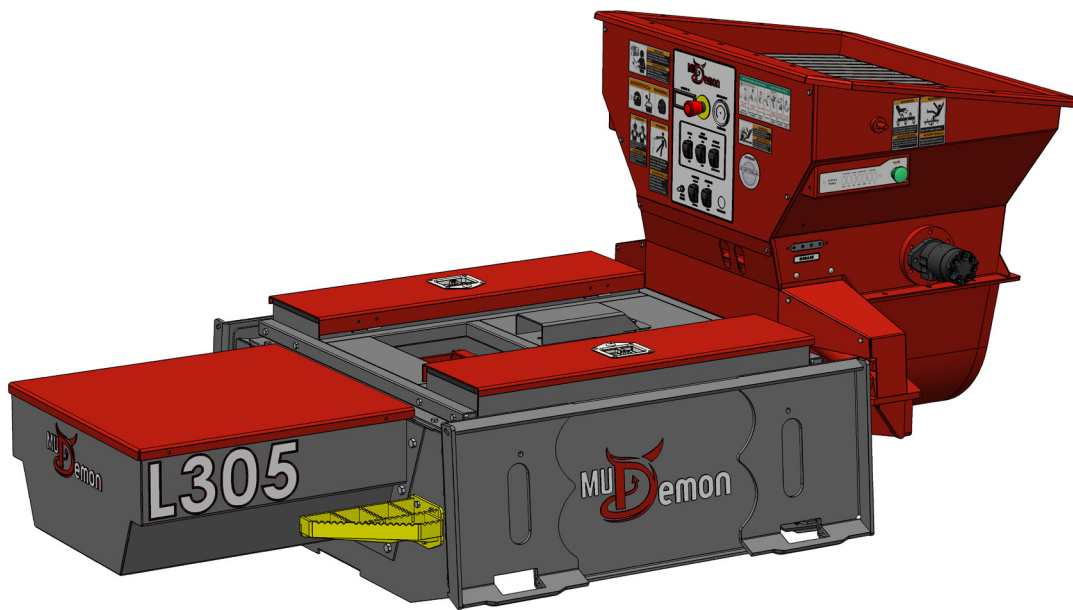


# Operation Manual | L305

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2200 14th Ave S  
Moorhead, MN 56560  
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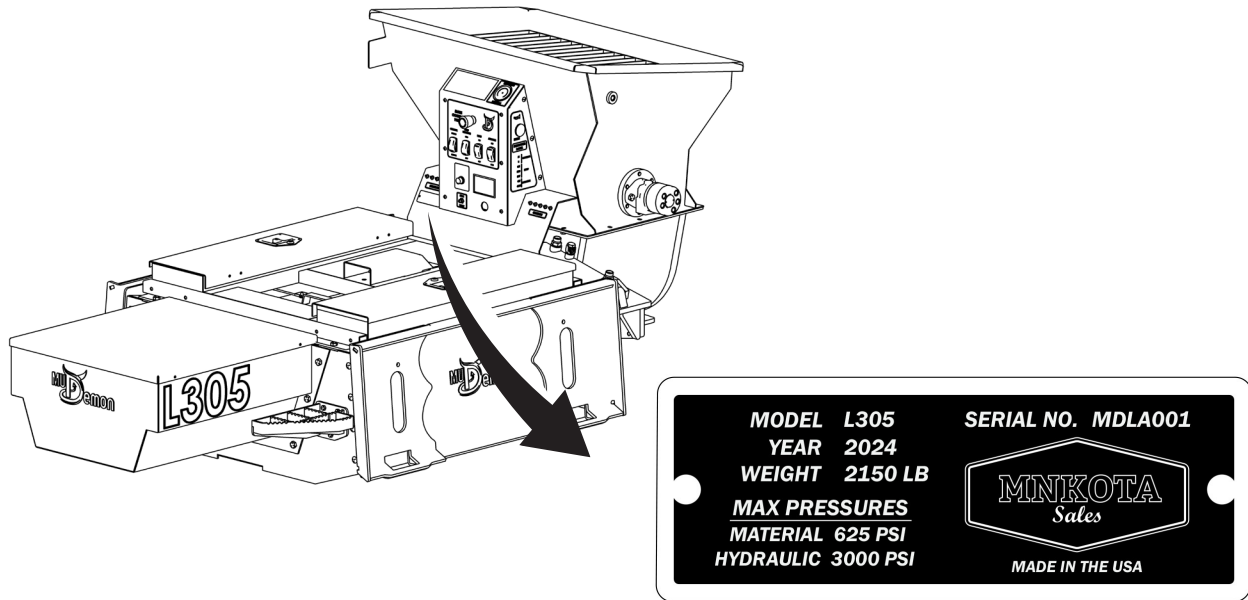
### Introduction

Mud Demon is a brand of MNKOTA Sales, a manufacturer of high-quality industrial equipment. MNKOTA Sales is committed to exceeding customer expectations for product performance and safety.

The information contained within this manual is necessary for the setup, operation, and maintenance of your concrete pump. All operators should become familiar with the information contained here as it will promote safety, efficiency of operation and long life to the equipment.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The technical information provided are subject to change at any time and may affect the service that is given to the product. Obtain the complete and most current information before using the product. MNKOTA Sales has the most current information available.

### Serial Tag Location



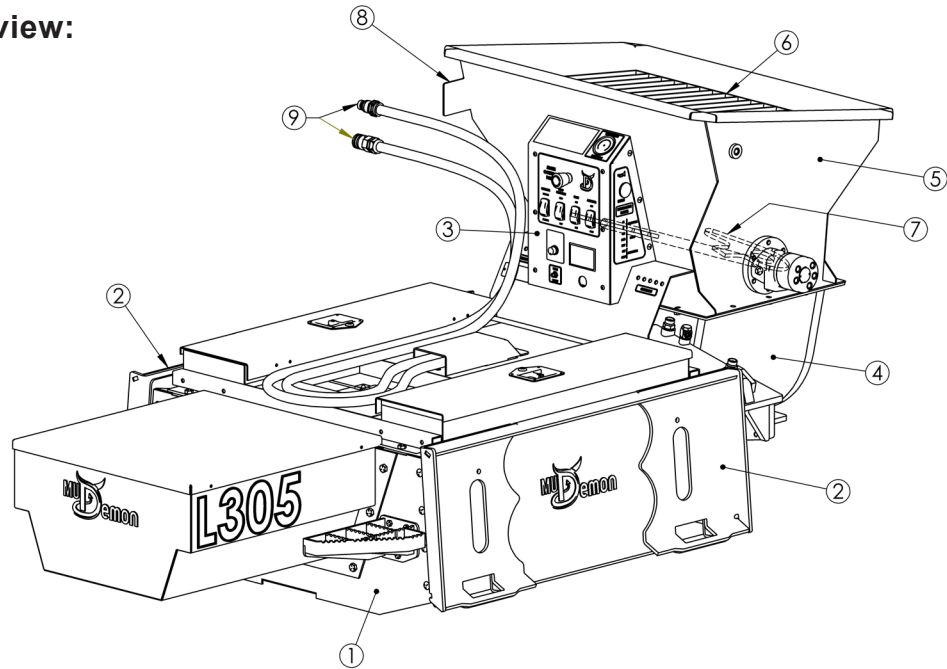
#### How to order missing tags:

If serial tag is missing, a new tag can be ordered by contacting MINKOTA Sales and providing the serial number of your concrete pump.

### Specifications

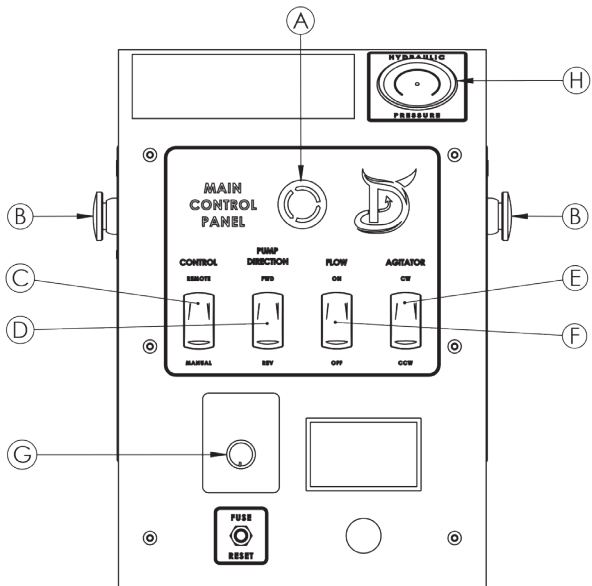
| Specification                  | Value            |
|--------------------------------|------------------|
| Max. concrete output           | 30 yards/hr      |
| Concrete pressure              | 625 psi          |
| Max. aggregate size            | 3/4"             |
| Concrete piston diameter       | 5"               |
| Hydraulic piston diameter      | 2.5"             |
| Concrete valve type            | S-Valve          |
| Outlet diameter                | 4"               |
| Max. strokes per minute        | 40               |
| Hydraulic pressure             | 2500 psi         |
| Weight                         | 2100 lb          |
| Overall dimensions (L x W x H) | 101" x 50" x 48" |
| Load height (hopper)           | 42"              |

**Machine Overview:**



|   |                    |   |                        |
|---|--------------------|---|------------------------|
| 1 | Main frame         | 6 | Hopper grate           |
| 2 | Quick attach plate | 7 | Agitator               |
| 3 | Control Panel      | 8 | Agitator safety switch |
| 4 | Pumpkit            | 9 | Supply/return hoses    |
| 5 | Hopper             |   |                        |

**Control Panel Layout:**



|   |                          |
|---|--------------------------|
| A | E-Stop                   |
| B | Horn                     |
| C | Control Selection        |
| D | Pump Direction Selection |
| E | Pump On/Off              |
| F | Agitator CW-CCW          |
| G | Pump Flow Dial           |
| H | Pressure Gauge           |

## Safety

### Safety Alert Symbols



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 signal words will appear after the safety alert symbol:



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



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

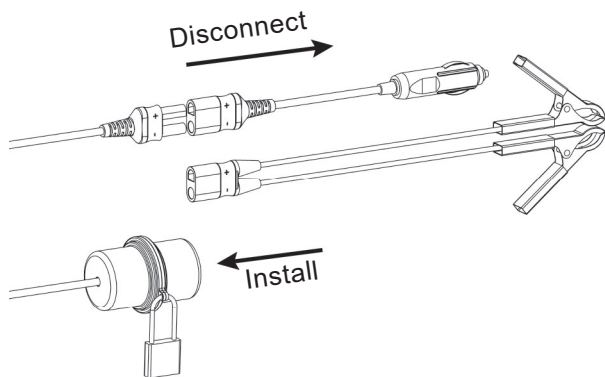


If the safety alert symbol is followed by the signal word **CAUTION**, it indicates a potentially hazardous situation which, if not avoided, **MAY** result in **minor to moderate injury**.

The signal word **CAUTION** used without the safety alert symbol means the hazard **COULD** cause damage to **equipment or property**. The signal word **CAUTION** used without the safety alert symbol may also be replaced by the signal word **NOTICE**.

### Lock Out-Tag Out

Some troubleshooting and/or maintenance procedures may require the machine to be locked out and tagged out prior to performing. To lock and tag out your machine, verify that the power adapter is disconnected from the skid steer (or other construction equipment) and remove the adapter from the power cord. Enclose the power cord receptacle in an approved plug cover and ensure that the plug cover is locked using a padlock.



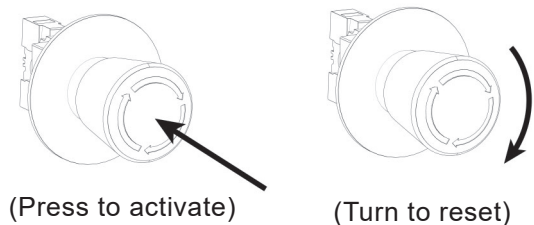
### Safety Devices

The following devices are included with your concrete pump. These devices must be maintained in good working condition to avoid injury. Bypassing a safety device for servicing or emergency cleanout should only be done by qualified personnel. All bypassed devices must be set back to their original position upon completion of the service or emergency procedure.

#### Emergency stop switch (E-Stop):

There is one emergency stop switch located on the concrete pump control panel (see Machine Overview) and one on the wireless remote.

Pressing the E-Stop knob disables the pump. To reset the system, turn the E-stop knob clockwise.

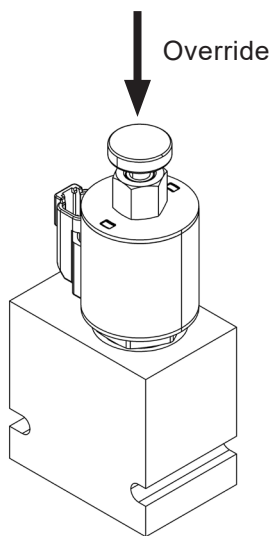
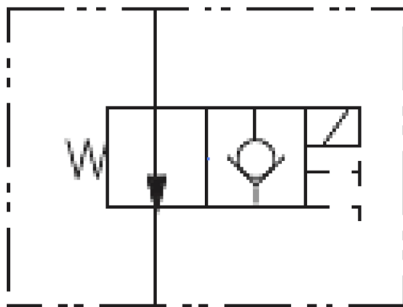


**Dump valve:**

The dump valve is a safety device that consists of a 2-way solenoid valve with override button. The 2-way solenoid valve is in the normally open position. When electrical current is applied to the dump valve solenoid, the 2-way valve will take over the spring and put the valve in a closed position. This will block the hydraulic oil from escaping to tank, allowing ppressure to build in the circuit.

If the E-Stop switch or manual override button is pressed, the 2-way valve will return to the normally open position and will route the hydraulic oil back to tank.

To bypass the dump valve, press and hold the override button.



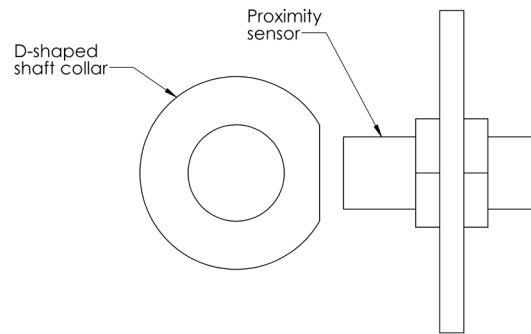
[Dump Valve]

**Hopper grate switch:**

The hopper grate switch consists of proximity sensor and D-shaped shaft collar. The shaft collar is attached to the hopper grate, sensor is attached to the hopper.

*When the hopper grate is lifted*, the flat face of the shaft collar will rotate away from the sensor, breaking the circuit. The concrete pump and agitator will stop moving.

*Shutting the hopper grate* will reconnect the electrical circuit. The agitator will begin to move, the concrete pump will need to be turned on again to continue pumping.



**Safety Device Spare Parts Ordering:**

In the case that one of these safety devices becomes inoperable and needs to be replaced, decommission the concrete pump until device can be replaced. Contact MNKOTA Sales to order replacement device and reference the following part number.

| Device              | Part Number |
|---------------------|-------------|
| E-Stop switch       | 950-0002    |
| Hopper grate sensor | 950-0003    |
| Dump valve          | 933-0008    |

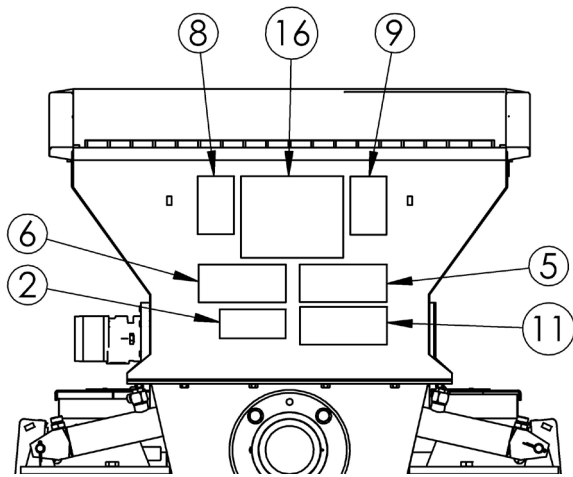
**Safety Manual**

The following Safety Manual is a separate document from the rest of this manual and contains its own page numbering and formatting. The Safety Manual also has its own index section which is located at the end of this section.

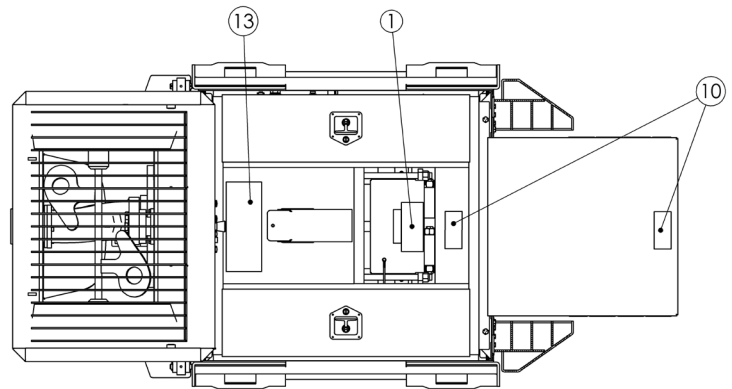
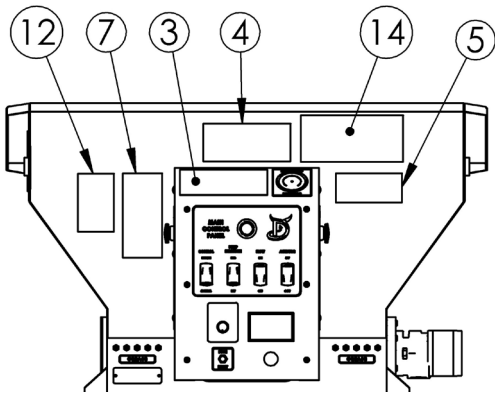
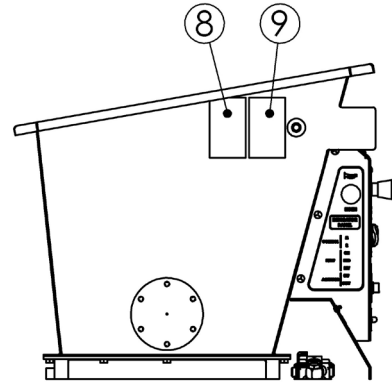
To order additional Safety Manuals, contact MNKOTA Sales via email or telephone.

### Safety Decals

This product is equipped with a set of safety decals. These decals must be replaced if they become damaged, faded, missing, or unreadable. For replacement labels, reference the Parts Diagram portion of this manual for part numbers and contact MNKOTA Sales.



(Both sides of hopper)



|   |                               |    |                                      |
|---|-------------------------------|----|--------------------------------------|
| 1 | Safety Decal - Waterbox       | 9  | Safety Decal - Fingers out of hopper |
| 2 | Safety Decal - Reverse pump   | 10 | Safety Decal - Not a platform        |
| 3 | Safety Decal - Read manual    | 11 | Safety Decal - Air in line           |
| 4 | Safety Decal - PPE            | 12 | Safety Decal - Breathe hazard        |
| 5 | Safety Decal - Pipe Pressure  | 13 | Safety Decal - Remote control        |
| 6 | Safety Decal - Coupler leaks  | 14 | Safety Decal - Hand signals          |
| 7 | Safety Decal - Oil leaks      | 15 | Safety Decal - Air in hopper         |
| 8 | Safety Decal - Stay off grate | 16 | Safety Decal - Hopper instructions   |



# SAFETY MANUAL

## 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!

Version 7.0.1  
February 2015

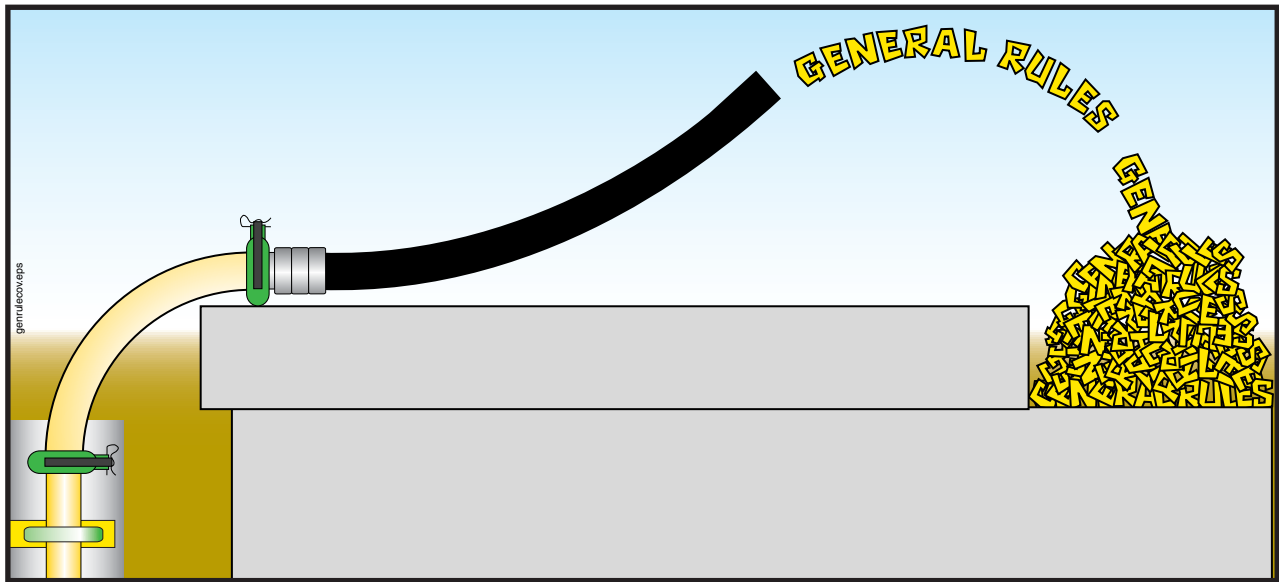
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## I. Before You Leave The Yard

### 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;

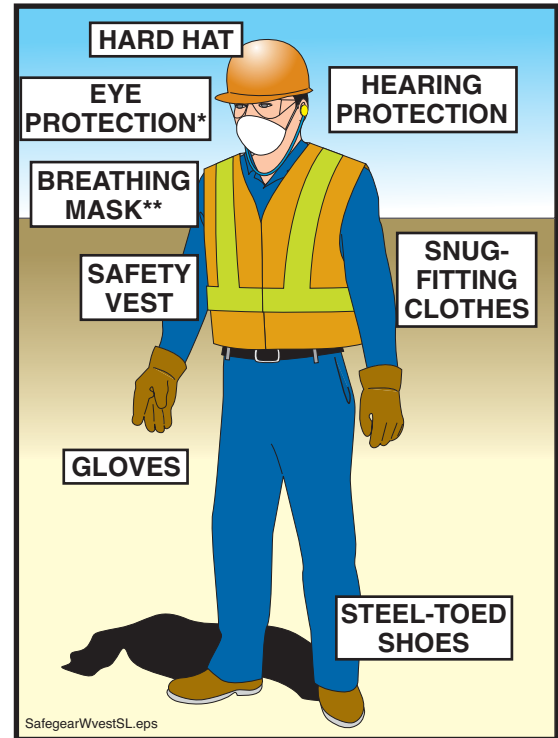
In addition, you should wear:

- 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.

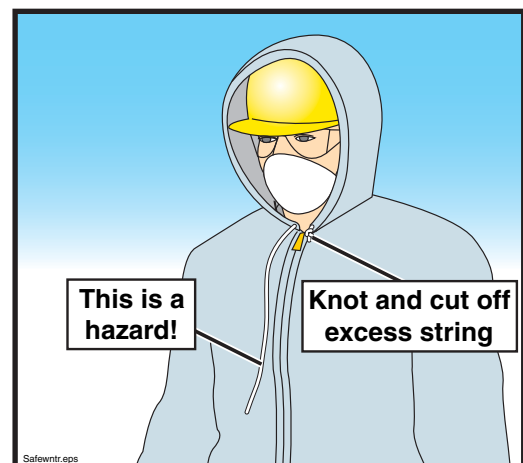
\*\* Breathing mask needed when cement dust (or other toxic dust) is present in the air.



**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**

# SAFETY MANUAL

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.

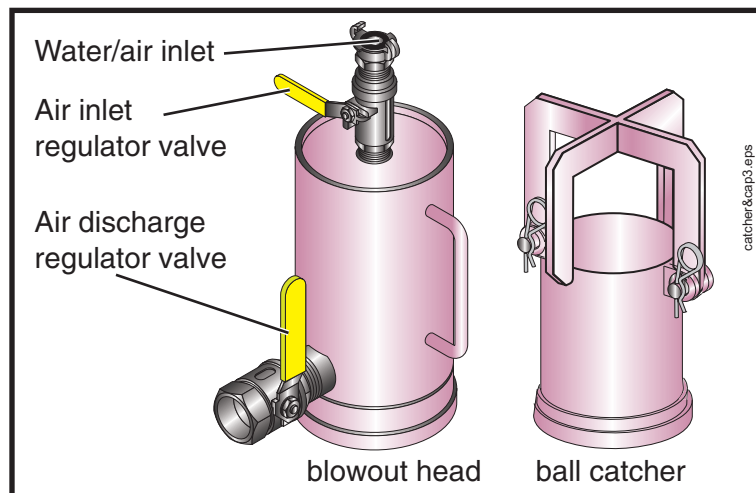
### 3. What To Check Before You Leave The Yard

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).

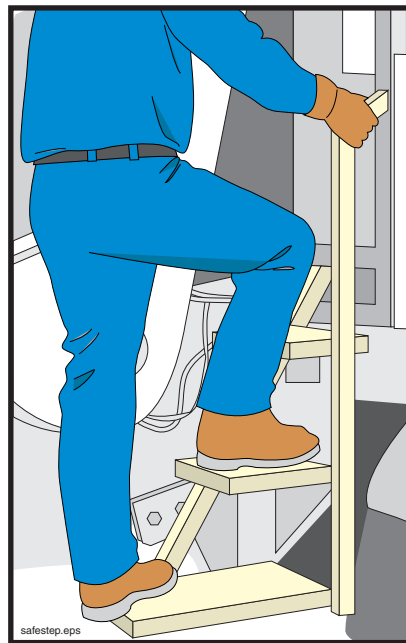


**Figure 4**  
**Compressed air accessories**

- 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.

# SAFETY MANUAL

- 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).



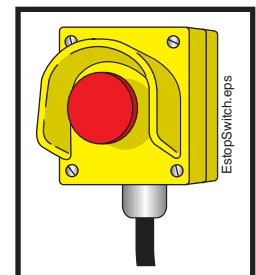
**Figure 5**  
**The 3-point Rule**

- 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.

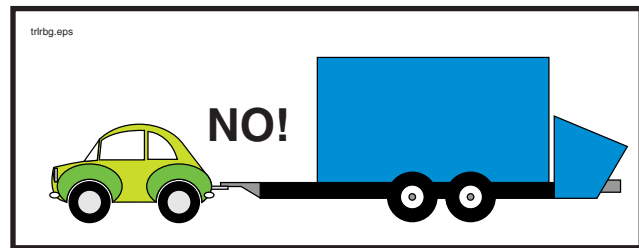
**Figure 6**  
**Periodically check your emergency stop switches (E-stops) for proper function**



#### 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



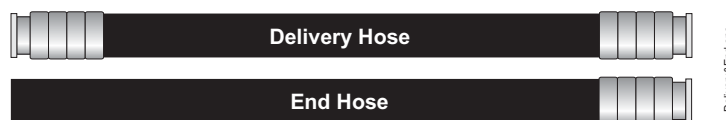
- 4.2 **WARNING** Never tow a trailer that has concrete in the hopper. The extra weight in the back of the machine will remove weight from the tongue and cause the trailer to fishtail.
- 4.3 **WARNING** Check the tires, tire pressure, and brakes on the trailer before towing. Never tow a vehicle with 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.

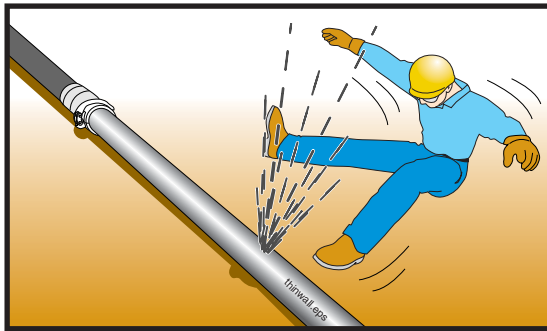
**Figure 8**  
End hose vs delivery hose



## SAFETY MANUAL

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.

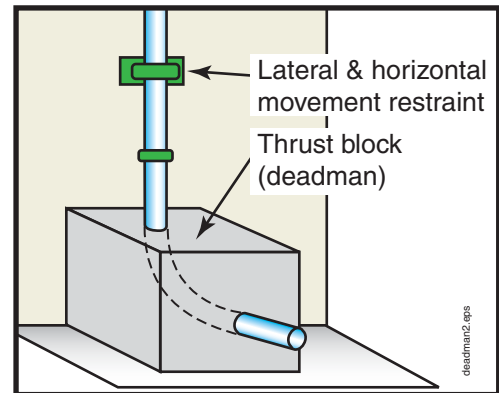
5.17

**⚠ 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

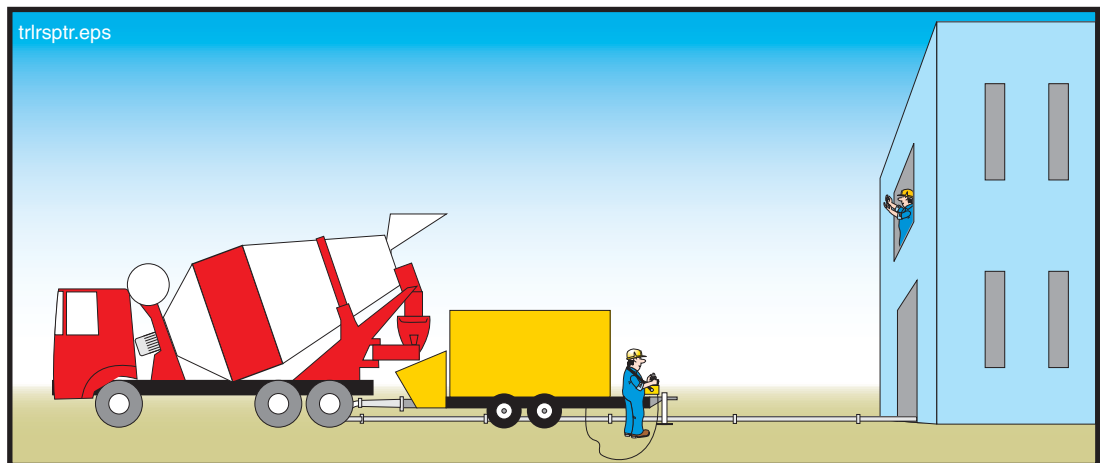
**⚠ WARNING** In vertical runs, the weight of the vertical sections of pipe must be supported by a thrust block (often called a *deadman*, Figure 10) or other load-bearing device. **Each section of pipeline in a vertical run must be secured from lateral and horizontal movement.**



**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!**



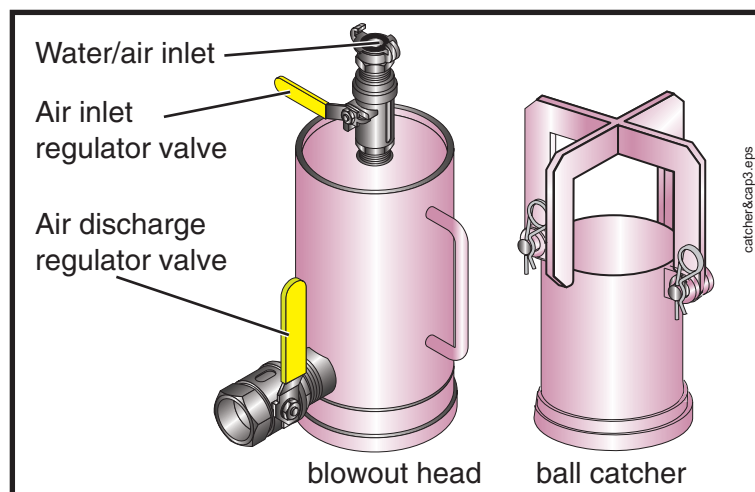
**Figure 11**  
Arrange communications before starting

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!**



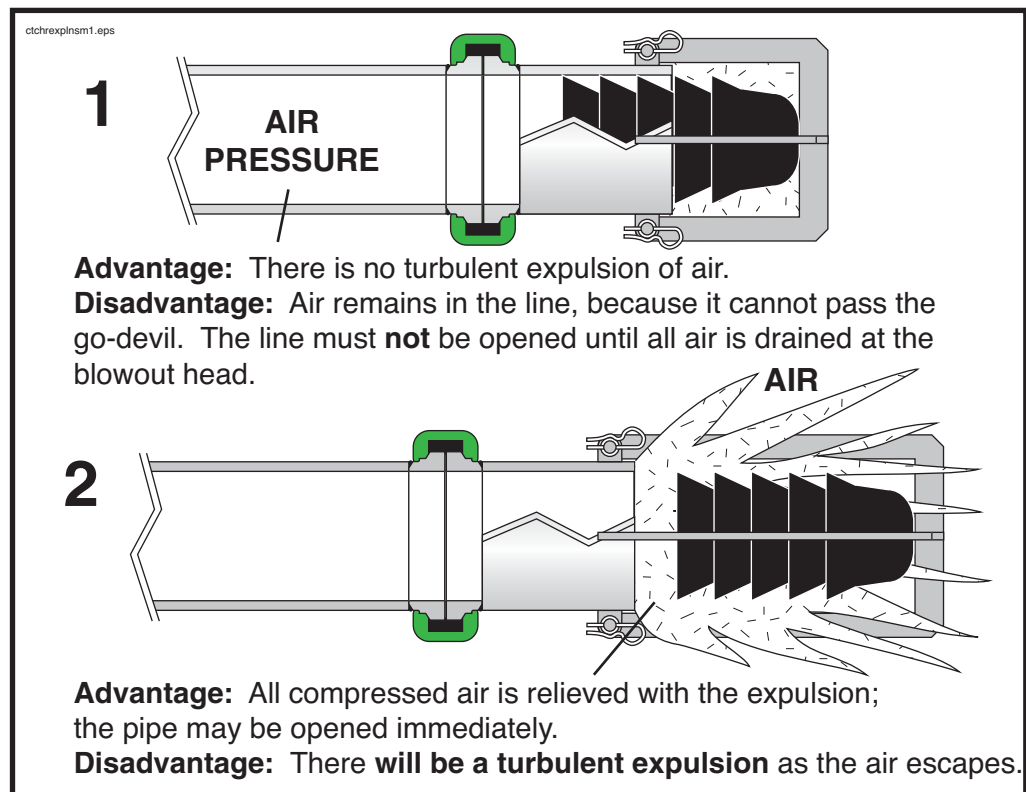
**Figure 12**  
**Ball catcher and blowout head**

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:

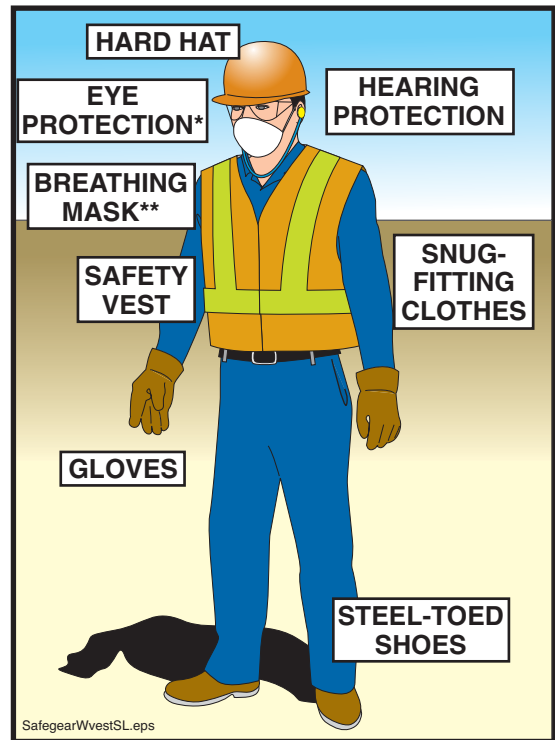
- has reached the age of 18 years (21 for interstate travel);
- is physically and mentally capable;
- has been trained in the operation and maintenance of the pump and the placing boom (if applicable);
- has demonstrated their capabilities to the employer in respect to the operation and maintenance of 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.

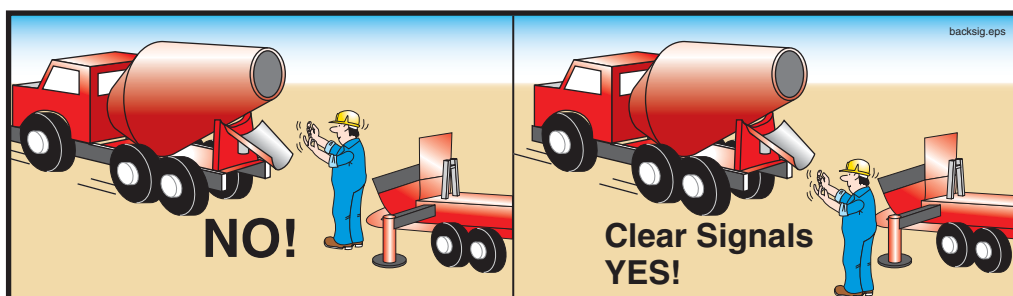
\*\* Breathing mask needed when cement dust (or other toxic dust) is present in the air.



**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<br>in HOURS | Sound level in dB (A)<br>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**

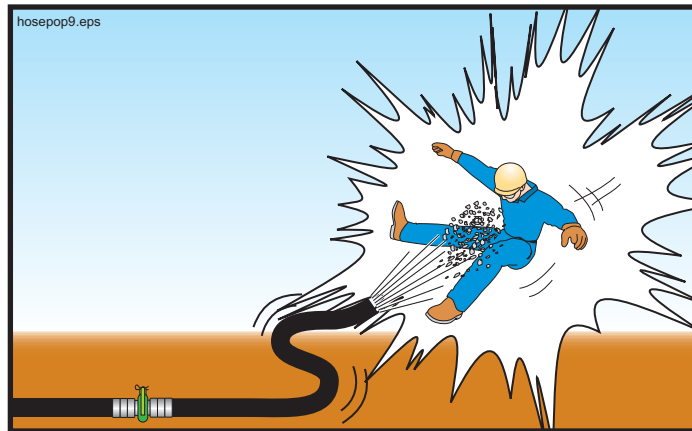
## 6.10

**⚠ 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

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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 unkink 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.

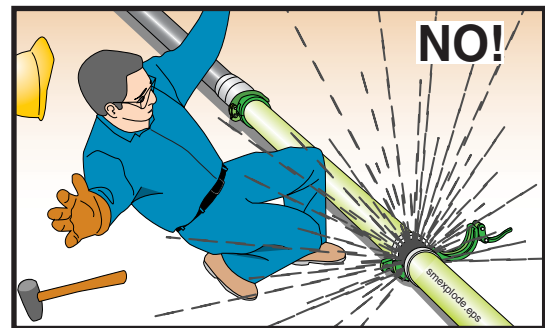
6.16

 **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

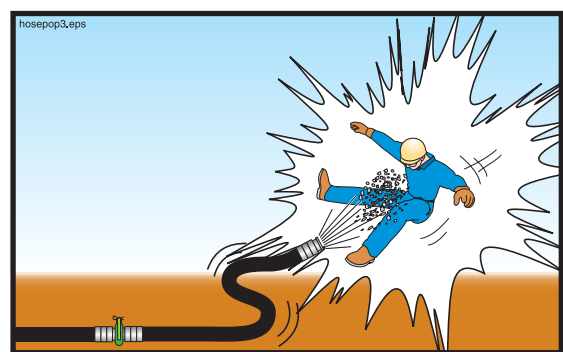
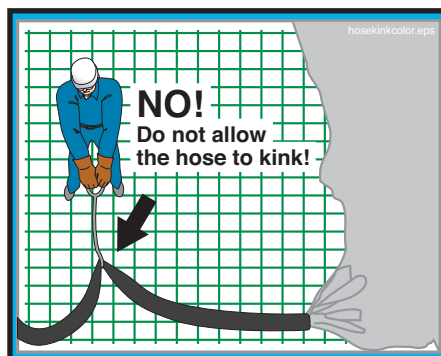
jammed material will keep the pipeline from vibrating. (This method won't find a plug in a hose.)

- 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

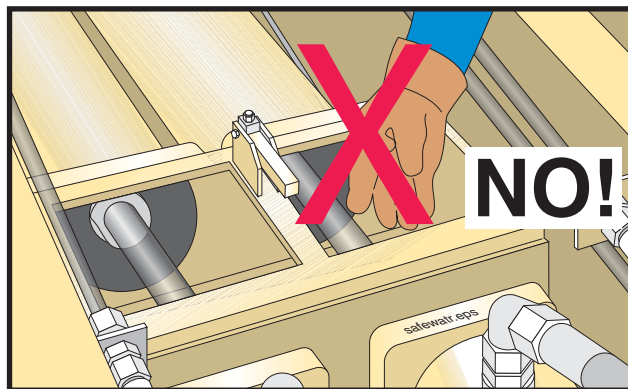
**⚠ WARNING** Never stand on, sit on, or straddle a pipeline while it's in use, or whenever it is pressurized. Pipeline wears out with each stroke of the pump. If the pipe bursts, you want to be to the side of it, not on top of it (Figure 20).



**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

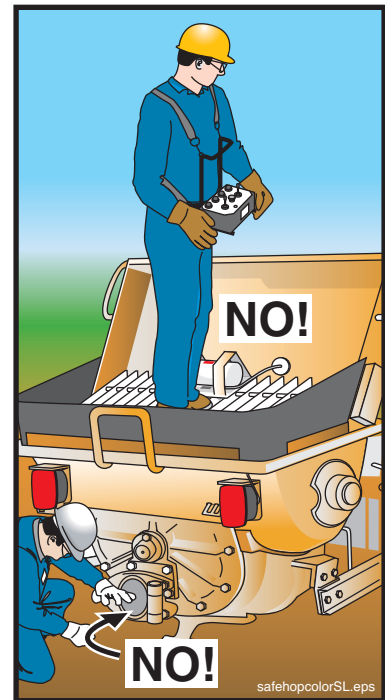
**⚠ WARNING** Never leave the pump unattended! Before you leave a laborer, ready mix driver, or any other worker alone with the pump for any reason, make sure the worker who you leave with the pump knows:

- 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.)

**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

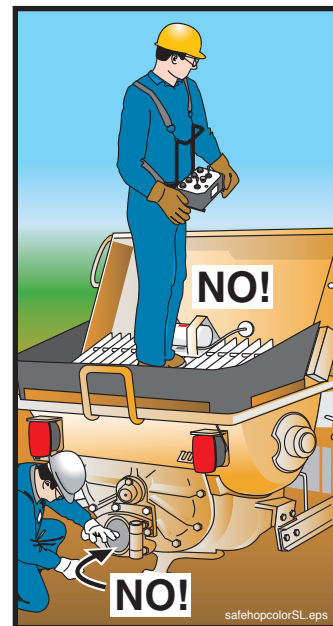
**⚠ WARNING** Check forms and rebar for stability—both backward and forward—before shotcreting. The rebar cage needs to be tied to something—usually the back form. When the shotcrete wall is being built up, the placed shotcrete wants to sag forward, bringing the rebar with it. If the rebar moves, the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

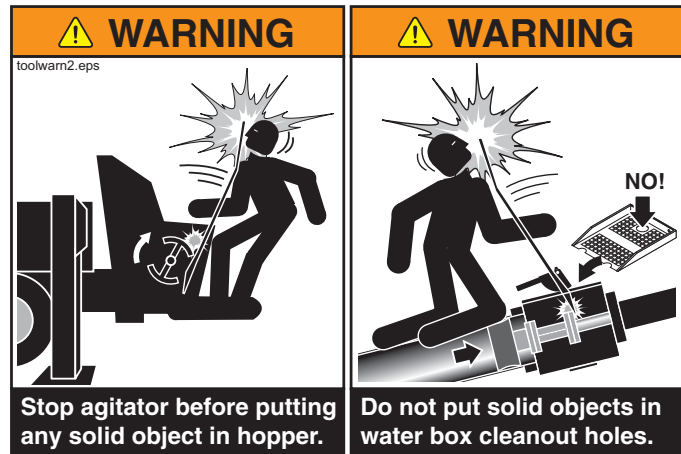
**Figure 27**  
**Keep your body parts**  
**out of the machine**



- 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

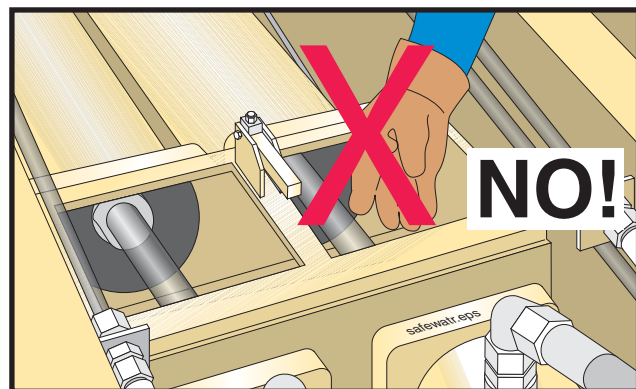


**Figure 28**  
Don't put solid objects into working systems

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

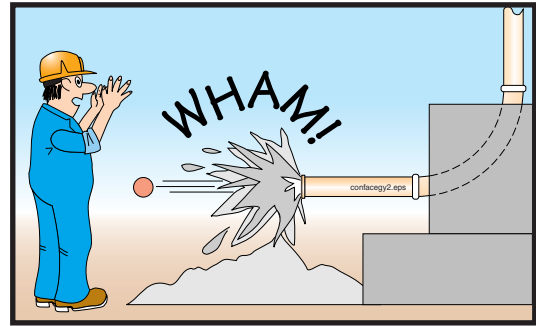
10.1 **WARNING** Flying particle hazard! Clear the discharge area of personnel and equipment before forcing a ball or go-devil through the pipeline, even if you are cleaning with water. Some air will be trapped in the pipeline, and the trapped air will become compressed before discharge.

## SAFETY MANUAL

**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.

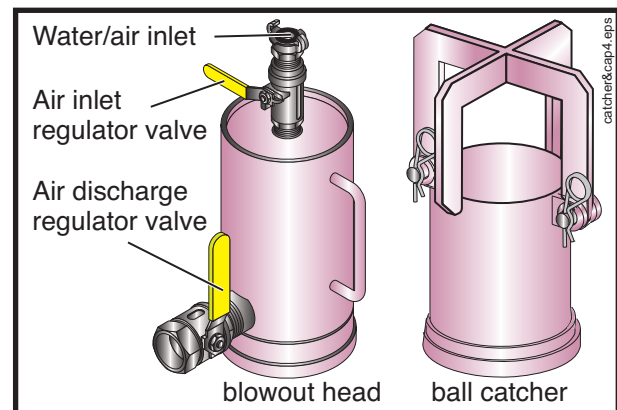
**10.7** **⚠ WARNING** It is better to let the pipe be ruined by setting concrete than to risk injury by ignoring safe procedures. Remember, pipeline is replaceable, you are not.

**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

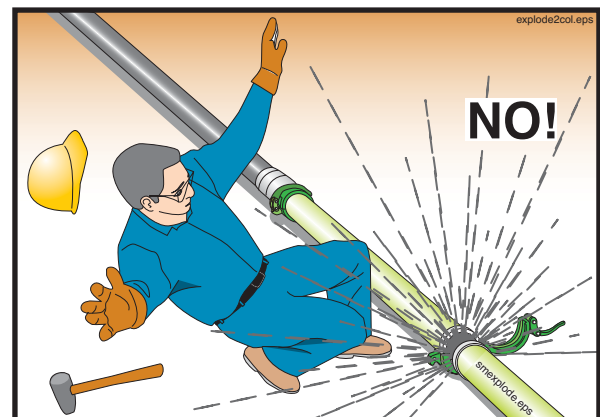
cleanout station erected to route the discharge into the ready mix truck.

- **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.)

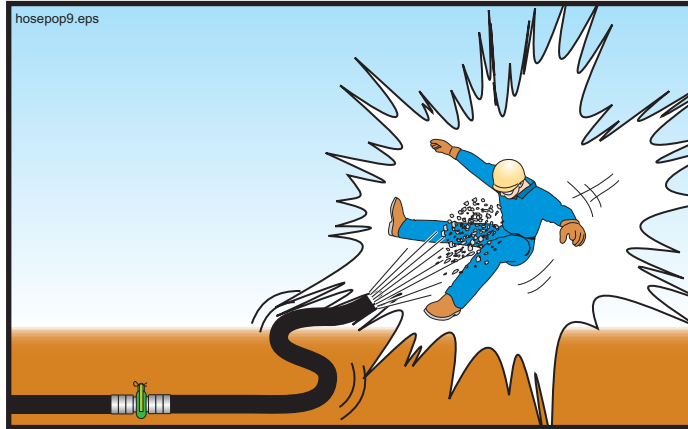


**Figure 32**  
Never open a  
pressurized  
pipeline

- **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

# SAFETY MANUAL

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**

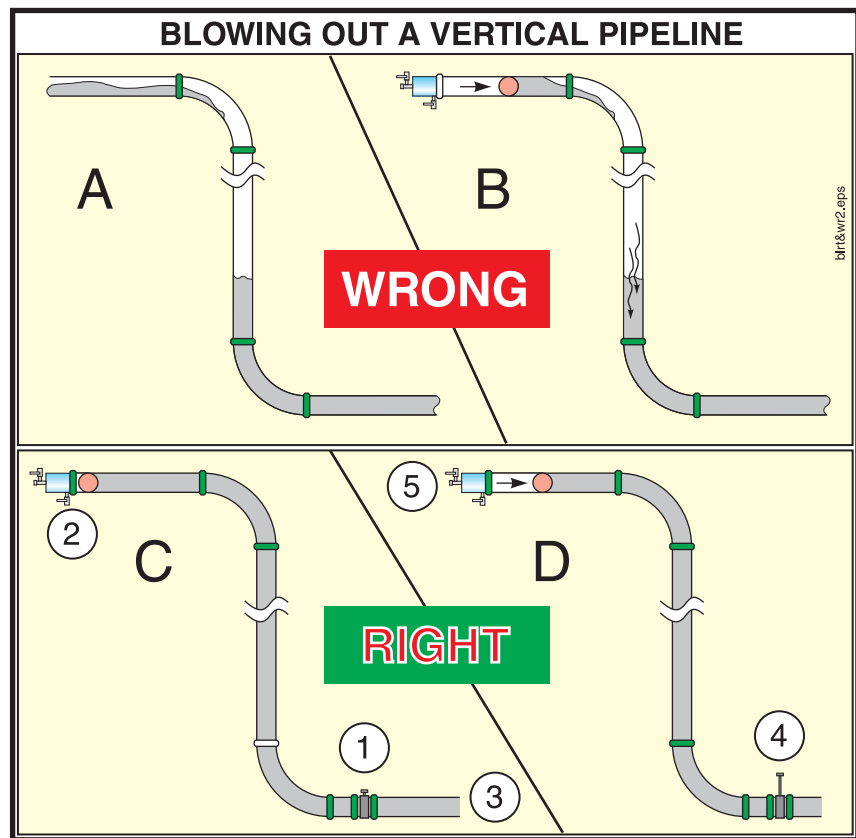
- **When air pressure begins to drop rapidly, shut off the air supply from the compressor, and immediately begin bleeding air out of the pipeline.** (The drop in pressure signifies that the pipeline is almost empty of concrete.)

## 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

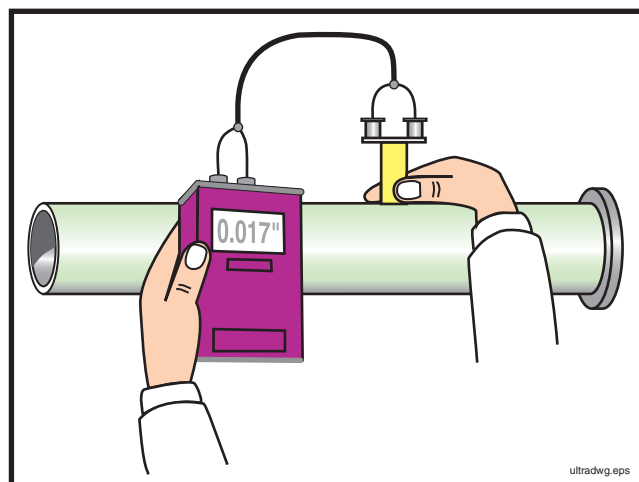
**⚠ WARNING** Never use compressed air to attempt to clear a blockage! It is unsafe and unnecessary. If the pump pressure can't move it, air pressure won't either.



## V. Maintenance Of The Machinery

### 11. Safety Rules Regarding Inspection

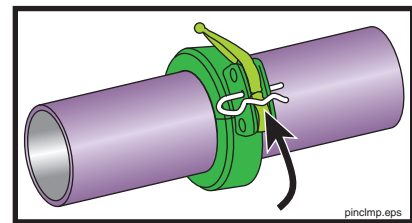
- 11.1 **⚠ WARNING** Visually inspect your unit each day before it is put into operation. If any problem is found that will affect the safe operation of the pump, don't use the pump until it is repaired!
- 11.2 **⚠ WARNING** If safety decals are faded, missing, damaged, or otherwise unreadable, they 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.

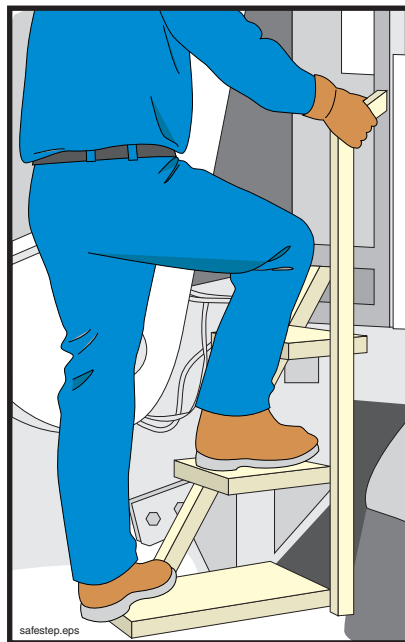
## 13. Safety Rules When Servicing The Machinery

- 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** **Electrocution 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.

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- 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**

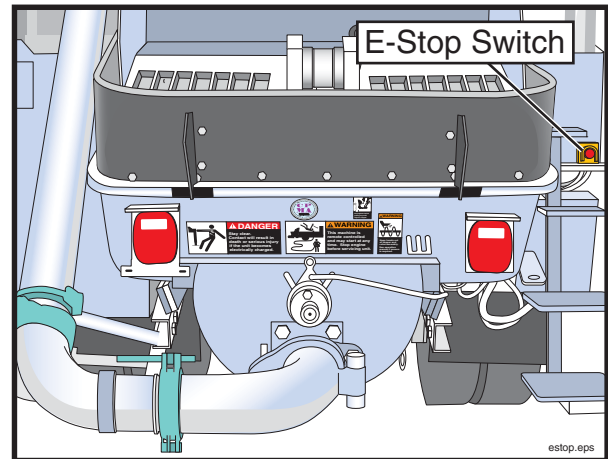
- 13.14** **⚠ WARNING** Always use the correct tools for the job. Tools should be kept clean and in good condition.
- 13.15** **⚠ WARNING** If you see a coworker engaging in an unsafe practice, warn him about the dangers. Safety is always in the hands of those on the job!
- 13.16** **⚠ WARNING** After 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).



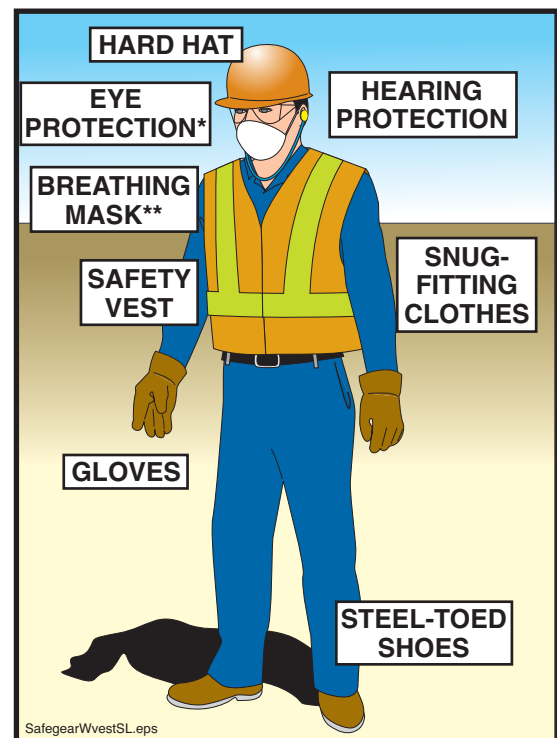
**Figure 39**  
Know how to stop the unit in an emergency

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

## SAFETY MANUAL

14.3

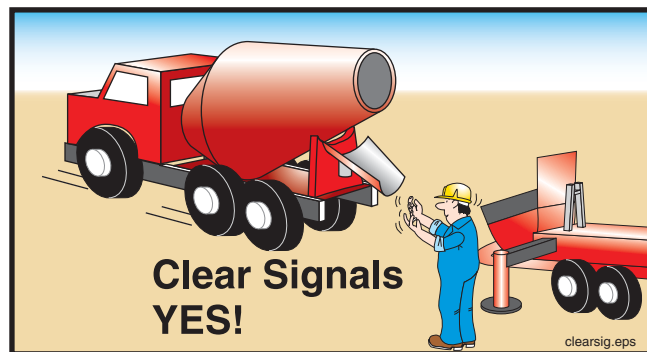
**⚠ WARNING** Crushing hazard. Never, ever position yourself between the ready mix truck and the pump! Stand to the side, where the driver can see you (Figure 41).



**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.



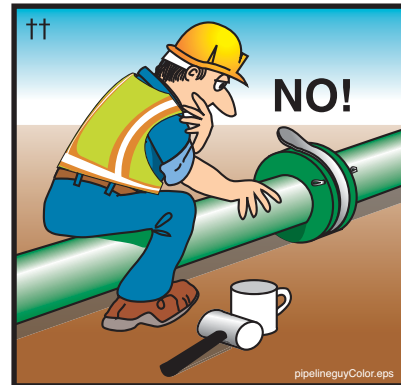
**Figure 43**  
**Remove everyone from the discharge area**  
**whenever air has been introduced into the line**

# SAFETY MANUAL

**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.

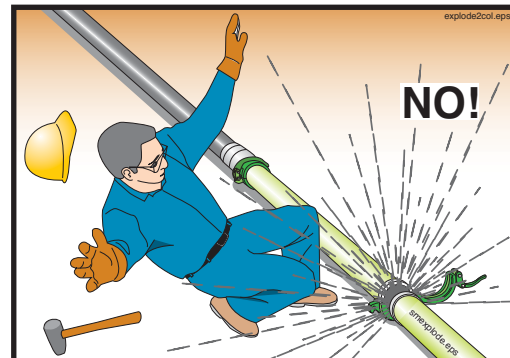
**14.12** **⚠ WARNING** **Never use compressed air to clear a blockage!** The operator is responsible for knowing the safe blockage removal procedures. It is unsafe and unnecessary to use compressed air. If the pump pressure cannot move it, air pressure won't either.

**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.



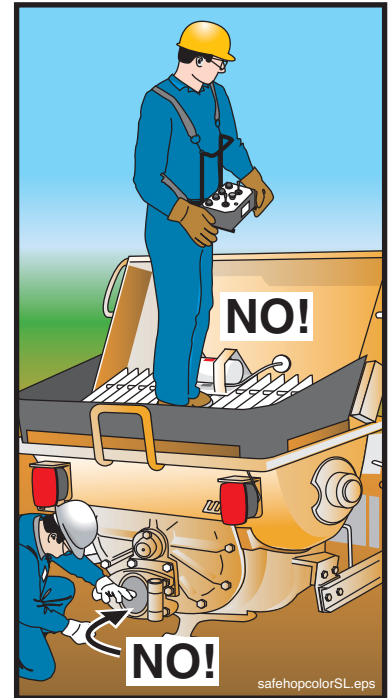
**Figure 45**  
Never open a pressurized pipeline

**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

# SAFETY MANUAL

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.



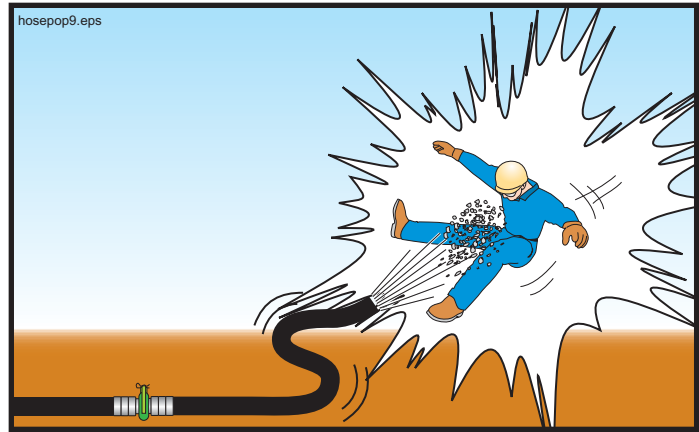
**Figure 50**  
Wear Personal Protective Equipment (PPE)

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:

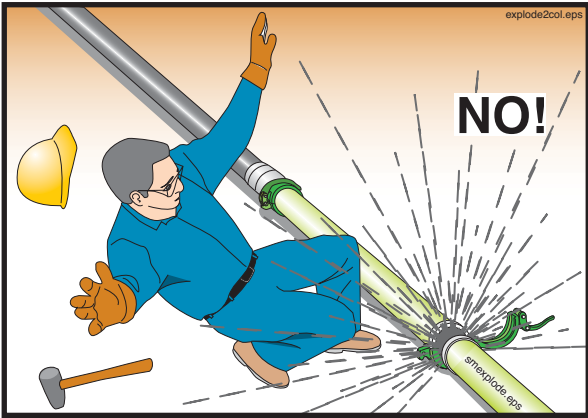
- Get to ground level (if in a high place) and remain well away from the discharge or at least take cover.
- Stay away from the discharge. Be sure that **all** the air is gone before getting near the point of discharge again. It is the operator's job to know when it's safe to go back to normal pumping.

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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.

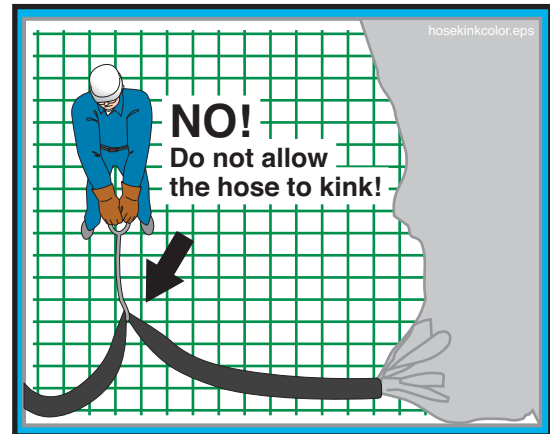


**Figure 52**  
**Never open a pressurized pipeline**

- 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.

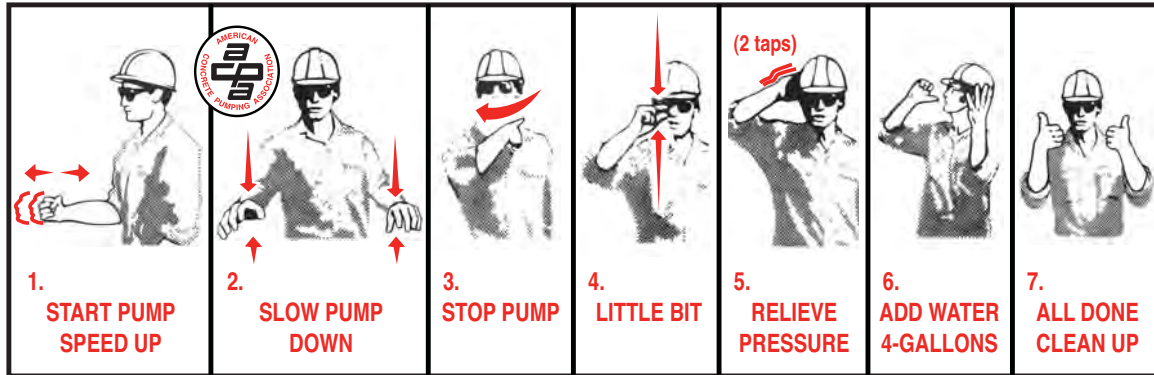


**Figure 54**  
Never straddle or sit on a pressurized pipeline

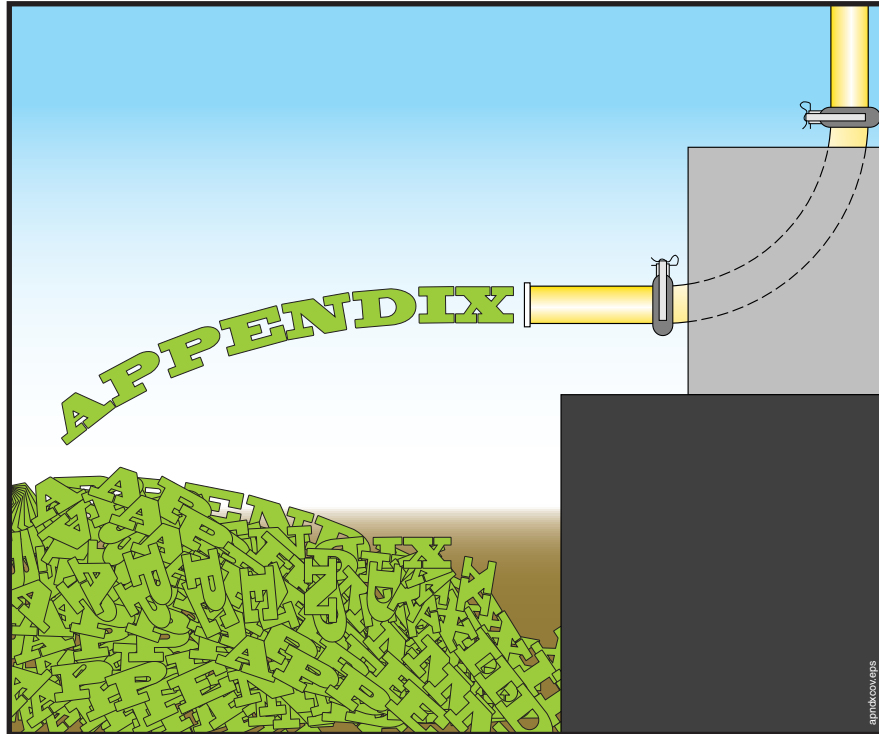
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**15.13** **⚠ WARNING** To avoid confusion and conflicting signals, only one person should act as a signalperson (give operational signals to the pump operator). However, the operator is trained to obey a stop signal from anyone and everyone.

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



**Figure 55**  
**Recommended ACPA hand signals**



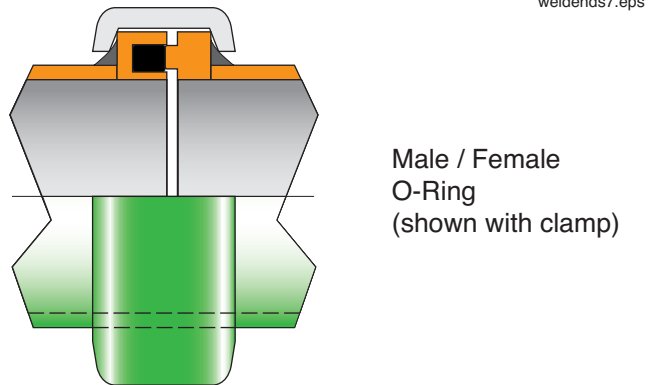
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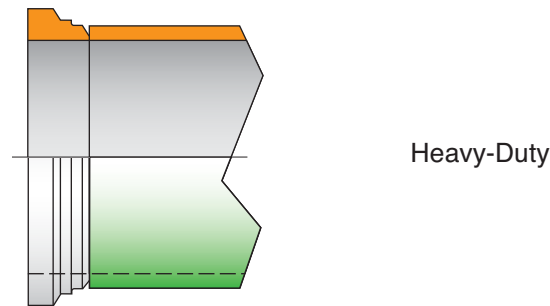
**VII. Weld-On Ends/Coupling Comparison**

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.

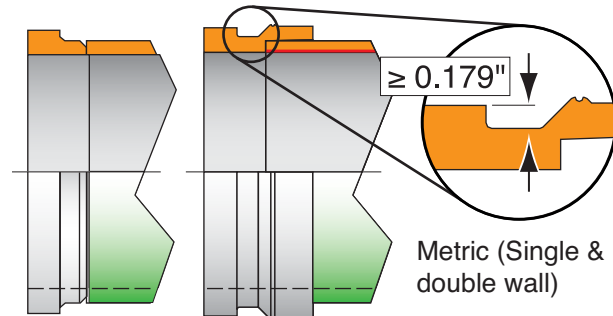
1. Male/female o-ring type couplings have the highest pressure rating of the ends commonly used for concrete pumping. They can withstand 4350 PSI @ a 2:1 safety factor. They are self-aligning and waterproof when used with o-rings in good condition. Typically not used on booms because of their weight.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



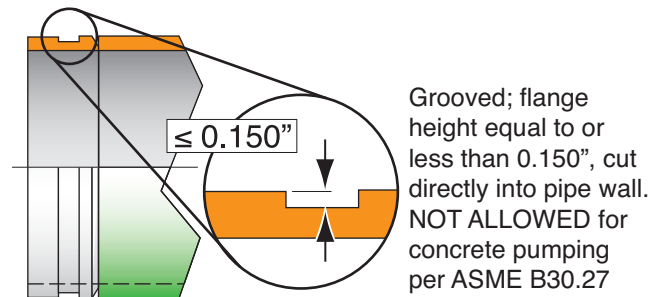
2. Heavy-Duty couplings are designed for pressures up to 2250 PSI @ 2:1. They have 20% more contact area than metric couplings, and a tapered face that draws the pipe sections together during assembly. Both the ends and clamps weigh more than metric style, and therefore should not be used on booms without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



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



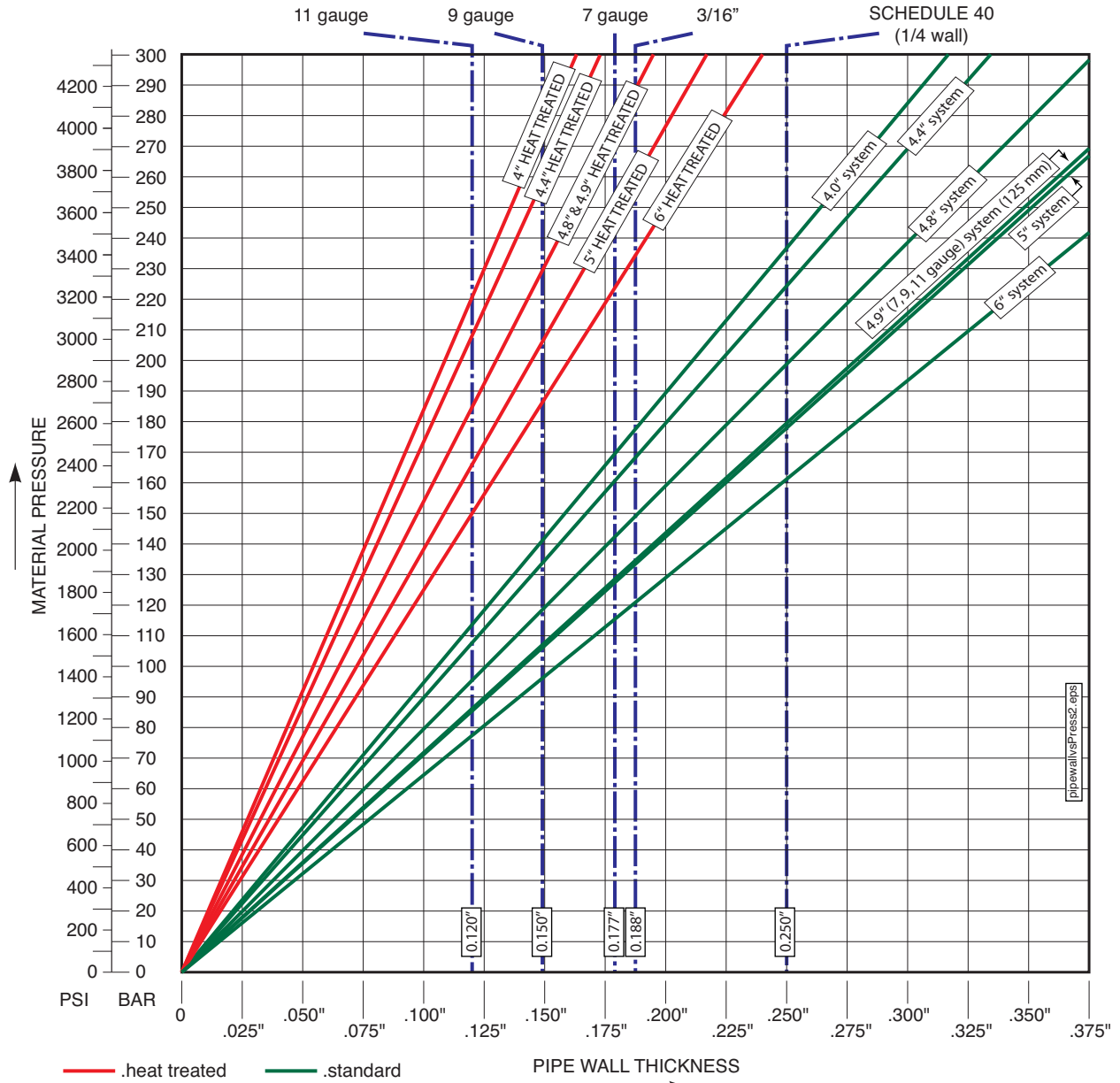
4. Grooved (Victaulic) couplings (lip height of 0.15” or less) are designed for pressures only up to 750 PSI @ 2:1. The recessed groove is hard to clean when changing pipe on a job. The weld-on end fails before the pipe because the groove is cut into the pipe thickness, making it the weakest spot. Grooved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



**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

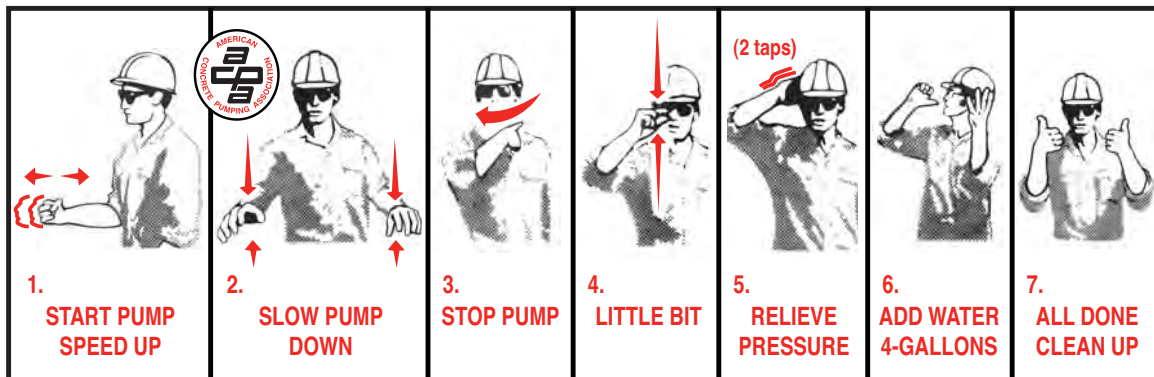
Sections of concrete delivery pipeline that are running in an up (or down) direction. Vertical runs have very specific procedures and rules for installation, support, cleaning, and inspection. Concrete pumping personnel should, therefore, have specific training in these procedures and rules before attempting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



## XI. Bibliography

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

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

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

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

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

Additional technical information and/or graphic were supplied by:

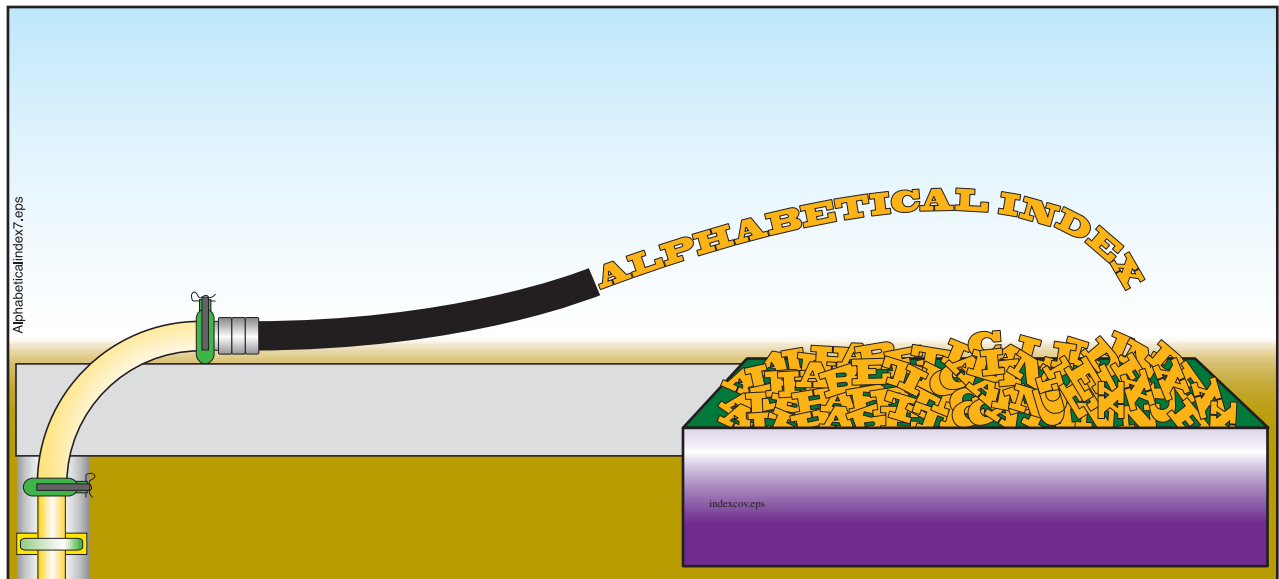
Construction Forms, Inc.

The American Concrete Pumping Association

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

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### Machine Inspection

Each of the following items should be checked upon initial product delivery and before each use thereafter. Any malfunctioning components or systems should be repaired or replaced prior to operation.

|    | Description  | Check |
|----|--|-------|
| 1  | Agitator greased                                   |       |
| 2  | Rock valve greased                                 |       |
| 3  | Main pressure relief setting                       |       |
| 4  | Pressure gauge functions properly                  |       |
| 5  | Hydraulic hoses and fittings checked for leakage   |       |
| 6  | Concrete pump - forward/reverse operation          |       |
| 7  | Agitator - forward/reverse operation               |       |
| 8  | Remote control functions                           |       |
| 9  | Manual check of hand valves, overrides             |       |
| 10 | Safety decals                                      |       |
| 11 | Tools/spare parts included (initial delivery only) |       |
| 12 | Visual paint inspection (initial delivery only)    |       |
| 13 |  |       |

### Site Installation

Proper site selection and inspection is critical to concrete pump performance and operator safety. Upon arriving on a new job site, the operator must observe site for any potential obstacles, hazards, and undesirable soil conditions. Consult your construction equipment (power source) user manual and/or dealer to determine necessary site conditions for your equipment.

### Skid Steer Requirements

Your concrete pump must be connected to a skid steer with adequate horsepower and weight to provide satisfactory results. Tracked loaders will provide superior traction in ground engaging applications and wheeled loaders may provide the best option for above ground material handling applications. The Mud Demon attachment plate will connect to the couplers on most major brand skid steer loaders. Do not modify the attachment plate to fit older styles of attachment couplers on older machines. Contact your skid steer loader dealer to supply an updated coupler on an older skid steer to fit this attachment. Your skid steer must also be equipped with an auxiliary circuit that is available on the loader arms and is controlled by a switch, pedal, or handle inside the skid steer loader cab.





## Operation

### Attaching to Skid Steer (or other construction equipment):

Verify that the hydraulic hoses are clear from the front of the attaching plate on the attachment and that the mounting plate is free from dirt and debris. When clear, move the skid steer to proximity of attachment plate. Tilt skid steer coupler forward to align coupling point with the upper part on the attachment plate and raise the coupler slightly.

When the top edge of the coupler is seated in the top part of the coupler plate, roll the skid steer tilt function back until the attaching plate is flat against the skid steer coupler. Lock down the coupler levers. Note: If your skid steer is equipped with a hydraulically operated coupler, activate the coupler lock at this time.

Before operating the attachment, always visually inspect and verify that the coupler lock pins are fully engaged through the latch slots on the attachment plate.

Connect the Stinger hydraulic hoses to the auxiliary supply couplers located on your skid steer loader lift arm.

**NOTICE: To keep contaminants from entering the hydraulic system, wipe off any dirt or dust from the male or female hydraulic flat-face cou-**

### Starting the machine:

- Enter and start the skid steer
- Activate skid steer parking break
- Activate the skid steer auxiliary hydraulic circuit and adjust engine RPM and continuous flow to desired settings.
- Activate the auxiliary hydraulics override. [This allows the operator to exit the skid steer cab while auxiliary hydraulics remain activated.]
- Exit skid steer.

On the concrete pump control panel:

- Select desired control type: Manual
- Set pump direction to: Forward (FWD)
- Set pump flow to: On
- Slowly turn the 'Pump Flow' dial clockwise to increase pump output.
- If the pump is stroking properly, you can either shut down the machine or begin pumping the job

### Shutting down the machine:

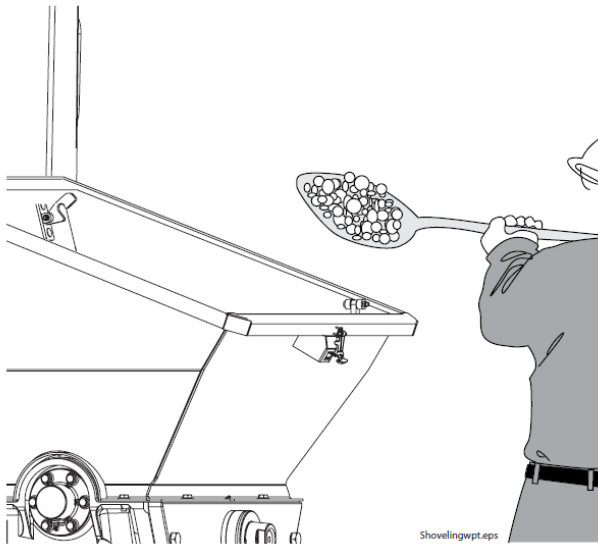
- Set pump flow to: Off
- Enter skid steer and deactivate the auxiliary hydraulic circuit.

### Adjusting concrete output:

- The concrete output can be increased or decreased by adjusting the 'Pump Flow' dial. This will adjust the output from 0 strokes per minute when set in the max counter-clockwise (CCW) position and will adjust to max output when in the max clockwise (CW) position.

### Lubricating Slurry

Shovel a couple loads of sand or dirt into the bottom of the Transfer tube housing, above the cleanout door. This will prevent concrete from filling the door area and setting during the course of the day. See (Figure 16).



**Figure 16**  
*Sand to Cover Hopper Cleanout Door*

### Lubricating the pipeline

When the ready-mix trucks arrive on the job, the pipeline can be lubricated. Schwing America highly recommends that you pre lubricate the pipeline each time you pump into dry pipe. In some parts of the United States and Canada, the concrete is so rich with cement fines that operators do not pre lubricate before beginning pumping operations. This practice is not recommended. The time you save by skipping pre lubrication is far less than the time you will spend removing pipe sections from a separately laid pipeline to remove a rock jam caused by dry pipe. Most importantly, the blockages caused by failure to lubricate can be dangerous (see the information on blockages in the Safety Manual.)

There are commercially available products that will lubricate a pipeline with much less volume (meaning much less weight) than portland cement and water. These products usually come in sandwich sized plastic bags, and lubricate about 100 feet of 5 inch pipe per bag. Instructions for mixing vary by the different manufacturers. These products are less expensive than

portland cement, and do not set like cement. If you use these products, pay close attention to the instructions and warnings on the package.

If you only have portland cement for lubricating your pipeline, you will have to wrestle with the weight. Before you begin to mix the slurry, put on your breathing mask and the rest of your personal protection equipment. Choose one of the methods shown below, based on the job situation.

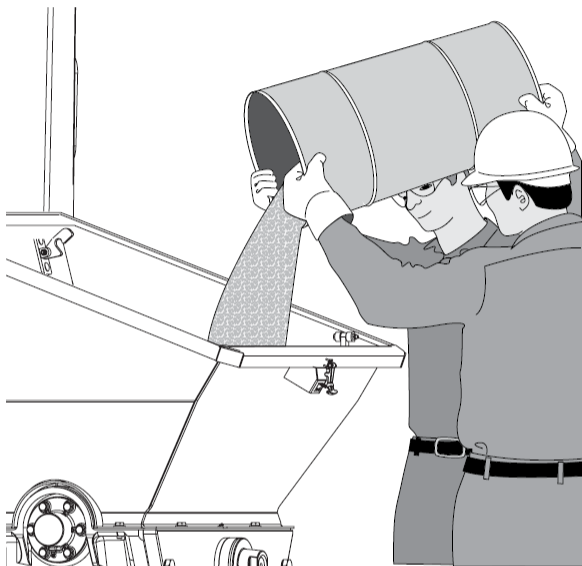
#### Barrel Method

If you have a helper assigned to work at the pump, you can mix the slurry in a barrel. The barrel method allows you to get good consistency and to break up clumps of cement in the slurry (Figure 17). However, you will need to lift the barrel, which weighs 200 to 300 pounds, and pour the slurry into the hopper. You should not attempt to lift this barrel alone. To use this method, lay a sack of portland on top of the barrel that has been filled with about 25 gallons of water. Use a shovel blade to break open the sack, allowing the cement to fall into the barrel. When the bag is empty, set it off to the side and mix the cement and water with the shovel blade. Break up any cement clumps and continue mixing until the mixture is smooth and creamy. You will need a helper to assist in lifting the barrel and pouring the mixture into the hopper (Figure 18). It may not cover the openings to the material cylinders, but this is not important at the moment.



**Figure 17**  
*Mixing Slurry In Barrel*

Make one barrel of mix for each 100 feet of laid pipeline that the concrete will be going through. If the concrete will be going through more than 200 feet of pipe, you, your boss, or the job site supervisor should arrange to have a grout mixture supplied to you by the ready-mix plant. Unless you have at least 1/2 yard of grout mixture delivered to the pump, do not try to pump this mix yet. Using the barrel method, you can add a little sand, if needed, to stretch the amount of slurry mixed. This is helpful if you must pump through 300 feet of line, but you have only two sacks of cement available.



**Figure 18**  
*Pouring Slurry into Hopper*

**Hopper Method**

If you have no one to help you lift the barrel, lay the sack of cement on the hopper grate and break it open.

---

**WARNING** Amputation/crushing hazard. Never stand on hopper grate.

---

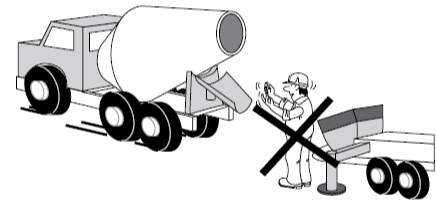
Get a water hose and direct the spray into the hopper, aiming at the edge of the pile of cement. This will wash the cement into the bottom of the valve housing and will mix the cement as well. Try to break up clumps of cement with the spray, but do not put your hands or any other body part into the hopper. Mix more slurry as needed for the length of the pipeline, as described above.

- After the correct amount of slurry has been placed in the hopper, open the hopper lid and direct the first ready-mix truck to backup to the hopper. Do not stand between the ready mix truck and the concrete pump. You could be crushed between the machines.

---

**WARNING** Never allow anyone to stand between the concrete mixer truck and the pump. Crushing hazard.

---



- Look at the concrete before putting it into your hopper. If the mixing fins of the truck are badly worn, the rock, sand, cement, and water will not be properly mixed. Do not allow a chute full of gray rocks to be put into your hopper; you will almost certainly plug the line before you get concrete out of the pipe. If the first chute full is all rock, have the driver dump it off to the side and show you the next chute full. The second chute full will almost always look much better than the first. If it does not, dump it to the side, too. You will learn by experience what mixes can and cannot be pumped. When the mix looks good, place the pump in forward using the Concrete Pump Forward Button. Take a couple of strokes to get some of the slurry into the pipeline ahead of the concrete. Position the Transfer tube so the open cylinder is on the opposite side of the hopper from the ready-mix chute, and shut off the pump. This allows the concrete to push the remaining slurry, below the Transfer tube, into the open cylinder. It also helps to place the agitator in reverse to pull the rocky part of the first chute full of concrete toward the end of the hopper, and direct the creamy concrete below the Transfer tube. Have the driver fill the hopper, and as the slurry is pushed into the open cylinder, you can put the pump in forward and begin pumping.

- Pump slowly and watch the concrete pump circuit pressure gauge until the slurry starts to escape from the pipe or hose. If the line plugs, immediately switch the pump to reverse mode, and notify the ready-mix driver to stop dumping. When pumping in reverse, always close the hopper lid to avoid escaping debris. To remove the plug, rock the concrete by alternately pumping a few strokes in forward and a few in reverse, or remove the plug manually. Rocking the concrete in forward and reverse usually only works well when pumping vertically, so gravity can help to create a vacuum in the line.

---

**⚠ WARNING** Expulsion hazard. Never remove a clamp from, or open a pressurized pipeline.

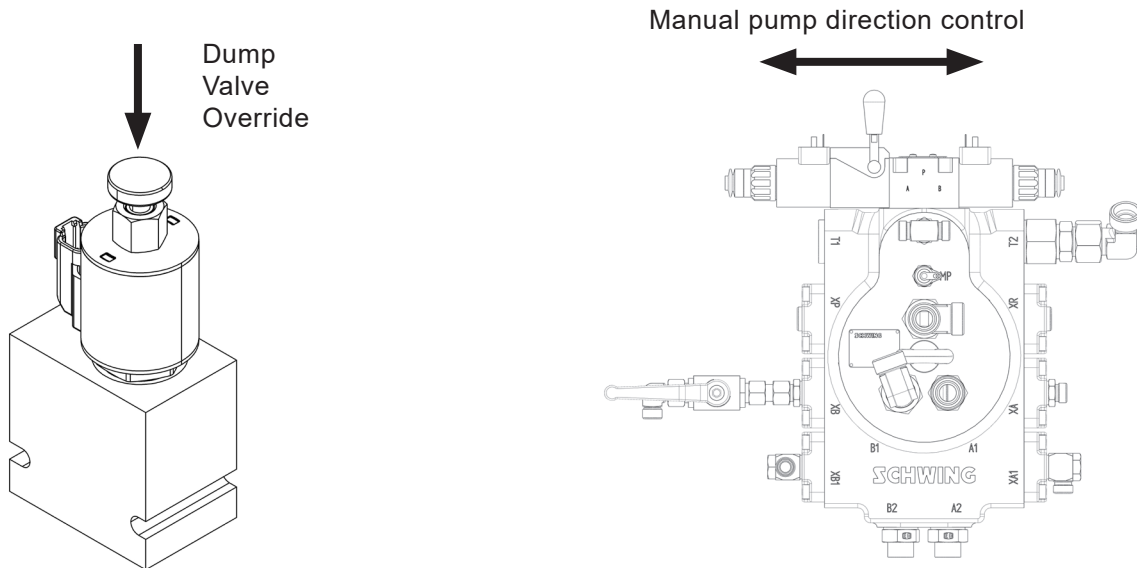
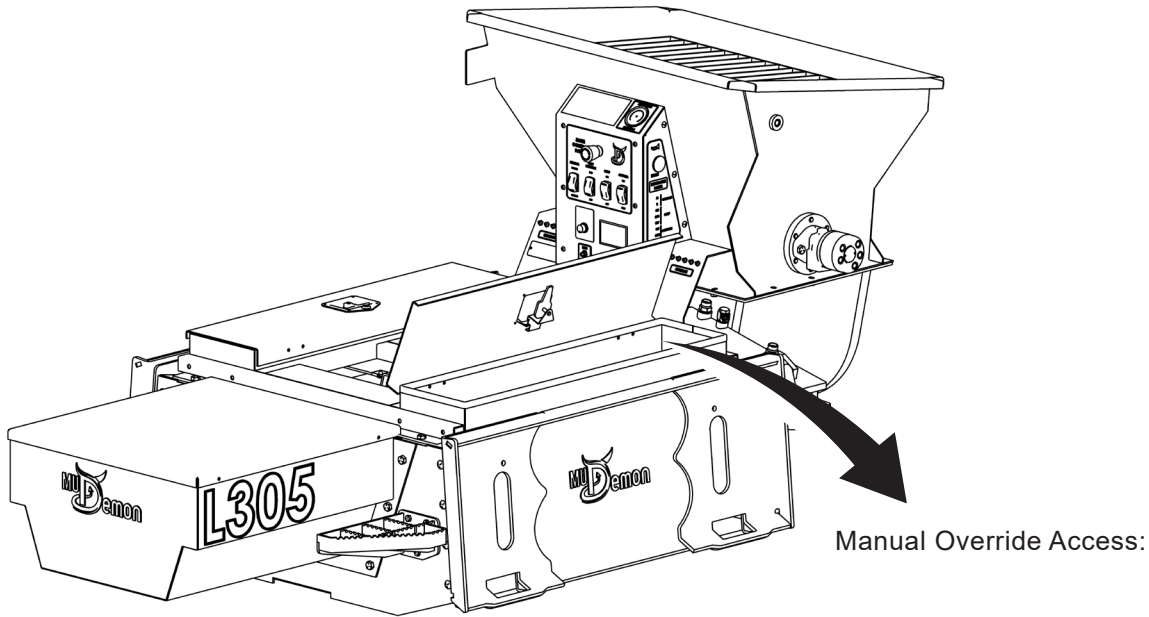
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You must not open a blocked pipeline without first sucking the concrete back into the hopper. Operating the pump into reverse for several strokes will release the pressure on the blockage. Understand the safety rules for opening a blocked pipe explained in the Safety Manual.

- Once concrete has emerged from the point of discharge, stop pumping. Wait for the start signal from your spotter before you start pumping.

**Emergency Operation (Power Loss):**

In case of electrical power loss, the pump can be operated in an emergency/override mode so that operator can clear placing system and pump components of concrete. These controls are meant for emergency use only and are not a means of standard operation. Inside the RH toolbox is a cutout which allows access to the dump valve and pump control valve overrides. With hydraulic flow being supplied by the skid steer, push the pump control valve override lever to engage preferred pump direction. With direction lever engaged, press down the dump valve override button, pump will begin to operate in chosen direction.



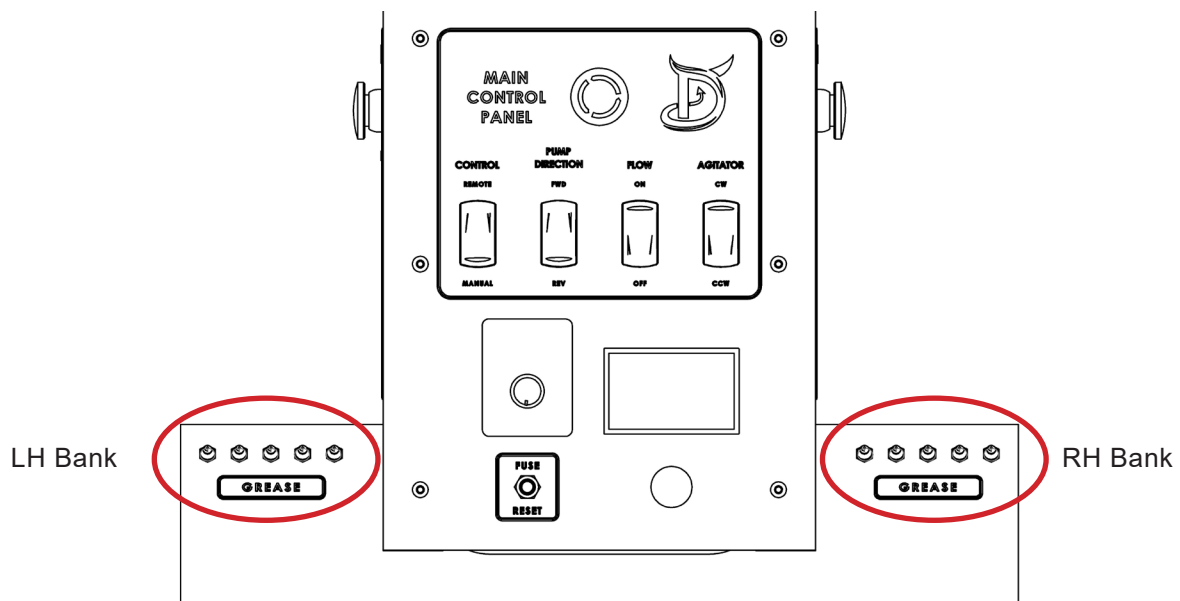
## Maintenance

### Scheduled Maintenance:

| Component                                | Daily | Weekly | Monthly | Semi- Annually |
|--|-------|--------|---------|----------------|
| Check differential cylinder rod packings | o     |        |         |                |
| Inspect bolts on S-Tube and rams         | o     |        |         |                |
| Grease all points on grease bank         | o     |        |         |                |
| Inspect for damage and leaks             | o     |        |         |                |
| Check if maintenance is due              | o     |        |         |                |
| Check mounting hardware                  |       |        | o       |                |
| Check hydraulic pressure                 |       |        | o       |                |
| Charge the accumulator                   |       |        |         | o              |

### Lubrication (Grease Points)

All grease points are located in one of the two (2) grease banks, located on the LH and RH side of the control panel. Grease all points daily. Add grease until seals begin to bulge. Over-greasing will cause grease to bypass seals and will result in premature wear.

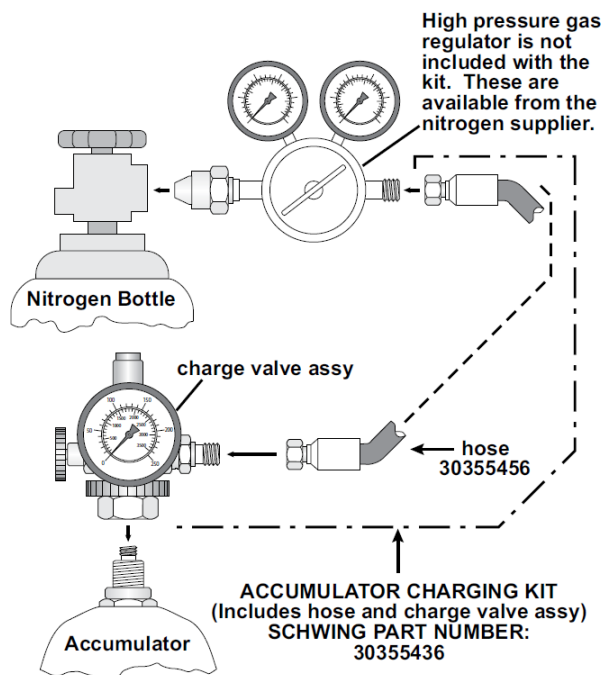
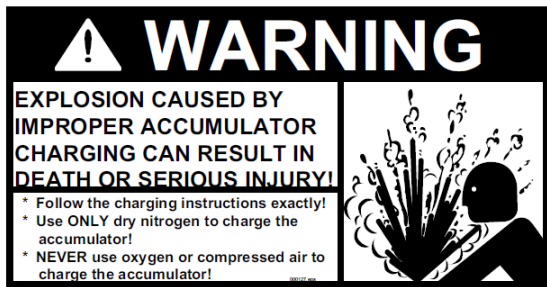


**Check mounting hardware.**

Check the mounting hardware at the connections between the main frame and quick attach plates, floor, and pumpkit. Check for bolt tightness, cracks, and other abnormalities.

**Charging Accumulators**

Check the accumulator gas charge every 6 months or 1,000 hours. Read all of the instructions before beginning the job. Accumulators must be charged only with dry nitrogen. Never use compressed air or oxygen, as the oxygen molecules will combine with the hydraulic oil and lower the flash point of the oil to below room temperature. You will create a major explosion by using compressed air or oxygen to charge accumulators. People have died using compressed air or oxygen to charge accumulators. Use dry nitrogen, not liquid nitrogen.

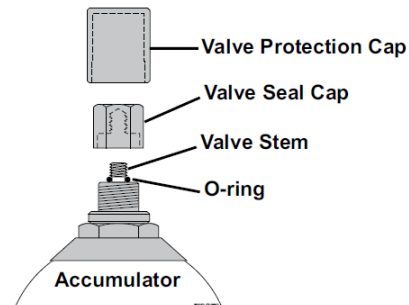


**Figure 12**  
 Accumulator charging kit

**Charging procedure**

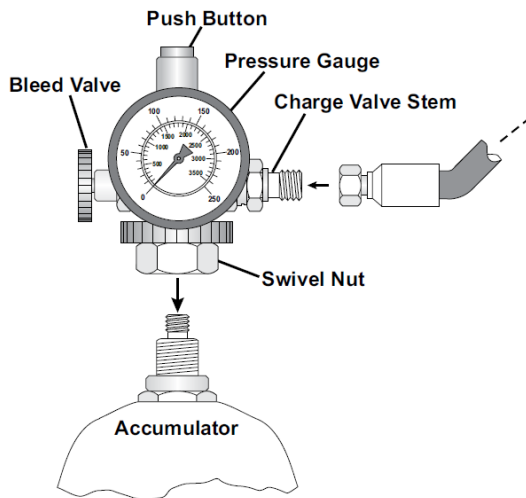
The following steps are required for checking and charging the accumulator:

1. Before you begin, you will need a charging kit (Figure 12). Do not attempt to charge the accumulators without one. Order the charge valve kit assembly from Schwing America using part number 30355436.
2. You must use a high-pressure regulator with the nitrogen bottle. If it was not supplied with the bottle, order one before proceeding with this job.
3. Before beginning the charging procedure, stop the engine, remove the key, and put a "Do Not Operate" tag over the key switch. Put the key in your pocket, so no one can start the engine.
4. Remove the valve protection cap and the valve seal cap from the accumulator that you will charge first.



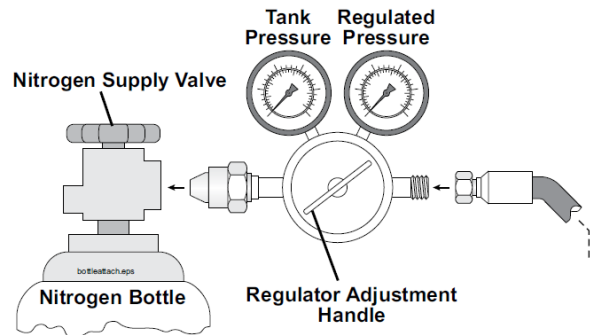
**Figure 13**  
 Accumulator protection cap

5. On the charge valve assembly ((Figure 14), close the bleed valve (turn it clockwise all the way in). If a hose is connected to the charge valve stem, disconnect the hose from the charge valve stem. This step closes the charge valve stem to prevent the gas pressure from escaping out of the hose. It ensures that the initial pressure reading is accurate.



**Figure 14**  
Charge valve assembly

6. Find the swivel nut on the charge valve assembly (Figure 14). Screw the swivel nut onto the accumulator gas valve. Tighten to 10–15 in./lb.
7. After the swivel nut is attached, depress the push button on the top of the charge valve assembly (Figure 14). This presses a pin into the accumulator gas valve and opens it. Read the pressure on the charge valve assembly pressure gauge. The pressure should read 103 bar (1500 PSI).
  - If pressure must be added, proceed to Step 8.
  - If pressure is too high, skip to Step 12.
  - If no adjustment is necessary, skip to Step 15.
8. Be sure that the nitrogen bottle supply valve is firmly closed. Attach the high-pressure regulator to the nitrogen bottle, then attach the hose to the high-pressure regulator. Finally, attach the other end of the hose to the charge valve stem on the charge valve assembly (Figure 15).
9. Do not open the nitrogen bottle supply valve yet. Turn the regulator adjustment handle on the high-pressure regulator (Figure 15) counter clockwise to its minimum setting (closed).



**Figure 15**  
Nitrogen bottle and regulator

10. Slowly open the nitrogen bottle supply valve (Figure 15). You will get a reading on the tank pressure gauge side of the regulator. If there is enough pressure in the nitrogen bottle to do the job, proceed to Step 11.

***If there is not at least 1500PSI in the nitrogen bottle (as shown on the regulator gauge at this time), you will not be able to charge the accumulator nitrogen to the 1500 PSI specification. If that is the case, you will need a new bottle of nitrogen before proceeding.***

11. Adjust the regulator adjustment handle clockwise, raising the regulated pressure. The accumulator will begin to fill. Continue filling until the charge valve assembly pressure gauge (Figure 15) reads the desired pressure of 1500 PSI. Close the nitrogen bottle supply valve.
  - Close the nitrogen bottle supply valve.
  - Depress the push button on the top of the charge valve assembly.
  - Slowly open the bleed valve on the charge kit. Close the bleed valve when the correct pressure is reached on the charge valve pressure gauge.
12. If you overcharge the nitrogen pressure, proceed as follows:
  - Close the nitrogen bottle supply valve.
  - Depress the push button on the top of the charge valve assembly.
  - Slowly open the bleed valve on the charge kit. Close the bleed valve when the correct pressure is reached on the charge valve pressure gauge.

***Never let nitrogen out of the accumulator by pressing the gas valve pin with a foreign object. The high pressure may rupture the valve seal!***



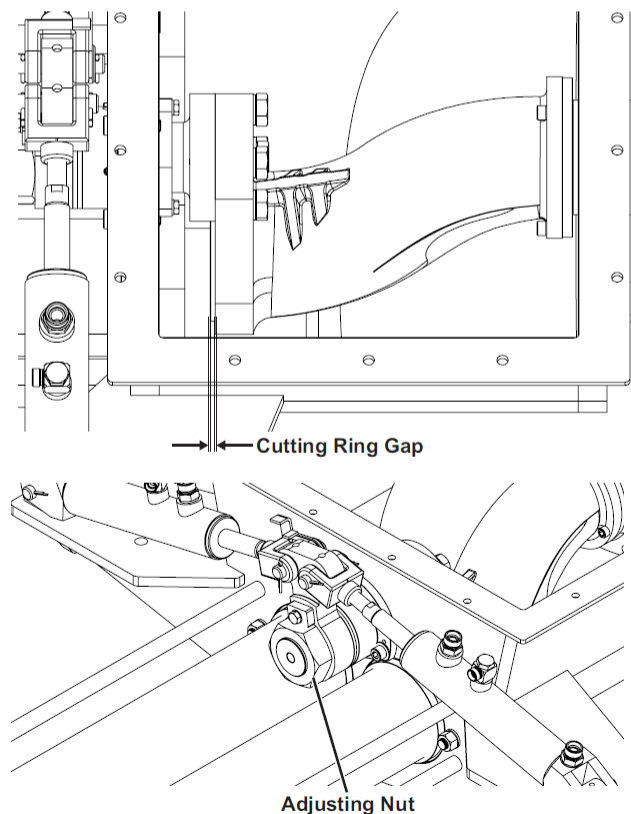
13. Let the nitrogen sit in the accumulator for 20 to 30 minutes. This allows the gas temperature to stabilize. Depress the push button on top of the charge valve assembly. Recheck the pressure on the charge valve assembly pressure gauge.
14. Add or release nitrogen until the pressure is correct. Be sure that the bleed valve is closed before adding pressure and that the nitrogen bottle supply valve is closed before releasing pressure.
15. When the correct pressure is reached, proceed as follows:
  - Close the nitrogen bottle supply valve.
  - Open the charge valve assembly bleed valve. This releases the pressure in the hose, charge valve assembly, and regulator.
  - While holding the charge valve assembly on the accumulator, unscrew the charge valve swivel nut.
  - Remove the charge valve assembly.
  - If you are finished with the charge valve assembly, remove the hose and regulator.
16. Make a bubbly mixture from soap and water. Spread the mixture around the accumulator gas valve to check for gas leaks. Gas leaks will push the bubbles away from the area of the leak. If you find a leak, replace the accumulator or have it repaired by qualified personnel. Never repair an accumulator yourself.
17. Replace the gas valve seal cap (tighten to 22 ft/lb), and hand-tighten the valve protection cap.

## Unscheduled Maintenance

The following items will have to be maintained on your stationary pump. The time of service that you get from these parts varies dramatically from unit to unit because of the wide range of applications to which these machines are subjected. Differences in concrete and pressure play a major role in the wear of these components.

### Cutting Ring

The cutting ring on this unit will wear with yards pumped. The gap between the cutting ring and transition tube (Figure 16) is designed to be 1/8th of an inch. The gap can be monitored and kept in tolerance by turning the adjusting nut on the slew lever (Figure 16) with the 3-1/4" wrench that is supplied or with a channel lock pliers. After the adjusting nut is tightened all the way, the cutting ring should be changed. Failure to maintain the 1/8th inch gap will cause premature wear of the cutting ring and spectacle plate.



**Figure 16**  
Cutting Ring Gap

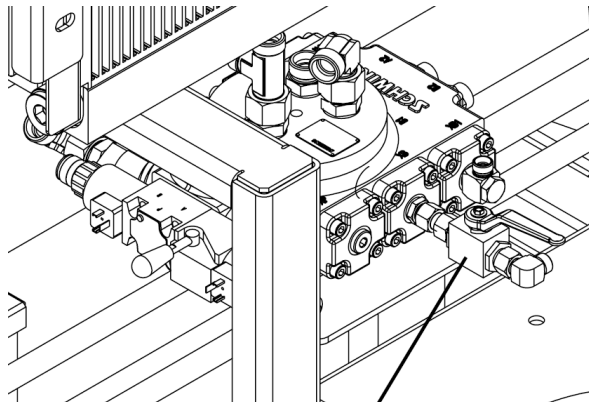
### Changing piston cups

When you begin to see small bits of sand or pebbles in your waterbox at the end of the day, it is time to change the rams.

When changing rams, you will have to put your hands in the transfer tube housing on several occasions. **You must disconnect the skid steer supply and return hoses each and every time before putting your hands into the transfer tube housing.**

To remove the old piston cups

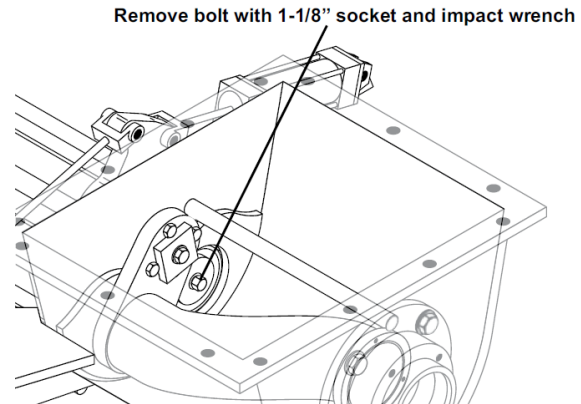
1. Follow skid steer startup process so that accessory hydraulics are maintained ON after leaving cab.
2. Connect skid steer supply and return hoses
3. Close the shut-off valve



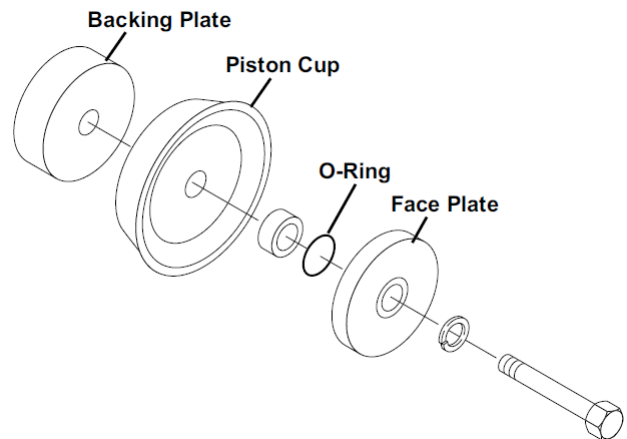
Shut-Off Valve (1/4 Turn Valve)

4. Drain the waterbox.
5. Cycle the piston cup down to the end of the material cylinder.
6. Push the e-stop button and disconnect the skid steer pressure and return hoses.

7. Place a 1 1/8" socket on an impact wrench, and remove the center mount bolt.
8. Remove the piston cup assembly from the



- material cylinder.
9. Separate the components and clean all residue from the face plate and o-ring back plate, as well as the o-ring groove.
10. Install the new o-ring on the back plate, and apply a coat of grease to the entire o-ring.



### To install the new piston cups

1. Connect the supply and return hoses, clear the e-stops, cycle pump forward and run the piston rod back down to the end of the stroke, push the e-stop button, disconnect the supply and return hoses.
2. The back side of the o-ring back plate is keyed for the purpose of rod alignment. This keyway, or pilot hole, should also be greased lightly before being placed on the alignment pin.
3. Push the back plate into the material cylinder, and align the pilot with the end of the rod.
4. Grease the new piston cup, and slide it over the alignment pin with the flat side to the back plate.
5. Coat threads of center bolt with anti-sieze.
6. Remove the alignment bolt and replace it with the 3/4" center bolt and face plate.
7. Tighten the 3/4" bolt until tight
8. Open the shutoff valve.
9. Repeat the procedure for the other side.

### Changing the material cylinders

The material cylinders eventually wear out. If you have changed piston cups and there is still grout in the waterbox at the end of the day, you need to change or rotate your material cylinders. Normally, it is the end attached to the transfer valve that wears out first, because it sees the most concrete. The waterbox end may be in brand new condition, because that end never experiences concrete. For this reason, the material cylinders were designed to be able to flip them end-for-end. That way you can move the worn out part to the waterbox and the like-new part to the concrete valve for double the life. If you are going to do this, you have to catch the wear on the material cylinders before they get too thin or break through in one or more spots. When that happens you can't flip them, because they would be structurally too weak to hold the pressure forces at the waterbox end.

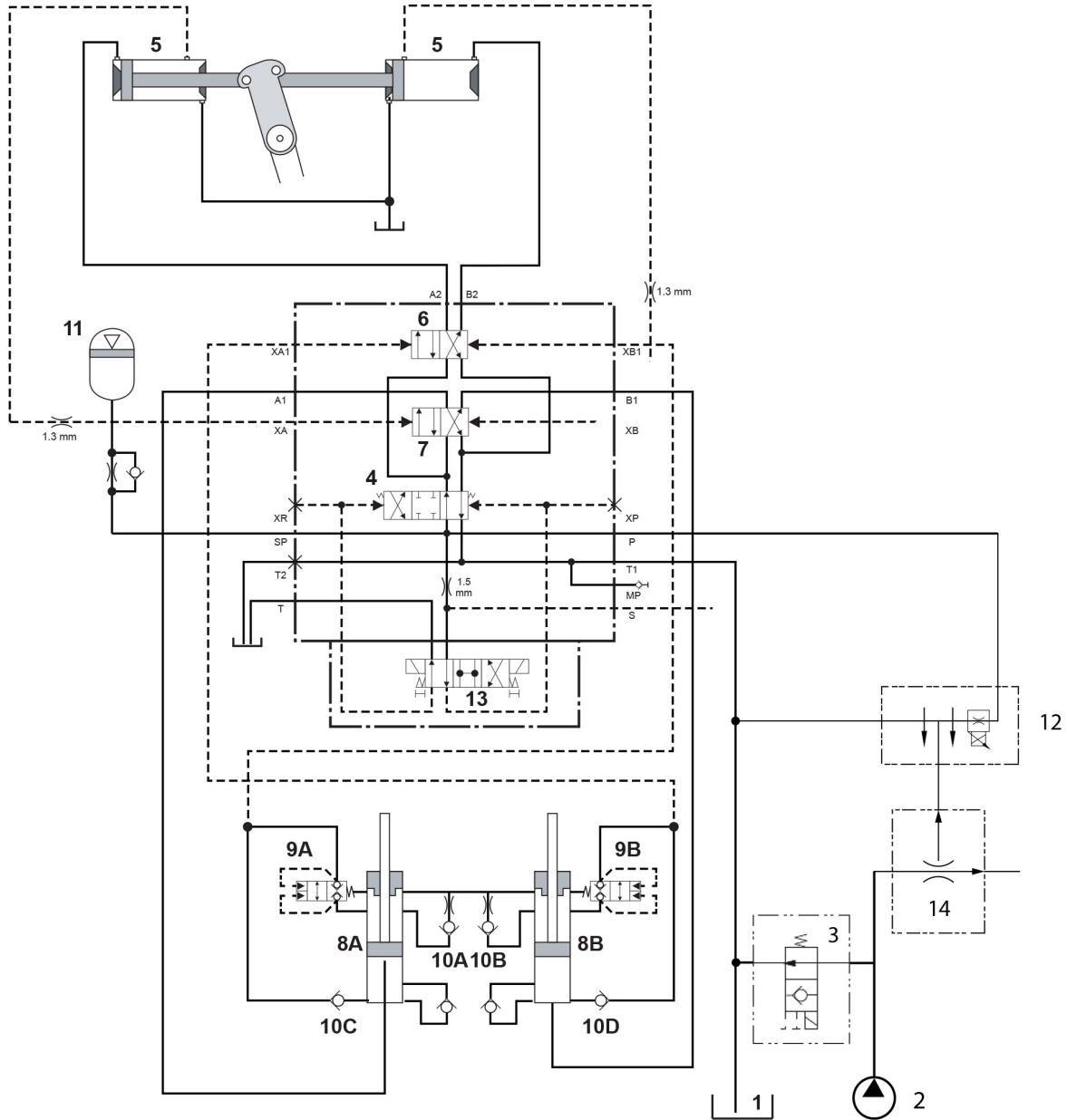
The actual act of changing and aligning the material cylinders was the subject of a service bulletin in 1986. The procedure still applies today. Contact Schwing America's Call Center if you need a copy of the bulletin.

### Inspecting hydraulic hoses

Hydraulic hoses should be checked during routine inspections. Check for damage to the outer layer or fittings. For example; Wire reinforcement is exposed, separation from the fitting, chafing, cuts, cracks, brittle outer layer or any other type of deformation like layer separation, blistering, crushing, corrosion, or kinking. In addition check for leaking fittings or improper fit.

***Hydraulic hoses should be replaced every six years to avoid the possibility of accidental rupture and possible personal injury. The date of manufacture of a hydraulic hose can be found stamped into the hose fitting.***

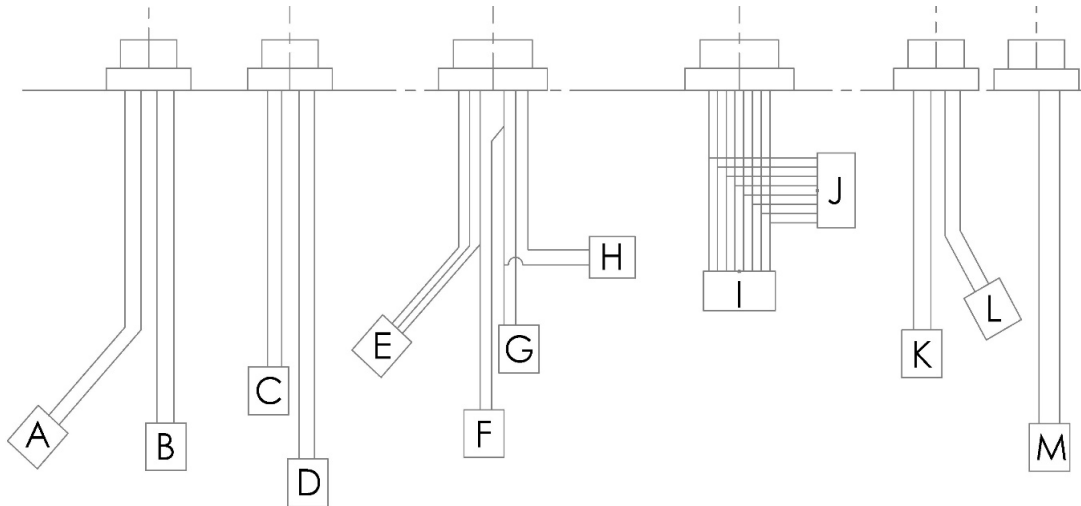
Hydraulic Diagram



|   |                                |    |                                  |
|---|--------------------------------|----|----------------------------------|
| 1 | Skid steer return line         | 8  | Differential hydraulic cylinders |
| 2 | Skid steer supply line         | 9  | Switching valves                 |
| 3 | Dump valve                     | 10 | Check valves                     |
| 4 | Directional control valve S1   | 11 | Accumulator                      |
| 5 | Transfer tube slewing cylinder | 12 | Flow control valve (pump flow)   |
| 6 | Directional control valve S3   | 13 | Forward/Neutral/Reverse Solenoid |
| 7 | Directional control valve S2   | 14 | Flow divider (agitator supply)   |

## Electrical Diagrams

### Component Connections



**A Agitator CW**

2-Pin Male Deutsch  
 1 Orange/Black  
 2 Black

**B Agitator CCW**

2-Pin Male Deutsch  
 1 Orange/Red  
 2 Black

**C Flow Control PWM**

2-Pin Male Deutsch  
 1 Blue/Red  
 2 Black

**D Main Power**

2-Pin Male Deutsch  
 1 Red  
 2 Black

**E Grate Sensor**

3-Pin Male Deutsch  
 1 Orange/Green  
 2 Red  
 3 Black

**F Horn Button**

2-Pin Male Deutsch  
 1 Red  
 2 White/Red/Black

**G Horn**

Female Spade  
 1 White/Red/Black  
 Female Spade  
 1 Black

**H Horn Button**

2-Pin Male Deutsch  
 1 Red  
 2 White/Red/Black

**I LH Status Lights**

8-Pin Male Deutsch  
 1 Blue/Black  
 2 Blue/White  
 3 Red/Green  
 4 White/Red  
 5 Blue/Red  
 6 Orange/Black  
 7 Orange/Red  
 8 Black

**J RH Status Lights**

8-Pin Male Deutsch  
 1 Blue/Black  
 2 Blue/White  
 3 Red/Green  
 4 White/Red  
 5 Blue/Red  
 6 Orange/Black  
 7 Orange/Red  
 8 Black

**K Pump REV**

2-Pin Male Deutsch  
 1 White/Red  
 2 Black

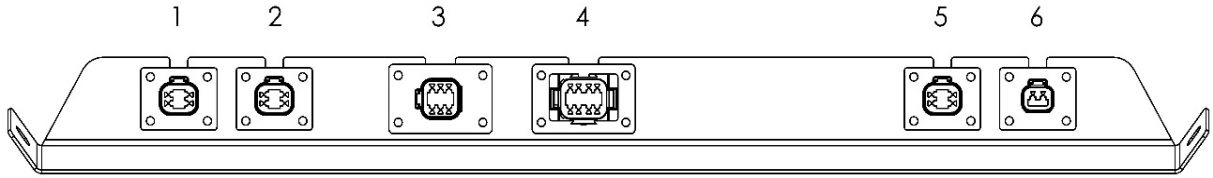
**L Pump FWD**

2-Pin Male Deutsch  
 1 Red/Green  
 2 Black

**M Dump Valve**

2-Pin Male Deutsch  
 1 Black/White/Red  
 2 Black

**Bulkhead Connections**



**1: Agitator**

- |                |              |
|----------------|--------------|
| 1 Orange/Black | Agitator CW  |
| 2 Black        | Ground       |
| 3 Orange/Red   | Agitator CCW |
| 4 Black        | Ground       |

**2: Power & Flow**

- |            |              |
|------------|--------------|
| 1 Blue/Red | Flow Control |
| 2 Black    | Ground       |
| 3 Red      | Main Power   |
| 4 Black    | Main Ground  |

**3: Grate & Horn**

- |                   |              |
|-------------------|--------------|
| 1 Orange/Green    | Grate Signal |
| 2 Red             | Grate Power  |
| 3 Black           | Ground       |
| 4 White/Red/Black | Horn Signal  |
| 5 Red             | Horn Power   |
| 6 -               | -            |

**4: Status Lights**

- |                |              |
|----------------|--------------|
| 1 Blue/Black   | Remote Mode  |
| 2 Blue/White   | Manual Mode  |
| 3 Red/Green    | Pump FWD     |
| 4 White/Red    | Pump REV     |
| 5 Blue/Red     | Flow ON      |
| 6 Orange/Black | Agitator CW  |
| 7 Orange/Red   | Agitator CCW |
| 8 Black        | Ground       |

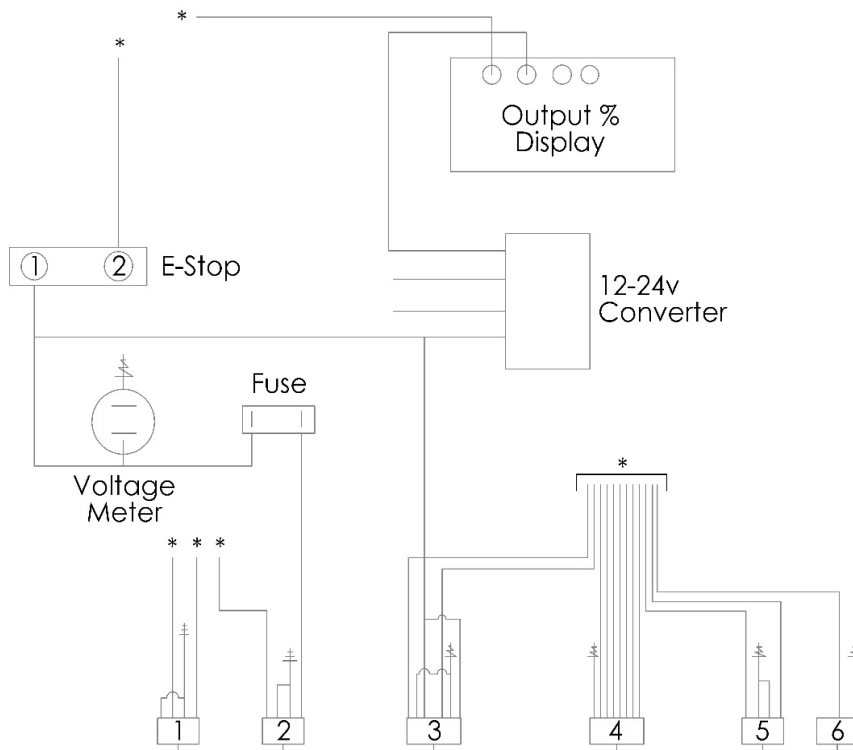
**5: Direction**

- |             |          |
|-------------|----------|
| 1 Red/Green | Pump FWD |
| 2 Black     | Ground   |
| 3 White/Red | Pump REV |
| 4 Black     | Ground   |

**6: Dump**

- |                   |             |
|-------------------|-------------|
| 1 Black/White/Red | Dump Signal |
| 2 Black           | Ground      |

**Main Panel Wiring**



**Notes:**

\* Wire goes to main controller

See bulkhead wiring diagram for wire colors and descriptions

**Control Panel Switch Wiring:**

