One Piece Stator Construction

A disassembled rotor stator and vanes that cannot be readily assembled by hand can be assembled by the following procedures.

1. Place stator onto wear plate (9) with seal ring (4) side down, after following assembly procedures 1 through 13. Be sure the seal ring is in place.

2. If assembly alignment studs are not being utilized, align stator bolt holes with wear plate and housing bolt holes and turn two bolts (1) finger tight into bolt holes approximately 180 degrees apart to retain stator and wear plate stationary.

3. Assemble the rotor, counterbore down if applicable, into stator, and onto wear plate (9) with rotor splines into mesh with drive link (10) splines.

4. Assemble six vanes, or as many vanes that will readily assemble into the stator vane pockets.

⚠ CAUTION

EXCESSIVE FORCE USED TO PUSH THE ROTOR VANES INTO PLACE COULD SHEAR OFF THE COATING APPLIED TO THE STATOR VANE POCKETS.

5. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes into stator, creating the necessary clearance to assemble the seventh or full complement of seven vanes. Assemble the seven vanes using minimum force.

6. Remove the two assembled bolts (1) if used to retain stator and wear plate.

Go to assembly procedure #15, to continue assembly.

Two Piece Stator Construction

A disassembled rotor set (8) that cannot be readily assembled by hand and has a two piece stator can be assembled by the following procedures.

1. Place stator half onto wear plate (9) with seal ring (4) side down, after following motor assembly procedures 1 through 13. Be sure the seal ring is in place.
2. Align stator bolt holes with wear plate and housing bolts and turn two alignment studs finger tight into bolt holes approximately 180 degrees apart to retain stator half and wear plate stationary.
3. Assemble rotor, counterbore down if applicable, into stator half, and onto wear plate (9) with rotor splines into mesh with drive link (10) splines.

NOTE: *Use any marking you applied to rotor set components to reassemble the components in their original relationship to ensure ultimate wear life and performance.*

4. Assemble six vanes, or as many vanes that will readily assemble into the stator vane pockets.

⚠ CAUTION

EXCESSIVE FORCE USED TO PUSH THE ROTOR VANES INTO PLACE COULD SHEAR OFF THE COATING APPLIED TO THE STATOR VANE POCKETS.

5. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes (8C) into stator half, creating the necessary clearance to assemble the seventh or full complement of seven vanes. Assemble the seven vanes using minimum force.
6. Place second stator half on a flat surface with seal ring groove up. Apply a small amount of grease to a new seal ring (4) and assemble it into stator half ring groove.
7. Assemble the second stator half over the two alignment studs and rotor with seal ring side down onto the first stator half aligning any timing marks applied for this purpose.

⚠ CAUTION

IF THE STATOR HALF (8B) IS A DIFFERENT HEIGHT (THICKNESS) THAN STATOR HALF (8D) THE STATOR VANES (8C) OR (8E)OF THE SAME LENGTH (HEIGHT) AS THE STATOR HALF MUST BE REASSEMBLED IN THEIR RESPECTIVE STATOR HALF FOR THE ROTOR SET TO FUNCTION PROPERLY.

8. Assemble six vanes, or as many vanes that will readily assemble into the stator vane pockets.
9. Grasp the output end of coupling shaft (12) with locking pliers or other appropriate turning device and rotate coupling shaft, drive link and rotor to seat the rotor and the assembled vanes into stator, creating the necessary clearance to assemble the seventh or full complement of seven vanes. Assemble the seven vanes using minimum force.

Go to assembly procedure #15, to continue assembly.

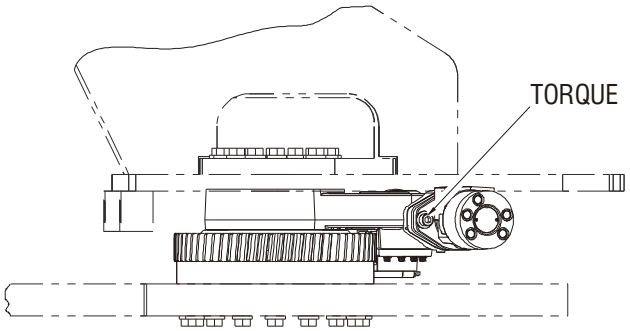
Final Checks

1. Pressurize the motor with 100 p.s.i. dry air or nitrogen and submerge in solvent to check for external leaks.
2. Check motor for rotation. Torque required to rotate coupling shaft should not be more than 50 ft. lbs. (68 N m)
3. Pressure port with "A" cast under it on housing (18) is for clockwise coupling shaft rotation as viewed from the output end of coupling shaft. Pressure port with "B" cast under it is for counterclockwise coupling shaft rotation.
4. Use test stand if available, to check operation of the motor.

Installation

Refer to Figure 3-10., Swing Motor Removal and Installation.

1. Carefully insert the swing motor into the swing drive, making sure the swing motor shaft key is aligned correctly.
2. Secure the swing motor to the swing drive assembly with the retaining bolts. Apply High Strength Threadlocking Compound to the threads of the retaining bolts and torque to 85 ft. lbs. (115 Nm).



3. Connect the hydraulic lines running to the swing motor as tagged during removal.
4. Operate the swing function in both directions to ensure proper operation. Inspect the hose connections for any leakage.

3.10 SWING BEARING

The swing drive assembly has five major components. They are the housing, worm, worm gear, output pinion and gear / pinion cap. The unit cannot be serviced while mounted on the machine.

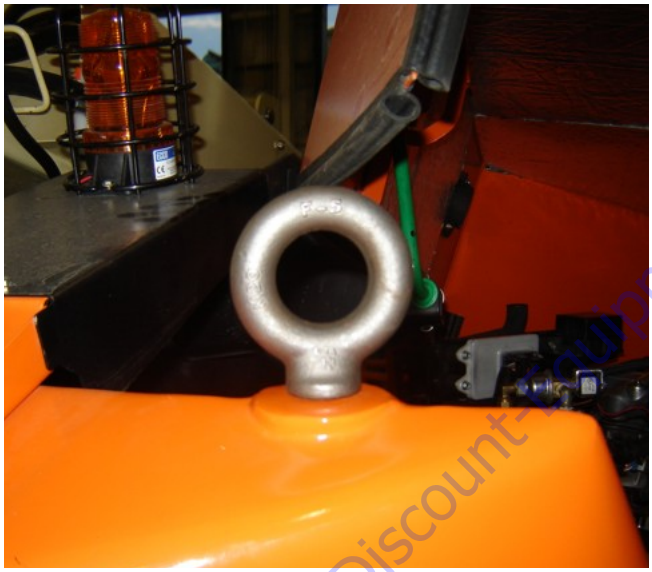
Removal

1. Remove the hardware securing the battery cover and remove the battery cover.
2. Disconnect the negative terminal on the battery.

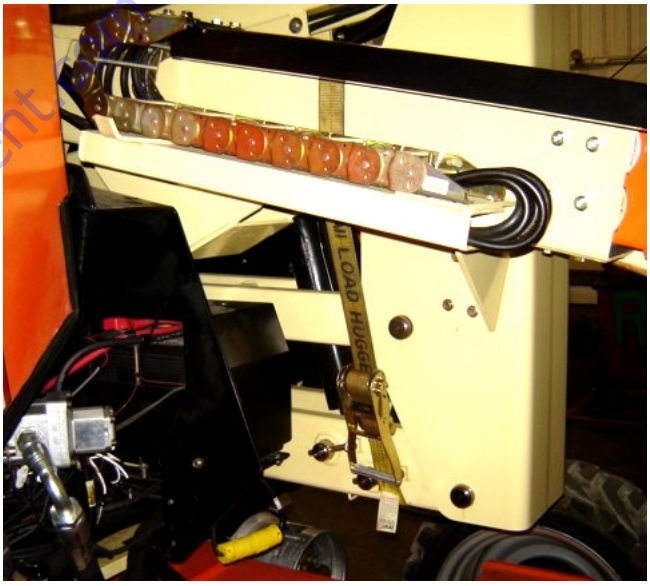
NOTICE

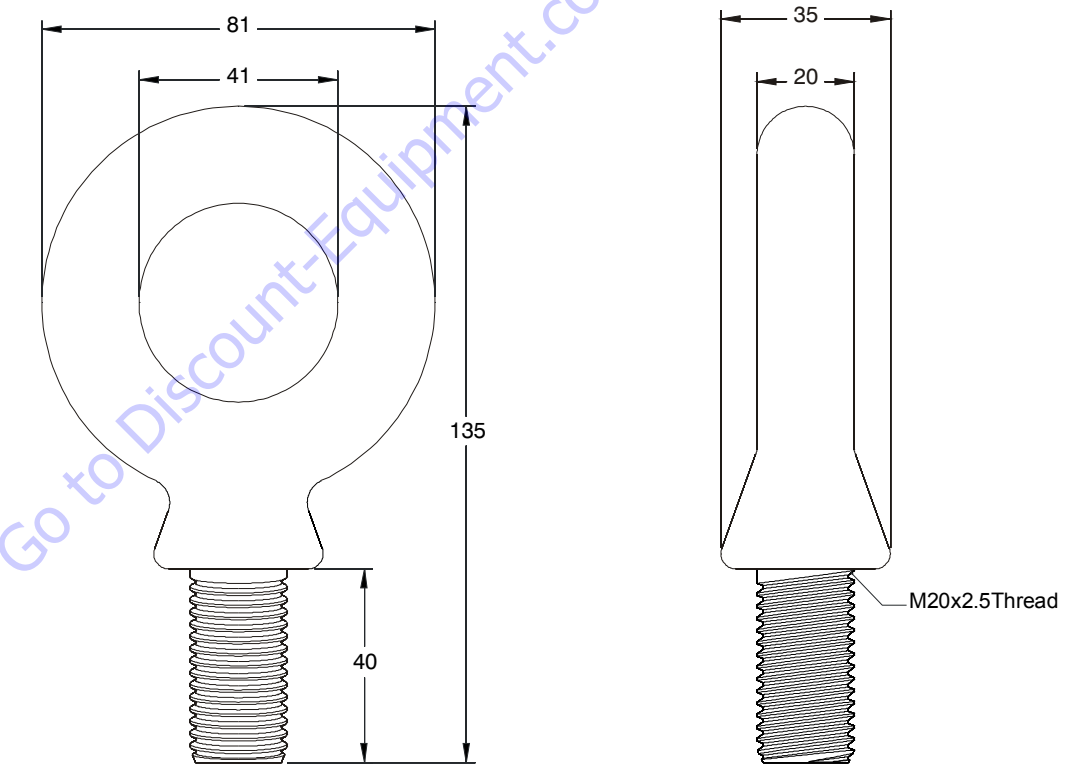
MAKE SURE THE EYEBOLTS HAVE A RATED WORK LOAD SUFFICIENT TO HANDLE THE LOAD OF THE UPPERSTRUCTURE OF THE MACHINE. THE UPPERSTRUCTURE WEIGHS APPROXIMATELY 7,000 LB (3175 KG).

3. Install eyebolts as specified in Figure 3-12., Eyebolt for Counterweight in the counterweight.



4. Securely strap the booms together to prevent any movement during the lifting process.



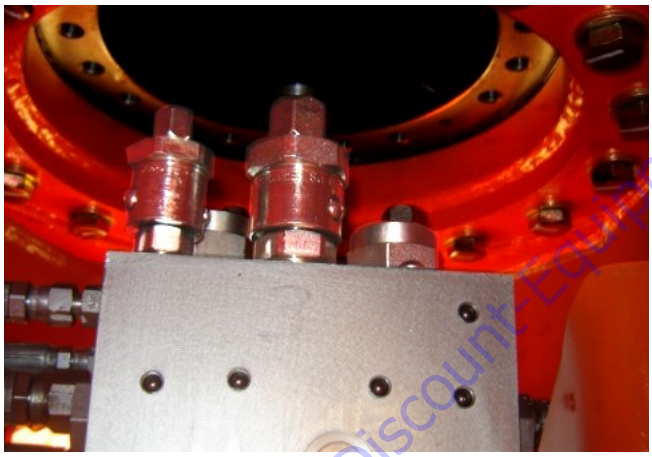


NOTE: *All measurements shown are in mm.*

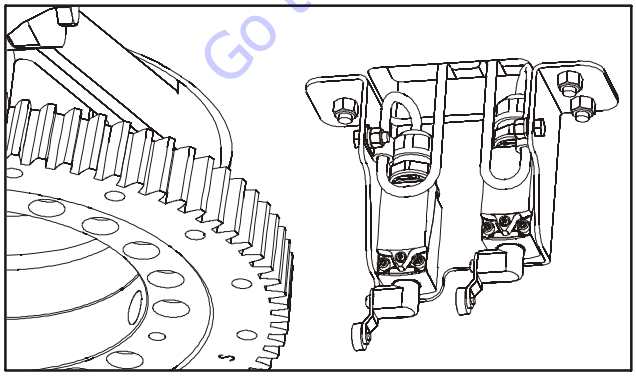
Figure 3-12. Eyebolt for Counterweight

5. Loosen and remove all but a few of the bolts securing the turntable to the swing bearing.

6. Place a drain pan under the flow divider valve to catch any escaping hydraulic oil. Tag and disconnect the hoses from the flow divider valve that go up through the turntable. Cap or plug all openings so no dirt enters the system.

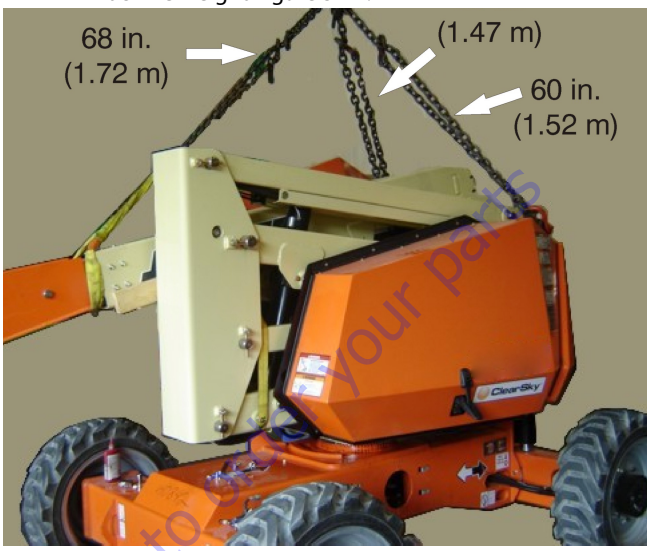


7. Remove the drive orientation and lockout switches so they don't get broken during the removal procedure.



8. Swing the engine tray back into position and secure it in place with the retaining bolt.

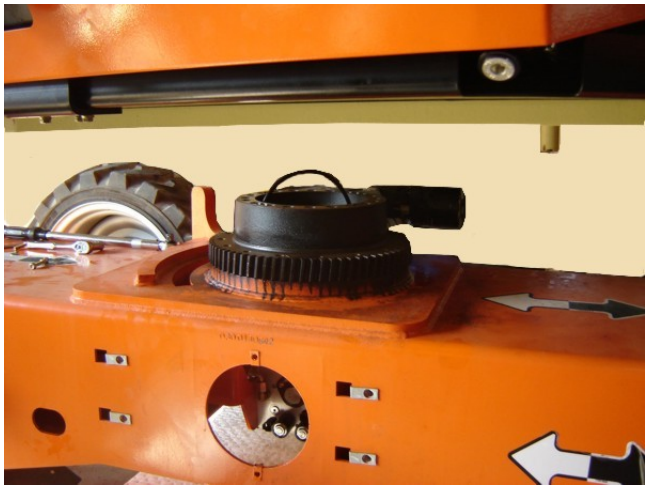
9. Attach chains and slings to support the upperstructure. Begin with the chain at the approximate lengths as shown below and adjust as necessary to maintain the turntable in a level position during lifting. For gross machine weight Figure 3-17.



10. Remove the remaining turntable bolts that were left in place earlier in the procedure.

11. Disconnect all cables or harnesses routed through the bearing on the chassis to turntables.

12. Lift the turntable off of the bearing and place it out of the way on adequate blocking.



13. Remove the bolts securing the bearing to the frame. It may be necessary to disconnect more hoses on the flow divider valve. If so, tag and disconnect all hoses and cap or plug all openings to prevent dirt from entering the hydraulic system.

NOTE: *The swing bearing assembly weighs approximately 125 lb (56.6 kg).*

14. Remove the bearing assembly from the frame.

Installation

NOTE: *The swing bearing assembly weighs approximately 125 lb (56.6 kg).*

1. Using an adequate lifting device, place the bearing assembly onto the frame.
2. Install the bearing in the position shown in Figure 3-15., Bearing Placement. Coat the bearing bolts with High Strength Threadlocking Compound and secure the bearing assembly to the frame with the bolts. Following the torque sequence diagram in Figure 3-16., Swing Bearing Torque Sequence, tighten the bolts to an initial torque of 95 ft.lbs. (130 Nm). Next, following the same sequence, tighten to a final torque of 133 ft. lbs. (180 Nm).
3. If any hydraulic hoses were disconnected to remove the swing bearing assembly, reconnect them as tagged during removal.

NOTE: *The turntable assembly weighs approximately 7000 lb (3175 kg).*

4. Using an adequate lifting device, lift the turntable assembly from the blocking it is resting on and lower it down onto the swing bearing assembly. Refer to the removal instructions for chain placement.
5. Install several bearing bolts snuggly to secure the turntable's position on the swing bearing assembly, but do not torque them at this time and keep the lifting device in place to support the weight of the turntable.
6. Coat the bearing bolts with High Strength Threadlocking Compound and install the remaining bolts securing the turntable to the swing bearing. Tighten the bolts snugly but do not torque them at this time. Remove the bolts installed to secure the turntable's position and apply threadlocker to them. Reinstall them in the same manner as the other bolts.
7. Following the torque sequence diagram in Figure 3-16., Swing Bearing Torque Sequence, tighten the bolts to an initial torque of 95 ft. lbs. (130 Nm). Next, following the same sequence, tighten to a final torque of 133 ft. lbs. (180 Nm).
8. Install the drive orientation and lockout switches.
9. Route the hydraulic hoses down through the turntable and reconnect them as they were tagged during removal.
10. Secure the charge filter bracket.
11. Install the access covers on the side of the frame.
12. Remove the lifting device from the machine.
13. Remove any straps that had been on the boom to prevent movement of the boom sections.
14. Remove the eyebolts from the counterweight.
15. Connect the negative terminal on the battery.
16. Install the battery cover.
17. Push the engine tray back into place and secure it.
18. Start the machine and run it through several operating cycles. Swing the machine in both directions.
19. Check for any leaks and that all functions are operating properly. Top off the hydraulic oil level if necessary.

Turntable Bearing Mounting Bolt Condition Check

NOTE: *This check is designed to replace the existing bearing bolt torque checks on JLG Lifts in service. This check must be performed after the first 50 hours of machine operation and every 600 hours of machine operation thereafter. If during this check any bolts are found to be missing or loose, replace missing or loose bolts with new bolts and torque to the value specified in the torque chart, after lubricating the bolt threads with High Strength Threadlocking Compound. After replacing and retorquing bolt or bolts recheck all existing bolts for looseness.*

Check the frame to bearing. Attach bolts as follows:

1. Elevate the fully retracted boom to 70 degrees (full elevation).
2. At the positions indicated on the figure titled Swing Bearing Tolerance Boom Placement. Try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.
3. Assure that the 0.0015" feeler gauge will not penetrate under the bolt head to the bolt shank.
4. Swing the turntable 90 degrees, and check some selected bolts at the new position.
5. Continue rotating the turntable at 90 degrees intervals until a sampling of bolts have been checked in all quadrants.

Check the turntable to bearing. Attach bolts as follows:

1. Elevate the fully retracted boom to 70 degrees (full elevation).
2. At the positions indicated in the figure below, try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

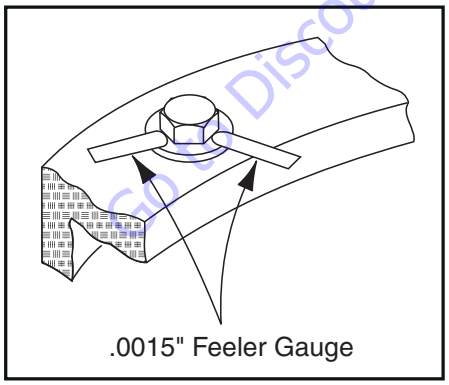


Figure 3-13. Swing Bearing Feeler Gauge Check

3. Lower the boom to horizontal and fully extend the boom.
4. At the position indicated on Figure 3-13. Try and insert the 0.0015" feeler gauge between the bolt head and hardened washer at the arrow indicated position.

Wear Tolerance

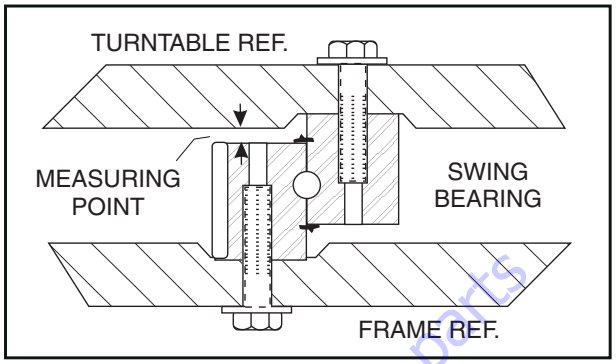


Figure 3-14. Swing Bearing Tolerance Measuring Point

1. With the boom positioned over the side of the machine, the Upper Boom horizontal with telescope fully extended and Mid/Lower Boom stowed, using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable.
2. At the same point, with the boom positioned over the side of the machine, the Upper Boom fully elevated and the Mid/Lower Boom fully elevated, using a magnetic base dial indicator, measure and record the distance between the swing bearing and turntable.
3. If a difference greater than 0.057 in. (1.40 mm) is determined, the swing bearing should be replaced.
4. If a difference less than 0.057 in. (1.40 mm) is determined, and any of the following conditions exist, the bearing should be removed.
   a. Metal particles in the grease.
   b. Increased drive power.
   c. Noise.
   d. Rough rotation.
5. If bearing inspection shows no defects, reassemble bearing and return to service.

Swing Bearing Torque Value

Install bolts with High Strength Threadlocking Compound; Torque to 133 ft. lbs. (180 Nm).

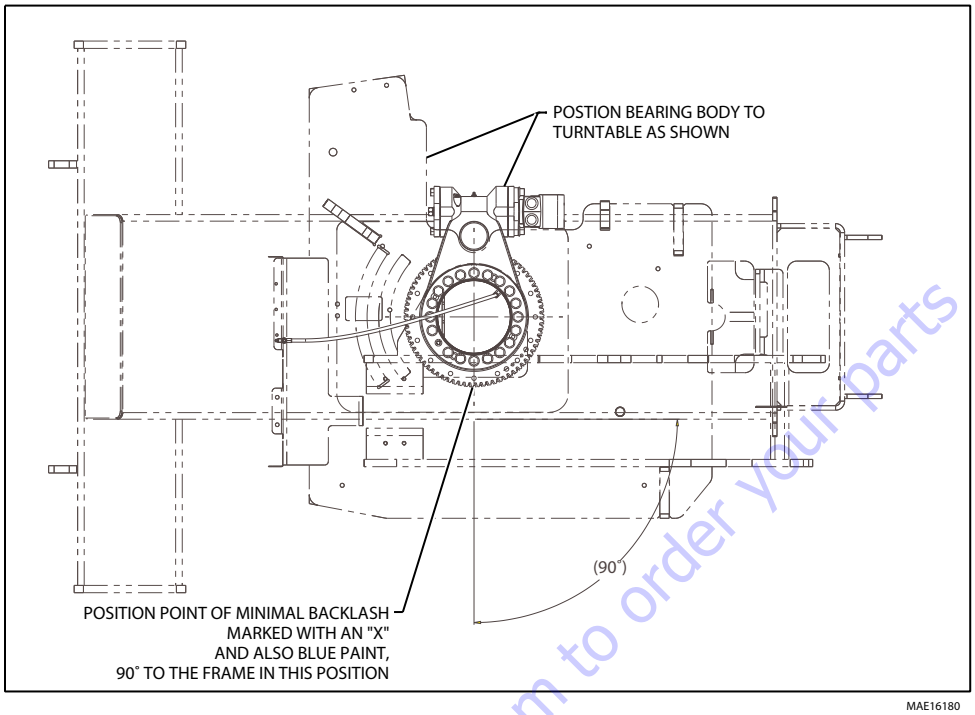


Figure 3-15. Bearing Placement

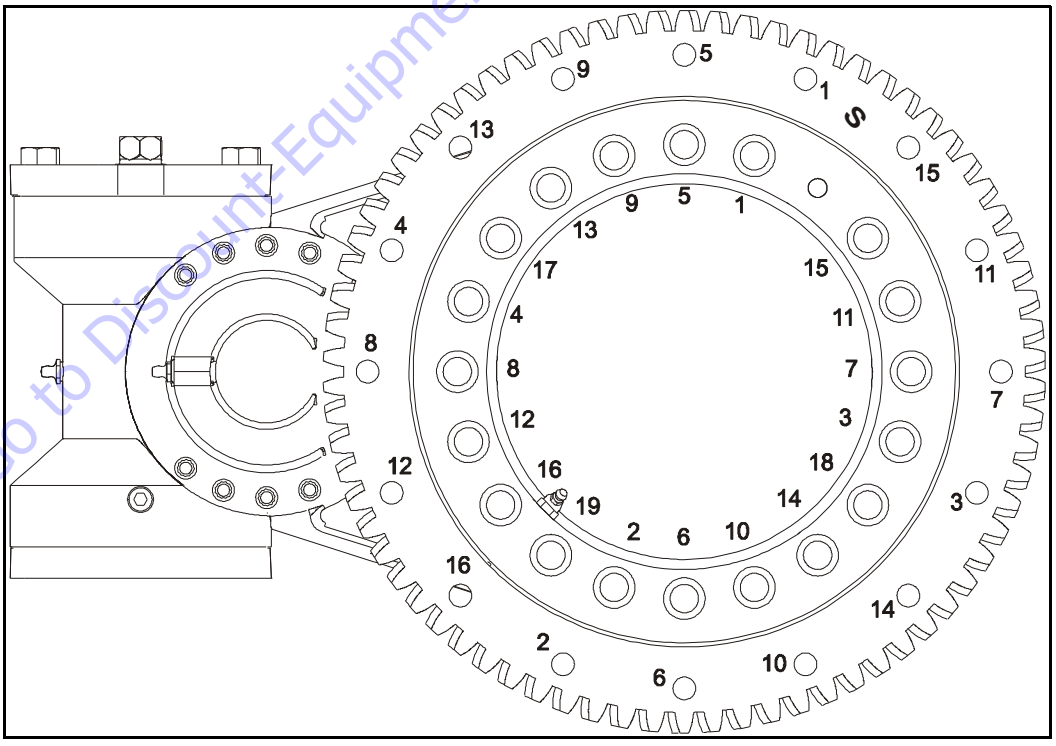


Figure 3-16. Swing Bearing Torque Sequence

Disassembly

The servicing of these units requires a press, a 5/16" 12 point socket, a 7/16" socket, a ¾" socket, torque wrench (80 lb-ft), steel hammer, soft face hammer, bearing puller (external and internal), large flat blade screw driver. Also needed are a shim and seal kit (available from the JLG Parts Department), ¾" steel rod at least 10" long, Threadlocking Compound #515, Mobil SHC 007 grease, Mobil SHC 460 grease, Medium Strength Threadlocking Compound for bolts, and any replacement parts.

1. Remove the swing bearing assembly from the machine.
2. To remove the slew ring (14), remove two 1/4" (5) bolts and washers (1) that hold the slew ring to the housing.
3. Remove four #6 machine screws (13) that are located on the cover plate (19) immediately in front of the Pinion (21).
4. Remove eight 5/16" 12 point capscrews (4) from gear/pinion cap (18). Pry cap from housing. Cover plate (19) will come off with cap. Note where sealant is on Cover and plate so when assembling can put sealant in same place. Note number and color of shims (26) between cap and housing. Remove 6 small screws (13) from cover plate. Pry cover plate (19) from cap (18) and discard cover plate. Note number and color of shims between cover plate and cap.
5. Remove Pinion and Gear assembly (15, 16, 17, 21, 23, 24, and 31) from housing. These lift directly upward from the housing.
6. Disassemble pinion and gear assembly using a press. Support worm gear (31) on press with pinion (21) down allowing room for pinion to be pressed out of gear. Press pinion out of bearing (17) spacer (24) and worm gear (31) Pressing on end of pinion. Remove face seal (23) from face of worm gear (31). Note how the seal is assembled.
7. Remove bearing (15) and Nilos Ring (16) from pinion (21) using external bearing puller or press.
8. Remove motor and motor adapter (22) and shims (28).
9. Remove ¾" bolts (7) from Worm Cap (20) using ¾" socket. Remove shim (29) and seal (9) and discard.
10. Remove worm (32) from housing (25) by pushing worm from motor end using steel rod and hammer. Bearing cup (3) on hex end of worm will be forced out of housing. Once the bearing cup (2) has come out of housing use soft hammer to tap worm on hex end to remove other bearing cup (2) out the other end of housing.
11. Remove both bearings (2) from worm (32) from worm using external bearing puller or press.
12. Bearing cup (17) can be removed from housing (25) by lifting out (this is not a press fit just a close slip fit).
13. Bearing cup (15) can be removed from cap (18) using small pry bar. Or by welding a small bead of weld on internal diameter of cup, this is a press fit.

Assembly

1. Press bearing cup (15) into cap (18).
2. Place bearing cup (17) into housing (25).
3. Put face seal (23) on to hub of worm gear (31) with flap of seal pointing away from gear.
4. Place worm gear (31) on press with face seal up and press pinion (21) into worm gear. Place Nilos Ring (16) on to pinion so that cup shape is up and press bearing (15) on to pinion tight to Nilos Ring.
5. Turn assembly over and place spacer (24) on pinion against gear hub so that large chamfer on I.D. of spacer is against Bronze gear. Press Bearing (17) on to pinion tight to spacer and gear.
6. Place pinion/gear assembly into housing. Place gear cap (18) and shims (26) over gear/pinion assembly to achieve a slight preload on pinion bearings. Remove cap and shims and set shims aside. Install new cover plate (19) on to cap using 6 screws (30) and shims (26) equal to or close to equal to total thickness of shims just set aside. Apply sealant (Threadlocking Compound #515) to both sides of each of these shims and tighten screws take care not to twist these screws off. Clean extra sealant from surfaces of cover plate. Apply a small amount of grease to this flap. Set this assembly to the side.
7. Install bearing (2) on bore end of worm (32) only. This is almost a slip fit, may have to be lightly tapped with soft hammer.
8. Install worm (32) into housing (25), hex end first.
9. On bore end of worm, install bearing cup (2) into worm bore of housing. Also on bore end of worm (32) install motor adapter (22) and 1 shim (28 yellow) to housing using ¾-13 x 1" bolts (6) and sealant. Torque to 75 ft. lbs. (3.1 Nm) (these bolts will be replaced with motor bolts when motor is mounted).
10. Install bearing cone (2) on hex end of worm (32). Place bearing cup (2) over bearing and lightly tap cup into bore using soft hammer.
11. Install worm cap (20) using proper shims (29) to achieve 0.000 to 0.001" (0.0000 to 0.0254 mm) end play. Apply Medium Strength Threadlocking Compound to end of ¾-13 x 1.25" grade 5 bolts (7) and Threadlocking Compound #515 sealant to shims. Torque bolts to 75 ft. lbs. (3.1 Nm).
12. Place pinion/gear assembly into housing so gear teeth mesh with worm gear teeth. May have to turn worm or gear set by hand to achieve this.
13. Apply Threadlocking Compound #515 to surfaces of housing where cap assembly will touch. This includes the vertical surfaces.
14. Place gear cap assembly and shims set aside in step 6, over pinion assembly.
15. Apply Medium Strength Threadlocking Compound to end of eight 5/16" 12 point screws (4) and torque to 20 ft. lbs. (0.84 Nm).
16. Install 4 small screws (30) through cover plate (18) and into housing (25) tighten screws take care not the twist these screws off.
17. Install seal (9) in worm cap at hex end of worm.
18. Install slew ring (14) using two 1/4" bolts (5) and washer (1). Adjust backlash with pinion to 0.008/0.012" (0.203/0.305 mm) and torque bolts to 10 ft. lbs. (0.42 Nm).
19. Fill unit with SHC 007 grease and grease pinion bearing (15) thru fitting (11) with Mobil SHC 460 grease.

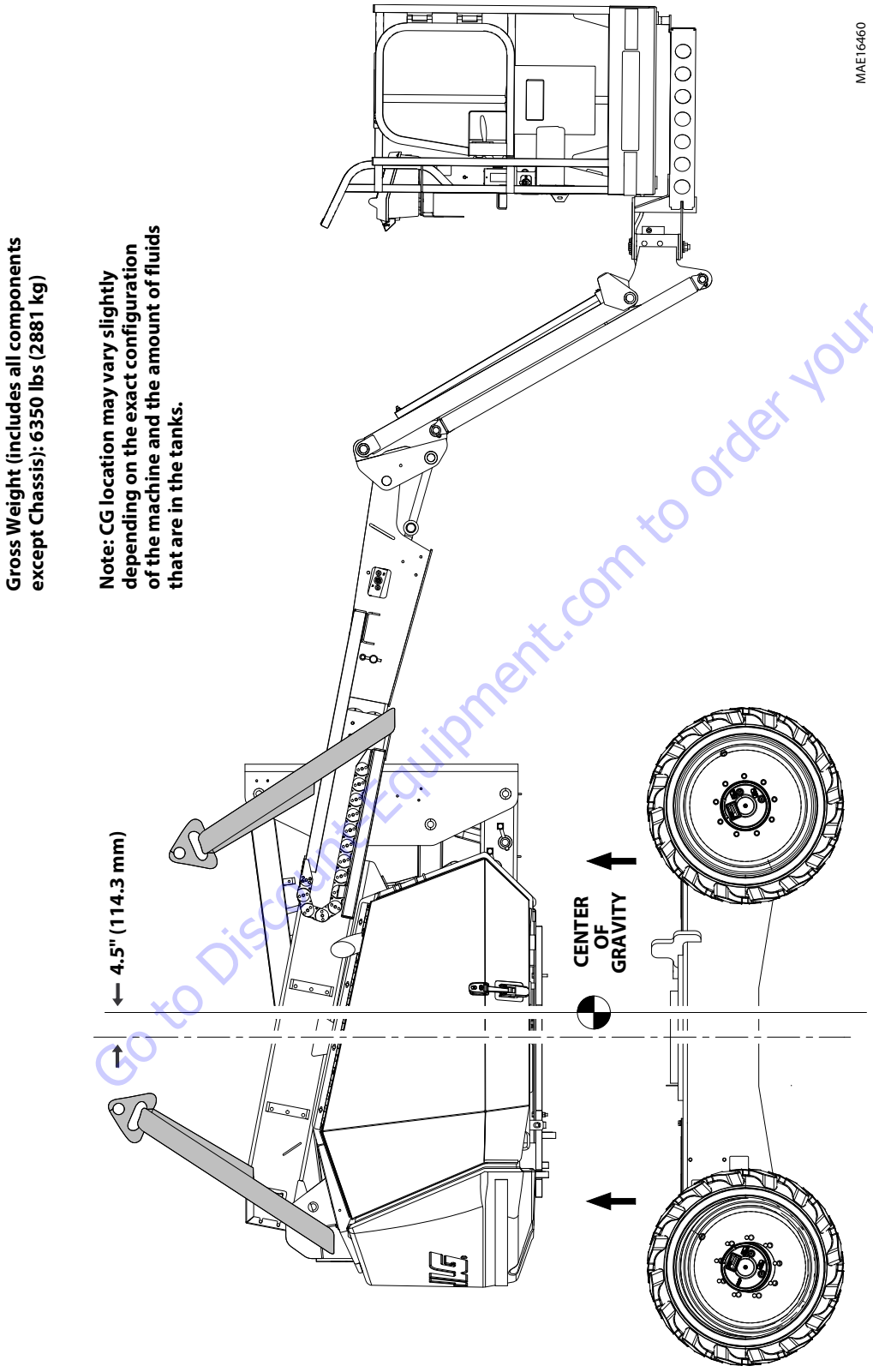
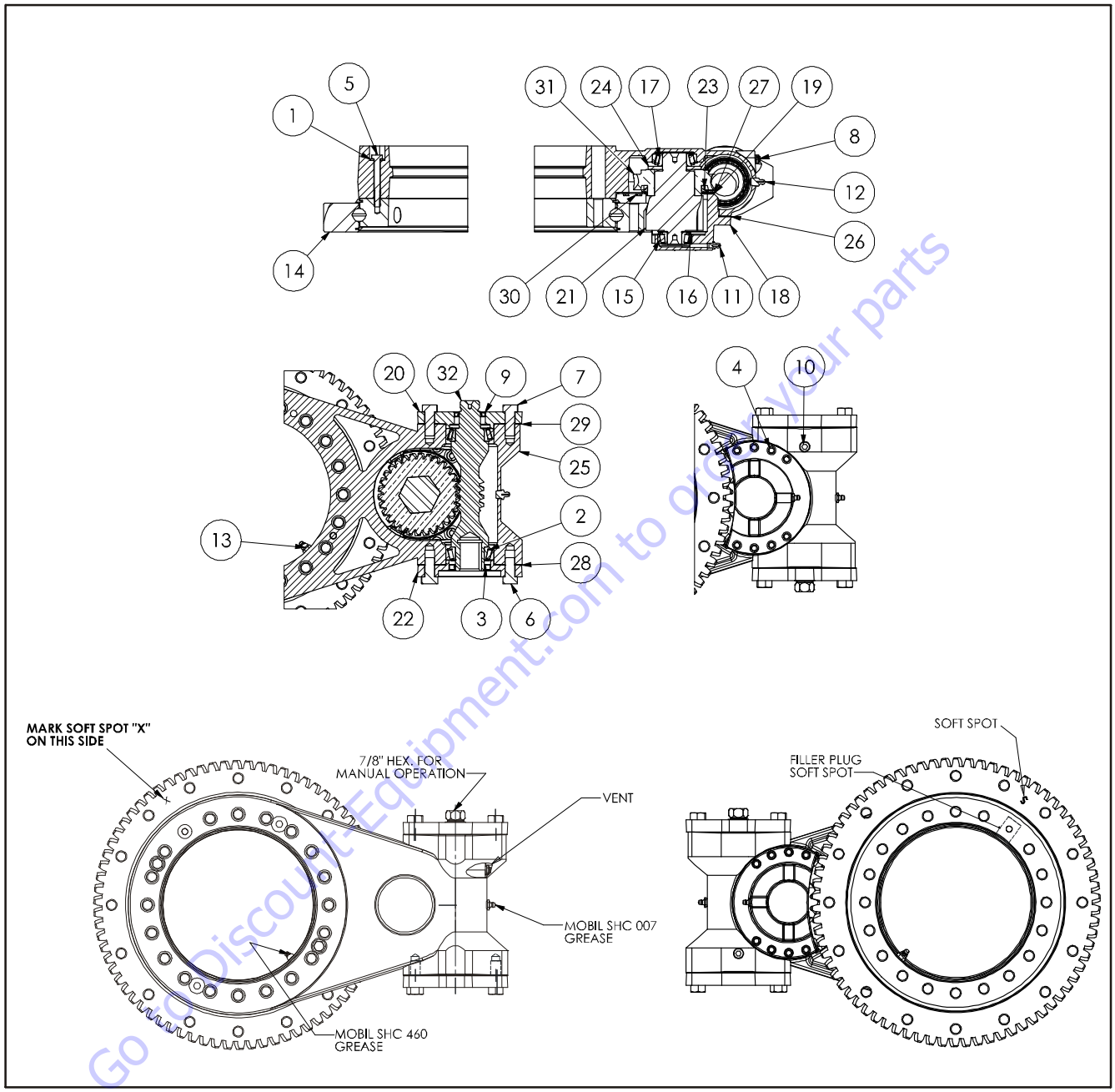
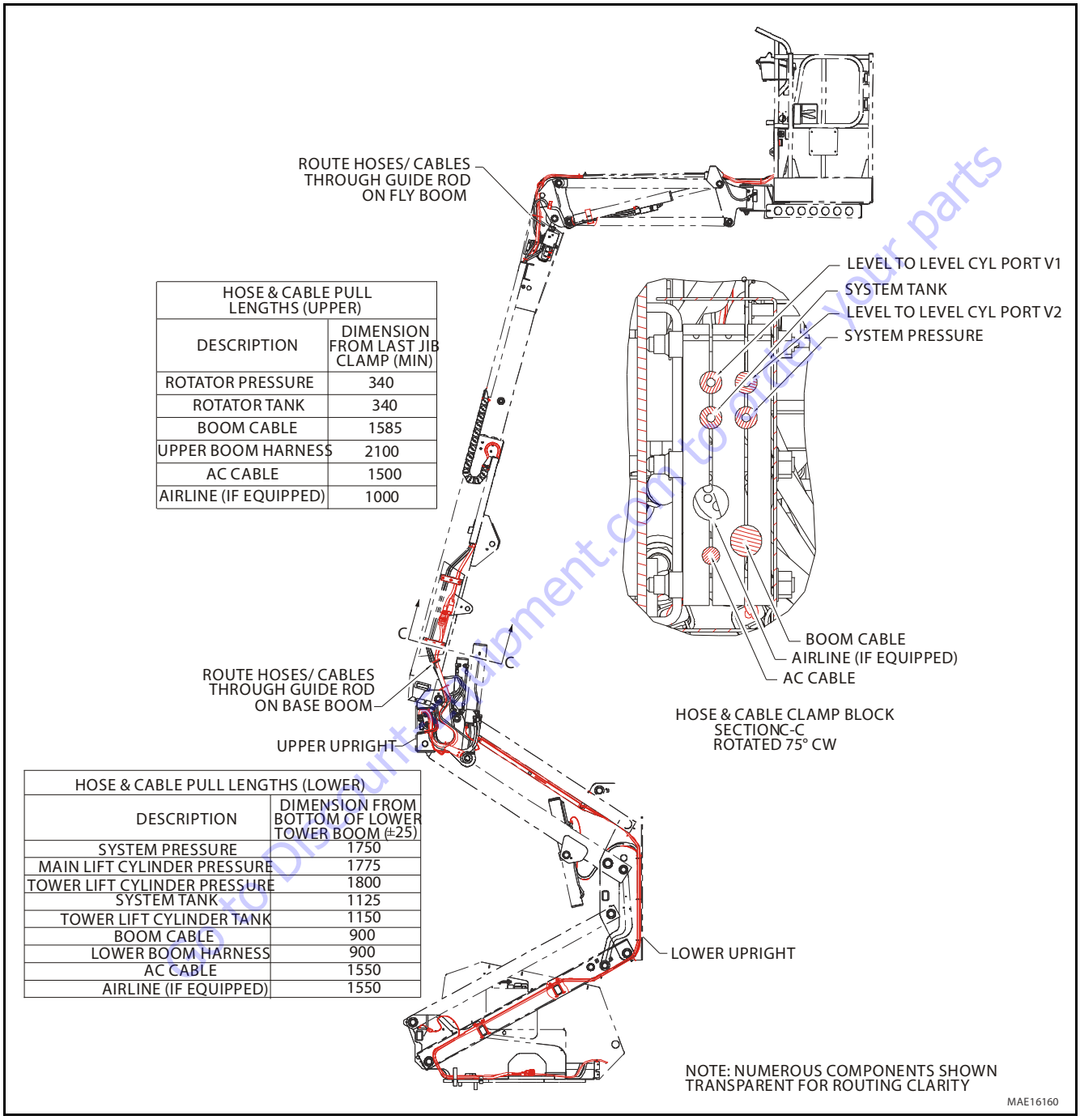


Figure 3-17. Swing Bearing Removal



1. Washer
2. Bearing
3. Oil Seal
4. Capscrew
5. Bolt
6. Bolt
7. Bolt
8. Pressure Vent
9. Oil Seal
10. Pipe Plug
11. Grease Fitting
12. Grease Fitting
13. Grease Fitting
14. Slew Ring
15. Bearing
16. Grease Ring
17. Bearing
18. Gear Cap
19. Cover Plate
20. Worm Cap
21. Output Pinion
22. Motor Adapter
23. Face Seal
24. Washer Spacer
25. Housing
26. Cap Shim
27. Cover Shim
28. Gasket
29. Gasket
30. Screw
31. Worm Gear
32. Worm

Figure 3-18. Swing Gear Assembly



HOSE & CABLE PULL LENGTHS (UPPER)	
DESCRIPTION	DIMENSION FROM LAST JIB CLAMP (MIN)
ROTATOR PRESSURE	340
ROTATOR TANK	340
BOOM CABLE	1585
UPPER BOOM HARNESS	2100
AC CABLE	1500
AIRLINE (IF EQUIPPED)	1000

HOSE & CABLE PULL LENGTHS (LOWER)	
DESCRIPTION	DIMENSION FROM BOTTOM OF LOWER TOWER BOOM (±25)
SYSTEM PRESSURE	1750
MAIN LIFT CYLINDER PRESSURE	1775
TOWER LIFT CYLINDER PRESSURE	1800
SYSTEM TANK	1125
TOWER LIFT CYLINDER TANK	1150
BOOM CABLE	900
LOWER BOOM HARNESS	900
AC CABLE	1550
AIRLINE (IF EQUIPPED)	1550

Figure 3-19. Cable Installation and Identification - Sheet 1 of 8

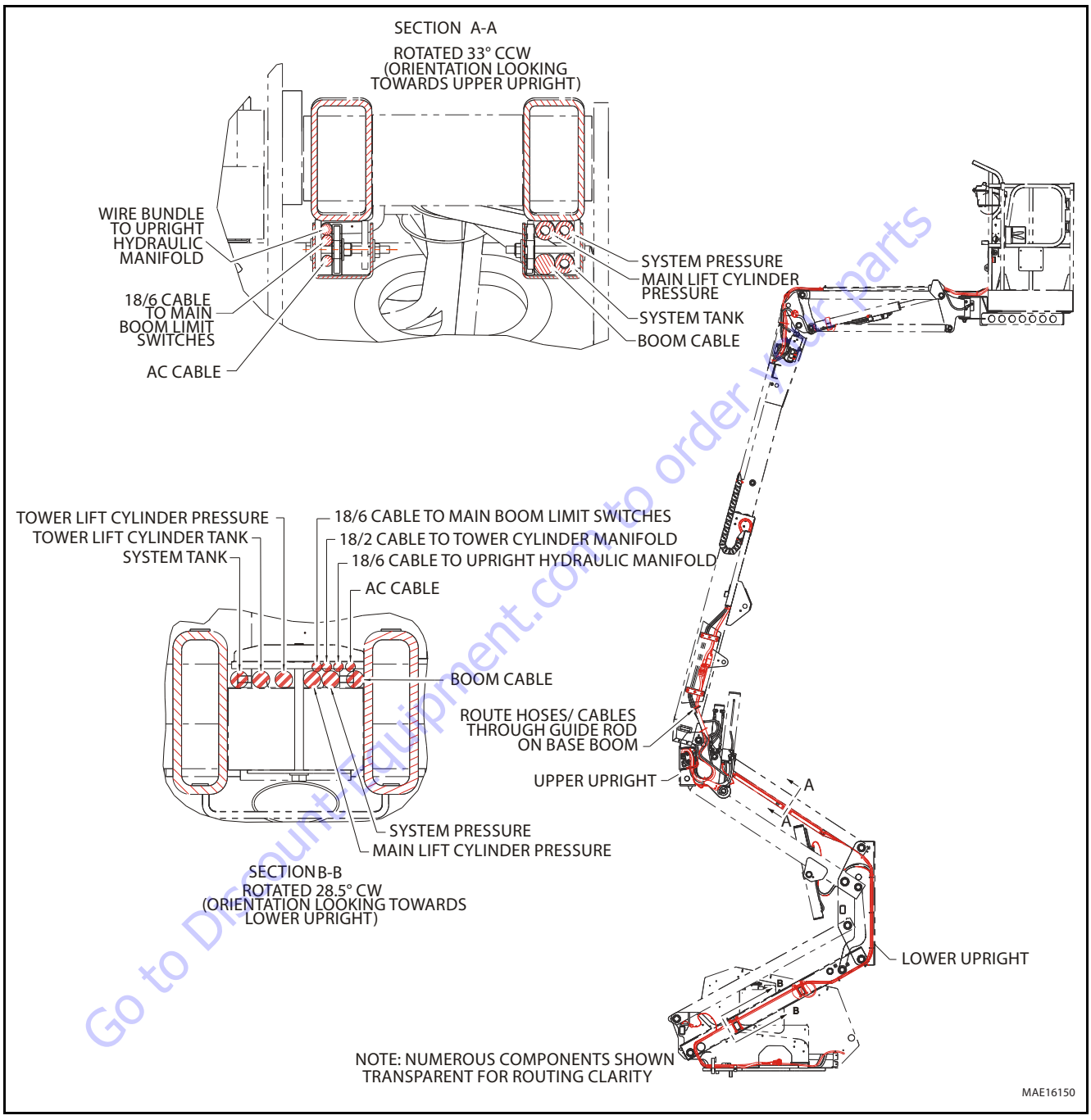


Figure 3-20. Cable Installation and Identification - Sheet 2 of 8

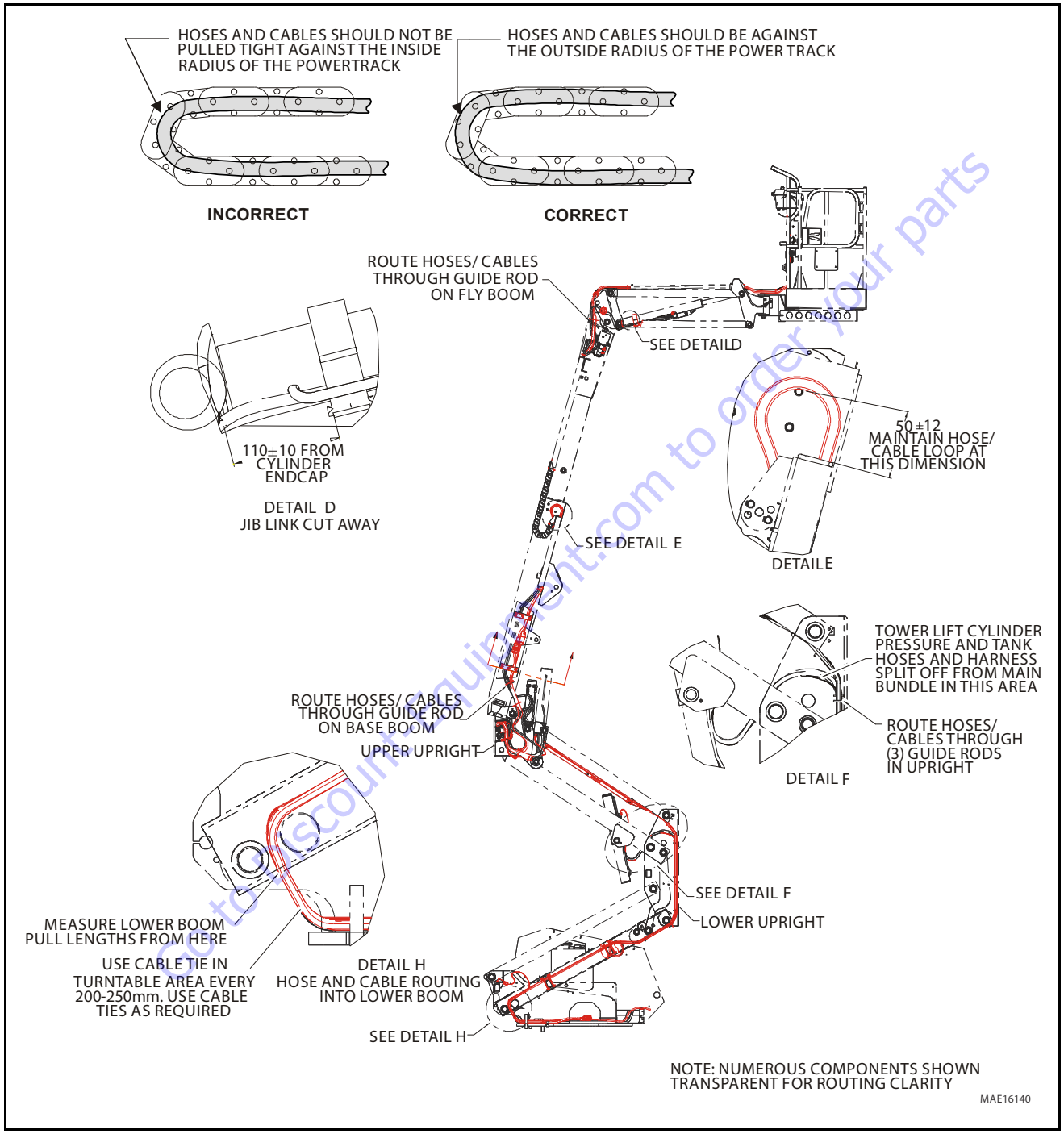
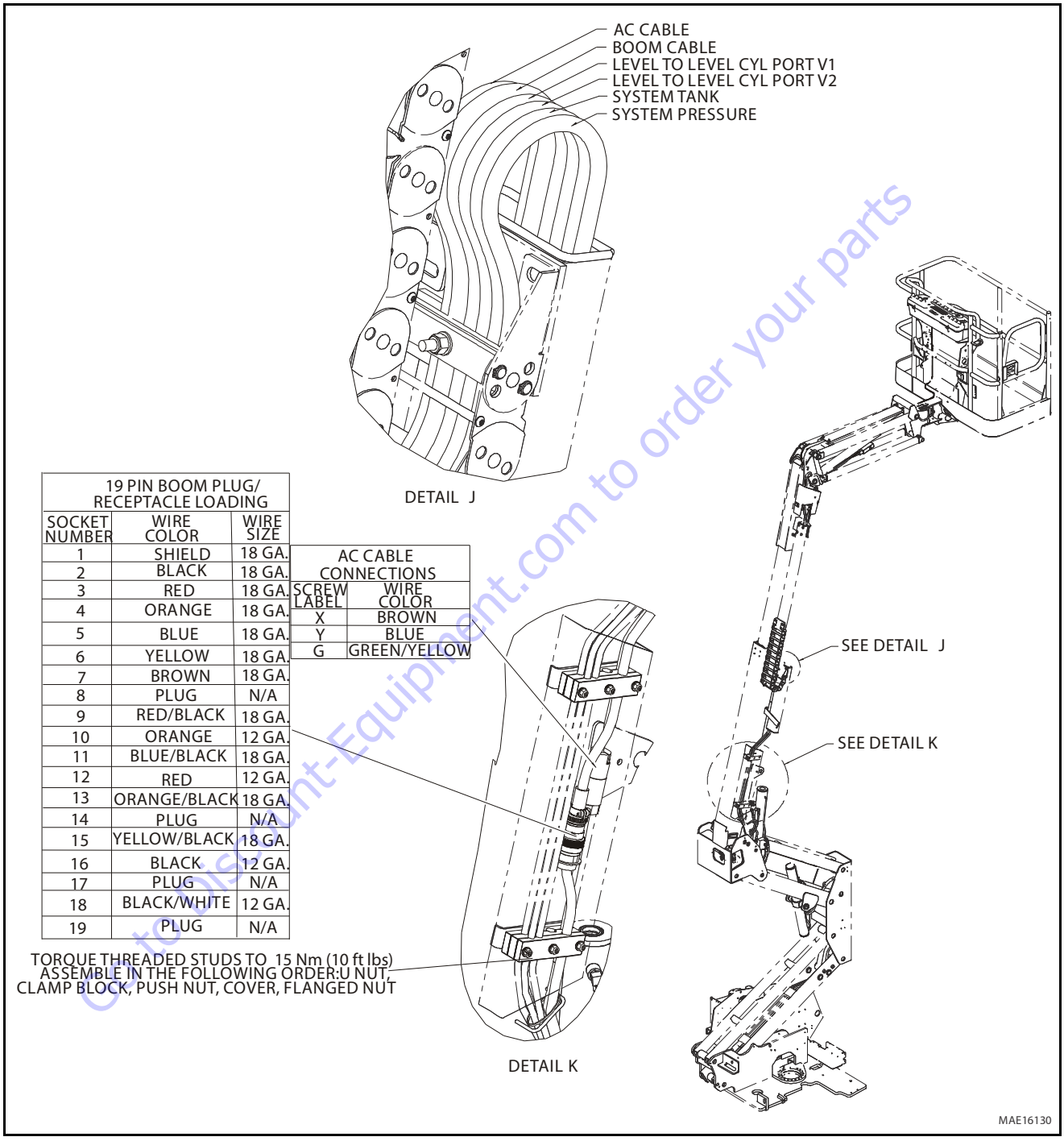


Figure 3-21. Cable Installation and Identification - Sheet 3 of 8



19 PIN BOOM PLUG/ RECEPTACLE LOADING		
SOCKET NUMBER	WIRE COLOR	WIRE SIZE
1	SHIELD	18 GA.
2	BLACK	18 GA.
3	RED	18 GA.
4	ORANGE	18 GA.
5	BLUE	18 GA.
6	YELLOW	18 GA.
7	BROWN	18 GA.
8	PLUG	N/A
9	RED/BLACK	18 GA.
10	ORANGE	12 GA.
11	BLUE/BLACK	18 GA.
12	RED	12 GA.
13	ORANGE/BLACK	18 GA.
14	PLUG	N/A
15	YELLOW/BLACK	18 GA.
16	BLACK	12 GA.
17	PLUG	N/A
18	BLACK/WHITE	12 GA.
19	PLUG	N/A

AC CABLE CONNECTIONS	
SCREW LABEL	WIRE COLOR
X	BROWN
Y	BLUE
G	GREEN/YELLOW

Figure 3-22. Cable Installation and Identification - Sheet 4 of 8

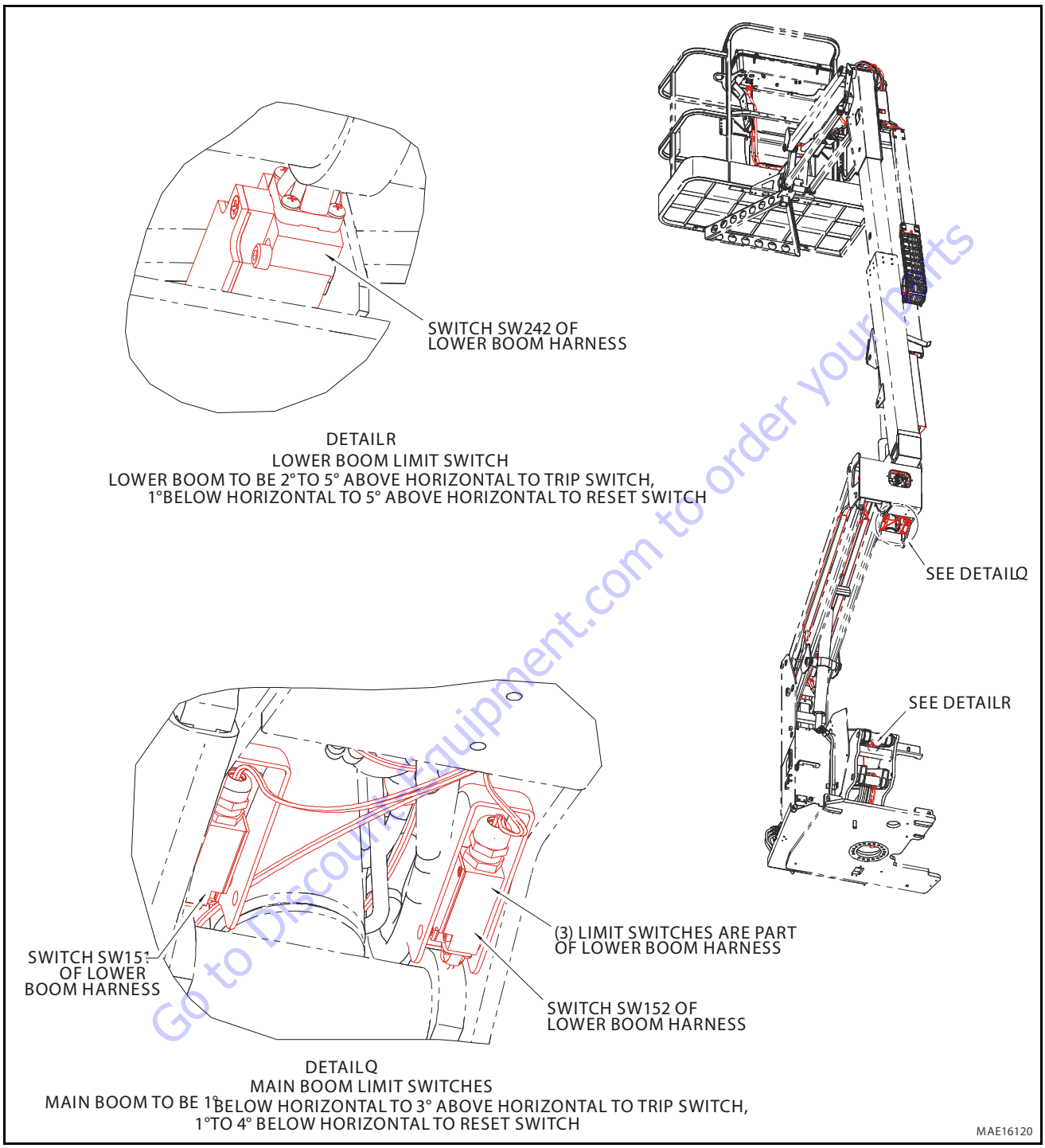


Figure 3-23. Cable Installation and Identification - Sheet 5 of 8

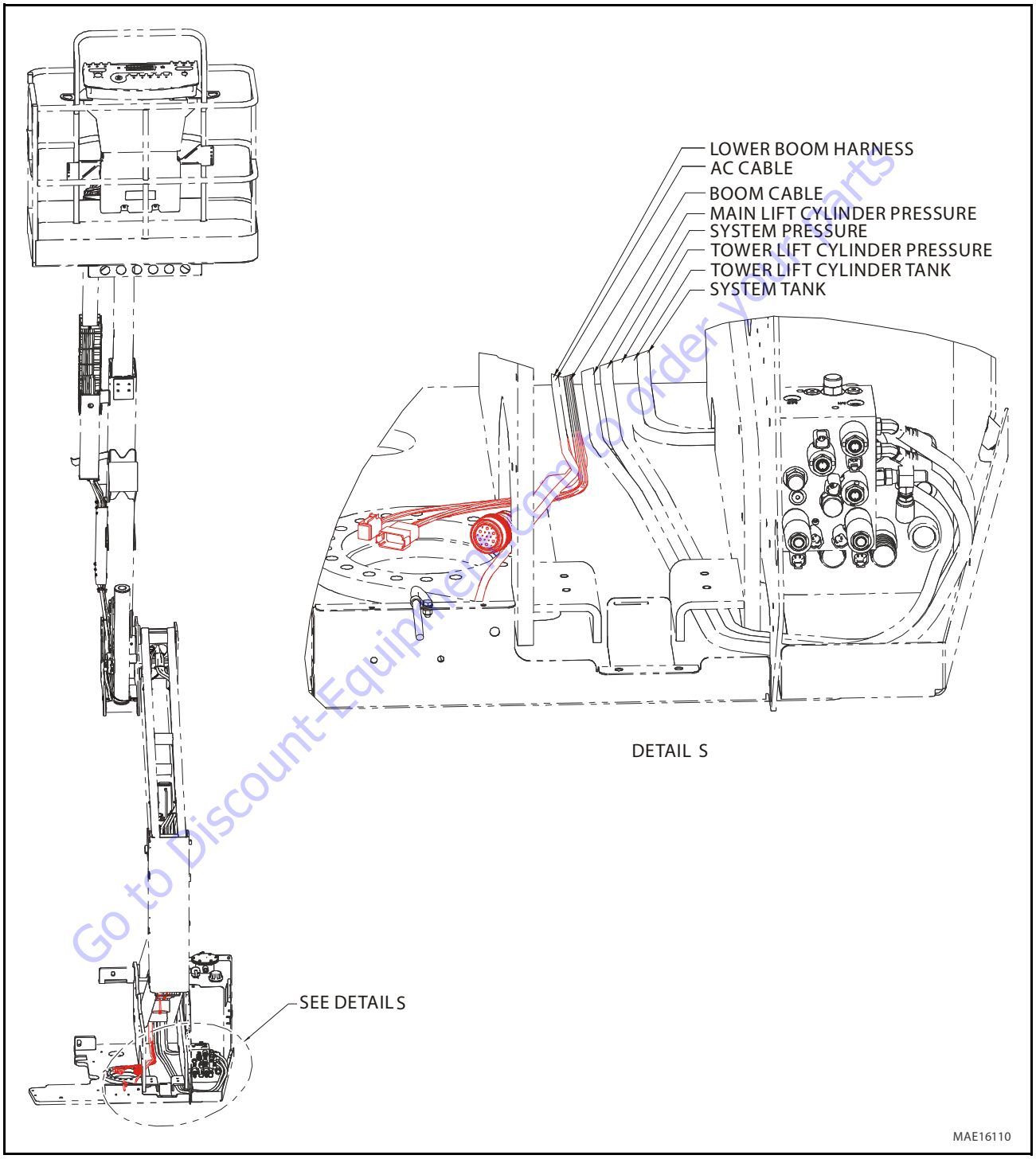


Figure 3-24. Cable Installation and Identification - Sheet 6 of 8

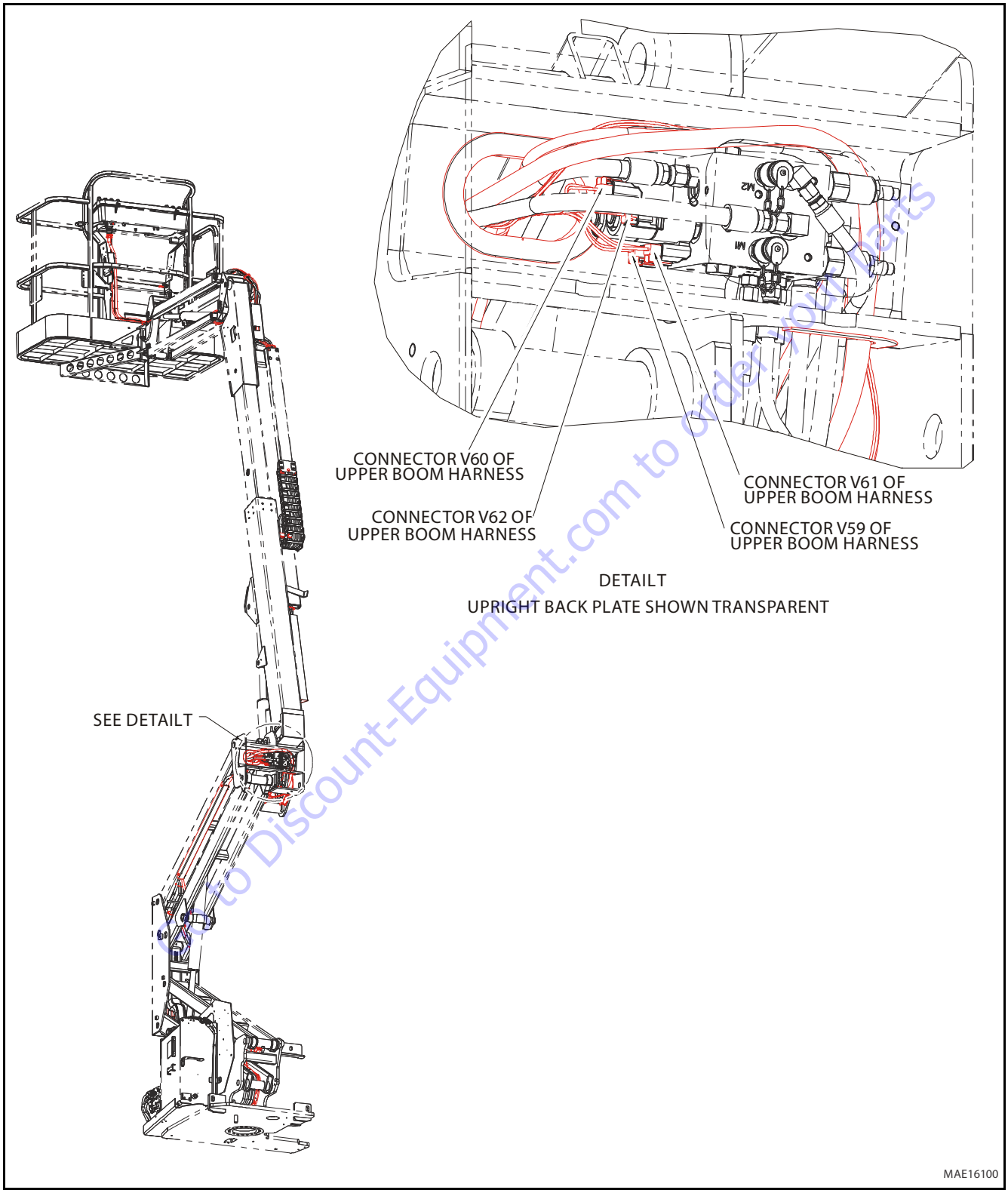


Figure 3-25. Cable Installation and Identification - Sheet 7 of 8

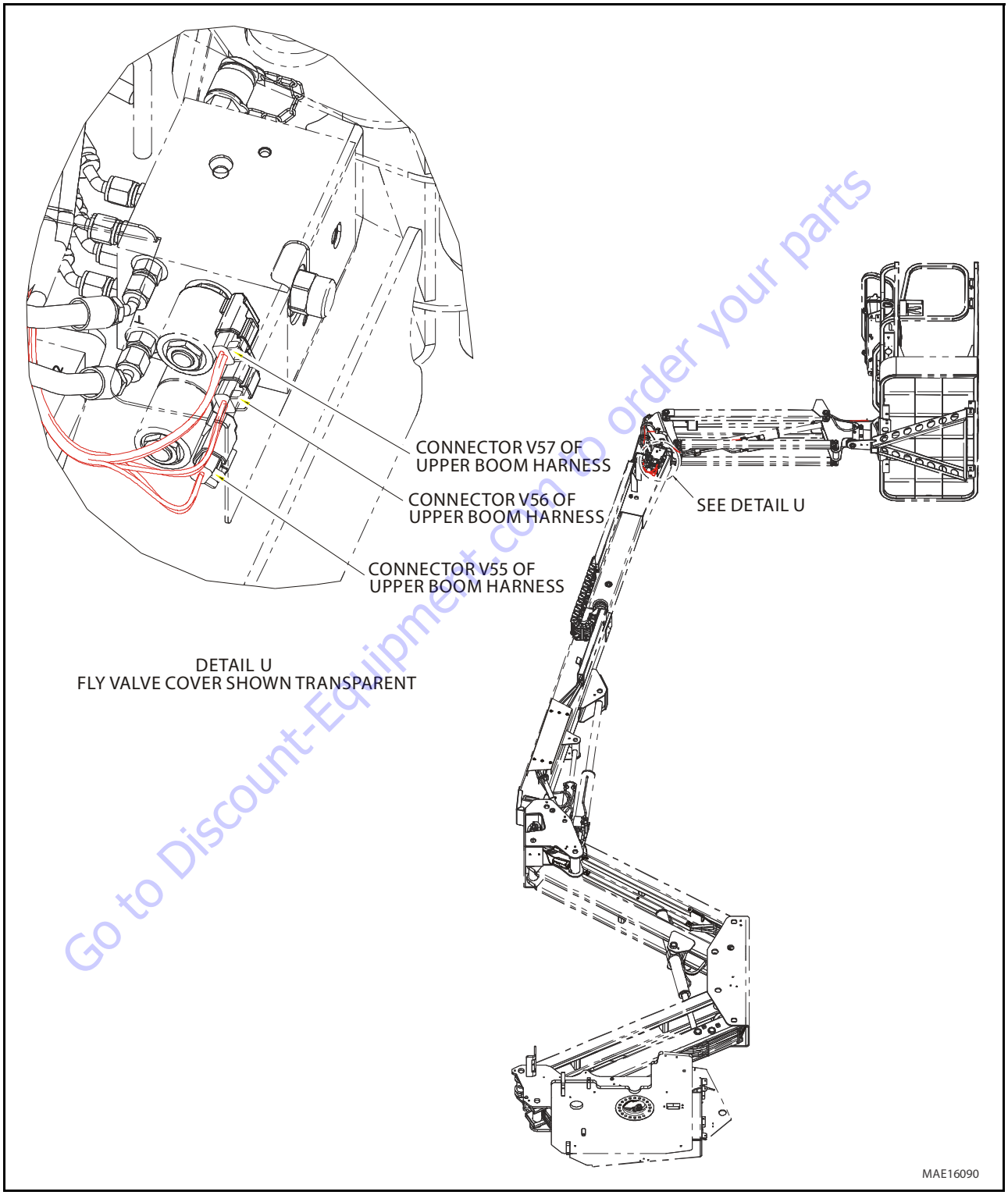


Figure 3-26. Cable Installation and Identification - Sheet 8 of 8

3.11 ENGINE OPERATING STATES

The Engine Operating State is determined by the Ground Module. There are four different Engine Operating States which include;

- Engine Stopped
- Engine Cranking
- Engine Starting
- Engine Running

NOTE: *Refer Operation and Safety Manual for engine starting procedure.*

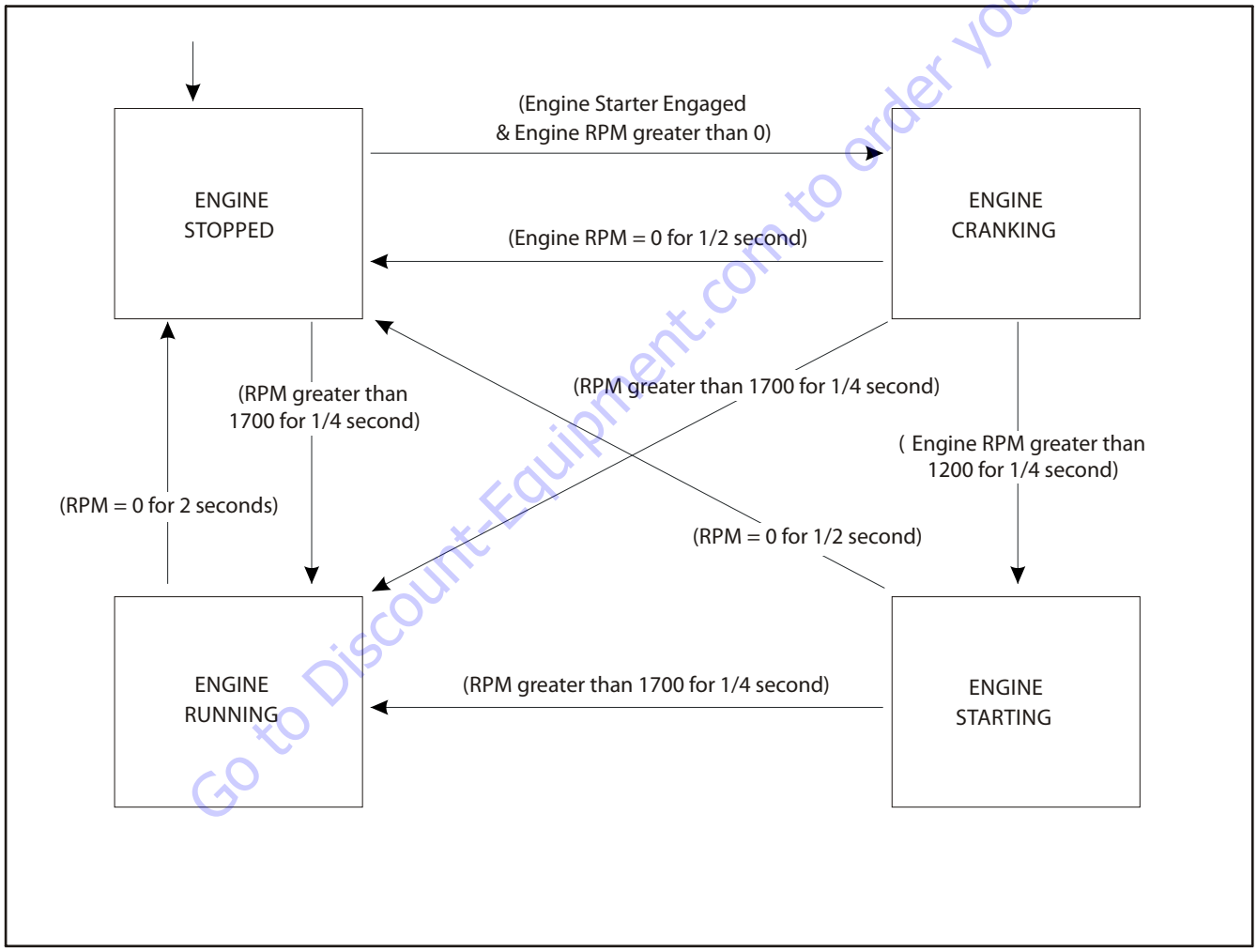
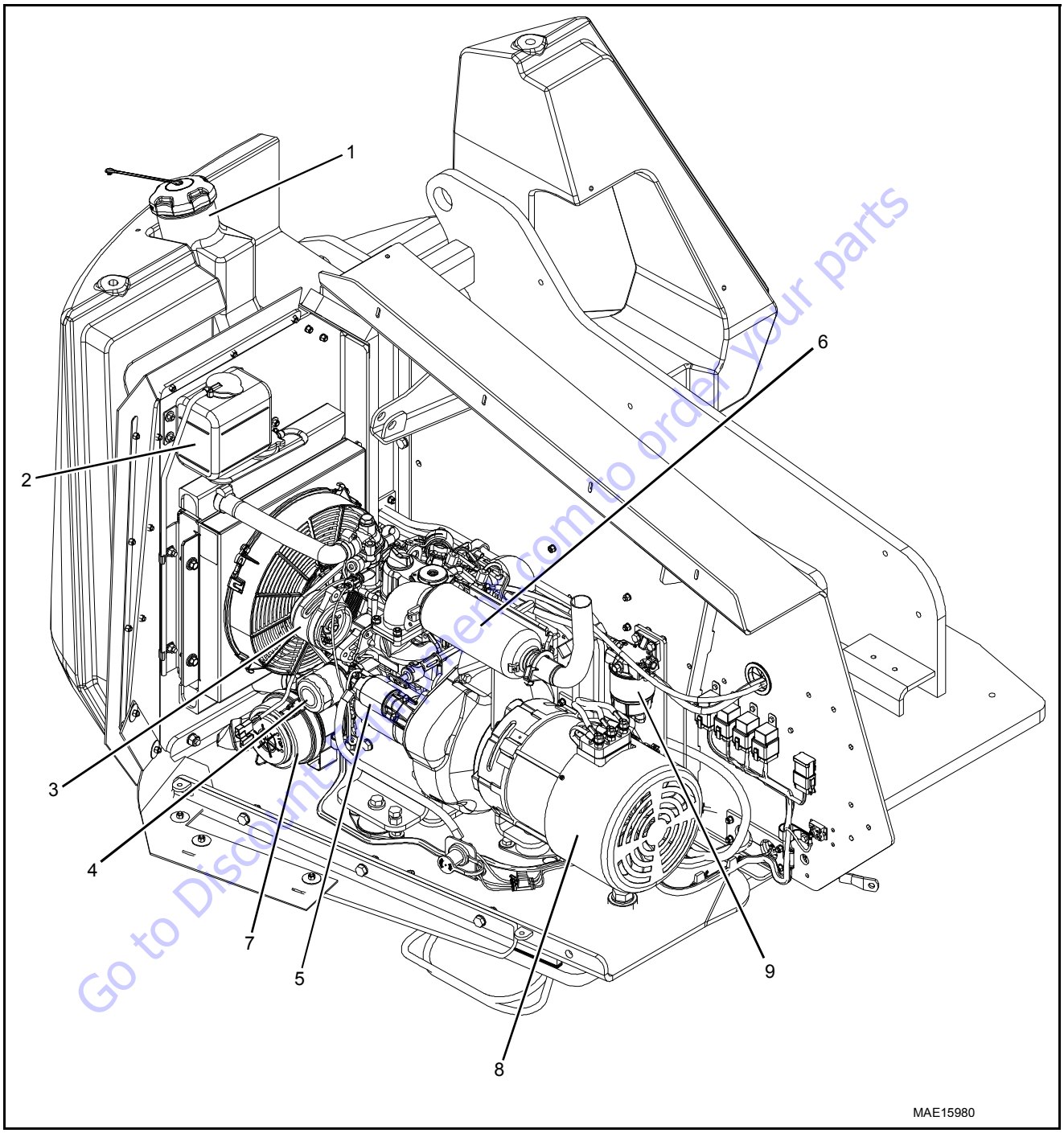


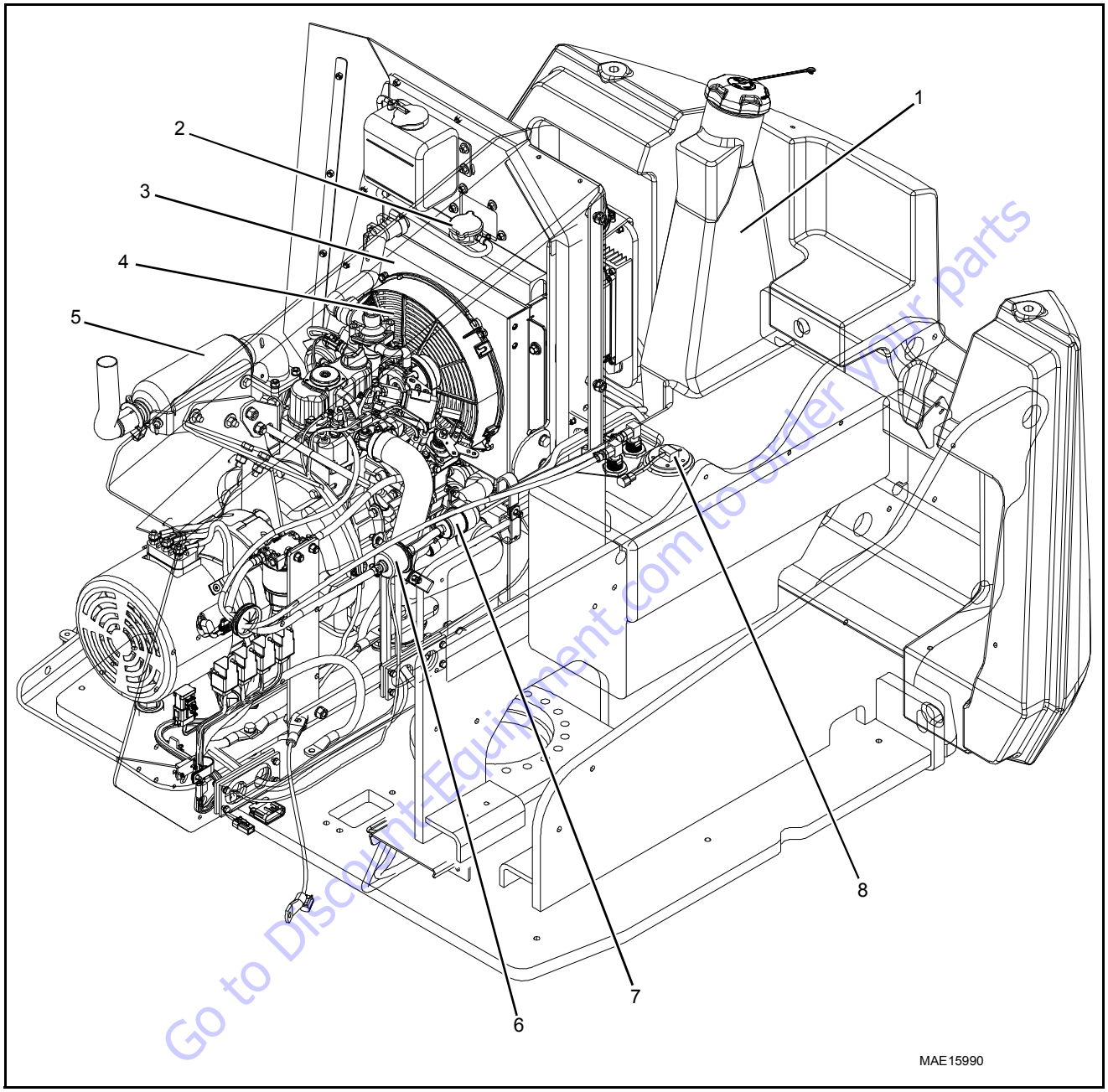
Figure 3-27. Engine Operating State Diagram

3.12 KUBOTA ENGINE



1. Fuel Tank
2. Coolant Recovery Tank
3. Alternator
4. Oil Filter
5. Starter
6. Muffler
7. Air Filter
8. Generator
9. Fuel Filter/ Water Separator

Figure 3-28. Kubota Engine - Sheet 1 of 2

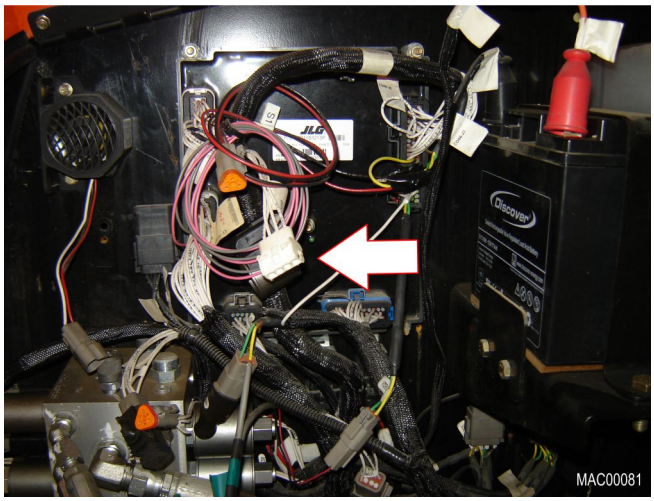


1. Fuel Tank
2. Pressure Cap
3. Radiator
4. Electric Fan
5. Muffler
6. Fuel Pump
7. Fuel Pre Filter
8. Fuel Level Sensor

Figure 3-29. Kubota Engine - Sheet 2 of 2

Retrieving Engine Hours

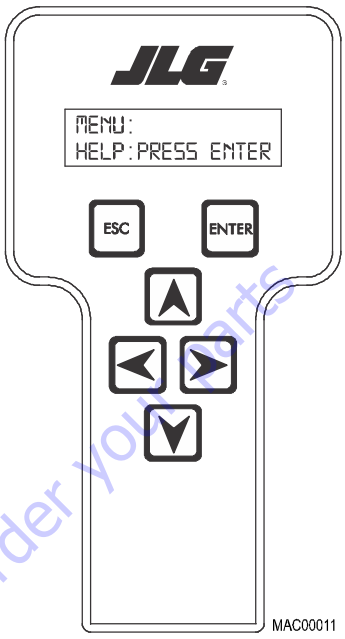
1. Plug the analyzer into the connector inside the Ground control box.



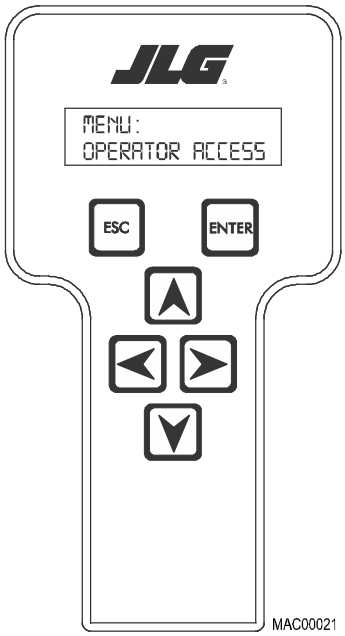
2. Position the Platform/Ground select switch to the Ground position.

3. Pull out the Emergency Stop Switch.

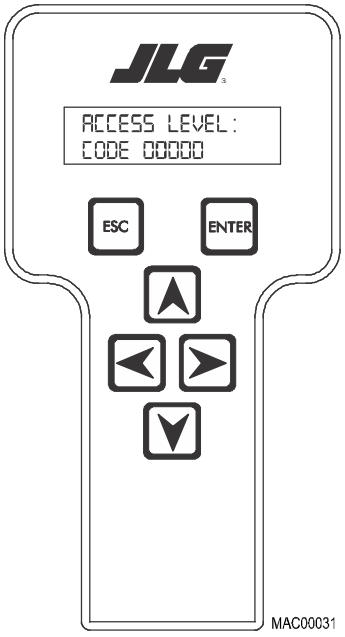
4. The analyzer screen should read:



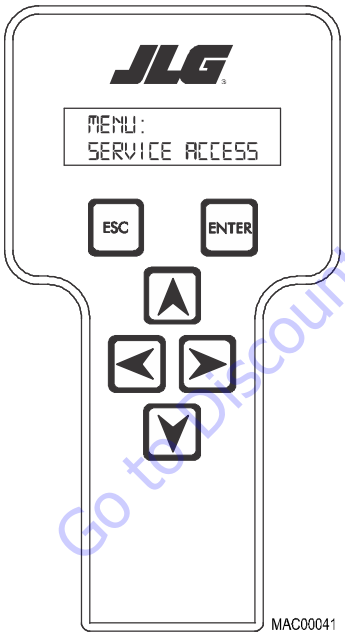
5. Use the arrow button to reach MENU: OPERATOR ACCESS.



6. Press Enter. The screen will read:

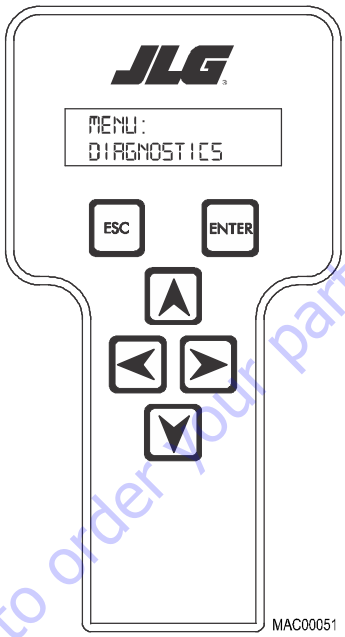


7. Using the Up and Down Arrow Keys, enter Access Code, 33271. Press Enter. The screen will read:

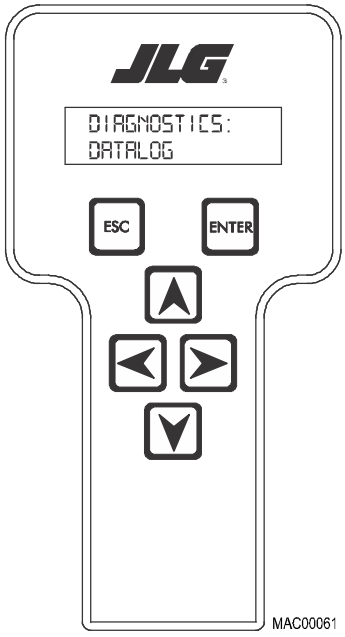


8. Press Enter. Use the right Arrow key to reach CALIBRATIONS. Press Enter.

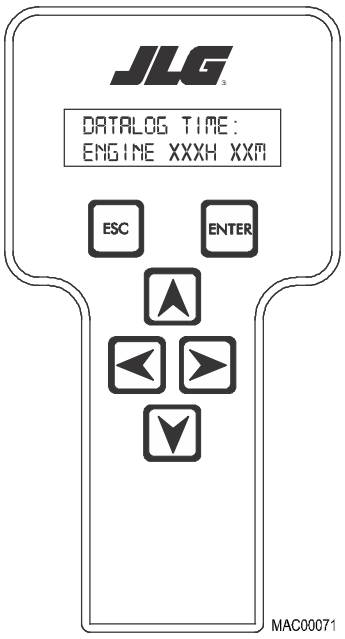
9. Use the arrow keys to scroll to Diagnostics. The screen will read:



10. Using the arrow keys, scroll to Diagnostics Datalog The screen will read:



11. Press Enter. Scroll to Datalog Time: Engine. The screen will read:



12. After recording the engine hours, press in the Emergency stop switch, place the Platform/ Ground Selector Switch in the Off position, and remove the JLG Analyzer.

Fuel Level Sensor

The fuel level sensor is mounted in the fuel tank and consists of a float device guided by a rod. This rod provides a variable resistance to ground which is communicated to the ground module, which in turn, communicates the information to the operator by way of the fuel level indicator on the platform console and the low fuel indicator on the ground console.

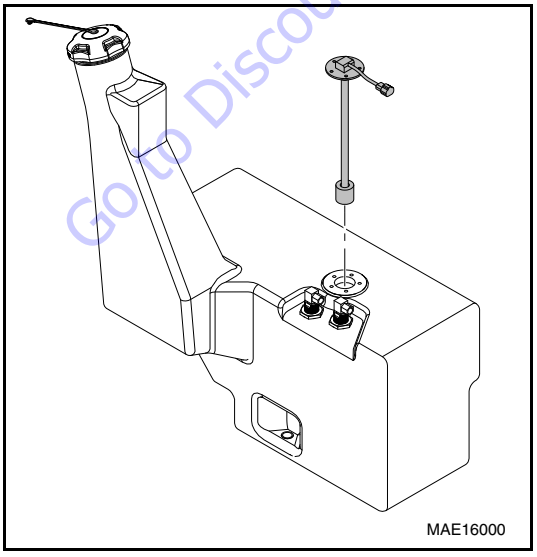


Figure 3-30. Fuel Level Sensor

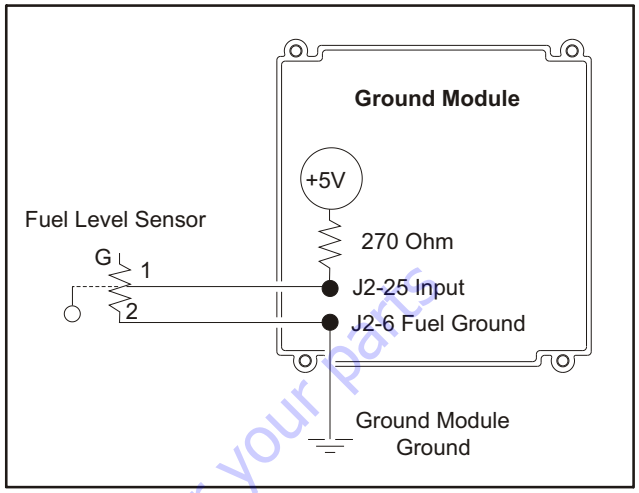


Figure 3-31. Fuel Level Sensor Schematic

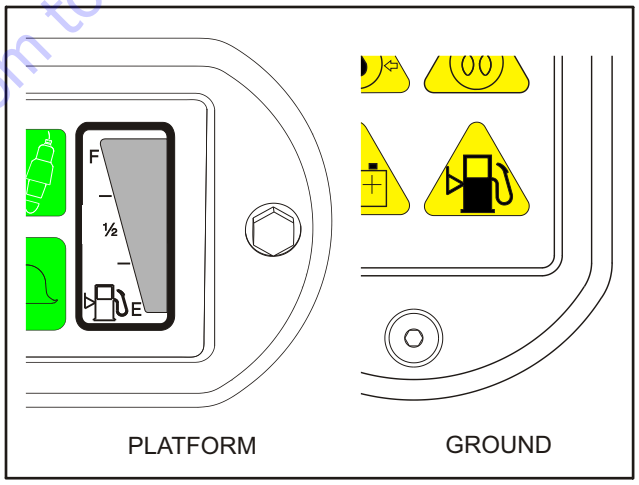


Figure 3-32. Low Fuel Indicators

Coolant Sensor

The coolant sensor operates by providing variable resistance to ground based on coolant temperature.

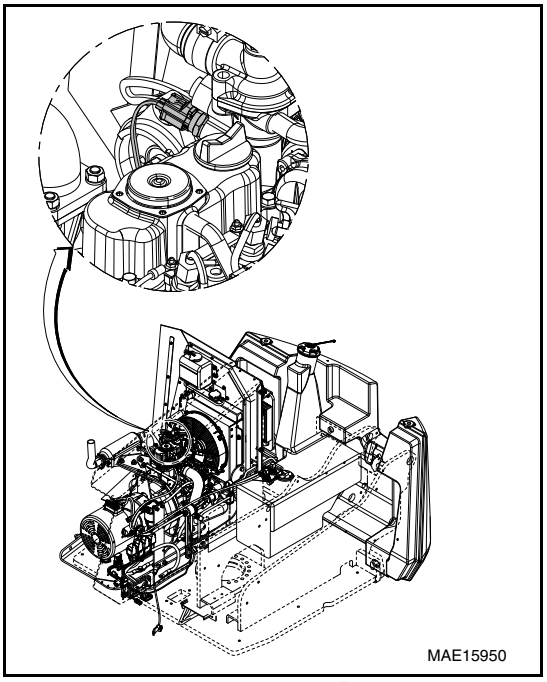


Figure 3-33. Engine Coolant Sensor

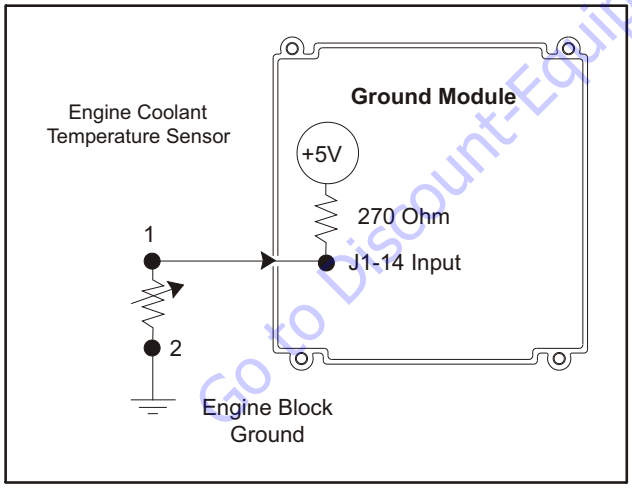


Figure 3-34. Engine Coolant Sensor Schematic

Engine Oil Pressure Switch

The engine oil pressure switch monitors oil pressure and sends an electronic message to the control system. This is accomplished by creating an open electrical circuit for normal oil pressure and a closed electrical circuit for low pressure.

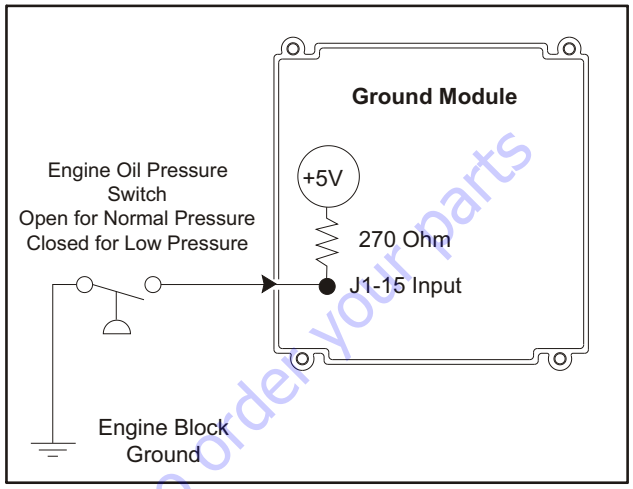


Figure 3-35. Engine Oil Pressure Switch Schematic

Table 3-4. Engine Oil Pressure Switch Conditions

Oil Pressure	Oil Pressure Switch	Voltage at Input
0 - 7 psi (0 - 0.48 Bar)	Closed	0V
Greater than 7 psi (0.48 Bar)	Open	5V

Glow Plugs

The diesel engine has two in-cylinder glow plugs to assist in cold starting. The ground module controls the glow plugs and uses a relay to switch battery current.

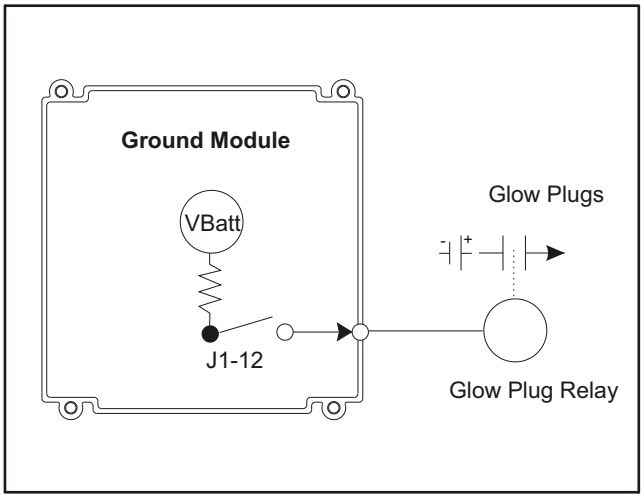


Figure 3-36. Engine Glow Plug Schematic

The Ground Module calculates the length of time the glow plugs are energized prior to startup based upon ambient temperature, engine coolant temperature, and battery voltage. The machine control system monitors the engine coolant and ambient temperature to make an estimate of cylinder preheating requirements. If the coolant temperature is below 50° C (122° F) and the battery has sufficient voltage when control power is turned on, the glow plugs will be automatically fired for a duration that is based on the ambient temperature. During this preheat period, the glow plug indicators will flash. The glow plugs will be turned off before the engine begins to crank. Refer to Table 3-5, Glow Plug Conditions.

Table 3-5. Glow Plug Conditions

Engine Coolant Temperature	Battery Voltage	Ambient Temperature	Pre-Glow Plug State/Time	Start/Run Glow Plug State/Time
Greater than or equal to 122°F (50°C)	--	--	Off	Off
--	Less than 11V	--	Off	Off
Less than 122°F (50°C)	Greater than 11V	Greater than 68°F (20°C)	On for 20 sec.	Engine State = Cranking, Starting or Running: On for 20 sec
Less than 122°F (50°C)	Greater than 11V	Temp Between 23°F and 68°F (-5°C and 20°C)	On for 20 sec.	Engine State = Cranking, Starting or Running: On for 20 sec
Less than 122°F (50°C)	Greater than 11V	Temp Between 5°F and 23°F (-15°C and -5°C)	On for 20 sec.	Engine State = Cranking, Starting or Running: On for 20 sec
Less than 122°F (50°C)	Greater than 11V	Temp Less Than 5°F (-15°C)	On for 20 sec.	Engine State = Cranking, Starting or Running: On for 20 sec

3.13 CHASSIS TILT INDICATOR SYSTEM

The Chassis Tilt Indicator System measures the turntable angle with respect to level ground. The tilt sensor, mounted centrally in the turntable, has two settings: 5.0°/4.0° (depending on market) and 6.0° degrees.

The 5.0°/4.0° angle is set by choosing the desired market selection for the machine (Market based machine setup on the JLG Analyzer) Table 6-2, Machine Configuration Programming Information (Software Version P1.6).

The 5.0°/4.0° angle is used for the purpose of warning the operator by means of the chassis tilt light in the platform display panel. Additionally, when used in conjunction with the Beyond Transport - Drive Speed Cutback System, the tilt sensor will cause an alarm to sound, and drive and extending functions are cut automatically. The operator is responsible for preventing the machine from attaining an unstable position.

The 6° angle is used exclusively for the purpose of automatically slowing drive speed when this angle is reached, and the boom is in Transport position. By default setting, when the boom is in Transport Position, and the chassis is at or above 6°, the drive and steer system will automatically switch into Max Torque mode that cuts back at speed. Other functions will automatically switch into creep mode. The control system responds to indicated angle readings 0.25 degree smaller than the required angles to account for calibration and sensor variation.

3.14 FUEL RESERVE / CUT-OUT SYSTEM

The Fuel Shutoff System senses when the fuel level is getting low and automatically shuts the engine down before the fuel tank is emptied. When the fuel level gets below ≈ 1.3 gallons, the fault light will flash at the platform controls and the control system will report fault 0/0 "FUEL LEVEL LOW – ENGINE SHUTDOWN" on the analyzer. There is an analyzer personality setting in the control system to control the machines response to this fault. If this personality setting is set to "STOP", the machine will remain in this fault mode until the fuel level is returned to a level above ≈ 1.3 gallons. If the personality setting is set to "ONE START", the operator will be able to start the engine and run for 2 minute. After 2 minute, the engine will shut off for a second time and the machine will return to the "Engine Shutdown" fault mode. The machine will then stay in this mode until the fuel level is returned to a level above 1.3 gallons. If the personality setting is set to "RESTART", the operator will be able to start the engine and run for 2 minute. After 2 minute, the engine will shut off again and the machine which can be restarted immediately if desired.

3.15 HOT WEATHER OPERATION

The machine control system having multiple sensors to monitor temperatures of traction motor, traction module, battery, generator module, and engine coolant.

If the ambient temperature is more than the respective pre-set values, distress signals will be displayed. Machine will cut back in power available and eventually be disabled if high component temperatures persistent. This will prevent permanent damages to power components.

Hot weather package option (if the ambient temperature is more than the 35°C (95°F)) consists of a electrical cooling fan installed inside the chassis to provide additional air flow to the traction module compartment to cool down the components inside.

3.16 COLD WEATHER OPERATION

The battery capacity will decrease as ambient temperature drops. Typically, the battery will decrease to 50% of its specification capacity when temperature is around -20°C / -4°F, even though the analyzer or battery gauge may still shows 100% SoC.

Under low ambient temperature, charging the machine with wall AC power will may not return the battery pack to 100% charge even though the Delta stops charging automatically and displays a green light. It is recommended to charge the machine in warmer ambient conditions. The optional cold weather package could improve the charging capability under this condition.

When the traction motor temperature is below 0°C / 32°F, the software will reduce power available for driving to prevent large current spikes from tripping the fuses. When the traction motor temperature back to normal due to driving, the power level will be back to normal too.

This machine offers Cold Weather Package Option for working environments below freezing temperature. With Cold Weather Package and proper operational practices, machine shall be operational properly down to -20°C / -4°F, though may require considering below general guidelines in operation and maintenances.

Operation below -20°C / -4°F is not recommended at this point of time due to concerns on batter capacity decrease and drive hub temperature range of operation.

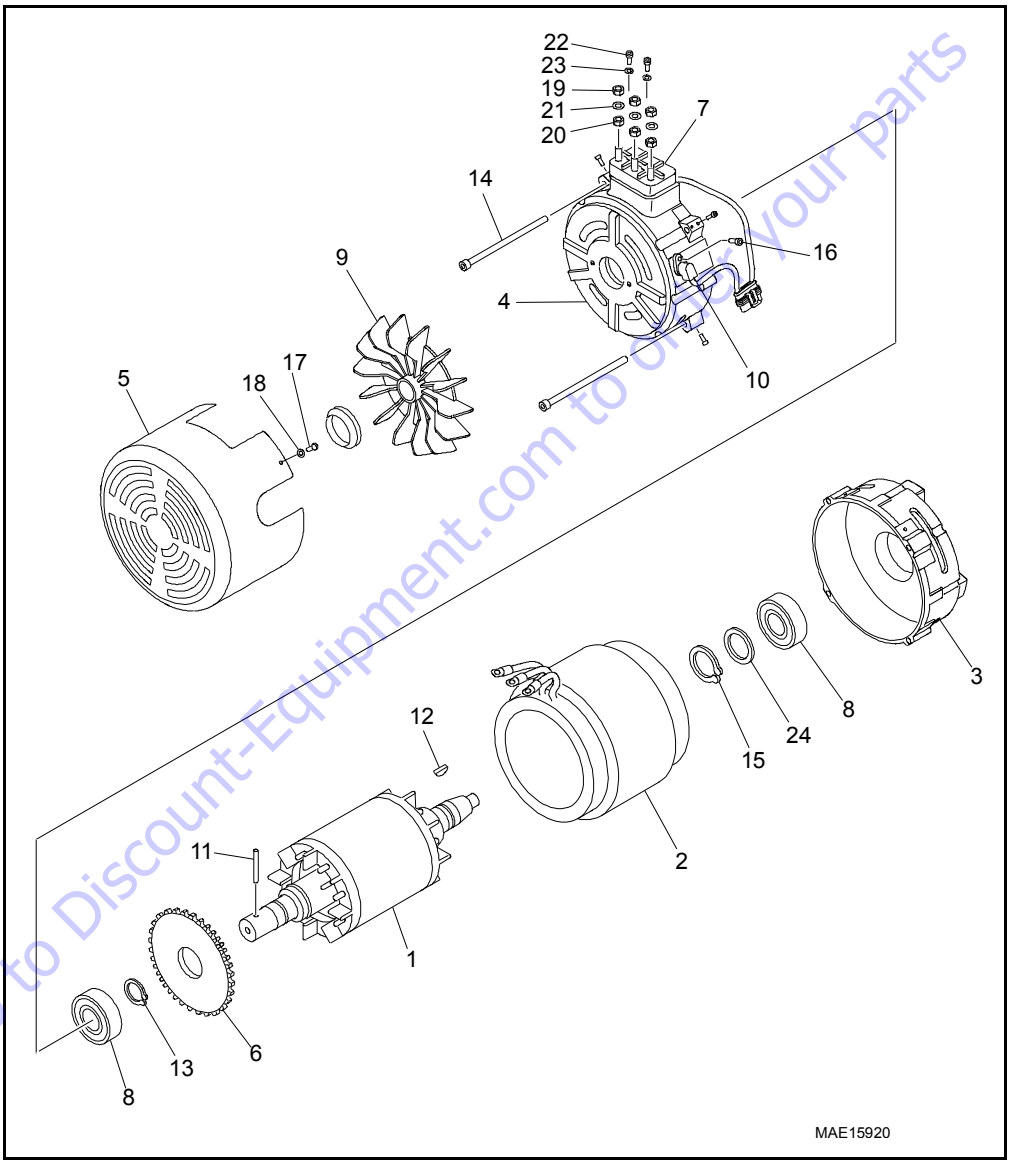
3.17 GENERATOR

The machine is equipped with an engine powered AC generator with controller that converts to DC which connected in parallel to the 48V DC battery stack.

Ball Bearing Repair/Replacement

Both ball bearings are maintenance free. If the bearings are removed, they must be replaced along with any seals.

If a bearing which is to be replaced has only one sealing lip, this should be greased with quality bearing grease. After approximately 10,000 operating hours the bearings have to be replaced.



1. Rotor
2. Stator
3. Flange
4. Flange
5. Fan Cover
6. Impulse Wheel
7. Terminal Block
8. Bearing
9. Lock Ring with Fan
10. Sensor
11. Rollpin
12. Key
13. Retaining Ring
14. Screw
15. Retaining Ring
16. Screw
17. Screw
18. Washer
19. Nut
20. Nut
21. Spacer
22. Screw
23. Washer
24. Ring

Figure 3-37. Generator Assembly

3.18 BATTERY CHARGER

NOTICE

JLG MACHINES EQUIPPED WITH DELTA Q BATTERY CHARGERS ARE DESIGNED FOR THE BEST PERFORMANCE WITH OEM FACTORY APPROVED BATTERIES.

APPROVED JLG REPLACEMENT BATTERIES ARE AVAILABLE THROUGH JLG'S AFTERMARKET PARTS DISTRIBUTION CENTERS OR JLG'S AFTERMARKET PROGRAMS. FOR ASSISTANCE WITH PROPER BATTERY REPLACEMENT, PLEASE CONTACT YOUR LOCAL JLG SUPPORT OFFICE.

BATTERIES APPROVED BY JLG HAVE BEEN TESTED FOR COMPATIBILITY WITH THE ALGORITHM PROGRAMMING OF THE DELTA Q BATTERY CHARGER TO OPTIMIZE BATTERY LIFE AND MACHINE CYCLE TIMES. THE USE OF NON APPROVED BATTERIES IN YOUR JLG EQUIPMENT MAY RESULT IN PERFORMANCE ISSUES OR BATTERY CHARGER FAULT CODES. JLG ASSUMES NO RESPONSIBILITY FOR SERVICE OR PERFORMANCE ISSUES ARISING FROM THE USE OF NON APPROVED BATTERIES.

Indications on the Charger 3-LED Display

The charger may become hot during charging. Use hand protection to safely handle the charger during charging.

Extension cords must be 3-wire cord no longer than 30m (100') at 10 AWG or 7.5m (25') at 16 AWG per UL guidelines.

Only connect one QuiQ Charger to a single 120VAC 15A circuit, or the circuit may become overloaded.

The charger will conduct a self-test after being powered on, visible by flashing all of its LEDs in sequence.

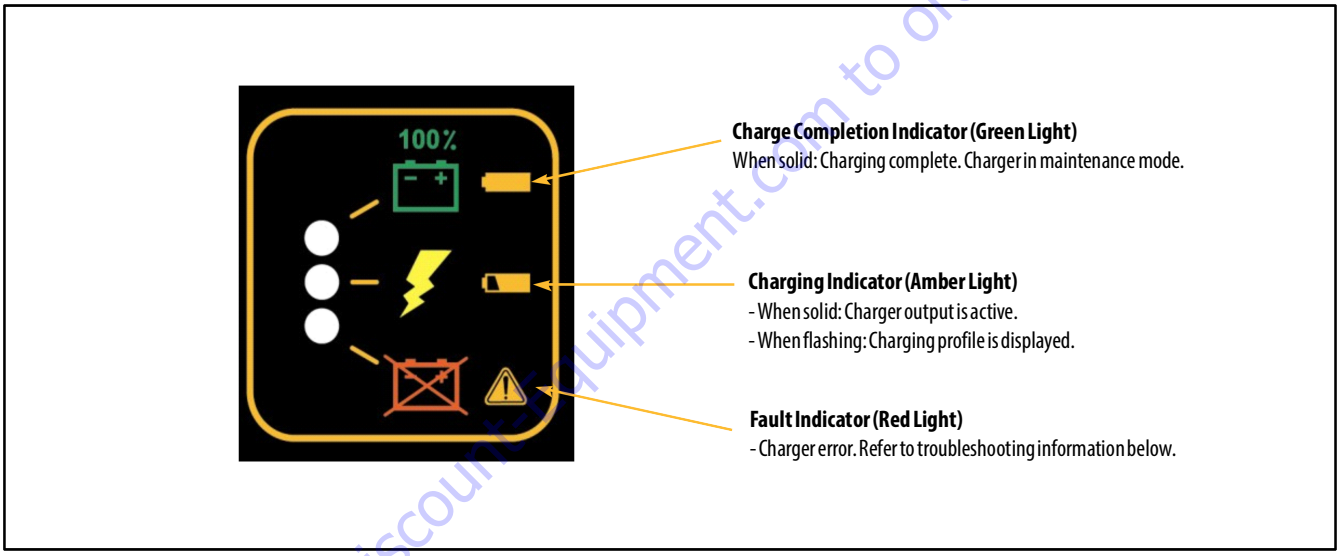


Figure 3-38. Battery Charger LED Display

Troubleshooting Instructions

If a fault occurs, count the number of red flashes between pauses and refer to the table below.

Table 3-6. LED Flashes

Flashes	Cause	Solution
	Battery high voltage	Check battery size and condition. This fault will clear automatically once the condition has been corrected.
	Battery low voltage	Check battery size and condition. This fault will clear automatically once the condition has been corrected.
	Charge timeout caused by battery pack not reaching required voltage; or charger output reduced due to high temperatures.	Check connections, that battery type matches selected charge profile and operate the charger at a lower ambient temperature. Reset the charger by interrupting AC power for 15+ seconds.
	Battery could not be trickle charged up to minimum voltage.	Check for shorted or damaged cells. Reset the charger by interrupting AC power for 15+ seconds.
	Charger shutdown due to high internal temperature.	Ensure sufficient cooling airflow. Reset the charger by interrupting AC power for 15+ seconds.
	Internal charger fault	Reset the charger by interrupting AC power for 15+ seconds. Return to service depot if fault persists.

Table 3-7. Detailed LED Fault Indications

Flashes	Explanation and Solution
	High Battery Voltage Detected - starting voltage above 2.5V/cell or voltage during charge rose above 2.7V/cell (algorithm dependent). - Check that the battery charger voltage is consistent with the battery pack voltage. - Check for wiring errors. - Occasionally a new, fully charged battery pack may cause this condition. Use this pack before charging it again. - Disconnect any other sources during charging. - If this problem does not clear after the battery voltage is measured to be less than 2.5V per cell, contact Delta-Q. - This fault will automatically clear and the charger will restart charging when the voltage drops to within operating range.
	Low Battery Voltage Detected - starting voltage below 0.5V/cell - Check the battery and connections to the battery. - Check the nominal battery voltage. Confirm that the nominal battery voltage is the same as the charger voltage. - If this problem does not clear after the battery voltage is measured to be higher than 1V per cell and all connections are good, contact Delta-Q. - This fault will clear automatically when the returns within range.
	Charge Timeout - Indicates the battery failed to charge within the time allowed by the charge algorithm. This could occur if the battery is of larger capacity than the algorithm is intended for. In unusual cases it could mean charger output is reduced due to high ambient temperature. It can also occur if the battery is damaged, old, or in poor condition. - Check the battery for damage such as shorted cells and insufficient water. Try the charger on a good battery. - If the same fault occurs on a good battery, check the connections on the battery and connection to AC power, and AC voltage. - Confirm that the nominal battery pack voltage is the same as the battery charger voltage. - If a charger displays this fault on a battery pack, and the pack is of questionable status, reset the charger by disconnecting AC power for 30 seconds, and then reconnect the AC to start a new charge cycle. After a few charge cycles this problem could stop occurring as the pack "recovers." - This fault must be cleared manually by unplugging the AC, waiting 30 seconds and reconnecting the ac power.
	Check Battery - This fault indicates the battery pack could not be trickle charged up to the minimum level required for the normal charge cycle to be started. - Check that none of the battery pack connections between modules are reversed or incorrectly connected. - Check that one or more cells in the battery are not shorted. - Confirm that the nominal battery pack voltage is the same as the battery charger voltage. - Try the charger on a good battery. - If this fault occurs the battery pack is likely in poor condition. Try to recover the pack with a charger that can charge the individual batteries - such as an automotive charger. Be sure to set this charger to the appropriate voltage - 6V per 6V battery, 12V per 12V string/battery.
	Over-Temperature: This fault indicates the charger has become too hot during operation and has shut down. This extra fault indication (as opposed to the flashing ammeter described above), indicates an even higher temperature was reached inside the charger. Though not damaging to the charger, charge time will be extended significantly - This fault indication will not clear automatically, but the charger will restart charging automatically when the temperature drops. The fault indication must be cleared manually by unplugging the AC power, waiting 30 seconds and reconnecting the AC. - If possible, install the charger in a cooler location or increase cooling airflow to the cooling fins. - Confirm that dirt or mud is not blocking the cooling fins of the charger. If required, clean the charger by rinsing it with a low-pressure hose.
	QuiQ Internal Fault: This fault indicates that the batteries will not accept charge current, or an internal fault has been detected in the charger. This fault will nearly always be set within the first 30 seconds of operation. If it occurs after the charger has started charging normally, be sure to make a note of it. - Try to clear the fault by unplugging AC power, waiting 30 seconds and reconnecting the AC. - Check all battery connections. Look for a high resistance connection. The most likely reason for this fault is a fault in the battery such as a bad battery connection, an open cell, or insufficient water. - Other electrical hardware such as contactors, switches, etc. which are badly wired may also cause this fault. - This fault will occur if an internal fuse inside the charger blows. If the green wire is shorted to ground even momentarily this fuse will blow. To check the fuse, measure with an ohmmeter between the green and red wires with the AC disconnected. If a short circuit is not measured, the fuse has blown. Contact Delta-Q - If this fault occurs after battery charging has started, confirm that AC power was not interrupted and that all battery connections are good. - If all battery connections are good, an internal fault has been detected. Contact Delta-Q.

Table 3-8. Charger/Converter Troubleshooting

Symptom	Possible Causes and Solutions
No or low output	- Input voltage out of range: - 35 - 87V for the 48V model - 50 - 130V for the 72V model - Unit overheating - increase cooling air flow - Short circuit detected - Poor connections - Inspect connections - Converter damaged
No switched output	- Switched input voltage out of range: - 8 - 87V for the 48V model - 8 - 130V for the 72V model - Switching input circuit damaged from high voltage - Poor connections - Inspect connections
Turn-on or turn-off delay greater than 3 seconds	- Switched input circuit variability - no action required
Wiring or connectors overheating	- Wire gauge too small (minimum 18AWG) - More than 18A drawn from single connector

Table 3-9. Other Conditions

Indication	Explanation and Solution
AC on LED lit, charger won't start charging.	Charger has detected a condition that does not allow it to charge - This condition is generally corrected by resetting the charger by removing AC power for 30 seconds and reconnecting it.
Excessive battery watering or strong sulphur (rotten egg) smell	Overcharging or high battery temperature. These symptoms are unlikely to be caused by too high a charge current since the maximum charge current of the charger will be small compared to even a moderately sized battery pack. The most likely cause for this problem is incorrect charge algorithm setting and/or high ambient temperatures. - Confirm that the battery pack is not too small - Delta-Q chargers are usually used with batteries larger than 50Ah. - Confirm that the nominal battery voltage matches the charger output voltage. - Confirm the correct battery charge algorithm. If the battery pack is new, the algorithm will need to be changed if the pack is not the same as the old one. Refer to the Product Manual for instructions on how to determine and change the battery charge algorithm. - If the pack is older, it is possible sulphation has taken root. Increased resistance of the battery pack due to this will cause excessive heat and water usage.
Charger operates at low current only	Delta-Q charge algorithms only operate at a low current, usually 2-5A if the battery voltage is less than 2.0V/cell. This is to slowly recharge an over discharged battery to avoid damaging it. - Check the battery pack voltage, if it is <2.0V/cell then this low current is normal.
Charger restarts automatically	There are two features of algorithms that may cause this: - Maintenance Mode - charger automatically restarts after 14d or 30d, or when the battery voltage falls below 2.08V/cell or 1.5V/cell. These settings are algorithm dependent. - Battery overvoltage - If the battery is very resistive, sometimes in new batteries, the voltage may rise so quickly the charger trips off due to overvoltage. It will then restart the charge cycle when the voltage falls back into range.
Difficulty changing the default battery charge algorithm	- The mode to change the battery charge algorithm can only be selected during the first 10 seconds of operation. Refer to the Product Manual for instructions. - If the 10 second window is missed, cycle AC power by unplugging the charger, waiting 30 seconds, and reconnecting AC power. - To extend Battery Charge Algorithm Change Mode by 30 seconds (120 seconds on newer models), connect the charger output to a good battery for approximately 1 second and then disconnect the battery again.

Table 3-10. Part Number Reference

JLG Part Number	Factory Set Algorithm	Delta-Q Part Number
1001197707	43	922-4854-08

Table 3-11. Charging Profile (Algorithm) Matrix

	Description	Optimized Battery	JLG Part Number	Approved Battery Manufacturers	Other Tested Batteries	May be Compatible with *
#1	150 - 260Ah Trojan flooded Temperature compensated	T105			T875, T1260, T1275, T145	Flooded 150-260Ah
#3	150 - 260Ah Trojan flooded non-temperature compensated	T105			T875, T1260, T1275, T145	Flooded 150-260Ah
#5	80 - 150Ah Trojan flooded Temperature compensated	Trojan 31XHS			30XHS, 27TMX, SC225	Flooded 12V "Marine" batteries
#6	80 - 150 Ah Gel cell temperature compensated	DEKA 8G31			N/A	80-15Ah gel
#7	300 - 400Ah Trojan Flooded Batteries non-temperature compensated	Trojan J305			Trojan L16	Flooded 300-400Ah
#8	10XAh AGM, temperature compensated	Concord AGM	0400209	DOUGLAS DG12-100M US BATT 12V100AH AGM FULL RIVER HGL100-12X UNIVERSAL BATTERY UB121000	N/A	N/A
#11	180Ah - 250Ah Flooded batteries non-temperature compensated	US125's			US2200, US12VXC, US8VCX	Flooded 180-250Ah
#17	General Flooded/ AGM battery charging Non Temperature compensated	180-260Ah batteries	1001112112 0400215	HARRIS BATT. DISCOVER EVGC6A-A GES BATTERY A 1055 TROJAN T105 EAST PENN GC-110-WNL TROJAN T105 PLUS CHAMPION CHGC2 GC2 USBATT 2200 XC	Interstate GC2, Trojan T105, US2200XC, Deka 8CGG2	AGM, gel or Flooded 180-250Ah
#21	Exide Flooded 200-250Ah Temperature compensated	Exide 3ET200	ST2719	OLDHAM 3PZS240HP +CY	FF06255, Exide 185PZB210	N/A

Table 3-11. Charging Profile (Algorithm) Matrix

	Description	Optimized Battery	JLG Part Number	Approved Battery Manufacturers	Other Tested Batteries	May be Compatible with *
#23	JLG 200Ah Flooded, no-temperature compensated	Douglas Flooded	0400215 0400216 1001112112 510089 510093	GES BATTERY A1055 TROJAN T105 EAST PENN GC-110-WNL TROJAN T105 PLUS CHAMPION CHGC2 GC2 US BATT 2200 XC US BATT EV-145-WNL HARRIS BATT. DISCOVER EVGC6A-A BATTERY 6V 225Ah TROJAN T145 (6V 260Ah)	N/A	N/A
#26	180-220Ah Gel Temperature compensated	Deka 8GCC2			N/A	150-230Ah gel
#28	180-220Ah Gel Float finish Temperature compensated	Deka 8GCC2			N/A	150-230Ah gel
#42	Discover AGM 80-150Ah Temperature compensated	Discover EV31A	1001136380 1001178278	DISCOVER EV27A-A VISION EV27-90A-AM	N/A	80-150Ah AGM
#43	Discover AGM 200-400Ah Temperature compensated	Discover EVGC6A	1001112112 1001120445 1001114782 510094 1001177558 0400209 (48V, 200Ah; 2 parallel strings of 4 series batteries)	HARRIS BATT. DISCOVER EVGC6A-A US AGM 6V27 (210AH) DISCOVER EV 305A-A DISCOVER EVGT-6A (6V 255Ah) VISION 3FM180D-X US BATTERIES AGM27	EVL16A, EV185A	200-400Ah AGM
#51	Exide 150-200Ah gel Temperature compensated	Sonnenschein 180Ah gel			N/A	150-200Ah gel
#52	Exide 80-130Ah gel Temperature compensated	Sonnenschein 105Ah gel			N/A	80-130Ah gel
#62	Trojan Group 31 Flooded non-temperature compensated	Trojan 31XHS			30XHS, 27TMX, SC225	Flooded 12V "Marine" batteries
#71	140-200Ah Flooded non-temperature compensated	US8VCX			US2200, US12VXC	Flooded 140-200Ah
#72	250-335Ah Flooded non-temperature compensated	US305HC			N/A	Flooded 250-330Ah
#73	300-400Ah Flooded non-temperature compensated	USL16HC			N/A	Flooded 330-400Ah
#125	FullRiver 160-200Ah AGM Temperature compensated	DC180-6, DC224-6			N/A	160-200Ah AGM

Table 3-11. Charging Profile (Algorithm) Matrix

	Description	Optimized Battery	JLG Part Number	Approved Battery Manufacturers	Other Tested Batteries	May be Compatible with *
#126	FullRiver 85-145Ah AGM Temperature compensated	FullRiver DC115-12			N/A	85-145Ah AGM
#141	FullRiver 300-370Ah AGM Temperature compensated	FullRiver DC335-6			N/A	300-370Ah AGM
#143	Discover AGM (200-400Ah), temperature compensated	Discover AGM	1001102534	DISCOVER EVL16A-A	N/A	200-400Ah AGM
#151	FullRiver 220-290Ah AGM Temperature compensated	FullRiver DC250-6			N/A	220-290Ah AGM
#173	JLG 400Ah flooded, non temperature compensated	US Battery L16	400055 0400202	US BATT L16 US Batt L16HC	N/A	N/A

Instructions for using the Delta-Q QuiQ Programmer CTQuiQ Programming Kit

CONTENTS OF THE QUIQ PROGRAMMING KIT (JLG PART NUMBER: 2915230)

- QuiQ USB Interface Module
- QuiQ Programmer CT Installation CD
- USB Cable
- Wire Assembly
- QuiQ Programmer CT Instructions

Figure 3-39. QuiQ Programming Kit

With QuiQ Programmer CT you can:

- Add a battery charge algorithm
- Select a different algorithm for battery charging
- Delete a battery charge algorithm
- Upgrade the software in your QuiQ or QuiQ-dci charger
- View charge tracking data from charger
- Upload Charge Events to Delta-Q's Online Charge Event Database

INSTALLING QUIQ PROGRAMMER CT SOFTWARE AND DRIVERS

You will find the QuiQ Programmer CT application on the QuiQ Programmer CT installation CD. QuiQ Programmer CT requires a PC with a minimum of 512 MB of RAM, running 32-bit or 64-bit edition of Windows XP, Vista, or 7.

To install QuiQ Programmer CT Insert the QuiQ Programmer Installation CT CD into the CD or DVD drive of your PC (label must be facing up). If the setup application does not launch the QuiQ Programmer CT installer automatically (this will depend on your computer's security settings and configuration), click the Start button (or  icon) on the taskbar; click My Computer; double click the drive labeled QuiQ Programmer CT; double click Setup.exe to launch the installer. You may also use Windows Explorer to navigate to Setup.exe. Then follow the instructions on your screen to complete the software installation.

NOTE: *If your computer is running Windows XP Professional 64-bit, you must install x64 .NET Framework 2.0 before installing QuiQ Programmer CT. You will find x64 .NET Framework 2.0 on the CD in the subfolder Net64Fx.Double click Net64Fx.exe to start installing the software.*

Connecting a QuiQ Charger to your Computer

⚠ WARNING

CHARGER OUTPUTS GREATER THAN 40VDC POSE AN ENERGY AND/OR SHOCK HAZARD UNDER NORMAL USE. DO NOT ENERGIZE CHARGER WITH AC UNTIL WIRE ASSEMBLY CLIPS ARE SECURELY CONNECTED TO CHARGER OUTPUT, AND ALL LEADS ARE SECURED AGAINST MOVEMENT.

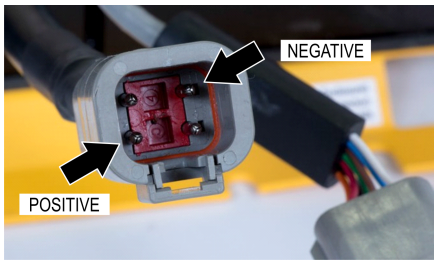
⚠ WARNING

ENSURE THE BATTERY LEADS FROM THE USB INTERFACE MODULE ARE PROTECTED FROM SOURCES OF ELECTROSTATIC DISCHARGE THAT MAY DAMAGE THE UNIT.

To connect a QuiQ charger to your computer:

NOTE: *QuiQ Programmer CT must be installed on your computer before you connect a QuiQ charger.*

1. Disconnect AC power from the QuiQ charger.
2. Disconnect the QuiQ charger from all batteries.
3. Connect the Wire Assembly red clip to the charger positive wire (red).



4. Connect the Wire Assembly black clip to the charger negative wire (black).

5. Connect the Wire Assembly to the QuiQ USB Interface Module.

6. Connect the USB cable upstream end to an open USB port on your PC.

7. Connect the USB cable downstream end to the QuiQ USB Interface Module.

8. Upon connection, Windows will detect the QuiQ USB Interface Module and install drivers for it. If Windows does not detect the QuiQ Module you will need to reinstall QuiQ Programmer CT. See section Installing QuiQ Programmer CT Software and Drivers.

9. Connect the QuiQ charger to AC power.

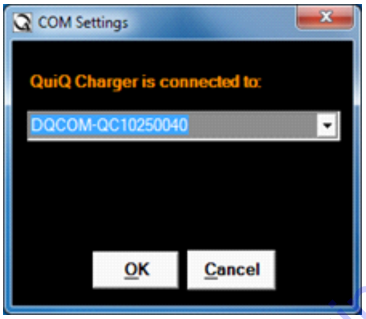
NOTE: *For a reliable connection, ensure that the bare leads do not touch each other or other metallic objects.*

Starting QuiQ Programmer CT

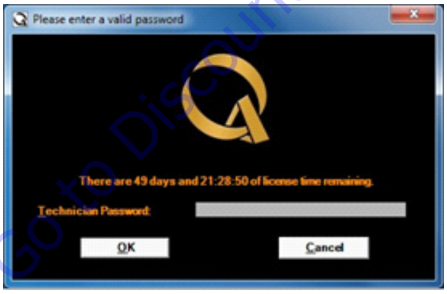
START APPLICATION IN USER MODE

1. To start QuiQ Programmer CT, select Program/QuiQ Programmer CT/QuiQ Programmer CT from the Start Menu.

2. If your installation has not been registered with a license key, starting the application in User Mode is the only option. First select the Dongle you wish to connect in the COM Setting dialog.



3. Then, the QuiQ Programmer CT starts. If your installation has been registered with a license key, then upon starting the application the login dialog appears:



Click on "Cancel" to start the application in User Mode.

4. The QuiQ Programmer CT interface will appear. The connection status area at the bottom of the window will indicate if the QuiQ USB Interface Module is properly connected to your PC and the QuiQ charger.

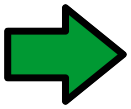
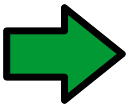
If the connection area displays Status: No Connection, then QuiQ Programmer is unable to communicate with your charger. This may be due to one of the following:

- The charger is not connected to the PC. Ensure that all wires are connected (see section Connecting a QuiQ Charger to your Computer).
- The wrong COM port was chosen. Exit QuiQ Programmer CT; restart QuiQ Programmer CT and choose the correct COM port (see step 2 above).
- The USB connection may be temporarily disabled. Exit QuiQ Programmer CT; disconnect the USB cable from your PC; wait 5 seconds, then re-connect the USB cable to your PC. Start QuiQ Programmer CT and choose the correct COM port. See Starting QuiQ Programmer step 2.
- The charger is not connected to an AC power source. Ensure that the charger is connected to AC.
- The QuiQ USB Interface Module driver was installed incorrectly. Exit QuiQ Programmer CT. Disconnect the QuiQ USB Interface Module USB cable from your PC. Remove QuiQ Programmer software from your computer. Reinstall QuiQ Programmer CT.

Programming Delta-Q QuiQ and QuiQ-dci Chargers

Click on the Charger Status tab to activate the Charger Status tab. Then click Browse, to select the folder on your PC containing the QuiQ charger software and algorithms.

Table 3-12. Programming Delta-Q QuiQ and QuiQ-dci Chargers

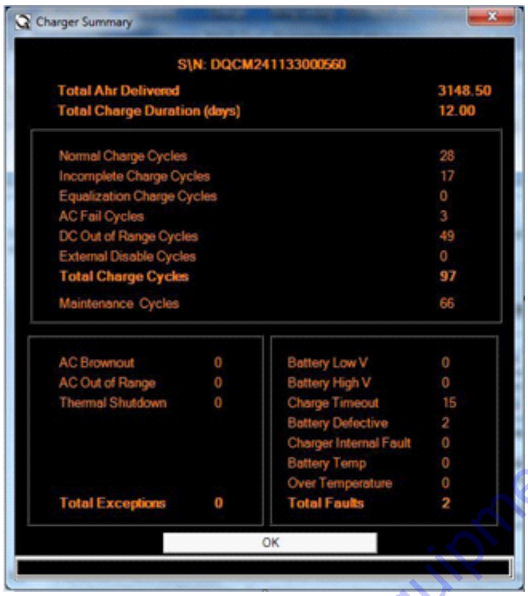
What do you want to do?	Icon	Action
Add a charge algorithm to the charger		In the Battery Charge Algorithms list, on the QuiQ Programmer CT user interface, select the algorithms that you want to add to the charger; click the Add to Charger icon.
Upgrade the charger software		In the Charger Software Versions list, on the QuiQ Programmer CT user interface, select the software version that you want to add to the charger; click the Add to Charger icon. Software may take up to 90 seconds to load.
Select a different default algorithm		In the Algorithms Present list on the QuiQ Programmer CT user interface, select the algorithm that you want to set as the default charge algorithm; click Set as Default icon.
Delete an algorithm from the charger		In the Algorithms Present list on the QuiQ Programmer CT user interface, select the algorithms that you want to delete from the charger; click the Delete from Charger icon. Note: You cannot undo an algorithm deletion.
Tip: To select two or more items one after the other in a list, select the first item, press and hold down the SHIFT key on your keyboard, then select the last item. To select two or more items in a list that may not be one after the other, press and hold down the CRTL key, and select the items.		

View Charge Tracking Data with QuiQ Programmer CT

Requirement: To view the charge tracking data in your charger, your charger must have version 3.X software. Note that only chargers with serial number beginning with "DQCM" may have version 3.X software programmed in it.

Start Application in User Mode

- Click on the Charge Event Database tab. This will display the Charger Summary Dialog for that summarizes charge data for the connected charger.



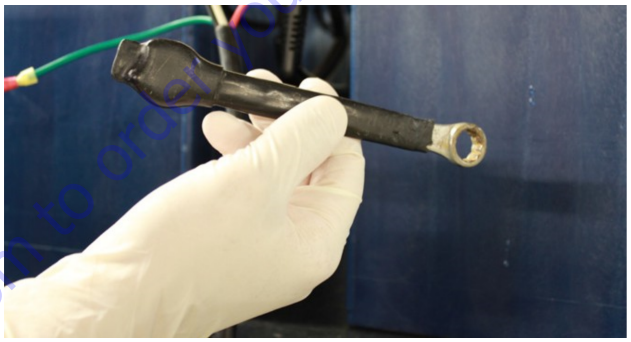
Selecting a Charge Profile

Delta-Q's QuiQ Charger can store up to 10 charging profiles, also called charge algorithms. This section shows how to identify the default profile and select a new profile using the "tap method."

QuiQ chargers are reprogrammable using the QuiQ Programmer supplied by Delta-Q to its OEM partners. Pre-2006 QuiQ chargers with serial number prefix DQCP allow pre-loaded profiles to be selected, but cannot be reprogrammed with new profiles.

IDENTIFY THE DEFAULT PROFILE

1. Required supplies include an insulated wrench, eye protection and gloves.



2. Disconnect the AC power source from the charger, either from the wall outlet, or from the IEC320 connector on the charger.
3. Disconnect power from the batteries using the battery disconnect on the side of the machine.
4. Reconnect AC power.
5. For 11 seconds after the self-test, the charger will display its default charge profile. Profiles are indicated by the number of consecutive flashes followed by a pause

   (e.g. #2 = ).

   5b. Charge profiles in the double digits will display in the same way, by one or more flashes, a pause, then one or more flashes

   (e.g. #42 = )
6. After 11 seconds the red fault light will then blink.

SELECT A NEW PROFILE

1. Disconnect the AC power source from the charger, either from the wall outlet, or from the IEC320 connector on the charger.
2. Reconnect AC power.
3. Touch the positive lead to the positive terminal for 3 seconds (+/- 0.5 seconds), then remove the lead. You will see the next profile displayed on the charger's display. Repeat this step until you reach the desired charge profile.
4. When the charger displays the desired charge profile, apply the positive lead to the positive battery terminal for 10 seconds. When the charge profile is locked, you will hear a click from the charger.
5. Disconnect AC power, wait for the LED indicator display to turn off, then reconnect AC power.
6. Check the LED display to ensure that the desired charge profile is selected.
7. Disconnect the charger from AC power and wait for the LED indicator display to turn off.
8. Reconnect the positive lead to the positive battery terminal.

Battery Testing

As part of regular maintenance, battery testing using a discharge tester or calibrated load is recommended. Battery condition can be determined by comparing actual discharge capacity versus a battery manufacturer's stated reserve capacity (RC). Discharge testing can also help identify defective batteries or cells in battery packs which need attention. Industry standard battery discharge machines use the following rates of discharge to measure battery capacity:

Battery Pack Size (Nominal)	24V	36V	48V
Discharge Rate (Amps)	75	75	56
Cutoff Voltage (1.75Vpc)	21	31.5	42

PROCEDURE:

- Using Delta-Q charger, fully charge the battery pack (indicated by solid green 100% LED)
- Using a discharge tester/load rated for the nominal battery pack size, discharge the pack at a rate appropriate for the type of battery modules in use (see chart above) until the pack voltage reaches 1.75 volts per cell (see chart above)
- Compare the duration of the discharge test (in minutes) to the manufacturer's rated reserve capacity for your specific battery make and model. A Trojan T-105 battery reserve capacity specification @75A is shown as an example:

PRODUCT SPECIFICATIONS

BCI GROUP SIZE	TYPE	CAPACITY A Minutes		CAPACITY B Amp-Ho		
		@25 Amps	@75 Amps	5-Hr Rate	10-Hr Rate	20-H
6 VOLT DEEP CYCLE						
GC2	T-105	447	115	185	207	2

There is no set pass/fail criteria for battery discharge times but use the following results as a guide:

- 80 - 100 % rated capacity minutes - Good
- 50 -80 % rated minutes - Acceptable
- Under 50 % - One or more defective batteries. Battery service recommended

A method used to identify a battery with a weak or shorted cell(s) is to restart a discharge tester after reaching the cutoff voltage. Measure the voltage of each battery with the discharge tester running (or under load). A battery with a weak cell under load will have a lower voltage compared to other batteries in a pack.

3.19 BATTERY MAINTENANCE, QUARTERLY

1. Open battery compartment cover to allow access to batteries.
2. Remove battery cables from each battery post one at a time, negative first. Clean cables with acid neutralizing solution (e.g. baking soda and water or ammonia) and wire brush. Replace cables and/or cable clamp bolts as required.
3. Clean battery post with wire brush then re-connect cable to post. Coat non-contact surfaces with mineral grease or petroleum jelly.
4. When all cables and terminal posts have been cleaned, ensure all cables are properly positioned and do not get pinched. Close battery compartment cover.
5. Ensure all circuits functions properly.

3.20 COUNTERWEIGHT

If the counterweight has been removed, ensure the retaining bolts are torqued to the proper value as shown in Figure 3-40., Counterweight Bolt Torque.

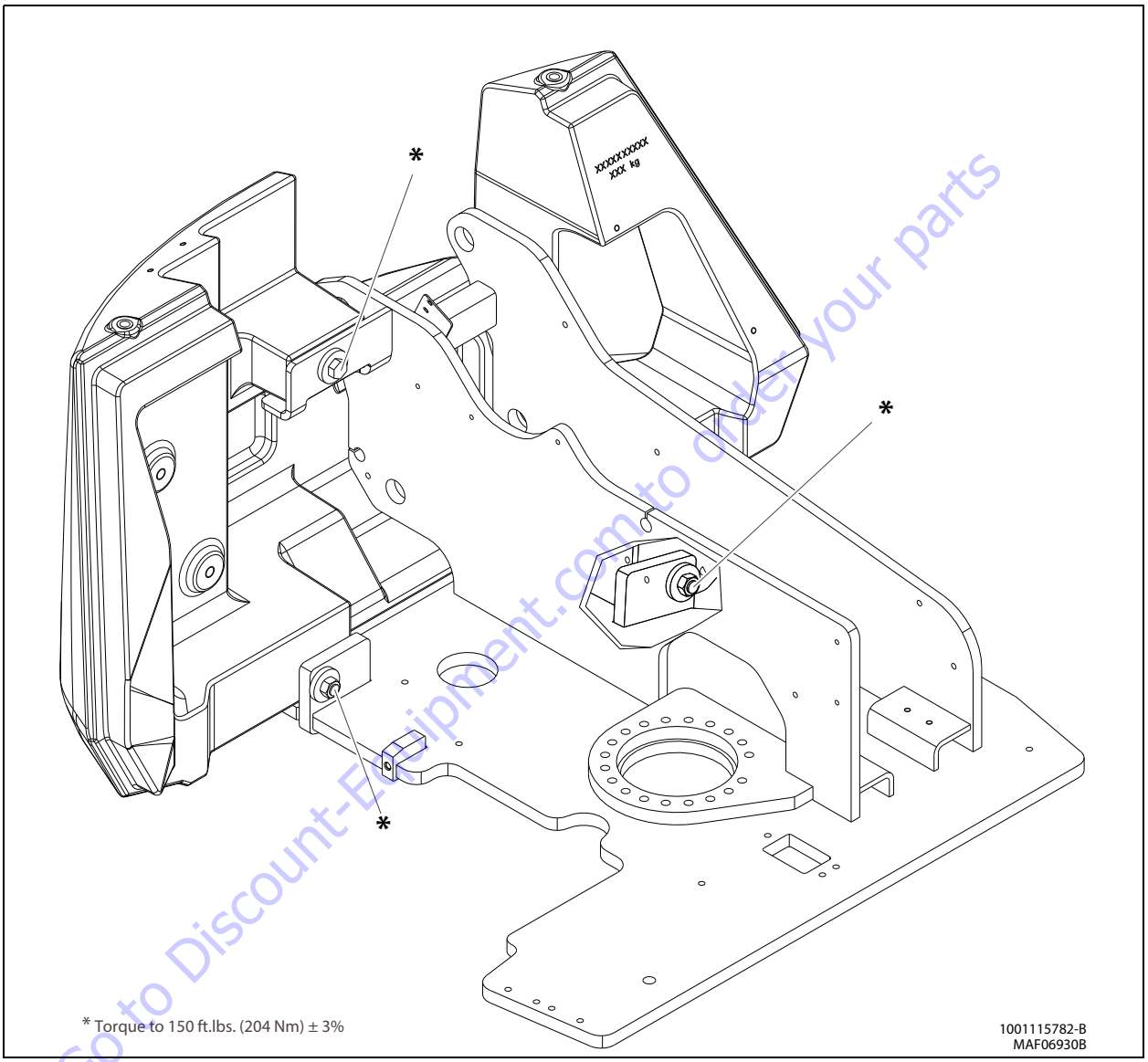
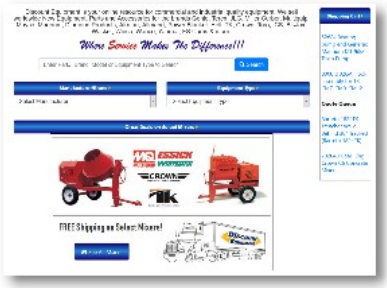


Figure 3-40. Counterweight Bolt Torque

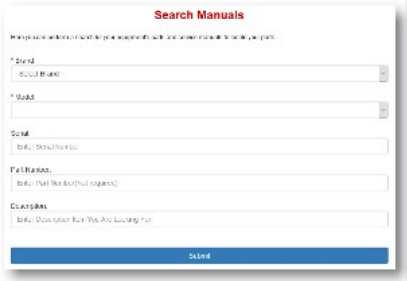
PARTS FINDER

Search Website by Part Number

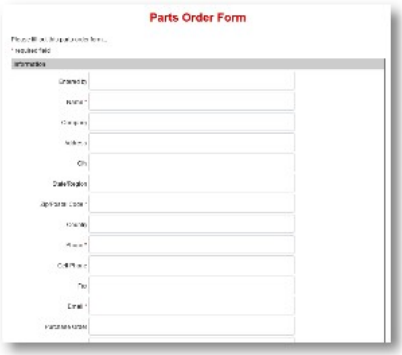
Discount Equipment



Search Manual Library For Parts Manual & Lookup Part Numbers – Purchase or Request Quote



Can't Find Part or Manual? Request Help by Manufacturer, Model & Description



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SECTION 4. BOOM & PLATFORM

4.1 BOOM SYSTEMS

Platform Control Enable System

The platform controls use a time dependant enable circuit to limit the time availability of "live" or enabled controls. When the footswitch is depressed, the controls are enabled and the operator has 7 seconds to operate any control. The controls will remain enabled as long as the operator continues to use any function and will remain enabled 7 seconds after the last function has been used. While the controls are "live", the enabled light will be illuminated in the platform display panel. When the time limit has been reached, the enabled light will turn off and the controls will be disabled. To continue use of the machine the controls must be re-enabled to start the timer system over again. This is done by releasing all functions, then releasing and re-depressing the footswitch.

Transport Position Sensing System

The transport position sensing system uses two redundant main boom angle switches (mounted on the upper upright at the lift cylinder pivot bushing) and the tower boom angle switch (mounted between the turntable side sheets at the lower boom link pivot bushing) to sense when the boom is in the position associated with high speed travel. Both of these switches are normally closed and positively open in the safe state. Above transport angle is recognized when the main boom travels from the stowed position to 1° below horizontal to 3° above horizontal (it resets at 1° to 4° below horizontal) or when the tower boom is sensed to be more than 2° to 5° above horizontal (it resets at 1° below horizontal to 5° above horizontal). The main boom may be telescoped to any position, and the articulating jib may be in any position. This system is used to control the following systems:

- Above Elevation - Drive Speed Cutback System
- Drive/Steer-Boom Function Interlock System (CE Only)
- Tower soft stop
- Boom soft stop

Beyond Transport Position - Drive Speed Cutback System

When boom is positioned beyond the Transport Position as described in the Transport Position Sensing System, the UGM automatically restricts drive speed to approximately 0.6 mph. Refer to Drive System in Section 3 for more detail on the drive speeds, and Chassis Tilt Indicator System in Section 3 for interaction with the tilt sensor.

Drive/Steer – Boom Function Interlock System (CE ONLY)

The Drive/Steer – Boom Function Interlock System uses the Transport Position Sensing System to sense when the boom is out of the transport position. Drive and Boom functions are simultaneously functional when the booms are within the transport position, as on the standard machine. When the boom is beyond the transport position, the control functions are interlocked to prevent simultaneous operation of any boom function with drive/steer. The first function set to be operated in this mode, becomes the master function set. In other words, while operating drive/steer functions the boom functions are inoperable. Likewise, while operating boom functions drive/steer functions are inoperable.

Platform Load Sensing System

The Platform Load Sensing System (LSS) consists of 1 load cell and 2 linkages mounted to the platform rotator. The load cell includes a sealed circuit and is connected directly to a CAN-based platform control panel within the platform box. This system measures the weight in the platform. When the capacity is exceeded, or when there is a fault in the system, the platform overload indicator will flash, the platform alarm will sound at the standard JLG duty cycle of 5sec ON/2sec OFF and all platform controls (except emergency descent) will be disabled.

Jib Lift End of Stroke Dampening

The Jib Lift cylinder is constructed in a way that causes the Jib Lift Cylinder oil flow to be restricted by an orifice while lowering the jib near the end of stroke at minimum elevation. This flow restriction reduces the speed of this function just before bottoming out the cylinder.

Ground Control Keyswitch System

The ground control keyswitch is used for selecting the active control of the machine between the platform or ground control stations and as another shut off switch for machine power. On the standard keyswitch, the key is removable only in the off position. This allows the ground control station to have ultimate priority over the platform control.

Side Entry Platform

The end gate platform is the common platform for all markets and accommodates the accessories in the sky options. It is offered in, 60 in. x 36 in. (1524 mm x 914 mm) and 48 in. x 36 in. (1219 mm x 914 mm) options, has a self-closing gate with adjustable spring hinges and common 9/16 in. (15 mm) opening floor mesh.

Function Speed Control System

The platform controls for the platform rotate, platform level, jib lift, telescope, and tower lift functions are controlled through a common variable speed control knob. This knob provides a common control signal allowing a smooth ramp up, controlled maximum output speed, and ramp down. Each function has its own personality settings allowing the characteristics of each function to be modified using the standard analyzer. Not all functions will respond the same to the changes in the function speed knob position.

Emergency Decent System

The emergency descent system allows the boom and jib to be lowered in the event of primary power (engine power and power battery pack) loss. This system uses electrically powered solenoid valves and the force of gravity to lower the booms and jib. The following functions are included in this system and will operate normally if the engine is not running and the “auxiliary power” switch has been activated.

- Main Lift Down
- Tower Lift Down
- Jib Down

Additionally, the jib can be raised by the use of a manual hand pump located between the hydraulic tank and ground control station. See the instructions at that location. Also the turntable can be swung manually by using a wrench to turn the swing motor shaft.

The 12V accessory battery will provide power to control system to allow boom and jib down even the 48V battery pack is off line or depleted of power.

4.2 PLATFORM

Support Removal

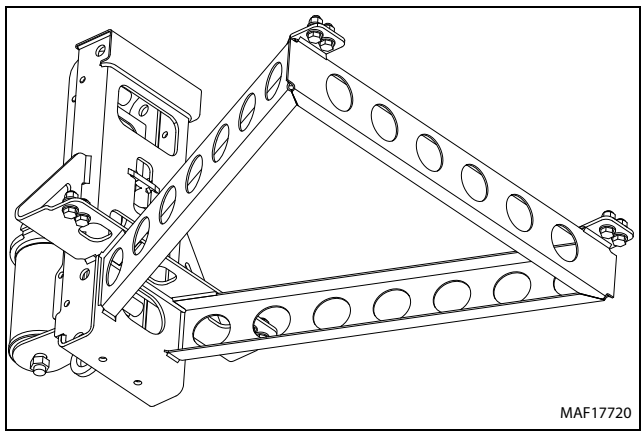
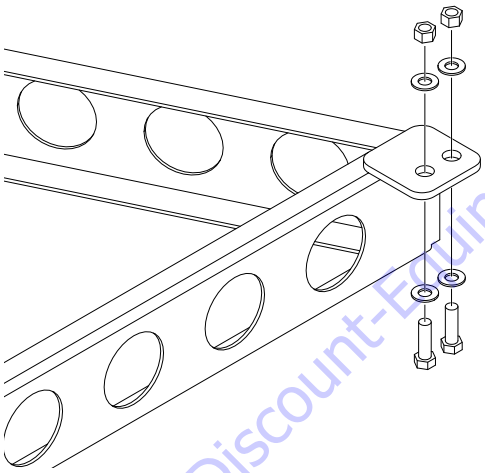


Figure 4-1. Location of Components Platform Support

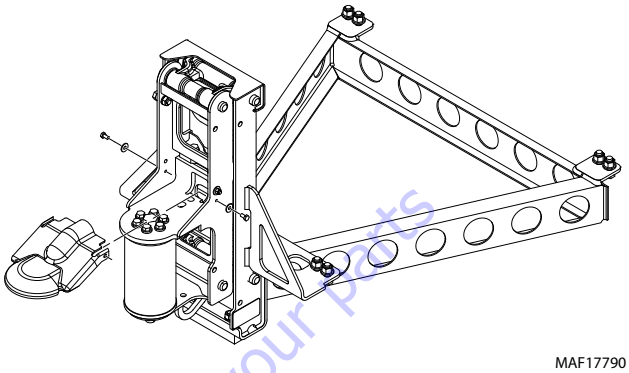
1. Disconnect electrical cables from control console.
2. Remove the bolts securing the platform to the platform support, then remove the platform.



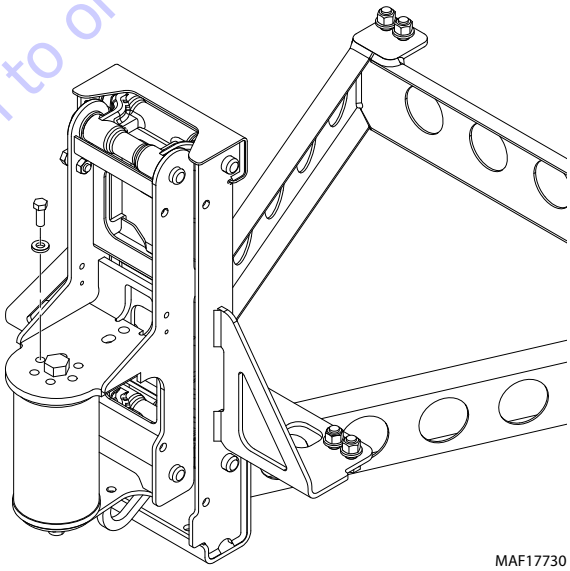
3. Using a suitable lifting device, support the platform support.

NOTE: *The platform support weighs approximately 77 lb (35 kg).*

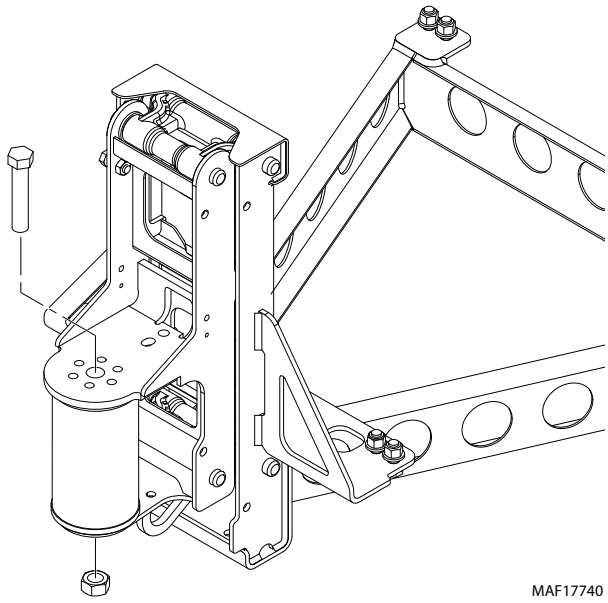
4. Remove the bolts and washer securing the platform support cover to the platform support. Remove platform support cover.



5. Remove the bolts and locknut securing the support to the rotator.



6. Using a suitable brass drift and hammer, remove the rotator shaft, then remove the support from the rotator.



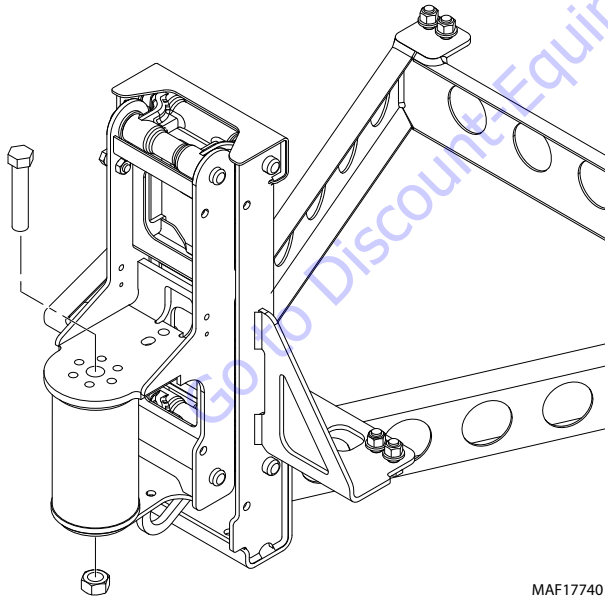
MAF17740

Support Installation

1. Using a suitable lifting device, support the platform support and position it on the rotator.

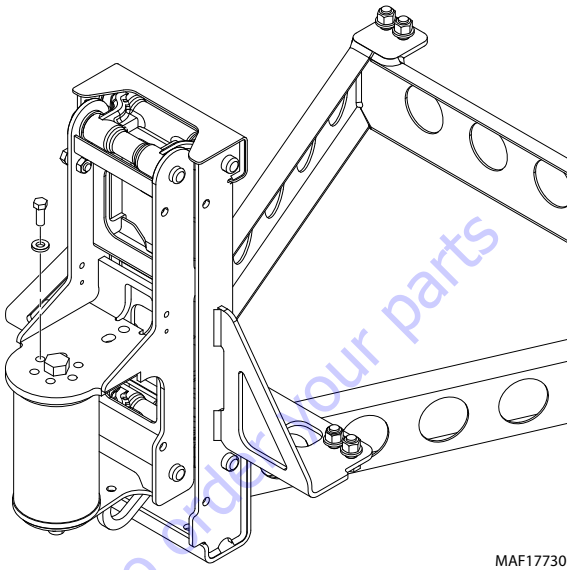
NOTE: *The platform support weighs approximately 77 lb (35 kg).*

2. Install the rotator center bolt.



MAF17740

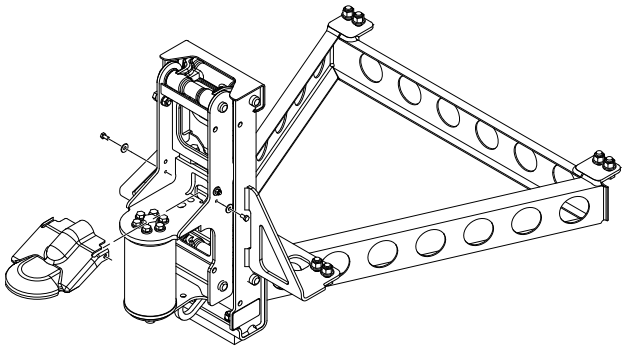
3. Apply Medium Strength Threadlocking Compound to the bolts and locknuts securing the support to the rotator and install the bolts and locknuts.



MAF17730

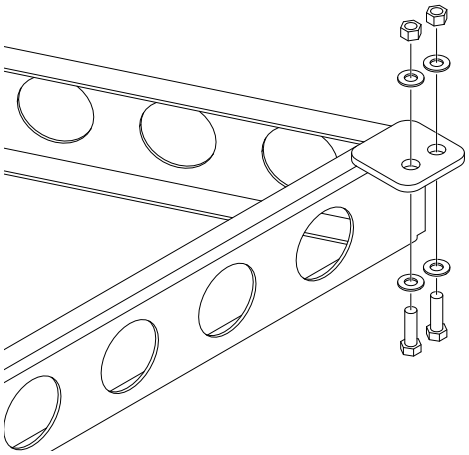
4. Torque the nut on the rotator center bolt to 250-270 ft. lbs. (339-366 Nm). Torque the retaining bolts to 40 ft. lbs. (55 Nm).

5. Apply Medium Strength Threadlocking Compound to the bolts and washers securing platform support cover to the platform support.



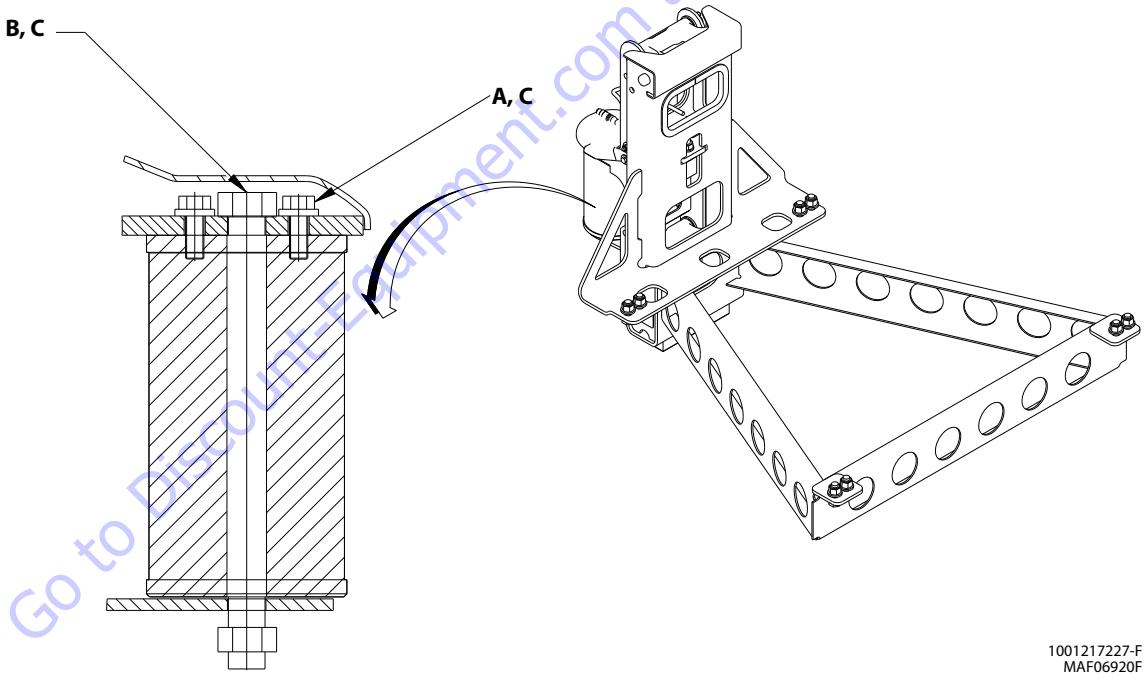
MAF17790

6. Position the platform on the platform support and install the bolts securing the platform to the platform support.



7. Connect the electrical cables to the platform control console

NOTE: *If any rotator bolts are replaced, all bolts on the rotator should be retorqued.*



A Torque to 40 ft.lbs. (55 Nm)
B Torque 250-270 ft. lbs. (340-365 Nm)
C Check torque every 150 hours of operation

Figure 4-2. Platform Support Torque Values (Single Cell LSS)

4.3 BOOM REMOVAL AND INSTALLATION

Main Boom Removal

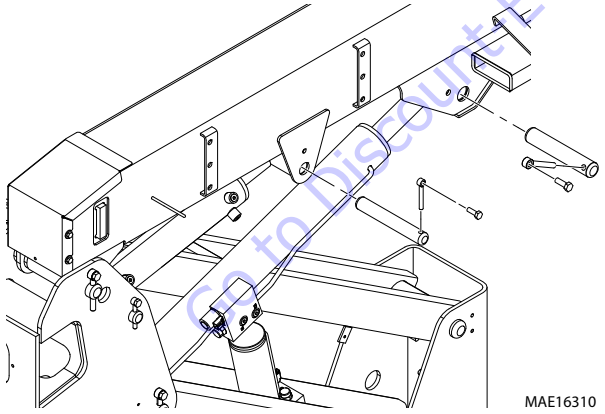
NOTE: *The main boom alone weighs approximately 472 lb (214.1 kg).*

1. Remove the jib and platform assembly. Refer to Section 4.5 - Jib.
2. Using a suitable lifting equipment, adequately support main boom assembly weight along entire length.

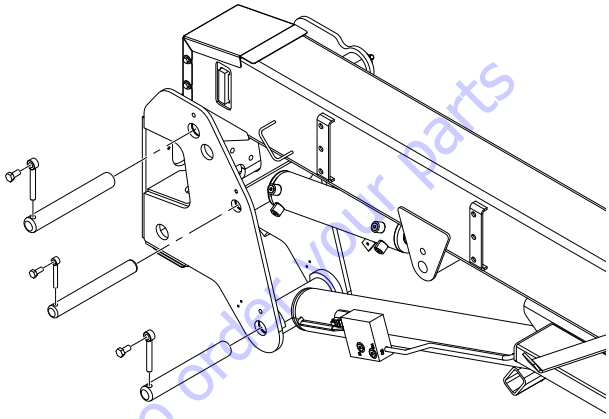
NOTICE

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

3. Tag and disconnect hydraulic lines from upper lift cylinder and master cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
4. Attach an adequate supporting device to the upper lift cylinder and master cylinder to support its weight.
5. Remove bolt and pin keeper from upper lift cylinder pin. Using a suitable brass drift and hammer, remove the cylinder pin from main boom securing upper lift cylinder to mid boom.
6. Remove bolt and pin keeper from master cylinder pin. Using a suitable brass drift and hammer, remove the cylinder pin from main boom securing master cylinder to mid boom.


MAE16310

7. Remove bolt and pin keeper from upper lift cylinder pin. Using a suitable brass drift and hammer, remove the cylinder pin from upper upright.
8. Carefully remove the upper lift cylinder assembly from upper upright.
9. Remove bolt and pin keeper from master cylinder pin. Using a suitable brass drift and hammer, remove the cylinder pin from upper upright.
10. Carefully remove the master cylinder assembly from upper upright.
11. Attach an adequate lifting device to support the rear of the main boom.
12. Remove bolt and pin keeper securing the boom sections to the upper upright. Using a suitable brass drift and hammer, remove the pivot pin from upper upright.


MAE16070

13. Using all applicable safety precautions, carefully lift main boom assembly clear of upper upright and lower to ground or suitably supported work surface.

Mid Boom Removal

NOTE: *The mid and lower booms together weighs approximately 1126.56 lb (511 kg).*

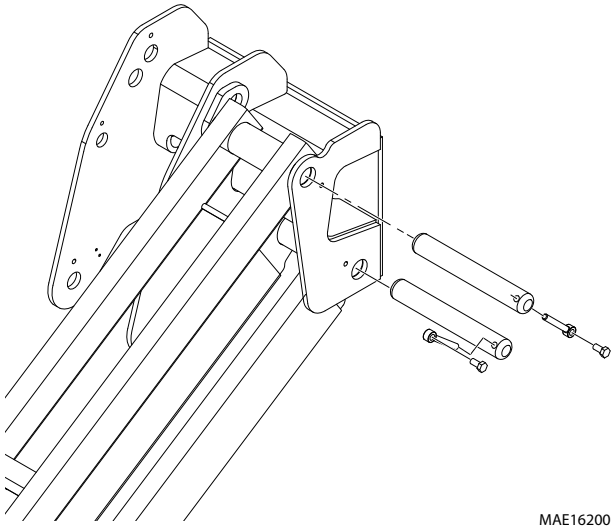
1. Using a suitable lifting equipment, adequately support mid boom assembly weight along entire length.

NOTICE

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

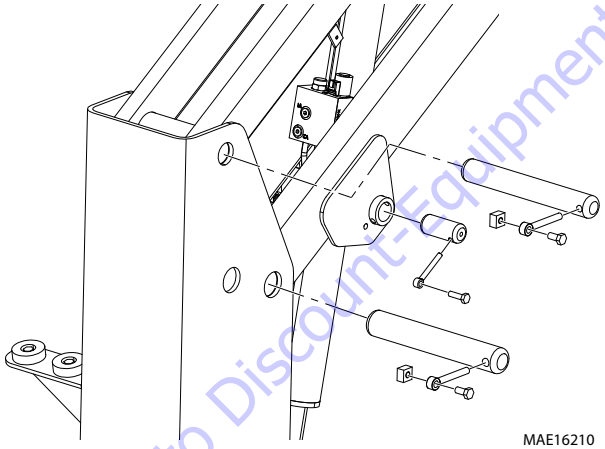
2. Tag and disconnect hydraulic lines from tower lift cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
3. Attach an adequate supporting device to the tower lift cylinder to support its weight.
4. Remove mounting hardware from pins. Using a suitable brass drift and hammer, remove the pins from upper upright.

5. Remove the upper upright from mid boom assembly.



6. Remove mounting hardware from pin. Using a suitable brass drift and hammer, remove the pin from tower lift cylinder securing to lower boom assembly.

7. Remove mounting hardware from pins. Using a suitable brass drift and hammer, remove the pins from lower upright.

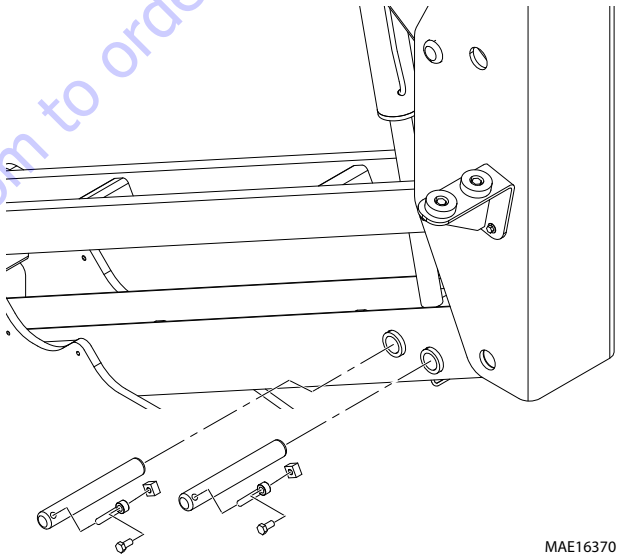


8. Using all applicable safety precautions, carefully lift mid boom assembly clear of lower upright and lower to ground or suitably supported work surface.

Lower Boom Removal

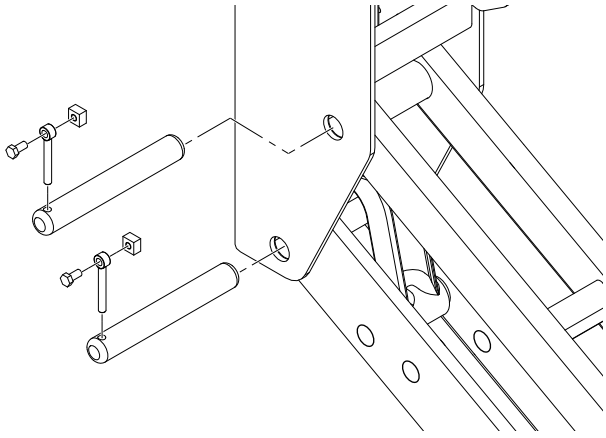
NOTE: *The mid and lower booms together weighs approximately 1126.56 lb (511 kg).*

1. Using a suitable lifting equipment, adequately support lower boom assembly weight along entire length.
2. Attach an adequate supporting device to the tower lift cylinder to support its weight.
3. Remove mounting hardware from pin. Using a suitable brass drift and hammer, remove the pin from tower lift cylinder.
4. Carefully remove the tower lift cylinder assembly from lower upright.
5. Remove mounting hardware from pin. Using a suitable brass drift and hammer, remove the pin from lower boom timing link.



6. Remove mounting hardware from pins. Using a suitable brass drift and hammer, remove the pins from lower upright.

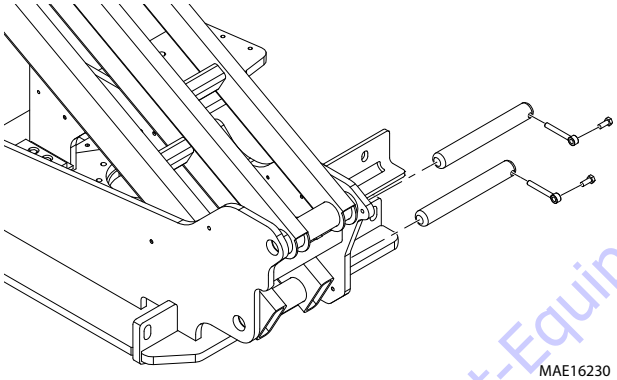
7. Remove the lower upright from lower boom assembly.



MAE16220

8. Attach an adequate supporting device to the tower lift cylinder to support its weight.

9. Remove mounting hardware from pins. Using a suitable brass drift and hammer, remove the pins from turntable.



MAE16230

10. Using all applicable safety precautions, carefully lift lower boom assembly clear of turntable and lower to ground or suitably supported work surface.

11. Using all applicable safety precautions, carefully lift tower lift cylinder and lower boom timing link clear of turntable and lower to ground or suitably supported work surfaces.

Lower Boom Installation

NOTE: *The mid and lower booms together weighs approximately 1126.56 lb (511 kg).*

1. Using all applicable safety precautions, carefully lift lower boom assembly to align the pivot holes in the lower boom with those of the turntable.

2. Align lower boom assembly with the turntable. Using a soft head mallet, install pins into turntable and secure with mounting hardware.

3. Using all applicable safety precautions, carefully lift and align lower upright with lower boom assembly. Using a soft head mallet, install pins into lower upright and secure with mounting hardware.

4. Align lower boom timing link with lower boom assembly. Using a soft head mallet, install pin into lower boom timing link and secure with mounting hardware.

5. Using all applicable safety precautions, carefully lift and align tower lift cylinder assembly with lower boom assembly. Using a soft head mallet, install pin into tower lift cylinder assembly and secure with mounting hardware.

Mid Boom Installation

NOTE: *The mid and lower booms together weighs approximately 1126.56 lb (511 kg).*

1. Using all applicable safety precautions, carefully lift mid boom assembly to align the pivot holes in the mid boom with those of the lower upright.

2. Align mid boom assembly with the lower upright. Using a soft head mallet, install pins into lower upright and secure with mounting hardware.

3. Attach an adequate supporting device to the tower lift cylinder to support its weight.

4. Using all applicable safety precautions, carefully lift and align tower lift cylinder with mid boom assembly. Using a soft head mallet, install pin into tower lift cylinder and secure with mounting hardware.

5. Align upper upright with mid boom assembly. Using a soft head mallet, install pins into upper upright and secure with mounting hardware.

6. Connect hydraulic lines to the tower lift cylinder as tagged during removal.

Main Boom Installation

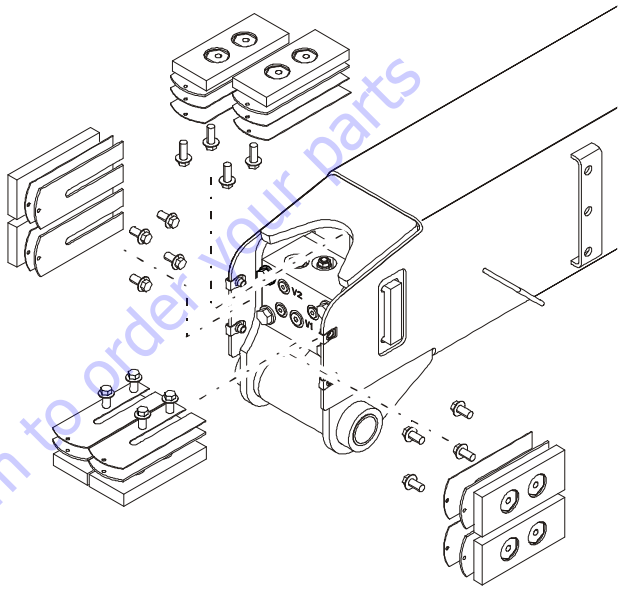
NOTE: *The main boom alone weighs approximately 472 lb (214.1 kg).*

1. Using all applicable safety precautions, carefully lift main boom assembly to align the pivot holes in the main boom with those of the upper upright.
2. Using all applicable safety precautions, carefully lift and align main boom assembly with the upper upright. Using a soft head mallet, install pivot pin into upper upright and secure with bolt and pin keeper.
3. Using all applicable safety precautions, carefully lift and align master cylinder with the upper upright. Using a soft head mallet, install cylinder pin into upper upright and secure with bolt and pin keeper.
4. Using all applicable safety precautions, carefully align master cylinder with the main boom. Using a soft head mallet, install cylinder pin into main boom and secure with bolt and pin keeper.
5. Using all applicable safety precautions, carefully lift and align upper lift cylinder with the upper upright. Using a soft head mallet, install cylinder pin into upper upright and secure with bolt and pin keeper.
6. Using all applicable safety precautions, carefully align upper lift cylinder with the main boom. Using a soft head mallet, install cylinder pin into main boom and secure with bolt and pin keeper.
7. Connect hydraulic lines to the master cylinder and upper lift cylinder as tagged during removal.
8. Install the jib and platform assembly. Refer to Section 4.5 - Jib.

4.4 BOOM MAINTENANCE

Disassembly of the Main Boom

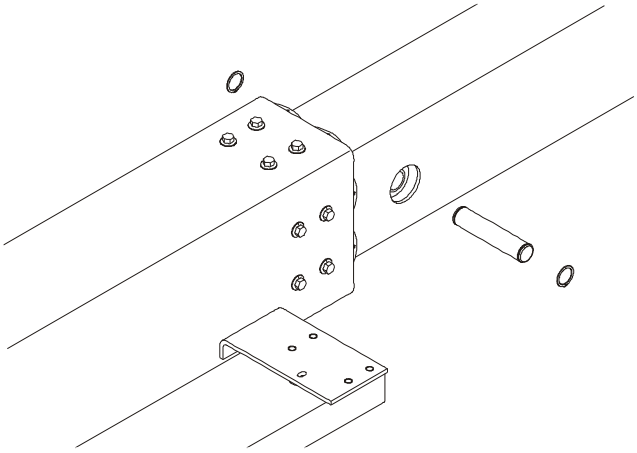
1. Loosen the wear pad retaining bolts at the rear of fly boom section and remove the shims and wear pads noting the location and amount of shims to aid in reassembly.



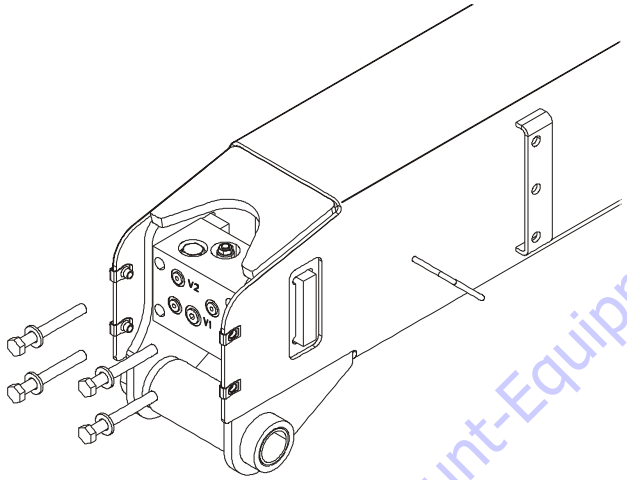
2. Using a portable power source, attach hose to telescope cylinder port block. Using all applicable safety precautions, activate hydraulic system and extend cylinder to gain access to cylinder rod retaining pin. Shut down the portable power source.
3. Carefully disconnect hydraulic hose from retract port of cylinder. There will be initial weeping of hydraulic fluid which can be caught in a suitable container. After initial discharge, there should be no further leakage from the retract port. Cap or plug all openings.

NOTE: *When removing the retaining pin from the rod end of the telescope cylinder, make sure the cylinder is properly supported.*

4. Remove the retaining ring and pin securing the telescope cylinder rod end to the fly boom section.

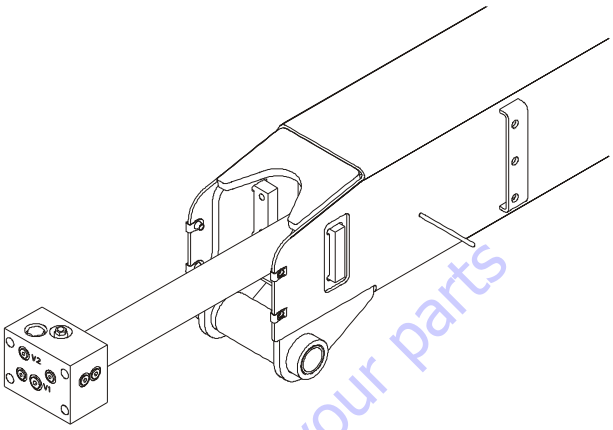


5. Remove the bolts and washers securing telescope cylinder to the rear of the base boom section.

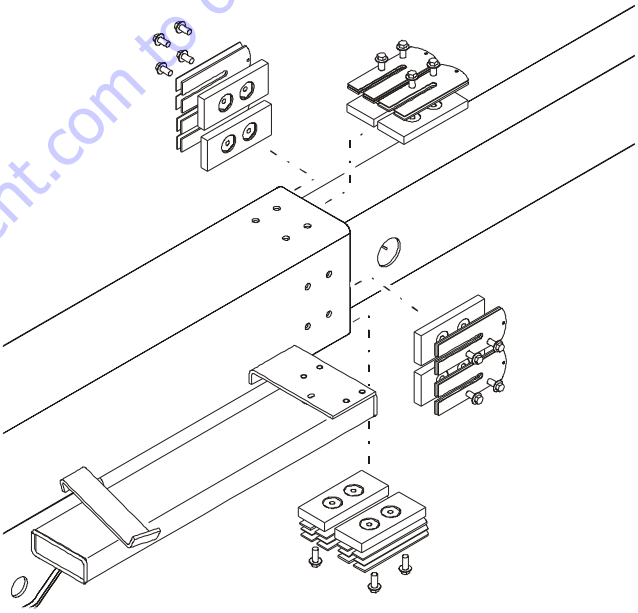


NOTE: *The telescope cylinder weighs approximately 53 lb (24 kg).*

6. Using a suitable lifting device, remove telescope cylinder from the rear of the boom sections.



7. Remove hardware securing the front wear pads on base boom section, remove wear pads and shims, noting the location and amount of shims to aid in reassembly.



NOTE: *The fly boom section weighs approximately 188 lb (85 kg).*

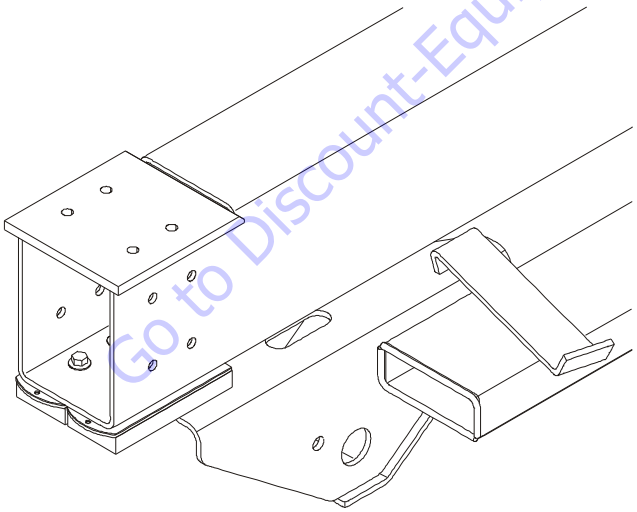
8. Using a suitable lifting device, remove fly boom from boom section.

Inspection

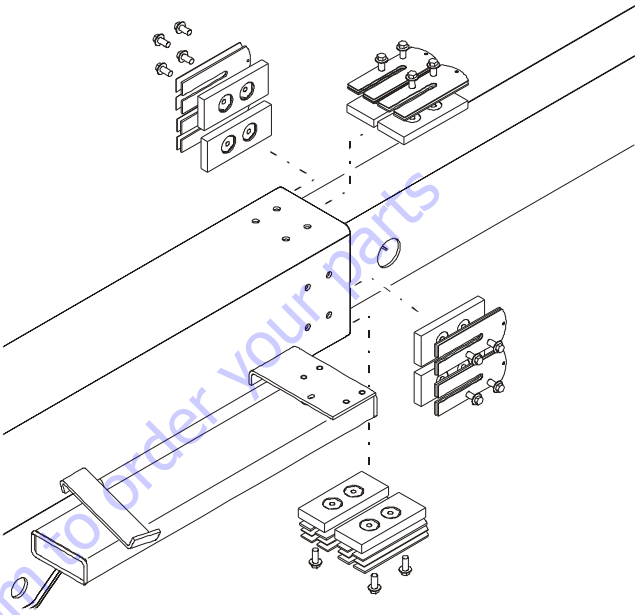
1. Inspect all boom pivot pins for wear, scoring or other damage, and for tapering or ovality. Replace pins as necessary.
2. Inspect lift cylinder pins for wear, scoring or other damage, and for tapering or ovality. Ensure pin surfaces are protected prior to installation. Replace pins as necessary.
3. Inspect telescope cylinder rod attach pin for wear, scoring or other damage. Replace pin as necessary.
4. Inspect inner diameter of boom pivot bushings for scoring, distortion, wear or other damage. Replace bushings as necessary.
5. Inspect wear pads for wear.
6. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.
7. Inspect structural units of boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

Assembly of the Main Boom

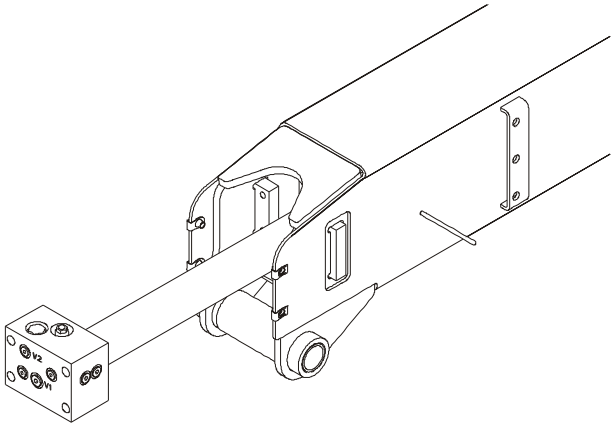
1. Using Medium Strength Threadlocking Compound, install the bottom wear pads and shims as noted during disassembly on the rear of the fly section. Torque the retaining bolts to 40 ft.lbs. (55 Nm). Install the rest of the wear pads on the rear of the fly section but do not install the shims or torque them at this time.



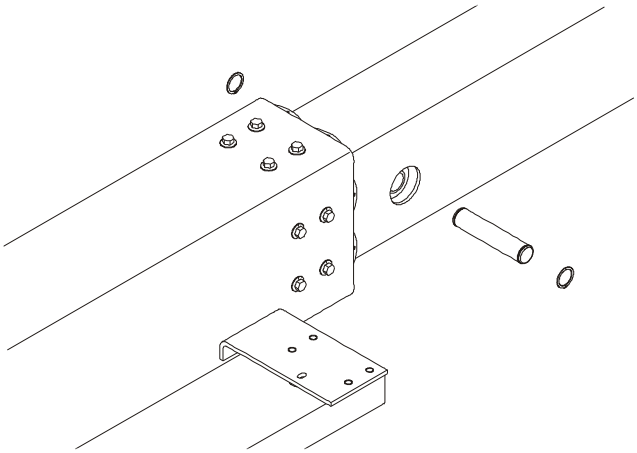
2. Using an adequate lifting device, slide the fly boom section into the base boom section. Install the remaining shims on the rear of the fly section as noted during disassembly and torque the retaining bolts to 40 ft.lbs. (55 Nm). Pull the fly section out of the base section enough to install the pin that secures the telescope cylinder rod to the fly boom section.
3. Using Medium Strength Threadlocking Compound, install the front wear pads and shims as noted during disassembly on the base boom section. Torque the retaining bolts to 40 ft.lbs. (55 Nm).



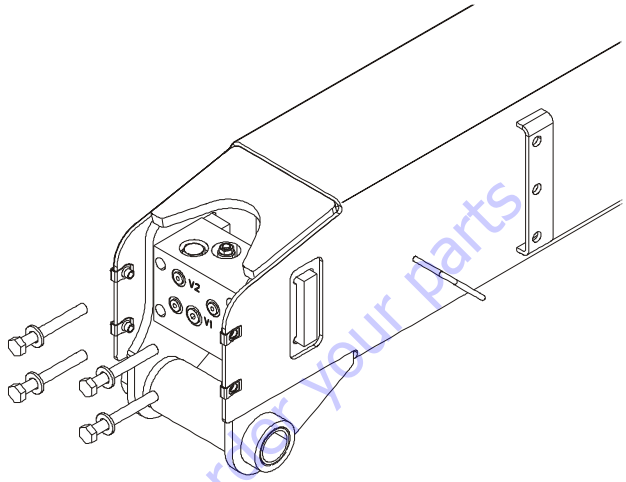
4. Using an adequate lifting device, install the telescope cylinder into the boom assembly. It will aid assembly if the cylinder is extended to enable connection to the fly boom section.

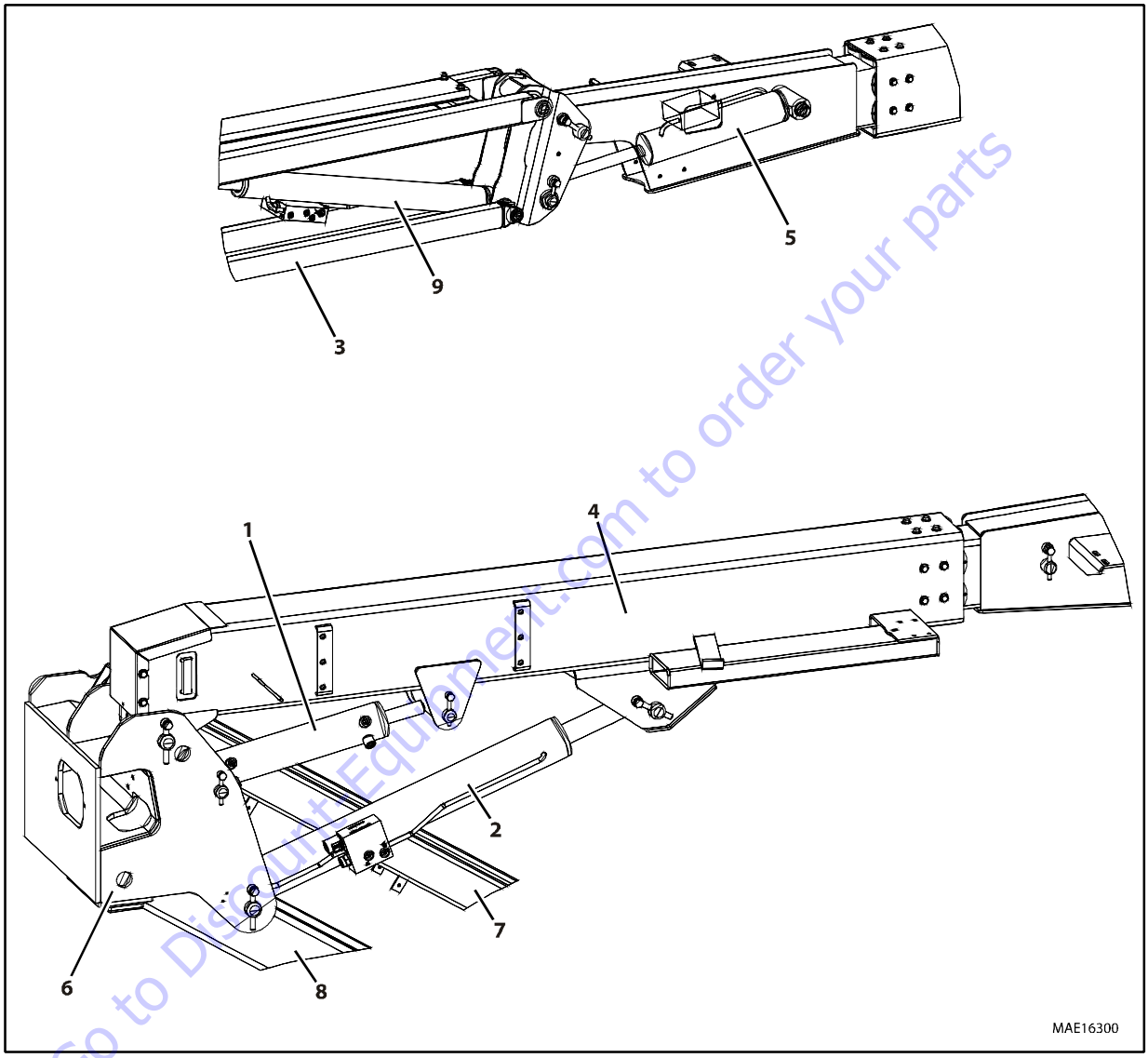


5. Align the telescope cylinder rod end with the corresponding hole in the fly boom section. If necessary, attach a portable power supply to the cylinder to extend or retract the cylinder for alignment. Install the retaining pin and secure it in place with the retaining ring.



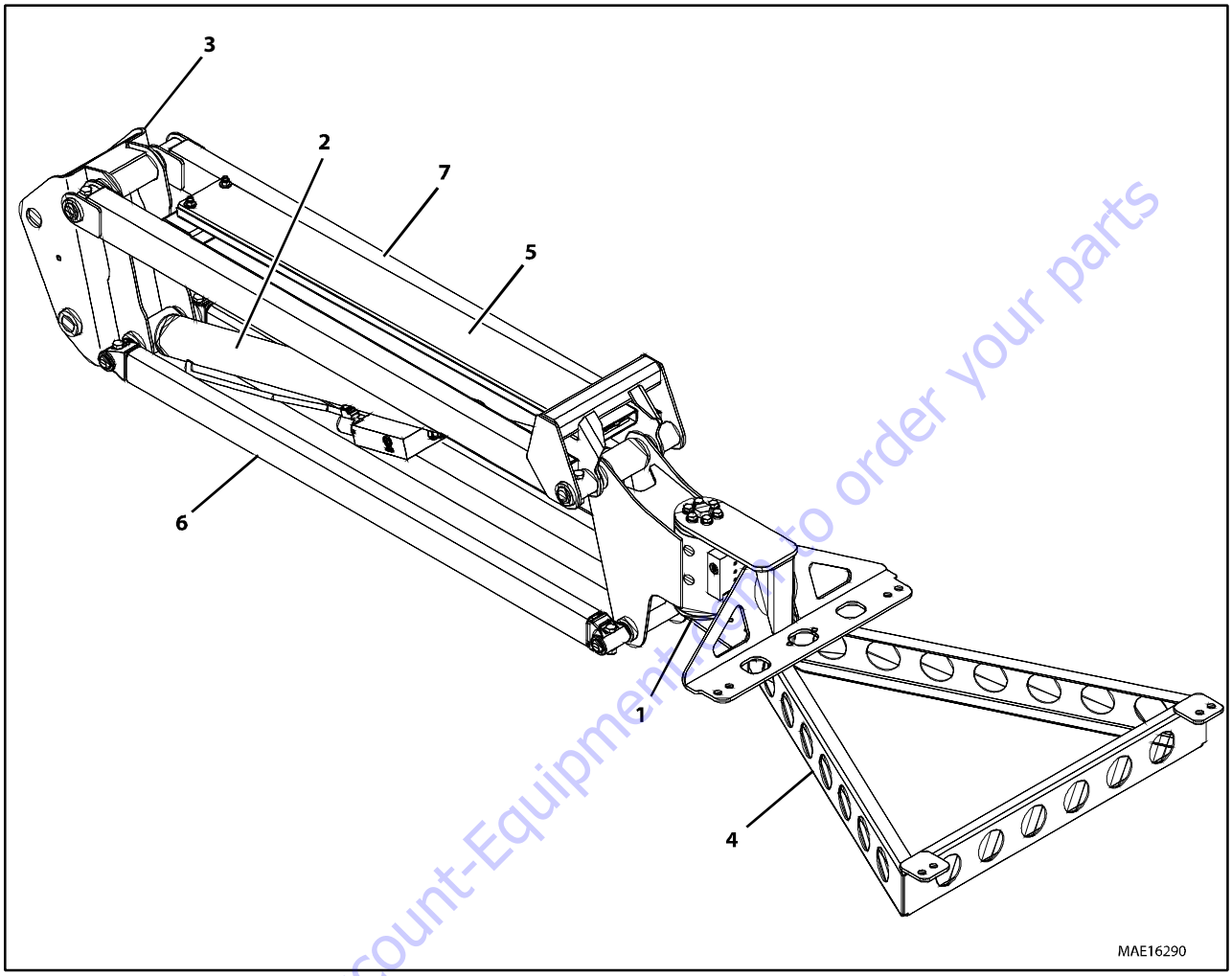
6. Using Medium Strength Threadlocking Compound, secure the rear of the telescope cylinder to the base boom section with the attaching bolts and washers. Torque the bolts 95 ft.lbs. (129 Nm).





1. Master Cylinder
2. Upper Lift Cylinder
3. Jib
4. Main Boom
5. Level Cylinder
6. Upper Upright
7. Mid Boom Link
8. Mid Boom
9. Jib Cylinder

Figure 4-3. Main Boom Assembly



1. Rotator
2. Jib Cylinder
3. Jib Pivot
4. Platform Support
5. Hose Carrier
6. Lower Jib Link
7. Upper Jib Link

Figure 4-4. Jib/ Platform Support

4.5 JIB

Removal

1. Lower the jib and platform assembly to the ground or onto blocking to support the weight of the jib.

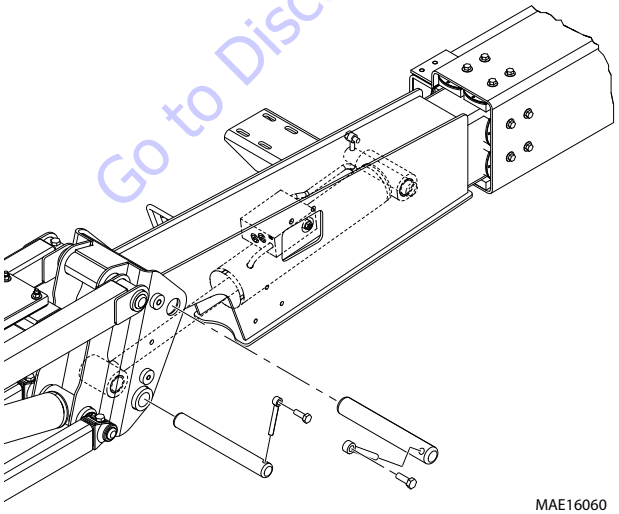
NOTICE

HYDRAULIC LINES AND PORTS SHOULD BE CAPPED IMMEDIATELY AFTER DISCONNECTING LINES TO AVOID ENTRY OF CONTAMINANTS INTO SYSTEM.

2. Tag and disconnect hydraulic lines from level cylinder and lift cylinder. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
3. Attach an adequate supporting device to the lift cylinder assembly to support its weight.
4. Remove bolt and pin keeper securing level cylinder assembly. Using a suitable brass drift and hammer, remove the cylinder pin from jib assembly.
5. Place blocking under the cylinder rod or a soft material under the cylinder rod to protect the rod from being scratched.

NOTE: *The jib and platform assembly weighs approximately 121.9 lb (55.3 kg.).*

6. Attach an adequate supporting device to the jib and platform assembly to support its weight.
7. Remove bolt and pin keeper securing jib and platform assembly to the boom sections. Using a suitable brass drift and hammer, remove the pin from jib and platform assembly.

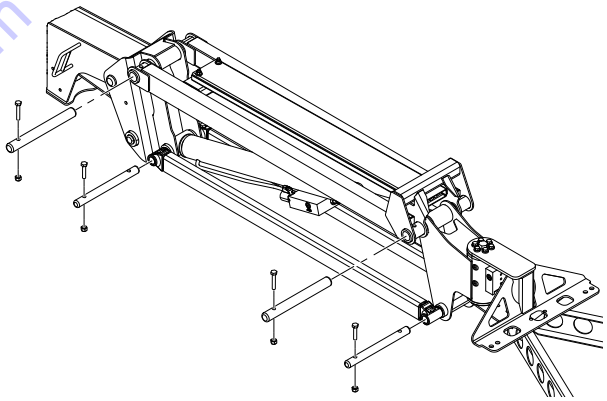


MAE16060

8. Remove the jib and platform assembly from the boom.

Disassembly

1. Remove bushings and mounting hardware from jib pivot pin. Using a suitable brass drift and hammer, remove the pin from jib pivot.
2. Remove bushings and mounting hardware from jib boom pivot pin of the lift cylinder assembly. Using a suitable brass drift and hammer, remove the pin from jib pivot.
3. Remove the jib pivot from jib and platform assembly.
4. Attach an adequate supporting device to the lift cylinder assembly to support its weight.
5. Remove mounting hardware from cylinder pin of the lift cylinder assembly. Using a suitable brass drift and hammer, remove the pin from the lift cylinder assembly.
6. Carefully remove the lift cylinder assembly from jib and platform assembly.
7. Remove mounting hardware from rotator pin. Using a suitable brass drift and hammer, remove the pin from the rotator.



MAE16080

8. Remove rotator from jib and platform assembly.

Inspection

NOTE: *When inspecting pins and bearings Refer to Section 2.5 - Pins and Composite Bearing Repair Guidelines.*

1. Inspect fly boom pivot pin for wear, scoring, tapering and ovality, or other damage. Replace pins as necessary.
2. Inspect fly boom pivot attach points for scoring, tapering and ovality, or other damage. Replace pins as necessary.
3. Inspect inner diameter of fly boom pivot bearings for scoring, distortion, wear, or other damage. Replace bearings as necessary.
4. Inspect lift cylinder attach pin for wear, scoring, tapering and ovality, or other damage. Ensure pin surfaces are

protected prior to installation. Replace pins as necessary.

5. Inspect inner diameter of rotator attach point bearings for scoring, distortion, wear, or other damage.
6. Inspect all threaded components for damage such as stretching, thread deformation, or twisting. Replace as necessary.
7. Inspect structural units of jib boom assembly for bending, cracking, separation of welds, or other damage. Replace boom sections as necessary.

Assembly

1. Align lift cylinder assembly and rotator with jib assembly. Using a soft head mallet, install cylinder pin into jib assembly and secure with mounting hardware.
2. Align rotator with jib assembly. Using a soft head mallet, install rotator pin into jib assembly and secure with mounting hardware.
3. Align lift cylinder assembly and jib pivot with jib assembly. Using a soft head mallet, install pin into jib assembly and secure with bushings and mounting hardware.
4. Align jib pivot with jib assembly. Using a soft head mallet, install pin into jib assembly and secure with bushings and mounting hardware.

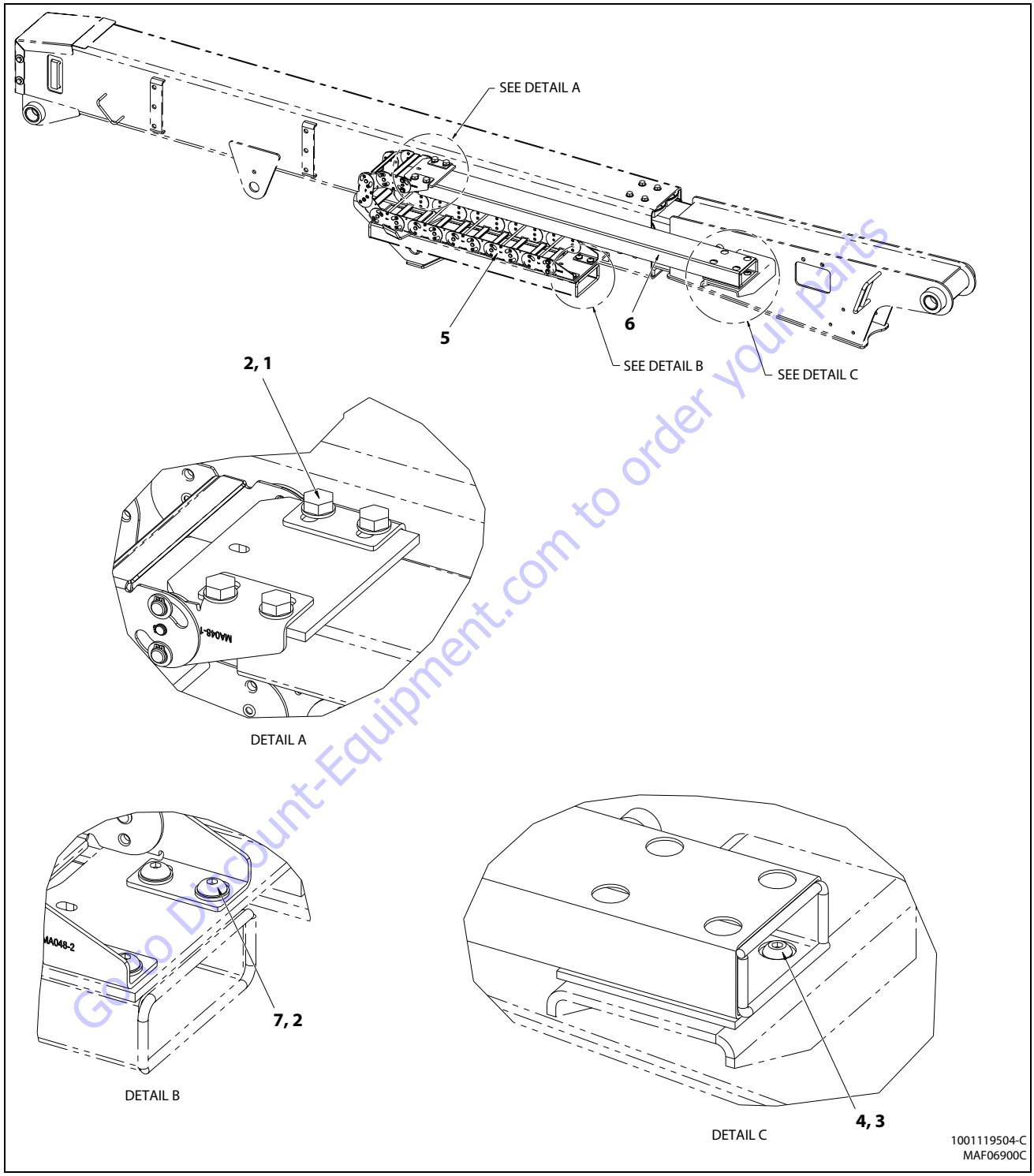
Installation

1. Attach an adequate lifting device to the jib and platform assembly and position it in front of the fly boom.
2. Place something under the front of the jib and platform assembly that will allow it to slide or move along the ground easily. Attach a lifting device to the rear of the jib, allowing the front to pivot on the ground.
3. Lift the jib and platform assembly into position on the boom fly section and install the pin. Secure the pin in place with the bolt and pin keeper.
4. Align level cylinder assembly with fly boom and install pin. Secure the pin in place with the bolt and pin keeper.
5. Connect hydraulic lines to the level cylinder as tagged during removal.

4.6 BOOM CLEANLINESS GUIDELINES

The following are guidelines for internal boom cleanliness for machines that are used in excessively dirty environments.

1. JLG recommends the use of the JLG Hostile Environment Package if available to keep the internal portions of a boom cleaner and to help prevent dirt and debris from entering the boom. This package reduces the amount of contamination which can enter the boom but does not eliminate the need for more frequent inspections and maintenance when used in these types of environments.
2. JLG recommends that you follow all guidelines for servicing your equipment in accordance with the instructions outlined in the JLG Service & Maintenance Manual for your machine. Periodic maintenance and inspection is vital to the proper operation of the machine. The frequency of service and maintenance must be increased as environment, severity and frequency of usage requires.
3. Debris and foreign matter inside of the boom can cause premature failure of components and should be removed. Methods to remove debris should always be done using all applicable safety precautions outlined in the JLG Service & Maintenance Manuals.
4. The first attempt to remove debris from inside the boom must be to utilize pressurized air to blow the debris toward the nearest exiting point from the boom. Make sure that all debris is removed before operating the machine.
5. If pressurized air cannot dislodge the debris, then water with mild solvents applied via a pressure washer can be used. Again the method is to wash the debris toward the nearest exiting point from the boom. Make sure that all debris is removed, that no “puddling” of water has occurred, and that the boom internal components are dry prior to operating the machine. Make sure you comply with all federal and local laws for disposing of the wash water and debris.
6. If neither pressurized air nor washing of the boom dislodges and removes the debris, then disassemble the boom in accordance to the instructions outlined in the JLG Service & Maintenance Manual to remove the debris.



1. Bolt
2. Washer
3. Nut
4. Screw
5. Hose and Cable Carrier
6. Hose Carrier Support
7. Bolt

Figure 4-5. Powertrack Assembly

4.7 HOSE ROUTING

For proper hose routing, refer to Figure 3-19. thru Figure 3-26. It is important to periodically inspect hoses, wraps and clamps for proper slack adjustments and clamping integrity (pull check). Any changes as a result of inspection should be verified by performing full strokes of boom functions especially lift, telescope, jib, and platform rotate.

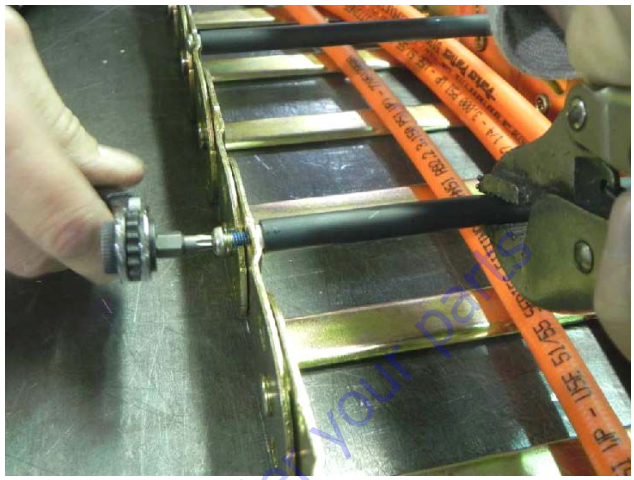
4.8 POWERTRACK MAINTENANCE

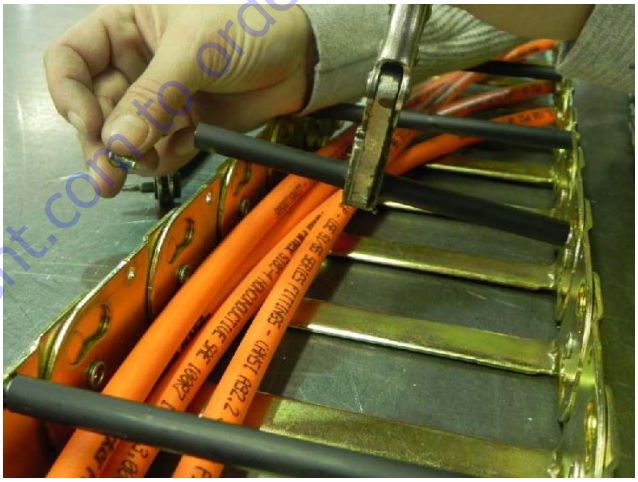
Remove Link

NOTE: *Hoses shown in powertrack are for example only. Actual hose and cable arrangements are different.*

1. Clamp bar and poly roller tightly so they do not spin when removing screw. With a small 1/4 in. ratchet and a T-20 torx bit, remove 8-32 x 0.500 screw from one side.

2. Repeat step 1 and remove screw from other side of track. Remove bar/poly roller from powertrack.

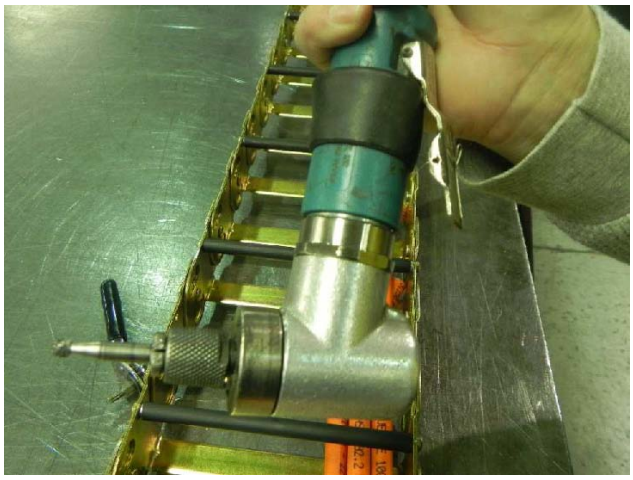




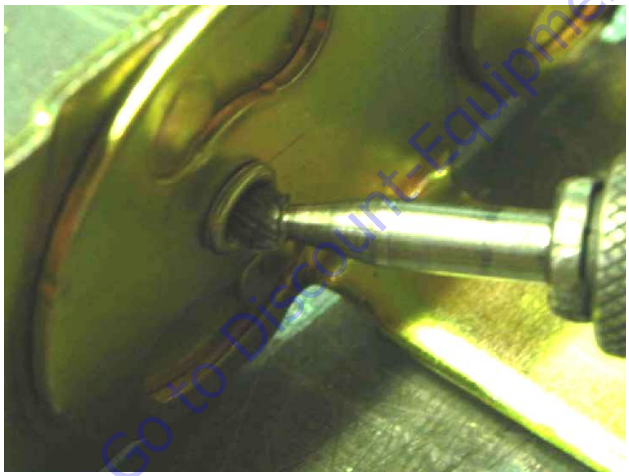
NOTICE

REPOSITION CABLES/HOSES AND KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

3. To remove a link, rivets holding links together must be removed. Use a right-angle pneumatic die grinder with a 1/4 in. ball double cut bur attachment.

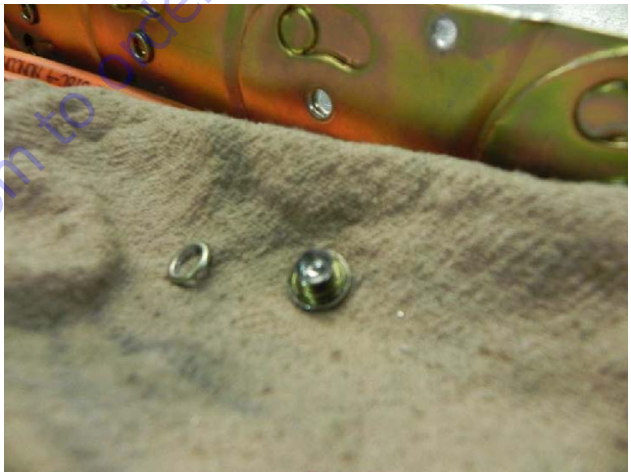


4. insert tool into rolled over end of rivet. Grind out middle of rivet until rolled over part of rivet falls off. Repeat for all rivets to be removed.

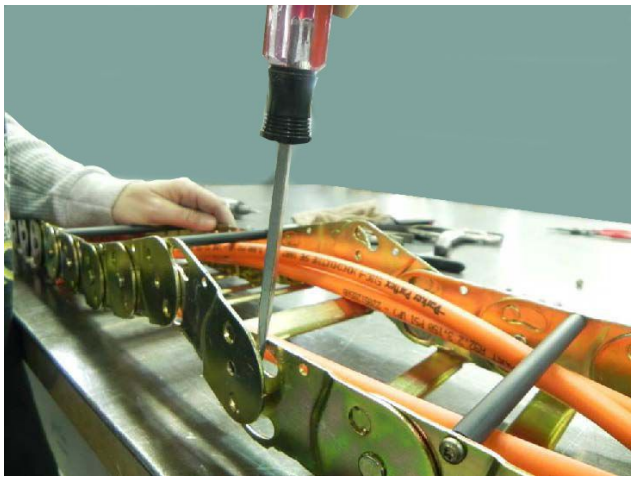


5. After grinding it may be necessary to use a center punch with a hammer to remove rivet.

NOTE: *It may be necessary to loosen fixed end brackets from machine to move track section enough to disconnect links.*



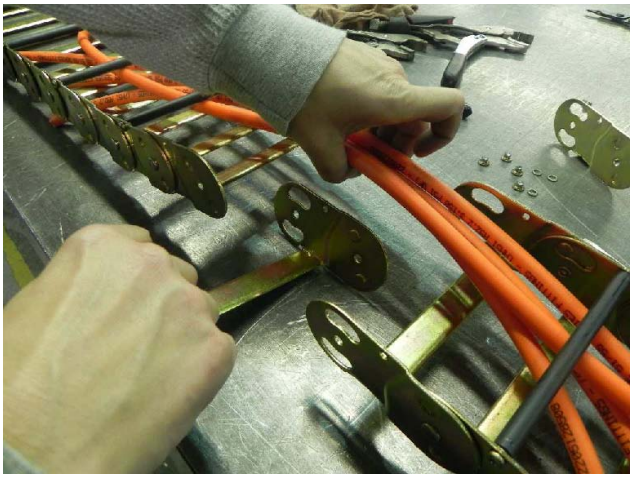
6. Insert flat head screwdriver between links. Twist and pull links apart.



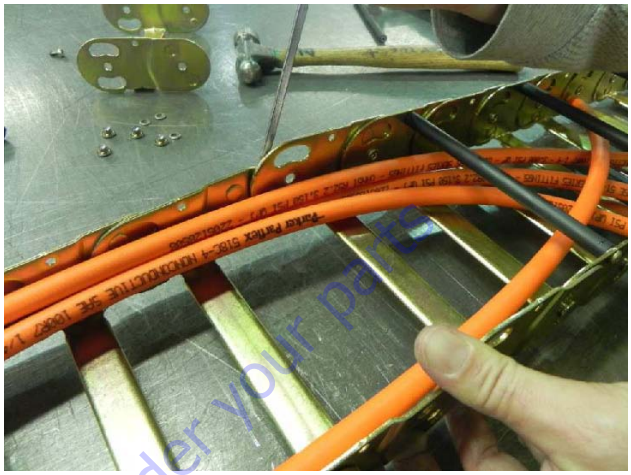
7. Remove link from other section of powertrack using screwdriver.

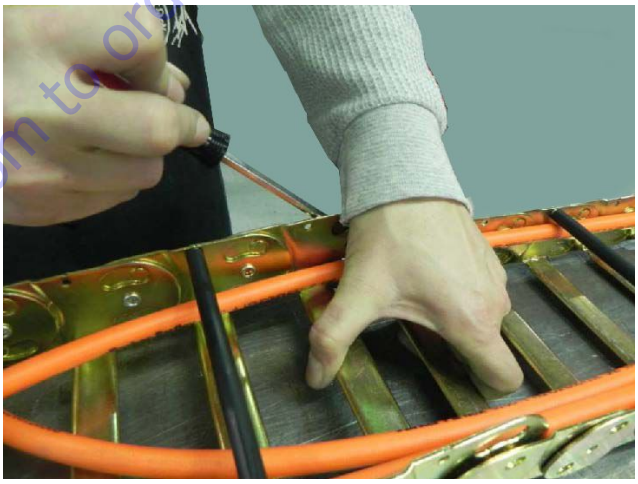
Install New Link

1. Squeeze cut-out end of new link into half-shear (female) end of track section.

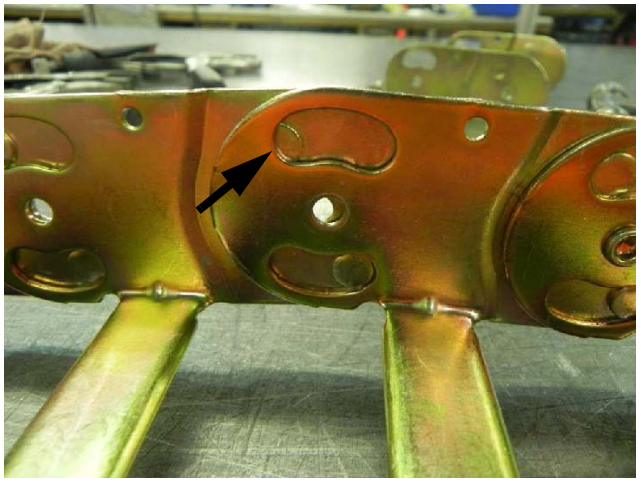


2. Spread half-shear (female) end of new link and slide cut-out end of track section into it. Use a screwdriver if necessary.

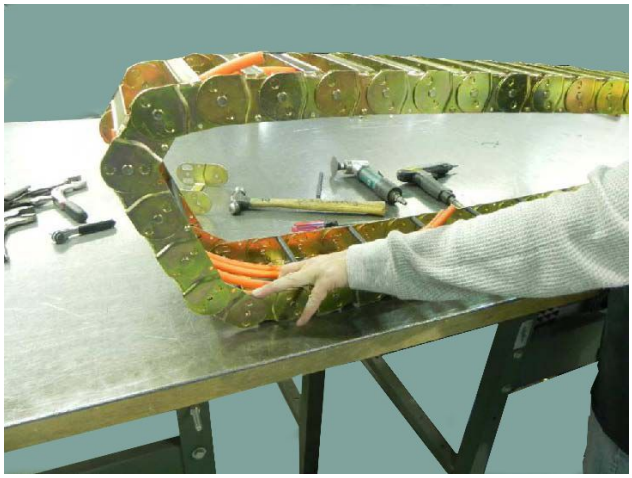


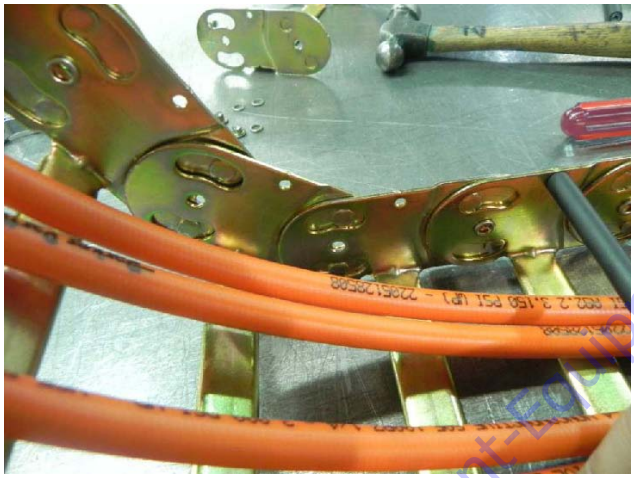


3. After new link is installed round half-shears do not fit properly in cut-outs.

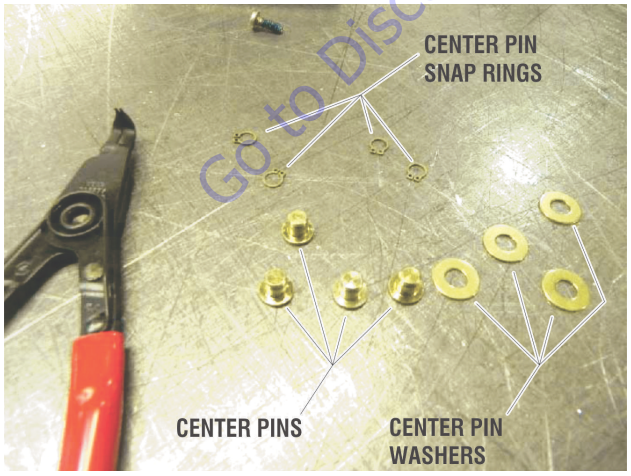


4. Pull moving end over track so new connection is positioned in curve of powertrack. Round half-shears will rotate into cut-outs.





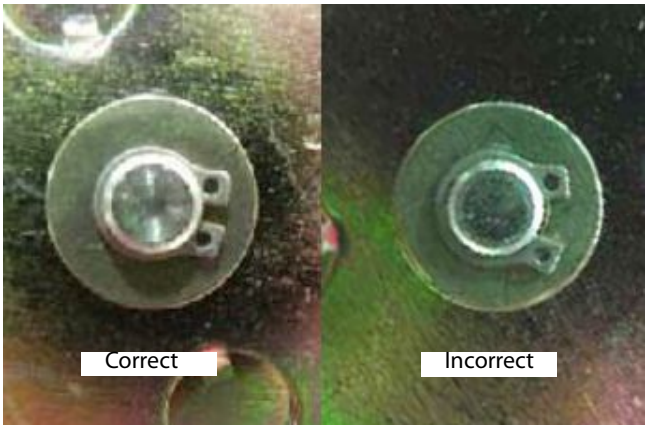
5. Parts shown below connect new link to powertrack.



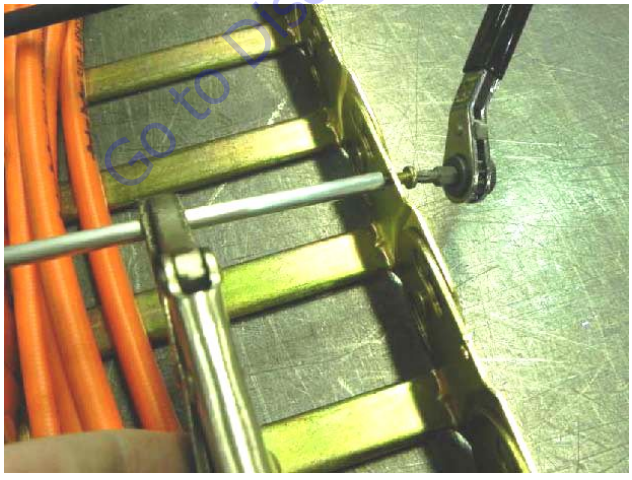
6. Push pin through center hole then slide washer on pin.

7. Install snap ring in groove on pin. Repeat pin installation steps for all center holes with rivets removed.

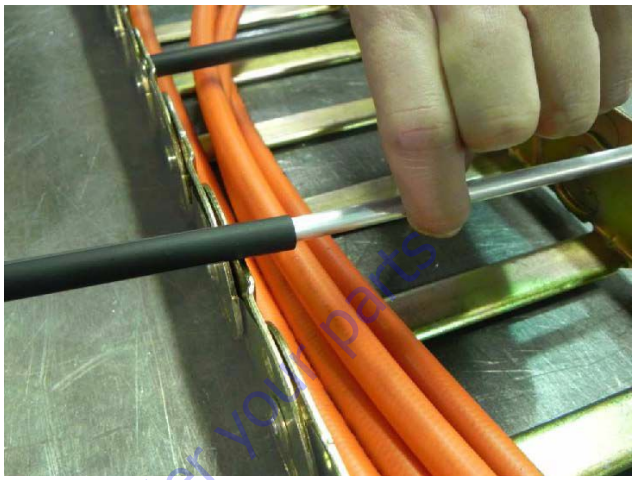
NOTE: *Make sure snap rings are seated in pin groove and closed properly.*



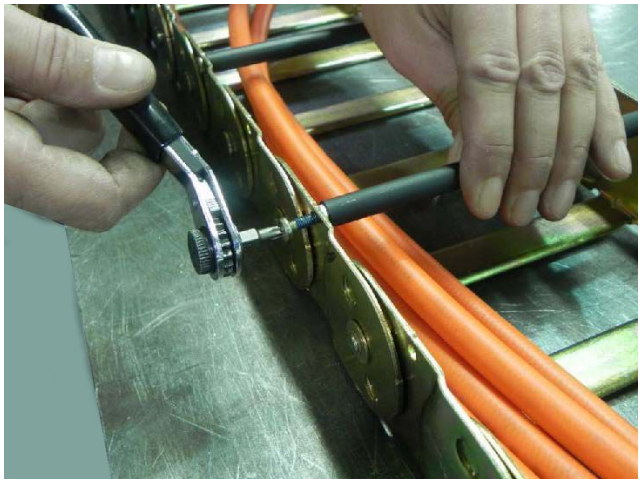
1. Install new 8-32 x 0.500 self-threading torx head screw in end of new aluminum round bar. Torque to 18-20 in. lbs. (2-2.25 Nm).



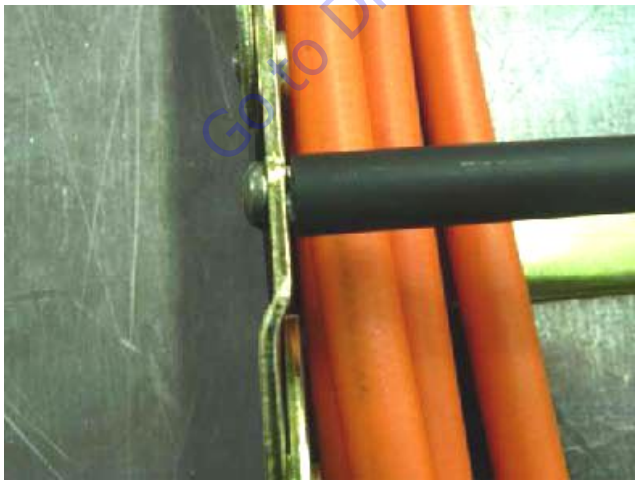
2. Pull up on other end of round bar and slide new poly roller on bar.



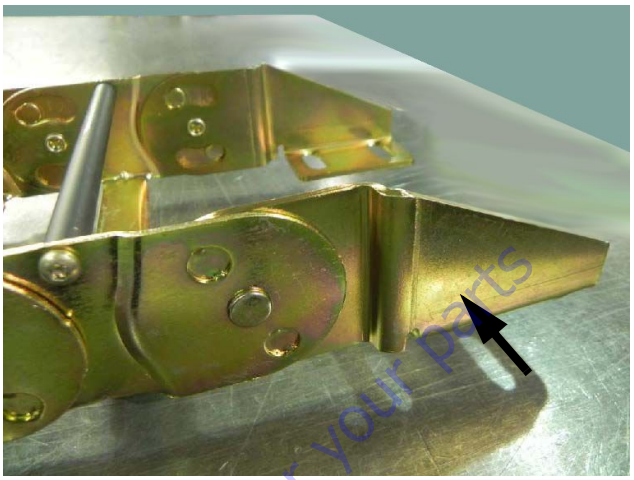
3. Install new 8-32 x 0.500 self threading screw on other side. Torque to 18-20 in. lbs. (2-2.25 Nm).



NOTE: *When tightening screws make sure screw head is seated against link with no space in between link and underside of screw head.*



Replace Fixed End Brackets



NOTICE

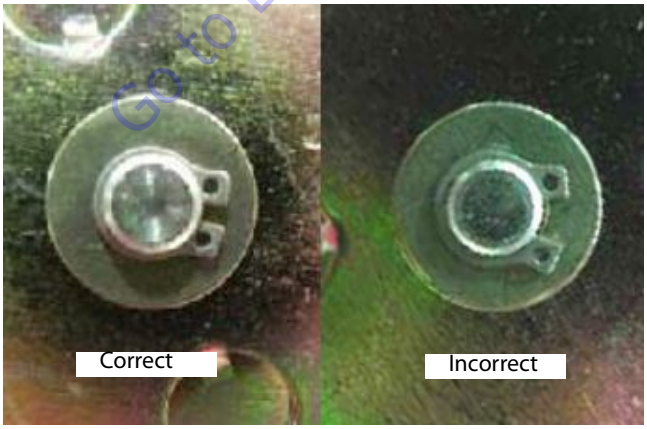
REPOSITION CABLES/HOSES AND KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

1. Remove rivets as shown in link removal instructions on page 19.

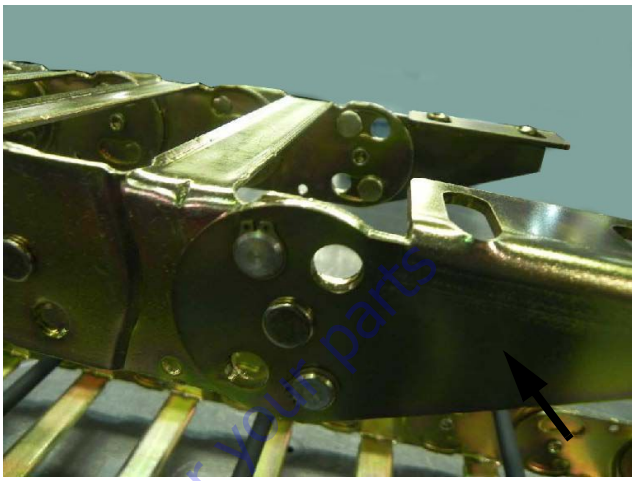
2. Parts used: Bracket Center Pin and Center Pin Snap Ring.

3. Take new bracket and install bracket center pin and snap ring. Repeat on other bracket if replacing it.

NOTE: *When installing snap rings make sure they are seated in pin groove and closed properly.*



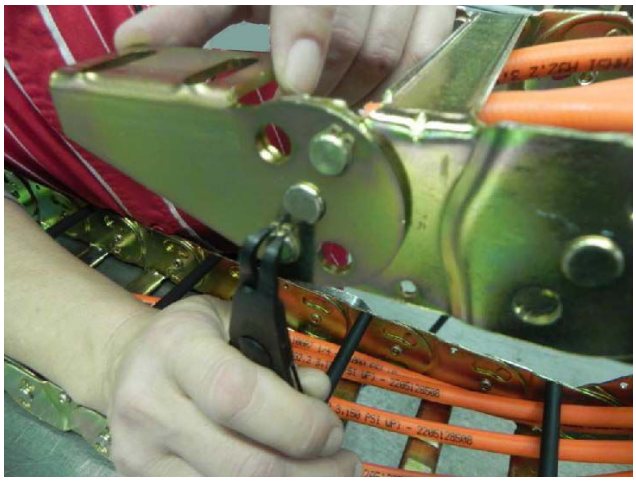
Replace Moving End Brackets



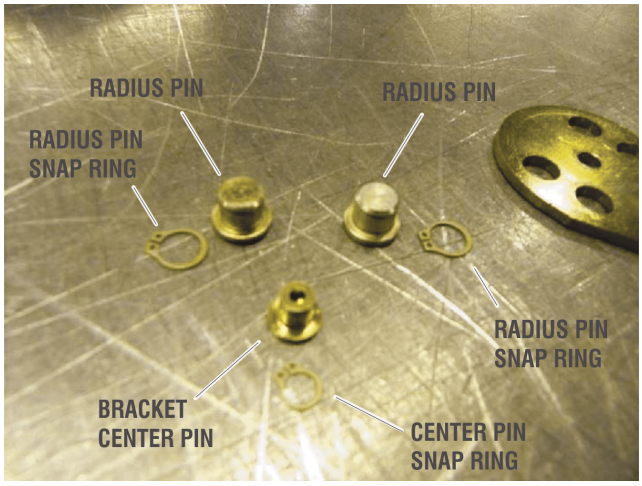
NOTICE

REPOSITION CABLES/HOSES AND KEEP COVERED DURING GRINDING TO PREVENT DAMAGE.

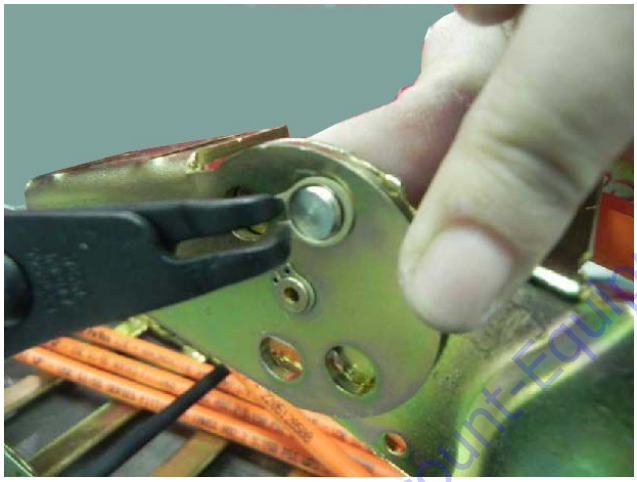
1. Remove existing pins and center rivet. Remove rivet as shown in link removal instructions on page 4-20. Repeat on other bracket if replacing it.



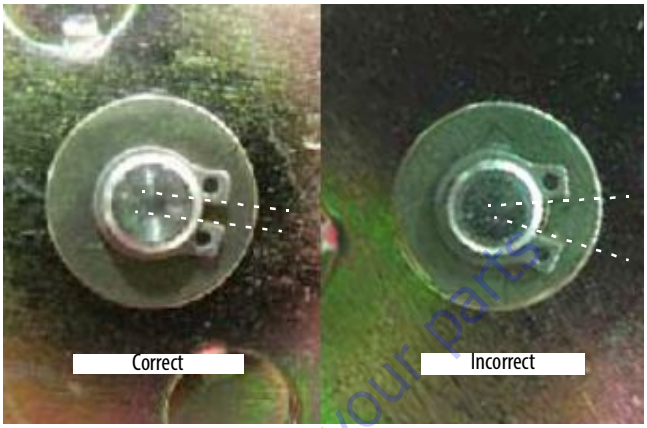
2. Install center pin with snap ring in new bracket.



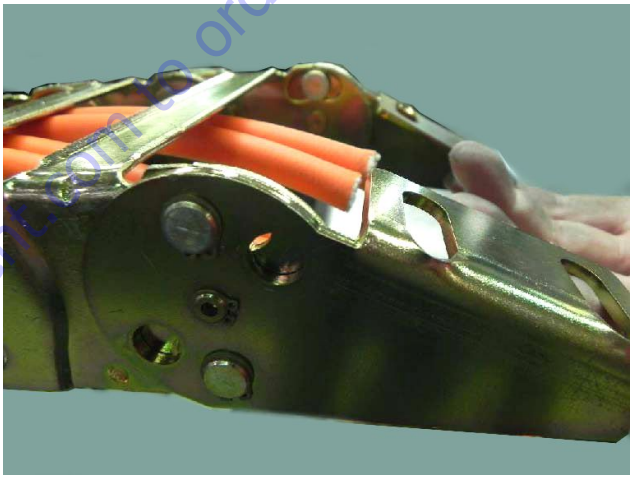
3. Install radius pins and snap rings in original locations. Repeat with other moving end if replacing it.



NOTE: *When installing snap rings make sure they are seated in pin groove and closed properly.*



4. Make sure both brackets rotate correctly.



4.9 ROTARY ACTUATOR

Theory of Operation

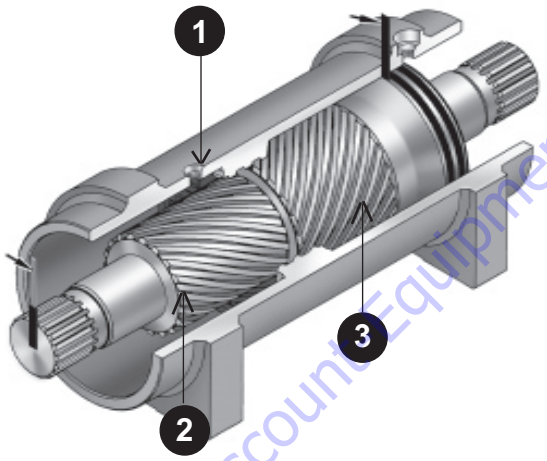
The rotary actuator is a simple mechanism that uses the sliding spline operating concept to convert axial piston motion into powerful shaft rotation. Each actuator is composed of a housing with integrated gear ring (1) and only two moving parts: the central shaft with integrated bearing tube and mounting flange (2), and the annular piston sleeve (3). Helical spline teeth machined on the shaft engage matching splines on the inside diameter of the piston. The outside diameter of the piston carries a second set of splines, of opposite hand, which engage with matching splines in the housing. As hydraulic pressure is applied, the piston is displaced axially within the housing similar to the operation of a hydraulic cylinder while the splines cause the shaft to rotate. When the control valve is closed, oil is trapped inside the housing, preventing piston movement and locking the shaft in position.

The shaft is supported radially by the large main radial bearing and the lower radial bearing. Axially, the shaft is separated from the housing by the main and lower thrust washers. The end cap is adjusted for axial clearance and locked in position by set screws or pins.

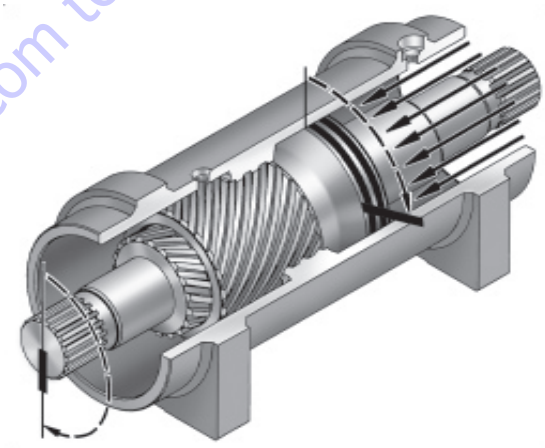
The actuators are equipped with factory installed counterbalance valves, which performs four major functions.

- Protects the actuator in the event of overload.
- Enables the actuator to hold position without drifting when external loads are applied.
- Reduces hydraulic backlash by pressuring the hydraulic fluid.

Provides a constant controlled rate of rotation in over-center load conditions.



Bars indicate starting positions of piston and shaft. Arrows indicate direction they will rotate. The housing with integral ring gear remains stationary.



Applying fluid pressure will displace the piston axially while the helical gearing causes the piston and shaft to rotate simultaneously.

The double helix design compounds rotation: shaft rotation is about twice that of the piston. Applying pressure to the opposite port will return the piston and shaft

Required Tools

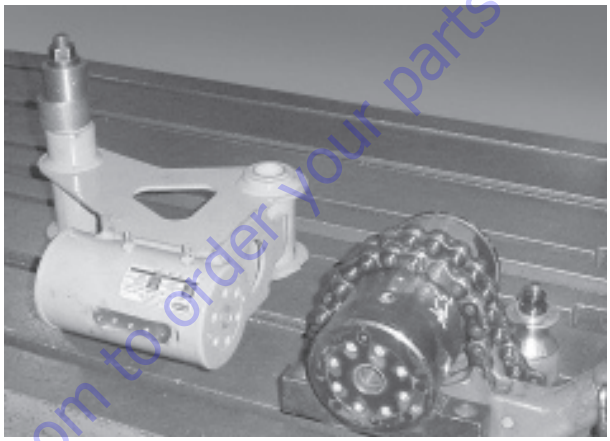
Upon assembly and disassembly of the actuator there are basic tools required. The tools and their intended functions are as follows:

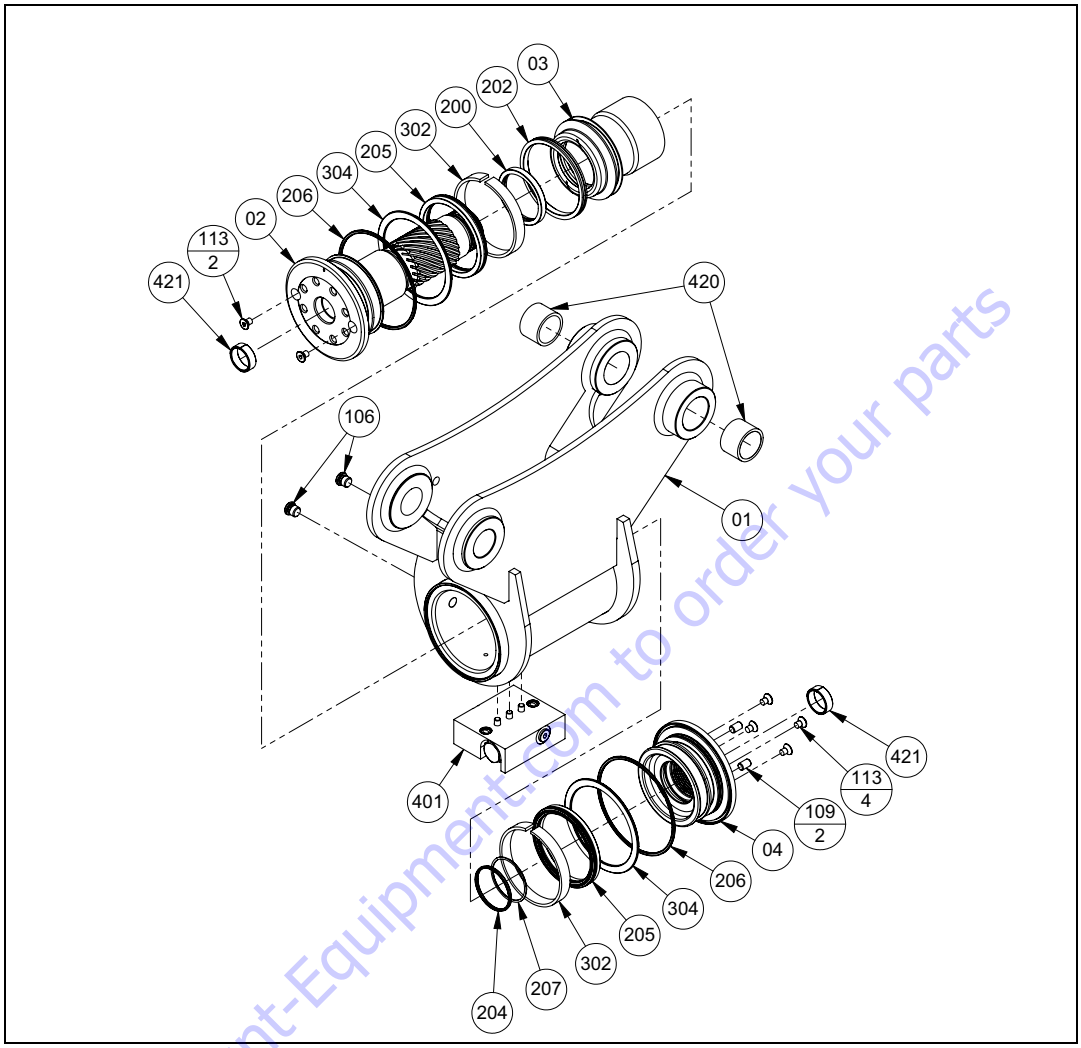
1. PIPE VISE
2. HEX WRENCH - Removal and replacement of port plugs and setscrews.
3. ASSORTED SCREWS
4. SAFETY GLASSES
5. END CAP REMOVAL TOOLS (provided with Helac seal kit).
6. DRILL
7. FLASHLIGHT - Helps to locate and examine timing marks, component failure and overall condition.
8. RUBBER MALLET - Removal and installation of shaft and piston sleeve assembly.
9. PLASTIC MANDREL
10. PRY BAR - Removal of end cap and manual rotation of shaft.
11. FELT MARKER - Highlights the timing marks and outline troubled areas.
12. T-HANDLE SCREW EXTRACTOR
13. HEX WRENCH SET - Removal and replacement of port plugs and setscrews (106 &110).
14. SEAL TOOLS - Removal and installation of seals and wear guides.
15. PUNCH
16. DOWEL PINS - Removal and installation of end cap.

Before Disassembly

Inspect the actuator for corrosion prior to disassembly. Severe corrosion can make it difficult to remove the lock pins (109) and unthread the end cap (04). If corrosion is evident, soak the lock pins and end cap with penetrating oil for several hours before disassembly.

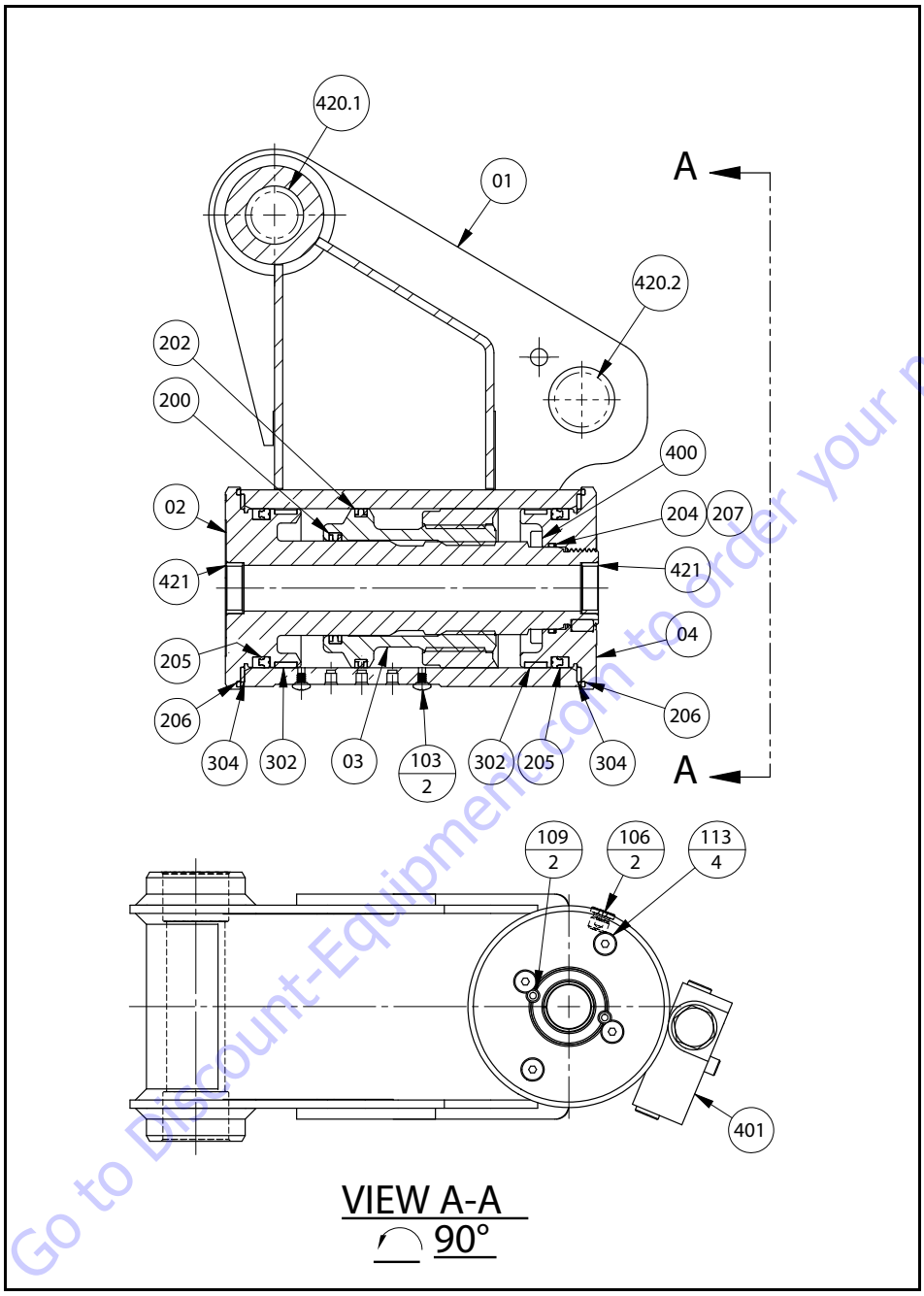
Disassembly is considerably easier if the actuator is firmly secured to the work bench. A pipe vise or mounting fixture work well.





PARTS	HARDWARE	SEALS	BEARINGS	ACCESSORIES
1. Housing	103. Screw	200. T-Seal	302. Wear Guide	400. Stop Tube
2. Shaft	106. Port Plug	202. T-Seal	304. Thrust Washer	401. Counterbalance Valve
3. Piston Sleeve	109. Lock Pin	204. O-ring		403. Motion Control Valve
4. End Cap	113. Capscrew	205. Cup Seal		420. Bushing
		206. Exclusion Seal		421 Bushing
		207. Backup Ring		

Figure 4-6. Rotator - Exploded View



PARTS
1. Housing
2. Shaft
3. Piston Sleeve
4. End Cap

HARDWARE
103. Screw
106. Port Plug
109. Lock Pin
113. Capscrew

SEALS
200. T-Seal
202. T-Seal
204. O-ring
205. Cup Seal
206. Exclusion Seal
207. Backup Ring

BEARINGS
302. Wear Guide
304. Thrust Washer

ACCESSORIES
400. Stop Tube
401. Counterbalance Valve
403. Motion Control Valve
420.1 Bushing
420.2 Bushing
421 Bushing

Figure 4-7. Rotator - Assembly Drawing

Disassembly

⚠ CAUTION

SECURE PRODUCT TO SLOTTED TABLE OR VISE.

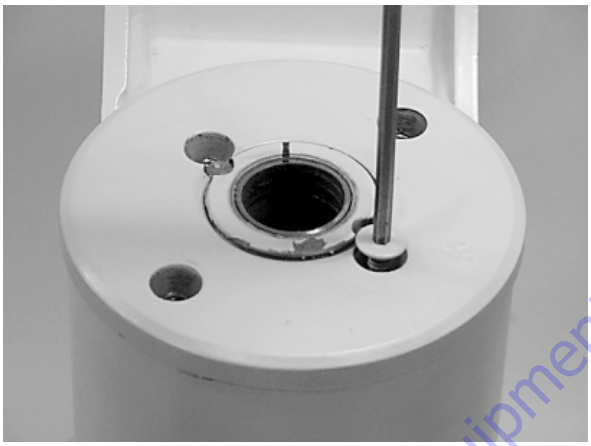
⚠ CAUTION

CONTENTS UNDER PRESSURE. WEAR APPROVED EYE PROTECTION. USE CAUTION WHEN REMOVING PORT PLUGS AND FITTINGS.

NOTICE

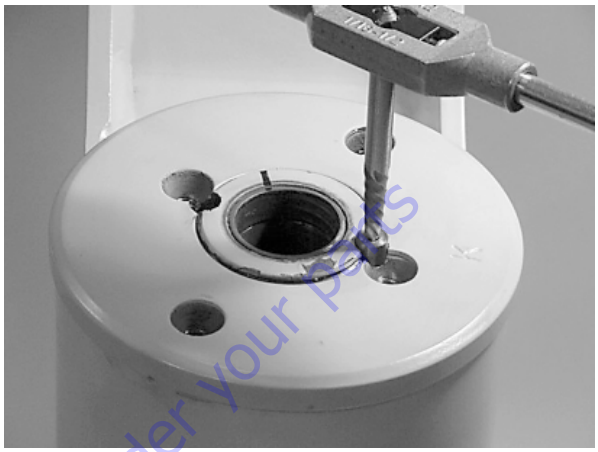
MAKE SURE WORK AREA IS CLEAN.

1. Remove the capscrews (113) over end cap lock pins (109).



2. Using a 1/8 in. (3.18 mm) drill bit, drill a hole in the center of each lock pin to a depth of approximately 3/16 in. (4.76 mm).

3. Remove the lock pins using an "Easy Out" (a size #2 is shown). If the pin will not come out with the "Easy Out", use 5/16 in. drill bit to a depth of 1/2 in. (12.7 mm) to drill out the entire pin.



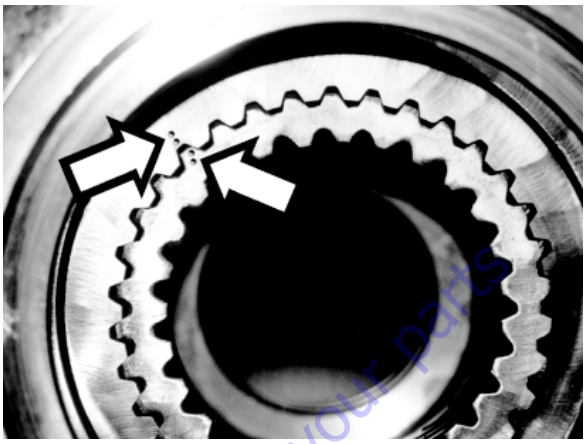
4. Install the end cap (4) removal tools provided with the Helac seal kit.

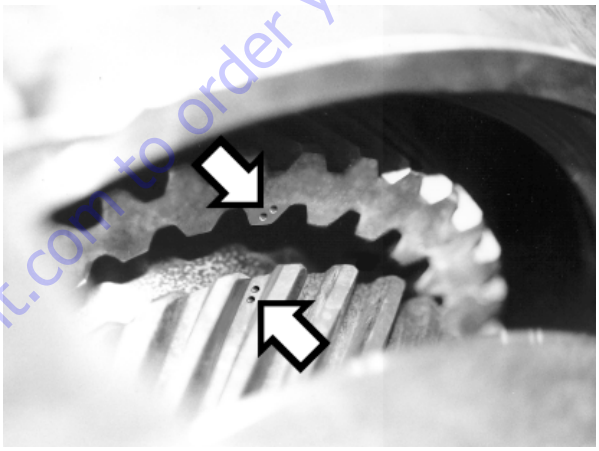
5. Using a metal bar, or similar tool, unscrew the end cap (4) by turning it counterclockwise.

6. Remove the end cap (4) and set aside for later inspection.

7. Remove the stop tube if equipped. The stop tube is an available option to limit the rotation of the actuator.

8. Every actuator has timing marks for proper engagement.





9. Prior to removing the shaft, (2), use a felt marker to clearly indicate the timing marks between shaft and piston. This will greatly simplify timing during assembly.