MAINTENANCE INSTRUCTION
M.I. 1550

Service Department
ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION
March 2002

SCHEDULED MAINTENANCE AND OVERHAUL INSTRUCTIONS FOR DE/DM30AC LOCOMOTIVES EQUIPPED WITH SIEMENS FABRICATED TRUCKS

Equipped With

AC Traction Motors

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 procedure as outlined in this instruction is specific to the Siemens fabricated trucks fitted to DE/DM30AC locomotives and is offered for planning purposes only. As written, this document reflects current EMD product design and service experience for the DE/DM30AC type of locomotive truck with AC traction motors. 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 is intended to serve as a guide when establishing maintenance schedules to meet the particular requirements of individual operations and planned economic life of the locomotive truck. It provides average recommendations, which should ensure satisfactory locomotive operation, and economical maintenance costs where average load factors and climatic conditions are encountered.

The scheduled inspection and maintenance items defined herein are specific to the DE/DM30AC fabricated trucks. Component renewal provisions are consistent with traditional overhaul procedures.

For planning purposes, EMD has established the following overhaul interval recommendations for the DE/DM30AC fabricated trucks. These overhaul interval recommendations are based on whichever event occurs first: time, miles, or megawatt hours.

DE/DM30AC Trucks:

- High Speed Service: 8 years / 1,000,000 miles.
- Heavy Haul Service: 8 years / 750,000 miles.

NOTE

Mileage values referenced above are defined by Microprocessor Archive Data when the locomotive is equipped with a 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 GENERAL DESCRIPTION

The Siemens designed DE30AC fabricated truck assembly, Figure 1 and Figure 2, and DM30AC fabricated truck assembly, Figure 3 and Figure 4, support the weight of the locomotive and provide the means for transmission of power to the rails. This series of truck is applied to AC transmission DE and DM locomotives using Siemens 1TB2624 AC traction motors. Note that while the DM locomotives use the same AC traction motors, they are also equipped with Third Rail power equipment. There are minor differences in specifications between the two types of truck, however the basic design is similar.

Unlike conventional two axle "rigid" trucks in which the axles are held parallel to each other with a bolster system, the DE/DM series is designed as a powered "bolster-less" unit. Although the truck frame itself is rigid, the truck design allows the axles "yaw" freedom within the frame to position the wheelset axles radially to the curves center for reduced wheel and rail wear. Tie rods and bushings attached to the journal bearing adapters and truck frame control lateral movement of the axles, and transfer all longitudinal forces.

The truck frame itself is fabricated assembly, of welded plate steel. This allows lighter weight while still retaining the required strength.

Tractive and braking forces are transmitted from the journal bearing adapters, through tie rods mounted on the adapters (See Figures 1, 2, 3 & 4). The tie rods transfer the movement forces through bushing assemblies to the truck frame. The Watt's lemniscate linkage transfers the forces through center pivots from the truck frame, and then to the locomotive underframe through the carbody pivot assembly, refer to Figure 6.

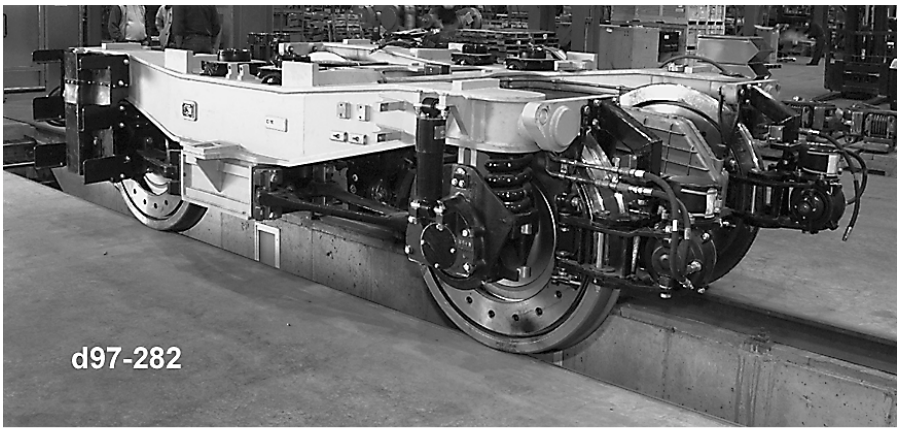

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Figure 1 Siemens Fabricated Truck Applied to a DE30AC Locomotive – Three Quarter View

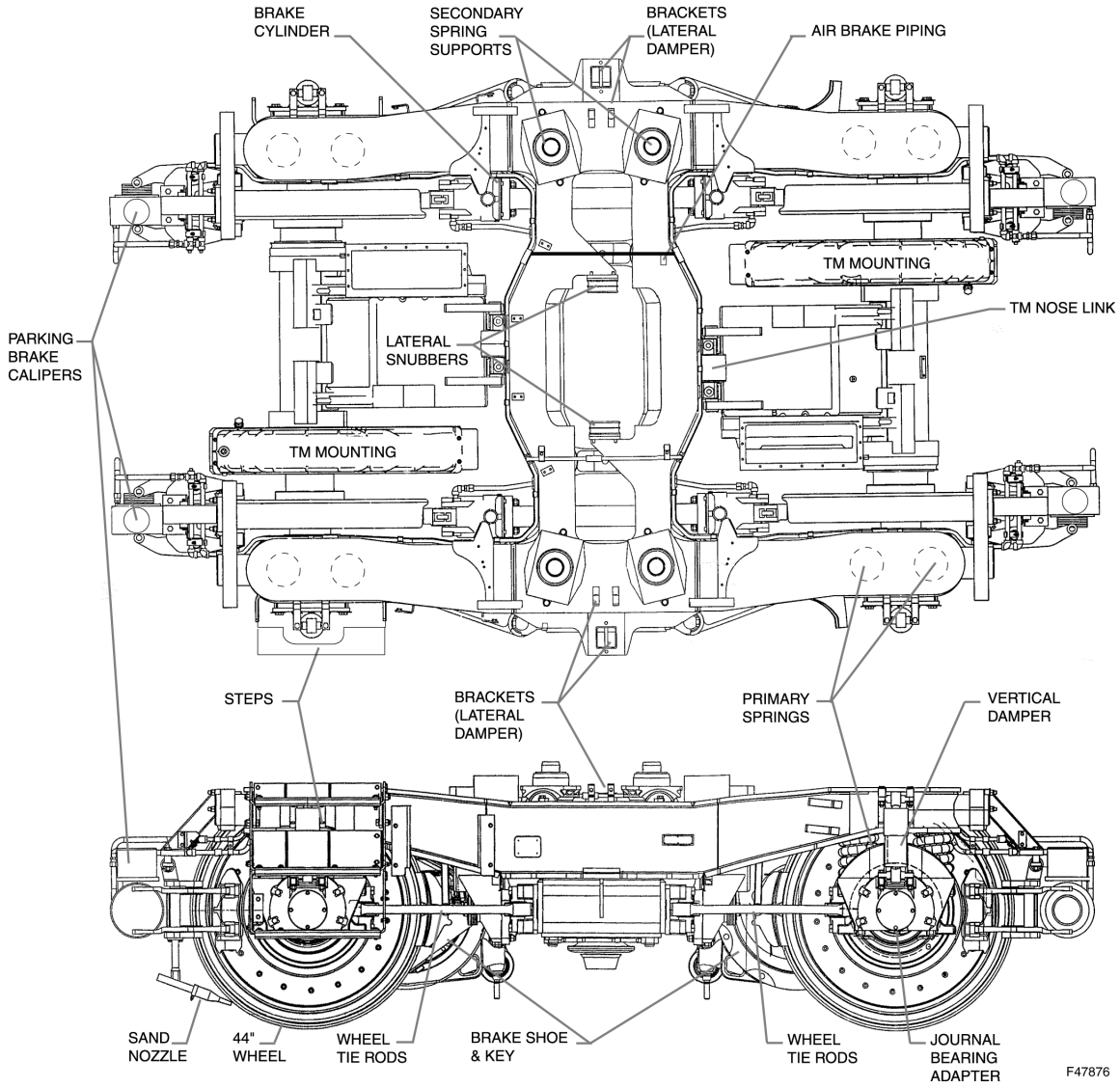


Figure 2 Siemens Fabricated Front Truck Applied To A DE30AC Locomotive – Major Components

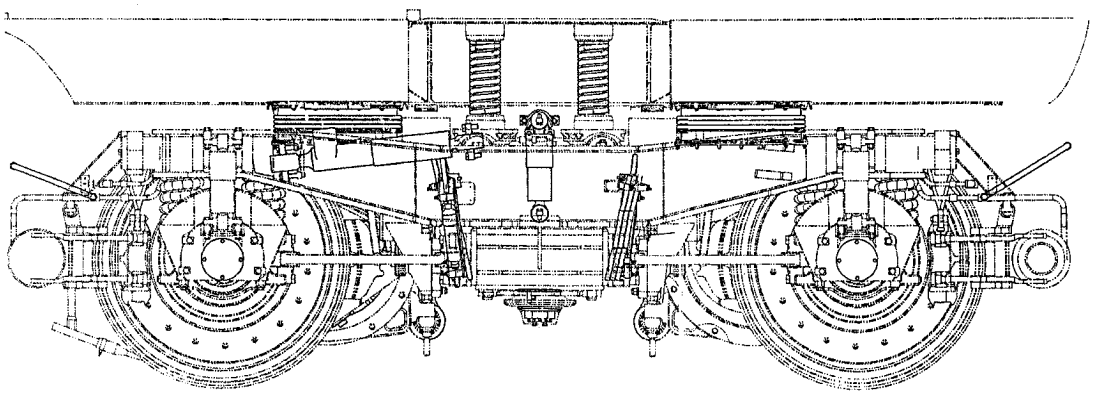


Figure 3 Siemens Fabricated Rear Truck Applied To A DE30AC Locomotive – Side View

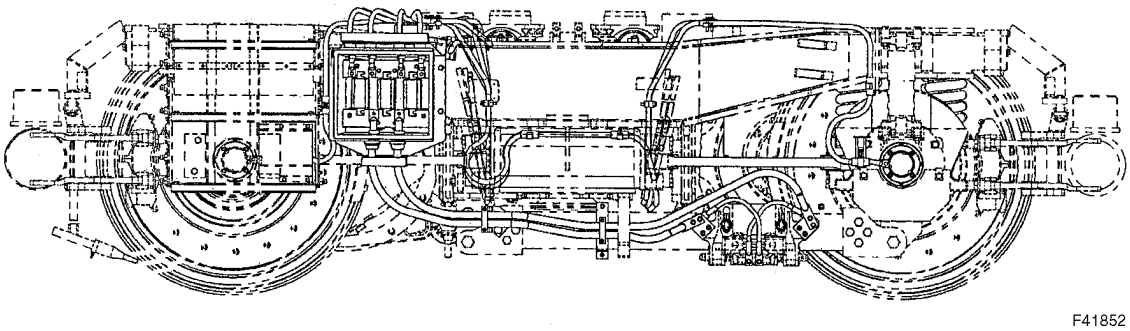


Figure 4 Siemens Fabricated Truck Applied To A DM30AC Locomotive – Side View

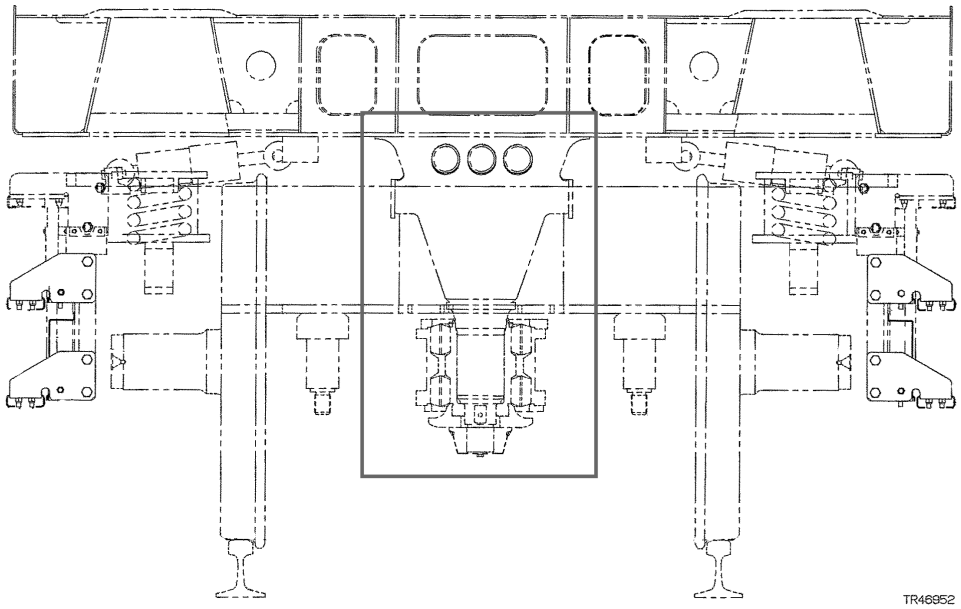


Figure 5 Partial Illustration Of Lemniscate Assembly Showing Alignment Of Carbody Transom Pivot

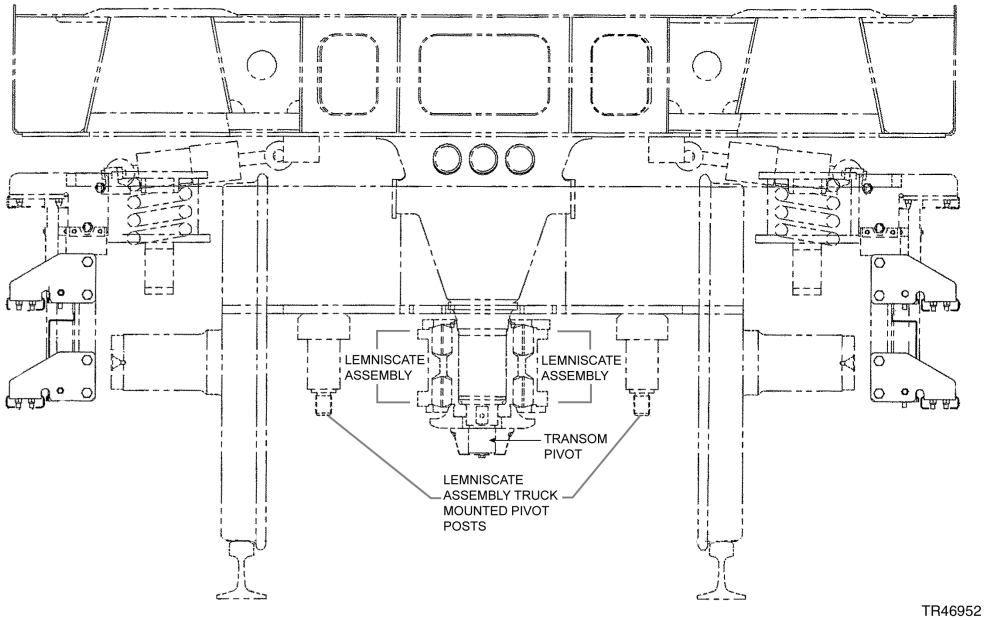


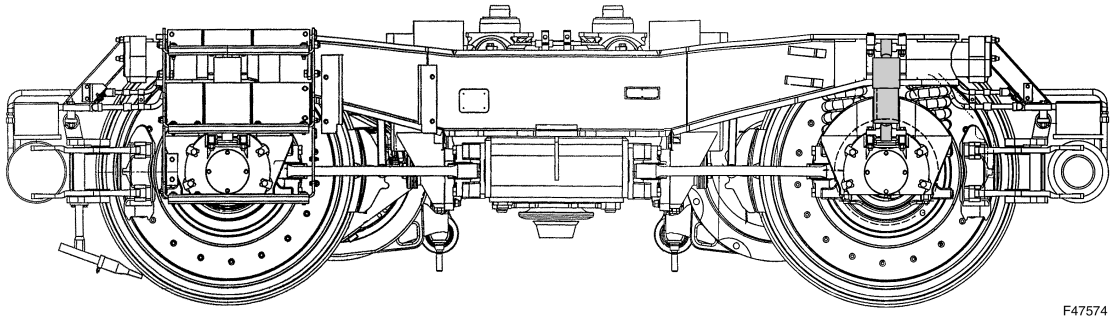
Figure 6 Carbody Pivot Assembly And Lemniscate Linkage

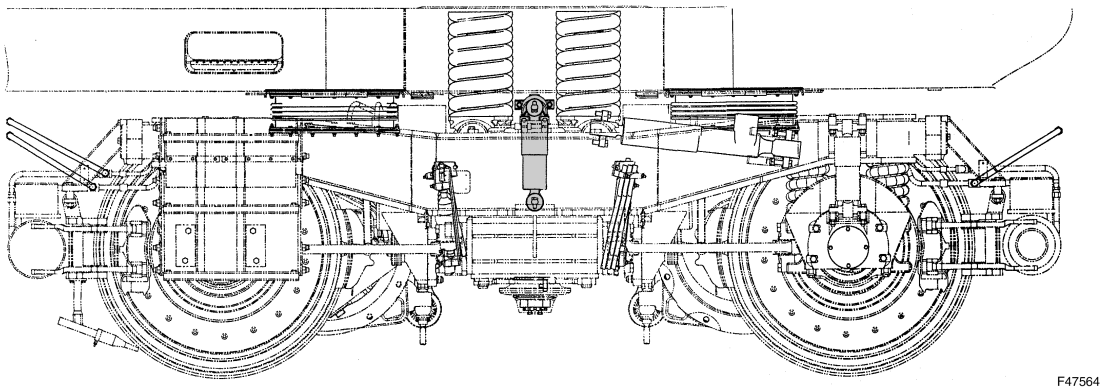
The locomotive carbody weight is transferred directly to the truck frame through four rubber "secondary" spring support pad assemblies (see Figures 1, 2, 3 and 4), and dual "secondary" or carbody springs which also provide controlled lateral and yaw stiffness for tracking stability. The relatively stiff "secondary" suspension and uniform reversed traction motor orientation improve weight transfer within the truck for optimal adhesion performance. A soft "primary" suspension, consisting of eight single coil journal springs (two at each journal-bearing adapter), is designed to provide good ride quality and equalization of wheelset loads for operation over track irregularities. Axle, lateral and vertical dampers enhance ride quality, while high-speed stability is aided with yaw dampers on each side of the truck.

The truck is designed to provide for extended maintenance intervals via reduced number of rubbing wear interfaces and improved tracking performance of the wheels on the rails.

Two AC traction motors, mounted in each truck, convert electrical energy into locomotive tractive effort. The motors are geared to the driving axles, which in turn apply force to the rail through the wheels. The driving force is transmitted to the truck frame via the journal bearing adapters, through the tie rods to the truck frame, and then to the locomotive underframe through the linkage and carbody pivot assembly.

Heavy-duty dampers are used vertically between the journal bearing adapters and the truck frame to damp excessive vertical and roll oscillations of the locomotive (axle dampers). See Figure 7. Secondary vertical dampers are connected between the under carbody and truck frame to control dynamic movement of the truck. See Figure 8. Two lateral and two yaw dampers are mounted on each truck. Lateral dampers are mounted between the truck and the locomotive carbody to damp the lateral movements, and the yaw dampers are mounted between the truck and the underframe to control yaw movements of the truck for stability and ride at higher operating speeds.





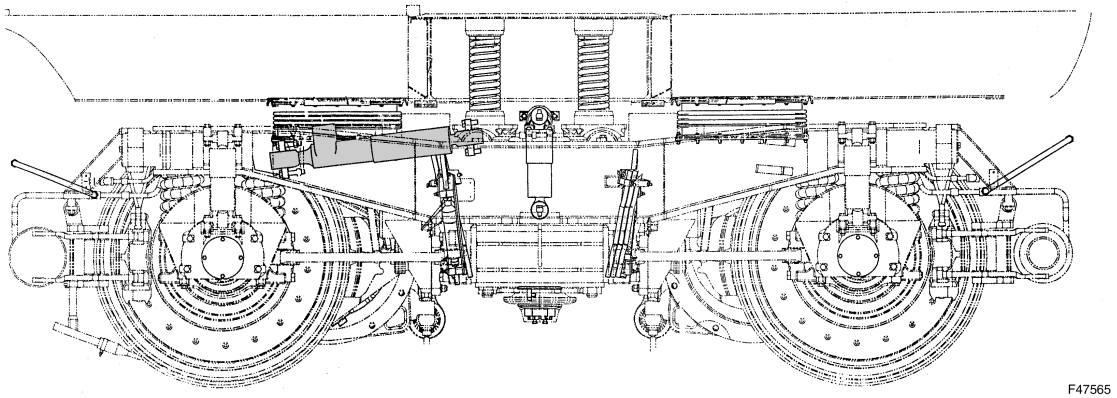


Figure 7 Vertical, Axle, Yaw Dampers And Secondary Suspension Components

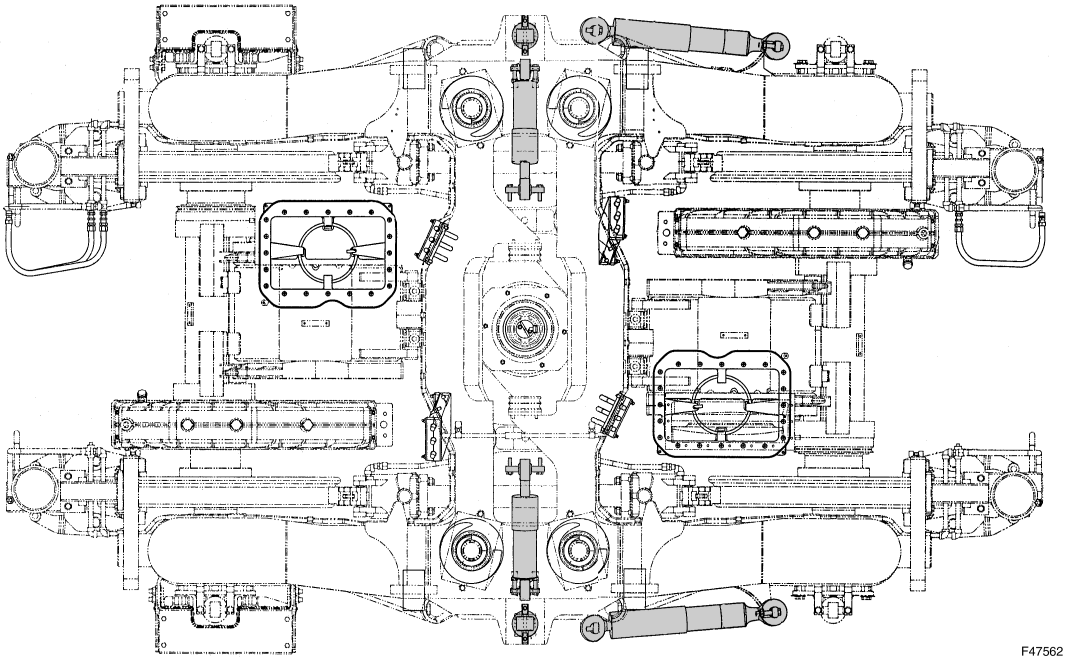


Figure 8 Lateral And Yaw Dampers

Lateral stops equipped with wear pads, Figure 9, and are provided on the truck frame adjacent to the carbody underframe transom post position to help limit lateral movement between the truck and underframe. Rotational stops are located on the carbody bottom.

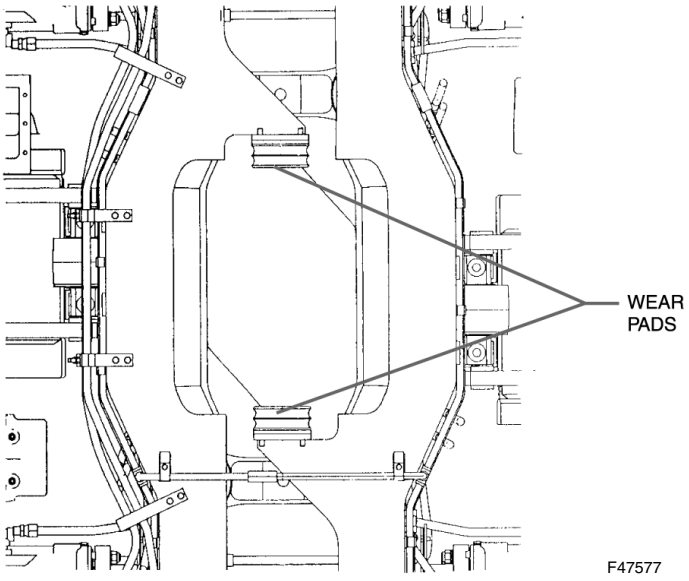


Figure 9 Lateral Transom Post Wear Pads (Snubbers)

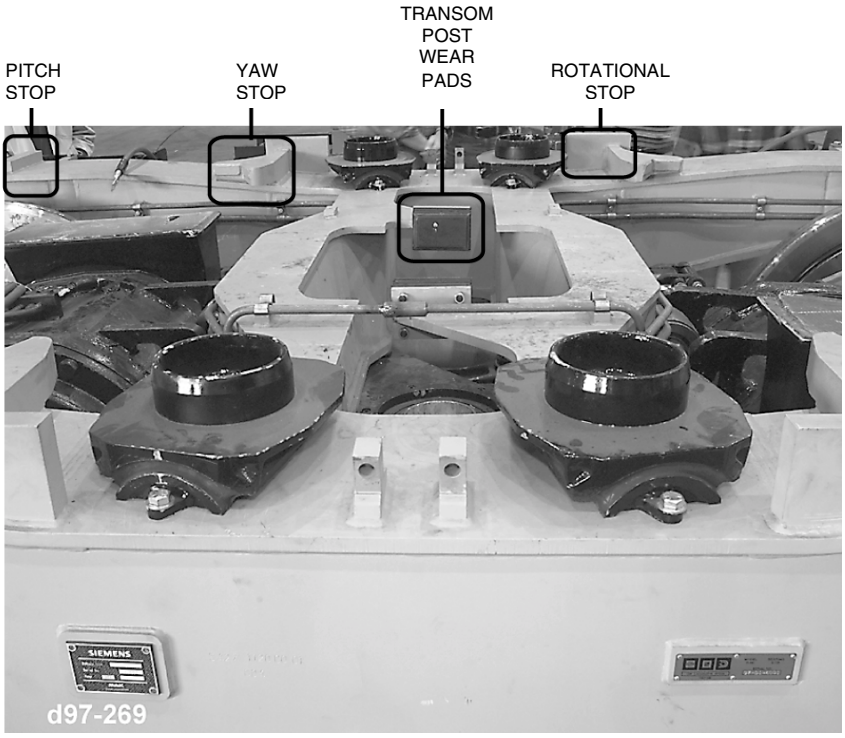


Figure 10 Lateral Transom Post Wear Pads, Rotational, Yaw, And Pitch Stops

Vertical clearance is established between the truck frame and the underframe using shims at locations outward of the lateral stops and secondary springs towards the end axle positions. These shims are welded to the underframe. See Figure 11. Note that lateral and vertical clearance measurements are taken at the journal bearing adapter housing. See Figure 14.

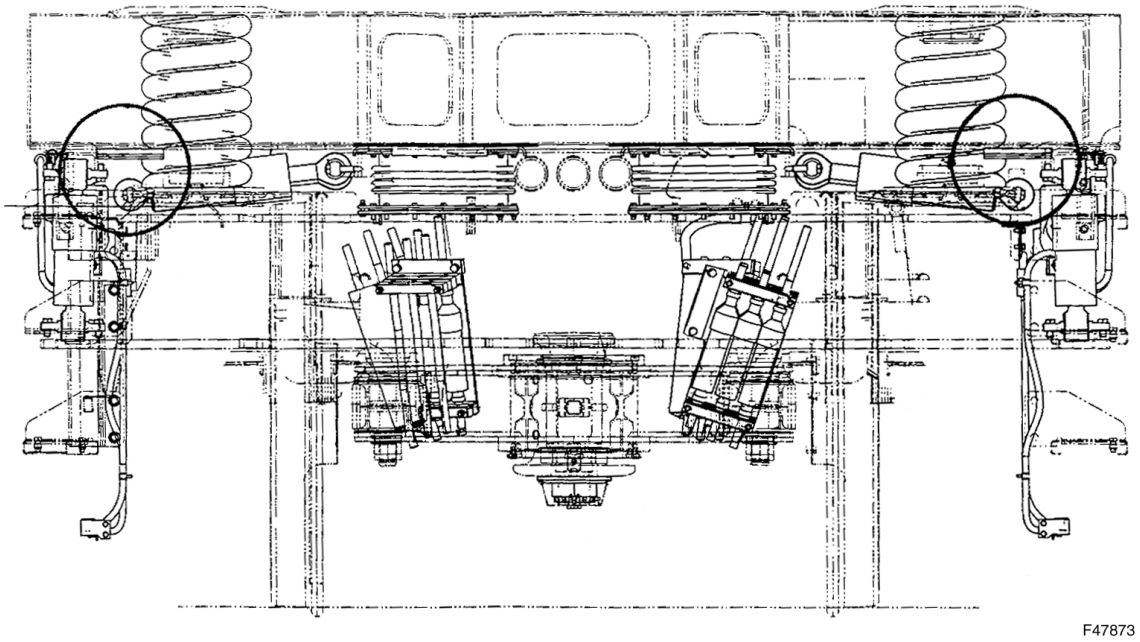


Figure 11 Vertical Clearance And Shims

For both models of truck, there are no interlock links as with other EMD locomotives. Instead the prevention of the truck separating from the locomotive during lifting operations is accomplished by the use of a locking mechanism on the underframe transom center pivot (Figure 12 and Figure 13).

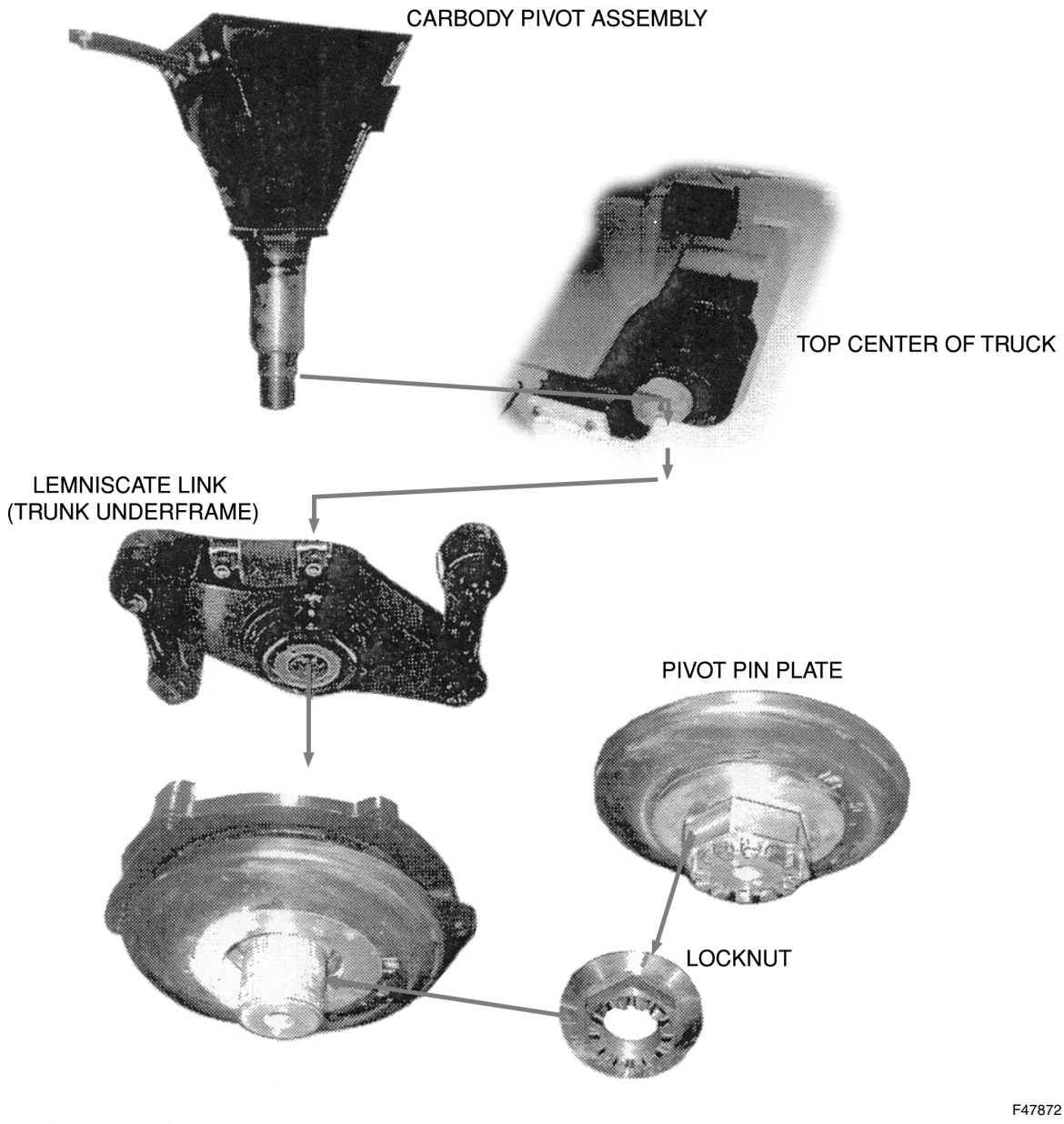


Figure 12 Transom Pivot Pin Components

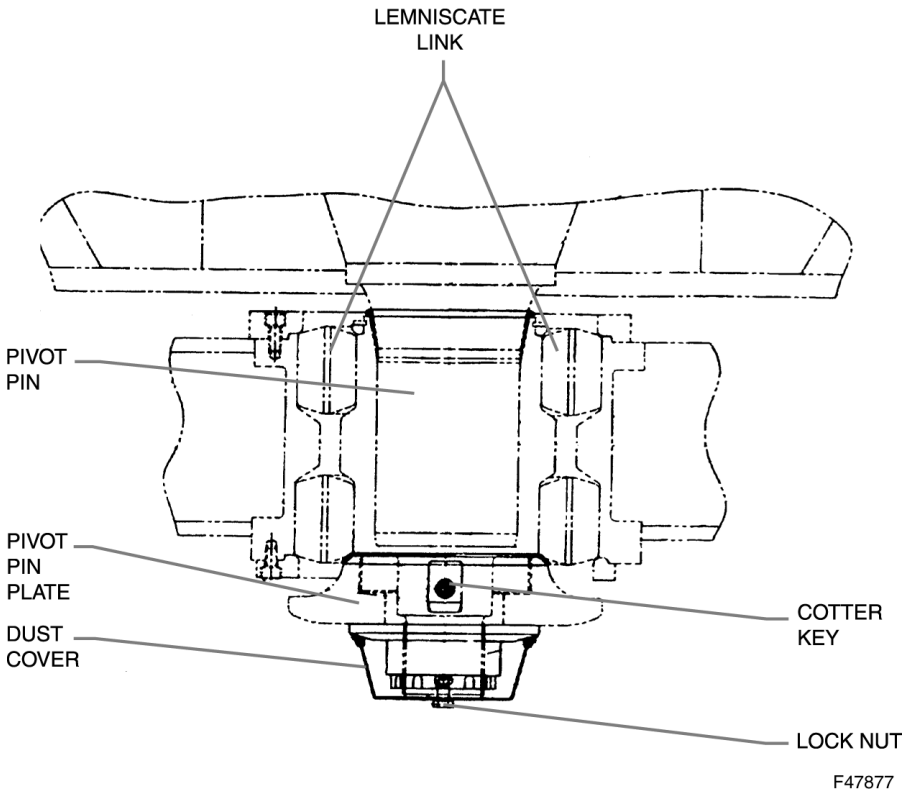


Figure 13 Carbody Transom Pivot Pin Safety Lock Mechanism

Note that a small amount of grease leakage around the seals below the transom pivot pin plate may be expected during an initial run-in period. This leakage will eventually be reduced to normal "weepage."

Interlocking of the journal bearing adapters to the truck frame for lifting is accomplished with a pin within a slotted link. The slotted link is held in position by a retaining plate, held on with two bolts and washers. See Figure 14. This is allowed to move with the journal-bearing adapter during normal operation and only comes into play when the locomotive is lifted with the truck. However, the internal dimensions between this link and the upper journal bearing adapter housing are the actual measurements for lateral and vertical clearance. See Figure 14. These dimensions are given at the end of this M.I. in the Specifications section.

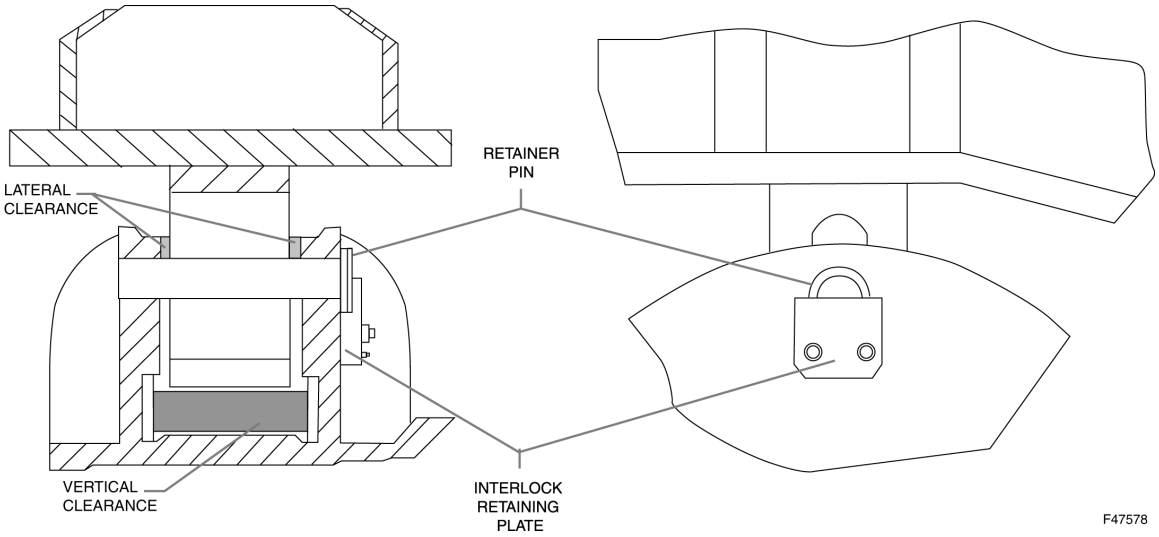


Figure 14 Interlock Retainer Plate And Pin

When using a drop table to remove a wheel set and motor, the bearing adapter cap can be removed in order to avoid having to disconnect and remove the entire bearing adapter and primary suspension.

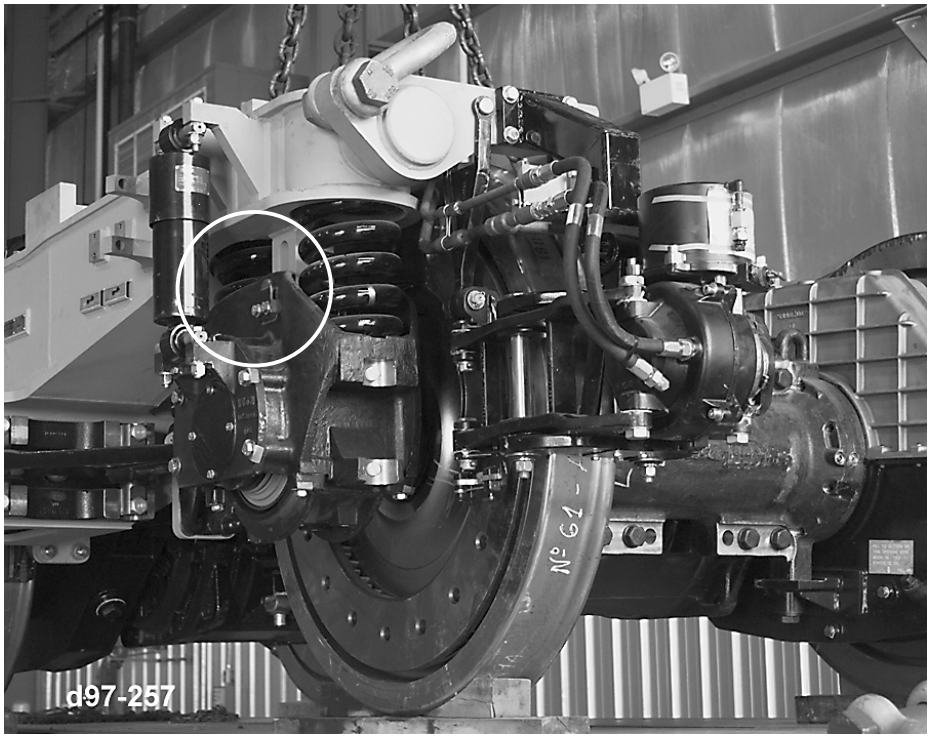


Figure 15 Journal Bearing Adapter And Interlock Link

The journal bearings transmit the vertical load from the springs to the axles.

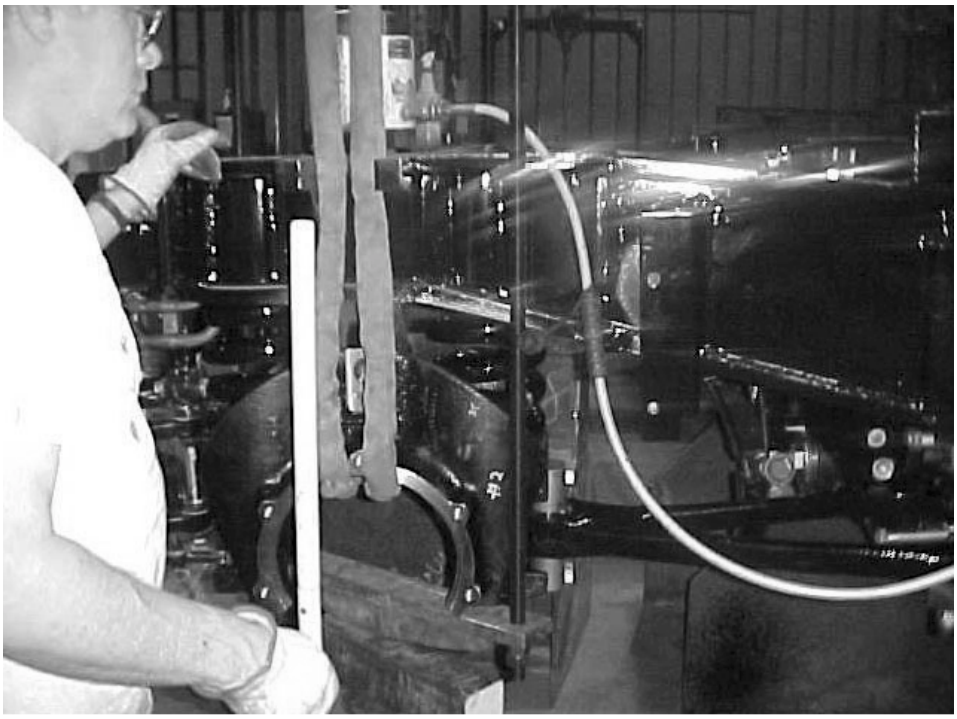


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Figure 16 Journal Bearing Adapters Being Installed

The two traction motors are supported on their respective drive axles and at motor nose link assemblies, Figure 17, attached to the truck frame. An important feature of the DE/DM30AC truck design is the orientation of the traction motors in opposite directions. This arrangement provides excellent motor accessibility and good adhesion characteristics.

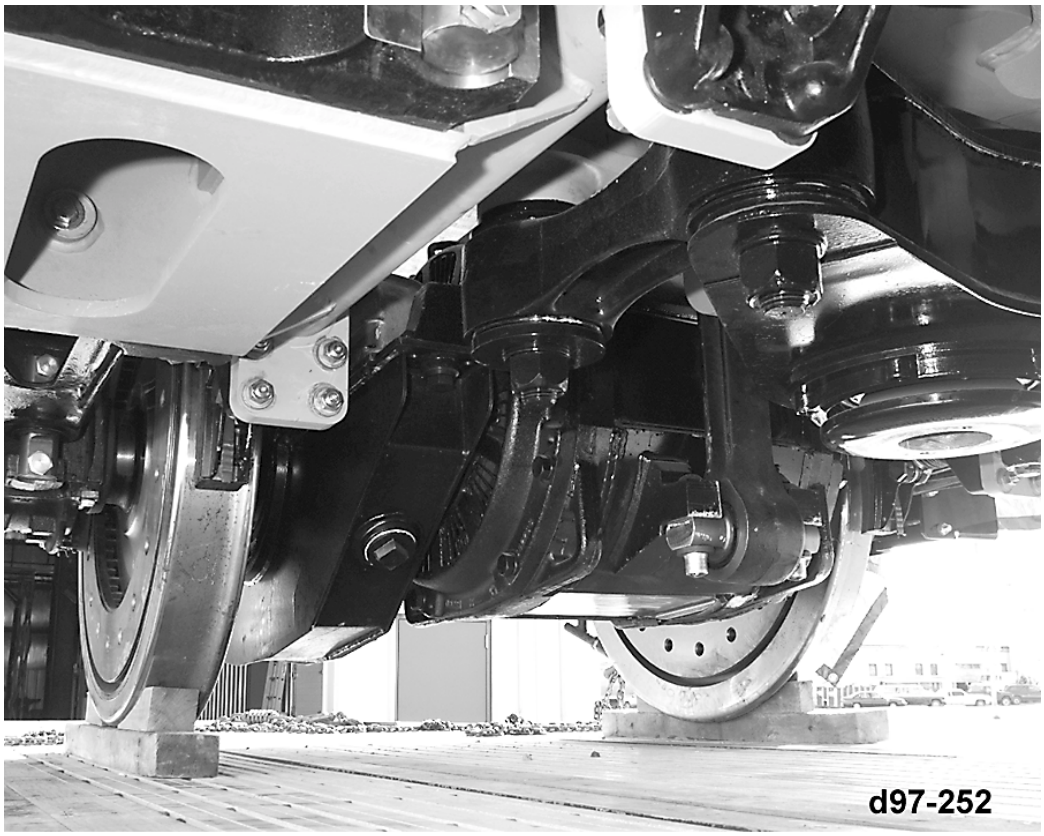


Figure 17 Typical Traction Motor Nose Support

Air brake cylinders and brake rigging mounted on the truck are used to apply retarding forces to the wheels to slow and stop the locomotive. A single shoe tread brake system, which utilizes one composition shoe at each wheel, is used with "cheek" type disc brakes. See Figure 18. Note that the disc brake assemblies provide 80% of pneumatic braking effort, with only the remaining 20% coming from the tread brake assemblies.

Figure 18 Tread Brake System

Brake cylinders are mounted to the face of the inside truck frame side beams and operate the brake system through a pneumatic cylinder expansion and linkage arrangement. Automatic slack adjusters are fitted to allow for periodic adjustment of brake cylinder travel and wear. Brake shoe and brake pad renewal is covered later in this M.I. An air released/spring activated parking brake, Figure 19, is fitted to the #1 truck for DE30AC locomotives; DM30AC locomotives utilize the same type of parking brake, however, the mechanisms are located on both the #1 and the #2 trucks, due to clearance issues.

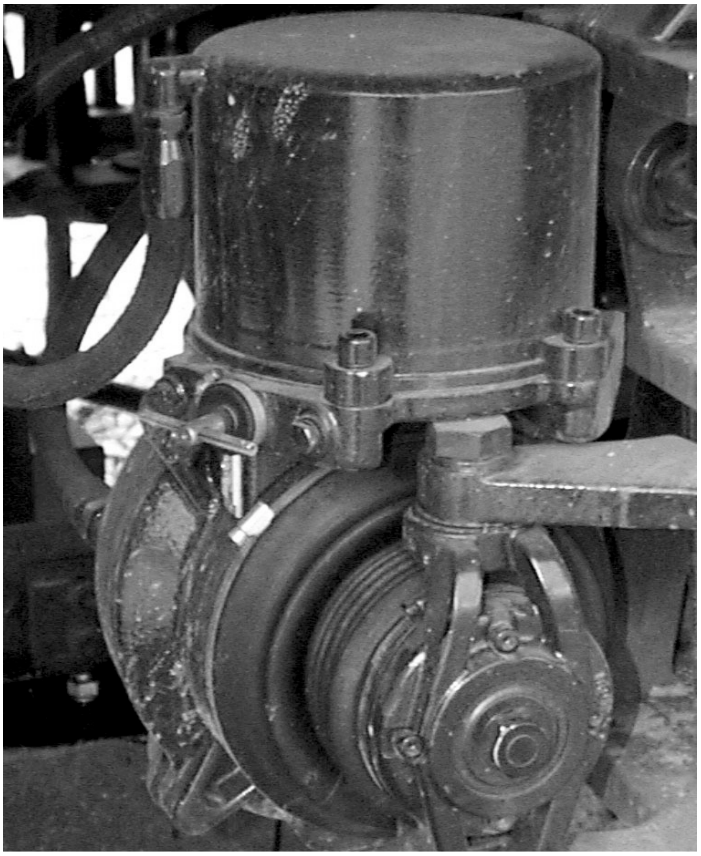


Figure 19 DE/DM30AC Disc And Parking Brake

Both the tread and disc brake (including parking brake) assemblies are covered in detail in M.I. 1578 & 1579. Please refer to this document for more information.

2.0 GENERAL MAINTENANCE

2.1 TRUCK CLEANING

2.1.1 UNDER LOCOMOTIVE

Truck(s) should be periodically cleaned while under the locomotive to eliminate any accumulation of oil and road dirt. An oily accumulation presents a fire hazard and tends to increase wear of moving parts on the truck, as well as detract from the general appearance of the equipment.

CAUTION!

When cleaning trucks under the locomotive, the engine should be kept running to supply air under pressure to the traction motors. Discharged air will help prevent over-spray from entering the motors. Care should be taken to direct spray away from any motor openings.

A wetting agent and an alkaline solution type cleaner can be used on the truck. Spray wetting agent over truck surfaces and let it remain for 10 to 15 minutes. Then using steam and an alkaline solution in a mixing gun, thoroughly spray entire truck assembly. Rinse assembly with hot water.

2.1.2 TANK CLEANING

When the truck assembly is removed from the locomotive, the traction motors, tie rod assemblies, wheels, axles, bearing adapters, rubber suspension components, dampers, and brake assemblies should be removed if the truck is to be immersed in a cleaning tank containing an alkaline solution. In addition, non-metallic wear components such as the carbody pivot transom buffer pads and the secondary suspension spring mounting pads should not be immersed. After a sufficient time to assure removal of all foreign material, remove the assemblies and rinse thoroughly with hot water remove all cleaning solution.

2.2 LUBRICATION

Periodic lubrication on the truck assembly is not required. However, depending on the type of traction motor gear and support bearing assemblies used, reference Table 1 lists the lubrication intervals required for their maintenance.

The carbody transom pivot pin assembly cylinder is lined with bearing grease. The pivot pin is to be coated with this grease (EMS 1032) at time of overhaul or re-trucking only. No additional oil or grease is needed during operational service.

The parking brake rigging will require lubrication on a semi-annual basis.

NOTE

Special care should be taken with all rubber components, the secondary suspension base plates on the truck frame, all dampers, all pads, and brake components in order to keep them free of oil or grease.

Table 1 Traction Motor Gear and Axle Lubrication

Roller support bearings (BTR), grease lubricated:	250,000 miles, or at wheel change (whichever comes first)
Oil lubricated gear case:	92 days or as required by locomotive service demands.

2.3 WHEEL AND AXLE INSPECTION

Wheels should be inspected for any visible defects before and/or after each trip or when required by the FRA. Wheels should be periodically checked for wear, sharp flanges, shelling, cracks, flat spots, and other injurious defects. Corrective action should be taken immediately, if unacceptable defects are found.

REFERENCE:

Wheel and axle defects, which typically require the removal of any particular wheelset are well defined and illustrated in the "Wheel and Axle Manual" published by the Association of American Railroads (AAR), 50 "F" Street, North West Washington, D.C. 20001.

Further wheel and axle component inspections and wear limit information is provided in M.I. 1518, entitled: "Wheels, Axles, Axle Gears and Pinions" and at the end of this publication in Service Data. Use the following guidelines in conjunction with M.I. 1518 when determining wheel and axle condition.

- Minimum wheel diameter after last truing operation.
- Maximum diameter mismatch of two wheels on a common axle.
- Maximum diameter mismatch between wheels on one axle compared to those of any other axle. These include wheels on the same truck.
- Minimum rim thickness.
- Axle longitudinal limits.
- Circumferential defects on or below the axle surface.
- Axle Run-out.

Note that DE/DM30AC locomotive wheels have discs or rotors bolted to them for the disc brake system. See Figure 20. These are an unsplit disc, which require the removal of the wheel from the axle to remove. See M.I. 1518 for wheel and axle removal, for wheel disc inspection and truing information and specifications.

Figure 20 Wheel With Disc

2.4 JOURNAL BEARINGS

Under normal operating conditions, running temperatures of approximately 133 degrees F (56 degrees C) above ambient temperatures may be expected. If the bearing appears noticeably warmer than other bearings on the locomotive, the bearing should be checked on the outside face of the adapter with a temperature-indicating crayon, 200 degrees F (93 degrees C), or with a direct pyrometer. If the bearing temperature is in excess of 200 degrees F (93 degrees C), the bearing should be removed from service for further examination.

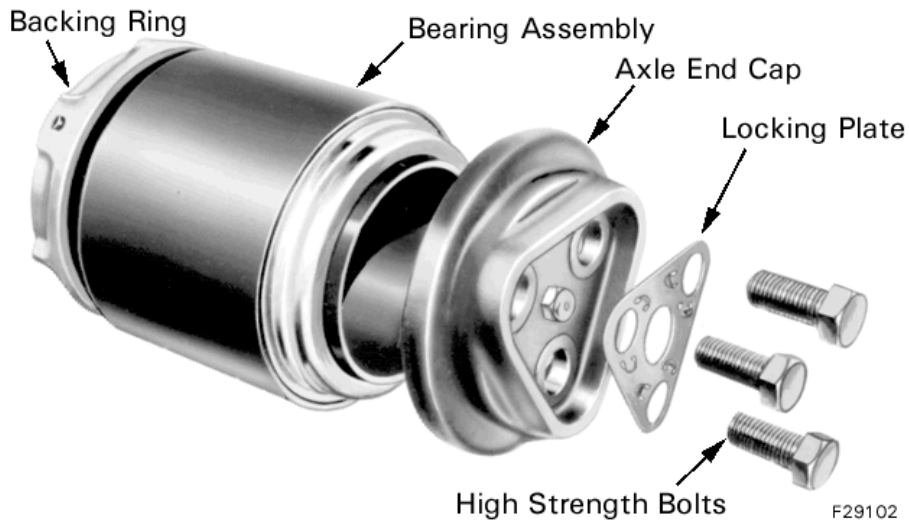


Figure 21 Roller Type Journal Bearing

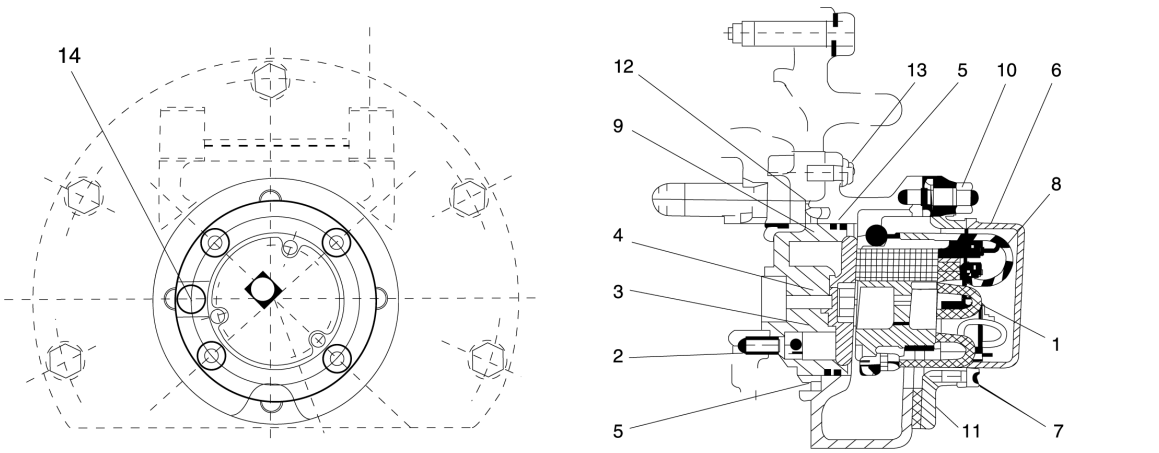
In the event that one or more axle end cap bolts are found to be loose or missing from the bearing - the wheel, gear, axle, and journal bearing assembly should be removed from the truck. The bearing should then be removed from the axle and a full inspection made to determine the cause and possible resultant damage.

A small amount of grease leakage around the seals may be expected during an initial run-in period. This leakage will eventually be reduced to normal "weepage." However, if a bearing appears to be leaking excessively, check for seal damage. Carefully wipe the area around the seal to allow inspection for a displaced or torn seal. Do not use solvents to clean the seal area or a probe to try to displace the seal. Both of these actions will damage the seal and may lead to premature bearing failure.

Distorted, cracked, or damaged axle end caps should be replaced, and the damaged caps should be scrapped.

When locomotives equipped with cartridge-type roller bearings are placed in storage, the parking brake should be set and the wheels chocked to prevent the equipment from moving. It is necessary to periodically move the locomotive to distribute lubricant over the bearing surfaces.

2.5 JOURNAL BEARING GROUNDING SYSTEM



1. Intermediate Flange
2. Special Washers
3. Slip Assembly
4. Special Washer
5. Multi-Piece Oil Rings
6. Outer Cover
7. M6-16 Cap Screws (Metric)
8. Coiled Tape Spring
9. Brushes
10. M10 Nuts (Metric)
11. M6-12 Screws (Metric)
12. O-ring
13. 3/8" - 16 bolts
14. M10-20 Grounding Cable Screw (Metric) & Spring Disc

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Figure 22 Journal Bearing Grounding Brush Assembly

DE/DM locomotives are equipped with a grounding brush system mounted in the journal bearing end cap. See Figure 22. This provides protection against electrical current flow on the DE locomotives and current return flow on the DM locomotives. The protection on the DE locomotives is required in case of contact with the third rail system, shunting fault current around the journal bearing path.

The brushes within the grounding brush assembly should be inspected for wear at regular intervals and changed accordingly. In addition, inspect the grounding straps for damage and proper application. It will be necessary to remove the step assemblies to gain access to the brush assemblies on number one (front) axles.

2.6 GROUNDING BRUSH INSTALLATION AND REMOVAL

Reference Figure 22 for the following procedures:

1. Mount the intermediate flange (#1) to the axle journal bearing end cap with three 3/8-16 HS cap screws (P/N 426370) and special washers (#2) supplied with the assembly (10632187).
2. Torque to 37 ft.lbs.
3. Apply slip assembly (#3) to the intermediate flange (#1) with one M10-30 screw (metric) and special supplied washer (#4).
4. Torque to 37 ft.lbs. Note that the bolt location is designed to be off center.
5. Ensure that the two multi-piece oil rings (#5) are in place in the intermediate flange (#1).
6. Partially disassemble the housing by removing the outer cover (#6) secured with three M6-16 (metric) cap screws (#7). Carefully pull back the bow attached to the coiled tape spring (#8) pressing down on the brushes (#9). Do not fully uncoil the tape spring (#8). The brushes (#9) should now be unloaded.
7. For the DE30AC only, disassemble the mounting flange secured with four M10 (metric) nuts (#10). Remove two of the three brushes. Note that the brush cable is secured with M6-12 (metric) screws (#11). Once these screws are removed, loosen the respective tape-spring assemblies, and in turn remove the brushes. On the DM30AC do not remove any brushes.
8. Reassemble the housing. Torque the M6 – 12 (metric) brush cable screws (#11) to 8 ft.lbs. and the M10 (metric) nuts (#10) to 22 ft.lbs.
9. Apply the supplied O-ring (#12).
10. Apply the housing, with the unloaded brushes, onto the intermediate flange (#1). Ensure that the oil rings are not damaged during application and that the housing is oriented to suit the application of the grounding cables.
11. Secure with four 3/8-16" bolts (#13), (P/N 454904) and washers (P/N 8373316) and torque to 55 ft.lbs.
12. Push the brushes into place (DE30AC only) and re-apply tape spring (#8).
13. Apply the cover and torque the three M6-16 (metric) screws (#7) to 8 ft.lbs.
14. Apply the grounding cable with the M10-20 (metric) screw and spring disc (#14). Torque to 22 ft.lbs.

WARNING!

Before lifting a locomotive, ensure that the grounding brushes are removed before lifting. Other wise there could be damage to the brush assemblies.

2.7 DAMPERS

There is rarely a partial failure of a damper. When it fails there is no resistance to movement in compression, in rebound or in both directions and a simple manual test can detect the failure.

NOTE

If a damper is new or has not been used for some time, it must be stroked to obtain consistent motion before being checked for control. Resistance developed during testing is proportional to velocity of the test stroke.

Dampers contain a reserve of hydraulic fluid, and allow seepage to lubricate the piston rod. A light film of oil / dust is normal and is not cause for rejection. A failed seal is recognizable by an excessive accumulation of fluid (wet) on the damper. However, it is not possible to ascertain the amount of reserve fluid in the damper and predict remaining life.

Periodic inspection or when loss of damping action is suspected:

1. Check for leaking fluid. Make certain that oil has not been deposited from some other source and check damper per Manual Qualification Procedures before condemning.

2. Perform manual qualification tests to detect gross loss of control.

3. Inspect bushing integrity. Bushings should not permit uncontrolled vertical or lateral movements of the damper.

    a) If a failed axle damper is detected, inspect journal springs, transom lateral thrust pads and wear at each journal bearing location as well.

    b) If a failed primary yaw damper is detected, check the items noted in the above step as well as all lemniscate linkage and tie rod bushings. Also, check condition of lateral snubbers and stops.

c) If a failed secondary yaw/lateral damper is detected, check the items noted in the above steps as well as the carbody pivot assembly, seals and bushings, and the four rubber secondary suspension spring pad assemblies.

4. Use the following steps to qualify vertical dampers.

a) Remove the damper from the journal bearing adapter and truck frame.

NOTE

Vertical dampers must be tested in the normal vertical position. Precautions must be taken to avoid damaging the damper bushings during the testing or wheel maintenance.

b) Manually stroke the damper while retaining the normal vertical position. Smooth, controlled movement should be felt through both extension and compression.

c) Renew damper if necessary. If damper tests good, reapply the damper and torque the fasteners.

KONI – 5/8-11 X 4" mounting bolts – 135 ft-lbs.

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Figure 23 Typical KONI Damper (note ID Tag)

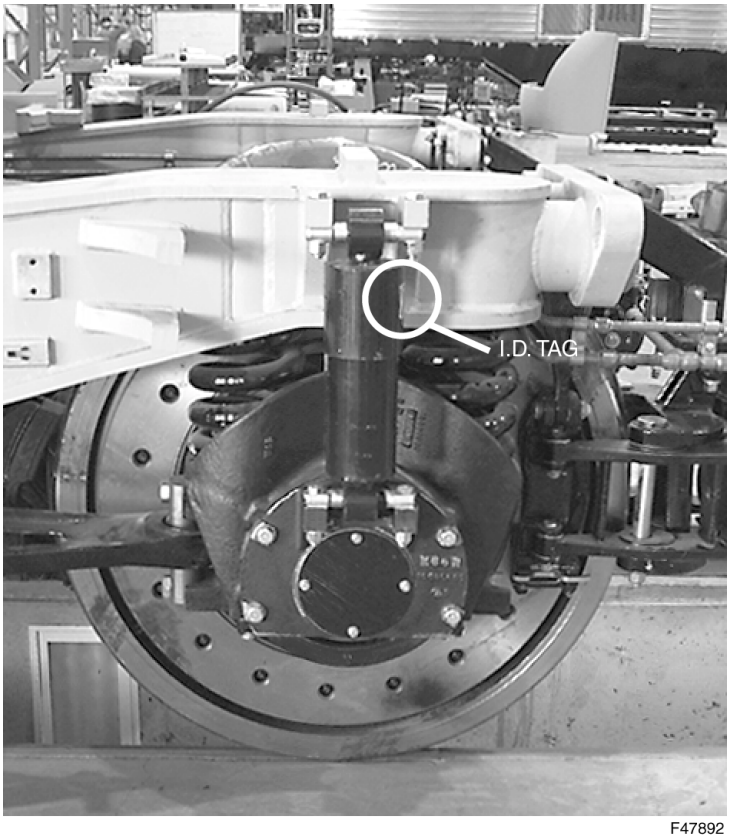

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Figure 24 Typical KONI Damper (note Identification Plate)

KONI dampers may be identified with the ID plate attached to the upper (outer) sleeve. Common markings on these types of dampers are:

- A – axle (primary vertical damper)
- H – horizontal (secondary lateral damper)
- R – rotational (primary and secondary yaw damper)
- V – vertical (secondary vertical damper)

It is essential that dampers be replaced with the correct type to ensure proper adhesion characteristics and ride quality.

NOTE

Whenever a damper is tested or replaced, the mounting lock nuts, which are removed in the process must be discarded and replaced with new lock nuts of the same type.

2.8 SECONDARY SPRING RUBBER MOUNTING PADS

Thoroughly inspect the spring mounting pads (Figure 25) for signs of degradation. Grease and dirt accumulations on the rubber portion, resulting from normal service, will not cause deterioration of the rubber material; however, continuous exposure to lubrication and fuel oils has a detrimental effect on the life of the rubber. Take care to keep such oil deposits off the rubber portions. In addition, cleaning the rubber spring mounting pads will facilitate visual inspection.

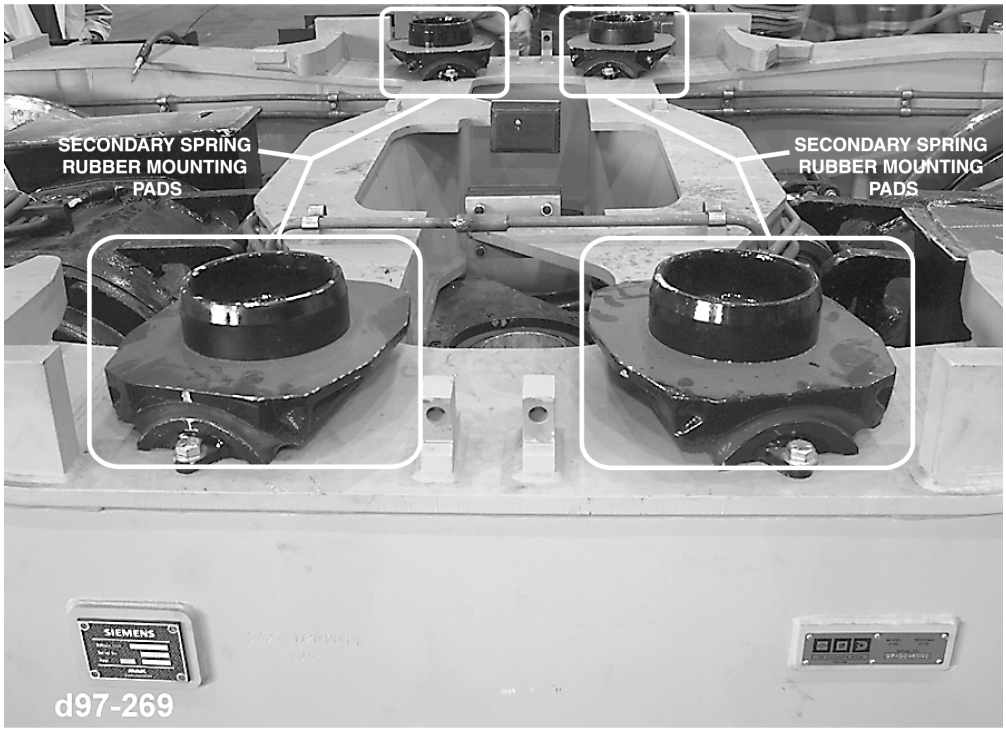

Figure 25 Secondary Spring Rubber Mounting Pads

To clean the rubber spring mounting pad, wipe excess grease, oil, and dirt from the pads with a clean cloth soaked in a mild alkali solution. Do not wash the pads in paraffin de-greasing agents (such as trichloro-ethylene), caustic soda, or diesel fuel oil.

Check the pads for degradation. A certain amount of superficial cracking (crazing) of the rubber surface is not unusual or detrimental to performance. Replace any pads if any layer has a tear or cut which exceeds 25% of the pads diameter in length and 2” in depth.

Lifting of rubber from bonded metal surface is limited to a total length of 50% on any one rubber/metal interface. If separation these specifications, the rubber spring should be replaced.

Metal plates adjacent and bonded to the rubber layers are sometimes covered with a thin layer of rubber on the exposed edges. This is to protect the metal from corrosion. Due to physical contact with foreign objects, in time, it is expected that some of the protective rubber covering at the edges and corners of the metal plates will become split, torn, and ripped away. This is not bonding separation. This condition will not affect the performance of the part, and is not cause for replacement.

Overhanging edges of metal parts are occasionally bent or burred through mishandling or excessive service conditions. This is of no consequence, as the rubber is not trapped and there is no sharp metal edge to come into contact with the free rubber surface. Any excessive burrs should be filed off without touching the rubber.

2.9 WHEEL SET TIE RODS

DE/DM30AC locomotives are equipped with wheel axle tie rods, two per axle. The purpose of these tie rods is to transfer longitudinal (traction and braking) and lateral loads between the wheel set and the truck frame, as well as help maintain lateral alignment.

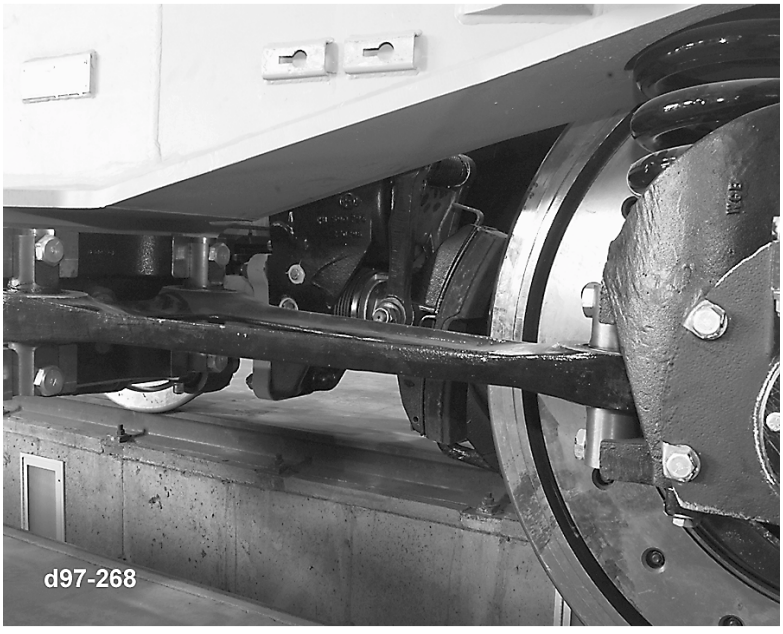

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Figure 26 Axle Tie Rod

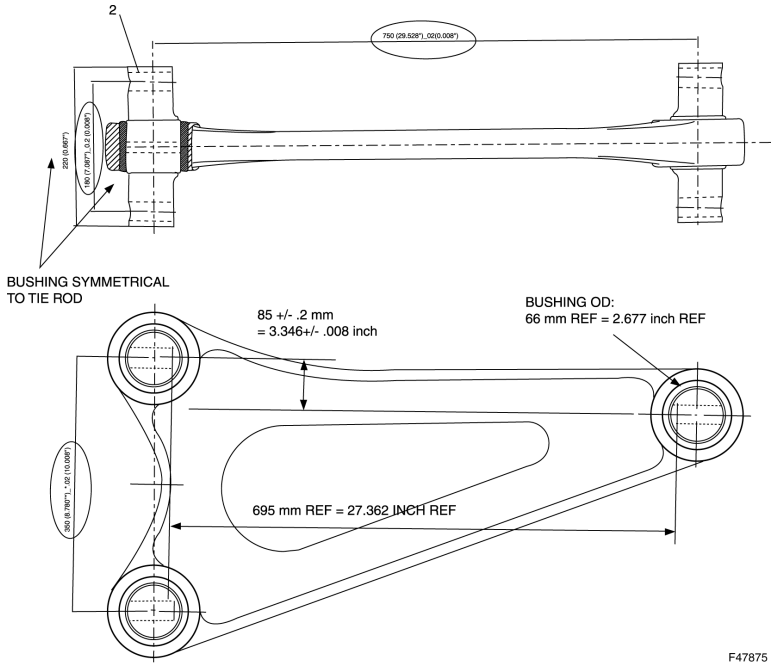


Figure 27 Axle Tie Rod

These tie rods are to be inspected for cracking, especially at the welds, and damage. Grind smooth any cracking at the welds smaller then .06" in depth. Any cracking larger than this on the welds, as well as any cracking of the casting will mandate replacement of the tie rod assembly. Bushings should also be inspected at this time, for cracking, rubber deterioration, twisting, or separation. Also see bushing maintenance and repair section in this M.I. The tie rod end bushings are mounted to the truck with a through bolt, see Figure 28. Note that the torque line between the bolt and the truck should be inspected for any movement and repaired or corrected, if any defect is found.

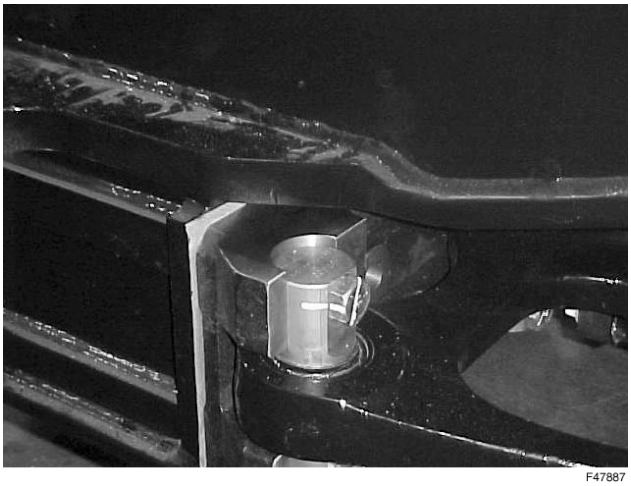


Figure 28 Tie Rod Bushing Mounting Bolt Showing Torque Line

2.10 REMOVAL OF WHEEL SET TIE RODS

2.10.1 TIE ROD REMOVAL

It is recommended that the removal of Wheel Set Tie Rods be performed on a drop table whenever possible. Whenever a wheel set tie rod assembly needs to be removed; the following basic procedures should be used:

1. While supporting the rear of the traction motor with a suitable lift device such as a hydraulic jack, disconnect the nose link (dog bone rod) assembly from the traction motor. If locking bolts were used in the assembly, they will have to be removed with a locking bolt collar splitter or cutting torch. For detailed description and procedures of lock bolt removal, see Special Procedures in this M.I.

2. Disconnect and remove the lower connections on the axle dampers on the wheel set being worked on.

CAUTION!

Use care when removing any locking bolts with a torch in order to avoid damage to the surrounding truck frame, linkages and bushings. Make sure that all bearing adapter interlock chains are in place, secure and not worn.

3. Remove the bearing adapter cap from the bottom of the journal bearing adapter, on the opposite side from the tie rod being changed.

4. Remove grounding brushes. See “Removing Grounding Brushes”, this M.I.

5. Remove bolts and cover plates from bearing adapter on the side of the truck that the tie rod is being removed from. Then remove carbody/truck interlock pin from truck. Use the tooling pictured in Figure 29 to remove the Tie Rod Bushing dowel pin.

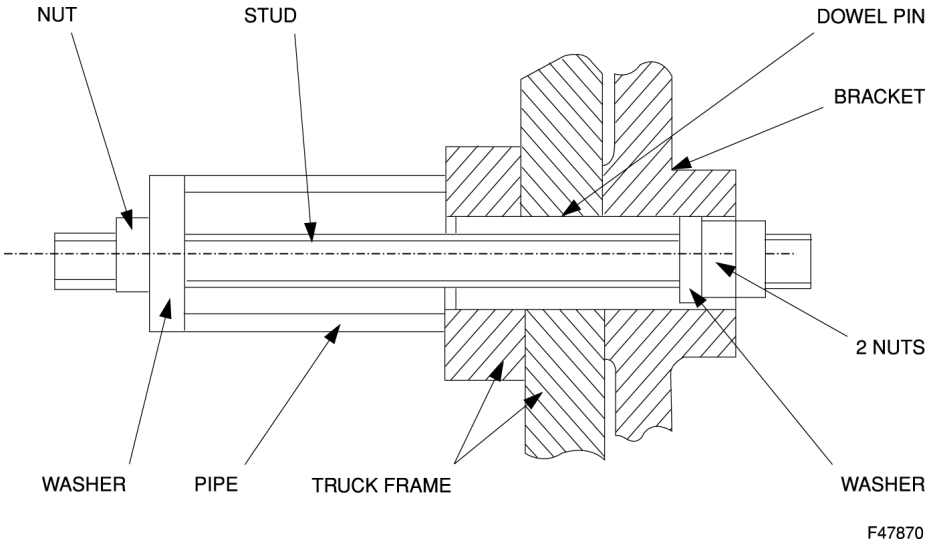


Figure 29 Tie Rod Dowel Pin Removal Tooling

6. Disconnect the traction motor leads and any other hardware attached to the motor / wheelset or truck frame that would interfere with the lowering of the motor/wheelset – including the sanding nozzles. On the front traction motor remove the lower step assembly.

7. Undo the brake slack adjusters and back the brake shoes and pads away from the wheels and discs. If necessary remove brake shoes and/or pads to achieve proper clearance. Secure all cables and hardware in a manner that places them safely out of the way during removal. Install wooden or steel blocks between truck and carbody to prevent excessive tilting of the truck.

8. Hold the nose link assembly away from the motor. Remove four bolts connecting tie rod to be removed from truck frame. Lift the locomotive or lower the drop table, tilting the traction motor in a manner that will disengage the motor from the truck frame interlock.

9. Lower the motor/wheelset approximately six to seven inches. Support the tie rod to be removed. Remove the two bolts connecting tie rod to be removed from journal bearing adapter. Remove tie rod from the truck.

2.10.2 TIE ROD INSTALLATION

10. Move the replacement tie rod bushing assembly beneath the truck and support it. Loosely attach tie rod to journal bearing adapter. Ensure tie rod/journal adapter assembly is level. Drive the dowel pin outboard approximately 1/8". Raise motor/wheel set slowly until bracket catches edge of dowel pin.

11. Re-assemble in the reverse order of disassembly and note that the journal bearings seat properly in the adapters before supporting the weight of the locomotive. See Figure 30. Adjust motor/wheel set angle with jack below traction motor.

Figure 30 Journal Bearing Entering Journal Adapter

12. Ensure proper seating of coil springs in spring pockets in truck frame spring pockets.

13. Connect tie rod bushings to truck frame with four bolts. Drive dowel pin outboard until flush with frame, and torque tie rod bushing mounting bolts. See torque specifications. Mark bolt heads with torque line for future inspection.

14. Using new hardware, apply the journal bearing adapter caps (binders) at all locations, and torque to 205 ft/lbs. Bend the tabs on the lock plate (if equipped) to fully engage one side of the bolt head.

15. Install grounding brushes.

16. Note that as the motor is placed in its final position, the traction motor / frame interlock (dogbone) is properly engaged. Install lock bolts. Reconnect all hardware and electrical connections. Re-adjust the brake slack adjusters.

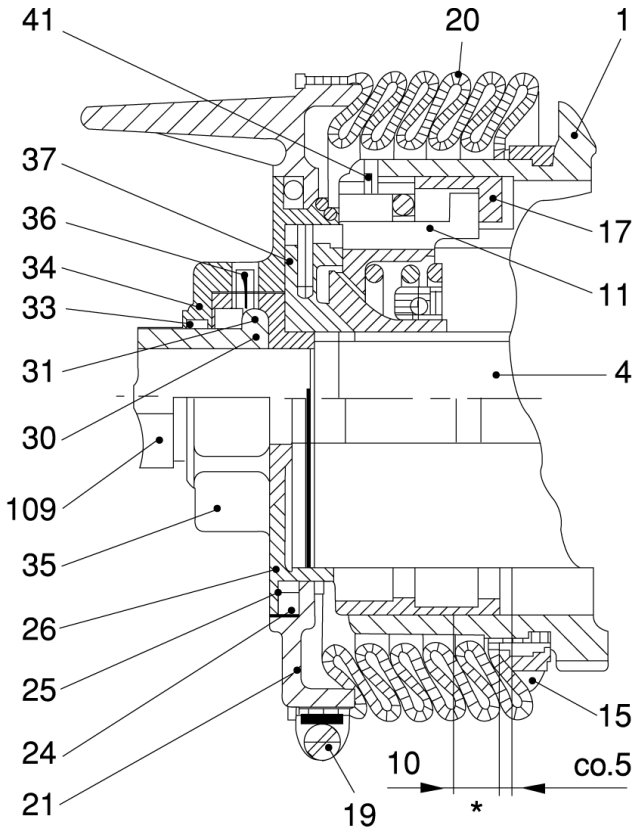
2.10.3 TIE ROD BUSHING REMOVAL AND INSTALLATION

Tie rod bushings are pressed out using special tooling. For detailed instructions see Special Procedures, Bushing Removal and Installation at the end of this M.I.

2.11 SLACK ADJUSTERS

2.11.1 GENERAL DESCRIPTION

The brake slack adjusters on the DE/DM30AC locomotive are an automatically adjusted assembly designed specifically for single tread shoe/cheek disc brake equipped locomotives. Currently there are two styles of adjusters used: the tread brake (or block brake) type (Figure 31) and the cheek or disc brake type (Figure 32). Overhaul procedures and dimensions for both types, as well as repair procedures are covered in M.I. 1578 & 1579.



1	HOUSING
4	SPINDLE
11	ADJUSTING SLEEVE (TURNED BY 90˚ IN THIS VIEW)
15	HOSE CLIP
17	STOP RING
19	HOSE CLIP
20	BELLOWS
21	PROTECTIVE RING
24	O-RING
25	WASHER
26	CIRCLIP
30	CIRCLIP
31	RING
33	O-RING
34	SPRING WASHER
35	ADJUSTING NUT
36	SET SCREW
37	STOP SCREW
41	RING
109	ROD HEAD

* THREADS OF ITEM 1 COATED WITH ADHESIVE

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Figure 31 Tread Brake Assembly Slack Adjuster

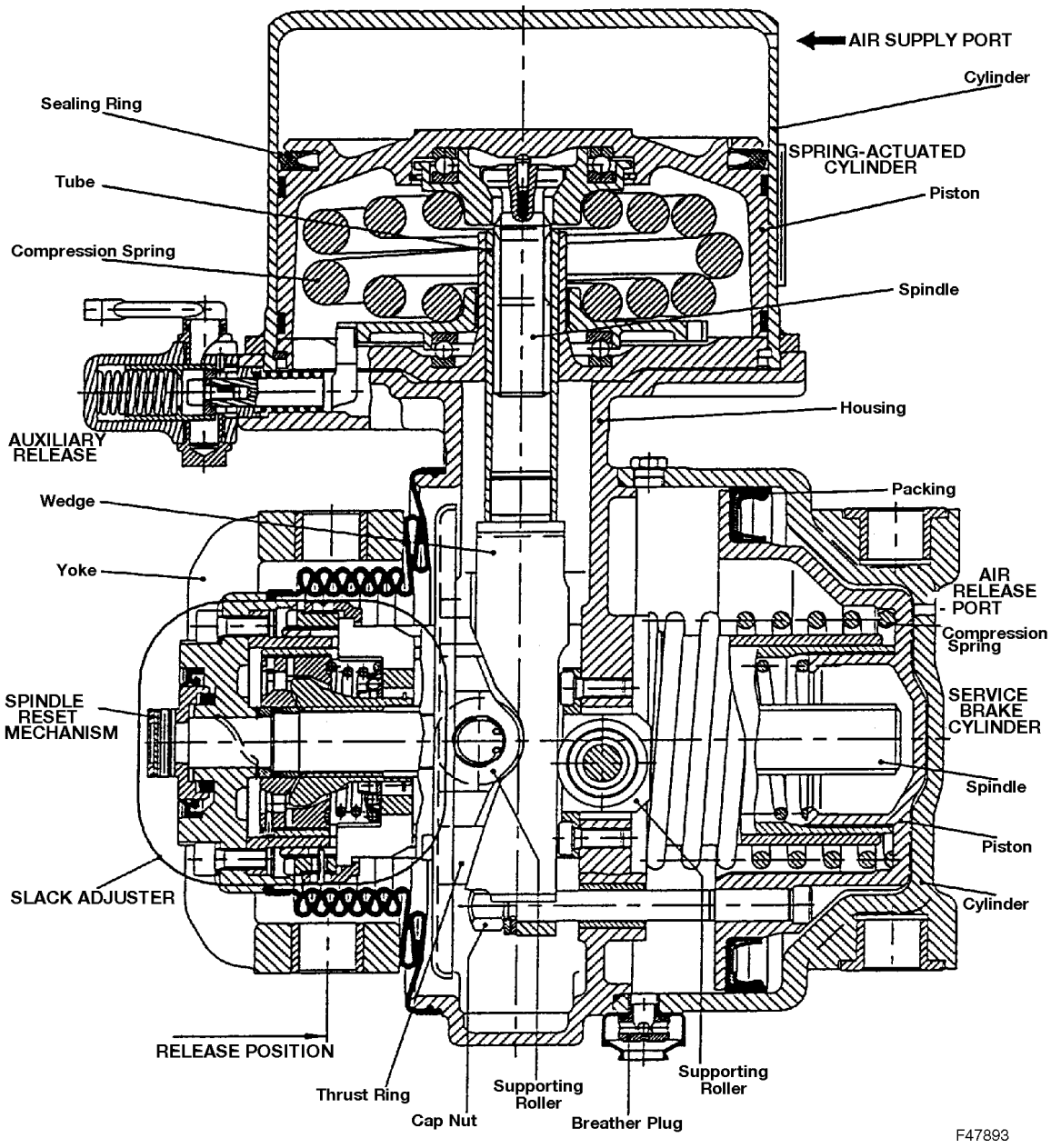

Figure 32 Cheek/Disc Brake Assembly (With Parking Brake)

2.11.2 ADJUSTMENT AND INSPECTION

Brake travel is self-adjusting with both tread and disc brake assemblies. Therefore, adjustment shouldn't be required in normal service. Tread brake inspection consists of checking the brake shoe itself for wear, as well as the bellows for any tears or soiling. The bellows should be kept as clean as possible to prevent unnecessary wear. As well, the filter on each brake assembly has to be changed once a year. This should be done before the onset of winter. The brake bellows should be inspected for proper travel. The procedure for tread brakes is as follows:

CAUTION!

This procedure must be conducted with the locomotive parked on tangent track, If conducted with the locomotive in a curve, error in measuring and setting the piston travel will result.

1. With the brakes applied, measure the piston travel. See Figure 33. (Per Federal Railroad Administration (FRA) rule 49CFR Part 229.55, piston travel must not exceed 1.50" (38 mm) less than the maximum piston travel of the brake cylinder. All DE and DM trucks use PC7T tread brake cylinders having a maximum piston travel of 3.75" (94 mm); thus the maximum FRA allowed piston travel is 2.25" (57 mm).

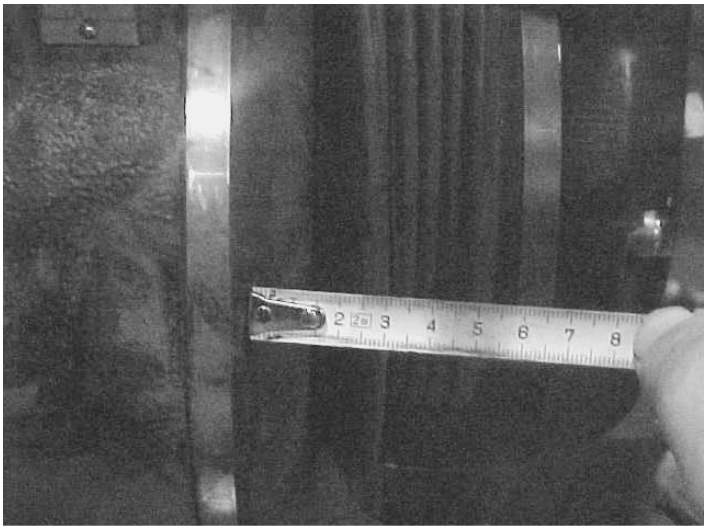

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Figure 33 Checking Brake Piston Travel

2. If the piston travel exceeds 2.25" (57 mm), the slack adjuster must be reset to reduce the piston travel. It is worth noting that if the piston travel is at this limit or has exceeded it, a new brake shoe (or block) should be applied at this time. It is prudent to limit the piston travel allowed to some lower value to allow continued brake shoe wear and resulting piston travel increase such that the piston travel will not exceed FRA limits prior to the next inspection and adjustment. The operating Railroad must determine these amounts based on their operation and experience.

WARNING!

To avoid potential injury, be certain the locomotive will not roll if the brakes are released before performing the next step. Take measures such as chocking the wheels if necessary. It is strongly recommended that this procedure only be conducted on level track.

3. Release the air brakes on the truck to be adjusted using the brake cylinder cutout cock on the underframe above the center of the truck. THIS WILL VENT ALL AIR FROM THIS TRUCK, ON BOTH SIDES, SO BE CERTAIN OTHER PERSONS IN THE IMMEDIATE AREA ARE AWARE THE BRAKE EQUIPMENT WILL MOVE. KEEP HANDS AND FEET AWAY FROM THE BRAKE EQUIPMENT!

4. Back off the slack adjuster nut set screw (Part 36 in Figure 31). Turn the 55mm. slack adjuster nut (Part 35 in Figure 31) clockwise or counterclockwise to decrease or increase piston travel. This procedure is the same as when changing the brake shoe itself.

5. Using a suitable wrench, turn the adjusting nut extend the slack adjuster toward the wheel. When it is judged that the shoe release is at least 5/8", reapply the set screw.

6. Turn the truck air cutout cock to apply the brakes. This will Apply air to all brake cylinders on this truck, on both sides, so be certain other persons in the immediate area are aware the brake levers will move. Keep hands and feet away from the brake equipment!

7. With the brakes applied, measure the piston travel at the tread brake bellows. It must be a minimum of 1.88" (48 mm) and a maximum of 2.25" (57 mm). It is desirable to set the piston travel as near to these values, without going less than them, to obtain the greatest interval of time before readjustment is necessary. Note that repeatedly cutting the brakes in and out on the truck you are working on will allow the automatic slack adjusters to properly set the slack.

2.11.3 DISC BRAKE SLACK ADJUSTMENT

CAUTION!

This procedure must be conducted with the locomotive parked on tangent track. If conducted with the locomotive in a curve, error in measuring and setting the piston travel will result.

8. With the brakes applied, measure the piston travel. See Figure 34 (Per Federal Railroad Administration (FRA) rule 49CFR Part 229.55, piston travel must not exceed 1.50" (38 mm) less than the maximum piston travel of the brake cylinder. All DE and DM trucks use PC7T tread brake cylinders having a maximum piston travel of 3.75" (94 mm); thus the maximum FRA allowed piston travel is 2.25" (57 mm).

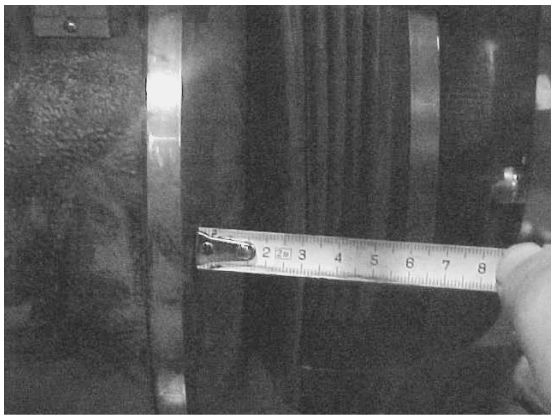

Figure 34 Checking Brake Piston Travel At Bellows

9. If the piston travel exceeds 6.50", the slack adjuster must be reset to reduce the piston travel. It is worth noting that if the piston travel is at this limit or has exceeded it, new brake pads should be applied at this time. It is prudent to limit the piston travel allowed to some lower value to allow continued brake pad wear and resulting piston travel increase such that the piston travel will not exceed FRA limits prior to the next inspection and adjustment. The operating Railroad must determine these amounts based on their operation and experience.

WARNING!

To avoid potential injury, be certain the locomotive will not roll if the brakes are released before performing the next step. Take measures such as chocking the wheels if necessary. It is strongly recommended that this procedure only be conducted on level track.

10. Release the air brakes on the truck to be adjusted using the brake cylinder cutout cock on the underframe above the center of the truck. THIS WILL VENT ALL AIR FROM THIS TRUCK, ON BOTH SIDES, SO BE CERTAIN OTHER PERSONS IN THE IMMEDIATE AREA ARE AWARE THE BRAKE EQUIPMENT WILL MOVE. KEEP HANDS AND FEET AWAY FROM THE BRAKE EQUIPMENT!

11. ENSURE THAT THE PARKING BRAKE MECHANISM (BOTH PNEUMATIC AND MECHANICAL) IS RELEASED.

12. Turn the 55mm. slack adjuster nut (shown in Figure 32) clockwise or counterclockwise to decrease or increase piston travel. This procedure will be the same for changing the pads.

13. Using a suitable wrench, turn the adjusting nut and extend the slack adjuster toward the wheel. When it is judged that the pad release is at least 5/8", stop turning the nut.

14. Turn the truck air cutout cock to apply the brakes. This will Apply air to all brake cylinders on this truck, on both sides, so be certain other persons in the immediate area are aware the brake levers will move. Keep hands and feet away from the brake equipment!

15. Ensure that the parking brake is reapplied. Check that the pneumatic and mechanical systems are both properly set at each wheel equipped.

16. With the brakes applied, measure the piston travel at the disc brake bellows. It must be a minimum of 1.88" (48 mm) and a maximum of 2.25" (57 mm). It is desirable to set the piston travel as near to these values, without going less than them, to obtain the greatest interval of time before readjustment is necessary. Note that by repeatedly cutting the brakes in and out, you will allow the automatic slack adjuster to properly set the slack.

2.11.4 GENERAL PHYSICAL INSPECTION

It is recommended that a periodic visual inspection should be performed to find out if there is any damage, e.g. loose or missing lock pins, torn bellows or a bent or damaged assembly. Replace or repair the adjuster as required.

2.12 PARKING BRAKE

2.12.1 DESCRIPTION OF OPERATION

The pneumatic released and spring applied parking brake (Figure 35) used on DE30AC and DM30AC locomotives was designed so that it is operated from inside the cab, eliminating the physical need to turn a wheel, ratchet a lever, or turn a crank. The parking brake is controlled by a lever, located in the locomotive cab on the lower right hand side of the Engineman's Control Panel, labeled as "PARKING BRAKE" (See Figure 35). A 90-degree clockwise turn is used to apply the parking brake, and a return to the original position is used to release the parking brake. This movement of the lever controls the movement of air into the parking brake mechanisms mounted on the disc brake rigging.

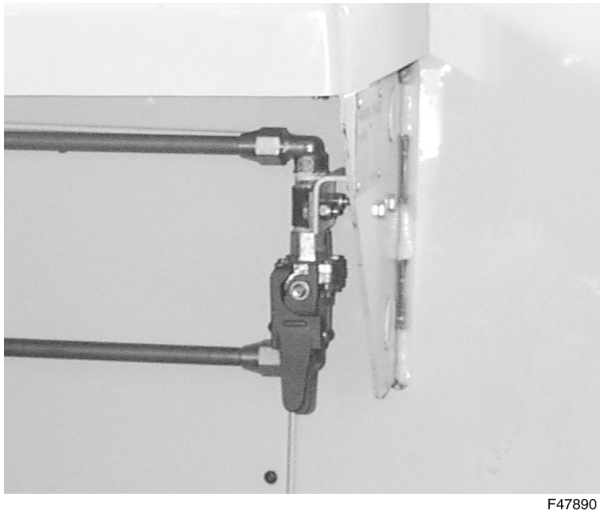

Figure 35 Pneumatic Parking Brake Control

The pneumatic parking brake system has a manual back-up system that can be utilized for release in the event of a lack of air supply. The components of this system are comprised of a brake rigging mounted spring housing, and linkages that act on the disc brake systems on the front truck of DE30AC locomotives, and on both trucks of DM30AC locomotives.

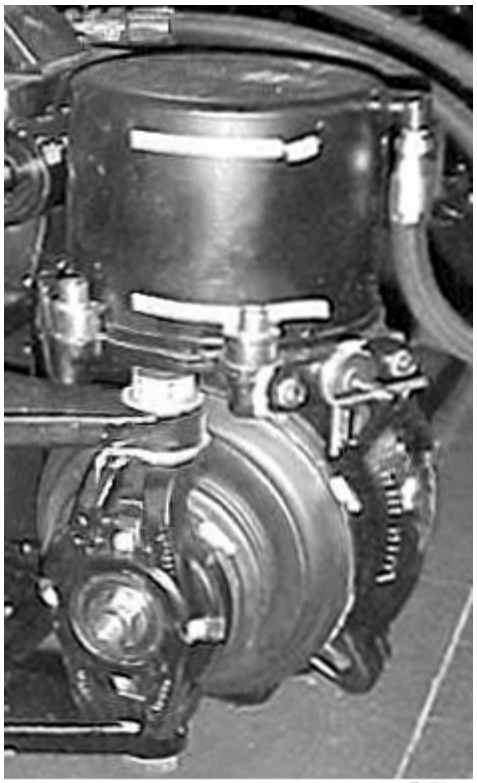

Figure 36 Pneumatic Parking Brake And Manual Release System

Air applied to the system releases the parking brake, air removed from the system allows spring pressure to apply the parking brake. In this way if there is a loss of brake air pressure, the system fails to the brake on position. The release of the air pressure from the system simply allows spring pressure to move the spindle, which, connected to the disc brake linkage applies the disc brake on the wheel affected.

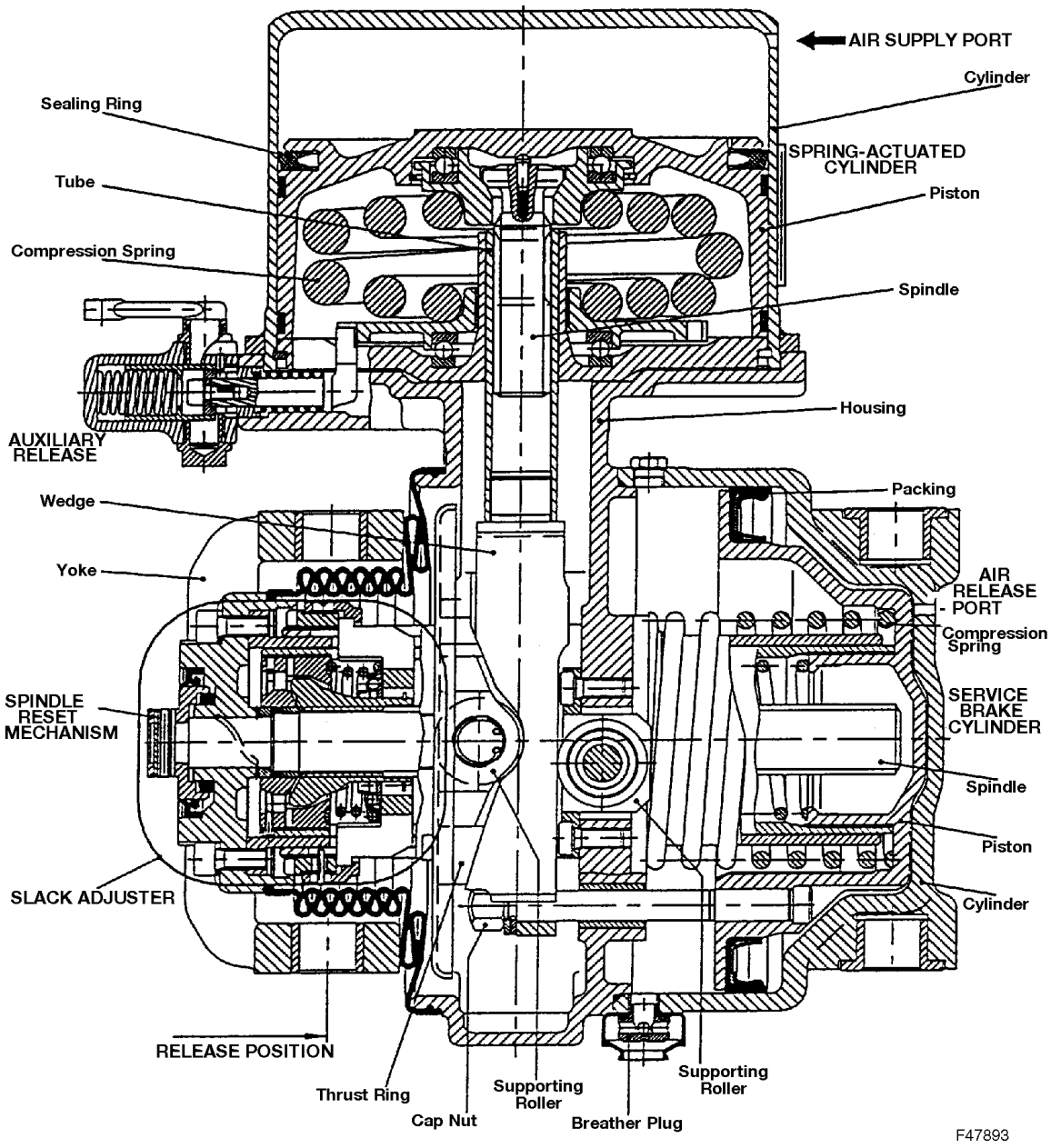

Figure 37 Parking Brake Mechanism

2.12.2 MANUAL RELEASE OF PARKING BRAKE

The parking brake may be released manually in the event of air pressure loss, or other emergencies. The "tee" handle assembly used for manual release of the parking brake is located on the brake pots mounted on the disc brake rigging, above the caliper assembly. Since the parking brake is spring applied and air pressure released, this method of release is a single use only. That is, an operator cannot release and re-apply the parking brakes using this method. The preferred method of parking brake control on a locomotive lacking air pressure, is to charge the main reservoir from another locomotive or an external (ie: shop air) source.

CAUTION!

Before attempting to operate the parking brake manually, make certain that air pressure is not supplied to the brake assembly. Severe injury can occur if pressure is applied to the brake assembly while operating the manual release.

The parking brake can be prevented from releasing pneumatically by:

- turning the cut-off valve below the car body floor (#1 truck) and within the compressor room (#2 truck).
- or removing and plugging the air supply line to the parking brake cylinder (pot).

2.12.3 ADJUSTMENTS & TROUBLESHOOTING

If the parking brake appears to need adjustment, check for wear in the linkage and rigging. Replace any items that have extensive wear (see Maintenance & Lubrication in this section). If the parking brake linkage isn't worn, check the service brakes for proper adjustment by referring to the Slack Adjuster Section of this MI before making any adjustments to the parking brake linkage. The parking brake linkage is adjusted by varying the adjustment nut on the brake caliper assembly. Once this dimension has been established, it should not have to be re-done.

Check the brake cylinder bellows travel with the parking brake applied. If the travel is greater than 2.25" (57 mm), readjust the slack adjuster until the desired travel of less than 2.25" (57 mm) is achieved.

2.12.4 MAINTENANCE & LUBRICATION

Quarterly

- Check that all fasteners (nuts & bolts), clamps, and brackets are secure.

- Check condition of external air lines, connectors, clamps and hoses for fraying, chafing, pinching, or other damage.

- Verify condition of linkage, air pots, and pins for wear and damage. Replace as required.

- Check that the dust boot (bellows) is in good condition and properly secured. Replace if required.

2.13 GEAR CASES (AC TRACTION LOCOMOTIVES)

2.13.1 GENERAL DESCRIPTION

The Gear Case, which is an integral part of the Traction Motor Assembly, is mounted on support arms at the traction motor. The gearcase for AC traction motors is covered in detail in M.I.'s 3908, 3909, and 3910.

As illustrated in Figure 38, the gear case is comprised of two close fitting halves to provide a complete oil-tight enclosure. The oil in the gear case is used to lubricate the pinion / bull gear mesh as well as the traction motor rotor support bearing at the pinion end of the motor.

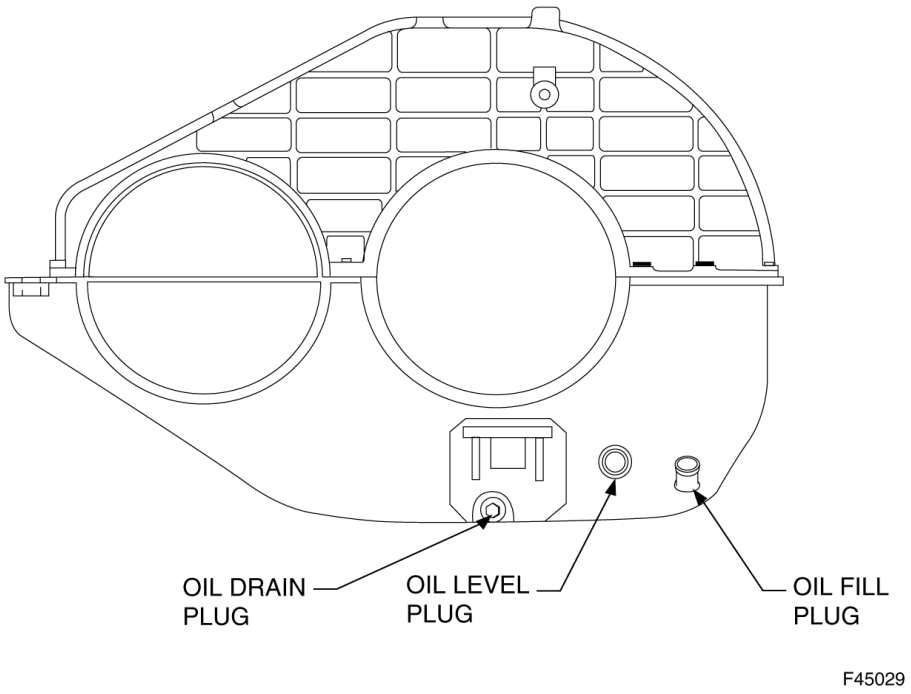

Figure 38 Typical AC Gear Case

Located on the inboard side of the gear case on older models are three hex head pipe plugs as shown in Figure 38. These plugs cap the openings used for oil fill, oil level, and oil drain as illustrated. When filling the gear case, both the oil fill and oil level plugs must be removed. Lubricant should be added until oil flows from the level plug. Do not use the oil fill hole as a reference for a full gear case.

Overcharging the gear case with lubricant will cause leakage through the seals into the traction motor and will also result in increased oil and bearing temperatures.

On newer models there is a fill cap located on the inboard face of the gear case. Proper oil level is maintained by adding lubricant until the level is even with the lip of the fill opening.

When a gear case is removed from the traction motor/wheel axle assembly, the case should be checked for possible damage such as cracks, perforations, or deformation. The case should be cleaned and the old seal assemblies must be discarded. Seal retainers and parting lines must be free of dirt, oil, gasket compound, or any other foreign material.

2.13.2 GEAR CASE APPLICATION

Reinstall the gear case using the detailed procedure found in Maintenance Instruction 3908, 3909, or 3910.

2.14 TRACTION MOTOR

2.14.1 TRACTION MOTOR REMOVAL

It is recommended that personnel involved with traction motor removal review the EMD videotape "HTCR and HTCR II Traction Motor Removal and Installation" if unfamiliar with the process. Although some of the material and procedures are not directly applicable to the DE/DM30AC locomotives, the general information contained in these videotapes should prove useful. Whenever a traction motor-wheelset assembly needs to be removed, the following basic procedures should be used:

1. While supporting the rear of the traction motor with a suitable lift device such as a hydraulic jack, disconnect the nose link (dog bone rod) assembly from the traction motor. If locking bolts were used in the assembly, they will have to be removed with a locking bolt collar splitter or cutting torch. For detailed description and procedures of lock bolt removal, see Special Procedures in this M.I.

CAUTION!

Use care when removing any locking bolts with a torch in order to avoid damage to the surrounding frame, linkages, and bushings. Make sure that all bearing adapter interlock chains are in place, secure and not worn.

2. Remove the bearing adapter cap from the bottom of the journal bearing adapter.

3. Remove bolts and cover plates from bearing adapters, then remove carbody/truck pins from truck (4 locations).

4. Remove grounding brushes. See "Removing grounding brushes", this M.I.

5. Disconnect the traction motor leads and any other hardware attached to the motor / wheelset or truck frame that would interfere with the removal – including the sanding nozzles. On the front traction motor remove the lower step assembly.

6. Undo the brake slack adjusters and back the brake shoes and pads away from the wheels. Secure all cables and hardware in a manner that places them safely out of the way during removal.

7. Hold the nose link assembly away from the motor. Lift the locomotive or lower the drop table, tilting the traction motor in a manner that will disengage the motor from the truck frame interlock. Remove the motor / wheelset from beneath the locomotive.

2.14.2 TRACTION MOTOR INSTALLATION

1. Move the replacement wheelset assembly beneath the locomotive. Re-assemble in the reverse order of disassembly and note that the journal bearings seat properly in the adapters before supporting the weight of the locomotive.

2. Using new hardware, apply the journal bearing adapter caps (binders) at all locations, and torque to 205 ft/lbs. Bend the tabs on the lock plate (if equipped) to fully engage one side of the bolt head.

3. Install grounding brushes.

4. Note that as the motor is placed in its final position, the traction motor / frame interlock is properly engaged. Install lock bolts. Reconnect all hardware. Re-adjust the brake slack adjusters.

2.15 TRUCK REMOVAL

2.15.1 INSPECTIONS BEFORE TRUCK REMOVAL

The following items should be inspected before the trucks are removed from the locomotive. In addition, these inspections should be part of a routine inspection schedule, to indicate worn parts before they fail.

The list is to be used as a guideline. Each item to be inspected has a reference to a section in this Maintenance Instruction where the inspections to be performed are detailed.

NOTE

Perform inspections with the locomotive on straight level track.

Item:

1. Vertical and Lateral Yaw Dampers – Reference this M.I., the section on yaw dampers.
2. Primary Suspension Springs - Reference this M.I., the section on primary suspension springs.
3. Secondary Suspension Springs – Reference this M.I., the section on secondary suspension springs.
4. Carbody transom pivot pin clearance – Reference this M.I., the section on carbody transom pivot pin.
5. Brake rigging – Reference this M.I., the section on brake rigging.
6. Wheel condition – Reference M.I. 1518, Wheels, Axles, Axle Gears and Pinions.

2.15.2 TRUCK ASSEMBLY REMOVAL

The truck(s) may be removed from the locomotive by using an overhead crane or jacks to raise the locomotive, or by use of a drop table of sufficient capacity to handle one entire truck assembly.

NOTE

If working on a locomotive equipped with AC traction equipment, it is required without exception that all appropriate discharge procedures be performed prior to commencing work on the trucks or related components.

1. Secure locomotive and follow discharge procedures before disconnecting any traction motor electrical cables.

2. Align jack stands or drop table as per local requirement, Figure 39.

CAUTION!

When jacks are used to raise the locomotive, ensure that all jacks are raised in equal amounts. Failure to keep the locomotive level may result in excessive stress on the underframe and carbody structure, or in failure of the jacks. After the lift is completed, the locomotive should be supported with safety blocking located under the center sills near the jacking pads.

Figure 39 Typical Jack Alignment

3. Disconnect brake piping; Figure 40, parking brake connections, and sanding equipment.

Figure 40 Typical Brake Cylinder Air Piping

4. On DE/DM units: Remove traction motor lead boots/heat shrink tubing and disconnect traction motor leads, ground cables, and unplug lead to junction box (if equipped), Figure 41.

NOTE

Secure cables, hoses, and all other hardware in a manner that places them safely out of the way during the truck removal.

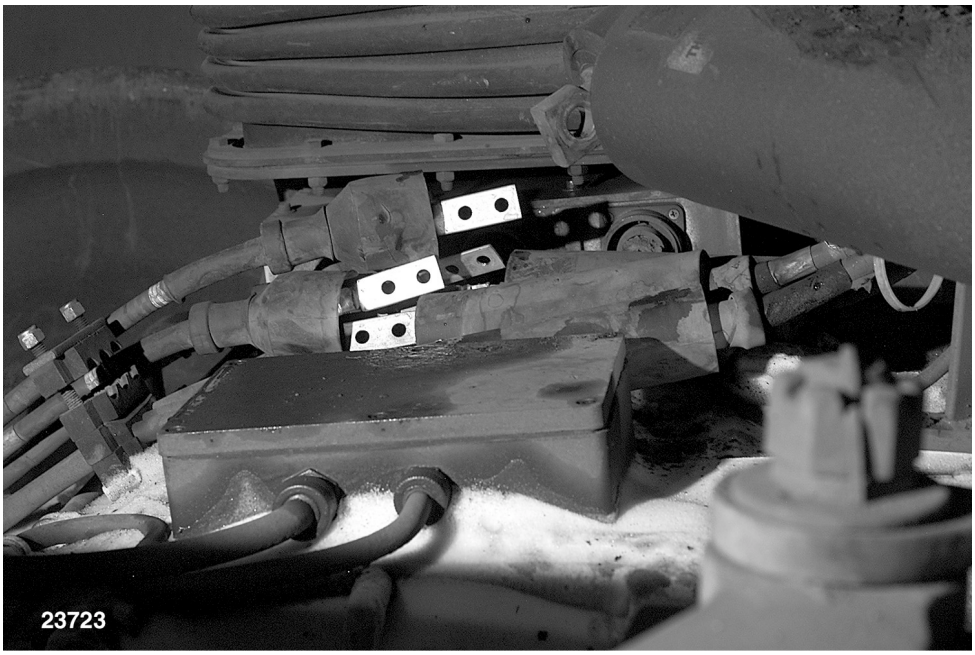

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Figure 41 Typical Traction Motor Connections (AC motor shown)

5. Remove bolts and dust cover plate from bottom of carbody pivot pin, and then remove cotter pin from hex nut, Figure 42.

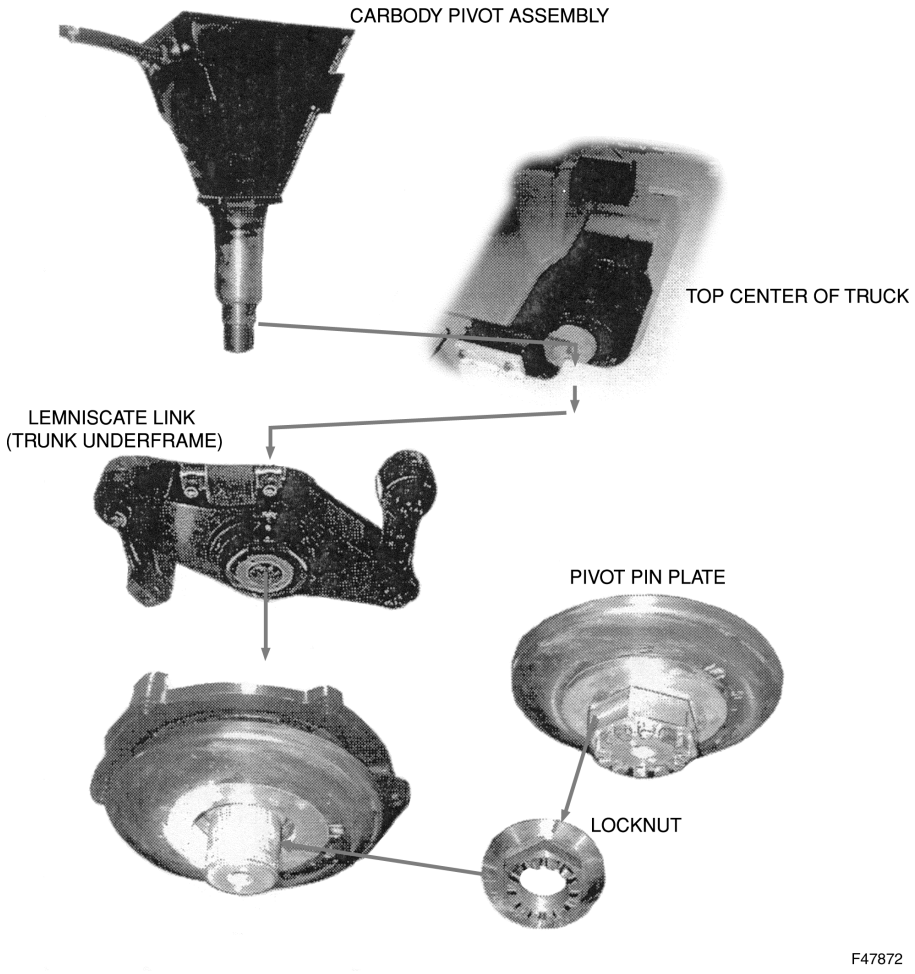

Figure 42 Carbody Pivot Pin Assembly

6. Remove pivot pin seal and pivot pin plate. A new seal should be fitted on reassembly. Remove the Pivot Pin lock screw.

7. Disconnect yaw dampers from carbody, Figure 43. Note any differences between carbody bolts and truck end bolts. Note also that the bolts are fitted with special washers. Retain all washers. Inspect hardware for damage, discard and replace all locknuts with new.

8. On front truck, detach lower portion of step assembly.

Figure 43 Removal of Typical Carbody Yaw Dampers

9. On DM units only, disconnect leads from third rail pick up junction box to carbody,

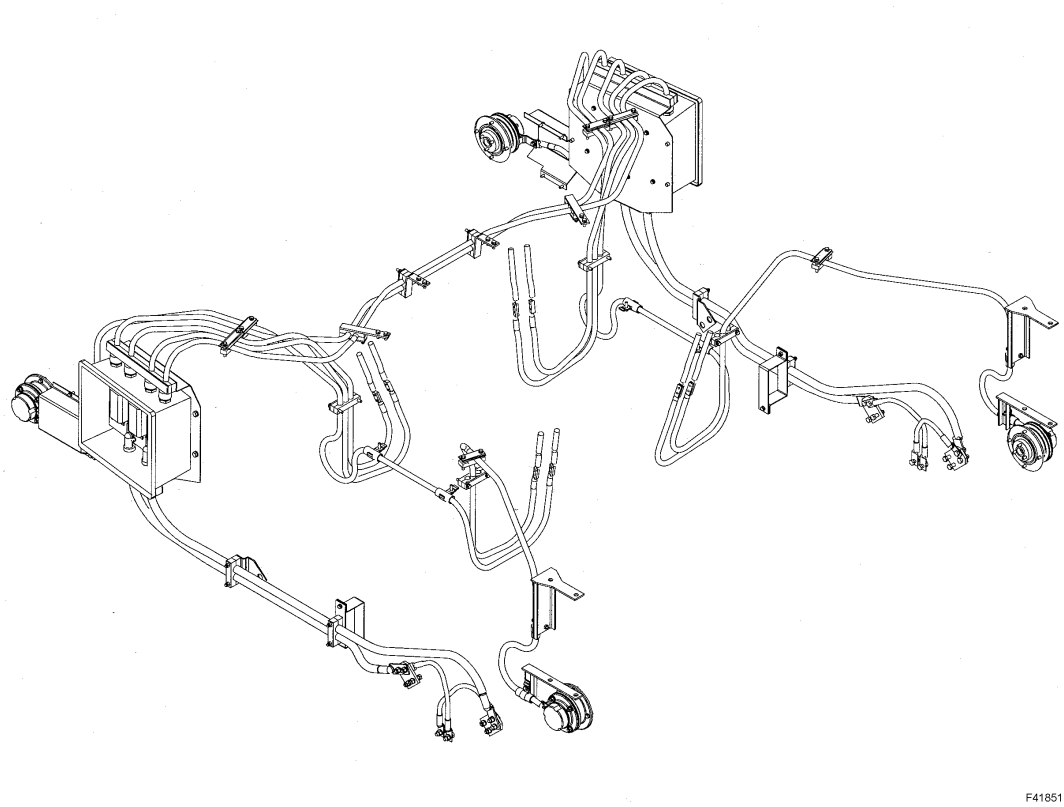

Figure 44 Third Rail Junction Box

10. Lift carbody or lower truck, ensuring separation of secondary springs from carbody.

11. Remove secondary springs from spring mounting pads. See Figure 45.

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Figure 45 Secondary Spring Mounting Pads

12. Remove truck from under locomotive and locate it right side up in the stripping area, Figure 46.

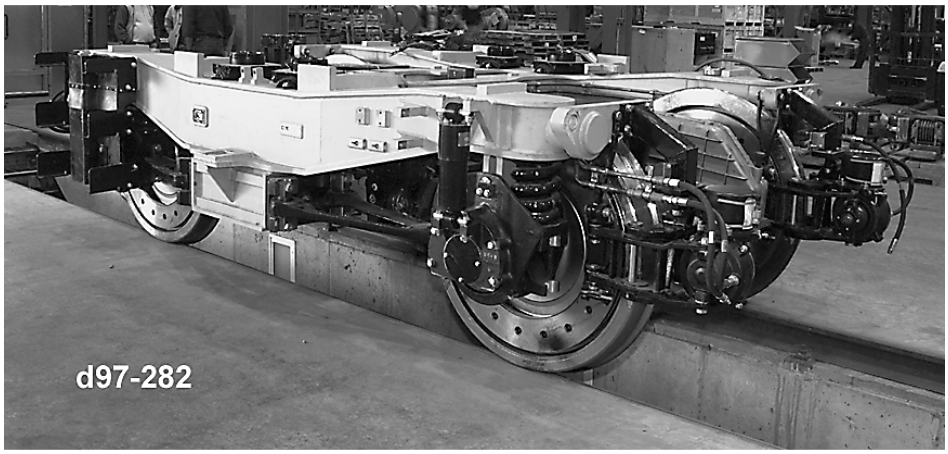

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Figure 46 Truck In Stripping Area

2.16 TRUCK APPLICATION

2.16.1 INITIAL INSTALLATION

The truck(s) may be applied to the locomotive by using an overhead crane or jacks to raise the locomotive, or by use of a drop table of sufficient capacity to handle one entire truck assembly.

CAUTION!

When jacks are used to raise the locomotive, ensure that all jacks are raised simultaneously in equal amounts. Failure to keep the locomotive level may result in excessive stress on the underframe and carbody structure, or in a failure of the jacks.

1. Install nylon suspension mounting pads on truck. Ensure carbody transom pivot has been cleaned of dirt and corrosion. Spray pivot pin with moly lube. Clean the pads on the underframe of any rust, grease and oil prior to trucking. Inspect lateral snubber pads and replace as required.

2. Roll truck assembly under raised locomotive, or if using drop table, install truck on table and raise under locomotive.

3. Verify alignment of the carbody transom pivot pin with the truck opening and lemniscate linkage. Install a new pivot pin upper O-ring and lubricate. Note that the feather key on the bottom of the pivot pin must be aligned properly, that is, in line with fore and aft locomotive travel.

4. Install the secondary springs on the nylon truck pads, aligned with the holes in the underframe. Orient the secondary springs as per the Special Procedures in this M.I. Slowly lower the locomotive until the carbody transom pin enters the opening in the lemniscate linkage (Figure 47).

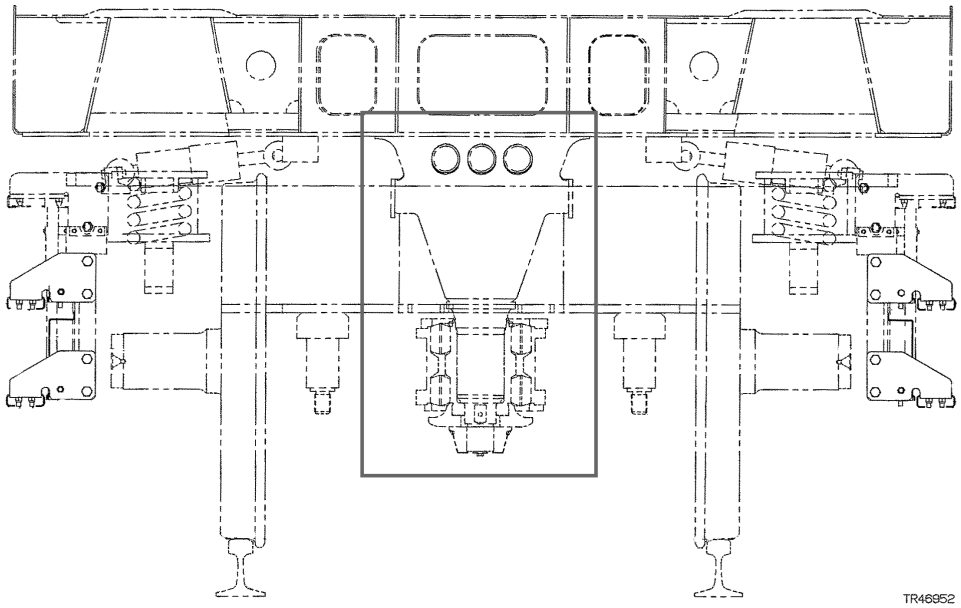

Figure 47 Alignment Of Carbody Transom Pivot Pin In Lemniscate Assembly

CAUTION!

Great care must be taken during this portion of the application process to prevent damage to the carbody transom pivot assembly; lemniscate linkage and secondary suspension springs. The carbody transom pivot pin and secondary springs should slide into place easily. If this is not the case, slight movement of the truck will be required to aid in assembly.

5. Note that the carbody transom pivot pin will begin to engage before the secondary springs. It is permissible to apply anti-seize lubricant to the springs and pin surface, but the flat surfaces of the springs must remain dry for friction purposes. As well, note that the upper opening of the pivot pin plate should be filled with lubricant (see Specifications data at end of M.I.) before final lowering of carbody.

6. Once the weight of the locomotive is resting on the trucks, the clearances between the bottom of the carbody and the top of the lemniscate linkage, as well as the clearance between the bottom of the lemniscate linkage and the pivot pin plate. Reference drawing 10632420, detail D. Discrepancies can be compensated for with shims installed above the pivot pin plate. Note that locomotive load (sand, fuel etc) will affect this dimension. Adjustments for this are given on the drawing.

2.16.2 VERTICAL STOP CLEARANCE

With the weight of the locomotive fully resting on the trucks, verify the vertical clearance at all four side locations, two per truck at both the stop plates and the vertical clearance pin assembly. The vertical stop surfaces on the side of the truck frame are designed to mate with similar vertical stops (shims) welded beneath the carbody underframe, as indicated in Figure 48.

Clearance is provided between the truck frame vertical stops and the carbody underframe vertical stops (shims) during normal operation. The vertical stops are designed to prevent excessive tilting or leaning of the locomotive, but are not designed to carry a continuous load.

The clearances are measured at the vertical stop/lateral stop lifting interlock, shown in Figure 48 and Figure 49.

Reference vertical stop clearance on a new assembly should be 1.48". +/-3.2 mm (0.62" +/- 0.12"). Reference lateral clearance should be 0.48" +/- 1.2 mm. All clearances and measurements for components are given at the end of this M.I., in Specifications.

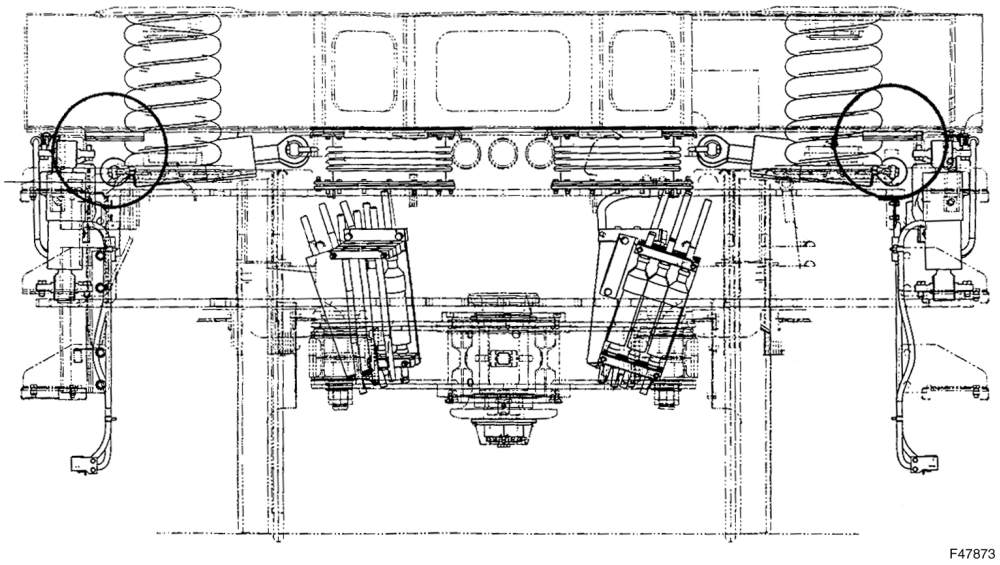

Figure 48 Vertical Stop Clearance

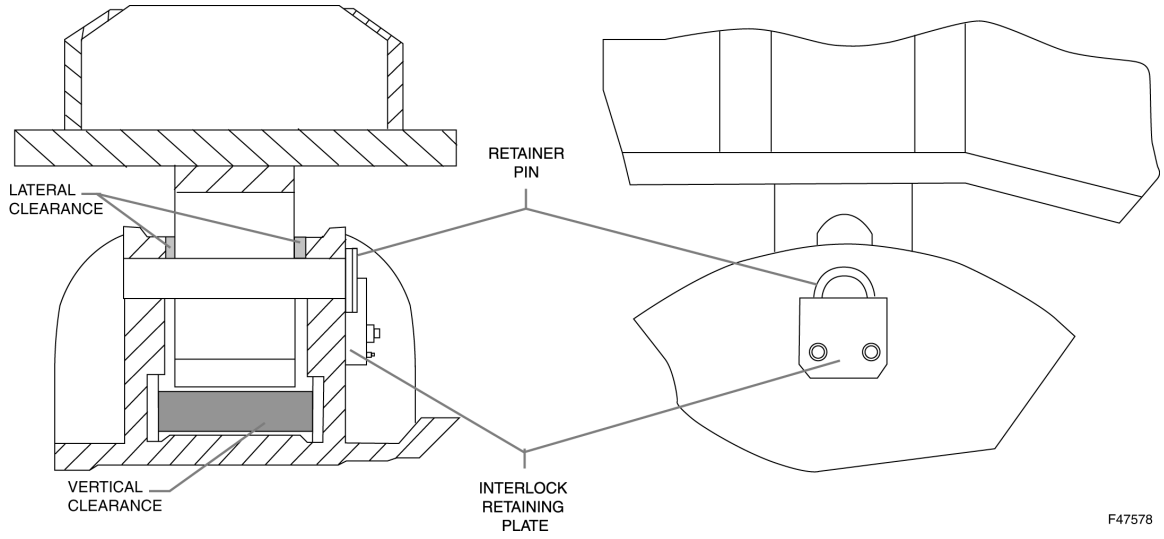

Figure 49 Vertical And Lateral Clearance On Lifting Interlock

2.16.3 FINAL INSTALLATION

Connect vertical carbody dampers at carbody bracket using 3/4-16" bolts. Note that the damper dust cover end must be attached to the carbody with the label facing up. The truck end must have the label facing down, and is attached with ¾-16" bolts and lock nuts. Torque to 154.8 ft/lbs.

Connect horizontal yaw dampers at carbody bracket using 3/4-16" bolts. Note that the damper dust cover end must be attached to the carbody with the label facing up. The truck end must have the label facing down with reservoir box upwards, and is attached with ¾-16" bolts and lock nuts. Torque to 272.7 ft/lbs.

Apply the pivot pin feather key locking screw, ½-13", the pivot pin plate, and dust cap seal. Use thread-locking compound on locking screw bolt threads and torque to 90 ft/lbs.

Install pivot pin hex nut, and torque to 369 ft/lbs. Then tighten hex nut to align with next key opening in pivot pin. Install 3/8 x 5" cotter pin and bend.

Install pivot pin dust cover, ensuring seal is properly placed, and install ½-13" dust cover bolts. See Figure 50. Use thread-locking compound on dust cover bolt threads and torque to 90 ft/lbs.

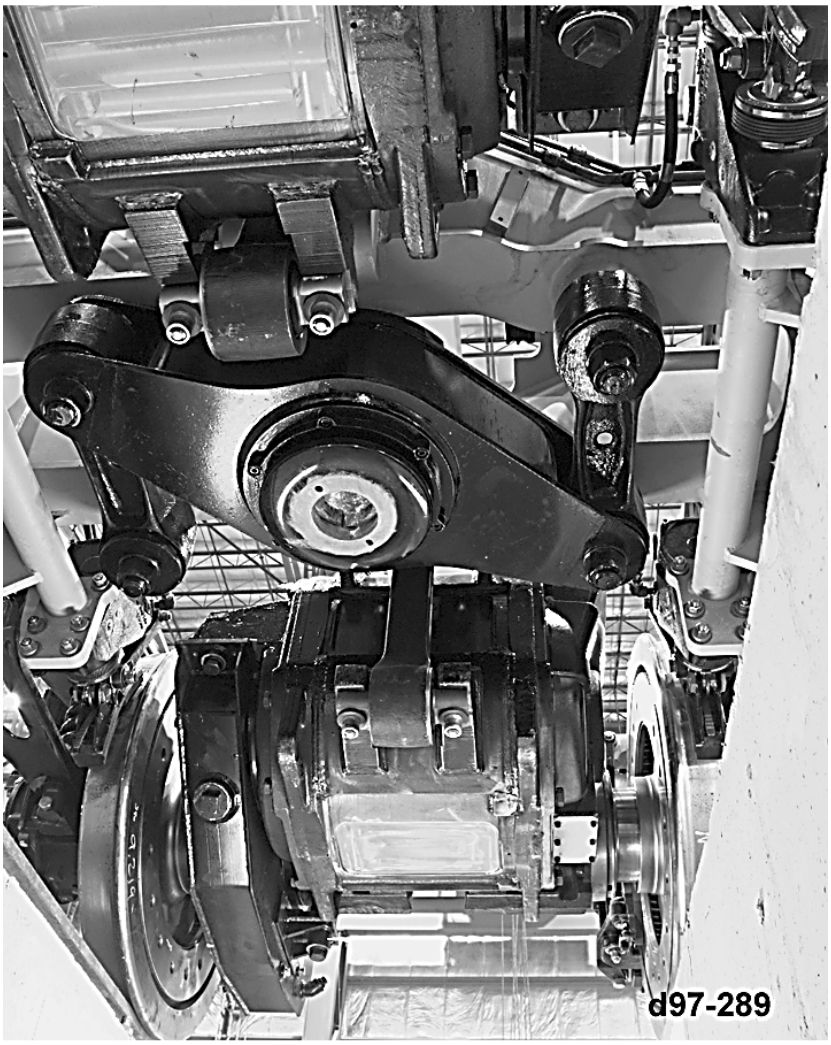

Figure 50 Lemniscate Plate And Pivot Pin Dust Cover

1. Connect traction motor leads and traction motor temperature / speed probes as required.

2. Attach carbody interlock pins and covers.

3. Connect carbody air piping to truck air piping.

4. Connect truck flange lube equipment if applied.

5. Connect parking brake piping.

6. Check and confirm that all truck and carbody interconnections have been completed.

2.17 REMOVAL AND INSTALLATION OF TRUCK MOUNTED STEP ASSEMBLIES

NOTE

Ensure the locomotive being worked on has been upgraded with the improved truck mounted steps. If the locomotive has not been updated, or if not sure, contact your EMD representative. Some locomotives will allow the step/bracket assembly to be removed as a single unit.

2.17.1 FRONT STEP REMOVAL

It is recommended that the removal of Front Step Assemblies be performed on a flat, stable surface whenever possible. Whenever a Front Step Assembly needs to be removed, the following procedures should be used:

1. Remove the ground cable and bus bar attached to the grounding brush for the step position being removed, if required. See Figure 51.

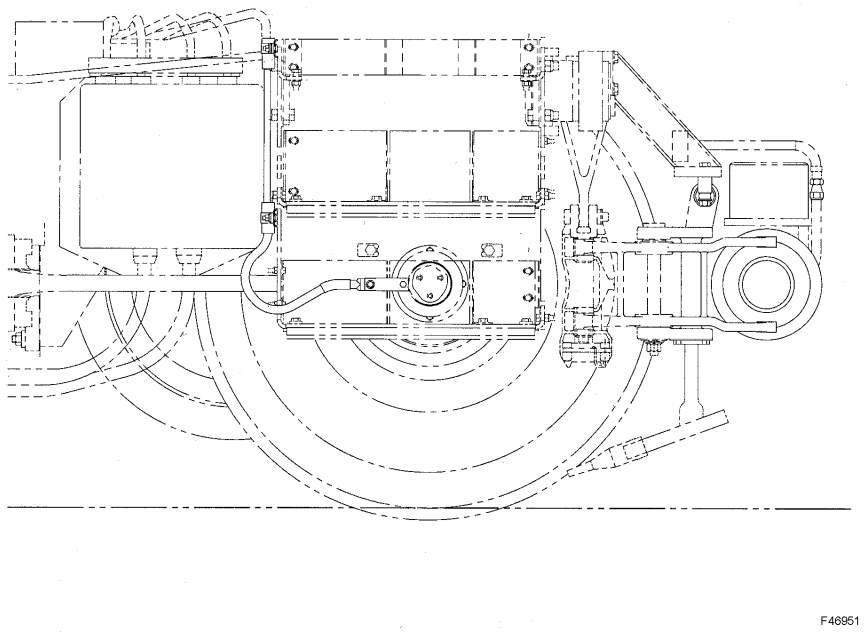

Figure 51 Grounding Brush Ground Cable And Bus Bar

2. Remove all step treads.

CAUTION!

Use care when removing the step treads and brackets, due to weight issues.

3. Remove the step supporting brackets.

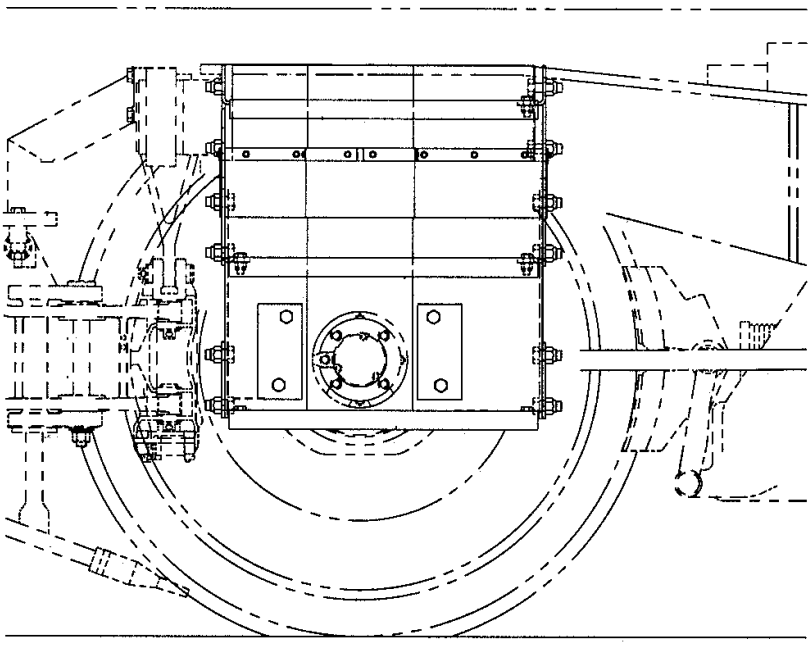

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Figure 52 Truck Mounted Step Assembly

2.17.2 TRUCK MOUNTED STEP ASSEMBLY INSTALLATION

4. Install step support brackets, using new locking hardware. Do not torque at this time.

5. Install step treads using new locking hardware. Do not torque at this time.

6. Check clearance between the back of the step assembly and the grounding brush components. Ensure there is at least ½" clearance. Adjust as required.

7. Check vertical clearance between top step and vertical damper. If clearance is less than ¼", the step assembly may be shimmed for clearance.

8. Torque all 3/8”-16 fasteners to 24 ft.lbs.

9. Torque all ½”-13 fasteners to 58 ft.lbs.

10. Torque step bracket mounting bolts (¾”-10) to 205 ft/lbs.

11. Secure grounding cable and bus to step as required. Torque as above.

2.18 REMOVAL, ASSEMBLY, INSTALLATION, AND ADJUSTMENT OF THIRD RAIL COMPONENTS

CAUTION!

When working on any third rail components ensure that all power is shut down on locomotive. All capacitors should be discharged and all appropriate safety steps should be taken. Read the safety chapter in the Locomotive Service Manual before attempting any repairs, adjustments, or modifications.

2.18.1 THIRD RAIL COMPONENT REMOVAL

1. Disconnect cables from third rail pick up assembly to third rail fuse box at pick up end. Remove cable restraining clamps.

2. Remove safety hanger mounting bolts at truck and journal bearing adapter ends.

3. Ensure that assembly is properly supported before lowering it to the ground.

2.18.2 THIRD RAIL COMPONENT ASSEMBLY & INSTALLATION

This assembly instruction is for the Third Rail Shoe beam components. Note that there are both right and left hand assemblies, with dedicated parts. Reference is made to EMD drawings 40077425, 40078814, 40078815, and 40085128.

NOTE

For proper installation of the following components and instructions the reference drawings must be used. Failure to install and these components properly could result in serious damage.

2.18.2.1 ASSEMBLY OF BEAM AND PLATE BRACKETS

This step involves subassembly of the wooden shoe beam to 4 plate brackets bolting to the beam ends, along with a spacer that is used at 1 beam end, adjacent to 1 plate bracket. The beam, spacer, and plate brackets are bolted together using 7/8-9 bolts, nuts, and flat washers. Although not mandatory at this stage, it is also recommended that a bracket assembly used during the cabling application also be applied at this time.

- Orient the beam 40075794 (item # 3 on parts list) with the two pick up shoe holes toward the top, biased on the right side of the beam, as shown in view A-A.

- Insert four bolts 9429919 (item # 26) into plate 40078506 (item #19) and spacer 40082525, and then insert into the four bolt holes on the right side of the beam (item # 3), with the bolt heads against plate (item # 19), as in section D-D. Note that to maximize the gap distance to the third rail, the heads of the bolts used on the shoe beam brackets are all outboard. Make sure plate (item # 19) is configured with the 1 1/4" hole toward the bottom of the beam (item # 3), as in view A-A

- As shown in section D-D, apply spacer 40081219 (item # 16), plate assembly 40081216 (item # 15), four flat washers 131018 (item # 37), and locknuts 9416543 (item # 31), to the inboard side of the beam. Tighten and torque the bolts (item # 26) and nuts (item # 31) in opposing sequence (i.e., 12 o'clock, 6 o'clock, 9 o'clock, 3 o'clock); first to 200 ft-lbs (dry), then to 310 ft-lbs.(dry).

- Going to the opposite end of the beam (item # 3), insert four bolts (item # 26) into plate assembly 40080390 (item # 21) and spacer 40082525, and then insert into the four boltholes on the left. (An optional step at this point would be to install bracket assembly 40081700 (item # 35 of 40078514) to two of the bolts, as shown in 40078514). Note that the 1 1/4" hole at the end of plate assembly (item # 21) should be oriented downward.

- Apply plate assembly 40081211 (item # 18), four flat washers 131018 (item # 37), and locknuts 9416543 (item # 31), to the inboard side of the beam, as shown in the lower isometric view. Tighten and torque the bolts (item # 26) and nuts (item # 31) in opposing sequence (i.e., 12 o'clock, 6 o'clock, 9 o'clock, 3 o'clock); first to 200 ft-lbs (dry), then to 310 ft-lbs.(dry). Note that item # 18 has a bushing pressed into it, and the bushing should be oriented with the longer protrusion towards item # 21, as shown in section C-C.

- In the case of the opposite side shoe beam, the assembly is very similar. Refer to isometric views of drawing 40077425. At the beam end that will be mounted to the axle (end nearest to the third rail pick up shoe), all of the parts are identical to the other beam assembly. Remember to configure the assembly with spacer 40081219 (item # 16) on the inboard (truck frame) side of the beam, and tighten and torque the bolts in the manner prescribed previously. On the other end of the beam assembly, note that plate assembly 40081215 (item # 14) is used in place of plate assembly 40081211 (item # 18), and plate assembly 40081210 (item # 17) is used in place of plate assembly 40080390 (item # 21). The optional installation of bracket 40081702 (item # 36 of 40078514) can be performed at this end of the beam as well). Again note that all headed ends of the bolts should be on the third rail side of the beam. Again note that the 1 1/4" diameter holes in the plate bracket should be oriented towards the bottom of the beam.

At this stage, the beam sub-assembly is complete.

2.18.2.2 ASSEMBLY OF PICK UP SHOE AND HANGAR

This subassembly is identical for both shoe beams on a truck.

- With bracket 40076118 (item # 2) clamped in a vise, put 2 shoe pins 40075796 (item # 5) into the bushings of bracket (item # 2), with the pin tips extended inward approximately 2".

- Refer to view A-A. Pass spring 40075798 (item # 7) over the shoe pin on the side of bracket (item # 2) as shown in view A-A. Note that one end of the spring bears against bracket 40076118 (item # 2), and the other against the third rail shoe 40076117 (item # 1) after the spring is compressed. Do not attempt to compress the spring at this point. Next, pass spring 40075799 (item # 8) on the other pin, per view A-A. Note that the springs (items # 7 and # 8) are wound in opposite directions, must be installed in the positions shown in view A-A, and cannot be interchanged.

- Using third rail shoe 40075798 (item # 1) and a screwdriver as a lever, compress spring 40075799 (item # 8) until you can fully insert the pin (item # 5) from the bushing of bracket 40076118 (item # 2) into third rail shoe 40076117 (item # 1). Repeat the above process with spring 40075798 (item # 8). When both springs are compressed and pinned, drive out one of the pins using the other pin as a dowel. Insert cotter pin 119199 (item # 22) to the end of shoe pin 40075796 (item # 5).

- At this stage, the pick up shoe and hangar subassembly is complete.

2.18.2.3 APPLICATION OF AXLE END BRACKETS TO TRUCK ASSEMBLY

Axle end brackets 40077408 (item # 10) and 40077409 (item # 11) are left and right hand assemblies having the same design. These two assemblies mount to the bearing adapter caps and covers in an identical manner. Note that these brackets are mounted at the axle locations nearest to the yaw damper brackets on the DM truck frames. Also note that the 1 1/4" pin center for these brackets is always mounted slightly inboard (longitudinally) of the axle centerline.

- Using 5/8" bolts 271727 & 271731 (items # 24 & # 25), flat washers 131016 (item # 38) and lock caps 10631905 (item # 23), install bracket assemblies 40077408 & 40077409, as shown in view A-A and in the isometric views. Tighten and torque all bolts to 150 ft. lbs. (dry).

2.18.2.4 APPLICATION OF LINK END BRACKETS AND LINK TO TRUCK ASSEMBLY

Link end brackets 40081217 (item # 12) and 40081218 (item # 13) are left and right hand assemblies having the same basic design. These two assemblies mount to the bottom surface of the truck frame traction box, using 5/8" -11 bolts, and also to two of the axle traction rod mountings, using 1" -12 bolts. Also note that these brackets are installed on the side of the traction box opposite the side where the axle end brackets (items # 10 & # 11) are installed. The link end brackets can be applied when the wheelsets are installed onto the truck assembly, if desired.

- Position link end bracket assembly 40081217 (item # 12) against the traction box, as shown in the isometric views and view A-A.

- Apply the bracket to the traction box using 1" bolts 40081267 (item # 27), 5/8" bolts 271727 (item # 24), flat washers 131016 (item # 38), and lock caps. At this stage, make sure all the bolts are snug but not tightened.

- After confirming that bracket 40081217 (item # 12) is in contact with all four bolting surfaces, tighten the 5/8" bolts 271727 (item # 24) to 150 ft-lbs (dry).

- After tightening both 5/8" bolts 271727 (item # 24) to 150 ft-lbs., tighten the 1" traction rod bolts 40081267 (item # 27) to 544 ft lbs, lubricated in the same manner as for all other traction rod bolts.

- Install link assembly 40077422 (item # 20) to the link assembly bracket, using hardened washers 40081208 (item # 39), a 1 1/4" bolt 9429818 (item # 28), and a locknut 9421269 (item # 33). Apply a light lubricant to the 1 1/4" bolt threads prior to installing the locknut (motor oil, threadtex, or similar lubricant). Do not tighten any hardware at this stage - only apply the nut, bolt and washers loosely at this time. Note that the hardened washers 40081208 (item # 39) are applied only at 2 locations per bolt on this application, as shown in section C-C.

Note that at the bolted connection of the link to the link end bracket there will be a gap between assembly parts. There is a steel bushing pressed into the link end bracket, which will move when the 1 1/4" bolt is tightened to close this gap. A similar assembly gap will exist during the initial assembly at all of the 1 1/4" diameter bolted connections. This gap will be taken up when the 1 1/4" bolts are tightened. The 1 1/4" bolt should not be tightened at this point.

2.18.2.5 INSTALLATION OF BEAM SUBASSEMBLY ONTO TRUCK ASSEMBLY

This step is identical for both shoe beams.

- Loosely position the safety hangar 40081658 (item # 40) onto the beam, as access to do this may be difficult after the beam subassembly is installed onto the truck.

- Position the beam subassembly beneath the link and axle end brackets, as shown in view A-A Carefully lift the beam into the proper position.

- At the link end, attach the beam subassembly to the link; using spacer-bushing 40082526 (item # 43), hardened washers 40081208 (item # 39), a 1 1/4" bolt 40087058 (item # 29) and a locknut 9421269 (item # 33). Apply a light lubricant to the 1 1/4" bolt threads prior to installing the locknut (motor oil, threadtex, or similar lubricant). Do not tighten any hardware at this stage - only apply the nut, bolt and washers loosely at this time. The hardened washers 40081208 (item # 39) are applied only at two locations per bolt on this application, as shown in section C-C. Note that the bolting configuration is identical at both the upper and lower link attachments, per section C-C.

- At the axle end, attach the beam subassembly to the axle bracket as in section E-E, using spacer bushing 40082526 (item # 43), one hardened washer 40081208 (item # 39), 1 1/4" bolt 40087058 (item # 29) and locknut 9421269 (item # 33). Apply a light lubricant to the 1 1/4" bolt threads prior to installing the locknut (motor oil, threadtex, or similar lubricant). Do not tighten any hardware at this stage - only apply the nut, bolt and washers loosely at this time. The axle end beam attachment uses only 1 hardened washer.

2.18.2.6 FINAL ASSEMBLY

This step is identical for both shoe beams.

- Tighten the two 1 1/4" nuts 9421269 (item # 33) and bolts 9429818 (item # 28) at the link end and the nut 9421269 (item # 33) and bolt 40087058 (item # 29) at the axle end. Final torque for these three bolts is 860 ft.-lbs. lubricated. First tighten the upper link bolt 9429818 (item # 28) to its indicated torque. Next tighten and torque the axle end bolt 4007058 (item # 29). Finally, tighten and torque the lower link bolt 9429818 (item # 28).

- Apply the safety hangar 40081658 (item # 40) to the truck frame; using 5/8" bolts 271724 (item # 41) and nuts 9416539 (item # 30). The safety hangar should be approximately centered about the beam so there is uniform clearance between the beam and safety hangar on both sides. Tighten and torque the 5/8" bolts 271724 (item # 41) to 150 ft.-lbs. (dry).

- Insert two square headed bolts 40075800 (item # 9) into the contact shoe strap 40075797 (item # 6) in the manner shown in the upper isometric view. Insert the two bolts 40075800 (item # 9) into the shoe beam from the inboard side, so that the contact shoe strap 400 75797 (item #6) bears against the inboard beam surface, and the threads of the bolt protrude outboard from the beam subassembly. Refer to section B-B of drawing 40077425.

- Fit the adjusting plate 40075795 (item # 4) over the outboard notches of the wooden shoe beam and over the threaded ends of the two protruding square headed bolts 40075800 (item # 9).

- Apply the pick up shoe sub-assembly (step 2 above) over the adjusting plate 40075795 (item # 4), and clamp the pick up shoe sub-assembly in place using locknuts 9416545 (item # 32), lock washer 131048 (item # 35), and flat washer 131019 (item # 34). Tighten and torque these bolts and nuts in opposing sequence; first to 175 ft-lbs. (dry); and finally to 350 ft.lbs. (dry).

At this point, the shoe beam application is completed.

2.18.3 THIRD RAIL COMPONENT ADJUSTMENT

2.18.3.1 INTRODUCTION

The DM30AC locomotive has a provision to operate in Electric (E) Mode, whereby the engine is shut down and power is collected from a third rail, using a pick up shoe for the purposes of power collection. Correct operation of the third rail power apparatus requires that proper settings be made to the third rail pick up shoe hangar (p.n. 40076118, item # 2 of drawing 40077425), the third rail pickup shoe (p.n. 40076117, item # 1 of drawing 40077425), and to the proximity sensor probe (p.n. 40077652, item # 1 of drawing 40078814). Proper setting of these items is essential for optimum DM30AC locomotive operation in gaps, as well as to obtain proper shoe contact and tracking to the third rail. Note that all part and item numbers are from drawing 40077425, unless specified differently.

2.18.3.1.1 Adjustment & Gauging Process

(All of the following adjustments should be performed with the locomotive on level, tangent track, with rail-wheel flange clearances all uniform, not in proximity to a third rail. It is recommended that the third rail truck equipment application (see drawing 40077425) be completely fitted to the trucks before beginning these adjustments.)

The process of gauging the third rail pickup shoe and proximity probe involves 3 major steps, which must be performed in following sequence:

2.18.3.2 ADJUST THE HEIGHT OF THE HANGAR BRACKET

The first step is to set the height of the third rail pickup shoe hangar bracket 40076118 (item # 2), referencing this height off of the running rail. (To accurately perform this step, it is recommended that a height adjustment gage be manufactured.. This gage should be designed to rest on two running rails, with offsets accurately placed at 2.938” and 2.500” from the surfaces in contact with the running rails.)

The height of the hangar is adjusted by loosening self locking nuts 9416545 (item # 32 of drawing 40077425; see section B-B or Isometric View), and then moving the serrated teeth of the hangar up or down relative to the teeth of adjusting plate 40075795 (item # 4). Note that the pitch of these serrated teeth is 3/8", and since the height tolerance for setting the hangar off the running rail is +/-.187", the process followed in making this adjustment is to set the hangar as near as possible to 3.125" off the running rail, without going below the 2.938" dimension.

2.18.3.3 SET THE PICK UP SHOE TOE HEIGHT

The second step is to accurately set the toe height of the 3rd rail pick up shoe 40076117 (item # 1), again referencing this height off the running rail, and using the gauge. For optimal shoe wear and electrical contact performance, it is required that this height be set as close as possible to 2.500" above the running rail height. (Setting the height lower than 2.500" risks damaging the pick up shoes at ramps in the third rail leading to and exiting the gapped sections; setting this height greater than 2.500" will worsen the third rail tracking/contact performance, especially when the shoes are worn.) Note this step should be done with the contact shoe springs 40075798 (item # 7) & 40075799 (item # 8) disengaged. The tolerance on the 2.500" contact shoe toe height is +.032"/-.000".

Coat adjusting screw threads 40085120 (item # 1 on drawing 40078815) with lubricant 40079485.

Refer to the elevation view on drawing 40078815. With the toe height gage positioned, turn adjusting screw 40085120 (item # 1 of drawing 40078815) clockwise or counterclockwise as required to obtain the required 2.500" shoe toe height. Once this height is obtained, lock the adjusting screw into place with locknut 40078959 (item # 17 of drawing 40078815). Take care not to cause the adjusting screw to move when locking the plug with the locknut, as this will change the toe height setting.

Prior to moving on to the next step, reapply the contact shoe springs 40075798 & 40075799 (items # 7 and # 8 in drawing 40077425).

2.18.3.4 ADJUST THE PROXIMITY SENSOR GAP

Prior to performing this final step, it is required that a subassembly be made, as shown in drawing 40085128. Insert the proximity sensor of 40078814 (item # 1 on drawing 40085128) through the locking bushing 40085122 (item # 3 of drawing 40085128). Apply the bushing jam nut 40085121 (item # 4 of drawing 40085128) onto the locking bushing as shown on drawing 40085128. Next, thread two proximity pick up nuts 40083802 (item # 2 on drawing 40085128) onto the proximity sensor probe 40077652 (item # 1 of drawing 40078814). The two proximity pick up nuts should be threaded so that the probe protrudes 0.196" beyond the shoulder of the inboard nut when locked in place, as shown in drawing 40085128. This 0.196" dimension should be accurately set using a dial indicator. This protrusion is then held and maintained by using the other nut as a locking device. Torque to lock the proximity pick up nuts with the proper protrusion is 11 ft.-lbs. Note that excessive torque will damage the proximity sensor.

Insert the adjusted sub-assembly from drawing 40085128 into the adjusting screw 40085120 (item # 1 on drawing 40078815), making certain that the shoulder of the proximity pickup nut seats against the shoulder of adjusting screw 40085120 (item # 1 on drawing 40078815), as shown in Section C-C of drawing 40078815. With the proximity probe properly seated, lock the probe in place by tightening the locking bushing 40085122 (item # 3 on drawing 40085128). Use two wrenches for this operation - one on the head of the adjusting screw 40085120 (item # 1on drawing 40078815), and another on the head of the locking bushing 40085122 (item # 3 on drawing 40085128). Use care not to move the adjusting screw 40085120 (item # 1 on drawing 40078815), as this will change the shoe toe height. After the locking bushing is tightened against the adjusting screw, tighten the bushing jam nut 40085121 (item # 4 on drawing 40085128). Again, use 2 wrenches; one on adjusting screw 40085120 (item # 1 on drawing 40078815), and the other on nut 40085121 (item # 4 on drawing 40085128).

2.18.3.5 COMPLETING THE PROXIMITY SENSOR APPLICATION

Clamping the cable from the proximity sensor to the truck frame and to the shoe hanger, as shown in drawing 40078815, will now complete the proximity sensor application. The proximity sensor cover assemblies 40085169 (item # 3 on drawing 40078815) may also be installed at this time.

The cable of the proximity sensor assembly is attached to a connection on the locomotive carbody, using strain relief elbow 8224088 (item # 5 of drawing 40078815) and locknut 8038585 (item # 16 of drawing 40078815).

The proximity sensor cable is attached to the truck frame, using clamp 8168450 (item # 2 of drawing 40078815) and ¼"-20 screw 9419646 (item # 12 of drawing 40078815). To attach these parts to the truck frame, it may be necessary to drill a .228" diameter hole into the sidewall of the truck frame. Prior to drilling this hole, the cable should be attached to both the carbody and to the covers down at the third rail pick up shoes. The hole should not be drilled either close to the top or the bottom of the truck side frame section. Refer to elevation view of drawing 40078815 for an appropriate clamp location.

Prior to clamping the proximity sensor cable to the truck frame, be certain to provide sufficient slack to accommodate truck rotation as well as a lesser amount to accommodate primary suspension movement.

In a similar manner attach the proximity sensor cable to the shoe hangar, again using clamp 8168450 (item # 2 of drawing 40078815) and screw 9419646 (item # 12 of drawing 40078815).

Install the proximity sensor covers 40085169 (item # 3 on drawing 40078815). Be certain the proximity sensor cable slack does not rub against the shoe hangar or guard. As additional protection against cable contact, silicone rubber tubing may be applied over the sensor cable, as shown on drawing 40078814.

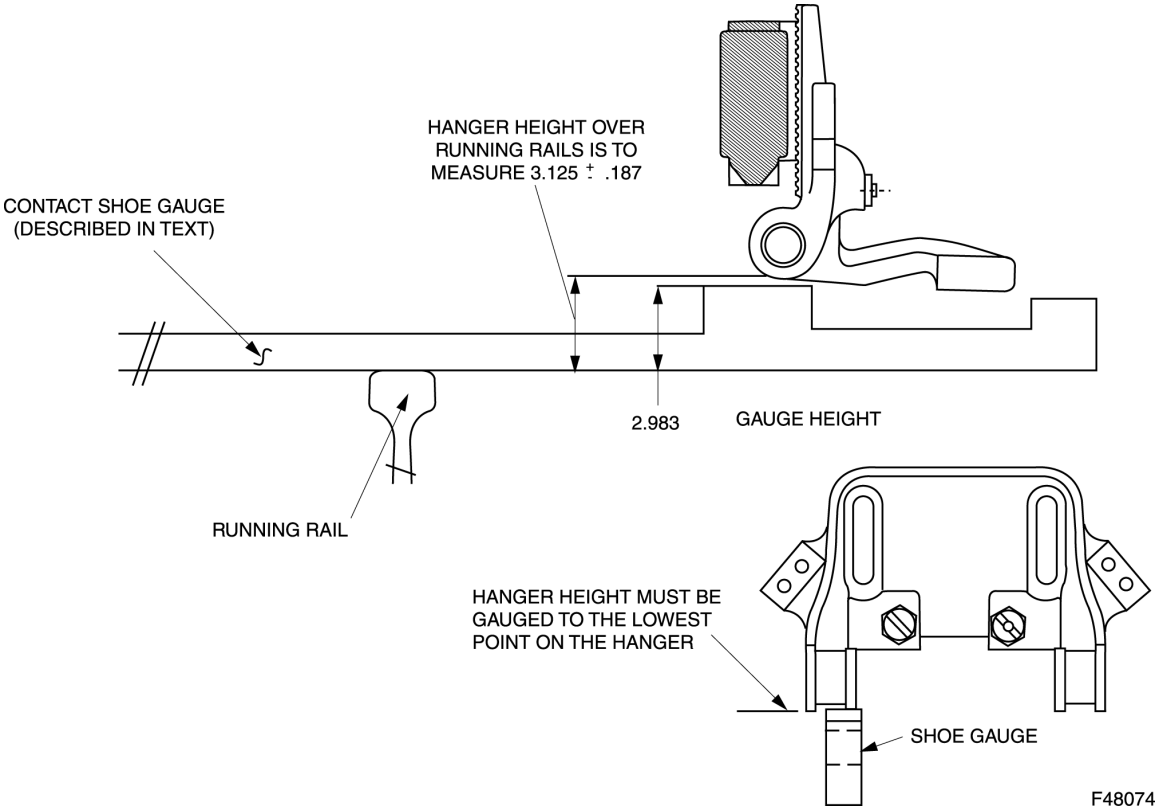

Figure 53 Gauging Hanger Height

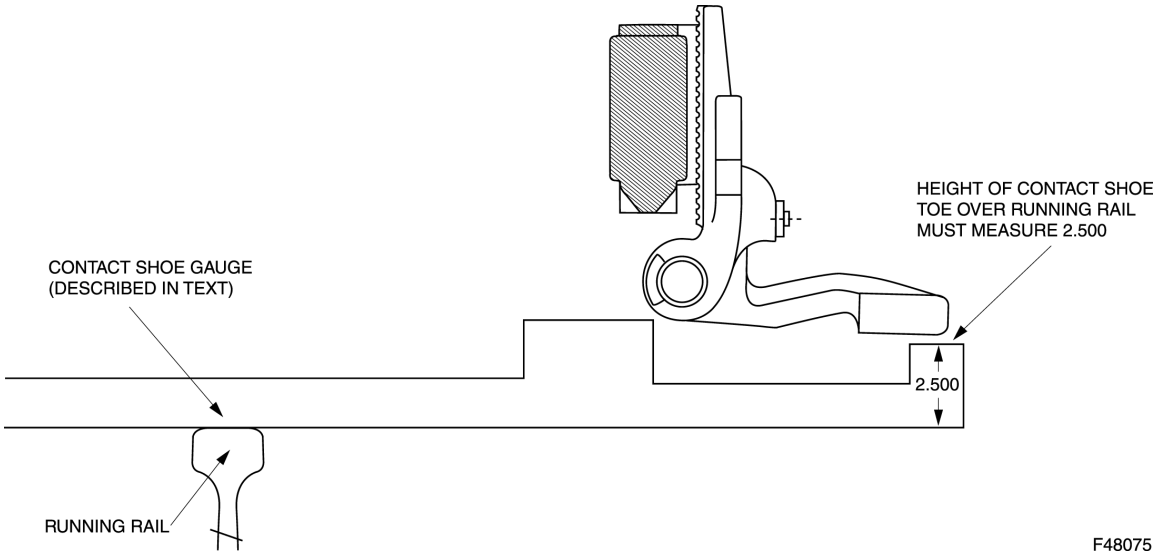

Figure 54 Gauging Shoe Height

3.0 TRUCK OVERHAUL

This section details the procedures required to perform a complete overhaul of the Siemens Fabricated Truck Assembly. Following removal from the locomotive (as outlined in the previous section), all traction motor / wheelsets are to be removed. Depending on the facilities available, the truck may be lifted off of the traction motors, or placed inverted in a suitable stand.

During re-assembly, qualified wheelsets / motors should be applied to the truck assembly.

3.1 TRUCK DISASSEMBLY

With the truck assembly removed from the locomotive, the assembly may be disassembled (stripped) to facilitate component inspection, repair, and replacement. Begin with the truck located in a suitable work area or stand in a normal orientation. Take care to identify and properly store all components as they are removed to aid in re-assembly. Note that components can be both truck and direction specific (Front and rear, right and left). Retain all hardened flat washers. Replace all lock nuts and washers with new on re-assembly.

1. Remove step assembly if required. See "Step Removal" in this M.I.

2. Remove mounting bolts and nuts, disconnect disc brake rigging, and remove pins and pads. Disconnect air lines. Support disc brake rigging and remove. For detailed information on brake components, see M.I. 1578.

3. Remove secondary springs and bases. Tag springs as to location. See "Special Procedures" in this M.I. for spring inspection and diagnosis.

4. Remove lateral, yaw and vertical dampers, as required.

5. Remove carbody transom post wear pads (snubbers).

6. Remove third rail pickups and cabling. Mark as right or left, front or rear.

7. Remove third rail fuse box and cabling. Mark as right or left, front or rear.

8. Remove piping to brake assemblies (disc and tread).

9. Remove all brackets and clips from truck.

10. Remove brake shoe keys and remove brake shoes. Slack off brake rigging to maximum possible (if not already done).

11. Remove tread brake assembly mounting bolts. Support and remove tread brake assemblies. See M.I. 1578 or details of tread brake assemblies.

12. It is recommended that brake cylinder be removed when reconditioning is performed. Remove the brake cylinder hex nuts, and remove brake cylinder internal components. See M.I. 1579.

13. Remove upper and lower axle damper mounting bolts and remove axle damper. Repeat as required.

14. Remove axle damper mounting brackets from journal bearing adapters.

15. Remove tie rod mounting bolts and tie rod. Repeat as required.

16. Remove sander piping and any remaining air piping.

17. Using either the lock bolt cutting tool or a cutting torch, remove the lower traction motor nose link (dog bone) lock bolt collars, Figure 55. Repeat as required. See "Special Procedures" in this M.I. for details.

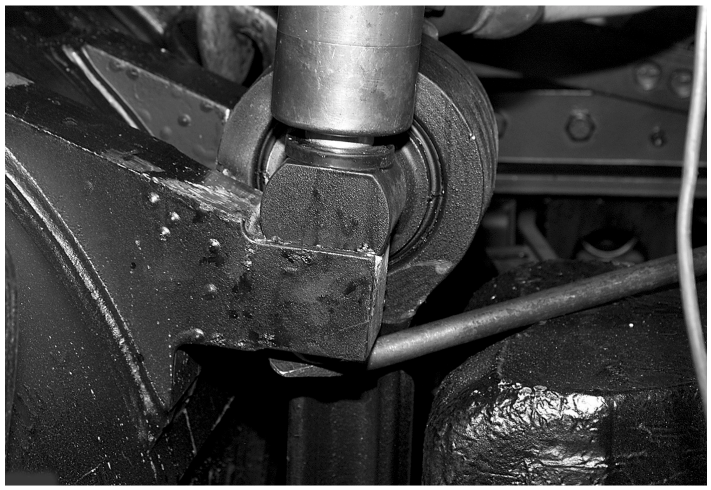

Figure 55 Dog Bone Removal

18. Put wooden blocks under the traction motor noses to minimize the drop when the truck is lifted.

19. Remove the lower journal adapter caps, Figure 56.

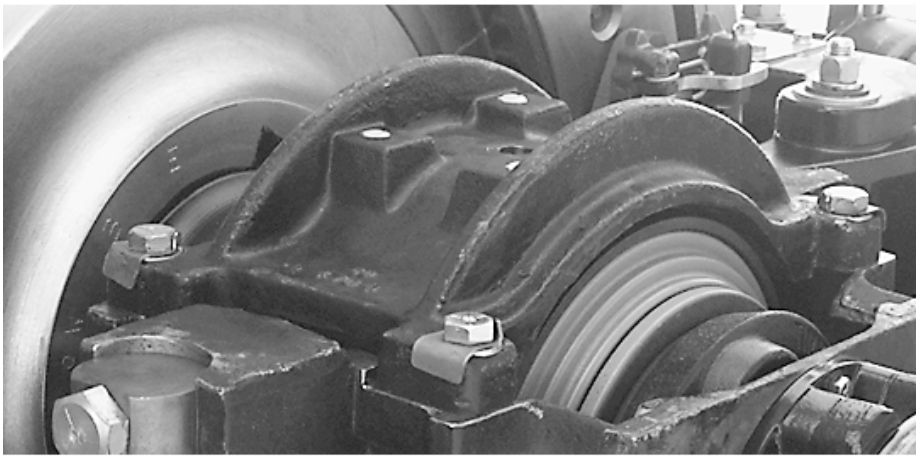

Figure 56 Typical Journal Adapter Cap Removal

CAUTION!

Before lifting the truck inspect all lifting points for cracking or separation. Using the proper lifting equipment, lift the truck from the TM/WHL combo's and send it for cleaning.

20. Remove truck link retaining bolts and link pins.

21. Lift truck from traction motors.

22. Remove the journal coil springs and clean for inspection and grading. See "Special Procedures" in this M.I. Retain the shims and spacers from the top and bottom of the springs. Note where the springs and spacer shims came from, as each axle on each truck is shimmed for locomotive weight and the springs and shims should be returned to their original positions.

23. Using the lock bolt cutting tool, remove the traction motor nose support (dog bone) upper lock bolts collars and supports.

24. Once the truck has been cleaned, invert it and mount it on stands set on the top (now the bottom, when inverted) of the front and rear spring pockets. The stands should be approximately 24".

25. Clean all machined surfaces on the truck with a file, wire brush, or buffer pad, removing dirt, rust, etc. Do not grind surfaces and ensure all machined steps are properly cleaned.

3.2 COMPONENT QUALIFICATION

3.2.1 BEARING ADAPTERS

Journal bearing adapters, Figure 57, should be given a visual inspection for signs of overheating, cracks, or evidence of excessive wear in the journal bore and the spring seat area. Welding may repair worn or cracked areas. Grind off excess material and thoroughly clean the adapter before re-assembly.

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Figure 57 Typical Journal Bearing Adapter

3.2.2 AXLE DAMPERS

Remove the axle dampers, Figure 58, from the truck assembly if required. Renew or qualify the unit as per the section on Dampers in this M.I. Inspect all rubber mounting components, replace as required.

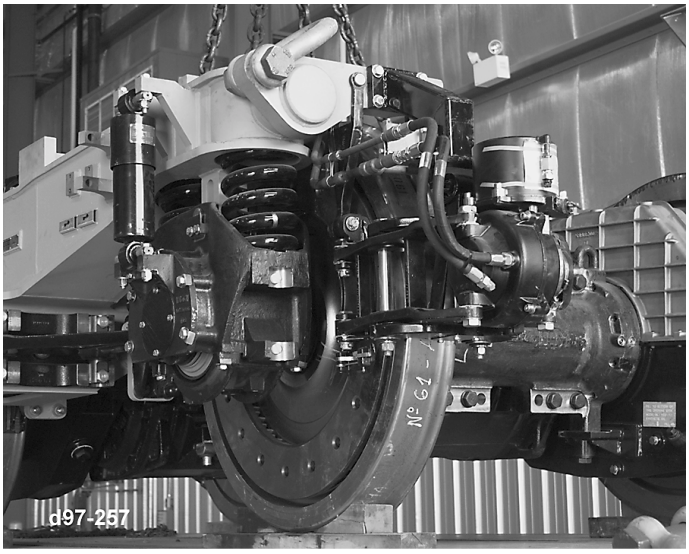

Figure 58 Typical Axle Dampers

3.2.3 VERTICAL DAMPERS

Remove the vertical dampers from the truck assembly if required. Renew or qualify the unit as per the section on Dampers in this M.I. Inspect all rubber mounting components, replace as required.

3.2.4 YAW DAMPERS

Yaw dampers are mounted longitudinally between the truck frame and the carbody. There are two yaw damper assemblies per truck. To remove the yaw damper, remove the mounting bolts and self-locking nuts, one per end. Renew or qualify the unit as per the section on Dampers in this M.I. To re-install, reverse the above process ensuring that the hydraulic reservoir of the damper (box shape) is situated on the top of the damper.

3.2.5 LATERAL DAMPERS

Lateral dampers, Figure 59, are mounted diagonally between the truck frame and the locomotive underframe. There are two damper assemblies per truck. To remove the lateral damper, remove the four mounting bolts and self-locking nuts, two per end. Renew or qualify the unit as per the section on Dampers in this M.I. To re-install, reverse the above process ensuring that the large end of the damper (end with outer sleeve) is attached to the locomotive underframe.

Figure 59 Typical Lateral Dampers

3.2.6 SECONDARY SPRING BASES

Unbolt secondary spring bases from the truck frame if required and remove from the truck assembly. Qualify as per the section on Secondary Springs in this M.I. Note that if it is required to renew a secondary spring assembly, they should be renewed as a set (all four on the affected truck).

3.2.7 TRANSOM POST WEAR PADS

Transom post wear pads, (snubber pads), are located on the mounting beams in the center of the truck, one on each side. To remove the pads, unbolt the four retaining nuts and remove the pad assemblies from the truck frame. Replace thrust pads with new components.

3.2.8 PARKING AND DISC BRAKE ASSEMBLY

1. Disconnect and remove the parking brake and disc brake assembly from the truck frame, if required.

2. Qualify as per the specific maintenance instructions on this device. See M.I. 1578.

3.2.9 TREAD BRAKE CYLINDERS AND BRAKE RIGGING

The tread brake cylinders (4 per truck) should be replaced with qualified components, per the supplier's maintenance guide, at the time of truck overhaul. See M.I. 1579.

All brake rigging components should be thoroughly cleaned and examined for damage and wear. Renew all brake rigging bushings in preparation for truck re-assembly by pressing the old bushing out and pressing new bushing in place. Use the appropriate parts catalogue for bushing locations and part numbers.

3.2.10 TIE RODS

1. Remove the tie rod assemblies from the journal adapters and truck mounting plate by removing the locking bolts.

2. Once the traction rod assemblies have been removed, extract all bushings using an arbor press, Figure 60.

Figure 60 Bushing Removal

3.2.11 TRACTION MOTOR NOSE SUPPORT LINKS

Qualification of the traction motor nose support links (dogbones) includes a visual inspection of the links and replacement of the bushing assemblies, Figure 61.

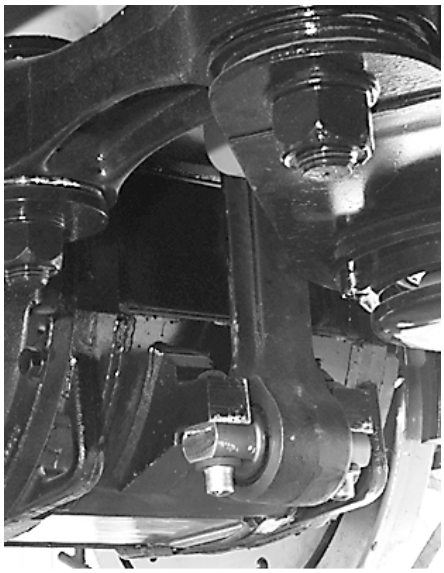

Figure 61 Typical Traction Motor Nose Support Link

Thoroughly clean all components and inspect for straightness, damage or wear. Bushings are replaced using the following procedure:

1. The used traction motor nose support bushings are to be pressed out with the proper sized press tool.

2. Thoroughly clean the bushing bores and liberally apply P-80 rubber lubricant to the replacement bushings and bores.

3. Using the correct size insertion funnel press the bushings into the bores.

Note that the metal supports that protrude from the sides of the bushing have a wider contact surface on one side. This wider surface is the contact area between the support and the truck or traction motor. Ensure bushings are installed with these wider surfaces facing each other, Figure 62.

Figure 62 Bushing Orientation

3.2.12 COIL SPRING INSPECTION AND QUALIFICATION

Locomotive truck frame-to-axle journal primary suspension is provided by steel helical coil springs. Two single coils per journal adapter are utilized that generally provide for large amounts of deflection. This assists in wheel load equalization, and improves the ride quality over rough sections of track.

Helical coil springs are specifically designed for various locomotive weight ranges, and provide the optimum suspension system for each range of locomotive weights. See the specific application print for grading procedure and standards.

For additional spring identification and qualification, refer to M.I. 1512.

In order to secure the coil springs on the journal bearing adapters, spring pilot tubes are used along with pilot (wear) plates between the springs and the adapter. Spring pilot tubes and shims (spacers) are also located in the truck frame spring pockets to perform the same function.

3.3 TRUCK FRAME INSPECTION AND RECONDITIONING

Make a thorough inspection for the following and recondition if necessary.

3.3.1 TRUCK FRAME TRAMMING

Tramming of the truck is done from the transom points. Clean off the surfaces (carefully) and locate the tram points. These are small indentions on the surface of the truck. Note that they can be in different positions on the front and rear of the truck.

Measure the distance between diagonal pairs of tram points. For example, the distance between the left front tram point and the right rear tram point will be considered "L_A" while the distance between the right front and left rear tram points will be considered to be "L_B". If "L_A" is within +/- .06 of "L_B", the tram is considered to be within specification.

If the tramming dimensions are not within specification, contact your EMD Service representative for corrective procedures.

3.3.2 BENT, BROKEN, OR CRACKED MEMBERS

Inspect all truck frame members and weldments for breaks or cracks. Perform magnetic particle inspection at any areas suspected of being cracked. Before performing any weld repairs to major structural areas, contact your EMD Service Representative for corrective procedures.

Breaks or cracks are repaired by welding, using AWS E-7016 electrode. It is permissible to remove a broken or bent section for straightening if it can be welded back into place after preparing the joint to obtain a 100 percent section of weld with reinforcement as shown in Figure 63.

To minimize localized stressing when several welds are required, allow sufficient time for frame to cool to the touch between welding passes. Water soaked rags or air fans may be used to cool the welding area. Make certain that area to be welded is dry before welding. To further minimize localized stress distortion, each welding pass, except the root pass, should be 100% needle peened. Peen immediately after each pass, except for the final pass. Peen final pass after it has cooled to below 66 degrees C (150 degrees F). Use a needle-peening gun with a minimum of twenty-eight 3-mm wires with rounded end. Avoid excessive peening that will impair the quality of the welds.

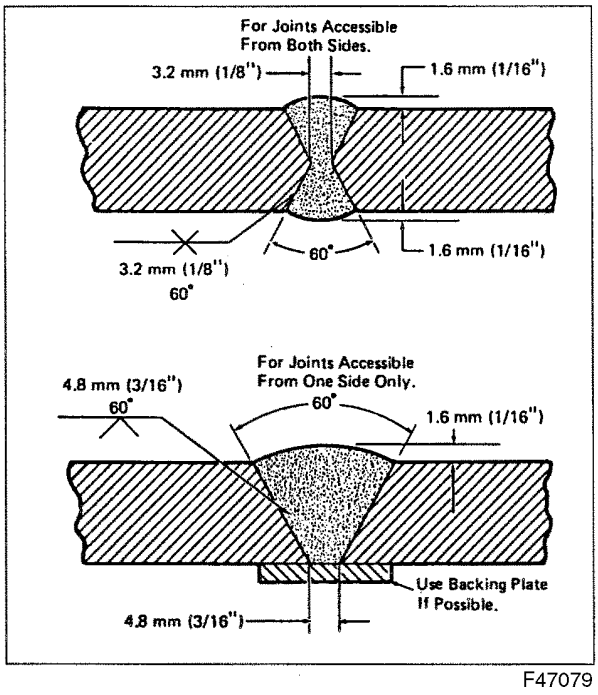

Figure 63 Preparing Joints For Welding

All welds should be magnetic particle inspected after welds have cooled to below 204 degrees C (400 degrees F).

Bent sections may be straightened either cold or after application of heat. Before straightening any bent section, determine what effect the straightening will have on the adjoining sections. If necessary, the affected section should be removed from the frame assembly, and rebuilt provided the welding criteria described above is complied with.

3.3.3 WORN SPOTS

The truck frame should be checked for worn areas. Worn spots can be repaired by building up the affected area(s) with weld as outlined in the above paragraphs. After the welding operation is complete, grind the area(s) smooth to match its original form.

3.3.4 ELONGATED OR OVERSIZE HOLES

Drilled holes elongated by wear due to loose bolts, screws, sleeves, or bushings can be re-conditioned by either ring or plug welding. Holes that are too small to permit proper manipulation of the welding electrode should be drilled oversize to permit proper access for the electrode. The hole should be re-drilled to proper size after completion of the welding.

3.3.5 WORN BUSHINGS

All bushings should be pressed out and replaced at each truck overhaul. After the bushing is removed, inspect the drilled hole in the frame for wear or an out-of-round condition. Holes found unsuitable for a new bushing can be reconditioned by ring welding and then drilling to accept the new bushing. Applying a band of heat parallel with the drilled hole may shrink holes that are slightly oversize.

3.3.6 DAMAGED THREADS

All threaded holes should be checked and re-tapped if required. If the threaded holes cannot be reconditioned by re-tapping they should be plug welded, re-drilled and tapped. An alternate method of reclaiming unsatisfactory threaded holes is to re-tap them to accommodate an oversize bolt.

3.3.7 BROKEN OR BENT STUDS

Replace any broken or bent studs with studs that are in satisfactory condition.

3.3.8 MISSING PARTS

Make a thorough inspection to see that all the necessary parts are intact. Special attention should be given to wear plates, cotter keys, washers, bushings, studs, brake guides, and brake pins.

3.4 TRUCK RE-ASSEMBLY

It is recommended that the truck(s) be initially re-assembled in the inverted position, using suitable work stands of sufficient size and stability to properly support the weight of the assembled truck(s). All secondary suspension components, external piping, and brake cylinders should be left off the truck(s) until they are up-righted prior to application to the locomotive. Simply reverse the Dis-assembly Instructions for specific procedures.

3.4.1 INITIAL TRUCK ASSEMBLY

The following truck assembly (build up) procedure assumes that all bushings and replaceable parts have been changed out, all traction motor/wheelset combos are pre-assembled, and the truck frame has been qualified.

1. Install traction motor nose support link assemblies (dogbones). Insert lock bolt [1 x 9-3/8”] through the nose link bushing, and through the truck support bracket, the washer, and the collar. Ensure the wide surface of the bracket in the bushing faces the truck support brackets, Figure 64. Tighten with the lock bolt tool.

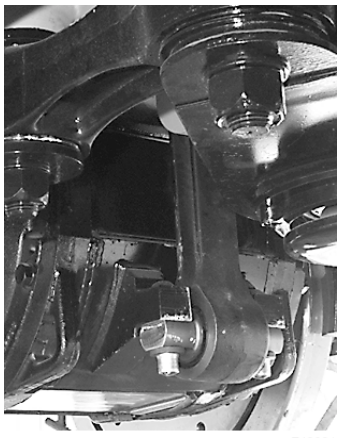

Figure 64 Traction Motor Nose Link Support

2. Insert coil spring shims into spring pockets, tapered end towards the journal-bearing adapter. The amount and thickness of shims recorded on disassembly should be the starting point for re-assembly.

3. Fit journal spring adapters to truck frame ensuring proper orientation and spring engagement.

4. Apply the journal adapter retainer cables using new hardware.

5. Install the combo into the truck while the truck is still inverted, Figure 65. Ensure pilot/wear plates [8-1/4 OD x 4-7/8 ID x ½" thick] are between the springs and the journal spring adapters. Note that combo's will have to be installed at an angle to clear truck brackets.

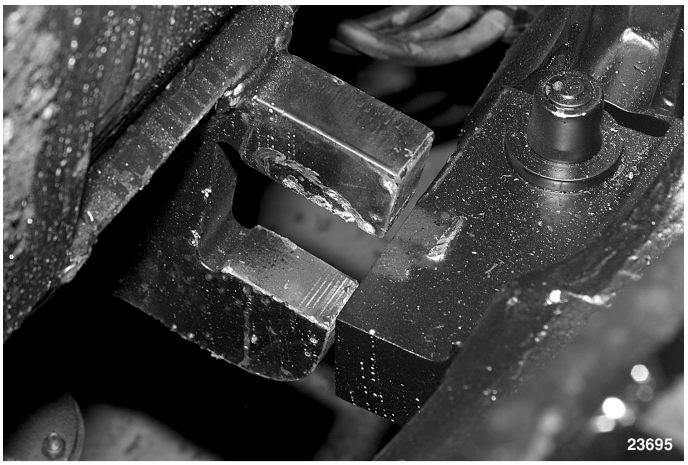

Figure 65 Traction Motor Safety Brackets

6. As the combo is being lowered into place, pry the traction motor nose link (dog bone) away from the combo for clearance. When the combo is fully inserted release the traction motor nose link (dog bone) into position on the traction motor nose brackets, Figure 66. Insert the lock bolts [1 x 9-3/8"], washers [2-1/2 OD x 1-1/16 ID x 3/8" thick], and collars. Using the lock tool, tighten the collars. Repeat for each combo.

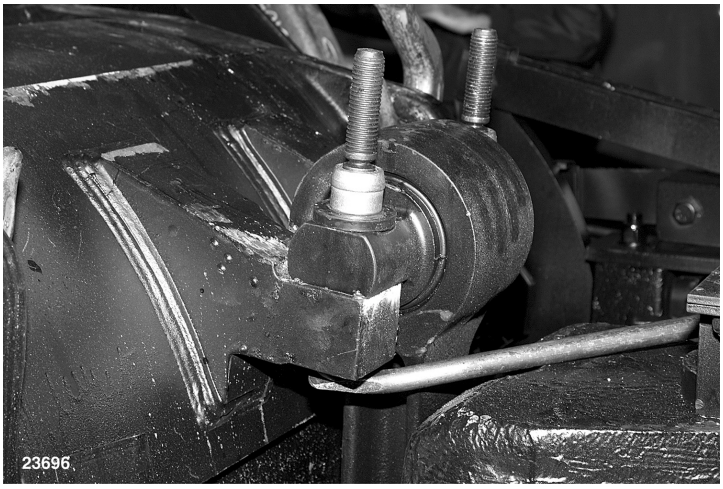

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Figure 66 Traction Motor Nose Support Alignment

NOTE

Ensure interlock links are aligned before proceeding.

7. Ensure proper engagement of all journal bearings with the journal adapters, Figure 67.

F48098

Figure 67 Alignment of Bearing and Adapter

8. Using new hardware [3/4" – 10 X 3-1/2" bolt and washer ¾" hardened], apply the journal bearing adapter caps (binders) at all locations, Figure 68 and torque to 205 ft/lbs. Bend the tabs on the lock plate to fully engage one side of the bolt head.

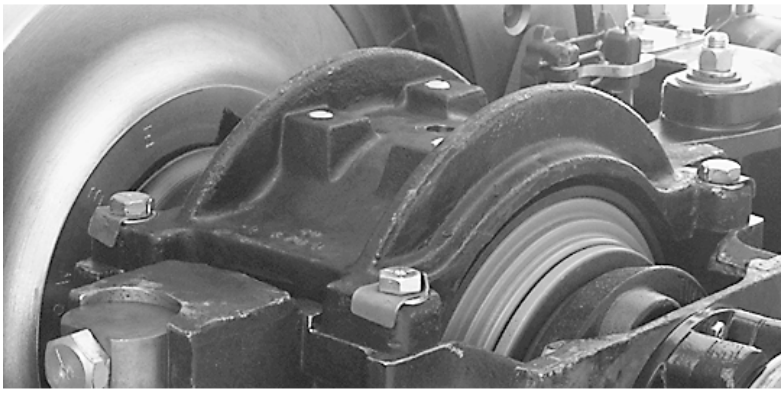

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Figure 68 Journal Bearing Adapter Cap Hardware

9. Rebuilt brake cylinders may be applied to the truck frame at this stage to facilitate assembly of the brake rigging. It is recommended that new pins be used at all locations on the rigging assembly.

10. Ensure all bolts are torqued or locked.

11. Install lower damper bracket. Torque bolts.

12. Install upper damper bracket and torque.

13. Install axle damper. Torque bolts. Repeat as required.

14. Install yaw dampers. Use new locking hardware. Torque fasteners. Ensure that reservoir on damper faces up in relation to truck (marked on damper).

15. Install lemniscate linkage. Ensure proper alignment before torquing lock nuts.

3.4.2 FINAL TRUCK ASSEMBLY

1. Using the proper lifting device, invert truck so that it sits normally (on the wheels).

2. Install rubber secondary spring base assemblies. Use thread-locking compound on these bolts. Torque.

3. Install vertical damper on truck. Torque bolts.

4. Install lateral carbody dampers on the truck. Shock end goes on truck and dust cover end goes towards carbody. Torque bolts.

5. Install truck brake cylinder piping. Reference correct parts catalogue for orientation of piping.

6. Apply traction motor air ducts (if applicable) to the motor assemblies and temporarily cover the openings with a metal plate or cardboard to prevent ingress of dirt or foreign objects.

7. Refill traction motor gearcases with the appropriate lubricant, Figure 83, to the normal running level. Note that it may be easier to refill the gearcase with lubricant through the breather opening. Fill to the level indicated by the level plug on the side of the gearcase.

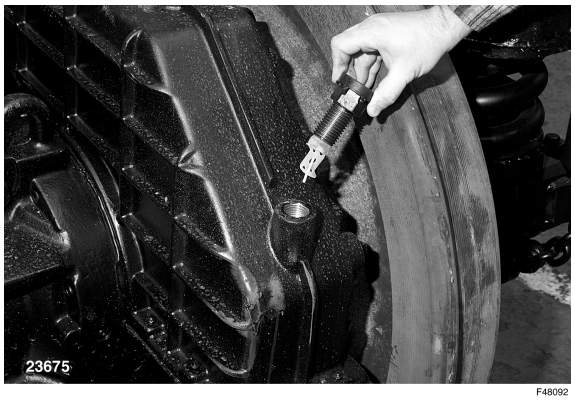


Figure 69 Traction Motor Gearcase Lubrication

8. Assemble all remaining auxiliary equipment such as third rail equipment. See "Third Rail Equipment Assembly And Disassembly" in this M.I. Do not apply sander guides until locomotive is trucked. Apply all junction boxes and other electrical connections.

3.5 TRUCK APPLICATION TO LOCOMOTIVE

1. Ensure carbody transom pivot has been cleaned of dirt and corrosion. Spray pivot with moly lube.

2. Roll rebuilt truck assembly under raised locomotive, or if using a drop table, install truck on table and raise truck up under locomotive. Ensure contact areas are cleaned of dirt and corrosion.

3. Align carbody transom pivot pin with pivot opening and secondary rubber spring bases with appropriate holes in truck. Install dual secondary coil springs. See Special Procedures in this M.I. for spring alignment specifications. Note that the carbody transom pivot will meet the truck before the secondary springs meet the carbody. Also note that the carbody transom pivot pin is keyed and must be aligned with truck opening. Anti-seize lubricant is permissible on the ends only of the secondary springs.

4. The pivot post must align and be inserted through the lemniscate linkage.

5. Connect lateral carbody dampers at carbody bracket. Torque bolts.

6. Install new carbody transom post pivot pin wear ring and plate using castled nut. Use new cotter pin.

7. Connect traction motor leads, and traction motor temperature probe plug, if required.

8. Connect all third rail leads, if required.

9. Connect carbody air piping to truck air piping, Figure 70.

F48099

Figure 70 Typical Air Brake Piping

10. Connect parking brake air lines.

11. Check truck and carbody to ensure all loose ends have been accommodated.

4.0 SPECIAL PROCEDURES AND INFORMATION

4.1 LOCK BOLTS

There are various locations at which lock bolts are used in the DE/DM30AC locomotives.

The nose link assemblies will need to be disassembled and re-assembled each time the traction motor/wheelset combination is removed or re-installed.

The general instructions given here apply to all the lock bolt connections, although the hardware set and orientation of each fastener is different. Since the lock bolt does not use threads, but instead makes use of locking grooves, there are no nuts needing to be torqued. Instead, there is a collar that is swaged (cold formed) onto the locking grooves that holds the connection secure.

4.1.1 REMOVING LOCK BOLTS

Lockbolt removal is accomplished by either cutting the collar with a cutting torch or with a mechanical cutting tool. The cut collar and loose lockbolt are waste and must be discarded.

Before removal of lockbolt, ensure that mating parts are secure and that when the lockbolt (pin) comes loose, the lockbolt either remains in position, falls safely, or will be held securely.

Note that all mating components should be blocked, held up by straps or secured as needed.

CAUTION!

All safety precautions and procedures of the lockbolt and lockbolt tool manufacturer should be strictly adhered to. Ensure that hose connections are tight, and that hand tool and power rig connections are secure and proper. Do not stay directly in line with the lockbolt during installation. Push the tool as far as possible onto the collar before pulling trigger. Keep hands clear from connection before pulling trigger. When the collar is cut, release trigger. Keep hands and fingers out of nose openings, and hold hand tool only below hand guard. Stop tool operation in case of breakage or wrong adjustment, or if hoses are leaking or cables damaged.

If using a cutting torch, cut the collar longitudinally (in the same direction as the axis of the pin) along its entire length. Be careful to not damage other components, rubber bushings or truck frame with the cutting torch flame, placing a steel sheet or protection as necessary between working area and adjacent components.

4.1.2 LOCK BOLT INSTALLATION

The pin or lockbolt is inserted into the prepared hole together with all the washers, bushings and other components that are to be joined in the connection, Figure 71.

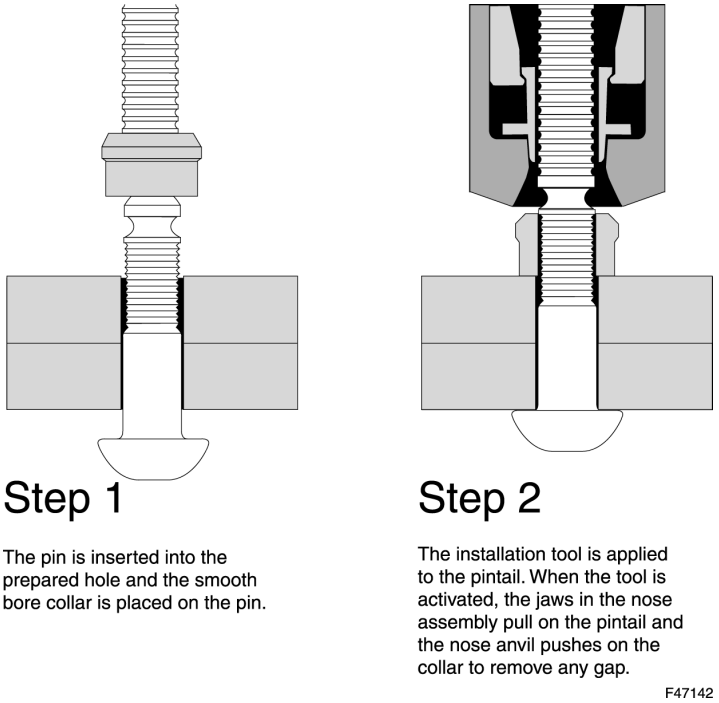


Figure 71 Lockbolt Installation

Then, the mating smooth bore locking collar is slipped on to the pin, with its bevel end towards the outside.

The lockbolt installation tool (which is hydraulically operated, and is connected to its power source) is applied to the pintail (end of lockbolt that is opposite to the head).

When the trigger of the lockbolt tool is activated, Figure 65 the chuck jaws in nose of the tool assembly pull on the pintail, inducing an initial clamp load, and the nose anvil pushes on the collar to remove any gap.

As the tensile load is increased, the nose anvil of the tool overcomes the resistance of the beaded collar and begins to move over the collar toward the work pieces, thus swaging the collar onto the annular locking grooves of the pin, and locking in the full clamp load.

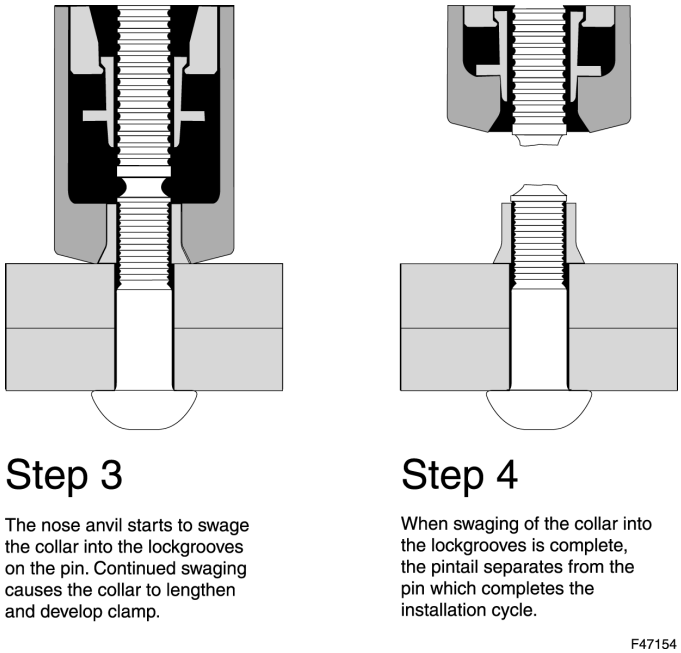
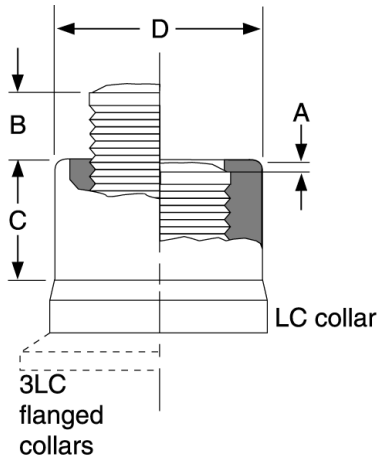


Figure 72 Final Lock Bolt Assembly

After the swaging of the collar is complete, the tensile force on the pintail continues to increase until fracture occurs at the breakneck groove separating the pintail from the installed fastener. The collar is automatically separated from the tool and the remaining fractured pintail containing the pull grooves is ejected. Note that the installed lockbolt collars must within dimensions shown in Figure 73.



Huck Bolt Dia.	Collar Part #	A max	B max	C min	D max
1"	40034493	1/16"	3/8"	7/8"	1.465"
1 3/8"	40022911	1/4"	11/16"	1 1/4"	2.020"

F47143

Figure 73 Lockbolt Finished Dimensions

CAUTION!

All safety precautions and procedures of the lockbolt equipment manufacturer should be strictly adhered to. Never install a lockbolt without a lock collar, as the lockbolt may be forcefully ejected. Ensure that hose connections are tight, and that hand tool and power rig connections are secure and proper. Do not stay directly in line with the lockbolt during installation. Push the tool as far as possible onto the pin and collar before pulling trigger. Keep hands clear from connection before pulling trigger. When the pin snaps, release trigger. Keep hands and fingers out of nose openings, and hold hand tool only below hand guard. Stop tool operation in case of breakage or wrong adjustment, or if hoses are leaking or cables damaged.

5.0 TRUCK SPRING GROUPING AND SPRING END POSITIONING

5.1 INTRODUCTION

The DE30AC and DM30AC locomotives use springs that are grouped according to their relative stiffness within a spring stiffness tolerance band. This instruction outlines the preferred variation in truck spring grouping for the primary (axle box) and secondary (truck to carbody) springs. To obtain uniform locomotive height, it is desirable to apply springs in a controlled manner, both when assembling the trucks, as well as when trucking a locomotive. This document will identify the ideal manner for grouping the springs, as well as prescribe optional groupings to follow when inventory circumstances do not permit the ideal spring grouping arrangement.

Another characteristic of the DE30AC and DM30AC locomotives is the requirement that the secondary (truck to carbody) springs be positioned onto the truck assembly springs seats with the spring ends (tips) in a prescribed manner. This instruction will also indicate the required orientation of the secondary spring ends prior to trucking of the locomotives. This mandatory spring end orientation requirement is necessary to obtain proper truck curve negotiation performance.

5.2 SPRING GROUPING INFORMATION

Primary Spring (axle box) 10630099 and Outer Secondary Spring (truck to carbody) 10630100 carry marking ribbons which are attached to the coils approximately 2 turns from the end of the spring. These ribbons identify the coils as belonging to either “Group 1” or “Group 2”, with Group 1 springs on the stiffer end of the spring stiffness tolerance, and Group 2 springs on the softer end of the spring stiffness tolerance.

5.2.1 PRIMARY SPRING USAGE RULES

When building up truck sets for a locomotive, it is desirable that all primary springs within the locomotive be from the same group. When inventory conditions do not permit this, the primary suspension springs may be mixed within the truck assembly using the following rules:

1. With 7 springs of Group I and 1 spring of Group II (or vice versa), the position of the 1 odd spring within the truck assembly is optional.

2. With 6 springs of Group I and 2 springs of Group II (or vice versa *), the springs of Group II (*I) should be located across from each other on the same axle or truck as shown on Figure 74.

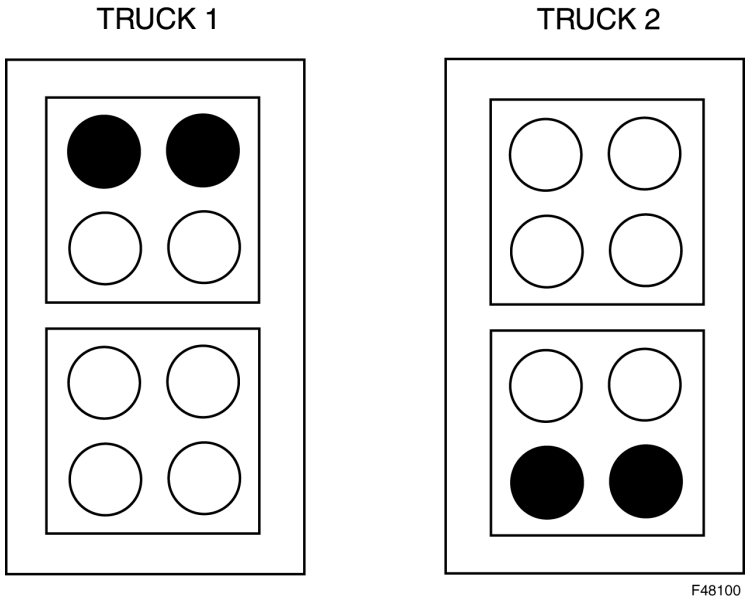


Figure 74 Variations Of Group 1 & Group 2 Positioning Examples

3. With 5 springs of Group I and 3 springs of Group II (or vice versa *), two springs of Group II (* I) are located as in note 2 above and the third spring should be located on the other truck or axle as shown on Figure 75.

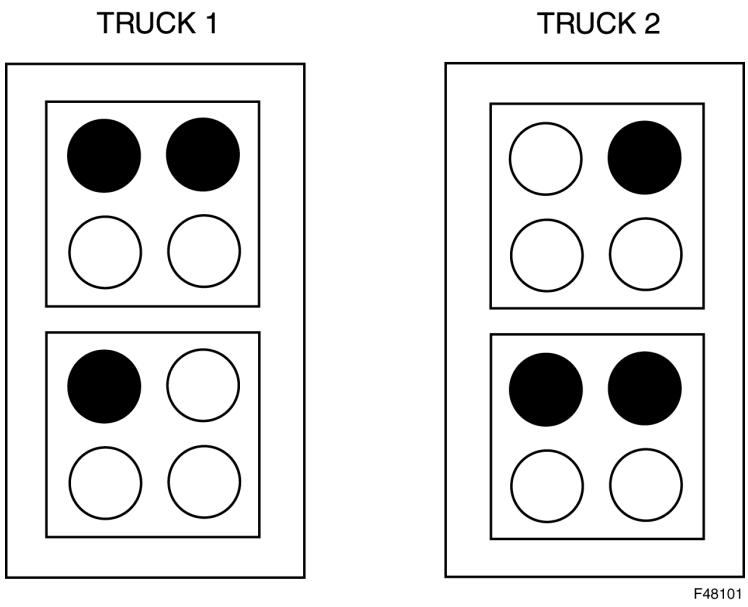


Figure 75 Variations Of Group 1 & Group 2 Positioning Examples

4. With 4 springs of each Group, two springs are located across from each other on each truck or axle as shown on Figure 76.

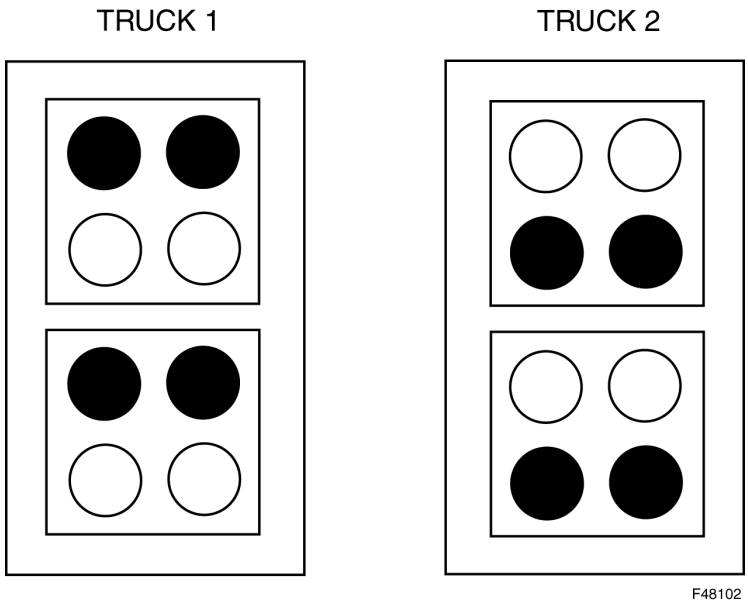


Figure 76 Variations Of Group 1 & Group 2 Positioning Examples

The purpose of maintaining the above practice for primary springs is to minimize truck height variation and carbody lean within a locomotive order. When unusual circumstances arise which prevent grouping as described above, the Engineering department should be contacted for review.

5.2.2 SECONDARY SPRING USAGE RULES

The secondary spring application on the DE30AC and DM30AC locomotives use an inner coil (10644458) and an outer coil spring (10630100) at each of 4 spring mounting locations per truck assembly. Note that while the outer coil springs (10630100) will be identified as "Group 1" or "Group 2", the inner coil springs do not carry grouping identification. Both of these springs are applied to the locomotive prior to trucking.

1. The desirable condition for assembly is to use 4 outer coil springs (10630100) from Group 2 at the #1 (F-end) truck, and 4 outer coil springs from Group 1 at the #2 (B-end) truck. Note that the inner coil springs (10644458) which is also used on both trucks does not carry grouping information.

2. In addition to the grouping requirement, the secondary springs have a requirement that the spring ends (tips) be oriented in a prescribed manner, to obtain correct curve negotiation performance. Figure 77 shows the correct secondary spring end orientation, as viewed from the top of truck, looking down.

When inventory conditions prohibit the spring grouping arrangement (described in #1 above), consult your EMD representative for instructions on how to proceed.

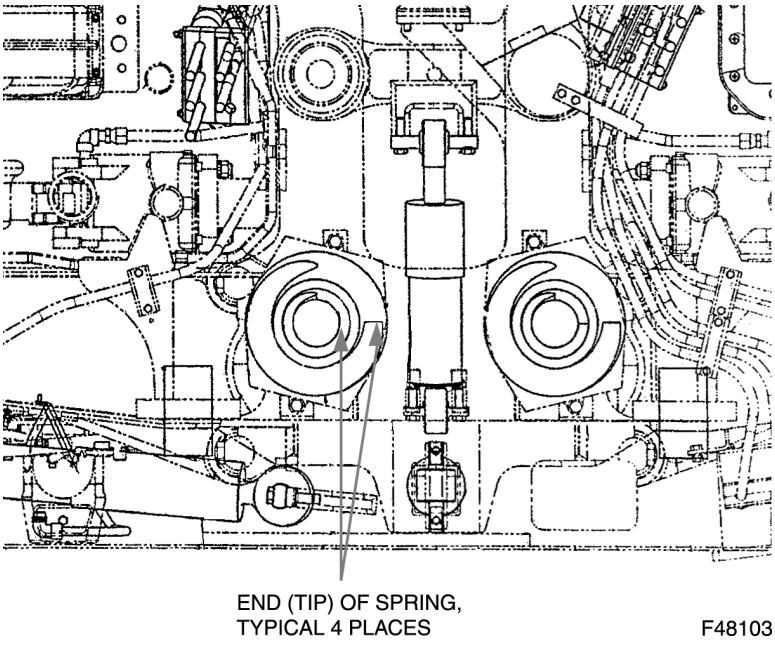


Figure 77 Spring Placement Showing Spring Tip Positioning

6.0 GROUNDING BRUSHES

6.1 PURPOSE

The DE30AC & DM30AC are equipped with FROST AB430 axle grounding brushes. This instruction details the mounting instructions for installing the Grounding Brush Asm, 10632187, to an axle.

Because of very tight assembly tolerances, it is necessary to apply the Ground Brush Assembly when the wheels of the locomotive are resting on the rail. If for any reason either the locomotive or the truck assembly is to be removed off of the rails, either due to lifting or due to operations over a drop table, it is necessary that all components of the Ground Brush Assembly be removed from the trucks, and then reapplied when the trucks are resting on the rails.

6.1.1 INSTALLATION

- Mount intermediate flange (Figure 78 - #95) to the axle journal bearing end cap with three 3/8-16 HS cap screws (p/n 426370) and special washer supplied with 10632187 (Figure 78 - #170 & #180). Prior to tightening cap screws, position the intermediate flange approximately in a concentric position relative to the opening in the bearing adapter front cover (it can be helpful to establish concentricity with the aid of feeler gages). Torque the cap screws to 37 ft.lb.

- Apply slip assembly (Figure 78 - #70) to the intermediate flange with one M10x30 screw and special washer supplied with 10632187 (Figure 78 - #200 & #210). Torque to 37 ft.lb. Note, the bolt location is designed to be off center.

- Partially disassemble housing by removing outer cover (Figure 78 - #20) secured with three M6x16 cap screws (Figure 78 - #110 & #115). Carefully pull back bow attached to coiled tape-spring (Figure 78 - #40) pressing down on brushes (Figure 78 - #30). Do not fully uncoil tape spring. The brushes should now be unloaded.

- Apply o-ring supplied with 10632187 (Figure 78 - #190).

- Apply housing, with unloaded brushes, onto the intermediate flange. Ensure the housing is oriented to suit the application of the grounding cables. See application drawing. Secure with four 3/8-16 bolts (p/n 40019578) (Figure 78 - #80) with washers (p/n 8373316) and torque to 44 ft.lb.

- Push brushes into place, and re-apply tape-spring.

- Apply the cover and torque the three M6x16 screws (Figure 78 - #110 & #115) to 8 ft.lb.

- Apply grounding cable with the M10x20 screw and spring disc (Figure 79 - #150 & #160) and torque to 22 ft.lb.

Assembly is now complete.

6.1.2 REMOVAL

- The process used to remove a grounding brush assembly is essentially the reverse of the installation process.

- Any sharp gouges found during disassembly to the intermediate flange (Figure 78 - #95) or to the housing can be repaired by light filing with emery cloth.

- Any dirt, debris, or dust from brush wear should be removed from the internal components of the grounding brush assembly using compressed air.

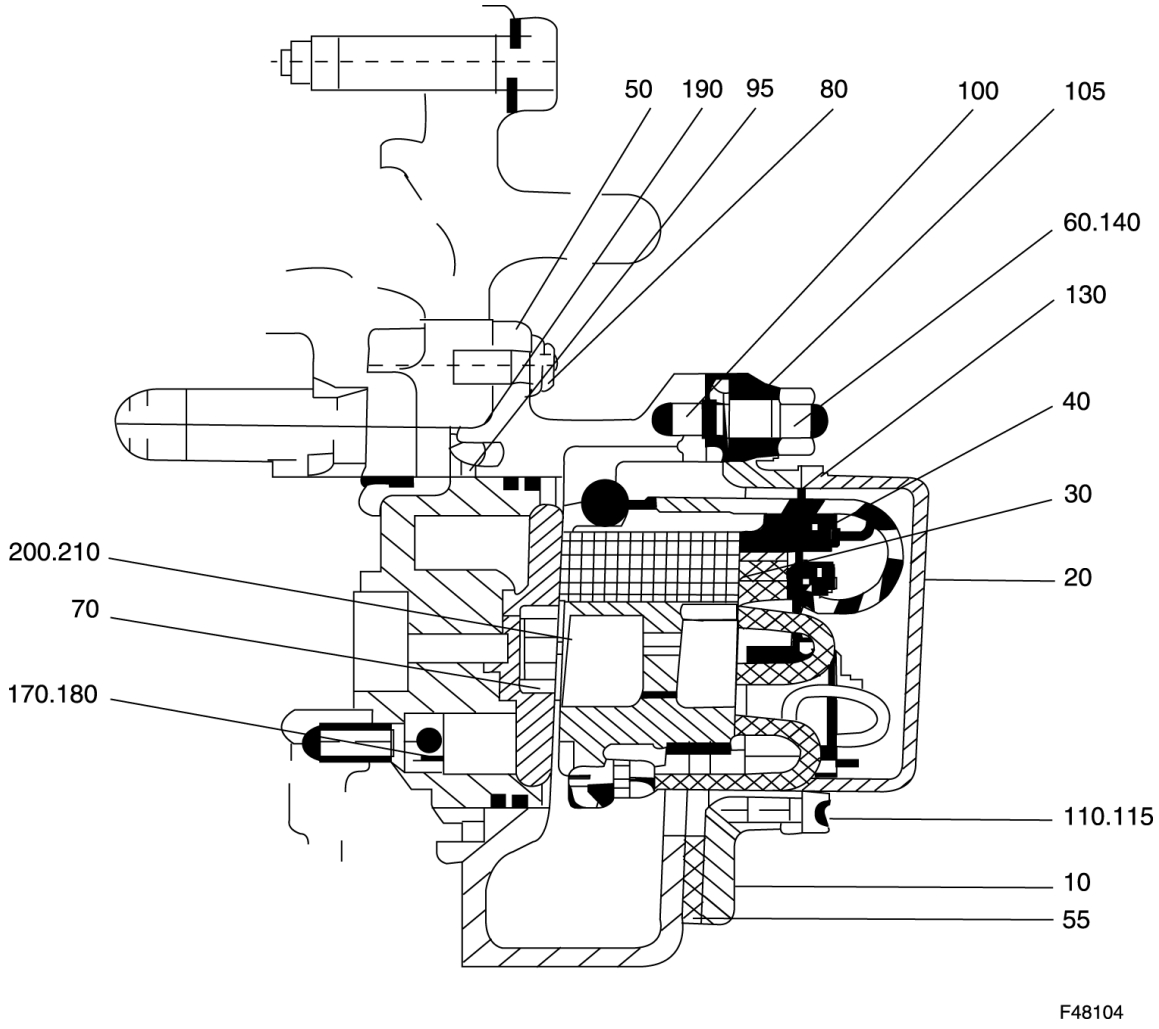


Figure 78 Journal Bearing Grounding Brush Assembly

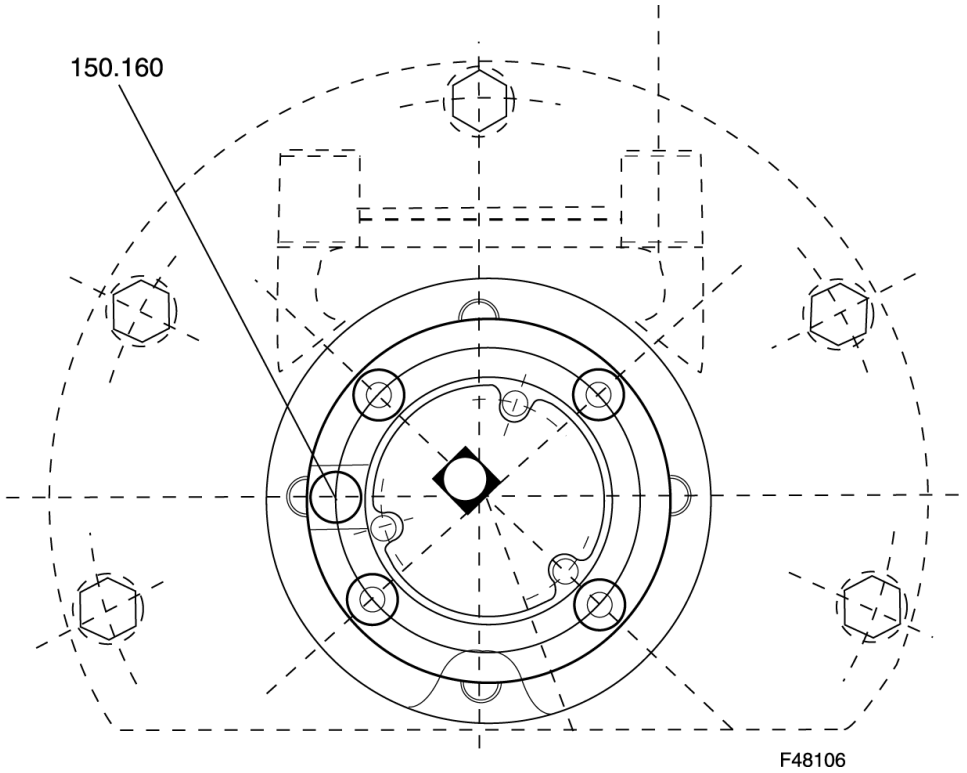


Figure 79 Journal Bearing Grounding Brush Assembly

7.0 TORQUES

1. Certain applications of threaded fasteners require that they be tightened to definite torque values. This instruction outlines the torque values that are to be used when specified.

2. These torque values are generally based on those found in the EMD Engineering Standards Book, Page B-2.051, for lubricated 280M bolts. This does not mean that bolts to be torqued are to be oiled. It does mean that the lubricated torque values used herein are more generally appropriate for our use than are the "dry" torque values since such things as the phosphate coating on some bolts, the wax thread coating on lock nuts, and residual cutting oil in tapped holes tend to give a bolt clamp load closer to the desired clamp load when using the so-called lubricated values. If for any reason a bolt is to be oiled before application, such will be called for on the application drawing along with the appropriate torque value.

3. The Quality Control Department is to establish the necessary audit procedures to ensure that bolts having specified installation torque values are properly tightened.

   a. When application drawings are marked thus 

, the torque values in Table 2 are to be used.

   b. When application drawings are marked thus 

, the torque values in Table 3 are to be used.

4. When the torque on a bolt is checked, it is to be checked in the tightening direction, noting the value when breakaway occurs. This value is then to be compared to the specified breakaway value.

NOTE

Since breakaway torque for a bolt used in a gasketed joint may be as low as 65% of installation torque, checking breakaway torque for such a bolt may not be an acceptable means of auditing that it had been applied at the correct installation value. Therefore, columns B and C of Table 2 do not apply to bolts used in gasketed joints.

5. The Tables are constructed as follows. For each size bolt the specified installation torque is shown in column A. Column B shows a breakaway value, which is usually but not always 15% above the installation torque. Surveys in the Locomotive Division have shown that the great majority of bolts properly torqued at installation will breakaway at some value between the Column A value (installation torque) and the Column B value.

6. Column C shows breakaway value usually but not always 30% above the installation value. If the bolt torque checks on breakaway above the Column C value, it has been overtightened. While the great majority of properly torqued bolts will breakaway between the Column A value (installation torque) and the Column B value, a very small percentage will be found to breakaway between the Column B value and the Column C value. **If a large percentage of bolts check near the Column C value, installation procedures should be reviewed as many are being overtightened.**

Table 2 Nominal, Breakaway & Maximum Breakaway Torque Values

Size – Threads/Inch	**A** Nominal Installation Torque	**B** Normal Breakaway Between This Value – See Paragraph 5.	**C** Max. Breakaway Value – See Paragraph 6.
#10-34	18 Inch Lbs.	21 Inch Lbs.	24 Inch Lbs.
#10-32	22 Inch Lbs.	25 Inch Lbs.	28 Inch Lbs.
¼-20	6 Ft. Lbs.	7 Ft. Lbs.	8 Ft. Lbs.
¼-28	7 Ft. Lbs.	8 Ft. Lbs.	9 Ft. Lbs.
5/16-18	13 Ft. Lbs.	15 Ft. Lbs.	17 Ft. Lbs.
5/16-24	15 Ft. Lbs.	17 Ft. Lbs.	19 Ft. Lbs.
3/8-16	24 Ft. Lbs.	28 Ft. Lbs.	31 Ft. Lbs.
3/8-24	27 Ft. Lbs.	31 Ft. Lbs.	35 Ft. Lbs.
7/16-14	38 Ft. Lbs.	44 Ft. Lbs.	50 Ft. Lbs.
7/16-20	42 Ft. Lbs.	48 Ft. Lbs.	55 Ft. Lbs.
½-13	58 Ft. Lbs.	67 Ft. Lbs.	75 Ft. Lbs.
!/2-20	65 Ft. Lbs.	75 Ft. Lbs.	85 Ft. Lbs.
9/16-12	84 Ft. Lbs.	96 Ft. Lbs.	110 Ft. Lbs.
9/16-18	93 Ft. Lbs.	107 Ft. Lbs.	120 Ft. Lbs.
5/8-11	115 Ft. Lbs.	132 Ft. Lbs.	150 Ft. Lbs.
5/8-18	130 Ft. Lbs.	150 Ft. Lbs.	170 Ft. Lbs.
¾-10	205 Ft. Lbs.	235 Ft. Lbs.	265 Ft. Lbs.
¾-16	230 Ft. Lbs.	265 Ft. Lbs.	300 Ft. Lbs.
7/8-9	305 Ft. Lbs.	350 Ft. Lbs.	395 Ft. Lbs.
7/8-14	335 Ft. Lbs.	385 Ft. Lbs.	435 Ft.Lbs.
1-8	455 Ft. Lbs.	525 Ft. Lbs.	590 Ft. Lbs.
1-14	510 Ft. Lbs.	585 Ft. Lbs.	665 Ft. Lbs.
1-1/8-7	610 Ft. Lbs.	700 Ft. Lbs.	800 Ft. Lbs.
1-1/14-7	860 Ft. Lbs.	990 Ft. Lbs.	1120 Ft. Lbs.
1-1/14-12	955 Ft. Lbs.	1100 Ft. Lbs.	1240 Ft. Lbs.
1-3/8-6	1130 Ft. Lbs.	1300 Ft. Lbs.	1470 Ft. Lbs.
1-3/8-12	1290 Ft. Lbs.	1485 Ft. Lbs.	1675 Ft. Lbs.
1-1/2-6	1500 Ft. Lbs.	1725 Ft. Lbs.	1950 Ft. Lbs.
1-1/2-12	1690 Ft. Lbs.	1950 Ft. Lbs.	2200 Ft. Lbs.
1-3/4-5	2370 Ft. Lbs.	2725 Ft. Lbs.	3075 Ft. Lbs.
2-1/2-4	3550 Ft. Lbs.	4100 Ft. Lbs.	4600 Ft. Lbs.

Table 3 Nominal, Breakaway & Maximum Breakaway Torque Values

Application And Bolt Size		A Nominal Installation Torque	B Normal Breakaway Between This Value And Column A Value– See Paragraph 5.	C Max. Breakaway Value – See Paragraph 6
¼-28	Clamp between exhaust manifolds	70 Inch Lbs.	80 Inch Lbs.	90 Inch Lbs.
½-13	Step Thread Sq. Hd. Bolts	30 Ft. Lbs.	35 Ft. Lbs.	39 Ft, Lbs.
½-20	Sheave Retaining Bolt-Switcher Fan Drive	90 Ft. Lbs.	103 Ft. Lbs.	117 Ft. Lbs.
9/16-18	Aux. Gen. Drive rubber coupling bolts.	100 Ft. Lbs.	110 Ft. Lbs.	120 Ft. Lbs.
	"EMD" Coupling to Drive Shaft at engine end and compressor end	100 Ft. Lbs.	110 Ft. Lbs.	120 Ft. Lbs.
5/8-11	Hub to Aux. Gen. Shaft	90 Ft. Lbs.	105 Ft. Lbs	120 Ft. Lbs.
5/8-11	Alternator Rotor to Gear box	165 Ft. Lbs.	185 Ft. Lbs.	210 Ft. Lbs.
¾-10	Compressor mounting	165 Ft. Lbs,	190 Ft. Lbs,	215 Ft. Lbs.
	Gear Box Drive Flange	375 Ft. Lbs.	430 Ft. Lbs.	487 Ft. Lbs.
	Aux. Gen. Mounting	290 Ft. Lbs.	335 Ft. Lbs.	380 Ft. Lbs.
2/4-16	Engine – Gen. Coupling	295 Ft. Lbs.	325 Ft. Lbs.	350 Ft. Lbs.
	Speed increaser fan drive rubber coupling bolts	230 Ft. Lbs.	265 Ft. Lbs.	300 Ft. Lbs.
	Gen. Dr. Cplg. To Shaft	380 Ft. Lbs.	437 Ft. Lbs.	494 Ft. Lbs.
7/8-14	Fan drive gear box mounting	335 Ft. Lbs.	385 Ft. Lbs.	435 Ft. Lbs.
-8x2 ½ 1g	Engine Mtg. Bolts	445 Ft. Lbs.	525 Ft. Lbs.	590 Ft. Lbs.
-8x4 ½ 1g	Engine Mtg. Bolts	650 Ft. Lbs.	750 Ft. Lbs.	850 Ft. Lbs.

Application And Bolt Size		A Nominal Installation Torque	B Normal Breakaway Between This Value And Column A Value– See Paragraph 5.	C Max. Breakaway Value – See Paragraph 6
-8	Eyebolt – Long Hood	200 Ft. Lbs.	230 Ft. Lbs.	260 Ft. Lbs.
1-14	Oil rig generator gears to drive flange	400 Ft. Lbs.	460 Ft. Lbs.	520 Ft. Lbs.
1-1/18-12	Oil rig adapter to main gear support	500 Ft. Lbs.	575 Ft. Lbs.	650 Ft. Lbs.
1-1/4-7	Main generator mounting	800 Ft. Lbs.	925 Ft. Lbs.	1050 Ft. Lbs.
2-8	Compressor Flywheel nut	500 Ft. Lbs.	575 Ft. Lbs.	650 Ft. Lbs.
	Gear Box Compr. Cplg. Nut	500 Ft. Lbs.	575 Ft. Lbs.	650 Ft. Lbs.

NOTE

Tighten set screw (14 Ft. Lbs.) but do not stake.

7. Where this instruction is to be used as part of the specification of an assembly, reference to the instruction will be made as an "X" quantity in the Bill of Material. The specific fasteners to which torque wrench tightening is to be applied will be indicated by a symbol or on the assembly drawing.

   Also a note will appear on the face of the drawing as follows:

   "All fasteners signaled thus  and/or  are to be tightened per engineering specification."

8. There are some application drawings which carry torque notes and specific torque values and which do not refer to this specification. These cases are usually because higher strength 300M bolts have been specified on the drawing and this instruction covers the more common 280M bolt. The establishment of practical breakaway values for checking these higher strength bolt applications should be done as follows:

   Case 1

   300 M bolt with specified installation torque same as lubricated value.

   Example: 3/4-10 with installation torque of 290 Ft. Lbs. Add 15 percent for normal breakaway value and use 335 Ft. Lbs. Add 30 percent for maximum breakaway value and use 380 Ft. Lbs.

   Case 2

   300 M bolt with specified installation torque below lubricated value.

   Example: 3/4-10 with installation torque of 225 Ft. Lbs. Add 15 percent for normal breakaway and use 260 Ft. Lbs. Add 30 percent for maximum breakaway and use 290 Ft. Lbs.

   Case 3

   300M bolt with specified installation torque above lubricated value.

   Example: 3/4-10 with installation torque of 320 Ft. Lbs. Use same maximum breakaway value as for Case 1 -- i.e., 380 Ft. Lbs. (30 percent above page B-2.051 value). Use mean between 320 and 380 or 350 Ft. Lbs. for normal breakaway value. This then is the only 9-1/2 percent above the installation value instead of the usual 15 percent.

9. Torque Values

   Models AR10, A20, D32 or variations thereof using bolt 272572 (1 1/2-6) for generator mounting hold down.

   Production torque value = 1500 Ft. Lbs. (nominal wrench setting) using Texaco threadtex lubricant #2303 (8307731) on threads, washer and washer face of bolt. Inspection limit 1350 to 1650 # ft.

8.0 RUBBER BUSHINGS

8.1 INTRODUCTION

The purpose of this instruction is to provide installation instructions for applying rubber bushing 40077424 into link assembly 40077422, and into bracket assemblies 40077408 & 40077409. Link Assembly 40077422 uses 2 rubber bushings per assembly, with each bushing on a separate axis. Bracket Assemblies 40077408 & 40077409 both use 2 rubber bushings per assembly, with both bushings on the same axis. The installation instructions for applying the rubber bushings is nearly the same for both assembly types, requiring the use of a driving bolt, a funnel, and a rubber emulsion lubricant.

8.1.1 TOOLS REQUIRED FOR BUSHING INSTALLATION

Figures Figure 80 & Figure 81 (attached) show a suggested design for a driving bolt and funnel to be used in the installation of the rubber bushings. Note that both the driving bolt and funnel are designed with sufficient length to apply 2 rubber bushings on the same shaft, as is required when installing the bushings into bracket assemblies 40077408 & 40077409). These tools may also be used when installing the single bushings onto link assembly 40077422.

In addition to the driving bolt and funnel, a press with sufficient clearance to support the bracket assemblies during the bushing installation and to pass the driving bolt will be needed to drive in the bushings

8.1.2 INSTALLATION INSTRUCTIONS

1. Insure that the work piece that the bushings will be fitted into is free of burrs, cuts and gauges in the socket area.

2. Lightly lubricate the socket in the link or bracket assemblies, the funnel, and the outside diameter of the rubber bushing (40077424 ref.) with lubricant 40081776.

3. Position the funnel onto the bracket or link assembly, using the alignment holes in the assemblies.

4. Loosely apply lubricated bushing(s) into the funnel. If 2 bushings are being installed on the same axis (ref. bracket assemblies 40077408 & 40077409) both bushings should be pressed on at the same time. Insert the driving bolt into the collar of the rubber bushing(s).

5. With the bushings, driving bolt, funnel, and work piece all properly supported and aligned, gently apply pressure to the driving bolt with the press to seat the bushing(s) into the socket of the work piece. When properly seated, the steel collar of the rubber bushing assembly should overhang the surface of the work piece by approximately 0.06" on both sides of the work piece.

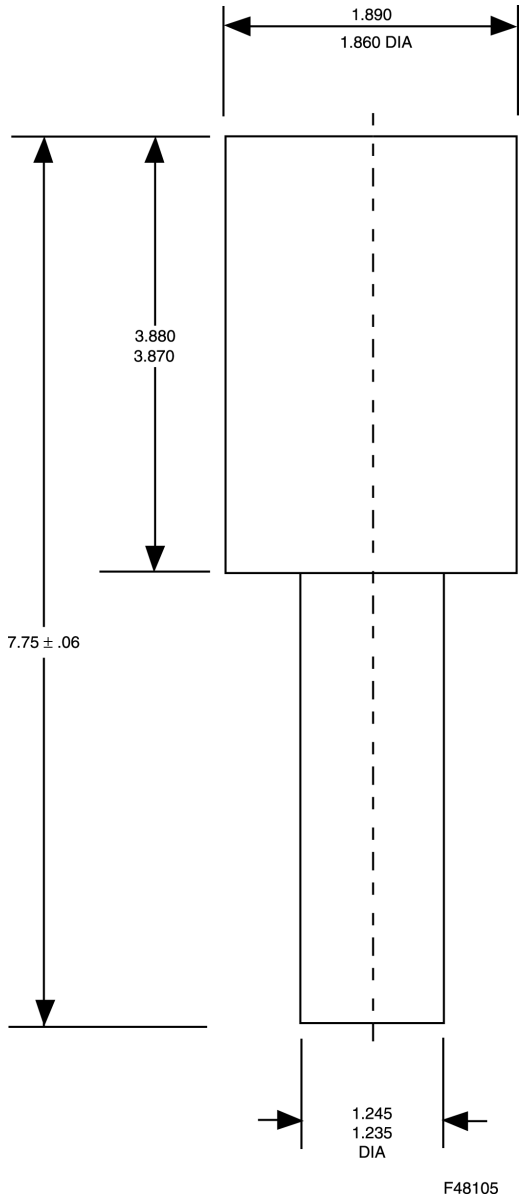


Figure 80 Suggested Drive Bolt Design

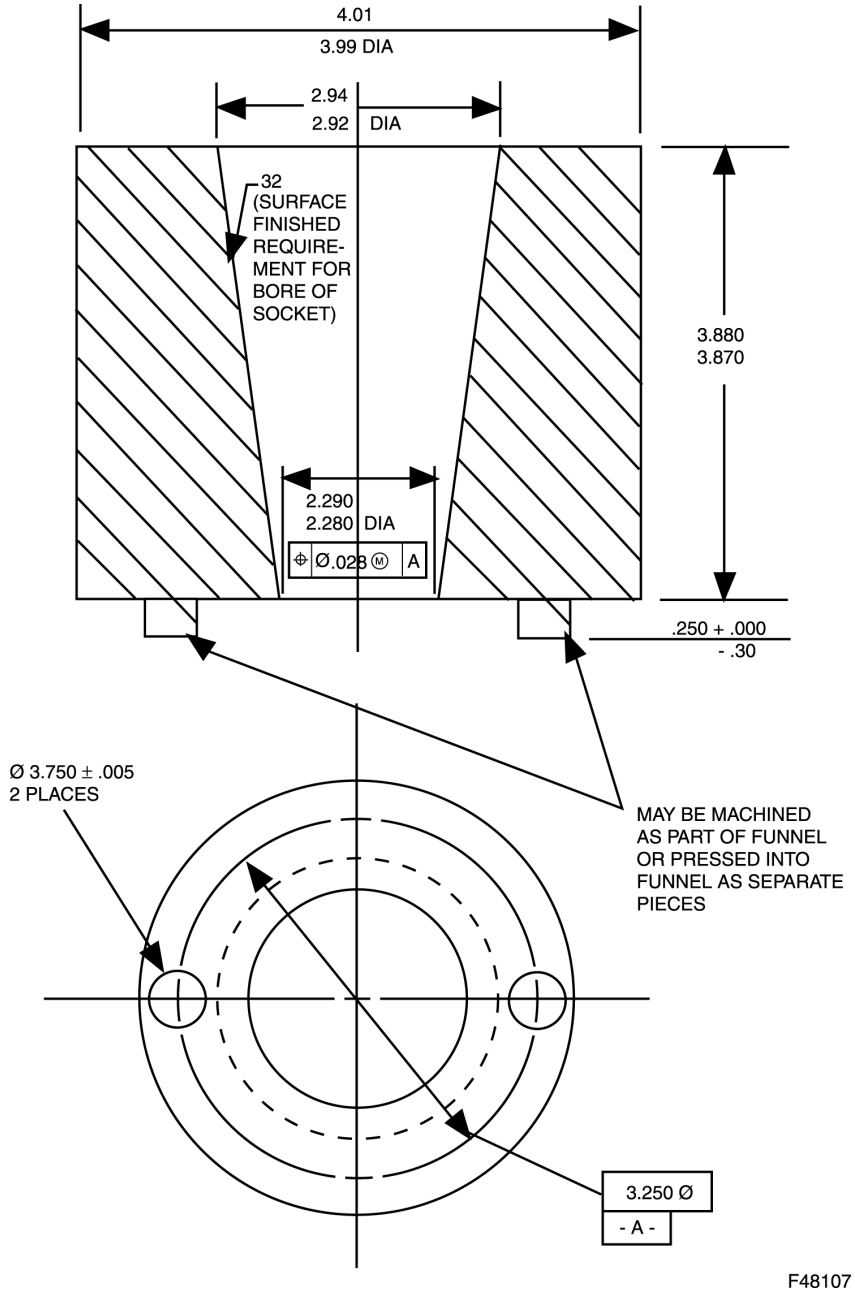


Figure 81 Suggested Funnel Design

9.0 THIRD RAIL ASSEMBLY

9.1 INTRODUCTION

The purpose of this instruction is to provide installation instructions for assembly and application of the 3rd Rail Shoe Beam (ref. 40077425) to the Truck Assemblies of the DM30AC (ref. 10635291 & 10635292). There are 6 major steps of assembly, each which in general should be completed before starting the next step. It is suggested that the sub assembly steps be performed in the order presented in this instruction although this is not a requirement.

Note that there are many bracket designs that have left and right hand versions. To avoid confusion, the installation instructions will refer to item and part number references for the beam shown in view A-A of drawing 40077425. Once the beam installation on this side of the truck is understood, the procedure of installation for the opposite hand side will be also be clear.

9.1.1 INSTALLATION INSTRUCTIONS

9.1.1.1 STEP 1 - ASSEMBLY OF BEAM AND PLATE BRACKETS

This step involves subassembly of the wooden shoe beam to 4 plate brackets bolting to the beam ends, along with a spacer that is used at 1 beam end, adjacent to 1 plate bracket. The beam, spacer, and plate brackets are bolted together using 7/8-9 bolts, nuts, and flatwashers. Although not mandatory at this stage, it is also recommended that a bracket assembly used during the cabling application also be applied at this time.

- Orient the beam 40075794 (it. 3) with the 2 pick up shoe holes toward the top, biased on the right side of the beam, as shown in View A-A.

- Insert 4 bolts 9429919 (it 26) into plate 40078506 (it.19) and spacer 40082525, and then insert into the 4 bolt holes on the right side of the beam (it. 3), with the bolt heads against plate (it.19), as in section D-D. Note that to maximize the gap distance to the 3rd rail, the headed sides of the bolts used on the shoe beam brackets are all outboard. Make sure plate (it.19) is configured with the 1 1/4" hole toward the bottom of the beam (it. 3) as shown in View A-A.

- As shown in section D-D, apply spacer 40081219 (it. 16), plate assembly 40081216 (it. 15), 4 flatwashers 131018 (it. 37), and locknuts 9416543 (it. 31), to the inboard side of the beam. Tighten the bolts (it. 26) and nuts (it.31) in sequence (i.e., 12 o'clock, 6 o'clock, 9 o'clock, 3 o'clock); first to 200 ft-lbs (dry), then to 310 ft-lbs.(dry).

- Going to the opposite end of the beam (it. 3), insert 4 bolts (it. 26) into plate assembly 40080390 (it. 21) and spacer 40082525, and then insert into the 4 bolt holes on the left. (An optional step at this point would be to install bracket assembly 40081700 (it. 35 of 40078514) to 2 of the bolts, as shown in 40078514). Note that the 1 1/4" hole at the end of plate assembly (it. 21) should be oriented downward.

- Apply plate assembly 40081211 (it. 18), 4 flatwashers 131018 (it. 37), and locknuts 9416543 (it. 31), to the inboard side of the beam, as shown in the lower isometric view. Tighten the bolts (it. 26) and nuts (it.31) in sequence (i.e., 12 o'clock, 6 o'clock, 9 o'clock, 3 o'clock); first to 200 ft-lbs (dry), then to 310 ft-lbs.(dry). Note that it. 18 has a bushing pressed into it, and the bushing should be oriented with the longer protrusion towards it. 21, as shown in section C-C.

- In the case of the opposite side shoe beam, the assembly is very similar. Refer to isometric views of 40077425. At the beam end that will be mounted to the axle (end nearest to the 3rd rail pick up shoe), all of the parts are identical to the other beam assembly. Remember to configure the assembly with spacer 40081219 (it. 16) on the inboard (truck frame) side of the beam, and tighten the bolts in the manner prescribed previously. On the other end of the beam assembly, note that plate assembly 40081215 (it. 14) is used in place of it. 18, and plate assembly 40081210 (it. 17) is used in place of it. 21. (The optional installation of bracket 40081702 (it. 36 of 40078514) can be performed at this end of the beam as well). Again note that all headed ends of the bolts should be on the 3rd rail side of the beam. Again note that the 1 1/4" diameter holes in the plate bracket should be oriented towards the bottom of the beam.

At this stage, the beam sub- assembly is complete.

9.1.1.2 STEP 2 - ASSEMBLY OF PICK UP SHOE AND HANGAR

This subassembly is identical for both shoe beams on a truck.

- With bracket 40076118 (it. 2) clamped in a vise, put 2 shoe pins 40075796 (it. 5) into the bushings of it. 2, with the pin tips extended inward approximately 2".

- Refer to view A-A. Pass spring 40075798 (it. 7) over the shoe pin on the side of it. 2 as shown in view A-A. Note that one end of the spring bears against bracket 40076118, and the other against the 3rd rail shoe 40076117 (it. 1) after the spring is compressed. Do not attempt to compress the spring at this point. Next, pass spring 40075799 (it. 8) on the other pin, per view A-A. Note that items 7 and 8 are wound in opposite directions, must be installed in the positions shown in view A-A, and cannot be interchanged.

- Using 3rd rail shoe 40075798 (it. 1) and a screwdriver as a lever, compress spring 40075799 (it. 8) until you can fully insert the pin (it. 5) from the bushing of bracket 40076118 (it. 2) into 3rd rail shoe 40076117 (it. 1). Repeat the above process with spring 40075798 (it. 8). When both springs are compressed and pinned, drive out 1 of the pins using the other pin as a dowel. Insert cotter pin 119199 (it. 22) to the end of shoe pin 40075796 (it. 5).

At this stage, the pick up shoe and hangar subassembly is complete.

9.1.1.3 STEP 3 - APPLICATION OF AXLE END BRACKETS TO TRUCK ASSEMBLY

Axle end brackets 40077408 (it. 10) and 40077409 (it. 11) are left and right hand assemblies having the same design. These two assemblies mount to the bearing adapter caps and covers in an identical manner. Note that these brackets are mounted at the axle locations nearest to the yaw damper brackets on the DM truck frames. Also note that the 1 1/4" pin center for these brackets is always mounted slightly inboard (longitudinally) of the axle centerline.

- Using 5/8" bolts 271727 & 271731 (its. 24 & 25), flatwashers 131016 (it. 38) and lock caps 10631905 (it. 23), install bracket assemblies 40077408 & 40077409, as shown in view A-A and in the isometric views. Tighten all bolts to 150 ft. lbs. (dry).

9.1.1.4 STEP 4 - APPLICATION OF LINK END BRACKETS AND LINK TO TRUCK ASSEMBLY

Link end brackets 40081217 (it. 12) and 40081218 (it. 13) are left and right hand assemblies having the same basic design. These 2 assemblies mount to the bottom surface of the truck frame traction box, using 5/8" -11 bolts, and also to 2 of the axle traction rod mountings, using 1" -12 bolts. Also note that these brackets are installed on the side of the traction box opposite that where the axle end brackets (its. 10 & 11) are installed. The link end brackets can be applied when the wheelsets are installed onto the truck assembly, if desired.

- Position link end bracket assembly 40081217 (it. 12) against the traction box, as shown in the isometric views and view A-A.

- Apply the bracket to the traction box using 1" bolts 40081267 (it. 27), 5/8" bolts 271727 (it. 24), flatwashers 131016 (it. 38), and lock caps. At this stage, make sure all the bolts are snug but not tightened.

- After confirming that bracket 40081217 is in contact with all 4 bolting surfaces, tighten the 5/8" bolts to 150 ft-lbs (dry).

- After tightening both 5/8" bolts to 150 ft-lbs., tighten the 1" traction rod bolts to 544 ft lbs, lubricated in the same manner as for all other traction rod bolts.

- Install link assembly 40077422 (it. 20) to the link assembly bracket, using hardened washers 40081208 (it. 39), a 1 1/4" bolt 9429818 (it. 28), and a locknut 9421269 (it. 33). Apply a light lubricant to the 1 1/4" bolt threads prior to installing the locknut (motor oil, threadtex, or similar lubricant). Do not tighten any hardware at this stage - only apply the nut, bolt and washers loosely at this time. Note that the hardened washers (it. 39) are applied only at 2 locations per bolt on this application, as shown in section C-C.

Note that at the bolted connection of the link to the link end bracket there will be a gap between assembly parts. There is a steel bushing pressed into the link end bracket, which will move when the 1 1/4" bolt is tightened to close this gap. A similar assembly gap will exist during the initial assembly at all of the 1 1/4" diameter bolted connections. This gap will be taken up when the 1 1/4" bolts are tightened. The 1 1/4" bolt should not be tightened at this point.

9.1.1.5 STEP 5 - INSTALLATION OF BEAM SUBASSEMBLY ONTO TRUCK ASSEMBLY

This step is identical for both shoe beams.

- Loosely position the safety hangar 40081658 (it. 40) onto the beam, as access to do this may be difficult after the beam subassembly is installed onto the truck.

- Position the beam subassembly beneath the link and axle end brackets, as shown in view A-A Carefully lift the beam into the proper position.

- At the link end, attach the beam subassembly to the link, using spacer 40082526, hardened washers 40081208 (it. 39), a 1 1/4" bolt 40087058 and a locknut 9421269 (it. 33). Apply a light lubricant to the 1 1/4" bolt threads prior to installing the locknut (motor oil, threadtex, or similar lubricant). Do not tighten any hardware at this stage - only apply the nut, bolt and washers loosely at this time. The hardened washers (it. 39) are applied only at 2 locations per bolt on this application, as shown in section C-C. Note that the bolting configuration is identical at both the upper and lower link attachments, per section C-C.

- At the axle end, attach the beam subassembly to the axle bracket as in section E-E, using spacer 40082526, one hardened washer 40081208 (it. 39), 1 1/4" bolt 40087058 and locknut 9421269 (it. 33). Apply a light lubricant to the 1 1/4" bolt threads prior to installing the locknut (motor oil, threadtex, or similar lubricant). Do not tighten any hardware at this stage - only apply the nut, bolt and washers loosely at this time. The axle end beam attachment uses only 1 hardened washer.

9.1.1.6 STEP 6 - FINAL ASSEMBLY

This step is identical for both shoe beams.

- Tighten the 1 1/4" nuts and bolts at the link end (2 bolts, it. 28) and at the axle end (1 bolt, it. 29). Final torque for these 3 bolts is 860 ft.-lbs. lubricated. First tighten the upper link bolt to its indicated torque (it. 28). Next tighten the axle end bolt (it. 29). Finally, tighten the lower link bolt (it. 28).

- Apply the safety hangar 40081658 (it. 40) to the truck frame, using 5/8" bolts 271724 (it. 41) and nuts 9416539 (it. 30). The safety hangar should be approximately centered about the beam so there is uniform clearance between the beam and safety hangar on both sides. Tighten the 5/8" bolts to 150 ft.-lbs. (dry).

- Insert 2 square headed bolts 40075800 (it. 9) into the contact shoe strap 40075797 (it. 6) in the manner shown in the upper isometric view. Insert the 2 bolts into the shoe beam from the inboard side, so that the contact shoe strap (it.6) bears against the inboard beam surface, and the threads of the bolt protrude outboard from the beam subassembly. Refer to section B-B.

- Fit the adjusting plate 40075795 (it. 4) over the outboard notches of the wooden shoe beam and over the threaded ends of the 2 protruding square headed bolts (it. 9).

- Apply the pick up shoe sub-assembly (step 2 above) over the adjusting plate (it. 4), and clamp the pick up shoe sub-assembly in place using locknuts 9416545 (it. 32), lockwasher 131048 (it. 35), and flat washer 131019 (it. 34). Tighten these bolts and nuts in sequence; first to 175 ft-lbs. (dry); and finally to 350 ft.lbs. (dry).

At this point, the shoe beam application is completed.

10.0 PICKUP SHOE PROXIMITY SETTING

10.1 INTRODUCTION

The DM30AC locomotive has a provision to operate in Electric (E) Mode, whereby the engine is shut down and power is collected from a 3rd rail, using a pick up shoe for the purposes of power collection. Correct operation of the 3rd rail power apparatus requires that proper settings be made to the 3rd rail pick up shoe hangar (p.n. 40076118, item of 40077425), the 3rd rail pickup shoe (p.n. 40076117, item of 40077425), and to the proximity sensor probe (pn. 40077652, an item of 40078815). The purpose of this instruction is to present the correct process to set and gage these components. Proper setting of these items is essential for optimum DM30AC locomotive operation in gaps, as well as to obtain proper shoe contact and tracking to the 3rd rail.

To aid in the application of these components, it is recommended that the reference drawings and the drawings listed in specifications be available.

10.1.1 ADJUSTMENT & GAUGING PROCESS

(All of the following adjustments should be performed with the locomotive on level, tangent track, with rail-wheel flange clearances all uniform, not in proximity to a 3rd rail. It is recommended that the 3rd rail truck equipment application (40077425) be completely fitted to the trucks before beginning these adjustments.)

The process of gauging the 3rd rail pickup shoe and proximity probe involves 3 major steps, which must be performed in following sequence:

10.1.1.1 STEP 1 - ADJUST THE HEIGHT OF THE HANGAR BRACKET 40076118

The first step is to set the height of the 3rd rail pickup shoe hangar, referencing this height off of the running rail. (To accurately perform this step, it is recommended that a height adjustment gage be manufactured, as shown in Figures 1 & 2. This gage should be designed to rest on 2 running rails, with offsets accurately placed at 2.938" and 2.500" from the surfaces in contact with the running rails.)

The height of the hangar is adjusted by loosening self locking nuts 9416545 (it. 32 of 40077425; see section B-B or Isometric View), and then moving the serrated teeth of the hangar up or down relative to the teeth of adjusting plate 40075795 (it. 4 of 40077425). Refer to Figure 1. Note that the pitch of these serrated teeth is 3/8", and since the height tolerance for setting the hangar off the running rail is +/-.187, the process followed in making this adjustment is to set the hangar as near as possible to 3.125 off the running rail, without going below the 2.938 dimension.

10.1.1.2 STEP 2 - SET THE PICK UP SHOE (40076117) TOE HEIGHT

The second step is to accurately set the toe height of the 3rd rail pick up shoe, again referencing this height off the running rail, and using the gage shown in Figures 1 & 2. . For optimal shoe wear and electrical contact performance, it is required that this height be set as close as possible to 2.500" above the running rail height. (Setting the height lower than 2.500" risks damaging the pick up shoes at ramps in the 3rd rail leading to and exiting the gapped sections; setting this height greater than 2.500" will worsen the 3rd rail tracking/contact performance, especially when the shoes are worn.) Note this step should be done with the contact shoe springs 40075798 & 40075799 disengaged (its. 7 & 8 of 40077425). The tolerance on the 2.500" contact shoe toe height is +.032"/.000".

Coat adjusting screw threads 40085120 with lubricant 40079485.

Refer to the elevation view on drawing 40078815. With the toe height gage positioned as shown in Figure 2, turn the adjusting screw 40085120 (it. 1 of 40078815) clockwise or counterclockwise as required to obtain the required 2.500" shoe toe height. Once this height is obtained, lock the adjusting screw into place with locknut 40078959 (it. 17 of 40078815). Take care not to cause the adjusting screw to move when locking the plug with the locknut, as this will change the toe height setting.

Prior to moving on to the next step, reapply the contact shoe springs 40075798 & 40075799 (ref. 40077425).

10.1.1.3 STEP 3 - ADJUST THE PROXIMITY SENSOR GAP

Prior to performing this final step, it is required that a subassembly be made,.as shown in 40085128. Insert the proximity sensor of 40078814 thru the locking bushing 40085122 (it. 3 of 40085128). Apply the bushing jam nut 40085121 (it. 4 of 40085128) onto the locking bushing as shown on 40085128. Next, thread 2 proximity pick up nuts 40083802 onto the proximity sensor probes 40077652 (it. 1 of 40078814). The 2-proximity pick up nuts should be threaded so that the probe protrudes 0.196" beyond the shoulder of the inboard nut when locked in place, as shown in 40085128. This 0.196" dimension should be accurately set using a dial indicator. This protrusion is then held and maintained by using the other nut as a locking device. Torque to lock the proximity pick up nuts with the proper protrusion is 11 ft.-lbs. Note that excessive torque will damage the proximity sensor.

Insert the adjusted assembly 40085128 into the adjusting screw, making certain that the shoulder of the proximity pickup nut seats against the shoulder of adjusting screw 40085120, as shown in Section C-C of 40078815. With the proximity probe properly seated, lock the probe in place by tightening the locking bushing 40085122. Use 2 wrenches for this operation - one on the head of the adjusting screw 40085120, and another on the head of the locking bushing 40085122. Use care not to move the adjusting screw 40085120, as this will change the shoe toe height. After the locking bushing is tightened against the adjusting screw, tighten the bushing jam nut 40085121 (again use 2 wrenches; one on adjusting screw 40085120, and the other on nut 40085121).

10.1.2 COMPLETING THE PROXIMITY SENSOR APPLICATION

The proximity sensor application may now be completed by clamping the cable from the proximity sensor cable to the truck frame and to the shoe hanger, as shown in 40078815. The proximity sensor cover assemblies 40085169 may also be installed at this time.

The cable of the proximity sensor assembly is attached to a connection on the locomotive carbody, using strain relief elbow 8224088 (it. 5 of 40078815) and locknut 8038585 (it. 16 of 40078815).

The proximity sensor cable is attached to the truck frame, using clamp 8168450 (it. 2 of 40078815) and 1/4-20 screw 9419646 (it. 12 of 40078815). To attach these parts to the truck frame, it will be necessary to drill a .228" diameter hole into the sidewall of the truck frame. Prior to drilling this hole, the cable should be attached to both the carbody and to the covers down at the 3rd rail pick up shoes. The hole should not be drilled either close to the top or the bottom of the truck sideframe section. Refer to elevation view of 40078815 for an appropriate clamp location.

Prior to clamping the proximity sensor cable to the truck frame, being certain to provide sufficient slack to accommodate truck rotation as well as lesser amount to accommodate primary suspension movement.

In a similar manner attach the proximity sensor cable to the shoe hangar, again using clamp 8168450 and screw 9419646.

Install the proximity sensor covers 40085169. Be certain the proximity sensor cable slack does not rub against the shoe hangar or guard. As additional protection against cable contact, silicone rubber tubing may be applied over the sensor cable, as shown on 40078814.

The cable of the proximity sensor assembly is attached to a connection on the locomotive carbody, using strain relief elbow 8224088 (it. 5 of 40078815) and locknut 8038585 (it. 16 of 40078815).

The proximity sensor cable is attached to the truck frame, using clamp 8168450 (it. 2 of 40078815) and 1/4-20 screw 9419646 (it. 12 of 40078815). To attach these parts to the truck frame, it will be necessary to drill a .228" diameter hole into the sidewall of the truck frame. Prior to drilling this hole, the cable should be attached to both the carbody and to the covers down at the 3rd rail pick up shoes. The hole should not be drilled either close to the top or the bottom of the truck sideframe section. Refer to elevation view of 40078815 for an appropriate clamp location.

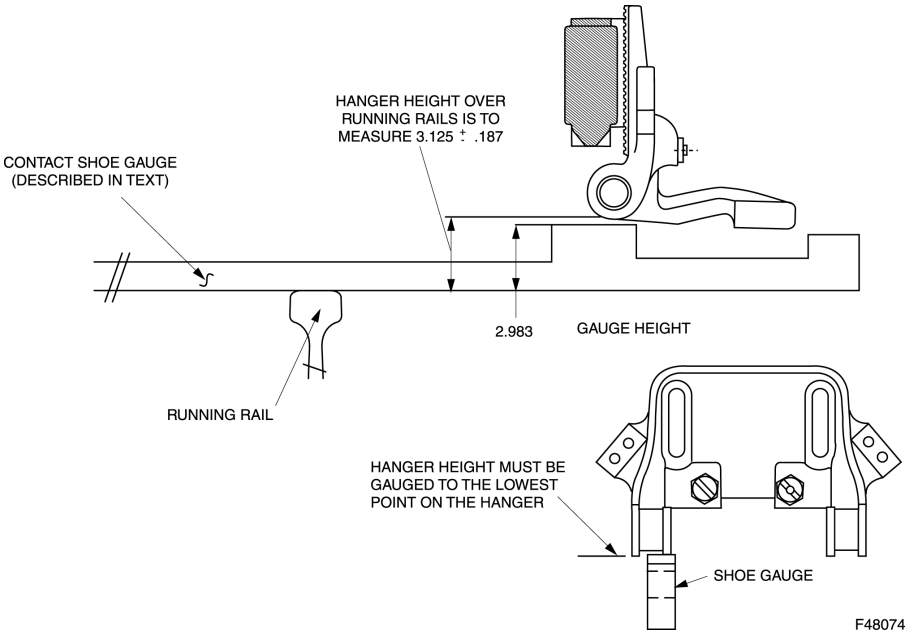


Figure 82 Gauging Hangar Height

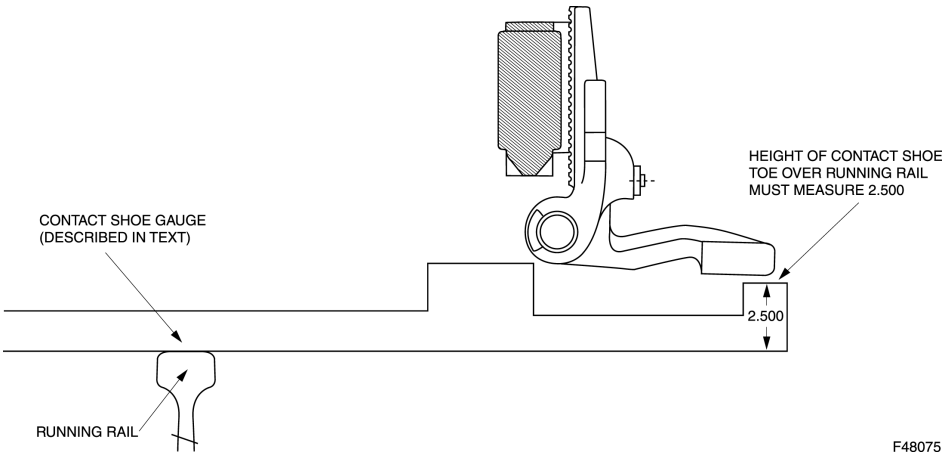


Figure 83 Gauging Shoe Height

11.0 SERVICE DATA - TRUCK ASSEMBLY

11.1 REFERENCES

11.1.1 MAINTENANCE INSTRUCTIONS

Coil, Elliptic, and Rubber Truck Spring, Qualification and Replacement ..... M.I. 1512
Wheels, Axles, Axle Gears and Pinions ..... M.I. 1519
Grease Lubricated, Cartridge-Type Journal Bearings ..... M.I. 1553
Lubricant Specifications ..... M.I. 1756
AC Traction Motor Maintenance ITB2624-ØTAØ2 ..... M.I. 3911
Traction Motor Roller Support Bearing ..... M.I. 3912
Disc, Tread, and Parking Brake ..... M.I. 1578

11.1.2 TYPICAL PARTS CATALOGUES

DE/DM30AC 623

11.1.3 DRAWING NUMBERS

Truck Assembly #1 (DM30AC) 10635291
Truck Assembly # 2 (DM30AC) 10635292
Truck Assembly # 1 (DE30AC) 10630165
Truck Assembly # 2 (DE30AC) 10630166
Truck Application (DM30AC) 40079211
Truck Application (DE30AC) 10632420
Third Rail Truck Equipment Application (DM30AC) 40077425
Truck # 1 Cable Fuse Box Application (DM30AC) 40078513
Truck # 2 Cable Fuse Box Application (DM30AC) 40078514
Third Rail Guard Application 40088577
Proximity Pickup Assembly (DM30AC) 40085128
Proximity Sensor Application (DM30AC) 40078815
Proximity Sensor Assembly (DM30AC) 40078814

11.1.4 OTHER REFERENCES

"Wheel and Axle Manual" - Association of American Railroads (AAR)

11.2 WEIGHTS

11.2.1 COMPONENT WEIGHTS

11.2.2 WEIGHT SUMMARY

WEIGHT SUMMARY

	#1 Truck	#2 Truck	Per Loco
Truck Asm (-)qty. 2 combos	*12849*	*12342*	*25191*
Qty. 1 T/M/Wheelset	*11128*	*11128*	*44512*
Total Truck Asm	*35105*	*34598*	*138394*
Truck Apl	*1601*	*1601*	*3201*
GRAND TOTAL =	*36706*	*36199*	*72905*

11.2.3 TRUCK ASM #1

TRUCK ASM #1

DESCRIPTION	it	GM p/n	QTY	Weight(lb)	TOTAL
Truck Asm	0	10630165			*35105.11*
Truck Frame Asm	1	10631263	1	*6602.78*	*6602.78*
Traction Motor Mtg	2	40065490	2	*11128.11*	*22256.22*
Brg Adptr Body-Mach	3	10630890	4	*330.69*	*1322.76*
Brg Adptr Cap-Mach	4	10630891	4	*34.17*	*136.69*
Front Cover - Mach	5	10630892	4	*36.60*	*146.39*
Primary Vertical Shock	6	10630095	4	*44.09*	*176.37*
Primary Springs	7	10630099	8	*92.59*	*740.75*
Wheelset Tie Rod Asm	8	10630089	4	*132.28*	*529.10*
Bracket(Tie Rod)	9	10630081	4	*78.00*	*312.00*
Spring Support Asm	10	10630087	4	*63.93*	*255.73*
Securing Plate	11	10630094	4	*0.64*	*2.56*
Motor Nose Link	12	40034943	2	130.00	260.00
Cover	13	10630091	4	*1.10*	*4.40*
Bracket-Disk Brake	14	10630106	4	*33.07*	*132.28*
Lateral Snubber	15	10630090	2	*4.41*	*8.82*
Sheet-Snubber	16	10630084	2	*2.58*	*5.16*
Sander Guide Asm	17	10631922	2	*4.00*	*8.00*
Brake Shoe - Offset	18	40012998	4	7.87	31.48
Key	19	9501303	4	*0.00*	*0.00*
Split Pin(Tie Rod)	20	10631904	4	*0.75*	*3.00*
Pin-Pri Intrlk	21	10631903	4	*2.00*	*8.00*
Lockbolt - 1	22	40034492	8	2.00	16.00
Collar - 1	23	40034493	8	0.35	2.80
Washer - Special	24	8427242	8	0.44	3.52
Lock - Cap Bolt	25	10631905	36	*0.10*	*3.60*
Caliper Asm - PB	26	10632002	2	*270.00*	*540.00*
Caliper Asm - PB	27	10632003	2	*270.00*	*540.00*
Nozzle	28	8328553	2	*0.50*	*1.00*
Clamp	29	8374760	2	*0.25*	*0.50*
Ppg apl - #1 Trk	30	10631407	1	*134.88*	*134.88*
Tr Mtd Step Apl	31	10630818	1	*284.66*	*284.66*
Bolt-1-12	32	10632061	8	*1.25*	*10.00*
Bolt-1-12	33	10632062	16	*1.88*	*30.08*
Pad	34	10632067	8	*3.00*	*24.00*
Pad	35	10632068	8	*3.00*	*24.00*

TRUCK ASM #1

DESCRIPTION	it	GM p/n	QTY	Weight	TOTAL
Tread Brake Cylinder	36	10631635	4	*136.40*	*545.60*
Nut-5/8-18	37	121358	4		*0.00*
Washer-5/8	38	130999	8		*0.00*
Bolt-1/2-13	39	180177	8		*0.00*
Cmpnd-Thrd(Loctite)	40	9581262	0.1		*0.00*
Bolt-5/8-18	41	271748	16		*0.00*
Washer-5/8	42	131016	76		*0.00*
Bolt-5/8-11	43	271731	8		*0.00*
Nut-5/8-11	44	124589	24		*0.00*
Bolt-5/8-11	45	271729	16		*0.00*
Bolt-5/8-11	46	271725	16		*0.00*
Bolt-5/8-11	47	271723	20		*0.00*
Bolt-5/8-11	48	271735	4		*0.00*
Bolt-5/8-18	49	271744	8		*0.00*
Bolt-3/8-16	50	9428638	16		*0.00*
Washer-3/8	51	120382	36		*0.00*
Nut-1/2-13	52	120378	8		*0.00*
Bolt-3/8-16	53	180122	8		*0.00*
Washer-1/2	54	120396	8		*0.00*
Cover	55	9533926	4	*0.50*	*2.00*
Nameplate	56	10631548	2		*0.00*
Screw-#4	57	145369	12		*0.00*
Bolt-5/8-11	58	271715	16		*0.00*

11.2.4 TRUCK ASM #2

TRUCK ASM #2

DESCRIPTION	it	GM p/n	QTY	Weight	TOTAL
Truck Asm	0	10630165			*34598.49*
Truck Frame Asm	1	10631263	1	*6602.78*	*6602.78*
Traction Motor Mtg	2	40065490	2	*11128.11*	*22256.22*
Brg Adptr Body-Mach	3	10630890	4	*330.69*	*1322.76*
Brg Adptr Cap-Mach	4	10630891	4	*34.17*	*136.69*
Front Cover - Mach	5	10630892	4	*36.60*	*146.39*
Primary Vertical Shock	6	10630095	4	*44.09*	*176.37*
Primary Springs	7	10630099	8	*92.59*	*740.75*
Wheelset Tie Rod Asm	8	10630089	4	*132.28*	*529.10*
Bracket(Tie Rod)	9	10630081	4	*78.00*	*312.00*
Spring Support Asm	10	10630087	4	*63.93*	*255.73*
Securing Plate	11	10630094	4	*0.64*	*2.56*
Motor Nose Link	12	40034943	2	130.00	260.00
Cover	13	10630091	4	*1.10*	*4.40*
Bracket-Disk Brake	14	10630106	4	*33.07*	*132.28*
Lateral Snubber	15	10630090	2	*4.41*	*8.82*
Sheet-Snubber	16	10630084	2	*2.58*	*5.16*
Sander Guide Asm	17	10631922	2	*4.00*	*8.00*
Brake Shoe - Offset	18	40012998	4	7.87	31.48
Key	19	9501303	4	0.00	0.00
Split Pin(Tie Rod)	20	10631904	4	*0.75*	*3.00*
Pin-Pri Intrlk	21	10631903	4	*2.00*	*8.00*
Lockbolt - 1	22	40034492	8	2.00	16.00
Collar - 1	23	40034493	8	0.35	2.80
Washer - Special	24	8427242	8	0.44	3.52
Lock - Cap Bolt	25	10631905	36	*0.10*	*3.60*
Caliper Asm	26	10632004	2	*216.00*	*432.00*
Caliper Asm	27	10632005	2	*216.00*	*432.00*
Nozzle	28	8328553	2	*0.50*	*1.00*
Clamp	29	8374760	2	*0.25*	*0.50*
Ppg apl - #2 Trk	30	10631408	1	*128.92*	*128.92*
Bolt-3/8-16	31	180116			
Bolt-1-12	32	10632061	8	*1.25*	*10.00*
Bolt-1-12	33	10632062	16	*1.88*	*30.08*
Pad	34	10632067	8	*3.00*	*24.00*
Pad	35	10632068	8	*3.00*	*24.00*
Tread Brake Cylinder	36	10631635	4	*136.40*	*545.60*

TRUCK ASM #2

DESCRIPTION	it	GM p/n	QTY	Weight	TOTAL
Nut-5/8-18	37	121358	4		*0.00*
Washer-5/8	38	130999	8		*0.00*
Bolt-1/2-13	39	180177	8		*0.00*
Cmpnd-Thrd(Loctite)	40	9581262	0.1		*0.00*
Bolt-5/8-18	41	271748	16		*0.00*
Washer-5/8	42	131016	76		*0.00*
Bolt-5/8-11	43	271731	8		*0.00*
Nut-5/8-11	44	124589	24		*0.00*
Bolt-5/8-11	45	271729	16		*0.00*
Bolt-5/8-11	46	271725	16		*0.00*
Bolt-5/8-11	47	271723	20		*0.00*
Bolt-5/8-11	48	271735	4		*0.00*
Bolt-5/8-18	49	271744	8		*0.00*
Bolt-3/8-16	50	9428638	16		*0.00*
Washer-3/8	51	120382	36		*0.00*
Nut-1/2-13	52	120378	8		*0.00*
Bolt-3/8-16	53	180122	8		*0.00*
Washer-1/2	54	120396	8		*0.00*
Cover	55	9533926	4	*0.50*	*2.00*
Nameplate	56	10631548	2		*0.00*
Screw-#4	57	145369	12		*0.00*
Bolt-5/8-11	58	271715	16		*0.00*

11.2.4.1 TM MTG

TM MTG

DESCRIPTION	it	GM p/n	QTY	Weight	Total Wt
T/M Mounting	0	40065490			*11128.11*
T/M	1	40063788	1	*5040.00*	*5040.00*
W/A/G	2	40063842	1	*5811.80*	*5811.80*
Screw-3/8-16	3	138245	14	*0.25*	*3.50*
Gear Case Lwr	4	40023251	1	166.00	166.00
Gear Case Upr	5	40023253	1	60.00	60.00
Cmpnd-Thd	6	9581263	0		*0.00*
Vent Cap-G/C	7	40058896	1	0.81	0.81
Decal-Oil	8	40065084	1		*0.00*
Bolt-1 1/8-7hx	9	40037899	10	*2.50*	*25.00*
Washer-Special	10	8387832	10	*0.50*	*5.00*
Filter Breathr	11	40059296	1		*0.00*
Oil-Synthetic	12	40031793	8 qt	*16.00*	*16.00*
Sealant	13	40027958	32 oz		*0.00*
Sealant	14	8342123	0		*0.00*

11.2.4.2 PIPING

PIPING

DESCRIPTION	It	GM p/n	QTY	Weight	Total WT
Truck #1 Ppg Apl	0	10631407			*134.88*
Pipe Asm	1	10631533	1	*5.80*	*5.80*
Pipe Asm	2	10631757	4	*2.00*	*8.00*
Pipe Asm	3	10631756	3	*0.68*	*2.04*
Pipe-3/8	4	10631534	2	*3.70*	*7.40*
Pipe Asm	5	10631540	1	*4.50*	*4.50*
Pipe-3/8	6	10631543	2	*2.60*	*5.20*
Pipe Asm	7	10631538	1	*2.50*	*2.50*
Pipe Asm	8	10631544	2	*5.00*	*10.00*
Pipe Asm	9	10631546	2	*5.00*	*10.00*
Pipe-1/2	10	10631550	2	*4.70*	*9.40*
Pipe Asm	11	10631537	4	*3.00*	*12.00*
Pipe Asm	12	10631536	4	*3.00*	*12.00*
Clamp	13	10631554	5	*0.13*	*0.65*
Clamp Asm	14	10631555	4	*0.38*	*1.52*
Hose Asm	15	9577614	4	*2.00*	*8.00*
Hose Asm	16	10631556	4	*2.00*	*8.00*
Pipe Asm	17	10632150	4	*0.50*	*2.00*
Hose Asm	18	10632146	4	*2.00*	*8.00*
Clamp	19	8081686	3	*0.25*	*0.75*
Clamp-1/2-3/8	20	10631423	22	*0.38*	*8.36*
Angle	21	10631578	2	*0.60*	*1.20*
Angle	22	10631552	2	*0.60*	*1.20*
Channel	23	10631551	2	*1.10*	*2.20*
Channel	24	10631846	2	*1.10*	*2.20*
Bolt-5/16-18	25	180077	38		*0.00*
Washer-5/16	26	120214	46		*0.00*
Bolt-5/16-18	27	180083	8		*0.00*
Nut-5/16-18	28	120376	8		*0.00*
Plug-1/2	29	103880	5		*0.00*
Tube-Sleeve	30	10631426	2	*0.38*	*0.76*
Nipple-1/4	31	8060971	4	*0.20*	*0.80*
Bushing-1/4-1/2	32	144045	4	*0.10*	*0.40*

PIPING

DESCRIPTION	It	GM p/n	QTY	Weight	Total WT
Truck #2 Ppg Apl	0	10631408			*128.92*
Pipe Asm	1	10631533	1	*5.80*	*5.80*
Pipe Asm	2	10631757	4	*2.00*	*8.00*
Pipe Asm	3	10631756	3	*0.68*	*2.04*
Pipe-3/8	4	10631534	2	*3.70*	*7.40*
Pipe Asm	5	10631540	1	*4.50*	*4.50*
Pipe-3/8	6	10631543	2	*2.60*	*5.20*
Pipe Asm	7	10631538	1	*2.50*	*2.50*
Pipe Asm	8	10631544	2	*5.00*	*10.00*
Pipe Asm	9	10631546	2	*5.00*	*10.00*
Pipe-1/2	10	10631550	2	*4.70*	*9.40*
Pipe Asm	11	10631537	4	*3.00*	*12.00*
Pipe Asm	12	10631536	4	*3.00*	*12.00*
Clamp	13	10631554	5	*0.13*	*0.65*
Clamp Asm	14	10631555	4	*0.38*	*1.52*
Hose Asm	15	9577614	4	*2.00*	*8.00*
Hose Asm	16	10631556	2	*2.00*	*4.00*
Pipe Asm	17	10632150	4	*0.50*	*2.00*
Hose Asm	18	10632146	4	*2.00*	*8.00*
Clamp	19	8081686	3	*0.25*	*0.75*
Clamp-1/2-3/8	20	10631423	22	*0.38*	*8.36*
Angle	21	10631578	2	*0.60*	*1.20*
Angle	22	10631552	2	*0.60*	*1.20*
Channel	23	10631551	2	*1.10*	*2.20*
Channel	24	10631846	2	*1.10*	*2.20*
Bolt-5/16-18	25	180077	38		*0.00*
Washer-5/16	26	120214	46		*0.00*
Bolt-5/16-18	27	180083	8		*0.00*
Nut-5/16-18	28	120376	8		*0.00*
Plug-1/2	29	103880	9		*0.00*

11.2.4.3 STEP APL

STEP APL

DESCRIPTION	It	GM p/n	QTY	Weight	Total WT
Truck Mtd Step Apl	0	10630818			*284.66*
Step Tread Asm	1	10632117	3	*10.00*	*30.00*
Step Tread Asm	2	10632118	3	*10.00*	*30.00*
Step Asm-Weld	3	10632119	1	*65.00*	*65.00*
Step Asm-Weld	4	10632120	1	*65.00*	*65.00*
Plate	5	10632127	4	*5.90*	*23.60*
Plate	6	10632128	4	*5.90*	*23.60*
Sheet	7	10632129	1	*9.50*	*9.50*
Sheet	8	10632130	1	*9.50*	*9.50*
Plate	9	10632131	2	*5.10*	*10.20*
Plate	10	10632132	2	*5.10*	*10.20*
Bolt-3/4-10	11	271772	8		*0.00*
Nut-3/4-10	12	9416541	24		*0.00*
Bolt-1/2-13	13	180175	24		*0.00*
Nut-1/2-13	14	9416536	24		*0.00*
Sheet	15	10632133	2	*0.50*	*1.00*
Sheet	16	10632134	4	*0.50*	*2.00*
Screw	17	9420156	18		*0.00*
Screw	18	9419874	4		*0.00*
Screw	19	9424036	4		*0.00*
Bolt-3/4-10	20	271769	16		*0.00*
Bolt-5/8-11	21	271733	8		*0.00*
Sheet	22	10632135	4	*1.00*	*4.00*
Strip	23	10632700	4	*0.05*	*0.20*
Strip	24	10632701	4	*0.11*	*0.44*
Strip	25	10632702	2	*0.14*	*0.28*
Strip	26	10632703	2	*0.07*	*0.14*

11.2.4.4 AWG

AWG

DESCRIPTION	It	GM p/n	QTY	Weight	Total WT
W/A/G	0	40063842			*5811.80*
Bearing Hsg	1	40063843	1	***400.00***	***400.00***
Brg Asm - RLR	2	40034583	1	**28.00**	**28.00**
Brg Asm - RLR	3	40034582	1	**42.00**	**42.00**
Spacer	4	40063777	1	*34.00*	*34.00*
Seal	5	9085559	1	*0.10*	*0.10*
Seal	6	40023838	1	**18.00**	**18.00**
Cap-PE AxleBrg	7	40044913	1	**40.00**	**40.00**
Spacer-CE	8	40006526	1	**4.00**	**4.00**
Cap-Axle Brg	9	40044915	1	**30.00**	**30.00**
Seal	10	9084265	1	*0.10*	*0.10*
Spacer	11	40044969	1	*1.00*	*1.00*
Spacer	12	40044968	0	*0.00*	*0.00*
Spacer	13	40044967	0	*0.00*	*0.00*
Spacer	14	40044966	0	*0.00*	*0.00*
Spacer	15	40044965	0	*0.00*	*0.00*
Spacer	16	40044964	0	*0.00*	*0.00*
Spacer	17	40044963	0	*0.00*	*0.00*
Plug-1/8 PT	18	8348617	2	*0.25*	*0.50*
Plug-3/8 PT	19	8348619	2	*0.25*	*0.50*
Seal-Gear	20	40009050	1	**30.00**	**30.00**
Wheel Asm	21	40069545	2	***1500.00***	***3000.00***
Axle-Finished	22	40063849	1	***1380.00***	***1380.00***
Cover Asm	23	40012764	1	***40.00***	***40.00***
Screw-1/2-13HS	24	138293	4	*0.10*	*0.40*
Screw-1/2-13HS	25	138299	12	*0.10*	*1.20*
Gear	26	40063698	1	***480.00***	***480.00***
Journal Brg	27	9532124	2	**140.00**	**280.00**
Grease	28	ems1032	1	*2.00*	*2.00*
Paint	29		ar		

11.2.4.5 TRUCK APPL

TRUCK APPL

DESCRIPTION	It	GM p/n	QTY	Weight	Total WT
Truck Apl	0	10632420			*3201.15*
T/M Air Duct Asm	1	40045238	4	*80.00*	*320.00*
Yaw Dampers	2	10630098	4	*88.18*	*352.74*
Sec. Vertical Shocks	3	10630097	4	*44.09*	*176.37*
Sec. Lateral Shocks	4	10630096	4	*44.09*	*176.37*
Secondary Springs	5	10630100	8	*253.53*	*2028.23*
Shim - 1.12	6	10632491	0	*9.20*	*0.00*
Shim - .88	7	10632492	8	*7.20*	*57.60*
Shim - .62	8	10632493	0	*5.10*	*0.00*
Feather Key	9	10631265	2	*0.70*	*1.40*
Hex Castle Nut	10	10631264	2	*10.58*	*21.16*
Stud Plate Asm	11	10632414	4	*11.00*	*44.00*
Stud Plate Asm	12	10632415	4	*1.75*	*7.00*
Cleat	13	40057981	8	*0.25*	*2.00*
Cleat	14	10632419	8	*0.25*	*2.00*
Cleat	15	10569388	8	*0.25*	*2.00*
Ins Sleeve	16	40057979	12		*0.00*
Pad	17	8471588	12	*0.50*	*6.00*
Screw-3/8-13	18	426370	2		*0.00*
Bolt-3/8-16	19	180126	44		*0.00*
Nut-3/8-16	20	9416532	24		*0.00*

TRUCK APPL

DESCRIPTION	It	GM p/n	QTY	Weight	Total WT
Bolt-1/2-13	21	180173	16		*0.00*
Bolt-5/8-18	22	271744	8		*0.00*
Bolt-5/8-18	23	271750	16		*0.00*
Bolt-5/8-18	24	271752	8		*0.00*
Bolt-3/4-16	25	271801	8		*0.00*
Bolt-3/4-16	26	271795	8		*0.00*
Nut-5/8-18	27	9416540	8		*0.00*
Nut-3/4-16	28	9416542	8		*0.00*
Hose Asm	29	10632814	5		*0.00*
Bushing-3/4-1/2PT	30	144042	4		*0.00*
Shim	31	10632761	2	*1.14*	*2.28*
Grease	32	ems 1032	1	*2.00*	*2.00*
Ins Sleeve	33	40057980	12		*0.00*
H S Tubing	34	8491336	12		*0.00*
Pin-3/8 Cotter	35	217971	2		*0.00*
Pad-Tapping	36	40060270	12		*0.00*
Washer-Special	37	40060272	12		*0.00*
Bolt Asm	38	40060271	24		*0.00*
Clamp Hose	39	8052175	12		*0.00*

11.3 MAINTENANCE AND WEAR LIMITS

11.3.1 WHEEL LIMITS

11.3.1.1 WHEEL SIZE VARIATION LIMITS

The following limits apply to wheel diameters. The "new" values listed below are to be used when turning (truing or profiling) wheels in the shop.

Between two wheels on the same axle:	New……..0.020"
Between axles within a truck:	New…….0.1875"
Between trucks:	New……..0.75"

LIRR Lemniscate linkage **Siemens dwg** 5.42.7-11.50.00-01
EMD Part number 10624376

Item	Name	Siemens dwg	EMD Part number	Clean component, inspect for cracks and damage and verify the following characteristics		New MIN		New Max		Condemning limit		
										Limit		
1	Outer sleeve (Beam)	5.42.7-11.50.20-02	10624404	d1	Top interface ID to item 3	120.000 mm	4.7244 in	120.035 mm	4.7258 in	MAX	120.050 mm	4.7264 in
				d2	Bottom interface ID to item 3	75.000 mm	2.9528 in	75.030 mm	2.9539 in	MAX	75.100 mm	2.9567 in
				b1	Width over wear plates (Interface to item 2) Replace wear plate 5.42.7-11.50.42-02 (Please check EMD number) if necessary	259.000 mm	10.1969 in	261.000 mm	10.2756 in	MAX	262.600 mm	10.3386 in
2	Inner sleeve	5.42.7-11.50.20-01	10624403	d3	Interface ID to carbody pivot pin	150.043 mm	5.9072 in	150.106 mm	5.9097 in	MAX	150.300 mm	5.9173 in
				b2	Width over wear plates (Interface to item 1) Replace wear plate 5.42.7-11.50.42-01 (Please check EMD number) if necessary	239.000 mm	9.4094 in	241.000 mm	9.4882 in	MIN	237.400 mm	9.3465 in
3	Threaded pin	5.42.7-11.50.23-04	10624408	d4	Top interface OD to Item 1	119.841 mm	4.7181 in	119.928 mm	4.7216 in	MIN	119.750 mm	4.7146 in
				d5	Interface OD to item 15. This also applies to welded-on pin at truck frame.	99.780 mm	3.9283 in	100.000 mm	3.9370 in	MIN	99.700 mm	3.9252 in
				d6	Bottom interface OD to Item 1	74.866 mm	2.9475 in	74.940 mm	2.9504 in	MIN	74.750 mm	2.9429 in
4	Ring	5.42.7-11.50.23-10	10630036									
5	Ring	5.42.7-11.50.23-09	10630035									
6	Ring	5.42.7-11.50.23-05	10624409									
7	Ring	5.42.7-11.50.23-03	10624407									
8	Ring	5.42.7-11.50.23.07	10630033									
9	Ring	5.42.7-11.50.23-08	10630034									
10	Rubber spring	5.42.7-11.50.80-01	10630048		Replace at overhaul							
11	Nut	5.42.7-11.50.84-02	10630050									
12	Cover	5.42.7-11.50.50-02	10630040									
13	Seal	5.42.7-11.50.79-02	10630047		Replace at overhaul							
15	Sleeve (stainless steel)	5.42.7-11.50.23-06	10630032	d7	Interface OD to item 16	109.740 mm	4.3205 in	109.880 mm	4.3260 in	MIN	109.650 mm	4.3169 in
				d8	Interface ID to item 3 and the welded-on pin at the truck frame	100.000 mm	3.9370 in	100.054 mm	3.9391 in	MAX	100.150 mm	3.9429 in
16	Sleeve (Vulcolan)	5.42.7-11.50.79-01	10630046		Replace at overhaul							
17	Spacer	5.42.7-11.50.81-01	10630049									
18	Lever	5.42.7-11.50.13-01	10624402	d9	Interface ID to item 16	150.000 mm	5.9055 in	150.035 mm	5.9069 in	MAX	150.070 mm	5.9083 in
22	Cap bolt (1/2 UNF x .75)	?	9406838									
23	Cap bolt (1/2 UNF x .1)	?	444270									
24	Hex bolt (not supplied)	1/2 UNCx 5/8	18168									
25	Washer	DIN125 B50- 140HV-A3C	?									
27	Spring clip	DIN471 180x4	?		Replace at overhaul							
29	V-Ring	V-160L - NBR297	?		Replace at overhaul							
30	O-Ring	OR151.76x7.0 NBR90	10632516?		Replace at overhaul							
32	Lock nut	Flaig&Hommel FS-M48 8-A3C	?		Can be used up to 10 times							
34	Glue	Loctite 415	?									

LIRR Lemniscate linkage **Siemens dwg** **5.42.7-11.50.00-01**
EMD Part number **10624376**

Item	Name	Siemens dwg	EMD Part number
1	Outer sleeve (Beam)	5.42.7-11.50.20-02	10624404
2	Inner sleeve	5.42.7-11.50.20-01	10624403
3	Threaded pin	5.42.7-11.50.23-04	10624408
4	Ring	5.42.7-11.50.23-10	10630036
5	Ring	5.42.7-11.50.23-09	10630035
6	Ring	5.42.7-11.50.23-05	10624409
7	Ring	5.42.7-11.50.23-03	10624407
8	Ring	5.42.7-11.50.23.07	10630033
9	Ring	5.42.7-11.50.23-08	10630034
10	Rubber spring	5.42.7-11.50.80-01	10630048
11	Nut	5.42.7-11.50.84-02	10630050
12	Cover	5.42.7-11.50.50-02	10630040
13	Seal	5.42.7-11.50.79-02	10630047
15	Sleeve (stainless steel)	5.42.7-11.50.23-06	10630032
16	Sleeve (Vulcolan)	5.42.7-11.50.79-01	10630046
17	Spacer	5.42.7-11.50.81-01	10630049
18	Lever	5.42.7-11.50.13-01	10624402
22	Cap bolt (1/2 UNF x .75)	?	9406838
23	Cap bolt (1/2 UNF x .1)	?	444270
24	Hex bolt (not supplied)	1/2 UNCx 5/8	18168
25	Washer	DIN125 B50- 140HV-A3C	?
27	Spring clip	DIN471 180x4	?
29	V-Ring	V-160L - NBR297	?
30	O-Ring	OR151.76x7.0 NBR90	10632516?
32	Lock nut	Flaig&Hommel FS-M48 8-A3C	?
34	Glue	Loctite 415	?

11.3.2.1 TOTAL FREE LATERAL AXLE CLEARANCES BETWEEN INTERLOCK LINKS AND BEARING ADAPTERS

These are shown below as axle left and right totals, which can be measured on both sides with feeler gauges (Axle #1 is lead locomotive axle at cab end).

DE/DM30AC Truck

Axles 1, 2, 3, 4 -

Nominal is 0.38" (19.6 mm).....62" (15.7mm)

11.3.2.2 SECONDARY VERTICAL STOP CLEARANCE

This is measured between the truck and the underframe on each side of the truck at the stop axle position.

Minimum gap at any location

Nominal is 0.63" +/- 0.12" (1.6mm +/- 3.1 mm).....0.25" (6.4 mm)

11.4 ROUTINE MAINTENANCE EQUIPMENT and SPECIAL TOOLS

11.4.1 FIXTURES

Lifting Fixture (Traction Motor, Axle and Wheel assembly)

..... File No. 288

Wall Mounted Fixture To Test Dampers

..... Work Sketch #41089

11.4.2 GEAR RATIOS

DE/DM30AC (with 44” wheels)..... 92:19

- Note: File Drawings and Work Sketches are available from the EMD Service Department. These drawings include construction details of tooling that can be manufactured.

11.4.3 SPECIAL LUBRICANTS

P80 Rubber Lubricant..... 8251651

Document Number MM001001 (DE-LP)

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