MAINTENANCE INSTRUCTION

M. I. 1516

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

SCHEDULED MAINTENANCE AND OVERHAUL INSTRUCTIONS HTCR and HTCR-II Trucks

Equipped With
AC or DC 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 HTCR and HTCR-II trucks and is offered for planning purposes only. As written, this document reflects current EMD product design and service experience for the radial design type of locomotive truck with AC or DC 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 HTCR and HTCR-II trucks. Component renewal provisions are consistent with traditional overhaul procedures.

For planning purposes, EMD has established the following overhaul interval recommendations for the HTCR and HTCR-II trucks. These overhaul interval recommendations are based on whichever event occurs first: time, miles, or megawatt hours.

HTCR / HTCR-II Trucks:

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

NOTE

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

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

TABLE OF CONTENTS

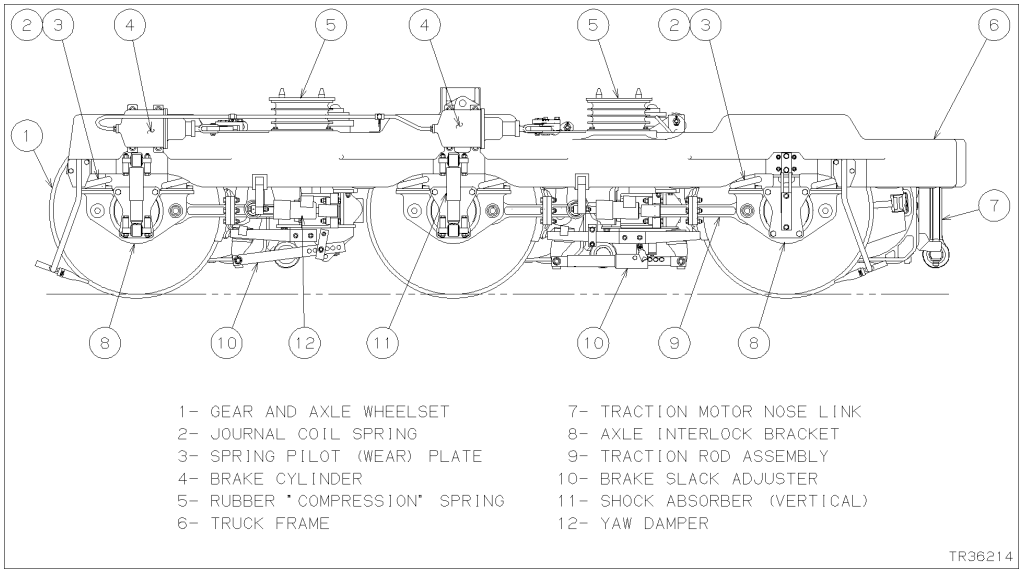


Figure 1 – HTCR Truck Applied to a 70 Series DC Locomotive

1.0 GENERAL DESCRIPTION

The HTCR (high traction three axle radial) truck assembly, Figure 1, and HTCR-II truck assembly, Figure 2, support the weight of the locomotive and provide the means for transmission of power to the rails. The HTCR series truck is applied to AC or DC transmission locomotives using 1TB2630 (AC) or D90 (DC) traction motors, while the HTCR-II is applied to AC transmission locomotives using 1TB2830 (AC) traction motors only. There are minor differences in specifications between the two types of truck, however the basic design is similar.

Unlike conventional three axle “rigid” trucks in which the axles are held parallel to each other, the HTCR series is designed as a powered self-steering “bolster-less” unit. Although the truck frame itself is rigid, the radial truck design allows the end axles “yaw” freedom within the frame to position the wheelset axles radially to the curves center for reduced wheel and rail wear. A traction rod and steering linkage attached to the journal bearing adapters and truck frame controls movement of the end axles.

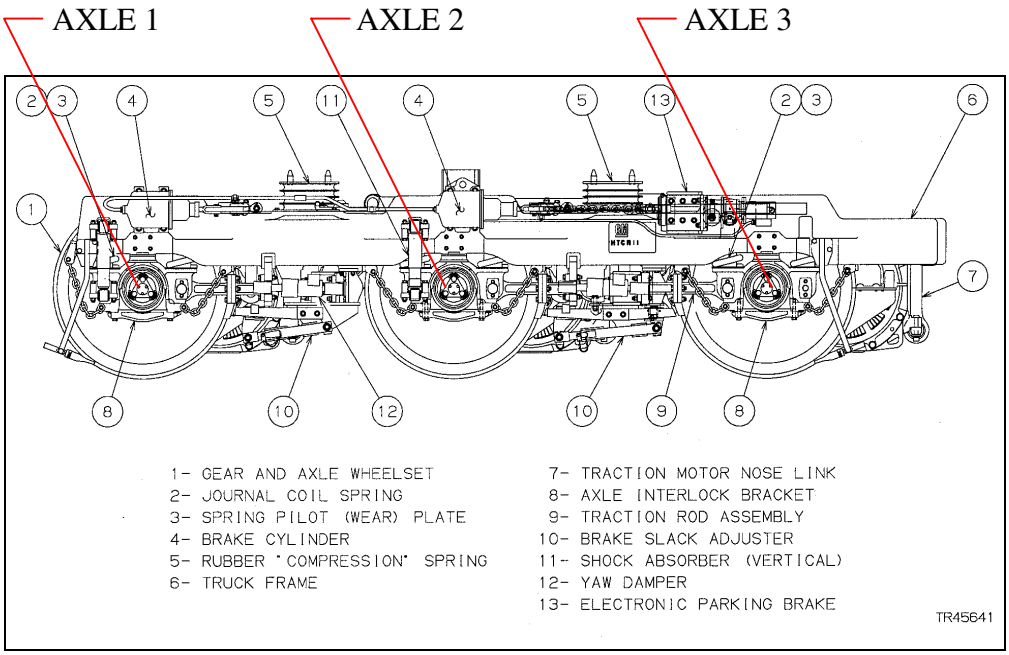


Figure 2 – HTCR-II Truck as Applied to an SD90 Series AC Locomotive

Steering beams connect each end axle wheelset to the truck frame while allowing yaw motion of the wheelset for steering. An inter-axle linkage couples the end axle yaw motions together for steering around curves. The center axle is not allowed to yaw with respect to the truck frame, but has an increased lateral free clearance of 0.62" (15.9mm) per side. This design provides the radial alignment of each driving wheel to the rail in a curve for optimum contact between the wheel tread and the top of the rail, with a minimum amount of lateral force between the wheel flange and gage face of the rail head.

Tractive and braking forces are transmitted from the journal bearing adapters, through either traction rods on the center axle, or traction rods and steering beams on the end axles (Ref. Figures 1 & 2). The steering beams transfer the forces through center pivots to the truck frame, and then to the locomotive underframe through the carbody pivot assembly, Figure 3.

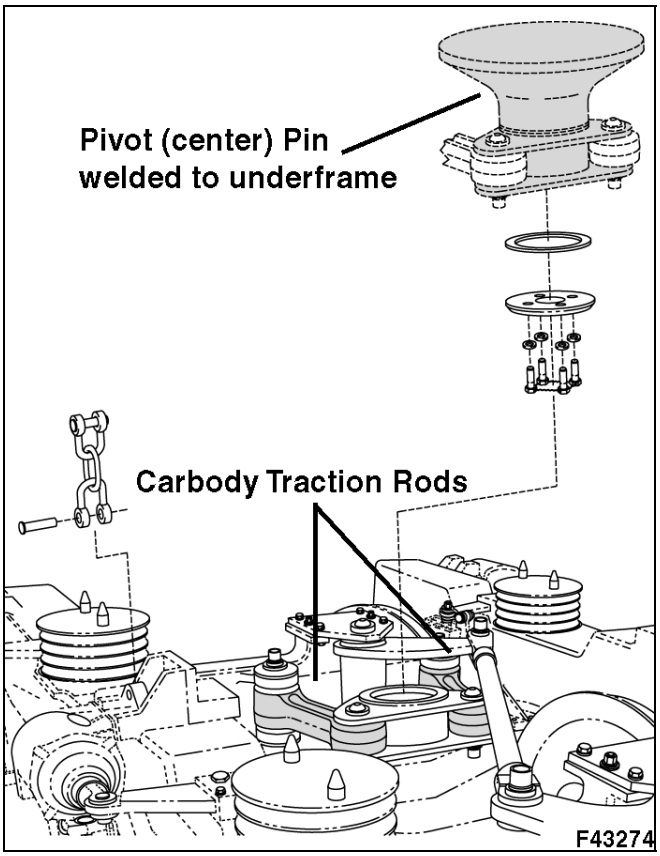


Figure 3 – Carbody Pivot Assembly

The locomotive carbody weight is transferred directly to the truck frame through four rubber "secondary" spring pad assemblies (ref. Figures 1 and 2), which also provide controlled lateral and yaw stiffness for tracking stability. The relatively stiff "secondary" suspension and uniform traction motor orientation improve weight transfer within the truck for optimal adhesion performance. A soft "primary" suspension, consisting of twelve 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.

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.

Three AC or DC 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 through the traction rods and steering mechanism to the truck frame, and then to the locomotive underframe through the 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. Yaw dampers are connected between the steering beam and truck frame to control dynamic movement of the end wheelsets within the truck. Two secondary yaw dampers are mounted diagonally between each truck and the locomotive underframe to damp the lateral and yaw movements of the truck for stability and ride at higher operating speeds.

Lateral stops, Figure 4, are provided on the truck frame at the center axle position to limit lateral movement nominally to +/- 1.75" (+/- 45 mm) between the truck and underframe. Vertical stop clearance is established between the truck frame and the underframe nominally at 0.62" (15.9 mm) using shims at locations inward of the lateral stops at the center axle position. All shims are welded to the underframe, as shown on Figure 4.

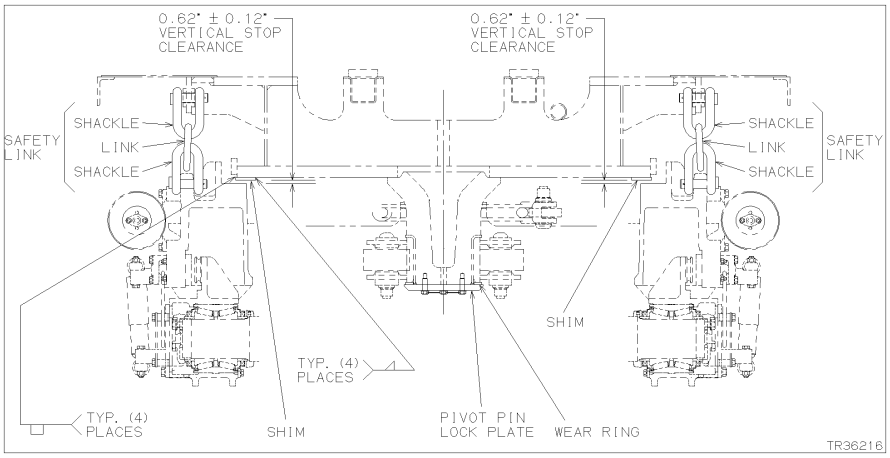


Figure 4 – Lateral Stops, Vertical Stops, and Interlock Links

For both models of truck, two interlock links are located on either side of the truck frame at the center axle location (Figure 4). These two links serve to prevent separation of the truck assembly from the locomotive during lifting operations of the locomotive with the truck(s). Rubber compression pads, provided on the ends of the steering beams, restrict total steering travel of the end axles within the truck frame.

A balance link, Figure 5, is located near the longitudinal centerline of the truck at the front of the third motor position. This link serves to interconnect the underframe and truck frame to balance the truck during lifting operations. Because the truck secondary springs connect directly to the underframe, side bearings and side bearing wear-plates are not used or required.

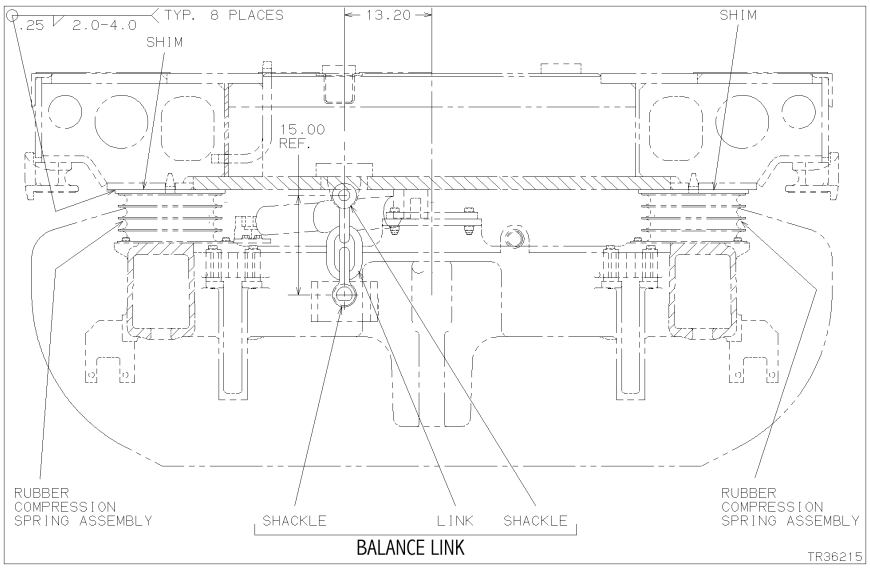


Figure 5 - Balance Link

Interlocking of the journal bearing adapters to the truck frame for lifting differs between trucks equipped with one-piece bearing adapters and those equipped with two-piece bearing adapters. On one-piece bearing adapter types, this is accomplished via a link that interconnects a bracket on the bearing adapter and an adapter on the truck frame (Figure 6).

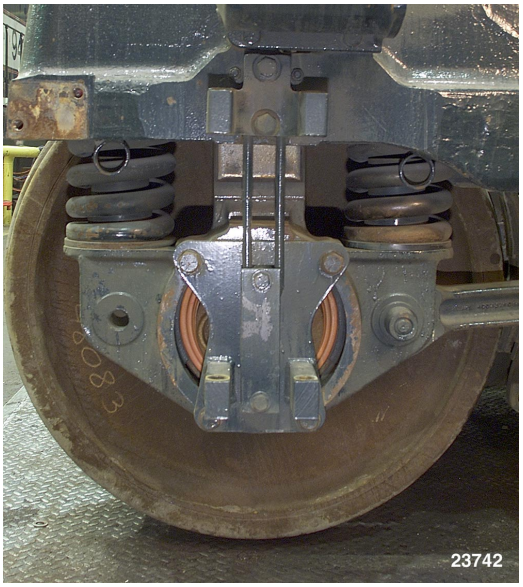
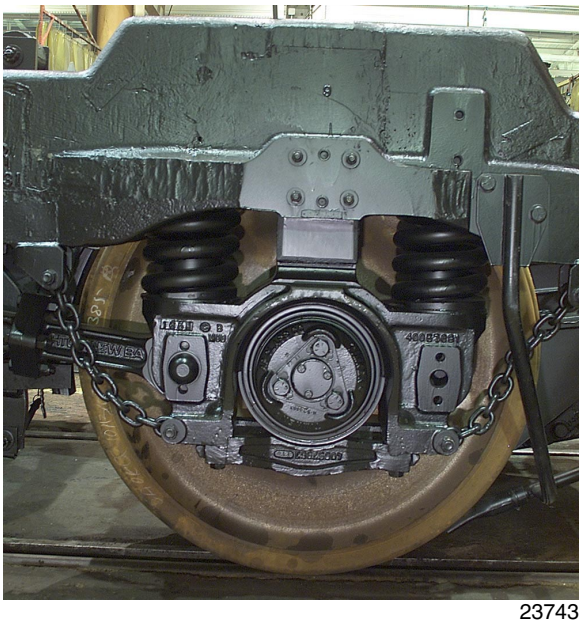


Figure 6 –One-Piece Bearing Adapter

The two-piece adapter design has two interlock chains per adapter. When the bearing adapter caps are in place, if the locomotive and truck are lifted these interlocks will support the weight of the bearing adapters, the wheel and axle set, and the traction motor (Figure 7). 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 support the traction rods.



23743

Figure 7 –Two-Piece Bearing Adapter

The journal bearings transmit the vertical load from the springs to the axles. Non-metallic wear plates mounted inside the truck frame in combination with metal-faced rubber lateral thrust pads mounted on the bearing adapters control the lateral thrust loads of the axles. These renewable non-metallic wear plates Figure 8, provide the means to maintain the nominal free lateral clearances at the center (middle) axle of +/-0.62” (15.9 mm) and +/- 0.06” (1.6 mm) at the end (front and rear) axles. The non-metallic wear plates are each retained by four bolts and nuts.

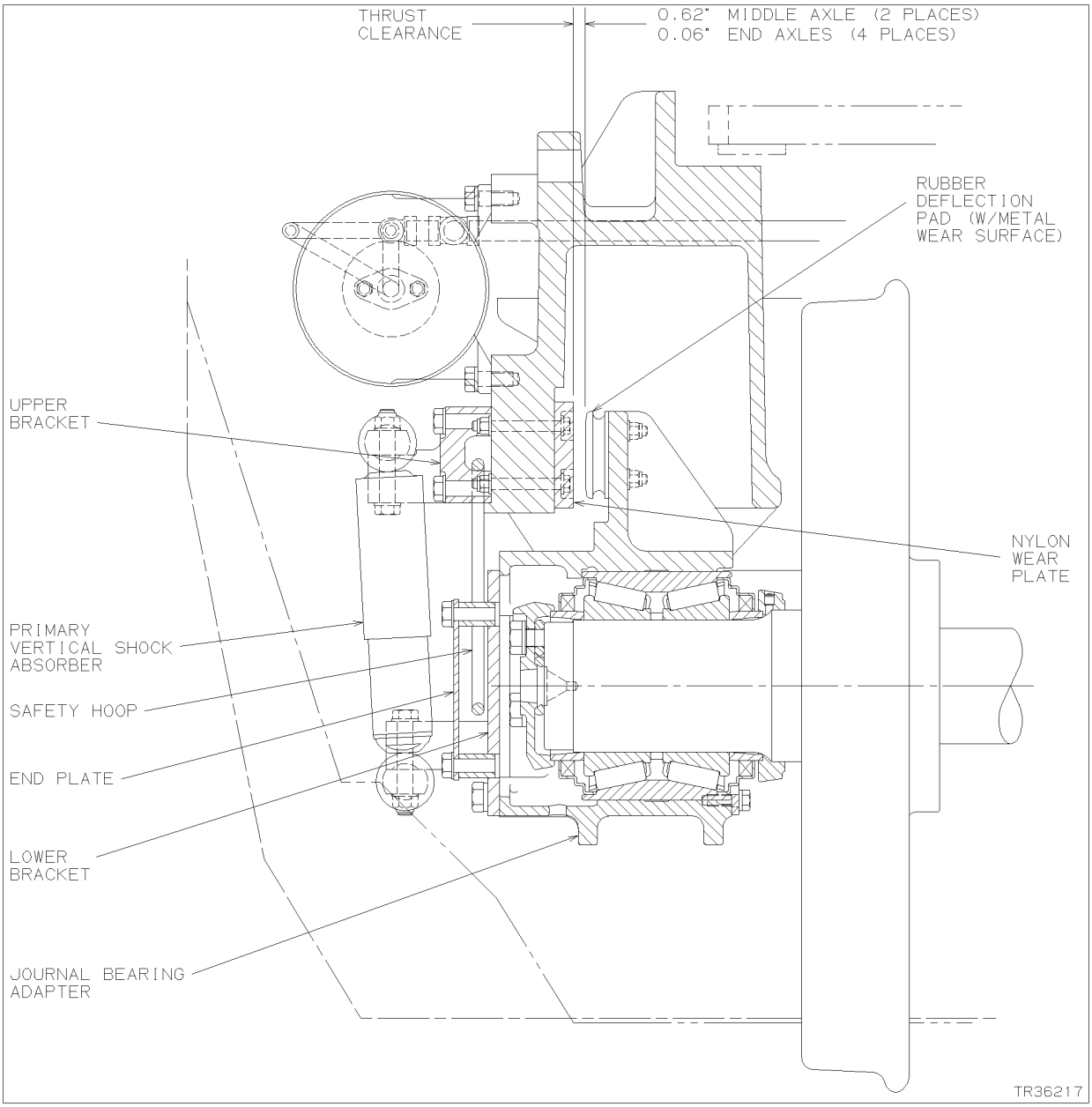


Figure 8 – Typical Journal Adapter Lateral Thrust

The three traction motors are supported on their respective drive axles and at motor nose link assemblies, Figure 9, attached to the truck frame. An important feature of the HTCR truck design is the orientation of the traction motors in one direction. This arrangement provides excellent motor accessibility and good adhesion characteristics.

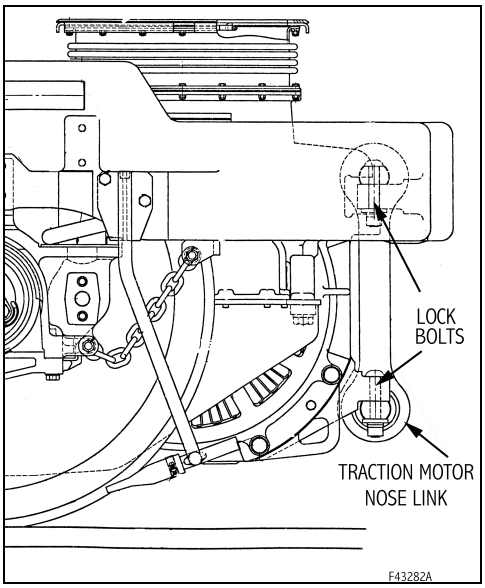


Figure 9 – Traction Motor Nose Support

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 brake system is used, which utilizes one composition shoe at each wheel. Brake cylinders are mounted outboard of the truck frame side beams and operate the brake system through a lever arrangement. Manual slack adjusters are fitted to allow for periodic adjustment of brake cylinder travel and brake shoe renewal. An electrically operated parking brake, Figure 10, is fitted to the left rear side of the #1 truck for SD80MAC and SD90MAC locomotives; all other model locomotives utilize a conventional handbrake mounted to the carbody and connected with a chain to a brake lever at the trailing truck.

Figure 10 – Electric Parking Brake

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, steering assembly, wheels, axles, bearing adapters, rubber suspension springs, dampers, and brake cylinders 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 pin liners 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 pivot pin assembly cylinder is lined with Nylon bushing halves. The pivot pin is to be coated with a bonded dry spray lubricant at time of overhaul or re-trucking only. No additional oil or grease is needed during operational service.

The electric parking brake jackscrew assembly will require lubrication on a semi-annual basis.

NOTE

Special care should be taken with all rubber components, the axle lateral wear plates on the truck frame, steering beam dampers, and brake rigging 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 (*2nd to last page*). 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.

2.4 JOURNAL BEARINGS

Under normal operating conditions, running temperatures of approximately 56 degrees C (133 degrees F) 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 93 degrees C (200 degrees F), or with a direct pyrometer. If the bearing temperature is in excess of 93 degrees C (200 degrees F), the bearing should be removed from service for further examination.

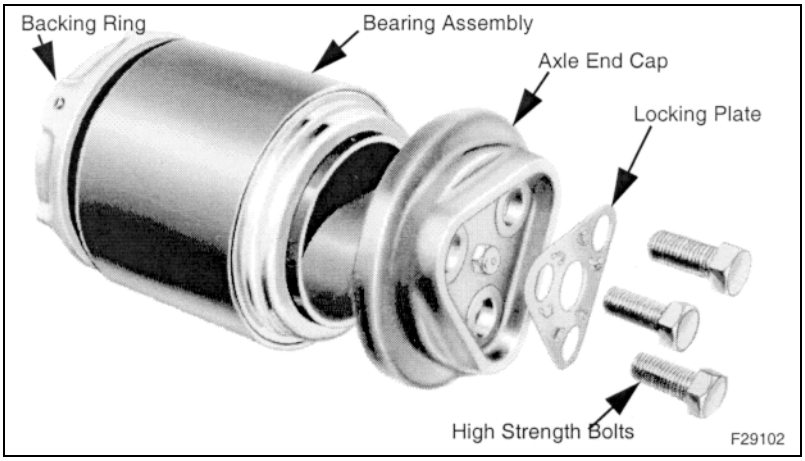


Figure 11 – Roller Type Journal Bearing

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 hand brake should be set or 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 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 vertical primary damper is detected, inspect journal springs, lateral thrust pads and wear plates 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 steering beam, inter-axle linkage and traction rod bushings. Also, check condition of rubber bumper pads on the applicable steering beam.

   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 and rod assembly bearings and bushings, and the four rubber 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. Note that there are currently two types of damper (Figure 12 and Figure 13) in service that require different mounting procedures.

   DELCO – 3/4-10 X 4" mounting bolts – 250 ft-lbs.
   KONI – 5/8-11 X 4" mounting bolts – 135 ft-lbs.

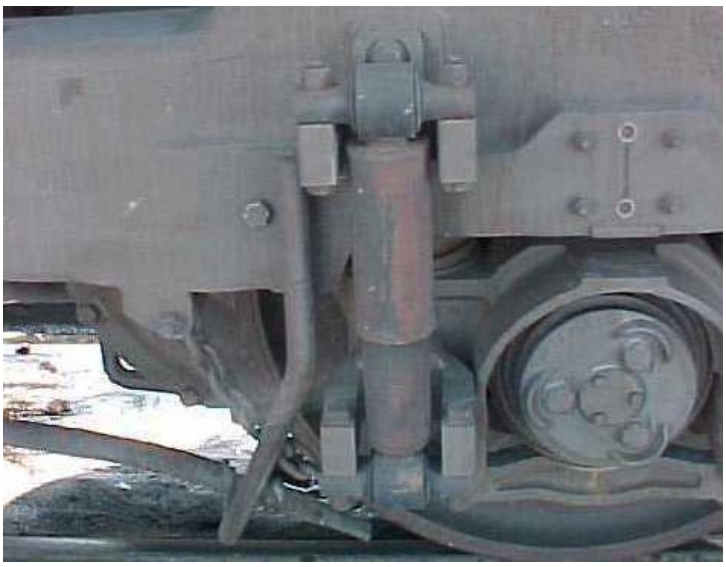


Figure 12 – DELCO Damper (note flare on upper tube)

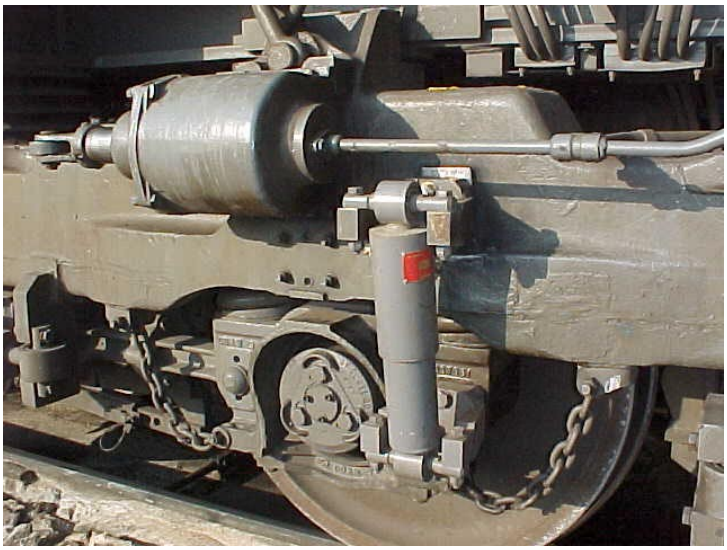


Figure 13 – KONI Damper (note identification plate)

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 (not used on EMD trucks)

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.

2.6 RUBBER SECONDARY SPRINGS

Thoroughly inspect the springs (Figure 14) for signs of degradation. Grease and dirt accumulations on the rubber spring, 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 springs. In addition, cleaning the rubber spring will facilitate visual inspection.

1516-12

Figure 14 – Secondary Springs

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

Check the unloaded spring for degradation. A certain amount of superficial cracking (crazing) of the rubber surface is not unusual or detrimental to performance. Replace any spring if any layer has a tear or cut which exceeds 1' in length and ¼' in depth. Replace any spring if the accumulated length of tears in any layer exceeds 4".

Metal plates separating the rubber layers are 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.

2.7 BRAKE SHOE GUIDES

Brake shoe stabilization guides (Figure 15) are provided on the underside of the truck frame at each brake lever location. A 0.25" (6.4 mm) Nylon wear plate is riveted to each brake lever which mates to a steel stabilizing bar. Each brake lever uses a guide bracket which straddles the stabilizing bar to maintain brake shoe to wheel alignment. The "dead" brake lever uses a safety hanger, which is a "U" shaped bracket that straddles the lever pivot bracket at the top side of the truck frame to maintain brake shoe to wheel alignment. The stabilizing bars are bolted to brackets under the truck frame. The long bars used between the "live" and "dead" brake levers are further supported by a tie bar assembly connected laterally from the bar on one side of the truck to the other. The wear plates should be replaced when the thickness is half of the original, or 0.125" (3.0 mm).

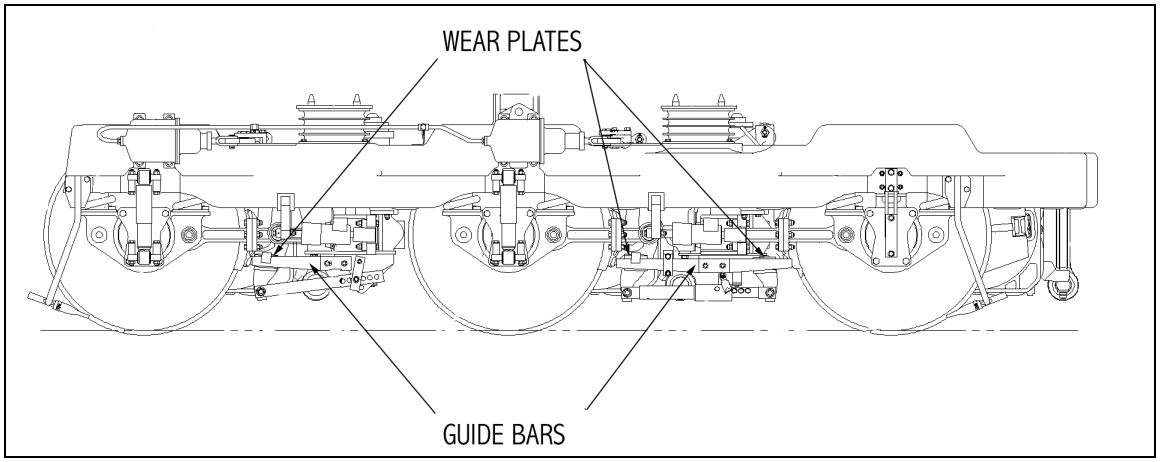


Figure 15 – Typical Brake Shoe Guides

2.8 SLACK ADJUSTERS

2.8.1 GENERAL DESCRIPTION

The brake slack adjuster is a manually adjusted pin type assembly designed for single shoe brake locomotives. Currently there are two styles of adjuster used: the tube type (Figure 16a) and the box type (Figure 16b). Adjustment procedures and dimensions are identical for both types.

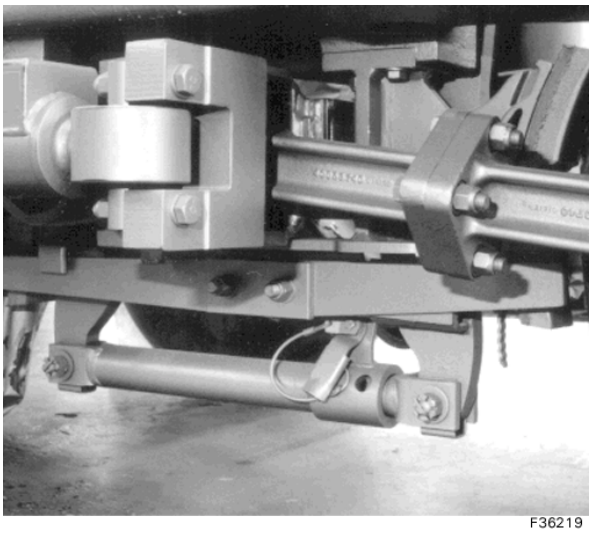


Figure 16a – Manual Type Slack Adjusters (Tube Type)

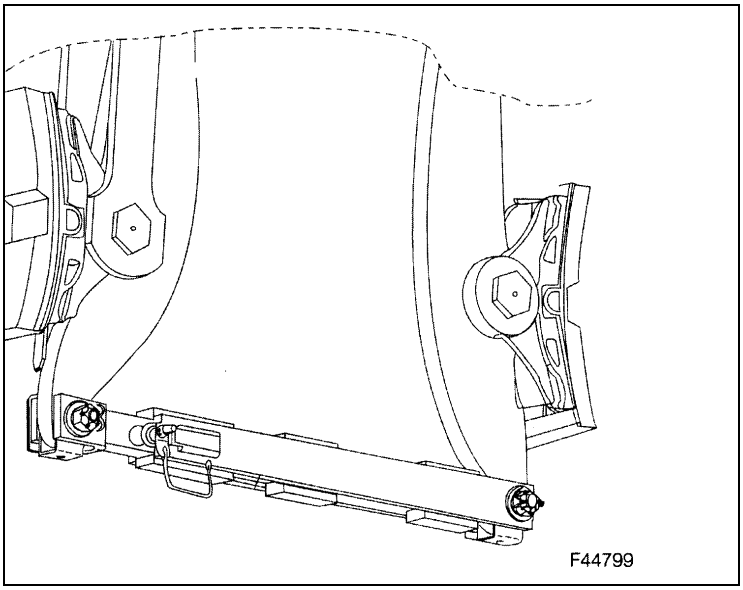


Figure 16b – Manual Type Slack Adjusters (Box Type)

2.8.2 ADJUSTMENT

Piston travel is set by the placement of a pin into one of the available adjustment holes in the slack adjuster. A spring-loaded clip that is positioned over the pin in service retains the pin. For adjustment, the clip is lifted and simultaneously rotated out of position to enable the pin to be removed. A ring and cable lanyard provides a means to pull the pin to perform an adjustment. The slack adjustment procedure 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 setting the piston travel will result.

1. With the brakes applied, measure the piston travel. (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 HTCR and HTCR-II trucks use 9x8 brake cylinders having a maximum piston travel of 8" (203 mm); thus the maximum FRA allowed piston travel is 6.50" (165 mm).)

2. If the piston travel exceeds 6.50", the slack adjuster must be reset to reduce the piston travel. 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 LEVERS WILL MOVE. KEEP HANDS AND FEET AWAY FROM THE BRAKE EQUIPMENT!

4. Lift and turn the pin retainer clip on the slack adjuster to be adjusted and remove the pin.

5. Using a suitable pry bar, work through the pinholes to extend the slack adjuster toward the wheel. When it is judged that the shoe release is at least 0.75" (19 mm) total for two shoe position, 5/8" for single shoe position, reapply the pin in the hole where it best fits.

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. It must be a minimum of 1.88" (48 mm) at the single shoe positions (axles #1 and #6) and a minimum of 2.25" (57 mm) at the two shoe positions (axles #2, 3, 4, and 5). 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.

2.8.3 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 or a bent or damaged assembly. Replace or repair the adjuster as required.

2.9 PARKING BRAKE

2.9.1 DESCRIPTION OF OPERATION

The motorized parking brake, Figure 17, used on SD80 and SD90 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. It does however, have a manual back-up system that can be utilized in the event of a power loss. The components of this system are comprised of a truck-mounted electric motor driven jackscrew, which is connected by chain to the locomotive brake rigging.

Figure 17 – Motorized Parking Brake

The motor is controlled by a push button switch, located in the locomotive cab on the Engine Control Panel, labeled as “PARKING BRAKE”. The outer ring of the switch is used to control motor direction. The jack screw applies force to the brake shoes at axle positions 2 left and 3 left via a chain that is shackled to the brake rigging crossover lever.

The jack screw motor is powered by locomotive system voltage (64/74 VDC), and is designed to shut down when 30-35 amperes are drawn over a time period of 3-5 seconds. When the current draw has stabilized (30-35A), the appropriate contactor will open to turn off the motor. Caution should always be exercised when using the parking brake, because brake component damage, obstruction (such as debris or severe icing), improper adjustment, or the jack screw bottoming out (fully retracted) may result in an improper indication of status and little or no brake capability. After setting the parking brake, it is good practice to visually check the brake application.

2.9.2 MANUAL OPERATION OF PARKING BRAKE

The parking brake may be operated manually in the event of power loss, jackscrew motor failure, or other emergencies. The crank handle assembly used for manual operation of the jackscrew is located on truck adjacent to the parking brake motor. Since the jackscrew has a large gear reduction, it takes many revolutions of the crank handle to set the brake. Caution should be exercised to ensure that the parking brake circuit breaker is turned off before applying the manual crank handle, and that no more than 60 LBS of force is applied to the manual crank handle when setting the brake manually.

CAUTION:
Before attempting to operate the parking brake manually, make certain that power cannot be supplied to the motor. Severe injury can occur if power is applied to the motor while operating the manual crank.

The parking brake can be prevented from operating electrically by:

- turning the circuit breaker off in the control panel in the #1 cab;
- cutting off the main power Battery Knife Switch located on the fuse and circuit breaker panel;
- or disconnecting the jack screw power connector located on the underframe by the #2 left wheel position.

CAUTION:
If the handle is left engaged in the coupling and the brake is operated electrically; the manual system will be back-driven by the electrical operation, causing the crank handle to spin rapidly. This may cause the handle to become disengaged and hurled, posing bodily harm or equipment damage.

2.9.3 ADJUSTMENTS & TROUBLE-SHOOTING

If the parking brake appears to need adjustment, check for wear in the chain, pins, and shackles. 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 number of links in the chain. Once this dimension has been established, it should not have to be re-done.

Check the brake cylinder piston travel with the parking brake applied. If the travel is greater that 6 ½", readjust the slack adjuster until the desired travel of less than 6 ½" is achieved.

2.9.4 MAINTENANCE & LUBRICATION

Quarterly

- The electric motor is ½ HP, totally enclosed, non-ventilated and has sealed bearings and requires no maintenance.

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

- Check condition of external electrical connectors, clamps and cabling for fraying, chafing, pinching, or other damage.
- Verify condition of chain, shackles, 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.

Semi-Annually

- The jackscrew has a grease fitting and a pipe plug on opposite sides of the housing. Remove the pipe plug and fill unit with MOBIL SHC 32 grease or equivalent with temperature range from -60^{o} F to 350^{o}F until lubricant seeps from the pipe plug opening. Replace pipe plug.

2.10 GEAR CASES (DC TRACTION LOCOMOTIVES)

2.10.1 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 the DC traction motor is covered in detail in M.I. 3900.

As illustrated in Figure 18, the gear case is comprised of two close fitting halves, and has seals to provide contact and closure. The upper half is equipped with a filler cap. In addition, the lower half has a drain plug and a level plug (used with oil lubricant).

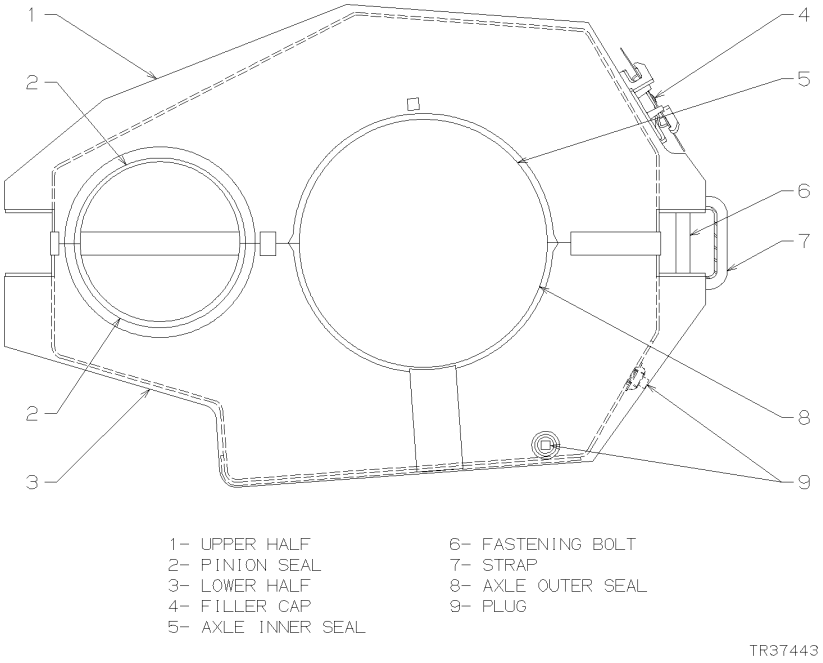


Figure 18 – Typical DC Gear Case

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.

2.10.2 GEAR CASE APPLICATION

Reinstall the gear case using the detailed procedure found in Maintenance Instruction 3900.

2.11 GEAR CASES (AC TRACTION LOCOMOTIVES)

2.11.1 GENERAL DESCRIPTION

The Gear Case, which is an integral part of the Traction Motor Assembly, is mounted on support arms at the traction motor.

As illustrated in Figure 19, 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.

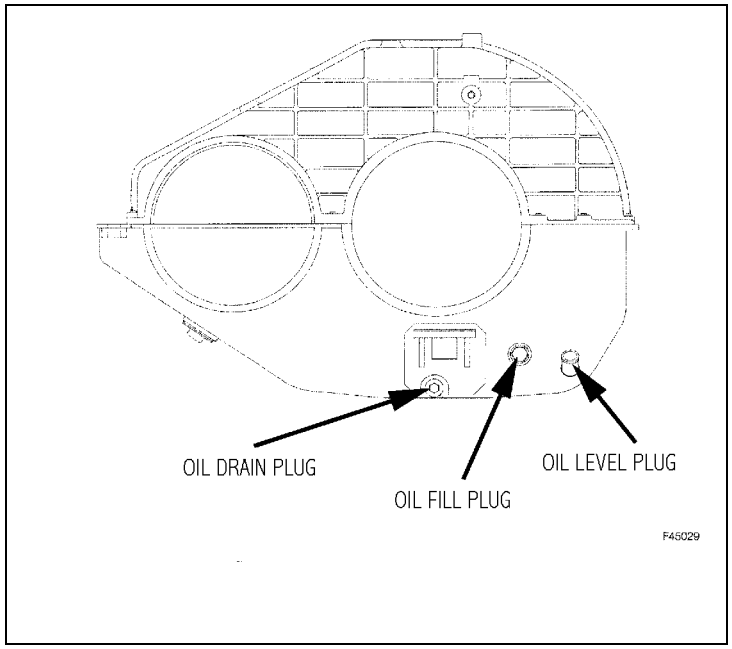


Figure 19 – Typical AC Gear Case

Located on the inboard side of the gear case on older models are three hex head pipe plugs as shown in Figure 19. 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.

2.11.2 GEAR CASE APPLICATION

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

2.12 TRACTION MOTOR REMOVAL (Models with One Piece Journal Adapter)

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. Whenever a traction motor-wheelset assembly needs to be removed, the following basic procedures should be followed:

WARNING:

Journal bearing adapters at both ends of the motor-wheelset being removed must be supported or restrained in such a manner that prevents them from rotating. This is necessary in order to prevent the journal springs from dropping out of the spring pockets in the truck frame – which could endanger maintenance personnel.

If the truck assembly is provided with rings / tubes on the frame (inside and outside) insert bars or cables through the rings and the springs to retain them within the frame. Care must still be used to restrain the journal adapter from rotation in order to keep the spring pilot (wear) plates from falling off the pilot tubes on the adapter.

1. While supporting the rear of the traction motor with a suitable lift device such as a hydraulic jack, disconnect the nose link (rod) assembly from the traction motor. If lock bolts were used in the assembly, they will have to be removed with a lock-bolt cutter or cutting torch.

> **CAUTION:**
> Use care when removing any lock-bolts with a torch in order to avoid damage to the surrounding truck frame, linkages, and bushings.

2. Disconnect the traction rods by removing the bolts at the flanged joints.

3. Disconnect safety hoops and / or vertical shock absorber(s) from the journal adapters of the motor being removed. Also 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 wheel flange lubricator nozzles and sanding guide/ nozzles.

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

5. Hold the nose link assembly clear of 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. Cover the traction motor air inlet to prevent the ingress of foreign material.

6. After removal of the motor / wheelset, journal bearing adapters may be removed from the axle bearings by first removing the retainer plates on the inboard side of the adapter. Support the adapter housing using a sling and hoist. Drive the housing off using two hammers to apply even force to two sides of the housing.

NOTE:

The HTCR truck uses "Full Bore" adapter housings, which require the use of some force to remove them from the journal bearings. However, the fit tolerance is such that they should only require light tapping around the inner circumference. Also a tool to facilitate the removal of the bearing adapter is available, EMD P/N 40069459.

7. Mount bearing adapters on the replacement wheelset and move the assembly beneath the locomotive. Re-assemble in the reverse order of disassembly using restraints or supports in a similar manner to keep the journal adapters level. In order to align the traction rods, motor should be back in place with locomotive weight supported by the journal springs.

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

2.13 TRACTION MOTOR REMOVAL (Models with Two Piece Journal Adapter)

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. 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 (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.

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.

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

3. 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 wheel flange lubricator nozzles and sanding nozzles.

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

5. 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.

6. 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.

7. 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 to fully engage one side of the bolt head.

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

2.14 TRUCK REMOVAL

2.14.1 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. Primary and Secondary 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 pivot pin clearance – Reference this M.I., the section on carbody 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.

2.14.2 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 20.

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. After the lift is completed, the locomotive should be supported with safety blocking located under the center sills near the jacking pads.

Figure 20 – Jack Alignment

3. Disconnect brake piping, Figure 21, handbrake connections, sanding equipment, and flange lube equipment (if equipped).

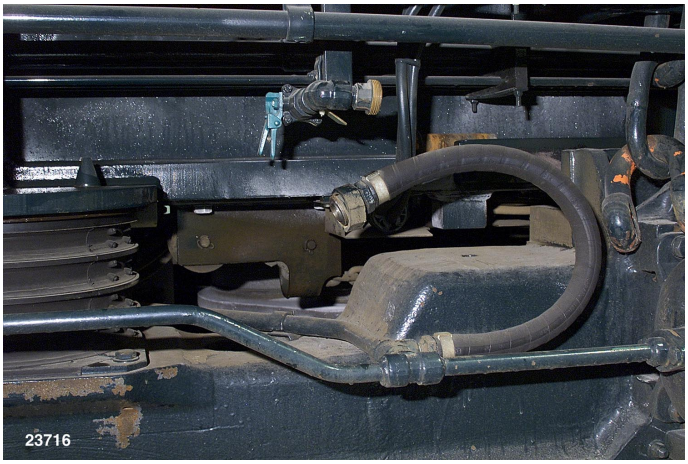


Figure 21 – Brake Cylinder air Piping

4. Apply penetrating lubricant to secondary spring pins; Figure 22.

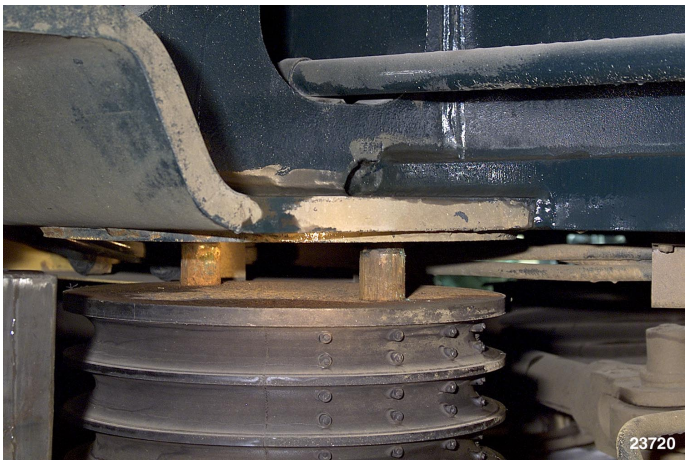


Figure 22 – Secondary Spring Pins (shown with unit lifted)

5. On DC units: Disconnect the air ducts, traction motor leads, ground cable, and speed probes (if equipped).

6. On AC 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 23. For SD80MAC and SD90MAC locomotives, disconnect the electric parking brake cable.

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

Figure 23 – Typical Traction Motor Connections (AC motor shown)

7. Remove cotter pins and disconnect carbody/truck shackles from truck, Figure 24 (3 locations).

Figure 24 – Carbody/Truck Shackles

8. Disconnect yaw dampers from carbody, Figure 25. Note that the carbody bolts are 5/8-11 x 3-3/4", while the truck end bolts are 5/8-11 x 2-3/4". Note also that the bolts are fitted with special washers, 1-5/16" OD x 21/32" ID x .105". Retain all washers. Inspect hardware for damage, discard and replace all locknuts [5/8-11].

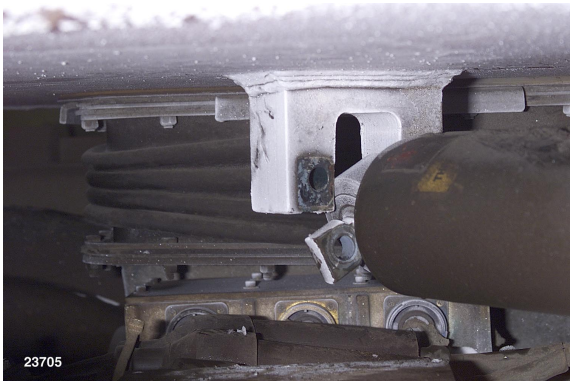


Figure 25 – Removal of Carbody Yaw Dampers

9. Remove and discard lock wire from carbody pivot pin bolts (Figure 26) and remove 3/4-10 x 2-1/2" bolts, pivot plate and wear ring (Figure 27). Wear ring should be discarded and a new one fitted on re-assembly.

Figure 26 – Lock Wire and Bolt Removal

Figure 27 – Pivot Plate and Wear Ring

10. Lift carbody or lower truck, ensuring separation of secondary springs from carbody, Figure 28.

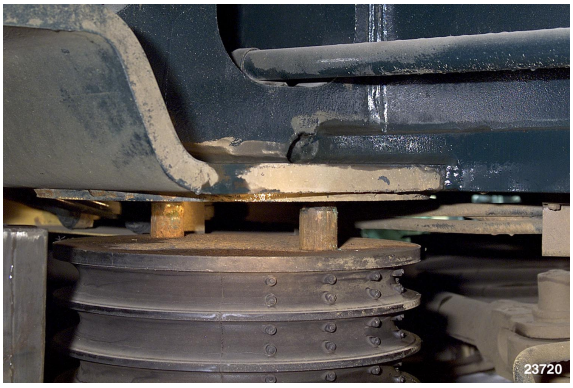


Figure 28 – Secondary Spring / Underframe Separation

11. Remove truck from under locomotive and locate it right side up in the stripping area, Figure 29.

Figure 29 – Truck in Stripping Area

2.15 TRUCK APPLICATION

2.15.1 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 wear cylinders in carbody pivot on truck. Note that the split lines of the two nylon pieces should be positioned towards the sides of the truck. Ensure carbody 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.

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 pivot pin with the carbody yoke and the secondary spring pins with the holes in the underframe. Slowly lower the locomotive until the carbody pin enters the nylon insert on the pivot assembly (Figure 30).

Figure 30 – Alignment of Pivot Pin

CAUTION

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

4. Note that the carbody pivot will engage before the tapered pins on the secondary springs. It is permissible to apply anti-seize lubricant to the pins, but the flat surfaces must remain dry for friction purposes.

2.15.2 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 the center axle location. 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 31.

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.

Vertical stop clearance on a new assembly should be at 0.62” –12”/+.25” (16 mm).

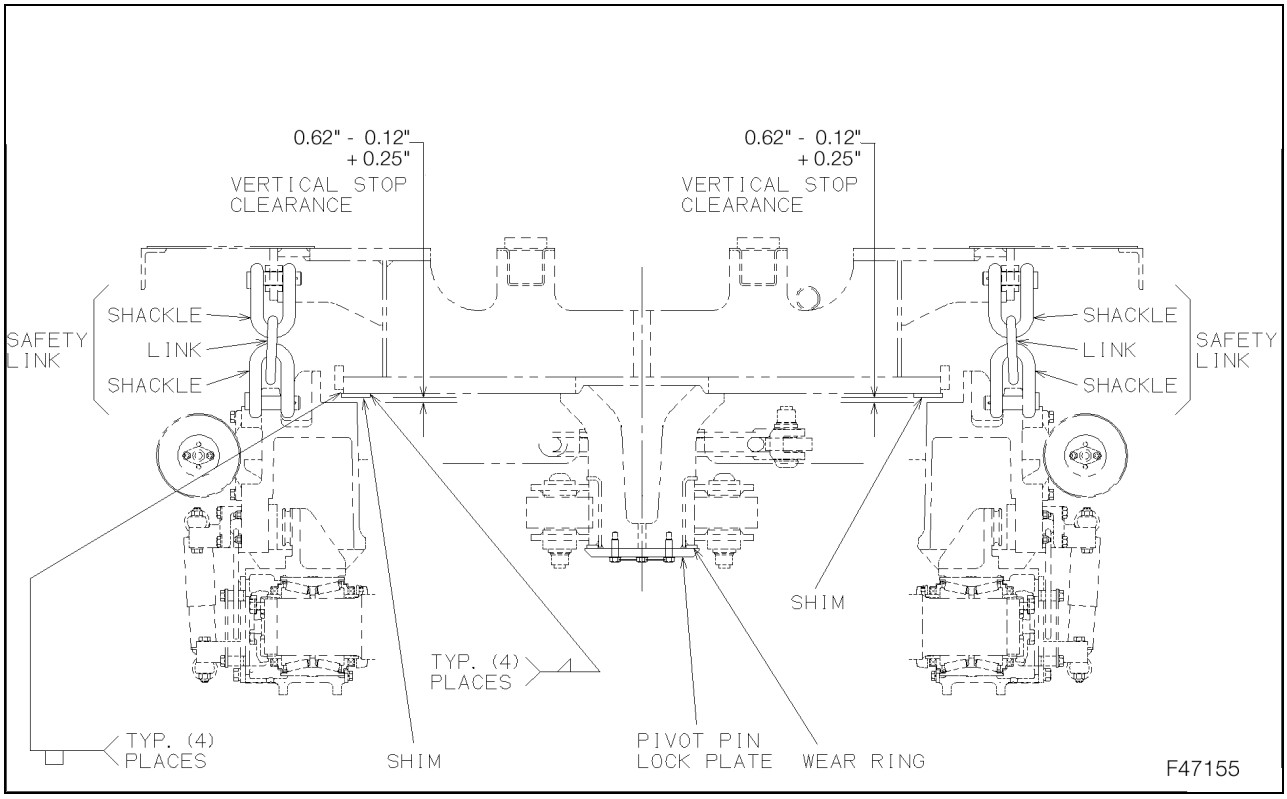


Figure 31 – Vertical Stop Clearance

2.15.3 FINAL INSTALLATION

1. Connect diagonal carbody dampers at carbody bracket using 5/8-11 x 3-3/4" bolt and 1-5/16 OD x 21/32 ID x .105" thick washer. Note that the dust cover end must be attached to the carbody with the label facing up. The truck end must have the label facing down. Torque to 115 ft-lbs.

2. Apply the pivot pin lock plate and new wear using ¾-10 x 2-1/2 drilled head bolt and ¾ hardened washer. Torque to 205 ft-lbs.

3. Install 14-gauge lockwire (approximately 6 feet) (Figure 32) through the holes in the bolt heads and safety wire in place.

Figure 32 – Application of Safety Wire

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

5. Attach carbody links to truck flanges using shackle assembly and new cotter pins.

6. Connect carbody air piping to truck air piping.

7. Connect truck flange lube equipment if applied.

8. Connect and adjust handbrake chain / connect parking brake wiring as applied.

9. Check and confirm that all truck and carbody inter-connections have been completed.

3.0 TRUCK OVERHAUL

This section details the procedures required to perform a complete overhaul of the HTCR / HTCR II 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 in a normal orientation. Take care to identify and properly store all components as they are removed to aid in re-assembly.

1. Remove cotter keys, disconnect brake rigging, and remove pins.

2. Remove brake lever mounting plate bolts, remove brake lever pin retaining rings, remove brake lever pivot pins and remove brake lever. Repeat as required.

3. Remove brake shoe keys and remove brake shoes. Slack off brake rigging to maximum possible (if not already done). Remove brake slack adjuster ¾-10" slotted hex nut and remove brake slack adjuster pins.

4. Remove 3/8-16 x 4-1/2" pin hanger bolts. Remove hanger ¾-10"slotted hex nut. Remove outside hanger pins and inside hanger pins. Remove brake hangers.

5. It is recommended that brake cylinder be removed when reconditioning is performed. Remove the brake cylinder hex nuts, and remove brake cylinder internal components.

6. Remove upper and lower yaw damper mounting bolts. Remove and discard ¾-10" lock nuts, retaining the special hardened ¾" flat washers. Replace the lock nuts with new on re-assembly. Remove the yaw damper. Repeat as required.

7. On HTCR trucks *only*: Remove upper yaw damper brackets mounting bolts and remove damper bracket. Repeat as required.

8. On HTCR trucks *only*: Remove lower damper plate mounting bolts, damper bracket mounting bolts and special washers. Retain washers. Repeat as required.

9. Remove brake cylinder piping. Repeat as required.

10. Remove secondary spring assemblies.

11. Remove horizontal yaw damper bolts, special washers, and locknuts. Retain special washers and discard locknuts. Replace locknuts with new on re-assembly.

12. HTCR trucks with the one-piece journal adapter only: Remove traction rod assembly bolts, special hardened washers, and locknuts, Figure 33. Retain washers and discard locknuts. Replace locknuts with new on re-assembly. Note that the traction rod sections will attempt to twist due to bushing torsion and will therefore require external force to keep them aligned until disassembly is complete.

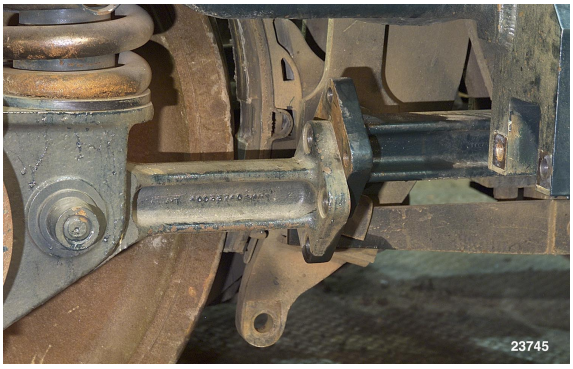


Figure 33 – Splitting of Traction Rods on One-Piece Adapters

13. Using the proper size lock bolt cutting tool or torch, remove the lock bolts from the steering link, Figure 34. Ensure the proper lubricant for the cutting tool is used as shown in Figure 35. If required cut one end of the steering link free with a cutting torch. Discard the link and replace it on re-assembly (after steering beam alignment). Retain special flat washers and flanged bushings from steering link ends.

Figure 34 – Steering Link Removal

Figure 35 – Cutting Tool Lubricant

14. Loosen the bolts holding the doweled steering beam top plate to the steering beam, Figure 36, but don't remove them. Remove the dowel locknuts, Figure 37, but not the dowels. If the dowels are damaged and require removal, use an impact wrench along with stacked washers to remove the dowels, washers, and lock nuts from the steering beam top plate. Discard the lock washers and replace with new on re-assembly. Repeat as required.

Figure 36 – Removing Plate Bolts

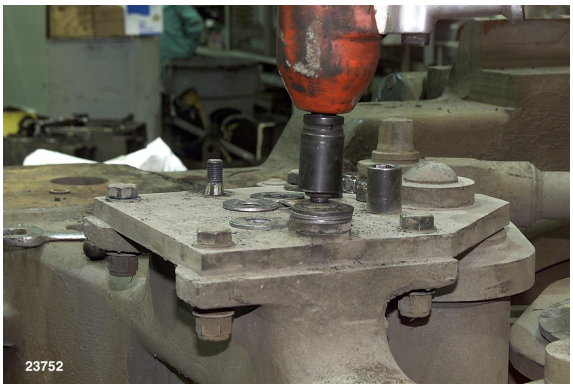


Figure 37 – Removing Dowel Lock Nuts

15. Apply a lifting device to the carbody pivot assembly to support it, and then, using the lock bolt collar-cutting tool, remove the carbody traction rod lock bolts from the truck end. Remove the carbody pivot assembly. Once the assembly has been flipped over on the floor or workbench, use the lock bolt-cutting tool to remove the two remaining lock bolt collars. This may require the use of a hydraulic tool (such as a portable hydraulic ram with spreader jaws), Figure 38, to separate the two components, as they can be very tight.

Figure 38 – Separating Carbody Traction Rods

16. Using either the lock bolt cutting tool or a cutting torch, remove the lower traction motor nose link (dog bone) lock bolt collars, Figure 39. Repeat as required.

Figure 39 – Dog Bone Removal

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

18. Remove the brake lever bracket assembly bolts and remove the brake lever bracket assembly.

19. If the truck is a HTCR II, remove the lower journal adapter caps, Figure 40.

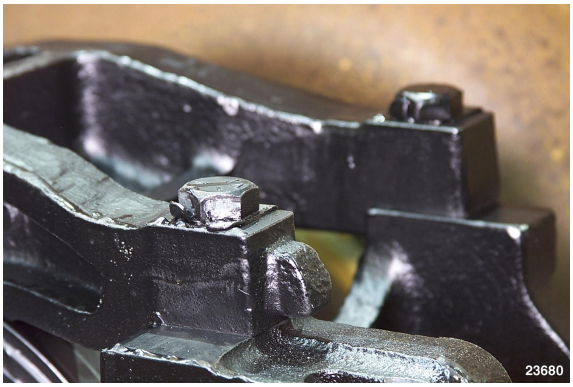


Figure 40 – Journal Adapter Cap Removal

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. If equipped, remove flange lube bracket assembly, Figure 41.

Figure 41 – Flange Lube Bracket

21. Remove the journal coil springs and clean for inspection and grading. 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.

22. Support the one-piece journal bearing adapter (if equipped) and attach the journal bearing Lifting and Removal Fixture P/N 40069459, Figure 42. Remember to remove the two bolts, washers, and the retainer plate from the rear of the adapter. Remove the one-piece journal-bearing adapter. Mark the journal adapters so they may be returned to their original position.

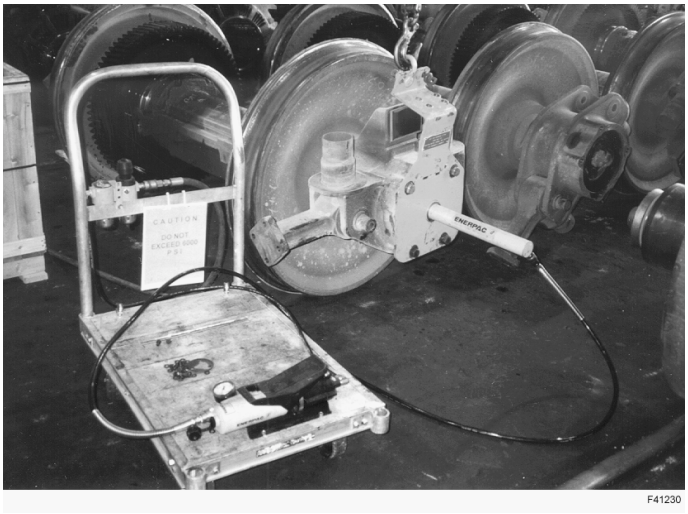


Figure 42 – Journal Adapter Removal

23. Using the lock-bolt cutting tool remove the journal bearing adapter traction rod lock bolt collar and then the traction rod. Retain special flat washers. Remove the four lock nuts and flat washers holding the lateral thrust pad in place (Figure 43) and then remove the thrust pad (Figure 44). Discard the pad and replace with new on re-assembly. Send journal adapter and traction rod for cleaning. Repeat as required.

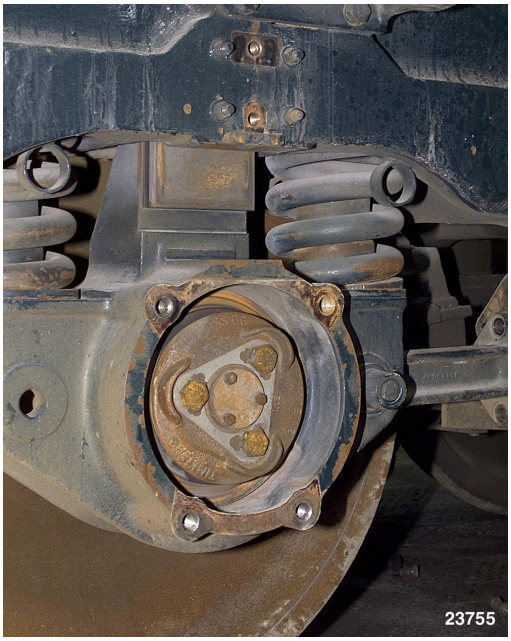


Figure 43 – Thrust Pad Wear Plate Retainer Bolts

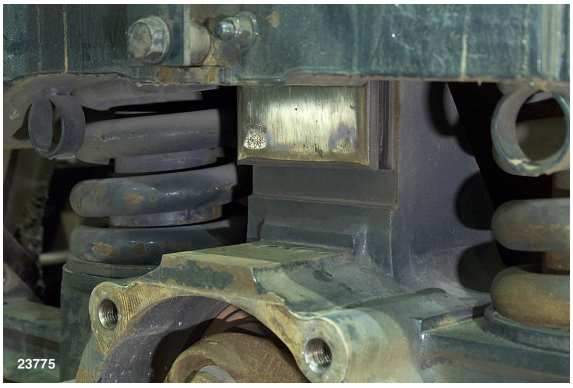


Figure 44 – Thrust Pad

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

25. 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 high enough to allow the steering beam lock bolt to drop free after the collar is removed (approximately 24”).

CAUTION:
Do not support the weight of the truck on the steering beam, as this may damage it. This does not apply if this procedure is being performed with the truck upside down.

26. Using the lock-bolt cutting tool cut the steering beam lock bolt collar, Figure 45. Remove the steering beam pedestal bolts, special washers, and locknuts. Apply new locknuts on re-assembly. Remove steering beam pedestal assemblies, Figure 46. Note that both of the #1 pedestals are the same, the #3 pedestals are different from side to side. It is important that these pedestals are retained in their original positions.

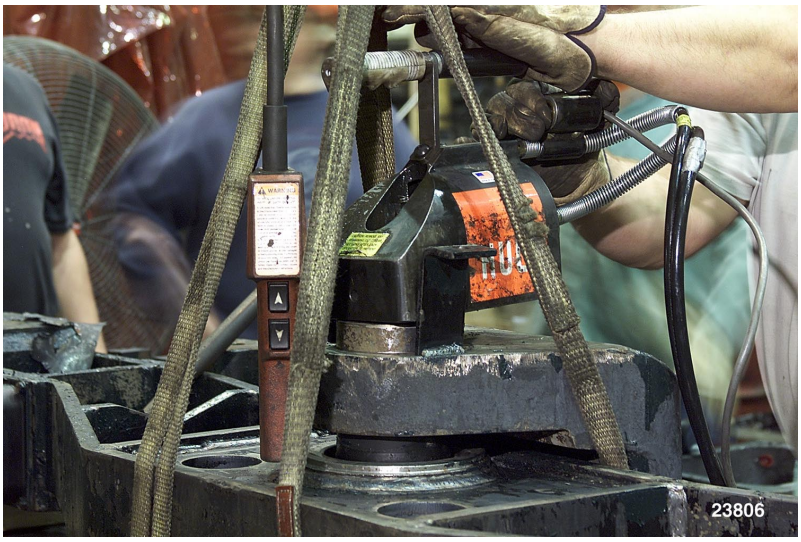


Figure 45 – Steering Beam Lock Bolt

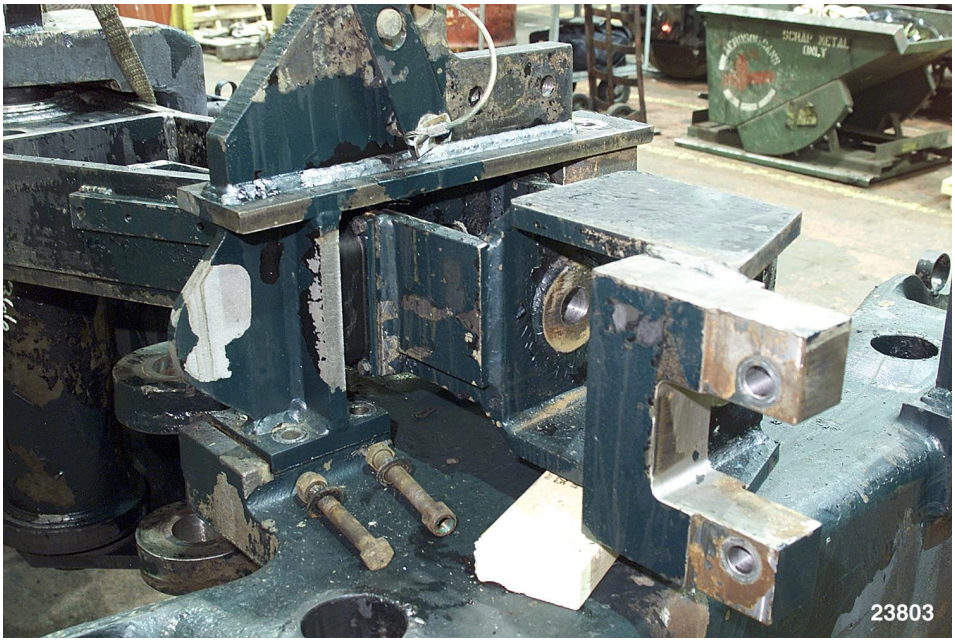


Figure 46 – Pedestal Removal

27. Support the steering beam plate and then remove the steering beam plate bolts. Lower the steering beam plate and lock bolt to the floor, Figure 47. If the truck stands are not high enough, the lock bolt will have to be cut with a cutting torch to remove it as in Figure 48. Note that these plates are serial numbered to the truck and their position (A & B; A to the open end of the truck). They are not interchangeable, refer to Figure 49.

Figure 47 –Steering Beam Plate Removal

Figure 48 – Cutting Steering Beam Lock Bolt

Figure 49 – Plate Serial Numbers and Location

28. Once the steering beam plate and lock bolt are removed, the steering beams themselves can be removed. Slide them away from the transom pedestals and remove them from the truck, Figure 50. Note that the steering beams are not interchangeable. The front steering beam assembly is the one with the straighter inter-axle link connecting plate. The rear steering beam assembly has the more curved inter-axle link connecting plate.

Figure 50 – Steering Beam Removal

29. Remove the truck-mounted journal bearing adapter wear plate bolts, the flat washers, and the locknuts. Note the length difference between end and middle axle bolts. Discard the locknuts and replace with new on re-assembly. Remove the truck-mounted journal bearing adapter nylon wear plates.

30. Using the lock bolt cutting tool cut the traction rod lock bolt collar and remove the lock bolt and traction rods from the center axle position. Repeat as required.

31. 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 51, 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.

Figure 51 – Journal Bearing Adapter

3.2.2 VERTICAL DAMPERS

Remove the vertical dampers, Figure 52, from the truck assembly. Renew or qualify the unit as per the section on Dampers in this M.I. Inspect all rubber mounting components, replace as required.

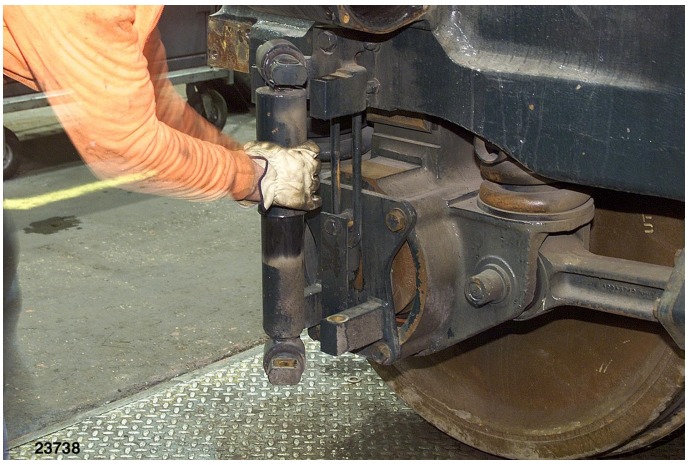


Figure 52 – Vertical Dampers

3.2.3 PRIMARY YAW DAMPERS

Primary yaw (steering) dampers, Figure 53, are mounted longitudinally between the truck frame and the ends of the steering beams. There are four primary 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.

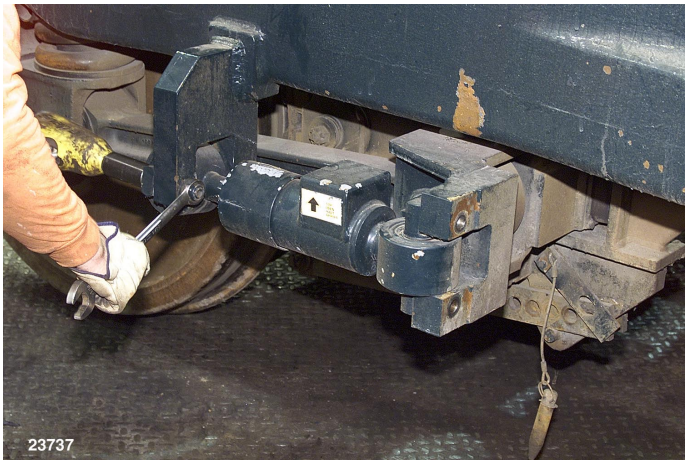


Figure 53 – Primary Yaw Dampers

3.2.4 SECONDARY YAW DAMPERS

Secondary (carbody) yaw dampers, Figure 54, are mounted diagonally between the truck frame and the locomotive underframe. There are two damper assemblies per truck. To remove the yaw 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.

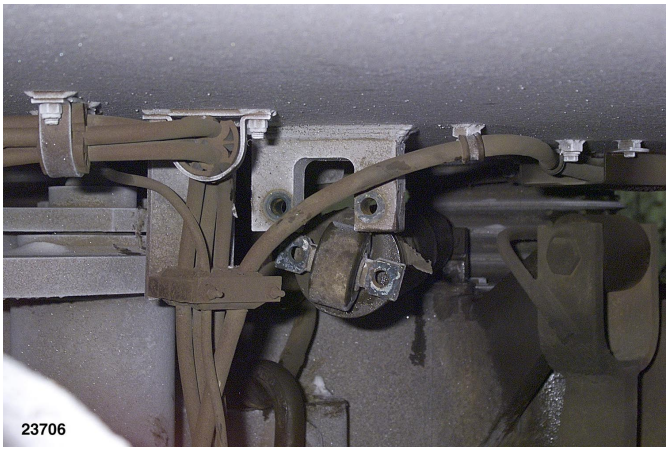


Figure 54 – Secondary Yaw Dampers

3.2.5 SECONDARY SPRINGS

Unbolt secondary springs, Figure 55, from the truck frame and remove from the truck assembly. Discard the secondary springs.

Figure 55 – Secondary Spring

3.2.6 LATERAL THRUST PADS

Lateral thrust pads, (refer to Figure 43), are located on the bearing adapters, adjacent to the primary springs at each journal bearing location. To remove the pads, unbolt the four retaining nuts and remove the pad assemblies from the bearing adapter . Replace thrust pads with new components.

3.2.7 ELECTRIC PARKING BRAKE (If Equipped)

1. Disconnect and remove the parking brake assembly (refer to Figure 17) from the truck frame.

2. Qualify as per the specific maintenance instructions on this device.

3.2.8 BRAKE CYLINDERS AND BRAKE RIGGING

The brake cylinders (4 per truck) should be replaced with qualified components, per the supplier's maintenance guide, at the time of truck overhaul, Figure 56.

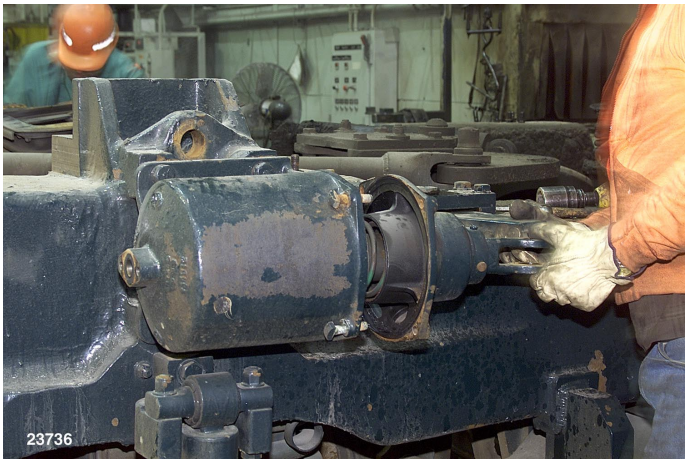


Figure 56 – Brake Cylinders

All brake rigging components, Figure 57, should be thoroughly cleaned and examined for damage and wear. Brake levers may be straightened if required. 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.

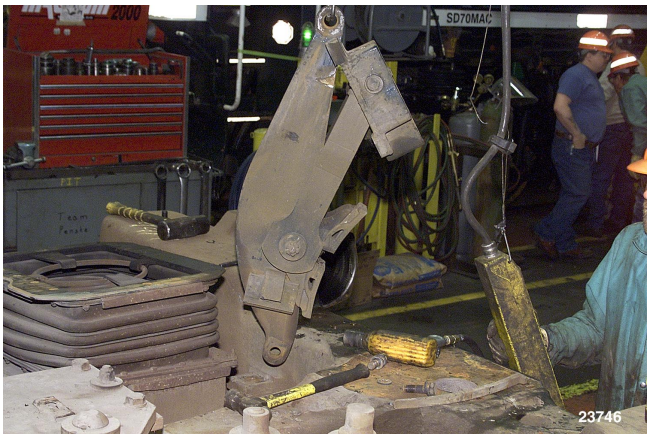


Figure 57 – Brake Rigging

3.2.9 TRACTION RODS

1. Remove the traction rod assemblies from the journal adapters and steering beam bushings by removing the locking bolts using a cutting torch (burned-off) or lock bolt collar cutting tool.

2. Use care when removing any locking bolts with a torch in order to avoid damage to the surrounding truck frame, linkages, and bushings.

3. Once the traction rod assemblies have been removed, extract all bushings using an arbor press, Figure 58.

Figure 58 – Bushing Removal

4. Thoroughly clean the traction rods, using a wire brush to clean all bushing bores.

5. Liberally coat the funnel and bushing with P80 Rubber Lubricant (EMD P/N 8251651) before attempting to press the bushing into place.

> **CAUTION:**
> Do **NOT** use soap, oil, or any other unapproved type of lubricant as this may lead to deterioration of the bushing material.

6. Insert new bushings (12 per truck) into traction rod halves using an arbor press and the bushing insertion funnel, Figure 59. Ensure that bushings are started true with the bore and are correctly centered.

Figure 59 – Bushing Insertion with Funnel

3.2.10 CARBODY PIVOT ASSEMBLY

Qualification of the carbody pivot assembly (Figure 60) includes inspection of the pivot and carbody traction rods.

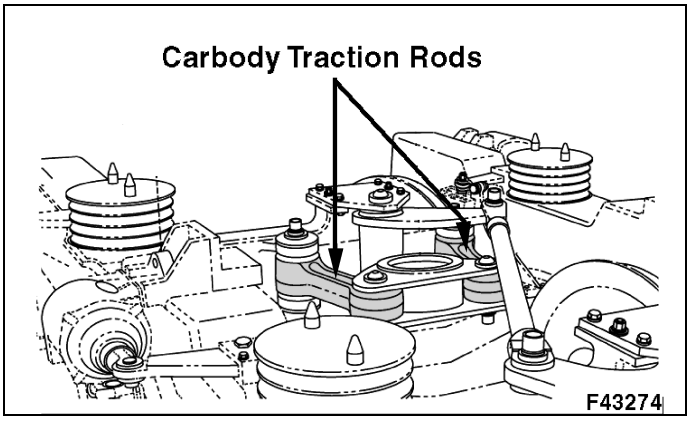


Figure 60 – Carbody Pivot Assembly

Thoroughly clean all components and inspect for damage or fatigue. Carbody rods are equipped with both rubber bushings (truck end) and spherical bearings (carbody pivot end). All must renewed prior to re-assembly using the following procedure:

1. The spherical bearings have a snap ring that must be removed before the bearing can be pushed out, Figure 61. Under the snap ring is a spacer that must also be removed.

Figure 61 – Carbody Rod Snap Ring Removal

2. Using a hydraulic press and appropriately sized pressing devices, remove all rubber bushings from the rod ends, Figure 62.

Figure 62 – Carbody Rod Bushing Removal

3. Clean all bushing bores and liberally apply rubber lubricant P-80.

4. Using the correct size arbor and insertion funnel, press the bushings into the truck ends of the carbody traction rods.

5. Using the proper pushing tool assemble the pivot ends, Figure 63, by first pressing the spherical bearing in until it seats against the shoulder on the inside of the rod. Apply the spacer and snap ring. Then press the flanged bushings into the spherical bearing inner race. Do this in a single operation to avoid overloading the spherical bearing in the axial direction.

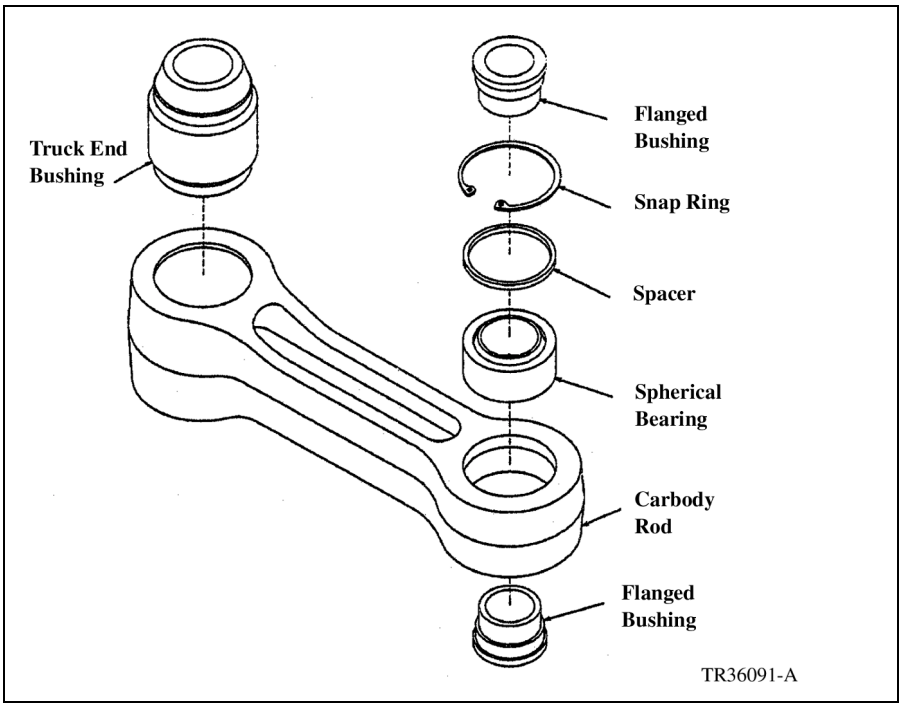


Figure 63 – Carbody Rod Assembly

6. Insert the upper spacers and snap ring. Ensure all components are fully and correctly installed. Note the following items:

    - The press adapter used must only contact the outer portion of the bearing, not the seal or sphere.
    - The split line of the outer race must lie on a 90-degree angle to the centerline of the rod.
    - Ensure that the bearing is properly seated in the rod bore to facilitate application of the snap ring.

7. Clean the pivot assembly bore in preparation for re-assembly.

3.2.11 AXLE TRACTION ROD ASSEMBLIES

Qualification of the traction rod assemblies includes a visual inspection of the traction rods and replacement of the bushing assemblies. Traction rods are equipped with rubber bushings at both ends.

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

1. Using the proper sized press tool, press the bushings out and clean the bores.

2. Liberally apply P-80 rubber lubricant to the new bushings and bores.

3. Using the correctly sized insertion funnel, center the bushings in the rod and press the new bushing into place.

Note that on reinstallation the machined surface of the bushing end of the rod is placed to the outside of the truck, and the lock bolt is installed so that the collar is on the wheel side of the journal-bearing adapter.

3.2.12 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 64.

Figure 64 – 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 65.

Figure 65 – Bushing Orientation

3.2.13 STEERING BEAMS

Qualification of the steering beams includes a visual inspection of the beams and replacement of the bushing assemblies and steering beam rubber snubbers.

Thoroughly clean all components and inspect for damage or wear. Repair as required. Bushings are replaced using the following procedure (refer to Figure 66; note that the procedure is identical for the front and rear steering beams):

1. Remove the spherical bearing snap ring and spacer.

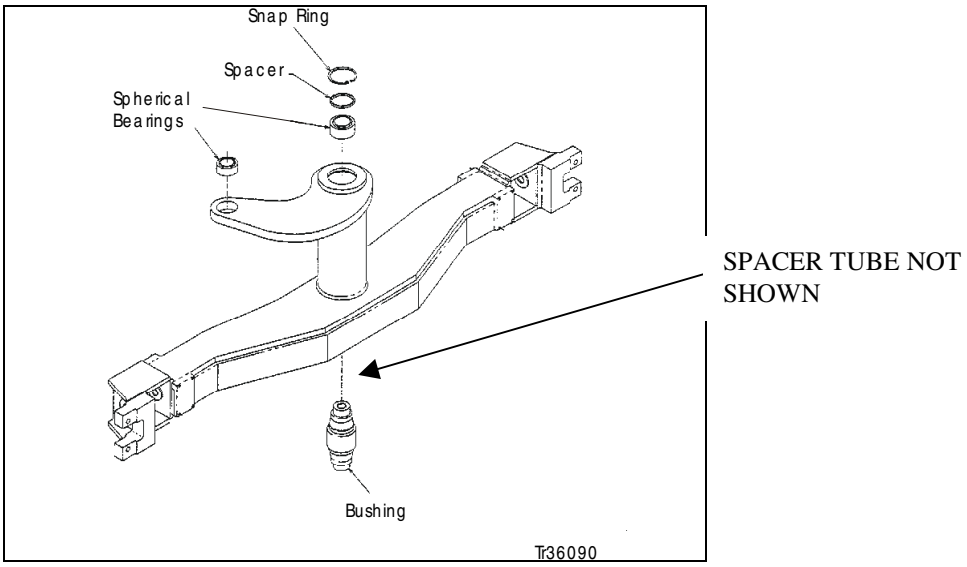


Figure 66 – Steering Beam Bushing and Bearing Assembly

2. Remove the steering beam bushings by pushing the rubber bushing into the bottom side of the beam to force the spherical bearing out of the topside of the beam. Alternatively, if the press can be set up for it, push the rubber bushings out first, then the spherical bearing. Use a 42" push rod to accomplish this. (Note: this push rod is usually made from the discarded steering link).

3. Remove the inner spacer tube (not shown in illustration).

4. Rotate the steering beam assembly and push the rubber bushing out.

5. Clean the bushing bores and lubricate the rubber bushing and bore with P-80 lubricant.

6. Press in the new rubber bushing using the appropriate funnel and pressing tools.

7. Insert the spacer tube.

8. Using the correct insertion funnel, apply the replacement bushing assemblies. Ensure that the pressing tool used on the spherical bearing only bears on the outer race, not the seal or spherical inner race. The split lines on the spherical bearing should be oriented to the front and rear of the steering beam.

9. Ensure the spherical bearing is fully bottomed out, then insert the spacer and snap ring.

10. The spherical bearing in the steering beam lever arm is simply pressed in (with due caution to the sphere and seal) until centered. Note however, that the race split on both spherical bearings must align with one another, oriented to the front and rear of the steering beam.

The steering beam rubber snubbers, four per beam, may be changed out using the following procedure:

1. Remove the four 5/16-18 x 1" bolts and 5/16" lock washers from each pad and discard the pad assemblies, Figure 67.

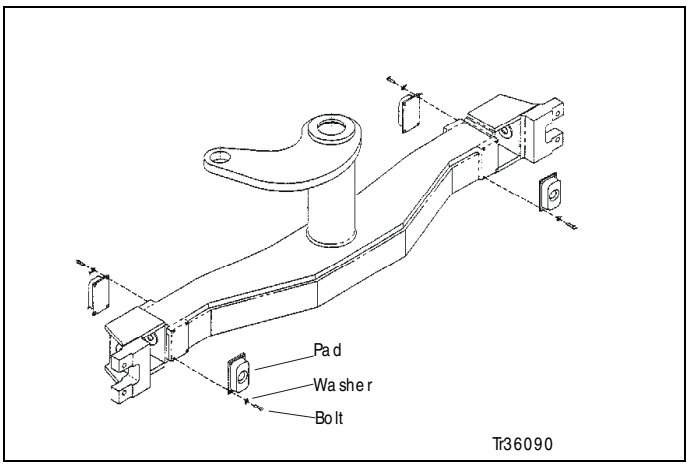


Figure 67 – Steering Beam Pads

2. Apply the new pad assemblies using new hardware. Ensure correct orientation of the pads to the beams.

3.2.14 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.

3.2.15 INTER-AXLE LINK

The inter-axle link is normally renewed during a truck overhaul. If it is necessary to qualify the link in service, the following procedure may be used.

1. Disconnect and remove the inter-axle assembly from the crank arm assemblies using the procedure outlined in the section on truck disassembly.

2. Inspect the inter-axle link for straightness.

3. If the inter-axle link is bent, this indicated an abnormal event has occurred. It is possible that the truck frame and/or steering beams may also be bent or damaged. Therefore, it is necessary to check truck frame tram and straightness and steering beam straightness. The truck frame should then be re-aligned with a new inter-axle link.

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 pedestals. Clean off the surface (carefully) and locate the tram points. Note that they are in different positions on the front and rear transom pedestals. Refer to Figure 68 for identification of tram points (indentation points).

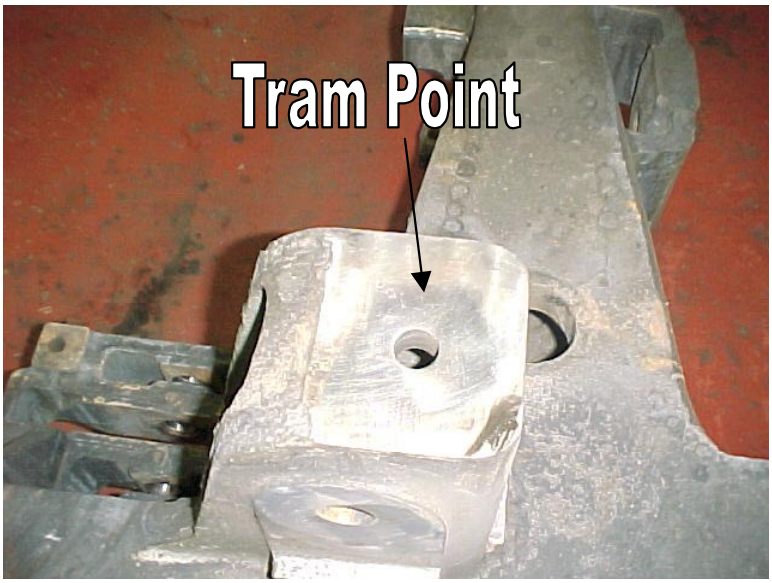


Figure 68 – Tramming Dimensions

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 69.

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.

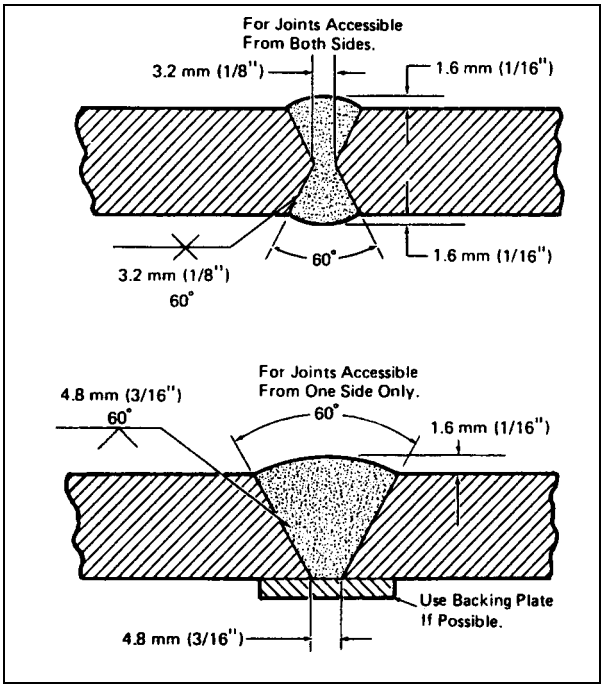


Figure 69 – Preparing Joints For Welding

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 (Figure 70). 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.

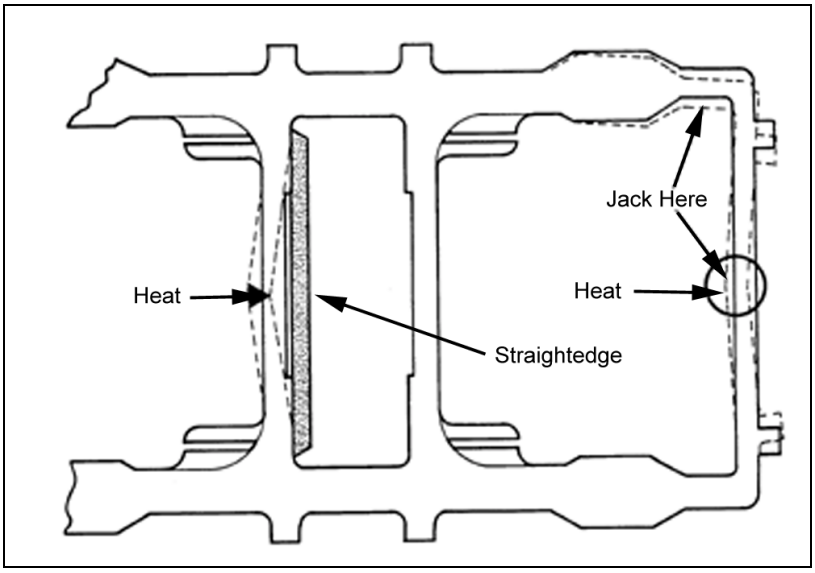


Figure 70 – Truck Frame Straightening

Jacks, turnbuckles or fixtures designed for straightening members will expedite the straightening of bent sections.

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 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.

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. Place steering beam lock bolt [1-3/8 x 40”] with washer [4 OD x 1-7/16 ID x 1” thick] on top of the doweled steering beam plate. Plate is flat on the floor, properly oriented to truck, Figure 71. Note the serial number and location letter of the steering beam plate to ensure proper placement. Lock bolt is vertical, so as to fit steering beam assembly down over it. Note also that there is a flange bushing that fits between the doweled steering plate and the steering beam assembly.

Figure 71 – Steering Beam Plate Orientation

2. Lower the steering beam assembly over the lock bolt and then carefully slide the steering beam/ lock bolt/doweled steering beam plate assembly into place on the truck. Ensure the steering beams are correctly placed in the truck frame; front or rear.

3. Place the removable steering beam pedestals on the truck in the correct positions, Figure 72. Torque bolts to 115 ft-lbs. Check to be sure that each pedestal is tight against shoulder machined onto truck frame with a .010 feeler gage to qualify.

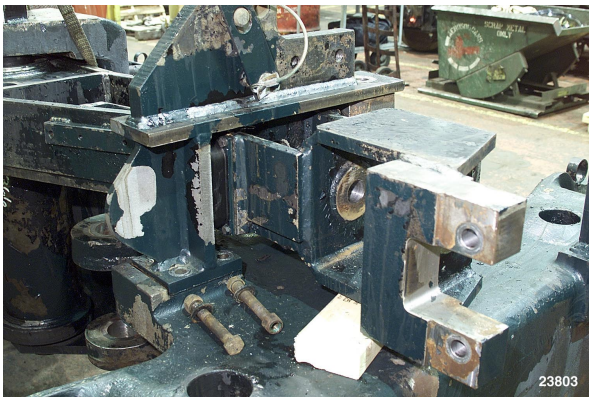


Figure 72 – Steering Beam Pedestals

4. Before applying closed end steering beam to truck frame pre-assemble clevis, spacers, link sleeves and lock bolts to steering beam. Repeat for second steering beam and removable truck steering beam pedestals.

5. If they were removed earlier, install the doweled steering beam plate dowels into the holes in the truck transoms.

6. Lift doweled steering beam plate/lock bolt assembly up into place and install lock bolt collar and washer [4 OD x 1-7/16 ID x 1" thick]. Ensure the doweled steering beam plate fits over the dowels to ensure proper alignment.

7. Install doweled steering beam top plate bolts, washers, and lock nuts. Tighten and torque to 305 ft-lbs. Using the lock bolt tool, swage the steering beam lock bolt collar.

8. Align the two steering beams. This is done by inserting shims [3 x 3 x 1/8"] between the steering beam pads and the pedestals, Figure 73. Once these shims are in place (four per beam) and the two steering beams are square, the steering beam inter-axle link is fitted.

Figure 73 – Steering Beam Alignment

9. Install the steering link lock bolts [1-3/8 x 10-5/8”] and link sleeve, but **do not** swage collars. Ensure that the lock bolts are parallel at both clevis ends of the steering link.

10. Install the remaining steering link sleeves, washers [4 OD x 1-7/16 ID x 1” thick], and collars. Swage with the lock bolt collar tool.

11. Weld the steering link/clevis joint at the aligned length. The welds are ½” beads, with two or three complete passes around the clevis/steering link joint.

12. Install brake bracket assembly with bolts [3/4-10 x 2-1/2”] and washers [3/4 hardened]. Install brake lever mounting plate with bolts [3/4-10 x 4”] and washers [3/4 hardened]. Torque bolts to 205ft-lbs.

13. Lift carbody rod and slide into place on truck. Note that rubber bushing end goes towards truck. Insert bolt [1-3/8 x 20-5/8”] and washer [4 OD x 1-7/16 ID x 1” thick], Figure 74. These are normally oriented so that when the truck is re-inverted, the lock collars and washers are on the top of the rod/truck assembly. Note that a flange bushing is also required on the carbody rod truck flanges. Repeat for each side of truck.

Figure 74 – Carbody Traction Rod Bolt

14. Lift carbody pivot assembly into position with the two carbody rods properly aligned in the assembly. Insert the pivot end lock bolts [1-3/8 x 15-5/8"]. These bolts are inserted from below if the truck is inverted, or above if not. Washers [4 OD x 1-7/16 ID x 1" thick] are required on both sides of the pivot, and then secured with the lock bolt tool on the collar.

Note that at this point, procedures will vary somewhat between trucks equipped with one piece journal adapters, and those equipped with two piece adapters. One-piece adapters are applied as part of the traction motor/wheelset combos, while two-piece adapters are applied to the truck frame prior to motor installation.

3.4.1.1 ONE-PIECE ADAPTERS

15. Install the truck end traction rods. Note that the longer traction rod goes towards the front or open end of the truck. The rods are installed horizontally, in line with the trucks machined surfaces, Figures 75 and 76. Ensure that the ends of the fasteners are "touched up" with a hand grinder to prevent injuries.

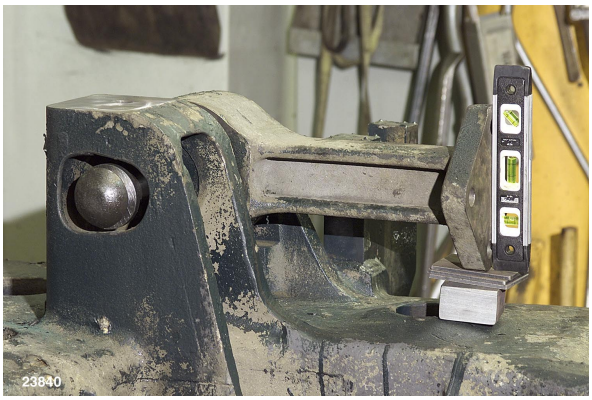


Figure 75 – Traction Rod Assembly

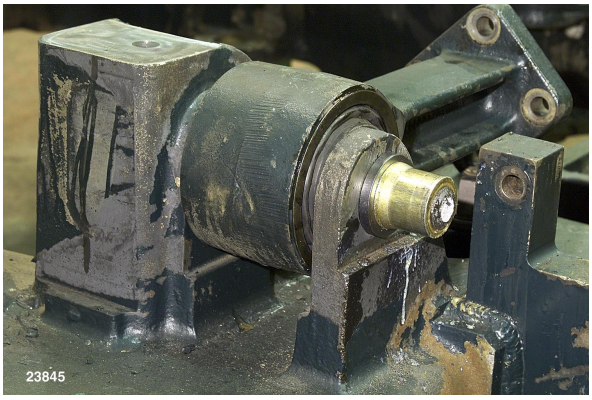


Figure 76 – Traction Rod Assembly

16. 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 77.

Figure 77 – Traction Motor Nose Link Support

17. 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.

18. Install the journal adapter ends of the traction rods. Note that the traction rods should have their machined edge facing outwards of the truck.

19. Fit journal bearing adapters to traction motor/wheel sets.

20. Install the journal bearing adapter retaining plates with bolts [5/8-11 x 1-1/2"] and washers [1-5/16 OD x 21/32 ID x .105" thick]. Torque the bolts to 115 ft-lbs. When lifting the combo's ensure a sling or other device is used to keep the journal bearing adapters level with the combo's.

21. Install the combo into the truck while the truck is still inverted, Figure 78. 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.

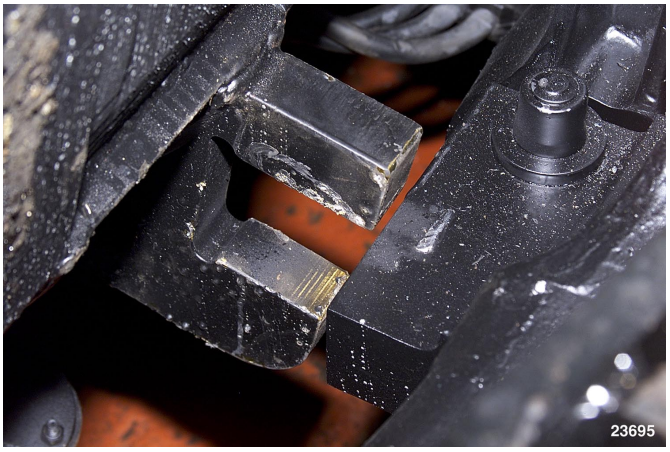


Figure 78 – Traction Motor Safety Brackets

22. 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 79. 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, swage the collars. Repeat for each combo.

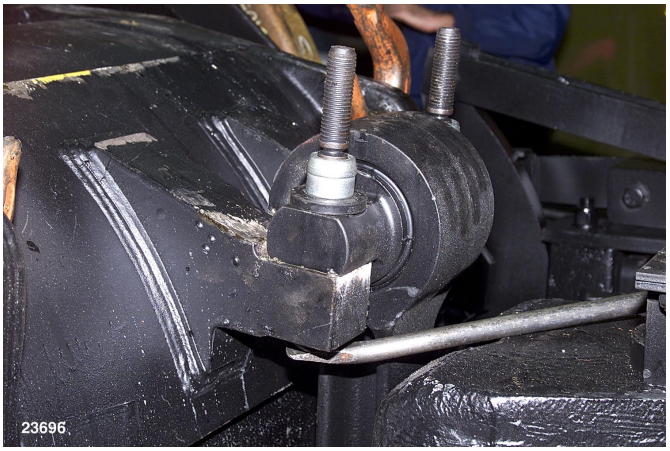


Figure 79 – Traction Motor Nose Support Alignment

23. Using a hydraulic jack or portable hydraulic ram, align the traction rod ends. Insert the bolts [3/4-10 x 3-1/2”], washers [3/4 hardened], and locknuts [3/4-10]. Torque to 205 ft-lbs. Repeat as required.

3.4.1.2 TWO-PIECE ADAPTERS

24. 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.

25. 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.

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

27. Apply the journal adapter retainer chains using new hardware.

28. Install the traction rods between the journal adapter and steering beams on outboard axles; and between the journal adapters and truck frame on the center axle. The rods are installed horizontally, in line with the truck's machined surfaces.

29. Install brake cylinder levers. Use new push rod pins and cotter pins on the cylinder end and lever pivot pin with retainer on the truck end.

30. Install the traction motor/wheelset combo into the truck while the truck is still inverted. Ensure proper engagement of all journal bearings with the journal adapters, Figure 80. Note that combo's will have to be installed at an angle to clear truck brackets.

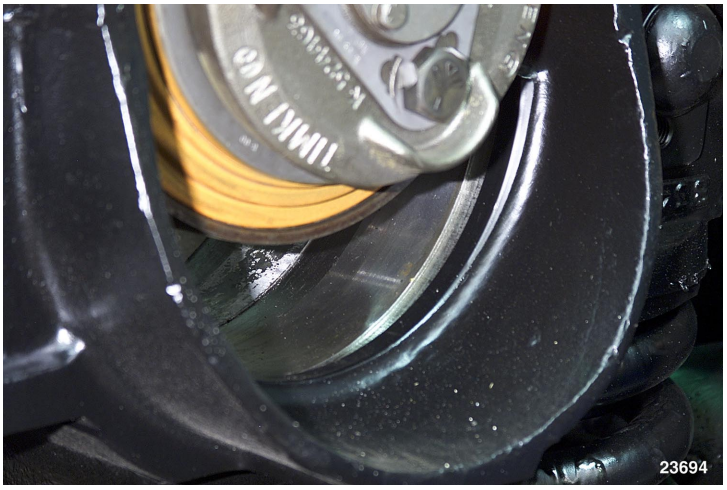


Figure 80 – Alignment of Bearing and Adapter

31. 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. 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.

32. 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 81 and torque to 205 ft-lbs. Bend the tabs on the lock plate to fully engage one side of the bolt head.

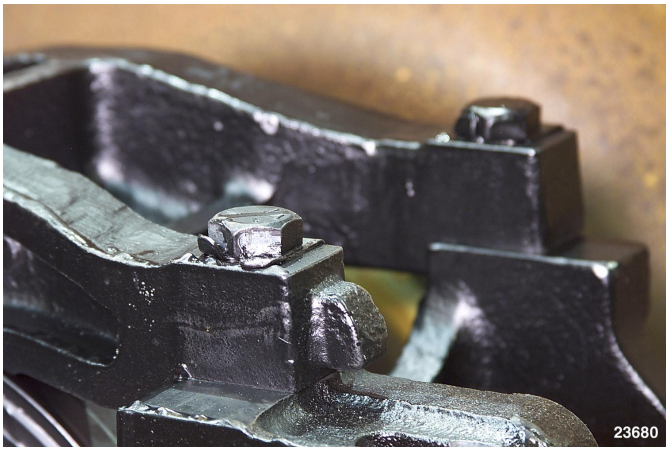


Figure 81 – Journal Bearing Adapter Cap Hardware

33. 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.

34. Install brake cylinder lever using bolts [3/4-10 x 3-1/2" and ¾-10 x 4"] and washers [3/4" hardened]. Torque bolts to 205 ft-lbs.

35. Install brake hanger assemblies, brake levers and brake heads. Install rigging and slack adjusters. Use new pins and cotter keys.

36. For trucks equipped with one-piece adapters, install lower damper bracket, interlock hoop, and plate. Lower damper bracket uses bolt [7/8-9 x 2"] and washer [1-5/8 OD x 15/16 ID x 1/8" thick]. Torque to 305 ft-lbs. Retaining hoop plate uses bolt [5/8-11x 1-1/2"] and washer [1-5/16 OD x 21/32 ID x .105" thick]. Torque to 115 ft-lbs.

37. Install upper damper bracket with bolt [3/4-10 x 3-3/4"] and washer [3/4 hardened]. Torque to 205 ft-lbs. Install shock with bolts [3/4-10 x 5"] and washers [3/4 hardened]. Torque to 205 ft-lbs. Repeat as required.

38. For trucks equipped with two piece adapters, install lower damper bracket. Lower damper bracket uses bolt [7/8-9 x 2”] and washer [1-5/8 OD x 15/16 ID x 1/8”]. Torque to 305 ft-lbs. Retaining hoop plate uses bolt [5/8-11x 1-1/2”] and washer [1-5/16 OD x 21/32 ID x .105” thick]. Torque to 115 ft-lbs.

39. Install upper damper bracket with bolt [3/4-10 x 3-3/4”] and washer [3/4 hardened]. Torque to 250 ft-lbs.

40. Install Delco damper with bolts [3/4-10 x 4”] and washers [3/4 hardened]. Torque to 250 ft-lbs. Repeat as required. Install Koni damper with bolts [5/8”-11 x 4”] and washers [5/8” hardened]. Torque to 135 ft-lbs. Repeat as required.

41. Install horizontal yaw dampers. Use bolt [3/4-10 x 4-1/2”], washer [3/4 hardened], and locknut [3/4-10]. Torque to 205 ft-lbs. Ensure that reservoir on damper faces up in relation to truck (marked on damper).

3.4.2 FINAL TRUCK ASSEMBLY

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

2. Install new secondary rubber spring assemblies, Figure 82, with bolt [5/8-11 x 1-1/4”] and washer [1-5/6 OD x 21/32 ID x .105” thick]. Torque to 115 ft-lbs.

Figure 82 – Secondary Spring Application

3. Install diagonal carbody yaw damper on truck, using bolt [5/8-11 x 1-3/] and washer [1-5/16 OD x 21/32 ID x .105" thick]. Torque bolts to 115 ft-lbs. All late model truck frames have these brackets welded to the frame instead of bolted.

4. Install diagonal carbody yaw dampers on the truck. Shock end goes on truck and dust cover end goes towards carbody. Use bolts [5/8-11 x 2-3/4] and washers [1-5/16 OD x 21/32 ID x .105" thick] on the truck end. Torque to 115 ft-lbs.

5. Install truck brake cylinder piping. Reference correct parts catalogue for orientation of piping. It may be advisable to apply an air pressure test of approximately 80 psi to verify pipe connections at this time.

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 83 – Traction Motor Gearcase Lubrication

8. Assemble all remaining auxiliary equipment such as flange lubricators. Do not apply sander guide until locomotive is trucked.

3.5 TRUCK APPLICATION TO LOCOMOTIVE

1. Install nylon wear cylinders in carbody pivot on truck. Ensure carbody 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 pivot pin with pivot and secondary rubber spring pins with appropriate holes in truck, Figure 84 and Figure 85. Note that the carbody pivot will meet the truck before the secondary spring pins meet the carbody. Anti-seize lubricant is permissible on the pins only of the secondary rubber springs. The flat plate surface must remain dry for friction purposes.

Figure 84 – Carbody Pivot Pin Installation

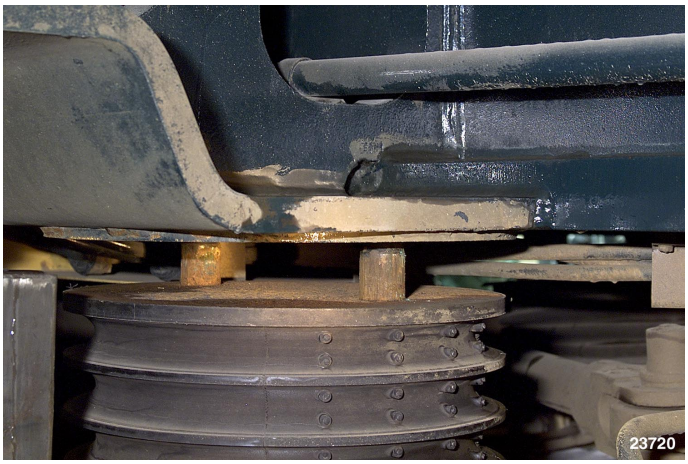


Figure 85 – Secondary Spring Alignment

4. Connect diagonal carbody dampers at carbody bracket, using bolt [5/8-11 x 3-3/4"] and washer [1-5/16 OD x 21/32 ID x .105" thick]. Torque to 115 ft-lbs.

5. Install new carbody pivot pin wear ring and plate using drilled head bolt [3/4-10 x 2-1/2"] and washer [3/4 hardened]. Torque to 205 ft-lbs. Install 14-gauge lock wire, Figure 90, (approximately 6 feet) through the holes in the bolt heads and safety wire them in place.

Figure 86 – Carbody Pivot Pin Lock Wire

6. Connect traction motor leads, and traction motor temperature probe plug.

7. Attach carbody links to truck flanges using shackle assembly and new cotter pins.

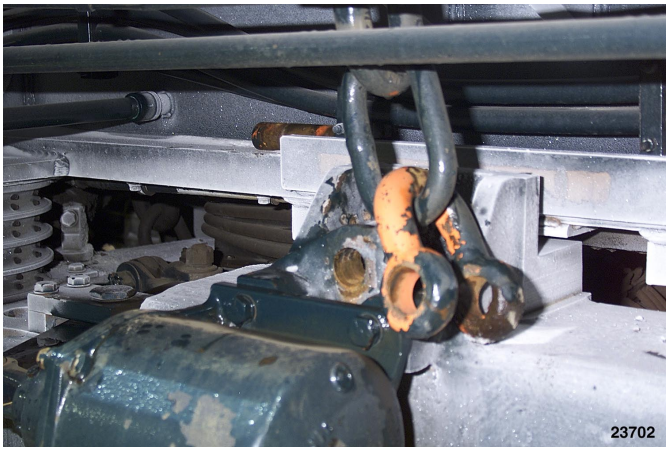


Figure 87 – Carbody Links (Shackles)

8. Connect carbody air piping to truck air piping, Figure 88.

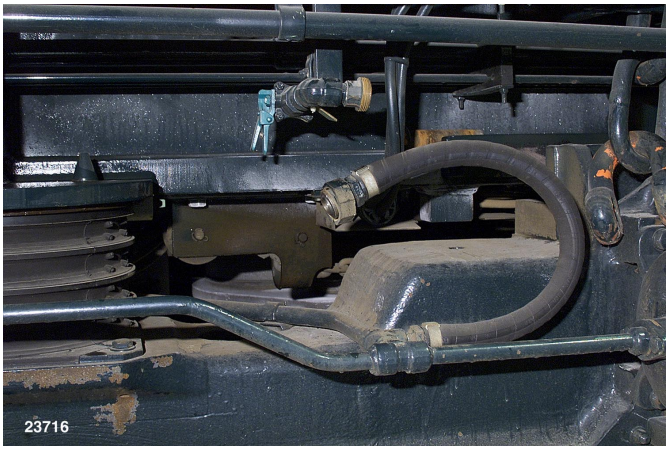


Figure 88 – Air Brake Piping

9. Connect truck flange lube equipment if equipped.

10. Connect and adjust handbrake chain (SD70/75 series locomotives).

11. Connect electric parking brake leads (SD80/90 series locomotives).

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

13. Check and adjust brake cylinder piston travel as described in Section 2.8.2.

4.0 SERVICE DATA - TRUCK ASSEMBLY

4.1 REFERENCES

4.1.1 MAINTENANCE INSTRUCTIONS

4.1.2 TYPICAL PARTS CATALOGUES

4.1.3 EMD VIDEO PRESENTATIONS

HTCR and HTCR II TM Change-Out and Installation Procedures

4.1.4 OTHER REFERENCES

"Railway Damper Field Inspection Manual" - KONI
"Wheel and Axle Manual" - Association of American Railroads (AAR)

4.2 WEIGHTS

Approximate weight of trucks fully equipped……60,000 lbs (SD70)
68,000 lbs (SD80/SD90)
Approximate weight of Tm/wheel combo (per combo)… 13,000 lbs (SD70)
15,000 lbs (SD80/SD90)
Approximate weight of stripped truck frame…… 14,000 lbs

Approximate weight of steering beams (per beam)……..1200 lbs

4.3 SPECIAL TORQUE VALUES

Damper (DELCO ¾-10 x 4" bolts)……..…..250 ft-lbs

Damper (KONI 5/8-11 x 4" bolts)…..…….……..….135 ft-lbs

Damper (Carbody 5/8-11 x 3-3/4" bolts)……...…115 ft-lbs

Damper (Yaw 3/4-10 x 4-1/2" bolts)……..205 ft-lbs

Upper Damper Bracket (3/4-10 x 3-3/4" bolts)……..……250 ft-lbs

Lower Damper Bracket (7/8-9 x 2" bolts)……..…305 ft-lbs

Carbody Pivot (3/4-10 x 2-1/2" bolts)……205 ft-lbs

Steering Beam Pedestal Bolts (5/8-11")…….……115 ft-lbs

Steering Beam Plate Bolts (7/8-9")……..…… 305 ft-lbs

Brake Rigging Bracket (3/4-10 x 4" bolts)……205 ft-lbs

HTCR Journal Adapter Retainer (5/8-11 x 1-1/2" bolts)…..…….115 ft-lbs

Traction Rod Split (3/4-10 x 3-1/2" bolts)…….……205 ft-lbs

HTCR II Journal Retainer (3/4-10 x 3-1/2" bolts)……205 ft-lbs

AC Gearcase (3/8-16" parting bolts)…….. 35 ft-lbs

AC Gearcase (1-1/8-7" mounting bolts)…… 990 ft-lbs

Temporary Nose Link (1-12" diameter Grade 8)……750-800 ft-lbs

Secondary Springs (5/8-11 x 1-1/4" bolts)…….115 ft-lbs

4.4 WHEEL SIZE VARIATION LIMITS (shown on wheel diameter)

All Locomotives

- Between two wheels on the same axle……..……0.020”

DC Transmission Locomotives

- Between axles within a truck……..0.50”
- Between trucks……0.75”

AC Transmission Locomotives

- Between axles within a truck……..0.1875”
- Between trucks……0.75”

4.5 ROUTINE MAINTENANCE EQUIPMENT and SPECIAL TOOLS

4.5.1 FIXTURES

Journal Bearing Lifting and Removal Fixture……...40069459

Lifting Fixture
(Traction Motor, Axle and Wheel assembly)…….....* File No. 288

Wall Mounted Fixture
To Test Dampers…….....* Work Sketch #41089

4.5.2 BUSHING REPLACEMENT TOOLS

Bushing # 40036366…….....* Work Sketch #50336

Bushing # 40036365…….....* Work Sketch #50337

Bushing # 9580305…….....* Work Sketch #50337

Bushing # 40036364…….....* Work Sketch #50358

Bushing # 40036365…….....….....* Work Sketch #50401

Bushing # 40036900 (extraction)….....* Work Sketch #50402

Bushing # 40036900 (application).....* Work Sketch #50403

Bushing # 40003262…….....* Work Sketch #50407

Bushing # 40036365 (application).....* Work Sketch #50409

Bushing # 9580305…….....* Work Sketch #50413

4.5.3 SPECIAL LUBRICANTS

P80 Rubber Lubricant……..…….8251651

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

Document Number MM001001 (DE-LP)

Electro-Motive Division of General Motors Corporation
La Grange, Illinois 60525 USA
Telephone: 708-387-6000
Website: www.gmemd.com