel and axle assemblies are removed from the truck for wheel turning, the bearings should be inspected in accordance with previous instructions. If the lathe centers of the axle are accessible by removing the plugs in the end caps, remove plug but do not remove the end caps, Fig. 2. If it is necessary to remove the end caps, protective caps, as shown in Fig. 18, O-rings, or other suitable wrapping should be used to prevent steel chips from entering the bearing or damaging the seals. The opening between the backing ring and the bearing cup should also be closed by wrapping with suitable material such as masking tape to protect the inner enclosure seal from being damaged by chips. Heavy grease must be used to lubricate the lathe centers. **DO NOT USE WHITE LEAD.**

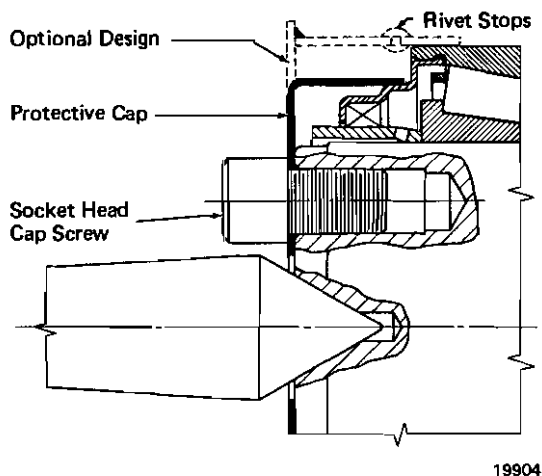


Fig.18 – Application Of Protective Cap

If the end caps were removed, clean the end faces, center holes, and bolt holes of the axles after the wheel turning operation has been completed. Reapply the end caps, using new locking plates torque to value listed in Service Data.

If the end caps were not removed, reapply plugs and torque to value listed in Service Data. Use new locking plate or lockwire as applicable. Refer to Applying End Caps paragraphs.

When wheels are trued under a locomotive with a wheel truing machine, the axle end cap should not be allowed to remain off the bearing with the weight of the locomotive on the bearing. If an access hole is not provided in the axle end cap, a temporary axle end cap with an access hole should be applied to the bearing.

WHEEL REMOVAL

When wheels are removed from axles, the roller bearings may be removed separately, using portable fixtures, or they may be removed along with the wheels.

ELECTRIC WELDING - CAUTION

Do not attach the ground cable of an electric arc-welder so that the circuit formed will allow current to flow through the roller bearing assembly. Electric current passing through the bearing can cause pitting, fluting, or corrugations.

BEARING DISASSEMBLY

GENERAL

Roller bearing maintenance should be confined to a specific area. The work space should be clean, well lighted, and free from congestion. Benches, tools, cleaning tanks, and other facilities should be used exclusively for the maintenance of roller bearings.

Typical small shop and large shop bench layouts for roller bearing maintenance are shown in Fig. 19. The layouts may be modified to suit available space and number of bearings to be serviced.

Roller bearing shops should have facilities, tools, and fixtures available for disassembly, maintenance, and reassembly.

DISASSEMBLING THE BEARING

To disassemble the bearing, the seals must be removed from both ends of the bearing cup. The seals are retained in the bearing cup by a press fit and by a small bead on the seal which snaps into grooves located in the counterbores of the bearing cup.

A pry bar, Fig. 20, is satisfactory for removing the seals from the bearing cups. Remove the seal wear rings and insert the pry bar between the cone assembly and the seal case as shown in Fig. 21. Pry the bead on the seal case out of the locking groove in the bearing cup. It may be necessary to pry the bead out of the locking groove in two or more places.

All seals removed from bearing assemblies are to be scrapped and new seals applied at reassembly.

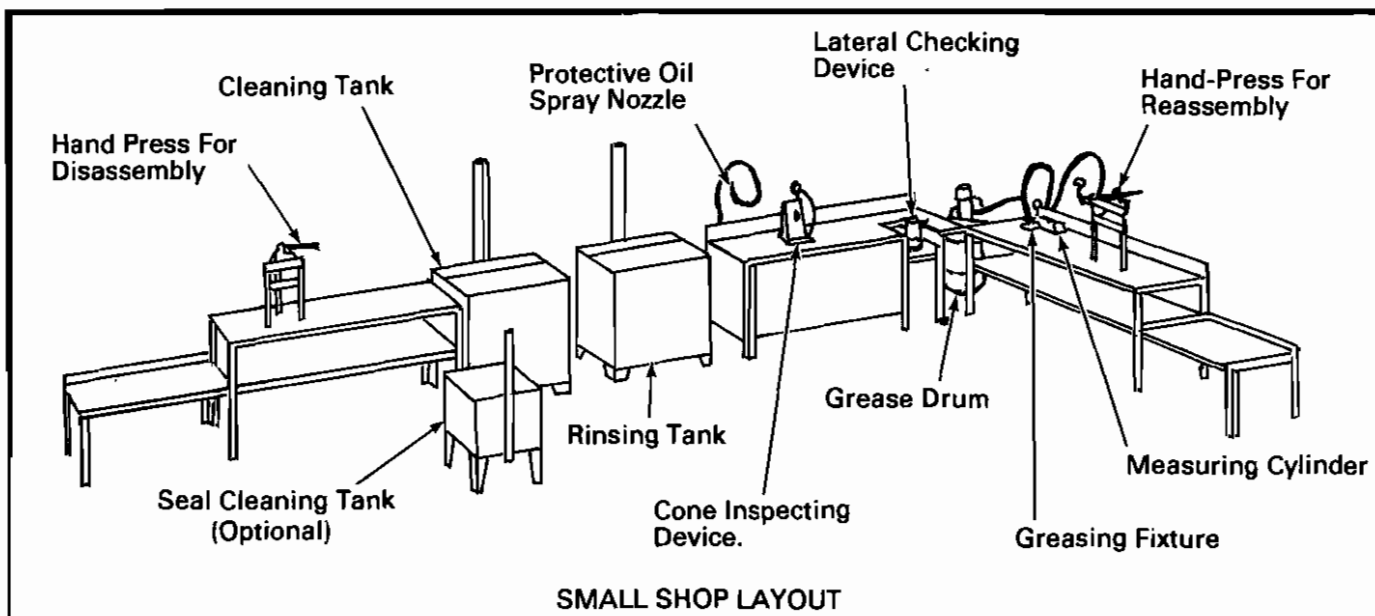
Excess grease should be removed from bearing parts with a clean shop towel during disassembly.

A preliminary visual inspection of all bearing parts should be made at disassembly. Parts that are obviously damaged to the extent that they will be rejected should be scrapped.

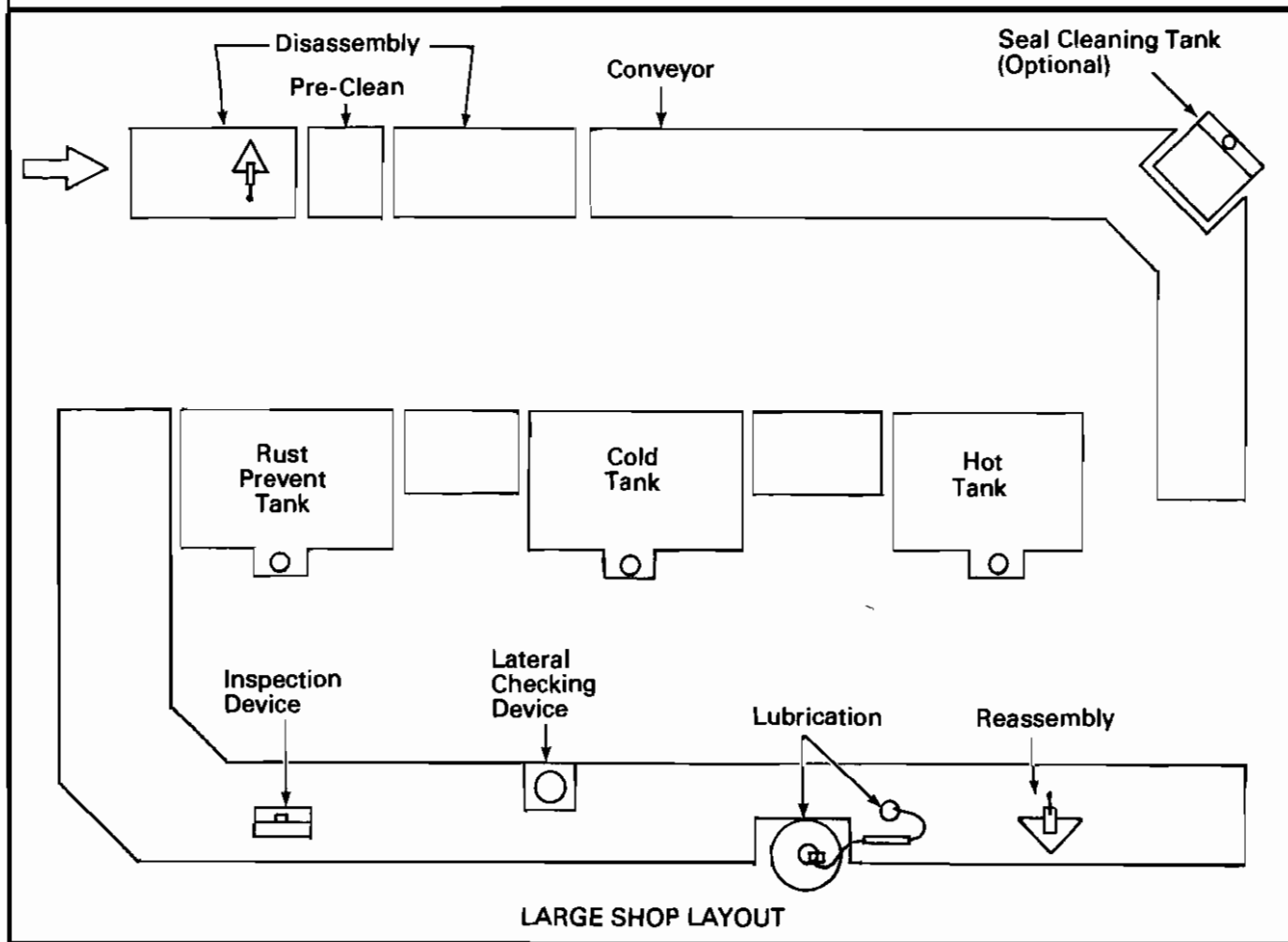
It is essential that cone assemblies identified with the end of the bearing cup from which they were removed through the disassembly, cleaning, and inspection operations. Cone assemblies are to be scrapped if the mating roller race in the end of the cup from which they were removed is found to be brinelled to the extent that the cup will be scrapped.

A preliminary visual inspection of all bearing parts should be made at disassembly. Parts that are obviously damaged to the extent that they will be rejected should be scrapped.

If desired, the existing bearing lateral play of an assembly may be maintained by keeping the cone assemblies, cone spacer, and bearing cup together through disassembly, cleaning, inspection, and reassembly. At reassembly the cone assemblies may be applied to either end of the bearing cup from which they were removed.

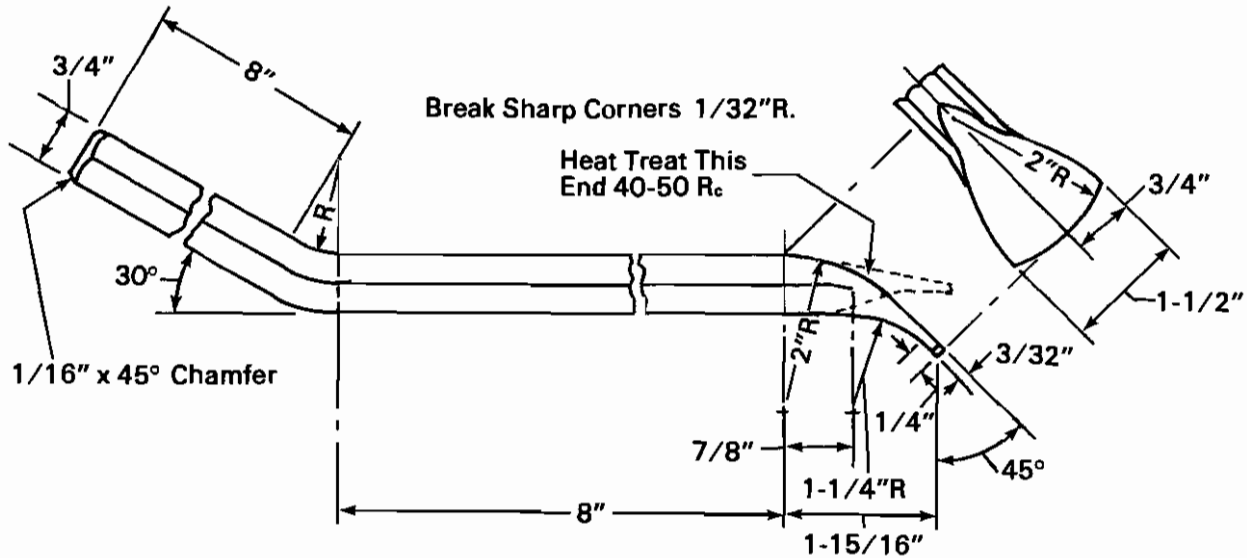


SMALL SHOP LAYOUT



LARGE SHOP LAYOUT

Fig.19 - Recommended Bearing Maintenance Shop Layout



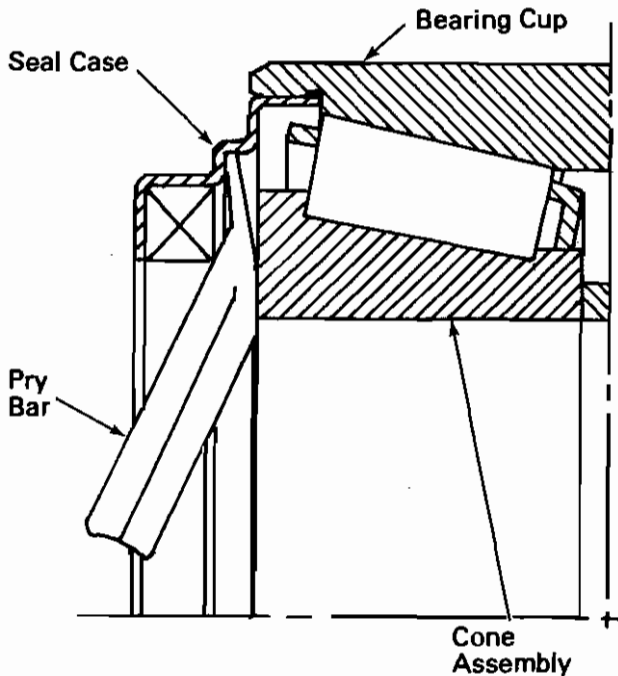
Timken Part No. K-82630

Material: 3/4" Hex Or Round - 4340 Steel Or Equivalent

METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
1/32	1	1-1/4	32.0
1/16	1.5	1-1/2	38.0
3/32	2.5	1-15/16	49.0
1/4	6.5	2	51.0
3/4	19.0	8	203.0
7/8	22.0		

29114

Fig.20 - Pry Bar To Remove Bearing Shell



29115

Fig.21 - Removing Bearing Seal With Pry Bar

It is not necessary for reassembly purposes to identify seal wear rings, backing ring, or axle end cap with each other or with the bearing from which they were removed.

CLEANING GENERAL

After the bearings have been disassembled, the excess grease should be removed from the bearing parts prior to proceeding with the cleaning operation.

Continuous type solvent washers, solution agitating, or agitating batch-type cleaning tanks large enough to handle one truck set of bearings and equipped to heat the cleaning solution are best suited for cleaning bearings.

To minimize the time required for cleaning bearings and to increase the life of the cleaning solutions the

grease may be purged from the cone assemblies by using a centrifugal grease slinger, Fig. 22. The slinger may be either single or double ended.

CAUTION

SANDBLAST CLEANING METHODS MUST NOT BE USED FOR CONE ASSEMBLIES, CUPS, SPACERS, OR WEAR RINGS.

Waste should not be used to clean roller bearings. Only clean, lint free shop towels should be used.

After cleaning, all parts should be coated with light machine oil to prevent corrosion.

BEARING PARTS

NOTE

EMD recommends that the seals be discarded after removal. However, if seals are to be reused, the seals should not be cleaned with other bearing parts.

Petroleum solvents such as kerosene or Stoddarts Solvent should be used for cleaning seals either by hand or in an agitating batch type cleaning tank.

Cleaning solvents which are strong oxidizing agents, chlorinated or nitrated hydrocarbons, acetones, or acetate should not be used.

All bearing parts, except the seals which should be scrapped, may be cleaned in granular caustic soda or alkaline compounds, mixed with water, 0.23 kg (8 oz) per gallon, and heated 88° to 93° C (190° to 200° F).

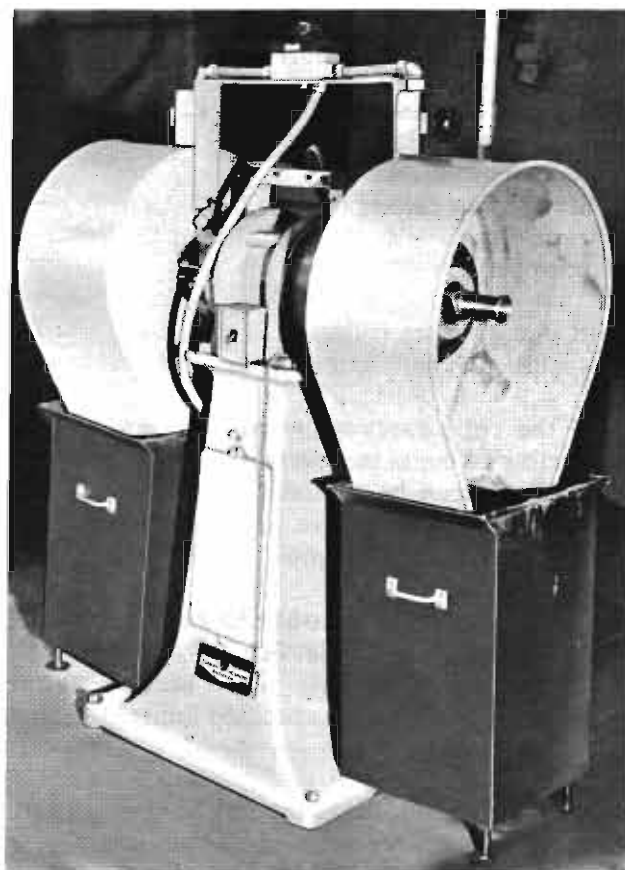
Following the cleaning operation, rust removers may also be used, followed immediately by a hot water rinse and a water displacing oil bath to prevent corrosion.

Car oil or an oil having a flash point above 149° C (300° F) are also suitable for cleaning bearing parts in agitating batch-type cleaning tanks.

Adapters, end caps, backing rings, and cap screws should have the accumulation of road dirt removed prior to cleaning if these parts are to be cleaned in the same cleaning tank used for other bearing parts.

Adapters, end caps, and backing rings may be cleaned by sand or shotblasting.

DO NOT USE ANY ABRASIVE such as emery cloth for cleaning the outside surface of seal wear rings. The use of such materials will scratch the wear ring surface and may prevent the seal from retaining the lubricant.



19913

Fig.22 – Centrifugal Grease Slinger

INSPECTION AND REPAIR

The following inspection and repair procedures are intended as a guide to qualify bearings which have been in service. For complete procedures and specifications, refer to the Association of American Railroads Roller Bearing Manual.

GENERAL

Under normal conditions no perceptible wear will occur on the bearing cup or cone assembly. However, due to the abrasive action of contaminants that sometimes do get into the lubricant, wear may occur.

Locomotive axle journal roller bearings can be damaged as a result of being subjected to loads and conditions other than those for which they were designed.

COMMON BEARING DEFECTS

Bearing components including the outer race and rollers should be carefully and individually inspected. Refer to Service Data section for common bearing defects.

CONE ASSEMBLY INSPECTION

Inspect the cone assemblies for any of the described common bearing defects.

If the roller race of bearing cone (bearing inner race) is spalled, the cone assembly must be scrapped.

If one or more rollers of a cone assembly are spalled, the cone assembly must be scrapped.

If the cone raceway or rollers do not show peeling or metal pickup from the cup, the cone assembly can be returned to service. If cone raceway or rollers are peeled or have metal pickup, the cone assembly should be scrapped.

The cone assemblies should be checked to the dimensions given in the Service Data to ensure an interference fit on the axle. If the bore of a cone assembly is not within the specified limits, it should be scrapped.

The cone bore inside diameter may be checked with either an inside micrometer of known accuracy or with a dial bore gauge which has been set with a master ring as shown in Fig. 23.

Cone bores should be checked at both ends of the bore 9.5 mm to 13 mm ($3/8"$ to $1/2"$) from the cone faces rather than at the center of the cone.

Cracks or pieces broken out of the cone shall constitute cause for scrapping the cone assembly.

Some special tools are available or may be made up and used to facilitate cone inspection. A stand, Fig. 24, is for the purpose of holding the cone assembly for inspection. The stand is provided with a slot to direct light between the small rib of the cone and the cage flange onto the roller race. Also, a probe, Fig. 25, can be inserted between the rollers.

CAGE INSPECTION

Examine the cage of the cone assembly. If the cage is bent or deformed, the cone assembly should be scrapped. Particular attention should be given to the development of cracks at the corners of the roller pockets. Cracks of any size constitute cause for scrapping the cone and roller assembly.

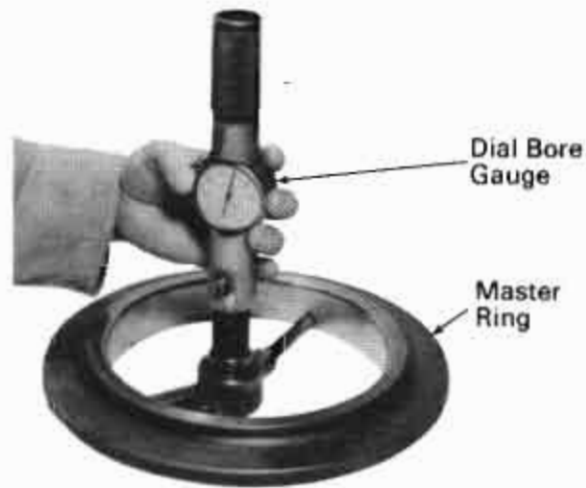
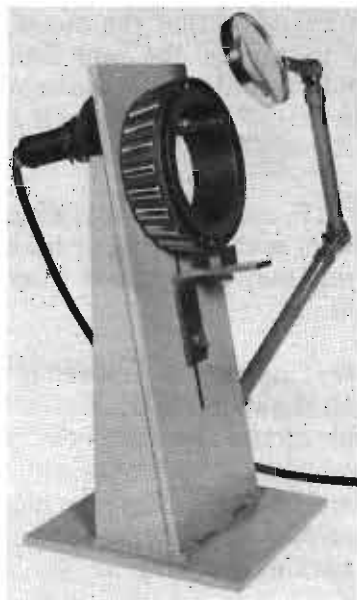


Fig.23 - Checking Cone Bore With Dial Bore Gauge

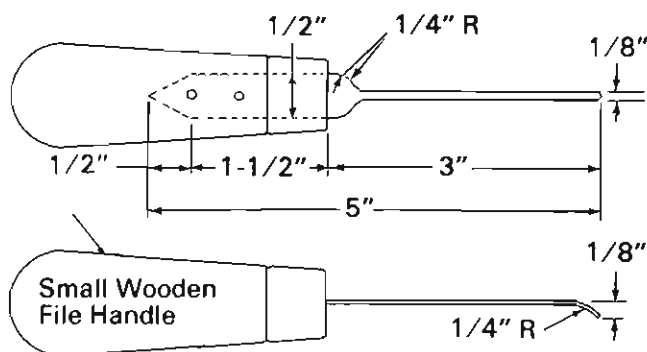
The cages are guided on the small cone rib. Cages are considered to be worn excessively when the total clearance of the diameters between the small rib of the cone and the cage flange is 2.29 mm (.090") or more. Measure this clearance using two sets of feeler gauges. Insert the feeler gauges between the small rib of the cone and the cage flange at two locations diametrically opposite. If the total of the two sets of feeler gauges is 2.29 mm (.090") or more, the cone assembly should not be returned to service.

If the roller pocket of the cage is worn to the extent that a 1.52 mm (.060") feeler gauge can be inserted between the roller and the cage bridge, the cone and roller assemblies should not be returned to service.



19914

Fig.24 – Inspection Stand



Material - 0.010" Feeler Gauge Stock

METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.010	0.25	1-1/2	38.0
1/8	3.0	3	76.0
1/4	6.5	5	127.0
1/2	12.5		

29126

Fig.25 – Inspection Probe

BEARING CUP INSPECTION

Cracks or pieces broken out of the bearing cup shall constitute cause for rejection.

The outside diameter and counterbore should be checked to the dimension shown in the Service Data. The counterbore may be checked with inside

micrometers of known accuracy or with a dial bore gauge, Fig. 26. A master ring should be used to set the dial bore gauge as shown in Fig. 23. Pieces not within limits should be scrapped.

SEALS

All used seals should be scrapped. Seals that have been applied to a cup should be scrapped after removal from the cup.



19916

Fig.26 – Checking Bearing Cup Counterbore With Dial Bore Gauge

SEAL WEAR RING AND BACKING RING INSPECTION

Classes E, F, and GG bearings have separate seal wear rings and backing rings, while Class G bearings have a one piece seal wear and backing ring. See Service Data and Fig. 3 for description.

If the outside surface of the seal wear ring is cracked or scratched or if the lip contact path has worn to a depth of 0.13 mm (.005") or 0.25 mm (.010") on the diameter, it should be scrapped. On Classes E, F, and GG bearings it is not necessary to remove the inner seal wear ring from the backing ring for cleaning or inspection of the wear ring.

Backing rings should be checked for cracks and bent or broken areas. On Classes E and F bearings and bearings with non-fitted backing rings, check the breakout diameter and the axle fillet contact location with the gauge shown in Fig. 27. The axle fillet contact can be checked by attempting to insert a 25-gauge, 0.518 mm (.0204") diameter steel wire between the gauge and the backing ring. If wire can be inserted, the backing should be scrapped.

Refer to Electro-Motive Division Service representative to obtain drawing for Class G or Class GG bearings and bearings with fitted backing rings inspection gauges.

If pits and gouges in the radius are deeper than 0.05 mm (.020"), the backing ring should be scrapped.

On Classes E, F, and GG bearings the backing ring counterbore must have a press fit with the seal wear ring. If the backing ring counterbore is oversize by not more than 0.25 mm (.010"), the press fit on the seal wear ring may be restored by center punching the face, adjacent to the counterbore, at six equally spaced locations with a center punch or counterbore repair punch, Fig. 28.

The vent fitting in the backing ring should be inspected to make sure that it is not clogged or damaged. If the vent fitting is damaged a new one should be applied.

To remove the vent fitting, Fig. 29, from the backing ring, clamp the backing ring between the back face and counterbore face in a vise using brass jaw faces. Insert a 11 mm (7/16") diameter rod in the vent hole in the bore of the backing ring and force the vent fitting past the peen marks by tapping the rod with a hammer. Care must be taken to see that the machined faces of the backing ring are not damaged.

The two upset spots of the vent fitting hole, Fig. 29, can be displaced so that a new vent fitting can be inserted in the hole by driving a 13 mm (1/2") rod that is slightly tapered on the end into the vent fitting hole.

Clean the vent hole thoroughly.

Insert a new vent fitting and upset the metal over the vent fitting at two diametrically opposite points preferably at the points of the original peening using a hand punch and hammer. A 4 mm (5/32") diameter flat face punch with the sharp corners on the flat face rounded is well suited for this operation.

Care must be taken that the metal is not upset sufficiently to damage the vent fitting. The vent fitting must be forced against the backing shoulder in the hole so that the fitting will fit snug after assembly.

On Classes E, F, and GG bearings if it is necessary to scrap the inner seal wear ring or backing ring, the seal wear ring may be removed from the backing ring, Fig. 30.

The seal wear ring may be removed in a small press with the tools shown in Fig. 31. Position the backing ring assembly on two support blocks, place the wear ring removal plate on the wear ring, position the forcing tube with the forcing tube plate applied on the wear ring removal plate, and press the wear ring out of the backing ring, Fig. 32.

The wear ring may also be removed from the backing ring as shown in Fig. 33. Position the backing ring assembly on the support blocks. Place the wear ring removal plate on the wear ring. Place a steel block on the removal plate and strike the block firmly with a hammer.

AXLE END CAPS

Axle end caps that are distorted, cracked, or damaged should be scrapped.

CAP SCREWS

Cap screw threads should be inspected for excessive wear or damage. Cap screws which cannot be tightened to the recommended torque must be scrapped.

LOCKING PLATES

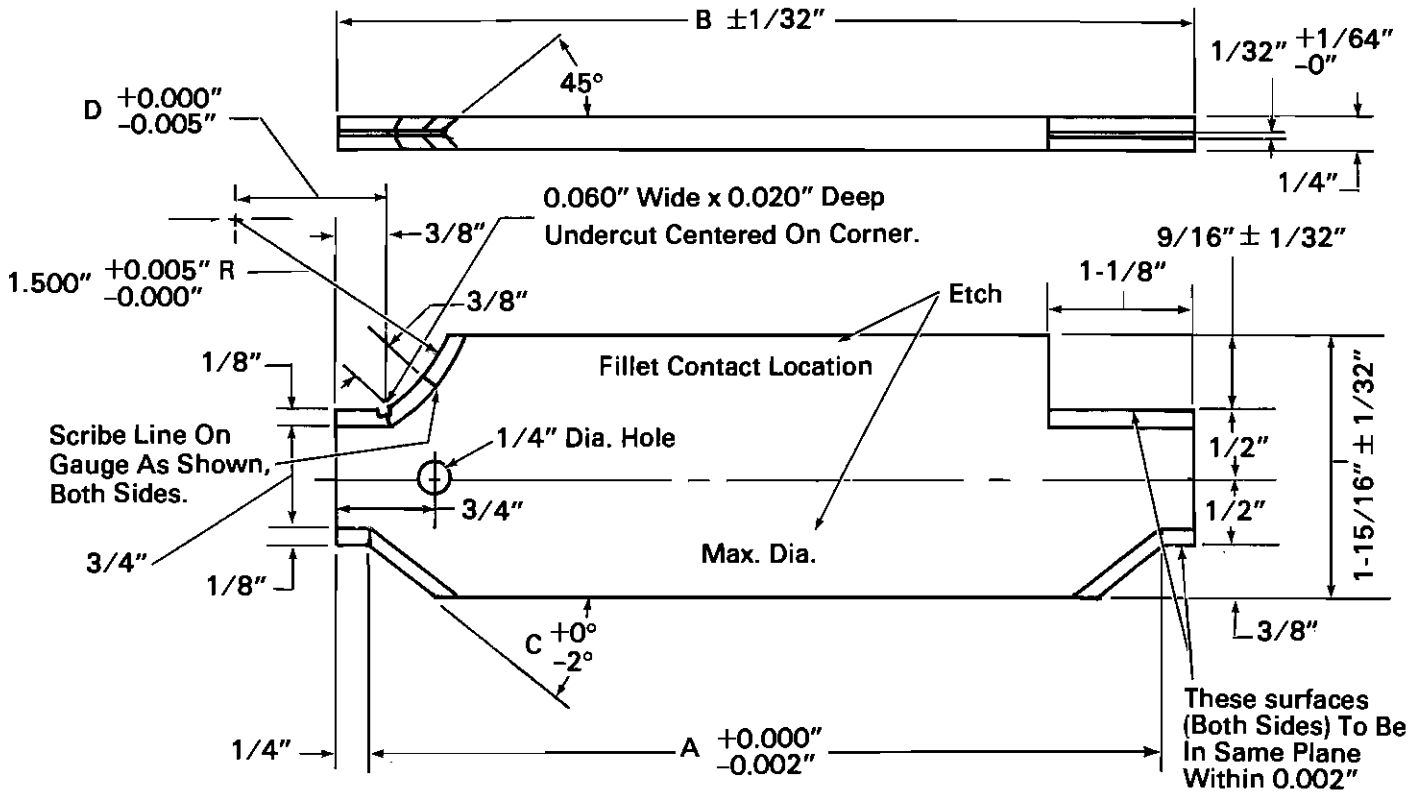
Whenever locking plates are removed they should be scrapped and replaced with new locking plates.

BEARING REASSEMBLY

REPLACEMENT OF BEARING PARTS

After the bearing parts have been disassembled, cleaned, inspected, and repaired, bearings should be reassembled from the satisfactory used parts together with new parts as required. Bearing component parts of different manufacture should not be mixed in assemblies.

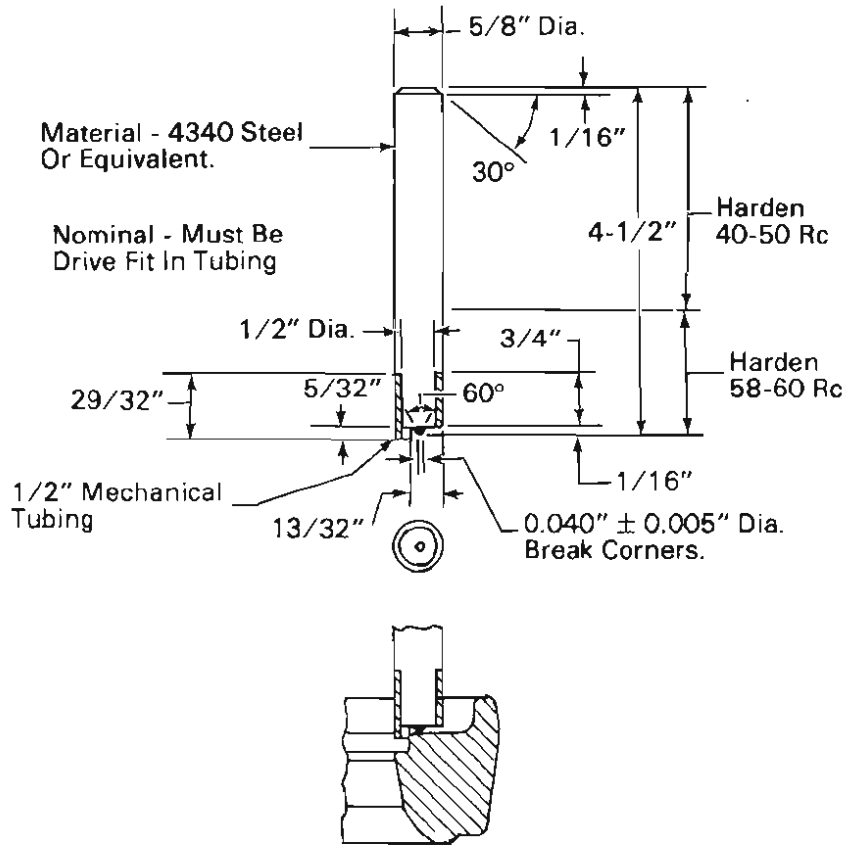
Class	DIMENSIONS						
	A		B		C	D	
	(inch)	mm	(inch)	mm		(inch)	mm
E	7.035	178.69	7-1/2	190.5	34°49'	0.845	21.46
F	7.535	191.39	8	203.2	32°49'	0.845	21.46



Material: Steel Hardened To R_c 60-64
 Tolerances: ± 1/64" Unless Otherwise Indicated
 Rust Proof Finish - Break All Sharp Corners

METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.002	0.05	1/4	6.5
0.005	0.13	3/8	9.5
1/64	0.5	1/2	12.5
0.020	0.51	9/16	14.0
1/32	1.0	3/4	19.0
0.060	1.52	1-5/16	33.5
1/8	3.0	1.500	38.0

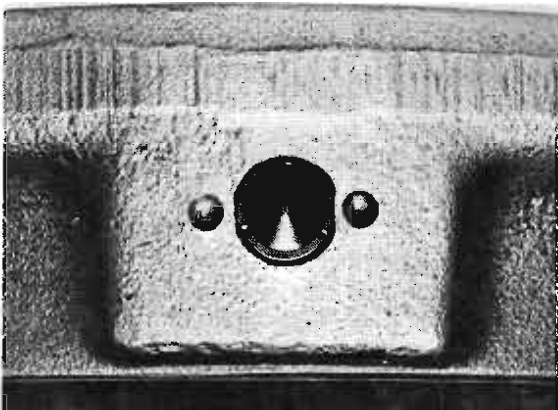
Fig.27 - Backing Ring Inspection Gauge



METRIC CONVERSION CHART			
(inch)	mm	(inch)	mm
0.005	0.13	1/2	12.5
0.040	1.02	5/8	16.0
1/16	1.5	3/4	19.0
5/32	4.0	29/32	23.0
13/32	10.5	4-1/2	114.5

29128

Fig.28 - Backing Ring Counterbore Repair Punch



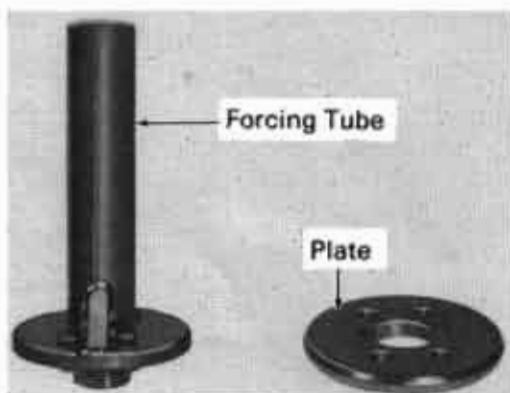
19920

Fig.29 - Vent Fitting



19921

Fig.30 - Seal Wear Ring And Backing Ring



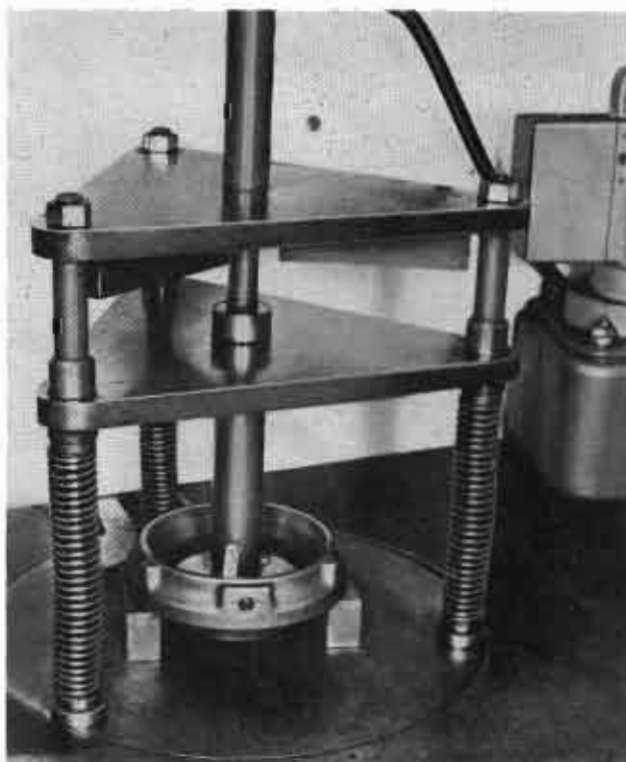
19922

Fig.31 - Seal Wear Ring Removal Tool



19924

Fig.33 - Alternate Method Of Removing Seal Wear Ring



19923

Fig.32 - Removing Seal Wear Ring

CHECKING BEARING BENCH LATERAL PLAY

Lateral adjustment of the bearing is controlled by the cone spacer between the two cone and roller assemblies.

Cone assemblies and bearing cups of the same size bearings are interchangeable until a cone spacer has been selected to establish the bearing lateral play, after which these parts must be kept together as a unit assembly.



19926

Fig.34 - Device For Checking Bearing Bench Lateral Play

If the bearing cone assemblies, cups, or cone spacers or two or more bearing sets become mixed, or if new replacement bearing parts are substituted, the bench lateral play must be checked to make sure that the cone spacer has the required width necessary to provide running lateral play after the bearing is pressed on the axle. The bearing bench lateral play should not be checked when the bearings are dry. All bearing parts should be dipped in light machine oil after they have been cleaned.

The bearing bench lateral play may be checked with the device shown in Fig. 34. Bearing bench lateral play cannot readily be obtained by using micrometer measurements.

Select the bearing adapter sleeve for the bearing size to be checked. Place the adapter sleeve on the adapter sleeve holder of the lateral checking device and tighten the set screw, Fig. 35. Place a cone assembly and a cone spacer on the adapter sleeve, Fig. 36. Position the bearing cup on the cone assembly and carefully place a second cone assembly in the cup. Position the collar on the upper cone assembly. The collar is designed to fit all bearing sizes. Make sure that the collar is clear of the upper cup face after the locking bolt has been tightened.



19926

Fig.35 - Application Of Adapter Sleeve

With the lateral checking fixture in the raised position, tighten the locking bolt securely to clamp the cone assemblies and cone spacer tightly together, Fig. 37. Lower the bearing assembly and revolve the upper cone assembly 12 revolutions to seat the rollers of the upper cone assembly against the large cone rib, Fig. 38. Apply a dial indicator mounted on a magnetic base to the bearing cup and set the indicator dial to zero, Fig. 39.

Actuate the cam arrangement of the fixture to lift the bearing cup off the top plate of the fixture. The bearing cup is then oscillated to seat the rollers of the lower cone assembly against the large cone rib, Fig. 40. The dial indicator reading is the bearing bench lateral play.

This procedure should be reversed by actuating the cam to lower the bearing assembly and oscillating the upper cone to seat the rollers. The dial indicator should return to the zero reading. Raise the bearing by actuating the cam to repeat the check on the lateral measurement.



19927

Fig.36 - Application Of Cone Assembly And Cone Spacer On Adapter Sleeve



19928

Fig.37 - Clamping Cone Assemblies And Cone Spacer

If the bearing bench lateral play is not within the limits specified in the Service Data, the cone spacer should be ground or a new cone spacer selected to provide the specified bearing bench lateral play. To reduce the lateral play, a narrower spacer is required. To increase the lateral play, a wider spacer is required. Cone spacers are available from the bearing manufacturer in increments of 0.05 mm (.002") from +0.15 mm (.006") wider than normal to -1.17 mm (.046") narrower than normal. Each spacer is marked to indicate its width from +0.15 mm to -1.17 mm (+.006" to -.046").



19929

Fig.38 - Seating Upper Cone Assembly Rollers



19931

Fig.40 - Seating Lower Cone Assembly Rollers



19930

Fig.39 - Application Of Dial Indicator

When a cone spacer has been ground or selected to provide the specified bench lateral play, this set of bearing parts then becomes a unit assembly and must be kept together until the final assembly has been completed.

LUBRICATION AT ASSEMBLY

As mentioned previously, new bearing assemblies are prelubricated at the factory. No additional lubricant is to be added after the bearing is applied to the axle.

If other than new bearings are to be installed, the bearings should either be requalified at an approved Service Center or disassembled, cleaned, inspected, and if within specifications, lubricated, and reassembled.

Refer to Service Data for proper lubricant quantity to be applied to individual components.

When applying grease to roller bearings, every possible precaution must be taken to prevent contaminants from getting into the lubricant. The grease should be kept covered and in the containers in which it is shipped. Pumping devices equipped with adapter covers to fit the containers in which the grease is shipped should be used for roller bearing lubrication to prevent contamination with dirt or moisture.

The grease containers must be stored away from heat and the grease must not be heated to facilitate application. If the grease is heated, separation of the oil from the soap in the grease will result.

If the bearing is equipped with a lubricant fitting in the axle end cap, the fitting is for periodic field lubrication. The initial charge of grease for the bearing cannot be applied through this fitting after the bearing is installed on the axle.

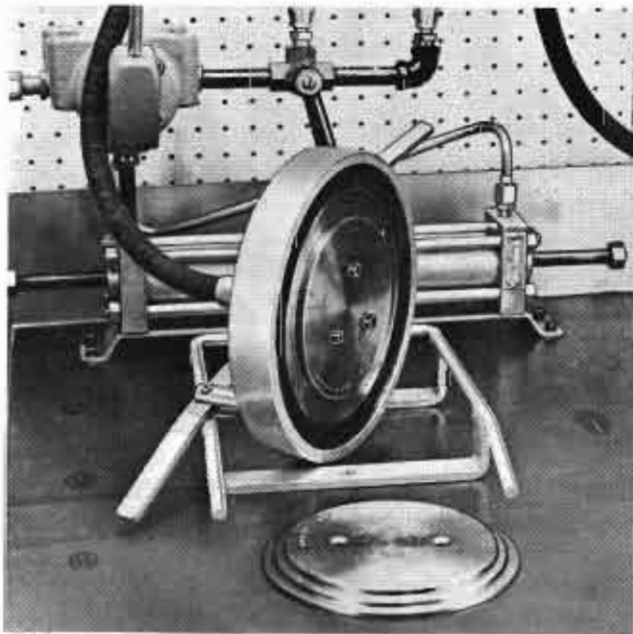
All bearing sizes are available with a no-field-lubrication (NFL) design having cap screw seal rings and a no-lubricant fitting. NFL design bearings do not require periodic field lubrication and will last the life of the wheel or up to 402 250 km

(250,000 miles). The NFL bearing is replenished with grease during normal wheel replacement when the bearings are reworked.

When wheels are replaced, bearings are to be requalified and reassembled using a fresh charge of grease.

Refer to Service Data for grease quantity at bearing assembly and the amount of grease to be added at field lubrication.

A grease fixture, similar to that shown in Fig. 41, should be used to pack the cone and roller assembly with grease. A cone assembly properly packed is shown in Fig. 42.



19932

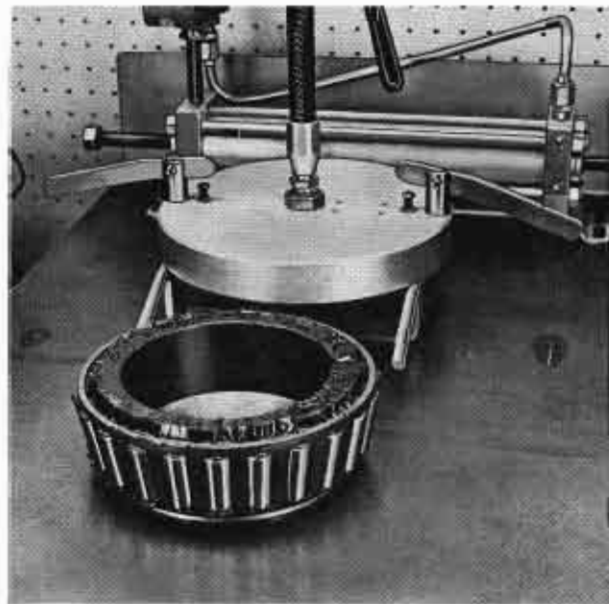
Fig.41 - Greasing Fixture

SEAL INSTALLATION

The seal may be installed in the bearing cup in a small press by using the tools shown in Fig. 43.

Be sure the lips of the seal are well lubricated with grease.

Position the bearing cup in the bearing support ring and place a cone and roller assembly, that has been packed with grease, in the bearing cup, Fig. 44. Place the seal in position to be pressed into the bearing cup and position and adapter ring on the seal, Fig. 45. Center the bearing in the press and press the seal into the bearing cup, Fig. 46. Check the seal and make sure that it is properly seated. The



19933

Fig.42 - Properly Packed Cone Assembly



19934

Fig.43 - Seal Installation Tools



19935

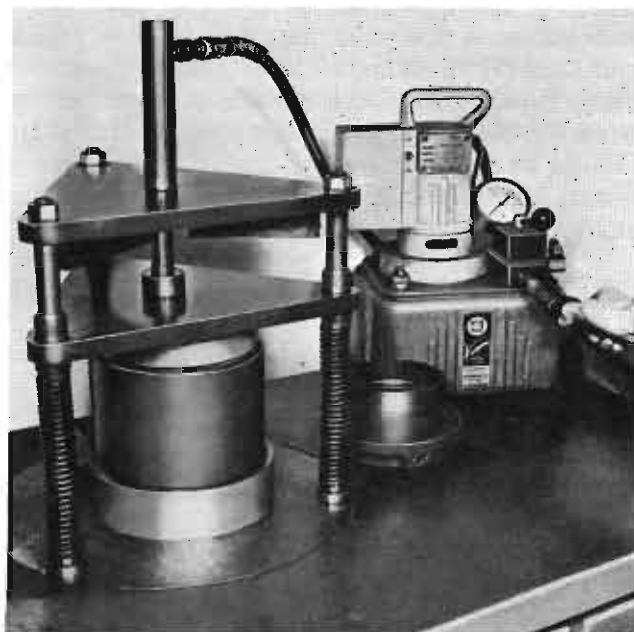
Fig.44 - Application Of Cone And Roller Assembly

shoulder of the seal case must be flush with or below the bearing cup face, Fig. 47. Apply the outer seal wear ring. The seal wear rings must be applied with care. The end of the seal wear ring which is to be started into the seal is chamfered so that the seal lips will gradually expand over the seal wear ring without turning under.



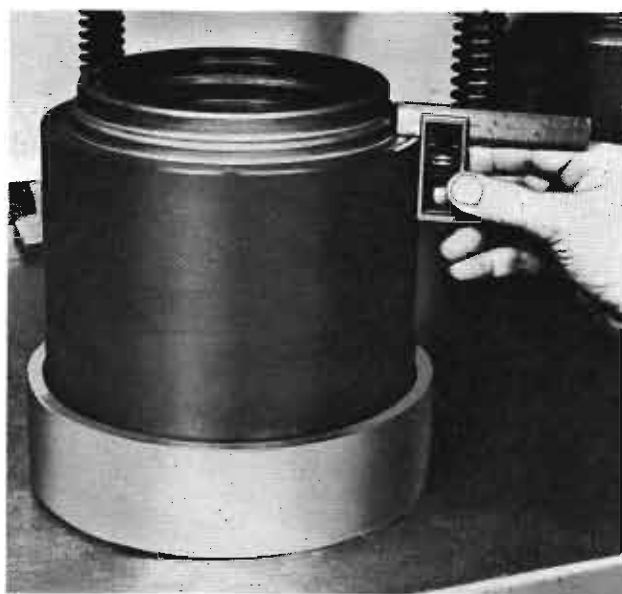
19936

Fig.45 - Positioning Adapter Ring



19937

Fig.46 - Pressing Seal In Bearing Cup



19938

Fig.47 - Properly Seated Seal

DO NOT INSERT ANY TOOL OR OTHER INSTRUMENT BETWEEN THE SEAL ELEMENT LIPS AND SEAL WEAR RING. This may damage the seal element lips or scratch the seal wear ring, resulting in bearing lubricant leakage.

Turn the bearing assembly over and place the cone spacer in position in the bearing cup on the face of the cone.

The amount of grease specified in the Service Data should be spread evenly around the cone spacer before the second cone assembly is placed in the bearing cup, Fig. 48.

Place the second cone assembly, which has been previously packed with grease, in position in the bearing cup. Apply the second seal and check to make sure that it is properly seated, Fig. 41.

Apply the inner seal wear ring and backing ring. If the seal wear ring has been removed from the backing ring, apply the wear ring and place the backing ring in position to be pressed on the wear ring, Fig. 49. The bearing support ring must not be used when the backing ring is pressed on the seal wear ring. The bearing assembly must be resting on the seal wear ring at the opposite end of the bearing.

Center the bearing assembly in the press and press the backing ring on the seal wear ring, Fig. 50.



19939

Fig.48 - Applying Grease Around Cone Spacer



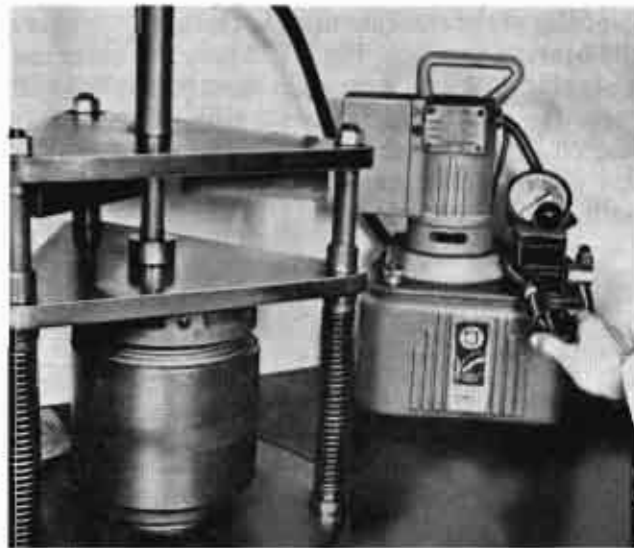
19940

Fig.49 - Positioning Backing Ring

A cardboard insert as used in the original packaging, or a similar device, should be used to keep the bearing cones and cone spacer in alignment to facilitate installing the bearings on the axle and to prevent dirt or dust from entering the bearings before they are applied to the axle.

Apply a protective coating of grease over the vent fitting in the backing ring.

The bearing assembly is now ready to be applied to the axle or placed in stock.



19941

Fig.50 - Application Of Backing Ring

When bearing assemblies are to be placed in stock, they should be covered and stored in a dry area well protected from moisture.

JOURNAL BEARING ADAPTER WEAR PLATES

DRIVING WEAR PLATES

Check the outside dimension across the bearing adapter driving wear plates. Refer to Fig. 51 and Table II for new adapter driving wear plate dimensions. A new wear plate is 6 mm (1/4") thick and 3 mm (1/8") maximum wear is allowed per wear plate. Typically, during rebuild, if the wear plate is worn 1.5 mm (1/16") or more, a new wear plate should be applied. Before replacing both wear plates, verify that the wear is on both wear plates and not totally on one wear plate.

DRIVING WEAR PLATE REPLACEMENT

If the driving wear plates are to be replaced with new wear plates, perform the following procedure.

1. Remove the bearing adapter from the cartridge bearing before welding.
2. Remove the used wear plate by chipping, grinding, or by metal cutting electrode process. Removal should not be attempted with an acetylene torch because of distortion which could result from intense heat. The metal cutting electrode process is recommended because of the speed and ease of operation; and when reasonable care is exercised, the low heat

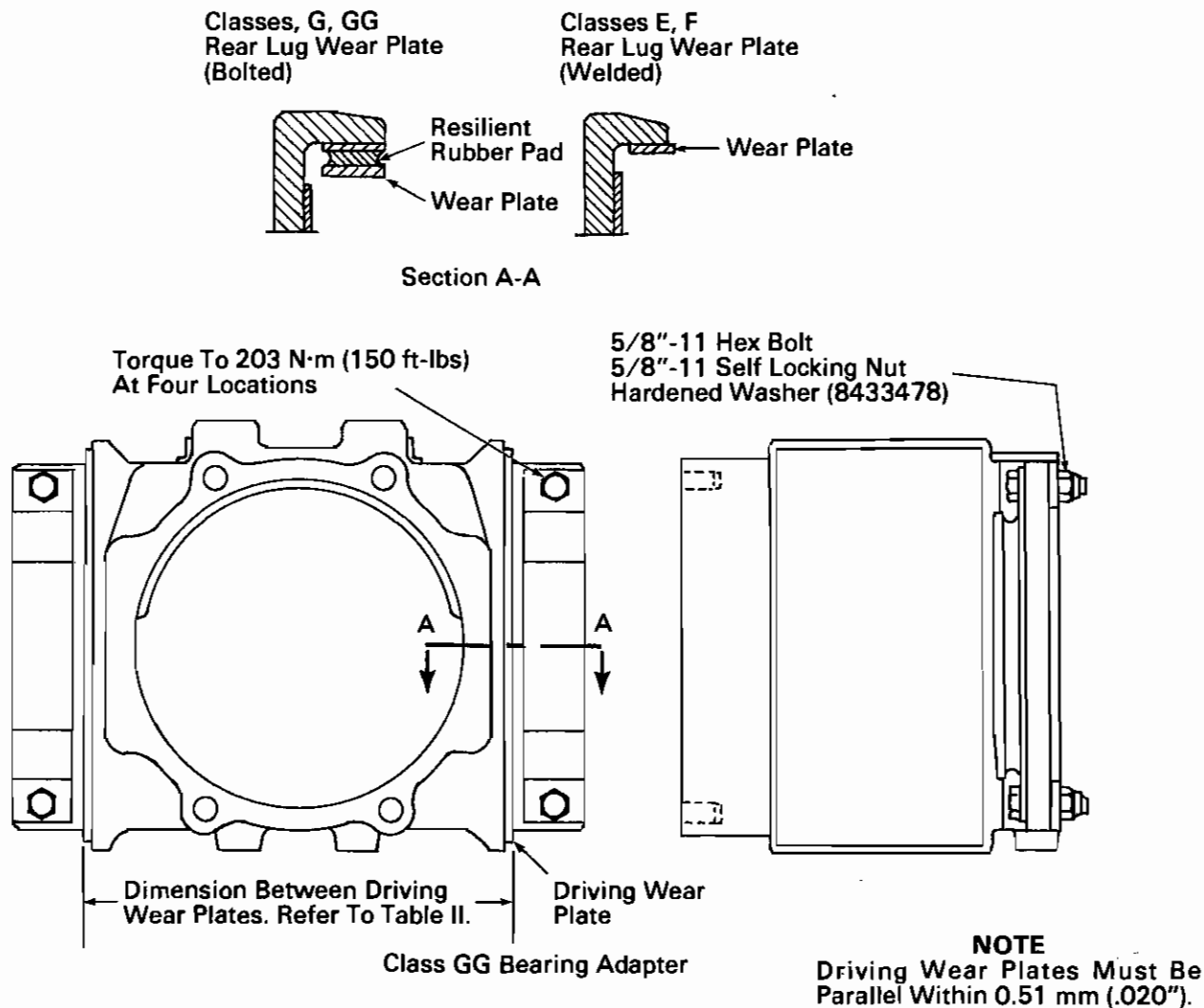


Fig.51 - Journal Bearing Adapter Wear Plates

29129

Bearing Class	Bearing Size	Truck Model	Typical Dimension Across New Driving Wear Plates	
			(inch)	mm
E	6" x 11"	GLC	10.980 ^{+0.000} -0.050	278.90 ^{+0.00} -1.27
F	6-1/2" x 12"	Switcher	*11.050 ^{+0.010} -0.020	280.67 ^{+0.25} -0.51
F	6-1/2" x 12"	GB, GC	13.284 ^{+0.000} -0.036	337.41 ^{+0.00} -0.91
F	6-1/2" x 12"	GHC	13.310 ^{+0.000} -0.050	338.07 ^{+0.00} -1.27
G	7" x 12"	Switcher	*11.050 ^{+0.000} -0.020	280.67 ^{+0.25} -0.51
G	7" x 12"	GB, GC, GHC	13.310 ^{+0.000} -0.050	338.07 ^{+0.00} -1.27
GG	6-7/8"	GP, HTC	15.000 ^{+0.000} -0.062	381.00 ^{+0.00} -1.57

*Hardened wear surfaces, no wear plates.

Table II - Typical Dimensions Across Driving Wear Plates

developed will not distort the housing bore. If the metal cutting electrode process is to be used, refer to the Metal Cutting Electrode Process procedure which follows. Prepare the wear plate surface by grinding flat and parallel within 0.50 mm (.020") of the opposite side. Wire brush wear plate surface of the adapter.

3. Place the wear plate on the adapter surface to which it will be welded. Ensure that no bumps interfere with the wear plate laying flat. Use clamps to hold wear plate flat and tight against the adapter during welding.
4. Immerse the bearing adapter in water during welding operation to prevent distortion of the adapter bore due to welding heat.

NOTE

The following electrode is used by the bearing manufacturer to weld wear plates to the bearing adapter. The electrode is a type of AWS E-310 or AWS E-312.

Metal And Thermit Corporation,
New York, N.Y.

Murex 25-20 Stainless Steel Welding
Electrode (25% chromium, 20% nickel)

Lime Coated, 4 mm (5/32") Diameter

150 Amps, DC, Reversed Polarity

(Bearing Manufacturer's recommendation,
88-160 Amps)

5. Refer to Fig. 52 for welding details and weld wear plate to bearing adapter using AWS E-310 or AWS E-312 electrode.
6. Chip off weld scale and allow housing to cool. Inspect welds for cracks.

METAL CUTTING ELECTRODE PROCESS

To remove driving wear plates from the bearing adapter with the metal cutting electrode process requires no special equipment other than a metal cutting electrode and standard DC weld equipment. Use the following:

Chamfer Trode Electrode (or equivalent).

3 mm (1/8") Electrode for 6.5 mm (1/4")
fillet welds.

4 mm (5/32") Electrode for large fillets.

DC Straight Polarity.

325 Amps (approx.) for 3 mm (1/8") electrode.

375 Amps (approx.) for 4 mm (5/32") electrode.

Perform the following procedure to remove welds.

1. Clamp electrode in regular welding rod holder of a DC welding machine.
2. Position electrode at a shallow angle directed at the weld to be removed. Push the molten material ahead of the electrode, pulling back and pushing forward to prevent a puddle forming in back of the electrode tip.
3. After cutting all the welds, the wear plate can be remove by striking with a hammer. Grind flat and parallel within 0.50 mm (.020") of the opposite side. Wire brush wear plate surface of the adapter.

REAR LUG WEAR PLATES

Bearing Classes E and F adapters have welded rear lug wear plates and bearing Classes G and GG have bolted-on wear plates mounted on resilient rubber pads as shown in Section A-A Fig. 51. A new wear plate is 9.5 mm (3/8") thick in the middle and tapered down to 6 mm (1/4") on the long ends. Measure thickness at the middle of the wear plate.

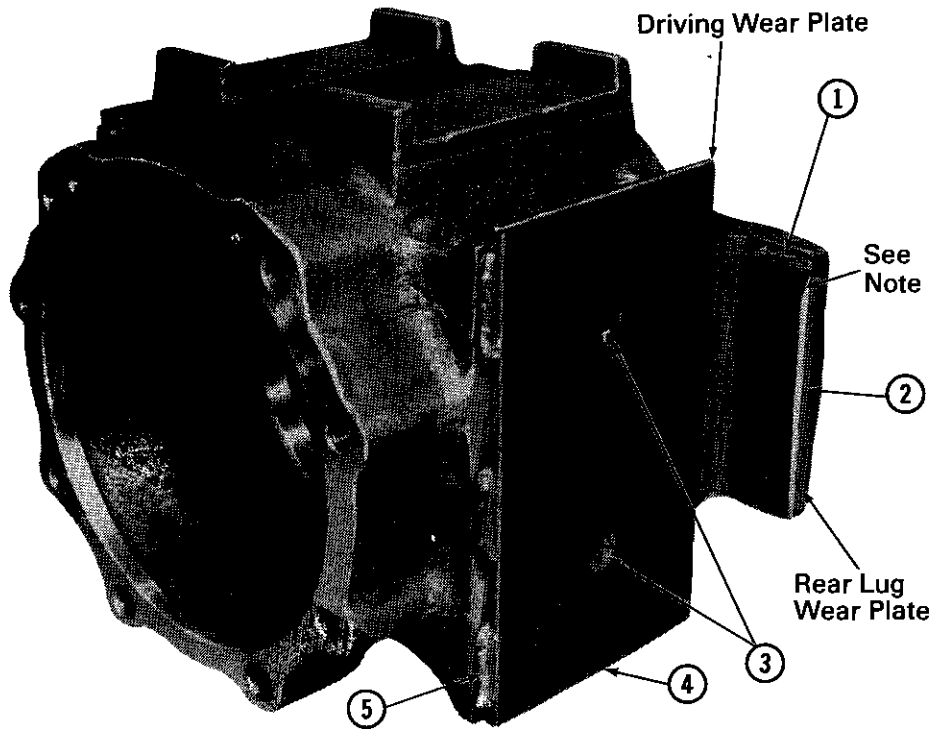
REAR LUG WEAR PLATE REPLACEMENT

If the wear plates of bearing Classes E or F adapters require replacement, remove and weld on new wear plates per procedure for driving wear plate replacement. For bearing Classes G or GG, the wear plate and resilient rubber pad are a bolted-on assembly. If the wear plates are worn or missing, or the resilient rubber pad shows signs of distress or excessive tearing, replace the bolted-on assembly. Torque the wear plate assembly mounting bolts to 203 N·m (150 ft-lbs). Ensure hardened washers 8433478 are used.

STORAGE

ROLLER BEARING ASSEMBLIES AND COMPONENT PARTS

Unmounted roller bearings and component parts must be stored in an area that is clean and well protected from moisture.



NOTE: Beveled edges of rear lug wear plate to be assembled towards outside as shown.

29130A

Journal Bearing Class	Weld Location	5 mm (3/16") Fillet Welds
E	1	Both ends
	2	38 mm (1-1/2") long on 102 mm (4") centers
	3	Around inside of each hole
	4	38 mm (1-1/2") long on 140 mm (5-1/2") centers
	5	38 mm (1-1/2") long on 102 mm (4") centers
F	1	Both ends
	2	38 mm (1-1/2") long on 102 mm (4") centers
	3	Around inside of each hole
	4	38 mm (1-1/2") long on 102 mm (4") centers
	5	38 mm (1-1/2") long on 121 mm (4-3/4") centers
GG	1 } 2 }	Bolted rear lug wear plate
	3	Around inside of each hole
	4	25.4 mm (1") long on 76 mm (3") centers
	5	51 mm (2") long on 152 mm (6") centers

NOTE: Class G journal bearing adapter has hardened wear surfaces, no wear plates.

29130B

Fig.52 – Journal Bearing Adapter Wear Plate Welding Details

A periodic inspection should be made of stored roller bearings. Any undesirable condition found should be corrected immediately.

Stored roller bearing assemblies or component parts that have been subjected to moisture must be cleaned and inspected. Roller bearing assemblies, showing evidence of moisture having entered the bearing, must be disassembled, cleaned, and inspected. Damaged roller bearing parts must be repaired or replaced in accordance with instructions.

Roller bearings, either new or used, that are placed in storage as individual parts, or as complete assemblies, should be used in the order in which they were stored, oldest stock first.

New roller bearings and component parts should not be removed from the shipping package until they are to be installed on an axle or assembled as a unit assembly.

New seals held in storage must be kept covered to protect them from dust or other possible damage until they are installed in a bearing.

When new roller bearing parts are removed from storage, it is not necessary to clean the protective coating of lubricant from the parts that have been retained in their original shipping package.

When bearings that have had previous service are disassembled, cleaned, and inspected in accordance with instructions, and are to be placed in stock, they may be stored as unit assemblies or as individual parts. Bearing assemblies made up of bearing parts that have had previous service, and that are to be placed in storage should be lubricated with the specified quantity of grease and should be adequately protected from dirt and moisture. Individual bearing parts that have had previous service and are to be placed in storage should be dipped in a suitable rust preventive such as light oil and adequately protected from dirt and moisture. When roller bearing parts that have had previous service are removed from stock, they must be cleaned before they are assembled.

WHEEL GEAR & AXLE ASSEMBLIES WITH ROLLER BEARINGS APPLIED

Wheel gear and axle assemblies with roller bearings applied must be handled with care. Damage may occur if bearings are permitted to strike other objects. It is best to store assemblies on track with

the wheels flange to flange. It is not necessary to periodically revolve the bearing to distribute lubricant over the bearing surfaces.

The vent fitting recess in the backing rings of bearing assemblies removed from storage should be cleared of all foreign material.

Wheel and axle assemblies with roller bearings applied should be used in the order in which they were stored, using oldest stock first.

LOCOMOTIVES WITH ROLLER BEARINGS APPLIED

When locomotives with cartridge-type roller bearings applied are placed in storage, the hand brake should be set or the wheels chocked to prevent the equipment from moving. It is not necessary to move the locomotive periodically to distribute lubricant over the bearing surfaces.

INSTALLATION AND REMOVAL EQUIPMENT

Cartridge-type roller bearings may be installed or removed with a bearing press, wheel press, or with portable fixtures.

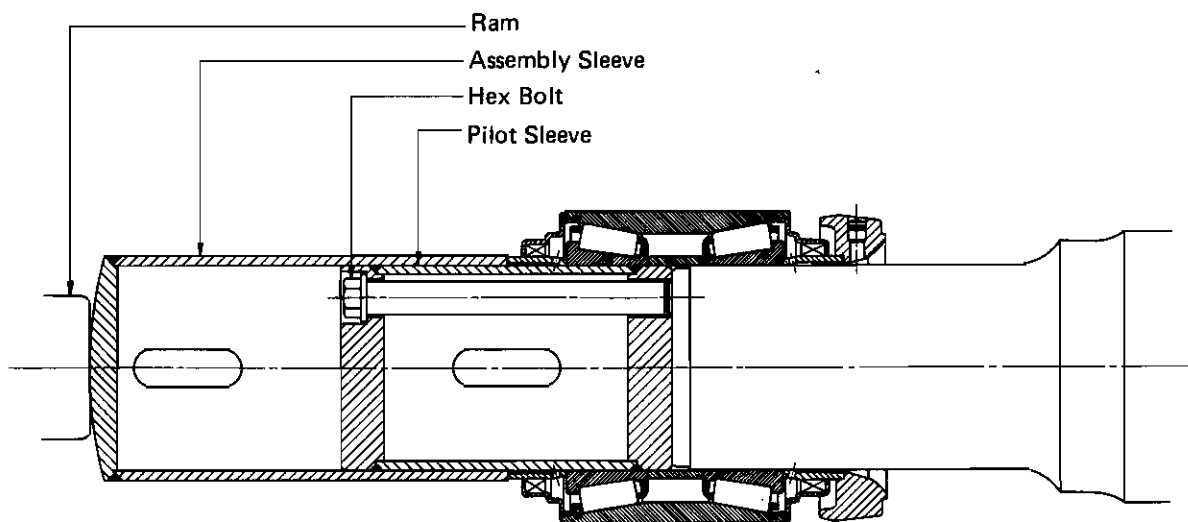
To ensure that bearings are properly seated, bearing or wheel presses should be equipped with relief valves so that the specified pressure can be maintained for a short interval. Bearings may not be properly seated if the required pressure is obtained only during the surge of the press when the backing ring of the bearing contacts the axle fillet. The required pressure must be maintained after the surge.

Bearing presses or wheel presses should be checked periodically with a load cell to ensure the gauge indicates the correct pressure. Ensure the piston travel is adequate for bearing application.

When roller bearings are applied in a bearing or wheel press, pilot sleeves fastened to the end of the axle, and separate assembly sleeves, Fig. 53, or telescoping pilot and assembly sleeves fastened directly to the ram of the press, Fig. 54, may be used. The pilot sleeve must be used to keep the cone spacer in alignment with the bore or the cone and to guide the bearing assembly onto the axle.

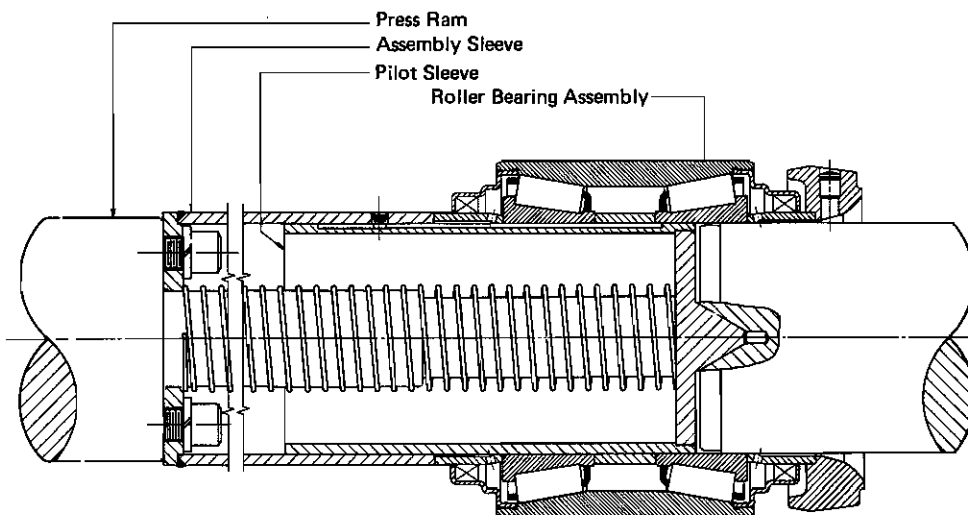
Bearing presses may be double ended, Fig. 55, to apply bearing assemblies to both ends of the axle at the same time.

Details of separate pilot and assembly sleeves are shown in Fig. 56.



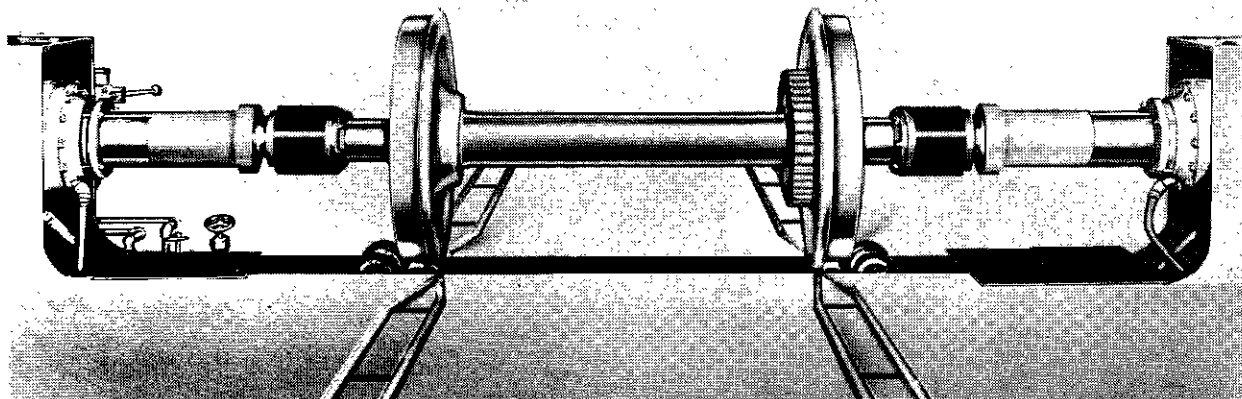
19887

Fig.53 - Separate Sleeve Method Of Applying Bearings To Axle



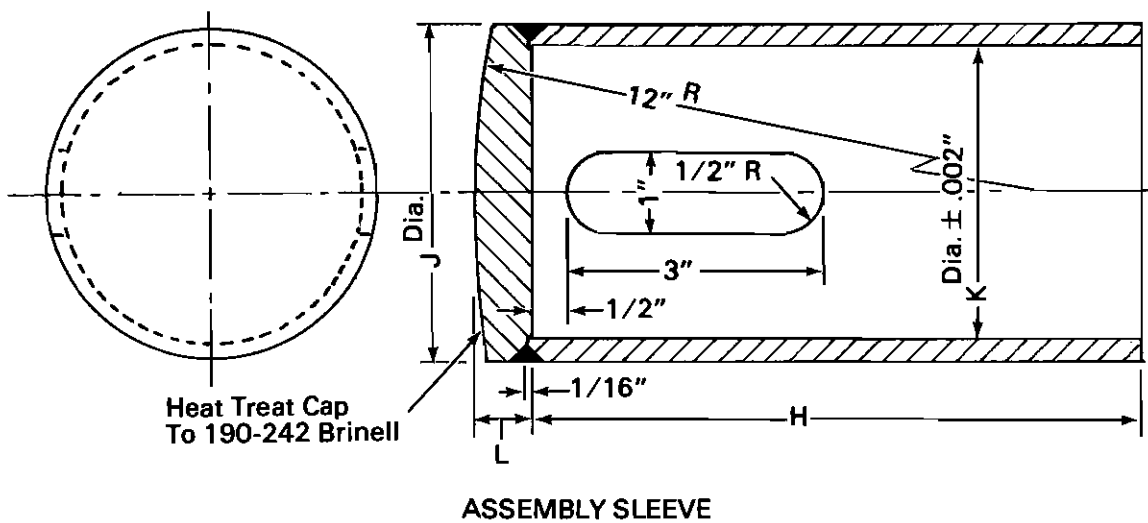
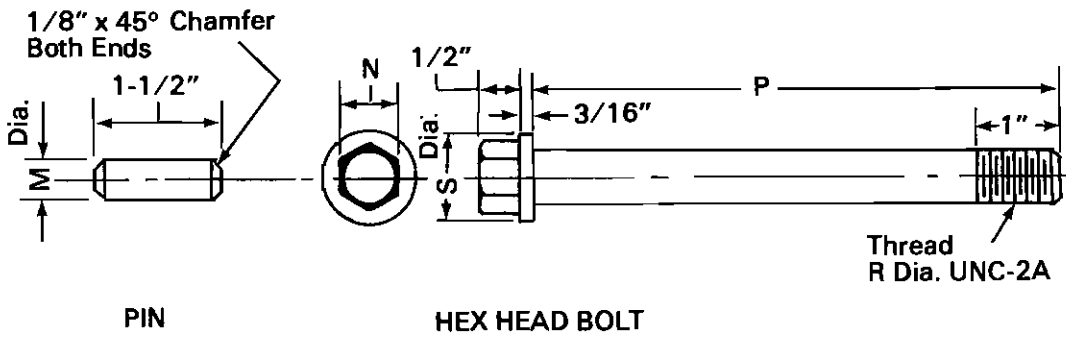
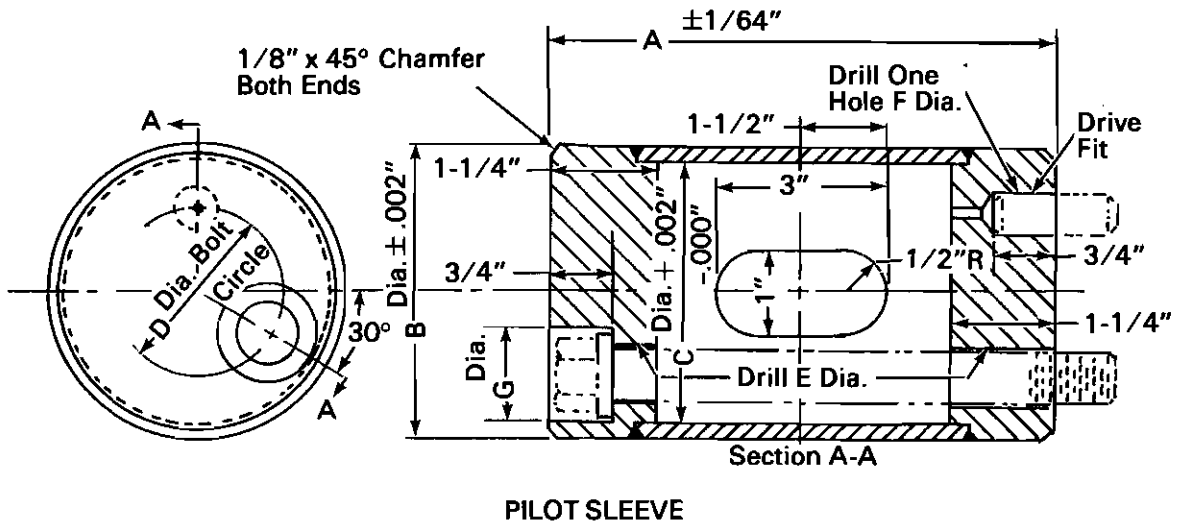
19888

Fig.54 - Telescoping Sleeve Method Of Applying Bearings To Axle



19889

Fig.55 - Applying Bearing Assemblies To Both Ends Of Axle At Same Time



29106

Fig.56 - Pilot Sleeve And Assembly Sleeve Details

Class Size	Pilot Sleeve						
	A	B	C	D	E	F	G
E (6x11)	9-3/8	5.665	5.187	3-7/8	1-1/32	27/32	1-7/16
F (6-1/2x12)	10-1/4	6.165	5.687	4-1/4	1-5/32	61/64	1-9/16
G (7x12)	10-1/4	6.978	6.500	4-5/8	1-9/32	1-5/64	1-11/16
GG (6-7/8)	9-3/4	6.853	6.375	5	29/32	47/64	1-5/16

Class Size	Assembly Sleeve				Pin	Hex Head Bolt			
	H	J	K	L	M	N	P	R	S
E (6x11)	11	6-1/4	5.698	3/4	27/32	15/16	9-3/8	1"-8	1-3/8
F (6-1/2x12)	11	6-3/4	6.198	1	61/64	1	10-1/4	1-1/8"-7	1-1/2
G (7x12)	11-1/8	7-9/16	7.012	1-1/4	1-5/64	1-1/8	10-1/4	1-1/4"-7	1-5/8
GG (6-7/8)	10-13/16	7-15/16	6.887	1	47/64	7/8	9-3/4	7/8"-9	1-1/4

METRIC CONVERSION CHART							
(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm
0.002	0.05	1-1/32	26.0	3-7/8	98.5	6-3/4	171.5
1/64	0.5	1-1/8	28.5	4-1/4	108.0	6.853	174.07
1/16	1.5	1-5/32	29.5	4-5/8	117.5	6-7/8	174.5
1/8	3.0	1-1/4	32.0	5.127	130.23	6.887	174.93
3/6	5.0	1-9/32	32.5	5.187	131.75	6.978	177.24
1/2	12.5	1-5/64	27.5	5.665	143.89	7	178.0
47/64	18.5	1-5/16	33.5	5.687	144.45	7.012	178.10
3/4	19.0	1-3/8	35.0	5.698	144.73	7-9/16	192.0
27/32	21.5	1-7/16	36.5	6	152.5	9-3/8	237.5
7/8	22.0	1-1/2	38.0	6.165	156.60	9-3/4	247.5
29/32	23.0	1-9/16	39.5	6-1/4	159.0	10-1/4	260.5
15/16	23.8	1-5/8	41.5	6.198	157.43	10-13/16	274.5
61/64	24.2	1-11/16	43.0	6.375	161.92	11	279.5
1	25.4	3	76.0	6.500	165.10	11-1/8	282.5

A fixture, Fig. 57, is required for removing a bearing in a bearing or wheel press without removing the wheel. The adapter shoe and reach rods required to attach the fixture to the bearing or wheel press should be designed to suit the specific press conditions.

Fixtures must be used for bearing installation and removal. These fixtures can be operated by hand, air, or electrically-operated pumps and jacks which are available commercially to suit production requirements.

A self-contained portable fixture equipped with an electrically-operated pump is shown in Fig. 58. A self-contained portable fixture using a reversible hollow-stem hydraulic jack actuated by a hand-pump is shown in Fig. 59. These fixtures with applicable accessories are available from:

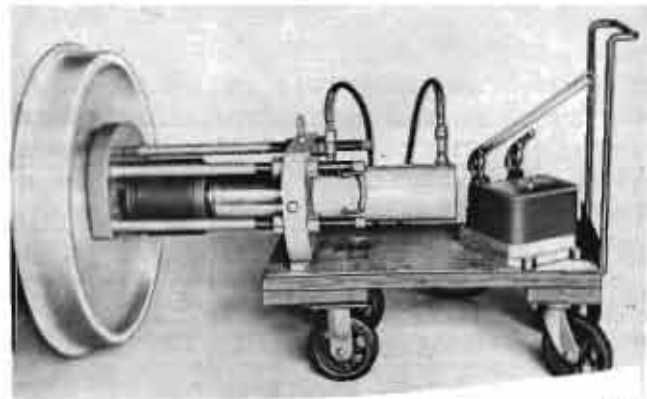
Owatonna Tool Company
Owatonna, Minnesota

When wheels or gears are removed or applied, the axle should be protected with an axle protection sleeve as shown in Fig. 60. The protection sleeve eliminates upsetting the ends of the axle and prevents high spots on the bearing seats resulting from uneven pressure applied to the ends of the axle.



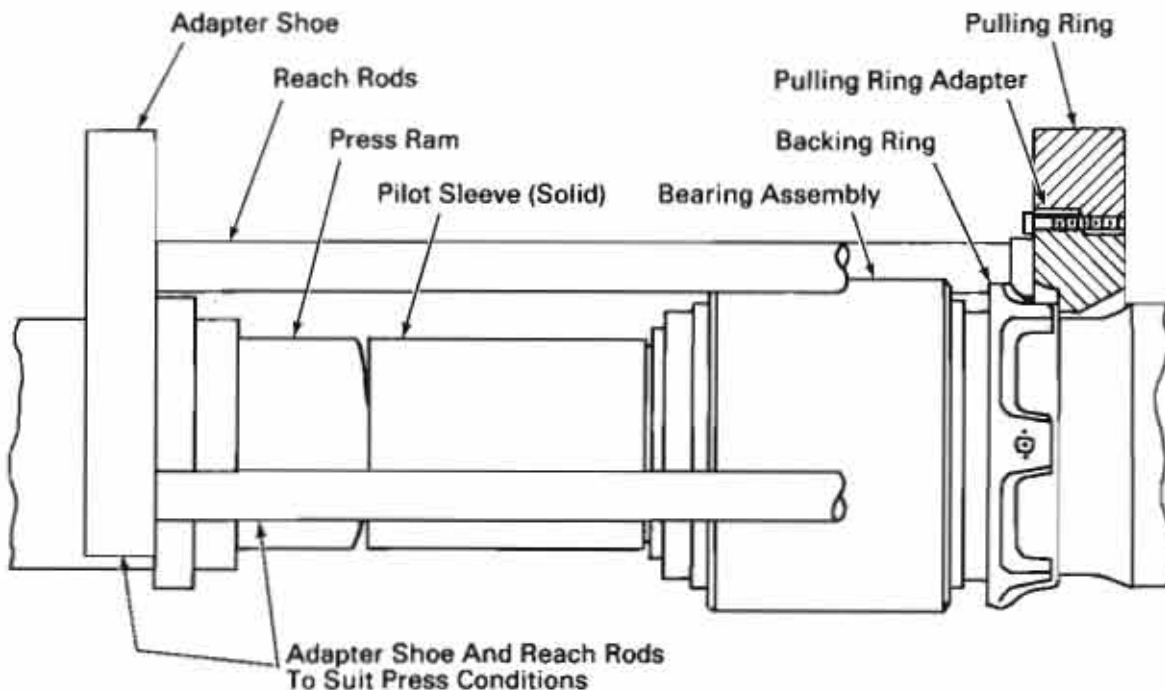
19892

Fig.58 - Bearing Removal/Installation Fixture With Electrically-Operated Pump



19893

Fig.59 - Bearing Removal/Installation Fixture With Hand-Operated Pump



29107

Fig.57 - Fixture For Removing Bearing

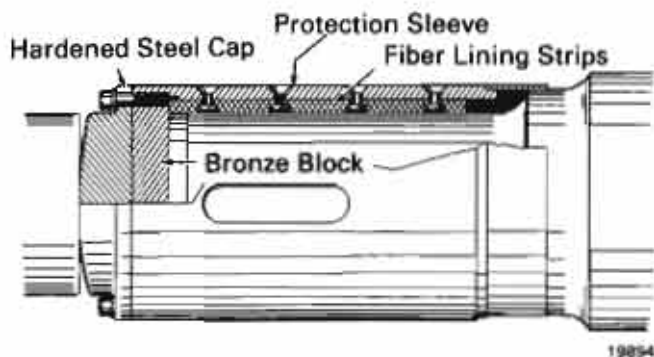


Fig.60 - Axle Protection Sleeve

COMMON BEARING DEFECTS

Bearing components including the outer race and rollers should be carefully and individually inspected for the following common bearing defects.

STAINS AND DISCOLORATION

Surface discoloration caused by moisture or acidity in the lubricant having no depth, Fig. 61, is not considered detrimental if discoloration can be removed by polishing with a wire wheel and polishing rough or 320 grit abrasive cloth, Fig. 62.

ETCHING

Etching is gray or grayish black in color, caused by water or acidity in the lubricant. Superficial etching, Fig. 61, is acceptable after surfaces have been polished. Slight pitting after polishing is acceptable.

CORROSION PITTING AND RUST

Black corrosion lines or pit marks can have some depth. Rust is a build-up of iron oxide, sometimes due to finger prints and is a form of advanced etching. Corrosion pitting or rusting which has advanced to severe pitting, Fig. 61, and cannot be removed by polishing the raceways or rollers with a wire wheel and polishing rouge, Fig. 62, should be considered cause for rejecting parts affected.

HEAT DISCOLORATION

Bearing parts discolored by heat (faint straw color to dark blue) indicate the hardness of the metal has been affected and the parts must be scrapped. Ensure discoloration is not lubricant staining.

FATIGUE CRACKS

Fatigue cracks are minute cracks in load carrying surfaces which are the first indication of metal failure. Fatigue cracks are not detrimental to operation of bearing, but can progress into spalls which can be a cause for rejection.

BRINELLING

Brinelling indentations are caused by the bearing rollers being forced into the surface of the race while the bearing was subjected to heavy impact loading beyond the capability of the bearing.

CUPS

If the brinell marks are faint, Fig. 63, of any length up to the full width of the roller path, or if heavy brinell marks are less than half of the width of the roller path, Fig. 64, the cup is acceptable.



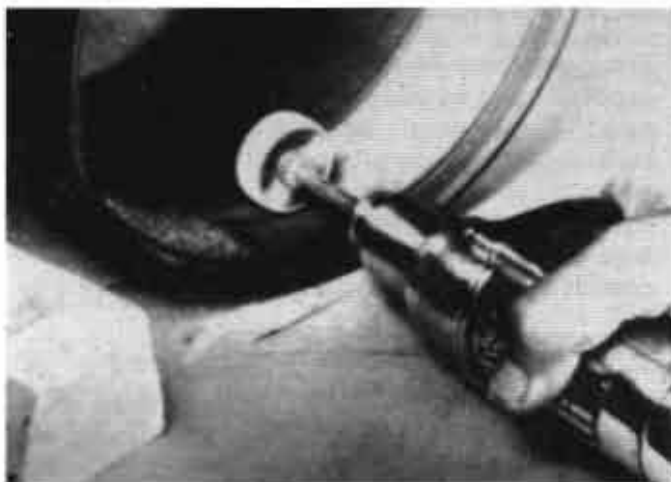
Stains And Discoloration



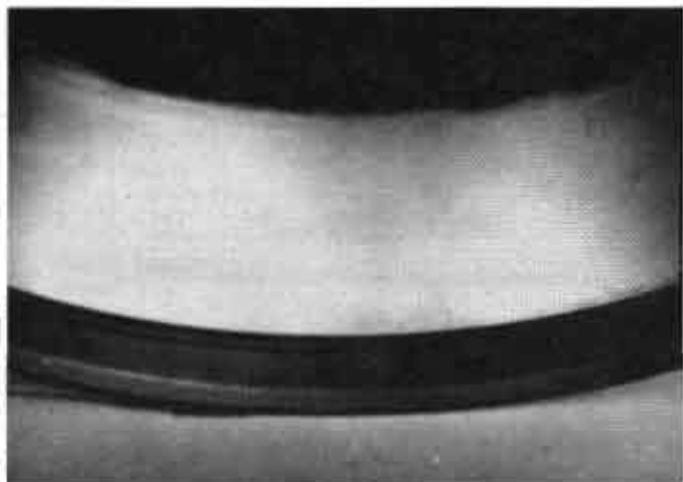
Etching

Corrosion, Pitting
And Rust

Fig.61 - Stains, Etching, Corrosion Pitting And Rust



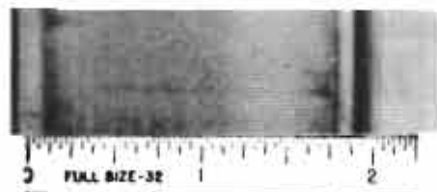
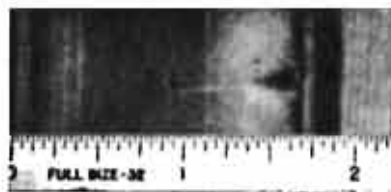
Polishing



After Polishing

29117

Fig.62 – Polishing With Wire Wheel And Polishing Rouge



Acceptable Brinelling

Fig.63 – Faint Brinell Marks

29118

SPALLING (FLAKING OF SURFACE METAL)

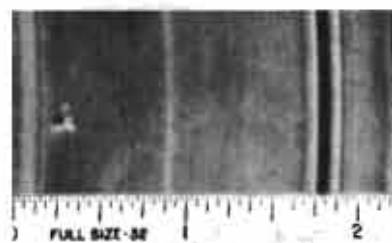
Spalling originates as minute fatigue cracks and eventually pieces of metal drop out, Fig. 65.



Fig.64 – Heavy Brinell Mark



A



B

Fig.65 – Spalling

29120

CONE ASSEMBLIES

A cone assembly may be considered for further service if the mating cup race is acceptable within the limits of Fig. 63.

CUPS

Spalls which are just beginning may be repaired by grinding and the repaired cups may be returned to service. Spalling out of the load zone is acceptable.

A small hand grinder and fine abrasive grinding wheels, approximately 8 mm (3/16") in diameter, should be used to repair spalls, Fig. 66. The grinding wheel should be dressed to a point for convenience.

Spalling may be repaired within the following limitations:

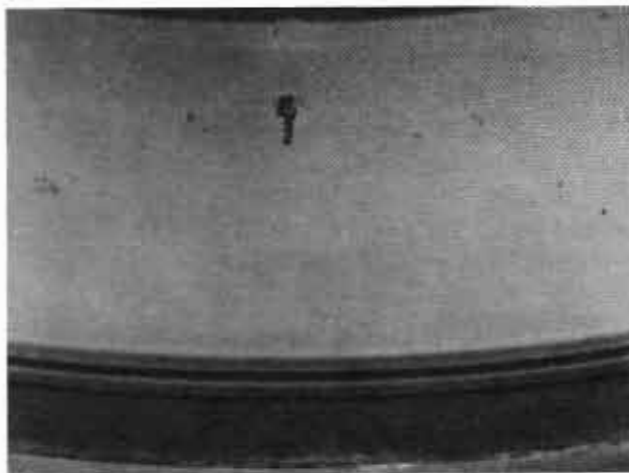
All loose material should be ground away and the edges of the ground area must be rounded by polishing with fine emery cloth or crocus cloth, Fig. 66.

The repaired spall must not be more than 9.5 mm (3/8") deep.

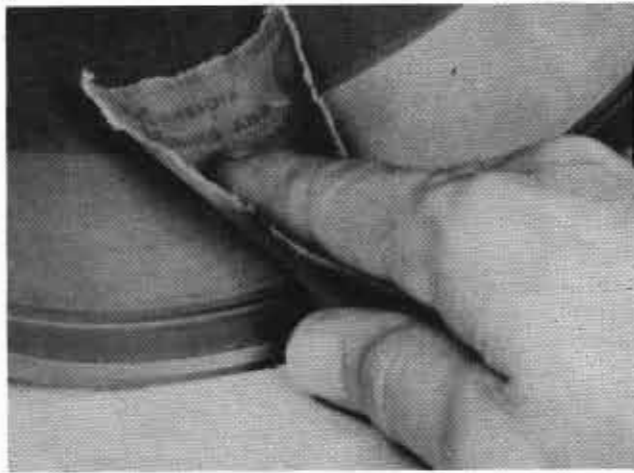
Not more than two spalls of maximum size are to be repaired by grinding in any 51 mm (2") circumferential section of a cup roller track.

Not more than four small spalls 1.5 mm x 1.5 mm (1/16" x 1/16") or less can be repaired by grinding in any 51 mm (2") circumferential section of a cup roller track.

If the bridge between two or more spalls is less than 4.5 mm (3/16"), the spalls should be combined by removing the bridge. The overall dimension must not exceed 9.5 mm x 9.5 mm (3/8" x 3/8").



Small Repairable Spall In Bearing Cup



Polishing Ground-Out Spall With Emery Cloth



Grinding Spall With Pencil Grinder



Repaired Spall

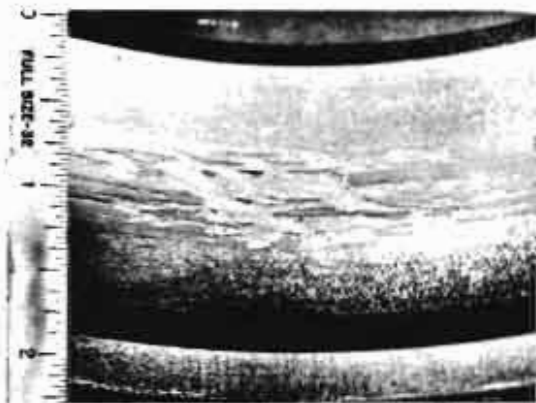
CONE ASSEMBLIES

If the roller race of a bearing cone (bearing inner race) is spalled, the cone assembly must be scrapped.

If one or more rollers of a cone assembly are spalled, the cone assembly must be scrapped.

PEELING OR SMEARING

Peeling or smearing is surface roughness caused by transfer of metal from one surface to another, Fig. 67. This can be caused by rollers sliding on the roller path because of excess bearing grease.



19388

Fig.67 - Peeling Or Smearing

CUPS

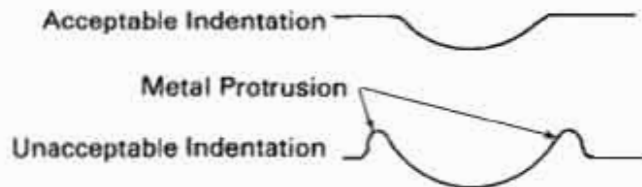
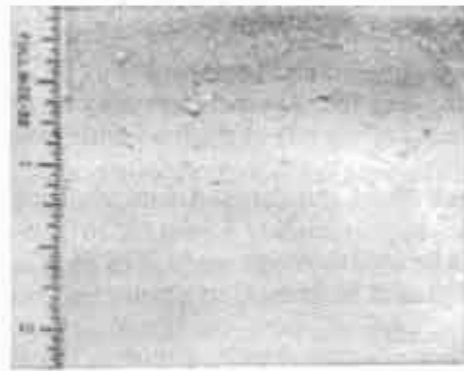
If the outer race roller pathway of the cup has shallow smearing less than 0.025 mm (.001") deep which can be easily removed by polishing, the outer race may be returned to service after polishing. If the smearing is more than 0.025 mm (.001") deep, the outer race must be scrapped.

CONE ASSEMBLIES

If the cone raceway or rollers are pealed or have metal pickup, the cone assembly must be scrapped.

FRAGMENT INDENTATIONS

Fragment indentations are usually caused by contaminants in the lubricant passing through the bearing while the bearing is loaded. Moderate surface damage, Fig. 68, is not considered sufficient



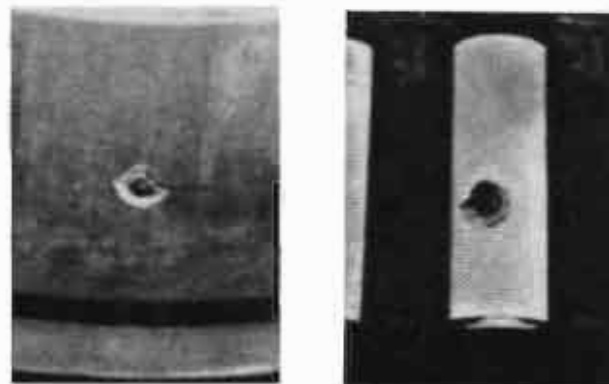
29122

Fig.68 - Fragment Indentations

cause for rejection unless roughness can be detected when bearing is rotated by hand. The roughness is caused by metal protrusions above the normal operating surface of the bearing as shown in Fig. 68.

ELECTRIC BURNS

Electric burns are caused by passage of electric current through the bearings causing craters, pits, fluting, or corrugations. The pitting shown in Fig. 69, could be the result of heavy electrical failure or by the connection of a ground cable from an arc welder to the rail or wheel. Although only one pit is shown, pitting may occur at several points on the bearing.



29123

Fig.69 - Electric Burn

The fluting or corrugations shown in Fig. 70 are caused by electrical current passing through the rotating bearing.

Bearing parts affected by electric burns (craters, pits, fluting, corrugations) must be scrapped.



29124

Fig.70 - Fluting Or Corrugation

SERVICE DATA

DIMENSIONS (NEW)

Class E 152 mm x 279 mm (6" x 11") Bearing

Cone Bore Diameter	144.501 mm (5.6890") Maximum 144.450 mm (5.6870") Minimum
Cup Outside Diameter	220.790 mm (8.6925") Maximum 220.408 mm (8.6775") Minimum
Cup Counterbore Diameter	209.652 mm (8.2540") Maximum 209.423 mm (8.2450") Minimum

Class F 165 mm x 305 mm (6-1/2" x 12") Bearing

Cone Bore Diameter	157.200 mm (6.1890") Maximum 157.150 mm (6.1870") Minimum
Cup Outside Diameter	252.540 mm (9.9425") Maximum 252.158 mm (9.9275") Minimum
Cup Counterbore Diameter	238.227 mm (9.3790") Maximum 237.998 mm (9.3700") Minimum

Class G 175 mm (7" x 12") Bearing

Cone Bore Diameter	177.838 mm (7.0015") Maximum 177.787 mm (6.9995") Minimum
Cup Outside Diameter	276.352 mm (10.8800") Maximum 275.971 mm (10.8650") Minimum
Cup Counterbore Diameter	261.087 mm (10.2790") Maximum 260.858 mm (10.2700") Minimum

Class GG 175 mm (6-7/8") Bearing

Cone Bore Diameter	225.463 mm (8.8765") Maximum 174.612 mm (6.8745") Minimum
Cup Outside Diameter	301.828 mm (11.8830") Maximum 301.625 mm (11.8750") Minimum
Cup Counterbore Diameter	284.264 mm (11.1915") Maximum 284.036 mm (11.1825") Minimum

WEAR LIMITS

Cone
 Bore Out-Of-Round 0.08 mm (.003")

Cage
 When the total clearance on the diameter between the small rib of the cone and cage flange is 2.29 mm (.090") or more, cages are considered to be worn excessively. Measure this clearance using two sets of feeler gauges. Insert the feeler gauge between the small rib of the cone and cage flange at two locations diametrically opposite. If the total of the two sets of feeler gauges is 2.29 mm (.090") or more, the cone assembly should not be returned to service.

If the roller pocket of the cage is worn to the extent that a 1.52 mm (.060") feeler gauge can be inserted between the roller and cage bridge, the cone and roller assembly should be scrapped.

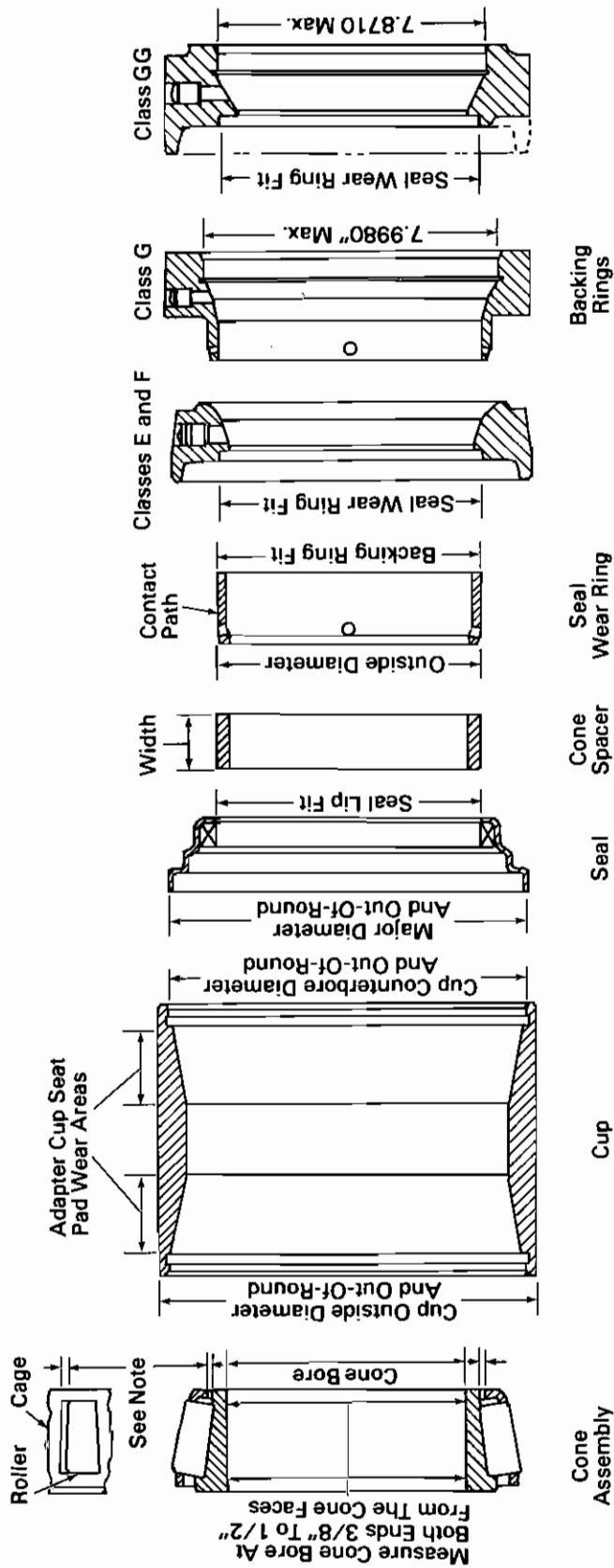
Cup
 Wear Of Adapter Seat
 Pads Into Bearing Cup 0.25 mm (.010")

Counterbore Out-Of-Round Or Distorted
 By Being Struck 0.13 mm (.005")

If the cup is distorted in the area of the counterbore, a close visual inspection of the inside and outside surfaces of the cup is required. Cups that have hairline cracks must be scrapped.

SERVICE DATA (CONT'D)

29131



METRIC CONVERSION CHART

(inch)	mm
3/8	9.5
1/2	12.5
7.8710	199.923
7.9980	203.149

NOTE
Refer to Wear Limits section which follows.

SEAL

All used seals should be scrapped.

CONE SPACER

Bench Lateral Play (Classes E, F, and G)	0.74 mm (.029") Maximum 0.58 mm (.023") Minimum
Bench Lateral Play (Class GG)	0.69 mm (.027") Maximum 0.58 mm (.023") Minimum

If bearing bench lateral play is not within the specified limits, the cone spacer should be ground or a new cone spacer selected to provide the specified bench lateral play.

SEAL WEAR RING (Class E, Class F, Class GG Bearing)

The seal wear ring must have a tight fit in the backing ring counterbore.

If the outside surface is cracked or scratched or if the seal lip contact path has worn to a depth of 0.005" (0.010" on the diameter), the seal wear ring should be scrapped.

BACKING RING (Class E, Class F, Class GG Bearing)

The counterbore of the backing ring must have a tight fit on the seal wear ring.

Check the backing ring for distortion and the bore radius of Classes E and F for proper location of contact with axle fillet.

ONE PIECE BACKING RING AND SEAL WEAR RING (Class G Bearing Only)

Maximum Major Inside Diameter	7.998"
-----------------------------------------	--------

(Check with dial bore gauge, I.D. micrometers or pin gauge)

If the outside surface is cracked or scratched or if the lip contact path has worn to a depth of 0.005" (0.010" on the diameter), the one piece backing ring and seal wear ring should be scrapped.

Check for distortion and the bore radius for proper location of contact with the axle fillet.

VENT FITTING

Check the vent fitting to see that is not clogged, hardened, or damaged.

LUBRICATION

Bearing Class E, Class F, Class G	AAR-M-942-78 Grease
Bearing Class GG	Exxon 5121 EP Grease

SERVICE DATA (CONT'D)

Bearing Class And Size	AMOUNT OF GREASE AT ASSEMBLY							
	1st Cone Assembly		Around Cone Spacer		2nd Cone Assembly		Total Quantity	
	kg	oz	kg	oz	kg	oz	kg	oz
E 152 mm x 277 mm (6" x 11")	0.11	4	0.23	8	0.11	4	0.45	16
F 165 mm x 305 mm (6-1/2" x 12")	0.17	6	0.34	12	0.17	6	0.68	24
G 178 mm x 305 mm (7" x 12")	0.23	8	0.45	16	0.23	8	0.91	32
GG 175 mm (6-7/8")	0.34	12	0.34	12	0.34	12	1.02	36

PERIODIC LUBRICATION (Field Lubrication)

Bearings equipped with lubricant fitting in the axle end cap may be field lubricated at some convenient time, such as at wheel turning or at annual or semi-annual inspections which occur nearest 201 125 km (125,000 miles) for locomotives in main line and light road service or 20,000 hours or four years of operation for locomotives in switching service.

NOTE

The Class GG bearing requires no periodic lubrication between wheel renewal operations or up to 402 250 km (250,000 miles). All bearing sizes are available with a no-field lubrication design.

Refer to the following table for amount of grease to be periodically added to the bearing.

Bearing Class	Amount Of Grease To Be Added To Field Lubricated Bearings On Axle			
	Thru Axle End Cap		Thru Relube Fixture	
	kg	oz	kg	oz
E	0.22	8	0.11	4
F	0.34	12	0.11	4
G	0.45	16	0.17	6

AXLE END CAP, CAP SCREW SIZE AND TORQUE

Bearing Class And Size	Cap Screw Size	Torque	
		N·m	ft-lb
E 152 mm x 277 mm (6" x 11")	1"	339-366	250-270
F 165 mm x 305 mm (6-1/2" x 12")	1-1/8"	488-529	360-390
G 178 mm x 305 mm (7" x 12")	1-1/4"	583-624	430-460
GG 175 mm (6-7/8")	7/8" Grade 5	407-434	300-320

LUBRICANT FITTING AND PIPE PLUG TORQUE

Lubricant Fittings Or Pipe Plugs		
Size	Torque	
	N·m	ft-lbs
3/8"-18 NPT	40-55	30-40
1/2"-14 NPT	55-70	40-50
Plugs		
1-1/2"-18 NEF	120-150	90-110
1-3/4"-16 NEF	170-205	125-150
2-7/8"-16 N	340-375	250-275