Reliability at work

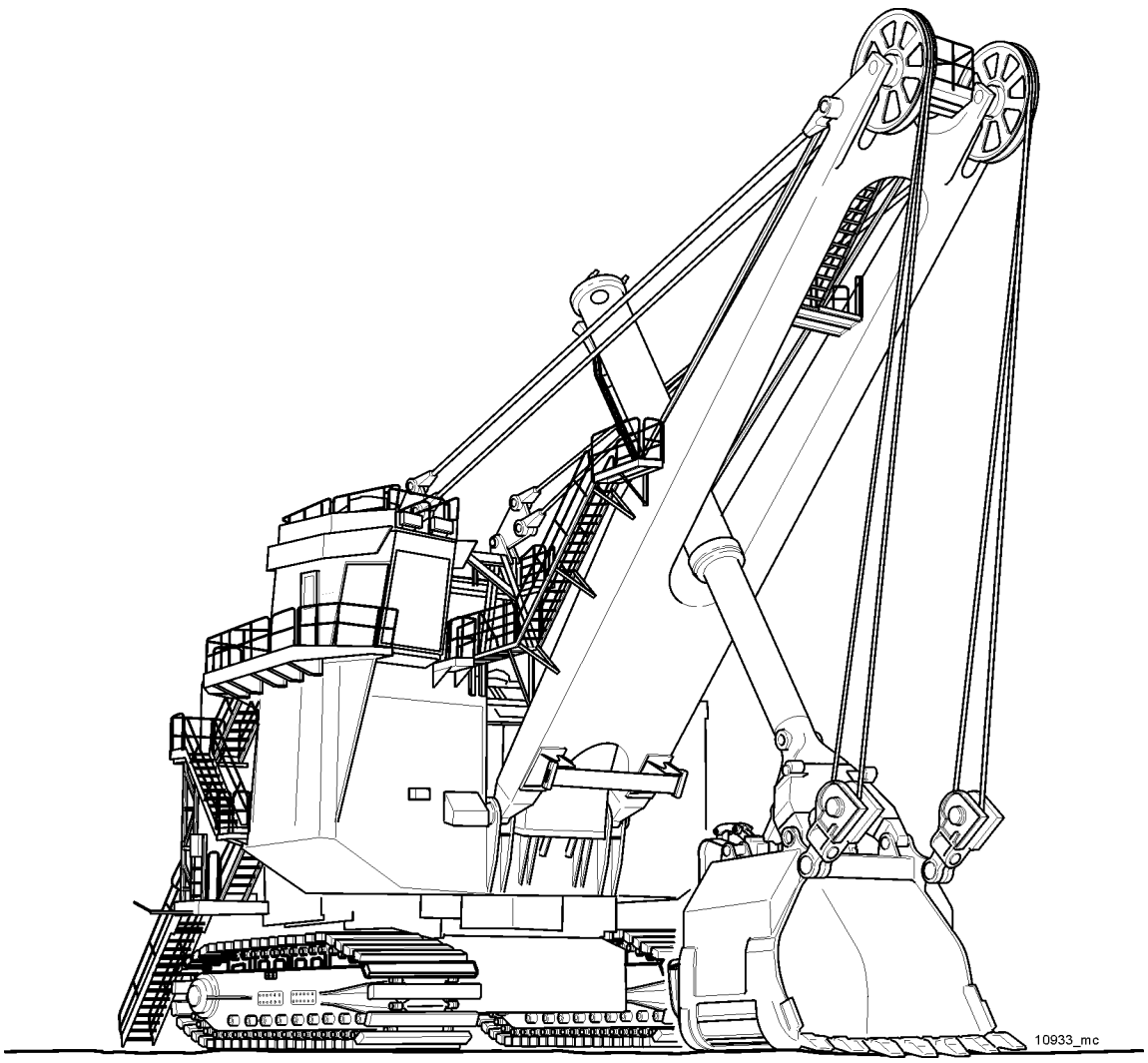
BUCYRUS®

495HD

Mining Shovel

Service Manual

Manual No. SM141443-EN



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S.2.4 Fire Prevention

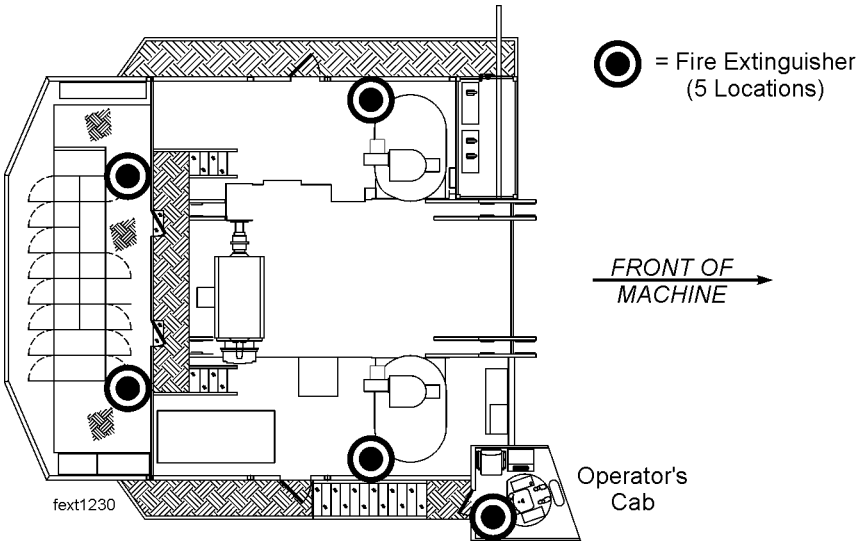


Figure S-1 Fire Extinguisher Locations

- Always have a “charged” fire extinguisher on hand and know how to use it. Inspect and service the extinguisher as indicated on its instruction plate.
- DO NOT smoke while handling flammables or when near batteries.
- Inspect all lines, tubes and hoses carefully. Tighten all connections to the recommended torque.
- Repair or replace loose or damaged lines, tubes and hoses as soon as possible.
- Make certain all clamps, guards and shields are replaced correctly so as to prevent vibration and the chafing of parts during operation.
- DO NOT carry flammable fluids such as gasoline or solvents on board the machine.
- DO NOT over-bend or strike pressurized lines or hoses. DO NOT install bent or damaged lines, tubes, or hoses. Replace them immediately.
- DO NOT start the machine or move any of the controls if a warning tag is attached to the controls or the start panel.

1.1.4 Revisions

This manual may be revised without notice. The most recent electronic version is available online.

1.1.5 Precautions and Disclaimers

- Carefully study and follow all procedures in this manual. Safety guidelines are intended to prevent accidents and are provided in the interest of all mine personnel. Overall safety depends on the use of good judgment and the alertness of the entire mining crew.
- It is the owner/mine's responsibility to perform the necessary risk assessment to outline proper safety precautions. A minimum of unplanned machine downtime and more reliable machine operation should result when a systematic and thorough maintenance/service procedure is adhered to for this machine.
- It is the policy of the manufacturer to improve its products whenever possible and practical to do so. The company reserves the right to make changes or add improvements to its machines at any time. This will be without incurred obligations to install such changes on machines sold previously. Due to this ongoing program of product research and development some procedures, specifications and parts may be altered in a constant effort to improve our machines.

1.1.6 Contact

For more information or factory service assistance, contact your regional service representative or:

Caterpillar Global Mining LLC

6744 S. Howell Ave.
Oak Creek, WI, USA 53154

Telephone (+1) 414.768.4000

1.3.4 Roller Circle

The roller circle is composed of the upper rails, lower rails, thrust rails, 50 tapered rollers and inner/outer roller cages. The lower rail segments are secured to the top surface of the swing rack forming a continuous rolling path for the rollers. The upper rails are attached to the bottom of the revolving frame, fore and aft of the center pintle. Upper rail ends are tapered to provide a smooth approach for the rollers. Rollers are tapered to ensure non-skid contact with rails. The rollers are spaced and aligned with pins and low maintenance polyurethane bushings.

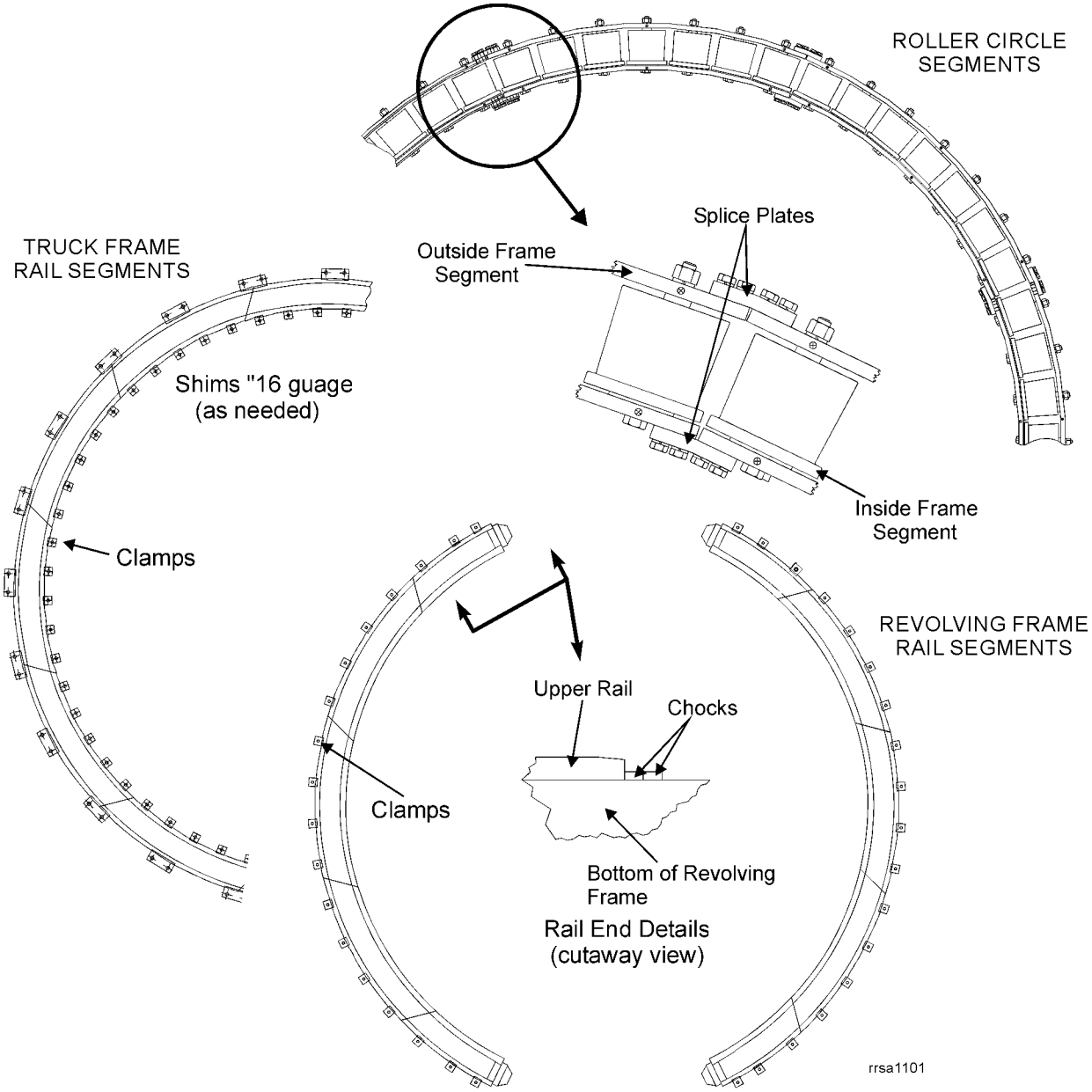
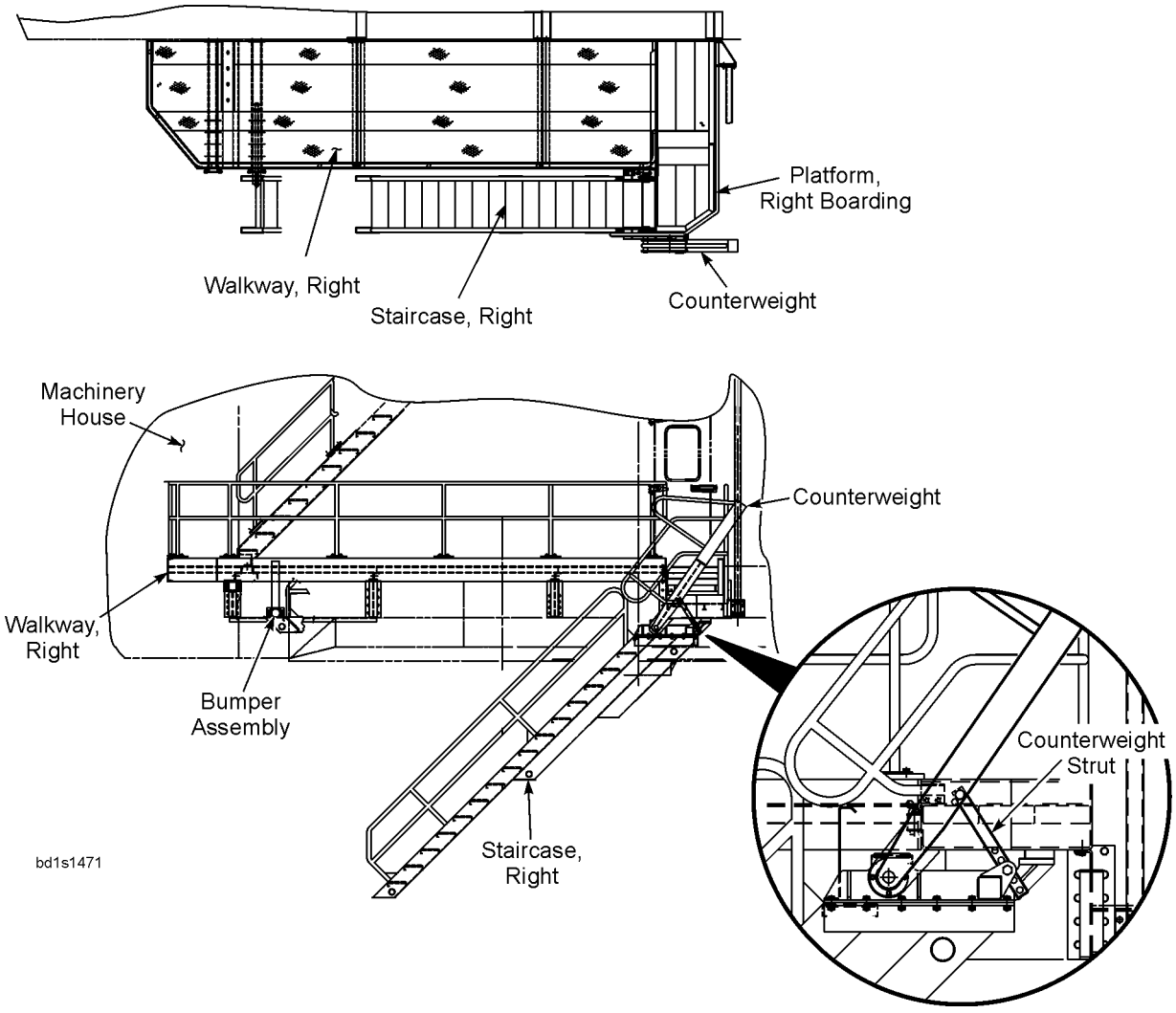


Figure 1-5 Roller Circle Assembly

1.4.6 Boarding Stairs

A set of boarding stairs is attached to the machinery house platform - either on the left side of the machine, the right side or both. When lowered, the stairs allow entrance to the machinery house from ground level. The stairs must be in their raised position to enable the operator's controls.

The boarding stairs pivot about a pivot shaft attached to the boarding platform. A set of counterweights offsets the weight of the stairs.



1.5.2 Boom

The boom is a welded steel structure consisting of twin box girders integrally connected at the boom point and in the lower section between the shipper shaft and boom feet. Impact resistant steel is utilized, coupled with 100% penetration and UT quality welds on all main splice joints. Design optimization has resulted in heavier outside skin plates, minimizing the need for internal diaphragms. This reduction in weld related stress concentrations further enhances structural life. Open manholes have been incorporated in the boom as a standard feature permitting periodic structural inspection. Integral “ladders” within the upper boom sections permit internal access without lowering the boom.

The boom is supported by four pre-stressed suspension (structural) strands attached to equalizer links on the A-frame. These inherent long life structural strands carry the working loads of the front end equipment. A boom limit switch with soft setdown prevents boom jacking shock loads.

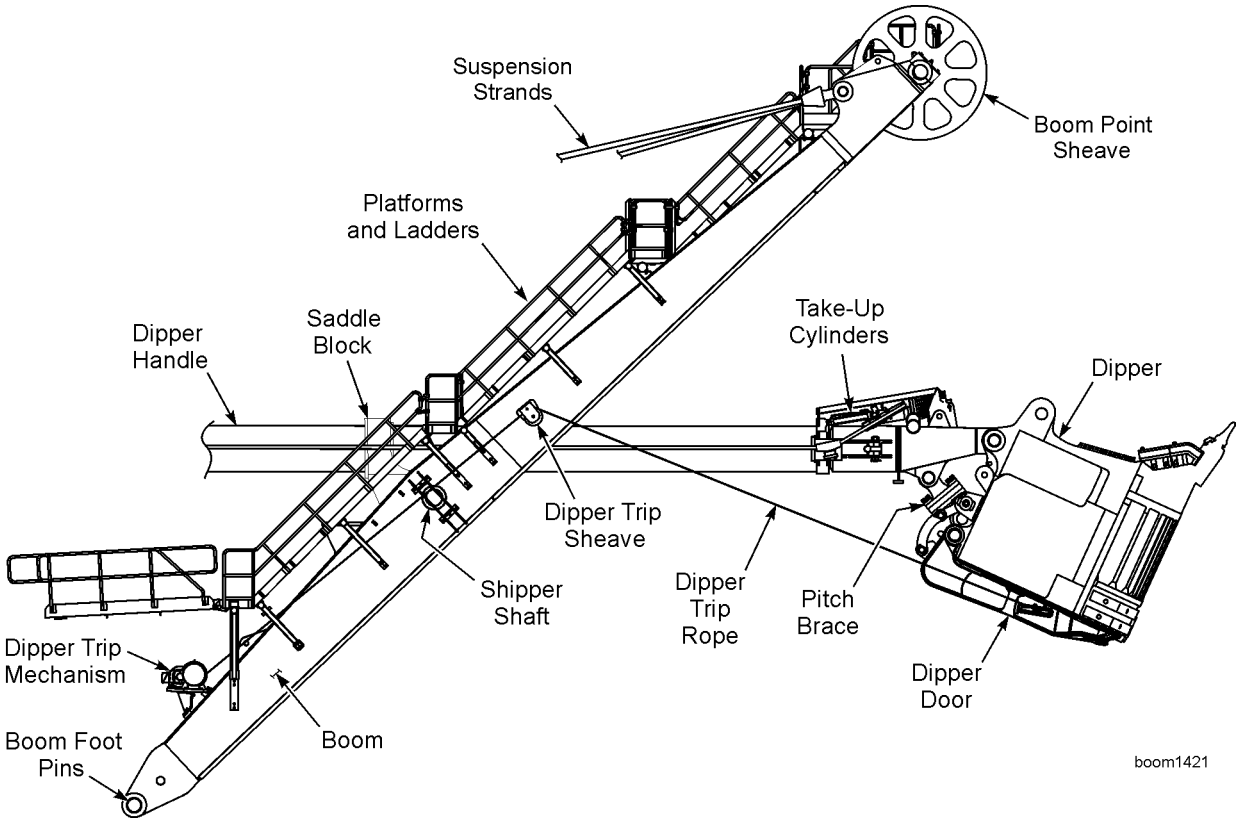


Figure 1-13 Boom Assembly

LOWER WORKS (Continued)

	Quantity	Weight Each (U.S. Pounds)
Roller, Upper	8	620
Shaft, Upper Roller	8	400
Washer, Thrust,Lower Roller	8	50
Collar, Lower Roller	8	210
Center Pintle Sleeve Assy	1	7,900
Center Pintle Lower Nut	1	1,450
Collar, Center Pintle, Upper	1	380
Washer, Thrust, Center Pintle	1	400

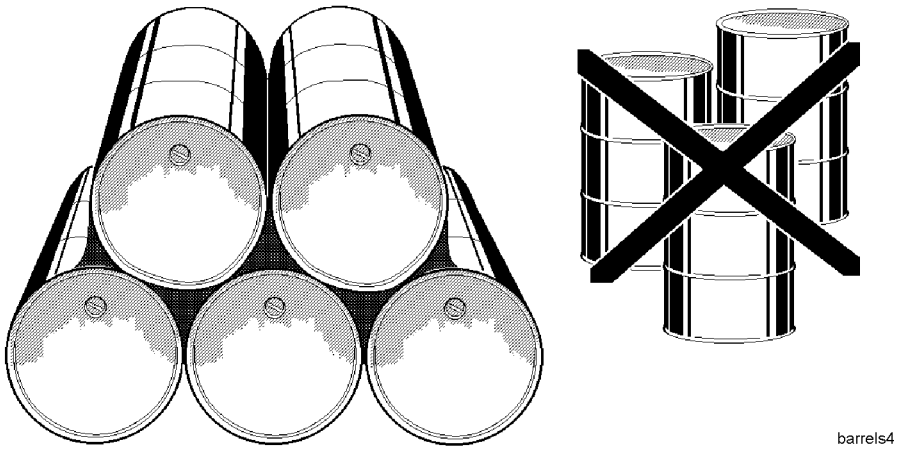
2.3 Lubricant Selection

The selection of the proper lubricants for use on this machine is critical to its reliability. Improperly lubricated bearings, gears, couplings and other precision parts quickly fail. For this reason, lubricants selected in accordance with the “American Standards Testing Material” (ASTM) standards are recommended. These standards were compiled in cooperation with major petroleum suppliers to ensure the consumer of an exact supply to specific requirements, regardless of source.

We recommend you advise the petroleum supplier of the following information to assist in selecting the proper product for each application of this machine.

Final acceptance of all lubricants supplied to this standard will be based upon their satisfactory performance in the intended application and does not relieve the supplier of performance responsibility for brand name products.

Operation of this machine in extreme temperatures (below -20°F/-29°C or above 110°F/44°C) requires special lubrication. Note the temperature ranges on the following lubricant specification sheets. Contact your local supplier, your Bucyrus representative, or the Service Department of your local Bucyrus International office for recommendations if you require additional information or advice.



barrels4

- STORE LUBRICATION DRUMS ON THEIR SIDE, WITH THE OPENING TOWARD THE TOP.
- STORE ALL LUBRICANTS IN TIGHTLY COVERED CONTAINERS!
- WIPE OFF COVERS AND SURROUNDING AREA BEFORE OPENING!
- FILTER ALL OIL BEFORE ADDING IT TO THE SYSTEM!
- USE ONLY CLEAN and PROPER LUBRICANTS!
- DO NOT MIX TYPES or BRANDS of LUBRICANTS!

Even the best lubricants are less useful in preventing wear if they become contaminated by dirt or water due to careless handling or storage.

2.5.4.1 Lubricant Replacement/Sampling

The recommended mineral oils should have additives that improve corrosion protection and aging resistance, as well as reduce wear in the mixed friction field. Polyalphaolefin oils (oils on the basis of synthetic hydrocarbons) as well as bio-oils (oils on the basis of synthetic ester) which satisfy the demands specified for industrial type gear oils according to DIN 51517, part 3, are also permitted.

Designation to DIN 5157 part 3:	CLP 220
ISO viscosity to DIN 51519:	ISO - VG 220
Kinematic viscosity at 40° C:	min. 199 mm2/s (cSt) max. 242 mm2/s (cSt)
FZG test A /8,3/90 to DIN 51354, pg. 2:	min. breakdown load stage 12

The lubricant is to be selected from a proven, stable, and reliable lubricant vendor that meets the above listed specification.

It is strongly suggested that the gearcase lubricant be part of a routine spectrometric oil analysis program to forecast impending problems and thereby reduce the possibility of catastrophic failure. This analysis should take place every 250 propel hours and monitor the elements listed in the following table, at a minimum:

Element	*Normal*	*Excessive*	*Critical*
Iron	<400	400-700	>700
Copper	<25	25-60	>60
Chromium	<5	5-15	>15
Silicon	<40	40-60	>60

NOTES:

- All values are Parts per Million.
- Particle count may be higher during the initial run-in period.
- The oil should be changed when any element value exceeds normal levels.
- Maintain an analysis record using the gearcase serial number and machine operating hours.

2.5.4.1.1 Lubricant Change Cycle

For all machinery motions - Hoist, Crowd, Swing & Propel - the gearcase lubricant should be first changed after approx. 500 machine operating hours.

Thereafter, the lubricant should then be changed every 6,000 hours or 12 months, whichever comes first. Flush the gearcase prior to refilling with new oil.

To fill the propel gearcase, remove the inboard plug at the center of the gearcase. Remove the oil breather at the top of the gearcase and fill the gearcase with oil until oil flows from the unplugged port. Replace the removed plug. Oil capacity is approx. 70 US Gallons (265 liters).

2.5.11 Lincoln Type SL-1 Lubricant Injectors

These pressure-operating, spring-reset, series-installed injectors are supplied in banks mounted on manifolds or individually. Each injector expels a maximum of 0.08 cu. inch of lubricant from its outlet port each cycle. Dual outlet ports on each injector permit the injectors to be piped in series for increased lube supply to a common point. The quantity of lube to each point on this machine has been carefully designed by our engineers for proper coverage. Each injector output can be adjusted; however Bucyrus recommends that injectors initially be set and used at their maximum setting.

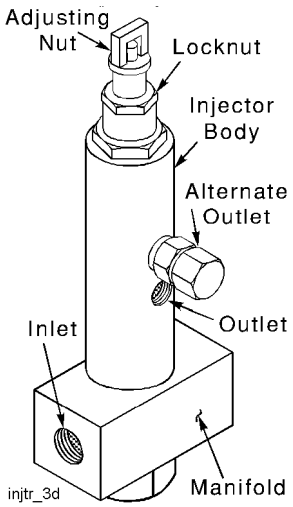
NOTE:

MAXIMUM Operating Pressure:	3,500	PSI
RECOMMENDED Operating Pressure:	2,500	PSI
MINIMUM Operating Pressure:	1,850	PSI
MAXIMUM Recharge Pressure:	600	PSI

⚠ CAUTION

STORED ENERGY! Contact with or ingestion of petroleum products can be harmful. Automatic lubrication systems operate under pressure. Before opening any lube supply line, relieve the system and that line in particular, of any residual pressure.

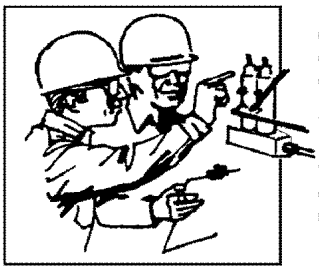
To set an injector for maximum output:



1. Loosen locknut.
2. Turn adjusting screw until there is a small gap at the top of the stem.
3. Orient the adjusting screw so that the opening is toward the front of the injector.
4. Tighten the locknut.

2.5.12.2 Injector Advantages

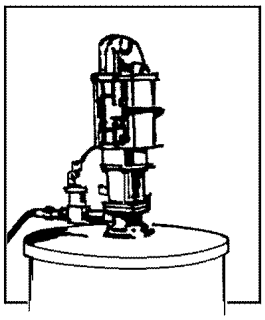
SIMPLICITY



Lincoln Centro-Matic is not only simpler and less expensive to install than other systems-it is also much easier to understand. Your maintenance personnel will appreciate the ease with which they can learn the operation and service of Centro-Matic.

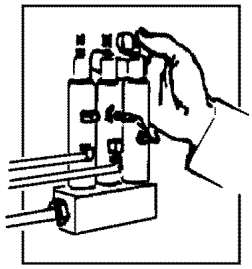
POWERFUL PUMPING UNIT

Lincoln's Power-Master pump widely recognized as a most powerful, trouble-free pump, so much so, that Lincoln Power-Master pumping units often are specified even where other centralized lubrication systems are used.

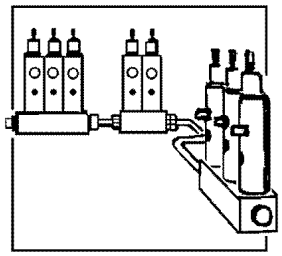


EXTERNAL ADJUSTMENT

A micrometer-type adjustment makes each injector (metering device) adjustable externally, without special tools. The Lincoln Centro-Matic System permits lubricant adjustments to meet actual bearing requirements - not just an approximation, as with all other systems.

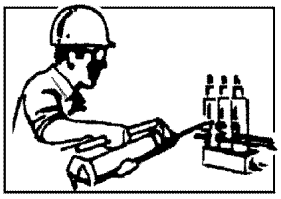


EXTREME PUMPING DISTANCE



Single-line design and powerful pumping unit permit installations at long distances from original refinery containers of bulk tanks to point of application. And if you plan to expand your operation, the Lincoln Centro-Matic System has the design and capacity that lets you do it - normally without adding booster pumps and controls.

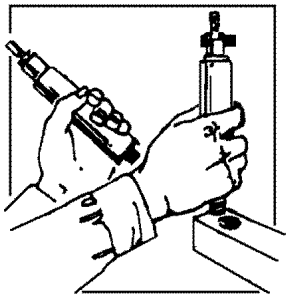
BUILT-IN GREASE FITTING



Lincoln Centro-Matic is the only system that has a capped grease fitting on the injector. This permits easy filling of lines when the system is installed. It also allows hand lubrication of the machine in the event of a pump or power failure, damage to the supply line, or even a malfunction in the air system. NO OTHER SYSTEM OFFERS THIS! The built-in grease fitting can also be used as an inspection system. When the cap is removed, the lubricant normally metered to a bearing will come out of the grease fitting head.

EASY INJECTOR REPLACEMENT

Should the Lincoln injector ever need replacing, it can be done quickly and easily without disturbing adjacent injectors or removing the supply line connections - does not require machine shutdown as do all other systems. As a matter of fact, injector replacement usually can be done between lubricating cycles, thus preventing lubricant loss or machine downtime.



injadvan

Property	*Reference*	*Requirement*
Pressure Oil Separation	The Lubrication Engineers Manual (United States Steel).	U.S. Steel test method - Cake penetration not less than 25% of grease penetration.
Grease Mobility	The Lubrication Engineers Manual (United States Steel).	U.S. Steel method - not less than 0.10 grams flow per second at the lowest anticipated ambient temperature. (Testing temperature not less than -34°C/-30°F).
Pumpability, Lincoln Ventmeter	The Lubrication Engineers Manual (United States Steel).	To vent from 1800 psi (127 kgf cm^2) to less than or equal to 600 psi (42 kgf/cm^2) within 30 seconds at the lowest anticipated ambient temperature (Testing temperature not less than -25°C/-13°F).
Lubricating Solids (Molybdenum Disulfide, Graphite, Etc.) % by Weight		Less than or equal to 5%
Lubricating Solids (Molybdenum Disulfide, Graphite, Etc.) Particle Size, (Microns, max.)		10 Microns

NOTES:

1. Ambient Temperature - The ambient temperature shall be the temperature at the point of lubricant application.
2. Low Temperature Grease - For extended use in low temperature (-12°C to -46°C / +10°F to -50°F) areas, this product should be capable of slumping in containers and should be pumpable through lube lines without the aid of heat tracing. This product should meet the Mobility and Pump-ability criteria for the lowest anticipated ambient temperature. In order to minimize compatibility problems, it is desirable that the thickener and additive system be compatible with the additional grades that are suitable for the other ambient temperatures.

3.4 Frequency of Inspection and Maintenance

The suggested maintenance schedule is developed on a planned usage of 5,000 operating hours per year. This is a planned reference only. The actual conditions within the mine site, operator's abilities and habits, along with the quality of components and consumables will ultimately drive the inspection schedule used on the machine.

Care should be taken to properly evaluate the maintenance approach during the initial period after machine commissioning.

3.5 Maintenance Schedules

The following maintenance schedule is based on a typical machine. Certain features or configurations may be different on a specific machine. This maintenance schedule is intended to outline the intervals for the various repetitive maintenance requirements. For any assistance, refer to the appropriate section in this Maintenance Manual. This maintenance schedule is not to be substituted for the Maintenance section of this manual.

For locations of the specified components, refer to the graphics at the end of this section.

3.5.1 Maintenance Inspection Check Points

The recommended check point schedules in this section are scheduled inspection guides. Perform inspection based on hours of use or time lapse intervals, which ever comes first. To verify inspection, copy the schedule pages of this manual, check all items inspected. If needed, add comments to the *Noted Discrepancy* column.

✓	Check Points - Every 1250 Hours or Quarterly		
	Location	***Check***	***Noted Discrepancy***
	14. Hoist Motor	Inspect the mounting bolts for security, the blower duct work for damage and security.	
	15. Hoist Brake Air System	Check the operation of the solenoid valve, release and set operations, hoses, fittings and quick release valve.	
	16. Crowd Machinery Frame	Inspect for loose bolts or chock blocks, worn mount pins and cracks. Repair as required.	
	17. Crowd Drum Bearing Journals	Inspect the retainer, bearing retainer bolts, seals and condition of bearings.	
	18. Bearing Cap Mounting Bolts	Check for tightness.	
	19. Crowd 1st Gear Reduction	Inspect the gear and pinion teeth for the proper wear pattern, excessive wear and alignment. Correct as required.	
	20. Crowd 2nd Gear Reduction	Inspect the gear and pinion teeth for the proper wear pattern, excessive wear and alignment. Correct as required.	
	21. Crowd 3rd Gear Reduction	Inspect the gear and pinion teeth for the proper wear pattern, excessive wear and alignment. Correct as required.	
	22. Crowd Machinery Bearings	Inspect the bearings, retainers and seals. Re-tighten the retainer bolts.	
	23. Crowd Motor Coupling	Check for lubrication and wear.	
	24. Air Compressor(s)	Change the crankcase oil, clean the intake filter and, if so equipped, refill the anti-freeze with the required agent.	
	25. Compressor V-Belts	Check the belt tension, readjust as required. Maintain belt/pulley alignment.	
	26. Compressor Intercooler	Inspect the intercooler tubing, replace as required.	

Date	
Shift	
Inspected By	
Supervisor	

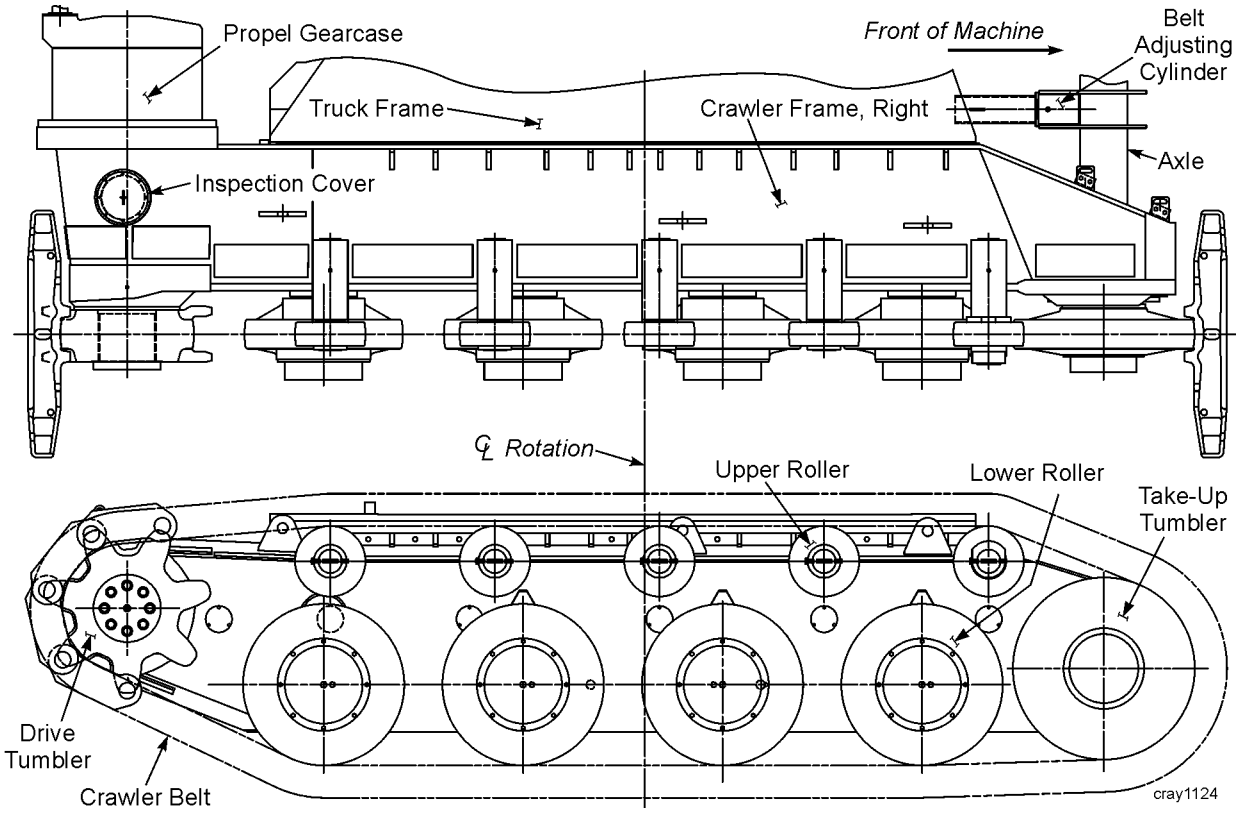


Figure 3-3 Crawler Assembly

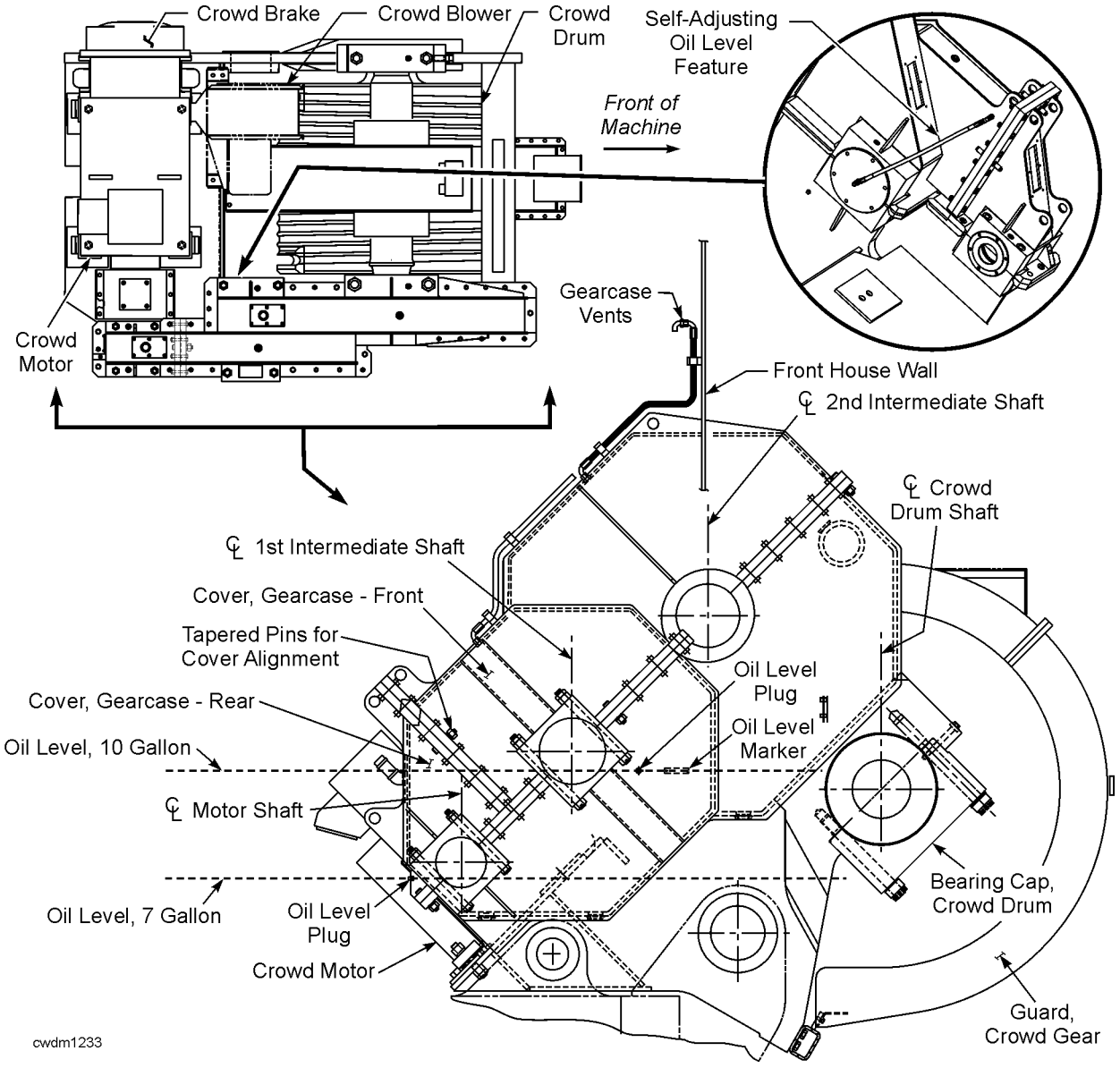
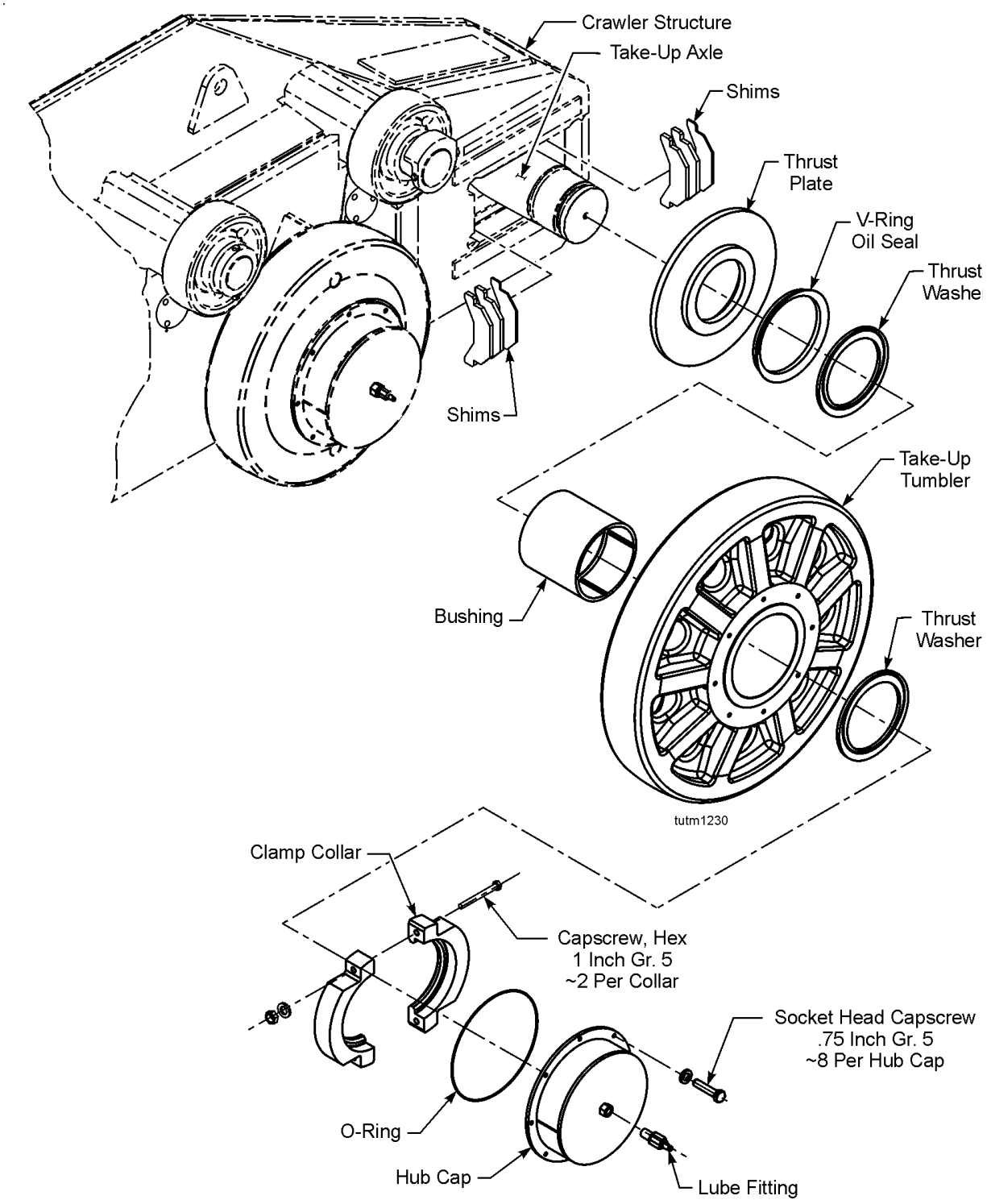


Figure 3-13 Crowd Machinery

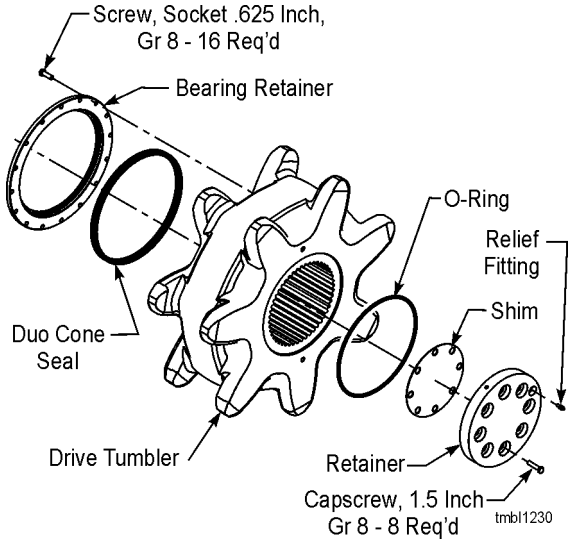

Crawler Structure
Take-Up Axle
Shims
Thrust Plate
V-Ring Oil Seal
Thrust Washe
Shims
Take-Up Tumbler
Bushing
Thrust Washer
tutm1230
Clamp Collar
Capscrew, Hex
1 Inch Gr. 5
~2 Per Collar
Socket Head Capscrew
.75 Inch Gr. 5
~8 Per Hub Cap
O-Ring
Hub Cap
Lube Fitting

4.0.2.7 Drive Tumbler

Inspect the drive tumbler for cracked or broken lugs, lug wear, and other defects which can impair tumbler function and belt tracking. Check the tumbler retainer bolts and tighten if loose. Replace worn or damaged seal or bearing. Check inner bearing retainer by opening inspection hole in crawler frame. LUBE MUST BE PRESENT!

4.0.2.7.1 Drive Tumbler Repair

The drive tumbler is splined to the drive shaft and is held securely to the shaft with a retaining plate. If repair of the tumbler is deemed necessary, consult with the Bucyrus International Service Department for repair instructions.



To replace the drive tumbler:

1. Relieve crawler belt tension and separate the belt as described earlier. Separation of the belt should take place at a point near the drive tumbler. Lay the links back out of the way.
2. Remove the bolts securing the retaining plate to the drive shaft and remove the plate and shims. Remove the O-Ring from the plate.
3. Attach a suitable lifting device to the drive tumbler and slide the tumbler from the drive shaft.
4. Inspect the bearing and duo-cone seal on the drive shaft for defects and damage. Remove any burrs from the splines of the shaft.
5. Examine the exposed end of the drive shaft for defects and damage. Remove any burrs from the splines of the shaft.
6. If the duo-cone seal was removed, reinstall it as per DUO-CONE SEAL INSTALLATION found in Section 9 of this manual.
7. Lightly lubricate the tumbler bore and the splines of the drive shaft with MolyKote Type G.
8. Slide the new tumbler on to the shaft. Install the retaining plate and shim to obtain a gap of 0.002 to 0.005 inch and tighten the bolts to specification. Install a new O-ring onto the retaining plate prior to installation.
9. Join the crawler belt links and adjust belt tension as previously described.

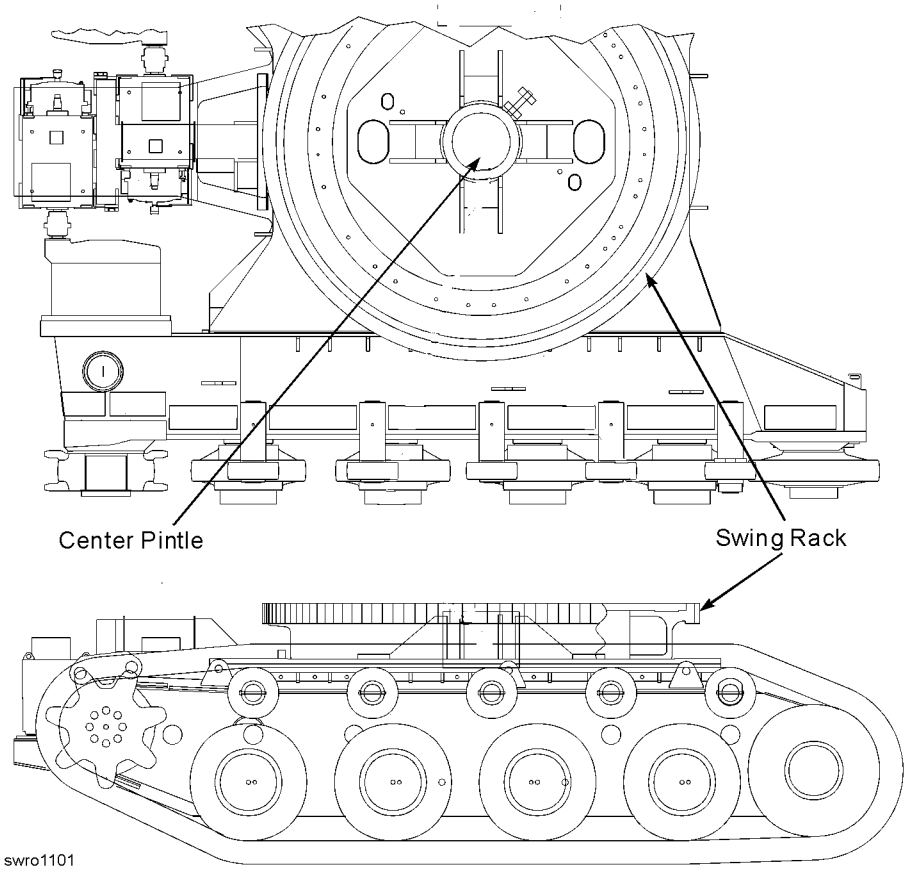
4.0.3 Swing Rack

Make sure all teeth carry a protective coating of lubricant to reduce wear. Inspect the swing rack weekly for broken teeth and unusual wear patterns. Every six months, disconnect power, remove access covers and inspect the weld between swing rack and truck frame. Also, clean and inspect swing rack teeth for pitting, abrasion, spalling and galling.

If during inspection a broken tooth is noted, shut down the machine immediately and do not operate the machine until the tooth has been repaired. Due to the specific materials and processes involved in the manufacture of this component, contact your Bucyrus International Service representative for an appropriate repair procedure.

⚠ CAUTION

DO NOT OPERATE THE MACHINE WITH ONE OR MORE BROKEN TEETH IN THE SWING RACK. This could result in additional damage to the swing rack, swing pinions and swing machinery units.



g. If "T" is greater than 0.107 inch, the pintle lower nut should be adjusted to reduce the amount of lift. Refer to Center Pintle Adjustment.

2. The thrust washer, rails, or rollers may be sufficiently worn to require replacement rather than center pintle nut adjustment. If necessary, replace a worn thrust washer per the center pintle repair procedure and replace a worn roller and/or rail per the applicable repair procedure.
3. Clearance for free rotation of the revolving frame must be provided between the truck frame bushing and the sleeve. Such clearance, however, cannot be excessive or premature wear of the truck frame bushing or sleeve will occur.

To determine this clearance, proceed as follows:

⚠ DANGER

HIGH VOLTAGE! EXTREME CARE MUST BE EXERCISED AT ALL TIMES WHEN PERFORMING MAINTENANCE IN THE CENTER PINTLE AREA. High voltage can cause serious or fatal injury. Installation, operation and servicing of components should be performed only by qualified personnel. ALWAYS DISCONNECT the electrical power BEFORE accessing the center pintle area.

a. Disconnect the power to the machine. Enter the truck frame through the bottom access opening.
b. Remove the cover from the top of the truck frame and gain access to the space between the pintle and the rollers. Insert a feeler gauge between the sleeve and the bushing of the truck frame. Any measurement over 0.250" diametral clearance is considered excessive and replacement of the bushing and/or sleeve is necessary.

4.0.7.2 Swing Motor

For lubrication of the drive motor, refer to GREASING MAIN AC DRIVE MOTORS in *LUBRICATION* section of this manual.

⚠ DANGER

BEFORE ATTEMPTING TO DISCONNECT ANY POWER LEADS, PRESS THE MAIN POWER OFF BUTTON AND TAG IT TO AVOID INADVERTENT ENERGIZING OF THE ELECTRICAL CIRCUIT. Electrocution or serious injury may occur if appropriate safety measures are not followed. Electrical connections should only be handled by trained electrical personnel.

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4.0.7.4.2 Swing Pinion Installation

Installation of the pinion is the reverse of disassembly with the exception of shim pack determination. This will be covered in the following topic.

4.0.7.4.3 Swing Shaft Removal

NOTES:

- Removal of the swing shaft will require the prior removal of:
  - An appropriate section of the machinery house roof panel.
  - Swing motor and brake assembly.
  - Planetary gearcase.
- Remove the swing shaft through the *TOP* of the revolving frame structure when removing the shaft without the bearing. (The bearing fits on the tapered portion of the shaft.)
- Remove the swing shaft from the *BOTTOM* of the gearcase support if removing the shaft, bearing and carrier as an assembly.

⚠ DANGER

BE EXTREMELY CAUTIOUS WHEN REMOVING THE SHAFT ASSEMBLY THROUGH THE BOTTOM. AFTER LOOSENING THE BEARING CARRIER BOLTS THE SHAFT IS UNSUPPORTED AND MAY FALL.

1. Remove the appropriate machinery house roof panel.

⚠ DANGER

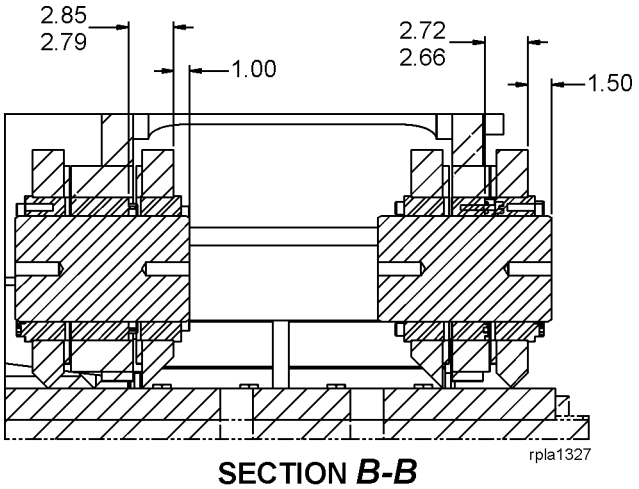
BEFORE ATTEMPTING TO DISCONNECT ANY POWER LEADS, PRESS AND TAG THE *MAIN POWER OFF* BUTTON. This will avoid inadvertent energizing of the electrical circuit. Electrocution or serious injury may occur if appropriate safety measures are not followed. Electrical connections should only be handled by trained electrical personnel.

2. Remove the swing motor and planetary gearcase from the swing to be removed. Refer to SWING MOTOR REMOVAL and SWING PLANETARY GEARCASE in this section of the manual.
3. Remove the swing shaft bushing retainer at the top of the shaft and its capscrews. Remove the bushing.
4. Remove the proximity switch clamp collar from the swing shaft just above the bearing assembly. Refer to the figure *"Proximity Switch Clamp Collar"* in this section of the manual.
5. Remove the swing shaft pinion. Refer to SWING PINION REMOVAL in this section of the manual.
6. Remove the spacer between the lower bearing retainer and the swing shaft.
7. Attach a crane to a 2 inch lifting eye threaded into the top of the shaft.

11. With the gearcase supported, it may be necessary to use a come-a-long or other suitable pulling device to pull the gearcase slightly toward the rear of the machine, in order to disengage it from the hoist gear.
12. Once the gearcase will clear all obstructions, lift it through the house roof and away from the machine.

The hoist gearcase can be reinstalled using the reverse procedure. To install the gearcase mounting pins with locking assemblies:

1. Move the gearcase back into position and align the gearcase and pedestal bores.
2. Install the gearcase's rear locking assemblies "B" and "C" and two rear pins using the pilot bushings with assembly "B". Maintain pin and bushing dimensions in Section B-B and torque as specified below.

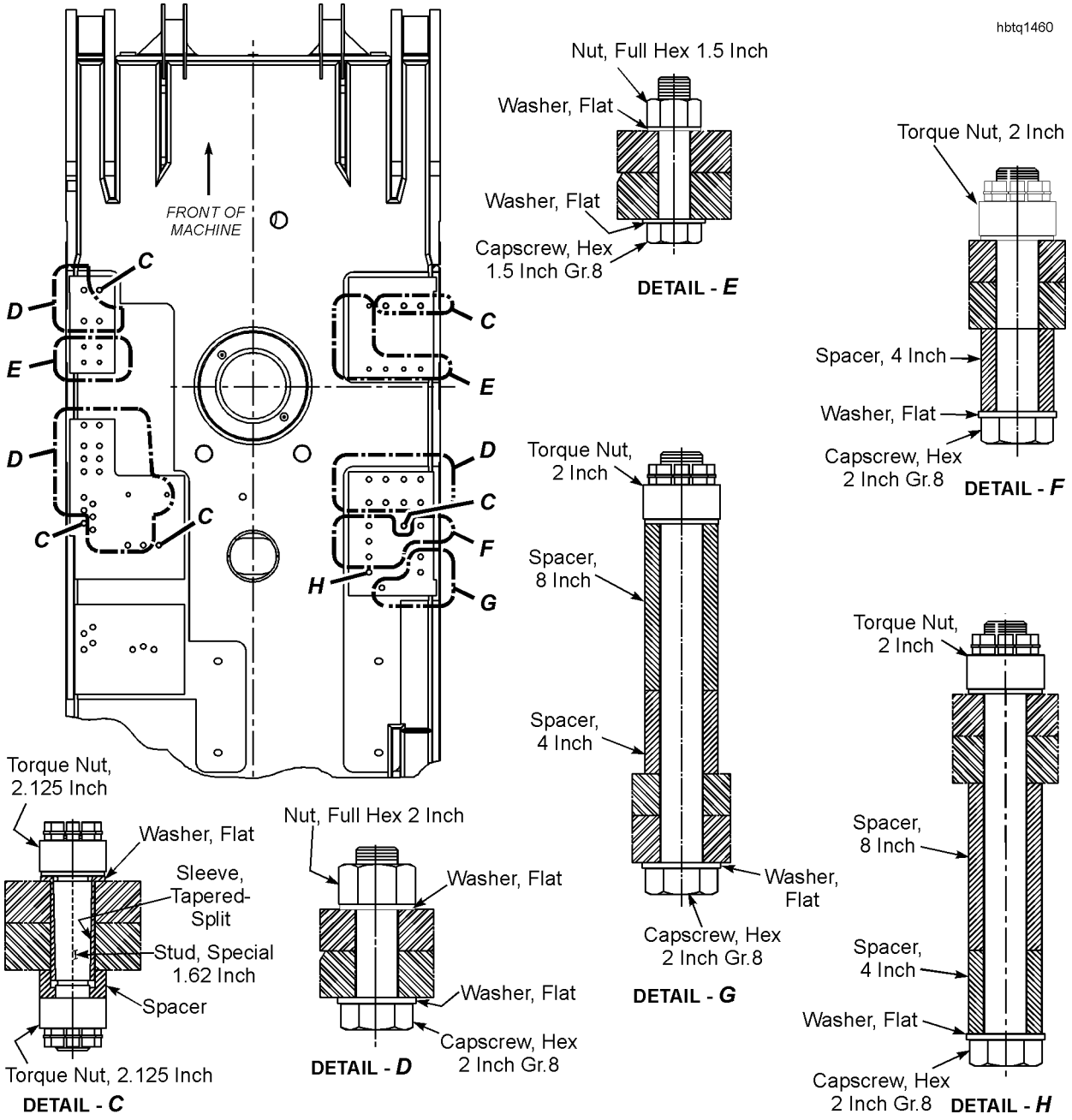


SECTION *B-B*
REAR PINS

3. Install the gearcase's front locking assemblies "B" and "C" and front pin using pilot bushings with assembly "B". Maintain pin and bushing dimensions in Section C-C and torque as specified below.

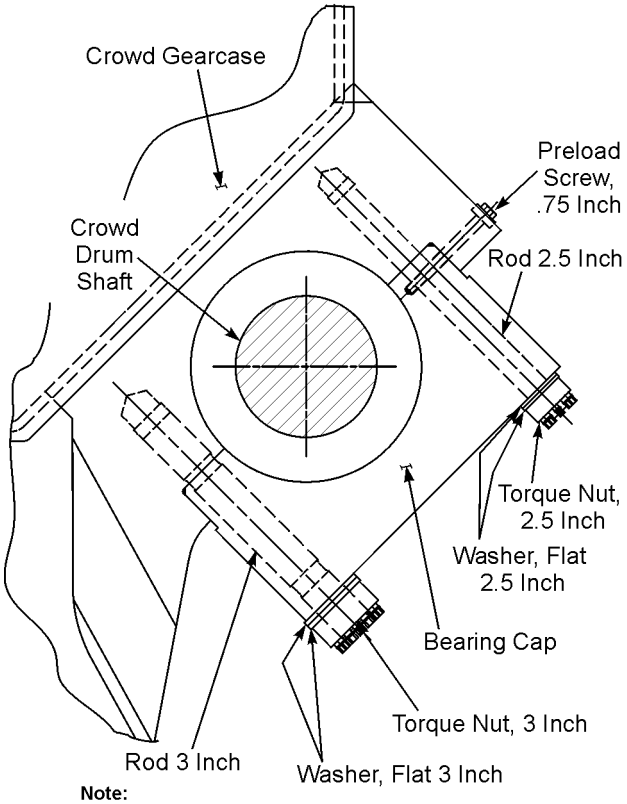
4.1.0.7 Hoist Mounting Bolts

Use the following view to identify the correct installation of the mounting bolts for the hoist machinery.



NOTE: For tightening, refer to TORQUE NUT INSTALLATION in ENGINEERING DATA section of this manual.

IMPORTANT:
For repairs which include torque nuts, refer to the proper tightening AND loosening procedures.

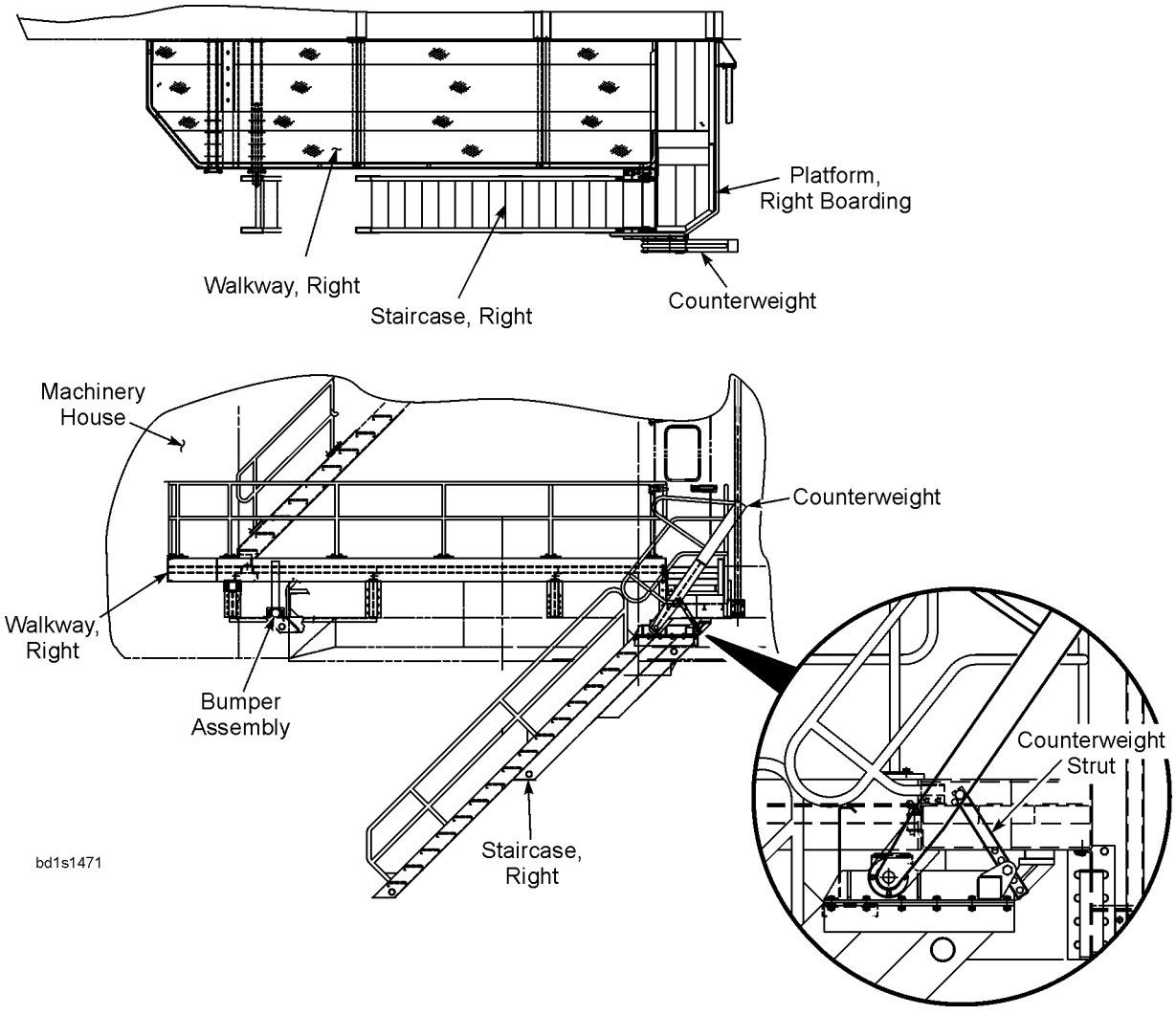


5. Tighten the torque nuts on the rods using the proper procedure.
6. Install the retainer hardware. Install and secure the shaft end covers. Be careful not to pinch the O-Rings.
7. Attach the lubrication lines and lubricate the bearings. Fill the gearcases with oil to level with the bottom of the oil filler opening. Attach the electrical leads to the motor and the blower motor.
8. Install the crowd and retract ropes on the drum. Refer to FRONT END EQUIPMENT in this section of the manual.

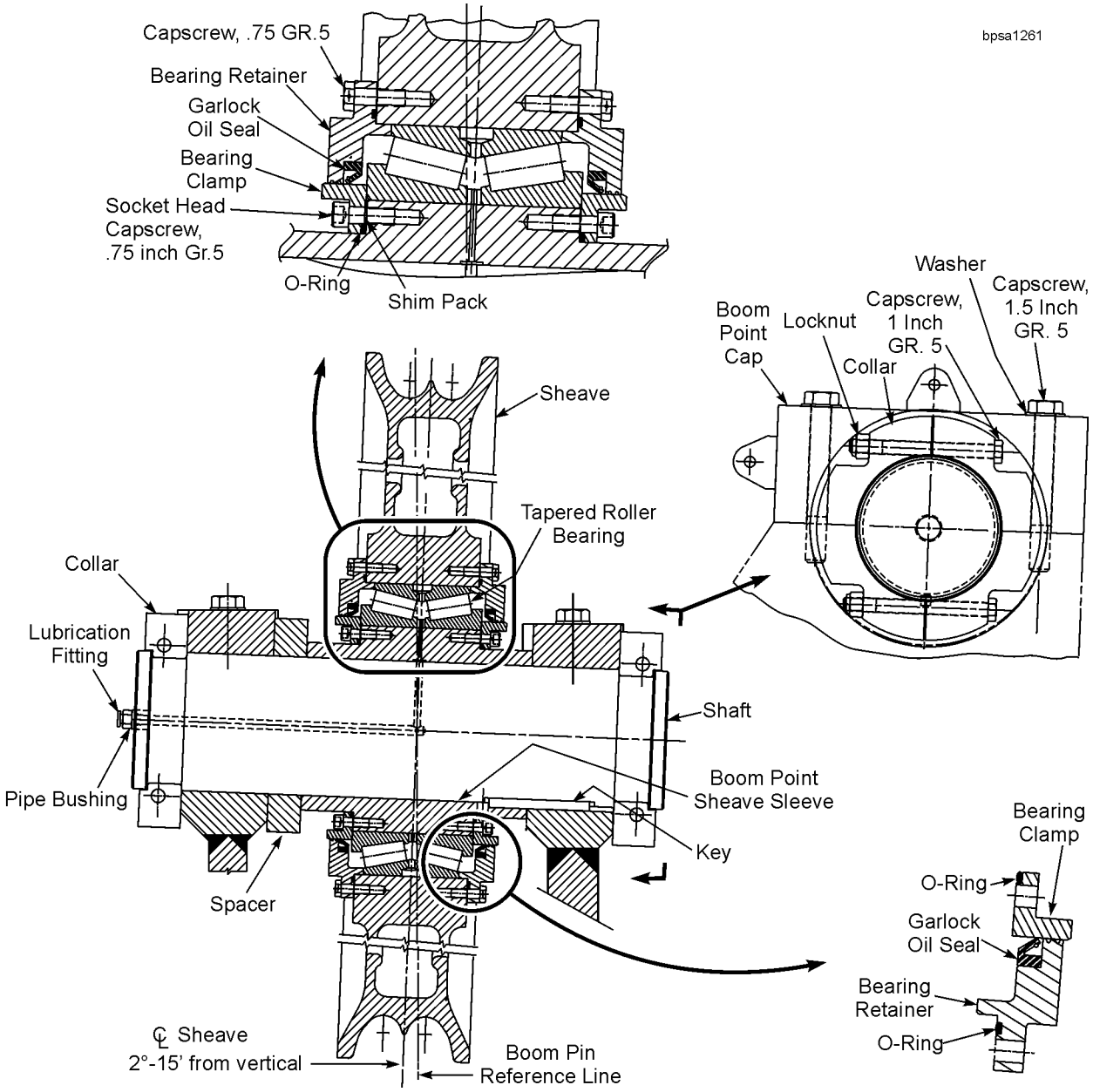
4.2.3 Boarding Stairs

A set of boarding stairs is attached to the machinery house platform - either on the left side of the machine, the right side or both. When lowered, the stairs allow entrance to the machinery house from ground level. The stairs must be in their raised position to enable the operator's controls.

The boarding stairs pivot about a pivot shaft attached to the boarding platform. A set of counterweights offsets the weight of the stairs.



A bumper assembly attached on the right machinery house platform stops the stairs when raised to the upper position. Another block is attached to the counterweights to prevent the stairs from lowering too far. Ensure that all bumpers are in place and have not deteriorated.

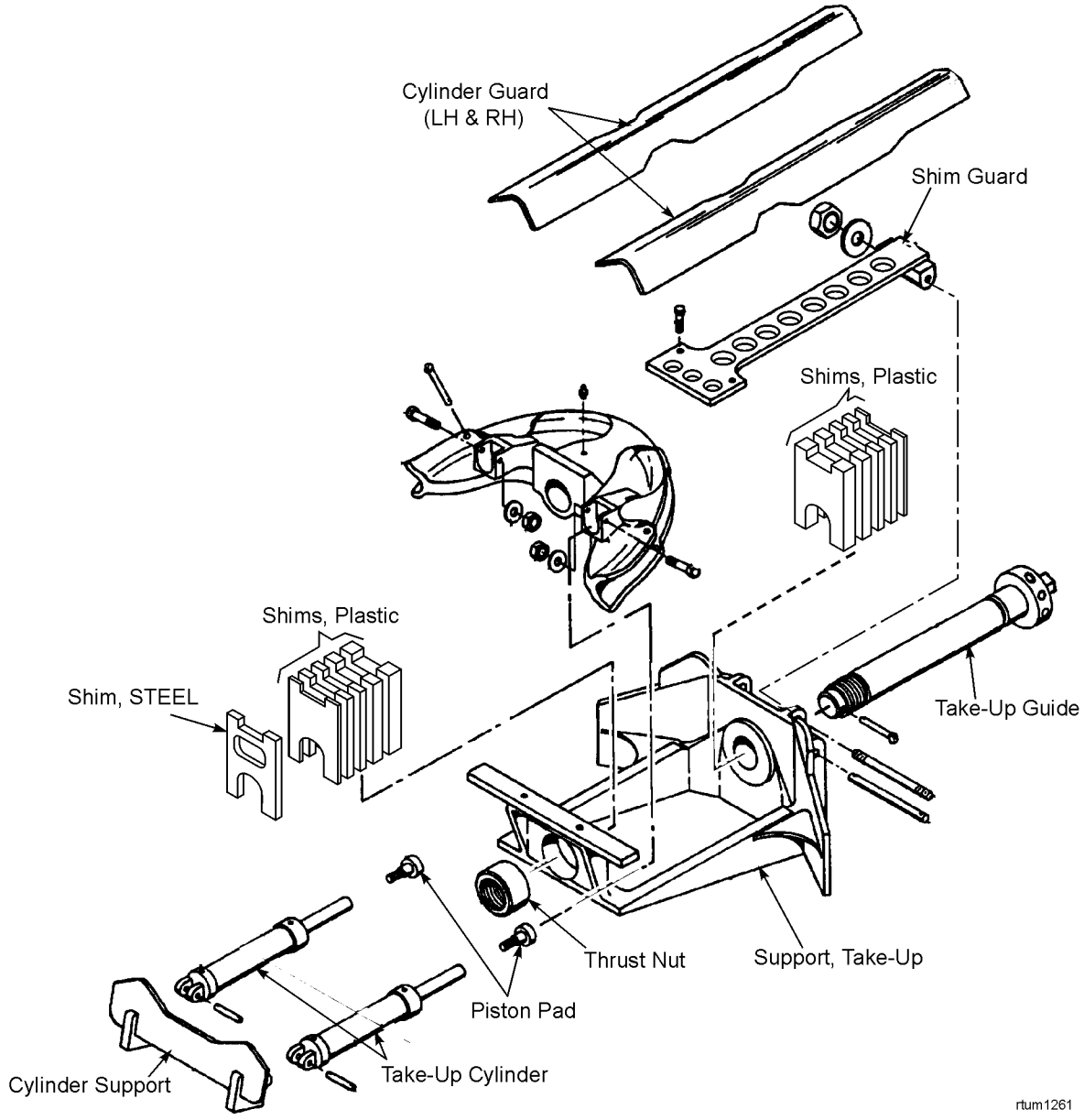


NOTE: Refer to SHIM INSTALLATION procedures in BOOM POINT SHEAVE REASSEMBLY AND INSTALLATION.

3. Use caution and remove the O-Ring and seal from each retainer.
4. Remove the bearing clamp from each side of the sheave and also the O-Ring from each bearing clamp.
5. Remove the shims from the inboard side of the sheave.
6. Remove the sheave and bearing from the sleeve. Separate the bearing from the sheave.
7. Remove the sleeve from the shaft.
8. Check and repair all damaged or worn parts.

4.3.4.2 Retract Rope Take-up Mechanism

The retract rope take-up mechanism is attached to the dipper handle at the dipper end and provides the ability to remove slack from, and apply the proper tensioning to, the retract rope.



NOTE: The steel shim must rest against the thrust nut.

To repair the retract mechanism:

1. Lower the dipper so that the front of the dipper is flat on the ground.
2. Remove the shim guard bolts and rotate shim guard out of the way.

4.3.5.4 Dipper Padlock

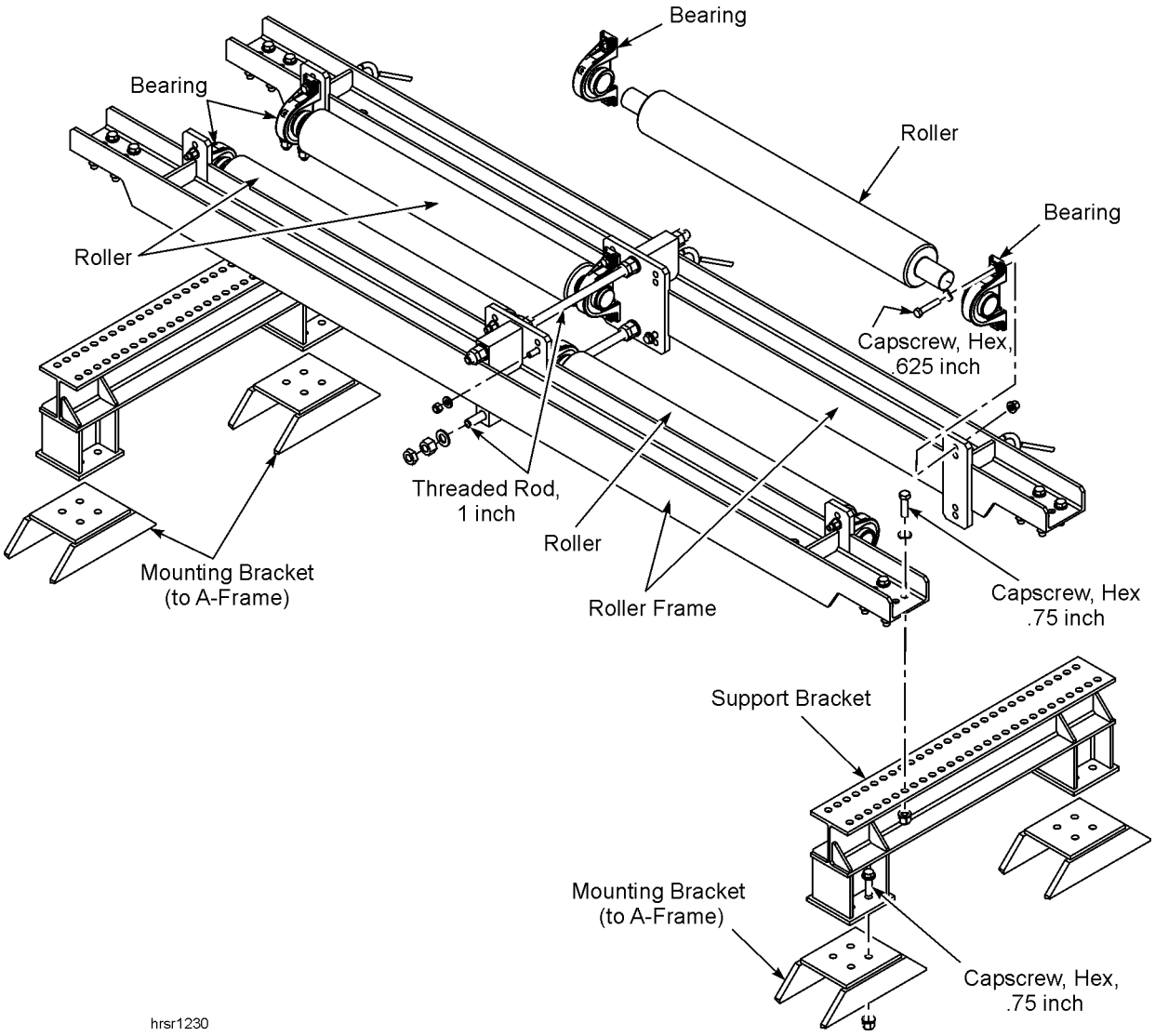
The padlock should be checked every shift to see that all pin mounting hardware is not loose or missing. Daily check for excessive movement at the pin joints which indicate bushing wear. Replace worn bushings and pins. Check for cracking in the frames and links and make repairs when required.

⚠ DANGER

STORED ENERGY! Removal of bolts and pins requires the attached items to have proper support to release the load. Failure to comply could result in death, severe personal injury, or damage to the machine.

4.3.8 Hoist Rope Support Roller

The hoist rope support rollers are used to guide the hoist ropes as they leave the hoist drum and exit the machinery house.



The rollers should be inspected daily for wear. The roller bushings should be lubricated once every shift. Repair of the rope rollers will consist mainly of replacement of worn bushing and/or rollers.

NOTE: Liberally lubricate the grooves of the crowd drum to help prevent damage to the new crowd rope as it is pulled into position on the crowd drum.

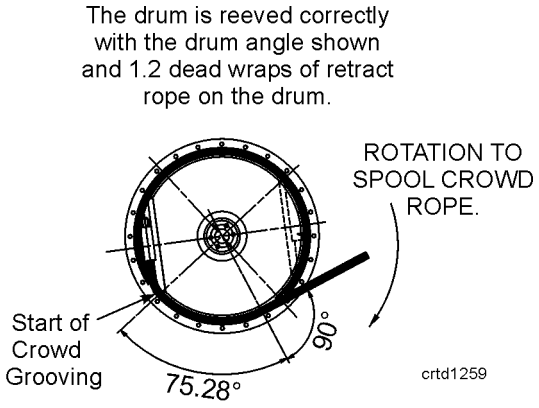


Figure 4-38 Crowd Rope Termination Details

13. Bring the auxiliary line over the top of the crowd drum, through the crowd rope socket, around the rear of the drum and forward from the bottom of the drum to the corresponding end of the new crowd rope. Connect the auxiliary line to the corresponding end of the crowd rope. Release the corresponding end of the crowd rope from (step 12) securing means, and with the ground vehicle still attached to the other end of the auxiliary line, pull the crowd rope onto the rope ferrule socket on the drum. Secure the crowd ferrule button into the drum ferrule socket. Release the auxiliary line from the crowd rope.
14. Connect the other end of the crowd rope to the other corresponding crowd drum ferrule socket in the same way as described in the previous step.
15. Remove the locks and tags from the controls, and using the crowd motor, rewind the new crowd rope onto the crowd drum by rotating the drum in the crowd direction. Make sure rope is seating properly in the drum grooves and the inner grooves of the saddle block sheaves. Stop rotating drum when the crowd rope is tight. Set the brakes and replace the tags and locks on the controls.

NOTE: The construction stretch may be out of the crowd rope when it becomes necessary to adjust the rope for about the third time. Therefore; after the third rope adjustment after replacement, back off the adjustment by one 0.50 inch shim after obtaining a tight rope by pressurizing the cylinders and thus prevent working with an overly tight rope.

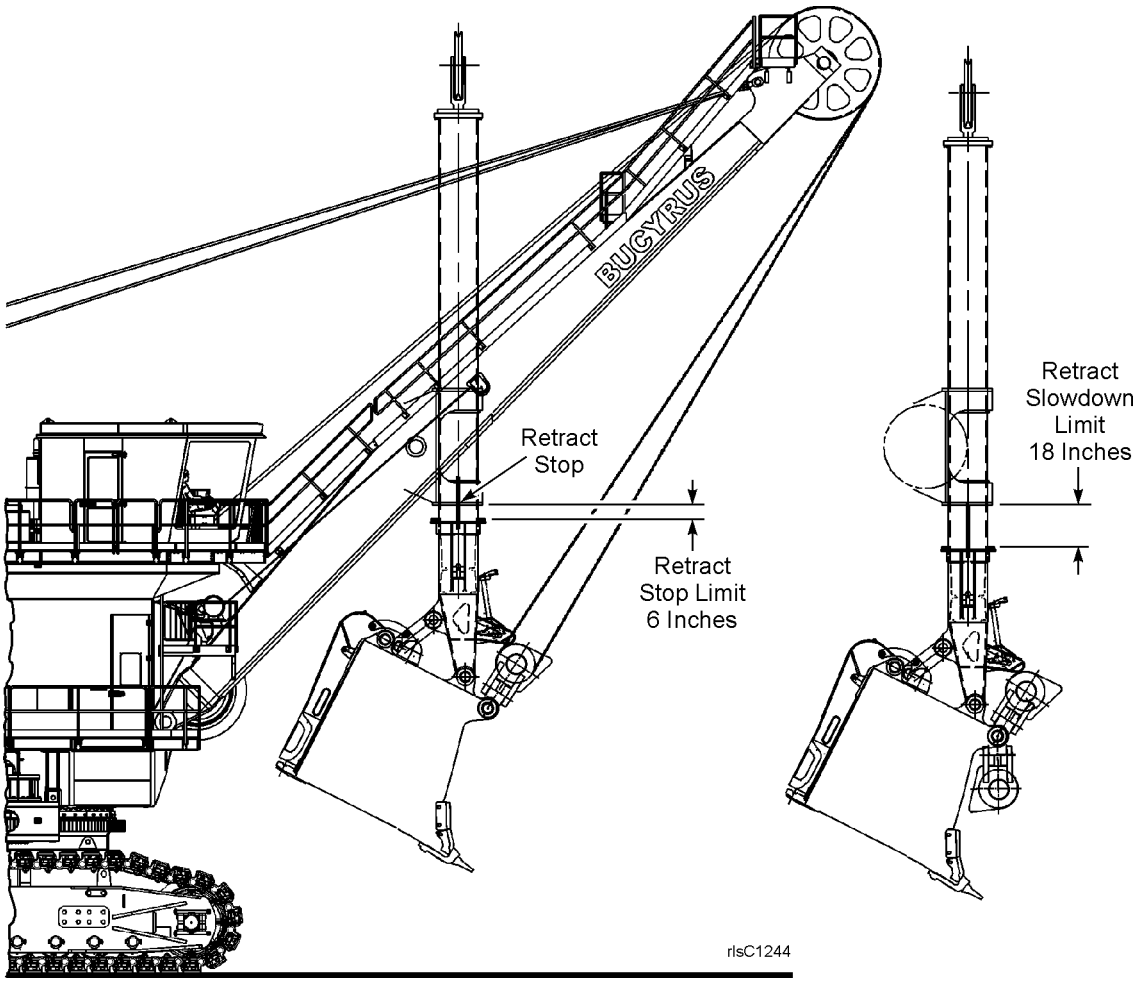
16. With the ferrule button-end of the retract rope controlled by an auxiliary line to start with, reinstall the retract rope to the crowd drum by following steps 6 through 13 of the RETRACT ROPE REEVING PROCEDURE.

4.3.16.1.2 Retract Slowdown/Stop Limits

To set the retract slowdown and stop limits:

1. Position the handle vertically. Retract the handle until the retract stops are approximately 18 inches from the front end of the saddle block.
2. Press the RETRACT SLOWDOWN LIMIT button on the operator display.

3. Position the handle with the retract stops approximately 6 inches from the saddle block and press the RETRACT STOP LIMIT button on the operator display.



1. When wear has reached 0.65 inch, remove a single shim. Loosen the “X” stud nuts enough to slide the assembly back approximately 0.06 inch. Do not completely remove the stud nuts.
2. Spread one shim at the split line and remove it from the brake, taking care not to bend or spring the shim. For ease of removal, the shims are split radially.
3. Tighten outer cylinder nuts to 110-120 Ft-Lbs.

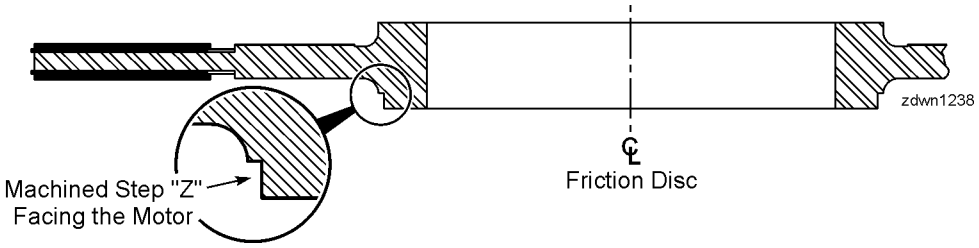
⚠ CAUTION

Tighten the stud nuts as per the instructions on the brake drive ring to a maximum of 120 Ft-Lbs. Excessive or improper tightness can cause the drive ring to become deformed and seriously reduce the effectiveness and life of the brake assembly.

4. Re-check the piston stroke. If the piston stroke is greater than 0.27 inch, place the unit back into service.

If the brake has already had a single shim removed, a second adjustment is possible. If the brake movement is greater than 0.65 inch the second shim may be removed.

NOTE: If friction disc(s) show signs of uneven wear, move the inner friction disc to outer location and the outer disc to the inner location to equalize wear. Ensure the side of the disc with the machined step “Z” faces the motor.



5.1.4.2 Hoist Brake Installation

The tachometer, furnished with the electric motor, must be installed before installing the brake assembly.

1. Install the drive hub and keyway on the motor. Refer to *PINION & HUB INSTALLATION* in *ENGINEERING DATA section*.
2. Install motor shaft nut and secure to shaft with Loctite.
3. Install brake adapter onto the motor and secure with hardware. Use care to align the access slots in the adapter for future tachometer inspections.
4. Lubricate the hub and friction disc splines with a light coat of Teflon grease or anti-seize compound.
5. Install the friction discs and center plates onto the shaft adapter in the required order before sliding on the brake assembly. Tighten the drive ring hardware and install the brake guard.

⚠ CAUTION

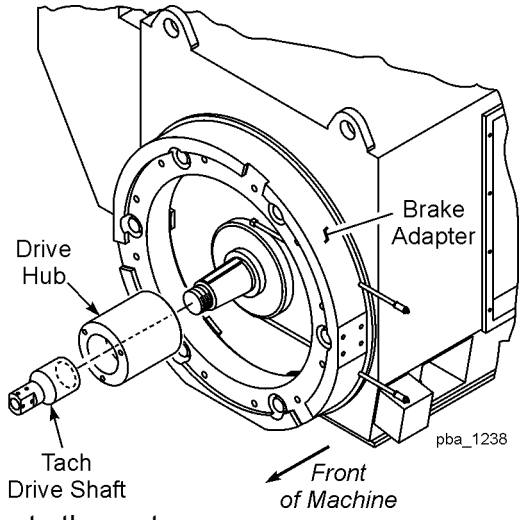
Do not overtighten the stud nuts as this will cause drive ring distortion and lead to excessive wear on brake disc and mating surfaces.

8. Reinstall the brake guard, tach supports and tachometer.

NOTE: If opposing plate surfaces (center, wear and pressure plates) show 0.03 inches per surface wear, they must be replaced.

5.1.6.2 Propel Brake Installation

1. Install the drive hub and keyway on the motor. Refer to *PINION & HUB INSTALLATION* in *ENGINEERING DATA section*.
2. Assemble the tach drive shaft onto the propel motor shaft using retaining compound. Tighten to 300 Ft-Lbs.



3. Install the brake adapter to the motor.
4. Install brake adapter (approximately 365 lbs.) onto the motor and secure with hardware. Use care to align the access slots in the adapter for future tachometer inspections.
5. Lubricate the hub and friction disc splines with a light coat of Teflon grease or anti-seize compound.
6. Install the friction discs and center plates onto the shaft adapter in the required order before sliding on the brake assembly (approximately 365 lbs.). Tighten the drive ring hardware.
7. Install tach supports, tachometer and tach coupling. Refer to *TACHOMETER MOUNTING & ALIGNMENT* procedure in this section of the manual.
8. Install the brake guard.

12. Slide the pressurized piston with cylinder and pressure plate assembly onto the cylinder studs. (When applicable, make sure cylinder shimming is in place between the cylinder and drive ring.) Secure the assembly in place with the stud nuts. Tighten the nuts in a diametrical pattern to 90-100 Ft-Lbs.

⚠ CAUTION

Do not overtighten the stud nuts as this will cause drive ring distortion leading to excessive wear on brake disc and mating surfaces.

NOTE: Observe the temporary regulator pressure gauge. If the pressure has dropped, the piston O-Rings may need replacement.

13. Open the temporary shut-off valve and release the brake pressure. Remove the temporary regulator with gauge and the shut-off valve from the brake inlet and reconnect the brake airline to the brake inlet.
14. Reinstall the brake guard, the tach supports, the tach and the tach cover.

5.1.9 Friction Disc Replacement — All Brakes

The friction disc(s) will require replacement when excessively worn or when contaminated by grease, oil or other foreign materials.

⚠ CAUTION

Major damage will occur to the components of the brake assembly if the friction disc is not replaced when worn. The result of "pushing" will result in metal-to-metal contact that will cause extremely expensive repairs and a seriously degraded braking system.

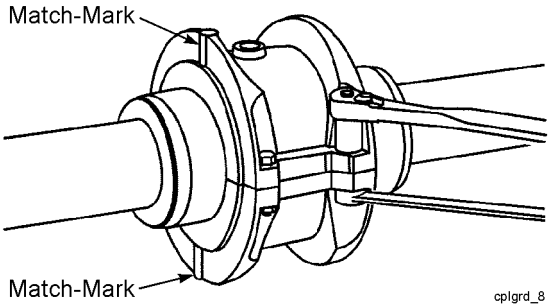
⚠ CAUTION

Do not remove the socket head capscrews near the bore of the piston as this will release the spring pressure within the brake assembly and make re-assembly much more difficult.

1. Remove the brake guard as required.
2. Release air pressure and remove the air line from the air INLET to the brake.
3. Install a ball or gate valve into the air INLET. This valve will be used to capture pressure within the piston during removal.
4. Reconnect the air source and pressurize the brake to the full released position. Close the valve, and then remove the air lines. At this point the brake is disengaged and not connected to an air source.

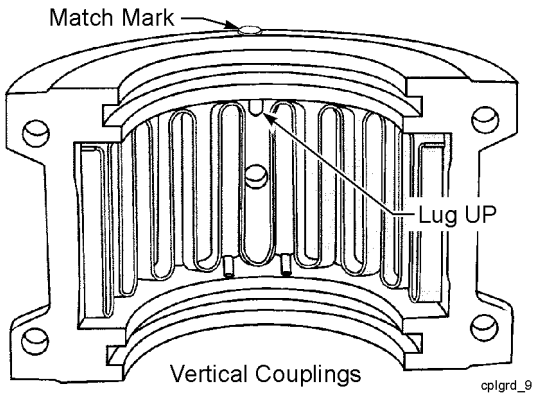
NOTE: The cylinder, piston and pressure plate may be removed as a single unit.

5. Remove the outer cylinder stud nuts at this time and the lift the entire brake assembly off the top of the studs as a unit. Once removed from the motor the pressure may be removed from the cylinder.



5. Pack with grease and assemble covers

Pack the spaces between and around the grid with as much lubricant as possible and wipe off excess flush with top of grid. Position seals on hubs to line up with grooves in cover. Position gaskets on flange of lower cover half and assemble covers so that the match marks are on the same side as shown above. If shafts are not level (horizontal) or coupling is to be used vertically; assemble cover halves with the lug and match mark up, or on the high side. Secure covers halves with fasteners and tighten to torque specified in the coupling data table. *MAKE SURE LUBE PLUGS ARE INSTALLED BEFORE OPERATING!*

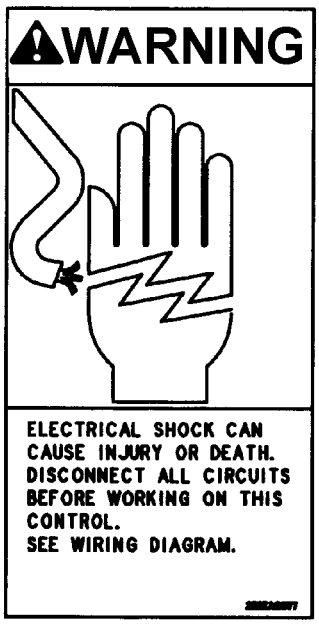


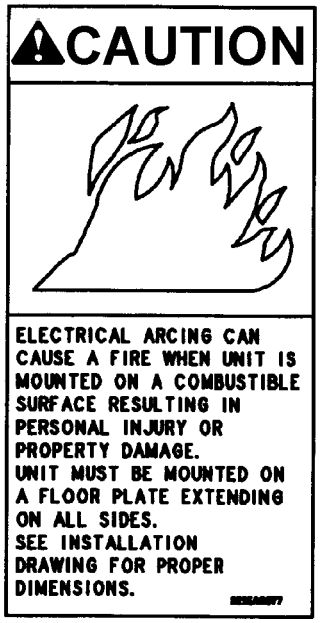
6. Periodic Lubrication

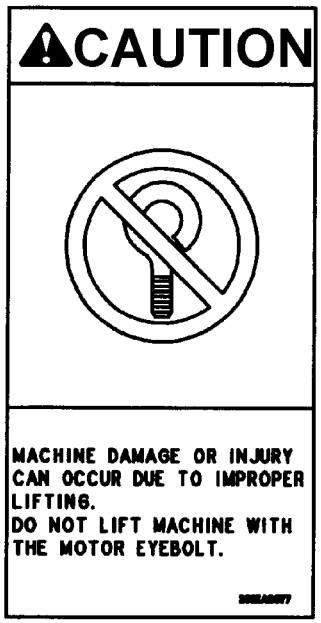
Remove both lube plugs and insert a lube fitting. Fill with recommended lubricant until excess appears at hole opposite; then insert plug. Lubricate couplings at least once ever year. Lubricate more frequently when exposed to excessive-moisture, extreme temperatures, rapid reversing or shock loads or excessive misalignment. It is not necessary to re-lube couplings filled with Long Term Grease (LTG) until disassembled for service to attached components.

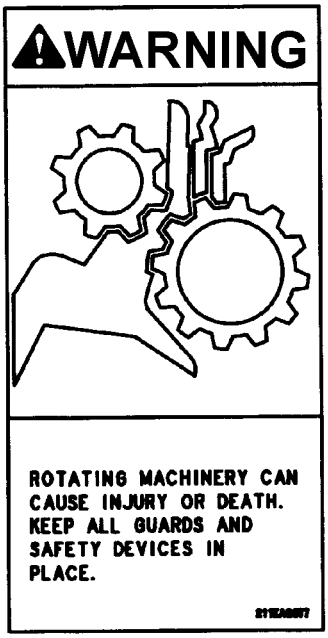
NOTE: For Long Term Grease (LTG) use part number MP295148.

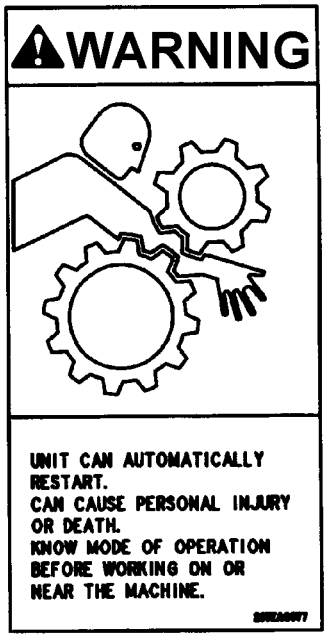
Compressed Air System


WARNING
ELECTRICAL SHOCK CAN CAUSE INJURY OR DEATH. DISCONNECT ALL CIRCUITS BEFORE WORKING ON THIS CONTROL.
SEE WIRING DIAGRAM.


CAUTION
ELECTRICAL ARCING CAN CAUSE A FIRE WHEN UNIT IS MOUNTED ON A COMBUSTIBLE SURFACE RESULTING IN PERSONAL INJURY OR PROPERTY DAMAGE.
UNIT MUST BE MOUNTED ON A FLOOR PLATE EXTENDING ON ALL SIDES.
SEE INSTALLATION DRAWING FOR PROPER DIMENSIONS.


CAUTION
MACHINE DAMAGE OR INJURY CAN OCCUR DUE TO IMPROPER LIFTING.
DO NOT LIFT MACHINE WITH THE MOTOR EYEBOLT.


WARNING
ROTATING MACHINERY CAN CAUSE INJURY OR DEATH.
KEEP ALL GUARDS AND SAFETY DEVICES IN PLACE.

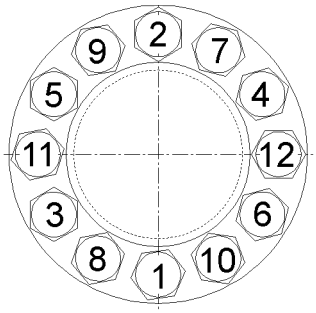

WARNING
UNIT CAN AUTOMATICALLY RESTART.
CAN CAUSE PERSONAL INJURY OR DEATH.
KNOW MODE OF OPERATION BEFORE WORKING ON OR NEAR THE MACHINE.

wrnb1101

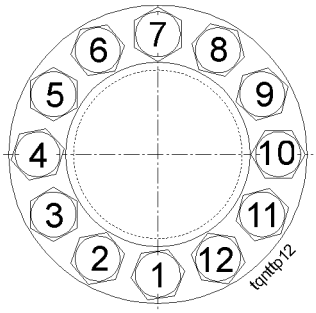
Table 8-7 - Area Conversions

Metric to English	*English to Metric*
1 sq. Kilometer = 0.3861 sq. Miles	1 sq. Mile = 2.590 sq. Kilometers
1 sq. Kilometer = 247.1 Acres	1 Acre = 0.004047 sq. Kilometers
1 sq. Meter = 1.196 sq. Yards	1 Acre = 4047 sq. Meters
1 sq. Meter = 10.76 sq. Feet	1 sq. Yard = 0.8361 sq. Meter
1 sq. Meter = 1550 sq. Inches	1 sq. Foot = 0.0929 sq. Meter
1 sq. Centimeter = 0.1550 sq. Inch	1 sq. Foot = 929.0 sq. Centimeters
1 sq. Millimeter = 0.001500 sq. Inch	1 sq. Inch = 6.452 sq. Centimeters
	1 sq. Inch = 645.2 sq. Millimeters

8.6.2 Tightening Procedure for 2-Inch Torque Nut



"STAR" Tightening Pattern



CIRCULAR Tightening Pattern

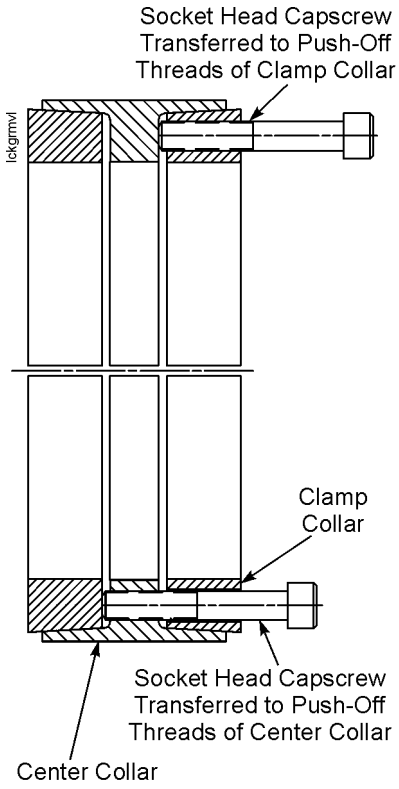
Torque Nut with 12 Jackbolts

1. Ensure that a special steel washer, supplied with the torque nut, is placed beneath the torque nut. DO NOT USE STANDARD COMMERCIAL WASHERS.
2. The jackbolt threads and faces are prelubricated with graphite lube. Ensure that this lube is present. Apply additional lube (part number, MP390331) as needed.
3. Check the base of the torque nut to ensure that all jackbolts are flush with the bottom.
4. Spin the torque nut onto the rod or bolt by hand.
5. Tighten the jackbolts to **114** Ft-Lbs (155 N•m) as follows:
   a. Snug all jackbolts to **10** Ft-Lbs (14 N•m) each.
   b. Using the STAR pattern shown, tighten all jackbolts to **55** Ft-Lbs (75 N•m).
   c. Switch to the CIRCULAR pattern shown and tighten all jackbolts to **85** Ft-Lbs (116 N•m).
   d. Continue with the CIRCULAR pattern and tighten all jackbolts to **125** Ft-Lbs. (170 N•m)

NOTES:

- With longer rods and bolts, stretch in the rod or bolt occurs during tightening of the jackbolts. Therefore, after tightening with the circular pattern in step 5-d above, the first jackbolt may have loosened. The higher torque value is used in this step only to speed the tightening process. After performing the above steps, use a torque wrench for the final torque values and continue tightening the jackbolts in a circular pattern until all jackbolts are tightened to a value of **114** Ft-Lbs (155 N•m).
- An impact wrench can be used for the initial tightening sequences, *however a torque wrench must be used to achieve the final torque values.*
- Repeat the above steps for all remaining torque nuts.

8.9.1 Locking Assembly Removal



Locking Assembly Removal
Series **1015** Shown

For series 1015 assemblies with a center collar:

1. Loosen all capscrews on the locking assembly by at least 2 turns in 1/4 turn increments.
2. Transfer all the capscrews to the push-off threads provided in the clamp collar and in the center collar.
3. Progressively tighten all screws in a diametrical pattern - except the screws adjacent to the slit in the clamp collar - these should be tightened one after the other.

For series 4000 assemblies with NO center collar:

1. Loosen all capscrews on the locking assembly by at least 2 turns in 1/4 turn increments.
2. The locking assembly incorporates a self-releasing taper, which should allow the assembly to be removed. However if the thrust rings jam, tap on the heads of 3 equally spaced capscrews to positively release the connection.
3. Insert pullout screws in the threads under the cadmium plated locking screws to remove the assembly.

Inspect closely for cracks, undercut or overlap of beads, and gouge out or grind flaws where they occur before continuing. It is very important on highly loaded parts, particularly members subject to cyclic or dynamic stresses, to obtain sound repair welds.

The presence of any stress risers on the surface of a part is detrimental to fatigue life and can result in future cracking. Therefore, it is essential that the finished repair be smooth and well blended into the base metal. Repair weld any undercuts, grind off overlapped weld beads and blend out any notches or gouges. The best condition in a repair weld location is provided by grinding the repair smooth and flush with the surface of the base metal. Final grinding direction is to be identical with the direction of applied load on the structure. Refer to the figure.

8.11.3 Repair Welding of Broken Parts

All recommendations given for repair of cracks apply to repair of broken parts, with additional corrections. Depending on the size and cross-section of the part, a specific sequence of welding procedures may be required in making the repair. These techniques include back-step welding sequence, block welding sequence, alternating from side to side, welding simultaneously on opposite sides, etc. All of these precautionary measures are intended to minimize shrinkage stresses and subsequent distortion or cracking during welding. The method to follow should be determined after a careful analysis of the situation and by approaching the problem with common sense. Generally a procedure which has proven successful in previous experience could logically be applied in most cases.

Use of doubling plates, stiffeners or other reinforcements to strengthen a member which has cracked in service, must be carefully considered before that repair measure is decided upon. Additional material added for strengthening alters the configuration and geometry of the member, possibly with a pronounced effect on the fatigue life of that structure. Many times, such attempts at strengthening by adding plates only serves to “chase the crack someplace else.” The stress flow in the part has been altered, creating a location for stress concentration. Attachments requiring fillet welds across a tension member for example, are poor repair methods. A sound repair weld, carefully made and smoothly blended into the base metal on all sides, is preferable to additional reinforcements. Any application of reinforcements requires careful consideration regarding total overall effect on the structure during service, and should be done only after consulting Bucyrus International, Inc.

NOTE: Avoid unreeling and uncoiling methods that are likely to provide kinks. Such IMPROPER procedures should be strenuously avoided in order to prevent the occurrence of loops. These loops, when pulled taut, will inevitably result in kinks. No matter how a kink develops, it will damage strands and wires, resulting in a kinked section that must be cut out. Proper and careful handling will keep the wire rope free from kinks.

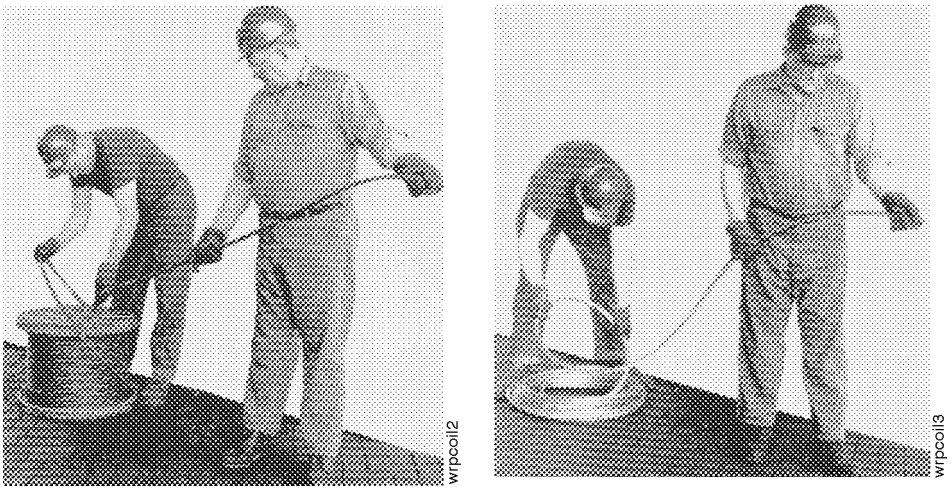


Figure 8-4 Improper Methods for Uncoiling Wire Rope

8.12.10 Guideline to Inspections and Reports

(Equipment, Wire Rope and Wire Rope Slings)

1. Maintain all inspection records and reports for the length of time deemed appropriate.
2. Prior to daily use, the following procedure should be followed.
   a. Check all equipment functions.
   b. Lower load blocks and check hooks for deformation or cracks.
   c. During lowering procedure and the following raising cycle, observe the rope and the reeving. Particular notice should be paid to kinking, twisting or other deformities. Drum winding conditions should also be noted.
   d. Check wire rope and slings for visual signs of any unsafe condition, including broken wires, excessive wear, kinking or twisting, and severe corrosion. Particular attention should be given to any new damage during operation.
3. Periodic inspections consistent with applicable standards are recommended with a signed report by an authorized and competent inspector. These Periodic Reports should include inspection of the following:
   a. All functional operating mechanisms for excessive wear of components, brake system parts and lubrication.
   b. Limit switches.
   c. Crane hooks for excessive throat opening or twisting, along with a visual for cracks.
   d. Wire rope and reeving for conditions causing possible removal.
   e. Wire rope slings for excessive wear, broken wires, kinking, twisting and mechanical abuse.
   f. All end connections such as hooks, shackles, turnbuckles, plate clamps, sockets, etc. for excessive wear, and distortion.
4. At least one annual inspection with signed report must be made for the following:
   a. Crane hook for cracks.
   b. Hoist drum for wear or cracks.
   c. Structural members for cracks, corrosion and distortion.
   d. For loose structural connections such as bolts, rivets, and weldments.

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