

# LUBRICATION GUIDE

Model MLC300

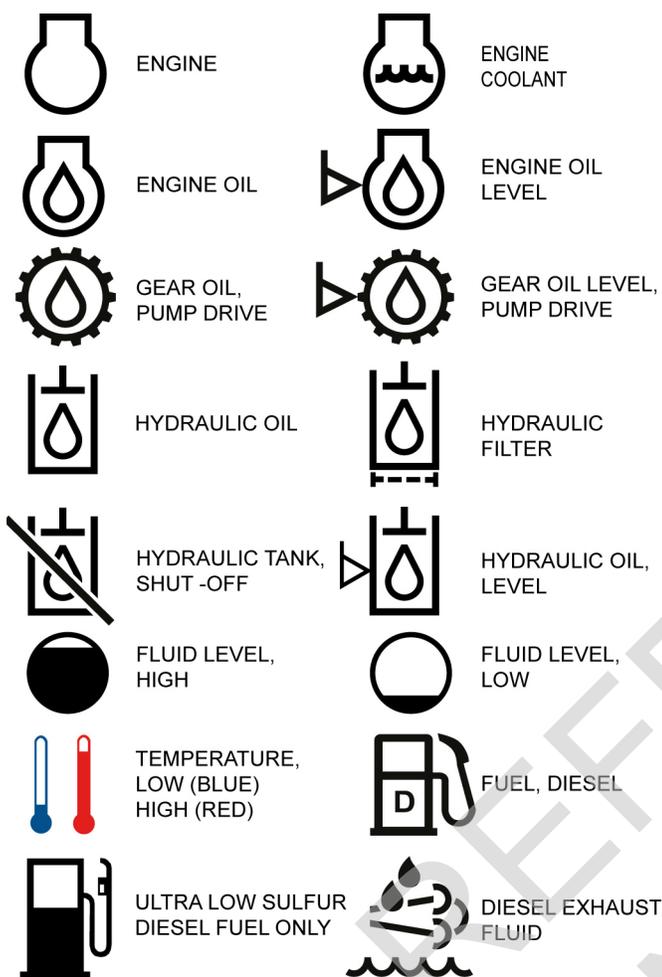
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**THE ORIGINAL LANGUAGE OF THIS PUBLICATION IS ENGLISH**

## LUBRICATION SYMBOLS

The symbols in [Figure 1](#) are used in decals on the crane to identify lubrication points.



M102550

FIGURE 1



### WARNING

#### Personal Injury Hazard!

Personal injury can occur if the following safety precautions are not taken before and after servicing machinery:

- Stop the engine and wait until all moving parts have completely stopped (if necessary, position any grease fittings on moving parts at the access point and then stop the engine).
- Attach a WARNING “out-of-order” sign to the engine start control in the operator’s cab to warn all personnel that the crane is being serviced.
- Do not operate the crane until all safety guards and covers have been securely reinstalled and all maintenance equipment has been removed.

## GENERAL LUBRICATION

This publication describes the major lubrication considerations for this crane. Some points requiring lubrication (for example, the linkage in control members not equipped with grease fittings) have been omitted, but they should be lubricated in accordance with good maintenance practices (see [“Oil Can Points” on page 3](#)).

The lubrication intervals for vendor-supplied parts (engine, light plant, etc.) have also been omitted from this Lubrication Guide. **Service vendor-supplied parts according to the original equipment manufacturers’ manuals.**

Depending on the options your crane is equipped with, some lubrication points given in this Lubrication Guide may not apply to your crane.

## LUBRICATION INTERVALS

The intervals listed in this Lubrication Guide are for **average operating conditions** based on experience gained by testing lubricants at the factory and on recommendations given by the lubricant suppliers. Severe operating conditions (such as excessively dusty or corrosive atmosphere, unusually high or low outside temperature, extreme loadings, uncommonly frequent or long operating cycles) may require shortening the lubrication intervals. Follow the intervals given in this Lubrication Guide until adequate experience is obtained to establish intervals which meet your operating conditions.

Bearings and bushings that are too warm, excessive play in moving parts, binding in moving parts, excessive or abnormal wear in gears and chains, and rust accumulation indicate a lack of lubrication. If these conditions are found during regular inspection, the lubrication interval for the faulty parts should be shortened.

## CAUTION

### Machinery Damage!

Before lengthening lubrication intervals, check that all parts are receiving an adequate supply of clean lubricant. Otherwise, parts will be damaged from a lack of lubrication. Contact your Manitowoc dealer or Manitowoc Crane Care Lattice Team for recommendations on lengthening lubrication intervals.

Perform an oil analysis at regular intervals of each fluid used in the crane to determine oil-change intervals. Oil sample kits are provided in the Parts Box of current production cranes.

It is assumed that the maintenance intervals are cumulative, that is, daily maintenance tasks will be performed together with weekly tasks, daily and weekly tasks will be performed together with monthly tasks, etc.

Intervals are based on engine hour meter or individual component hours of operation readings, as required. Individual component hours of operation can be viewed on the display in the cab (see MLC300 Main Display Manual for instructions).

## OVER-LUBRICATION

Over-lubrication is not only wasteful, but also harmful:

- Excess lubrication can work its way onto friction surfaces and result in faulty operation.
- Oil or grease that drips onto walkways can cause personnel to slip and be hurt.
- Too high an oil level can cause churning and foaming of the oil and result in excessive heat and over-flow from the reservoir.
- An extra shot of grease, if too stiff or under too much pressure, can pop out a bearing seal.

## LUBRICATION TIPS

Use the following tips during lubrication:

- Check all oil levels before start-up so the oil has had a chance to run down from the reservoir walls and moving parts.
- Avoid introducing dirt into reservoirs. Carefully clean the area around dipsticks, level plugs, fill plugs, and breathers before removing them.
- Replace level plugs, fill plugs, drain plugs, and breathers snugly and wipe up any spillage.
- Keep oil and grease dispensers and containers tightly closed and store in a dirt and moisture-free location.
- Clean grease fittings before and after applying grease.
- Apply grease until the bushing or bearing is purged so dirt and water cannot enter. Wipe up excess grease.
- Protect the environment. Dispose of waste fluids, filters, and batteries properly. See [“Environmental Protection” on page 5](#).

## WATER IN HYDRAULIC OIL

Prevent damage that can occur when water mixes with hydraulic oil. Drain any accumulated water from the bottom of the hydraulic tank at the **start of each work day**. Crack open the drain valve at the bottom of the hydraulic tank. Securely close the drain valve as soon as the water stops draining and a steady stream of oil appears.

## OIL CAN POINTS

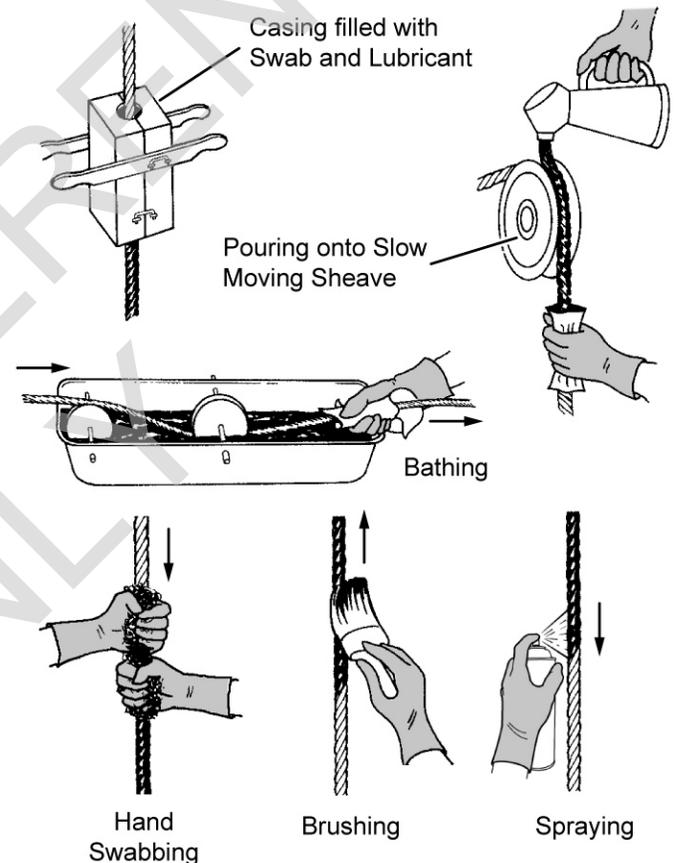
Oil **all pins** not equipped with grease fittings with engine oil every 40 hours of operation or once a week, whichever comes first.

## WIRE ROPE LUBRICATION

New wire rope is lubricated during manufacturing, but this lubricant is only adequate for initial storage and the early stages of operation. To prevent the damaging effects of corrosion and to reduce wear, the wire rope must be lubricated at regular intervals.

Contact your wire rope manufacturer/dealer for lubrication recommendations. The lubrication interval and the type of lubricant used depends on the type of wire rope, the severity of duty, and the type of corrosive elements the wire ropes is subjected to:

- The wire rope must be properly protected at all times.
- The lubricant must be fluid enough to fully penetrate the strands and rope core. Use one of the methods shown in [Figure](#) to lubricate the wire rope.
- For maximum penetration, apply lubricant where the wire rope “opens up” as it travels around a sheave or winds onto a drum.
- The wire rope must be clean and dry before applying lubricant. An air jet or wire brush may be used.



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FIGURE 2

### WARNING

#### Moving Rope Hazard!

Take every precaution to protect hands from injury when rope is moving. Wear heavy gloves and move rope as slowly as possible.

**Do not use grease to lubricate wire rope. Grease will not penetrate rope properly and will buildup in valleys**

*between wires and strands. This buildup will inhibit rope inspection and could trap moisture in the rope's interior. A high-quality wire rope lubricant is available from the Manitowoc Crane Care Lattice Team.*

## CYLINDER ROD LUBRICATION

### General

The cylinder rods on Manitowoc cranes have a layer of chrome plating on their surfaces to help protect them from corrosion.

However, the chrome plating has cracks in its structure which can allow moisture to corrode underlying steel. Depending on ambient temperature and the frequency of cylinder operation, the crane's hydraulic oil may not penetrate these cracks and protect the rods. Even if the cylinders are operated on a regular basis, many cylinders have portions of exposed rod even when the cylinders are fully retracted.

Exposed cylinder rods on cranes that are stored, transported, or used in inclement environments (high humidity, rain, snow, and salt air) are at a high risk of corrosion.

### Protecting Cylinder Rods

All exposed cylinder rods must be protected by applying a thorough coat of cylinder-rod protectant available from Manitowoc in 12 oz. aerosol cans—order part number 9999101803.

The cylinder-rod protectant contains solvents and lubricants that penetrate metal pores, displace moisture, dissolve existing corrosion, and then dry to a resilient waxy coating. Cylinder operation and weather will remove the protectant over time. Therefore, inspect all cylinder rods weekly and reapply protectant to exposed rods.

## HYDRAULIC QUICK DISCONNECT LUBRICATION

All hydraulic quick disconnects must be protected by applying LPS-2 Aerosol Lubricant. Lubricant must be applied while connecting and disconnecting the hydraulic quick disconnects during crane assembly and disassembly.

1. All Quick Disconnects must be fully screwed together until there is metal to metal contact during crane assembly.
2. All plugs, regardless of location, must be fully screwed together into their corresponding caps until there is metal to metal contact during crane assembly.

Examples of locations of caps and plugs:

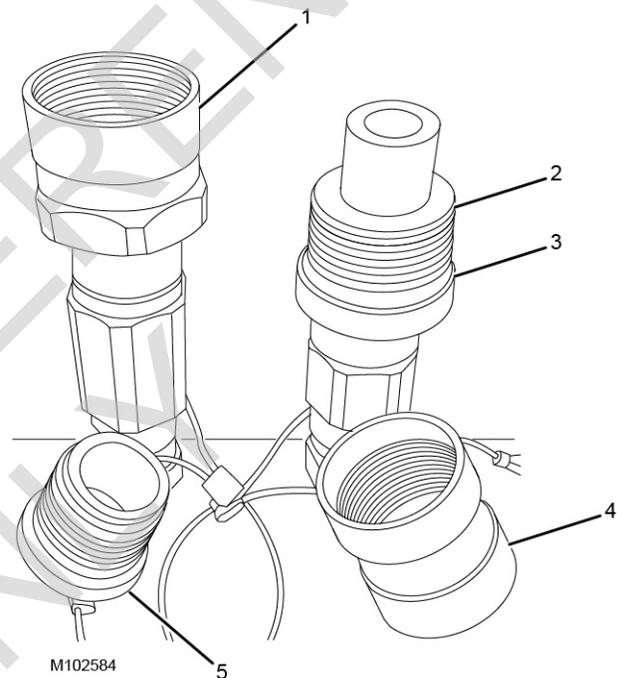
- hanging lanyards
- storage brackets
- job box

3. All Quick Disconnects must be fully screwed together with their corresponding cap and plug until there is metal to metal contact during crane disassembly.

The following threaded areas of the quick disconnects, caps, and plugs must be lubricated during crane assembly and disassembly (see [Figure 3](#)):

- threaded surface of male quick disconnect
- threaded surface of female quick disconnect
- threaded surface of aluminum caps and plugs
- o-rings

**NOTE** If the crane is stored without operating for long duration, the hydraulic quick disconnects, caps, and plugs must be lubricated every 6 months.



| Item | Description             |
|------|-------------------------|
| 1    | Female Quick Disconnect |
| 2    | Male Quick Disconnect   |
| 3    | O-ring                  |
| 4    | Aluminum Cap            |
| 5    | Aluminum Plug           |

**FIGURE 3**

## ENVIRONMENTAL PROTECTION



### WARNING

#### Environmental Damage

**Dispose of waste properly!** Improperly disposing of waste can threaten the environment.

Potentially harmful waste used in Manitowoc cranes includes—but is not limited to—oil, fuel, grease, coolant, air conditioning refrigerant, filters, batteries, and cloths which have come into contact with these environmentally harmful substances.

Handle and dispose of waste according to local, state, and federal environmental regulations.

When filling and draining crane components, do not pour waste fluids onto the ground, down any drain, or into any source of water:

- Always drain waste fluids into leak-proof containers that are clearly marked with what they contain.
- Always fill or add fluids with a funnel or a filling pump.
- Immediately wipe up any spills.

## REFERENCE INSTRUCTIONS

See the MLC300 Service/Maintenance Manual for detailed information on specific maintenance checks and procedures.

### CraneLUBE

Manitowoc highly recommends the use of CraneLUBE lubricants to increase your crane's reliability and performance. Contact your Manitowoc dealer for detailed information about our CraneLUBE lubrication program.

## LUBRICATION POINTS

Use the following figures to find locations for lubrication points:

- See [Figure 5](#) through [Figure 7](#) for locations of lubrication points for the crane.
- See [Figure 10](#) for locations of engine components.
- See [Figure 11](#) through [Figure 14](#) for locations of the lubrication points for the boom and other attachments.
- See [Figure 15](#) for locations of the lubrication points for the automatic lubrication systems.

The letters before the item numbers in the illustrations correspond to the intervals they should be inspected:

- A—At Assembly
- D—Daily
- W—Weekly
- M—Monthly
- Q—Quarterly
- S—Semiannually
- O—At Overhaul
- Y—Yearly

## APPROVED LUBRICANTS FOR NORMAL OPERATION

**NOTE** For operation in arctic climates see [“Approved Lubricants for Arctic Operation” on page 8.](#)

For operation in high temperature climates see [“Approved Lubricants for High Temperature Operation” on page 9.](#)

### Grease

#### Manitowoc Factory Fill

For the Manitowoc factory fill, see [Table 1.](#)

**Table 1 Grease**

| Turntable Bearing and Crawlers | Temperature Range       | Application                   |
|--------------------------------|-------------------------|-------------------------------|
| CraneLUBE XHP 320 Mine         | -40°C (-40°F) and above | Automatic Lubrication Systems |
| CraneLUBE XHP 321 Mine         | 4°C (40°F) and above    |                               |
| CraneLUBE XHP 322 Mine         | -18°C (0°F) and above   | Manual Lubrication            |

| Other Grease Points                      | Temperature Range     | Application        |
|--|-----------------------|--------------------|
| CraneLUBE E.P. # 2 (MCC Part No. 471197) | -18°C (0°F) and above | Manual Lubrication |

**NOTE** For all operation below -18°C (0°F) use arctic grease specified in the Approved Lubricants for Arctic Operation topic in this section.

### Open Gear Oil

This type of oil requires heating or thinning for proper application to gear teeth. Apply a light film of oil to each gear tooth. **Do not rely on gear rotation to distribute the oil.**

#### Manitowoc Factory Fill

- CraneLUBE 375 NC (MCC Part No. 471178)

### Gear Oil

#### Manitowoc Factory Fill

- CraneLUBE 75W-90 Synthetic (MCC Part No. 549515) for all gearboxes (drums, pump drive, swing, VPC) except the crawler gearboxes and the Drum 0 gearbox
- CraneLUBE 80W-140 Synthetic (MCC Part No. A13890) for the crawler gearboxes
- CraneLUBE 80W-90 GL5 for the Drum 0 (rigging winch) gear box (MCC Spec No. 6829003479)

For specific product recommendations, contact the Manitowoc Crane Care Lattice Team.

### Hydraulic Oil

Use a shear, stable anti-wear hydraulic oil that meets the following viscosity targets:

- Cold Start Viscosity—<1600 cST
- Operating Temperature Viscosity—>12 cST (the operating temperature is 38°C [100°F] over ambient temperature)

#### Manitowoc Factory Fill

- Phillips 66 Trans XP (MCC Spec No. 6829006444)

The factory fill hydraulic oil is a zinc-based multigrade hydraulic oil that may not be compatible with certain ash-less (metal-free) hydraulic oils. Consult with your oil supplier to make sure the oil you select meets the above specification.

#### Filter new oil through a 10 micron portable filter.

The factory fill hydraulic oil is an all-weather hydraulic oil suitable for use in ambient temperatures from -18°C to 43°C (0°F to 110°F).

The factory fill hydraulic oil can cloud up (form wax crystals) at ambient temperatures below -18°C (0°F). *This condition can result in damage to hydraulic components during start-up.*

When the expected ambient temperature will be below -18°C (0°F), the hydraulic oil must be heated to at least -18°C (0°F) prior to start-up. Tank heaters are available from Manitowoc.

The cloud point of oil selected must be equal to or less than the expected ambient temperature.

## CAUTION

### Hydraulic Pump Damage!

To prevent damage to hydraulic pumps, warm hydraulic oil to at least 16°C (60°F) before operating the crane functions.

#### Field Make-Up

Do not dilute the oil in the hydraulic tank with more than 25% of another brand of oil. **Dilution beyond the 25% maximum could effect the crane's operating performance at certain temperatures.**

If in doubt as to how much make-up oil has been added to the tank on your crane, Manitowoc recommends that a laboratory viscosity test be performed to determine if the oil still meets the viscosity targets given above OR that the system should be completely drained and refilled.

## HYDRAULIC FILTER REPLACEMENT

For instructions, refer to Section 2 of the MLC300 Service/Maintenance Manual.

Hydraulic filter elements on this crane are specially designed to withstand high pressure as the elements fill with dirt. This feature prevents the elements from collapsing.

See [Table 2](#) for the Manitowoc part numbers of replacement filter elements. See the lubrication charts in this section for identification and location of the filter elements.

**Table 2 Replacement Hydraulic Filter Elements**

| MCC No.  | System  | Qty    |
|----------|---|--------|
| 81029158 | Spring for Return Filter Element<br>(inside Hydraulic Tank) | 1      |
| 81038029 | 10 Micron Return Filter<br>(inside Hydraulic Tank)          | 1      |
| 81029289 | Suction Strainer<br>(inside Hydraulic Tank)                 | 4      |
| A16689   | Desiccant Breather Cartridge                                | 1      |
| 427282   | Crawler Motor Case Flushing Filter<br>(if equipped)         | 1      |
| 427282   | Cooling Circuit Filter                                      | 2      |
| 90040437 | Free Fall Filter  | 1 or 2 |

### CAUTION

#### Hydraulic System Damage!

Original Equipment Manufacturer (OEM) filter elements—available from Manitowoc—must be used on this crane. Substituting with any other brand or type filter element is prohibited.

Filter elements made by other manufacturers may collapse under pressure. This action will allow unfiltered oil to be drawn into the hydraulic system and pumps, motors, and valves can be destroyed.

Manitowoc will reject warranty claims for damaged hydraulic components if the proper hydraulic filter elements are not used.

## APPROVED LUBRICANTS FOR ARCTIC OPERATION

The lubricants listed in [Table 3](#) are recommended for use in Manitowoc's line of hydraulic cranes when operating in an arctic-type climate—*climates with an outside temperature continuously between -18°C (0°F) and -40°C (-40°F)*.

Use these lubricants in place of the lubricants listed for normal operation in this section.

Additionally, the crane should have hydraulic tank heaters available from Manitowoc Crane Care Lattice Team.

### CAUTION

#### Machinery Damage!

Do not operate the main crane functions (swing, travel, drums, boom hoist) with approved arctic lubricants when the ambient temperature is above 16°C (60°F). Crane machinery will be damaged.

When the ambient temperature is above 16°C (60°F), limit operation to the crane setup functions (that is, jacking cylinders).

When the ambient temperature is expected to remain above 16°C (60°F), drain the arctic lubricants and refill with the lubricants recommended for normal operation.

#### Structural Damage!

Cold weather can affect the structural integrity of the crane and attachment. Before operating in cold weather, read the Cold Weather Operation —Crane Limitations topic in Section 3 of the Crane Operator Manual.

**Table 3 Lubricant for Arctic Operation**

| System                                      | Approved Arctic Lubricants  |
|---|---|
| Grease Points                               | Chevron RPM Arctic Grease NLGI 1  |
| All Gear Cases, Pump Drives, and Gear Boxes | Mobil SHC 626 Synthetic Gear Oil  |
| Hydraulic System                            | Petro-Canada Hydrex MV Arctic 15  |
| Engine Oil System (see <b>NOTE</b> )        | Duron XL Synthetic 0W-30<br><b>OR</b><br>Mobil Delvac 1   |
| Engine Fuel (see <b>NOTE</b> )              | No. 1 Diesel  |
| Engine Cooling System (see <b>NOTE</b> )    | Mix anti-freeze (Ethylene Glycol) and water 60/40 by volume. This mixture will provide coolant protection to -54°C (-65°F).<br><b>Pure antifreeze freezes at -23°C (-10°F).</b> |
| <b>NOTE</b>                                 | See the engine manufacturer's manual for specifications and cold weather operating guidelines.  |

## APPROVED LUBRICANTS FOR HIGH TEMPERATURE OPERATION

The lubricants listed in [Table 4](#) are approved for use in Manitowoc's line of hydraulic cranes when operating in a high temperature climate— **climates with an outside temperature between 38°C (100°F) and 50°C (122°F)**.

Use these lubricants in place of the standard lubricants listed in the Lubrication Guide.

### CAUTION

#### Machinery Damage!

To avoid damage to crane machinery, switch back to the standard lubricants listed in the lubrication guide when the ambient temperature will be below 0°C (32°F).

**Table 4 Lubricant for High Temperature Operation**

| System                           | Approved Lubricants<br>(or equivalent)                       |
|----------------------------------|--|
| All Grease Points                | Mobil CM-S   |
| All Gear Boxes and Pump Drive    | Mobil Delvac Synthetic (80W-140)                             |
| Hydraulic System                 | Shell Tellus 100T  |
| Engine Oil System (see NOTE)     | Shell Rotella T (15W-40)                                     |
| Engine Fuel (see NOTE)           | Diesel   |
| Engine Cooling System (see NOTE) | Mix anti-freeze (Ethylene Glycol) and water 50/50 by volume. |

**NOTE** Refer to the engine manufacturer's manual for specifications and high temperature operating guidelines.

**FLUID CAPACITIES**

*Always fill each system to the level plug opening or to the specified point on the sight gauge or dipstick.*

Fluid capacities are approximate and should be used only as a guide for ordering sufficient fluid at oil change intervals.

| System  | Capacity |         | Approved Lubricant                          |
|---|----------|---------|---|
|   | Liters   | Gallons |   |
| Cooling System–Cummins QSG12 Engine               | 75       | 20      | See NOTE 1                                  |
| Cooling System–MTU 13000 Engine                   | 91       | 24      | See NOTE 1                                  |
| Crawler Gearbox (one gearbox in each Crawler)     | 60       | 15.85   | Gear Oil                                    |
| Crawler Grease Pump Reservoir                     | 4        | 1       | Grease                                      |
| Diesel Exhaust Fluid (DEF) Tank                   | 57       | 15      | DEF approved for use by engine manufacturer |
| Drum 1 (Main Load Hoist–Standard)                 | 12.25    | 3.24    | Gear Oil (see NOTE 3)                       |
| Drum 2 (Aux. Front Hoist–Optional)                | 12       | 3.17    | Gear Oil (see NOTE 3)                       |
| Drum 3 (Aux. Rear Hoist–Optional)                 |          |         |   |
| Drum 2 (Aux. Front Hoist with Free Fall–Optional) | 20       | 5       | Gear Oil (see NOTE 3)                       |
| Drum 3 (Aux. Rear Hoist with Free Fall–Optional)  |          |         |   |
| Drum 4 (Boom Hoist–Standard)                      | 7.5      | 2       | Gear Oil                                    |
| Drum 4 (Mast Hoist–VPC-MAX)                       |          |         |   |
| Drum 5 (Boom Hoist–VPC-MAX)                       | 7.5      | 2       | Gear Oil                                    |
| Drum 6 (Luffing / Aux. Hoist)                     | 7.5      | 2       | Gear Oil                                    |
| Fuel Tank   | 776      | 205     | See NOTE 1                                  |
| Hydraulic Tank                                    | 552      | 145     | Hydraulic Oil                               |
| Pump Drive  | 8.7      | 2.3     | Gear Oil                                    |
| Swing Drive (each Gearbox)                        | 16       | 4.23    | Gear Oil                                    |
| Turntable Bearing Grease Pump Reservoir           | 4        | 1       | Grease                                      |
| VPC Drive (each Gearbox)                          | 5        | 1.32    | Gear Oil                                    |
| VPC-MAX Gearbox (each Gearbox)                    | 6        | 1.6     | Gear Oil                                    |
| Windshield Wiper Washer Tank                      | 5        | 1.32    | Non-Freezing Washer Fluid                   |

**NOTE 1** See the engine manual for fuel, antifreeze, and engine oil specifications.

**NOTE 2** Brake housings for the swing, boom hoist, and load drums are filled automatically with oil from the gear boxes.

Brake housings for the crawlers are flushed with cooling oil from the hydraulic system.

**NOTE 3** The capacity given is approximate. Fill the gear oil till the oil is visible in the sight glass.

## QUICK-DRAIN VALVE

Each of the following components is equipped with a quick-drain valve:

- Engine oil pan
- Pump drive
- Radiator
- Hydraulic tank
- Fuel tank
- Swing gear box
- Each drum gear box

The quick-drain valves require the use of the quick-drain drainer assembly which is stored in the Parts Box provided with the crane.

When the quick-drain drainer assembly is connected to the quick-drain valve it opens a check valve that allows the fluid to drain.

Always insert the hose from the quick-drain drainer assembly into a suitable container to catch the drained fluid. Do not drain fluids onto the ground.

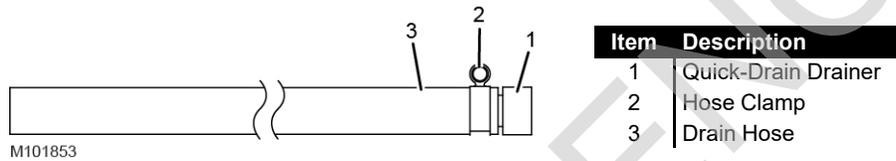


FIGURE 4

# UPPERWORKS AND LOWERWORKS LUBRICATION

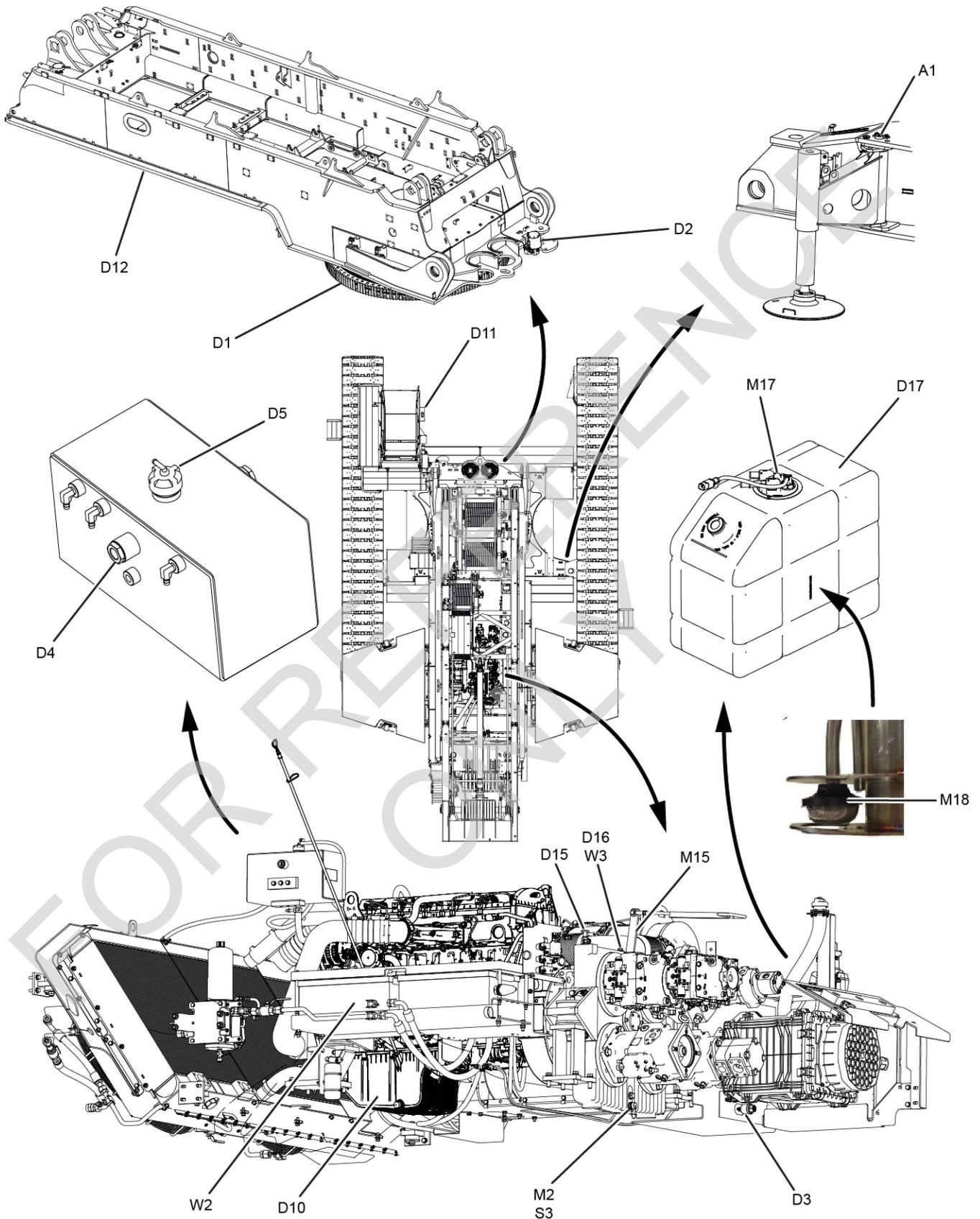
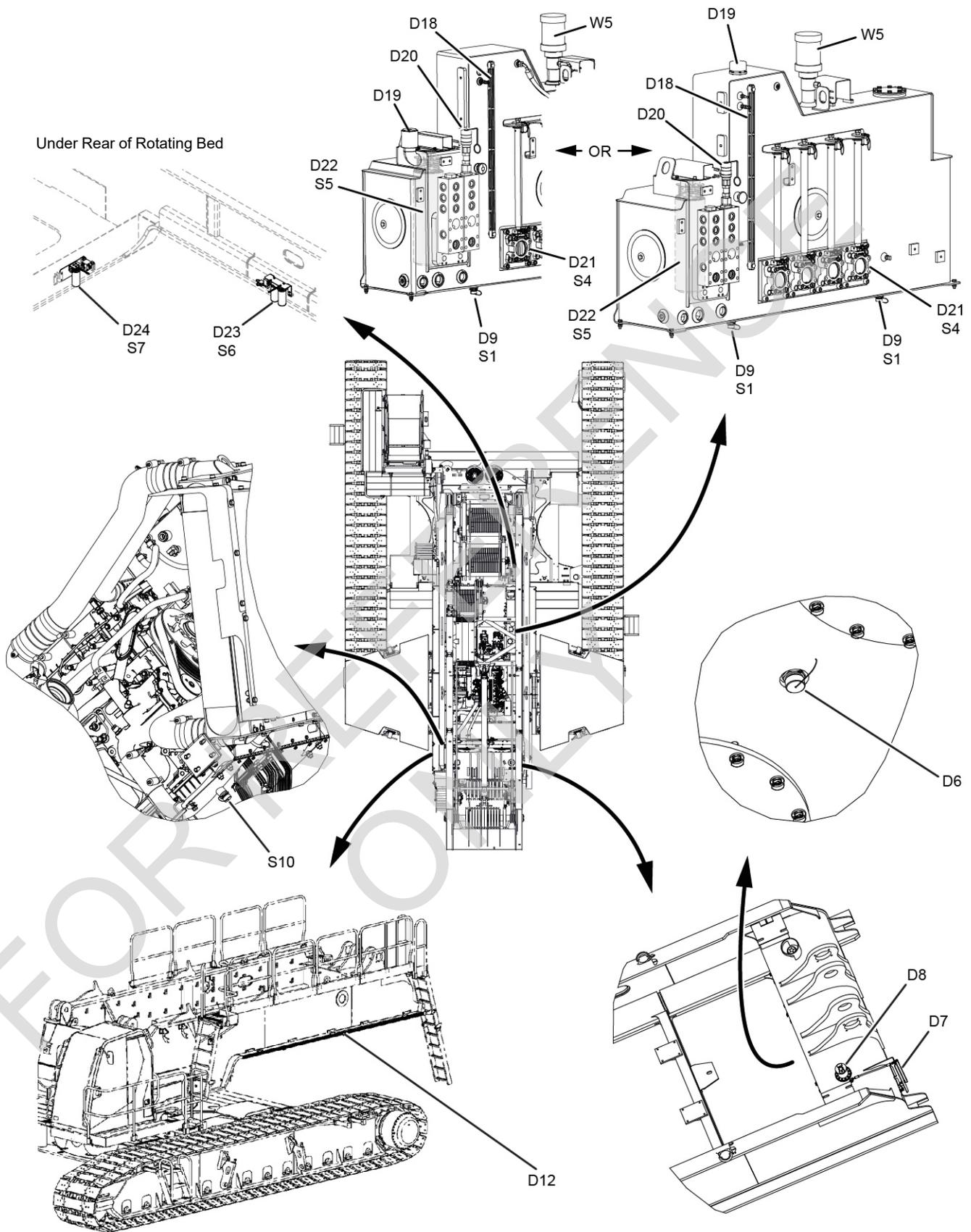


FIGURE 5

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FIGURE 6

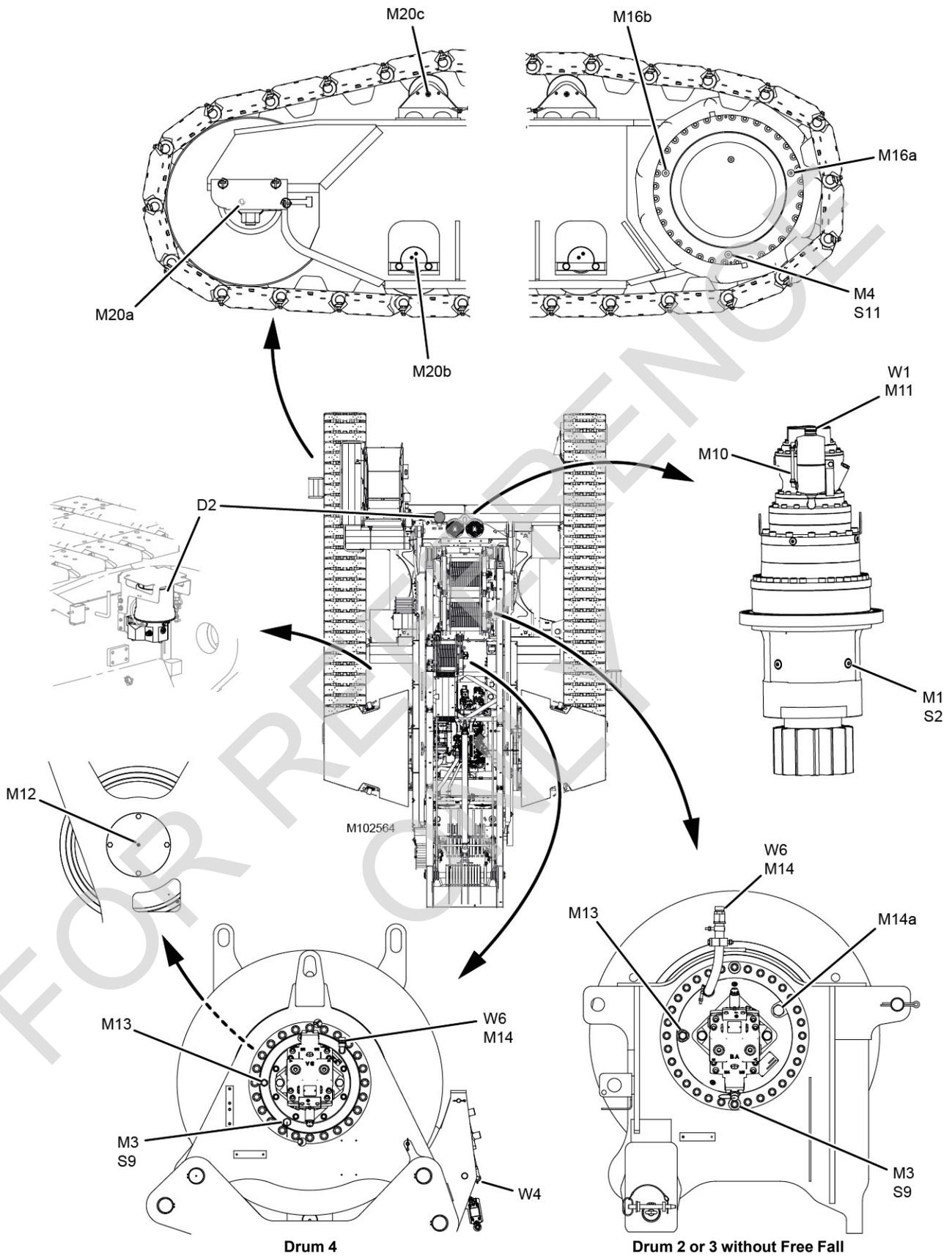


FIGURE 7

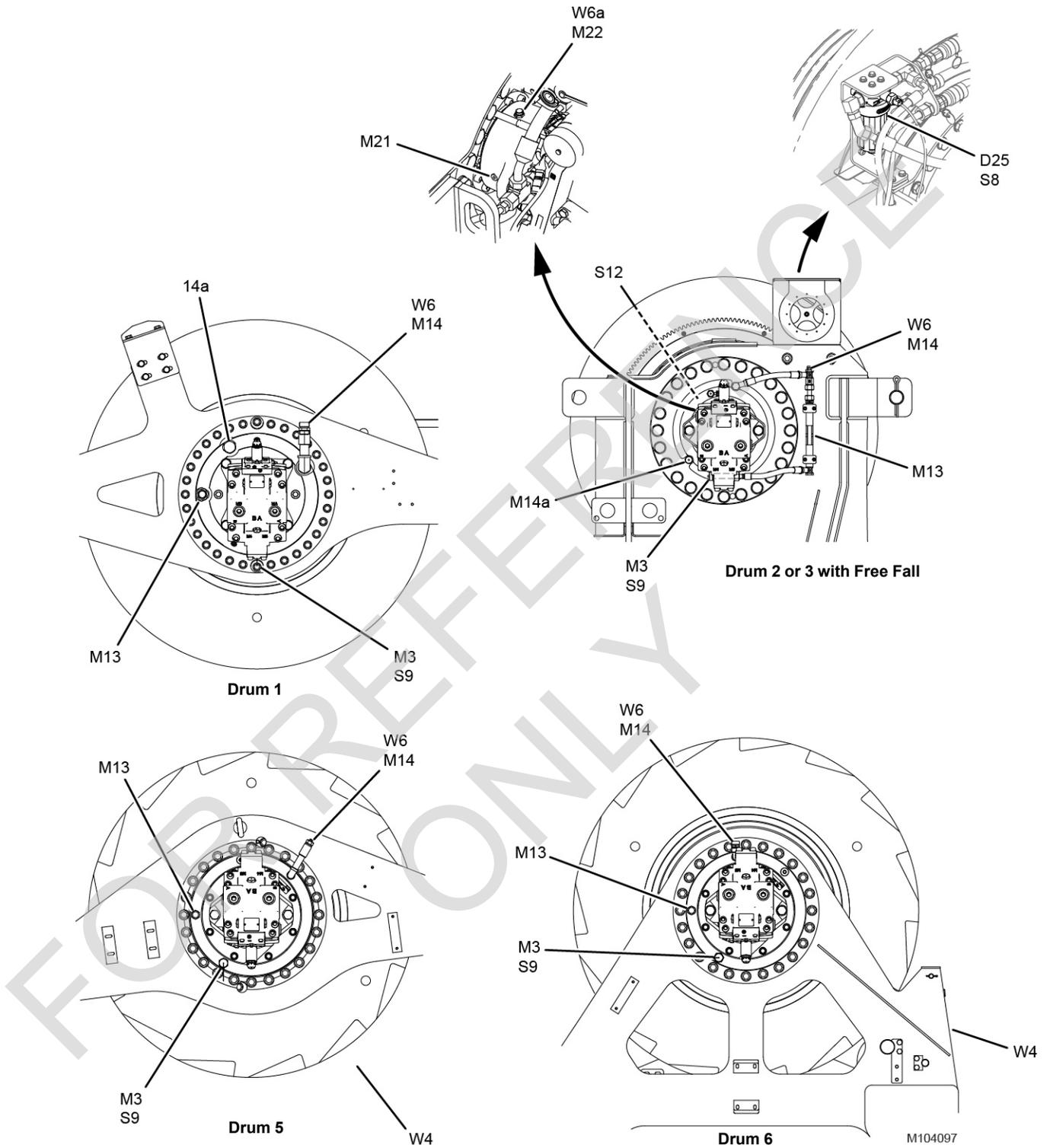
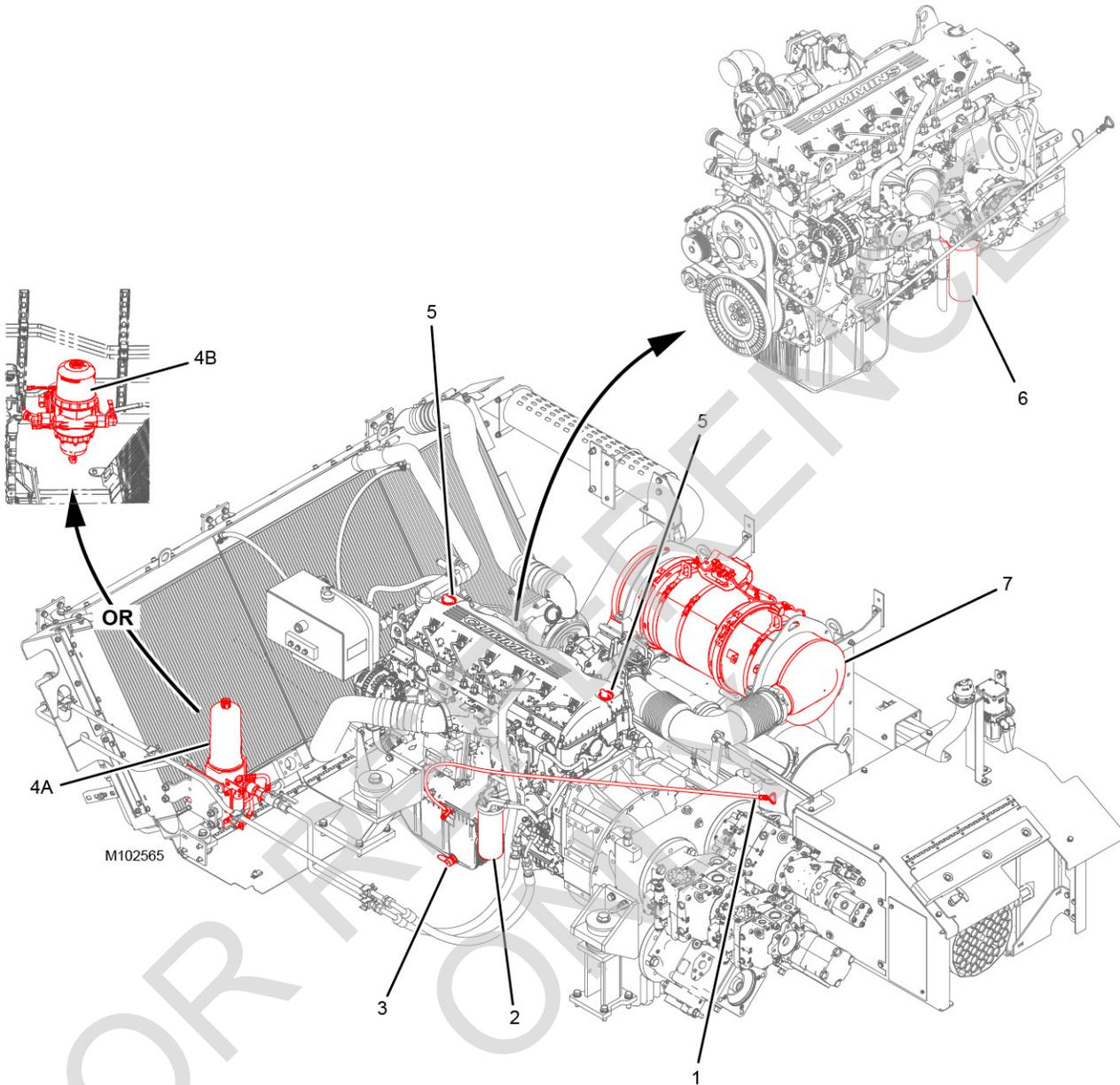


FIGURE 8

### Engine Components – Cummins QSG12 Engine



| Item | Description               | Required Service   |
|------|---------------------------|--|
| 1    | Dipstick                  | Service according to the engine manufacturer's instructions. |
| 2    | Fuel Filter               |  |
| 3    | Quick-Drain Valve         |  |
| 4A   | Fuel Filter               |  |
| 4B   | Fuel Filter (see NOTE)    |  |
| 5    | Oil Fill Caps             |  |
| 6    | Oil Filter                |  |
| 7    | Diesel Particulate Filter |  |

**NOTE** Inspect fuel filter (4B) daily while the engine is running. Change the filter element only when the fuel level reaches and remains at the top of the black band on the filter cover.

FIGURE 9



## Upper and Lower Lubrication — Identification

| Item  | Description   | Required Service   |
|---|---|--|
| <b>Prior to Use When the Crane is Assembled</b>                                     |   |  |
| A1  | Carbody Jack Connecting Pin (1 fitting, top and bottom of each pin, 4 places) (Lowerworks Jacking Option) | Grease each fitting.   |
| <b>Every 8 Hours of Operation or Daily (whichever comes first)<br/>(see NOTE 1)</b> |   |  |
| D1  | Ring Gear   | Check for proper lubrication. Coat with open gear oil if needed.                                       |
| D2  | Grease Pump Reservoirs (1 for turntable bearing and 1 optional for each crawler)                          | Check reservoir level. Fill to the proper level with approved grease (see NOTE 2).                     |
| D3  | Air Cleaner Service Indicator   | Check. Replace element when indicated.   |
| D4  | Coolant Expansion Surge Tank Sight Gauge  | Check the level, should be at full cold mark (see NOTE 4).   |
| D5  | Coolant Expansion Surge Tank Fill Cap   | Fill to the proper level with coolant.   |
| D6  | Fuel Tank Quick-Drain Valve   | Drain water (see NOTE 3).  |
| D7  | Fuel Tank Level Gauge   | Check level, fill to high mark on gauge.   |
| D8  | Fuel Tank Fill Cap  | Fill to the proper level with fuel oil.  |
| D9  | Hydraulic Tank Quick-Drain Valve  | Drain water (see NOTE 3).  |
| D10   | Engine (see <a href="#">Figure 9</a> and <a href="#">Figure 10</a> )                                      | Service according to the engine manufacturer's instructions.   |
| D11   | Windshield Washer Reservoir   | Check level. Fill to base of opening with windshield washer fluid.                                     |
| D12   | VPC Gear Rack (both sides of crane)   | Check for proper lubrication. Coat with open gear oil if needed.<br>Clean all debris from roller path. |
| Item D13 and D14 Not Used   |   |  |

**NOTE 1** Inspect the crane daily for leaks. If a leak is found, determine the cause, take corrective action, and refill the applicable component with proper fluid.

**NOTE 2** Fill through the fitting in the base of the reservoir using a hand-operated grease gun or pump. Refill the reservoir when the grease reaches the MIN mark. Fill the reservoir to the MAX mark.

The crawlers and turntable bearing are greased automatically by electric pumps when the ignition switch is on.

**NOTE 3** Drain any accumulated water from the fuel and hydraulic tanks at the **start of each work day**.

Crack open the quick-drain valve using the quick-drain drainer assembly. Disconnect the quick-drain drainer assembly as soon as water stops draining and a steady stream of fuel or hydraulic oil appears.

**NOTE 4** Check the coolant level when the **coolant is cold**.

| Item   | Description   | Required Service   |
|--|---|--|
| <b>Every 8 Hours of Operation or Daily Continued</b> |   |  |
| D15  | Pump Drive Dipstick                                       | Check level. Full at mark on dipstick.   |
| D16  | Pump Drive Fill Plug                                      | Fill to the proper level with gear oil.  |
| D17  | Diesel Exhaust Fluid (DEF) Tank (T4F engine only)         | Check level. Fill as needed according to Cummins engine manuals                |
| D18  | Hydraulic Oil Level Sight Gauge                           | Check level. Fill to full cold mark on decal next to sight gauge (see NOTE 1). |
| D19  | Hydraulic Oil Fill Cap or Fill Plug (current cranes only) | Fill to proper level with hydraulic oil (see NOTE 2).                          |
| D20  | Hydraulic Oil Power-Fill Coupling                         |  |
| D21  | Hydraulic Suction Strainers (4 each mounted in tank)      | Service when indicated and at each oil change interval (see NOTE 3).           |
| D22  | Hydraulic Filter 1 (in tank return)                       | Replace when indicated and at each oil change interval (see NOTE 4).           |
| D23  | Hydraulic Filter 2 (2 for oil cooler circuit)             | Replace when indicated and at each oil change interval (see NOTE 4).           |
| D24  | Hydraulic Filter 3 (for crawler motor flushing circuit)   | Replace when indicated and at each oil change interval (see NOTE 4).           |
| D25  | Hydraulic Filter 4 (Drum 2) or Filter 5 (Drum 3)          | Replace when indicated and at each oil change interval (see NOTE 4).           |

 **WARNING**  
**Burn Hazard**

The oil in the hydraulic tank may be under pressure and extremely hot. Hot oil can escape when servicing components.

- Allow the hydraulic system to cool before replacing the breather or the hydraulic filters.
- Before opening the hydraulic tank for any reason, relieve the tank pressure using either vent valve on the top of the hydraulic tank.

See Section 2 of the MLC300 Service/Maintenance Manual for hydraulic system servicing procedures.

**NOTE 1** The hydraulic tank oil level can be checked during operation in the hydraulic tank display on the information screen in the cab (see MLC300 Main Display Manual):

- **FULL COLD LEVEL**  
Approximately 16°C (60°F)  
The screen should read 90%.
- **FULL HOT LEVEL**  
Approximately 82°C (180°F)  
The screen should read 100%.

**Do not fill the tank to 100%. Oil will flow out of the breather.**

If the oil level drops to 80%, the fault alarm will come on and the fault symbol will appear on the

active display screen. The HYDRAULIC FLUID LOW icon will appear on the fault screen. **Fill the tank immediately.**

**NOTE 2** Fill the hydraulic tank:

- On current cranes only, through the fill cap or fill plug opening (D19). If this method is used, the oil must be filtered through an owner supplied 10-micron filter.
- By pumping oil through the power-fill coupling (D20). The oil will be filtered by Filter 1.

Do not fill the tank through the breather port or through the top of the return filter.

**NOTE 3** Service the suction strainers when the fault alarm comes on and the suction pressure icon appears in the fault bar of the main display.



**NOTE 4** Replace the filter element when the fault alarm comes on and the corresponding filter icon appears in the fault bar of the main display.

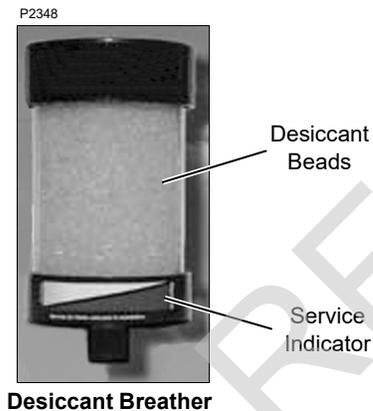


It is normal for this fault alert to come on at start-up when the hydraulic oil is cold. The alert should shut off as the oil warms up.

| Item   | Description  | Required Service   |
|--|--|--|
| <b>Every 40 Hours of Operation or Weekly</b> (whichever comes first) |  |  |
| W1   | Swing Gear Box Oil Fill and Breather Plug (2 places)               | Clean each (see NOTE 1).                                   |
| W2   | Batteries  | Check the electrolyte level.                               |
| W3   | Pump Drive Fill Plug   | Clean (see NOTE 1).  |
| W4   | Drum Pawl and Lever (Drum 4, 5, and 6)                             | Apply open gear oil to sliding surfaces of Pawl and Lever. |
| W5   | Hydraulic Tank Breather  | Inspect and replace (see NOTE 2).                          |
| W6   | Drum Gearbox Oil Filling / Breather Plug (1 each drum)             | Clean each (see NOTE 1).                                   |
| W6a  | Drum Motor Shaft Oil Filling / Breather Plug (each free fall drum) | Clean each (see NOTE 1).                                   |

**NOTE 1** Soak the breathers in non-flammable solvent and blow dry with compressed air.

**NOTE 2** Inspect the breather weekly. Replace the cartridge with a new one when all of the desiccant beads turn dark green. The desiccant beads are gold when new.



| Item  | Description   | Required Service                                  |
|---|---|---|
| <b>After First 200 Hours of Operation</b><br>(see NOTE 1) |   |   |
| M1  | Swing Gear Box Quick-Drain Valve (1 or 2 places)            | Drain and refill each with gear oil.              |
| M2  | Pump Drive Quick-Drain Valve                                | Drain and refill with gear oil.                   |
| M3  | Drum Gear Box Quick-Drain Valve (1 each drum)               | Drain and refill each with gear oil (see NOTE 2). |
| M4  | Crawler Gearbox Drain Plug (1 each crawler)<br>(see NOTE 3) | Drain and refill each with gear oil.              |
| Items M5-M9 Not Used                                      |   |   |

- NOTE 1** Service after first 200 hours of operation is required to remove metal particles and other impurities collected during the initial run-in of the gear boxes.
- NOTE 2** Lower the boom to horizontal when changing the oil in Drums 1 and 6.
- NOTE 3** Travel the crawlers so the centerline through the fill and level plugs is horizontal when changing oil.

| Item   | Description  | Required Service   |
|--|--|--|
| <b>Every 200 Hours of Operation or Monthly (whichever comes first)</b> |  |  |
| M10  | Swing Gear Box Sight Gauge (1 or 2 places)                           | Check level. Should be at level indicated on decal next to sight gauge |
| M11  | Swing Gear Box Oil Fill and Breather Plug (1 or 2 places)            | Fill each to proper level with gear oil.                               |
| M12  | Drum Bearing (1 fitting, each drum)                                  | Grease.  |
| M13  | Drum Gear Box Sight Gauge (1 each drum)                              | Check level. Should be at middle of sight gauge (see NOTE 1).          |
| M14  | Drum Gear Box Oil Filling / Breather Plug (1 each drum)              | Fill each to proper level with gear oil.                               |
| M14a   | Drum Gear Box Optional Oil Fill Plug                                 |  |
| M15  | Engine Clutch Lever and Bearing (4 fittings - 1 top and 3 bottom)    | Grease.  |
| M16a   | Crawler Gearbox Oil Level Plug (1 each crawler) (see NOTE 2)         | Check level. Should be up to plug opening.                             |
| M16b   | Crawler Gearbox Oil Level Plug (1 each crawler)                      | Fill each to proper level with gear oil.                               |
| M17  | Dosing Module Filter (Tier 4F engine only)                           | Inspect and replace as needed according to engine manual.              |
| M18  | DEF Tank Filter (40 micron suction filtration) (Tier 4F engine only) | Inspect and replace as needed according to engine manual.              |
| M19  | Not Used   |  |
| M20a   | Crawler Front Roller (1 fitting each crawler).                       | Grease (see NOTE 3).   |
| M20b   | Crawler Intermediate Rollers (2 fittings, 15 places each crawler)    |  |
| M20c   | Top Roller (2 fittings, 2 places each crawler)                       |  |
| M21  | Drum Motor Shaft Level Plug (each free fall drum)                    | Check level. Should be up to plug opening.                             |
| M22  | Drum Motor Shaft Oil Filling / Breather Plug (each free fall drum)   | Fill to proper level with gear oil.                                    |

**NOTE 1** Lower the boom to horizontal when checking oil level in Drums 1 and 6.

**NOTE 2** Travel the crawlers so the centerline through the plugs M16a and M16b is horizontal.

**NOTE 3** Crawlers are greased manually only when the crane does not have the optional crawler auto lube system.

| Item   | Description   | Required Service                                  |
|--|---|---|
| <b>Every 1000 Hours of Operation or Semiannually (whichever comes first)</b> |   |   |
| S1   | Hydraulic Tank Quick-Drain Valve                                | Drain and refill with hydraulic oil.              |
| S2   | Swing Gear Box Quick-Drain Valve (1 or 2 places)                | Drain and refill each with gear oil.              |
| S3   | Pump Drive Quick-Drain Valve                                    | Drain and refill with gear oil.                   |
| S4   | Hydraulic Suction Screens (4 each mounted in tank)              | Service when tank is drained.                     |
| S5   | Hydraulic Filter 1 (in tank)                                    | Replace all elements at each oil change.          |
| S6   | Hydraulic Filter 2 (oil cooler circuit)                         |   |
| S7   | Hydraulic Filter 3 (crawler motor flushing circuit)             |   |
| S8   | Hydraulic Filter 4 and 5  |   |
| S9   | Drum Gear Box Quick-Drain Valve (1 each drum)                   | Drain and refill each with gear oil (see NOTE 1). |
| S10  | Radiator Quick-Drain Valve                                      | Drain and refill with coolant.                    |
| S11  | Crawler Gearbox Drain Plug (1 each crawler)<br>(see NOTE 2)     | Drain and refill each with gear oil.              |
| S12  | Free Fall Drum Bearing (1 fitting left end each free fall drum) | Grease – 135 g (5 oz)                             |

**NOTE 1** Lower the boom to horizontal when changing oil in Drums 1 and 6.

**NOTE 2** Travel the crawlers so the centerline through the fill and level plugs is horizontal when changing oil.

# BOOM RIGGING LUBRICATION

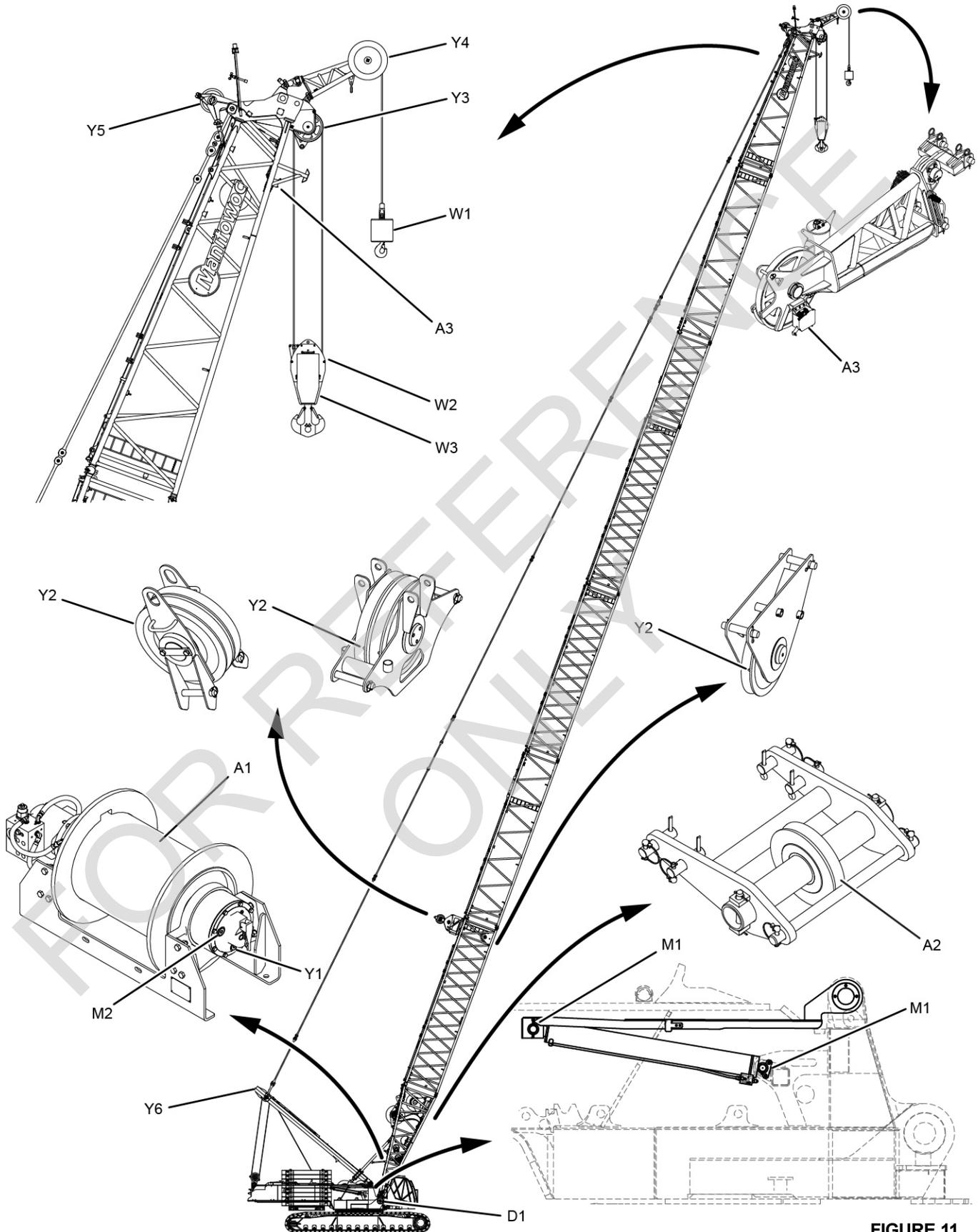


FIGURE 11

M102561

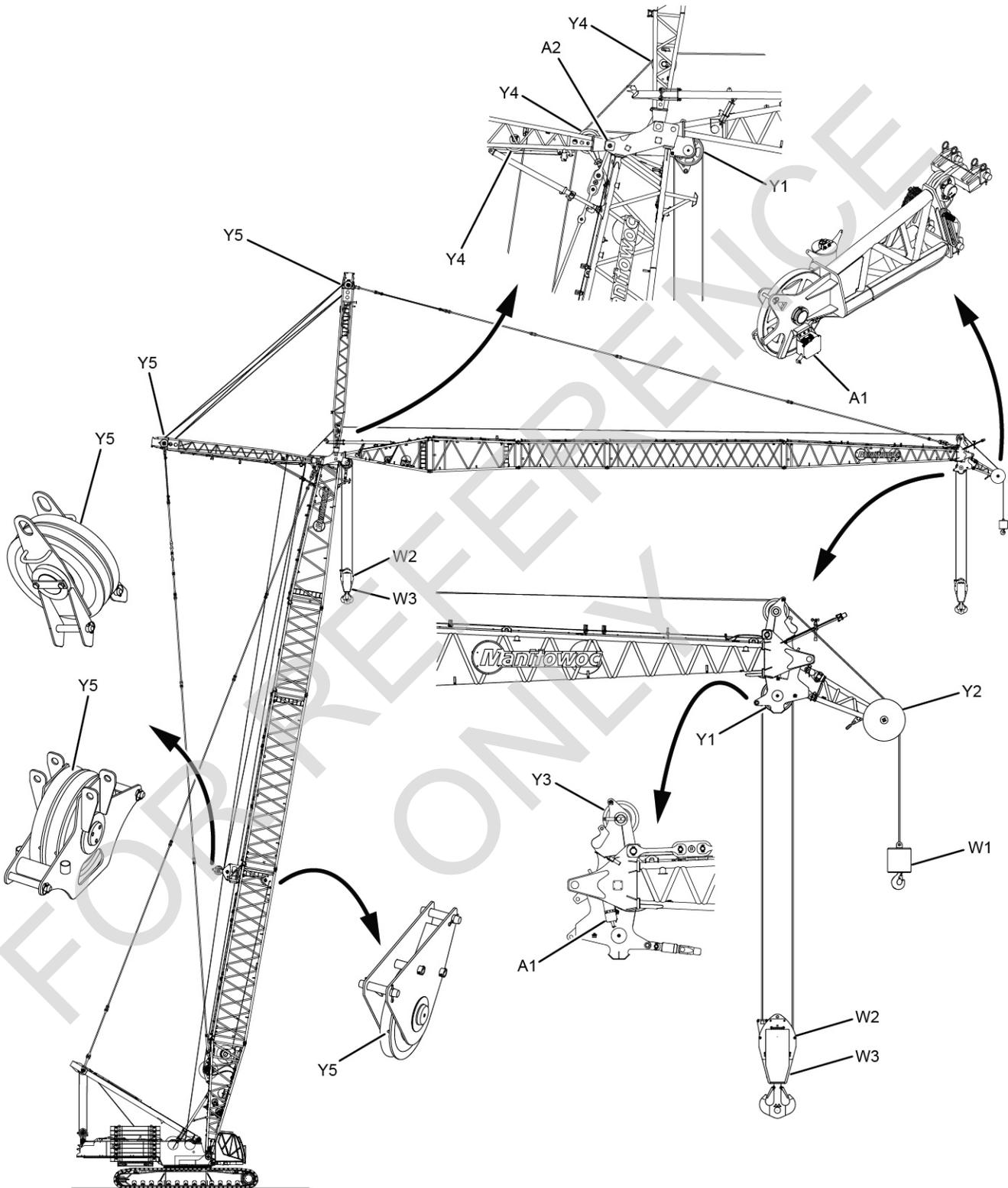
| Item   | Description   | Required Service   |
|--|---|--|
| <b>Prior to Operation</b>  |   |  |
| A1   | Rigging Winch   | Inspect for oil leaks prior to using. If found, repair and refill unit with gear oil.  |
| A2   | Boom Butt Fleeting Sheaves (Rigging Winch) (2 places on Boom Butt)  | Grease. Make sure entire length of both shafts is coated with grease.  |
| A3   | Block-Up Limit Switch (1 fitting inside each switch)                | Grease each.   |
| <b>Every 8 Hours of Operation or Daily (whichever comes first)</b>       |   |  |
| D1   | Boom Hinge Pin (1 fittings, 2 places)                               | Grease each.   |
| <b>Every 40 Hours of Operation or Weekly (whichever comes first)</b>     |   |  |
| W1   | Weight Ball Swivel (1 fitting each)                                 | Grease each.   |
| W2   | Load Block Sheaves (1 fitting, each sheave)                         | Grease each.   |
| W3   | Hook Bearing  | Grease.  |
| <b>Every 200 Hours of Operation or Monthly (whichever comes first)</b>   |   |  |
| M1   | Mast Cylinder End Pins (2 fitting each cylinder)                    | Grease each.   |
| M2   | Rigging Winch   | Check level. If the level is not at least half full, fill with gear oil.   |
| <b>Every 2000 Hours of Operation or Annually (whichever comes first)</b> |   |  |
| Y1   | Rigging Winch   | Drain and refill with 1.9 to 2.3 L (64 to 80 oz) of gear oil. Refer to winch manufacturer operator manual included in the shop reference and maintenance guide for winch lubrication drain and fill procedure.                                   |
| Y2   | Whip / Aux. Line Wire Rope Guide Sheave (1 fitting)                 | Grease each.   |
| Y3   | Lower Point Sheave (1 fitting, each sheave)                         | Inspect the sheaves for proper operation yearly or every 2000 hours of crane operation. Overhaul the sheaves and repack them with grease if needed.<br><br>The sheaves can be greased at a desired interval established by the crane owner/user. |
| Y4   | Upper Point Sheave (1 fitting, each sheave - Greased Sheave Option) |  |
| Y5   | Boom Top Wire Rope Guide Sheave (1 fitting, each sheave)            |  |
| Y6   | Live Mast Sheaves (1 fitting, each sheave)                          |  |

### CAUTION

#### Bearing Damage!

For sheaves with grease fitting in groove of sheave, fitting must be clean and free of debris when greased. Contaminating a bearing with debris while greasing can damage the bearing.

### LUFFING JIB LUBRICATION



M102567

FIGURE 12

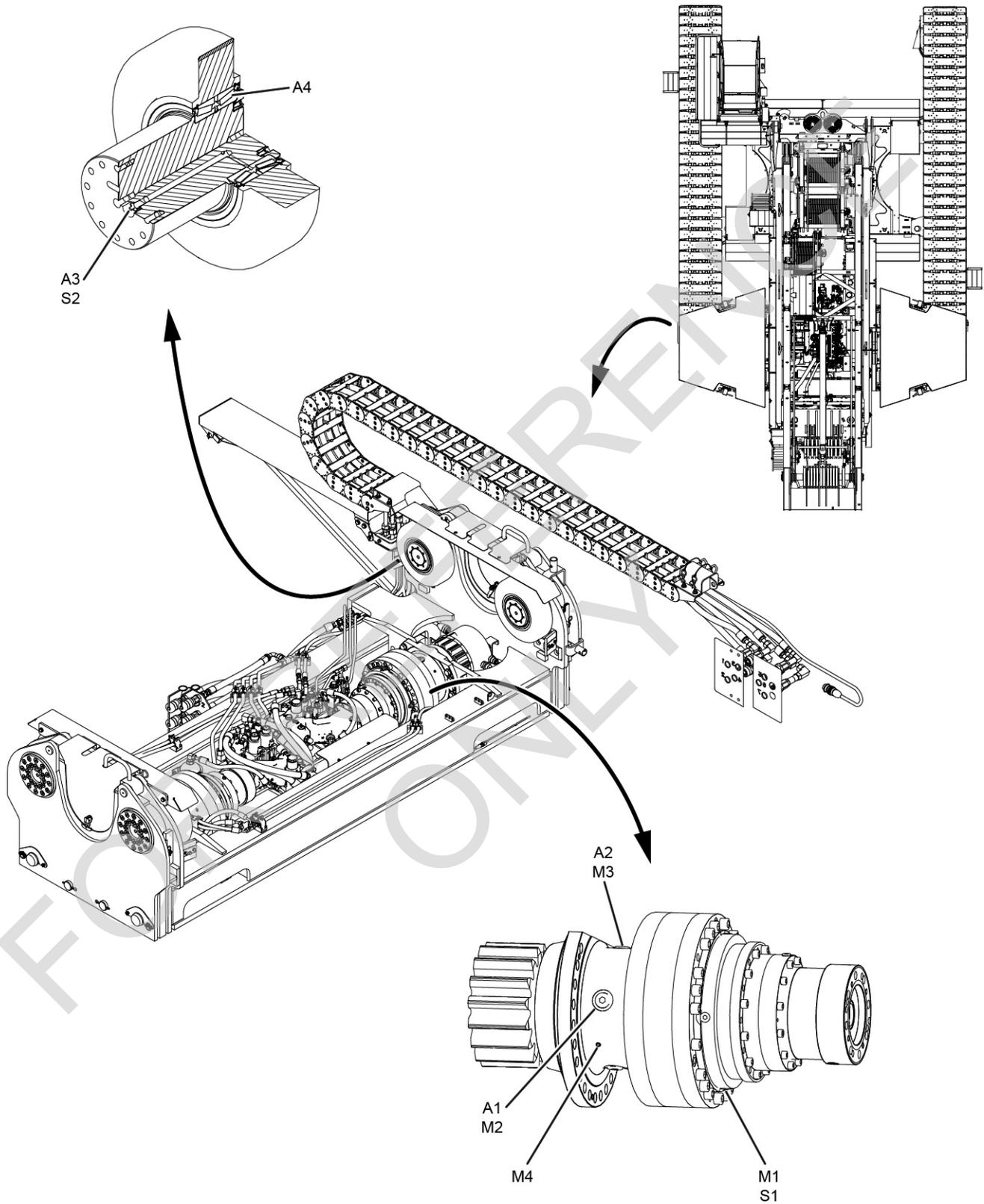
| Item   | Description   | Required Service   |
|--|---|--|
| <b>Prior to Operation</b>  |   |  |
| A1   | Block-Up Limit Switch (1 fitting inside each switch)                    | Grease each.   |
| A2   | Main Strut Hinge Pin (each bore)  | Grease each  |
| <b>Every 40 Hours of Operation or Weekly (whichever comes first)</b>     |   |  |
| W1   | Weight Ball Swivel (1 fitting each)                                     | Grease each.   |
| W2   | Load Block Sheaves (1 fitting, each sheave)                             | Grease each.   |
| W3   | Hook Bearing  | Grease.  |
| <b>Every 2000 Hours of Operation or Annually (whichever comes first)</b> |   |  |
| Y1   | Lower Point Sheave (1 fitting, each sheave)                             | Grease each.   |
| Y2   | Upper Jib Point Sheave (1 fitting, each sheave - Greased Sheave option) | Inspect the sheaves for proper operation yearly or every 2000 hours of crane operation. Overhaul the sheaves and repack them with grease if needed.<br><br>The sheaves can be greased at a desired interval established by the crane owner/user. |
| Y3   | Jib Top Wire Rope Guide Sheave (1 fitting, each sheave)                 |  |
| Y4   | Jib Strut Wire Rope Guide Sheave (1 fitting, each sheave)               |  |
| Y5   | Luffing Hoist Sheave (1 fitting, each sheave)                           |  |
|  |   |  |

### CAUTION

#### Bearing Damage!

For sheaves with grease fitting in groove of sheave, fitting must be clean and free of debris when greased. Contaminating a bearing with debris while greasing can damage the bearing.

### VPC™ LUBRICATION



M102568

FIGURE 13

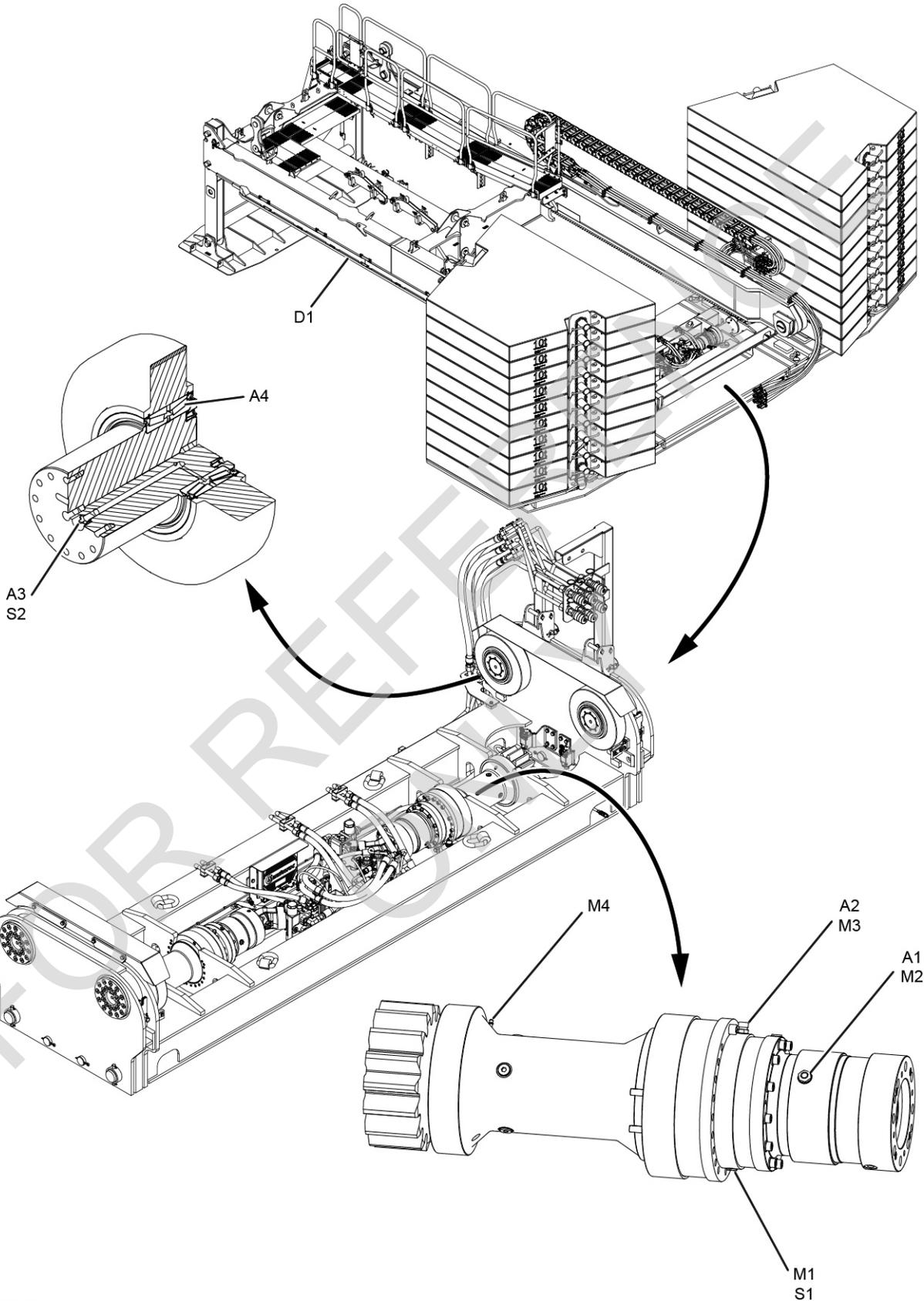
| Item   | Description                       | Required Service                                       |
|--|-----------------------------------|--|
| <b>Prior to Operation</b>  |                                   |  |
| A1   | VPC Gearbox Oil Level Sight Glass | Check the level, fill with gear oil through fill plug. |
| A2   | VPC Gearbox Oil Fill Plug         | Fill to the proper level with gear oil.                |
| A3   | VPC Roller Assembly (each roller) | Grease each fitting (see NOTE 2).                      |
| A4   | VPC Roller Bearing (each roller)  | Grease each (see NOTE 3).                              |
| <b>After First 200 Hours of Operation<br/>(see NOTE 1)</b>                   |                                   |  |
| M1   | VPC Gearbox Oil Drain Plug        | Drain and refill with gear oil through fill plug.      |
| <b>Every 200 Hours of Operation or Monthly (whichever comes first)</b>       |                                   |  |
| M2   | VPC Gearbox Oil Level Plug        | Check the level, fill with gear oil through fill plug. |
| M3   | VPC Gearbox Oil Fill Plug         | Fill to the proper level with gear oil.                |
| M4   | VPC Drive (each gearbox)          | Grease each fitting.                                   |
| <b>Every 1000 Hours of Operation or Semiannually (whichever comes first)</b> |                                   |  |
| S1   | VPC Gearbox Oil Drain Plug        | Drain and refill with gear oil through fill plug.      |
| S2   | VPC Roller Assembly (each roller) | Grease each fitting (see NOTE 2).                      |

**NOTE 1** Service after first 200 hours of operation is required to remove metal particles and other impurities collected during the initial run-in of the gearboxes.

**NOTE 2** Before assembly, make sure that all the grease holes are open.

**NOTE 3** Before assembling the bearing, hand pack the bearing with grease.

### VPC-MAX™ LUBRICATION



M102569

FIGURE 14

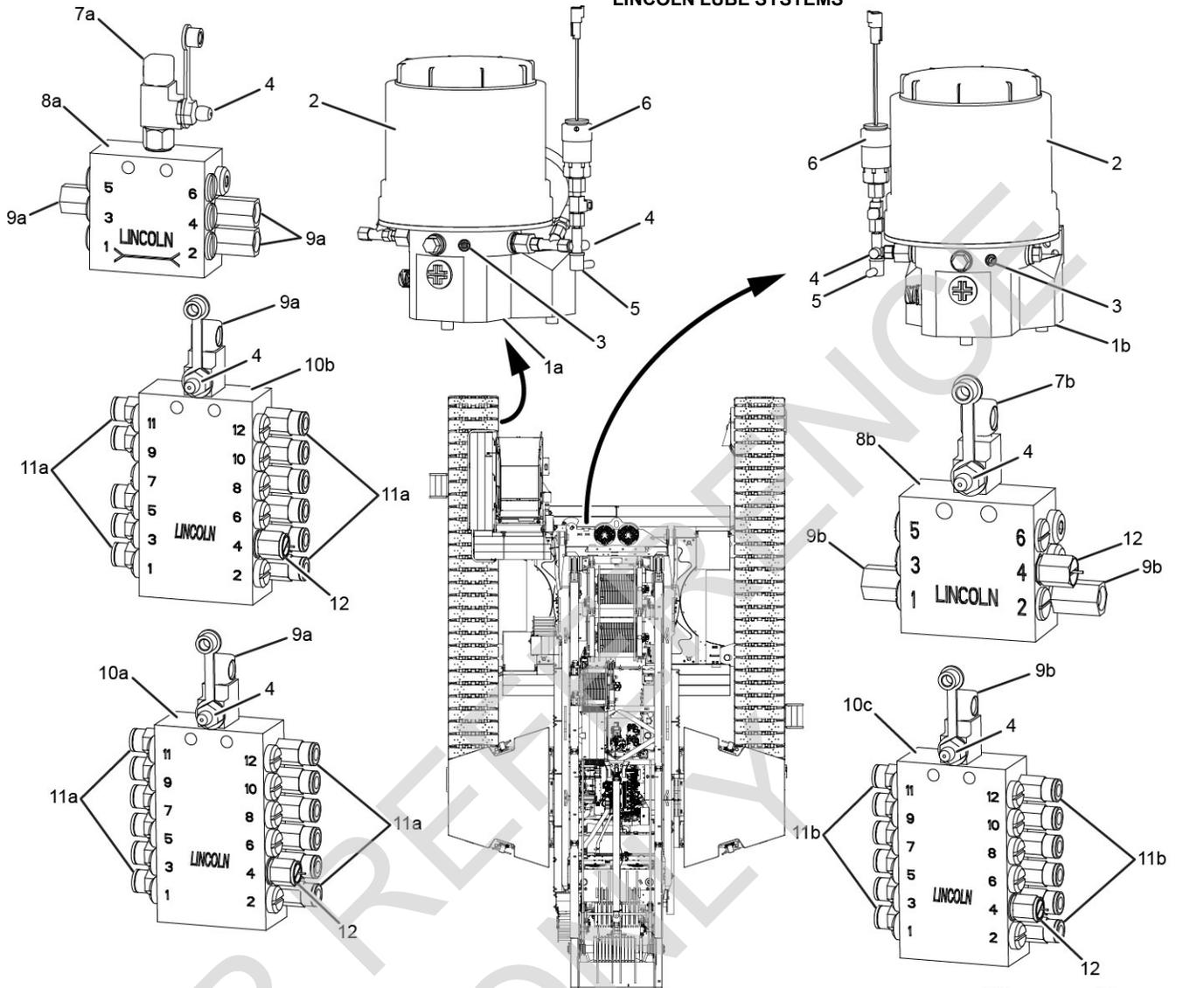
| Item   | Description                             | Required Service  |
|--|---|---|
| <b>Prior to Operation</b>  |   |   |
| A1   | VPC-MAX Gearbox Level Plug              | Check the level, fill with gear oil through fill plug.  |
| A2   | VPC-MAX Gearbox Filler / Breather Plug  | Fill to the proper level with gear oil.   |
| A3   | VPC-MAX Roller Assembly (each roller)   | Grease each fitting (see NOTE 2).   |
| A4   | VPC-MAX Roller Bearing (each roller)    | Grease each (see NOTE 3).   |
| <b>Every 8 Hours of Operation or Daily (whichever comes first)</b>           |   |   |
| D1   | VPC-MAX Gear Rack (both sides of crane) | Check for proper lubrication. Coat with open gear oil if needed. Clean all debris from roller path. |
| <b>After First 200 Hours of Operation<br/>(see NOTE 1)</b>                   |   |   |
| M1   | VPC-MAX Gearbox Drain Plug              | Drain and refill with gear oil through fill plug.   |
| <b>Every 200 Hours of Operation or Monthly (whichever comes first)</b>       |   |   |
| M2   | VPC-MAX Gearbox Level Plug              | Check the level, fill with gear oil through fill plug.  |
| M3   | VPC-MAX Gearbox Filler / Breather Plug  | Fill to the proper level with gear oil.   |
| M4   | VPC-MAX Gearbox (each gearbox)          | Grease each fitting.  |
| <b>Every 1000 Hours of Operation or Semiannually (whichever comes first)</b> |   |   |
| S1   | VPC-MAX Gearbox Drain Plug              | Drain and refill with gear oil through fill plug.   |
| S2   | VPC-MAX Roller Assembly (each roller)   | Grease each fitting (see NOTE 2).   |

**NOTE 1** Service after first 200 hours of operation is required to remove metal particles and other impurities collected during the initial run-in of the gearboxes.

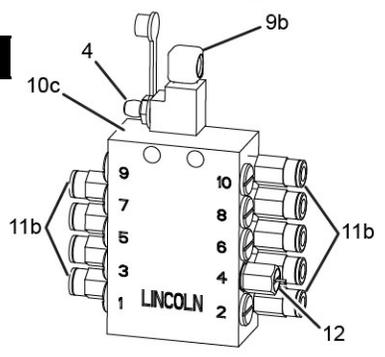
**NOTE 2** Before assembly, make sure that all the grease holes are open.

**NOTE 3** Before assembling the bearing, hand pack the bearing with grease.

LINCOLN LUBE SYSTEMS



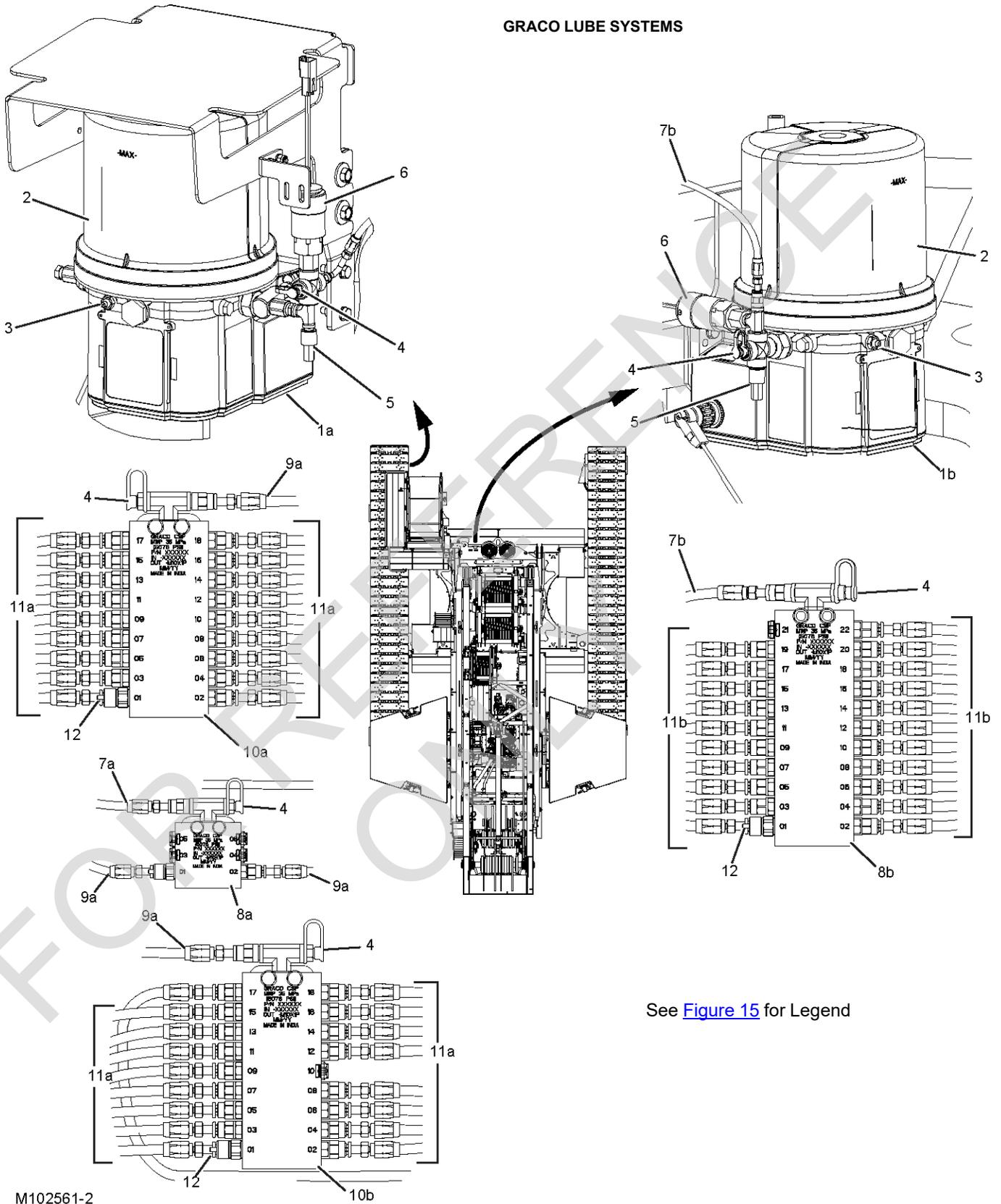
| Item | Description                                 | Item | Description  |
|------|---|------|--|
| 1a   | Grease Pump (Crawler - 1 each)              | 8b   | Primary Divider Valve (Turntable)                    |
| 1b   | Grease Pump (Turntable Bearing)             | 9a   | Grease Lines to Secondary Divider Valves (Crawler)   |
| 2    | Grease Reservoir                            | 9b   | Grease Lines to Secondary Divider Valves (Turntable) |
| 3    | Grease Fitting for Filling Reservoir        | 10a  | Secondary Divider Valves (Crawler - 2 each)          |
| 4    | Grease Fitting for Greasing System Manually | 10b  | Secondary Divider Valves (Crawler - 2 each)          |
| 5    | Pressure Relief Valve                       | 10c  | Secondary Divider Valves (Turntable)                 |
| 6    | Variable Pressure Switch                    | 11a  | Grease Lines to Lube Points (Crawler)                |
| 7a   | Grease Line from Pump (Crawler)             | 11b  | Grease Lines to Lube Points (Turntable)              |
| 7b   | Grease Line from Pump (Turntable)           | 12   | Indicator Pin  |
| 8a   | Primary Divider Valve (Crawler - 1 each)    |      |  |



M102560

FIGURE 15

GRACO LUBE SYSTEMS



See [Figure 15](#) for Legend

FIGURE 16

## AUTOMATIC LUBRICATION SYSTEM

The crane has two grease systems that automatically grease points on the turntable bearing and the rollers on each crawler. Grease is pumped to each point at the intervals given in [Table 5](#) when the ignition switch is on. The grease pumps use 24 VDC power.

**Table 5 Automatic Greasing Intervals**

| Item                    | Cycle Time               | Interval        |
|-------------------------|--------------------------|-----------------|
| Turntable Bearing       | 2 minutes                | Every hour      |
| Crawler Roller Bearings | Continuous               | While Traveling |
| Reservoir Capacity      | 4 L (1 gal)              |                 |
| Pump Output:            |                          |                 |
| Turntable Bearing       | 2.8 cm <sup>3</sup> /min |                 |
| Crawlers                | 8.0 cm <sup>3</sup> /min |                 |

### Operation

See [Figure 15](#) on [page 32](#) and [Figure 16](#) on [page 33](#) on for the following procedure.

The crane's programmable controller controls the grease pumps.

- The pumps push grease to the grease points when the automatic grease system component is operating, usually when the crane is swung or traveled. See [Table 5](#) for greasing intervals.
- The pumps stop pumping when the automatic grease system is not operating.
- The pumps also stop pumping if the crane's ignition switch is turned off.
- Each divider valve has an indicator pin (12) that extends and retracts during a lubrication cycle.

### Daily Inspection

See [Figure 15](#) on [page 32](#) and [Figure 16](#) on [page 33](#) on for the following procedure.

To ensure maximum reliability and to protect crane components, the **automatic lubrication systems must be inspected daily**:

1. Check the grease level in each reservoir.
2. When the grease level reaches the MIN mark on the reservoir, fill the reservoir to the MAX mark with a hand operated grease pump through the grease fitting on the pump housing.

Use a recommended grease (see [Table 1](#) for the factory fill).

3. Visually inspect the automatic lubrication systems:
  - a. Inspect the divider valve inlets, outlets, and lubrication points for leaks.

- b. Inspect for broken or cut grease lines.
  - c. Inspect the terminal ends of each grease line to verify there are no leaks.
  - d. Tighten any fittings if grease leakage is detected.
4. With the power on, check that the pumps are working by moving the swing and travel handles.
  5. Check to see if the indicator pin on each valve is working when the system is cycling. The indicator pin on each valve should extend and retract.
  6. If grease is pumped out through the pressure relief valve, pressure within system is greater than 276 ± 17 bar (4,000 ± 247 psi). An obstructed grease line or divider valve is indicated. Troubleshoot the system (see the next page).

### CAUTION

#### Crawler/Turntable Bearing Hazard!

In extreme cold weather operation—temperatures down to -40°C (-40°F)—pumps may not pump grease through the automatic lubrication systems. It will be apparent that the lines are obstructed when the pump pushes grease out the relief valve.

If this occurs, **grease the crawler rollers and the turntable bearing manually** using the grease fittings (4) on the divider valves.

### Manual Greasing

See [Figure 15](#) on [page 32](#) and [Figure 16](#) on [page 33](#).

Each divider valve is equipped with a grease fitting (4) so that the crawler rollers and the turntable bearing can be greased manually if the need arises.

Additionally, each crawler roller is equipped with a grease fitting to allow manual greasing, if necessary.

## Automatic Lubrication System Troubleshooting

| Symptom   | Probable Cause  | Solution   |
|---|---|--|
| 1. Pump will not operate.   | Not receiving 24-volt DC input.<br><br>Blocked pump cam.        | Check fuses and electrical supply.<br>Check electrical supply to the pump, by tracing to electrical source. Repair.<br>If voltage is available to pump, check for blockage. Repair.<br>Replace pump motor if blockage is not identified.   |
| 2. The pump motor is running but there is no grease being discharged. | Air pocket at pump element inlet.                               | Disconnect main delivery hose from pump outlet.<br>Run pump until solid grease with no bubbles flows from outlet. If solid grease does not discharge after 20 minutes, pump inlet is blocked.<br><br><b>NOTE</b> Depending on operating temperature and grease type, it can take up to 10 minutes to obtain full volume at outlet.   |
|   | Blocked pump inlet.   | Remove pump element from pump body and check suction inlet port for foreign particles.<br>Reassemble pump and element, then test pump. If pump element does not discharge grease, replace element.   |
| 3. Pump operated with an empty reservoir.                             | Grease in reservoir is low.                                     | Fill reservoir and test system with grease gun at system manual grease fitting.<br>Disconnect main delivery hose from pump and watch until solid grease with no bubbles flows from outlet.<br>Reconnect main delivery hose to pump outlet.   |
| 4. Grease is discharged at pressure relief valve.                     | There is blockage in meter valves, hose, tubing, or at bearing. | Test system with grease gun at system manual grease fitting. Loosen each outlet line at primary valve, one at a time. The blocked outlet line will start flowing grease and indicator pin starts indexing.<br>Retighten all outlets at primary valve.<br>Trace hose that flowed to its secondary valve.<br>Repeat process of loosening each outlet one at a time until blocked line is found.<br>Retighten all outlets.<br>Repair bearing blockage.<br>If a metering valve is causing blockage, replace valve. |
| 5. Indicator pin on primary valve does not move.                      | See item 4.   | See item 4.  |
| 6. Lubrication point is not receiving grease.                         | Cut in hose or tubing.  | Replace hose or tubing.  |

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