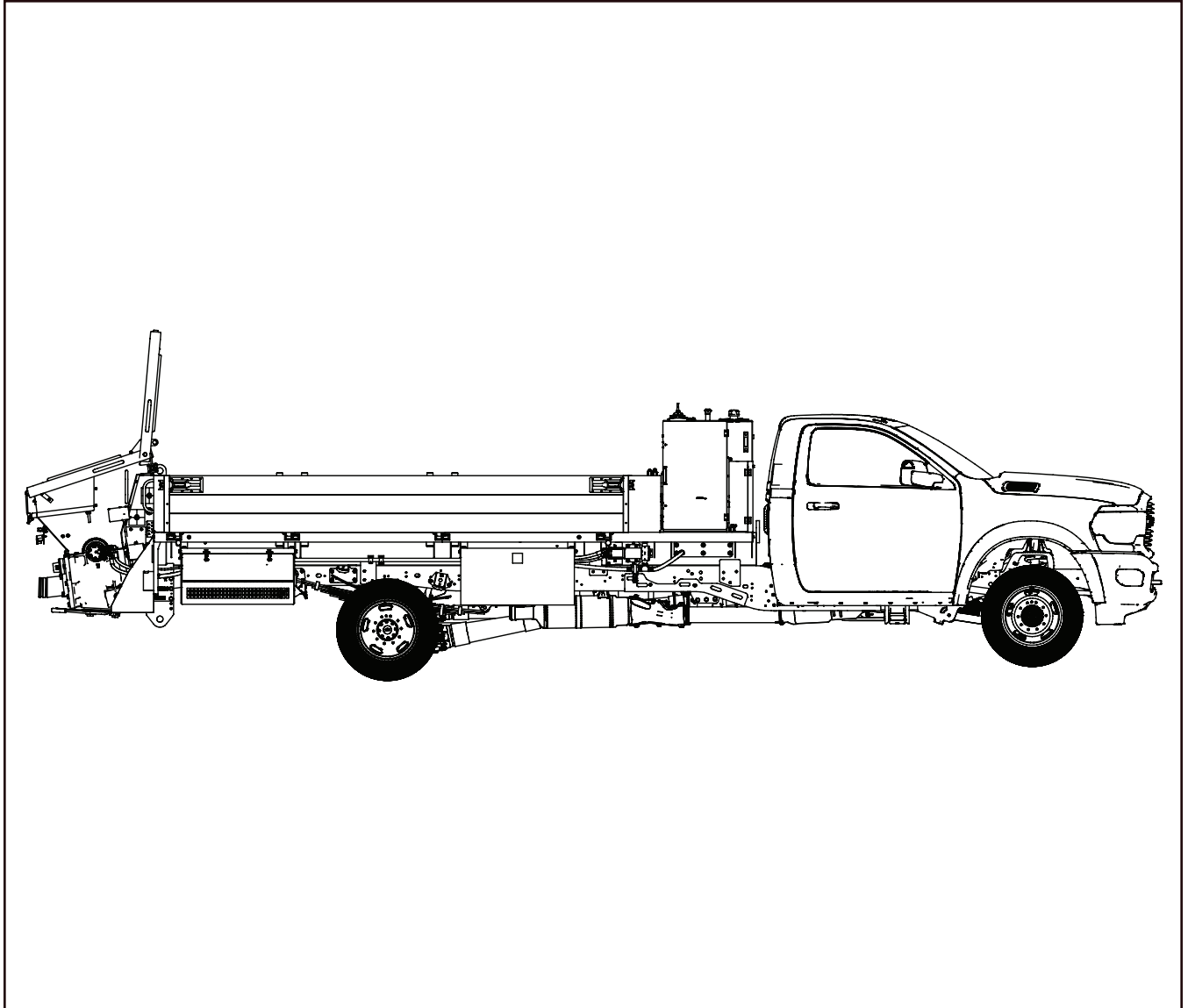


Operation Manual

SPT0 1000 - Dodge 5500



Part# 98510393

Revision: 1.1

Date: 01/21/25



SCHWING
AMERICA INC.

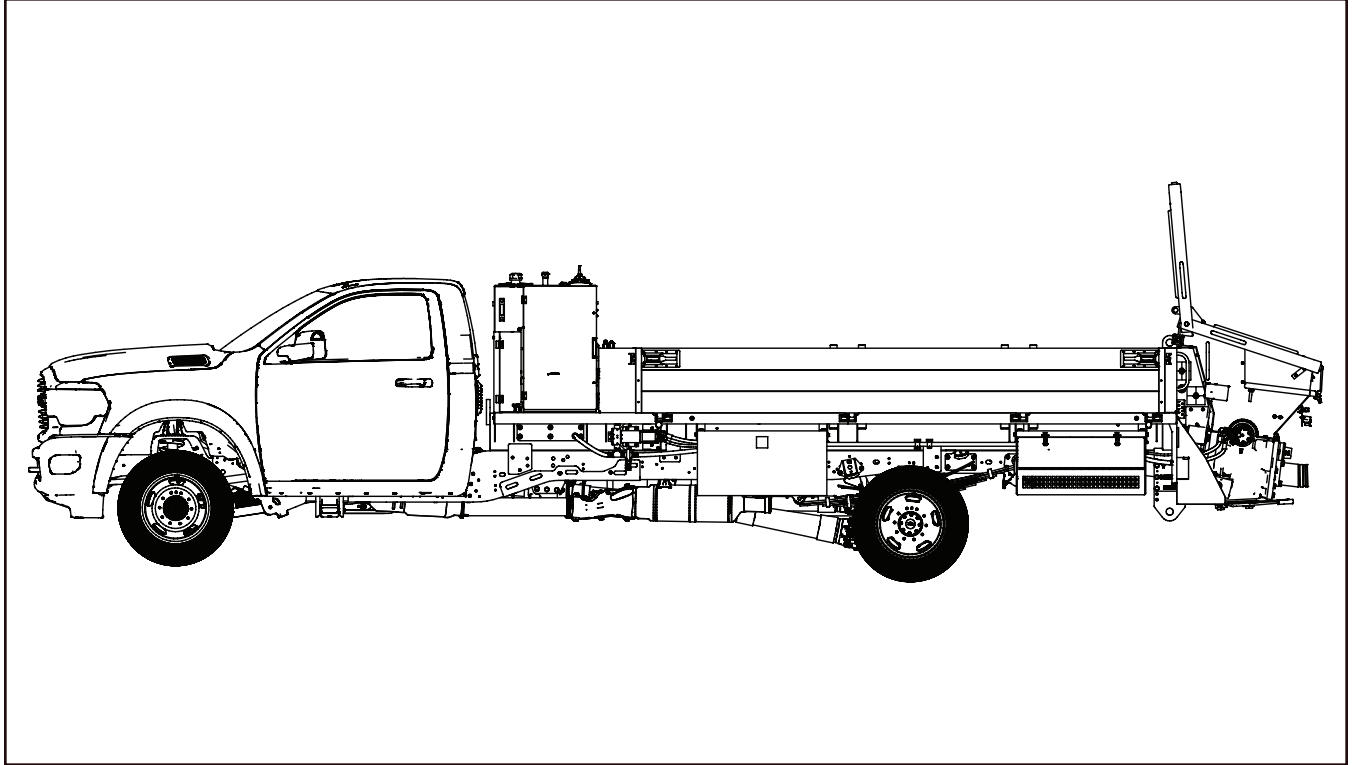
5900 Centerville Road
St. Paul, MN 55127
1-888-SCHWING (724-9464)
www.schwing.com



WARNING

CALIFORNIA PROPOSITION 65 WARNING

Breathing diesel engine exhaust exposes you to chemicals known to the State of California to cause cancer, birth defects, and other reproductive harm. Always start and operate the engine in a well-ventilated area. If in an enclosed area, vent the exhaust to the outside. Do not modify or tamper with the exhaust system. Do not idle the engine except as necessary. For more information go to www.P65warnings.ca.gov/diesel.



Operation Manual

SPT0 1000 - Dodge 5500

Part# 98510393

Revision: 1.1

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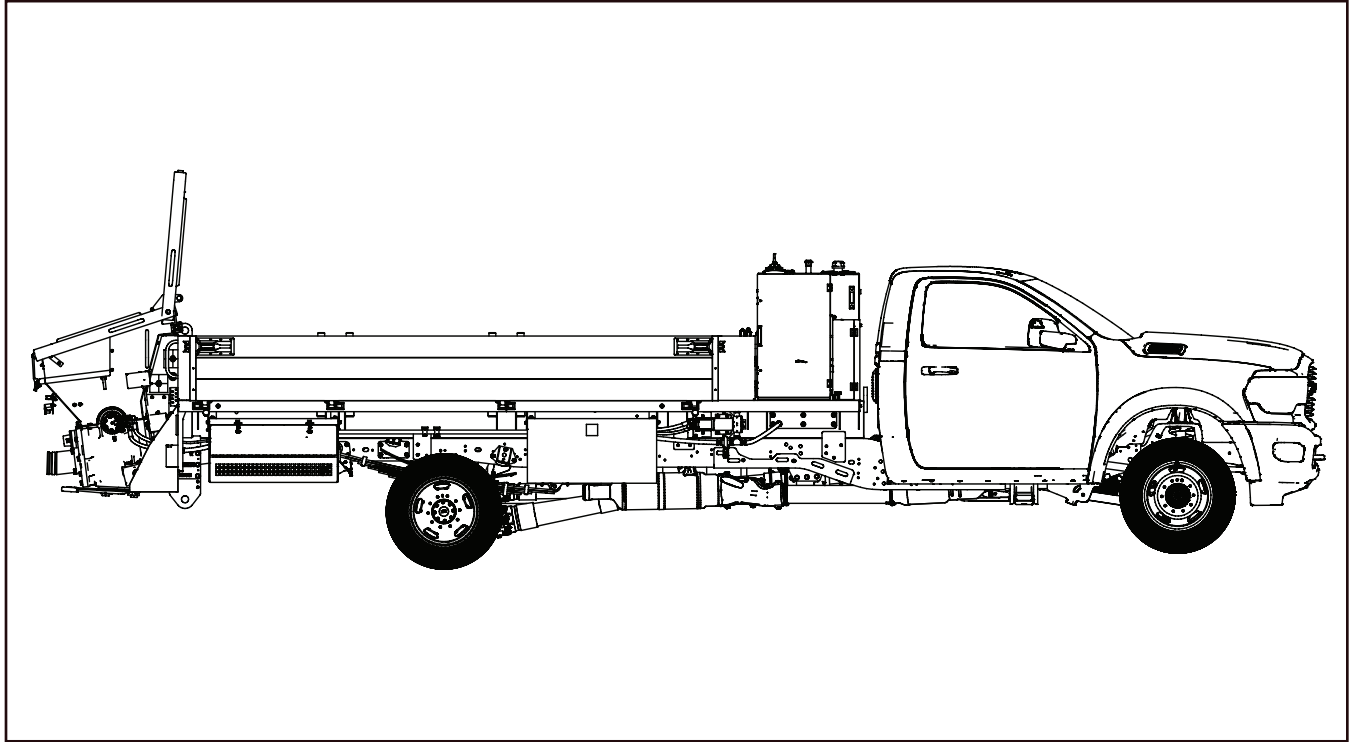
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Manufacturer's Statement

SCHWING America is a member of the SCHWING Group, a worldwide designer, manufacturer, and distributor of premium concrete production and handling equipment, headquartered in Herne, Germany. SCHWING is committed to supporting customer success, and excels in producing high quality concrete equipment used in the most demanding construction applications through innovative engineering, premiere manufacturing, and optimum after-sales support. SCHWING America, located in St. Paul, Minnesota, offers industry leading concrete pumps, truck conveyors, and genuine parts for distribution in North and Latin America.

The information contained in this operation manual is absolutely necessary for the setup, operation, maintenance, and servicing of your concrete pump. All operators should become familiar with the information in this manual as it will promote safety, efficiency of operation, and long life of the equipment. Keep this manual and all included literature in a safe and convenient location.

Read and understand this manual before operating, repairing, or adjusting your SCHWING concrete pump. Individuals who operate and maintain it must be trained and know the equipment. Death or severe injury can occur if this equipment is misused or poorly maintained.

Illustrations may look slightly different from the actual machine but only in ways that do not fundamentally change the information presented.

New editions of the operation manual will be created as technical modifications are made to this machine.



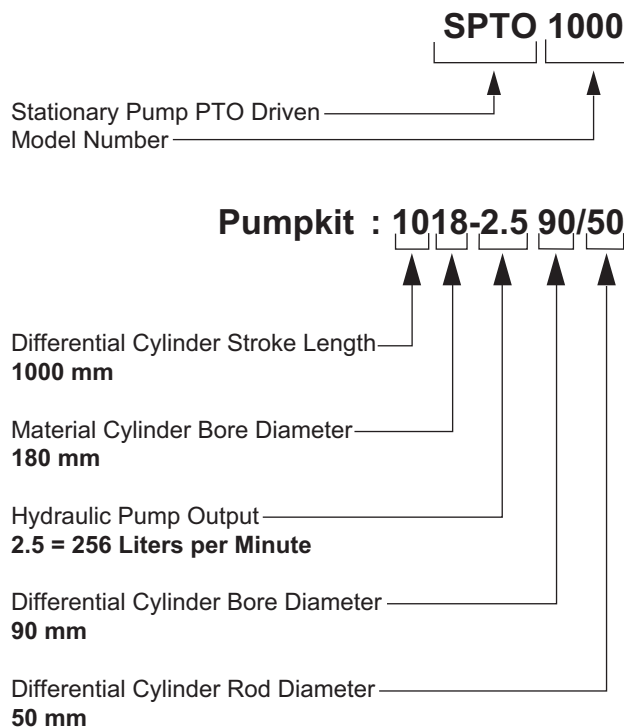
Concrete Pump Nomenclature



The complete model number of a SCHWING concrete pump is designated by the following code:

SPTO 1000
1018-2.5 90/50

The code is broken down as follows:



If other pumpkits are available, the model number will change. For example, if you have a concrete pump with a 1418 pumpkit, the model number is SPTO 1250 1418-2.6 80/55. For this model, the stroke length has changed from 1000 mm to 1400 mm.

How to Reach Us

If you encounter a circumstance that is not covered by this manual, the SCHWING Service Center is more than happy to assist you with all of your parts and service needs.

- Service Center: **1-888-292-0262**
- Spare Parts: **1-800-328-9635**
- Spare Parts (Fax): **(651) 429-2112**
- Minnesota (Main Office): **(651) 429-0999**

To place an order for spare parts, go online to **Schwingparts.com**, or call the toll free spare parts line from anywhere in the continental United States. Hours are Monday through Friday from 6:00 am to 6:00 pm (Central time). Orders will also be accepted via fax 24 hours a day.

When contacting the Service Center please provide the concrete pump model and serial number. You can find the model and serial number on the ID tag (Figure 1) that is mounted to the subframe of the unit.

ID Tags

An ID tag (Figure 1) lists the model and serial number of the concrete pump. This tag also provides information on the pumpkit, weights, year of manufacture, and material and hydraulic system pressures.

ID tags and serial numbers shown in this manual are for "REFERENCE ONLY". Locate each of the tags on your own unit to determine specific information for your pump.

Schwing America 5900 Centerville Rd White Bear, MN 55127 Phone: 651-429-0999 www.schwing.com		SUBSIDIARY OF SUBSIDIARIA DE		Schwing GmbH Heerstrasse 9-27 D-44653 Herne / Germany Phone: +49-2322-987-4 www.schwing.de	
This product is covered by one or more U.S. patents - see patent decal. Este producto está cubierto por una o más patentes de Estados Unidos-vea la etiqueta.					
MODEL MODELO	SERIAL # # DE SERIE	YEAR AÑO	MAX SPM	HP kW	
WEIGHTS/LOADS/PESOS/CARGA					
Total Weight Peso Total	LBS N	Tongue Weight Lengua De Peso	LBS N	Allowable Vertical Tongue Load Carga Vertical Permissible	LBS N
HYDRAULIC PRESSURES/PRESIONES HIDRAULICAS		MATERIAL PRESSURE/PRESIONES			
Concrete Pump / Bomba De Concreto	P.S.I. bar	Agitator El Agitador	P.S.I. bar	Accumulator El Acumulador	P.S.I. bar
			Auxiliary Auxiliar	P.S.I. bar	
				Material RS	PS PS
					P.S.I. bar

Figure 1
ID Tag

Unit Built-To Tag

The unit built-to tag lists document numbers relating to the hydraulic and electrical schematics used to manufacture this machine (Figure 2). The tag provides quick reference numbers that can be used when speaking with SCHWING Service Center support technicians.

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

ATTENTION!
¡ATENCIÓN!

Serial #:
No. de Serie:

Was built according to these drawings:
Se construyó de acuerdo a estos dibujos:

electric:
electricidad:

hyd. pump:
bomba hidráulica:

hyd. boom:
pluma hidráulica:

output chart:
tabla de saída:

Nomograph:
Nomograma:

30357363 02

Figure 2
Unit Built-To Tag (Located in Truck Cab)

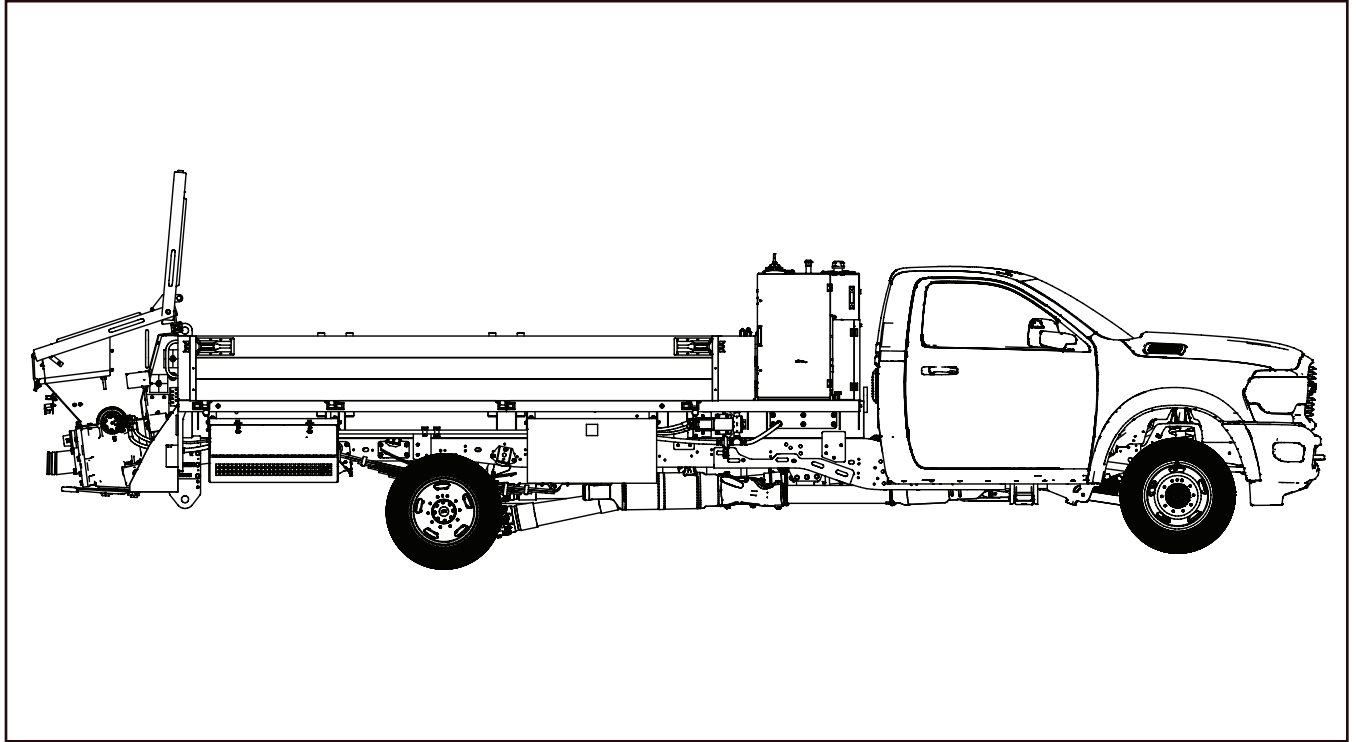
How to Order Missing Tags

If an ID tag is missing or has been removed, a new tag can be ordered through the SCHWING Service Center. Simply provide the concrete pump serial number, and a new ID tag will be created. The serial number is punched into the steel subframe near the ID tag (Figure 3).

Figure 3
ID Tag Location

SPTO 1000 - Dodge 5500 Operation Manual

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Concrete Pump Specifications

SPTO 1000

Concrete Pump Kit	1018-2.5 90/50	
	Piston Side Only	
Concrete Valve Type	Long Rock	
Maximum Strokes per Minute	35	
Volume Control	0 to Maximum	
Hydraulic System	Open Loop	
Main Hydraulic Pump	A11VO130	
Maximum Concrete Volume	70 yd ³ /hr	54 m ³ /hr
Maximum Flow	65 gpm	246 L/min
Hydraulic Tank Capacity	81 gal	305 L
Hydraulic Pump Speed	2300 rpm	
Maximum Hydraulic Pressure	4350 psi	300 bar
Maximum Pressure on Concrete	1100 psi	76 bar
Maximum Horizontal Pumping Distance	1160 ft	353.6 m
Maximum Vertical Pumping Distance	330 ft	100.6 m
Maximum Aggregate Size	1.5 in	37 mm
Minimum Concrete Slump	0 in	0 mm
Pumping Cylinder Diameter	7 in	180 mm
Stroke Length	39 in	1000 mm
Differential Piston Diameter	3.54 in	90 mm
Differential Rod Diameter	1.96 in	50 mm
Outlet Diameter	5 in	125 mm
Remote Control Cable Length	100 ft	30.5 m

Max RPM of the hydraulic pumps is calculated while the pump is under a full load. Depending on the unit, it is acceptable for the max RPM to vary slightly from the published estimate.

Assembled Unit Specifications

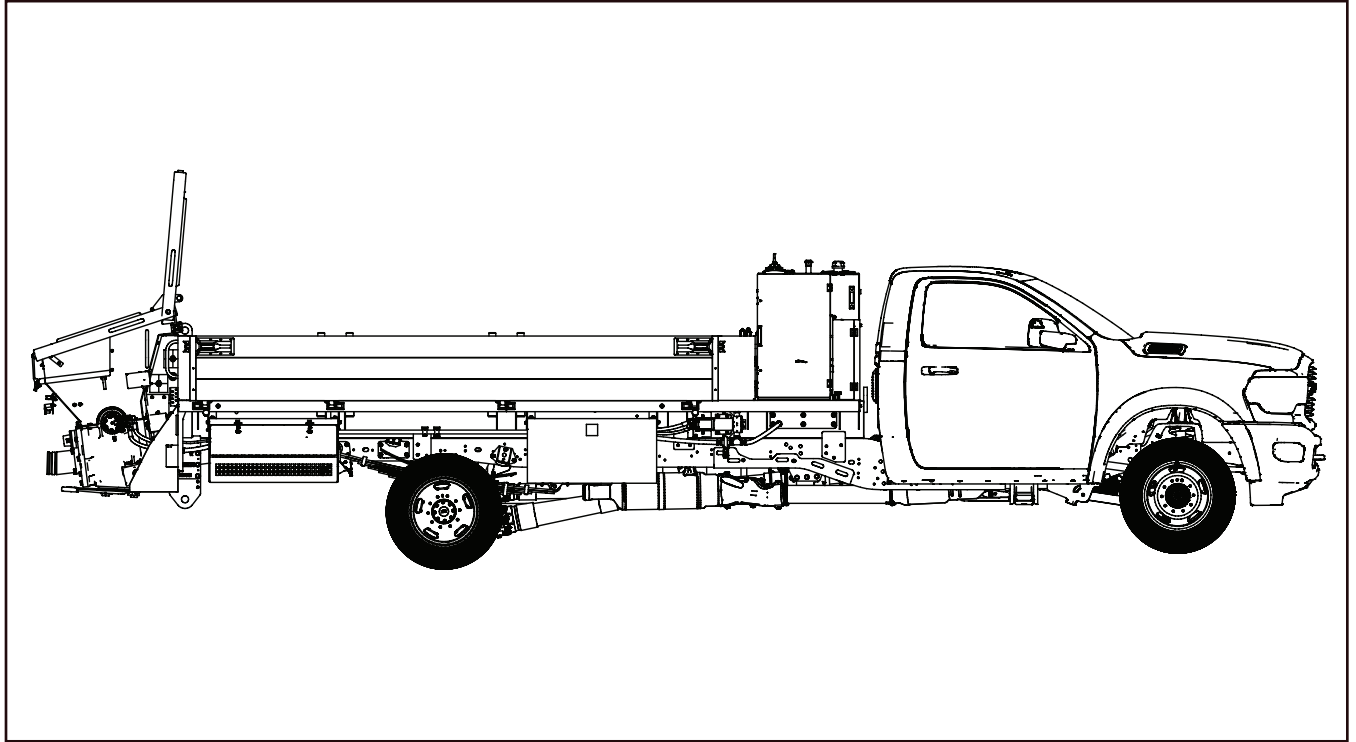
Description	SPTO 1000
Charging Hopper Height	48.5 in
Charging Hopper Capacity	11 ft ³
Water Tank Capacity	150 gal

Hydraulic Pressure Specifications

Concrete Pump	Pressure
SPTO 1000 - Long Rock	300 bar (4350 psi)
Agitator	125 bar (1812 psi)
Accumulator Dump Valve	200 bar (2900 psi)
Accumulator Secondary Relief	220 bar (3200 psi)
Soft Switch Relief	100 bar (1450 psi)
Stroke Limiter Circuit	0 to 25 bar (0 to 363 psi)
Nitrogen Pressure	100 bar (1450 psi)
Water Pump Relief	125 bar (1812 psi)

Optional Equipment

- Autogreaser - Rock Valve
- Extended Life Wear Parts (CR & WP)
- Decals - Company Name / Phone / Stripe
- High Pressure Water Pump w/ Spray Wand
- Hopper Grate - Round Bar (for Fiber)
- Pipe Rack
- Red Light / Green Light (Pump On/Off)
- Tool Box (36 in)
- Vibrator (12v)
- Water Tank Heater
- Work Light - Hopper Cover Mount
- 125 mm Outlet
- Low Oil Sensor
- Accumulator Bypass
- Auxiliary Hydraulic Connection
- Onboard Filtration
- Shotcrete Setup



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Safety Alert Symbols



The triangle with an 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 keywords listed above will be displayed throughout the text of this manual in the form of information boxes like the ones shown in Figure 1.

The black text in the information box will describe the hazard to beware of and the consequences that can occur if that hazard is encountered.

All persons working near the concrete pump must be able to recognize hazardous situations. They must know how to avoid these situations and how to react quickly and appropriately whenever hazardous situations arise.

DANGER

Indicates a hazardous situation which, if not avoided, **WILL** lead to death or serious injury.

WARNING

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

CAUTION

Indicates a potentially hazardous situation which, if not avoided, **COULD** result in minor to moderate injury.

Figure 1
Safety Alert Information Boxes

Safety Manual

The Safety Manual is a separate document from the rest of this manual and has its own page numbering and formatting. This was done to allow the Safety Manual to be inserted in many different publications while appearing identical in all documents. The Safety Manual also has its own alphabetical index, which is found at the end of this section.

How to Order Additional Safety Manuals

To order additional Safety Manuals call the toll-free Spare Parts line from anywhere in the continental United States. Hours are Monday through Friday from 6:00 am to 6:00 pm (Central Time). Orders will also be accepted via fax 24 hours aday.

SCHWING America Phone Numbers:

- **Service Center: 1-888-292-0262**
- **Spare Parts: 1-800-328-9635**
- **Spare Parts (Fax): (651) 429-2112**
- **Minnesota (Main Office): (651) 429-0999**

We will ship one set of the following manuals free of charge for each unit that is listed with its serial number and current location:

Manual	Part Number
Safety Manual, English	30327535
Safety Manual, Spanish	30381024
Co-worker Safety, laminated, English	30381022
Co-worker Safety, Spanish	30381027
Small line Safety Manual, English	30381680
Small line Safety Manual, Spanish	30381841

Warning Labels (Decals)

Every concrete pump is equipped with a set of warning labels. Warning labels **MUST** be replaced if they are damaged, faded, missing, or unreadable. Ultraviolet radiation, rain, steam cleaning, and other factors cause these labels to fade over time. Re-apply warning labels to any parts or components that have been replaced.

For replacement labels, call the Spare Parts Department and provide your concrete pump serial number. Reference the Decal Location Guide (Figure 2) in the parts book for installation locations and part numbers. Complete sets or single labels can be ordered. Decal sets do not include metal ID Tags, which can be ordered separately.

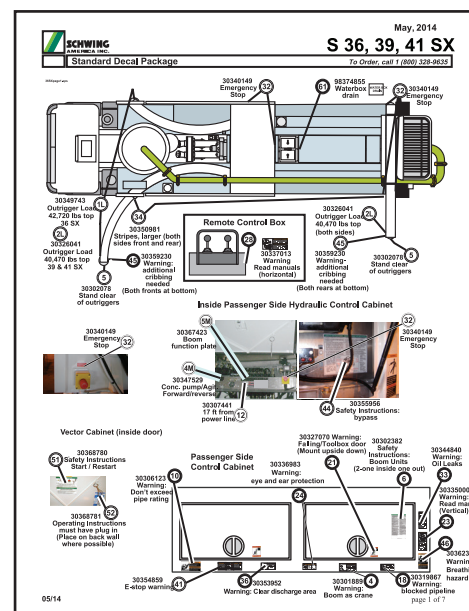


Figure 2
Sample Decal Location Guide

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

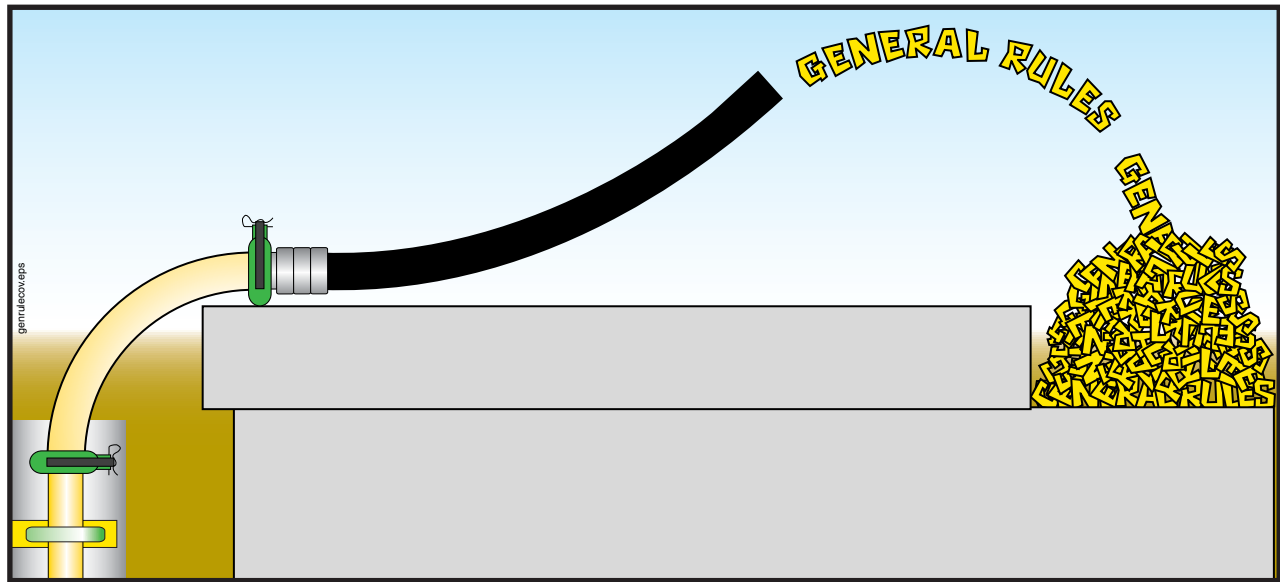
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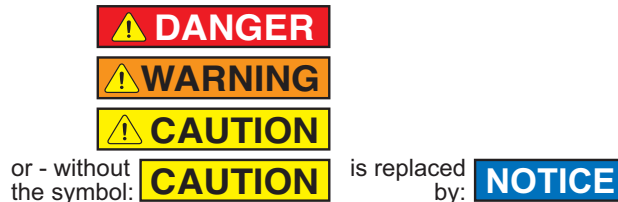
I. Before You Leave The Yard

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:



- 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:

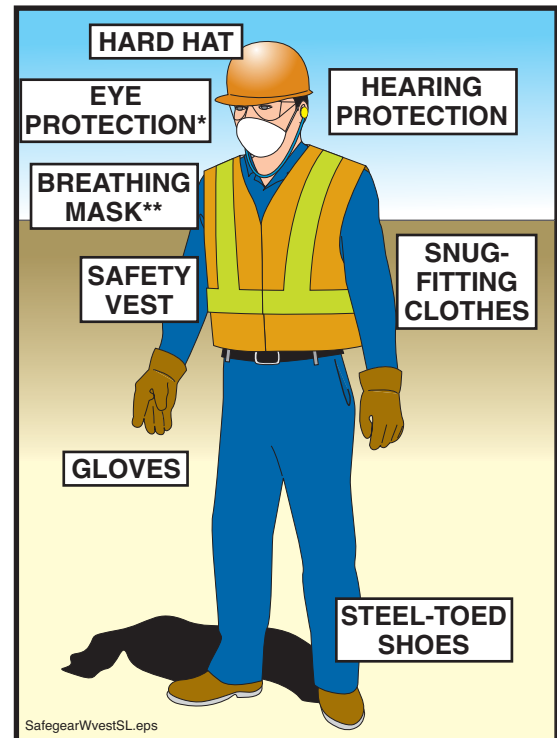
- hearing protection if you stand near the pump or any other source of noise;

- 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

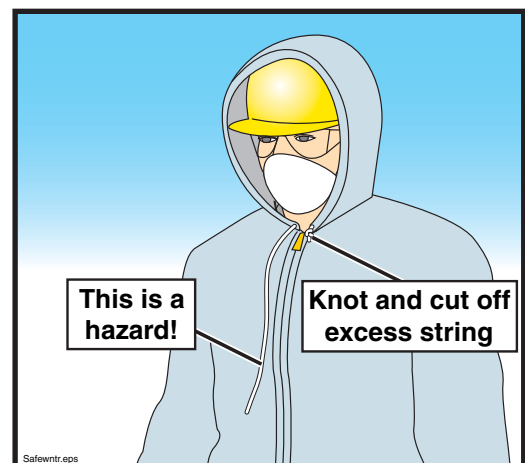
Jewelry, athletic shoes, sandals, and shorts are examples of clothing that should NOT be worn when pumping.

2.4



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).

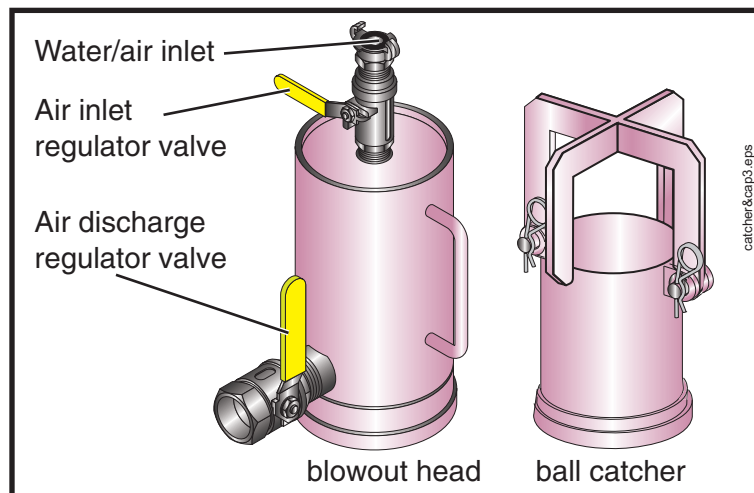


Figure 4
Compressed air accessories

- 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.

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- 3.8** **⚠ WARNING** The operator is responsible for checking that all safety equipment and guards are in place and in good condition. If found to be missing, incomplete, or damaged, **work must not begin** until the situation has been made safe.
- 3.9** **⚠ WARNING** The operator is responsible for checking that all safety decals are in place and are in readable condition. If found to be missing or unreadable for any reason, steps should be taken to obtain replacements.
- 3.10** **⚠ WARNING** Inspect the tires and brakes on the truck. Never drive a truck with bald or cracked tires, or with weak or worn brakes. If you have air brakes, be sure that the air system is free from leaks and will maintain pressure when driving. Loss of air pressure will cause the brakes to be applied while driving. If driving continues after the brakes are applied, the resulting friction could cause enough heat to start a fire.
- 3.11** Drain moisture from the air tanks that supply the unit's brakes (if so equipped). This is especially important if weather conditions could cause the moisture to freeze. If you lose air pressure because of frozen moisture, the brakes will apply themselves, and you will have to stop driving until the unit is repaired.
- 3.12** **⚠ WARNING** (See Figure 5.) Mount or dismount the pump or truck using the *3-point Rule* (i.e. keep two hands and one foot or one hand and two feet in contact with a secure surface at ALL times).

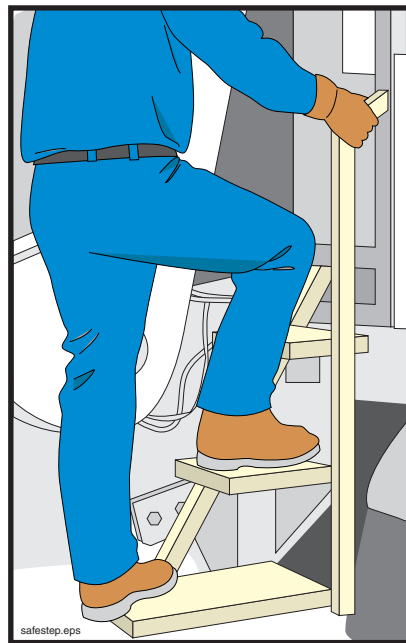
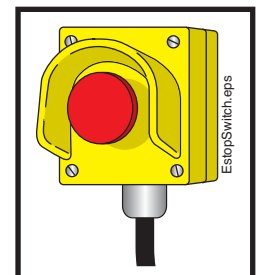


Figure 5
The 3-point Rule

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

- 3.14**  **WARNING** If applicable, be sure that outriggers are pinned and locked before traveling. If the locking device is damaged or worn, it should be repaired immediately and the unit **must not be driven until the outriggers can be positively locked** against accidental opening.
- 3.15**  **WARNING** Be sure there is nothing in the cab of the truck (such as empty soda cans, loose tools, etc.) that could interfere with the operation of the vehicle.
- 3.16** Be sure that all road-related safety devices (warning signs, flares, fire extinguisher, etc.) are present and secured for travel.
- 3.17** Be sure all personal protective equipment (hard hat, safety goggles, rubber gloves, etc.) are secured for travel.
- 3.18**  **WARNING** Be sure the windshield and mirrors are clean and free of frost or ice, and that the mirrors are properly adjusted.
- 3.19**  **WARNING** Verify that head lights, tail lights, turn signals, brake lights, backup warning horn, and backup lights are operational.
- 3.20** In some cases you may be asked to operate a machine other than the one with which you are familiar. In these cases, be sure to:
- Know the weight, height, and width of the machine.
 - Have a copy of the operation manual with you.
 - Ask the machine's normal operator, the dispatcher, or your supervisor questions regarding any unusual or unique operational characteristics of the machine.
 - Familiarize yourself with the machine by setting it up in the yard and running the functions, and by familiarizing yourself with the operation manual. This is especially important if the new machine is significantly different than the one you normally operate. Your coworkers depend on you to know the machine.
- 3.21**  **WARNING** Be certain that all loose items on the unit are secured for travel before driving.
- 3.22**  **WARNING** Emergency stop switches (E-stops) should be periodically checked by activating the switch in the yard and confirming that none of the pump functions operate electrically or manually.

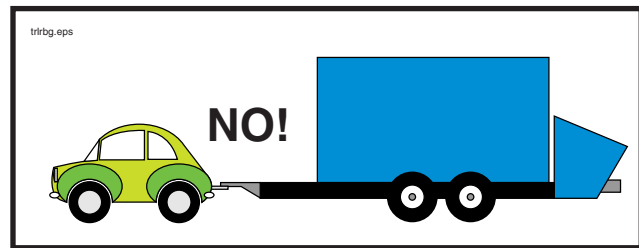
Figure 6
Periodically check your emergency stop switches (E-stops) for proper function



4. Safety Rules For Towing Trailer-Mounted Concrete Pumps

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

Figure 7
Do not under size the
towing vehicle



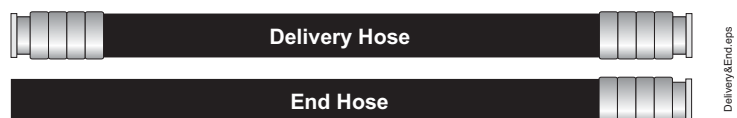
- 4.2 **WARNING** Never tow a trailer that has concrete in the hopper. The extra weight in the back of the machine will remove weight from the tongue and cause the trailer to fishtail.
- 4.3 **WARNING** Check the tires, tire pressure, and brakes on the trailer before towing. Never tow a vehicle with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

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

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

- 5.1 **The job setup phase sets the stage for most accidents.** Taking a few extra moments to correctly set up the job will improve your chances of having a safe, trouble free day.
- 5.2 **The operator is responsible for the safe operation of the machine.** Notify your employer, the job superintendent, and/or O.S.H.A. if you are being asked to set up in an unsafe manner. **You are never required to take a chance with safety.** You are the **only** person who can determine that the job circumstances under your control are safe.
- 5.3 **⚠ WARNING** Any power connections above 28 volts must be made by a **licensed electrician**. The supply power and appropriate disconnect boxes are the responsibility of the contractor.
- 5.4 **⚠ WARNING** Electrical power on the job site may be taken only from a **fused, grounded disconnect box with a disconnect switch that can be locked against activation**. If you will be making repairs to the concrete pump or separate placing boom, first lock out the power at the disconnect box.
- 5.5 **⚠ WARNING** On units equipped with electric motors, **check the power cables every day**. If they are frayed or have open spots in the insulation, replace the wire. If the connectors are worn or loose, have repairs made by a licensed electrician.
- 5.6 **⚠ WARNING** Consider the **safe approach and departure of the ready-mix trucks and adjust your setup accordingly**. Adjusting your setup position by a few degrees one way or another could mean the difference between a safe approach and an unsafe approach. Some examples of unsafe approaches are: too near an excavation or sticking out into traffic.
- 5.7 **⚠ WARNING** **Avoid collisions!** Secure the immediate area of the machine from public traffic in accordance with all applicable regulations (warning lights, safety cones, barricades with flashers, etc.).
- 5.8 **⚠ WARNING** Pipelines, end hoses, couplings, and all other **material delivery components must be able to withstand the maximum concrete pressure of the pump. Be sure** of it! Read and understand the minimum wall thickness chart found in the *Appendix* of this manual. If you don't understand the chart, contact the pipe manufacturer for assistance.
- 5.9 A *concrete delivery hose* is a flexible concrete hose that has two end couplings. An *end hose* is a flexible concrete hose that has one end coupling. See Figure 8.

Figure 8
End hose vs delivery hose



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5.10

⚠ WARNING Do not use a piece of pipeline, end hose, coupling, or any other material delivery component that is not in good condition. **Replace, do not repair damaged pipes and hoses.** Concrete pipeline system is subject to wear, and the rate of wear is affected by pumping pressure, concrete composition, pipeline material, and other factors. Read and understand the minimum wall thickness chart in the *Appendix* of this manual. **Bursting pipes and concrete escaping under pressure is a serious safety hazard (Figure 9)!**

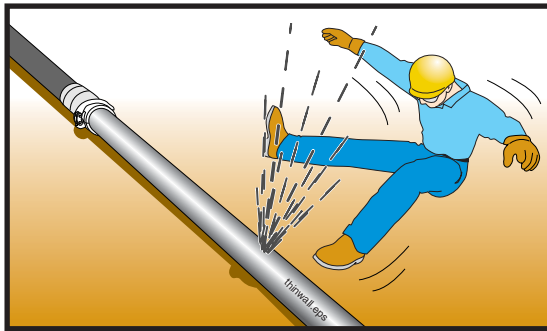


Figure 9
Delivery system components must be able to withstand maximum pump pressure

5.11

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

5.12

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

5.13

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

5.14

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

5.15

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

5.16

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

5.17

⚠ WARNING If the pipeline remains on the job (as is the case when pumping a high-rise building), the operator is responsible for checking the pipeline for

dents, cracks, wear, and continuous connection each day before the pour begins.

5.18

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

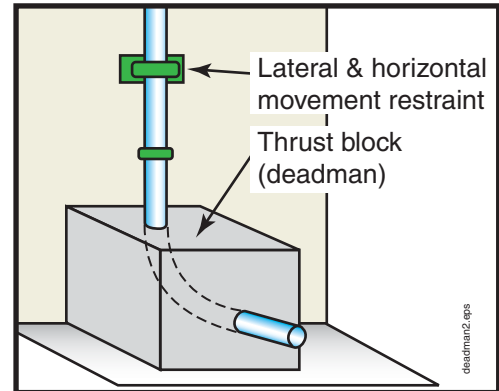


Figure 10
A thrust block (deadman)

5.19

⚠ WARNING If you will be unable to see the point of placement, establish a system of communications with the workmen who will be there. Arrange for radio communications, a system of visual or auditory signals (lights or bells), or a signalperson (Figure 11). If a signalperson is used, **agree on hand signals before beginning the pour!**

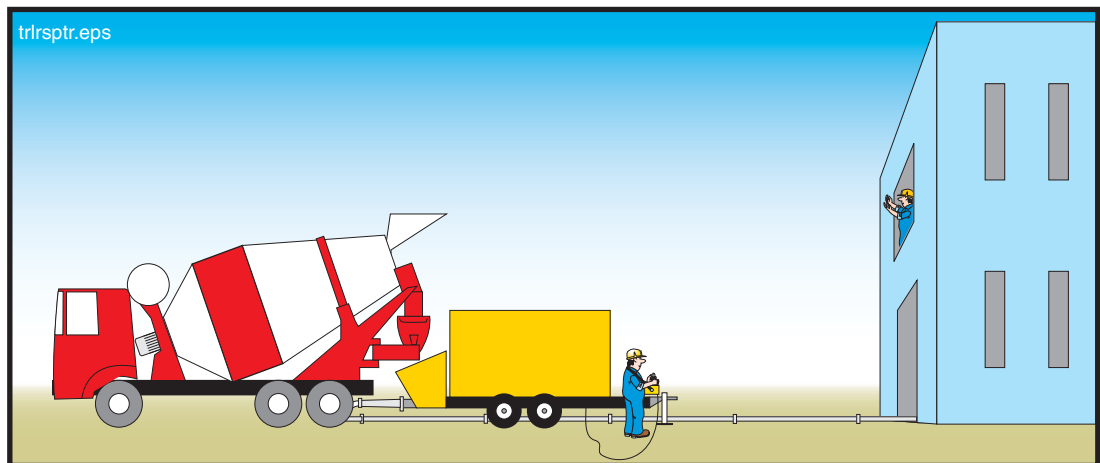


Figure 11
Arrange communications before starting

5.20

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

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5.21

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

5.22

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

5.23

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

- A blowout head with properly sized air discharge regulator valve, and separate water/air inlet. The two openings must be spaced apart far enough that a blow-out ball could not cover both openings at once.
- A *go-devil*, or a hard sponge ball. Regardless of which is used, it **must** fit into the pipeline tight enough that air cannot escape ahead of it.
- A ball or go-devil catcher that will catch the go-devil or ball, or some other method of controlling the discharge while the line is being purged of material. There are two types of catchers (see paragraph 5.24).
- A hose that is rated for the pressure of the air compressor you will use and that is able to connect with both the air compressor and the blowout head. The hose must be in good working condition and must be free of cracks, frays, tears or other damage.
- If you will be cleaning the pipeline with compressed air at the completion of the job, be sure an adequate air compressor is available before starting the job.
- If you will be cleaning a vertical pipeline with compressed air at the completion of the job, you **must have a shutoff valve or switching valve installed at the bottom of the vertical run!**

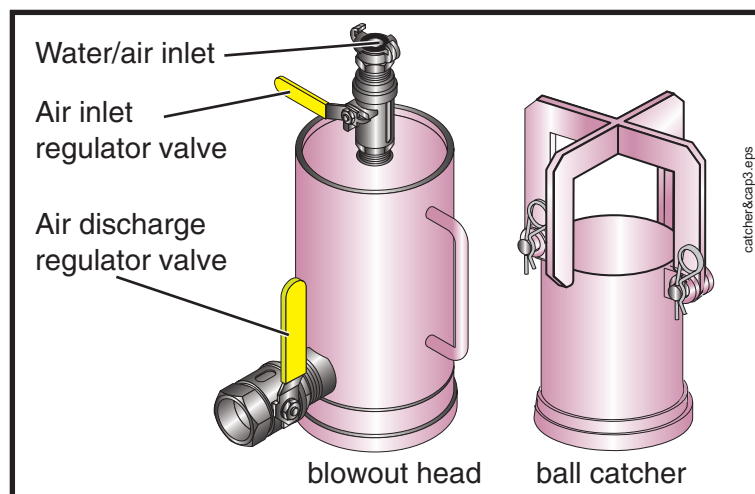


Figure 12
Ball catcher and blowout head

5.24

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

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

Each type of catcher has advantages and disadvantages (Figure 13).

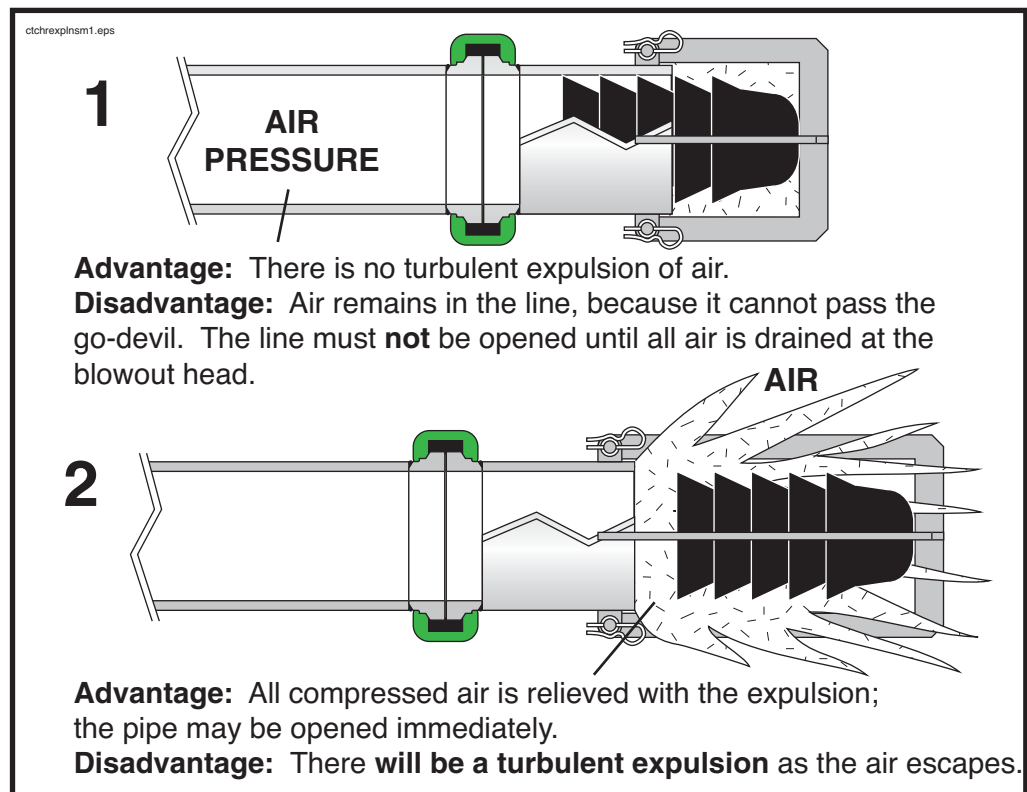


Figure 13
Types of catchers

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

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

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

III. Concrete Pump Operation

6. Safety Rules For Pump Operators

6.1

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

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

6.2

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

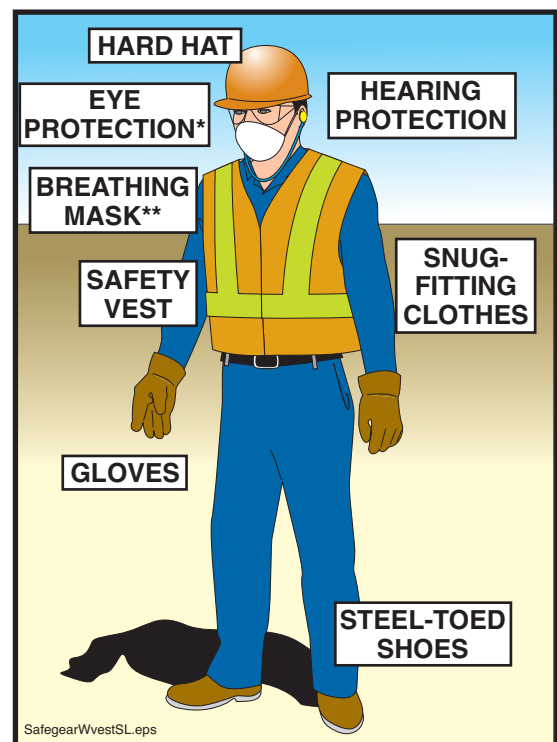
6.3

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

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

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

Figure 14
Wear Personal
Protective Equipment
(PPE)



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GENERAL RULES

- 6.4 **⚠ WARNING** All guards, covers, and service flaps must be secured in place during operation.
- 6.5 **⚠ WARNING** **Electrocution hazard!** If you are operating and lightning moves into the area, seek shelter until the lightning is gone.
- 6.6 **⚠ WARNING** **Crushing hazard! Never, ever** position yourself between a ready mix truck and the pump! Stand off to the side, so the ready mix driver can see you at all times (Figure 15).

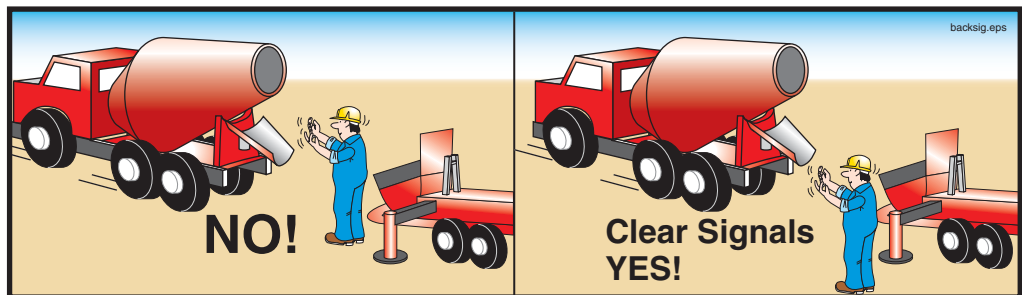


Figure 15
Never stand between the ready mix truck and the pump
Use clear and concise hand signals

- 6.7 **⚠ WARNING** When backing in ready mix trucks, use clear and concise hand signals (Figure 15).
- 6.8 **⚠ WARNING** If the job requires that you work above ground to operate your machine, an approved fall protection plan must be implemented.
- 6.9 **⚠ CAUTION** **Loss of hearing!** While standing near a working concrete pump, sound pressure levels may exceed O.S.H.A. standards for constant exposure (Figure 16).

PERMISSIBLE NOISE EXPOSURES*

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

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



WEAR HEARING PROTECTION!

Figure 16
Noise level and exposure time limits

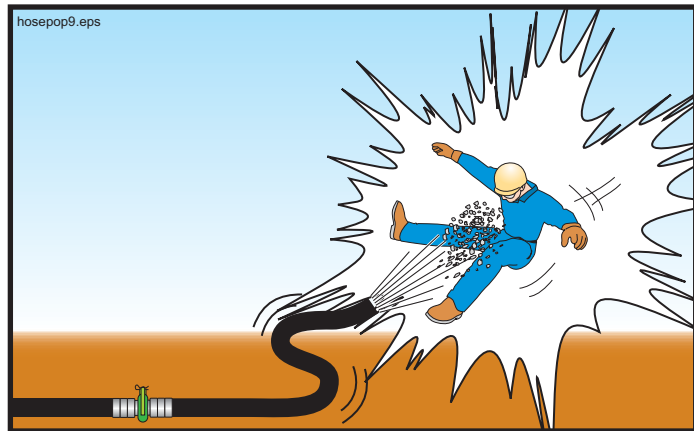
6.10

⚠ 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.

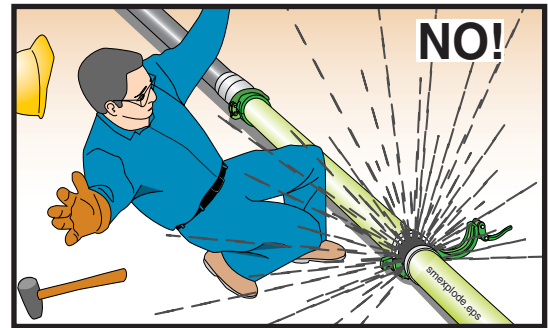


Figure 18
Never open a pressurized pipeline

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.)

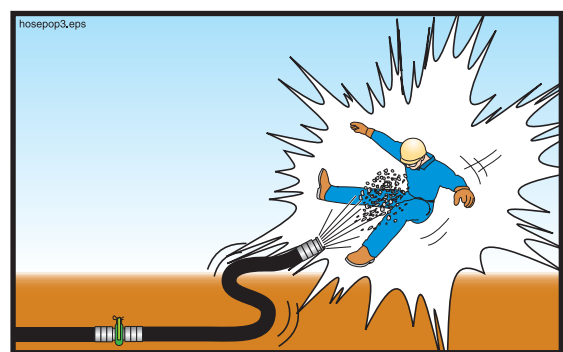
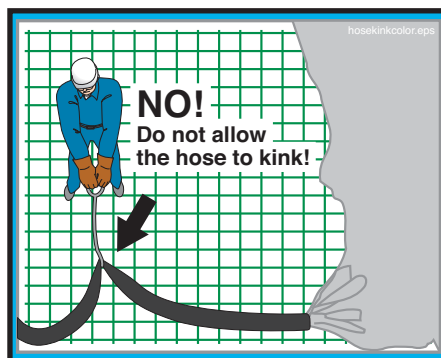


Figure 19
Kinking the hose creates a hazard

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.

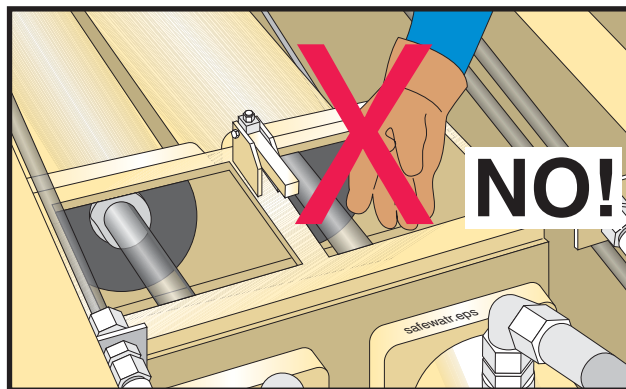


Figure 21
Keep your body out of the water box

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.)

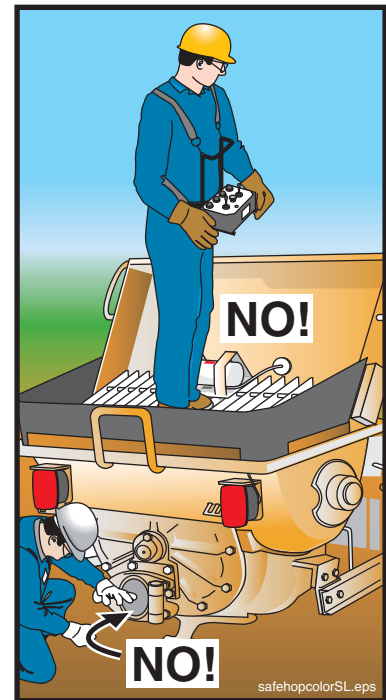


Figure 22
Don't put your body in the machine

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.

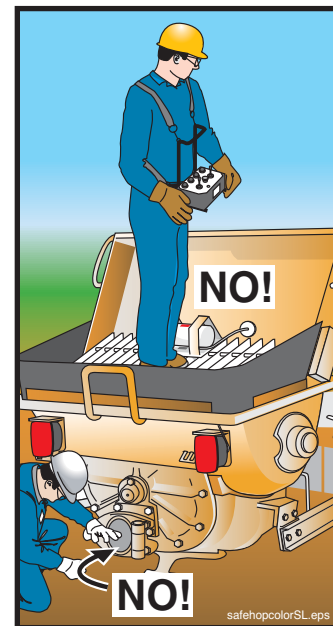
IV. Cleaning The Pump And System

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

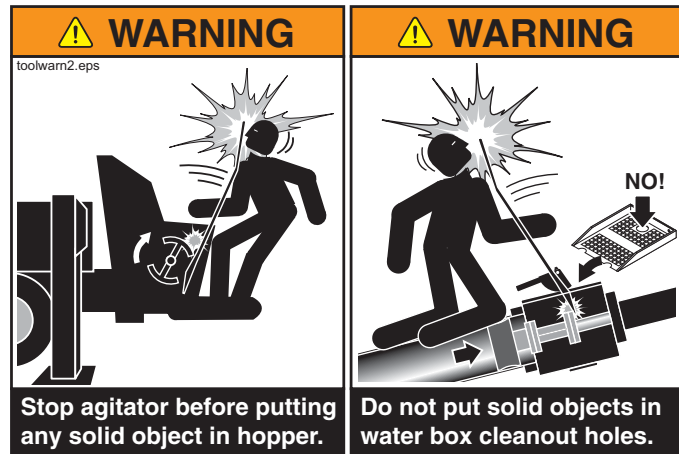


Figure 28
Don't put solid objects into working systems

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).**

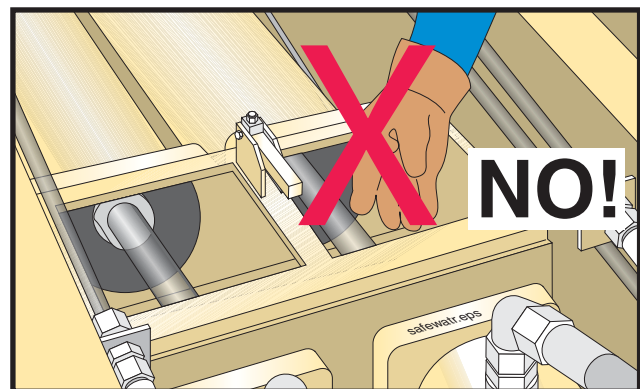


Figure 29
Keep your hands out of the water box

10. Safety Rules For Cleaning A Separately Laid Pipeline

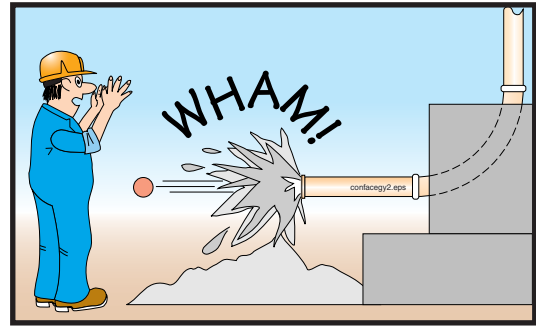
10.1 **WARNING** Flying particle hazard! Clear the discharge area of personnel and equipment before forcing a ball or go-devil through the pipeline, even if you are cleaning with water. Some air will be trapped in the pipeline, and the trapped air will become compressed before discharge.

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

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

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



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

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

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

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

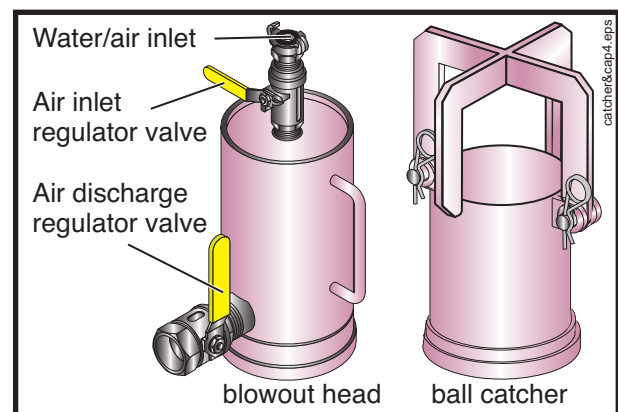
10.8 **⚠ WARNING** **Blowing out with compressed air creates potential hazards! Serious injury or death could result** if you do not adhere to these safety points.

- **Blowing out must be performed under the supervision of a qualified person.** (See the glossary for the definition of *qualified person*.)
- **Blowing out requires two people!** One trained person must be at the inlet end to operate the air insertion, and the other trained person must be near (but safely back from) the discharge point to monitor the discharge and to make sure that no one enters the hazard area.
- **No pipe bends or flexible delivery hoses may be connected to the end of the pipeline during the blowing out process,** unless there is a pre-planned

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

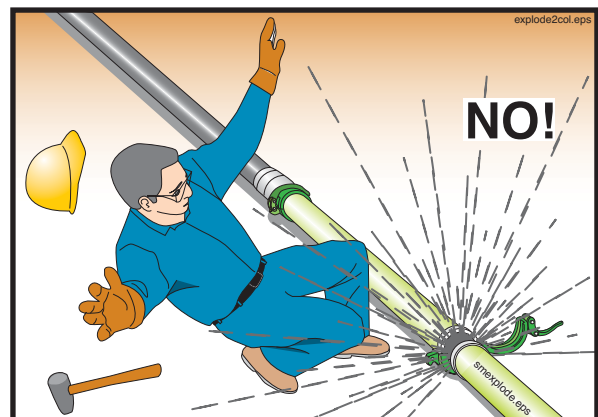
- **The point of discharge must be controlled. Clear the discharge area of personnel and equipment** before beginning the blowing out process. Do not allow anyone to enter the area during the blowout process. If a ball catcher is used, be aware of which type you have, and adjust your procedure accordingly. Ball catcher types are described in paragraph 5.24 on page 13.
- **The concrete outlet must be positioned high enough to permit easy discharge of the material.**
- If you are going to divert the discharge into a discharge pipe system, you must lubricate the discharge line with slurry, or a plug could occur.
- **The pipe cleaning blowout head must be equipped with a properly sized air discharge regulator valve and a separate water/air inlet.** The two openings should be spaced apart far enough that a blowout ball could not cover both openings at once (Figure 31).

Figure 31
Ball catcher and
blowout head



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

Figure 32
Never open a
pressurized
pipeline



- **Do not use compressed air to blow out concrete delivery hose, single pipe sections and short pipelines up to a length of 40 feet.** Hoses will jump and

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move unpredictably; short pipelines don't have enough concrete to resist the force of the air, causing it to discharge too quickly, like a cannon (Figure 33).

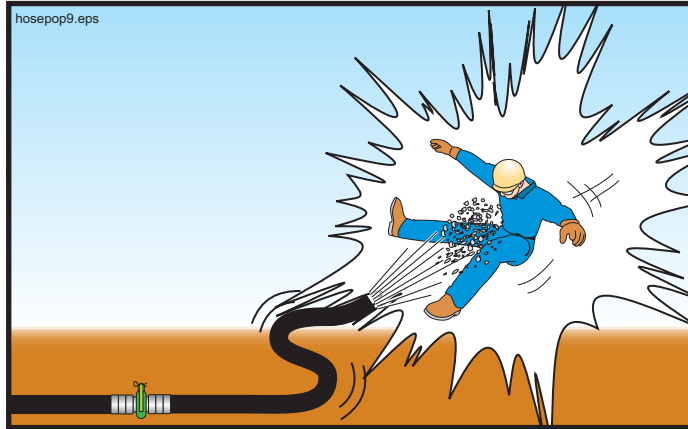


Figure 33
Never use air to blow out hoses or short pipelines

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

10.9

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

1. (See diagram A in Figure 34.) Without a shutoff valve installed, the pipeline is disconnected from the pump. Immediately, the concrete drains out of the vertical sections of pipe, leaving concrete in both horizontal sections, and air trapped in between.
2. (See diagram B in Figure 34.) The ball is inserted, and pushed with compressed air. This also compresses the air that is trapped in the vertical sections of pipe. The trapped air will be violently expelled when it reaches the end of the pipe, but the pipe will not yet be empty.

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

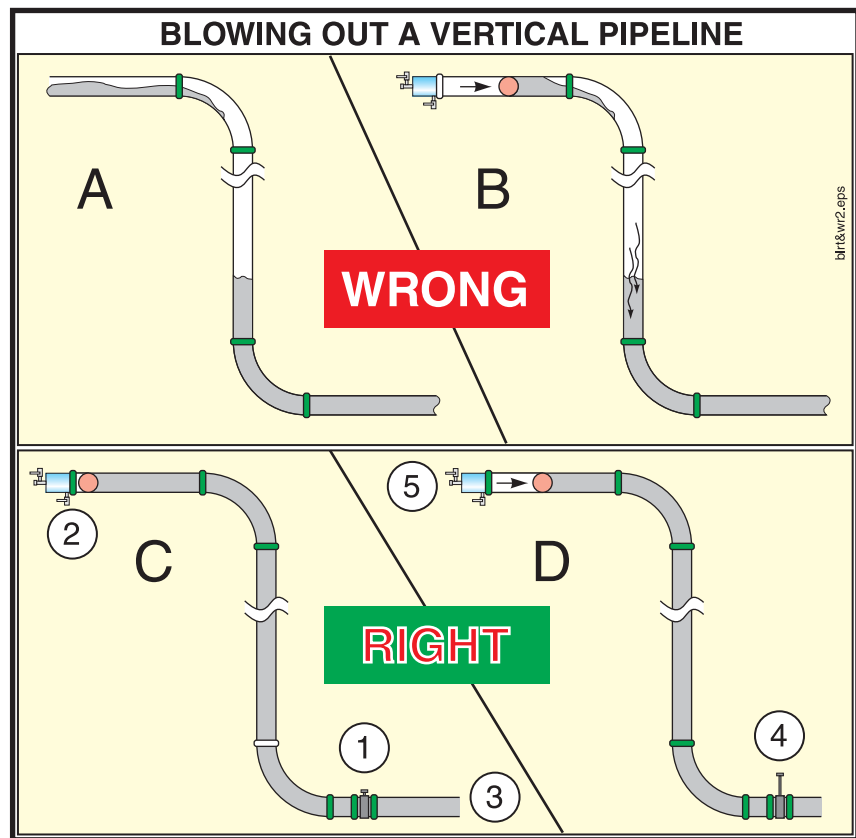


Figure 34
Blowout of a vertical line

10.10

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

1. **Know where the discharge area for blowing out will be before the pour begins.** Ready the area and accessories before the pour begins so you will not waste time when pumping is completed.
2. **Blowing out with compressed air requires two qualified persons.**
3. **The persons at both ends of the pipeline must be able to communicate without delays,** which means you must establish communications (for example, with a radio).
4. **When pumping is complete, close the shutoff valve before disconnecting the pipeline from the pump** (Item 1, Figure 34). Failure to do this will cause the concrete to fall out of the vertical sections of pipe, leaving concrete in the horizontal sections of pipe and an air pocket in the vertical sections. This does not apply if you are using a switching (diversion) valve.
5. Install the ball(s) in the pipeline, secure the blowout head and hook up the air compressor. **Do not apply the air yet!** (Item 2, Figure 34.)

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6. If you will be diverting the discharge to a cleanout area, lubricate the discharge line with slurry, or a plug could occur.
7. **Position the ready mix truck at the cleanout standpipe,** or install the ball catcher or other containment device at the end of the discharge line. (Item 3, Figure 34.)
8. **Clear the discharge area of personnel.** You must allow no one to enter the discharge area until the pipeline is depressurized.
9. **Divert the vertical pipe line to the cleanout area and secure the discharge (Figure 35), or open the shutoff valve in the delivery pipe line now.** Allow gravity to start the concrete moving through the discharge line. As the concrete falls from the vertical sections, it will take the ball with it, making it impossible to trap air in the line. (Item 4, Figure 34.)



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

10. **Apply the compressed air to the pipeline.** Close communications must be maintained at this time. Add only enough air to keep the concrete moving. Do not allow the concrete to accelerate. (Item 5, Figure 34.)
11. **When concrete starts to accelerate, shut off the air supply from the compressor, and open the air regulator to bleed air from the line.** Rapidly accelerating concrete indicates that the pipeline is almost empty. After the ball has been expelled from the pipeline, leave the air regulator open to be sure that all air is removed from the system.
12. All the rules for blowing out found in Point 10.8 on page 26 also apply to blowing out a vertical pipe line. These rules are in addition to the general cleaning a pipeline with compressed air rules.

10.11

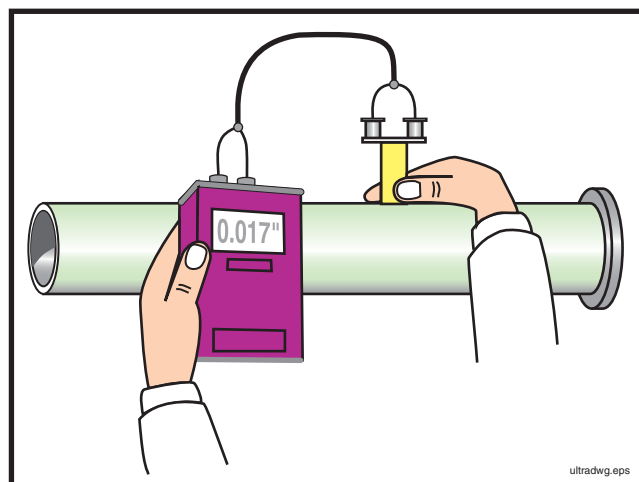


WARNING Never use compressed air to attempt to clear a blockage! It is unsafe and unnecessary. If the pump pressure can't move it, air pressure won't either.

V. Maintenance Of The Machinery

11. Safety Rules Regarding Inspection

- 11.1** **⚠ WARNING** Visually inspect your unit each day before it is put into operation. If any problem is found that will affect the safe operation of the pump, don't use the pump until it is repaired!
- 11.2** **⚠ WARNING** If safety decals are faded, missing, damaged, or otherwise unreadable, they must be replaced immediately. Contact the manufacturer of your unit to obtain replacements.
- 11.3** **⚠ WARNING** If safety devices or guards are removed for inspection purposes, they must be replaced before someone uses the machine.
- 11.4** **⚠ WARNING** Pay attention to the operation manual and manufacturers service bulletins regarding maintenance and inspection procedures and intervals.
- 11.5** **⚠ WARNING** If inspection reveals something that looks wrong, or even suspicious, report it to the manufacturer for consideration. Don't just assume that it's okay.
- 11.6** **⚠ WARNING** Visual inspection of the concrete pump circuits and safety devices should be done daily. Hands-on inspection and documentation of results should be done weekly, or at least when preventive maintenance is scheduled.
- 11.7** **⚠ WARNING** Do not neglect the delivery pipeline, clamps, or hoses. Check them often for wear, dents, and frays. Never send a unit to a job with a worn or damaged delivery system. For single wall pipes, ultrasonic thickness testers are more accurate than the tap method.



††

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

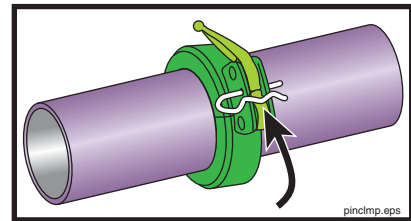
12. Safety Rules Regarding Scheduled Maintenance

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

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

12.3 **WARNING** Pins should be used on all delivery system clamps. Clamps that will hang over workers, and clamps used on system that will be dragged shall be pinned (Figure 37).

Figure 37
Pin the clamps



12.4 **WARNING** Be sure that you are installing the correct clamps for the types of pipe ends used. Never try to mate dissimilar pipe ends unless using a clamp specifically made for this purpose. See the comparison regarding weld-on ends on page 46 in the *Appendix* of this manual.

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

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

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

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

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

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

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

12.12

NOTICE Electronic components can be destroyed by welding current. Before welding on the unit, you must disconnect the battery cables, and unplug all radio remote control power wires. If in doubt, contact the Service Department of the manufacturer for instructions **before** proceeding.

13. Safety Rules When Servicing The Machinery

13.1

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

13.2

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

13.3

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

13.4

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

13.5

WARNING If maintenance work requires that you use a crane, hoist, fork truck, or similar machine, read and understand the safety regulations for that equipment.

13.6

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

13.7

DANGER 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).

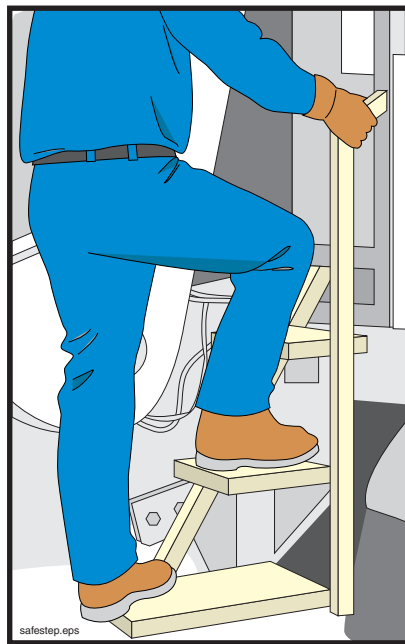


Figure 38
The 3-point Rule

- 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).

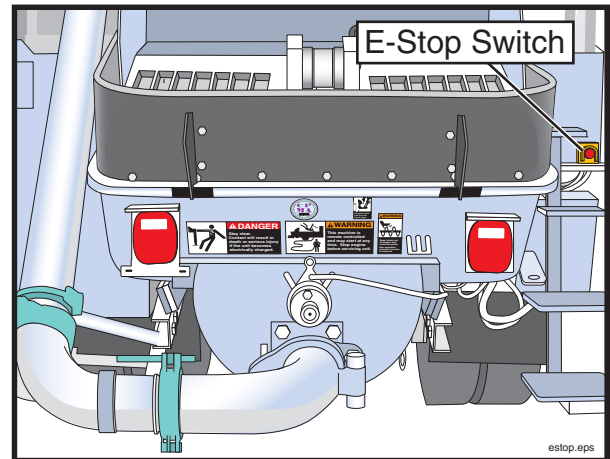


Figure 39
Know how to stop the unit in an emergency

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.

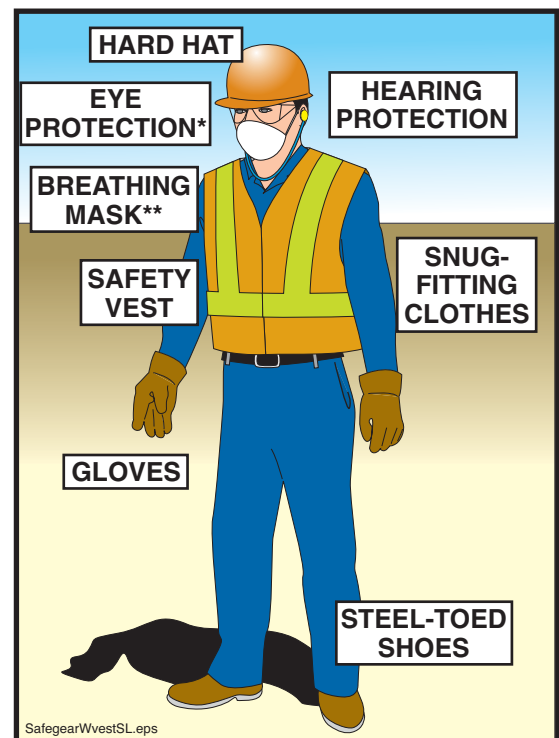


Figure 40
Wear the same personal protective equipment as the operator

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14.3

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



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

14.4

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

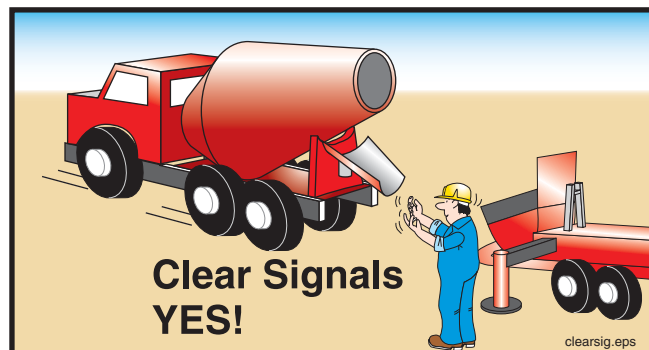


Figure 42
Use clear, concise hand signals

14.5

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

14.6

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

14.7

⚠ WARNING If you see foreign material that could create a blockage coming from the ready mix truck, alert the operator to stop the pump. Do not attempt to remove the material from the hopper or grate while the hydraulic system is ready to work. (See Point 14.16 on page 39.) If necessary, depress the E-stop button to stop the pump and alert the operator.

14.8

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

14.9

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

14.10

⚠ WARNING Do not let the concrete level in the hopper become low! If air is sucked into the material cylinders, the pump will compress the air. Compressed air always poses a hazard as it is expelled from the hopper or the delivery pipeline (Figure 43). If air is taken into the material cylinders, take the following steps to minimize the hazard:

1. Stop the pump immediately. Hit the emergency stop switch (E-stop) if that is the quickest way to stop the pump. There will be an expulsion of compressed air the next time the concrete valve shifts. If possible, fill the hopper with concrete to help contain the expulsion. Do not put your face directly over the hopper.
 2. Alert the operator of the problem. It is the operator's job to know the procedures for safe removal of air from the pump and delivery system. These procedures include pumping in reverse for a couple of strokes.
 3. Persons standing at the discharge end or near the delivery line must be warned to move away until all of the air has been purged. Warn them to stay a reasonable and prudent distance beyond the reach of the end hose or point of discharge (Figure 43).
 4. When the pump is restarted, don't assume that the first little air bubble is the end of the compressed air.
 5. Do not allow anyone near the discharge until concrete runs steadily from the end and there is no movement of the delivery system.
- If workers are positioned in high or precarious places, warn them to expect a loud sound as the air escapes the pipeline. (Warn them even if they are well away from the discharge.) That way, we can prevent the worker from falling as a result of being startled by the noise.

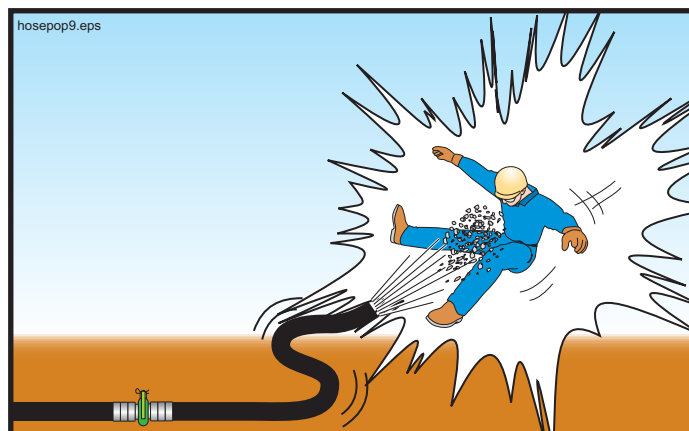


Figure 43
Remove everyone from the discharge area
whenever air has been introduced into the line

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.

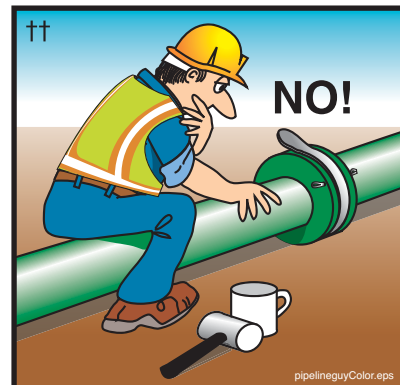
14.12

⚠ 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).

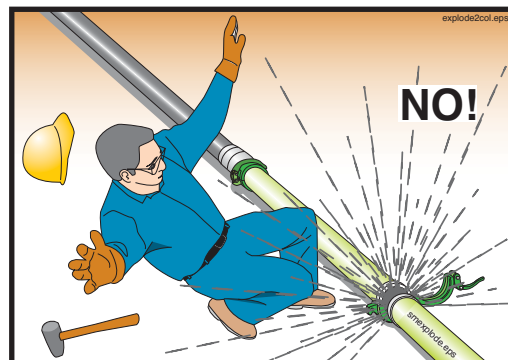
Figure 44
Never straddle or sit on a pressurized pipeline



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.)

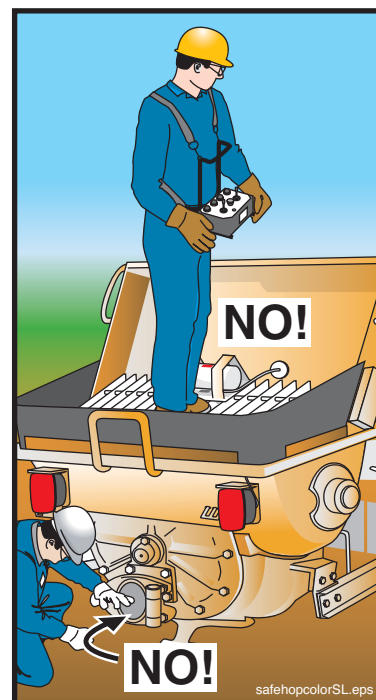


Figure 46
Never put your body in the machine!

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.

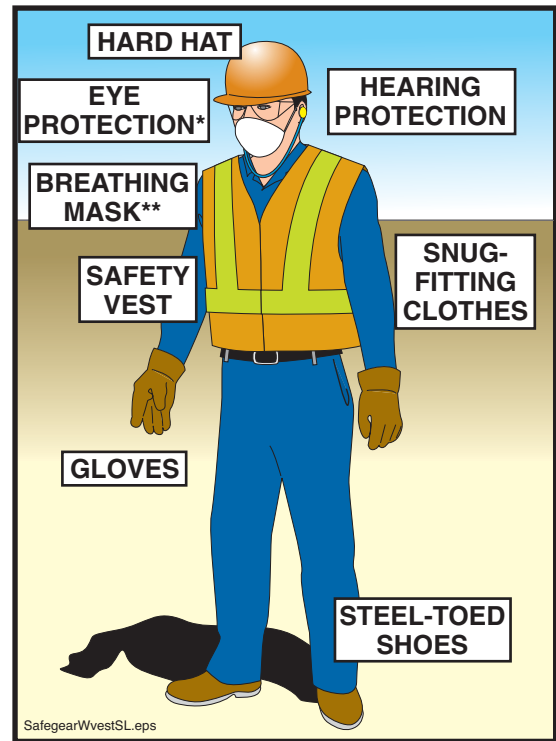


Figure 50
Wear Personal Protective Equipment (PPE)

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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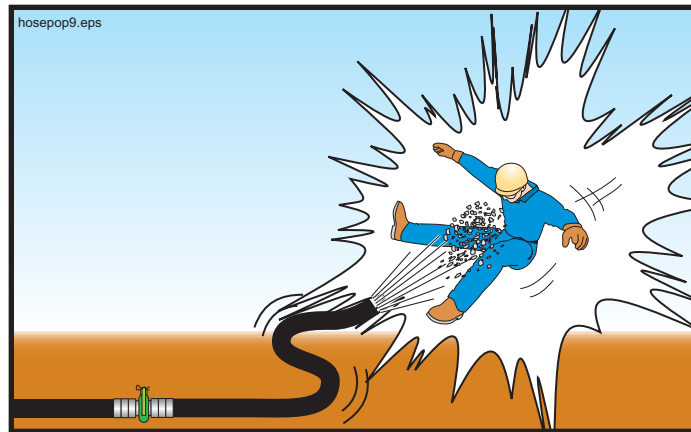


Figure 51

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.

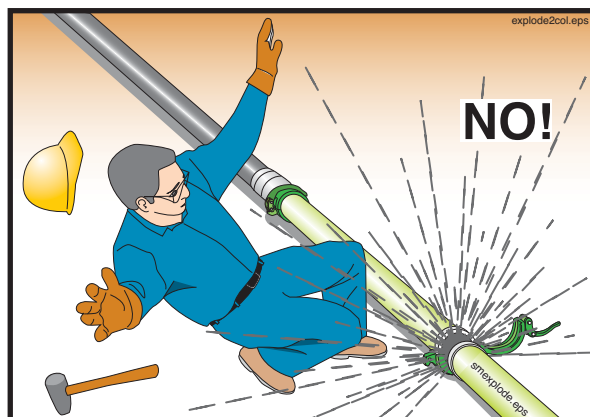


Figure 52

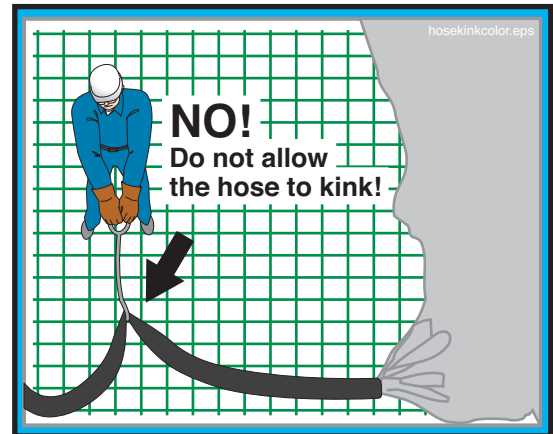
Never open a pressurized pipeline

- 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).

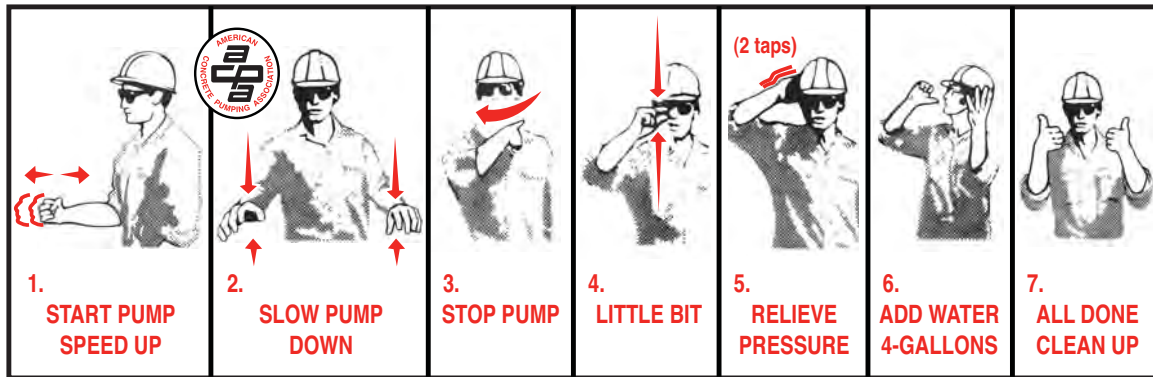
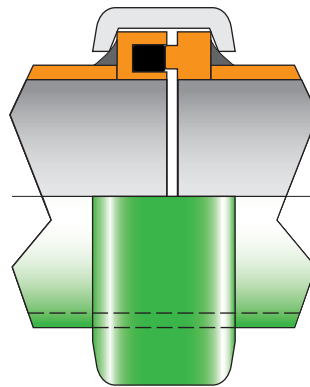


Figure 55
Recommended ACPA hand signals

VII. Weld-On Ends/Coupling Comparison

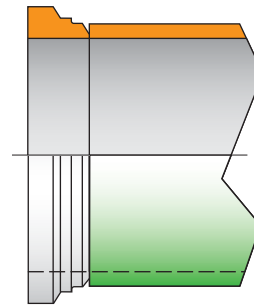
Shown is a comparison among commonly used ends/couplings. No two ends shown can be joined without the use of an adapter pipe or a special adapter clamp. Clamps and pipe strength must also be considered when determining proper system requirements. The ratios shown in the text below represent the safety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

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



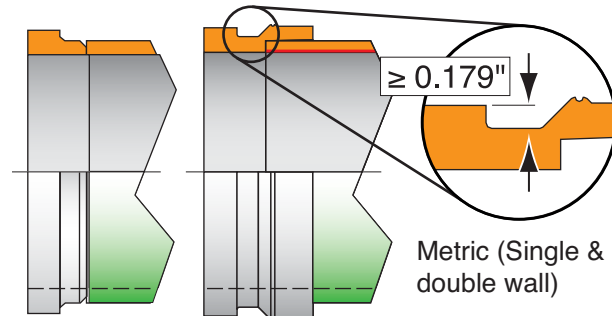
Male / Female
O-Ring
(shown with clamp)

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



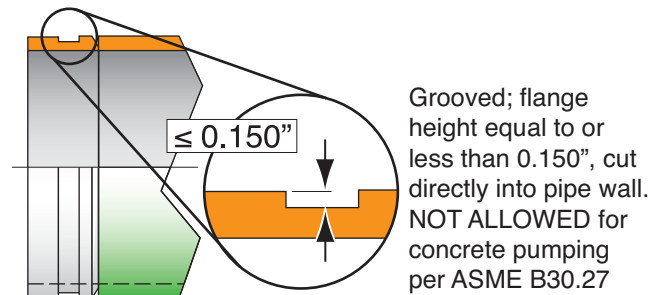
Heavy-Duty

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



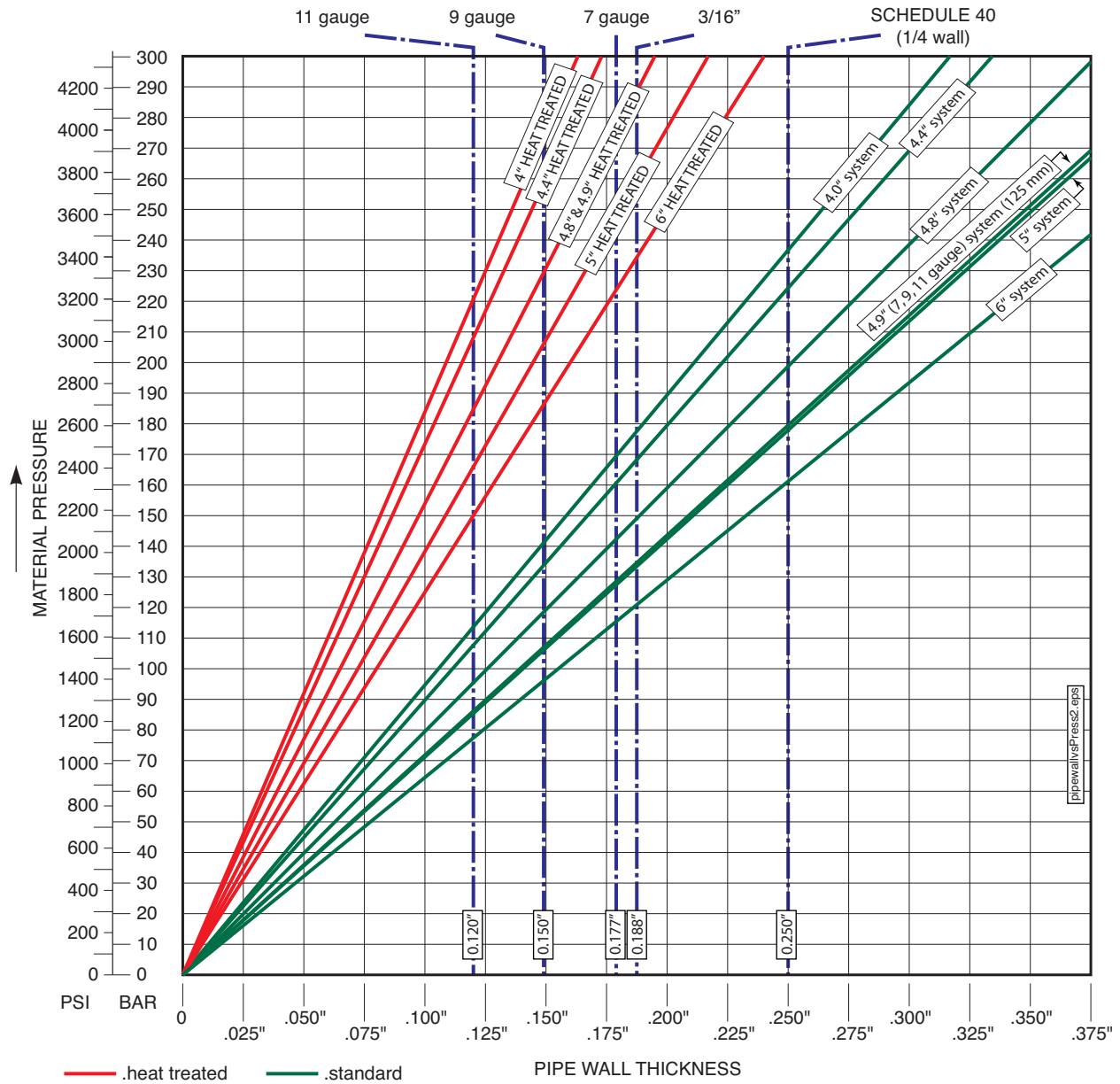
Metric (Single &
double wall)

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



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:* Signallerperson

High Voltage

For the purposes of this manual, anything over 28 volts is to be considered high voltage. In the U.S., electrically driven concrete pumps normally operate the motors at 480 volts AC (high voltage) and the controls at 24 volt DC (low voltage).

Hopper Grate

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

Jacking the Outriggers

Adjustment of the outriggers in the vertical direction.

Licensed Electrician

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

Maintenance

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

Maximum Pressure

When talking about a hydraulic system, maximum pressure refers to the highest pressure that can be achieved with the settings of the circuit relief valves. When discussing concrete output, maximum pressure refers to the pressure that will be developed if the hydraulic system pressure

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reaches the relief valve setting. Concrete pressure is the force at which the differential cylinders are moving, divided by the cross sectional area of the concrete cylinder. Maximum concrete pressure, then, is developed when the differential cylinders are moving with maximum force, which is determined by the hydraulic system relief valve setting. *See Also:* Concrete Pressure.

Minimum Safety Distance

In this manual, the term “minimum safety distance” refers to the closest distance that you are allowed to approach an object, electrical wires, etc. and still leave room for errors in human judgement or machine malfunction. With electrical wires in the U.S., this distance is 20 feet from the wires (50 feet above 350 Kv), as recommended by the American Concrete Pumping Association. This distance may have other values in different locations. It is up to the operator to know the value for the place of operation.

Operational Area

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

O.S.H.A.

Occupational Safety and Health Administration. A branch of the United States federal government that deals with job safety. It establishes and enforces safety regulations for industry and business. Among the areas over which it has authority are construction job sites and work shops.

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

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

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

Plug

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

Point of Discharge

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

Pour

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

Qualified Person

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

Qualified Operator

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

Qualified Personnel

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

Qualified Workshop Personnel

An individual who:

- has reached the age of 18 years,
- is physically and mentally capable,
- has been trained in proper repair, maintenance, and inspection procedures plus the pertinent safety rules for concrete pumps and related equipment,
- has demonstrated their capabilities to their company in regards to the above mentioned procedures and rules, and
- can be expected to perform these duties, as assigned, in a reliable manner.

Rock Jam

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

Separate Pipeline

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

Shutoff Valve

In hydraulics: a valve with the ability to stop the flow or pressure of hydraulic oil. It must be able to withstand the maximum pressure of the hydraulic circuit that it controls.

In concrete: A manually or hydraulically operated valve that will prevent the flow of concrete in either direction. The shutoff valve must be able to withstand the maximum pressure on the concrete of which the pump is capable of exerting.

Signalperson

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

Soil Pressure

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

Sponge Ball

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

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Spotter

A person positioned at a vantage point where the distance between a hazard and the pump can be clearly seen and evaluated and the pump operator can be alerted if a predetermined safety distance is compromised. *See Also:* Guide

Sucking Back

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

Thrust Block

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

Towing Vehicle

In this manual, *Towing Vehicle* applies only to vehicles that tow trailer-mounted concrete pumps. It is the vehicle that you will use to tow the trailer on the road, on the job site, or in the yard. See the safety rules regarding this subject on page 8 of this *Safety Manual*.

Transport Position

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

Unauthorized

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

Unintentional Movement

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

Vertical Run

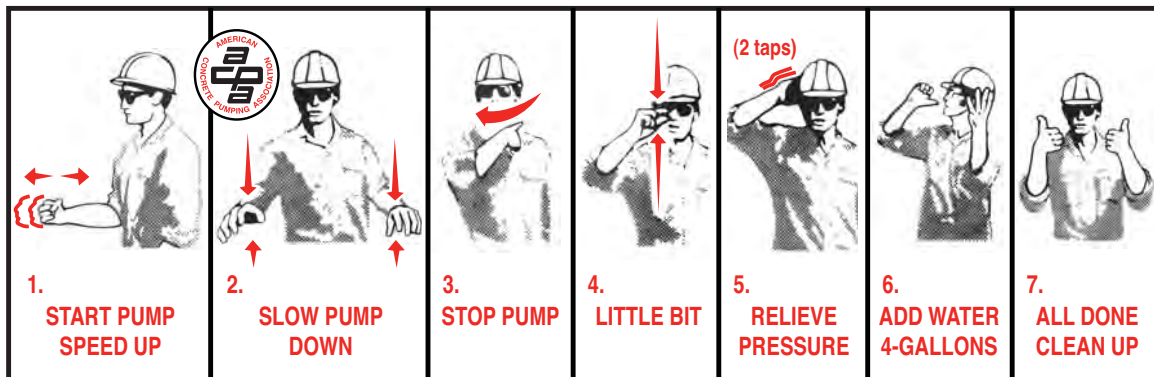
Sections of concrete delivery pipeline that are running in an up (or down) direction. Vertical runs have very specific procedures and rules for installation, support, cleaning, and inspection. Concrete pumping personnel should, therefore, have specific training in these procedures and rules before attempting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

Water Jet

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

X. Recommended ACPA Hand Signals

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



ACPAhandsgsmallline2.eps

XI. Bibliography

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

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

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

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

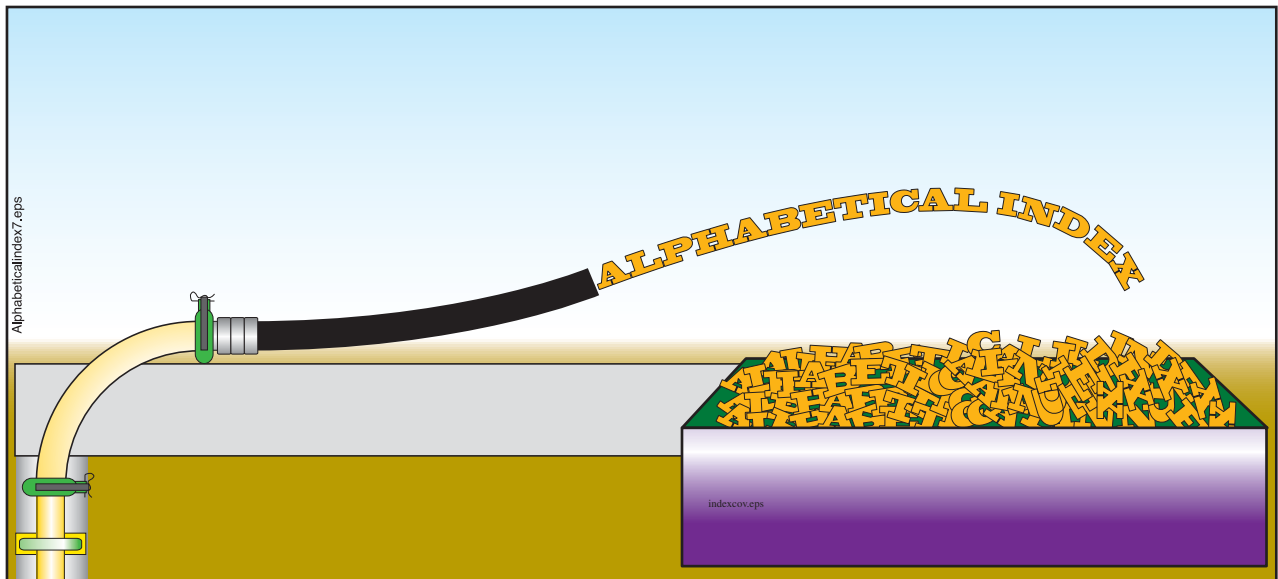
SAFETY STANDARD FOR CONCRETE PUMPS, PLACING BOOMS, AND DELIVERY SYSTEM by the Concrete Pump Manufacturers Bureau

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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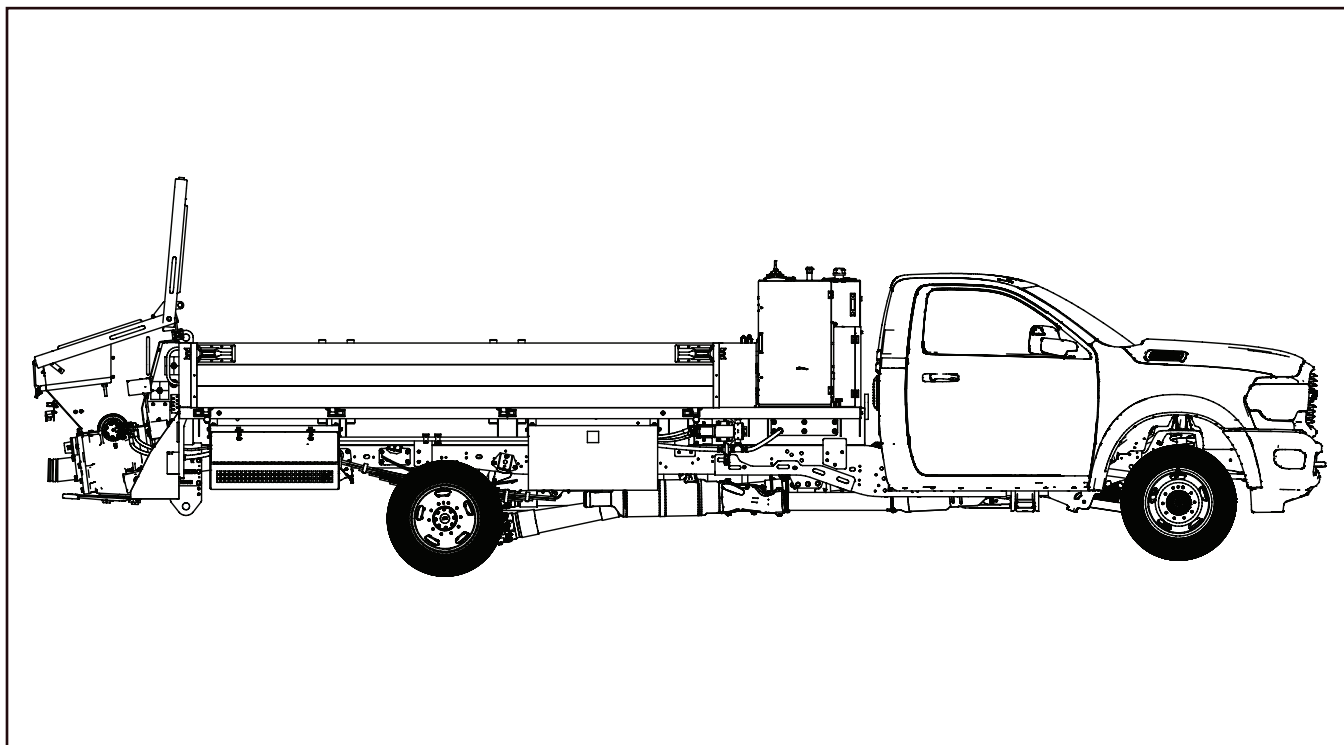
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This section provides an overview of the SPTO concrete pump circuit and describes all safety features on the unit. This section also identifies the components on the truck cab, the truck chassis, the concrete pump, and the hopper. It is recommended that you read this section of the manual while you are near the concrete pump so that you can identify the components as they are described.

This section is not intended to be used for information on operating the pump. Operating procedures, along with their applicable warnings and cautions, are contained in the Operation section of this manual.

Concrete Pump Circuit Overview

SCHWING concrete pumps have a fully hydraulic, twin-cylinder, reciprocating design. The pumpkit consists of:

- Two differential hydraulic cylinders
- Waterbox
- Two material cylinders
- Concrete valve (rock valve) and slewing cylinder

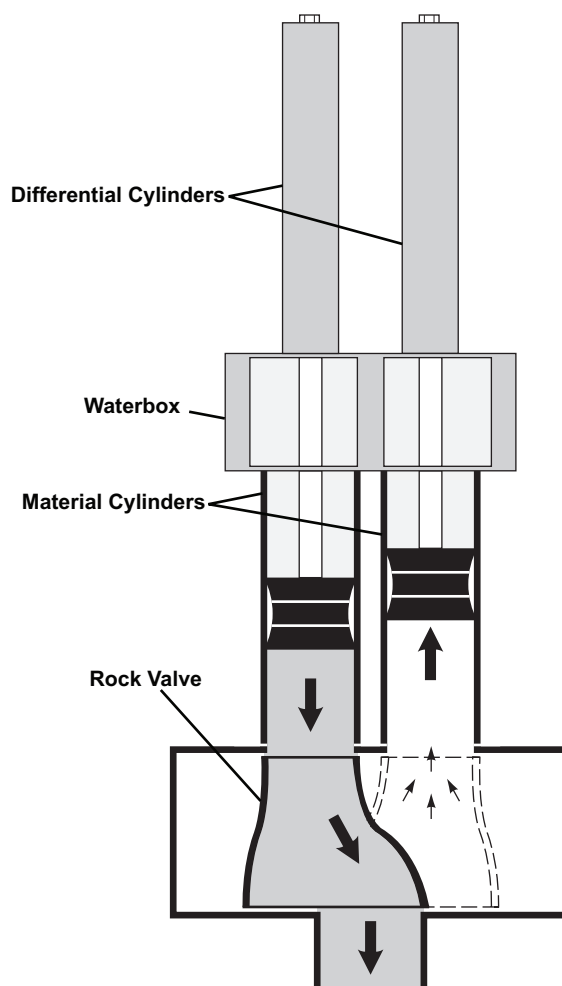
The waterbox acts as a mounting structure for the differential cylinders and as a container to hold flushing water. The concrete valve directs the flow of concrete from the hopper to the outlet piping.

During operation, the two hydraulic cylinders move back and forth in perfect synchronization. When one hydraulic cylinder reaches the end of its stroke both cylinders then shift direction, and the cylinder that had been pushing the concrete now begins to suck concrete from the hopper. The cylinder that had been sucking concrete from the hopper now begins to push it into the pipeline. When the machine runs in reverse mode, concrete is sucked from the pipeline and pushed into the hopper.

It is the job of the rock valve to shift the direction of the two hydraulic cylinders. These cylinders are connected via hydraulic plumbing and share hydraulic oil on one side of their pistons. This shared oil, called rocking oil, keeps the two cylinders moving. Another pair of hydraulic cylinders (the rock valve slewing cylinders) cycles the rock valve back and forth.

The hydraulic pumps that supply oil to the concrete pumpkit adjust the amount of oil they deliver by internal pressure-sensing devices and by external valves (the stroke limiter and the dampener valves).

Each hydraulic cylinder has an area difference referred to as an “area differential” between the two sides of the piston. This area differential exists because the rod extends from only one side of the piston. This is in contrast to a cylinder which has a rod extending from both sides of the piston, and, therefore, has the same area on both sides of the piston.



Twin-Circuit Versus Single-Circuit

Twin-circuit systems have a hydraulic circuit to move the differential cylinders and a separate circuit to switch the rock valve. On single circuit machines, the main hydraulic pumps move both the main differential cylinders and the rock valve.

There are advantages to having a separate hydraulic circuit to switch the rock valve. For instance, with a stiff, lean mix and high-pressure, a single-circuit system does not always have enough pressure available to move the rock valve. Generally, this deficit occurs when the mix is being pumped directly upwards. The rock valve must dislocate a column of concrete that still has pressure on it from the stroke, and the next stroke cannot begin until the rock valve has completed its travel. In a twin-circuit system, as soon as the S-3 spool changes direction, oil is routed to the rock valve so it can change direction, as well as to the valve that changes the direction of the differential cylinders. If the rock valve cylinder has enough pressure available to switch, it will do so. If it has insufficient pressure, it will wait.

When the differential cylinders change direction, one of the following happens:

- If the rock valve has already switched, concrete is drawn immediately from the hopper and pushed into the pipeline with a normal stroke, or
- If the rock valve has not already switched, concrete begins to be drawn from the pipeline and pushed into the hopper. This reduces the pressure in the pipeline to zero. As soon as pipeline pressure is relieved, the rock valve moves across. Once the rock valve has moved, concrete accelerates out of the pipeline as normal.

The concrete is not pumped in reverse, because as soon as the pressure in the pipeline drops to zero, the rock valve switches. This system has the added benefit of reducing wear on the cutting ring, the spectacle plate, the kidney seal and kidney plate, and the rock valve slewing cylinder.

One advantage of a single-circuit machines is a lack of an accumulator. When the engine is shut off, no hydraulic pressure exists in the system, and the hydraulic lines can be safely opened. This is not the case with twin-circuit machines; even with the engine shut off, pressure could be stored the accumulator. If a line is removed, oil could be discharged raising the possibility of injury.

Whenever you work with accumulators be sure to follow

these simple rules:



Accumulator Safety Rules

1. Never assume that the accumulator has no stored pressure. Check the gauge before removing any lines, valves, or fittings. Verify zero pressure, and periodically check that the gauge is in good working order.
2. Recharge an accumulator (add dry nitrogen) only after you read and understand all the instructions for recharging accumulators. Accumulators are charged with dry, not liquid, nitrogen. Complete recharging instructions can be found in the Maintenance section of this manual.
3. Never charge an accumulator with oxygen or compressed air. Under pressure, oxygen can contact some of the molecules of hydraulic oil and lower the flash point of the oil to below room temperature. If the oil flashes, the accumulator will explode.
4. Never work on the accumulator, the rock valve cylinder, the cutting ring, or any other connected component with the engine running. After shutting off the engine, remove the key and place it in your pocket. Then verify zero pressure on the accumulator gauge before opening or working on any of these items.
5. Never substitute the tools or equipment needed to recharge the accumulator. The correct tools are shown in the Maintenance section of this manual.
6. Do not operate the machine if the accumulator develops a gas leak, an oil leak, or a ruptured bladder. Replacement bladders can be ordered through SCHWING's Spare Parts Department, or the accumulator can be sent in for repair. Call the SCHWING Service Center at 1-888-292-0262 for assistance.

First Commissioning

Installation of Your New Unit

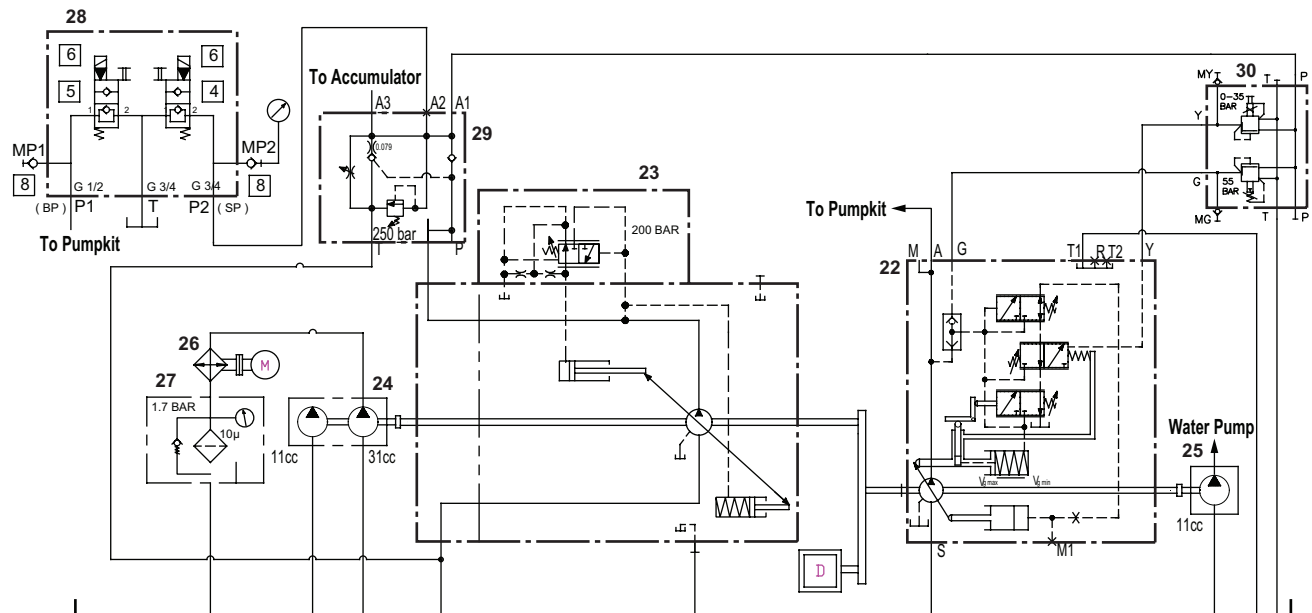
When your new SCHWING pump was delivered, it was accompanied by several documents in addition to this operation manual. One of those important documents is the “Delivery Inspection Report.”

Each of the thirty-five items listed should be checked before your new pump is sent to the first job.

	Operational	Repair Required	Comments (If repair is required)
1. Engine Coolant			
2. Engine Oil Level			
3. Transmission Oil Level			
4. Oil Level - System I and II			
5. Oil Level - System III			
6. Transfer Case or FTD Oil Level			
7. Oil in Gear Compartment of Hydraulic Pump 1			
8. Oil Level in Distribution Gearbox			
9. Oil Level in Agitator Gearbox			
10. Flushing Oil Level (Gate Valve System)			
11. Oil Level in Compressor			
12. Agitator Greased			
13. Rock Valve Greased (if Equipped)			
14. Drive Line Greased			
15. Outriggers and Boom Greased			
16. Manual and Remote Throttles Set to Proper RPMs			
17. Setting of Relief Valve - System I			
18. Setting of Relief Valve - System II			
19. Setting of Relief Valve - System III			
20. Pressure Gauges Work - Systems I, II, and III			
21. Hydraulic Lines Checked for Leakage (Heat Oil to 80°C)			
22. Hydraulic Oil Cooler Checked for Leakage and Proper Air Flow			
23. Water Pump			
24. Agitator			
25. Forward-Reverse for Pumpkit			
26. Outriggers			
27. Remote Control (Boom) Functions			
28. Manual Check of All Hand Valves			
29. Holding Valves on Boom			
30. All Boom Pin Retainers in Place			
31. End Hose Cable Hook Installed			
32. Tail Light and Clearance Lights			
33. Safety Decals (see Decal Sheet)			
34. Tools/Spare Parts (see Tool Checklist)			
35. Visual Inspection of Paint Job			



1	Hydraulic Oil Reservoir	12	Accumulator Pump
2	Main Hydraulic Pump	13	Main Pressure Gauge
3	Main Pressure Relief Valve	14	Accumulator
4	Directional Control Valve S-1	15	Check Valves
5	Rock Valve Slewing Cylinder	16	Shuttle Valve
6	Directional Control Valve S-3	17	NG 10 Valve for Forward/Reverse
7	Directional Control Valve S-2	18	Soft Switch Relief Valve
8A/8B	Differential Hydraulic Cylinder	19	Soft Switch Shut-Off Handle
9A/9B	Switching Valves	20	Main Relief Poppet Valve
10	Forward/Reverse Valve	21	Soft Switch Valve
11	Quarter Turn Valve		



22	Main Pump		
23	Accumulator Pump		
24	Oil Cooler Gear Pump		
25	Optional Water Pump		
26	Oil Cooler		
27	Filter		
28	E-stop Manifold		
29	Accumulator Unloading Valve		
30	Stroke Limiter		

Safety Devices

The following paragraphs describe the safety devices found on the stationary pump. The devices listed here must be maintained in good working condition to avoid injury. Bypassing a safety device for servicing or emergency clean out should only be done by qualified personnel. All bypassed devices must be set back to their original state upon completion of the service or emergency procedure.

Emergency Stop (E-stop) Buttons

There are five emergency stop (E-stop) buttons (Figure 1) located on the concrete pump and remotes. Emergency stop buttons are found near or on the following:

- Rear Control Panel
- Waterbox
- Hopper (Driver-Side)

An emergency stop button is also located on every remote.

Pushing an emergency stop (E-stop) button disables the hydraulic circuit.

To reset an E-stop on the concrete pump and enable the hydraulic circuit, pull the button back out and press the horn button on the active remote.

To reset an E-stop on a remote, turn the button clockwise and press the horn button.

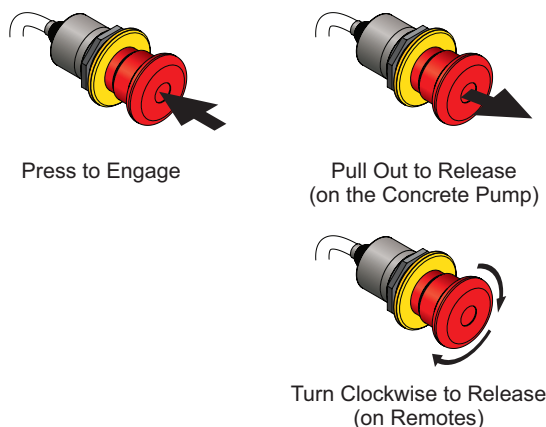


Figure 1
Emergency Stop (E-stop) Button

Emergency Stop (E-stop) Manifold

The emergency stop manifold (Figure 2) is a safety device that consists of two dump valves with override buttons.

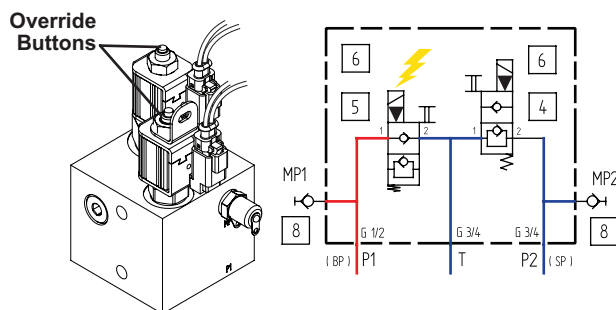


Figure 2
Emergency Stop (E-stop) Manifold

The dump valves are normally open, which means that electricity must be present before the valve can close and pressure can develop in the hydraulic circuits. If there is an electrical problem or an emergency stop button is activated, power is lost to the solenoids, the dump valves open and route all oil from the hydraulic pump directly back to the hydraulic tank, causing a loss of hydraulic pressure and disabling the hydraulic circuit.

If power is lost to the emergency stop solenoids, press and hold the emergency override buttons (Figure 2) to restore hydraulic pressure. The concrete pump can now be placed into forward or reverse with handle located on the S1/S2 control block (Figure 3).

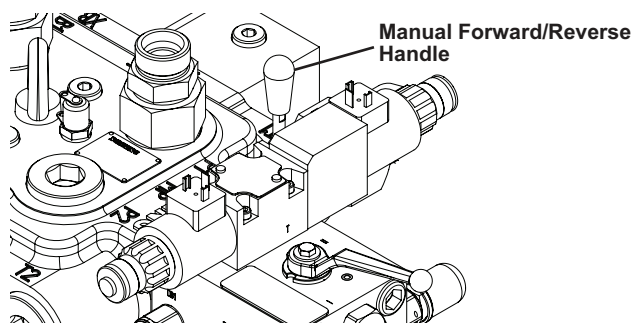


Figure 3
Concrete Pump Forward/Reverse Handle

Hopper Grate Interlock Switch

The hopper grate switch (Figure 4) consists of a switching cam and pressure roller switch. The switching cam is attached to the hopper grate. The pressure roller switch is wired through the concrete pump forward / reverse solenoids and the agitator dump valve. When the hopper grate is lifted, the switching cam will press against the pressure roller switch and break the circuit. The concrete pump will go into the neutral position and the agitator will stop moving.

Shutting the hopper grate will reconnect the electrical circuit, the concrete pump and agitator will remain in neutral until you activate a forward or reverse function.

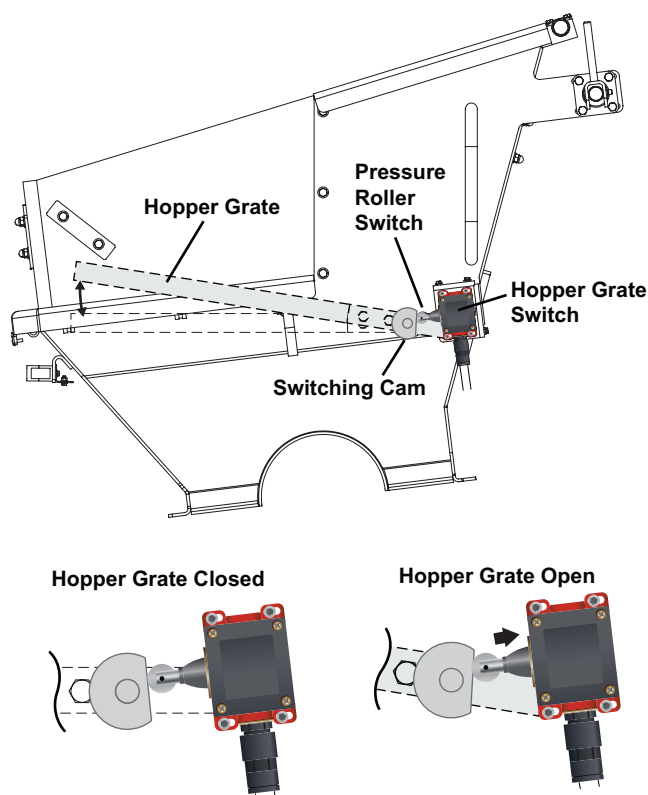


Figure 4
Hopper Grate Interlock Switch

⚠ WARNING

Never put any part of your body in the hopper or in the concrete valve, either from above (through the hopper) or from below (through the outlet pipe or clean out door). Serious injury can occur.

Pressure Relief Valves

Pressure relief valves (Figure 5) are the safeguards which limit maximum pressure in a hydraulic circuit by diverting excess oil to the hydraulic tank when maximum pressures are exceeded. The relief pressures listed on the hydraulic schematics are not nominal figures. They are the hydraulic relief pressures that the concrete pump was designed to work with and that the components were designed to accommodate.

Under no circumstances should you raise hydraulic relief pressures. Conversely, lowering the hydraulic relief pressure settings may cause poor performance, heat, and related premature component failure. In some extreme cases, raising or lowering hydraulic relief pressures may cause dangerous operation. Check with the SCHWING Service Center before changing any hydraulic relief pressure settings.

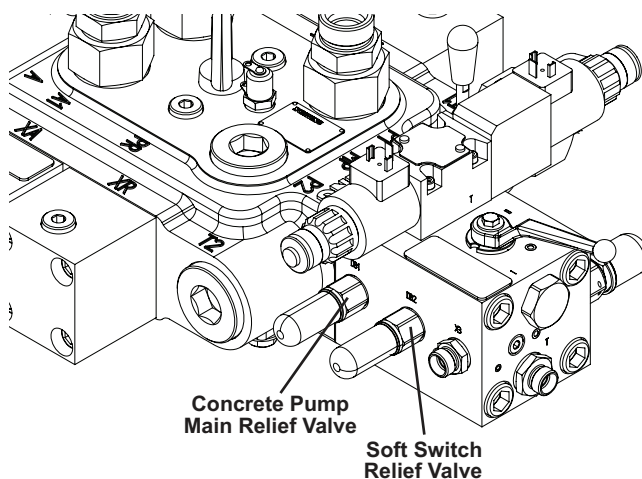


Figure 5
Example of Pressure Relief Valves

Safety Guards

Safety guards (Figure 6) protect against personal injury. Do not operate the machine unless all the safety guards are in place. If they become damaged, lost, stolen, or inoperable for any reason, they must be replaced before operation continues.

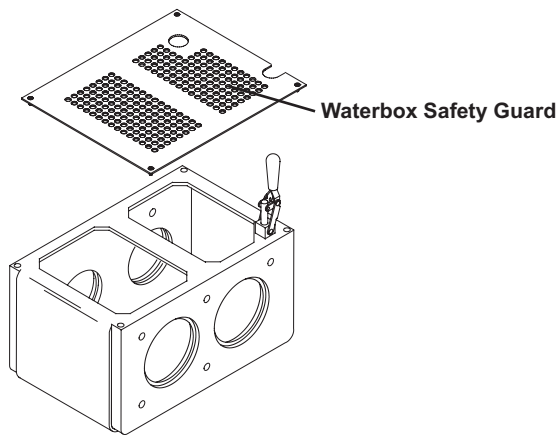


Figure 6
Safety Guard Example (Waterbox Safety Guard)

Fuses and Circuit Breakers

Fuses and circuit breakers protect against circuit overload. They do so by melting or opening when the current in an electrical circuit becomes higher than it was designed for. Here are some causes for circuit overload:

- Short circuits (positive goes to negative without resistance)
- Component malfunction (a coil that has to move a sticky valve)
- Mechanical interference (a shovel handle stuck through the oil cooler fan blade)

To maintain this safety device, simply replace a blown fuse with the correct size and type fuse, and never bypass a fuse. A very good rule of thumb for fuses is this: if it blows once, replace it, but if it blows again, something is wrong. Find the cause of the problem, and repair it before activating the circuit again.

Rear Hopper Buttons

There are three buttons on the rear passenger side of the machine (Figure 7):

- Horn
- E-stop
- Agitator Reverse Direction

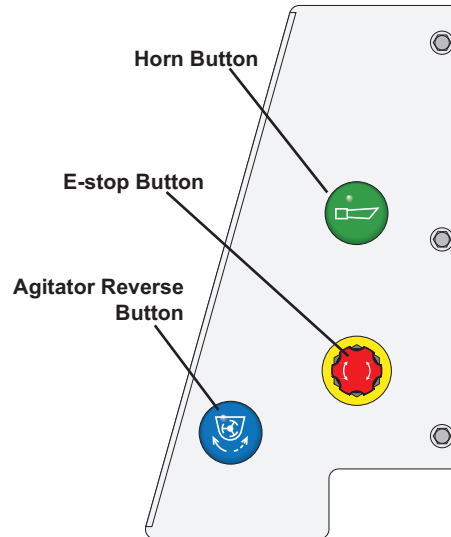


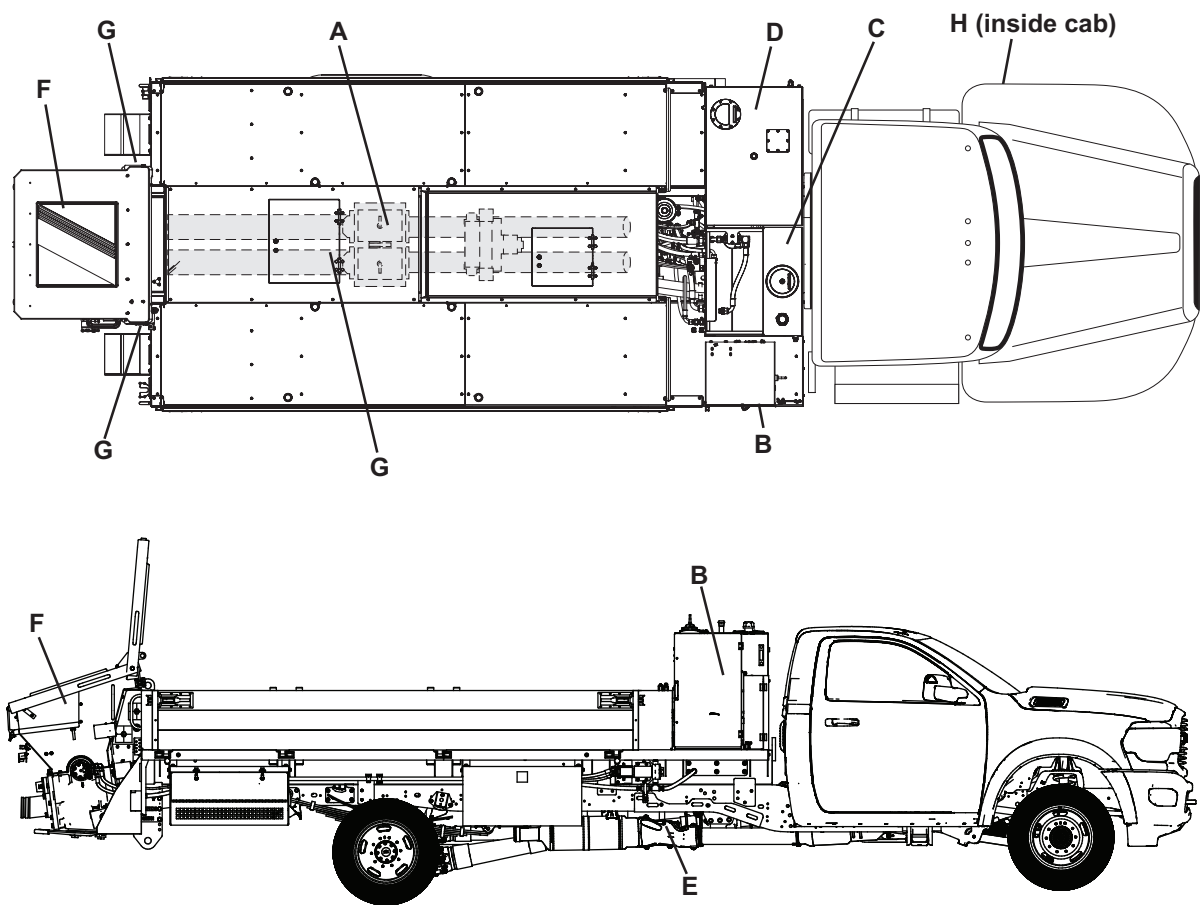
Figure 7
Rear Hopper Buttons

Pressing the horn button will sound the horn. This button will NOT reset the E-stop circuit.

When pressed, the agitator reverse direction button will change the current direction of the agitator to the opposite direction. If the agitator is in the forward position, pressing and holding this button will turn the agitator in the reverse direction.

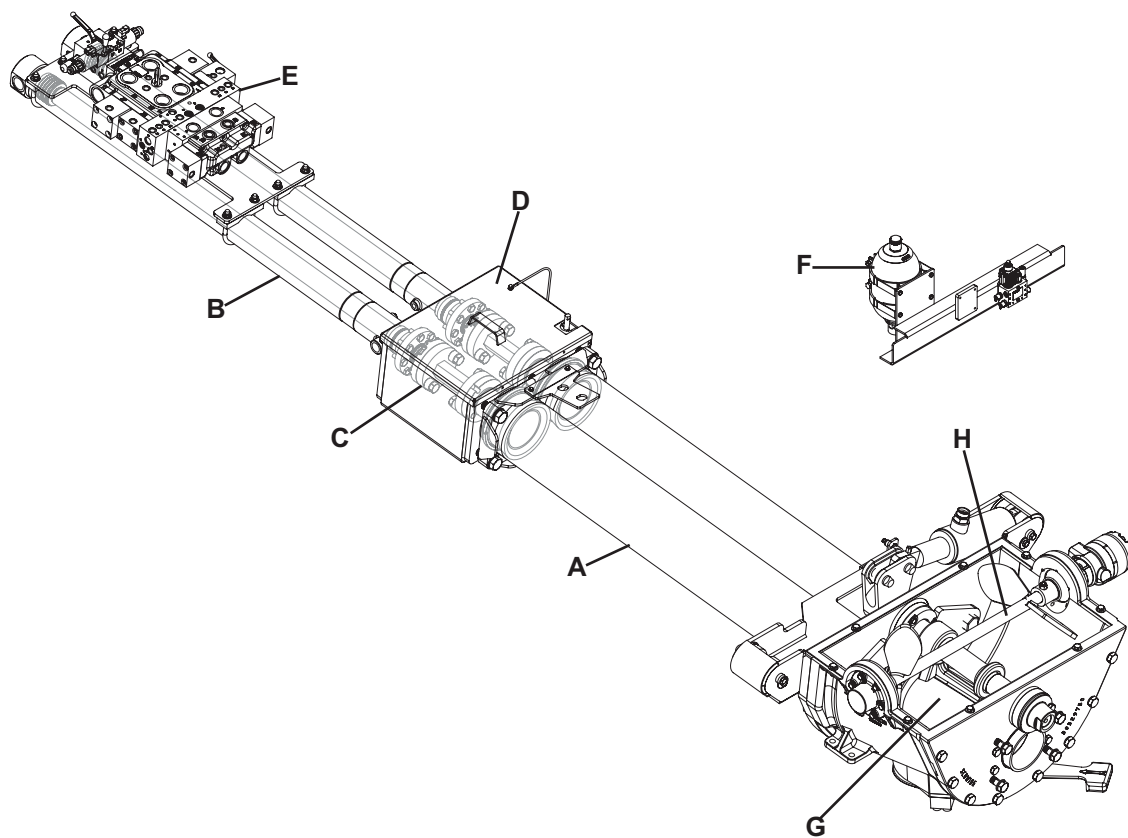
Machine Overview

- A. Pumpkit
- B. Operator Control Station
- C. Hydraulic Tank
- D. Water Tank
- E. Gearbox
- F. Hopper
- G. E-stop Buttons
- H. In-Cab Controller



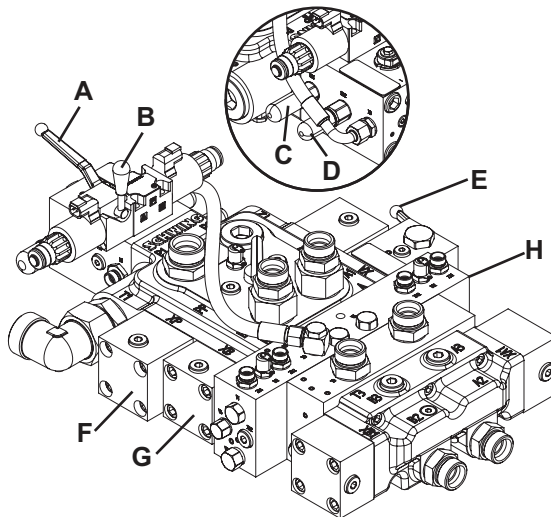
Pumpkit Overview

- A. Material Cylinders
- B. Differential Cylinders
- C. Rams
- D. Water Box
- E. S1/S2/S3 Control Valve
- F. Accumulator
- G. Rock Valve
- H. Agitator



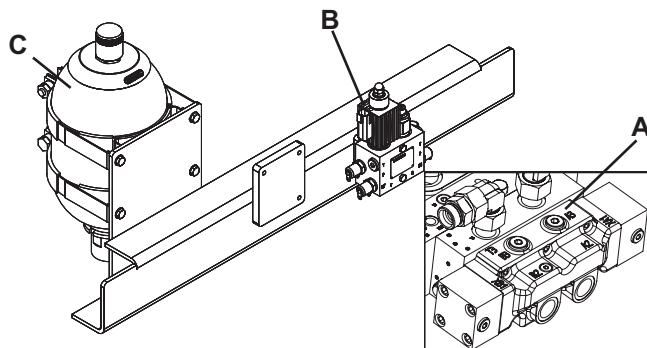
S1/S2/S3 Control Valve

- A. Soft Switch Quarter Turn Handle
- B. Manual Forward / Reverse Handle
- C. Main Pressure Relief
- D. Soft Switch Pressure Relief
- E. Quarter Turn Valve
- F. S2 Spool (Internal)
- G. S1 Spool (Internal)
- H. MPS Valve



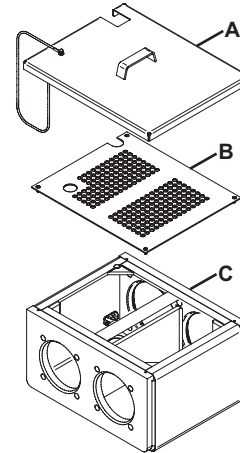
Accumulator

- A. S3 Spool (Internal)
- B. Stroke Limiter
- C. Accumulator Bottle



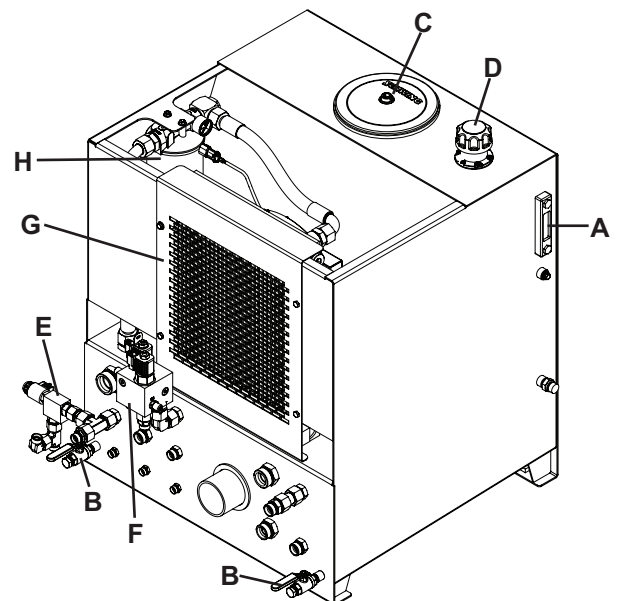
Waterbox

- A. Cover
- B. Guard
- C. Reservoir with Drain



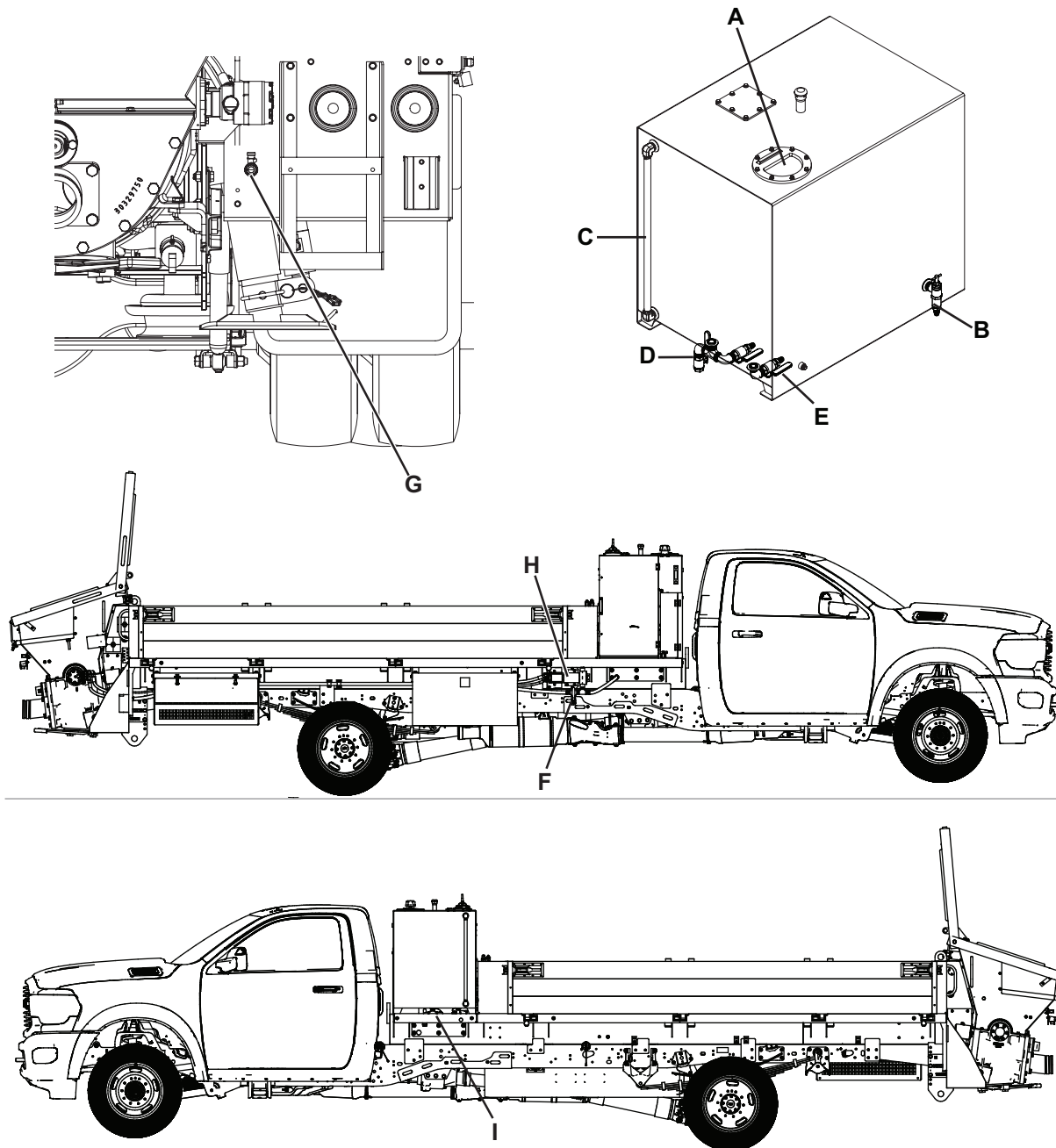
Hydraulic Tank

- A. Hydraulic Oil Level / Temperature Gauge
- B. Drain
- C. Cleanout Cover
- D. Breather
- E. Agitator Dump Valve
- F. E-stop Manifold
- G. Oil Cooler
- H. Filter



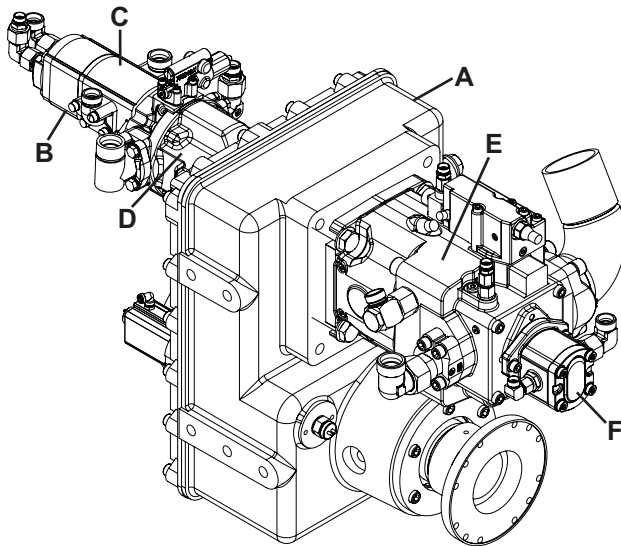
Water System

- A. Access Flap
- B. Pressure Relief
- C. Water Level Gauge
- D. Water Tank Drain
- E. Waterbox Fill Valve
- F. Water Pump Drain
- G. Rear Water Supply Outlet
- H. Water Pump
- I. Waterbox Drain (pneumatic)



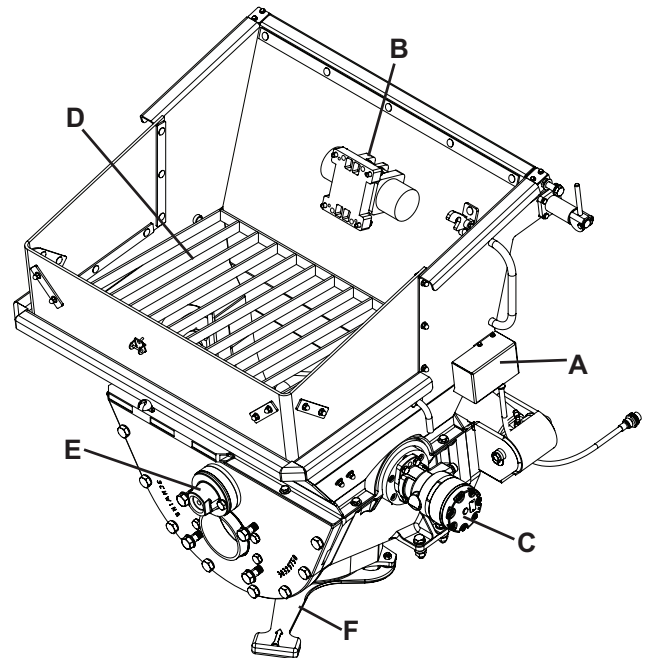
Gearbox

- A. Gearbox
- B. Agitator Gear Pump
- C. Oil Cooler Gear Pump
- D. Accumulator Pump
- E. Main Hydraulic Pump
- F. Water Pump Gear Pump



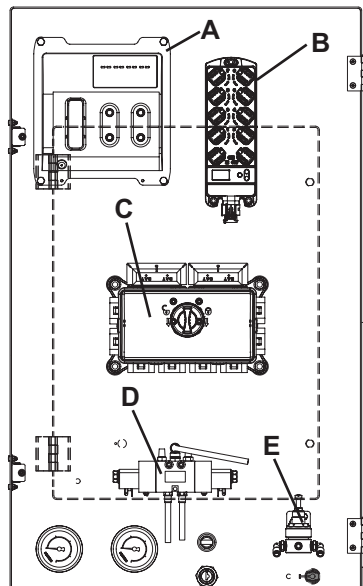
Hopper

- A. Hopper Grate Switch
- B. Vibrator (Optional)
- C. Agitator
- D. Hopper Grate
- E. Tension Nut
- F. Clean Out Door



Operator Panel (Inside)

- A. PLC Controller
- B. PLC IO module
- C. Fuse Box
- D. SCC Solenoid Valve
- E. Air Regulator

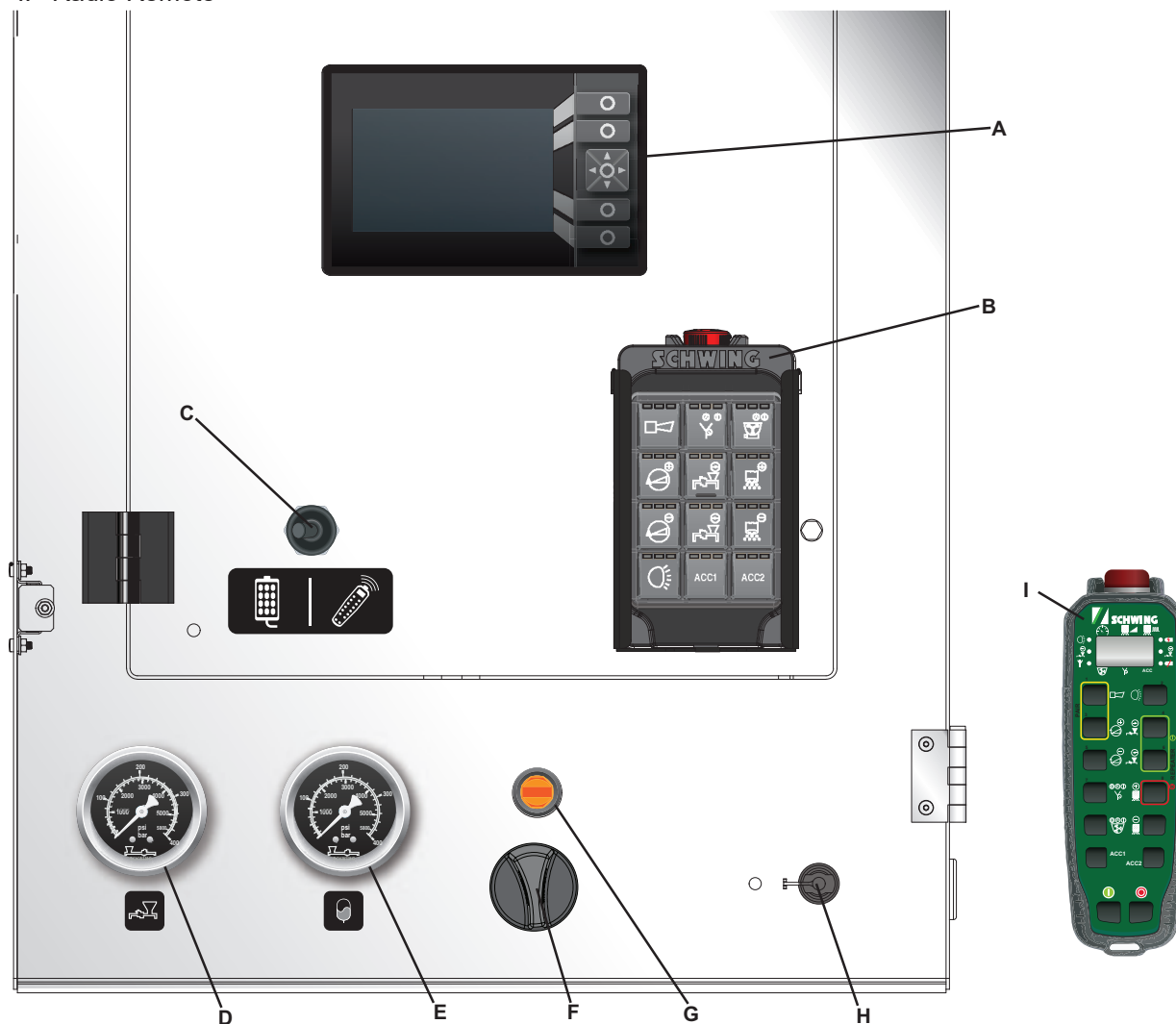


SCT II (SCHWING Control Technology)

The SCT II system allows the operator to electronically run all functions of the concrete pump. The system includes the operator control panel, pendant remote, and radio remote.

The SCT II system contains the following components:

- A. HMI (Human Machine Interface)
- B. Pendant Remote
- C. Pendant/Radio Remote Selector Switch
- D. Concrete Pump Pressure Gauge
- E. Accumulator Pump Pressure Gauge
- F. SCC Maintenance Switch
- G. SCC Maintenance Switch Light
- H. Pairing Port
- I. Radio Remote

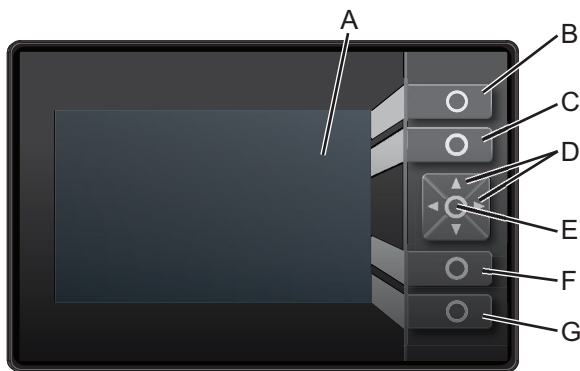


HMI (Human Machine Interface)

The HMI is the primary interface between the operator and the concrete pump. From the HMI, operators can view and set machine parameters.

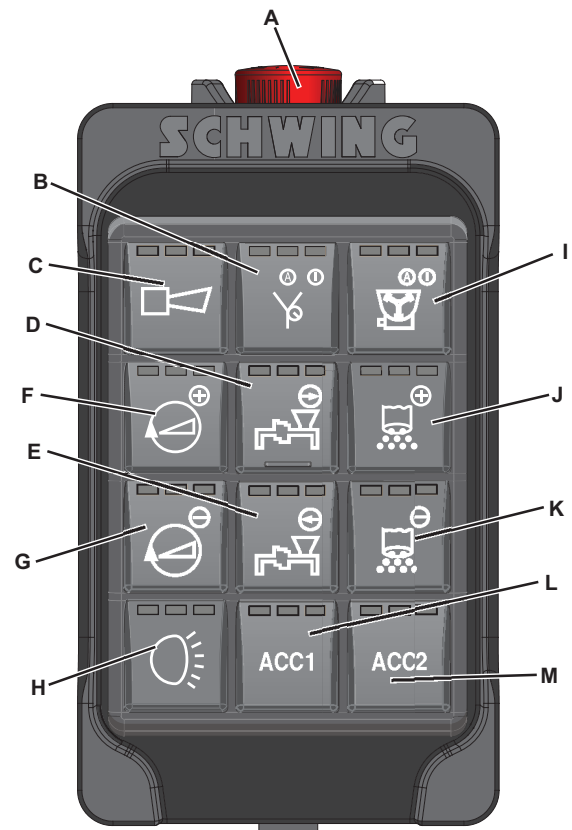
The HMI contains the following:

- A. LCD Touch Screen
- B. (F3) Function Button
- C. (F1) Function Button
- D. Navigation Arrows Button
- E. Enter Button
- F. (F2) Function Button
- G. (F4) Function Button



Pendant Remote

- A. E-stop Button
- B. Vibrator (On/Off) Button
- C. Horn/Reset Button
- D. Concrete Pump Forward Button
- E. Concrete Pump Reverse Button
- F. Throttle Increase Button
- G. Throttle Decrease Button
- H. Work Light Button
- I. Agitator (On/Off) Button
- J. Stroke Limiter Increase Button
- K. Stroke Limiter Decrease Button
- L. Accessory 1 Button
- M. Accessory 2 Button



Pendant Remote Buttons

E-stop Button

Pushing the emergency stop (E-stop) button disables the hydraulic circuit.

To reset the system and enable the hydraulic circuit, rotate the E-stop button clockwise, and press the horn button on the pendant remote.

Horn/Reset Button

Press once or press and hold to sound the horn. Press to reset E-stop requests.



= Horn / Off



= Horn / On (Push/Hold)



= E-stop Pressed



= E-stop Reset Request

Throttle Increase Button

Press once to increase engine throttle. Press and hold or press multiple times to ramp up engine throttle.



= Inactive



= Throttle (+) (Push/Hold)

Throttle Decrease Button

Press once to decrease engine throttle. Press and hold or press multiple times to ramp down engine throttle.



= Inactive



= Throttle (-) (Push/Hold)

Work Light Button

Press once to turn on the work lights, press again to turn work lights off.



= Work Light (Off)



= Work Light (On)

Vibrator (On/Off) Button

This button works in conjunction with the concrete pump forward button. When the vibrator button is pressed once (auto mode), the vibrator will turn on when the concrete pump is in the forward position and turn off when the concrete pump is off or in the reverse position. When the vibrator button is pressed twice (manual mode), the vibrator will run until the vibrator is shut off. Pressing the button a third time will turn the vibrator off.



= Vibrator OFF



= Vibrator Auto ON



= Vibrator Manual ON

Concrete Pump Forward Button

Moves the concrete pump into forward. This is called the pumping position. Press once to place the inactive concrete pump into forward. Press again to make the pump inactive.



= Inactive



= Pump/Forward

Concrete Pump Reverse Button

Moves the concrete pump into reverse. This is typically used for cleaning out or unclogging jams in the pipeline. Press once to place the inactive concrete pump into reverse. Press again to make the pump inactive.



= Inactive



= Pump/Reverse

Stroke Limiter Increase Button

Press once to increase strokes rate by one increment. The first LED on the stroke limiter (-) button will start blinking. Pressing four more times turns the LED solid; this indicates reaching five increments of thirty (15% output). Pressing the button again will increase one more increment; the second LED on the stroke limiter (-) button will start blinking. Pressing four more times turns the second LED solid; this indicates reaching ten increments of thirty (33% of output). Every five presses turns the next LED solid. Once all the LEDs on the stroke limiter (-) button are solid after fifteen presses, the first LED on the stroke limiter (+) button will start blinking. Repeat the process above to change the LEDs on the stroke limiter (+) button. When all of the LEDs on the stroke limiter (-) and stroke limiter (+) buttons are solid, thirty increments of thirty (100% output) has been reached.

Press and hold to ramp up strokes rate.



Stroke Limiter Decrease Button

Once all of the LEDs on the stroke limiter (-) and stroke limiter (+) buttons are solid (100% output) press once to decrease strokes rate by one increment. The third LED on the stroke limiter (+) button will start blinking. Pressing four more times turns the LED off; this indicates reaching twenty-five increments of thirty (83% output). Pressing the button again will decrease one more increment; the second LED on the stroke limiter (+) button will start blinking. Pressing four more times will turn the second LED off; this indicates reaching twenty increments of thirty (66% of output). Every five presses turns the next LED off. Once all of the LEDs on the stroke limiter (+) button are off after fifteen presses, the third LED on the stroke limiter (-) button will start blinking. Repeat the process above to change the LEDs on the stroke limiter (-) button. When all of the LEDs on the stroke limiter (+) and stroke limiter (-) buttons are off, zero increments of thirty (0% output) has been reached.

Press and hold to ramp down strokes rate.



Agitator (On/Off) Button

This button works in conjunction with the concrete pump forward and concrete pump reverse buttons. When the agitator button is pressed once (auto mode), the agitator will turn forward when the concrete pump is in the forward position and will turn in the reverse direction when the concrete pump is in the reverse position. When the agitator button is pressed twice (forward mode), the agitator will run continuously. Pressing the button a third time turns the agitator off.



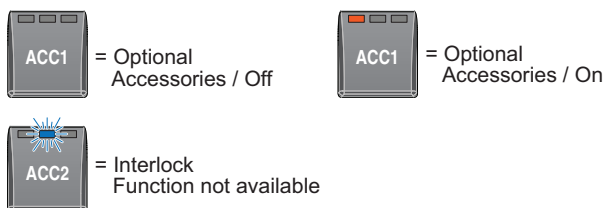
ACC1 and ACC2

This button can be used with optional accessories installed on the concrete pump. Press once to activate the installed function. The default for ACC1 is the water pump. Parameters for the ACC buttons can be changed using the Settings Screen.

If the optional high-pressure washer is installed, there is an interlock that will prevent you from running both accessories at the same time. If ACC1 is active, ACC2 will not work.

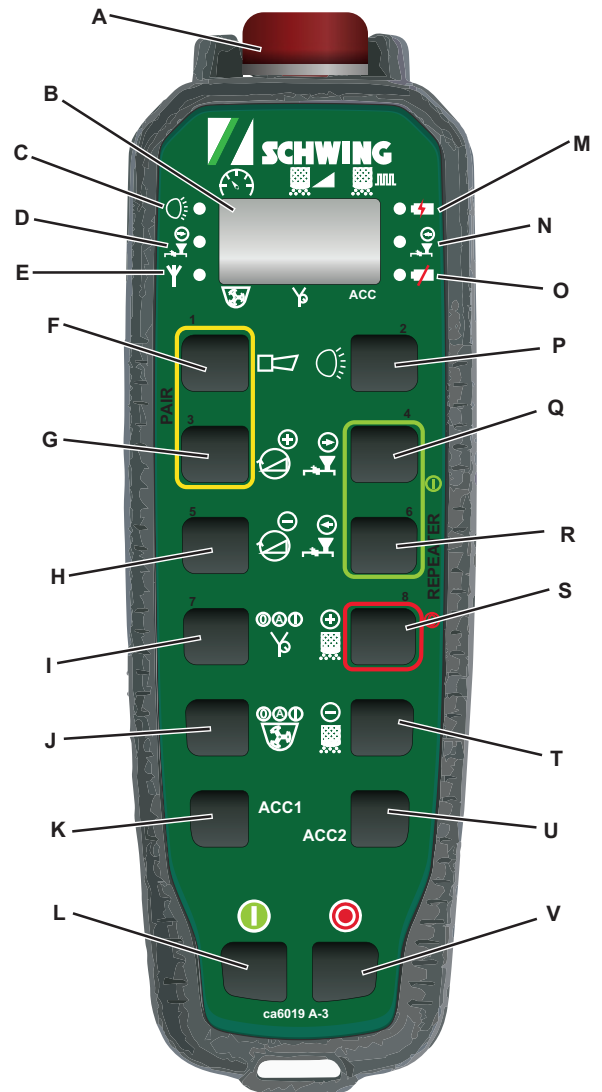
The high-pressure washer option has an interlock with the low water tank sensor. If the water tank is low, the center LED on the ACC button will flash blue. This indicates that the high-pressure washer cannot be activated.

If a compressor is installed and the compressor high-temperature alarm is activated, the center light on ACC button will flash blue and the compressor can't be activated.



Radio Remote

- A. E-stop Button
- B. LCD Screen
- C. Work Light Indicator Light
- D. Concrete Pump Forward Indicator Light
- E. Wireless Signal Indicator Light
- F. Horn/Reset Button
- G. Throttle Increase Button
- H. Throttle Decrease Button
- I. Vibrator (On/Off) Button
- J. Agitator (On/Off) Button
- K. Accessory 1 Button
- L. Power On Button
- M. Battery Charging Indicator Light
- N. Concrete Pump Reverse Indicator Light
- O. Battery Low Indicator Light
- P. Work Light Button
- Q. Concrete Pump Forward Button
- R. Concrete Pump Reverse Button
- S. Stroke Limiter Increase Button
- T. Stroke Limiter Decrease Button
- U. Accessory 2 Button
- V. Power Off Button



Radio Remote Buttons and Lights

E-stop Button

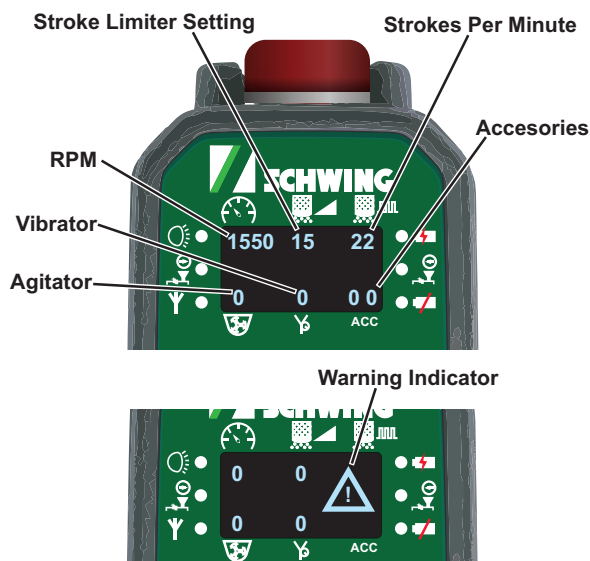
Pushing the emergency stop (E-stop) button disables the hydraulic circuit.

To reset the system and enable the hydraulic circuit, turn the E-stop button clockwise and press the horn button on the radio remote.

Indicator Lights

	Orange = On
	Orange = Pump Forward
	Green = Linked Green Flashing = Connecting
	Blue = Battery Charging
	Orange = Pump Reverse
	Flashing Red = Battery Low Red = Loss of Signal

LCD Screen



LCD Screen Indicator

	RPM Readout
	Stroke Limiter Setting (0 to 30)
	Current Strokes Per Minute
	0 = Off A = Auto Agitator 1 = Manual
	0 = Off A = Auto Vibrator 1 = Manual
ACC (Accessories)	0 0 = ACC1=Off ACC2=Off 1 0 = ACC1=On ACC2=Off 0 1 = ACC1=Off ACC2=On
	Warning message See SCT2 HMI LCD Display



Horn/Reset Button

Press once or press and hold to sound the horn. Press to reset E-stop requests.



Throttle Increase Button

Press once to increase engine throttle. Press and hold or press multiple times to ramp up engine throttle.



Throttle Decrease Button

Press once to decrease engine throttle. Press and hold or press multiple times to ramp down engine throttle.



Vibrator (On/Off) Button

This button works in conjunction with the concrete pump forward button. When the vibrator button is pressed once (auto mode), the vibrator will turn on when the concrete pump is in the forward position and turn off when the concrete pump is off or in the reverse position. When the vibrator button is pressed twice (manual mode), the vibrator will run until the vibrator is shut off. Pressing the button a third time will turn the vibrator off.



Agitator (On/Off) Button

This button works in conjunction with the concrete pump-forward and concrete pump-reverse buttons. When the agitator button is pressed once (auto mode), the agitator will turn forward when the concrete pump is in the forward position and will turn in the reverse direction when the concrete pump is in the reverse position. When the agitator button is pressed twice (forward mode), the agitator will run continuously. Pressing the button a third time turns the agitator off.



Work Light Button

Press once to turn on the work lights, press again to turn work lights off.



Concrete Pump Forward Button

Moves the concrete pump into forward. Press once to put the concrete pump into forward. Press again to make the pump inactive. When the concrete pump is in forward, the concrete pump forward indicator light will turn orange.



Concrete Pump Reverse Button

Moves the concrete pump into reverse. Press once to put the concrete pump in reverse. Press again to make the pump inactive.



Stroke Limiter Increase Button

The stroke limiter (+) button is used to increase the strokes rate with zero being minimal output and thirty being maximum output. Press once to increase strokes per minute by increments of one (3%). Hold down the stroke limiter (+) button to continually ramp up the strokes rate.



Stroke Limiter Decrease Button

The stroke limiter (-) button is used to decrease the strokes rate with thirty being maximum output and zero being minimal output. Press once to decrease strokes per minute by increments of one (3%). Hold down the stroke limiter (-) button to continually ramp down the strokes rate.



Accessory 1 and Accessory 2 Buttons

These buttons are used with optional accessories installed on the concrete pump. Press once to activate the installed function.



Power On Button

Turns the radio remote ON when pressed. Press and hold to refresh the LCD screen.

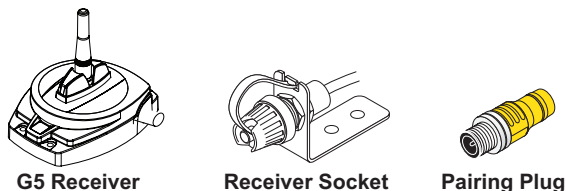


Power Off Button

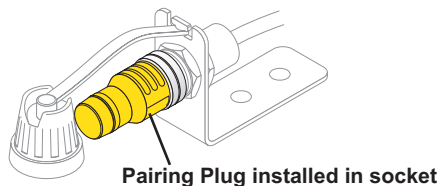
Turns the radio remote OFF when pressed.

Safe Pairing of Transmitter to Receiver

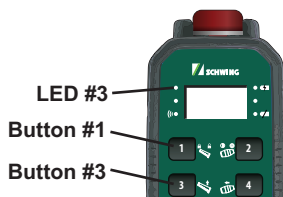
Safe pairing is used to get a unique assignment between a single transmitter and a single G5 receiver. To exchange the transmitter and receivers IDs when replacing either the receiver or transmitter in a system follow the safe pairing procedure below:



1. Power off the receiver by turning the ignition key switch to STOP.
2. Install the pairing plug into the receiver socket.



3. Simultaneously press button #1 and button #3 on the transmitter (radio remote). LED #3 will light up indicating the transmitter is ready for safe pairing.



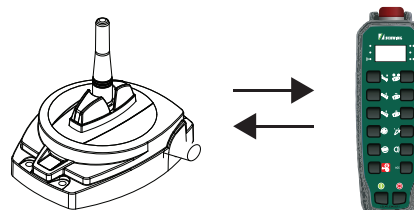
4. Within 10 seconds, reapply power to the receiver by putting the ignition key switch in the RUN position.
5. The transmitter will confirm the download is complete by flashing LED #3 eight times.



6. The receiver LCD screen will flash Po-Id.



7. Power off the receiver by turning the ignition key switch to STOP. Remove the pairing plug from the receiver socket. Reapply power to the receiver by putting the ignition key switch in the RUN position. The transmitter has now been paired to the receiver.



NOTE

If pairing is performed when the transmitter battery is low, it may look like the pairing works but it does not. This is a safety precaution. Recharge or replace the battery, and repeat the pairing procedure.

HMI LCD Screens

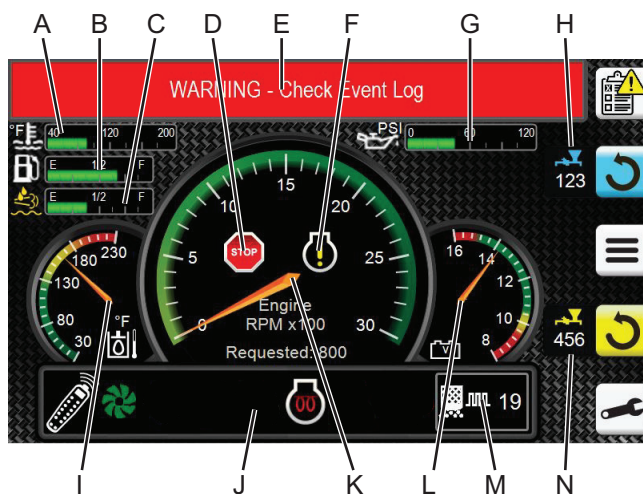
Start-Up Screen

When the ignition key switch is turned on, power will be supplied to the operator control panel. The Start-Up Screen will briefly appear on the HMI LCD screen.

Home Screen

The Home Screen appears after the Start-Up Screen and displays the following information:

- A. Engine Temperature
- B. Fuel Level
- C. DEF Level
- D. Shutdown Lamp
- E. Message Center
- F. Warning Lamp
- G. Engine Oil Pressure
- H. Stroke Counter 1
- I. Hydraulic Oil Temperature
- J. Symbols Display
- K. Engine RPM
- L. Battery Level
- M. Strokes per Minute
- N. Stroke Counter 2



- Press  to disable the horn (if active).
- Press  to go to the Event Log Screen.
- Press  and hold to reset stroke counter 1.
- Press  to go to the Menu Screen.
- Press  and hold to reset stroke counter 2.
- Press  to go to the Maintenance Screen.

Pump Status Symbols

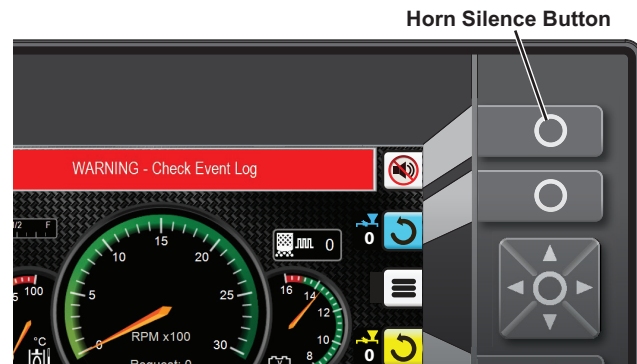
The Symbols Display on the Home Screen shows all relevant pump status symbols.

Symbol	Description
	Radio Remote Mode
	Pendant Remote Mode
	Oil Cooler Green = On Red Outline = Override Enabled
	Wait-to-Start

Warning and Info Messages

The Message Center on the Home Screen will notify you to check the Event Log Screen when there is a warning message (“WARNING: Check Event Log”). The horn will beep until the horn silence button is pressed on the HMI, and pressing the horn also opens the Event Log Screen to view specific warning messages. Info messages flash through the Message Center and are also displayed on the Event Log Screen.

A Fault Isolation Manual is available with detailed troubleshooting steps. Contact the SCHWING Service Center for assistance addressing warning messages.



Warning Messages	
Vbb0-Voltage Low	Agitator Dump Valve-Short Circuit
Vbb1-Voltage Low	Agitator Dump Valve-Open Circuit
PLC Processor-High Temp	Comm Loss HMI<>PLC
HMI Processor-High Temp	Comm Loss SCT2<>SCC
Pump Forward Valve-Short Circuit	Comm Loss PLC<>Radio
Pump Forward Valve-Open Circuit	Comm Loss PLC<>Keypad
Pump Reverse Valve-Short Circuit	E-stop Button Error-Cycle Buttons
Pump Reverse Valve-Open Circuit	Hopper Switch Error-Cycle Switch
Stroke Limiter Valve-Error	Fuel Level Sensor Error
Stroke Limiter Valve-Overload	Potential Power Loss at F21/CB10
Agitator Forward Valve-Short Circuit	HMI Processor-High Temp
Agitator Forward Valve-Open Circuit	Engine Oil Pressure - Low
Agitator Reverse Valve-Short Circuit	Engine Oil Pressure - High
Agitator Reverse Valve-Open Circuit	
Oil Temp Sensor Error	Info Messages
Operate Oil Cooler Manually	WARNING: Check Event Log
Water Level Low	Reset E-stop Request
Hydraulic Oil Level Low	E-stop Left
Battery Level Low	E-stop Right
Grease Level Low	E-stop Water Box
Fuel Level Low	E-stop Radio Remote
Hydraulic Oil Temp High	E-stop Pendant Remote
Compressor Temp High	Hopper Grate Open
Engine Fault-DM1 Code	Hopper Switch Bounce Detected
SCC Fault-Check Cab Display	Ram Change Mode
Pump Dump Valve-Short Circuit	Override is Active
Pump Dump Valve-Open Circuit	Set Date/Time
Accumulator Dump Valve-Short Circuit	DM1 Engine Code - SPN*** FMI***
Accumulator Dump Valve-Open Circuit	Unit Serial Number Changed from *** to ***

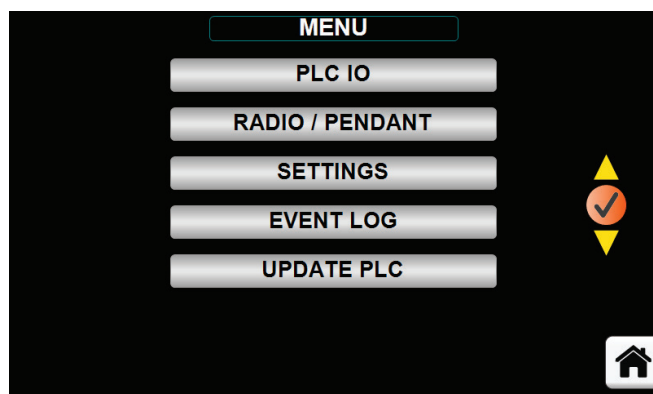
Menu Screen

The Menu Screen displays these additional status and parameter settings screens:

- PLC I/O
- Radio/Pendant
- Settings
- Event Log
- Update PLC

To access the additional screens, either press the button on the screen or use the  to scroll up and down the menu items. After the desired screen is highlighted, press .

- Press  to return to the Home Screen.



PLC IO Screen

Displays the electronic input and output signals. This screen can be used to assist in troubleshooting electrical issues.

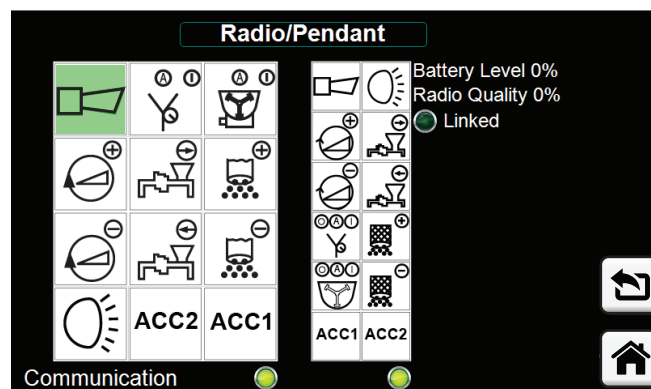
PLC		
Source	Value	Function
Vbb15	13.6 V	Vbb15 Supply Voltage
Vbb30	13.6 V	Vbb30 Supply Voltage
Vbb0<	13.6 V	Vbb0 Input Voltage
Vbb0>	13.6 V	Vbb0 Output Voltage
Vbb0-A	57 mA	Vbb0 Amps
Vbb1<	13.6 V	Vbb1 Input Voltage
Vbb1>	13.6 V	Vbb1 Output Voltage
Vbb1-A	43 mA	Vbb1 Amps
Temp.	37 °C	PLC Temperature
HMI		
IN0		
IN1		
OUT0		Oil Cooler/PTO
OUT1		Backup Throttle Control
Vbb15	13.6 V	Vbb15 Voltage
Vbb30	13.6 V	Vbb30 Voltage
Vbb0	13.6 V	Vbb0 Voltage
Temp.	41 °C	Temperature

- Press  to return to the Home Screen.
- Press  to return to the previous screen.
- Press  to scroll through the PLC IO Screen.

Radio/Pendant Screen

Displays active functions on the radio and pendant remotes. A green overlay will appear over the function that is being activated. Battery level and radio quality percentage are shown. When the radio remote is properly linked, the “Linked” field will be highlighted with a green dot.

When the radio and pendant remotes are properly connected a green dot will be displayed below the Radio or Pendant icons (Communication).



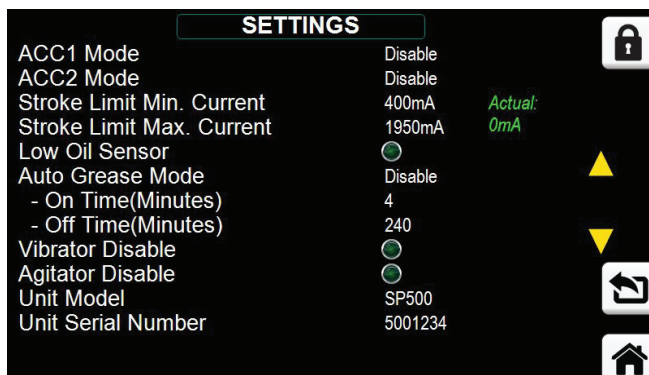
- Press  to return to the Home Screen.
- Press  to return to the Menu Screen.

Settings Screen

The Settings Screen allows operators to turn on or off installed functions or change parameters. To change settings, operators need to login. Pressing the button prompts operators to provide a password. The default password is “1” “2” “3” “4”. Pressing the button will allow operators to change or reset the password.

Use the arrows to select the parameter to change. The selected parameter will have a green outline around it. If a password hasn't been provided, this outline will be grey. With a variable parameter selected, such as “Stroke Limit Min. Current,” use the arrows to raise or lower the value. For on/off parameters such as Low Oil Sensor, press to turn on or off the function.

- Use the arrows to move through the list of settings. A green outline will mark which setting is selected.
- Use the arrows to raise or lower a setting.
- Press to turn a specific setting on or off.

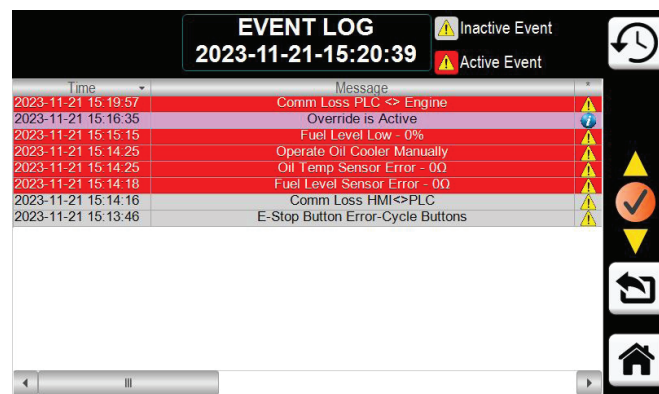


- Press to login into the system.
- Press to logout of the system.
- Press to change or reset the password.
- Press to return to the Home Screen.
- Press to return to the Menu Screen.

Event Log Screen

Any time the SCT2 HMI displays a message, it is recorded as an event. Events can either be a warning message or contain important information. All events are recorded in the Event Log Screen. The Event Log Screen displays the time, message, and what type of event. If the event has a yellow triangle with an exclamation point, it's a warning and the issue must be addressed right away. If a circle with an “I” is displayed, the message contains information on machine status and no immediate action needs to be taken. Events can also be active or inactive. Active events are highlighted in red; inactive events are light grey.

- Use the arrows to move through the list of events. A green outline will mark which event is selected.
- Press to acknowledge a highlighted event.



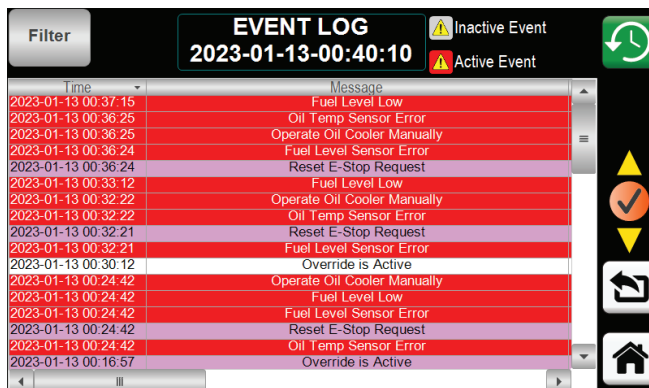
All events are stored in the Event History Screen. The Event History Screen can be accessed by pressing .

- Press to go to the Event History Screen.
- Press to return to the Home Screen.
- Press to return to the Menu Screen.

Event History Screen

The Event History Screen stores all event messages. Events can be filtered by date.

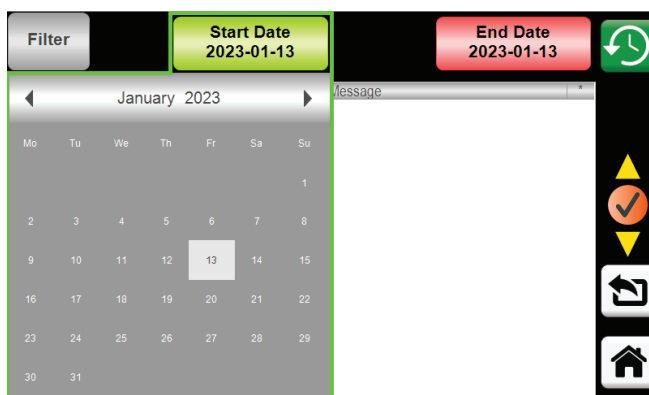
- Use the  arrows to move through the list of events. A green outline will mark which event is selected.
- Press  to acknowledge a highlighted event.
- Press  to filter events by date range.



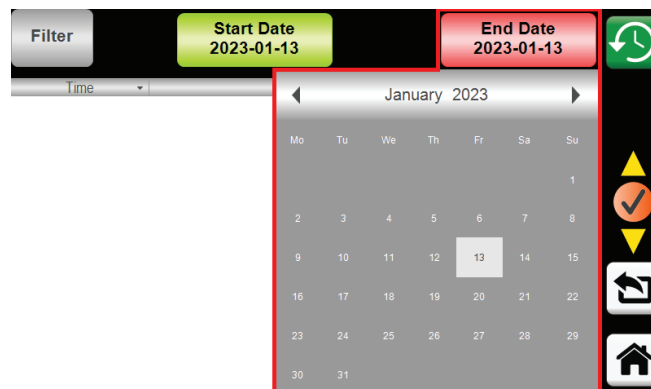
- Press  to return to the Home Screen.
- Press  to return to the previous screen.
- Press  to return to the Event Log Screen.

Event History Screen - Date Filter

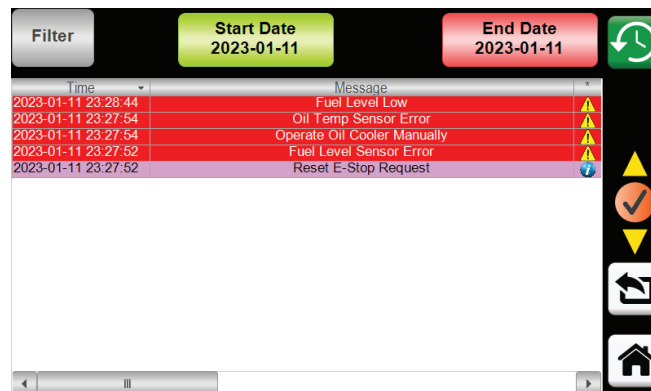
- Press "Start Date," and a calendar will appear. Chose the start date.



- Once the start date has been selected, press "End Date," and choose the end date.



The events that fall into the date range selected will be displayed. When the machine is restarted, the filtered dates will be reset.



- Press  to return to the Home Screen.
- Press  to return to the previous screen.
- Press  to return to the Event Log Screen.

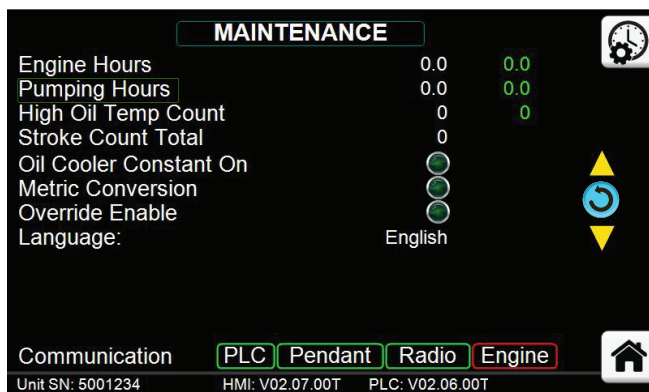
Maintenance Screen

The Maintenance Screen displays four parameters and four functions.

The four parameters are:

- Engine Hours
- Pumping Hours
- High Oil Temp Count
- Stroke Count Total

- Use the arrows to move through the list of parameters. If a green outline is around the parameter and the symbol appears, the green parameter number can be reset.
- Press and hold the enter button for three seconds to clear the green parameter field.



The four functions below can be turned on/off or changed on the Maintenance Screen:

- Oil Cooler Constant On (SCT2 Fan Constant On)
- Metric Conversion
- Override Enable
- Language

- Use the arrows to move through the list of functions. A green outline will mark which function is selected.
- Press to turn on or off a specific function
- Use the arrows to change the language function.
- Press to change the internal clock settings.

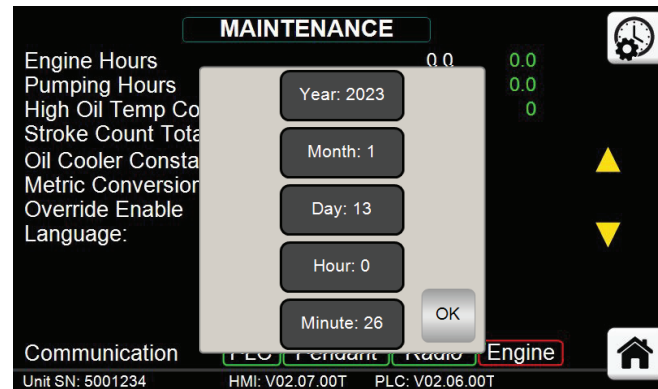
It's important to have the correct time set to validate the Event Log Screen.

Maintenance Screen - Clock Setting

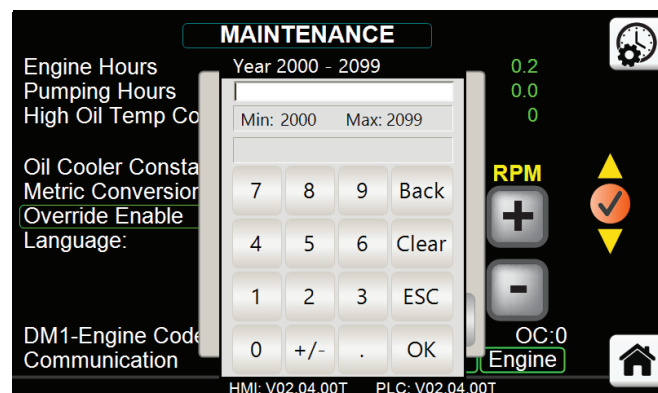
It's important to have the correct time to validate the Event Log Screen.

To set the internal clock:

- Press to change the internal clock and date settings.
- A date and time settings screen will appear. Select the parameter you would like to change.



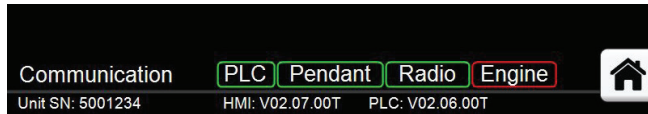
- With the parameter selected, a number pad will appear. Use the keypad to change the selected parameter. Press OK.



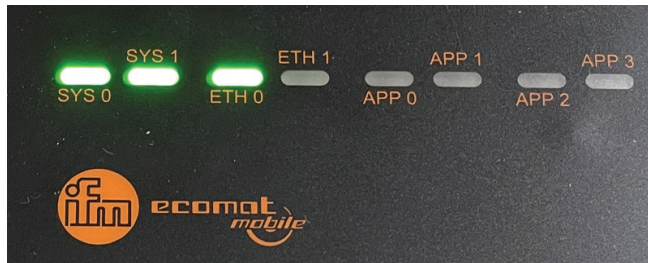
- When all the parameters have been set, press OK.

Communication

If the PLC, pendant remote, radio remote, and engine are communicating with the HMI, a green outline will appear around those words. If communication is disrupted, the outline will be red.

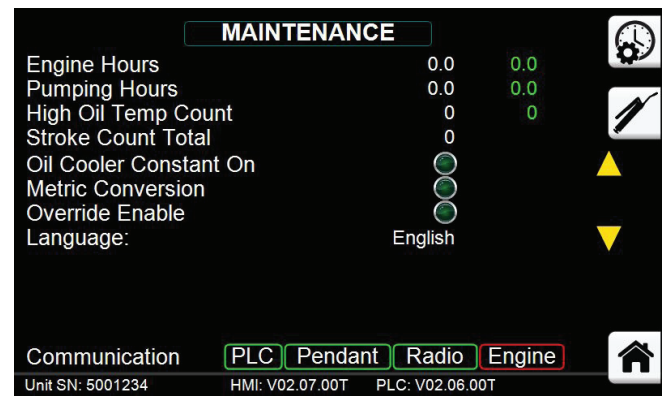


Communication status can also be checked by looking at the ETH0 light on the PLC. If the ETH0 light isn't flashing green, communications between the PLC and HMI has been lost.



Manual Greaser Button

If Auto Grease Mode is enabled on the Settings Screen (factory set with Autogreaser option), the  button will appear on the Maintenance Screen. Pressing this button resets the autogreaser timer. Example: if the Auto Grease Mode setting is 4 minutes ON and 240 minutes OFF, pressing the  button will immediately turn the autogreaser ON for 4 minutes and then OFF for 240 minutes. The  button will change to  when the autogreaser is running. This feature allows you to manually grease the machine before or after a job.



- Press  to activate the manual grease cycle.
- Press  to return to the Home Screen.
- Press  to return to the Menu Screen.

Software Version

The installed PLC software version is shown on the bottom of the Maintenance Screen. In the event of display failure, you can use your pendant remote to determine your software version.

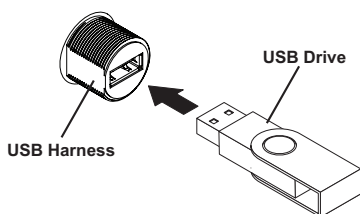
Flip the pendant/radio remote selection switch to radio mode. Press and hold the ACC2 button on the pendant remote, and after 2 seconds a series will be displayed on the pendant remote.

Example: PLC V02.01 will be shown as:



Updating HMI Software via USB

The SCT2 HMI can be updated via USB drive. A USB cable harness is located next to the operator control panel. Remove the cap on the USB cable harness and insert the USB drive.

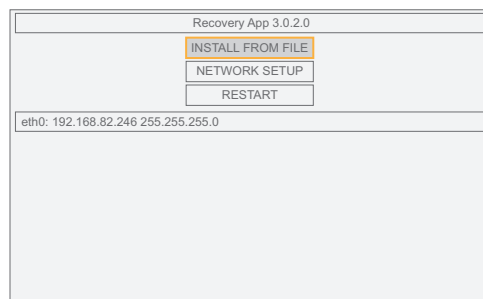


With the machine turned off. Hold down any three buttons on the HMI panel while turning the key switch to the ON position.

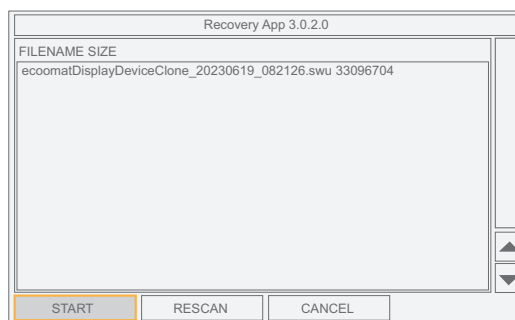


Press and hold three of these buttons simultaneously while starting the machine.

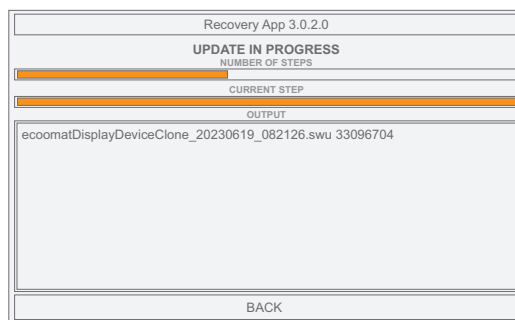
The download may begin automatically within a few seconds. If not, select INSTALL FROM FILE.



A file explorer screen will appear; select the file to install by pressing on the screen or using the navigation arrow buttons. With the file selected, press the "START" button.



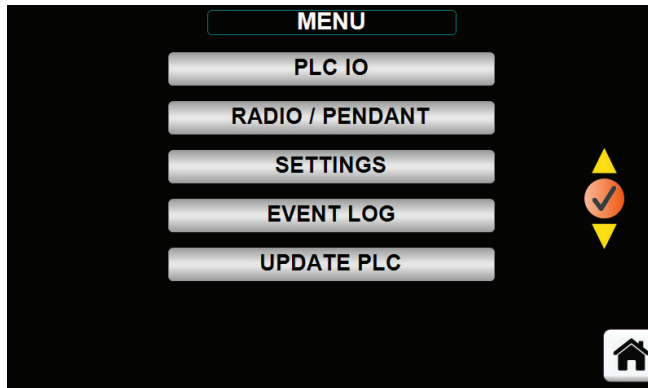
A download status screen will appear. After the screen indicates the download is complete, restart the system by turning the key to the OFF position.



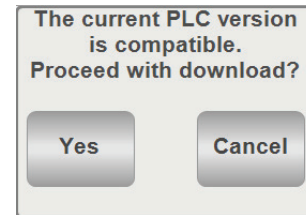
With the software updated on the HMI, we now have to update the PLC (see page 55).

Updating PLC Controller

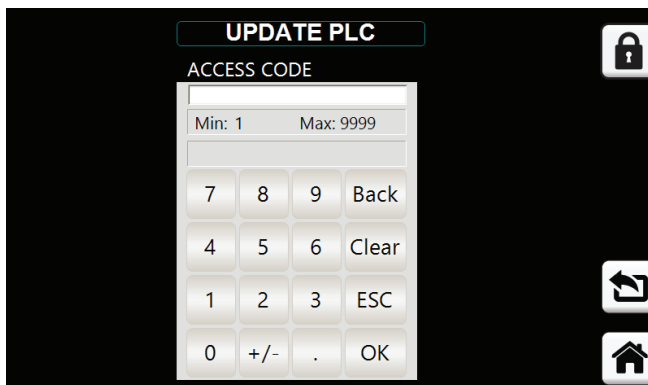
From the Home Screen, press the  button. On the Menu Screen, press the UPDATE PLC button.



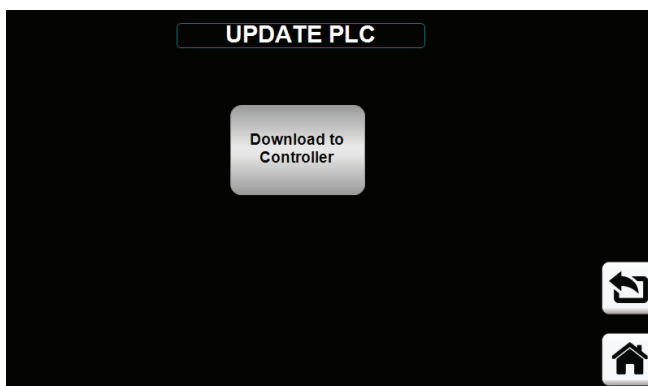
If the current version in PLC is equal to the install version, a pop-up window will appear; press Yes to continue with the installation or Cancel to quit.



Press  to log in to update the PLC. After a number pad appears, use the keypad to enter the access code and then press OK.



Once logged in, the “Download to Controller” button will appear; press this button to update the PLC.



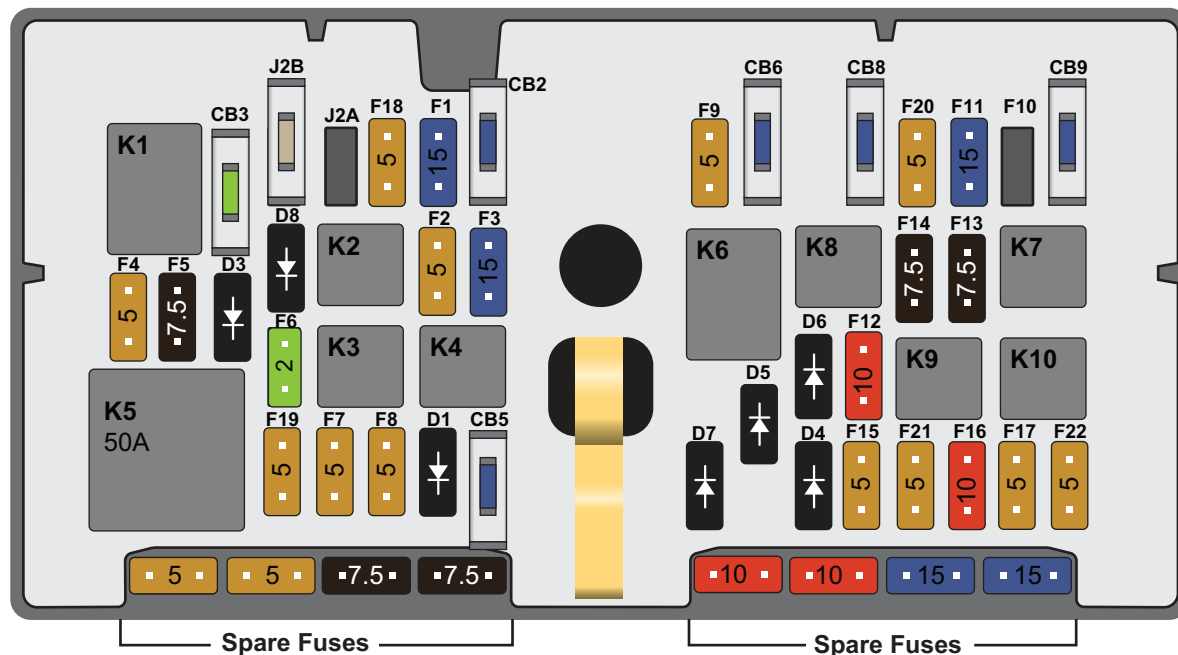
Fuses

F1	Pump Display Vbb30	15A
F2	Acc1 & Acc2 Power	5A
F3	Pump Display Vbb0	15A
F4	eVBBs	5A
F5	SCT2 Dump Valve Override	7.5A
F6	N/A	2A
F7	Telematics	5A
F8	D+ Alternator	5A
F9	Spare Ignition	5A
F10	Spare Relay Power (Max 10A)	10A
F11	Spare Battery	15A
F12	Spare Ignition	10A
F13	Horn	7.5A
F14	Grease Pot	7.5A
F15	Spare Ignition	5A
F16	Spare Ignition	10A
F17	Spare Ignition	5A
F18	PLC Vbb30	5A
F19	Pendant, PLC Vbb15, Display Vbb15	5A
F20	N/A	5A
F21	E-stop Circuits, Radio Power	5A
F22	SCT2 Sensors	5A

CB2	PLC Vbb0	15A
CB3	Oil Cooler	30A
CB5	PLC Vbb1	15A
CB6	Vibrator	15A
CB8	SCT2 Exp Module Vbb2	15A
CB9	Ignition Switch	15A
J2A	DO NOT USE	-
J2B	N/A	-

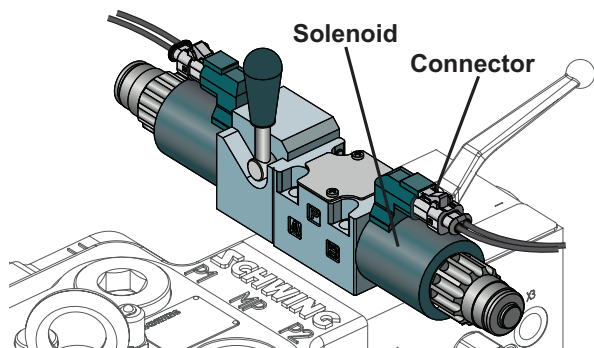
Relays

K1	Oil Cooler
K2	N/A
K3	ACC2
K4	ACC1
K5	SCT2/Pump
K6	Ignition
K7	Spare
K8	Vibrator
K9	Grease Pot
K10	Horn

Fuse/Relay Locations

Checking Solenoids

Check any wires, terminals, or other connections to the solenoid, as well as the mounting of the solenoid itself, to ensure that everything is connected solidly and that none of the terminals are corroded.



If all the connectors and wires are ok, disconnect the connector plug. Use a multimeter to test resistance (ohms) in the coil. Set the multimeter dial to resistance (Ω), and place probes on both power terminals (Figure 8). Compare resistance readings with the table below. If the resistance reading is higher for a specific function, the solenoid has degraded and is not conducting enough electricity to function properly. The solenoid should be replaced. If the ohms reading is too low, the solenoid is conducting too much current. The solenoid should be replaced.

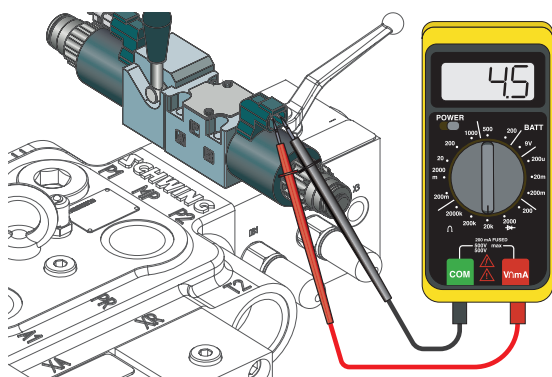


Figure 8
Testing the Resistance

Ohms	Solenoid
4.5	Concrete Pump Forward/Reverse
8.0	E-stop Manifold
4.0	Stroke Limiter
8.0	Agitator

Troubleshooting Screens

PLC IO Screen

Displays the electronic input and output signals. This screen can be used to assist in troubleshooting electrical issues.

Output	Value	Function
000	0 mA	Oil Cooler Relay
001	9 mA	Concrete Pump Dump
002	1 mA	Vibrator Relay
003	13 mA	Accumulator Dump
004	3 mA	Grease Pump Relay
005	15 mA	Agitator Dump
006	5 mA	Concrete Pump Forward
007	0 mA	Concrete Pump Reverse
100	0 mA	Stroke Limiter
101	10 mA	Work Light
102	9 mA	
103	19 mA	Acc1 Relay
104	0 mA	Acc2 Relay
105	2 mA	Horn Relay
106	0 mA	Agitator Forward
107	10 mA	Agitator Reverse

- Press to return to the Home Screen.
- Press to return to the previous screen.

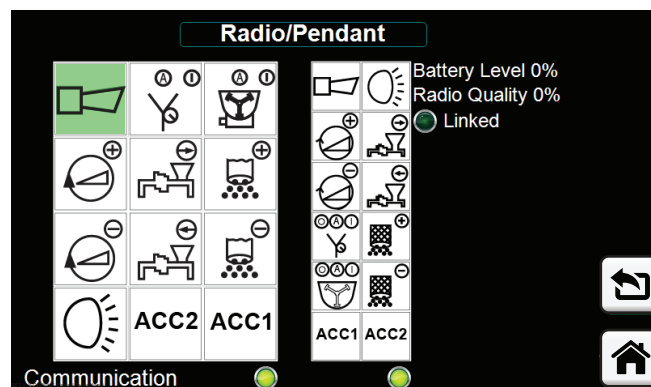
Example

To test the input or output of a particular function, navigate to the PLC IO Screen. Activate the stroke limiter function. A green indicator light will appear next to output 100. This indicates the stroke limiter function is outputting a signal from the PLC.

Radio/Pendant Screen

Displays active push buttons on the radio remote and pendant remote. When the radio and pendant remotes are properly connected a green dot will be displayed below the Radio or Pendant icons (Communication).

- Press to return to the Home Screen.
- Press to return to the previous screen.



Dodge 5500 Cab Control

The Dodge 5500 SPTO 1000 has a unique cab control system. An S22 indicator light underneath the driver-side of the dashboard provides an assortment of colors and flash patterns to indicate the current function of the unit. The system is interlocked with the parking brake. Operators must follow a specific procedure for moving between pump and drive mode.

Enable Pump Mode

- Start the vehicle.
- With the engine running, apply the parking brake.
- Verify the vehicle is in 2-wheel drive. If the vehicle is not in 2-wheel drive, the indicator light underneath the driver-side of the dashboard will be a solid magenta.
- Use the indicator light underneath the driver-side of the dashboard to guide you through each step:
 - A solid red light means that the air pressure needs to raise, wait for the air pressure to build up.
 - A flashing white light is the signal to shift the vehicle into neutral.
 - A flashing magenta light is the signal to press the AUX5(PTO) button on the center of the dashboard, which will shift the transfer case.
 - A flashing green light is the signal to shift the vehicle into drive without pressing on the brake; the unit should lockup into 16th gear.
 - A solid green light indicates that the machine is ready to pump.
- If at any point the indicator light is flashing white or flashing yellow, then there is an error and the cycle outlined above should be repeated.
- A flashing red indicator light means that there is an error displayed on the PLC; check the error and correct it.

Indicator Light Meaning	
Flashing Blue	Set Parking Brake
Solid Magenta	Disable AWD/4x4
Solid Red	Low Air Pressure - Wait
Flashing White	Shift to Neutral
Flashing Magenta	Enable Pump Mode (Aux5(PTO))
Flashing Green	Shift to Drive
Solid Green	Lockup Successful - Ready to Pump
Flashing Yellow	Enable Drive Mode
Flashing Red	Check Error at PLC

Enable Drive Mode

- Press foot on the brake and then shift vehicle into neutral.
- The indicator light underneath the driver-side of the dashboard should begin flashing yellow; press the AUX5(PTO) button on the center of the dashboard to shift into drive mode.
- Put vehicle into park.
- Verify the parking brake is disabled before driving.

NOTE If the transmission is shifted to neutral after pumping, the system will not allow you to re-enter pump mode until the AUX5(PTO) switch is cycled.

NOTE Pump mode will be disabled if you start the truck while still in pump mode; it must be taken out of pump mode and then put back in.

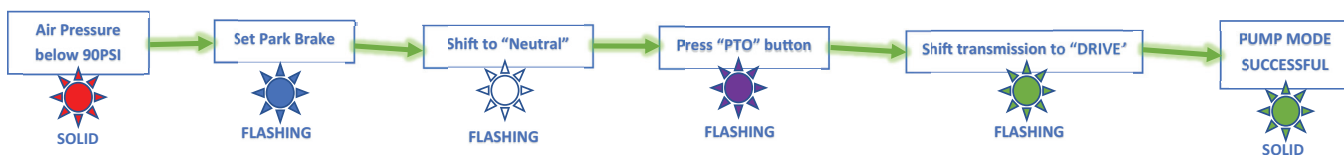


Figure 9
Typical Order of Operations

PLC Display

If the indicator light is flashing red, go to the PLC located inside the control cabinet and read the error.



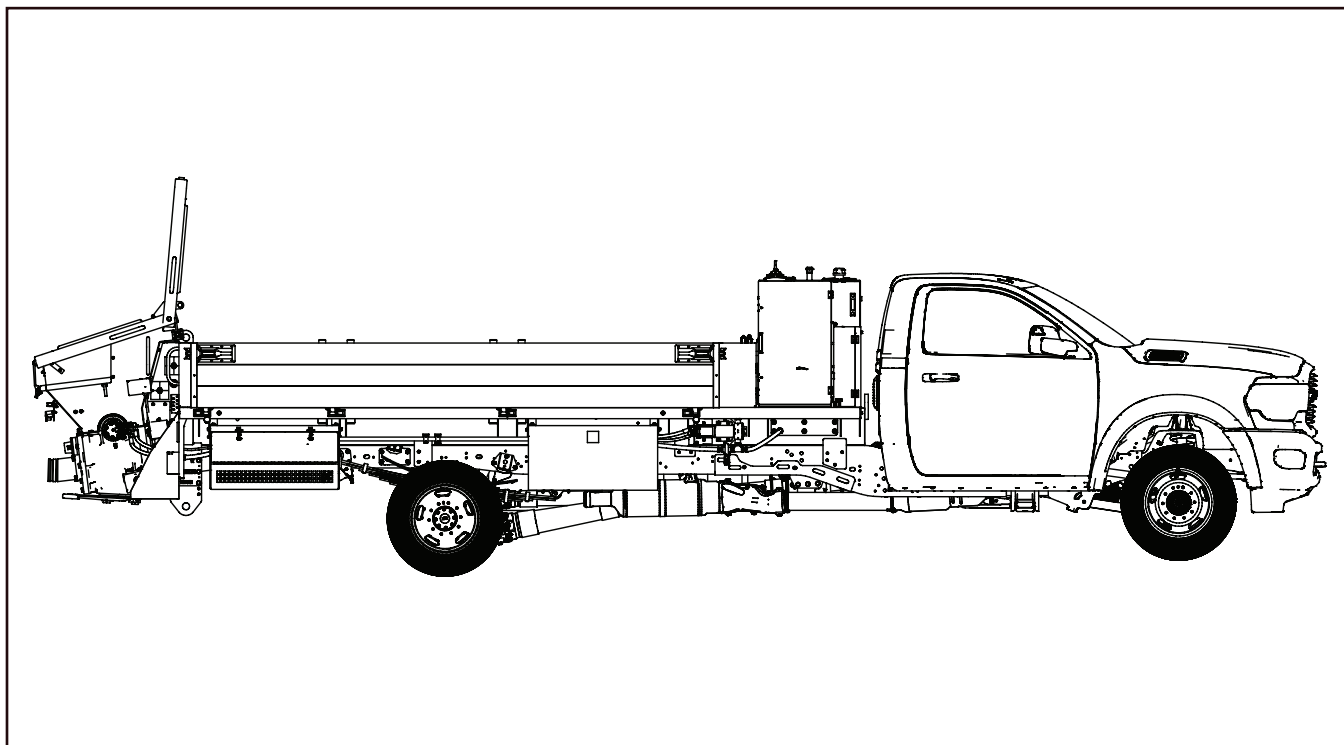
Display Screen and Icons Above Display	
	Default view shows the Node ID.
	Holding the up button will display the PLC version.
PWR	Blinking green power light is normal.
A	Comms are good to SCT2
B	Comms are good to Truck
C	Comms are good to Axiomatic Module (2024 trucks only)
D	N/A
M	Comms are good between SCC and 2 nd Exp Module (Optional)

Figure 10

PLC Display Screen and Icon Descriptions

PLC Dodge 5500 Error Codes

PLC Error	Description	Notes
BALL	Ball Switch Fault	Check the ball switch for proper wiring and function.
P.O	PTO Solenoid Open	The PTO Solenoid is not drawing any amperage. Check connections and wiring to solenoid.
P.S	PTO Solenoid Shorted	The PTO solenoid is drawing too many amps, check for shorts to ground.
P.C	PTO Solenoid Connection	The PTO solenoid is bad or not connected.
D.O	Drive Solenoid Open	The drive solenoid is not drawing any amperage. Check connections and wiring to the solenoid
D.S	Drive Solenoid Shorted	The drive solenoid is drawing too many amps; check for shorts to ground.
D.C	Drive Solenoid Connection	The drive solenoid is bad or not connected. <100 mA draw



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Preparing for the Job

Personal Protective Equipment (PPE)

Waterproof gloves and steel-toed work boots will help prevent burn and damage to the skin caused by the lime in the concrete. There are boots made specifically for concrete work that protect your feet from lime and accidental impact.

Hard hats protect from falling objects on the job site.

Safety goggles prevent splashed concrete from getting in the eyes. Whenever there is danger of ricocheted rocks or sand (when shotcreting, for example), wear a full face shield.

Safety vests make you more visible to others while on the jobsite preventing possible accidents.

Snug-fitting work clothes help prevent accidents involving moving parts.

Hearing protection is recommended when on or near an operating concrete pump. Concrete pumps may generate higher sound pressure levels than O.S.H.A. allows for constant exposure.

Breathing protection will prevent inhalation of dangerous contaminants when mixing grout or any time there is airborne cement or other fine powder nearby.



Figure 1
Personal Protective Equipment (PPE)

Pipeline and Clamps

Determine what kind of concrete you will be pumping. Use a pipe and/or hose system that is three to four times larger than the biggest rock in the mix. Use the chart below to select the correct pipe diameter for the job.

Largest Stone Size	Minimum Pipe/Hose Diameter
3/8 inch (peagravel)	1 inch
1/2 inch	2 inches
3/4 inch	3 inches
1 inch	4 inches
1 1/4 inch	5 inches
1 1/2 inch	5 inches

Are extra pipe sections needed to make the pour?

Use the following checklist for pipeline needs:

- Pipe sections
- Adapter pipes
- End hoses
- Reducers
- Clamps for all pipe end styles and sizes
- Clamp pins

Have all pipe and pipe accessories inspected for condition, loaded, and secured for travel before moving the unit. Keep in mind the pressure rating of the unit when inspecting the condition of pipe accessories; refer to the chart regarding pipe-wall thickness versus pressure provided in the Appendix.

Tools and Accessories

These are common tools and accessories used for concrete pumping:

- Shovel
- Bucket/barrel for mixing slurry
- Pipeline lubrication mixes
- Grease gun and grease tubes
- Spray can filled with form oil
- Clean out balls
- Water hose and nozzle
- Clean out rake
- Working lamps for night work
- Approved air blow-out cap
- Hand tools
- Hammer

Additional Items

It is recommended to carry the following items in your vehicle:

- Valid driver's license
- Fuel permit
- Vehicle registration information
- Insurance card
- First aid kit
- Flares
- Reflector signs
- Fire extinguisher
- Maps
- Job ticket
- Job site contact information

Check with your local Department of Transportation for any other requirements.

Truck and Pump Checklist

Check the following items, **on the truck**, each day before leaving for the job site:

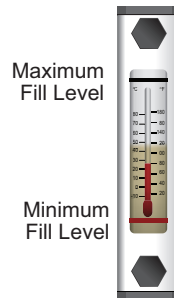
- Check truck engine oil level and condition.
- Check antifreeze/coolant level in the radiator.
- Check battery fluid level and condition.
- Check tire condition and air pressure.
- Check brake system air pressure.
- Clean the windows/mirrors of ice, frost, mud, etc.
- Remove any debris from the cab, especially the floor. Accidents can happen when foreign objects are stuck between the clutch or brake pedal and the fire wall.

Hydraulic Oil Level and Condition

The oil should be clear and clean looking. "Milky" looking oil, or oil with a lot of air bubbles, should be changed right away.

NOTE

Oil that holds air bubbles overnight should be replaced. Air bubbles in the oil during operation do not indicate an oil issue but instead indicate a problem with the integrity of the hydraulic seals somewhere in the system.



Top off oil levels **ONLY** with the same type of oil that is in the reservoir. Do not mix name brands, even if they have the same viscosity. Each oil manufacturer uses different additive packages to accomplish anti-foaming, silt settling, anti-wear, etc. The mixing of these different chemical additive packages may render them useless.

Hydraulic Reservoir

Drain water from the hydraulic reservoir each morning. Open the hydraulic tank drains on the hydraulic reservoir (Figure 2), and allow the fluid to run into a pan until it changes from water to oil. (Water is heavier than oil, so it sits on the bottom of the tank and therefore drains out first.)

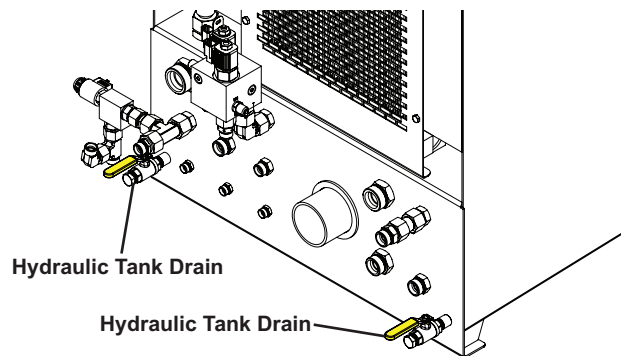


Figure 2
Hydraulic Tank Drain (Ball Valve)

Water Tank

If allowed, fill the water tank before leaving the yard (Figure 3). In some localities, filling the water tank may cause an overweight condition for driving. If you cannot carry water with you, be sure that there will be an ample water supply at the jobsite. It is not possible to pump a job without water! It is used in the waterbox to cool the rubber rams and differential cylinder rods. Water is also used for cleaning out the hopper and pipeline.

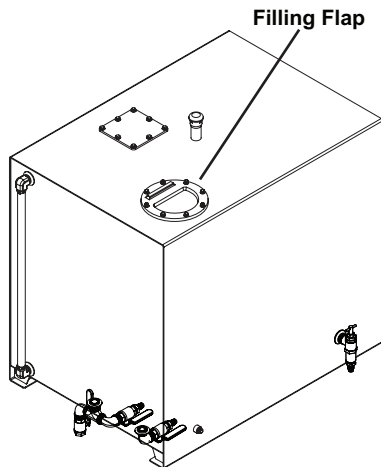


Figure 3
Water Tank Filling Cover

Hopper Vibrator

The hopper vibrator is an optional item. This device is an electric motor that has eccentric weights attached to a shaft at each end. When the motor spins, the weights shake the unit and whatever is attached to it (the hopper grate or the hopper). The purpose of the device is to assist low slump concrete in falling through the grate and into the concrete cylinders. If your use of the concrete pump includes pumping of low slump concrete, you will find this option invaluable.

Work Light (Spot Light)

The power receptacle for the spot light or work light is located behind the hopper lid. The on/off switch for the work light is located on the pendant or radio remote. The cap for the work light receptacle should be installed when a work light is not being used.

Driving the Unit

Many accidents involving concrete pumps are traffic accidents. To avoid accidents when driving a concrete pump truck, you must obey traffic laws and warning signs. Concrete pump trucks are heavy, which results in longer stopping distances. If you don't have a valid driver's license, **do not drive this unit**.

Enable Drive Mode

- Press foot on the brake and then shift vehicle into neutral.
- The indicator light underneath the driver-side of the dashboard should begin flashing yellow; press the AUX5(PTO) button on the center of the dashboard to shift into drive mode.
- Put vehicle into park.
- Verify the parking brake is disabled before driving.



NOTE

If the transmission is shifted to neutral after pumping, the system will not allow you to re-enter pump mode until the AUX5(PTO) switch is cycled.



NOTE

Pump mode will be disabled if you start the truck while still in pump mode; it must be taken out of pump mode and then put back in.

Backing Up

You will be able to see the road behind you on the left and right sides, but you will not be able to see directly behind you. If you need to back up, use a guide. A guide is a person who watches for traffic, pedestrians, and other obstructions. Position the guide where you can see him or her giving you instructions. Your concrete pump was installed with a back-up alarm, while this provides a measure of safety, do not rely on it.

If you are in an isolated area where there is no traffic and no pedestrians, you can get out of the cab and look for obstructions before you start to back up.

Changing Lanes

Whenever you drive a vehicle, you have blind spots to your right and left sides. Unfortunately, many drivers are unaware of these spots and will travel in them for extended periods. You can avoid these blind spots by using convex mirrors, which attach on or below the outside rear view mirrors. Before changing lanes, check the convex mirrors for other drivers who may be "hiding" in your blind spots. Signaling well in advance will warn other drivers of your intention to change lanes.

Towing the Unit

Sometimes poor driving conditions on the construction site make towing the unit necessary. If you encounter deep mud, sand, snow, or other driving hazards, it is better to tow the unit in and out of position than to risk breaking an axle or sliding off the road. In these cases, remember the following points:

- It is always best to use the towing pin supplied by the truck manufacturer. On trucks that are so equipped, the towing pin is usually located on the front bumper.
- If towing from the front is not possible, or if the truck is not equipped with a towing pin, you will have to use extreme caution when selecting a place to hook the towing cable. Be sure that the place you select has adequate room for the cable to move without hitting or damaging other parts, and that it is capable of handling the load of towing the unit. There are tow hooks located on the front and rear of the unit.
- Use only undamaged towing straps or cables strong enough to tow the unit. Never use chains for towing because if a link breaks, the chain will whip in both directions away from the broken link with great force. This could cause injury or property damage.

Unit Setup

Selecting the Setup Location

When you arrive on the job, check with the job supervisor to determine where you should set up. If possible, choose a flat, firm, and dry location that allows hopper access for two ready-mix trucks.

Laying Out the Pipeline

Start at the point of discharge and work your way back to the pump. In most cases, you will need rubber hose at the point of discharge. Placing crews always prefer 3 or 4-inch rubber hose over 5-inch hose. This means that you will need a reducer at the discharge end.

If you will have to reduce to smaller-diameter pipe or hose for the placing crew, always make the long part of the run with the larger diameter, and reduce as close as possible to the point of discharge.

Use the fewest hoses possible. Hose has greater resistance to flow than pipe does, so more pressure is needed to push through hoses than through pipe.

Use the largest-diameter hose the crew will allow you to use. The diameter of the hose determines the largest-size stone you can pump. If you will be pumping stone larger than 1 inch in diameter, you will not be able to use hose that is 3 inches or smaller. To attempt to do so would result in a blockage.

Do not use hose for changing pipeline direction. Pipe elbows are available with many degrees of bend, and pipes require less pumping pressure than hose.

Preparing for Ready-Mix Trucks

If you have completed setup before the first ready-mix truck arrives on the job, use this time to get some things ready for the day.

- Find out who will be giving you signals throughout the day. To avoid conflicts in instructions, only one person should give you signals. Make sure both of you understand what signals will be used. The American Concrete Pumping Association (ACPA) has standardized hand signals for concrete pumping.

INSTRUCCIONES DE SEGURIDAD						SAFETY INSTRUCTIONS					
 1. START PUMP SPEED UP						 2. SLOW PUMP DOWN					
 3. STOP PUMP						 4. LITTLE BIT					
 5. RELIEVE PRESSURE						 6. ADD WATER 4-GALLONS					
 7. ALL DONE CLEAN UP											
 8. BOOM UP						 9. BOOM DOWN					
 10. BOOM LEFT						 11. BOOM RIGHT					
 12. OPEN OR EXTEND BOOM						 13. CLOSE OR RETRACT BOOM					
 14. STOP BOOM											

- Talk to the placing crew foreman to make sure the placing crew is aware of the safety rules described in the Safety Manual. Make sure the crew members especially understand the importance of not kinking the tip hose.
- Review the safety rules with any oilers or laborers who have been assigned to work with you at the pump. Show them the concrete pump stop switch and emergency stop buttons.

- If an oiler or laborer will be backing ready-mix trucks up to your hopper, emphasize the danger they are in when they place themselves between the pump and the ready-mix truck.
- Clear the unit's decks and walkways of debris and ice or snow to prevent tripping or falling.
- Place your water hose where it will be out of the way but still handy for washing pipes and clamps and spraying down the hopper.
- When using the pendant remote, position the remote box and cable where they will be out of the way.
- Wear all of your personal protective devices, or have them nearby.
- Remove the waterbox cover and fill the waterbox with water (Figure 4). **Do not remove the waterbox grate for this procedure.** The waterbox fill valve can also be used.

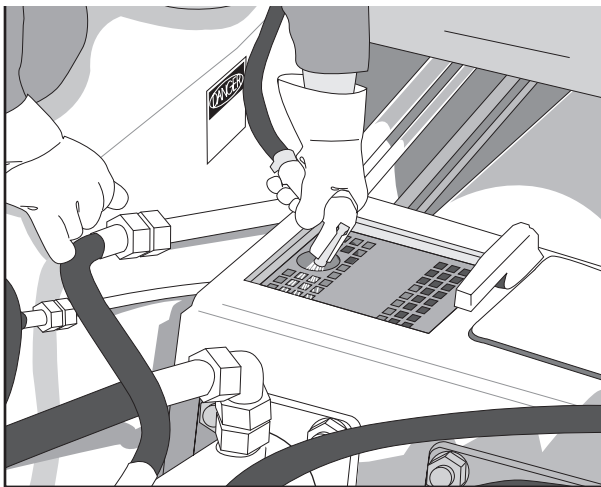


Figure 4
Fill Waterbox

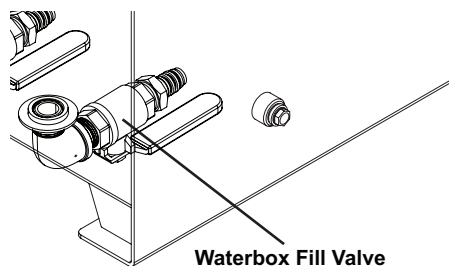


Figure 5
Fill Waterbox

- If you will be using portland cement and water to make your lubricating slurry, prepare it now. Position your barrel, shovel, and sack of portland cement on the ground behind your hopper. Fill the barrel with 25 to 30 gallons of water (Figure 6).



Figure 6
Water for Lubricating Slurry

This step can be skipped if slurry will be delivered to you from the ready-mix company, or if you are using powdered slurry mix.

- Place your cleanout rake where you will not trip on it but can reach it when you begin cleanout. Pump cleanout is often done when you are in a hurry, when concrete is setting and there is no time to look for the rake. **Never** use your hands in place of a cleanout rake.
- **Put a couple of shovelfuls of sand or dirt in the bottom of the rock valve housing, above the cleanout door** (Figure 7). This will prevent concrete from filling the door area and setting during the course of the day.

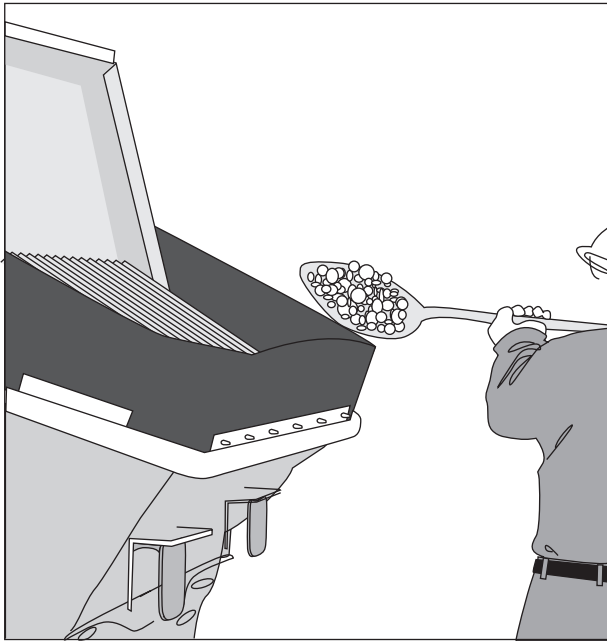


Figure 7
Sand to Cover Hopper Cleanout Door

- Grease the agitator bearings. There are two grease zerks for the agitator on the hopper, one on each side. Re-grease the agitator bearings every 2 or 3 hours, as the pour allows.

Do not pump in grease until you see it come out around the agitator shaft. When you grease the agitator bearings, watch the rubber grease cones located inside the hopper. You want the cones to bulge slightly when they are full of grease. You do not want the grease to come out around the shaft, because wherever grease comes out, concrete will be able to go in.

Once concrete gets inside the grease cone, the bearings will wear out quickly. When re-greasing after the hopper is full of concrete and you can no longer see the cones, give the zerks a couple of squirts. This is one of the few times when it is better to under-grease than to over-grease.

1 ○	1	Right-Hand Inside Shift Cylinder
2 ○	2	Left-Hand Shift Cylinder
3 ○	3	Right-Hand Shift Cylinder
4 ○	4	Right-Hand Agitator
	5	Left-Hand Inside Shift Cylinder
	6	Left-Hand Side Agitator
	7	Front Rock Pivot
	8	Rear Rock Pivot

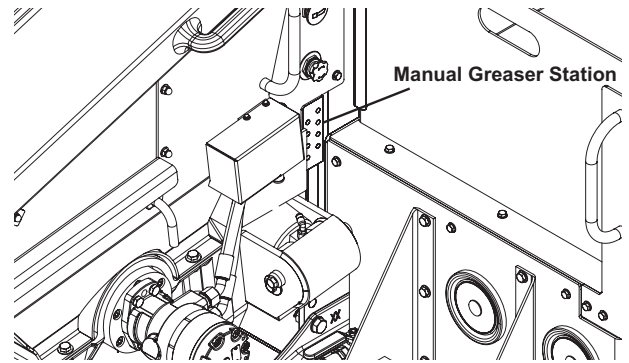


Figure 8
Agitator Grease Points

- Grease the rock valve lubrication points before the pour begins. Once started, grease them every couple of hours. The rock valve has eight grease zerks. The zerks are on the manual greaser station accessible from the passenger side of the unit (Figure 8).

Lubricating the Pipeline

When the ready-mix trucks arrive on the job, the pipeline can be lubricated. SCHWING 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 9). 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 10). It may not cover the openings to the material cylinders, but this is not important at the moment.



Figure 9
Mixing Slurry In Barrel

Make one barrel of mix for each 100 feet of laid pipeline that the concrete. 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 10
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.

Enable Pump Mode

- Start the vehicle.
- With the engine running, apply the parking brake.
- Verify the vehicle is in 2-wheel drive. If the vehicle is not in 2-wheel drive, the indicator light underneath the driver-side of the dashboard will be a solid magenta.
- Use the indicator light underneath the driver-side of the dashboard to guide you through each step:
 - A solid red light means that the air pressure needs to raise, wait for the air pressure to build up.
 - A flashing white light is the signal to shift the vehicle into neutral.
 - A flashing magenta light is the signal to press the AUX5(PTO) button on the center of the dashboard, which will shift the transfer case.
 - A flashing green light is the signal to shift the vehicle into drive without pressing on the brake; the unit should lockup into 16th gear.
 - A solid green light indicates that the machine is ready to pump.
- If at any point the indicator light is flashing white or flashing yellow, then there is an error and the cycle outlined above should be repeated.
- A flashing red indicator light means that there is an error displayed on the PLC; check the error and correct it.

Indicator Light Meaning	
Flashing Blue	Set Parking Brake
Solid Magenta	Disable AWD/4x4
Solid Red	Low Air Pressure - Wait
Flashing White	Shift to Neutral
Flashing Magenta	Enable Pump Mode (Aux5(PTO))
Flashing Green	Shift to Drive
Solid Green	Lockup Successful - Ready to Pump
Flashing Yellow	Enable Drive Mode
Flashing Red	Check Error at PLC

Agitate the Slurry

Locate the operator control panel on the front passenger side of the machine. You can control the pump with either the pendant or radio remote.

Place the pendant/radio remote selector switch in the pendant position (Figure 11). Connect the pendant remote to the cable located just ahead of the operator control panel. Ensure all E-stops have been cleared. Press the horn/reset button to clear all E-stop requests. The machine can now be operated from this pendant

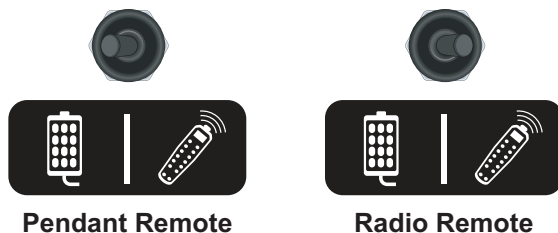


Figure 11

Pendant/Radio Remote Selector Switch

To use the radio remote, place the pendant/radio remote selector switch in the radio position (Figure 11). Press the power (green) button on the wireless radio remote. Press the horn/reset button to clear all E-stop requests.

- With the cement washed to the bottom of the hopper, press the concrete pump forward and then reverse buttons (Figure 12) to cycle the rock valve back and forth a few times. This will agitate the mix a little more. Do not try to pump this mix until you can add concrete.
- Use the throttle increase and decrease buttons (Figure 12) to increase the engine RPMs to the specified maximum engine speed. Note: The ECU will not allow you to go above this limit.
- With the cement washed to the bottom of the hopper, press the concrete pump forward and then reverse buttons (Figure 12) to cycle the rock valve back and forth a few times. This will agitate the mix a little more. Do not try to pump this mix until you can add concrete.

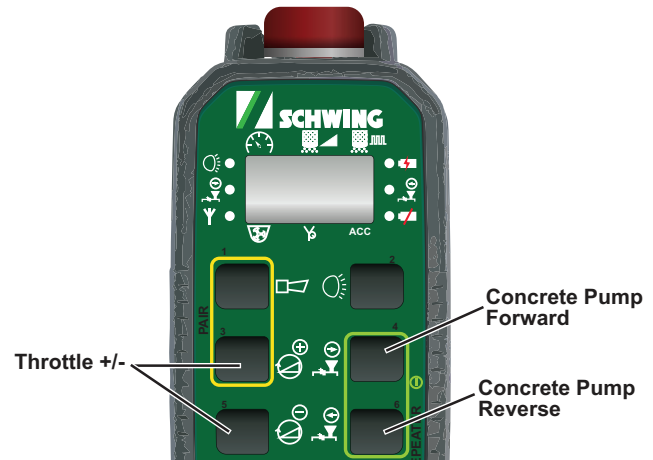


Figure 12

Cable/Radio Remote Buttons

- After the correct amount of slurry has been placed in the hopper, 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 Crushing hazard. Never allow anyone to stand between the concrete mixer truck and the pump.



- 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/reverse buttons. Take a couple of strokes to get some of the slurry into the pipeline ahead of the concrete. Position the rock valve 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 rock valve, 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 rock valve. 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. 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.

You must not open a blocked pipeline without first sucking the concrete back into the hopper. Operating the pump in 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.

Pumping the Job

Operate this machine from the ground to avoid falling and other possible hazards.

If you cannot see the point of discharge from where you are operating the unit, be sure your spotter is in position before you start the pump.

As soon as the spotter gives you the start signal, put the pump in forward and alert the ready-mix driver to start dumping.

WARNING You cannot completely empty the hopper, because air will be drawn into the concrete cylinders. This air will compress during the pushing stroke and explode into the hopper when the transfer tube switches

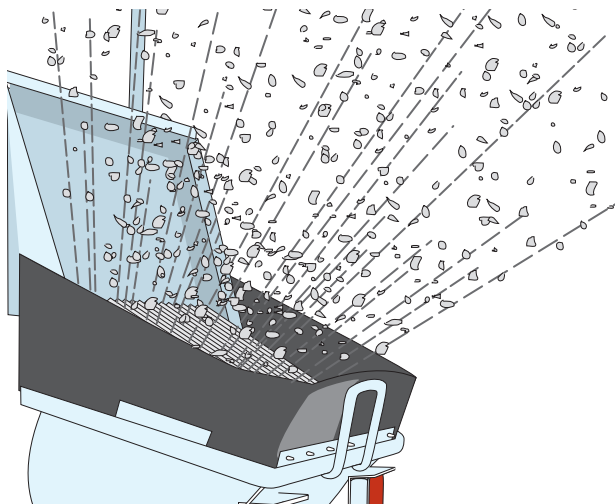


Figure 13
Concrete Exploding from Hopper

Concrete must always cover the openings of the material cylinders so air will not be sucked into the material cylinders. If that occurred, concrete would be rapidly expelled as compressed air escaped on the next stroke. This can be extremely dangerous, so be sure the ready-mix driver understands the situation. If air has entered the material cylinders, you can cushion the expulsion by stopping the concrete pump and filling the hopper with concrete before the next stroke. When the hopper is full, it is still not safe to resume pumping. Even with the hopper full of concrete, some compressed air will be introduced into the delivery pipeline. When it reaches the discharge point, the air will cause the concrete to

be expelled forcefully. If the hose handler is walking a wall or column or is in another precarious position when this occurs, an accident could easily occur. It is best to avoid ever sucking air into the material cylinders. **If you do accidentally suck air into the material cylinders, warn the hose handler and clear the immediate area around the hose until the air is released and concrete is flowing steadily.**

Point out the emergency stop switches to the driver if you will be standing somewhere other than at the operator's panel. That way, the driver can warn you or stop the machine if he sees a dangerous situation developing.

Always keep an eye on the point of discharge or on your spotter. If the hose person is giving you signals, he will have his hands full and will not be able to jump up and down or wave his hands to get your attention. On a typical job site, it is doubtful that you could hear him yelling.

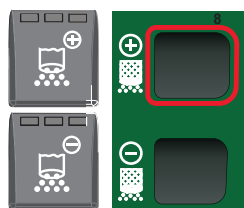
As the day progresses and the crew removes pipe sections from the end of the slickline, wash the pipes, clamps and gaskets with water as soon as possible. If you do not wash them until the pour is finished, you will not be able to get the hardened concrete out of them. This job can be done between loads of concrete, or by an oiler or laborer at almost any time.



Figure 14
Washing the Pipe System

Controlling the Concrete Pump

Stroke Limiter



The stroke limiter is a hydraulic device that can be electrically adjusted with the stroke limiter (+) and (-) buttons, located at the rear operators station or cable remote. Its function is to raise and lower the output of the hydraulic pumps

that operate the concrete pumpkit. This has the advantage of allowing the engine to remain at higher RPMs, where horsepower is at the maximum.

The stroke limiter has an adjustment range of 95 percent. That means it can go from as low as 2 strokes per minute to maximum strokes per minute. The stroke limiter only adjusts the output of the hydraulic pumps while the differential cylinders are moving. That means that when the differential cylinders are stopped at the end of the stroke and the rock valve is moving, the pumps don't return to maximum output until the rock valve cylinder has completed its travel.

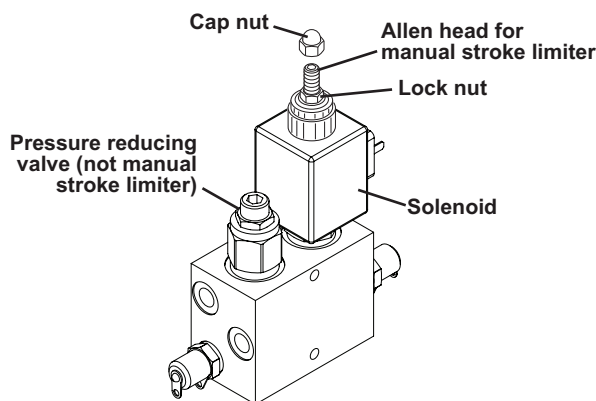


Figure 15
Stroke Limiter Control Block

If electrical control of the stroke limiter is lost, it can be adjusted manually by removing the cap nut located on the top of the solenoid assembly and loosening the lock nut with a 1/2 inch wrench. The adjustment is then accomplished with a 5/32 inch allen wrench by turning the screw in (clockwise) to decrease strokes or out (counter clockwise) to increase strokes. Always return the manual stroke limiter to maximum strokes (full counter clockwise out position) when electrical power is restored.

Soft Switch

Your pump is designed with a soft switch system that reduces main system pressure during the shifting of the rock valve. In the event of a failure in the soft switch system, it is possible that your main system pumping pressure could be reduced to the continuous pressure of the soft switch system (100 bar). In an emergency, it is possible to disable the soft switch function by turning the soft switch shut-off valve 90 degrees (Figure 16).

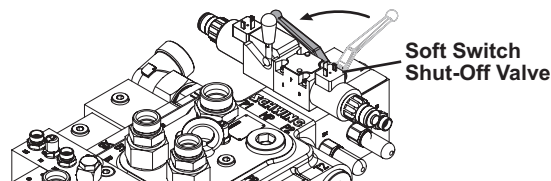


Figure 16
Disabling Soft Switch

Vibrator (Optional)



If you are pouring stiff concrete that is not flowing well through the hopper grate, use the Vibrator On/Off Switch to turn on your vibrator. The vibrator helps low-slump concrete fall through the hopper grate by shaking the hopper itself or the grate. If you didn't buy a vibrator with your unit, you can purchase one for field retrofit by calling the SCHWING Service Center at 1-888-292-0262.

Time Constraints

Remember, if anything goes wrong on the unit while it is pumping, you only have 15 to 30 minutes to solve the problem before the concrete sets. (Less with old concrete on a hot day, more with fresh concrete on a cool, cloudy day). If you know that it will take longer than 30 minutes to fix, the problem, clean out before you begin repairs. If concrete is beginning to set, you will have to clean out in a very quick an efficient manner. There are special instructions which you will find in the Operation section of this manual. If you don't panic and keep moving, you can usually avoid cleaning or replacing the pipes. Old concrete and hot days is the worst case scenario. Under certain hot weather and old concrete circumstances, the concrete may go from being pumpable to setting very, very quickly. This is called 'flashing', and if it happens, you may lose some pipe. See also the section on delays described in "Cold-Weather Pumping" on page 83.

Cold Conditions

Always keep the hopper at least half full. If any problem arises with the unit while it is pumping, you have just 15 to 30 minutes to solve it before the concrete begins to set, and possibly less time if the temperature is extremely cold. If you know you will need more time, clean out before you begin repairs. If the concrete is beginning to set or freeze, you will have to clean out quickly and efficiently. Review the special instructions for quick cleanout and delays in the Operation section of this manual.

Emergency Disablement

Broken Hose or Fitting

If an emergency requires you to disable the hydraulic system completely (such as if a hose or fitting breaks), you must stop the truck engine or at least take the transmission out of gear. This can be done only from the cab of the truck. Shut off the engine first; investigate later. Keep one long length of each of the five possible diameters of hose with the unit for such emergencies. (See "Recommended Emergency Hose Kit" in the Appendix for a list of the five hose diameters and the recommended length of each for emergency use.)

Electrical Power Loss

If you lose electricity on the unit for any reason, the dump valve will open. This will route oil from the hydraulic pump directly back to the tank. The dump valve also opens whenever an emergency stop button is pushed. To continue pumping, you will need to reset that emergency stop switch.

To reset the system and enable the hydraulic circuit, turn the E-stop button clockwise.

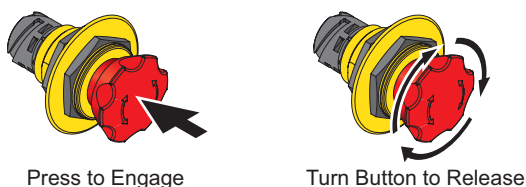


Figure 17
Emergency Stop (E-stop) Button

For any other electrical power loss, you will have to find out the problem and correct it to continue pumping. If you cannot find the problem within 10 minutes or so, you will have to take action to prevent the concrete from setting up or freezing.

If you cannot correct the electrical power loss problem, try activating the dump valves by pushing the two override buttons on the E-stop while another person activates the concrete pump forward/reverse handle, on the S1/S2 Control Block. Activating the three valves will close the dump valves allowing the accumulator to shift the concrete valve and the pump to be cleaned out.

For additional assistance with electrical power loss issues, contact the SCHWING Service Center at 1-888-292-0262.

Delays

Expect delays on the job. Waiting for concrete, workers needing to finish the next form to be pumped, and form failures are all common delays. Make good use of this idle time by washing pipe, clamps, and gaskets that have been removed from the delivery system, washing splashed concrete from the hopper area, eating lunch, or taking care of miscellaneous tasks. Concrete begins to set as soon as it becomes motionless, so approximately every 5 minutes give the pump a stroke. This will make the concrete in the elbows and reducers change its shape, thus breaking the set. Concrete setting in the pipeline acts like a blockage. Blockages can be dangerous because the pump will create maximum pressure on the concrete. Always keep the hopper at least half full. If the concrete is getting stiff, add water to the hopper while you are waiting. A word of warning regarding this procedure: the concrete will eventually set up anyway. If you wait so long that the concrete is setting, it is a good idea to clean out and then start over when the fresh concrete has arrived.

- If you are waiting for a form to be finished or repaired, or anytime that the delay has nothing to do with waiting for concrete, you can give the pump one or two strokes in 5-minute intervals for a longer time because the ready-mix truck will be able to refill your hopper. Be careful about where the concrete is pouring when you are giving the machine these one or two-stroke cycles. If the form is broken, you will complicate matters by putting more concrete into it.

- Eventually, you will have to make a call; once concrete begins to set while it is being pumped, you have only minutes to get the machine cleaned out. See “Clean Out” on page 78 for this procedure.
- Also consider the condition of the concrete in the ready-mix trucks. If three or four trucks have been waiting on the site for a period of time, the concrete may be setting up. If it is a hot day and the concrete is setting up, you are risking a pipe cleaning party by pumping this concrete. The concrete pump operator must make the decision to use or not to use this concrete..

Keep the Waterbox Full

Remember to check the water in the waterbox regularly (stopping the pump before opening the waterbox covers). Water is very important for cooling the differential cylinders and for lubricating the rubber rams.

Under no circumstances should you remove the hopper grate while the machine is operating, nor should the machine be operated when the grate is not in place. If your grate is in place, it will catch all types of foreign objects: mixer fins, clumps of unmixed cement, rebar, tools of all sorts, etc. If any of these items made it into your hopper, they would probably cause a blockage, which is always dangerous.



WARNING Amputation / crushing hazard.
Keep hopper grate in place during operation and cleaning.

Blockages

If there is a blockage in the pipeline that you cannot remove by the backward/forward rocking motion (two strokes in reverse, then go back to forward), you will have to disassemble the pipeline to find it. Before you disassemble the pipeline, you must relieve the pressure by pumping in reverse for several strokes.

- When you go to the pipeline to find the blockage, take your hammer with you. Wear all of your personal protective devices for this procedure. Most of the time, you will find the blockage in a reducer, hose, or elbow. The act of reversing the pump will make the pipeline sound different when tapped with a hammer than if it were pressurized. “Tapped” is a key word here. You can damage the pipe by striking it hard. You should be able to

hear the difference. An empty pipe has a definite reverberating “tong” sound. A full pipe without pressure will have a meaty “thak” sound, and a pressurized pipe full of concrete will have a thin “tik” sound because the forces on the steel will not allow it to vibrate. **Once you have located the blockage, carefully remove the clamps from the blocked pieces. Put on a full face shield before you pull the handle. If you have relieved pressure by stroking in reverse, you should be fine, but sometimes a blockage will store pressure because there is another blockage upstream or downstream. It is better to be safe than sorry. Once the clamps are removed, the danger is past.** Displace the blocked piece enough that you can push a piece of rebar or another long poking device into it. If the blockage is in a hose, it will help to hit the outside of the hose with the hammer. Again, do not damage the hose by hitting it so hard that the steel braids inside get permanently disfigured. When the blockage is loosened, elevate one end of the pipe or hose and dump out all remaining concrete.

- Once the blockage is removed, clean up the clamp, gasket, and pipe end with a rag or, in a pinch, wipe the concrete off with your hands (always wear rubber gloves when working with concrete. Reassemble the pieces, and pin the clamps. Return to the pump and start pumping in forward again, slowly at first, until you are sure that there are no more blockages. If you encounter another blockage, relieve the pressure again by pumping in reverse for several strokes before finding the remaining blockages.
- Do not use compressed air to remove a blockage. Your concrete pump has at least six times more pressure available than an air compressor. If the pump won’t push the plug, air certainly won’t. In addition, air that is compressed builds a reservoir of pressure that will continue to be dangerous even when the compressor is shut off.

Clean Out

You will often have to wait for the “balance load” of concrete to arrive. This is usually 1 or 2 yards that the contractor ordered at the last minute. This often happens late in the day, so typically four of the five ready-mix drivers you worked with all day have gone home. The same person who brought the next-to-last load will have to go and get the balance load. This gives you time to get ready for cleanout and to stow pipeline, clamps, and accessories, but if the concrete in your machine will be old by the time the ready-mix driver returns (This is the most dangerous time for concrete setting in the machine), be aware of it, and take any steps necessary to keep the concrete alive. Clean out, if you must, but if the balance load is very small, refilling the hopper, material cylinders and pipeline may use up the entire balance load without ever delivering concrete to the form. In that case, another balance load would need to be ordered, and no one is going to be happy about that.

The balance load is usually fresh concrete. That means that if you pump at least 1/2 yard, your machine will be filled with fresh concrete for cleanout, which is to your advantage. The worst thing that can happen is that, on a hot day, the balance load is only one wheelbarrow full. You will not be able to get fresh concrete all the way through the pipe when you pump the balance load, so the concrete that is in the end of the pipe for cleaning is as old as the next-to-last load. Be careful! With old concrete, it is imperative that the pipe be cleaned immediately upon finishing the pour.

- Check your water supply! You will need water for cleanout.
- If you will be cleaning the pipeline by forcing a sponge ball through the line with air or water, wet the ball first. You can start soaking your sponge ball in your 5-gallon bucket when 1/2 hour of pumping remains, or you can start soaking the ball in the morning; if you let the ball soak all day, however, it will not last as long.

⚠ WARNING Hose whip hazard. Never use compressed air to clean out rubber hose. The result could be a violent whip of the hose as the air is released. If water must be conserved, dump the hoses manually and rinse them with the water nozzle.

Cleaning the Hopper

Do not do the following procedure while the pump is engaged in either forward or reverse. The pump must be in OFF or neutral position.

⚠ WARNING Amputation hazard. Stop pump before cleaning the rock valve and hopper.

Using your hammer, tap on the T-handle that opens the cleanout door on the bottom of the hopper (Figure 18). When the door opens, the concrete at the bottom of the hopper should fall out.

If the concrete does not fall out, aim your hammer upward and pound any material that is lodged in the cleanout door. A couple of taps will probably free the material, but if you need to, keep tapping until all the material is free. **You can minimize or eliminate this procedure by putting sand or dirt in the bottom of the rock valve housing before you begin pumping.**

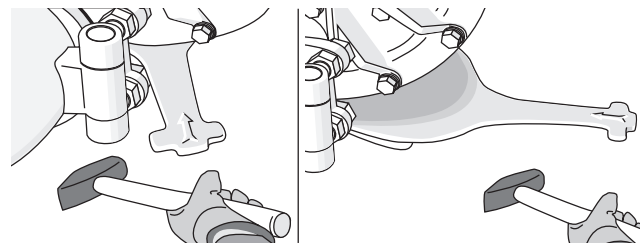


Figure 18
Opening the Hopper Cleanout Door

For the following procedure, be sure of your footing and keep the hopper grate in place.

- Spray water into the hopper from above the hopper grate (Figure 19).

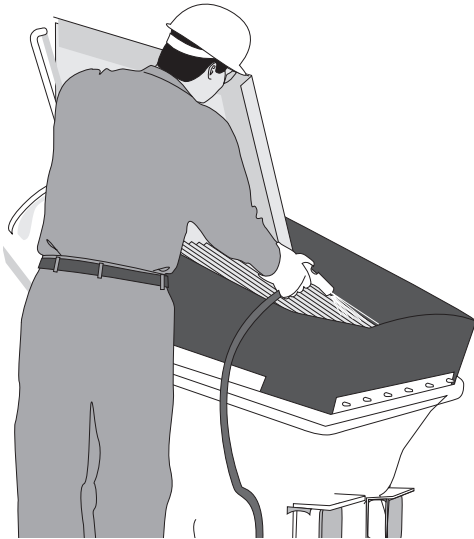


Figure 19
Clean Agitator and Hopper

- Keep the agitator turning until you have sprayed the blades clean. Wash the material from the hopper out of the cleanout door on the bottom.
- Stop the agitator from turning with the agitator switch on the control panel. Do not proceed to the next step until this is done. Visually confirm that the agitator has stopped by looking into the hopper.

- Poke any material that has set in the corners of your hopper with a piece of rebar or another stiff, long bar (Figure 20). Do not remove the hopper grate for this cleanout procedure. This procedure must be done with the hopper grate in place. **Do not spend too much time on this procedure**, or the concrete will have time to set up in the rock valve and material cylinders.

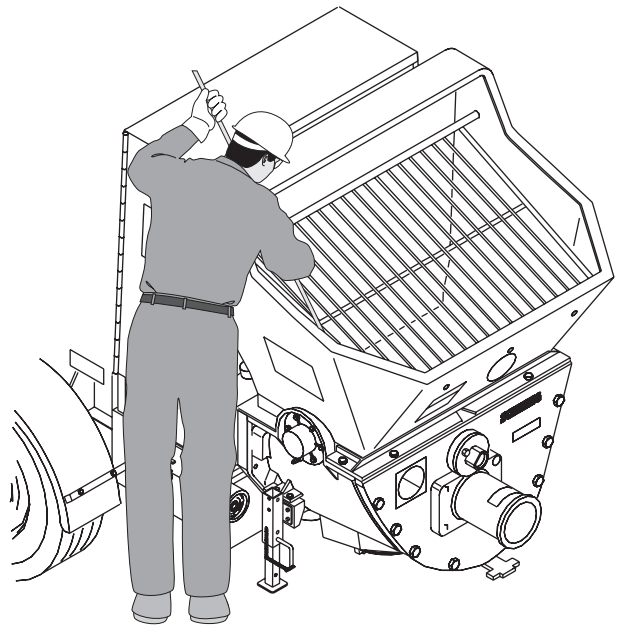


Figure 20
Remove Hardened Concrete From Hopper

If concrete in the hopper has completely set, you will need to use a chipping hammer or another power tool to clean it. The grate is removable for this purpose.

⚠ WARNING Amputation / crushing hazard. Never work inside the hopper without disabling the hydraulic system.

For safety reasons, return to your shop before you remove any concrete that has completely set. Once the concrete has set, there is no advantage to chipping it away at the job site.

Cleaning the Rock Valve

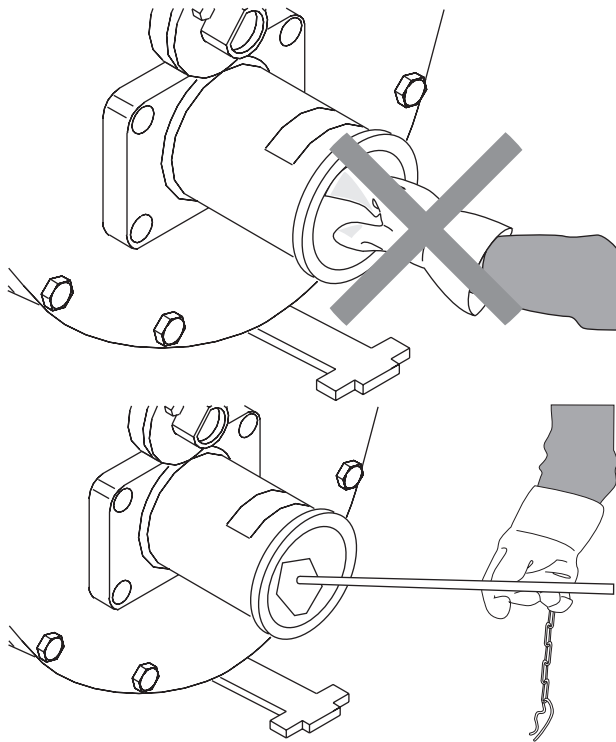


Figure 21
Rock Valve and Material Cylinder Cleanout

Once the hopper is clean, you should clean out the rock valve and material cylinders. Before you begin this step, bring the engine speed to an idle. Stroke the concrete pump one complete stroke in reverse, until the rock valve shifts across, then stop the pump. This step ensures that the exposed material cylinder will have the rubber ram extended to the end, thereby eliminating the need to pull material from deep inside the cylinder.

⚠ WARNING Amputation hazard. Stop the pump before cleaning the rock valve and hopper.

Be sure that the concrete pump is turned to the OFF position before proceeding. Using your cleanout rake, pull any material from the exposed material cylinder, the rock valve, and the outlet pipe (Figure 21).

- Spray water into the opening, washing the end of the rubber ram, the material cylinder, the rock valve, and the outlet pipe (Figure 22). Continue washing until the water that leaves the valve is clear and clean. Visually inspect that no rocks, sand, or clumps of concrete remain. If there is still material, continue spraying water.

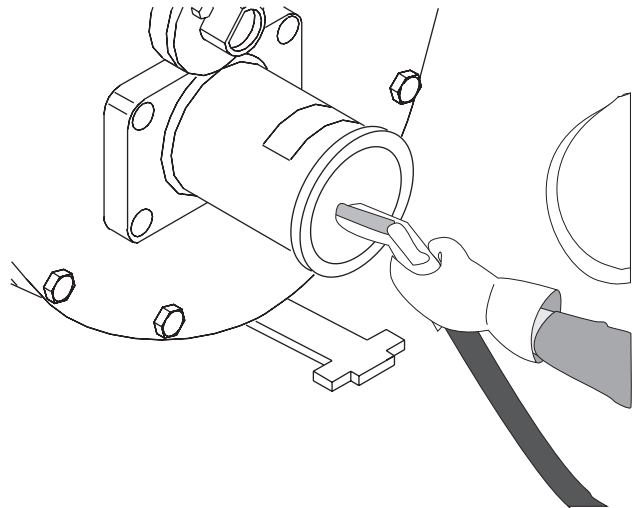


Figure 22
Spraying out Rock Valve

- Be sure that your rake and other tools are out of the rock valve area, then cycle the machine in reverse for one more stroke. This will expose the opposite material cylinder, and completely extend its rubber ram. Remove any loose material with the clean out rake, then spray out the material cylinder as in the previous step.
- By putting the pump into reverse mode, you are sucking from the direction of the pipeline (which is not connected during the cleanout procedure) and pumping into the hopper. Because of this, you may find that you now have some material in the bottom of the hopper again. You need to wash this material out.
- Spray off the clamps, gaskets, and wedges.
- Close the hopper cleanout door, and reattach the bungee cord, if used.

Cleaning the Waterbox

To clean the waterbox (Figure 23), start by lowering the engine RPM to an idle. Leave the waterbox cover in place for now. Open the drain and allow the existing water to flow out the bottom. When water stops flowing, give the unit a stroke or two in either forward or reverse. This will force the water in the extended cylinder back into the waterbox and out the drain. The waterbox is empty when no more water flows out the drain, even after the unit is cycled.

⚠ WARNING Crushing / amputation hazard. Disable the hydraulic system before removing waterbox guards.

Stop the pump and secure it against unintentional starting by pushing the emergency stop button.

Be sure of your footing. Remove the waterbox covers and spray the waterbox and cylinders through the safety grate, until all cement fines and grout are flushed.

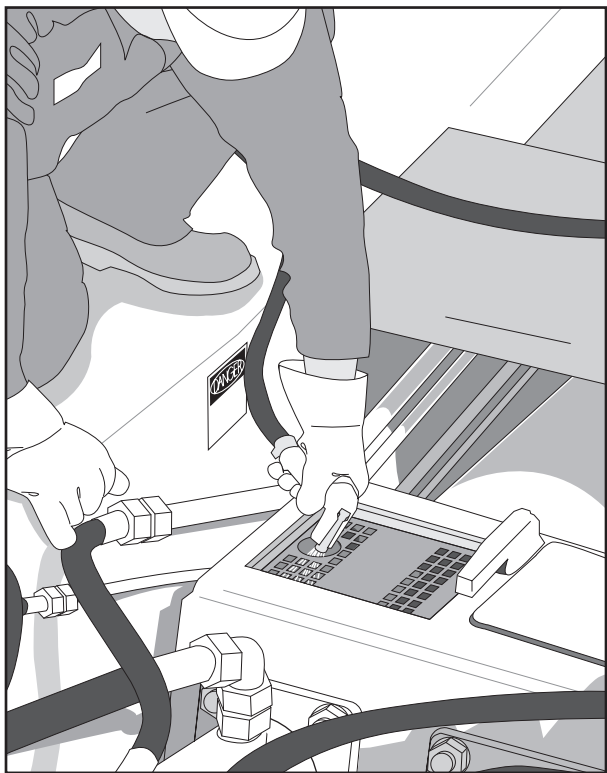


Figure 23
Spraying out Waterbox

If you will not be filling the waterbox again until just before the next pour, follow this procedure:

- Replace the waterbox cover.
- Put the pump into forward or reverse for one or two strokes to force the clean water out the drain.
- Close the drain.

If you will be refilling the waterbox immediately, simply close the drain and finish filling the waterbox. Remember to replace the waterbox cover before restarting the unit.

If the concrete pump will be transported or stored in below freezing temperatures, you must drain all the water from the waterbox. (See “Cold-weather Pumping” in this section for details.)

Draining the Water System

Standard Water Tank

To drain water out of the water lines, open the quarter turn valves located on the rear and passenger side of the unit. Turn on the water pump until water is drained from the system. For long term storage, open both the quarter turn valve below the water tank and the passenger side outlet.

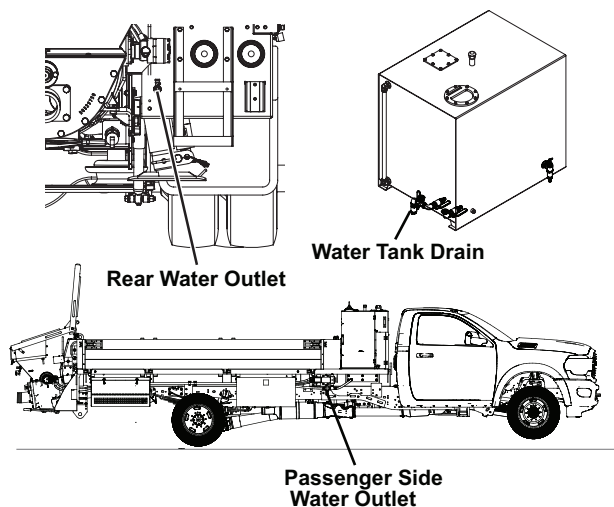


Figure 24
Water System Drains - with Water Pump

NOTE It will not hurt the Hypro pump to run it empty for a short time. After opening all drain cocks and activating the pump, you may want to run the pump again to be sure all water has been removed.

Preparing for Travel

Securely store your cleanout rake, sponge ball, grease gun, hammer, shovel, and accessories for travel.

- If you collected concrete delivery tickets on your job, hand them to the concrete supervisor when you turn in your job ticket for signing.
- Before you get into the cab to drive, walk around the truck and pump. Look for items you may be forgetting, look under the unit for personnel and obstructions, and check for air pressure, tire pressure and wear. Many driving accidents happen on the way back to the shop after a job, or on the way to a second job. The walk around check before going on the road may prevent these accidents. Think about your route, bearing in mind the time of day, road construction, and other conditions.

Enable Drive Mode

- Press foot on the brake and then shift vehicle into neutral.
- The indicator light underneath the driver-side of the dashboard should begin flashing yellow; press the AUX5(PTO) button on the center of the dashboard to shift into drive mode.
- Put vehicle into park.
- Verify the parking brake is disabled before driving.

 **NOTE** If the transmission is shifted to neutral after pumping, the system will not allow you to re-enter pump mode until the AUX5(PTO) switch is cycled.

 **NOTE** Pump mode will be disabled if you start the truck while still in pump mode; it must be taken out of pump mode and then put back in.

Special Pumping Situations

The following paragraphs describe operations that may be required due to timing or weather conditions.

Quick Clean Out

If concrete is setting up in the machine, you must clean out in a hurry. Accidents happen when you panic. Stay calm and work as fast as you can without skipping any safety rules.

Prioritize the order of cleanout by calculating the amount of time and money involved to replace any components that are ruined by failure to clean before the concrete completely sets. To help you make these calculations, use the following list, which is arranged in order from most expensive and difficult to replace, to easiest and least expensive to replace.

1. Rock Valve Cast Housing
2. Rock Valve
3. Material Cylinders
4. Hopper
5. Pipeline

An experienced operator will dump the hopper and material cylinders, and then rake out the bulk of the material from the valve in just a couple of minutes, moving immediately to the pipeline. The rest of the material in the hopper and valve can be chipped out if it will not wash clean. Be sure to disable the hydraulic system on the unit by stopping the engine, putting the key in your pocket, and putting a “Do Not Operate” tag on the ignition switch before entering the valve or hopper area for chipping.

When cleaning a machine with concrete setting up, do not worry about getting each part perfectly clean before moving on to the next part. Once you have used water to remove the bulk of the concrete from a component, it will be thinned enough to not completely set until you can return to it.

Cold-Weather Pumping

It is possible (and routine in some parts of the world) to pump concrete with outside temperatures as low as -10°F, and even colder under certain circumstances. This can present a variety of problems compared with pumping in moderate temperatures, such as:

- Water in the water tank and waterbox freezes while you are driving to the job.
- Moisture in the truck air system freezes, stopping air flow and freezing air-operated components. Be particularly aware of the air-operated PTO.
- The hydraulic components are slow in responding to your commands.
- Slurry freezes in the pipeline when you are starting the pour.
- Concrete freezes in the line or the hopper while you are pumping.
- The concrete is loaded with calcium chloride or an equivalent to allow the concrete to set before it freezes. This additive accelerates setting time in much the same way that hot weather accelerates setting.
- Washing components with water causes them to become coated with ice, which will not melt until the temperature rises above freezing.
- Machine parts that you sometimes stand on or grasp become very slippery when they become coated with ice.

Some of these potential problems can be solved or tolerated, but others cannot. Here are some tips for cold-weather pumping:

- In locations that have cold winters, store the machine indoors. If you do not have a heated shop, consider renting one.
- Do not put water in the water tank or waterbox before driving to the job. If possible, contact the ready-mix company and arrange for the first truck to be loaded with hot water to fill your waterbox and to mix your slurry. Arrange for the last truck to be filled with hot water and to be prepared to let you clean out using this water.

- If you are expecting cold weather for extended period, change your oil to a thinner viscosity type, such as an ISO VG 32. Be aware, however, that this oil cannot protect the components to as high a temperature as the standard oil shipped with your unit (ISO VG 46).

Pours that require a separate pipeline are usually canceled when the weather is very cold. If the pour is not canceled, be sure that any pipeline laid outside is covered with insulated blankets and has a hot air supply flowing through it from a torpedo heater or a similar heat source. If the pipeline is not heated, the concrete will probably not be able to get through the line because the slurry will freeze against the walls of the pipe. This can result in a blockage. To clear the line, take all normal steps to clear the block, and work fast enough that the concrete will not freeze again as soon as it starts moving.

If the concrete freezes in the pipeline, you are finished pumping until you have warmed up the line. The good news is that the concrete will not set when it is frozen. If you bring the pipeline into a warm place, you will be able to clean it out.

If the concrete freezes in the hopper, you are finished pumping. Find a warm place to bring the machine and clean it as it warms.

If the concrete contains calcium chloride, keep the concrete alive using the same techniques used for pumping on hot days. The calcium chloride accelerates setting, but if it does freeze, the setting stops. When you do begin to warm the machine, the concrete will begin to set again, even more quickly than on the job, because you are now in a warm area. Do not waste time when cleaning a machine in these conditions.

Be very careful of ice when pumping in cold conditions. Never stand on ice-coated pipes or other round objects.

External Cleaning

We recommend washing the exterior of the SPTO during breaks to prevent concrete from setting. We also recommend spraying the outside of the hopper with form oil. Form oil is designed to inhibit the bond between your stationary pump and the concrete. Use only environmentally friendly oils and make sure no oil gets inside the hopper.

High Pressure Washer

Observe the operating instructions of the high-pressure washer and wear the appropriate personal protective covering.

⚠ WARNING

Never point or aim the gun/wand at yourself or anyone else. Never put your hand, fingers or body directly in front of the spray nozzle.

📄 NOTE

Do not spray directly at electronics or electrical components.

Newly painted surfaces may only be cleaned with a garden hose and cold water during the first 3 months of operation. New paint needs 3 months to properly cure. This also applies to repainted areas. Use a soft brush, if necessary.

No high pressure should be used in areas with mechanical paint damage, because this can cause painted areas to separate even more. Damaged painted surfaces should be repaired as soon as possible and in a professional manner.

Use the following guidelines for high pressure washing:

- Maximum water temperature: 140°F.
- Do not use additives.
- Maximum water pressure: 100 bar / 1450 psi.
- Minimum permissible spraying distance: 12 in.

If the high pressure washer used generates a higher water pressure, the spraying distance must be increased accordingly.

Use of Cleaning Agents

Do not use aggressive cleaning agents. They can affect different materials (e.g. rubber) and painted surfaces.

Commercially available paint-cleaning and -care products can be used, provided they do not exceed a pH value of 9 or fall below a pH value of 4.

Always rinse off cleaning agent with clean water. Do not leave puddles.

Protecting New Paint

First 30 to 45 days

- Park stationary pump in the shade. Whenever possible, avoid extreme hot and cold conditions.
- Paint can easily chip from gravel road debris during the first 30 to 45 days. Avoid towing on gravel when possible.
- Tree sap or factory emissions can spot or mar a freshly painted surface. If possible, watch where you park.
- Clean bird droppings as soon as possible. Droppings have high acid content and will damage freshly painted surfaces.
- Solvents such as gas, oil, antifreeze, transmission fluids or windshield cleaners can damage a new finish. If contact occurs, immediately rinse with water; do not wipe.
- Ice and snow should not be scraped from newly painted surfaces. Remove loose material with a soft brush.

Emergency Procedures

Electrical Power Loss

If there is an electrical malfunction with the E-stop circuit, the dump valves will open, disabling the hydraulic circuit. To continue use, remove the main power connectors from the E-stop harness and replace them with the emergency power cable connectors (Figure 25). This will restore power to the dump valves and allow the system to build hydraulic pressure. On the SCT2 controller, navigate to the Maintenance Screen. Use the  arrows to select Override Enable (Figure 26). When selected, press . Engine RPM buttons will appear on the screen. Press the RPM  button to ramp up engine RPM to the desired speed. Hydraulic functions can now be controlled by the override handles and the oil cooler will be turned on. Note: for LRC machines, the RPM  button will place the engine to maximum RPM. Use the RPM  button to lower engine RPM. To return the engine to idle and shut the oil cooler off, ensure "Override Enable" is selected on the Maintenance Screen, and press . This will disable the override.

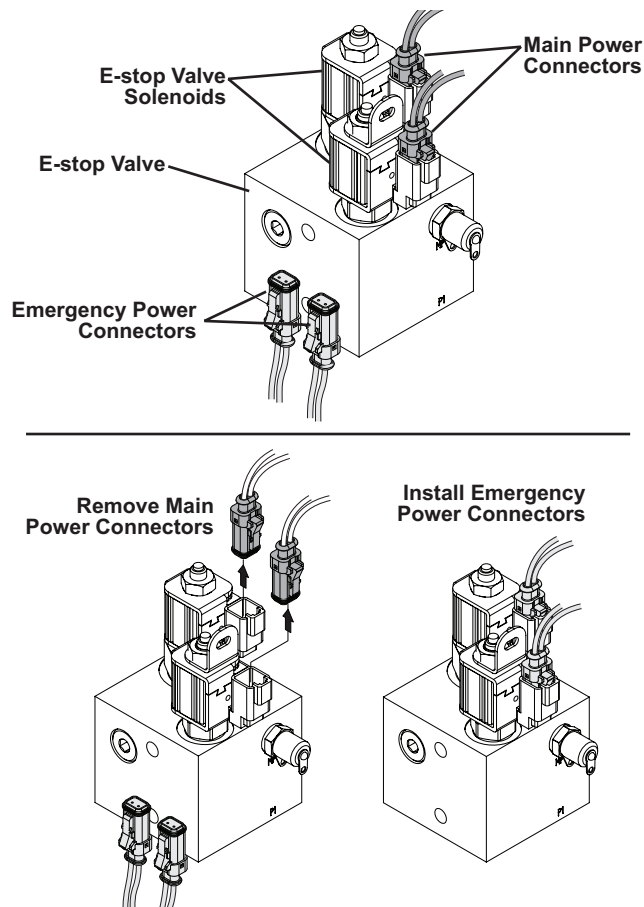


Figure 25
Connecting the Emergency Power Harness

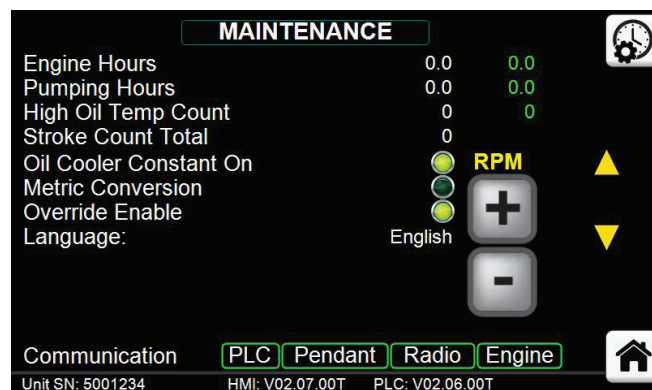


Figure 26
Maintenance Screen - Override Enable

NOTE With Override Enable activated on the Maintenance Screen, the throttle up/down buttons on the pendant and radio remotes will be disabled.

Emergency Override Button

⚠ DANGER If the hydraulic dump valves are electrically overridden, the E-stop buttons will no longer be operable. This removes all E-stop buttons and the hopper grate sensors as machine safeguards. This procedure should only be performed by a certified operator.

If you cannot correct the electrical power loss problem, try activating the dump valves by pushing the two override buttons on the E-stop while another person activates the concrete pump forward/reverse handle on the S1/S2 control block (Figure 27). Activating the three valves will close the dump valves allowing the accumulator to shift the concrete valve and the pump to be cleaned out.

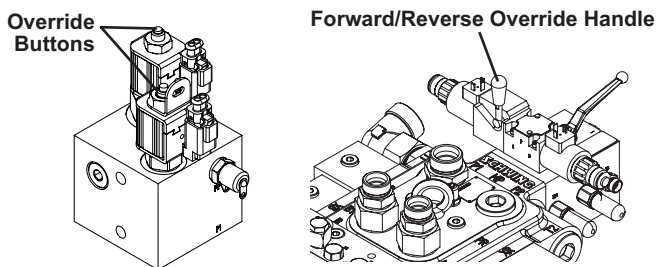


Figure 27
E-stop Override Buttons / Concrete Pump Forward/Reverse Override Handle

For information on where to look and what to do if you lose electricity on the unit, contact the SCHWING Service Center at 1-888-292-0262.

Adjusting the Stroke Limiter - Electrically

If the dump valve coils are connected with the emergency power connectors, SCT2 will trigger the stroke limiter to minimum strokes per limit. It may still be possible to operate the stroke limiter via remote control. All other functions must be operated manually.

Adjusting the Stroke Limiter - Manually

With the emergency power connector plugged in and the PLC working, the maximum amount of milliamps will be sent to the stroke limiter producing minimum strokes per minute. Before manually adjusting the stroke limiter, the power connector needs to be removed from the solenoid to open the circuit (Figure 28).

NOTE If the PLC is not working, the stroke limiter will produce the maximum strokes per minute.

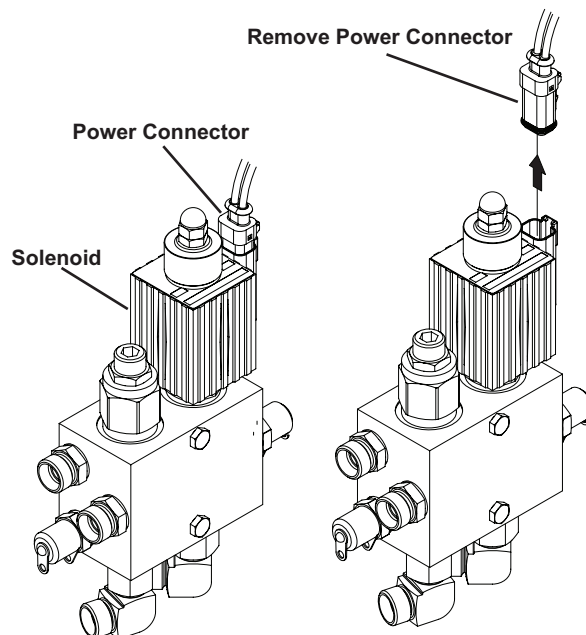


Figure 28
Removing Power Connector

Once the power connector is removed from the solenoid, the valve will go to maximum stroke output. To lower the strokes per minute, remove the cap nut located on the top of the solenoid assembly and loosen the lock nut with a 1/2-inch wrench. Use a 5/32-inch allen wrench and turn the screw in (clockwise), this will decrease the strokes per minute. When the proper speed is reached, lock the jam nut with the 1/2-inch wrench (Figure 29).

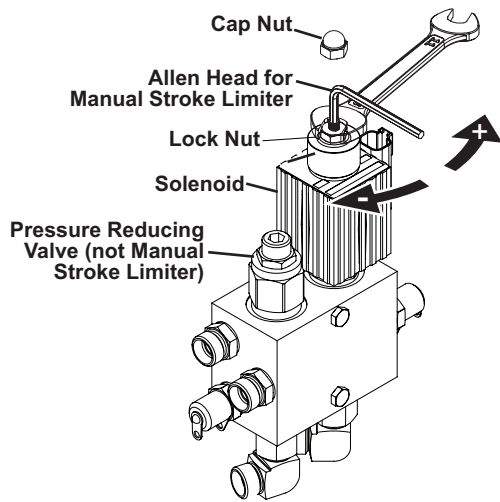
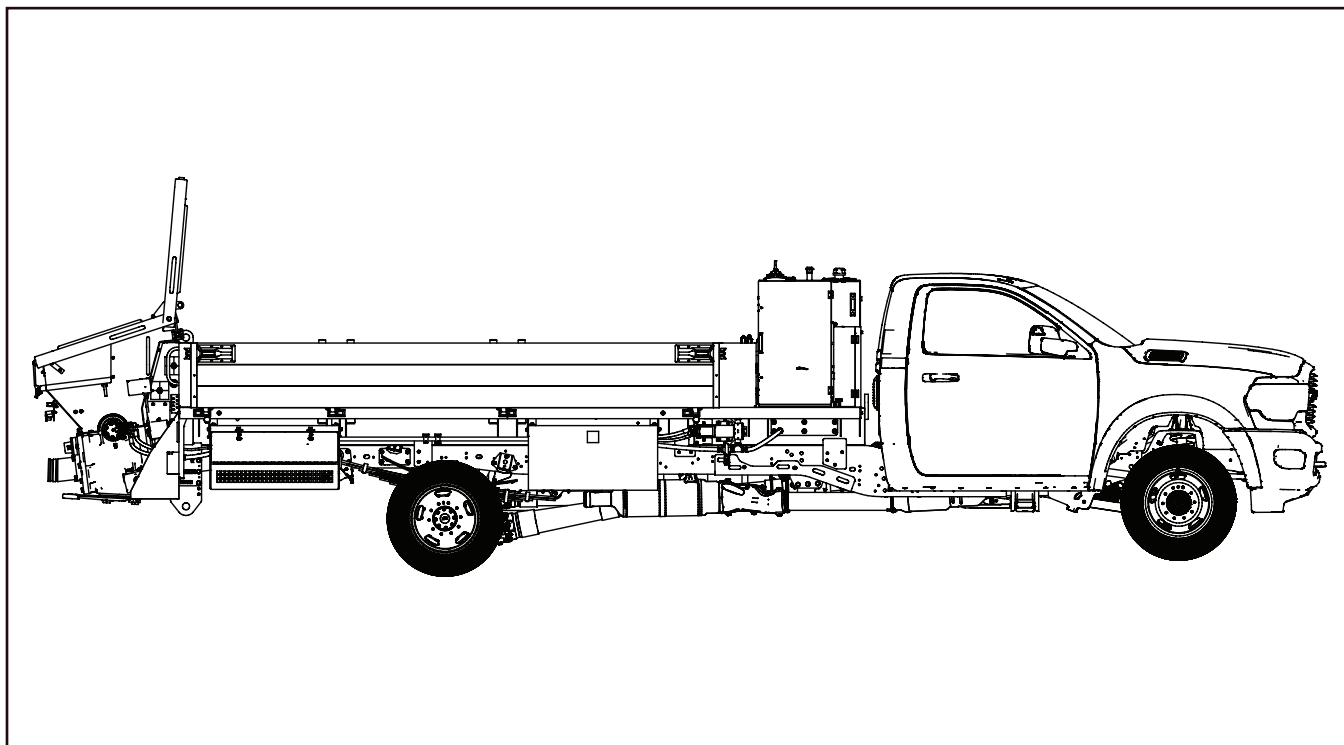


Figure 29
Stroke Limiter Control Block

Return the lock nut and cap to the solenoid assembly and reconnect the power connector to the solenoid once power is restored to the unit.



Maintenance

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Regular maintenance is required to keep the machine in good working condition. There are two kinds of maintenance: preventive and scheduled.

Preventive maintenance will help you avoid unnecessary repairs, but eventually even well-maintained machine parts wear out and require repair or replacement.

Scheduled maintenance needs to be done on a timely basis. That may be daily, weekly, monthly, quarterly, semi-annually, or annually. It is a good idea to create and keep a checklist to track what maintenance is due and when. Keep accurate records of maintenance performed and when the work was completed.

Hoses and Fittings

SCHWING uses metric fittings and hoses with metric threads on the couplings. There are six sizes of tubes and fittings and six sizes of hoses, all measured by diameter.

All block threads are metric or BSPP.

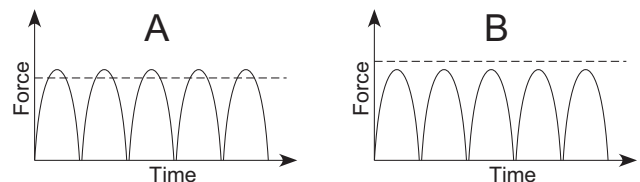
Hose Size	Hose ID (mm)	Connects with Fitting and Tube Size
8	8	12
13	13	16
16	16	20
20	20	25
25	25	30
32	32	38

Tube and Fitting Size	Tube and Fitting OD (mm)	Connects with Hose Size	Tube and Fitting ID (mm)
12	12	8	8
16	16	13	13
20	20	16	16
25	25	20	20
30	30	25	25
38	38	32	32

Torque Specifications

When performing maintenance that requires removing and replacing bolts, you must adhere to the torque specifications for those bolts.

The graph below demonstrates what happens to a bolt if it is not properly torqued. The dashed line represents the pre-stress or tightness of the bolt. As the device that uses the bolt goes through its normal functions, the bolt in Example A below (which is not tight enough) gets stretched and relaxed with every duty cycle because the bolt is pre-stressed under the maximum force of the cycle. In Example B below, the torque on the bolt has been raised to the proper level (which is more than the maximum force of the duty cycle), so the bolt doesn't ever feel the cycle. In the examples below, bolt B would last much longer than bolt A. The torque specifications for bolts used on this concrete pump are found in the Appendix section of this manual.



Welding Precautions

To avoid possible electronic component damage, check the owners manual of the truck to see if anything other than the battery must be disconnected prior to welding anywhere on the unit.

Adjusting Relief Valves

Take care when raising relief valve pressure settings. In extreme cases, this can cause hoses or fittings to burst or other components to fail. To be safe, you should begin the adjustment procedure by turning the adjustment device to the lowest possible setting and then bringing the device back up to the proper setting.

Removing Safety Devices

Sometimes you will have to remove a safety guard (Figure 1) or another safety device to perform maintenance. For these situations, you must take extra care to ensure your own safety and that of your co-workers. If you have to put your hands, feet, or any other body part into a part of the machine that would normally be guarded, be sure to follow the approved "Lockout/Tagout Procedure."

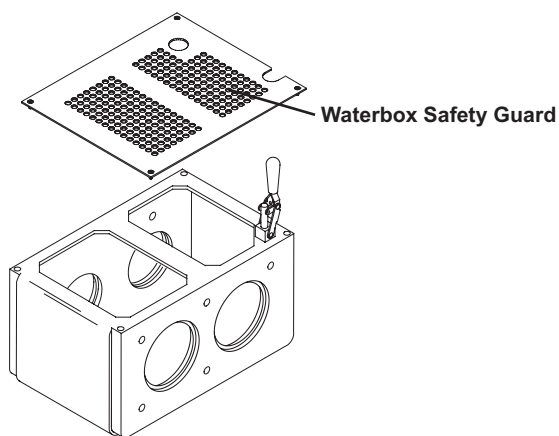
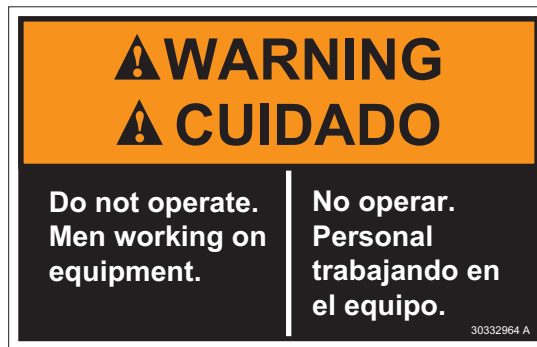


Figure 1
Safety Guard Example (Waterbox Safety Guard)

Lockout/Tagout Procedure

SCHWING includes approved warning devices with all new concrete pumps and recommends the following procedure prior to performing any maintenance in an area of the unit that would normally be guarded:

- Stop the diesel engine.
- Remove the key from the operator control panel, and place it in your pocket.
- Put the static cling "DO NOT OPERATE" label next to the operator control panel.
- Perform the needed service on the unit.
- Remove the labels and reinstall the key.
- Store the label in the document holder for future use.



Before restarting the machine after performing maintenance, be sure to put away all tools, parts, and supplies, and clear the area of personnel.

Before starting the unit at any time, yell "Clear!" and allow enough time for a response before proceeding.

Replacing the Hydraulic Pump

It is highly recommended that prior to the installation of any hydraulic pump that the hydraulic drive spline (Figure 2) is lubricated with a special pre-assembly grease. SCHWING recommends Texaco-Chevron coupling grease to add extended life to the spline and related parts. SCHWING also recommend removing and re-greasing all hydraulic pump splines each year.

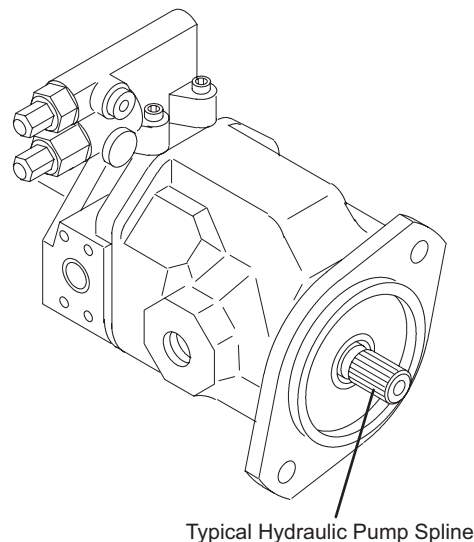


Figure 2
Hydraulic Pump Spline

Hydraulic Oils

General Information

Hydraulic oils are rated for viscosity, heat dissipation, foaming characteristics, pour point, anti-wear additives, anti-corrosive additives, lubricating qualities, compressibility, temperature range, temperature stability, and other functions. Although many different brands of oil meet these specifications, they may use different chemical additive packages to achieve the end result. For this reason, do not mix two different brands of oil. The additive package from one brand may be incompatible with the additive package from the other, rendering both packages useless.

Recently a few manufacturers have introduced biodegradable hydraulic oils onto the market. These oils are based on vegetable extracts instead of mineral extracts. They are considered safer for the environment in the event of a spill, although the additive packages are not inert. These oils must not be mixed with mineral-based hydraulic oils, even in very small amounts. When wanting to use this type of hydraulic oil when pumping a job in an environmentally sensitive location, contact the SCHWING Service Center at 1-888-292-0262 for instructions on making the change from mineral oil. Reference ISO 15380 for more information.

Viscosity of hydraulic oil is similar in concept to the different weights of motor oil. For example, in the winter you may run 5W-30 in your car, while in the summer you run 10W-40. The same is true for hydraulic systems. In climates where the weather changes from extremely hot to extremely cold conditions, consider changing the weight of the hydraulic oil used each season. The International Standards Organization (ISO) has developed a method of grading hydraulic oils for viscosity. For summer in northern North America, SCHWING recommends ISO VG 46 weight oil, while in the winter we recommend ISO VG 32 or even VG 22, depending on how cold it gets in your area. For southern North America and Central America, we recommend ISO VG 46 for the winter and ISO VG 68 or VG 100 for the summer, depending on how hot it gets. The lower the ISO VG number the thinner the oil and the lower the pour point of the oil. On the other hand, the thinner the oil, the lower the temperature will have to be before it breaks down the lubricating film that protects your components.

The quality of the oil needed for use in a SCHWING concrete pump is in the DIN system. The ratings have to do with the chemical additive package that is introduced into the oil. Both the DIN rating HLP and HV qualities are approved for use in our concrete pumps.

Specific Information

New SCHWING factory equipment is filled with Texaco Rando HD 46 hydraulic oil, which has an ISO viscosity rating of VG 46. If you want your new concrete pump filled with a different brand or different viscosity oil, you should specify it when ordering.

Many other brands of oil have been approved for use in SCHWING equipment, including:

- Mobil Univis
- Shell Tellus oil
- BP Energol
- Aral Vitam
- Esso Nuto
- Esso Univis
- Total Azolla
- Wintershall Wiolan

The order of the brands listed is not significant. Any oil that meets the quality and viscosity standards described above can be used.

Filter all new oil to meet ISO 4406 18/16/13.

“Industrial” Gear Lubricant Codes

CLP - An “industrial” gear lubricant oil with additives to improve corrosion protection, aging stability, and protection against wear in areas with many types of friction, and to increase gear stability under load. Meets DIN 51517.

Vehicle Gearbox Oil Codes

GO 90 - BI standard lubricant, a gearbox oil that meets API-GL 5.

Hydraulic Oil Recommendations

Viscosity (ISO):	VG32		VG 46		VG68	
Quality (DIN):	HLP	HVLP	HLP	HVLP	HLP	HVLP
ARAL-Vitam	GF 32	HF 32	GF 46	HF 46	GF 68	/
BP-Energol HLP BP-Bartran	HM 32	HV 32	HM 46	HV 46	HM 68	HV 68
KLÜBER-Lamora	HLP 32	/	HLP 46	/	HLP 68	/
MOBIL DTE MOBIL Nuto MOBIL DTE 10 MOBIL Univis	24 H 32	Excel 32 N 32	25 H 46	Excel 46 N 46	26 H 68	Excel 68 N 68
SHELL-Tellus	32	T 32	Multi Grade Hydraulic Oil Tellus T 46*			
TEXACO-Rando	HD 32	HDZ-32	HD 46	HDZ 46	HD 68	HDZ 68
WINTERSHALL- Wiolan	HS 32	HV 32	HS 46	HV 46	HS 68	HV 68

Biodegradable Hydraulic Oils

Type of fluid	Synthetic hydraulic fluids based on Polyglycol, HEPG			Synthetic hydraulic fluids based on esters, HEES			
ISO- viscosity class	VG 22	VG 32	VG 46	VG 22	VG 32	VG 46	VG 68
Manufacturer ↓							
ESSO		Univis WEPG 32	Univis WEPG 46			Univis HEES 46	
MOBIL/USA					Envirosyn 32 H	Envirosyn 46 H	Envirosyn 68 H
PETRO-Canada					Premium ECO HT-E 32	Premium ECO HT-E 46	
SHELL					Naturelle HF-X 32 ¹⁾	Naturelle HF-E 46 Naturelle HF-X 46 ¹⁾	Naturelle HF-E 68
VALVOLINE			Ultrasyn PG 46		Unisyn HLP 22/46	Unisyn HLP 32/68	

Filtration

General Information

Filtration is the single most important method of keeping your unit's hydraulic system operational. Particles that could damage the components are introduced into the oil by the differential cylinders and the valves, through the reservoir breather, and by internal wear in the components. Additionally, when you change hydraulic oil, the new oil is not clean enough to be used in a concrete pump without being pre-filtered. In fact, new hydraulic oil is only filtered at the refinery to 40 μm . The oil in your unit needs to be filtered to a MINIMUM of 25 μm , and preferably finer than that. Filters are rated by:

- the size of particles they trap, and whether that size is nominal or absolute
- the dirt holding capacity, in grams
- the clean element pressure drop for a given flow rate (in psi and gpm or bar and L/min), and
- the ratio of particles of a given size encountered versus particles passed (referred to as the beta ratio). An example of a beta ratio would be $\beta_{25} = 200$ (pronounced beta twenty five equals two hundred). This means that for every 200 particles of 25 microns or larger that hit the filter media, one makes it through. A finer filter would be, for example, $\beta_{12} = 200$. A coarser filter example would be $\beta_{25} = 75$. For concrete pumps, medium to fine filtration is required.

Specific Information

Here are some facts regarding filtration as they relate to your pump:

- Your unit has a separate oil conditioning circuit, which includes an oil cooler and a filter. The oil is pumped from the reservoir, through the cooler and filter, back to the reservoir.
- As delivered from the factory, your concrete pump is equipped with a filter that is rated at 10 μm absolute.
- The beta ratio is $\beta_{10} = 200$. In this case, the beta ratio means that for every 200 particles of dirt that hit the filter media that are 10 μm or larger in size, 1 will make it through. Although we are not happy about the one particle that is allowed through, we do not use finer filtration because the

components don't require it. Additionally, a finer filter would plug up with dirt too often, resulting in high maintenance costs to you. We have settled on a compromise that should afford long service life and minimum maintenance costs. Don't be fooled by the one particle that gets through, this is a high quality element with very good trapping characteristics.

- The clean element pressure drop is about 3 psi at 22 gpm (element only) +7 psi for the housing, making a total of 10 psi DP (drop in pressure) when the element is clean. The pressure drop varies with the viscosity of the oil, which means pressure in the filter will be high until the oil is heated to normal operating temperatures. The filter will hold 55 grams of dirt, when operating at a flow rate of 27 gpm. The flow rate is important, because the filter would hold more if you operated at a lower flow rate. Good filtration is not cheap, but it will save you thousands of dollars by preventing component failure.
- Your concrete pump is equipped with a recirculation type of filtration system, meaning that there is a pump that sucks oil from the reservoir, pumps it through the filter and cooler, and back to the tank. Whenever the engine is running, oil is being filtered. The filtration is done with a spin-on filter assembly (Figure 3). It is equipped with an integral bypass check valve set at 25 psi. The bypass valve protects the filter element from damage, as explained below. The assembly is equipped with an anti-back-flow check valve, which prevents oil from draining out of the tank while you are changing the spin-on element. There is a dirty filter indicator to tell you when the element is dirty. You should replace the element whenever the indicator enters the yellow area and the oil is heated above 20°C. Under normal circumstances, the element will need replacement about every 6 months. The element has been designed to remove all particles large enough to cause undue wear and jobsite breakdowns ($\beta_{10} = 200$). You can keep the hydraulic system running year after year by replacing the element when replacement is due. Do not substitute "will fit" elements in this housing.

Bypass Check Valve

The filter is equipped with an integral bypass check valve with a 25 psi pressure-to-open rating. This is what it does:

When the filter is clogged with dirt and oil is having a hard time making it through, the pressure difference between the filter inlet and the outlet rises. This pressure difference (commonly referred to as a pressure differential) is called delta P and is shown as DP. When the DP reaches 25 psi, the check valve opens and the oil returns to the tank unfiltered. If the filter did not have the bypass check valve, it would simply break apart when it was clogged. That could cause the filter to fail in one of two ways:

All of the dirt ever trapped by the filter, plus the filter itself, could go directly into the system.

Worse yet, the filter could split open and leak to the ground, draining the reservoir, and contaminating the environment.

Both potential problems are avoided by the bypass check valve.

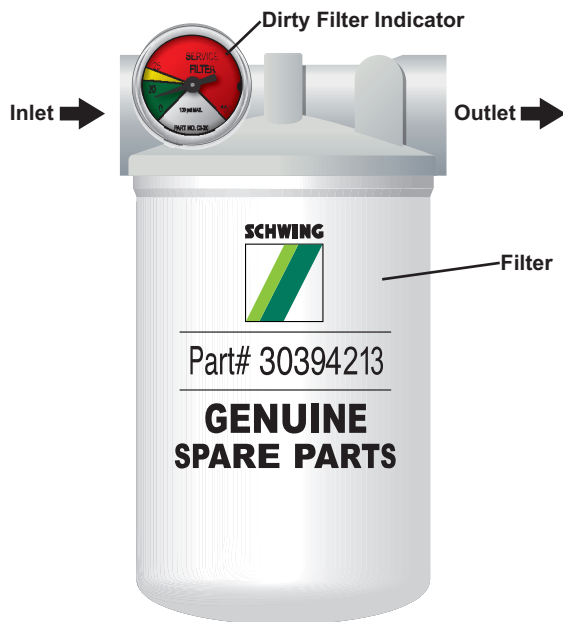


Figure 3
Hydraulic Oil Filter

Scheduled Maintenance Maintenance Chart

Component	Daily	Weekly	Monthly	Quarterly	Semi-Annually	Annually	Page
Check Engine Fluid Levels	√						98
Check Tires	√						98
Check Hydraulic Oil	√						98
Bleed Moisture from Hydraulic Tank	√						98
Check Differential Cylinder Rods	√						98
Inspect Bolts On Rams	√						99
Grease Rock Valve and Agitator Bearings	√						99
Inspect for Damage or Leaks	√						99
Check if Maintenance is Due	√						99
Check Hydraulic Pressures	√						100
Adjust the Rock Valve Tension Nut		√					101
Inspect Cutting Ring/Rotate if Needed		√					101
Lubricate Mechanical Moving Parts		√					102
Check the Unit Mounting Hardware			√				103
Clean the Hydraulic Oil Cooler Fins			√				103
Check Gearbox Oil Level			√				103
Check the Accumulator Pre-Charge				√			103
Change Hydraulic Oil (Seasonal Change)					√		104
Change Hydraulic Oil Return Filter					√*		104
Change Gearbox Oil					√		104
Change Hydraulic Oil (Age Reasons)						√	105

* or as needed

Daily Maintenance

Check Engine Fluid Levels

Check the levels and condition of the lubricants and coolant in the truck. Follow the manufacturer's recommendations for quantity and type. Bleed the moisture out of the truck air system by opening the petcocks on the bottom of the air tanks. This is especially important if there is a chance that the moisture will freeze.

Check Tires

Check the condition of the tires on the truck. Do not drive the unit with bald, cracked, or damaged tires.

Check Hydraulic Oil

Check the level and condition of the hydraulic oil. Fill it, if necessary, with the same brand and type of oil. Add only filtered oil. Use a filter cart to pump oil into the tank. New oil contains more contaminants than SCHWING approves for their machines. Replace milky looking oil, which is a sign of water contamination. Try to determine the source of the water. If the oil has turned milky quickly, such as from one day to the next, then simply replacing the oil will not solve your problem.

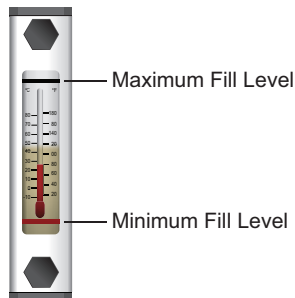


Figure 4
Hydraulic Level/Temperature Gauge

Bleed Moisture from Hydraulic Tank

Bleed the water out of the bottom of the hydraulic oil tank by opening the drain valve, at the bottom of the reservoir. Place a drain pan under the outlet tube, open the valve, and watch the liquid as it leaves the tube. When the liquid changes from water to clean oil, close the valve. Because of condensation, which increases with dramatic heating-cooling cycles, there may be a small amount of water in the tank every day. However, it should settle to the bottom of the tank overnight. The water that is drained should be clean and so should the oil that follows it.

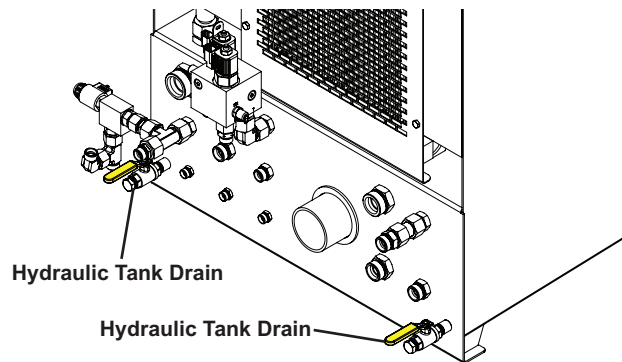


Figure 5
Hydraulic Tank Oil Drain

Check Differential Cylinder Rods

With the engine turned off, remove the waterbox cover. Remove the waterbox safety guard, or use a flashlight and look through the waterbox safety guard holes. Check for excessive hydraulic oil around or below the differential cylinder rod. Excessive oil in the waterbox is an indication that the rod packings are worn out. Failure to replace worn rod packings will result in water and debris from the waterbox entering the differential cylinder, damaging the cylinder components and contaminating the hydraulic oil. You should replace your differential cylinder rod packings every year.

Inspect Bolts on Rams

Each day, visually inspect the bolts on the rubber rams. If you see something unusual, shut off the engine, put the key in your pocket and remove the waterbox covers and inspect with a wrench. If you find that they are loose, tighten with a torque wrench to the “Torque Specifications for Metric Bolts” listed in the Appendix section. Remember to replace the waterbox covers before using the machine.

Grease Rock Valve and Agitator Bearings

Grease the rock valve lubrication points before the pour begins. Once started, grease them every couple of hours. The rock valve has eight grease zerks. The zerks are on the manual greaser station accessible from the passenger side of the unit (Figure 6).

1 ○	1 Right-Hand Inside Shift Cylinder
2 ○	2 Left-Hand Shift Cylinder
3 ○	3 Right-Hand Shift Cylinder
4 ○	4 Right-Hand Agitator
5 ○	5 Left-Hand Inside Shift Cylinder
6 ○	6 Left-Hand Side Agitator
7 ○	7 Front Rock Pivot
8 ○	8 Rear Rock Pivot

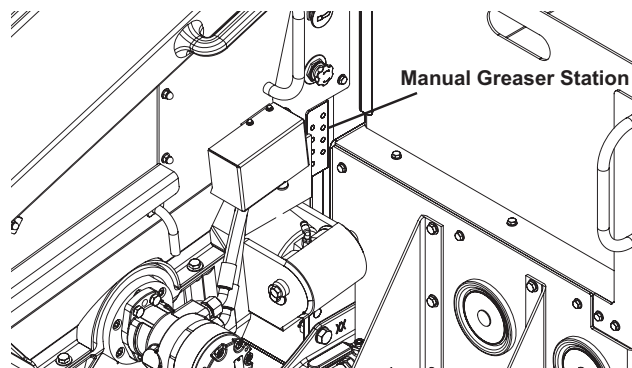


Figure 6
Agitator Grease Points

Inspect for Damage or Leaks

Visually inspect the unit for damage or leaks each day. Repairs should be made before the unit is operated.

Check if Maintenance is Due

Check your “Scheduled Maintenance Checklist” to see if any weekly, monthly, semiannual, or annual maintenance is due.

Check Hydraulic Pressures

Check your main pressure cut-off, soft switch and accumulator pressure cut-off settings. Pressure relief settings are shown below and on the hydraulic schematic that shipped with this unit. Changes in pressures may indicate trouble in one or more components and will serve as early warning indicators if you check them on a daily basis.

Pressure Cut-Off - SPTO 1000	300 bar
Main Relief - SPTO 1000	320 bar
Soft Switch	100 bar
Accumulator Pressure Cut-Off	200 bar

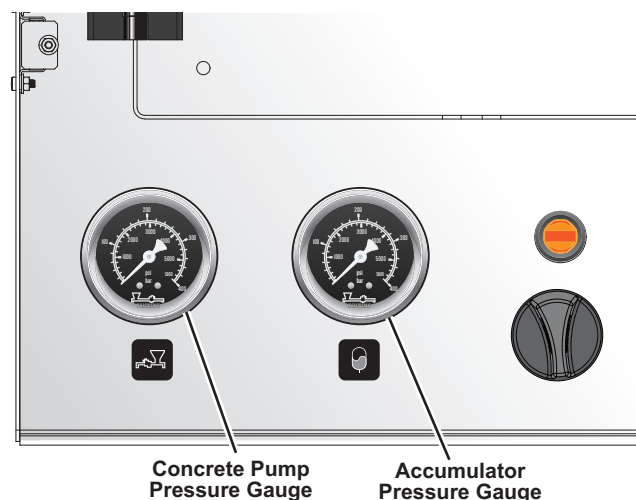


Figure 7
Concrete Pump and Accumulator Pressure Gauges

Checking Main Pressure Cut-Off

With the engine running, PTO engaged and the E-stops cleared, increase the throttle to maximum RPM. Close the quarter turn and soft switch valve (Figure 8). Put the concrete pump into forward using the Concrete Pump Forward/Reverse switch. With the quarter turn valve closed, the concrete pump will not be able to shift. The reading on the concrete pressure gauge will show pressure cut-off (Figure 10). If the reading is different from your schematic, refer to “Setting Main Relief/Pressure Cut-Off” on page 113.

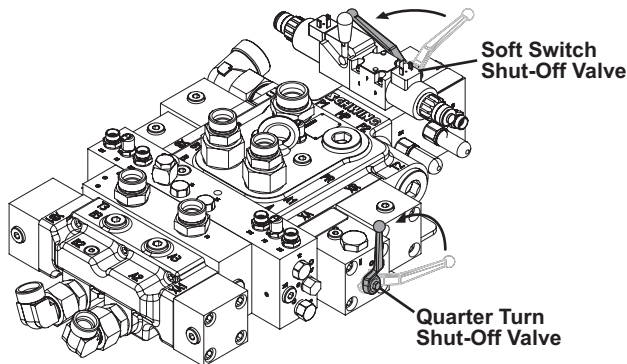


Figure 8
Closing the Soft Switch and Quarter Turn Valves

Checking Soft Switch Pressure

With the engine running, PTO engaged, and all E-stops cleared, increase the throttle to maximum RPM. Close the quarter turn valve (Figure 9). Put the concrete pump into forward using the Concrete Pump Forward/Reverse switch. With the quarter turn valve closed, the concrete pump will not be able to shift. The reading on the concrete pressure gauge will show softswitch pressure (Figure 10). If the reading is different from your schematic, refer to “Setting the Soft Switch Relief Pressure” on page 115.

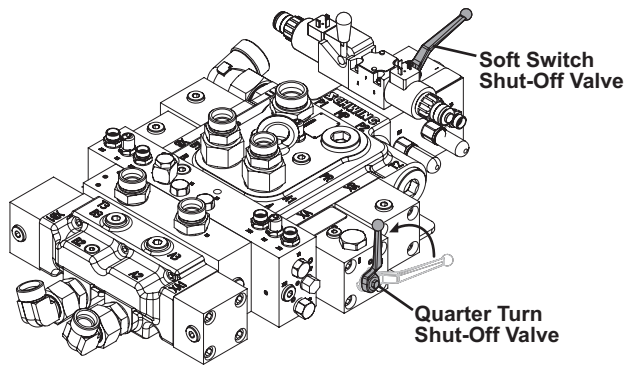


Figure 9
Opening the Soft Switch and Quarter Turn Valves

Checking Accumulator Pressure

With the engine running, PTO engaged, and all E-stops cleared, the reading on the accumulator pressure gauge (Figure 10) will show the accumulator pump pressure cut-off. If the reading is different from your schematic, refer to “Set Accumulator Pressure Cut-Off” on page 116.

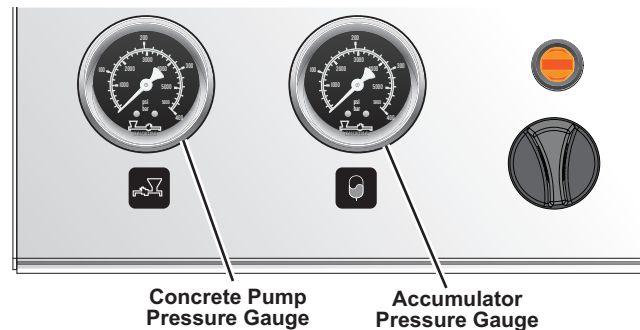


Figure 10
Concrete Pump and Accumulator Pressure Gauges

Weekly Maintenance

Adjust the Rock Valve Tension Nut

Remove the 16-mm keeper bolt, grasp the tension nut by hand, and turn it clockwise (Figure 11). There are holes for the keeper bolt on the spacer behind the tension nut. The object is to place the keeper bolt in the furthest hole that you can reach when you turn the tension nut by hand. If the tension nut will turn enough to get all the way to the next hole, then turn it back to the previous hole. Do not put a wrench on the tension nut to get it to go to the next hole. Replace and tighten the keeper bolt. Overtightening the tension nut will cause premature wear on the kidney seal.

The tension nut adjusts the spacing of the rock valve on the kidney seal end. Spacing between the spectacle plate and cutting ring is compensated for by the pressure spring as the spectacle plate wears.

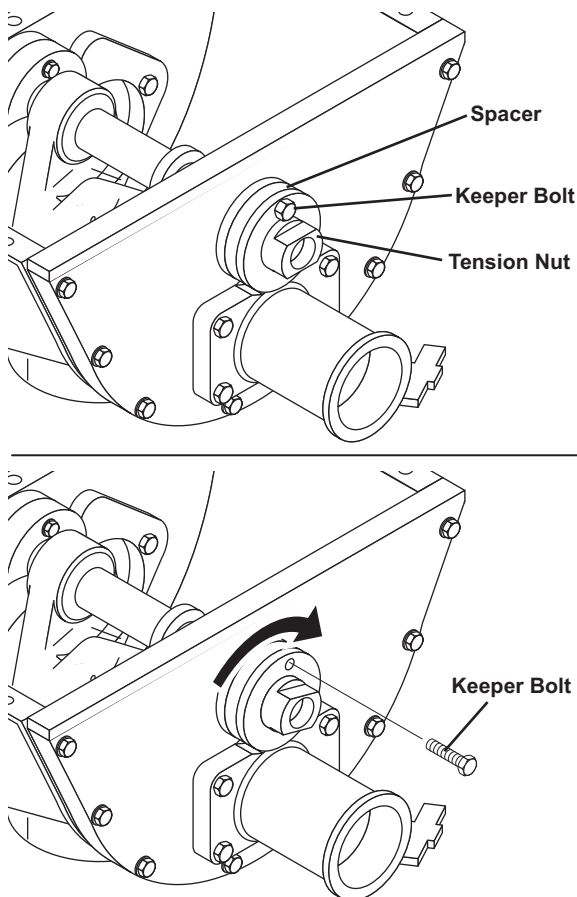


Figure 11
Adjusting the Rock Valve Tension Nut

Inspect Cutting Ring/Rotate if Needed

Needing to rotate the cutting ring depends more on the type of concrete and the number of cubic yards pumped than on a time schedule, but you should at check it for wear at least once per week, and rotate it as needed.

To rotate the cutting ring:

1. Turn off the engine and perform a proper lockout/tagout procedure.
2. Loosen the tension nut as explained in the "Adjust the Rock Valve Tension Nut" procedure.
3. Loosen the eight cover bolts a couple of threads, but do not remove the bolts (Figure 12).
4. Loosen the 12 x 30 bolt on the end of the rock shaft by the slewing lever.
5. The rock valve will slide far enough out for you to loosen the cutting ring.

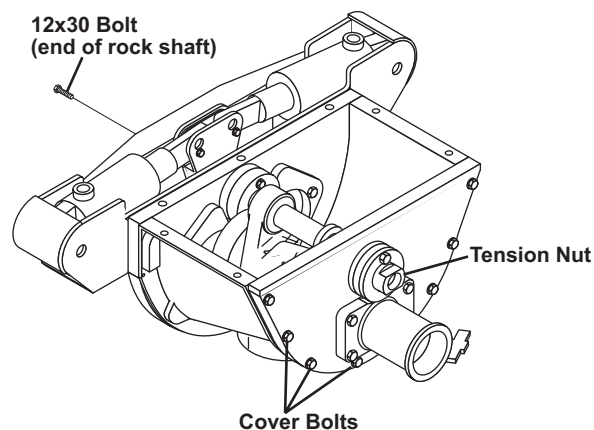


Figure 12
Loosen Bolts on Rock Valve Cover and Shaft

6. Lift the hopper grate.
7. From inside the hopper, tap the cutting ring forward, towards the spectacle plate. The ring should come loose. (If it does not, loosen the cover bolts a little more, then gently pry the rock valve rearwards a little more). Rotate the ring 90 degrees clockwise (Figure 13). It does not matter which way you rotate, but to keep from forgetting which way you went last time, we recommend going clockwise each time.

Rotate the Cutting Ring 90 Degrees Clockwise

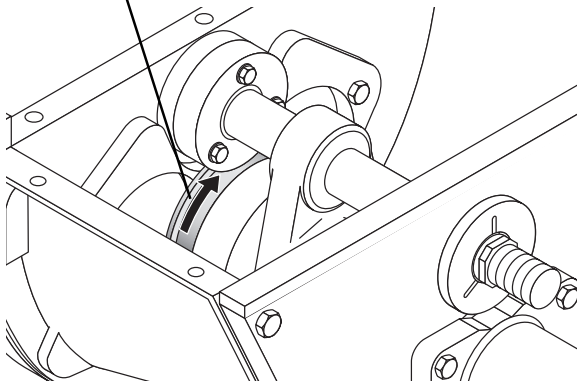


Figure 13
Rotate the Cutting Ring

8. Center the cutting ring in the rock valve. Tighten the cover bolts slightly, if needed, to be sure that the ring is not crooked.
9. Tighten the cover bolts just enough to bring the back plate up against the rock housing. Then tighten each bolt equally, using a torque wrench. Alternate which bolts you tighten, as you would when tightening a wheel on a car. The torque specs for these bolts (M20 x 65 class 8.8) is 300 ft-lbs.
10. Tighten the tension nut according to the instructions in the "Check the Rock Valve Tension Nut" procedure. Tighten the keeper bolt.

Lubricate Mechanical Moving Parts

Lubricate mechanical moving parts with oil or a lubricant such as WD-40. This applies to pins, hinges, valve handles and other components.

Monthly Maintenance

Check the Unit Mounting Hardware

Check for bolt tightness, cracks, and other abnormalities on the subframe, hydraulic tank, pumpkit, differential cylinders, and material cylinders.

Clean the Hydraulic Oil Cooler Fins

Spray out the coils of the oil cooler with a high- velocity water nozzle or pressure washer. If you use a pressure washer, be careful not to get so close that you damage the electric motor or bend the cooler fins.

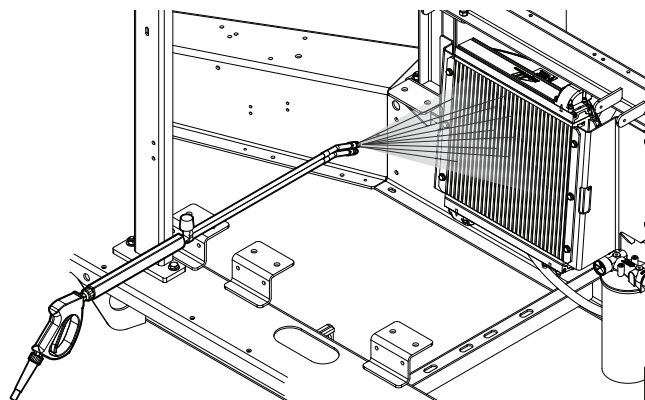


Figure 14
Pressure Washing Oil Cooler

Check Gearbox Oil Level

Be sure the truck is on reasonably level ground. With the truck engine off, and the key in your pocket, remove the oil check plug (Figure 15). The oil should be at the level of the bottom of the hole in the gear case. If oil is needed, add it by removing the breather and pouring in the oil through the top.

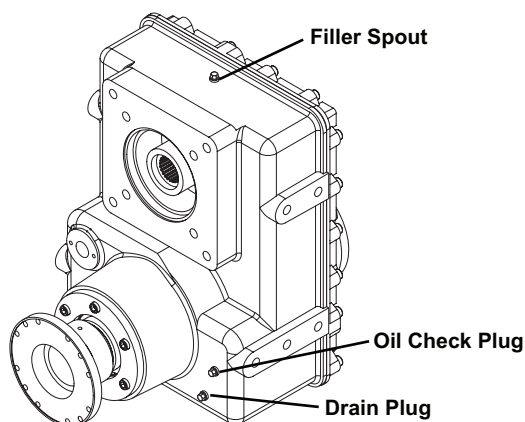


Figure 15
Gearbox Oil Plugs and Fill Spout

Quarterly Maintenance

Check the Accumulator Pre-Charge

Check the accumulator gas pre-charge as shown:

- 1st check- one week after first use
- 2nd check-one month after first use
- 3rd check- quarterly

If the accumulator requires charging, 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. To charge the accumulator see "Accumulator Charging Procedure" on page 110.

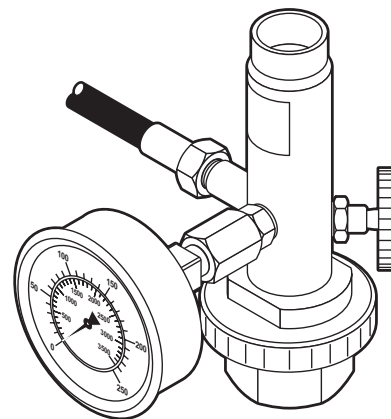


Figure 16
Accumulator Charging Kit

Semi-Annual Maintenance

Change Hydraulic Oil (Seasonal Change)

If the machine will be used in a location where seasonal temperature changes are extreme, replace the machine's hydraulic oil every 6 months. Use an oil of the correct viscosity for the temperature in which the machine will be operated. If the used oil is saved in clean barrels that are then properly stored, the same oil can be reinstalled in the machine when another seasonal temperature change occurs. Hydraulic oil can be used for a maximum of two 6-month seasons. Contact your hydraulic oil dealer to obtain clean barrels and the proper storage procedures. If you ignore proper storage procedures, the oil will become so contaminated that reuse will become destructive to the machine. Use a filter cart for transferring hydraulic oil. If you do not own one, consider buying or renting one. When you change the hydraulic oil for temperature reasons, use the same procedure "Change Hydraulic Oil (Age Reasons)" on page 105.

Change Hydraulic Oil Return Filter

1. Make sure the engine is shut off. Put the key in your pocket to prevent someone else from starting the engine.
2. Position a pan or bucket under the filter housing to catch drips. The check valve built into the filter, which prevents back flow, should not allow much leakage oil, but there will be some. Oil spills contaminate the environment.
3. Unscrew the filter element. Use an oil filter wrench, if needed.
4. Remove the spin-on element, and pour the oil out into the catch pan. Do not reuse this oil.
5. Remove the old element and replace with a new element. Replace the bowl and tighten according to the installation instructions that come with the filter.
6. Start the engine, and check for leaks.

Change Gearbox Oil

The oil in the distribution gearcase should be changed twice a year or after 1000 working hours.

Do this procedure when the oil is warm. When the oil is cold, it does not drain as easily.

1. Park the truck in a level area. Place the "Do Not Operate" sticker on the window in front of the driver's seat. Stop the engine, and put the key in your pocket.
2. Remove the breather filter and the drain plug (Figure 17), and drain the old fluid into a drain pan.

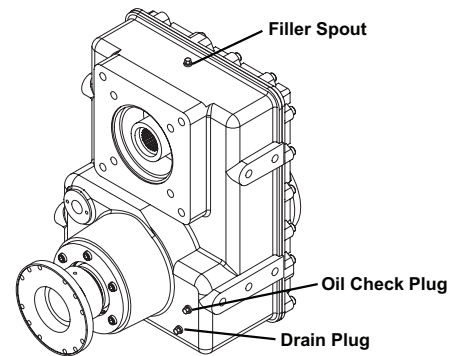


Figure 17
Gearbox Oil Plugs and Fill Spout

3. Clean the breather filter with cleaning solvent. Never use gasoline!
4. Rinse the case with clean hydraulic oil. Let the oil drain immediately out of the case. Dispose of this oil; do not reuse it.
5. Replace the drain plug.
6. Remove the full level plug or oil check plug.
7. Refill through the filler spout to the full level plug or oil check plug with 90W gear lube. Replace the full level plug and the breather filter.

Annual Maintenance

Change Hydraulic Oil (Age Reasons)

Change the hydraulic oil annually. If you have recently changed the hydraulic oil because of changing weather conditions, you can ignore this procedure. The same filling rules that apply to adding hydraulic oil apply to filling the tank after draining and cleaning. Use the following procedure to change the hydraulic oil:

1. The engine must be shut off. Put the key in your pocket.
2. The oil should be cool. This is for safety reasons. Do not change oil that is above 120°F (50°C).
3. Drain the old oil into barrels or another waste oil receptacle. The oil can be pumped out of the inspection cover on the top of the tank, or be drained out of the bottom of the tank.
4. Once the oil is drained, clean the tank through the inspection covers, using cleaning solvent and lint-free rags. Do not use gasoline! Remove all silt from the bottom of the tank.
5. Close the drain, if open. Refill by pumping new hydraulic oil out of the barrels with a filter cart. If no cart is available, rent one.

Unfiltered new hydraulic oil is not clean enough to install in your unit. Filter oil to meet ISO 4406 code 18/16/13.

6. If you ignore this step, you may begin having trouble with pumps and valves immediately or within the first few days. See the information at the beginning of this chapter for specific information about hydraulic oils that are approved for use in SCHWING machines.
7. Change the main return filter before restarting the unit.

Unscheduled Maintenance

The following items will have to be maintained on your 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.

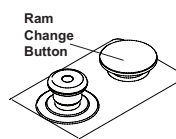
Changing Rams

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.

To assist in ram replacement, SCHWING offers a ram change mode feature. This feature drops engine RPMs and stroke limiter outputs to minimal levels. The differential cylinders will now move as slow as possible allowing the operator to easily position the rams inside the waterbox for replacement.

When changing rams, you will have to put your hands in the waterbox on several occasions. **You must stop the engine each and every time before putting your hands into the waterbox.**

Ram Change Mode



To activate ram change mode, press the ram change button located next to the waterbox (Figure 18). When pressed, engine RPMs and stroke limiter outputs will be reduced to minimal levels. You

must use the pendant remote to control the concrete pump forward and reverse. All other functions on the rear operator panel keypad or pendant remote will be disabled. Once enabled - you can only deactivate ram change mode by shutting off the engine and restarting the machine.

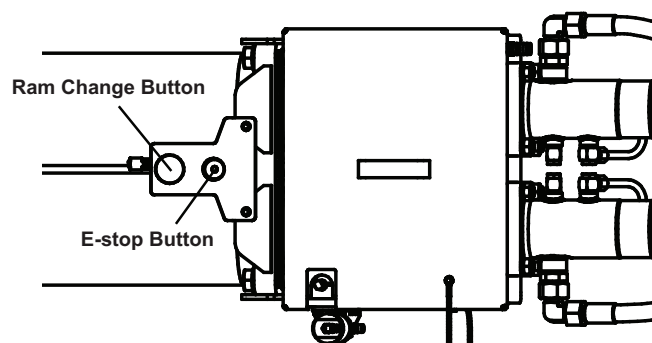
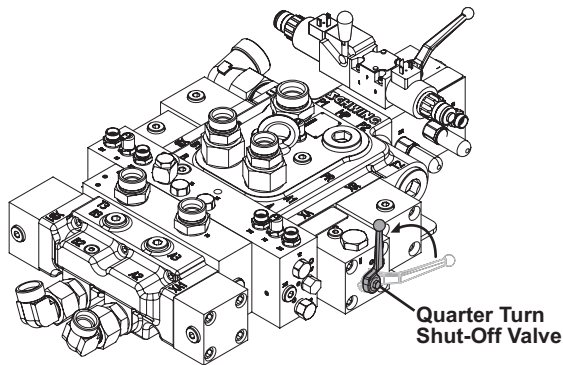


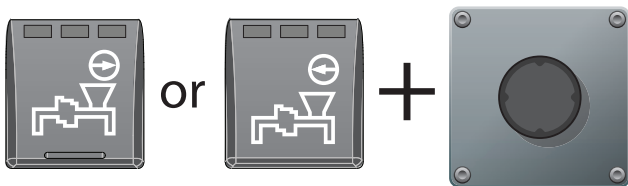
Figure 18
Ram Change Mode Button Location

Remove the Old Rams

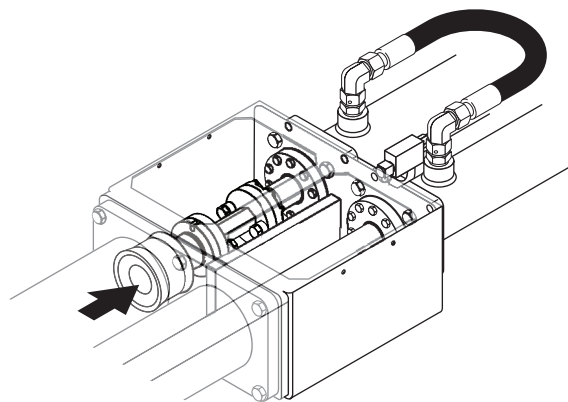
1. Close the concrete pump quarter turn shut-off valve located on the concrete pump control block (Figure 19).

**Figure 19***Closing the Quarter Turn Valve*

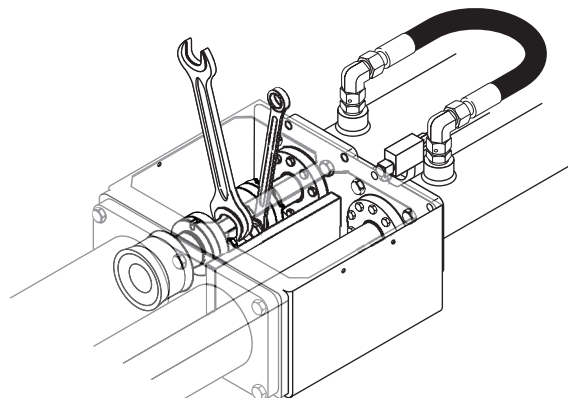
2. Drain the waterbox. Remove the waterbox cover, and the bolt-down grate.
3. Using the pendant remote, press and hold the concrete pump forward or reverse button, while simultaneously pressing the ram change mode button. Both buttons must be pressed within a half second of each other, in order to move the differential cylinders. To stop the differential cylinders, release either the concrete pump forward/reverse button or ram change mode button. To activate the differential cylinder again, release any pressed button, then simultaneously press both the concrete pump forward/reverse and ram change mode button again.

**Figure 20***Button Selection to Move Differential Cylinders*

4. Retract the left-hand side differential rod almost all the way into the waterbox (Figure 21). Leave about 1.5 inches of travel, which will allow you to remove the spacer coupling (dogbone). When in position, shut-off the engine.

**Figure 21***Retract Spacer Coupling (Dogbone) into the Waterbox*

5. Using the 50-mm open-end wrench and 24–30 mm box-end wrench provided with the unit, place the 50-mm wrench on the spacer coupling to hold the assembly from turning. Use the 24–30 mm box-end wrench to unscrew the four M20 bolts that hold the assembly together (Figure 22).

**Figure 22***Removing the Spacing Coupler*

6. Restart the engine and clear all E-stops. With the concrete pump forward or reverse button and Ram Change Mode button pressed, finish retracting the lefthand side rod into the waterbox. The spacer coupling will fall out. Release the concrete pump forward/reverse or Ram Change button to stop the differential cylinders. Shut off the engine.
7. Remove the spacer coupling from the waterbox (Figure 23).

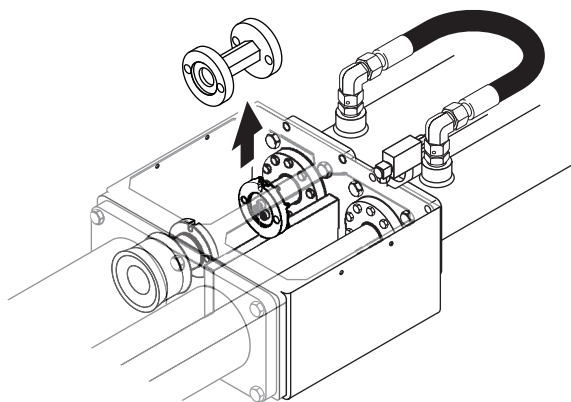


Figure 23
Remove Spacer Coupling

8. Restart the engine and clear all E-stops. Press the concrete pump forward or reverse button and ram change mode button simultaneously to slowly extend the cylinder rod until it just contacts the rubber ram flange (Figure 24). Release the concrete pump forward/reverse or ram change button to stop the differential cylinders. Shut off the engine.

Be careful not to drive the rubber ram into the material cylinder. If you accidentally knock the ram into the material cylinder so far that you can't reach it, you will have to remove it by knocking it out from the rock valve end of the unit. Call the SCHWING Service Center for additional assistance.

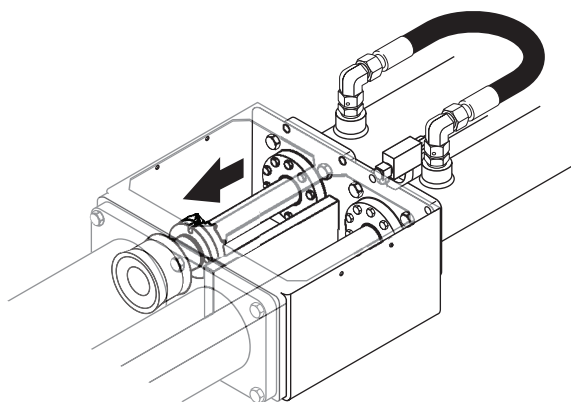


Figure 24
Extend Cylinder to Ram

9. There is a groove in the ram flange that will line up with a groove in the cylinder flange. The M12 x 45 bolt with nut will drop into this groove and allow you to pull the ram out. The fit should be snug, but there is no need to tighten the nut with tools (Figure 25). The ram flange and cylinder flange are shown outside of the waterbox for clarity of the illustration.

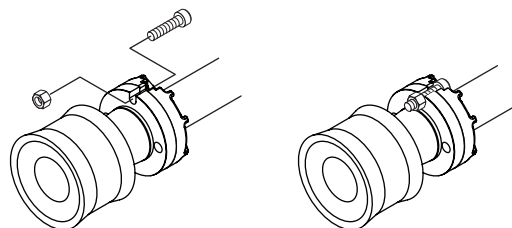


Figure 25
Bolt Ram to Differential Cylinder Rod

10. Restart the engine and clear all E-stops. Press the concrete pump forward or reverse button and Ram Change Mode button simultaneously to slowly retract the cylinder rod until the ram is clear of the material cylinder (Figure 26). Release the concrete pump forward/reverse or ram change button to stop the differential cylinders. Shut off the engine.

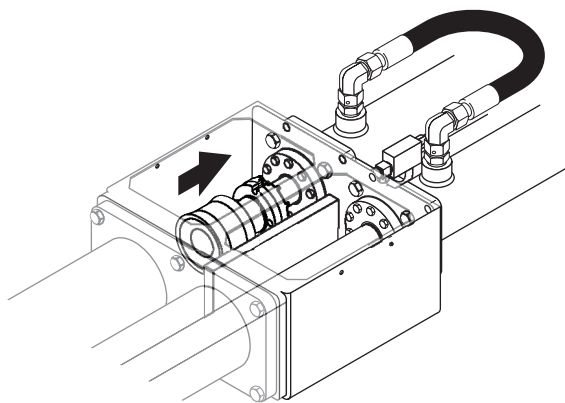


Figure 26
Retract Ram into Waterbox

11. Remove the nut and bolt, and the ram will be free to come out of the waterbox (Figure 27).

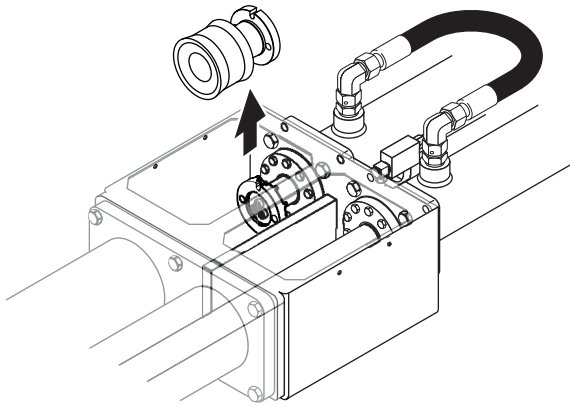


Figure 27
Remove Ram from Waterbox

12. Clean and inspect the bolts and bushings, the spacer coupling, and the cylinder flange. Replace any damaged or worn parts with new ones.

Install the New Rams

1. Apply Loctite primer (or equivalent) to the M20 bolts. Allow the primer to dry.
2. While the primer is drying, apply a liberal coat of clean grease to the new rams. It is impossible to use too much grease in this procedure, because the excess will be wiped off by the material cylinders during installation.
3. Hold the new ram up to the cylinder flange. Line up the grooves, and drop your nut and bolt into place to hold the assembly together. Again, you should tighten the nut only finger-tight.

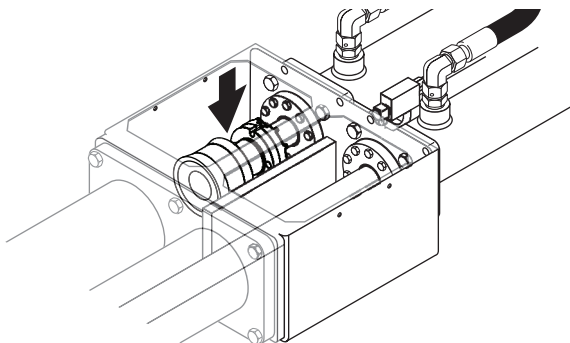


Figure 28
Install New Ram

4. Restart the engine and clear all E-stops. Press the concrete pump forward or reverse button and Ram Change Mode button simultaneously. Slowly extend the cylinder until the ram is installed in the material cylinder, but the mounting flange is still exposed enough to remove the nut and bolt (Figure 29). When in position, release the concrete pump forward/reverse or Ram Change button to stop the differential cylinders. Shut off the engine. Remove the nut and bolt.

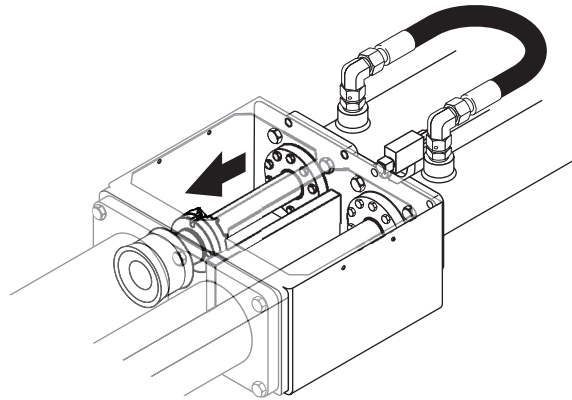


Figure 29
Push Ram into Material Cylinder

5. Restart the engine and clear all E-stops. Press the concrete pump forward or reverse button and ram change mode button simultaneously. Slowly retract the rod again (Figure 30), until there is room to install the spacer coupling.

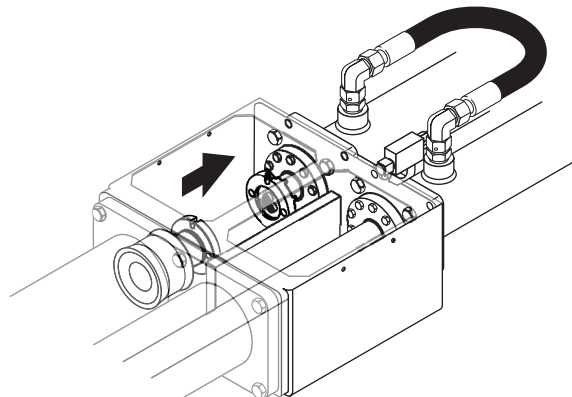


Figure 30
Retract Cylinder Away from Ram

6. Release the concrete pump forward/reverse or Ram Change button to stop the differential cylinders. Shut off the engine. Apply Loctite 242 or equivalent to 2 of the M20 bolts. Place the spacer coupling up against the flange of the new ram. Install two of the M20 bolts (with Loctite) and bushing, finger-tighten only.

It is important to install the spacer flange against the new ram first, not the cylinder flange. This gives you an extra 6 to 8 inches of safety margin when you extend the cylinder to meet the spacer flange. If you attach to the cylinder flange first, chances are good that you will accidentally knock the new ram into the material cylinder so far that you won't be able to reach it.

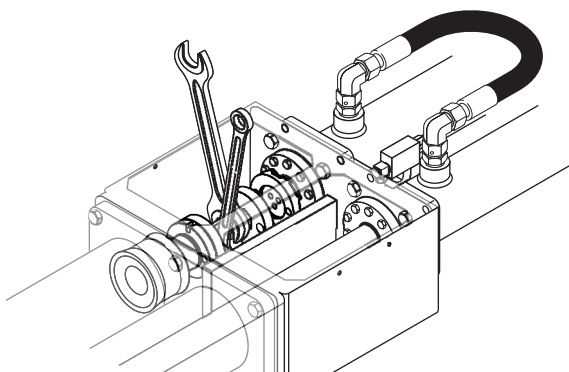


Figure 31
Attach Spacer Coupling to Ram

7. Restart the engine and clear all E-stops. Press the concrete pump forward or reverse button and ram change mode button simultaneously. Slowly move the cylinder down to where its flange butts up to the spacer coupling. Be careful not to go too far (Figure 32).

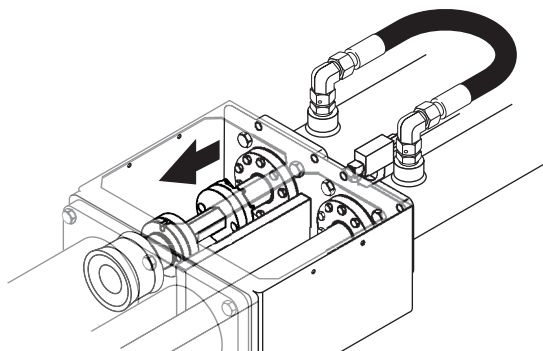


Figure 32
Move Cylinder to Spacer Coupling

8. Release the concrete pump forward/reverse or ram change mode button to stop the differential cylinders. Shut off the engine. You may have to slightly rotate the spacer coupling to align the bolt holes with the cylinder flange. When aligned, coat the remaining two M20 bolts with Loctite and install, including the bushings. Once all four bolts are started, you may tighten the bolts to the torque spec for M20 10.9 bolts (420 ft-lbs).
9. Repeat all steps in the "Remove the old rams procedure" and "Install the new rams procedure" for the righthand side ram.
10. Open the shut-off valve (Figure 33). The unit will not stroke with this valve closed.

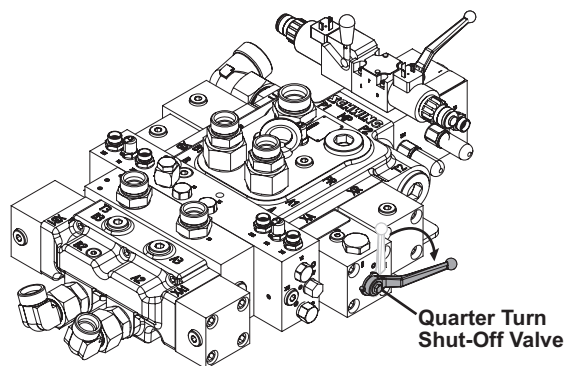


Figure 33
Opening the Quarter Turn Shut-Off Valve

Changing the Material Cylinders

The material cylinders eventually wear out. They are considered worn out when the chrome starts to wear off the barrel. Normally, the end attached to the rock valve wears out first, because it sees the most concrete. The waterbox end may be in like-new condition, because that end never experiences concrete. For this reason, the material cylinders were designed to be able to flip 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. Once that happens, you cannot flip them, because they will be structurally too weak to hold the pressure forces at the waterbox end.

The procedure for changing and aligning the material cylinders is the subject of Service Bulletin G-102/88. For a copy of this bulletin, contact the SCHWING Service Center at 1-888-292-0262.

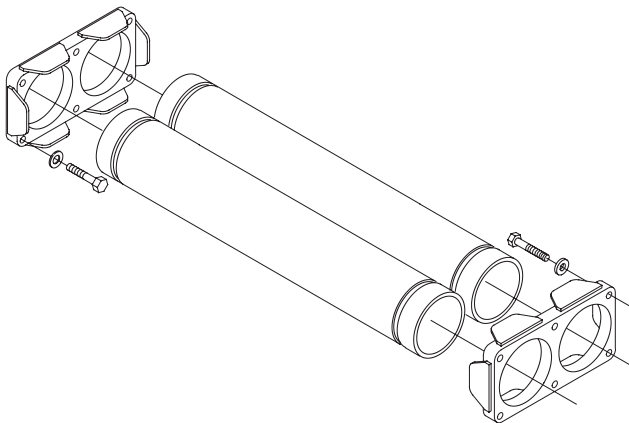


Figure 34
Material Cylinder Assembly

Accumulator Charging Procedure

Check the accumulator gas charge quarterly or after 500 hours of use. 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.

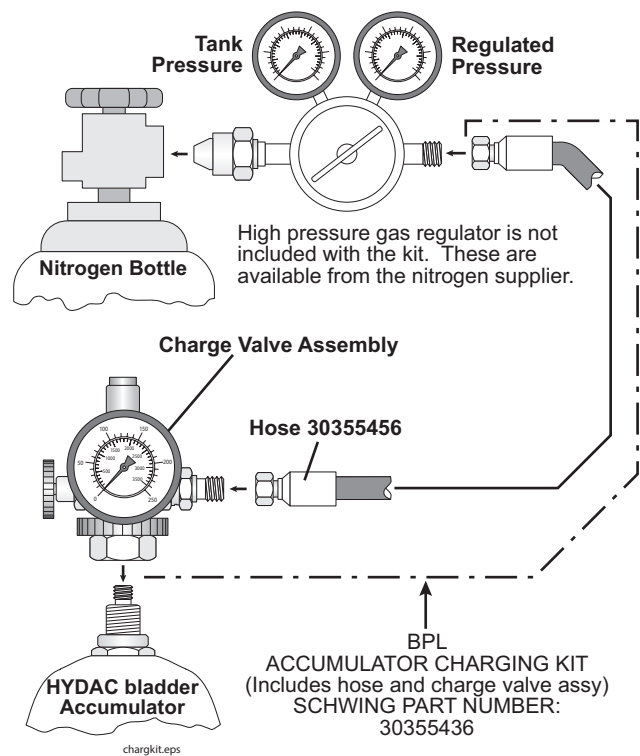


Figure 35
Accumulator Charging Kit

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

1. Before you begin, you will need a charging kit (Figure 35). Do not attempt to charge the accumulators without one. Order the charge valve kit assembly from the SCHWING Service Center 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 36).

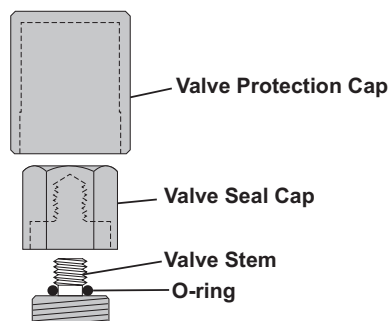


Figure 36
Accumulator Protection Cap

5. On the charge valve assembly (Figure 37), 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.

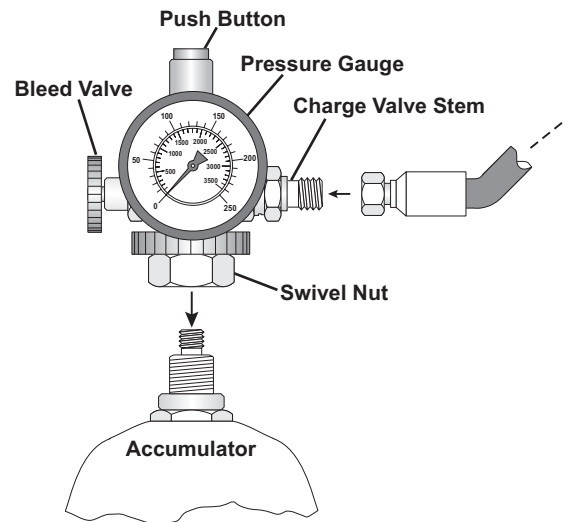


Figure 37
Charge Valve Assembly

6. Find the swivel nut on the charge valve assembly (Figure 37). Screw the swivel nut onto the accumulator gas valve. Tighten to 10 to 15 in-lbs.
7. After the swivel nut is attached, depress the push button on the top of the charge valve assembly (Figure 37). 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 38).
9. Do not open the nitrogen bottle supply valve yet. Turn the regulator adjustment handle on the high-pressure regulator (Figure 38) counter clockwise to its minimum setting (closed).

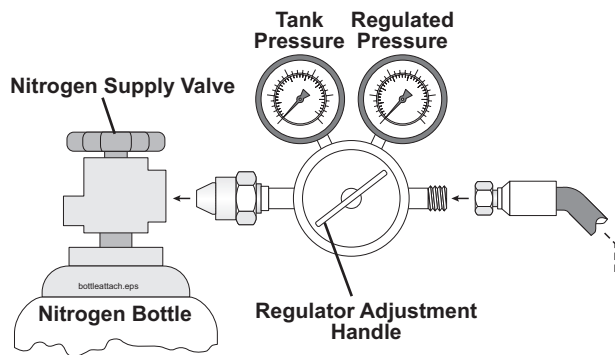


Figure 38
Nitrogen Bottle and Regulator

10. Slowly open the nitrogen bottle supply valve (Figure 38). 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 the next step.

If there is not at least 1500 psi 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 38) reads the desired pressure of 1500 psi. Close the nitrogen bottle supply valve.
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-lbs), and hand-tighten the valve protection cap (Figure 39).

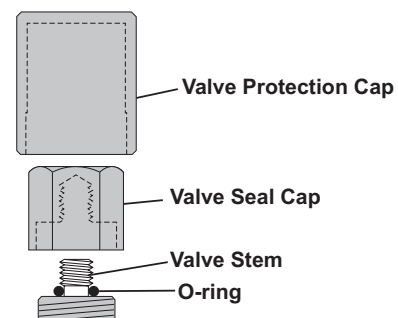


Figure 39
Accumulator Protection Cap

Setting Main Relief/Pressure Cut-Off

Pressure settings must be made with the oil at normal operating temperatures (40°C to 60°C).

Main system adjustments are preset at the factory. The following procedure begins with adjustment of the main relief cartridge and pressure cut-off. If proper pressures can not be obtained through these steps, contact the SCHWING Service Department.

It is vital that each adjustment screw be properly identified prior to making any adjustment. All screw adjustments for the system relief must be made with the pumpkit in the neutral position, and adjustments for pressure cut-off must be made with the engine shut off.

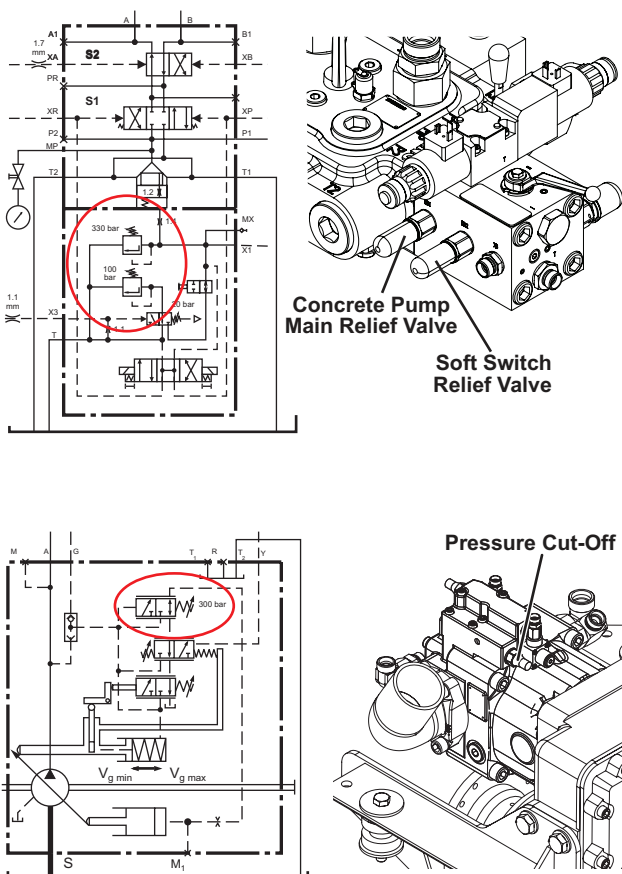


Figure 40
Relief Cartridges and Pressure Cut-Off Screw

1. With the engine running, PTO engaged, and all E-stops cleared, increase the throttle to maximum RPM. Close the quarter turn and soft switch valve (Figure 41).

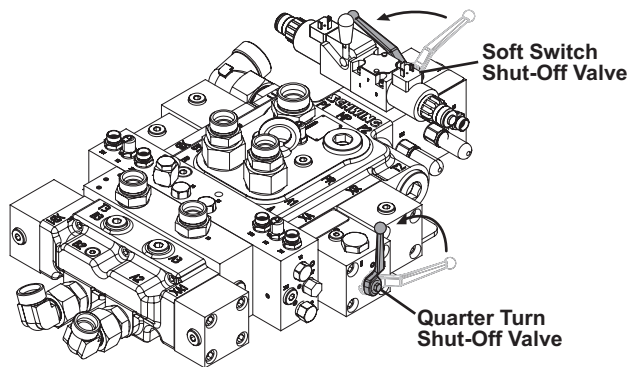


Figure 41
Closing the Soft Switch and Quarter Turn Valves

2. On the pendant remote, press and hold the stroke limiter increase button until all the lights are lit and the machine is at maximum stroke per minute. (Figure 42).

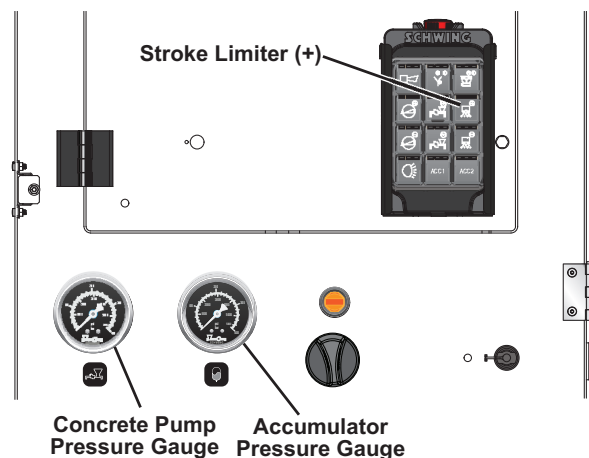
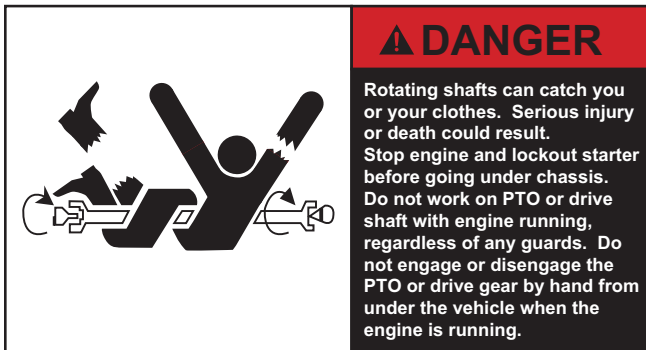


Figure 42
Concrete Pump and Accumulator Pressure Gauges

3. The main system control block pressure must be set first to properly set the pressure cut-off on the pump.
4. Stop the truck, put the key in your pocket, and place a "Do Not Operate" sign on the windshield.



5. Go to the pressure cut-off screw on the hydraulic pump, and back off the jam nut with a 13-mm wrench. Turn the adjustment screw *in* (clockwise) one quarter turn with a 4-mm allen wrench then tighten the jam nut. This should raise the pressure cut-off above the main relief valve pressure setting
6. Restart the engine and place the concrete pump into forward using the concrete pump forward/reverse switch. The system will pressure out, with the oil going over the main relief valve. The pressure showing on the concrete pump pressure gauge will be the main relief valve setting.
7. To increase the main relief valve setting, first stop the truck and apply the proper lock-out/tag-out procedures. On the main relief valve cartridge use a 9/16-in wrench to loosen the jam nut and a 5/32-in allen wrench to turn the adjustment screw *in* (clockwise). When increasing the pressure, the adjustments should be made in quarter turn increments.
8. Turn on the engine and check the main relief pressure. Your target pressure will be found on the hydraulic schematic.
9. If further adjustment is needed, again turn off the engine and apply the proper lock-out/tag-out procedures, make adjustments, turn on the engine, and check the main relief pressure. Repeat this process until the proper main relief pressure is achieved.
10. When the proper main relief pressure is achieved, the pressure cut-off can be set. Turn off the engine, and apply the proper lock-out/tag-out procedures.
11. Return the pressure cut-off screw to it's original position by turning the pressure cut-off screw *out* (counterclockwise) one quarter turn and locking the jam nut.
12. Start the truck engine, engage the PTO, clear all E-stops, and increase the throttle to maximum RPM. Place the concrete pump into forward using the concrete pump forward/reverse switch. The pressure showing on the concrete pump pressure gauge will show the pressure cut-off setting.
13. Turn off the engine, and apply the proper lock-out/tag-out procedures.
14. Go to the pressure cut-off screw on the hydraulic pump and back off the jam nut with a 13-mm wrench. With a 4-mm allen wrench, turn the adjustment screw *in* (clockwise) to raise the pressure or *out* (counter clockwise) to lower the pressure..
15. Turn on the engine and check the pressure cut-off. Your target pressure will be found on the hydraulic schematic.
16. If further adjustment is needed: again turn off the engine, apply the proper lock-out/tag-out procedures, make the adjustment, turn on the engine, and check the main relief pressure. Repeat this process until the proper main relief pressure is achieved.
17. After pressure cut-off is set, return the pump to neutral, bring engine RPM to idle, open the soft switch quarter turn valve, and either proceed to other pressure settings or take the transmission and PTO out of gear and shut off the truck.

Setting the Soft Switch Relief Pressure

First, open the soft switch quarter turn valve that you closed in the previous procedure. The rest of the unit should still be set up as if you were going to check the main relief valve pressure; concrete pump shut-off valve still closed (Figure 43).

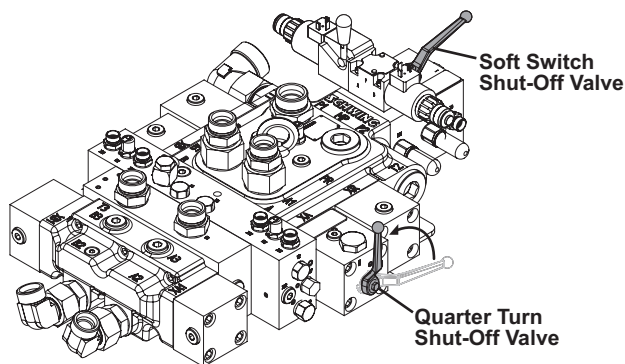


Figure 43
Closing the Quarter Turn Shut-Off Valve

When you put the pump in forward now, the main concrete pump pressure gauge should read 100 bar (1450 psi).

If pressure adjustment is needed, follow these steps:

1. Stop the truck, put the key in your pocket, and place a "Do Not Operate" sign on the windshield.
2. Loosen the soft switch relief valve jam nut (Figure 44) with a 9/16 open end wrench, and use a 5/32 allen key to adjust the pressure. Turn the adjustment screw *in* (clockwise) to raise the pressure or *out* (counter clockwise) to lower the pressure.

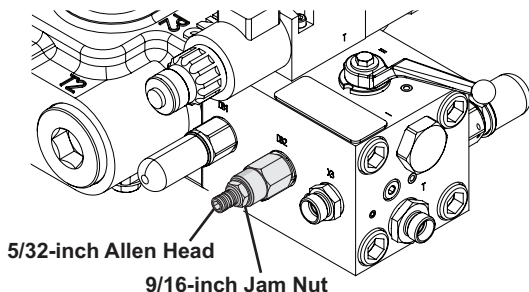


Figure 44
Soft Switch Relief Valve

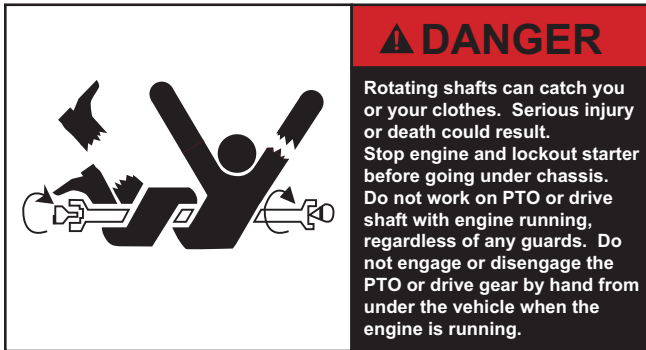
3. Turn on the engine and check the main concrete pump pressure. The gauge should read 100 bar (1450 psi).
4. If further adjustment is needed: again turn off the engine, apply the proper lock-out/tag-out procedures, make the adjustment, turn on the engine, and check the main concrete pump pressure. Repeat this process until the proper main concrete pressure is achieved
5. When you attain the required pressure, tighten the jam nut while holding the allen key to keep the pressure from rising. Be sure to open the quarter turn shut-off valve when you are finished. The unit will not stroke with this valve closed.

Set Accumulator Pressure Cut-Off

Read the pressure on the accumulator circuit pressure gauge. The pressure should read 200 bar (2900 psi).

If pressure adjustment is needed, follow these steps:

1. Stop the truck, put the key in your pocket, and place a "Do Not Operate" sign on the windshield.



2. Loosen the jam nut on the pressure regulator of the accumulator hydraulic pump (Figure 45). Turn the screw *in* (clockwise) to increase the pressure or *out* (counterclockwise) to decrease the pressure.

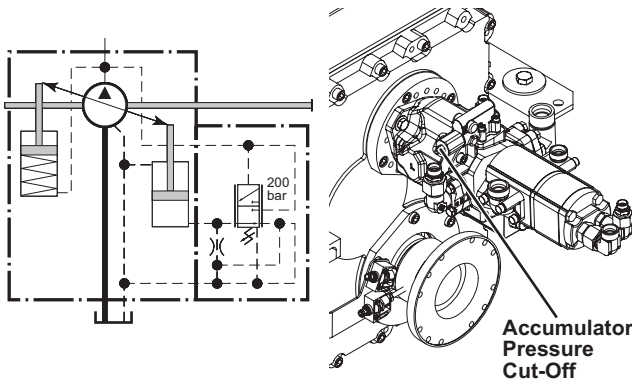
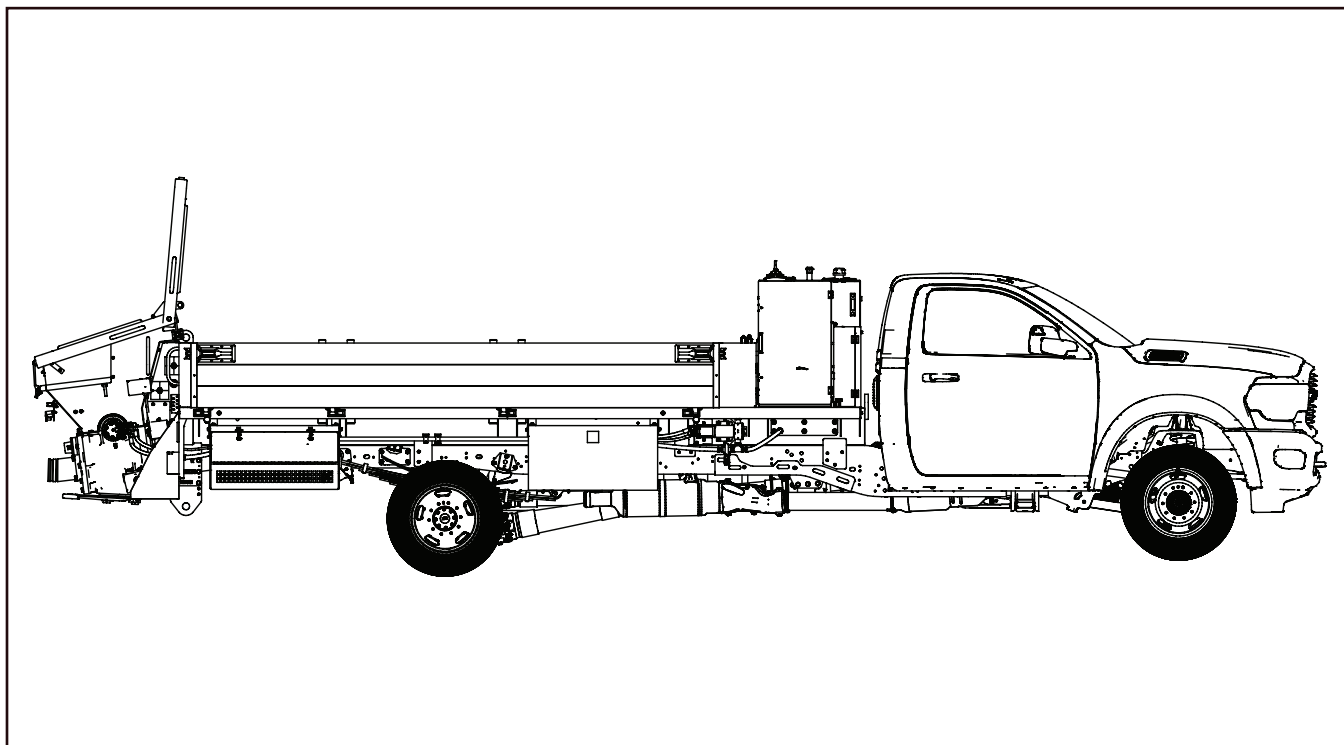


Figure 45

Accumulator Pressure Cut-Off Screw

3. Turn on the engine and read the pressure on the accumulator gauge. The gauge should read 200 bar (2900 psi).
4. If further adjustment is needed: again turn off the engine, apply the proper lock-out/tag-out procedures, make the adjustment, turn on the engine, and check the main concrete pump pressure. Repeat this process until the proper main concrete pressure is achieved
5. Lock the jam nut when the pressure is correct.



Appendix

Hydraulic Oil Viscosity Chart	119	Minimum Pipe Wall Thickness	127
Torque Specifications for Metric Bolts	120	Single Wall	127
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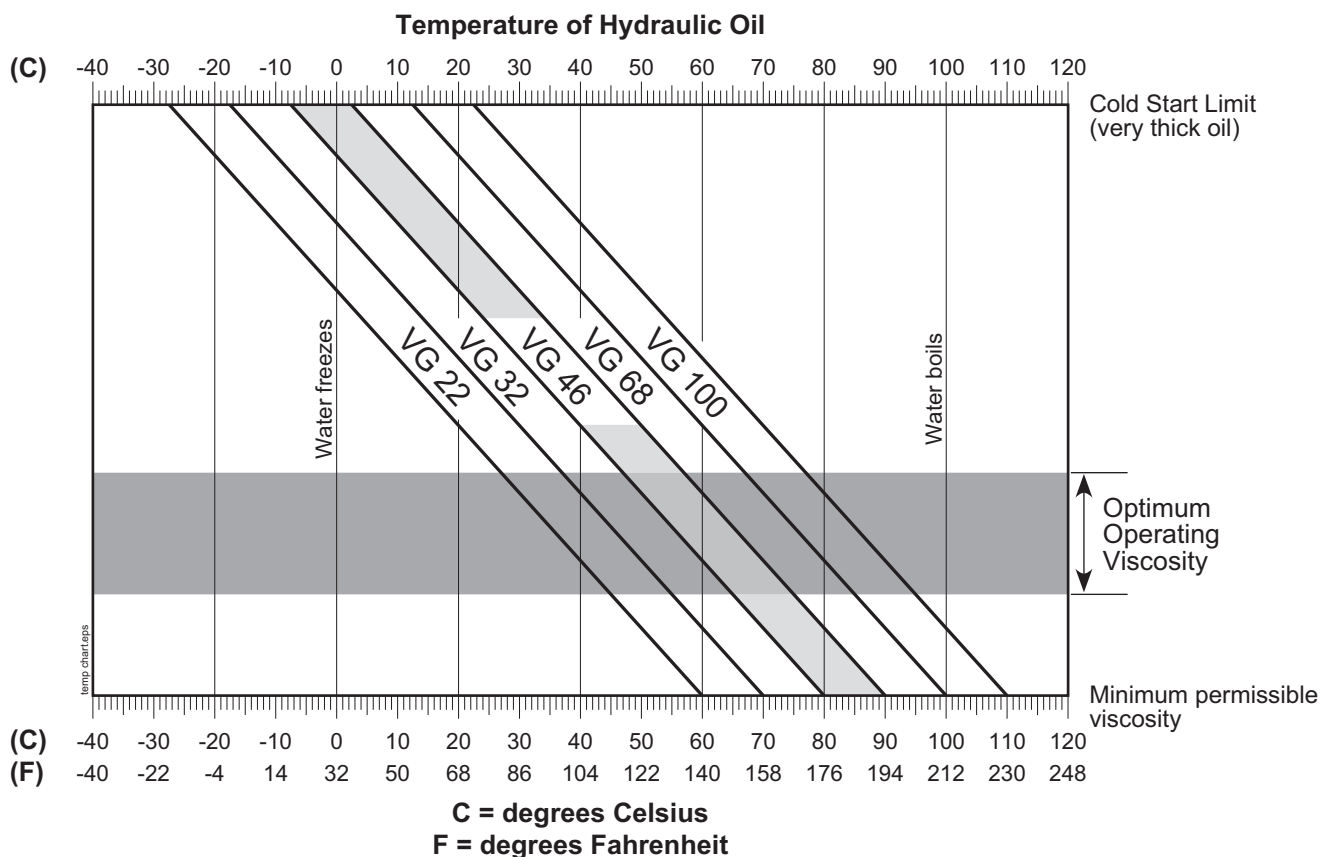
Hydraulic Oil Viscosity Chart

The illustration below shows the relationship between the oil temperature and its viscosity. As you can see, the oil gets thicker when the temperature is low and thinner as the temperature rises.

Your SCHWING concrete pump was delivered with Mobil Univis N46 hydraulic oil. This multi viscosity works for any temperature between -20°F and 100°F. If you have chosen to change to a regular viscosity oil, pay close attention to the following.

- The cold start limit represents the coldest temperature at which the oil is thin enough to flow into the hydraulic pumps. If it were any colder, the pumps would not be able to suck in the oil (cavitation).

- The minimum permissible viscosity represents the warmest temperature at which the oil will still be thick enough to provide lubrication and sealing. If it were warmer, the components would have metal-to-metal contact (thermal breakdown).
- The optimum operating viscosity is the range of oil thickness at which the oil works best (thin enough to flow easily, yet thick enough to protect the system components).
- An example of how to read a chart for VG 46 oil is given in the chart below. The chart shows the cold start limit as -8°C (18°F) and the minimum permissible viscosity as 90°C (194°F). The optimum range is 50°C to 76°C.



Torque Specifications for Metric Bolts

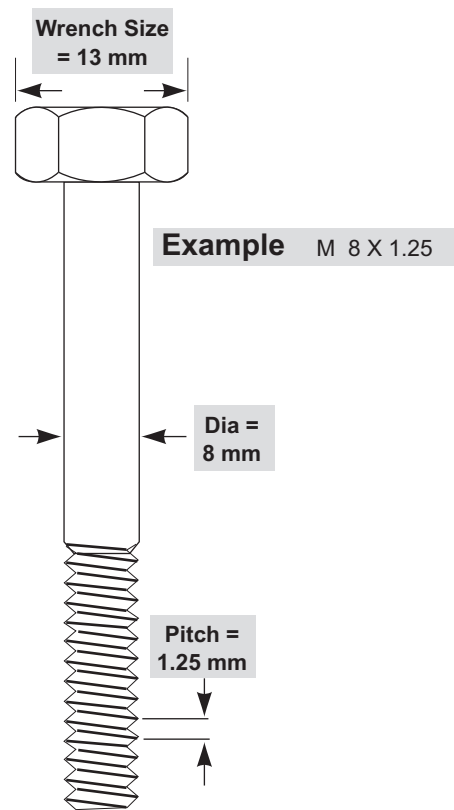
The following charts show the tightening torques specified for the bolts used on SCHWING equipment.

A torque wrench must be calibrated to within 1% of its indicated value throughout its range. Bolts must be torqued to within 4% of the requirement if the wrench has a dial scale. If no dial scale is present, the bolts must be torqued to within 6% of the requirement.

For example, a bolt to be torqued to a 200 ft-lbs requirement must be within 208 to 192 ft-lbs for a dial scale torque wrench.

SCHWING equipment uses two different types of bolts; one has a black or silver finish, and the other has a Dacromet/Geomet finish.

Torque specifications are very important for proper machine function. For more information on this subject, refer to the section on bolt tightening in the Maintenance section of this manual.



The torque specifications on the following pages refer to wrench size, bolt size and thread pitch. Above is an example showing what those numbers refer to.

Torque Chart

ZFSHL/Geomet 500 Coated

Electro-Galvanized

1. Setscrews and nuts

VALID for:	1.	ZFSHL (zinc flake coating) , GEOMET500 (GT500)
	2.	Black (PHO), electro-galvanized, galvanized screws and nuts mounted with assembly paste, such as Cu or MOS2, or with a screw lock (adhesive bond) Loxeal or Loctite.

In this case, a friction value of $\mu = 0.09$ is assumed!

Coarse-pitch thread						
Thread specification	* Mounting tightening torque (Nm, ft lb)					
	Strength class					
	8.8		10.9		12.9	
	Nm	ft lb	Nm	ft lb	Nm	ft lb
M 4 X 0.7	2.4	1.8	3.5	2.6	4	3.0
M 5 X 0.8	4.7	3.5	7	5.2	8	6.0
M 6 X 1	8.3	6.1	12	8.9	14	10
M 8 X 1.25	20	15	29	21	34	25
M 10 X 1.5	39	29	58	43	67	49
M 12 X 1.75	68	50	100	74	117	86
M 14 X 2	108	80	158	117	185	136
M 16 X 2	165	122	243	179	285	210
M 18 X 2.5	240	177	340	251	400	295
M 20 X 2.5	335	247	475	350	560	413
M 22 X 2.5	455	336	650	479	760	561
M 24 X 3	575	424	820	605	960	708
M 27 X 3	845	623	1200	885	1400	1033
M 30 X 3.5	1150	848	1640	1210	1920	1416
M 36 X 4	2000	1475	2850	2102	3330	2456
M 36 X 4**			2000**	1475**		

Fine-pitch thread						
Thread specification	* Mounting tightening torque (Nm, ft lb)					
	Strength class					
	8.8		10.9		12.9	
	Nm	ft lb	Nm	ft lb	Nm	ft lb
M 8 X 1	21	15	31	23	36	27
M 10 X 1	42	31	62	46	73	56
M 10 X 1.25	41	30	60	44	70	52
M 12 X 1.25	72	53	106	78	124	91
M 12 X 1.5	70	52	103	76	120	89
M 14 X 1.5	114	84	167	123	196	145
M 16 X 1.5	175	129	255	188	300	221
M 18 X 1.5	260	192	370	273	430	317
M 20 X 1.5	360	266	510	376	600	443
M 20 X 2	350	258	495	365	580	428
M 22 X 1.5	485	358	690	509	810	597
M 24 X 2	610	450	870	642	1020	752
M 27 X 2	890	656	1265	933	1480	1092
M 30 X 2	1230	907	1755	1294	2055	1516

* The mounting tightening torque corresponds to the axial force in the screw, whose yield point is used at 90% by traction and torsion.

** For octagonal tube boom column

Torque Chart

Black and Yellow Chromated

2. Setscrews and nuts

VALID for:	1.	Black (PHO), yellow chromated (A2C, A3C), electro-galvanized and galvanized (galv.) screws and nuts. Self-locking nuts.
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In this case, a friction value $\mu = 0.14$ is assumed!

Coarse-pitch thread						
Thread specification	* Mounting tightening torque (Nm, ft lb)					
	Strength class					
	8.8		10.9		12.9	
	Nm	ft lb	Nm	ft lb	Nm	ft lb
M 4 X 0.7	3.2	2.4	4.8	3.5	5.6	4.1
M 5 X 0.8	6.4	4.7	9.4	6.9	11	8.1
M 6 X 1	11	8	16	12	19	14
M 8 X 1.25	27	20	40	30	46	34
M 10 X 1.5	53	39	79	58	92	68
M 12 X 1.75	93	69	136	100	160	118
M 14 X 2	147	108	217	160	253	187
M 16 X 2	228	168	335	247	393	290
M 18 X 2.5	328	242	465	343	545	402
M 20 X 2.5	460	339	660	487	770	568
M 22 X 2.5	630	465	900	664	1055	778
M 24 X 3	795	586	1130	833	1325	997
M 27 X 3	1180	870	1675	1235	1960	1446
M 30 X 3.5	1600	1180	2275	1678	2660	1962
M 36 X 4	2780	2050	3960	2921	4630	3415

Fine-pitch thread						
Thread specification	* Mounting tightening torque (Nm, ft lb)					
	Strength class					
	8.8		10.9		12.9	
	Nm	ft lb	Nm	ft lb	Nm	ft lb
M 8 X 1	29	21	42	31	50	37
M 10 X 1	59	44	87	64	102	75
M 10 X 1.25	56	41	83	61	97	72
M 12 X 1.25	101	74	148	109	173	128
M 12 X 1.5	97	72	142	105	166	122
M 14 X 1.5	160	118	235	173	275	203
M 16 X 1.5	245	181	360	266	420	310
M 18 X 1.5	365	269	521	384	610	450
M 20 X 1.5	510	376	725	535	848	625
M 20 X 2	485	358	690	509	809	597
M 22 X 1.5	690	509	985	726	1150	848
M 24 X 2	865	638	1230	907	1440	1062
M 27 X 2	1265	933	1780	1313	2105	1553
M 30 X 2	1760	1298	2500	1844	2930	2161

* The mounting tightening torque corresponds to the axial force in the screw, whose yield point is used at 90% by traction and torsion.

Torque Chart VZD

3. Setscrews and nuts

VALID for:	1.	VZD screws and nuts
------------	----	---------------------

In this case, a friction value of $\mu = 0.12$ is assumed!

Coarse-pitch thread						
Thread specification	* Mounting tightening torque (Nm, ft lb)					
	Strength class					
	8.8		10.9		12.9	
	Nm	ft lb	Nm	ft lb	Nm	ft lb
M 4 X 0.7	2.9	2.1	4.3	3.2	5.0	3.7
M 5 X 0.8	5.8	4.3	8.5	6.3	10	7.4
M 6 X 1	10	7.4	14	10	17	13
M 8 X 1.25	24	18	36	27	42	31
M 10 X 1.5	48	35	71	52	83	61
M 12 X 1.75	83	61	122	90	143	105
M 14 X 2	132	97	195	144	228	168
M 16 X 2	205	151	300	221	352	260
M 18 X 2.5	295	218	420	310	490	361
M 20 X 2.5	415	306	590	435	690	509
M 22 X 2.5	565	417	805	394	940	693
M 24 X 3	710	524	1015	749	1190	878
M 27 X 3	1050	774	1500	1106	1750	1291
M 30 X 3.5	1430	1055	2035	1501	2380	1755
M 36 X 4	2485	1833	3540	2611	4140	3053

Fine-pitch thread						
Thread specification	* Mounting tightening torque (Nm, ft lb)					
	Strength class					
	8.8		10.9		12.9	
	Nm	ft lb	Nm	ft lb	Nm	ft lb
M 8 X 1	26	19	38	28	44	32
M 10 X 1	53	39	78	58	91	67
M 10 X 1.25	50	37	74	55	87	64
M 12 X 1.25	90	66	132	97	155	114
M 12 X 1.5	86	63	127	94	149	110
M 14 X 1.5	140	103	210	155	245	181
M 16 X 1.5	220	162	320	236	370	273
M 18 X 1.5	325	240	465	343	540	398
M 20 X 1.5	450	332	645	476	755	557
M 20 X 2	435	321	620	457	720	531
M 22 X 1.5	610	450	870	642	1020	752
M 24 X 2	770	568	1090	804	1280	944
M 27 X 2	1120	826	1600	1180	1870	1379
M 30 X 2	1560	1151	2220	1637	2600	1918

* The mounting tightening torque corresponds to the axial force in the screw, whose yield point is used at 90% by traction and torsion.

Recommended Emergency Hose Kit

SCHWING recommends that you carry one of each of the following hoses on the unit in case a hose is blown on the job. Each size listed represents the longest hose of each diameter that is installed on the unit at the factory. Keep the insides of the hoses clean until they are needed by capping the ends and using tape to hold the cap in place. Dirt introduced into your hydraulic system through the installation of a hose that was not kept clean will cause a variety of operational problems.

Diameter	Length	Part Number
8	6400 mm	30314105
13	6400 mm	30314106
16	1350 mm	10049948
20	1000 mm	10049959
25	2100 mm	30347677
32	1100 mm	10000230

Complete hose kits can be ordered through the SCHWING Service Center using the appropriate part number: 98494447 (SPTO 1000).

Fitting Wrench Sizes

This chart is provided as an aid to selecting the proper wrench to hold or tighten the hydraulic fittings on SCHWING equipment. Sizes may change, so use this chart only as a guide.

Straight Fittings

Fitting or Tube Size (mm)	Metric Wrench Sizes		Nearest American Wrench Sizes	
	Cap Nut (mm)	Coupling Body (mm)	Cap Nut (in)	Coupling Body (in)
8	17	17	11/16	11/16
12	22	19	7/8	3/4
16	30	27	1 3/16	1 1/16
20	36	32	1 7/16	1 1/4
25	46	41	1 13/16	1 5/8
30	50	46	2	1 13/16
38	60	55	2 3/8	2 3/16

Banjo Fittings

End Cap Separate from Stem

Fitting or Tube Size	Metric Wrench Sizes			Nearest American Wrench Sizes		
	Cap Nut (mm)	Coupling Body (mm)	End Cap (mm)	Cap Nut (mm)	Coupling Body (in)	End Cap (in)
8 mm	17	22	19	11/16	7/8	3/4
12 / R 1/4 in	22	22	19	7/8	7/8	3/4
12 / R 3/8 in	22	27	22	7/8	1 1/16	7/8
12 / R 1/2 in	22	30	24	7/8	1 3/16	15/16
16 mm	30	32	27	1 3/16	1 1/4	1 1/16
20 mm	36	41	32	1 7/16	1 5/8	1 1/4
25 mm	46	50	41	1 13/16	2	1 5/8
30 mm	50	60	50	2	2 3/8	2
38 mm	60	70	55	2 3/8	2 13/16	2 3/16

End Cap Part of Stem

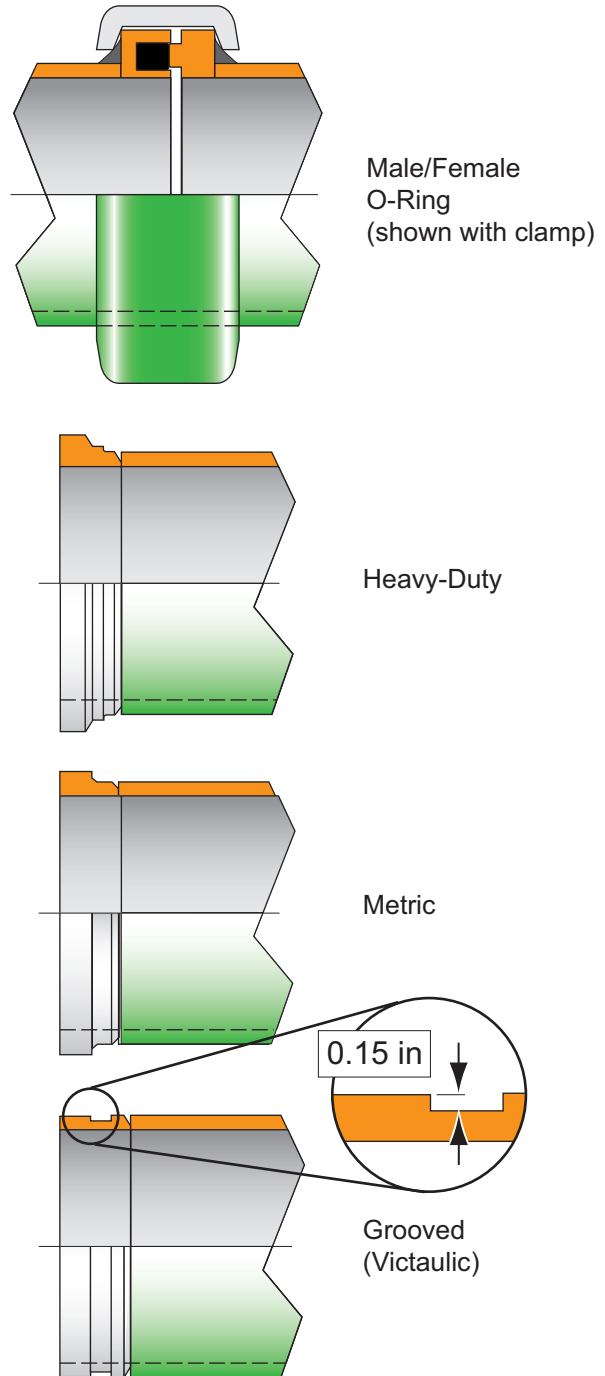
12 / R 3/8 in	22	24	22	7/8	15/16	7/8
16 mm	30	30	27	1 3/16	1 3/16	1 1/16
25 mm	46	46	41	1 13/16	1 13/16	1 5/8
38 mm	60	65	55	2 3/8	2 9/16	2 3/16

Weld-On Ends/Couplings 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.

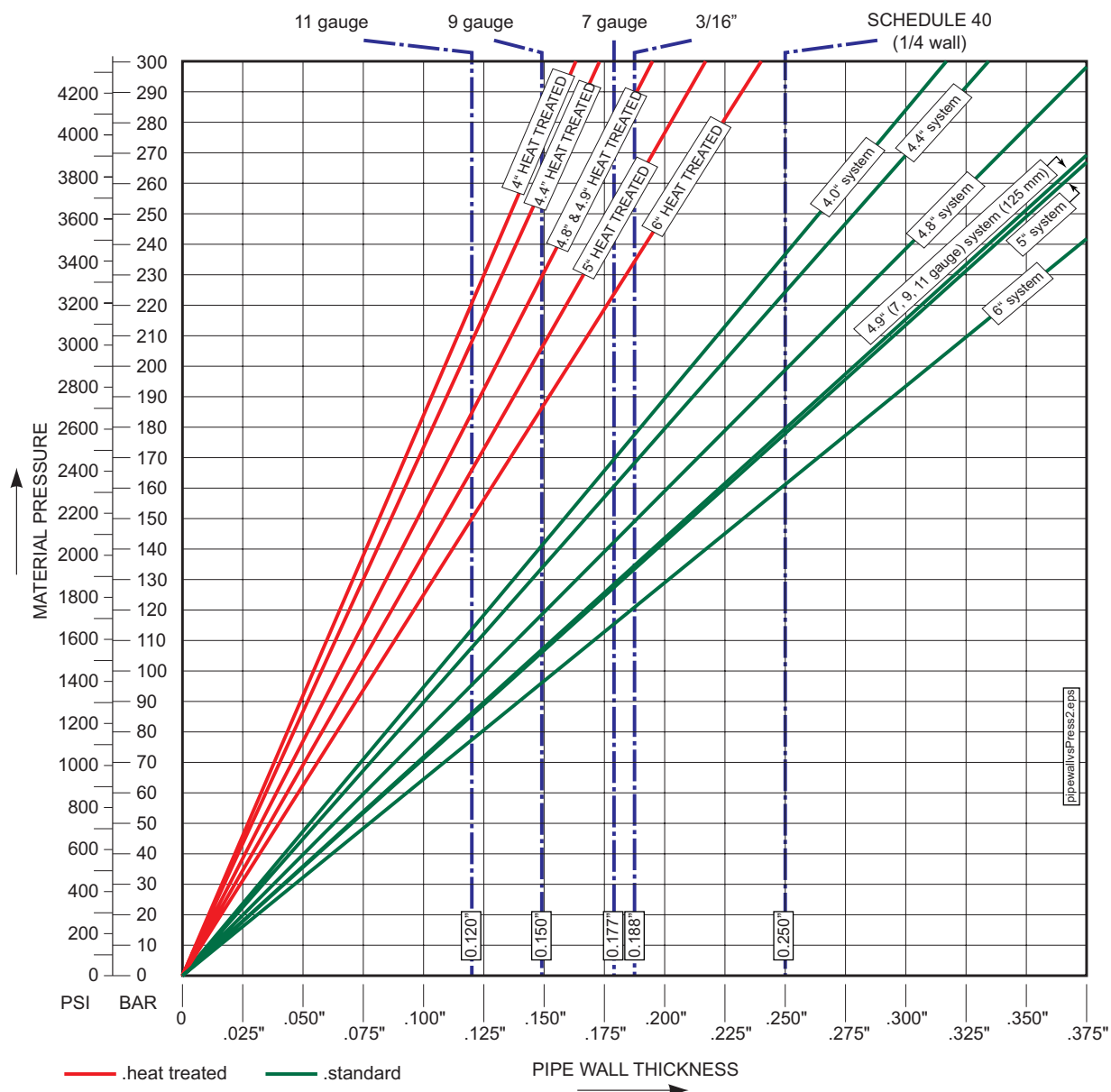
1. Male/female O-ring style couplings have the highest pressure rating of the ends commonly used for concrete pumping. They can withstand 4350 psi at a 2:1 safety factor. They are self aligning and waterproof when used with O-rings in good condition. They are typically not used on booms because of their 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 at a 2:1 safety factor. 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 at a 2:1 safety factor. They have 85% more contact area than grooved couplings. The face is flat and will not draw pipe together. Although they have a raised edge, they are not compatible with Heavy Duty couplings unless a special clamp or an adapter pipe is used to change from one style to the other. Metric connections are standard equipment on booms because of the weight savings compared with other styles.
4. Grooved couplings (lip height of 0.15 in or less) are designed for pressures only up to 750 psi at a 2:1 safety factor. 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.

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



Minimum Pipe Wall Thickness

Single Wall



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.
7. The chart does not apply to the system at the back end of the pump. The outlet pipe, tapered bend, 6-inch elbow, and 6-inch to 5-inch reducer have a minimum wall thickness of 2 mm or .079 inches, and must be able to handle the maximum material pressure of the pumpkit.

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.

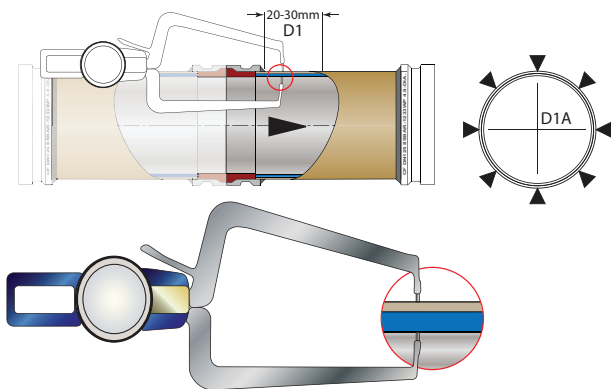
This chart does not apply to double-wall pipe. Double wall pipe can be checked by inspecting the inside of the pipe. If the insert is intact, the pipe is okay. If the insert is worn through, the pipe must be replaced. Contact your pipe supplier for the pressure capacity of your double-wall pipe.

Minimum Pipe Wall Thickness

Twin Wall

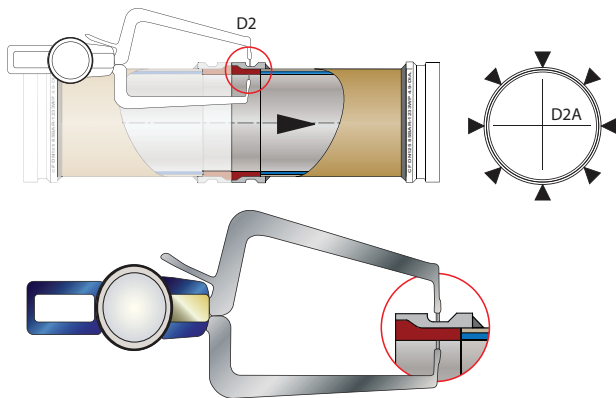
Measuring Points on Pipe Wall:

Measure multiple points circumferential, approximately 20 to 30 mm behind the weld zone (as illustrated in D1 and D1A). Measurements should be done on both ends of the pipe.



Measuring Points on Weld End:

Measure multiple points circumferential in the weld end groove as illustrated in (D2) and (D2A). Measurements should be done on both ends of the pipe.



S2000

Size	Overall Wall Thickness (New)	D1 in/mm	D2 in/mm
DN125/4.8	.180 / 4.572	.110 / 2.794	.230 / 5.842

S3000

Size	Overall Wall Thickness (New)	D1 in/mm	D2 in/mm
DN125/4.8	.188 / 4.775	.090 / 2.286	.230 / 5.842

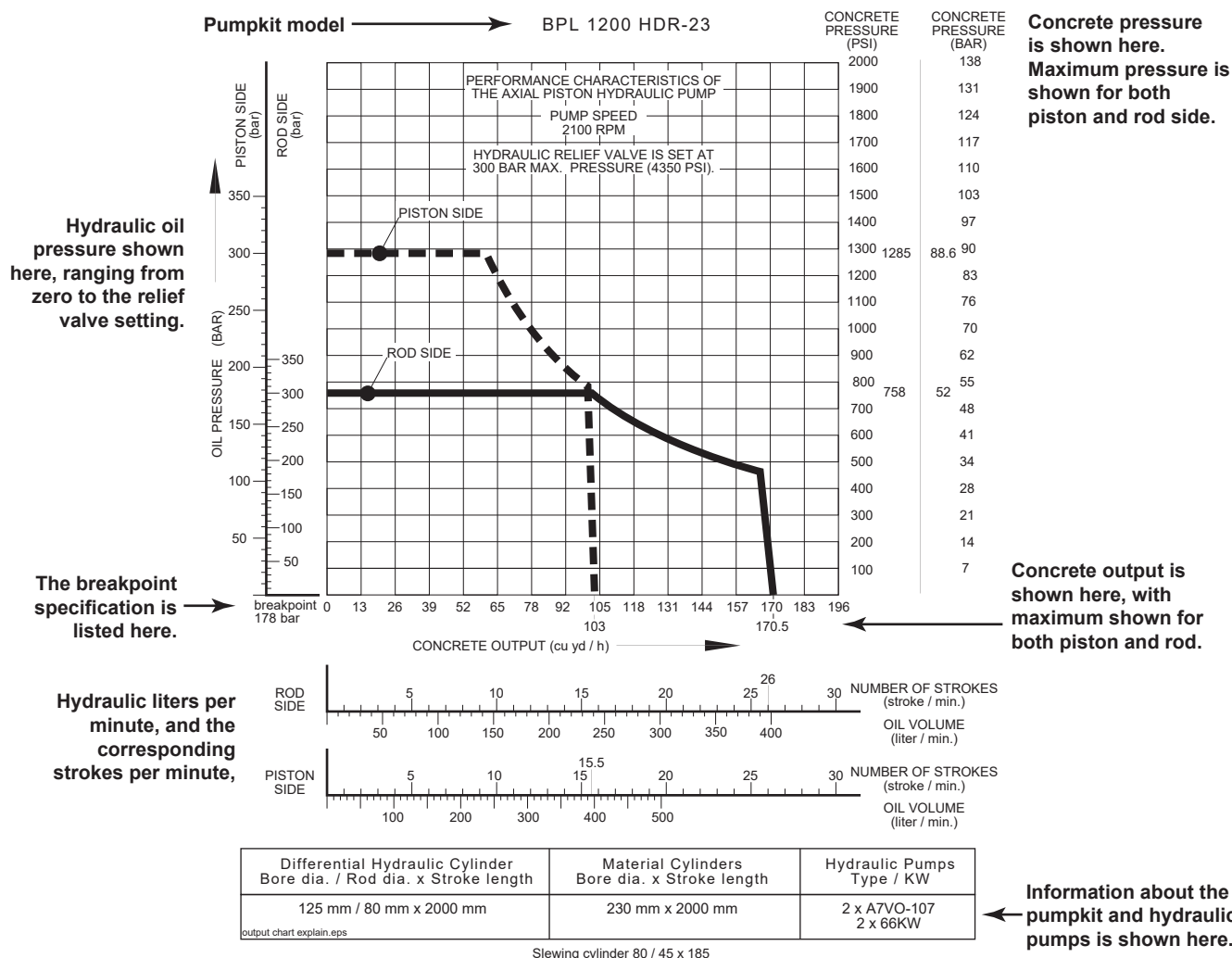
Output Charts

The hydraulic pumps that drive your concrete pump are horsepower controlled. When pressure rises past a certain point (known as the breakpoint), the pumps change their displacement per revolution, resulting in less flow and fewer strokes per minute. The reason for this is so the pumps will not stall your engine by drawing too much horsepower. Output charts show the horsepower curve (in kilowatts, or kW) of the concrete pump hydraulic circuit. From them, you can determine the:

- Maximum concrete pressure of the pumpkit.
- Maximum output (in cubic yards per hour) of the pumpkit.

- Maximum strokes per minute of your pumpkit.
- Maximum output (in L/min) of your hydraulic pumps,
- Output at various pumping pressures.
- Condition of your hydraulic pumps when used in conjunction with a flowmeter.
- Breakpoint of your hydraulic system.

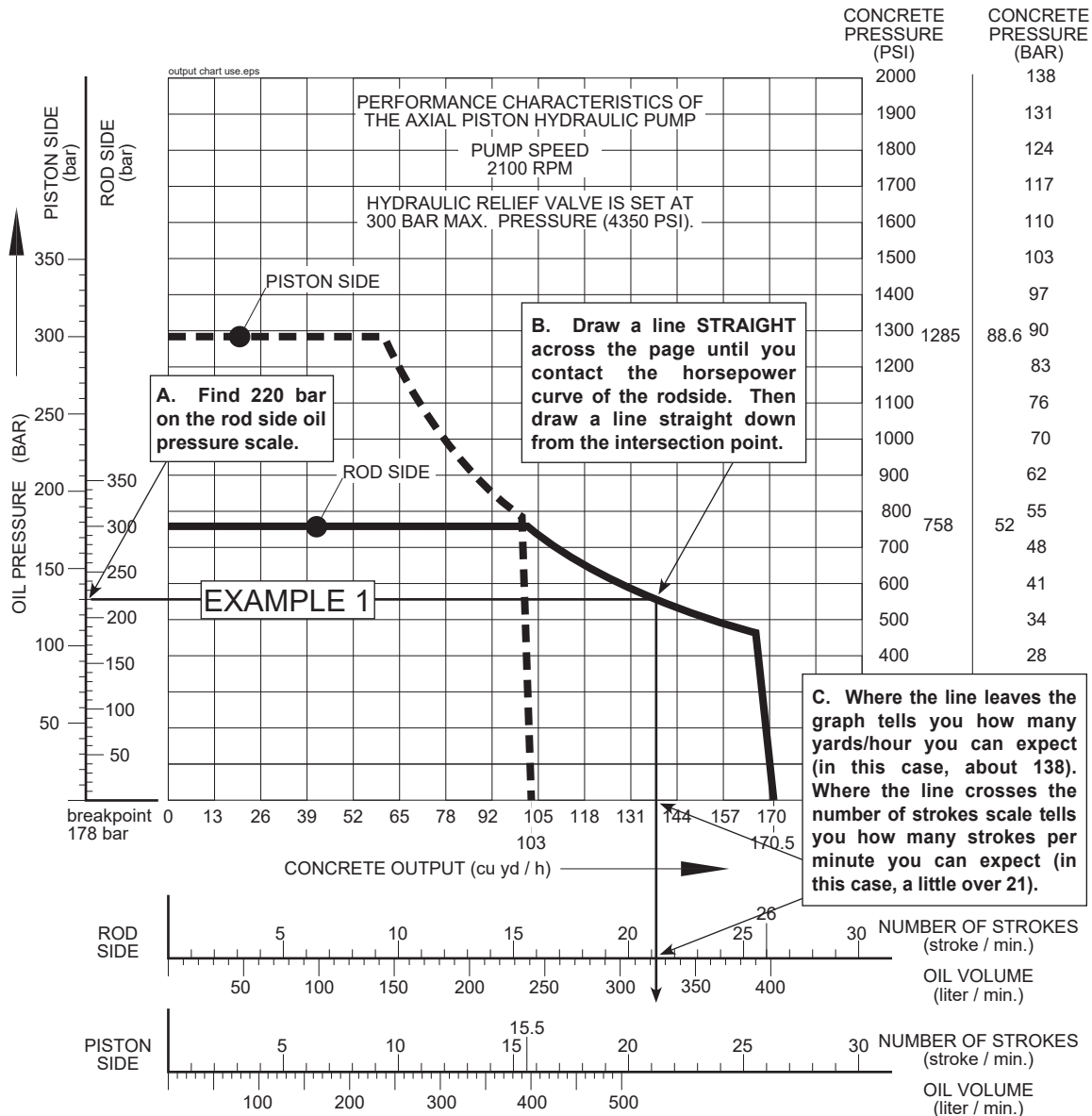
An explanation of an output chart is shown on the following pages, followed by some examples of chart usage. The output chart of the pumpkit shipped with this manual is shown later.



Example 1—Checking Flow at a Given Pressure

The machine is configured on the rod side (standard from the factory). It appears that the machine is not getting as many strokes per minute as usual. You count the strokes and see that you are getting about 21.5 strokes per minute. You check your pressure gauge and see that the hydraulic oil pressure is at 220 bar. To determine whether your unit is acting normally: locate the 220 bar oil pressure marking on the

rod side scale (Item A in the example below); draw a line straight across the page until you intersect with the horsepower curve (Item B); next, draw a straight line down from the intersection point until you pass through the rod side number of strokes scale, and read the strokes per minute. At 220 bar you should be getting a little more than 21 strokes per minute. Your unit is fine.



Example 2—Checking the Hydraulic Pumps

To determine whether your pumps are still in good working condition, use the output chart and a flow meter. Test one pump at a time, multiply the readings by two, and chart the result. You must multiply the readings because the chart is based on the output of two pumps, but we are only testing one at a time.

Breakpoint specification	1st Pump		2nd Pump	
	Liters/min (read on meter)	Total (for plotting)	Liters/min (read on meter)	Total (for plotting)
☐ 0 bar	_____	x 2 _____	_____	x 2 _____
100 bar	_____	x 2 _____	_____	x 2 _____
_____ breakpoint	_____	x 2 _____	_____ breakpoint	x 2 _____
☐ 150 or ☐ 200 bar	_____	x 2 _____	_____	x 2 _____
250 bar	_____	x 2 _____	_____	x 2 _____
300 bar	_____	x 2 _____	_____	x 2 _____

To test your pumps:

- Be sure you are using the chart that applies to your unit.
- Select the proper gear for pumping (found on the information plate mounted in the cab).
- Set the pump speed (input drive shaft) RPM. Pump speed information is found on line 16 of the Delivery Inspection Report, which arrived with your unit when it was new. A difference of even a few RPM will give you a bad reading. Check the RPM of the drive shaft with a digital tachometer if one is available.
- Know how to use your flowmeter. Read the instructions that came with it, and remember that a flowmeter must be calibrated periodically.
- Make two copies of the output chart so you don't ruin your original. You need one chart for each pump tested.

Read the flow at 0 bar, 100 bar, 150 or 200 bar, 250 bar, and 300 bar. Also, document the breakpoint. The breakpoint is where the flow drops off rapidly. You will be able to notice it on the flowmeter. If you think it would be helpful, copy the chart below. Check which reading you used (150 or 200 bar). The breakpoint will be very close to either 150 or 200 bar, so it is not necessary to take both readings. The breakpoint specification is shown on each output chart.

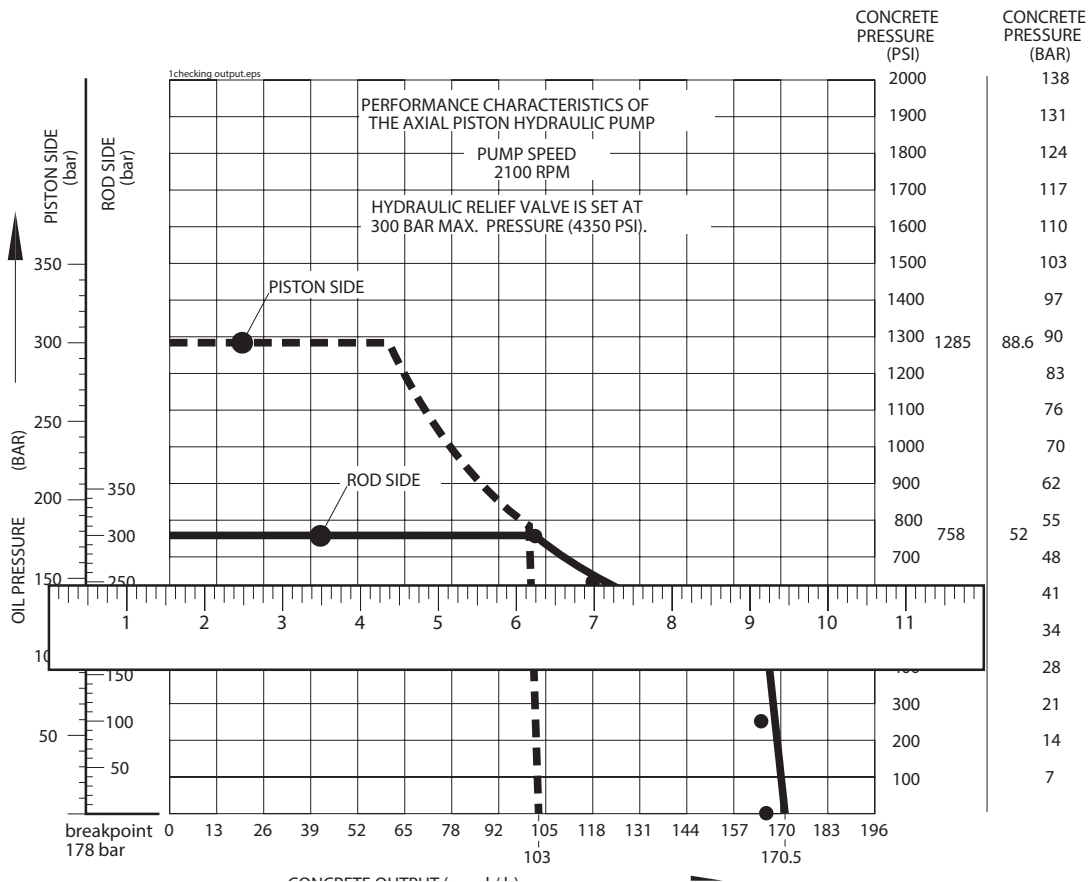
As an example, assume that these are the collected readings:

Breakpoint specification	1st Pump		2nd Pump	
	Liters/min (read on meter)	Total (for plotting)	Liters/min (read on meter)	Total (for plotting)
178	0 bar 199	x 2 398	_____	x 2 _____
	100 bar 196	x 2 392	_____	x 2 _____
178 breakpoint	194	x 2 388	_____ breakpoint	x 2 _____
☐ 150 or ☒ 200 bar	169	x 2 338	_____	x 2 _____
	250 bar 138	x 2 276	_____	x 2 _____
	300 bar 117	x 2 234	_____	x 2 _____

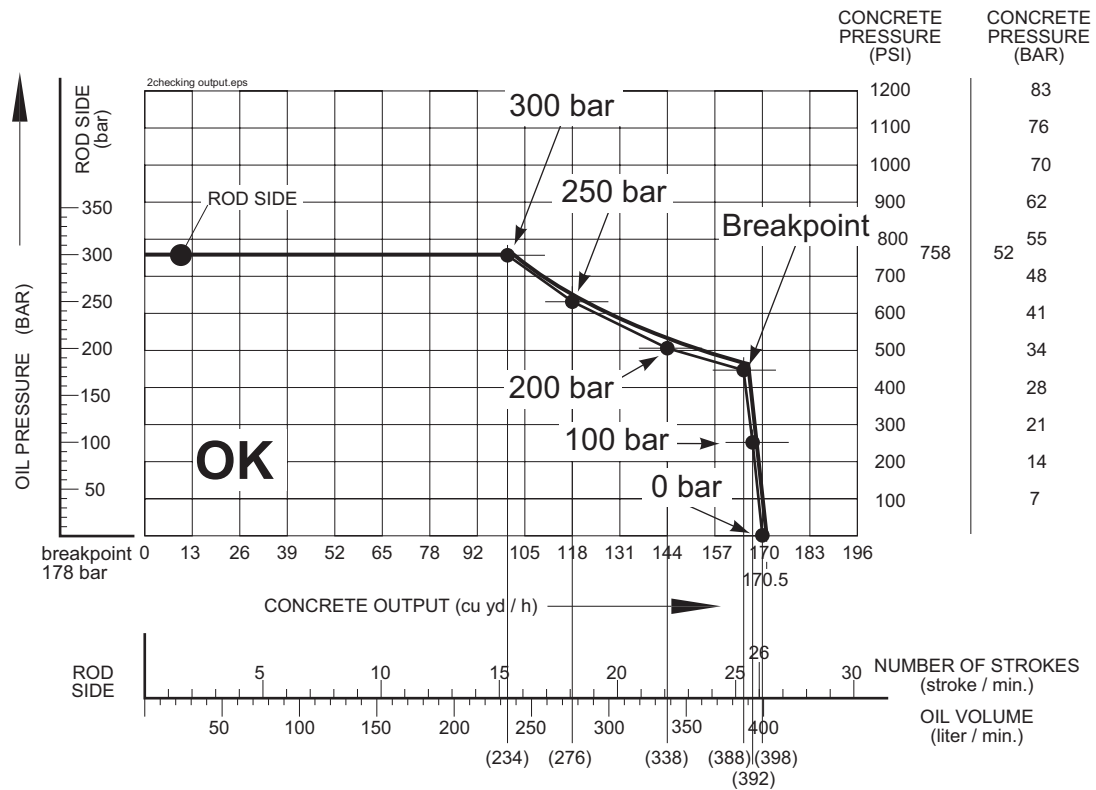
- Lay a straight edge horizontally across the page at the pressure point you are plotting. Draw a light line across the chart. The example below uses the rod side scales and curve (you could use the piston side scale and curve instead if you were configured on the piston side). The ruler is shown ready to draw a line at 250 bar hydraulic pressure.

- Turn the ruler sideways, and draw a light line up the page from the liters/minute reading you took at that pressure (remember to multiply the reading by two). In the example, 276 liters was measured at 250 bar.
- Put a dot at the point where the two lines intersect.

Do the same thing with each pressure reading. You should end up with six dots.



- Connect the dots. If the plotted line reasonably matches the specification plot on the chart, the pump is fine. If your line is to the lower left of the specification plot, the pump is getting weak. If your line is to the upper right, you have done the test incorrectly, or you are using the wrong chart. In our example, the pump is okay.

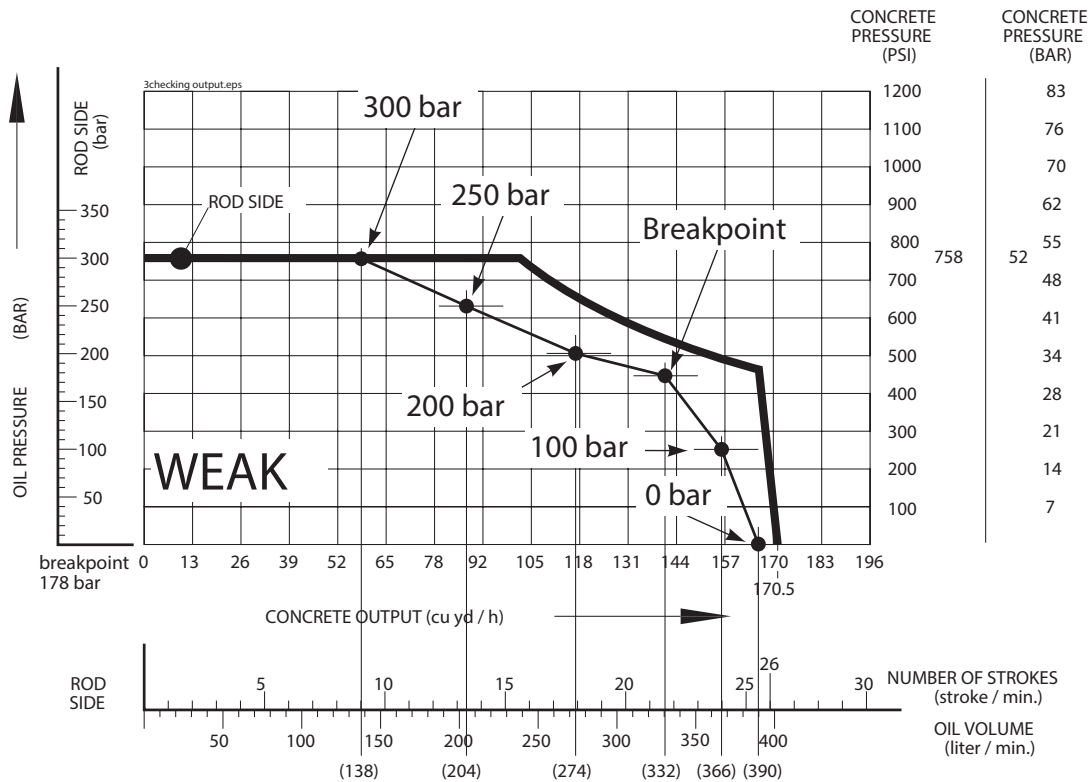


(Piston side scales have been removed for clarity.)

Check the second pump. Hook up the flowmeter just as when you checked the first pump. Again, ensure that you have the correct speed, gear, chart, and so on. This time the example will have worse results.

Breakpoint specification	1st Pump		2nd Pump	
	Liters/min (read on meter)	Total (for plotting)	Liters/min (read on meter)	Total (for plotting)
178	0 bar 199	x 2 398	195	x 2 390
	100 bar 196	x 2 392	183	x 2 366
178 breakpoint	194	x 2 388	178 breakpoint 166	x 2 332
☐ 150 or ☒ 200 bar	169	x 2 338	137	x 2 274
	250 bar 138	x 2 276	102	x 2 204
	300 bar 117	x 2 234	69	x 2 138

Again, plot the results on a clean copy of the flowchart. As this pump is plotted, it shows that the dots are moving quite a bit to the inside of the flow specification (see below).



Note: Piston side scales have been removed for clarity.

When you connect the dots, the line is completely below the specifications. This pump is very weak and will completely stop pumping oil soon. You may notice high heat with this unit if you are pumping at high oil pressures.

Never try to make up for a weak pump by increasing the speed of the engine. If the pump turns faster than specification, it will not be able to draw oil as fast as it is turning ("cavitation"), and immediate failure could result.

If the plotted curve matches the specification plot for a while but the breakpoint is too high or too low, it is possible to make an adjustment. Contact the SCHWING Service Center for the procedure.

There are many different possible pump kits and power settings for this unit. If you accidentally destroy your original output chart, please have your serial number handy when you call to get a replacement. Also, please advise us if you have changed differential cylinders, material cylinders, or hydraulic pumps, because you may need a different output chart than the one that was originally shipped with the unit.

Using a Nomograph

Concrete pumps are limited in what jobs they can do by three factors:

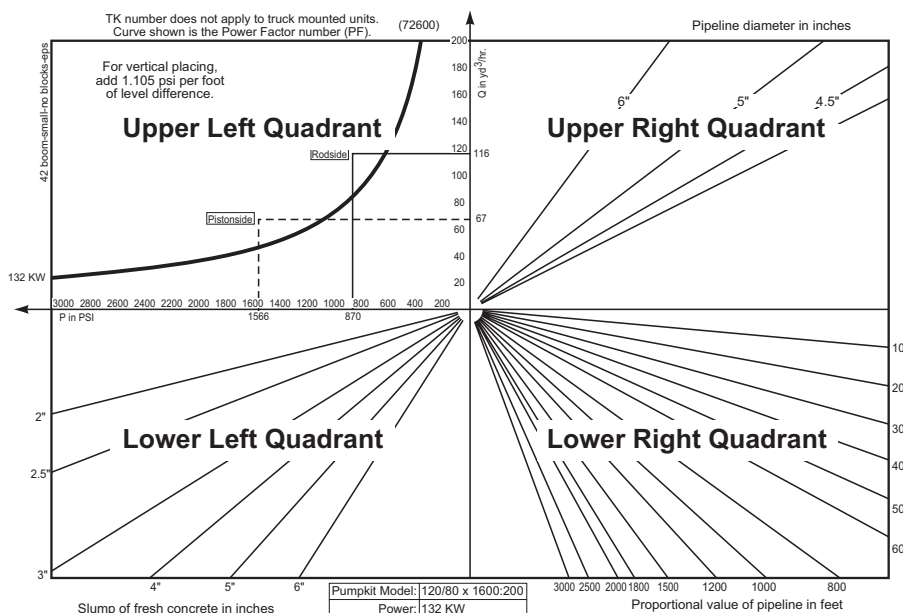
- the amount of power available,
- the maximum concrete output available, and
- the maximum concrete pressure available.

To estimate the power a pump requires to complete a particular job and to determine which pump is appropriate, a nomograph is used.

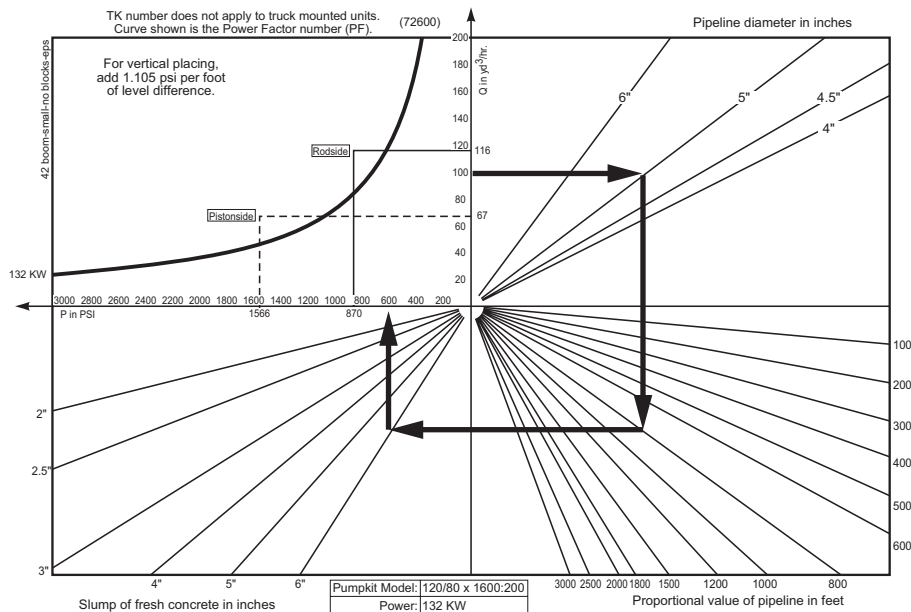
With a concrete pump that is driven by its own prime mover, such as a trailer-mounted concrete pump or a truck-mounted pump with a separate drive engine, the power rating (in kW) is shown for the engine or electric motor. With a truck-mounted pump that uses a PTO from the truck engine, the power rating reflects the power output of the hydraulic pumps only. (All the power from the truck engine is normally not available to the concrete pump and should not be used for power calculations.) If you know the required output for the job, the nomograph will help you calculate the required pressure. If you know the output and pressure, you can calculate the power requirement.

The nomograph was developed by extensive trial-and-error testing and has proven to be accurate to $\pm 10\%$ in nearly all pumping applications. The original nomographs used "spread measure" of fresh concrete instead of slump, and the two are not directly interchangeable. Some approximations are used in translating the charts from spread measure to slump, but the $\pm 10\%$ accuracy still applies. In all cases, it is assumed that you will receive fresh, high-quality concrete on your job and that the concrete will be plastic enough to flow into the material cylinders. If you know that the concrete will be hard to feed into the cylinders, you should adjust the output requirement to compensate for incomplete filling. For example, if you will need 50 cubic yards per hour into the form but the concrete is so stiff that it will fill the cylinders only 80%, you should multiply the required output by 1.25 ($1 \div 80\%$).

The nomograph is divided into four quadrants. The upper left quadrant is the beginning and end point of the graph, and it shows maximum output, pressure, and power for a specific machine. The upper right quadrant accounts for the relationship between concrete output and pipeline diameters. The lower right quadrant accounts for the resistance to flow of the entire pipeline system. The lower left quadrant accounts for the pumpability of the concrete.



To use the nomograph, begin at output required and move clockwise until you encounter the lines that represent your job situation. Each time you meet the line that applies, make a 90 degree turn until you come to a point on the bottom of the upper left quadrant that shows pressure required.



To illustrate the use of a nomograph, we will use a hypothetical job situation with the following specifications:

1. We will need an average output of 75 cubic yards per hour, but we will be pumping only 75% of the time. The rest of the time will be spent moving hose, removing pipe lengths, waiting for concrete trucks, and taking care of miscellaneous jobs. This means that when we are actually pumping, we will need an output rate of $75 \div 75 = 100 \text{ yd}^3/\text{hr}$.
2. We will use 5-inch diameter pipeline.
3. We will need the following pipeline lengths:

Separately laid pipeline:

- 40 ft of 5-inch rubber hose
- 150 ft of 5-inch horizontal steel pipe

Boom pipe, elbows, and deck system:

- 13 ft of 5-inch rubber hose
- 144 ft of 5-inch steel pipe (on the boom and pump deck)
- 5.25 ft of 6-inch x 5-inch reducer (on the pump)
- four 5-inch 45-degree elbows, radius 250 mm
- eleven 5-inch 90-degree elbows, radius 250 mm
- two 6-inch 90-degree elbows, radius 250 mm

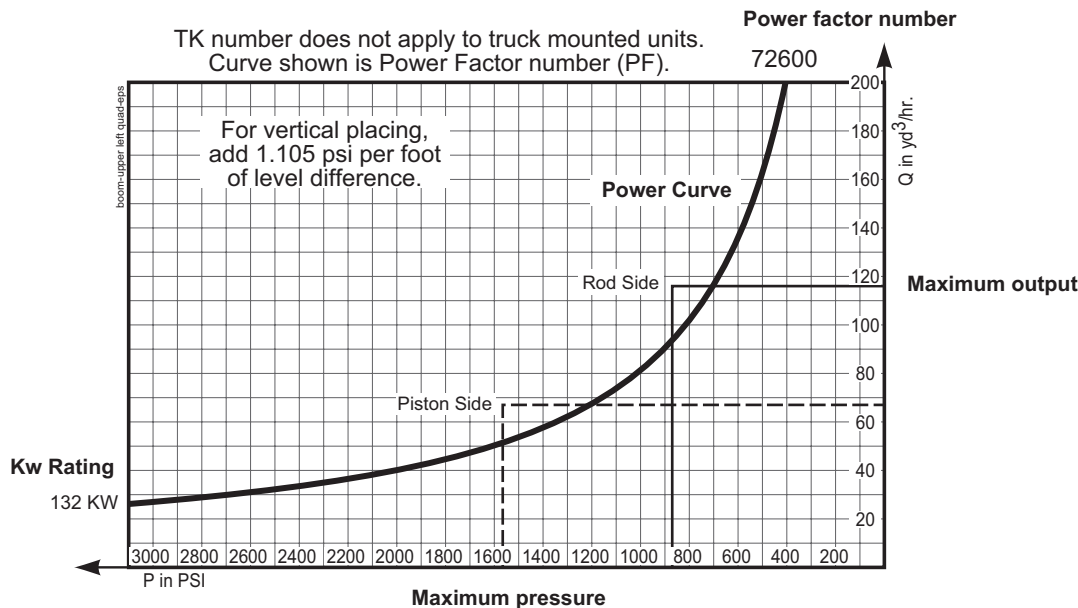
4. We will specify a slump of 5 inches x 6 inches and use the 5-inch line on the chart.

5. In addition, when we add the pressure for the vertical run, we will have to add 1.1 times 70 ft = 77 psi.

All of these criteria will be explained in detail as we go through the individual quadrants.

The Quadrants

1. The upper left quadrant describes the power curve of a given hydraulic pump Kw rating and the maximum output and maximum pressure of a particular model of concrete pump.



Any concrete pump selected for a job must meet three technical parameters:

- the power factor number of the pump must be equal to or greater than the power factor number of the job,
- the maximum output required by the job must be available from the pump, and
- the maximum pressure required by the job must be available from the pump.

It is important to notice the pump maximum pressure and maximum output, even if the power factor number of the pump is larger than the job requires. These parameters are decided during the design stage of the unit and cannot be adjusted on the job. If the unit is able to go from rod side to piston side, maximum pressure and output can be exchanged—that is, you can decrease one while increasing the other the same amount.

The power factor number (PF) replaces the TK number on a truck-mounted unit. It is the Kw multiplied by a

constant (550) that has several efficiency factors figured in. When using an Americanized nomograph (pressure in psi and flow in cubic yards per hour), the pressure multiplied by the output must always be less than or equal to the PF. For example, if you needed 50 cubic yards per hour and determined that this will require 750 psi, you can multiply 50 by 750, which equals 37,500. Any pump you select must have a PF of 37,500 or greater. If you are using a nomograph that has been converted to metric units of measure (pressure in bar and output in cubic meters per hour), you can still multiply the pressure by the output, but you must multiply the answer by the conversion factor between metric and English units of measure to get the PF. The conversion factor for cubic yards to cubic meters and for bar to psi is 18.966. For all practical purposes, you can use 19. For example, if you need 50 cubic meters per hour and determine that your job setup will require 65 bar, you can multiply 50 by 65, which equals 3250. Multiply this by 19, and you find that your PF requirement is 61,750. Again, any pump you select for the job in this example should have a PF of 61,750 or greater.

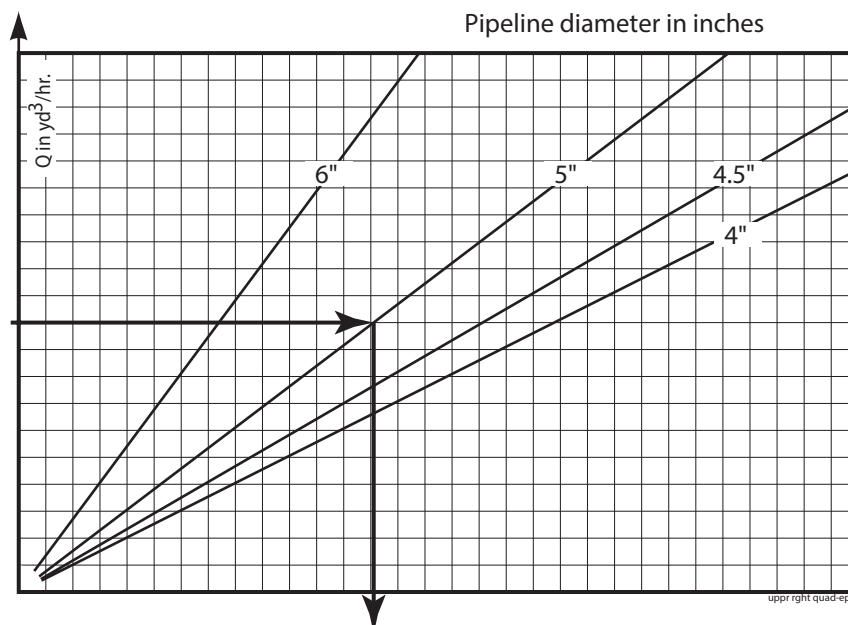
The **maximum output** (abbreviated as max Q) is determined by the size of the hydraulic pumps, the number of strokes per minute, and the size of the differential and material cylinders. The unit is usually designed so maximum output can be achieved only at less than maximum pressure.

Maximum pressure (abbreviated as max P) is determined by the size of the differential and material cylinders and the setting of the main relief valve. To be sure that the unit will handle the job, be careful to notice max P and max Q.

An example of why that is important: you contract to pump a job that requires only 20 yards per hour, and you calculate that you will need 2100 psi pressure; the PF of this job is 42,000 (20 x 2100), and the pump shown in the illustration has a TK of 72,600, so there is enough power available; however, the maximum pressure available from the pump is only 1570 psi, so this pump would not do the job.

2. Follow the chart in a straight line from required output into the upper right quadrant until you come to the size of the pipeline that you will use. A good rule of thumb for sizing pipeline is to use the largest diameter pipeline that you can. It takes less force to move concrete through a 6-inch pipeline than, for example, a 4-inch pipeline. When pressure is exerted on concrete in a pipeline, a paste of water and cement fines coats the inside of the pipeline

and forms a slippery layer on which the bulk of the concrete slides. While it is true that a 6-in pipeline has 49 percent more surface area to coat than a 4-inch pipeline, the volume of concrete that can move on the layer is increased by 125%, which results in lower velocity of the concrete (in feet per second), lower friction, and, therefore, lower pressure. A pump that may not be capable of completing a difficult job through 4-inch or 5-inch pipe may be able to do it easily through 6-inch pipe. Experience has taught us that 5 inches is the optimum pipeline size for lengthy vertical runs, such as those found on high-rise buildings. It is large enough for most aggregate but small enough that you minimize the amount of concrete that slides back into the hopper when the concrete valve cycles, which we call backwash. You must also consider the people at the point of placement. Very few hose handlers, if any, can move 6-in hose on a slab all day. There is no provision in the nomograph for mixing pipeline sizes. For example, if you will be reducing from 5-inch to 4-inch pipe, you should calculate the chart as if you were using 4-inch pipe for the entire distance. This will not be completely accurate, but you will be safe in your pressure calculation. In our example, we use 5-inch pipeline.

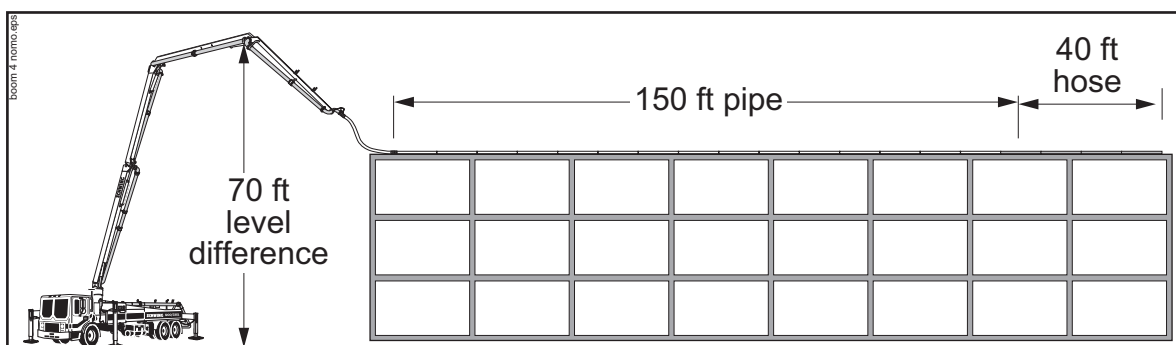


When the output line intersects the pipeline diameter that corresponds to your job, draw a line straight down into the lower right quadrant (see illustration).

3. The lower right quadrant refers to the proportional value of your pipeline. It is a way of taking into account not only the length of the pipeline, but also the number of bends, the increased resistance of flow in rubber hose, and other factors. It is more a measure of the resistance to flow than a measure of length. In calculating the proportional value of your pipeline, always apply the following criteria:

- each 90 degree bend with a radius of 250 mm (boom elbow) = 3.5 ft
- each 90 degree bend with a radius of 1 meter (long sweep) = 10 ft
- each 30 degree or 45 degree bend with a radius of 1 meter or 250 mm = 3 ft
- each section of rubber hose causes three times as much resistance as the same length of steel pipe (e.g., 12 ft of rubber hose has the same resistance as 36 ft of pipeline)

Figure all horizontal and vertical distances equally. The increased pressure required to push concrete vertically is accounted for by adding pressure, not distance. An example pipeline is shown below.



- elbow - 90 degrees, $r = 250 \text{ mm} \dots 3.5 \text{ ft}$
- elbow - 90 degrees, $r = 1 \text{ m} \dots 10 \text{ ft}$
- elbow - 30 degrees or 45 degrees, $r = 250 \text{ mm or } 1 \text{ m} \dots 3 \text{ ft}$

Example: You must go 150 feet out through the deck and boom pipe, including the tip hose, then through 40 feet of rubber hose. Calculate the proportional value as follows:

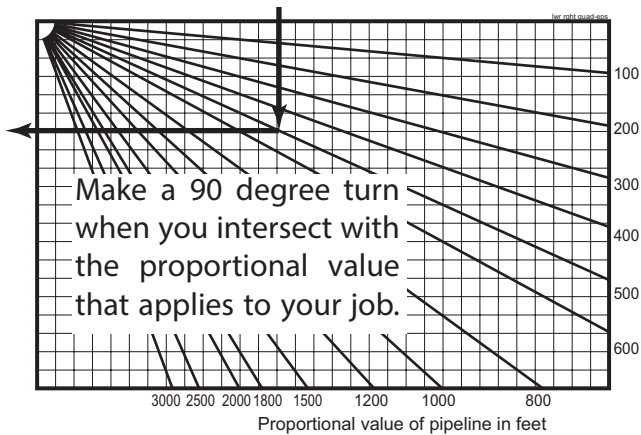
$$\begin{aligned}
 &\text{all boom system} = 260.0 \text{ ft (includes a 12-ft long, 5-inch tip hose)} \\
 &15 \text{ 10-foot pipe sections} = 150.0 \text{ ft} \\
 &40 \times 3 = 120.0 \text{ ft (for the rubber hose)} \\
 &\hline
 &\text{Total} = 530.0 \text{ ft}
 \end{aligned}$$

Round down to 500 ft to make it easy to use the chart.

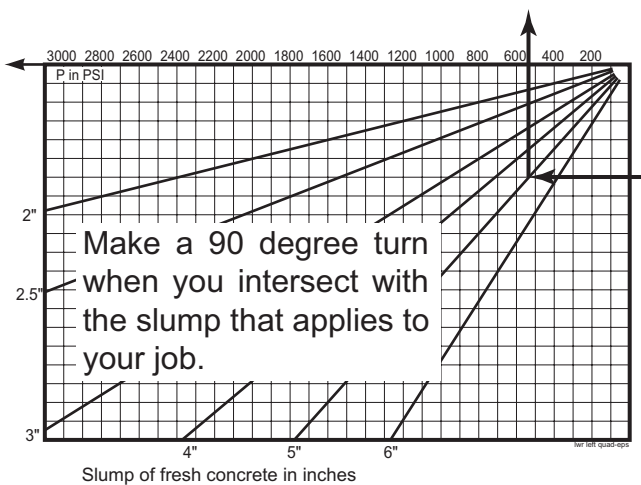
NOTE:

Proportional value of the 41-meter boom and deck pipe system is 260 ft. This value includes elbows, reducer, and tip hose.

Once you have calculated the proportional value of your pipeline, extend your line down from the upper right quadrant until it intersects with the line that represents your pipeline. When you reach the intersection, make a 90 degree turn clockwise into the lower left quadrant. As noted previously, 500 feet is the proportional value for this example.



4. The lower left quadrant refers to the pumpability of the concrete. If the concrete specifications allow a range in slump (for example 5 to 6 inches), always use the lower end to be safe. In this example, it is 5 inches. Extend the line from the lower right quadrant until it intersects with the 5-inch slump line, and then make a 90 degree turn clockwise. This will lead you back into the upper left quadrant through the pressure scale.



The line is re-entering the upper left quadrant through the pressure scale at about 550 psi. Remember, you now have to add the head pressure for the vertical rise. At 1.1 psi per foot of level difference and the 70-foot vertical run, you must now add $1.1 \times 70 = 77$ psi to the 550 psi from the chart.

$$550 \text{ psi} + 77 \text{ psi} = 627 \text{ psi}$$

When calculating the head pressure from vertical runs, it doesn't matter if the pipeline runs straight up and down or if it runs uphill at an angle. Only the level difference (in feet) is needed for the pressure calculation. If the pipeline is running downhill, the operator will need special knowledge, but you don't need to add any head pressure to the nomograph.

The nomograph is now complete. The PF of our job can be calculated like this:

$$PF = \text{psi} \times \text{yd}^3/\text{hr}$$

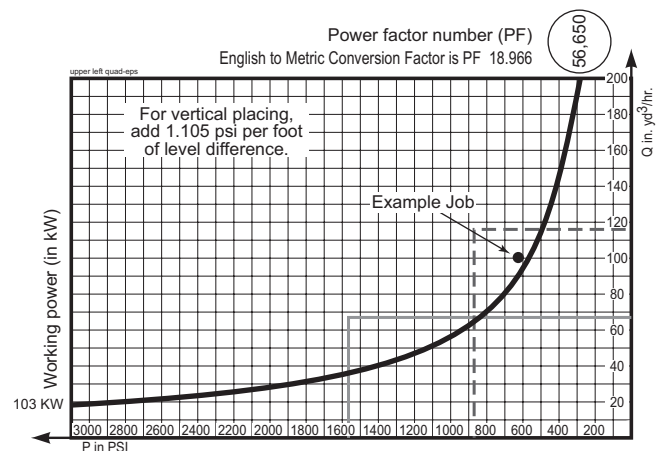
The unit needs to be capable of 627 psi and 100 yd^3/hr . The PF of this job is:

$$PF = (627 \times 100)$$

$$PF = 62,700$$

The unit must have a PF over 62,700, and it must be able to pump 100 yd^3/hr and 627 psi simultaneously. Look at the pump shown in the sample nomograph.

- Can the unit pump at 627 psi? **Yes**
 - Can the unit pump 100 yd^3/hr ? **Yes**
 - Can the unit pump both simultaneously? **No!**
- This unit will not do the job.**



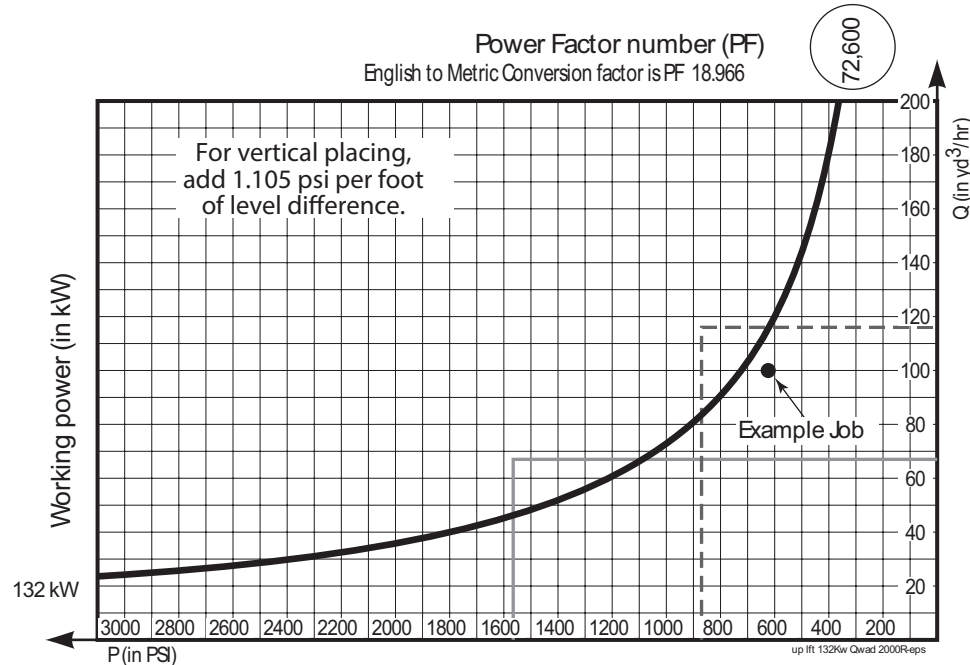
The engine is a little too small. The intersection of 100 yards³/hr and 627 psi has been plotted for visual representation, but you can see immediately that the PF of the job (62,700) is bigger than the PF of the unit (56,650). The curved black line represents the PF of the unit. If the unit is going to be able to handle the job, the intersection of pressure and yd³/hr will be to the right and down from the curved line. Anything to the left or above the line is beyond the power of the hydraulic pumps. If we could order this same unit with the pumps set to a higher kW, the PF of the higher kW unit would be 72,600, which would be sufficient.

Plotting the intersection of our hypothetical job again, you can see that it falls within the power zone of the hydraulic pumps of the higher kW unit.

Bearing in mind that the nomograph should only be considered accurate to within ± 10 percent, you should always calculate conservatively, and allow for the graph tolerance. In the case of our example, we should still be safe even if the pressure required were 10% greater

(690 psi). What if you already own the pump shown in our example? Is there anything that can be done to the job specifications to make the unit with the less powerful pumps work? You could use the smaller PF unit if you can get permission to do any of the following things:

- Pump the top of the building at 85 yd³/hr instead of 100 yd³/hr.
- Pump the top of the building at a 6-inch slump instead of 5 inches. (This would still be within specifications.)
- Remove some of the rubber hose at the end of the horizontal run. Normally, with job circumstances that did not require a substantial vertical run, you could also use 6-inch instead of 5-inch diameter pipeline. But in this example, the entire vertical run was made with the boom. The boom can never support a 6-inch pipeline.



Glossary of Terms

Accumulator

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

Agitator

A device set in the concrete hopper to keep concrete moving, which prevents it from setting. It is typically a rotating shaft to which several paddles have been mounted.

AWS D1.1

The code for structural welding with steel as defined by the American Welding Society. Sections 3, 5, and paragraph 9.25 of Section 9 apply.

Blanking Plate

Also referred to as a blanking plug or an end cap. It prevents material from falling out of the delivery system (typically the end hose) when moving a full boom over personnel or property.

Blockage

If the pump is pushing and concrete fails to come out at the point of discharge, a blockage is the cause. Blockages can create dangerous situations by causing high concrete pressure combined with the sometimes uncoordinated efforts of untrained workers to remedy the problem.

Bulk Density

The mass of a substance per volume. For example: 1 cubic foot of air weighs much less than 1 cubic foot of water; and one cubic foot of lightweight concrete weighs less than 1 cubic foot of steel-entrained concrete. Water has a higher bulk density than air, and 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 who 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 or she must pass tests regarding

operation, setup, and clean out for each category of pump. They must also pass the safety rules test common to all certification categories, meet the experience requirements set forth for each category, and maintain a safe and clean driving record. Certified operators are considered qualified operators in their categories.

Certified Welder

As it relates to concrete pumping and this safety manual, a Certified Welder is a person who has applied for, taken, and passed the American Welding Society (AWS) or the European Normal (EN) test for structural steel welding. Anyone welding on a concrete pump placing boom, outrigger, tower, or other device must be certified to AWS D1.1 or EN287-1/PREN288-3.

Concrete Pressure

The force per square area that is exerted on the concrete. The concrete pressure is always a ratio in direct proportion to the hydraulic oil pressure on the concrete pump circuit.

Conductors

Materials that conduct electricity. Copper, silver, aluminum, gold, steel, and water are considered good conductors of electricity. Air, fiberglass, rubber, ceramics, and glass are considered poor conductors. All conductors have a resistance to the flow of electricity, which is measured in terms of ohms per linear foot. As voltage increases, more current flows through the same resistance. With high-voltage electric wires—8000 volts, for example—even poor conductors carry enough current through your body to ground to kill you. (As little as 35 milliamps can cause cardiac arrest.) Some conductors, such as air, resist electricity verywell, but if the voltage gets high enough, current will flow. (Lightning is a good example of this.)

Decibels

A measurement of volume equal to one tenth of a bel, abbreviated dB. As it applies to concrete pumps, it is a measurement of the sound pressure level one meter away from a noise source. Because constant exposure to loud sound can cause permanent hearing loss, OSHA has developed guidelines for time limits on exposure to sound at different volumes. The chart is in section 6.9 of the Safety 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.

Electrocution

Made by combining the words “electric” + “execution.” It means “death by electricity.”

EN 287-1 / PREN 288-3

The code for structural welding with steel as defined by the European Norm.

Expert

As used in this manual, an expert is defined as a person who, on the basis of specialized training and experience, has developed a high degree of knowledge and skill in the areas of concrete pumps, concrete pumping, clean out procedures, generally accepted engineering norms, and safety regulations to the extent of being able to evaluate equipment and processes as they relate to job safety. Experts demonstrate their knowledge and abilities by passing the certification testing and experience requirements of the American Concrete Pumping Association. Other experts may include master mechanics and after-sales service technicians of the manufacturer.

Fast Switch

A secondary hydraulic circuit added to single- circuit machines to disable the stroke limiter during the switch of the rock valve cylinder, thereby making the rock valve switch quickly. This circuit is not needed or available on twin- circuit machines.

Foreign Material

Material that was never intended to be pumped but 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 soft drink cans. Many of these items can create a blockage if they are pumped through the system.

Go Devil

A plug made from a rubber composite, usually with several fins that expand to seal when pressure is applied. Go devils are intended to be inserted in a steel delivery pipeline and pushed with water or compressed air for the purpose of cleaning the pipe. Not to be used with rubber hose or short sections of pipe.

Guide

An assistant brought in to help with backing up a truck or trailer or with other circumstances in which the driver cannot see enough to ensure safety.

High Voltage

For the purposes of this manual, any current over 120 Vac is considered high voltage. In the United States, electrically driven concrete pumps normally operate the motors at 480 Vac (high voltage) and the controls at 24 Vdc (low voltage). With electric wires in residential or industrial areas, the voltage is approximately 8000 volts to ground or 13,800 volts from phase to phase (distribution voltage). When dealing with electric wires that are mounted high above the ground on steel towers, the voltage ranges from 100,000 V to 1,000,000 V (transmission voltage).

Hopper Grate

A meshwork typically made from steel bars and placed over the concrete hopper. It serves to keep human body parts away from the agitator (when left in its proper position) and to keep large foreign objects from falling into the hopper, which could cause blockages if they were pumped. The hopper grate must be secured in position in order to be effective.

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, but the work should still be completed by a competent professional. Under no circumstances should high-voltage connections be made by a concrete pump operator or related personnel.

Maintenance

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

Maximum Pressure

When talking about a hydraulic system, maximum pressure refers to the highest pressure that can be achieved with the settings of the circuit relief valves. When discussing concrete output, maximum pressure refers to the pressure that will be developed if the hydraulic system pressure reaches the relief valve setting. Concrete pressure is always 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. During normal pumping, the resistance of moving the concrete through the pipe or boom creates the pressure needed by the pump and is well under the maximum 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 or electrical wires while leaving room for errors in human judgment or machine malfunction. The distance from electrical wires in the United States is 20 feet, as recommended by the American Concrete Pumping Association. This distance may have other values in different countries.

Murphy’s Law

An old adage that says: “Anything that can go wrong, will go wrong, and at the worst possible time.”

Operational Area

The area around a working piece of equipment or point of discharge where dangers can be encountered because of the nature of the machinery or process in use. For safety reasons, do not allow unauthorized presence in the operational area.

OSHA

Occupational Safety and Health Administration. A branch of the US federal government that deals with job safety. One of the areas over which it has authority is construction job sites and workshops.

Personal Protective Equipment

Things worn to protect yourself from potential dangers in a concrete placing environment. Examples are: snug-fitting work clothes, steel-toed work boots, lime-resistant glove, safety glasses, ear muffs or ear plugs, rubber boots, and hard hats.

Point of Discharge

The location on the machine from which concrete is expelled from a delivery system. This can be the point of placement (the actual form that is being filled with concrete) or the clean out area after completion of a 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.”

Prime Mover

The primary power source for a hydraulic system. The term “prime mover” denotes neither an internal combustion engine nor an electric motor.

PTO (Power Take Off)

A switchable output from the transmission or an intermediate gearcase. On a concrete pump, the PTO is used to divert the power from the engine and drive train to turn the hydraulic pumps.

Qualified Operator

An individual who meets all the following qualifications:

- has reached the age of 18
- is physically and mentally capable
- has been trained in the proper operation and maintenance of the pump and placing boom, if applicable
- has demonstrated his or her capabilities to the hiring company with respect to the operation and maintenance of the pump and placing boom
- can be expected to perform assigned duties in a reliable manner

Qualified Personnel

A generic term used to describe people who are qualified to do work in their area of application. For example, having your boom repairs inspected by “qualified personnel” before use refers 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 meets all of the following qualifications:

- 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 with regard to the procedures and rules discussed above
- can be expected to perform assigned duties 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. The rock (larger aggregates of the mix) forms a wedge inside the pipe. Resistance to movement then becomes overpowering, and the concrete stops. Increasing pressure to try to remove the wedge only results in forcing more of the finest particles past the rocks, compounding the problem. In some cases, the wedge can be broken up by alternately pumping in forward and then reverse.

Separate Pipeline

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

Shut-Off Valve

In hydraulics: a valve with the ability to stop the flow or pressure of hydraulic oil. Must be able to withstand the maximum pressure of the hydraulic circuit that it controls. In concrete: A manually or hydraulically operated valve that prevents the flow of concrete in either direction. Some concrete shut-off valves also have the ability to divert the flow of concrete to a different pipeline (for example, to a discharge point for clean out). The shut-off valve must be able to withstand the maximum pressure on the concrete of which the pump is capable.

Soft Switch

A secondary hydraulic circuit added to twin-circuit machines to account for the oil coming from the main hydraulic pumps while the rock valve is being switched by the oil from the accumulator.

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 determine the stability of the soil, see the chart in section 5.16 of this manual.

Sponge Ball

A medium to hard, spherical sponge used to clean the inside of delivery pipelines.

Spotter

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

Sucking Back

The act of moving the concrete pump into the reverse mode for any of several reasons. Some examples of reasons to suck back:

- to relieve pressure in the delivery system before opening when a blockage has occurred
- to clean the boom with a sponge ball upon completion of the pour
- to remove concrete from the boom for the purpose of folding the boom for moving

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).

Transport Position

Transport position refers to the position of the boom during transport. For transport, the boom is completely folded and lowered into the rests, and the boom straps are secured. When stowing in the traveling position because of a thunderstorm, however, the boom straps need not be secured if no travel is imminent.

Twin Circuit

The plumbing method used for the pumpkit in which the differential cylinders are moved by the main hydraulic pumps but the rock valve is moved by the oil stored in an accumulator.

Unauthorized

Without having authority or permission. Examples: Unauthorized operation of the boom could be operation by a passing teenager. Unauthorized repairs to the boom could be repairs made without the manufacturer's permission.

Unintentional Movement

Movement of the pump, boom, or related equipment without a specific, intentional command by the operator. An example of an unintentional movement is if an operator fell while walking with the remote control box and accidentally hit a joystick, which caused a boom movement. Unintentional movement can be avoided by disabling the hydraulic system with the emergency stop devices when the unit is not in immediate use.

Vertical Run

Sections of concrete delivery pipeline that run in an up and 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.

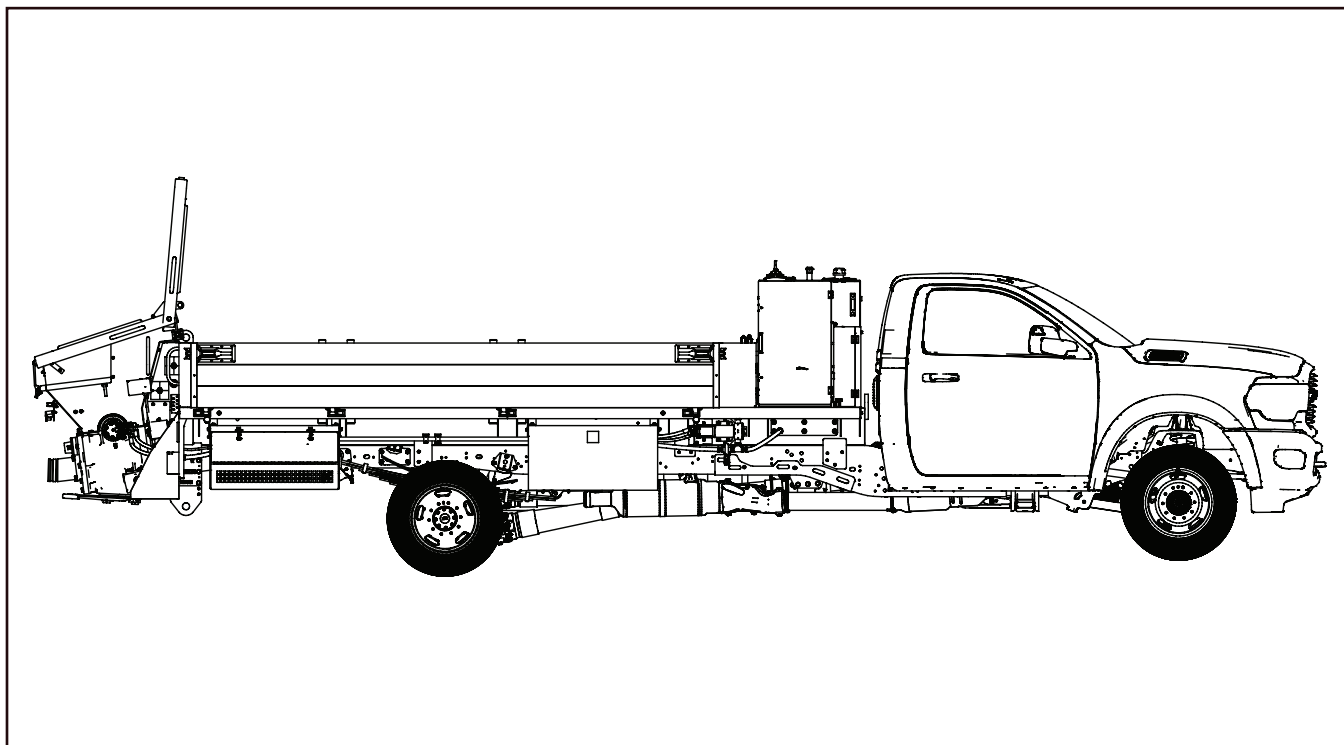
Water Jet

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

Additional Reading Material

This is a partial list of the books that have been written on the subject of concrete pumping. Omission of any relevant books was done so unintentionally.

- Pumping Concrete and Concrete Pumps. Karl Ernst v. Eckardstein. F. W. Schwing GmbH, 1983.
- Pumping Concrete—Techniques and Applications. Robert Allen Crepas. Aberdeen Group, 1991.



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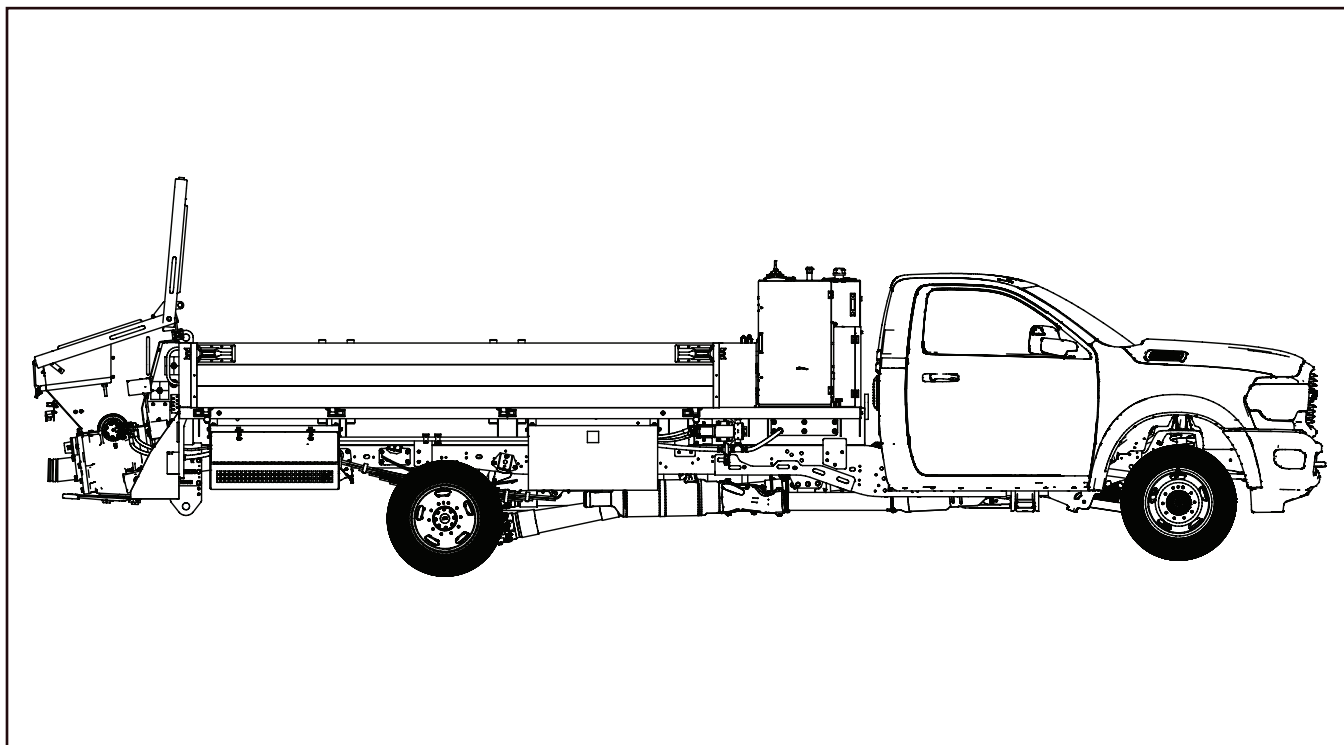
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Preparing for the Job

The Short Instruction section of this manual is for quick reference only. Operators need to read through and understand the entire manual.

Before using the stationary pump, please review the following topics:

- Safety (page 19)
- Safety Devices (page 30)
- Machine Overview (page 33)
- Personal Protective Equipment (page 63)
- Unit Setup (page 67)



Figure 1
Personal Protective Equipment (PPE)

Unit Setup

Selecting the Setup Location

When you arrive on the job, check with the job supervisor to determine where you should set up. If possible, choose a flat, firm, and dry location that allows hopper access for two ready-mix trucks.

Laying Out the Pipeline

Start at the point of discharge and work your way back to the pump. In most cases, you will need rubber hose at the point of discharge. Placing crews always prefer 3 or 4-inch rubber hose over 5-inch hose. This means that you will need a reducer at the discharge end.

If you will have to reduce to smaller-diameter pipe or hose for the placing crew, always make the long part of the run with the larger diameter, and reduce as close as possible to the point of discharge.

Use the fewest hoses possible. Hose has greater resistance to flow than pipe does, so more pressure is needed to push through hoses than through pipe.

Use the largest-diameter hose the crew will allow you to use. The diameter of the hose determines the largest-size stone you can pump. If you will be pumping stone larger than 1 inch in diameter, you will not be able to use hose that is 3 inches or smaller. To attempt to do so would result in a blockage.

Do not use hose for changing pipeline direction. Pipe elbows are available with many degrees of bend, and pipes require less pumping pressure than hose.

Enabling Pump and Drive Modes

Enable Pump Mode

- Start the vehicle.
- With the engine running, apply the parking brake.
- Verify the vehicle is in 2-wheel drive. If the vehicle is not in 2-wheel drive, the indicator light underneath the driver-side of the dashboard will be a solid magenta.
- Use the indicator light underneath the driver-side of the dashboard to guide you through each step:
 - A solid red light means that the air pressure needs to raise, wait for the air pressure to build up.
 - A flashing white light is the signal to shift the vehicle into neutral.
 - A flashing magenta light is the signal to press the AUX5(PTO) button on the center of the dashboard, which will shift the transfer case.
 - A flashing green light is the signal to shift the vehicle into drive without pressing on the brake; the unit should lockup into 16th gear.
 - A solid green light indicates that the machine is ready to pump.
- If at any point the indicator light is flashing white or flashing yellow, then there is an error and the cycle outlined above should be repeated.
- A flashing red indicator light means that there is an error displayed on the PLC; check the error and correct it.

Enable Drive Mode

- Press foot on the brake and then shift vehicle into neutral.
- The indicator light underneath the driver-side of the dashboard should begin flashing yellow; press the AUX5(PTO) button on the center of the dashboard to shift into drive mode.
- Put vehicle into park.
- Verify parking the brake is disabled before driving.



NOTE

If the transmission is shifted to neutral after pumping, the system will not allow you to re-enter pump mode until the AUX5(PTO) switch is cycled.



NOTE

Pump mode will be disabled if you start the truck while still in pump mode; it must be taken out of pump mode and then put back in.

Indicator Light Meaning	
Flashing Blue	Set Parking Brake
Solid Magenta	Disable AWD/4x4
Solid Red	Low Air Pressure - Wait
Flashing White	Shift to Neutral
Flashing Magenta	Enable Pump Mode (Aux5(PTO))
Flashing Green	Shift to Drive
Solid Green	Lockup Successful - Ready to Pump
Flashing Yellow	Enable Drive Mode
Flashing Red	Check Error at PLC

Pumping the Job

Operate this machine from the ground to avoid falling and other possible hazards.

If you cannot see the point of discharge from where you are operating the unit, be sure your spotter is in position before you start the pump.

As soon as the spotter gives you the start signal, put the pump in forward and alert the ready-mix driver to start dumping.

⚠ WARNING You cannot completely empty the hopper, because air will be drawn into the concrete cylinders. This air will compress during the pushing stroke and explode into the hopper when the transfer tube switches

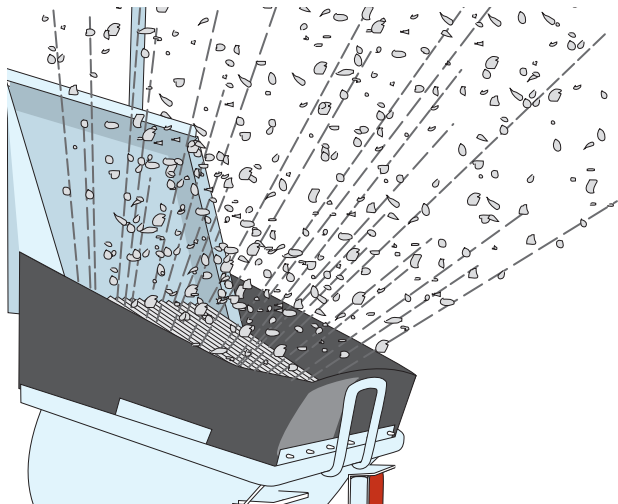


Figure 2
Concrete Exploding from Hopper

Concrete must always cover the openings of the material cylinders so air will not be sucked into the material cylinders. If that occurred, concrete would be rapidly expelled as compressed air escaped on the next stroke. This can be extremely dangerous, so be sure the ready-mix driver understands the situation. If air has entered the material cylinders, you can cushion the expulsion by stopping the concrete pump and filling the hopper with concrete before the next stroke. When the hopper is full, it is still not safe to resume pumping. Even with the hopper full of concrete, some compressed air will be introduced into the delivery pipeline. When it reaches the discharge point, the air will cause the concrete to

be expelled forcefully. If the hose handler is walking a wall or column or is in another precarious position when this occurs, an accident could easily occur. It is best to avoid ever sucking air into the material cylinders. **If you do accidentally suck air into the material cylinders, warn the hose handler and clear the immediate area around the hose until the air is released and concrete is flowing steadily.**

Point out the emergency stop switches to the driver if you will be standing somewhere other than at the operator's panel. That way, the driver can warn you or stop the machine if he sees a dangerous situation developing.

Always keep an eye on the point of discharge or on your spotter. If the hose person is giving you signals, he will have his hands full and will not be able to jump up and down or wave his hands to get your attention. On a typical job site, it is doubtful that you could hear him yelling.

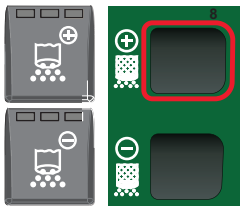
As the day progresses and the crew removes pipe sections from the end of the slickline, wash the pipes, clamps and gaskets with water as soon as possible. If you do not wash them until the pour is finished, you will not be able to get the hardened concrete out of them. This job can be done between loads of concrete, or by an oiler or laborer at almost any time.



Figure 3
Washing the Pipe System

Controlling the Concrete Pump

Stroke Limiter



The stroke limiter is a hydraulic device that can be electrically adjusted with the stroke limiter (+) and (-) buttons, located at the rear operators station or cable remote. Its function is to raise and lower the output of the hydraulic pumps that operate the concrete pumpkit.

This has the advantage of allowing the engine to remain at higher RPMs, where horsepower is at the maximum.

The stroke limiter has an adjustment range of 95 percent. That means it can go from as low as 2 strokes per minute to maximum strokes per minute. The stroke limiter only adjusts the output of the hydraulic pumps while the differential cylinders are moving. That means that when the differential cylinders are stopped at the end of the stroke and the rock valve is moving, the pumps don't return to maximum output until the rock valve cylinder has completed its travel.

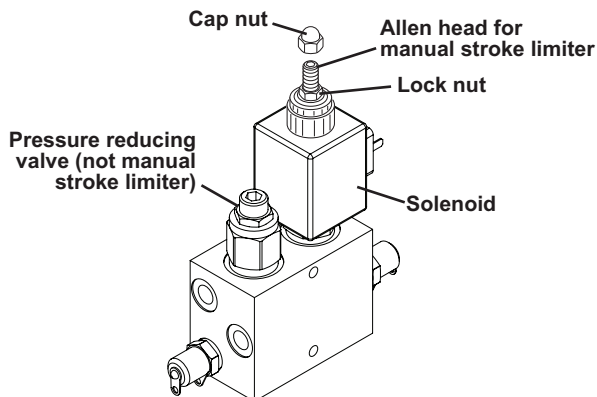


Figure 4
Stroke Limiter Control Block

If electrical control of the stroke limiter is lost, it can be adjusted manually by removing the cap nut located on the top of the solenoid assembly and loosening the lock nut with a 1/2 inch wrench. The adjustment is then accomplished with a 5/32 inch allen wrench by turning the screw in (clockwise) to decrease strokes or out (counter clockwise) to increase strokes. Always return the manual stroke limiter to maximum strokes (full counter clockwise out position) when electrical power is restored.

Soft Switch

Your pump is designed with a soft switch system that reduces main system pressure during the shifting of the rock valve. In the event of a failure in the soft switch system, it is possible that your main system pumping pressure could be reduced to the continuous pressure of the soft switch system (100 bar). In an emergency, it is possible to disable the soft switch function by turning the soft switch shut-off valve 90 degrees (Figure 5).

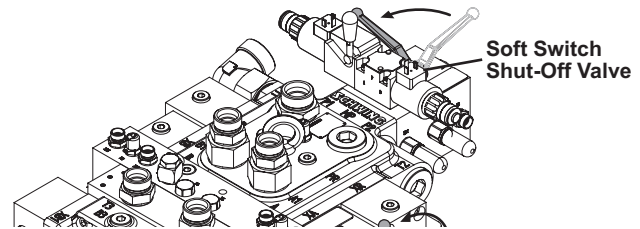


Figure 5
Disabling Soft Switch

Vibrator (Optional)



If you are pouring stiff concrete that is not flowing well through the hopper grate, use the Vibrator On/Off Switch to turn on your vibrator. The vibrator helps low-slump concrete fall through the hopper grate by shaking the hopper itself or the grate. If you didn't buy a vibrator with your unit, you can purchase one for field retrofit by calling the SCHWING Service Center at 1-888-292-0262.

Time Constraints

Remember, if anything goes wrong on the unit while it is pumping, you only have 15 to 30 minutes to solve the problem before the concrete sets. (Less with old concrete on a hot day, more with fresh concrete on a cool, cloudy day). If you know that it will take longer than 30 minutes to fix, the problem, clean out before you begin repairs. If concrete is beginning to set, you will have to clean out in a very quick and efficient manner. There are special instructions which you will find in the Operation section of this manual. If you don't panic and keep moving, you can usually avoid cleaning or replacing the pipes. Old concrete and hot days is the worst case scenario. Under certain hot weather and old concrete circumstances, the concrete may go from being pumpable to setting very, very quickly. This is called 'flashing', and if it happens, you may lose some pipe.

Emergency Procedures

Electrical Power Loss

If there is an electrical malfunction with the E-stop circuit, the dump valves will open, disabling the hydraulic circuit. To continue use, remove the main power connectors from the E-stop harness and replace them with the emergency power cable connectors (Figure 6). This will restore power to the dump valves and allow the system to build hydraulic pressure. On the SCT2 controller, navigate to the Maintenance Screen. Use the  arrows to select Override Enable (Figure 7). When selected, press . Engine RPM buttons will appear on the screen. Press the RPM  button to ramp up engine RPM to the desired speed. Hydraulic functions can now be controlled by the override handles and the oil cooler will be turned on. Note: for LRC machines, the RPM  button will place the engine to maximum RPM. Use the RPM  button to lower engine RPM. To return the engine to idle and shut the oil cooler off, ensure "Override Enable" is selected on the Maintenance Screen, and press . This will disable the override.

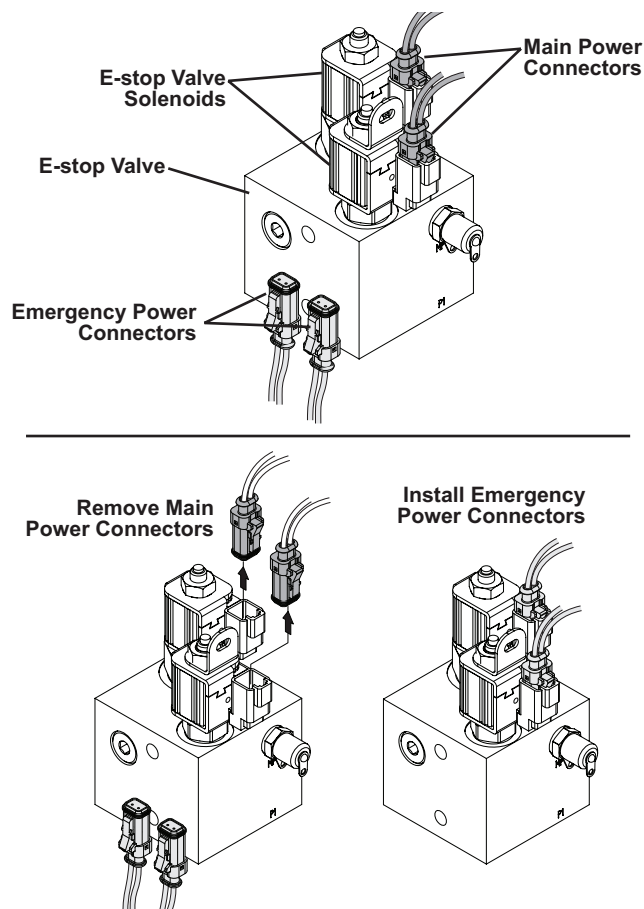


Figure 6
Connecting the Emergency Power Harness

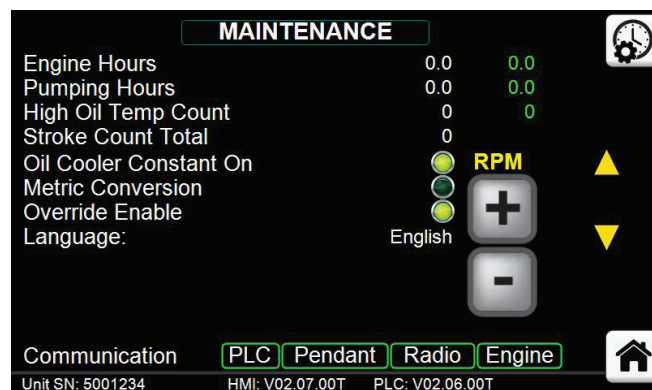


Figure 7
Maintenance Screen - Override Enable

Emergency Override Button

⚠ DANGER If the hydraulic dump valves are electrically overridden, the E-stop buttons will no longer be operable. This removes all E-stop buttons and the hopper grate sensors as machine safeguards. This procedure should only be performed by a certified operator.

If you cannot correct the electrical power loss problem, try activating the dump valves by pushing the two override buttons on the E-stop while another person activates the concrete pump forward/reverse handle on the S1/S2 control block (Figure 8). Activating the three valves will close the dump valves allowing the accumulator to shift the concrete valve and the pump to be cleaned out.

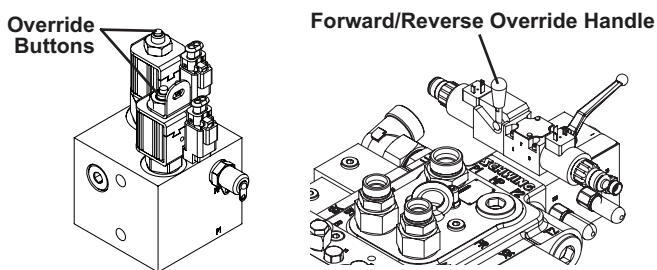


Figure 8
E-stop Override Buttons / Concrete Pump Forward/Reverse Override Handle

For information on where to look and what to do if you lose electricity on the unit, contact the SCHWING Service Center at 1-888-292-0262.

Adjusting the Stroke Limiter - Electrically

If the dump valve coils are connected with the emergency power connectors, SCT2 will trigger the stroke limiter to minimum strokes per limit. It may still be possible to operate the stroke limiter via remote control. All other functions must be operated manually.

Adjusting the Stroke Limiter - Manually

With the emergency power connector plugged in and the PLC working, the maximum amount of milliamps will be sent to the stroke limiter producing minimum strokes per minute. Before manually adjusting the stroke limiter, the power connector needs to be removed from the solenoid to open the circuit (Figure 9).

NOTE If the PLC is not working, the stroke limiter will produce the maximum strokes per minute.

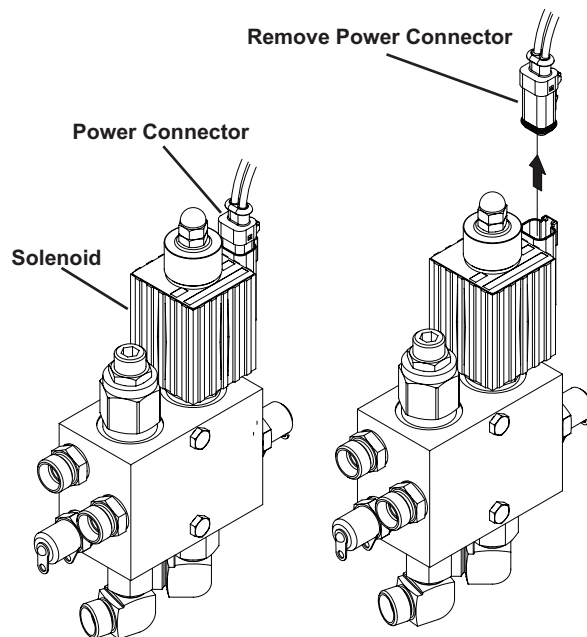


Figure 9
Removing Power Connector

Once the power connector is removed from the solenoid, the valve will go to maximum stroke output. To lower the strokes per minute, remove the cap nut located on the top of the solenoid assembly and loosen the lock nut with a 1/2-inch wrench. Use a 5/32-inch allen wrench and turn the screw in (clockwise), this will decrease the strokes per minute. When the proper speed is reached, lock the jam nut with the 1/2-inch wrench (Figure 10).

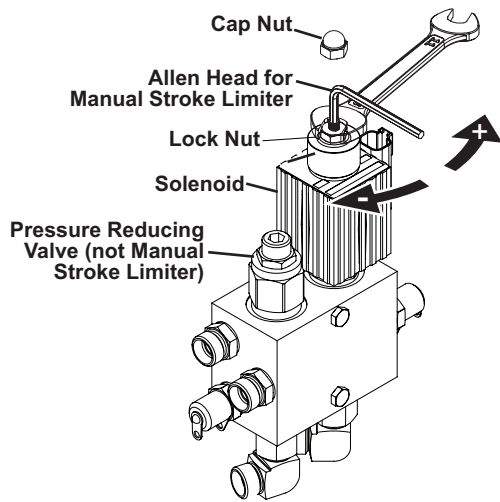


Figure 10
Stroke Limiter Control Block

Return the lock nut and cap to the solenoid assembly and reconnect the power connector to the solenoid once power is restored to the unit.

