



A-SERIES TIER 4 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

SAFETY MANUAL AMERICAN CONCRETE PUMPING ASSOCIATION



- Introduction
- General Safety Rules
- Appendix



OPERATION and MAINTENANCE

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INTRODUCTION

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

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 UNDERSTANDS this manual and the accompanying Safety Manual.



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

- 1 year or 1200 pumping hours whichever occurs first

B and C Series Pumps

- "Hitch to Hopper" for 1 year or 1200 pumping hours, whichever occurs 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, and/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



OPERATION and MAINTENANCE

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WARRANTY CLAIM FORM					
Claim Number:			Date:		
Distributor Account Number:			End User Account Number:		
Distributor:			End User:		
Address:			Address:		
City:	State:	Zip:	City:	State:	Zip:
Phone ()			Phone ()		
Pump Model: _____			In Service Date: _____		
Pump Serial Number: _____			Hours of Operation: _____		
			Failure Date: _____		
			Repair Date: _____		
Do not send part(s) until requested by REED or until claim is approved. All parts requested to be returned must have a Return Authorization Number provided by REED and shipping freight prepaid. Parts must ship within 30 days from REED request.					
Return Authorization Number:			Ship Date:		
Part Number	Description	Qty	Unit Price	Total Price	Replacement Part Invoice No.
Failure Description and Cause: _____					
REED Comments: _____					
Claim Value Approved:\$ _____			Claim Value Denied:\$ _____		
REED Print Name, Sign, and Date: _____					
Dealer Print Name, Sign, and Date: _____					

SAFETY

Everyone involved with the operation, maintenance, inspection, and repair of the concrete pump **MUST READ** and **UNDERSTANDS** 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 points 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. Unit must be OFF, and the ignition key must be removed from the control panel or dash.
2. Key must be securely stored in toolbox or with operator performing maintenance.
3. 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



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



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



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



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.

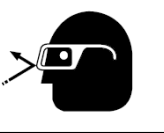
Do not paint over this label/No pintar encima de ésta etiqueta

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IMPORTANT	IMPORTANTE
<p>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</p>	<p>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</p>


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

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⚠ WARNING			SAFETY INSTRUCTIONS		
			<ol style="list-style-type: none"> 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. 		
<ul style="list-style-type: none"> • 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			INSTRUCCIONES DE SEGURIDAD		
<ul style="list-style-type: none"> • 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. 			<ol style="list-style-type: none"> 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. 		

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ADVERTENCIA ⚠ WARNING

		
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INSTRUCCIONES DE SEGURIDAD				SAFETY INSTRUCTIONS		
 <p>Recommended hand signals Señales de mano recomendadas</p>						
 <p>1. START PUMP SPEED UP</p>	 <p>2. SLOW PUMP DOWN</p>	 <p>3. STOP PUMP</p>	 <p>4. LITTLE BIT</p>	 <p>(2 golpecitos) (2 taps) 5. RELIEVE PRESSURE</p>	 <p>6. ADD WATER 4-GALLONS</p>	 <p>7. ALL DONE CLEAN UP</p>
<p>1. PRENDER LA BOMBA ACELERAR</p>	<p>2. BAJAR VELOCIDAD A LA BOMBA</p>	<p>3. PARAR LA BOMBA</p>	<p>4. UN POCO</p>	<p>5. ALIVIAR LA PRESIÓN</p>	<p>6. AÑADIR AGUA 4-GALONES</p>	<p>7. TERMINADO LIMPIAR</p>
<p><small>Do not paint over this label/No pintar encima de ésta etiqueta</small></p>						
<p><small>803235</small></p>						



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DECALS PLACED NEAR HOPPER GRATE AREA

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

⚠ WARNING



Keep hands out of hopper and valve assembly. See operation manual if access is required.

⚠ ADVERTENCIA

No meta las manos a la tolva o válvula. Consulte el manual de operación si necesita tener acceso.

800917

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

⚠ WARNING



Stay off hopper grates.

⚠ ADVERTENCIA

Manténgase alejado de la rejilla que cubren la tolva.

800918

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

! WARNING



Cement dust is toxic. Use lung protection when exposed.

! ADVERTENCIA

El polvo de cemento es tóxico. Use protección para los pulmones cuando se exponga.

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OPERATION and MAINTENANCE

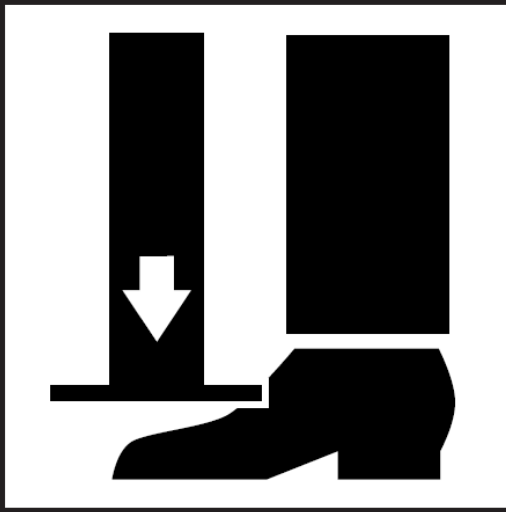


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DECALS PLACED NEAR WATERBOX AREA

	 WARNING
	Keep hands out of waterbox. Stop motor if access is required. Keep guards in place.
	 ADVERTENCIA
	No meta las manos a la caja de agua. Pare el motor si necesita tener acceso. Mantenga las cubiertas cerradas.

Do not paint over this label/No pintar encima de ésta etiqueta 800916

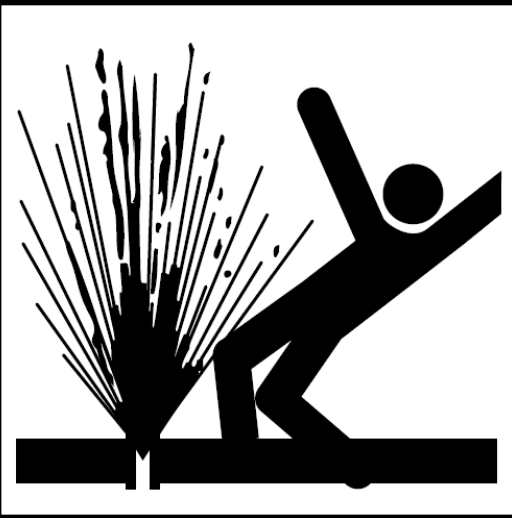
DECALS PLACED NEAR OUTRIGGER CONTROL AREA

	 WARNING
	Clear area before activating outriggers.
	 ADVERTENCIA
	Despeje el área antes de activar los estabilizadores.

Do not paint over this label/No pintar encima de ésta etiqueta 800919

DECALS PLACED NEAR HOPPER OUTLET AREA

	⚠ WARNING Do not operate at pressures exceeding the rating of the entire material delivery system.
	⚠ ADVERTENCIA No utilizar a presiones que excedan la presión nominal de todo el material de la línea de entrega.
Do not paint over this label/No pintar encima de ésta etiqueta	
800921	

	⚠ WARNING Before opening a blocked pipeline, relieve pressure by reversing pump. See manual.
	⚠ ADVERTENCIA Alivie la presión antes de destapar una tubería bloqueada, invirtiendo para ello la bomba. Vea el manual.
Do not paint over this label/No pintar encima de ésta etiqueta	
800922	

DECALS PLACED ON SIDE PANEL AREA



⚠ WARNING

This machine is remote controlled and may start at any time. Stop engine before servicing unit.

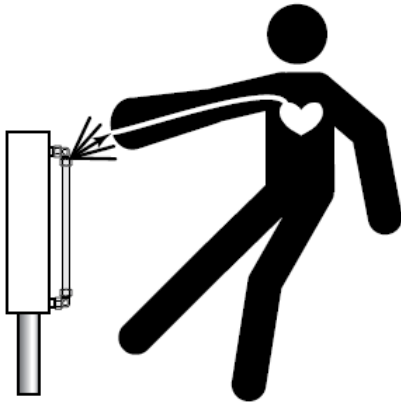
⚠ ADVERTENCIA

Esta máquina funciona a control remoto y puede ponerse en marcha en cualquier momento. Apagar el motor antes de realizar el mantenimiento.

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

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⚠ WARNING



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

Do not touch hydraulic oil leaks. Get immediate medical attention if oil penetrates skin.

⚠ ADVERTENCIA

No toque las fugas de aceite hidráulico. Obtenga atención médica inmediata si el aceite penetra en la piel.

803225



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OPERATION

OPERATOR QUALIFICATIONS

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

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



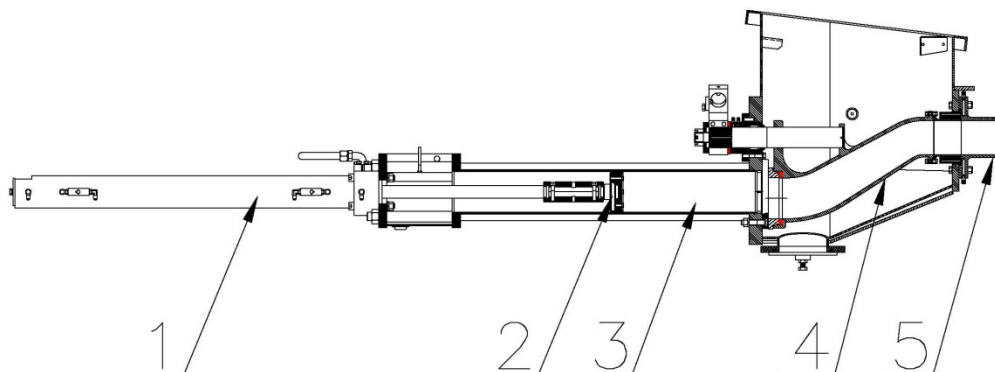
- Individuals who cannot read and understand this operation manual, Safety Manual, signs, warnings, notices, and operating instructions, in the language in which they are printed, must not be allowed to operate the concrete pump.
- Only qualified, experienced, and trained personnel may be allowed to operate the concrete pump.
- 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 safe operation and towing of concrete pumps.

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



hydraulic drive cylinders.

To energize the pump circuit, use the adjustable throttle control 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 also activates the S-Tube directional valve.

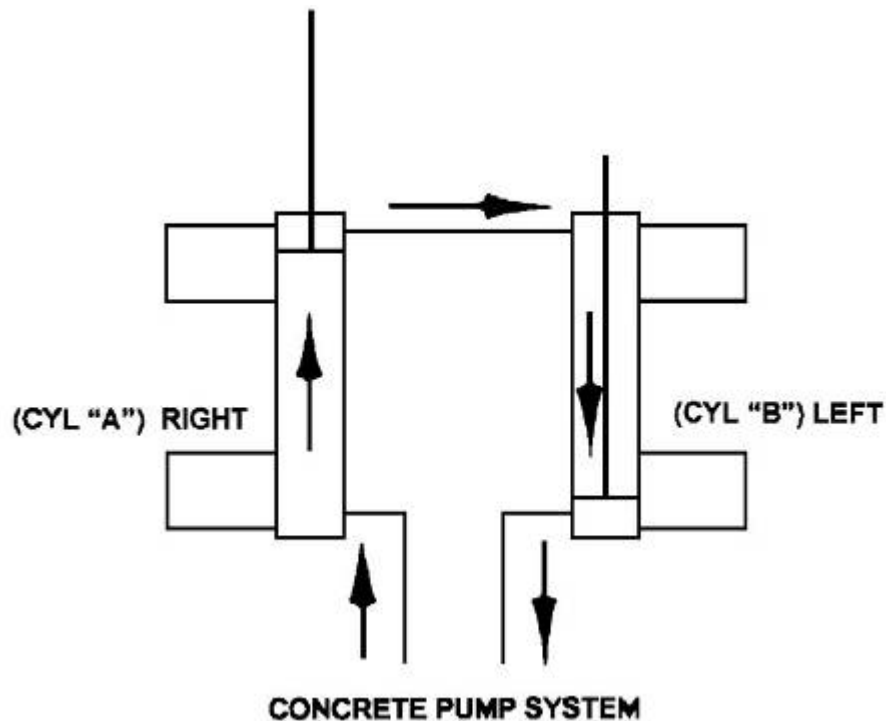
The material pumping action is the result of the two material cylinders cycling on an alternate basis. This alternating cycling is controlled by an electrical signal that is generated by the proximity sensors located in the flush box at the end of each material cylinder's suction or retraction stroke.

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.



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.

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 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.



SERIAL PLATE IDENTIFICATION

A-SERIES



REED 13822 OAKS AVENUE CHINO, CA 91710		PHONE (909) 287-2100 FAX (909) 287-2144	
MODEL: _____	SERIAL NO: _____	PSI: _____	BAR: _____
MAXIMUM FLOW: _____	PSI: _____	BAR: _____	PSI: _____
ENGINE: _____	HP: _____	VOL: _____	PSI: _____
VOLUME: _____	PSI: _____	PSI: _____	PSI: _____
YEAR OF MFG: _____	BY: _____		

B-SERIES



REED 13822 OAKS AVENUE CHINO, CA 91710		PHONE (909) 287-2100 FAX (909) 287-2144	
MODEL: _____	SERIAL NO: _____	PSI: _____	BAR: _____
MAXIMUM FLOW: _____	PSI: _____	BAR: _____	PSI: _____
ENGINE: _____	HP: _____	VOL: _____	PSI: _____
VOLUME: _____	PSI: _____	PSI: _____	PSI: _____
YEAR OF MFG: _____	BY: _____		

C-SERIES



REED 13822 OAKS AVENUE CHINO, CA 91710		PHONE (909) 287-2100 FAX (909) 287-2144	
MODEL: _____	SERIAL NO: _____	PSI: _____	BAR: _____
MAXIMUM FLOW: _____	PSI: _____	BAR: _____	PSI: _____
ENGINE: _____	HP: _____	VOL: _____	PSI: _____
VOLUME: _____	PSI: _____	PSI: _____	PSI: _____
YEAR OF MFG: _____	BY: _____		



A SERIES MAIN PANEL SERIAL IDENTIFICATION



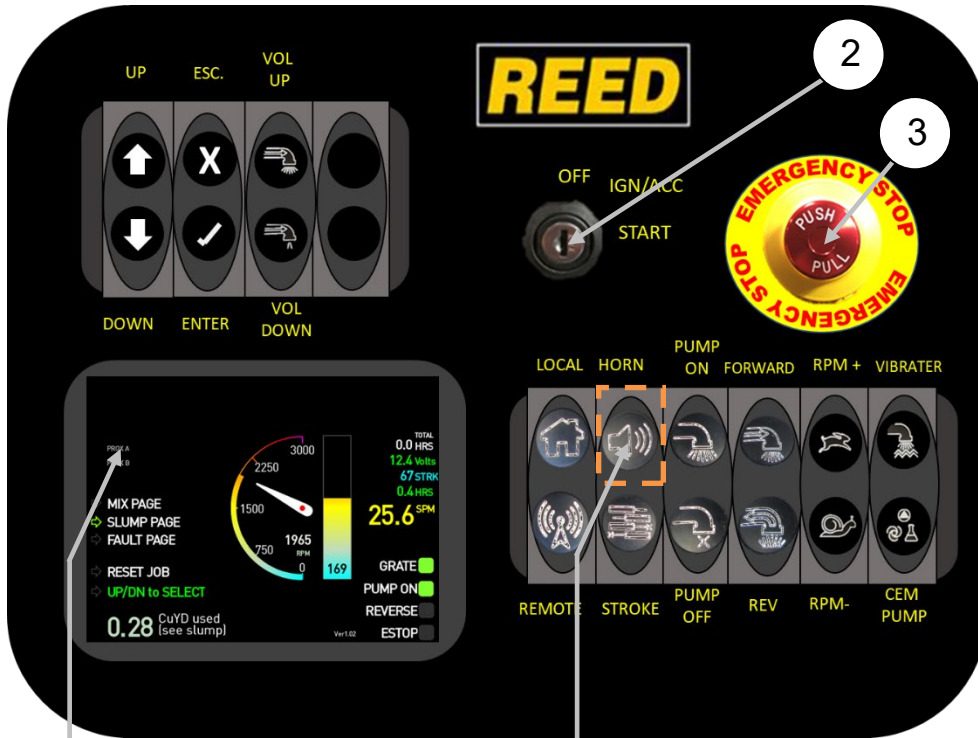
Serial Plate Identification

REED PLC CONTROL PANEL SERIAL PLATE	
Panel serial # →	Panel Part # BW10533 Pump S/N
Pump type →	Pump (A B C) Tier ver. (4) ← Tier version
PLC program →	PLC program ver. MD4-5 Display (Reed p/n 88612) serial # ← Display serial #
	MC42 Controller (Reed p/n 89613) serial # ← Controller module serial #



CONTROLS

PLC MAIN CONTROLS A-SERIES



1

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

4

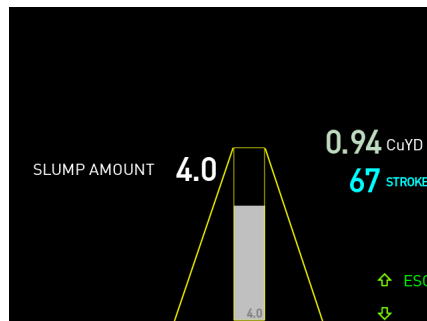
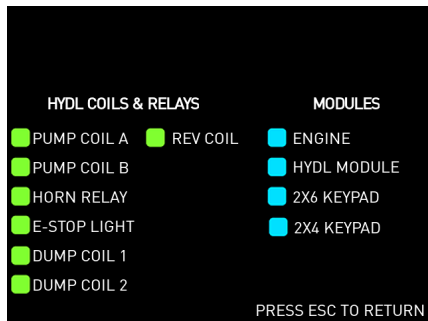
5

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.

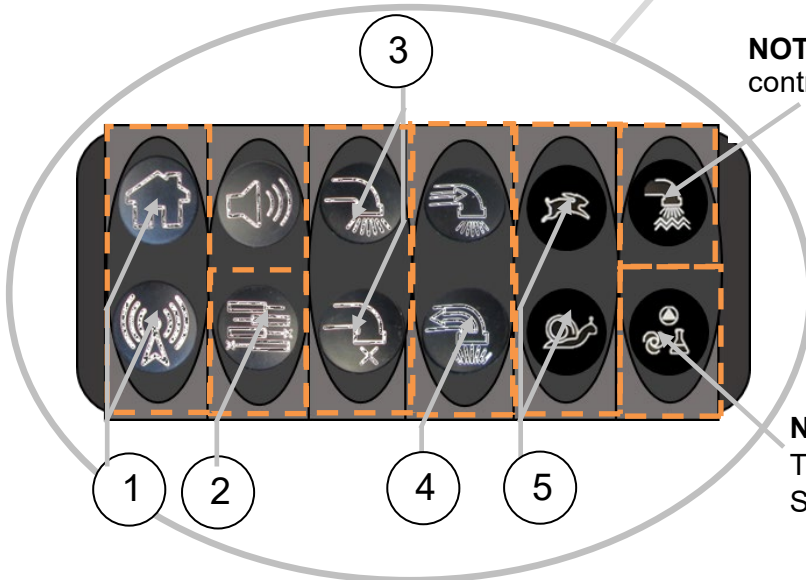


NOTE: Hopper grate safety switch engages
EMERGENCY STOP when grate is lifted

PLC MAIN CONTROLS A-SERIES



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: Vibrator on/off control (option only).

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.

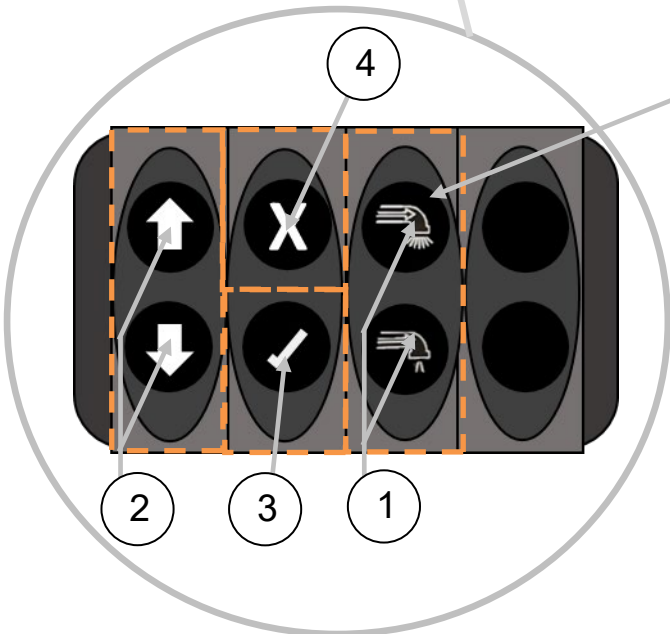
NOTE: Hopper grate safety switch engages EMERGERGENCY STOP when grate is lifted



PLC MAIN CONTROLS A-SERIES



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 **EMERGENCY STOP** when grate is lifted



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AGITATOR CONTROL controls agitator ON/OFF and FORWARD REVERSE functions.





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.

Works between a range of 90 PSI(6bar) min and 275 PSI (19 Bar max).

SET-UP

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



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



Position Machine On As Solid and Level Ground As Possible

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.

PUMPING

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 Waterbox
Or Other Moving Components



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 In OFF Position
- EMERGENCY STOPS Are Not Activated
- Controls On LOCAL Position



PUMPING Continued

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.

CLEANING



Do Not Remove Hopper Grate
Or Other Safety Components



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

1. Set VOLUME CONTROL to LOW
2. Pump as much material as possible out of the delivery system
3. Turn PUMP Switch OFF
4. Disconnect delivery system. Disconnect the line right after the reducer if a reducer is used
5. Open hopper door and empty hopper
6. Flush out hopper, S-Tube, and cylinders with water
7. Place DIRECTION Switch in REVERSE. Place no more than two feet of the water hose into the pump discharge outlet then turn the PUMP switch ON Water will drain into the material cylinders and as pump cycles, any sand and rocks will be forced out through the open clean out door.
8. Stroke the pump to make sure all sand and other material has been cleaned out, and then turn the pump off.
9. Close the hopper clean out door.
10. Place a clean out sponge into the disconnected delivery line. Reconnect the line to the hopper outlet or reducer with the sponge inserted as close to the hopper outlet as possible.
11. Fill the hopper with water. Place the DIRECTION Switch to the FORWARD position and check that VOLUME control is set at low speed. Turn PUMP Switch ON and cycle the pump until the sponge passes through the entire delivery system into a sponge catcher
12. Turn off the pump and allow the water to drain from the system
13. Clean up the remaining areas of the machine as needed
14. After clean-up is complete lubricate all grease points to expel any grout before it cures



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.

PUMP HISTORY FILE NOTING PUMP 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.



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.



Accumulator Pressure 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



MAIN CONTROLS

- Control box in good condition, sealed, not damaged
- All toggles in good condition, 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 securely mounted, connections tight
- Check accumulator condition, mounting brackets & clamps
- Hydraulic fluid to proper level and clean
- All hoses and tubing secure, check for leaks



LUBRICATION

The **REED** concrete pump is equipped with several components that require frequent lubrication. These areas involve the s-tube shifting mechanism, swing components, the shift and outlet bearings and agitator. To insure the economical service and the long life of these components, grease fittings are installed at each point.

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.

MINIMUM 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 each and every interval as recommended.

TYPE OF LUBRICANT

- Use EP grease, extreme pressure grease available for wheel bearings, general purpose grease, Shell Alvania EP (LFH2), or equivalent if this lubricant is unavailable in your area
- Do NOT use Moly grease, grease with Moly additives

LUBRICATION POINTS

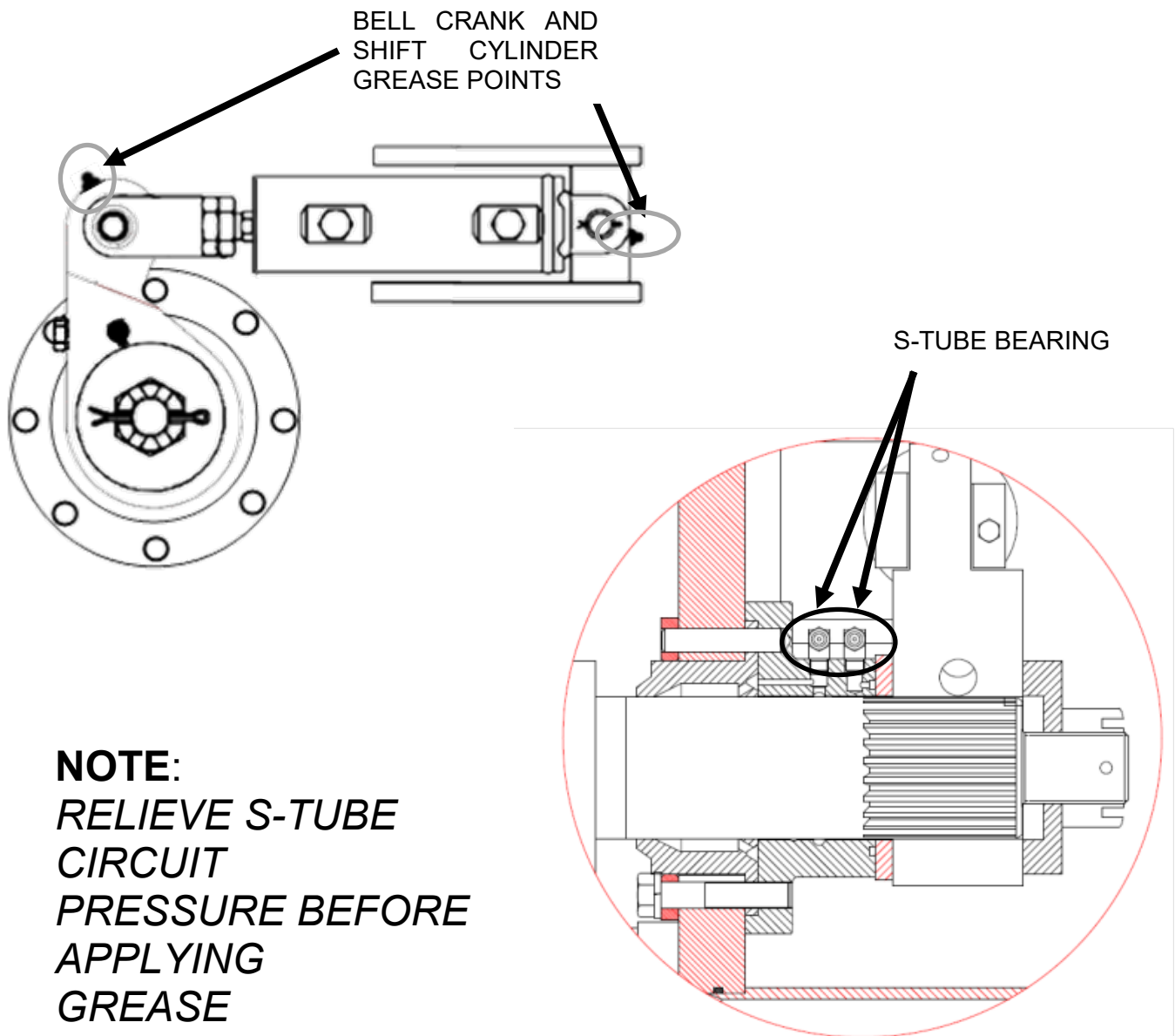
The following graphics are for REFERENCE ONLY.

S-TUBE SHIFT LUBRICATION

CAUTION

HYDRAULIC SHIFT CYLINDERS,
RELIEVE SHIFT CIRCUIT HYDRAULIC PRESSURE TO PROPERLY GREASE
HYDRAULIC SHIFT CYLINDERS AND BELL CRANK

GREASE POINTS

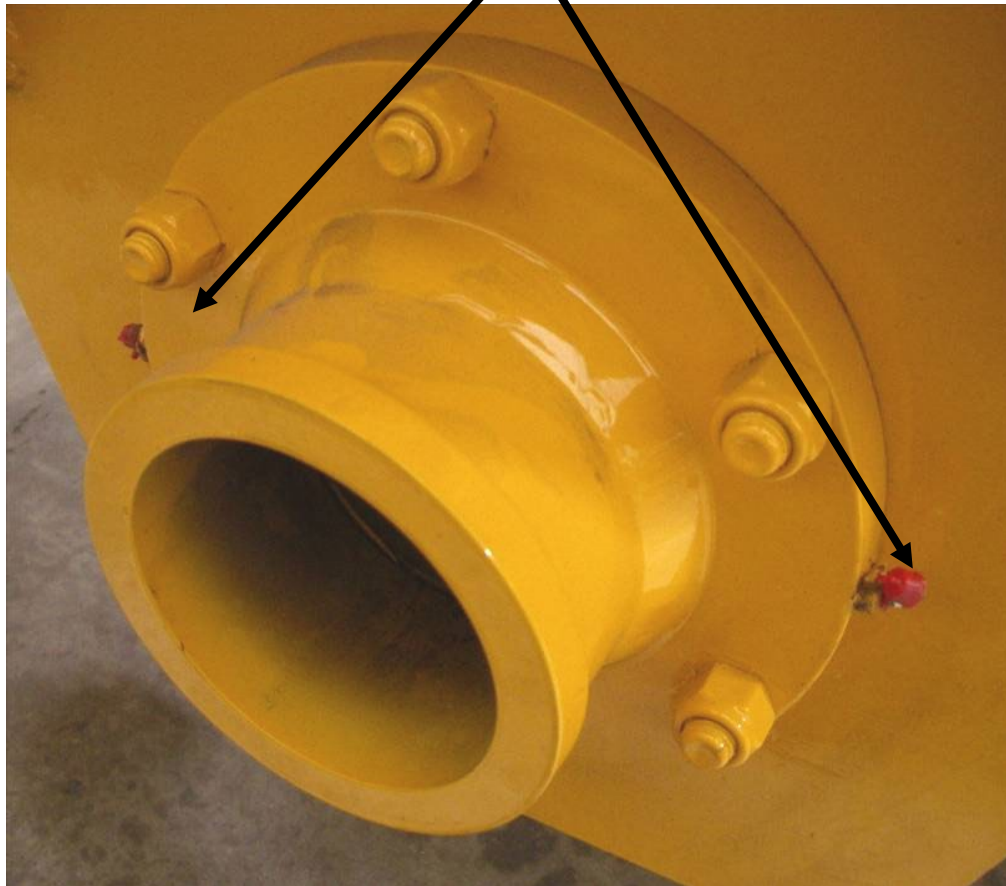


NOTE:
*RELIEVE S-TUBE
CIRCUIT
PRESSURE BEFORE
APPLYING
GREASE*



S-TUBE OUTLET LUBRICATION

S-TUBE OUTLET GREASE POINTS

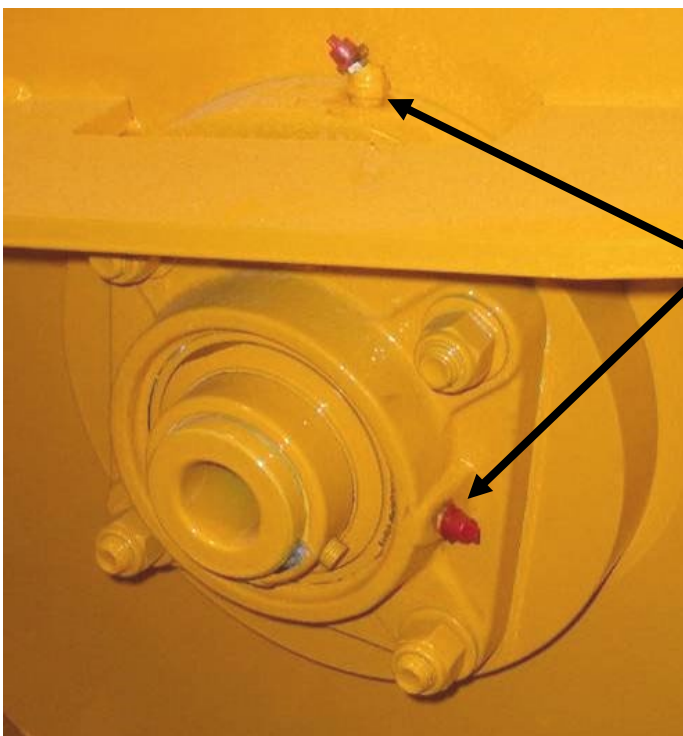


AGITATOR LUBRICATION

HYDRAULIC MOTOR SIDE
GREASE POINT



NON-HYDRAULIC MOTOR SIDE
GREASE POINTS





HYDRAULIC SYSTEM

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

The hydraulic tank is equipped with an access cover with breather and magnetic suction strainers inside the tank. A sight and temperature gauge is installed on the tank to determine the fluid level and temperature inside the tank. The tank is also equipped with drain valve.

In addition to the magnetic suction strainers, filtration is accomplished by use of a hydraulic return filter located on top of the hydraulic tank. The return filter is 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

The hydraulic system is filled with Shell Oil Company TELLUS #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 Tellus 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.

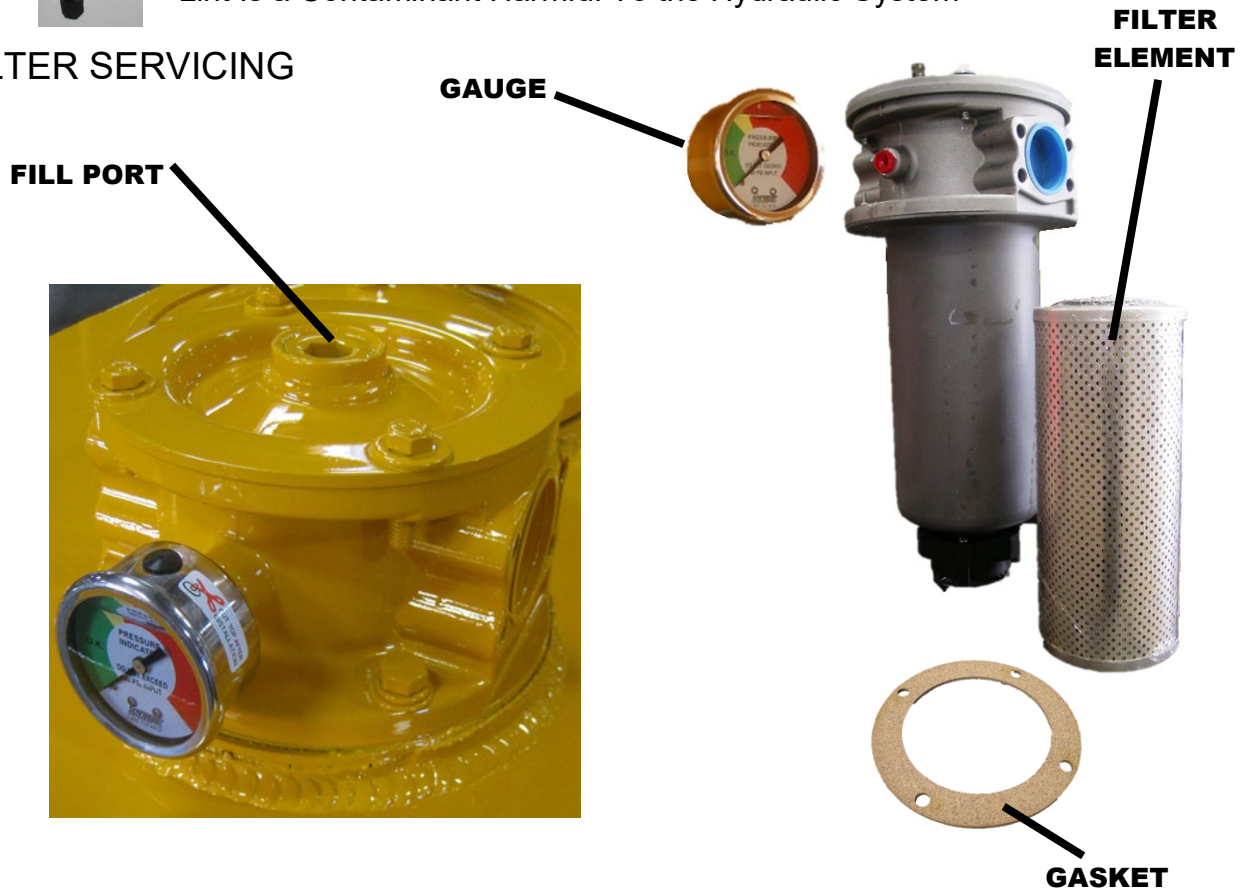
- To prevent any dirt or water from entering the hydraulic tank, thoroughly clean area around the return filter fill port plug, the vented fill cap or the inspection cover.
 - Remove return filter fill port plug, vented cap or inspection cover.
 - Fill system to MAX LEVEL mark on sight gauge with new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



CAUTION

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

FILTER SERVICING



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

breakdown.

The filter is equipped with a condition indicator gauge which should be checked daily and the element changed when indicated.

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. Remove and element bypass valve (if equipped)
7. Discard only element and discard responsibly
8. Install bypass valve (if equipped) and new element and replace cover
9. Wipe clean any contaminants around high pressure filter
10. Remove filter housing then remove and discard filter element
11. Check and replace O-ring or gasket if necessary
12. Replace filter element and install filter housing
13. Startup 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)



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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.

This section is provided as a general guideline to assist in replacing major components that will wear. Please contact the **REED** Service Department or your local dealer for technical support.

S-TUBE, WEAR RING, AND WEAR PLATE

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

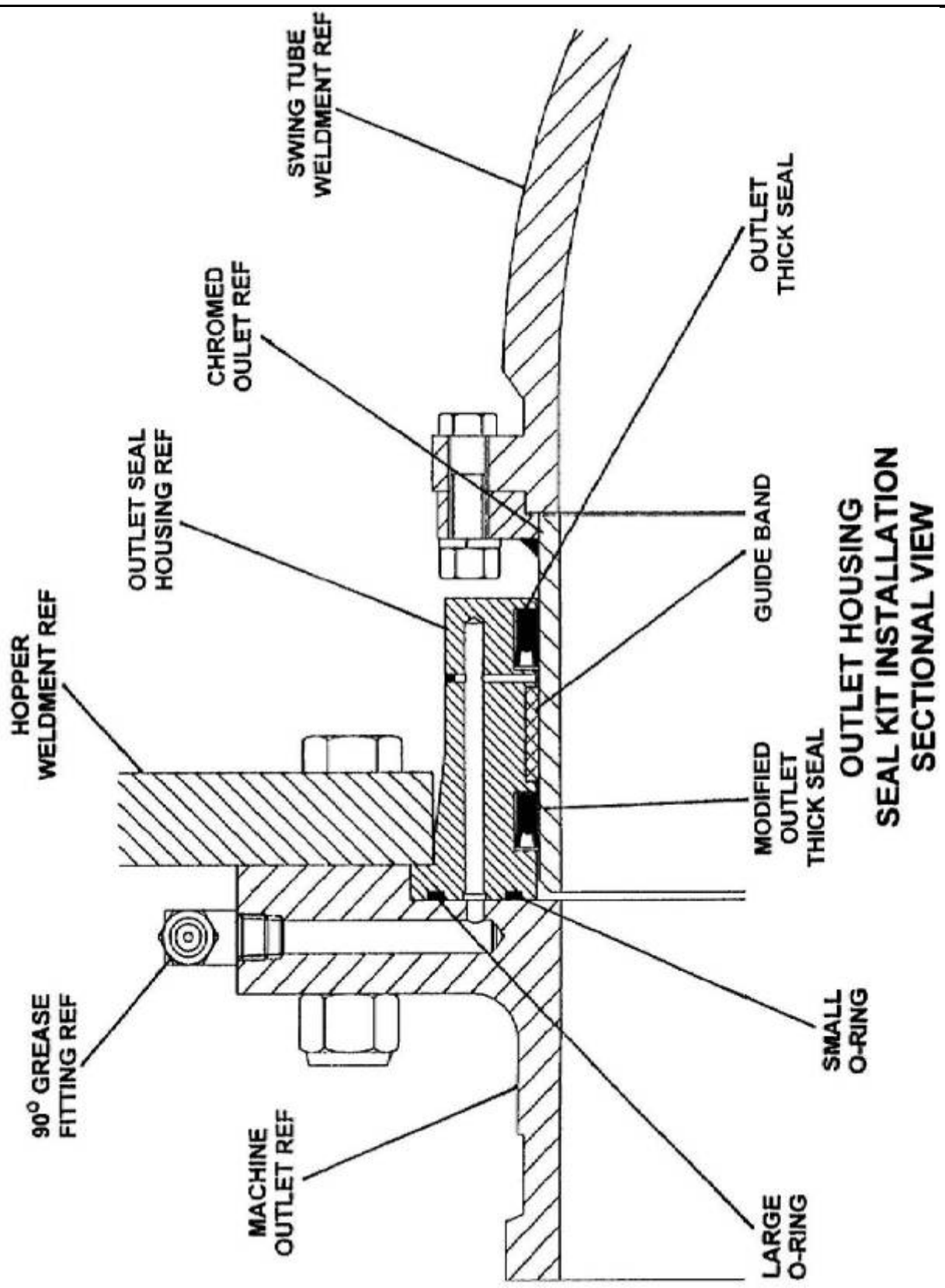


Accumulator Pressure Must Be ZERO
BEFORE AND DURING Any Maintenance Procedures

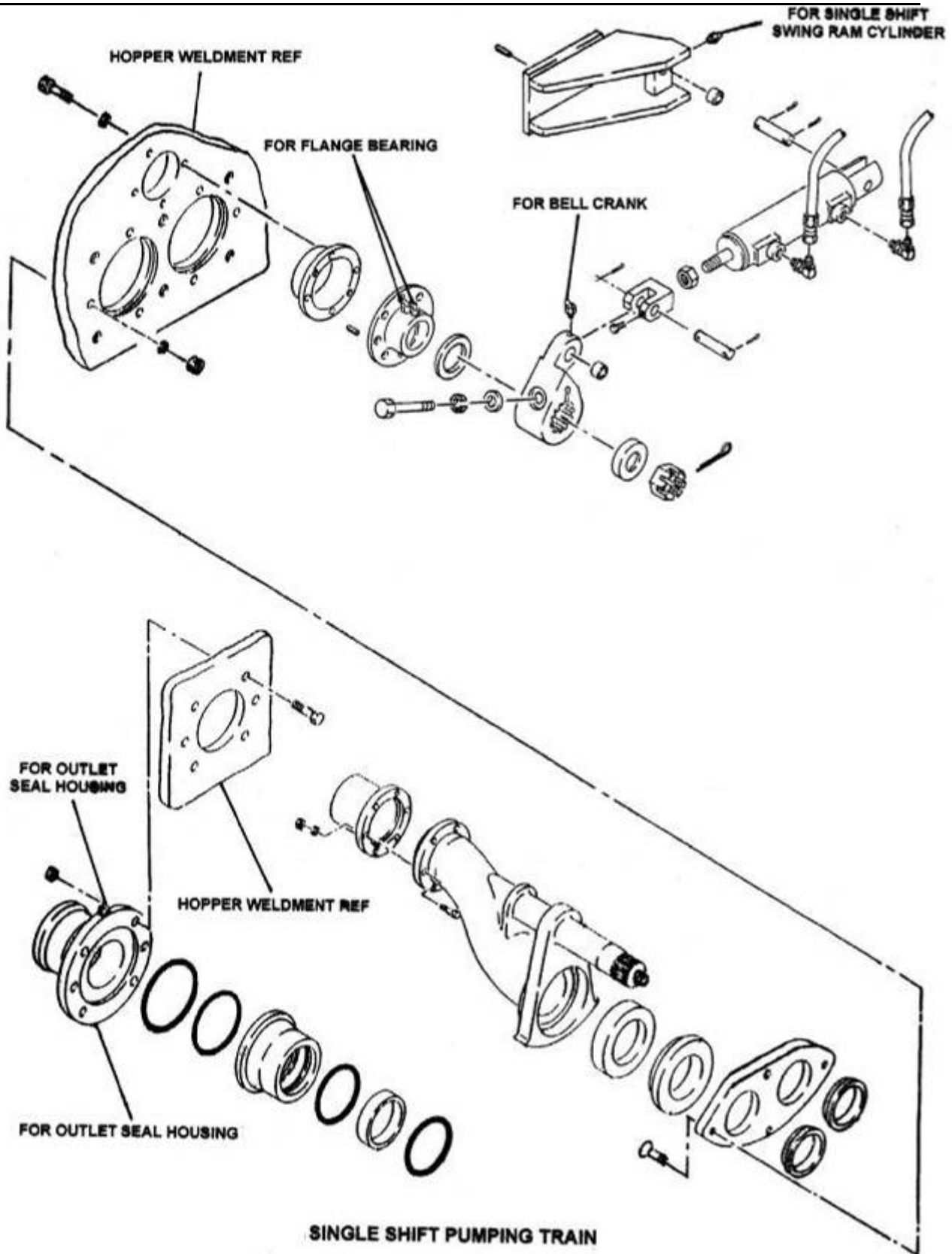


Engine Must Be Turned OFF and Lockout / Tagout Procedures Must Be Followed
BEFORE AND DURING Any Maintenance Procedures

NOTE: The following graphics are for REFERENCE ONLY.



**OUTLET HOUSING
SEAL KIT INSTALLATION
SECTIONAL VIEW**





Accumulator Pressure 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

1. Shut off machine
2. VERIFY PRESSURES IN ALL CIRCUITS READ ZERO!
3. Loosen bell crank pinch bolt (s), remove cotter pin, loosen s-tube nut 1 turn
4. Remove outlet bolts, remove outlet
5. Remove outlet seal housing followed by s-tube nut, spacer, bell crank, washer, swing ram(s)
6. Place a sling from an overhead hoist around the discharge end of s-tube to help support the tube.
7. Pry s-tube toward outlet, remove wear ring & thrust seal. The s-tube may be swung upside down to provide access to clean. Thrust seal groove or cavity must be properly cleaned

Note: for better access, the s-tube may be removed from hopper by removing flange bearing, seal and chromed outlet and hoisting it out of hopper

8. If wear plate is to be changed, remove wear plate mounting bolts. Pry wear plate from hopper using provided jack bolt.
9. Pry anti-chip rings out of hopper bore. Use caution not to damage chrome concrete cylinder. Clean anti-chip ring bore and wear plate area. Replace O-rings (if applicable). Test-fit new bolts in new wear plate-they should be below the surface of the wear plate and not protruding (grind if necessary).
10. Apply small bead of silicone to outer diameter of anti-chip rings, install into hopper bore with split at bottom
11. Apply small amount of silicone to hopper-side of wear plate and bolt-heads. Install wear plate, hand tighten bolts. A short pair of bolts with nuts may be

placed underneath new wear plate to adjust and align to concrete cylinders.

Torque wear plate mounting bolts to 250 ft lbs, remove adjusting bolts.

12. Install new thrust seal & wear ring in s-tube.
13. Install shaft seal and flange bearing (if removed), torque bolts to 100 ft lbs
14. Slide s-tube forward against wear plate, install washer, align/ mount bell crank, install spacer and castle nut. Do not tighten yet.
15. Replace outlet seals in proper orientation, apply grease and install outlet seal housing. Install outlet, torque outlet bolts to 100 ft lbs. Grease all zerk fittings for s-tube until grease comes out of seals.
16. Remove sling, tighten s-tube nut/bolt. It may be helpful to start machine and cycle s-tube to help new parts seat. Do final tightening to s-tube nut/bolt, install cotter pin/retainer, tighten bell crank pinch bolt (s). The nut should be as tight as possible without hampering the shift of s-tube

S-TUBE ADJUSTMENT



Accumulator Pressure 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

The s-tube will require periodic adjustment as the wear parts wear in order to ensure the good contact and sealing characteristics of the wear plate and wear ring, as well as maintaining a constant squeeze of the thrust seal behind the wear ring. S-tube adjustment is performed by tightening the castle nut. Generally, the castle nut should be as tight as it can be without slowing or hindering the throw of the s-tube.

1. With engine off and no pressure showing on gauges, loosen the bell crank pinch bolts
2. Remove cotter pin and tighten castle nut one flat or to next cotter pin slot.
3. Start and cycle machine to ensure proper s-tube operation. Adjust further if



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necessary, following lock out tag out rule for each adjustment.

4. When adjustment has been satisfied, install cotter pin and tighten bell crank pinch bolts.

PISTON CUP AND GUIDE BAND REMOVAL/REPLACEMENT

Because of the abrasiveness of the material being pumped, it will be necessary to periodically replace the piston cups.

Signs and identifying systems of worn parts might be:

- Slurry of the material being pumped starts to appear in the flush box
- The water or lubricating oil in water box begins to rapidly lower level without any sign of leakage
- Operation is rough and erratic



Accumulator Pressure 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

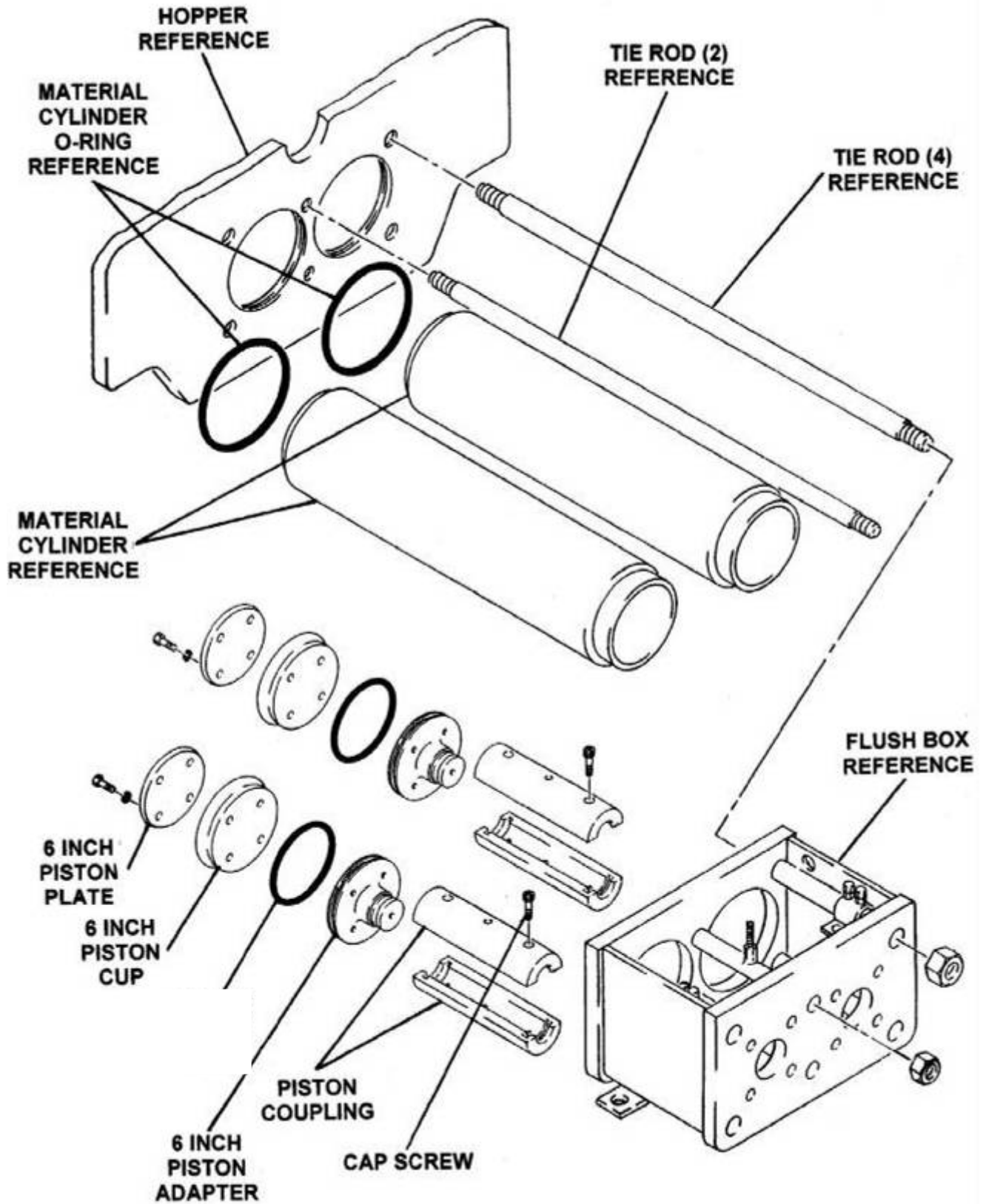
1. Drain all oil or water from the flush box.
2. Cycle machine using appropriate controls until one of the cylinders is completely retracted. Turn off engine and allow hydraulic systems to completely depressurize.
3. As a precaution, mark location of proximity sensor adjusting bracket. Remove proximity sensor cross bracket.
4. Mark the end of the piston coupler so that it can be placed in the same relation during reassembly.
5. Unbolt and remove top and bottom halves of coupler. Pry the piston assembly into flush box.
6. Disassemble and clean piston adapter and plate. Check flatness of plate, replace if necessary.
7. Install and grease new guide band. Push adapter/guide band squarely into cleaned and greased concrete cylinder.
8. Install coupler using medium strength Loctite on bolts and torque to 90 ft lbs.



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9. Start and completely extend the adapter and guide band to hopper side. Jog s-tube if necessary to expose fully extended piston adapter.
10. Turn off engine and allow hydraulic systems to completely depressurize
11. Install one alignment bolt (3/8"x24x5" with head cut off) into the piston adapter to assist in locating the cup in the correct position to line up the holes.
12. Slide new piston cup, small end first, over alignment bolt until it meets wear plate. Use a rubber hammer to drive piston cup into concrete cylinder until it seats against piston adapter
13. Slide piston plate into place.
14. Apply medium strength Loctite to bolts. After three bolts with lock washers are started, remove alignment bolt and thread in the last bolt. Tighten bolts equally and firmly using hand tools.
15. One concrete piston is complete. Follow steps 2-14 again for the other side.
16. Install proximity sensor cross bracket.
17. Install flush box plug, fill to top of rods with oil or water, and install flush box cover.





ACCUMULATOR



The hydraulic accumulator is a pressurized vessel and only **QUALIFIED TECHNICIANS** should perform the necessary repairs. Always drain the fluid **COMPLETELY** from the accumulator before performing any work on the component.

A qualified technician can check the pre-charge pressure of the accumulator using an accumulator charge kit if low pressure is suspected. Check the pre-charge pressure of the accumulator if the needle of the hydraulic s-tube gauge does not suddenly drop off at the specified pressure when the hydraulic s-tube circuit is depressurizing.



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 concrete 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 engine fluid levels (see engine manufacturer maintenance schedule for additional requirements)	
2	Check hydraulic tank fluid levels	
3	Check flush box fluid levels	
4	Check condition of hydraulic oil for water or other contamination	
	Additional Notes:	
5	Drain water from tank	
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	
10	Additional Notes:	



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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)	
	Additional Notes:	
2	Change hydraulic oil filters	
3	Inspect hydraulic hoses and fittings for any signs of external wear or damage	
	Additional Notes:	



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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:		



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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	



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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:		



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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	
	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:		



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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:		

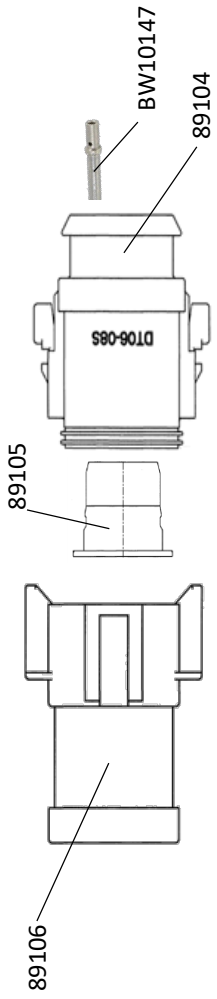


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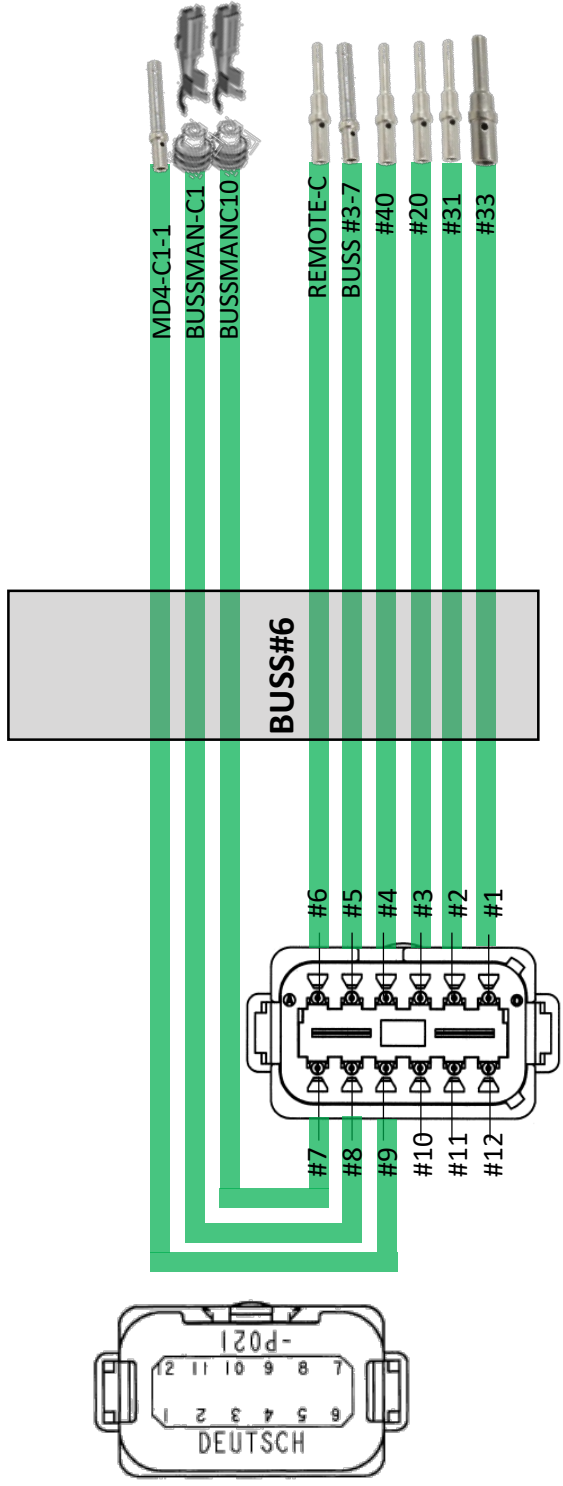
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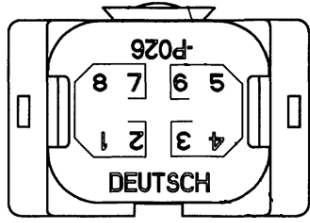
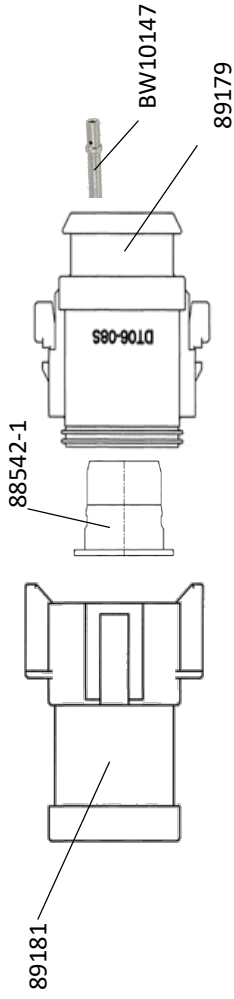
GROUND BUSS 6



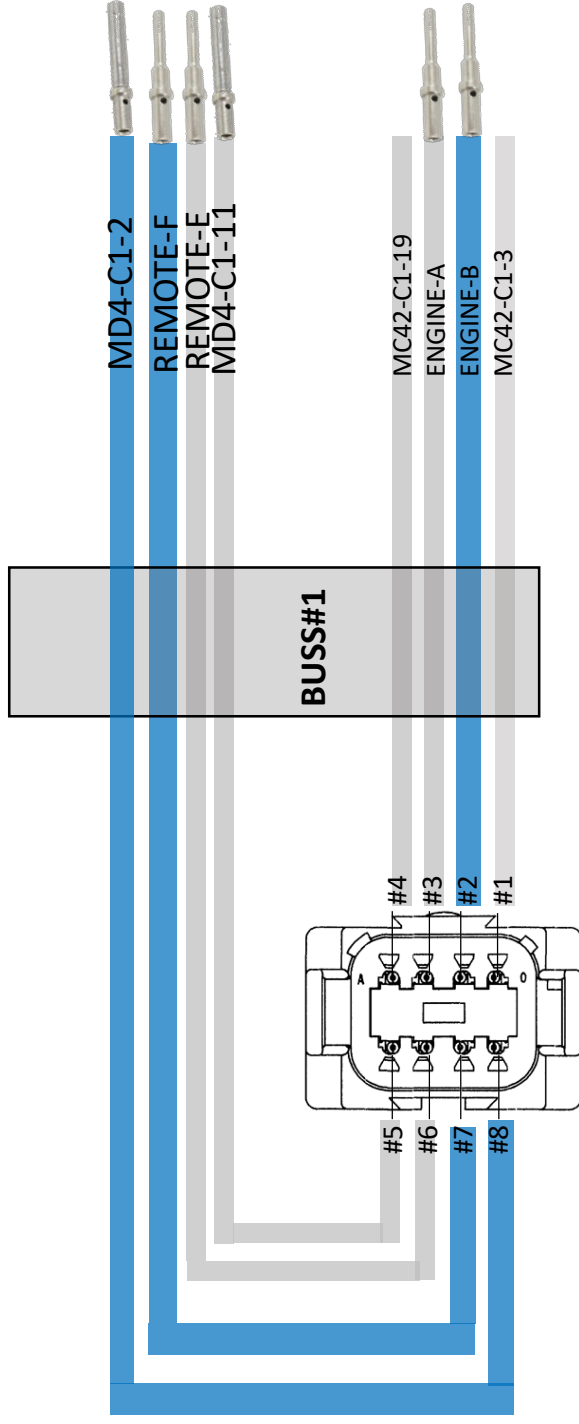
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	BUSS	BW10147
		88957
		87807
		88958



BUSS #1



89181

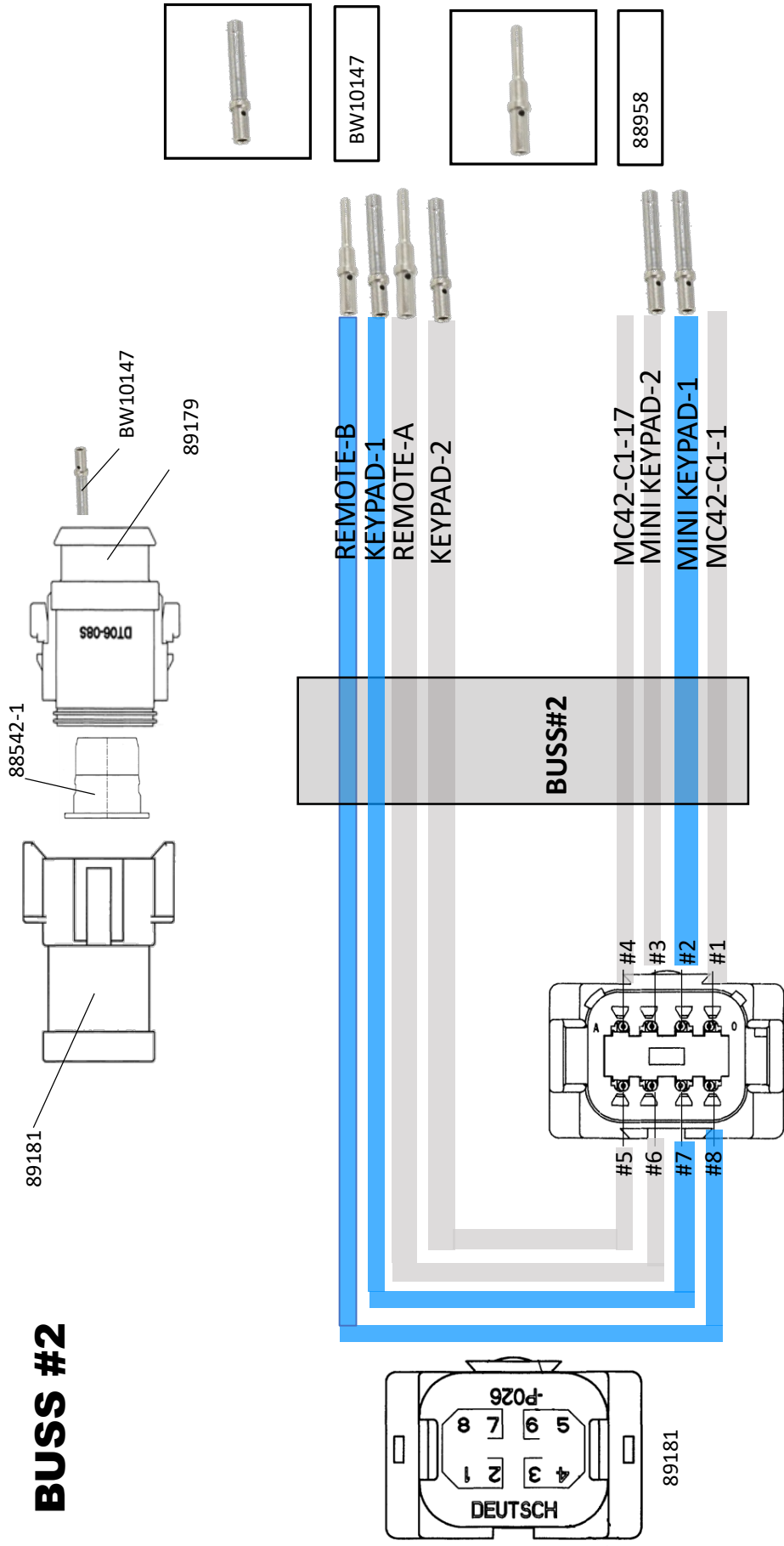


88958

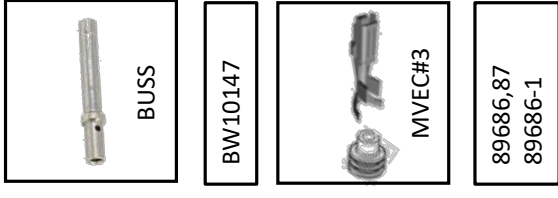
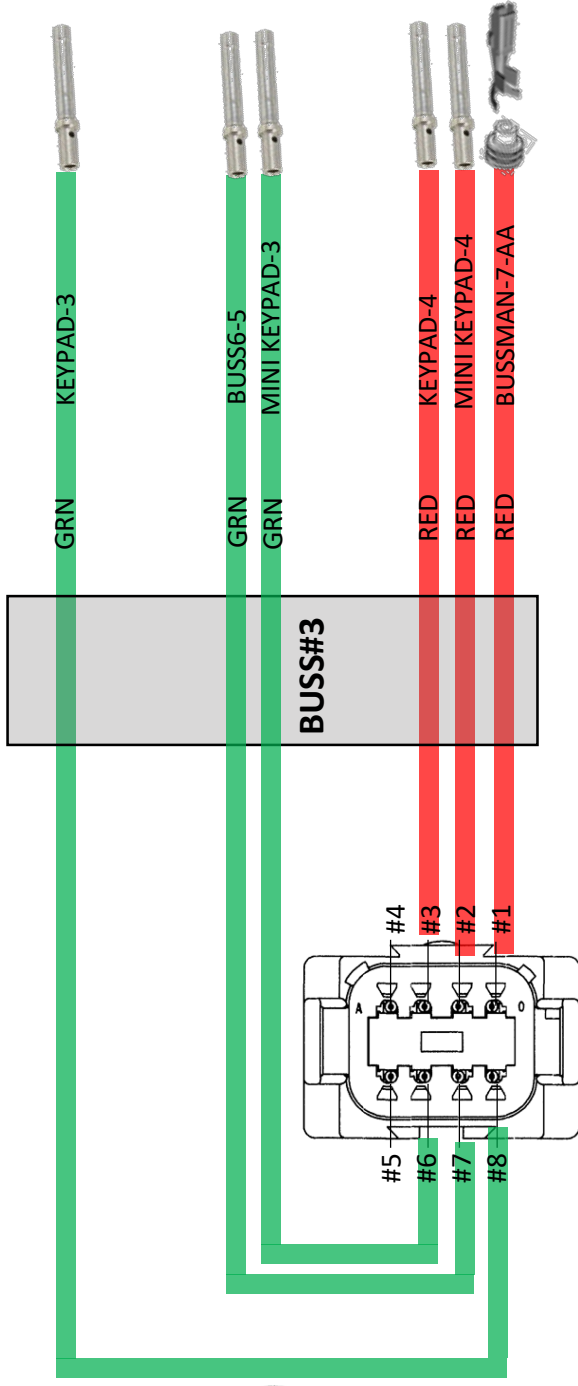
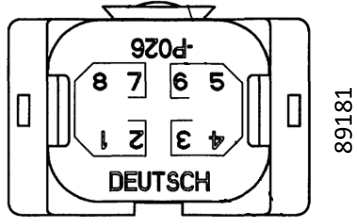
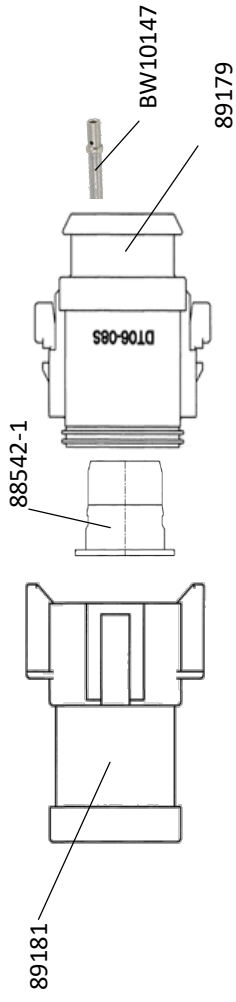


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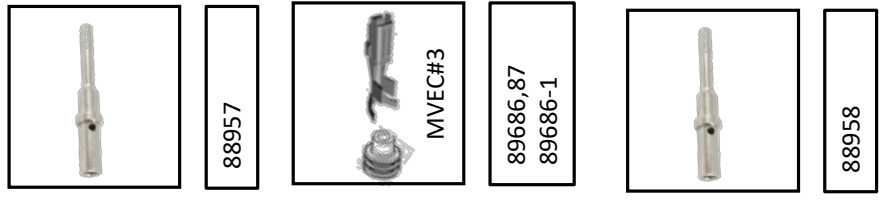
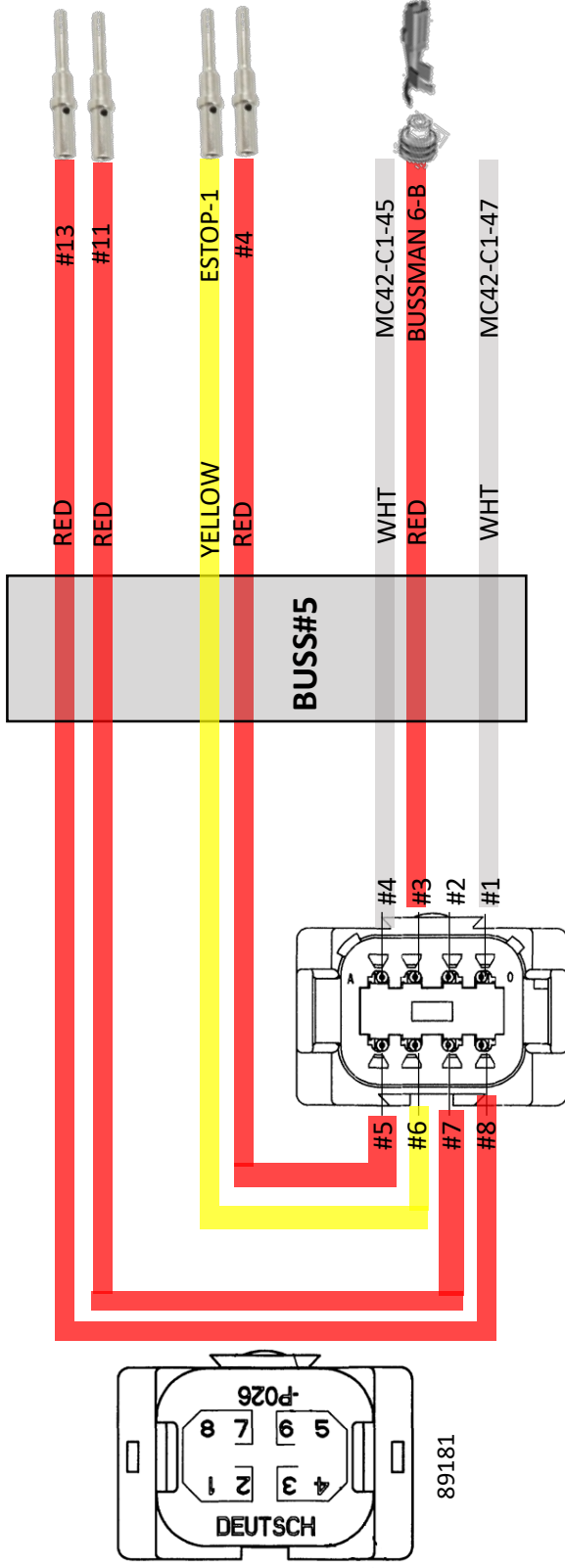
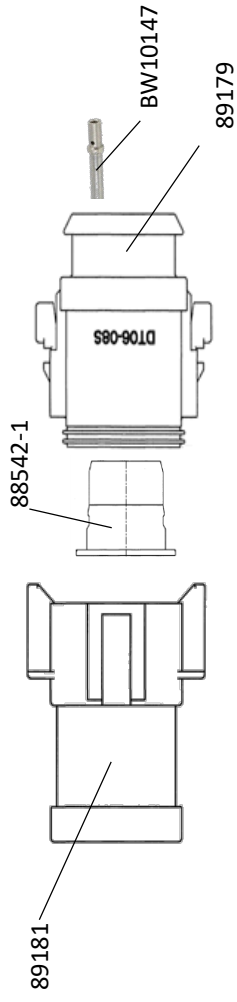
BUSS #2



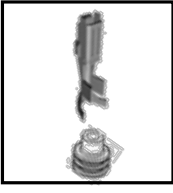
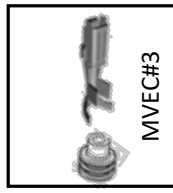
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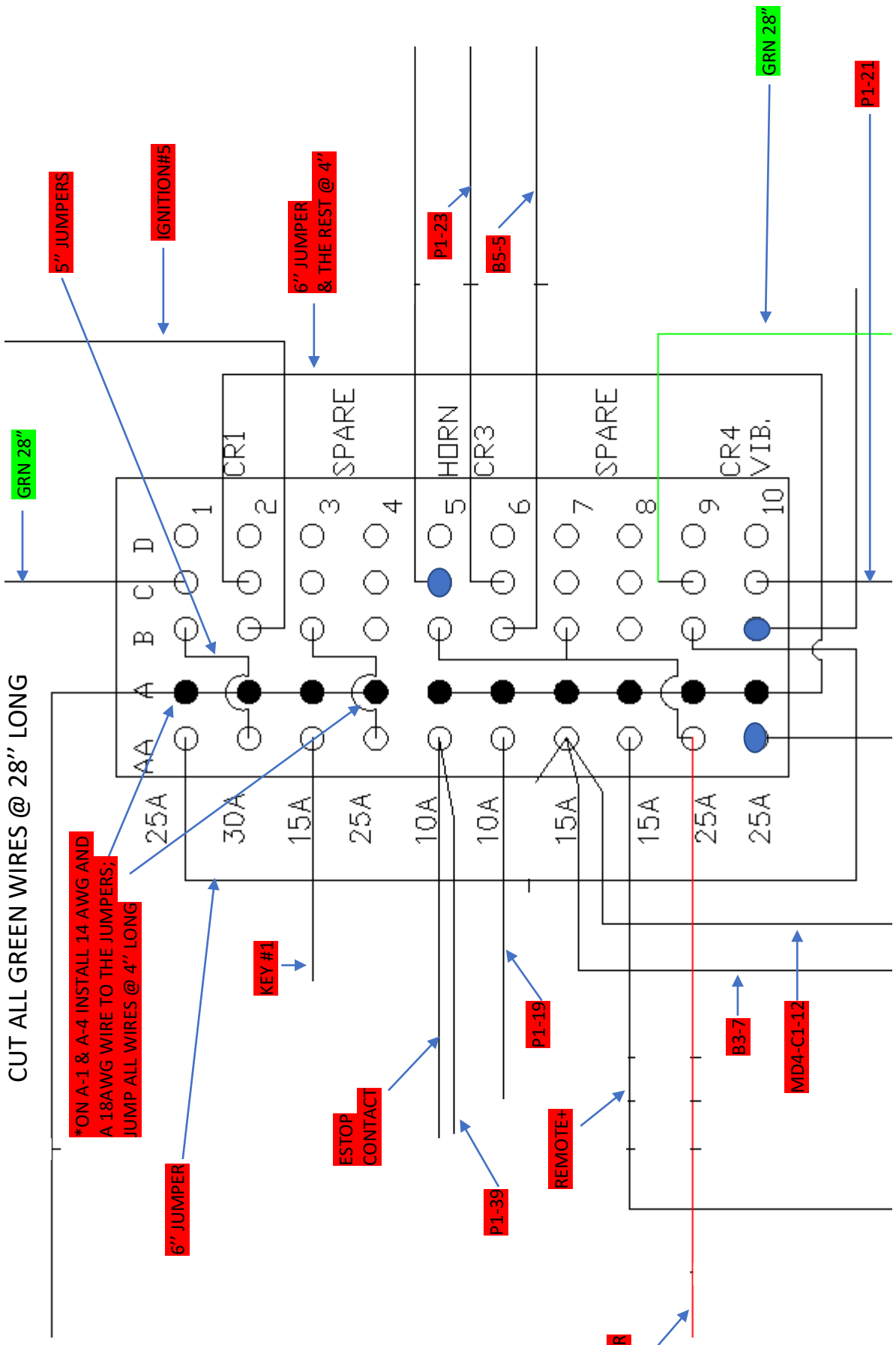
BUSS #5



NOTE: (●) THIS MEANS NO PINS @ THIS TIME!
 CUT ALL RED WIRES @ 40" LONG
 CUT ALL GREEN WIRES @ 28" LONG

- 
- 89686
89624-1
-  MVEC#3
- 89687
89624-1

*ON A-1 & A-4 INSTALL 14 AWG AND A 18AWG WIRE TO THE JUMPERS; JUMP ALL WIRES @ 4" LONG



5" JUMPERS
 IGNITION#5
 6" JUMPER & THE REST @ 4"
 GRN 28"
 P1-23
 B5-5
 P1-21

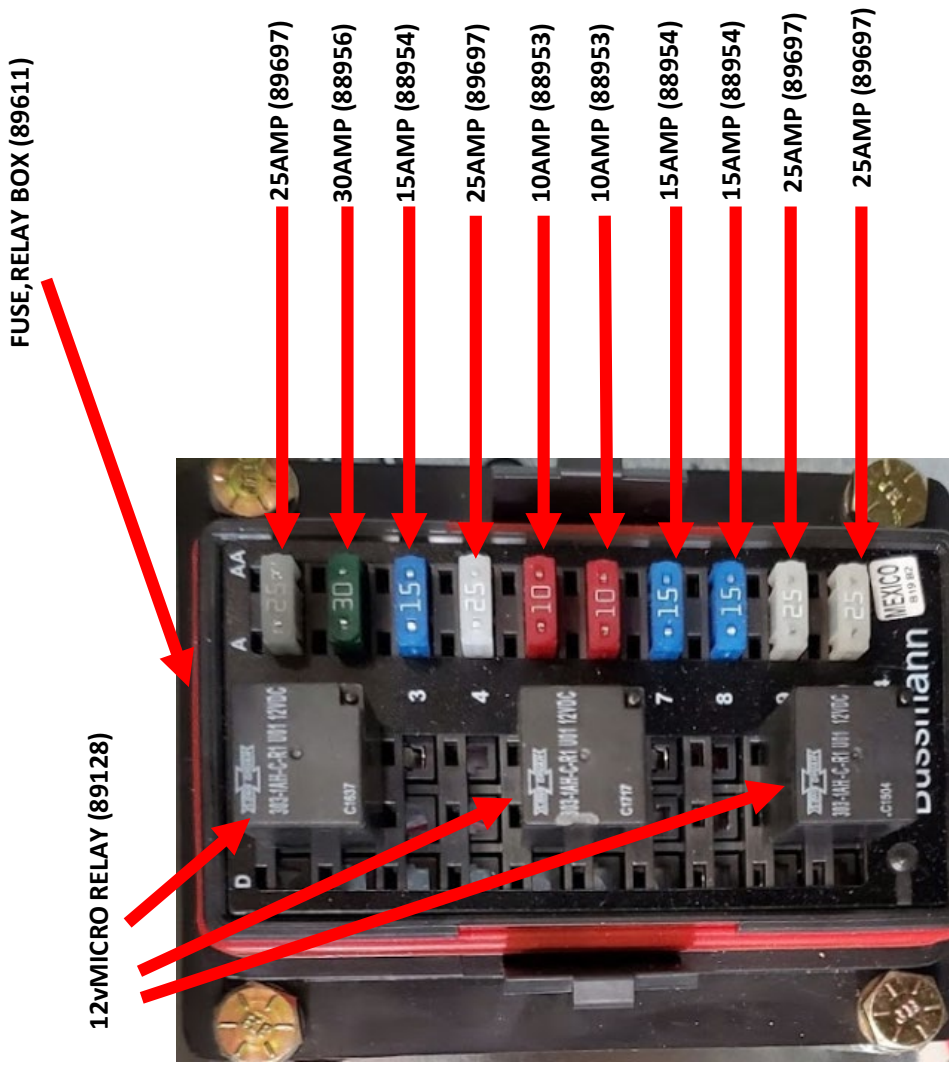
6" JUMPER
 KEY #1
 ESTOP CONTACT
 P1-39
 REMOTE+
 P1-19
 B3-7
 MD4-C1-12

5" JUMPER
 P1-36

BUSSMAN CONTROL

FUSE DESCRIPTION

- 1 VIB. POWER
- 2 MAIN POWER— SPARE CONSTANT
- 3 IGNITION POWER
- 4 COOLER POWER
- 5 'E' STOP/PROX/GRATE POWER
- 6 OUTRIGGER POWER
- 7 DISPLAY/KEYPAD POWER
- 8 REMOTE POWER
- 9 HORN POWER
- 10 PLC(MC42) POWER



9/17/2020

REV-A

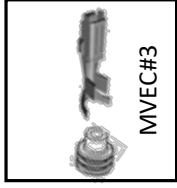
MD4-5-C1



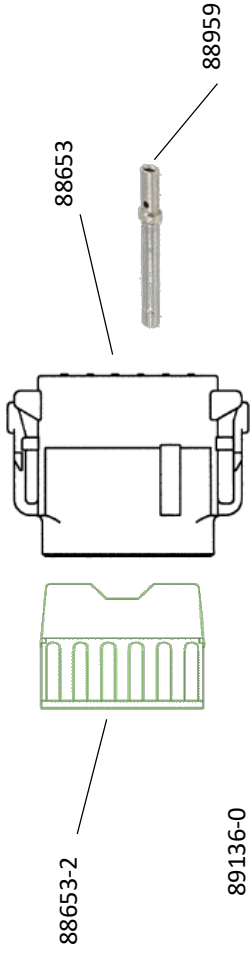
BW10147



BW10147



89686
89686-1

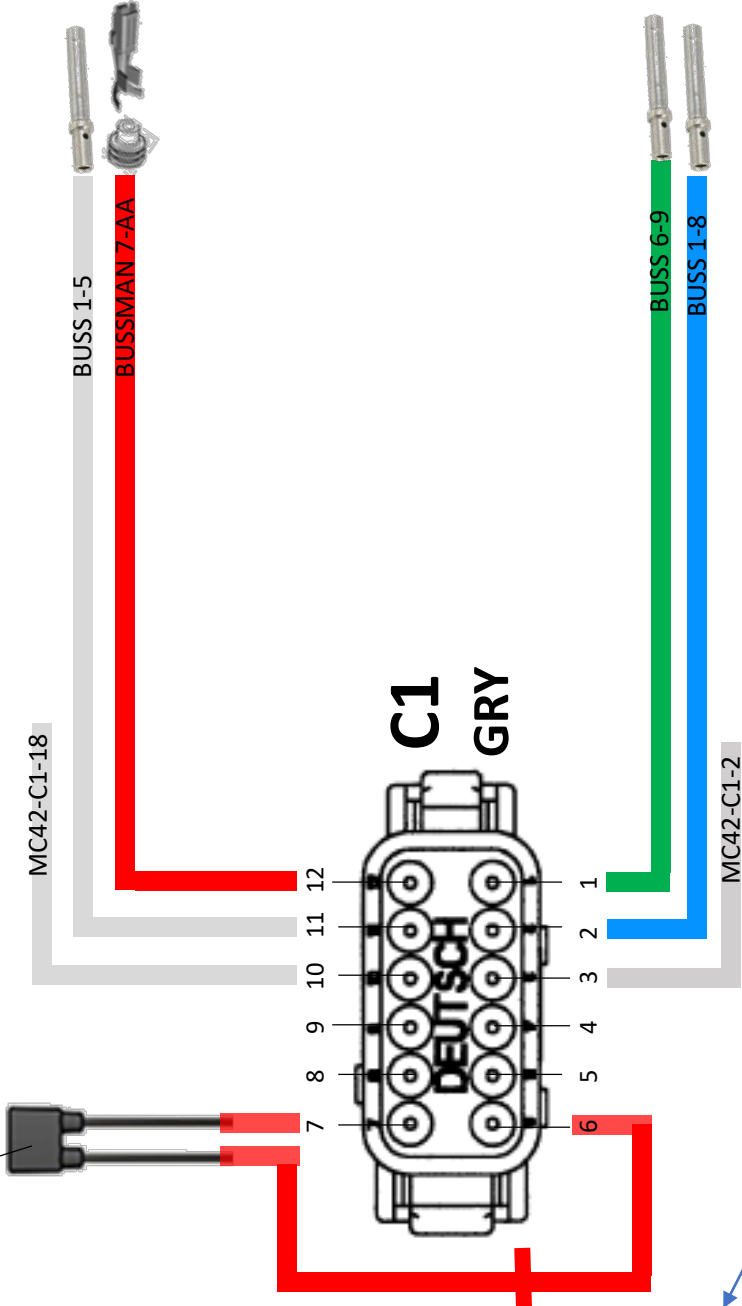


88653-2

88653

89136-0
ID(0)

88959

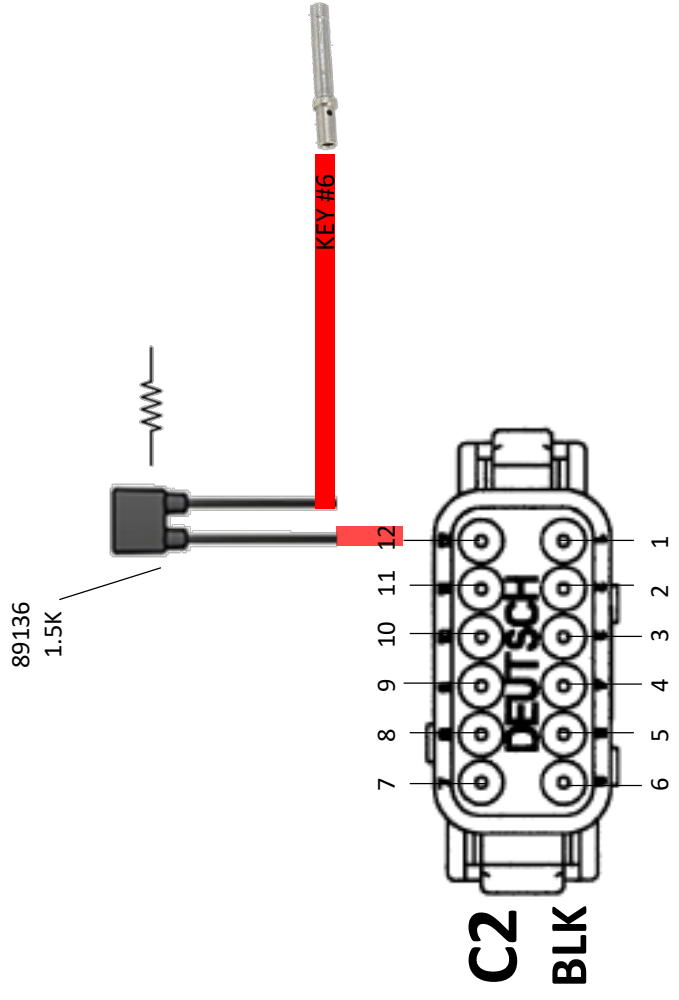
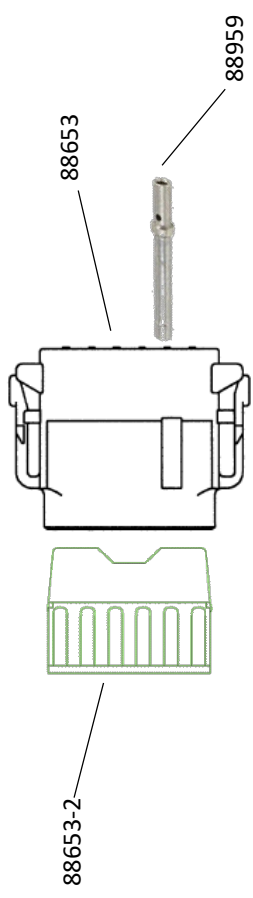


**C1
GRY**

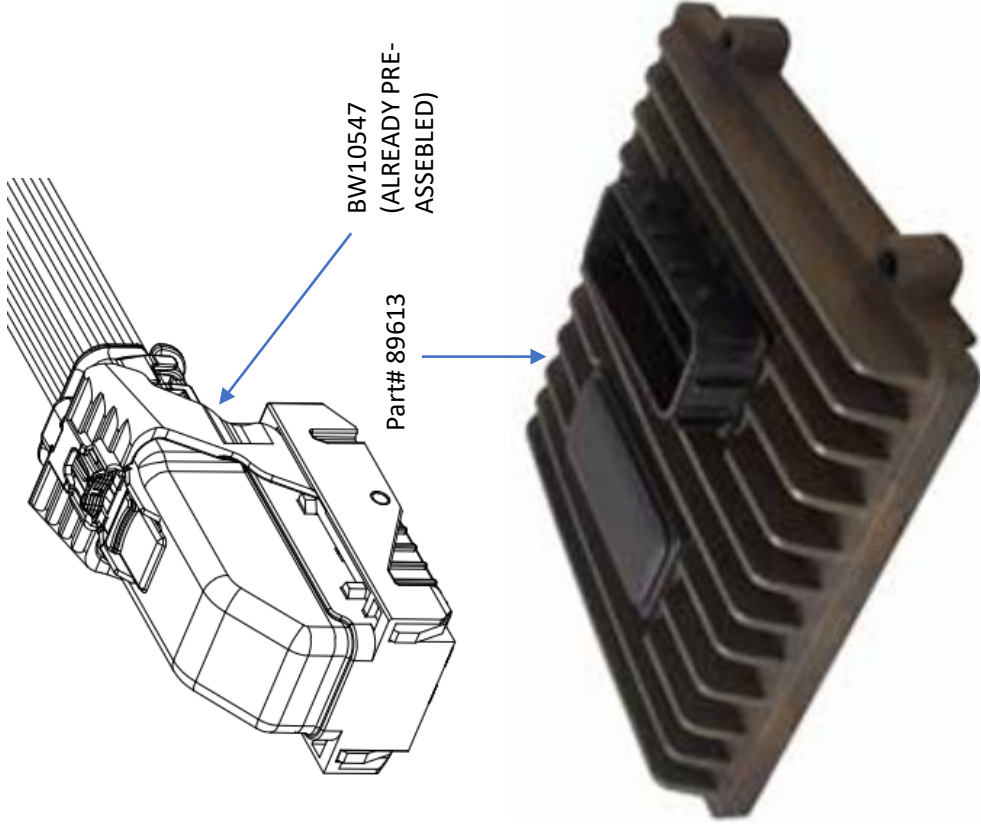


Part# 89612

MD4-5-C2

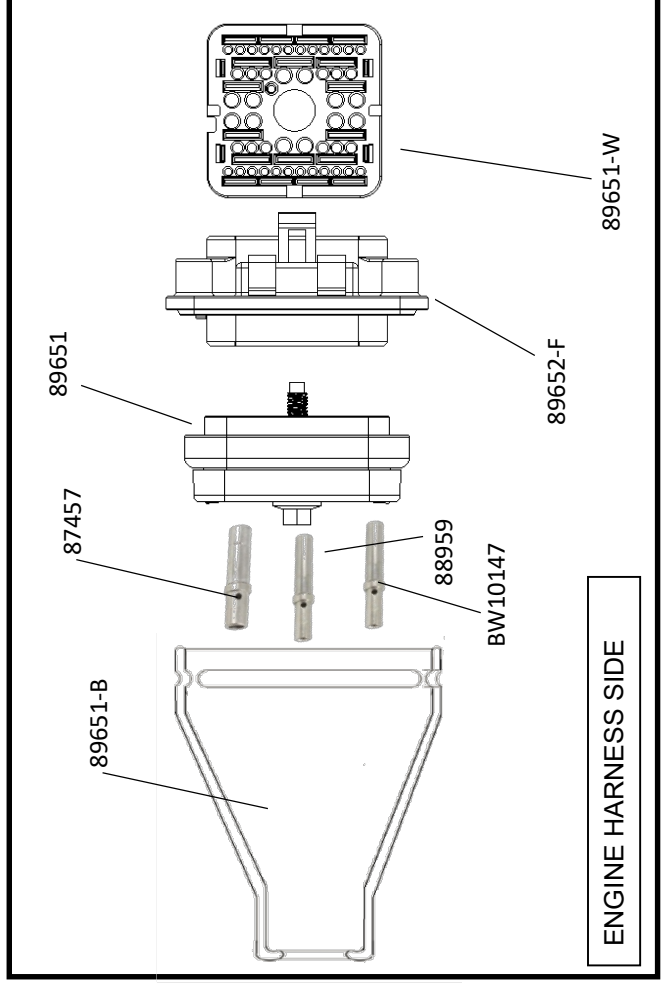
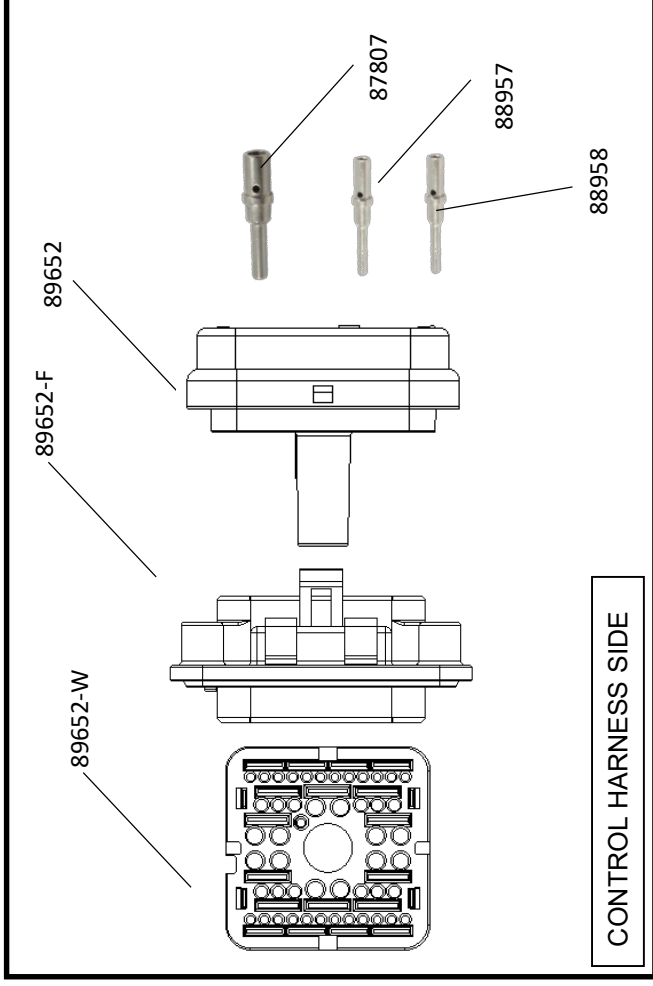
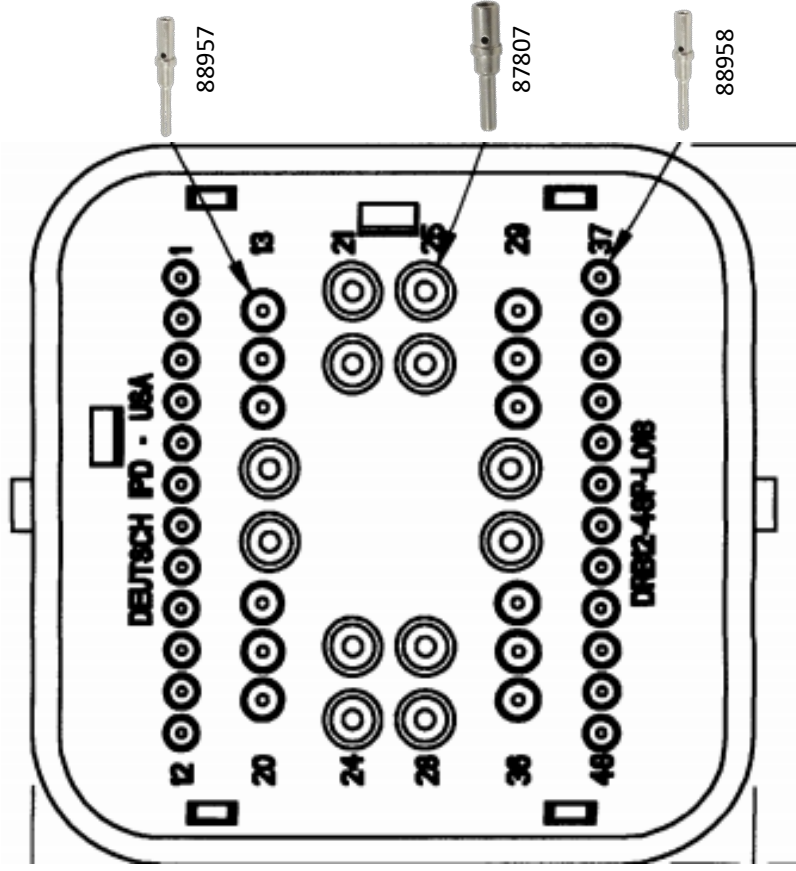


MC42-C1



MC42	Destination	MC42	Destination
C1: 1	BUSS 2- 1	C1: 37	?? (USED TO BE P1-20)
C1: 2	MD4-C1-3	C1: 38	N/A
C1: 3	BUSS 1-1	C1: 39	P1-6
C1: 4	ADDRESSING RESIS. (1) W/ C1:20	C1: 40	FUSEBOX C-5
C1: 5	N/A	C1: 41	P1-3
C1: 6	N/A	C1: 42	P1-35
C1: 7	P1-42	C1: 43	P1-12
C1: 8	N/A	C1: 44	P1-30
C1: 9	ESTOP-4 * P1-8	C1: 45	BUSS 5-4
C1: 10	P1-41	C1: 46	P1-2
C1: 11	N/A	C1: 47	BUSS 5-2
C1: 12	?? (Used to be P1-19)	C1: 48	25 AMP LETTER B
C1: 13	P1-9	C1: 49	N/A
C1: 14	N/A	C1: 50	N/A
C1: 15	N/A	C1: 51	N/A
C1: 16	N/A	C1: 52	P1-45
C1: 17	BUSS 2-4	C1: 53	N/A
C1: 18	MD4-C1-10	C1: 54	N/A
C1: 19	BUSS 1-4	C1: 55	P1-7
C1: 20	ADDRESSING RESIS. (1) W/ C1:4	C1: 56	ESTOP-2
C1: 21	N/A	C1: 57	P1-38
C1: 22	N/A	C1: 58	N/A
C1: 23	P1-46	C1: 59	P1-14
C1: 24	P1-43	C1: 60	N/A
C1: 25	P1-44	C1: 61	N/A
C1: 26	P1-47	C1: 62	N/A
C1: 27	P1-10	C1: 63	N/A
C1: 28	P1-48	C1: 64	N/A
C1: 29	P1-15	C1: 65	25AMP-AA
C1: 30	P1-34	C1: 66	P1-17
C1: 31	N/A		
C1: 32	P1-29		
C1: 33	N/A		
C1: 34	N/A		
C1: 35	N/A		
C1: 36	N/A		

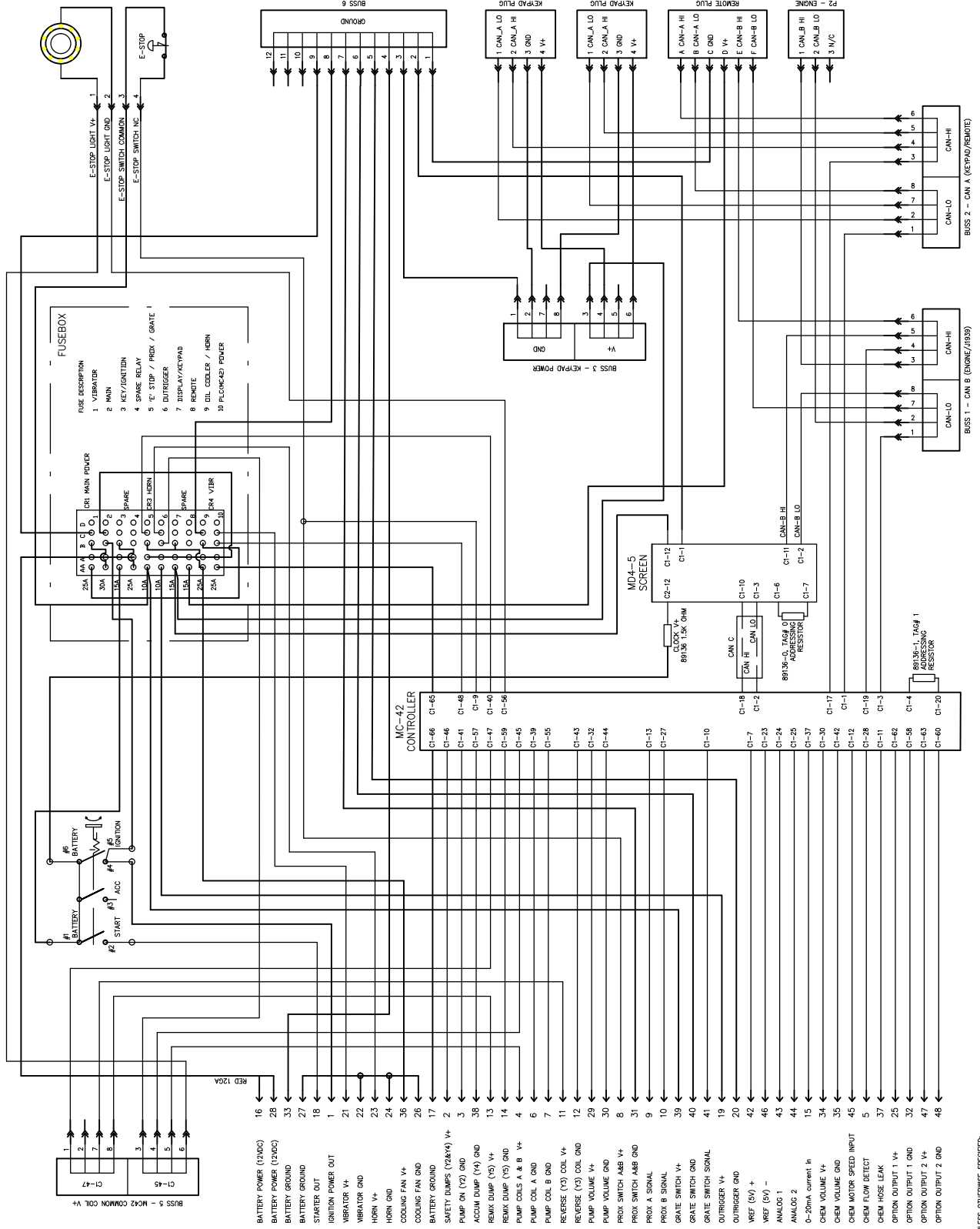
DEUTSCH 48 PLUG



PIN	Description	PANEL	Size
	P1 MAIN PLUG		
1	IGN POWER	KEY:5	20
2	PUMP ON & ACCUM DUMP (Y2&Y4) V+	MC42 C1:46	20
3	PUMP ON GND (Y2)	MC42 C1:41	20
4	PUMP A & B V+	B5:5 (MC42 C1:45)	20
5	PUMP B V+		20
6	PUMP A GND	MC42 C1:39	20
7	PUMP B GND	MC42 C1:55	20
8	PROX A&B V+	ESTOP:4, C1:9	20
9	PROX A SIGNAL	MC42 C1:13	20
10	PROX B SIGNAL	MC42 C1:27	20
11	REVERSE (Y3) V+	B5:7 (MC42 C1:47)	20
12	REVERSE (Y3) GND	MC42 C1:43	20
13	REMIX DUMP (Y5) V+	B5:8 (MC42 C1:47)	16
14	REMIX DUMP (Y5) GND	MC42 C1:59	16
15			16
16	BATTERY V+	FUSEBOX:A1	12
17	BATTERY GND	MC42 C1:66	12
18	ENGINE STARTER	KEY:2	16
19	OUTRIGGER V+	FUSEBOX:AA6	16
20	OUTRIGGER GND	B6:1	16
21	VIBR V+	FUSEBOX:C10	12
22	VIBR GND	P1:27**	12
23	HORN V+	FUSEBOX:C6	12
24	HORN GND	P1:32 P1:27**	12

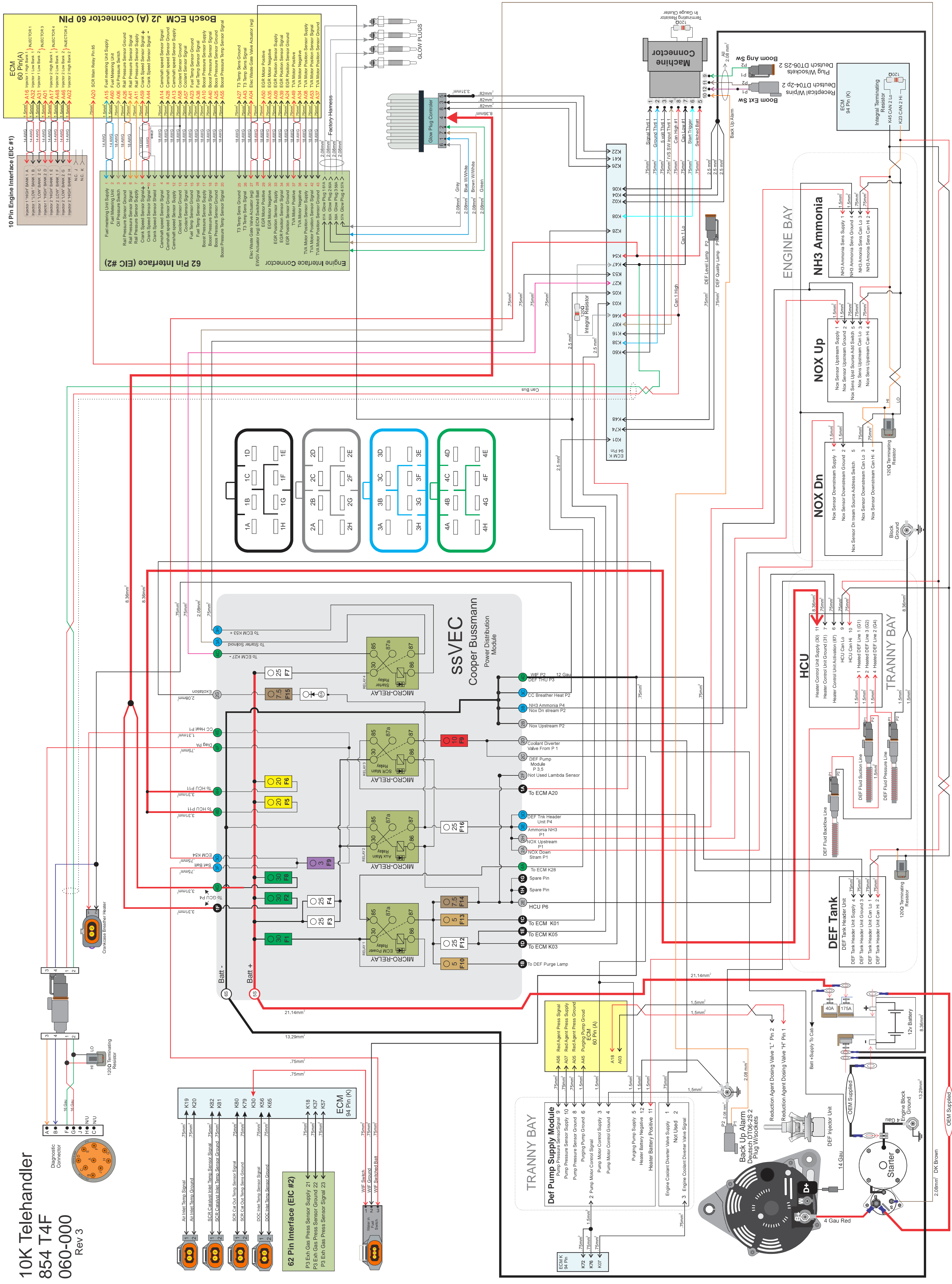
TIER4 A 48PIN PLUG REV. A

23	HORN V+	FUSEBOX:C6	12
24	HORN GND	P1:32 P1:27**	12
25	BATTERY GND		12
26	COOLING FAN GND	B6:1**	12
27	BATTERY GND	P1:22**	12
28	BATTERY V+	FUSEBOX:A1	12
29	PROPORTIONAL VOL V+	MC42 C1:32	16
30	PROPORTIONAL VOL GND	MC42 C1:44	16
31	PROX A&B GND	P1:25 B6:2	16
32	BATTERY GND	P1:24	12
33	BATTERY GND	B6:12	12
34			16
35			16
36	COOLING FAN V+	FUSEBOX:AA9	16
37	ACCUM DUMP (Y4) V+		20
38	ACCUM DUMP (Y4) GND	MC42 C1:57	20
39	GRATE SWITCH V+	FUSEBOX:AA5	20
40	GRATE SWITCH GND	B6:4	20
41	GRATE SWITCH SIGNAL	MC42 C1:10	20
42			20
43			20
44			20
45			20
46			20
47			20
48			20



UNLESS OTHERWISE SPECIFIED:
ALL WIRES ARE 18 AWG

10K Telehandler 854 T4F 060-000 Rev 3



10 Pin Engine Interface (EIC #1)

Injector 1 HIGH BANK 1 A	14AWG	A16
Injector 1 LOW BANK 2 B	14AWG	A32
Injector 2 HIGH BANK 1 C	14AWG	A31
Injector 2 LOW BANK 2 G	14AWG	A47
Injector 2 HIGH BANK 1 D	14AWG	A17
Injector 2 LOW BANK 2 H	14AWG	A48
Injector 1 HIGH BANK 1 E	14AWG	A18
Injector 1 LOW BANK 2 I	14AWG	A33
Injector 2 HIGH BANK 1 F	14AWG	A30
Injector 2 LOW BANK 2 J	14AWG	A46
Injector 1 HIGH BANK 1 K	14AWG	A19
Injector 1 LOW BANK 2 L	14AWG	A34
Injector 2 HIGH BANK 1 M	14AWG	A35
Injector 2 LOW BANK 2 N	14AWG	A49
Injector 1 HIGH BANK 1 O	14AWG	A20
Injector 1 LOW BANK 2 P	14AWG	A36
Injector 2 HIGH BANK 1 Q	14AWG	A37
Injector 2 LOW BANK 2 R	14AWG	A50
Injector 1 HIGH BANK 1 S	14AWG	A21
Injector 1 LOW BANK 2 T	14AWG	A38
Injector 2 HIGH BANK 1 U	14AWG	A39
Injector 2 LOW BANK 2 V	14AWG	A51
Injector 1 HIGH BANK 1 W	14AWG	A22
Injector 1 LOW BANK 2 Y	14AWG	A40
Injector 2 HIGH BANK 1 X	14AWG	A41
Injector 2 LOW BANK 2 Z	14AWG	A52
Injector 1 HIGH BANK 1 AA	14AWG	A23
Injector 1 LOW BANK 2 AB	14AWG	A42
Injector 2 HIGH BANK 1 AC	14AWG	A43
Injector 2 LOW BANK 2 AD	14AWG	A53
Injector 1 HIGH BANK 1 AE	14AWG	A24
Injector 1 LOW BANK 2 AF	14AWG	A44
Injector 2 HIGH BANK 1 AG	14AWG	A45
Injector 2 LOW BANK 2 AH	14AWG	A54
Injector 1 HIGH BANK 1 AI	14AWG	A25
Injector 1 LOW BANK 2 AJ	14AWG	A46
Injector 2 HIGH BANK 1 AK	14AWG	A47
Injector 2 LOW BANK 2 AL	14AWG	A55
Injector 1 HIGH BANK 1 AM	14AWG	A26
Injector 1 LOW BANK 2 AN	14AWG	A48
Injector 2 HIGH BANK 1 AO	14AWG	A49
Injector 2 LOW BANK 2 AP	14AWG	A56
Injector 1 HIGH BANK 1 AQ	14AWG	A27
Injector 1 LOW BANK 2 AR	14AWG	A50
Injector 2 HIGH BANK 1 AS	14AWG	A51
Injector 2 LOW BANK 2 AT	14AWG	A57
Injector 1 HIGH BANK 1 AU	14AWG	A28
Injector 1 LOW BANK 2 AV	14AWG	A52
Injector 2 HIGH BANK 1 AW	14AWG	A53
Injector 2 LOW BANK 2 AX	14AWG	A58
Injector 1 HIGH BANK 1 AY	14AWG	A29
Injector 1 LOW BANK 2 AZ	14AWG	A54
Injector 2 HIGH BANK 1 BA	14AWG	A55
Injector 2 LOW BANK 2 BB	14AWG	A59
Injector 1 HIGH BANK 1 BC	14AWG	A30
Injector 1 LOW BANK 2 BD	14AWG	A56
Injector 2 HIGH BANK 1 BE	14AWG	A57
Injector 2 LOW BANK 2 BF	14AWG	A60
Injector 1 HIGH BANK 1 BG	14AWG	A31
Injector 1 LOW BANK 2 BH	14AWG	A58
Injector 2 HIGH BANK 1 BI	14AWG	A59
Injector 2 LOW BANK 2 BJ	14AWG	A61
Injector 1 HIGH BANK 1 BK	14AWG	A32
Injector 1 LOW BANK 2 BL	14AWG	A60
Injector 2 HIGH BANK 1 BM	14AWG	A61
Injector 2 LOW BANK 2 BN	14AWG	A62
Injector 1 HIGH BANK 1 BO	14AWG	A33
Injector 1 LOW BANK 2 BP	14AWG	A62
Injector 2 HIGH BANK 1 BQ	14AWG	A63
Injector 2 LOW BANK 2 BR	14AWG	A63
Injector 1 HIGH BANK 1 BS	14AWG	A34
Injector 1 LOW BANK 2 BT	14AWG	A64
Injector 2 HIGH BANK 1 BU	14AWG	A65
Injector 2 LOW BANK 2 BV	14AWG	A64
Injector 1 HIGH BANK 1 BU	14AWG	A35
Injector 1 LOW BANK 2 BV	14AWG	A65
Injector 2 HIGH BANK 1 BW	14AWG	A66
Injector 2 LOW BANK 2 BX	14AWG	A65
Injector 1 HIGH BANK 1 BU	14AWG	A36
Injector 1 LOW BANK 2 BV	14AWG	A66
Injector 2 HIGH BANK 1 BU	14AWG	A37
Injector 1 LOW BANK 2 BV	14AWG	A67
Injector 2 HIGH BANK 1 BU	14AWG	A38
Injector 1 LOW BANK 2 BV	14AWG	A68
Injector 2 HIGH BANK 1 BU	14AWG	A39
Injector 1 LOW BANK 2 BV	14AWG	A69
Injector 2 HIGH BANK 1 BU	14AWG	A40
Injector 1 LOW BANK 2 BV	14AWG	A70
Injector 2 HIGH BANK 1 BU	14AWG	A41
Injector 1 LOW BANK 2 BV	14AWG	A71
Injector 2 HIGH BANK 1 BU	14AWG	A42
Injector 1 LOW BANK 2 BV	14AWG	A72
Injector 2 HIGH BANK 1 BU	14AWG	A43
Injector 1 LOW BANK 2 BV	14AWG	A73
Injector 2 HIGH BANK 1 BU	14AWG	A44
Injector 1 LOW BANK 2 BV	14AWG	A74
Injector 2 HIGH BANK 1 BU	14AWG	A45
Injector 1 LOW BANK 2 BV	14AWG	A75
Injector 2 HIGH BANK 1 BU	14AWG	A46
Injector 1 LOW BANK 2 BV	14AWG	A76
Injector 2 HIGH BANK 1 BU	14AWG	A47
Injector 1 LOW BANK 2 BV	14AWG	A77
Injector 2 HIGH BANK 1 BU	14AWG	A48
Injector 1 LOW BANK 2 BV	14AWG	A78
Injector 2 HIGH BANK 1 BU	14AWG	A49
Injector 1 LOW BANK 2 BV	14AWG	A79
Injector 2 HIGH BANK 1 BU	14AWG	A50
Injector 1 LOW BANK 2 BV	14AWG	A80
Injector 2 HIGH BANK 1 BU	14AWG	A51
Injector 1 LOW BANK 2 BV	14AWG	A81
Injector 2 HIGH BANK 1 BU	14AWG	A52
Injector 1 LOW BANK 2 BV	14AWG	A82
Injector 2 HIGH BANK 1 BU	14AWG	A53
Injector 1 LOW BANK 2 BV	14AWG	A83
Injector 2 HIGH BANK 1 BU	14AWG	A54
Injector 1 LOW BANK 2 BV	14AWG	A84
Injector 2 HIGH BANK 1 BU	14AWG	A55
Injector 1 LOW BANK 2 BV	14AWG	A85
Injector 2 HIGH BANK 1 BU	14AWG	A56
Injector 1 LOW BANK 2 BV	14AWG	A86
Injector 2 HIGH BANK 1 BU	14AWG	A57
Injector 1 LOW BANK 2 BV	14AWG	A87
Injector 2 HIGH BANK 1 BU	14AWG	A58
Injector 1 LOW BANK 2 BV	14AWG	A88
Injector 2 HIGH BANK 1 BU	14AWG	A59
Injector 1 LOW BANK 2 BV	14AWG	A89
Injector 2 HIGH BANK 1 BU	14AWG	A60
Injector 1 LOW BANK 2 BV	14AWG	A90
Injector 2 HIGH BANK 1 BU	14AWG	A61
Injector 1 LOW BANK 2 BV	14AWG	A91
Injector 2 HIGH BANK 1 BU	14AWG	A62
Injector 1 LOW BANK 2 BV	14AWG	A92
Injector 2 HIGH BANK 1 BU	14AWG	A63
Injector 1 LOW BANK 2 BV	14AWG	A93
Injector 2 HIGH BANK 1 BU	14AWG	A64
Injector 1 LOW BANK 2 BV	14AWG	A94
Injector 2 HIGH BANK 1 BU	14AWG	A65
Injector 1 LOW BANK 2 BV	14AWG	A95
Injector 2 HIGH BANK 1 BU	14AWG	A66
Injector 1 LOW BANK 2 BV	14AWG	A96
Injector 2 HIGH BANK 1 BU	14AWG	A67
Injector 1 LOW BANK 2 BV	14AWG	A97
Injector 2 HIGH BANK 1 BU	14AWG	A68
Injector 1 LOW BANK 2 BV	14AWG	A98
Injector 2 HIGH BANK 1 BU	14AWG	A69
Injector 1 LOW BANK 2 BV	14AWG	A99
Injector 2 HIGH BANK 1 BU	14AWG	A70
Injector 1 LOW BANK 2 BV	14AWG	A100
Injector 2 HIGH BANK 1 BU	14AWG	A71

62 Pin Interface (EIC #2)

Fuel Metering Unit Supply	14AWG	A15
Fuel Metering Unit	14AWG	A16
Oil Pressure Switch	18AWG	A08
Rail Pressure Sensor Ground	18AWG	A26
Rail Pressure Sensor Signal	18AWG	A27
Rail Pressure Sensor Ground	18AWG	A28
Crank Speed Sensor Signal	18AWG	A11
Crank Speed Sensor Ground	18AWG	A12
Crank Speed Sensor Signal	18AWG	A13
Crank Speed Sensor Ground	18AWG	A14
Camshaft speed Sensor Signal	18AWG	A17
Camshaft speed Sensor Ground	18AWG	A18
Camshaft speed Sensor Signal	18AWG	A19
Camshaft speed Sensor Ground	18AWG	A20
Coilant Sensor Ground	18AWG	A09
Coilant Sensor Signal	18AWG	A10
Coilant Sensor Ground	18AWG	A11
Full Temp Sensor Ground	18AWG	A21
Full Temp Sensor Signal	18AWG	A22
Full Temp Sensor Ground	18AWG	A23
Boost Pressure Sensor Signal	18AWG	A24
Boost Pressure Sensor Ground	18AWG	A25
Boost Pressure Sensor Signal	18AWG	A26
Boost Pressure Sensor Ground	18AWG	A27
Boost Pressure Sensor Signal	18AWG	A28
Boost Pressure Sensor Ground	18AWG	A29
T3 Temp Sens Ground	18AWG	A27
T3 Temp Sens Signal	18AWG	A28
T3 Temp Sens Ground	18AWG	A29
Electronic Valve Actuator (EVA)	18AWG	A43
EGR Motor Positive	18AWG	A50
EGR Motor Negative	18AWG	A51
EGR Position Sensor Supply	18AWG	A09
EGR Position Sensor Ground	18AWG	A10
EGR Position Sensor Signal	18AWG	A11
EGR Position Sensor Ground	18AWG	A12
TVA Motor Positive	18AWG	A48
TVA Motor Negative	18AWG	A49
TVA Motor Position Sensor Supply	18AWG	A34
TVA Motor Position Sensor Ground	18AWG	A35
TVA Motor Position Sensor Signal	18AWG	A36
TVA Motor Position Sensor Ground	18AWG	A37
Factory Harness	2.08mm ²	Grey
Factory Harness	2.08mm ²	Blue/White
Factory Harness	2.08mm ²	Brown/White
Factory Harness	2.08mm ²	Green

62 Pin Interface (EIC #2)

P3 Exhaust Press Sensor Supply	21
P3 Exhaust Press Sensor Ground	22
P3 Exhaust Press Sensor Signal	23
P3 Exhaust Press Sensor Ground	24
P3 Exhaust Press Sensor Signal	25
P3 Exhaust Press Sensor Ground	26
P3 Exhaust Press Sensor Signal	27
P3 Exhaust Press Sensor Ground	28
P3 Exhaust Press Sensor Signal	29
P3 Exhaust Press Sensor Ground	30
P3 Exhaust Press Sensor Signal	31
P3 Exhaust Press Sensor Ground	32
P3 Exhaust Press Sensor Signal	33
P3 Exhaust Press Sensor Ground	34
P3 Exhaust Press Sensor Signal	35
P3 Exhaust Press Sensor Ground	36
P3 Exhaust Press Sensor Signal	37
P3 Exhaust Press Sensor Ground	38
P3 Exhaust Press Sensor Signal	39
P3 Exhaust Press Sensor Ground	40
P3 Exhaust Press Sensor Signal	41
P3 Exhaust Press Sensor Ground	42
P3 Exhaust Press Sensor Signal	43
P3 Exhaust Press Sensor Ground	44
P3 Exhaust Press Sensor Signal	45
P3 Exhaust Press Sensor Ground	46
P3 Exhaust Press Sensor Signal	47
P3 Exhaust Press Sensor Ground	48
P3 Exhaust Press Sensor Signal	49
P3 Exhaust Press Sensor Ground	50
P3 Exhaust Press Sensor Signal	51
P3 Exhaust Press Sensor Ground	52
P3 Exhaust Press Sensor Signal	53
P3 Exhaust Press Sensor Ground	54
P3 Exhaust Press Sensor Signal	55
P3 Exhaust Press Sensor Ground	56
P3 Exhaust Press Sensor Signal	57
P3 Exhaust Press Sensor Ground	58
P3 Exhaust Press Sensor Signal	59
P3 Exhaust Press Sensor Ground	60
P3 Exhaust Press Sensor Signal	61
P3 Exhaust Press Sensor Ground	62

62 Pin Interface (EIC #2)

1A	1B	1C	1D	1E	1F
2A	2B	2C	2D	2E	2F
3A	3B	3C	3D	3E	3F
4A	4B	4C	4D	4E	4F

62 Pin Interface (EIC #2)

1A	1B	1C	1D	1E	1F
2A	2B	2C	2D	2E	2F
3A	3B	3C	3D	3E	3F
4A	4B	4C	4D	4E	4F

62 Pin Interface (EIC #2)

1A	1B	1C	1D	1E	1F
2A	2B	2C	2D	2E	2F
3A	3B	3C	3D	3E	3F
4A	4B	4C	4D	4E	4F

62 Pin Interface (EIC #2)

1A	1B	1C	1D	1E	1F
2A	2B	2C	2D	2E	2F
3A	3B	3C	3D	3E	3F
4A	4B	4C	4D	4E	4F

62 Pin Interface (EIC #2)

1A	1B	1C	1D	1E	1F
2A	2B	2C	2D	2E	2F
3A	3B	3C	3D	3E	3F
4A	4B	4C	4D	4E	4F

62 Pin Interface (EIC #2)

1A	1B	1C	1D	1E	1F
2A	2B	2C	2D	2E	2F
3A	3B	3C	3D	3E	3F
4A	4B	4C	4D	4E	4F

62 Pin Interface (EIC #2)

1A	1B	1C	1D	1E	1F
2A	2B	2C	2D	2E	2F
3A	3B	3C	3D	3E	3F
4A	4B	4C	4D	4E	4F

62 Pin Interface (EIC #2)

1A	1B	1C	1D	1E	1F
2A	2B	2C	2D	2E	2F
3A	3B	3C	3D	3E	3F
4A	4B	4C	4D	4E	4F



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REV	DATE	DESCRIPTION	NAME
A40HP-V15-TIER-4	7/7/19	INITIAL	J. SLACK
A	7/7/2020	UPDATED PARTS	J. SLACK
B	8/4/2020	ADD FINGER GUARD P/N	J.SLACK

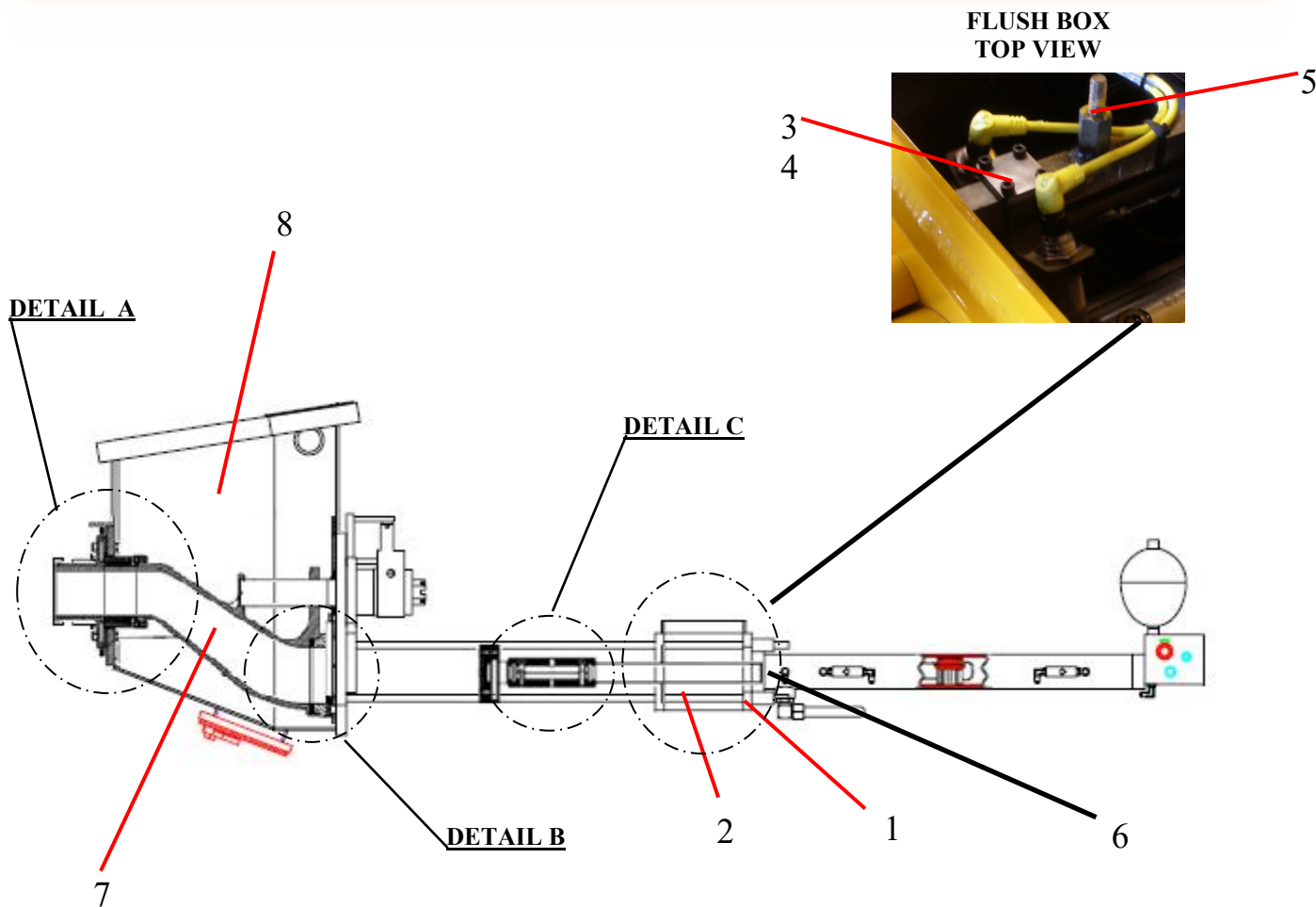


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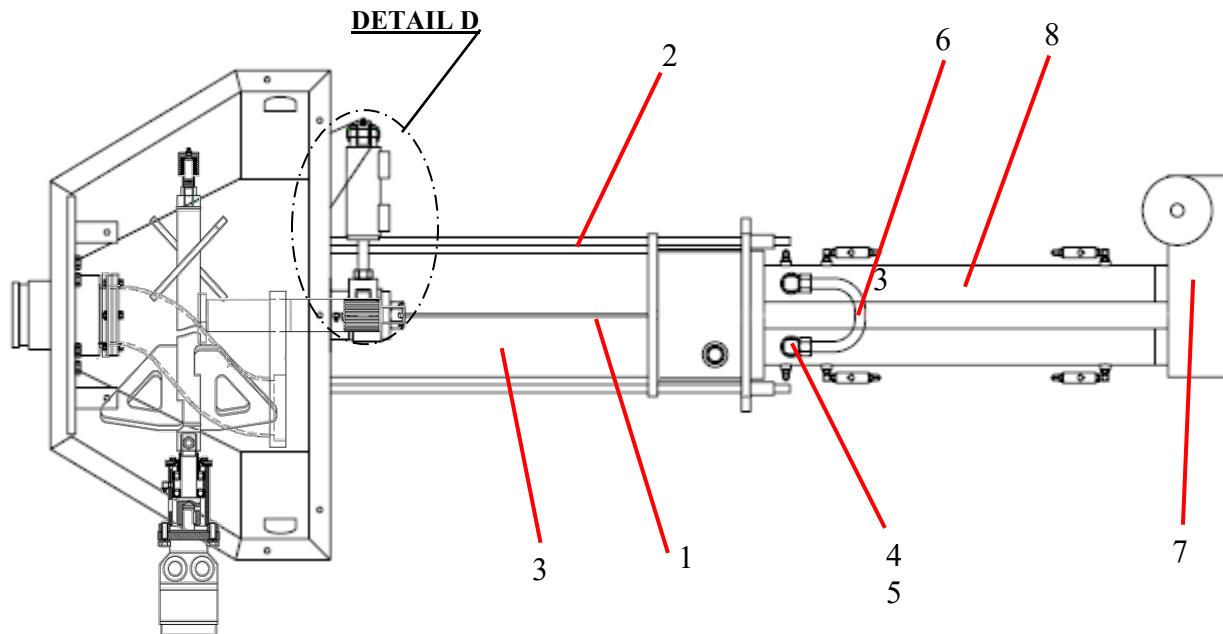
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PUMPING TRAIN ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW28045-5	PUMP CELL ASSEMBLY A40 W/SAFTY SWITCH, JARP-HYDATECH		REF
1	10282	PLUGS-PIPE GALV 1"	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	BW10379	SPACER, TIE ROD, A40	2	EA
7	BW10391	S TUBE WELDMENT, 6X5 A40	1	EA
8	BW10363A	HOPPER, WELDMENT A40 SAFETY SWITCH	1	EA

PUMPING TRAIN ASSEMBLY CONTINUED

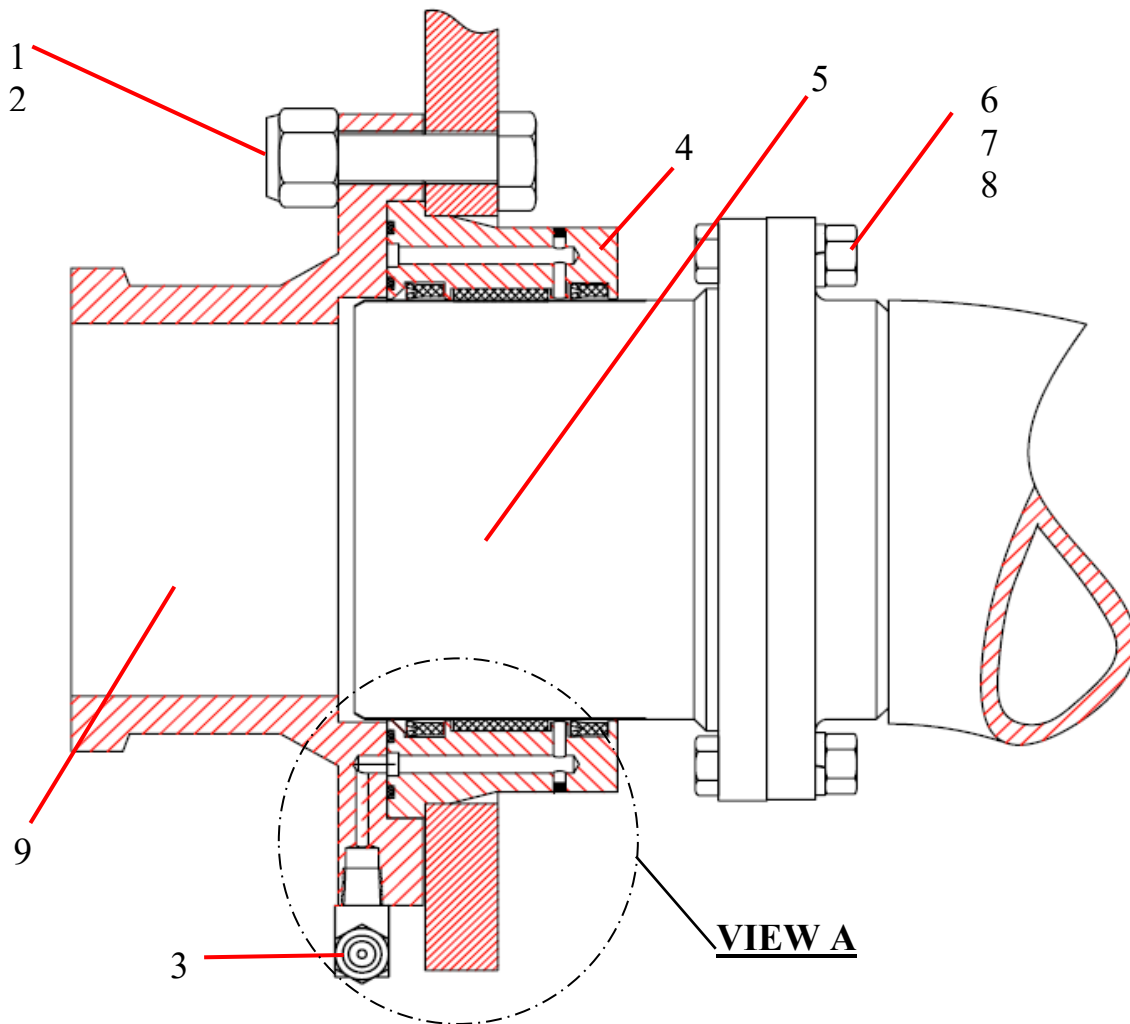


ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10380	TIE ROD, SHORT, A40	4	EA
2	BW10381	TIE ROD, LONG, A40	2	EA
3	BW10376	CONCRETE CYLINDER, 6" X 30" A40	2	EA
4	86728-023	ELBOW, MB – MJ90-16-16	2	EA
5	87786	O-RING-348 BUNA 70	2	EA
6	BW10394	TUBE, HYD, LOOP LINE, A40	1	EA
7	BW10395	MANIFOLD CONTROL W/CARTRIDGES, A40	1	EA
8	BW10373HT	DRIVE CYLINDER 3.75 X 2.00 X 30.00 (HYDRATECH)	REF	

S-TUBE ASSEMBLY

5" OUTLET ASSEMBLY

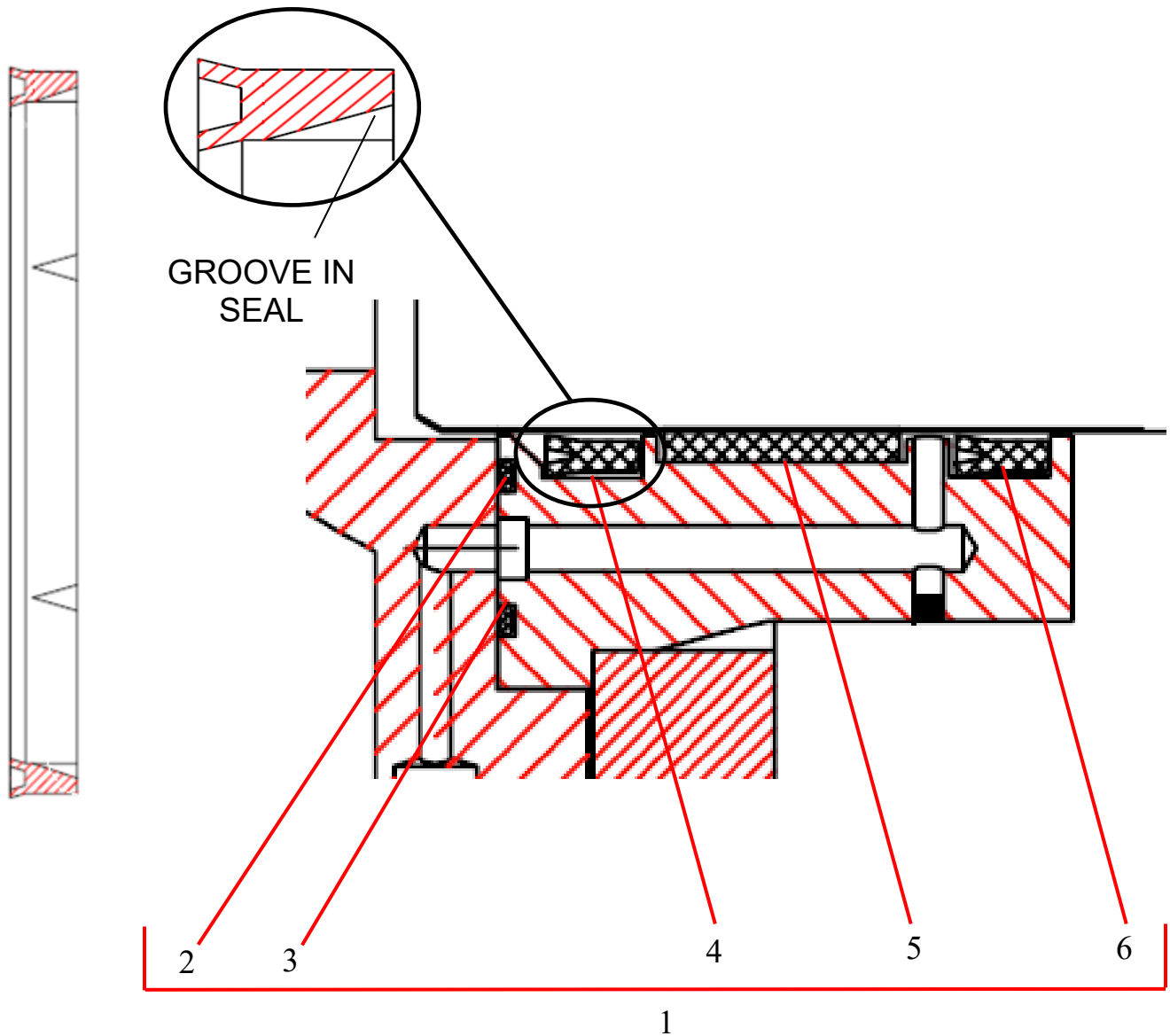
DETAIL A



ID #	PART #	PART DESCRIPTION	QUANTITY	
	86321	OUTLET ASSEMBLY	1	EA
1		HHCS, 5/8-18 x 3" GR/8	6	EA
2		LOCK NUT, 5/8-18	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 - 16 X1 1/2" 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

5" OUTLET SEAL KIT INSTALLATION

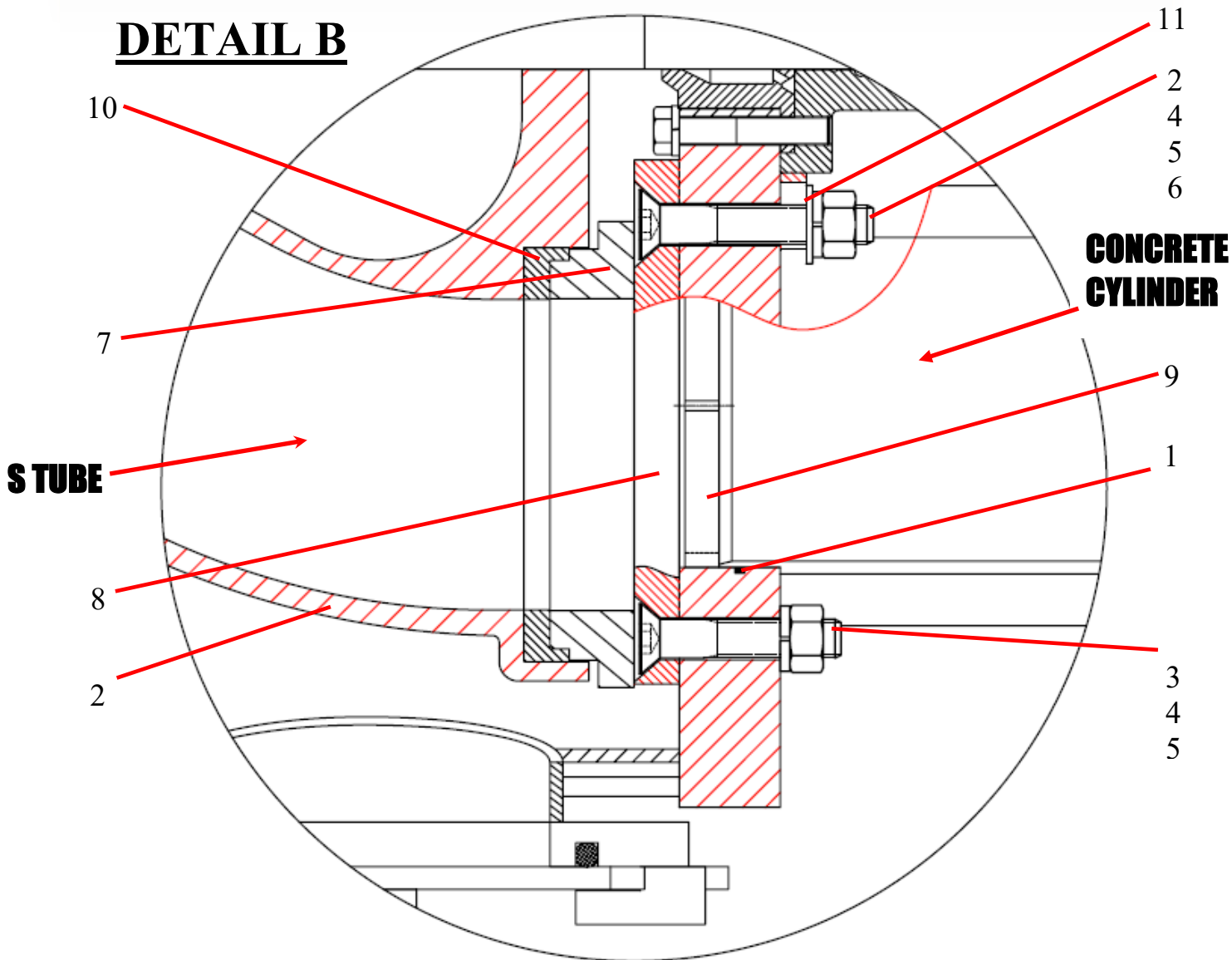
VIEW A



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

WEAR PLATE ASSEMBLY

DETAIL B



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	86149	O-RING, #259 BUENA 70	1	EA
2		FHCS, 3/4 - 10X 4 1/2" GR 8	1	EA
3		FHCS, 3/4 - 10X 3 1/2" GR 8	3	EA
4		HEX NUT, 3/4" - 10	4	EA
5		LOCK WASHER, 3/4"	4	EA
6		FLATWASHER, 3/4"	4	EA
7	72310	WEAR RING, CHROME, 6"-26% MACH'D	1	EA
8	BW10382	WEAR PLATE 6" A40 SELL W/2EA 86086 CHIP RING	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

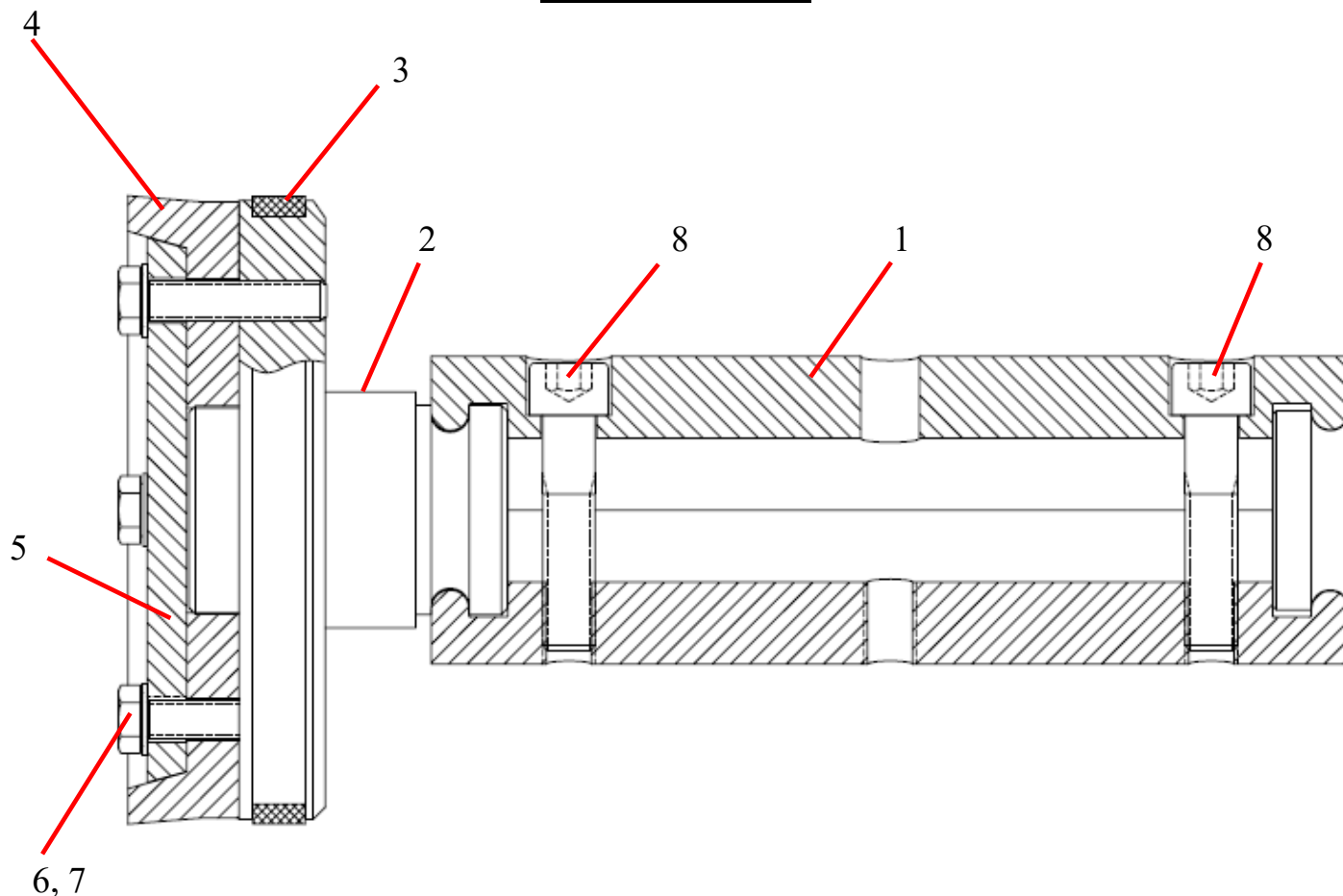


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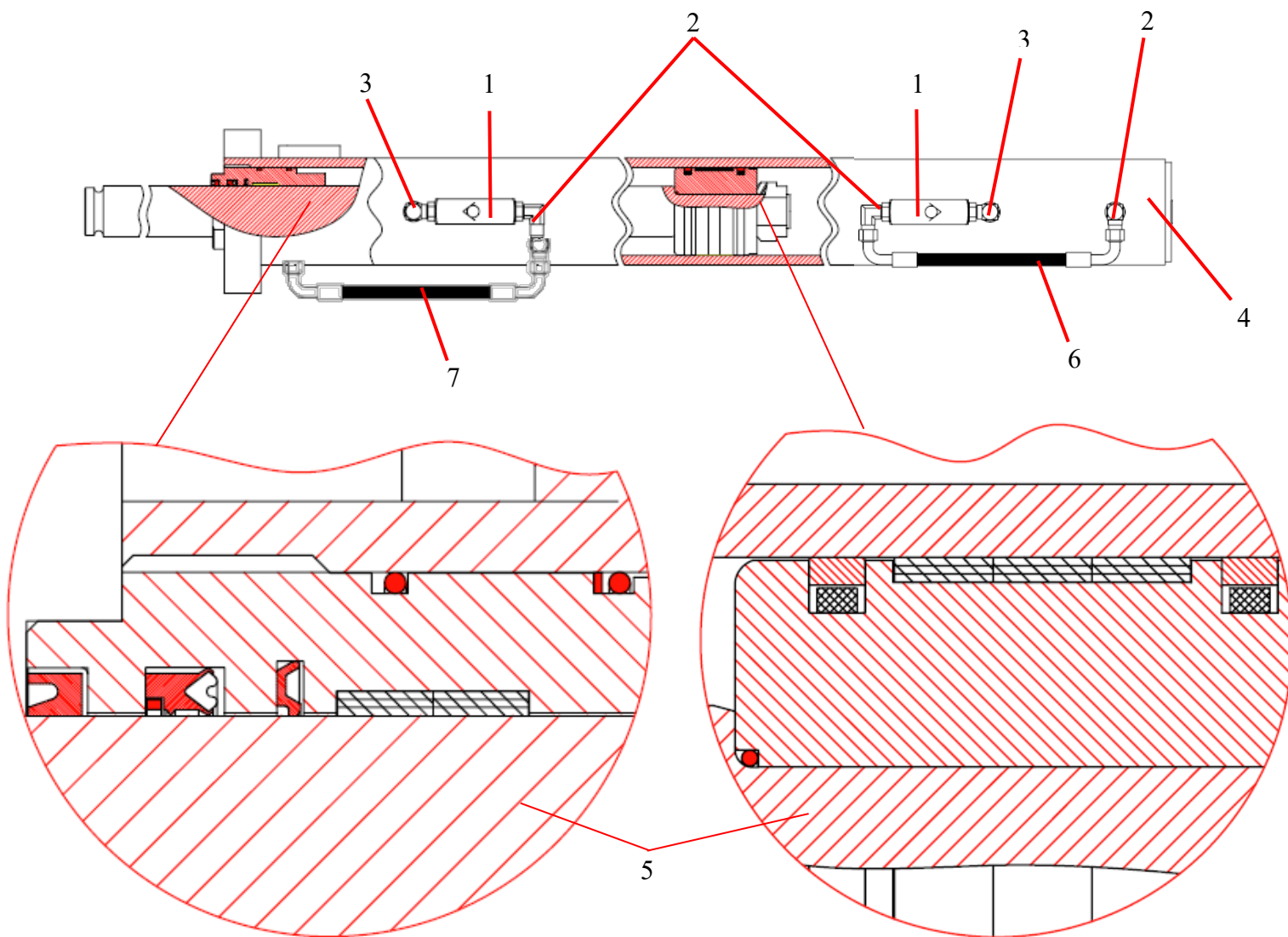
6" PISTON CUP ASSEMBLY

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, 3/8-24 x1 3/4" GR 8	4	E/SIDE
7		INTERNAL LOCKWASHER 3/8	4	E/SIDE
8		SHCS 1/2 - 20 x 2 1/4"	2	E/SIDE

DRIVE CYLINDER ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	78961	CHECK VALVE-5K PSI O-RING	1	EA/SIDE
2	86748	FITTING-MB-MJ90-6-6	3	EA/SIDE
3		ELBOW, MB-MB90-6-6	1	EA/SIDE
4	BW10373HT	DRIVE CYL-3.75 X 2.00 X 30.00 (HYDRATECH)	1	EA/SIDE
5	BW10373A-SK	SEAL KIT FOR BW10373HT CYL	1	EA/SIDE
6	BW10051	HOSE-RT2-FJS90-FJS09-06-06-12"	1	EA/SIDE
7	BW10405	HOSE-RT2-FJS90-FJS09-06-06-14"	1	EA/SIDE



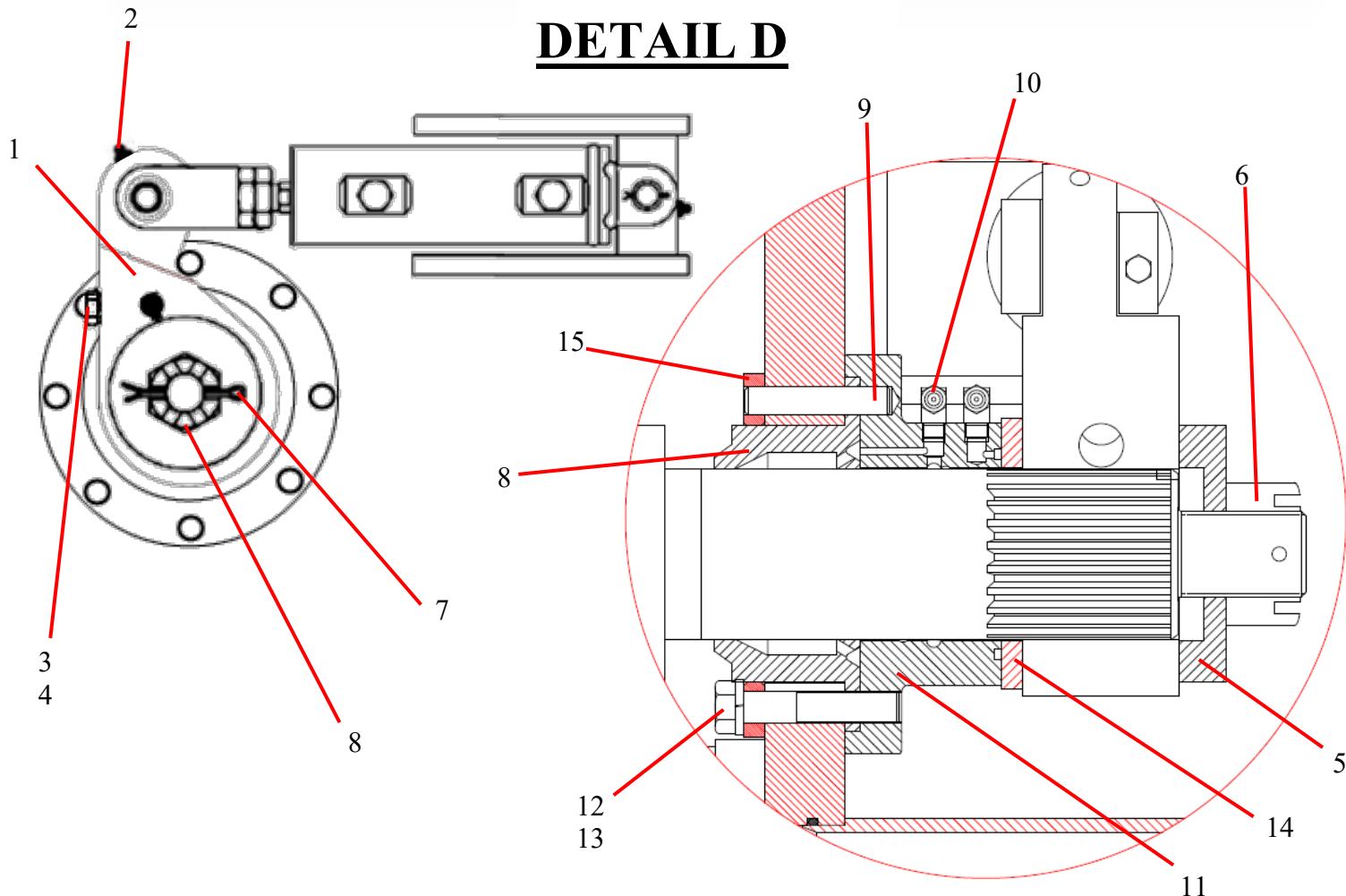
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SINGLE SHIFT BELL CRANK ASSEMBLY

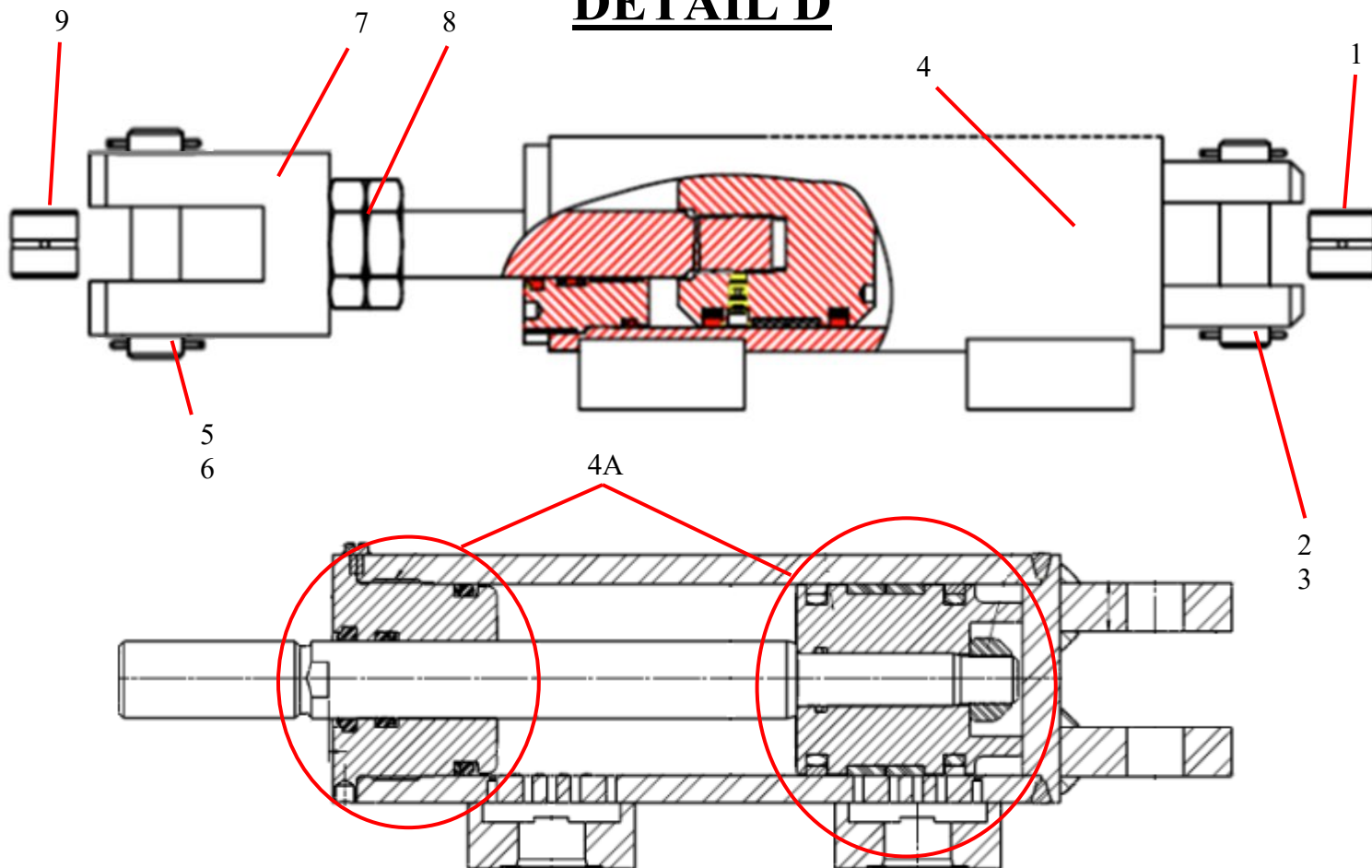
DETAIL D



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, 3/4 x 4" GR 8	1	EA
4		LOCK WASHER, 3/4"	1	EA
5	85134	SPACER, S-TUBE NUT	1	EA
6	70825	NUT 1 1/2" - 12 CASTLE	1	EA
7		COTTER PIN, 1/4 x 4"	1	EA
8	85962	SEAL, FLANGE BEARING, 3" SHAFT	1	EA
9		DOWEL PIN, 1/2" 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	85294-1	THRUST WASHER, S -TUBE (NYLON)	1	EA
15	BW10384	SPACER RING A40	1	EA

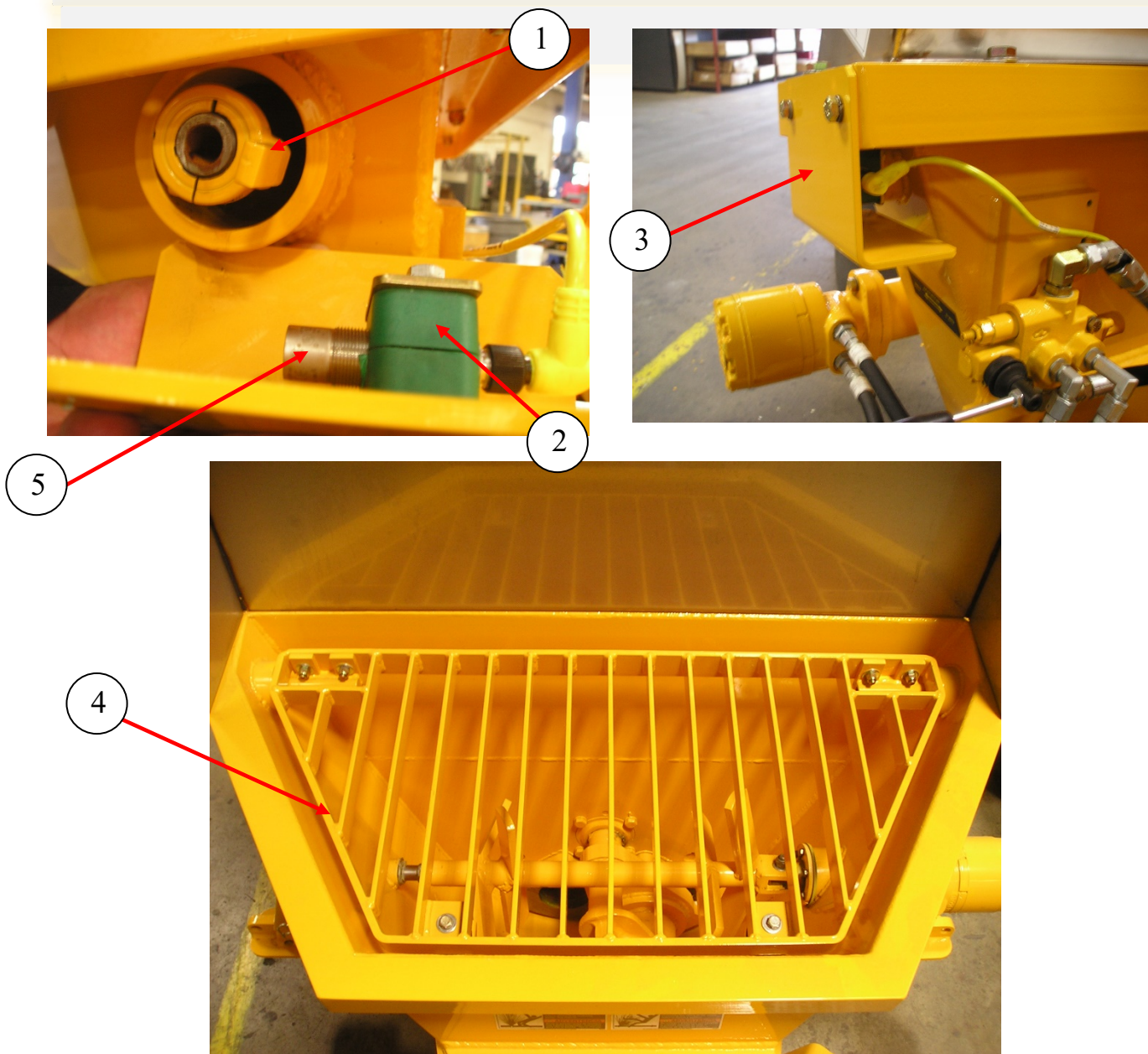
SINGLE SHIFT SWING CYLINDER ASSEMBLY

DETAIL D



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	71011	BUSHING - SHIFT CYLINDER	1	EA
2	74207	PIN - CLEVIS - .750 DIA	1	EA
3		COTTER PIN, 3/32X1 3/4"	2	EA
4	BW10374HT	SWING CYLINDER - 2.50 X 1.00 X 5.15 HYDRATECH	1	EA
4A	86221A-SK	SEAL KIT FOR BW10374HT	1	EA
5	86150	PIN, CLEVIS 1.00 DIA	1	EA
6		COTTER PIN, 1/8X2.00	2	EA
7	86135	CLEVIS, SHIFT CYLINDER	1	EA
8		1"X14 JAM NUT	2	EA
9	85538	BUSHING, SHIFT CYLINDER	1	EA

HOPPER GRATE WITH SAFETY SWITCH



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

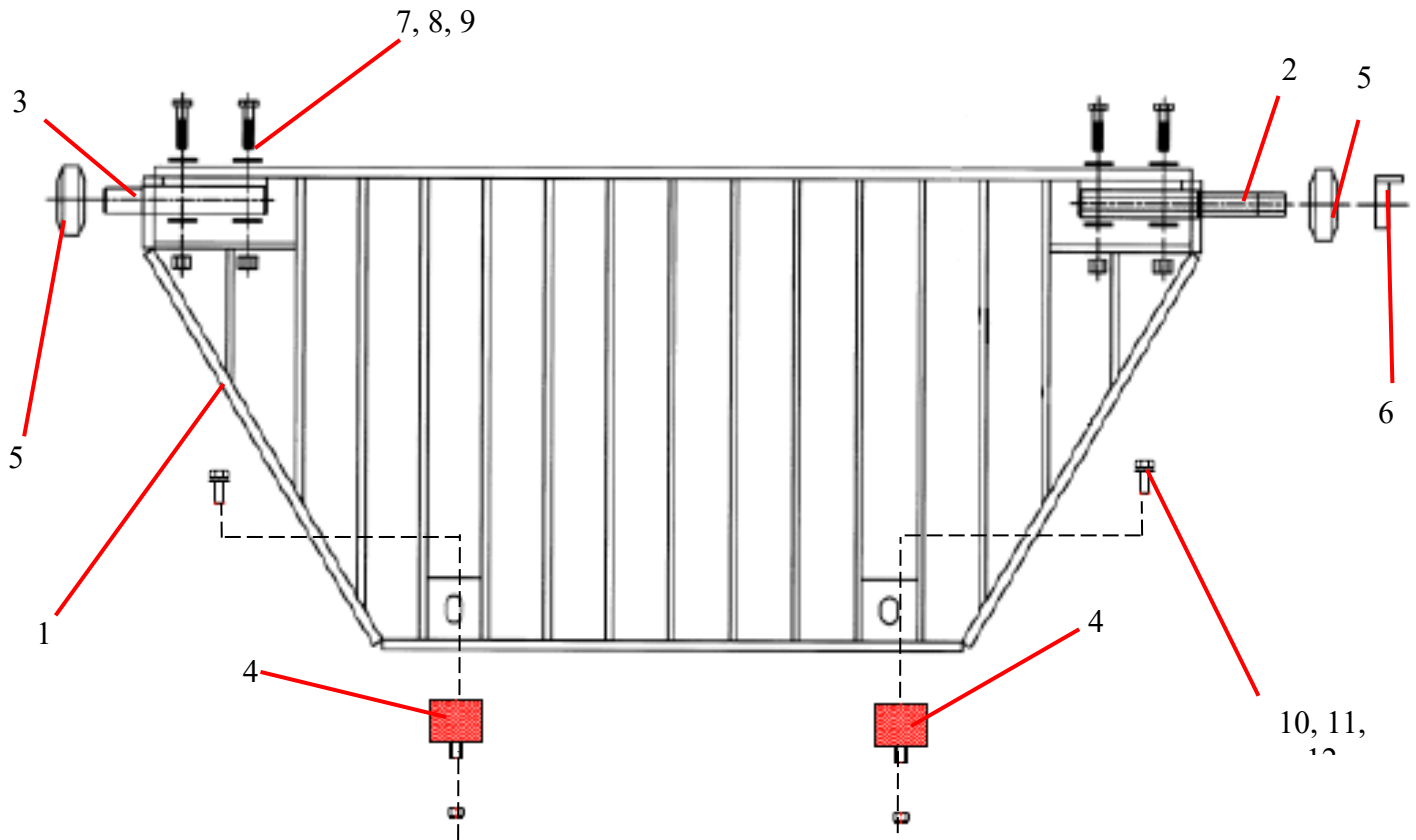


A40HP TIER 4

PARTS

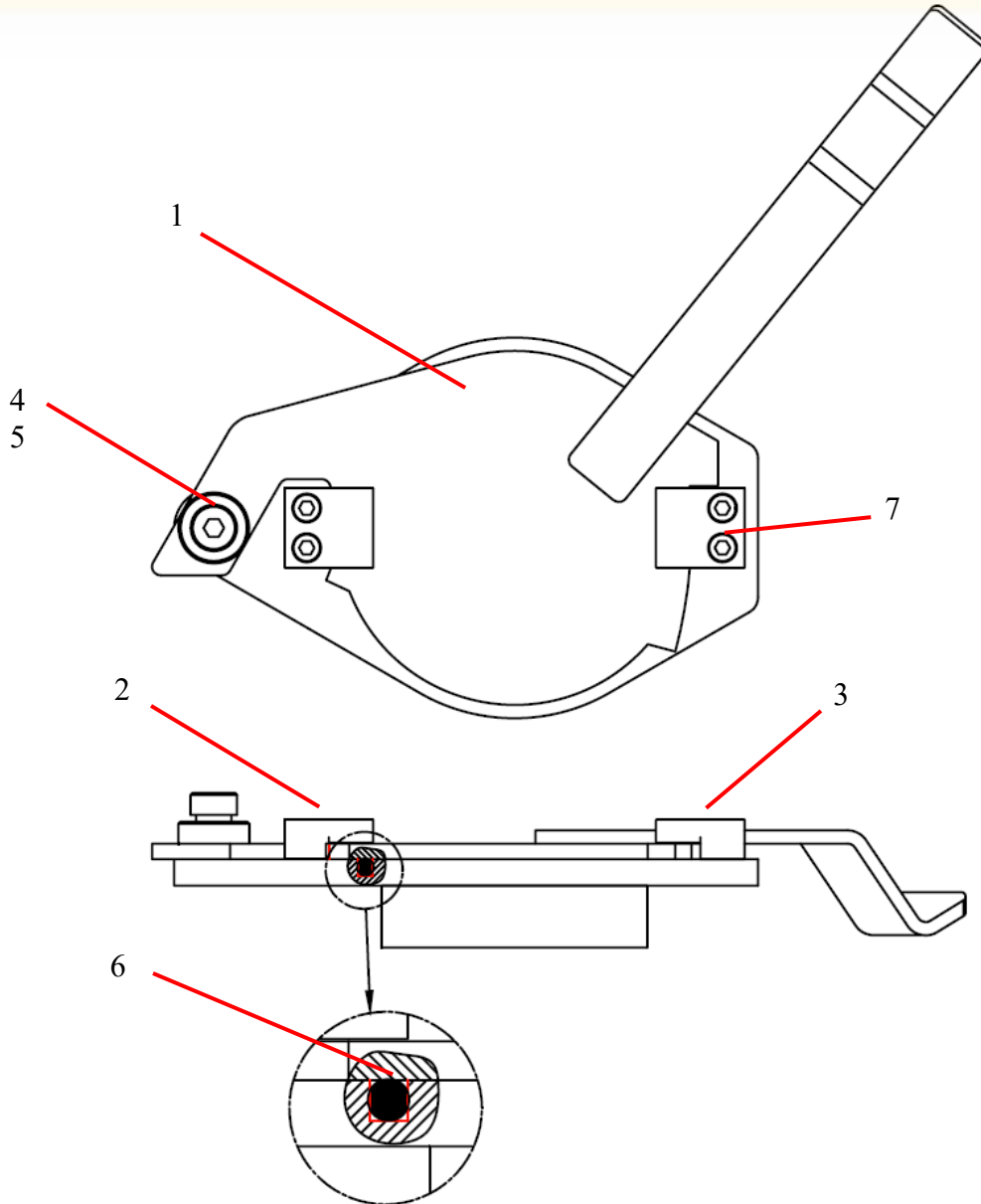
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GRATE ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	REF
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 1/4" 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

CLEAN OUTDOOR ASSEMBLY



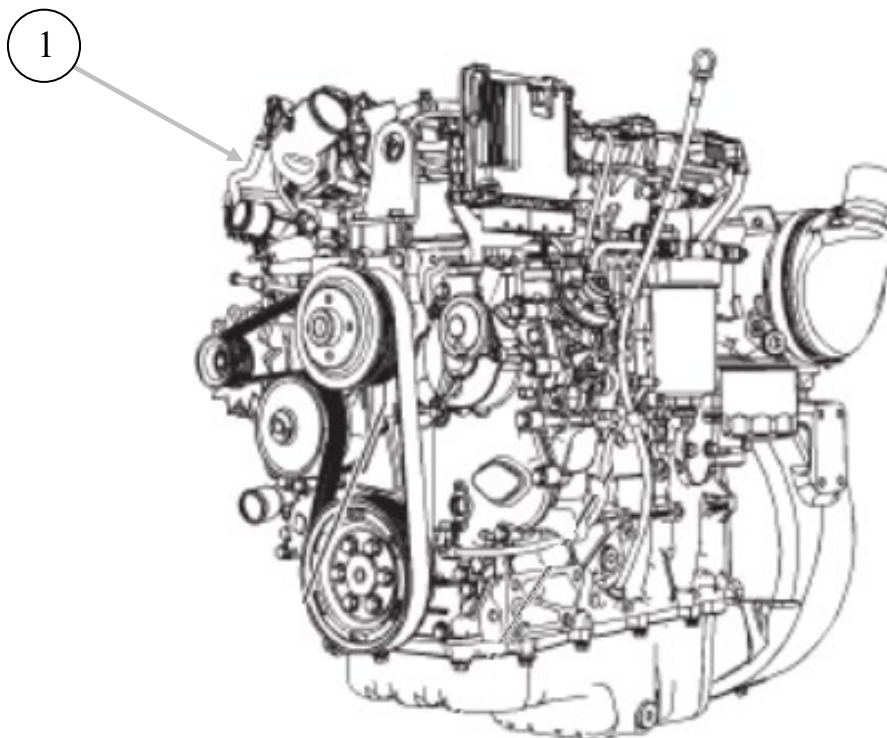
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	85370	DOOR WELDMENT, CLEAN OUT	1	EA
2	86559	BLOCK, CLEAN OUTDOOR, LH	1	EA
3	86560	BLOCK, CLEAN OUTDOOR, RH	1	EA
4		SHOULDER SCREW 1" DIA-1 1/4"	1	EA
5	85367	BOSS, CLEAN OUTDOOR	1	EA
6	W102908A	O-RING CORD, HOPPER DOOR	2.21	FT
7		SHCS 1/2"-13 X 1 1/4"	4	EA



A40HP TIER 4 PARTS

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POWER TRAIN ENGINE TIER 4 PERKINS



Designed to meet EU Stage IV/U.S. EPA Tier 4 Final emission standards
(reference Perkins manual for maintenance and troubleshooting)

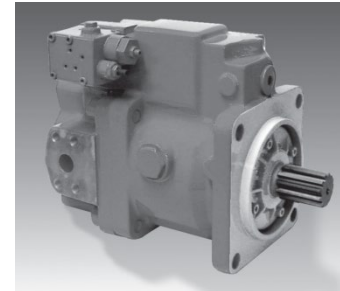
ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW31055	POWER TRAIN ASSY. A40HP W/SFTY GRT, HDRA	ASSY	
1	BW10511	ENGINE – PERKINS 8544F-E34T TIER-4	1	EA



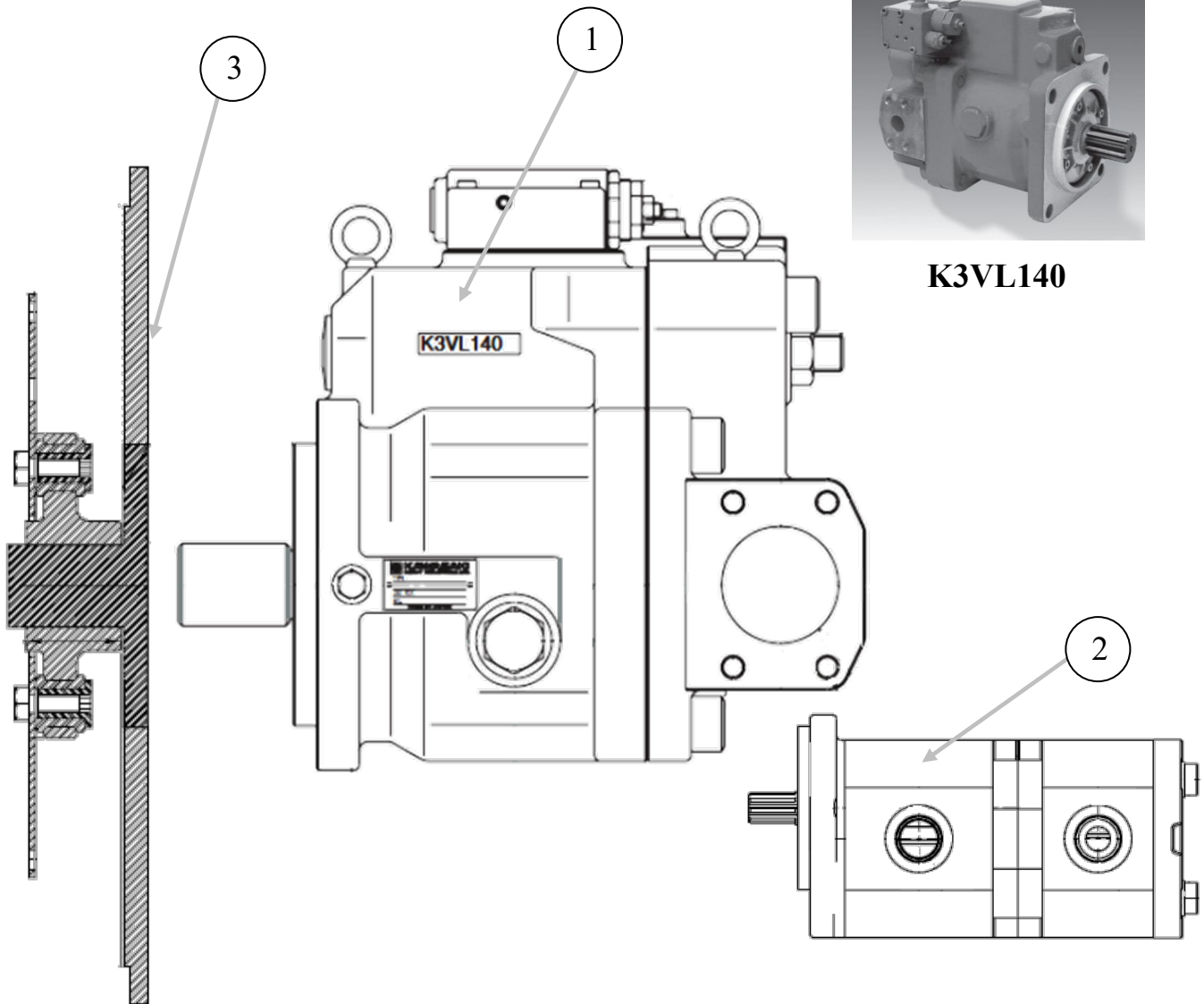
A40HP TIER 4 PARTS

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MAIN HYDRAULIC PUMP GEAR PUMP/PUMP DRIVE



K3VL140



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	85124-004	PUMP, KV3L112 KAWASAKI, 75HP	1	EA
2	87153-001	PUMP-RH-DBLE GEAR, 11.3/8.2 CC	1	EA
3	87360	PUMP DRIVE -SAE 3 - SAE D	1	EA

EXHAUST



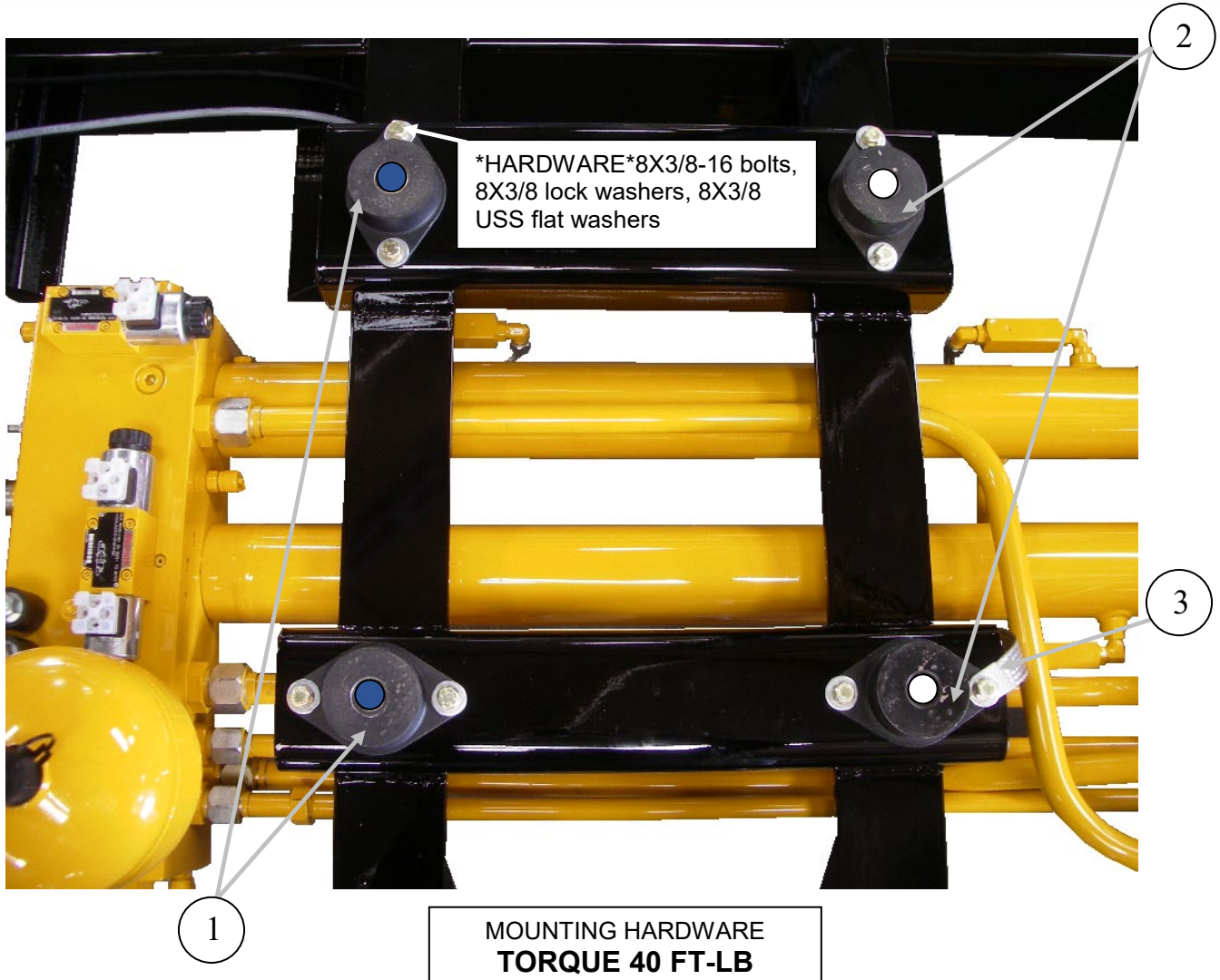
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	77347A	HOSE- 5/16 SAE30R7 BLK (FUEL)	13	FT
2	10577	CLAMP-HOSE FOR 1/2" OD	6	EA
3	BW10540	RUBBER ELBOW 90 DEG 3.50" ID	1	EA
4	BW10541	ALUMINUM TUBING 3.50" ID	0.3	FT
5	74461	CLAMP #68H FOR R-4000	3	EA
6	74310	CLAMP - T-BOLT - 2.50 DIA	1	EA
7	70849	RAIN CAP 2.5"	1	EA
8	78213	CLAMP	1	EA
9	80003	3/8-16 NUT	4	EA
10	80043	FLATWASHER-3/8 USS PLATED	8	EA
11	80072	LOCKWASHER-3/8	8	EA
12	BW10179	SAFETY PLATE, EXHAUST PAINTED RED	1	EA
13	BW10554	EXHAUST PIPE T-4 PERKINS	1	EA



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ENGINE MOUNTS



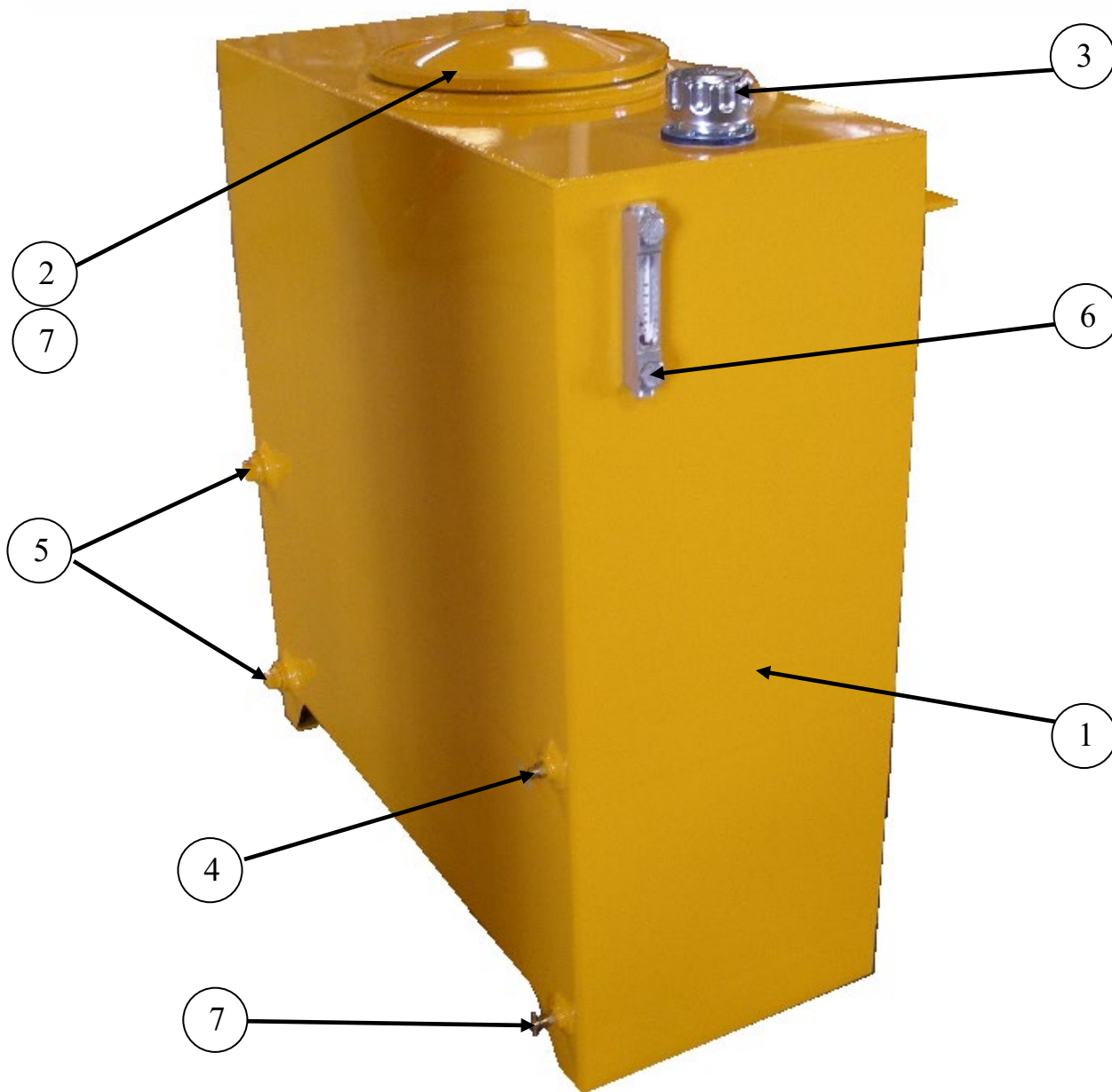
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10266	ENGINE MOUNT-FRT, 840 LB-BLUE DOT	2	EA
2	BW10270	ENGINE MOUNT-REAR, 1020 LB-WHITE DOT	2	EA
3	73269	GROUND STRAP	1	EA



A40HP TIER 4 PARTS

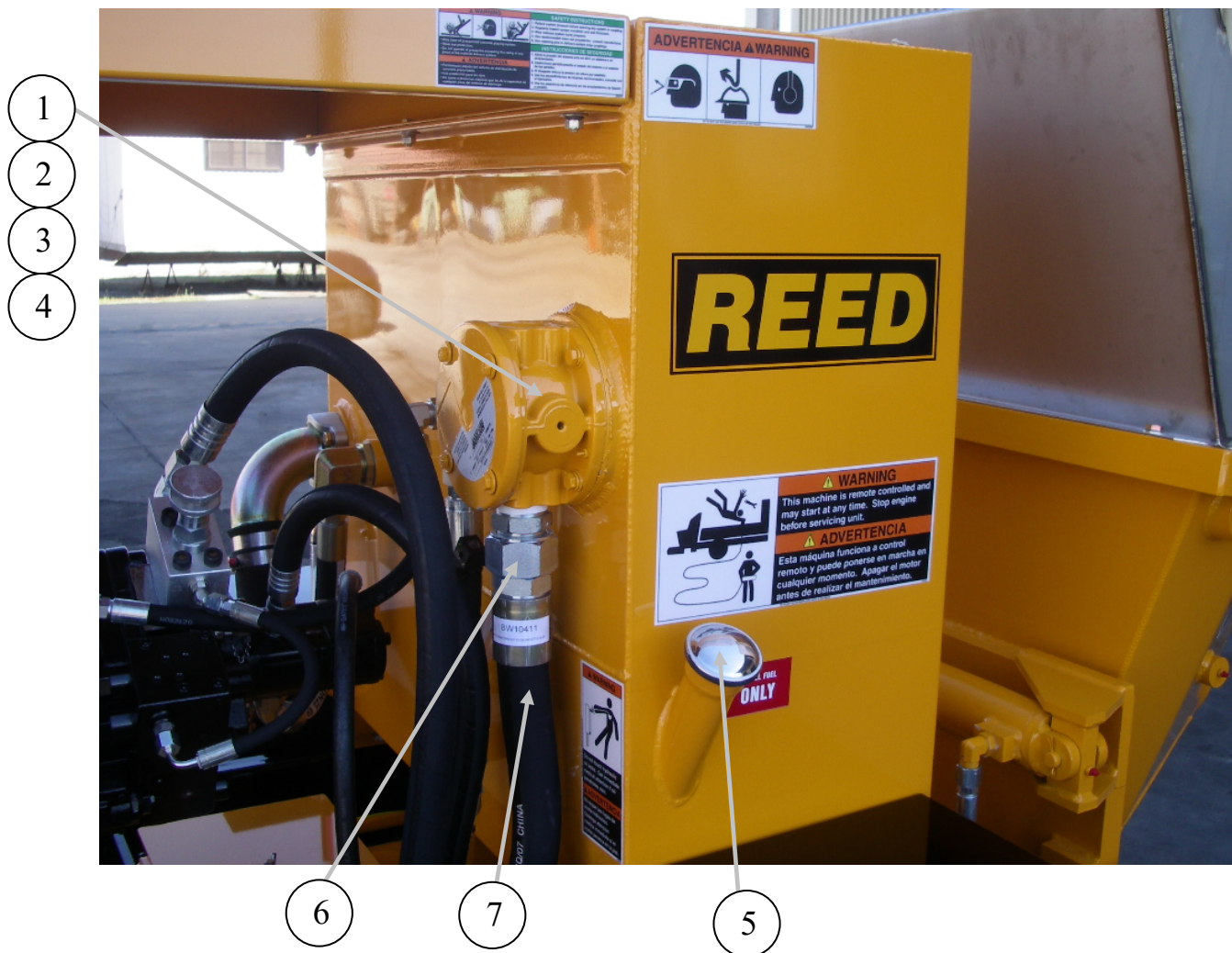
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HYDRAULIC AND FUEL TANK ASSEMBLY



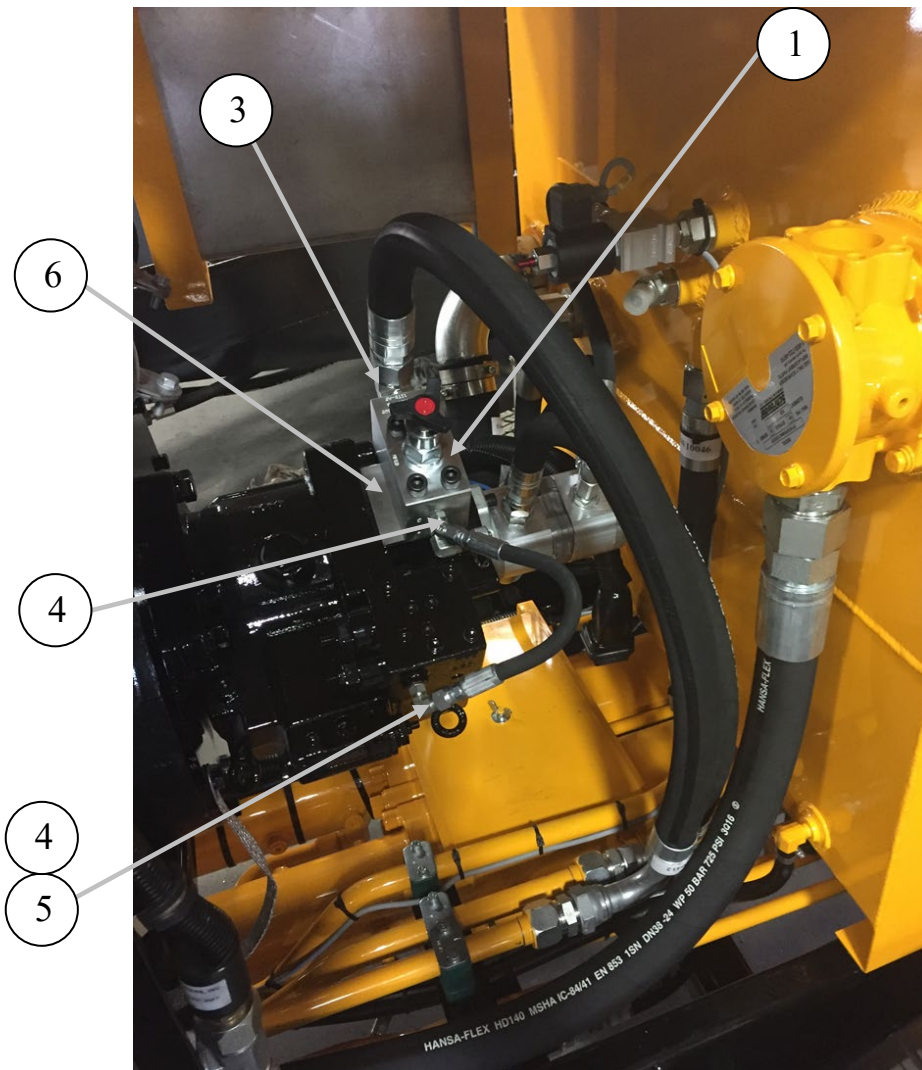
ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW10432	HYD./FUEL TANK ASSY.	ASSY	
1	BW10386	HYD./FUEL TANK WELDMENT	1	EA
2	BW10171	KIT, 12 END COVER	1	EA
3	74508	FILLER BREATHER W/CAP	1	EA
4	801025	DRIAN COCK, ¼ NPT	2	EA
5	10282	PLUG-PIPE / GALV 1"	2	EA
6	74509	GAUGE-SIGHT/TEMPERATURE	1	EA
7	85867	GASKET, END COVER 12" (SPARE PART)	REF	EA

HYDRAULIC AND FUEL TANK ASSEMBLY CONTINUED



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10027	FILTER, RETURN	1	EA
2	BW10241	SEAL KIT FOR BW10027 (RETURN FILTER)	1	EA
3	BW10242	GASKET FOR BW10027 (RETURN FILTER)	1	EA
4	BW10106-1	ELEMENT 25 MIKRON, FOR BW10027	1	EA
5	BW10256	CAP, FILLER	1	EA
6		FITTING, MP-MJ-24-24	1	EA
7	BW10411	HOSE, 24C1TH-24FJX-24FJX-70.00	1	EA

FLOW CONTROL VALVE



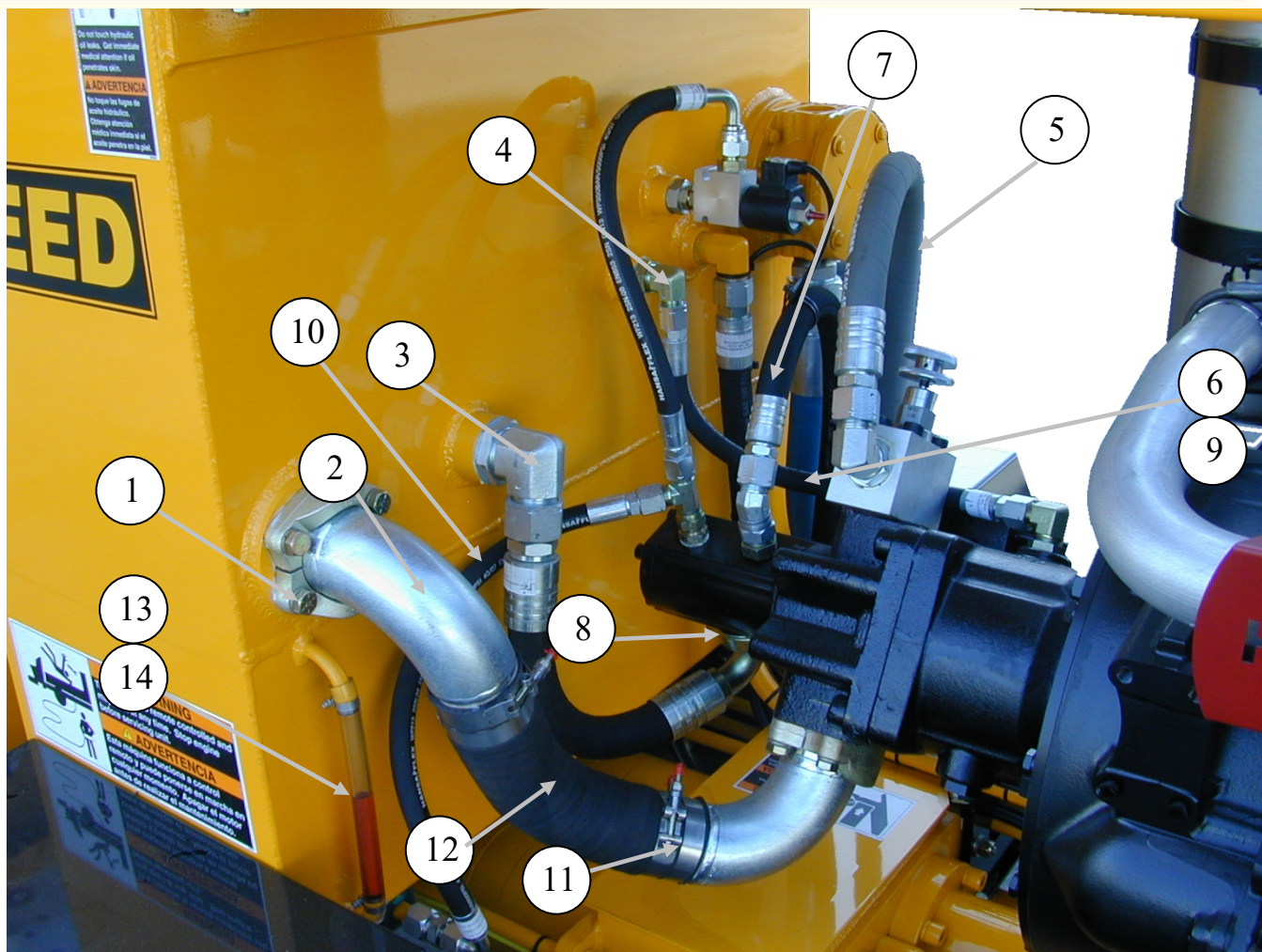
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	85125	FLOW CONTROL, HV10V0100 PUMP (HI SPEED)	1	EA
	79543	VOLUME CONTROL CARTRIDGE	1	EA
2		ADAPTER, 45 DEGREE -MB-MJ-4-6	1	EA
3	86728-023	ELBOW, MB-MJ90-16-16	1	EA
4		ELBOW, MB-MJ90-4-6	1	EA
5	85659-014	HOSE, 4M2T-6FJX-6FJX90S-12.50"	1	EA
6	BW10477	SPACER 85125 FLOW VALVE SPACER	1	EA



A40HP TIER 4 PARTS

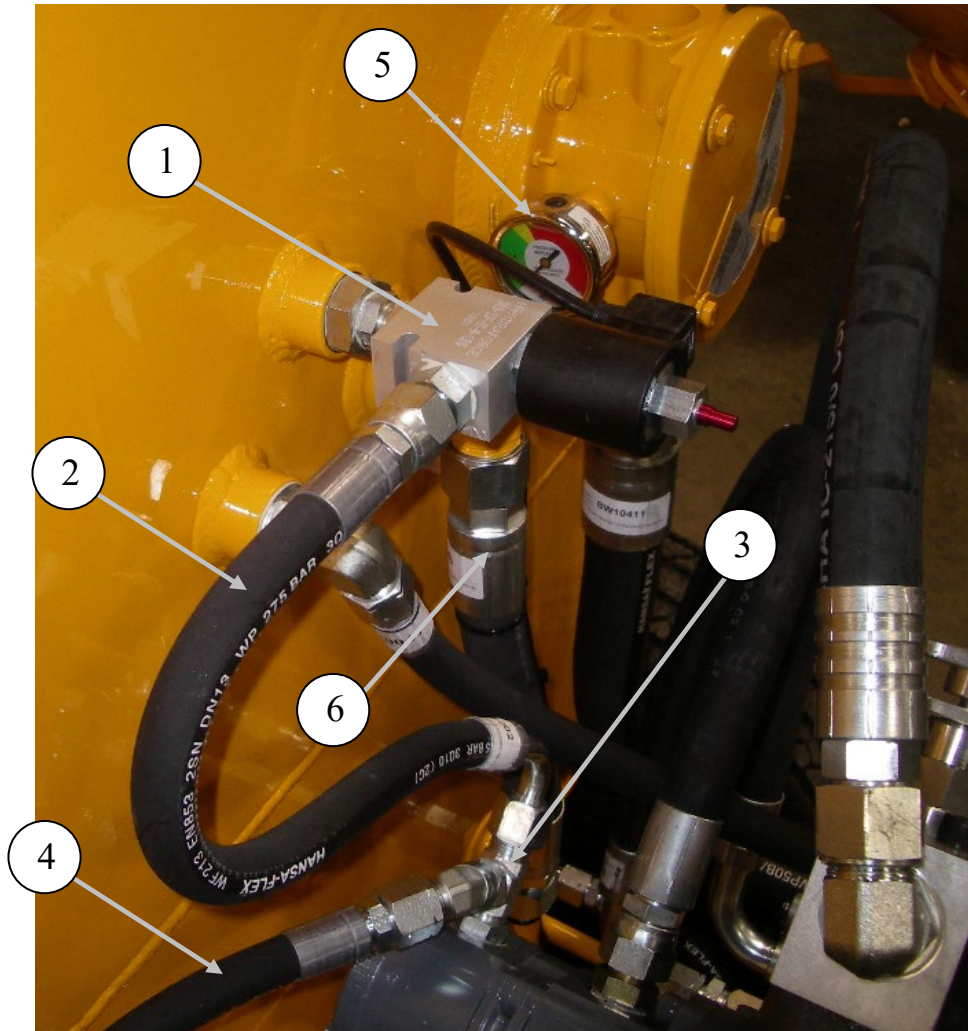
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HYDRAULIC LINES, HOSES, AND FITTINGS



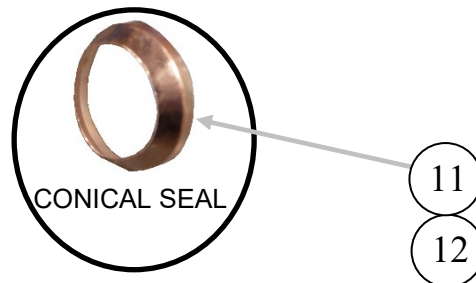
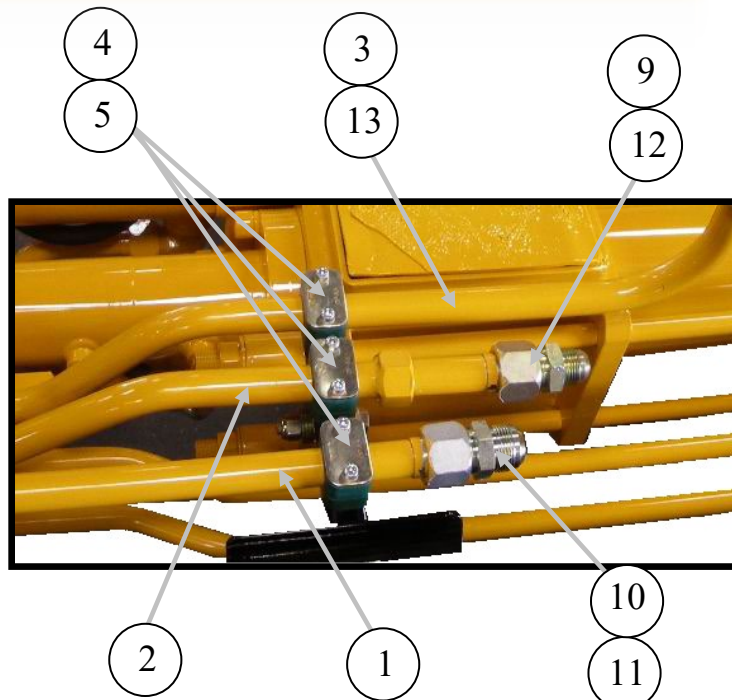
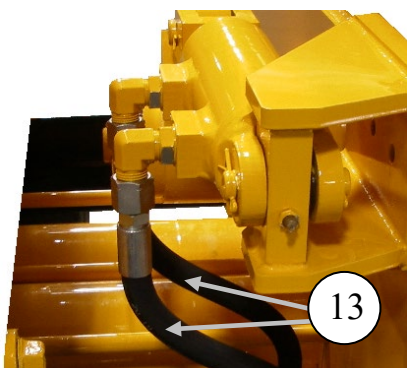
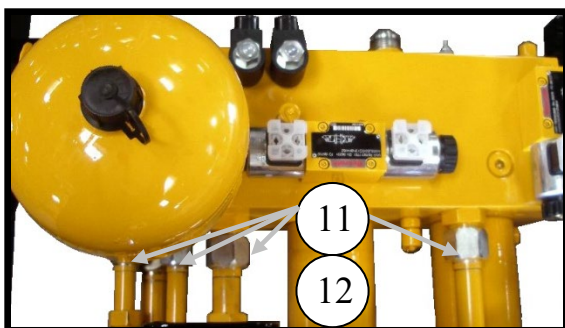
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	86264-007	SPIT FLANGE-CODE 61 -40 SAE	2	EA
2	86911-009	STEM, 2 1/2 "90 DEG. 40C4-40FL90	2	EA
3	86728-019	ELBOW MB-MJ90-12-12	2	EA
4		FITTING, MJ-MP90-16-16	1	EA
5	BW10412	HOSE, R12-FJS-FJS90-16-16-41"	1	EA
6	85667-004	HOSE, 12G5K-12FJX-12FJX90-32.00	1	EA
7	85657-002	HOSE, 8M2T-10FJX-10FJX90S-19.50	1	EA
8		FITTING, MB-MJ-10-12 (STRAIGHT)	1	EA
9		ADAPTER, MB-MJ-12-16	1	EA
10	85664-008	HOSE, 16G4H-16FJX-16FJX45-20"	1	EA
11	79803	CLAMP - T- BOLT -3.00 DIA	4	EA
12	85660-001	HOSE, 40G4H-NO ENDS-	12.00	EA
13	801978	TUBING, CLEAR PVC 1/2 ID X 3/4 OD	0.83	FT
14	802289	CLAMP, WORM-0.38-0.68 DIA	2	EA

HYDRAULIC LINES, HOSES, AND FITTINGS CONT



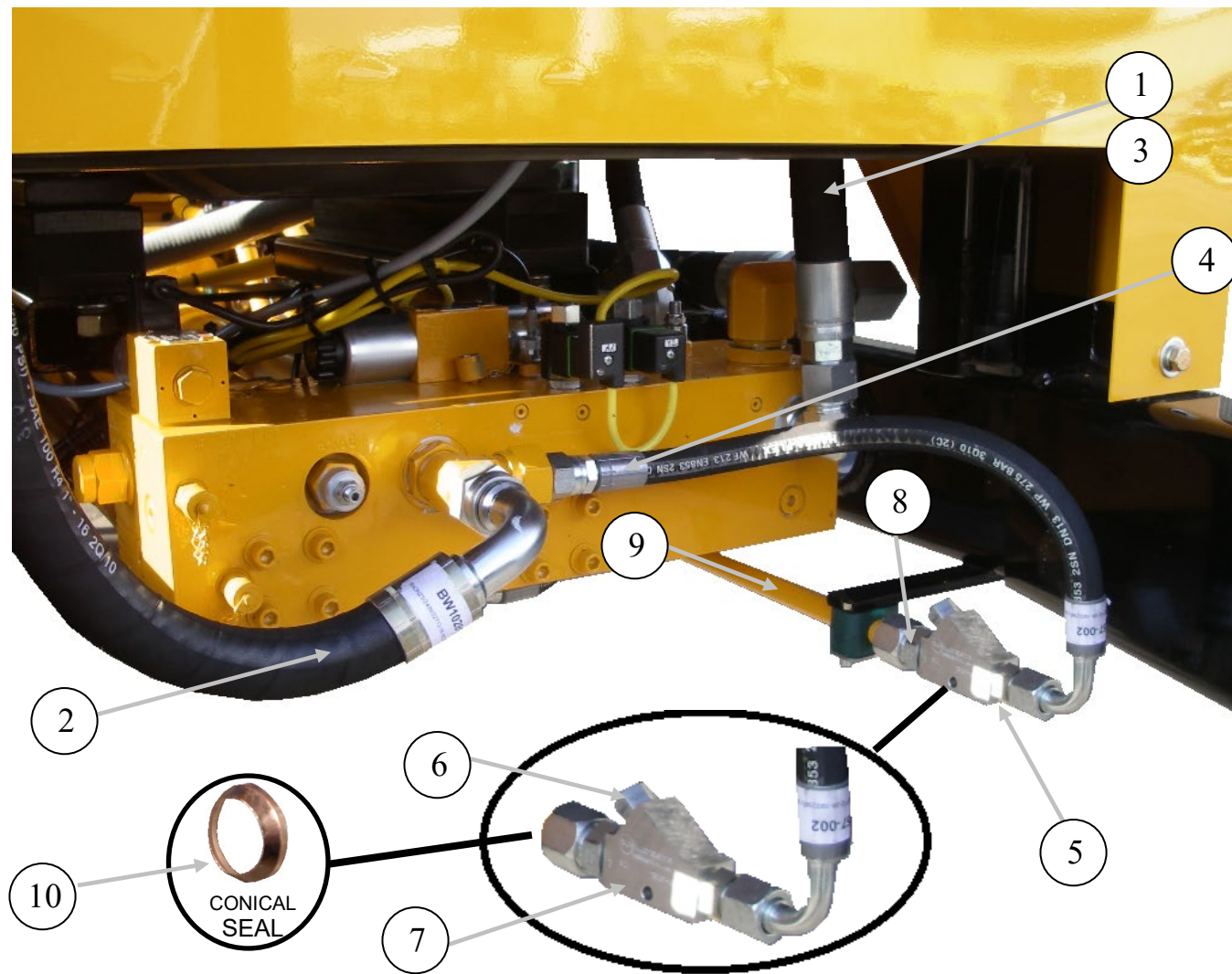
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	87154	SOLENOID VALVE, 2P-2W, NO, 12V DIN	1	EA
2	85657-002	HOSE, 8M2T-10FJX-10FJX90S-19.50	1	EA
3		MJ-MB-MJT10	1	EA
4	85657-024	HOSE, 8M2T-10FJX-10FJX90S-24.50	1	EA
5	BW10249	GAUGE-RETURN FILTER BW10027	1	EA
6	BW10046	HOSE, R1T-FJS-MJ-16-16-16-14.5"	1	EA

HYDRAULIC LINES, HOSES, AND FITTINGS CONTINUED



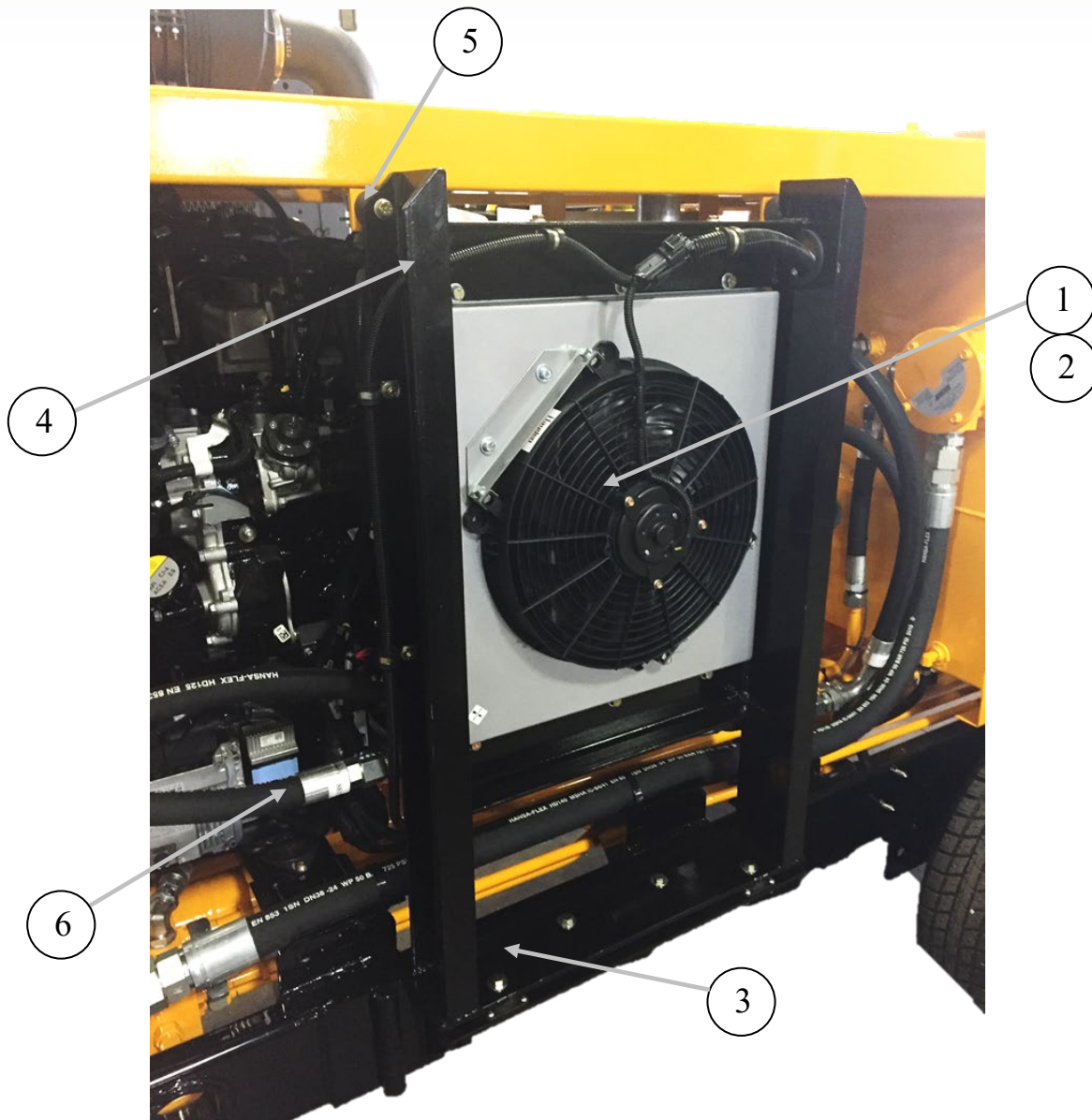
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10151	TUBE HYD, ACC.PUMP, PRESSURE-PAINTED	1	EA
2	BW10403	TUBE HYD, MAIN PUMP PRESSURE PAINTED	1	EA
3	BW10153	TUBE HYD, RETURN LINE-PAINTED	1	EA
4	801902-007	CLAMP, 25MM TUBE CLAMP SET	3	EA
5	801902-001	NUT, TEE TUBE CLAMP	6	EA
6	800897	CLAMP, 3/4" TUBE, SINGLE	2	EA
7	BW10154	TUBE HYD, SWING CYLINDER-PAINTED	2	EA
8		UNION MALE, MJ-MJ-12-10	2	EA
9	87415-001	UNION MALE JIC, MJ-MJ-16-12	1	EA
10	87415-002	UNION MALE JIC, MJ-MJ-12-12	1	EA
11	BW10229	CONICAL SEAL, SIZE 12	5	EA
12	BW10230	CONICAL SEAL, SIZE 16	6	EA
13	BW10049	HOSE R2T-FJS-FJS-10-10-08-20"	2	EA

HYDRAULIC LINES, HOSES, AND FITTINGS CONTINUED



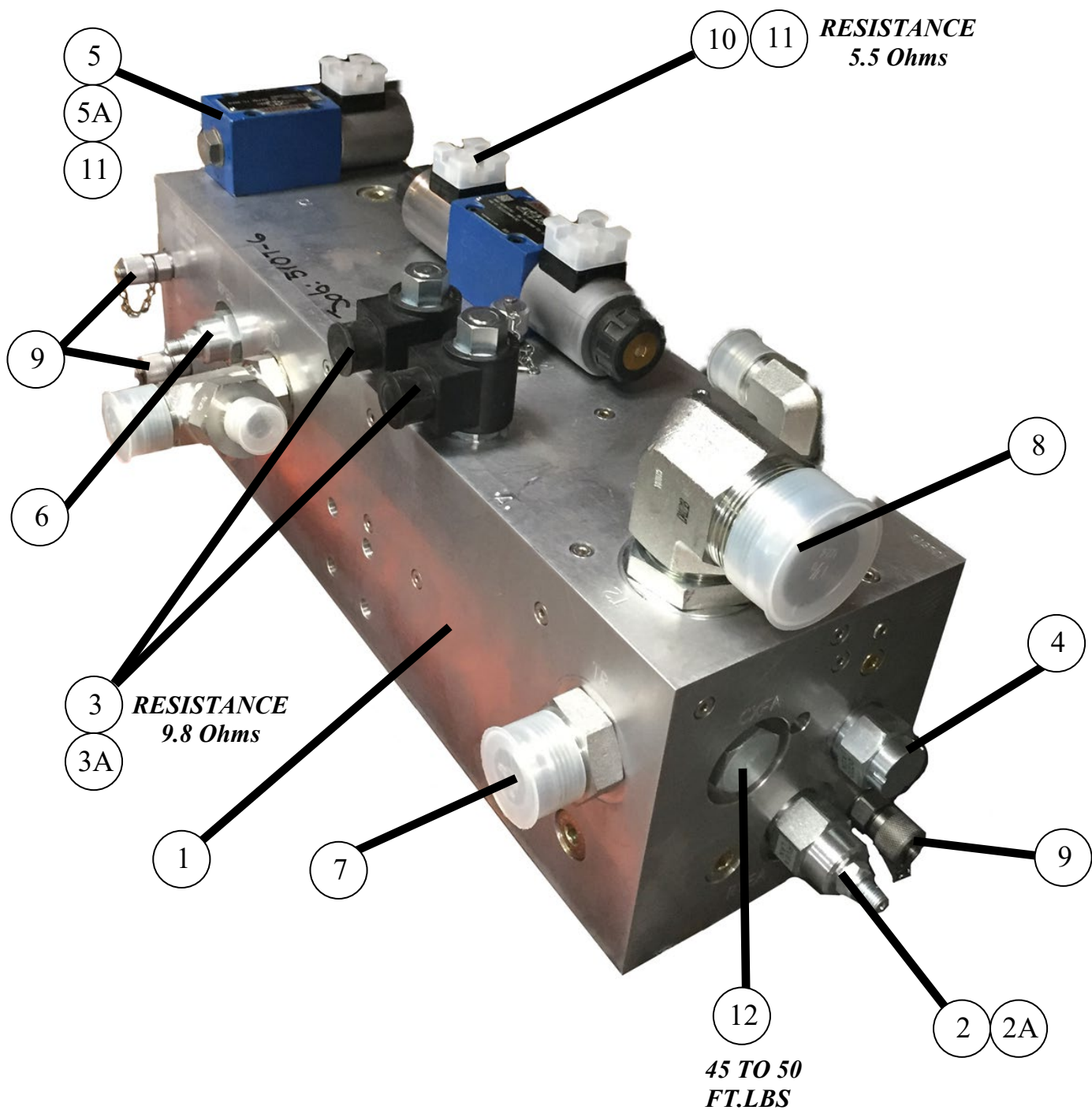
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	88138-008	HOSE, 16GMV--20FJX-16FJX90S-24"	1	EA
2	88138-005	HOSE, 16GMV--16FJX-16FJX	1	EA
3	86728-026	ELBOW, MB-MJ90-20-16	1	EA
4	85657-002	HOSE, 8M2T-10FJX-10FJX90S-19.50	1	EA
5	86900-018	MB-MJ-10-6	2	EA
6	BW10471	CHECK VALVE	1	EA
7	BW10472	MANIFOLD FOR BW10471 (MUST BE MODIFIED)	1	EA
8		MB-MJ-6-12	1	EA
9	BW10409	TUBE HYD. MIXER VALVE RETURN	1	EA
10	BW10229	CONICAL SEAL, SIZE 12	2	EA

OIL COOLER ASSY



ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW10537	OILCOOLER ASSY.	REF	
1	79433	OIL COOLER-ELECTRIC 12VDC	1	EA
2	89655	TEMPRATURE SWITICH 122-104F W/INTEG RELAY	1	EA
3	89653	MOUNT VIBRATION DAMPING	4	EA
4	BW10536	OIL COOLER MOUNTING BRACKET WELDMENT	1	EA
5	73748	BUMPERS	2	EA
6	88138-005	HOSE, 16M1T-16FJX-16FJX90-61.50"	1	EA
7	88138-008	HOSE, 16M1T-16FJX-16FJX90-32.0"	1	EA

CONTROL MANIFOLD





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CONTROL MANIFOLD CONTINUED

ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW10395	MANIFOLD, CYLINDER CIRCUIT ASSEMBLY, A40	1	EA
1	BW10375	MANIFOLD MACHINED, A40 SERIES	1	EA
2	85703	RELIEF VALVE CARTRIDGE, FOR 85249	1	EA
2A	85703SK	RELEIF VALVE CARTRIDGE SEAL KIT	1	EA
3	BW10185	VALVE POPET, 2 WAY N/O FORBW10186	2	EA
3A	87247	COIL, 12VDC, FOR 87246 (9.8 Ohms))	2	EA
4	BW10182	DIRECTIONAL CARTRIDGE VALVE 2 POSIT	1	EA
4A	BW10182-SK	DIRECTIONAL CARTRIDGE VALVE SEAL KIT	1	EA
5	BW10183	VALVE PILOT, 2 POSITION	1	EA
5A	BW10183-SK	DIRECTIONAL CARTRIDGE VALVE SEAL KIT	1	EA
6	BW10326	RELIEF VALVE CARTRIDGE, FOR BW1004	1	EA
7	BW10328	ADAPTER, MB-MB-12-12	1	EA
8	86728-028	ELBOW, MB-MJ90-20-24	1	EA
9	78593	MINICHECK ADAPTER, SAE 4	3	EA
10	85691	VALVE PILOT, FOR 85691 (5.5 Ohms)	1	EA
11	BW10329	10-24X2" SHCS (TORQE 6.5 FT. LBS.)	8	EA
12	BW10327	CHECK VALVE CARTRIDGE FOR BW10004	1	EA

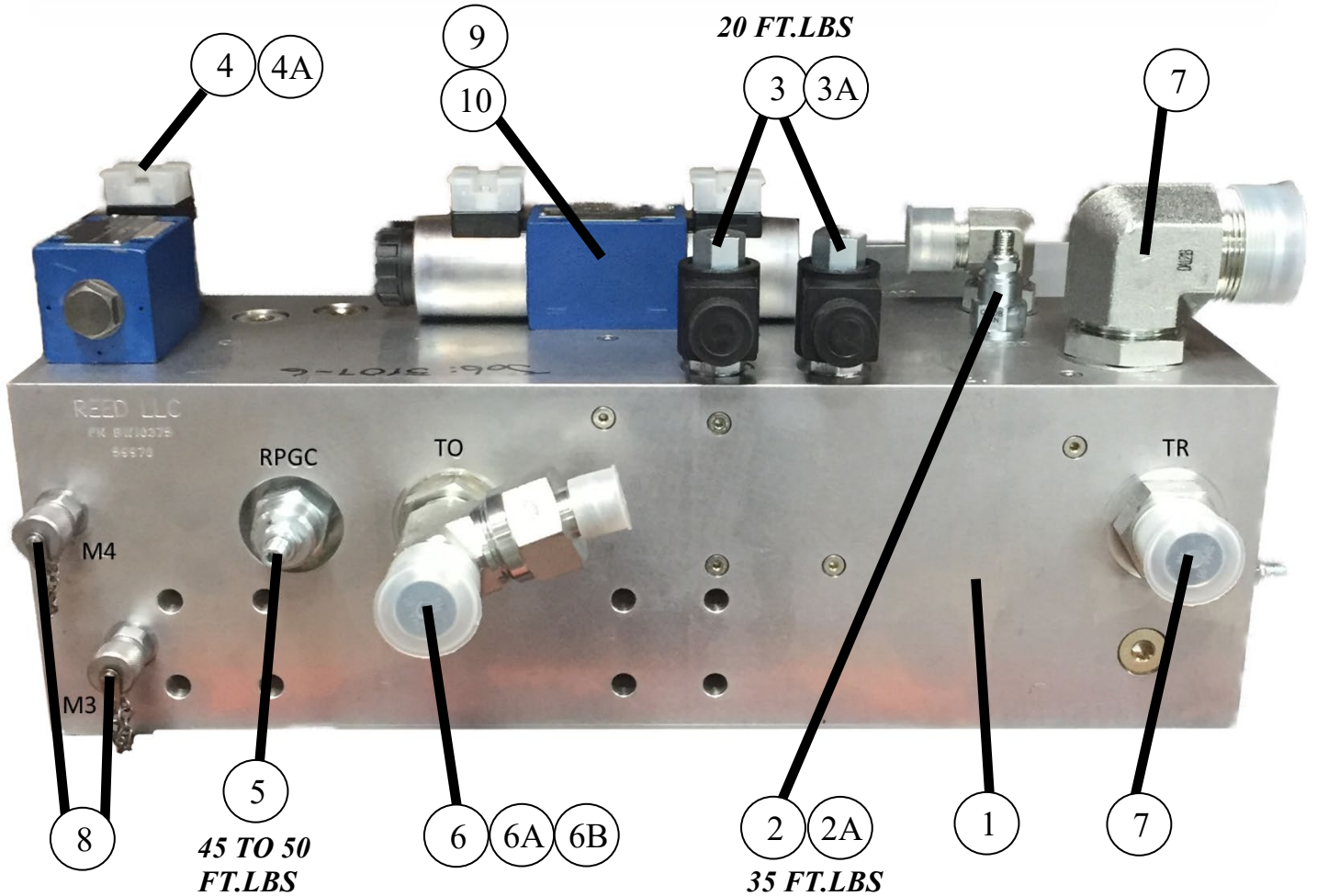
INSTALLATION TORQUE-CHART	
ITEM/CODE	TORQUE SETTING
RPGC	45 TO 50 FT. LBS.
CXFA	45 TO 50 FT. LBS.
RVEA	45 TO 50 FT. LBS.
QCDB	35 FT. LBS.
DCDD	50 FT. LBS.
DCEC	160 FT. LBS.
ITEM 4	20 FT. LBS.
ITEM 4A	5 FT. LBS.
ITEM 5&7	6.5 FT. LBS.



A40HP TIER 4 PARTS

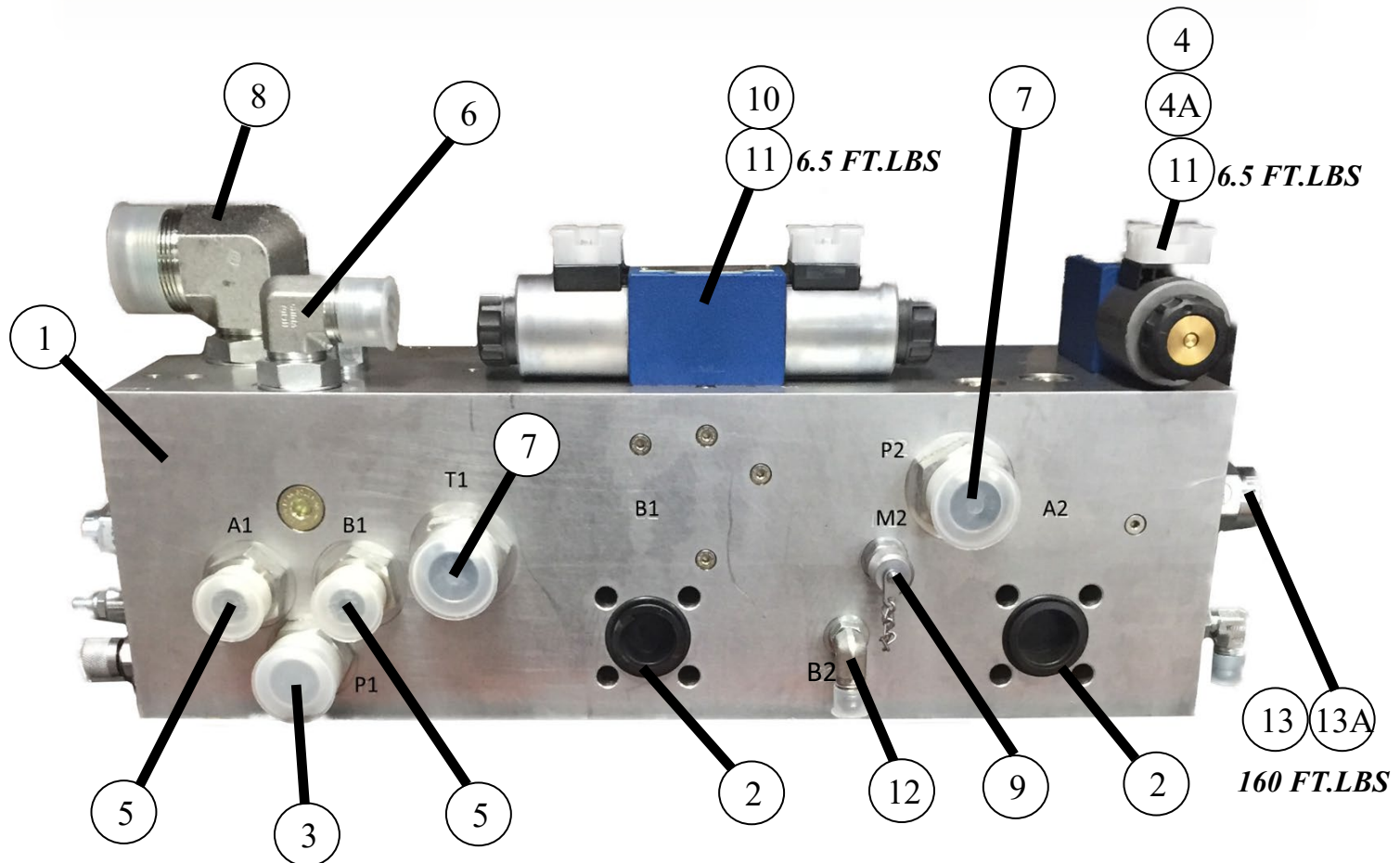
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CONTROL MANIFOLD FRONT SIDE



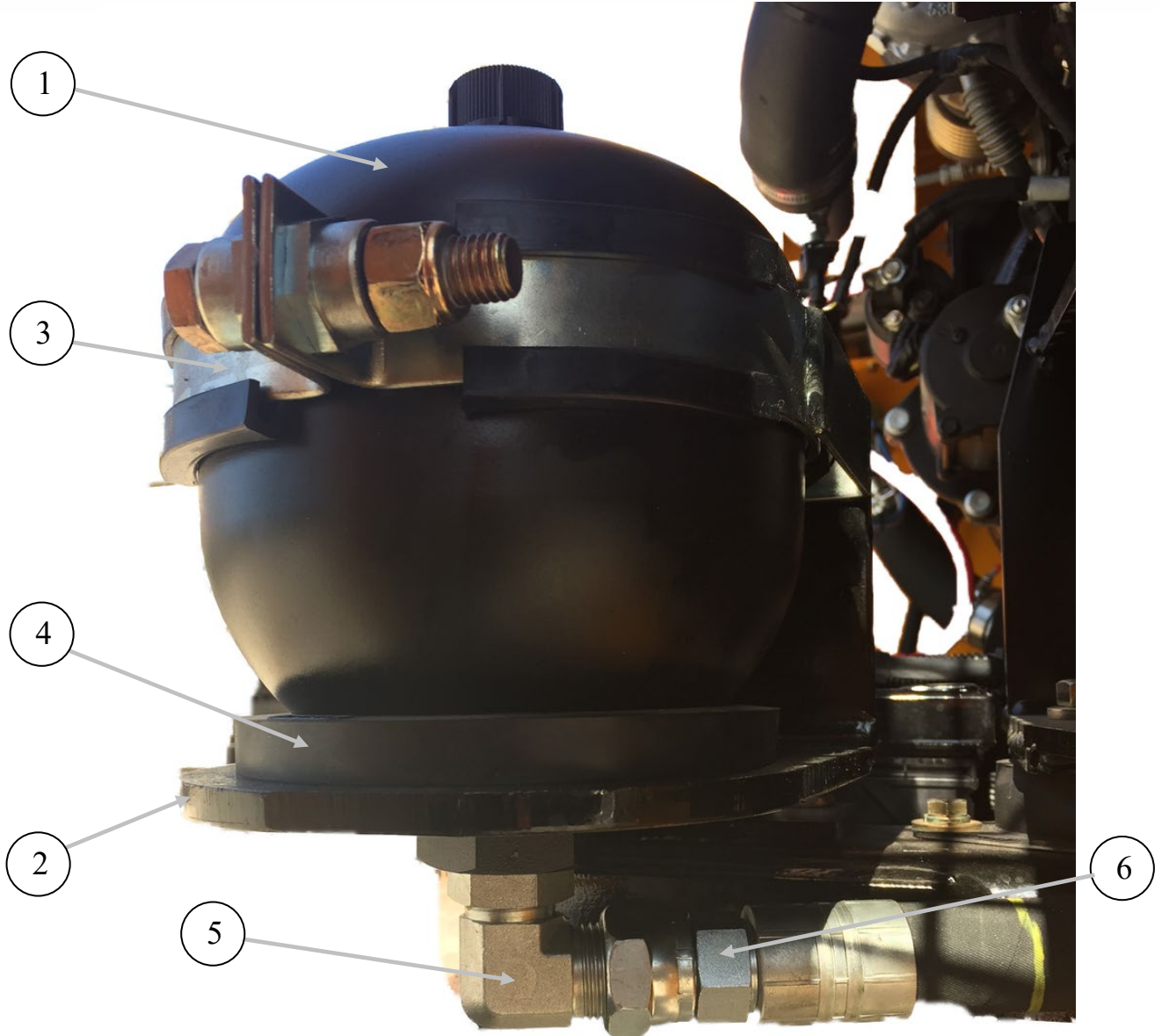
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10375	MANIFOLD MACHINED, A40 SERIES	1	REF
2	85704	UNLOADER VALVE CARTRIDGE, FOR 85249	1	REF
2A	85704-SK	UNLOADER VALVE CARTRIDGE SEAL KIT	1	EA
3	BW10185	VALVE POPET, 2 WAY N/O FORBW10186	2	REF
3A	87247	COIL, 12VDC, FOR 87246 (9.8 Ohms)	2	REF
4	BW10183	VALVE PILOT, 2 POSITION	1	REF
4A	BW10183-SK	DIRECTIONAL CARTRIDGE VALVE SEAL KIT	1	REF
5	BW10326	RELIEF VALVE CARTRIDGE, FOR BW1004	1	REF
6	86900-028	ADAPTER, MB-MJ-12-12	3	REF
6A	86945-001	TEE, MJ-MB-MJT-16	1	REF
6B	86948-001	REDUCER, JIC MJ-FJ-10-16	1	REF
7	86728-028	ELBOW, MB-MJ916-16	1	REF
8	78593	MINICHECK ADAPTER, SAE 4	2	REF
9	85691	VALVE PILOT, FOR 85689 (5.5 Ohms)	1	REF
10	BW10329	10-24X2" SHCS (TORQE 6.5 FT. LBS.)	8	REF

CONTROL MANIFOLD CYLINDER SIDE



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10375	MANIFOLD MACHINED, A40 SERIES	1	REF
2	BW10177	O-RING, #219	2	EA
3	86900-024	ADAPTER, MB-MJ-12-16	1	EA
4	BW10183	VALVE PILOT, 2 POSITION	1	REF
4A	BW10183-SK	DIRECTIONAL CARTRIDGE VALVE SEAL KIT	1	REF
5	86900-23	ADAPTER, MB-MJ-12-12	2	EA
6	86728-019	MB-MJ-90-12-12, ELBOW	1	REF
7	86900-028	ADAPTER, MB-MJ-16-16	2	REF
8	86728-028	ELBOW, MB-MJ90-20-24	1	REF
9	78593	MINICHECK ADAPTER, SAE 4	2	REF
10	85691	VALVE PILOT, FOR 85689 (5.5 Ohms)	1	REF
11	BW10329	10-24X2" SHCS (TORQUE 6.5 FT. LBS.)	8	REF
12	86728-006	ELBOW, MB-MJ90-4-6	2	EA
13	BW10181	DIRECTIONAL CARTRIDGE VALVE 3 POSIT	1	EA
13A	BW10181-SK	DIRECTIONAL CARTRIDGE VALVE SEAL KIT	1	EA

ACCUMULATOR



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10184	ACCUMULATOR, 2 LITERS	1	EA
2	BW10572	ACCUMULATOR MOUNTING BRACKET WELD T4	1	EA
3	73171	ACCUMULATOR BKT. W/HARDWARE	1	EA
4	801028	SUPPORT RING, ACCUMULATOR	1	EA
5	86728-019	MB-MJ-90-12-12, ELBOW	1	EA
6	85667-006	HOSE, 12G5K-12FJX-12FJX-23.00	1	EA



A40HP TIER 4 PARTS

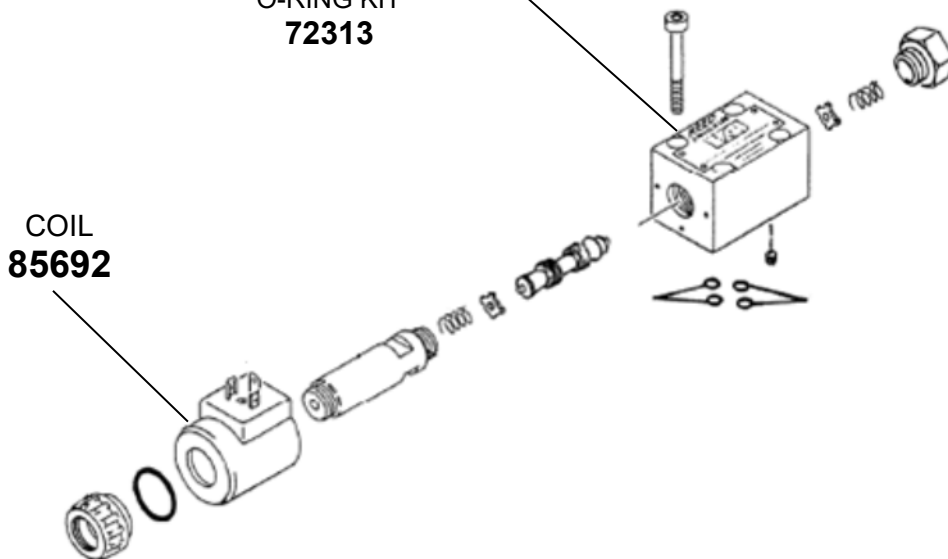
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SOLENIOD VALVE ASSEMBLIES

REVERSE CIRCUIT PILOT SOLENOID
VALVE ASSEMBLY

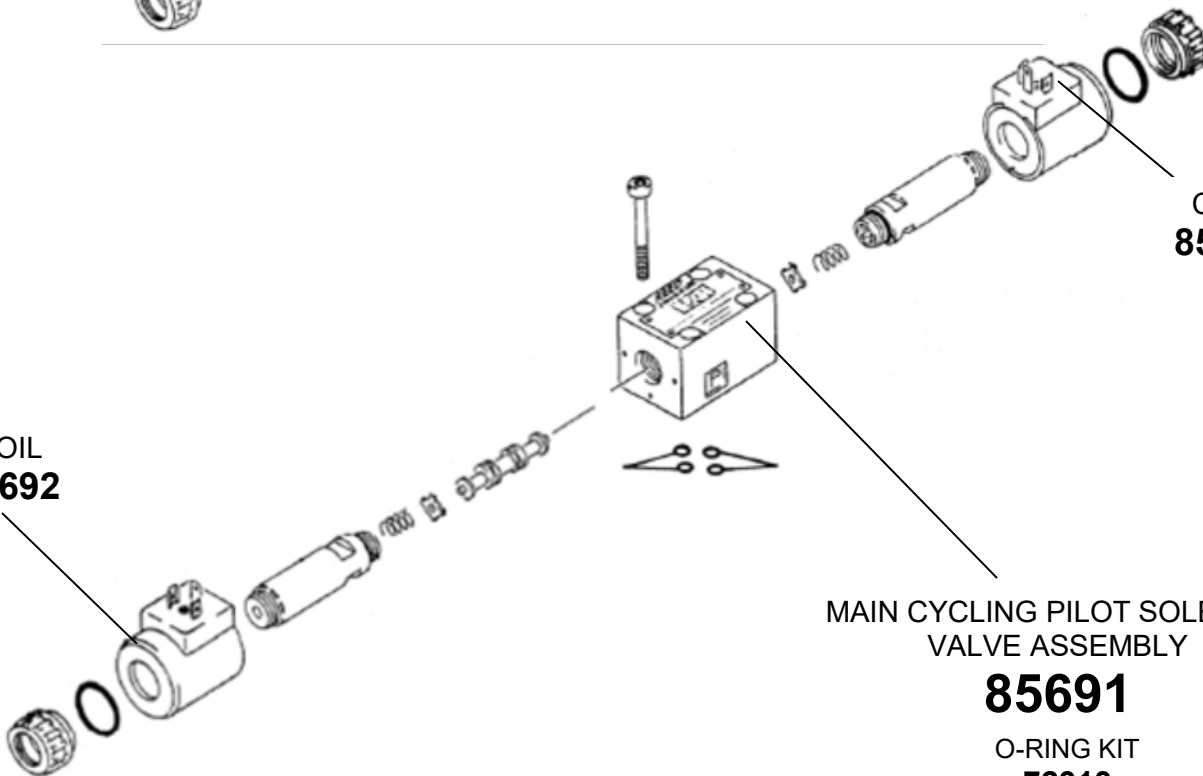
BW10183

O-RING KIT
72313



COIL
85692

COIL
85692



COIL
85692

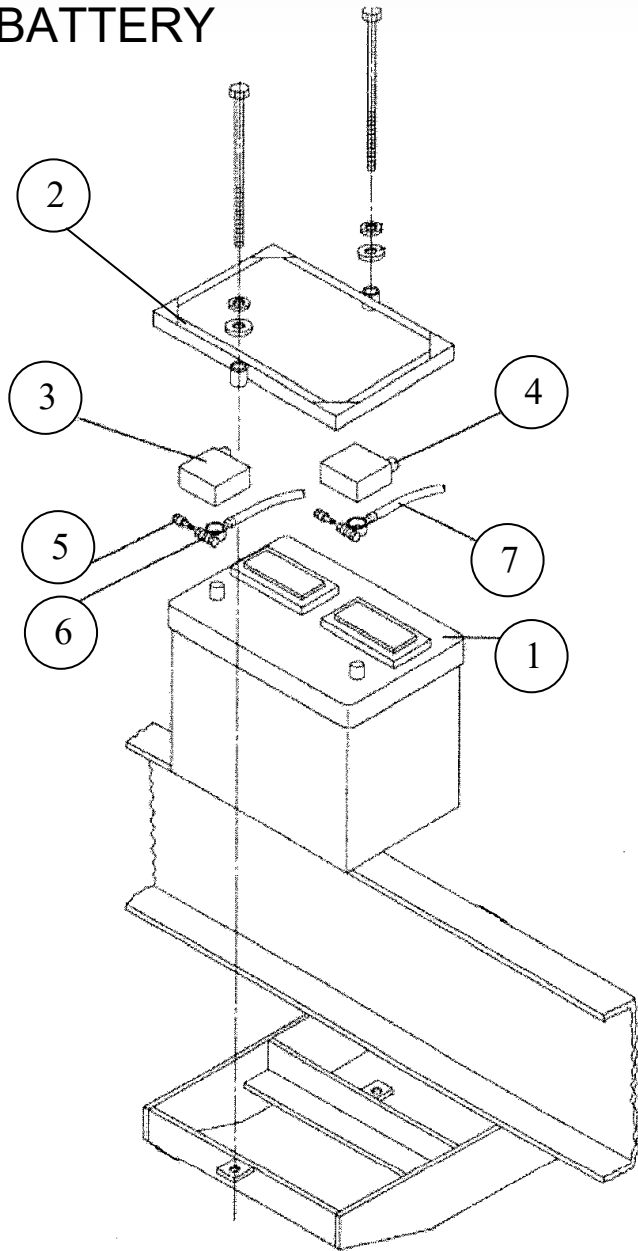
MAIN CYCLING PILOT SOLENOID
VALVE ASSEMBLY

85691

O-RING KIT
72313

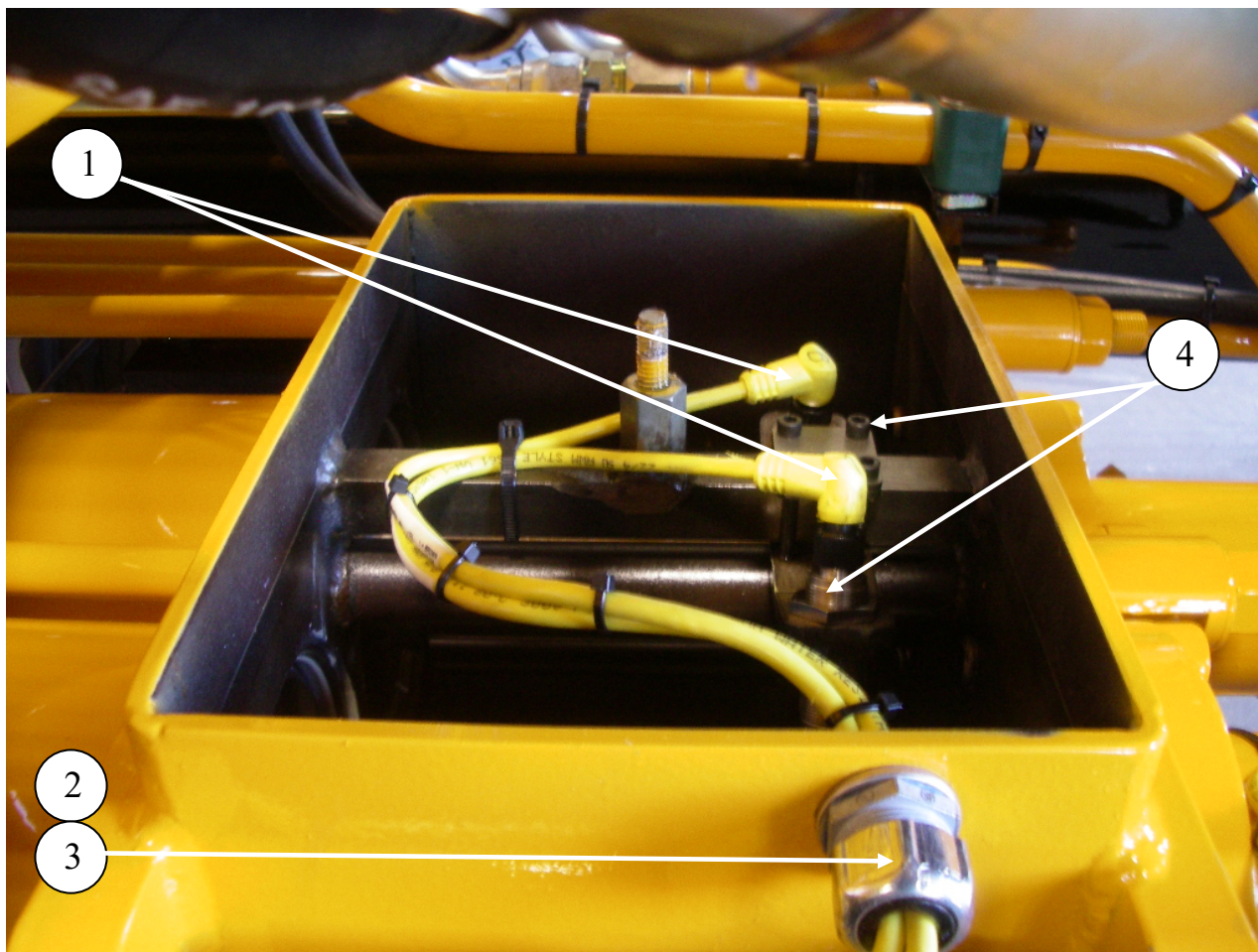
ELECTRICAL GROUP

BATTERY



ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW44020	ELECTRICAL GROUP A SER BW10039-2	1	EA
1	77075	BATTERY-12V 1000 CCA31	1	EA
2	72945	BATTERY HOLD DOWN	1	EA
3	77719	COVER, POSITIVE BATT-RED	1	EA
4	77720	COVER, NEGATIVE BATT-BLACK	1	EA
5	87223	EXTENDER, TOP TERMINAL BOLT	2	EA
6	72014	CABLE-38" BATTERY-RED	1	EA
7	75116	CABLE-26" BATTERY-BLACK	1	EA

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

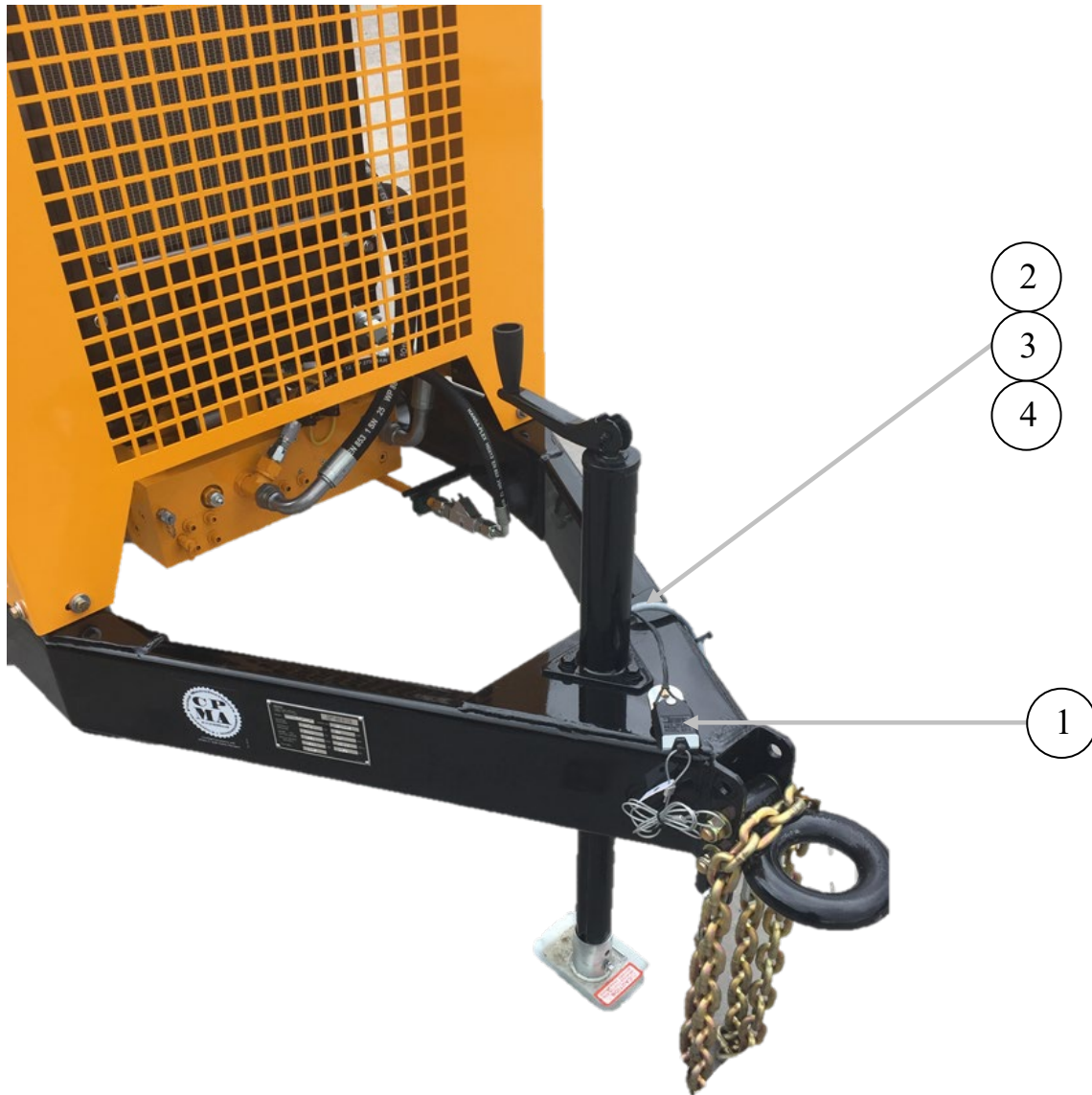


A40HP TIER 4

PARTS

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TRAILER HARNESS AND BREAKAWAY



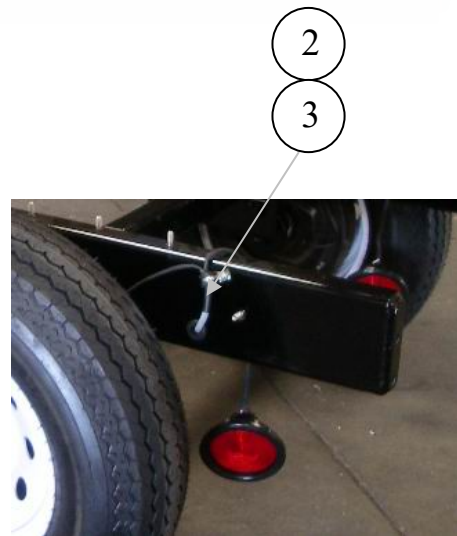
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	77705	BREAK-AWAY KIT 5000 SERIES	1	EA
2	86579	TRAILER PLUG 7C FLAT PI	1	EA
3	BW10139	WIRING HARNESS TRAILER A SERIES	1	EA
4	86759	GROMMET	1	EA



A40HP TIER 4 PARTS

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TAILLIGHTS



UNDERNEATH
FENDER

ID #	PART #	PART DESCRIPTION	QUANTITY	
1	72948	TAILLIGHT R3000 SERIES	2	EA
2	85981	LOOM CLAMP 5/8"	2	EA
3	86759	GROMMET	2	EA



A40HP TIER 4 PARTS

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WIRING HARNESS

ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW10534	WIRING HARNESS A SERIES, TIER 4 ASSY	1	EA
1	89651	PLUG, 48 SOCKET HARNESS SIDE	1	EA
2	89651-B	BOOT FOR 89651 PLUG	1	EA
3	89651-W	WEDGE FOR 89651 PLUG	24	EA
4	BW10147	CONTACT SOCKET SIZE-16,13 AMP	12	EA
5	88959	CONTACT SOCKET SIZ 20 7.5 AMP	24	EA
6	77990	CABLE, PROXIMITY SWITCH, 5M	3	EA
7	10528	NUT- 1/2" BONDING TYPE LOCK NUT	1	
8	30240	GASKET- LIQUID TITE- ELECT	1	EA
9	10522	STRAIN RELIEF	1	EA
10	87540	TURCK U7106-05 CABLES/CONNECTIVITY	6	EA
11	88935	3 WAY PLUG DT SER.	1	EA
12	88937	WEDGE LOCK, DT 3 PIN PLUG, BLUE	1	EA
13	88935-B	BOOT FOR 3 WAY DT SERIES PLUG	1	EA
14	89218	DEUSCH DT04 RECP, 12 PIN	1	EA
15	88958	CONTACT PIN SOLID SIZE 16	7	EA
16	89218-1	DEUTSCH WEDGE FOR 89218	1	EA
17	85617	CABLE, 14 AWG-4C, PVC-GRY	13	FT
18	89127	CABLE, BLUE HOSE, 20 AWG	13	FT
19	88678	CABLE SHIELD PROXIMITY SWITCH, 5M	1	EA
20	BW10254-125	1.25" DIA WIRING LOOM PLASTIC, SPLIT	3.5	FT
21	BW10254-062	.625" DIA WIRING LOOM PLASTIC, SPLIT	7	FT



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CONTROLS

A-SERIES TIER 4 CONTROL BOX PLC



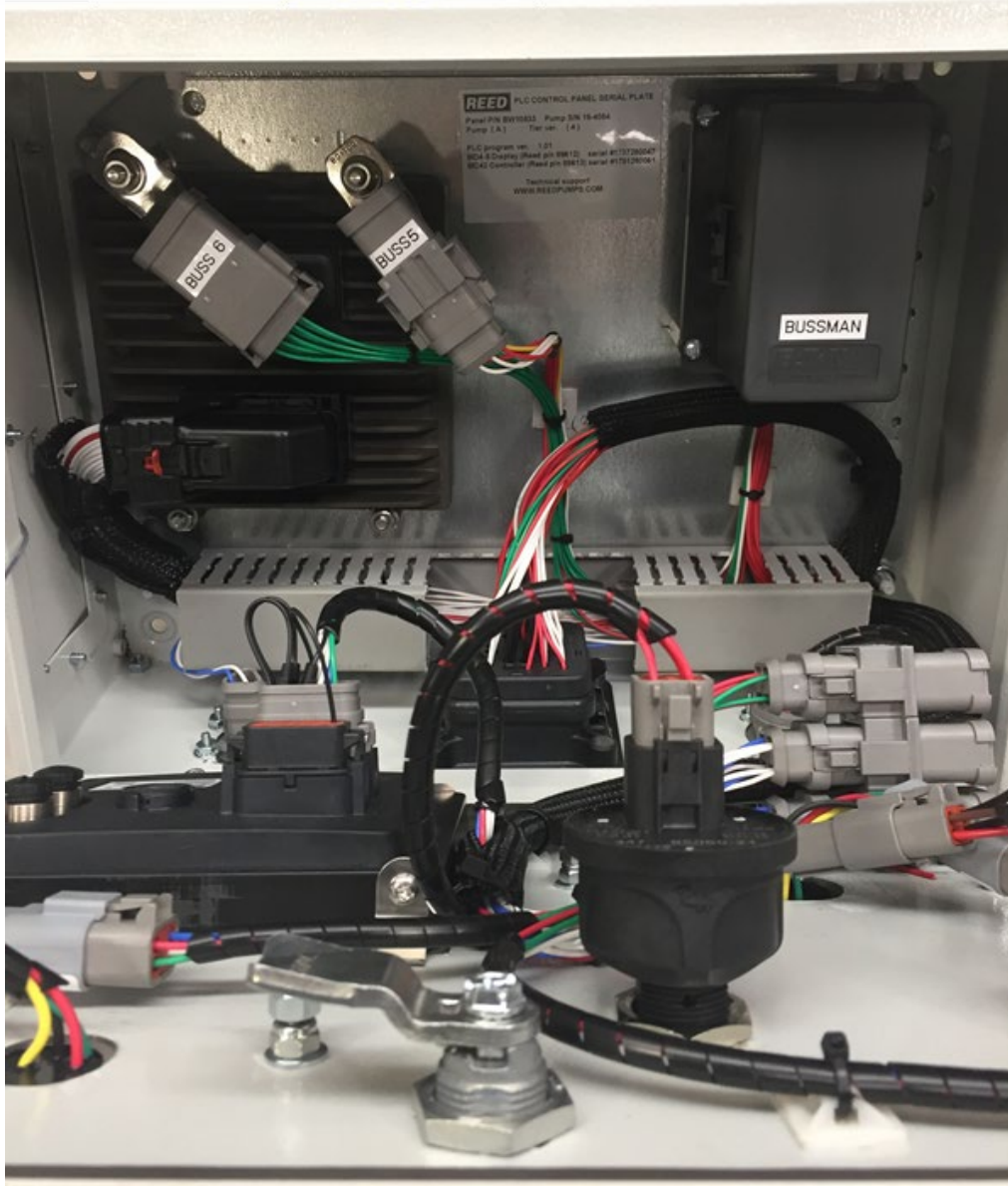
ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW10533	CONTROL BOX ASSY A SERIES TIER-4 PERKINS	ASSY	
1	89612	DISPLAY, 5", MD4-5	1	EA
2	89615	KEYPAD 2X4, PKU	1	EA
3	89615-B	BACKPLATE, 2X4	1	EA
4	89616-FG	FINGER GUARD, 2X4	4	EA
5	89616	KEYPAD 2X6, PKU	1	EA
6	89616-B	BACKPLATE, 2X6	1	EA
7	89616-FG	FINGER GUARD, 2X6	6	EA
8	89090	EMERGENCY STOP PUSH BUTTON HEAVY DUTY	1	EA
9	89090-L	ILLUMINATED E-STOP RING	1	EA
10	89359	JAM NUT, FOR 89090 EMERGENCY SWITCH	1	EA
11	BW10514	INSERT KIT FOR PLC SWITCH FUNCTIONES	1	EA
13	BW10535	ELDON MM ENCLOSURE 400X300X155 MM	REF	
14	BW10559	ENCLOSURE MACHINED TIER-4	1	EA
15	72862	GAUGE FOR PROX.SENSOR SETTING	1	EA
16	BW10555	DECAL CONTROL PANEL A SER PLC TIER-4	1	EA
17	89004	KEY SWITCH	1	EA



A40HP TIER 4 PARTS

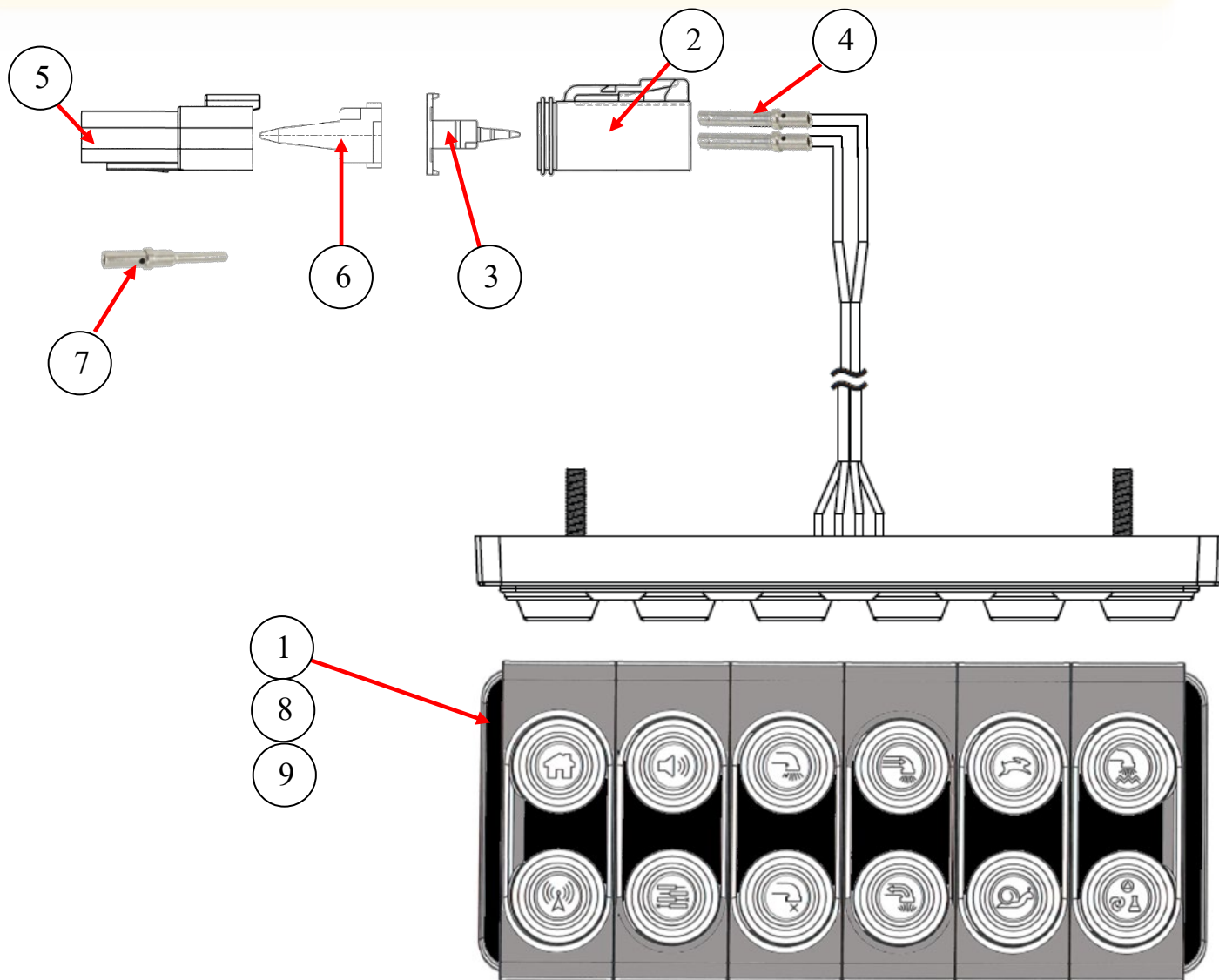
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A-SERIES TIER 4 CONTROL BOX PLC CONTINUE



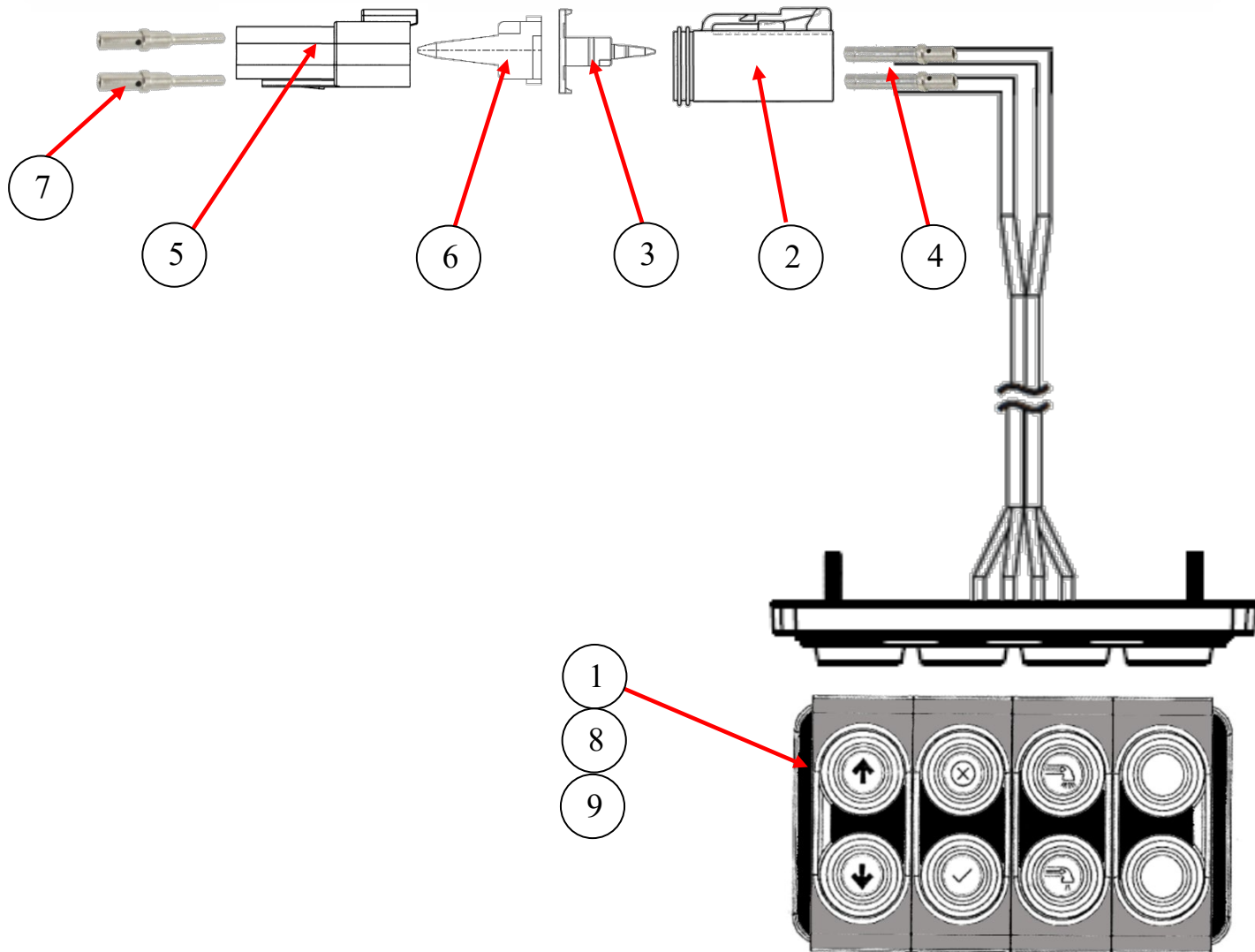
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89307	LANYARD, 18" – NYLON COATED	1	EA
2	89567	LOOM, BRAIDED, 1/2"		

KEYPAD 2X6



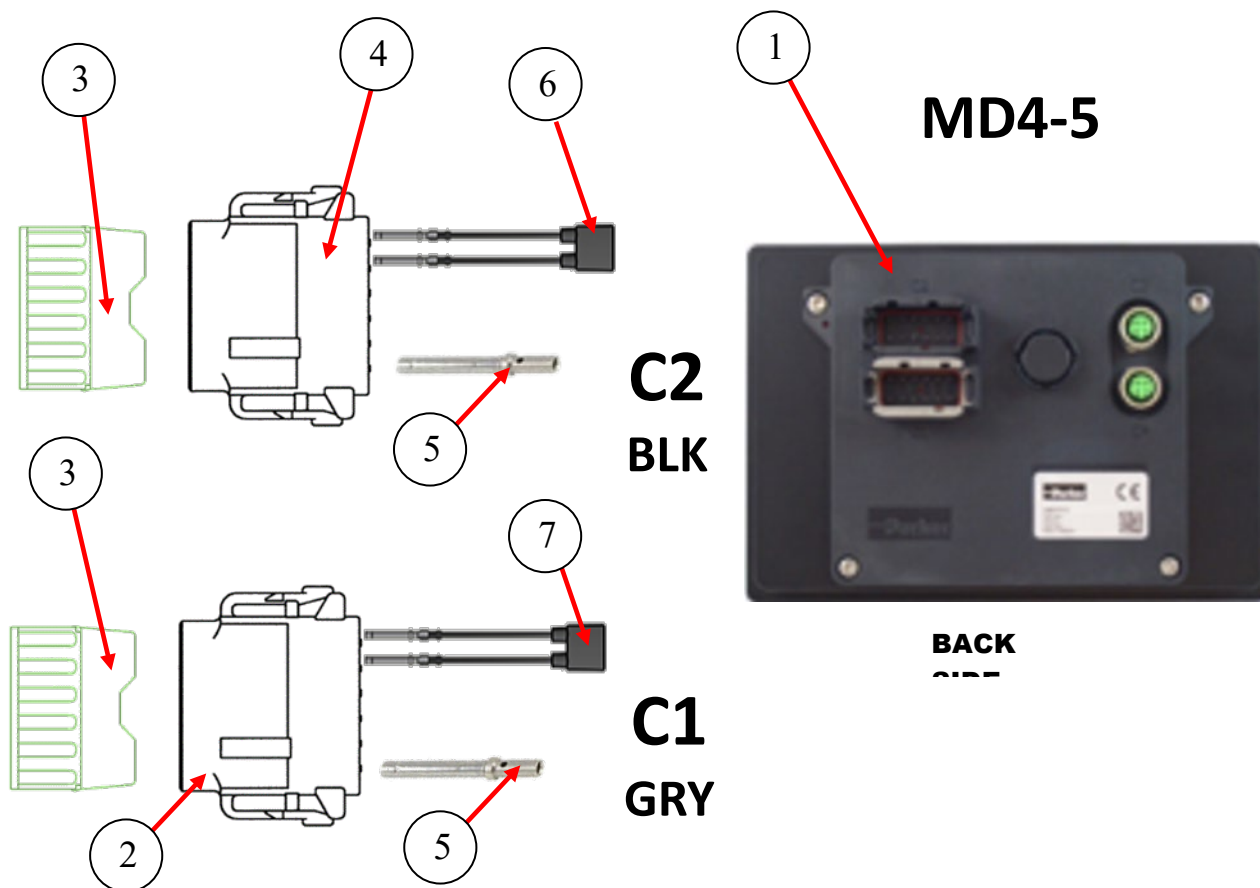
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89616	KEYPAD 2X6, PKU	ASSY	
2	89102	DEUTSCH DT04 PLUG, (FEMALE) 2X6	1	EA
3	89132	DEUTSCH WEDGE LOCK FOR 89102	1	EA
4	BW10147	CONTACT PIN 16 AWG (FEMALE)	4	EA
5	89146	DEUTSCH DT04 PLUG, (MALE) 2X6	1	EA
6	89209	DEUTSCH WEDGE LOCK FOR 89146	1	EA
7	88958	CONTACT PIN 16 AWG (MALE)	4	EA
8	89616-B	BACKPLATE, 2X6	1	EA
9	89616-FG	FINGER GUARD, 2X6	6	EA

KEYPAD 2X2



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89614	KEYPAD 2X2, PKU	ASSY	
2	89102	DEUTSCH DT04 PLUG, (FEMALE) 2X4	1	EA
3	89132	DEUTSCH WEDGE LOCK FOR 89102	1	EA
4	BW10147	CONTACT PIN 16 AWG (FEMALE)	4	EA
5	89146	DEUTSCH DT04 PLUG, (MALE) 2X4	1	EA
6	89209	DEUTSCH WEDGE LOCK FOR 89146	1	
7	88958	CONTACT PIN 16 AWG (MALE)	4	EA
8	89614-B	BACKPLATE, 2X2	1	EA
9	89616-FG	FINGERGUARD	4	EA

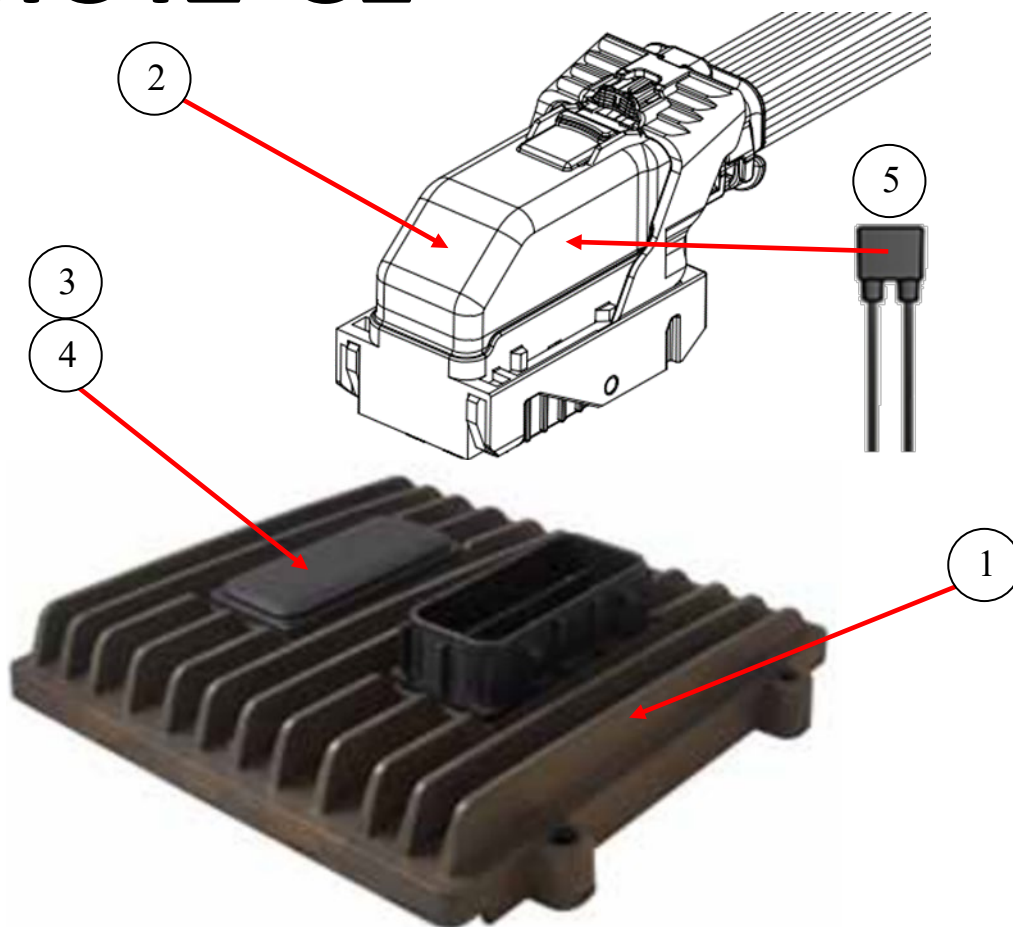
MD4-5 DISPLAY MODULE



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89612	DISPLAY, 5", MD4-5	ASSY	
2	88653	GREY PLUG C1 -GREY	1	EA
3	88653-2	WEDGE LOCK	2	EA
4	88652	BLACK PLUG C2 -BLK?	1	EA
5	88959	PIN, SOLID (FEMALE)	9	EA
6	89136	MOLDED 1.5K RESISTOR, TAG #3	1	EA
7	89136-0	MOLDED 294 RESISTORS, TAG #0	1	EA

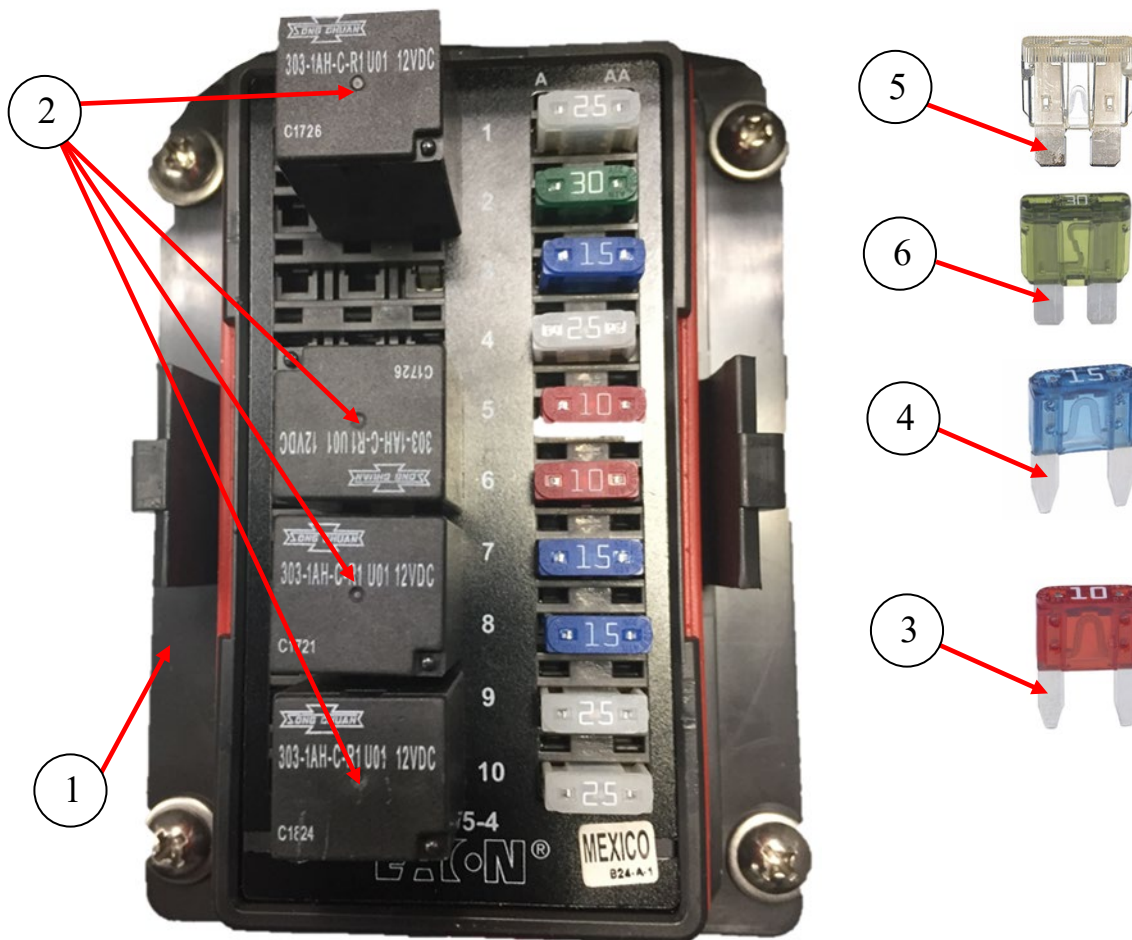
EXPANSION MODULE MC42

MC42-C1



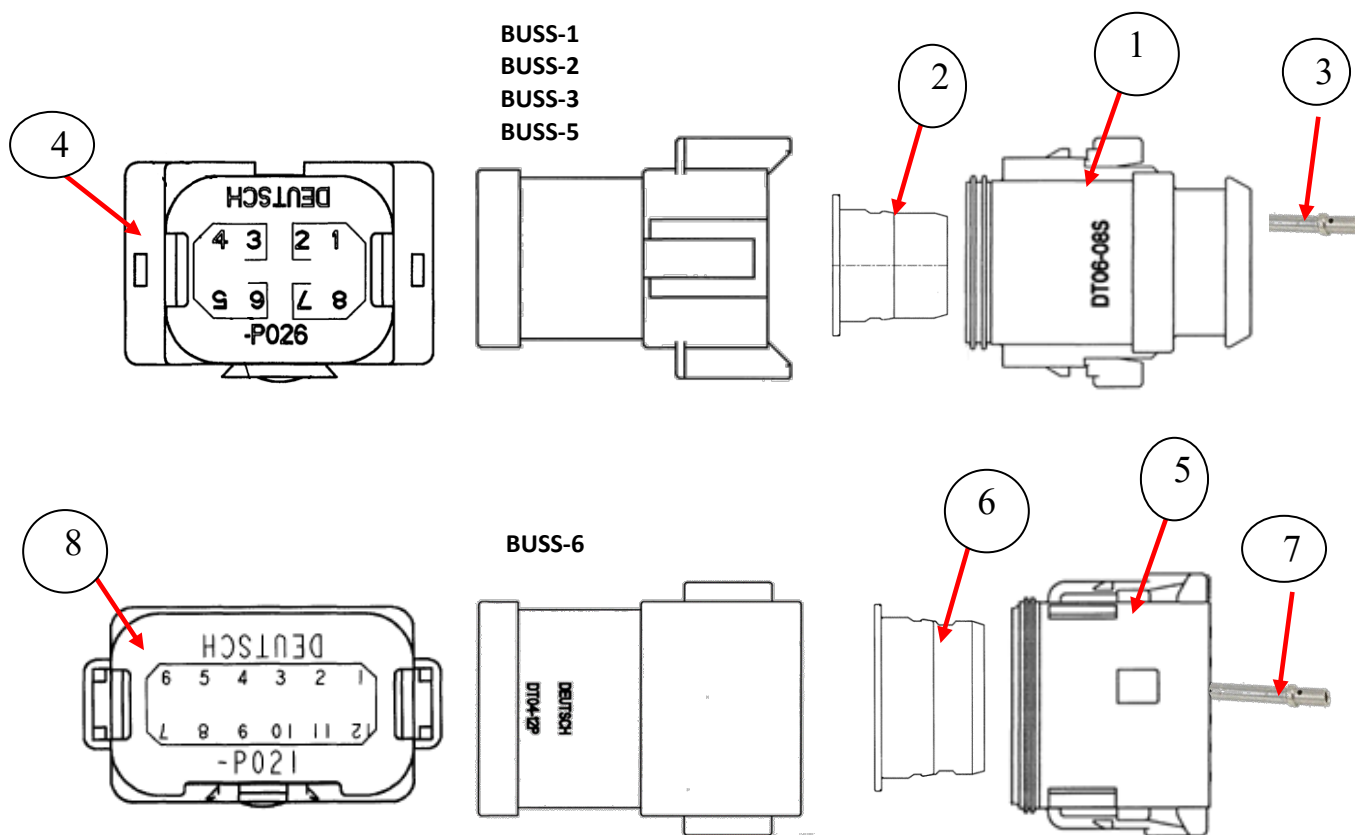
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89613	CONTROLLER, MC42	1	EA
2	BW10547	MC42 C1 CABLE HARNESS ASSY 2.5 M LONG	1	EA
3	89622	PLUG, FOR 89613 CONTROLLER	0	EA
4	89622-C	COVER, FOR 89622	0	EA
5	89136-1	MOLDED 590 RESISTORS, TAG #1	1	EA

FUSE/RELAY



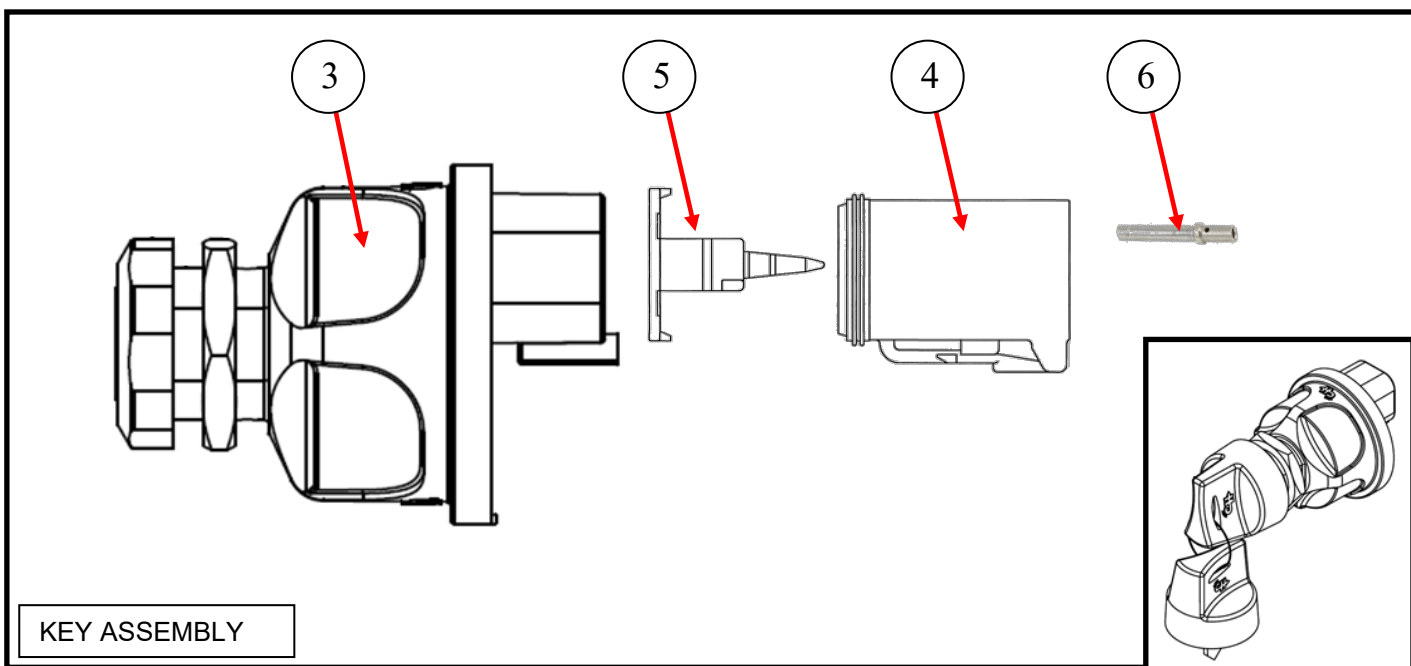
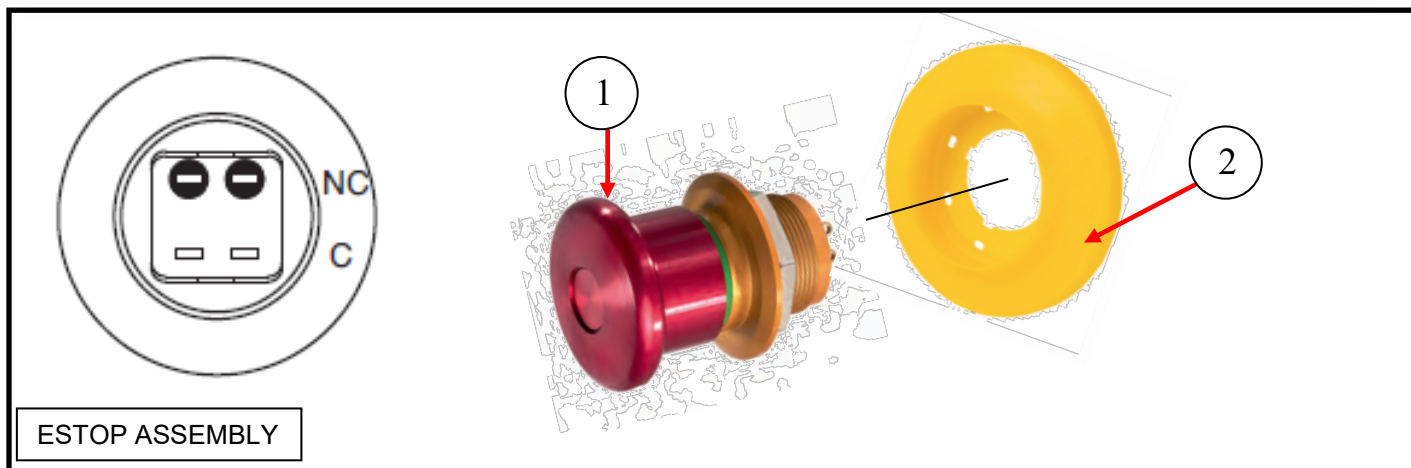
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89611	BOX, FUSE & RELAY	1	EA
2	89128	MICRO RELAY	4	EA
3	88953	FUSE 10AMP AUTOMOTIVE MINIATURE BLADE	2	EA
4	88954	FUSE 15AMP AUTOMOTIVE MINIATURE BLADE	3	EA
5	89697	FUSE 25AMP AUTOMOTIVE MINIATURE BLADE	4	EA
6	88956	FUSE 30AMP AUTOMOTIVE MINIATURE BLADE	1	EA
7	89686	TERMINAL FEMALE TANGLESS 22-22 GA.	20	EA
8	89687	TERMINAL FEMALE TANGLESS 14-16 GA.	16	EA
9	89624-1	WIRE SEAL, FOR 89624	36	EA

BUSSES, CONNECTORS, PINS



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89179	DEUTSCH DT06 PLUG, 2X4	4	EA
2	88542-1	WEDGE LOCK FOR 89179	4	EA
3	BW10147	CONTACT SOCKET PIN, SIZE16, 13 AMP	32	EA
4	89181	DEUTSCH DT04 BUS, 2X4	4	EA
5	89104	DEUTSCH DT06 PLUG, 2X6	1	EA
6	89105	DEUTSCH WEDGE FOR 89104	1	EA
7	BW10147	CONTACT SOCKET PIN, SIZE16, 13 AMP	9	EA
8	89106	DEUTSCH DT04 BUS, 1X12	1	EA
9	89165	BRACKET	3	EA

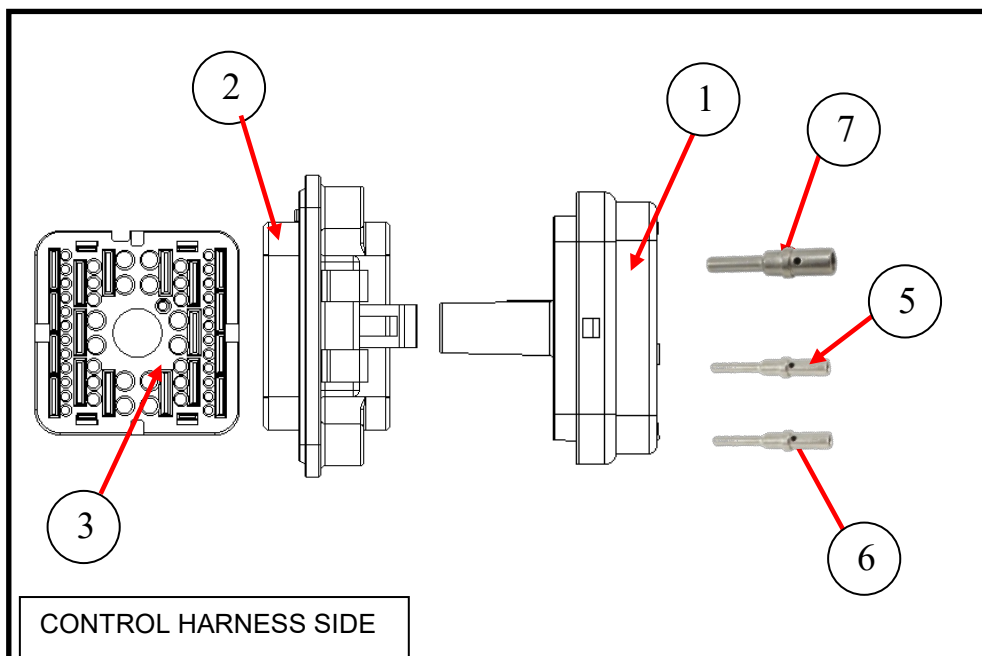
ESTOP, KEY ASSEMBLY, PLUGS



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89090	EMERGENCY STOP BUTTON HEAVY DUTY	1	ASSY
2	89090-L	ILLUMINATED E-STOP RING	1	ASSY
3	89004	KEY SWITCH SEALED	1	ASSY
4	89107	DEUSCH DT06, 1X6	1	QTY
5	89108	DEUTSCH WEDGE LOCK FOR 89107	1	QTY
6	BW10147	DEUTSCH CONTACT SOCKET, 16AWG	5	QTY

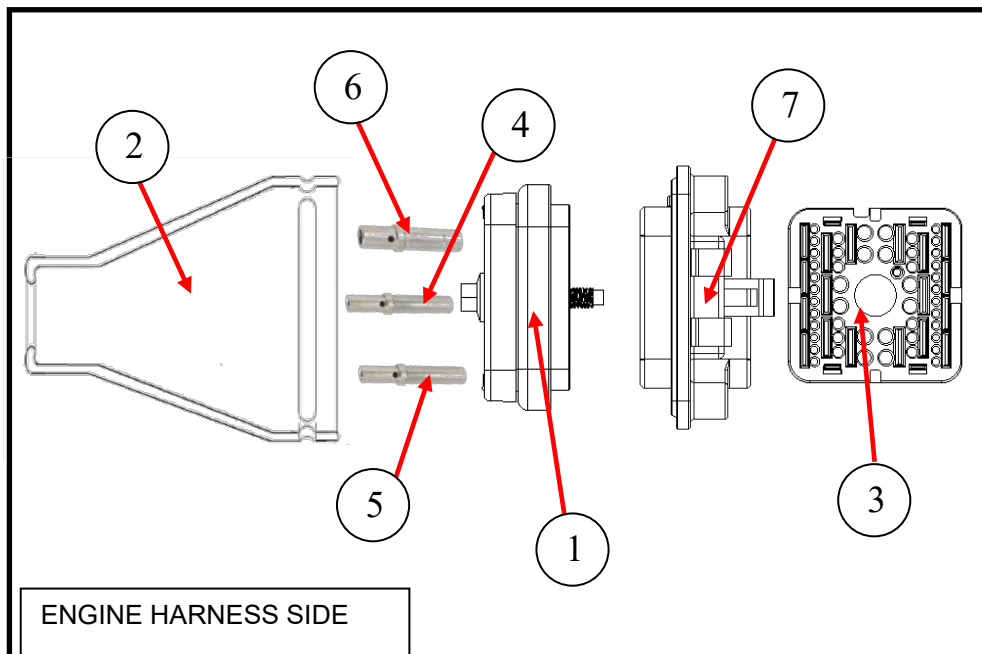
CONNECTORS

DUETSCH 48 MAIN PLUG PANEL SIDE



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89652	PLUG 48 PIN	1	EA
2	89652-F	FLANGE FOR 89651 PLUG	1	EA
3	89652-W	WEDGE FOR 89652 PLUG	1	EA
5	88958	CONTACT PIN SOLID SIZE 16	12	EA
6	88957	CONTACT PIN SOLID SIZE 20	24	EA
7	87807	CONTACT PIN SOLID SIZE 12	14	EA

DUETSCH 48 MAIN PLUG HARNESS SIDE



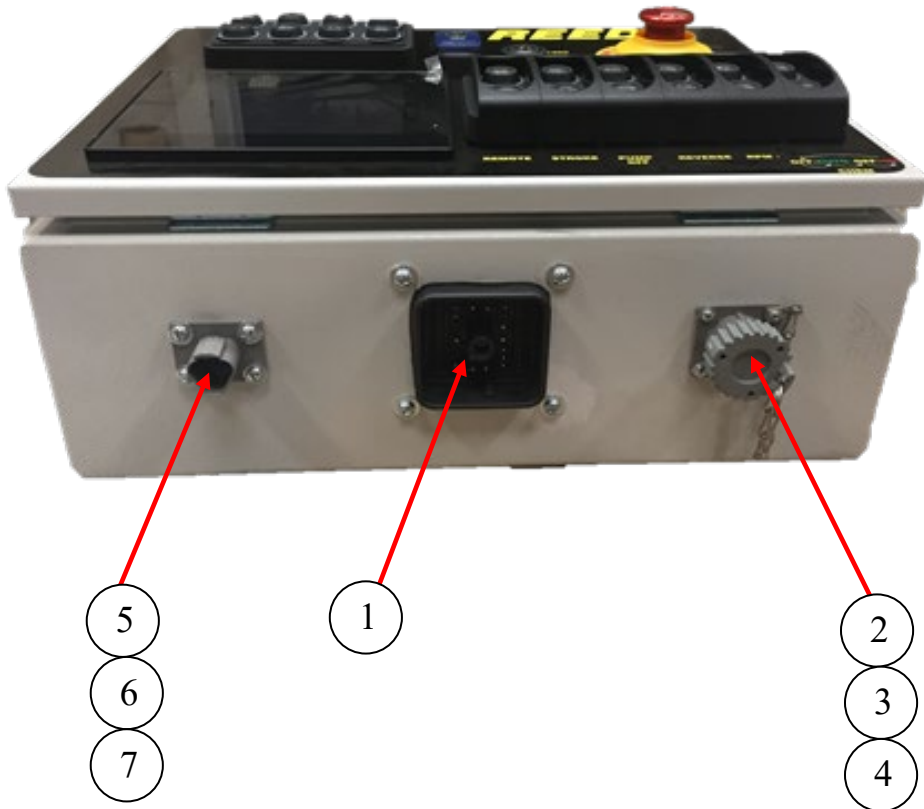
ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89651	PLUG, 48 SOCKET HARNESS SIDE	1	EA
2	89651-B	BOOT FOR 89651 PLUG	1	EA
3	89651-W	WEDGE FOR 89651 PLUG	24	EA
4	BW10147	CONTACT SOCKET SIZE-16,13 AMP	12	EA
5	88959	CONTACT SOCKET SIZ 20 7.5 AMP	24	EA
6	87457	CONTACT SOCKET SIZ 12	?	EA
7	89652-F	CONNECTOR FOR 48 PIN PLUG	1	EA



A40HP TIER 4 PARTS

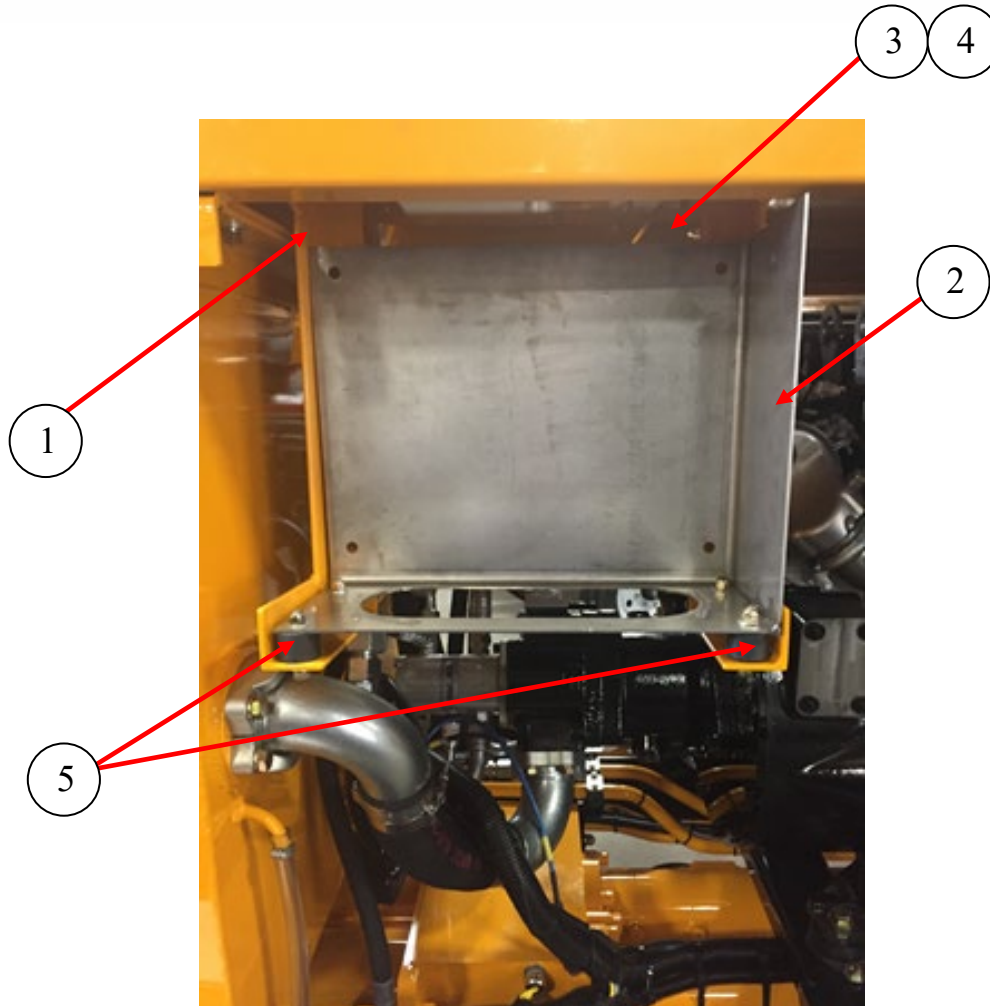
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CONNECTORS



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	89652	PLUG 48 PIN	REF	
2	89223	DEUTSCH HD10 PLUG, FLANGED 6 PIN	1	EA
3	89402	CHAIN SASH LANYARD	1	EA
4	89223-C	CAP FOR 89223	1	EA
5	88932	3 WAY RECEPTACLE FLANGE MOUNT DT SER.	1	EA
6	88938	KEYED WEDGE LOCK FOR 3 WAY RECEPTACLE	1	EA
7	88958	CONTACT PIN SOLID SIZE 16	3	EA

PANEL MOUNT, BRACKET



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10548	CONTROL BOX ASSY SUPPORT BRACKET	1	EA
2	BW10549	CONTROL BOX COVER A SER TIER-4	1	EA
3	BW10560	POLYETHYLEN BAR 2X2"	0.33	EA
4	80347	HORN, 12 V	1	EA
5	73748	BUMPER, MOUNT	4	EA



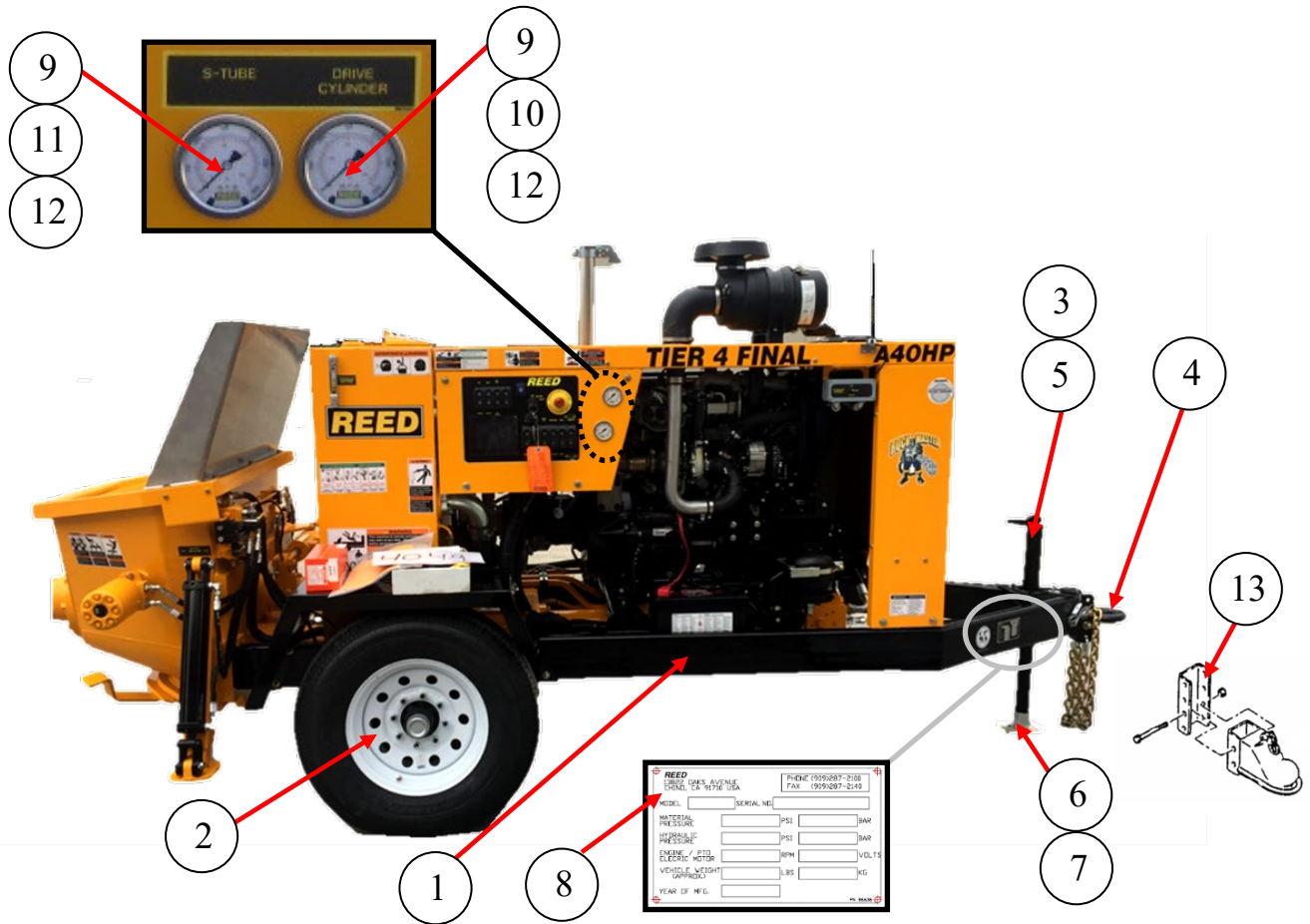
A40HP TIER 4

PARTS

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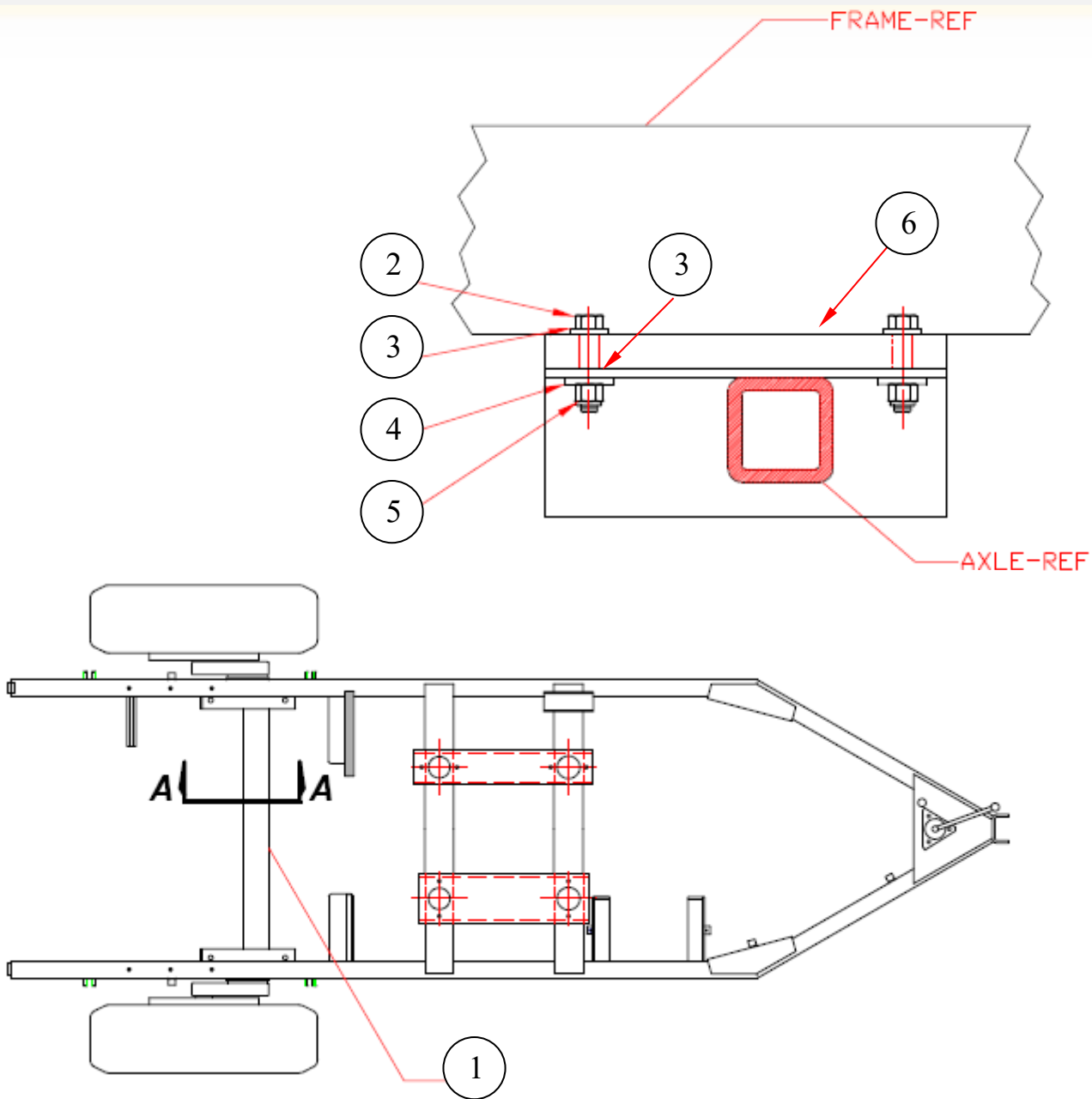
FRAME INSTALLATION

FRAME, GAUGES, TIRES, JACK, AND TOW EYE



ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW10516	FRAME ASSY A-SERIES TIER-4 PERKINS	1	EA
1	BW10513	FRAME WELDMENT A SER TIER-4 PERKINS	1	EA
2	BW10096	TIRE & WHEEL ASSY	2	EA
3	BW10098	JACK FRAME	1	EA
4	71051	EYE-LUNETTE 3"	1	EA
5	BW10169	JACK, FOOT	1	EA
6	86242	CHAIN-3/8 PROOF COIL GR 30 ZINC	6	FT
7	86243	CONNECTOR - 3/8 CHAIN TREADED	2	EA
8	86636	SERIAL NUMBER PLATE (BLANK)	1	EA
9	78594	MINICHECK GAUGE ADAPTER, 1/4" NPT	2	EA
10	74562	PRESSURE GAUGE, 6000 PSI/BAR	1	EA
11	70366	PRESSURE GAUGE, 3000 PSI/BAR	1	EA
12	BW10318-1	MINICHECK HOSE, 90° 120"	2	EA
13	71099	ASSEMBLY, ADJUSTABLE BALL COUPLER 2-5/16"	1	EA

5200LB AXLE MOUNTING ASSEMBLY



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10095	AXLE, TORSTION, 5200 LB, 6 ON 5.5 BC (BRAKE 71056)	1	EA
2		BOLT, 1/2"-20X3", GRADE 8	4	EA
3	80054	WASHER -SAE 1/2"	8	EA
4	80044	WASHER, 1/2" USS HARDENED EXTRA THICK	4	EA
5	80075	NUT NYLOCK 1/2"-13 COARSE	4	EA
6	BW10450	FLAT AXLE MOUNT SPACER	2	EA

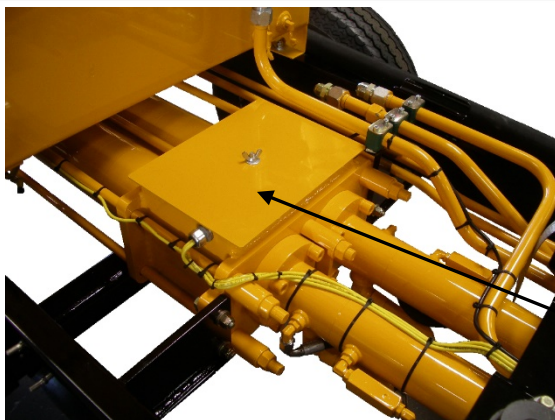
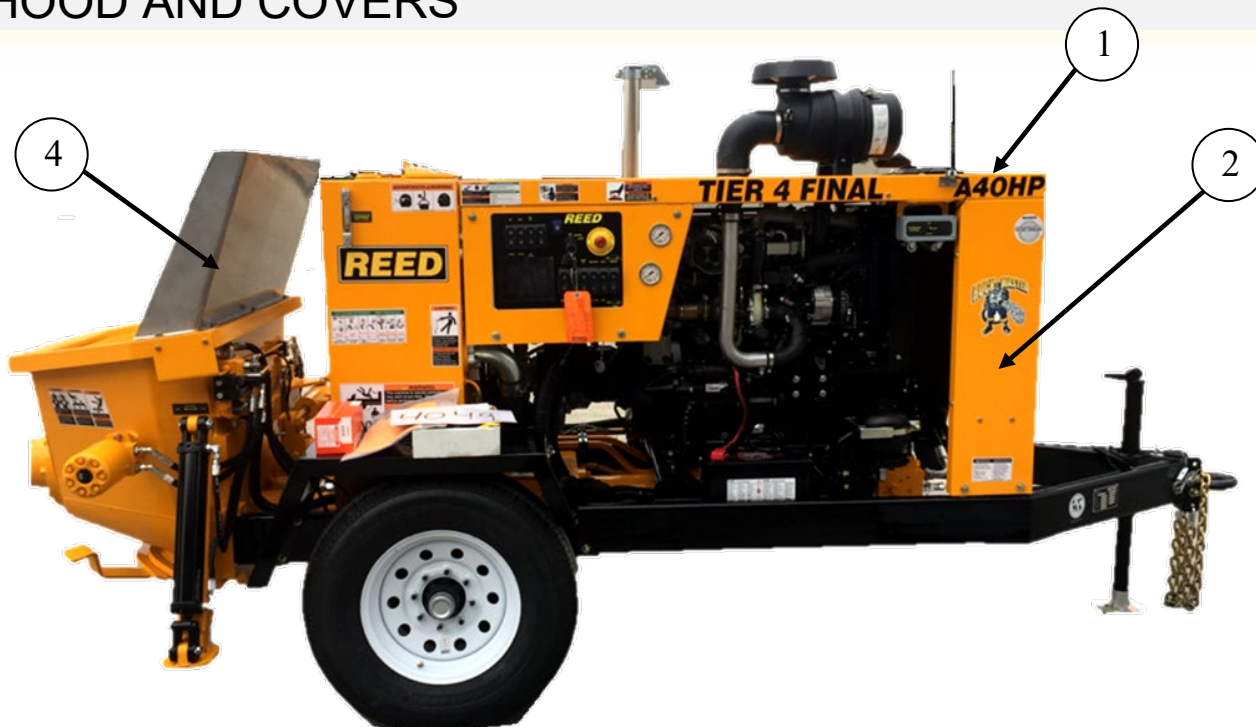


A40HP TIER 4

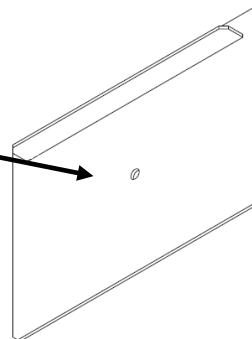
PARTS

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HOOD AND COVERS



3



**FLUSH
BOX**

ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10557	COVER TOP, A SERIES, T4F, PAINTED	1	EA
2	BW10556	COVER FRONT WELD, A SERIES, T4F, PAINTED	1	EA
3	BW10387	COVER, FLUSHBOX, A40 SER.	1	EA
4	85714-1	SPLASH GUARD, WITH HOPPER SAFETY	1	EA

FENDERS AND OUTRIGGERS



ID #	PART #	PART DESCRIPTION	QUANTITY	
1	BW10350	FENDER, LH, A SERIES PAINTED	1	EA
2	BW10349	FENDER, RH, A SERIES PAINTED	1	EA
3	BW10110	OUTRIGGER INNER LEG-PAINTED	2	EA
4	BW10114	OUTER TUBE, OUTRIGGER-PAINTED	2	EA
5	85595	PIN, Q/R, 5/8 DIA X 3 1/2 L	2	EA
6	800418	LANYARD, Q/R PIN	2	EA
7	BW10267	3/4 ID FENDER WASHER	4	EA
	BW10348	MANUAL OUTRIGGER (OPTION)		



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AVAILABLE OPTIONS

OUTRIGGER GROUP
HYD OUTRIGGER
OUTRIGGER/AGITATOR
ELECTRIC OUTRIGGER



AGITATOR GROUP
STD/PADDLE
OPTION/PADDLE
HYD/AGITATOR/SINGLE
HYD/AGITATOR/TRIPLE



RADIO REMOTE



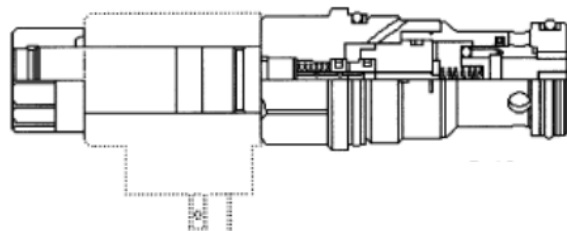
AARCOMM 2-WAY
RADIO W/STROKE
COUNTER AND
VOLUME INDICATOR
(IF EQUIPPED)

50' CABLE REMOTE,
100' CABLE REMOTE
AVAILABLE



ELECTRIC VOLUME CONTROL

RADIO CONTROL OF
VOLUME
(IF EQUIPPED)



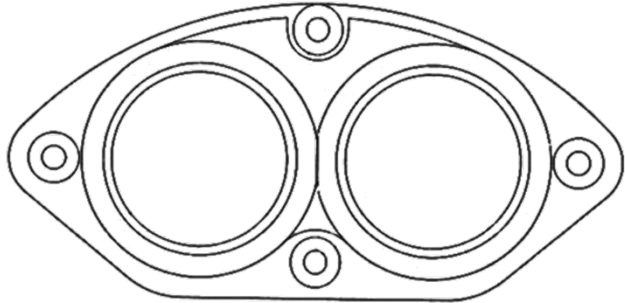


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AVAILABLE OPTIONS

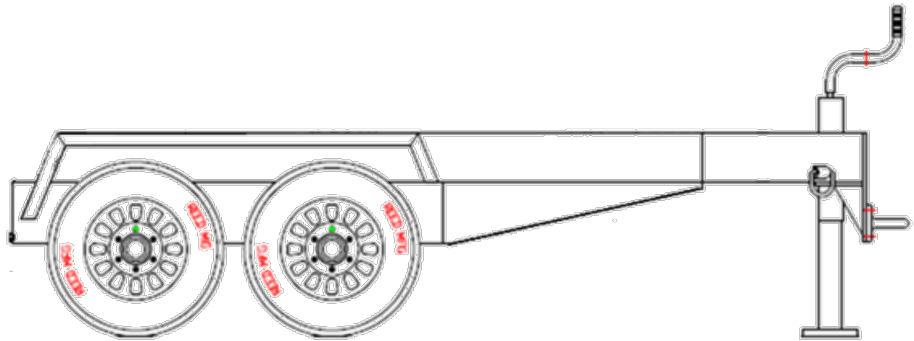
CARBIDE WEAR PARTS
WEAR RING/CARBIDE
WEAR PLATE/CARBIDE



VIBRATOR KIT
OL



DUAL AXLE

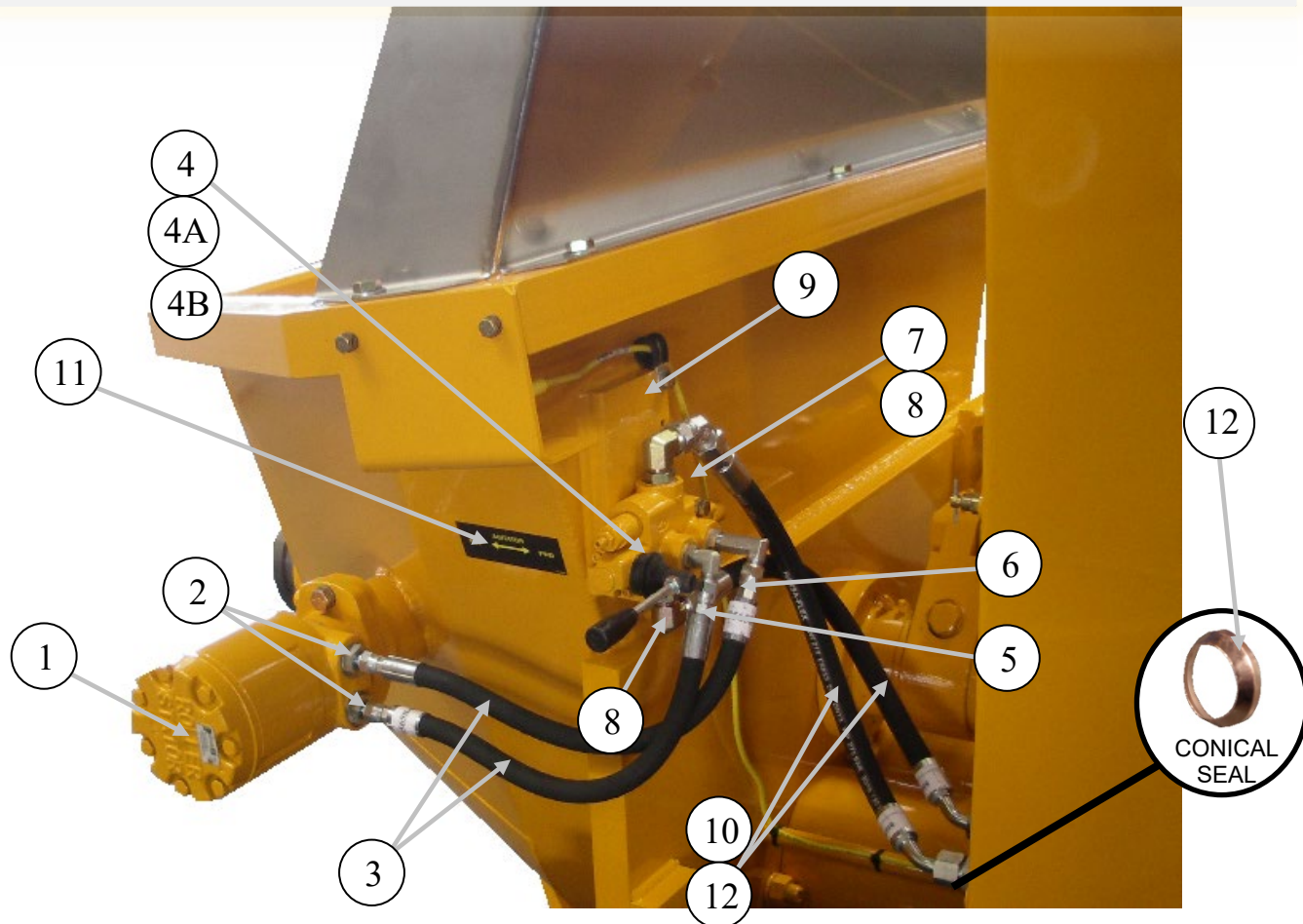


AUTO LUBE
STEEL TUBING 12 PORT
PLASTIC TUBING 12 PORT

MANUAL LUBE BLOCK



AGITATOR GROUP



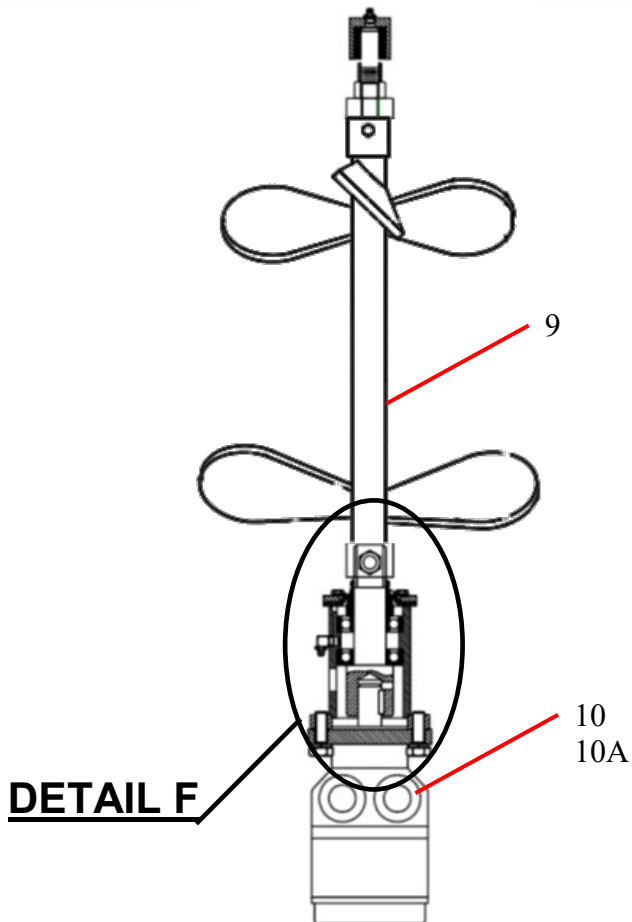
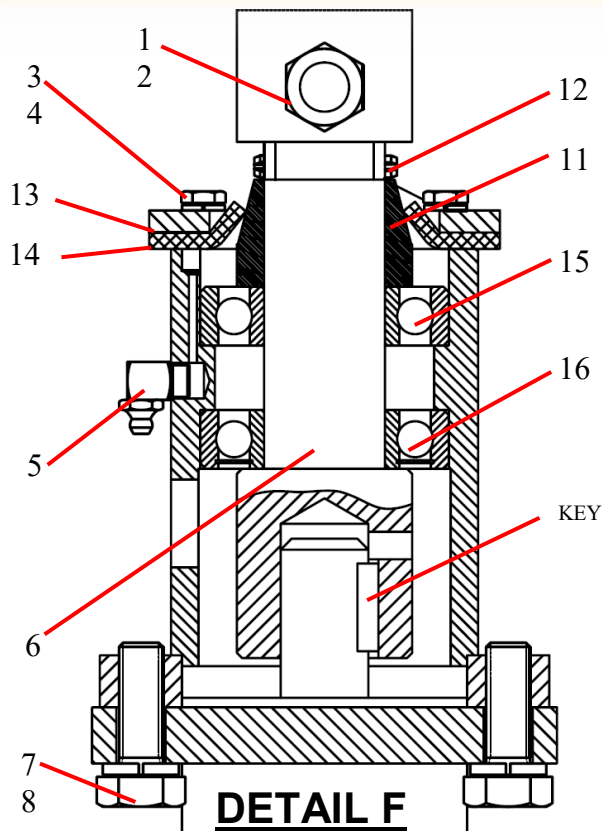
ID #	PART #	PART DESCRIPTION	QUANTITY	
	BW10396-2	AGITATOR ASSEMBLY, A40 (PARKER)		EA
1	89455	HYD MOTOR, 48 CID, 1" SHAFT-PAINTED	1	EA
2	81002	FITTING-MB-MJ-8-10	2	EA
3	85658-002	HOSE, 6M2T-6FJX-6FJX-17.00	2	EA
4	74584	VALVE 1 SPOOL, MANUAL PAINTED	1	EA
4A	89494	VALVE 1 SPOOL, MANUAL W/RELIEF (OPTION)	1	EA
4B	87154	VALVE, 2P-2W, NO, 12V,DIN (ELECTRIC OPTION)	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, 3/4" 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	85657-001	HOSE, 8M2T-10FJX-10FJX90S-26.00	2	EA
14	BW10407	TUBE HYD. AGITATOR PRESSURE (UNDER TANK)	1	EA



A40HP TIER 4 PARTS

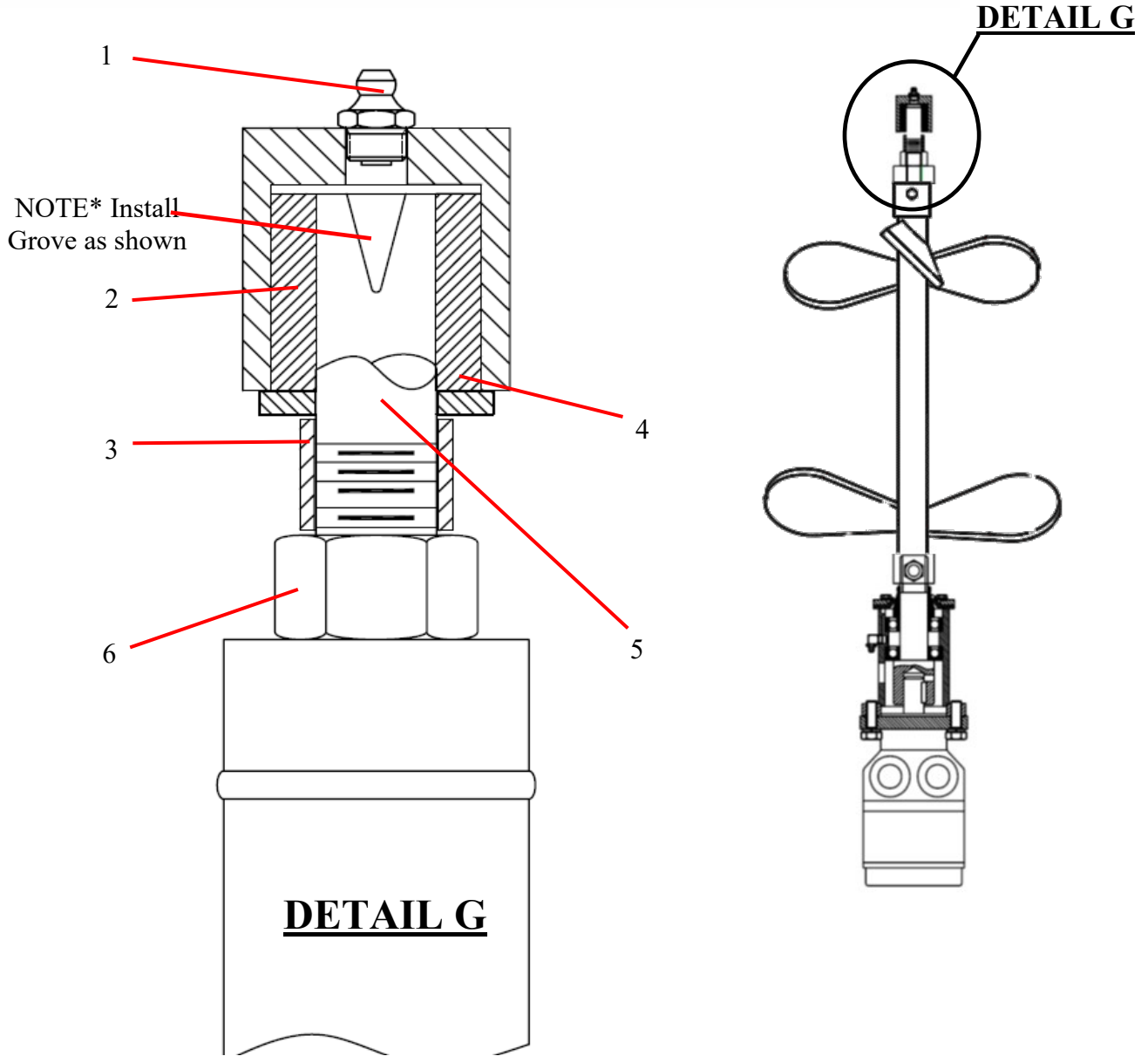
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HYDRAULIC AGITATOR ASSEMBLY



ID#	PART #	PART DESCRIPTION	QUANTITY	
1		HHCS, 1/2" -13X2 1/4" GR 8	1	EA
2	80075	LOCK NUT, 1/2" -13	1	EA
3		1/4"-28X3/4"	6	EA
4		LOCK WASHER, 1/4"	6	EA
5		GREASE FITTING, 1/8" NPT 90°	1	EA
6	85923	SHAFT, AGITATOR	1	EA
7		HHCS, 1/2" -20X1 1/2" GR 8	2	EA
8		LOCK WASHER, 1/2"	2	EA
9	87356	AGITATOR, PADDLE-A40-B20-M30	1	EA
10	89455	HYD MOTOR, 48 CID, 1" SHAFT	1	EA
10A	89455SK	SEAL KIT	1	EA
11	85976	WEAR RING, AGITATOR	1	EA
12	86758	SPRING PIN, 1/4" DIA X 1 3/4"	1	EA
13	70211	FLANGE SEAL SW	1	EA
14	70212	SEAL REMIXER	1	EA
15	85978	BEARING, BALL, PLAIN	1	EA
16	85979	BEARING, BALL 1 SEAL	1	EA

HYDRAULIC AGITATOR ASSEMBLY



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, 3/4" SAE	1	EA
5	70214	IDLER SHAFT, AGITATOR	1	EA
6	80030	HEX NUT-M20X2.5 PLATED	1	EA

LINE PUMP

SAFETY MANUAL 7

VERSION 7.0.1

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



AMERICAN CONCRETE PUMPING ASSOCIATION
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WWW.CONCRETPUMPERS.COM

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 LINE PUMPS 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, 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 coworkers 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**. The ACPA now has an Operator Training Program. Additional information and materials are available through the American Concrete Pumping Association, including, specifically, an Operator Certification Program. Make the commitment to be professional - get your certification!

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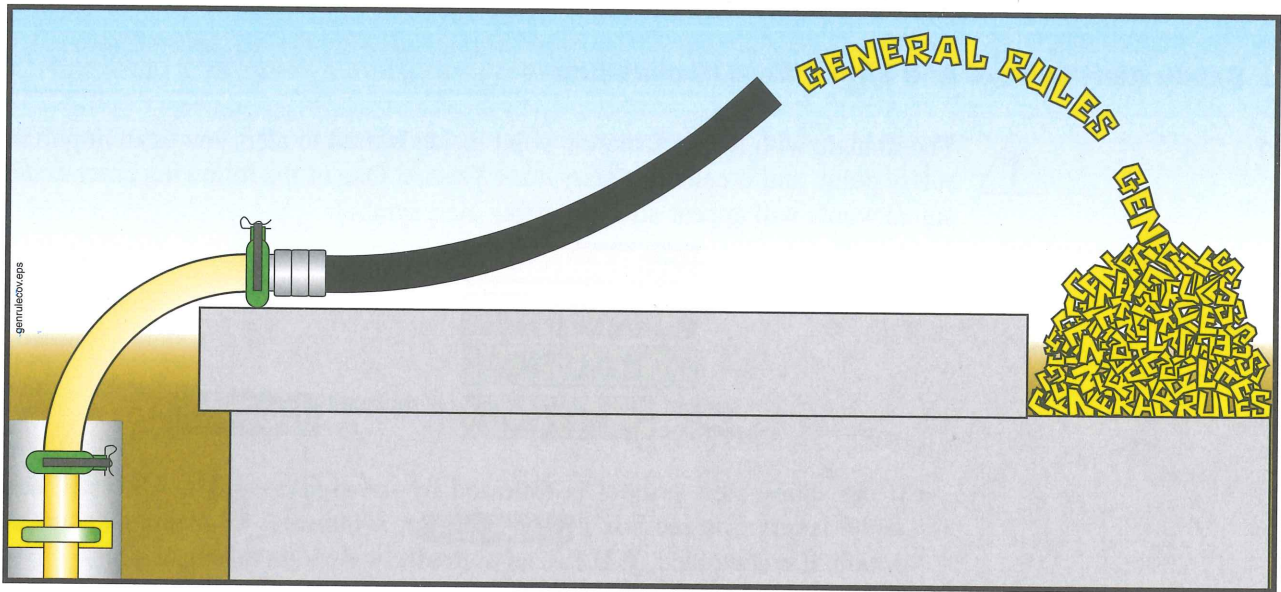
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I. Before You Leave The Yard

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:

or - without
the symbol:

is replaced
by:

- If the safety alert symbol is followed by the signal word **DANGER** with white letters in a red box (), 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 (), 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 (), 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** (), means the point addresses a hazard which, if not avoided, **COULD** cause **damage to equipment or property**.
- The signal word **NOTICE** (), now replaces the signal word caution (without the safety alert symbol), above.

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.

2.2

Dress in appropriate apparel and Personal Protective Equipment (P.P.E. or just PPE.) See Figure1. You should always wear these items when pumping concrete:

- hard hat;
- safety glasses or goggles (plus a full face shield, when shotcreting);
- snug-fitting clothes;
- gloves;
- steel-toed shoes;

In addition, you should wear:

- hearing protection if you stand near the pump or any other source of noise;

- breathing mask whenever there is cement dust in the air;
- rubber gloves during cleanout or if you'll be touching wet concrete;
- rubber boots anytime you have to stand in concrete;
- full face-shield when shotcreting, or any time material is rebounding.

* Full face shield should be used in addition to safety glasses when shotcreting, or any time material is rebounding.

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

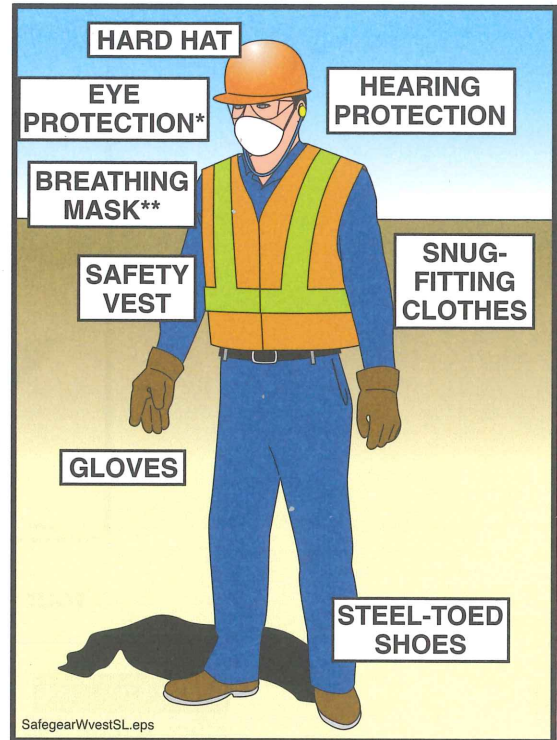


Figure 1
Personal Protective Equipment (PPE)

2.3

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

2.4

⚠ 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).

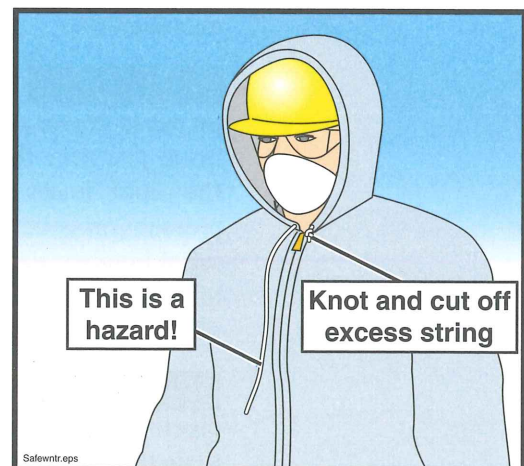


Figure 2
No strings attached

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

2.6 **⚠ 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 prescription medications or over the counter drugs, many of which have specific warnings about operating machinery after taking the medication (Figure 3).

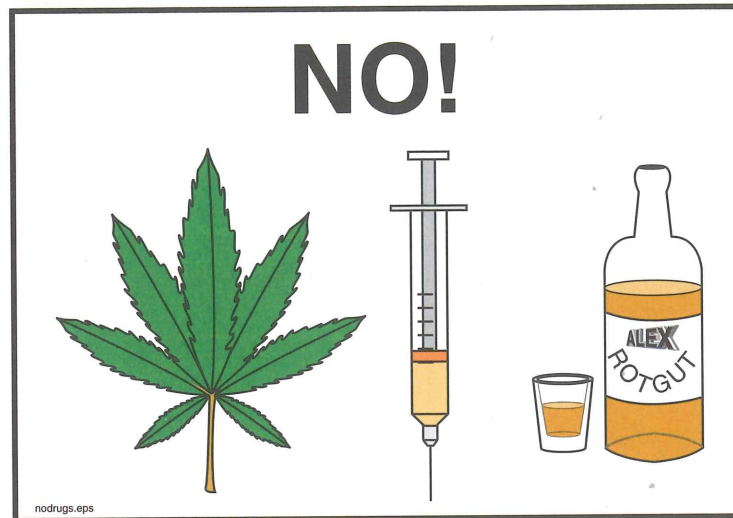


Figure 3
Your coworkers depend upon you for their safety

2.7 **⚠ WARNING** Don't bring your personal problems to work with you. In an office setting this may be annoying to coworkers, 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 hose or pipe that is dented or worn out. **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 47 in the Appendix section of this *Safety Manual*.

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

- A blowout 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, unless another method of controlling the outlet is used. There are two types of catchers (see paragraph 5.24 on page 13).
- 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 blowout 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** you have the right part (Figure 4).

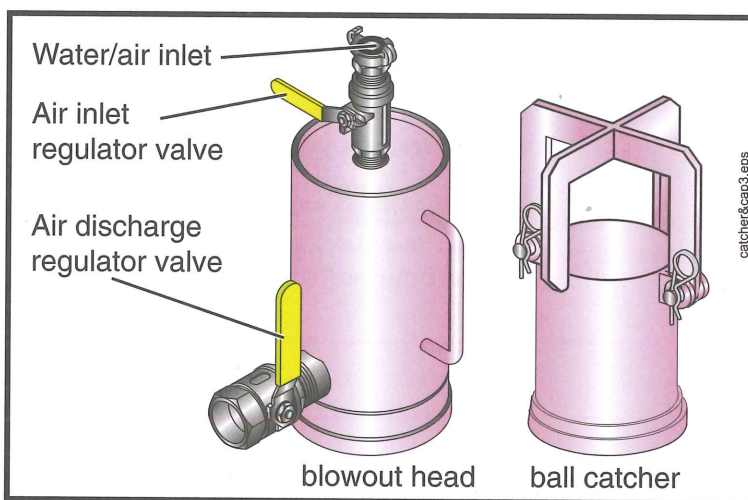


Figure 4
Compressed air accessories

- 3.4 **⚠ WARNING** Be sure that the unit is equipped with all the pipes, clamps, gaskets and hoses, blowout 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 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, 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.

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- 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).

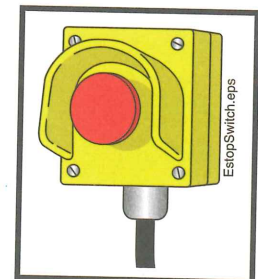


Figure 5
The 3-point Rule

- 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** If applicable, 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.
- 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 coworkers depend on you to know the machine.
- 3.21 **⚠ WARNING** Be certain that all loose items on the unit are secured for travel before driving.
- 3.22 **⚠ WARNING** Emergency stop switches (E-stops) should be periodically checked by activating the switch in the yard and confirming that none of the pump functions operate electrically or manually.

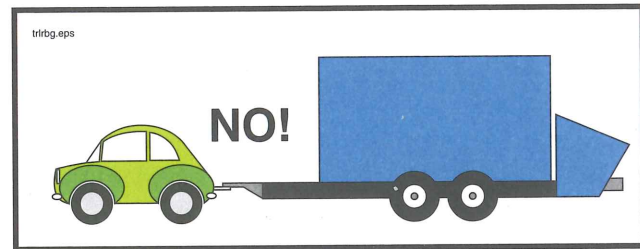
Figure 6
Periodically check your emergency stop switches (E-stops) for proper function



4. Safety Rules For Towing Trailer-Mounted Concrete Pumps

- 4.1 **⚠ WARNING** Be sure the towing vehicle is sized appropriately for the trailer. It must be heavy enough and have enough braking ability to maintain control at highway speeds and to stop—even on hills. If the trailer is heavier than the towing vehicle, braking distances will be greatly increased (Figure 7).

Figure 7
Do not under size the
towing vehicle



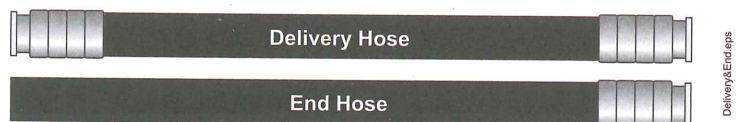
- 4.2 **⚠ WARNING** Never tow a trailer that has concrete in the hopper. The extra weight in the back of the machine will remove weight from the tongue and cause the trailer to fishtail.
- 4.3 **⚠ WARNING** Check the tires, tire pressure, and brakes on the trailer before towing. Never tow a vehicle with cracked or bald tires. A trailer tire blowout can cause loss of control in the towing vehicle.
- 4.4 **⚠ 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.
- 4.5 **⚠ WARNING** Be sure 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.
- 4.6 **⚠ WARNING** Always use safety chains and break-away protection when towing a trailer.
- 4.7 **⚠ CAUTION** Be aware of local or state regulations regarding mirrors, lights and maximum speed when towing a trailer.
- 4.8 **⚠ WARNING** When towing a trailer, your stopping distance and turning radius are greatly increased. Be aware of this **at all times**.
- 4.9 **⚠ WARNING** When towing a trailer long distances, it is important to frequently check the hitch, hitch pins, couplers, safety clips, towing eyes, wiring, emergency breakaway switch, safety chains, and other accessories, as equipped.
- 4.10 **⚠ WARNING** Be aware of your length when towing a trailer. A common cause of trailer accidents is turning too close to curbs or objects.
- 4.11 **⚠ WARNING** Never back up a trailer without a guide.
- 4.12 **⚠ WARNING** Frequently observe the trailer and watch for unusual swerving or indications of problems, such as a flat tire.

II. On The Job Site - Safety Rules For Job Setup

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

- 5.1 **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.
- 5.2 **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.
- 5.3 **⚠ WARNING** Any power connections above 28 volts must be made by a licensed electrician. The supply power and appropriate disconnect boxes are the responsibility of the contractor.
- 5.4 **⚠ 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.
- 5.5 **⚠ 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.
- 5.6 **⚠ 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.
- 5.7 **⚠ 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.).
- 5.8 **⚠ 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. If you don't understand the chart, contact the pipe manufacturer for assistance.
- 5.9 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. See Figure 8.

Figure 8
End hose vs delivery hose



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5.10

⚠ 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 (Figure 9)!**



Figure 9
Delivery system components must be able to withstand maximum pump pressure

5.11

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.

5.12

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.

5.13

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.

5.14

⚠ 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.

5.15

⚠ 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.**

5.16

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.

5.17

⚠ 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 continuous connection each day before the pour begins.

5.18

⚠ WARNING In vertical runs, the weight of the vertical sections of pipe must be supported by a thrust block (often called a *deadman*, Figure 10) or other load-bearing device. **Each section of pipeline in a vertical run must be secured from lateral and horizontal movement.**

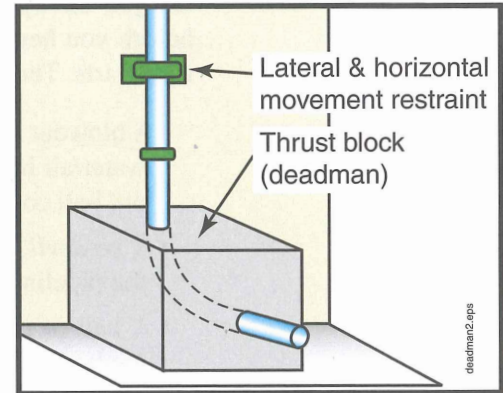


Figure 10
A thrust block (deadman)

5.19

⚠ 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 signalperson (Figure 11). If a signalperson is used, **agree on hand signals before beginning the pour!**

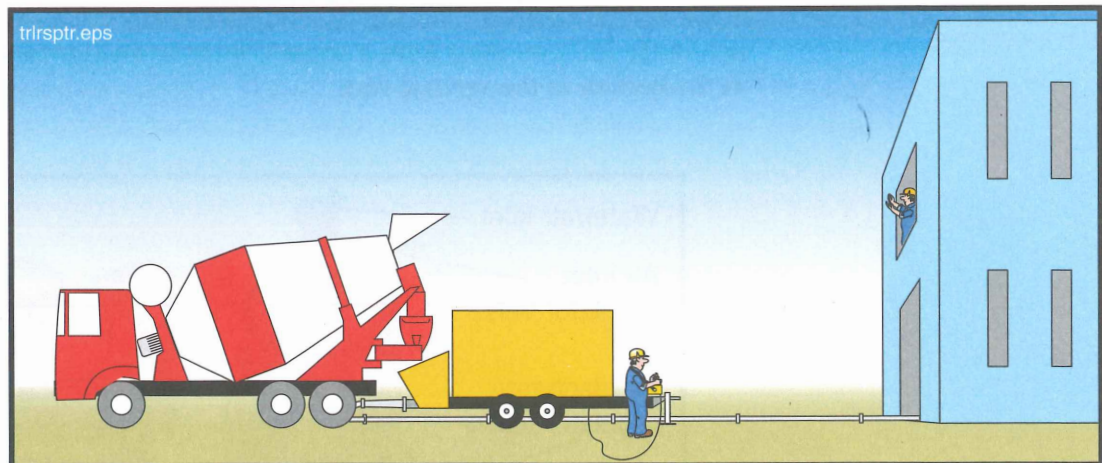


Figure 11
Arrange communications before starting

5.20

⚠ WARNING Never leave the machine unattended when it is running or ready to run. If you must leave the area, you must leave someone to monitor the unit. This is especially critical if there are children in the vicinity.

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5.21 **⚠ WARNING** Watch for children! It is possible for children to access the machine, but it is not safe for them to do so.

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

5.23 **⚠ 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** you have the right parts. The minimum accessories include:

- A blowout head with properly sized air discharge regulator valve, and separate water/air inlet. The two openings must be spaced apart far enough that a blow-out 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 5.24).
- 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 blowout 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!**

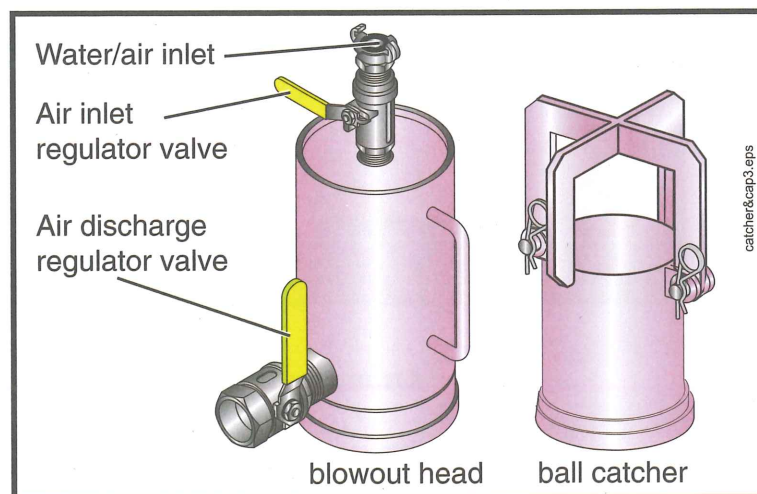


Figure 12
Ball catcher and blowout head

5.24

⚠ WARNING There are two types of ball catchers. Know which type of catcher you are using. You may need to adjust your cleanout 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 of catcher has advantages and disadvantages (Figure 13).

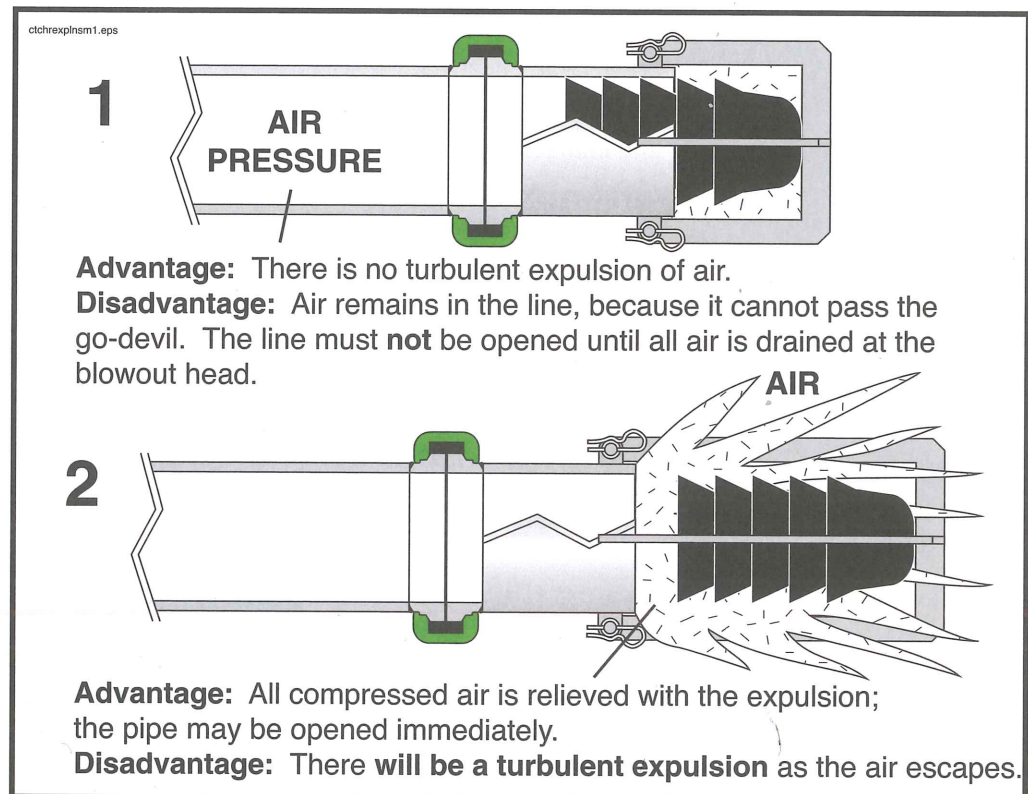


Figure 13
Types of catchers

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 blowout 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

6. Safety Rules For Pump Operators

6.1 **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 their capabilities to the employer in respect to the operation and maintenance of the pump and placing boom (if applicable); and
- can be expected to perform these duties, as assigned, in a reliable manner.

6.2 **WARNING** Because operators are responsible for the safe operation of the machine, it is crucial that they understand 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.

6.3 **WARNING** When operating the machine, wear **Personal Protective Equipment (P.P.E., or just PPE)**. (Including *full face shield and/or ** breathing mask, when necessary, as shown in Figure 14.)

* Full face shield should be used in addition to safety glasses when shotcreting, or any time material is rebounding.

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

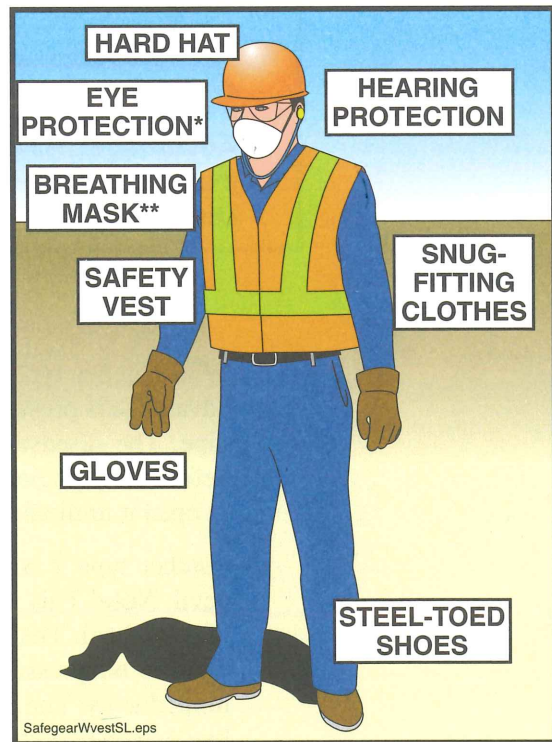


Figure 14
Wear Personal Protective Equipment (PPE)

- 6.4 **⚠️ WARNING** All guards, covers, and service flaps must be secured in place during operation.
- 6.5 **⚠️ WARNING** **Electrocution hazard!** If you are operating and lightning moves into the area, seek shelter until the lightning is gone.
- 6.6 **⚠️ 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 15).

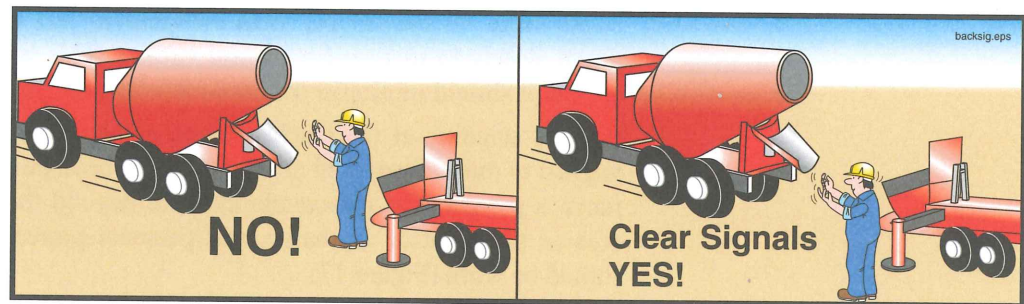


Figure 15
Never stand between the ready mix truck and the pump
Use clear and concise hand signals

- 6.7 **⚠️ WARNING** When backing in ready mix trucks, use clear and concise hand signals (Figure 15).
- 6.8 **⚠️ WARNING** If the job requires that you work above ground to operate your machine, an approved fall protection plan must be implemented.
- 6.9 **⚠️ 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 16).

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 16
Noise level and exposure time limits

SAFETY MANUAL

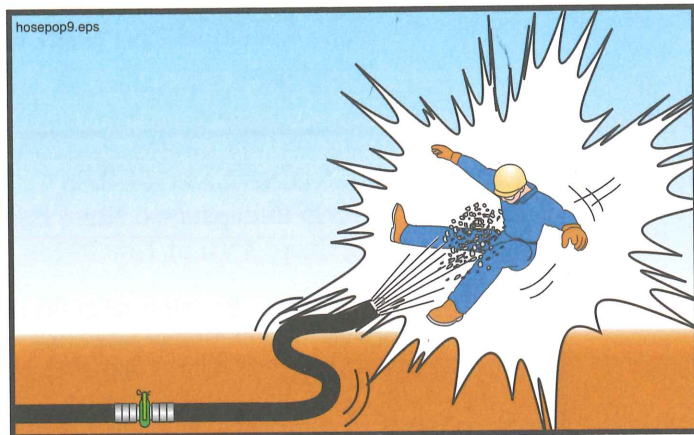
6.10

⚠ 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 17). 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 switch (E-Stop) 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. If possible, fill the hopper with concrete to just below the grate, then pump slowly in reverse for several 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 17).
4. When the pump is restarted, pump forward slowly 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 17
Remove everyone from
the discharge area
whenever air is in the line



6.11

⚠ WARNING Air can be introduced into the delivery system in several ways besides being sucked in through the hopper.

For example:

- when initially priming the delivery system;
- when restarting after moving;

- when restarting after adding or removing delivery system;
- when attempting to remove a blockage by rocking the concrete;
- when opening the system to remove a blockage;
- when pumping is stopped and the pipeline is at a downward angle.

6.12

⚠ 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 17).

6.13

⚠ 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 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 3 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

SAFETY MANUAL

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 or improperly trained placing crew can cause blockages by kinking the end hose.** This type of blockage can lead to serious accidents because the hose may unhook by the force of the pump.
- **The concrete becomes segregated in the hopper.**
 - a. If the concrete is too wet, the cement and fine material get washed from the stone and coarse sand. This mix will not pump. It is for this reason that you should cover the hopper as you wait out a passing storm, never allow a truck mixer to wash out in your hopper, and never add water to the mix.
 - b. If concrete is over vibrated, it will separate. Turn off the hopper vibrator when not actively pumping.

6.14

⚠ 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 several 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. If you are unable to move the blockage after a couple of attempts, stop the pump. Continuing to apply high pressure could create a hazardous condition.

6.15

⚠ 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.

6.16

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

- Pump in **reverse** for **at least two strokes**, then stop the pump. In the case of a mechanical pump (which cannot be reversed), it is important to carefully follow the manufacturer's instructions for relieving line pressure before any clamp is opened. **Do not allow anyone to open the pipeline** until the pressure is relieved (Figure 18).
- Wear personal protective equipment (PPE) when opening a blocked pipeline.
- Clear the area of nonessential personnel before opening the line.
- In all cases, the blockage must be removed before pumping again. Remember that air will be introduced when the system is taken apart, and keep personnel away from the discharge when restarting.
- Plugs will be found (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.)

- To find a plug in a hose: with the pressure relieved, tap or step on the hose to locate the hard spot where the hose is plugged.

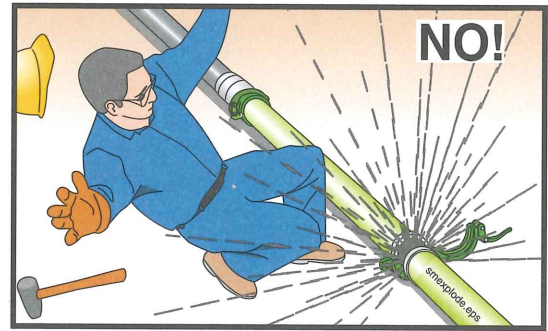


Figure 18
Never open a pressurized pipeline

- 6.17 **⚠ 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.
- 6.18 **⚠ 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.
- 6.19 **⚠ 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 19.)

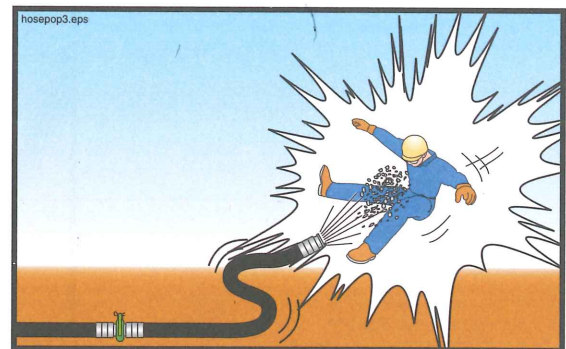
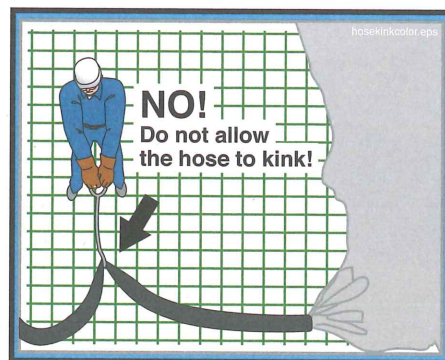


Figure 19
Kinking the hose creates a hazard

- 6.20 **⚠ 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 cannot move it, air pressure won't either.

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6.21

⚠️ 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 20).



Figure 20
Never straddle or sit on a pressurized pipeline

6.22

⚠️ WARNING Crushing/amputation hazard. Do not remove the water box covers or grates when the machine is stroking (Figure 21). 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 activate the emergency stop (E-stop) 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.

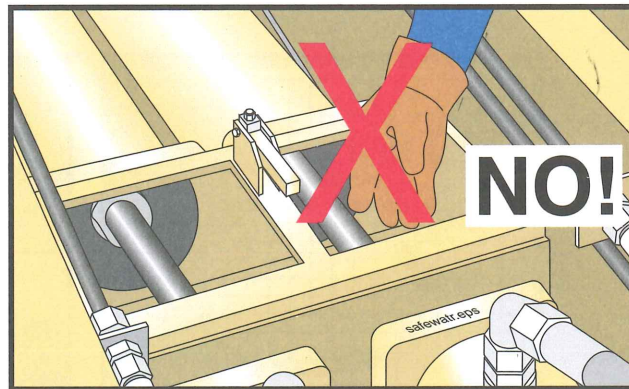


Figure 21
Keep your body out of the water box

6.23

⚠️ 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 35),

- how to stop the pump,
- the location of the emergency stop switches (E-stops),
- how to signal you.

6.24

⚠ 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 switch (E-stop).

6.25

⚠ 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 22.)



Figure 22
Don't put your body in the machine

6.26

⚠ 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.

6.27

⚠ WARNING Never operate the pump 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 signalperson. If a signalperson is used, **agree on hand signals before beginning the pour!** (Use of the ACPA standardized hand signals is highly recommended.)

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7. Safety Rules For Shotcreting

7.1 Keep the pump clean. A clean machine runs more efficiently. To enhance the cleaning of your pump, it will help to spray some type of bond breaker on the entire unit before each use (form oil or equivalent). Do not put oil on surfaces that will become hot, such as exhaust manifolds.

7.2 **⚠ WARNING** The nozzle person and nearby personnel should protect themselves by wearing appropriate safety gear, including a full face shield to prevent rebounding concrete from injuring their face and eyes (Figure 23).

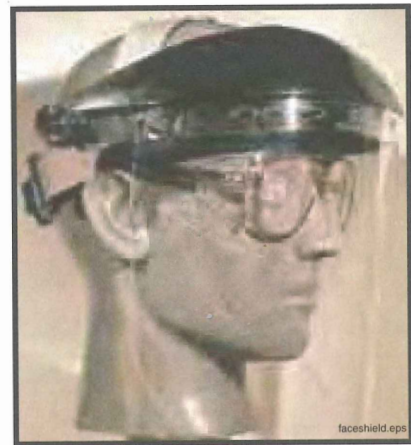


Figure 23
Wear a full face shield for rebound protection

7.3 **⚠ WARNING** Direct the reducers away from the operator and the concrete mixer driver. The line pressures can be quite high during the shotcrete process (Figure 24).



Figure 24
Point reducers away from the operator and driver

7.4 **⚠ WARNING** When practical, the nozzle man and the pump operator should use radios to communicate to facilitate a fast shut-down in the event of a line plug.

7.5 **⚠ WARNING** If setting up on a city street or some other obstacle prevents you from directing the reducers away from your work station, it can be helpful to use rubber matting and bungee cords to cover the reducers and act as a protective cover to protect you and the mixer driver in the event of a line rupture (Figure 25).

Figure 25
Cover reducers and use
containment boxes for cleanout



7.6

⚠ WARNING Crushing/amputation hazard! Always keep the hopper grate in place (Figure 26). Never put your hands, feet, or any other body part into the concrete valve, hopper, or water box when the hydraulic system is operational or ready to operate! Never stand on the hopper grate! In addition, the grate can keep many items from entering the hopper that would become blockages in the line.



Figure 26
Never remove the hopper grate
while the pump is operating

7.7

⚠ CAUTION Overspray always presents a problem during the shotcrete process. Protect personnel and equipment in the area by providing overspray protection, even when you are shooting on the inside. The most commonly used protection is plastic sheeting. It is easy to work with and can be nailed or fastened to almost any surface. Canvas tarps can be used in the same manner, but need to be cleaned frequently. Masonite and plywood also work well in some instances. It can help to over-form the area where shotcrete is to be applied. For example, if a wall is to be six feet high, you can form it to eight feet creating a two-foot area of protection. The same would apply to the end of a wall.

7.8

⚠ WARNING Check forms and rebar for stability—both backward and forward—before shotcreting. The rebar cage needs to be tied to something—usually the back form. When the shotcrete wall is being built up, the placed shotcrete wants to sag forward, bringing the rebar with it. If the rebar moves, the form may also move.

IV. Cleaning The Pump And System

8. Safety Rules For Cleaning The Concrete Valve And Hopper

8.1 **⚠ WARNING** Wear protective clothing and equipment when cleaning the concrete pump because the lime in concrete can burn your skin. 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.

8.2 **⚠ 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 27).



Figure 27
Keep your body parts
out of the machine

8.3 **⚠ 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 27).

8.4 **⚠ WARNING** Never put a bar or other solid tool into the hopper, water box, or other working system while the hydraulics are operational (Figure 28).

9. Safety Rules For Cleaning The Water Box

9.1 **⚠ 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 and activate the emergency stop (E-stop) so the pump cannot

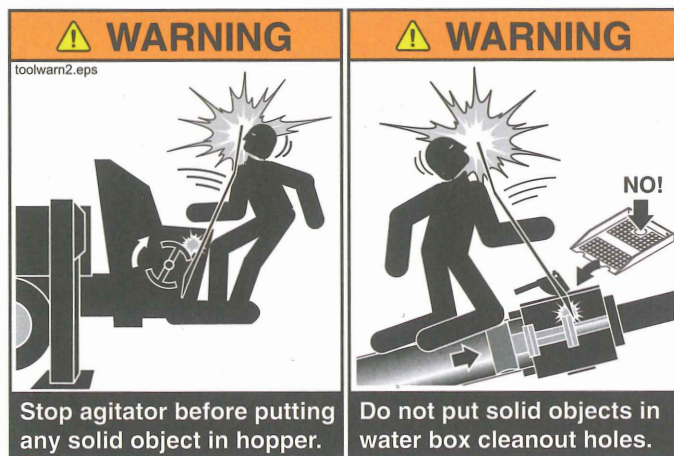


Figure 28
Don't put solid objects into working systems

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.

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

9.3 **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 hydraulic system is operational (Figure 29).**

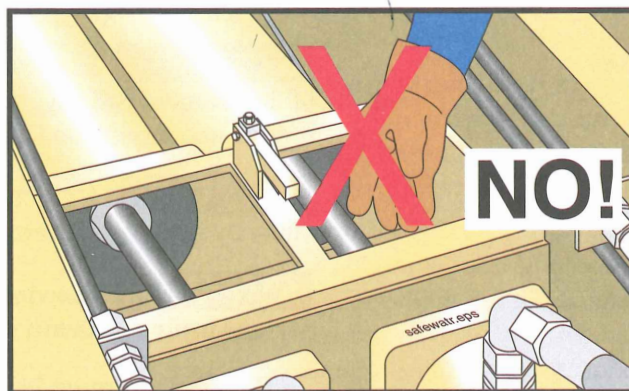


Figure 29
Keep your hands out of the water box

10. Safety Rules For Cleaning A Separately Laid Pipeline

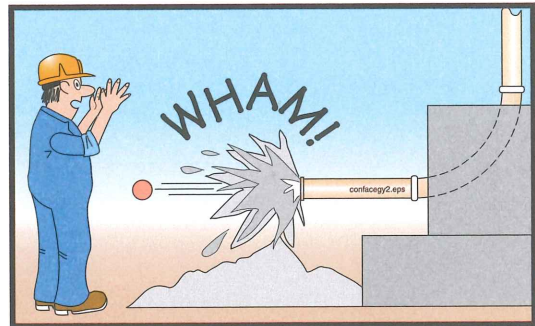
10.1 **WARNING** Flying particle hazard! Clear the discharge area of personnel and equipment before forcing a ball or go-devil through the pipeline, even if you are cleaning with water. Some air will be trapped in the pipeline, and the trapped air will become compressed before discharge.

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

10.3 **⚠️ 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 30
Cleaning with compressed air can be extremely hazardous if you don't follow the safety rules



10.4 **⚠️ WARNING** If you have to use compressed air for cleaning the line you **must** have all of the necessary accessories. Read and understand the complete safety rules regarding cleaning out with compressed air in this section of this *Safety Manual* starting at paragraph 10.8 on page 26. Cleaning with compressed air should only be done by qualified people. See Figure 30.

10.5 **⚠️ 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.

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

10.7 **⚠️ 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.

10.8 **⚠️ 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 blowout 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 5.24 on page 13.
- **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 blowout 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 31).

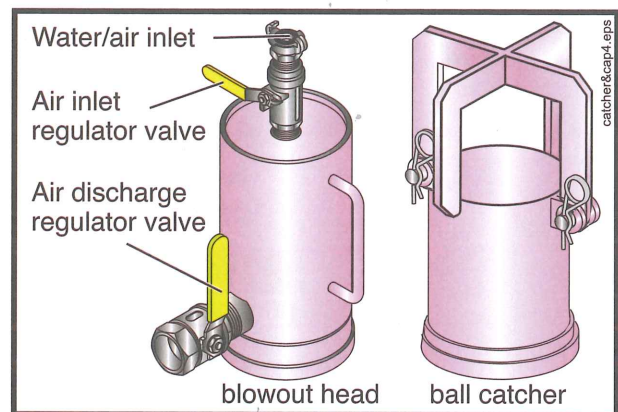


Figure 31
Ball catcher and
blowout head

- The ball or go-devil must be large enough to prevent compressed air flow around and into the concrete.
- **The pipeline must not be disassembled until it has been completely relieved of air.** Be sure of this! (See Figure 32.)

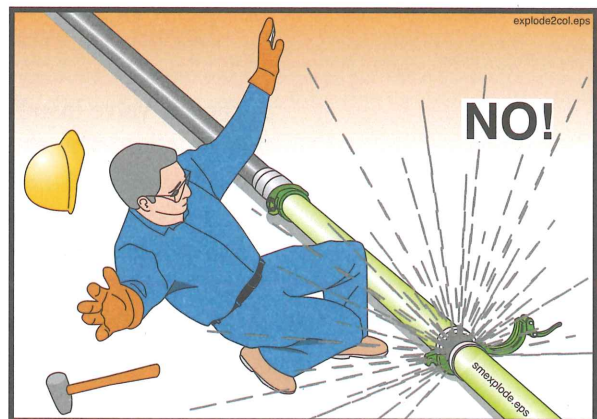


Figure 32
Never open a
pressurized
pipeline

- **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

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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 33).

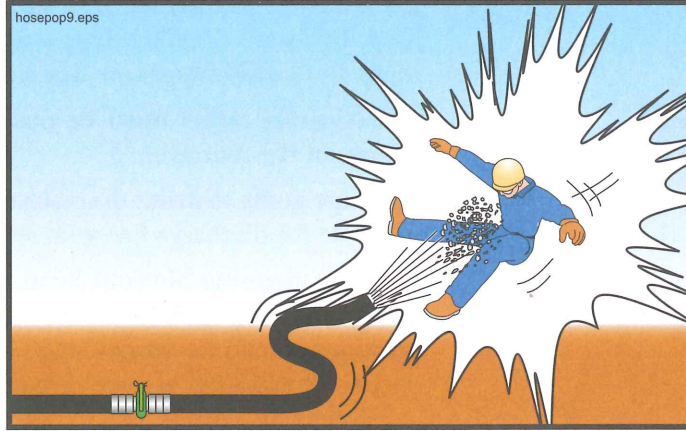


Figure 33
Never use air to blow out hoses or short pipelines

- **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.)

10.9

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

1. (See diagram A in Figure 34.) 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 34.) 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.

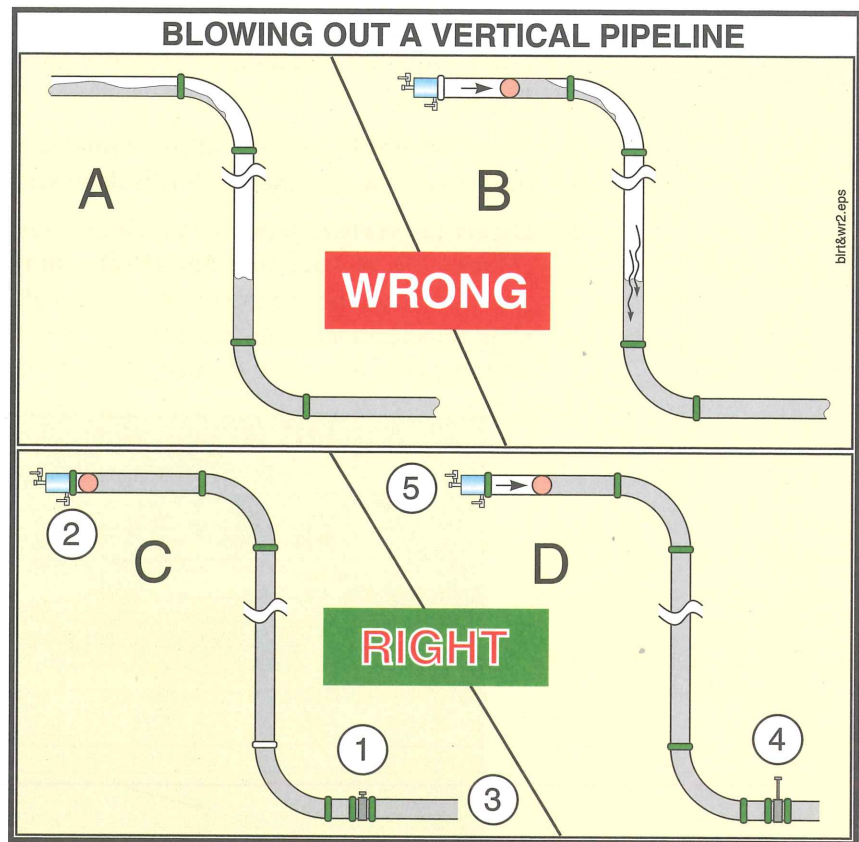


Figure 34
Blowout of a vertical line

10.10

⚠ 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 34). 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 blowout head and hook up the air compressor. Do not apply the air yet!** (Item 2, Figure 34.)

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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 34.)
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 cleanout area and secure the discharge (Figure 35), 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 34.)



Figure 35
Divert vertical pipeline to the cleanout area and be sure to secure the discharge before continuing

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 34.)
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 10.8 on page 26 also apply to blowing out a vertical pipe line. These rules are in addition to the general cleaning a pipeline with compressed air rules.

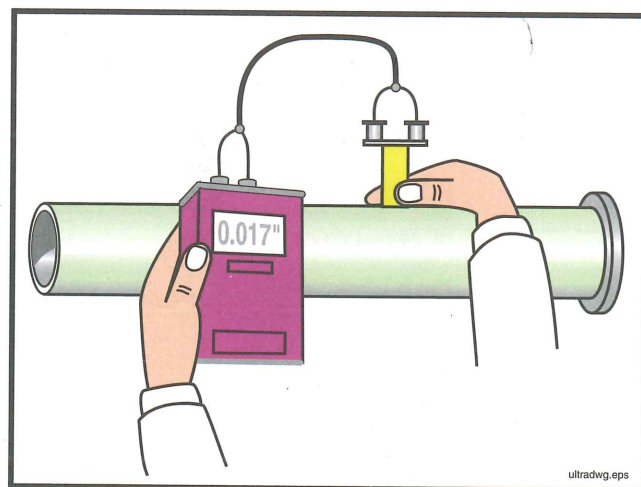
10.11

⚠ 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

11. Safety Rules Regarding Inspection

- 11.1 **⚠ 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!
- 11.2 **⚠ 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.
- 11.3 **⚠ WARNING** If safety devices or guards are removed for inspection purposes, they must be replaced before someone uses the machine.
- 11.4 **⚠ WARNING** Pay attention to the operation manual and manufacturers service bulletins regarding maintenance and inspection procedures and intervals.
- 11.5 **⚠ 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 okay.
- 11.6 **⚠ 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.
- 11.7 **⚠ 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. For single wall pipes, ultrasonic thickness testers are more accurate than the tap method.



††

Figure 36
Check delivery system wall thickness with
an ultrasonic thickness tester

12. Safety Rules Regarding Scheduled Maintenance

12.1 **⚠ WARNING** Proper and timely maintenance is important to the safe operation of a concrete pump. 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.

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

12.3 **⚠ 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 37).

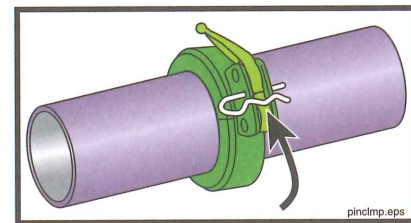


Figure 37
Pin the clamps

12.4 **⚠ 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 46 in the *Appendix* of this manual.

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

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

12.7 **⚠ 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.

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

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

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

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

- 12.12 **NOTICE** 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 in doubt, contact the Service Department of the manufacturer for instructions **before** proceeding.

13. Safety Rules When Servicing The Machinery

- 13.1 **WARNING** Repairs should be carried out by qualified workshop personnel. (See the glossary for the definition of *qualified personnel*.)
- 13.2 **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.
- 13.3 **WARNING** Burn hazard! **Never work on a hot hydraulic system.**
- 13.4 **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.
- 13.5 **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.
- 13.6 **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.
- 13.7 **DANGER** Electrocuting hazard! **Repair work on electrical systems over 28 volts must be done by qualified electricians.**
- 13.8 **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!
- 13.9 **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. A procedure may also be provided in the operation manual for the unit and 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.

SAFETY MANUAL

- 13.10** **⚠ 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.
- 13.11** **⚠ WARNING** Never work on a pressurized hydraulic system. Stop the engine or electric motor, relieve the accumulator circuit and verify zero pressure on the gauge (if so equipped), and be sure that no hydraulic components are loaded, (i.e., outrigger supporting the unit) before you open the hydraulic system.
- 13.12** **⚠ 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!
- 13.13** **⚠ 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 38).



Figure 38
The 3-point Rule

- 13.14** **⚠ WARNING** Always use the correct tools for the job. Tools should be kept clean and in good condition.
- 13.15** **⚠ WARNING** If you see a coworker engaging in an unsafe practice, warn him about the dangers. Safety is always in the hands of those on the job!
- 13.16** **⚠ WARNING** After any repair is completed, test the function of the repaired part to be sure that repairs were done correctly.

VI. Coworker Safety

14. Safety Rules For Workers Assigned To The Pump.

14.1

⚠ WARNING You must know how to stop the pump. Have the operator show you the locations of the emergency stop switches (E-stops) (Figure 39).

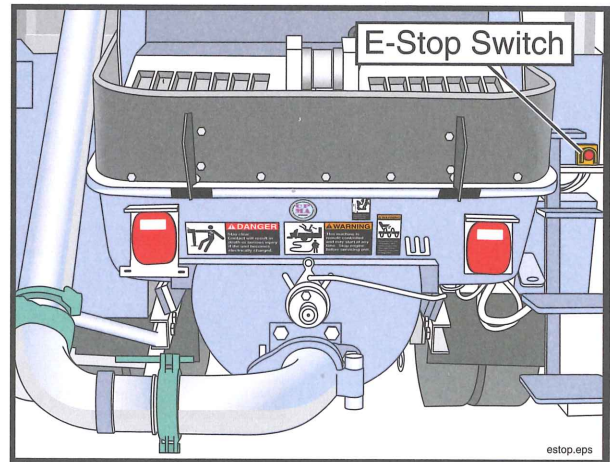


Figure 39
Know how to stop the unit in an emergency

14.2

⚠ DANGER 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, (including *full face shield and/or ** breathing mask, when necessary, as shown in Figure 40).

* Full face shield should be used in addition to safety glasses when shotcreting, or any time material is rebounding.

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

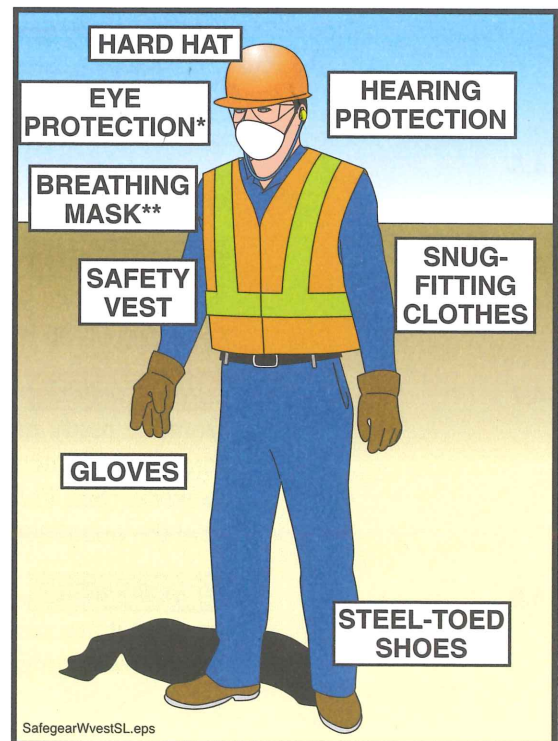


Figure 40
Wear the same personal protective equipment as the operator

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14.3

⚠ 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 41).



Figure 41
Never stand between the ready mix truck and the pump

14.4

⚠ WARNING When backing in ready mix trucks, use clear and concise hand signals (Figure 42).

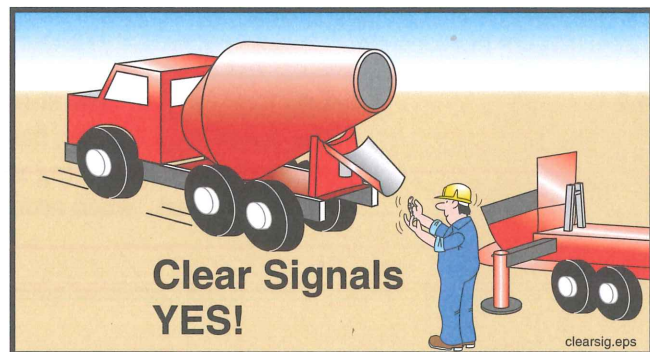


Figure 42
Use clear, concise
hand signals

14.5

⚠ WARNING If handling the chutes of a ready mix truck, keep your hands clear of the hinged areas.

14.6

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

14.7

⚠ 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 14.16 on page 39.) If necessary, depress the E-stop button to stop the pump and alert the operator.

14.8

⚠ 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.)

14.9

⚠ WARNING Do not operate the pump 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.

14.10

⚠ 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 43). 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 switch (E-stop) 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. Do not put your face directly over the hopper.
 2. Alert the operator of the problem. It is the operator's 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 43).
 4. When the pump is restarted, 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.

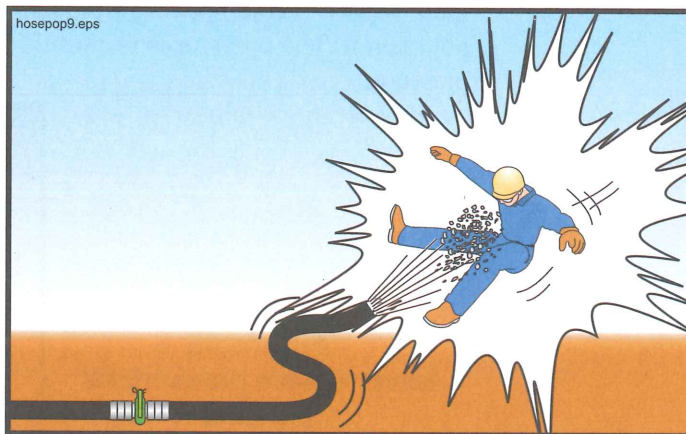


Figure 43
Remove everyone from the discharge area
whenever air has been introduced into the line

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14.11

⚠ 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 43). 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.

14.12

⚠ 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 cannot move it, air pressure won't either.

14.13

⚠ 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 44).



Figure 44
Never straddle or sit on
a pressurized pipeline

14.14

⚠ WARNING Expulsion hazard! Never open a pipeline that is under pressure (Figure 45). The pump must be run in reverse for at least two strokes and then stopped before opening a pipeline. If the pipeline is pressurized with air, do not open it. The operator is responsible for knowing how to safely release the air pressure.

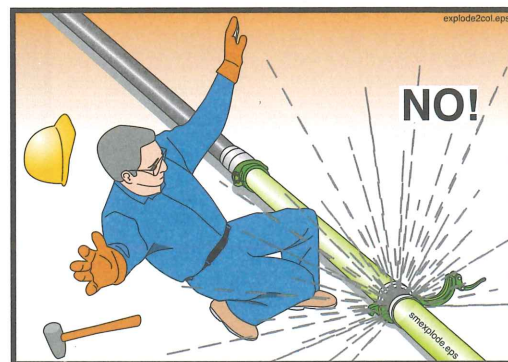


Figure 45
Never open a pressurized
pipeline

14.15

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

14.16

⚠ 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 46.)



Figure 46
Never put your body in the machine!

14.17

⚠ WARNING Never lift or remove the hopper grate for any reason (Figure 47).



Figure 47
Lifting hopper grate exposes the agitator and the concrete valve

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14.18

⚠ WARNING Do not remove the water box covers or grates when the machine is stroking (Figure 48). Do not remove the water box cover (to add water, for example), until the operator has disabled the machine. Replace the covers before the operator restarts the pump.

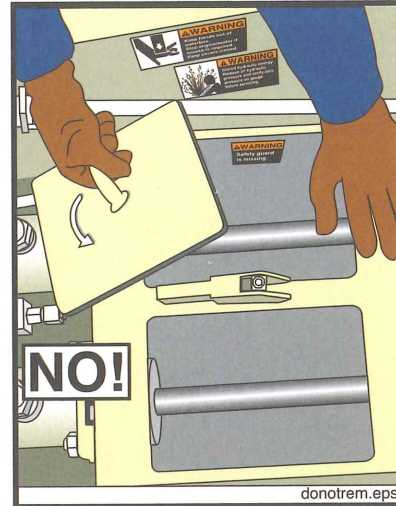


Figure 48
Do not remove the water box covers when the machine is stroking

14.19

⚠ 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 49).



Figure 49
The 3-point Rule

14.20

⚠ WARNING Keep unauthorized personnel off of the pump.

15. Safety Rules For The Placing Crew

15.1

⚠ WARNING Wear Personal Protective Equipment (P.P.E., or just PPE) when working around a concrete pump (Figure 50). 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 (including *full face shield and/or ** breathing mask, when necessary, as shown below).

* Full face shield should be used in addition to safety glasses when shotcreting, or any time material is rebounding.

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

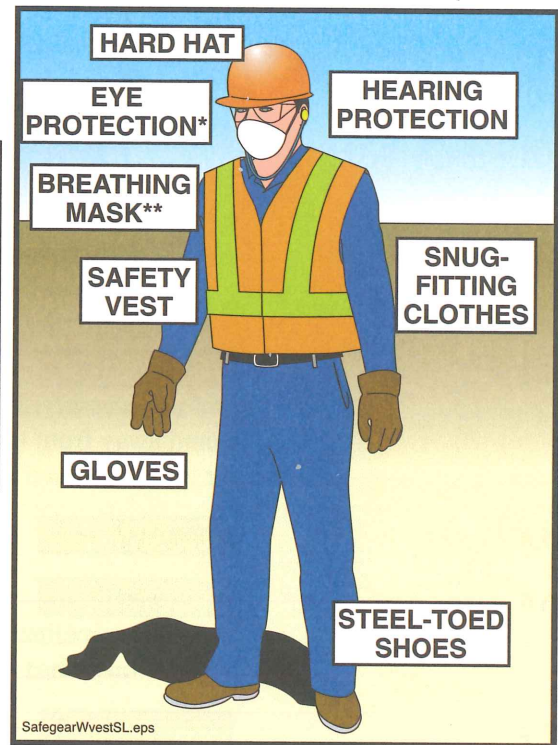


Figure 50
Wear Personal Protective Equipment (PPE)

15.2

⚠ 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 51). 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.

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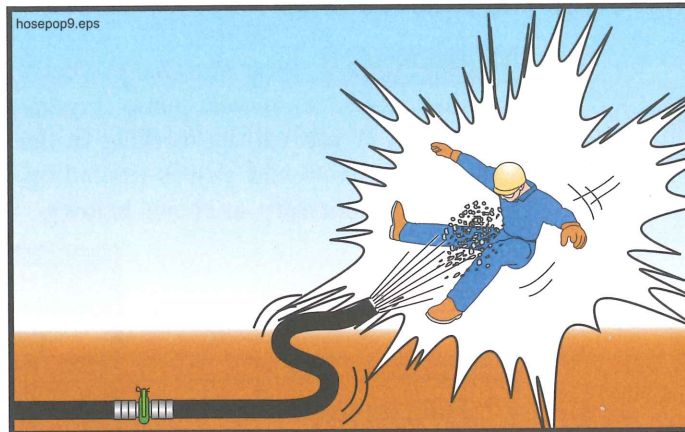


Figure 51
Stay away from the point of discharge when starting or restarting, and when there's air in the pipeline

- 15.3 **⚠ WARNING** Never use compressed air to clear a blockage! It is unsafe and unnecessary. If the pump pressure cannot 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.
- 15.4 **⚠ WARNING** Do not look into the end of a plugged hose or pipe!
- 15.5 **⚠ 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.**
- 15.6 **⚠ WARNING** Never open a pressurized pipeline (Figure 52). 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.

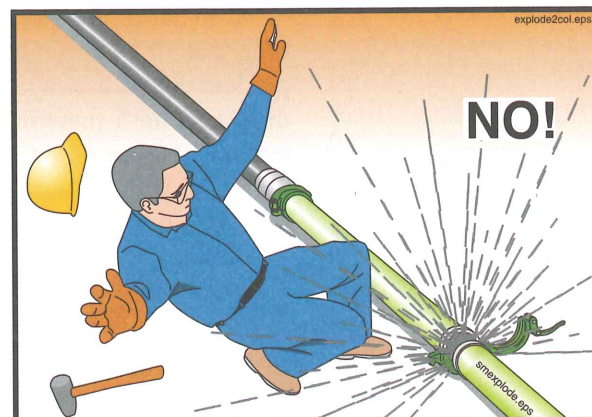


Figure 52
Never open a pressurized pipeline

- 15.7 **⚠ 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.

15.8 **⚠️ 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 near the pipeline, and wear protective clothing.

15.9 **⚠️ 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 53.)

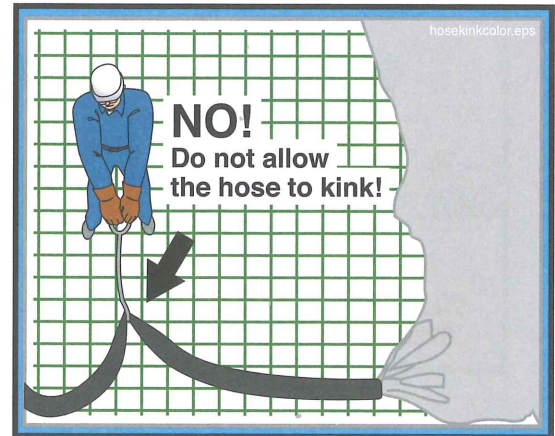


Figure 53
Never kink the hose;
Never hold the hose with your shoulder

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

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

15.12 **⚠️ WARNING** Never stand on, sit on, or straddle a pipeline while it's in use, or whenever it is pressurized (Figure 54). 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.

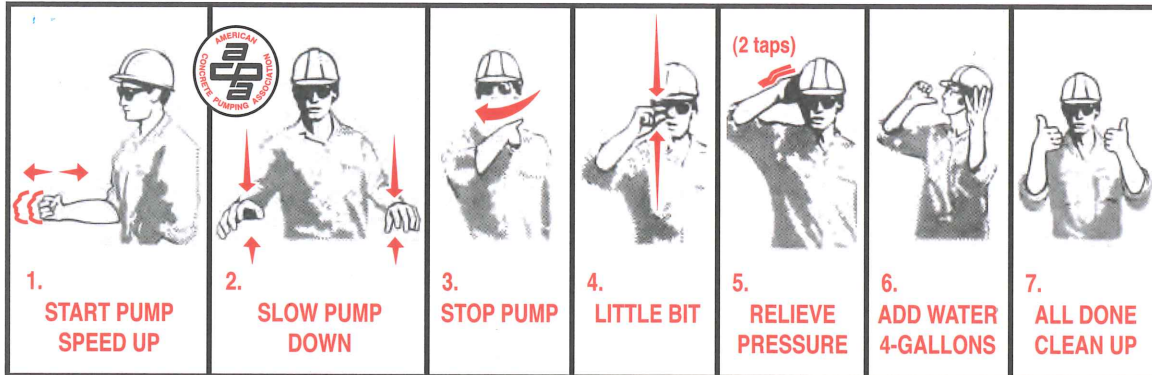


Figure 54
Never straddle or sit on a pressurized pipeline

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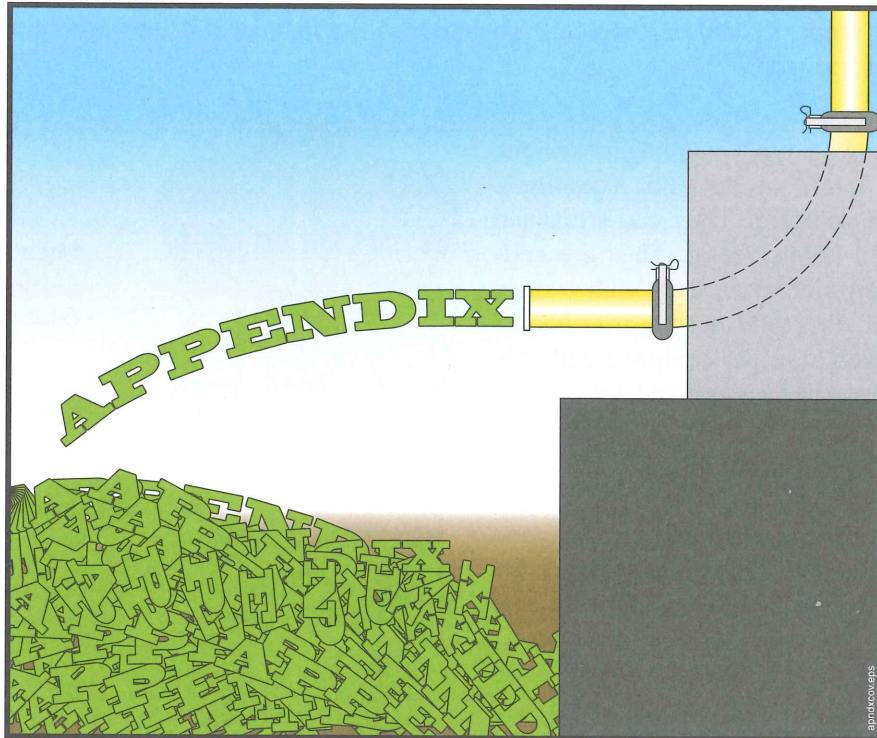
15.13 **⚠ WARNING** To avoid confusion and conflicting signals, only one person should act as a signalperson (give operational signals to the pump operator). However, the operator is trained to obey a stop signal from anyone and everyone.

15.14 **⚠ WARNING** Before the pour begins, the hose person, the signalperson, and the operator should agree on the hand signals (Figure 55).



ACPAhandsigsmallline2.eps

Figure 55
Recommended ACPA hand signals



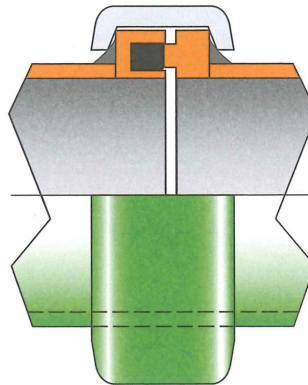
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VII. Weld-On Ends/Coupling Comparison

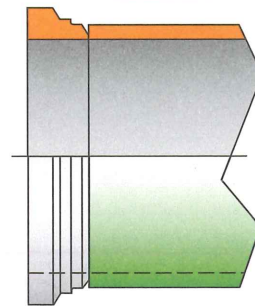
Shown is a comparison among commonly used ends/couplings. No two ends shown can be joined without the use of an adapter pipe or a special adapter clamp. Clamps and pipe strength must also be considered when determining proper system requirements. The ratios shown in the text below represent the safety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

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.



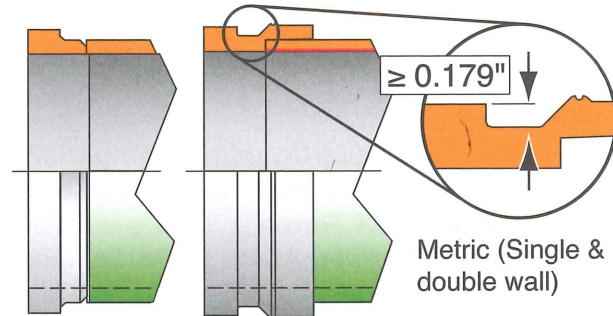
Male / Female
O-Ring
(shown with clamp)

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.



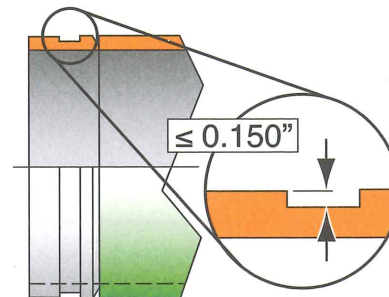
Heavy-Duty

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.



Metric (Single & double wall)

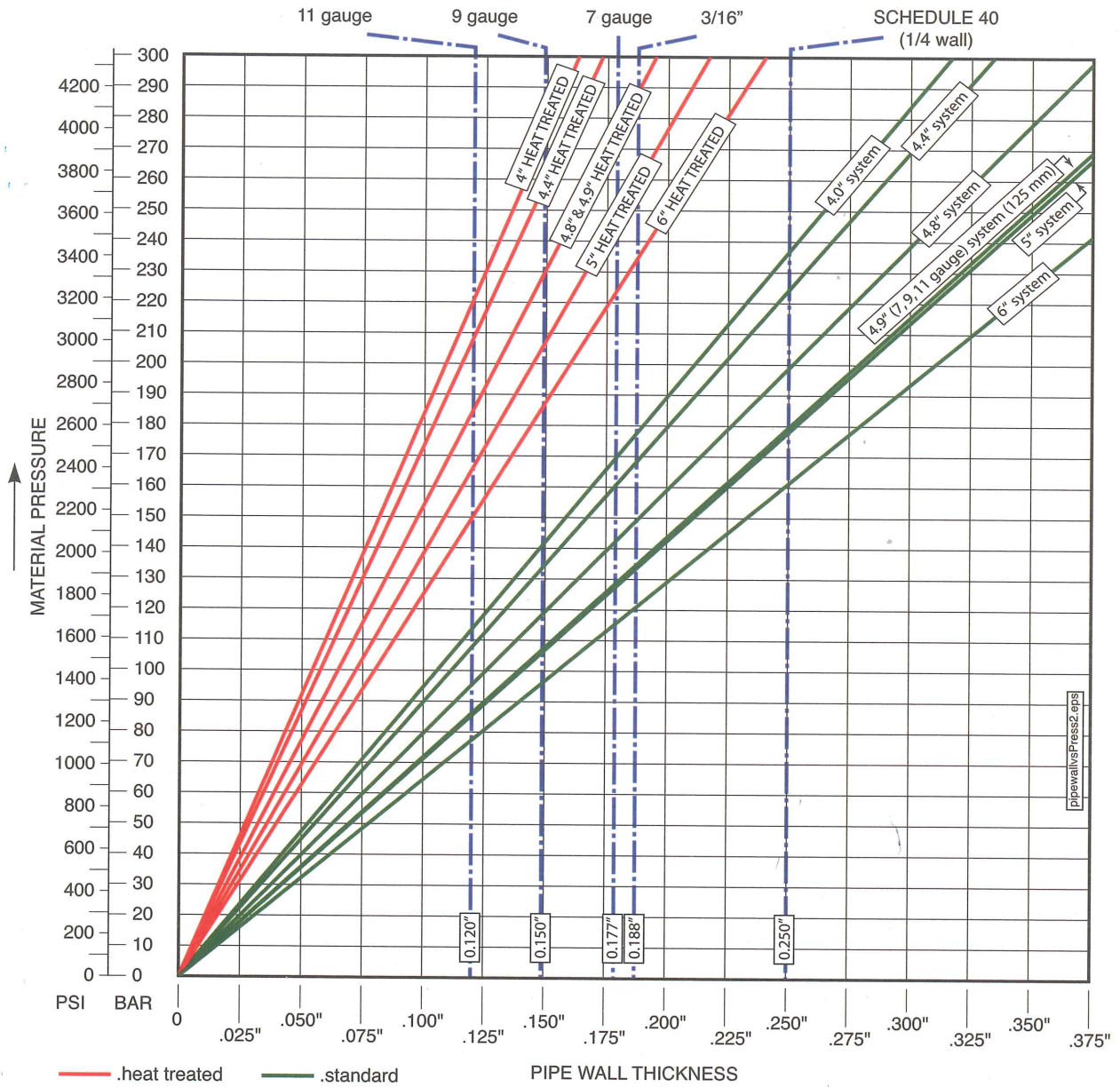
4. Grooved (Victaulic) couplings (lip height of 0.15" or less) are designed for pressures only up to 750 PSI @ 2:1. The recessed groove is hard to clean when changing pipe on a job. The weld-on end fails before the pipe because the groove is cut into the pipe thickness, making it the weakest spot. Grooved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



Grooved; flange height equal to or less than 0.150", cut directly into pipe wall. NOT ALLOWED for concrete pumping per ASME B30.27

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

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

ASME B30.27

A safety standard for material placement systems (concrete pumps and material placement conveyors) that has been accepted by ANSI as an American National Standard.

Blanking Plate

Also known as a blanking plug or end cap. Its purpose is to prevent material from falling out of the delivery system 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 cannot be removed in such a manner, it's called a plug. *See Also:* Plug, Rock Jam. The causes of blockages are detailed in Section 6.12 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 cleanout 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 ACPA certification proctor and does not attest to their ability to operate a concrete pump. *See Also:* Qualified Person, Qualified Operator.

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

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 15 of this manual.

Drive Engine

The primary source of power for a hydraulic system. Typically, the word "engine" denotes an internal combustion device, whereas the word "motor" denotes an electrical device.

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:* Signalperson

High Voltage

For the purposes of this manual, anything over 28 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).

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 its 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.

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

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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 20 feet from the wires (50 feet above 350 Kv), as recommended by the American Concrete Pumping Association. This distance may have other values in different locations. 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. It establishes and enforces safety regulations for industry and business. Among the areas over which it has authority are construction job sites and work shops.

Personal Protective Equipment (P.P.E. or just PPE)

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 cleanout 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.

Signalperson

A person positioned at a vantage point where both the point of discharge and the pump operator can be seen and who relays operational signals to the operator.

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.

Sponge Ball

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

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Spotter

A person positioned at a vantage point where the distance between a hazard and the pump can be clearly seen and evaluated and the pump operator can be alerted if a predetermined safety distance is compromised. *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 8 of this *Safety Manual*.

Transport Position

This relates to the position of the machinery when you will be driving or towing the unit. For example, the travel position of the engine hood is the position of the hood when it is completely lowered and latched into place.

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

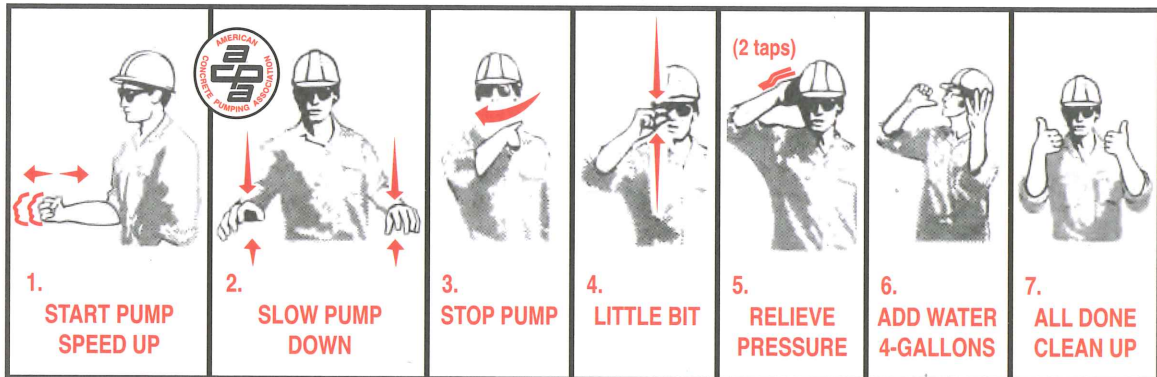
Sections of concrete delivery pipeline that are running in an up (or down) direction. Vertical runs have very specific procedures and rules for installation, support, cleaning, and inspection. Concrete pumping personnel should, therefore, have specific training in these procedures and rules before attempting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

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



ACPAhandsgsmallline2.eps

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

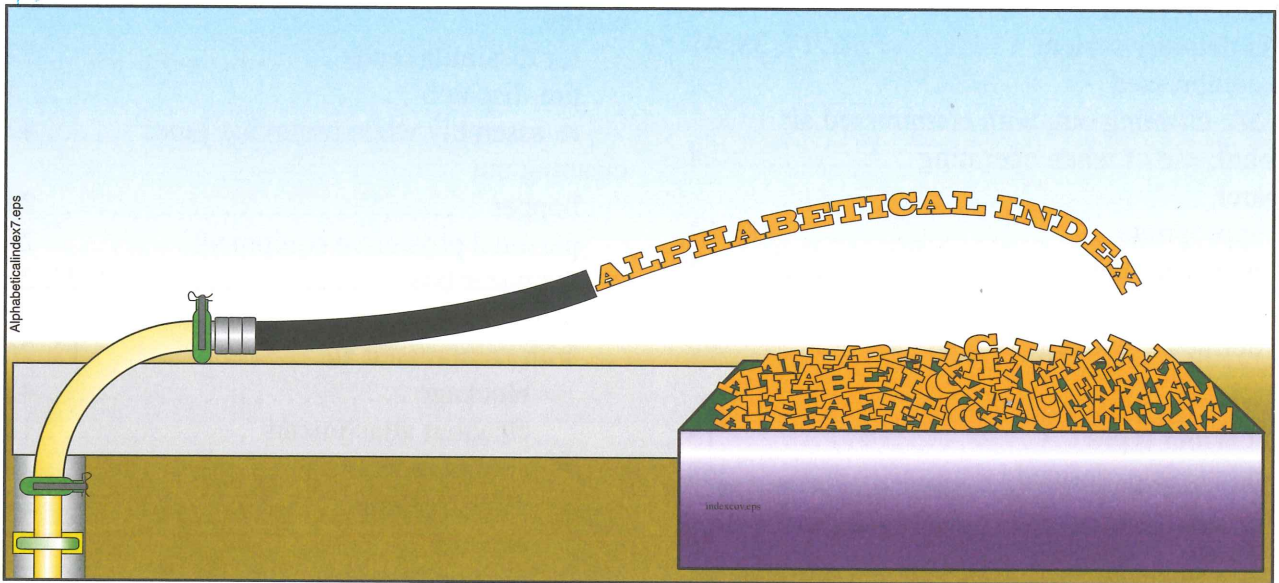
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Information contained in this Safety Manual is not intended to supercede the manufacturer's recommendations or company policies.



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