MAINTENANCE INSTRUCTION
M.I. 3911

Service Department
ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
October, 2001

AC TRACTION MOTOR – MODEL 1TB-2624
GENERAL MAINTENANCE
INSTRUCTIONS

SAFETY PRECAUTIONS

Please refer to the EMD Safety Precautions in appendix to the Locomotive Service Manual whenever routine service or maintenance work is to be performed on any AC traction equipped locomotive.

The maintenance procedures as outlined in this instruction are specific to the Model 1TB-2624 AC Traction Motor and are offered for planning purposes only. As written, this document reflects current EMD product design and service experience for this design. The content of this M.I. reflects maintenance requirements based on time from delivery or miles in service. This recommendation is consistent with present fleet performance and remains within the EMD experience envelope.

This Maintenance Instruction contains general or "running" maintenance recommended for Model 1TB-2624 AC traction motors. Stator rewinding or rotor repairs, by the user, are not recommended. Any motor requiring overhaul or extensive repairs should be returned to Electro-Motive for unit exchange (UTEX).

Also included is a procedure for removing a traction motor from a locomotive and the various inspections, which should be made in such an instance. Refer to the recommended maintenance intervals specified in the applicable Scheduled Maintenance Program.

For planning purposes, EMD has established the following overhaul interval recommendations for the AC Traction Motors. These overhaul interval recommendations are based on whichever event occurs first: time or miles.

1TB-2624 AC Traction Motors:

- High Speed Service: 10 years / 1,000,000 miles.
- Heavy Haul Service: 10 years / 1,000,000 miles.

NOTE

Mileage values referenced above are defined by Microprocessor Archive Data as accumulated by the locomotive control computer system.

As always, when specific operating conditions severely impact locomotive performance and or reliability, maintenance schedules must be adjusted accordingly.

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1.0 DESCRIPTION

The Model 1TB-2624 Traction Motor (Figure 1 through Figure 3) is a four pole, squirrel cage, three-phase induction motor that is designed for axle-hung installation. The stator has no separate housing, as the laminations are held together by sturdy end plates and welded tie rods. Class H insulation gives the machine large thermal reserves to prolong service life.

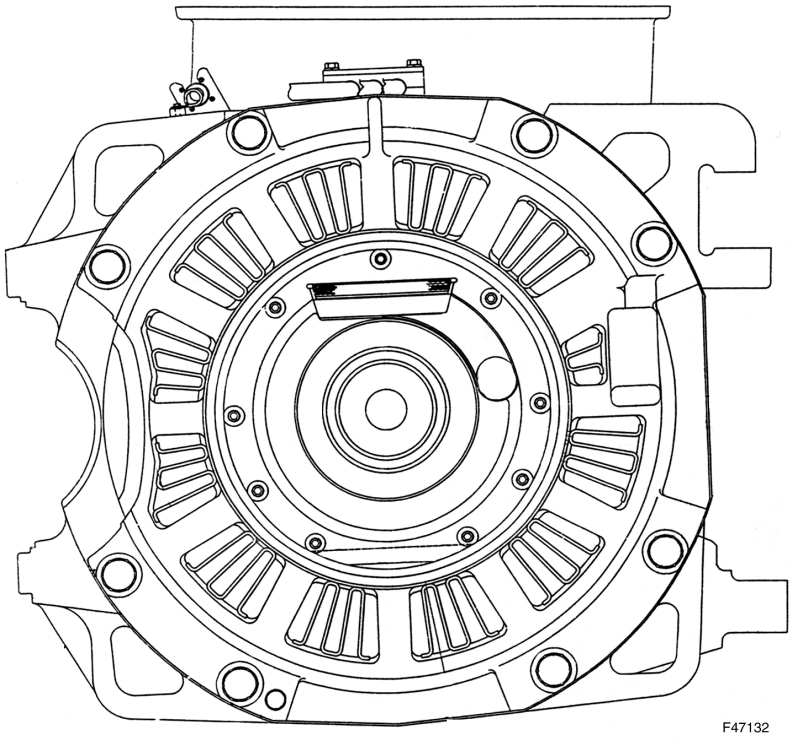


Figure 1 Model 1TB-2624 AC Traction Motor, Pinion End

The motor is force-ventilated, with cooling air entering the motor on the top of the non-driving end. The cooling air is forced laterally through the motor to exit on the driving (pinion) end. The traction motor has no inspection or access covers.

Electrical connections consist of three phase lead cables with through bolt connectors, a multi-pin Canon style connector for speed probe signals, and a ground connection.

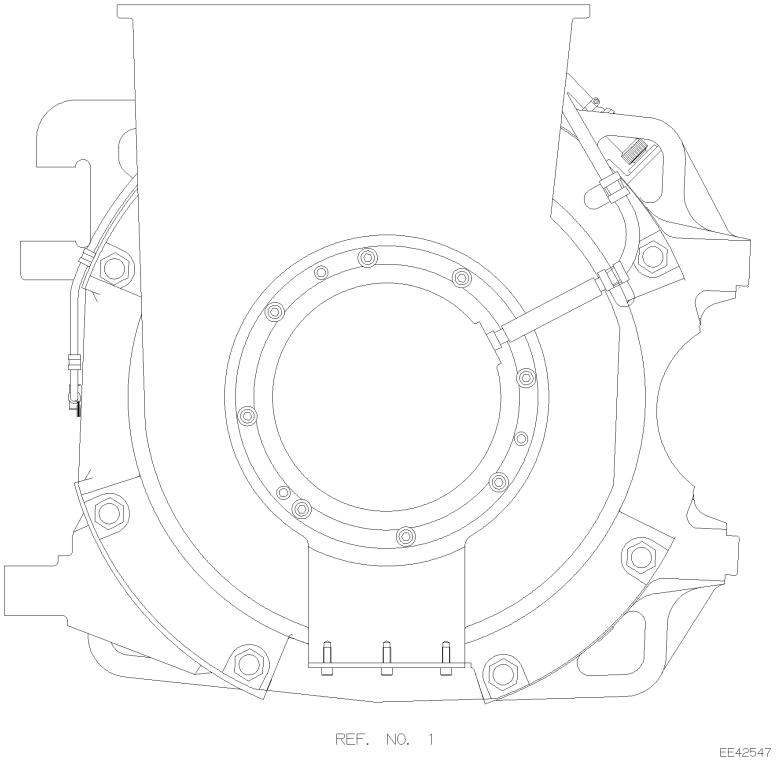


Figure 2 Model 1TB-2624 AC Traction Motor, Non Driving End

1.1 OPERATION

Power from the inverter is supplied to the traction motor through three phase leads (cables). As this is an induction motor, there is no internal brush gear or commutator. Reversing the phase rotation (two phases) of the 3-phase AC input controls motor direction.

In dynamic braking, a small amount of excitation is applied to the phase leads, resulting in the machine becoming an alternator. Locomotive movement is converted into 3-phase electrical power that is rectified by the inverters and dissipated through brake resistance grids.

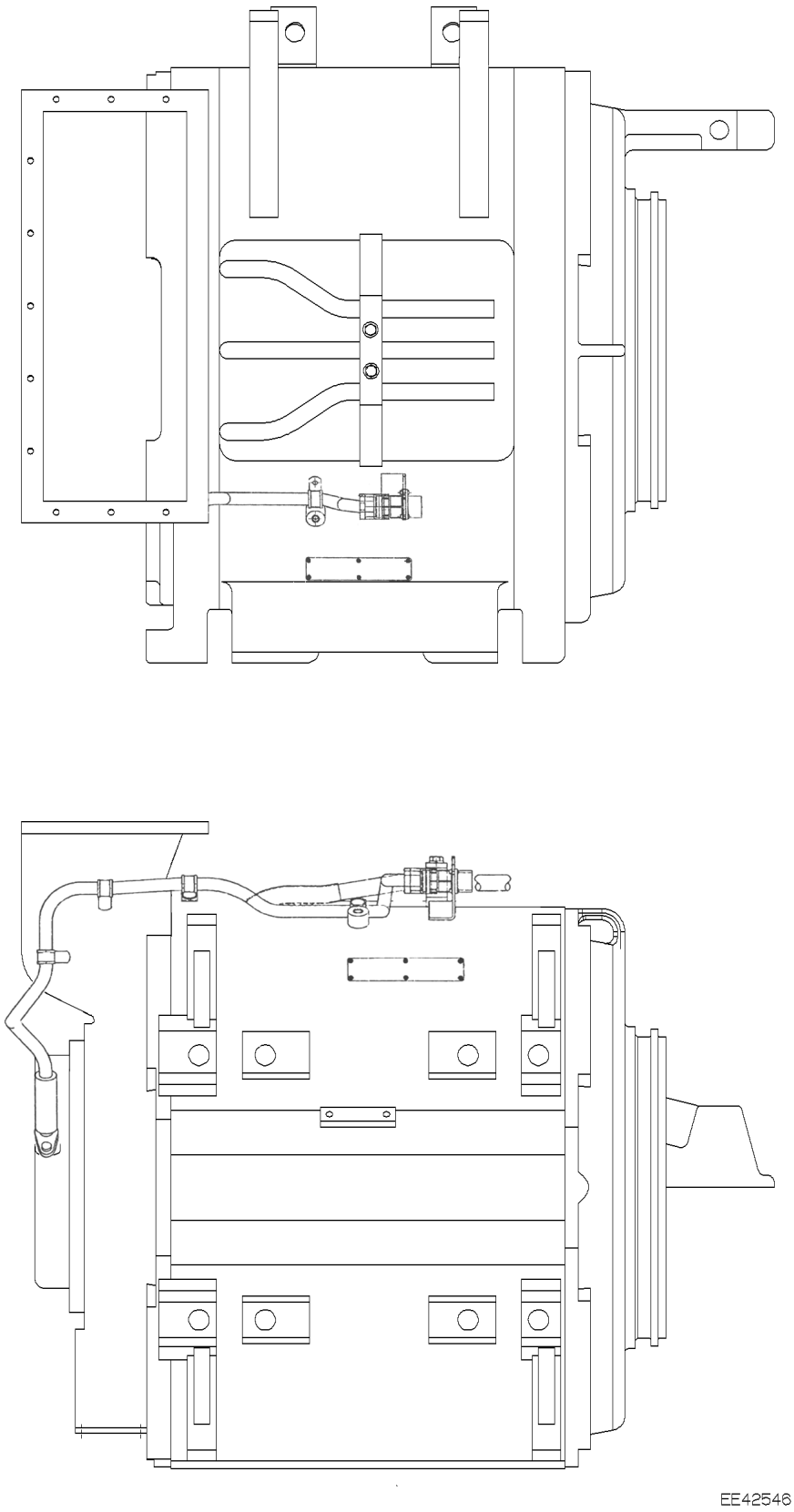


Figure 3 Model 1TB-2624 AC Traction Motor, Top View and Front View

2.0 SCHEDULED MAINTENANCE

The Traction Motors should be inspected and cleaned at intervals specified in the applicable Scheduled Maintenance Program. Operation and service, to which the motors are subjected, will determine the extent of maintenance required.

2.1 INSPECTION

2.1.1 CABLES AND CONNECTORS

1. Ensure tightness of all mechanical and electrical connections.

2. Phase leads should be properly secured and insulating boots correctly applied.

3. Ensure that the phase leads are securely clamped to the lead bracket.

4. Ensure that the canon-style connector for the speed probe signal is fully locked in place (an audible click will be heard as the connector is rotated fully clockwise).

5. Inspect the traction motor ground cable for proper connection at both ends.

2.1.2 GEARCASE

1. Inspect gearcase for proper level; add lubricant if required.

2. On an annual basis, drain lubricant from gearcase and refill to proper level with fresh oil.

3. Inspect gearcase for evidence of damage or lubricant leakage. Correct as required.

2.1.3 ROLLER SUPPORT BEARINGS

1. Inspect traction motor roller support bearings for damage or loss of lubricant. Refer to M.I. 3912 – Traction Motor Roller Support Bearings.

2. Lubricate support bearings as per Scheduled Maintenance Program.

2.2 CLEANING

2.2.1 GENERAL (External)

It is essential that the traction motor be kept as clean as possible, both on the inside and outside. Oil and grease soaked dust and dirt should not be allowed to accumulate, as this can prove detrimental to insulation life and motor performance in general.

Cleaning the outside of the motors can be done by common method of using a steam jet at the same time the trucks, underframe, and fuel tanks are washed. If this method is used, the diesel engine must be running at approximately 450 RPM to force sufficient traction motor blower air through the motors to prevent water or moisture from entering.

2.2.2 INTERNAL

The AC motor has no inspection or access covers to facilitate internal cleaning. Internal cleaning can only be performed when the motor is disassembled at normal overhaul.

2.3 INSULATION RESISTANCE MEASUREMENTS

Using a megger, make an insulation resistance test on the stator windings. This should be done prior to making the high potential test. Readings of two megohms or better at 5000 Volts are satisfactory.

2.3.1 STATOR

Disconnect the traction motor phase leads from the locomotive and temporarily connect all three together. Connect the megger ground lead to the traction motor frame and the other lead to the motor phase leads. This checks the stator insulation.

De-couple the phase leads, and using a Biddle low ohm resistance tester, check the phase to phase resistance of the stator. Resistance should be:

.106 to .111 (a to b, a to c, b to c) at 75° F.

3.0 REPAIR PROCEDURES

3.1 ARMATURE BEARINGS

3.1.1 SEALED GREASE LUBRICATING BEARING (NON-DRIVE END)

All AC traction motor bearings are manufactured with a sealed grease lubricated bearing at the non-drive end of the motor. Shell Cyprina RA Grade 3 grease is used exclusively. At six-year intervals these bearings will require inspection and re-packing. The following procedure must be followed when re-packing the bearing, to ensure satisfactory bearing and motor performance.

1. Position the motor on a suitable stand to allow access to the non-drive bearing area.

2. Using a scraper followed by a clean dry cloth, remove any build-up of dirt and contamination from around the bearing cover area to prevent contamination on re-assembly.

3. Removal of the speed probe is not required.

4. Remove the eight ½-13 x 2 ¾" bolts securing the outer bearing cover to the motor housing, Figure 4 (save hardware for re-use).

5. Tap and/or use the jackscrew holes to remove the cover. Move the cover and speed probe to the side and tie wrap out of the way.

6. Remove the five 5/8-11 x 3" bolts securing the transmitter wheel to the rotor shaft, Figure 5 (save hardware for re-use). Remove wheel and store for re-use.

7. Remove the eight ½-13 x 2 ¾" bolts securing the inner bearing cover to the motor housing, Figure 5 (save hardware for re-use). Tap and/or use the jackscrew holes to remove the inner cover.

NOTE

Take care not to damage the rubber O-ring on the outer edge of the cover. If it is damaged, replace with a new O-ring. (See Service Data)

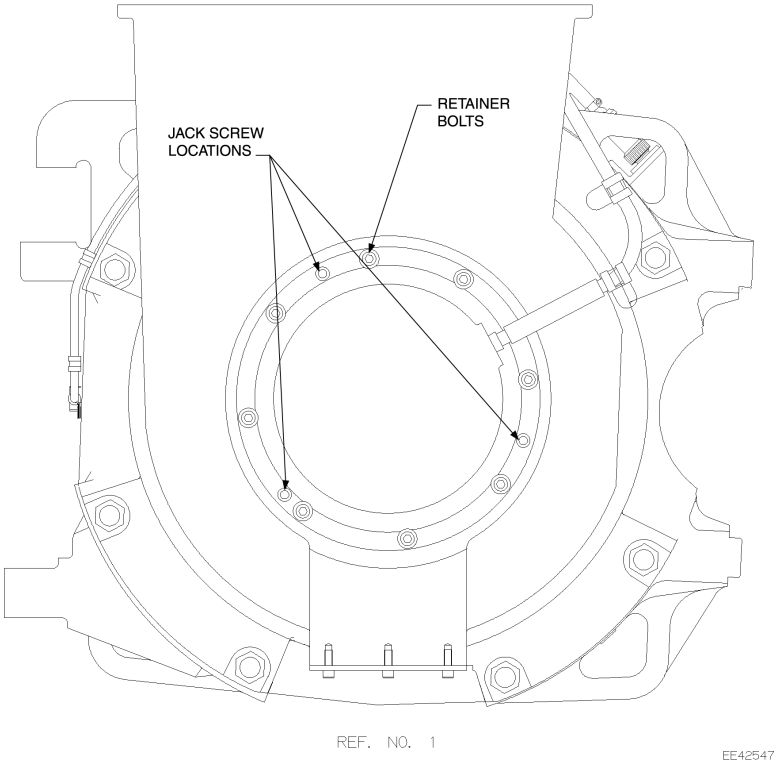


Figure 4 Bearing Cover Removal

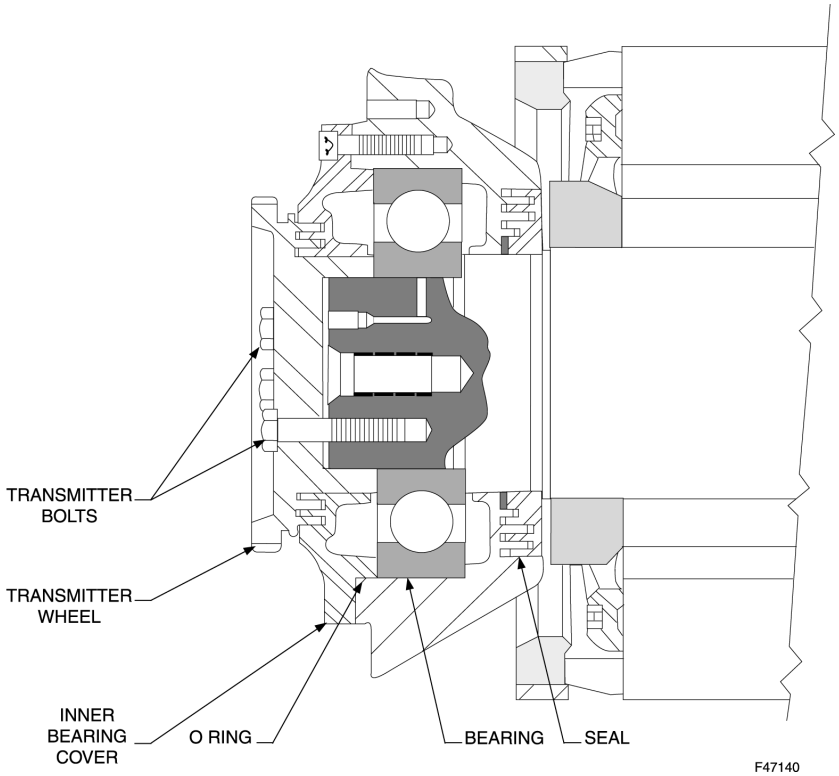


Figure 5 Bearing Assembly Cross Section

8. Perform a thorough inspection of the bearing and brass cage. Feel the grease for indications of metal/brass particles that may indicate bearing failure. If any abnormal conditions are observed, the motor should be sent for overhaul.

9. Using a clean dry cloth, wipe and remove all excess grease from the face of the bearing and cage.

10. Using a clean dry cloth, wipe and remove all old grease from the interior of the inner bearing cover.

11. Measure out a two-ounce quantity of Shell Cyprina RA Grade 3 Grease (See Service Data). Using a putty knife, force this grease evenly in and around all ball bearings and the cage pockets.

12. Weigh out 16 ounces of grease for the bearing cover. The lubricant is to be applied to the groove in the cover, starting from the bottom and working upwards on either side. The grease contour must be formed to the proper shape and dimension to ensure that a) the grease is high enough to contact the bearing cage and b) deep enough to contact the roller bearing, Figure 6.

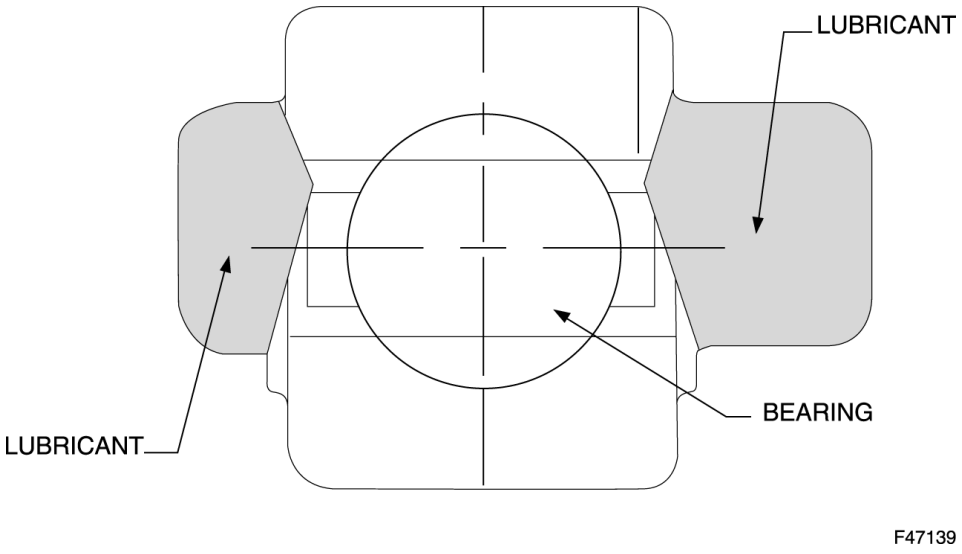


Figure 6 Grease Application

13. Contour gauges (grease masks) may be fabricated from the dimensions shown in Figure 7 to ensure that the lubricant is properly formed.

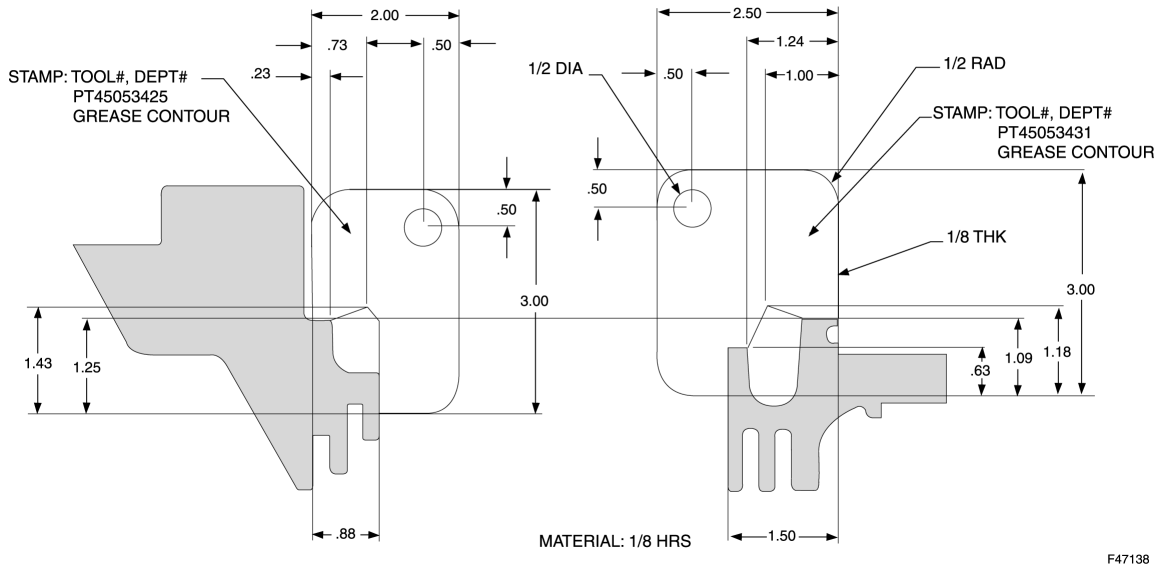


Figure 7 Contour Gauges (Grease Masks)

14. Re-apply the inner bearing cover to the face of the bearing cap ensuring that the grease is in the bottom area of the cover.

15. Apply the eight ½-13 x 2 ¾" cap screws (bolts) and torque to 100 ft/lbs. If the cover starts to rotate while torquing bolts apply one outer cover bolt to hold it in place.

16. Re-apply the transmitter wheel to the end of the rotor shaft.

17. Apply Loctite 262 to the threads of the five 5/8-11 x 3" bolts and apply the bolts to the rotor shaft. (See Service Data)

18. Apply the pinion cover hold down bolt through the pinion opening and use this to hold the rotor shaft while torquing the transmitter wheel bolts to 150 ft/lbs.

19. Replace the outer bearing cover with speed probe and apply the eight ½-13 x 2 ¾" hex screws (bolts).

20. Torque the ½" bolts to 100 ft/lbs.

21. Using a yellow metal marker or other system of identification, mark the date of re-grease on the bearing cover.

NOTE

It is recommended that at the time of bearing re-grease, the motor be thoroughly inspected for obvious damage such as cable (lead) defects. The motor should also be tested for stator grounds (megger test) and for phase-to-phase resistance. (See Service Data)

3.1.2 OIL LUBRICATED DRIVE END BEARING

The drive end (pinion end) bearing, Figure 8, is lubricated via the lubrication in the gear case. The gear case is physically mounted around the drive end bearing cover. A special oiling system is designed into the cover that allows the gear case oil to flow into the cover and into the bearing for lubrication and then recirculated back into the gear case. This new lubricating system allows for constant oil to the bearing where as the bearing can operate up to ten years without requiring replacement as compared to the sealed grease bearing that requires re-greasing at six years.

It is very important however, that proper lubricant level in the gearcase is maintained, and the oil is free of contaminants such as dirt, water, etc.

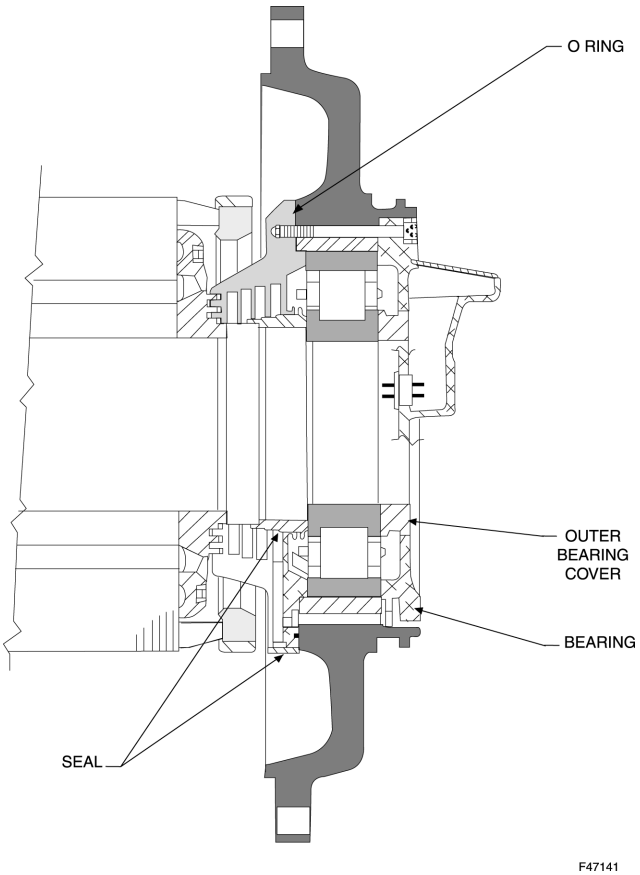


Figure 8 Drive End Bearing

3.2 PINIONS

The pinion, Figure 9, mounted in the traction motor rotor shaft is carburized, which provides an extremely hard outer surface yet retains a desired soft core. The pinion design is referred to as a plugged pinion where it is inserted into the bore of the rotor shaft instead of the traditional application over the shaft. The pinion is inserted into the shaft bore and by means of high pressure the shaft bore is expanded and at the same time the pinion is inserted further into the shaft until proper advance is achieved. Reference pinion application section for this process.

24376

Figure 9 Typical AC Pinion

3.2.1 PINION REMOVAL

3.2.1.1 PREPARATION

For pinion removal use glycerin - not oil. Glycerin is highly hydroscopic and must be protected from contact with air so that water is not absorbed. If water is absorbed corrosion of the tapered surfaces will result. Keep all containers and pumps tightly closed.

Figure 10 shows a typical 2 pump pinion service system.

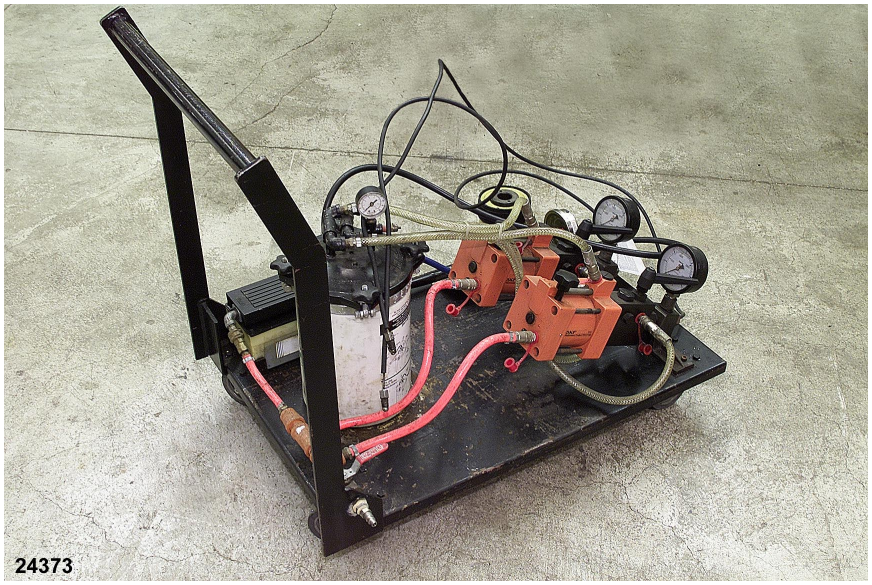


Figure 10 Pinion Service Equipment

1. Insert the threaded rod through the center of the pinion and into the rotor shaft, Fully engage the threads and tighten the rod hand tight, Figure 11.

NOTE

Threaded rod must be visually inspected before using. DO NOT use rod with damaged threads.

2. Connect both glycerin pumps to the tapped holes in the end of the pinion.

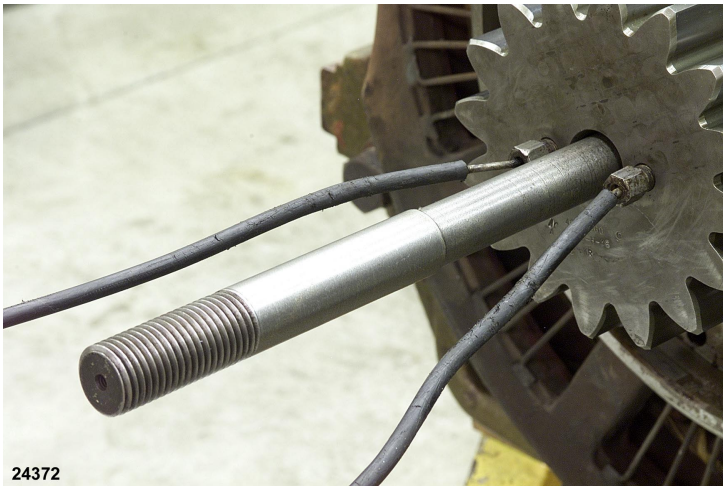


Figure 11 Threaded Rod and Pump Connections

3. Slide the spacer onto the rod, arranging the pump lines into the flats provided in the spacer.

4. Mount the hollow hydraulic cylinder on the rod (with the ram facing outboard) and apply the hexagon nut to allow approximately .25 inch gap between the ram and the nut. Figure 12 illustrates the tooling applied to a typical AC Traction Motor.

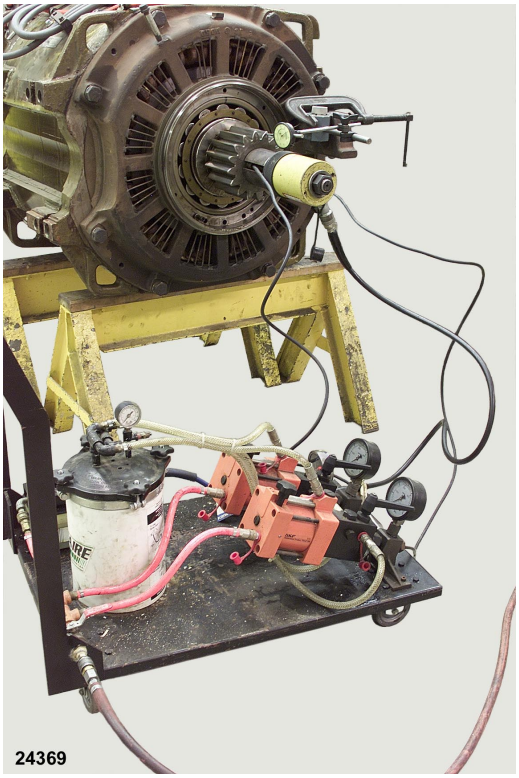


Figure 12 Pinion Removal and Application Tooling

NOTE
DO NOT use nut with damaged threads.

5. Connect air to the hydraulic pump set.

3.2.1.2 REMOVAL

1. Apply sufficient pressure to advance the ram to fill the .25 inch gap and slowly raise the pressure on the hydraulic pump to approximately 2,000-psi.

NOTE
Failure to do this step can lead to premature failure of the threaded rod with possible serious injuries.

2. Activate the glycerin pumps and raise the pressure in both pumps until glycerin emerges between the pinion and shaft, thereby disengaging the seating of the pinion.

3. Slowly release the pressure on the hydraulic pump and the ram will retract as the pinion floats out.

4. Dismantle individual parts and connections of the glycerin pumps and withdraw the pinion.

3.2.2 PINION APPLICATION

3.2.2.1 PREPARATION

Check temperature of Rotor Shaft and Pinion. A maximum of 10°F temperature differential between the parts is allowed.

For pinion mounting use glycerin - not oil. Glycerin is highly hydroscopic and must be protected from contact with air so that water is not absorbed. If water is absorbed corrosion of the tapered surfaces will result. Keep all containers and pumps tightly closed. The following procedure details the installation of the plug style pinion:

1. Thoroughly clean the taper of the pinion end of the shaft.

2. Insert the threaded rod into the pinion and thread into the tapped hole in the shaft. Fully engage the threads and tighten the rod hand tight.

3. Carefully insert the pinion into the shaft and lightly press into position.

4. Connect glycerin filled hydraulic pumps to the tapped holes in the end of the pinion.

5. Slide the spacer on the rod, arranging the glycerin pump lines into the notches or flats provided in the spacer.

6. Mount the hollow hydraulic cylinder on the rod and secure with a nut.

3.2.2.2 PINION APPLICATION

Before pushing in the pinion, measure the initial radial clearance of the drive end bearing. This should be done before the outer bearing collar is applied or after the collar has cooled to room temperature, as the hot collar will influence the bearing clearance. Insert a feeler gauge between bearing roller and race at the top 12:00 o'clock position to get initial clearance reading, Figure 13.

Figure 13 Using Feeler Gauge to Check Clearance

1. Slowly raise the glycerin pressure in both pumps until glycerin emerges between the pinion and shaft.

2. Apply sufficient pressure to the ram until a slight axial movement of the pinion is produced. Measure pinion advance with an appropriate dial indicator, Figure 14.

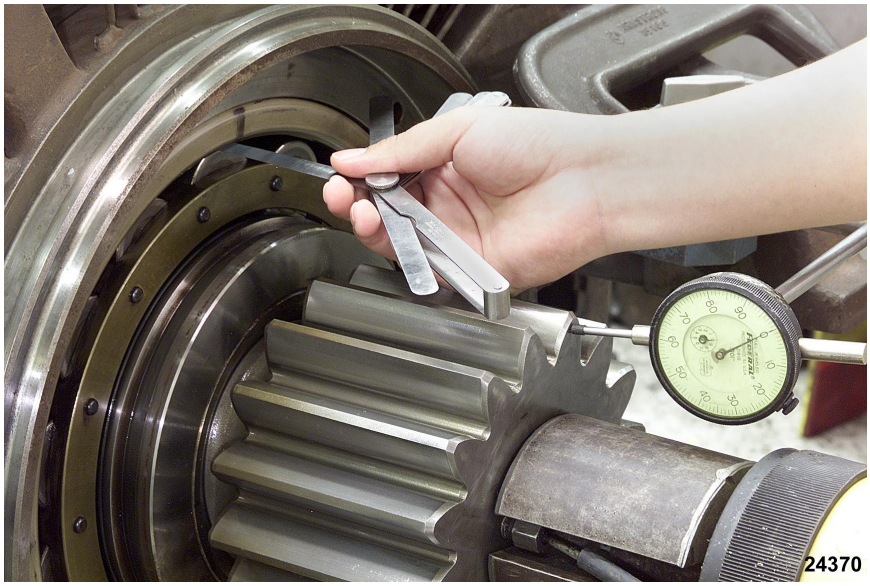


Figure 14 Measuring Pinion Advance

3. Increase pressure in all pumps sequentially, glycerin pumps first then the ram until the required pinion advance is achieved (.157 + .008 - .000). This requires glycerin pump pressures of approximately 23,000 p.s.i. and a hydraulic ram pressure of approximately 28,000 p.s.i.

NOTE

It is recommended that the pinion be pushed in an initial increment of .100 inch followed by increments of .010 inch until the required advance is achieved. Allow the pinion to rest two minutes between each increment and maintain pressure on the hydraulic ram.

4. Recheck the radial clearance of the bearing. It must decrease from the initial measurement by no less than .003 inch. If this value is not achieved, the pinion must be advanced in increments of .010 inches further until it is reached. If it can NOT be achieved, the pinion must be removed and a new different bearing applied and reapplication of pinion.

5. After the required advance is achieved, release the glycerin pressure while maintaining full pressure on the hydraulic ram. Maintain this pressure for one hour.

6. After one hour remove the pumps and apparatus.

7. Measure the radial clearance of the drive end bearing. It should be .0073 to .0116 inch. (.003 inches less than pre pinion application).

3.3 APPLICATION OF TRACTION MOTOR TO WHEELSET

Prior to assembly of the traction motor / pinion assembly to the roller support assembly, ensure that the mating surfaces of both assemblies are cleaned. Any debris such as packing tape, paper, rust or dirt must be removed to ensure proper fit of the components.

1. Mount traction motor and pinion assembly onto the roller support assembly, ensuring that pinion and axle gear are properly meshed. Check that the roller support assembly seats fully against the traction motor mating surface.

2. Apply Thread-Tex 3203 to all eight 1-1/8 x 7 bolts. (See Service Data)

3. Using new washers, apply the bolts and torque to 990 ft-lbs.

4. Prepare gear cases for installation by following the procedure listed in Section 3.4.4 of this M.I.

3.4 GEAR CASES AND GEARS

The gear case, Figure 15 and Figure 16, houses the traction motor pinion, mating axle gear, and drive end bearing assembly, protecting them from dirt or damage and carries the gear and bearing lubrication. The cases are made with two very close and tight fitting halves. As compared to the conventional gear case assemblies, these cases require no special seals. The split line between the two halves as well as the fit around the axle housing and pinion bearing housing is sealed with a simple bead of RTV sealant, making assembly very easy with little or no problems with leaking once in service.

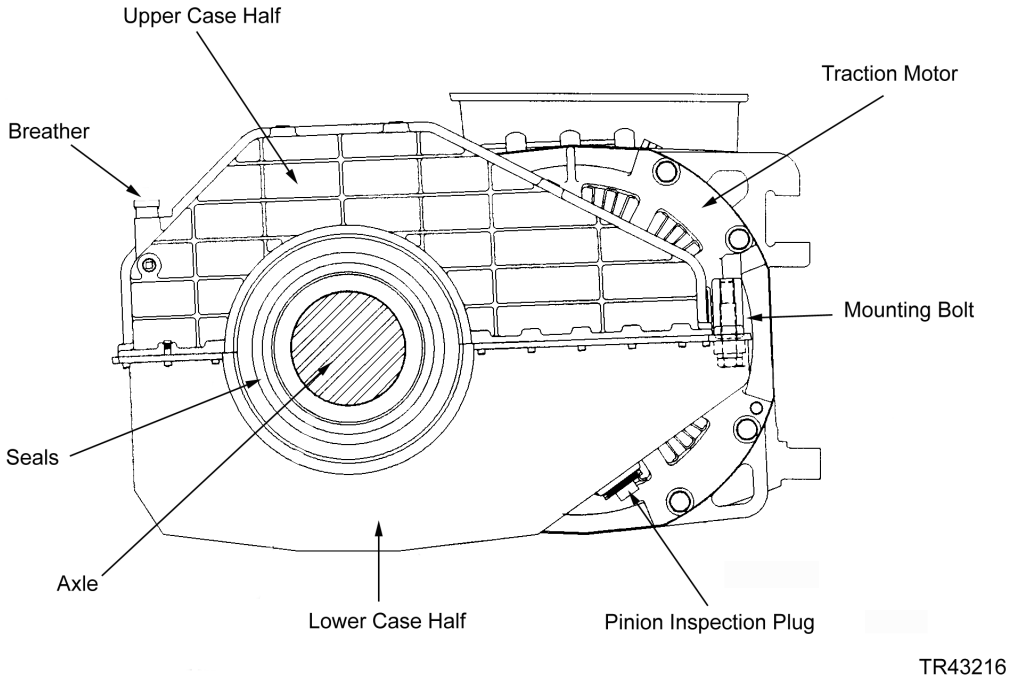


Figure 15 AC Traction Motor Gearcase (Outboard View)

3.4.1 LUBRICATION

Lubrication of gear cases should include checking for possible lubricant leaks. Any indication of oil leakage must be investigated and corrected before returning to service.

Refer to applicable Scheduled Maintenance Program for the recommended interval of gear case inspection and the type of lubricant to be used. Frequent gear case level inspections should be made using such intervals as a guide until the maximum mileage between lubrication intervals can be determined for the specific type of service encountered.

The oil level in the gearcase should be maintained even with the bottom of the oil level plug, Figure 16. On newer gearcases, the oil fill plug has been eliminated and the oil is added through the oil level plug.

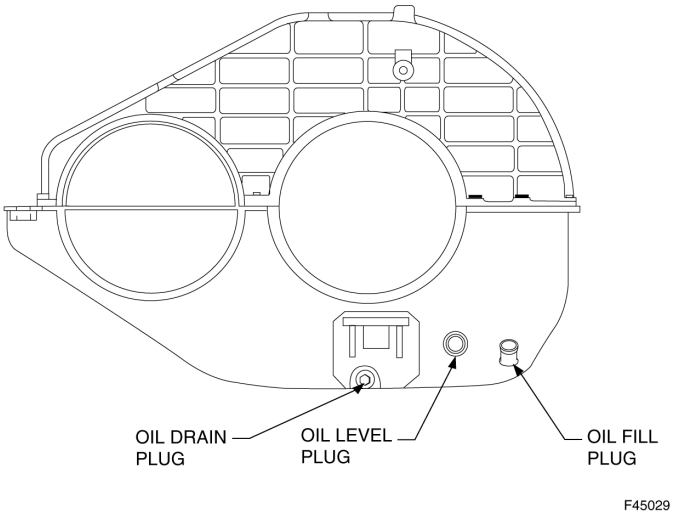


Figure 16 AC Gearcase (Inboard View)

3.4.2 GEAR CASE DISASSEMBLY PROCEDURE

Should it be necessary to remove a gear case from the traction motor/axle-wheelset assembly in place in the locomotive, the following procedure may be used:

1. Drain lubricant from gearcase by removing the oil drain plug from the lower case half.

2. Remove the gearcase split line cap screws (14 in total) and the gearcase mounting bolts (2 in total).

3. Split the gearcase halves by a) prying between the lower case half and the roller support unit, or b) using the two jacking holes located on the lower case half near the mount bolt.

NOTE

Take care when handling the aluminum upper case half. Do NOT pry against the case, or hit with a hammer or other hard object to spit the halves, as permanent damage to the case will occur.

4. Carefully remove the lower case half away from the traction motor/wheelset assembly.

5. Lift the upper case half off of the mounts and swing forward until it can be removed from the traction motor/wheelset assembly.

3.4.3 GEAR CASE INSPECTION WHEN REMOVED

After removal, thoroughly clean of all dirt and grease by immersing in a hot caustic cleaning solution. Never remove grease by burning as this may distort the gear case to the extent that the halves will not mate properly when installed and oil leakage will occur.

Visually inspect the case halves for damage such as cracks, perforations or deformities.

Once cleaned and dried the lower case, which is steel, can be painted using buff primer to reduce the chance of rust built-up. The upper case is made of aluminum and will not require painting.

3.4.4 GEAR CASE ASSEMBLY PROCEDURE

Prepare gear cases for application by thoroughly cleaning interior and exterior of chips, loose weld spatter, lubricant, etc. Also remove all traces of oil from sealing surfaces on gear case halves and mating motor seals.

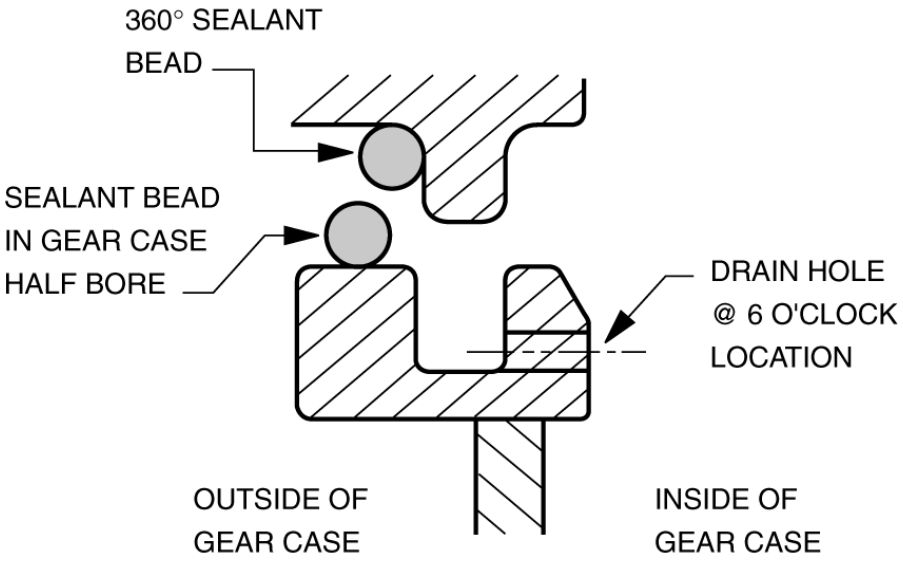
1. Install the vent pipe (if removed) with Loc-tite 262 into upper case half. Install the filter and vent cap assembly to the pipe.(See Service Data)

2. Check to see that the three drain holes in lower half bores are unobstructed, clean as required.

3. Wipe all traces of oil from the seal surfaces with a clean, lint-free cloth. Apply a continuous ¼" bead of RTV sealant at three places on the motor and axle assembly adjacent to the seal tongues.

4. Apply additional ¼" diameter sealant beads at each of the half bores in the upper and lower case halves as also shown in Figure 17. Note that these sealant beads are always placed outboard of the tongue or groove.

5. Apply a 1/8" diameter sealant bead on either the upper or lower gear case parting line flange segments. Form the beads continuously and surround each bolt hole with a ring of sealant.



TYPICAL CROSS SECTION THROUGH
3 GEAR CASE BORES

Figure 17 Gear Case Sealant Beads

6. Install the lower half gear case to the motor assembly. Using Thread-Tex 2302, apply the two 1-1/8-7" bolts and washers by hand.

7. Install the upper gear case half to the motor. Apply the 3/8-16 parting line bolts and dry torque to 35 ft/lbs.

8. Torque the two 1-1/8-7" bolts to 990 ft/lbs.

9. With the motor in the normal operating position, fill the gearcase with lubricant to the level inside the fill opening on the lower gear case half side. Use only EMD approved synthetic gear lubricant. (See Service Data)

3.5 PROCEDURE TO DROP TRACTION MOTOR FROM TRUCK

As procedures for traction motor removal will vary slightly between different models of trucks, refer to the maintenance instruction for the specific truck being worked on.

3.6 PROCEDURE TO ASSEMBLE TRACTION MOTOR TO TRUCK

As procedures for traction motor application will vary slightly between different models of trucks, refer to the maintenance instruction for the specific truck being worked on.

4.0 SERVICE DATA

4.1 SPECIFICATIONS

4.1.1 RATINGS

Nominal Continuous Current ..... 309 Amperes

4.1.2 STATOR RESISTANCE VALUES

Phase to Phase Resistance (@ 75 degrees F) .....106 to .111 ohms
Minimum Resistance to Ground @ 5000v ..... 2 Megohms

Use the following formula to convert resistance measured at any temperature to resistance at 75°C (167°F):

$$\text{Resistance at } 75°C = \frac{\text{measured resistance x } 309.5}{234.5 + \text{temperature of item being tested in } °C}$$

4.1.3 WEIGHTS (Approx.)

1TB-2624 AC Traction Motor
- w/o wheels, axle, and gearcase ..... 2300 kg. (5070 lbs.)
- with wheels, axle, and Gearcase ..... 5,062 kg. (11,160 lbs.)

Gearcase
- Top Half ..... 38 kg. (83 lbs)
- Lower Half ..... 92 kg. (202 lbs)

Pinion ..... 39 kg. (85 lbs)

4.2 MATERIAL

Loc-Tite 262 Thread Lock Compound 9581263
Non-Drive End Bearing Cover O-Ring 40044411
Threadtex #2303 8307731
RTV Sealant #1473 (Black - Oil Resistant) 40027958
Shell Cyprina RA Grade 3 Grease
- 35 lb pail 8489774
- 120 lb pail 8249820

Lubrication (gearcase) Mobil SHC 634
- 5 Gallon 40085744
- 55 Gallon 40085745

4.3 TOOLS

Megger, Insulation Resistance Test Set (250, 500, 1000 volt) 8174880
Leads, 3.7 m (12 ft.) 8174878
Carrying Case 8174879

Megger, Insulation Resistance Test Set (500, 1000, 2500, 5000volt) 40058161
(Carrying Case and 12 ft leads included)

Digital Low Ohm Resistance Tester Kit (Range 0 to 1.999 milliohms) ...9322573
(Includes AC – DC Power Supply and 6 foot test leads)

Hydraulic Pinion Removal/Application Equipment 40087932

†File Number represents facility drawings that are available (at no charge) from EMD Service Department. These drawings include construction details of tooling that can be manufactured.

Document Number MM001001 (DE-LP)

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