



GM Locomotive Group

M.I. 3902 MAINTENANCE INSTRUCTION

BUILD-UP OF TRACTION MOTOR MOUNTING ASSEMBLY

Installing wheel-axle-gear assemblies and gear cases in D77 or D87 traction motors requires prior preparation of components and on-going checks during assembly before releasing a complete traction motor and wheel assembly for use under a locomotive. This article will outline the recommended procedure for building up a traction motor mounting assembly. It will be assumed that the traction motor assembly has already been properly assembled and/or maintained as outlined in Maintenance Instruction 3900, M.I. 3950-1 through -7 (D77 Series) or Maintenance Instruction M.I. 3953-1 through -7 (D87 Series).

To conserve gear case lubricant, it is recommended to apply new plastic pinion seal part number 40007174 prior to applying pinion.

WHEEL-AXLE-GEAR ASSEMBLY

Preparation of the wheel-axle-gear assembly can be undertaken as indicated in M.I. 1518 Rev. E. However, there are some areas that are critical in the build-up of the traction motor assembly.

1. Axle surface micro finish and surface waviness in the support bearing area must be checked to confirm that the requirement of 7 micro-inches (maximum) (0.18 microns) and 100 micro-inches (maximum) has been met. The recommended axle finishing process to achieve the surface requirements is to machine the axle first to 125 micro-inches (3.18 microns); secondly, grind to 25-50 micro-inches (0.64 to 1.27 microns); and finally, roller burnish the surface down to 7 micro-inches (maximum). Grinding prior to rolling eliminates the helix left by lathe turning and establishes a flatter surface for the roller burnishing operation. Taylor Hobson surface measuring equip-

ment can be used to confirm the surface finish requirements.

2. The dimension between the axle gear hub face and opposite wheel hub face for all D77/D87 series traction motors must be $43.875 \pm .010$ ". In order to accurately qualify this dimension, an accurate measuring device, preferably with a dial indicator, should be used along with a permanent master calibration stand to allow for frequent rechecks.
3. The wheel and gear hub faces and adjacent outside hub diameters must be smooth and finished to 16 micro-inches (0.41 microns) maximum. This ensures a good thrust surface for the support bearing flanges and a good rubbing surface for seals.

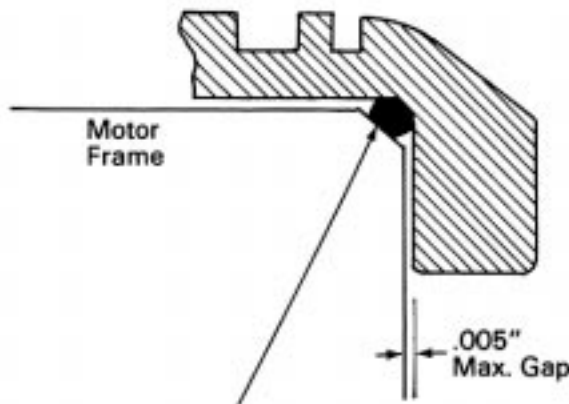
SUPPORT BEARING INSTALLATION

Before building up the traction motor mounting assembly, ensure all parts are clean; particularly the bearing shells, seats, axle, caps, and seal rings. Note that the solid and window halves of the support bearings are machined together and both are marked with an identical mating number on the flange. It is very important that the two matched halves are kept together during assembly.

Prior to installing the wheel-axle-gear assembly in the traction motor frame the following steps are necessary:

1. On the traction motor frame, verify that the support bearing keys are installed, and check for proper height and distance from frame edge. The dimension from the face of the traction motor axle bore to the key is $3\text{-}3/16$ " and the height of the key above the bore is 0.25" maximum.

2. When reapplying used support bearings, renew the "L" shaped felt thrust lubricators in the solid and window half bearings (four pieces of 9557831 or 9534143 as applicable per bearing). Saturate these flange lubricators with suspension bearing oil. Reused bearings must be qualified, especially with regard to the condition of the babbitt lining material and adequate flange thickness. Requalified bearings should be used on the lighter loaded C.E. side of the traction motor whenever possible and use a new support bearing on the P.E. side.
3. Prior to installing the support bearings, apply a bead of RTV sealant behind the support bearing flanges, Fig. 1. Generally a 1/4" to 3/8" bead of sealant is sufficient, but in any case the diameter of the bead must be large enough to span the gap between the motor frame chamfer and the radius at the base of the bearing flange. Note that oil residue must be removed from all sealing surfaces by wiping with a solvent before applying sealant. The sealant is added in order to reduce the possibility of water and dirt entry, thereby contributing to increased lubricating wick and support bearing life. Once water migrates under the bearing shell, capillary action draws water to the split line and results in water entry into the oil reservoir.



1/4" to 3/8" bead of RTV sealant must complete a 180° arc on the radius at the base of the bearing flange. Do not apply to the flat of the flange, since this may prevent seating the bearing flange against the motor frame (.005" maximum gap allowed).

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Fig. 1 - Application of RTV Bead And Maximum Frame-To-Flange Gap

4. Before installing the solid-half support bearing, brush oil on the support bearing area of the motor frame. This is for ease when rotating bearing halves. When bearings are in place, if necessary to

rotate, use a block of wood against one edge of the bearing and tap to set against the key.

5. After the solid-half bearing shells are installed some sealant may squeeze out over the edges. This excess sealant should be wiped clean to avoid interference with the seating of the mating bearing. The bearing should also be pressed tight against the motor frame to insure less than the maximum allowable gap of 0.005" between the bearing flange and frame as shown in Fig. 1. This gap will be checked later.

WHEEL-AXLE-GEAR ASSEMBLY INSTALLATION

Prior to installing the wheel-axle-gear assembly in the traction motor frame, brush suspension bearing oil on the inside diameter of the bearing shells and on the axle in the support bearing surface areas.

Install the wheel-axle-gear assembly in the traction motor frame.

SEAL RING INSTALLATION

Current support bearings are equipped with four grooves and dual seals (seals at inboard and outboard ends) to minimize support bearing oil leakage. Sealing is accomplished by nylon rings that clip onto the axle and rotate with the axle in circumferential grooves in the bearings.

Oil that would normally flow out of the bearing ends is retained by the seal rings and returns to the reservoir through a drilled passage from the seal groove to the



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Fig. 2 - Support Bearing With Twin Seals



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Fig. 3 - Threading Seal Ring Into Bearing Circumferential Groove

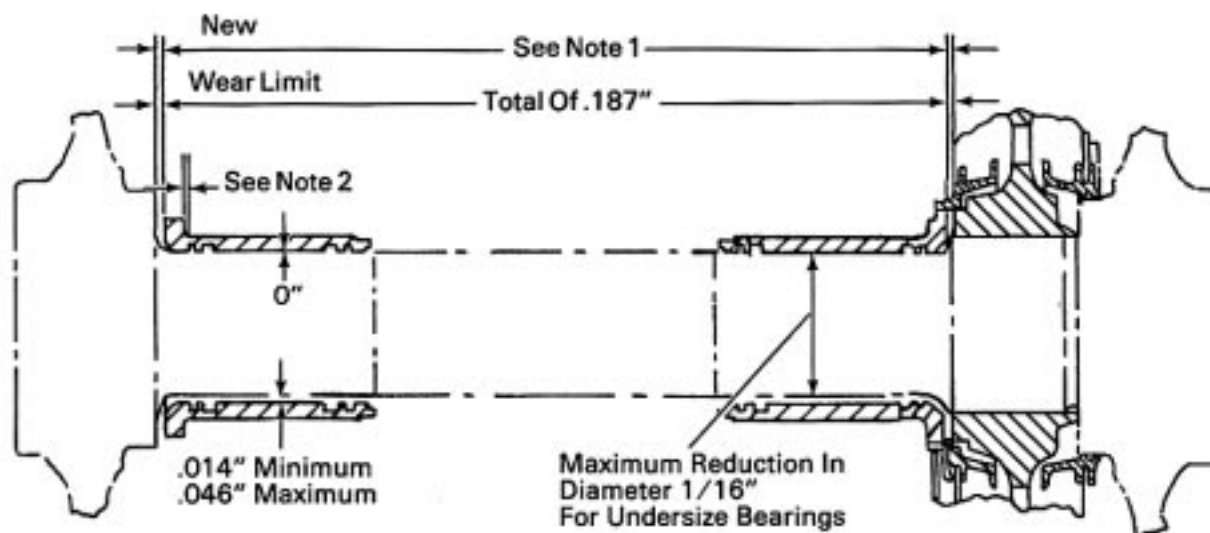
wick window. This design feature reduces oil consumption and lengthens the interval between oil additions.

Seal rings 9323317, which are flexible, should be spread and threaded into the $9/16$ " wide seal grooves, Fig. 3. Locking of these seal rings is by means of a tension spring that is extended and snapped into place. There are two seal rings in each bearing assembly (four per motor assembly).

Caution should be taken to avoid getting any RTV sealant on the seal rings since this could prevent rotation of the rings in the grooves and subsequently damage the axle. Also do not attempt to install seal rings on the axle prior to placing the axle into the frame. Ring damage is likely to result if the rings are installed prior to axle installation.

PRELIMINARY TOTAL LATERAL CLEARANCE CHECK

To avoid building up the assembly in error, a preliminary check should be made of the total lateral clearance. This check should be made with a magnetic base dial indicator that measures in 0.001 " increments. Mount the dial indicator on a flat surface on the frame and extend the dial indicator to measure axial movement of the wheel. Bar the wheel and axle assembly from side to side and record the total lateral clearance. If the clearance measured is below 0.040 " and the bearing flange-to-frame clearance is at 0.005 " or less "STOP"! Either the wheel-axle-gear assembly



NOTES

1. Total end play should be within $.040$ " to $.089$ ".
2. Maximum space between the bearing flange and support bearing cap should be $.005$ " with axle cap tightened.

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Fig. 4 - Support Bearing Clearances

or traction motor frame is in error and must be checked out before proceeding.

Total clearance preferred is 0.040" to 0.060" for assemblies with new components. Also if the measured clearance is too large, this may indicate that either the bearing flanges are worn excessively or the wheel-axle-gear assembly or the frame assembly is in error. After the lateral clearances are verified and acceptable, as shown in Fig. 4, continue with the assembly procedure.

LOWER (WINDOW) SUPPORT BEARINGS

Prior to installing the window-half support bearings, check bearing serial numbers since bearings *must be installed in matched sets*.

A 1/4" to 3/8" bead of RTV sealant is also added behind the window-half support bearing flange as previously described for the solid-half bearing. However, to avoid excess sealant from working out at the parting lines when installed, stop the sealant bead behind the flange approximately 3/8" from each edge of the shell.

Install window-half of the support bearings. Ensure that bearing flanges line up with upper bearing and both halves contact the mating surface on the motor frame to maintain the gap between the flange and frame of 0.005" maximum. If the existing gap is greater than 0.005", an additional bumping of the assembly may be necessary to better seat the bearing flange against the frame.

AXLE SHIELD

Install axle shield over the axle between the two support bearings. The shield serves to prevent dirt from entering the bearing surfaces.

SUPPORT BEARING AXLE CAP INSPECTION

Axle caps should previously have been qualified as follows:

1. Magnetic particle check for cracks in arm that supports gear case. Repair as required.
2. Check for dirt or contaminants in the axle caps that upon installation could allow dirt to be thrown through the support bearing window onto the support bearing surface.
3. Check for leaks and repair as required.

NOTE

Some commutator-end caps may be made of ductile iron and are marked "DO NOT WELD".

4. Verify that axle cap serial number matches the motor frame serial number.

SUPPORT BEARING AXLE CAP INSTALLATION

When installing the support bearing cap the following steps are recommended:

1. Use a 0.010" thick shim between the frame and each axle cap flange. Use two-hole shims 8478477 with the commutator-end and pinion-end caps. The shims are installed with cutout side turned out on the upper and lower split line.

The support bearing caps are machined and line bored to size when mounted on the traction motor with a 0.018" thick shim inserted between the cap and motor frame. When the motor assembly is built up, a 0.010" thick shim is used between the axle cap and frame thus giving a 0.008" clamp fit or crush to the axle bearing shells. Line boring of the caps to the motor frame is necessary to secure the accuracy of bearing fit required. The caps are not interchangeable with caps of other motors. To ensure that they are matched to the proper motor and location, they are stamped with a serial number matching the motor frame number.

2. Apply caps straight, as rocking will distort splines and pinch the bearings.
3. Prior to installing bolts lubricate with Texaco Threadtex to aid in torquing. Use a brush to apply lubricant on threads and also under bolt heads. It is important to lubricate under the head since one-half of the resisting friction is under the bolt head.
4. For standard axle caps use hardened flat washers under all bolts except the pinion end lower positions where spacers are used to provide additional bolt stretch and resistance to loosening. For increased capacity axle caps (first used on D87B motors), the mounting flanges have increased thickness to achieve the additional bolt stretch; hardened washers are used at all positions.
5. Snug up all axle cap bolts hand tight, then bump the wheel and axle assembly over by driving a wooden or steel wedge between the wheel (or gear) and the traction motor frame at the opposite end of the frame to take up clearance and to

ensure the bearing flanges are aligned with each other and tight against the motor frame and axle cap.

- Again, check the lateral clearance between the support bearing flanges and motor frame on both ends with a 0.005" feeler gauge. When the 0.005" maximum gauge cannot be inserted between the frame and bearing flange, tighten bolts on the side inspected with the wedge still in place on the opposite end of the frame. The following procedure should be used to tighten the axle cap bolts. An impact wrench may be used only to seat the cap onto the traction motor frame. During this seating process the axle cap bolts should be tightened uniformly in an "X" pattern so that the axle cap is drawn down evenly. After the axle cap is seated on the traction motor frame, the final torque (on every axle cap bolt of every motor) should be applied by hand with a calibrated click type torque wrench or with a suitably calibrated hydraulic tightening device to 1200 ft-lbs.
- Remove wedge after torquing is complete on one side and tighten the other axle cap by inserting a wedge between the wheel (or gear) and frame on the opposite side being tightened to ensure the bearing flanges are aligned with each other and are tight against the motor frame and axle cap (0.005" maximum gap).

Repeat all tightening and torquing of bolts on the second axle cap as recommended for the first axle cap.

Remove wedge after all torquing of bolts is complete.

FINAL LATERAL CLEARANCE CHECK

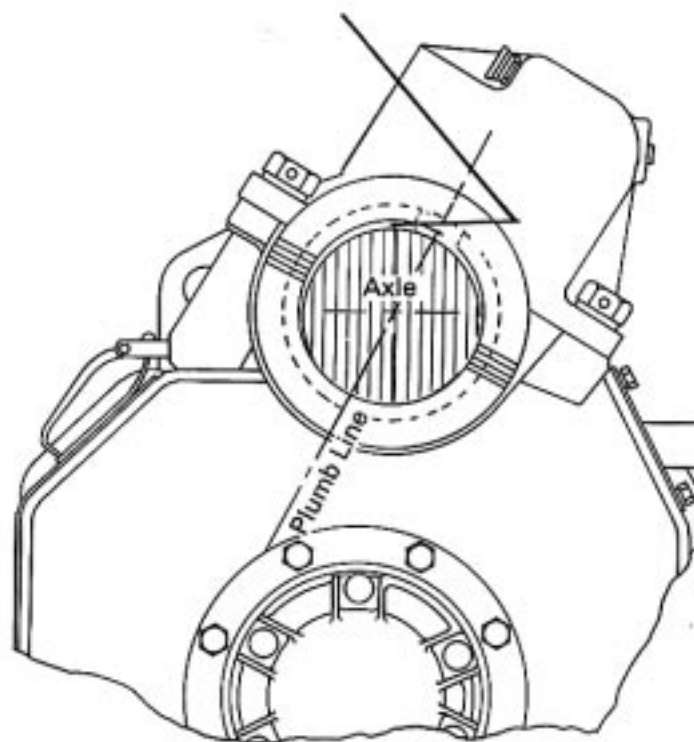
After all torquing of bolts is complete a final check of the total lateral clearance should be made. Mount the dial indicator on a flat surface of the motor frame and reference off the inside edge of the wheel rim. Bump the wheel and axle assembly over from side to side and measure the total lateral clearance. The resulting total lateral must be between 0.040" and 0.089".

RADIAL CLEARANCE CHECK

After the lateral clearance is confirmed and acceptable, the radial clearance must be checked.

With the traction motor assembly positioned so that the support bearing window is at an upper position as shown in Fig. 5. Insert a long, narrow feeler gauge

Obtain access through wick cover opening, and insert feeler gauge through wick window AT TOP OF AXLE.



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Fig. 5 - Traction Motor And Wheel-Axle Assembly Positioned For Radial Clearance Check

through the support bearing window, at the center of the window toward the top side, or twelve o'clock location; see Fig. 5, to a depth of 1" to 2" between the axle and the bearing. Radial bearing clearance must not be less than 0.014" or more than 0.046". For a new assembly a maximum of 0.030" is recommended. Check both pinion-end and commutator-end bearings.

If all clearance checks are acceptable, then lockwire the bolts on the axle caps.

FINAL APPLICATION OF SEALANT

All seams and split lines are sealed with RTV after the axle is mounted in the traction motor and the axle shield and caps are secured. Surfaces should be clean and oil free when RTV is applied. The bead of sealant must cover both metal surfaces and completely cover the parting line above the top support bearing cap bolts where water is most likely to enter. If necessary, a pointed tool may be used to press sealant into the parting line area.

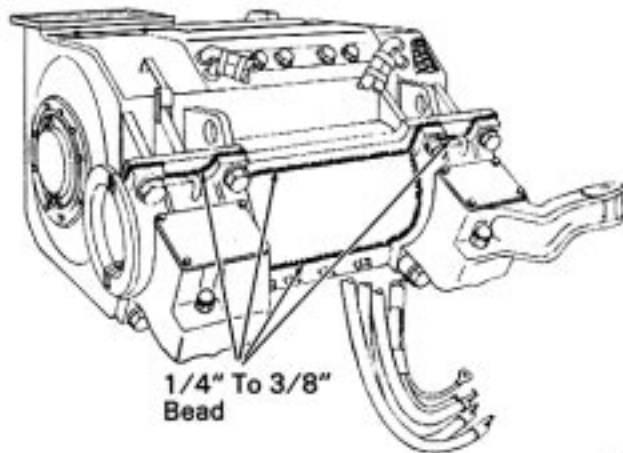


Fig. 6 - Application Of RTV Silicon Rubber Sealant

SUPPORT BEARING LUBRICATION

Lubrication of traction motor support bearings and axle is provided by a felt wick inserted into each bearing cap. A spring loading arrangement keeps the wicks firmly in contact with the axle through an opening in the bearing.

Felt wick lubricators should be carefully inspected at wheel turning time, or more frequently if service dictates. Wicks with excessive edge rounding, taper, wear, or with hardened, glazed, or burned contact surface should be replaced with new felt wick lubricators. More detailed inspection procedures can be found in M.I. 3900.

Prior to installing wicks in the traction motor, it is very important to presoak the wicks. The wicks should be immersed in approximately 160 degrees F oil for a minimum of ten minutes before application. If it is impractical to provide a warm oil bath, soak in oil at room temperature for a minimum of twenty minutes. The oil must be clean and the wicks must not touch the bottom of the oil receptacle. The oil receptacle should be kept covered. Use cleanliness precautions for satisfactory service life. After soaking, the wick may be allowed to drain for approximately ten minutes in order to facilitate handling.

CAUTION

Excessive draining time is detrimental.

Apply the previously soaked felt wick lubricator assemblies to the support bearing caps. Ensure wicks are correctly positioned at installation so that wick face contacts axle journal surface when assembled. Torque

wick lubricator 1/2-13 cover bolts to the proper torque of 40 ft-lbs.

A narrow window support bearing cap and support bearing arrangement are preferred and have been in use since the early D57B traction motor. The narrow window provides increased oil capacity and larger bearing surface, as well as an improved wick lubricator.

The lubricating oil should be added to the point of overflowing from the filler cap and must be maintained above the 2-1/2" absolute minimum level, Fig. 7.

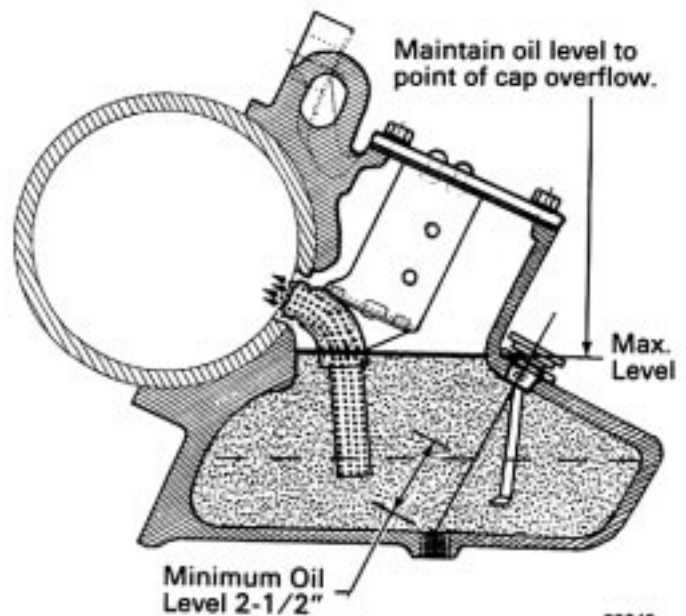


Fig. 7 - Motor Support Bearing Oil Level

Refer to Maintenance Instruction M.I. 1756 for recommendations on the type of lubricating oil specified for support bearings, adding as needed to maintain desired level.

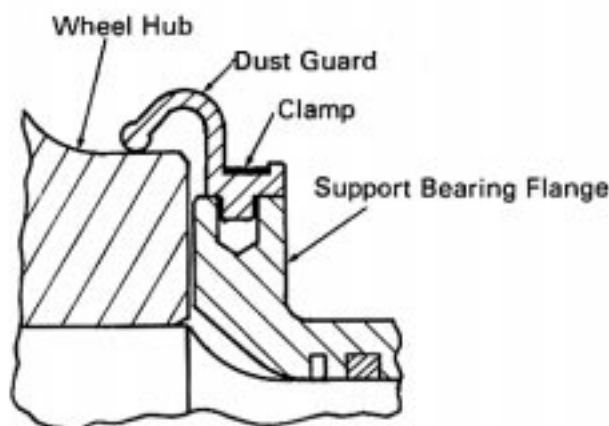
SUPPORT BEARING OIL FILLER CAP

Improved oil filler cap 9333024 is recommended for ease in oil level inspection. The new cap is held firmly in place with a coil spring and requires no maintenance.

DUST GUARD

Apply the rubber dust guard onto the non-gear side wheel hub. Dust guards are provided to keep dirt and grit out of the commutator-end support bearing.

Care must be taken to insure a good contact between the dust guard and the hub of the wheel. Mate the rubber alignment pin on the dust guard with the mating hole in the support bearing flange and with the split opening of the dust guard located toward the bottom of the traction motor (toward the rail). While tightening the dust guard clamp make sure that it seats properly in the slot provided, Fig. 8.



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Fig. 8 - Dust Guard Installation

GEAR CASE APPLICATION

The current gear case utilizes plastic seals at the gear case axle bore and plastic seals, part number 40012790, at the gear case pinion bore. For proper installation of these seals, plus an explanation of the gear case assembly, refer to Maintenance Instruction M.I. 1520.

GEAR CASE LUBRICATION

After the gear case has been assembled on the motor-wheel-axle assembly, approximately 14 to 18 lbs. of gear lubricant should be added as an initial charge. Depending upon gear ratio, use the following amounts of lubricant:

INITIAL CHARGE OF LUBRICANT

56 tooth gears	18 lbs.
57 thru 60 tooth gears	16 lbs.
61 and 62 tooth gears	14 lbs.
66 and 67 tooth gears	16 lbs.
69 and 70 tooth gears	14 lbs.

To assist with initial break-in of gears for D87 motor-wheel assemblies, a lubricant additive called Anglamol 99 is recommended. This sulfur-phosphorus extreme pressure additive, dispersed in an SAE 30 weight oil, is added at a rate of 14 fluid ounces per gear case, in addition to the initial 14 to 18 pound charge of gear lubricant. The two products mix through gear action. This additive part number is 40000052 for 5 U.S. gallons.

FINAL LUBRICATION CHECK IN SUPPORT BEARINGS

Now the traction motor wheel axle gear assembly is ready to be installed in a locomotive truck. After the assembly is installed and in the upright position add new suspension bearing oil to the pinion-end and commutator-end axle caps to the point of overflow from the filler caps.

If the assembly was built up as outlined in this article, the traction motor wheel axle assembly should provide a satisfactory service life, provided the applicable maintenance schedule is followed.

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