REED

M30 TECHNICAL MANUALS

Operations, Maintenance, Schematics, Parts, Safety

OPERATIONS/ MAINTENANCE

- Introduction
- Warranty
- Safety
- Operation
- Main Controls
- Priming
- Pumping
- Clean-up
- Maintenance
- Check-List

SCHEMATICS/ PARTS LISTS

- Pumping Train Group
- Power Train Group
- Electrical Group
- Controls
- Frame Installation
- Available Options

SAFTEY MANUAL

AMERICAN CONCRETE PUMPING ASSOCIATION

- Introduction
- General Safety Rules
- Appendix

Rev* REED LLC 2024

REV	DATE	DESCRIPTION	NAME
1.0	10/24/2023	NEW UPDATES	J. SLACK
1.1	03/13/2024	ADDED ELECTRIC PUMP CONTROLS	J. SLACK
1.2	04/11/2024	ADDED CEMP PUMP INSTRUCTIONS	J. SLACK

INTRODUCTION

This manual introduces the warranty policy, safe operation, safe maintenance, parts, and other aspects of the concrete equipment.

Reading and understanding this operation manual will help maximize performance and reliability, and help minimize dangers, improper operation, and repair costs. Contact REED Customer Service for additional replacement manuals.

All safety guidelines, product descriptions, illustrations, and specifications found throughout this manual were in effect at the time the manual was released for printing. It should be noted; **REED RESERVES THE RIGHT TO MAKE CHANGES IN DESIGN OR TO MAKE ADDITIONS TO OR IMPROVEMENTS IN THE PRODUCT WITHOUT IMPOSING ANY OBLIGATIONS UPON ITSELF TO INSTALL THEM ON PRODUCTS PREVIOUSLY MANUFACTURED.**

Everyone involved with the operation, maintenance, inspection, and repair of the concrete pump MUST READ and UNDERSTAND this manual and the accompanying Safety Manual.

REED

CONCRETE PUMP WARRANTY

REED warrants each new A, B, and C Series Concrete Pump to be free of defects in material and workmanship under normal use and service for a period as follows:

A Series Pumps

- "Hitch to Hopper" for 1 year or 1200 pumping hours, whichever comes first
- All Structural Parts for 1 years

B and C Series Pumps

- "Hitch to Hopper" for 1 year or 1200 pumping hours, whichever comes first
- All Structural Parts for 3 years

The **WARRANTY** is issued **ONLY** to the **INITIAL USER**. The warranty period begins when the product is delivered to the initial user or when first put into service, whichever occurs first. Said warranty is void if the machine is subject to misuse, neglect, accident or abuse.

REED'S obligation under this warranty is limited to correcting without charge, at its factory, any parts or parts thereof which shall be returned to its factory, transportation prepaid and upon ***REED'S*** examination proves to have been originally defective. Correction of such defects by repair or replacement shall constitute fulfillment of all obligations to the initial user. This warranty does not include labor or transportation charges unless specifically identified and authorized in writing by ***REED***. Nor does the warranty apply to any unit upon which repairs or unauthorized alterations have been made.

This warranty does not apply to normal maintenance service or to normal replacement of certain machine parts which are subject to normal wear (such as concrete cylinders and wear components, valve mechanisms, delivery systems, hopper grate, etc.) ***REED*** makes no warranty in respect to trade accessories or outside vendor components, such being subject to the warranties of their respective manufacturers.

THIS IS A LIMITED WARRANTY AND IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE. In no event shall ***REED*** be made liable for incidental, general or consequential damage, loss or any expense directly or indirectly related and resulting from use or lack of use caused by delay in delivery, parts failure, or any other causes associated with the product use. No person, firm or corporation is authorized to assume for ***REED*** any other liability in connection with the sale of ***REED*** products.

Effective April 2010

REED LLC* An Independent Member of the Shea Family of Companies
13822 Oaks Ave., Chino, CA, 91710-7008 * www.reedpumps.com * phone 909-287-2100

SAFETY

Everyone involved with the operation, maintenance, inspection, and repair of the concrete pump MUST READ and UNDERSTAND this manual and the accompanying Safety Manual.

SAFETY ALERT SYMBOLS AND SIGNAL WORDS

The following safety alert symbols, signals, and explanations are intended to warn the operator of hazardous and potentially hazardous situations.

The triangle with the exclamation point, inside is used to alert the operator to an important safety point and is called a safety alert symbol. One of the following signal words will appear after the safety alert symbol:

If the safety alert symbol is followed by the signal word **DANGER**, the safety alert symbol indicates a hazardous situation which, if not avoided, **WILL** lead to death or serious injury.

If the safety alert symbol is followed by the signal word **WARNING**, the safety alert symbol indicates a potentially hazardous situation which, if not avoided, **COULD** result in death or serious injury.

If the safety alert symbol is followed by the signal word **CAUTION**, the safety alert symbol indicates a potentially hazardous situation which, if not avoided, **COULD** result in minor to moderate injury.

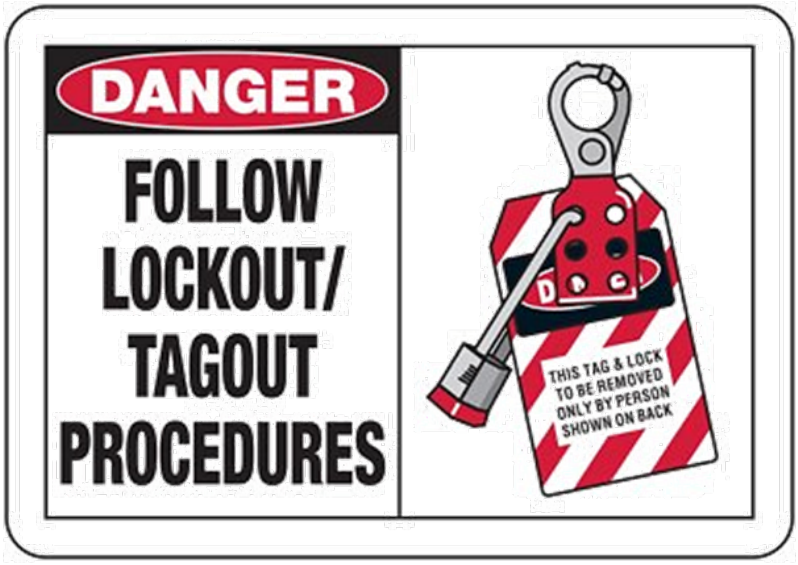
The signal word **CAUTION**, but without safety alert symbol means the safety symbol alert addresses a hazard which, if not avoided, **COULD** cause damage to equipment or property.

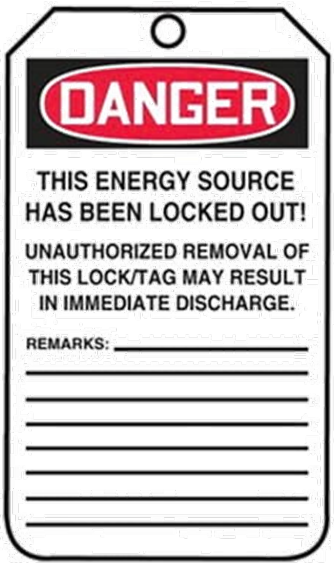
LOCKOUT / TAGOUT

The Lockout/Tagout procedure applies to all ***REED*** concrete placing equipment. Before performing any maintenance and/or repair on equipment.

1. Remove keys lock-out signage must be posted to indicate machine is currently under Lockout/Tagout.

The following symbol is a reminder to Lock Out and Tag Out equipment before working on equipment.





GENERAL SAFETY GUIDELINES

WARNING

Use Only Qualified, Experienced, and Trained Personnel
Wearing Protective Equipment At All Times

WARNING

For Safe Use, Maintenance, Inspection, and Repair,
Only Operate, Maintain, Inspect, and Repair
In Accordance with This Operation Manual and the Safety Manual

WARNING

Performance and Safety Features Must Never Be Altered, Disconnected, or Removed

WARNING

Contact ***REED*** Technical Support and Service When Assistance Is Required

SAFETY DECALS

Decals and placement of decals are standardized by the Concrete Pump Manufacturers Association (CPMA) for your protection. They are placed at appropriate areas on the concrete pump to be constant warnings of dangers. Know and adhere to the information they provide. Contact ***REED*** Customer Service for complimentary replacements of safety decals, shipping charges may apply.

DECALS PLACED NEAR CONTROL BOX AREA

⚠ WARNING

Do not operate this machine without training. Understand the warnings in safety manuals and on decals.

⚠ ADVERTENCIA

No use esta maquinaria sin estar capacitado. Entienda las advertencias de los manuales de seguridad y de las calcomanías.

Do not paint over this label/No pintar encima de ésta etiqueta 800925

IMPORTANT	IMPORTANTE
You can order additional operation manuals, spare parts books, safety manuals and decal sets by contacting us at: REED Manufacturing 1-(888)-779-7333 7:00 AM to 5:00 PM Pacific Time Monday through Friday	Usted puede solicitar manuales de operacion, catalogos de refacciones, manuales de seguridad y juegos de calcomanias adicionales contactando a: REED Manufacturing 1-(888)-779-7333 DE 7:00 AM a 5:00 PM Hora Pacifico LUNES A VIERNES

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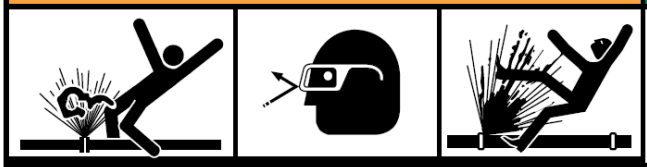
DO NOT OPERATE MACHINE WITHOUT ALL GRATES IN PLACE

⚠ WARNING



- Stay clear of pressurized concrete placing system.
- Wear eye protection.
- Do not operate at pressures exceeding the rating of any piece of the material delivery system.

⚠ ADVERTENCIA

- Permanezca alejado del sistema de distribución de concreto presurizado.
- Use protección para los ojos.
- No opere a presiones mayores que las de la capacidad de cualquier pieza del sistema de descarga.

SAFETY INSTRUCTIONS

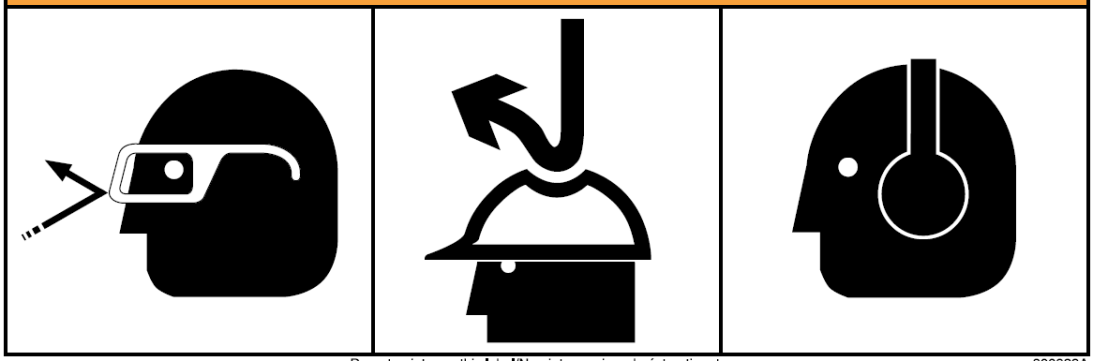
1. Relieve system pressure before opening any system or coupling.
2. Regularly inspect system condition and wall thickness.
3. Wear reduces system burst pressure.
4. Use recommended clean out procedures - consult manufacturer.
5. Use retaining pins in delivery system snap couplings.

INSTRUCCIONES DE SEGURIDAD

1. Alivie la presión del sistema ante de abrir un sistema o un acoplamiento.
2. Inspeccione periódicamente el estado del sistema y el espesor de las paredes.
3. El desgaste reduce la presión de rotura por estallido.
4. Use los procedimientos de limpieza recomendados, consulte con el fabricante.
5. Use los pasadores de retención en los acoplamientos de fijación a presión.

803237

ADVERTENCIA ⚠ WARNING



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INSTRUCCIONES DE SEGURIDAD SAFETY INSTRUCTIONS

Recommended hand signals
Señales de mano recomendadas

1. START PUMP SPEED UP	2. SLOW PUMP DOWN	3. STOP PUMP	4. LITTLE BIT	5. RELIEVE PRESSURE	6. ADD WATER 4-GALLONS	7. ALL DONE CLEAN UP
1. PRENDER LA BOMBA ACELERAR	2. BAJAR VELOCIDAD A LA BOMBA	3. PARAR LA BOMBA	4. UN POCO	5. ALIVIAR LA PRESIÓN	6. AÑADIR AGUA 4-GALONES	7. TERMINADO LIMPIAR

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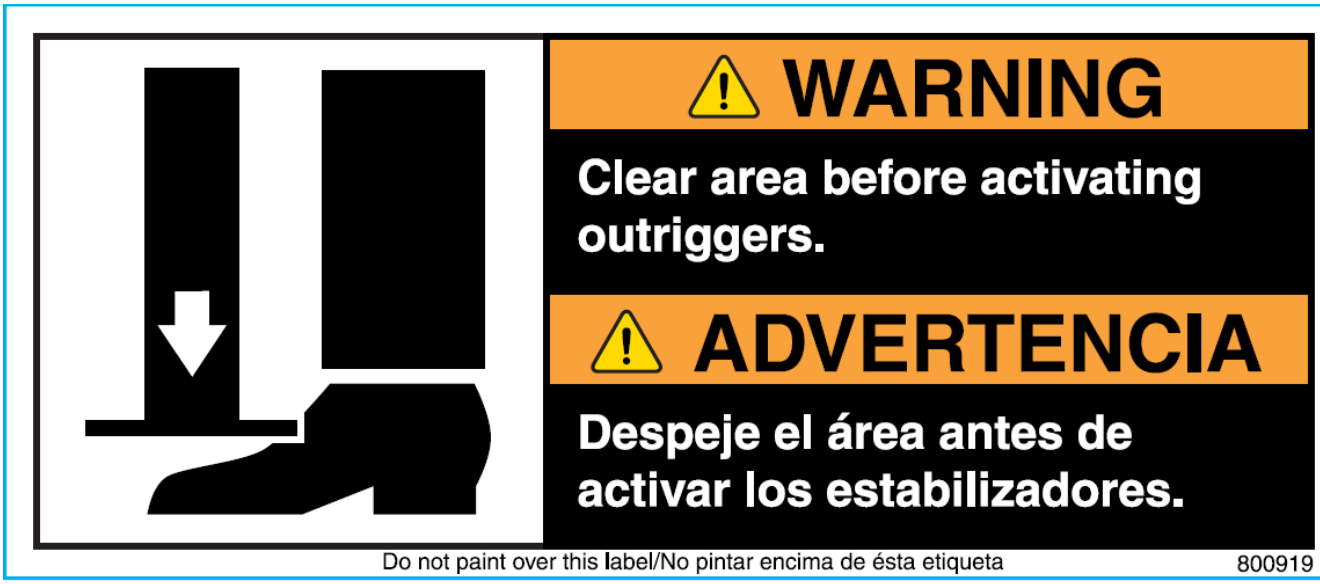
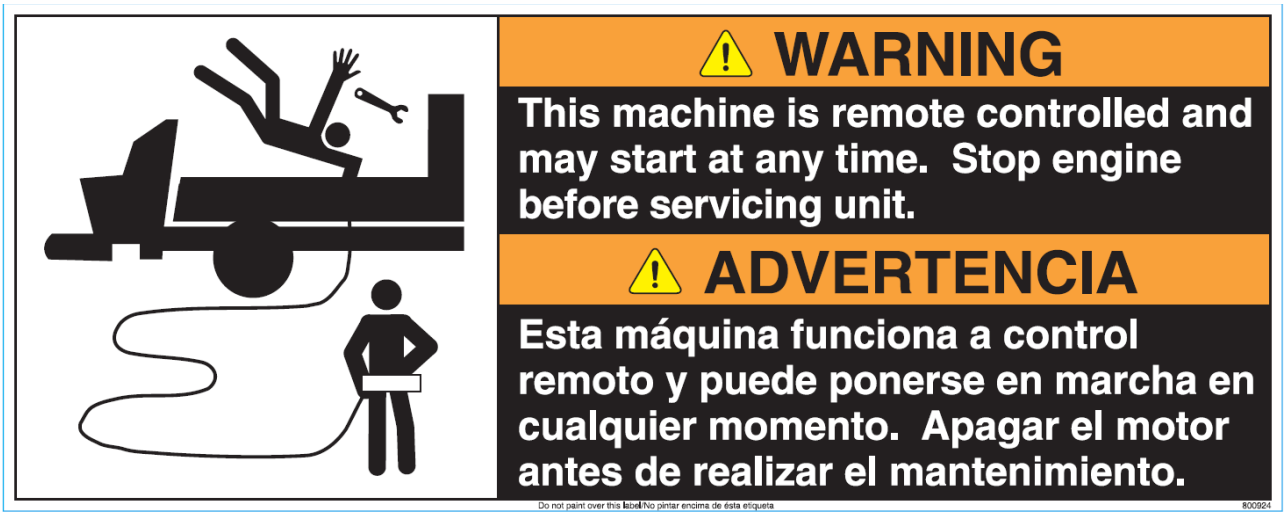
DECALS PLACED NEAR HOPPER GRATE AREA

DECALS PLACED NEAR WATERBOX AREA

DECALS PLACED NEAR OUTRIGGER CONTROL AREA



DECALS PLACED ON SIDE PANEL AREA




MEMBER
Concrete Pump
CPMA
Manufacturers Association

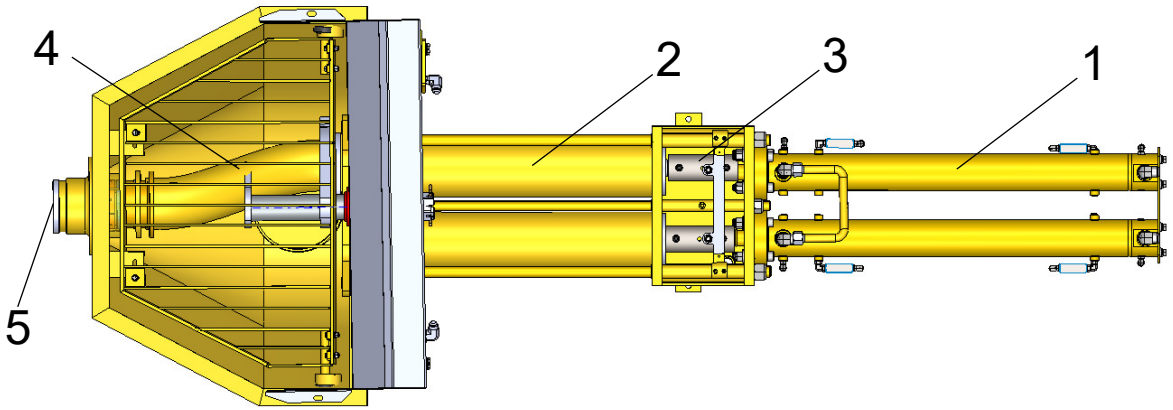

Pump Manufacturers Association
CPMA
Certified
Certified Compliance with
CPMA 27-2000 Safety Standard
0039 803236

PRODUCT DESCRIPTION

The operation of the concrete pump encompasses the use of hydraulic and electrical systems. The concrete pump is designed to safely pump wet concrete through a delivery system of pipes and hoses within its published ratings and specifications.

Stability of the concrete pump during operation is provided by the outriggers and front jack. Controls for the outriggers are located on the sides of the concrete pump.

The pumping system employs an S-Tube design valve system. This system incorporates material cylinders linked to hydraulic cylinders that cycle alternately. With concrete material in the hopper and the pump operating, a material cylinder retracts, drawing material into the cylinder. At full retraction of the cylinder, a signal is sent to both the S-tube swing cylinder and the drive cylinder directional valves causing the s-tube to shift position to the fully loaded material cylinder and the drive cylinders to change direction. The concrete piston of the loaded cylinder then pushes the material through the s-tube and into the delivery lines. The shifting from one cylinder to the other cylinder takes place providing a continuous flow of material through the delivery piping system. The pump can be operated at the control panel or can be operated from the remote control.



The hydraulic oil flow created by the hydraulic pump pushes the drive cylinder pistons inside the drive cylinders (1) alternately back and forth. Because the drive cylinders and concrete pistons (2) inside the concrete cylinders (3) are linked together, the pistons move synchronously.
When a drive cylinder retracts along with the concrete piston, concrete will be sucked from the hopper into the concrete cylinder. Simultaneously, the other drive cylinder and concrete piston are extended toward the hopper. The concrete piston will push concrete from the concrete cylinders through the S-Tube (4) and out to delivery system (5).
Next, the pump switches at the end of the stroke, causing the s-tube valve to shift to the other concrete cylinder which has sucked and filled the cylinder with concrete, starting the next cycle.
Reverse pumping links the concrete piston in the suction stroke and S-Tube valve to suck concrete from the s-tube instead of the hopper. As a result, the concrete piston pumps concrete into the hopper.

The power for operation of the concrete pump is provided by the engine, which drives the hydraulic pumps.

All functions for operation of the concrete pump can be accomplished from the local controls mounted on the side of the unit. Optional hand-held cable or radio remotes enable the pump to be operated away from a remote distance.

HYDRAULIC SYSTEM DESCRIPTION

The hydraulic system of the concrete pump consists of three separate circuits and although integrated, each is designed to perform a particular function within the operation of the concrete pump. The three circuits utilized are:

- Main Pump Circuit

Controls operation of the hydraulic drive cylinders.

- S-Tube Shift Circuit

Controls operation of shifting the s-tube from one material cylinder to the other.

- Auxiliary Circuit

Controls the operation of the agitator and other auxiliary equipment.

For the purpose of making the operation of each circuit easier to understand, they are being described separately.

MAIN PUMP CIRCUIT

The main hydraulic pump is a variable displacement axial piston pump of swashplate design. The pistons run along the swashplate which is capable of being tilted. This tilting changes the angle of the swashplate and thus the stroke length of the pistons, which in turn varies the displacement of fluid. The larger the angle of the swashplate, the greater the flow. The angle of the swashplate is varied by the volume control that works in conjunction with the load sense feature of this pump.

The main hydraulic pump is driven directly by the engine or electric motor. When the engine is running, PUMP switch in the OFF position and the VOLUME control minimized, there is no demand placed on the pump. This is referred to as the pump being de-stroked, meaning, it is only producing a minimal amount of flow to enable the lubrication of the pump. This lubrication exists regardless of whether the engine is at idle or maximum RPM.

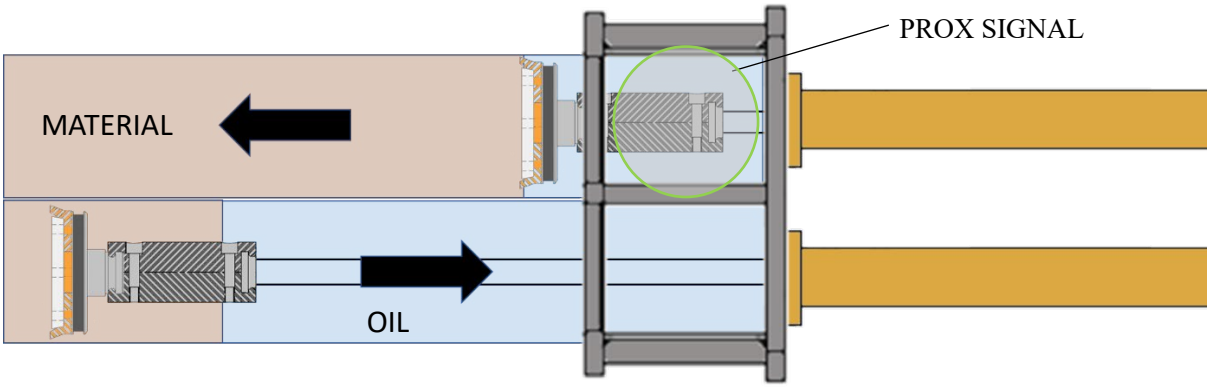
The main pump circuit is equipped with a manifold that is drilled and ported to accommodate the relief valve, check valve, flow control and the pilot operated directional valve. The cycle valve is a directional spool valve with electrohydraulic

solenoid operation. Its purpose is to direct the flow of oil from the main hydraulic pump to one or the other

To energize the pump circuit, use the RPM button to set the engine speed at maximum RPM. Open the VOLUME control to any range from 0 to FULL. In so doing, the load sense is alerted to the demand and places the pump on stroke. The pump will now produce the flow in proportion to the amount by which the volume control has been opened. Since the PUMP switch is OFF, the flow from the hydraulic pump is fed to the main directional valve, thru the valve, and then returns to the hydraulic tank.

To energize the cycling circuit, the PUMP switch must be ON. When this is done, an electrical signal is generated which in turn energizes the coils of the main directional pilot valve and activates the S-Tube directional valve.

The material pumping action is the result of the two material cylinders cycling on an alternate basis. This alternating cycling is controlled by an electrical signal that is generated by the proximity sensors located in the flush box at the end of each material cylinder's suction or retraction stroke.

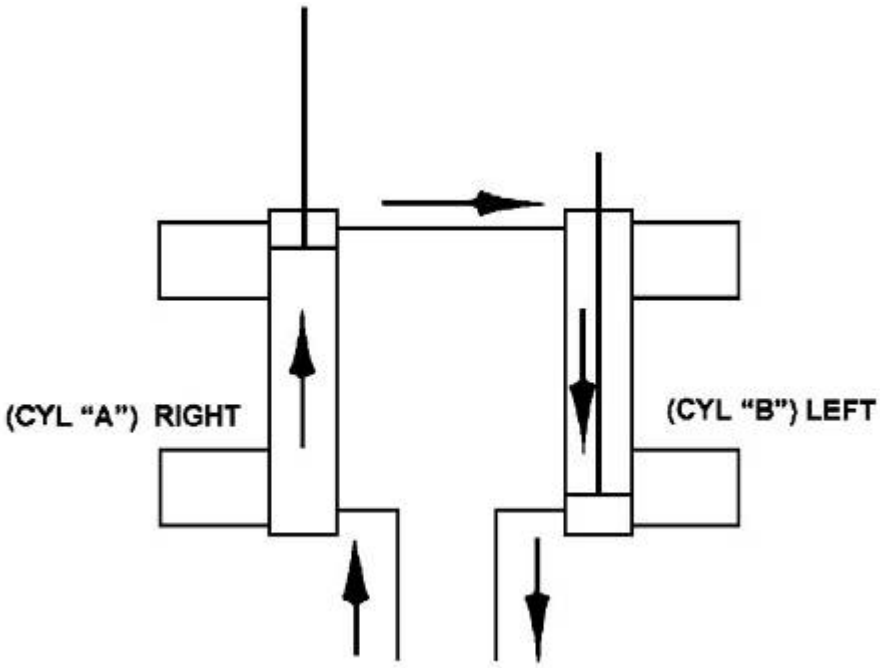


As the piston coupler passes under the proximity sensor, it generates an electrical input signal that is sent to the logic controller, designed to control the alternating action of the material cylinders and to synchronize the movement of the s-tube. The output signal from the logic controller is used to energize the coils of the main directional pilot valve as well as that of the s-tube directional valve.

As protection to the main pump circuit against excessive pressure, a relief valve has been installed and set. Thus, when the system pressure reaches the maximum factory settings, the relief valve opens directing the oil back to the tank.

MAIN PUMP CIRCUIT OPERATIONAL SEQUENCE

It can be noted in the schematic and the diagram below that the main pressure and flow is only directed to one side of the hydraulic drive cylinder. In this instance, it is directed to the head side or piston side of the double acting drive cylinder.



CONCRETE PUMP SYSTEM

The hydraulic drive cylinders are identical. Because only one cylinder is pressurized at a time, a means is required to assist in the retraction of the opposite cylinder. This is accomplished by connecting the rod sides of the cylinders together, forming a slave loop. In so doing, the hydraulic fluid that exists in the rod side of the extending cylinder (CYL "A") is transferred to the rod side of the other cylinder (CYL "B") causing it to retract simultaneously. The oil in the head side of CYL "B" is then forced out as it retracts and free flows through the directional valve back to the hydraulic tank or system.

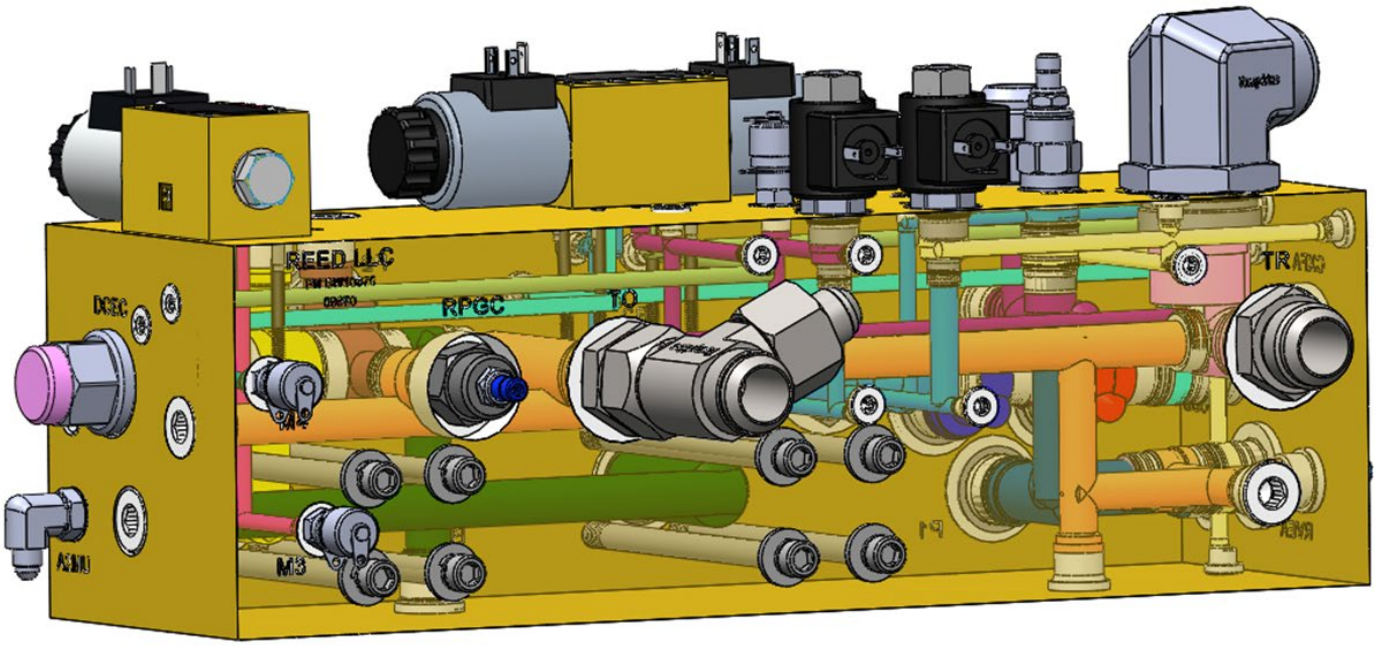
With this arrangement of connecting the two cylinders together, it is possible for various reasons, such as leakage around the piston seals, that more oil exists on the rod side of the cylinder than is required. When this condition exists, some hydraulic oil remains at the rod end of the cylinder being extended while the other cylinder is fully retracted. As a result, the cylinder will not completely extend and thus short strokes, which will also happen to the other cylinder on the next cycle.

This condition can be corrected by actuating and holding the STROKE CHANGE switch on the electrical control box until extending cylinder is fully extended. Hydraulically, this

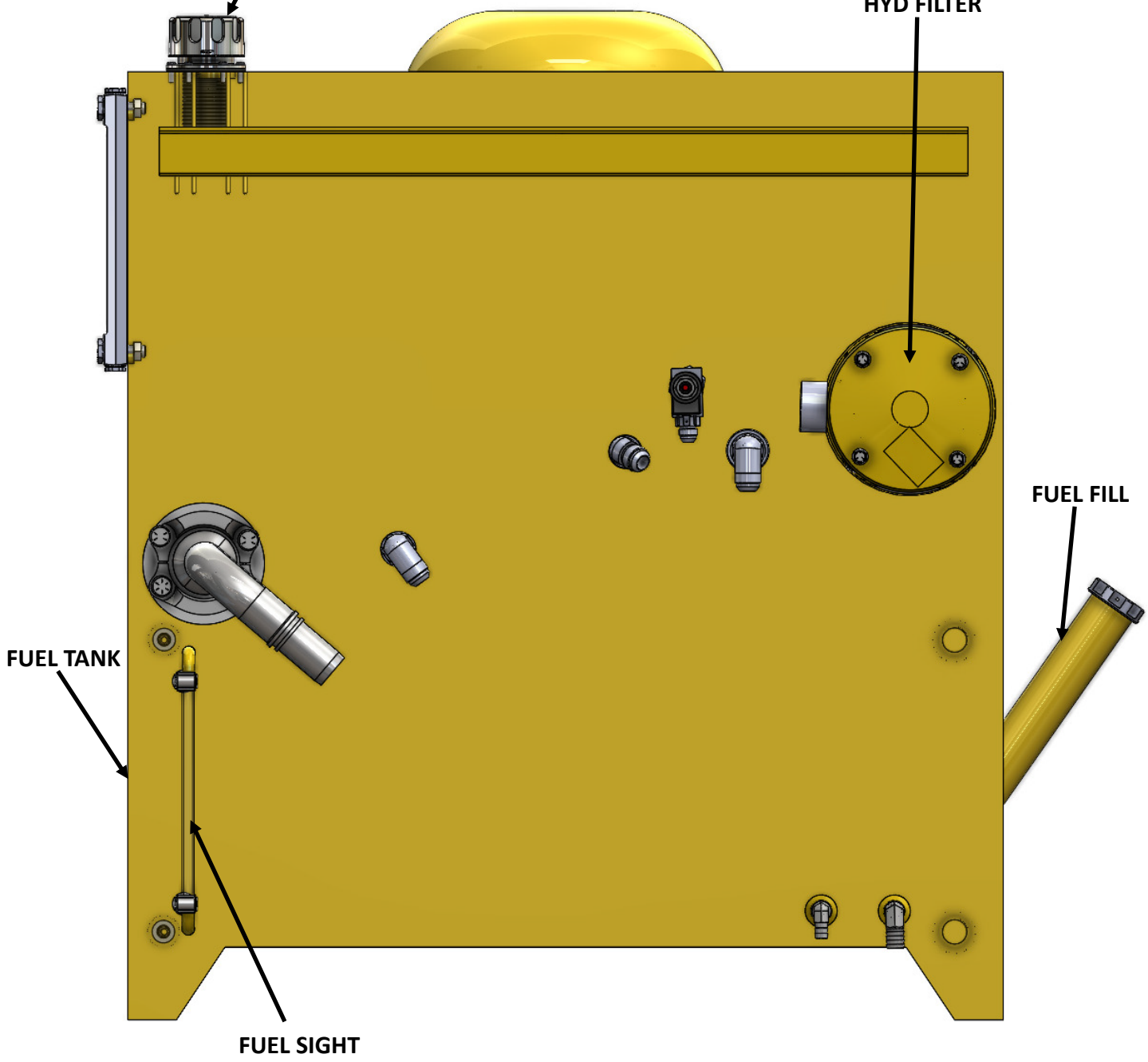
is accomplished by use of the check valves installed on both cylinders. By holding the STROKE CHANGE switch, you have interrupted the cycle and are forcing more oil into the head side of the extending cylinder. Since that cavity is full, pressure is built up in the rod side of the fully retracted cylinder, which unseats the head-side check valve and forces the excess oil out of the slave loop and back to the tank. Once the extending cylinder has reached its full stroke, regular operation can continue.

Short stroking can also occur from incorrect proximity sensor location or leaking check valves.

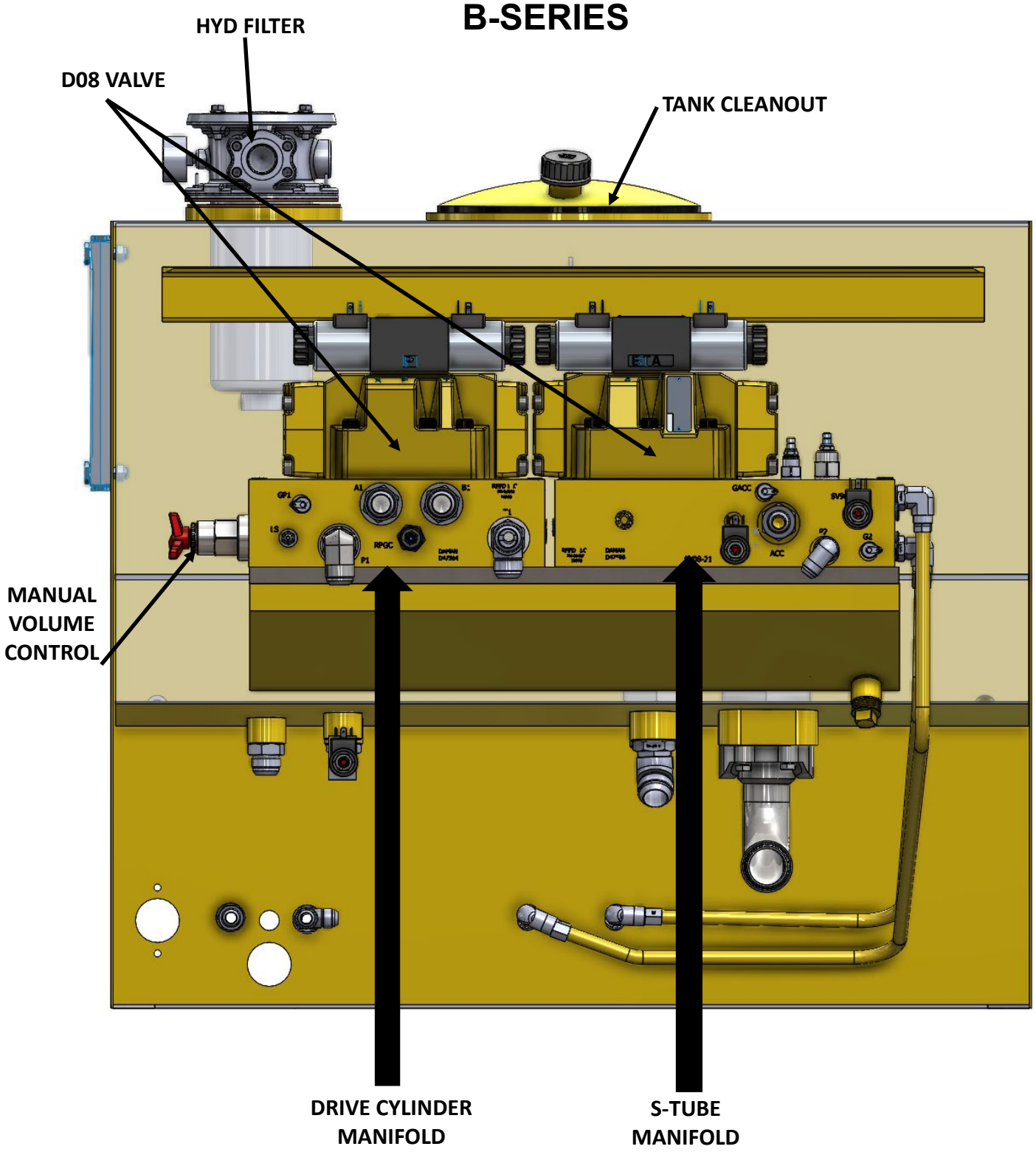
A-SERIES



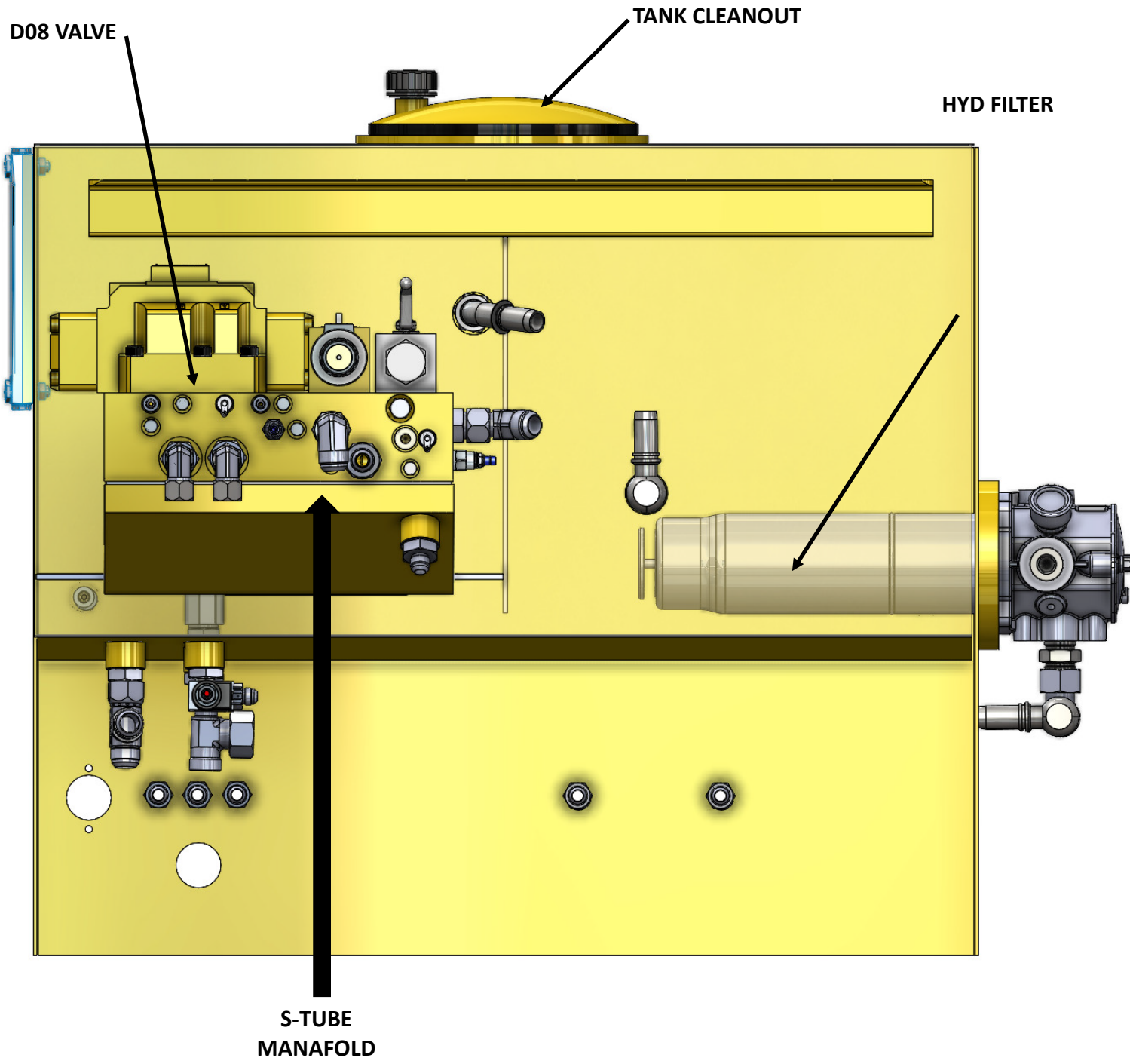
A-SERIES



B-SERIES


HYD FILTER
D08 VALVE
TANK CLEANOUT
MANUAL VOLUME CONTROL
DRIVE CYLINDER MANIFOLD
S-TUBE MANIFOLD

C-SERIES



S-TUBE CIRCUIT

Since there is only one outlet for the pumping material, a means is required to transfer the material from the material cylinder to the outlet and into the delivery line. To accomplish this, an s-tube is installed in the hopper. Since there are two material cylinders and one s-tube, the s-tube must be shifted from one material cylinder to the other, whichever one is loaded with the pumping material.

The s-tube shift hydraulic circuit is of the open center type, meaning that when the control valves are in the neutral position, the internal passages of the valves are open, allowing the hydraulic fluid to return to the tank. With the engine running the hydraulic pump is operating, producing a flow of oil which, with no control energized, will pass through the shift circuit on its way back to tank.

To meet the flow and pressure requirements of the shift circuit, one section of a tandem pump is used. Note: a single pump may be used if unit is not required for auxiliary equipment. The tandem hydraulic pump is of the gear pump design with a fixed displacement, meaning it is designed to constantly produce the same displacement at a pre-set maximum, depending on engine rpm. The tandem gear pump is directly connected to and driven through the main hydraulic pump. In addition to the hydraulic pump, the s-tube shift circuit consists of a manifold, an accumulator, solenoid valve cartridges, a solenoid directional valve, and 1 or 2 hydraulic shift cylinders. The following is offered to describe the function of each in the system.

S-TUBE CIRCUIT MANIFOLD

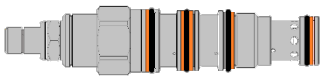
Like the main hydraulic circuit, the shift circuit is also equipped with a manifold block. It contains an unloader cartridge, relief cartridge and solenoid valve cartridges. A solenoid operated directional valve is mounted on top of the block and an s-tube selector control valve is located on front of the block. Each of these components is designed to perform a particular function in the swing circuit as explained in the following descriptions:

- RELIEF CARTRIDGE

This cartridge is used to divert the pump flow from going to the accumulator once its capacity has been reached, directing it back to tank. It becomes operational when the unloader cartridge setting has been reached, acting as a dump valve.

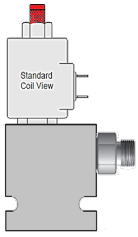
- UNLOADER CARTRIDGE

This pressure sensitive cartridge is used to protect the system from excessive pressure and to limit the amount of pressure being applied to the accumulator by hydraulically signaling the relief cartridge to open once the unloader setting has been reached. The unloader will also redirect the oil back to the accumulator when it senses a drop-in system pressure, when the hydraulic cylinder shifts for example.



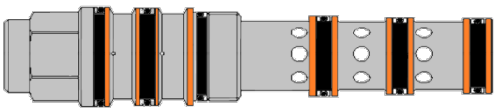
- SOLENOID VALVE CARTRIDGE

There are two (2) of these cartridges used in the circuit. Both, which may be referred to as a dump valve, are designed into the circuit as SAFETY VALVES. Their purpose is to automatically relieve pressure from the shift circuit as commanded by the emergency stop circuit. At start up, the normally open cartridges are open to tank so the shift circuit cannot build any pressure. When the emergency stop circuit is reset, an electrical signal is generated which energizes the solenoids, closing the cartridges and allowing the shift circuit to pressurize. When the emergency stop function is activated or the key switch turned off, the power is taken away from solenoids, causing the cartridges to open and dump shift circuit pressure back to tank.



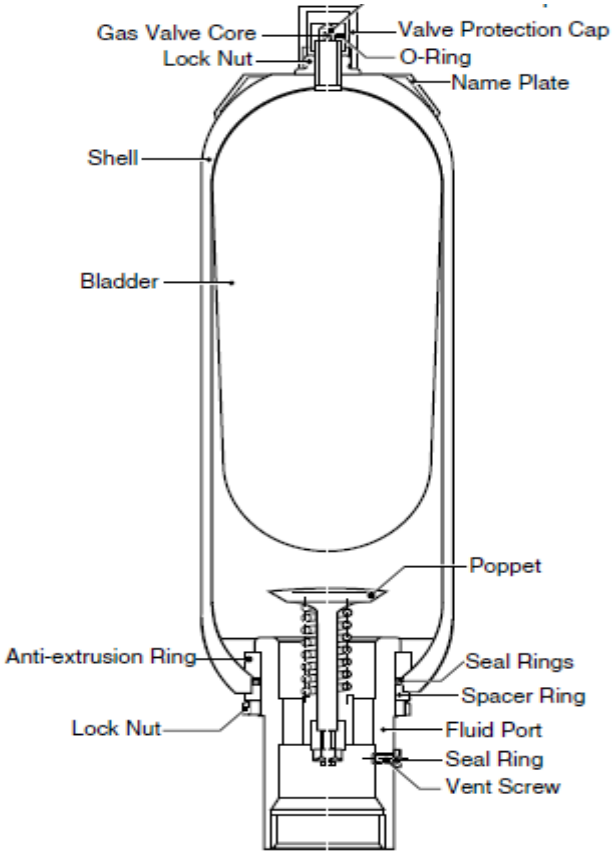
- SOLENOID DIRECTIONAL VALVE

This valve is a directional control valve that is shifted by electronically activated solenoids. Its purpose is to direct the flow of oil stored in the accumulator to one or the other end of the shift cylinder based on the signal received by the logic controller that was generated by the proximity sensor.



- ACCUMULATOR

The accumulator is incorporated into the shift circuit to provide instant pressure and volume for the shifting of the s-tube, which cannot be obtained under normal circumstances. An accumulator is a hydraulic reservoir that retains the hydraulic fluid under high pressure.
The accumulator contains a rubber bladder on the inside of the reservoir. The bladder is pre-charged with dry nitrogen. In the application of the shift circuit, the hydraulic fluid is pumped into the accumulator at a higher pressure than that inside the bladder. This compresses the bladder building up high pressure within the accumulator that is retained until released.



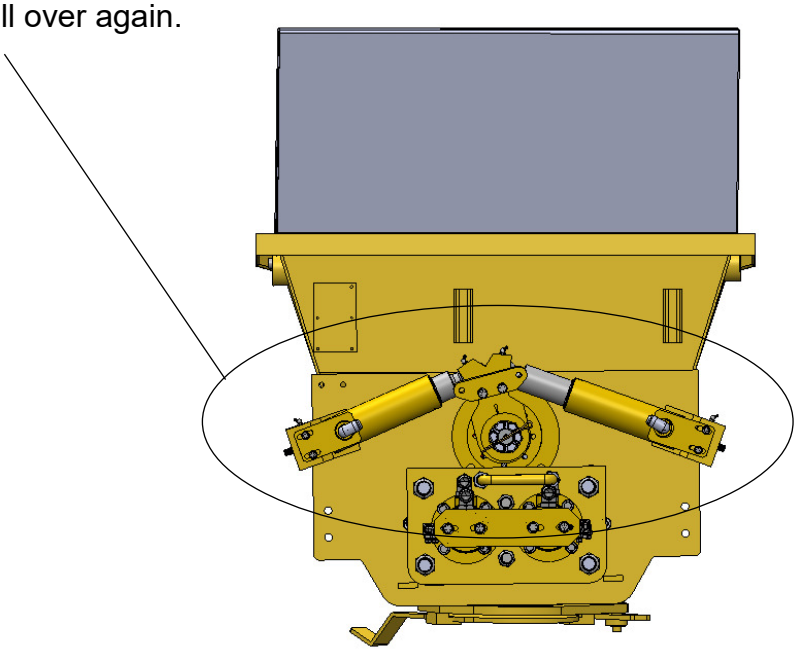
S-TUBE CIRCUIT OPERATIONAL SEQUENCE

In the operational sequence of the shift circuit with the engine at full RPM, the tandem pump is producing its rated displacement. The flow is going through the system and is being dumped or directed back to the tank thru the solenoid cartridges of the s-tube circuit manifold.

When the HORN/RESET switch is placed to RESET, an electrical signal closes the solenoid cartridges. When this occurs, the hydraulic fluid is now directed to the accumulator where it starts compressing the bladder and building up pressure. When the pressure in the shift circuit reaches a setting of the unloader valve, the unloader valve activates causing the relief cartridge to open. The open relief valve now directs the oil flow from the pump back to the tank instead of continuing to pressurize the accumulator. A check valve retains the pressure in the swing circuit and prevents the fluid from going back into the pump line.

In the main pump circuit description, it was described how an electrical signal was generated by the proximity sensor which was sent to the logic controller and used to control the alternating action of the hydraulic drive cylinders. This same signal is also used to shift the s-tube so that its movement is synchronized with that of the hydraulic drive cylinder, shifting the s-tube to the material cylinder which is ready to extend (normal forward operation).

The electrical signal activates the solenoid coil of the directional valve, shifting the spool to the appropriate side. The accumulator then releases, exhausting the fluid which flows through the directional valve and is directed to the appropriate side of the shift cylinder. As soon as the shift is made the accumulator is refilled immediately and the sequence starts all over again.



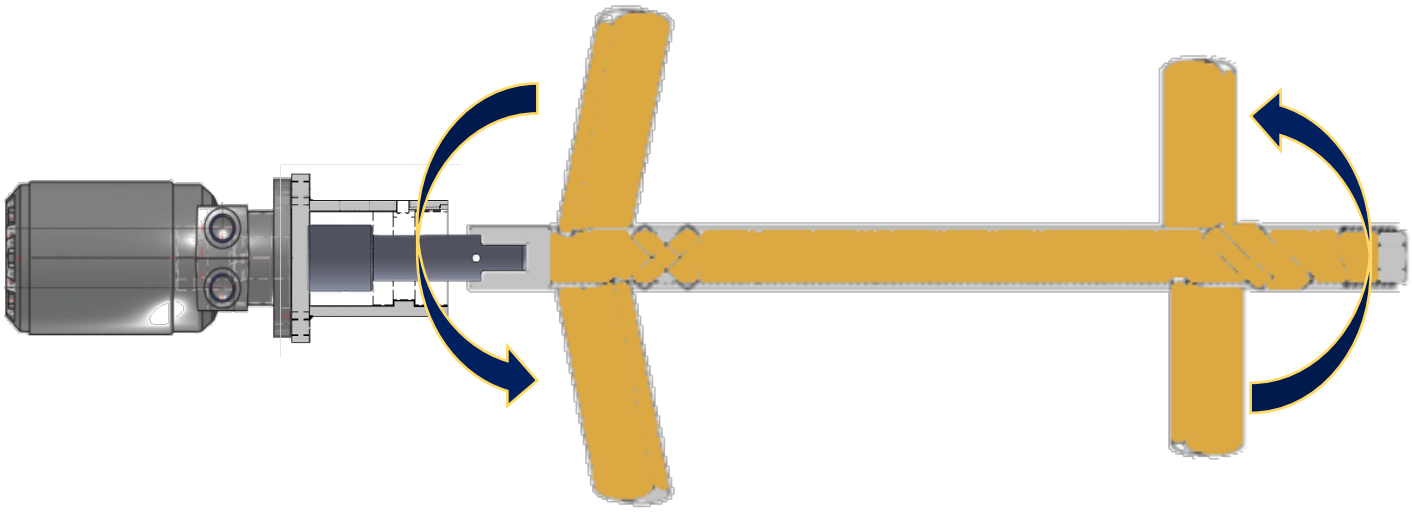
AUXILIARY CIRCUIT

The auxiliary circuit has been designed and installed for the purpose of operating the hydraulic function of the auxiliary equipment on the unit, primarily the agitator. This function is that of the agitator rotation for mixing the material in the hopper and feeding of the concrete cylinders.

The flow and pressure requirements for the auxiliary circuit are met by employing the second stage or section of the same tandem pump used on the s-tube shift circuit. With the engine running and throttle set to maximum RPM, the flow from the tandem pump is directed to a single spool directional control valve. This circuit also utilizes a solenoid valve cartridge or dump valve, designed as a safety valve with the purpose of preventing flow to the auxiliary circuit as commanded by the emergency stop circuit. At start up, the normally open cartridge directs the oil flow from the tandem pump to tank, prohibiting function of the auxiliary circuit. When the emergency stop circuit is reset, an electrical signal is generated to energize the solenoid, closing the cartridge, and blocking flow directly back to tank, instead allowing the flow to the single spool directional control valve for operation. The directional control valve has relief cartridge to protect the system against excessive pressure

When the valve lever is activated the agitator will rotate in forward direction as hydraulic fluid is

directed to that side of the motor. Rotation can be reversed by moving lever in other direction.



OPERATION

OPERATOR QUALIFICATIONS

Everyone involved with the operation, maintenance, inspection, and repair of the concrete pump MUST READ and UNDERSTAND this operation manual and the accompanying Safety Manual.

The following are a few general warnings for operator qualifications outlined in the Safety Manual.

- Individuals who cannot read and understand this operation manual, Safety Manual, signs, warnings, notices, and operating instructions, in the language in which they are printed, must not be allowed to operate the concrete equipment / mixer.
- Only qualified, experienced, and trained personnel may be allowed to operate the concrete equipment / mixer.
- Operation, maintenance, inspections, and repair must only be made by qualified, experienced, and trained personnel.
- Obey all applicable local and government statutes and regulations applying to safely operate equipment in their location.

SERIAL PLATE IDENIFICATION

A-SERIES

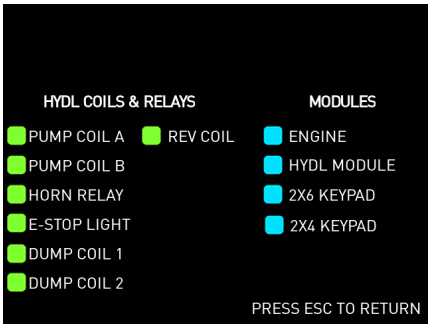
B-SERIES

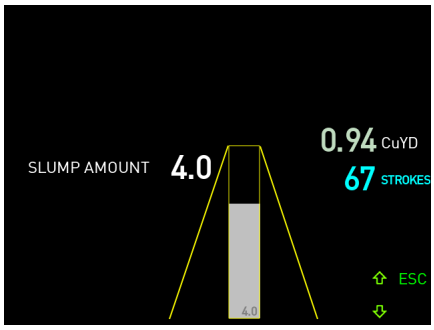
C-SERIES

CONTROLS

MAIN PUMP CONTROLS A-SERIES DIESEL TIER4

1. **MAIN DIGITAL DISPLAY** this is where all the pumping statues are displayed.





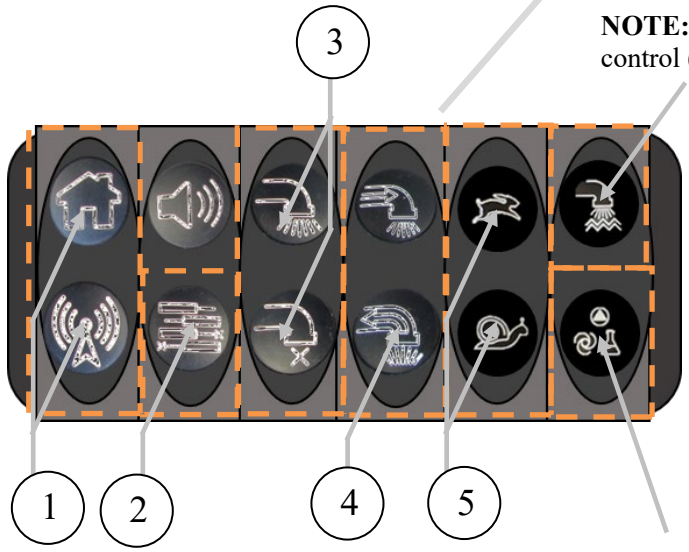
NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted

2. MAIN POWER SWITCH this is a three (3) position key switch. Turn-key to the **ON** position to power control box. Shut down power by turning key to **OFF** position. **START** position. To start engine turn to start position and hold until engine starts.

3. **EMERGENCY STOP** This push/pull emergency switch is used to shut down the pump in an emergency by disabling the hydraulic systems. It does not shut the engine or motor off. Depress **PUSH** knob in to **STOP** operation. **PULL** knob out to **REACTIVATE** system.

4. **NOTE:** the **HORN/RESET** must be switched one time to restart pump operation

5. HORN/RESET Press button down to activate horn/reset, it is used to reactivate the control and **PUMP CIRCUIT** after machine has been shut down using the **EMERGENCY STOP** switch or when you start the pump. Once the emergency stop has been depressed it will be necessary to press downs the **HORN** button to **RESET.** It will be backlit when engaged.



NOTE: Vibrator on/off control (option only).

1. CONTROL SWITCH **(LOCAL/REMOTE)** this is used to select the pump control location. Press button to **LOCAL** to enable operation of concrete pump for main stationary panel. Press button to **REMOTE** for operation using the remote control.

2. STROKE-SWITCH Press button to test stroke change. It is used for the purpose of pressure testing the main drive cylinders. Both main and swing cylinders reverse direction when button is depressed. When the main cylinders reach the end of the stroke they will “dead head” until the button is released.

3. PUMP ON/OFF SWITCH this is to turn the pump on and off. Press button **PUMP ON** to turn pump on, and press button **PUMP OFF** to turn pump off.
4. PUMP DIRECTION SWITCHES this is used to select and controls of the cycle direction of the concrete pump. Press button **FORWARD** to control pump forward, and press button **REVERSE** to control pump reverse functions.
5. RPM +/-, controls increase and decrease of engine RPM**.**

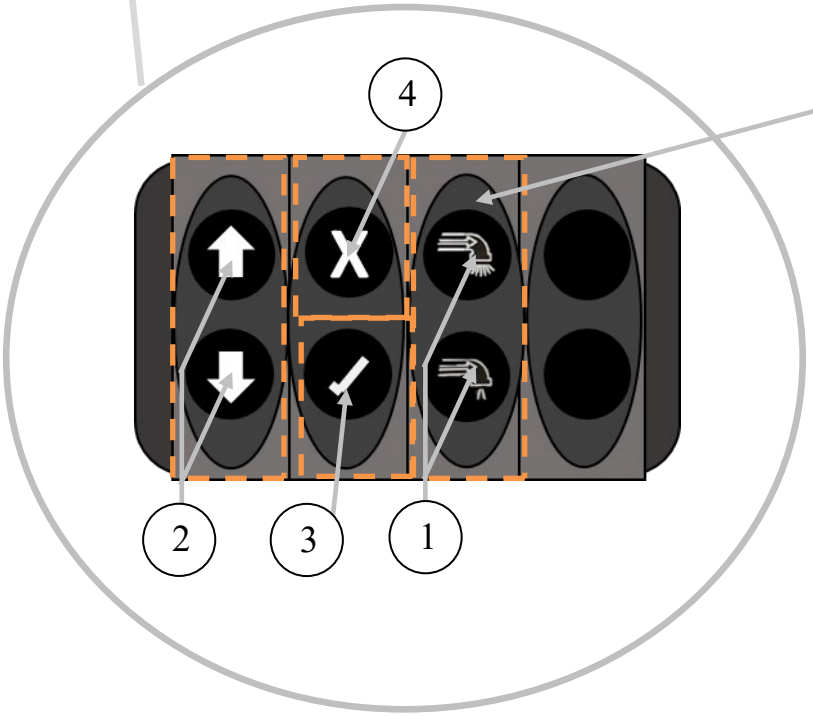
NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted

NOTE: Chemical Pump

THESE CONTROLS ARE USED FOR (OPTION SYNCHRONISED CHEMICAL PUMP)

- Manual mode is used when you can control the speed of the chemical pump.
- Auto mode is used when you need a specific amount of chemical to be pumped With each stroke of the concrete pump.

1. PUMP VOLUME, this is to turn the pump volume up or down. Press button **VOLUME UP** to increase volume, and press button **VOLUME DOWN** to reduce volume.
2. SCREEN NAVIGATION is to move UP and DOWN in screen menu.
3. ENTER, is to select enter in screen menu.
4. ESC. Is to select escape in screen menu.

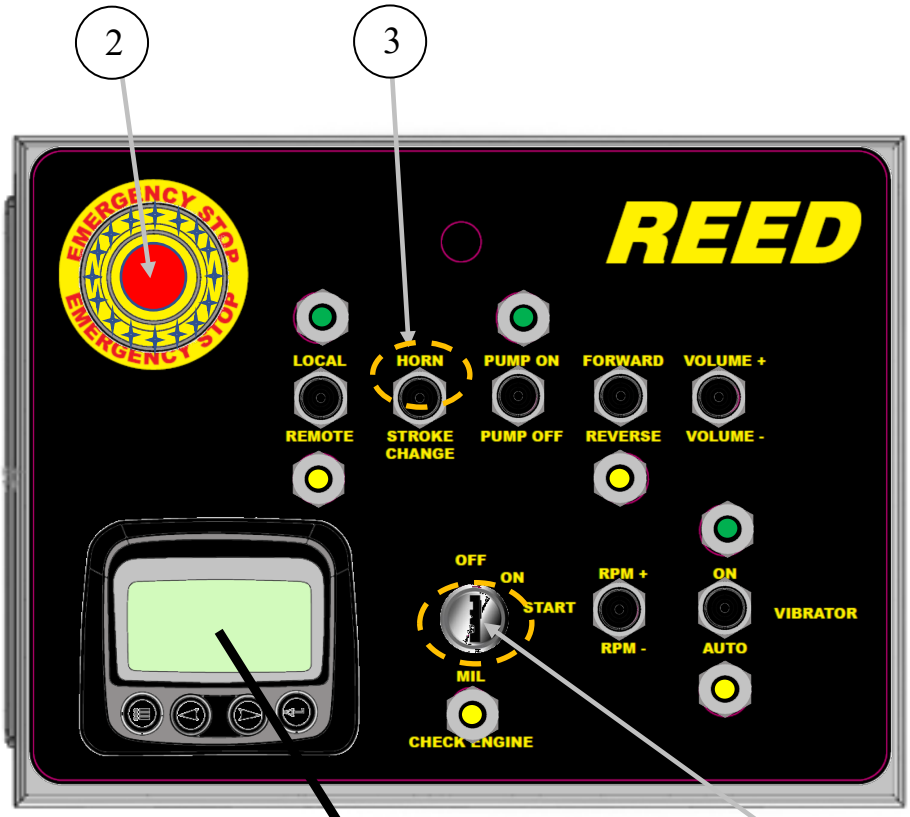


NOTE: Electric volume controls (option only).

NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted

CONTROLS

MAIN PUMP CONTROLS (GASOLINE) B-SERIES



1. MAIN POWER SWITCH this is a three (3) position key switch. Turn-key to the **ON** position to power control box. Shut down power by turning key to **OFF** position. **START** position. To start engine turn to start position and hold until engine starts.

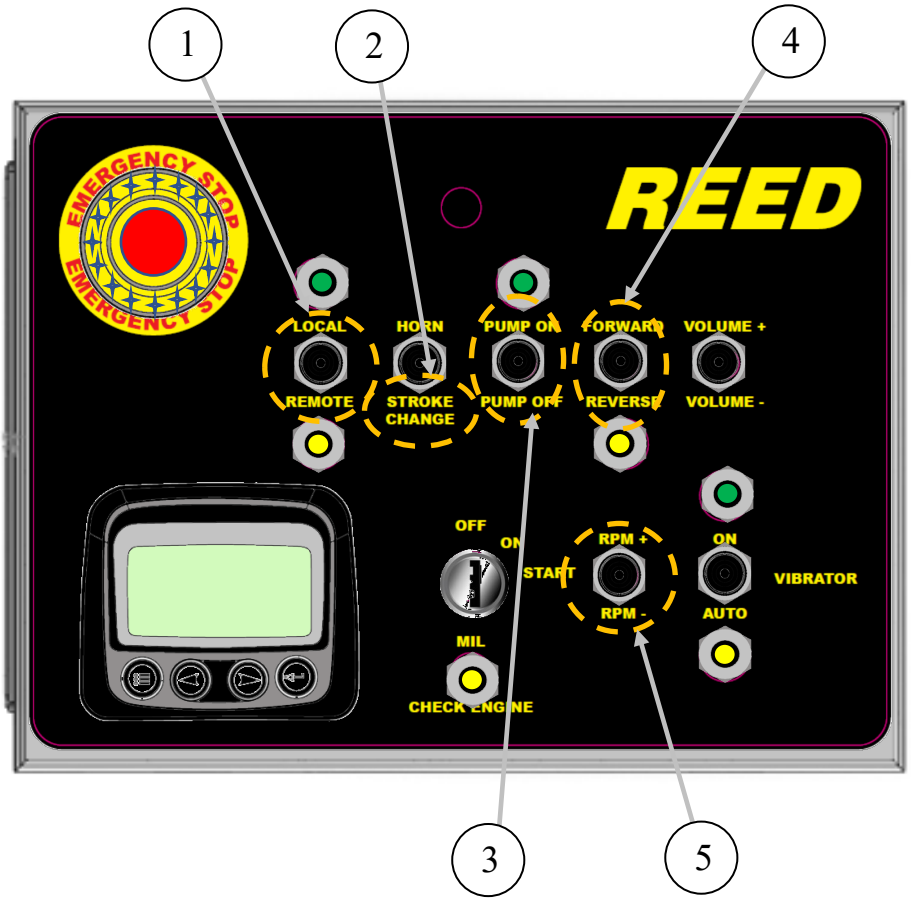
2. **EMERGENCY STOP** This push/pull emergency switch is used to shut down the pump in an emergency by disabling the hydraulic systems. It does not shut the engine or motor off. Depress **PUSH** knob in to **STOP** operation. **PULL** knob out to **REACTIVATE** system.

   NOTE: the **HORN/RESET** must be switched one time to restart pump operation

3. HORN/RESET Press button down to activate horn/reset, it is used to reactivate the control and **PUMP CIRCUIT** after machine has been shut down using the **EMERGENCY STOP** switch or when you start the pump. Once the emergency stop has been depressed it will be necessary to press downs the **HORN** button to **RESET.** It will be backlit when engaged.

NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted

GASOLINE CONTROLS B-SERIES



1. CONTROL SWITCH **(LOCAL/REMOTE)** this is used to select the pump control location. Press toggle to **LOCAL** to enable operation of concrete pump for main stationary panel. Press toggle to **REMOTE** for operation using the remote control. Led light will show status.

2. STROKE-SWITCH Press toggle (**DOWN**) to test stroke change. It is used for the purpose of pressure testing the main drive cylinders. Both main and swing cylinders reverse direction when toggle is depressed. When the main cylinders reach the end of the stroke they will "dead head" until the toggle is released.

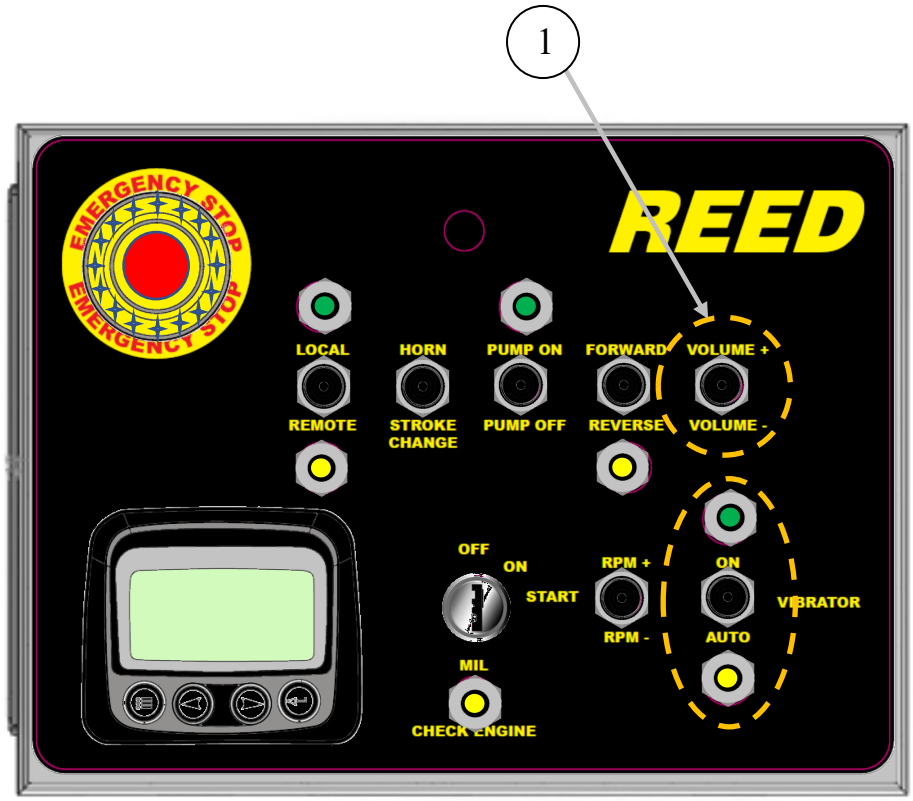
3. PUMP ON/OFF SWITCH this is to turn the pump on and off. Press toggle **PUMP ON** to turn pump on, and press toggle **PUMP OFF** to turn pump off. Led light will show status.

4. PUMP DIRECTION SWITCHES this is used to select and controls of the cycle direction of the concrete pump. Press toggle **FORWARD** to control pump forward, and press toggle **REVERSE** to control pump reverse functions. Led light will show status.

5. **RPM**+/-, press toggle to control the increase and decrease of engine RPM.

NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted

GASOLINE CONTROLS B-SERIES



1. PUMP VOLUME, this is to turn the pump volume up or down. Press toggle **VOLUME UP** to increase volume, and press toggle **VOLUME DOWN** to reduce volume.

2. VIBRATOR
(if equipped-HOPPER OPTION) controls vibrator activation. (AUTO/PUMP/ON/OFF)

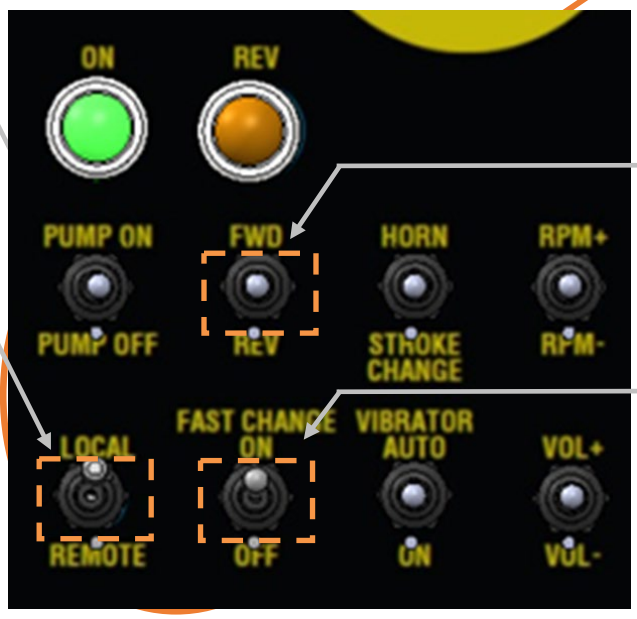
NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted

CONTROLS PLCv2

MAIN PUMP CONTROLS PLCv2 B, C-SERIES TIER-4

EMERGENCY STOP This push/pull emergency switch is used to shut down the pump in an emergency by disabling the hydraulic systems. It does not shut the engine or motor off. Depress **PUSH** knob in to **STOP** operation. **PULL** knob out to **REACTIVATE** system. **NOTE:** the **HORN/RESET** must be switched one time to restart pump operation.

PUMP ON/OFF SWITCH
this is to turn the pump on and off. Toggle switch **PUMP ON** to turn pump on, and toggle switch down **PUMP OFF** to turn pump off. When the pump is on the (Green) indicator light will be lit.



CONTROL SWITCH
(LOCAL/REMOTE) this is used to select the pump control location. toggle switch to **LOCAL** to enable operation of concrete pump for main stationary panel. toggle switch to **REMOTE** for operation using the remote control. Optional remotes are available, Radio or Cable Options.

PUMP DIRECTION SWITCHES
this is used to select and controls of the cycle direction of the concrete pump. Toggle switch **FORWARD** to control pump forward, and toggle switch **REVERSE** to control pump reverse functions. The indicator light (Orange) will be lit when reverse function is engaged.

FAST CHANGE
(If equipped-closed loop only) controls the fast change feature for smoother operation under certain conditions.

WARNING

NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted

PLC MAIN CONTROLS B, C-SERIES TIER-4

MAIN DIGITAL DISPLAY this is where all the pumping statues are displayed.

MAIN POWER KEY this is a three (3) position key switch. Turnkey to the **ON** position to power control box. Shut down power by turning key to **OFF** position.

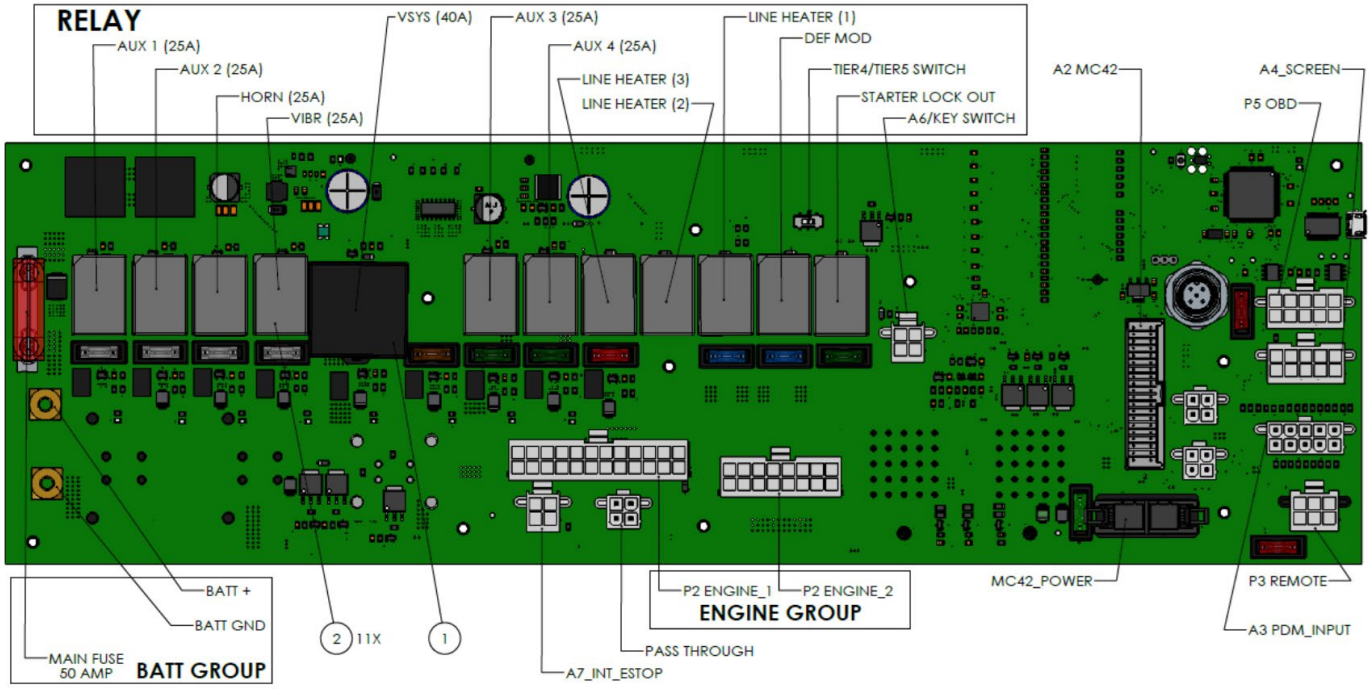
HORN/RESET
Press button down to activate horn/reset, it is used to reactivate the control and **PUMP CIRCUIT** after machine has been shut down using the **EMERGENCY STOP** switch or when you start the pump. Once the emergency stop has been depressed it will be necessary to press downs the **HORN** button to **RESET.** It will be backlit when engaged.

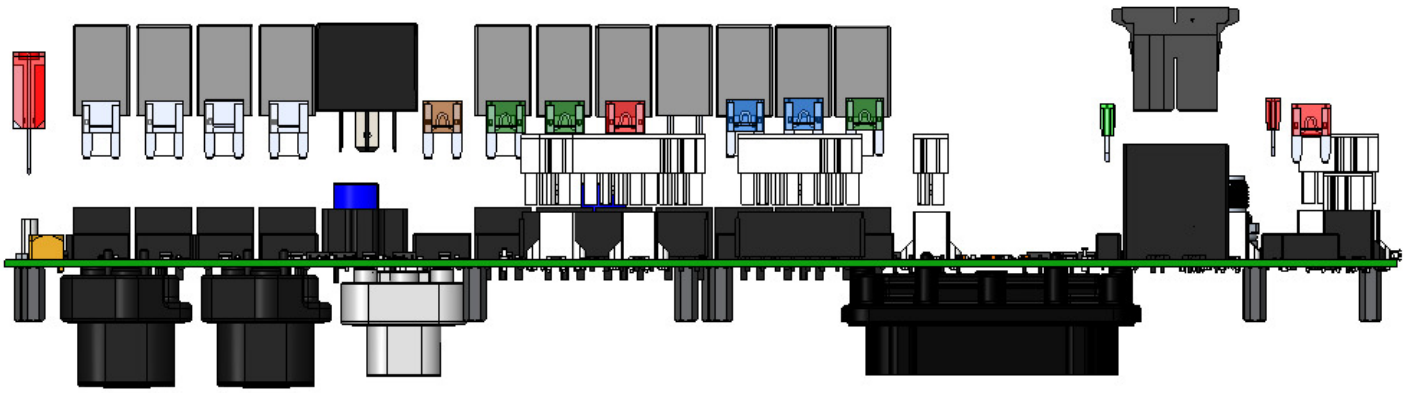
VIBRATOR
(if equipped-HOPPER OPTION) controls vibrator activation. (AUTO/PUMP/ON/OFF)

RPM +/-
controls increase and decrease of engine RPM It will be backlit when each function is engaged.

PUMP VOLUME
this is to turn the pump volume up or down. Press button **VOLUME UP** to increase volume, and press button **VOLUME DOWN** to reduce volume. It will be backlit when each function is engaged.

PDM LAYOUT


RELAY
AUX 1 (25A)
AUX 2 (25A)
HORN (25A)
VIBR (25A)
VSYS (40A)
AUX 3 (25A)
AUX 4 (25A)
LINE HEATER (3)
LINE HEATER (2)
LINE HEATER (1)
DEF MOD
TIER4/TIER5 SWITCH
STARTER LOCK OUT
A6/KEY SWITCH
A2 MC42
A4_SCREEN
P5 OBD
BATT +
BATT GND
MAIN FUSE
50 AMP
BATT GROUP
2
11X
1
P2 ENGINE_1
P2 ENGINE_2
ENGINE GROUP
PASS THROUGH
A7_INT_ESTOP
MC42_POWER
P3 REMOTE
A3 PDM_INPUT



ELECTRIC CONTROLS PLCv2
PLC MAIN CONTROLS B,C, M30-SERIES

1. MAIN ELECTRICAL PANEL POWER ON-OFF
   Turn handle to the ON or OFF position to activate system from the external source.

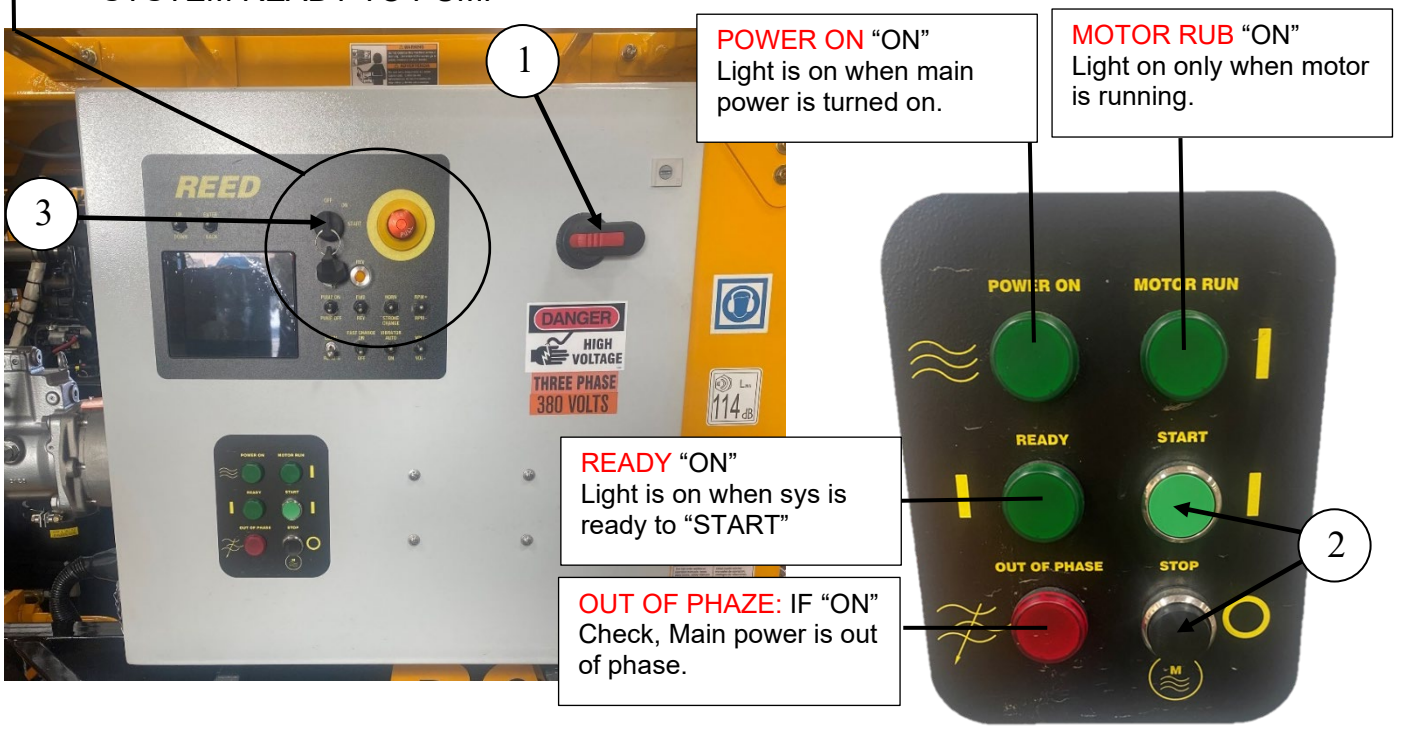
LIGHT STATIS CHECK
- POWER ON LIGHT IS "**ON**"
- OUT OF PHAZE LIGHT IS "**OFF**"
- READY LIGHT IS "**ON**"

2. HYDRAULIC MOTOR CONTROL SWITCH
   Then to START push the green button, then release button. To STOP motor, PUSH black button until motor stops.

LIGHT STATIS CHECK
- MOTOR LIGHT IS "**ON**"

3. KEY SWITCH "**ON**"

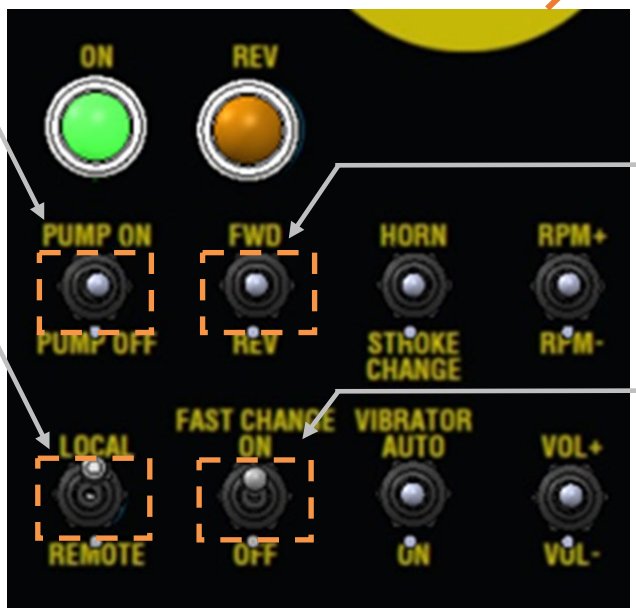
- DISPLAY "**ON**"
- "**PULL OUT**" E-STOP BUTTON/TOGGLE HORN/CLEAR E-STOP
- SYSTEM READY TO PUMP



ELECTRIC CONTROLS PLCv2
PLC MAIN PUMP CONTROLS B, C, M30-SERIES

EMERGENCY STOP This push/pull emergency switch is used to shut down the pump in an emergency by disabling the hydraulic systems. It does not shut the engine or motor off. Depress **PUSH** knob in to **STOP** operation. **PULL** knob out to **REACTIVATE** system. **NOTE:** the **HORN/RESET** must be switched one time to restart pump operation.

PUMP ON/OFF SWITCH
this is to turn the pump on and off. Toggle switch **PUMP ON** to turn pump on, and toggle switch down **PUMP OFF** to turn pump off. When the pump is on the (Green) indicator light will be lit.



CONTROL SWITCH
(LOCAL/REMOTE) this is used to select the pump control location. toggle switch to **LOCAL** to enable operation of concrete pump for main stationary panel. toggle switch to **REMOTE** for operation using the remote control. Optional remotes are available, Radio or Cable Options.

PUMP DIRECTION SWITCHES
this is used to select and controls of the cycle direction of the concrete pump. Toggle switch **FORWARD** to control pump forward, and toggle switch **REVERSE** to control pump reverse functions. The indicator light (Orange) will be lit when reverse function is engaged.

FAST CHANGE
(If equipped-closed loop only) controls the fast change feature for smoother operation under certain conditions.

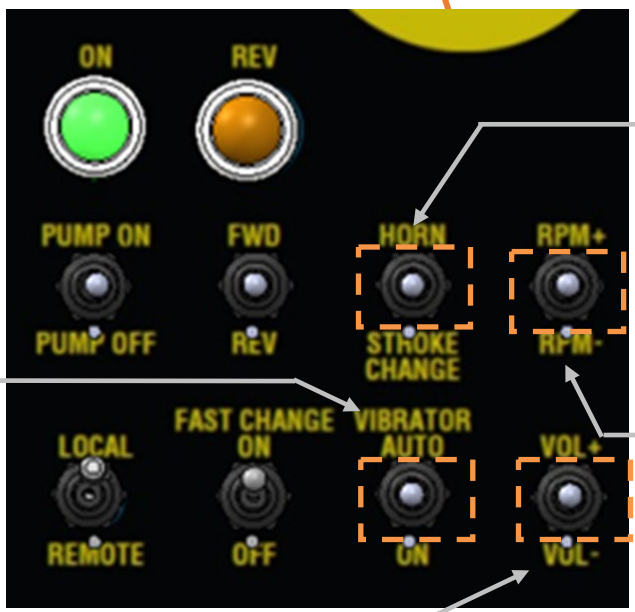
⚠WARNING

NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted

PLC MAIN CONTROLS B, C, M30-SERIES

MAIN DIGITAL DISPLAY this is where all the pumping statues are displayed.

MAIN POWER KEY this is a three (3) position key switch. Turnkey to the **ON** position to power control box. Shut down power by turning key to **OFF** position.



HORN/RESET
Press button down to activate horn/reset, it is used to reactivate the control and **PUMP CIRCUIT** after machine has been shut down using the **EMERGENCY STOP** switch or when you start the pump. Once the emergency stop has been depressed it will be necessary to press downs the **HORN** button to **RESET.** It will be backlit when engaged.

VIBRATOR
(if equipped-HOPPER OPTION) controls vibrator activation. (AUTO/PUMP/ON/OFF)

RPM +/-
controls increase and decrease of engine RPM It will be backlit when each function is engaged.

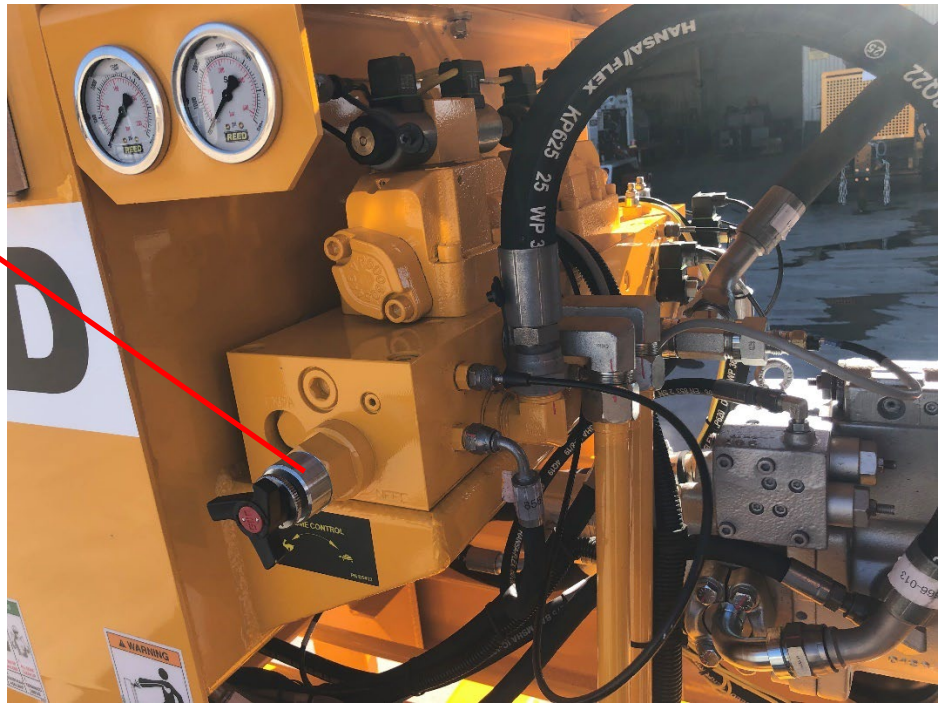
PUMP VOLUME (OPTION)
this is to turn the pump volume up or down. Press button **VOLUME UP** to increase volume, and press button **VOLUME DOWN** to reduce volume. It will be backlit when each function is engaged.

VOLUME CONTROL

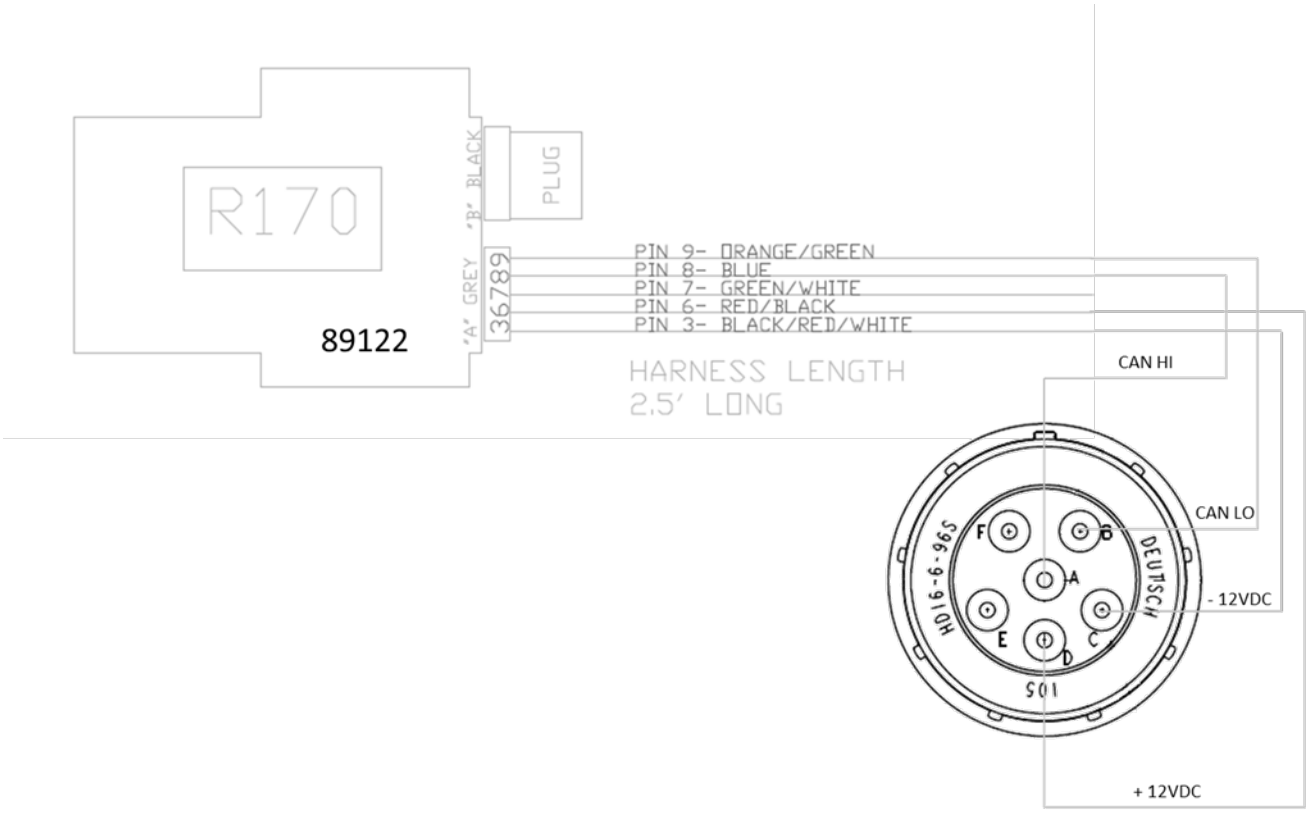
ELECTRIC VOLUME (OPTION)

VOLUME CONTROL can adjust volume output of the material.
Electrically on the control panel or the cable remote To INCREASE/+ Volume
And to DECREASE/- Volume

MANUAL VOLUME CONTROL



RADIO REMOTE
OMINEX



HYDRAULIC GAUGES

NOTE: C-SERIES SHOWN

GAUGES

PUMP or DRIVE CYLINDER GAUGE indicates the hydraulic pressure requirement of the pumping cylinders to push material. Gauge reading varies depending upon many circumstances such as: material slump, material line type, size and length, vertical, uphill, downhill or horizontal placement, pumping speed, etc.

S-TUBE GAUGE indicates amount of oil pressure stored in accumulator circuit. Pressure will build and stabilize at a set pressure once E-STOP is reset. Pressure will fluctuate as swing cylinder(s) shift but will always recharge to the same set pressure.

PILOT GAUGE (CLOSED LOOP ONLY) indicates volume adjustment of main hydraulic pump,
Works between a range of 90 PSI(6bar) min and 275 PSI (19 Bar max.

TOWING

Refer to the Safety Manual for set-up safety precautions not limited to the following guidelines:

Ensure Unit is Securely Attached Before Driving
Refer To Towing Instruction Manual

Tow Slowly and Safely Depending on Road Conditions
Overturning May Occur At Unsafe Speeds

Never Exceed 55 MPH

Maintain a Sufficient Distance for Braking
Overturning May Occur At Unsafe Stopping Distance

Do Not Tow with Concrete in the Hopper

Frequently Check, Monitor and Maintain all Towing Equipment
On Both the Towing Vehicle and the Trailer

Hitch Height

- Adjust the Hitch Height to Allow for Safe Towing
- The Tongue Weight on Tandem Axle Trailers Increases as the Tongue is Raised
- Towing With Insufficient or Excessive Tongue weight is Dangerous
- Perform Road Test to Ensure the Safety of the Tongue Weight

JOBSITE SET-UP

Refer to the Safety Manual for set-up safety precautions not limited to the following guidelines:

WARNING

Ensure Machine Can Be Safely Operated in Set-Up Location
Away from Hazards and Dangers
Away from Slopes and Excavations

WARNING

Position Machine on As Solid and Level Ground As Possible

WARNING

Adjust height of Machine and remove Leg pins

WARNING

Secure Machine Positions with Leg Pins and Locks

WARNING

Lower and Apply Pressure to the Front Jack on the Ground and if Necessary, Place Wooden Block Under the Jack Pad.
(This will Transfer Weight to the Outrigger Legs)

CAUTION

Not Using Outrigger Voids Warranty
Damage Will Occur If Outriggers Are Not Used

PRIMING

Priming consists of pumping a lubricant to coat the s-tube and delivery lines to assist the initial concrete material in getting through the delivery lines and avoid blockages. Once the delivery lines are full of concrete, that material will supply the lubrication necessary for the material to flow through the delivery lines. However, it is imperative that a primer be used ahead of the initial concrete material to pre-lubricate the lines in order to avoid blockages.

A suggested grout to use for priming and lubrication may consist of 2 parts sand and 1-part cement and mixed to a consistency of a thick cream.

The amount of grout required depends on the length of the delivery line as well as the material being pumped. Operator experience will eventually indicate the amount to be required.

In addition to grout, there is a wide variety of priming products available on the market.

PREPARING FOR SYSTEM START-UP

Everyone involved with the operation, maintenance, inspection, and repair of the concrete pump MUST READ and UNDERSTANDS this manual and the Safety Manual.

Refer to the Safety Manual for pumping and blockages safety precautions not limited to the following guidelines:

Perform Required Inspection, Lubrication, and Maintenance
Before, During, and After Pumping Operations

Do Not Remove Hopper Grate
Or Other Safety Components

Do Not Insert Body Parts into Hopper, S-Tube, or Water box
Or Other Moving Components

OPERATIONS

PUMP CONTROLS A-SERIES DIESEL TIER-4

THE HOPPER GRATE MUST BE CLOSED (There is a safety interlock that guards against the opening of the mixer grate).

SYSTEM START-UP

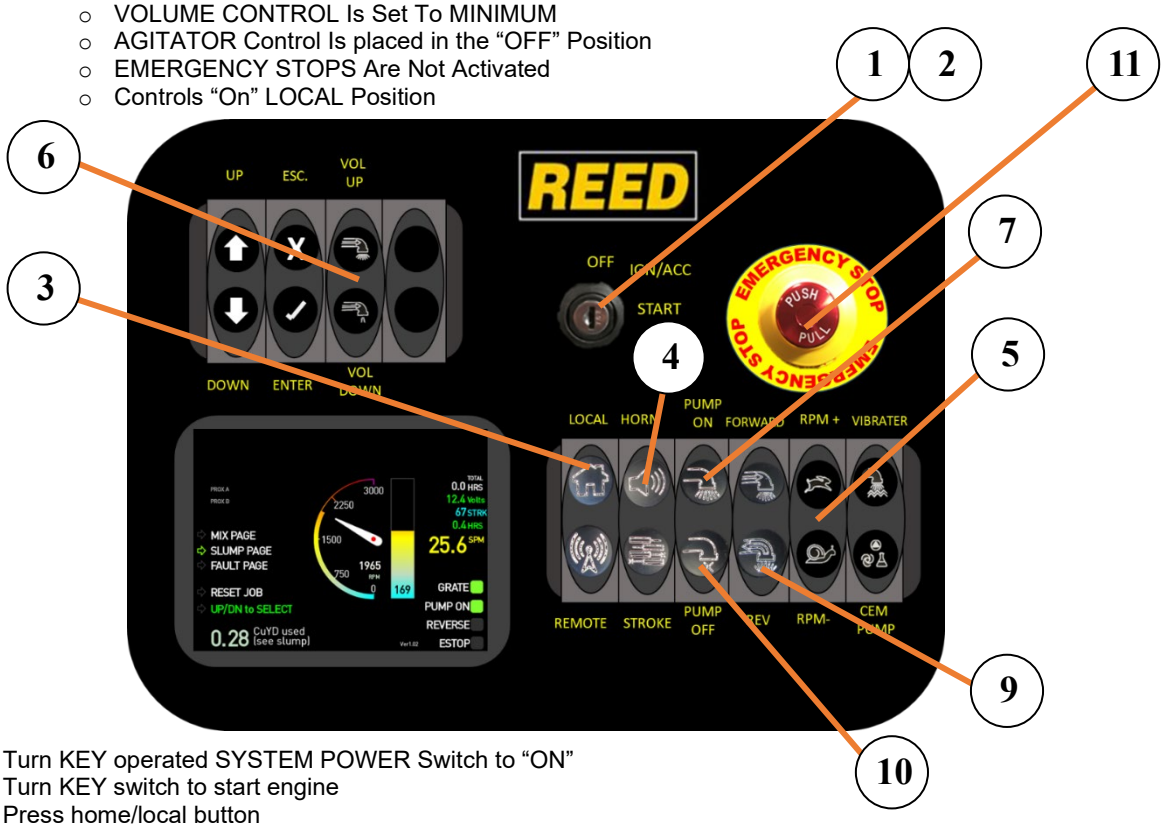
WARNING

Turn Pump ON Only When Hopper Is Full of Concrete

WARNING

Ensure the following conditions are met before activating pump:

- PUMP Switch Is “OFF”
- VOLUME CONTROL Is Set To MINIMUM
- AGITATOR Control Is placed in the “OFF” Position
- EMERGENCY STOPS Are Not Activated
- Controls “On” LOCAL Position



1. Turn KEY operated SYSTEM POWER Switch to “ON”
2. Turn KEY switch to start engine
3. Press home/local button
4. Activate the HORN/RESET to prepare the concrete pump for operation
5. After engine warms up, increase RPM to desired engine RPM by adjusting THROTTLE CONTROL
6. Adjust VOLUME CONTROL to low output when starting pumping operations (manual knob or electric control)
7. Switch PUMP Switch to “ON” to pump concrete when hopper is full, maintain full level
8. Closely monitor the PUMP pressure gauge while pumping
9. Turn PUMP Switch to “REVERSE” to reverse the pumping action if necessary. REVERSE function is typically used to relieve pressure in the delivery line in the event of a blockage. A blockage will generally result in the main hydraulic system reaching maximum pressure as indicated on the PUMP PRESSURE GAUGE
10. Turn PUMP Switch “OFF” to stop cycling and stop pumping concrete
11. 10.In the event of an emergency, push the “EMERGENCY STOP” Button” IN” to stop all functions of the concrete pump. Pull the “EMERGENCY STOP” Button “OUT” to enable system to reset; Horn/Reset function must be activated to reset pump operation.

OPERATION

PUMP CONTROLS B-SERIES (GASOLINE)

THE HOPPER GRATE MUST BE CLOSED (There is a safety interlock that guards against the opening of the mixer grate).

SYSTEM START-UP

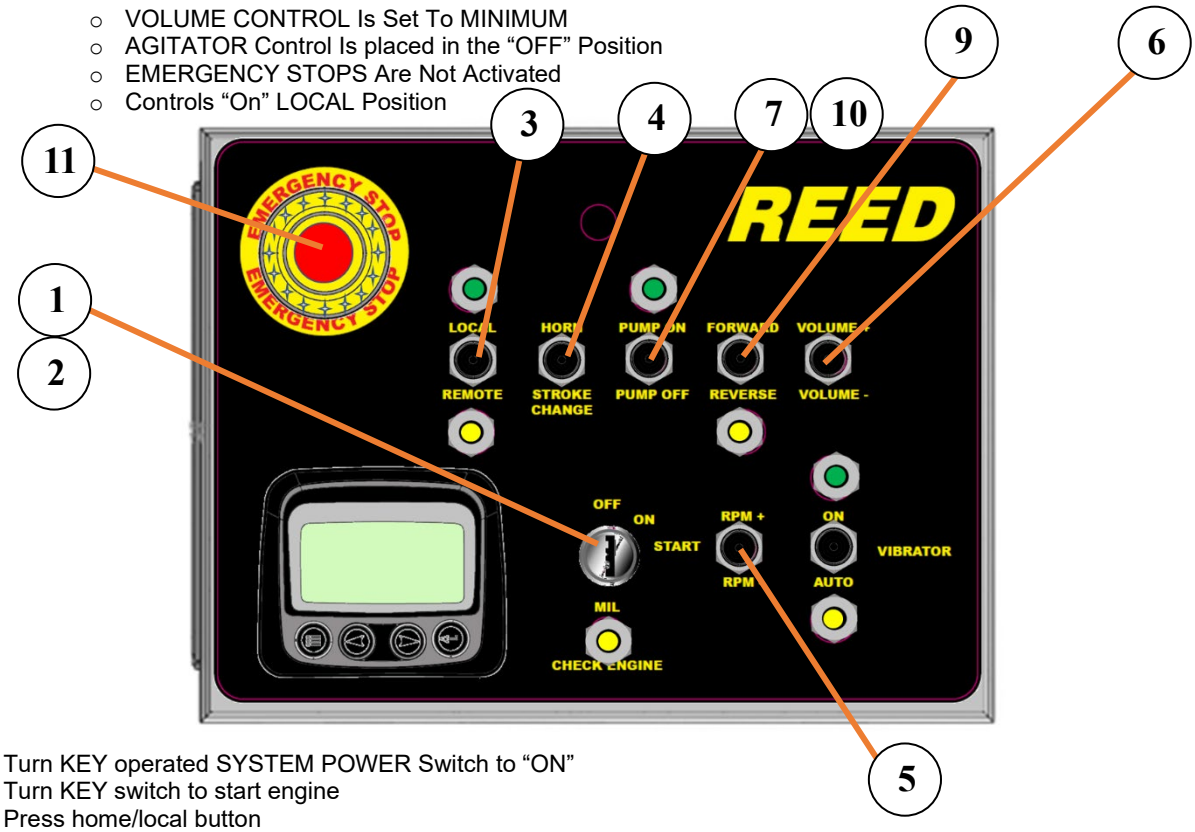
WARNING

Turn Pump ON Only When Hopper Is Full of Concrete

WARNING

Ensure the following conditions are met before activating pump:

- PUMP Switch Is “OFF”
- VOLUME CONTROL Is Set To MINIMUM
- AGITATOR Control Is placed in the “OFF” Position
- EMERGENCY STOPS Are Not Activated
- Controls “On” LOCAL Position



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2. Turn KEY switch to start engine
3. Press home/local button
4. Activate the HORN/RESET to prepare the concrete pump for operation
5. After engine warms up, increase RPM to desired engine RPM by adjusting THROTTLE CONTROL
6. Adjust VOLUME CONTROL to low output when starting pumping operations (manual knob or electric control)
7. Switch PUMP Switch to “ON” to pump concrete when hopper is full, maintain full level
8. Closely monitor the PUMP pressure gauge while pumping
9. Turn PUMP Switch to “REVERSE” to reverse the pumping action if necessary. REVERSE function is typically used to relieve pressure in the delivery line in the event of a blockage. A blockage will generally result in the main hydraulic system reaching maximum pressure as indicated on the PUMP PRESSURE GAUGE
10. Turn PUMP Switch “OFF” to stop cycling and stop pumping concrete
11. In the event of an emergency, push the “EMERGENCY STOP” Button” IN” to stop all functions of the concrete pump. Pull the “EMERGENCY STOP” Button “OUT” to enable system to reset; Horn/Reset function must be activated to reset pump operation.

OPERATION

PUMP CONTROLS PLCv2 B&C-SERIES DIESEL TIER-4

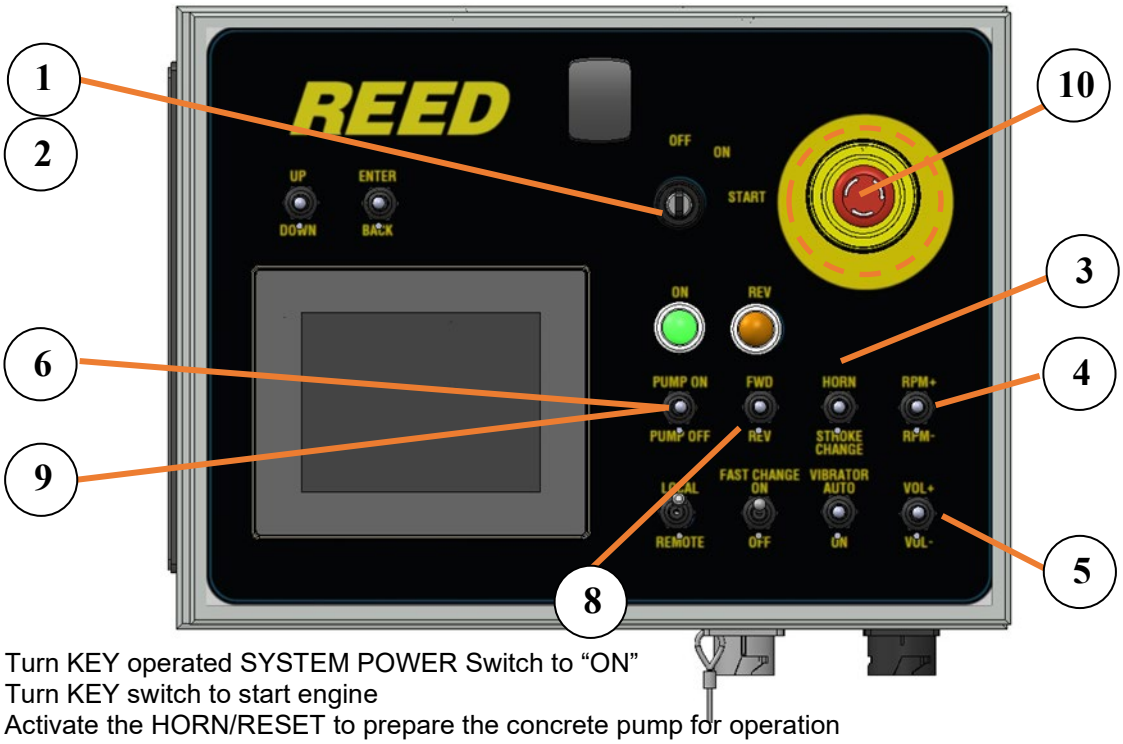
THE HOPPER GRATE MUST BE CLOSED (There is a safety interlock that guards against the opening of the mixer grate.

SYSTEM START-UP

Turn Pump ON Only When Hopper Is Full of Concrete

Ensure the following conditions are met before activating pump:

- PUMP Switch Is “OFF”
- VOLUME CONTROL Is Set To MINIMUM
- AGITATOR Control Is placed in the “OFF” Position
- EMERGENCY STOPS Are Not Activated
- Controls “On” LOCAL Position



1. Turn KEY operated SYSTEM POWER Switch to “ON”
2. Turn KEY switch to start engine
3. Activate the HORN/RESET to prepare the concrete pump for operation
4. After engine warms up, increase RPM to desired engine RPM by adjusting THROTTLE CONTROL
5. Adjust VOLUME CONTROL to low output when starting pumping operations
6. Switch PUMP Switch to “ON” to pump concrete when hopper is full, maintain full level
7. Closely monitor the PUMP pressure gauge while pumping
8. Turn PUMP Switch to “REVERSE” to reverse the pumping action if necessary. REVERSE function is typically used to relieve pressure in the delivery line in the event of a blockage. A blockage will generally result in the main hydraulic system reaching maximum pressure as indicated on the PUMP PRESSURE GAUGE
9. Turn PUMP Switch “OFF” to stop cycling and stop pumping concrete
10. In the event of an emergency, push the “EMERGENCY STOP” Button” IN” to stop all functions of the concrete pump. Pull the “EMERGENCY STOP” Button “OUT” to enable system to reset; Horn/Reset function must be activated to reset pump operation.

OPERATION
PUMP CONTROLS PLCv2 B,C, M30-SERIES ELECTRIC 380V-575V

PUMP CONTROLS PLCv2 B,C, M30-SERIES ELECTRIC 380V-575V

THE HOPPER GRATE MUST BE CLOSED (There is a safety interlock that guards against the opening of the mixer grate).

SYSTEM START-UP

WARNING

Turn Pump ON Only When Hopper Is Full of Concrete

WARNING

Ensure the following conditions are met before activating pump:

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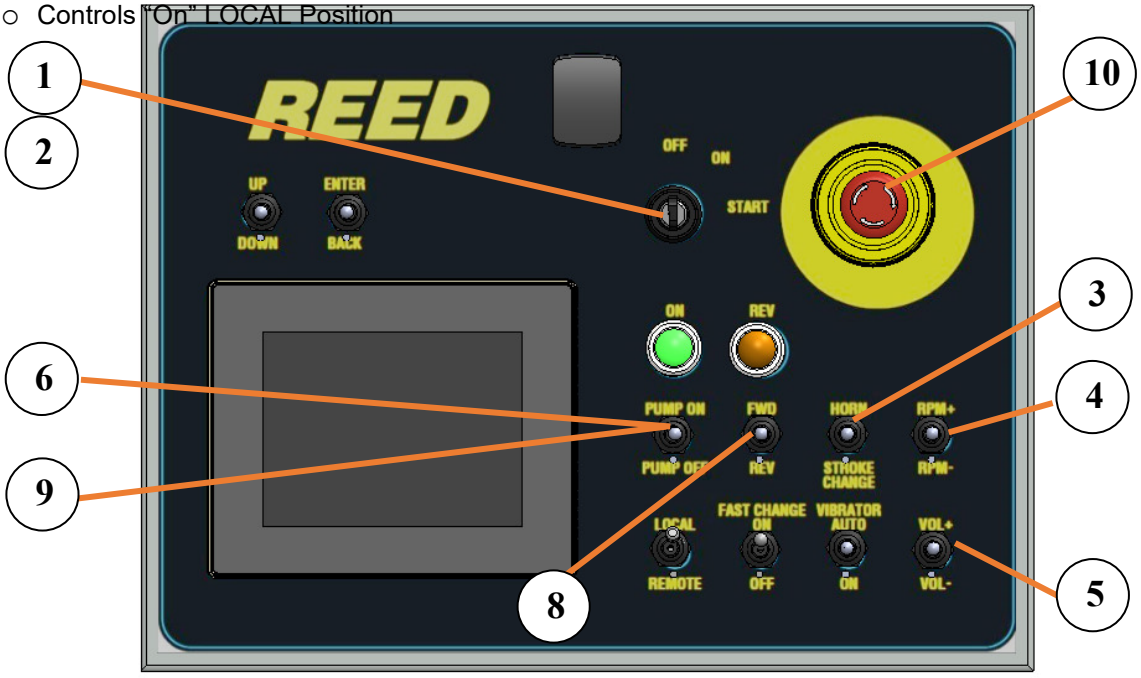

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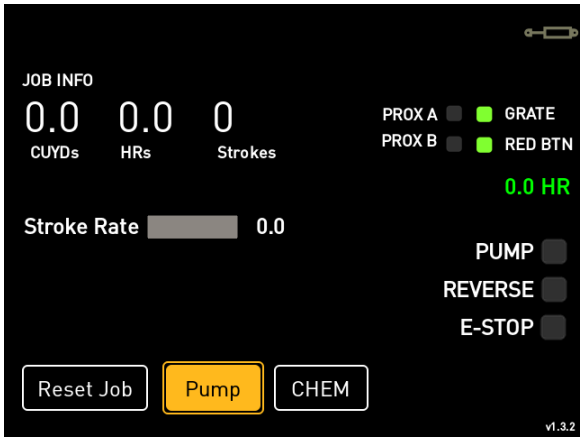
CHEMICAL PUMP OPERATION AND SET-UP

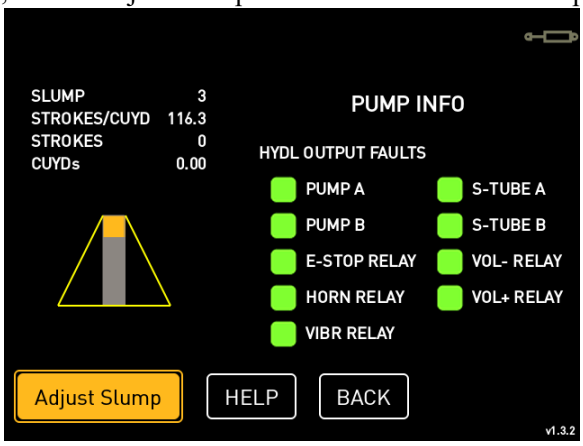
INPUTING CHEMICAL PUMP PARAMETERS

1. Obtain the following information from the Engineer responsible for the Concrete Mix design:
   a. Concrete Slump
   b. Cement weight per Cubic Yard
   c. Cement Dosing Mixture

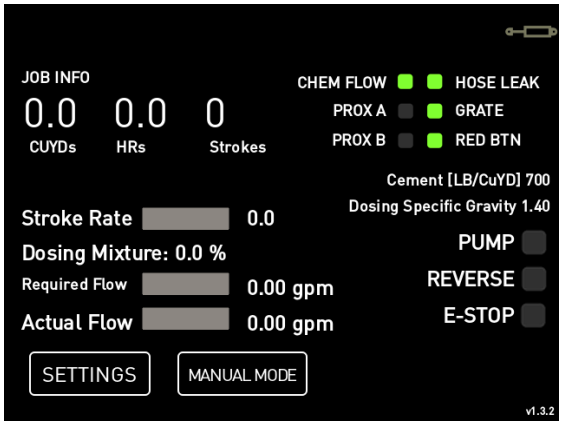
2. From the main page, select 'Pump' to open the pump info page.

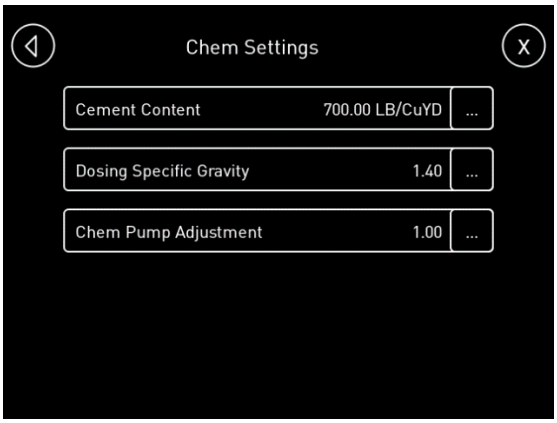


3. From the pump info page, select 'Adjust Slump' to enter the amount of slump in the concrete.



4. Use the MENU ESC toggle switch to exit the page.
5. From the main page, select 'CHEM' to open the main chemical dosing page. This will be the normal screen to see information about the chemical dosing pump during pumping.





6. Select settings to adjust dosing pump settings.
7. Adjust “Cement Content” according to the concrete mix design.
8. Adjust the Dosing Specific Gravity according to the additive chemical being used.
9. Use the MENU ESC toggle switch to exit the settings page.

OPERATING INSTRUCTIONS

MANUAL OPERATION OF THE CHEMICAL PUMP FOR PRIMING & CLEAN UP

1. With the motor running, clear the E-Stop by pressing the horn.
2. From the main Pump page, open the Chemical Dosing page by selecting the CHEM button.
3. Toggle the ‘MANUAL MODE’ button to the ON position.
4. Adjusting the CHEM SPEED to the desired amount.
5. Turn on the dosing pump switch to the ON position to run the pump.

AUTOMATIC OPERATION OF THE CHEMICAL PUMP

1. From the main Pump page, open the Chemical Dosing page by selecting the CHEM button.
2. Verify ‘MANUAL MODE’ is turned OFF.
3. Adjust the Dosing Mixture by adjust the CHEM SPEED Knob.
4. Set the Chem Pump switch to the ON position.
5. Turn the concrete pump on by using the PUMP ON toggle switch.
6. Once the concrete pump completes its first FULL stroke, the strokes/min (SPM) should update. At the same time the ‘Required Flow’ indicator will update with a value. The chemical dosing pump will start turning automatically and will adjust its speed automatically in order to meet the require flow value.

CALIBRATING CHEM PUMP FOR HIGHER ACCURACY

Proper chemical dosing requires the machine to be properly calibrated such that it produces the right amount of flow. Two factors the can change and severely change the accuracy are the concrete cylinder fill rate and the amount of dosing chemical produced per turn of the chemical pump.

Concrete Fill Rate:

Concrete fill rate refers to the amount of concrete that enters into the cylinders. A concrete mix of a low amount of slump will be harder to pump and thus requires more strokes of the concrete pump. While a mix with a high amount of slump will flow much better. Other factors also effect the fill rate including but not limited to: Concrete pressure, pumping speed (SPM), amount of concrete in the hopper, etc.

To set the fill rate:

1. Reset the trip totals on the Main pumping screen by selecting 'RESET JOB'.
2. Set up the concrete pump as close as possible to when you will be using the dosing pump. Amount of delivery hose, pumping speed (SPM) etc.
3. Pump a **KNOWN** amount of concrete.
4. Once the concrete has been pump, open the Pump Info page by selecting the PUMP button.
5. Adjust the slump such that the number of CUYDs of concrete matches that from step 3.

Adjusting the amount of chemical

Depending on the fluid characteristics of the dosing chemical being used, the amount of chemical being pumped can change.

To dial in the accuracy do the following:

1. From the Chemical Dosing page turn the chemical pump to manual mode.
2. Set the speed to around 50 to 75%
3. The flow rate should be stable at a particular flow rate.
4. Take a bucket of a known volume (say 1 gallon) and fill it with the dosing chemical.
5. Time how long it takes to fill the bucket. Repeat this several times to get a good average.
6. Compare the manually measure flow rate with that on the screen.
7. If the two measurements are not equal, then open the settings page.
8. Adjust the parameter "Chem Pump Adjustment"
9. Go back to the Chemical Dosing page and check the flow rate again. The number should be updated and read accurately. Repeat as needed.

TROUBLESHOOTING

The chemical pump has various sensor in order to operate. If a fault with a sensor occurs with the chemical pump occurs the following actions will take place: The horn will sound, concrete pump will be turned off and the chemical pump will be turned off.

TO CLEAR A FAULT, PRESS AND HOLD THE CHEM OFF BUTTON.

TYPES OF FAULTS:

Hose Leak

There is a hose leak detector in the peristaltic pump. The indicator for it is on the Chemical Dosing page. If a leak found then the indicator will be RED.

High Flow

This fault will occur only in automatic mode. It will go off if the required amount of dosing is too high for the chemical pump. If this occurs then pump at a slower pace such the amount of dosing require is within the chemical pump's capabilities.

Hydraulic Motor not turning

The chemical dosing system requires a sensor to know how fast the dosing pump shaft is turning. This is accomplished through a RPM sensor located on the HYD Motor of the chemical pump. Check the wire is intact and connected proper.

No flow detected

This fault occurs if the KEYENCE Flow Meter does not see any flow on the outlet of the chemical pump. If the Flow Meter is seeing flow then its main indicator light will turn green. This will also turn on the Flow indicator on the Chemical Dosing page on the screen. First thing to check would be if the pump has been primed and that there is adequate dosing chemical. Possible other issues include a high limit which keeps the sensor from seeing flow.

GENERAL MAINTENANCE

RECOMMENDED MAINTENANCE PRACTICES

MAINTENANCE MANAGEMENT

Schedule lubrication and maintenance inspections to anticipate maintenance issues. Maintenance management requires the assignment of responsibilities to individual personnel, training of personnel, keeping of records, and the exercise of judgment.

INSPECTION AND LUBRICATION CHECKLISTS AND OPERATOR REPORTS

Utilize checklists for scheduled inspection and lubrication and maintain a written record regarding observations and actions performed. Maintain all scheduled maintenance reports by the operator listing any malfunctions and observations.

MIXER HISTORY FILE NOTING MIXER SERIAL NUMBER

File the operator reports, inspection and lubrication checklists, shop repair, work orders and tickets, parts replacement, and pump usage records. This file should also include the parts book for the specific serial number and engine.

ANNUAL REVIEW

Review the history records of each unit once every year to find evidence of repetitive failures, adjustments, problems, or excessive wear so that action can be taken to minimize breakdowns and reduce excessive maintenance costs. A review of the machine history will help in the stocking of spare parts and assemblies in advance of a possible need.

CAUTION

Engine Manufacturer Maintenance Schedule Must Be Followed
Read Engine Manufacturer Manual

REED has provided only general guidelines regarding engine maintenance and will not cover engine warranty claims.

MAINTENANCE

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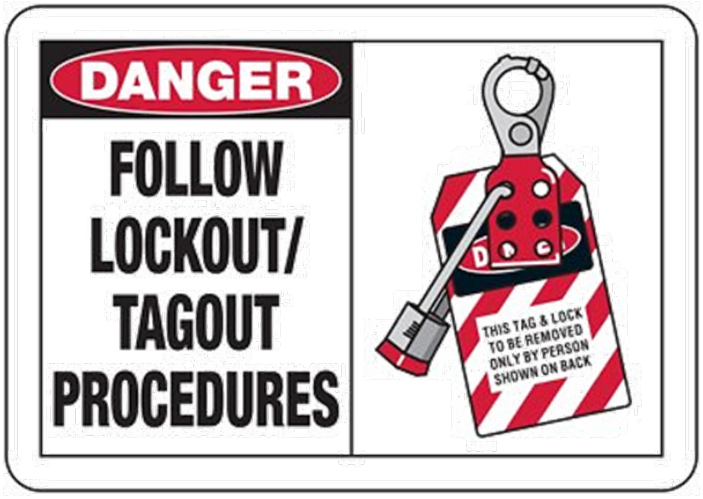
Hydraulic Pressure in All Systems Must Be ZERO
Before and During Any Maintenance Procedures

Engine Must Be Turned OFF and Lockout / Tagout Procedures Must Be Followed
Before and During Any Maintenance Procedures



GENERAL MAINTENANCE AREAS

Perform scheduled inspections to identify and detect any potential problems. The list presented should be inspected and checked on a regular basis and is a recommended minimum.

TRAILER

- Frame integrity, visually check welds, cracks
- Torsion axle secure
- Wheels and tires, lug nuts tight, tire pressure
- Electric brakes, breakaway switch connected
- Front jack stand handle turns easily, smoothly
- Manual jacks slide freely, lock pins in place
- Lighting good condition, operational

ENGINE (refer to engine manufacturer manual)

- Inspect mounts, bolts, brackets, and belts
- Oil and coolant fluids at proper level, check for leaks
- Fuel system, tank mounting, filter condition, leaks, damaged lines
- Battery hold down, condition, tightness of cables
- Key switch, indicator lights
- Throttle control functional
- Air cleaner and muffler securely mounted

PUMP CELL

- Visually check for structural damage, cracked welds
- Hydraulic drive cylinders in good condition, secure, check for leaks
- Material cylinders secure, tie rods tight
- Water box structurally sound, clean, cover in place
- S-Tube shift mechanism structurally sound, all pins and retainers in place
- Hydraulic shift cylinder(s) in good condition
- Bearing housing, seals etc. in good condition
- Hydraulic hoses secure no leaks

HOPPER ASSEMBLY

- Visually check for structural damage, cracked welds
- S-Tube secure, in good condition
- Check condition of wear plate, wear ring, seals
- Check connection of s-tube to outlet, seals, bearing
- Hopper drain is functional
- Cleaning hopper
- Zerk fittings accept grease

Perform scheduled inspections to identify and detect any potential problems. The list presented should be inspected and checked on a regular basis and is a recommended minimum.

MAIN CONTROLS

- Control box in good condition, sealed, not damaged
- All Switches, Push buttons, E-Stop in good condition, not broken, jammed or bent and stay in position or momentarily return to center
- Control identification in good condition, legible
- Gauges in good condition

REMOTE CONTROLS

- Control console in good condition, not damaged
- Switch in good condition
- Cord in good condition, no cuts, securely mounted to box

HYDRAULIC SYSTEM

- Hydraulic tank securely mounted, covers tight
- Breather, filler cap and strainer in place, level sight gauge in proper condition
- Check filter condition indicators
- Hydraulic oil cooler mounted securely, connections are tight
- Hydraulic fluid to proper level and clean
- All hoses and tubing secure, check for leaks

WHEEL AND TIRE SAFTEY

⚠ CAUTION

YOU MUST FOLLOW THE MAINTENANCE PROCEDURES TO PREVENT DAMAGE TO IMPORTANT STRUCTURAL COMPONENTS. DAMAGE TO CERTAIN STRUCTURAL COMPONENTS SUCH AS WHEEL BEARINGS CAN CAUSE THE WHEEL END TO COME OFF OF THE AXLE. LOSS OF A WHEEL END WHILE THE TRAILER IS MOVING CAN CAUSE YOU TO LOSS CONTROL AND LEAD TO AN ACCIDENT, WHICH CAN RESULT IN SERIOUS INJURY OR DEATH.

⚠ CAUTION

EXCEEDING THE TORQUE TO LUG NUTS CAN DAMAGE STUDS AND/OR NUTS AND LEAD TO EVENTUAL FRACTURE AND DANGEROUS WEEL SEPARATION.

⚠ CAUTION

PROPER MATCHING OF THE TIRES/WHEEL COMBINATION IS ESSENTIAL TO PROPER FUNTION OF YOUR TRAILER RUNNING GEAR. SOME TIRES MAY CALL FOR A MAXIMUM INFLATION PRESSURE ABOVE THE RIM OR WHEEL CAPACITY. **DO NOT EXCEED MAXIMUM INFLATION PRESSURE FOR THE RIM OR WHEELS.** CATASTROPHIC FAILURE MAY RESULT.

TRAILER RECOMMENDED MAINTENANCE

NEW AXLE SETUP AND ADJUSTMENTS

Wheels	Re-torque wheel nut torque requirements on new trailers at 50 miles.
Brakes	Adjust at 3,000 miles.
Tire Pressure	See tire manufacturers recommendations.
Brake Controller Settings	Refer to Brake Controller manufacturers recommendations

BRAKE ADJUSTMENT PROCEDURE

1. Make sure your trailer is on level surface and is free of any potentially dangerous items.
2. Jack up the trailer and secure with jack stands. Supporting the trailer until the tire and wheel are clear of the ground surface.
3. Find the adjusting hole cover and remove it from the backing plate.
4. Use a brake adjusting tool to adjust the star wheel (of the adjuster) and expand the brakes until the brake shoes are sufficiently expanded so that the tire and wheel will not easily rotate.
5. Now move the star wheel in the opposite direction until you can feel a little resistance from the brake and replace the hole cover.
6. Repeat this procedure for all wheels making sure to adjust all brake at the same time.

BEARING MAINTENANCE, ADJUSTMENTS, AND REPLACEMENT

1. Inspect for corrosion and wear.
2. If any rust or wear exists on the bearing, then remove and replace.
3. If bearing is found to be in good condition, then clean and repacking with grease is all you need.
4. Hand pack each bearing individually using premium lithium base wheel bearing grease.
5. Reinstall the hub, reversing the procedure above the bearing adjustment procedure below.

BEARING ADJUSTMENT

1. (FEEL AND DRAG METHOD) Tighten slotted nut until hub drags slightly when rotated. (Rotating the hub while tightening the nut seat and bearing.) Loosen the slotted nut 1/6 turn (1 hex) to align nut slot with cotter pin hole. Wheel should turn freely. Insert cotter pin through nut and spindle. Bend one leg of the cotter pin over the end of the spindle and the other leg of the nut. Tap legs slightly to set the cotter pin must be tight.
2. (TORGUE WRENCH METHOD) Make sure nut is loose. Tighten nut with torque wrench to an initial torque of 50 ft. lbs. Loosen nut from initial torque and finger tighten. Insert new cotter through nut and spindle.

WHEEL AND TIRE MAINTENANCE

Your trailer manufacture has specified the wheel and tires to be used. It is very important that you do not make changes that may alter the recommended size or load capacities. Any deviations, however slight or unnoticeable, may cause damage or be dangerous to operate.

TIGHTENING PROCEDURE

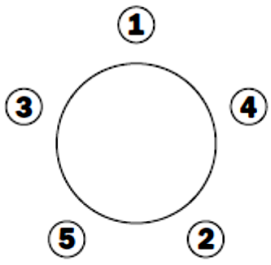
1. After mounting a wheel over the studs, start all lug nuts by hand to prevent cross threading.
2. After all the lug nuts have been snugged, tighten the nuts to the recommended torques using sequence pattern.

REQUIRED WHEEL TORQUES (ft – lbs)

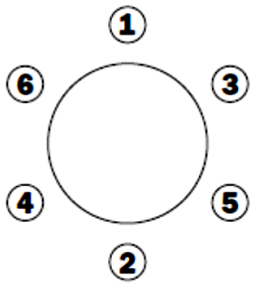
	1st Setting	2nd Setting	Final Setting
8-12-13″ Wheel	20 — 25	35 — 40	50 — 75
14-15-16″ Wheel	20 — 25	50 — 60	90 — 120
16″ Wheel 9/16″ studs	20 — 25	70 — 80	130 — 150

BOLT TIGHTENING SEQUENCE

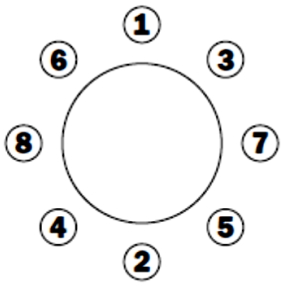
5 Hole Pattern



6 Hole Pattern



8 Hole Pattern



RE-TORQUE AFTER THE FIRST 50 MILES OF USE, AND PERIODICALLY RE-CHECK THE TORQUE.

TIRE PRESSURE

Tire pressure should be checked frequently, and inflate to the tire manufacure's recommendations.

LUBRICATION

Rapid wear and possible shutdown will result if the unit is operated with inadequate lubrication. Follow the recommendations stated herein, and if needed increase the application of lubricants above these recommendations when the equipment is subject to heavy usage.

RECOMMENDED LUBRICATING INTERVALS
Recommended lubrication intervals are based on normal use under normal conditions. The lubrication interval must be increased to meet more challenging uses and uses which subject the equipment to high and/or unusual concentration of forces. The lubrication interval must be increased if the pump has been exposed to environmental conditions such as low humidity, high humidity, excessive dust, high temperatures, low temperatures, heavy rainfall, long term storage, ocean air, etc…
1) every hour of operation
2) after completion of every job
All lubrication points must be greased on every interval as recommended.

TYPE OF LUBRICANT

- Use Shell **Gadus S2 U1000 2** EP grease, extreme pressure grease available for wheel bearings, general purpose grease, or equivalent if this lubricant is unavailable in your area.
- Use Shell **Tellus S2 M 46** hydraulic oil.

⚠WARNING

- Do NOT use Moly grease, grease with Moly additives.

Technical Data Sheet

Previous Name: **Shell Darina Grease SD 2**

Shell Gadus *S2 U1000 2*

- *Heavy Duty Protection*
- *High Temperature*
- *Clay*

High Performance Heavy Duty Grease

Shell Gadus S2 U1000 greases are multipurpose, non-soap greases. They give excellent lubrication for extended time periods, in wet or dry applications, and over a wide range of temperatures. They are also formulated to provide extreme pressure (EP) characteristics.
Shell Gadus S2 U1000 greases are based on a non-melting bentonite clay thickener system. Due to the inert nature of the clay, these greases are suitable for applications where the lubricant is exposed to contaminants such as water and chemicals found in many industrial applications including chemical plants and paper mills. These greases are not recommended for use in centralized lubrication systems.

DESIGNED TO MEET CHALLENGES

Performance, Features & Benefits

- Non-melting.
- Excellent resistance to water washout.
- Good load carrying capability.
- Good resistance to rust and corrosion.

Main Applications

- Industrial grease lubricated machinery at temperatures up to 250°F (350°F with frequent lubrication).
- Ball, roller and sleeve bearings, as well as sliding surfaces and grease lubricated gears.
- Wet and heavily loaded applications.
- Chemical plants and paper mills, where grease is exposed to very wet conditions.
- Mining and process plants, where crushers, screens and kilns are operated at high temperatures.

Specifications, Approvals & Recommendations

For a full listing of equipment approvals and recommendations, please consult your local Shell Technical Helpdesk.

Typical Physical Characteristics

Properties			Method	Shell Gadus S2 U1000 2
NLGI Grade				2
Thickener Type				Bentonite Clay
Appearance				Brown, Smooth
Viscosity	@40°C	cSt	ASTM D445	1000
Viscosity	@100°C	cSt	ASTM D445	90
Penetration, dmm Worked, 60X			ASTM D217	265-295
Dropping Point		°F / °C	Mettler	400+ / 205+
Copper Corrosion			ASTM D4048	1b
Rust Test, Distilled Water			ASTM D1743	Pass
Oil Separation, wt%			ASTM D1742	<3
Water Washout, wt% loss	@175°C		ASTM D1264	<5
Water Spray-off wt%			ASTM D4049	<10
Timken, OK Load, N			ASTM D2509	200
Weld Point		kgf	ASTM D2596	250

Technical Data Sheet

Previous Name: **Shell Tellus Oils**

Shell Tellus *S2 M 46*

- *Extra Protection*
- *Industrial Applications*

Industrial Hydraulic Fluid

Shell Tellus S2 M fluids are high performance hydraulic fluids that use Shell's unique patented technology to provide outstanding protection and performance in most manufacturing and many mobile equipment operations. They resist breakdown under heat or mechanical stress and help prevent damaging deposit formation that can decrease the efficiency of your hydraulic power system.

DESIGNED TO MEET CHALLENGES

Performance, Features & Benefits

- **Long fluid life – maintenance saving**

Shell Tellus S2 M fluids help extend equipment maintenance intervals by resisting thermal and chemical breakdown. This minimizes sludge formation and provides excellent performance in the industry standard ASTM D943 TOST test (Turbine Oil Stability Test), providing better reliability and system cleanliness.

Shell Tellus S2 M fluids also have good stability in the presence of moisture, which ensures long fluid life and reduces the risk of corrosion and rusting, particularly in moist or humid environments.

- **Outstanding wear protection**

Proven zinc-based anti-wear additives are incorporated to be effective throughout the range of operating conditions, including low load and severe duty high load conditions. Outstanding performance in a range of piston and vane pump tests, including the tough Denison T6C (dry and wet versions) and the demanding Vickers 35VQ25, demonstrates how Shell Tellus S2 M fluids can help system components last longer.

- **Maintaining system efficiency**

Superior cleanliness, excellent filterability and high performance water separation, air release and antifoam characteristics all help contribute to maintaining or enhancing the efficiency of hydraulic systems.

The unique additive system in Shell Tellus S2 M, in combination with superior cleanliness (meeting the requirements of ISO 4406 21/19/16 class or better ex Shell plant filling lines as recognised by DIN 51524 specification, the oil is exposed to various influences with transport and storage that could effect the cleanliness level), helps reduce the impact of contaminants on filter blocking, allowing both extended filter life and use of finer filtration for extra equipment protection.

Shell Tellus S2 M fluids are formulated for fast air release without excessive foaming to help efficient hydraulic power transfer and minimise fluid and equipment impacts of cavitation induced oxidation that can shorten fluid life.

Main Applications

- **Industrial hydraulic systems**

With an extensive range of equipment maker approvals and recommendations, Shell Tellus S2 M fluids are suitable for a wide range of hydraulic power applications found in manufacturing and industrial environments.

- **Mobile hydraulic fluid power transmission systems**

Shell Tellus S2 M fluids can be used effectively in mobile hydraulic power applications such as excavators and cranes, except where significant ambient temperature variations are encountered. For these applications we recommend the Shell Tellus "V" series.

- **Marine hydraulic systems**

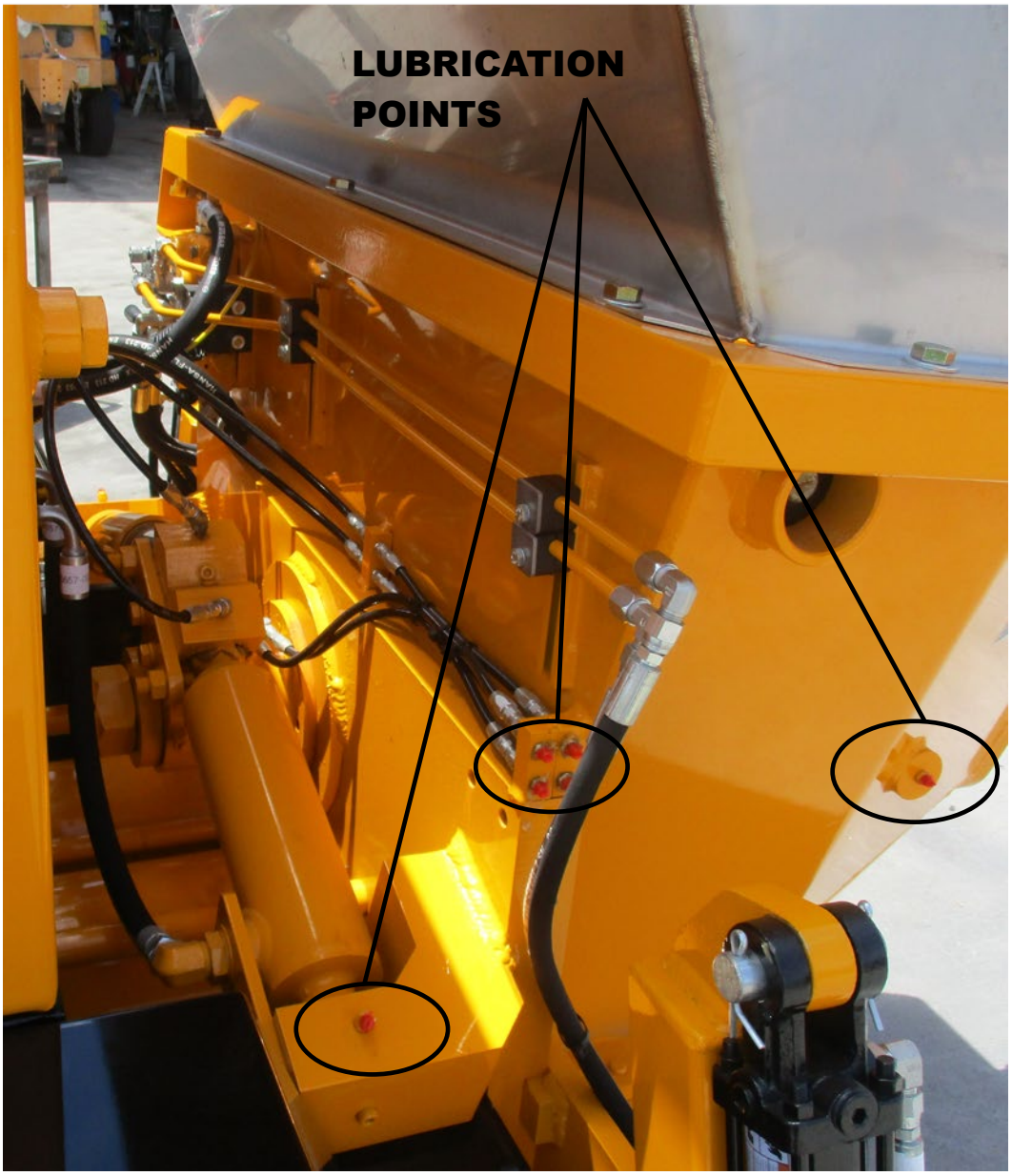
Suitable for marine applications where ISO HM category hydraulic fluids are recommended.

LUBRICATION POINTS

The following graphics are for REFERENCE ONLY.

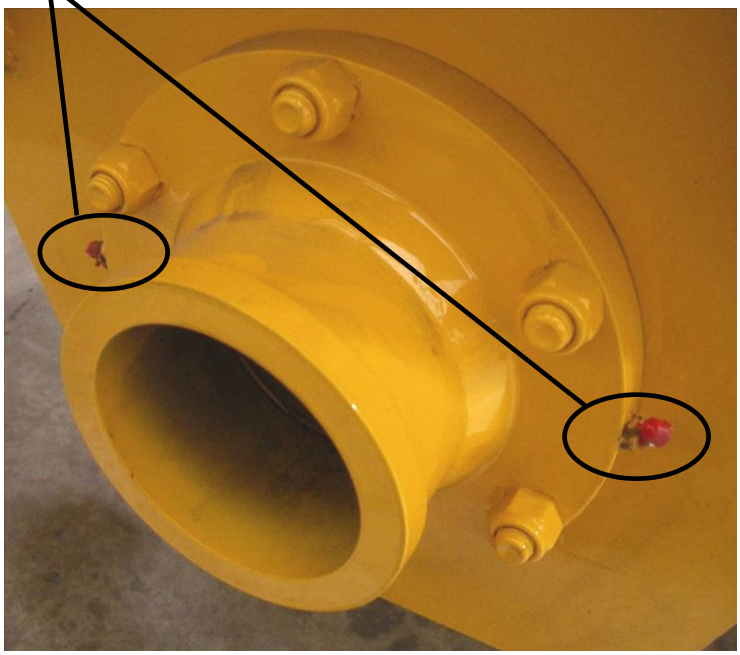
CAUTION

IF EQUIPPED WITH DUAL (2) HYDRAULIC SHIFT CYLINDERS,
RELIEVE SHIFT CIRCUIT HYDRAULIC PRESSURE TO PROPERLY GREASE
HYDRAULIC SHIFT CYLINDERS AND BELL CRANK



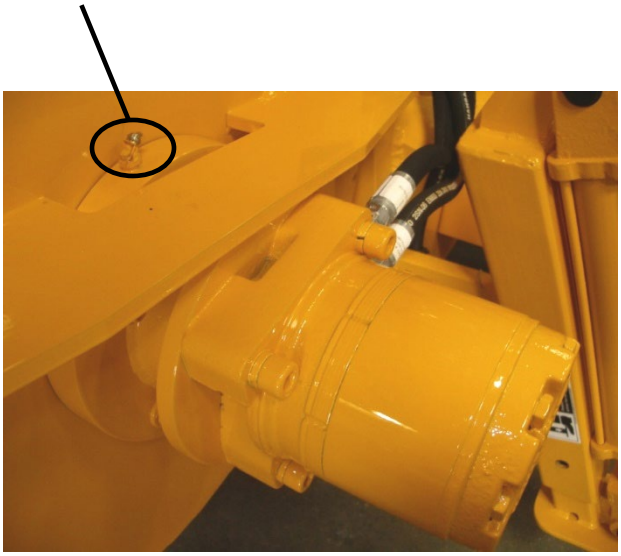
LUBRICATION POINTS

S-TUBE OUTLET GREASE POINTS

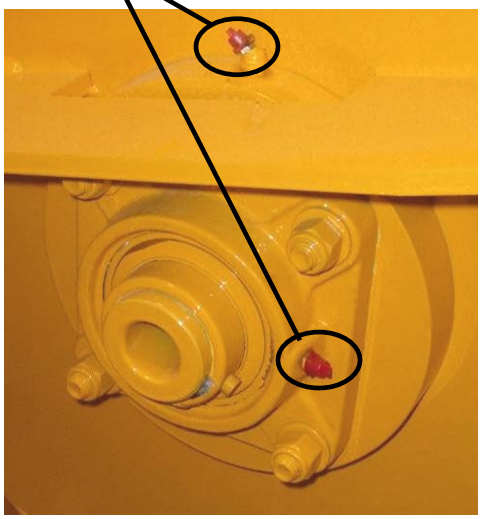


AGITATOR GREASE POINTS

HYDRAULIC MOTOR SIDE GREASE POINTS



BEARING SIDE GREASE POINTS



HYDRAULIC SYSTEM MAINTENANCE

Hydraulic pumps are used to supply the flow of oil necessary to operate actuators of the concrete pump.

CAUTION

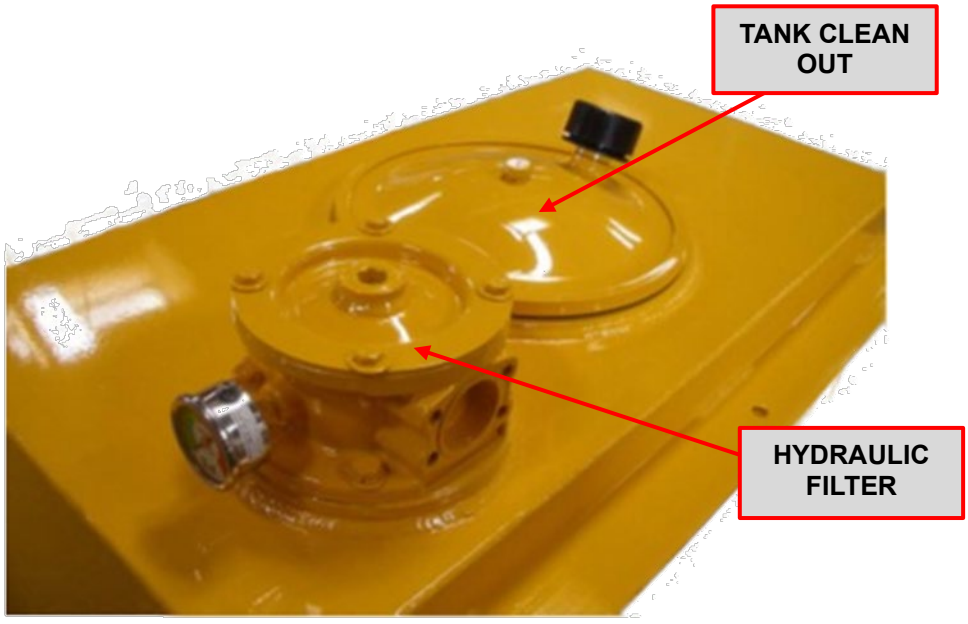
Contamination of the Oil Is the Leading Contributor to System Malfunctions

Extreme care must be exercised to prevent contaminants from entering the system. Always cap or plug open ports and hydraulic lines.

HYDRAULIC TANK

Hydraulic tank can be equipped with an access cover with breather. A sight and temperature gauge are installed on the tank to determine the fluid level and temperature inside the tank. The tank is also equipped with drain valve.

To accomplish filtration, hydraulic tanks can be equipped with the following: internal magnetic suction strainers, a suction filter, a return filter and a pressure filter. NOTE: Not all models use all these components. Suction and return filters are equipped with an indicator gauge to monitor filter restriction. An oil cooler is adjacent to the engine cooling unit.



HYDRAULIC SYSTEM MAINTENANCE ITEM DESCRIPTIONS

FLUID
Check fluid level and oil clarity daily with sight gauge provided. Maintain level at full mark. Add hydraulic oil through the return filter fill port when necessary.

TANK BREATHER
Clean every 50 hours of operation. Remove from tank, clean with solvent and air blow dry.

FILTER
Change after first 50 hours of operation. Thereafter change every 250 hours of operation or when condition gauge indicates change is necessary.

HYDRAULIC TANK
Change oil in tank every 500 hours of operation or yearly, whichever comes first.

HYDRAULIC FLUID

Fill with Shell Oil Company (**AW HYDRAULIC OIL S2 46**). It is to be used in ambient temperatures of 39-90° F (4-32° C). The normal fluid temperature will range from 100-167° F (38-75° C).

For ambient temperatures of 90° F (32° C) and above, use fluid designated with an ISO rating of 68. Use ISO 32 for ambient temperatures of 32° F (4° C) and below.

CAUTION

Use Only **Shell AW S2 46** or Equivalent
Never Mix with Other Types of Fluids

CAUTION

Always Use Clean and New Fluid

Using impure or other type of fluids not specified will contaminate the hydraulic system and lead to eventual system malfunction and/or damage.

ADDING HYDRAULIC FLUID

There are a few common methods for filling the hydraulic tank as described below. Exercise extreme care when adding fluid to the hydraulic tank to avoid contamination.

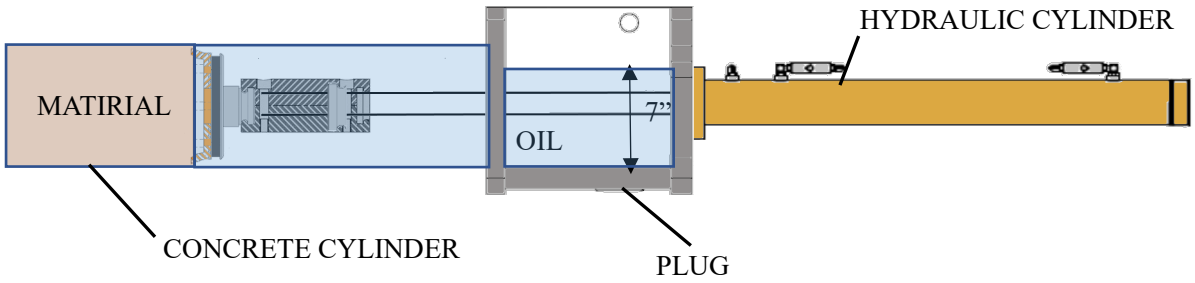
- To prevent any dirt or water from entering the hydraulic tank, thoroughly clean area around the return filter fill port plug, the vented fill cap or the inspection cover.
- Remove return filter fill port plug, vented cap or inspection cover.
- Fill system to MAX LEVEL mark on sight gauge with new clean hydraulic fluid.

If a pump is used to transfer the fluid, ensure the pump filter is clean. If pouring fluid from a container, pour it through a fine wire mesh screen, 200 mesh or finer.

- Replace filter fill port plug, vented cap, or inspection cover immediately after filling tank to proper level

SERVICING FLUSH BOX

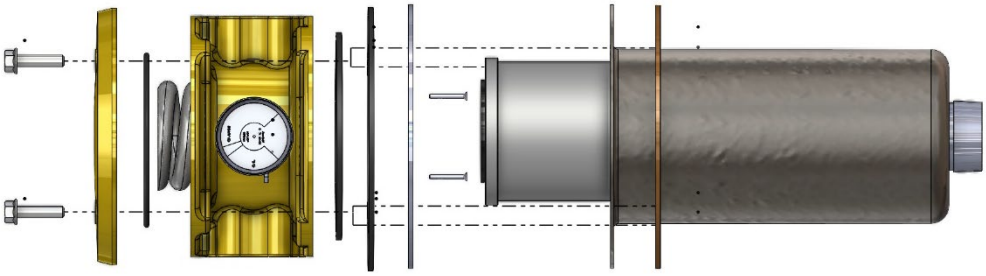
When servicing parts in flush box, drain old oil using plug underneath flush box. Clean out debris, fill with clean hydraulic fluid 7” as shown below.

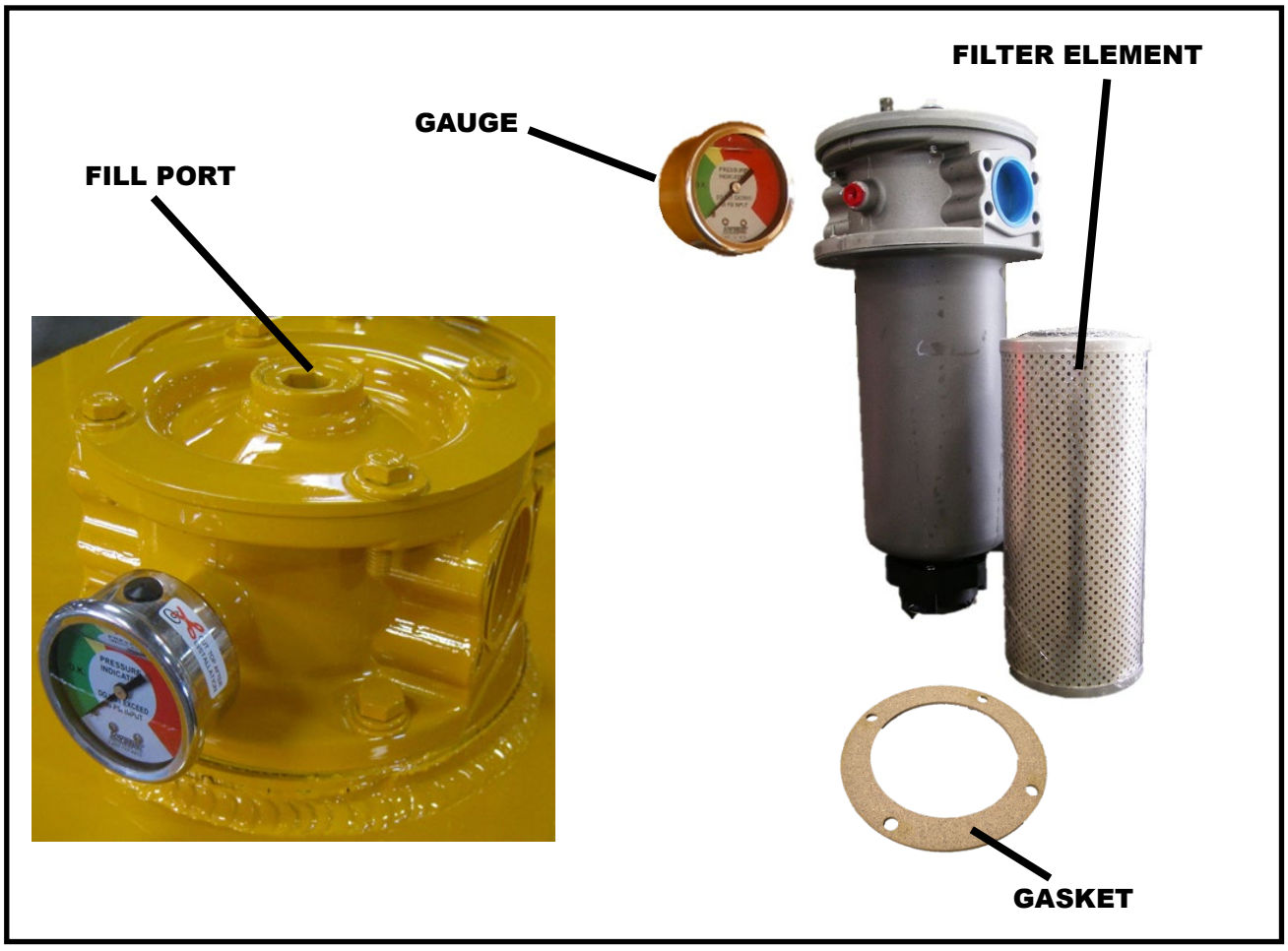


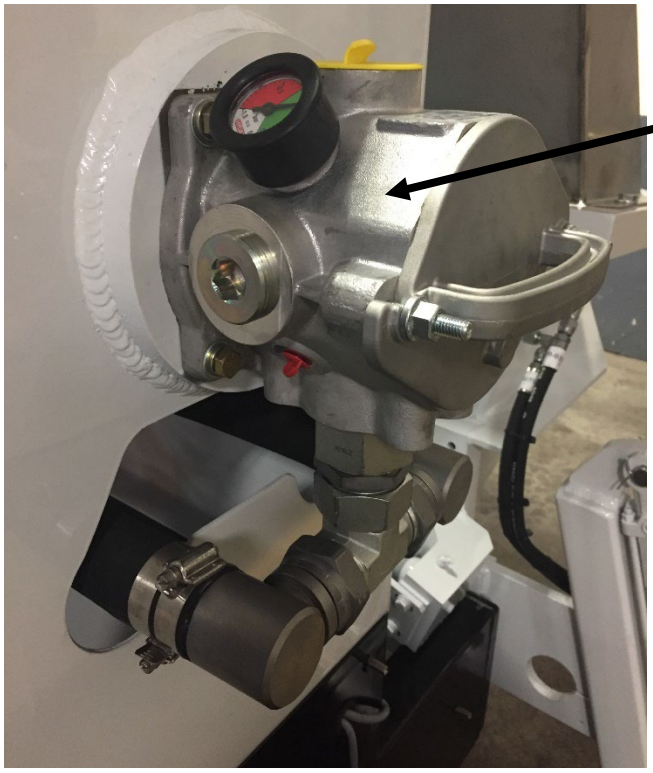
FILTER SERVICING

Hydraulic filters provide a means of continuous hydraulic fluid filtration to prevent recirculation of contamination which will cause rapid wear and component breakdown.

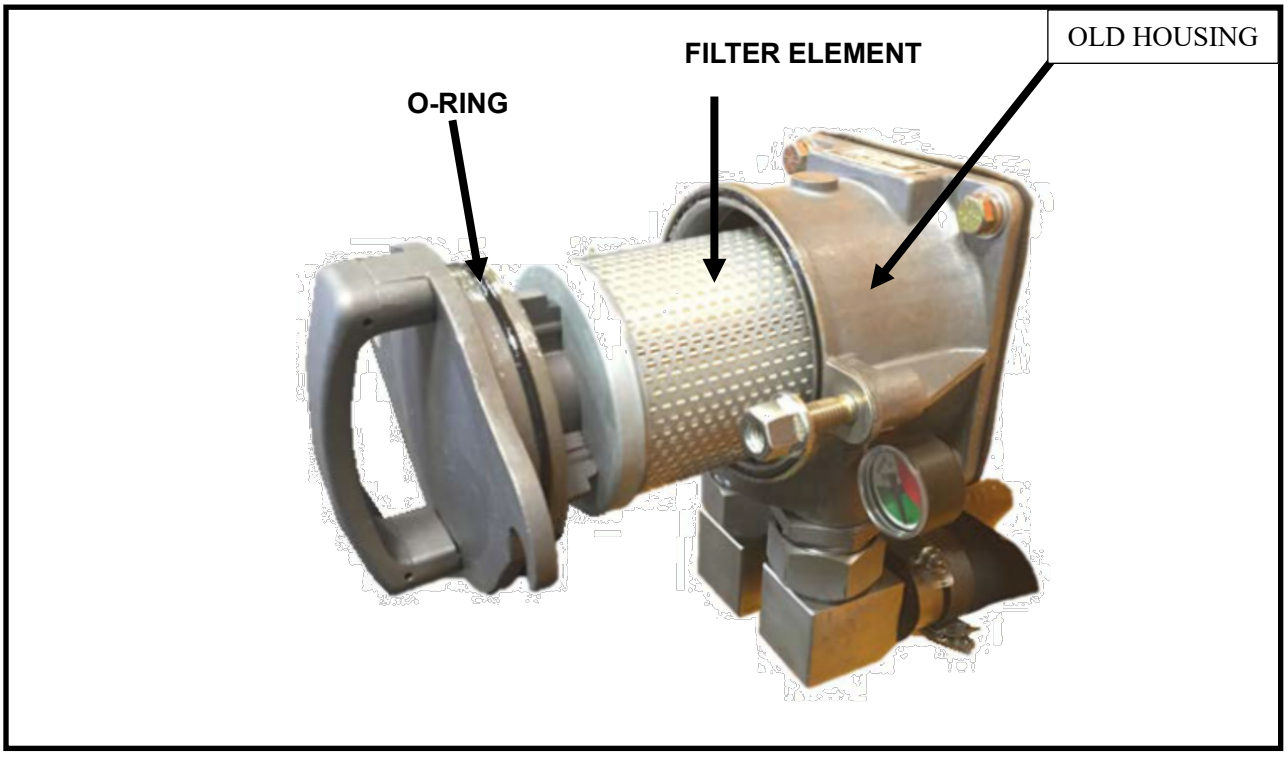
A filter that is equipped with a condition indicator gauge should be checked daily and the element changed when indicated to do so. Below are TYPICAL filters and filter elements.







Do Not Use Cloth for Straining Fluid
Lint Is a Contaminant Harmful to the Hydraulic System



To change the filter elements:

1. Shut off machine.
2. VERIFY PRESSURES IN ALL CIRCUITS READ ZERO!
3. Wipe clean any dirt and grime from area surrounding filter housing
4. Loosen the filter cover plate bolts
5. Carefully remove cover so as not to damage the gasket or O-ring
6. Discard only element and discard responsibly
7. Install bypass valve (if equipped) and new element and replace cover
8. Wipe clean any contaminants around high pressure filter
9. Remove filter housing then remove and discard filter element
10. Check and replace O-ring or gasket if necessary
11. Replace filter element and install filter housing
12. Start-up machine and observe for leakage

Do Not Wash Out and Reuse Disposable Filter Elements

CLEANING THE HYDRAULIC TANK

The hydraulic tank should be drained and cleaned after 500 hours of operation or yearly, whichever occurs first, to assist in keeping the systems clean and in proper condition.

1. Shut off machine
2. VERIFY PRESSURES IN ALL CIRCUITS READ ZERO!
3. Place a suitable size container under the hydraulic tank drain fitting and then remove drain plug. Dispose of used oil responsibly
4. After draining, remove the access cover on the hydraulic tank being careful not to damage the gasket
5. Remove, disassemble and clean magnetic suction strainers before reassembly (if equipped)
6. Flush the inside of hydraulic tank with clean solvent and wipe clean with lint free cloths
7. Install suction strainers (if equipped)
8. Replace sight gauge
9. Install the tank drain plug and access cover with gasket.
10. Change the hydraulic system filter element(s) and breather cap
11. Refill the hydraulic tank with new clean hydraulic fluid to MAX LEVEL mark
12. Start machine and check for leaks

COMPONENT REPLACEMENT

When parts are worn, do not delay in replacement. Continued usage with worn parts may lead to damage of other components.

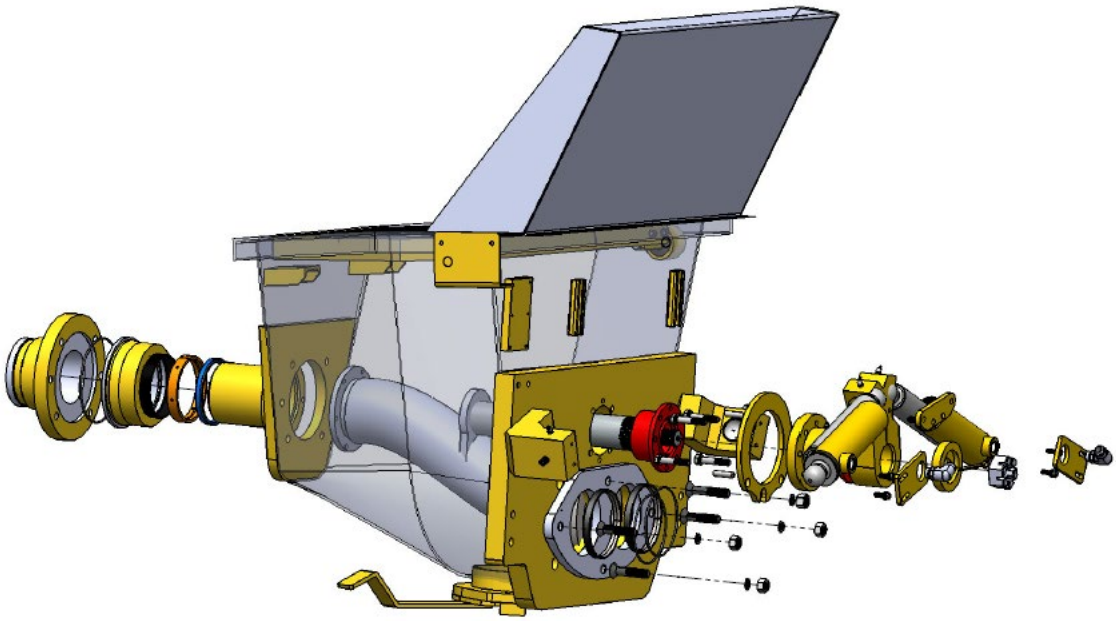
Please contact the ***REED*** Service Department or your local dealer for technical support.

S-TUBE, WEAR RING, WEAR PLATE, AND SEALS

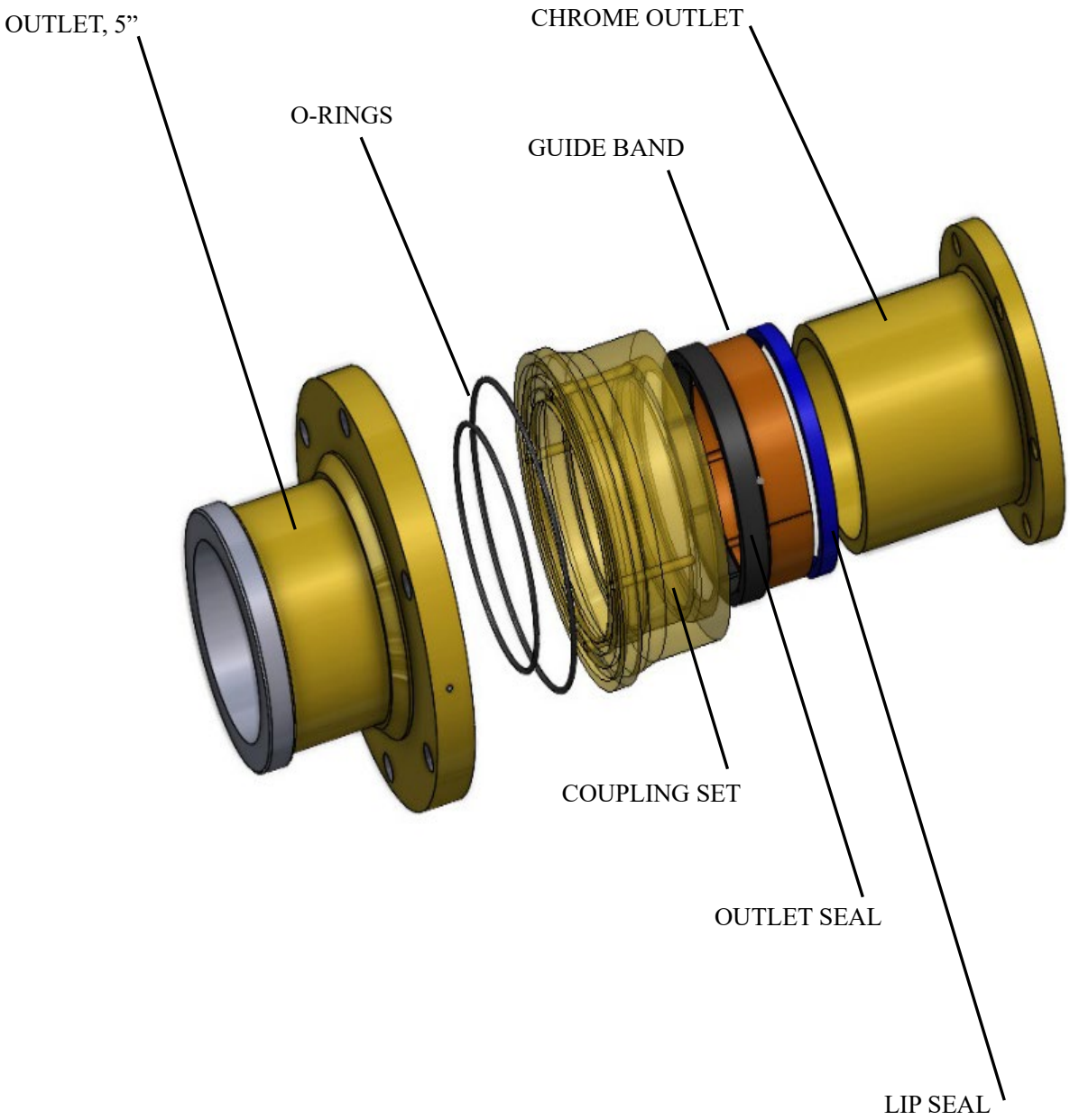
The sealing characteristics of the s-tube depend on the positive contact of the wear ring, located inside the s-tube, to the wear plate mounted inside of the hopper. The abrasiveness and friction of the concrete will cause wear and a breakdown of the sealing action. As this breakdown occurs, periodic adjustments to the s-tube can be made. This will help to improve the sealing quality; however, eventually the components will need to be replaced.

Adjustment or parts are required if:

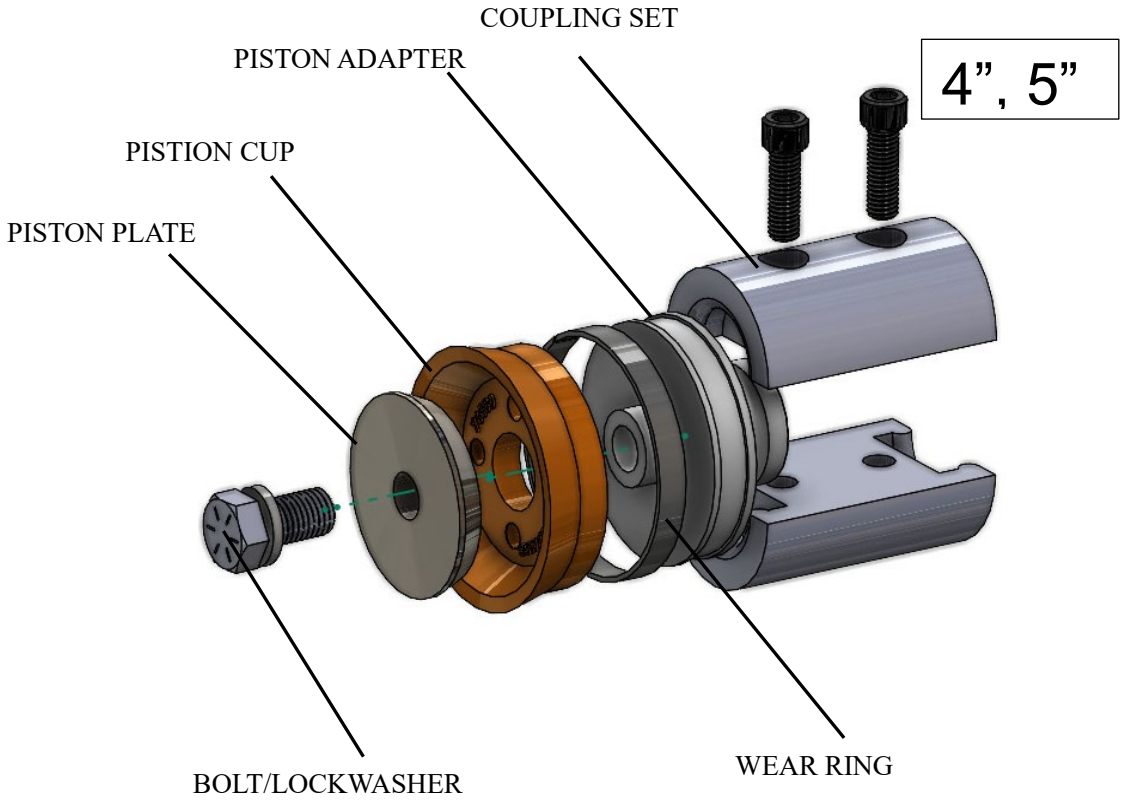
- s-tube concrete build up
- deep grooves have developed on the face of the wear plate and/or on the wear ring
- When the output volume at the end of the delivery line noticeably begins to decrease or eventually stops
- When the material being pumped is being forced back into the hopper under pressure

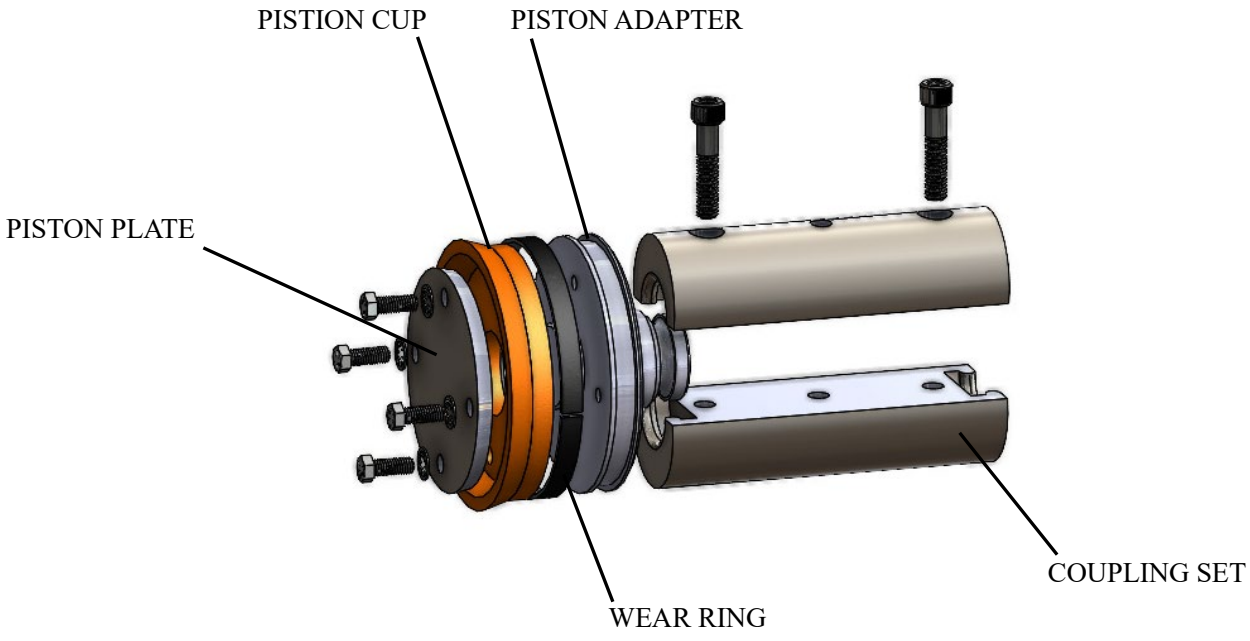


OUTLET SEALS

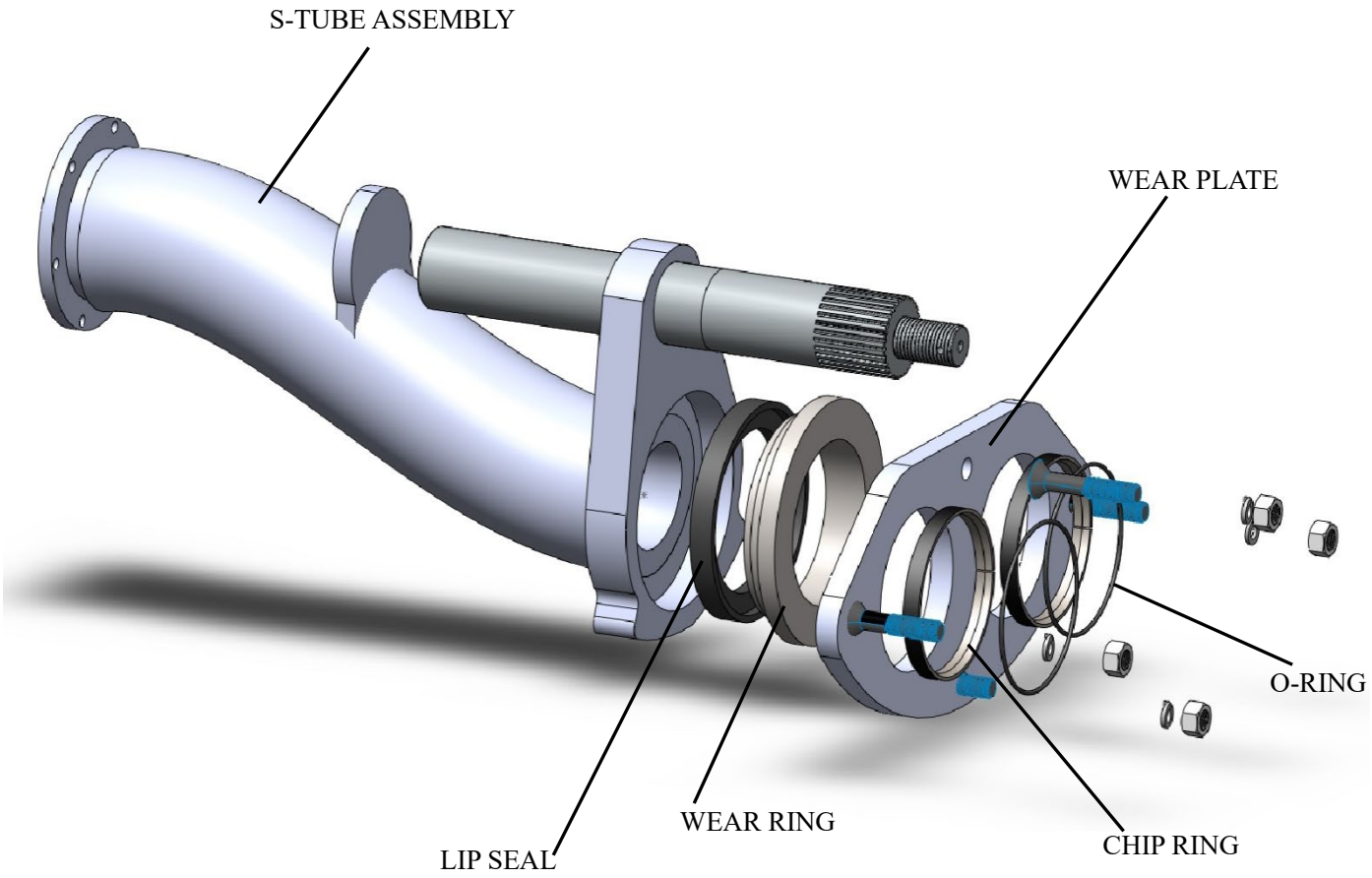


PISTON CUP SEALS/WEAR BAND





S-TUBE WEAR PARTS



PUMP MAINTENANCE SCHEDULE AND CHECKLISTS

Providing a maintenance schedule defined specifically by run hours or yardage pumped serves only as a general guideline given the large amount of variables a unit might be subject to, such as weather and ambient temperature conditions, jobsite conditions, material differences of mix design, the load burden the unit is typically subject to, i.e. light, medium or heavy duty operation, etc.

The list that follows is to be used as a reference guide. However, the end user is encouraged to develop a preventative maintenance program that specifically suites their needs depending on the usage of the equipment.

DAILY PUMP MAINTENANCE CHECKLIST		
Actual Hours_____		Date__/__/____
#	Maintenance Description	Initials
1	Check hydraulic tank fluid levels	
2	Check condition of hydraulic oil for water or other contamination.	
3	Drain water from hydraulic tank	
4	Check flush box fluid levels NOTE: If water is used instead of oil, water should be drained DAILY	
5	Check engine fluid levels (see engine manufacturer maintenance schedule for additional requirements)	
	Additional Notes:	
6	Check hydraulic filter indicator condition	
7	Lubricate lubrication points, during and after pumping	
8	Inspect unit for fluid leaks, loose hoses, loose nuts, bolts, fasteners etc.	
	Additional Notes:	
9	Trailer Towing Safety Inspection a) brakes functional	
	b) air pressure in tires is adequate and tire condition	
	c) all “lug nuts” are secure and in place	
	d) tow hitch is secure and in good condition	
	e) inspect trailer lights, make sure they are working properly.	
10	Additional Notes:	

INITIAL 50 HOUR MAINTENANCE CHECKLIST		
Actual Hours_____		Date___/___/____
#	Maintenance Description	Initials
1	Change engine oil and filters (see engine manufacturer maintenance schedule for additional requirements) IF REQUIRED	
	Additional Notes:	
2	Change hydraulic oil filters	
3	Inspect hydraulic hoses and fittings for any signs of external wear or damage	
4	Re-torque all “lug nuts” reference wheel and tire maintenance.	
	Additional Notes:	

EVERY 100 HOUR MAINTENANCE CHECKLIST		
Actual Hours_____		Date__/__/____
#	Maintenance Description	Initials
1	Clean hydraulic tank breather	
2	Inspect all structural components (check frame, hopper, axle, hood, towing hook, and other structural members for any damage)	
	Additional Notes:	
3	Adjust “S-Tube Nut” or “Castle Nut” (refer to “S-Tube Adjustment” in Maintenance Section)	
	Additional Notes:	
4	Change flush box oil and examine for excessive amounts of contamination (excessive contamination might indicate need to change the Piston Cups)	
	Additional Notes:	
5	Check coolers and radiators for dirt or debris. Clean as necessary	
6	Check condition of engine drive belts. Change if necessary (see engine manufacturer maintenance schedule for additional requirements)	
Additional Notes:		

EVERY 250 HOUR MAINTENANCE CHECKLIST		
Actual Hours_____		Date__/__/____
#	Maintenance Description	Initials
1	Change hydraulic filters (or change more frequently as indicated by indicator gauge on filter)	
2	Check that S-Tube, wear parts and seals in hopper are secure and adjusted well, rotate wear ring and replace seal if necessary	
	Additional Notes:	
3	Check swing cylinder components: cylinders, bell crank, pins, bushings, bearings and grease fittings are secure, tight, and not worn excessively	
	Additional Notes:	
4	Check piston cup wear (as indicated by analysis of contaminants found in flush box oil)	
	Additional Notes:	
5	Check that all electrical wires, cables, terminals, plugs are in good condition	
	Additional Notes:	
6	Change engine oil and filters (see engine manufacturer guide for all engine requirements)	
	Additional Notes**:**	
7	Check condition of fuel hoses, fittings, and clamps	
	Additional Notes:	
8	Inspect all safety decals to ensure that they are completely visible and legible	

EVERY 250 HOUR MAINTENANCE CHECKLIST		
Actual Hours_____		Date___/___/____
#	Maintenance Description	Initials
9	Perform complete inspection of the controls	
10	All toggles in good condition, stay in position or momentarily return to center	
11	Control identification in good condition, legible	
12	Gauges in good condition	
	Additional Notes:	
13	Remote controls, control console in good condition	
14	Switch in good condition	
15	Cord in good condition, no cuts, securely mounted to box	
	Additional Notes:	
16	Trailer frame integrity, visually check welds, cracks	
17	Torsion axle secure	
18	Wheels and tires, lug nuts tight, tire inflation	
19	Electric brakes, breakaway switch connected	
20	Front jack stand handle turns easily, smoothly	
21	Manual jacks slide freely, lock pins in place	
22	Lighting good condition operational	
Additional Notes:		

EVERY 500 HOUR MAINTENANCE CHECKLIST		
Actual Hours_____		Date__/__/____
#	Maintenance Description	Initials
1	Inspect hydraulic hoses and fittings for any signs of external wear or damage	
	Additional Notes:	
2	Inspect all wear parts and change as necessary (excessive wear may cause inefficient performance and/or shutdown of operation)	
	Additional Notes:	
3	Change hydraulic fluid, clean the reservoir and the suction strainers within reservoir, and replace all hydraulic oil filters A Series requires 51 gallons when system is empty, 45 if filling tank only. B Series requires 58 gallons when system is empty, 51 if filling tank only. C Series requires 65 gallons when system is empty, 57 if filling tank only.	
	Additional Notes:	
4	Complete inspection of the engine (refer to engine manufacturer maintenance schedule for details)	
5	Inspect mountings, bolts, brackets	
6	Oil level proper, coolant level proper, check for leaks	
7	Fuel system, tank mounting, filter condition, check for leaks, damaged lines	
8	Battery hold down, condition, tightness of cables	
9	Key switch, indicator lights operable	
10	Throttle control functional	
11	Air cleaner and muffler securely mounted	

Additional Notes:

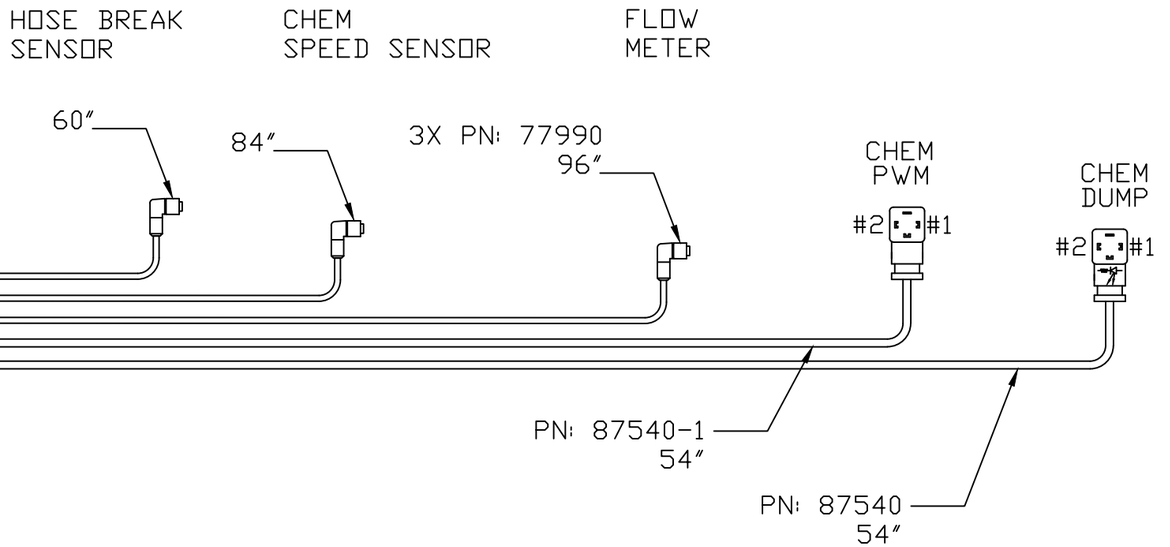
EVERY 500 HOUR MAINTENANCE CHECKLIST		
Actual Hours_____		Date___/___/____
#	Maintenance Description	Initials
12	Pump cell check for structural damage, cracked welds	
13	Hydraulic drive cylinders in good condition, secure, check for leaks	
14	Material cylinders secure, tie rods tight	
15	Water box structurally sound, clean, cover in place	
16	S-Tube shift mechanism structurally sound, all pins and retainers in place	
17	Hydraulic shift cylinders in good condition	
18	Bearing housing, seals etc. in good condition	
19	Hydraulic hoses secure no leaks	
	Additional Notes:	
20	Hopper check for structural damage, cracked welds	
21	S-Tube secure, in good condition	
22	Check condition of wear plate, wear ring, seals	
23	Check connection of S-Tube to outlet, seals, bearing	
24	Hopper drain is functional	
Additional Notes:		

EVERY 500 HOUR MAINTENANCE CHECKLIST
Actual Hours_____ Date__/__/____
ADDITIONAL GENERAL NOTES:

NOTES

128 PLUG

V+	#39	BRN
HOSE BREAK SIG	#86	WHT
VREF+	#92	BRN
VREF-	#91	BLU
SPEED SIGNAL	#93	BLK
24V V+	#115	BRN
24V V-	#116	BLU
METER SIGNAL 1	#95	BLK
METER SIGNAL 2	#96	WHT
CHEM PWM +	#57	#1
CHEM PWM -	#58	#2
CHEM DUMP +	#36	#1
CHEM DUMP -	#13	#2



LTR	DATE	ENGINEERING CHANGE NOTICE #	BY

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FRACT	DECIMAL	ANGLE
1/32	.030	1/2°

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DRAWN	JA	4/27/18
APPVD		

REED

CONCRETE PLACING EQUIPMENT
CHINO, CA 91710

TITLE
WIRING HARNESS MOD, CHEM PUMP

MATERIAL

PART NUMBER 89471-1-EL

REV

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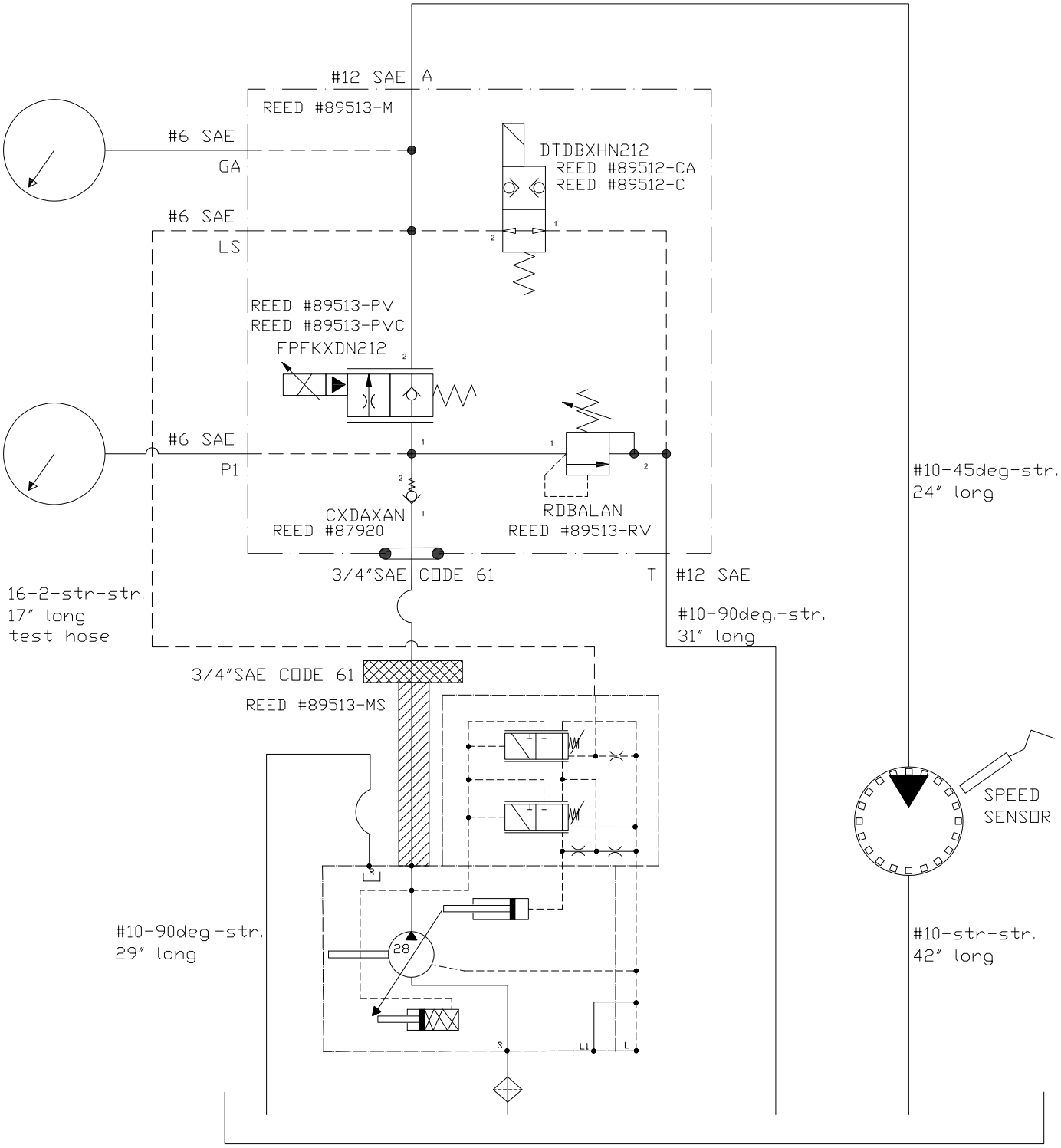
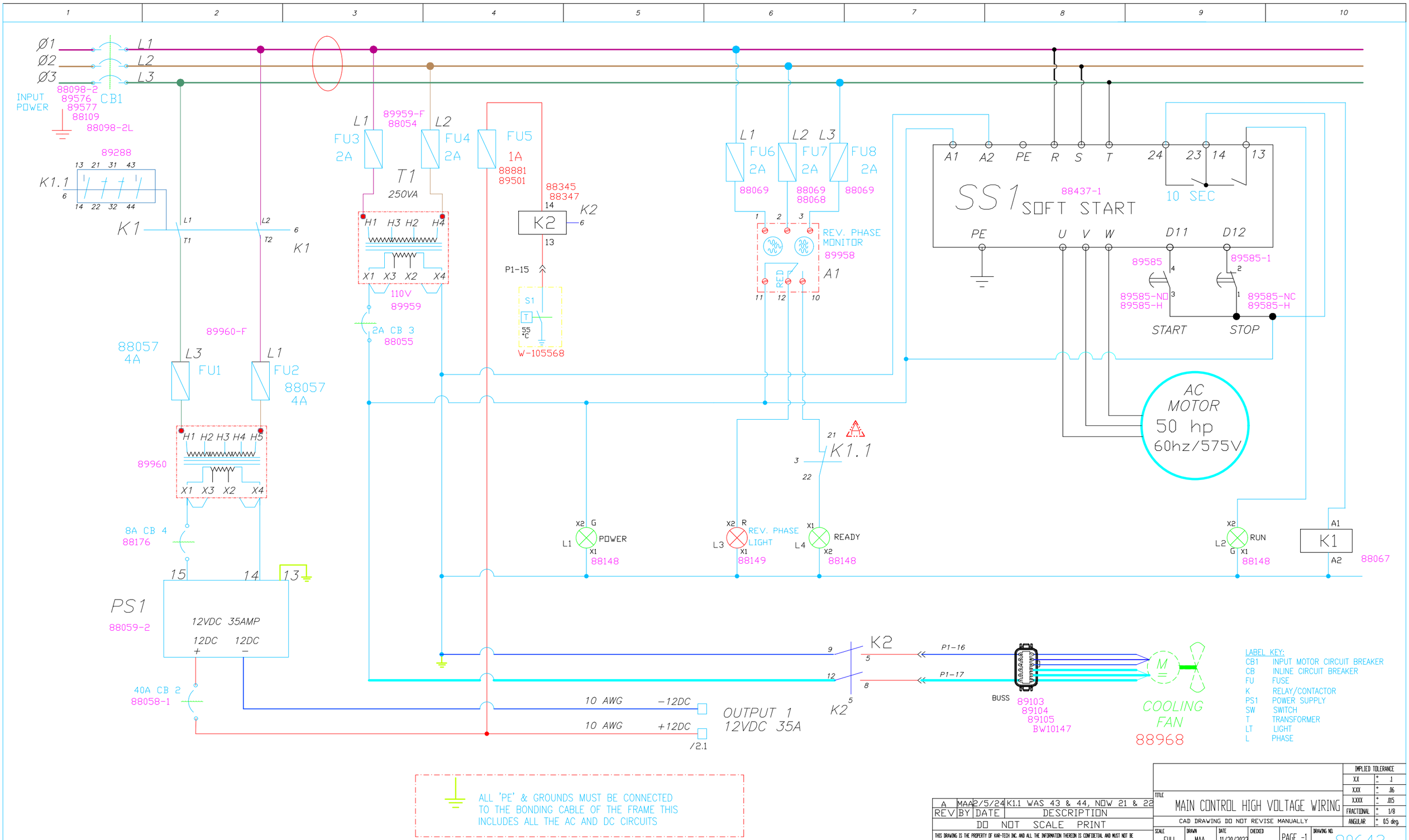
SHEET__OF__


#12 SAE A
REED #89513-M
#6 SAE
GA
DTDBXHN212
REED #89512-CA
REED #89512-C
#6 SAE
LS
REED #89513-PV
REED #89513-PVC
FPFKXDN212
#6 SAE
P1
CXDAXAN
REED #87920
RDBALAN
REED #89513-RV
3/4"SAE CODE 61
T #12 SAE
#10-45deg-str.
24" long
16-2-str-str.
17" long
test hose
#10-90deg.-str.
31" long
3/4"SAE CODE 61
REED #89513-MS
SPEED
SENSOR
#10-90deg.-str.
29" long
#10-str-str.
42" long



REV	BY	DATE	DESCRIPTION
A	MAA	2/5/24	K1.1 WAS 43 & 44, NOW 21 & 22

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TITLE: MAIN CONTROL HIGH VOLTAGE WIRING

CAD DRAWING DO NOT REVISE MANUALLY

SCALE	DRAWN	DATE	CHECKED	PAGE	DRAWING NO.
FULL	MAA	11/30/2023		-1	90642

IMPLIED TOLERANCE	
XX	± .1
XXX	± .06
XXXX	± .015
FRACTIONAL	± 1/8
ANGULAR	± 0.5 deg.

14 GA WIRE
18 GA WIRE

KEYSWITCH

AUTOLUBE

REMOTE PLUG

C1 SCREEN PLUG

DOOR CONTROLS

90633 IOBLOC

CHEM PUMP ON SWITCH

CHEM MIXTURE POTENTIOMETER

88881

89937

89938

FROM DC POWER SUPPLY

K3-70A

K4 VIBRATOR

K5 HORN

K6 VOLUME MOTOR (+)

K7 VOLUME MOTOR (-)

K8 E-STOP OUTPUT

R1: 89136-0, TAG# 0 ADDRESSING RESISTOR

R2: 89136-1, TAG# 1 ADDRESSING RESISTOR

R1_&_R2 90654 W-104185-1 W-104186

R3 90654 W-104185-1 W-104186

D1 SWITCH PLUG

MC42 CONTROLLER

24V POWER SUPPLY

E-STOP

VOLUME MOTOR

PUMP COIL 'A'

PUMP COIL 'B'

S-TUBE COIL 'A'

S-TUBE COIL 'B'

GRATE SENSOR

PROX SENSOR A

PROX SENSOR B

REMIX DUMP

S-TUBE DUMP 1

S-TUBE DUMP 2

24V GND

24V V+

CHEM FLOW METER 1

VREF (-)

VREF (+)

CHEM HYD MOTOR RPM SENSOR

HOSE LEAK SENSOR

CHEM PWM

CHEM DUMP

REV	BY	DATE	DESCRIPTION
B	JA	3/28/24	ADDED R3
A	MAA	2/5/24	K1.1 WAS 43 & 44, NOW 21 & 22

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IMPLIED TOLERANCE	
XX	± .1
XXX	± .06
XXXX	± .015
FRACTIONAL	± 1/8
ANGULAR	± 0.5 deg.

TITLE: MAIN CONTROL HIGH VOLTAGE WIRING

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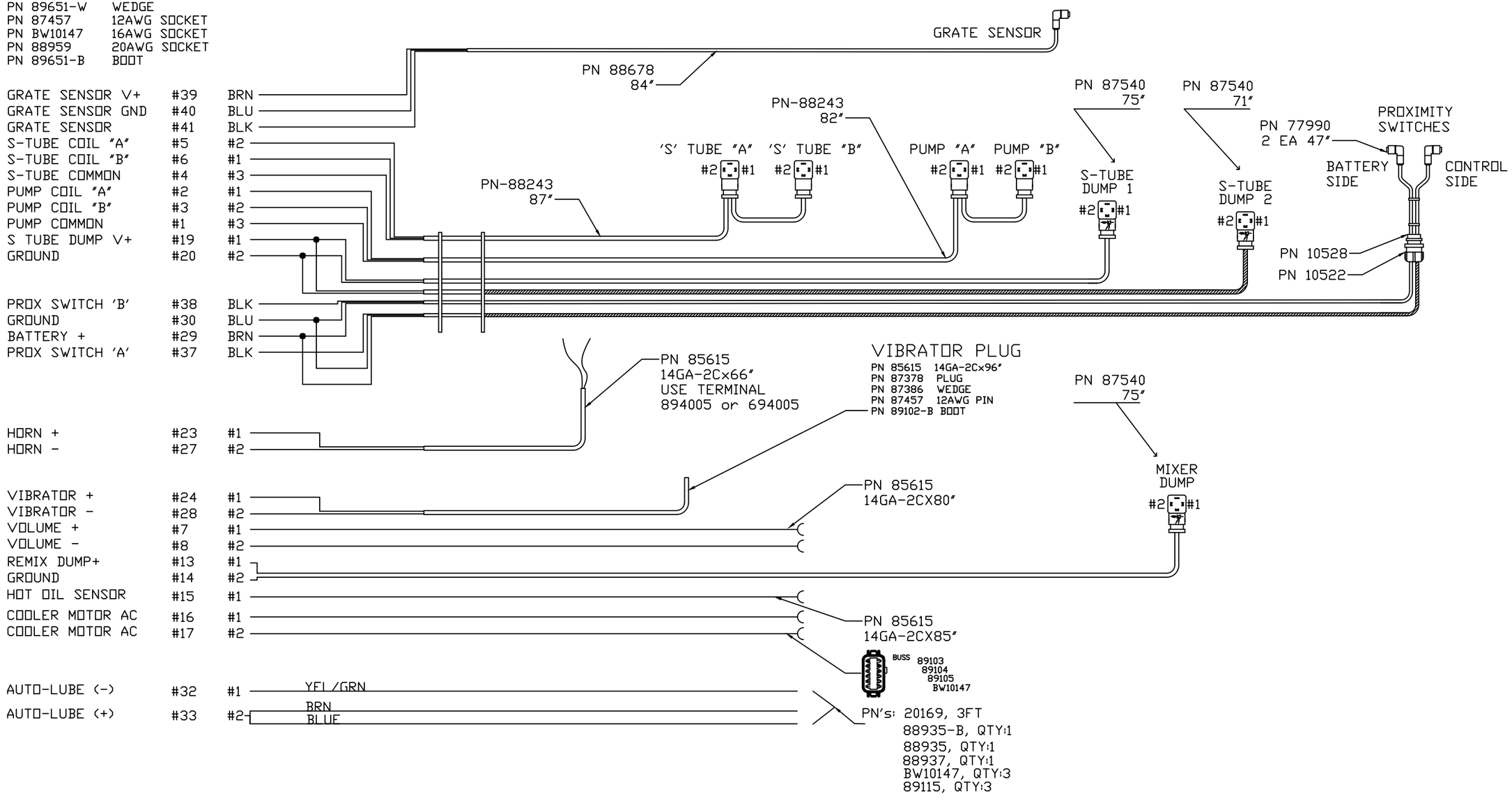
SCALE	DRAWN	DATE	CHECKED	DRAWING NO.
FULL	JA	1/19/23		PAGE -2 90642

P1 – 48 PIN MAIN PLUG

PN 89651	PLUG
PN 89651-W	WEDGE
PN 87457	12AWG SOCKET
PN BW10147	16AWG SOCKET
PN 88959	20AWG SOCKET
PN 89651-B	BOOT

GRATE SENSOR V+	#39	BRN
GRATE SENSOR GND	#40	BLU
GRATE SENSOR	#41	BLK
S-TUBE COIL "A"	#5	#2
S-TUBE COIL "B"	#6	#1
S-TUBE COMMON	#4	#3
PUMP COIL "A"	#2	#1
PUMP COIL "B"	#3	#2
PUMP COMMON	#1	#3
S TUBE DUMP V+	#19	#1
GROUND	#20	#2
PROX SWITCH 'B'	#38	BLK
GROUND	#30	BLU
BATTERY +	#29	BRN
PROX SWITCH 'A'	#37	BLK
HORN +	#23	#1
HORN –	#27	#2
VIBRATOR +	#24	#1
VIBRATOR –	#28	#2
VOLUME +	#7	#1
VOLUME –	#8	#2
REMIX DUMP+	#13	#1
GROUND	#14	#2
HOT OIL SENSOR	#15	#1
COOLER MOTOR AC	#16	#1
COOLER MOTOR AC	#17	#2
AUTO-LUBE (–)	#32	#1
AUTO-LUBE (+)	#33	#2



LTR	DATE	ENGINEERING CHANGE NOTICE #	BY
A	2/26/24	AUTO LUBE ADDED	MAA

REVISIONS

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FRACT	DECIMAL	ANGLE
1/32	.030	1/2°

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	BY	DATE
DRAWN	MAA	11/29/23
APPVD		

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CONCRETE PLACING EQUIPMENT
CHINO, CA 91710

TITLE
WIRING HARNESS, M-SER CHEM ELEC, PLCv2

MATERIAL

PART NUMBER 90643

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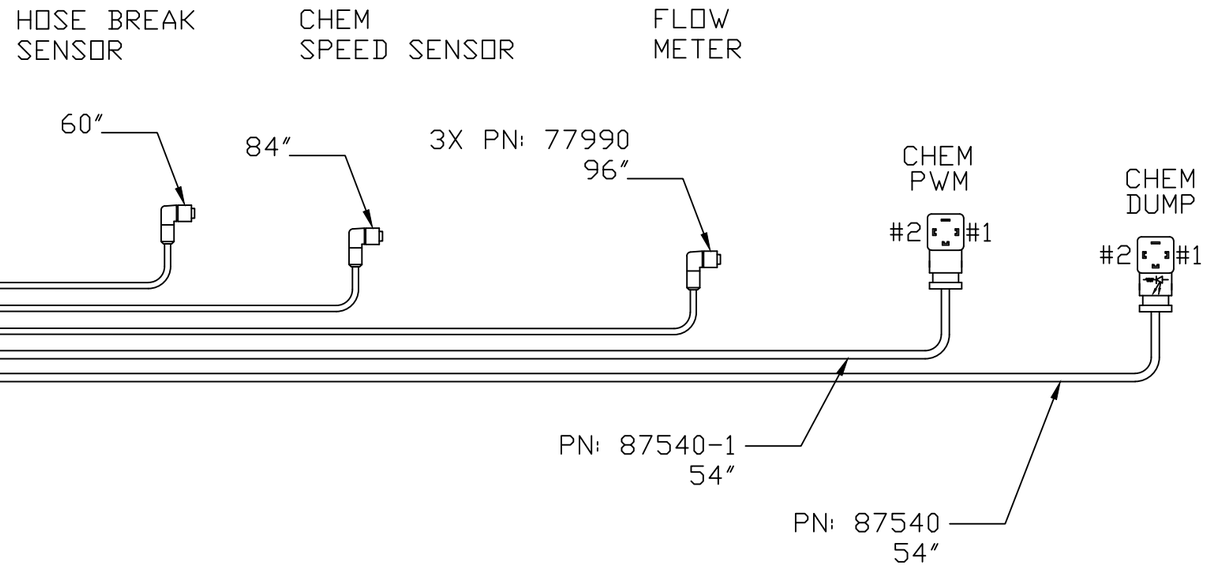
P1 – 48 PIN MAIN PLUG

V+	#44	BRN
LEAK SENSOR	#45	WHT
VREF+	#47	BRN
VREF-	#46	BLU
RPM SENSOR	#48	BLK
24V V+	#42	BRN
24V V-	#43	BLU
METER SIGNAL 1	#31	BLK
CHEM PWM +	#9	#1
CHEM PWM -	#10	#2
CHEM DUMP +	#11	#1
CHEM DUMP -	#12	#2



LTR	DATE	ENGINEERING CHANGE NOTICE #	BY
A	2/26/24	AUTO LUBE ADDED	MAA

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FRACT	DECIMAL	ANGLE
1/32	.030	1/2°

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APPVD		

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CHINO, CA 91710

TITLE
WIRING HARNESS, M-SER CHEM ELEC, PLCv2

MATERIAL

PART NUMBER 90643

REV A

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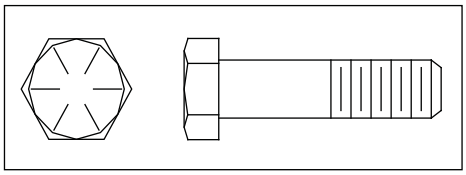
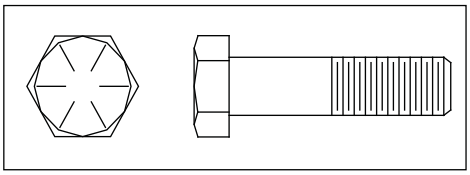
Torque Specification Chart

The following torque values are to be used on all fasteners unless otherwise specified. Lubricated refers to fasteners in the “As Received” condition, which is normally a light preservative oil coating on unplated fasteners and no oil coating on plated fasteners. No special steps are taken to add further lubrication prior to assembly. Anti-seize refers to parts that have had an anti-seize lubricant applied just prior to assembly.

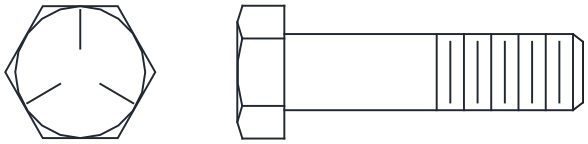


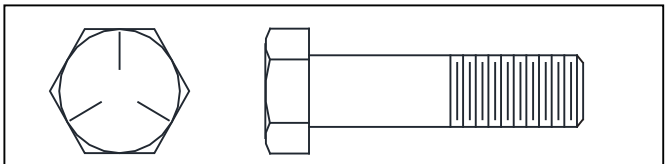


GRADE 8 COURSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-20	129	15	86	10
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-18	23	31	15	20
3/8”-16	40	54	27	37
7/16”-14	63	85	42	57
1/2”-13	96	130	64	87
9/16”-12	140	190	93	126
5/8”-11	195	264	130	176
3/4”-10	340	461	230	312
7/8”-9	550	746	365	495
1”-8	820	1,112	550	746
1 1/8”-7	1,160	1,573	775	1,051
1 1/4”-7	1,640	2,224	1,100	1,491
1 3/8”-6	2,150	2,915	1,430	1,939
1 1/2”-6	2,850	3,864	1,900	2,576
1 3/4”-5	4,490	6,088	3,000	4,067
2”-4.5	6,750	9,152	4,500	6,101
2 1/4”-4.5	9,870	13,382	6,580	8,921
2 1/2”-4	13,500	18,304	9,000	12,202
2 3/4”-4	18,400	24,947	12,300	16,677
3”-4	24,200	32,811	16,200	21,964

GRADE 8 FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-28	147	17	98	11
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-24	25	34	17	23
3/8”-24	45	61	30	41
7/16”-20	71	96	47	64
1/2”-20	108	146	72	98
9/16”-18	155	210	105	142
5/8”-18	220	298	145	197
3/4”-16	380	515	255	346
7/8”-14	605	820	405	549
1”-14	920	1,247	615	834
1 1/8”-12	1,300	1,763	870	1,180
1 1/4”-12	1,820	2,468	1,210	1,641
1 3/8”-12	2,450	3,322	1,630	2,210
1 1/2”-12	3,210	4,352	2,140	2,901

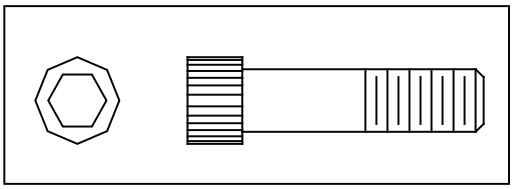
Allied Systems Co. reserves the right to make changes to new equipment without incurring the obligation to make such changes to equipment previously manufactured.



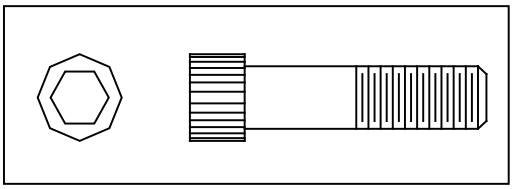


GRADE 5 COURSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-20	91	10	61	7
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-18	16	22	11	15
3/8”-16	28	38	19	26
7/16”-14	45	61	30	41
1/2”-13	68	92	46	62
9/16”-12	98	133	66	89
5/8”-11	140	190	91	123
3/4”-10	240	325	160	217
7/8”-9	390	529	260	353
1”-8	580	786	390	529
1 1/8”-7	715	969	480	651
1 1/4”-7	1,010	1,369	675	915
1 3/8”-6	1,330	1,803	885	1,200
1 1/2”-6	1,760	2,386	1,170	1,586
1 3/4”-5	2,770	3,756	1850	2,508
2”-4.5	4,160	5,640	2780	3,769
2 1/4”-4.5	6,090	8,257	4060	5,505
2 1/2”-4	8,330	11,294	5550	7,525
2 3/4”-4	11,300	15,321	7540	10,223
3”-4	15,000	20,337	9,940	13,477

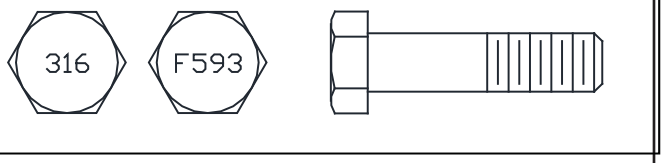
GRADE 5 FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-28	105	12	70	8
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-24	18	24	12	16
3/8”-24	32	43	21	28
7/16”-20	50	68	34	46
1/2”-20	77	104	51	69
9/16”-18	110	149	73	99
5/8”-18	155	210	105	142
3/4”-16	270	366	180	244
7/8”-14	430	583	285	386
1”-14	655	888	435	590
1 1/8”-12	805	1,091	535	725
1 1/4”-12	1,120	1,519	745	1,010
1 3/8”-12	1,510	2,047	1,010	1,369
1 1/2”-12	1,980	2,685	1,320	1,790

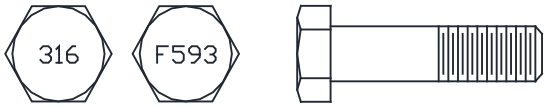


SOCKETHEAD COARSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-20	150	17	100	11
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-18	26	35	18	24
3/8”-16	46	62	31	42
7/16”-14	74	100	49	66
1/2”-13	115	156	75	102
9/16”-12	160	217	105	142
5/8”-11	215	292	145	197
3/4”-10	385	522	255	346
7/8”-9	615	834	410	556
1”-8	920	1,247	615	834
1 1/8”-7	1,305	1,769	870	1,180
1 1/4”-7	1,840	2,495	1,230	1,668
1 3/8”-6	2,415	3,274	1,610	2,183
1 1/2”-6	3,205	4,345	2,135	2,895
1 3/4”-5	5,050	6,847	3,370	4,569
2”-4.5	7,590	10,291	5,060	6,860
2 1/4”-4.5	11,100	15,050	7,400	10,033
2 1/2”-4	15,185	20,588	10,125	13,728
2 3/4”-4	20,610	27,943	13,740	18,629
3”-4	27,190	36,865	18,130	24,581



SOCKETHEAD FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-28	172	19	115	13
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-24	29	39	20	27
3/8”-24	52	71	35	47
7/16”-20	82	111	55	75
1/2”-20	130	176	84	114
9/16”-18	175	237	120	163
5/8”-18	245	332	165	224
3/4”-16	425	576	285	386
7/8”-14	680	922	455	617
1”-14	1,035	1,403	690	936
1 1/8”-12	1,465	1,986	975	1,322
1 1/4”-12	2,040	2,766	1,360	1,844
1 3/8”-12	2,750	3,728	1,835	2,488
1 1/2”-12	3,605	4,888	2,405	3,261

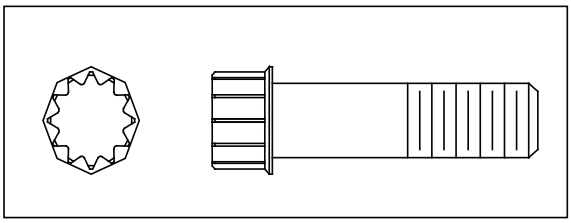




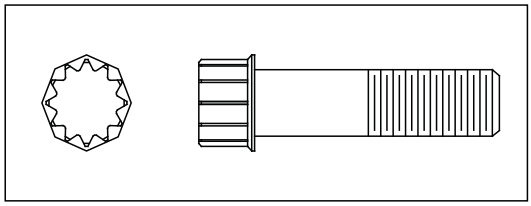
316 SS OR F593 G & H COURSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-20	59	7	40	5
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-18	11	15	7	9
3/8”-16	19	26	13	18
7/16”-14	29	39	20	27
1/2”-13	45	61	30	41
9/16”-12	64	87	43	58
5/8”-11	88	119	59	80
3/4”-10	110	149	72	98
7/8”-9	175	237	116	157
1”-8	265	359	174	236
1 1/8”-7	370	502	247	335
1 1/4”-7	525	712	348	472
1 3/8”-6	685	929	456	618
1 1/2”-6	910	1,234	605	820
1 3/4”-5	1440	1,952	954	1,293
2”-4.5	2160	2,929	1440	1,952
2 1/4”-4.5	3150	4,271	2100	2,847
2 1/2”-4	4310	5,844	2870	3,891
2 3/4”-4	5840	7,918	3900	5,288
3”-4	7710	10,453	5140	6,969

316 SS OR F593 G & H FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-28	68	8	45	5
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-24	12	16	8	11
3/8”-24	21	28	14	19
7/16”-20	33	45	22	30
1/2”-20	50	68	34	46
9/16”-18	71	96	48	65
5/8”-18	100	136	67	91
3/4”-16	125	169	81	110
7/8”-14	195	264	130	176
1”-14	295	400	200	271
1 1/8”-12	415	563	280	380
1 1/4”-12	580	786	385	522
1 3/8”-12	780	1,058	520	705
1 1/2”-12	1,030	1,396	685	929

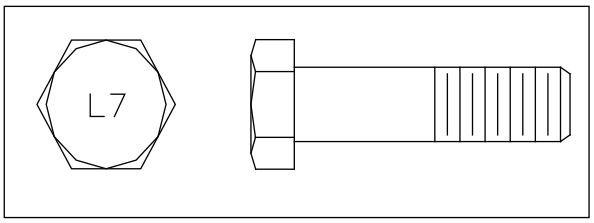
Unless otherwise specified, anti-seize shall be used on SS/SS connections.



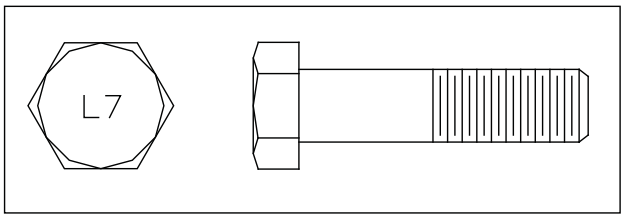
12 POINT FERRY HEAD COURSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-20	150	17	100	11
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-18	26	35	18	24
3/8”-16	46	62	31	42
7/16”-14	74	100	49	66
1/2”-13	115	156	75	102
9/16”-12	165	224	110	149
5/8”-11	225	305	150	203
3/4”-10	400	542	265	359
7/8”-9	640	868	425	576
1”-8	955	1,295	640	868
1 1/8”-7	1,310	1,776	870	1,180
1 1/4”-7	1,840	2,495	1,230	1,668
1 3/8”-6	2,420	3,281	1,610	2,183
1 1/2”-6	3,210	4,352	2,140	2,901
1 3/4”-5	5,050	6,847	3,370	4,569
2”-4.5	7,590	10,291	5,060	6,860
2 1/4”-4.5	11,100	15,050	7,400	10,033
2 1/2”-4	15,200	20,608	10,200	13,829
2 3/4”-4	20,700	28,065	13,800	18,710
3”-4	27,200	36,878	18,200	24,676



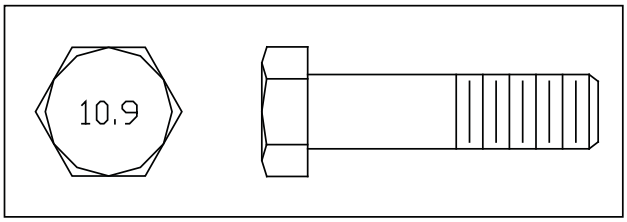
12 POINT FERRY HEAD FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-28	172	19	115	13
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-24	29	39	20	27
3/8”-24	52	71	35	47
7/16”-20	82	111	55	75
1/2”-20	130	176	84	114
9/16”-18	180	244	120	163
5/8”-18	255	346	170	230
3/4”-16	445	603	295	400
7/8”-14	705	956	470	637
1”-14	1,080	1,464	715	969
1 1/8”-12	1,470	1,993	980	1,329
1 1/4”-12	2,040	2,766	1,360	1,844
1 3/8”-12	2,750	3,728	1,840	2,495
1 1/2”-12	3,610	4,895	2,410	3,268



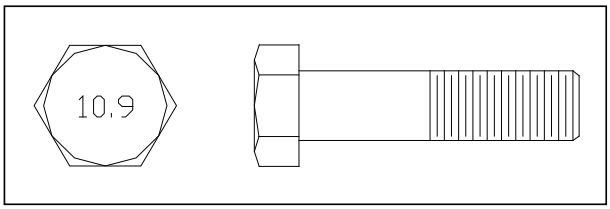
ASTM A320-7 COURSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-20	96	11	64	7
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-18	17	23	11	15
3/8”-16	30	41	20	27
7/16”-14	47	64	32	43
1/2”-13	72	98	48	65
9/16”-12	105	142	69	94
5/8”-11	145	197	95	129
3/4”-10	255	346	170	230
7/8”-9	410	556	275	373
1”-8	610	827	410	556
1 1/8”-7	865	1,173	575	780
1 1/4”-7	1,220	1,654	815	1,105
1 3/8”-6	1,600	2,169	1,070	1,451
1 1/2”-6	2,120	2,874	1,420	1,925
1 3/4”-5	3,340	4,528	2,230	3,023
2”-4.5	5,020	6,806	3,350	4,542
2 1/4”-4.5	7,340	9,952	4,900	6,644
2 1/2”-4	10,100	13,694	6,700	9,084
2 3/4”-4	13,700	18,575	9,090	12,324
3”-4	18,000	24,405	12,000	16,270



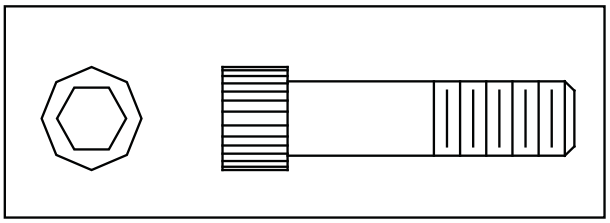
ASTM A320-7 FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
1/4”-28	110	12	73	8
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
5/16”-24	19	26	13	18
3/8”-24	34	46	23	31
7/16”-20	53	72	35	47
1/2”-20	81	110	54	73
9/16”-18	115	156	77	104
5/8”-18	165	224	110	149
3/4”-16	285	386	190	258
7/8”-14	450	610	300	407
1”-14	685	929	460	624
1 1/8”-12	970	1,315	645	875
1 1/4”-12	1,350	1,830	900	1,220
1 3/8”-12	1,820	2,468	1,220	1,654
1 1/2”-12	2,390	3,240	1,590	2,156



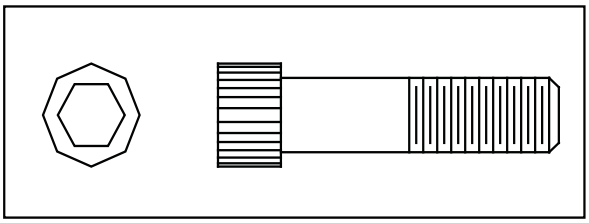
METRIC GRADE 10.9 COARSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
6-1.00	119	13	80	9
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
8-1.25	25	34	17	23
10-1.50	48	65	32	43
12-1.75	84	114	56	76
14-2.00	135	183	89	121
16-2.00	210	285	140	190
20-2.50	405	549	270	366
22-2.50	550	746	370	502
24-3.00	700	949	465	630
27-3.00	1,030	1,396	685	929
30-3.50	1,390	1,885	925	1,254
36-4.00	2,430	3,295	1,620	2,196
42-4.50	3,880	5,261	2,590	3,512
48-5.00	5,830	7,904	3,890	5,274
56-5.50	9,370	12,704	6,250	8,474
64-6.00	14,200	19,253	9,410	12,758
72-6.00	20,600	27,930	13,700	18,575
80-6.00	28,700	38,912	19,100	25,896
90-6.00	41,500	56,266	27,700	37,556
100-6.00	57,700	78,231	38,500	52,199



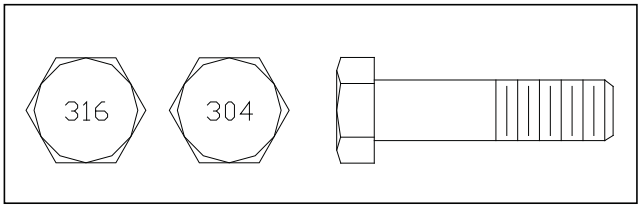
METRIC GRADE 10.9 FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
6-0.75	131	15	87	10
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
8-1.00	26	35	18	24
10-1.25	51	69	34	46
12-1.50	88	119	59	80
14-1.50	145	197	96	130
16-1.50	225	305	150	203
18-1.50	360	488	240	325
20-1.50	495	671	330	447
22-1.50	660	895	440	597
24-2.00	860	1,166	575	780
27-2.00	1,230	1,668	820	1,112
30-1.50	1,850	2,508	1,230	1,668



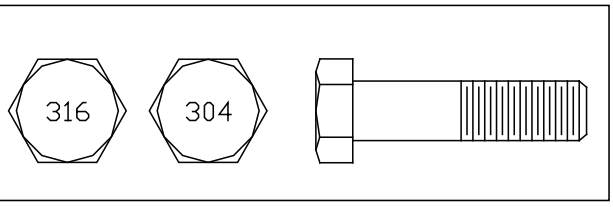
METRIC GRADE 12.9 SOCKET HEAD COARSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
6-1.00	135	15	90	10
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
8-1.25	28	38	19	26
10-1.50	54	73	36	49
12-1.75	95	129	63	85
14-2.00	155	210	105	142
16-2.00	235	319	160	217
20-2.50	460	624	305	414
22--2.50	625	847	415	563
24-3.00	790	1,071	525	712
27-3.00	1,160	1,573	770	1,044
30-3.50	1,570	2,129	1,050	1,424
36-4.00	2,740	3,715	1,830	2,481
42-4.50	4,390	5,952	2,930	3,973
48-5.00	6,590	8,935	4,390	5,952
56-5.50	10,600	14,372	7,060	9,572
64-6.00	16,000	21,693	10,700	14,507
72-6.00	23,200	31,455	15,500	21,015
80-6.00	32,400	43,929	21,600	29,286
90-6.00	46,900	63,588	31,300	42,437
100-6.00	65,200	88,399	43,500	58,978



METRIC GRADE 12.9 SOCKET HEAD FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
6-0.75	148	17	98	11
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
8-1.00	30	41	20	27
10-1.25	57	77	38	52
12-1.50	99	134	66	89
14-1.50	165	224	110	149
16-1.50	250	339	170	230
18-1.50	405	549	270	366
20-1.50	560	759	375	508
22-1.50	745	1,010	500	678
24-2.00	970	1,315	645	875
27-2.00	1,390	1,885	925	1,254
30-1.50	2,090	2,834	1,390	1,885

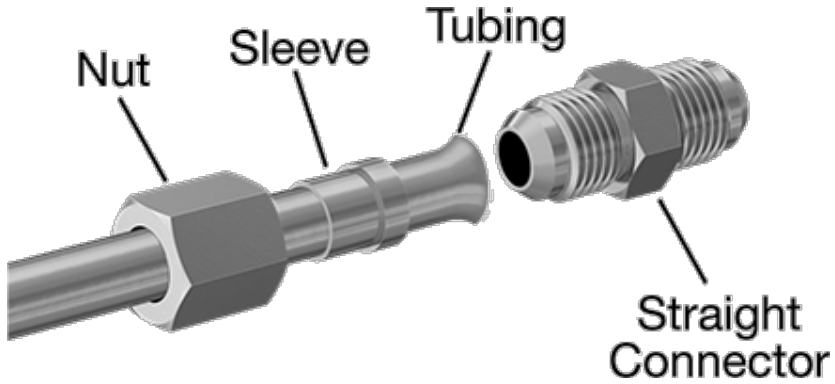


METRIC 316 OR 304 SS COURSE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
6-1.00	55	6	37	4
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
8-1.25	12	16	8	11
10-1.50	23	31	15	20
12-1.75	39	53	26	35
14-2.00	62	84	41	56
16-2.00	96	130	64	87
20-2.50	190	258	125	169
22--2.50	255	346	170	230
24-3.00	325	441	215	292
27-3.00	475	644	315	427
30-3.50	640	868	430	583
36-4.00	1,120	1,519	750	1,017
42-4.50	1,800	2,440	1,195	1,620
48-5.00	2,700	3,661	1,800	2,440
56-5.50	4,330	5,871	2,890	3,918
64-6.00	6,520	8,840	4,350	5,898
72-6.00	9,480	12,853	6,320	8,569
80-6.00	13,300	18,032	8,820	11,958
90-6.00	19,200	26,032	12,770	17,314
100-6.00	26,700	36,200	17,800	24,134



METRIC 316 OR 304 SS FINE THREAD				
BOLT size-pitch	LUBRICATED		WITH ANTI-SEIZE	
	in-lbs	**Nm**	**in-lbs**	**Nm**
6-0.75	60	7	40	5
	ft-lbs	**Nm**	**ft-lbs**	**Nm**
8-1.00	12	16	8	11
10-1.25	24	33	16	22
12-1.50	41	56	27	37
14-1.50	67	91	45	61
16-1.50	102	138	68	92
18-1.50	165	224	110	149
20-1.50	230	312	155	210
22-1.50	305	414	205	278
24-2.00	395	536	265	359
27-2.00	570	773	380	515
30-1.50	855	1,159	570	773

TECHNICAL DATA



The art of making a leak-proof connection with hydraulic couplings is to tighten the couplings properly at the time of installation. An overtightened coupling may be just as apt to leak as an under-tightened coupling. This is because over-tightening a coupling may result in overstressing and/or cracking. The torque values in the following tables give the minimum and maximum torque recommendations. The minimum value will create a leak-proof seal under most conditions. Applying torque values greater than the maximum recommendation will distort and/or crack the fitting. Values listed in SAE J514 are for qualification testing only and should not be used as the basis for setting up torque values for a production environment. These need to be established based on the coupling manufacturer's recommendations. When tightening couplings, make sure that the hose does not twist on the adapter. Twisting will shorten hose life and scar the sealing surfaces of swivel type couplings (JIC, 45°, etc.), which can create leaks. For straight couplings, use a torque wrench on the hex, swivel, nut and a standard, box, wrench on the stem hex. Bent tube couplings can be restrained by holding onto the ferrule. When a crowsfoot wrench is used with a torque wrench, adjustments to the torque readings must be made otherwise overtightening will occur. The distance from the center of the drive socket to the center of the crowsfoot must be added to the torque value reading.

We do recommend lubricating all O-rings prior to insertion into flange head and ORS grooves. This will minimize the possibility of nicking the O-ring when it is installed. The torque values obtained from tightening pipe threads can vary considerably, depending on the conditions of the threads. Adequate sealing can occur at values much lower than the maximum values listed in the chart. However, the minimum torque values must be used to obtain adequate sealing

REED TECHNICAL DATA

For 37° & 45° (Machined or Flared) and MegaSeal®

Size		Steel				Brass			
	Fractional	Ft. Lbs.		Newton-Meters		Ft. Lbs.		Newton-Meters	
Dash	(In.)	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
-4	1/4	10	11	13	15	5	6	6-3/4	9
-5	5/16	13	15	18	20	7	9	10	13
-6	3/8	17	19	23	26	12	15	17	20
-8	1/2	34	38	47	52	20	24	27-2/3	33
-10	5/8	50	56	69	76	34	40	46-1/3	55
-12	3/4	70	78	96	106	53	60	72-1/3	82
-16	1	94	104	127	141	74	82	100-1/2	111
-20	1-1/4	124	138	169	188	75	83	101-1/2	113
-24	1-1/2	156	173	212	235	79	87	107	118
-32	2	219	243	296	329	158	175	214	237

REED TECHNICAL DATA

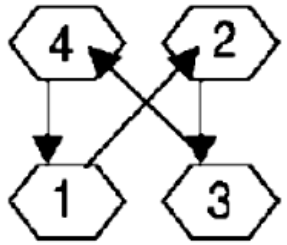
For SAE O-Ring Boss (Steel) & Gates Adapterless

Size		Ft.Lbs. Working Pressures 4,000 psi (27.5 Mpa) and below		Newton-Meters Working Pressures 4,000 psi (27.5 Mpa) and below		Ft.Lbs. Working Pressures Above 4,000 psi (27.5 Mpa)		Newton-Meters Working Pressures Above 4,000 psi (27.5 Mpa)	
Dash	Fractional (In.)	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
-3	3/16	–	–	–	–	8	10	11	13
-4	1/4	14	16	20	22	14	16	20	22
-5	5/16	–	–	–	–	18	20	24	27
-6	3/8	24	26	33	35	24	26	33	35
-8	1/2	37	44	50	60	50	60	68	78
-10	5/8	50	60	68	81	72	80	98	110
-12	3/4	75	83	101-1/2	113	125	135	170	183
-14	7/8	–	–	–	–	160	180	215	245
-16	1	111	125	150	170	200	220	270	300
-20	1-1/4	133	152	180	206	210	280	285	380
-24	1-1/2	156	184	212	250	270	360	370	490

REED TECHNICAL DATA

For 4-Bolt Flange Connections

Bolt Size	Line Size	Torque Nm	Torque Lb-Ft
.31	-8	23	17
.38	-12	35	26
.44	-16	58	43
.50	-20	88	65
.63	-24	176	130
.75	-32	298	220

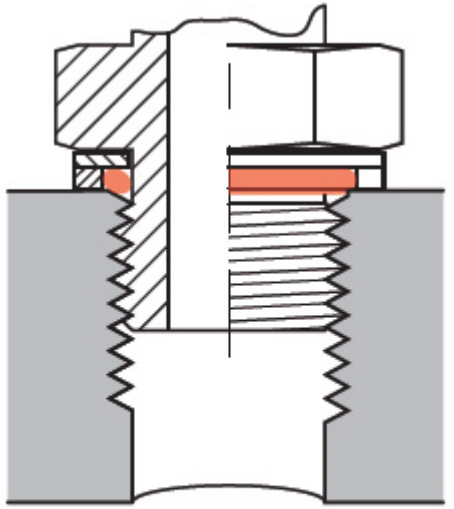


1. The 4-bolt flange seal is a face seal. The shoulder which contains the seal must fit squarely against the mating surface and be held there with even tension on all bolts.
2. Torque values apply to plated bolts and bolts with light engine oil.
3. Lubricate o-ring with a light oil (SAE 10W or 20W) before assembly.
4. Finger tighten all four bolts making sure the flange and fitting shoulder are started square.
5. Tighten all bolts evenly by partially tightening each bolt as shown in the figure below and repeating the sequence until all bolts are tightened to the specific torque in the table.

REED **TECHNICAL DATA**

Installation of Non-Adjustable & Straight Port Fitting

1. Observe unassembled parts, especially threads and bore to ensure it is free of foreign material, burrs, nicks, etc.
2. Make sure compound/material and hardness of O-ring are suitable for the medium type and temperature.
3. Observe O-ring for nicks or cuts and replace if any found. Never use a damaged O-ring!
4. Install O-ring on male thread and make sure the O-ring is not cocked or twisted. Abut O-ring to the base of the thread.
5. Lubricate the O-ring with a light coat of the system's fluid or suitable lubricant.
6. Install retaining ring over the O-ring (if included) and ensure O-ring is seated inside the retaining ring evenly.
7. Screw and tighten the fitting or adapter into the port using suggested torque values.
8. Inspect the assembly to ensure the O-ring is properly seated and there are no leaks.

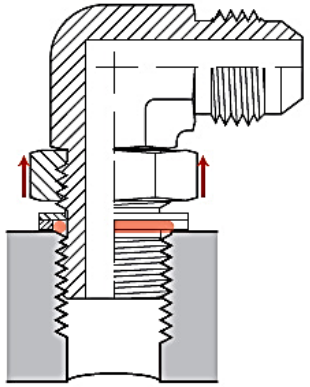


O-ring is properly installed and fitting torqued

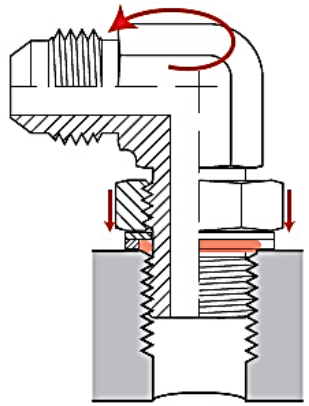
REED **TECHNICAL DATA**

Installation of Adjustable Port Fittings

1. Following the above steps (Non-Adjustable & Straight Port Fittings) and stop after step 6.
2. Back off the adjustable nut and backup washer as far back as possible, ensuring the threads are fully exposed.
3. Thread fitting into the port until the seal comes into full contact with the spotface (do not overtighten).
4. If installing an elbow, align the direction of the hose or tube end to a desirable orientation by unscrewing the fitting, but be sure not to go past one full turn.
5. Utilizing 2 wrenches (one being a torque wrench), hold the fitting in position with one wrench while tightening the adjustable nut with the torque wrench. Use suggested torque values.
6. Inspect the assembly to ensure that the O-ring & retaining ring are properly seated, and that there are no leaks.
7. If a crowsfoot is used with a torque wrench, adjustments might need to be made to the torque settings otherwise overtightening could occur. Consult your manufacturer for instructions.



Adjusable nut and washer are backed all the way off. Fitting is threaded in until seal is touching the port. Fitting is not oriented yet.

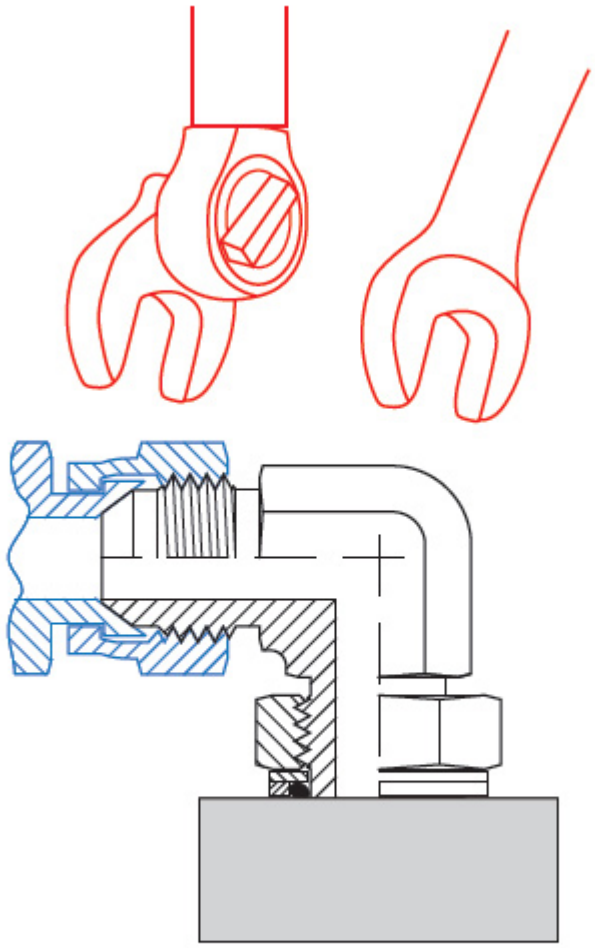


Orient the fitting to face direction of hose or tube by loosening the fitting, but not more then one turn. Then torque the adjustable nut to suggested setting while holding the fitting body.

REED **TECHNICAL DATA**

Installation of Female Swivel Fittings

1. Observe unassembled parts, especially threads and bore to ensure it is free of foreign material, burrs, nicks, etc.
2. Make sure the sealing surface angles are the same for the fittings you are connecting.
3. If there is an O-ring located on one of the cone seats, inspect it for damage and replace if used or worn. Make sure O-ring is seated properly and not cocked or twisted.
4. Never install an O-ring, bonded washer, or other seal at the base of the thread like you would a port fitting. Swivel fittings seal via internal surfaces.
5. Thread and then tighten the swivel nut with a torque wrench while holding the corresponding fitting body with a wrench. Torque to recommended settings.
6. If a crowsfoot is used with a torque wrench, adjustments might need to be made to the torque settings otherwise overtightening could occur. Consult your manufacturer for instructions.
7. Inspect final assembly for leaks.



Hand tighten, then orient the fitting to face direction of hose or tube. Then torque the swivel nut to suggested setting while holding the fitting body. Inspect for leaks.

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REV	DATE	DESCRIPTION	NAME
*	04/10/2024	INITIAL	J.SLACK

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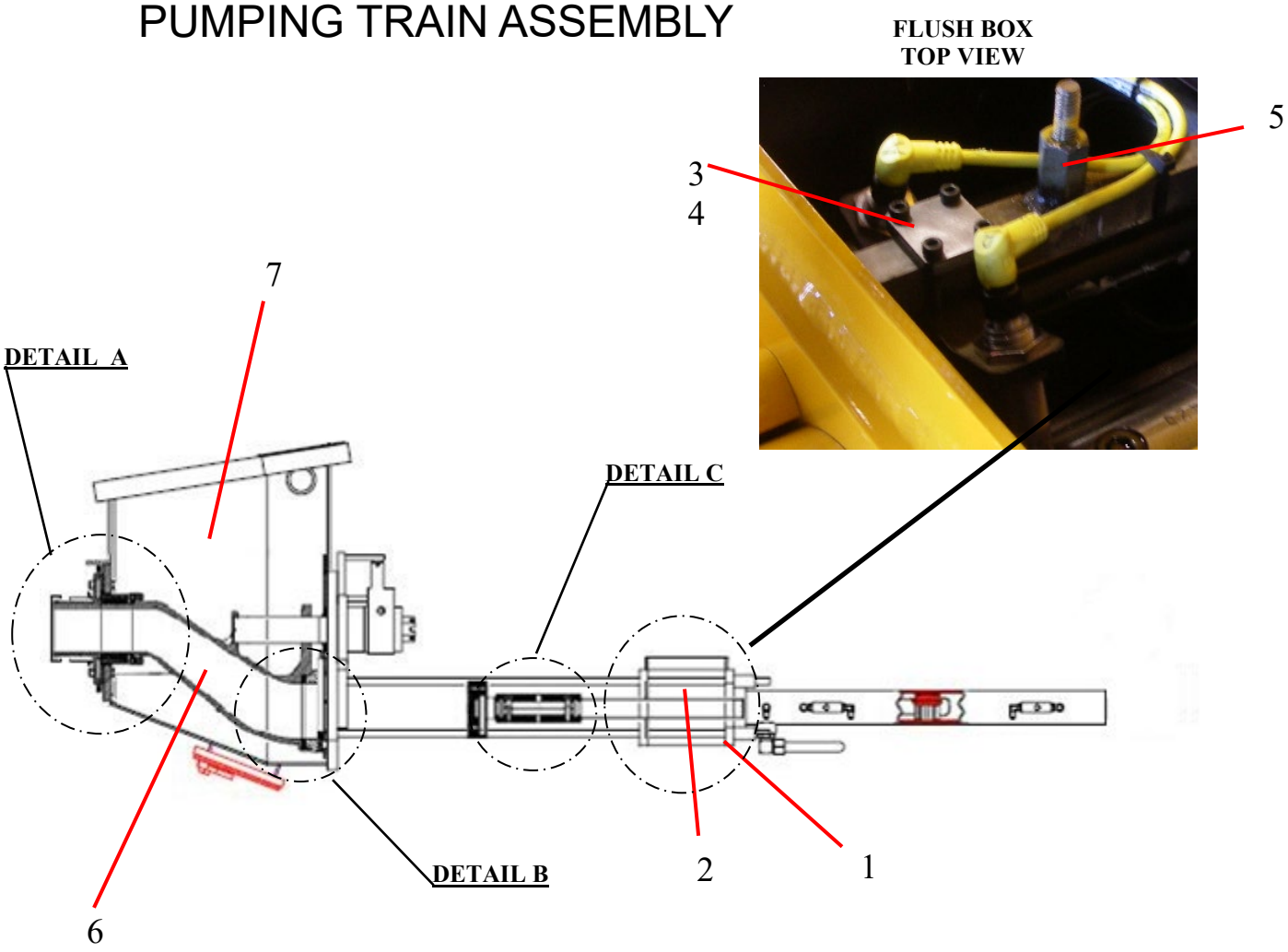
PARTS

PUMPING TRAIN ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
	88636-1	PUMP CELL ASSEMBLY M30 HYDRA		REF
1	10282	PLUGS-PIPE GALV 1” FOR DRAIN	1	EA
2	BW10368	FLUSH BOX WELDMENT, A40	1	EA
3	BW10102	BRACKET, PROX SWITCH,	1	EA
4	BW10383	BRACKET, PROX SWITCH	1	EA
5	BW10193	STUD, 3/8-16 X 2” LONG	1	EA
6	BW10391	S TUBE WELDMENT, 6X5 A40	1	EA
7	BW10363A	HOPPER, WELDMENT A40 SAFETY SWITCH	1	EA

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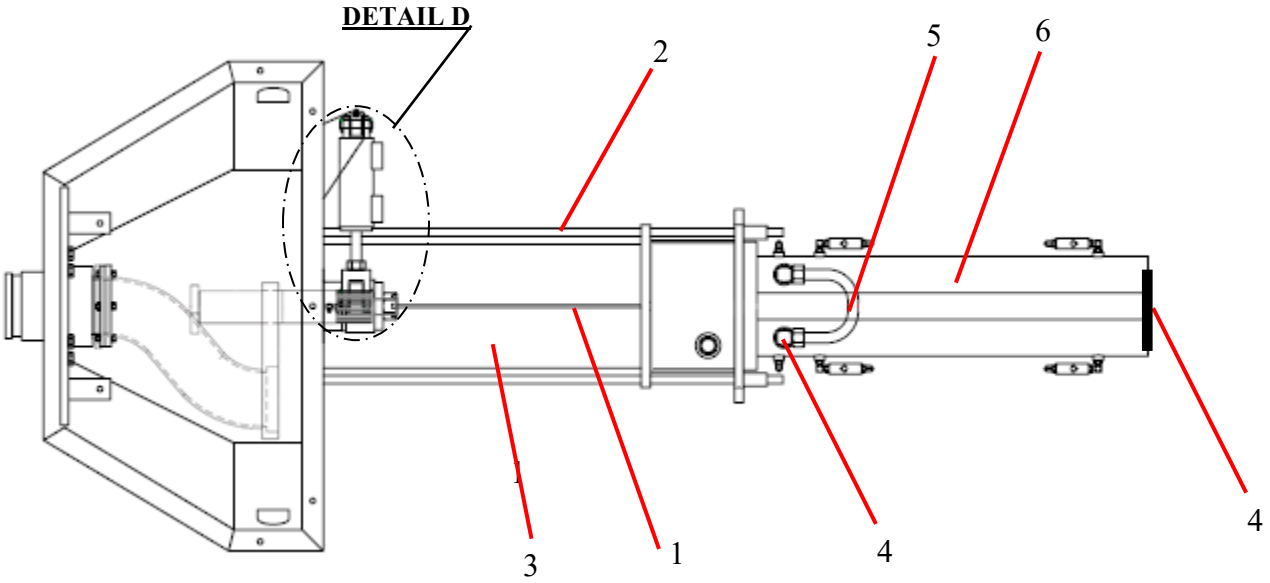
PUMPING TRAIN ASSEMBLY CONTINUED



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10380	TIE ROD, SHORT, A40	4	EA
2	88638	TIE ROD, LONG, A40	2	EA
3	88637	CONCRETE CYLINDER, 6” X 20” A40	2	EA
4	86728-023	ELBOW, MB – MJ90-16-16	2	EA
5	BW10394	TUBE, HYD, LOOP LINE, A40	1	EA
6	88633HT	DRIVE CYLINDER 3.75 X 2.00 X19.50 (HYDRA)	2	EA
7	88654	END PLATE DRIVE CYLINDER M30	1	EA

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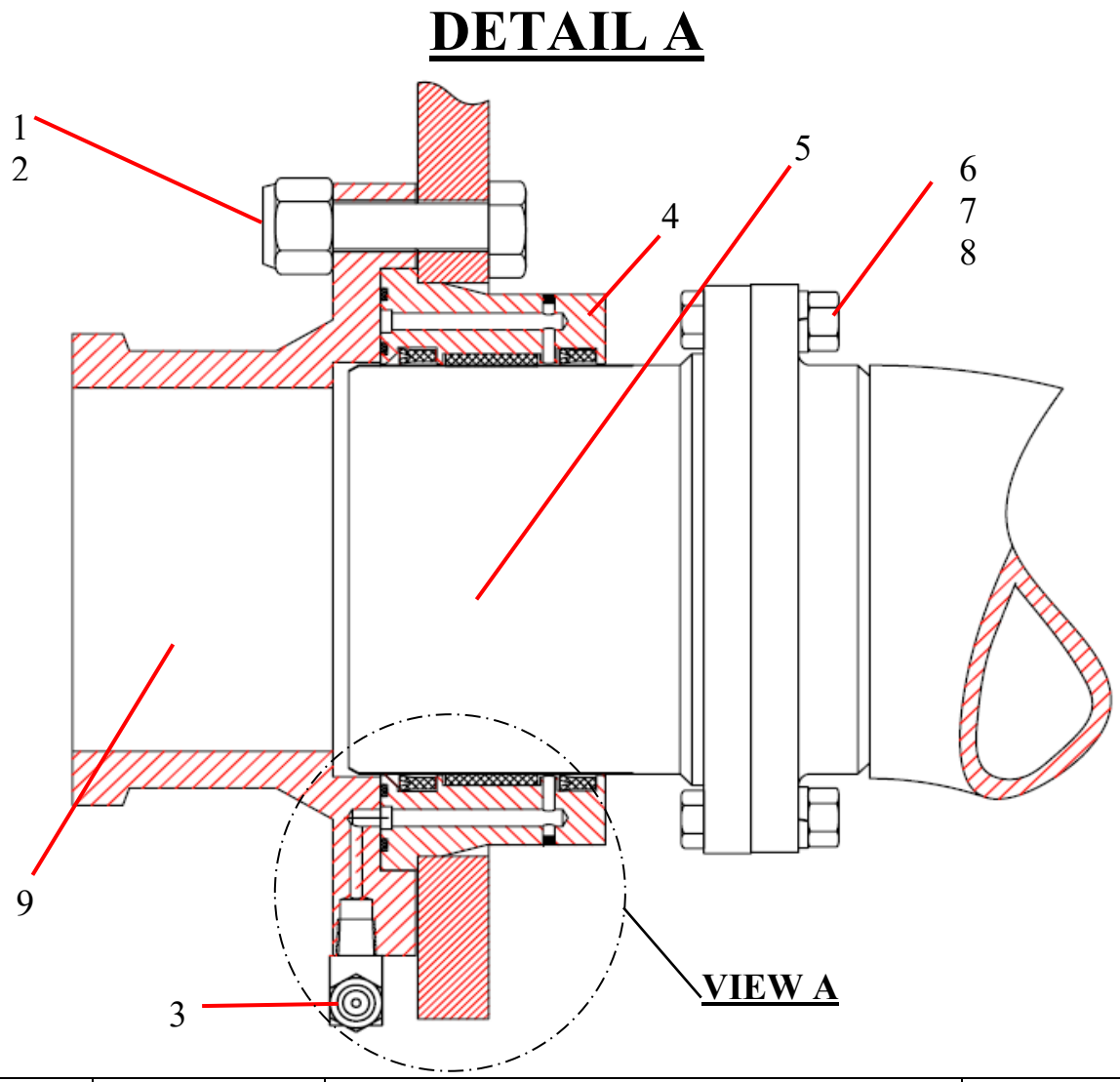
S-TUBE ASSEMBLY
5” OUTLET ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
	86321	OUTLET ASSEMBLY	1	EA
1		HHCS, 9/16-12 X 2 1/2 GR/8	6	EA
2		LOCK NUT, 9/16 -12	6	EA
3		GREASE FITTING, 1/8” NPT 90°	2	EA
4	72309	OUTLET SEAL HOUSING	1	EA
5	70042	WELD.-CHROMED OUTLET	1	EA
6		HHCS, 3/8 – 16X1 ½” GR 8	6	EA
7		HEX NUT, 3/8” - 16	6	EA
8		LOCK WASHER, 3/8”	6	EA
9	72482	OUTLET, 5" (1-PIECE)	1	EA

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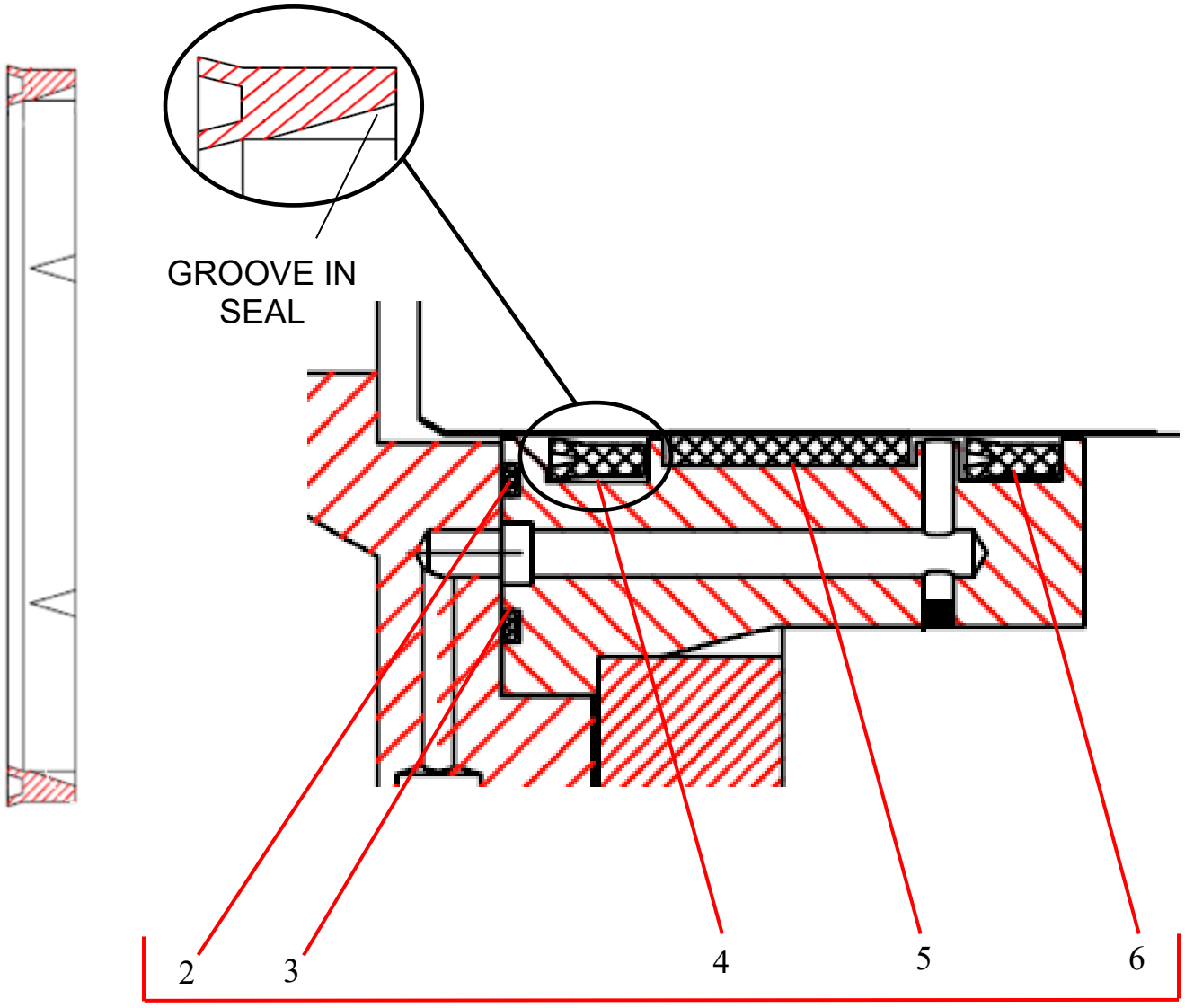
5” OUTLET SEAL KIT INSTALLATION

VIEW A



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	79895	SEAL KIT	1	EA
2	77762	O-RING-#257 BUNA 90	1	EA
3	77761	O-RING-#264 BUNA 90	1	EA
4	86504	SEAL-MODIFIED- 5 IN OUTLET	1	EA
5	77763	GUIDE BAND – 5.375 OD X 1.00W	1	EA
6	77765	LIP SEAL -5.50 ID X 6.00 OD X..56	1	EA

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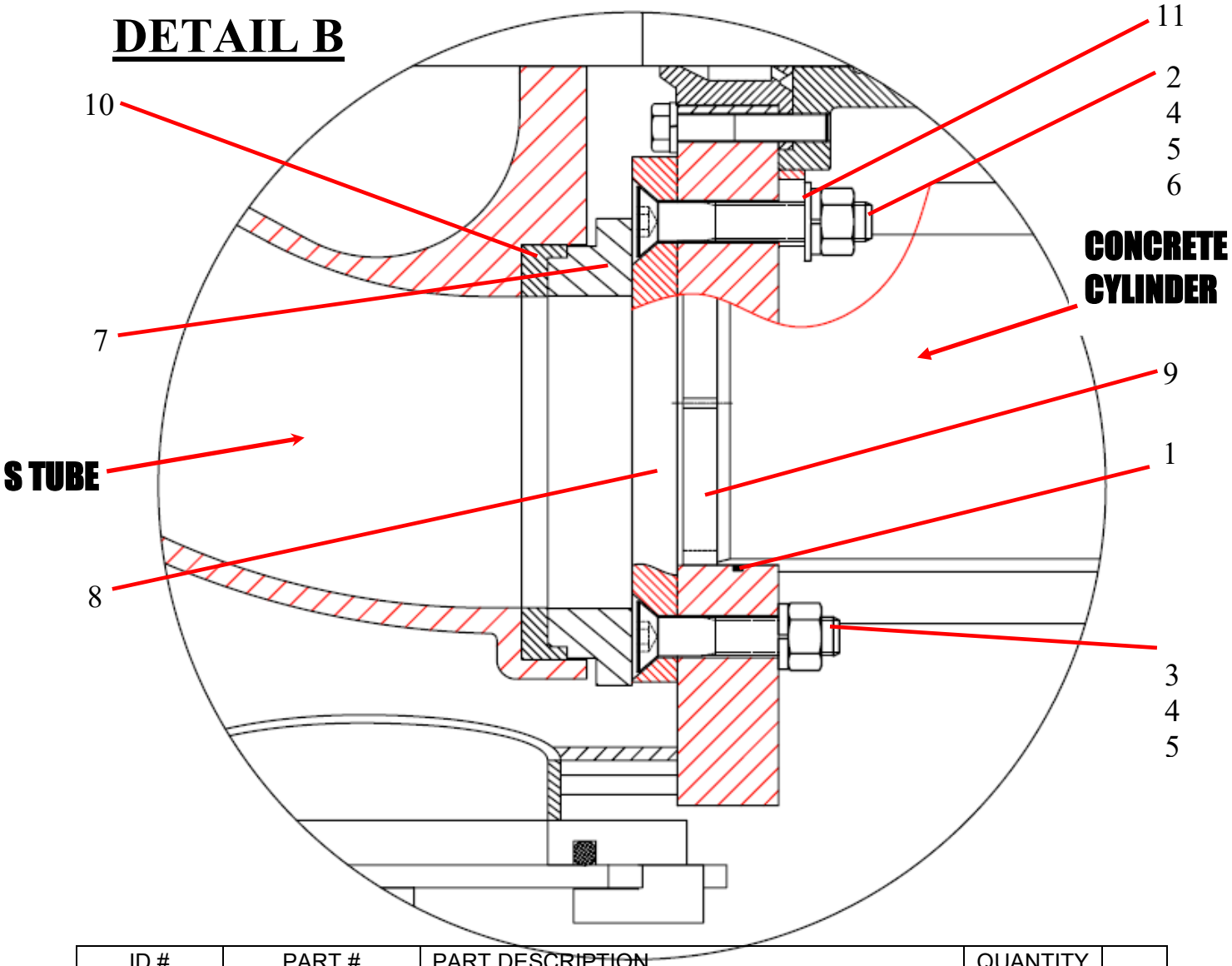
WEAR PLATE ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	86149	O-RING, #259 BUENA 70	4	EA
2		FHCS, ¾ - 10X 4½" GR 8	1	EA
3		FHCS, ¾ - 10X 3½" GR 8	3	EA
4		HEX NUT, ¾" - 10	4	EA
5		LOCK WASHER, ¾"	4	EA
6		FLATWASHER, ¾"	4	EA
7	72310	WEAR RING, 6"	1	EA
8	BW10382	WEAR PLATE 6" A40	1	EA
9	86086	CHIP RING, 6"	2	EA
10	86085	SEAL, SINGLE LIP, 6"	1	EA
11	86502	LOCATOR RING – FLANGE BEARING	1	EA

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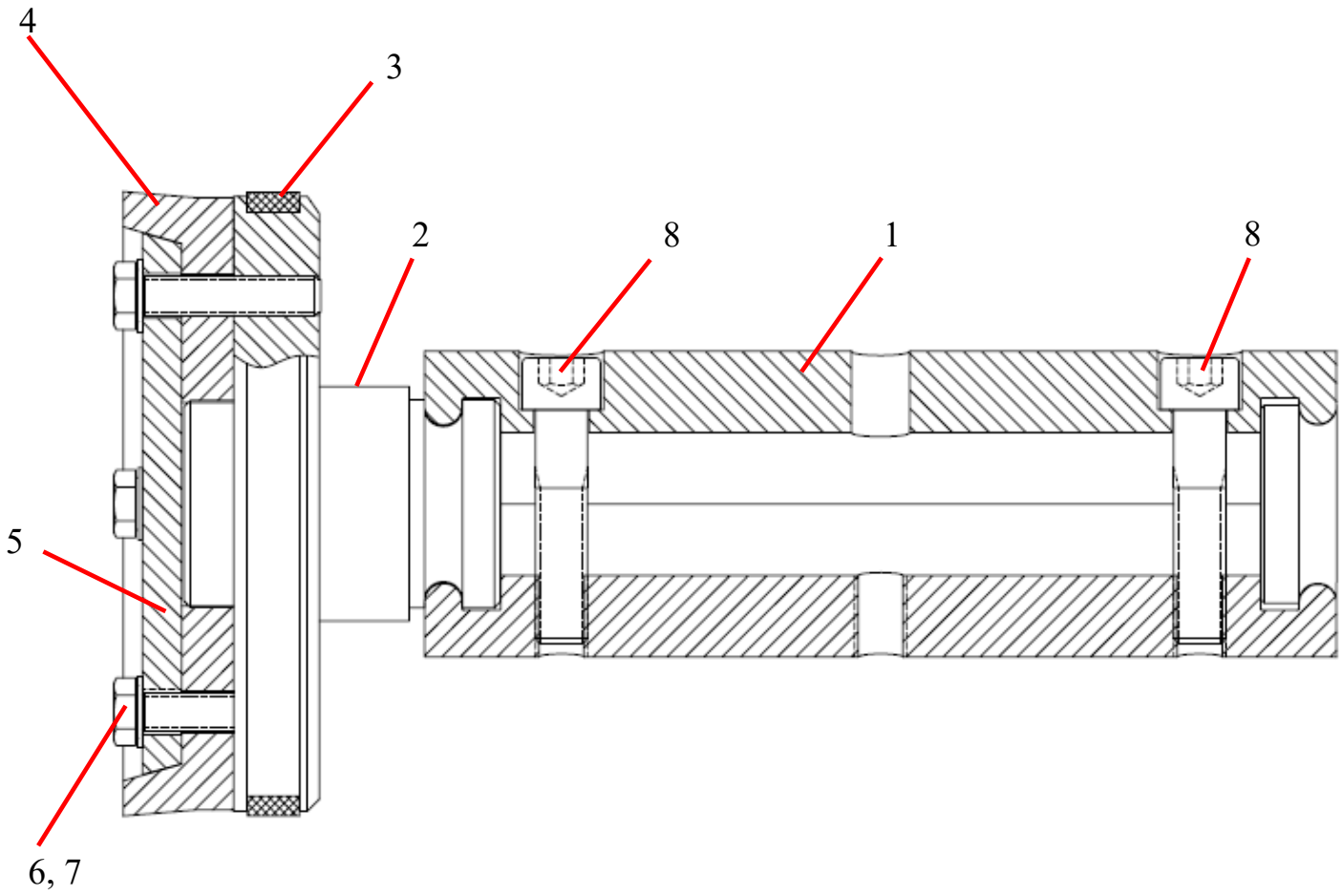
6” PISTION CUP ASSEMBLY

DETAIL C



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	73425	PISTON COUPLING	1	E/SIDE
2	77194	PISTON ADAPTER 6"	1	E/SIDE
3	77120	WEAR RING (GUIDE BAND) 6"	1	E/SIDE
4	70048	PISTON CUP, 6 IN.	1	E/SIDE
5	70057	PISTON PLATE 6”	1	E/SIDE
6		HHCS, 3/8 – 16X1 3/4”” GR 8	4	E/SIDE
7		LOCKWASHER 3/8	4	E/SIDE
8		SHCS ½ - 20 X 2 ¼”	2	E/SIDE

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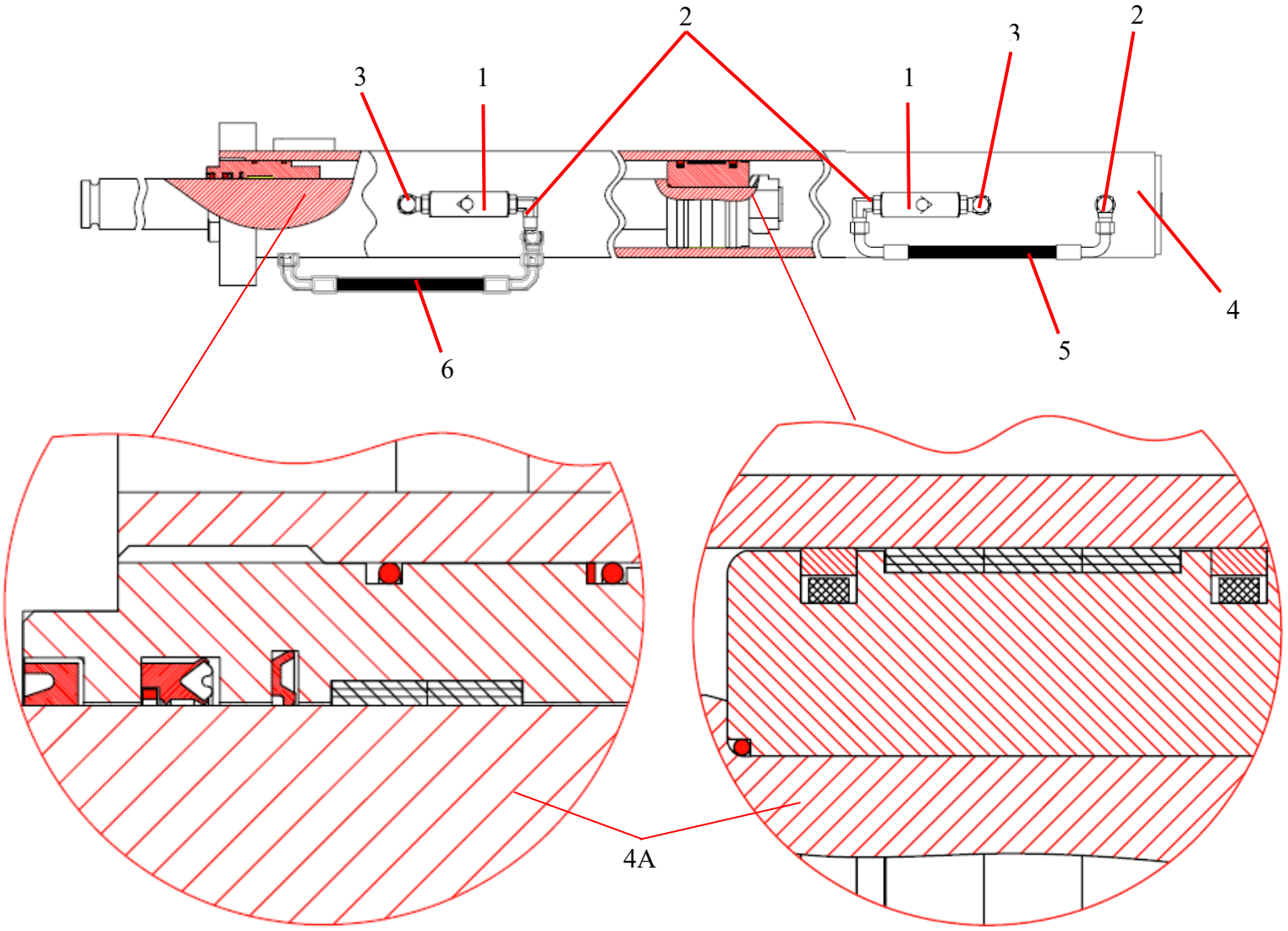
DRIVE CYLINDER ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	78961	CHECK VALVE-5K PSI O-RING	2	EA/SIDE
2	86748	FITTING-MB-MJ90-6-6	3	EA/SIDE
3		ELBOW, MB-MB90-6-6	2	EA/SIDE
4	88633HT	DRIVE CYL-3.75 X 2.00 X 19.50 (HYDRA)	2	EA/SIDE
4A	BW10373A-SK	SEAL KIT FOR 88633	2	EA/SIDE
5	BW10051	HOSE-RT2-FJS90-FJS09-06-06-06-12”	1	EA
6	BW10405	HOSE-RT2-FJS90-FJS09-06-06-06-14”	3	EA

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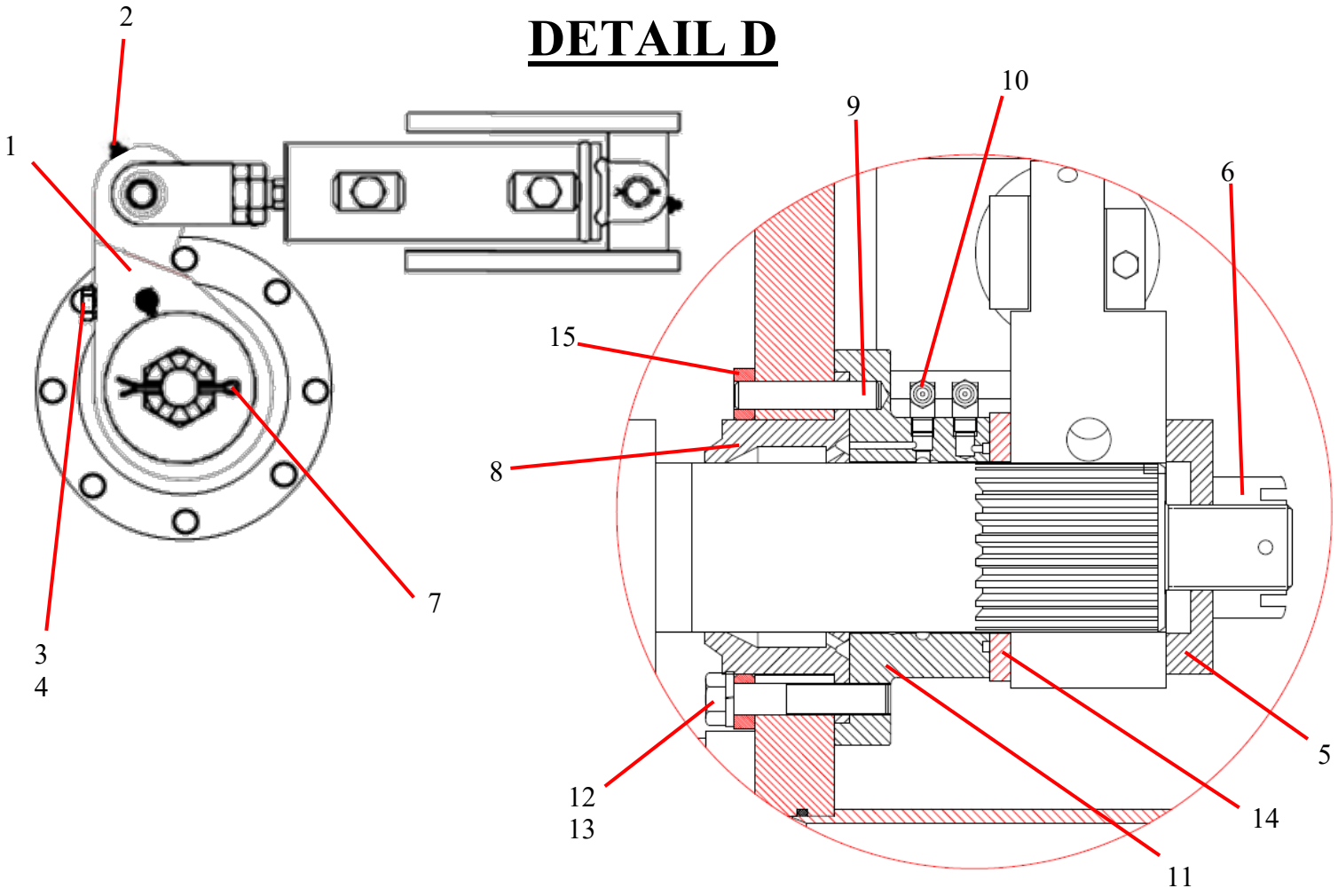
SINGLE SHIFT BELL CRANK ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	85131	BELL CRANK, 3 IN SPLINE, SINGLE	1	EA
2		GREASE FITTING, 1/8" NPT 45°	1	EA
3		HHCS, 5/8"-18X5 ½"" GR 8	1	EA
4		LOCK WASHER, 5/8"	1	EA
5	85134	SPACER, S-TUBE NUT	1	EA
6	70825	NUT 1 ½" - 12 CASTLE	1	EA
7		COTTER PIN, ¼ X4"	1	EA
8	85962	SEAL, FLANGE BEARING, 3" SHAFT	1	EA
9		DOWEL PIN, ½" DIA X 2"	2	EA
10		GREASE FITTING, 1/8" NPT	2	EA
11	85133	FLANGED BEARING, 3 IN SPLINE	1	EA
12		HHCS, 9/16 – 12X3" GR 8	4	EA
13		LOCK WASHER, 9/16"	4	EA
14	85294	THRUST WASHER, S –TUBE	1	EA
15	BW10384	SPACER RING A40	1	EA

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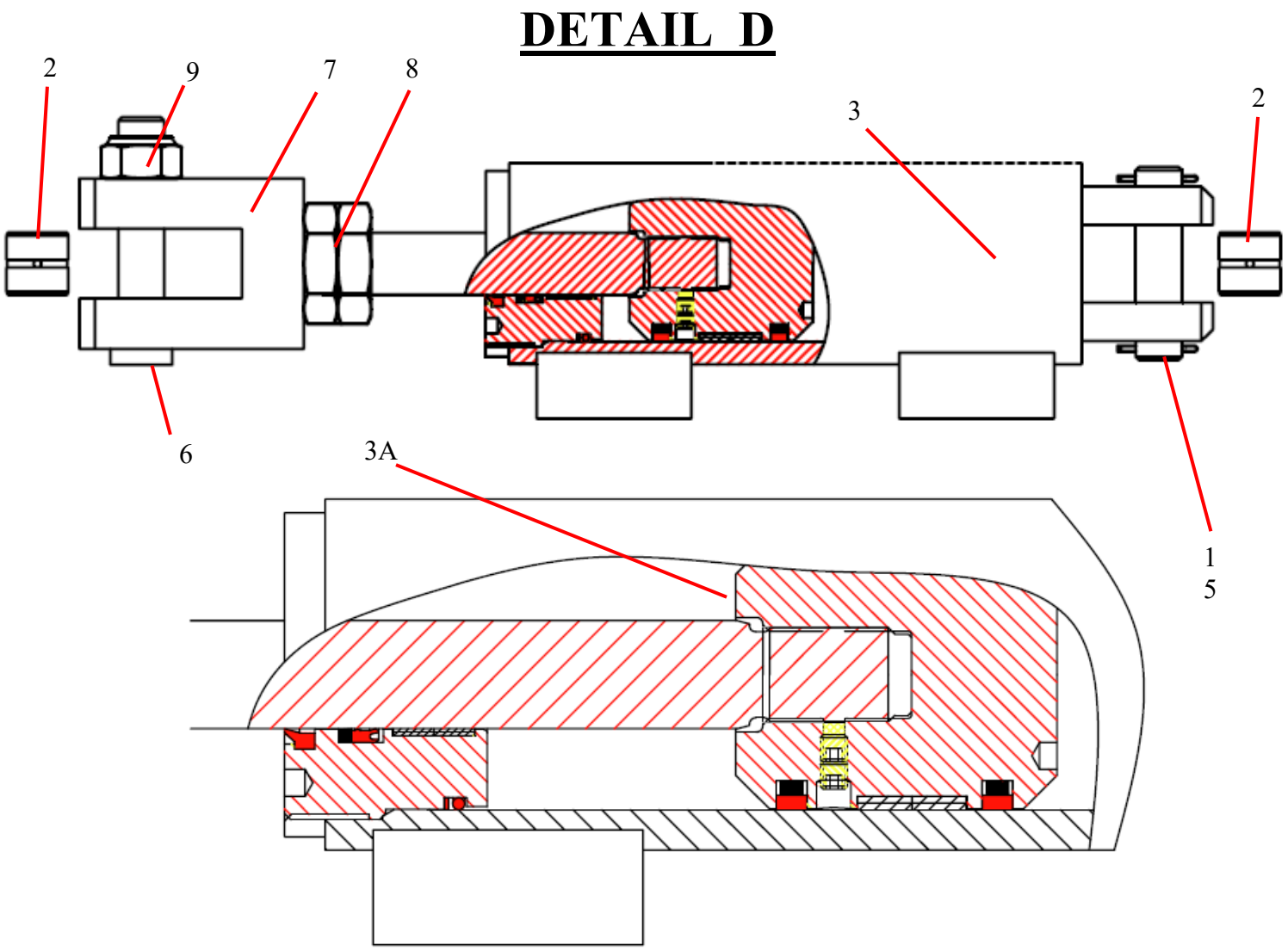
SINGLE SHIFT SWING CYLINDER ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	74207	PIN - CLEVIS - .750 DIA	1	EA
2	71011	BUSHING - SHIFT CYLINDER	2	EA
3	BW10374HT	SWING CYLINDER – 2.50 X 1.00 X 5.15 (HYDRA)	1	EA
3A	86221A-SK	SWING CYLINDER SEAL KIT (HYDRA)	1	REF
5		COTTER PIN, 3/32X1 ¾”	2	EA
6	86150	PIN, CLEVIS 1.00 DIA	1	EA
7	86135	CLEVIS, SHIFT CYLINDER	1	EA
8		1”X14 JAM NUT	2	EA
9		¾ -10 LOCK NUT	1	EA

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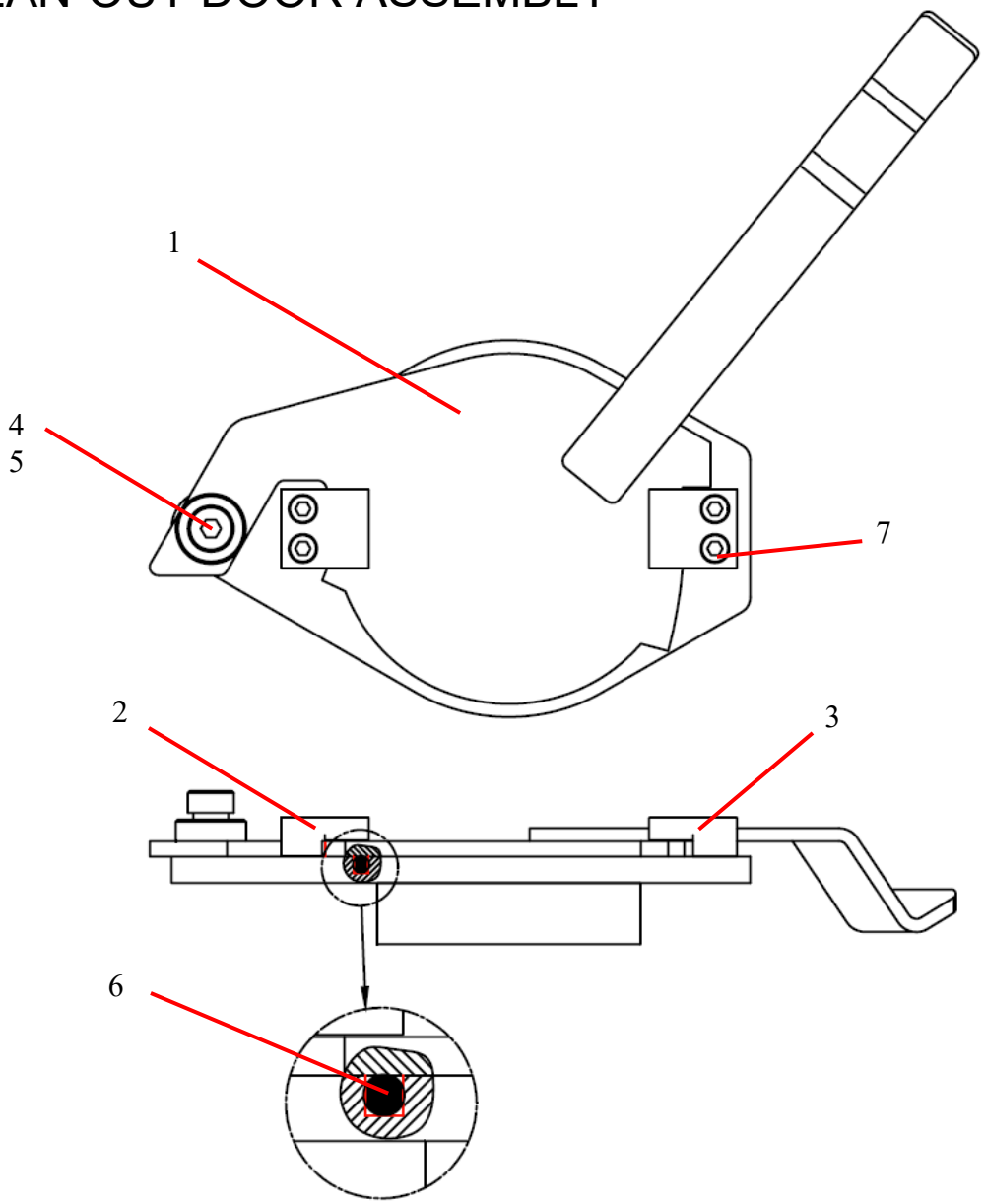
CLEAN-OUT DOOR ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
	86542	CLEAN OUT DOOR WELDMENT PARTS KIT	REF	
1	86988	DOOR WELDMENT, CLEAN OUT	1	EA
2	86559	BLOCK, CLEAN OUT DOOR, LH	1	EA
3	86560	BLOCK, CLEAN OUT DOOR, RH	1	EA
4		SHOULDER SCREW 1" DIA-1 1/4"	1	EA
5	85367	BOSS, CLEAN OUT DOOR	1	EA
6	W-102908A	O-RING CORD, HOPPER DOOR	2.21	FT
7		SHCS ½"-13 X 1 ¼"	4	EA

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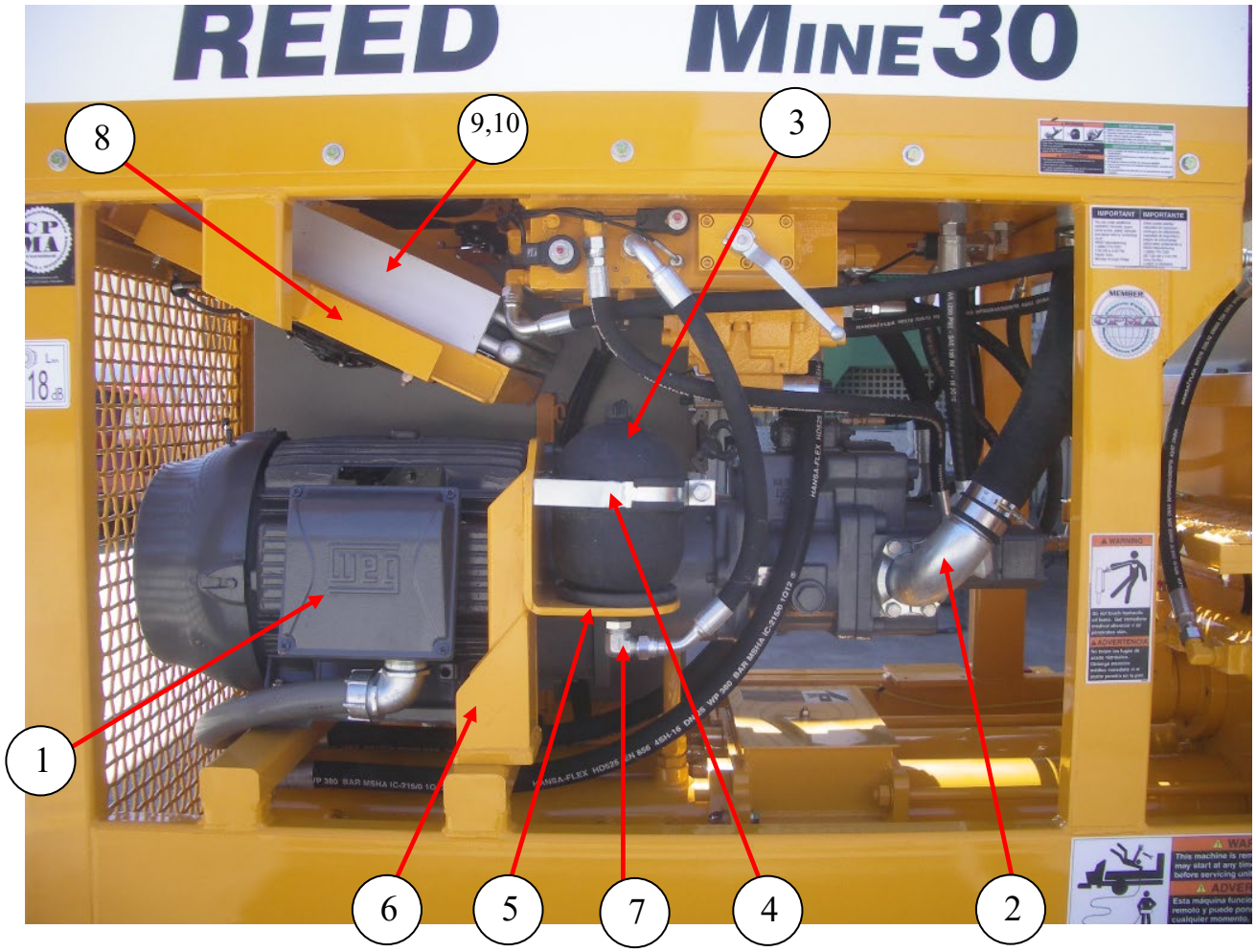
POWER TRAIN
ELECTRIC MOTOR AND PUMP



ID #	PART #	PART DESCRIPTION	QUANTITY	
	89962	POWER TRAIN ASSY M30 SKE		REF
1	85993	MOTOR, 50HP, 380V,60HZ,3PH BALDOR	REF	EA
1A	85991	MOTOR, 50HP, 230/380/460V	REF	EA
1B	89957	MOTOR, 50HP, 575/60HZ 3PH	REF	EA
2	85124-004	PUMP, KV3L112 KAWASAK, 75HP	REF	EA
3	71360	ACCUMULATOR	1	EA
4	73171	ACCUMULATOR BRK.W/CLOSING HARDWARE	1	EA
5	801028	GROMMET, ACCUMULATOR	1	EA
6	88748	BRACKET ACCUMULATOR MOUNT	1	EA
7	86904-009	ELBOW, MB-MJ90LL-12-12	1	EA
8	89450	BRACKET OIL COOLER MOUNT	1	EA
9	88968	HYD. OIL COOLER-ELECTRIC 115/120VAC	1	EA
10	85419-3	STANDOFF, 3/8”-16X3.5”	8	EA

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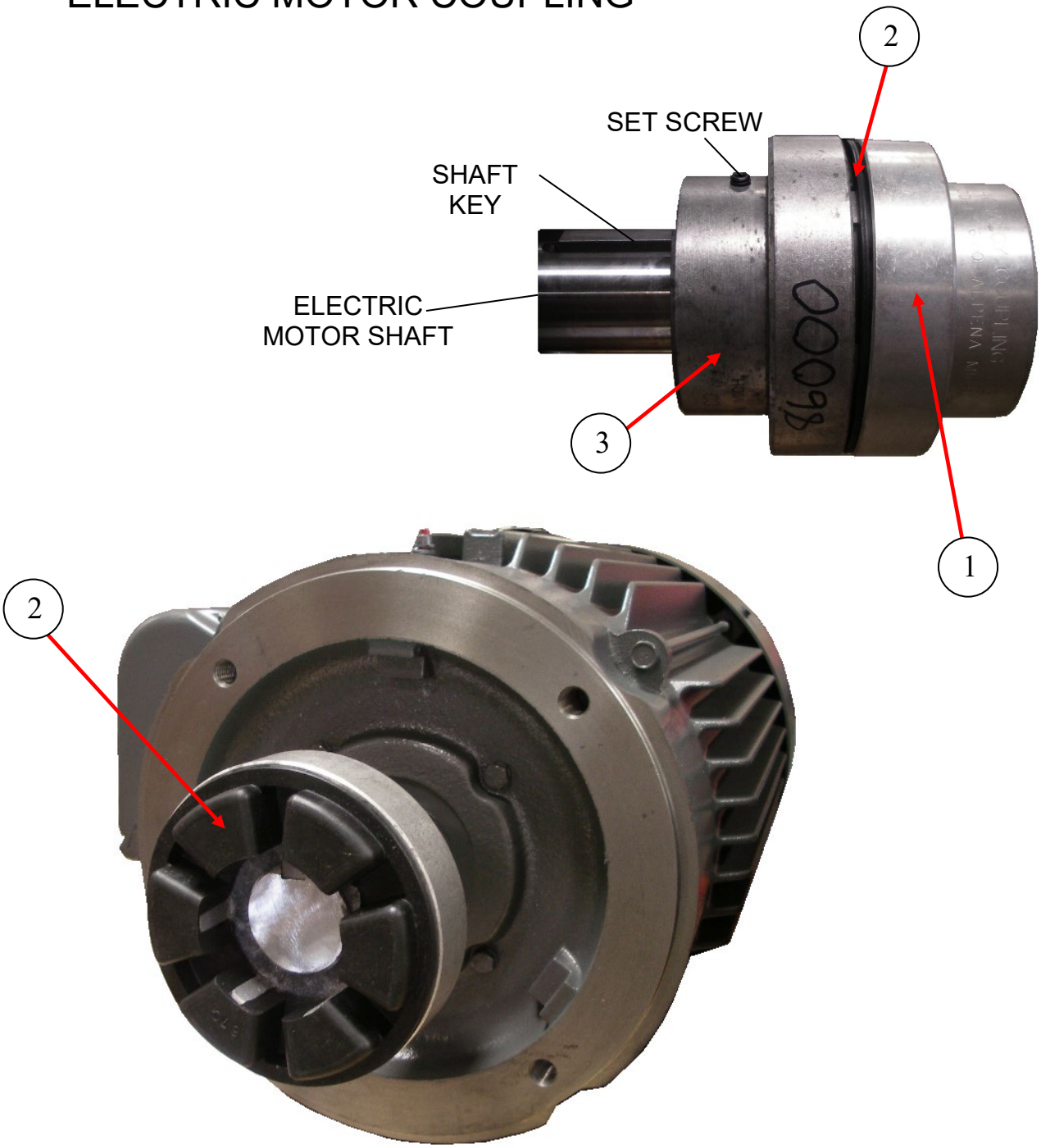
ELECTRIC MOTOR COUPLING



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	88028	COUPLING HALF FOR 13 TEETH 8/16 SAE-D, M600	1	EA
2	86002	COUPLING SPIDER, L190-NBR (USE P/N 87041)	1	EA
3	86000	COUPLING HALF, L190-2 1/2X1/2 (USE P/N 87039)	1	EA

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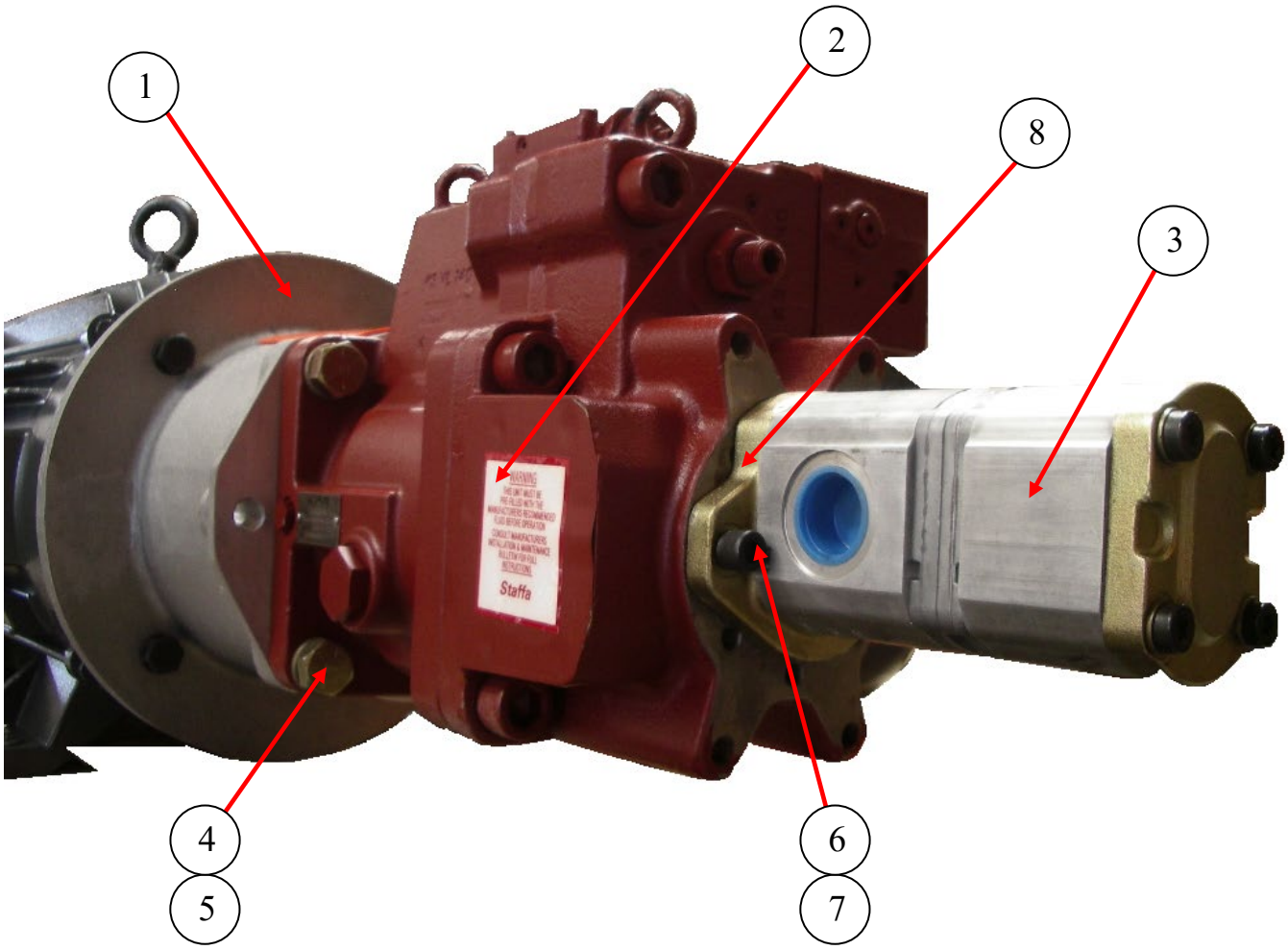
HYDRAULIC PUMP, GEAR BOX



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	87948	PUMP ADAPTER- 324-405TC X SAE-D	1	EA
2	85124-004	PUMP, KV3L112 KAWASAK, 75HP	1	EA
3	87153-001	PUMP-RH-DBLE GEAR, 11.3/8.2 CC BOSCH	1	EA
4		¾-2" BOLT	4	EA
5		¾ LOCK WASHER	4	EA
6		M10 X 30 SHCS	2	EA
7		10MM HI COLLAR LOCK WASHER	2	EA
8	88174	O-RING	1	EA
9	87723-TD	THRU DRIVE KIT "B" FOR 87723 140 KAW PUMP	1	EA

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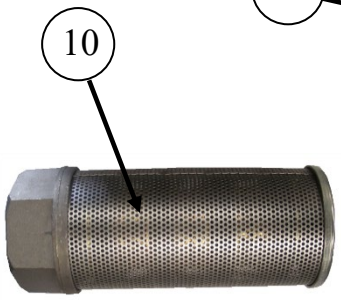
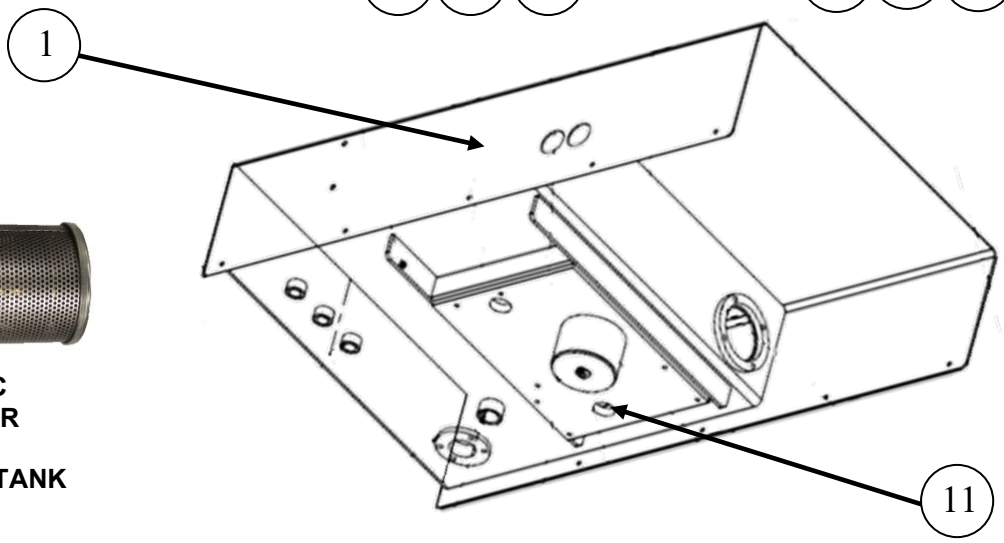
HYDRAULIC TANK ASSEMBLY



MAGNETIC SEPERATOR

NOTE: INSIDE TANK



ID #	PART #	PART DESCRIPTION	QUANTITY	
	89453	HYDRAULIC GR M30		EA
1	88632	HYDRAULIC TANK WELDMENT	1	EA
2	BW10171	ENDCOVER KIT, 12 IN W/DRAIN	1	EA
3	85867	GASKET	1	EA
4	74508	FILLER BREATHER W/CAP	1	EA
5	70366	PRESSURE GAUGE, 3000 PSI/BAR	1	EA
6	74562	PRESSURE GAUGE, 6000 PSI/BAR	1	EA
7	78594	MINICHECK GAUGE ADAPTER, ¼" NPT	2	EA
8	78608	MINICHECK HOSE, 48"	2	EA
9	74509	GAUGE-SIGHT-TEMPERTURE	1	EA
10	79247	MAGNETIC SEPERATOR	1	EA
11	801025	DRAIN COCK, ¼ NPT	1	EA

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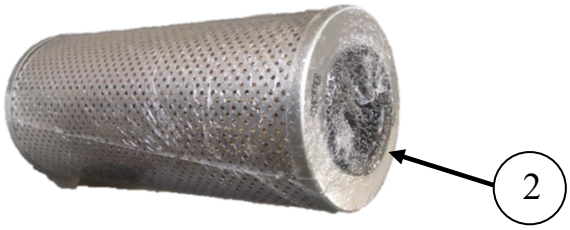
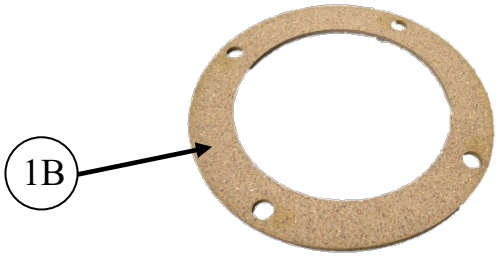
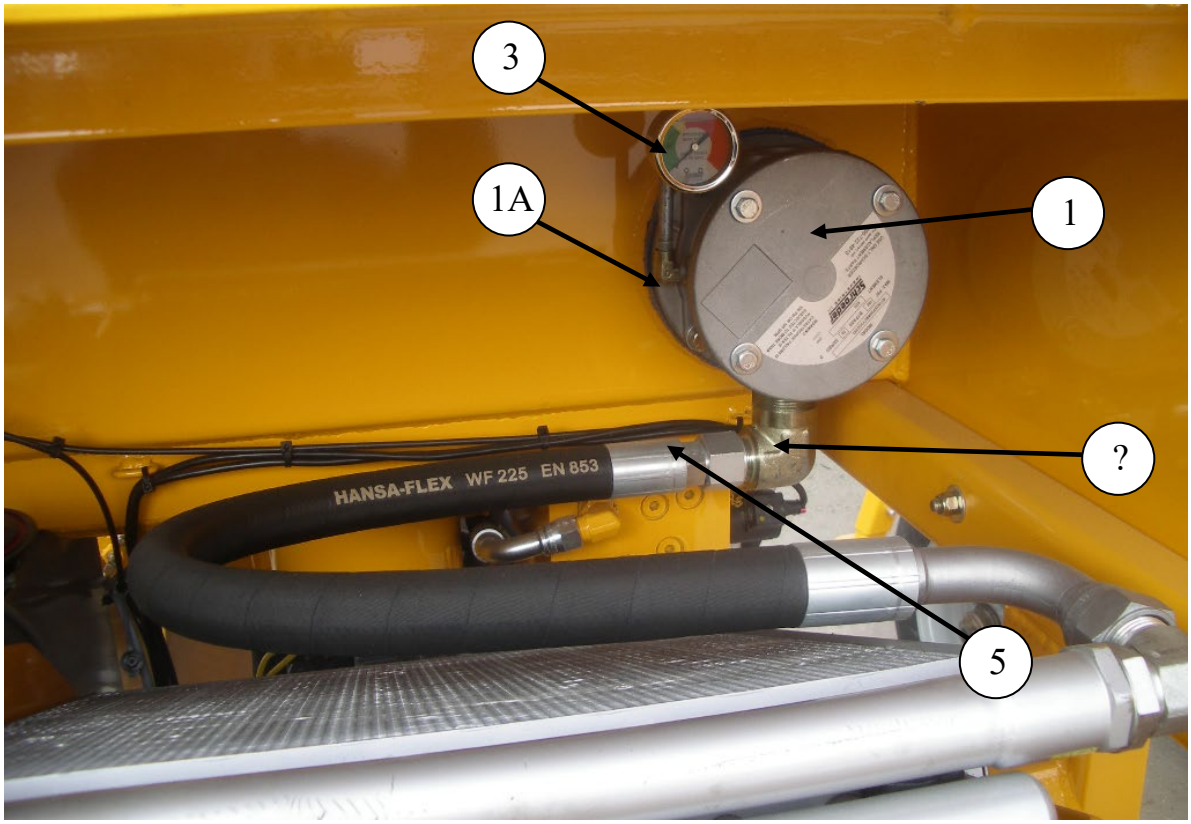
HYDRAULIC ASSEMBLY CONTINUE



FILTER ELEMENT
NOTE: INSIDE TANK





ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10027	RETURN FILTER	1	EA
1A	BW102241	SEAL KIT FOR RETURN FILTER BW10027	1	EA
1B	85282-G	GASKET-CORK	1	EA
2	BW10106-1	FILTER ELEMENT 25 MICRON	1	EA
3	85575	GAUGE, PN 85282 RETURN FILTER	1	EA
4		ADAPTER FITTING	1	EA
5	88813-H12	HOSE	1	EA

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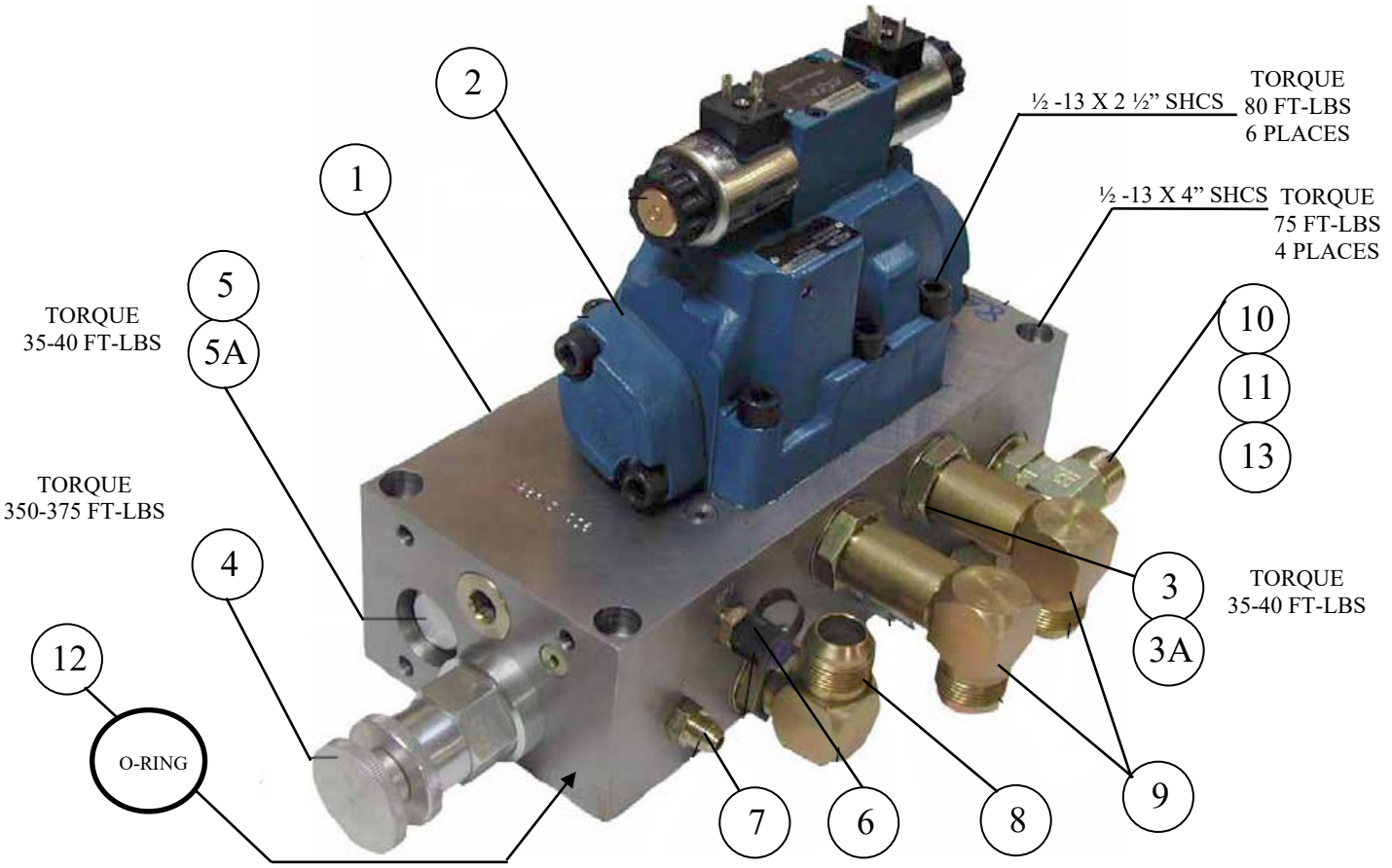
MANIFOLDS
DRIVE CYLINDER CIRCUIT MANIFOLD ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
	85248-M	MANIFOLD, CYLINDER CIRCUIT ASSEMBLY	1	EA
1	86820	MANIFOLD, MACHINED CYLINDER CIRCUIT	1	EA
2	85689	SOLENOID VALVE, DRIVE CYLINDER	1	EA
3	85696	RELIEF VALVE CARTRIDGE	1	EA
3A	85696-SK	SEAL KIT		
4	86952-003	MOTORIZED FLOW CONTROL FOR B SER	1	EA
5	85698	CHECK VALVE CARTRIDGE	1	EA
5A	85698-SK	SEAL KIT		
6	78593	MINICHECK ADAPTOR, SAE 4	1	EA
7	86900-002	ADAPTOR, MB-MJ-4-6	1	EA
8	86728-023	ELBOW, MB-MJ45-16-16	1	EA
9	86904-012	ELBOW, MB-MJ90LL-16-16	2	EA
10	86945-001	TEE, MJ-MB-MJT-16	1	EA
11	86905-016	ELBOW, MJ-FJX90-16-16	1	EA
12	86946	O-RING #230 BUNA 90DUR	1	EA
13	86948-001	REDUCER, JIC MJ-FJ-10-16	1	EA

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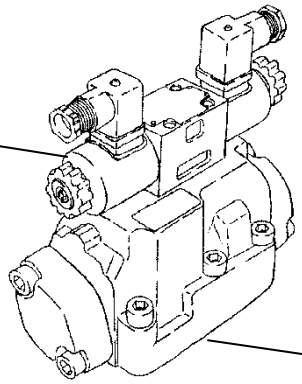
DRIVE CYLINDER CIRCUIT MANIFOLD ASSEMBLY CONT.



DRIVE CYLINDER PILOT SOLENOID VALVE

DRIVE CYLINDER VALVE ASSEMBLY COMPLETE
85689

DRIVE CYLINDER MAIN VALVE

DRIVE CYLINDER PILOT SOLENOID VALVE ASSEMBLY
85691

O-RING KIT
72313

PLUG
74597

COIL
85692

DRIVE CYLINDER MAIN SOLENOID VALVE ASSEMBLY
85690

O-RING KIT
74994

PILOT PRESSURE VALVE ASSY.
73147

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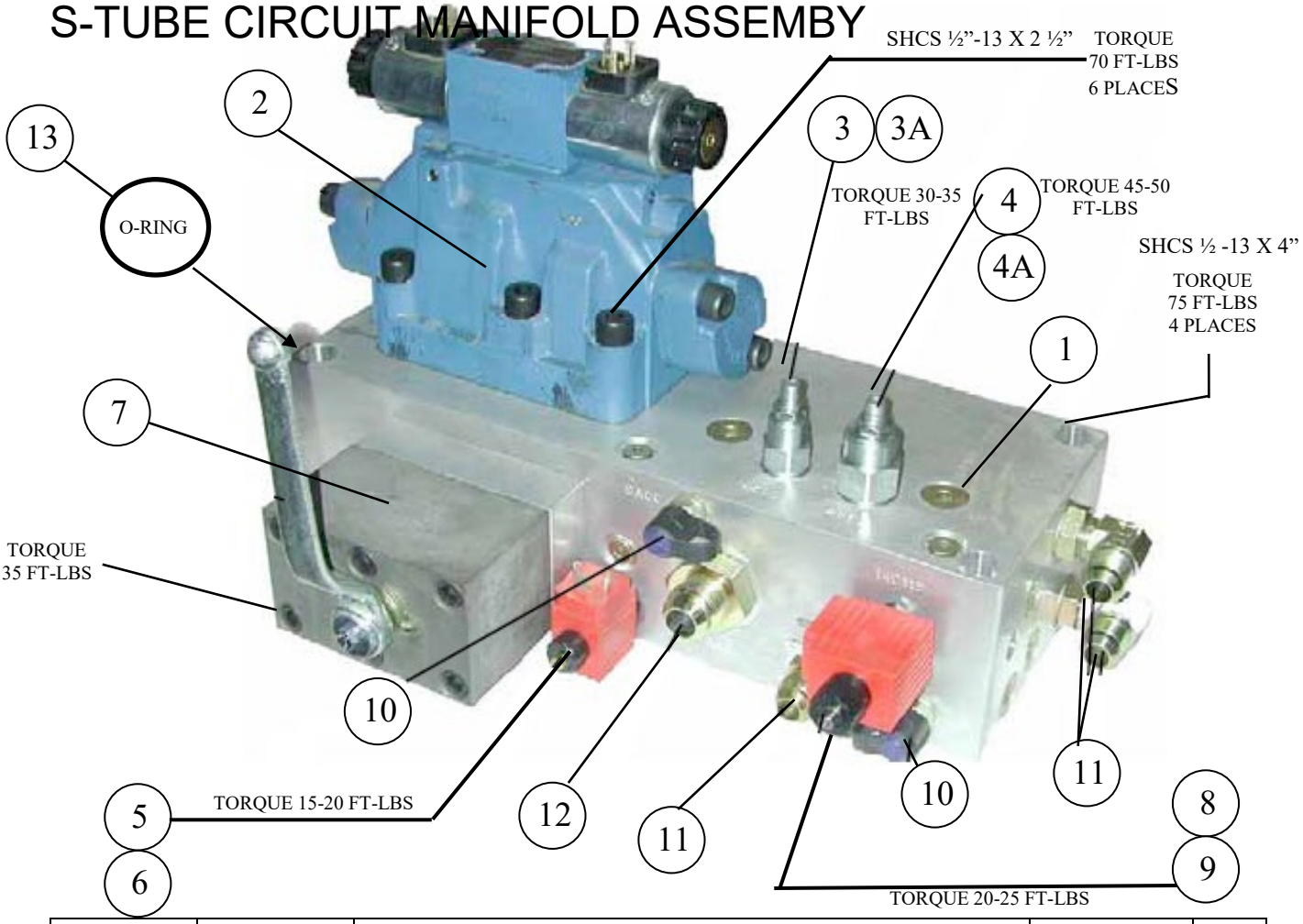
S-TUBE CIRCUIT MANIFOLD ASSEMBY



ID #	PART #	PART DESCRIPTION	QUANTITY	
	89631	MANIFOLD, S-TUBE CIRCUIT ASSEMBLY		
1	89602	MANIFOLD, MACHINED S-TUBE CIRCUIT	1	EA
2	85693	SOLENOID VALVE, S-TUBE SHIFT	1	EA
3	85704	UNLOADER VALVE CARTRIDGE, (QCDB)	1	EA
3A	85704-SK	SEAL KIT		
4	85703	RELIEF VALVE CARTRIDGE, (RVEA)	1	EA
4A	85703-SK	SEAL KIT		
5	87246	SOLENOID VALVE CARTRIDGE, (12CHS)	1	EA
6	87247	COIL, 12VDC,	1	EA
7	85705	BALL VALVE,	1	EA
8	87248	SOLENOID VALVE CARTRIDGE, (14CHS)	1	EA
9	87249	COIL, 12V DC FOR PN-87248	1	EA
10	78593	MINICHECK ADAPTOR, SAE	2	EA
11	86728-014	ELBOW, MB-MJ90-10-10	2	EA
12	86900-027	ADAPTOR, MB-MJ-16-12	1	EA
13	86946	O-RING #230 BUNA 90DUR	1	EA

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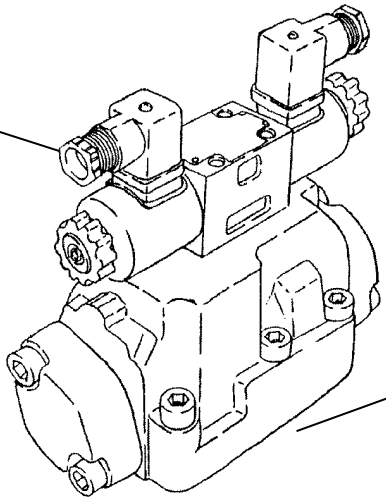
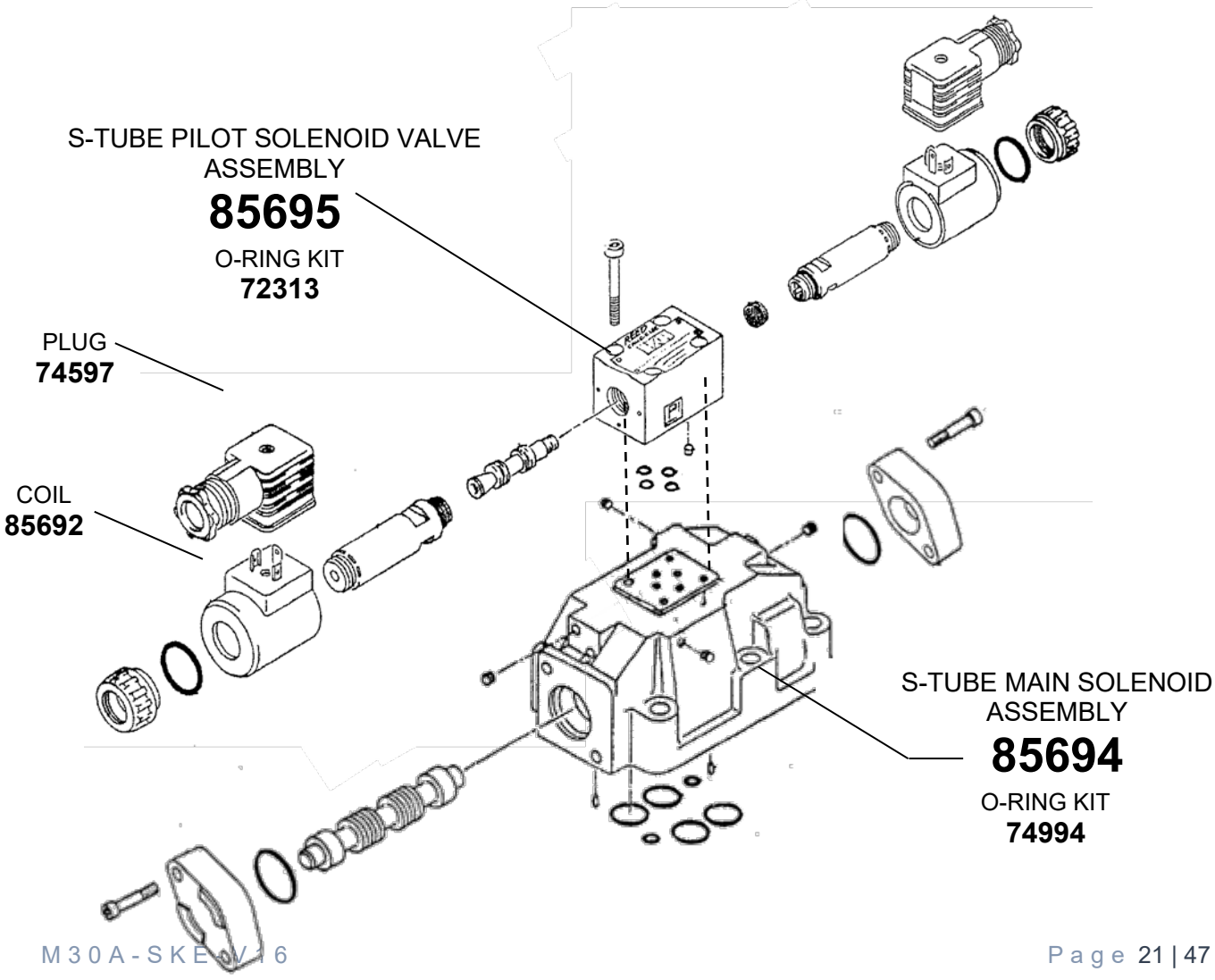
S-TUBE CIRCUIT MANIFOLD ASSEMBLY CONT.





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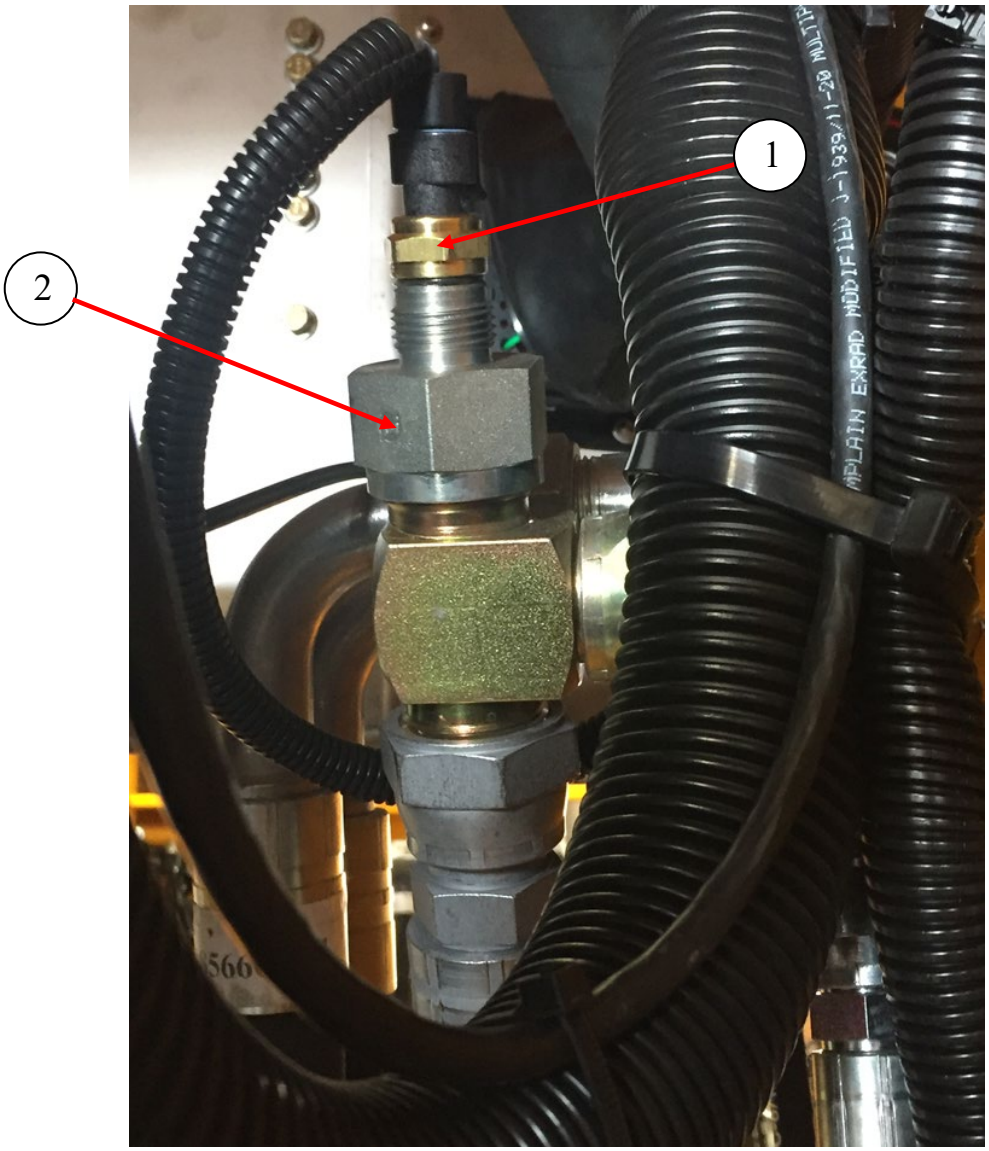
TEMPERTURE SENSOR HYD



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	W-105568	SENSOR TEMPERTURE, 55 DEG	1	EA
2	89593	ADAPTER TEMP SENSOR	1	EA

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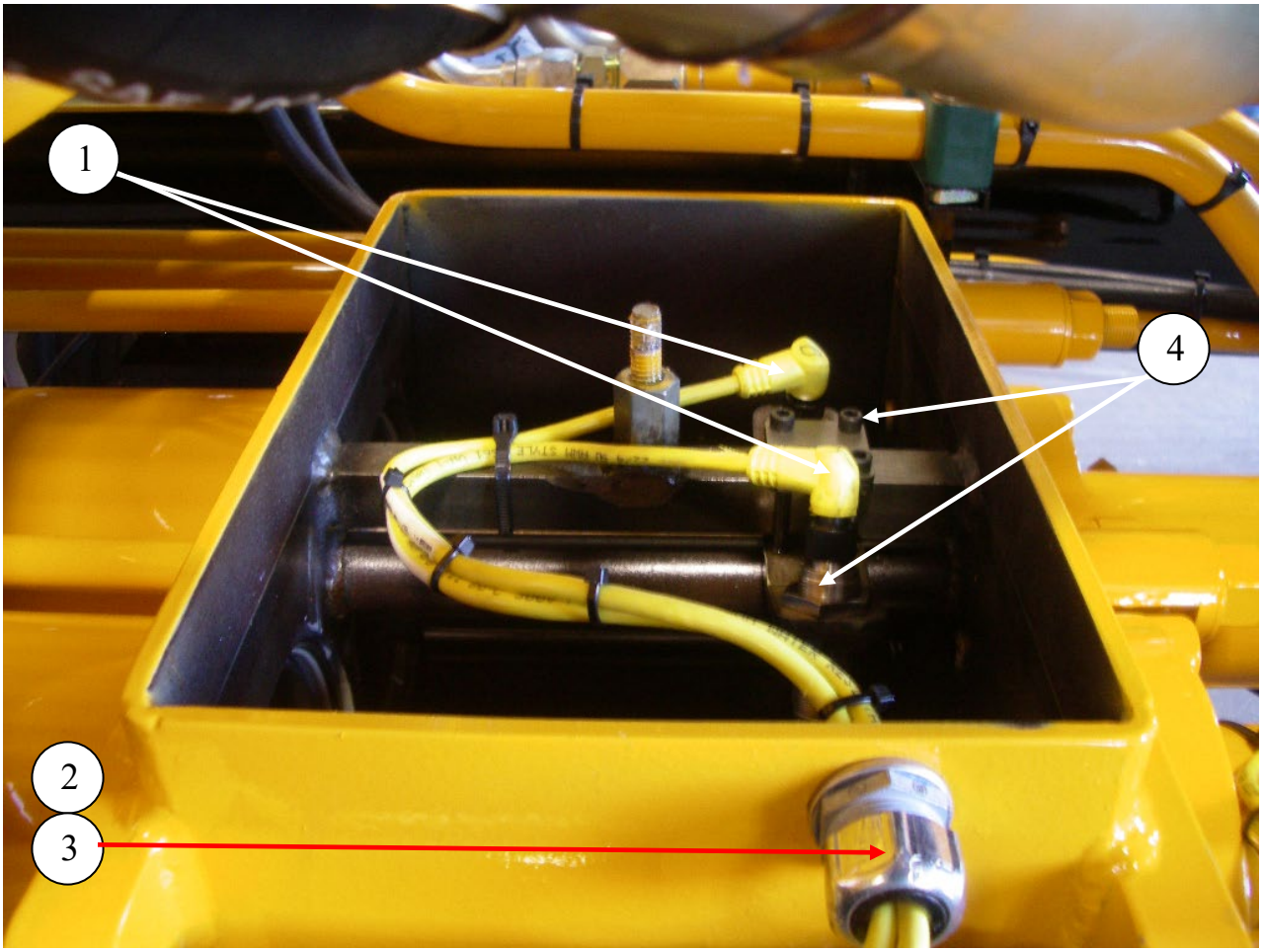
ELECTRICAL GROUP
PROXIMITY SWITCHES



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	77990	CABLE, PROXIMITY SWITCH	2	EA
2	10522	STRAIN RELIEF	1	EA
3	10528	NUT ½" BONDING TYPE LOCK	1	EA
4	77998	PROXIMITY SENSOR NPN	2	EA

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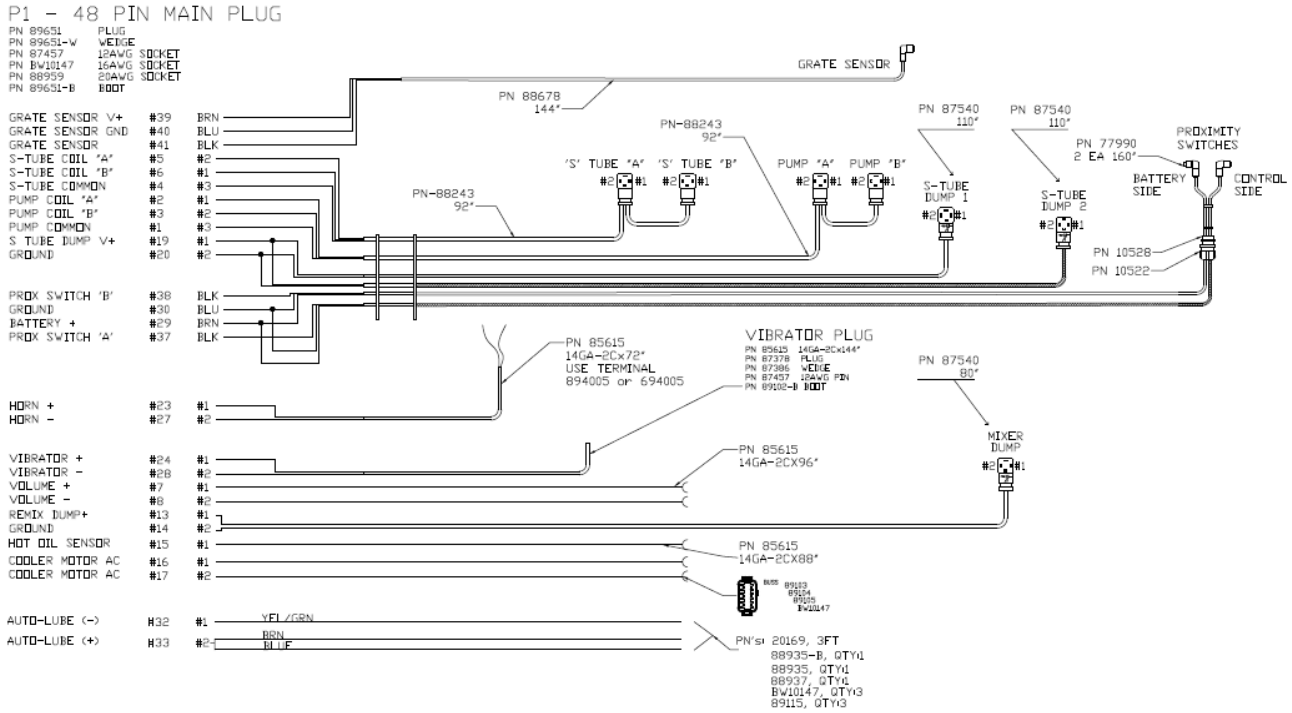
CONTROLS

WIRE HARNESS



ID #	PART #	PART DESCRIPTION	QUANTITY	
	90643	WIRING HARNESS M-SER PLCv2, ELECTRIC	REF	
1	88959	CONTACT SOCKET SIZE 20, 7.5 AMP	24	EA
2	89561-W	DEUTSCH WEDGE FOR 89651	1	EA
3	BW10147	CONTACT SOCKET PINS SIZE 16, 13 AMP	8	EA
4	87457	CONTACT SOCKET SIZE 12, 25 AMP	16	EA
5	88958	CONTACT PIN SOLID SIZE 16	2	EA
6	89651-B	BOOT FOR 89651 & 88944 PLUG	1	EA
7	89651	PLUG, 48 SOCKET HARNESS SIDE	1	EA
8	87540	CABLE SOLENOID	3	EA
9	88243	CABLE WITH 2 DIN PLUGS 5M	2	EA
10	77990	CABLE, PROXIMITY SWITCH	2	EA
11	10522	STRAIN RELIEF	1	EA
12	10528	NUT 1/2" BONDING TYPE LOCK	1	FT
13	30240	GASKET-LIQUID ½"	1	FT
14	85615	CABLE, 14AWG-2C, PVC-GRY	6.5	EA
15	85619	CABLE,16AWG-4C, PVC-GRY	9	EA
16	88678	HOPPER GRATE CABLE (SHIELDED)	1	FT
17	89103	DEUTSCH DT04 BUS, 2X6	1	EA
18	89104	DEUTSH DT06 PLUG, 2X6	1	EA
19	89105	DEUTSH WEDGE FOR 89104	1	EA
20	89276	DEUTSH DT04 RECEPTICAL, 2 CAVITY	1	EA
21	89276-1	WEDGE FOR 89276	1	EA

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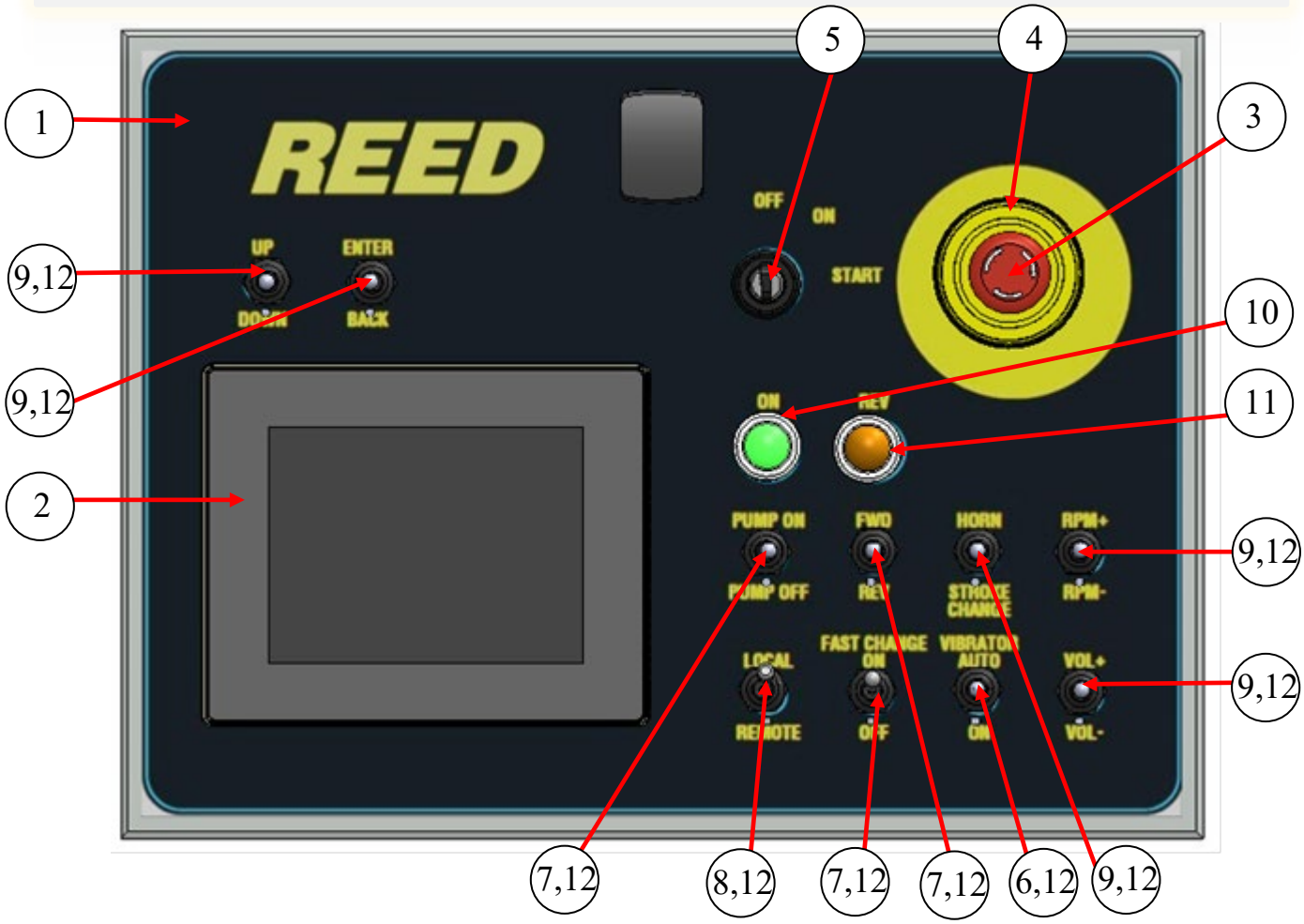
MAIN PUMP CONTROL PANEL



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89990-D	DECAL, LEX LAM.PLCv2	1	EA
2	89612	DISPLAY, 5” MD4-5	1	EA
3	89090	EMERGENCY STOP BUTTON	1	EA
4	89090-L	ILLUMINATED E-STOP RING	1	EA
5	89004	KEY SWITCH SEALED	1	EA
6	90076	TOGGLE SWITCH ON-OFF-ON	1	EA
7	90077	TOGGLE SWITCH ON-NONE-ON	3	EA
8	90078	TOGGLE SWITCH ON-NONE-ON LOCKING	1	EA
9	90079	TOGGLE SWITCH ON-OFF-ON	5	EA
10	90082	LED, GREEN	1	EA
11	90083	LED, AMBER	1	EA
12	BW10361-KT	BOOT, TOGGLE SWITCH	9	EA

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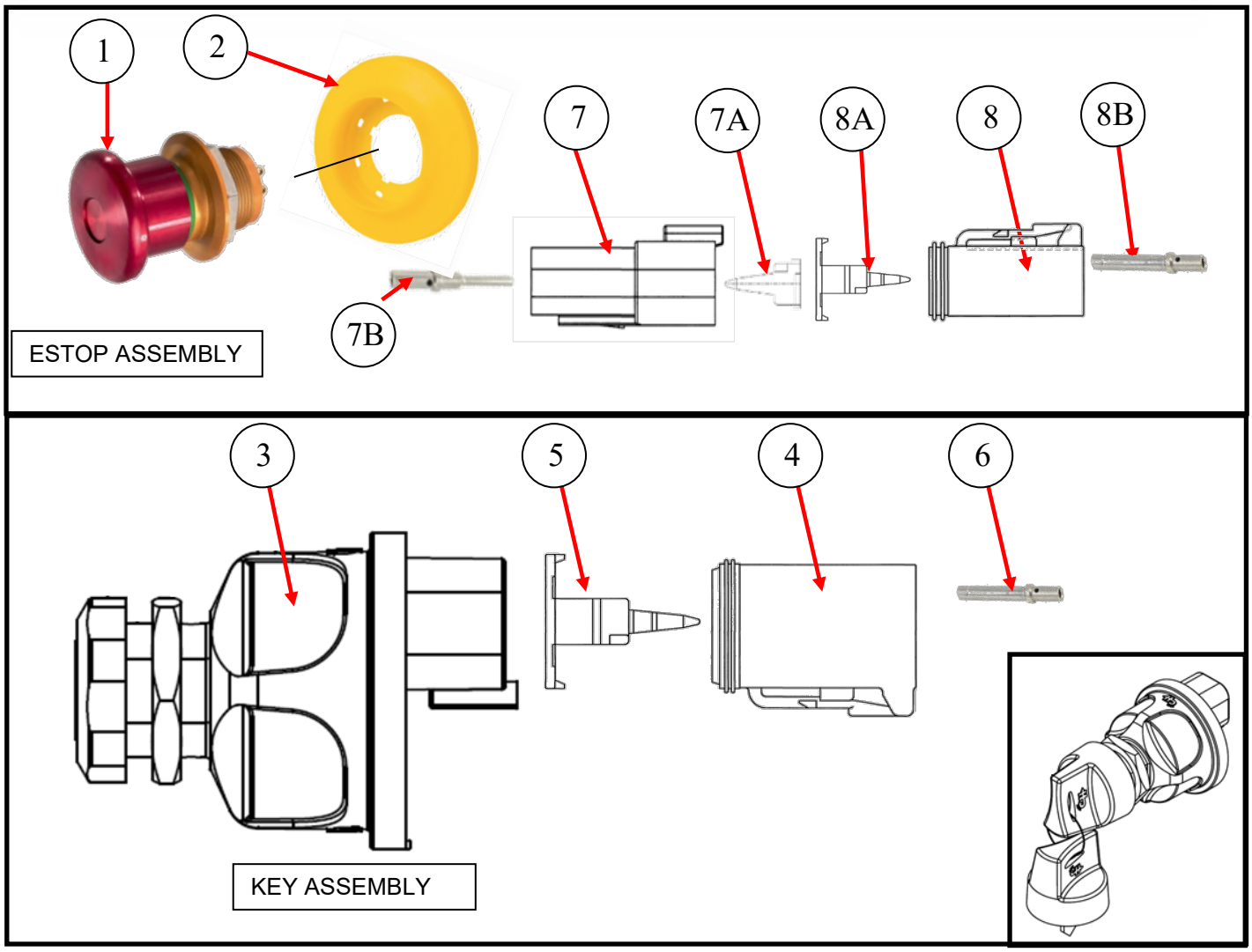
E-STOP, KEY ASSEMBLY, PLUGS



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89090	EMERGENCY STOP BUTTON HEAVY DUTY	1	REF
2	89090-L	ILLUMINATED E-STOP RING	1	REF
3	89004	KEY SWITCH SEALED	1	REF
4	89107	DEUSCH, DT06, 1X6	1	EA
5	89108	DEUTSCH WEDGE LOCK FOR 89107	1	EA
6	BW10147	DEUTSCH CONTACT SOCKET, 16AWG	6	EA
7	89102	DEUTSCH DT06 PLUG, RECP, 2X2	1	EA
7A	89132	DEUTSCH WEDGE FOR 89102	1	EA
7B	BW10147	CONTACT SOCKET SIZE 16, 13AMP	4	EA
8	89146	DEUTSCH DT04 PLUG, 2X2	1	EA
8A	89209	DEUTSCH WEDGE FOR 89146	1	EA
8B	88958	CONTACT PIN	4	EA

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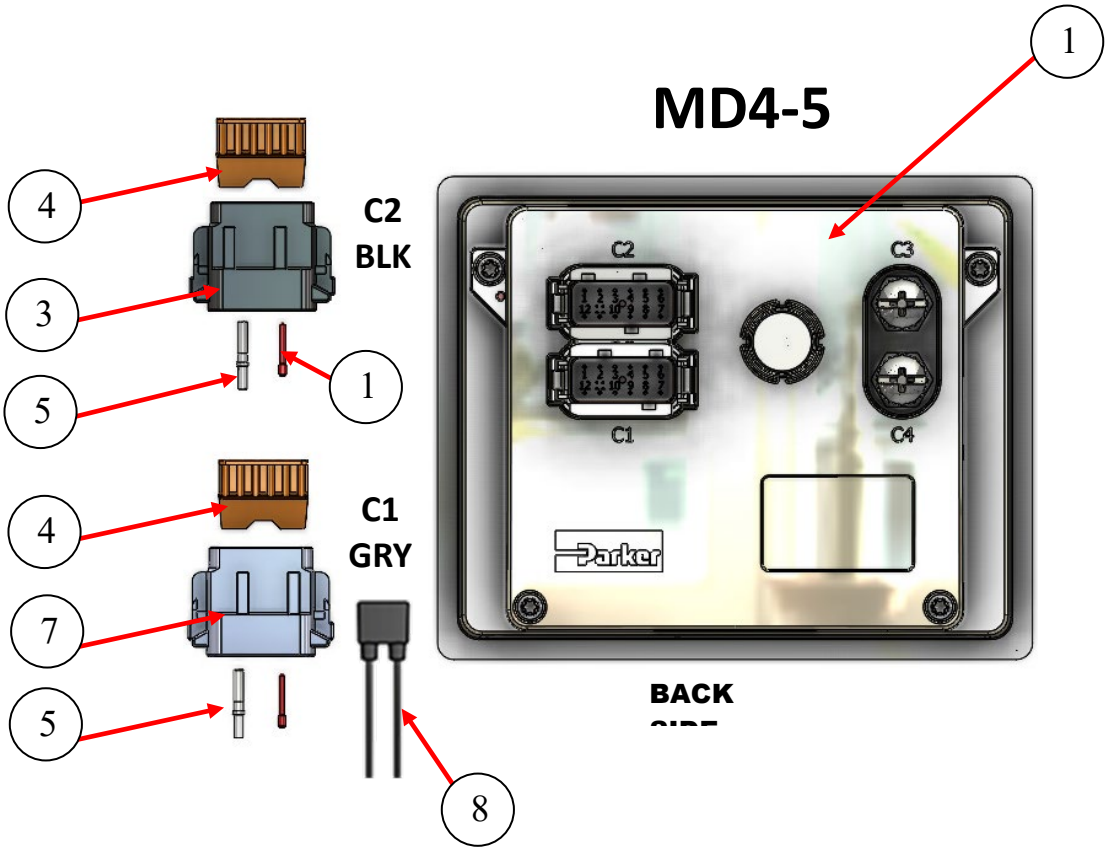
MD4-5



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89612	DISPLAY, 5” MD4-5	1	EA
2	88653	PLUG DTM 12 WAY KEY, GRAY (**MD4-C1**)	1	EA
3	88653-1	PLUG DTM 12 WAY KEY, BLK (**MD4-C2**)	1	EA
4	88653-2	WEDGELOCK DTM 12 WAY PLUG	2	EA
5	88959	PIN, CONTACT SOCKET 20 AWG	9	EA
6	89136-1	MOLDED 590 RESISTORS, TAG #1 (**MD4-C1**)	1	EA
7	88653-P	SEAL, PLUG (RED)	REF	
8	89136-0	MOLDED 294 RESISTOR, TAG #0 (**MC42**)	1	EA

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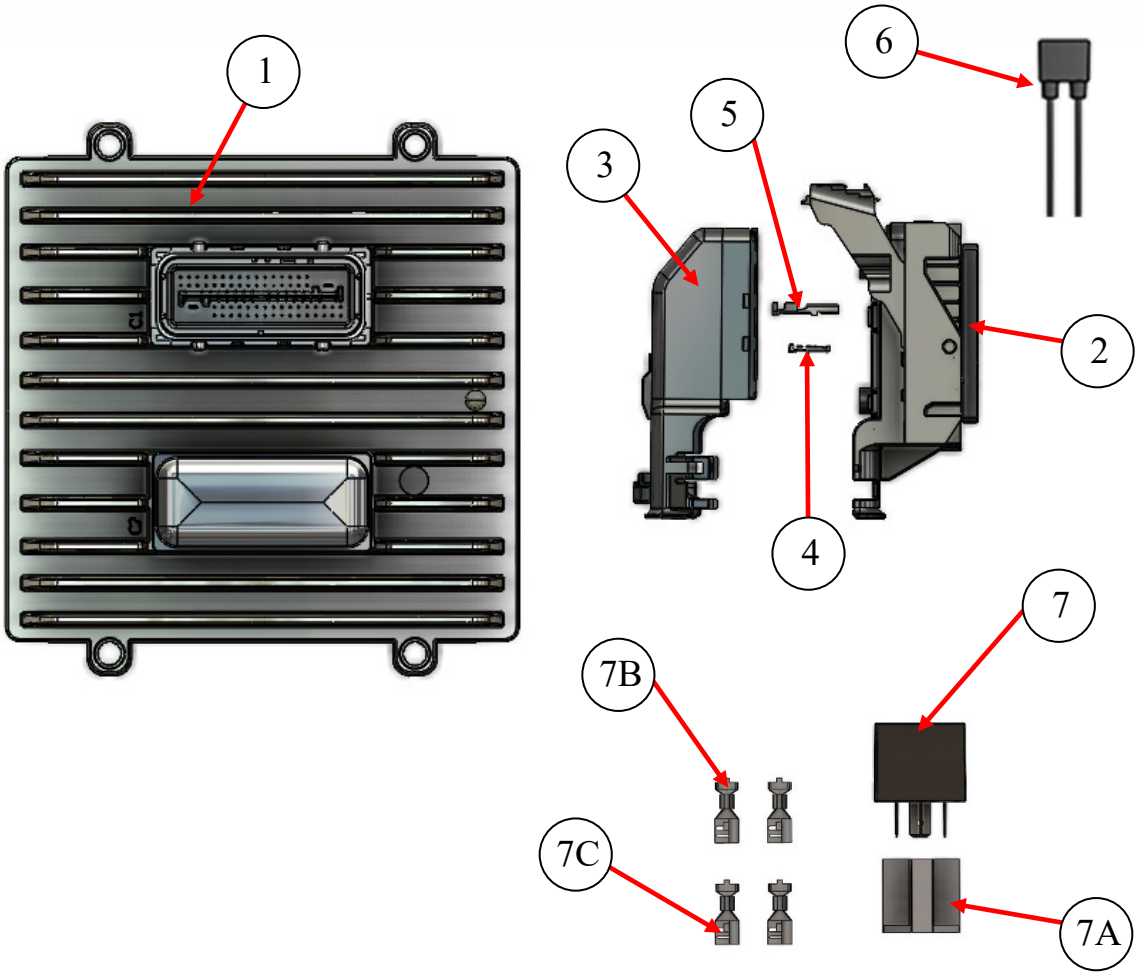
MC42



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89613-S	CONTROLER, MC42FS	1	REF
2	89622	PLUG FOR 89613 CONTROLER	1	REF
3	89622-C	COVER	1	REF
4	89623	PIN, 0.64 MOLEX	37	EA
5	89624	PIN, 2.8 MOLEX	2	EA
6	89136-0	MOLDED 294 RESISTOR, TAG #0 (**MC42**)	1	EA
7	W-105618	RELAY, SPST,12V, 70 AMP	1	EA
7A	W-105619	SOCKET, W-105618 RELAY (**MAIN POWER**)	1	EA
7B	W-105617	PIN, (LARGE)	2	EA
7C	72927	PIN, (SMALL)	2	EA

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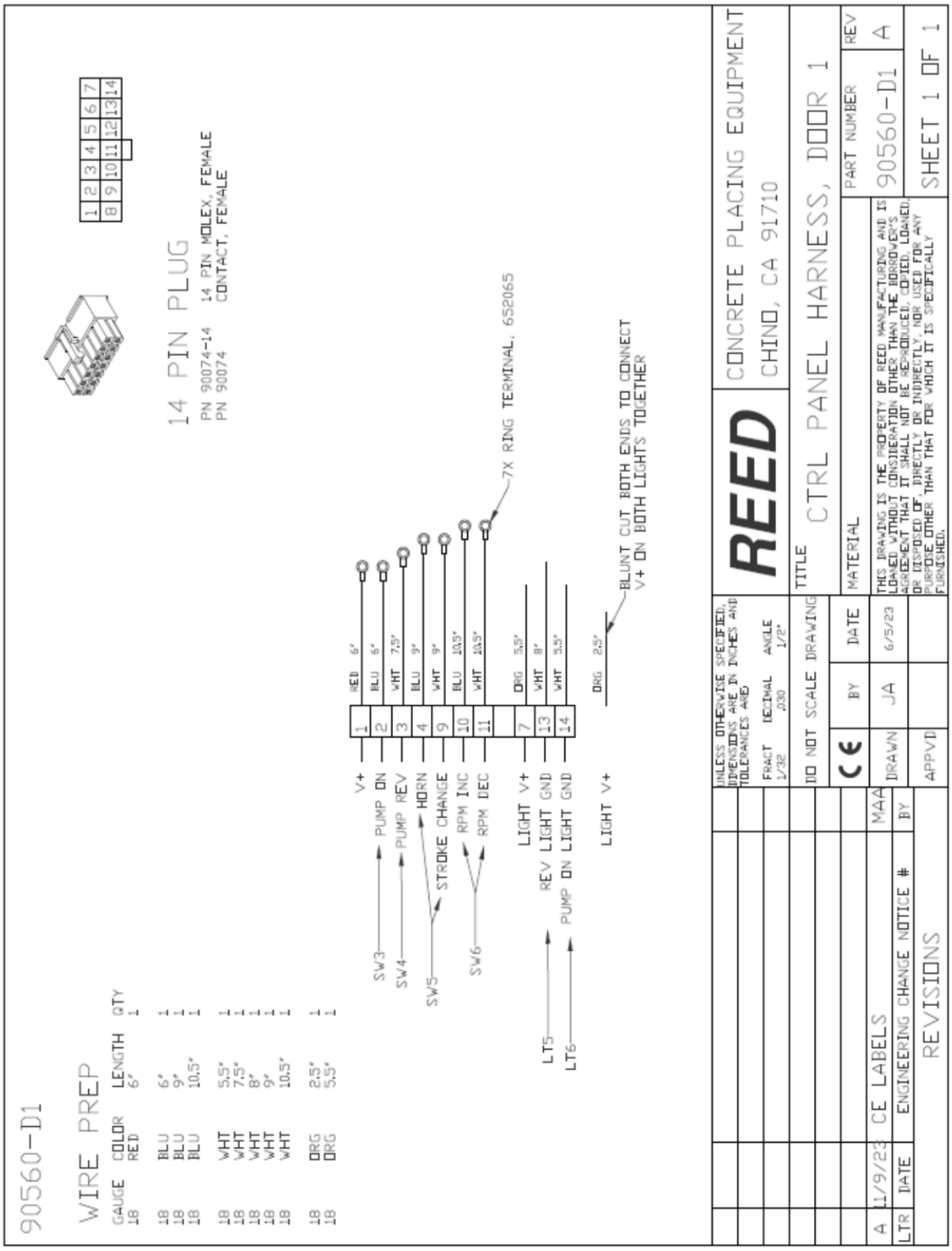

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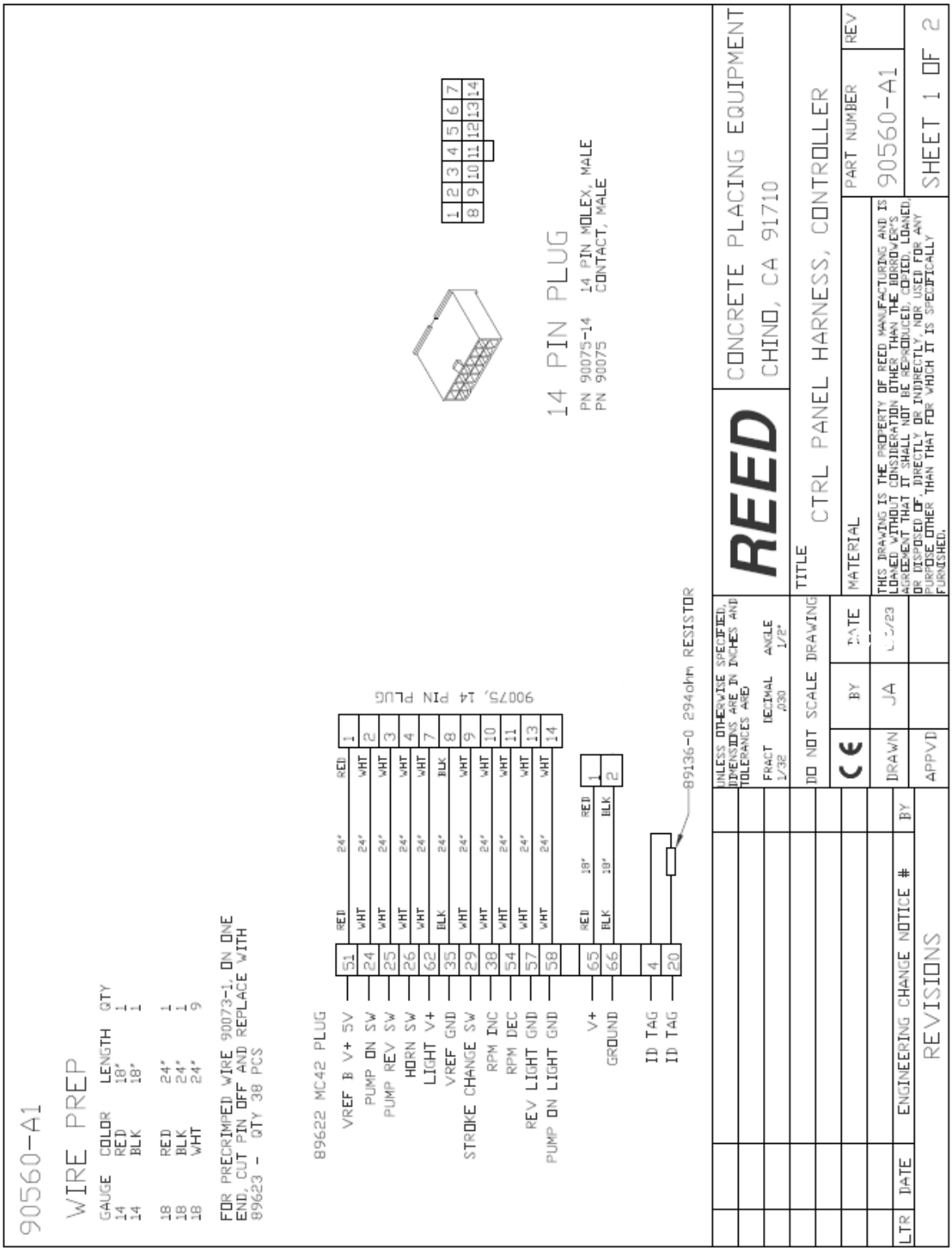

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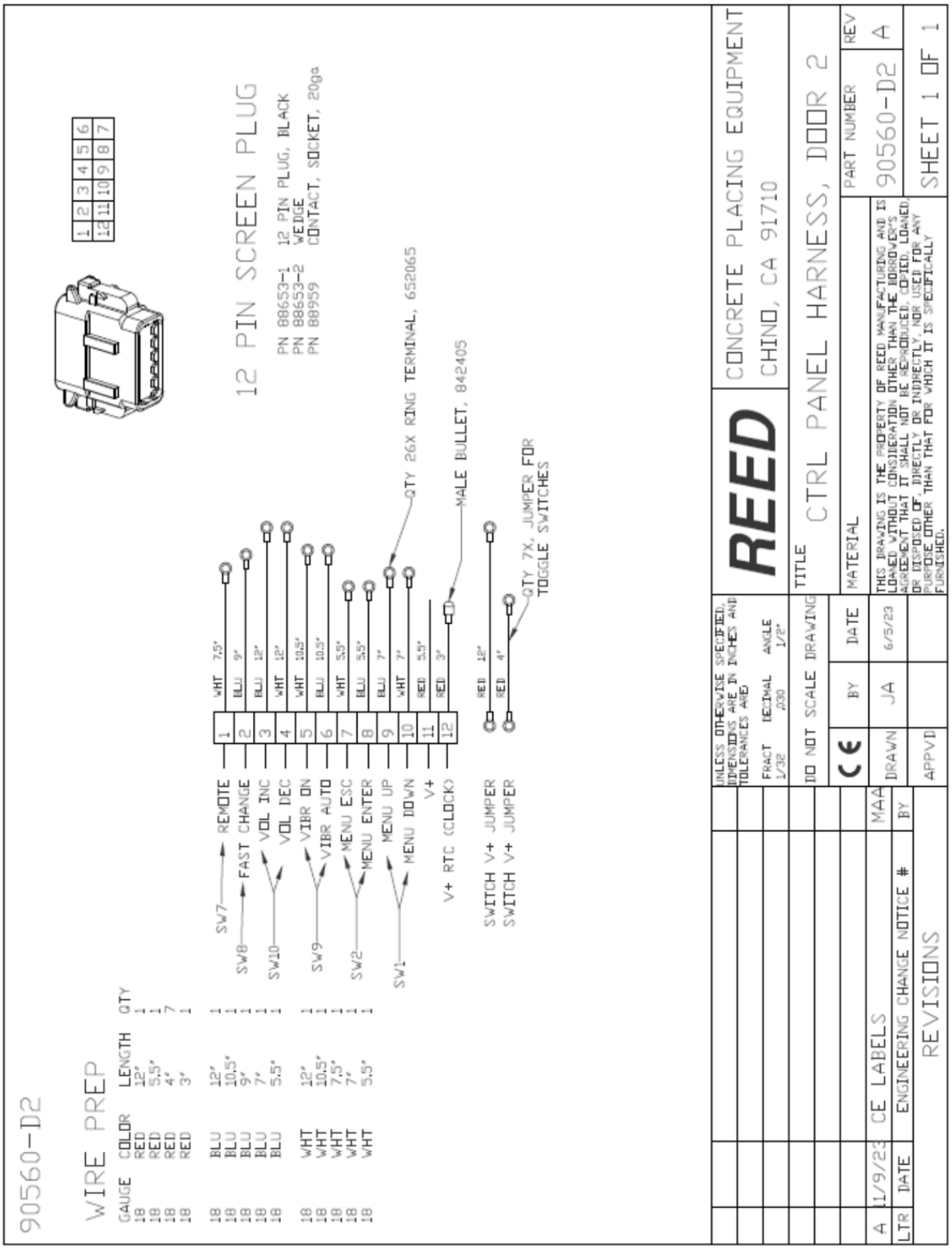

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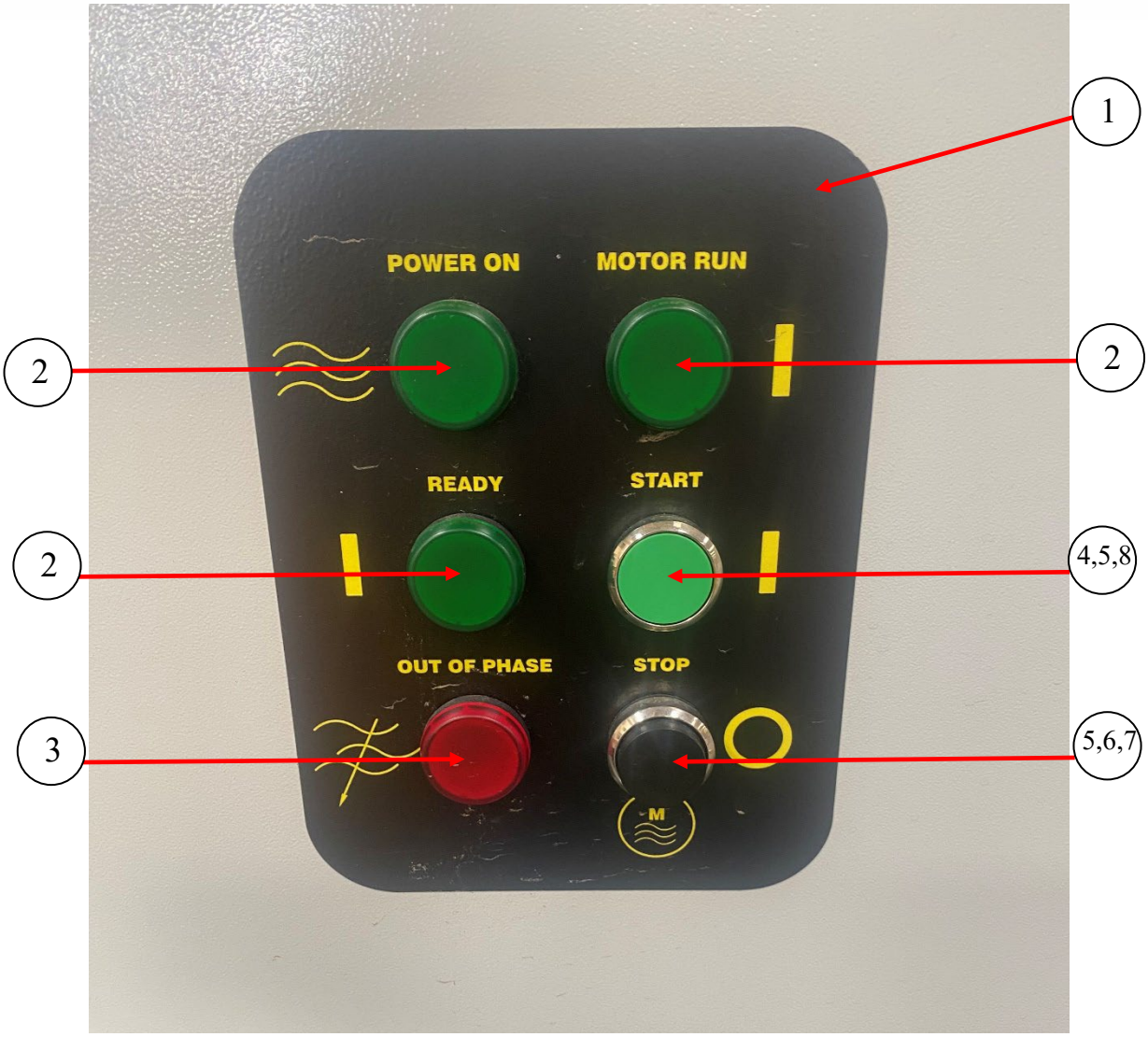
MAIN MOTOR CONTROLS



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89255	DECAL, START STOP, ELECTRIC MOTOR CONTROL	1	EA
2	88148	LIGHT GREEN 120VAC, 22M	3	EA
3	88149	LIGHT RED 120VAC, 22M	1	EA
4	89585	PUSHBUTTON GREEN	1	EA
5	89585-H	CONTACT HOLDER	2	EA
6	89585-NC	CONTACT BLOCK N.C.	1	EA
7	89585-1	PUSHBUTTON BLACK	1	EA
8	89585-NO	CONTACT BLOCK N.O.	1	EA

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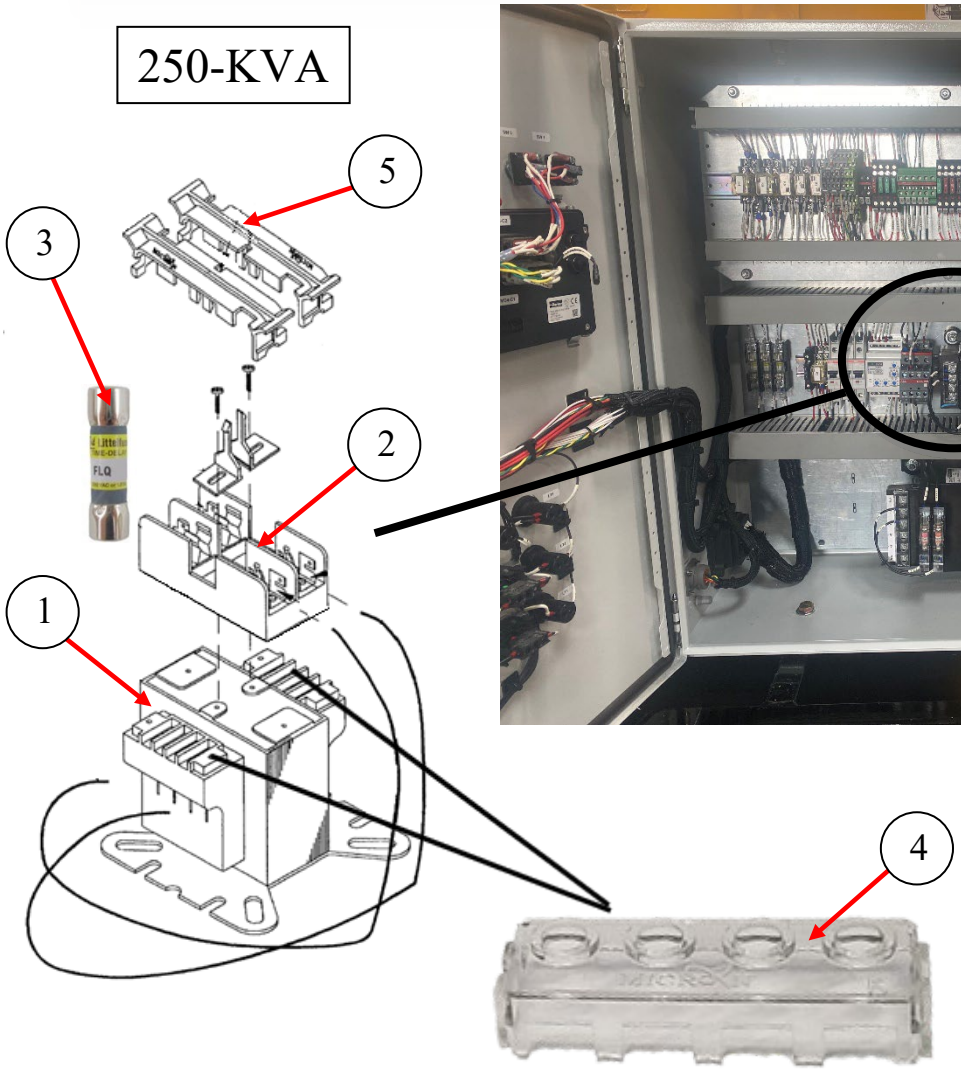
TRANSFORMER 250-KVA



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	88059	TRANSFORMER 250 KVA (600V-120V)	1	EA
2	88068	FUSE BLOCK KIT	1	EA
3	88054	FUSE 2 AMP	2	EA
4	88056-C	COVER KIT FOR TRANSFORMER (4 TERMINAL)	1	EA
5	88053-COVER	COVERKIT FOR 88053	1	EA

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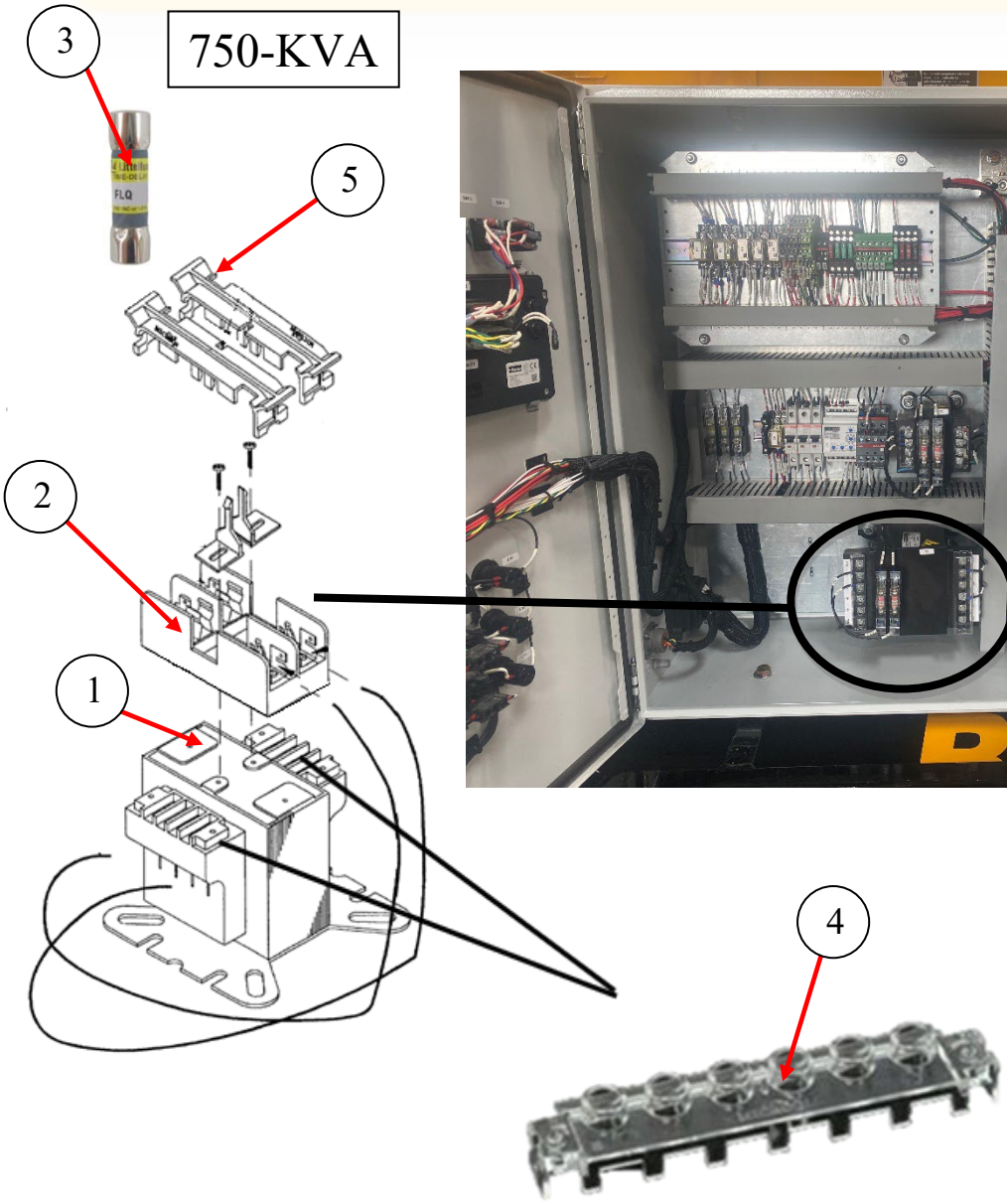
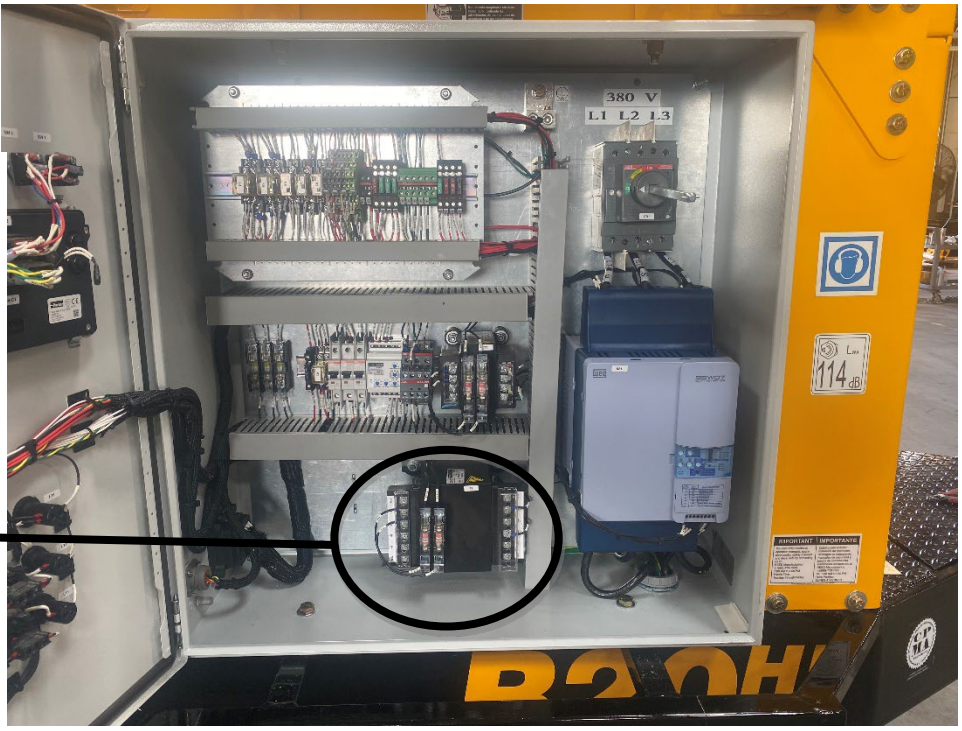
TRANSFORMER 750 KVA





ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89960	TRANSFORMER 750 KVA (600V-120V)	1	EA
2	88053	FUSE BLOCK KIT	1	EA
3	88368	FUSE 3 AMP	2	EA
4	88177-C	COVER KIT FOR TRANSFORMER (6 TERMINAL)	1	EA
5	88053-COVER	COVERKIT FOR 88053	1	EA

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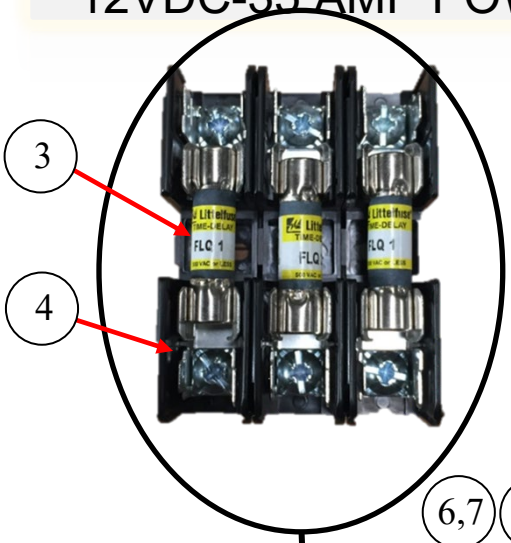
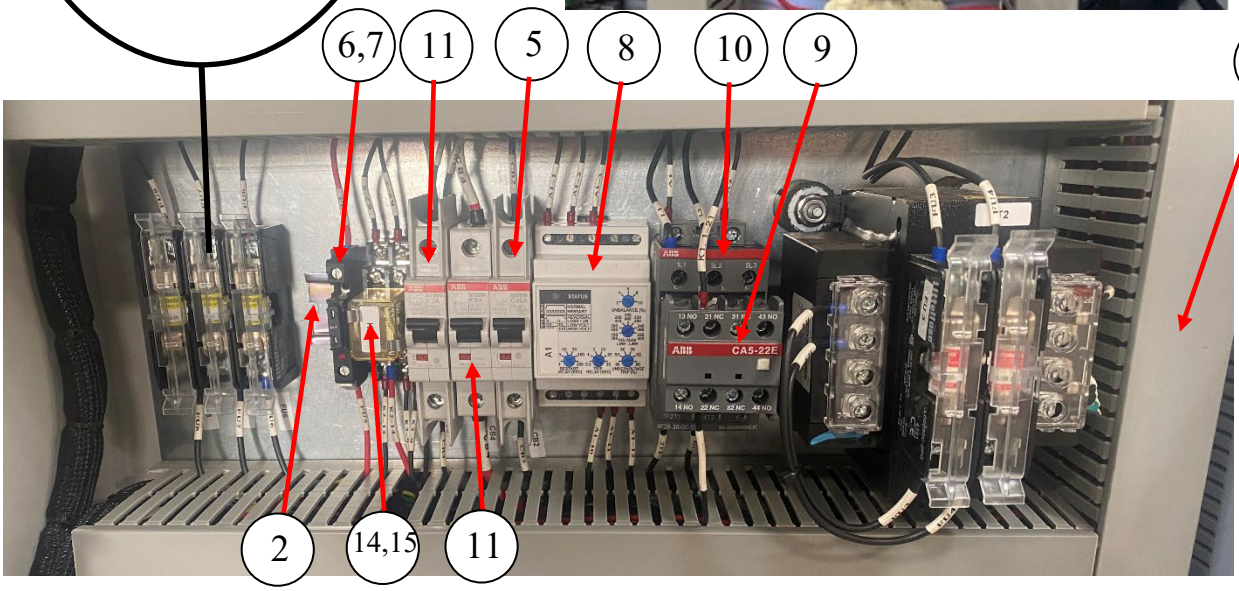
12VDC-35 AMP POWER SUPPY





ID #	PART #	PART DESCRIPTION	QUANTITY	
1	88059-2	POWER SUPPLY, 12VDC 35 AMP ACOPIAN (**PS1**)	1	EA
2	88059-2DR	DIN RAIL KIT	1	EA
3	88069	FUSE TIME DELAY (**FU6,FU7,FU8**)	3	EA
4	88053	FUSE BLOCK (**FU6,FU7,FU8**)	1	EA
5	88058-1	CIRCUIT BREAKER, 40 AMP (**CB2**)	1	EA
6	88881	FUSE HOLDERS DIN RAIL MOUNT (**FU5**)	1	EA
7	89501	FUSE, ATO 1 AMP (**FU5**)	1	EA
8	89958	PHAZE MONITOR (**A1**)	1	EA
9	89288	CONTACT BLOCK, AUX, 2 NO 2 NC (**K1.1**)	1	EA
10	88067	CONTACT CONTROL, 3 POL N/O 120V 28AMP (**K1**)		
11	88176	CIRCUIT BREAKER, 8 AMP (**CB4**)	1	EA
12	88055	CIRCUIT BREAKER, 2 AMP (**CB3**)	1	EA
13	88856-1	WIRE DUCT 1.5 X 4.00 W/COVER	60	IN
14	88345-1	RELAY, 2PDT, 12V, W/MOMENTARY CHECK BT	1	EA
15	88347	BASE, RELAY	1	EA

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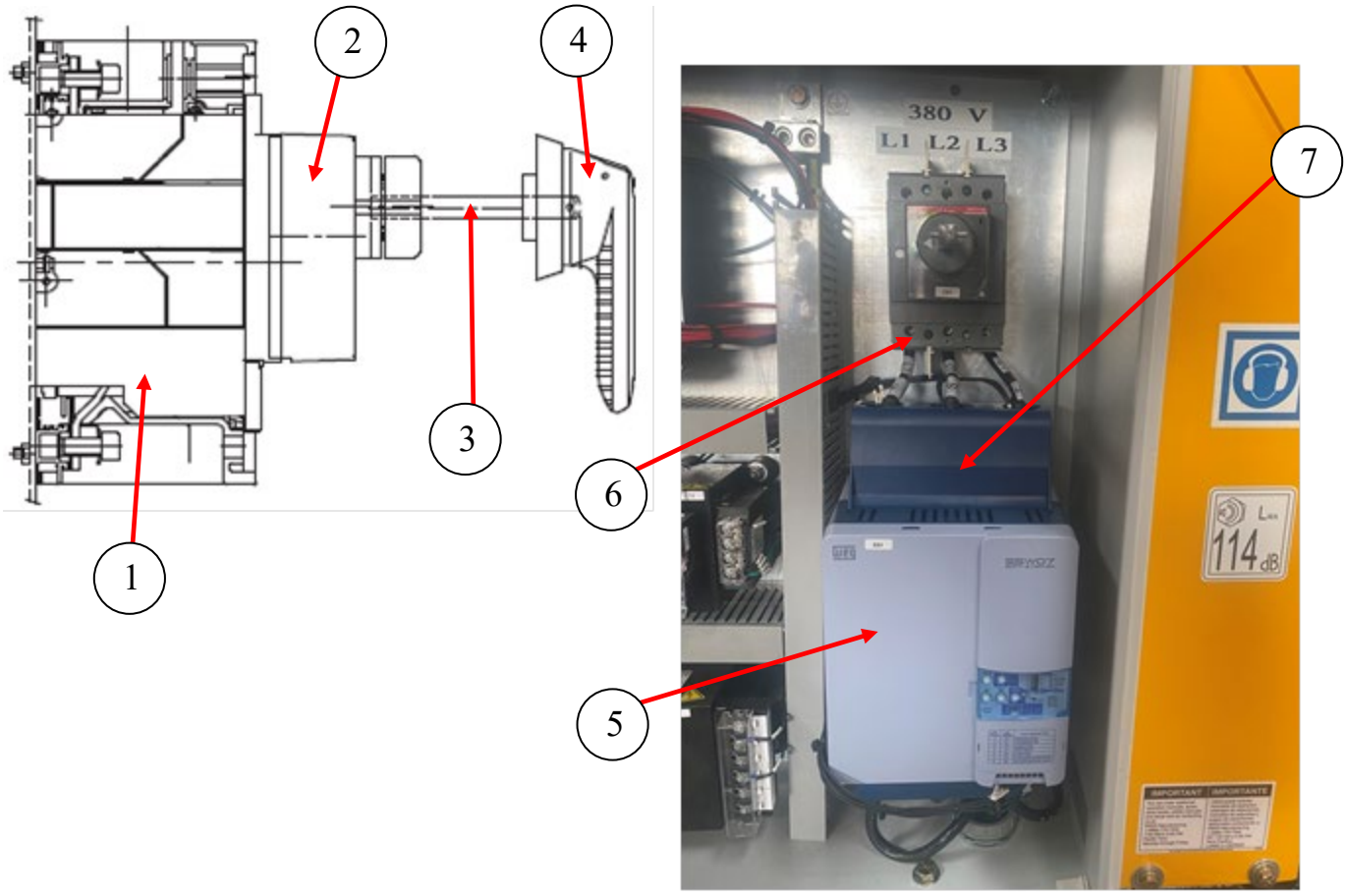
MOTOR CIRCUIT BREAKER, SOFT START



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	88098-2	CIRCUIT BREAKER 100 AMP (**CB1**)	1	EA
2	89576	MECHANISM FOR CIRCUIT BREAKER	1	EA
3	88109	SHAFT FOR 88047 HANDLES	1	EA
4	89577	HANDLE CIRCUIT BREAKER	1	EA
5	88437-1	SOFT START (**SS1**)	1	EA
6	88071-1	LUG KIT	1	EA
7	88637-2-IPC20	WEG SSW07 TOUCH SHIELD KIT	1	EA

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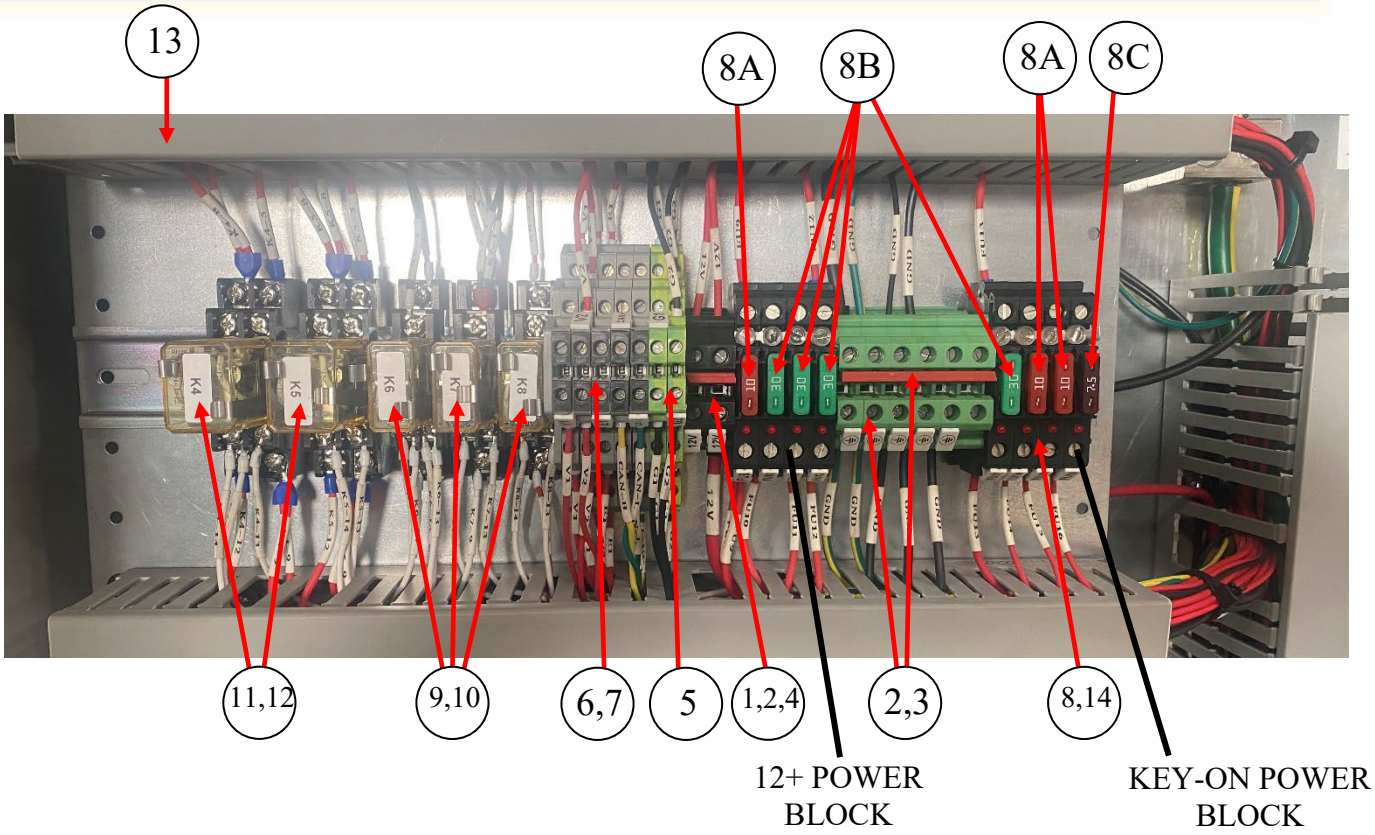
RELAY, FUSES, CONTACT BLOCK



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89937	TERMINAL BLOCK, 2 POSITIONS	2	EA
2	89938	TERMINAL BLOCK, 2 POSITION, GND	6	EA
3	89939	BRIDGE, 8MM, FOR 89937	1	EA
4	89940	END COVER FOR 89937	2	EA
5	89922	TERMINAL BLOCK, 6 POSITION GND BUSS	2	EA
6	89921	TERMINAL BLOCK, 6 POSITION BUSS	5	EA
7	89926	END COVER FOR 89921	4	EA
8	88881	FUSE HOLDERS DIN RAIL MOUNT	8	EA
8A	800449	FUSE, ATO 10 AMP	3	EA
8B	90394	FUSE, ATO 30 AMP	4	EA
8C	88952	FUSE, ATO 7.5 AMP (**AUTO LUBE**)	1	EA
9	88346	RELAY, SPDT, 12VDC (**K6,K7,K8**)	3	EA
10	88348	BASE, RELAY FOR 88346 (**K6,K7,K8**)	3	EA
11	88345	RELAY, 2PDT, 12VDC (**K4,K5**)	2	EA
12	88347	BASE, RELAY FOR 88345 (**K4,K5**)	2	EA
13	88856	WIRE DUCT 1 X 2.25 W/COVER	73	IN
14	88881-B	JUMPER BRIDGE FOR 88881 FUSE HOLDER	REF	

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MAIN PANEL BOX

ID #	PART #	PART DESCRIPTION	QUANTITY	
	89965	MAIN CONTROL PANEL 75HP 380V/50HZ PLCv2	REF	
1	88044-8	ENCLOSURE 30-30-12” NEMA-4		EA
2	88263-114	DECAL, CE DECIBEL SOUND LEVEL	2	EA
3		DECAL, DANGER HIGH VOLTAGE	1	EA
4		DECAL, TREE PHASE 380V	1	EA

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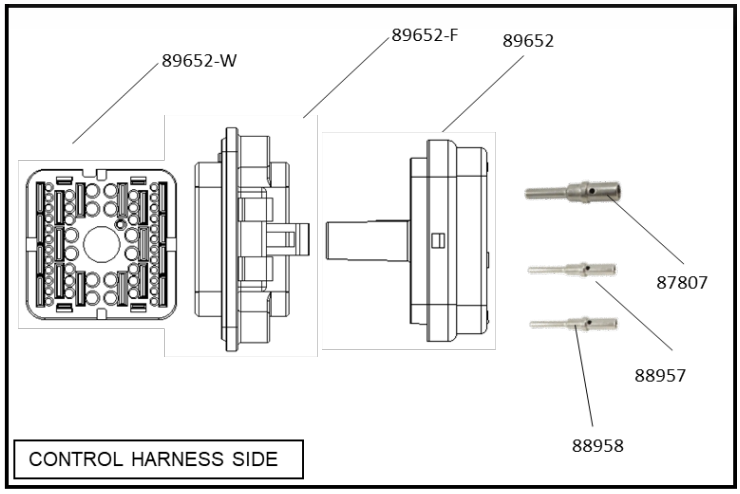
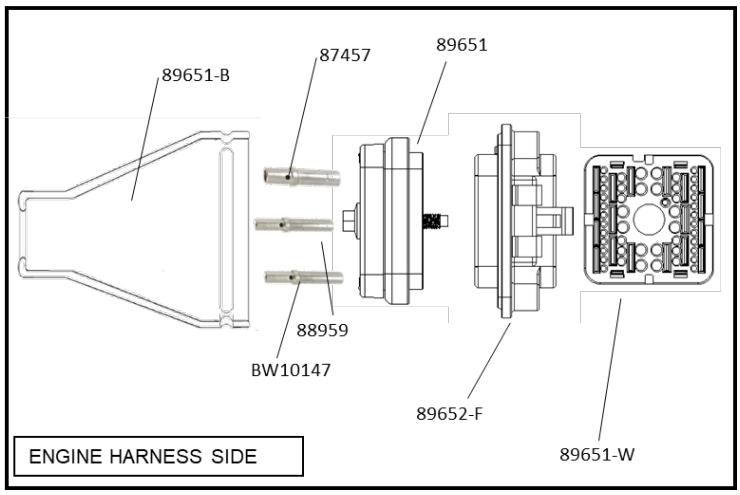
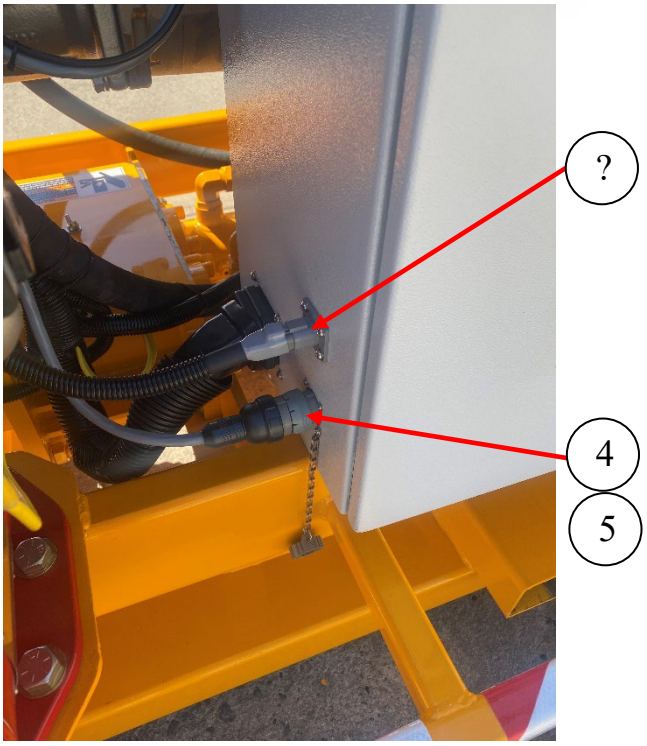
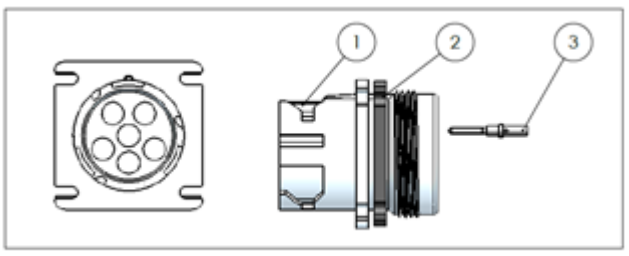
CONNECTORS









ID #	PART #	PART DESCRIPTION	QUANTITY	
	90560-P3	CONTROL HARNESS, REMOTE PLUG	1	EA
1	89223	DEUTSH HD 10 PLUG, 6 PIN	1	EA
2	89223-G	GASKET FOR 89223	1	EA
3	88958	CONTACT PIN SOLID SIZE 16	6	EA
4	89223-C	PLUG CAP	1	EA
5	89402	CHAIN SASH LANYARD	1	EA

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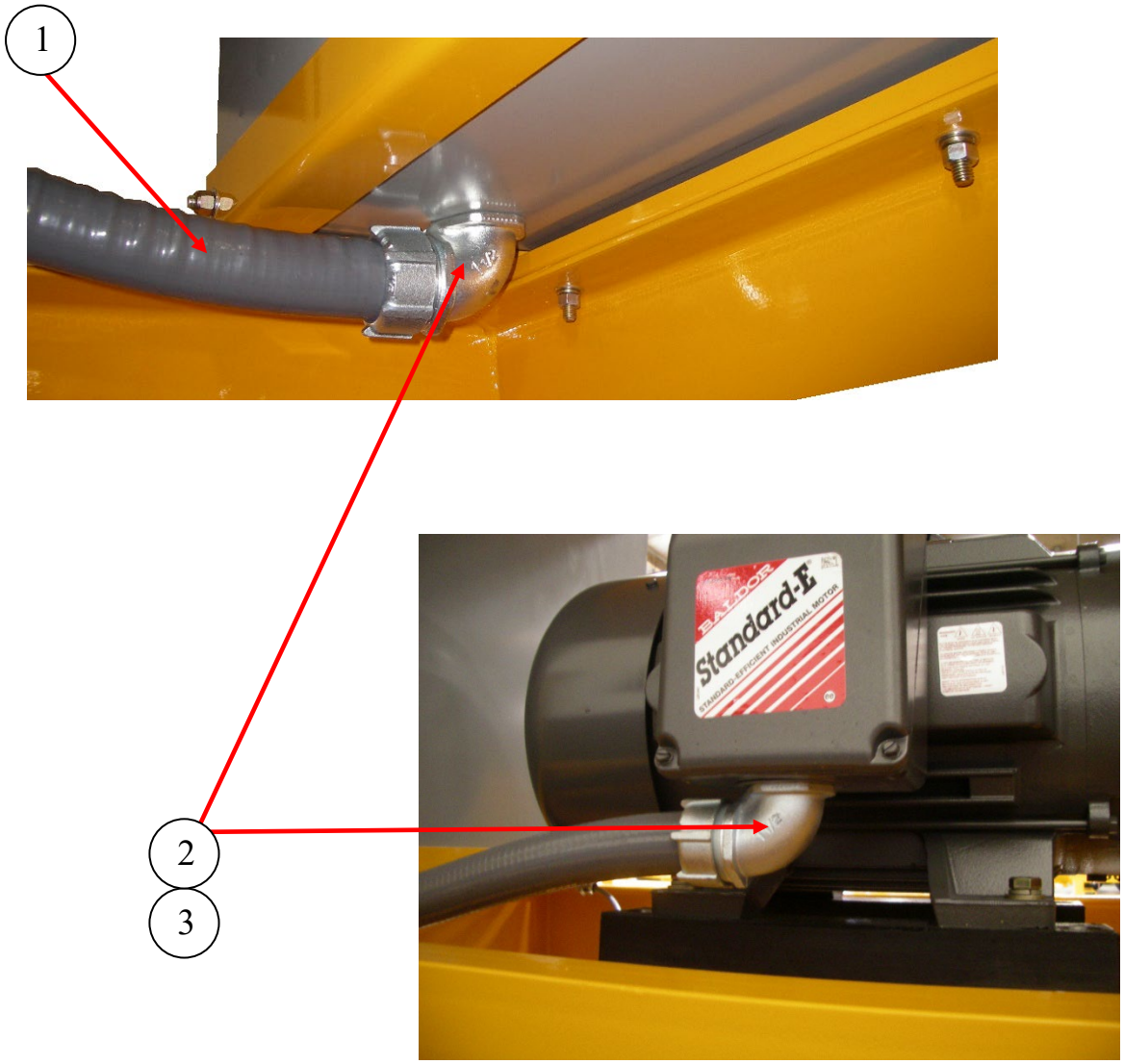
CONDUIT, FITTING



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	86518-1	CONDUIT – 2” IN LIQUID TITE	3	FT
2	86519-1	CONNECTOR 1 ½” ELBOW 90°	2	EA
3	86520-1	INSULATED BUSHING 1 ½”	4	EA
4	88928	TERMNL BLOCK WEG MOTOR CE	1	EA
5	86518-1W	WASHER 2”	1	EA
6	86523	CABLE-2 AWG BLACK NEC TYPE MTW & THW	20	FT
7	89902	CABLE-2 AWG GR/YL NEC	9	FT
8	89150-2	LUG COPPER 1 AWG STR 3/8” HOLE	4	EA

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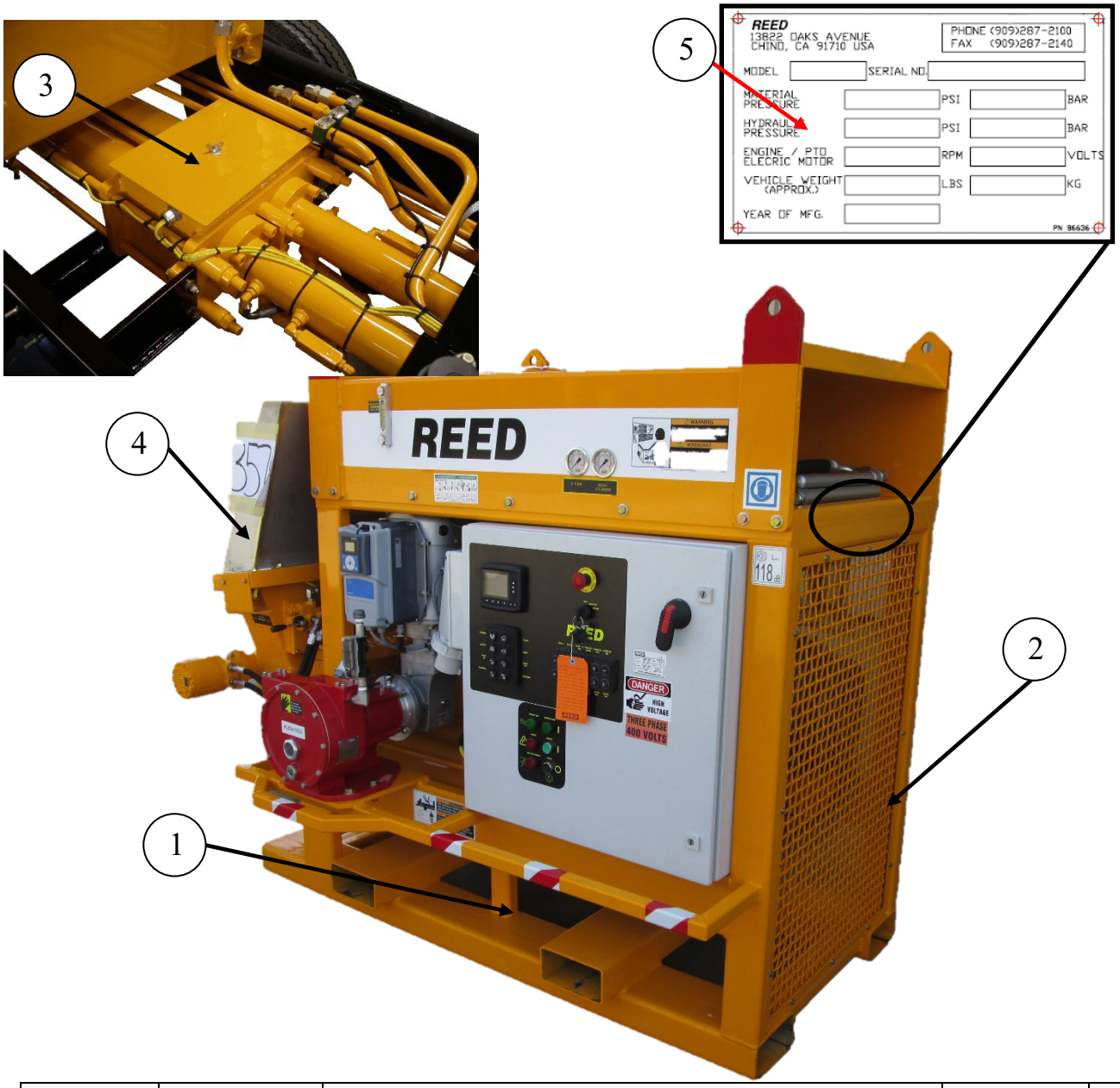
FRAME, PANELS



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89961	SKID FRAME WELDMENT, M SER ELECTRIC-CP	1	
2	88796	FRONT SKID MESH SCREEN	1	EA
3	BW10387	LID, FLUSHBOX, A40	1	EA
4	85714-1	SPLASH GUARD, WITH HOPPER SAFTY GRATE	1	EA
5	86636	SERIAL NUMBER PLATE (BLANK)	1	EA

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HOPPER SAFETY GRATE

ID #	PART #	PART DESCRIPTION	QUANTITY	
1	87769	COLLAR SHAFT, 7/8" DIA	1	EA
2	801902-006	CLAMP, 18MM TUBE CLAMP SET	1	EA
3	87997	COVER WELD PROX SWITCH HOPPER	1	EA
4	BW10416	GRATE WELDMENT, A SER STD HOPPER	1	EA
5	87369	PROXIMITY SENSOR PMP	1	EA

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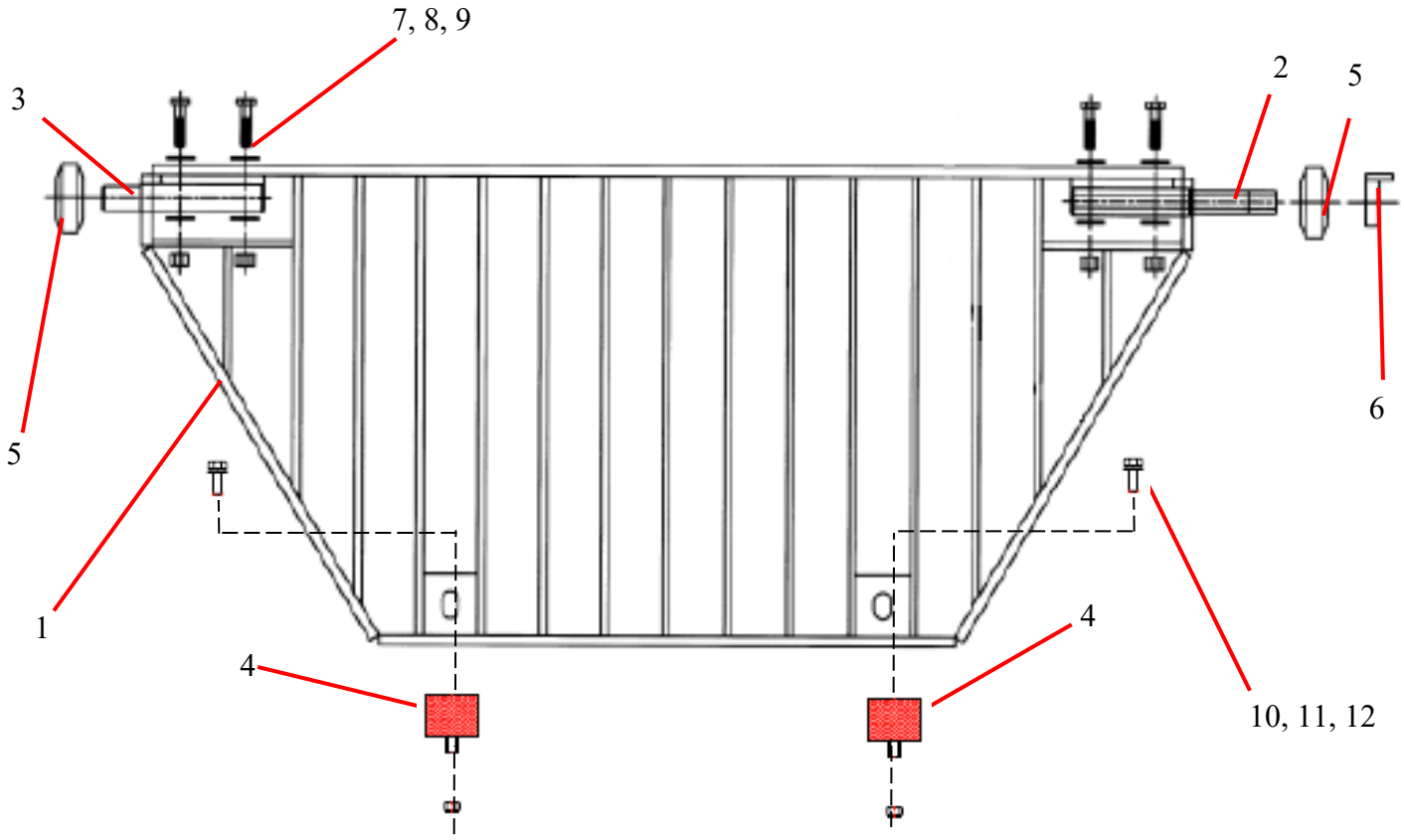
GRATE ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10416	GRATE WELDMENT, A SER STD HOPPER		REF
2	87857	PIN WELDMENT LONG	1	EA
3	87858	PIN WELDMENT SHORT	1	EA
4	86083	BUMPER, HOPPER GRATE	2	EA
5	W-114850	RUBBER BUFFER 65X22.5X26	2	EA
6	87769	COLLAR SHAFT, 7/8" DIA	1	REF
7		3/8"-16 X 1 ¼" HEX BOLT	4	EA
8		3/8 FLAT WASHER	8	EA
9		3/8-16 LOCK NUT	4	EA
10		3/8"-16 X 1" HEX BOLT	2	EA
11		3/8" FLAT WASHER	2	EA
12		3/8" LOCK WASHER	2	EA

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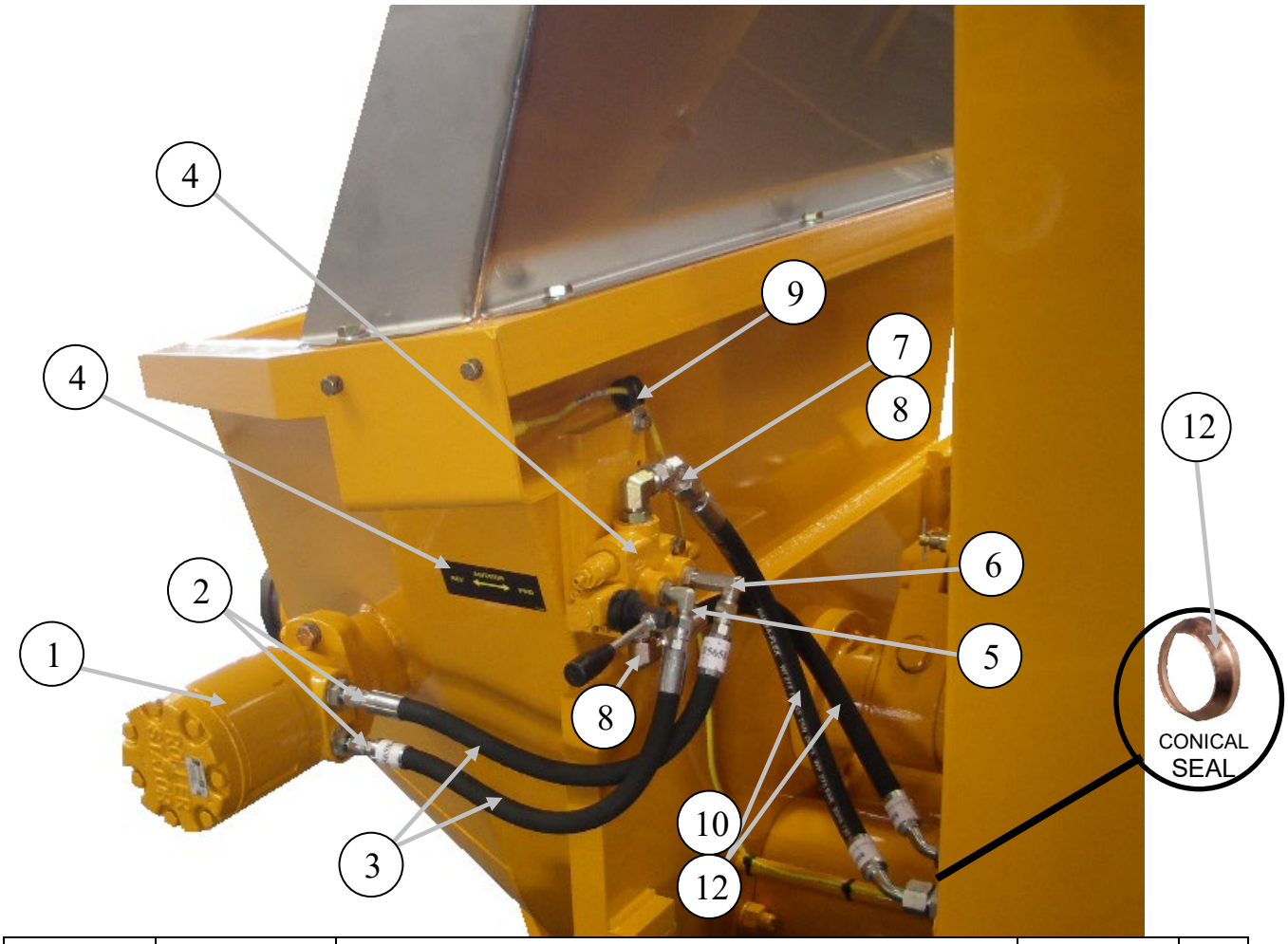
OPTION
HYDRAULIC AGITATOR



ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW10396-1	AGITATOR ASSEMBLY, A40		EA
1	85811	HYD MOTOR, 45.6 CID, 1” SHAFT-PAINTED	1	EA
2	86866	FITTING-MB-MJ-10-6	2	EA
3	85658-002	HOSE, 6M2T-6FJX-6FJX-17.00	2	EA
4	74584	VALVE 1 SPOOL, MANUAL PAINTED	1	EA
5	86748	FITTING-MB-MJ90-6-6	1	EA
6	86747	FITTING-MB-MJ90LL-6-6	1	EA
7	86749	FITTING-MJ-FJX45-10-10	1	EA
8	86746	FITTING-MB-MJ90-8-10	2	EA
9	800897	CLAMP, ¾” TUBE, SINGLE	1	EA
10	85657-016	HOSE, 8M2T-10FJX-10FJX45-20.00	2	EA
11	85846	DECAL, ADGITATOR	1	EA
12	BW10229	CONICAL SEAL, SIZE 12	4	EA
13	85657-024	HOSE, 8M2T-10FJX-10FJX90S-24.50 (UNDER TANK)	1	EA
14	BW10407	TUBE HYD. AGITATOR PRESSURE (UNDER TANK)	1	EA

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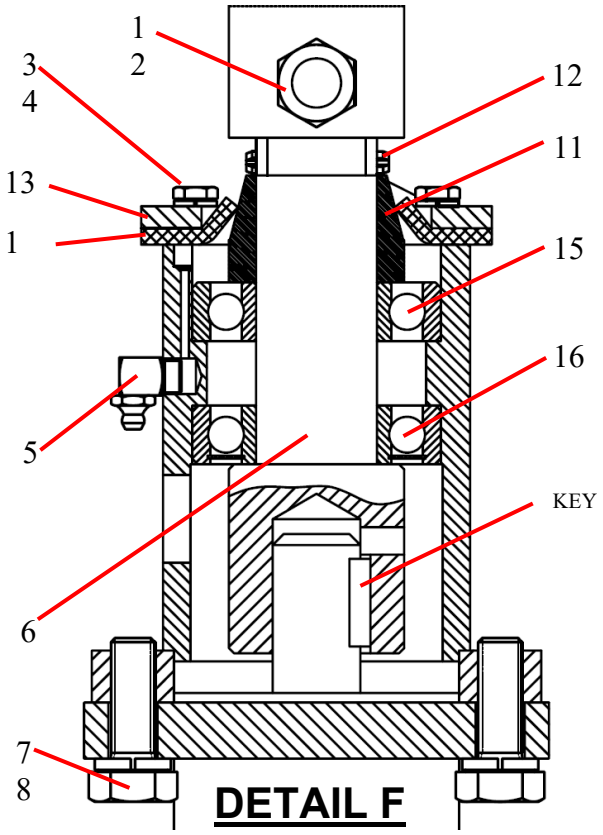
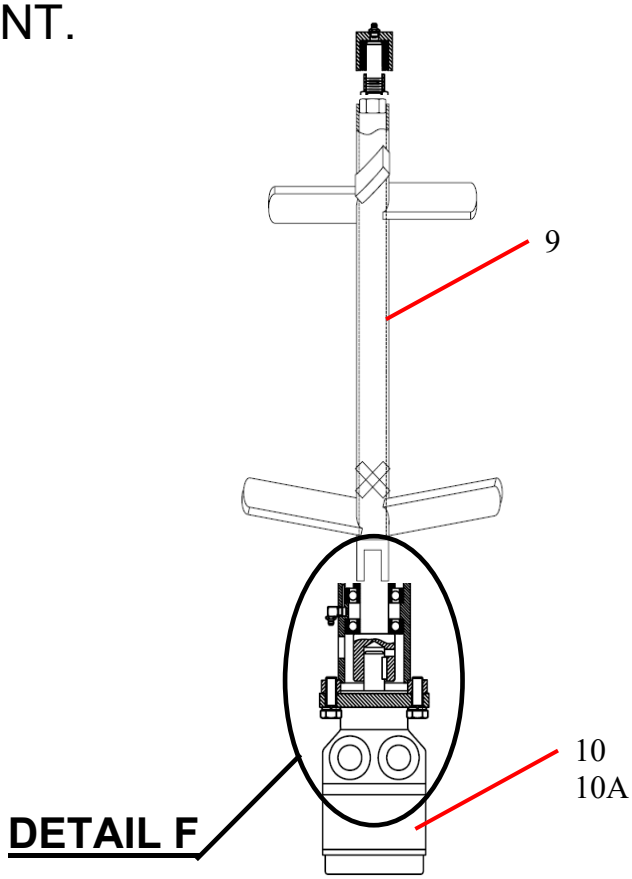
OPTION
HYDRAULIC AGITATOR CONT.





ID#	PART #	PART DESCRIPTION	QUANTITY	
	BW10396-1	AGITATOR ASSEMBLY		
1		HHCS, ½ -13X2 ¼" GR 8	1	EA
2		LOCK NUT, ½" -13	1	EA
3		¼-28X3/4"	6	EA
4		LOCK WASHER, ¼"	6	EA
5		GREASE FITTING, 1/8" NPT 90°	1	EA
6	85923	SHAFT, AGITATOR	1	EA
7		HHCS, ½ -20X1 ½" GR 8	2	EA
8		LOCK WASHER, ½"	2	EA
9	85717	AGITATOR, PADDLE-B20	1	EA
10	85811	HYD MOTOR, 45.6 CID, 1" SHAFT	1	EA
10A	85811SK	SEAL KIT	1	EA
11	85976	WEAR RING, AGITATIOR	1	EA
12	86758	SPRING PIN, ¼" DIA X 1 ¾"	1	EA
13	70211	FLANGE SEAL S/W	1	EA
14	70212	SEAL REMIXER	1	EA
15	87356	BEARING, BALL, PLAIN	1	EA
16	85979	BEARING, BALL 1 SEAL	1	EA

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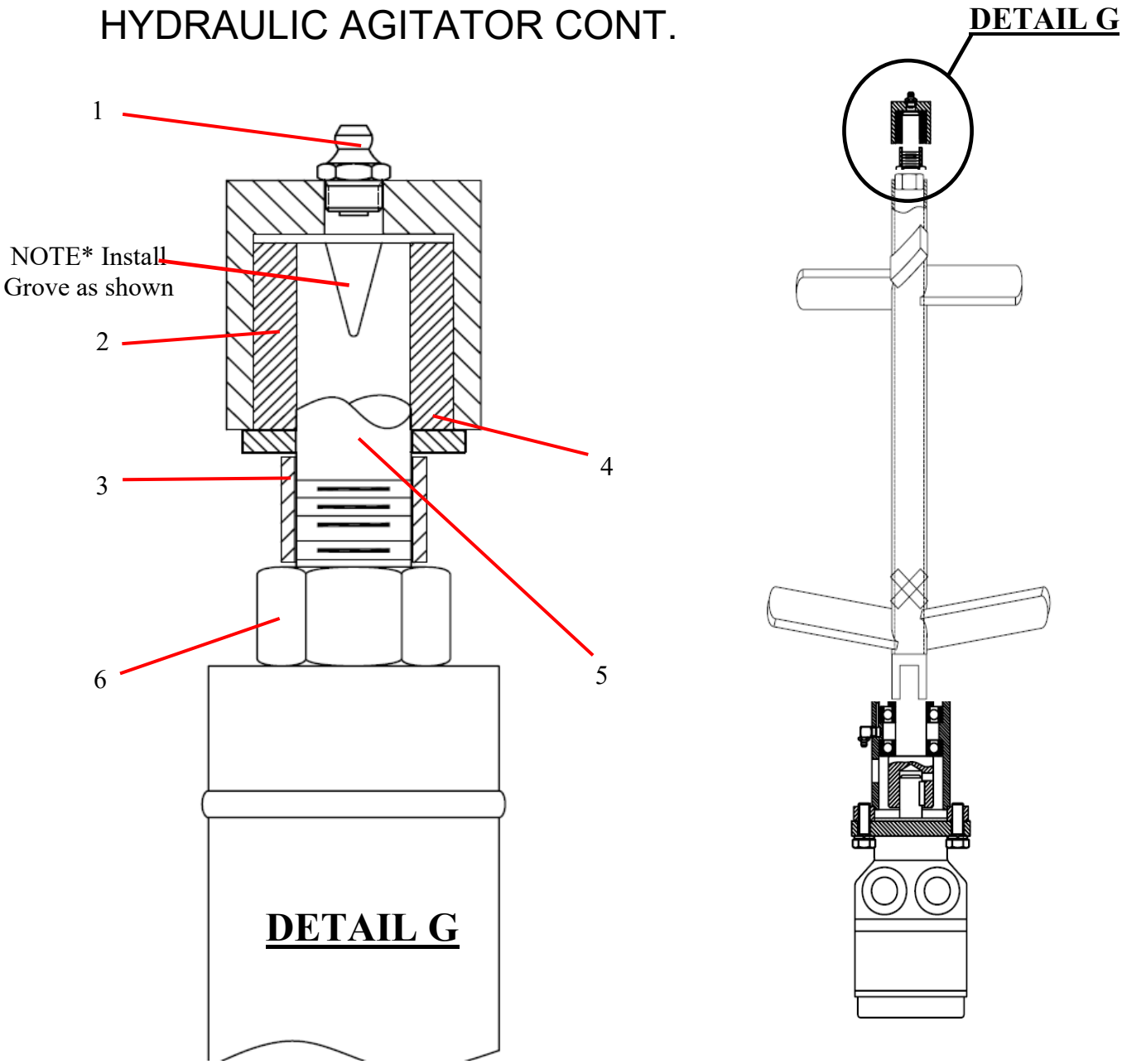
OPTION
HYDRAULIC AGITATOR CONT.



ID #	PART #	PART DESCRIPTION	QUANTITY	
1		GREASE FITTING, 1/8" NPT STRAITGHT	1	EA
2	70219	REMIX SHAFT BUSHING	1	EA
3	77877	SPACER, REMIX	1	EA
4	86824	FLAT WASHER, ¾" SAE	1	EA
5	70214	IDLER SHAFT, AGITATOR	1	EA
6	80030	HEX NUT-M20X2.5 PLATED	1	EA

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OPTION
CHEMICAL PUMP

ID #	PART #	PART DESCRIPTION	QUANTITY	
	88421-2	SYNCHRONIZED CHEM PUMP, 1-5 GPM NO/DOSE	REF	EA
	88421-1H	HOSE RUBBER	REF	EA
	88421-1-H-EPDM	HOSE, EPDM	REF	EA
	88421-1L	LUBRICATION GREASE FOR 88421/1 PUMPS	REF	EA
	89212-1	DOSING PUMP NO/MOTOR	REF	EA
	89098-1	FLOW SENSOR	REF	EA
	89468	CHEM PUMP MOTOR	REF	EA

A guide for the prevention of accidents when driving, operating, cleaning, and maintaining concrete pumps, placing booms, and related equipment.

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Version 5.0.1

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

SAFETY MANUAL

A GUIDE FOR THE PREVENTION OF ACCIDENTS WHEN DRIVING, OPERATING, CLEANING, AND MAINTAINING CONCRETE PUMPS, PLACING BOOMS AND RELATED EQUIPMENT

Introduction

Safety is one of the major concerns of every person involved in the concrete pumping industry. Although much of the responsibility for everyday safety rests upon the pump operator, it is vital that everyone involved makes safety the top priority. This includes the owners, the mechanics, the ready mix drivers, the placing crew, the concrete contractors and the machine manufacturers.

Although this Safety Manual covers a great deal of information regarding the prevention of accidents while operating a concrete pump or placing boom, it is unlikely that every conceivable circumstance has been covered. Regardless of how thorough a manual like this may be, there is always the unexpected. Please understand that there is no substitute for **common sense** and dedication to the idea that **you are responsible for your own safety**, and affect the safety of those around you. You have to know the rules first, but you must keep your mind on the job if knowledge of the rules is going to keep you and your co-workers alive and well. No attempt has been made in this Safety Manual to provide the highly specialized knowledge of the workings of the individual machines that is also critical for safe and proper operation. For that, you must **read and understand the operation manual for the machine(s) that you operate**!

This Safety Manual is a guide for the prevention of accidents and is to be used in conjunction with **professional training**. Additional information and materials are available through the American Concrete Pumping Association, including, specifically, an Operators Certification Program. Make the commitment to be professional - get your certification!

Version 5.0.1
January, 2006
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SAFETY MANUAL

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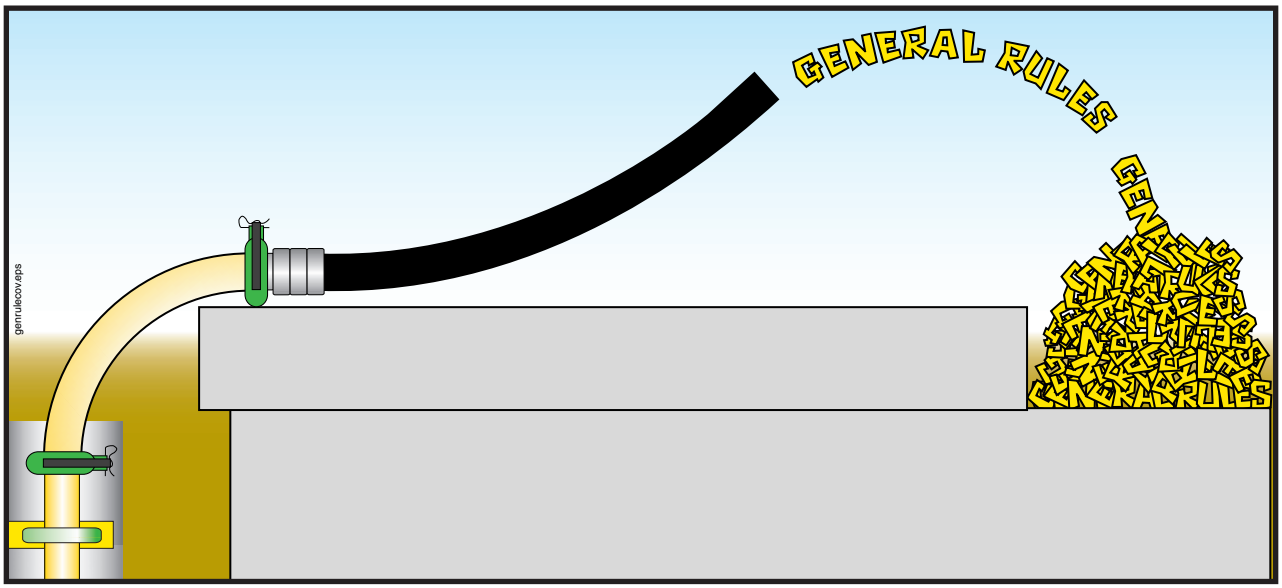


General Rules
Table of Contents

I. Before You Leave The Yard

1. Safety Alert Symbol And Signal Word Explanation

1.1

The triangle with the exclamation point inside is used to alert you to an important safety point, and is called a *Safety Alert Symbol*. One of the following color-coded signal words will appear after the safety alert symbol:

- If the safety alert symbol is followed by the signal word **DANGER** with white letters in a red box (DANGER), it indicates a hazardous situation which, if not avoided, **WILL** lead to **death or serious injury.**
- If the safety alert symbol is followed by the signal word **WARNING** with black letters in an orange box (WARNING), it indicates a potentially hazardous situation which, if not avoided, **COULD** result in **death or serious injury.**
- If the safety alert symbol is followed by the signal word **CAUTION** with black letters in a yellow box (CAUTION), it indicates a potentially hazardous situation which, if not avoided, **COULD** result in **minor to moderate injury.**
- The signal word **CAUTION,** used in a yellow box, but **without the safety alert symbol** (CAUTION), means the point addresses a hazard which, if not avoided, **COULD** cause **damage to equipment or property.**

2. What To Do Before You Arrive At Work

2.1

Get enough sleep to be ready for the day's work. Accidents can happen when the body is on the job, but the mind is not.

Dress in appropriate apparel and Personal Protective Equipment (P.P.E.) (see Figure 1). You should always wear these items when pumping concrete:

- hard hat
- safety glasses or goggles
- snug fitting clothes
- gloves
- steel toed shoes

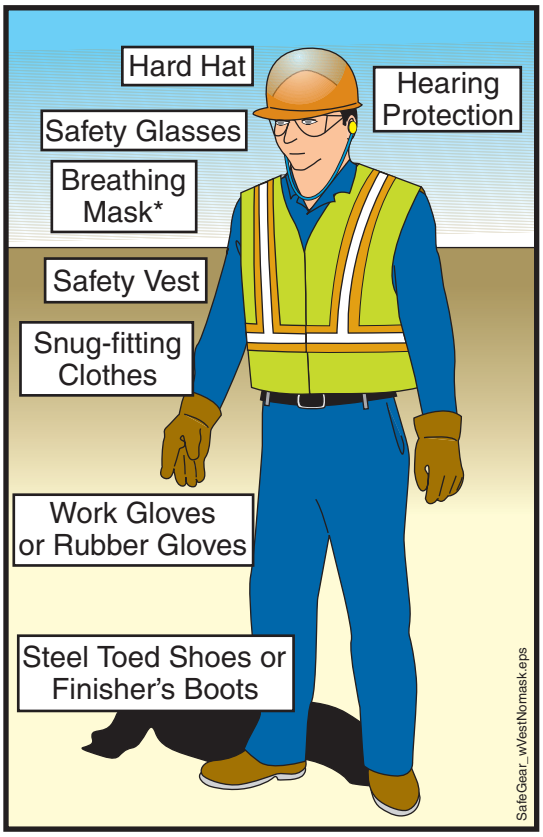
In addition, you should wear:

- hearing protection if you stand near the pump
- breathing mask when mixing slurry or whenever there is cement dust in the air

†† Illustration © British Concrete Pumping Association. Used by permission.

- rubber gloves during cleanout
- rubber boots anytime you have to stand in concrete

Jewelry, athletic shoes, sandals, and shorts are examples of clothing that should NOT be worn when pumping.



* Breathing mask needed when cement dust (or other toxic dust) is present in the air.

Figure 1
Personal Protective Equipment (P.P.E.)

2.2

⚠WARNING Be sure that any clothing you wear does not have strings, fringes, or other external tightening means that could be caught in moving parts (Figure 2).

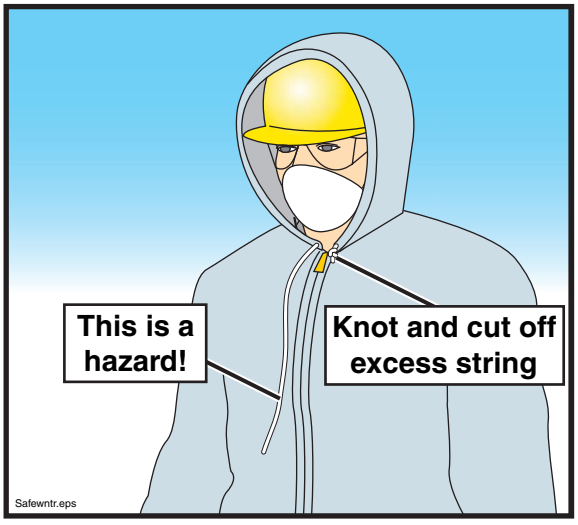


Figure 2
No strings attached

2.3 Arrive to work on time. Accidents can be caused by hurrying through procedures.

2.4 **⚠WARNING** **Never** go to work on a construction site or work on, around or near a piece of machinery when under the influence of drugs or alcohol. Beware of "over the counter" drugs, many of which have specific warnings about operating machinery after taking the medication (Figure 3).

Figure 3
Your co-workers depend upon you for their safety

2.5 **⚠WARNING** Don't bring your personal problems to work with you. In an office setting this may be annoying to co-workers, but on a construction site it can be deadly. The workers around you depend on you for their safety.

3. What To Check Before You Leave The Yard

3.1 **⚠WARNING** Do not operate the machine until you read and understand the unit's operation manual. Lack of understanding of proper operating procedures could result in unsafe operation. Operation manuals are issued with each new unit. If you haven't seen it, ask your supervisor. Replacements are available from the manufacturer.

3.2 **⚠WARNING** Inspect delivery pipes, concrete delivery hoses, and end hoses for wear. Never use a worn hose or worn or dented pipe. **Know the maximum pressure that your machine can exert on the concrete, and be sure that the pipes, hoses and clamps are capable of handling the pressure**. Maximum pressure on concrete is stated in operation manuals, service manuals, and on the serial number plate of the machine. A chart showing the minimum wall thickness of pipeline versus maximum pressure is found on page 73 in the appendix section of this Safety Manual.

3.3 **⚠WARNING** If you will need to use compressed air to clean out the boom or system pipeline, BE SURE that you have the proper training, equipment, and attachments to do this procedure safely! Proper attachments include:

- A blow out head with properly sized air discharge regulator valve and separate water/air inlet. The two openings should be spaced apart far enough that a blowout ball could not cover both openings at once.
- A *go devil*, or a hard sponge ball. Regardless of which is used, it **must** fit into the pipeline tight enough that air cannot escape ahead of it.
- A ball or go devil catcher that will catch the go devil or ball when the line has been purged of all concrete. There are two types of catchers (see paragraph 7.23 on page 31).
- A hose that is rated for the pressure of the air compressor you will use and that is able to connect with both the air compressor and the blow out head. The hose must be in good working condition and must be free of cracks, frays, tears or other damage. Do **NOT** improvise on this. **Make sure** that you have the right part (Figure 4).

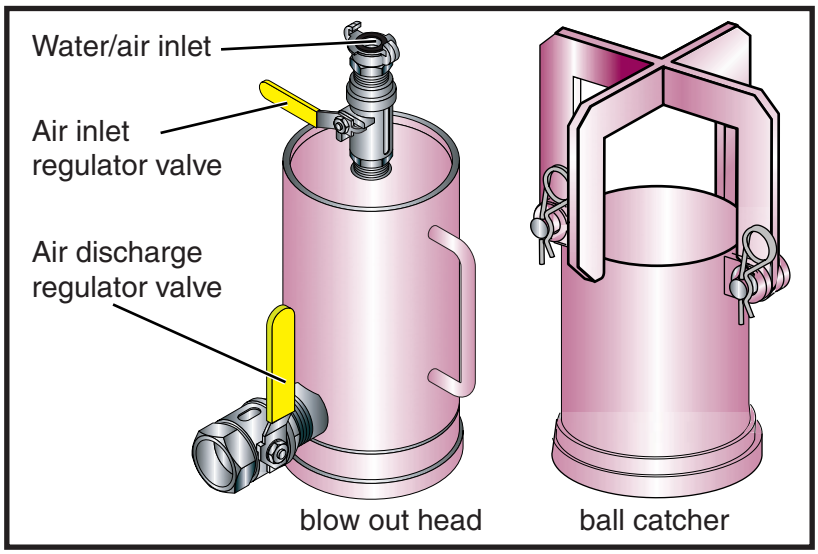


Figure 4
Compressed air accessories

3.4 ⚠**WARNING** Be sure that the unit is equipped with all the pipes, clamps, gaskets and hoses, blow out adapters, ball catchers, and other accessories that you will need for the day's work. "Making do" with inappropriate equipment could cause accidents.

3.5 On trailer mounted units, check the oil and cooling system (air or water cooled systems) of the pump drive engine. Accidents could occur when lack of maintenance is causing a distraction while operating the equipment.

3.6 Be sure the battery has enough charge to start the pump drive engine. You will be rushed on the job if you have to do repair work before you can begin operation.

3.7 **⚠WARNING** The operator is responsible for checking to see that the concrete pump, placing boom, and delivery system are in safe and proper working condition. If an unsafe condition exists, **work must not begin** until necessary repairs have been completed, or until the machine can be operated safely.

3.8 **⚠WARNING** The operator is responsible for checking that all safety equipment and guards are in place and in good condition. If found to be missing, incomplete, or damaged, **work must not begin** until the situation has been made safe.

3.9 **⚠WARNING** The operator is responsible for checking that all safety decals are in place and are in readable condition. If found to be missing or unreadable for any reason, steps should be taken to obtain replacements.

3.10 **⚠WARNING** Inspect the tires and brakes on the truck. Never drive a truck with bald or cracked tires, or with weak or worn brakes. If you have air brakes, be sure that the air system is free from leaks and will maintain pressure when driving. Loss of air pressure will cause the brakes to be applied while driving. If driving continues after the brakes are applied, the resulting friction could cause enough heat to start a fire.

3.11 Drain moisture from the air tanks that supply the unit's brakes (if so equipped). This is especially important if weather conditions could cause the moisture to freeze. If you lose air pressure because of frozen moisture, the brakes will apply themselves, and you will have to stop driving until the unit is repaired.

3.12 **⚠WARNING** (See Figure 5.) Mount or dismount the pump or truck using the *3 Point Rule* (i.e. keep two hands and one foot or one hand and two feet in contact with a secure surface at ALL times).

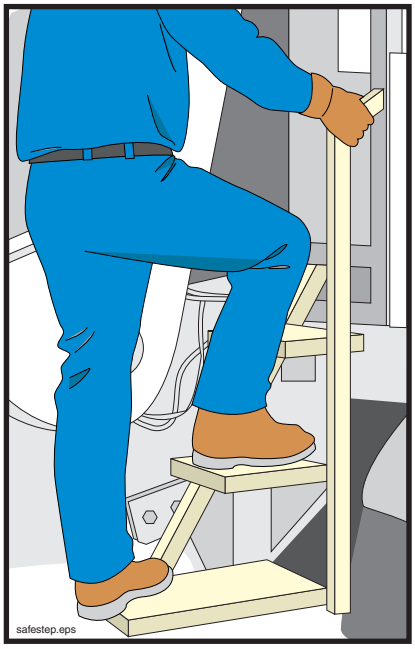


Figure 5
The 3 Point Rule

3.13 **⚠WARNING** Never mount or dismount the truck or pump while carrying objects that prevent you from using the "3 Point Rule." Move the objects separately, if needed.

3.14 **⚠WARNING** Be sure that outriggers are pinned and locked before traveling. If the locking device is damaged or worn, it should be repaired immediately and the unit **must not be driven until the outriggers can be positively locked** against accidental opening (see Figure 6).

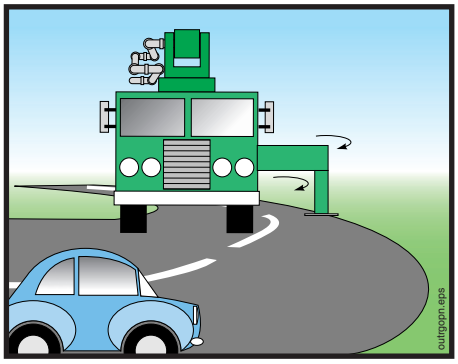


Figure 6
Before driving, be sure outriggers cannot open

3.15 **⚠WARNING** Be sure there is nothing in the cab of the truck (such as empty soda cans, loose tools, etc.) that could interfere with the operation of the vehicle.

3.16 Be sure that all road-related safety devices (warning signs, flares, fire extinguisher, etc.) are present and secured for travel.

3.17 Be sure all personal protective equipment (hard hat, safety goggles, rubber gloves, etc.) are secured for travel.

3.18 **⚠WARNING** Be sure the windshield and mirrors are clean and free of frost or ice, and that the mirrors are properly adjusted.

3.19 **⚠WARNING** Verify that head lights, tail lights, turn signals, brake lights, backup warning horn, and backup lights are operational.

3.20 In some cases you may be asked to operate a machine other than the one with which you are familiar. In these cases, be sure to:

- Know the weight, height, and width of the machine.
- Have a copy of the operation manual with you.
- Ask the machine's normal operator, the dispatcher, or your supervisor questions regarding any unusual or unique operational characteristics of the machine.
- Familiarize yourself with the machine by setting it up in the yard and running the functions, and by familiarizing yourself with the operation manual. This is especially important if the new machine is significantly different than the one you normally operate. Your co-workers depend on you to know the machine.

3.21 **⚠WARNING** Before driving the unit, be sure the boom is securely in its cradle, resting on approved boom rests that are in good condition, and secured by the tie-down strap (if so equipped). On some makes and models, the boom can be damaged by the bouncing motion that occurs while driving, but this damage is easily avoided by using the strap (Figure 7).

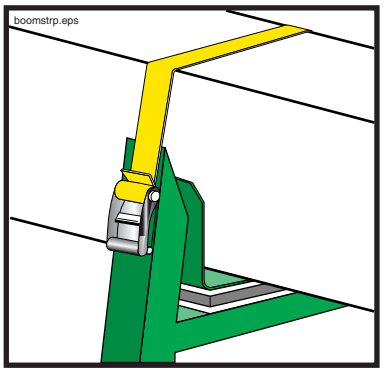


Figure 7
If your unit has a boom strap, use it

3.22 **⚠WARNING** Be certain that all loose items on the unit are secured for travel before driving.

4. Safety Rules For Driving Truck Mounted Concrete Pumps

4.1 **⚠WARNING** **Electrocution hazard!** (See figure 8.) If you're going to drive under low-hanging overhead power lines and it is not possible to maintain adequate safety distance between the pump and the wires, **you should look for another route!** If none is available, contact the power company responsible for the lines and have them de-energized.

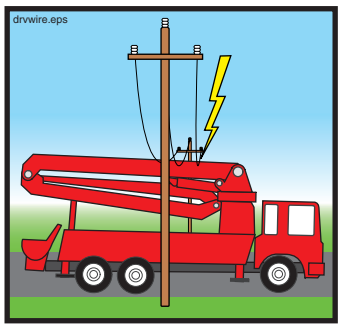
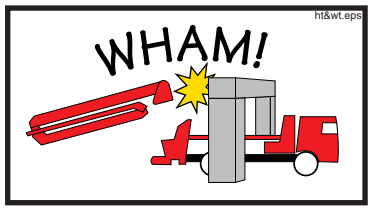


Figure 8
Watch for low-hanging power lines

4.2 Carefully select your route of travel. Avoid steep hills, residential areas, construction, low overpass clearances and narrow bridges whenever possible. **The driver is responsible for knowing the weight and height** of the machine.

4.3 **⚠WARNING** **Collision/falling hazard!** Before driving on bridge or elevated roadways, **be sure that they can support the weight of the vehicle** (Figure 9).



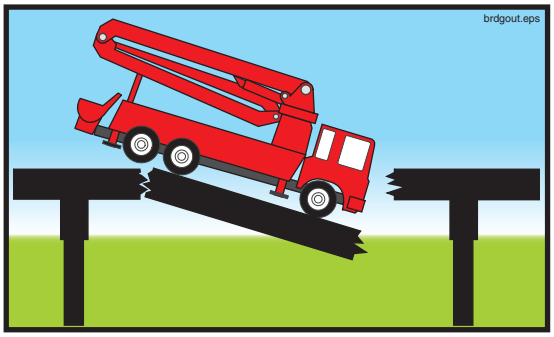


Figure 9
Know your height and weight

4.4 **⚠WARNING** **Collision hazard!** Before driving under ANY structure, **BE SURE** that the machine will clear (Figure 9).

4.5 **⚠WARNING** **Explosion hazard!** Never refuel the unit near hot surfaces, sparks, or open flames (Figure 10).

Figure 10
Be careful when refueling

4.6 **⚠WARNING** **Tipping hazard!** The vehicle must **not** be driven with an unfolded placing boom.

4.7 **⚠WARNING** **Possible boom movement.** Before driving the unit be sure that the distribution gearcase (PTO) has **disconnected** the hydraulic pumps. **Driving with the hydraulic pumps engaged creates a hazard** and is destructive to the pumps.

4.8 **CAUTION** Never drive the unit with concrete in the hopper. Concrete could splash out and damage other cars or property.

4.9 **⚠WARNING** **Runaway truck hazard!** When going down a hill, use one gear lower going down than it would take to go up.

4.10 **⚠WARNING** Truck mounted concrete pumps are generally top-heavy. Use caution when making sharp turns with the vehicle (Figure 11).

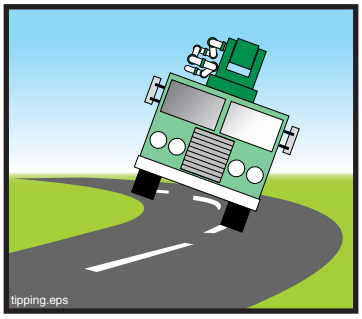


Figure 11
Maintain control on the curves

4.11 **⚠WARNING** Slow down at intersections, near playgrounds, residential areas, and near schools. Children have no knowledge of the increased stopping distances required by heavy vehicles.

4.12 **⚠CAUTION** Be familiar with your emergency equipment. Know how to light a flare, etc.

4.13 **⚠WARNING** Drive defensively. You are at a distinct disadvantage when it comes to maneuverability and stopping distance.

4.14 **CAUTION!** If you must tow the unit, know the correct places to hook the towing cable(s). Improper towing can damage the vehicle or pump.

4.15 **⚠WARNING** **Never** back up without a guide.

4.16 **⚠CAUTION** Know the rules and laws that apply to your state and locality. They have been enacted for your protection and the protection of those around you.

5. Safety Rules For Towing Trailer Mounted Concrete Pumps

5.1 **⚠WARNING** Be sure the towing vehicle is heavy enough and has enough horsepower and braking ability to tow the trailer. This is critical to maintaining control at highway speeds and to braking ability. If the trailer is heavier than the towing vehicle, braking distances will be greatly increased (Figure 12).

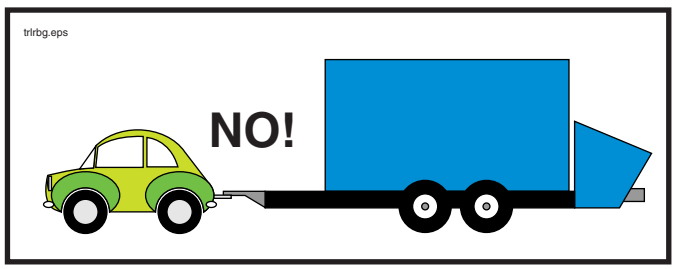


Figure 12
Do not under size the towing vehicle

5.2 **⚠WARNING** Check the tires, tire pressure, and brakes on the trailer before towing. Never tow a vehicle with cracked or bald tires. A trailer tire blowout can cause loss of control in the towing vehicle.

5.3 **⚠WARNING** Be especially careful on ice or slippery roads when towing a trailer. A skid that would normally be easily correctable can be multiplied by the trailer, causing loss of control.

5.4 **⚠WARNING** Be sure that the electrical connections between the towing vehicle and the trailer are sturdy and reliable, and that the lights on the towing vehicle and trailer are working.

5.5 **⚠WARNING** Always use safety chains and break-away protection when towing a trailer.

5.6 **⚠CAUTION** Be aware of local or state regulations regarding mirrors and lights when towing a trailer.

5.7 **⚠WARNING** When towing a trailer, your stopping distance and turning radius are greatly increased. Be aware of this **at all times**.

5.8 **⚠WARNING** When towing a trailer long distances, it is important to check the hitch, wiring, and safety chains frequently.

5.9 **⚠WARNING** Be aware of your length when towing a trailer. A common cause of trailer accidents is turning too close to curbs or objects.

5.10 **⚠WARNING** Never back up a trailer without a guide.

II. On The Job site

6. Safety Rules For Job Setup

SETTING UP A TRUCK MOUNTED BOOM PUMP

6.1 **The job setup phase can set the stage for accidents.** Taking a few extra moments to correctly set up the job will improve your chances of having a safe, trouble-free day.

6.2 **The operator is responsible for the safe operation of the machine**. Notify your employer, the job superintendent, and/or O.S.H.A. if you are being asked to set up in an unsafe manner. **You are never required to take a chance with safety.** You are the **only** person who can determine that the job circumstances under your control are safe.

6.3 Canadian law requires that the boom remains a minimum of 7 meters from electric wires. To conform to the Canadian law, any text in this manual that refers to a 17 foot or 5 meter safety distance from electric wires should be read as 7 meters for use in Canada.

6.4 **⚠ DANGER** **When overhead wires are in the area that the boom will be moving to complete a pour, a spotter must be employed whose only job is to warn the operator if the boom comes within 17 feet of the wires.** The spotter must understand the responsibilities assigned, and must be able to judge a 17 foot distance.

6.5 **⚠ DANGER** **You MUST avoid hazardous proximity or contact with electric lines at all times!** Position the machine so a minimum safety distance of **17 feet (5 meters)** is maintained in all boom positions needed to do the job (Figure 13). **Never decrease the safety distance to reach an unsafe area with the boom.**

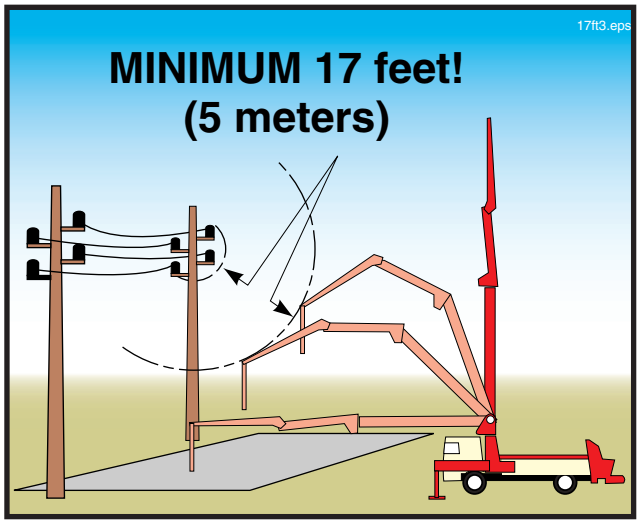


Figure 13
Always maintain the safety distance

6.6 **⚠ DANGER** If you are in doubt about your proximity to high voltage wires, or if it is not possible to maintain 17 feet of clearance, you must lay a separate pipeline or use a different placement method. **Never take chances with high voltage!** (See Figure 14.)

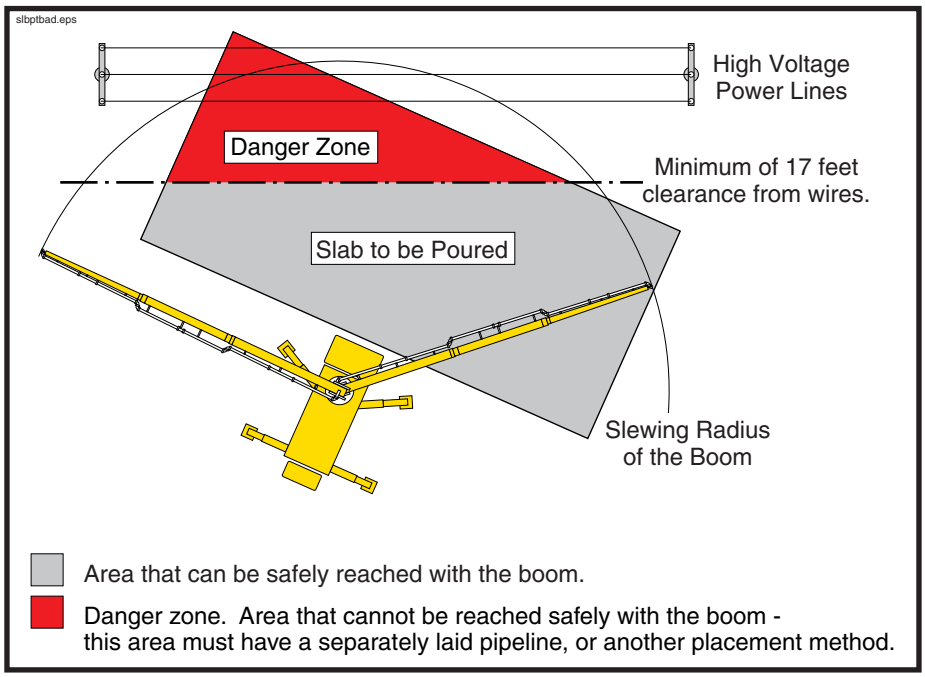


Figure 14
Lay a separate pipeline if you can't maintain the safety distance

6.7 **⚠ DANGER** Do not put the boom on top of electrical wires, even if you can maintain 17 feet of clearance. Mechanical or hydraulic malfunction may cause the boom to move down (Figure 15).

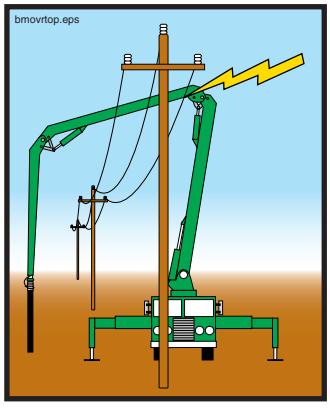


Figure 15
Never boom over wires

6.8 **⚠ DANGER** **It is crucial to take electric wires into consideration during setup, even if they are away from the area to be pumped!** Accidents may occur during cleanout and moving that can be avoided by proper initial setup. In the illustrations below, the pour is outside of the minimum safety distance, but the danger still exists. You **must** be aware of the wires at all times! (See Figure 16.)

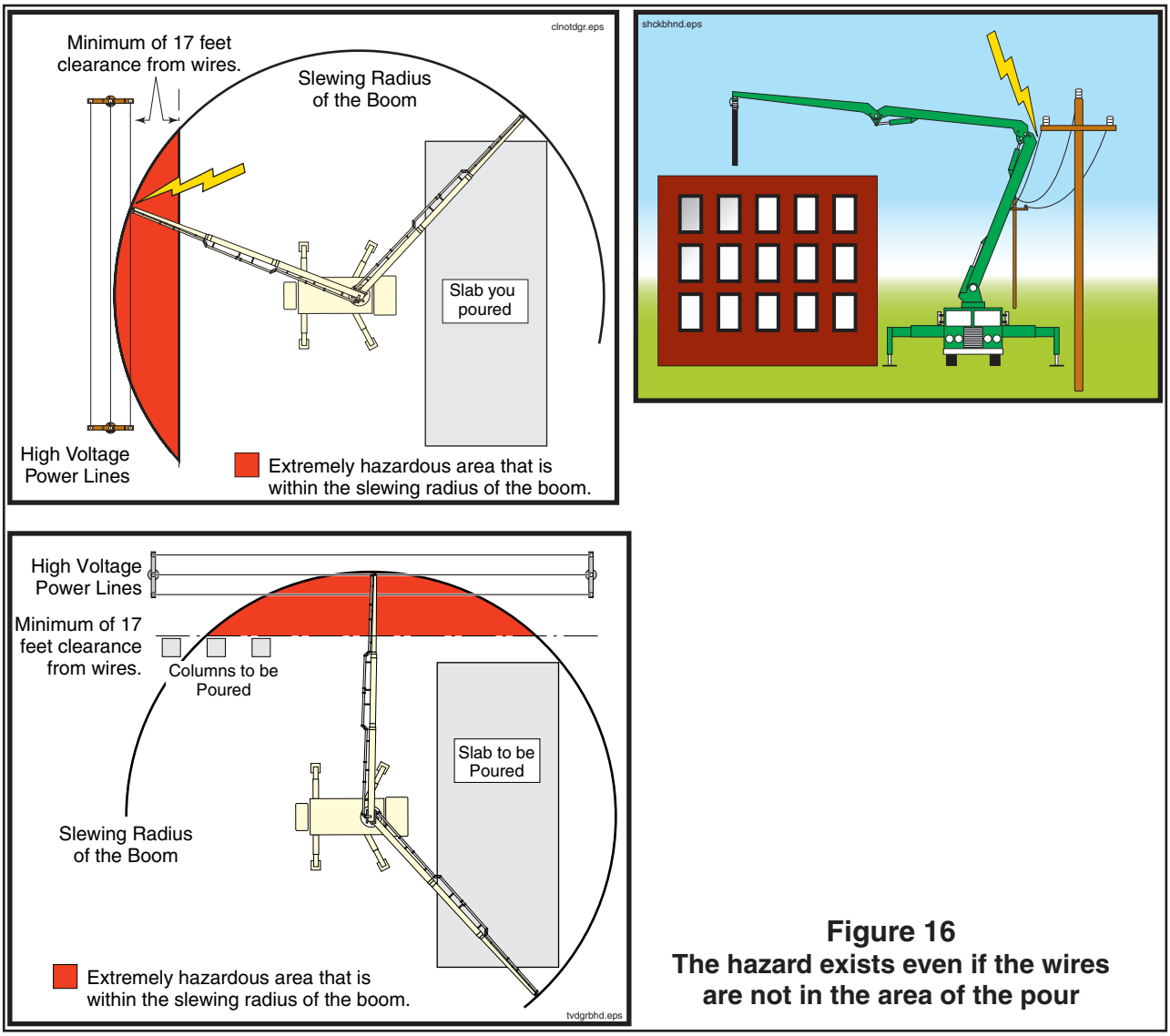
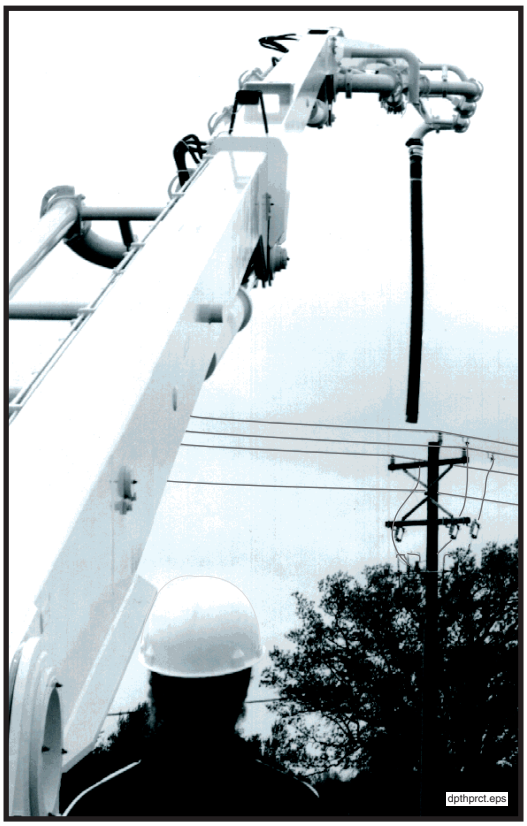


Figure 16
The hazard exists even if the wires are not in the area of the pour

6.9 **⚠ DANGER** Depth perception varies from person to person and is affected by the distance from the objects being observed. Minimum distances from electrical wires and other obstructions should always be judged by placing yourself in a viewing position that does not require depth perception judgements. If this is not possible, a spotter **must** be used! See the glossary for the definition of spotter (Figure 17).



Will it hit the wires?
You can't tell from here.

Get the best possible vantage point

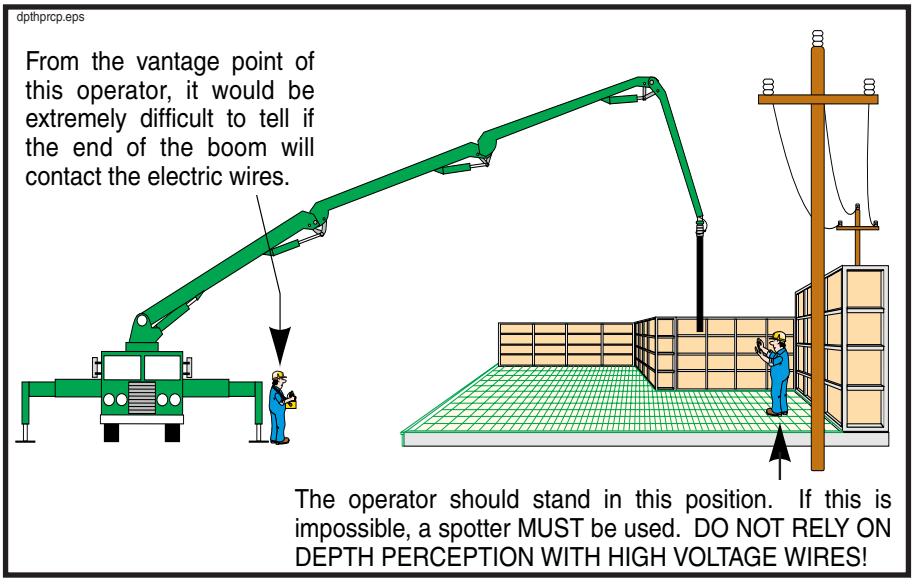


Figure 17
Never rely on depth perception with electric wires

6.10 **⚠ DANGER** Always assume that a power line is live. Never take the word of someone on the job site that it has been de-energized. **Only a qualified representative of the responsible power company can verify that a line has been de-energized** (see Figure 18).

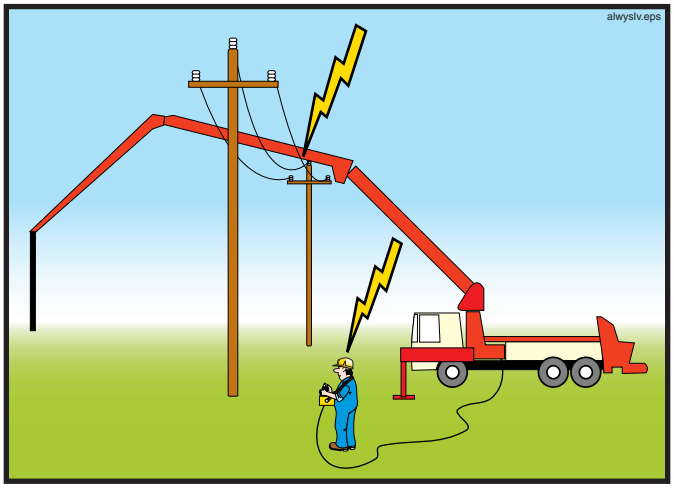


Figure 18
Assume the wires are energized

6.11 **⚠WARNING** Maintain a safe distance from obstructions, such as cranes, scaffolding, and buildings (Figure 19).

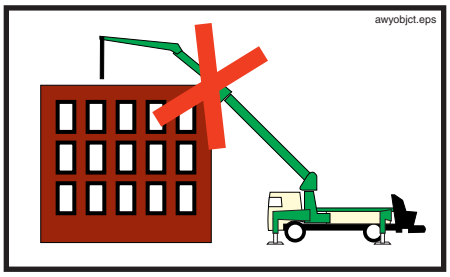


Figure 19
Maintain a safe distance from obstructions

6.12 **⚠WARNING** Place wheel chocks under the tires on sloping terrain. Release the brakes and allow the machine to settle against the chocks, then reapply the brakes.

6.13 **⚠CAUTION** Remove any snow, ice, oil, or dirt from steps and platforms.

6.14 **⚠WARNING** Possible boom damage! Never add extensions to the end of the placing boom! If continuation pipes are connected to the end hose, they must **NOT** impose any load on the boom (Figure 20).

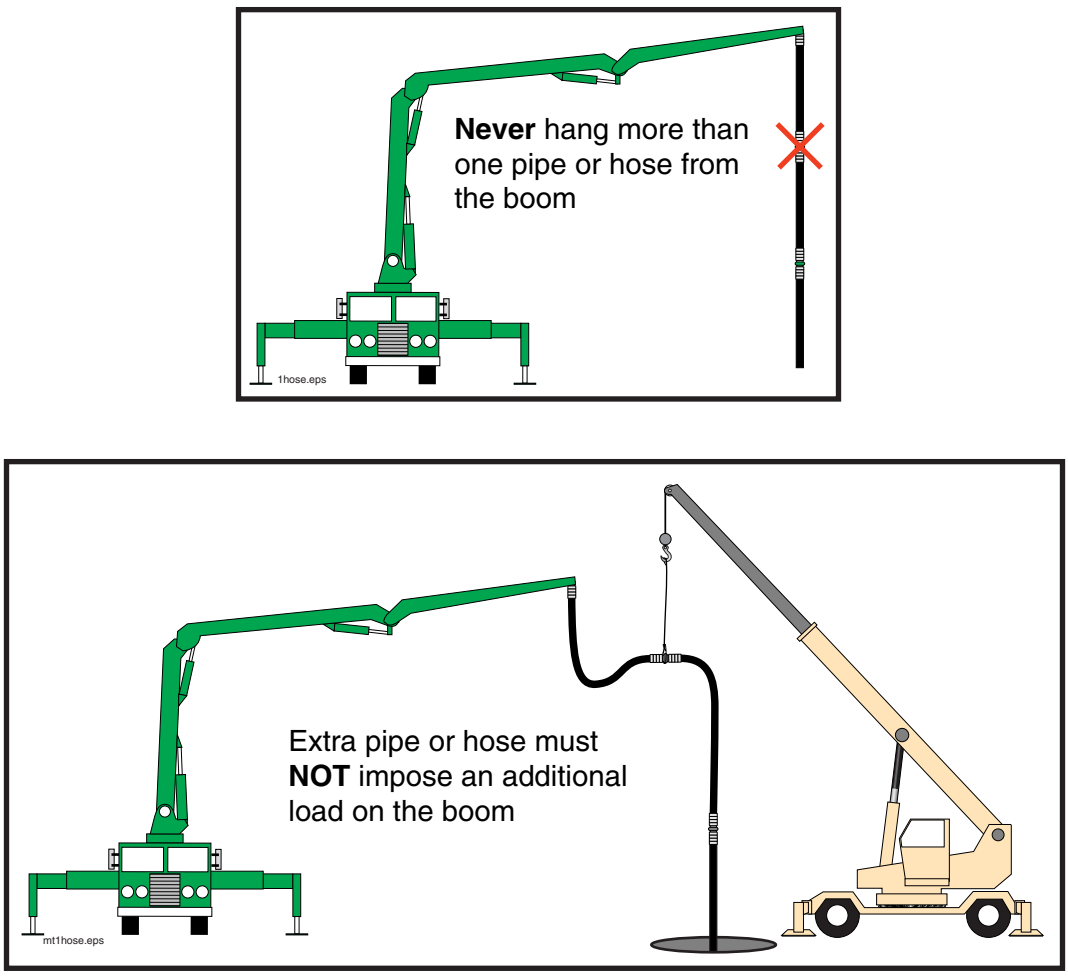


Figure 20
Know and do not exceed the maximum weight allowed to hang from the boom

6.15 **⚠WARNING** The length of a 125mm boom end hose may not exceed 13 feet (4 meters). Certain machines may require a shorter length or smaller diameter end hose. Check with the boom manufacturer.

6.16 **⚠WARNING** Possible structural damage. If you remove the supplied tip hose and replace it with a combination of reducers and hoses, the total weight of all hanging pieces (including the weight of the concrete) must not exceed the weight of the supplied tip hose (including concrete). The supplied tip hose is typically 12 feet long and 125mm (or 5 inch) diameter. When filled with normal, hard rock concrete it weighs 376 pounds. Certain units may have a lower allowable weight and, thus, a different tip hose. The operation manual included with the unit will inform you of the specification if the unit requires a smaller than standard tip hose. It is the operator's duty to know the specification of the unit in operation (Figure 21). **Find out if your unit has special requirements!**

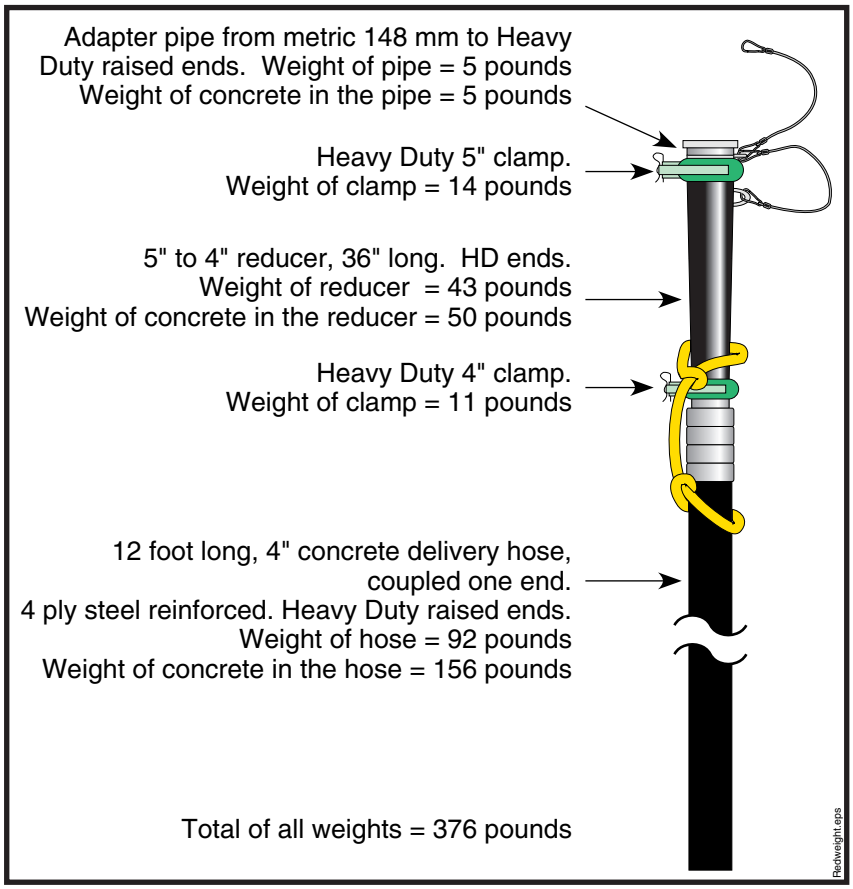


Figure 21
A typical reducer/hose combination

6.17 **⚠WARNING** A *concrete delivery hose* is a flexible concrete hose that has two end couplings. An *end hose* is a flexible concrete hose that has one end coupling. In normal usage, it is preferable to have an end hose as the last piece of delivery system. If you will be swinging the full boom over workers or property you must be able to plug the delivery system. See the instructions for plugging the delivery hose on page 43.

6.18 **⚠WARNING** All hanging system components must be fastened with safety cables or straps, and **each component must be capable of handling the maximum concrete pressure of the machine** (see Figure 22).

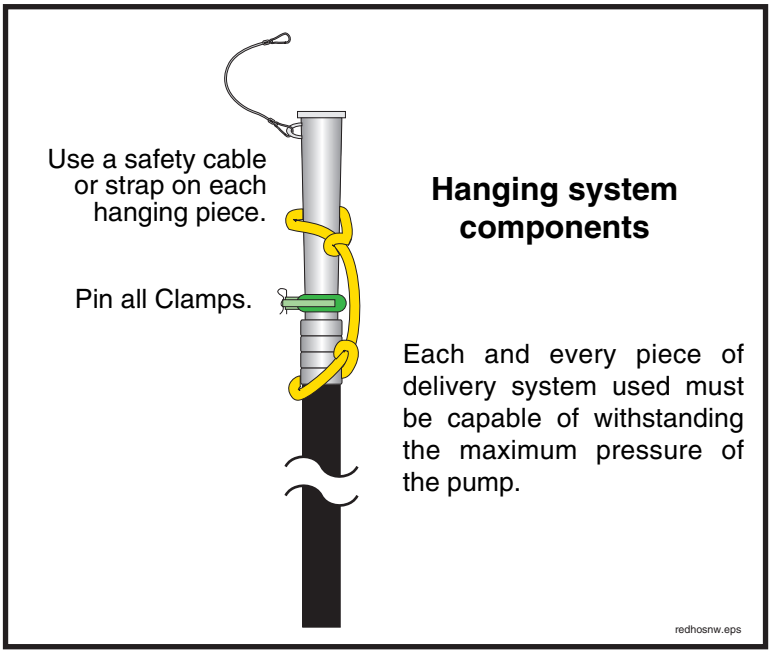


Figure 22
Assure the safety of hanging system components

6.19 **⚠WARNING** Placing booms possess a very wide effective operating range. Due to this high degree of mobility, some placing booms can reach a position unsuitable for practical operation. Under certain circumstances **overloading, tipping, or damage to the boom is possible**. These unsuitable areas are documented on safety decals and in operation manuals (see Figure 23). **Be aware of these areas if they apply to your unit and set up the pump taking these areas into consideration**.

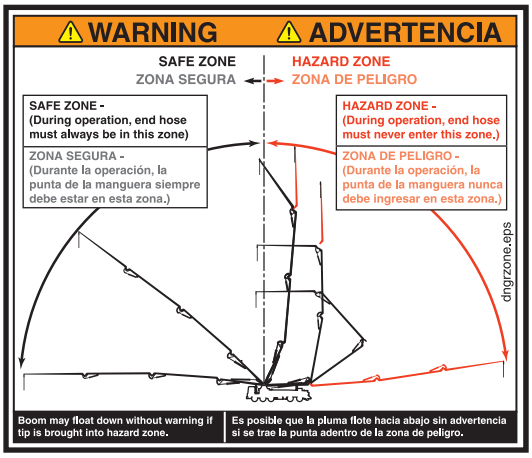


Figure 23
An example of a hazard area decal

6.20 **⚠WARNING** Collision hazard! Secure the immediate area of the machine from public traffic in accordance with all applicable regulations (warning lights, safety cones, barricades with flashers, etc.).

6.21 **⚠WARNING** Consider the safe approach and departure of the ready-mix trucks and adjust your setup accordingly. Adjusting your setup position by a few degrees one way or another could mean the difference between a safe approach and an unsafe approach. Some examples of unsafe approaches are: too near an excavation or sticking out into traffic.

6.22 **⚠WARNING** If you set up the unit with one or more outriggers not fully extended on the side away from the pour (shortrigging), you will tip the machine if you forget and rotate the boom over the side with the unextended outriggers. That being said, it is known that under certain circumstances, shortrigging is unavoidable (see Figure 24). If no alternatives are practical and you must shortrig for a particular job, keep these points in mind.

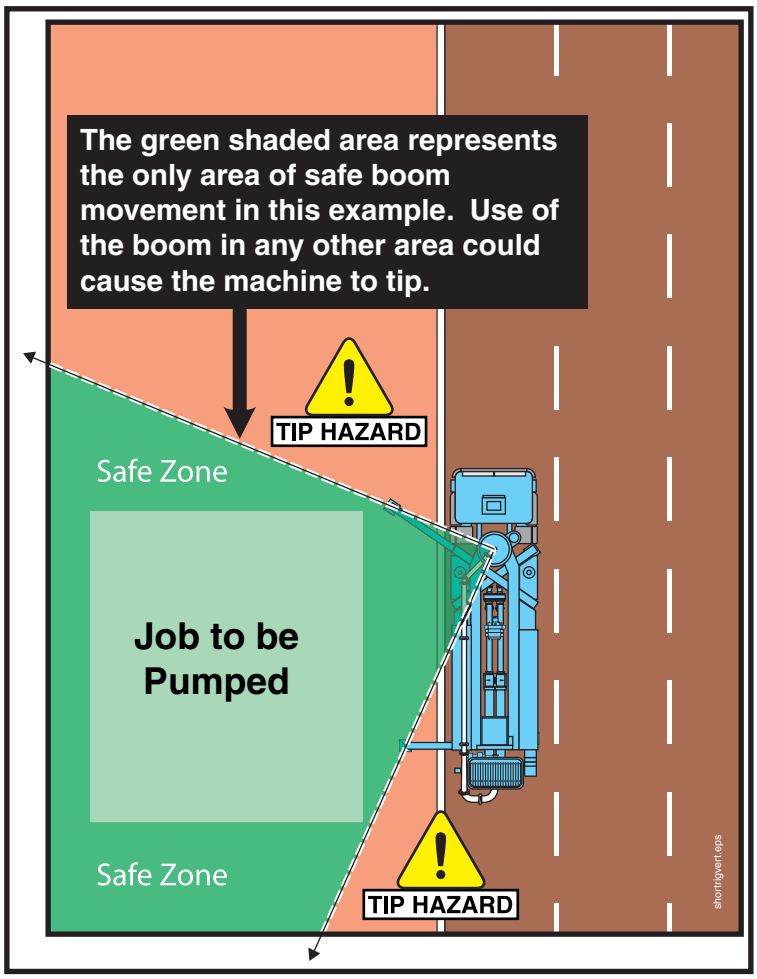
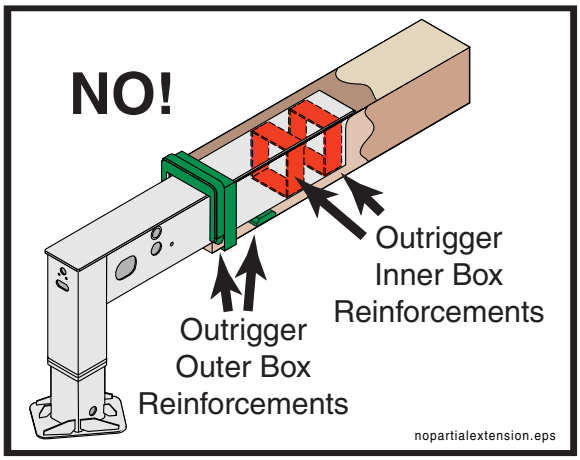


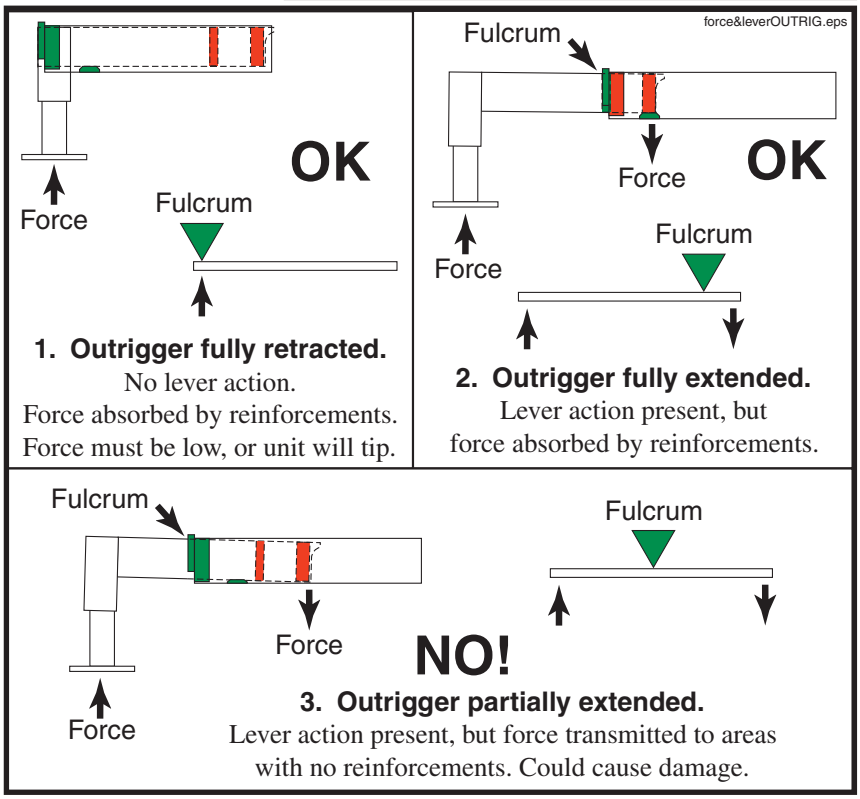
Figure 24
Shortrigging

- You may only operate the boom when it is placed between outriggers that are completely extended; you may tip if the boom is placed anywhere else.

- You should still jack the outriggers that are not fully extended. This will assist in stabilizing and preventing the unit from rocking. The margin of safety this gives you is very small; and won't prevent you from tipping.
- Don't get lazy! If it is possible to extend all of the outriggers, do it!
- Don't forget that you didn't fully extend all the outriggers. Explain to other workers on the job what will happen if you forget and slew the boom over unextended outriggers. That way, if they see you are moving the boom into a tipping area, they may be able to warn you.
- Outriggers that cannot be fully extended should NOT be partially extended unless specifically allowed by the manufacturer. The inner and outer outrigger box reinforcements will not align in intermediate positions. (Figure 25.)

Figure 25
Partial extension is not allowed





⚠WARNING When setting the outriggers, jack the unit to within 3° of level, or according to the operation manual of your unit. If the unit is not set up within the specification for level, the boom brakes could fail, causing the boom to rotate downhill by the force of gravity.

6.23 **⚠WARNING** Tipping hazard! Do not unfold the boom until the outriggers have been correctly positioned and secured! The outriggers must be completely extended and opened as described in the operation manual. Do not partially extend the outriggers because intermediate positions are **not safe!** See the information regarding shortrigging (paragraph 6.22).

6.24 **⚠WARNING** Tipping hazard! Check soil conditions before jacking the outriggers. If necessary, use cribbing or suitable pads under the outrigger legs to increase the area of soil contact. See the chart in Figure 26 for examples of load bearing capacities of various soil types and for an example of how to calculate how much cribbing is needed. If in doubt, the site management may be able to supply the load bearing capacity of the soil.

APPROXIMATE PRESSURE SUPPORTING CAPABILITY OF VARIOUS TYPES OF SOIL

Virgin ground	22 PSI
Asphalt, min. 8" thick	29 PSI
Compressed crushed stone	36 PSI
Clay/silt soil, firm	43 PSI
Mixed granular soil	51 PSI
Firm compacted gravel	58 PSI
more compacted	72 PSI
more compacted (e.g. class 5)	109 PSI
Brittle weathered rock	145 PSI

To calculate soil pressure: Divide the force on the outrigger leg (from the decal) by the number of square inches of soil contact.

PSI = LOAD÷AREA

PSI = pressure on the soil
Load = force in pounds
Area = square inches of soil contact.

EXAMPLE: Load bearing capacity of the soil (8 inches of asphalt) = 29 PSI
Force on the soil by the outrigger leg = 40,000 Pounds (from decal)
Pad on outrigger = 12" x 12" (144 square inches)
40,000 ÷ 144 = 278 PSI.
In this example you could expect the outrigger to sink into the asphalt and possibly cause a tip-over. To prevent this, you install additional cribbing:
Additional cribbing = 40" x 40" (1600 square inches)
40,000 ÷ 1600 = 25 PSI
Now the asphalt should support the outrigger.

soilpres.eps

Figure 26
Calculating load bearing capacity

6.25 **⚠WARNING** Tipping hazard! Regardless of whether you know the load bearing capacity of the soil or not, you must test your setup by slowly moving the empty boom over each outrigger (Figure 27). If the outrigger begins to sink, retract the boom or move it back in the direction from which it came, until the weight of the boom is removed from the outrigger. Add more cribbing under the outrigger pads and retest until the outriggers are stable. When you put concrete in the boom, again check the outriggers for sinking. Continue to add more cribbing until the soil can support the load. After the pour begins, continue to check the outriggers for sinking throughout the course of the day. The stability of the unit **must** be ensured.

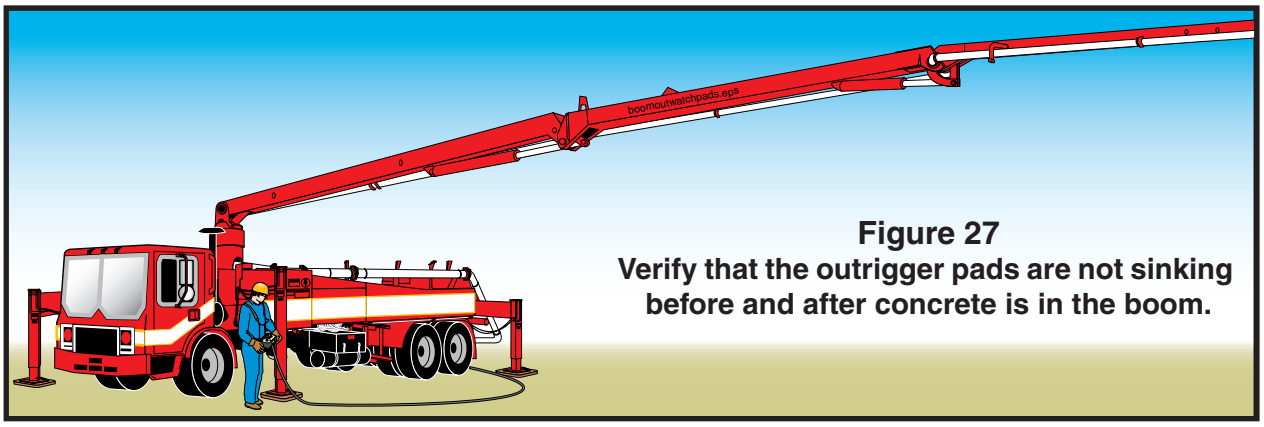


Figure 27
Verify that the outrigger pads are not sinking before and after concrete is in the boom.

6.26

⚠WARNING TIPPING HAZARD! Maintain a safe distance between the unit and the edge of a cliff or any excavation. The rule of thumb is: for every foot of drop, stay back from the base edge at least 1 foot (the one to one rule). (See Figure 28.) Note that the forces on the outriggers are transferred to the soil at a 45° angle. Watch out for the condition shown in Figure 29.

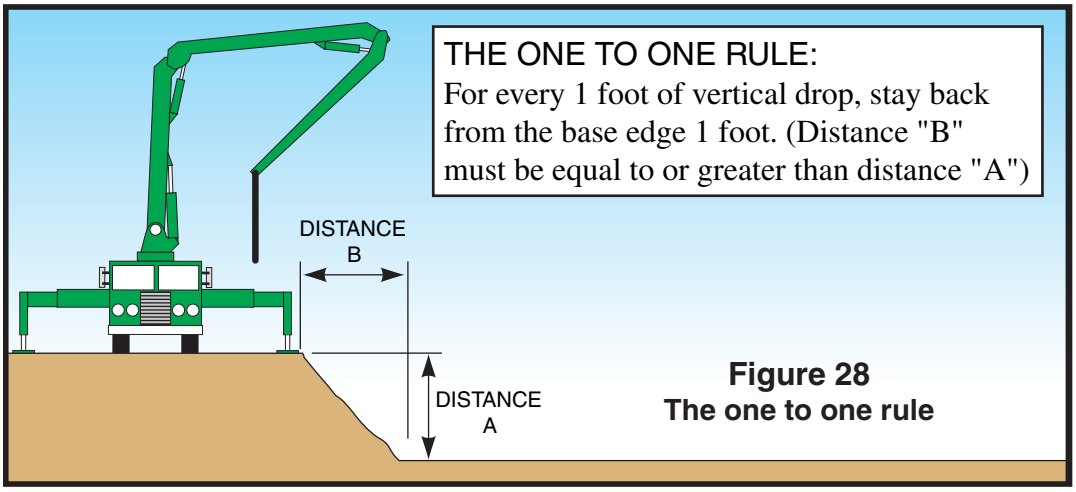


Figure 28
The one to one rule

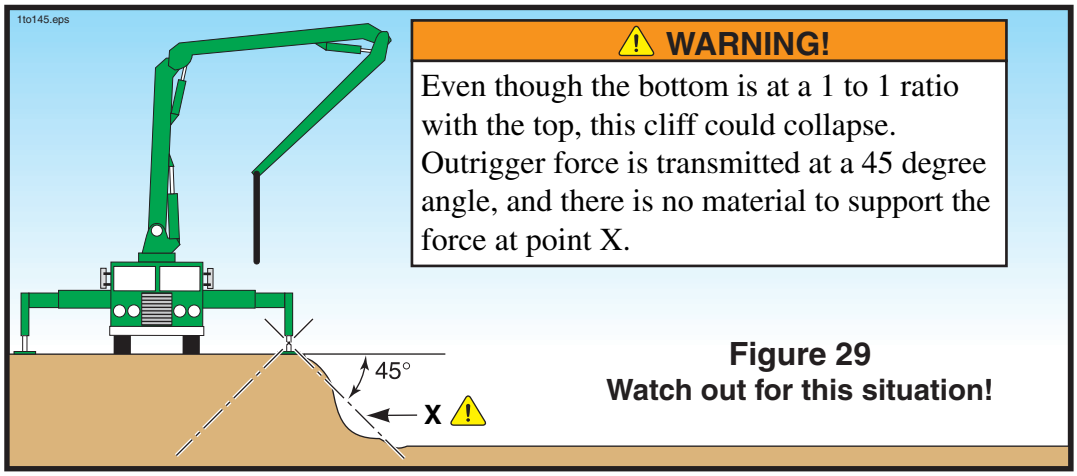


Figure 29
Watch out for this situation!

6.27 **⚠WARNING** Tipping hazard! Take care when setting the outriggers (Figure 30). Never set up on uneven or hilly soil or try to bridge a hole with cribbing. In these cases, you could dig a flat spot in the soil (A, B, & C). Be sure that the outrigger pad contacts all pieces of cribbing. Run cribbing in the opposite direction, if needed (D).

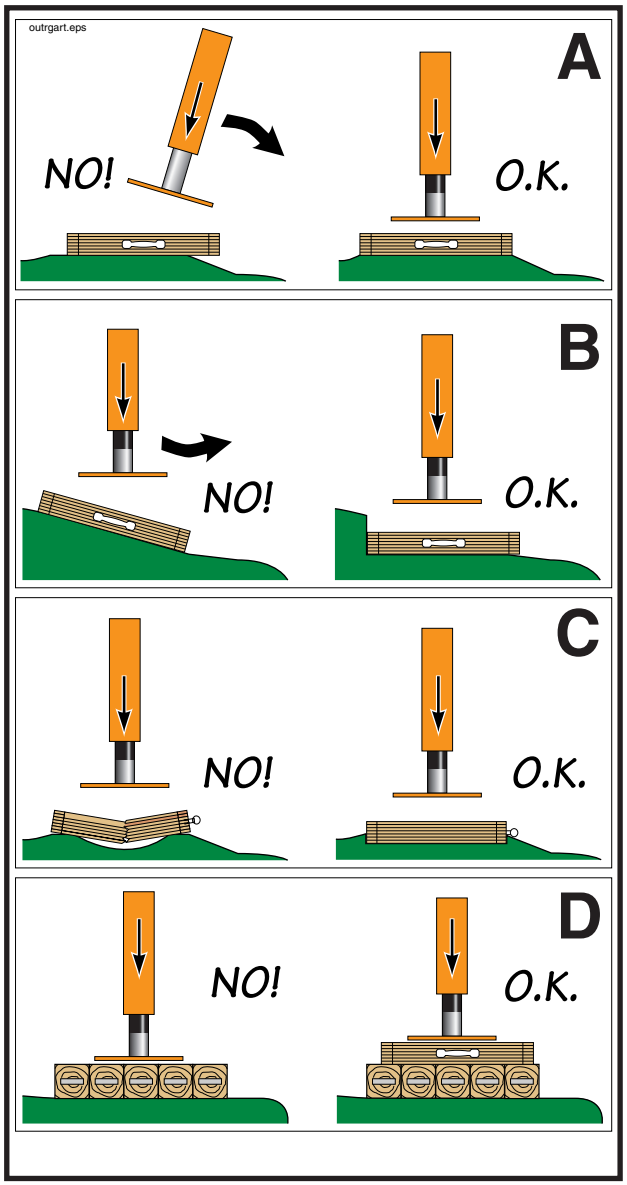


Figure 30
Beware of these outrigger hazards

6.28 **⚠WARNING** When you have the outriggers positioned correctly, close all outrigger hydraulic shutoff valves (if your machine is so equipped).

6.29 **⚠WARNING** Do not unfold or operate the placing boom when lightning is present in the immediate area. If you are operating and lightning moves into the area, put the boom into the transport position, or another low position, and seek shelter until the lightning is gone.

6.30 **⚠WARNING** Tipping hazard! Do not operate the placing boom when wind velocity exceeds 48 m.p.h. (77 k.p.h.)! When wind velocity exceeds 48 m.p.h. the machine could tip, and the boom may not be able to slew into or resist slewing away from the wind.

6.31 **⚠WARNING** If you will be unable to see the point of placement, establish a system of communications with the workmen who will be there. Arrange for radio communications, a system of visual or auditory signals (lights or bells), or a spotter. If a spotter is used, **agree on hand signals before beginning the pour!** If the boom will be moved extensively, arrange for a workman to stay with the pump and to put yourself in a position to see the end of the boom (Figure 31).

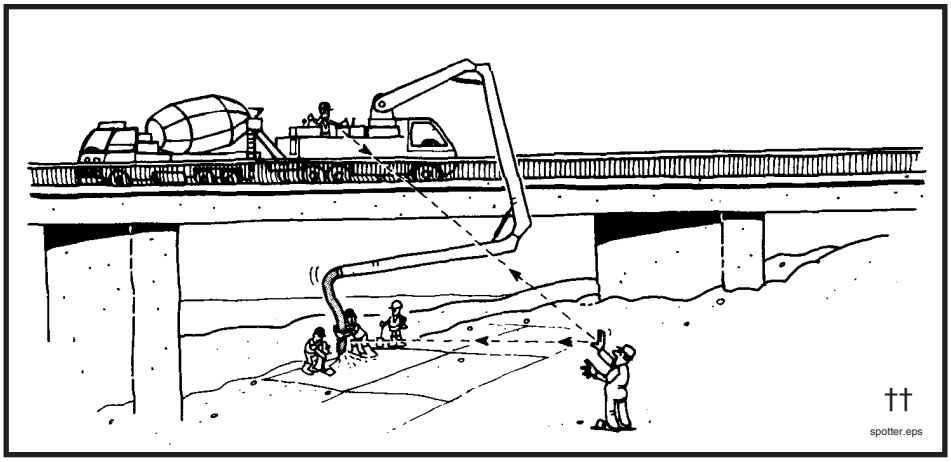


Figure 31
Arrange communications before starting

6.32 **⚠WARNING** **Possible boom damage**! If you will be pumping out of the boom into a separately laid pipeline, you must use a flexible hose to connect them. Do not connect steel pipe directly to the boom. **Be sure that the hose is capable of handling the maximum concrete pressure of the pump**. Do not let the end of the boom rest on the ground when connected to a separately laid pipeline.

6.33 **⚠WARNING** **It is extremely important to verify that the material delivery system of the boom is capable of handling the pressure of the concrete pump.** In some cases, you may not be able to use the boom if you are pumping on piston side. It is up to the machine owner and operator to determine if the boom can be used when pumping on piston side. Keep in mind that pipeline wears out with each stroke of the pump. Verify pipe wall thickness and compare it to pressure handling capabilities of that pipe style. The chart for this comparison is found in the appendix of this manual.

6.34 **⚠WARNING** **Use only material delivery system components in good condition.** The useful life of delivery system components is affected by pumping pressure, concrete composition, pipeline material, velocity of moving concrete, and other factors. The use of ultrasonic equipment for determining pipe wall thickness is highly recommended (Figure 32). Read and understand the minimum wall thickness chart in the appendix section of this manual. If you don't understand the chart, contact the service department of the manufacturer of your machine; they will assist you.

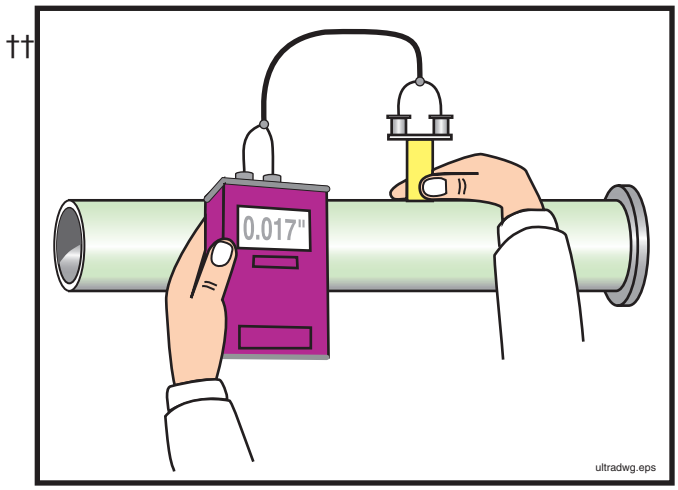


Figure 32
Check for wear on the delivery system components

6.35 **⚠WARNING** **When the machine is ready to work, secure it against unauthorized use!** Either stay with the unit or make sure no one can start it without you. This could be accomplished, for example, by activating the emergency stop switch of the remote control box (cable or radio, whichever is active), then locking it in the cab of the truck. Another way would be to take the transmission out of gear, lock the cab of the truck, and take the key with you.

6.36 **⚠WARNING** **Watch for children!** When the machine outriggers are jacked up, it is very easy for children to access the space underneath the machine. The rotating driveline(s) and hot components pose serious hazards. Do not let anyone remain under the machine while it is running.

6.37 **⚠WARNING** If spectators will be near the pour, cordon off an area where they will be safe. Never operate the machine if it is not safe to do so, even if the spectators just want to see a certain operation or function.

7. Setting Up A Trailer Mounted Pump and/or A Separate Pipeline

7.1 **The job setup phase sets the stage for most accidents.** Taking a few extra moments to correctly set up the job will improve your chances of having a safe, trouble free day.

7.2 **The operator is responsible for the safe operation of the machine**. Notify your employer, the job superintendent, and/or O.S.H.A. if you are being asked to set up in an unsafe manner. **You are never required to take a chance with safety.** You are the **only** person who can determine that the job circumstances under your control are safe.

7.3 **⚠WARNING** The **power connections for electrically driven concrete pumps or separate placing booms must be made by a licensed electrician.** The supply power and appropriate disconnect boxes are the responsibility of the contractor.

7.4 **⚠WARNING** **Electrical power on the job site may be taken only from a fused, grounded disconnect box with a disconnect switch that can be locked against activation.** If you will be making repairs to the concrete pump or separate placing boom, first lock out the power at the disconnect box**.**

7.5 **⚠WARNING** On units equipped with electric motors, **check the power cables every day.** If they are frayed or have open spots in the insulation, replace the wire. If the connectors are worn or loose, have repairs made by a licensed electrician.

7.6 **⚠WARNING** **Consider the safe approach and departure of the ready-mix trucks and adjust your setup accordingly.** Adjusting your setup position by a few degrees one way or another could mean the difference between a safe approach and an unsafe approach. Some examples of unsafe approaches are: too near an excavation or sticking out into traffic.

7.7 **⚠WARNING** **Avoid collisions!** Secure the immediate area of the machine from public traffic in accordance with all applicable regulations (warning lights, safety cones, barricades with flashers, etc.).

7.8 **⚠WARNING** Pipelines, end hoses, couplings, and all other **material delivery components must be able to withstand the maximum concrete pressure of the pump. Be sure** of it! Read and understand the minimum wall thickness chart found in the appendix of this manual.

7.9 **⚠WARNING** Do not use a piece of pipeline, end hose, coupling, or any other material delivery component that is not in good condition. **Replace, do not repair damaged pipes and hoses.** Concrete pipeline system is subject to wear, and the rate of wear is affected by pumping pressure, concrete composition, pipeline

material, and other factors. Read and understand the minimum wall thickness chart in the appendix of this manual. **Bursting pipes and concrete escaping under pressure is a serious safety hazard!** (See Figure 33.)

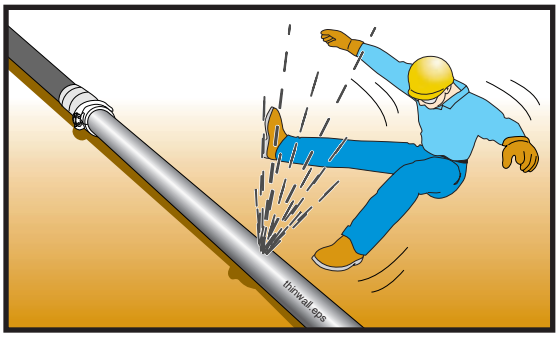


Figure 33
Delivery system components must be able to withstand maximum pump pressure

7.10 When laying out a pipeline, it is preferable to use an elbow instead of a hose to make direction changes. Elbows have less resistance to flow than hoses, and will therefore reduce the overall pressure required to push the concrete.

7.11 Always use the largest diameter pipeline that is practical, and use steel pipe instead of rubber hose. This will keep the pressure required to push the concrete to a minimum.

7.12 Support the delivery pipeline. Either an "S" transition pipe should be used to bring the pipe to ground level, or **each** section of the pipeline should be supported at the pump outlet level.

7.13 **⚠WARNING** The sections of pipe nearest the pump are subjected to the highest pressure and the greatest wear. Because of this increase of pressure near the pump, you should install only thick walled pipe, in "like new" condition there. Read and understand the minimum wall thickness chart in the appendix of this manual.

7.14 **⚠WARNING** **The maximum concrete pressure of the pump must be the only factor used to determine what thickness of pipe and what type of ends are needed**. In the case of a rock jam or any other type of blockage, **the maximum pressure of the pump will be exerted**.

7.15 Grooved (Victaulic) ends are **not recommended** for concrete pumping. Read and understand the comparison between heavy duty raised, metric, and grooved ends in the appendix of this manual.

7.16 **⚠WARNING** If the pipeline remains on the job (as is the case when pumping a high rise building), **the operator is responsible for checking the pipeline for dents, cracks, wear, and continuity each day before the pour begins**.

7.17 **⚠WARNING** In vertical runs, the weight of the vertical sections of pipe must be supported by a thrust block (often called a *deadman,* Figure 34) or other load-bearing device. **Each section of pipeline in a vertical run must be secured from lateral and horizontal movement.**

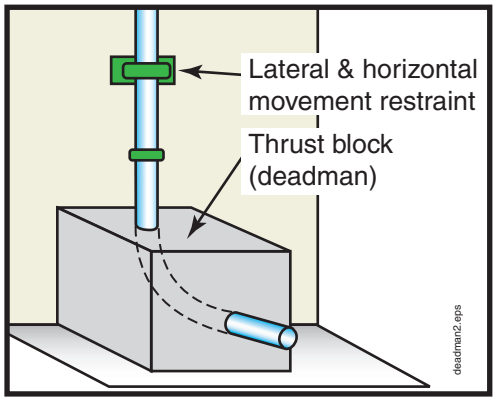


Figure 34
A thrust block (deadman)

7.18 **⚠WARNING** If you will be unable to see the point of placement, establish a system of communications with the workmen who will be there. Arrange for radio communications, a system of visual or auditory signals (lights or bells), or a spotter (Figure 35). If a spotter is used, **agree on hand signals before beginning the pour!**

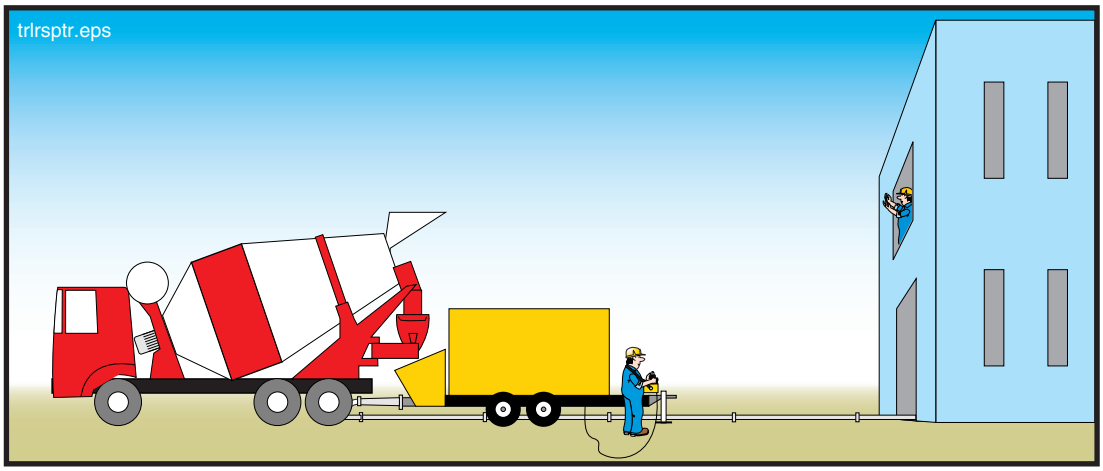


Figure 35
Arrange communications before starting

7.19 **⚠WARNING** Never leave the machine unattended when it is running or ready to run. Stop the engine and remove the key if you must leave the area. Make sure no one can start the machine without you. If you're unsure that the engine would restart, you must leave someone to monitor the unit. This is especially critical if there are children in the vicinity.

7.20 **⚠WARNING** Watch for children! It is easy for children to access the space underneath the machine, but it is not safe for them to do so.

7.21 **⚠WARNING** If spectators will be near the job, cordon off an area where they will be safe.

7.22 **⚠WARNING** If you will be cleaning the pipeline with compressed air at the completion of the job, **be sure that you have all the necessary accessories to do the job safely.** If you don't have all of them, make arrangements to get them before you begin to pump. **Do not improvise on this. Make sure** that you have the right parts. The minimum accessories include:

- A blow out head with properly sized air discharge regulator valve, and separate water/air inlet. The two openings should be spaced apart far enough that a blowout ball could not cover both openings at once.
- A *go devil*, or a hard sponge ball. Regardless of which is used, it **must** fit into the pipeline tight enough that air cannot escape ahead of it.
- A ball or "go devil" catcher that will catch the go devil or ball, or some other method of controlling the discharge while the line is being purged of material. There are two types of catchers (see paragraph 7.23).
- A hose that is rated for the pressure of the air compressor you will use and that is able to connect with both the air compressor and the blow out head. The hose must be in good working condition and must be free of cracks, frays, tears or other damage.
- If you will be cleaning the pipeline with compressed air at the completion of the job, be sure an adequate air compressor is available before starting the job.
- If you will be cleaning a vertical pipeline with compressed air at the completion of the job, you **must have a shutoff valve or switching valve installed at the bottom of the vertical run!**

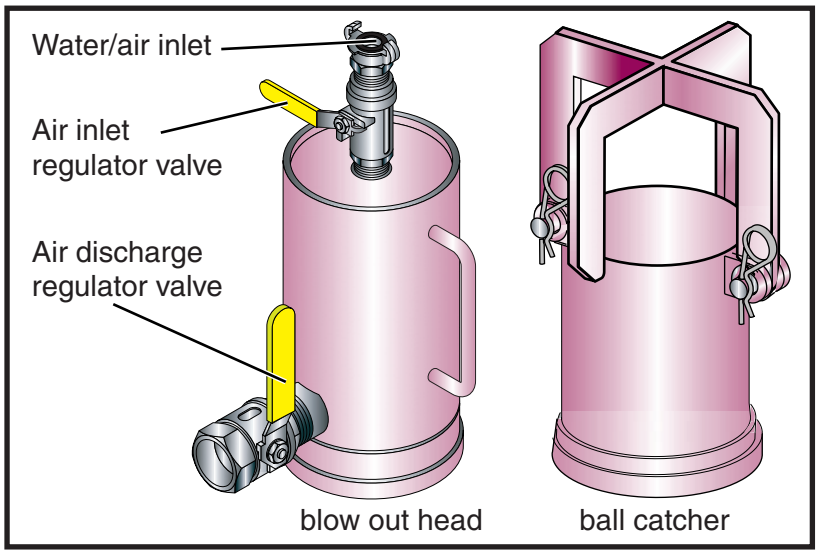


Figure 36
Ball catcher and blow out head

7.23

⚠WARNING There are two types of ball catchers. Know which type of catcher you are using. You may need to adjust your clean out procedure according to which type you have. The two types are as follows.

1. Catchers that stop the ball or go devil before air can escape, and
2. Catchers that allow the air out of the pipeline after the ball or go devil has reached the end.

Each type has advantages and disadvantages (Figure 37).

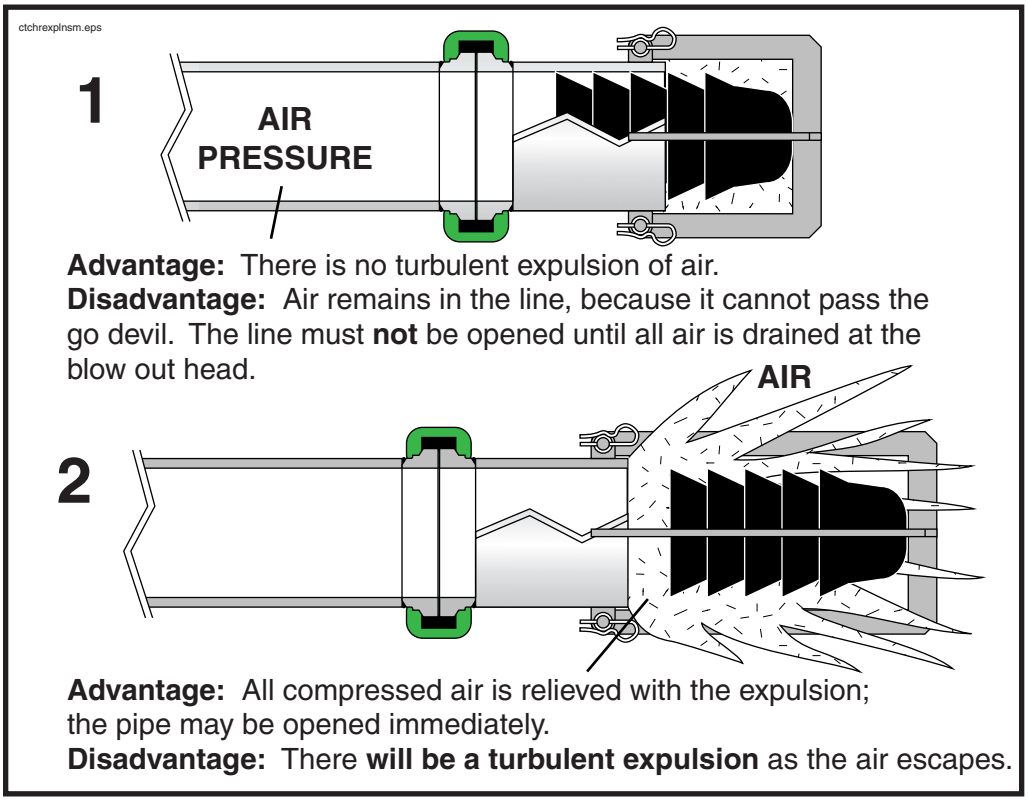


Figure 37
Types of catchers

With catcher type 1, the go devil stops, but air is still trapped behind it. The advantage is prevention of the sometimes violent expulsion of air at the end of the pipe. The disadvantage is that the air must be drained from the blow out head before the pipe line is safe to open. The pipeline must be controlled; allow no one to open it until all compressed air is relieved.

Catcher type 2 is long enough that the compressed air escapes behind the go devil. **Note!** This would happen with either catcher when used with a ball instead of a go devil. The advantage of this is that once you hear the turbulent expulsion, there is no pressurized air remaining in the line, and the line may be opened immediately. The disadvantage is the expulsion itself. In this case, the end of the line must be controlled because flying concrete and aggregate pose a hazard.

Both catchers can be safely used if care is given to the hazards involved.

III. Concrete Pump Operation

8. Safety Rules For Pump Operators

8.1 **⚠WARNING** Only qualified operators are allowed to operate the pump. A "Qualified Operator" is defined as someone who:

- has reached the age of 18 years (21 for interstate travel),
- is physically and mentally capable,
- has been trained in the operation and maintenance of the pump and the placing boom (if applicable),
- has demonstrated his/her capabilities to the employer in respect to the operation and maintenance of the pump and placing boom, and
- can be expected to perform these duties, as assigned, in a reliable manner.

8.2 **⚠WARNING** Because the operator is responsible for the safe operation of the machine, it is crucial that he/she understands the proper operation of the machine and the safety rules that apply to the job at hand, so the course of action taken in unforeseen circumstances will be a safe one. Only thorough training and supervised job experience can supply the necessary understanding.

8.3 **⚠WARNING** When operating the machine, **wear Personal Protective Equipment.** (See Figure 38.)

* Needed when exposed to airborne cement particles (or any other toxic dust).

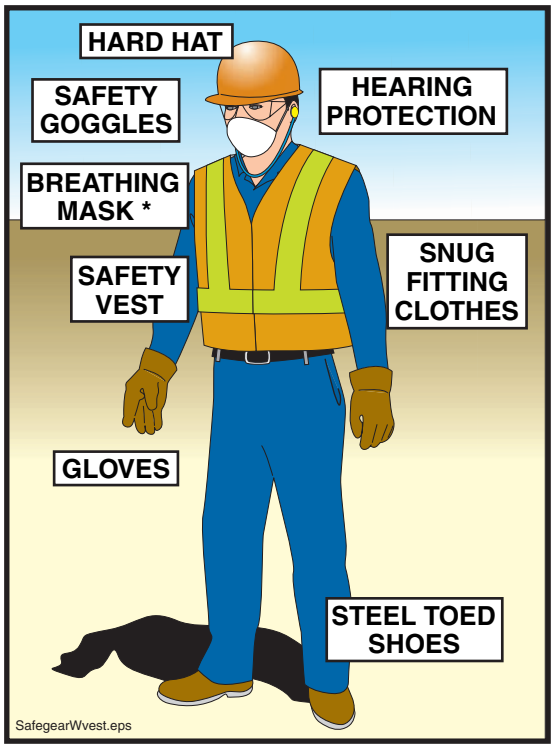


Figure 38
Wear Personal Protective Equipment (P.P.E.)

8.4 **⚠WARNING** All guards, covers, and service flaps must be closed and locked during operation.

8.5 **⚠WARNING** **Electrocution hazard!** If you are operating and lightning moves into the area, put the boom into the transport position, or another low position, and seek shelter until the lightning is gone.

8.6 **⚠WARNING** **Crushing hazard! Never, ever** position yourself between a ready mix truck and the pump! Stand off to the side, so the ready mix driver can see you at all times (Figure 39).

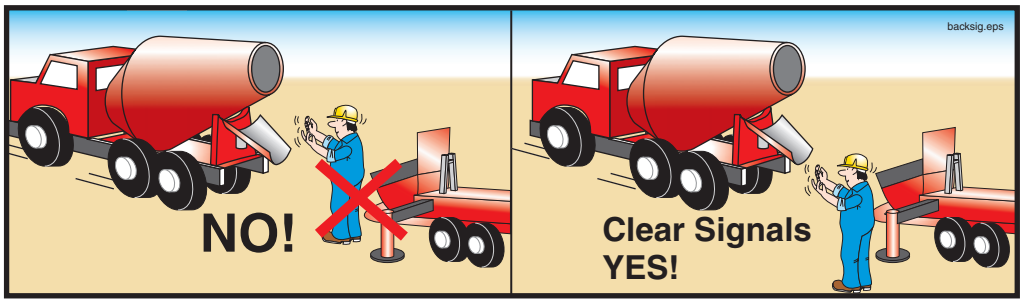


Figure 39
Never stand between the ready mix truck and the pump
Use clear and concise hand signals

8.7 **⚠WARNING** When backing in ready mix trucks, use clear and concise hand signals (Figure 39).

8.8 **⚠ DANGER** You must avoid hazardous proximity or contact with power lines under all circumstances. **Be <u>sure</u>** that you maintain 17 ft. (5 meter) clearance! The 17 foot clearance allows room for the movement of the wires and the boom by wind force, electrical arcing, and human error (Figure 40). **Do not take chances with high voltage; it is the number one killer of concrete pump operators!**

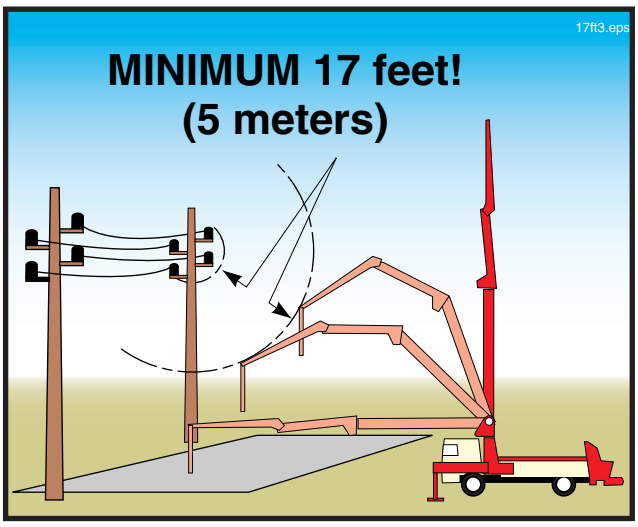


Figure 40
Maintain a clearance of at least 17 feet from wires

8.9 **DANGER** **When overhead wires are in the area that the boom will be moving to complete a pour, a spotter must be employed whose only job is to warn the operator if the boom comes within 17 feet of the wires.** The spotter must understand the responsibilities assigned, and must be able to judge a 17 foot distance.

8.10 **DANGER** Direct contact with a live power line is always dangerous to everyone and anyone electrically connected to the machine (Figure 41). **Use extreme caution** near high voltage wires.

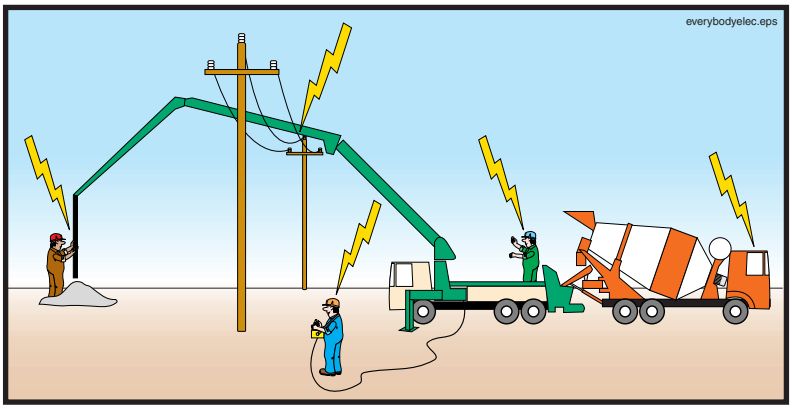


Figure 41
If the pump is energized, everything that touches the pump is also energized

8.11 **DANGER** Do not rely on depth perception when working near high voltage lines. Put yourself at the best possible vantage point to see the distance between the boom and the wires. If that is not possible, then **you must use a spotter!** (See Figure 42.) See the definition of "spotter" in the glossary found in the appendix of this manual.

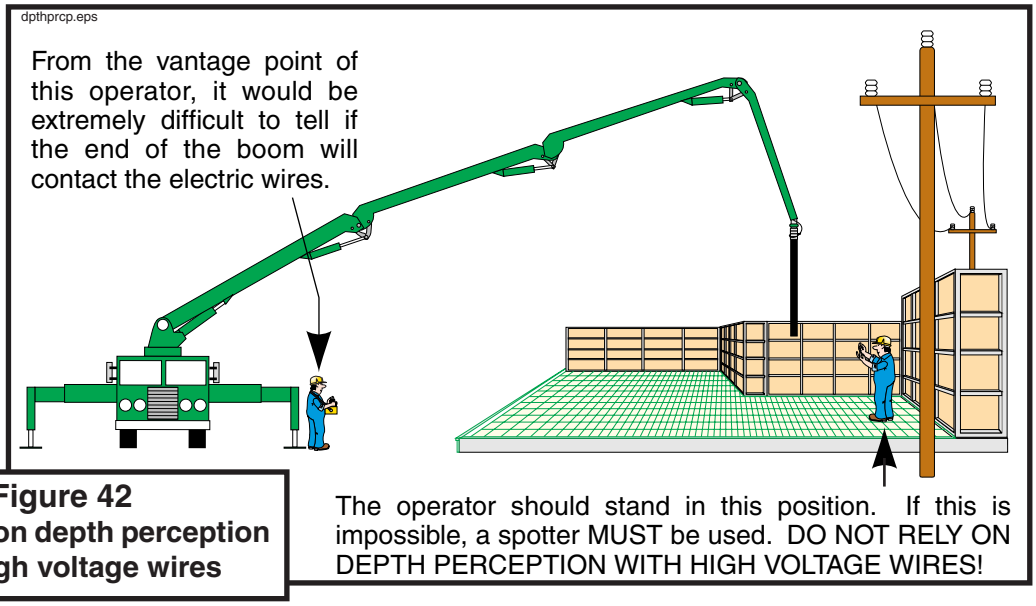
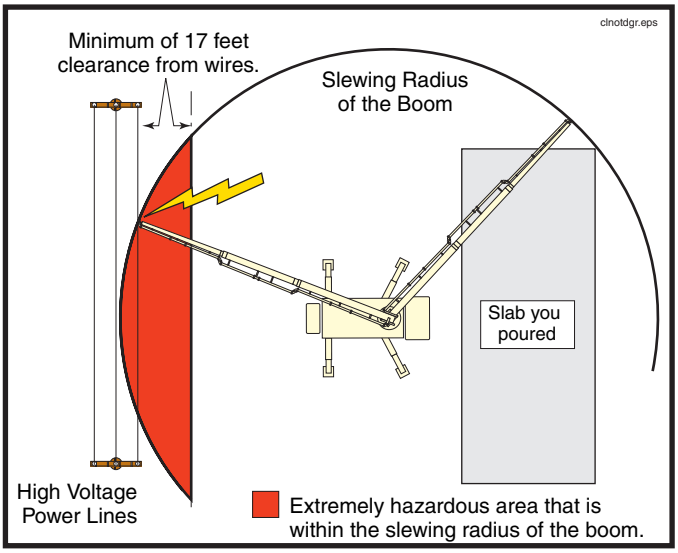


Figure 42
Never rely on depth perception with high voltage wires

8.12 **⚠ DANGER** Watch for wires that are not directly in the area of the pour. Accidents can happen when moving between points of placement, or when moving the boom after the pour is completed (Figure 43). **Never let down your guard when the boom is in the air!**



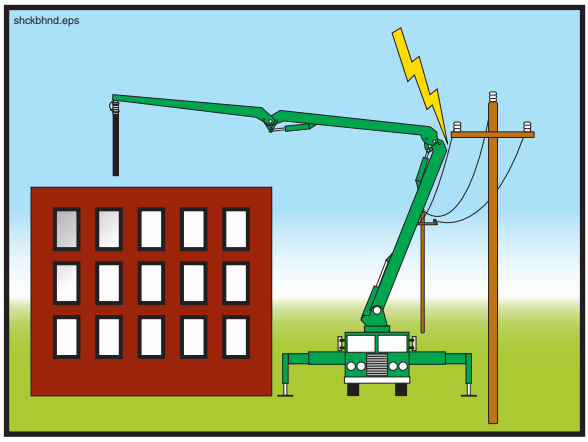


Figure 43
Never let down your guard when moving the boom

8.13 **⚠ DANGER** **High voltage makes conductors out of materials that would normally not conduct**! Many nonconductors will conduct enough current to kill you if you contact the 8000 volts to ground that is normally found on power poles in the United States (Figure 44). Voltage in the wires may be higher than 8000, especially in industrial areas.

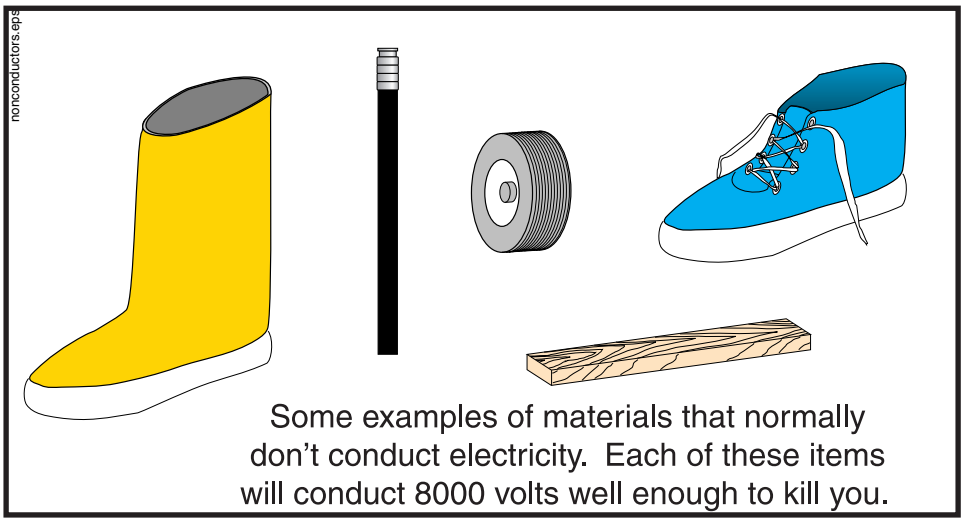


Figure 44
Even poor conductors will conduct high voltage

8.14 **⚠CAUTION** **Loss of hearing!** While standing near a working concrete pump, sound pressure levels may exceed O.S.H.A. standards for constant exposure (Figure 45).

PERMISSIBLE NOISE EXPOSURES*

*Under part 1910.95 "Occupational Noise Exposure," (Dept. of Labor) of the Code of Federal Regulations, Chap. XVII of Title 29 (39 F.R. 7006).

DURATION per DAY in HOURS	Sound level in dB (A) Slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or LESS	115

††

WEAR HEARING PROTECTION!

Figure 45
Noise level and exposure time limits

8.15 **⚠WARNING** Do not allow unauthorized persons in the operational area of the pump and boom. Warn unauthorized persons present in the area to leave and stop work if they do not comply.

8.16 **⚠WARNING** Do not use the boom as a hoist or crane! (Figure 46.)

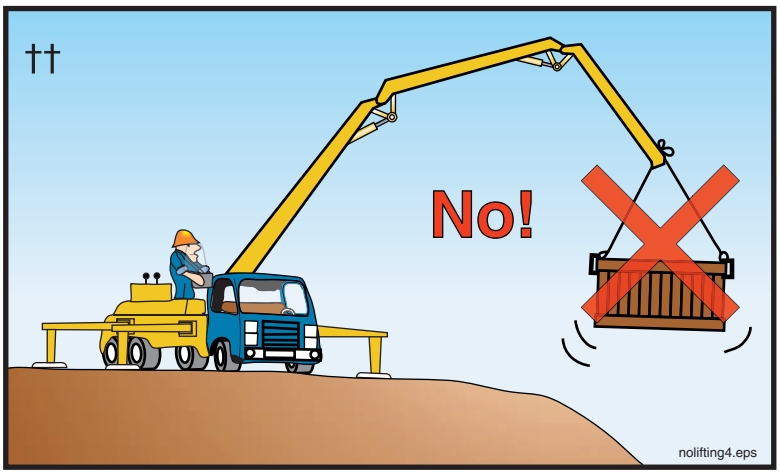


Figure 46
No lifting with the boom

8.17 **⚠WARNING** **Explosion hazard.** Never remove the fuel cap or refuel the unit near hot surfaces, sparks, or open flames. Never smoke while refueling.

8.18

⚠WARNING **Do not let the concrete level in the hopper become low!** If air is sucked into the material cylinders, the pump will compress the air. Compressed air always poses a hazard as it is expelled from the hopper or the delivery pipeline (Figure 47). If air is taken into the material cylinders, take the following steps to minimize the hazard:

1. Stop the pump immediately. Hit the emergency stop button if that is the quickest way to stop the pump. There will be an expulsion of compressed air the next time the concrete valve shifts, which can be safely absorbed by filling the hopper with concrete.
2. Pump slowly in reverse for a couple of strokes. This will not remove all the air, but it should minimize the amount left in the pipeline.
3. Persons standing at the discharge end or near the delivery line must be warned to move away until all of the air has been purged. Personnel should move a prudent and reasonable distance beyond the end-hose movement area or the point of discharge, and personal protective equipment (PPE) should be worn (Figure 47).
4. When the pump is restarted, the slowest possible speed should be used until **all** air is removed from the pipeline. Don't assume that the first little air bubble is the end of the compressed air.
5. Do not allow anyone near the discharge until concrete runs steadily from the end and there is no movement of the delivery system.

If workers are positioned in high or precarious places, warn them to expect a loud sound as the air escapes the pipeline. (Warn them even if they are well away from the discharge.) That way, we can prevent the worker from falling as a result of being startled by the noise.

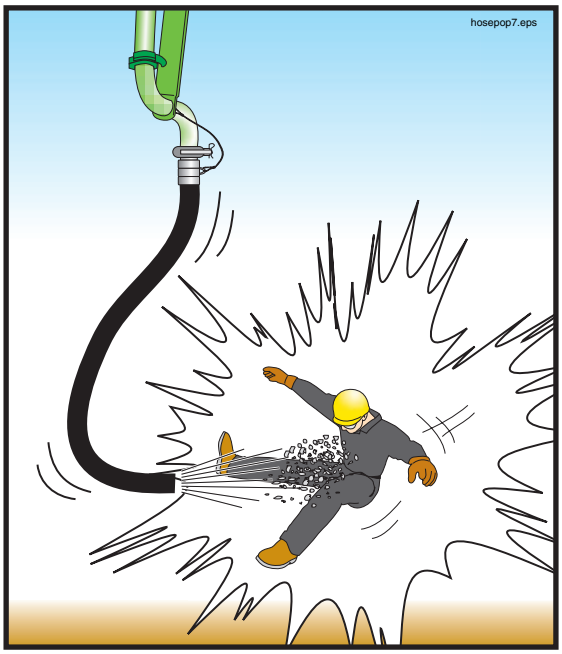


Figure 47
Remove everyone from the discharge area whenever air is in the line

8.19 **⚠WARNING** When initially priming the delivery system, when restarting after moving, when restarting after adding or removing hoses, when attempting to remove a blockage by "rocking" the concrete, or whenever air has been introduced into the line, warn everyone to stay away from the discharge until material runs steadily. Personnel should move a prudent and reasonable distance beyond the end-hose movement area or the point of discharge, and personal protective equipment (PPE) should be worn (Figure 47).

8.20 **⚠WARNING** A bulk density of approximately 150 pounds per cubic foot is assumed for the material to be pumped with a placing boom (normal concrete). If you intend to pump material with a higher bulk density (e.g., steel fiber entrained concrete), you must contact the manufacturer for advice. Failure to do so may result in damage to the boom and/or instability in certain operating positions.

8.21 **⚠WARNING** **Blockages in the pump or delivery pipeline can create an unsafe condition.** Blockages are caused by many different factors, as outlined below.

CAUSES OF BLOCKAGES

- **Faulty concrete mix design.** The concrete that is being supplied may not be a pumpable mix, for example there may be too much sand or too little cement. There may be bleeding or segregation. Some admixtures adversely affect pumpability (e.g., too much air entrainment). If the mix is not pumpable, no amount of operator expertise will make it so.
- **The line size may be inadequate.** The line size should always be at least 4 times larger than the largest aggregate being pumped, or blockages could occur.
- **Worn concrete valve parts.** Worn parts allow the finest material and water to escape back into the hopper when pressure is applied.
- **Pipeline and joint deficiencies.** This would include dirty pipes (pipes that have not been cleaned properly), worn and leaking pipe joints that allow loss of concrete fines and water, pipes that haven't been properly primed before starting, and too many sections of rubber hose, which increases friction. These are all causes of blockages that can be controlled by the operator.
- **Pump inadequate for the application.** The pump selected for the job may not have enough pressure or horsepower available for the required duty.
- **Concrete setting up in the pipeline.** This may be caused by delays on site (e.g., repairing a broken form), or by attempting to pump "old" concrete (concrete that was batched hours before pumping and is being kept alive only by adding water and constant agitation). Weather conditions can also affect how quickly the concrete becomes hard. Companies should establish procedures for these situations. A good rule of thumb is: **If in doubt...wash out**.
- **Foreign matter in the concrete.** Pieces of old concrete that break away from mixer fins, unmixed clumps of cement, mixer fins, hammers, and furry mammals are examples of foreign matter that have caused blockages.
- **An inexperienced operator can cause blockages by setting up the job improperly.** For example, if the placing crew is forced to add hose or pipe to reach a far point after the pour is already in progress, there is a great chance of creating a blockage due to the dry conditions inside the pipe or hose. It is for this reason that the job should be set up so pipe or hose need only be removed (never

added) as the day progresses. If dry pipe or hose must be added, it must be lubricated just like the rest of the pipe was lubricated when you first started.

- **An inexperienced placing crew can cause blockages by kinking the end hose.** This type of blockage can lead to serious accidents because the hose may un-kink by the force of the pump.
- **The concrete becomes segregated in the hopper.** When it's raining hard, the cement and fine material get washed from the stone and course sand. This mix will not pump. **Cover the hopper** as you wait out the passing storm. It is also for this reason that you should **never allow a truck mixer to wash out in your hopper!**

8.22 **⚠WARNING** Never try to remove a pipeline blockage by applying high pressure to it, because that will cause the blockage to become a plug. If you have a blockage, immediately stop the pump. Stroke the pump a couple of times in reverse. Slowly stroke the pump in forward, and try to dislodge the blockage. If you are moving the blockage, continue to do so slowly and gently. While attempting to clear the blockage, remove all personnel from the discharge area, as air may be introduced into the placing line during this process.

8.23 **⚠WARNING** If the pump or associated equipment develops a problem that creates an unsafe condition, you must stop pumping immediately! Do not restart until the unsafe condition has been remedied.

8.24 **⚠WARNING** The following points must be observed when locating a blockage.

- Pump in **reverse** for **at least two stroke**s, then stop the pump. **Do not allow anyone to open the pipeline** until this is done (Figure 48).
- Wear personal protective equipment when opening a blocked pipeline.
- Clear the area of nonessential personnel before opening the line.
- Plugs will be found in (in the order of likelihood) reducers, hoses, elbows, and pipe.
- If you are tapping the pipe to find the plug, the sound will be a dull thud (tik-tik) rather than a ringing sound (tong-tong) at the spot of the plug, because the jammed material will keep the pipeline from vibrating. (This method won't find a plug in a hose.)

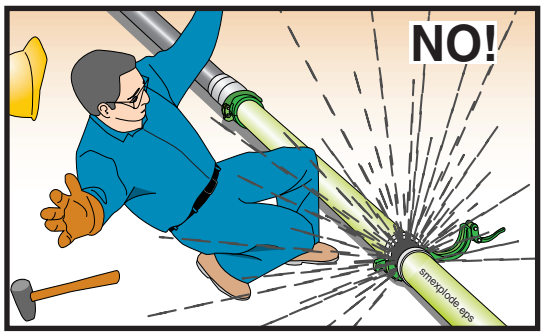


Figure 48
Never open a pressurized pipeline

8.25 **⚠WARNING** It is possible that some pressure will remain in the pipeline after reversing the pump. Use a shovel or pry bar to open the clamps on a blocked pipeline. Wear face protection, and turn away from the pipeline when opening the clamp.

8.26 **⚠WARNING** It would be better to let the pipe be ruined by setting concrete than to risk injury by ignoring safe procedures. Always use safe practices when cleaning pipe. Remember, pipeline is replaceable, you are not.

8.27 **⚠WARNING** **Do not kink hoses**. Kinking will cause the pump to create maximum concrete pressure. **The pump may unkink the hose with force!** (See Figure 49.)

Figure 49
Kinking the hose creates a hazard

8.28 **⚠WARNING** Never use compressed air to clear a blockage! It is unsafe and unnecessary. The pump can develop much more pressure than an air compressor. If the pump pressure can't move it, air pressure won't either.

8.29 **⚠WARNING** Never stand on, sit on, or straddle a pipeline while it's in use, or whenever it is pressurized. Pipeline wears out with each stroke of the pump. If the pipe bursts, you want to be to the side of it, not on top of it (Figure 50).

Figure 50
Never straddle or sit on a pressurized pipeline

8.30 **⚠WARNING** Crushing/amputation hazard. Do not remove the water box covers or grates when the machine is stroking (Figure 51). If you must remove the water box cover (to add water, for example), and there is not a bolt-down grate over the water box, then stop the pump, take the transmission out of gear, and lock the cab so the pump cannot be restarted until you are finished and the covers are back in place. If a bolt-down grate is installed, you may simply stop the pump from stroking before removing the water box covers. Replace the covers before restarting the pump.

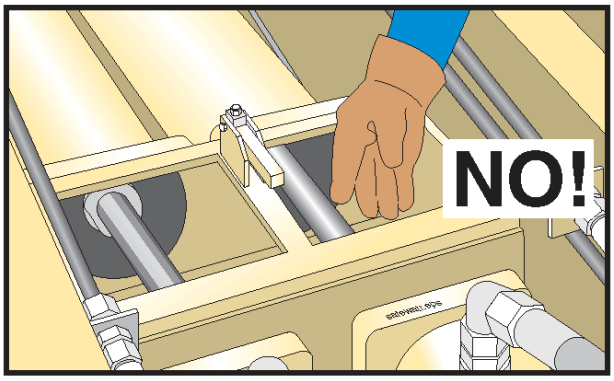


Figure 51
Keep your body out of the waterbox

8.31 **⚠WARNING** **Never leave the pump unattended!** Before you leave a laborer, ready mix driver, or any other worker alone with the pump for any reason, make sure the worker who you leave with the pump knows:

- the safety rules for a person stationed at the pump (the rules are listed in this Safety Manual, beginning on page 57)
- how to stop the pump
- the location of the emergency stop switches
- how to signal you.

8.32 **⚠WARNING** To prevent any unintentional movements of the machine, **all** control devices on the operator's panel and the remote control box must be switched off before changing from remote control to local control, or vice-versa. Whenever you are connecting or disconnecting the remote cable, push in the emergency stop button.

8.33 **⚠WARNING** Crushing/amputation hazard. Never put your hands, feet, or any other body part into the water box, concrete valve, or hopper when the hydraulic system is operational or ready to operate! (See Figure 52.)

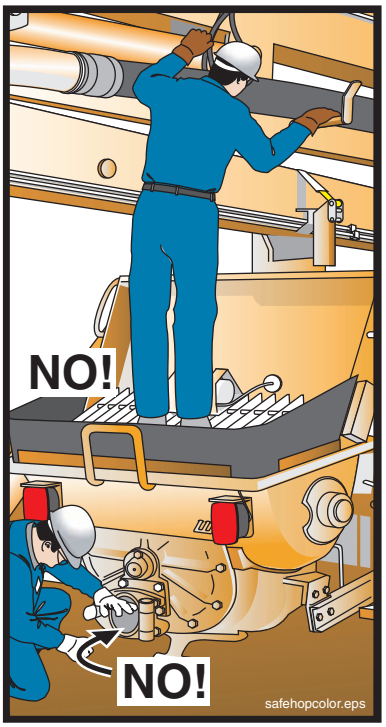


Figure 52
Don't put your body in the machine

8.34 **⚠WARNING** Do not work on the hopper, water box, concrete valve, or the hydraulic system unless the drive engine is turned off and the accumulator pressure (if so equipped) has been released! On units with internal combustion engines, the key must be removed. If there is more than one key, you should tag the ignition. On units driven by electric motors, the main disconnect must be locked out according to applicable standards.

8.35 **⚠WARNING** Never operate the boom "blind." If you can't see the point of placement, you must establish a system of communications with the workmen who can see the point of placement. Arrange for radio communications, a system of visual or auditory signals (lights or bells), or a spotter. If a spotter is used, **agree on hand signals before beginning the pour!** (Use of the ACPA standardized hand signals is highly recommended.) If the boom will be moved extensively, arrange for a workman to stay with the pump and put yourself in a position to see the end of the boom (Figure 53).

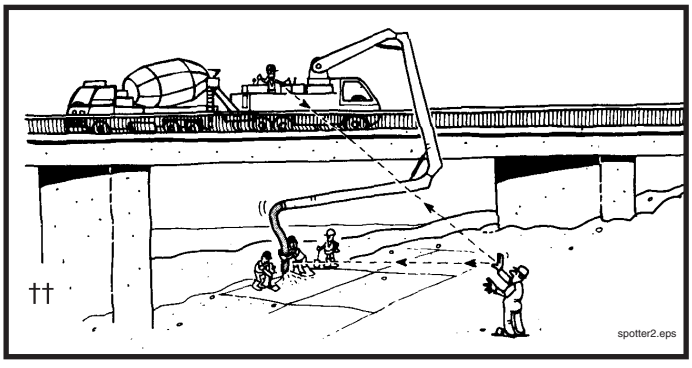


Figure 53
Never pump blind

8.36

⚠WARNING Always block the discharge end when you must swing a full boom over workers or property. You must stop concrete from falling out of the boom. This can be done with a shut-off valve, or by removing the hose and putting a blanking plug on the last elbow (Figure 54), or by kinking the end hose and securing it in the kinked position. Please note— hoses that can be easily kinked may not be strong enough to withstand the pressure of the pump. Verify the working pressure of the hose against the maximum pressure of the pump before using this type of hose.

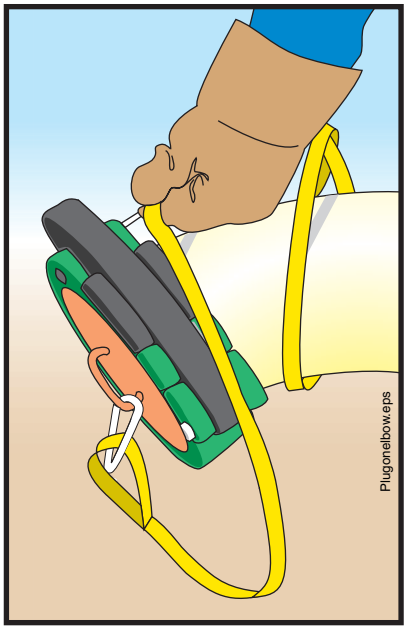


Figure 54
A blanking plug in place on a tip elbow with safety sling

IV. Cleaning The Pump And System

9. Safety Rules For Cleaning The Boom

9.1 **⚠WARNING** Do not let down your guard when the pour is completed. Accidents also happen during cleanout and the drive back to the yard. It is important not to become relaxed about job safety until you are no longer on the job.

9.2 **⚠WARNING** Watch for electric wires when moving the boom for cleanout or folding the boom for transport!

9.3 **⚠WARNING** Using compressed air to clean the boom delivery system should only be done when no other method is practical or as recommended by the manufacturer.

9.4 **⚠WARNING** If you have to use compressed air for cleaning the boom you **must** have all of the necessary accessories. Read and understand the complete safety rules regarding cleaning out with compressed air (point 12.4 on page 47 of this Safety Manual). Cleaning with compressed air should only be done by a qualified person.

9.5 **⚠WARNING** **Never** use compressed air to blow through rubber hoses or short sections of pipe. In the case of rubber hoses, their flexibility will allow them to "whip" wildly with the force of the air and moving concrete. Short sections of pipe will not have sufficient mass to allow the concrete to move slowly, so there will be rapid expulsion of the material.

9.6 **⚠WARNING** If the ball or go devil doesn't come out of the delivery system after applying compressed air, **you must relieve the pipe of air pressure before opening it.** If the bleed off valve plugs when you are draining the air, the only safe way to proceed is to drill small holes into the pipeline, which will then allow the air to escape. Wear a full face shield when drilling the holes. Pipe you have drilled into is ruined and must be replaced. Drill the holes to relieve the air pressure even if the concrete has set up in the pipe. The pipe is hazardous until the pressure is relieved.

9.7 **⚠WARNING** Exercise care when "tapping" on the pipeline to find the location of the cleanout ball. Applying too much force will dent a standard pipe (making it weak and unsafe) and could break the carbide insert of double wall pipe.

9.8 **⚠WARNING** It is better to let the pipe be ruined by setting concrete than to risk injury by ignoring safe procedures. Remember, pipeline is replaceable, you are not.

10. Safety Rules For Cleaning The Concrete Valve & Hopper

10.1 **⚠WARNING** Tipping hazard! Before moving the unit for cleaning, **fold the boom and secure the outriggers into the travel position.**

10.2 **⚠WARNING** Wear protective clothing and equipment when cleaning the concrete pump. Protect against concrete burns and concrete poisoning by wearing rubber boots and gloves during cleanout or any other time that you will be **in** contact with the concrete.

10.3 **⚠WARNING** Crushing and amputation hazard! **Never put your hands or any other body part into the concrete valve.** Instead, use water jets and the supplied rake (Figure 55).

10.4 **⚠WARNING** **Never put your hands or any other body part into the machine when the hydraulic system is operational.** If you must remove the grate to chip at hardened concrete, you must first disable the system by taking the transmission out of gear and locking the cab door, or stopping the engine, relieving pressure in the accumulator circuit (if so equipped) and securing the controls against unintended operation. Reinstall the grate before restarting the engine (Figure 55).

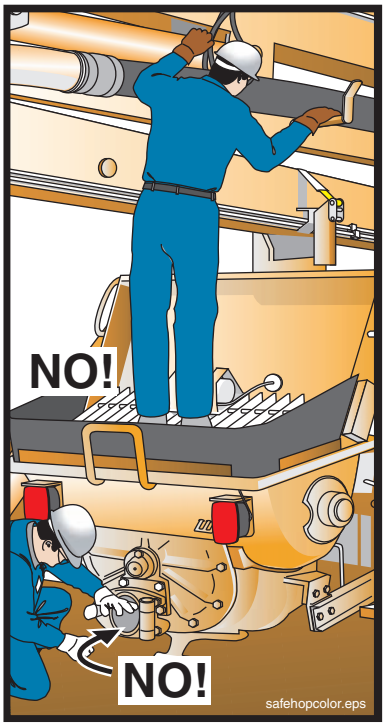


Figure 55
Keep your body parts out of the machine

11. Safety Rules For Cleaning The Water Box

11.1 **⚠WARNING** Crushing and amputation hazard! Stop the concrete pump before removing the water box covers. If your unit has bolt down guards, do not remove them for cleaning. If there is not a bolt-down guard over the water box, then stop the pump, take the transmission out of gear, and lock the cab so the pump cannot be restarted until you are finished cleaning and the covers are back in place. If a bolt-down grate is installed, you may simply stop the pump from stroking before removing the water box covers. Replace the covers before restarting the pump.

11.2 **⚠WARNING** If possible, position the folded boom in a slightly raised position when cleaning the water box (watch for wires when raising the boom). The outriggers must be extended and jacked. If the boom is raised, it will be unnecessary to bend over the water box for cleaning.

11.3 **⚠WARNING** Falling hazard! Be sure of your footing when cleaning the water box.

11.4 **⚠WARNING** Crushing and amputation hazard! Do not remove the water box guards for cleaning. Clean the water box with water jets only. **Do not put your hands or any other body part into the water box for cleaning, or at any other time when the machine is running or ready to start.**

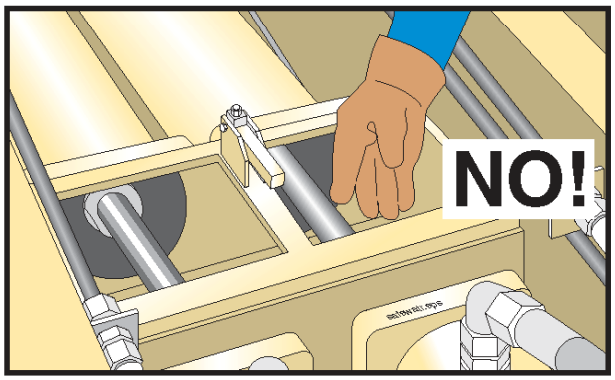


Figure 56
Keep your hands out of the waterbox

12. Safety Rules For Cleaning A Separately Laid Pipeline

12.1 **⚠WARNING** Flying particle hazard! Clear the discharge area of personnel and equipment before forcing a ball or go devil through the pipeline, even if you are cleaning with water. Some air will be trapped in the pipeline, and the trapped air will become compressed before discharge.

12.2 **⚠WARNING** Short pipelines and single pipe sections should be cleaned by removing the clamps and dumping the pipe sections. Remember to lift with your legs, not with your back.

12.3 **⚠WARNING** The point of discharge must be controlled. Use a ball catcher or some other containment device at the point of discharge, even when cleaning with water.

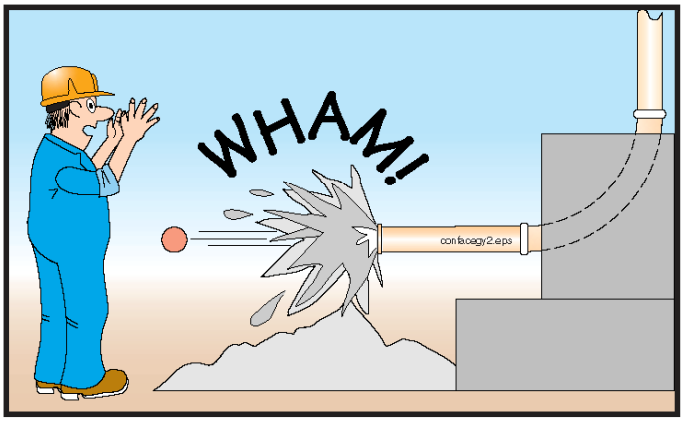


Figure 57
Cleaning with compressed air can be extremely hazardous if you don't follow the safety rules

12.4 **⚠WARNING Blowing out with compressed air creates potential hazards! Serious injury or death could result** if you do not adhere to these safety points.

- **Blowing out must be performed under the supervision of a qualified person.** (See the glossary for the definition of *qualified person*.)
- **Blowing out requires two people!** One trained person must be at the inlet end to operate the air insertion, and the other trained person must be near (but safely back from) the discharge point to monitor the discharge and to make sure that no one enters the hazard area.
- **No pipe bends or flexible delivery hoses may be connected to the end of the pipeline during the blowing out process,** unless there is a pre-planned cleanout station erected to route the discharge into the ready mix truck.
- **The point of discharge must be controlled. Clear the discharge area of personnel and equipment** before beginning the blowing out process. Do not allow anyone to enter the area during the blow out process. If a ball catcher is used, be aware of which type you have, and adjust your procedure accordingly. Ball catcher types are described in paragraph 7.23 on page 31.
- **The concrete outlet must be positioned high enough to permit easy discharge of the material**.
- If you are going to divert the discharge into a discharge pipe system, **you must lubricate the discharge line with slurry, or a plug could occur.**
- **The pipe cleaning blow out head must be equipped with a properly sized air discharge regulator valve and a separate water/air inlet.** The two openings should be spaced apart far enough that a blowout ball could not cover both openings at once (Figure 58).

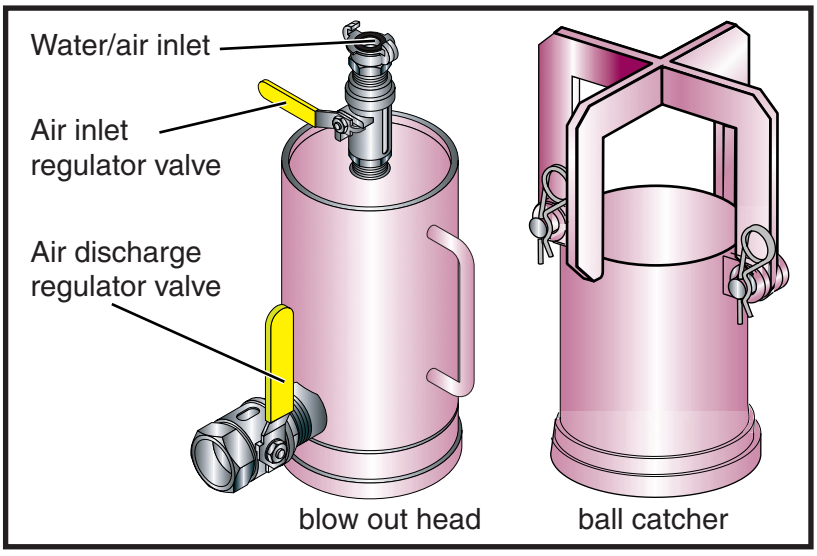


Figure 58
Ball catcher and blow out head

- The plug or go devil must be thick enough to prevent compressed air flow around the plug into the concrete.

- **The pipeline must not be disassembled until it has been completely relieved of air.** Be **sure** of this! (See Figure 59.)

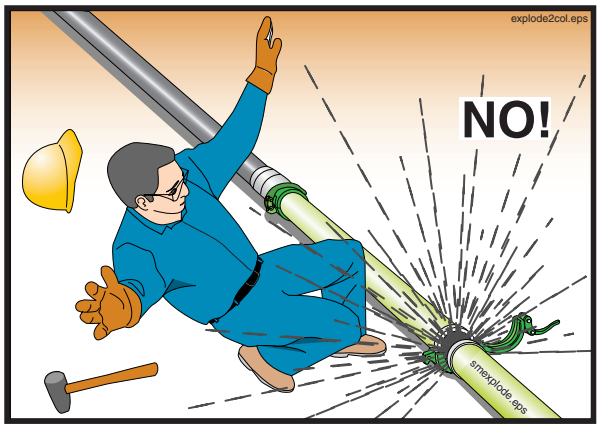


Figure 59
Never open a pressurized pipeline

- **Do not use compressed air to blow out concrete delivery hose, single pipe sections and short pipelines up to a length of 40 feet.** Hoses will jump and move unpredictably; short pipelines don't have enough concrete to resist the force of the air, causing it to discharge too quickly, like a cannon (Figure 60).

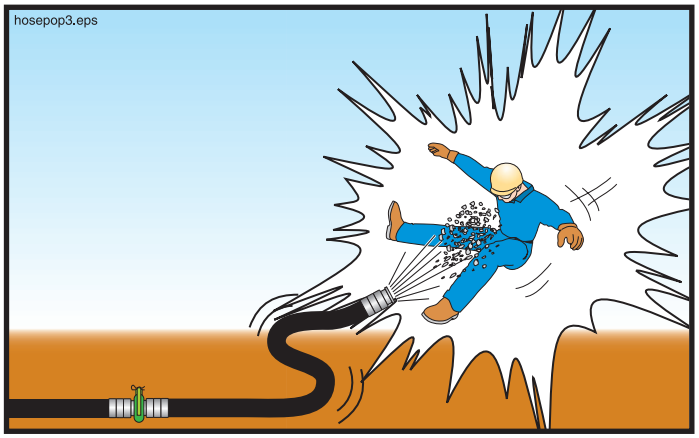


Figure 60
Never use air to blow out hoses or short pipelines

- **When air pressure begins to drop rapidly, shut off the air supply from the compressor, and immediately begin bleeding air out of the pipeline.** (The drop in pressure signifies that the pipeline is almost empty of concrete.)

12.5 **⚠WARNING** When blowing out a vertical line, a shutoff valve is required to prevent the following scenario.

1. (See diagram A in Figure 61.) Without a shutoff valve installed, the pipeline is disconnected from the pump. Immediately, the concrete drains out of the vertical sections of pipe, leaving concrete in both horizontal sections, and air trapped in between.

2. (See diagram B in Figure 61.) The ball is inserted, and pushed with compressed air. This also compresses the air that is trapped in the vertical sections of pipe. The trapped air will be violently expelled when it reaches the end of the pipe, but the pipe will not yet be empty.

A shutoff valve installed at the bottom of the vertical run will prevent this hazardous situation. The shutoff valve must be capable of handling the maximum concrete pressure of the pump and, of course, must be installed before the pour begins. Several different styles are available, ranging from a manually operated flat gate that is put into place with a hammer to fully hydraulic types that will also divert the concrete to a different pipeline. With a shutoff valve installed, you can proceed as indicated below.

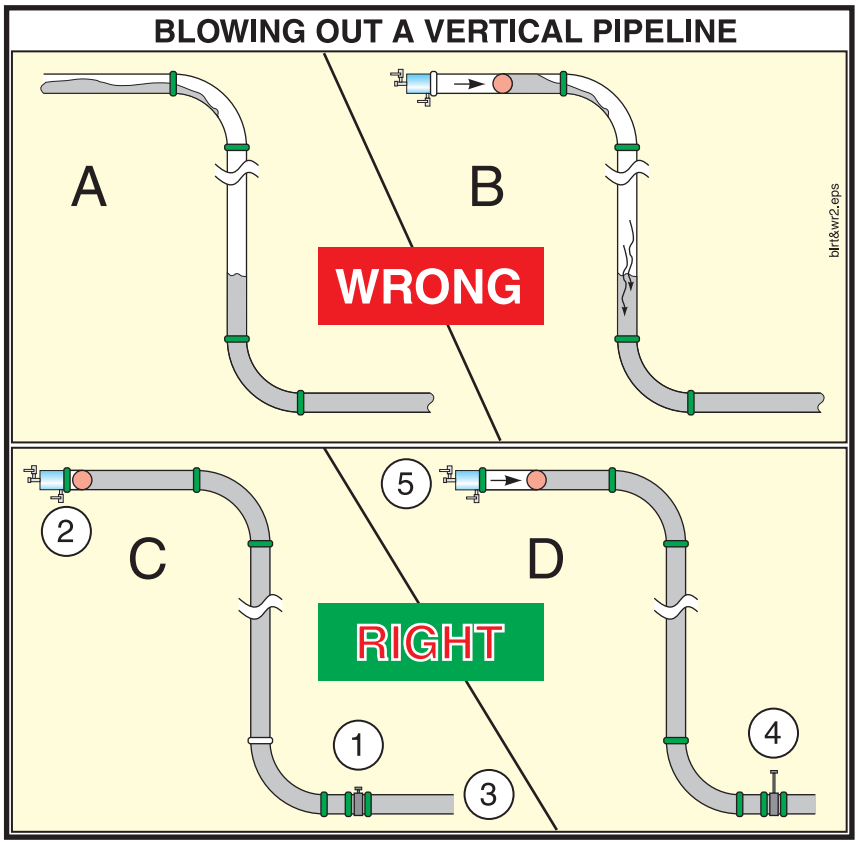


Figure 61
Blowout of a vertical line

12.6 **⚠WARNING** **Blowing out vertical sections of pipe** (for example on a high rise building) **requires additional safety precautions.**

1. **Know where the discharge area for blowing out will be before the pour begins**. Ready the area and accessories before the pour begins so you will not waste time when pumping is completed.
2. **Blowing out with compressed air requires two qualified persons.**

3. **The persons at both ends of the pipeline must be able to communicate without delays**, which means you must establish communications (for example, with a radio).
4. **When pumping is complete, close the shutoff valve before disconnecting the pipeline from the pump** (item 1, Figure 61). Failure to do this will cause the concrete to fall out of the vertical sections of pipe, leaving concrete in the horizontal sections of pipe and an air pocket in the vertical sections. This does not apply if you are using a switching (diversion) valve.
5. Install the ball(s) in the pipeline, secure the blow out head and hook up the air compressor. **Do not apply the air yet!** (Item 2, Figure 61.)
6. If you will be diverting the discharge to a cleanout area, lubricate the discharge line with slurry, or a plug could occur.
7. **Position the ready mix truck at the cleanout standpipe**, or install the ball catcher or other containment device at the end of the discharge line. (Item 3, Figure 61.)
8. **Clear the discharge area of personnel.** You must allow no one to enter the discharge area until the pipeline is depressurized.
9. **Divert the vertical pipe line to the clean out area, or open the shutoff valve in the delivery pipe line now.** Allow gravity to start the concrete moving through the discharge line. As the concrete falls from the vertical sections, it will take the ball with it, making it impossible to trap air in the line. (Item 4, Figure 61.)
10. **Apply the compressed air to the pipeline.** Close communications must be maintained at this time. Add only enough air to keep the concrete moving. Do not allow the concrete to accelerate. (Item 5, Figure 61.)
11. **When concrete starts to accelerate, shut-off the air supply from the compressor, and open the air regulator to bleed air from the line.** Rapidly accelerating concrete indicates that the pipeline is almost empty. After the ball has been expelled from the pipeline, leave the air regulator open to be sure that all air is removed from the system.
12. All the rules for blowing out found in point 12.4 on page 47 also apply to blowing out a vertical pipe line. These rules are in addition to the general "cleaning a pipeline with compressed air" rules.

12.7 **⚠WARNING** **Never use compressed air to attempt to clear a blockage!** It is unsafe and unnecessary. If the pump pressure can't move it, air pressure won't either.

V. Maintenance Of The Machinery

13. Safety Rules Regarding Inspection

13.1 **⚠WARNING** It is imperative that your boom, outriggers, and other structural members be inspected by a certified boom inspector on a regular basis. The results should be documented carefully and a record kept. Consult the manufacturers recommendations for the proper interval for your machine.

13.2 **⚠WARNING** Visually inspect your unit each day before it is put into operation. If any problem is found that will affect the safe operation of the pump, don't use the pump until it is repaired!

13.3 **⚠WARNING** Any structural problem found on the placing boom, outriggers, or tower section of the unit should be reported to the manufacturer so that proper repair procedures can be designed and implemented. You do not need to report any structural problem that has been previously reported and for which a repair procedure has already been designed and implemented.

13.4 **⚠WARNING** If safety decals are faded, missing, damaged, or otherwise unreadable, they must be replaced immediately. Contact the manufacturer of your unit to obtain replacements.

13.5 **⚠WARNING** If safety devices or guards are removed for inspection purposes, they must be replaced before someone uses the machine.

13.6 **⚠WARNING** Pay attention to the *Operation Manual* and manufacturer's service bulletins regarding maintenance and inspection procedures and intervals.

13.7 **⚠WARNING** If inspection reveals something that looks wrong, or even suspicious, report it to the manufacturer for consideration. Don't just assume that it's OK.

13.8 **⚠WARNING** Inspect the tip hose safety cable and mounting hardware on a regular basis. Replace it if it becomes old, frayed, or rusted.

13.9 **⚠WARNING** Inspect the boom tie down and boom rest assemblies regularly (if your unit is so equipped). The boom must not be allowed to bounce during travel.

13.10 **⚠WARNING** Visual inspection of the concrete pump circuits and safety devices should be done daily. Hands on inspection and documentation of results should be done weekly, or at least when preventive maintenance is scheduled.

13.11 **⚠WARNING** Do not neglect the delivery pipeline, clamps, or hoses. Check them often for wear, dents, and frays. Never send a unit to a job with a worn or damaged delivery system. Ultrasonic thickness testers are more accurate than the tap method.

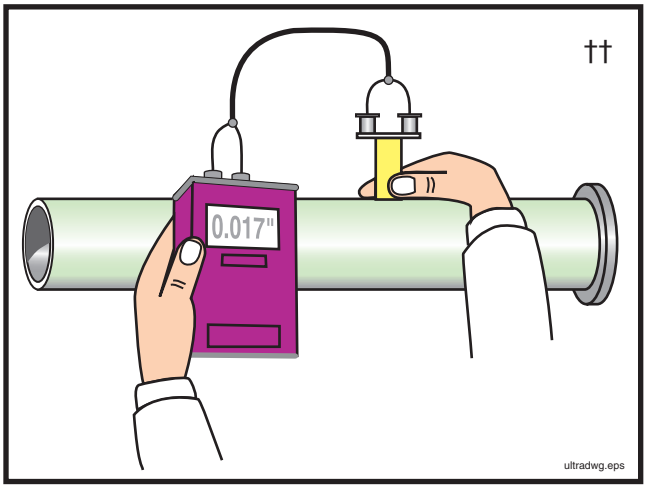


Figure 62
Check delivery system wall thickness with an ultrasonic thickness tester

14. Safety Rules Regarding Scheduled Maintenance

14.1 **⚠WARNING** Proper and timely maintenance is important to the safe operation of a concrete pump and placing boom. The proper procedures are outlined in the operation manual supplied with the pump. Do not put it off. Do not treat it lightly. Do not "fudge" results. The lives of the operator, oiler, and workers on the job are depending on it.

14.2 **⚠WARNING** Keep the machine clean! Oil spills, grease, loose tools, and displaced accessories are hazards.

14.3 **⚠WARNING** Pins should be used on all delivery system clamps. Clamps that will hang over workers, and clamps used on system that will be dragged shall be pinned (Figure 63).

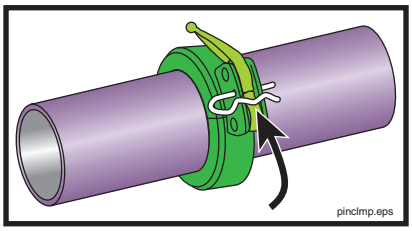


Figure 63
Pin the clamps

14.4 **⚠WARNING** Be sure that you are installing the correct clamps for the types of pipe ends used. Never try to mate dissimilar pipe ends unless using a clamp specifically made for this purpose. See the comparison regarding weld-on ends on page 72 in the appendix of this manual.

14.5 **⚠WARNING** When installing new pipe and/or hose on the machine be sure that it is capable of handling the maximum concrete pressure of the pump.

14.6 **⚠WARNING** Remember that boom pipe cannot weigh more than 10.14 pounds per foot, when empty. Certain models and brands may have different requirements. Check the operation manual for your machine.

14.7 **⚠WARNING** If safety devices or guards are removed for servicing, they must be replaced before the machine is put back in service.

14.8 **⚠WARNING** Do not change the maximum relief valve setting on any hydraulic circuit without permission from the manufacturer. **Never** change an accumulator circuit pressure setting without specific instructions from the manufacturer.

14.9 **⚠WARNING** Never make unauthorized modifications to structural members or pressure circuits.

14.10 **⚠WARNING** You must **replace, not repair** damaged hydraulic or concrete hoses or pipes.

14.11 **⚠WARNING** Never try to repair a machine using worn, damaged, or defective components.

14.12 **⚠WARNING** Welding on the boom, outriggers, tower, or any other structural member may be done **only** by a welder certified to A.W.S. D1.1 (Sections 3, 5 and paragraph 9.25 of Section 9). All structural welding must be done to the manufacturer's specifications.

14.13 **CAUTION** **Never allow welding current to travel through bearings or hydraulic cylinders**. Keep the ground cable on the component that is being welded.

14.14 **CAUTION** **Electronic components can be destroyed by welding current**. Before welding on the unit, you must disconnect the battery cables, and unplug all radio remote control power wires. If you have a proportional boom system, the proportional amplifiers must be removed from the mother board before welding. If in doubt, contact the service department of the manufacturer for instructions **before** proceeding.

15. Safety Rules When Servicing The Machinery

15.1 **⚠WARNING** **Repairs should be carried out by qualified workshop personnel** (See the glossary for the definition of *qualified personnel*.)

15.2 **⚠WARNING** **Read and understand the maintenance procedures in the *Operation Manual* of the machine before attempting any repairs.** If in doubt, call the manufacturer. Incorrectly done repairs affect the safe use of the machine.

15.3 **⚠WARNING** Burn hazard! **Never work on a hot hydraulic system.**

15.4 **⚠WARNING** **If it is necessary to unfold the placing boom to do maintenance work, the outriggers must be extended and jacked, just as if the machine were on a job site**. If you are not an operator, have the operator set up the machine for you. The need to repair the machine does not qualify you to operate the machine.

15.5 **⚠WARNING** Electrocution hazard! **If it is necessary to unfold the placing boom to do maintenance work, you must watch for overhead power lines.** You must maintain a minimum of 17 ft. (5 meters) clearance between the power line and any part of the unit.

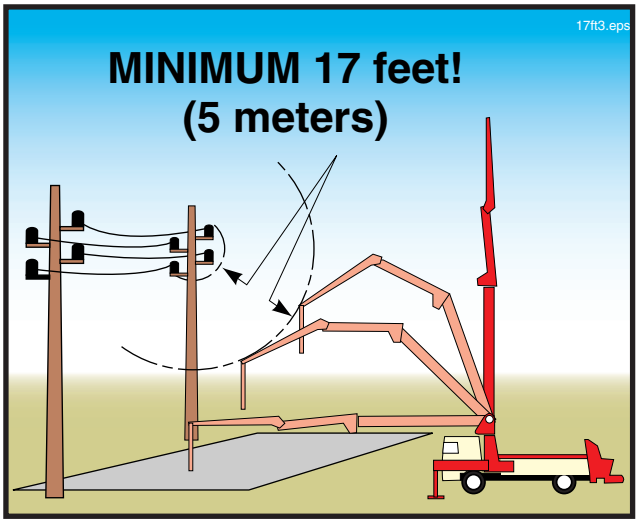


Figure 64
Watch for power lines if you must unfold the boom

15.6 **⚠WARNING** Falling hazard! If you cannot work at ground level, you must find and use a suitable work platform, a tie-off harness system, or otherwise secure yourself from falling.

15.7 **⚠WARNING** If maintenance work requires that you use a crane, hoist, fork truck, or similar machine, read and understand the safety regulations for that equipment. Remember, **the boom may not be used as a hoist or crane!**

15.8 **⚠WARNING** Crushing hazard! **Secure the placing boom and relieve all pressure before working on the boom hydraulic system.**

15.9 **⚠WARNING** **Only operators should operate the unit.** If work on the machine requires that it be operated and you are not qualified as an operator, you must get someone who is qualified to assist you.

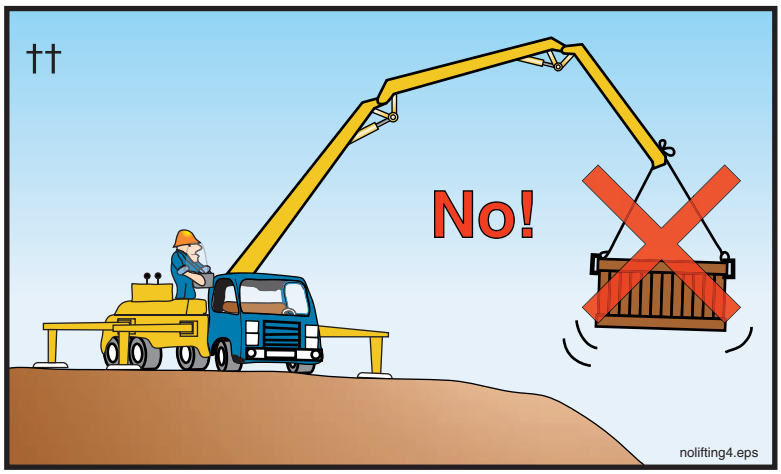


Figure 65
No lifting with the boom

15.10 **⚠WARNING** Electrocution hazard! **Repair work on high voltage electrical systems must be done by qualified electricians.** For this rule, high voltage means anything over 24 volts.

15.11 **⚠WARNING** Explosion hazard! **Be sure that you understand the potential danger of spring loaded or compressed gas components before you service them.** (Examples: nitrogen accumulators, gas springs for toolbox doors, tires, brake chambers.) If you don't know the dangers, call the manufacturer **before** beginning work!

15.12 **⚠WARNING** If you will be working in a hidden area inside the machine, lock it out as follows.

- With a gas or diesel engine, remove the ignition key and place a *Do Not Operate* sign on the controls. Carry the key with you.
- With an electrically driven pump, lock out the main breaker and tag the controls.

The above rules are one simple "Lock Out-Tag Out" procedure. There may be state or local regulations that require a more advanced or stringent Lock Out-Tag Out program. Be aware of the regulations in your area.

15.13 **⚠WARNING** **Never activate the system hydraulics without checking if another workman is in a hidden position.** Always yell "clear" before starting the engine or electric motor, and allow time for response.

15.14 **⚠WARNING** **Never work on a pressurized hydraulic system.** Stop the engine or electric motor and relieve the accumulator circuit (if so equipped) before you open the hydraulic system.

15.15 **⚠WARNING** **Never use gasoline or diesel fuel as a cleaning solvent**. This is critical to remember when cleaning hydraulic oil reservoirs, because gas and diesel fuels are highly explosive and **traces left in the oil may ignite when compressed!**

15.16 **⚠WARNING** Remember to mount and dismount the unit using the "3 Point Rule." One hand and two feet or two hands and one foot are to be in contact with a secure surface at all times (Figure 66).

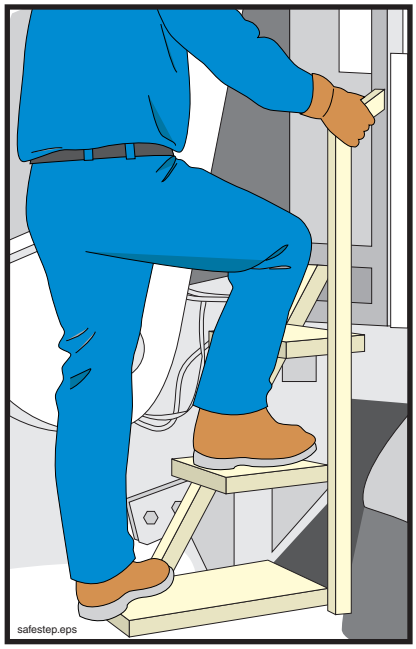


Figure 66
The 3 Point Rule

15.17 **⚠WARNING** **Inspect the repairs.** After modifications to structural members (boom, outriggers, tower, etc.) the repair must be inspected by qualified personnel before use.

15.18 **⚠WARNING** **Always use the correct tools for the job.** Tools should be kept clean and in good condition.

15.19 **⚠WARNING** If you see a co-worker engaging in an unsafe practice, warn him about the dangers. Safety is always in the hands of those on the job!

15.20 **⚠WARNING** After any repair is completed, test the function of the repaired part to be sure that repairs were done correctly.

VI. Co-worker Safety

16. Safety Rules For Workers Assigned To The Pump.

16.1 **⚠WARNING** **You must know how to stop the pump and boom.** Have the operator show you the locations of the emergency stop switches (Figure 67).

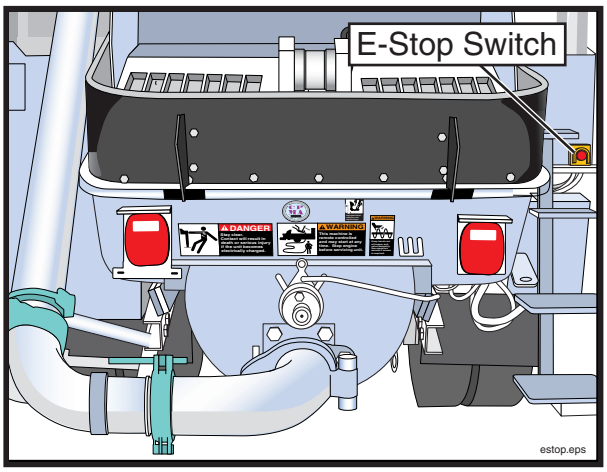


Figure 67
Know how to stop the unit in an emergency

16.2 **⚠WARNING** **You should wear the same personal protective equipment as the operator.** Goggles, hard hat, ear protection, and rubber gloves are especially important when working near the hopper (Figure 68).

* Breathing mask needed when cement dust (or other toxic dust) is present in the air.

Figure 68
Wear the same personal protective equipment as the operator

16.3 **⚠WARNING** **Electrocution hazard!** If the pump or boom becomes energized with high voltage and you are in contact with **any** part of it, you are at **risk of electrocution!** You should monitor the movement of the boom and **alert the operator if the boom comes within 17 feet of an electrical wire.** (See Figure 69.)

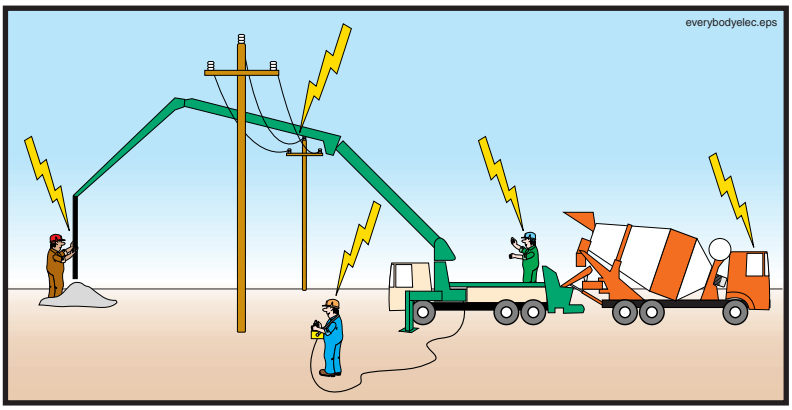


Figure 69
If the pump becomes energized, everything that touches the pump is also energized

16.4 **⚠WARNING** Keep an eye on the movements of the boom, even when there are no electrical wires nearby. Alert the operator if the boom is nearing any obstruction or hazard. Where job site safety is concerned, two sets of eyes and ears are better than one.

16.5 **⚠WARNING** **Crushing hazard. Never, ever position yourself between the ready mix truck and the pump!** Stand to the side, where the driver can see you (Figure 70).

Figure 70
Never stand between the ready mix truck and the pump

16.6 **⚠WARNING** When backing in ready mix trucks, use clear and concise hand signals (Figure 71).

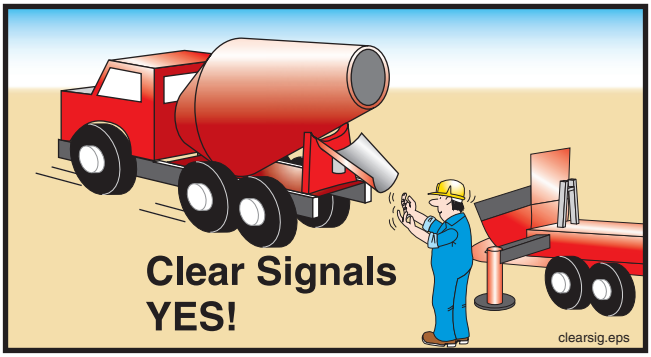


Figure 71
Use clear, concise hand signals

16.7 **⚠WARNING** Do not allow the ready mix driver to put concrete in the pump hopper until the pump operator gives him the OK. Filling the hopper early can cause the pump to plug.

16.8 **⚠WARNING** If you see foreign material that could create a blockage coming from the ready mix truck, alert the operator to stop the pump. Do not attempt to remove the material from the hopper or grate while the hydraulic system is ready to work. (See point 16.17 on page 62.) If necessary, depress the E-stop button to stop the pump and alert the operator.

16.9 **⚠WARNING** **Never allow the ready mix driver to clean out in the hopper,** because it can create a blockage. (Water will wash the cement and fine sand from the course aggregate causing segregation.)

16.10 **⚠WARNING** Do not operate the pump or boom unless you are also a trained operator and the regular operator has released the controls to you. **There must not be more than one operator at a time.** This does not apply to stopping the pump or boom if there is a need to do so.

16.11 **⚠WARNING** Do not let the concrete level in the hopper become low! If air is sucked into the material cylinders, the pump will compress the air. Compressed air always poses a hazard as it is expelled from the hopper or the delivery pipeline (Figure 72). If air is taken into the material cylinders, take the following steps to minimize the hazard:

1. Stop the pump immediately. Hit the emergency stop button if that is the quickest way to stop the pump. There will be an expulsion of compressed air the next time the concrete valve shifts. If possible, fill the hopper with concrete to help contain the expulsion.
2. Alert the operator of the problem. It is his job to know the procedures for safe removal of air from the pump and delivery system. These procedures include pumping in reverse for a couple of strokes.
3. Persons standing at the discharge end or near the delivery line must be warned to move away until all of the air has been purged. Warn them to stay

a reasonable and prudent distance beyond the reach of the end hose or point of discharge (Figure 72).

4. When the pump is restarted, the slowest possible speed should be used until **all** air is removed from the pipeline. Don't assume that the first little air bubble is the end of the compressed air.
5. Do not allow anyone near the discharge until concrete runs steadily from the end and there is no movement of the delivery system.

- If workers are positioned in high or precarious places, warn them to expect a loud sound as the air escapes the pipeline. (Warn them even if they are well away from the discharge.) That way, we can prevent the worker from falling as a result of being startled by the noise.

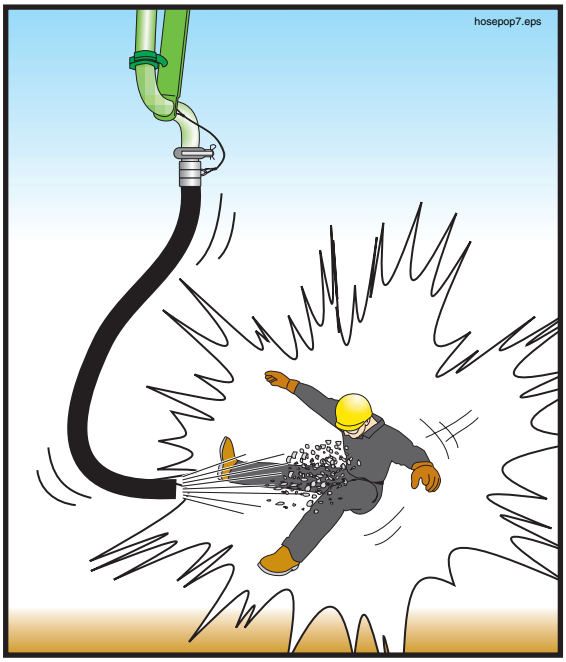


Figure 72
Remove everyone from the discharge area whenever the pump is first starting, restarting after moving, or if air has been introduced into the line

16.12

⚠WARNING When initially priming the delivery system, when restarting after moving, when restarting after adding or removing hoses, or whenever air has been introduced into the line, warn everyone to stay away from the discharge until concrete runs steadily and there is no movement of the delivery system. Personnel should stay back a reasonable and prudent distance beyond the reach of the end hose or point of discharge (Figure 72). Air will be in the line when first starting, when restarting after moving, when a blockage has been successfully removed by "rocking" the concrete, and after the line has been taken apart or opened for any reason.

16.13 **⚠WARNING** **Never use compressed air to clear a blockage!** The operator is responsible for knowing the safe blockage removal procedures. It is unsafe and unnecessary to use compressed air. If the pump pressure can't move it, air pressure won't either.

16.14 **⚠WARNING** Never stand on, sit on, or straddle a pipeline while it's in use, or whenever it is pressurized. Pipeline wears out with each stroke of the pump. If the pipe bursts, you want to be to the side of it, not on top of it (Figure 73).

Figure 73
Never straddle or sit on a pressurized pipeline

16.15 **⚠WARNING** Expulsion hazard! (See Figure 74.) **Never open a pipeline that is under pressure.** The pump must be run in reverse for at least two strokes and then stopped before opening a pipeline. If you don't know how to reverse the pump, have the operator do it. If the pipeline is pressurized with air, do not open it. The operator is responsible for knowing how to safely release the air pressure.

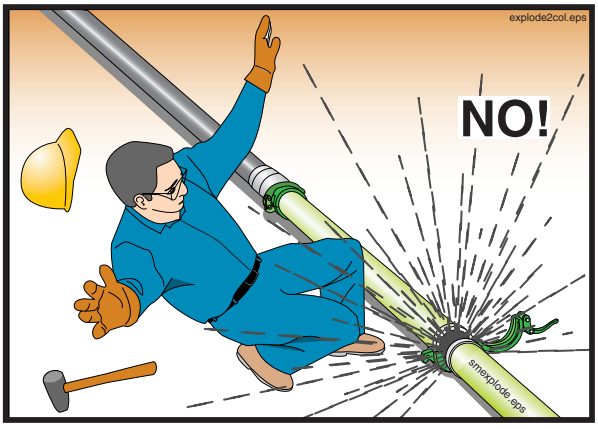


Figure 74
Never open a pressurized pipeline

16.16 **⚠CAUTION** Be careful when handling pipeline or any other heavy object. Learn how to lift without using your back. Get assistance if needed.

16.17 **⚠WARNING** Crushing/amputation hazard! Never put your hands, feet, or any other body part into the water box, concrete valve, or hopper when the hydraulic system is operational or ready to operate! Never stand on the hopper grate! (See Figure 75.)

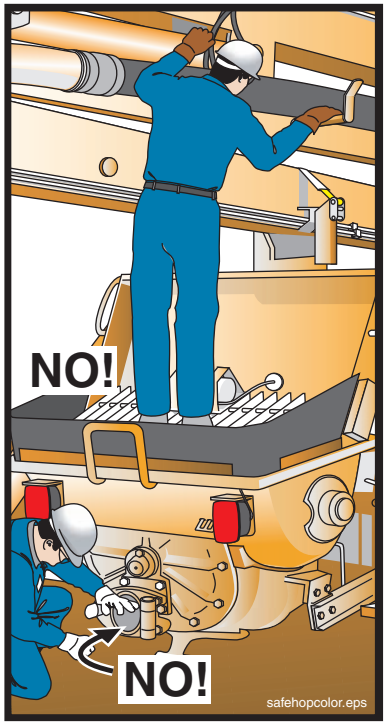


Figure 75
Never put your body in the machine!

16.18 **⚠WARNING** Never lift or remove the hopper grate for any reason (Figure 76).

Figure 76
Lifting hopper grate exposes the agitator and the concrete valve

16.19 **⚠WARNING** Do not remove the water box covers or grates when the machine is stroking (Figure 77). If you must remove the water box cover (to add water, for example), and there is not a bolt-down grate over the water box, then stop the pump and engine, and put the key in your pocket so it cannot be restarted

until you are finished and the covers are back in place. If a bolt-down grate is installed, you may simply stop the pump from stroking before removing the water box covers. Replace the covers before restarting the pump.

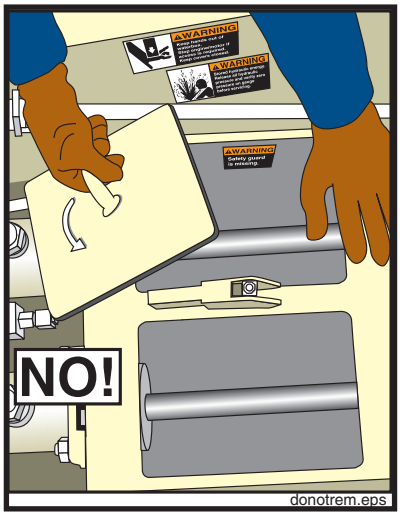


Figure 77
Do not remove the water box covers when the machine is stroking

16.20 **⚠WARNING** Mount or dismount the pump or truck using the *3 Point Rule.* One hand and two feet or two hands and one foot are to be in contact with a secure surface at all times (Figure 78).

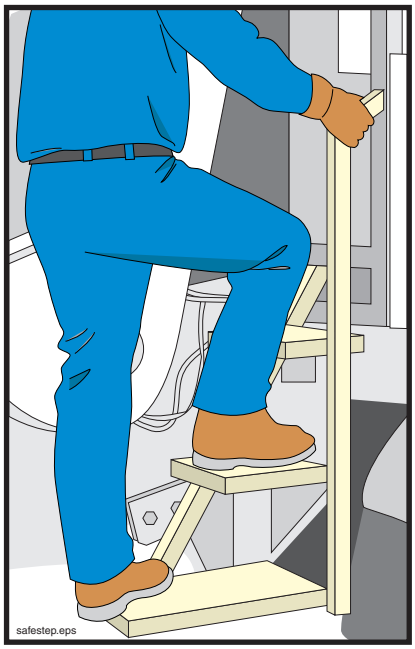


Figure 78
The 3 Point Rule

16.21 **⚠WARNING** Keep unauthorized personnel off of the pump.

17. Safety Rules For The Placing Crew

17.1 **⚠WARNING** **Electrocution hazard!** If the pump or boom becomes energized with high voltage and you are in contact with **any** part of it, you are at **risk of electrocution!** You should monitor the movement of the boom and **alert the operator if the boom comes within 17 feet of an electrical wire.** (See Figure 79.)

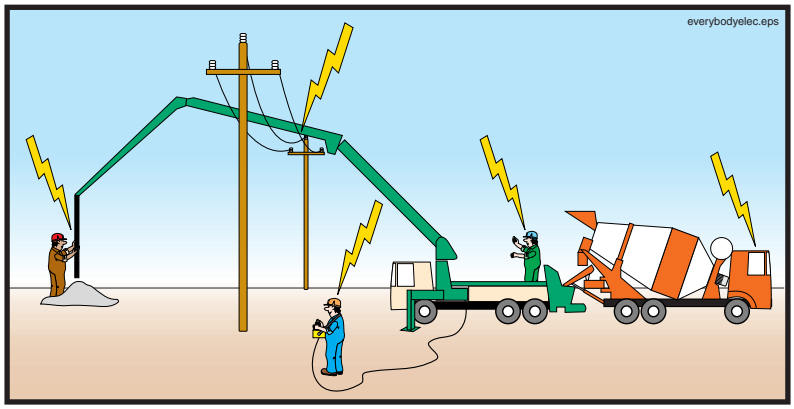


Figure 79
If the pump becomes energized, everything that touches the pump is also energized

17.2 **⚠WARNING** If the boom can contact overhead wires a spotter must be used to warn the operator if the boom is coming near the wires (Figure 80.)

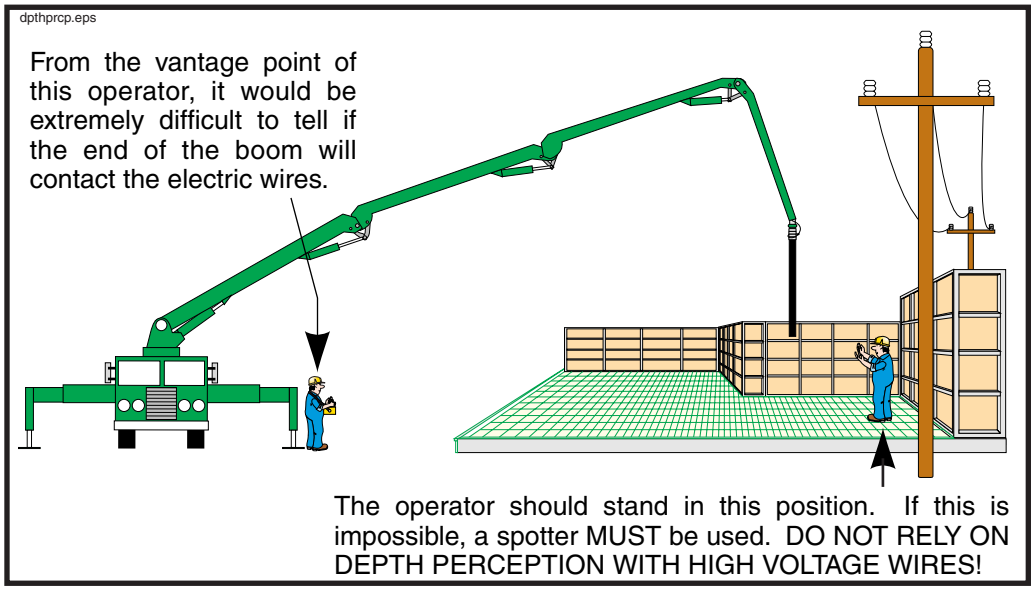


Figure 80
Use a spotter near obstructions or wires

17.3 **⚠WARNING** Keep an eye on the movements of the boom, even when there are no electrical wires nearby. Alert the operator if he is nearing any obstruction or hazard. Where job site safety is concerned, two sets of eyes and ears are better than one.

17.4 **⚠WARNING** Wear Personal Protective Equipment (P.P.E.) when working around a concrete pump (Figure 81). The gloves should resist concrete lime burns. If you will be working **in** the concrete, protect your feet and hands with rubber boots and gloves.

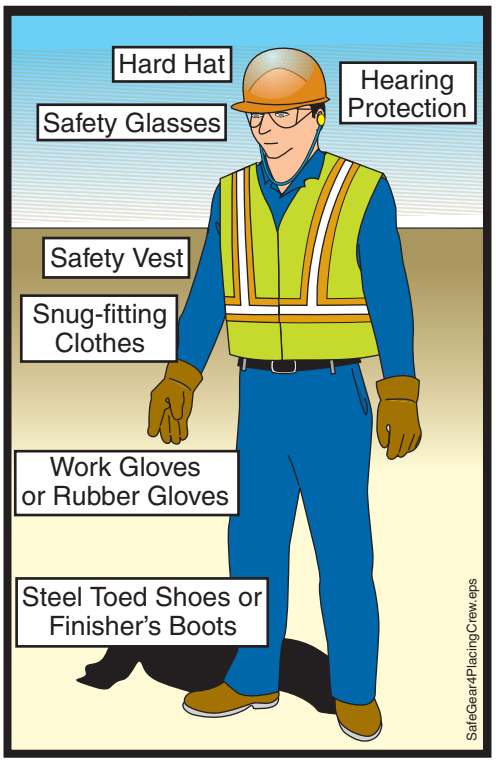


Figure 81
Wear Personal Protective Equipment (P.P.E.)

17.5 **⚠WARNING** When the operator is initially priming the delivery system, restarting after moving, restarting after adding or removing pipes or hoses, or any time that air has been introduced into the delivery system, stand a reasonable and prudent distance away from the tip hose or point of discharge. Do not get near the discharge until material runs steadily and there is no movement of the delivery system. (Figure 82). Compressed air in the line can cause rubber hose to move violently. If the operator tells you that air is coming in the delivery system, proceed as follows:

- Get to ground level (if in a high place) and remain well away from the discharge or at least take cover.
- Stay away from the discharge. Be sure that **all** the air is gone before getting near the point of discharge again. It is the operator's job to know when it's safe to go back to normal pumping.

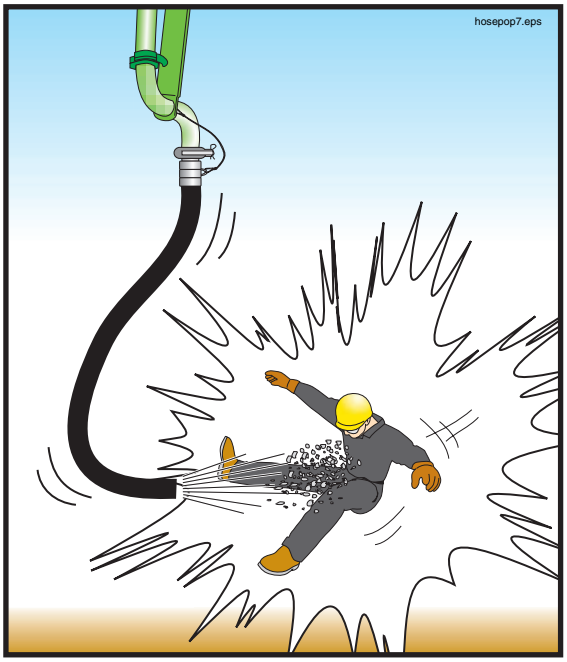


Figure 82
Stay away from the point of discharge when starting or restarting, and when there's air in the pipeline

17.6 **⚠WARNING** **Never use compressed air to clear a blockage!** It is unsafe and unnecessary. If the pump pressure can't move it, air pressure won't either. Stand away from the discharge and the line if anyone attempts to use compressed air in this manner.

17.7 **⚠WARNING** **Do not look into the end of a plugged hose or pipe!**

17.8 **⚠WARNING** When the pump crew is using compressed air to clean the boom or system pipeline, stay away from the discharge area. **Never try to hold down a pipe or hose that is being cleaned with air.**

17.9 **⚠WARNING** Never open a pressurized pipeline (Figure 83). The pump operator must release the pressure before you open the line. If the line is pressurized with compressed air, let the operator release the pressure and verify that the air has escaped before you proceed.

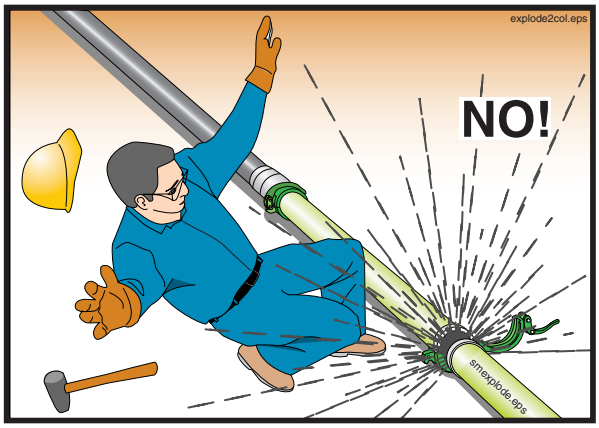


Figure 83
Never open a pressurized pipeline

17.10 **⚠WARNING** After removing pipe sections you must **reassemble using gaskets and clamps.** Pipelines assembled without gaskets will leak cement and water, which can cause a blockage.

17.11 **⚠WARNING** Concrete is being moved through the delivery system by pressure. Failure of a pipe, clamp, hose, or elbow is possible. For this reason, spend as little time as possible standing under the boom, and wear protective clothing.

17.12 **⚠WARNING** The hose man should not hug the hose, but hold it with both hands, to allow the hose to move freely (Figure 84).

Figure 84
Do not hug the boom hose

17.13 **⚠WARNING** The hose man should not walk backwards (Figure 85). Walking forward will allow him to see obstacles and avoid tripping.

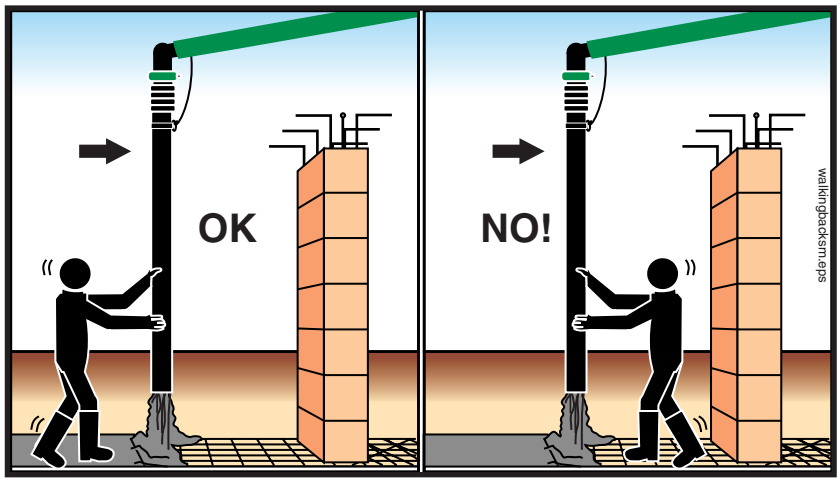


Figure 85
Do not walk backwards, stay out of the path of the boom

17.14 **⚠WARNING** The hose man should never position himself between the boom or boom hose and any fixed object like a wall or column (Figure 85).

17.15 **⚠WARNING** Do not kink the end hose. Kinking will cause the pump to create maximum concrete pressure. The pump may unkink the hose by force! (See Figure 86.)

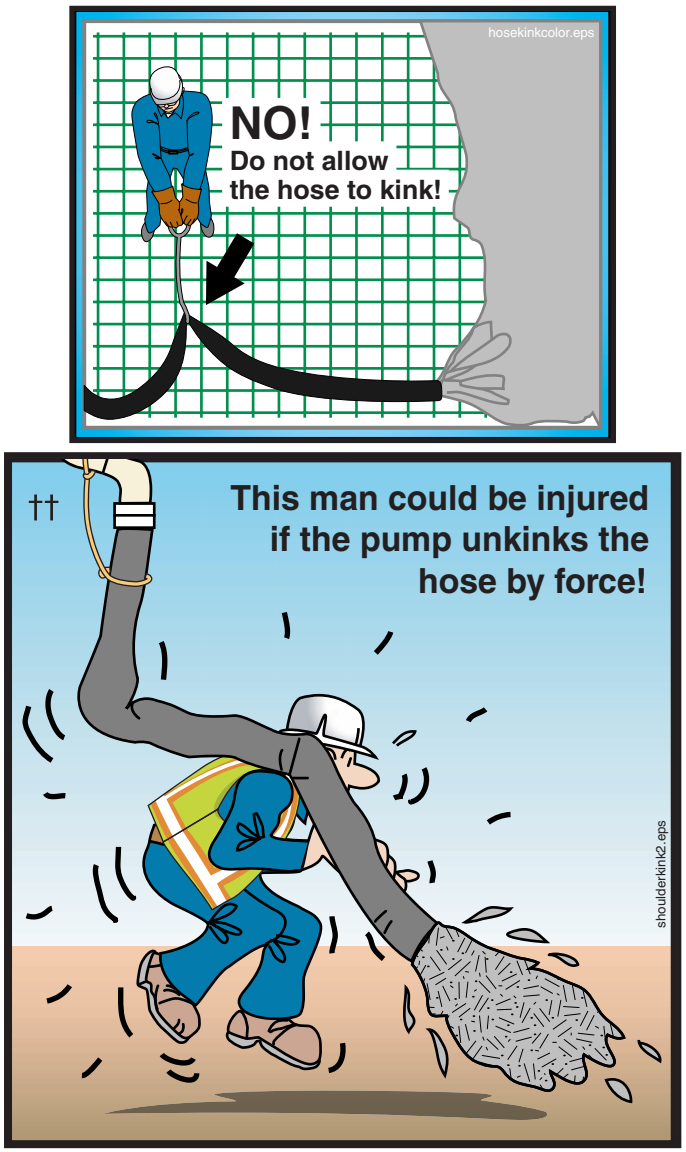


Figure 86
Never kink the hose; Never hold the hose with your shoulder

17.16 **⚠WARNING** Never try to support the tip hose with your back or shoulders. Let the hose hang from the boom (Figure 86).

17.17 **⚠CAUTION** Be careful when handling pipeline or any other heavy object. Learn how to lift without using your back. Get assistance if needed.

17.18 **⚠WARNING** Crushing hazard! Never position your hands or any body part between the end of the delivery system and a fixed object (e.g., between the tip hose and the concrete form) (Figure 87). Watch for clamps lowering with the line, because they have a larger diameter than the pipes/hoses they connect.

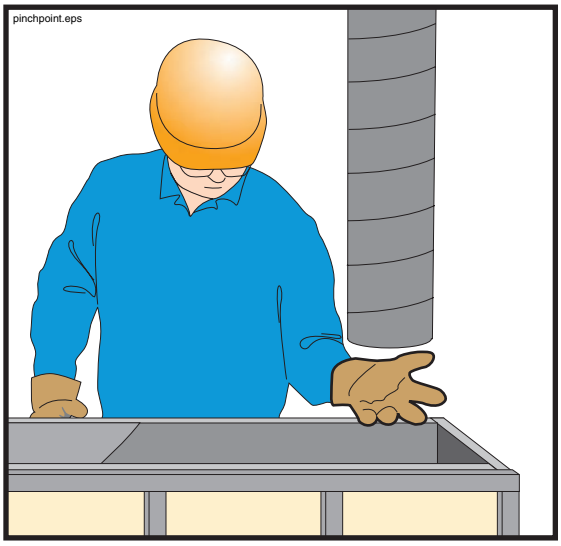


Figure 87
Watch out for the pinch points

17.19 **⚠WARNING** Do not allow the boom hose to get lower than two feet above the deck to prevent the boom hose from hitting the feet of the hose man, and to prevent the hose opening from being blocked by the deck, which could cause the hose to whip.

17.20 **⚠WARNING** Falling hazard! When pouring columns, slabs, or walls above ground, secure yourself from falling.

17.21 **⚠WARNING** Never stand on, sit on, or straddle a pipeline while it's in use, or whenever it is pressurized (Figure 88). Pipeline wears out with each stroke of the pump. If the pipe bursts, you want to be to the side of it, not on top of it.

Figure 88
Never straddle or sit on a pressurized pipeline

17.22 **⚠WARNING** To avoid confusion and conflicting signals, only one person should signal the pump operator.

17.23 **⚠WARNING** Before the pour begins, the hose man, the operator and the spotter should agree on the hand signals (Figure 89).

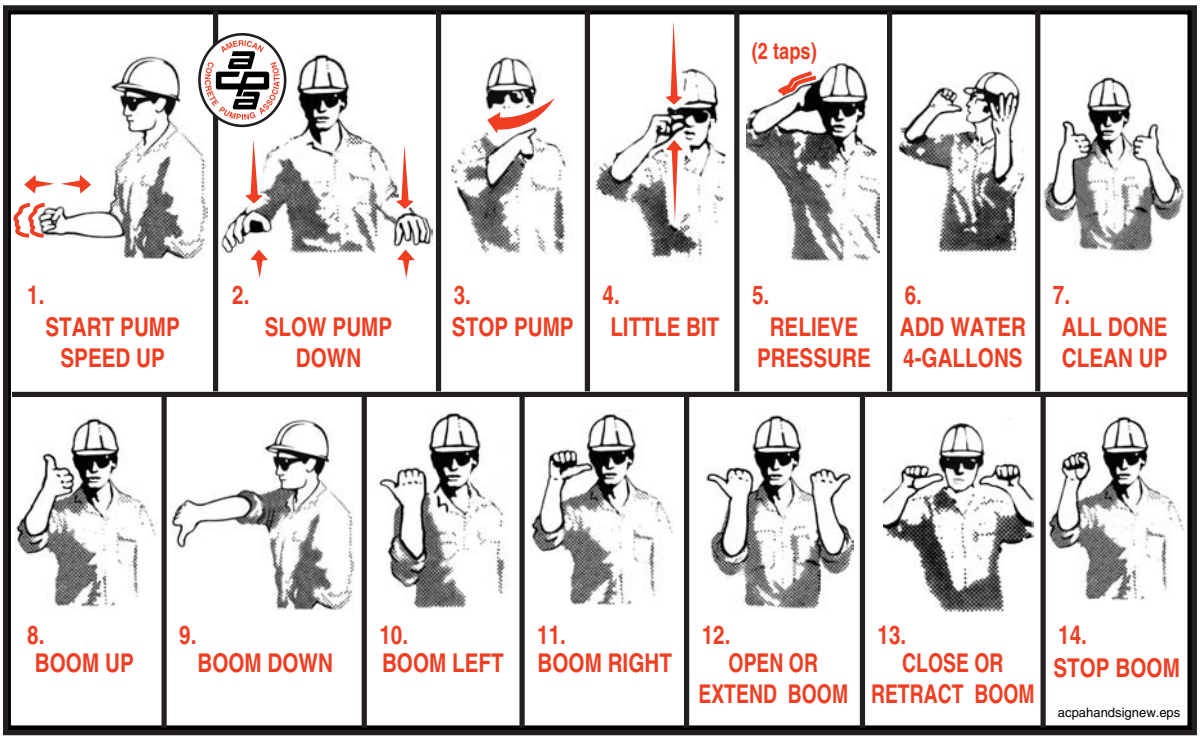
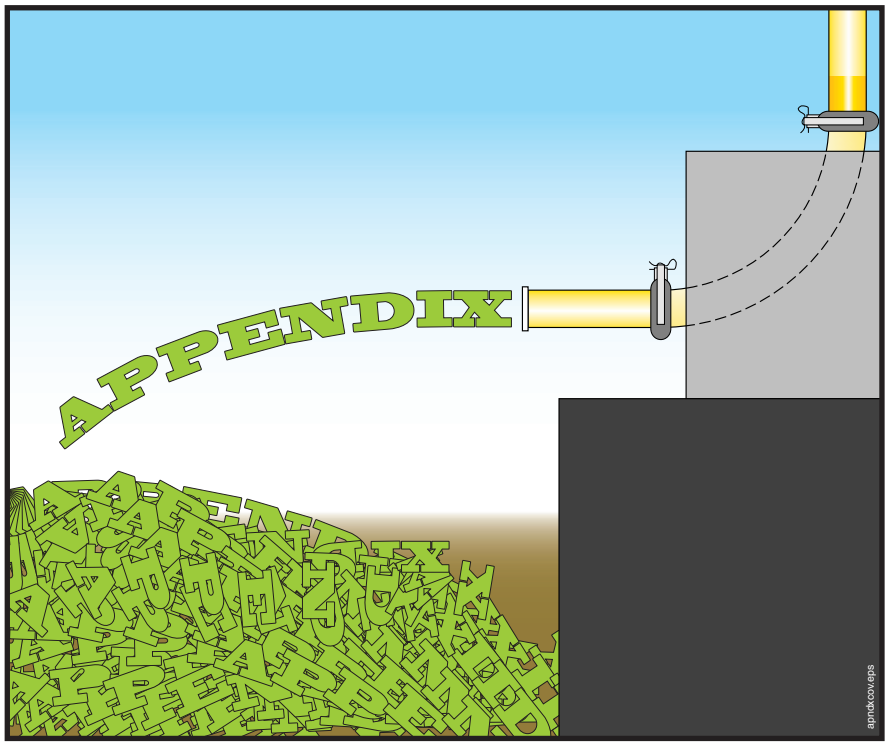


Figure 89
ACPA recommended hand signals



Appendix

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VII. Weld On Ends / Coupling Comparison

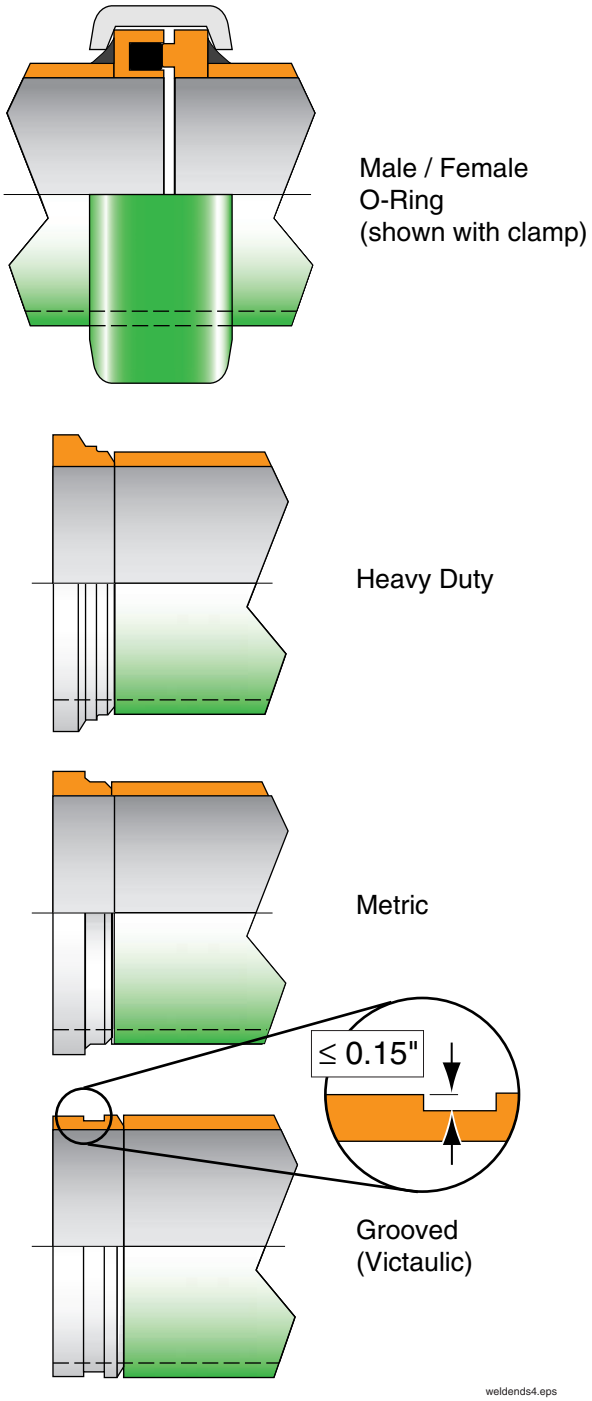
Shown is a comparison among commonly used ends/couplings. No two ends shown can be joined without the use of an adapter pipe or a special adapter clamp. Clamps and pipe strength must also be considered when determining proper system requirements. The ratios shown in the text below represent the safety factor from burst : working

1. Male / female o-ring type couplings have the highest pressure rating of the ends commonly used for concrete pumping. They can withstand 4350 PSI @ a 2:1 safety factor. They are self aligning and waterproof when used with o-rings in good condition. Typically not used on booms because of their weight. Pipes equipped with this style coupling cannot be swapped end-for-end.

2. Heavy-Duty couplings are designed for pressures up to 2250 PSI @ 2:1. They have 20% more contact area than metric couplings, and a tapered face that draws the pipe sections together during assembly. Both the ends and clamps weigh more than metric style, and therefore should not be used on booms without consulting the manufacturer.

3. Metric couplings are designed for pressures up to 1400 PSI @ 2:1. They have 85% more contact area than grooved couplings. The face is flat and will not draw pipe together. Although they have a raised edge, they are not compatible with Heavy Duty couplings unless a special clamp or an adapter pipe is used to change from one style to the other. Metric connections are standard equipment on booms because of the weight savings compared with other styles.

4. Grooved couplings (lip height of 0.15” or less) are designed for pressures only up to 750 PSI @ 2:1. The recessed groove is hard to clean when changing pipe on a job. The weld-on end fails before the pipe because the groove is cut into the pipe thickness, making it the weakest spot. Grooved couplings are not recommended for concrete pumping applications.



NOTE: All pressure ratings listed refer to 5 inch (125mm) diameters in like-new condition. Other pressures would apply to other sizes.

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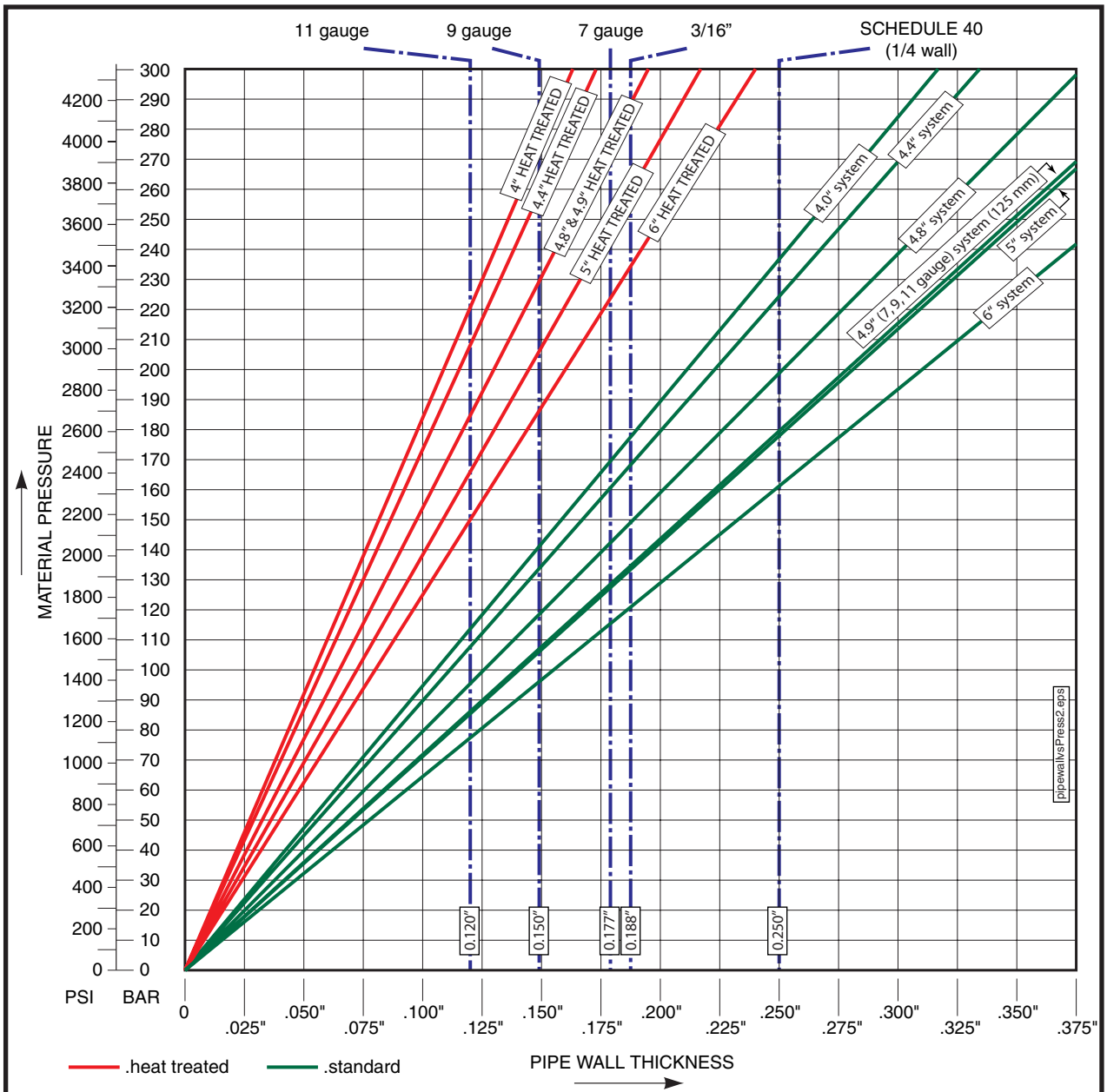
VIII. Minimum Pipe Wall Thickness Chart



1. This chart assumes a safety factor of 2:1. Higher safety factors may be required in some circumstances.
2. Wear reduces wall thickness. Thickness must be checked on a regular basis.
3. Pressures may be limited even more by clamp style or pipe end used.
4. The chart is based on 62,000 PSI tensile strength. Heat-treated calculations are based on 120,000 PSI tensile strength.
5. The chart is for pressure calculations ONLY. There is no allowance for mechanical forces other than pressure, and thicker walls may be needed for mechanical strength because of support or restraint considerations.
6. The chart does not take into account metal fatigue caused by pressure cycles.

Note! This chart is intended as a guide for concrete pumping applications and is subject to the notes, assumptions, and conditions listed above. Any other use of this chart is not recommended.

This chart does not apply to double-wall pipe. Double wall pipe can be checked by inspecting the inside of the pipe. If the insert is intact, the pipe is okay. If the insert is worn through, the pipe must be replaced. Contact your pipe supplier for the pressure capacity of your double-wall pipe.

IX. Glossary Of Terms

Accumulator

A hydraulic device that stores fluid power energy in much the same way that a battery stores electrical energy. Because an accumulator will store energy, it MUST be drained and depressurized before work begins on an accumulator equipped actuator or hydraulic system.

Agitator

A device that sits in the concrete hopper to keep concrete moving, preventing it from setting. It is typically a rotating shaft to which several paddles have been mounted. *See Also:* Hopper Grate

AWS D1.1

The code for structural welding with steel as defined by the American Welding Society. Sections 3, 5, and paragraph 9.25 of section 9 apply. *See Also:* Certified Welder and EN 287-1

Blanking Plate

Also known as a blanking plug or end cap. It's purpose is to prevent material from falling out of the delivery system (typically the end hose) when moving a boom with a full pipeline over personnel or property.

Blockage

Simply put, if the pump is pushing and concrete fails to come out at the point of discharge, it is called a blockage. Blockages can be removed with pump pressure, by rocking the pump between forward and reverse, or some other remedial measure. If the blockage can not be removed in such a manner, it's called a plug. *See Also:* Plug, Rock Jam. The causes of blockages are detailed in section 8.21 of this manual. In all cases, blockages create a hazard by causing high concrete pressure, combined with the sometimes uncoordinated efforts of untrained workmen to remedy the problem.

Bulk Density

The mass of a substance per volume. For example, one cubic foot of air weighs much less than one cubic foot of water. One cubic foot of lightweight concrete weighs less than one cubic foot of steel entrained concrete. We could say that steel entrained concrete has a higher bulk density than lightweight concrete. All calculations for the operation manuals and specifications of concrete pumps are based upon 150 pounds per cubic foot, which is the approximate mass of hard rock (normal) concrete.

Certified Operator

An operator that has been issued a certification card by the American Concrete Pumping Association. There are several classes of certification, each relating to a different category of pump. For an operator to become certified, he (she) must pass the written tests regarding operation, setup, and clean out for each category of pump, pass the safety rules test which is common to all certification categories, meet the experience requirements set forth for each category, and maintain a safe and clean driving record. The certification card only certifies that the operator has passed a written test administered by an A.C.P.A. certification tester and does not attest to their ability to operate a concrete pump. *See Also:* Qualified Person, Qualified Operator.

Certified Welder

As it relates to concrete pumping and this Safety Manual, a Certified Welder is a person that has applied for, taken and passed the American Welding Society (AWS) or the European Norm (EN) test for structural steel welding. Anyone welding on a concrete pump placing boom, outriggers, towers, etc. must be certified to AWS D1.1 sections 3, 5, and paragraph 9.25 of section 9 **and/or** EN287-1/PREN288-3.

Concrete Delivery Hose
A flexible concrete hose that has two end couplings.

Concrete Pressure
The force per square area that is exerted on the concrete. The concrete pressure will always be a ratio in direct proportion to the hydraulic oil pressure on the concrete pump circuit. *See Also*: Maximum Pressure

Conductors
Materials that will conduct electricity. Copper, silver, aluminum, gold, steel, and water are considered GOOD conductors of electricity. Air, fiberglass, rubber, ceramics and glass are considered POOR conductors. All of these conductors have a resistance to the flow of electricity that can be measured in terms of ohms per linear foot. As voltage gets higher, more current flows through the same resistance. In the case of high voltage electric wires (8000 volts, for example) even the poor conductors will carry enough current through your body to ground that you could be killed. (As little as 35 milliamps can cause fibrillation of the heart.) Some conductors, like air, resist electricity very well, but if the voltage gets high enough, current will flow (lightning is a good example of this). *See Also:* Electrocution

Decibels
One tenth of a bel. Abbreviated dB. It is a measurement of sound volume. As it applies to concrete pumps, it is a measurement of the sound pressure level one meter away from a noise source. O.S.H.A. has developed guidelines for time limits on exposure to sound at different volume levels. The chart can be found on page 36 of this manual.

Drive Engine
The primary source of power for a hydraulic system. Typically, the word “engine” denotes and internal combustion device, whereas the word “motor” denotes an electrical device.

Electrocution
Made from the words “Electric” + “Execution.” It means death by electricity. *See Also:* Conductors

EN 287-1 / PREN 288-3
The code for structural welding with steel as defined by the European Norm. *See Also:* Certified Welder, AWS D1.1.

End Hose
A flexible concrete hose that has one end coupling.

Foreign Material
Material that was never intended to be pumped, which ends up in the concrete hopper. Examples of foreign material include small animals, hammers, ready mix truck fins, unmixed clumps of cement, hardened concrete that breaks away from ready mix truck fins, and soda pop cans. These items could create a blockage if pumped.

Go Devil
A plug made from a rubber composite, usually with several fins that expand to seal when pressure is applied. They are intended to be inserted in a steel delivery pipeline and pushed with water or compressed air for the purpose of cleaning the pipe. *See Also:* Sponge Ball

Guide
An assistant brought in to help in backing up a truck or trailer, or to help in other circumstances where the driver cannot see enough to assure safety. *See Also:* Spotter

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High Voltage

For the purposes of this manual, anything over 24 volts is to be considered high voltage. In the U.S., electrically driven concrete pumps normally operate the motors at 480 volts AC (high voltage) and the controls at 24 volt DC (low voltage). When dealing with electric wires in residential or industrial areas the voltage will be approx. 8000 volts to ground, or 13,800 volts from phase to phase (distribution voltage). When dealing with electric wires that are mounted on steel towers high above the ground, the voltage will range from 100,000 to 1,000,000 volts (transmission voltage).

Hopper Grate

A meshwork placed over the concrete hopper, typically made from steel bars. It serves the functions of keeping human body parts away from the agitator (when left in it's proper position) and keeping large foreign objects from falling into the hopper, which could cause blockages if they were pumped.

Jacking the Outriggers

Adjustment of the outriggers in the vertical direction. With boom mounted concrete pumps you should strive to make the adjustments so that the unit sits within 3° of level.

Licensed Electrician

A qualified electrician licensed by the state, county or municipality where the connections are to be made. In some locations electricians are not required to be licensed, and in these cases the work should still be carried out by competent professionals. Under no circumstances should high voltage connections be made by a concrete pump operator or related personnel.

Maintenance

All procedures for service, inspection, and repair of concrete pumps and related equipment and devices. Maintenance and inspection are methods of ***maintaining*** the desired state of the equipment. Repair is the method of ***restoring*** the desired state of the equipment.

Maximum Pressure

When talking about a hydraulic system, maximum pressure refers to the highest pressure that can be achieved with the settings of the circuit relief valves. When discussing concrete output, maximum pressure refers to the pressure that will be developed if the hydraulic system pressure reaches the relief valve setting. Concrete pressure is the force at which the differential cylinders are moving, divided by the cross sectional area of the concrete cylinder. Maximum concrete pressure, then, is developed when the differential cylinders are moving with maximum force, which is determined by the hydraulic system relief valve setting. *See Also:* Concrete Pressure.

Minimum Safety Distance

In this manual, the term "minimum safety distance" refers to the closest distance that you are allowed to approach an object, electrical wires, etc. and still leave room for errors in human judgement or machine malfunction. With electrical wires in the U.S., this distance is 17 feet, as recommended by the American Concrete Pumping Association. This distance may have other values in different countries (Canada specifies 7 meters). It is up to the operator to know the value for the place of operation.

Operational Area

The area around a working piece of equipment or point of discharge where hazards can be encountered due to the nature of the machinery or process in use.

O.S.H.A.

Occupational Safety and Health Administration. A branch of the United States federal government that deals with job safety. They establish and enforce safety regulations for industry and

business. Among the areas over which they have authority are construction job sites and work shops.

Personal Protective Equipment (P.P.E.)

Things you can wear to protect yourself from potential dangers in a concrete placing environment. Examples are:

- Snug fitting work clothes
- Steel toed work boots
- Lime resistant gloves
- Safety glasses
- Ear muffs or ear plugs
- Rubber boots when you have to stand in concrete
- Hard hat
- Breathing mask when working with cement dust

Plug

A plug is a blockage that cannot be removed with the pump pressure, or by other remedial measures. A plug must be removed manually. *See Also:* Blockage.

Point of Discharge

Also known as the point of placement. The location of concrete expulsion from a delivery system. This can be the point of placement (the actual form that is being filled with concrete) or the clean out area after completion of the job.

Pour

Used by the concrete pumping industry and in this manual as a noun. It is the specific job for the pump during any given time period. (e.g. "We'll grab lunch right after the pour.")

Qualified Person

As used in this Safety Manual, a *qualified person* is defined as: a person who, by possession of a recognized degree of certificate of professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to the subject matter and work. Other qualified persons may include master mechanics and after-sales service technicians of the manufacturer. *See Also:* Certified Operator

Qualified Operator

Operators shall be considered qualified when they have completed a program of training and supervised operation of concrete pumps and have passed a practical operating examination of their ability to operate a specific model and type of equipment as well as their understanding of the controls and operating procedures. Furthermore, the operator must meet the knowledge and physical requirement sections of the concrete pumping safety standard.

Qualified Personnel

A generic term used to describe a person who is qualified in the area of application. For example, having your boom repairs inspected by "qualified personnel" before use would refer to inspection by a certified welder or certified welding inspector. Having repairs to your hydraulic system done by "qualified personnel" would refer to repairs made by qualified workshop personnel.

Qualified Workshop Personnel

An individual who:

- has reached the age of 18 years,
- is physically and mentally capable,
- has been trained in proper repair, maintenance, and inspection procedures plus the pertinent safety rules for concrete pumps and related equipment,
- has demonstrated their capabilities to their company in regards to the above mentioned

procedures and rules, and
- can be expected to perform these duties, as assigned, in a reliable manner.

Rock Jam

A specific type of blockage caused when the cement and fines of the concrete are not present in sufficient quantity to fully coat the larger aggregates and the walls of the delivery system. In these cases, the rock (larger aggregates of the mix) will form a wedge inside of the pipe. Resistance to movement then becomes overpowering and the concrete stops. *See Also:* Blockage.

Separate Pipeline

A pipeline that is laid between the concrete pump and the point of discharge, other than the placing boom pipeline.

Shutoff Valve

In hydraulics: a valve with the ability to stop the flow or pressure of hydraulic oil. It must be able to withstand the maximum pressure of the hydraulic circuit that it controls. In concrete: A manually or hydraulically operated valve that will prevent the flow of concrete in either direction. The shutoff valve must be able to withstand the maximum pressure on the concrete of which the pump is capable of exerting.

Soil Pressure

The force per square area that is exerted on the ground by the outrigger legs. The amount of pressure that the soil will support varies with the composition and compaction of the soil. To make a determination on the stability of the soil, see the chart on page 22 of this manual.

Sponge Ball

A medium to hard sponge formed into a sphere and used to clean the inside of delivery pipelines. *See Also:* Go Devil

Spotter

A spotter is a person who stands at a vantage point where he (she) can see both the point of discharge and the operator of the pump. The spotter would then direct the operator to operate the unit as required by the job circumstances with two-way radios or hand signals. A spotter can be anyone who is familiar with the safety rules for the pump and workers and is equipped with a radio or knows the appropriate hand signals. A spotter is needed whenever the operator cannot safely see the point of placement or the distance between the unit and an unsafe area. *See Also:* Guide

Sucking Back

The act of putting the concrete pump into the reverse mode for any of several reasons.

Thrust Block

Also known as a “dead man”. This is a large block of poured concrete, usually with one or more sweep elbows cast inside, placed at the bottom of a vertical run for the purpose of supporting the weight of the vertical run and for lateral stabilization of the pipeline. It stabilizes and supports the vertical run by virtue of its enormous mass (normally one cubic yard or larger).

Towing Vehicle

In this manual, *Towing Vehicle* applies only to vehicles that tow trailer mounted concrete pumps. It is the vehicle that you will use to tow the trailer on the road, on the job site, or in the yard. See the safety rules regarding this subject on page 10 of this Safety Manual.

Transport Position

This relates to the position of the boom when you will be driving the unit. The travel position of the boom is the position of the boom when it is completely folded and lowered into the rests.

Unauthorized

Without authority, without permission. Examples: Unauthorized operation of the boom could be operation by a passer-by, unauthorized repairs to the boom could be repairs designed without the manufacturer's knowledge.

Unintentional Movement

Movement of the pump, boom or related equipment without a specific intentional command by the operator. An example of an unintentional movement would be if an operator fell while walking with the remote control box and accidentally hit a joystick, causing a boom movement.

Vertical Run

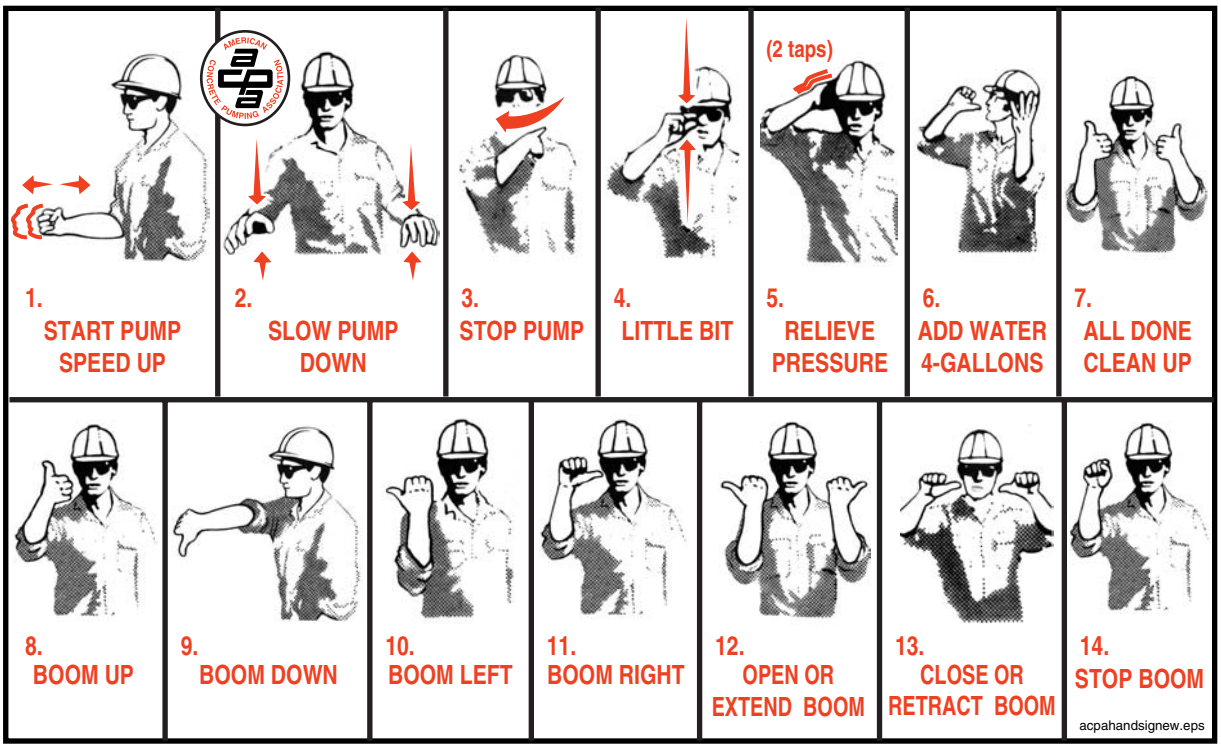
Sections of concrete delivery pipeline that are running in an up (or down) direction. Vertical runs have very specific procedures and rules for installation, support, cleaning, and inspection. Concrete pumping personnel should, therefore, have specific training in these procedures and rules before attempting to use them in a job setting.

Water Jet

The actual stream of water that comes out of the end of a water hose or pressure washer. This is the only part of the water system that needs to go into the hopper, concrete valve, or water box for cleaning.

X. Recommended Hand Signals

The American Concrete Pumping Association (ACPA) recommends using the following hand signals as standard procedure.



XI. Bibliography

Further information regarding concrete pumping is available from the sources listed below. Information for this book was gathered from several different sources, including the following books:

PUMPING CONCRETE AND CONCRETE PUMPS © F. W. Schwing, GmbH

CONCRETE PUMP OPERATOR'S GUIDE TO SAFETY © British Concrete Pumping Association

The MANUAL and ADVISORY SAFETY CODE of PRACTICE for CONCRETE PUMPING © British Concrete Pumping Association

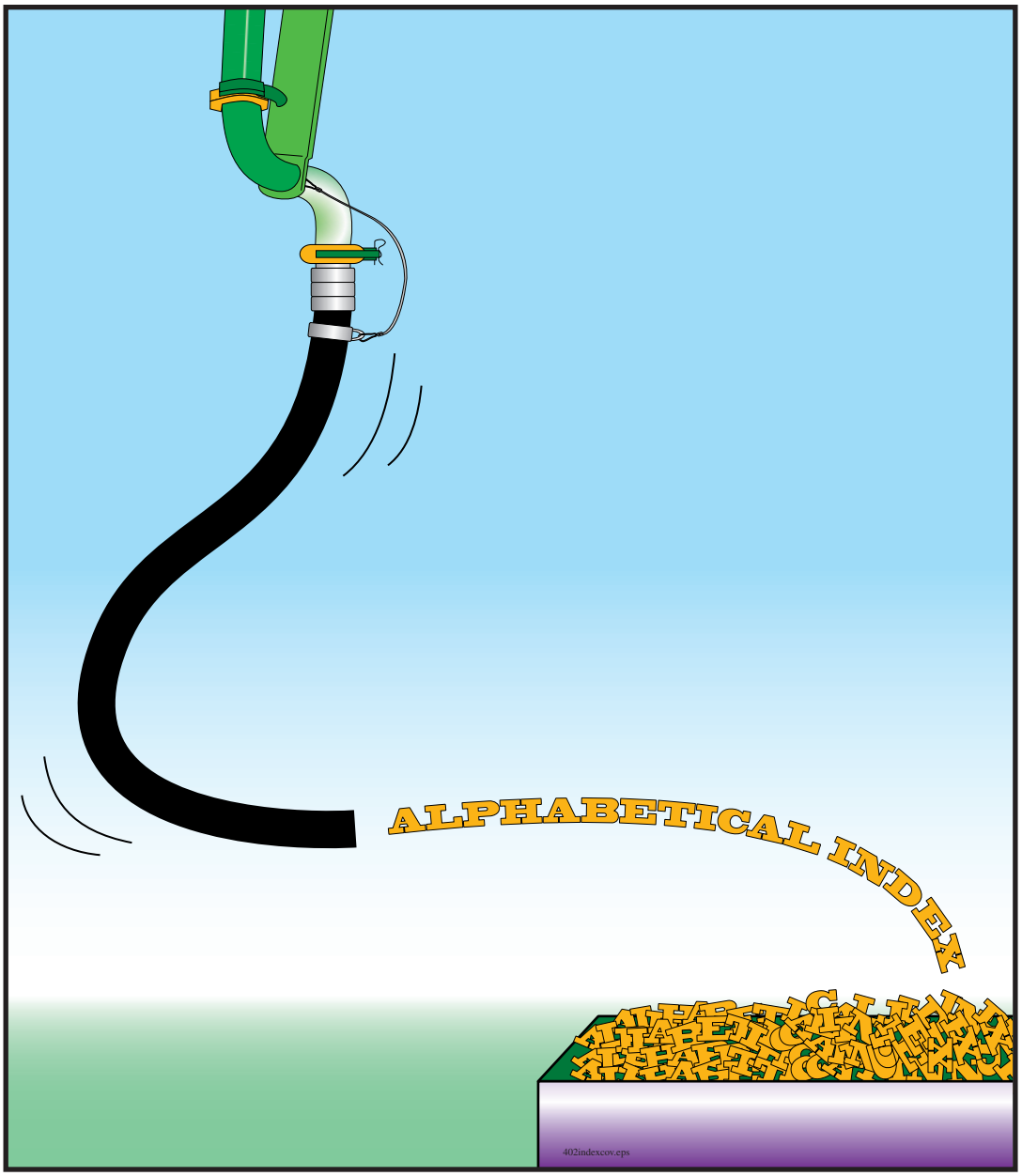
SAFETY STANDARD FOR CONCRETE PUMPS, PLACING BOOMS, AND DELIVERY SYSTEM by the Concrete Pump Manufacturers Bureau

Additional technical information and/or graphic were supplied by:

Construction Forms, Inc.

The American Concrete Pumping Association

Some cartoons were scanned from the book CONCRETE PUMP OPERATOR'S GUIDE TO SAFETY © British Concrete Pumping Association. Used by Permission.



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