OPERATION & PARTS MANUAL

Lateral Pipe Thruster for Collector Well

Pipe Thruster Frame SN: F62213F
Pipe Thruster Container SN: F62002F

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SERVICE • RELIABILITY • INNOVATION

Introduction

This operator's manual contains important safety, operation, and maintenance information for your Akkerman Lateral Pipe Thruster for Collector Well and Container. You must read and understand this manual before you operate and maintain this equipment. Keep this manual with your Pipe Thruster System at all times. Additional copies of this manual may be purchased from the Akkerman Aftermarket Support Department, or downloaded from the Akkerman web site at www.akkerman.com.

The contractor is responsible for the overall safety program on the job site. Use this manual as a part of the safety program.

The use of second rate parts could affect the efficient performance of the Pipe Thruster System. ALWAYS use genuine Akkerman parts.

Understand safety signal words, DANGER, WARNING, CAUTION, SAFETY INSTRUCTIONS, and NOTICE. When you see these words in this manual or on safety decals mounted on your equipment, follow the safety message to avoid personal injury and/or property damage.

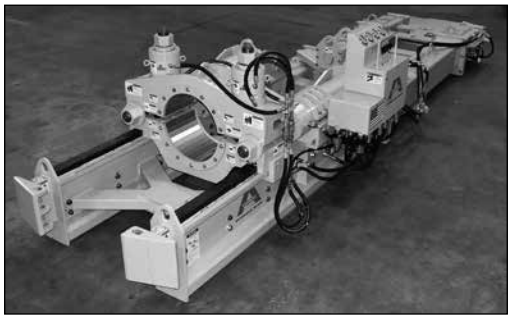
⚠DANGER Indicates an extremely hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.

⚠CAUTION Indicates a potentially hazardous situation, which, if not avoided, MAY result in minor or moderate injury. It may also be used to alert against unsafe practices.

SAFETY INSTRUCTIONS Usually consists of individual messages stating procedures or actions that must be followed for the safe operation of a product.

NOTICE Identifies potential property damage and important installation, operator, or maintenance information.



Lateral Pipe Thruster System for Collector Well

The Lateral Pipe Thruster is used inside the bottom of a collector well caisson to horizontally install 16.25 and 18.25-inch segmented temporary projection pipe (casing) and lateral screen pipe. The finished laterals create aquifer surface water intakes to increase collector well water output. The Pipe Thruster Container is positioned alongside the caisson at the surface and provides hydraulic power for Lateral Pipe Thruster operations and electrical power for auxiliary functions.

The Lateral Pipe Thruster is first used to hydraulically install the segmented temporary projection pipe (casing) through sealed port assemblies in the wall of the caisson. The first section of temporary casing projection pipe is equipped with a digging head. The digging head and port assemblies help seal off hydrostatic pressure to the caisson. After all the temporary projection pipe is installed to a predetermined length, the screen pipe is manually slipped inside. Next, the temporary projection pipe is hydraulically retracted from the port assembly while the packing cylinder on the lateral pipe thruster holds the screen pipe in place. The digging head remains in place at the end of the screen laterals. Next, the Lateral Pipe Thruster is horizontally rotated to the next port assembly and the process is repeated until screen pipe laterals are installed through all port assemblies.

If you find any errors with this manual or know of ways to improve procedures, please let us know. Mail your suggestions to:
Akkerman Inc, ATTN: Technical Publications, 58256 266th Street, Brownsdale, MN 55918.

Akkerman Inc. reserves the right to improve its product without notice or obligation.

Contents

(continued on next page)

NOTES

Safety

BE ALERT FOR SAFETY INFORMATION

When you see this safety alert symbol on your equipment or in this manual, be alert to the possibility of personal injury or property damage.

Read all safety information.

Keep safety decals clean and in good condition. Replace missing or damaged safety decals.

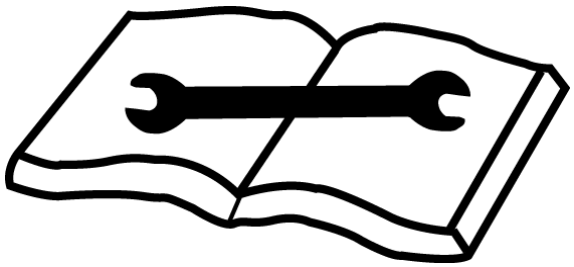
ATTENTION!
BECOME ALERT!
YOUR SAFETY IS INVOLVED!

READ OPERATOR'S MANUAL

⚠WARNING Unsafe operation or maintenance can cause severe injury or death.

Read and understand the Operator's Manual before operating or servicing this equipment.

Any unauthorized modifications will void the warranty.



WEAR PROTECTIVE CLOTHING

Wear OSHA approved protective clothing, such as hard hat, gloves, safety goggles, earmuffs or ear plugs, face shield, and steel-toed boots, when operating and servicing this equipment.

Wear reasonably close fitting clothing and remove jewelry before working on or near this equipment. This will help prevent the danger of catching them in moving parts or controls.

WORKING WITH ELECTRICAL EQUIPMENT

⚠DANGER HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH.

Failure to follow these instructions will result in death or serious injury.

• Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E.

• This equipment must be installed and serviced only by qualified electrical personnel.

• Turn off all power supplying this equipment before working on or inside equipment.

• Always use a properly rated voltage sensing device to confirm power is off.

• Replace all devices, doors and covers before turning on power to this equipment.

PROPERLY GROUND ELECTRICAL EQUIPMENT

⚠DANGER Improper grounding can result in equipment damage or electrical shock, causing sever injury or death.

Be sure equipment is properly ground before engaging power.

LOCKOUT TAGOUT POWER BEFORE SERVICING

⚠WARNING Failure to lockout tagout power before servicing can cause severe personal injury or death.

LOCKOUT TAGOUT main power supply and controls before servicing.

Any electrical repairs must be performed only by a certified electrician.

HYDRAULIC OIL/FLUIDS UNDER PRESSURE

⚠WARNING Escaping oil or other fluids under pressure can penetrate your skin causing serious injury.

Release all pressure before performing maintenance or repairs. Never weld near pressurized fluid lines.

DO NOT use your hands to check for leaks. When searching for leaks, use a piece of wood or cardboard.

Contact medical help immediately if any oil or fluid is injected into your skin. A serious infection or reaction can emerge without proper medical treatment.

BEWARE OF SUSPENDED LOADS

⚠WARNING Suspended loads may fall and cause severe personal injury or death.

If a hydraulic hose breaks from the boom of a crane/excavator, or the lifting support fails, the boom and/or load can fall instantly.

Do not enter area under or around a suspended load.

KEEP PERSONNEL AWAY FROM MOVING PARTS

⚠WARNING Crushing hazard.
Keep personnel away from inside of pipe thruster frame when thrusting or moving gripper assembly. Failure to do so could result in serious personal injury or death.

INSPECT ELECTRICAL CONNECTIONS

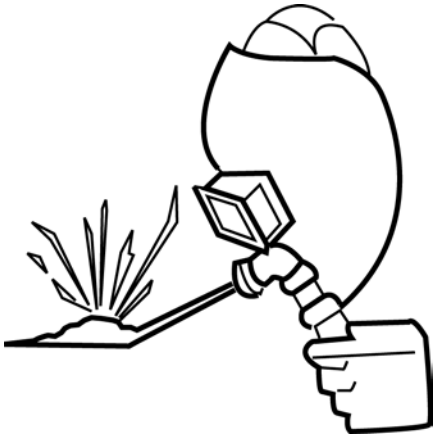
⚠WARNING Regularly inspect electrical connections to be sure they are secure. Failure to do so could cause an explosion if moisture enters an unsecured electrical connection.

CONTACT WITH POWER CABLE

⚠DANGER Contact with a severed electrical cable WILL cause serious injury or death.

CONSTANTLY monitor electrical cables during drive to prevent cutting or stretching of any electrical cables.

UNAUTHORIZED WELDING



⚠WARNING Unauthorized welding can cause structural failure resulting in possible injury or death.

Do not weld on any structural member. Unauthorized welding or repair will void the warranty.

USING PLUMB BOB

⚠WARNING Falling plumb bob can cause serious personal injury or death, and/or equipment damage.

NEVER hang or secure the plumb bob overhead when not in use.

ALWAYS remove the plumb bob from the string lines and place in storage container after use.

HANDLING PIPE

⚠WARNING Suspended loads may fall and cause severe personal injury or death.

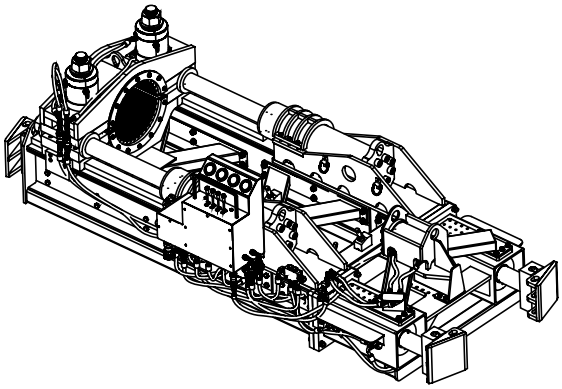
Properly secure projection pipe and screen pipe BEFORE lowering into or lifting out of caisson.

Do not stand or walk under a suspended casing.

REGULARLY CLEAN AND INSPECT EQUIPMENT

Remove any grease, oil, or debris buildup to avoid potential injury or equipment damage.

Inspect equipment for damage. If damaged, repair or replace immediately.



PRACTICE SAFE MAINTENANCE

⚠WARNING Unexpected frame movement may cause serious personal injury.

LOCKOUT TAGOUT power before performing any maintenance.

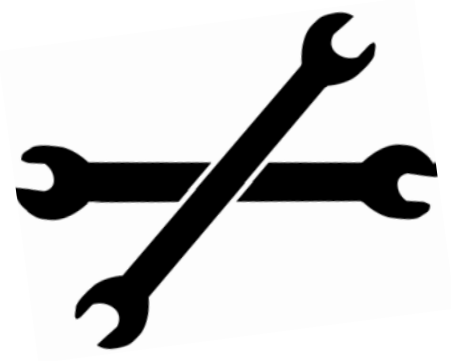
Shut down pipe thruster system before making repairs, adjustments, or removing obstructions.

Only trained and qualified personnel should perform maintenance or repairs.

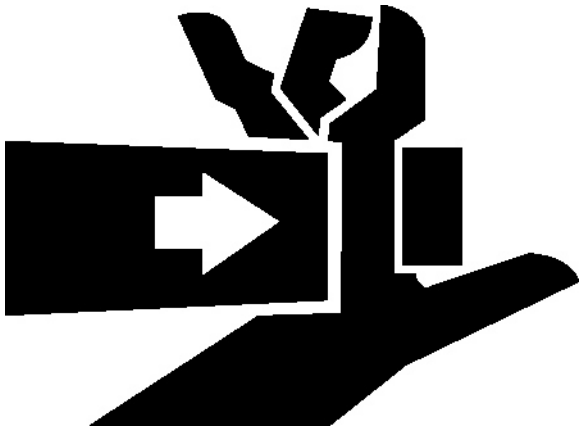
Keep the area around the equipment clean and dry when performing maintenance.

Do not service the machine while it is in motion.

Replace worn or damaged parts. Remove grease, oil, or debris buildup.



AVOID PINCH POINTS



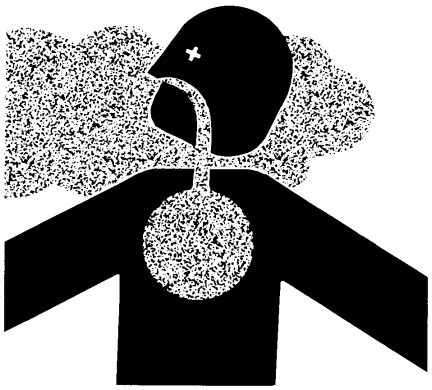
⚠WARNING Moving parts or the mishandling of parts can cause severe personal injury.

Keep hands away from moving parts.

Watch your fingers, hands, and legs while equipment is in operation.

Handle parts carefully to avoid crushing and pinch point hazards.

TEST CAISSON VENTILATION



⚠WARNING Keep caisson well ventilated at all times.

Use an approved air analyzer to detect hazardous gases and oxygen content.

Before and during the operation, test for combustible and toxic gases and oxygen deficiency.

If the levels exceed MSHA/OSHA prescribed levels, leave caisson immediately! Do not activate or deactivate any electrical or hydraulic devices, since any sparks could cause an explosion.

Once ALL personnel are out of caisson, cut power from power source.

Gases MUST be removed before reentering caisson.

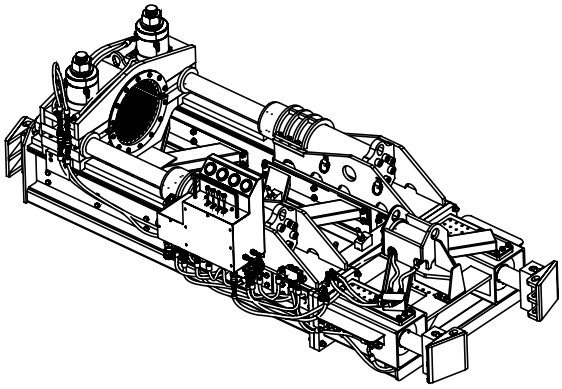
FIRE PREVENTION

⚠CAUTION Fires can cause injury or property damage.

Keep equipment clean. Remove all debris from equipment.

Have a fire extinguisher available at all times. Keep the fire extinguisher fully charged.

HIGH PRESSURE HYDRAULICS



⚠WARNING The pipe thruster system contains high pressure hydraulics.

Keep all guards in place.

KEEP JOB SITE CLEAN AND ORGANIZED

⚠WARNING Tripping can cause serious personal injury.

Be sure to keep job site clean and organized.

SLIPPERY WHEN WET

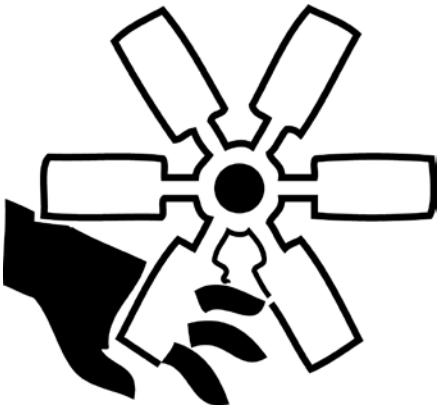
⚠WARNING Slips and falls can cause serious personal injury.

Ensure firm footing in wet or slippery conditions.

Replace skid-resistant material if it is damaged or missing to prevent slips and falls.

Remove any buildup of grease, oil, or debris.

ROTATING COOLING FAN BLADES



⚠WARNING Serious personal injury could result if contact is made with rotating fan blade. Fan blades can rotate at any time power is connected and the main disconnect is in the ON position.

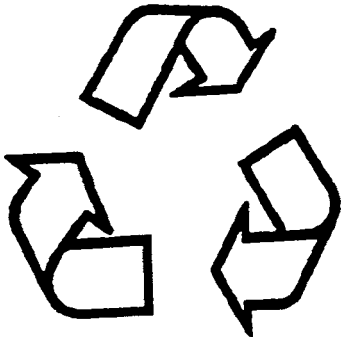
If the power is connected to the power pack and the main disconnect is in the ON position, the fan can rotate anytime the hydraulic oil is at 120°F (49°C) (factory default setting).

NO SMOKING IN CAISSON

⚠WARNING Smoking in caisson could cause an explosion if combustible gases are present.

Do not smoke in caisson.

RECYCLE WASTE

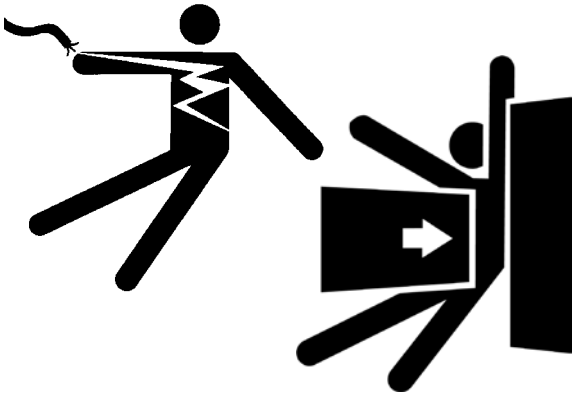


Follow local, state, federal, and international regulations when recycling or disposing of waste. Waste includes fluids/oil, fuel, filters, coolant, and batteries.

Use leakproof containers when draining fluids/oil. Do not pour waste on the ground, down a drain, or into any water source.

LOCKOUT TAGOUT PROCEDURE GUIDELINE

LOCKOUT TAGOUT power before attempting to make repairs, service or adjustments. Proper lockout tagout will prevent accidents and save lives. OSHA requires equipment placed in lockout tagout when the unexpected machine start up or release of stored energy could injure workers during cleaning, adjustments, repairing and servicing.



⚠DANGER Failure to lockout tagout power before adjustments, repairs or servicing WILL cause severe personal injury or death.

LOCKOUT TAGOUT power before adjustments, repairs or servicing. Electrical repairs must be performed only by a certified electrician.

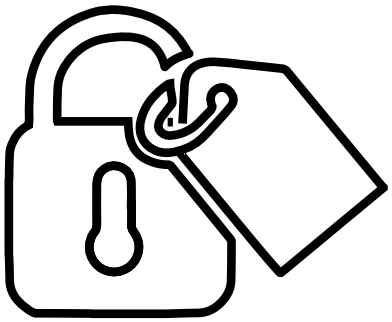
The contractor is fully responsible for the safety of all personnel on the job site. Use the following as a guideline for a lockout tagout procedure. The contractor must determine the best lockout tagout practices for his/her employees on the job site.

1. Follow all Federal, State and Local safety regulations and procedures.
2. Be sure OSHA prescribed safety personal protective equipment is being worn by all personnel.
3. Be sure the area is safe for operation. Keep work site clean and organized.
4. Set all controls to the OFF or neutral position.
5. Push IN all E-Stop buttons.
6. There are various lockout tagout options for the pipe thruster equipment:

   • Lockout Tagout the Power Source - refer to step 7 for details.

   • Lockout Tagout the Main Breaker on the Main Power Disconnect Panel - refer to step 8 for details.

   • Lockout Tagout the Pipe Thruster Container - refer to step 9 for details.



7. ***Lockout Tagout the Power Source Option***

   Lockout Tagout power source or generator. Refer to the power source or generator manufacturer for proper lockout tagout procedure.

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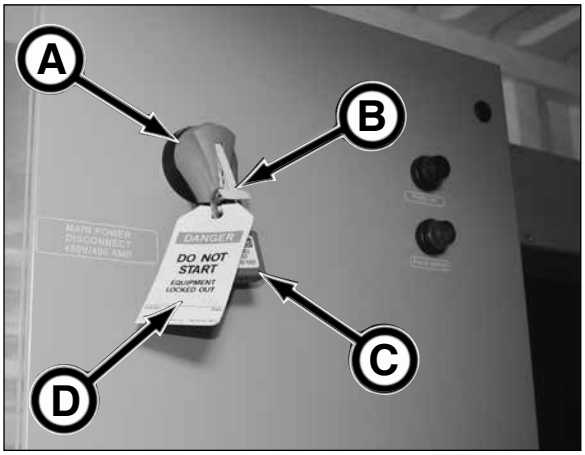
8. ***Lockout Tagout the Main Breaker on the Main Power Disconnect Panel Option***

Be sure the main power breaker switch (A) on the main power disconnect panel is in the OFF position. Flip safety latch (B) out and install shackle of OSHA approved lock (C) with tag (D) through latch.



Secure lock by pushing shackle into body of the lock until the shackle is locked into the locking mechanism. Turn key to lock shackle in place.

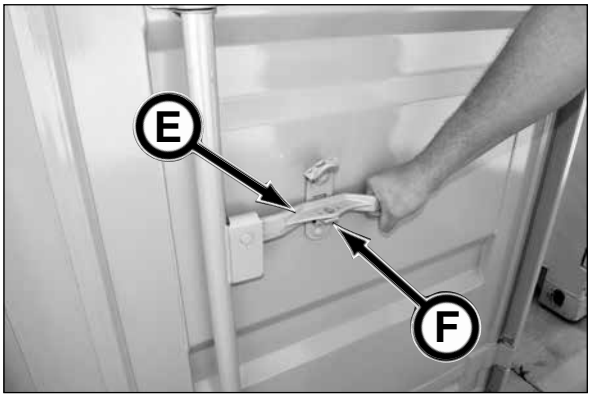
Remove key from lock.

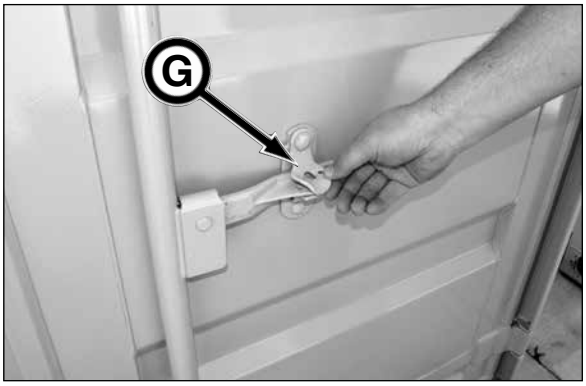
Test to be sure shackle is fully secured into lock.

Sign “Equipment Locked Out” tag or equivalent.

9. ***Lockout Tagout the Pipe Thruster Container Option***

With all power disconnects in the OFF position, close container doors. Secure door handle (E) into locking keeper (F) with handle retainer (G).





Install shackle of OSHA approved lock with tag through container, locking keeper and handle retainer.

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Secure lock by pushing shackle into body of the lock until the shackle is locked into the locking mechanism.

Test to be sure shackle is fully secured into lock.

Remove key from lock.

Sign “Equipment Locked Out” tag or equivalent.

NOTES

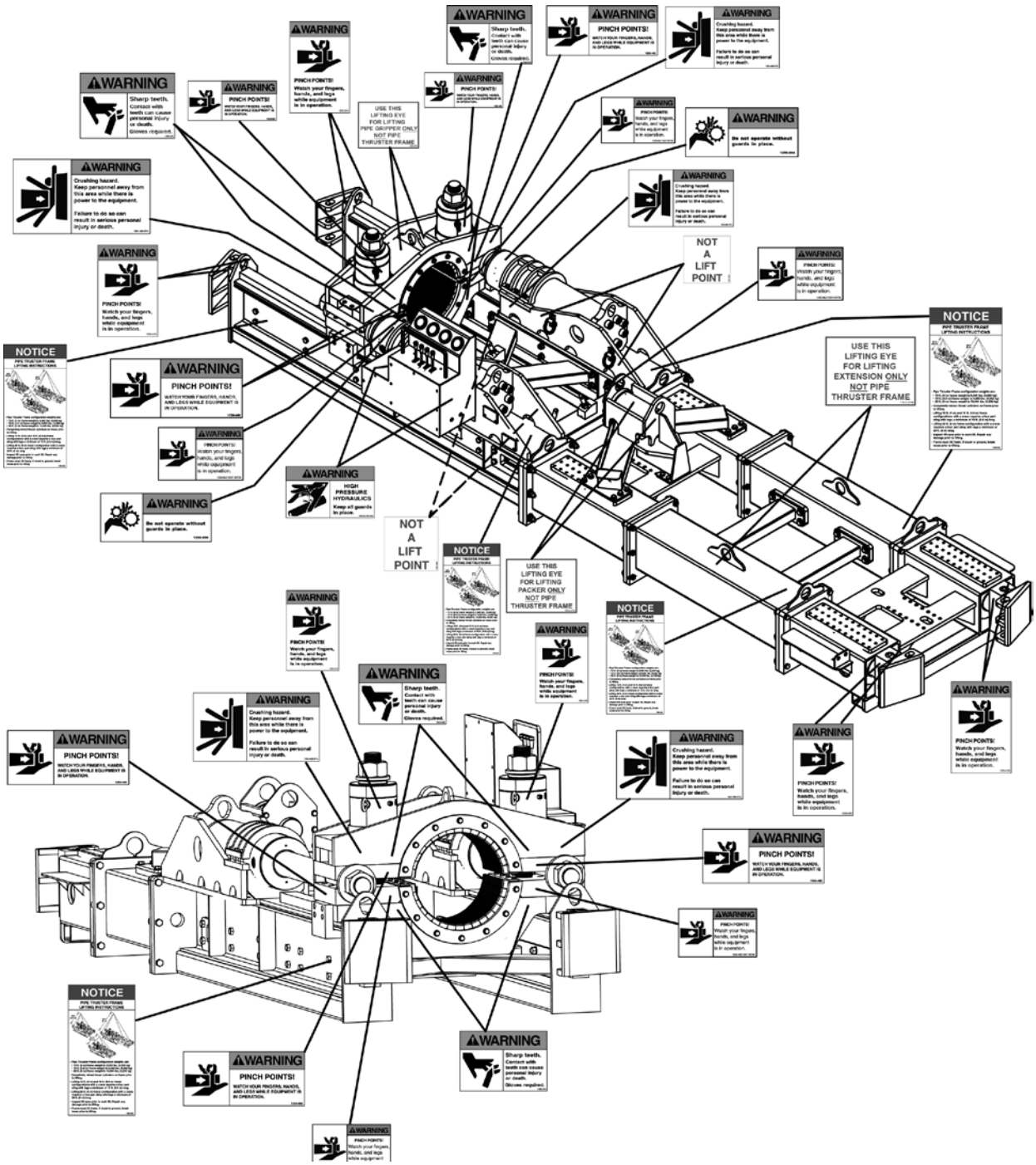
Safety Decals

Keep all safety decals clean and readable. Use soft cloth, water, and a mild soap to clean the decals if they are too dirty to read. DO NOT clean safety decals with solvent. Solvent can damage them. Replace safety decals immediately if they are damaged, missing, or hard to read.

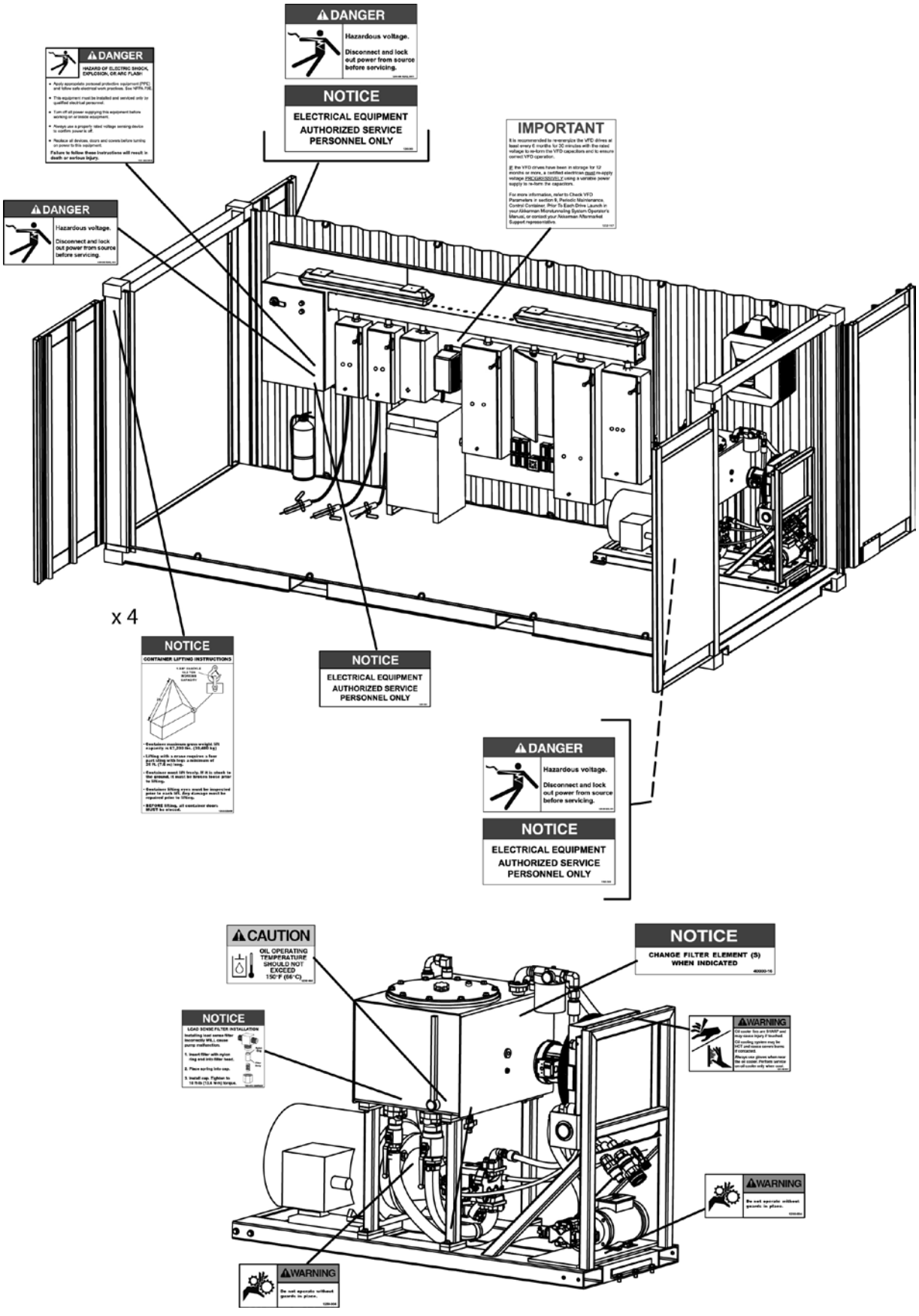
Serious injury or property damage can occur if safety instructions are not followed. Contact your Akkerman Product Support representative for free replacement safety decals.

If a part is replaced that has a safety decal on it, apply a new safety decal to the replacement part. Before applying a new decal, be sure the surface is clean and dry.

PIPE THRUSTER FRAME

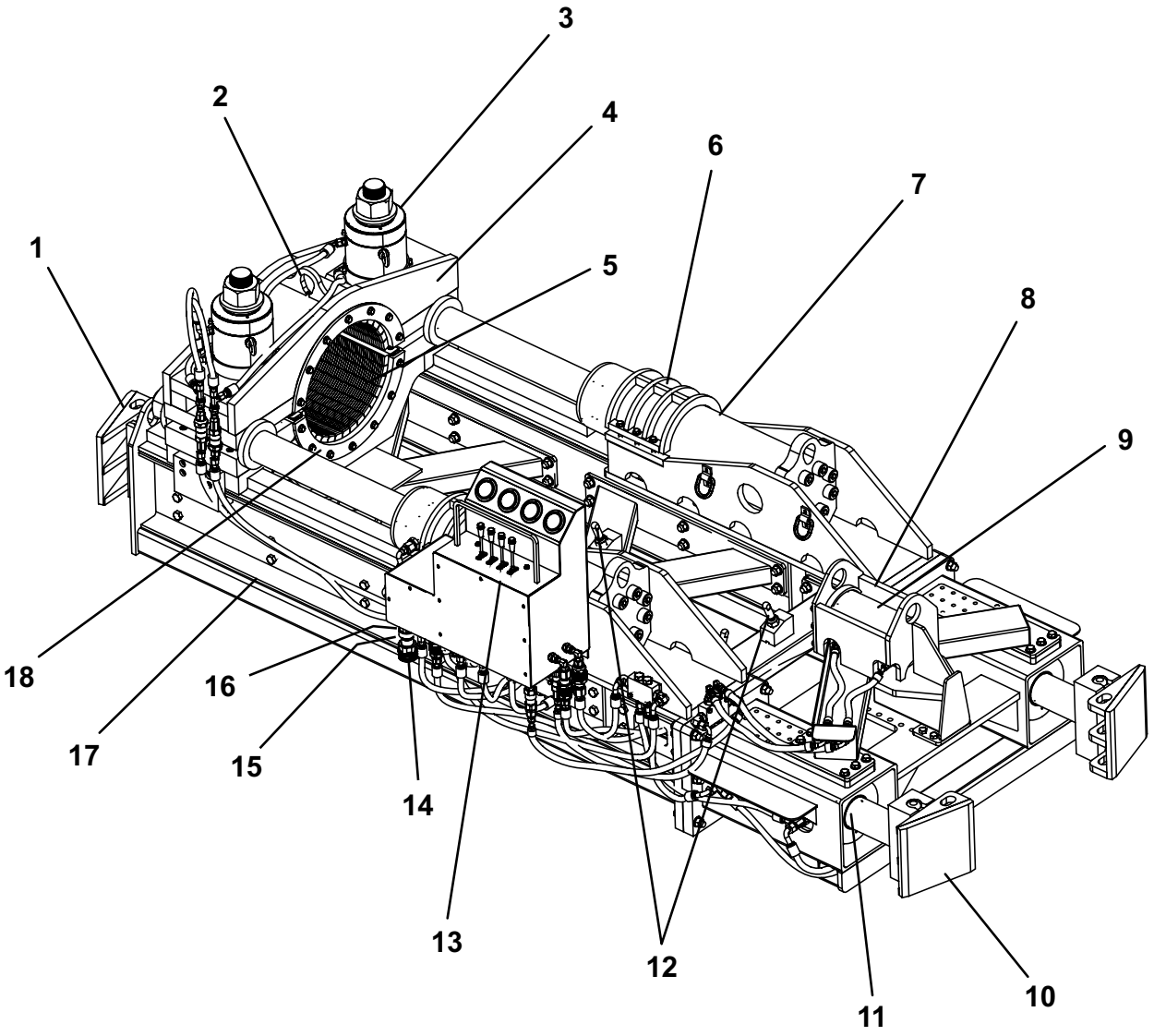


PIPE THRUSTER CONTAINER



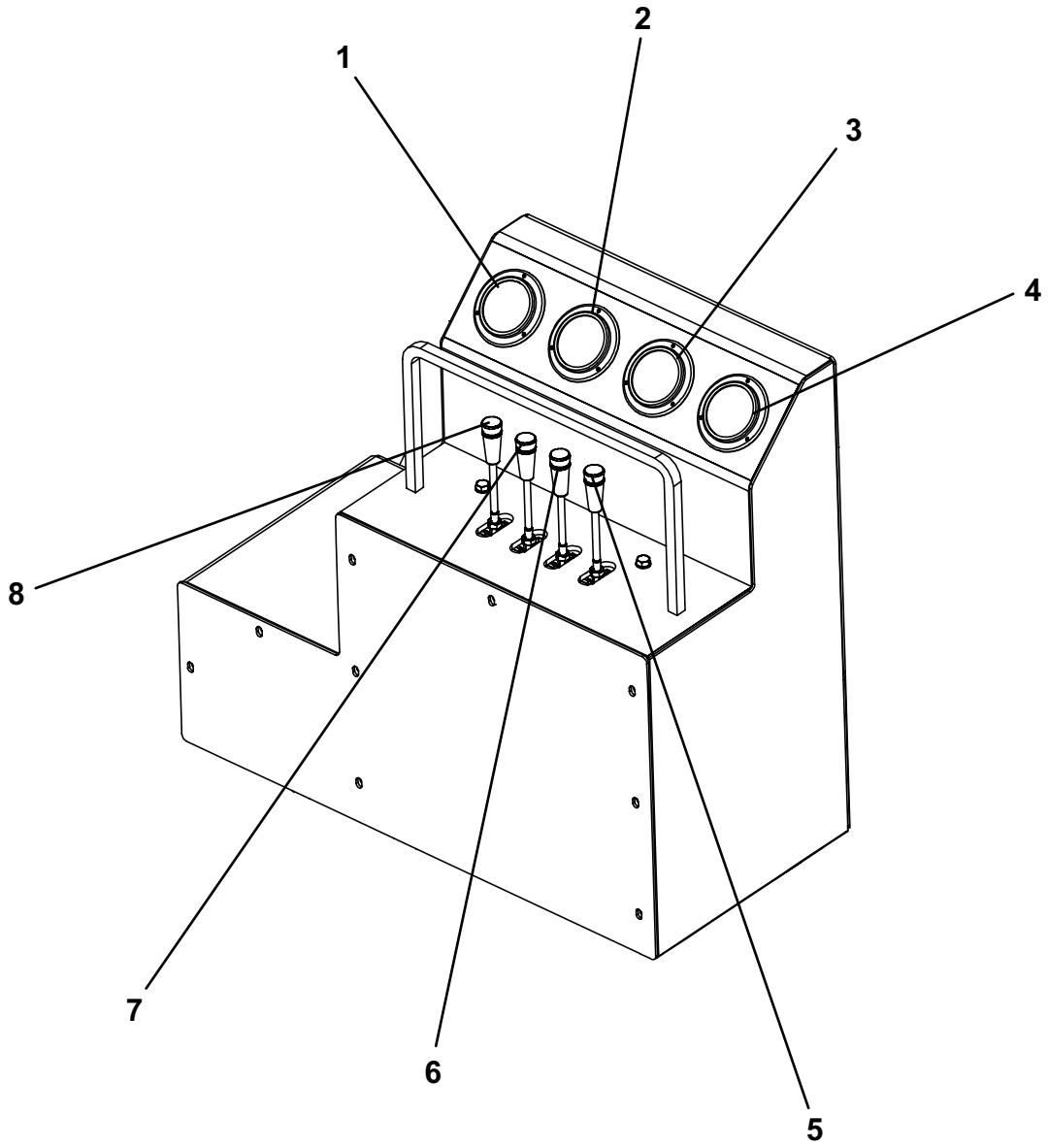
Terminology

PIPE THRUSTER FRAME



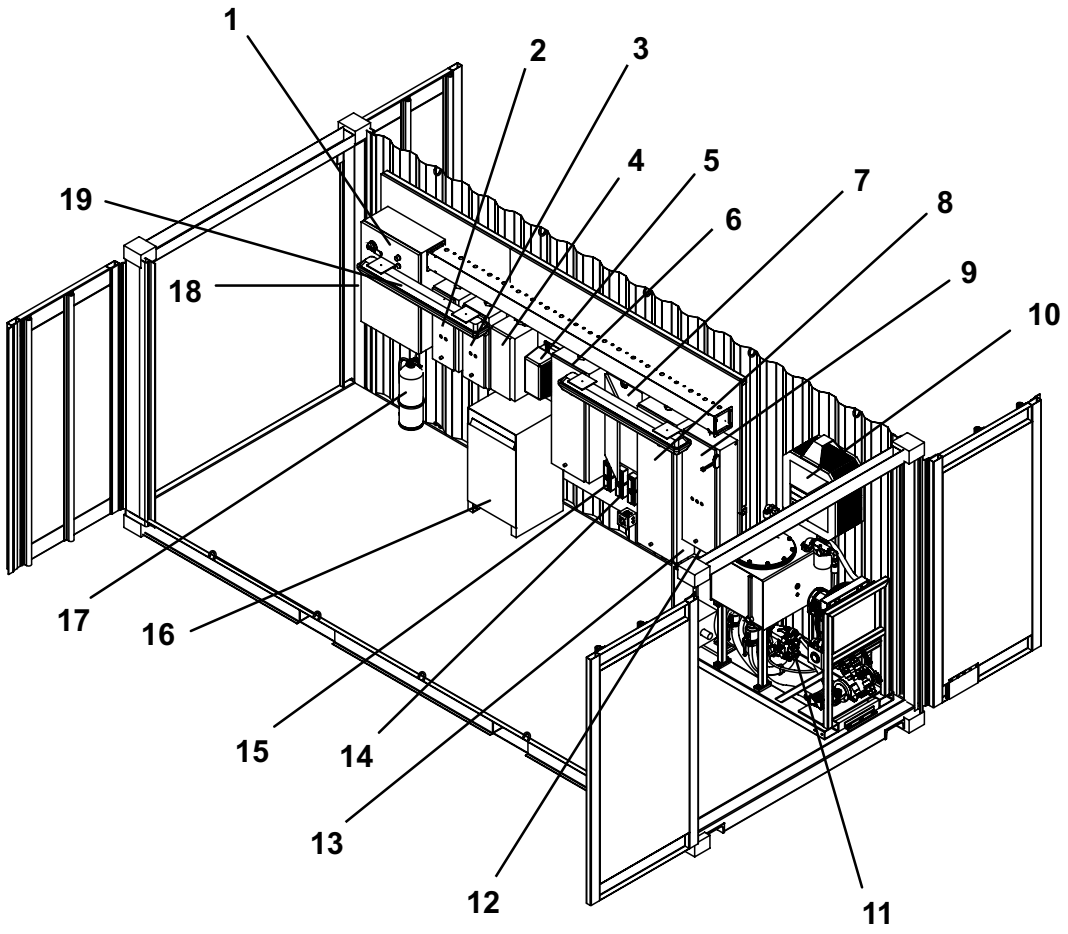
1. Front Foot Pad
2. Gripper Lift Eye
3. Gripper Cylinder
4. Gripper Assembly
5. Gripper Teeth
6. Cylinder Clamp
7. Thrust Cylinder
8. Packer (Screen Retainer)
9. Packer Cylinder
10. Rear Foot Pad
11. Foot Pad Cylinder
12. Tube Support
13. Operator Station
14. Pressure Hose (3/4”) Connection
15. Load Sense Hose (3/8”) Connection
16. Return Hose (1”) Connection
17. Gripper Holder Bar
18. Pipe Thrust Frame

OPERATOR STATION - PIPE THRUSTER FRAME



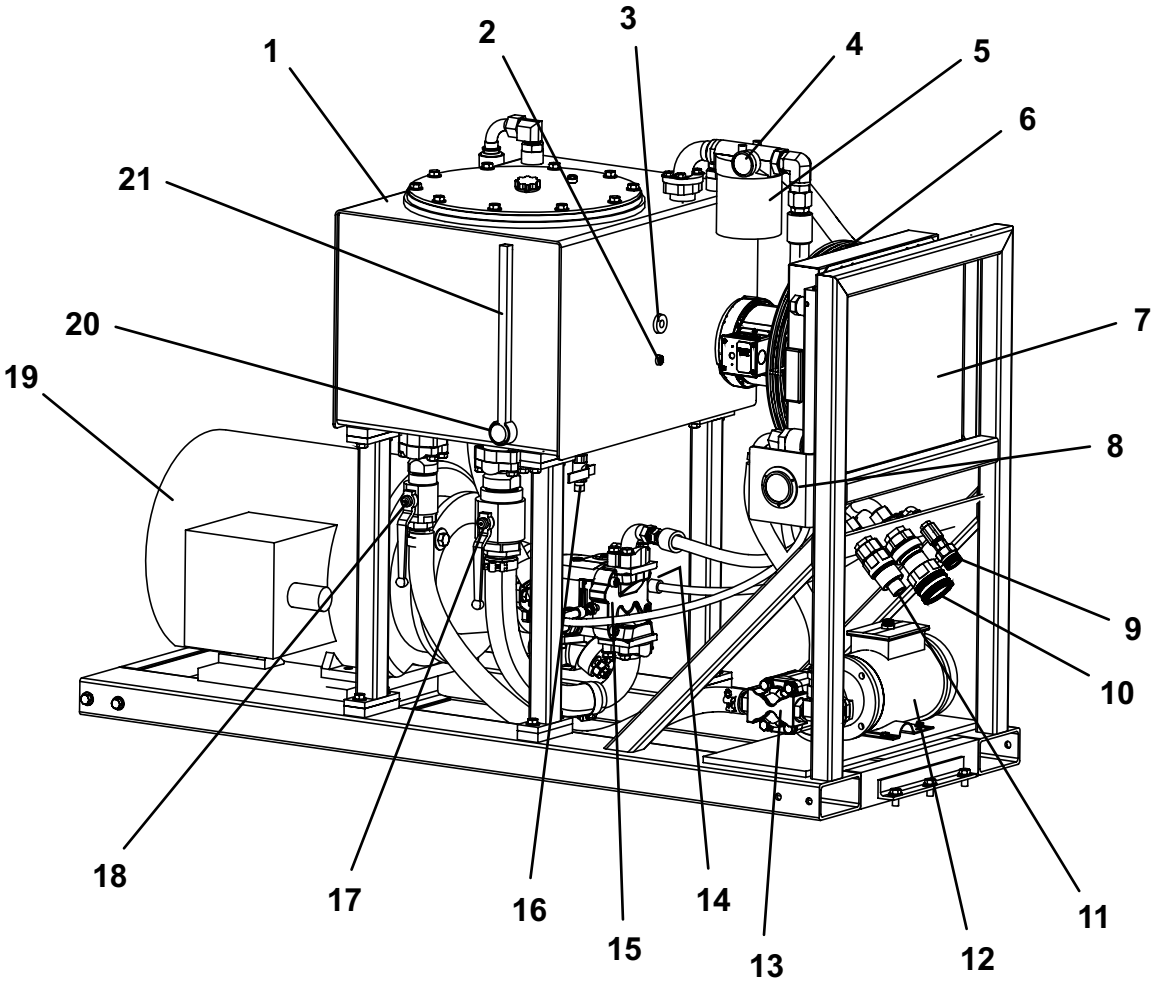
1. Packer Cylinder Pressure Gauge
2. Thrust Cylinder Retract Pressure Gauge
3. Thrust Cylinder Extend Pressure Gauge
4. Gripper Cylinder Pressure Gauge
5. Foot Pad Cylinder Control
6. Gripper Cylinder Control
7. Thrust Cylinder Control
8. Packer Cylinder Control

PIPE THRUSTER CONTAINER



1. Main Power Disconnect 480V/400 Amp
2. To 20 HP Blower Motor
3. To 15 HP Tank Pump Motor
4. 10 HP Can Pump Motor
5. 10 HP Can Pump VFD
6. To 50 Amp 120V/240V Transformer
7. Panel Board Main Breaker 150 Amp
8. To 100 HP Shaft Pump Motor
9. To 50 HP Hydraulic Power Pack
10. Heater Unit
11. Hydraulic Power Pack
12. Hydraulic Power Pack Pendant Connection
13. Shaft Pump Pendant Connection
14. 220V 50 Amp Outlet
15. 120V 20 Amp GFI Outlets
16. Transformer 37.5 kVa
17. Fire Extinguisher
18. Light Switch
19. Light

HYDRAULIC POWER PACK



1. Hydraulic Oil Reservoir - 40 Gal.
2. Oil Temperature Switch
3. Low Oil Level Switch
4. Hydraulic Filter Indicator
5. Return Filter
6. Cooling Fan
7. Oil Cooler
8. System Pressure Gauge
9. Load Sense Hose (3/8”) Connection
10. Return Hose (1”) Connection
11. Pressure Hose (3/4”) Connection
12. Cooling Motor 2 HP
13. Cooling Pump
14. Load Sense Filter
15. Main Pump
16. Tank Drain Shutoff
17. Main Pump Tank Shutoff
18. Cooling Pump Tank Shutoff
19. Electric Motor 50 HP
20. Tank Temperature Gauge
21. Tank Sight Gauge

Controls & Instruments

EMERGENCY STOP

IMPORTANT: Emergency Stop buttons are used for emergency situations only. Emergency Stop buttons alone are ***NOT*** intended for lockout tagout purposes. Refer to Lockout Tagout Procedure Guideline in Section 1, Safety.

⚠WARNING **ALL** Emergency Stop buttons MUST be operating properly BEFORE operation. Failure to do so may cause severe injury or death.

NOTICE The remote pendant cord MUST be plugged into the remote pendant connection receptacle on the electrical panel to energize the start and stop circuit on both the electrical panel and the remote pendant. Otherwise the Emergency Stop, Start and Stop buttons will not function.

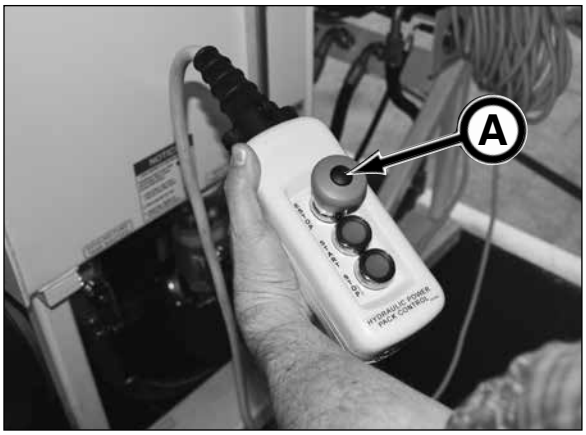
REMOTE PENDANT - HYDRAULIC POWER PACK

The Emergency Stop button (A) is located on the remote pendant.

Push Emergency Stop button IN to stop all electrical and hydraulic functions.

The button will illuminate when it is pulled OUT.

NOTICE The emergency stop button must be pulled out for motor to start.



Remote Pendant for Hydraulic Power Pack

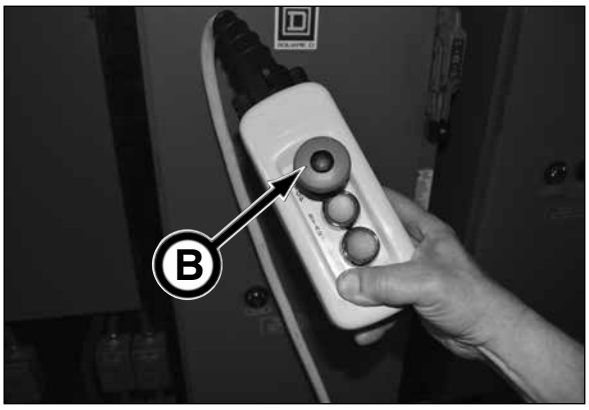
REMOTE PENDANT - SHAFT PUMP

The Emergency Stop button (B) is located on the remote pendant.

Push Emergency Stop button IN to stop all electrical and hydraulic functions.

The button will illuminate when it is pulled OUT.

NOTICE The emergency stop button must be pulled out for motor to start.



Remote Pendant for Shaft Pump

PHASE INDICATOR LIGHTS

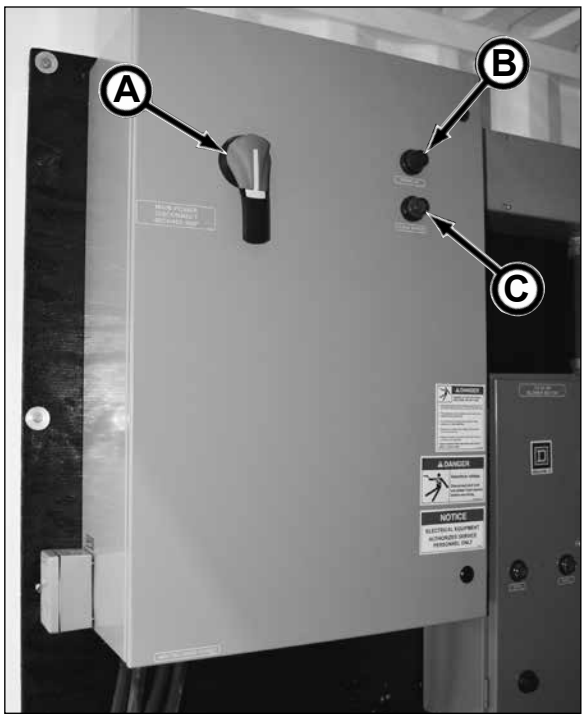
⚠DANGER Hazardous voltage. Disconnect and lockout/tagout power from source before servicing.

⚠DANGER If high voltage cables or cable connections are damaged, contact with cables/ connections may result in electrical shock causing severe injury or death. Disconnect and lockout/tagout power from source before servicing

⚠WARNING Any electrical work performed on the pipe thruster container must be performed by a certified electrician.

The input power on the pipe thruster container is monitored for proper three phase electrical power. Therefore the green Phase OK light **MUST** be illuminated before operating equipment.

IMPORTANT: DO NOT start up electric components if the green phase indicator light is not illuminated. Doing so will run components backwards causing damage.



Once generator or other external power source is connected to the pipe thruster container and power engaged, flip the main disconnect switch (A) to the ON position.

If the green Phase OK indicator light (B) is illuminated, this indicates that the external power source phase power is installed correctly and the system is available for use.

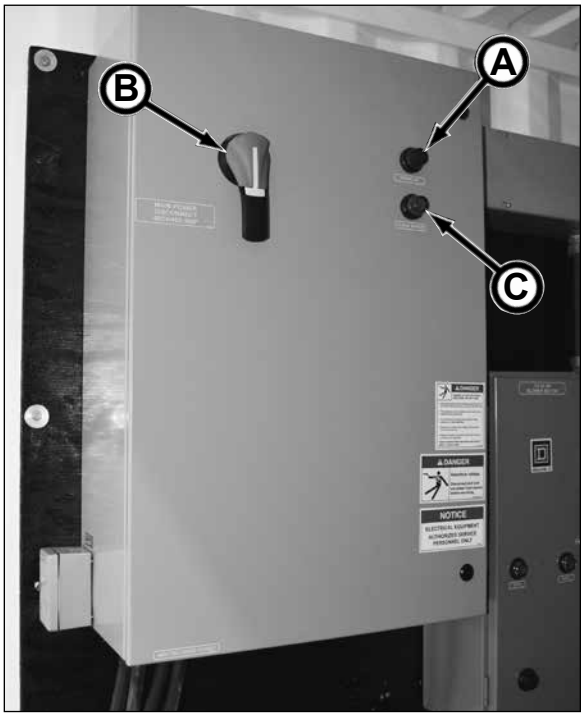
If the red Phase Error indicator light (C) is illuminated, flip main disconnect switch to the OFF position and lockout/tagout ALL power before attempting to reverse two of the generator power leads on the power circuit.

MAIN DISCONNECT SWITCH

⚠DANGER Hazardous voltage. Disconnect and lockout/tagout power from source before servicing.

With generator or other power source power cables connected to the main disconnect cable connections and the external power is on, flip the main disconnect switch (B) to the ON position. If the green Phase OK indicator light (A) is ON, this indicates that the external power source phase power is installed correctly and the system is available for use..

If the red Phase Error light (C) is on, flip the main disconnect OFF. The red light indicates that the generator phase power is installed incorrectly. Disconnect and lockout tagout ALL power before attempting to reverse the two generator power leads.

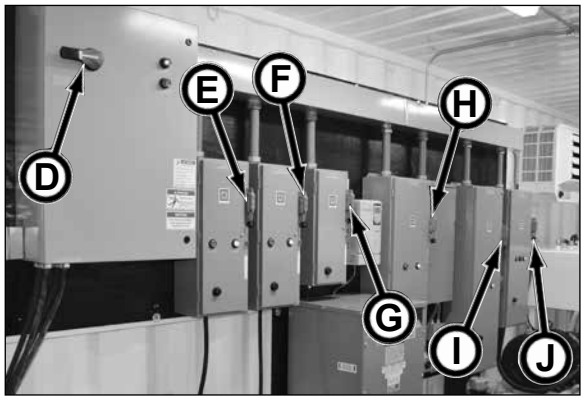


A - Phase Indicator (Green) (Phase OK)
B - Main Power Disconnect
C - Phase Indicator (Red) (Phase Error)

OPERATOR CONTROL DISCONNECTS

⚠DANGER Hazardous voltage. Disconnect and lockout/tagout power from source before servicing.

With the main power disconnect (D) ON, the power disconnects to the blower motor (E), tank pump motor (F), can pump/VFD (G), 120/240V transformer (H), shaft pump motor (I), and the hydraulic power pack (J) must be powered ON before utilizing the devices.



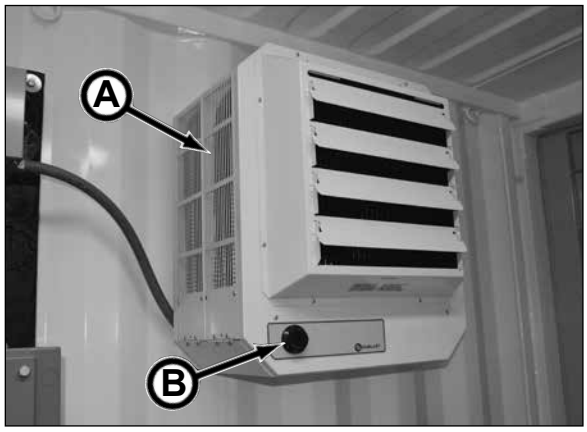
D - Main Power Disconnect
E - Blower Motor Disconnect
F - Tank Pump Motor Disconnect
G - Can Pump/VFD Disconnect*
H - 120/240V Transformer Disconnect
I - Shaft Pump Motor Disconnect**
J - Hydraulic Power Pack Disconnect**

Once the device disconnect is flipped to the ON position, press the Start and Stop buttons as needed for device operation.

* The Can Pump VFD must be setup for potential load. Refer to WEG CFW11 for details.

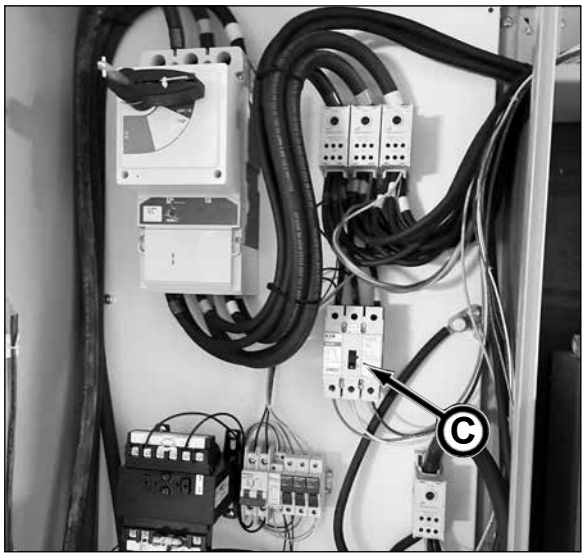
** The remote pendant cord MUST be plugged into the remote pendant connection receptacle on the electrical panel to energize the start and stop circuit on both the electrical panel and the remote pendant. Otherwise the Emergency Stop, Start and Stop buttons will not function.

HEATER UNIT



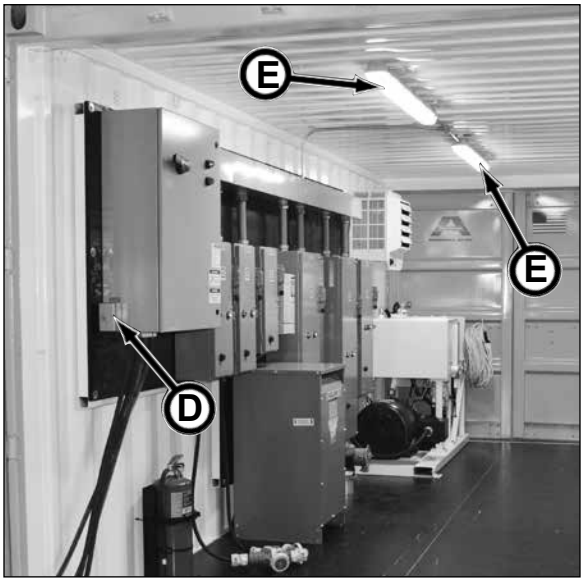
The container is equipped with a heater unit (A).

Turn the heat thermostat (B) to the desired setting.



NOTICE If the heater does not operate, flip the main disconnect switch to the OFF position, open electrical box door panel and be sure the 30 amp breaker (C) is in the ON position.

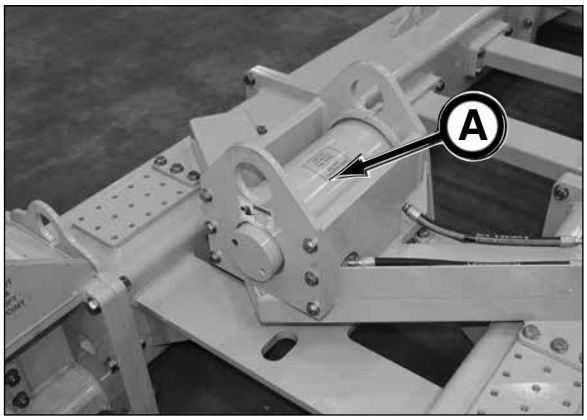
LIGHTS



A light switch (D) is equipped in the container.

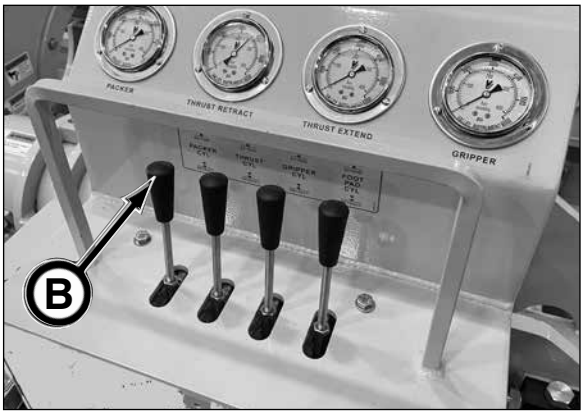
Rotate the switch to turn the lights (E) on and off.

PACKER CYLINDER CONTROL



The Packer (A) is used to retain the screen pipe sections in place while the projection pipe is being removed.

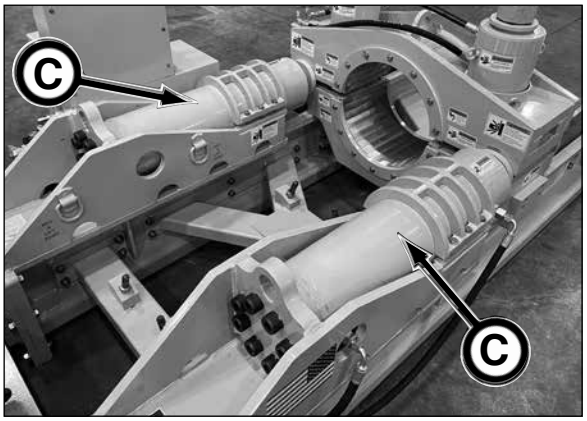
This control is a spring centered, variable control and will return to the neutral position when released.



Use the packer cylinder control (B) to extend and retract the packer cylinder:

Extend Cylinder - Push lever Forward
Retract Cylinder - Pull lever Back

THRUST CYLINDER CONTROL



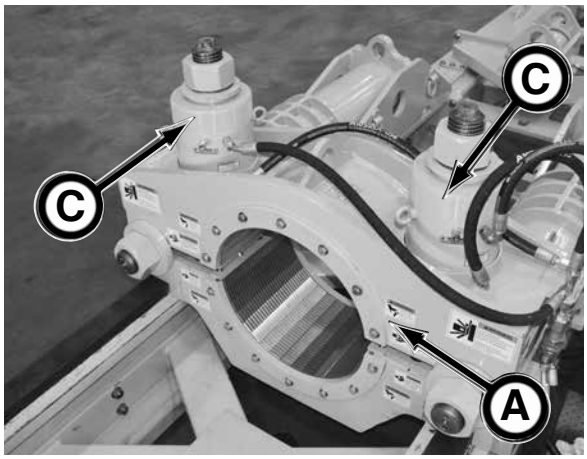
The thrust cylinders (C) are used to push projection pipe through the caisson port assembly and to pull the projection pipe out once the screen pipe sections are in place.

This control is a spring centered, variable control and will return to the neutral position when released.

Use the thrust cylinder control (D) to extend and retract the thrust cylinders:

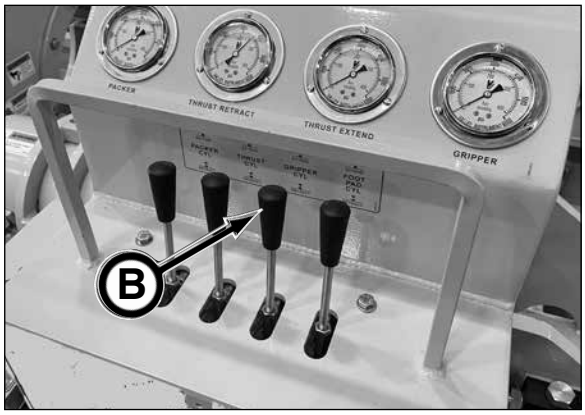
Extend Cylinder - Push lever Forward
Retract Cylinder - Pull lever Back

GRIPPER (CLAMP) CYLINDER CONTROL



The gripper assembly (A) holds the projection pipe while each section is being threaded together during the installation of the pipe. It will also hold the pipe while the sections are being removed once the screen pipe sections are in place.

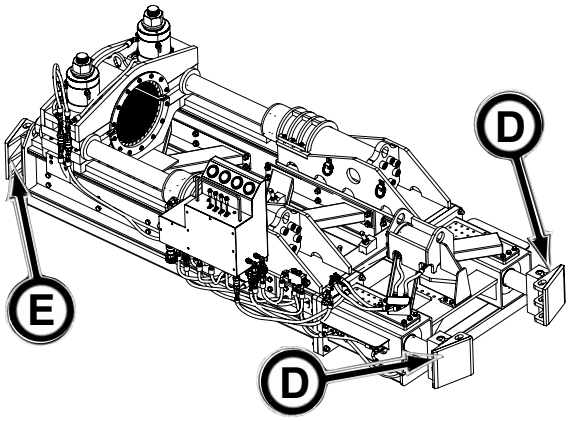
This control is a spring centered, variable control and will return to the neutral position when released.



Use the gripper cylinder control (B) to extend and retract the gripper cylinders (C):

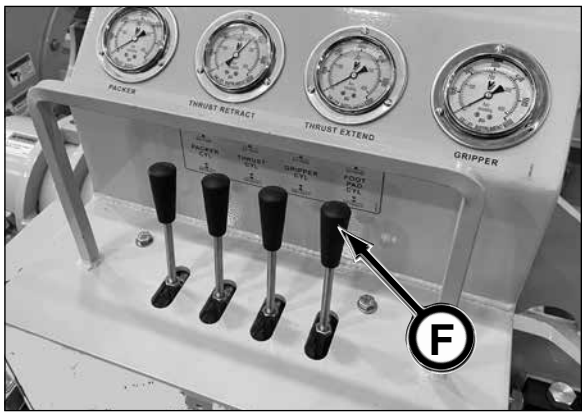
Extend Cylinder - Push lever Forward
Release/Retract Cylinder - Pull lever Back

FOOT PAD CYLINDER CONTROL



The adjustable foot pads (D) are used to secure the pipe thruster frame against the caisson wall to prevent the frame from moving while adding or removing pipe. The foot pads (E) at the front of the frame are stationary.

This control is a spring centered, variable control and will return to the neutral position when released.



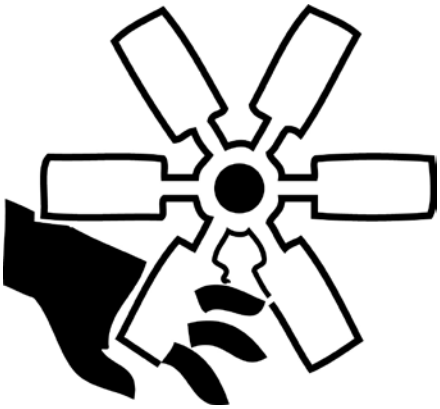
Use the foot pad cylinder control (F) to extend and retract the foot pad cylinders:

Extend Cylinder - Push lever Forward
Retract Cylinder - Pull lever Back

OIL COOLER FAN CONTROL

⚠WARNING Serious personal injury could result if contact is made with rotating fan blade. Fan blades can rotate at any time power is connected and the main disconnect switch is in the ON position.

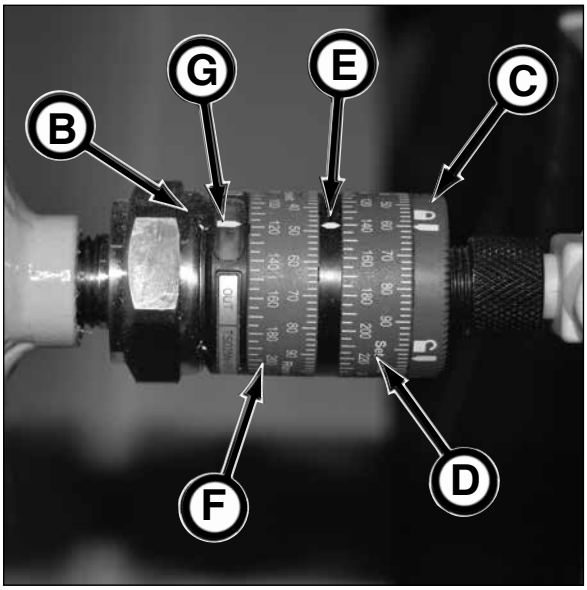
If the power is connected to the power pack and the main disconnect is in the ON position, the fan can rotate anytime the hydraulic oil is at 120°F (49 °C) (factory default setting).



The oil cooler fan (A) is equipped with an automatic temperature control. The fan will turn on at 140°F (60°C) and turn off at 120°F (49°C).

To change the temperature settings from the factory default settings:

1. Gain access to the temperature switch (B).
2. Turn lock/unlock dial (C) to unlock position.
3. Turn high temp dial (D) to desired temperature for fan to turn on and align with arrow (E). Default temperature setting is 140°F (60°C).
4. Turn low temp dial (F) to desired temperature for fan to turn off and align with arrow (G). Default temperature setting is 120°F (49°C).
5. Once the high and low dials are set, turn lock/unlock dial (C) to the lock position.



The Emergency Stop will override the automatic operation.

REMOTE PENDANT CONTROL - HYDRAULIC POWER PACK

The remote pendant control allows the operator in the caisson to control the power pack electrical motor for the hydraulic operation of the pipe thruster frame.

NOTICE The remote pendant cord MUST be plugged into the remote pendant connection receptacle on the electrical panel to energize the start and stop circuit on both the electrical panel and the remote pendant. Otherwise the Emergency Stop, Start and Stop buttons will not function.

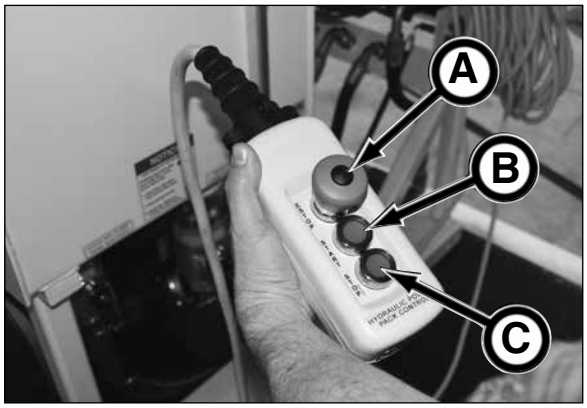
Emergency Stop Button (A)
Push Emergency Stop button IN to stop all electrical and hydraulic functions.

The button will illuminate when it is pulled OUT.

NOTICE The emergency stop button must be pulled out for motor to start.

Start Button (B)
Depress the Start button to start the 50 HP hydraulic power pack motor. The E-Stop button must be pulled out for motor to start.

Stop Button (C)
Depress the Stop button to stop the 50 HP hydraulic power pack motor. The stop button is NOT an emergency stop button.



Remote Pendant for Hydraulic Power Pack

REMOTE PENDANT CONTROL - SHAFT PUMP MOTOR

The remote pendant control allows the operator in the caisson to control the shaft pump motor for pumping water out of the caisson.

NOTICE The remote pendant cord MUST be plugged into the remote pendant connection receptacle on the electrical panel to energize the start and stop circuit on both the electrical panel and the remote pendant. Otherwise the Emergency Stop, Start and Stop buttons will not function.

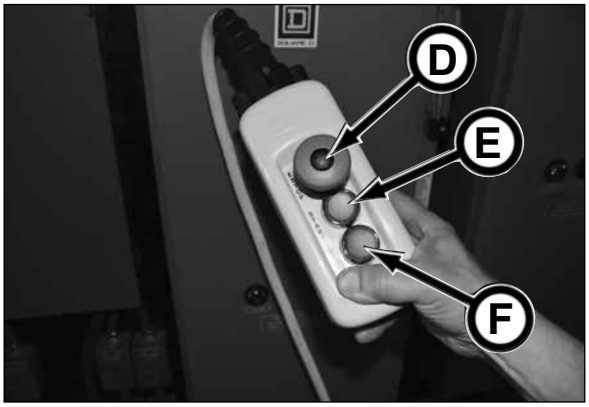
Emergency Stop Button (D)
Push Emergency Stop button IN to stop all electrical and hydraulic functions.

The button will illuminate when it is pulled OUT.

NOTICE The emergency stop button must be pulled out for motor to start.

Start Button (E)
Depress the Start button to start the 100 HP shaft pump motor. The E-Stop button must be pulled out for motor to start.

Stop Button (F)
Depress the Stop button to stop the 100 HP shaft pump motor. The stop button is NOT an emergency stop button.



Remote Pendant for Shaft Pump

HYDRAULIC PRESSURE GAUGES

Use the hydraulic pressure gauges on the frame operation station and the system pressure gauge (A) in the container to monitor the hydraulic functions of the pipe thruster system pressures; thrust, packer and gripper (clamp) pressures.

Maximum system pressure is 5,000 psi (34.474 mPa).

Hydraulic Power Pack System Pressure

Thrust Pressure Gauges (B, C)

Extend (B):
Operating range is up to 4,200 psi (29.000 mPa)

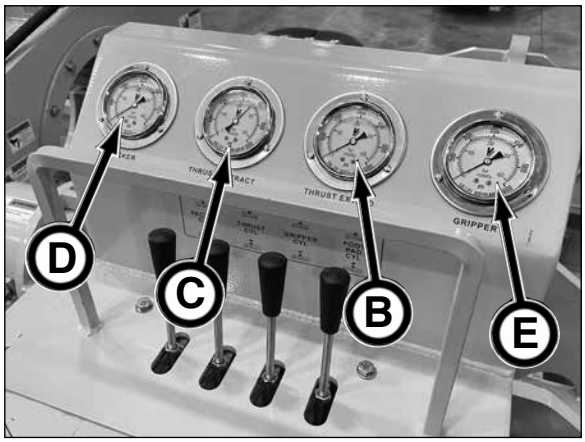
Retract (C):
Operating range is up to 4,500 psi (31.026 mPa)

Packer Pressure Gauge (D)

Operating range is up to 4,200 psi (29.000 mPa)

Gripper Pressure Gauge (E)

Operating range is up to 4,500 psi (31.026 mPa)

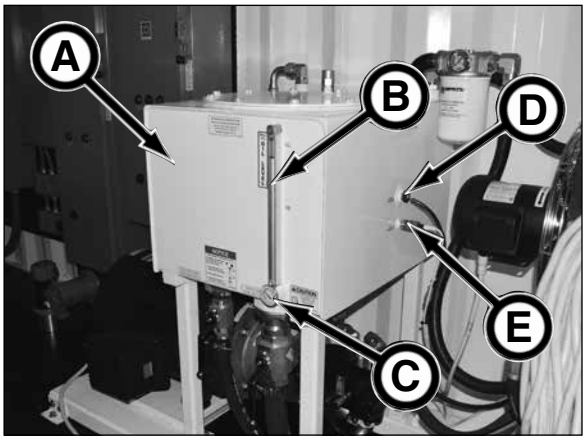


Foot Pad Pressure*

Operating range is up to 4,200 psi (29.000 mPa)

* The foot pad pressure is shown on system pressure gauge (A).

HYDRAULIC RESERVOIR



The 40 gal (151 L) hydraulic reservoir (A) is filled with ISO-VG-68 premium hydraulic turbine oil.

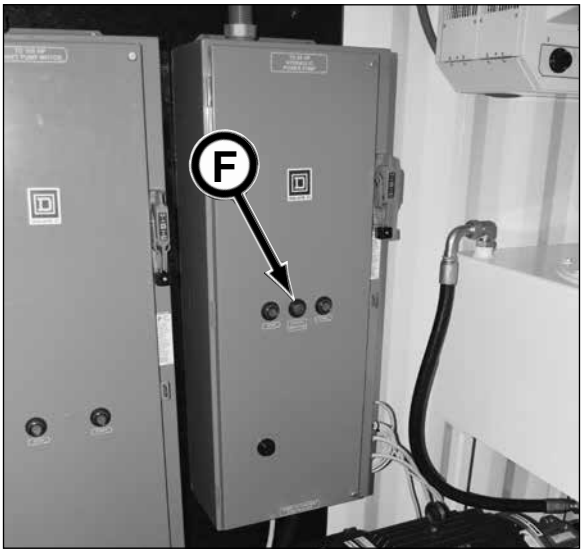
NOTICE Refer to section 8, Lubricants for recommended hydraulic oil.

The reservoir is equipped with a sight gauge (B) and temperature gauge (C).

There is also a low oil level switch (D) and an oil temperature switch (E) installed in the reservoir.

- *Low Oil Level Switch (D)*
  When the oil level in the reservoir reaches approximately 20 gallons (76 L), the hydraulic system will shutdown and the low oil indicator (F) on the hydraulic power pack disconnect panel will illuminate. Fill reservoir immediately. The hydraulic system cannot be restarted until the oil level is above the low oil level switch.

- *Oil Temperature Switch (E)*
  The cooling fan will start rotating when the hydraulic oil temperature reaches 140°F (60°C) and will stop rotating when the oil temperature reaches 120°F (49°C).



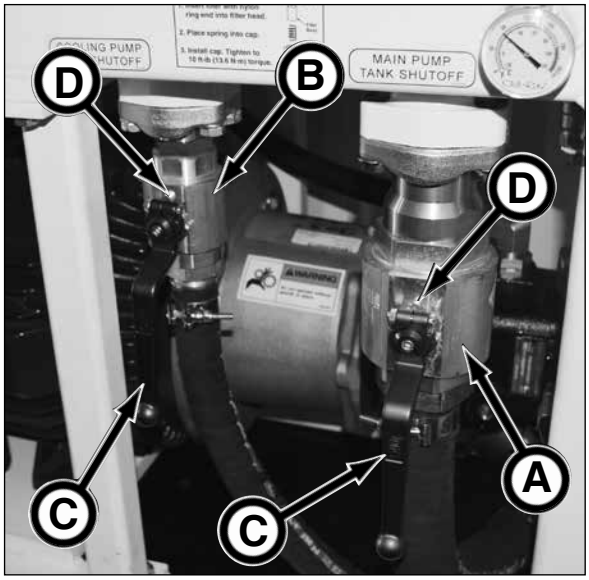
HYDRAULIC RETURN FILTER INDICATOR

To prevent under or over servicing of the hydraulic filter element, a filter indicator (G) is installed on the return filter assembly.

The green OK zone indicates that the filter is functioning properly. The yellow zone indicates that the filter will soon require replacement.

Replace return filter when the needle on the gauge is in the red CHANGE zone (see 5. Check Hydraulic Return Filter Indicator in Periodic Maintenance section).

TANK SHUTOFF VALVES

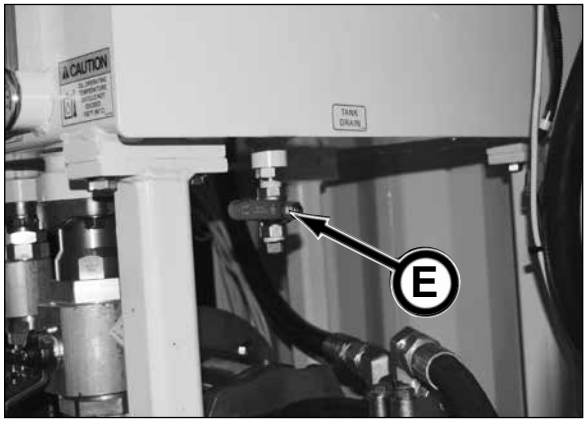


The hydraulic reservoir is equipped with two suction shutoff valves.

- Main Pump Shutoff Valve (A)
- Cooling Pump Shutoff Valve (B)

BEFORE operation, both shutoff valves MUST be in the open position, otherwise pump damage will occur.

IMPORTANT: With the valve open (valve lever (C) in vertical position as shown), be sure the valve lever (C) is tightly against the valve stop (D) to prevent accidental closure during operation.



The hydraulic reservoir is also equipped with a tank drain shutoff valve (E) for ease of draining reservoir oil.

NOTES

Pre-Start Inspection

⚠WARNING Do not operate this equipment until you read, study, and understand this manual and any additional equipment manuals before you operate and maintain this equipment. A daily inspection of the equipment must be performed to prevent severe personal injury or death and equipment damage.

The contractor is fully responsible for the safety of all personnel on the job site. Check with the contractor that all site preparation requirements are in place. Be sure to comply with all OSHA regulations, such as: an active safety program is in practice, a confined space permit (if needed) is issued, personal protective equipment is being worn; flammable, combustible, and hazardous materials are properly stored; and a lockout tagout procedure is in place.

Use the following checklist ✓ as a guide for your daily pre-start inspection. Make a copy of this Pre-Start Inspection checklist. Once it is complete, check off, initial and date each item and file the copy as a record of Inspection.

	1. Use “ONE-CALL” notification to check for buried utility lines prior to project.
	2. Check the caisson sections for proper installation and the concrete floor seal is properly cured.
	3. A qualified electrician must check that all electrical connections are properly secured and grounded prior to operation.
	4. Thoroughly clean equipment of mud and dirt.
	5. Check condition of personal protective equipment. Replace equipment if defective.
	6. Contractor is responsible for all personnel to wear proper protective equipment on the job site.
	7. Remove combustible or flammable materials from equipment. Store materials properly.
	8. Test air monitoring and ventilation detectors for proper operation.
	9. Inspect equipment for damage. Repair or replace as needed.
	10. Be sure all covers and guards are in place before operation.
	11. Test E-Stop operation. If operation is faulty, E-Stop MUST be repaired before operation.
	12. Check controls and switches for proper operation. Repair or replace if damaged for worn.
	13. Check hydraulic reservoir oil level. Add as needed.
	14. Be sure all covers and guards are in place before operation.
	15. Check for loose or missing hardware. Replace damaged or missing hardware.
	16. Check for worn, loose, or damaged wire. Repair or replace wiring.
	17. Tighten loose clamps or fittings.
	18. Check wire harnesses for frayed or worn insulation or wires. Replace damaged or worn harnesses.
	19. Check for fluid leaks. Repair leak or replace components.
	20. Keep job site clean and organized.
	21. Check equipment for proper lubrication.
	22. Remove all personnel from inside the pipe thruster frame.
	23. Check hydraulic hoses and lines for wear and/or damage. Replace any defective hoses and/or lines.
	24. Be sure all suction valves are open to prevent accidental closure.
	25. Remove all tools on pipe thruster frame.

NOTES

Operation

IMPORTANT: You must read and understand this manual and any additional equipment manuals before you operate and maintain this equipment.

OPERATING GUIDELINES

⚠WARNING Do not operate this equipment until you read, study, and understand this manual. Failure to do so, could result in severe personal injury or death.

1. Before operating, read and understand the Safety, Pre-Start Inspection, and Operation sections.
2. Do not operate this equipment while under the influence of alcohol, drugs, or medication.
3. Follow all Federal, State, and Local safety regulations and procedures.
4. Be sure OSHA prescribed safety personal protective equipment is being worn by all personnel.
5. Be sure the area is safe for operation. Keep work site clean and organized.
6. NEVER operate equipment if it has been engulfed with water. Contact your Akkerman Aftermarket Support representative for proper procedures on how to restore equipment for operation.
7. Have a fully charged fire extinguisher on the job site at all times.
8. Before operating, repair all equipment problems.
9. Check to be sure the caisson sections are properly installed and the concrete floor seal is properly cured.
10. Test air monitoring and ventilation detectors for proper operation. Never enter the caisson without gas detectors.
11. A fully trained and qualified signal person must direct the excavator or crane operator when lifting and lowering equipment into the launch or reception pits.
12. Never walk or work under any part of the excavator or crane and suspended loads.
13. Test all controls to make sure they work properly.
14. Pressure peaks cause hoses to jump without notice. Keep all personnel away from hoses during operation of equipment.
15. Lock out tag out electrical power at the source (generator) before servicing electrical components.
16. Beware of pinch points.
17. If this manual is lost, contact your Akkerman Aftermarket Support Representative for a new manual or download this manual from the Akkerman web site at www.akkerman.com.
18. High pressure hydraulics are used on the pipe thrusting system. Be sure all covers and guards are in place before operating.
19. Do not make any modifications to any Akkerman products. Doing so could cause structural failure and will void the warranty.
20. Do not make adjustments or repairs to the hydraulic system components while in operation or until all pressure is released and power pack is placed in locked out, tagged out.
21. Be sure all suction valves are open to prevent accidental closure.

USING EMERGENCY STOP

IMPORTANT: Emergency Stop buttons are used for emergency situations only. Emergency Stop buttons alone are ***NOT*** intended for lockout tagout purposes. Refer to Lockout Tagout Procedure Guideline in Section 1, Safety.

⚠WARNING **ALL** Emergency Stop buttons MUST be operating properly BEFORE operation. Failure to do so may cause severe injury or death.

NOTICE The remote pendant cord MUST be plugged into the remote pendant connection receptacle on the electrical panel to energize the start and stop circuit on both the electrical panel and the remote pendant. Otherwise the Emergency Stop, Start and Stop buttons will not function.

REMOTE PENDANT - HYDRAULIC POWER PACK

The Emergency Stop button (A) is located on the remote pendant.

Push Emergency Stop button IN to stop all electrical and hydraulic functions.

The button will illuminate when it is pulled OUT.

NOTICE The emergency stop button must be pulled out for motor to start.

Remote Pendant for Hydraulic Power Pack

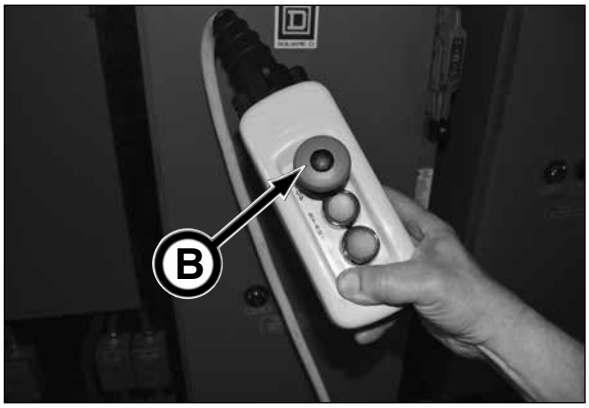
REMOTE PENDANT - SHAFT PUMP

The Emergency Stop button (B) is located on the remote pendant.

Push Emergency Stop button IN to stop all electrical and hydraulic functions.

The button will illuminate when it is pulled OUT.

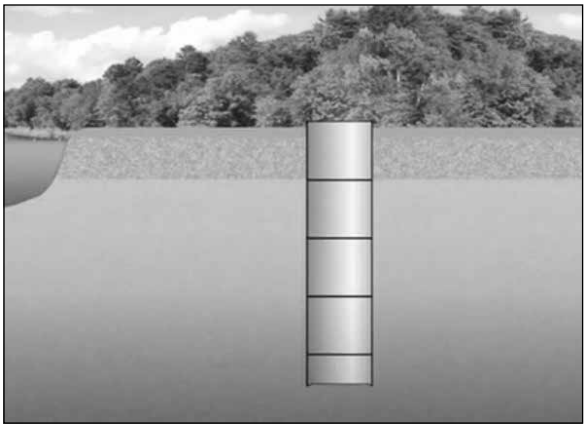
NOTICE The emergency stop button must be pulled out for motor to start.



Remote Pendant for Shaft Pump

SITE PREPARATION

1. The contractor is fully responsible for the design and construction of the caisson and collector well laterals.



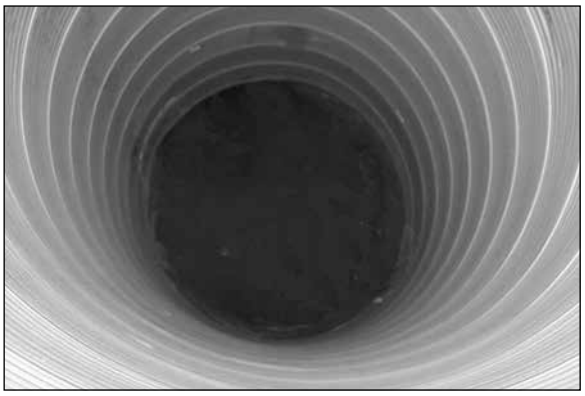
A Layne Ranney Illustration

⚠WARNING Gases may be present during excavation and could cause severe personal injury or death. Use an approved air analyzer to detect hazardous gases on the job site and in the caisson at all times.

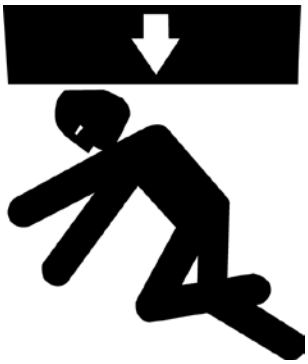
2. Once a collector well site is selected and a geological analysis is conducted, a caisson is constructed.

3. Dirt is removed at the well site and the top section of the caisson is pushed down until the top section is level with the ground level.

4. Once all sections of the caisson are sunk to the required well depth, a concrete well plug or seal is placed at the bottom of the caisson.



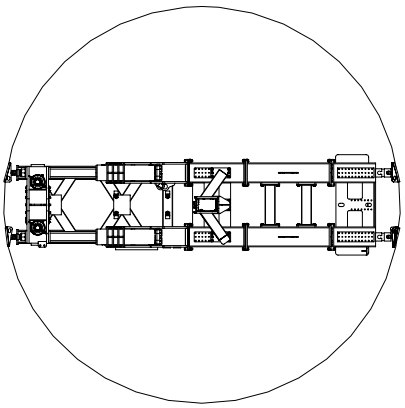
5. After the plug is cured, the water in the well is pumped out.



⚠WARNING Suspended loads may fall and cause severe injury or death. Do not allow anyone to enter area under or around a suspended load.

NOTICE Be sure the crane or excavator and all lifting equipment is rated to lift load. Remember, you may be able to lift the load in close at ground level, but as the load radius and elevation change, the lifting capacity of the crane or excavator or other lifting equipment will decrease.

6. Lower the pipe thruster frame to the bottom of the caisson, aligning the front of the frame with one of the port assemblies in the caisson wall.



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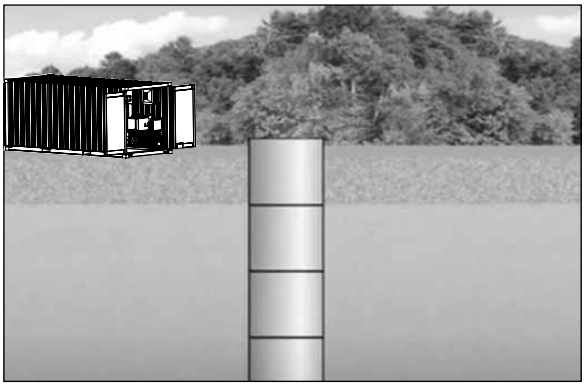
7. Place the pipe thruster container on a firm, level surface a safe distance from the caisson wall. The container should be located so the hydraulic power pack end of the container is towards the caisson wall.



A Layne Ranney Illustration

8. Place the generator or main power source as far away from the pipe thruster container as possible. This will reduce the noise at the job site and make it easier to communicate with the caisson personnel.

9. Connect hydraulic hoses from the pipe thruster hydraulic power pack hoses to the pipe thruster frame (refer to Connecting Hydraulic Hoses to Power Pack and Frame in this section).

⚠DANGER Improper grounding can result in equipment damage or electrical shock, causing severe injury or death.

⚠DANGER Ground connection MUST be connected prior to connecting incoming power.

10. **Properly ground the generator (or other power source) and pipe thruster container.**

⚠DANGER Hazardous voltage. Disconnect and lock out tag out power from source before attempting to install electrical connections.

11. Connect and secure power cables from generator to pipe thruster container power leads (refer to Connecting Power Leads To Power Source in this section).

12. Connect all other utility equipment as needed.

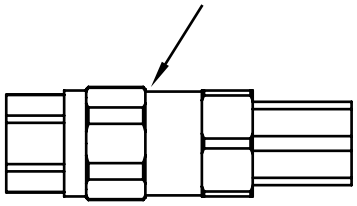
13. Proceed to Checkout Equipment Prior To Start-Up in this section.

CONNECTING HYDRAULIC HOSES TO POWER PACK & FRAME

IMPORTANT: NEVER clamp on the coupler sleeve. This will cause distortion, resulting in coupler damage.

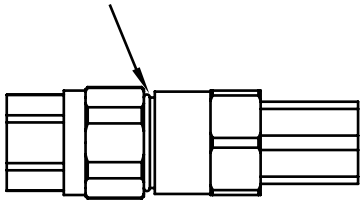
1. Use the following instructions to properly install the couplers. BEFORE installation, be sure to clean ALL mating surfaces to prevent contamination and improper installation.

CONNECT COUPLERS
Hand tighten coupler by rotating clockwise (CW) until o-ring is no longer visible. If o-ring is visible, the connection is not locked.



Connection Locked
Metal To Metal Contact

DISCONNECT COUPLERS
Rotate hose coupler counterclockwise (CCW) until coupler is removed.

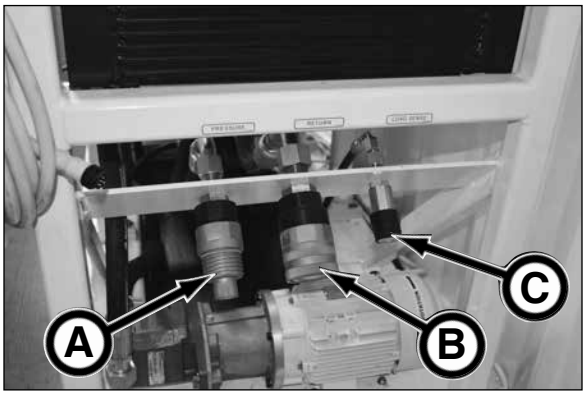


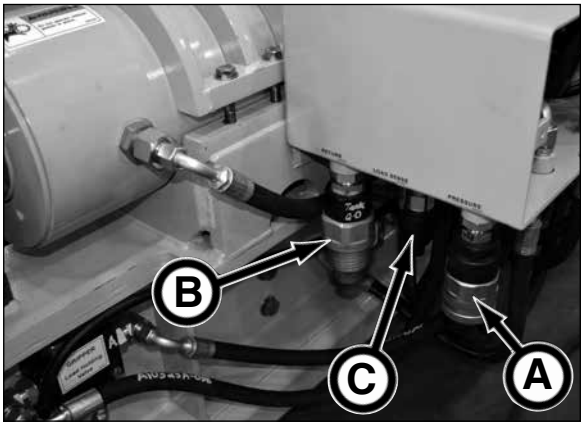
Connection Unlocked
O-Ring Partially Exposed

2. Route and install the hydraulic hoses from the hydraulic connections pressure (A), return (B) and load sense (C) on the container power pack to the frame. Be sure quick disconnects are properly connected.

Pressure Hose (A) - 3/4”
Return Hose (B) - 1”
Load Sense (C) - 3/8”

Cover sharp corners to prevent damage to the hoses. Keep in mind, pressure peaks cause hoses to jump without notice.



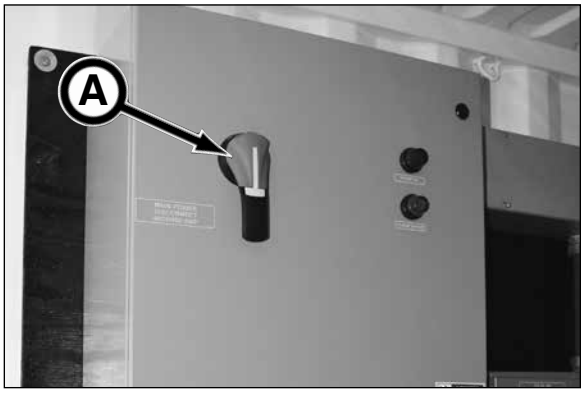


CONNECTING POWER LEADS TO POWER SOURCE

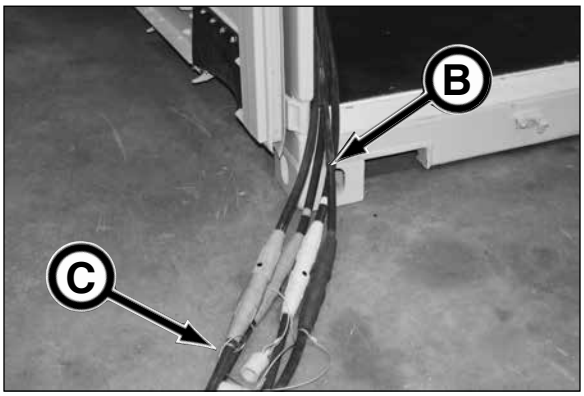
⚠DANGER Hazardous voltage.
This machine is powered by high voltage electricity.

Failure to lockout tagout power before connecting power leads or servicing will cause severe personal injury or death.

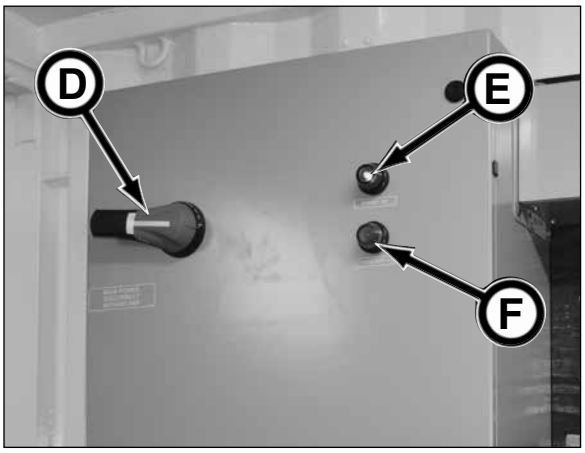
LOCKOUT TAGOUT main power supply before connecting power leads or servicing. ONLY a qualified and trained technician can operate this equipment. Electrical repairs must be performed only by a certified electrician.



1. Lockout tagout generator or other power source.
2. Turn container main disconnect (A) to the OFF position.



3. Connect pipe thruster power cable leads (B) to generator or other power source connections (C).
4. Turn on generator or other power source.



5. Turn main disconnect (D) to the ON position.
6. Check Phase Indicator lights. If green Phase OK light (E) is not illuminated, proceed to step 7, otherwise continue to step 8.
7. If red Phase Error light (F) is illuminated, a certified electrician must turn main disconnect to the OFF position and lockout tagout power source. Then the electrician must reverse the two generator power leads. Repeat steps 3 - 6. For more information, refer to Phase Indicator in the Controls & Instruments section.
8. The power in the pipe thruster container is now available for operation.

CHECKOUT EQUIPMENT PRIOR TO START-UP

1. Before checking equipment, the caisson must be properly vented and monitored for accumulation of combustible and toxic gases including the depletion of oxygen.

2. Check the operation of ALL E-Stop buttons before operating pipe thrusting system.

3. All electrical lines and hydraulic hoses must be properly installed and in good working condition.

4. Perform maintenance in Prior To Each Drive Launch in section 9, Periodic Maintenance before operation.

5. Check oil level (A) in hydraulic reservoir. Add oil if needed.

6. Check that the Main Pump Shutoff valve (B) and the Cooling Pump Shutoff valve (C) are in the open position.

7. Check return filter indicator (D). Replace filter element if needed.

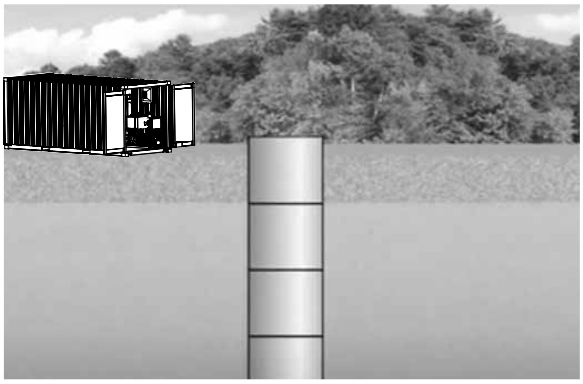
   NOTICE The return filter indicator gauge must be in the green OK zone BEFORE operating the hydraulic system. Operating unit in the red CHANGE zone will cause oil to go into bypass mode, resulting in unfiltered oil with possible contaminants returning to the tank. This WILL cause system failure.

   If the filter indicator gauge is still in the red CHANGE zone after attempting to warm the oil, the filter MUST be changed before operating.

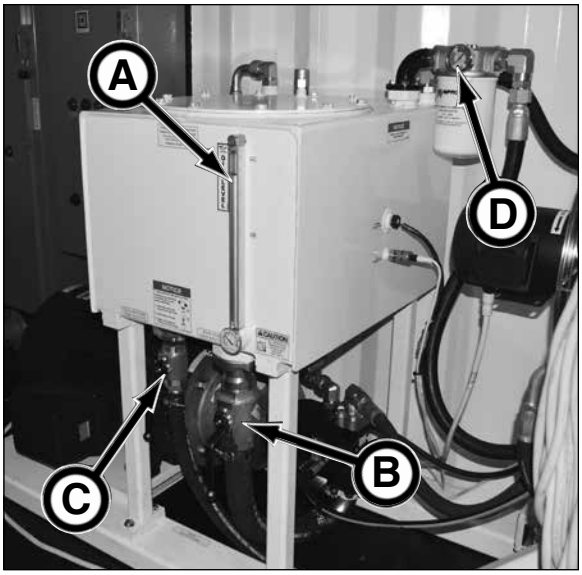
8. If using the VFD drive (E), check to be sure the VFD drive parameters are set properly for the can pump motor.

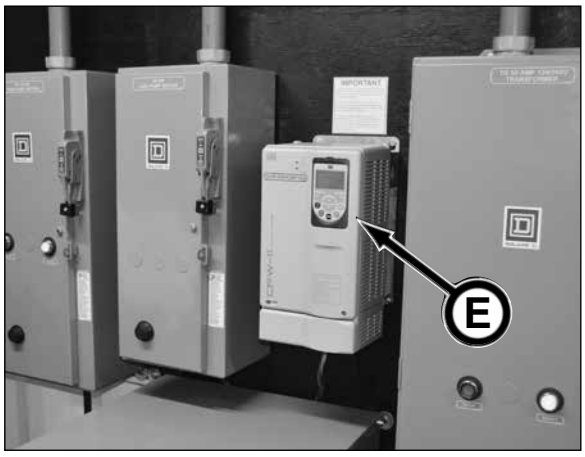
   IMPORTANT: It is recommended to re-energize the VFD drive at least every 6 months for 30 minutes with the rated voltage to re-form the VFD capacitors and to ensure correct VFD operation.

   <u>IF</u> the VFD drive has been in storage for 12 months or more, a certified electrician must re-apply voltage <u>PROGRESSIVELY</u> using a variable power supply to re-form the capacitors. Contact WEG for details.



A Layne Ranney Illustration



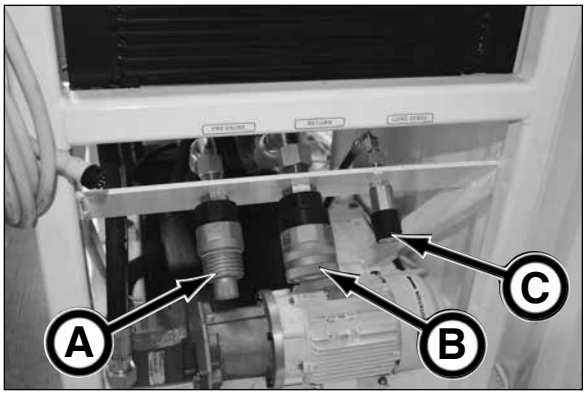


SYSTEM START-UP

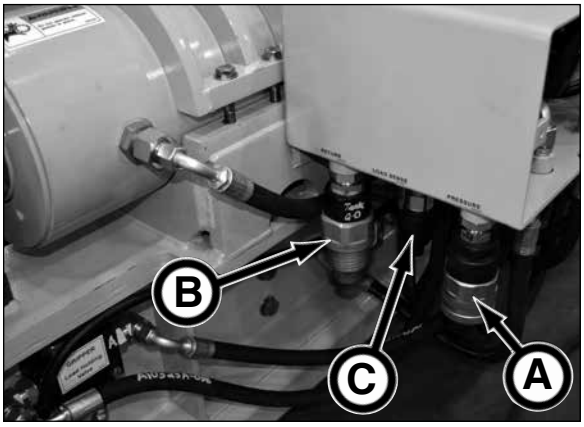
⚠DANGER Hazardous voltage. Disconnect and lockout/tagout power from source before servicing.

1. Lockout tagout power to the pipe thruster container.

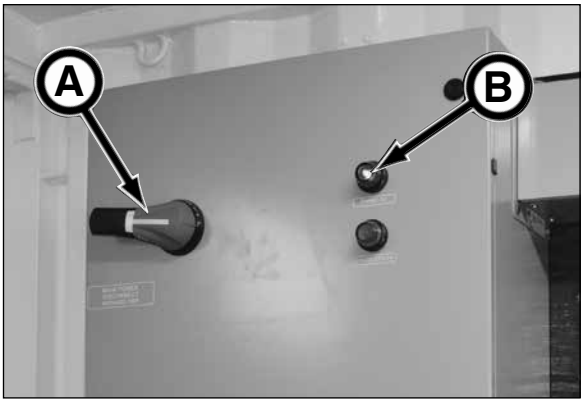
2. Push IN all E-Stop buttons to prevent accidental powering of equipment.



3. Connect hydraulic hoses (pressure (A), return (B), load sense (C)) from the container to the frame (refer to Connecting Hydraulic Hoses To Power Pack & Frame in this section) and power cables from the power source to the container (refer to Connecting Power Leads To Power Source in this section).

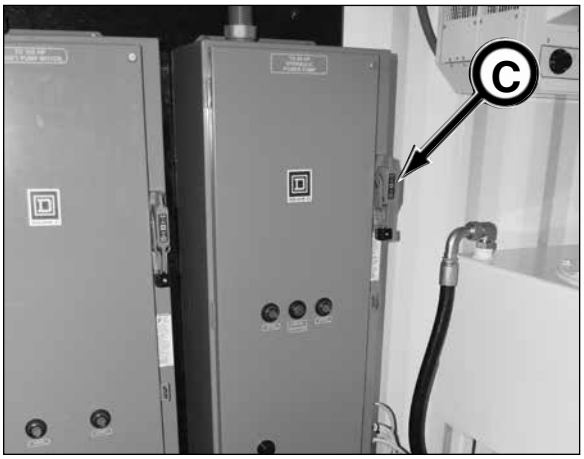


4. With verification from all job site personnel for start up approval, pull out ALL E-Stop buttons.



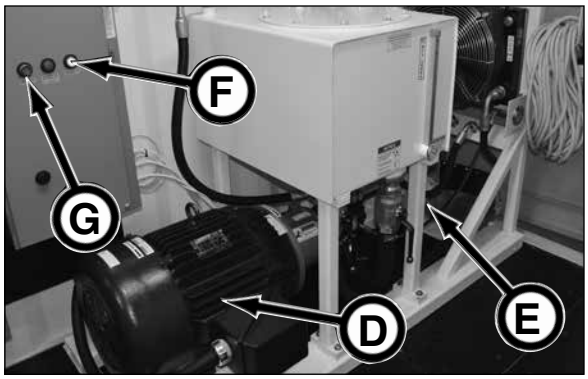
5. Turn main disconnect switch (A) to the ON position and verify the green Phase OK light (B) is illuminated.

   If the red Phase Error indicator light is illuminated, turn main disconnect to the OFF position and lockout tagout ALL power before a certified electrician attempts to reverse the two generator power leads on the power circuit. Then recheck phase indicator lights.



6. Flip the Hydraulic power pack disconnect (C) to the ON position.

NOTICE The remote pendant cord MUST be plugged into the remote pendant connection receptacle on the electrical panel to energize the start and stop circuit on both the electrical panel and the remote pendant. Otherwise the Emergency Stop, Start and Stop buttons will not function.



7. Check the motor rotation on the 50 HP motor (D) and the cooling motor (E) by bumping the START button (F) on the panel (or the remote pendant START button) and then the STOP button (G).

   IMPORTANT: Check rotation of all electric motors to ensure correct rotation. Failure to do so may cause component damage. The phase monitoring only ensures that the input phases are correct.

8. Flip other utility equipment power disconnects to the ON position as needed.

9. Check all controls for proper operation. Repair as needed.

10. Proceed to Launch Sequence in this section.

LAUNCH SEQUENCE

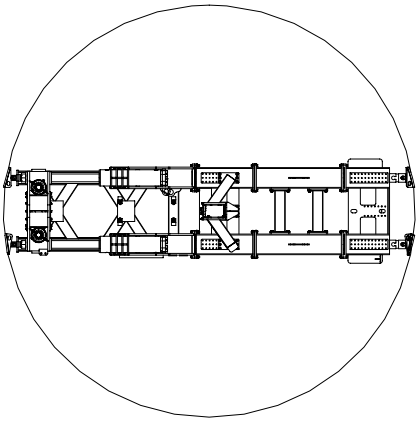
This is a general overview of the launch sequence. The operation and installation details are determined by the owner and contractor of the project.

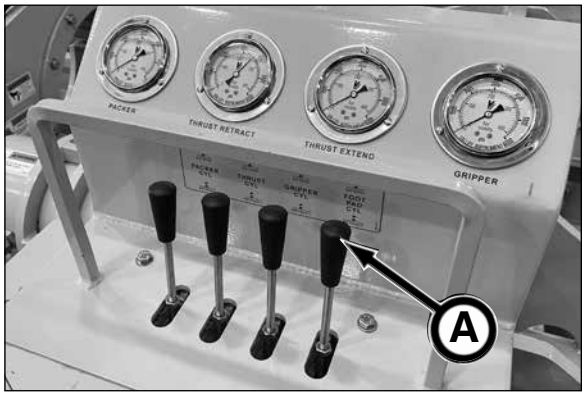
Perform System Start-Up procedure before following the launch sequence. Refer to System Start-Up in this section.

⚠WARNING Suspended loads may fall and cause severe injury or death. Do not allow anyone to enter area under or around a suspended load.

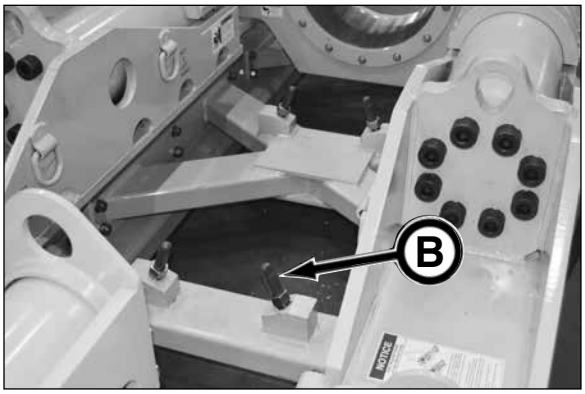
NOTICE Be sure the crane or excavator and all lifting equipment is rated to lift load. Remember, you may be able to lift the load in close at ground level, but as the load radius and elevation change, the lifting capacity of the crane or excavator or other lifting equipment may decrease.

1. With the pipe thruster frame in proper position to the port assembly in the caisson, secure pipe thruster frame against caisson wall by extending the foot pad cylinder using the foot pad cylinder control (A) so the frame does not shift or move while adding and removing projection pipe.





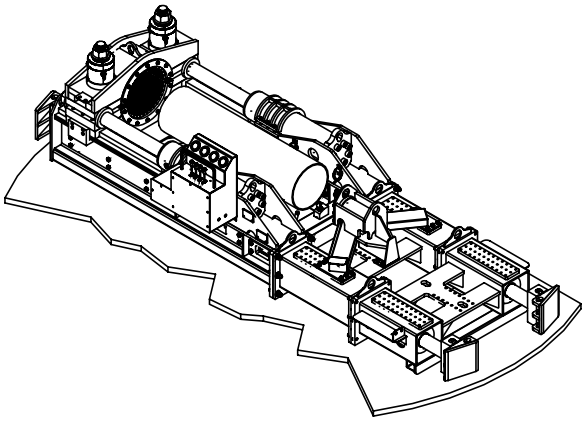
2. Adjust four tube supports (B) as needed for the OD of the projection pipe.



3. Lower a section of projection pipe onto pipe thruster frame.

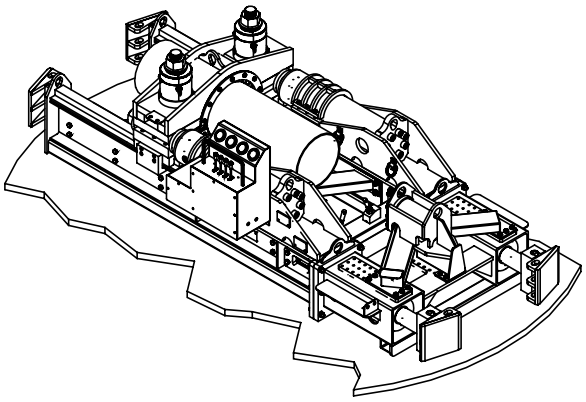
4. (Not shown) Lower digging head and install to front of the lead projection pipe.

5. Add sand line (not shown) to digging head and projection pipe as needed.

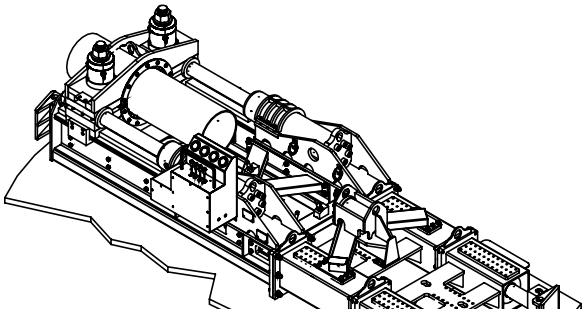


6. With the digging head (not shown) through the port assembly seal, push the pipe through the port assembly by:

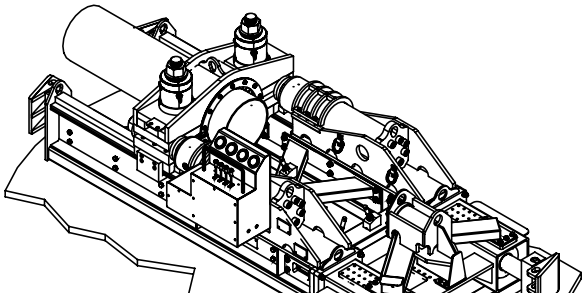
   a. retracting the gripper cylinder, retract the thrust cylinders to move the gripper assembly to the back of pipe thruster frame as shown.

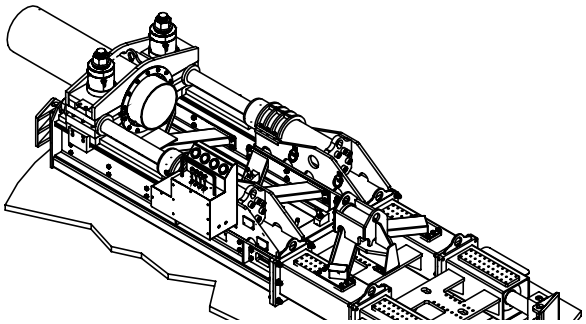


   b. then extend the gripper cylinders against the pipe and extend thrust cylinders to full stroke.



   c. repeat steps 6a and 6b until the next pipe can be lowered onto frame.





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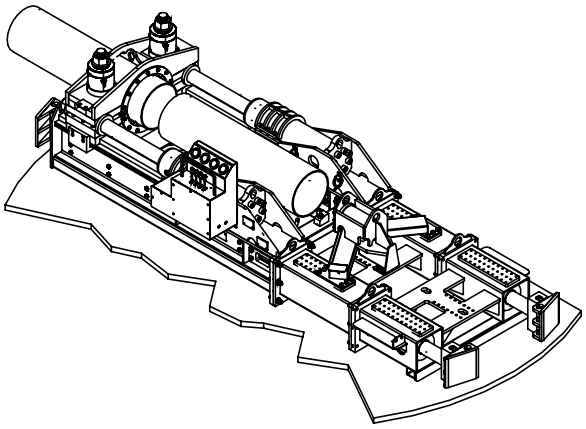
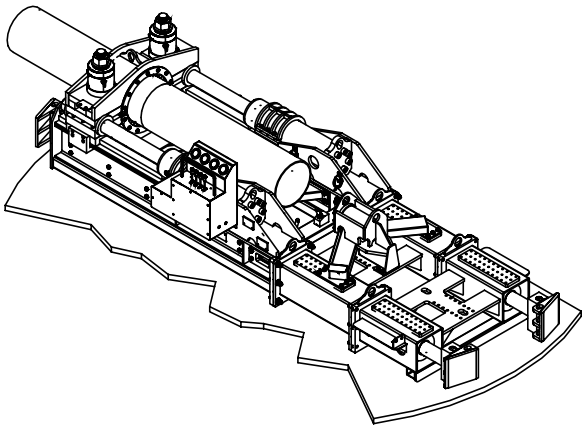
7. Lower next pipe onto frame and thread the pipe to the lead pipe.

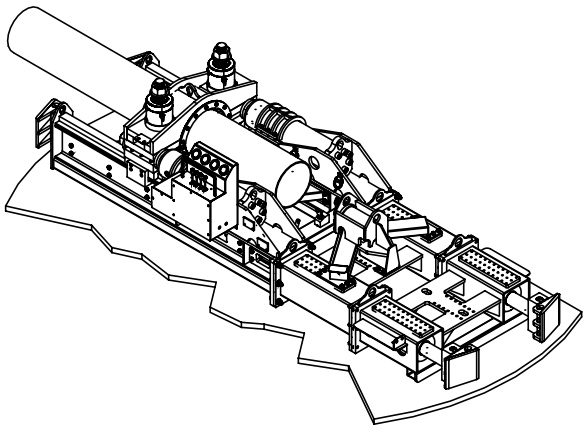


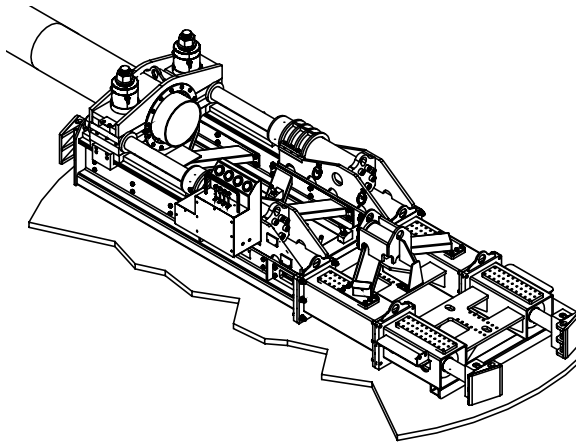


8. Push the pipe through the port by:

   a. retracting the gripper cylinder, retract the thrust cylinders to move the gripper assembly to the back of pipe thruster frame.

   b. then extend the gripper cylinders against the pipe and extend thrust cylinders to full stroke.





   c. repeat steps 8a and 8b until the next pipe can be lowered onto frame. Continue this process until all the projection pipe have been installed.

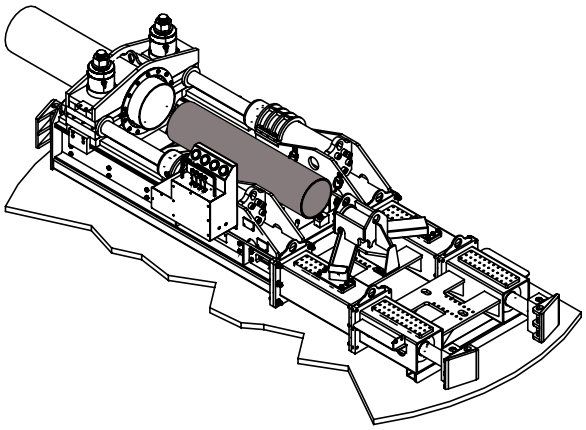
9. With the projection pipe installed and the gripper assembly against the pipe, remove the sand line.

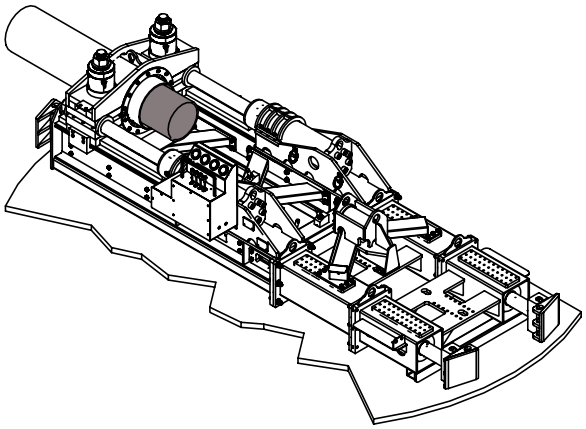
(continued on next page)

10. The well screens are now installed.

11. A screen pipe is placed one section at a time into the projection pipe. Each consecutive section of screen pipe is secured to the one already in place.

12. The screen pipe installation process continues until all the screen pipe has been installed. Install sand line as needed.





13. Once all sections of the screen pipe are in place. the projection pipe is removed to expose the screen pipe to the aquifer deposits.

14. Install screen retainer (A) onto screen.

15. Install retaining rod (B) to retainer and packer cylinder.

16. Extend packer cylinder to hold screen pipe in place while removing pipe.

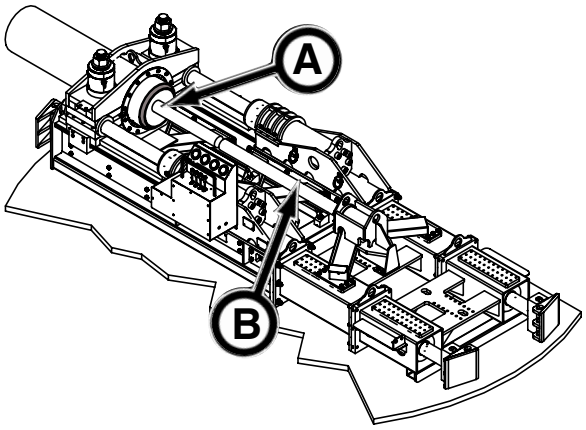
17. With the gripper cylinder against the projection pipe, retract thrust cylinders. The gripper assembly will have to be repositioned to position full size of pipe in the unloading area of the frame. Release gripper cylinder, extend thrust cylinders and extend gripper cylinders. Retract thrust cylinders until complete pipe is in the unloading area.

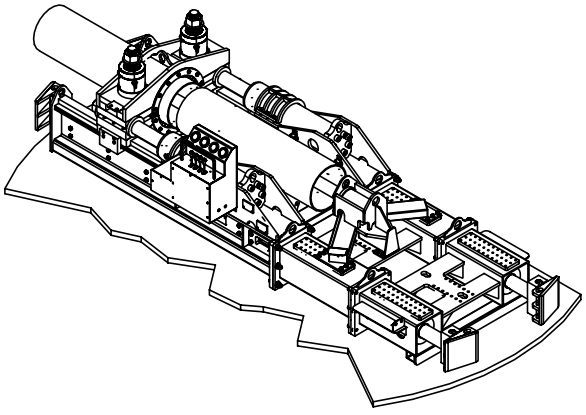
18. Retract packer cylinder.

19. Unthread pipe. Retrieve retaining rod.

20. Remove pipe.

21. Repeat steps 15 through 20 until all pipe are removed.





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22. Remove frame from caisson (refer to Removing Pipe Thruster Frame From Caisson) in this section.

23. Complete collector well construction.

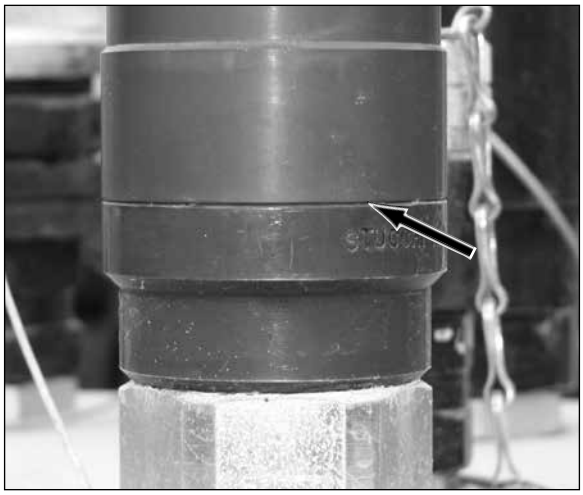
A Reynolds Construction Illustration

QUICK COUPLER INSTALLATION

Use the following instructions to properly install the couplers. BEFORE installation, be sure to clean ALL mating surfaces to prevent contamination and improper installation.

NOTICE **NEVER** clamp on the coupler sleeve. This will cause distortion, resulting in coupler damage.

1. CONNECT COUPLERS
   Hand tighten coupler by rotating clockwise (CW) until o-ring is no longer visible. If o-ring is visible, the connection is not locked.

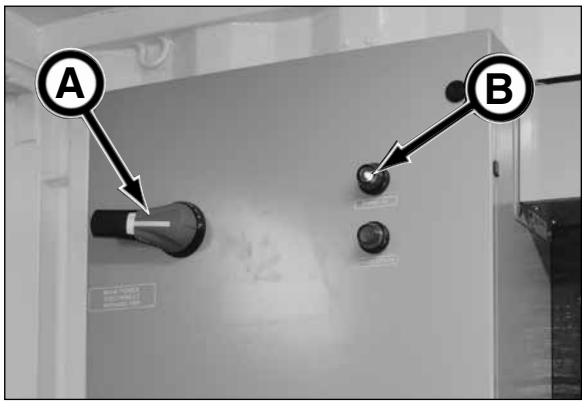


Connection Locked

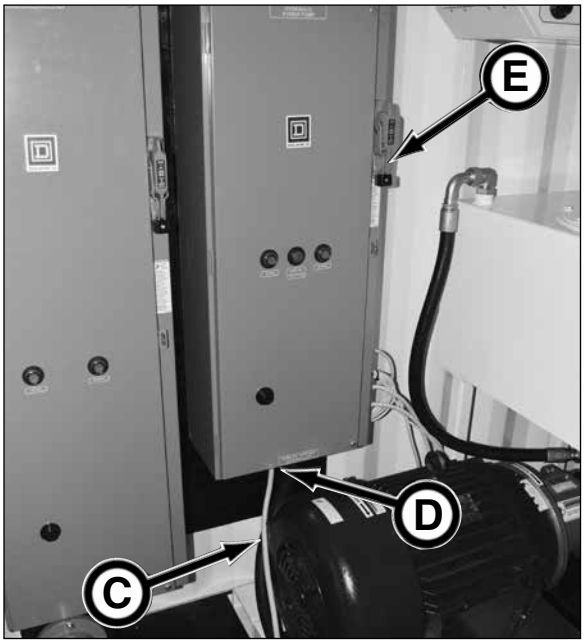
2. DISCONNECT COUPLERS
   Rotate hose coupler counterclockwise (CCW) until hose is removed.

Connection Unlocked

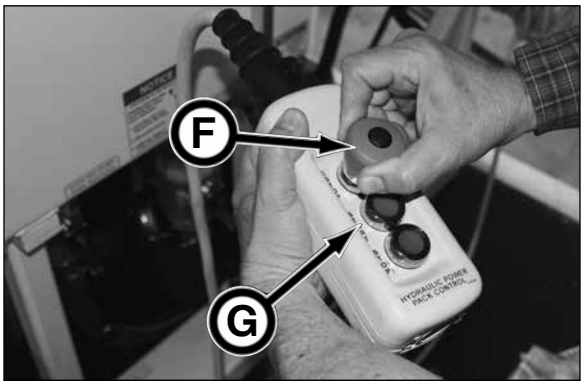
STARTING POWER PACK MOTOR



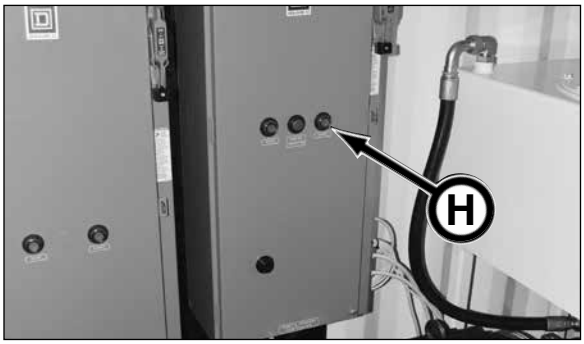
1. Check that the main disconnect switch (A) is in the ON position with proper phase power; the green Phase OK light (B) is illuminated.



2. Connect remote pendant cord (C) to the remote pendant connection receptacle (D) on the panel box.
3. Flip the hydraulic power pack disconnect (E) to the ON position.



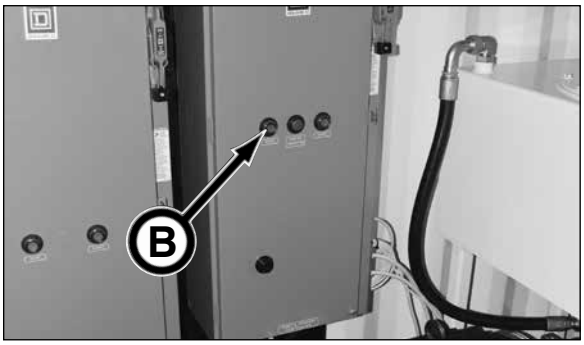
4. Pull out the E-Stop button (F) on the remote pendant.
5. Start the 50 HP hydraulic power pack motor by either:
   - pressing the Start button (G) on the remote pendant
   - pressing the Start button (H) on the electrical panel



NOTICE The remote pendant cord MUST be plugged into the remote pendant connection receptacle (D) on the electrical panel to energize the start and stop circuit on both the electrical panel and the remote pendant. Otherwise the Start and Stop buttons will not function.

STOPPING POWER PACK MOTOR

1. Press the Stop button on either the remote pendant (A) or the electrical panel (B).



2. Flip hydraulic power pack disconnect (C) to the OFF position.

3. If shutting down for the day, perform daily shutdown (refer to Daily Shutdown in this section).

CHECK HYDRAULICS AFTER MOTOR START-UP

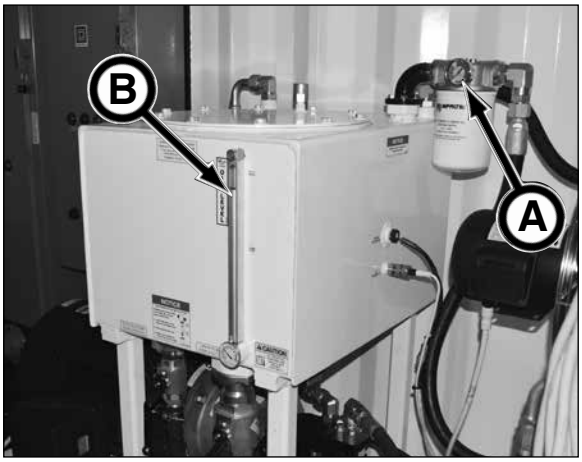
⚠WARNING Escaping oil or other fluids under pressure can penetrate your skin causing serious injury or death.

Release all pressure before performing maintenance or repairs, Never weld near pressurized fluid lines.

DO NOT use your hands to check for leaks. When searching for leaks, use a piece of wood or cardboard.

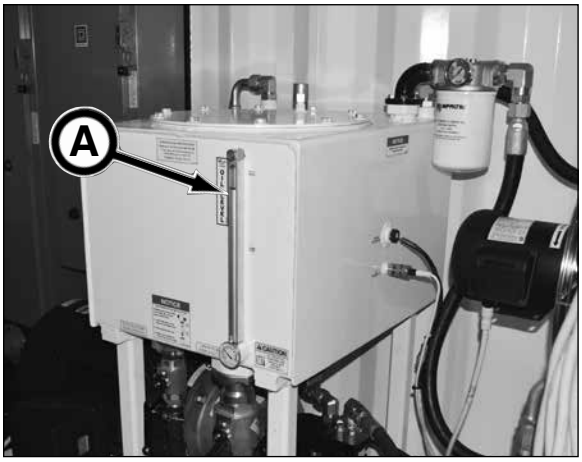
Contact medical help immediately if any oil or fluid is injected into your skin. A serious infection or reaction can emerge without proper medical treatment.

1. Check return filter indicator (A). Once operating temperature reaches at least 100°F (38°C), if the filter indicator needle is in the red CHANGE zone, replace filter.
2. Check hydraulic reservoir oil level (B). Add oil as needed.
3. Check hydraulic components and hoses for leaks. Repair or replace as needed.



FILLING HYDRAULIC OIL RESERVOIR

Check hydraulic tank oil level gauge (A).



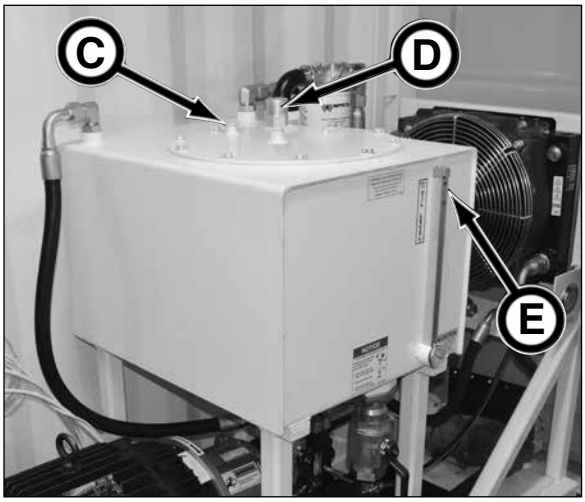
If the fluid level in the reservoir is less than 3/4 full, fill the reservoir as follows:

1. Flip hydraulic power pack disconnect (B) to the OFF position.

2. Clean area around the fill plug (C) and breather (D).
3. Remove fill plug.
4. Fill hydraulic oil until it reaches the full mark (E) on gauge.

   NOTICE Refer to section 8, Lubricants section for recommended hydraulic oil.

5. Replace fill plug.



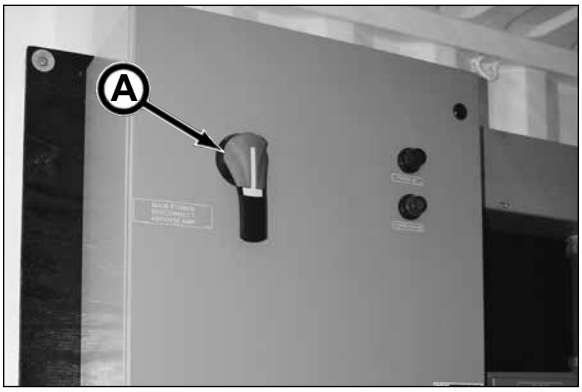
DAILY SHUTDOWN

1. Press the Stop button on all equipment disconnect panels. The hydraulic power pack and the shaft pump can also be stopped using the Stop button on the remote pendant.

2. Flip all operator disconnects to the OFF position.

3. Push IN all E-Stop buttons.

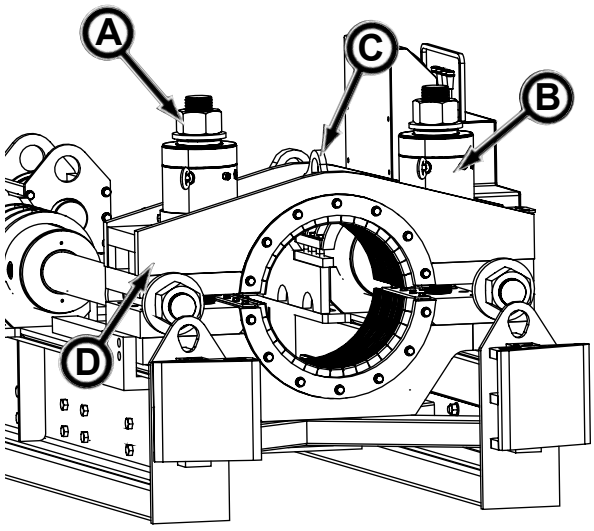
4. Flip the main power disconnect switch (A) to the OFF position.



5. Perform lockout tagout procedure on main power disconnect switch (refer to Lockout Tagout Procedure Guideline in section 1, Safety).

6. Shut down generator or other power source and perform lockout tagout procedure (refer to Lockout Tagout Procedure Guideline in section 1, Safety).

CHANGING GRIPPER TEETH



1. Remove gripper cylinder nuts (A) and washers.

2. Remove gripper cylinders (B).

3. Connect properly rated hoist and strap to lift eye (C), carefully remove upper clamp (D) of gripper.

4. Carefully lower upper gripper clamp to the upside down position as shown.

5. Remove holding bar (E) and retain the eight 3/8 UNC x 1 bolts and flat washer hardware.

6. Remove holding bar ring (F) and retain the fourteen 1/2 UNC x 1.25 bolts and flat washer hardware.

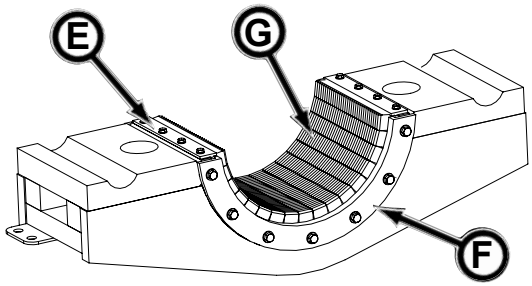
7. Using gloves, remove teeth (G) and carefully replace with new.
   - Straight Gripper Teeth

Diameter	Part Number	Qty
16.25 in.	062051P	32
16.25 in.	062311P	2*
18.27 in.	062210P	36
18.27 in.	062312P	2*

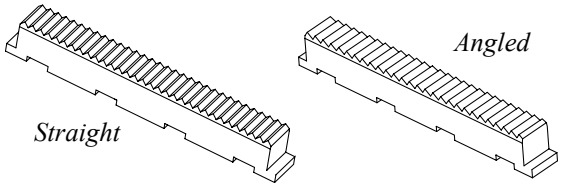
   - Angled Gripper Teeth

16.25 in.	062057P	32
16.25 in.	062313P	2*
18.27 in.	062209P	36
18.27 in.	062314P	2*

* One on upper gripper clamp, one on bottom gripper clamp.



Upper Gripper Clamp

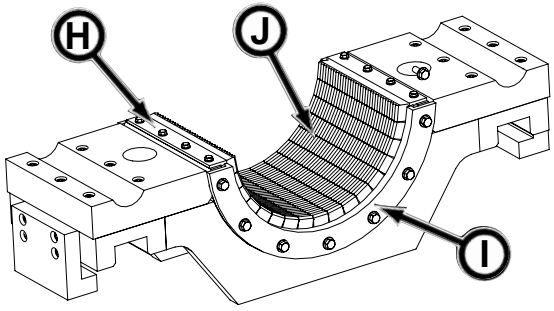


Gripper Teeth

8. Replace holding bar ring and holding bar with hardware removed in steps 5 and 6. If hardware is damaged, replace with new.

9. On bottom gripper clamp, remove holding bar (H) and retain the eight 3/8 UNC x 1 bolts and flat washer hardware.

10. Remove holding bar ring (I) and retain the fourteen 1/2 UNC x 1.25 bolts and flat washer hardware.

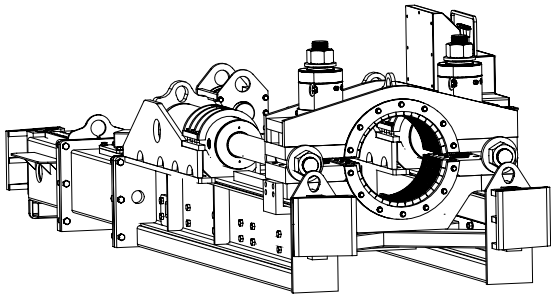


Bottom Gripper Clamp

11. Using gloves, remove teeth (J) and carefully replace with new.

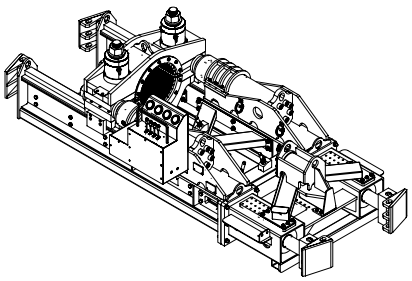
12. Replace holding bar ring and holding bar with hardware removed in steps 8 and 9. If hardware is damaged, replace with new.

13. Carefully replace upper gripper clamp, gripper cylinders, washers and nuts. It may be necessary to back nuts off to gain additional clearance from the projection pipe (casing).

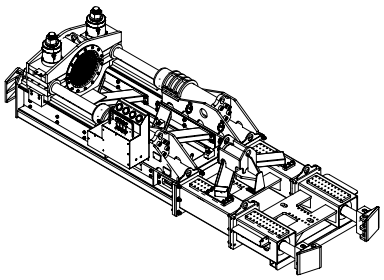


CONFIGURING PIPE THRUSTER FRAME

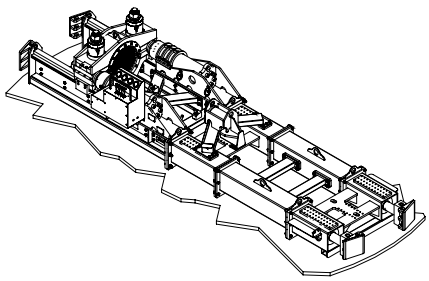
The pipe thruster frame is modular and can be changed in length to accommodate caisson diameters of 13, 16 and 20 feet. Use hardware shown below for different configurations.



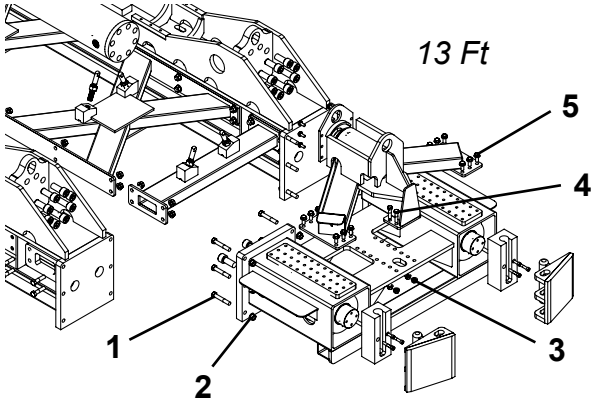
13 Ft Caisson Configuration

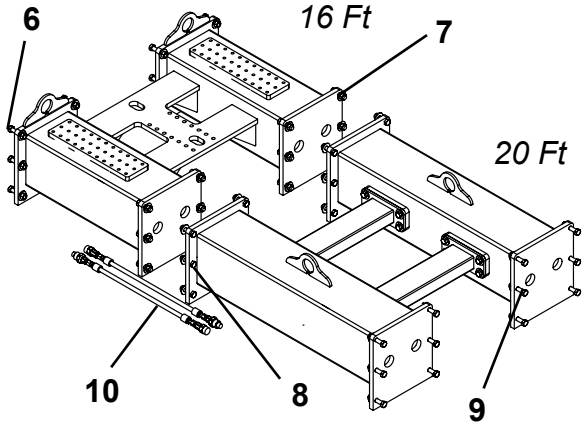


16 Ft Caisson Configuration



20 Ft Caisson Configuration





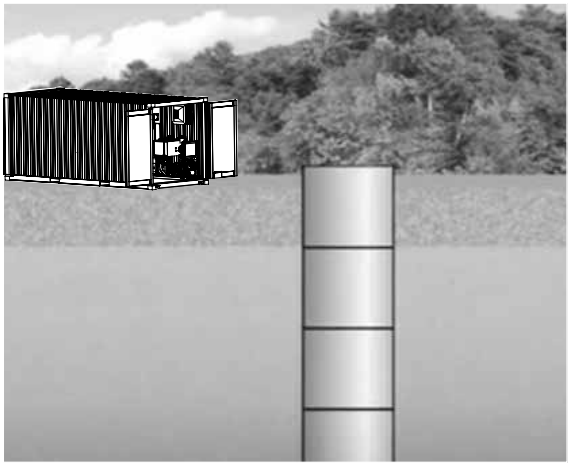
ITEM	QTY	PART NO.	DESCRIPTION
1	12	P0001-12-018	BOLT, Hex 3/4 UNC x 4.5
2	12	P0040-012	WASHER, Flat 3/4 UNC
	12	P0003-12-000	NUT, 3/4 UNC
3	4	P0040-010	WASHER, Flat 5/8 UNC
	4	P0003-10-000	NUT, 5/8 UNC
4	4	P0001-10-010	BOLT, Hex 5/8 UNC x 2.5
5	12	P0001-10-006	BOLT, Hex 5/8 UNC x 1.5
	12	P0040-010	WASHER, Flat 5/8 UNC
16 FT Section			
6	12	P0001-12-014	BOLT, Hex 3/4 UNC x 3.5
	12	P0040-012	WASHER, Flat 3/4 UNC
	12	P0003-12-000	NUT, 3/4 UNC
7	12	P0001-12-012	BOLT, Hex 3/4 UNC x 3
	12	P0040-012	WASHER, Flat 3/4 UNC
	12	P0003-12-000	NUT, 3/4 UNC
20 FT Section			
8	12	P0001-12-014	BOLT, Hex 3/4 UNC x 3.5
	12	P0040-012	WASHER, Flat 3/4 UNC
	12	P0003-12-000	NUT, 3/4 UNC
9	12	P0001-12-012	BOLT, Hex 3/4 UNC x 3
	12	P0040-012	WASHER, Flat 3/4 UNC
	12	P0003-12-000	NUT, 3/4 UNC
10	1	062221A	HOSE ASSEMBLY 1/2 x 90

(Used with 16 ft & 20 ft spacers to extend and connect foot pad cylinder hydraulics)

COLD WEATHER OPERATION

Freezing temperatures during the projection pipe and lateral screen pipe process, creates the necessity to prepare the site and equipment for the cold weather. Failure to do so will cause damage to components and supporting equipment.

- Tent working areas with a heating system when possible.
- For all equipment, use proper lubricant based on ambient temperature to prevent damage.
- Install heaters for hydraulic systems.
- Refer to supporting equipment manufacturer for more information on cold weather operation.
- Water tanks must be drained or treated with RV anti-freeze.
- Drain hoses to prevent freezing and keep low areas properly drained to prevent freezing damage.
- Motors with water jackets must be flushed including water lines and add RV anti-freeze.
- For diesel engines, use a diesel conditioner as well as a non-gelling winter fuel.

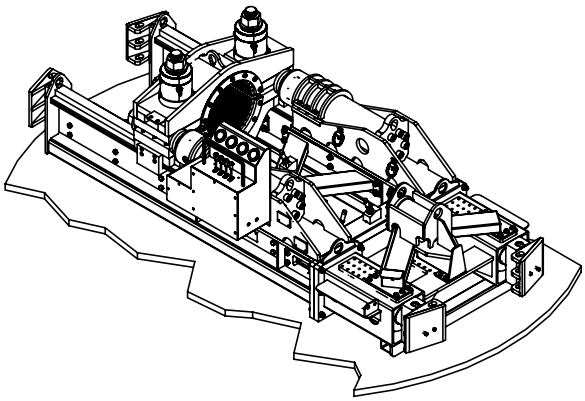


A Layne Ranney Illustration

If systems were shut down for freezing weather, be sure to start systems slowly and let them run for at least five minutes to allow for warm up and in the case of a pump, to displace any surface ice that may have accumulated in the fluid before going back to full operation mode.

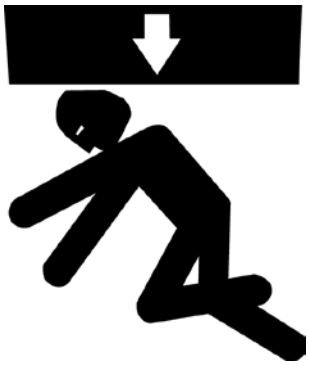
Remember it is also critical to keep the work site safe and employees comfortable during the freezing weather. Good training, supervision, proper clothing and limiting personal exposure to the weather is essential for keeping personnel and equipment safe on the job site.

REMOVING PIPE THRUSTER FRAME FROM CAISSON



1. Retract foot pad cylinders completely.
2. Retract thrust cylinders completely so clamp assembly is positioned as shown.
3. Shutdown power pack motor (refer to Stopping Power Pack Motor in this section).
4. Flip all operator control disconnects to the OFF position.
5. Flip main disconnect switch to the OFF position.
6. Lock out tagout power source.
7. Remove hydraulic hoses from frame to power pack connections in container.
8. Place hydraulic power pack remote pendant in container.
9. Remove personnel from caisson.

⚠WARNING Suspended loads may fall and cause severe injury or death. Do not allow anyone to enter area under or around a suspended load.



NOTICE Be sure the crane or excavator and all lifting equipment is rated to lift load. Remember, you may be able to lift the load in close at ground level, but as the load radius and elevation change, the lifting capacity of the crane or excavator or other lifting equipment will decrease.

10. With properly rated lifting device, lift frame out of caisson.

Transporting

TRANSPORTING GUIDELINES

1. Know the local, state, and federal transportation regulations.

2. Obtain required permits for transporting.

3. Remove any obstacles from the trailer floor.

4. Clean debris from machine.

5. Load and unload on level ground.

6. If lifting equipment with a hoist or lifting device, the equipment lifting eyes and sling must be inspected for damage before lifting. If damaged, replace.

7. Use chains to fasten the container and frame to trailer floor.

8. Securely fasten all tooling to trailer floor.

9. Observe all lifting capacities and lifting instructions.

LIFTING INSTRUCTIONS - PIPE THRUSTER FRAME

• Pipe Thruster Frame configuration weights are:

  - 13’ frame weight is 8,000 lbs. (3,629 kg)

  - 16’ frame weight is 9,000 lbs. (4,082 kg)

  - 20’ frame weight is 10,000 lbs. (4,536 kg)

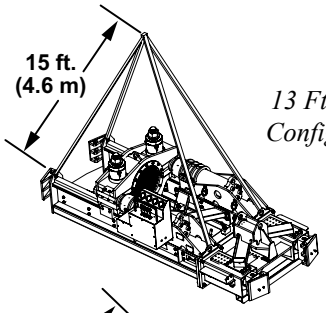
• Completely retract thrust cylinders prior to lifting.

• Lifting 13 ft. (4 m) and 16 ft. (4.9 m) frame configurations with a crane requires a four part sling with legs a minimum of 15 ft. (4.6 m) long.

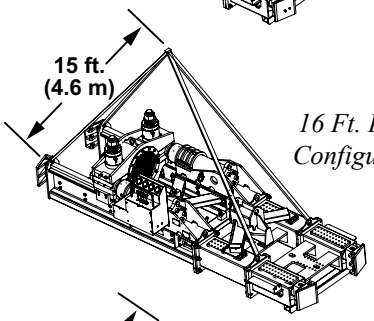
• Lifting 20 ft. (6 m) frame configurations with a crane requires a four part sling with legs a minimum of 20 ft. (6 m) long.

• Inspect lift eyes prior to each lift. Repair any damage prior to lifting.

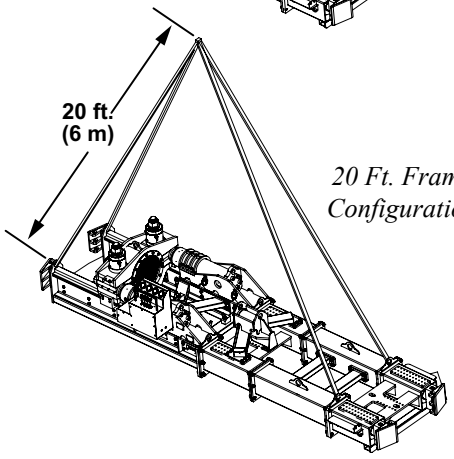
• Frame must lift freely. If it is stuck to ground,break loose prior to lifting.



13 Ft. Frame Configuration



16 Ft. Frame Configuration



20 Ft. Frame Configuration

LIFTING INSTRUCTIONS - PIPE THRUSTER CONTAINER

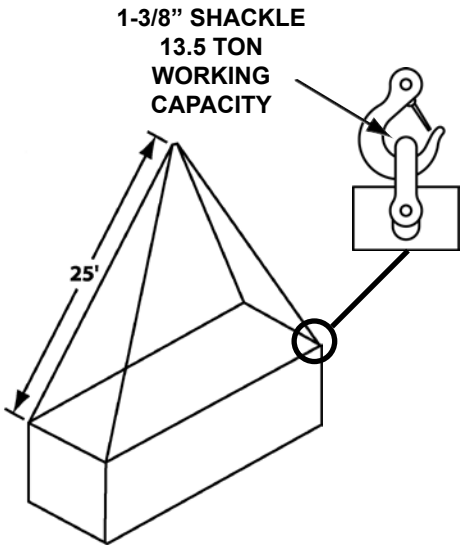
- Container maximum gross weight lift capacity is 67,200 lbs. (30,480 kg)

- Lifting with a crane requires a four part sling with legs a minimum of 25 ft. (7.62 m) long.

- Container must lift freely. If it is stuck to the ground, it must be broken loose prior to lifting.

- Container lifting eyes and sling must be inspected prior to each lift. Any damage must be repaired prior to lifting.

- All container doors must be closed before lifting.



Lubricants

NOTICE Use of inferior lubricants can affect the efficient performance of your Akkerman Power Pack and equipment. Always use high quality lubricants as specified in this section.
Refer to the Periodic Maintenance section for proper lubrication quantity, maintenance intervals, and procedures.

POWER PACK HYDRAULIC OIL RESERVOIR LUBRICANT

The power pack oil reservoir is typically filled with ISO-VG-68 Premium Hydraulic/Turbine Oil.

Use an API GL-1/GL-2 or equivalent when adding or changing lubricant.

NOTICE If using a too heavy of viscosity oil in cold temperatures, hydraulic oil pump damage could result due to pump cavitation. On the contrary, using ISO 32 or 46 oils above 150°F operating temperatures (oil temp. in reservoir) will result in reduced hydraulic power to functions.

Recommended hydraulic oil:

Ambient Temp.	**Hydraulic Oil**
-25°F to 60°F (-32°C to 16°C)	ISO 32
0°F to 95°F (-18°C to 35°C)	ISO 46
32°F to 105°F (-0°C to 41°C)	ISO 68

NOTICE If you change to a different oil, use a reputable oil supplier to meet or exceed the ISO-VG-68 or API GL-1/GL-2 oil specification.
Do not mix oil manufacturers or grades.

Oil capacity is approximately 40 US gal. (151 L).

ELECTRIC MOTOR GREASE

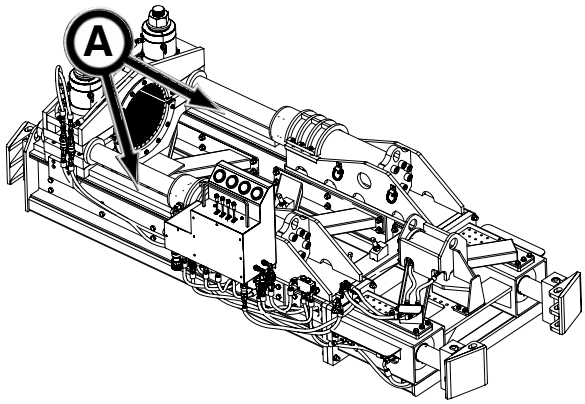
The electric motor bearings with are lubricated with Mobil Polyrex® EM grease or equivalent (refer to Grease Type below).

GREASE TYPE (unless nameplate states otherwise:
Nameplate Ambient Temperature between -22°F (-30°C) to 150°F (65°C) inclusive:
Recommended grease for standard service conditions is Mobil Polyrex® EM. Equivalent and compatible greases include: Texaco Polystar RB, Rykon Premium #2, Pennzoil Pen 2 Lube, Chevron SRI & Mobil SHC 100.

Nameplate Ambient Temperature below -22°F (-30°C):
Special low temperature grease is recommended such as Aeroshell 7 or Beacon 325 for ball bearings and Mobil SHC 100 for roller bearings.

50 HP Electric Motor

FRAME RAIL LUBRICANT



Lubricate the pipe thruster frame rails (A) as needed with CRC® Dry Moly Lube or equivalent.

The CRC® Dry Moly Lube contains high anti-friction and anti-seize properties. It is a fast drying film that resists dirt and dust build-up.

STORING LUBRICANTS

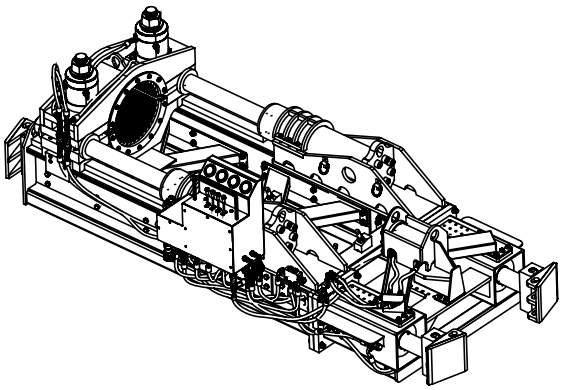
Your equipment can operate at maximum performance only if clean lubricants are used. Use clean containers to handle all lubricants.

Lubricants should be stored in an area protected from dust, moisture, and other contaminates.

Periodic Maintenance

⚠WARNING Review the Safety section in this manual before performing maintenance. Failure to do so, could cause severe injury or death.

LUBRICATION & MAINTENANCE INTERVALS



The requirements for lubrication and maintenance are shown on the maintenance charts in this section. Intervals of maintenance are based on normal operating conditions. If operating under more difficult conditions, use a shorter time interval between maintenance.

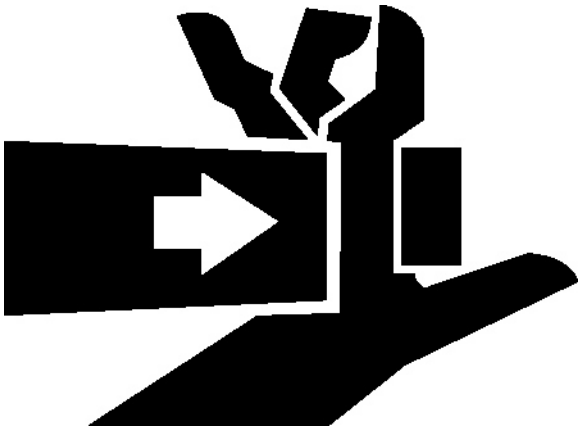
LOCKOUT TAGOUT POWER BEFORE SERVICING

⚠WARNING Severe personal injury or death can result from unexpected power pack start-up or machine movement.

It is the responsibility of the contractor to determine the best method of lockout tagout on the job site.

LOCKOUT TAGOUT power before attempting to make repairs or adjustments to this equipment (refer to Lockout Tagout Procedure Guideline in section 1, Safety). Proper lockout tagout will prevent accidents and save lives. Performing the lockout tagout will also prevent the equipment from moving or operating unexpectedly.

AVOID PINCH POINTS



⚠WARNING Moving parts or the mishandling of parts can cause severe personal injury.

Keep hands away from moving parts.

Watch your fingers, hands, and legs while equipment is in operation.

Handle parts carefully to avoid crushing and pinch point hazards.

USING EMERGENCY STOP

IMPORTANT: Emergency Stop buttons are used for emergency situations only. Emergency Stop buttons alone are ***NOT*** intended for lockout tagout purposes. Refer to Lockout Tagout Procedure Guideline in Section 1, Safety.

NOTICE The remote pendant cord MUST be plugged into the remote pendant connection receptacle on the electrical panel to energize the start and stop circuit on both the electrical panel and the remote pendant. Otherwise the Emergency Stop, Start and Stop buttons will not function.

REMOTE PENDANT - HYDRAULIC POWER PACK

The Emergency Stop button (A) is located on the remote pendant.

Push Emergency Stop button IN to stop all electrical and hydraulic functions.

The button will illuminate when it is pulled OUT.

NOTICE The emergency stop button must be pulled out for motor to start.

Remote Pendant for Hydraulic Power Pack

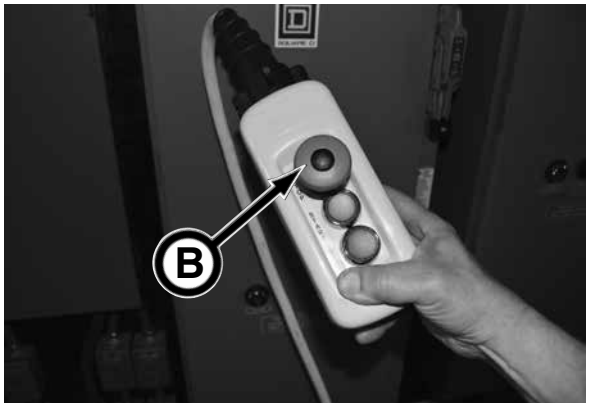
REMOTE PENDANT - SHAFT PUMP

The Emergency Stop button (B) is located on the remote pendant.

Push Emergency Stop button IN to stop all electrical and hydraulic functions.

The button will illuminate when it is pulled OUT.

NOTICE The emergency stop button must be pulled out for motor to start.



Remote Pendant for Shaft Pump

HYDRAULIC OIL/FLUIDS UNDER PRESSURE

⚠WARNING Escaping oil or other fluids under pressure can penetrate your skin causing serious injury.

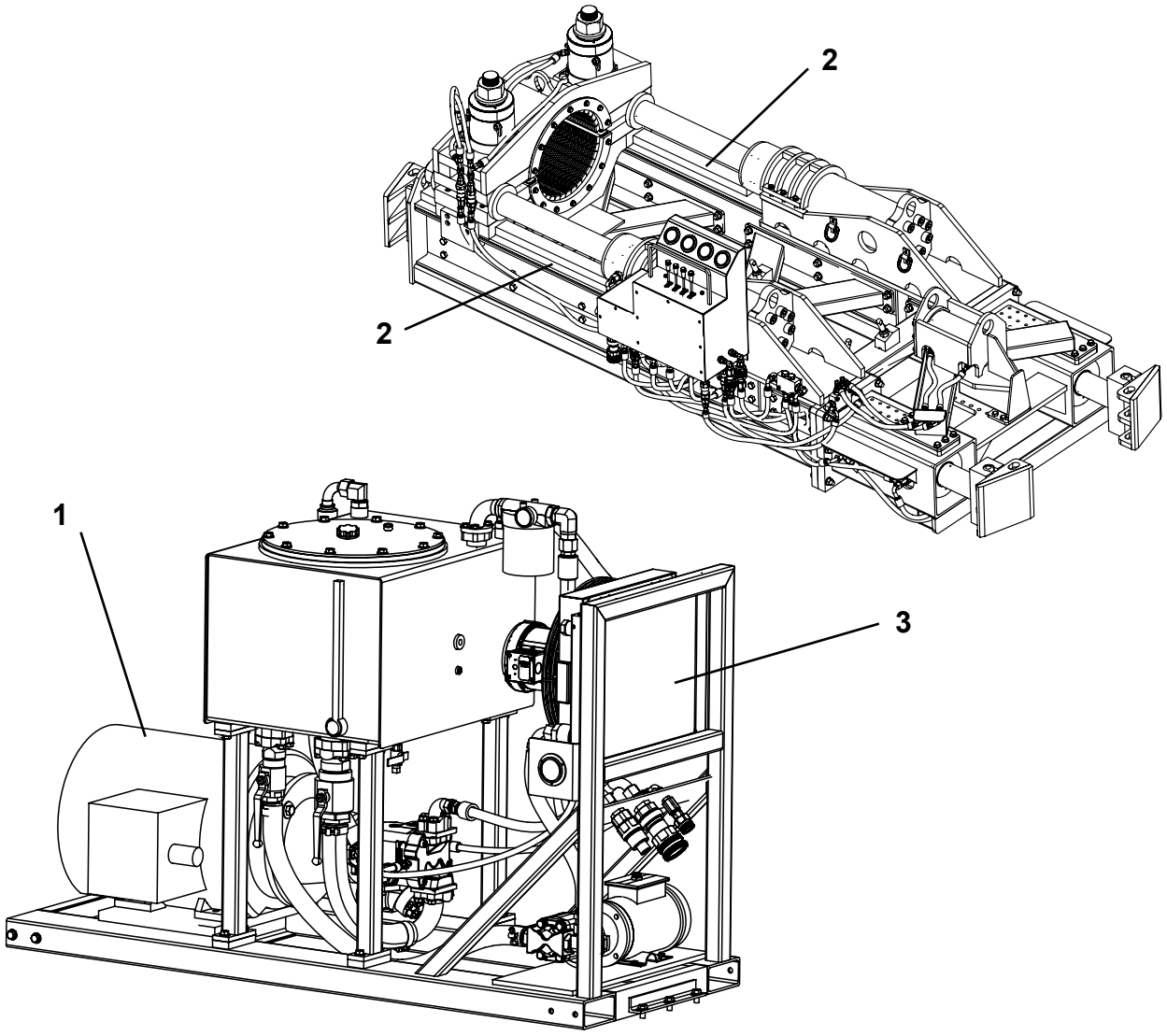
Release all pressure before performing maintenance or repairs. Never weld near pressurized fluid lines.

DO NOT use your hands to check for leaks. When searching for leaks, use a piece of wood or cardboard.

Contact medical help immediately if any oil or fluid is injected into your skin. A serious infection or reaction can emerge without proper medical treatment.

MAINTENANCE CHARTS - PIPE THRUSTER SYSTEM

Use the item number in the chart to refer to the detailed maintenance procedures later in this section.



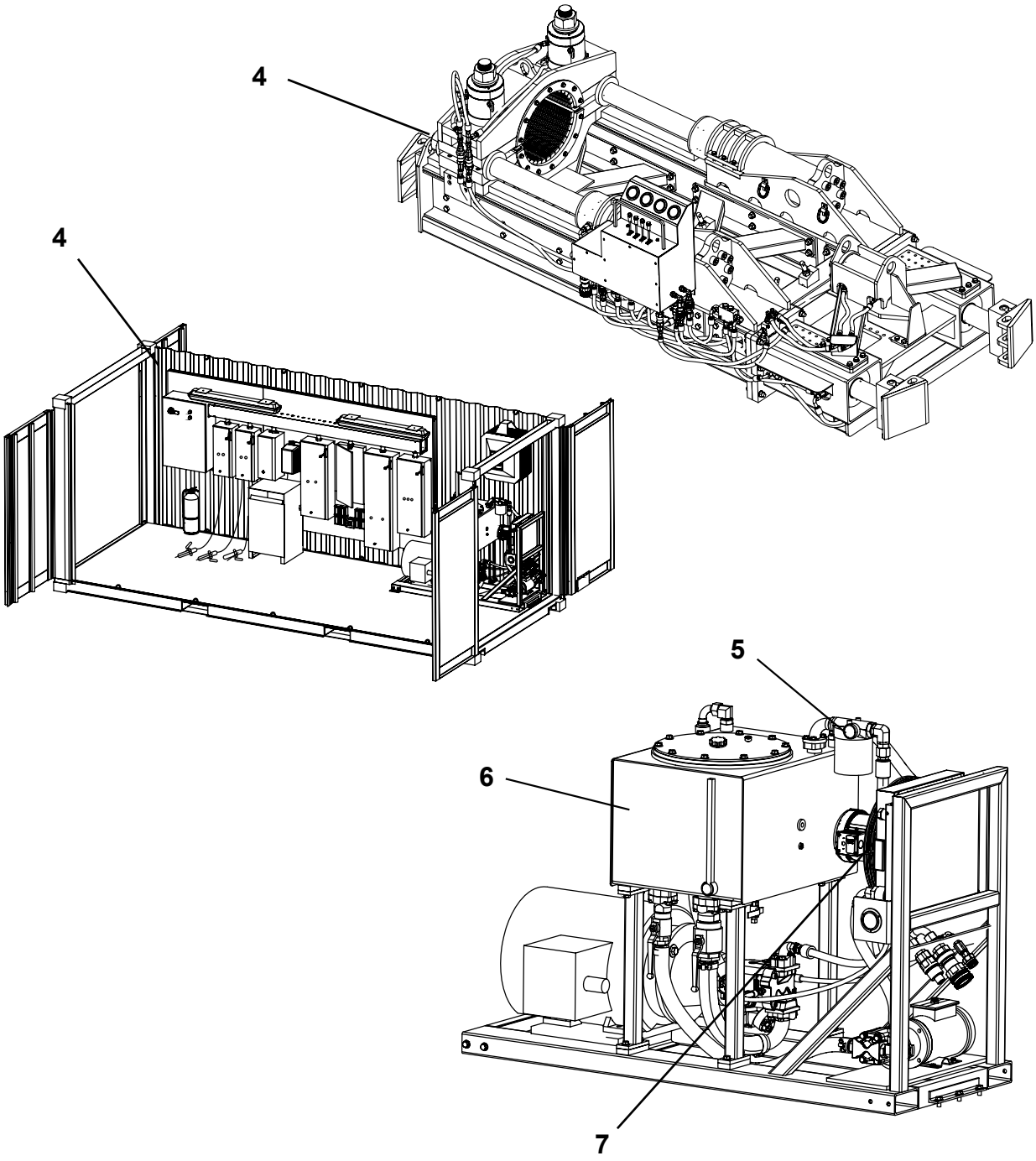
ELECTRIC MOTOR MAINTENANCE

ITEM	COMPONENT	SERVICE	REQUIREMENT	MATERIAL
1.	Electric Motor	Maintenance	Per maintenance instructions	See pg 11-6

PRIOR TO EACH JOB LAUNCH

ITEM	COMPONENT	SERVICE	REQUIREMENT	MATERIAL
2. 3.	Frame Rail Oil Cooler	Lubricate Clean	As needed. As needed.	Dry Moly Lube

Use the item number in the chart to refer to the detailed maintenance procedures later in this section.

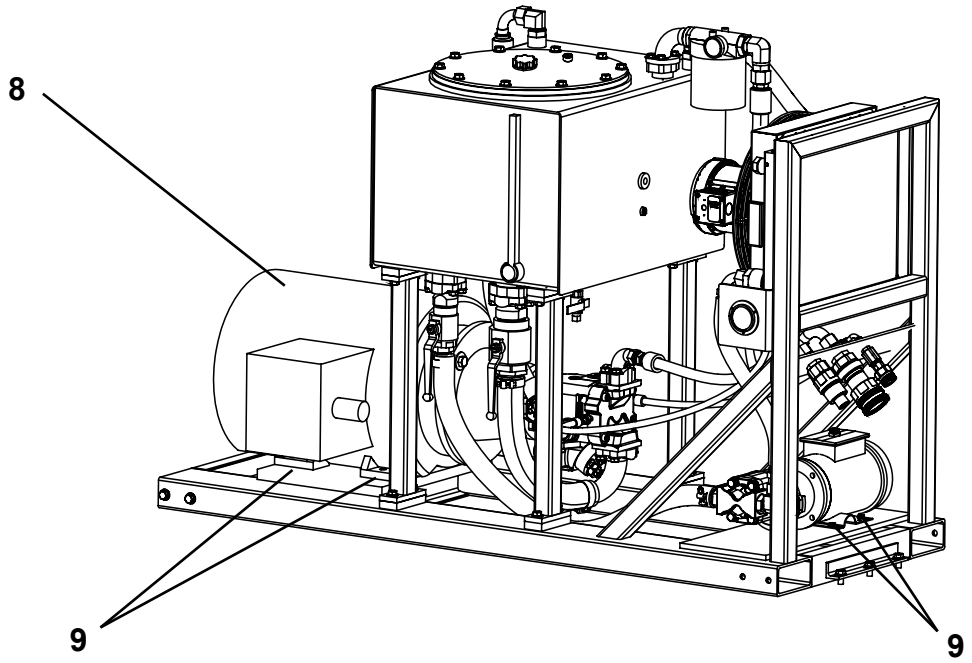


DAILY OR EVERY 10 HOURS OF OPERATION

ITEM	COMPONENT	SERVICE	REQUIREMENT	MATERIAL
4.	Frame & Container	Visual Inspection	If parts are damaged or missing, replace.	
5.	Hydraulic Return Filter	Check Indicator	Replace filter as needed per indicator.	Return Filter
6.	Hydraulic Reservoir	Check Fluid Level	Add hydraulic fluid as needed.	See Section 8*
7.	Fan	Inspect Fan & Guard	If damaged, replace with new.	

* Refer to section 8, Lubricants for recommended hydraulic oil.

Use the item number in the chart to refer to the detailed maintenance procedures later in this section.



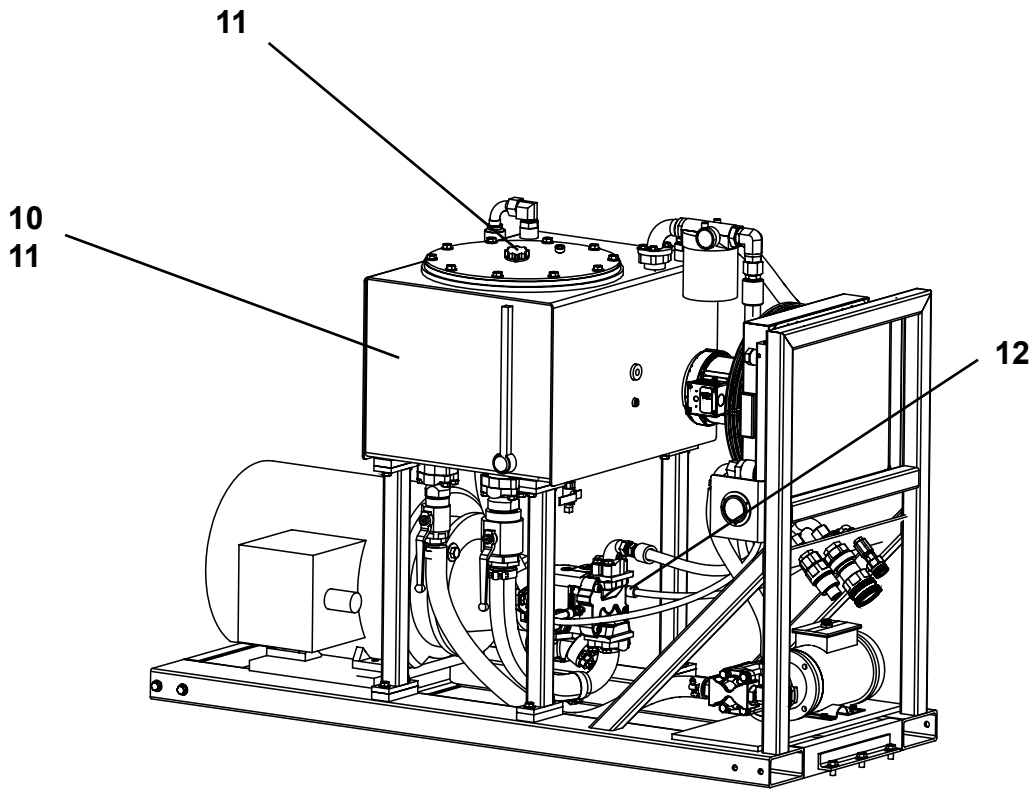
WEEKLY OR EVERY 50 HOURS OF OPERATION

ITEM	COMPONENT	SERVICE	REQUIREMENT	MATERIAL
8.	Motor	Check	Ventilation openings clean and drain holes open.	

MONTHLY OR EVERY 250 HOURS OF OPERATION

ITEM	COMPONENT	SERVICE	REQUIREMENT	MATERIAL
9.	Motor Mounts	Inspect	Replace as needed.	

Use the item number in the chart to refer to the detailed maintenance procedures later in this section.



COMPLETION OF EACH DRIVE

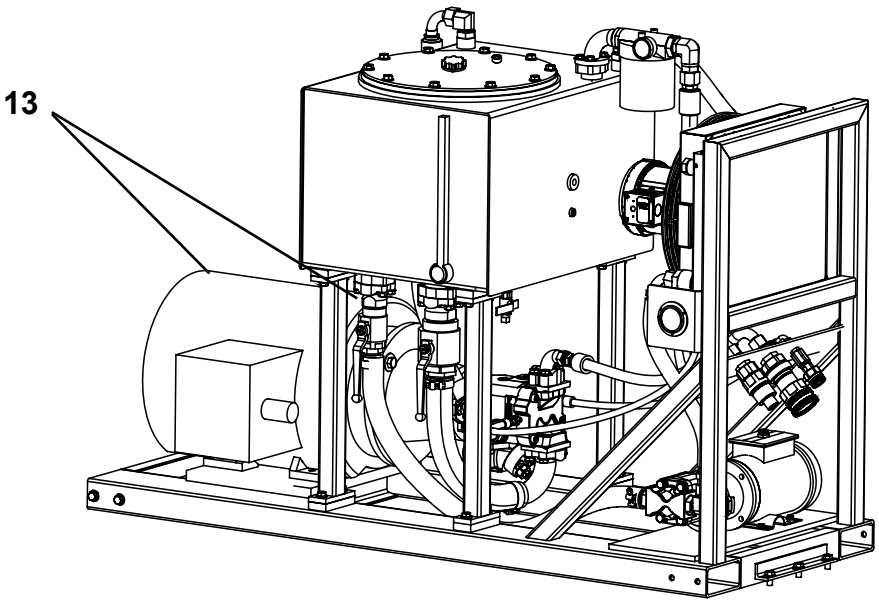
ITEM	COMPONENT	SERVICE	REQUIREMENT	MATERIAL
10.	Hydraulic Reservoir	Drain Water	Drain until water is removed.	

EVERY 500 HOURS OF OPERATION

ITEM	COMPONENT	SERVICE	REQUIREMENT	MATERIAL
11.	Hydraulic Reservoir	Drain & Fill	Drain and fill with new oil.	See Section 8*
12.	Load Sense Filter	Replace	Replace with new.	LS Filter

* Refer to section 8, Lubricants for recommended hydraulic oil.

Use the item number in the chart to refer to the detailed maintenance procedures later in this section.



ANNUALLY

ITEM	COMPONENT	SERVICE	REQUIREMENT	MATERIAL
13.	Electric Motor Brgs.	Lubricate (2 places)	2 Shots	Mobil Polyrex EM

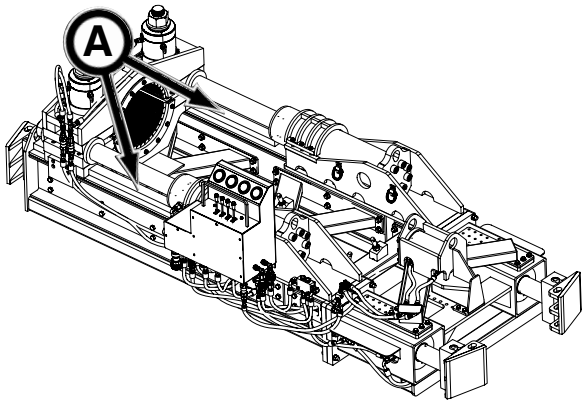
ELECTRIC MOTOR MAINTENANCE

1. ELECTRIC MOTOR MAINTENANCE

Perform maintenance on each motor as defined in the Installation, Operation and Maintenance Instructions section, starting on page 11-6.

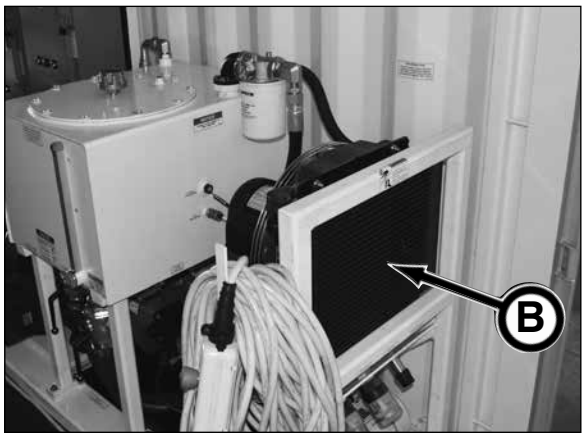
The motors require inspection of the ventilation openings and lubrication of the motor bearings per the manufacturer’s instructions.

PRIOR TO EACH JOB LAUNCH



2. LUBRICATE FRAME RAIL

Lubricate the pipe thruster frame rails (A) prior to each job launch and then as needed with CRC® Dry Moly Lube or equivalent to reduce the friction between the frame rail and the gripper assembly.



3. CLEAN OIL COOLER

Clean oil cooler (B) fins and tubes with compressed air (50 psi maximum). Check for oil leaks. Repair as needed.

DAILY OR EVERY 10 HOURS OF OPERATION

4. VISUALLY INSPECT EQUIPMENT

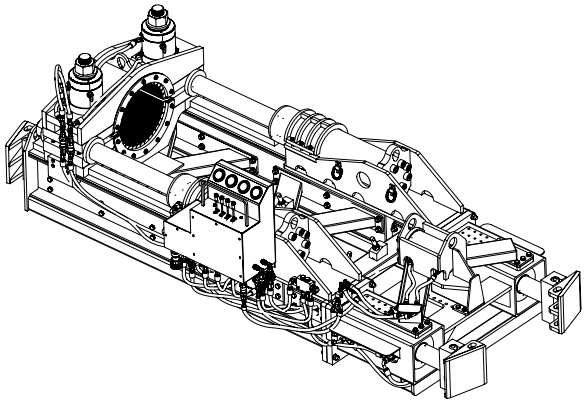
Perform a visual inspection of the pipe thruster frame, container and supporting equipment. Inspect structures, cylinders, mountings and lubricant levels.

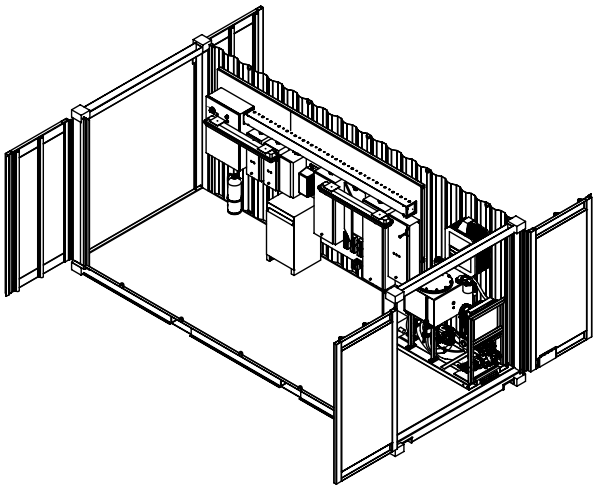
Immediately report any structural problems to your Akkerman Aftermarket Support representative.

Check for oil or leaks, and debris buildup. Make repairs as needed and remove debris.

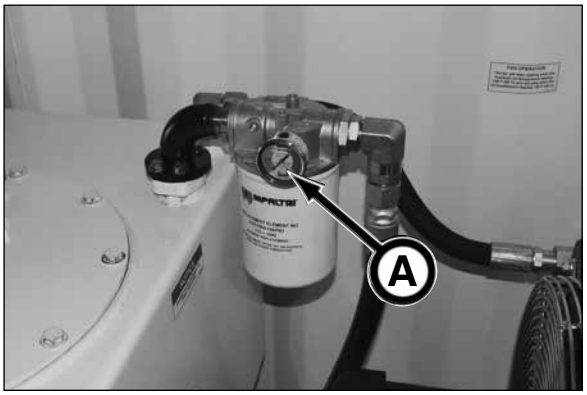
Check for loose, damaged, or missing parts. Repair or replace as necessary. Replace any defective parts.

Tighten hardware as needed. Replace any damaged hardware with new.





5. CHECK HYDRAULIC RETURN FILTER INDICATOR



To prevent over or under servicing of the hydraulic return filter, a filter indicator (A) has been installed on hydraulic return filter housing.

Always check gauge when the oil is at normal operating temperature and the system is at normal operating flow. Otherwise, the gauge may indicate a false reading.

The filter and oil require replacement if any of the following situations occur:
- A major component fails.
- Any sign of water contamination from an oil analysis or if oil is milky or foaming.
- A hydraulic oil sample indicates large particle contamination.

The green OK zone indicates that the filter is functioning properly.

The yellow zone indicates that the filter will soon require replacement.

When the needle on the gauge is in the red CHANGE zone, replace filter as soon as possible to prevent hydraulic component damage.

REPLACING FILTER

1. Clean and dry area around return filter.

2. Remove filter. Dispose of oil and filter properly.

NOTICE Remove filter gasket if stuck in filter housing.

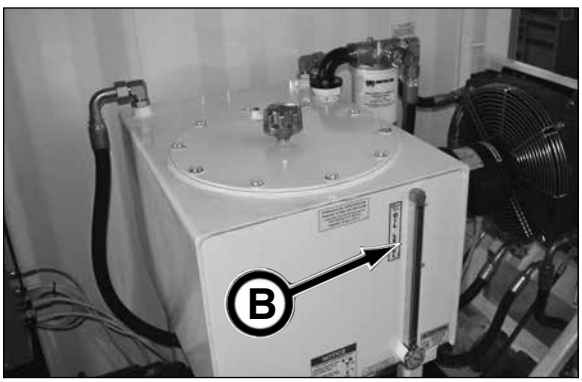
3. Fill new filter with clean hydraulic oil.

4. Lubricate new filter gasket with a light coating of clean hydraulic oil.

5. Install new filter. Hand tighten only.

6. With the hydraulic hoses disconnected from the pipe thruster frame, start motor and run until the hydraulic system is warm. Then check for leaks.

7. Stop motor.



8. Check hydraulic reservoir oil level on gauge (B). Add hydraulic oil, if necessary.

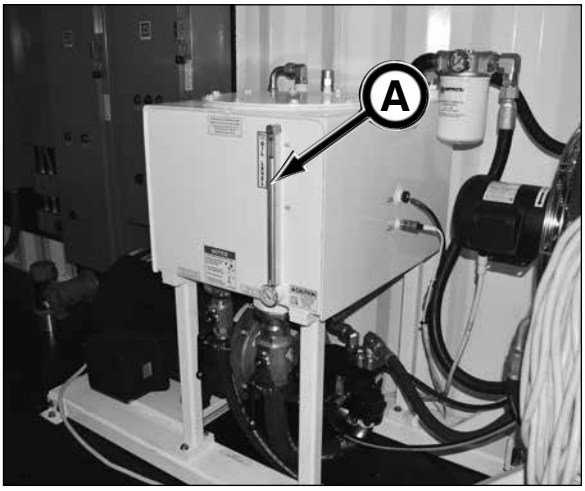
6. CHECK HYDRAULIC RESERVOIR OIL LEVEL & CONDITION OF OIL

1. Check hydraulic reservoir oil for the following:

   a. Check for oil bubbles or foaming oil. This may indicate an air leak in the system.
   b. Check for milky oil. This indicates that there is water in the system. Be sure your oil is being properly stored.
   c. Large particle contamination from oil sample.

If any of these conditions are found, the reservoir must be drained, cleaned, and refilled with new, clean hydraulic oil and all hydraulic filters must be replaced. Refer to Every 500 Hours of Operation, “11. Drain & Fill Hydraulic Reservoir” in this section.

2. Check hydraulic reservoir oil level gauge (A).



FILLING RESERVOIR
If the fluid level in the reservoir is less than 3/4 full, fill the reservoir as follows:

1. Flip hydraulic power pack disconnect (B) to the OFF position.

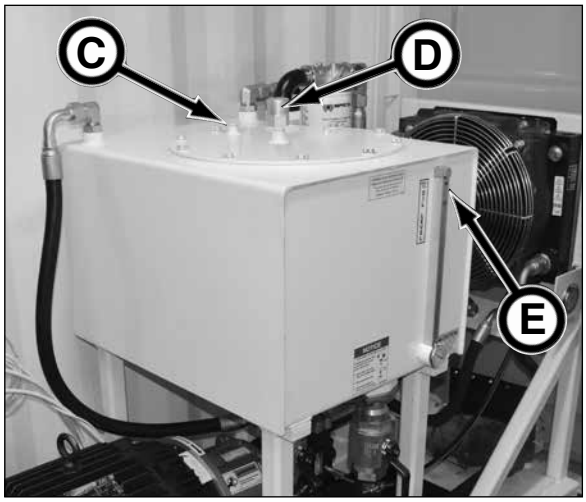
2. Clean area around the fill plug (C) and breather (D).

3. Remove fill plug.

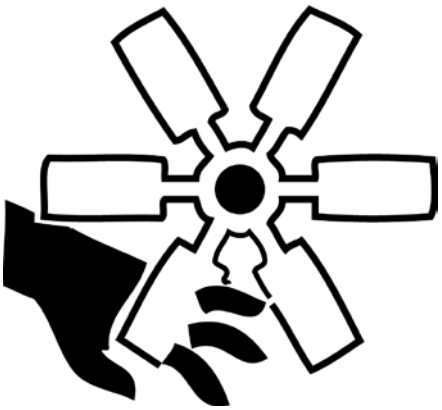
4. Fill hydraulic oil until it reaches the full mark (E) on gauge.

   NOTICE Refer to section 8, Lubricants for recommended hydraulic oil.

5. Replace fill plug.



7. INSPECT FAN



⚠WARNING Serious personal injury could result if contact is made with rotating fan blade. Fan blades can rotate at any time power is connected and the main disconnect is in the ON position. NEVER operate without fan guard in place.

If the power is connected to the pipe thruster container and the main disconnect is in the ON position, the fan can rotate anytime the hydraulic oil is at 120°F (49°C) (factory default setting).

With the main disconnect in the OFF position and the hydraulic power pack remote pendant Emergency Stop pushed IN to prevent accidental starting, check fan (A) for cracks, and bent or loose blades. Replace damaged fan.

WEEKLY OR EVERY 50 HOURS OF OPERATION

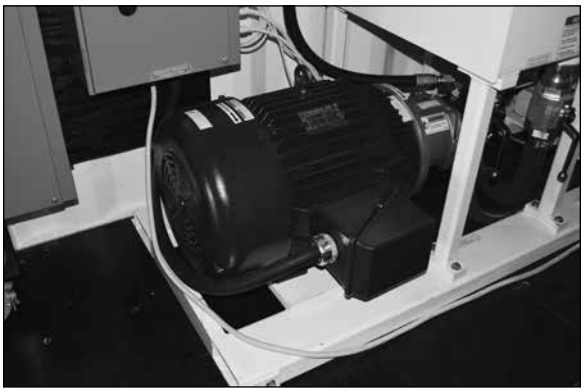
8. CHECK MOTORS

NOTICE Refer to the electric motor operation and maintenance instruction manual on page 11-6 for more information.

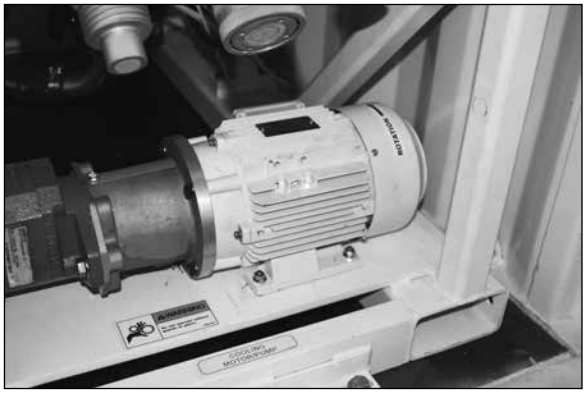
Inspect the ventilation openings of the 50 HP and 2 HP motors so they are clear to allow the free passage of air. Also, be sure the drain holes are open.

Use compressed air (maximum 50 psi) to clear openings.

Grease and oil can be removed from the motors with a petroleum solvent.



50 HP Electric Motor



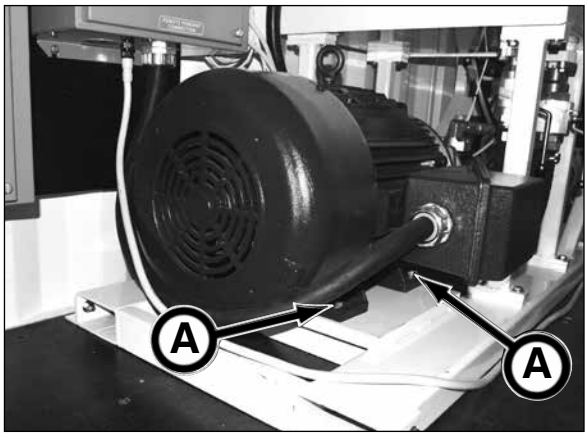
2 HP Electric Motor

MONTHLY OR EVERY 250 HOURS OF OPERATION

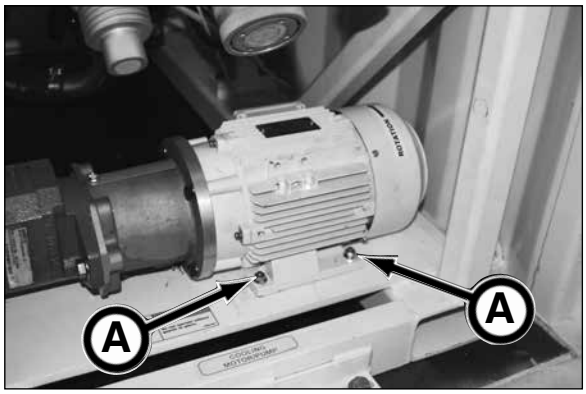
9. INSPECT MOTOR MOUNTS

Visually inspect motor mounts (A) for loose hardware or damaged parts.

Tighten all loose hardware and replace defective parts.



50 HP Electric Motor

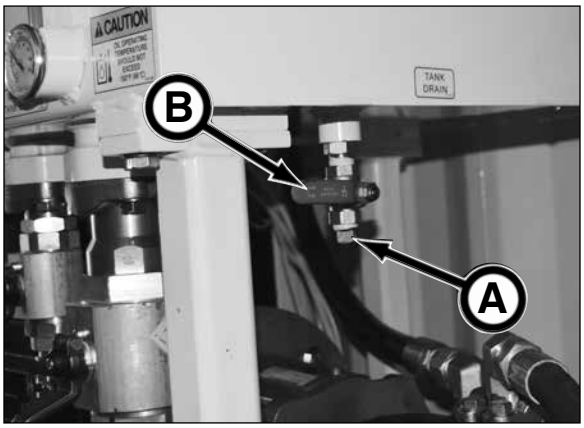


2 HP Electric Motor

COMPLETION OF EACH DRIVE

10. DRAIN WATER FROM HYDRAULIC RESERVOIR

Remove water contamination from the hydraulic reservoir by draining water from the reservoir at the completion of each drive.



1. With container on level ground, allow oil in hydraulic reservoir to settle overnight.

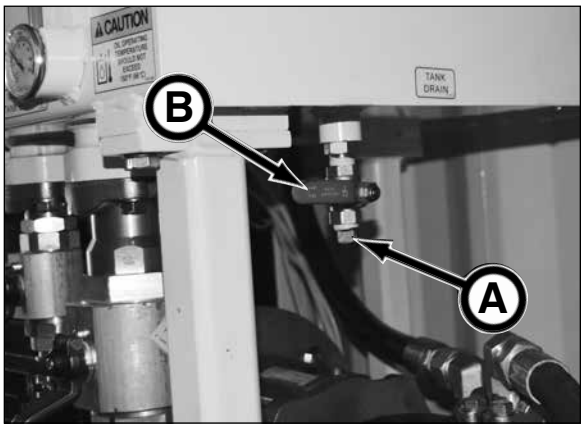
2. Remove plug (A) and install a 1/2” NPT hose to tank valve fitting.

3. Route hose into a catch pan.

4. Slightly open tank drain ball valve (B) and drain until there is no water in oil.

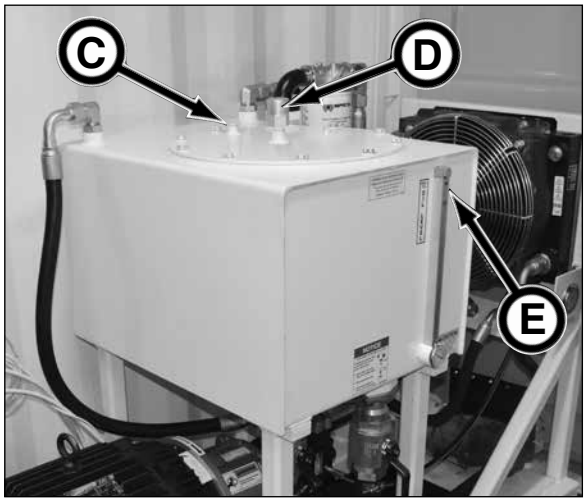
5. Once water is removed from tank, close tank drain ball valve, remove hose (if used) and reinstall plug.

EVERY 500 HOURS OF OPERATION



11. DRAIN & FILL HYDRAULIC RESERVOIR

1. Drain oil into an appropriate sized catch pan as follows:
   Remove plug (A) from ball valve (B) and install a 1/2 NPT hose to fitting. Open ball valve and drain oil. Close ball valve, remove hose and reinstall plug.

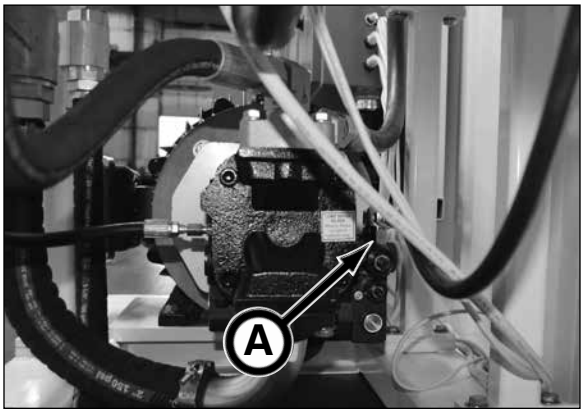


2. Clean area around the fill plug (C) and breather (D).
3. Remove breather and replace with new.
4. Remove fill plug.
5. Fill hydraulic oil until it reaches the full mark (E) on gauge.

   NOTICE Refer to section 8, Lubricants section for recommended hydraulic oil.

6. Replace fill plug.

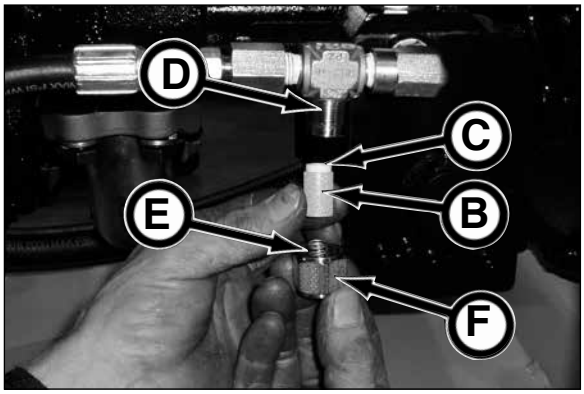
12. REPLACE LOAD SENSE FILTER



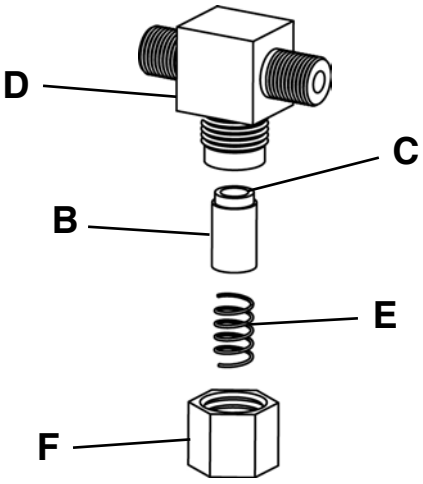
The load sense filter must be replaced at:

- 500 hours or yearly, which ever occurs first
- a major component fails
- any signs of water contamination
- hydraulic fluid sample indicates large particle contamination
- controls are sluggish

NOTICE Installing the load sense filter incorrectly, WILL cause pump malfunction.



1. Remove cap, spring, and filter from filter head.
2. Insert new filter (B) with nylon ring end (C) into filter head (D).
3. Place spring (E) into cap (F).
4. Install cap onto filter head. Tighten to 10 ft-lb (13.6 N·m) torque.



Load Sense Filter Installation

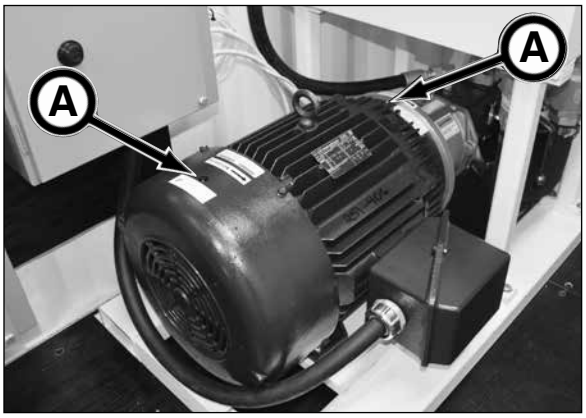
ANNUALLY

13. LUBRICATE MOTOR BEARINGS

NOTICE For additional electric motor maintenance information, refer to the electric motor operation and maintenance instruction manual on page 11-6 for more information.

Lubricate the electric motor bearings (A) with two shots of Mobil Polyrex® EM grease or equivalent (refer to Grease Type below). There are two lubrication fittings on the electric motor.

When adding lubricant, keep dirt out of the lubrication area. Wipe the fitting completely clean and use clean greasing equipment.



50 HP Electric Motor

GREASE TYPE (unless nameplate states otherwise):
Nameplate Ambient Temperature between -22°F (-30°C) to 150°F (65°C) inclusive: Recommended grease for standard service conditions is Mobil Polyrex® EM. Equivalent and compatible greases include: Texaco Polystar RB, Rykon Premium #2, Pennzoil Pen 2 Lube, Chevron SRI & Mobil SHC 100.

Nameplate Ambient Temperature below -22°F (-30°C): Special low temperature grease is recommended such as Aeroshell 7 or Beacon 325 for ball bearings and Mobil SHC 100 for roller bearings.

NOTES

Storage

PREPARING FOR STORAGE

1. Repair worn or damaged parts.
2. Check for leaks. Repair or replace as necessary.
3. Wash all equipment thoroughly.
4. Grease threads on bolts used for adjustments.
5. Retract all hydraulic cylinders if possible. If not, coat exposed cylinder rods with a corrosion preventive.
6. Electric motors must be stored indoors in a clean, dry, climate controlled location. Avoid locations with large temperature swings that will result in condensation. Motors must be covered to eliminate airborne dust and dirt. If the storage location exhibits high vibration, place isolation pads under motor to minimize damage to motor bearings.
7. Contact the electric motor manufacturer for long term storage requirements.
8. Check condition of wires and cables. Repair or replace as necessary.
9. Repaint equipment where necessary.
10. Drain hydraulic oil, flush oil reservoir, change hydraulic filter, and refill hydraulic reservoir. Check for leaks.
11. Wipe up lube spills. Dispose of rags and trash properly.
12. If possible, store equipment under cover and out of the weather in a ventilated area.

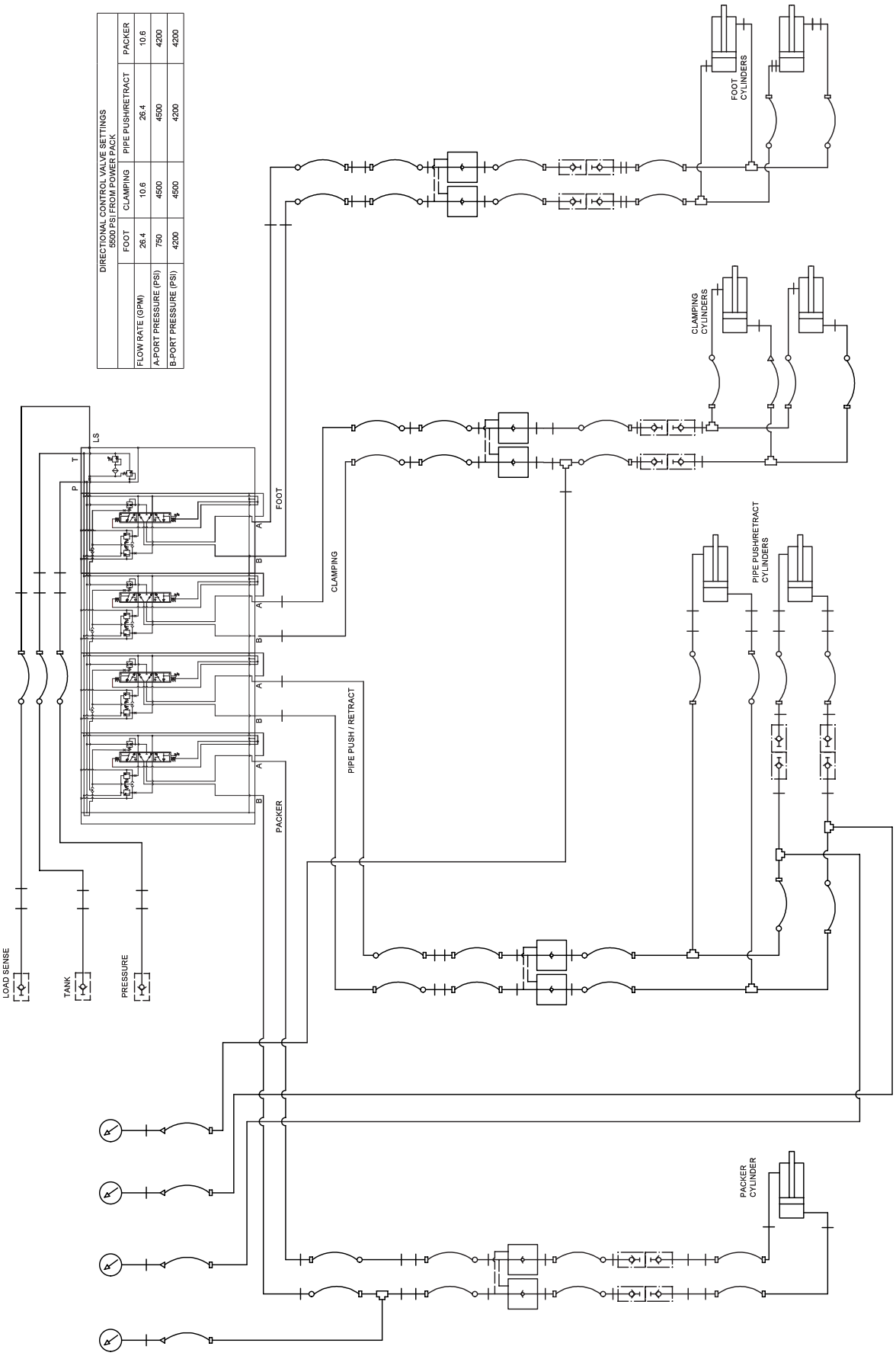
REMOVING FROM STORAGE

1. Clean equipment thoroughly.
2. Check to make sure all decals including safety decals are clean and readable.
3. Check condition of wires and cables. Repair or replace as necessary.
4. Remove the cylinder corrosion preventive from the cylinder rods if it is not compatible with hydraulic oil or seal materials.
5. Contact the electric motor manufacturer on how to restore the electric motor to service.
6. Check for leaks. Repair or replace as necessary.
7. Check hydraulic oil level. If fluid is low, check for leaks and add oil as required. See Power Pack Oil Reservoir Lubricant in section 8, Lubricants section.
8. Check condition of all hoses and connections. Tighten, repair or replace with new as needed.
9. Before operating, cycle hydraulic functions several times to purge air from the hydraulic system.
10. Review this Operator's Manual and your supporting equipment manuals before operation.

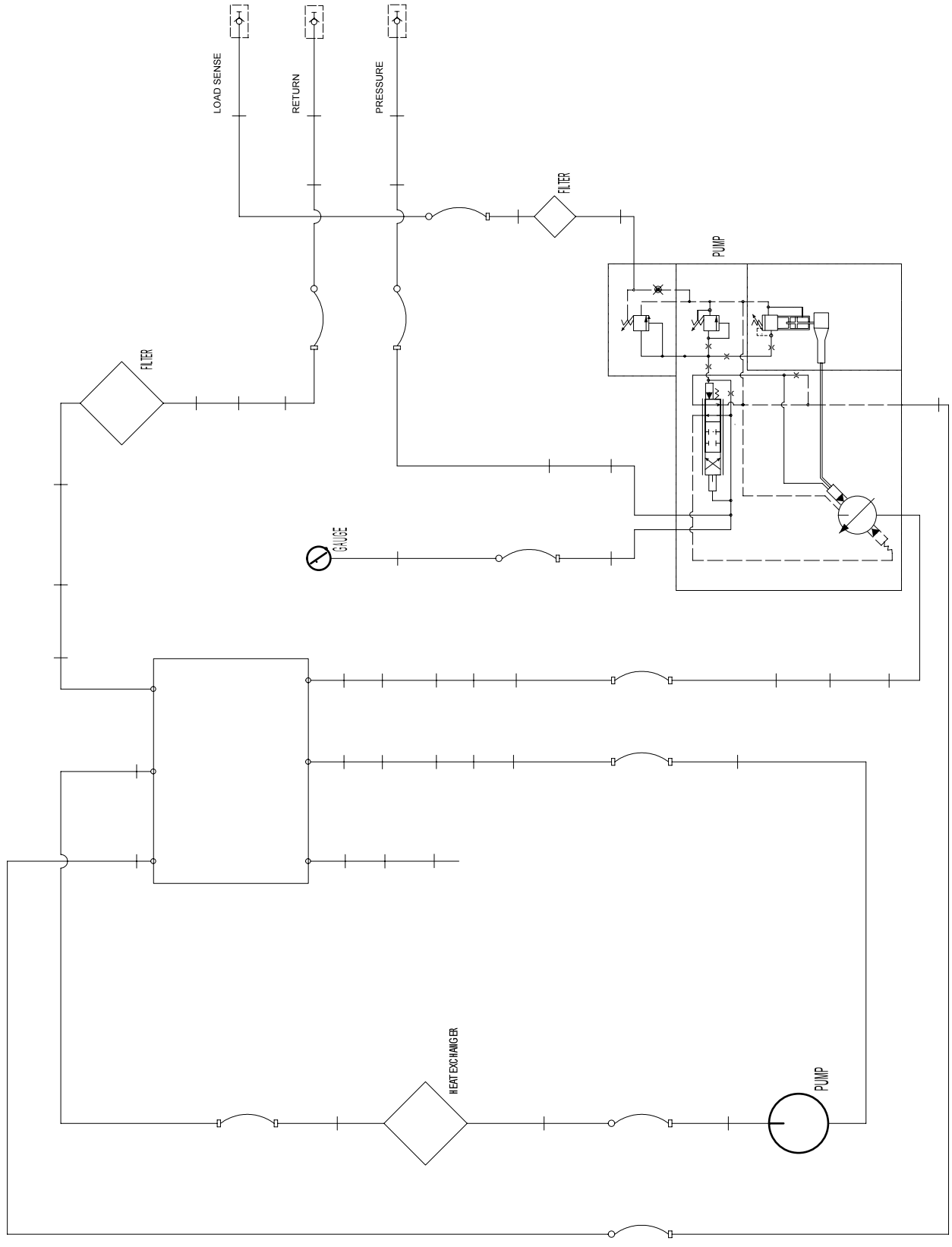
Troubleshooting

Problem	Cause	Solution
Valve functions (thrust, gripper, packer) do not operate.	Power pack motor is not running.	Start up motor.
	Remote pendant cord not connected.	Connect remote pendant cord into receptacle.
	Main disconnect is OFF	Flip main disconnect to ON position.
	Hydraulic power pack power disconnect is OFF.	Flip hydraulic power pack disconnect to ON.
	Insufficient oil in hydraulic reservoir.	Check oil level and fill as needed.
	Quick couplers are not properly connected.	Connect quick couplers on gear box properly.
	Main pump shutoff valve is closed.	Open main pump shutoff valve.
	Load sense hose not connected.	Properly connect load sense hose to pipe thruster frame.
	Load sense filter clogged.	Replace load sense filter.
	Load sense filter installed incorrectly.	Install load sense filter properly.
Valve bank leaking.	Return hose not connected.	Properly connect return hose from power pack to frame.
Lack of hydraulic power.	High oil temperature (above 150°F (66°C)	Cool oil to operating temperature.
		Change hydraulic oil to higher viscosity.
	Cooling pump not operating.	Repair pump.
Heater unit does not operate.	The 30 amp breaker in the main power disconnect panel is OFF.	Flip 30 amp breaker in main disconnect panel to the ON position.

HYDRAULIC SCHEMATIC - PIPE THRUSTER FRAME



HYDRAULIC SCHEMATIC - PIPE THRUSTER HYDRAULIC POWER PACK



ELECTRICAL SCHEMATIC - PIPE THRUSTER

Refer to Parts Manual section 16

ELECTRICAL MOTORS

Refer to troubleshooting for the electrical motors in the Installation, Operation and Maintenance Instructions booklet starting on page 11-6.

4.3.2 Motor Trouble-shooting Cause / Corrective Action - Table 4-5

Issue:	Likely Cause:	Corrective Action:
Motor fails to start upon initial installation:		
A.)	Supply voltage is too low or is severely unbalanced (one phase is low or missing).	(1) Check power supply fuses (2) Match motor lead wiring to nameplate connection diagram and supply voltage (3) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (4) Obtain correct motor to match actual supply voltage.
B.)	Motor leads are miswired at conduit box.	
C.)	Driven load exceeds motor capacity	(1) Verify that motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely. Note: Roller bearings make noise when motor is uncoupled and shaft is rotated (3) Verify that motor starts when disconnected from load (4) Remove excessive / binding load if present
D.)	Load is jammed.	
E.)	Fan guard is bent and making contact with fan	Replace fan guard & fan (if blades are damaged)
F.)	VFD with power factor capacitors installed	Remove power factor correction capacitors if equipped
G.)	VFD with motor neutral lead grounded	Ensure that motor neutral lead is ungrounded
H.)	VFD programmed incorrectly	(1) Repeat checks listed above (2) Verify that VFD current limit and starting boost are set correctly (5) Double-check motor and feedback parameter settings and VFD permissives (6) Repeat autotune (for vector drives) procedure (7) Consult VFD supplier
Motor has been running, then slow down, stalls, or fails to restart:		
A.)	Supply voltage has drooped or has become severely unbalanced	(1) Replace fuse or reset circuit breaker. Allow motor to cool down before resetting manual protector on motor. **Warnings** - See section 1.1 for automatic and manual reset protector warnings (2) Verify that rated and balanced supply voltage has been restored before restarting motor. Measure voltage during restart. Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3).
B.)	Motor is overloaded	(1) Verify that motor & load turn freely. Repair binding components as needed (2) Reduce driven load to match motor capacity or increase motor size to match load requirements.
C.)	Motor bearings are seized	
D.)	Load is jammed.	
E.)	VFD will not restart motor after tripping	(1) Check fault codes on VFD and follow VFD troubleshooting procedures (2) Verify that VFD input voltage is balanced and within limits (3) Remove excessive mechanical load if present.
F.)	Capacitor failure on single phase motor (if equipped)	**Warning: Potential Shock Hazard:** Contact service shop to check capacitor.
Motor takes too long to accelerate:		
A.)	Motor leads are not connected correctly	Match motor lead wiring to nameplate diagram.
B.)	Supply voltage has drooped or become severely unbalanced.	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (2) Obtain correct motor to match actual supply voltage.
C.)	Load exceeds motor capability	Determine correct motor size and co replacement motor
D.)	Faulty start capacitor (Single Phase)	Motor may be too small for load. Record fail if acceleration time exceeds 3 seconds.
E.)	Mechanical Failure	(1) Check to make sure motor & load turn ensure motor turns freely
Motor rotates in the wrong direction:		
A.)	Incorrect wiring connection at motor	[Single Phase] Reconnect motor according Some motors are non-reversible
		[Three Phase] Interchange any two power
Motor overheats or overload protector repeatedly trips		
A.)	Driven Load is excessive	(1) If motor current exceeds nameplate increased. Correct as needed. (2) If new rating is the same as the old motor. If p general purpose motor may not have the c
B.)	Ambient temperature too high	Most motors are designed to operate in an Hot Surface Caution)
C.)	Motor cooling fins and/or vent openings blocked	Remove foreign materials – clear vent o fins (TEFC motors)
D.)	Insufficient Air Flow	TEAO (Totally Enclosed Air Over) motors and obtain minimum requirements from mo
E.)	Motor is started too frequently	See section 3.4.5.3
F.)	Supply voltage too low, too high, or unbalanced	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3) Correct as needed (2) Reconnect motor per input voltage (3) Obtain correct motor to match power supply.
Motor Vibrates		
A.)	Motor misaligned to load.	Realign load
B.)	Load out of balance (Direct drive application)	(1) Ensure that load is dynamically balanced: (2) Remove motor from load and inspect motor by itself. Verify that motor shaft is not bent. Rule of thumb is 0.002" runout for shafts extension lengths up to 3.00". Add 0.0005" per every additional inch of shaft length beyond 3.00".
C.)	Uneven tension on multiple belts	Mixing new with used belts. Replace multiple belt applications with a complete set of matched belts.
D.)	Driven load operating at resonant point / natural frequency.	(1) De-energize motor and record vibration as load coasts from 100% speed to 0 RPM. If vibration drops immediately, vibration source is electrical. If levels do not drop immediately, source is mechanical (2) Redesign system to operate below the resonant point (3) On VFD-driven loads, program skip frequencies to bypass resonant points (4) Increase carrier frequency to obtain <3% THD current (5) On variable torque loads reduce volts/hertz below base speed.
E.)	VFD torque pulsations	(1) Adjust VFD to obtain <3% THD current @ rated motor current (2) Adjust VFD stability for smooth operation. Vector drives may be unstable at light load.
F.)	Motor miswired at terminal box	Match motor lead wiring to nameplate connection diagram.
G.)	Uneven, weak or loose mounting support.	Shim, strengthen or tighten where required.
H.)	Motor bearings defective	Test motor by itself. If bearings are bad, you will hear noise or feel roughness. Roller bearings are normally noisy when operated without load. If sleeve bearing, add oil per nameplate instructions. For motors with regreasing provisions, add grease per relubricating instructions (see section 4.2.3). If noise persists contact warranty service.
I.)	Motor out of balance	Disconnect from load. Set motor on rubber pads on solid floor. Secure a ½ height key in shaft keyway and energize from balanced power supply @ rated voltage. Record vibration levels and compare with appropriate standards. If excessive vibration persists contact motor manufacturer.
Bearings repeatedly fail.		
A.)	Load to motor may be excessive or unbalanced	(1) If belt drive check system per section 3.3.4. (2) Other than belting, check loading on motor shaft. An unbalanced load will also cause the bearings to fail. (3) Check runouts of mating components, such as a C-face and pump flange.
B.)	Bearings contaminated.	Motor enclosure not suitable for environment. Replace with correct enclosure construction.
C.)	Incorrect grease or bearings for ambient extremes.	See section 4.2.1
D.)	VFD bearing damage	Ground brush, common mode filter, or insulated bearings must be added. Contact motor manufacturer.
Motor, at start up, makes a loud rubbing, grinding, or squealing noise.		
A.)	Contact between rotating and stationary components	Belt squeal during across the line starting is normal: (1) Verify that supply voltage is within limits (see section 3.4.1.3). (2) Ensure that motor lead wiring matches nameplate connection diagram: (3) Isolate motor from load. (4) To locate point of contact turn motor shaft by hand. (5) If point of contact is not located contact motor service shop.
Start capacitors repeatedly fail.		
A.)	The motor acceleration time is too long	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
B.)	Motor is being started too frequently	Excessive starting will damage motor capacitors. Contact motor manufacturer if motor is started more than 20 times/hour or if acceleration time exceeds 3 seconds.
C.)	Motor voltage low	Verify that voltage at the motor terminals is within limits (see section 3.4.1.3).
D.)	Defective start switch inside motor	Motor internal switch failure overheats start capacitor. Contact service shop or motor manufacturer.
Run capacitor fails.		
A.)	High ambient temperature	Verify that the ambient does not exceed motor's nameplate value
B.)	Input voltage exceeds limit	Verify that voltage to the motor terminals is within limits (see section 3.4.1.3).
C.)	Power surge to motor (caused by lightning strike or other high transient voltage).	If a common problem, install surge protector.

Installation, Operation and Maintenance Instructions

for AC Induction Motors

INSTALLER: PLEASE LEAVE THIS MANUAL FOR THE OWNER'S USE
OWNER: READ AND SAVE THESE INSTRUCTIONS

SAFETY INSTRUCTIONS

⚠ This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ WARNING
Before installing, using, or servicing this product, carefully read and fully understand the instructions including all warnings, cautions, & safety notice statements. To reduce risk of personal injury, death and/or property damage, follow all instructions for proper motor installation, operation and maintenance.

These instructions are not intended as a complete listing of all details for installation, operation, and maintenance. If you have any questions concerning any of the procedures, STOP, and call the appropriate Regal-Beloit motor company.

Table of Contents

motor is suitable for use on Pulse Width Modulated (PWM) type VFD power. In addition, the nameplate must be marked with the inverter rating; for example, “2:1 CT”, “2 to 1 Constant Torque”, etc.

1.0 INSTALLER/OWNER/OPERATOR RESPONSIBILITY:

1.1 ELECTRICAL SAFETY

WARNING: ELECTRICAL SHOCK HAZARD

Electrical connections shall be made by a qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable National Code (USA = NEC) and local codes should install or repair electrical motors and their accessories.

WARNING: ELECTRICAL LIVE CIRCUIT HAZARD

Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

WARNING: ELECTRICAL GROUNDING HAZARD

Failure to properly ground motors, per the National Electrical Code (NEC) Article 430 and local codes may cause serious injury or death to personnel. For general information on grounding refer to NEC Article 250. (Also see “Ground Connections section 3.4.4“).

WARNING: AUTOMATIC RESET PROTECTOR HAZARD

Do not use automatic reset protectors if automatically restarting the motor will place personnel or equipment at risk. . Failure to follow this instruction could result in serious personal injury, death and/or property damage

WARNING: MANUAL RESET PROTECTOR HAZARD

If a tripped manual reset thermal protector is exposed to a temperature less than –7°C (20°F) it may reset and restart the motor automatically. If an application requires a motor with a manual reset thermal protector that will be operated at temperatures less than –7°C (20°F) contact the manufacturer to review the application / motor requirements. Failure to follow this instruction could result in serious personal injury, death and/or property damage

1.2 MECHANICAL SAFETY

WARNING: LOOSE PARTS HAZARD

Before starting the motor, remove all unused shaft keys and loose rotating parts to prevent them from flying off. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

WARNING: ROTATING PARTS HAZARD

Keep extremities, hair, jewelry and clothing away from moving parts. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

1.3 ENVIRONMENTAL SAFETY

WARNING: HAZARDOUS LOCATIONS

(1) The NEC and the local authority having jurisdiction must be consulted concerning the installation and suitability of motors for use in Hazardous Locations. The local authority having jurisdiction must make the final determination of what type of motor is required. The application and operation is beyond the control of the motor manufacturer.

(2) Division 1 Hazardous Locations motors can only be modified or reworked by the manufacturer or a facility that is Listed under UL’s category “Motors and Generators, Rebuilt for use in Hazardous Locations”. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

(3) Do not use a Hazardous Locations motor with a Variable Frequency Drive (VFD) unless the motor nameplate specifically states that the

2.0 RECEIVING AND INSPECTION

2.1 INITIAL INSPECTIONS

2.1.1 CHECK PACKING LIST AND INSPECT the packaging to make certain no damage has occurred in shipment. If there is visible damage to the packaging, unpack and inspect the motor immediately. Claims for any damage done in shipment must be made by the purchaser against the transportation company.

2.1.2 TURN MOTOR SHAFT by hand to be certain that it rotates freely. Note: Shaft seals and bearing seals may add drag.

2.1.3 CHECK NAMEPLATE for conformance with purchase order requirements and compliance with power supply and control equipment requirements.

2.2 HANDLING:

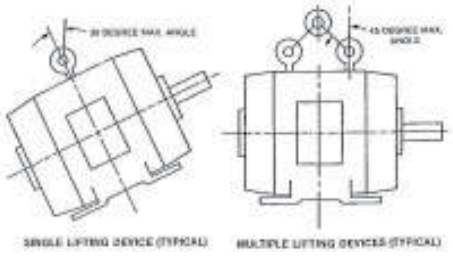
WARNING: FALLING OBJECT HAZARD

Eyebolts or lifting lugs, where provided, are intended for lifting only the motor and accessories mounted by the motor manufacturer (unless specifically stated otherwise on the motor). Utilizing the motor lifting provision to lift other components such as pumps and gear boxes could result in serious personal injury, death and/or property damage.

WARNING: FALLING OBJECT HAZARD

Before using the lifting provision, check the eyebolts and/or other lifting means to assure they are not bent or damaged and are completely threaded, seated & secured to the motor. Equipment to lift motor must have adequate lifting capacity. While lifting the motor DO NOT stand under or in the vicinity of the motor. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

2.2.1 LIFTING ANGLE LIMITATIONS



2.3 STORAGE: Motors, not put into service immediately, must be stored indoors in a clean, dry location. Avoid locations with large temperature swings that will result in condensation. Motors must be covered to eliminate airborne dust and dirt. If the storage location exhibits high vibration, place isolation pads under motor to minimize damage to motor bearings.

2.3.1 BEARING LUBRICATION: Bearings are grease packed at the factory; relubrication upon receipt of motor or while in storage is not necessary. If stored more than one year, add grease per lubrication instructions (Table 4-4) before start-up.

2.3.2 SHAFT ROTATION: It is recommended that the motor shaft be rotated 5 to 10 rotations every three months to distribute the grease in the bearings. This will reduce the chance for corrosion to form on the bearing rolling elements and raceways. Note: Shaft seals and bearing seals may add drag.

2.3.3 DAMP OR HUMID STORAGE LOCATIONS: Treat unpainted flanges, shafts, and fittings with a rust inhibitor. Apply appropriate power to the motor's space heaters (if so equipped)

3.0 INSTALLATION AND OPERATION

WARNING: Only qualified personnel who are familiar with the appropriate national code, local codes and sound practices should install or repair electrical motors and their accessories. Installation should conform to the appropriate national code as well as local codes and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

WARNING: ELECTRICAL LIVE CIRCUIT HAZARD
Do not touch electrically live parts. Disconnect, Lockout and Tag input power supply before installing or servicing motor (includes accessory devices). Use a voltmeter to verify that power is off before contacting conductors.

3.1 LOCATION

3.1.1 SELECTING A LOCATION: Consideration should be given to environment and ventilation. Motors should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and vibration. A motor with the proper enclosure for the expected operating condition should be selected. Provide accessible clearance for cleaning, repair, service, and inspections (See section 3.1.3 for construction clearances). The location should be considered for possible future motor removal / handling. The free flow of air around the motor should not be obstructed.

3.1.2 AMBIENT TEMPERATURE LIMITS: The ambient temperatures of the air inlet to the motor should not exceed 40°C (104°F) or be less than -30°C (-22°F) unless the motor nameplate specifically states an ambient temperature outside of these limits. The ambient inside an enclosure built around the motor shall not exceed the nameplate ambient. For ambient temperatures outside of these limits consult the motor manufacturer.

CAUTION: INSULATION DEGRADATION WARNING
Insulation at high temperatures ages at an accelerated rate. Each 10°C increase in temperature reduces the insulation life by one half.

WARNING: HAZARDOUS LOCATIONS AMBIENT LIMIT: Division 1 Hazardous Locations motors shall **NOT** be operated below –25°C (-13°F) ambient. (Low temperatures reduce the component mechanical properties.)

3.1.3 CONSTRUCTION SELECTION per LOCATION:

3.1.3.1 DRIPPROOF (OPEN) MOTORS are intended for use indoors where the atmosphere is relatively clean, dry, and non-corrosive. Recommended a minimum clearance of ½ the shaft height between vent openings and the nearest obstruction.

3.1.3.2 TOTALLY ENCLOSED MOTORS are suitable for indoor or outdoor standard service applications.

TEAO or AOM (Totally Enclosed Air Over) motors must be mounted in the air stream. When the motor nameplate states a minimum airflow the motor must be mounted in an air stream meeting this minimum value.

TEFC (Totally Enclosed Fan Cooled) motors must meet a minimum distance of ½ the shaft height between the fan guard grill openings and the nearest obstruction.

3.1.3.3 HAZARDOUS LOCATIONS MOTORS: Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the applicable national codes, local codes, and the authority having jurisdiction.

Division 1 Installations – includes Class I & II: Use only motors that are UL Listed and CSA Certified or UL Listed and UL Certified for Canada. These motors bear a separate nameplate that includes the UL Listing Mark and CSA Certification Mark or includes the UL Listing Mark and the UL Mark for Canada. This plate also bears the phrase: " Electric motor for Hazardous Locations" and is marked with the Class, Group and Operating Temperature Code.

Division 2 Installations – Class I only: Use only motors that are CSA Certified and bear the CSA Certification Mark. These motors include a phrase on the main motor nameplate that indicates the motor is CSA Certified for Class I, Division 2 / Zone 2 locations.

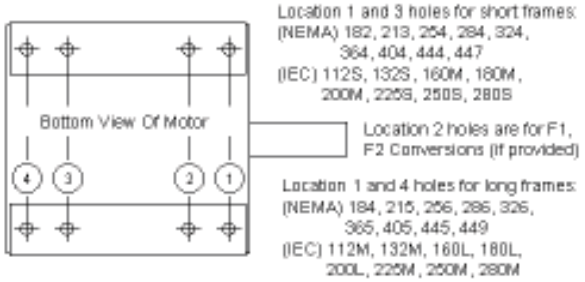
Division 2 Installation – Class II only: Use only Class II motors as described above under "Division I Installations".

WARNING: EXPLOSION HAZARD
A motor should never be placed in an area with a hazardous process or where flammable gases or combustible materials may be present unless it is specifically designed and nameplated for this type of service. Hazardous Locations motors are intended for installations in accordance with NEC Article 500. For all installations involving Hazardous Locations motors, consult the NEC, local codes, and the authority having jurisdiction. Failure to follow these instructions could result in serious personal injury, death and/or property damage. (For other limitations see section 1.3)

3.2 MOUNTING MOTOR:

3.2.1 RIGID BASE (FOOTED): The motor must be securely installed to a rigid foundation or a mounting surface to minimize vibration and maintain alignment between the motor shaft and the load's shaft. The mounting surfaces of the four mounting pads must be flat within 0.01 inches for 210 frame & smaller; 0.015 inches for 250 frame & larger. [IEC 0.25 mm for 130 frame & smaller, 0.38 mm for 160 frame & larger]. This may be accomplished by shims under the motor feet. For special isolation mounting, contact manufacturer for assistance

3.2.2 RIGID BASE HOLE SELECTION -6 OR 8 HOLES



3.2.3 VERTICAL MOUNTING:

CAUTION: ENCLOSURE PROTECTION CAUTION: Most Dripproof rigid base (footed) motors do **NOT** meet "Dripproof" requirements when mounted vertically. If the motor is located in unprotected environments, the addition of a drip cover may be available. Drip covers not available for cast iron rigid base motors.

WARNING: FALLING OBJECT HAZARD
The lifting provision on standard horizontal footed motors is not designed for lifting the motor in a vertical shaft up or shaft down position. (see 2.2.1 lifting angles). Lifting method / provisions for

mounting a rigid base (footed) motor vertically is the responsibility of the installer.

VERTICAL SHAFT DOWN: Most standard horizontal motors thru 449 Fr. (excluding brake motors) can be mounted in a vertical shaft down orientation. For vertical brake motors see section 3.3.6.2.

VERTICAL SHAFT UP:

⚠ **WARNING: HAZARDOUS LOCATIONS VERTICAL MOUNT:** Hazardous locations motors must **NOT** be mounted vertically shaft up without approval by the motor manufacturer. Without proper retaining provisions the rotor may move axially and contact components, creating a spark hazard.

Belted or Radial Load when mounted vertically: The following frame sizes / constructions with applied (axial) down loads within the limit stated are acceptable when mounted vertical shaft up.

Table 3-1 Belted or Radial Load Applications (All speeds)

Frame Size	Enclosure	Construction	Shaft Up OK	Max Applied Down Load[3]
56	TEFC & ODP	Steel	Yes	25 lbs
140	TEFC	Steel & Cast Iron	Yes	25 lbs
	ODP	Steel	Yes	25 lbs
180	TEFC	All	Yes	35 lbs
	ODP	Steel	Yes	35 lbs
210	TEFC	All	Yes	40 lbs
	ODP	Steel	Yes	40 lbs
250	TEFC	All	Yes	40 lbs
	ODP	Steel	Yes	40 lbs
		Cast Iron	No[2]	N/A
280-320	320 TTFC models	Cast Iron	Eng[1]	N/A
	All Other TEFC	Cast Iron & Aluminum	Yes	30 lbs
	ODP	Cast Iron	No[2]	N/A
	TEFC & ODP	Steel	Build Up Only[4]	N/A
360 & Up	TEFC	Cast Iron	Build Up Only[4]	N/A
	ODP	Cast Iron	No[2]	N/A
	TEFC & ODP	Steel	Build Up Only[4]	N/A

Notes:

1 For TEFC model numbers beginning with 324TTFC or 326TTFC consult the motor manufacturer to determine if a build up motor is required.

2 The max applied down load is any applied load external to the motor, including such things as sheave weight, fan loads, axial belt force, pump load, etc. If the application is direct drive with no applied radial load, consult the motor manufacturer.

3 "Build-up only", refers to motors that are specifically ordered and built for shaft up applications. It does not imply that all build-up motors are suitable for shaft up applications.

3.3 APPLICATION ASSEMBLY TO MOTOR:

⚠ **CAUTION: EQUIPMENT DAMAGE:**
Do not connect or couple motor to load until correct rotational direction is established.

3.3.1 GENERAL: PROPER ALIGNMENT of the motor and driven equipment minimizes vibration levels, maximizes bearing life, and extends the overall life of the machinery. Consult the drive or equipment manufacturer for more information.

⚠ **CAUTION: BEARING FAILURE**
During assembly do NOT force components onto the shaft. Striking or hammering the component may result in bearing damage.

3.3.2 DIRECT COUPLING: Use flexible couplings if possible. For applications that apply radial, axial or moment loading on the motor shaft see section 3.3.3.

⚠ **CAUTION: BEARING FAILURE**
Unless approved by the motor manufacturer do **NOT** direct couple a vertical shaft up or roller bearing motor. Direct coupling a vertical shaft up motor or a motor with a roller bearing may result in bearing damage.

3.3.3 DIRECT CONNECTED: Radial loading for direct connected equipment (gears, fans etc.) must be approved by the motor manufacturer unless within the maximum overhung load limits (Table 3-2). Combined loading (axial, radial and/or moments) must be approved by motor manufacturer. For belted loads see section 3.3.4.

Table 3-2 Maximum Radial Load (lbf) @ Middle of the Shaft Extension Length

Frame Number	Motor Rated RPM			
	3600	1800	1200	900
143T	106	166	193	210
145T	109	170	199	218
182T	187	230	261	287
184T	193	237	273	301
213T	319	317	470	510
215T	327	320	480	533
254T	500	631	729	793
256T	510	631	736	820
284T	-	866	990	1100
286T	-	871	1005	1107
324T	-	950	1100	1215
326T	-	950	1113	1230
364T	-	1078	1365	1515
365T	-	1078	1380	1540
404T	-	1388	1590	1762
405T	-	1400	1610	1780
444T	-	1580	1795	2005
445T	-	1520	1795	1985
447T	-	1455	1765	1985
449T	-	1640	1885	2130

Values based on 26,280 hrs B-10 Life
For "End of Shaft" Load multiply value by 0.88
To convert from lbf to N multiply value by 4.4482.

3.3.4 BELTED:

The goal of any belted system is to efficiently transmit the required torque while minimizing the loads on the bearings and shafts of the motor and driven equipment. This can be accomplished by following four basic guidelines:

1. Use the largest practical sheave diameter.
2. Use the fewest number of belts possible.
3. Keep sheaves as close as possible to support bearings.
4. Tension the belts to the lowest tension that will still transmit the required torque without slipping. It is normal for V-belts to squeal initially when line starting a motor

3.3.4.1 Sheave Diameter Guidelines:

In general, smaller sheaves produce greater shaft stress and shaft deflection due to increased belt tension. See Table 3-3 for recommended minimum sheave diameters. Using larger sheaves increases the contact with belts which reduces the number of belts required. It also increases the belt speed, resulting in higher system efficiencies. When selecting sheaves, do not exceed the manufacturer's recommended maximum belt speed, typically 6,500 feet per minute for cast iron sheaves. Determine belt speed by the following formula:

Figure 1

$$\text{BELT SPEED (Ft/min)} = \frac{\text{Shaft RPM} \times 3.14 \times \text{Sheave Dia (inches)}}{12}$$

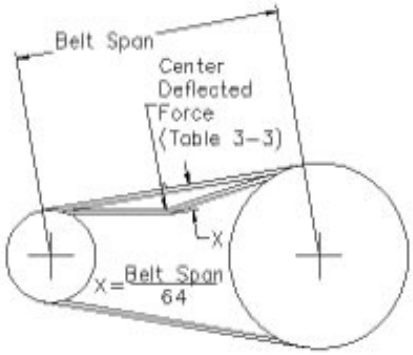
3.3.4.2 Number of Belts

In general, use the fewest number of belts that will transmit the required torque without slipping. See Table 3-3 for recommended maximum number of belts. Each belt adds to the tension in the system, which increases load on the shafts and bearings. Belts are most efficient when operated at or near their rated horsepower.
If the sheaves have more grooves than the number of belts required, use the grooves closest to the motor.

3.3.4.3 Sheave Location

Install sheaves as close to the housing as possible to increase the bearing life of the motor and driven equipment

Figure 2



3.3.4.4 Belt Tension

⚠ CAUTION: Equipment Failure Caution

Belt tensioning by feel is NOT acceptable. Tensioning by "feel" can be very misleading, and can damage motor and equipment.
It is normal for V-belts to squeal initially when line starting a motor.

In general, belt tensions should be kept as loose as possible while still transmitting the required torque without slipping. Belt tensions must be measured with a belt tension gage. These inexpensive gages may be obtained through belt manufacturers, or distributors.

Proper belt tension is determined by measuring the force required to deflect the center of the belt a given distance. The proper deflection (in inches) is determined by dividing the belt span in inches by 64. Calculate the proper deflection and then see Table 3-3 for the required "Deflected Force" to achieve that deflection.
After tensioning the belt, rotate the sheaves for several rotations or operate the system for a few minutes to seat belts into the grooves, then re-tension the belts. New belts will stretch during use, and should be retensioned after the first eight hours of use.

Table 3-3 Recommended Minimum Sheave Diameters, Belt Type, Number of Belts and Deflected Force

Motor Hp	1200 rpm				1800 rpm				3600 rpm			
	Min Sheave Dia (in)	Belt Type	Max # of Belts	Avg. Deflected Force (lbs)	Min Sheave Dia (in)	Belt Type	Max # of Belts	Avg. Deflected Force (lbs)	Min Sheave Dia (in)	Belt Type	Max # of Belts	Avg. Deflected Force (lbs)
0.75	2.2	3VX	1	2.4	2.2	3VX	1	2.2	2.2	3VX	1	1.3
1	2.4	3VX	1	4.0	2.2	3VX	1	3.1	2.2	3VX	1	1.6
1.5	2.4	3VX	2	3.1	2.4	3VX	2	2.1	2.2	3VX	1	2.5
2	2.4	3VX	3	2.8	2.4	3VX	2	2.9	2.4	3VX	1	2.7
3	3.0	3VX	2	3.3	2.4	3VX	3	2.9	2.4	3VX	2	2.3
5	3.0	3VX	3	4.0	3.0	3VX	3	3.7	2.4	3VX	3	2.5
7.5	3.8	3VX	4	4.7	3.0	3VX	4	4.1	3.0	3VX	2	4.2
10	4.4	3VX	4	5.4	3.8	3VX	4	4.3	3.0	3VX	3	3.8
15	4.4	3VX	5	5.4	4.4	3VX	4	5.4	3.8	3VX	3	4.4
20	5.2	3VX	6	6.0	4.4	3VX	6	4.8	4.4	3VX	3	5.0
25	6.0	3VX	7	5.6	4.4	3VX	7	5.2	4.4	3VX	4	4.7
30	6.8	3VX	7	5.9	5.2	3VX	7	5.3				
40	6.8	5VX	4	11.6	6.0	3VX	7	6.0				
50	8.2	5VX	4	14.6	6.8	3VX	8	5.9				
60	8.2	5VX	5	14.1	7.4	5VX	4	13.3				
75	10.0	5VX	5	14.5	8.6	5VX	4	14.3				
100	10.0	5VX	6	16.0	8.6	5VX	6	13				
125	12.0	5V	7	14.1	10.5	5V	6	13.1				
150	13.2	5V	7	15.4	10.5	5V	7	13.4				
200	15.0	5V	8	16.0	13.2	5V	8	13.1				
250	15.0	8V	6	27.6	14.0	5V	9	13.8				
300	16.0	8V	7	27.1	14.0	5V/8V	11 / 7	23.4				
350	16.5	8V	7	30.3	14.5	5V/8V	12 / 7	26.0				
400	17.5	8V	8	29.1	15.0	5V/8V	13 / 8	25.7				
450	18	8V	8	31.6	16.0	5V/8V	14 / 9	25.2				
500	18.5	8V	9	30.7	16.5	5V/8V	15 / 9	26.9				
600					17.5	8V	11	26.3				
700					19.0	8V	12	27.3				
800					20.0	8V	13	28.2				

Contact Motor Manufacturer when Belting 3600 rpm Motors Greater than 25 HP

Notes:

1. Horsepower is the nameplate motor horsepower, and RPM is the motor (driver) speed.
2. Minimum sheave diameters are from NEMA standards where applicable.
3. **For variable speed applications or values outside these recommendations, consult motor manufacturer.**
4. Selections are based on a 1.4 service factor, 5 to 1 speed ratio and various Power Transmission Manufacturers' catalogs.
5. These selections are for Narrow V-belt sections only. Consult manufacturer for details on conventional V-belt sections (A, B, C, D and E), or other belt types.
6. "Average Deflected Force is per section 3.3.4.4 of this document and is the force required to deflect the center of a belt 1/64 of the belt span distance. Tolerance on this force is ±1 lbf for forces ≤10 lbs, and ±2 lbs for forces >10 lbs as measured utilizing a belt tension gage.
7. When more than one belt is required the belts must be a matched set (matched for length).
8. If possible, the lower side of the belt should be the driving side to increase the length of wrap on the sheave).
9. For belted loads do not exceed 125% of 60 Hz operating RPM.

3.3.5 VFD (Variable Frequency Drives) OPERATION:

⚠ **WARNING: VFD Motors with Reset Thermal Protectors**
UL Recognition, UL Listing, or CSA certification does not apply to motors that are equipped with a manual or automatic reset thermal protector when the motor is operated on VFD power.

⚠ **WARNING: Power Factor Correction Capacitors:**
Power factor correction capacitors should never be installed between the drive and the motor.

⚠ **CAUTION: VFD / Motor Setup:**
It is the responsibility of the startup personnel during set up of the VFD / motor system to properly tune the drive to the motor for the specific application per the VFD user manual. The correct voltage boost and volts per hertz settings are application dependent and unique to each motor design. Failure to connect over temperature devices (when provided) will void the warranty.

3.3.5.1 Overspeed Capability:

Belted loads: Do not exceed 125% of 60 Hz operating RPM.

Table 3-4 Maximum Safe Continuous Speed (RPM) For Coupled and Direct Connected Loads

NEMA / [IEC] Frame Size	2-Pole	4, 6, or 8 Pole
56-180 [80-110]	7200 *	5400 *
210-250 [130-160]	5400 *	4200*
280 [180]	5400 *	3600
320 [200]	4500 *	3600
360 [225]	4500 *	2700
400-440 [250-280]	3600	2700
>440 [>280]	3600	1800

* = Fan cooled motors (Totally Enclosed & Hazardous Locations Motors) are limited to a maximum safe continuous speed of 4000 RPM **For higher speeds or shortened duty cycle contact motor manufacturer**

3.3.5.2 Cable Lengths: For optimum insulation life, limit VFD to motor cable lengths of general purpose motors

to Table 3-5 values. Definite purpose VFD motors may accommodate longer cable lengths. For additional information contact motor manufacturer.

Table 3-5 Max Cable Lengths General Purpose Motors
These values are based on 3 kHz carrier frequency. Add suitable VFD output-side filters when exceeding the listed values.

Frame Size	230V	460 V	575 V
NEMA 56-320	600 ft.	125 ft.	40 ft.
NEMA 360-5011	1000 ft.	225 ft.	60 ft.
IEC 80-200	180 m.	40 m.	12 m.
IEC 225-280.	300 m.	70 m.	18 m.

3.3.5.3 VFD Grounding: Equipment grounding conductors may be run in the same conduit as the AC motor power leads. This wire must be used as the equipment ground for the motor and not as the fourth current carrying wire of a "WYE" motor circuit. The grounded metal conduit carrying the output power conductors can provide EMI shielding, but the conduit does not provide an adequate ground for the motor; a separate grounding conductor must be used. Grounding the motor neutral (WYE) of a VFD powered motor may result in a VFD ground fault trip. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. Refer to Grounding section 3.4.4

3.3.5.4 VFD – Single Phase:

CAUTION: SINGLE PHASE MOTOR FAILURE:
Single Phase motors are **NOT** suitable for use on VFD power. Connecting a Single Phase Motor to a VFD voids the warranty.

3.3.5.5 Stray Voltage on Accessory Leads:

VFD's will couple stray (common-mode) voltage to motor-mounted RTDs, thermistors, thermostats and space heaters. The leads of these elements must be properly insulated and control input circuits must be designed to withstand this common-mode voltage.

3.3.6 ACCESSORIES / PROVISIONS:

3.3.6.1 General: Carefully read and understand the accessory manufacturer's instructions, supplied with motor. Contact the manufacturer for additional information.

3.3.6.2 Brake Motors:

⚠ CAUTION: Vertical Motor Premature Brake Failure
Motors with brakes that are designed for vertical applications are equipped with springs to support the brake pressure plate. Mounting a horizontal brake motor vertically shaft up or down may require a pressure plate spring modification. Failure to modify the brake for the vertical application may result in premature brake failure. If in question, consult brake literature or brake manufacturer.

Brake Solenoid Wiring: Do NOT connect the brake solenoid to the output of a VFD. The brake solenoids must be wired to 50/60 Hz line power

3.3.6.3 Space Heaters:

Motors provided with space heaters have two leads that are brought into the conduit box or into an auxiliary box. These leads are marked "H1", "H2" ("H3", "H4" if a second space heater is supplied). See the space heater nameplate on motor for heater rating.

⚠ WARNING: DIVISION 2 EXPLOSION HAZARD
The space heater temperature rating when used in Class I, Division 2 motors shall **NOT** exceed 80% of the auto ignition temperature of the hazardous gas or vapor. See the space heater nameplate on motor for heater Temperature Code and heater rating. Failure to follow this instruction could result in serious personal injury, death and/or property damage

3.3.6.4 Thermal Protection:

General Information: When thermal protection is provided, one of the following will be stamped on the nameplate:

1. **"THERMALLY PROTECTED"** This motor has built in thermal protection. Thermal protectors open the motor circuit electrically when the motor overheats or is overloaded. The protector cannot be reset until the motor cools. If the protector is automatic, it will reset itself. If the protector is manual, disconnect motor from power supply. After protector cools (five minutes or more) press the reset button and reapply power to the motor. In some cases a motor is marked "Auto" and the connection diagram on the motor will identify T'Stat leads – see "2 " below. (See warnings on Manual and Automatic reset protectors - section 1.1)

2. **"WITH OVERHEAT PROTECTIVE DEVICE"**: This motor is provided with an overheat protective device that does not directly open the motor circuit. Motors nameplated with this phrase have either thermostats, thermisters or RTD's. The leads to these devices are routed into the motor conduit box or into an auxiliary box. The lead markings are defined on the nameplate (normally "P1", "P2") . The circuit controlled by the overheat protection device must be limited to a maximum of 600 volts and 360 volt-amps. See connection decal provided inside the terminal box cover. Failure to connect these over temperature devices (when provided) will void the warranty.

   ⚠ WARNING: EXPLOSION HAZARD
   For Hazardous Locations motors provided with thermostats UL and the NEC require connection of thermostat leads into the control portion of a manual reset start circuit. Failure to follow this instruction could result in serious personal injury, death and/or property damage

Resistance Temperature Detectors (RTD): When winding and/or bearing RTDs are provided the RTD lead markings are defined on the nameplate. (Normally "R1", "R2", "R3" etc.)

3.3.6.5 RTD Alarm & Trip Settings:

Tables 3-6 & 3-7 are suggested initial RTD alarm and trip settings. For motors found to operate significantly below these values the settings may be reduced accordingly.

Table 3-6 Winding RTD – Temperature Limit (°C) 40 °C Max Ambient

Motor Load	Class B Temp Rise≤ 80°C		Class F Temp Rise≤ 105°C	
	Alarm	Trip	Alarm	Trip
Up to 1.0 SF	130	140	155	165
>1.0 to 1.15 SF	140	150	160	165

Table 3-7 Bearing RTD – Temperature Limit (°C) 40 °C Max Ambient

Ambient	Alarm	Trip
Up to 40°C	95	100
> 40°C	110	115
Bearings that are Heat Stabilized to 150 °C	130	135

3.3.7 GUARDS:

⚠ WARNING: ROTATING PARTS HAZARD
When devices are assembled to the motor shaft, be sure to install protective devices such as belt guards, chain guards, and shaft covers. These devices must protect against accidental contact with extremities, hair, and clothing. Consider the application and provide guarding to protect personnel. Remove all unused shaft keys and loose rotating parts to prevent them from flying off and causing bodily injury. Failure to follow this warning could result in serious personal injury, death and/or property damage.

3.4 ELECTRICAL CONNECTIONS:

⚠ WARNING: ELECTRICAL HAZARDS
Before proceeding read Section 1-1 on Electrical Safety. Failure to follow the instructions in Section 1-1 could result in serious personal injury, death and/or property damage

3.4.1 POWER SUPPLY / BRANCH CIRCUIT

⚠ WARNING: POWER SUPPLY INCOMPATIBILITY HAZARD
Check power supply to make certain that voltage, frequency and current carrying capacity are in accordance with the motor nameplate. Failure to match motor nameplate values could result in serious personal injury, death and/or property damage

⚠ WARNING: BRANCH CIRCUIT SUPPLY HAZARD
Motor and control wiring, fusing, overload protection, disconnects, accessories and grounding must always conform to the applicable electrical codes as well as local codes and sound practices.

3.4.1.1 Branch Circuit Supply to a motor should include a disconnect switch, short circuit current fuse or breaker protection, motor starter (controller) and correctly sized thermal elements or overload relay protection.

3.4.1.2 Fuses, Breakers, Overload Relays
Short Circuit Current Fuses or Breakers are for the protection of the branch circuit. Starter or motor controller overload relays are for the protection of the motor. Each of these should be properly sized and installed per the applicable electrical codes as well as local codes and practices.

⚠ WARNING: PROTECTIVE DEVICE DISABLED HAZARD
DO NOT bypass or disable protective devices. Protection removal could result in serious personal injury, death and/or property damage

3.4.1.3 AC Power Supply Limits
Motors are designed to operate within the following limits at the motor terminals:
1- AC power is within +/- 10 % of rated voltage with rated frequency applied. (Verify with nameplate ratings) **OR**
2- AC power is within +/- 5% of rated frequency with rated voltage **OR**
3- A combined variation in voltage and frequency of +/- 10% (sum of absolute values) of rated values, provided the frequency variation does not exceed +/-5% of rated frequency.
4- For 3 phase motors the line to line full load voltage must be balanced within 1%.
5- If the motor is rated 208-230V, the voltage deviations must be calculated from 230V.

CAUTION: Reduced Motor Performance
Operation outside of these limits will degrade motor performance and increase operating temperature.

3.4.2 TERMINAL BOX:

3.4.2.1 Conduit Opening: For ease of connections, motors are typically provided with large terminal boxes. Most motors have conduit access in 90 degree increments, the terminal box conduit opening is typically provided via knockouts, holes with covers, or the terminal box is rotate-able. Fabricated conduit boxes may have a removable plate for the installer to provide correctly sized hole(s).

3.4.2.2 Hazardous Locations Motors:

⚠ WARNING: EXPLOSION HAZARDS
(1) Terminal Boxes mounted to motor with a pipe nipple: If a pipe nipple mounted terminal box is removed or rotated it must be reassembled with a minimum of five full threads of engagement.
(2) Component Removal: Do not set a terminal box component on its machined surfaces. Prior to component reassembly wipe clean all machined surfaces.
(3) Machined Surface Gap (Hazardous Locations Terminal Boxes): The gap between mating surfaces with the machined terminal box MUST BE LESS THAN 0.002 inches. This gap must be checked with a feeler gage along the entire perimeter. If there is visible damage to the mating surfaces, or if the gap between these surfaces exceeds 0.002 inches, DO NOT complete the installation and contact the motor manufacturer. Failure to follow these instructions could result in serious personal injury, death and/or property damage

3.4.3 LEAD CONNECTIONS
Electrical connections to be made per nameplate connection diagram or separate connection plate. In making connections follow the applicable electrical code as well as local codes and practices.

⚠ WARNING: ELECTRICAL CONNECTION HAZARD
Failure to correctly connect the motor leads and grounding conductor can result in injury or death. Motor lead connections can short and cause damage or injury if not well secured and insulated.

3.4.3.1 Wire Size (Single Phase) Requirements
The minimum wire size for Single Phase, 115 & 230 Volt Circuits must meet table 3-8 for a given distance between motor and either Fuse or Meter Box.

Table 3-8 Minimum Wire Gage Size Single Phase 115 & 230 Volt Circuits

Distance (Feet) - Motor to Fuse or Meter Box								
Motor	100 Ft.		200 Ft.		300 Ft.		500 Ft.	
HP	115	230	115	230	115	230	115	230
1/4	14	14	10	12	8	10	6	8
1/3	12	14	10	12	6	10	4	8
1/2	10	12	8	10	6	8	4	6
3/4	10	12	6	10	4	8	2	6
1	8	10	6	8	4	6		4
1 1/2	4	10	0	8		6		4
2		8		6		4		2
3		8		6		4		2
5		6		4		2		0

3.4.3.2 Extension Cords (Single Phase Motors):
Where an extension cord(s) is utilized to provide power to the motor the extension cord(s) must be…(1) the proper gauge size per table 3-8, (2) in good working condition (3) properly grounded.

3.4.4 GROUND CONNECTION(S):

⚠ WARNING: ELECTRICAL GROUNDING HAZARD
For general information on grounding (USA) refer to NEC Article 250. Improper grounding of an inverter fed motor may result in frame voltages in excess of 500 Volts. In making the ground connection, the installer must make certain that a good electrical connection is obtained between motor and grounding lead. Failure to properly ground motors, per the applicable national code (such as NEC Article 430) and local codes may cause serious injury or death to personnel.

Primary "Internal" Ground: A grounding conductor must be connected to the grounding terminal provided in the terminal housing. This grounding terminal is either a ground screw, ground lug, or a tapped hole to be used with a separately provided ground screw. The internal grounding feature is accessible inside the terminal housing and must be used as the primary grounding connection.
Secondary "External" Ground: Some motors are provided with a supplemental grounding terminal located on the external surface of the motor frame or feet. This external terminal is for supplemental bonding connections where local codes permit or require such connection

3.4.5 START UP:

⚠ WARNING: ELECTRICAL SHOCK HAZARD:
Be certain that all connections are secure and the conduit box cover is fastened in place before electrical power is connected. Failure to follow these instructions could result in serious personal injury, death, and/or property damage.

⚠ WARNING: LOOSE & ROTATING PARTS HAZARD
Before proceeding read Section 1-2 on Mechanical Safety. Failure to follow the instructions in Section 1-2 could result in serious personal injury, death and/or property damage

⚠ WARNING: EXCESSIVE SURFACE TEMPERATURE HAZARD
Motors with the temperature code stated on the nameplate are designed to operate within this limit. Improper application or operation can cause the maximum surface temperature to be exceeded. A motor operated in a Hazardous Location that exceeds this surface temperature limit increases the potential of igniting hazardous materials. *Therefore, motor selection, installation, operation, and maintenance must be carefully considered to ensure against the following conditions:* (1) Motor load exceeds service factor value, (2) Ambient temperature above nameplate value, (3) Voltages outside of limits (3.4.1.3), (4) Loss of proper ventilation, (5) VFD operation exceeding motor nameplate rating, (6) Altitude above 3300 feet / 1000 meters, (7) Severe duty cycles, (8) Repeated starts, (9) Motor stall, (10) Motor reversing, and (10) Single phase operation. Failure to follow these instructions could result in serious personal injury, death and/or property damage.

⚠ CAUTION: HOT SURFACE
Normal motor surface temperatures may exceed 90 ° C (194° F). Touching the motor frame may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

3.4.5.1 Start Up - No Load Procedure

1. **Check Instructions:** Before startup carefully read and fully understand these instructions including all warnings, cautions, and safety notice statements.
2. **Motor out of storage after more than three months:** Check winding insulation integrity with a Megger. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before energizing the motor.
3. **Check Installation: Mechanical** - Check tightness of all bolts and nuts. Manually rotate the motor shaft to ensure motor shaft rotates freely. Note: Shaft & bearing seals will add drag.
   Electrical - Inspect all electrical connections for proper terminations, clearance, mechanical tightness and electrical continuity. Be sure to verify connections are made per the nameplate connection diagram or separate connection plate. Replace all panels and covers that were removed during installation before energizing the motor.
4. **Energize Motor: Check Rotation**
   If practical check motor rotation before coupling to the load. Unlock the electrical system. Momentarily provide power to motor to verify direction of rotation. If opposite rotation is required, lock out power before reconnecting motor. If motor has a rotational arrow only operate the motor in the rotation identified. Reapply power to ensure proper operation.
5. **Record No Load Amps, Watts & Voltage:**
   Recommend - To establish a baseline value check and record the no load amps, watts, and voltage.

3.4.5.2 Start Up – Load Connected Procedure

1. **Check Instructions:** Before startup carefully read and fully understand these instructions including all warnings, cautions, & safety notice statements.
2. **Coupling Installation:** Check that the connected equipment is properly aligned and not binding. Check that all guards and protective devices are properly installed.
3. **Energize Motor:** When all personnel are clear of the machine, apply power and verify that the load is not transmitting excessive vibration back to the motor though the shaft or the foundation. Verify that motor amps are within nameplate rating. For repeated starts see 3.4.5.3. The equipment can now be fully loaded and operated within specified limits as stated on the nameplate.

3.4.5.3 Jogging and/or Repeated Starts

Do not start more than twice in succession under full load. Repeated starts and/or jogs of induction motors can cause overheating and immediate failure. Contact the motor manufacturer if it is necessary to repeatedly start or jog the motor.

4.0 MAINTENANCE:

⚠ WARNING: Hazardous Locations Motor Repair HAZARD:
Division 1 Hazardous Locations motors can only be modified or repaired by the manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage.

⚠ WARNING: ELECTRICAL SHOCK HAZARD
Electrical connections are to be made by qualified electrical personnel in accordance with all applicable codes, ordinances and sound practices. Failure to follow these instructions could result in serious personal injury, death and/or property damage. Only qualified personnel who are familiar with the applicable national codes, local codes and sound practices should install or repair electric motors and their accessories.

⚠ WARNING: ELECTRICAL LIVE CIRCUIT HAZARD
Do not touch electrically live parts. Disconnect, lockout and tag input power supply before installing or servicing motor (includes accessory devices).

4.1 GENERAL INSPECTION

Inspect the motor approximately every 500 hours of operation or every three months, whichever occurs first. Keep the motor clean and the ventilation and fin openings clear. The following steps should be performed at each inspection:

4.1.1 VENTILATION: Check that the ventilation openings and/or exterior of the motor is free of dirt, oil, grease, water, etc, which can accumulate and block motor ventilation. If the motor is not properly ventilated, overheating can occur and cause early motor failure.

4.1.2 INSULATION: Use a "Megger" periodically to ensure that the integrity of the winding insulation has been maintained. Record the Megger readings. If winding resistance to ground is less than 1.5 Meg-ohms consult the local authorized service shop before re-energizing the motor.

4.1.3 ELECTRICAL CONNECTIONS: Check all electrical connectors to be sure that they are tight.

4.2 LUBRICATION & BEARINGS:

The lubricating ability of grease (over time) depends primarily on the type of grease, the size of the bearing, the speed at which the bearing operates and the severity of the operating conditions. Longer bearing life can be obtained if the listed recommendations are followed:

NOTE: If lubrication instructions are provided on the motor nameplate, the nameplate instructions will supersede these instructions. Motors marked "Permanently Lubricated" do not require additional service.

⚠ CAUTION: BEARING / MOTOR DAMAGE WARNING
Lubricant should be added at a steady moderate pressure. If added under heavy pressure bearing shield(s) may collapse. Over greasing bearings greatly increases bearing friction and can cause premature bearing and/or motor failure.

4.2.1 GREASE TYPE (unless nameplate states otherwise):
Nameplate Ambient Temperature between -30°C (-22°F) to 65°C (150°F) inclusive: Recommended grease for standard service conditions is Mobil Polyrex ® EM. Equivalent and compatible greases include: Texaco Polystar RB, Rykon Premium #2, Pennzoil Pen 2 Lube, Chevron SRI & Mobil SHC 100.

Nameplate Ambient Temperature below -30°C (-22°F): Special low temperature grease is recommended, such as Aeroshell 7 or Beacon 325 for ball bearings and Mobil SHC 100 for roller bearings.

Nameplate Ambient Temperature above 65°C (150°F): Dow Corning DC44 or equivalent, a special high temperature grease is required. Note that Dow Corning DC44 grease does not mix with other grease types.

For RTD settings see Table 3-7.

4.2.2 BEARING OPERATING TEMPERATURE:

⚠ CAUTION: HOT SURFACE

The external surface temperature of the end shield (bracket) bearing hub may reach 100° C (212° F) during normal operation. Touching this surface may cause discomfort or injury. Surface temperatures should only be measured with suitable instruments and not estimated by hand touch.

4.2.3 LUBRICATION INTERVALS: (For motors with regreasing provisions)

Eq. 4.2 Lubrication Interval = [(Table 4-1) hrs] x [Interval Multiplier (Table 4-2)] x [Construction Multiplier (Table 4-3)]

Table 4-1 Lubrication Intervals (Hours) These values are based on average use.

NEMA / [IEC] Frame Size	Operating Speed – RPM (See Table 3.4 for Maximum Operating Speed)					
	<7200	<5400	<4500	<3600	<1800	<1200
56-180 [80-110]	2500 Hrs.	4000 Hrs	5000 Hrs	6000 Hrs.	17000 Hrs.	20000 Hrs.
210-250 [130-160]		2500 Hrs	4000 Hrs	5000 Hrs.	12000 Hrs.	16000 Hrs.
280 [180]		2000 Hrs	3000 Hrs	4000 Hrs.	10000 Hrs.	14000 Hrs.
320 [200]			2000 Hrs	3000 Hrs.	9000 Hrs.	12000 Hrs.
360 [225]			1500 Hrs	2000 Hrs.	8000 Hrs.	10000 Hrs.
400-440 [250 – 280]				1500 Hrs.	4000 Hrs.	7000 Hrs.
>440 [>280]				1000 Hrs.	3000 Hrs.	5000 Hrs.

Seasonal Service: If motor remains idle for more than six months, Lubricate at the beginning of the season, then follow lubrication interval.

Do not exceed maximum safe operating speed Table 3-4 without manufacturer's approval

Table 4-2 Service Conditions

Use highest level Multiplier: Maximum Ambient Temperature and Contamination are independent factors

Severity of Service	Maximum Ambient Temperature	Atmospheric Contamination	Multiplier
Standard	Less than 40° C (104° F)	Clean, Slight Corrosion, indoors, less than 16 hrs per day	1.0
Severe	Above 40° C (104° F) to 50° C	Moderate dirt or Corrosion or outdoors or more than 16 hrs per day	0.5
Extreme	Greater than 50° C or Class H Insulation	Severe dirt or Abrasive dust or Corrosion	0.2

Table 4-3 Construction Multiplier

Construction	Multiplier
Angular Contact or Roller Bearing	0.5
Vertical Motor	0.5
All others	1.0

Table 4-4 Relubrication Amounts

Frame Size		Volume		
NEMA	IEC	Cu. In.	Fluid oz	ml
48-56	80	0.25	0.14	4.0
143-145	90	0.25	0.14	4.0
182-184	110	0.50	0.28	8.0
213-215	130	0.75	0.42	12.5
254-256	160	1.00	0.55	16.0
284-286	180	1.50	0.83	25.0
324-326	200	2.00	1.11	33.0
364-365	225	3.00	1.66	50.0
404-405	250	3.80	2.11	62.0
444-449	280	4.10	2.27	67.0
>449	>280	4.50	2.50	74.0

For regreasing while operating multiply volume by 125%.

4.2.4 LUBRICATION PROCEDURE: (For Motors with Regreasing Provisions)

CAUTION: BEARING DAMAGE WARNING
Added grease must be compatible with the original equipment's grease. If a grease other than those stated in 4.2.1 is to be utilized contact the motor manufacturer. Nameplate information supersedes section 4.2.1 (GREASE TYPE). New grease must be free of dirt. Failure to follow these instructions and procedure below may result in bearing and/or motor damage.

For an extremely dirty environment, contact the motor manufacturer for additional information.

LUBRICATION PROCEDURE:

1. Clean the grease inlet plug or zerk fittings prior to regreasing.
2. (If present) Remove grease drain plug and clear outlet hole blockage.

CAUTION: GREASE DRAIN PLUGGED:
Old grease may completely block the drain opening and must be mechanically removed prior to regreasing. Forcing a blocked drain open by increased greasing pressure may collapse bearing shields and / or force excess grease through the bearings and into the motor.

3. Add grease per Table 4-4
4. Re-install grease inlet and drain plugs (if removed).

⚠ WARNING: EXPLOSION HAZARD
Do NOT energize a Hazardous Locations motor without all grease fittings properly installed.

4.2.5 EXAMPLE: LUBRICATION

Assume - NEMA 286T (IEC 180), 1750 RPM Vertical motor driving an exhaust fan in an ambient temperature of 43° C and the atmosphere is moderately corrosive.

1. Table 4-1 list 10,000 hours for standard conditions.
2. Table 4-2 classifies severity of service as "Severe" with a multiplier of 0.5.
3. Table 4-3 lists a multiplier value of 0.5 for "Vertical"
4. (Eq. 4.2) Interval = 10,000 hrs x 0.5 x 0.5 = 2500 hrs

Table 4-4 shows that 1.5 in^3 of grease is to be added.

Relubricate every 2,500 hrs of service with 1.5 in^3 of recommended grease.

4.3 TROUBLE-SHOOTING

⚠ WARNING: READ INSTRUCTIONS:
Before trouble-shooting a motor, carefully read and fully understand the warnings, cautions, & safety notice statements in this manual.

⚠ WARNING: Hazardous Locations Motor Repair:
Motors nameplated for use in Division 1 Hazardous Locations can only be disassembled, modified or repaired by the plant of manufacturer or a facility that is Listed under UL's category "Motors and Generators, Rebuilt for use in Hazardous Locations". Failure to follow these instructions could result in serious personal injury, death and/or property damage

CAUTION: DISASSEMBLY APPROVAL REQUIRED:
Motor disassembly must be performed by a party approved by the motor manufacturer. To disassemble the motor without approval voids the warranty.

4.3.1 GENERAL TROUBLE-SHOOTING WARNINGS

1. **DISCONNECT POWER TO THE MOTOR BEFORE PERFORMING SERVICE OR MAINTENANCE.**
2. **Discharge all capacitors before servicing motor.**
3. **Always keep hands and clothing away from moving parts.**
4. **Be sure required safety guards are in place before starting equipment.**
5. **If the problem persists contact the manufacturer.**

4.3.2 Motor Trouble-shooting Cause / Corrective Action - Table 4-5

Issue:	Likely Cause:	Corrective Action:
Motor fails to start upon initial installation:		
A.)	Supply voltage is too low or is severely unbalanced (one phase is low or missing).	(1) Check power supply fuses (2) Match motor lead wiring to nameplate connection diagram and supply voltage (3) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (4) Obtain correct motor to match actual supply voltage.
B.)	Motor leads are miswired at conduit box.	
C.)	Driven load exceeds motor capacity	(1) Verify that motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely. Note: Roller bearings make noise when motor is uncoupled and shaft is rotated (3) Verify that motor starts when disconnected from load (4) Remove excessive / binding load if present.
D.)	Load is jammed.	
E.)	Fan guard is bent and making contact with fan	Replace fan guard & fan (if blades are damaged)
F.)	VFD with power factor capacitors installed	Remove power factor correction capacitors if equipped
G.)	VFD with motor neutral lead grounded	Ensure that motor neutral lead is ungrounded
H.)	VFD programmed incorrectly	(1) Repeat checks listed above (2) Verify that VFD current limit and starting boost are set correctly (5) Double-check motor and feedback parameter settings and VFD permissives (6) Repeat autotune (for vector drives) procedure (7) Consult VFD supplier.
Motor has been running, then slow down, stalls, or fails to restart:		
A.)	Supply voltage has drooped or has become severely unbalanced	(1) Replace fuse or reset circuit breaker. Allow motor to cool down before resetting manual protector on motor. **Warnings -** See section 1.1 for automatic and manual reset protector warnings (2) Verify that rated and balanced supply voltage has been restored before restarting motor. Measure voltage during restart. Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3).
B.)	Motor is overloaded	(1) Verify that motor & load turn freely. Repair binding components as needed (2) Reduce driven load to match motor capacity or increase motor size to match load requirements.
C.)	Motor bearings are seized	
D.)	Load Is jammed.	
E.)	VFD will not restart motor after tripping	(1) Check fault codes on VFD and follow VFD troubleshooting procedures (2) Verify that VFD input voltage is balanced and within limits (3) Remove excessive mechanical load if present.
F.)	Capacitor failure on single phase motor (if equipped)	**Warning: Potential Shock Hazard**: Contact service shop to check capacitor.
Motor takes too long to accelerate:		
A.)	Motor leads are not connected correctly	Match motor lead wiring to nameplate diagram.
B.)	Supply voltage has drooped or become severely unbalanced.	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3). Correct as needed (2) Obtain correct motor to match actual supply voltage.
C.)	Load exceeds motor capability	Determine correct motor size and contact motor representative to obtain replacement motor.
D.)	Faulty start capacitor (Single Phase)	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
E.)	Mechanical Failure	(1) Check to make sure motor & load turn freely (2) Disconnect motor from load & ensure motor turns freely
Motor rotates in the wrong direction:		
A.)	Incorrect wiring connection at motor	[Single Phase] Reconnect motor according to wiring schematic provided. Note: Some motors are non-reversible
		[Three Phase] Interchange any two power supply (phase) leads.
Motor overheats or overload protector repeatedly trips		
A.)	Driven Load is excessive	(1) If motor current exceeds nameplate value, ensure that driven load has not increased. Correct as needed. (2) If new motor is a replacement, verify that the rating is the same as the old motor. If previous motor was a special design, a general purpose motor may not have the correct performance.
B.)	Ambient temperature too high	Most motors are designed to operate in an ambient up to 40 ºC. (See section 4.2.2 Hot Surface Caution)
C.)	Motor cooling fins and/or vent openings blocked	Remove foreign materials – clear vent openings, fan guard air inlets and frame fins (TEFC motors)
D.)	Insufficient Air Flow	TEAO (Totally Enclosed Air Over) motors: Measure airflow next to motor surface and obtain minimum requirements from motor manufacturer.

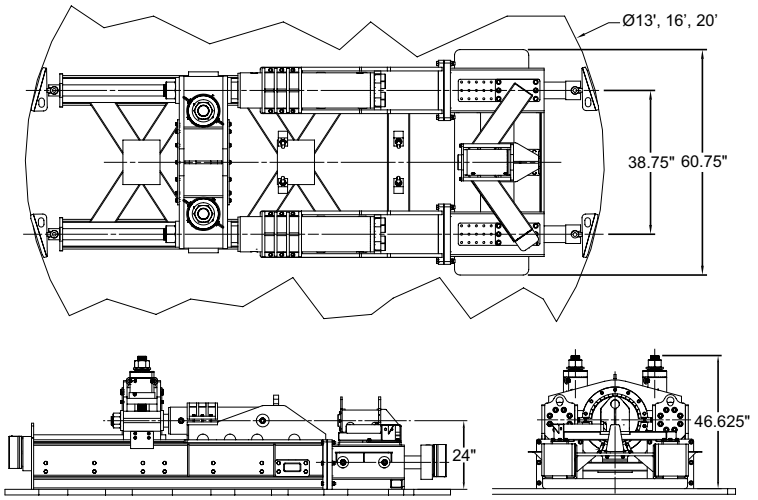
	E.)	Motor is started too frequently	See section 3.4.5.3
	F.)	Supply voltage too low, too high, or unbalanced	(1) Ensure that steady state supply voltage at motor terminals is within limits (see section 3.4.1.3) Correct as needed (2) Reconnect motor per input voltage (3) Obtain correct motor to match power supply.
Motor Vibrates			
	A.)	Motor misaligned to load.	Realign load
	B.)	Load out of balance (Direct drive application)	(1) Ensure that load is dynamically balanced: (2) Remove motor from load and inspect motor by itself. Verify that motor shaft is not bent. Rule of thumb is 0.002" runout for shafts extension lengths up to 3.00". Add 0.0005" per every additional inch of shaft length beyond 3.00".
	C.)	Uneven tension on multiple belts	Mixing new with used belts. Replace multiple belt applications with a complete set of matched belts.
	D.)	Driven load operating at resonant point / natural frequency.	(1) De-energize motor and record vibration as load coasts from 100% speed to 0 RPM. If vibration drops immediately, vibration source is electrical. If levels do not drop immediately, source is mechanical (2) Redesign system to operate below the resonant point (3) On VFD-driven loads, program skip frequencies to bypass resonant points (4) Increase carrier frequency to obtain <3% THD current (5) On variable torque loads reduce volts/hertz below base speed.
	E.)	VFD torque pulsations	(1) Adjust VFD to obtain <3% THD current @ rated motor current (2) Adjust VFD stability for smooth operation. Vector drives may be unstable at light load.
	F.)	Motor miswired at terminal box	Match motor lead wiring to nameplate connection diagram.
	G.)	Uneven, weak or loose mounting support.	Shim, strengthen or tighten where required.
	H.)	Motor bearings defective	Test motor by itself. If bearings are bad, you will hear noise or feel roughness. Roller bearings are normally noisy when operated without load. If sleeve bearing, add oil per nameplate instructions. For motors with regreasing provisions, add grease per relubricating instructions (see section 4.2.3). If noise persists contact warranty service.
	I.)	Motor out of balance	Disconnect from load. Set motor on rubber pads on solid floor. Secure a ½ height key in shaft keyway and energize from balanced power supply @ rated voltage. Record vibration levels and compare with appropriate standards. If excessive vibration persists contact motor manufacturer.

Bearings repeatedly fail.			
	A.)	Load to motor may be excessive or unbalanced	(1) If belt drive check system per section 3.3.4. (2) Other than belting, check loading on motor shaft. An unbalanced load will also cause the bearings to fail. (3) Check runouts of mating components, such as a C-face and pump flange.
	B.)	Bearings contaminated.	Motor enclosure not suitable for environment. Replace with correct enclosure construction
	C.)	Incorrect grease or bearings for ambient extremes.	See section 4.2.1
	D.)	VFD bearing damage	Ground brush, common mode filter, or insulated bearings must be added. Contact motor manufacturer.
Motor, at start up, makes a loud rubbing, grinding, or squealing noise.			
	A.)	Contact between rotating and stationary components	Belt squeal during across the line starting is normal: (1) Verify that supply voltage is within limits (see section 3.4.1.3). (2) Ensure that motor lead wiring matches nameplate connection diagram: (3) Isolate motor from load. (4) To locate point of contact turn motor shaft by hand. (5) If point of contact is not located contact motor service shop.
Start capacitors repeatedly fail.			
	A.)	The motor acceleration time is too long	Motor may be too small for load. Record acceleration time. Start capacitors may fail if acceleration time exceeds 3 seconds.
	B.)	Motor is being started too frequently	Excessive starting will damage motor capacitors. Contact motor manufacturer if motor is started more than 20 times/hour or if acceleration time exceeds 3 seconds.
	C.)	Motor voltage low	Verify that voltage at the motor terminals is within limits (see section 3.4.1.3).
	D.)	Defective start switch inside motor	Motor internal switch failure overheats start capacitor. Contact service shop or motor manufacturer.
Run capacitor fails.			
	A.)	High ambient temperature	Verify that the ambient does not exceed motor's nameplate value

	B.)	Input voltage exceeds limit	Verify that voltage to the motor terminals is within limits (see section 3.4.1.3).
	C.)	Power surge to motor (caused by lightning strike or other high transient voltage).	If a common problem, install surge protector.

Specifications

PIPE THRUSTER SYSTEM



Frame Configuration Weight
- 13' Frame ..... 8,000 lbs. (3,629 kg)
- 16' Frame ..... 9,000 lbs. (4,082 kg)
- 20' Frame ..... 10,000 lbs. (4,536 kg)

Operating Pressure (Maximum) ..... 5,000 psi (34.475 mPa)

Power Requirement ..... 480V, 400 Amp, 3 Phase, 60 Hz

Power Pack Electric Motor ..... 50 HP (37 kW)

Electrical Disconnects
- ..... Main Power Disconnect 480V / 400 Amp
- ..... 20 HP Motor
- ..... 15 HP Tank Pump Motor
- ..... 10 HP Can Pump Motor
- ..... 50 Amp 120/240V Transformer
- ..... 100 HP Shaft Pump Motor
- ..... 50 HP Hydraulic Power Pack

Pump
- Variable Piston, Load Sense ..... 0 to 30 gpm (0 to 114 L/min)

Thrust Cylinders (2)
- Size (bore x rod x stroke) ..... 7.50 x 4.50 x 26 in.
- Push Force (both cylinders) ..... 185 Ton @ 4,200 psi
- Pull Force (both cylinders) ..... 127 Ton @ 4,500 psi

Gripper Cylinders (2)
- Size (bore x rod x stroke) ..... 6.50 x 5.00 x 3 in.
- Clamp Force (both cylinders) ..... 93 Ton @ 4,500 psi

Foot Cylinders (2)
- Size (bore x rod x stroke) ..... 7.50 x 4.50 x 12 in.
- Extension Force (both cylinders) ..... 185 Ton @ 4,200 psi
- Pull Force (both cylinders) ..... 21 Ton @ 750 psi

Packer Cylinder
- Size (bore x rod x stroke) ..... 5.50 x 4.00 x 6 in.
- Extension Force ..... 48 Ton @ 4,200 psi
- Pull Force ..... 22 Ton @ 4,200 psi

Fluid Capacity
- Hydraulic Reservoir ..... 40 gal (151 L)

Cooling
- Motor ..... 2 HP, 3 Phase, 480V
- Gear Pump ..... 17 gpm @ 1,750 rpm

• Pipe Thrust Die with replaceable grip inserts. Configured for 16.25 in. OD & 18.27 in. OD thrust casing.
• Separate forward and rear skid sections. Adaptable to 13 ft, 16 ft and 20 ft ID caisson.

Akkerman Inc. reserves the right to improve its product without notice or obligation.

TORQUE CHART

Use these torque values as a guideline when tightening hardware unless otherwise specified in this manual.

Lubricated Coarse UNC Threads Grade 8 Fasteners			Lubricated Fine UNF Threads Grade 8 Fasteners		
Bolt Size	**Torque ft. lbs.**	**(N·m)**	**Bolt Size**	**Torque ft. lbs.**	**(N·m)**
1/4 - 20	10	(14)	1/4 - 28	11	(15)
5/16 - 18	20	(27)	5/16 - 24	22	(30)
3/8 - 16	35	(47)	3/8 - 24	39	(53)
7/16 - 14	56	(76)	7/16 - 20	62	(84)
1/2 - 13	85	(115)	1/2 - 20	96	(130)
9/16 - 12	123	(167)	9/16 - 18	137	(186)
5/8 - 11	170	(231)	5/8 - 18	192	(260)
3/4 - 10	301	(408)	3/4 - 16	336	(456)
7/8 - 9	450	(610)	7/8 - 14	500	(678)
1 - 8	680	(922)	1 - 12	740	(1003)
1-1/8 - 7	960	(1302)	1-1/8 - 12	1030	(1397)
1-1/4 - 7	1360	(1844)	1-1/4 - 12	1500	(2034)
1-1/2 - 6	2360	(3200)	1-1/2 - 12	2660	(3607)

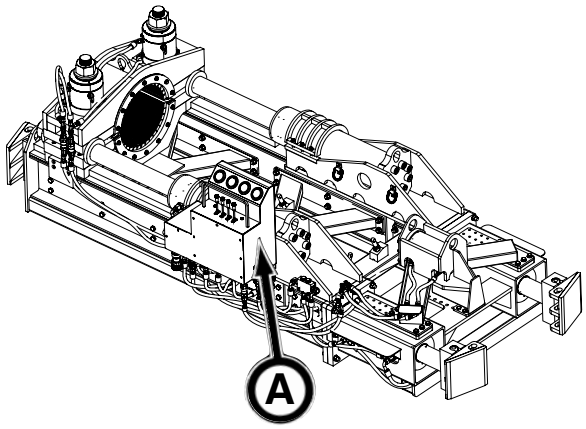
Identification Numbers

Model and serial numbers are required when ordering parts or requesting service information. Record your model and serial numbers below.

PIPE THRUSTER FRAME (A)

Model Number _____

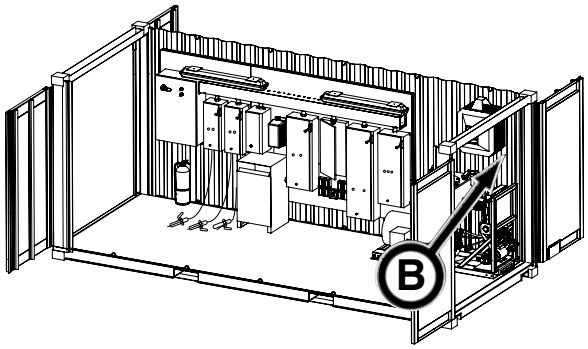
Serial Number _____



PIPE THRUSTER CONTAINER (B)

Model Number _____

Serial Number _____



NOTES

Safety Data Sheets

The Federal Occupational, Safety, and Health Administration (OSHA) Standard 29 CFR 1910.1200, require that specific safety data sheets (SDS) be available to employees before operating this equipment. This may include information on substances contained in this equipment such as hydraulic fluid and gear lubricant.

Akkerman Inc. will provide, at no cost, SDS which apply to its product line. Simply contact your Akkerman Aftermarket Support representative for a copy.

To ensure a prompt response to your SDS request, include your return address (including zip or postal code) and the equipment's model numbers and serial numbers with your request.

NOTES

Warranty

Akkerman warrants that all equipment manufactured by it be free from defects due to workmanship or material when normally used and serviced for a period of 90 days from the date of shipment by Akkerman. Normal wear and tear to the equipment, including, but not limited to, wear on the cutter face tooling, hydraulic filters, augers, casings, slurry line and seals is not covered by this warranty. Akkerman does not warrant that the equipment meets the requirements of any particular safety code or rule governing equipment classification. If the Customer has questions about local safety codes, rules or ordinances, authorities local to the project should be consulted.

In order to be considered as a potential warranty claim, the component in question must be returned to Akkerman (freight prepaid) for factory inspection and analysis, and determination of warranty applicability. No warranty is provided for electronics or electrical components of any kind. The validity of all warranty claims are subject to the discretion and determination of the Akkerman Aftermarket Support Department. All such determinations are final.

NOTES

Parts
Contents

INTRODUCTION

This parts section of the manual contains assembly illustrations of the Akkerman Pipe Thruster Frame and Pipe Thruster Container. The illustrations in this section are intended to show typical construction of various parts. In some instances, the details of parts illustrated may not exactly represent their actual appearance, but will help to identify parts performing the same functions.

LOCATING PARTS
This manual is organized to help you locate parts information quickly. An Alphabetical Index, Section 17, is provided to determine the page number of the assembly a part is used. If the part number is known, the Numerical Index, Section 18, can also be utilized to find the page number of the assembly.

USE GENUINE AKKERMAN PARTS
The use of second-rate parts could affect the efficient performance of the Power Pack.
ALWAYS use genuine Akkerman parts.

PARTS ORDERING
To order fast, accurate, and reliable parts service, call (800) 533-0386, (507) 567-2261, or fax (507) 567-2720, and provide the following information.

1. Model Number
2. Serial Number
3. Part Number, Description, and Quantity
4. Shipping Preference

MEASUREMENTS
The unit of measure in this manual is in inches unless indicated otherwise.

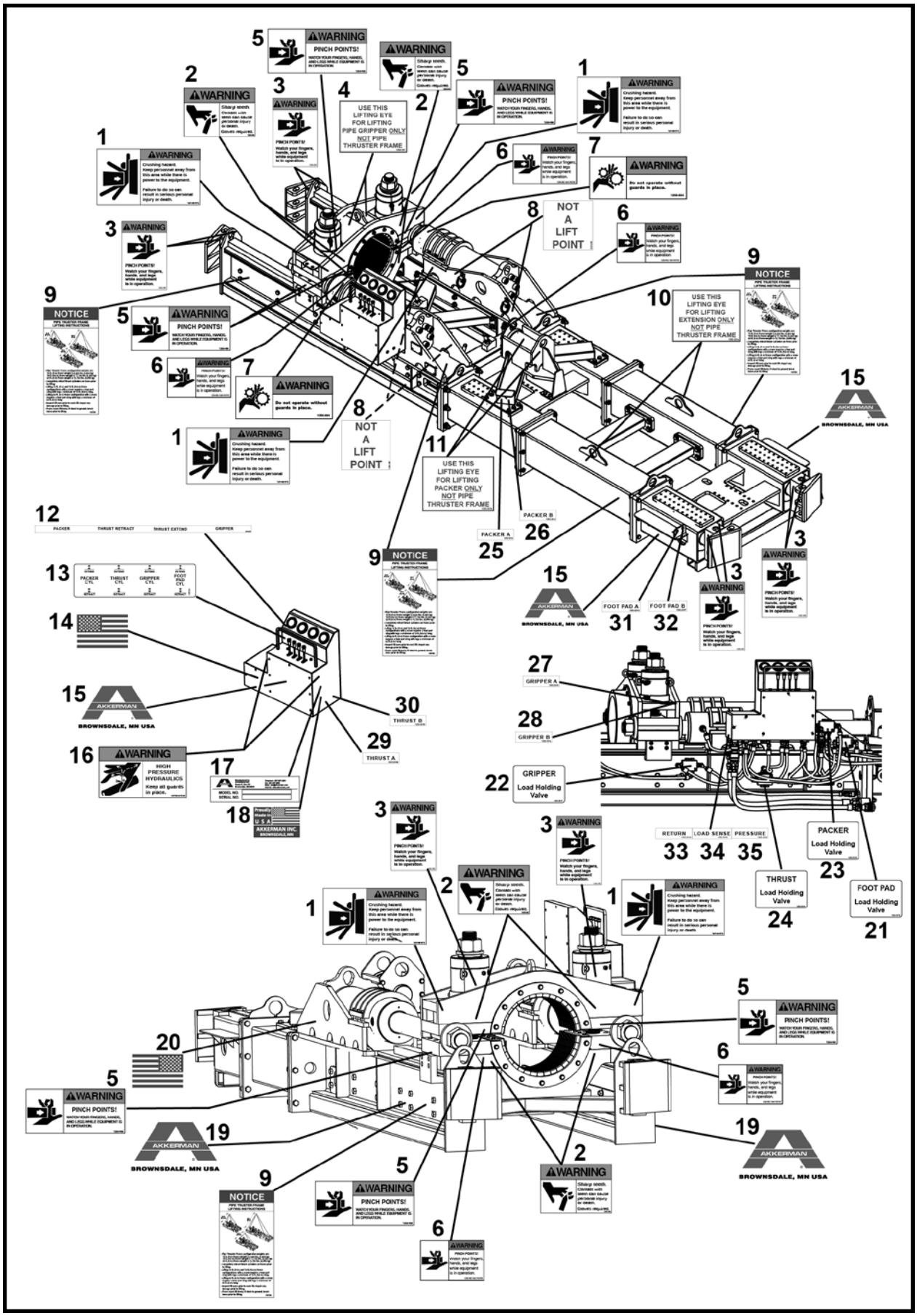
HARDWARE SPECIFICATION
All Akkerman products are assembled with SAE Grade 8 bolts, nuts, and washers. ALWAYS use matched fastener hardware when replacing or repairing the unit.

If you find any errors with this manual or have any suggestions for improvement, please let us know.
Mail your suggestions to:
Akkerman Inc, ATTN: Technical Publications, 58256 266th Street, Brownsdale, MN 55918.

Akkerman Inc. reserves the right to improve its product without notice or obligation.

NOTES

PIPE THRUSTER FRAME DECALS, 1255-135

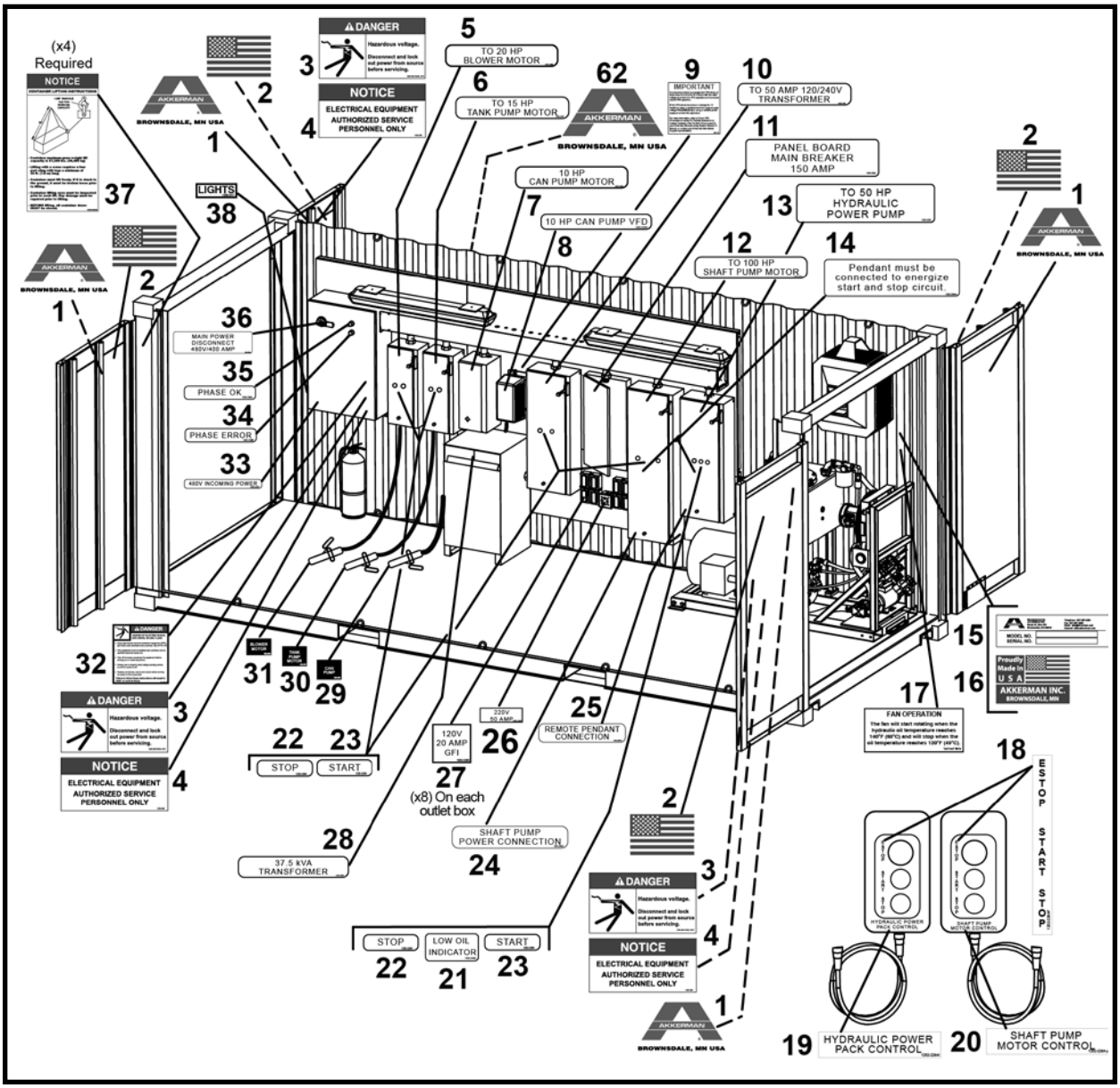


PIPE THRUSTER FRAME DECALS, 1255-135

ITEM	QTY	PART NO.	DESCRIPTION
0	1	1255-134	KIT, Decal, Pipe Thruster Frame
1	6	1251-458	DECAL, Warning Crushing Hazard
2	8	1252-232	DECAL, Warning Sharp Teeth
3	10	1252-233	DECAL, Warning Pinch Points, Vertical
4	2	1252-231	DECAL, Pipe Gripper Lift Only
5	8	1250-480	DECAL, Warning Pinch Points
6	5	1250-562	DECAL, Warning Pinch Points
7	2	1250-004	DECAL, Warning Guards
8	4	1251-066	DECAL, Not a Lift Point
9	6	1252-230	DECAL, Notice Lifting Instructions
10	2	1252-231A	DECAL, Extension Lift Only
11	2	1252-231B	DECAL, Packer Lift Only
12	1	1252-231D	DECAL, Pipe Thruster Gauges
13	1	1252-231C	DECAL, Pipe Thruster Controls
14	1	1250-559	DECAL, USA Flag, Medium
15	3	1251-246	DECAL, Akkerman, Large
16	2	1250-003	DECAL, Warning High Pressure Hydraulics
17	1	REF	PLATE, Serial Number
18	1	1250-544	DECAL, Made in USA
19	2	1251-245	DECAL, Akkerman Logo XL
20	1	1251-325	DECAL, USA Flag, Medium, Right
21	1	1252-231E	DECAL, Foot Pad Load Holding Valve
22	1	1252-231F	DECAL, Gripper Load Holding Valve
23	1	1252-231G	DECAL, Packer Load Holding Valve
24	1	1252-231H	DECAL, Thrust Load Holding Valve
25	1	1252-231I	DECAL, Packer A
26	1	1252-231J	DECAL, Packer B
27	1	1252-231K	DECAL, Gripper A
28	1	1252-231L	DECAL, Gripper B
29	1	1252-231M	DECAL, Thrust A
30	1	1252-231N	DECAL, Thrust B
31	1	1252-231O	DECAL, Foot Pad A
32	1	1252-231P	DECAL, Foot Pad B
33	1	1252-231Q	DECAL, Return
34	1	1252-231R	DECAL, Load Sense
35	1	1252-231S	DECAL, Pressure

REF - Reference

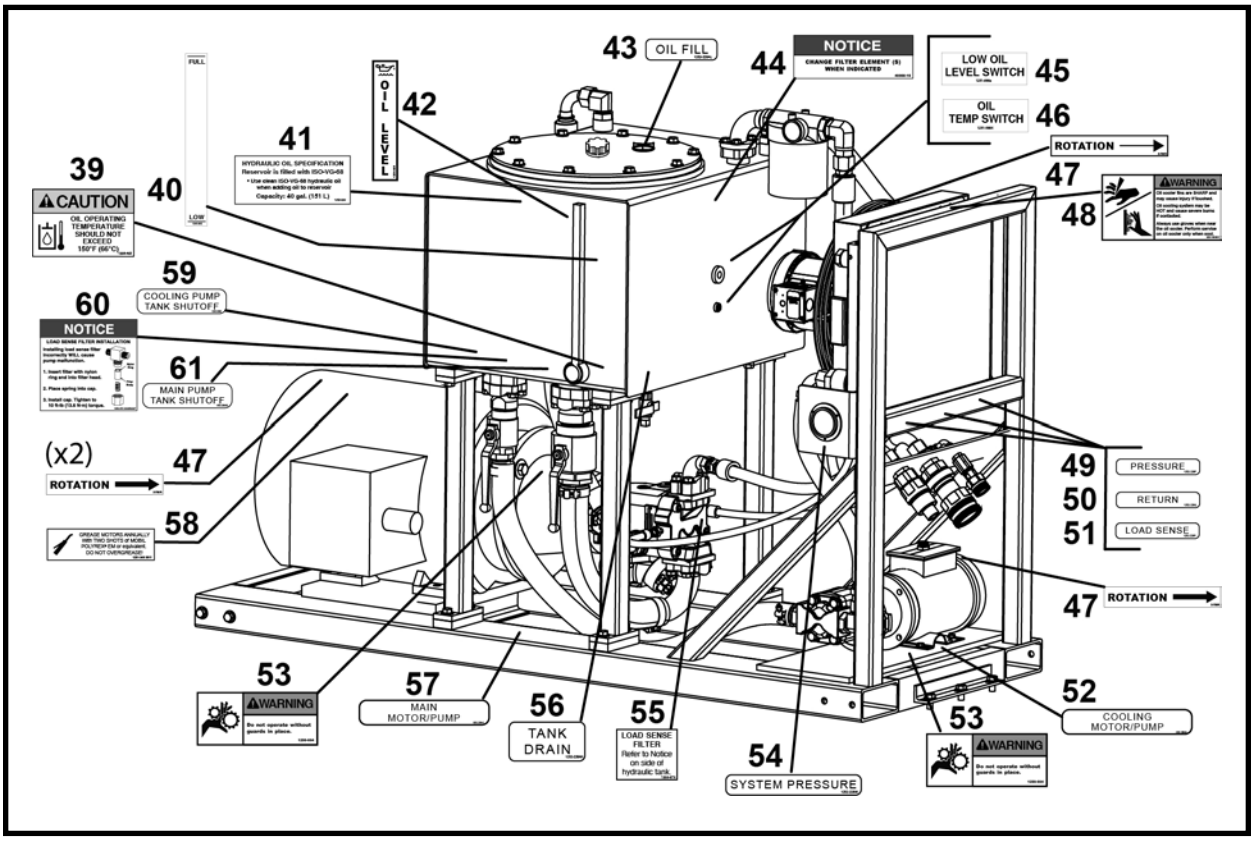
PIPE THRUSTER CONTAINER DECALS, 1255-134



ITEM	QTY	PART NO.	DESCRIPTION
0	1	1255-134	KIT, Pipe Thruster Power Pack Decal
1	4	1252-004	DECAL, Akkerman XX-Large
2	4	1250-560	DECAL, USA Flag, Large
3	3	1250-385	DECAL, Danger Hazardous Voltage
4	3	1250-383	DECAL, Notice Electrical Equipment
5	1	1252-228E	DECAL, To 20 HP Blower Motor
6	1	1252-228F	DECAL, To 15 HP Tank Pump Motor
7	1	1252-228G	DECAL, 10 HP Can Pump Motor
8	1	1252-228H	DECAL, 10 HP Can Pump VFD
9	1	1252-107	DECAL, Important Re-Energize VFD
10	1	1252-228I	DECAL, To 50 AMP 120/240V Transformer
11	1	1252-228J	DECAL, Panel Board Main Breaker 150 Amp
12	1	1252-228K	DECAL, To 100 HP Shaft Pump Motor
13	1	1252-228L	DECAL, To 50 HP Hydraulic Power Pump
14	2	1252-228AA	DECAL, Pendant Must be Connected
15	-	REF	PLATE, Serial Number
16	1	1250-544	DECAL, Made in USA
17	1	1251-591	DECAL, Fan Operation
18	2	1252-228AF	DECAL, EStop Start Stop
19	1	1252-228AI	DECAL, Hydraulic Power Pack Control
20	1	1252-228AJ	DECAL, Hydraulic Shaft Pump Motor Control
21	1	1252-228M	DECAL, Low Oil Indicator
22	4	1252-228O	DECAL, Stop

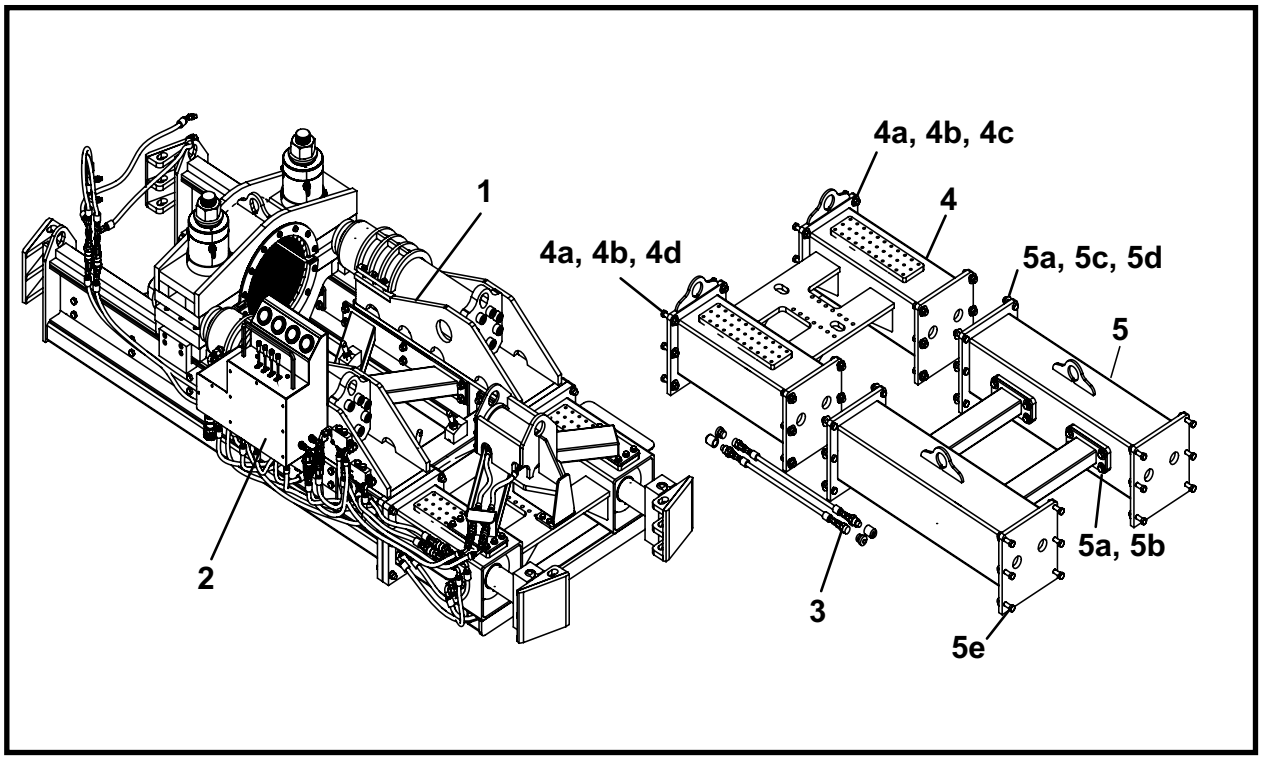
(Continued on next page)

PIPE THRUSTER CONTAINER DECALS, 1255-134



ITEM	QTY	PART NO.	DESCRIPTION
23	4	1252-228N	DECAL, Start
24	1	1252-228AK	DECAL, Shaft Pump Power Connection
25	2	1252-228AG	DECAL, Remote Pendant Connection
26	1	1252-228Y	DECAL, 220V 50 AMP
27	8	1252-228X	DECAL, 120V 20 AMP GFI
28	1	1252-228V	DECAL, 37.5 kVA Transformer
29	2	1252-228U	DECAL, Can Pump
30	2	1252-228T	DECAL, Tank Pump Motor
31	2	1252-228S	DECAL, Blower Motor
32	1	1251-865	DECAL, Danger Arc Flash
33	1	1252-228D	DECAL, 480V Incoming Power
34	1	1252-228B	DECAL, Phase Error
35	1	1252-228A	DECAL, Phase OK
36	1	1252-228C	DECAL, Main Power Disconnect 480V-400AMP
37	4	1252-228AM	DECAL, Notice Container Lifting Instructions
38	1	1250-517	DECAL, Lights
39	1	1250-483	DECAL, Caution, Oil Temp
40	1	1250-932	DECAL, Tank Level
41	1	1252-229	DECAL, Hydraulic Oil Specification 68/40 gal.
42	1	1250-649	DECAL, Oil Level
43	1	1252-228AL	DECAL, Oil Fill
44	1	40000-16	DECAL, Notice Change Filter Element
45	1	1251-860Z	DECAL, Low Oil Level Switch
46	1	1251-589X	DECAL, Oil Temp Switch
47	4	3-700R	DECAL, Rotation Right
48	1	1251-749	DECAL, Warning Oil Cooler Fins
49	1	1252-228P	DECAL, Pressure Service Load
50	1	1252-228Q	DECAL, Return Service Load
51	1	1252-228R	DECAL, Load Sense Service Load
52	1	1252-228AD	DECAL, Cooling Motor/Pump
53	2	1250-004	DECAL, Warning, Guards
54	1	1252-228W	DECAL, System Pressure
55	1	1250-873	DECAL, Load Sense Filter
56	1	1252-228AH	DECAL, Tank Drain
57	1	1252-228AC	DECAL, Main Motor/Pump
58	1	1251-349	DECAL, Grease Motors Annually
59	1	1252-228Z	DECAL, Cooling Pump Tank Shutoff
60	1	1250-872	DECAL, Notice Load Sense Filter Installation
61	1	1252-228AB	DECAL, Main Pump Tank Shutoff
62	2	1251-272	DECAL, Akkerman XXX-Large

PIPE THRUSTER ASSEMBLY AND FRAME EXTENSIONS, F62213F

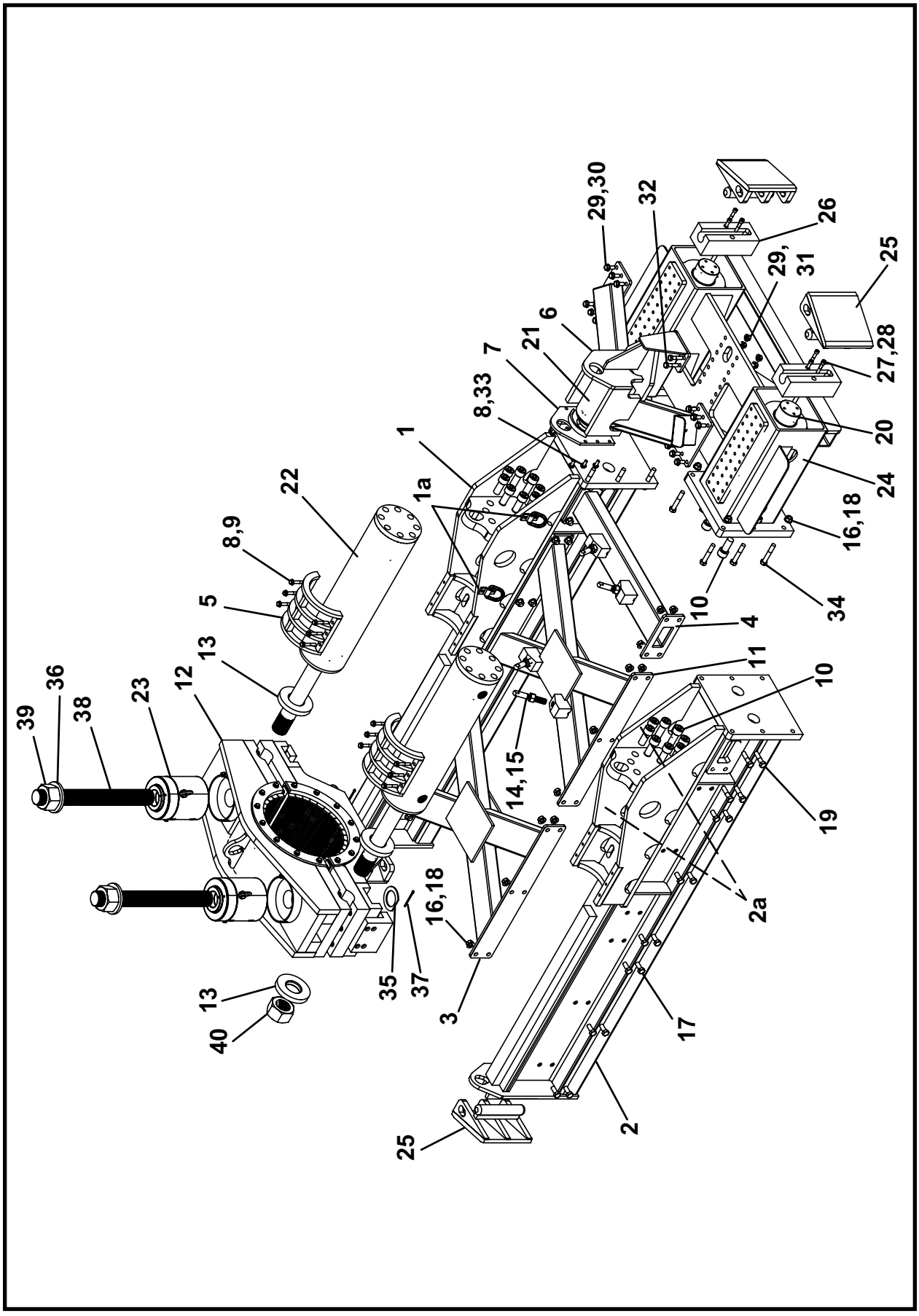


ITEM	QTY	PART NO.	DESCRIPTION
0	1	F62213F	ASSEMBLY, Pipe Thruster & Frame Extensions
1	1	062058A	ASSEMBLY, 16.25” Pipe Thruster
2*	1	062214A	ASSEMBLY, Pipe Thruster Hydraulics
3**	1	062221A	ASSEMBLY, Pusher Whip Hose
4	1	062264A	SPACER, 16’ (Includes items 4a - 4d)
4a	24	P0003-12-000	NUT, 3/4 UNC
4b	24	P0040-012	WASHER, Hardened Flat 3/4
4c	12	P0001-12-012	BOLT, Hex 3/4 UNC x 3
4d	12	P0001-12-014	BOLT, Hex 3/4 UNC x 3.5
5	1	062274A	EXTENSION, 20’ Frame Extension (Includes items 5a - 5e)
5a	40	P0040-012	WASHER, Hardened Flat 3/4
5b	16	P0001-12-006	BOLT, Hex 3/4 UNC x 1.5
5c	24	P0003-12-000	NUT, 3/4 UNC
5d	12	P0001-12-012	BOLT, Hex 3/4 UNC x 3
5e	12	P0001-12-014	BOLT, Hex 3/4 UNC x 3.5

* Refer to this section for parts information.
** Used with 16’ or 20’ caisson or extensions.

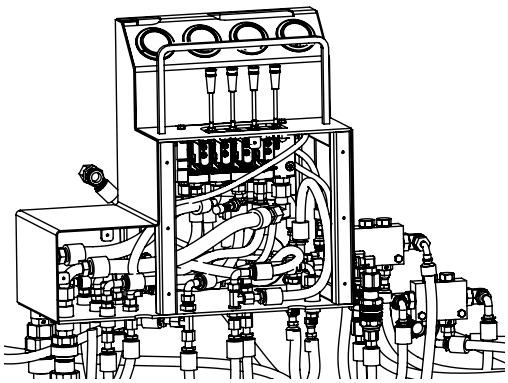
NOTES

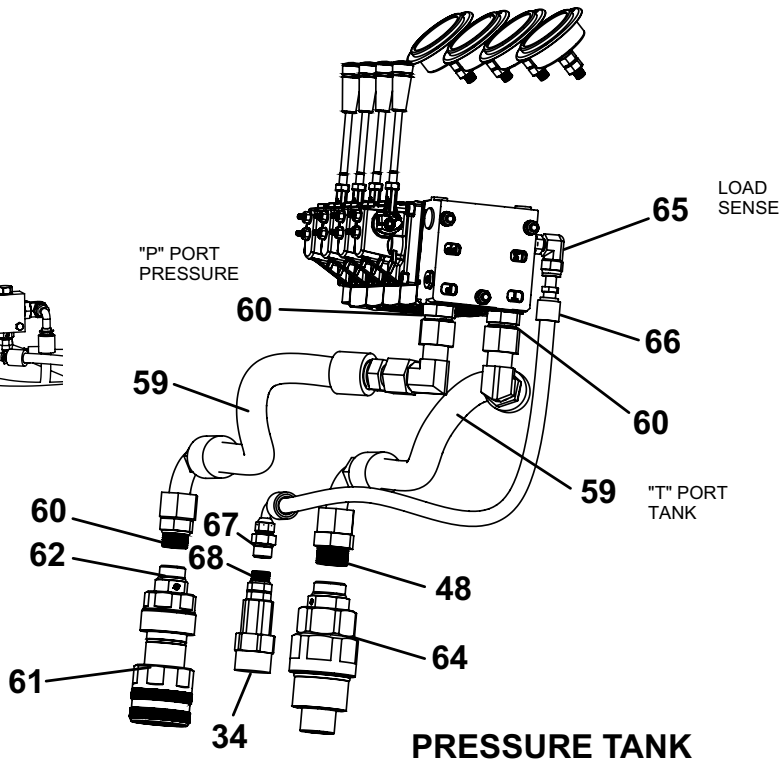
PIPE THRUSTER ASSEMBLY, 062058A



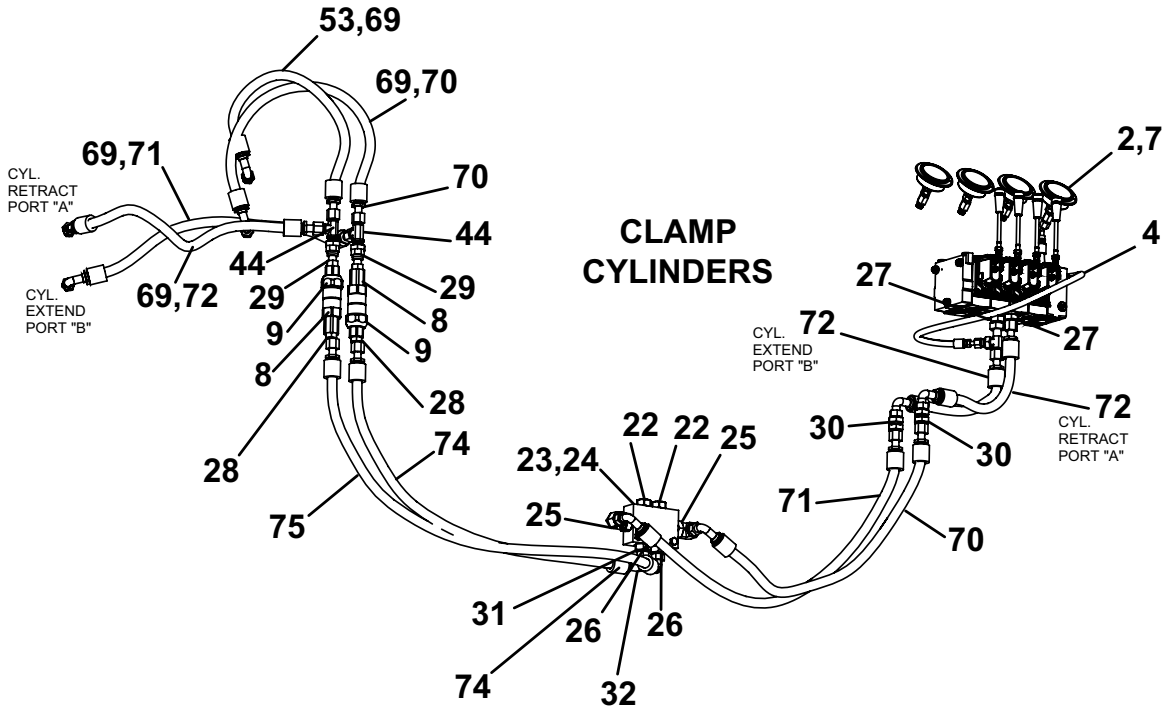
PIPE THRUSTER ASSEMBLY, 062058A

ITEM	QTY	PART NO.	DESCRIPTION
0	1	062058A	ASSEMBLY, Pipe Thruster
1	1	061916A	ASSEMBLY, Frame, Right (includes item 1a)
1a	2	P0079-003	RING, D 1/2
2	1	061973A	ASSEMBLY, Frame, Left (includes item 2a, not shown)
2a	2	P0079-003	RING, D 1/2
3	1	061908A	BRACE, Cross
4	1	062060A	TUBE, Cross
5	2	061968A	CLAMP, Cylinder, Top
6	1	061936A	MOUNT, Packer Cylinder Back
7	1	061939A	MOUNT, Packer Cylinder Front
8	18	P0040-008	WASHER, Flat 1/2
9	12	P0001-08-012	BOLT, Hex 1/2 UNC x 3
10	20	P0031-20-012	SCREW, Socket Head Cap 1-1/4 UNC x 3
11	1	062092A	BRACE, Cross
12	1	062022A	ASSEMBLY, Pipe Gripper
13	4	062059P	WASHER
14	4	062061P	PIN, Tube Support
15	4	P0003-16-000	NUT, 1
16	44	P0003-12-000	NUT, 3/4
17	24	P0001-12-007	BOLT, Hex 3/4 UNC x 1.75
18	44	P0040-012	WASHER, Hardened Flat 3/4
19	8	P0001-12-012	BOLT, Hex 3/4 UNC x 3
20	2	P0307-250	CYLINDER, Feet
21	1	P0307-251	CYLINDER, Packer
22	2	P0307-252	CYLINDER, Frame
23	2	P0307-253	CYLINDER, Gripper
24	1	062065A	MOUNT, Wall Cylinder Rear
25	4	062072A	ASSEMBLY, Foot
26	2	062081P	MOUNT, Foot
27	4	P0031-08-005	SCREW, Socket Head Cap 1/2 x 1.25
28	4	P0031-08-010	SCREW, Socket Head Cap 1/2 x 2.5
29	16	P0040-010	WASHER, Hardened Flat 5/8
30	12	P0001-10-006	BOLT, Hex 3 5/8 UNC x 1.5
31	4	P0003-10-000	NUT, 5/8
32	4	P0001-10-010	BOLT, Hex 5/8 UNC x 2.5
33	6	P0001-08-005	BOLT, Hex 1/2 UNC x 1.25
34	12	P0001-12-018	BOLT, Hex 3/4 UNC x 4.5
35	2	062095P	WASHER
36	2	062096P	WASHER
37	2	P0048-067	PIN, Cotter 1/4 x 3.5
38	2	062101P	ROD, Threaded 27
39	2	062100P	NUT, 3
40	2	P0005-36-000	NUT, 3





PRESSURE TANK LOAD SENSE

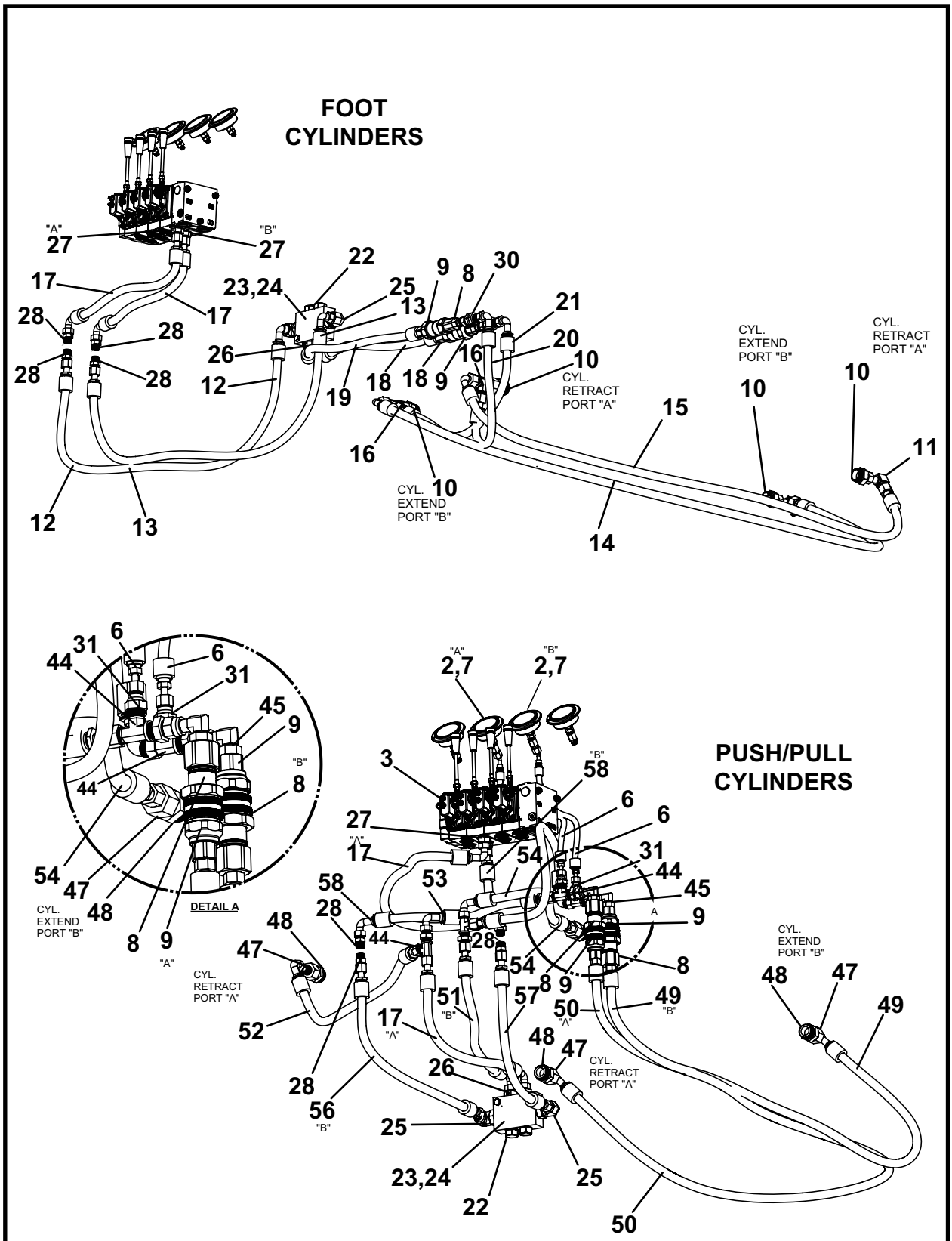


062214A drawings continued on next pages.

PIPE THRUSTER HYDRAULICS, 062214A

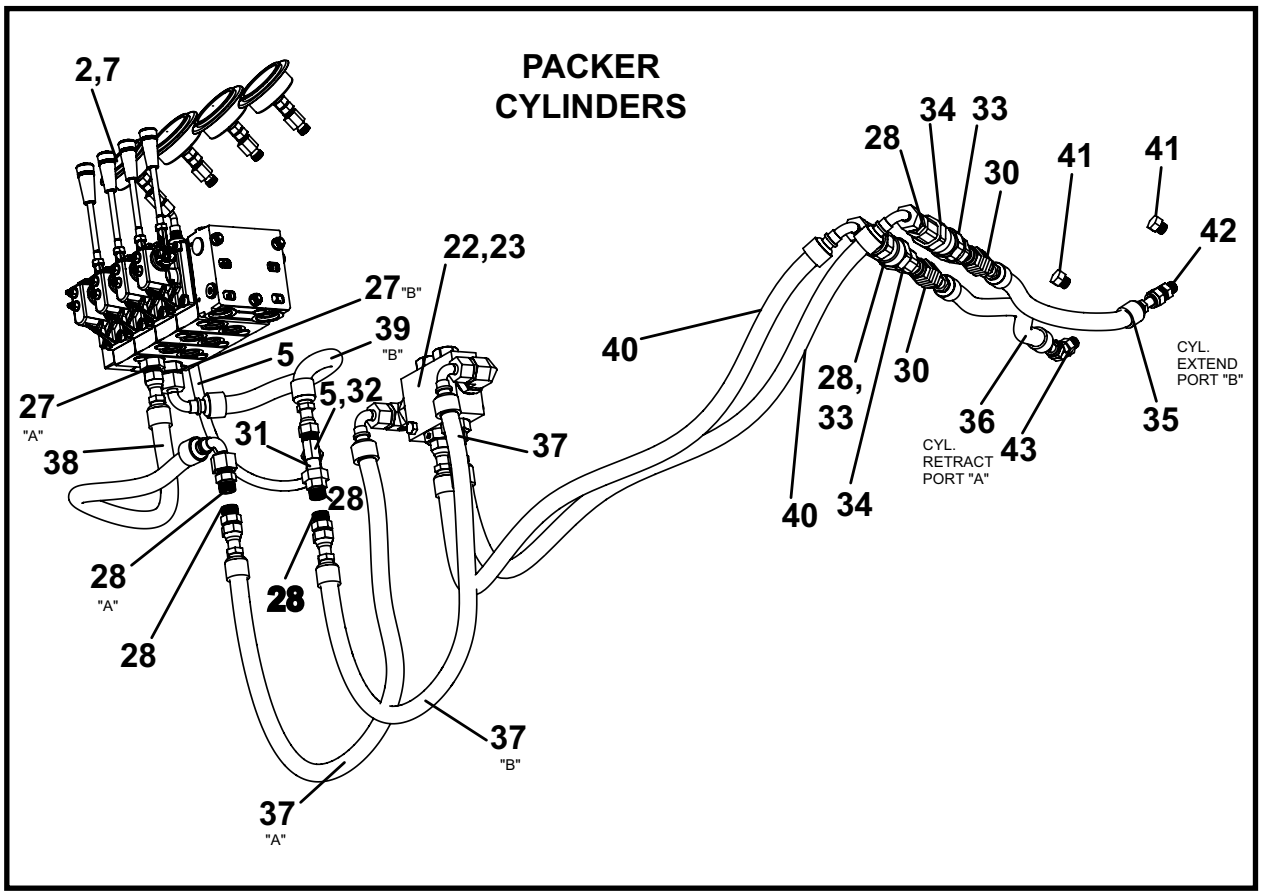
ITEM	QTY	PART NO.	DESCRIPTION
0	1	062214A	ASSEMBLY, Pipe Thruster Hydraulics
1	1	062223A	ENCLOSURE, Hydraulic Valve
2	4	P0301-146	GAUGE, 6000 PSI
3	1	P0302-936	VALVE, 4-Section
4	1	A09920A-063	ASSEMBLY, Hose 1/4 x 63
5	1	A09920A-030	ASSEMBLY, Hose 1/4 x 30
6	2	A09920A-022	ASSEMBLY, Hose 1/4 x 22
7	4	P0300-594	ADAPTER, 4FB-4MFFOR
8	6	P0100-112	COUPLER, 1/2 QD
9	6	P0100-111	NIPPLE, 1/2 QD
10	4	P0300-782	FITTING, 10MFFOR-16MB
11	2	P0300-389	FITTING, 10MFOR-10FFORX90
12	1	A10423A-046	ASSEMBLY, Hose 1/2 x 46
13	1	A10423A-051	ASSEMBLY, Hose 1/2 x 51
14	1	A10365A-091	ASSEMBLY, Hose 1/2 x 91
15	1	A10365A-070	ASSEMBLY, Hose 1/2 x 70
16	2	P0300-422	FITTING, 10MFOR-10FFORX-10MFOR
17	4	A10323A-023	ASSEMBLY, Hose 1/2 x 23
18	1	A10423A-022	ASSEMBLY, Hose 1/2 x 22
19	1	A10423A-024	ASSEMBLY, Hose 1/2 x 24
20	1	A10421A-024	ASSEMBLY, Hose 1/2 x 24
21	1	A10421A-025	ASSEMBLY, Hose 1/2 x 25
22	8	P0302-873	CARTRIDGE
23	4	P0302-872	BODY, Dual PO Check
24	8	P0001-06-007	BOLT, 3/8 UNC x 1.75
25	8	P0300-373	FITTING, 08MFOR-12MB90
26	8	P0300-375	FITTING, 08MFOR-12MB
27	8	P0300-300	FITTING, 08MFOR-10MB
28	17	P0300-305	FITTING, 08MFOR-08MB
29	6	P0300-401	FITTING, 08MB-08FFORX
30	6	P0300-595	FITTING, 8MFFOR-8MFFOR-BKHD
31	4	P0300-395	FITTING, 08FFOR-04MFOR
32	2	P0300-318	FITTING, 08MFOR-08FFORX-08MFOR
33	2	P0100-109	NIPPLE, 3/8 QD
34	3	P0100-110	COUPLER, 3/8 QD
35	1	A10088A-015	ASSEMBLY, Hose 3/8 x 15
36	1	A10088A-019	ASSEMBLY, Hose 3/8 x 19
37	2	A08569A-032	ASSEMBLY, Hose 3/8 x 32
38	1	A08569A-026	ASSEMBLY, Hose 3/8 x 26
39	1	A08569A-019	ASSEMBLY, Hose 3/8 x 19
40	2	A08569A-052	ASSEMBLY, Hose 3/8 x 52
41	2	P0300-027	FITTING, 06MB-PLUG
42	1	P0300-356	FITTING, 06MFOR-06MB
43	1	P0300-612	FITTING, 06MFOR-06MB45
44	6	P0300-303	FITTING, 08MFOR-08MFOR-BKHD-08MFOR
45	2	P0300-812	FITTING, 08FFORX-08MB90
46	1	P0300-316	FITTING, 08MFOR-08MB90
47	4	P0300-622	FITTING, 12FFOR-08MFOR
48	5	P0300-378	FITTING, 12MFFOR-16MB
49	1	A10423A-085	ASSEMBLY, Hose 1/2 x 85
50	1	A10423A-109	ASSEMBLY, Hose 1/2 x 109
51	1	A10323A-022	ASSEMBLY, Hose 1/2 x 22
52	1	A10323A-028	ASSEMBLY, Hose 1/2 x 28

062214A Drawings continued on next pages.



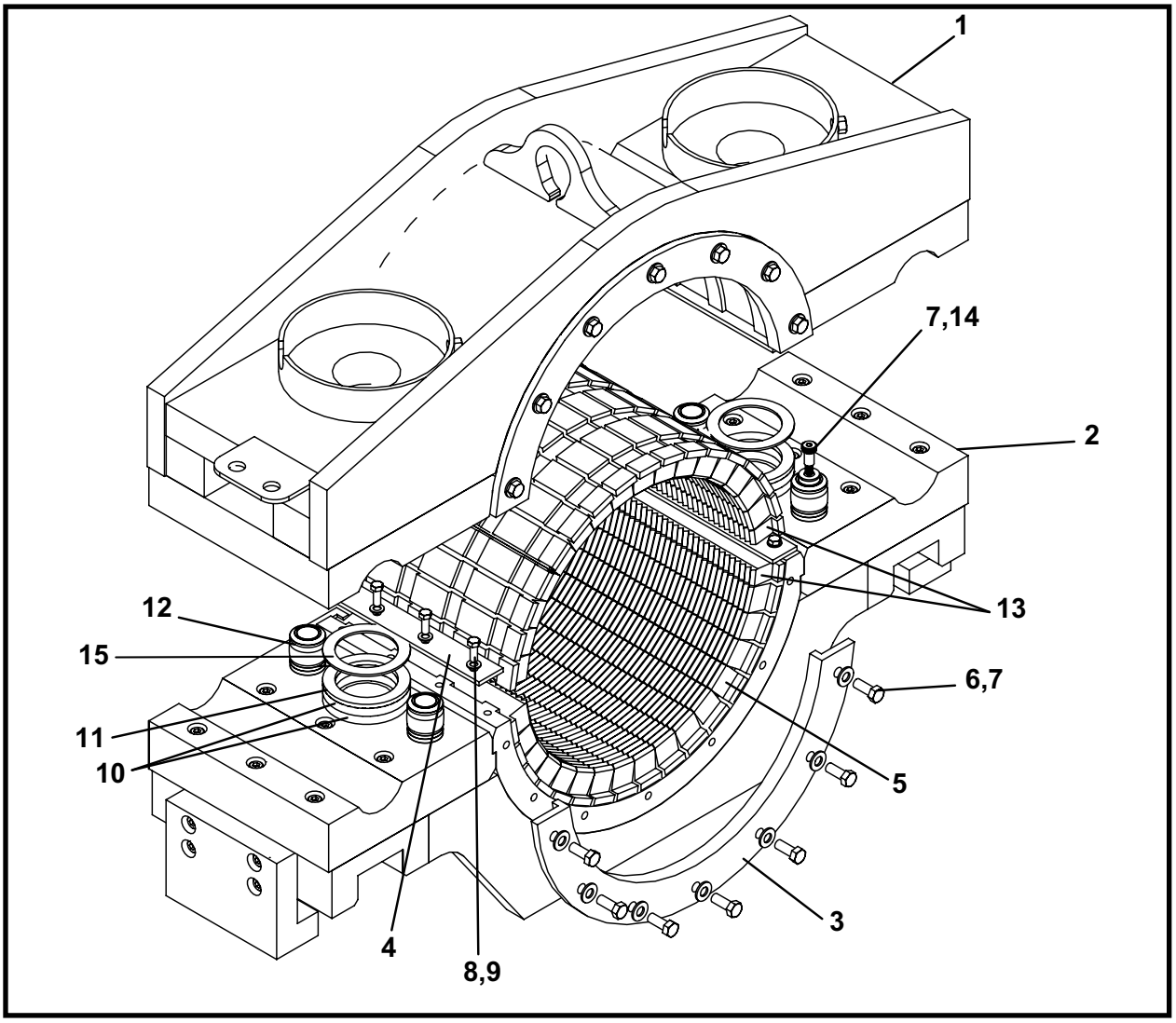
062214A drawings continued on next pages.

PIPE THRUSTER HYDRAULICS, 062214A



ITEM	QTY	PART NO.	DESCRIPTION
53	2	A10323A-026	ASSEMBLY, Hose 1/2 x 26
54	1	A10323A-014	ASSEMBLY, Hose 1/2 x 14
55	1	A10323A-034	ASSEMBLY, Hose 1/2 x 34
56	1	A10321A-026	ASSEMBLY, Hose 1/2 x 26
57	1	A10321A-020	ASSEMBLY, Hose 1/2 x 20
58	1	A10323A-020	ASSEMBLY, Hose 3/4 x 20
59	2	A10331A-022	ASSEMBLY, Hose 3/4 x 22
60	3	P0300-329	FITTING, 12MFFOR-12MB
61	1	P0100-103	COUPLER, Half, Female 3/4
62	1	P0300-884	FITTING, 12MB-12MB
63	1	P0300-473	FITTING, 16MB-16MB
64	1	P0100-100	NIPPLE, Half, Male 1
65	1	P0300-429	FITTING, 06MFOR-05MB90
66	1	A10327A-030	ASSEMBLY, Hose 1/4 x 30
67	1	P0300-430	FITTING, 06MFOR-08MB
68	1	P0300-542	FITTING, 08MB-08MB
69	4	P0300-795	FITTING, 06MP-08MFFOR
70	2	A10323A-030	ASSEMBLY, Hose 1/2 x 30
71	2	A10323A-038	ASSEMBLY, Hose 1/2 x 38
72	2	A10323A-016	ASSEMBLY, Hose 1/2 x 16
73	1	A10322A-040	ASSEMBLY, Hose 1/2 x 40
74	1	A10322A-041	ASSEMBLY, Hose 1/2 x 41
75	1	A10322A-047	ASSEMBLY, Hose 1/2 x 47
76	2	P0300-317	FITTING, 08MFOR-08FFORX90
77	5	P0040-006	WASHER, Hardened Flat 3/8
78	5	P0001-06-006	BOLT, Hex 3/8 UNC x 1.5
79	4	P0001-05-002	BOLT, Hex 5/16 UNC x 0.5
80	4	P0040-005	WASHER, 5/16 Hardened Flat
81	2	P0300-424	FITTING, 12MFOR-12FFORX90

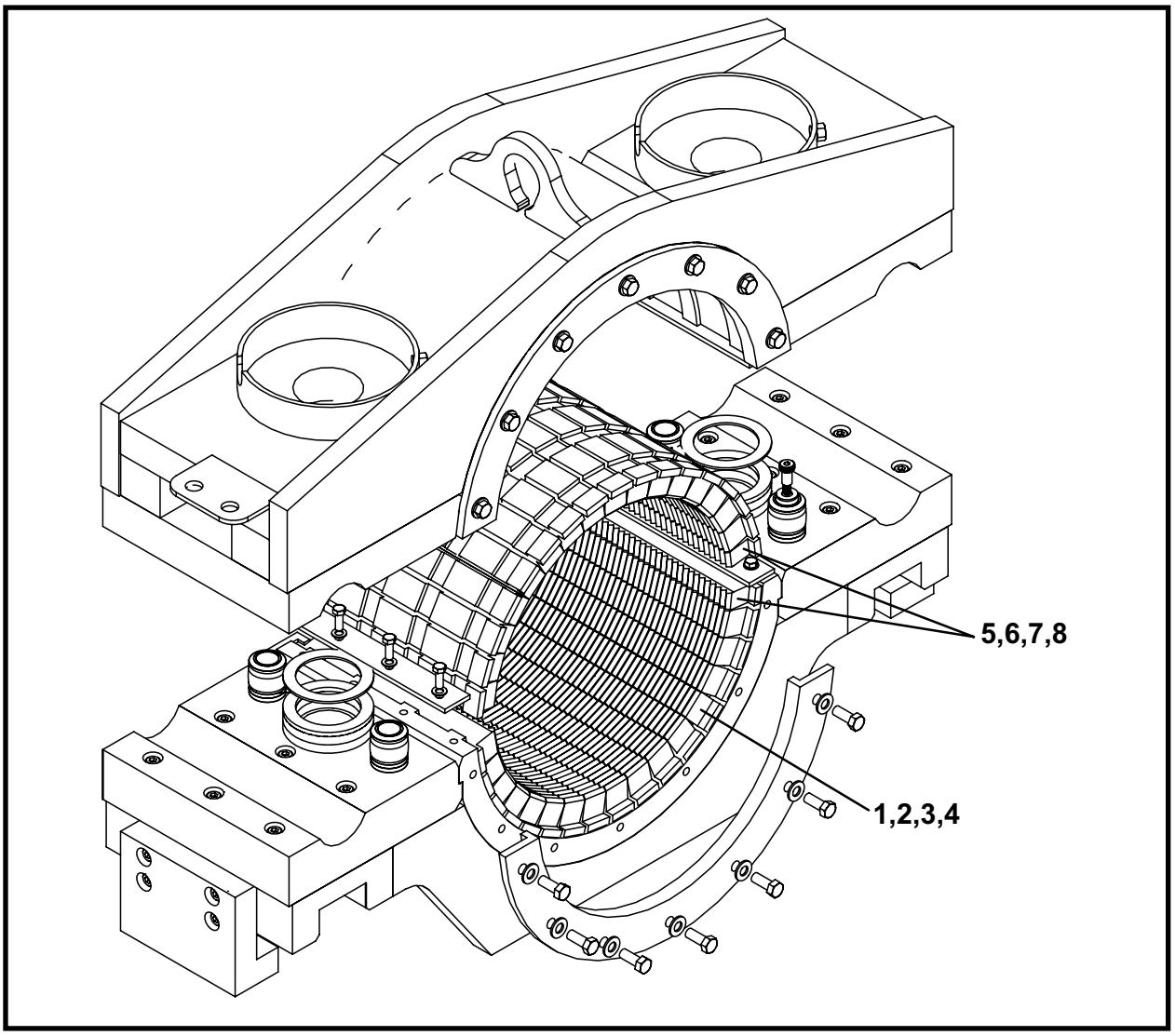
PIPE THRUSTER GRIPPER ASSEMBLY, 062022A



ITEM	QTY	PART NO.	DESCRIPTION
0	1	062022A	ASSEMBLY, Pipe Thruster Gripper
1	1	062027A	ASSEMBLY, Pipe Thruster Gripper Top
2	1	062043A	ASSEMBLY, Pipe Thruster Gripper Bottom
3.1	4	062044P	RING, Gripper Holding Bar 16.25
3.2	4	062211P	RING, Gripper Holding Bar 18.27
4	4	062050P	PLATE, Gripper Holding Bar
5*	-	REF	TEETH, Gripper
6	28	P0001-08-005	BOLT, Hex 1/2 UNC x 1.25
7	32	P0040-008	WASHER, Hardened Flat 1/2
8	16	P0040-006	WASHER, Hardened Flat 3/8
9	16	P0001-06-004	BOLT, Hex 3/8 UNC x 1
10	4	062302P	WASHER, 1/2 x 3.25 x 0.5
11	2	062303P	WASHER, 1/2 x 3.25 x 0.25
12	4	P0253-141	BUMPER, Rubber
13*	-	REF	TEETH, Gripper x 1
14	4	P0030S-06-003	BOLT, Shoulder 1/2 x 0.875
15	2	062328P	WASHER, 4-1/2 x 3.25 x 0.12

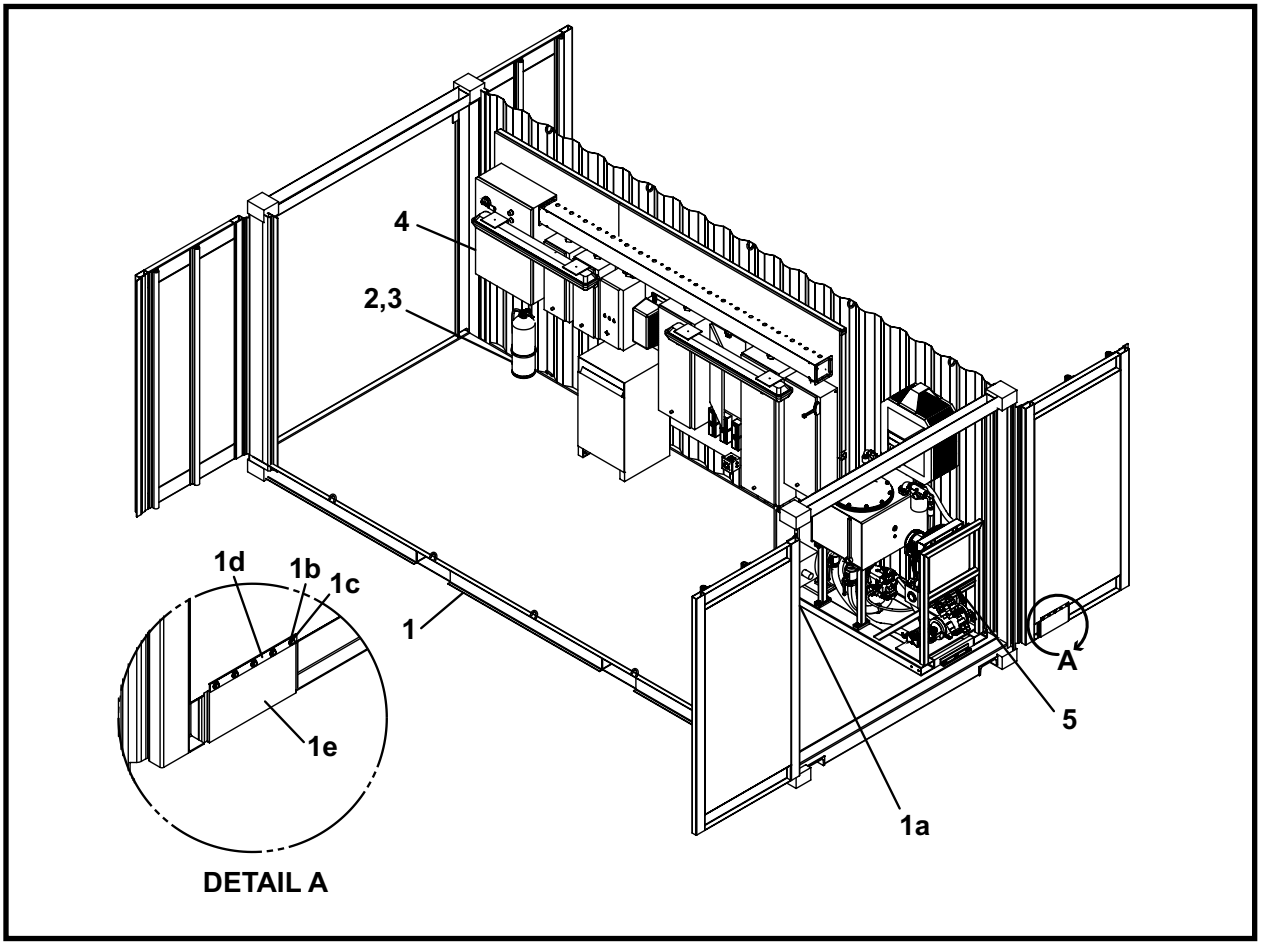
* Refer to Gripper Teeth in this section.

GRIPPER TEETH



ITEM	QTY	PART NO.	DESCRIPTION
1	32	062051P	TEETH, Straight 16.25
2	32	062057P	TEETH, Angled 16.25
3	36	062210P	TEETH, Straight 18.27
4	36	062209P	TEETH, Angled 18.27
5	2	062311P	TEETH, Straight 16.25 x 1
6	2	062312P	TEETH, Straight 18.27 x 1
7	2	062313P	TEETH, Angled 16.25 x 1
8	2	062314P	TEETH, Angled 18.27 x 1

PIPE THRUSTER CONTAINER ASSEMBLY, F62002F

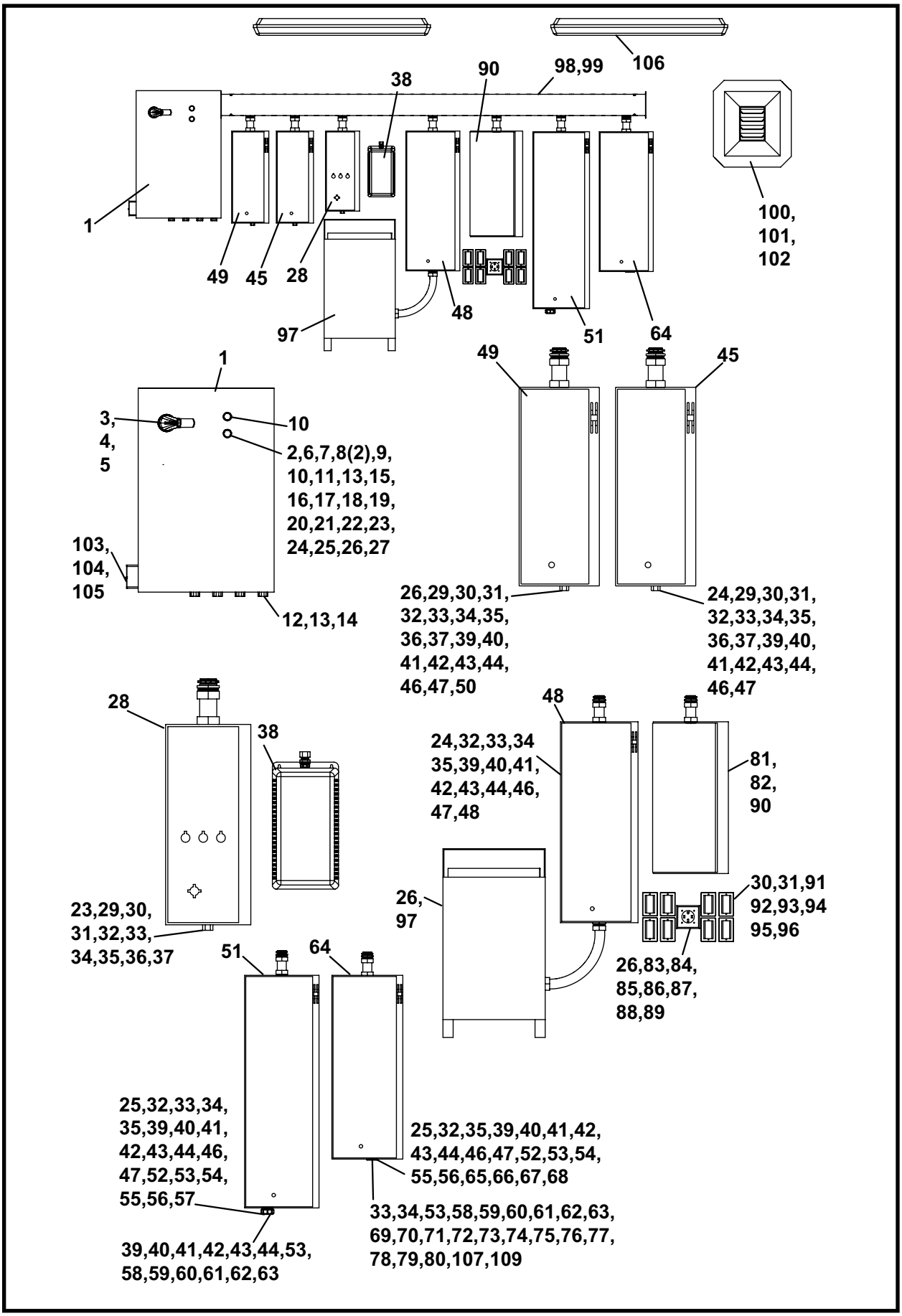


ITEM	QTY	PART NO.	DESCRIPTION
0	1	F62002F	ASSEMBLY, Pipe Thruster Container
1	1	061934A	ASSEMBLY, Container (Includes items 1a - 1e)
1a	2	A48119P	BRACKET, Skid Mount
1b	10	P0040-004	WASHER, Flat 1/4
1c	10	P0035-008	SCREW, Self Tap 1/4 x 1
1d	2	A44722P	MOUNT, Door Flap
1e	2	A40749P	FLAP, Rubber Door
2	1	F0095-110	FIRE EXTINGUISHER, #20
3	1	P0095-110A	BRACKET
4*	1	062083A	ASSEMBLY, Pipe Thruster Container Electric
5*	1	061995A	ASSEMBLY, Power Pack

* Refer to this section for parts information.

NOTES

PIPE THRUSTER CONTAINER ELECTRICAL ASSEMBLY, 062083A



PIPE THRUSTER CONTAINER ELECTRICAL ASSEMBLY, 062083A

ITEM	QTY	PART NO.	DESCRIPTION
0	1	062083A	ASSEMBLY, Pipe Thruster Container Electrical
1	1	P0251-422	BOX, Electrical
2	1	P0311-036	CLAMP, Ground
3	1	P0251-430	HANDLE, Rotary
4	1	P0251-595A	TERMINAL, 3 Pole Aluminum
5	1	P0251-429	BREAKER, 400 AMP
6	4	P0251-441	BLOCK, Power Distribution
7	1	P0251-398	TRANSFORMER, Control
8	1	P0310-1011	BREAKER, Circuit 480V 2 Pole 3A
9	1	P0310-472	FUSE, 6 Amp Time delay Class CC
10	1	P0251-1043	PILOT, Green LED, 480V
11	1	P0251-1042	PILOT, Red LED, 480V
12	4	P0311-034	BUSHING, 1 Insulating
13	4	P0311-020	NUT, 1
14	4	P0311-135	RELIEF, Strain
15	1	P0251-1033	BREAKER, 3 Phase 30 AMP
16	40 LI	P0054-012	WIRE, 16 Gage Standard
17	240 LI	P0054-409	WIRE, 4/0-1/C Motor Lead
18	1	P0054-664	PLUG, Brown Male Detach Cam Lock
19	1	P0054-665	PLUG, Orange Male Detach Cam Lock
20	1	P0054-666	PLUG, Yellow Male Detach Cam Lock
21	1	P0054-667	PLUG, Green Female 2/0-4/0 DSS
22	4	F61657F	ASSEMBLY, Power Cable
23	80 LI	P0054-002	CABLE, 12 Gage 4 Cond.
24	420 LI	P0054-264	WIRE, 4-1/C EPDM Motor Lead
25	450 LI	P0054-593	CABLE, 2 Gage D10
26	100 LI	P0054-001	CABLE, 4 Gage Welding
27	1	P0251-906	MONITOR, Phase 500VAC
28	1	P0310-1020	STARTER, Motor Disconnect 10HP
29	5	P0311-040	RELIEF, Strain Connector
30	21	P0311-018	NUT, 1/2
31	21	P0311-032	BUSHING, 1/2 Insulating
32	130 LI	P0312-024	LIQUATITE, 1-1/2
33	18	P0311-044	CONNECTOR, 1-1/2 Straight
34	18	P0311-048	NUT, 1-1/2
35	18	P0311-047	BUSHING, 1-1/2 Insulating
36	3	P0054-731	PLUG, 20A, 480VAC, IP67
37	3	P0054-732	RECEPTACLE, 20A, 480VAC, IP67
38	1	P0251-1034	VFD, Weg, 480VAC, 15HP
39	16	P0056-156	LIGHT, Pilot Control
40	7	P0310-411F	BUTTON, Illuminated 22.5 mm
41	7	P0310-412F	BUTTON, Illuminated 22.5 mm
42	7	P0056-121F	CONTACT
43	9	P0056-122F	BLOCK, Contact
44	11	P0310-419F	LATCH, Mounting 310-417
45	1	P0310-1021	DISCONNECT, Motor Starter 15HP
46	5	P0056-165	CONTACTOR, Auxillary 8502
47	11	P0310-1027	ADAPTER, 30mm to 22mm
48	1	P0310-1022	DISCONNECT, Motor Starter 40HP
49	1	P0310-1025	DISCONNECT, Motor Starter 20HP
50	600 LI	P0054-036	CORD, 4C 10GA
51	1	P0310-1023	DISCONNECT, Motor Starter 100HP
52	4	P0311-053	BUSHING, 2 Insulating
53	3	P0311-083	RELIEF, Strain Connector 2575

LI - Linear Inch

(Continued on next page)

PIPE THRUSTER CONTAINER ELECTRICAL ASSEMBLY, 062083A

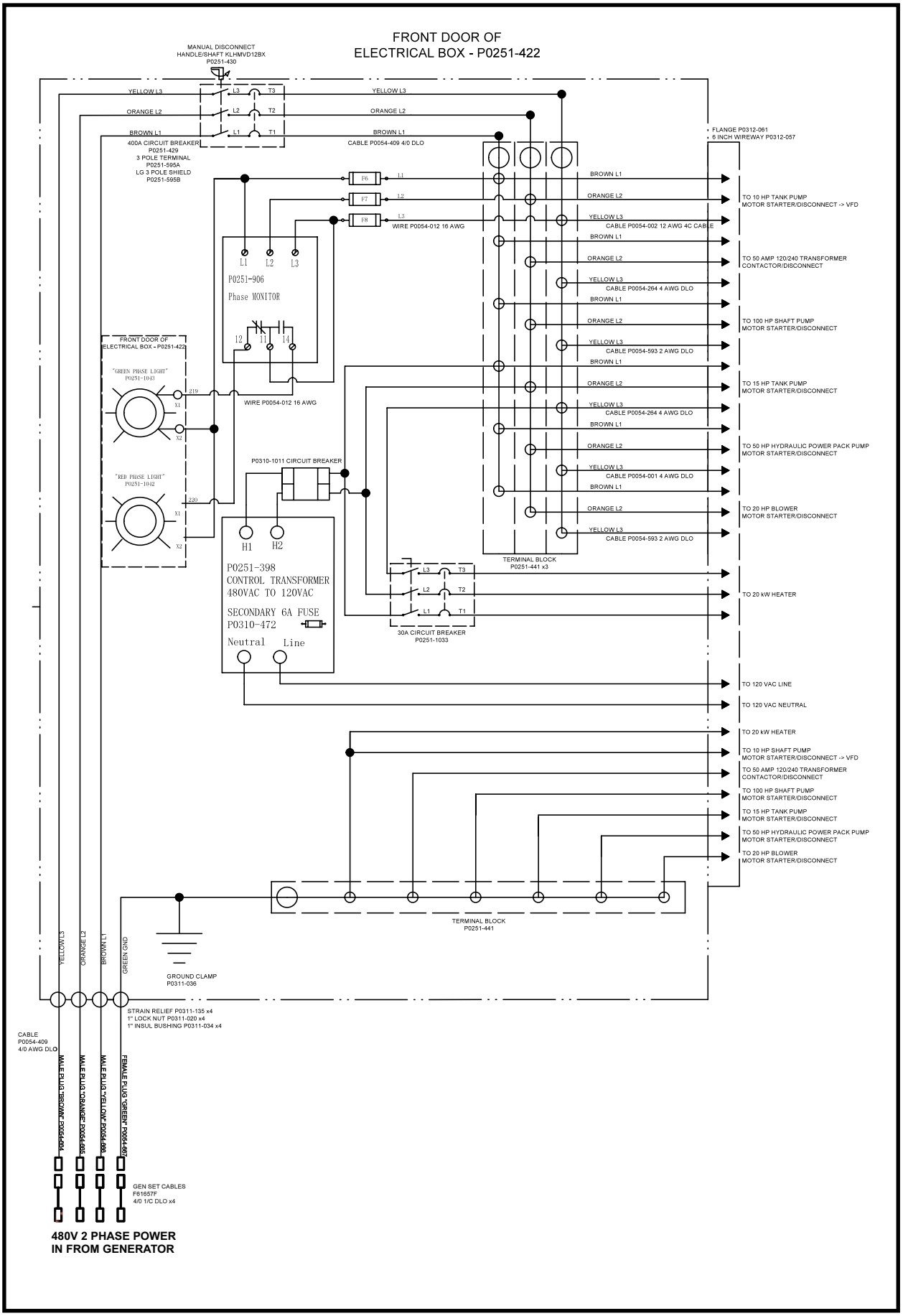
ITEM	QTY	PART NO.	DESCRIPTION
54	3	P0311-054	NUT, 2
55	2	P0054-729	CONNECTOR, 200A, 600V, Recaptacle
56	2	P0054-728	CONNECTOR, 200A, 600V, Plug
57	48 LI	P0054-017	CABLE, 1 4C TYPE W 5B-1014C
58	2	P0310-420F	BUTTON, E-Stop, Illuminated
59	2	P0251-1039	PENDANT, 3 POS, 22mm
60	5	P0056-131F	LATCH, Mounting 3-Across
61	2	P0054-216	RECEPTACLE, 6 C 16 GA Mini 3’
62	2	P0054-215	RECEPTACLE, 6 C 16 GA Mini 12
63	2	P0054-436	CABLE, 6C 16G Mini 150’
64	1	P0310-1024	DISCONNECT, Motor Starter 50HP
65	1	P0054-574	RECEPTACLE, 4C 18G MICRO 4’
66	2	P0313-049	RECEPTACLE, 4
67	2	P0251-563	LIGHT, White LED Pilot
68	1	P0250-074	SUPPLY, 24V 4.2A Power 120V
69	1	P0250-077	MOUNT, Din Rail
70	2	P0310-399K	REPLAY, Overload
71	2	P0251-263	STARTER, Size 9 IEC 5 HP 120V
72	2	P0054-288	CABLE, 4 C 16 GA MINI 12’
73	1	061299A	CABLE, 3C F MIC DK-3C 10’
74	1	P0054-540	CABLE, 4C M 4C F 22G Micro 15’
75	1	061300A	ASSEMBLY, Low Oil Switch
76	1	P0251-543	SWITCH, Temperature Single Set
77	96 LI	P0054-280	CABLE, 2 AWG 4 Conductor Type W
78	2	P0054-286	RECEPTACLE, 4 C 16 GA Mini 12
79	1	P0251-406	MOTOR, 50 HP
80	1	P0310-388A	MOTOR, 2 HP
81	1	P0251-1037	BREAKER, 2 Pole, 240V 50AMP
82	8	P0251-493B	BREAKER, Single Pole 20 AMP
83	1	P0251-1036	BOX, Steel, 3-Gang, 3.5 Deep
84	1	P0054-730	RECEPTACLE, 14-50R,50A,250V
85	1	P0251-1035	PLATE, SS, 50A, 2-Gang, 2.15”
86	2	P0311-019	NUT, 3/4
87	2	P0311-033	BUSHING, Insulating 3/4
88	2	P0311-006	CONNECTOR, Straight 3/4
89	24 LI	P0312-012	CONDUIT, 3/4
90	1	P0251-1038	BOX, Circuit Breaker Panel 150A
91	8	P0310-492B	RECEPTACLE, Cover Lift
92	8	P0310-105	BOX
93	8	P0310-795	OUTLET, 20 AMP
94	16	P0311-005	CONNECTOR, Straight 1/2
95	100 LI	P0312-008	CONDUIT, 1/2
96	300 LI	P0054-008	WIRE, 12 Gage
97	1	P0310-1026	TRANSFORMER, 37.5KVA 480V 240V
98	120 LI	P0312-057	WIREWAY, Cone 6 x 10’
99	2	P0312-061	FLANGE, End 6
100	1	P0093-050	THERMOSTAT, 20KW, 2-Stage
101	1	P0093-049	HEATER, 20kW, 480VAC 3-Phase
102	2	062295P	TUBE, Heater Mount 22
103	1	P0251-847	BOX, Electrical
104	1	P0251-848	COVER AND SWITCH
105	1	P0251-533	SWITCH, 120V
106	2	P0251-907	LIGHT, LED 4’ Vapor Tight 50W
107	3	P0251-838	RELAY, Coil 24V DC
108	2	P0251-836	RELAY, Socket
109	3	P0251-840	RELAY, 24V Indicator

LI - Linear Inch

NOTES

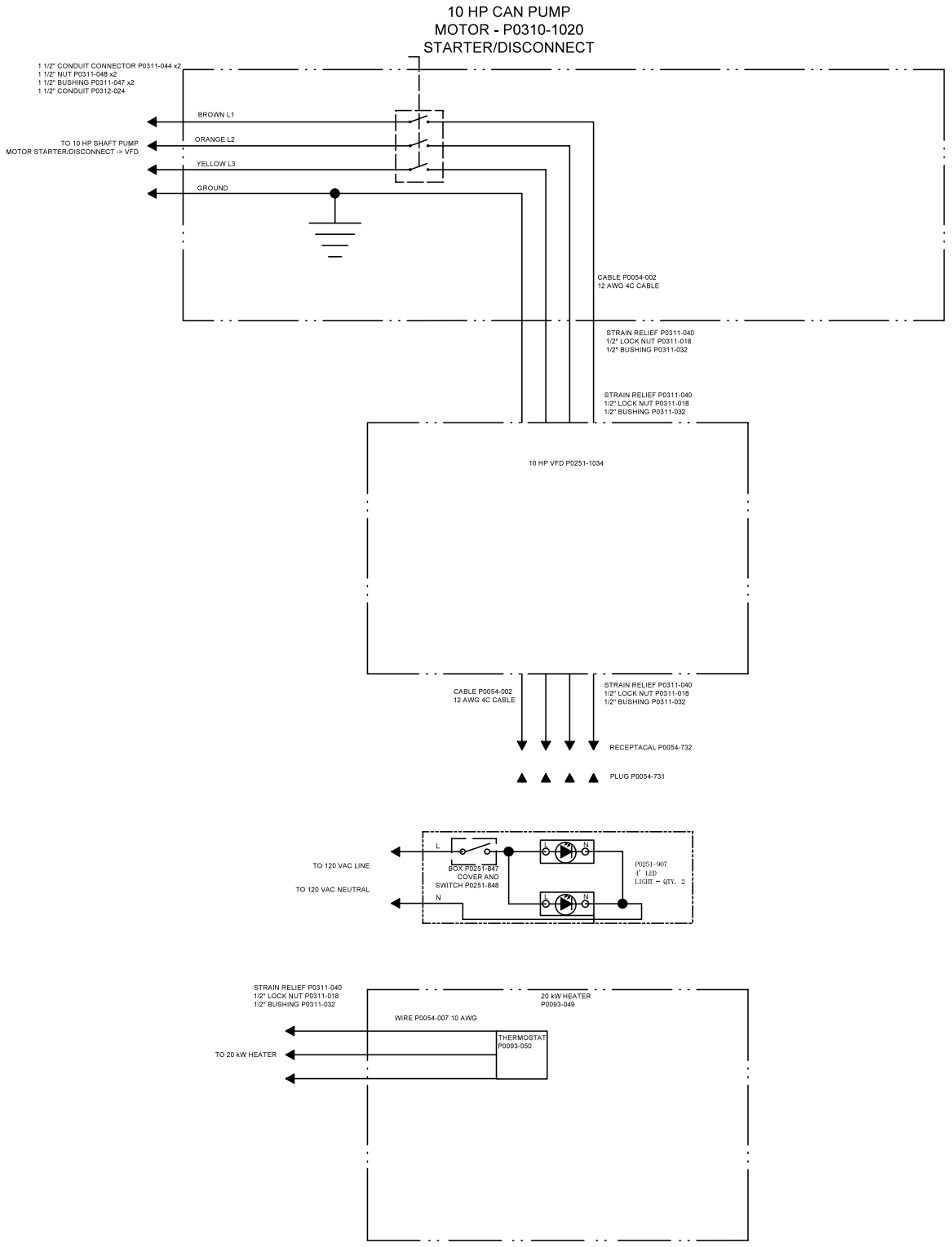
PIPE THRUSTER CONTAINER ELECTRICAL SCHEMATIC, A63492A

PART 1 OF 8



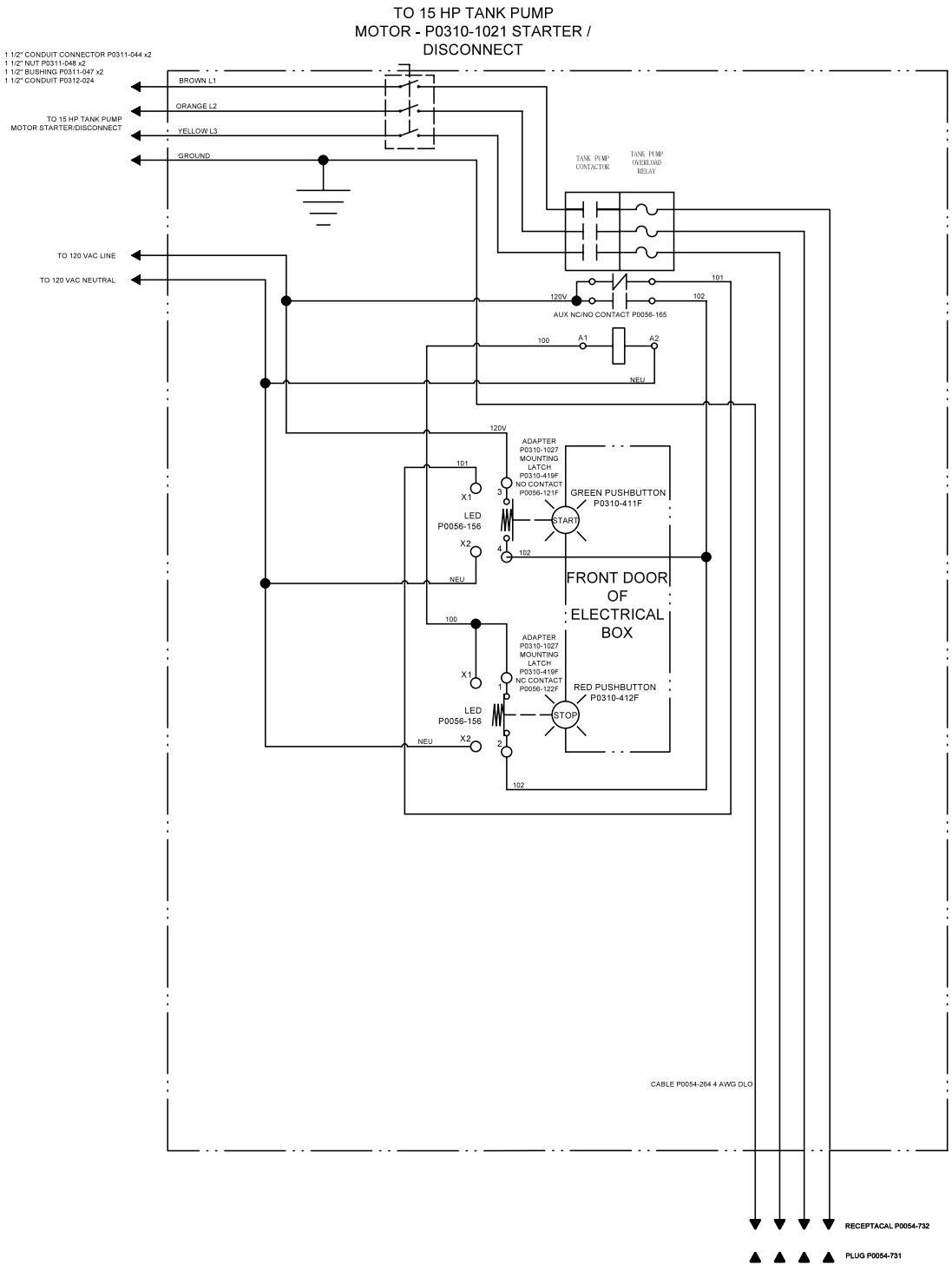
PIPE THRUSTER CONTAINER ELECTRICAL SCHEMATIC, A63492A

PART 2 OF 8



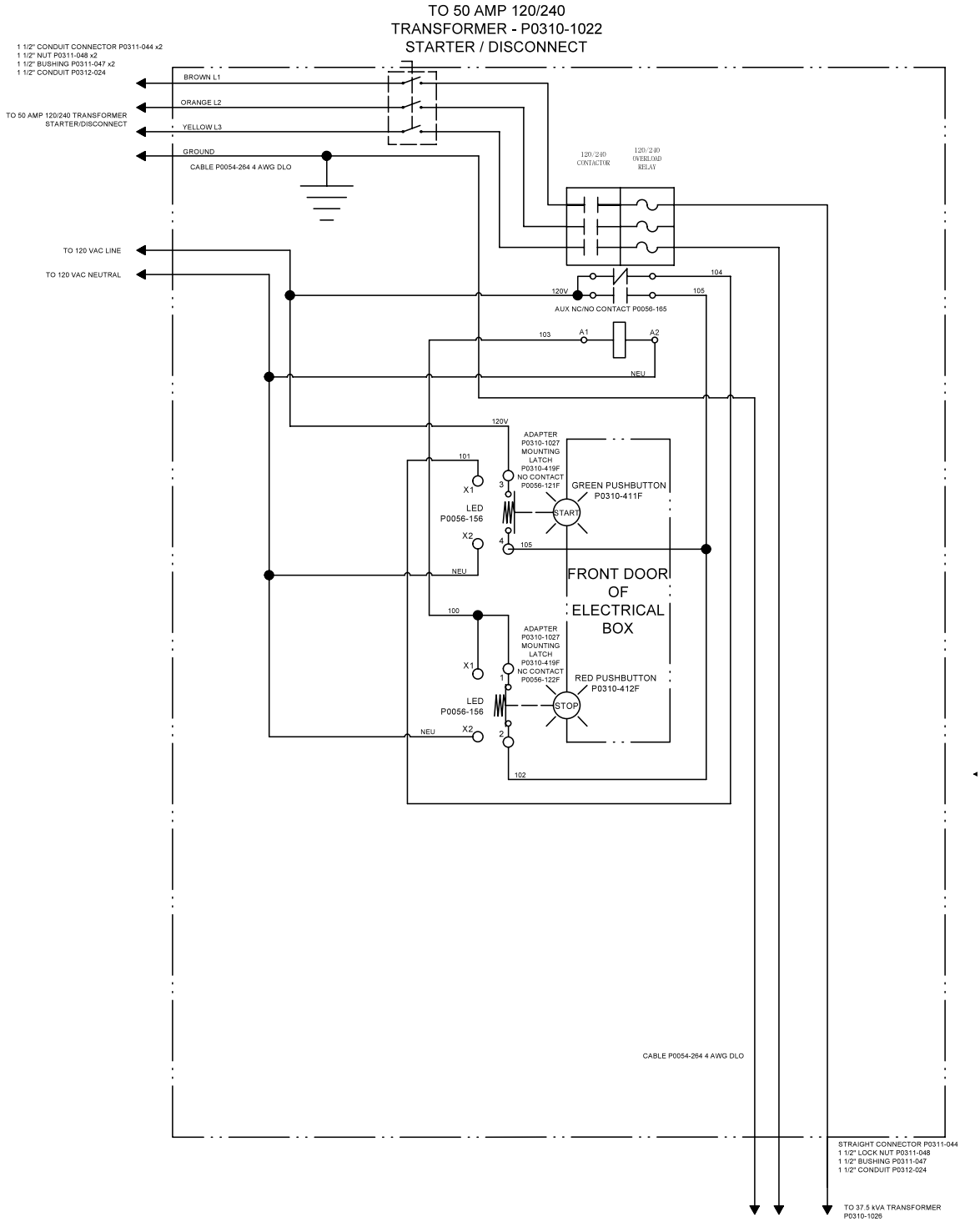
PIPE THRUSTER CONTAINER ELECTRICAL SCHEMATIC, A63492A

PART 3 OF 8



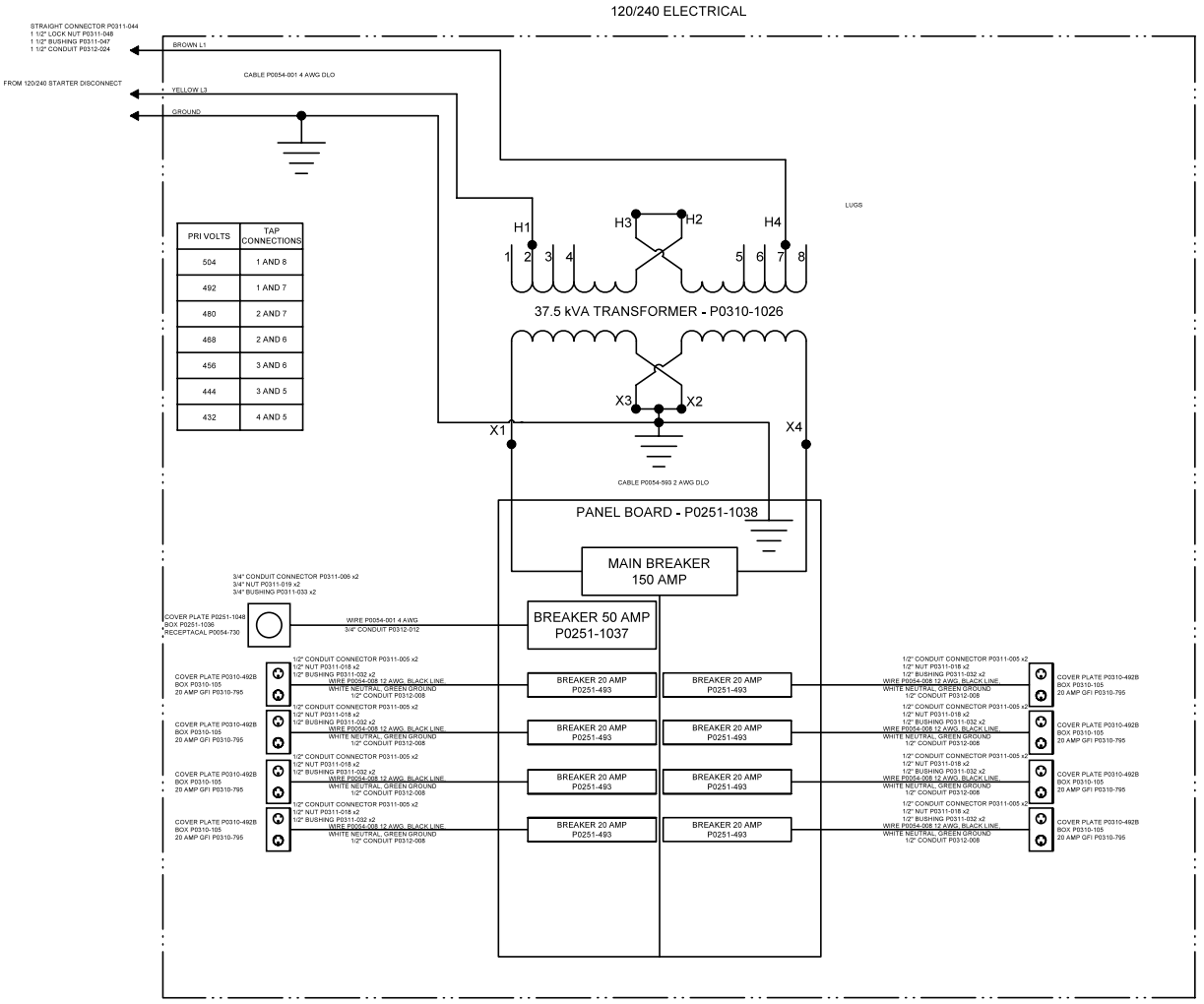
PIPE THRUSTER CONTAINER ELECTRICAL SCHEMATIC, A63492A

PART 4 OF 8



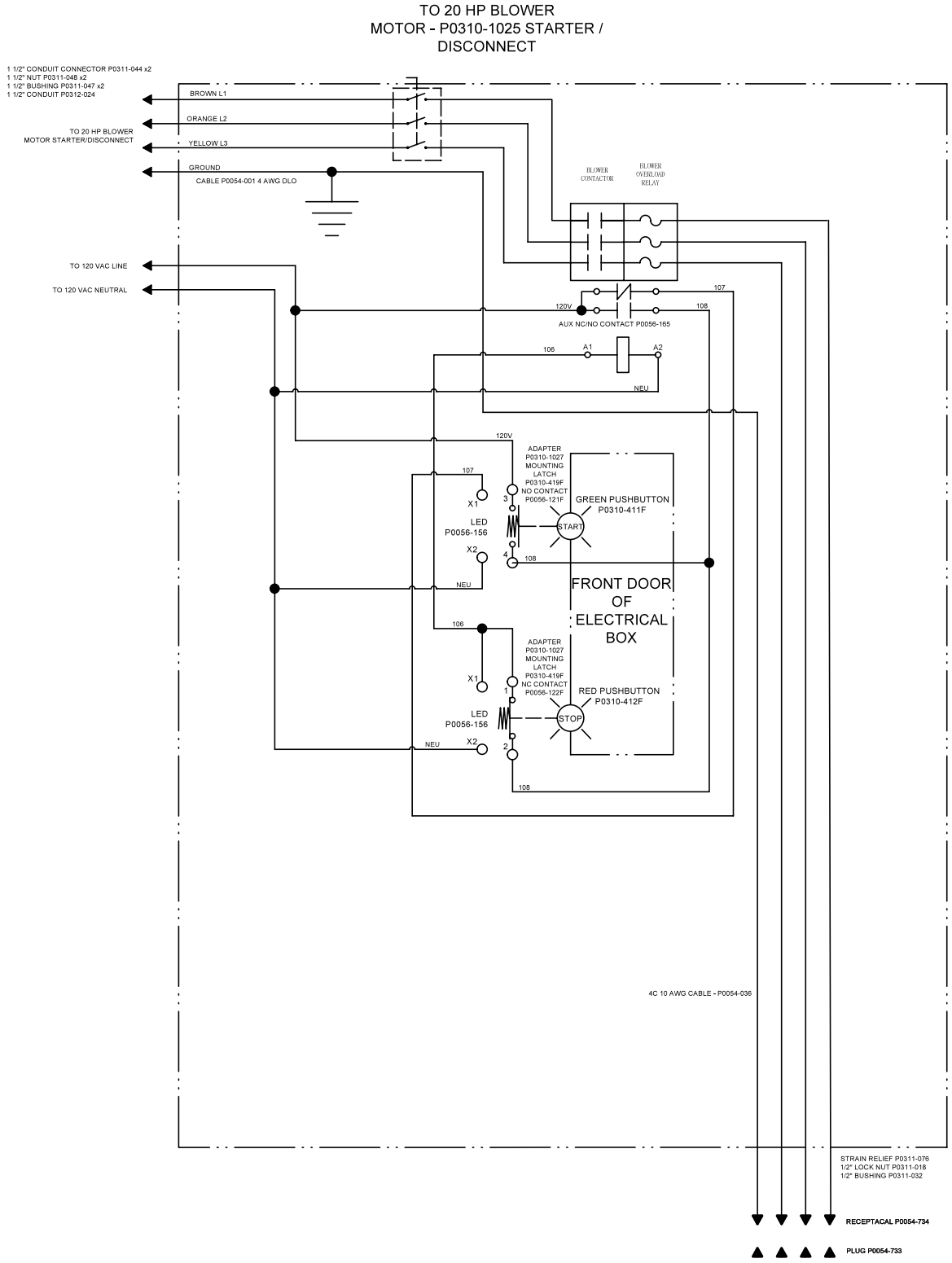
PIPE THRUSTER CONTAINER ELECTRICAL SCHEMATIC, A63492A

PART 5 OF 8



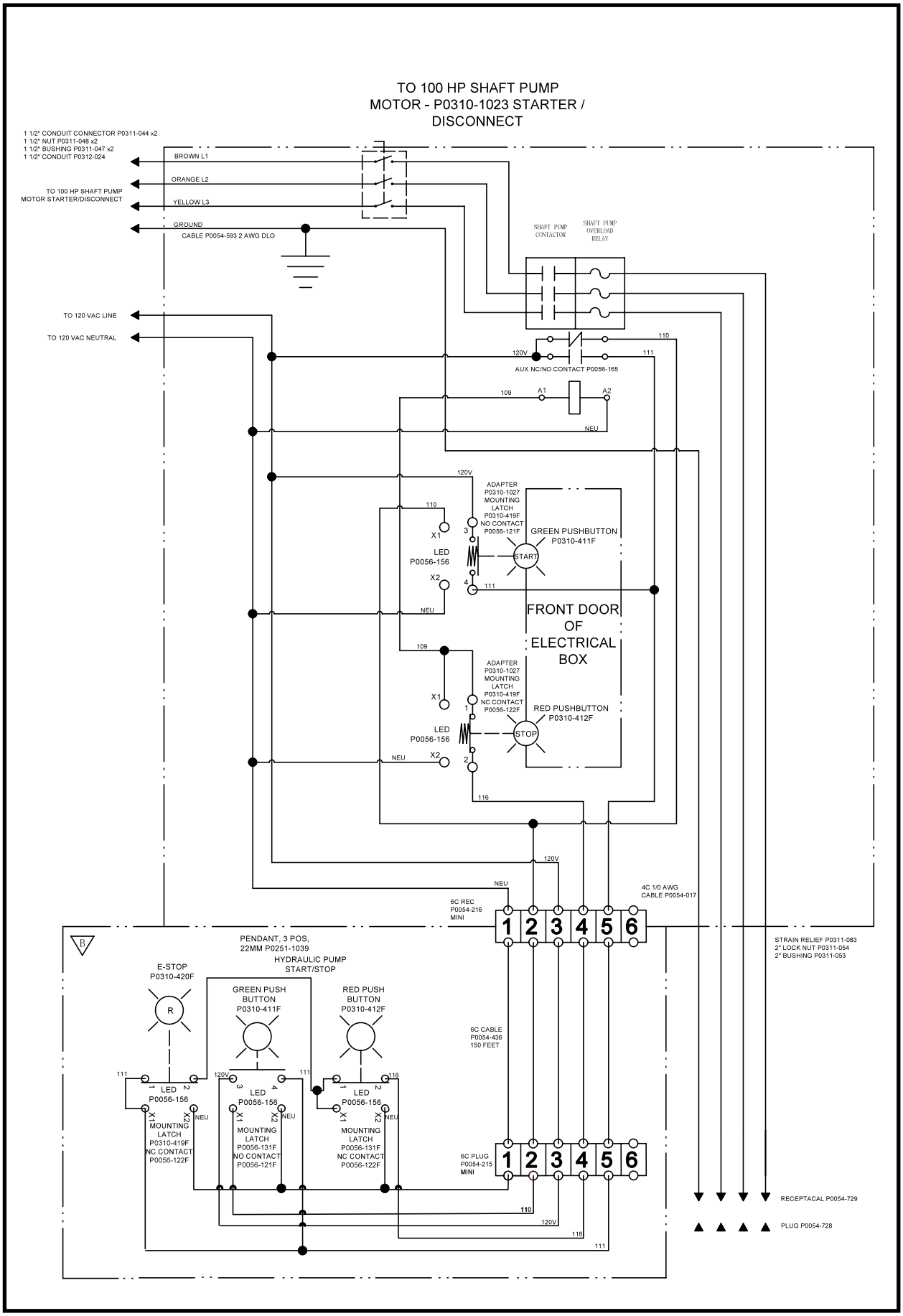
PIPE THRUSTER CONTAINER ELECTRICAL SCHEMATIC, A63492A

PART 6 OF 8



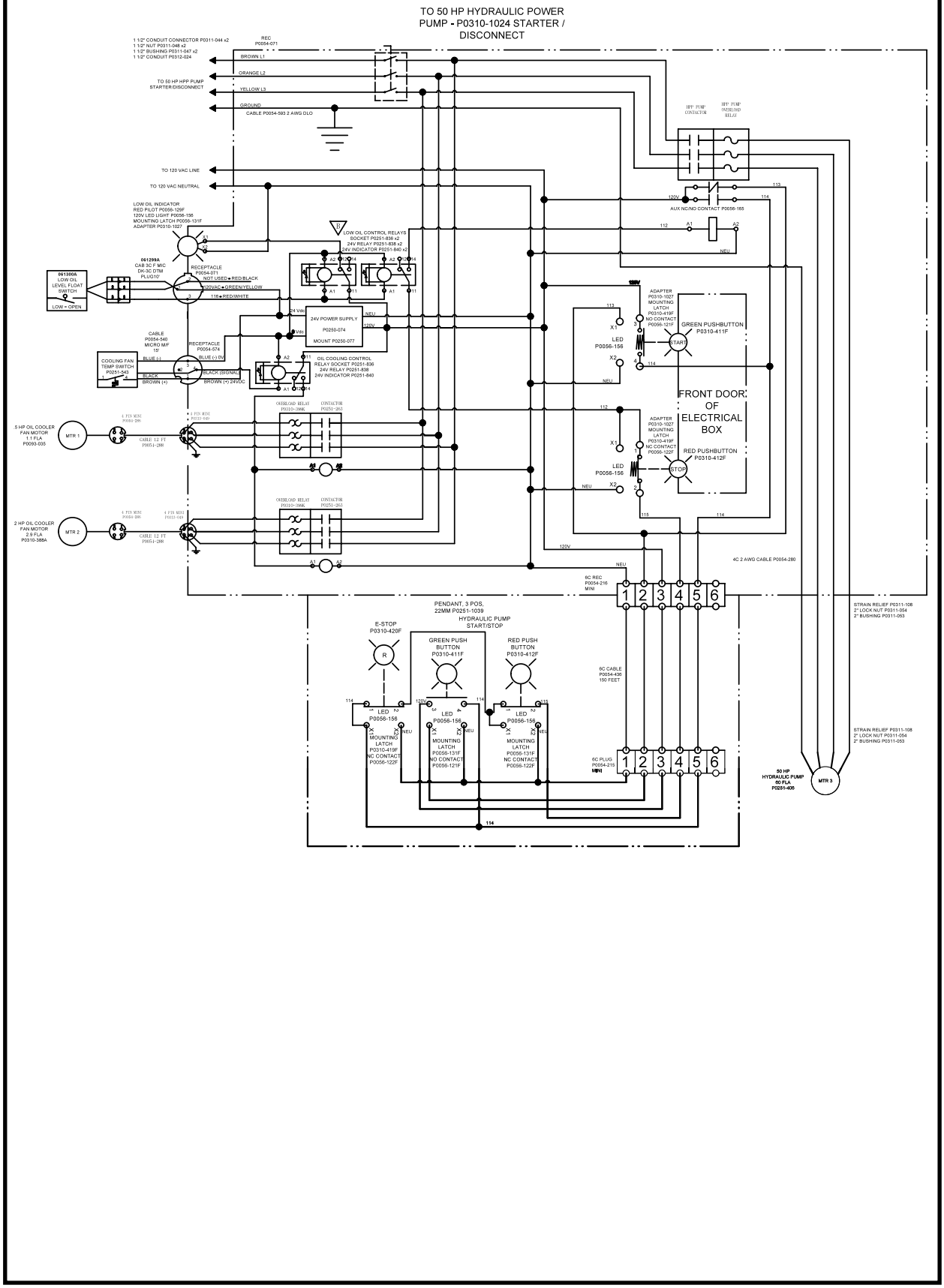
PIPE THRUSTER CONTAINER ELECTRICAL SCHEMATIC, A63492A

PART 7 OF 8



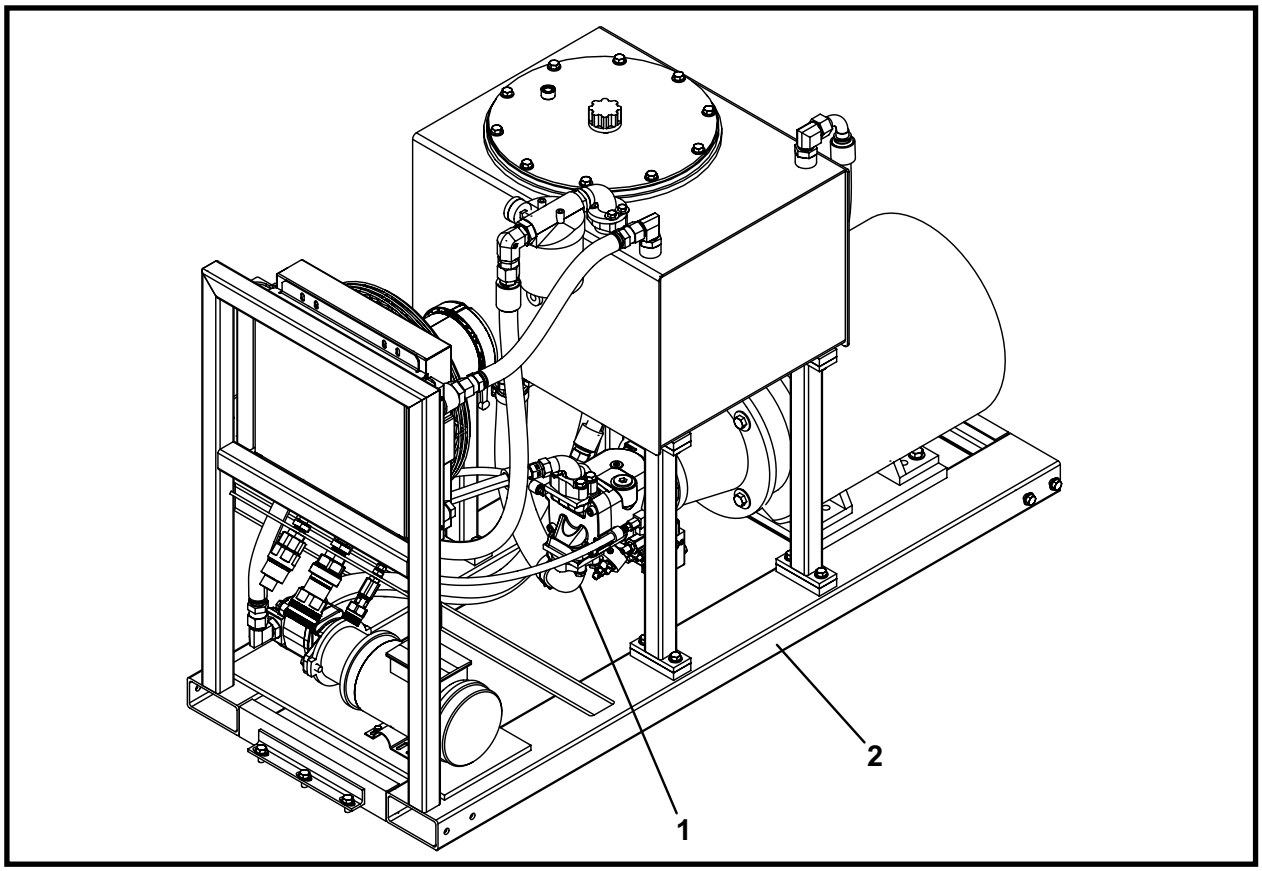
PIPE THRUSTER CONTAINER ELECTRICAL SCHEMATIC, A63492A

PART 8 OF 8



NOTES

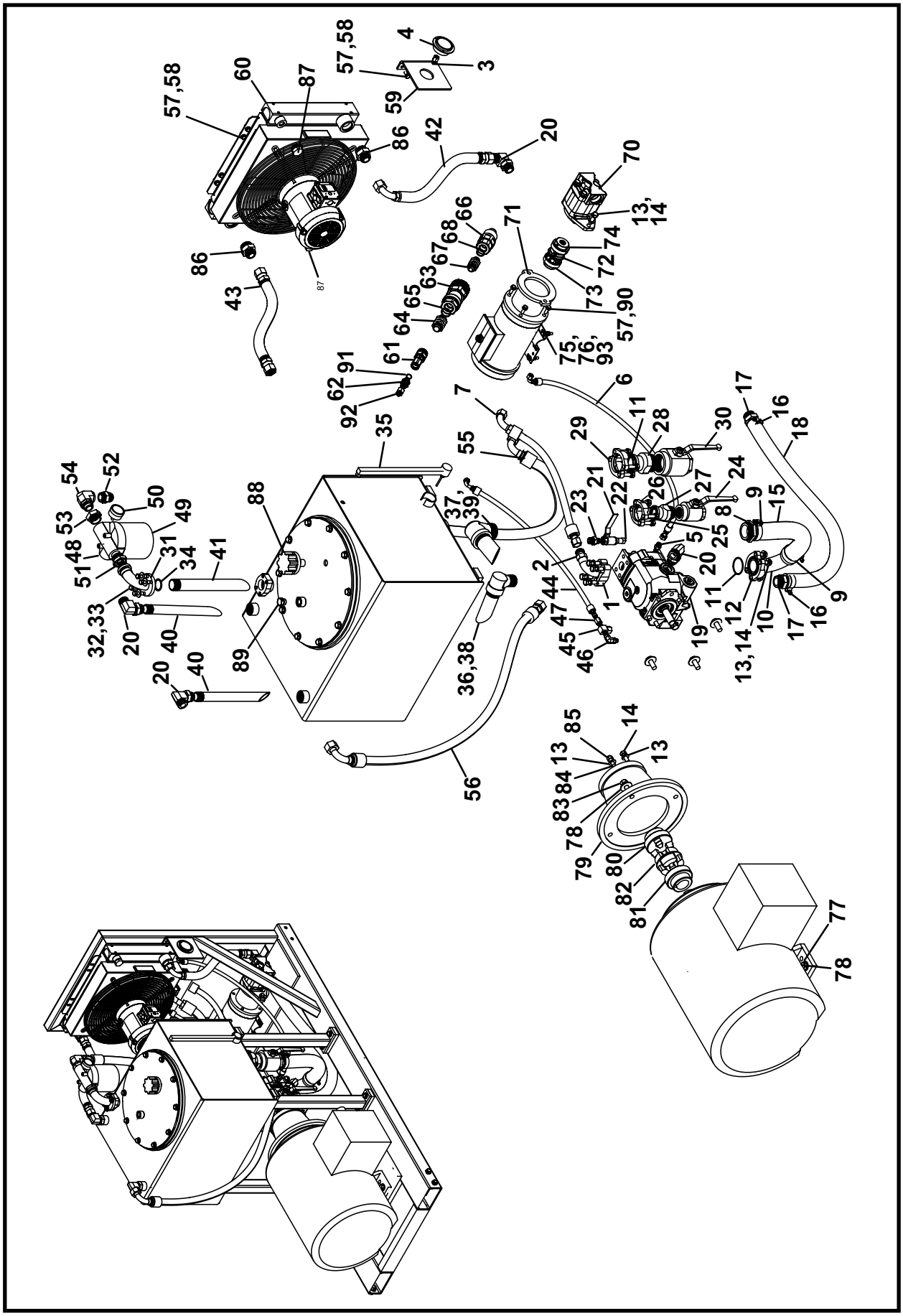
POWER PACK ASSEMBLY, 061995A



ITEM	QTY	PART NO.	DESCRIPTION
0	1	061995A	ASSEMBLY, Power Pack
1*	1	061935A	ASSEMBLY, Power Pack Hydraulics
2*	1	061933A	ASSEMBLY, Power Pack Skid

* Refer to this section for parts information.

POWER PACK HYDRAULICS ASSEMBLY, 061935A



POWER PACK HYDRAULICS ASSEMBLY, 061935A

ITEM	QTY	PART NO.	DESCRIPTION
0	1	061935A	ASSEMBLY, Power Pack Hydraulics
1	1	P0300-420	FITTING, 20SFXO
2	1	P0300-421	FITTING, 20FLH6K-16MJ90
3	1	P0300-594	FITTING, 4FB-4MFFOR
4	1	P0301-146	GAUGE, 6000 PSI GAUGE
5	1	P0300-679	FITTING, 6MFFOR-4MP
6	1	A10338A-034	ASSEMBLY, Hose 1/4 x 34
7	1	A10304A-028	ASSEMBLY, Hose 3/4 x 28
8	1	P0220-224	FITTING, 32 INSERT-32MB
9	2	P0201-180	CLAMP, T-Bolt
10	1	P0220-210	FITTING, 32 Insert-90-Code 61-20FL
11	2	P0300-460	ORING, 32FLOR
12	1	P0300-518	FLANGE, Code 61 Captive
13	12	P0040-008	WASHER, Hardened Flat 1/2
14	8	P0001-08-006	BOLT, Hex 1/2 UNC x 1.5
15	19 LI	P0201-159	HOSE, Suction 2
16	2	P0201-205	T CLAMP
17	2	P0220-243	FITTING, 20GS-20MB
18	44 LI	P0201-227	HOSE, Suction 1-1/4
19	1	P0303-895	PUMP, 5000PSI
20	4	P0300-371	FITTING, 16MFOR-16MB90
21	1	P0302-185	VALVE, Ball 1/2
22	1	P0416-003	PLUG, Square Head 1/2
23	1	P0300-222	FITTING, 10MB-08MP
24	1	P0302-418	VALVE, Suction, Ball 1-1/4
25	1	P0300-447	FITTING, 20OR
26	1	P0300-446	FITTING, 24SFO
27	1	P0300-445	FITTING, 20MJ-24FL
28	1	P0300-442	FITTING, 32FL-32MB
29	1	P0300-443	FITTING, 32CFHS
30	1	P0302-434	VALVE, 2 Orb Suction Ball
31	1	P0303-280	ELBOW, 90 Degree
32	4	P0001-07-005	BOLT, Hex 7/16 UNC x 1-1/4
33	4	P0040-007	WASHER, Hardened Flat 7/16
34	1	P0300-458	ORING, 20FLOR
35	1	P0301-141	GAUGE, Sight 15
36	1	P0412-007A	ELBOW, 90 Degree
37	1	A40761P	PIPE, PVC 2
38	1	A42511P	PIPE, Return
39	1	P0258-056	ELBOW, 90 Degree
40	2	061931P	PIPE, Case Drain Return
41	1	061932P	PIPE, Return
42	1	A09987A-022	ASSEMBLY, Hose 3/4 x 22
43	1	A10096A-021	ASSEMBLY, Hose 3/4 x 21
44	1	A08545A-030	ASSEMBLY, Hose 1/4 x 30
45	1	P0309-180	FILTER, Load Sense
46	1	P0300-528	FITTING, 06MB-04FP90
47	1	P0300-268	FITTING, 04MJ-04FP
48	1	P0309-144B	HEAD, w/25 PSI Bypass
49	1	P0309-145A	FILTER, Element 10 Micron
50	1	P0301-105	GAUGE, Filter Indicator
51	1	P0300-658	FITTING, 20MB-12FB
52	1	P0300-322	FITTING, 16MJ-16MB

LI - Linear Inch

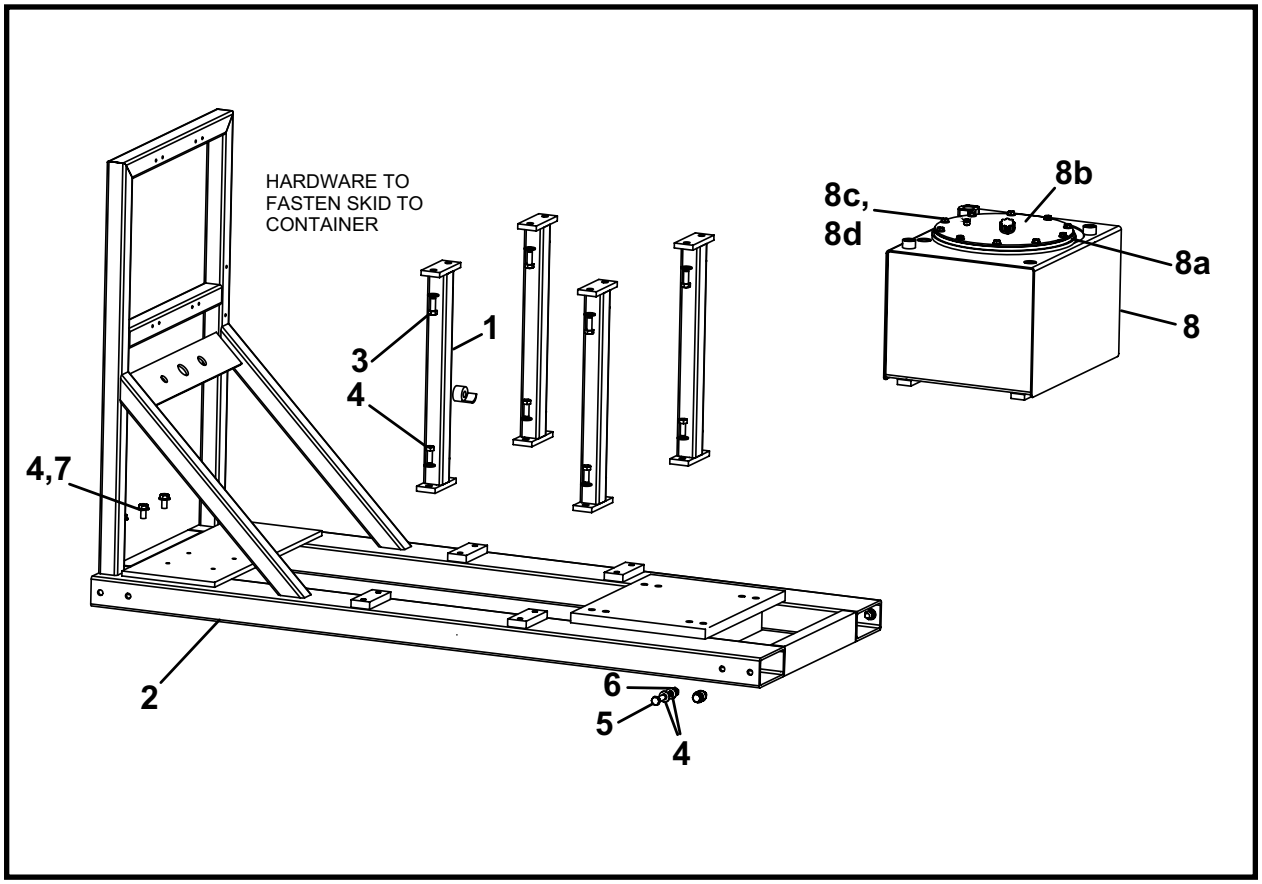
(Continued on next page)

POWER PACK HYDRAULICS ASSEMBLY, 061935A

ITEM	QTY	PART NO.	DESCRIPTION
53	1	P0300-380	FITTING, 20MB-16FB 1.75
54	1	P0300-780	FITTING, 16MB-16FB90
55	1	A63749A-045	ASSEMBLY, Hose 1 x 45
56	1	A10342A-048	ASSEMBLY, Hose 1 x 48
57	14	P0040-006	WASHER, Hardened Flat 3/8
58	10	P0001-06-003	BOLT, Hex 3/8 UNC x 0.75
59	1	A21997P	PLATE, Pressure Gauge Mount
60	1	P0093-051	HEAT EXHANGER
61	1	P0100-110	COUPLER, 3/8
62	1	P0300-325	FITTING, 08MJ-08MJBKHD
63	1	P0100-099	COUPLER, Half Female 1
64	1	P0300-308	FITTING, 16MJ-16MJBKHD
65	1	P0300-309	FITTING, 16OR
66	1	P0100-104	NIPPLE, Half Male 3/4
67	1	P0300-330	FITTING, 12MJ-12MJBKHD
68	1	P0300-324	FITTING, 12OR
69	160	P0126-038	OIL, Hydraulic AW-68
70	1	P0303-250	PUMP, Gear CW Rotation
71	1	P0305-236	MOUNT
72	1	P0305-139C	COUPLER, Insert
73	1	P0305-139A	COUPLER, Half
74	1	P0305-237	COUPLING
75	4	P0001-05-006	BOLT, Hex 5/16 UNC x 1.5
76	4	P0003-05-000	NUT, 5/16 UNC
77	4	P0001-10-007	BOLT, Hex 5/8 UNC x 1.75 UNC
78	8	P0040-010	WASHER, Hardened Flat 5/8
79	1	P0305-168	ADAPTER, Pump Motor
80	1	P0305-132A	COUPLER, Bore Keyway 1 x 0.25
81	1	P0305-177	COUPLING
82	1	P0305-182	INSERT
83	4	P0001-10-006	BOLT, Hex 5/8 UNC x 1.5
84	4	P0025-002A	STUD, 1/2 UNC x 1.5
85	4	P0003-008	WASHER, Flat 1/2
86	2	P0300-374	FITTING, 16MFOR-20MB
87	2	P0300-081	FITTING, 14MB-PLUG
88	1	P0309-188	BREATHER, Reservoir
89	1	P0300-060	PLUG, 10MB
90	4	P0001-06-004	BOLT, Hex 3/8 UNC x 1
91	1	P0300-322	FITTING, 16MJ-16MB
92	1	P0300-454	FITTING, 08FJ-06MJ
91	8	P0040-005	WASHER, Hardened Flat 5/16

QT - Quart

POWER PACK SKID ASSEMBLY, 061933A



ITEM	QTY	PART NO.	DESCRIPTION
0		061933A	ASSEMBLY, Power Pack Skid
1	4	A48112A	LEGS, Tank 22.25
2	1	061903A	SKID, Base
3	16	P0001-08-005	BOLT, Hex 1/2 UNC x 1.25
4	27	P0040-008	WASHER, Hardened Flat 1/2
5	4	P0001-08-006	BOLT, Hex 1/2 UNC x 1.5
6	4	P0003-08-000	NUT, 1/2 UNC
7	8	P0001-08-004	BOLT, Hex 1/2 UNC x 1
8	1	061913A	TANK, 40 Gallon Hydraulic (Includes items 8a - 8d)
8a	1	A22742P	ORING
8b	1	062279P	Cover
8c	10	P0040-008	WASHER, Flat 1/2
8d	10	P0001-08-004	BOLT, Hex 1/2 UNC x 1

NOTES

Alphabetical Index

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

T (continued)

U

V

W

Numerical Index