

SECTION 4 SET-UP AND INSTALLATION

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SECTION 4

SET-UP AND INSTALLATION PROCEDURES

GENERAL

This section provides procedures for installing the hoist cable on the hoist drum, cable reeving, and erecting and stowing the boom extension.

INSTALLING CABLE ON THE HOIST

CAUTION

If cable is wound from the storage drum, the reel should be rotated in the same direction as the hoist.

NOTE: The cable should preferably be straightened before installation on the hoist drum.

Install cable on the hoist drum in accordance with the following procedure.

1. Position the cable over the boom nose sheave and route to the hoist drum.
2. Position the hoist drum with the cable anchor slot on top.
3. Insert the cable through the slot and position around the anchor wedge (Figure 4-1).

NOTE: The end of the cable should be even with the bottom of the anchor wedge.

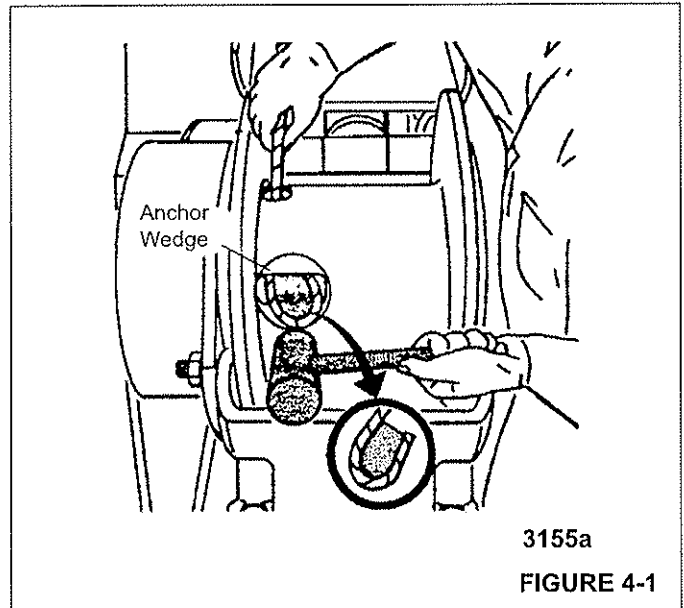
4. Position the anchor wedge in the drum slot; pull firmly on the free end of the cable to secure the wedge.

NOTE: If the wedge does not seat securely in the slot, carefully tap the top of the wedge with a mallet.

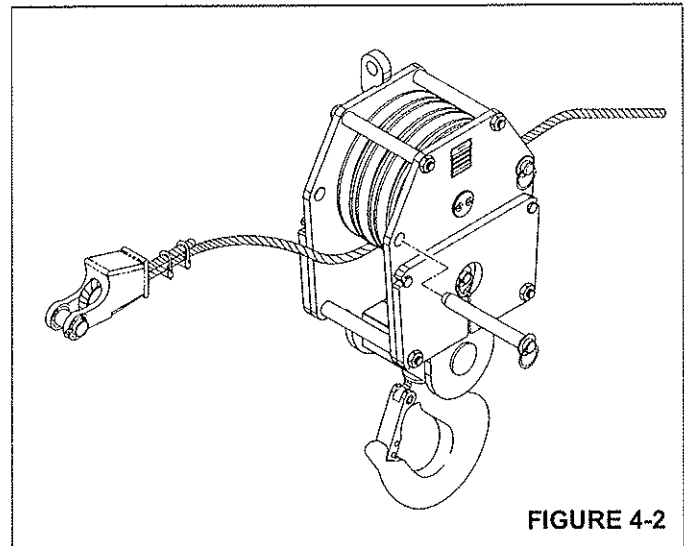
5. Slowly rotate the drum, ensuring the first layer of cable is evenly wound onto the drum.
6. Install the remainder of the cable, as applicable.

CABLE REEVING

NOTE: There are two types of cable (wire rope) available on this crane; 6 x 37 WS and 35 x 7 (non-rotating).



Within the limits of the load and range charts and permissible line pull, multi-part lines allow the operator to raise a greater load than can be raised with a single part line. Various cable reeving (part line) is possible with the boom nose and hook block. This reeving should be accomplished by a qualified rigger using standard rigging procedures (Figure 4-3).



In order to quick reeve the hook block without removing the wedge socket on the end of the cable refer to (Figure 4-2)

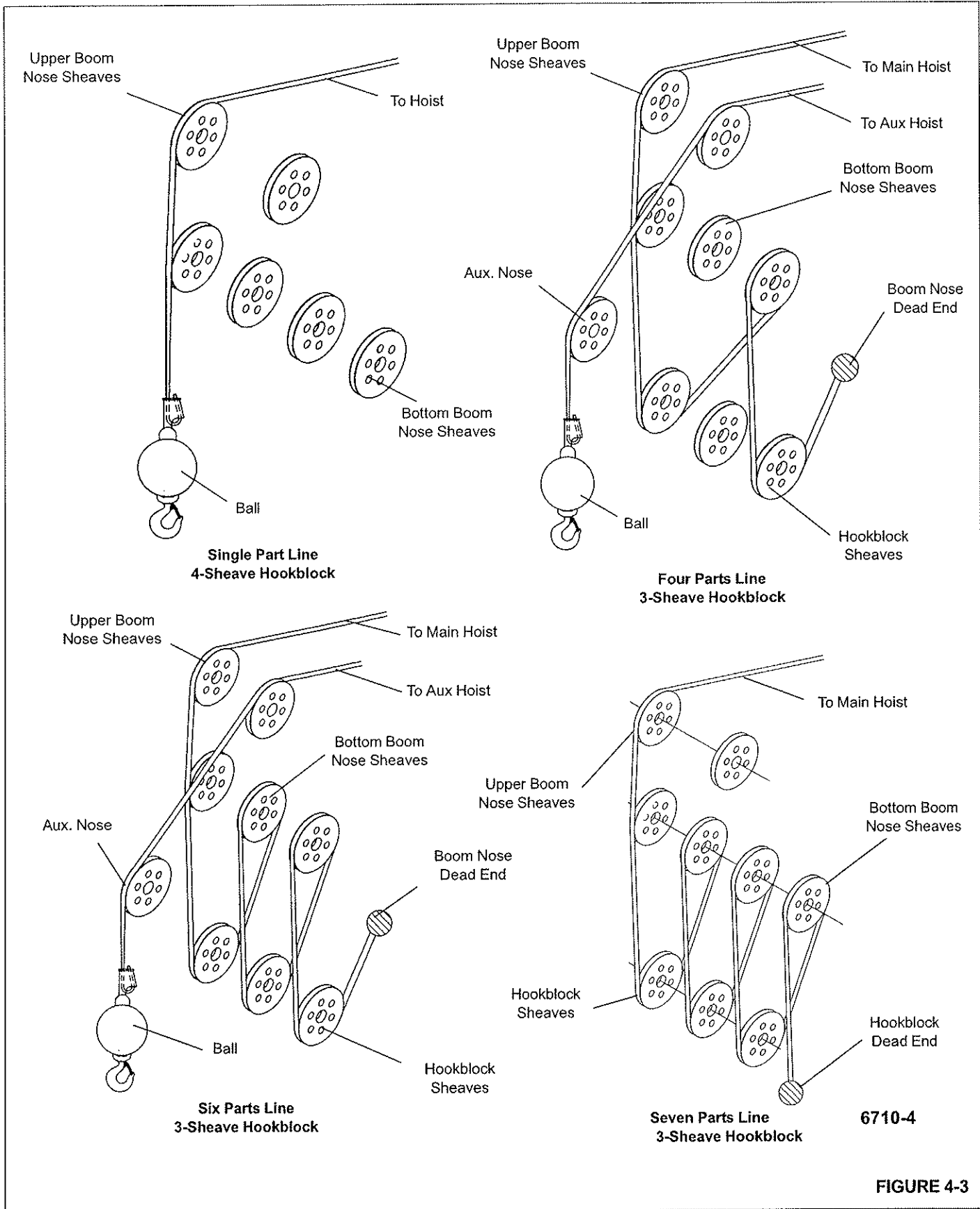


FIGURE 4-3

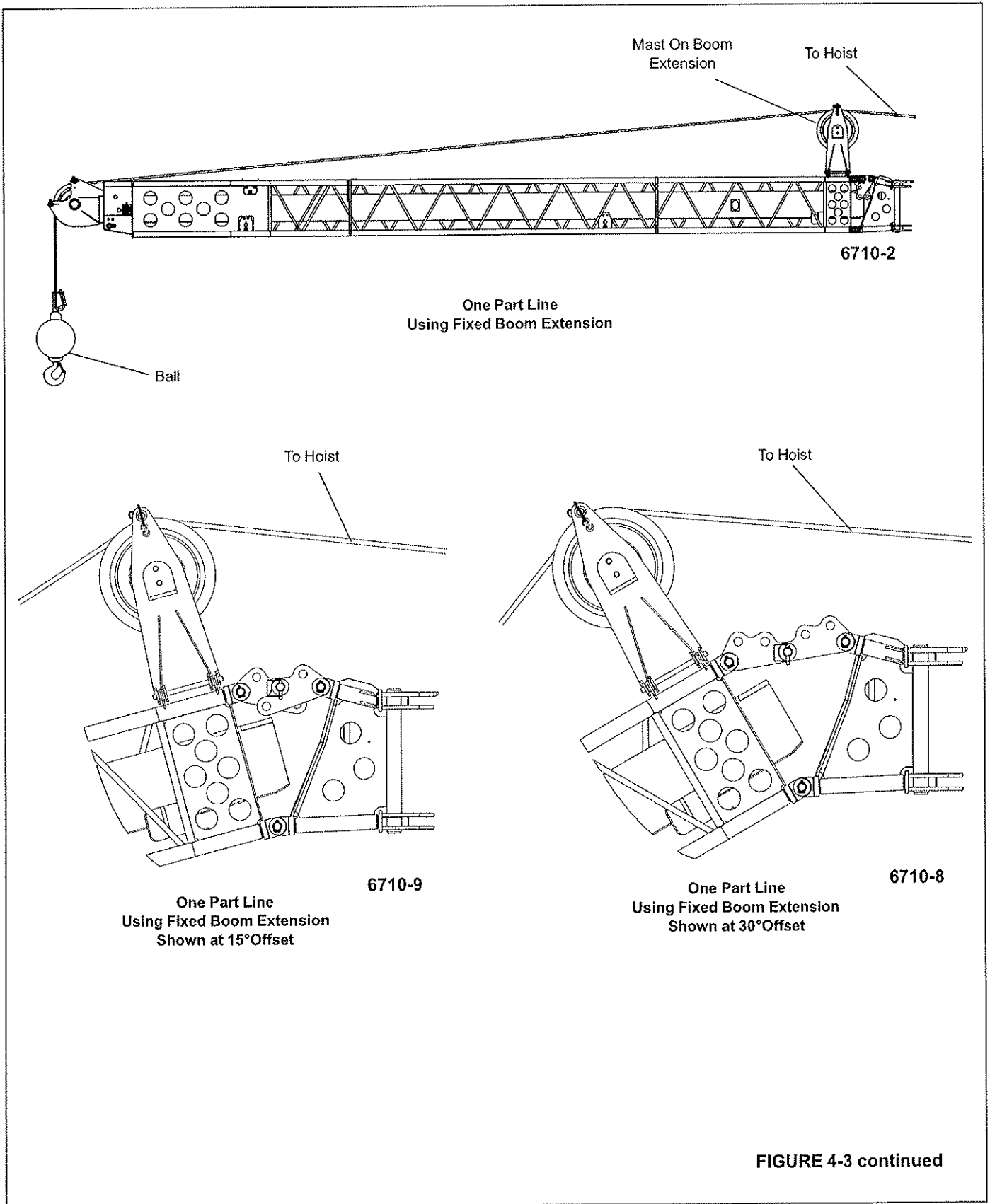


FIGURE 4-3 continued

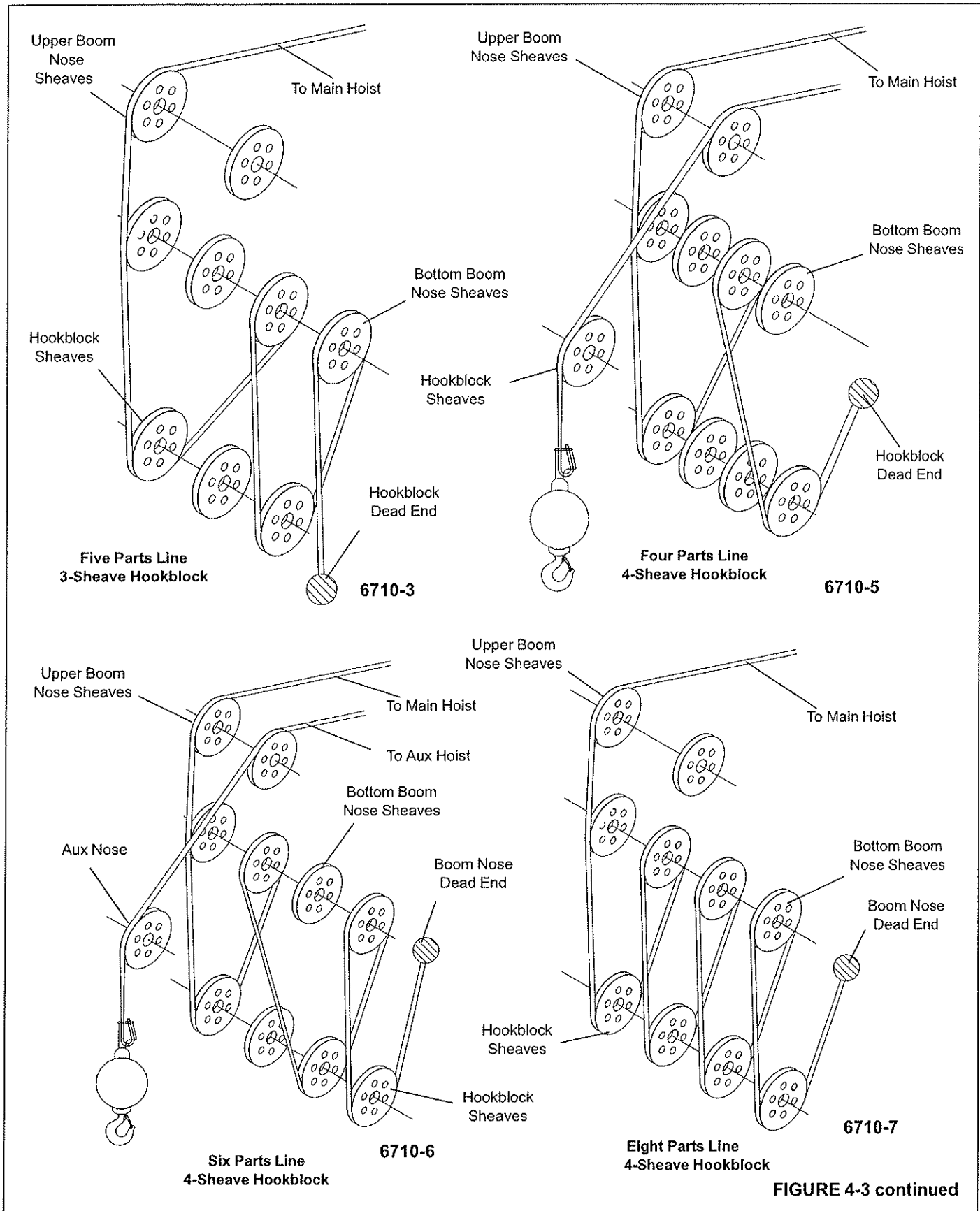


FIGURE 4-3 continued

DEAD-END RIGGING/WEDGE SOCKETS

Wedge socket assemblies are popular rigging accessories and have been successfully used for decades to terminate wire ropes on mobile cranes. A wedge socket assembly is easily installed and dismantled but it must be installed and used correctly. It is essential to use only a wedge and socket of the correct size for the rope fitted. Failure to do so may result in the rope pulling through the fitting.

Since state and local laws may vary, alternate attachment methods may be necessary depending upon work conditions. If alternate methods are selected, the user is responsible and should proceed in compliance with the regulations in force. If there are any questions, contact your local Grove Distributor or Manitowoc CraneCARE.

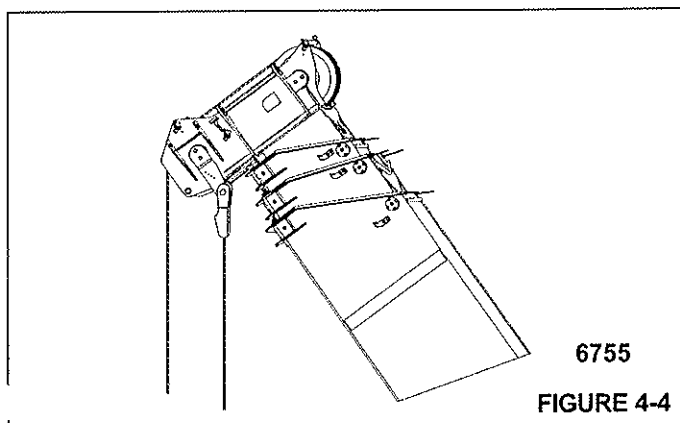
Do not mix components from different manufacturers. The selection, installation and use of a wedge socket assembly must be in accordance with the requirements of the wedge socket manufacturer and the wire rope manufacturer upon whose wire rope the wedge socket assembly will be used.

Grove Crane specifies the size, type, class and line pulls for wire rope, predominately rotation resistant wire rope, and rigging accessories such as overhaul balls and hook blocks for use with each new crane that it manufactures. Other wire ropes and rigging accessories are available from various vendors. Different wire rope manufacturers have differing requirements for the construction, handling, cutting, seizing, installation, termination, inspection and replacement of the wire ropes they produce. Their advice should be sought for each specific type of wire rope a crane user intends to install on a mobile crane.

When assembly is complete, raise the boom to a working position with a load suspended to firmly seat the wedge and rope into the socket before the crane is used operationally.

CAUTION

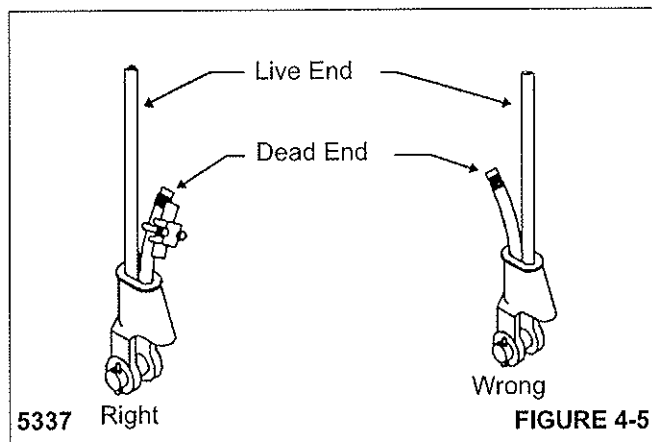
If the socket is not positioned with the flat face toward the boom sections, structural damage will occur.



When anchoring the socket to the boom, ensure the flat face of the socket is in position, as shown, toward the boom sections (Figure 4-4).

Installing Wedge And Socket

1. Inspect the wedge and socket. Remove any rough edges and burrs.
2. The end of the wire rope should be seized using soft, or annealed wire or strand. If the end of the rope is welded, the welded end should be cut off. This will allow the distortion of the rope strands, caused by the bend around the wedge, to adjust themselves at the end of the line.



3. Make sure the live-loaded side (Figure 4-5) of the rope is directly in line with the ears of the socket and the direction of pull to which the rope will be subjected. If the rope is loaded into the socket incorrectly, under a load the rope will bend as it leaves the socket, and the edge of the socket will wear into the rope causing damage to the rope and eventual failure.
4. Insert the end of a wire rope into the socket, form a loop in the rope, and route the rope back through the socket allowing the "dead" end to protrude from the socket. Ensure the dead end of the rope is of sufficient length to apply end treatment to the dead end after the wedge has been seated.
5. Insert the wedge into the loop and pull the live end of the rope until the wedge and rope are snug inside the socket. It is recommended that the wedge be seated inside the socket to properly secure the wire rope by using the crane's hoist to first apply a light load to the live line.
6. After final pin connections are made, increase the loads gradually until the wedge is properly seated.
7. The wire rope and wedge must be properly secured inside the socket before placing the crane into lifting service. It is the wedge that secures the wire rope inside the socket whereas the dead-end treatment is used to

restrain the wedge from becoming dislodged from the socket should the rope suddenly become unloaded from the headache ball or hook block striking the ground, etc.

Sketches A through F (Figure 4-6) illustrate various methods for treating the dead-ends of wire ropes which exit a wedge socket assembly. While use of the loop-back method is acceptable, care must be exercised to avoid the loop becoming entangled with tree branches and other components during crane transport and with the anti-two block system and other components during use of the crane.

Of the methods shown below, Grove prefers that method A or B or F be used on Grove cranes, i.e., clipping a short piece of wire rope to the dead-end or using a commercially available specialty clip or wedge. Typically, it is recommended that the tail length of the dead-end should be a minimum of 6 rope diameters but not less than 15.2 cm (6 in) for standard 6 to 8 strand ropes and 20 rope diameters but not less than 15.2 cm (6 in) for rotation resistant wire ropes.

When using method A, place a wire rope clip around the dead end by clamping a short extra piece of rope to the rope dead end. DO NOT CLAMP THE LIVE END. The U-bolt should bear against the dead end. The saddle of the clip should bear against the short extra piece. Torque the U-bolts according to the figures listed in (Table 4-1).

Other sources for information with which crane users should be familiar and follow is provided by the American Society of Mechanical Engineers, American National Standard, ASME B30.5, latest revised. ASME (formerly ANSI) B30.5 applies to cableways, cranes, derricks, hoists, hooks, jacks, and slings. It states, in section 5-1.7.3, "(c) Swagged,

compressed, or wedge socket fittings shall be applied as recommended by the rope, crane or fitting manufacture." Wire ropes are addressed in ASME B30.5, section 5-1.7.2, ROPES, It states, in pertinent part, "(a) The ropes shall be of a construction recommended by the rope or crane manufacturer, or person qualified for that service." Additional information is published by the Wire Rope Technical Board in the Wire Rope Users Manual, latest revised.

Table 4-1

WIRE ROPE CLIP TORQUE VALUES			
Clip Sizes		*Torque	
mm	Inches	Nm	Ft-Lbs
3.18	1/8	6	4.5
4.76	3/16	10	7.5
6.35	1/4	20	15
7.94	5/16	40	30
13.28	3/8	60	45
11.11	7/16	90	65
12.70	1/2	90	65
14.29	9/16	130	95
15.88	5/8	130	95
19.05	3/4	175	130
22.23	7/8	300	225
25.40	1	300	225
28.58	1-1/8	300	225
31.75	1-1/4	490	360
38.68	1-3/8	490	360
38.10	1-1/2	490	360

*The tightening torque values shown are based upon the threads being clean, dry, and free of lubrication.

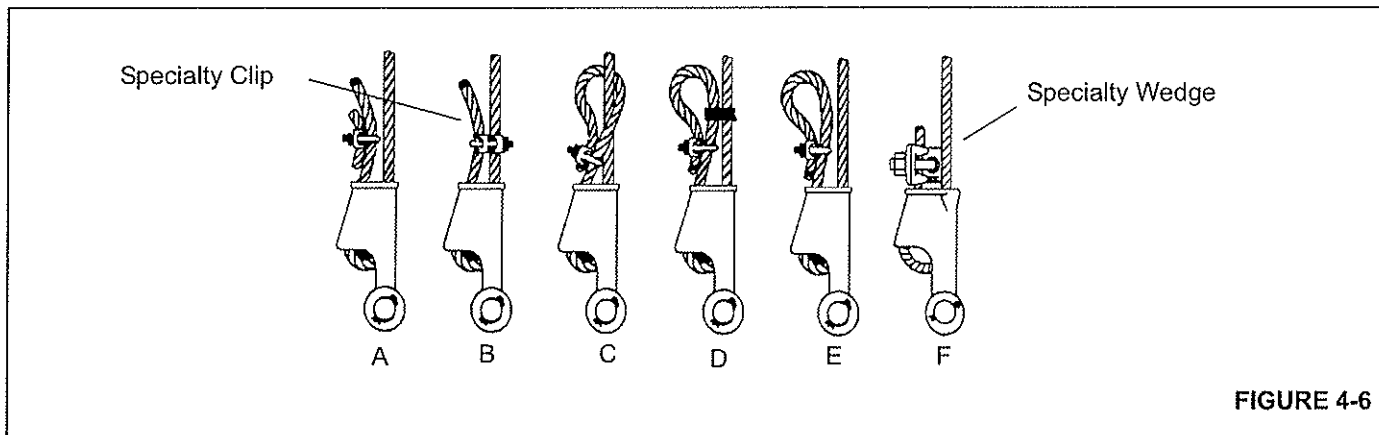


FIGURE 4-6

ERECTING AND STOWING THE BOOM EXTENSION

General Warnings



DANGER

To prevent serious injury or death, always wear personal protective equipment; i.e., a hard hat, eye protection, gloves and metatarsal boots.



DANGER

Boom angles are used to control speed at which extensions swing during erecting and stowage. Improper boom angles will cause uncontrollable swing speeds of extension.

NOTE: Tag line used in these procedures is to control the movement of the boom extension.



DANGER

Before attempting to erect or stow the boom extension; read and strictly adhere to all danger decals installed on the boom/boom nose, boom extension, and stowage brackets.

Erecting



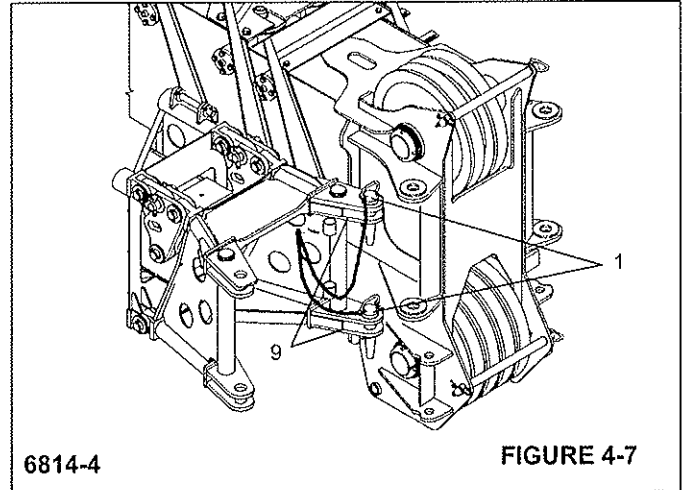
DANGER

To prevent serious injury or death, do not stand on decking until extensions are secure.

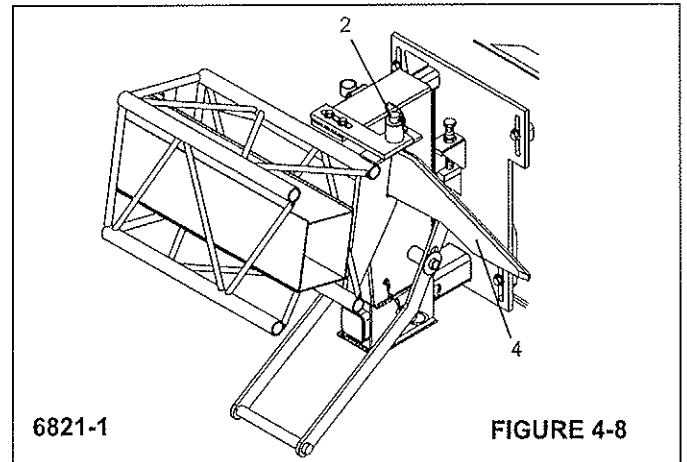
1. Visually check to ensure all pins are installed.
2. Crane should be set up on outriggers using normal setup procedures. Refer to Section 3 - OPERATING CONTROLS and PROCEDURES.
 - a. Fully retract boom.
 - b. Lower boom to horizontal for erecting over the front of the crane.

NOTE: The auxiliary boom nose (rooster sheave) does not have to be removed. However, if reeved, the hoist cable must be removed from the sheave.

3. Rig either the main hoist or optional auxiliary hoist cable for single part line with nothing but the wedge socket on the end of the cable. Refer to Cable Reeving and Dead End Rigging in this section.
4. Remove the retainer clips from the right side attachment pins stowed in the base of the boom extension and remove the attachment pins from the boom extension. Insert the right side attachment pins (1) through the boom attachment and boom extension anchor fittings. Install the retainer clips in the attachment pins. (Figure 4-7)

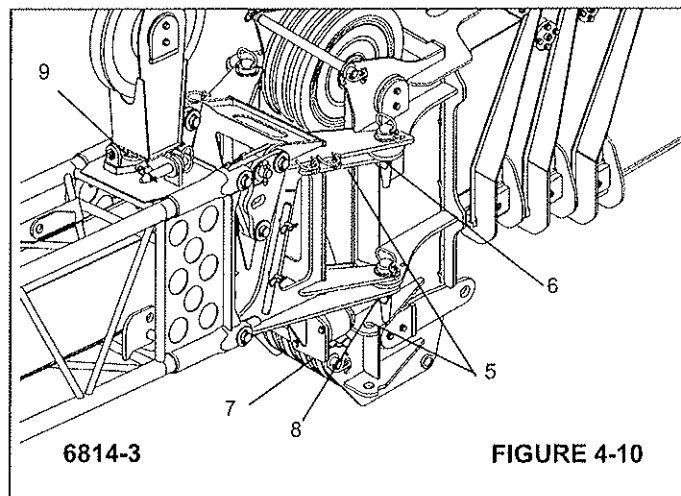
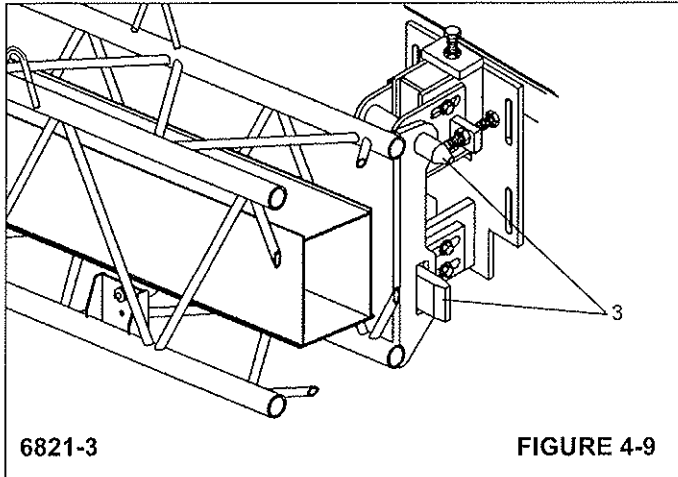


5. Remove the retaining pin from the hitch pin (4) that secures the boom extension to the rear stowage bracket. Remove the hitch pin, unlocking the boom extension from the boom. (Figure 4-8)



6. Attach a length of rope to the boom extension tip to aid in swinging the boom extension into place ahead of the boom nose.
7. Raise the boom to horizontal and extend the boom approximately 51 to 64 cm (20 to 25"). Make certain that the boom extension stowage lugs clear the guide pins

(Figure 4-9) (3) and ramp (Figure 4-8) (4) on the front and rear storage brackets.



DANGER

When erecting the boom extension, ensure that all personnel and equipment are kept clear of the swing path.

8. Slightly raise and/or lower the boom to help control the boom extension. Using the rope attached to the top of the boom extension, manually swing the extension into place ahead of the boom nose, engaging the attachment fittings (5) with the anchor fittings on the left side of the boom nose. (Figure 4-10)

DANGER

Do not modify the attachment points to permit the installation of the attachment pins.

CAUTION

Do not place blocking under the boom extension sheave wheel. Damage to the sheave wheel may occur.

9. Install the top left side attachment pin (6) and retainer clip into the upper anchor and attachment fittings of the boom nose. (Figure 4-10)

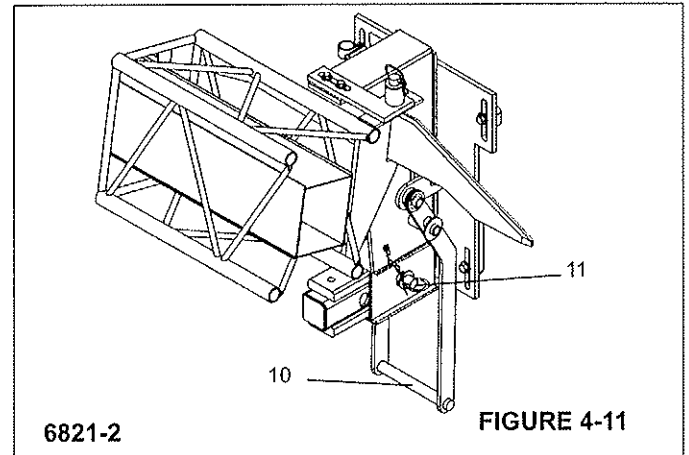
10. Extend the boom extension alignment jack (7) until the lower left side boom nose and boom extension adapter lugs are aligned.
11. Install the bottom left side attachment pin (8) and retainer clip into the lower anchor and attachment fittings of the boom nose.
12. Connect LMI cables:
 - a. Remove cable from boom extension.
 - b. Remove dummy plug from junction box on the boom nose.
 - c. Install cable end connector from the boom extension where dummy plug was removed
13. Release pressure on the boom extension alignment jack (7). (Figure 4-10)
14. Install the Mast Assembly (9) in the upright position using the locking pin.
15. Reeve the hoist cable. Refer to Cable Reeving in this section.

Stowing

1. With crane set up on outriggers, fully retract the boom and swing to over-the-front.
2. Lower the boom to minimum elevation.
3. Remove the cable retainer pin from the boom extension tip and the mast assembly. Remove the hoist cable from the sheaves. Install the cable retainer pins.
4. Remove the mast assembly retainer pin and the pin securing the mast assembly in the upright position (9). (Figure 4-10) Lay the mast assembly over to the stowed position. Insert the pins securing the mast to the base section.
5. Attach a length of rope to the boom extension tip.

6. Disconnect LMI cable:
 - a. Remove connector from junction box on boom nose.
 - b. Install dummy plug in junction box.
 - c. Route cable to and attach to boom extension
7. Raise the boom to horizontal.
8. Extend the boom approximately 51 to 64 cm (20 to 25"). Make certain that the boom extension stowage lugs will line up in front of the guide pins (3) (Figure 4-9) and ramp (4) (Figure 4-8) on the stowage brackets when the boom extension is positioned to the side of the boom.
9. Ensure the hitch pin (2) (Figure 4-8) and clip pin are removed from the rear stowage bracket.
10. Extend the boom extension alignment jack (7) (Figure 4-10) until the bottom left side attachment pin (8) is free. Remove the bottom left side boom extension clip pin and attachment pin.
11. Release pressure on the boom extension alignment jack. Completely retract the jack.
12. Remove the top left side attachment pin (6) and clip pin from the upper anchor and attachment fittings of the boom nose.

17. On the rear stowage bracket, remove the pin securing the sliding support in the "OUT" position. Push in on the handle (10) (Figure 4-11) to push the swingaway against the rear of the boom and disengage the swingaway anchor fittings from the boom nose attachment lugs (9) (Figure 4-7). Install the retainer pin (11) (Figure 4-11) securing the sliding support in the "IN" position.



18. Rig the boom nose and hoist cable as desired and operate the crane using normal operating procedures.

! DANGER

When stowing the boom extension, ensure that all personnel and equipment are kept clear of the swing path.

CAUTION

Do not allow the boom extension to slam into the stowage bracket when swinging into the stowed position.

13. Using the rope attached to the tip of the boom extension, manually swing the extension to the side of the boom.
14. Align the stowage lugs on the boom extension with the guide pins and ramp on the stowage brackets (Figure 4-8) and (Figure 4-9) and fully retract the boom.
15. Install the hitch pin (2) (Figure 4-8) and clip pin securing the boom extension to the rear stowage bracket.
16. Remove the attachment pins (1) and clip pins from the anchor and attachment fittings on the right side of the boom nose (Figure 4-7) and stow them in the base of the boom extension. Stow left side attachment pins and clips in outside attachment fitting on swingaway.

Setting The Offset

CAUTION

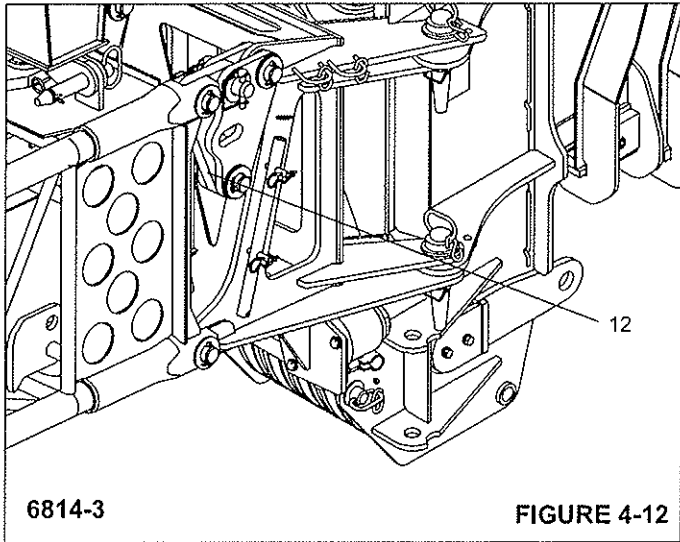
The mast assembly must be positioned on top of the base section before attempting to offset the swingaway to 30 degrees. Failure to do so can cause damage to the mast and/or swingaway adapter.

1. Extend and set the outriggers. Swing the boom over to the front of the crane.
2. To set the offset from zero degrees (0°) to thirty degrees (30°), perform the following:

CAUTION

Do not overload the swingaway or the attachment points when lowering the boom.

- a. Slowly lower the boom until the tip of the swingaway is on the ground and the pressure on the offset pin is relieved.
- b. Remove the lock pin, two washers, and offset pin (12). (Figure 4-12)



- c. Slowly elevate and telescope the boom at the same time until the offset shaft takes the full load of the swingaway.
3. To set the offset from thirty degrees (30°) to zero degrees (0°), perform the following:
 - a. Slowly lower the boom until the tip of the swingaway is on the ground and the offset pin can be installed.
 - b. Install the offset pin, two washers, and lock pin (12). (Figure 4-12)
 - c. Raise the boom and operate as desired.

Changing Boom Extension From Telescoping Type To Fixed Type

1. Erect the boom extension.
2. Position the boom to horizontal.
3. Disconnect the anti-two block cable connector from the junction box.
4. Remove the telescoping section hitch pin and retaining pin.

NOTE: The telescoping section weighs approximately 250 kg (551 pounds).

5. Extend the telescoping section and attach an adequate lifting device to support the telescoping section. Remove the stop bolts from the base section and remove the telescoping section from the base.

NOTE: The pin-on boom extension nose weighs approximately 60 kg (132 lb).

6. Using an adequate lifting device, position the pin-on boom extension nose in the base section and secure with the two pins and hitch pins.

7. Connect the anti-two block cable connector to the junction box.

Setting The Telescoping Extension Length

Extending

1. Position the boom to over the front.
2. Lower the boom to horizontal.
3. Remove the loop of anti-two block cable from the spool on the side of the base section and let the cable hang free.
4. Remove the hitch pin and retainer pin securing the telescoping section in the base.
5. Carefully pull the telescoping section from the base until the holes in the base and telescoping section lineup. Install the retainer pin and hitch pin.
6. If not already reeved, reeve the hoist cable over the mast and boom extension nose sheave. Install all cable retainer pins.

Stowing

1. Unreeve the boom extension nose.
2. Position the boom to horizontal.
3. Remove the hitch pin and retainer pin securing the telescoping section in the base.
4. Push the telescoping section into the base and secure with the retainer pin and hitch pin.
5. Loop the anti-two block cable over the spool on the side of the base section.

COUNTERWEIGHTS

Fixed Counterweight Description

The counterweight is pinned to the rear of the turntable and weighs 4300 kg (9490 pounds). For cranes without an auxiliary hoist, an additional 350.6 kg (773 pounds) counterweight is bolted to the hoist mounting area in lieu of the auxiliary hoist.

Fixed Counterweight Removal



DANGER

Death or serious injury could result from being crushed by a falling counterweight.

! DANGER

Ensure the retainer pin is properly installed to secure the counterweight mounting pin.

NOTE: Use of a forklift to remove/install the fixed counterweight is not recommended.

NOTE: Refer to (Figure 4-13) for counterweight removal.

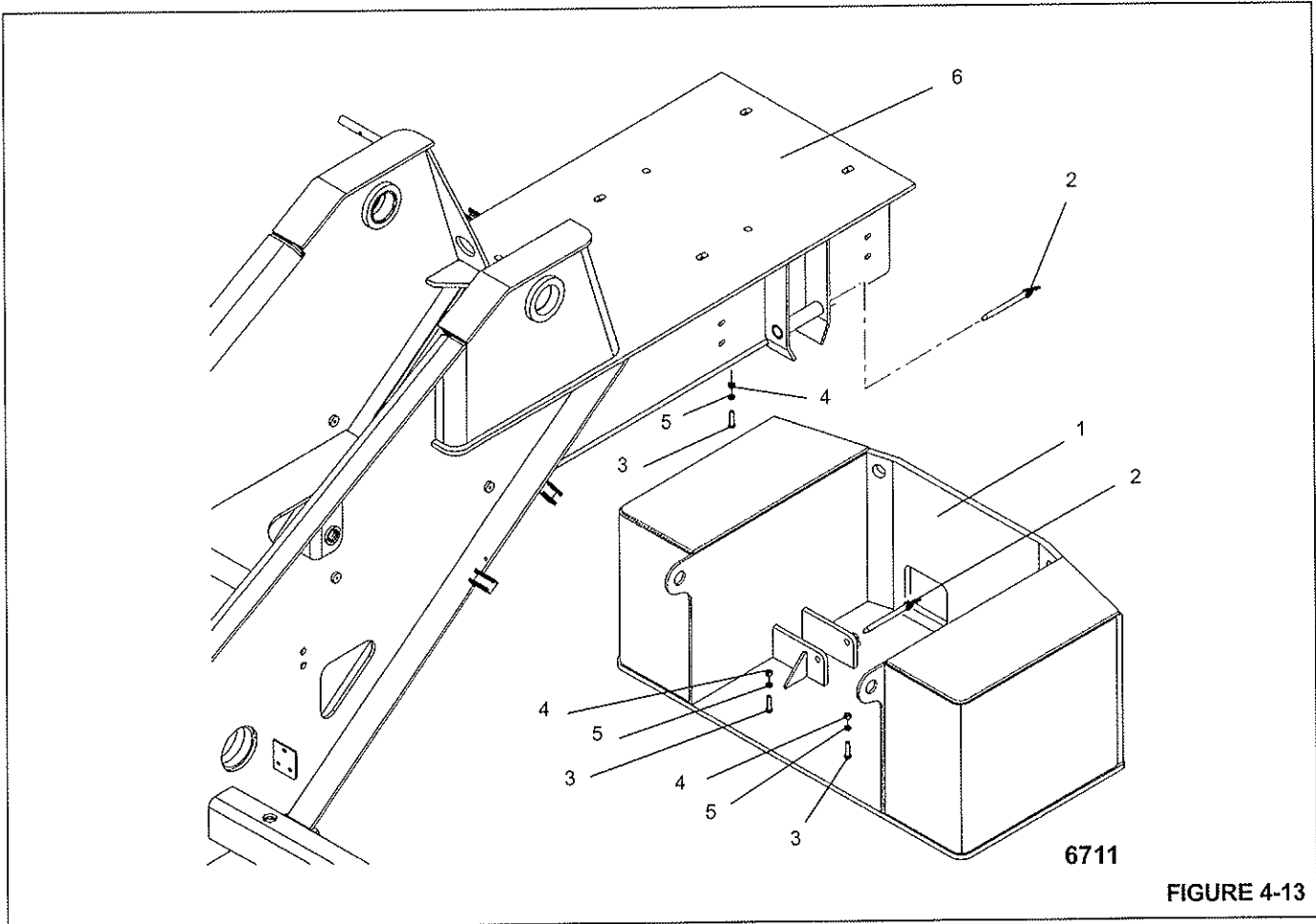


FIGURE 4-13

4

Item	Description
1	Counterweight
2	Pin Assembly
3	Capscrew
4	Jam Nut
5	Hex Nut
6	Turntable

1. Fully extend and set the outriggers.
2. Rotate the superstructure so the counterweight is over the front of the carrier to gain additional clearance. Engaging the pin type turntable lock will aid alignment.

NOTE: The counterweight weighs approximately 4300 kg (9490 pounds).

3. Lower and fully retract the boom
4. Shut down crane.
5. Remove and cap hydraulic lines from auxiliary hoist (if installed)
6. Attach an adequate lifting device to the counterweight.
7. Ensure the four counterweight leveling capscrews are set for maximum clearance with the turntable.
8. Slowly raise counterweight until pin assembly can be removed by pushing and turning the pin.
9. Remove pin assembly from opposite side.

10. Lower counterweight until attaching lugs are clear of the turntable.
11. Back counterweight away from turntable until it is clear of crane.
12. Replace pin assembly in turntable counterweight mounting lugs.
13. Move counterweight far enough from crane to allow the turntable/superstructure to clear during repositioning.
14. Rotate superstructure to the normal travel position.

Fixed Counterweight Installation

1. Fully extend and set the outriggers.
2. Rotate the superstructure so the counterweight will be over the front of the carrier to gain additional clearance.
3. Shut down crane.
4. Remove and cap hydraulic lines from auxiliary hoist (if installed).

CAUTION

When lifting/handling the counterweight, keep the chains/straps vertical to minimize side pull on the lifting lugs.

NOTE: The counterweight weighs approximately 4300 kg (9490 pounds).

NOTE: Use of a forklift to remove/install the fixed counterweight is not recommended.

5. Attach an adequate lifting device to the counterweight and lift the counterweight into place on the superstructure, aligning the mounting holes on the counterweight to the holes in the superstructure.
6. Install the counterweight mounting pins and secure them in place with hitch pin retainers.
7. Remove the lifting device from the counterweight.
8. Using the four counterweight leveling bolts, level the counterweight and eliminate any relative movement between the counterweight and turntable. Maximum width of counterweight shall not exceed 6.0 mm (0.25 in) out of level with the turntable bearing when measured from either counterweight outer edge.

SECTION 5

LUBRICATION

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SECTION 5 LUBRICATION

GENERAL

Following the designated lubrication procedures is important in ensuring maximum crane lifetime and utilization. The procedures and lubrication charts in this section include information on the types of lubricants used, the location of the lubrication points, the frequency of lubrication, and other information.

The service intervals specified are for normal operation where moderate temperature, humidity, and atmospheric conditions prevail. In areas of extreme conditions, the service periods and lubrication specifications should be altered to meet existing conditions. For information on extreme condition lubrication, contact your local Grove Distributor or Manitowoc CraneCARE.

CAUTION

Chassis grease lubricants must not be applied with air pressure devices as this lubricant is used on sealed fittings.

CAUTION

The multipurpose grease installed during manufacture is of a lithium base. Use of a noncompatible grease could result in damage to equipment.

Arctic Conditions Below -18°C (0°F).

In general, petroleum based fluids developed especially for low temperature service may be used with satisfactory results. However, certain fluids, such as halogenated hydrocarbons, nitro hydrocarbons, and phosphate ester hydraulic fluids, might not be compatible with hydraulic system seals and wear bands. If you are in doubt about the suitability of a specific fluid, check with your authorized Grove distributor or Manitowoc CraneCARE.

NOTE: All fluids and lubricants may be purchased by contacting the Manitowoc CraneCARE Parts Department.

Regardless of temperature and oil viscosity, always use suitable start-up procedures to ensure adequate lubrication during system warm-up.

Arctic Conditions Down To -40°F.

ALL Weather Package & Lubricants

Engineering recommends the following lubricants for components for ambient temperatures to -40F. Special lubricants alone are not sufficient to operate at extreme low temperatures. We also recommend the use of appropriately sized heaters for the hydraulic tank, engine oil pan, engine jacket water and batteries. The operator needs to follow the guide lines as stated in the operator's manual. We assume that the customer has take steps for use of an appropriate engine antifreeze coolant, have taken care of the fuel, fuel system and starting system. And has done whatever they feel necessary to add insulation for under hood temperatures and meet the engine manufacture's intake air temperature. Other lubricants may be used if they meet the specification of the lubricant that is requested. Please consult factory.

Axles and Swing Box -- Petro- Canada Traxon E Synthetic 75W-90; CITGO, Syntetic Gear Lube 75W-90; Eaton, Roadranger EP75W-90; Mobil, Mobilube SCH 75W-90; Shell, Spirax S 75W-90; Sunoco Duragear EP75W-90; -- **Spec 6829014058**

Engine -- Petro-Canada Duron Synthetic CI-4- 5W-40; Mobil Delvac 1, 5W-40; -- **Spec 6829101560**

Hydraulic tank and Transmission -- Petro-Canada Duratran Synthetic THF; Chevron All Weather THF; Texaco TDH Oil SS; -- **Spec 6829101559**

Hoist -- Petro-Canada ENDURATEX Synthetic EP 150; Mobil SHC629; -- **Spec 6829103636**

Grease -- Petro-Canada Precision Synthetic EP1; Mobil: Mobilith SHC 220; -- **Spec 6829104275**

Open Gear Lube -- (bearing/swingdrive teeth) ---Vultrex... OGL Synthetic All Season -- **No Spec**

Antifreeze Coolant -- Petro-Canada AFC 60/40; Old World Industries, Inc Fleet Charge SCA Pre-charged Antifreeze/Coolant-60/40; Fleetguard Compleat EG Antifreeze/Coolant Premix 60/40; -- **Spec 6829104212**

Standard Lubricants Package

Axle and Swing Box -- Century Unigear Semi-synthetic SAE 80W-90; Texaco Multigear SS 80W-90; Chevron DELO 80W-90; -- **Spec 6829012964**

Engine -- CI-4 Rated 15W-40 Engine Oil Exxon XD-3; Conoco Fleet Supreme; -- **Spec 6829003483**

Hydraulic Tank and Transmission -- To meet John Deere Standard JDM J20C – Hyden 052-10W-20; Exxon Torque

Fluid 56- 10W-20; Esso Torque Fluid 56- 10W-20; BP- Eldoran UTH & Trak-Tran 9 – 10W20; BP- Blend- 7367 - 10W20; Exxon Mobil 424- 10W-30 -- **Spec 6829006444**

Hoist -- AGMA No. 4 EP Extreme Pressure Gear Lube- Mobil: Mobilfluid 629 ; Texaco: Meropa 150; -- **Spec 6829100213**

Grease -- EP-MPG- Multipurpose Grease – Citgo Lithoplex MP # 2; Texaco Starplex Moly # 2; Phillips 66 Philube M Grease; Mobil Mobilgrese XHP 222 Special, # 53055-0; Chemtool Inc, Lube-A-Boom-Grease; -- **Spec 6829003477**

Open Gear Lube -- (bearing / swingdrive teeth -- FUCHS: CEPLATTYN 300 SPRAY -- **Spec 6829102971**

Antifreeze Coolant -- AFC – 50/50 Old World Industries, Inc. Fleet Charge SCA Pre-charged Antifreeze/Coolant; Caterpillar DEAC Antifreeze/Coolant; Fleetguard Complete EG Antifreeze/Coolant; -- **Spec 6829101130**

LUBRICATION POINTS

A regular frequency of lubrication must be established for all lubrication points. Normally, this is based on component operating time. The most efficient method of keeping track of lube requirements is to maintain a job log indicating crane usage. The log must use the engine hourmeter to ensure coverage of lube points that will receive attention based on their readings. Other lubrication requirements must be made on a time basis, i.e. weekly, monthly, etc.

All oil levels are to be checked with the crane parked on a level surface in transport position, and while the oil is cold, unless otherwise specified.

On plug type check points, the oil levels are to be at the bottom edge of the check port.

On all hoists with a check plug in the drum, the fill plug shall be directly on top of the hoist, and the check plug level.

All grease fittings are SAE STANDARD unless otherwise indicated. Grease non-sealed fittings until grease is seen extruding from the fitting. One ounce(28 grams) of EP-MPG equals one pump on a standard one pound (0.45 kg) grease gun.

Over lubrication on non-sealed fittings will not harm the fittings or components, but under lubrication will definitely lead to a shorter lifetime.

On sealed U-joints, care must be exercised to prevent rupturing seals. Fill only until expansion of the seals first becomes visible.

Unless otherwise indicated, items not equipped with grease fittings, such as linkages, pins, levers, etc., should be

lubricated with oil once a week. Motor oil, applied sparingly, will provide the necessary lubrication and help prevent the formation of rust. An Anti-Seize compound may be used if rust has not formed, otherwise the component must be cleaned first.

Grease fittings that are worn and will not hold the grease gun, or those that have a stuck check ball, must be replaced.

Where wear pads are used, cycle the components and relubricate to ensure complete lubrication of the entire wear area.

Surface Protection for Cylinder Rods

Steel cylinder rods include a thin layer of chrome plating on their surfaces to protect them from corroding. However, chrome plating inherently has cracks in its structure which can allow moisture to corrode the underlying steel. At typical ambient temperatures, hydraulic oil is too thick to penetrate these cracks. Normal machine operating temperatures will allow hydraulic oil to warm sufficiently to penetrate these cracks and if machines are operated daily, protect the rods. Machines that are stored, transported, or used in a corrosive environment (high moisture, rain, snow, or coastline conditions) need to have the exposed rods protected more frequently by applying a protectant. Unless the machine is operated daily, exposed rod surfaces will corrode. Some cylinders will have rods exposed even when completely retracted. Assume all cylinders have exposed rods, as corrosion on the end of the rod can ruin the cylinder.

It is recommended that all exposed cylinder rods be protected using Boeshield® T-9 Premium Metal Protectant. Manitowoc CraneCARE has Boeshield® T-9 Premium Metal Protectant available in 12 oz. cans that can be ordered through the Parts Department.

Cylinder operation and inclement weather will remove the Boeshield® protectant; therefore, inspect machines once a week and reapply Boeshield® to unprotected rod

The following describe the lubrication points and gives the lube type, lube interval, lube amount, and application of each. Each lubrication point is numbered, and this number corresponds to the index number shown on the Lubrication Figures 5-1 thru 5-4. Lube description and symbols are found in (Table 5-1) and (Table 5-2).

SAFETY

To lubricate many of the locations the engine will need to be started. After positioning areas of the unit for lubrication the engine must be turned off and the moved areas stable before approaching.

**WARNING**

Movement of the superstructure and the boom may create a crushing and/or pinching hazard. Failure to observe this warning could result in death or serious injury if the message is ignored.

Table 5-1

Symbol	Description
EP-MPG	Extreme Pressure Multipurpose Grease - Lithium Soap Base, NLGI Grade 2.
SSGL-5	Semi-Synthetic Gear Lubricant
AFC - 50/50	50/50 Blended Fully Formulated Antifreeze/Coolant, SAE J1941, ASTM D6210
HYDO	Hydraulic Oil - Must meet John Deere Standard JDM-J20C (Anti-brake chatter) and ISO 4406 cleanliness level 17/14
EO-15W/40	Engine Oil - SAE 15W-40, API Service Classification CI-4 or better
EP-OGL	Open Gear Lubricant, CEPLATTYN 300 Spray, NLGI Class 1-2
AGMA EP-4	Extreme Pressure Gear Lubricant.

Table 5-2
Lube Description

Lubrication Description	Lube Specification
Extreme Pressure Multipurpose Grease	A6-829-003477
Extended Service Interval Gear Lube	A6-829-012964
Fully Formulated Anti-Freeze Coolant	A6-829-101130
Hydraulic Oil	A6-829-006444
Engine Oil SAE 15W40	A6-829-003483
Open Gear Lube	A6-829-102971
Extreme Pressure Gear Lube	A6-829-100213
See Service Manual	***

CAUTION

The following lube intervals are to be used as a guideline only. Actual lube intervals should be formulated by the operator to correspond accordingly to conditions such as continuous duty cycles and/or hazardous environments.

STEERING & SUSPENSION LUBRICATION

1. Steering Cylinder Pivot Pins (1). (Figure 5-1)

Lube Type - EP-MPG

Lube Interval - 500 hours or 3 months

Lube Amount - Until grease extrudes

Application - 8 grease fittings

2. Upper and Lower King Pins (2). (Figure 5-1)

Lube Type - EP-MPG

Lube Interval - 500 hours or 3 months

Lube Amount - Until grease extrudes

Application - 8 grease fittings

3. Fifth Wheel Pivots (3). (Figure 5-1)

Lube Type - EP-MPG

Lube Interval - 500 hours or 3 months

Lube Amount - Until grease extrudes

Application - 2 grease fittings

4. Lockout Cylinder Pivot Pins (4). (Figure 5-1)

Lube Type - EP-MPG

Lube Interval - 500 hours or 3 months

Lube Amount - Until grease extrudes

Application - 4 fittings

AXLE LUBRICATION

5. Differentials (5). (Figure 5-1)

Lube Type - SSGL-5

Lube Interval -

- Check lubricant level every 500 hours or 3 months and refill as necessary.
- Drain and refill every 4000 hours or 2 years.

CAUTION

If the makeup amount is substantially more than 0.5 pint (0.23 liter), check for leaks.

CAUTION

Use of non-extended service interval lubricant may damage components and/or invalidate published lubricant intervals.

Lube Amount - Capacity - 9.5 liters (20 pints) -
Normal makeup - less than 0.23 liter (0.5 pint)

Application - Fill to bottom of hole in the housing on the steer cylinder side.

NOTE: Lube level close enough to the hole to be seen or touched is not sufficient. It must be level with the hole.

When checking lube level, also check and clean housing breathers.

6. Planetary Hubs and Wheel Bearings (6). (Figure 5-1)

Lube Type - SSGL-5

Lube Interval -

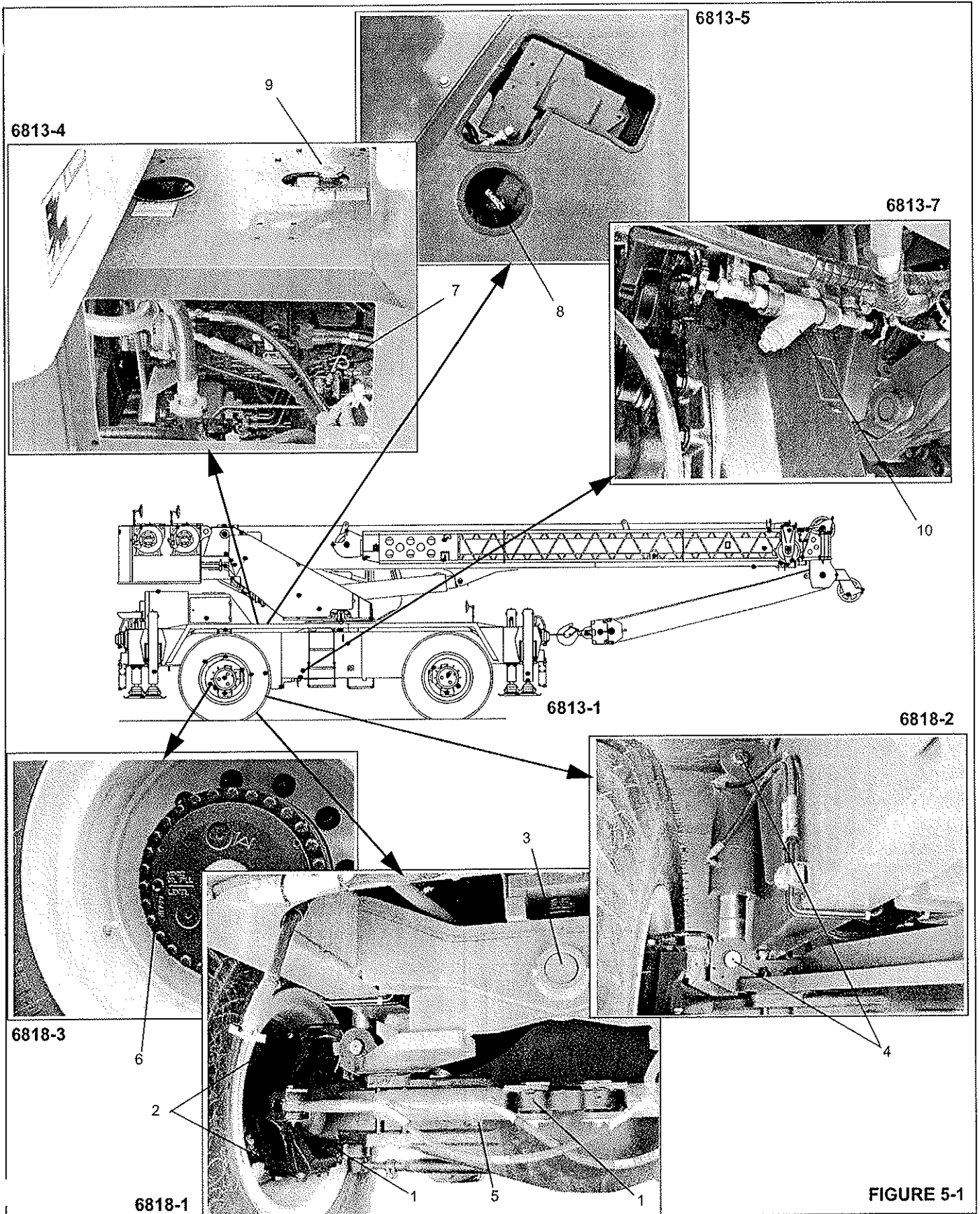
- Check fluid level every 500 hours or 3 months and refill as necessary.
- Drain and refill every 4000 hours or 2 years

CAUTION

Use of non-extended service interval lubricant may damage components and/or invalidate published lubricant intervals.

Lube Amount - 1.6 liters (3.5 pints)

Application - Fill to the bottom of the level hole in the housing with the fill plug and the oil level mark horizontal



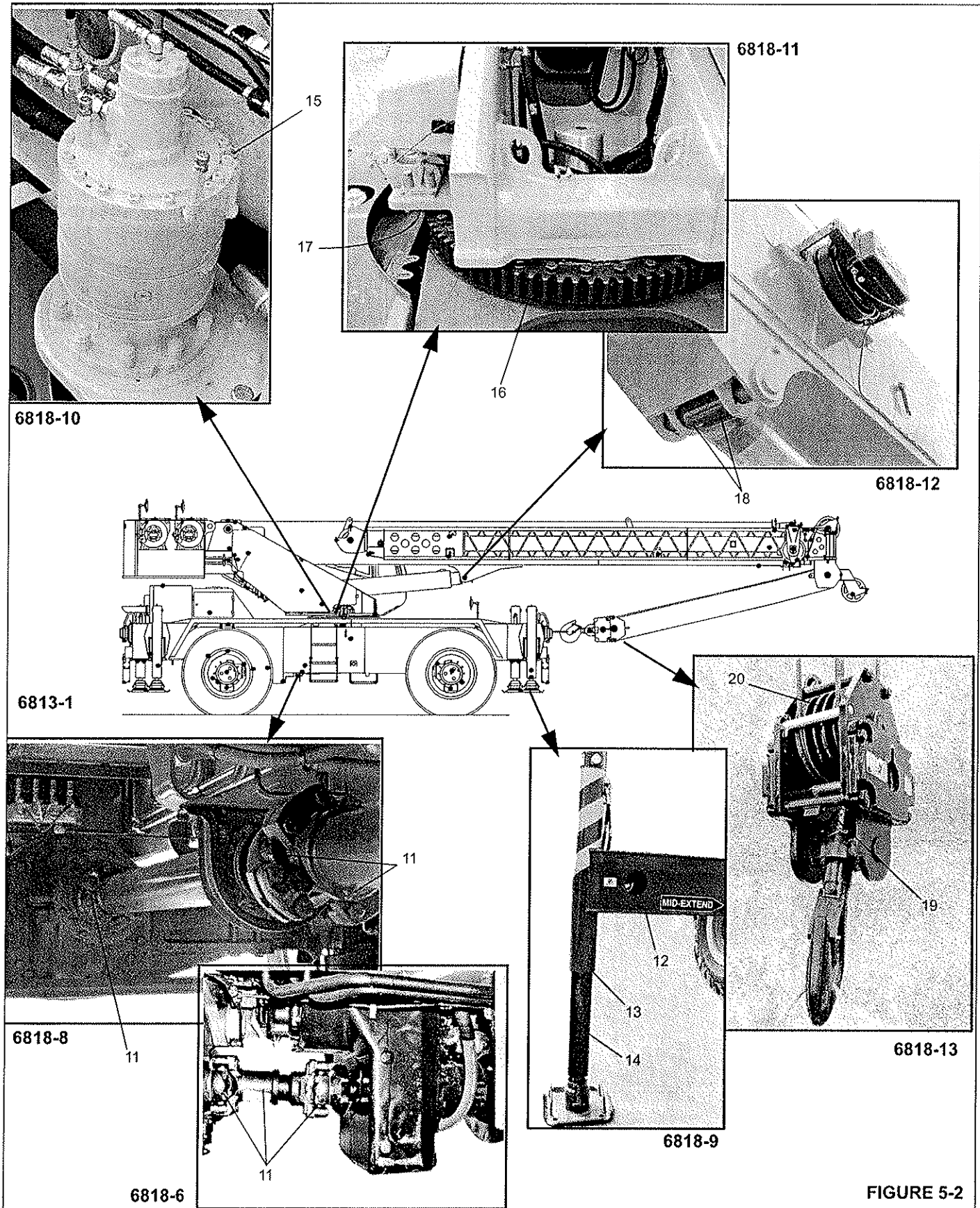


FIGURE 5-2

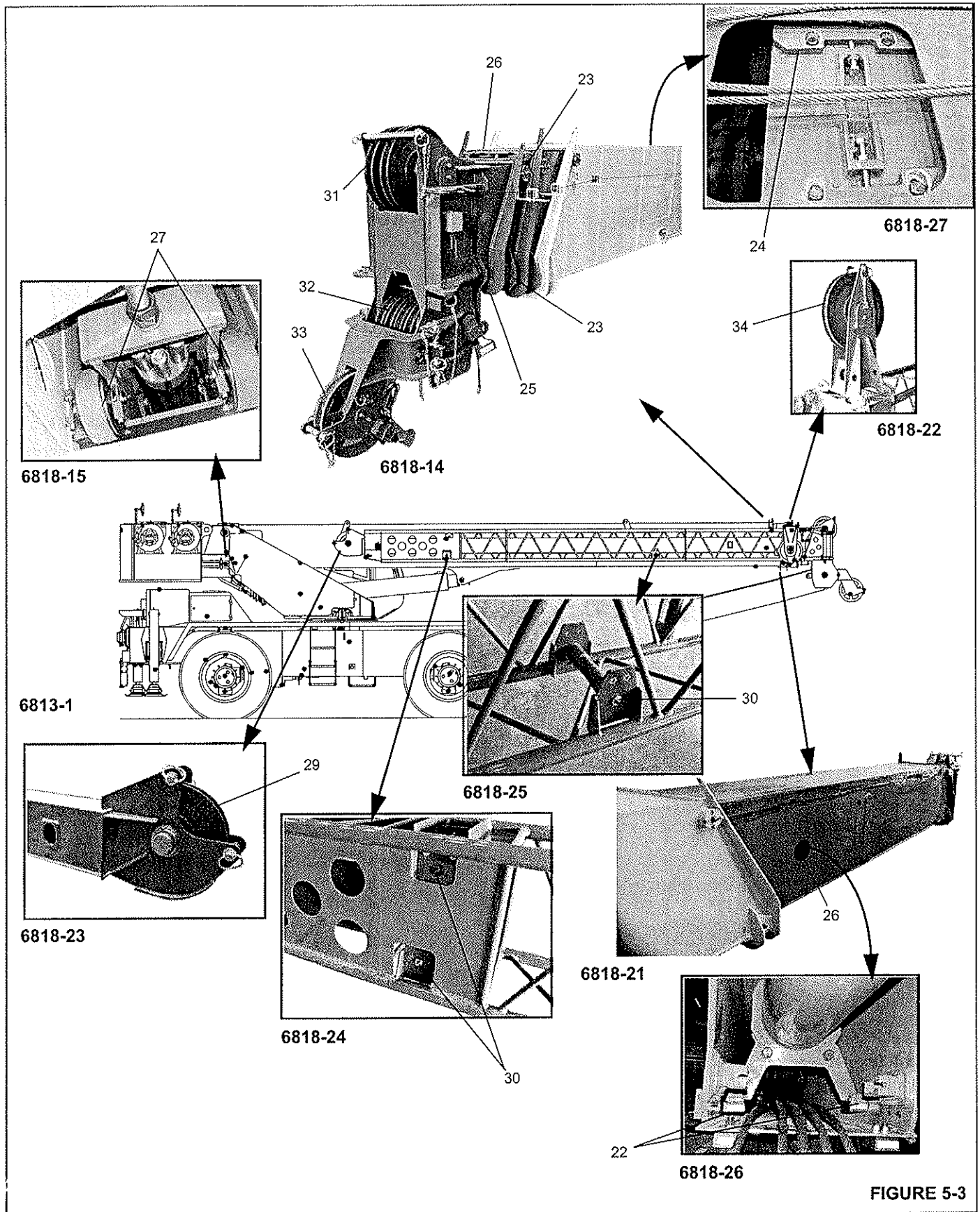


FIGURE 5-3

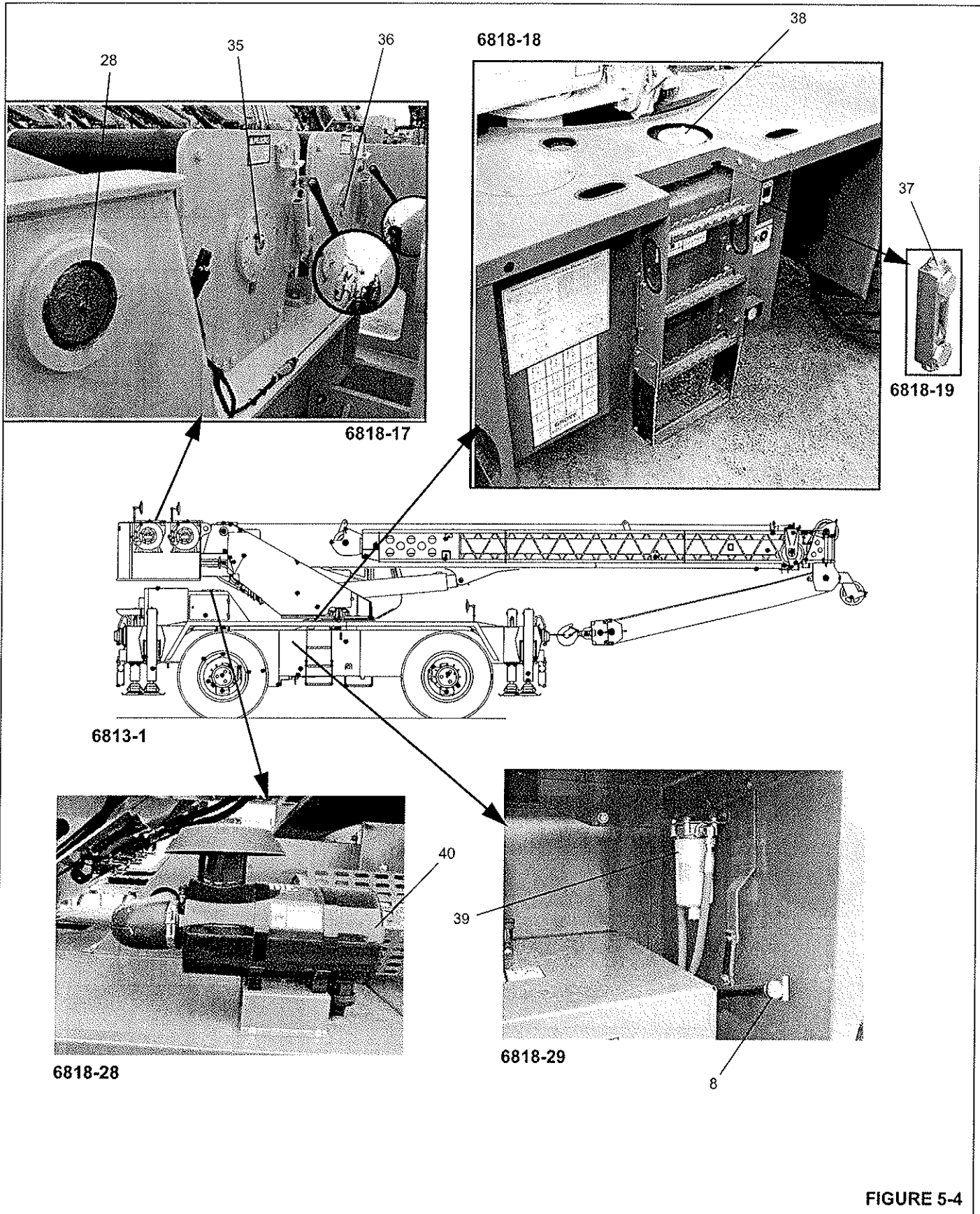


FIGURE 5-4

DRIVE TRAIN LUBRICATION**7. Engine Crankcase (With Filter) (7). (Figure 5-1)**

Lube Type - EO-15W40

Lube Interval -

- Check fluid level every 10 hours or daily
- Drain and fill every 250 hours
- Replace filter every 250 hours

Lube Amount - Capacity - 16.4 liters (17.3 quarts)

Application - Fill to FULL mark on dipstick.

8. Transmission, Torque Converter and Filter (8). (Figure 5-1) and (Figure 5-4)

Lube Type - HYDO

Lube Interval -

- Check fluid level every 10 hours or daily with the engine running at 800 rpm and the oil at 82 to 93 °C (180 to 200 °F)
- Drain and refill every 1000 hours or 6 months with the oil at 65 to 93 °C (150 to 200 °F)
- Change transmission filter after the first 50 and 100 hours of service, then every 500 hours thereafter.

To add fluid:

- a. Fill to FULL mark on dipstick.
- b. Run engine at 800 rpm to prime torque converter and lines
- c. Check oil level with engine running at 800 rpm and oil at 82 to 93 °C (180 to 200 °F). Add oil to bring oil level to FULL mark on dipstick.

NOTE: When checking the oil level, the oil temperature must be stabilized at 82 to 93 °C (180 to 200 °F) to properly check the oil level. Do not attempt an oil level check with cold oil.

To bring the oil temperature to this range, it is necessary to either work the crane or stall the converter. Converter stall should be accomplished by engaging the shift lever in forward high range with the brakes applied and then accelerating the engine to half or three-quarter throttle. Hold the stall until the desired temperature is reached and stabilized.

Lube Amount - Capacity of torque converter, lines and transmission as a system - 23.7 liters (25 quarts)

Application - Through fill pipe to FULL mark on dipstick

9. Engine Cooling System (9). (Figure 5-1)

Lube Type - AFC-50/50

Lube Interval -

- Check and fill coolant level every 10 hours or daily
- Drain and refill cooling system per engine service manual

Lube Amount - Capacity - 19.9 liters (21 quarts)

Application - Fill surge tank to bottom of filler neck with mixture of 50% AFC and 50% water. Run engine through two (2) thermal cycles. Check coolant level and refill as required.

10. Coolant Strainer (Cab Heater Supply) (10). (Figure 5-1)

Lube Type - Not applicable

Lube Interval - Change strainer element at first 100 hours of cab heater use, and at 2000 hours or 1 year intervals of heater use thereafter.

Lube Amount - Not applicable

Application - Not applicable

11. Driveline - Slip and U-Joints (11). (Figure 5-2)

Lube Type - EP-MPG

Lube Interval - 500 hours or every 3 months

Lube Amount - Until grease extrudes

Application - 6 grease fittings

OUTRIGGER LUBRICATION**12. Outrigger Beams (12). (Figure 5-2)**

Lube Type - EP-MPG

Lube Interval - 50 hours or one week, whichever comes first

Lube Amount - Brush on lubricant on both sides of the bottom of the outrigger beams.

Application - Brush on 8 points (4 beams)

13. Jack Cylinder Support Tubes (13). (Figure 5-2)

Lube Type - EP-MPG

Lube Interval - Inspect and grease weekly or every 50 hours of operation; whichever occurs first

Lube Amount - Thoroughly coat barrel

Application - Brush on 4 points

14. Jack Cylinder Barrels (14). (Figure 5-2)

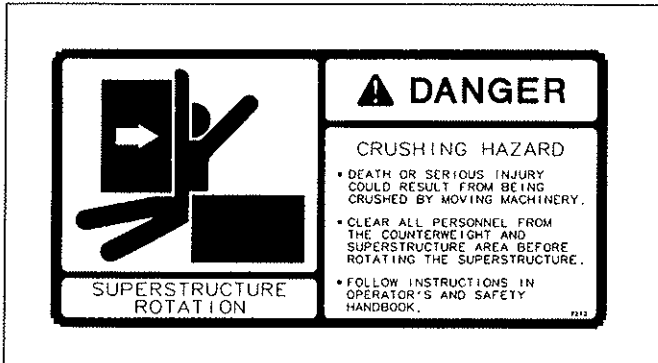
Lube Type - EP-MPG

Lube Interval - Inspect and grease weekly or every 50 hours of operation; whichever occurs first

Lube Amount - Thoroughly coat barrel

Application - Brush on 4 points

TURNTABLE LUBRICATION



15. Turntable Gear Box (15). (Figure 5-2)

Lube Type - SSG-L5

Lube Interval -

- Check and fill every 50 hours.
 - a. Check level on dipstick. Do not screw dipstick cap into the tube to check.
 - b. If no lubricant is visible on dipstick, add until between minimum and maximum on dipstick
- Drain and fill after first 250 hours and every 500 hours or 12 months thereafter.
 - a. Unscrew drain plug; remove breather and dipstick to ensure all oil has been removed.
 - b. After oil is drained, replace the drain plug and any other plugs that were removed to drain the oil.
 - c. To refill with oil, make sure the breather is open. Fill until proper location on dipstick.
 - d. Tighten breather and dipstick.

Lube Amount - 4.0 liters (4.25 quarts)

Application - Fill to mark on dipstick

16. Turntable Gear and Drive Pinion (16). (Figure 5-2)

Lube Type -EP-OGL

Lube Interval - 500 hours or 6 months

Lube Amount - Coat all teeth

Application - Spray on

17. Turntable Bearing (17). (Figure 5-2)

Lube Type - EP-MPG

Lube Interval - 500 hours or 6 months

Lube Amount - Until grease extrudes the whole circumference of the bearing.

Application - 2 grease fittings at the front of the turntable. Rotate the turntable 90° and apply grease

to fittings. Continue rotating 90° and grease the fittings until the whole bearing is greased.

LIFT CYLINDER LUBRICATION

18. Upper Lift Cylinder Pivot Pin (18). (Figure 5-2)

Lube Type - EP-MPG

Lube Interval - 500 hours or every 3 months

Lube Amount - Until grease extrudes

Application - 2 grease fitting

19. Lower Lift Cylinder Pivot Pin

Lube Type - NA

Lube Interval - NA

Lube Amount - NA

Application - NA

BOOM LUBRICATION

**WARNING**

Do not place hands into openings in the boom unless the engine is turned off and boom position is secured. Death or serious injury could result if this message is ignored.

20. Hook Block Swivel Bearing (19). (Figure 5-2)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 1 grease fitting

21. Hook Block Sheaves (20). (Figure 5-2)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 1 grease fitting per sheave

(4 fittings total - 35 ton)(3 fittings total - 35 ton)

22. Telescope Cylinder Wear Pads (22). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 125 hours or 3 months

Lube Amount - Thoroughly coat the area the wear pad moves on

Application - Brush on 2 places; extend boom for access through access holes in fly section

NOTE: Lubricate more frequently than interval indicated if environmental condition and/or operating conditions necessitate.

NOTE: Should boom chatter or rubbing noises in the boom occur, it will be necessary to lubricate the telescope cylinder wear pads. By adding an extension adapter to a grease gun the wear pads and wear areas can be reached through the lubrication access holes in the side of the boom and through the access hole in the boom nose between the sheaves.

23. Side Wear Pads (23). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

NOTE: Lubricate more frequently than interval indicated if environmental condition and/or operating conditions necessitate.

Lube Amount - Thoroughly coat all areas the wear pad moves on (bottom, top, and side plates)

Application - By brush: 12 places; with boom in extended position.

24. Boom Section Upper Wear Pads (24). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 50 hours or 1 week

NOTE: Lubricate more frequently than interval indicated if environmental condition and/or operating conditions necessitate.

Lube Amount - Thoroughly coat the area the wear pad moves on

Application - Brush on - 6 places; with boom in extended position.

25. Boom Section Lower Wear Pads (25). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 50 hours or 1 week

Lube Amount - Thoroughly coat all areas the wear pad moves on (bottom, top, and side plates)

Application - By brush; 3 places; with boom in extended position.

26. Extend & Synchronization Cable Sheaves (26). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 3 grease fittings. Two on the top of the boom and one inside at the end of the tele cylinder.

27. Retract Cable Sheaves (27). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 4 grease fittings; extend boom for entry through access holes

28. Boom Pivot Shaft (28). (Figure 5-4)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 2 grease fittings, one on each side

29. Boom Extension Sheave (29). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 1 grease fitting

30. Boom Extension Roller (30). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 4 grease fittings

31. Upper Boom Nose Sheave (31). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 1 grease fitting per sheave

32. Lower Boom Nose Sheave (32). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 1 grease fitting per sheave

33. Auxiliary Boom Nose Sheave (33). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 250 hours or 3 months

Lube Amount - Until grease extrudes

Application - 1 grease fitting

34. Mast Sheave (34). (Figure 5-3)

Lube Type - EP-MPG

Lube Interval - 500 hours or 12 months

Lube Amount - As Necessary

Application - 1 grease fitting

HOIST LUBRICATION**35. Main Hoist (35).** (Figure 5-4)

Lube Type - AGMA EP-4

Lube Interval - Every 1000 hours or 12 months

Lube Amount - Capacity - 5.2 liters (5.5 quarts)

Application - Fill until level with the check plug opening

36. Auxiliary Hoist (Optional) (36). (Figure 5-4)

Lube Type - AGMA EP-4

Lube Interval - Every 1000 hours or 12 months

Lube Amount - Capacity - 5.2 liters (5.5 quarts)

Application - Fill until level with the check plug opening

HYDRAULIC LUBRICATION**37. Hydraulic Reservoir (Figure 5-4)**

Lube Type - HYDO

Lube Interval -

- Check fluid level every 10 hours or daily, using sight gauge (37) on side of tank, with boom down and all outrigger cylinders retracted
- Drain and refill as necessary

Lube Amount - 397.4 liters (105 gal.), to FULL mark on sight gauge.

Application - Fill through breather/fill cap on top of tank. When tank is drained, clean the magnetic pipe plug.

38. Hydraulic Filter (38). (Figure 5-4)

Change the filter when the restriction indicator is in the red.

FUEL FILTER**39. Fuel Filter (39).** (Figure 5-4)

- Drain water trap every 10 hours or daily
- Change filter every 500 hours or 6 months

AIR CLEANER FILTER**40. Air Cleaner Filter (40).** (Figure 5-4)

Replace air cleaner filter element when indicator shows red (25" H2O).

WIRE ROPE LUBRICATION

Wire rope is lubricated during manufacturing so that the strands, and individual wires in strands, may move as the rope moves and bends. A wire rope cannot be lubricated sufficiently during manufacture to last its entire life. Therefore, new lubricant must be added periodically throughout the life of a rope to replace factory lubricant which is used or lost.

NOTE: Wire rope may be purchased by contacting the Manitowoc CraneCARE Parts Department.

For more detailed information concerning the lubrication and inspection of wire rope, refer to WIRE ROPE in Section 1-INTRODUCTION in the Service Manual.

SECTION 6
MAINTENANCE CHECKLIST

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SECTION 6

MAINTENANCE CHECKLIST

GENERAL

This section contains a list of daily inspection and maintenance checks. Performing the checks will help maintain the safety, dependability, and productivity designed into your crane.

INSTRUCTIONS

See Service Manual for specific maintenance and adjustment procedures.

Refer to your Maintenance Inspection Manual for all inspection intervals.

See Section 5 (in this handbook) for lubrication intervals, types of fluids, and lube point locations.

INSPECTION SERVICE LOG

Reference	Items to be Inspected Daily	Interval	DAY OF INSPECTION																															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
	December	D																																
1	Verify Outrigger Foot Pads are properly installed & show no signs of structural damage	D																																
2	Verify Tire Condition has no excessive wear and Pressure is at the proper level	D																																
3	Visually check machine for any Hydraulic Components (including Hoses) with excessive wear, loose fittings, or leaks	D																																
4	Visually check for any loose or damaged Wiring	D																																
5	Verify Engine Coolant is at the proper level	D																																
6	Verify Crankcase and Transmission have the proper fluid levels	D																																
7	Verify Hoists are installed properly with no signs of damage, or leaks	D																																
8	Operator's Manual installed properly on machine.	D																																
9	Verify that the "Operator Aids" are working properly - Boom Angle Indicator, Load Moment Indicator (LMI), Antitwo-Block.	D																																
10	Gauges and Instruments are functional	D																																
11	Back-up Alarm operates properly when operating machine	D																																
12	Swing Brake operates properly	D																																
13	Verify Brakes and Air System (if equipped) are working properly	D																																
14	Lights and Horn are in good working order and not damaged	D																																
15	Verify Hydraulic Reservoir has the proper fluid level	D																																
16	Hydraulic Oil Filter (check back pressure)	D																																
17	Verify Boom and Attachments are properly installed with no signs of damage, or leaks	D																																
18	Verify Wire Rope has no damaged, frayed, or broken strands	D																																
19		D																																
20		D																																
Inspector's Initials																																		
22		D																																
23		D																																
24		D																																
25		D																																
Inspector's Initials																																		

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