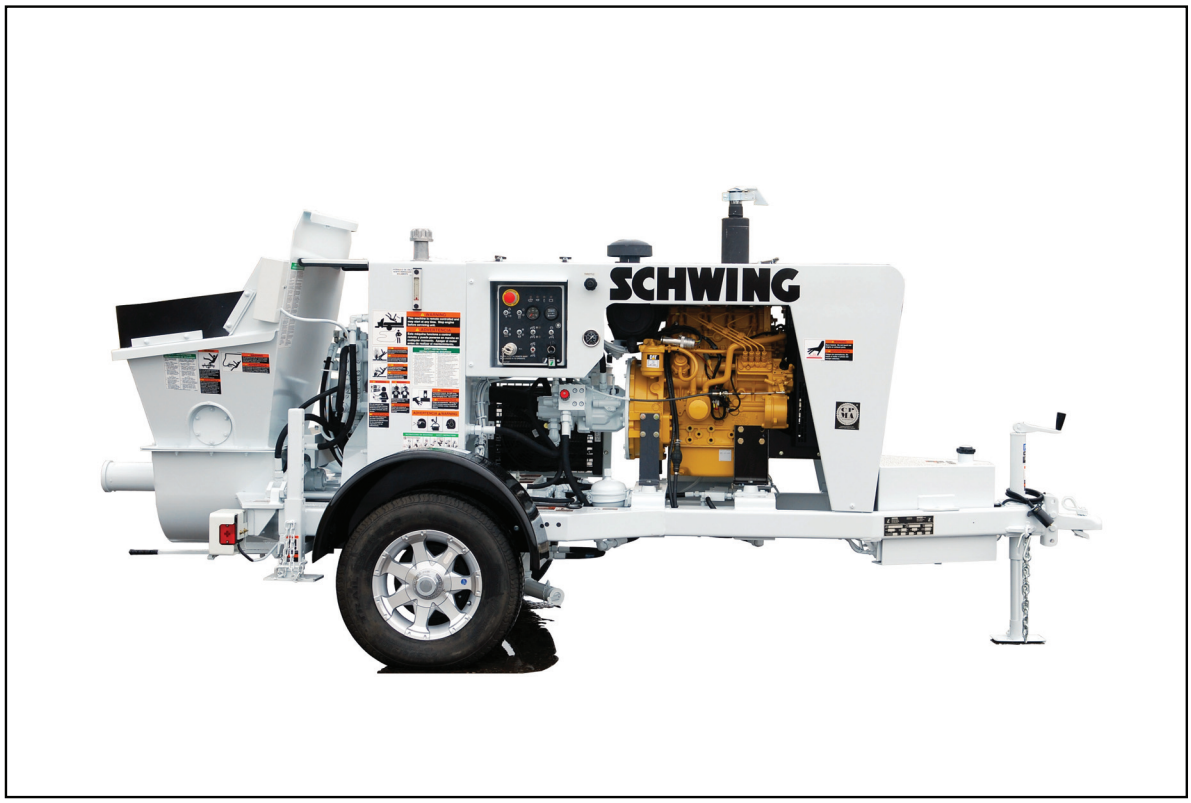
SCHWING AMERICA INC.

Operation Manual for

Model SP 305



Operation Manual

Version 5.0.1

Part Number 30362000

INTRODUCTION

SPECIFICATIONS

SAFETY

OPERATION

MAINTENANCE

APPENDIX

INDEX

INTRODUCTION

INTRODUCTION

This operation manual contains unit specifications, product overview information, the *Safety Manual*, operation information, and maintenance information for your concrete pump unit.

Manufacturer's Statement

⚠ WARNING

Improper setup / operation creates hazards. Do not operate this machine without training. Understand the warnings in safety manuals and on decals.

000099.eps

The information contained in the operation manual is absolutely necessary for the safety, proper setup, operation, maintenance, and servicing of your concrete pump. By learning this information and practicing it every day, you can expect that your concrete pump unit will give you efficient and reliable service year after year.

For your own benefit and safety, read the information in this manual, and follow the instructions to the letter.

Before you operate your concrete pump for the first time, you should read the operating instructions several times through. We recommend that you keep a copy with the concrete pump for quick reference while on the job site. The general knowledge must be in place before you arrive on the job site. Any and all persons who operate a concrete pump must be familiar with the operating instructions. Even a temporary operator (for example, if the normal operator is ill or on vacation) must be familiar with the operation instructions. It stands to reason that a person who has not operated a particular concrete pump before will not know how to safely operate that concrete pump. The machine is built to the latest technology and safety regulations, but it may still be dangerous to people and property if it is operated, maintained, repaired, or used incorrectly.

The illustrations contained in this manual are intended to clarify text passages. They may look slightly different from your unit, but this has only been allowed if it does not fundamentally change the factual information.

Technical modifications that are made to units will be documented in each new edition of the operation manual.

Safety alert symbol and signal word explanation

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

Danger

⚠

Warning

Caution

- 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 point addresses a hazard which **COULD** cause **damage to equipment or property.**

Warnings have been placed in the text where needed. Additional information used with the signal words is printed in decal format, as shown below, to explain the specific hazard. Occasionally **bold** text is used in addition to the decal for emphasis.

All persons working near the concrete pump unit 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.

Heed the warnings shown on the decals!

⚠ DANGER

Hazard and consequence will be shown in this space.

000054.eps

⚠ WARNING

Hazard and consequence will be shown in this space.

000057.eps

⚠ CAUTION

Hazard and consequence will be shown in this space.

000036.eps

How to reach us

If you encounter a circumstance that is not covered by this manual, Schwing America's Service Department will be more than happy to assist you with all of your parts and service needs. Call us at either of these #'s:

- Minnesota (main office) **(651) 429 - 0999**
- Call Center **1- 888-Schwing (724-9464)**

How to order parts

To place an order for spare parts, you can order on line at **schwingparts.com**, or you can call our toll free parts line from anywhere in the continental United States, except Minnesota. Parts department hours are Monday through Friday, 6:00 AM to 6:00 PM (central time). Orders will also be accepted via fax, 24 hours/day.

- Spare Parts **1- 888-Schwing (724-9464)**
- Spare Parts **(fax) (651) 429 - 2112**

Whenever you call the factory for spare parts or service, always have the model number handy. You can find the model and serial number on the ID tag that is mounted to the subframe of the unit (Figure 2).

For future reference, the model number and serial number of your machine has been placed in the spaces provided below

Orientation

Throughout this manual, we will refer to locations on the unit as *driver side* and *passenger side*. We use these terms instead of right or left to avoid confusion regarding which way you must be facing to have a left or right orientation (Figure 1).

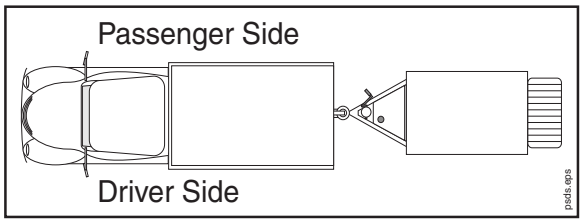


Figure 1
Driver Side / Passenger Side orientation

Model Number

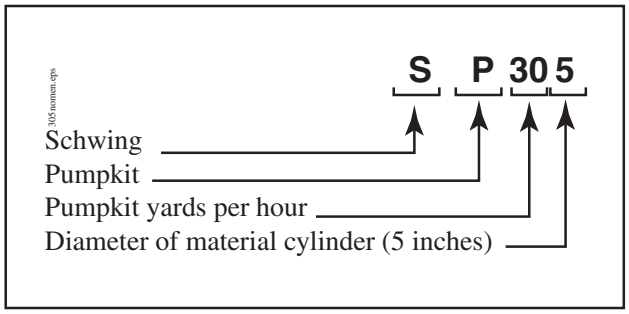
Serial Number

Model Number Nomenclature

The complete model number of Schwing America's concrete pumps is designated by codes like the following:

SP 305

The code is broken down as follows:

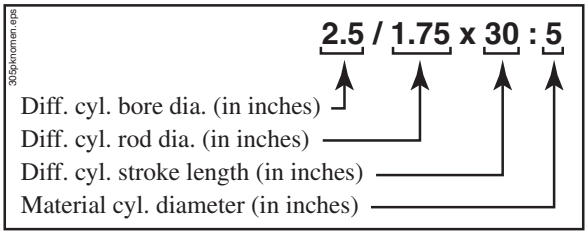


The "P", as the illustration shows, stands for pumpkit. The 305, in this example, designates 30 yards per hour and the 5 inch diameter of the material cylinders.

Other pumpkits are available for this machine style, and using any of them would change the model number of the unit. For example, if you ordered this unit with a 204 pumpkit, the model number of the same unit would become:

P 305

The pumpkit has its own complete model number which will tell you about the differential cylinder bore diameter, rod diameter, and stroke length, as well as the material cylinder diameter. You will find this used on the output charts and nomographs for specific machines. For example:



The bore diameter of the differential cylinders in this example is 2.5 inches, while the rod diameter is 1.75 inches. The stroke length of the differential cylinders is 30 inches, and the diameter of the material cylinders is 5 inches.

ID Tags

There is an identification tag on the unit, called the *main ID tag*. The main ID tag is attached on the passenger side of the subframe (Figure 2).

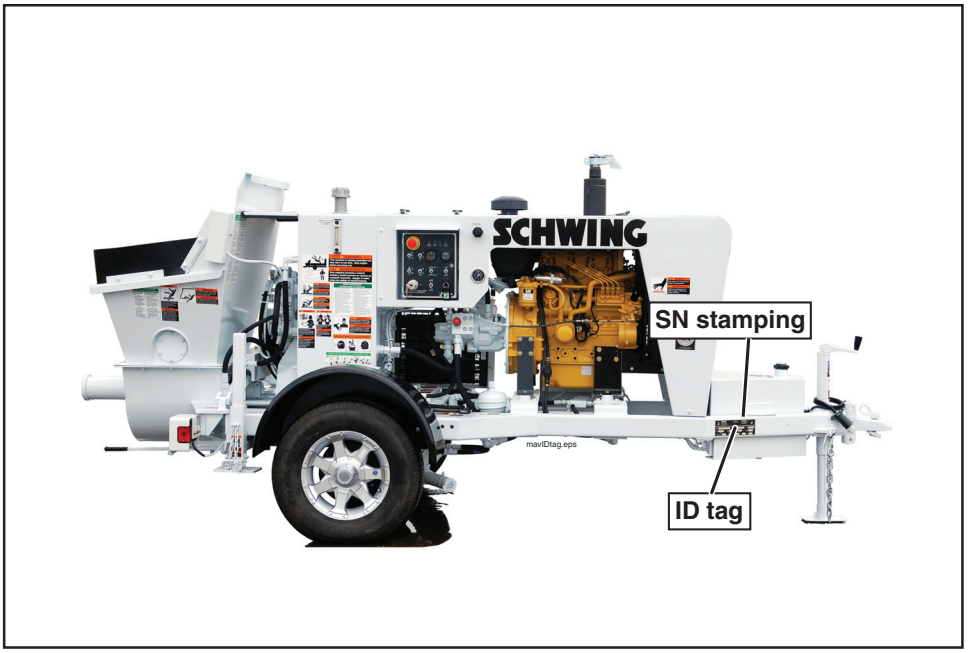


Figure 2
Main ID tag and stamped serial number locations

NOTE!

The information represented on the tag is for illustration only. Check the tag on your unit to obtain the specific numbers which apply to your unit.

Main ID tag

The main ID tag contains model information, the serial number, the year of manufacture, the weight of the unit, the strokes per minute and material pressure, and the hydraulic systems. The unit serial number is stamped into the subframe immediately above or below the ID tag (Figure 3).

If your ID tag is missing

If the tag has been removed from the unit and you must have some information about it, read the main serial number that is stamped into the steel subframe. The serial number is located at the base of the tongue on the right-hand side, as shown in Figure 2. When you find the number, call Schwing America's Service Department for the information. The unit files are arranged by this serial number, and we can find out anything about the unit from the file that corresponds to this number. New ID tags are available once we have the unit serial number.

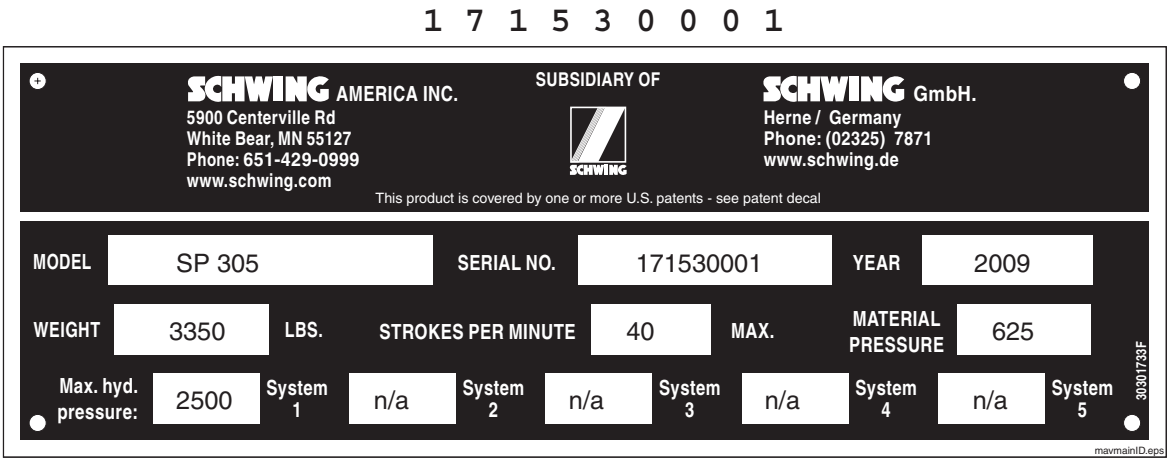
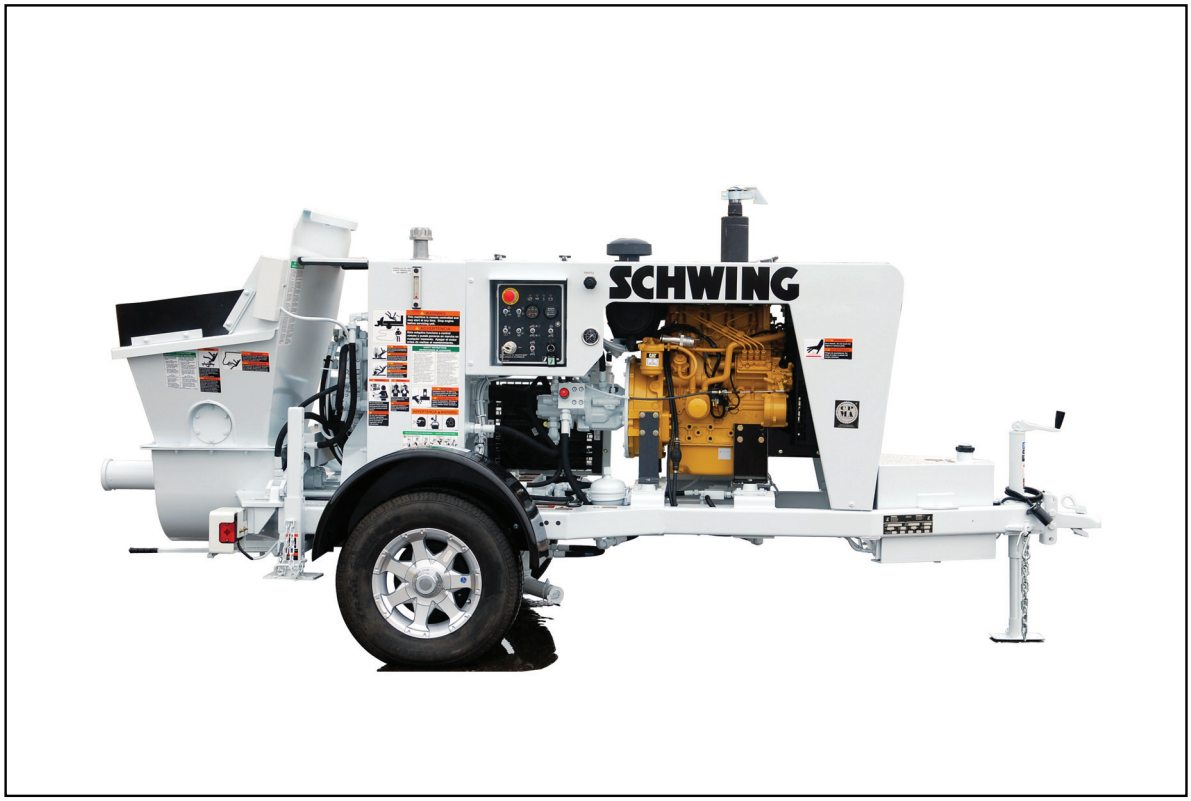


Figure 3
Main ID Tag (for reference only)

NOTES



SPECIFICATIONS

SPECIFICATIONS

Note! All specifications are subject to change without notice.

Model	SP 305
Pump Kit	2.5/1.75 x 30:5
Orientation	Piston Side
Strokes/minute (max.)	40
Material Output (max.)	30 yd^3/hr (23 m^3/hr)
Material Pressure (max.)	625 PSI (43 bar)
Power (Diesel Engine)	CAT C2.2NA (Tier 4 interim) 50 HP (37 Kw)
Power (Electric Motor)	40 HP (30 Kw)
Power (hyd. pumps)	30 Kw
Output (hyd. pumps)	27 GPM (102 lpm)
Speed (hyd. pumps) (diesel)	2700 RPM**
(elect. motor)	1800 RPM
Pressure (max. hyd.)	2500 PSI (172 bar)
Max. horizontal distance	800 feet (244 m)
Max. vertical distance	200 feet (61 m)
Max. aggregate size	1” (25 mm)
Minimum Slump	0”
Material Cylinder Diameter	5” (125 mm)
Stoke Length	30” (762 mm)
Differential Cyl. Diameter	2.5 (63.5 mm)
Concrete Valve Type	S
Hopper Height	42” (1065 mm)
Fuel Tank Capacity	15 gal. (58 l)
Gross Weight	3400 lb. (1525 Kg)
Length	149” (3785 mm)
Width	64” (1625 mm)
Height	66” (1675 mm)
Remote Cable Length	100 ft. (30.5 m)
Electric Motor (optional)* *Contact Schwing America for specs	*

** 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.

Functional Description of the Main Control Block

When the spool of the NG06 solenoid valve is in the neutral position (no electrical signal to the solenoids of the NG06), the S-port of the load sensing pump is vented to tank so that the pump is in “stand-by” mode. When the NG06 solenoid valve is switched to an activated position (forward or reverse), the S-port of the load sensing pump is closed, the pump will create a pressure, and at 3.5 bar the S1 spool starts to open the internal connections to the S2 spools. At 5 bar the S1 spool is totally switched over into the activated position, so the pump kit starts to work. (The 5 bar pressure is always necessary to hold the S1 spool in the activated position, just like the NG 20 control block). The signal of the shifting cylinder pilots the S2 spool and the signal of the switching valve pilots the S3 spool.

The needle valve cartridge DVE 16 of the manifold at the pump regulates the flow of the pump, and the direct acting SUN pressure relief cartridge limits the max. pressure if the regulator of the pump fails. (The SUN pressure relief cartridge is good for a flow of 200 l/min.)

The small accumulator damps the pressure spikes.

To stop pumping, the NG06 solenoid valve has to be deactivated; the spring centers the NG06 spool in the neutral position. The S1 pilot system, the S-port of the load sensing pump, and the accumulator are vented to tank, the S1 spool switches into the neutral position, and the pump kit stops working. The nozzle in the P-line restricts the flow so that the accumulator is vented softly. During “stand-by” mode, the pump creates the stand-by pressure, so there is a flow through the nozzle back to tank. If the stand-by pressure of the pump is adjusted to 15 bar (218 PSI), there would be a flow through the 1.5mm orifice of 4.3 l/min. In this operating status we would create a lost energy of 0.1 KW.

Even a bigger orifice (quicker reaction) should not cause a heat problem.

NOTES

SAFETY

SAFETY

The information contained in this section of the operation manual is absolutely necessary for the safe setup, operation, maintenance, and servicing of your concrete pump and placing boom.

The Safety Manual is a separate document from the rest of this manual. Because it is a separate document, the page numbering and formatting will be different than the rest of your manual. This was done to allow the Safety Manual to be inserted in many different publications while appearing exactly the same in all places. The Safety Manual has its own alphabetical index, which is found at the end of the Safety Manual.

How to Order Additional Safety Manuals

To place an order for additional Safety Manuals (or any other manual), you can call our toll free parts line from anywhere in the continental United States except Minnesota, where you must use the main Schwing office number. Schwing Spare Parts Department hours are Monday through Friday, 6:00 AM - 9:00 PM (Central Time). Orders will also be accepted via fax, 24 hours/day.

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

Safety Manual, English: 30327535

Safety Manual, Spanish: 30381024

Co-worker Safety Rules, laminated, English: 30381022

Co-worker Safety Rules, laminated, Spanish: 30381027

Co-worker Safety Rules, paper, English: 30381023

Co-worker Safety Rules, paper, Spanish: 30381028

Small line Safety Manual, English: 30381680

Small line Safety Manual, Spanish: 30381841

Schwing phone numbers

Spare Parts (Small line)(800) 237 - 8960

Spare Parts(800) 328 - 9635

Spare Parts (fax)(651) 429 - 2112

Spare Parts (toll free fax)(877) 554 - 5119

In Minnesota,

or outside of continental U.S.(651) 429 - 0999

NOTE!

To order manuals, copy the order form shown on page 18, and Fax it to Schwing at one of the above numbers, or mail it to:

Schwing Spare Parts Department
5900 Centerville Rd
St. Paul, MN, 55127

October 27, 2008

Safety/Service Bulletin 1023-08

Subject: Release of *Safety Manual* version 6.x.1

Dear Schwing Customer,

The *Safety Manual* has been updated to version 6.0.1 and has several changes most of which pertain to the more common incidents currently being reported in the concrete pumping industry (hose whipping, tip overs and electrocution). One notable pagination change occurred. The pipewall thickness chart, which has always appeared on page 73 of the Safety Manual, has been pushed back to page 75. In the past, releases such as this would include the complete paperback manual and a non-laminated version of the updated *Co-worker Safety Rules*. In an effort to "Go Green" we have decided to ship a CD containing six PDF files: Version 6.0.1 of Safety Manual (English & Spanish); version 6.0.1 of the Co-worker Safety Manual (English & Spanish); and version 6.0.1 of the Line Pump Safety Manual (English & Spanish). This package, as in the past, also includes an order form for hard copies of any of those documents. Just fill out the attached form(s) and fax it to us at the number listed. We will ship one of each manual ordered free of charge for each unit that is listed with its serial number (including line pump units if you want that manual) and current location. Additional manuals are available at a nominal fee. The Co-worker Safety Rules are available as laminated books intended to be kept on the pump for easy reference. Please instruct your operators to make the co-worker information available to the placing crew and laborers and to read the information to the workers if they believe the workers would not understand the printed text. If you are planning any safety training for your customers, the *Co-worker Safety Rules* booklet is also available in a non-laminated version at a fraction of the cost. If you choose to order the un-laminated version, the part numbers are 30381023 for English and 30381028 for Spanish. You could also print them yourself from the file on the enclosed disc. Of course, the non-laminated version is not intended to be kept on the pump. It is our objective to get a copy of each of these publications into the hands of every operator and the workers around the pump. Please help us make the Safety Manual effective for jobsite safety by obtaining a copy for each of your operators and encourage them to read and understand the rules. Older versions of the manual should be discarded when the new version is in hand.

Thank you in advance for your consideration in this matter.

Best Regards,

Danny L. Mace
Manager, Product Safety Department
Schwing America, Inc.

safemanbulletinletter.fm

Safety Manual v 6.0.1 Order Form

SCHWING AMERICA INC.
5900 Centerville Road
White Bear, Mn. 55127
Telephone (651) 429-0999
Attention: Publications

Please complete this form and mail to:

Or send via fax to: Fax # (651) 429 - 8261 (publications dept.)

Company: _____

Street Address: _____
We cannot ship manuals to a P.O. box

City, State, Zip: _____

Attention: _____ Phone ( ) —

Manual part number:_____ Model number: _____

Manual part number:_____ Serial number: _____

Manual part number:_____ Model number: _____

Manual part number:_____ Serial number: _____

Manual part number:_____ Model number: _____

Manual part number:_____ Serial number: _____

Manual part number:_____ Model number: _____

Manual part number:_____ Serial number: _____

Manual part number:_____ Model number: _____

Manual part number:_____ Serial number: _____

Safety Manual, Bound, English v 6.0.1 ..... Part #30327535
Safety Manual, Bound, Spanish v 6.1.1 ..... Part #30381024
Co-worker, Bound & Laminated, English v 6.0.1 ..... Part #30352799
Co-worker, Bound & Laminated, Spanish v 6.1.1 ..... Part #30381027
Line Pump, Bound, English v 6.0.1 ..... Part #30381680
Line Pump, Bound, Spanish v 6.1.1 ..... Part #30381841

Feel free to copy or otherwise reproduce this form if more copies are needed.

internal250:servicebulletins:601order form.ai

page 2 of 2

safemanbulletinletter.fm

Warning Labels (Decals)

Each machine is equipped with a set of warning labels specific to the model, boom style and installed options. Safety decals MUST be replaced if they are damaged, faded, missing, or unreadable for any reason. Ultraviolet radiation, rain, steam cleaning, and other factors cause these labels to fade in time. Sets include outrigger load labels, but they do not include metal plates, which can be ordered separately. For installation locations, see the decal location guide insert found in the *Appendix* section of this manual. To get replacement labels, identify which label(s) you need from the diagrams and lists, get the serial number of the unit from the serial number plate, and call the Schwing America Call Center at 888- Schwing **(724-9464)**. The person taking the order will make a note of the serial number of the unit for our files and send you the labels you need. You may order complete sets or single labels. If the serial number plate is missing or unreadable, the number is stamped into the subframe just below the normal location of the serial number plate.

NOTES

OPERATION

OPERATION

Preparing for the Job

Find out what kind of concrete you will be pumping. You should use a pipe and/or hose system that is three to four times bigger than the largest rock in the mix. You can use the chart in Figure 1 to select the correct pipe diameter for the job.

Largest stone size	Recommended minimum pipe/hose diameter
$\frac{3}{8}$" (Peagravel)	$1\frac{1}{2}$"
$\frac{1}{2}$"	2"
$\frac{3}{4}$"	3"
1"	4"

min_pipe_dia.eps

Figure 4
A guide for sizing pipeline on a SP305

Be sure that there is a water source on the job. You will not be able to clean out without water.

Be sure that you have all items required for the pour. You will need:

- a 5-gallon bucket
- a tool box with tools
- enough hoses, pipes and clamps to do the job (Never join two different sizes of pipes or hoses without a reducer. The longer the reducer, the less pressure it will take to make the reduction. Never join two different pipe styles (for example, a metric coupling with a heavy-duty coupling). There is no clamp made that will be able to keep the two sizes together. If you have to change pipe styles, an adapter pipe must be used. Any pipe or hose that you use **must** be able to withstand the maximum pressure of the concrete pump. The SP 305 can put out significant pressure on the material. Use only pipe and hoses that are in good shape. Do not use pipe that has dents or thin spots. Do not use hose that is frayed, has loose ends, or has loose rubber on the inside.)
- a shovel
- any paperwork required for the job, such as directions and contact person, fuel permit card, cab card, insurance certificate
- any safety devices required for travel in your location, such as flares, caution signs, first aid kit, fire extinguisher

Be sure that lights and brakes on the towing vehicle and on the trailer are in good working order before leaving the yard.

Check all fluid levels on both the trailer and the towing vehicle before leaving the yard (Figure 5).

Figure 5
Oil level indicator

Check the tires on both the trailer and the towing vehicle before leaving the yard.

Don't overload the trailer by using it as a cargo trailer. The chassis was designed to carry only the weight of the trailer. Don't travel with concrete in the hopper.

Towing the unit

You will need more stopping distance when pulling a trailer than when you are not. Do not tailgate.

Be extremely careful when backing up with a trailer. If you are not experienced with trailer backing, you should practice before getting on a public roadway.

The SP 305 has electric brakes as standard equipment. Be sure that the electrical connections from the towing vehicle are secure and working, and always use the breakaway switch (Figure 6.)

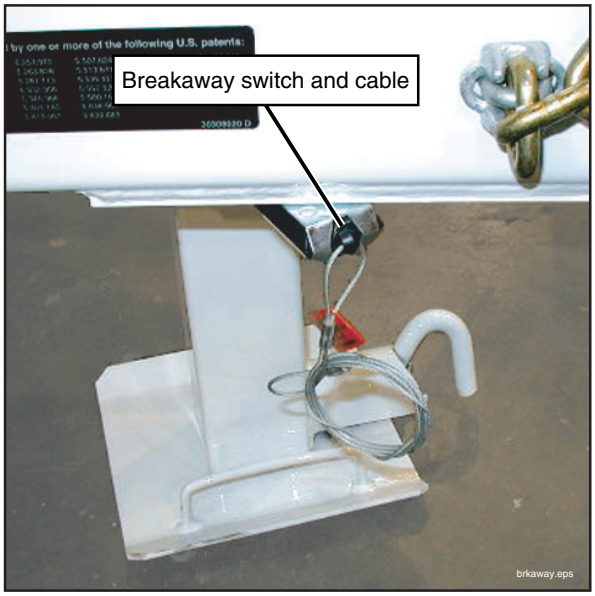


Figure 6
The breakaway switch

Setting Up

Arrival at the job

When you arrive on the job, first check with the job supervisor to determine where you should set up. If possible, choose a spot that allows hopper access for two ready-mix trucks. A flat, firm, and dry location is ideal. Find your source of water for the waterbox and cleanout.

If the weather is above freezing, fill your waterbox as soon as you can. If it is below freezing, wait until just before you being pumping to fill the water box.

Laying pipe

Generally, it is best to set up the outlet pipe and/or hose from the required point of discharge backwards towards the pump. When the pipe is in place, move the pump to meet the pipe, then chock the wheels and set the manual outriggers (Figure 7).

NOTE!

In some circumstances, you must start setting the delivery system from the pump and work towards the point of discharge. (Example: If the pump cannot be moved at all, you must start laying pipe at the pump.) Lay out the pipe in such a fashion that you will not have to add pipe or hose during the pour, only remove it.

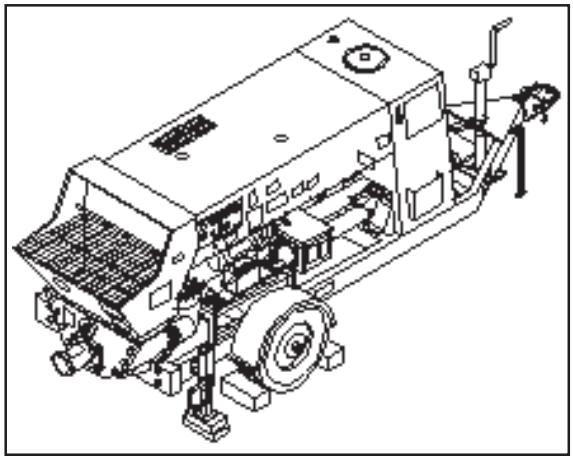


Figure 7
Proper cribbing and chocking

Be sure that all clamps are pinned and tight.

Never join two different sizes of pipes or hoses without a reducer. The longer the reducer, the less pressure it will take to make the reduction.

Never join two different pipe styles (for example, a metric coupling with a heavy-duty coupling). There is no clamp made that will be able to keep that spot together. If you have to change pipe styles, you must use an adapter pipe.

Any and all pipes, hoses, clamps, adapters, or reducers that you use **must** be able to withstand the maximum pressure of the concrete pump. The maximum concrete pressure that your pump can create is stamped into the main ID tag, as described in the *Introduction* section of this operation manual. Know this pressure number for your unit, and be sure all pipe and hose components you use can withstand this pressure.

Use only pipe and hoses that are in good shape. Do not use pipe that has dents or thin spots. Do not use hose that is frayed, has loose ends, or has loose rubber on the inside.

Lay out the remote control cable so that you will be able to see the point of discharge when pumping begins. Be careful not to leave the unit alone while it is pumping, however, because children are attracted to construction machines. An ideal spot for the remote gives you visual access to both the point of placement and the pump. If that is not possible, you must have a spotter for either the point of placement or the pump.

Before you start the engine, fill the waterbox with water, and grease the pivot yoke grease zerks and shaft bushings.

⚠ WARNING

Do not grease the pivot yoke while the machine is stroking. Stop engine and verify zero pressure before greasing.

W026.eps

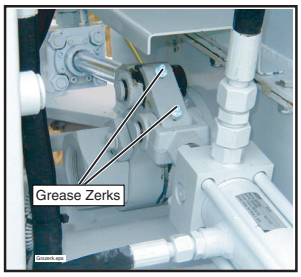


Figure 8
Pivot yoke grease zerks

Replace the waterbox cover before starting the engine, and do not remove it when the engine is running.

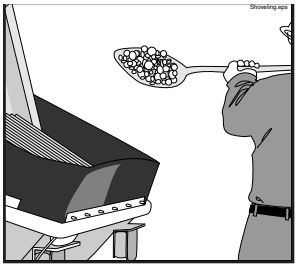
Put a couple of shovelfuls of sand or dirt in the bottom of the hopper, above the cleanout door. This will keep concrete from filling up that area and setting.

Spray the back of the hopper and nearby areas with form oil. This will greatly speed up the cleanout process when you have finished pumping.

Talk to the hose handler and agree on hand signals. Know the signals for starting, stopping, speeding up, slowing down, and so on. The ACPA recommended hand signals are shown in the *Safety Manual*.

The delivery system will have to be lubricated before you can pump concrete through it. Many operators use a sack of portland cement and water (mixed together in a bucket to a creamy consistency) to lubricate the delivery system. Other operators use specially designed pipeline lubrication packets that are mixed with water to lubricate the line (sometimes referred to as *pipe snot*). If you don't know where to get these packets in your area, contact your local Schwing dealer.

Figure 9
Sand in the cleanout door opening at the start of the day helps cleanout



Get your slurry mixing items ready, but don't actually mix the slurry until concrete is on the job.

If it's cold outside, start the engine and run it at an idle while you are waiting for the concrete to show up. This will cycle the hydraulic oil and warm it up a bit. This step is not necessary if it's warm outside. (See the items in the following section for engine starting tips.)

Starting the engine

Either the remote control cable or the dummy plug must be plugged into the remote control cable receptacle on the control panel. The hopper grate must be in the *down* position. Adjust the manual throttle to about $^1/_4$ to start. This allows the oil pressure to build, which lubricates the cylinders. This is especially important in cold weather.

- Turn the Pump Switches to the OFF position.
- Place Pump shift lever into the NEUTRAL position.
- Make sure all Emergency Switches are in the RUN positions.
- If using the optional radio (cordless) remote, the engine won't start unless radio remote and receiver are linked. Turn the radio on by using the following sequence:
  1. Turn the ignition key to the *ON* position which supplies power to the receiver.
  2. Engage the E-stop on the radio remote.
  3. Press power button on radio remote, light will flash.
  4. Disengage E-stop on radio remote, light will be solid.
- Wait 10 seconds before turning ignition key to engage the starter.
- Start the engine by turning the switch to the **start** position. Release key when engine starts. After the engine is running, the charging system and oil pressure lamps should go off. If they don't go off within 5 or 6 seconds, stop the engine and find the cause of the problem.

CAUTION

The engine can be destroyed by lack of oil pressure. Don't run the engine if the oil pressure light won't go out.

CAUTION

If the charging system lamp won't go out, you are not charging the battery. The engine doesn't need electricity to run, so you may still be able to pump for a short time before the emergency stop valves open and send all the oil back to tank.

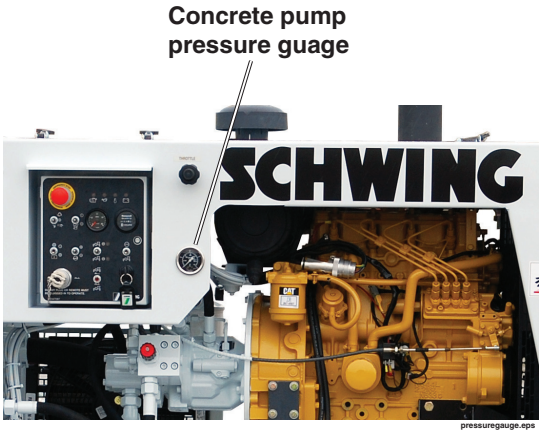


Figure 10
Pressure gauge location

Don't run the engine at high RPM until it has warmed up by running for a couple of minutes.

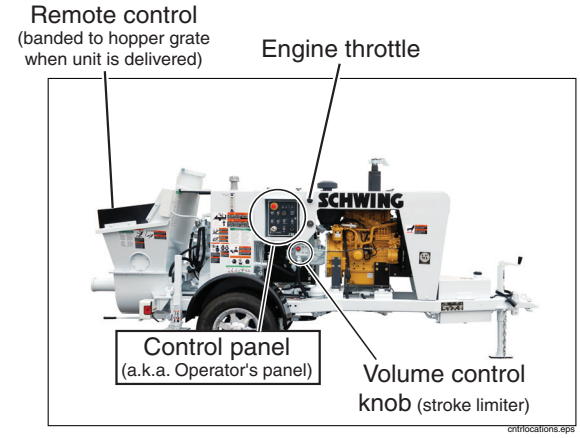
You don't need to lower the RPM of the engine to adjust the strokes per minute output of this unit. The following pages explain ways to control the unit.

Controlling the pump

These are the places on the unit that have operational control functions:

- The control panel
- The volume control knob
- The throttle control
- The remote control box
- The driver side emergency stop switch

Figure 11 shows the location of the controls.



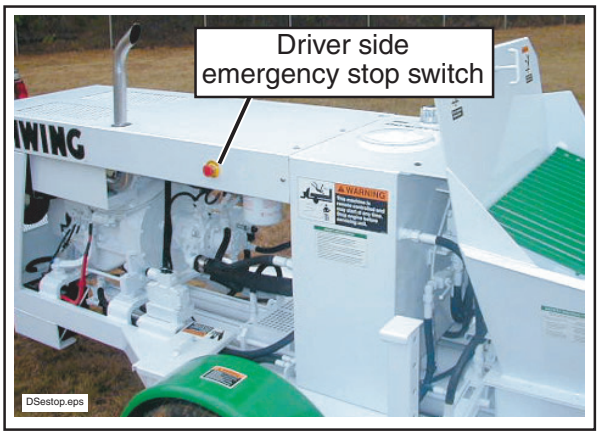


Figure 11
Locations of the control devices

The control panel

The control panel (Figure 12) contains:

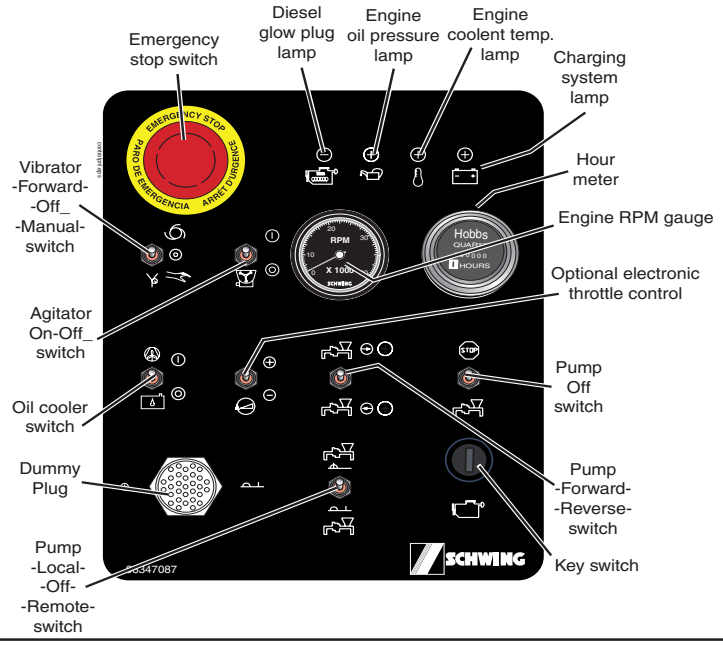


Figure 12
The control panel

- Engine oil pressure indictor lamp - This lamp illuminates only when there is no engine oil pressure, so it is normal for it to light when the key switch is on but the engine is not running. It is **not** normal for it to light when the engine is running; if that happens, you should stop the engine immediately.
- Emergency stop button (also known as an *E-stop switch*). This is a standard, red-faced push button. Pushing it disables all the circuits on the unit, including the accumulator circuit, by stopping the diesel engine. The engine stops because the E-stop switch also disables the diesel engine fuel shutoff valve. The E-stop switch must be turned and pulled to reset, and it must be out to start the engine. The emergency stop switches on the driver side of the pump and on the remote control have identical functionality and are wired in series with the emergency stop on the control panel.
- Hour meter - This meter keeps track of the number of hours on the diesel engine and hydraulic pumps. Use it to keep track of hours for maintenance purposes.
- Engine temperature indicator lamp - This lamp illuminates whenever the engine oil becomes too hot. Hot oil is a sign of a loose, worn, or broken V-belt or of oil that is so old that the viscosity properties have broken down.
- Key switch - Starts and stops the diesel engine, and supplies power to the rest of the electrical system.
- Charging system lamp - This should illuminate if the key switch is in the *on* position, but the engine is not running. It should also illuminate if the engine is running but the V-belt breaks or the alternator stops working.
- Remote control cable receptacle - This is where you plug in the remote control box cable. The plug is covered with a weather proof cap which must be removed to plug in the remote cable**.**
- Concrete pump local - off - remote switch - Selects between local control concrete pump on, concrete pump off and remote control. When *remote control* is selected, the pump on - off function is transferred to the remote control box. When you select the *off* position, the hydraulic pump maintains a standby pressure of 300 PSI.
- Concrete pump forward - off - reverse switch - When the **local - off - remote** switch is in the *local* position, then the **forward - off - reverse** switch is active for controlling pump forward and reverse functions. This switch does nothing when the **local - off - remote** switch is set to *remote*.
- Other switches - as labeled

The remote control box

The cable remote control box (Figure 13) transfers the **forward - off - reverse** functions of the control panel to a handheld electrical enclosure. The remote control can be carried away from the pump to allow the operator to select the best vantage point to see both the point of discharge and the pump.

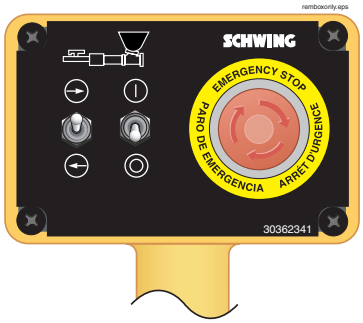


Figure 13
The cable remote control box

Note about the electric system

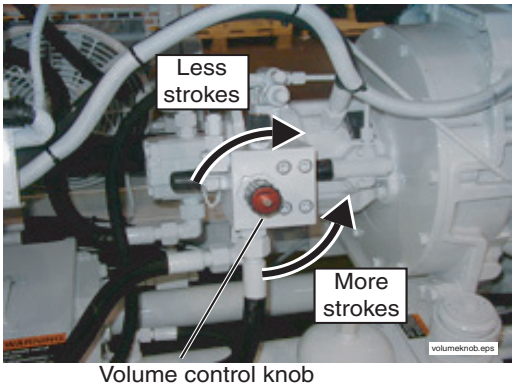
- The machine cannot be operated unless either the dummy plug or the remote control cable is plugged into the remote control cable receptacle on the control panel. The emergency stop circuit is completed by either device.

The volume control knob

(Also known as the stroke limiter) (Figure 14). This knob tells the hydraulic pump to put out more or less oil (independent of the motor speed) to control the rate of concrete output.

Turning the knob *clockwise* (CW) causes less oil and, therefore, less strokes per minute.

Turning the knob *counterclockwise* (CCW) causes the pump to put out more oil and, therefore, more strokes per minute.



Volume control knob
(stroke limiter)

Figure 14
The volume control knob

Throttle control

Push the button on the end of the knob (Figure 15), then pull the knob and cable *out* to increase RPM. Push the button on the end of the knob, then push the knob and cable *in* to decrease RPM.

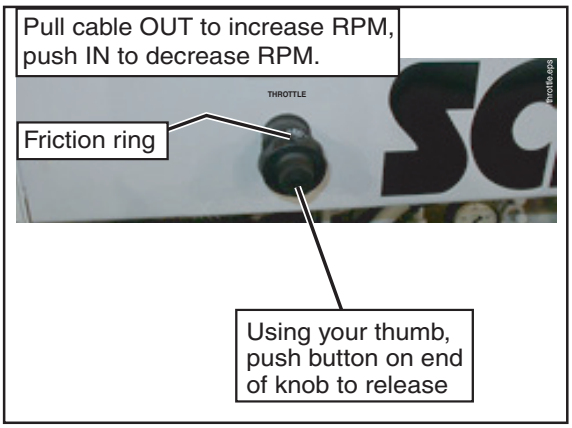


Figure 15
Adjusting the throttle

The pressure gauge

This gauge indicates pressure in the hydraulic circuit that pushes the concrete and includes the accumulator. NOTE! Because accumulators store hydraulic energy, it is critical that this gauge work at all times. **Do not operate the unit unless this pressure gauge is functional!**

Starting the Pour

Concrete mixes

This machine is capable of pumping many different mix types, up to and including one inch rock, but the mix must be graded with some components in all of the different sieve sizes. Generally speaking, any durable, good quality concrete will pump. If you have trouble pumping a mix, look at the mix design. Sieve sizes #4, #8, and #16 must be present for the concrete to have good pumping characteristics.

Preparing for concrete

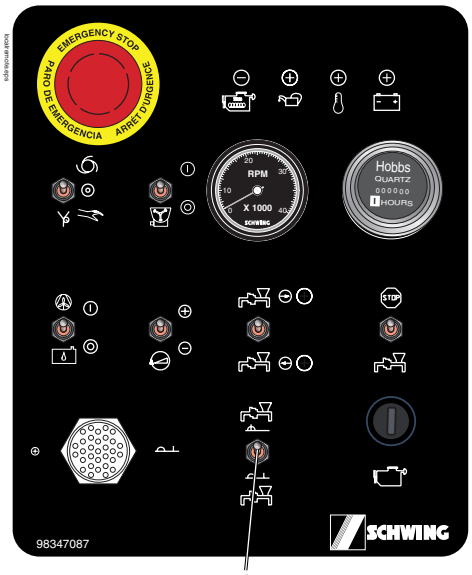
When concrete arrives on the job, have the ready-mix driver discharge a small amount of concrete onto the chute so you can look at it. The concrete should be well mixed, meaning that you won't see just large rocks or

sand coming out. When a ready-mix truck has worn-out fins, the concrete does not always become well mixed. The bulk of the load will be pumpable, but the first and last chute full will not pump. If you are allowed to, have the ready-mix driver put the chute to the side and dump the first chute full on the ground; then bring the chute back to your hopper when the concrete looks good. It's important to have good concrete until the pipe is completely filled, so if the mix doesn't look pumpable, don't put it into your machine. This is something that becomes easy to see with experience. Many times, water will have to be added to the concrete in the truck to make the consistency that is desired for the job. Find out from the job supervisor if the slump is correct and who has the authority to add water to loads as they arrive.

Ready the pump

The pump can be operated at the control panel or with the remote control box. When operating, you must be able to see both the pump and the point of discharge. If you cannot see one or the other, a spotter must be used. Use the remote control if it allows you to get a better view of the job. If you decide to use the remote control, you should get it ready and plug it in now.

- To use the remote control, first select "off" with the "local/remote" switch (Figure 16).



Local/remote
Local (up position)
-Off- (center position)
Remote (down position)

Figure 16
Select OFF before plugging or unplugging the remote cable

- Plug in the remote cable; then select *remote* on the control panel switch. *On - off*, and *forward - reverse* control is now transferred to the remote box switch (Figure 17).

Figure 17
The remote cable

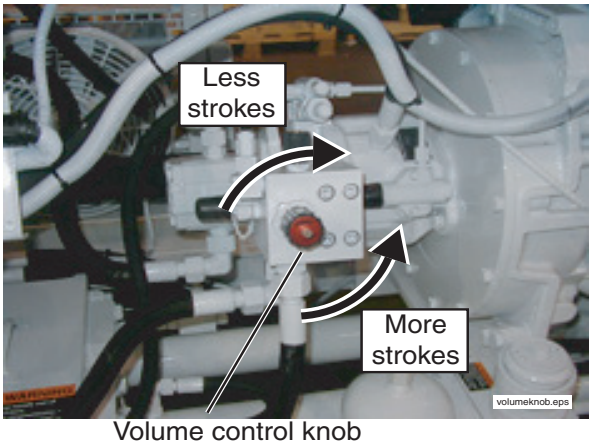
- Select a low to low-medium setting on the volume control knob. This will make the concrete move slowly through the line, which reduces the chance of plugs or trapped air (Figure 18).

Mix your slurry

When the concrete is right, mix your lubricating slurry and pour it into the hopper or delivery system (depending on whether you are mixing commercial slurry or portland cement and water). If you have poured the lubrication into the delivery system, be sure to reconnect the system to the pump.

Beginning to pump

- Have the ready mix driver fill the hopper with concrete, and stop when the hopper is full.
- Clear the discharge area of personnel before starting the pump for the first time of the day, after you've moved, or anytime air has been introduced into the line or the line has been taken apart.



Volume control knob
(stroke limiter)

Figure 18
Adjust the volume control

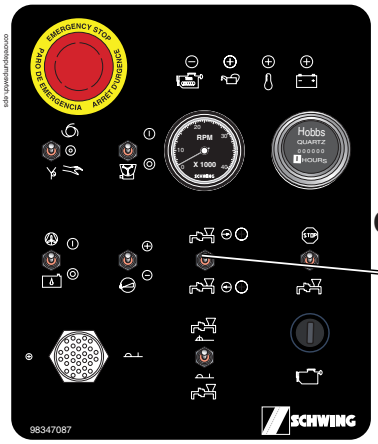
⚠ WARNING

Clear the discharge area before first starting, restarting after moving, or anytime air has been introduced into the line.

000359.eps

000518.eps

- Adjust the engine throttle to maximum RPM. This will allow the engine to develop it's rated horsepower. Note! You do NOT want to pump fast when first starting. Be sure that the volume control knob is at a low setting (Figure 18).
- When the placing crew signals to begin pumping, activate the switch of the control panel or the remote control box (Figure 19). To get warning of plugs, you should monitor the pressure gauge, until concrete comes out of the discharge. If you cannot see the point of discharge from the area around the pump (near the gauge), arrange for a spotter to monitor the end of the line. The spotter should watch that no one gets near the discharge and alert you when concrete is flowing from the end.



Concrete pump switch
Forward
(up position)
Reverse
(down position)

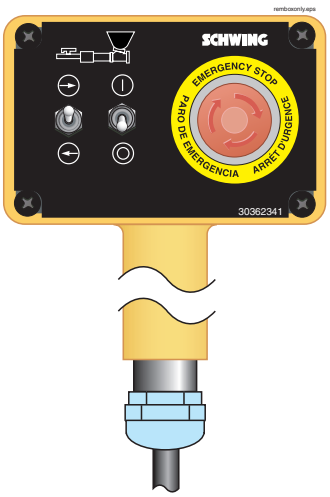
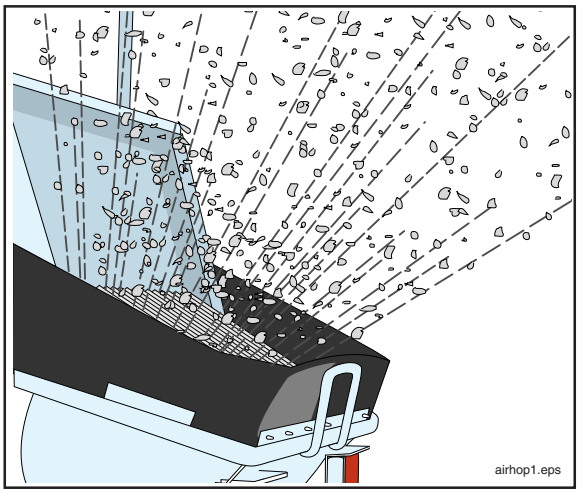


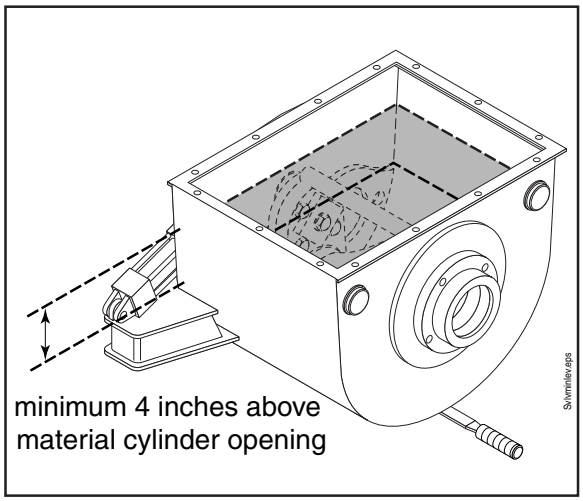
Figure 19
Activate the pump

- Pump slowly (few strokes per minute) until concrete has come out at the discharge point.
- If you hear the engine starting to bog down, notice the pressure gauge. If the pressure goes to the maximum setting of 2500 PSI, you may have a plugged line. Immediately switch the forward / reverse switch to the "reverse" position and pump a couple of strokes. Switch back to forward and watch the pressure gauge. If the pressure rises to the relief valve setting again, switch immediately

back to reverse and relieve the pressure in the line. See the information in this manual about removing plugs from lines starting on page 34.

- Once the concrete comes out at the discharge point, move yourself into position to see the discharge. Remember, you must also be able to see the pump, so arrange for a spotter if you cannot. In some circumstances, it is allowed to have the ready mix driver monitor the pump end of the job. If you will be allowing it, you MUST be sure that the ready mix driver understands how to stop the pump and what will happen if air is allowed into the delivery line. The ready mix driver may refuse the responsibility of watching the pump. If this happens, you will still need to arrange for a spotter. Because of the risk of injury to the ready mix driver and the placing crew if air is introduced into the delivery system, the hopper level must be monitored at all times. If the ready mix driver will not do it, you must still arrange that it be done (Figure 20).
- Adjust the volume control knob as needed for faster or slower pumping.
- Watch the hose handler closely. Be ready to stop the pump when required. Kinking a placing hose while pumping can be dangerous, because it causes the pump to go to maximum pressure, simulating a blockage. If you see that the placing crew is kinking the hose, stop pumping and talk to them about it.
- Keep an eye on the pump. Listen for engine bogging (a sign of plugging). Watch that no one, especially children, get near the unit.
- When the ready-mix truck is empty, the driver should signal you by voice or horn. If you have shown the driver how to stop the pump, you could also be signaled that way. In addition, an experienced pump operator will be able to tell by the sound of the rotating drum that it is almost empty. The remaining larger aggregate in an almost-empty drum falls from the fins, and instead of hitting on concrete, it hits on steel, making a distinctive sound. Be aware to listen for these clues, so that you can stop the pump with a full hopper. (You will need a full hopper so that you can keep the concrete moving if you have to wait for the next load.) If no more concrete will be coming, such as at the end of the pour, try to end up with only about a third of a hopperful. **WARNING!** You cannot completely empty the hopper, because air will be drawn into the concrete





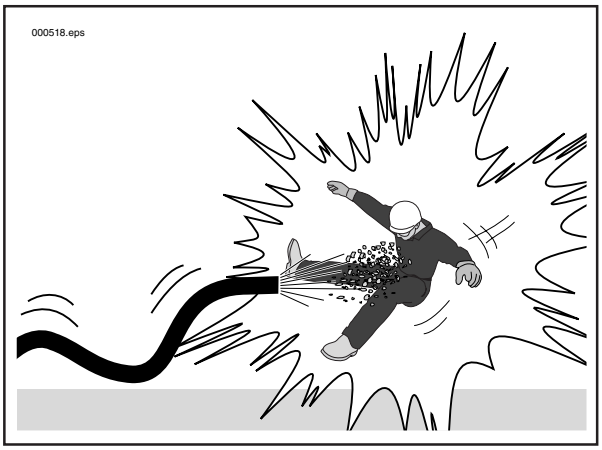


Figure 20
Do not allow air to enter the pumping cylinders. Keep the hopper full when pumping.

cylinders. This air will compress during the pushing stroke and explode into the hopper when the concrete valve switches (Figure 20).

- As discussed in the safety rules section of this manual, do not let the ready-mix driver wash out his drum or chute in your hopper. This may cause plugging because the cement and other fine particles are washed away from the course aggregate. The same holds true if it is raining hard; try to protect the hopper from getting so much water that the aggregates start to separate.
- On many jobs, pipe or hose will be removed as the day goes on. Wash the removed pipe, hose, clamps, and gaskets so the concrete residue doesn't harden (Figure 21).

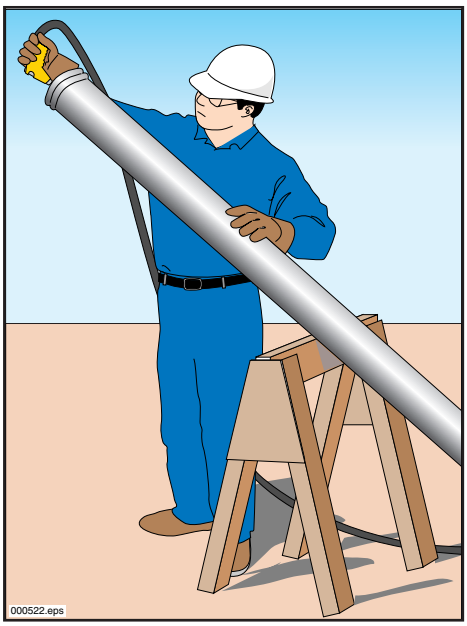


Figure 21
Wash system as it is removed

Cleanout

Clean the delivery system

Begin the cleanout procedure as soon as the pour is finished. Start by pumping out as much concrete from the hopper as possible. Again, **be sure that you do not empty the hopper to the point that air can be sucked into the concrete cylinders!**

Clean out the delivery line. It is very important that all concrete is removed from the delivery system. If even a small amount of concrete is allowed to set in a pipe or hose, it will probably cause a plug the next time the pipe or hose is used. Cleaning the delivery system can be done one of four ways:

1. **Pump out the delivery system using the concrete pump's pressure.** Fill the hopper with water and pump until you reach the minimum hopper level. Refill the hopper with water and continue pumping. When the concrete has disappeared from the hopper and concrete valve area, stop the pump, reverse it to remove any residual pressure, and disconnect the delivery system from the concrete valve outlet. Open the cleanout door and rinse the hopper. Use the rake to pull concrete from the valve through the outlet pipe, and rinse the valve. Shift the valve, and rinse the open cylinder. Put a sponge ball in the delivery system, and reconnect the line to the pump outlet. Refill the hopper with water, and pump until you reach the minimum hopper level. Refill the hopper and, again, pump until you reach the minimum hopper level. Continue doing this until the sponge ball has been pumped out of the delivery system. This is the method used by most operators in most circumstances. It has the advantage of getting most of the concrete out of the hopper and material cylinders while you are cleaning the pipeline. The disadvantage of this method is that it takes a large water supply to get the entire system and pump clean.
2. **Manually clean the delivery system.** Reverse the pump to remove any pressure in the delivery system. Stop the pump and the engine. Disconnect the delivery system at all connection points, manually empty the hoses and pipes, and immediately wash them inside and out. For long hoses, you can pour 5 or 10 gallons of water in one end of the hose, then walk the hose towards the other end, lifting as you go, so the water will always travel downhill towards the far end. This method is best and quickest when there are only a few pipes or hoses to clean. It has the advantage of taking the least amount of water to finish. If you find that you must use this method for long delivery systems (if the unit is broken, for example), get some help so that you can clean out the unit before the concrete sets. If no help is available, you should know that if concrete sets, it ruins whatever is holding it. It is harder and more expensive to replace the concrete valve and material cylinders than to replace a delivery system, so adjust your cleanout accordingly.

3. **Pump out the delivery system with source water pressure.** Reverse the pump to remove any pressure in the delivery system. Stop the pump and engine. Disconnect the delivery system from the concrete valve outlet. Install a sponge ball in the delivery system. Place a water blowout cap on the delivery system. Hook a hose between the water source and the water blowout cap and pump water into the delivery system until the sponge ball appears at the other end. This method doesn't always work, because the source water pressure may not be high enough to move the concrete through the delivery system.
4. **Blow the delivery system with compressed air.** We do not recommend this method, because compressed air can be very dangerous if not handled correctly. Use it only as a last resort. Complete safety rules for using compressed air are discussed in the *Safety Manual*. **Never use compressed air to clean out rubber hose** because the hose will jump around and move through the air by the force of the pressure in the hose. You cannot hold or stand on the hose to steady it because the forces will exceed your weight, even if you are a huge person. You cannot have an entire crew of people holding the hose because the force will exceed all of their weights combined. If you have only steel pipe to clean, it is possible to use air, but it can still be dangerous. **Always control the discharge end of the pipeline. Either a catch basket must be used, or the discharge must be made safe in some other manner, such as routing it into a ready mix truck. The blowout head must have two pressure bleed possibilities: an inlet valve and a bleed-off valve. There must be enough space between the two valves that a cleanout ball cannot block both ports at the same time** (Figure 22)**.** Remember, if you use this method, you must disconnect all rubber hose from the delivery system and clean them manually anyway, so it might be just as quick to clean the entire delivery system manually.

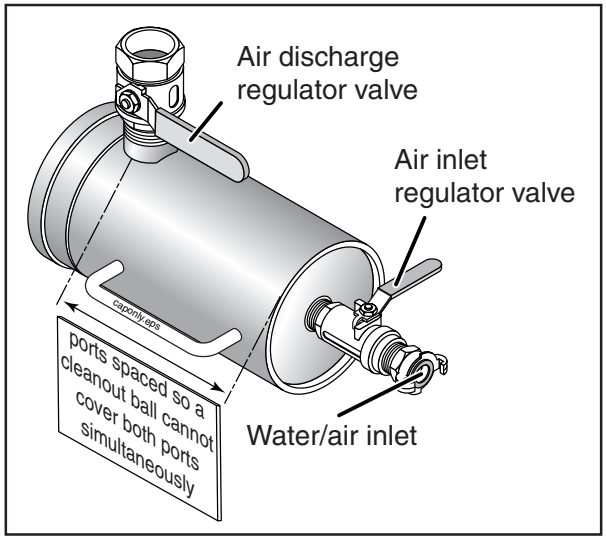


Figure 22
Blow-out head

- Clean the clamps and gaskets used on the delivery system. Do not leave any concrete, stones, or sand on them, or the clamps won't properly close the next time you use them.

Clean the pump

Clean the hopper and concrete valve. If not already done, stop the pump and disconnect the delivery system. (Note! Once the delivery system is disconnected, there is no more danger of compressing any air that gets sucked into the material cylinders). Proceed as follows:

- Restart the unit and pump out the rest of the concrete from the hopper and concrete valve. Put the pump in reverse, and give it one stroke. Stop the pump as soon as the concrete valve switches (this step assures that the material cylinder is empty and the piston cup is towards the back of the unit).

NOTE!

If you used method # 1 to clean the pipeline, there will only be some clean, washed stones and sand left in the material cylinders and concrete valve; in that case, you can skip this step.

- Stop the unit. Open the cleanout cover on the bottom of the concrete valve (Figure 23).

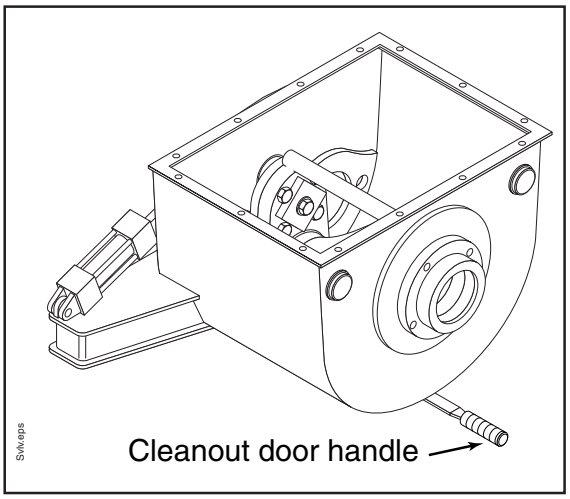


Figure 23
Cleanout door

- Leave the hopper grate in place. Spray water through the grate into the hopper to clean concrete out of the corners and the concrete valve. If you need to rotate the hopper grate to the open position to chip away hardened concrete or for any other reason, the pump must be stopped. To assure that this is done, the electrical supply to the concrete pump circuit is connected through an interlock switch on the hopper grate. The pump will not operate unless the hopper grate is shut, and the pump will stop if you rotate the grate open while it is running. Do NOT disable or bypass the hopper grate interlock switch. It was installed for your protection (Figure 24).
- Stop the pump. Spray water through the outlet pipe into the concrete valve opening. One cylinder will be exposed through the valve. Use the supplied cleanout rake to dig out excess material. When you have removed as much material as you can, switch the concrete valve as instructed below.

NOTE!

Never put your hands into the concrete valve!

- Make certain that no one is near the concrete valve or the waterbox. Start the pump, and let it stroke in reverse until the concrete valve switches to the other material cylinder. Stop the pump again.
- Spray water through the outlet pipe into the concrete valve and the material cylinder. The opposite cylinder is now exposed through the concrete valve. Again, NEVER reach into the concrete valve with your hands. Use the supplied cleanout rake to remove any material that won't come out with the water spray. Continue stopping the unit, switching the concrete valve, and cleaning until the water flows out clean and clear.

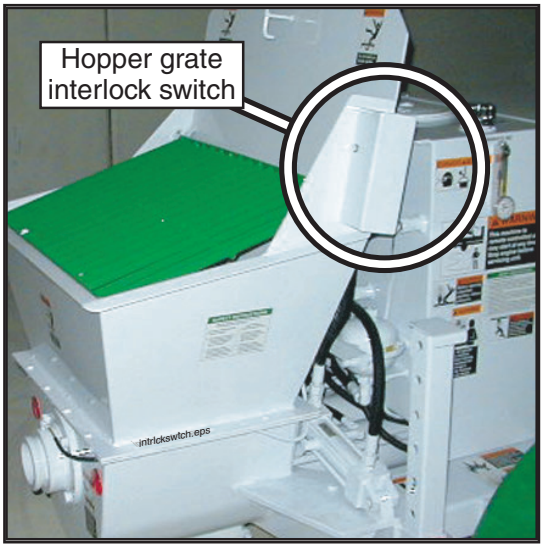


Figure 24
The hopper grate interlock switch

- Spray into the top of the hopper again, as some material will have been washed into the hopper area by cleaning the inside of the concrete valve. When it is clean, close the cleanout door on the bottom of the concrete valve housing.
- **ALWAYS DRAIN THE WATERBOX AT THE END OF EACH POUR. The reason for this to prevent the oil from being contaminated by water. Here's how it happens:**
  As the oil cools after a pour, it creates a vacuum in the differential cylinders. This vacuum causes the water in the box to be pulled past the packing seals of the cylinder and into the oil. The result is milky oil.
- With the engine stopped, remove the waterbox cover. Find the drain plug on the bottom of the waterbox (Figure 25). Remove the plug by unscrewing the T-handle until the plug becomes loose. When the plug is out, the water will drain out of the hole. Spray water into the waterbox, the material cylinders, and around the tension rings where the hydraulic cylinder rods come out of the waterbox wall. Do not allow cement particles or fine sand to build up. If you notice a layer of sand or cement particles at the bottom, the rubber rams need to be replaced. (For ram replacement

procedures, see the *Maintenance* section of this manual). When the waterbox is clean, replace the top cover and start the unit. Stroke the machine twice (two times), which will flush the water from the material cylinders. Stop the unit. Replace the drain plug in the bottom of the waterbox. Make sure that it is tight so that it doesn't fall off on the road.

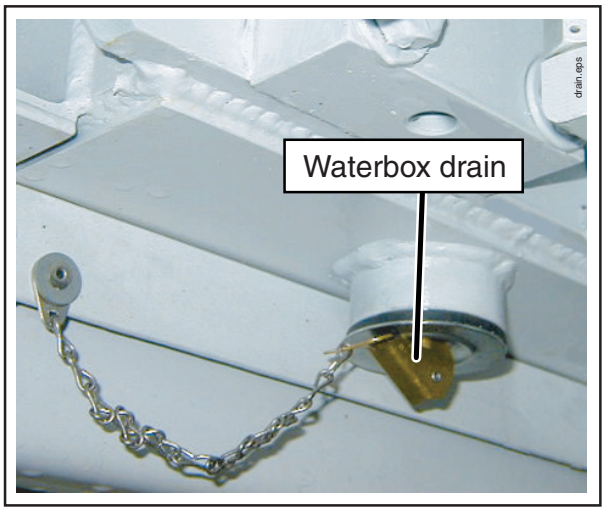


Figure 25
The waterbox drain

- Spray off the rest of the unit to remove dust and cement particles. If you have time, brush off any concrete spatters that may have landed on the machine during the course of the day. If the spatters are already dry, use a putty knife to scrape them off. If you let the spatters stick for weeks, you will need to sandblast the unit or give it an acid bath to remove them. I**f you are going to give the unit an acid bath, please call our service department for advice on protecting the machine before proceeding**. Acid must NOT touch chrome or rubber parts.
- Place all of the accessories back on the towing vehicle. Secure all hoses, clamps, buckets, and other equipment to be sure that they don't fly off the truck while you're driving. Take a moment to make a final check of the area to be sure you're not forgetting anything.
- Retract the outriggers. Check your brake light connections, adjust and clean your mirrors, and make all other necessary adjustments before driving off the job site.
- Remember to get your paperwork signed before you leave.

Special Pumping Situations

Plugs

Many plugs can be avoided by simply pumping slowly until concrete runs steadily from the end of the line. The difference between a plug that can be rocked out of the line and a plug that must be manually removed is generally how hard the plug has been pressed. If you pump slowly when you first begin to pump, you can watch the pressure gauge and stop the pump before a plug has a chance to become jammed with force.

Is the line plugged?

Before taking the corrective action, you must first determine whether the line is actually plugged. Other situations can cause symptoms that appear to be plugs but are not. Hydraulic components can stick in one position or the other, electric valves can stick open, and so on.

If you answer "yes" to all of the following questions, the line is plugged:

- Is the pressure gauge going to the maximum pressure setting?
- Is the pressure much lower when you stroke the unit in reverse?
- If the machine stops pumping, reverse it for two strokes. Put it back into forward. Does the machine pump in forward for two strokes, and then stop pumping again?

If the answer to any of the above questions is "no," the line is not plugged. Look for the problem elsewhere, or call the Schwing Service Department for help.

Removing a plug from a pipeline.

If you determine that your delivery line is plugged, you will need to remove the plug before you can continue with the pour. Follow these steps:

1. **Don't try to force the plug!** If the machine stops because of a plug, trying to free it with high pressure just makes the plug worse.
2. **Try to rock the plug free**.

⚠ WARNING

Clear the discharge area before first starting, restarting after moving, or anytime air has been introduced into the line.

000359.eps

WARNING! Release of stored energy hazard (Figure 26). If you are successful at rocking the plug loose, air will be introduced into the line at the delivery end. If a blockage would then form in front of the air, the air would become compressed when you switch back to forward pumping. Clear the discharge area of personnel before rocking the plug.

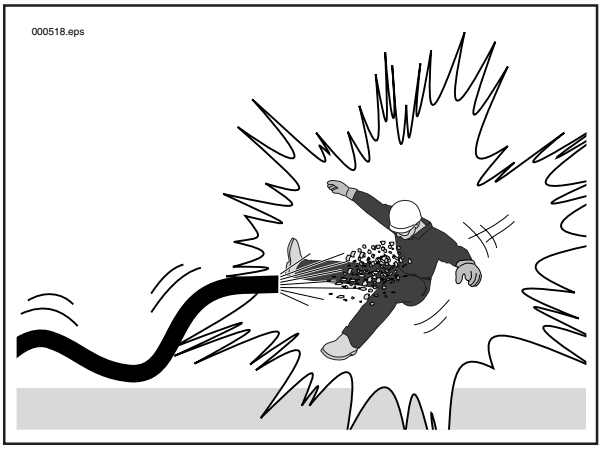


Figure 26
Successfully rocking a plug loose introduces air into the line

To rock the plug: When the unit stops pumping, immediately put the **pump forward - reverse** switch into the *reverse* position. Pump in reverse for two strokes. Put it back in forward and pump for two more strokes. Put it in reverse for two strokes, then to forward, etc. Sometimes this method dislodges the plug. It is less likely that reversing the pump will help dislodge a blockage in a longer pipeline, because the suction you create at the pump doesn't have enough power to move a long horizontal line of concrete.

3. **Remove the plug manually.** If the above step didn't help, you will have to locate the plug and remove it manually. **Never open a delivery system line that is pressurized! First, relieve the pressure in the line by pumping in reverse for at least two strokes.** Locate the plug by tapping on the line with a hammer. (NOTE! TAP is the key word. If you hit the line too hard it will dent. A dented line wears out at the dent quickly.) When pressure is removed from the line, it has a hollow sound, except for the plug, which sounds solid. Reducers, elbows, and rubber hoses are most susceptible to plugs, so start by checking them. If you cannot locate the plug by tapping, break the line at about the halfway point. Clear the discharge area of personnel, then try pumping in forward again. If the machine still stops, the plug is in the half of the line that is still connected to the pump. If concrete comes out of the line where you disconnected it, then the plug is in the half of the line that was disconnected. **Remember to relieve the pressure on the line again before breaking the line anywhere else!** You can locate the plug by the process of elimination if you keep breaking the line in different spots and trying to push concrete to the disconnected point. When you locate the plug, remove it. Reassemble the line, **including the clamp gaskets**. NOTE: Air is introduced into the line when you break it apart, so remember to clear the discharge area of personnel before starting again. Lower the volume control to stroke slowly until concrete is running steadily.

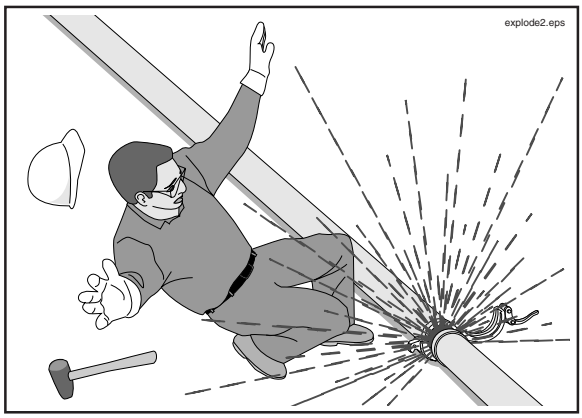


Figure 27
Never open a pressurized delivery line

Cold weather pumping

Keep these things in mind if you must pump at temperatures below 32° F (0° C):

- Water freezes below 32°F, so cleanout must be done with heated water.
- If concrete sits for too long, it freezes. When it freezes, setting action stops. To prevent this, the engineer will probably order the concrete with calcium chloride or a similar chemical intended to make the concrete set before it can freeze. This can work against you if you take too long to clean out or if you have to wait during the pour. Speed up the cleanout process as much as possible without taking risks.

- If it is very cold—below zero, for example—concrete that sits will freeze in your machine whether there are additive chemicals or not. If that happens, you are done pumping. Pick up your system, load it on the towing vehicle, and find a warm place to clean out. Concrete will not set when it is frozen, so you will be able to clean the system and pump as soon as it is warmed enough to thaw.
- If it is extremely cold — below –20° F, or colder—the concrete may freeze even while it is moving under pressure. Again, you will have to find a warm place to clean out.
- **CAUTION!** When you are cleaning out in cold weather, ice will form on your hoses, pipe, clamps, gloves, boots, and other gear. Be very careful when handling iced objects, and take care about your footing around the machine.
- **CAUTION!** Be sure to drain the waterbox when you are finished pumping in cold weather. If the water is allowed to freeze, the unit will be damaged.

Hot weather pumping

Keep the following in mind if you are pumping in temperatures above 85° F.

- Concrete sets faster in hot weather. You have a reduced margin of error for cleanout and while waiting for concrete. Under certain circumstances, concrete will go from being pumpable to setting in a very short time. This quick setting is known as *flashing*.
- If you must wait a long time for the balance load, you will be in trouble. You should clean out and start over if the load will take more than 15 minutes to arrive. This means that you will have to refill the hoses and pipes with concrete to finish the job, which means that they will need more concrete to finish than the ready-mix company thought. Use your best judgement. If you know you will have to clean out before the load arrives, inform the supervisor on the job, so enough concrete can be ordered to refill the pipes and hoses and also to finish the pour.
- If concrete is flashing, you will have to act fast to save the system.

NOTE!

Stay calm. Do not hurry so much that you ignore safe procedures. Nothing would slow down the cleanout process more than an injury to you or a coworker.

- **If concrete is flashing in the system:** Put the pump in reverse for 2 strokes; then break the delivery system away from the pump. Put the pump in forward for 10 or 15 strokes to remove the bulk of the concrete from the hopper, valve, and material cylinders. Spray just enough water through the concrete valve and hopper so that you know you will be able to chip out the rest later. Immediately get to work on the pipeline. Don't worry about the small pieces of concrete left in the valve and hopper until after the pipe is cleaned. If you pumped out the bulk of the concrete and sprayed it out a little, the rest can be removed afterwards. After the pipe is clean, go back to the valve and hopper as soon as possible. The concrete may be too hard to pump or rinse with water, but it will still be easier to clean if you get at it sooner rather than later. Concrete becomes much harder to clean after several hours. If allowed to fully dry, it can become extremely hard to remove, and will have to be chipped away with power tools.

Warning: Never put a body part into the concrete valve or hopper. Also, do not open the hopper grate to chip concrete or for any other reason, unless you have disabled the machine according to your company's lock-out, tag-out program.

Emergency procedures

Disabling the machine in an emergency

If an emergency requires that the hydraulic system be disabled completely—such as if a hose or fitting breaks—you must stop the prime mover (engine or electric motor) immediately. With the SP 305, pushing any emergency stop switch will kill the engine.

Lock-Out, Tag-Out

A lock-out, tag-out program should be developed by your employer, according to current OSHA/ANSI rules. The procedure to disable the machine from accidental starting or energy release is as follows:

1. Stop the engine.
2. Remove the key. Carry the key with you. If there are additional keys, lock them away or otherwise account for them.
3. Put a "Do Not Operate" tag over the key switch.
4. Verify zero pressure on the gauge shown in Figure 10.
5. If you will be working on the accumulator or the tires, be aware that the compressed gas in those items will remain a possible hazard even when the machine is disabled. In the case of the accumulator, contact Schwing America's Service Department for advice. Before working with the tires, know the safety rules for tires.

Other Things You Need to Know

Reordering documentation or warning labels

It is our intention that each machine in the field have an *Operation Manual*, a *Safety Manual*, a laminated *Quick Index*, a laminated *Co-worker Safety Rules* booklet, and a *Spare Parts List* available to the operator and shop personnel at all times. Replacement *Operation Manuals* and *Spare Parts Lists* are available for a nominal charge. The *Safety Manual, Quick Index*, and *Co-worker Safety Rules* booklets are available without charge if you supply a serial number when ordering, and additional sets are available for a nominal fee. In addition, the warning labels which are supplied with the unit must be easily readable and firmly attached to the unit. If the labels fade or peel, if you repaint the machine, or if they become loose or unreadable for any reason, duplicate sets are available. The only charge for replacement labels is the cost of shipping. The labels are available as sets or individually. Each label has a part number printed on it, and a decal location guide is available. Aluminum tags are not shipped with decal sets and must be purchased separately.

Charging Accumulators

Before charging the accumulator, read and understand all of the instructions found in the *Maintenance* section of this manual. Charging an accumulator with compressed air or oxygen may result in a serious explosion.

⚠ WARNING

EXPLOSION CAUSED BY IMPROPER ACCUMULATOR CHARGING CAN RESULT IN DEATH OR SERIOUS INJURY!

- **Follow the charging instructions exactly!**
- **Use ONLY dry nitrogen to charge the accumulator!**
- **NEVER use oxygen or compressed air to charge the accumulator!**

000127.eps

MAINTENANCE

MAINTENANCE

Maintenance is what you do to the machine to keep it in good working condition. There are two kinds of maintenance: preventative and repairs. Preventative maintenance is important to avoid unnecessary repairs, but eventually even well maintained machine parts will wear out and require repair or replacement.

Some maintenance needs to be done by a time interval such as daily, monthly, or annually. It is a good idea to make a checklist that will tell you what maintenance is due and when it is due. A suggested checklist is included in this section of this manual. It can be found on page 57. Keep accurate records of maintenance performed and when the work was completed. In this way, you will know that all necessary work has been completed on time. Complete maintenance records could also make the machine worth more money when it comes time to sell or trade it.

There are certain things you should know about the maintenance of your machine that will not come up on a timetable of things to do.

We begin the section with some general information regarding some of these items.

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 40µ (40 microns). The oil in your unit needs to be filtered to a MINIMUM of 25µ, 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 gallons per minute or bar and liters per minute), 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 courser 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, each SP 305 unit is equipped with a filter that is rated at 10 micron (shown as 10µ) absolute.
- The beta ratio is $\beta 10 = 200$. In our case, the beta ratio means that for every 200 particles of dirt that hit the filter media that are 10 micron 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 gallons per minute (element only) + 2.5 PSI for the housing, making a total of 5.5 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 (gallons per minute). 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.

- The model SP 305 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 28). It is equipped with an integral bypass check valve set at 30 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 degrees Celsius. 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 30 P.S.I. 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 ΔP. When the ΔP reaches 30 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:

1. All of the dirt ever trapped by the filter, plus the filter itself, could go directly into the system.
2. 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.

To change the element

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.

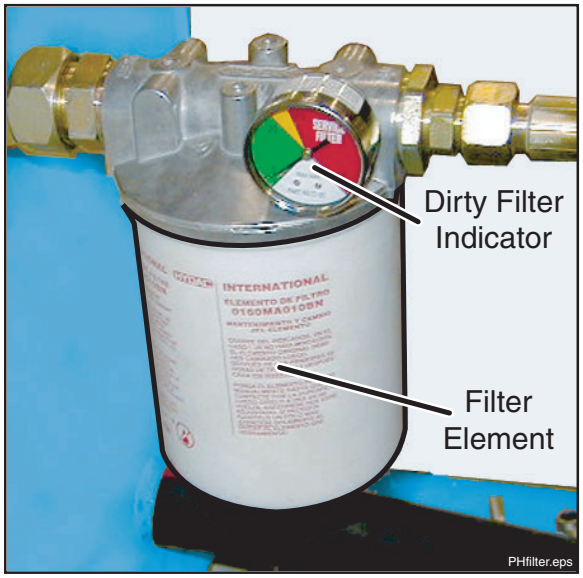


Figure 28
The hydraulic oil filter

Hydraulic Oils

General information

Hydraulic oils are rated for viscosity, heat dissipation, foaming characteristics, pour point, anti-wear additives, anticorrosive additives, lubricating qualities, compressibility, temperature range, temperature stability, and other functions. Although many different brands of oil will meet these specifications, they may

use different chemical additives packages to achieve the end result. For this reason, you should not mix 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 into 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. One brand, Mobil EAL 224-H has been accepted for use in Schwing pumps, and other brands are under consideration and testing now. The main thing that you have to remember about these oils is that they must NOT be mixed with mineral based hydraulic oils, even in very small amounts. If you will be pumping a job in an environmentally sensitive location and wish to use this type of hydraulic oil, please contact our service department at (651) 429-0999 for instructions on making the change from mineral oil.
- 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. If you live in a climate where the weather is changing from extremely hot conditions to extremely cold conditions, you should consider changing the weight of the hydraulic oil that you use by the season. The International Standards Organization (ISO) has developed a method of grading hydraulic oils for viscosity. For summer in northern North America, we recommend ISO VG 46 weight oil, while in the winter we would 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 is, and the lower the pour point of the oil is. On the other hand, the thinner the oil is, the lower the temperature will have to be before it breaks down the lubricating film that protects your components. See the chart in the *Appendix* section of this manual for help in selecting the proper oil for your requirements.
- The quality of the oil needed for use in a Schwing machine is rated 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 machines.

Specific information

- All machines leave the Schwing factory filled with Mobil DTE 25 hydraulic oil unless otherwise requested by the customer. DTE 25 has an ISO viscosity rating of VG 46. If you want your new machine filled with a different brand or different viscosity oil, you should specify when ordering.
- Many other brands of oil have been approved for use in Schwing machines, including:
  - Texaco Rando HD and Rando HDZ
  - Shell Tellus oil
  - BP Energol
  - Aral Vitam
  - Esso Nuto
  - Esso Univis
  - Total Azolla
  - Wintershall Wiolan

(The order of the list doesn't signify anything. Any oil which meets the quality and viscosity standards described above can be used).

When to change your hydraulic oil

- You should change your hydraulic oil at least once per year. If you use good filters and change them when they are dirty, the oil will be clean, even after a year, but the chemical additive packages that give the oil its properties will break down with time, and no amount of filtration will bring them back.

Pressure, Hoses and Fittings

General Information

The SP 305 concrete pump hydraulic systems run with medium-high pressures, in the 2500 PSI range. The maximum pressure is determined by adjustment of the pressure compensator on the main hydraulic pump. The machines are designed to operate at this pressure. Concrete pressure is just a ratio of the hydraulic pressure. The ratio of hydraulic pressure to concrete pressure is the same as the ratio of the differential hydraulic system piston area to the concrete piston cup area.

- If you lower the pressure at which the system runs, you can defeat the power of the system. For example, you ask the machine to develop 2400 PSI hydraulic pressure to push the concrete where you want it to go. You want to replace a hydraulic hose with a less expensive, lower pressure hose, so you lower the hydraulic pump pressure setting from 2500 PSI to 1500 PSI. What is the result? The concrete still requires 2400 PSI to get where you want it, but your pump can only put out oil up to 1500 PSI. Now the oil that should be pushing the concrete is instead telling the hydraulic pump to stop putting out oil. Nothing moves, and your concrete pump has been rendered useless by a cheap hydraulic hose.
- If you raise the pressure at which the system runs, you can harm the system. Using a new example, the concrete requires that the machine develop 2900 PSI hydraulic pressure to push it where you need it. Your machine is factory set to run at a maximum of 2500 PSI, so you raise the setting of the pump compensator to do the job. The hydraulic pump can't withstand 2900 PSI for more than a few minutes, and it breaks. You now have to replace a pump before you can make another pour.
- If you leave the machine at the factory specification, you DO NOT harm the system. It gives you years of dependable service. This means you should only use fittings and hoses that have a sufficient WORKING PRESSURE to handle the system requirements. If you take a job that needs more pressure than your machine has, you should buy or rent a higher pressure machine.

Specific Information

- Schwing uses high pressure fittings and hoses on all circuits, even if the relief valve for that circuit is set to low or medium pressure. The fittings and hoses are rated at a minimum of 5000 PSI working pressure, and in the case of some fittings, up to 15,000 PSI. We advise against changing any circuit to lower rated hoses or fittings.
- We use metric fittings and hoses, with metric threads on the couplings. There are four diameter sizes of tubes and fittings used on this unit and four diameter sizes of hoses. The chart in Figure 29 tells you what the sizes are and what they will attach to.

Hose Size	Hose I.D.	Connects with Fitting & Tube Size
8	8 mm	12
13	13 mm	16
16	16 mm	20
20	20 mm	25

1COLPhoseFITTING.eps

Tube & Fitting Size	Tube & Fitting O.D.	Connects with Hose Size	Tube & Fitting I.D.
12	12 mm	8	8 mm
16	16 mm	13	13 mm
20	20 mm	16	16 mm
25	25 mm	20	20 mm

Figure 29
Hose, fitting and tube sizes versus connection sizes

- All block threads are metric or BSPP.
- Instructions for setting the relief functions are shown in the preventative maintenance section of this manual.

General Maintenance Tips

Torque specifications

When performing maintenance that requires removal and replacement of bolts, it is very important to adhere to the torque specifications that apply to that bolt (Figure 30).

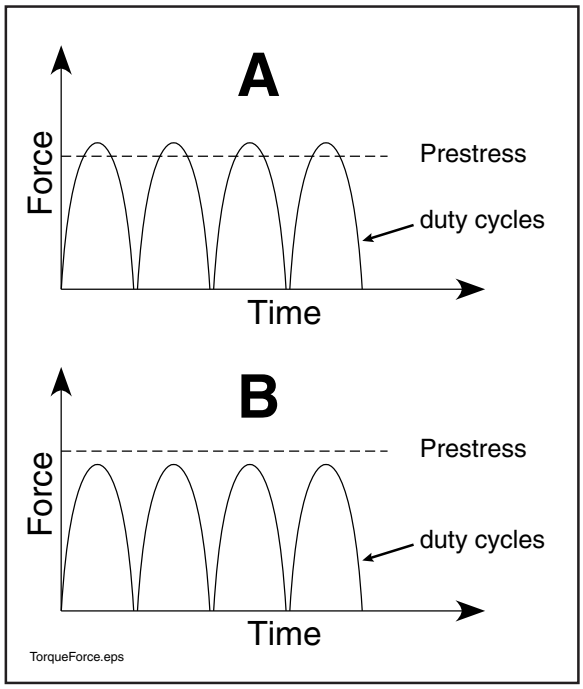


Figure 30
Effects of proper prestressing of a bolt

The graphs in Figure 30 demonstrate what happens to a bolt if it is not properly torqued. The dashed line represents the prestress on the bolt. As the device that uses the bolt goes through its normal functions, the bolt in example "A" gets stretched and relaxed with every duty cycle, because the bolt is prestressed under the maximum force of the cycle.

In example "B", the prestress of the bolt has been raised to more than the maximum force of the duty cycle, so the bolt doesn't ever feel the cycle. In this example, bolt "B" would last MUCH longer than bolt "A". The torque specifications for bolts used on Schwing equipment are found in the *Appendix* section of this manual.

Adjusting relief valves

While adjusting a relief valve is not normally a dangerous procedure, you should remember that it has the potential to cause trouble. The main thing to watch out for is this: Sometimes people who don't know better will have a problem with a machine and begin troubleshooting by raising the pressure setting. When that doesn't help, they forget to lower it back down. When you check the pressure by creating a hydraulic block, the pressure is set too high. In extreme cases, this can cause hoses or fittings to burst or other component failure. To be safe, you should begin the adjustment procedure by turning the adjustment device to the lowest possible setting, then bring the device back up to the proper setting.

Removal of safety devices

Sometimes you will have to remove a safety guard or other safety device in order to perform maintenance. For these situations, you must take extra care to be sure of 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 that the machine is turned off and that the key is in your pocket. If there is more than one key in existence, you should also put a "DO NOT OPERATE" sign on the controls or over the start switch.

Before restarting the machine after performing maintenance, be sure to put away all tools, parts and supplies, and clear the area of personnel. If your company has a "lock-out, tag-out" policy in place, abide by it.

Concrete pumps are big enough to hide a man. Be sure to yell "clear" before starting the unit at any time, and allow time for response before proceeding.

Preventative Maintenance

NOTE!

There is a sample maintenance chart shown in this section of the manual, page 57.

Daily maintenance

1. Check the levels and condition of the lubricants and coolant in the towing truck. Follow the manufacturers recommendations for quantity and type.
2. If the towing vehicle has air brakes, bleed the moisture out of the truck air system by opening the pet cocks located on the bottom of the air tanks. This is especially important if there is a chance that the moisture will freeze.
3. Check the condition of the tires on both the towing truck and the trailer. Do not drive the unit with bald, cracked or damaged tires.
4. Check the level and condition of the hydraulic oil (Figure 31). Top up, if necessary, with the same brand and type of oil. If you have a filter buggy to pump oil into the tank, use it. Replace milky looking oil, which is a sign of water contamination. Try to determine the source of the water, if possible. If the oil has turned milky quickly, like from one day to the next, then just replacing the oil will not solve your problem, and the new oil may be milky looking the next morning. If you need help with ideas of where to look for the source of water contamination, call Schwing America's Service Department at (651) 429-0999.

OilLEV.eps

Figure 31
The hydraulic oil level indicator

5. Bleed the water out of the bottom of the hydraulic oil reservoir by opening the drain cock or faucet located at the bottom of the reservoir (Figure 32). Place a drain pan under the outlet hose, open the valve, and watch the liquid as it leaves the hose. When the liquid changes from water to oil, close the valve. Because of condensation, which is aggravated by large heating-cooling cycles, it is normal that there will be a small amount of water in the tank every day, but it should settle to the bottom of the tank overnight. The water that is drained should be clear, and the oil that follows it should also be clean, not milky.

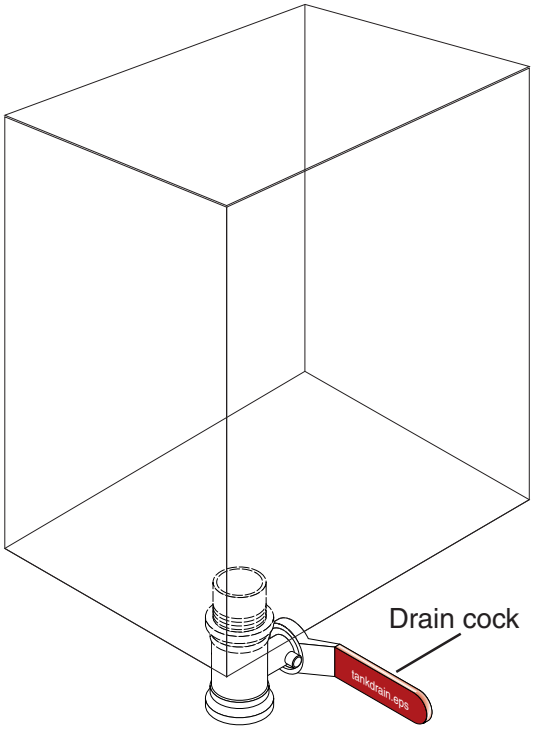


Figure 32
The drain cock used to drain water from the reservoir

6. Check the differential cylinder rod packings for wear by filling the waterbox with water above the level of the differential cylinder rods (if no grate is installed) or above the bolt down grates (if installed). Let it sit for a few minutes. If oil begins to float to the top of the water, it is an indication that the rod packings are worn. (Oil is lighter than water, and will float.) Don't forget to

let the water out after the check, especially if freezing temperatures are expected. Failure to replace the rod packings when they need it will result in contaminates from the water box, including water, entering the hydraulic oil at the packings and wearing on the rods, cylinder tubes, guide bushings, pistons and the piston rings. The material that gets worn off of the above mentioned items also becomes contamination, accelerating the wear. Left unchecked, this wear will totally destroy a differential cylinder. Normally, you will be due for new packings after 1 to 2 years.

7. Each day you should visually inspect the bolts on the rubber rams as well as those on the S - tube. Notice if there is any play. If you see something suspicious, shut off the engine, put the key in your pocket, remove the hopper grate, and inspect with a wrench. If you find that they are loose, tighten with a torque wrench to the torque specifications found in the *Appendix* section of this manual. Don't forget to replace the hopper grate before using the machine.
8. Grease the pivot shaft bearing and outlet assembly (Figure 33). This can be done on the job as described in the *Operation* section of this manual.
9. Visually inspect the unit for damage or leaks each day. Repairs should be made before the unit is operated.
10. Once a day you should check your maintenance checklist to see if any scheduled maintenance is due.

The Grease relief valve above is designed to prevent over greasing which could prevent valve movement. The decal below points out that it is indeed a relief and not a broken zerk. If it is replaced with a grease fitting the pressure from excess grease will prevent the valve from moving.

Figure 33
Grease zerks for the outlet assembly and the pivot shaft bearing to be greased each day

Monthly maintenance

Grease the two fittings of the crank arm lever monthly (Figure 34).

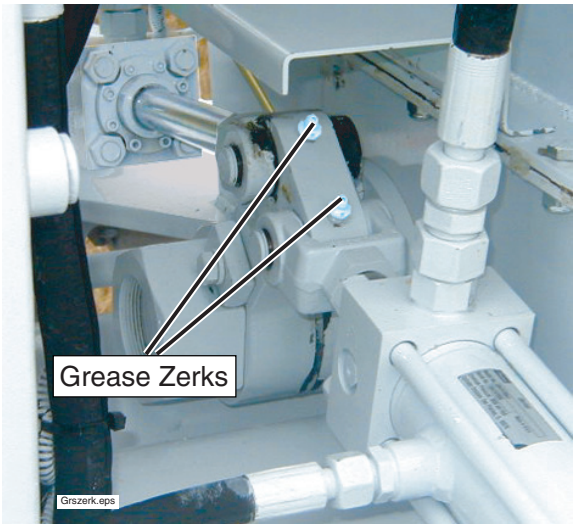


Figure 34
Grease zerks on the crank arm lever should be greased monthly

Check mounting hardware

Check the mounting hardware of the subframe, the oil tank, the pumpkit, the differential cylinders, and the material cylinders. Check for bolt tightness, cracks and other abnormalities.

Check hydraulic pressures

Check all hydraulic pressures. The specifications for each circuit are shown below and on the hydraulic schematic that applies to that circuit. The schematics are all contained in the *Appendix* section of this manual. Changes in pressures may indicate trouble in one or more components and will serve as early warning indicators IF you check them on a regular basis. PRESSURE SETTINGS MUST BE MADE WITH THE OIL AT NORMAL OPERATING TEMPERATURE (40° to 60° C). To heat the oil to operating temperature:

1. When the oil is very cold (at or below the pour point of your hydraulic oil), Bring engine RPM to an idle and let the engine idle until the temp. gauge on the operator's panel reads 20°.
2. When the oil is warm (40° C on the temperature gauge of the operator's panel), The pressure can be checked and assumed to be accurate.

Setting the concrete pump pressure

The concrete pump pressure is preset at the factory and should not require adjustment. The pressure cut-off on the hydraulic pump is set at 2500 PSI and the redundant relief is 2900 PSI. If you feel that your pump has a pressure problem, contact the Schwing America Service Department at the Call Center (888-Schwing).

Clean the oil cooler fins

Spray out the coils of the optional 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.

Semiannual maintenance (every 6 months)

Change hydraulic oil for temperature reasons

Change hydraulic oil if you live in a geographical location where the weather changes the temperature range drastically. If you save the oil in clean barrels and properly store the barrels, you can reinstall this oil when the weather changes back. You can use the oil for a maximum of 2 six month seasons. Contact your hydraulic oil dealer to obtain clean barrels and the proper storage procedures. Caution! If you ignore proper storage procedures, the oil will become so contaminated that reuse will become destructive to the machine. If you don't own a filter buggy for oil transfer, consider buying one, or at least rent one for the occasions when you change your hydraulic oil.

Checking the Accumulator

The accumulator on this unit does not store energy and does not require charging. The accumulator function is more to serve as a dampener than to store energy for the purpose of shifting the valve as accumulators in a twin circuit system do. The maximum pressure on the accumulator for the SP 305 is 1500 PSI and should function properly for years.

⚠ WARNING

EXPLOSION CAUSED BY IMPROPER ACCUMULATOR CHARGING CAN RESULT IN DEATH OR SERIOUS INJURY!

* Follow the charging instructions exactly!
* Use ONLY dry nitrogen to charge the accumulator!
* NEVER use oxygen or compressed air to charge the accumulator!

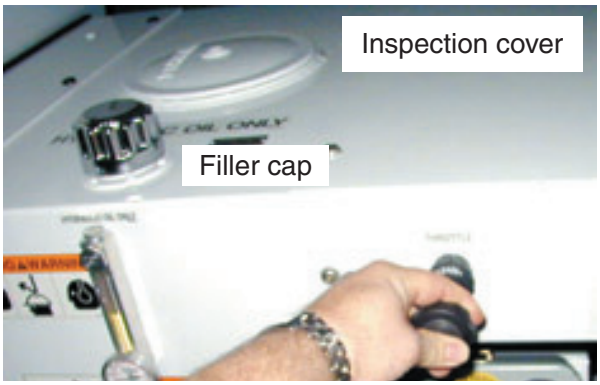
explosion warning.eps

Annual maintenance

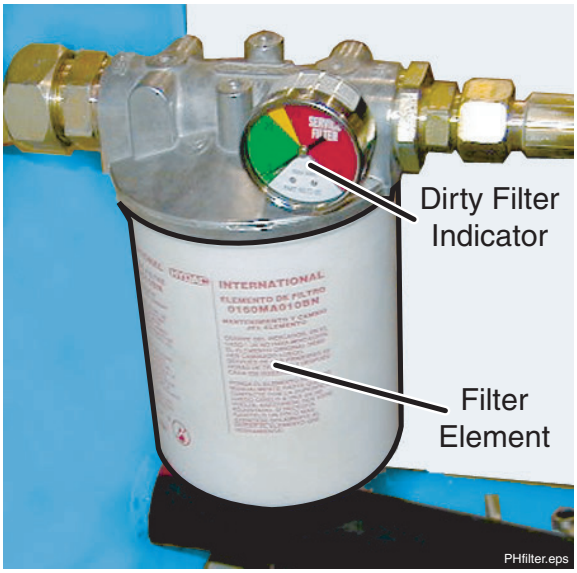
Change hydraulic oil for age reasons

Change hydraulic oil if you haven't already done it because of the weather. The same filling rules that apply to adding hydraulic oil apply to filling the tank after draining and cleaning. To change the 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 drained out of the bottom of the tank (Figure 35).
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 of the silt from the bottom of the tank.
5. Close the drain, if open. Refill by pumping new oil out of the barrels with a filter cart. If no cart is available, rent one. REMEMBER! NEW OIL IS NOT CLEAN ENOUGH TO INSTALL IN YOUR UNIT. 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.
6. Change the main return filter before restarting the unit (Figure 35).



tankfill.eps



PHfilter.eps

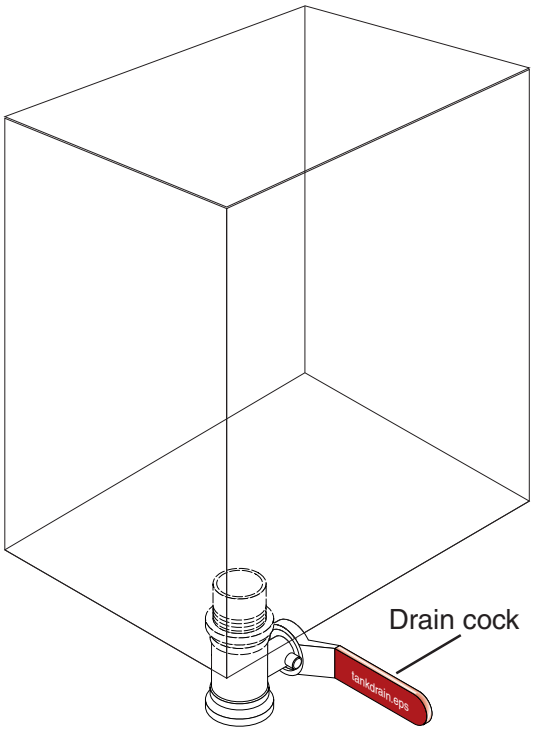


Figure 35
Change hydraulic oil

Check the pre- charge of accumulators

Check the accumulator gas pre-charge as shown:

- 1st check-one week after first use
- 2nd check-three months after first use
- 3rd check-one year after first use
- 4th check and beyond-annually

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** (Figure 36), 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.

Charging procedure

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

1. Before you begin, you will need a charging kit (Figure 37). Do not attempt to charge the accumulators without one. You can order the charge valve assembly from Schwing America using part number 30338635. There is also a kit available directly from Hydac. Hydac Corporation can be reached at (610) 264-9503. The Hydac part number is FPS 250 F 2.5 G4 K.
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, and remove the key.

NOTE!

The accumulator on the P305 does not serve to shift the Rock Valve as it would on a twin circuit system. The only function of the accumulator on this unit is to absorb shock from pressure spikes as the valve shifts.

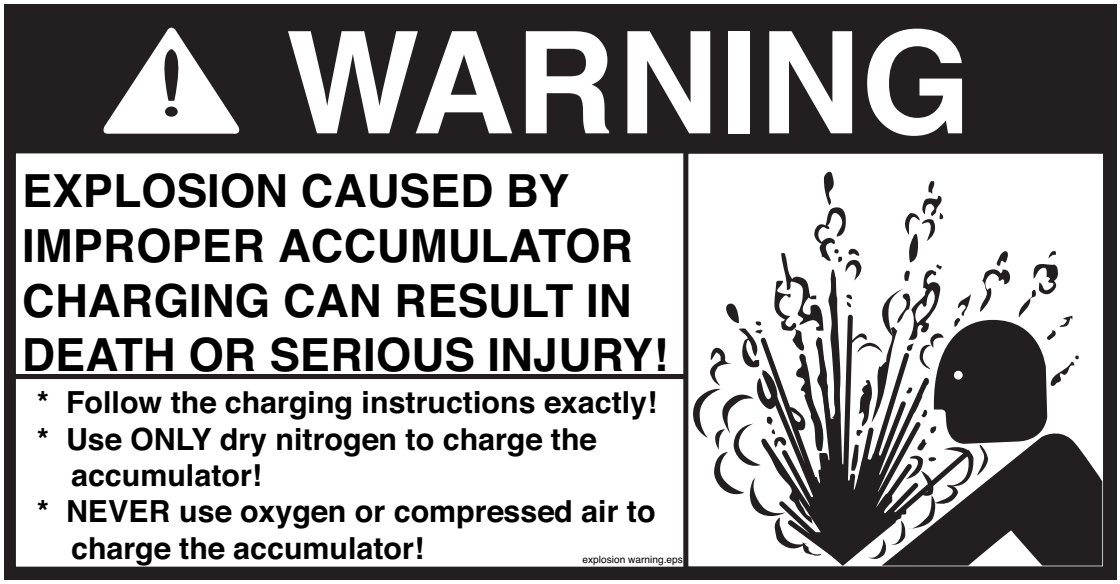


Figure 36
Warning decal for accumulator charging

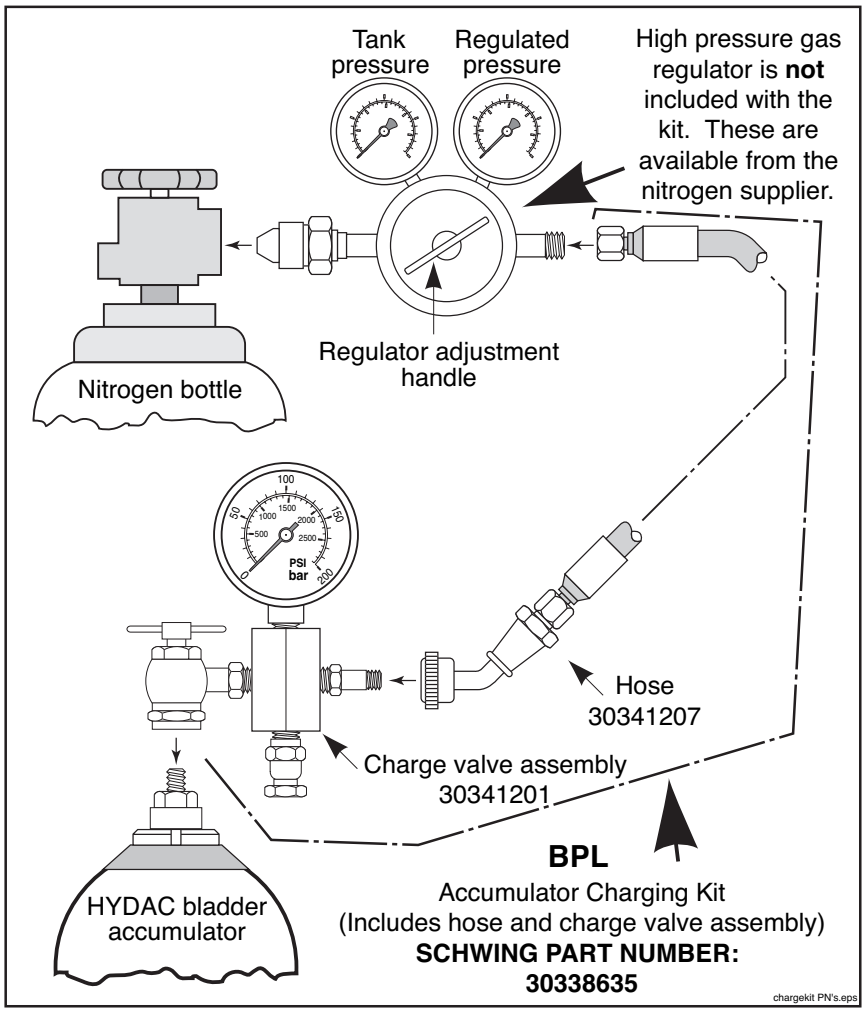


Figure 37
Accumulator charge kit for HYDAC bladder accumulators

4. Remove the valve protection cap and the valve seal cap from the accumulator that you will charge first (Figure 38).

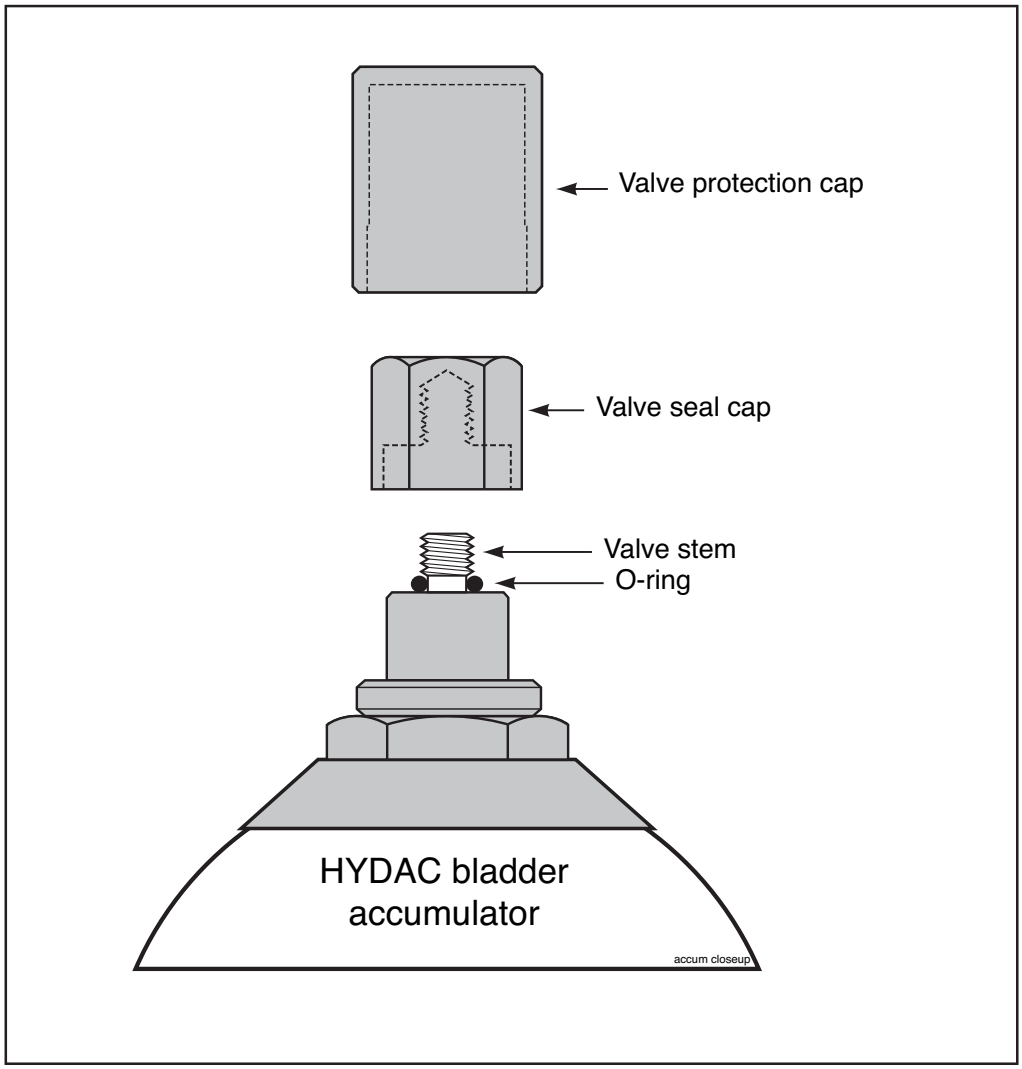


Figure 38
Detail of accumulator gas valve area

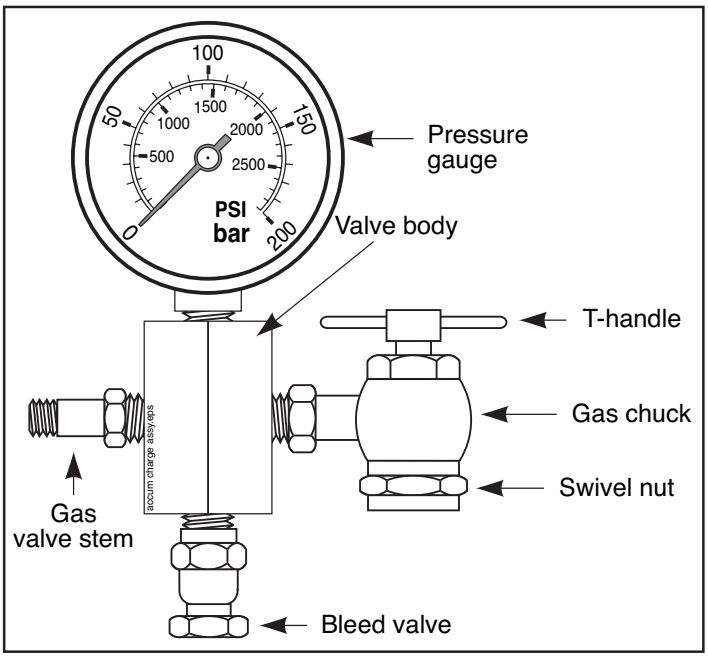


Figure 39
Charge valve assembly

5. On the charge valve assembly, locate the T-handle of the gas chuck (Figure 39). Rotate it *counterclockwise* (outward) completely before attaching the swivel nut to the accumulator gas valve stem.

6. On the charge valve assembly, close the bleed valve (Figure 40), and disconnect the hose from the gas valve stem. This step closes the charge valve stem to prevent the gas pressure from escaping out of the hose and ensures that the initial pressure reading is accurate.

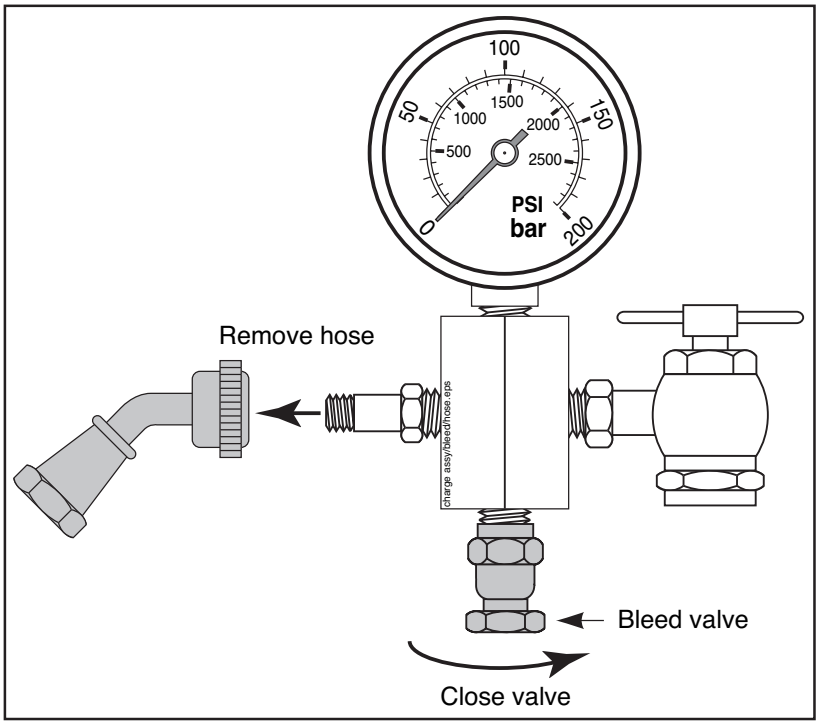


Figure 40
Close bleed valve and disconnect hoses

7. Find the swivel nut (Figure 41) on the charge valve assembly. Screw the swivel nut onto the accumulator gas valve. Tighten to 10–15 in./lb.
8. After the swivel nut is attached, screw the T-handle (Figure 39) *in* (clockwise) three (3) full turns. This presses a pin into the gas valve and opens it. Read the pressure on the charge valve assembly gauge (Figure 42) before you attach the nitrogen bottle to the charge valve assembly. The pressure should read 103 bar (1500 PSI). If there is no reading on the gauge, turn the T-handle *in* (clockwise) one more full turn.

NOTE!

If the T-handle is turned *in* (clockwise) more than 4 full turns from the full counterclockwise position, it may damage the accumulator gas valve.

- If no adjustment is necessary, skip to step #16.
- If pressure is too high, skip to step #13.
- If pressure must be added, proceed to step #9.

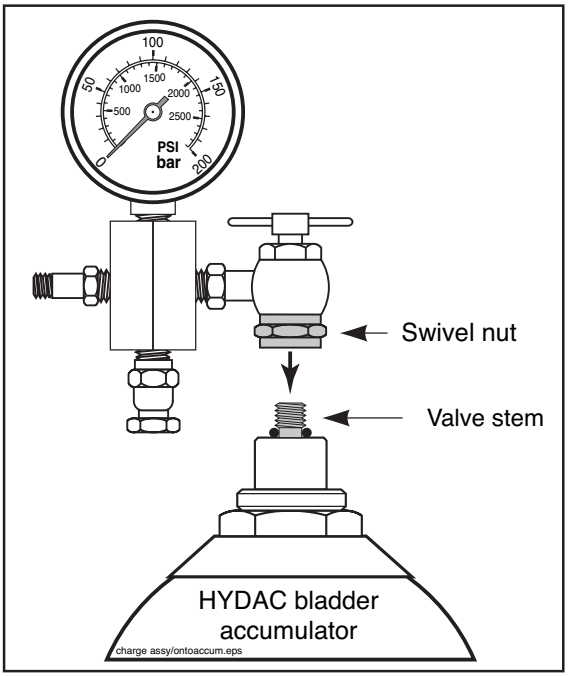


Figure 41
Attach swivel nut to accumulator gas valve

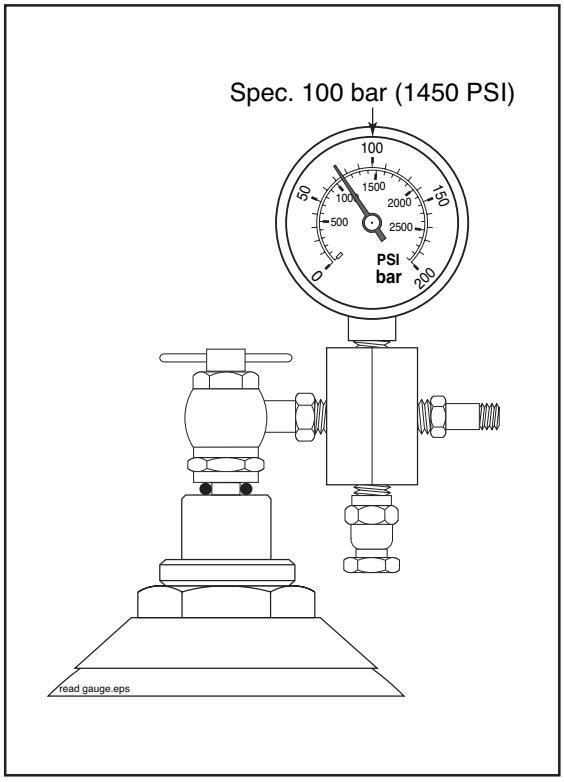


Figure 42
Read nitrogen pressure on gauge

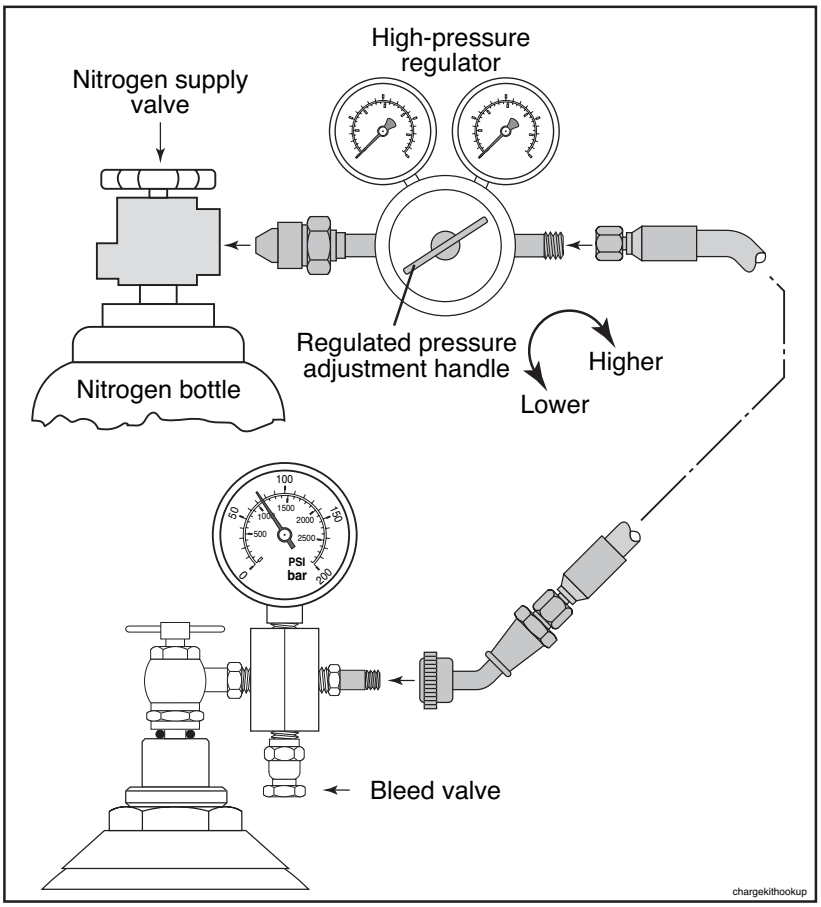


Figure 43
Make connections between nitrogen bottle and charge kit

9. 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 valve assembly gas valve stem, as shown in Figure 43. Do not open the nitrogen bottle supply valve yet.
10. Turn the regulated pressure adjustment handle on the high-pressure regulator *counterclockwise* to its minimum setting.
11. Crack open the nitrogen bottle supply valve (Figure 44). You will get a reading on the high-pressure gauge side of the regulator. Note that if there is not at least 1500 PSI showing on the high pressure regulator gauge at this time, you will not be able to charge the nitrogen to the 1500 PSI specification. If that is the case, you will need a new bottle of nitrogen before proceeding. If there is enough pressure in the nitrogen bottle to do the job, proceed to step #14.
12. Adjust the regulator handle *clockwise*, raising the regulated pressure. The accumulator will begin to fill. Continue filling until the charge kit gauge reads the desired pressure of 1500 PSI. Close the nitrogen bottle supply valve.
13. If you overcharge the nitrogen pressure, proceed as follows:
    - Close the nitrogen bottle supply valve.
    - *Slowly* open the bleed valve on the charge kit. Close the bleed valve when the correct pressure is reached.

NOTE!

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

14. Let the nitrogen sit in the accumulator for 10 to 15 minutes. This allows the gas temperature to stabilize. Recheck the pressure on the charge kit gauge.

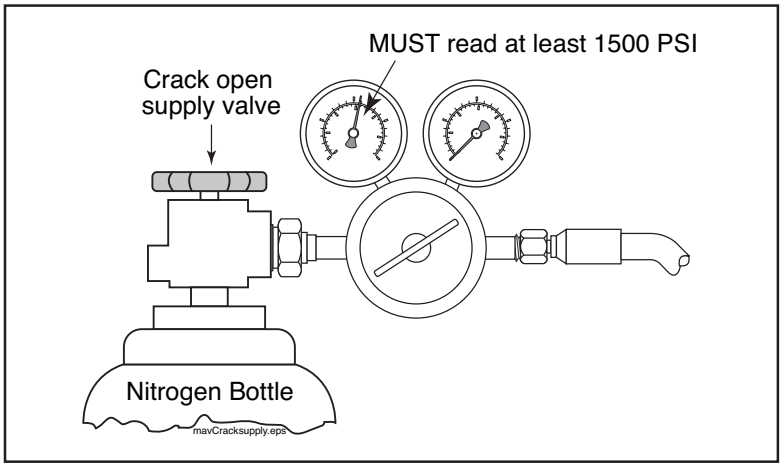


Figure 44
When the supply valve is open, bottle pressure shows on the high pressure gauge

15. 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.
16. When the correct pressure is reached, proceed as follows:
    - Close the nitrogen bottle supply valve.
    - Unscrew the T-handle on the charge kit (*counterclockwise*) until resistance is felt. This will close the accumulator gas valve.
    - Open the bleed valve, which releases the pressure in the hose, charge valve assembly, and regulator.
    - While holding the gas valve on the accumulator, unscrew the charge kit swivel nut.
    - Remove the charge kit.
    - If you are finished with the charge kit, remove the hose and regulator.
17. 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.
18. Replace the gas valve seal cap (tighten to 22 ft./lb.), and hand-tighten the valve protection cap.
19. Repeat the procedure for any other accumulators.

⚠ WARNING

EXPLOSION CAUSED BY IMPROPER ACCUMULATOR CHARGING CAN RESULT IN DEATH OR SERIOUS INJURY!

- **Follow the charging instructions exactly!**
- **Use ONLY dry nitrogen to charge the accumulator!**
- **NEVER use oxygen or compressed air to charge the accumulator!**

explosion warning.eps

Scheduled maintenance checklist

The following is the normal recommended maintenance schedules (after the break-in period).

SCHEDULED MAINTENANCE

Item	D	W	M	S A	A	page:
Change main return filter	When plugged.....					40
Check tires	X					45
Check hydraulic fluid	X					45
Bleed moisture from hyd. tank	X					45
Check differential cyl. rod packings	X					45
Inspect bolts on rock valve & rams	X					46
Grease rock & agitator bearings	X					46
Fill optional auto greaser reservoir	X					46
Inspect for damage and leaks	X					46
Check if maintenance is due	X					46
Inspect cutting ring & rotate, if needed		X				58
Check unit mounting hardware			X			47
Check hydraulic pressures			X			47
Change oil for temperature reasons				X		48
Charging the accumulator				X		48
Change oil for age reasons					X	49

D = daily, W = weekly, M = monthly, SA = semi annually, A = annually

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.

Wear parts

The cutting ring on this unit will wear with yards pumped. The gap between the cutting ring and transition tube (Figure 45, top) is designed to be 1/8th of an inch. The gap can be monitored and kept in tolerance by turning the adjusting nut on the slew lever (Figure 45, bottom) with the 3 1/4" wrench that is supplied or with a channel lock pliers. After the adjusting nut is tightened all the way, the cutting ring should be changed. Failure to maintain the 1/8th inch gap will cause premature wear of the cutting ring and spec. plate.

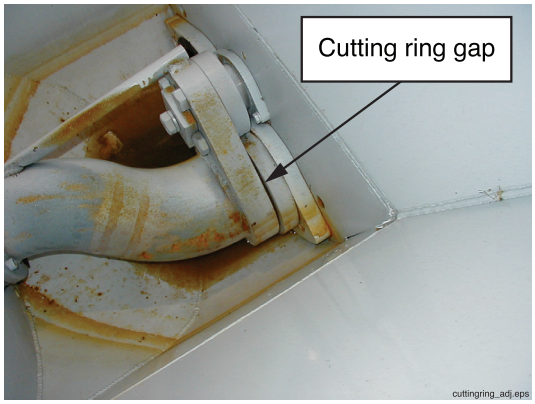
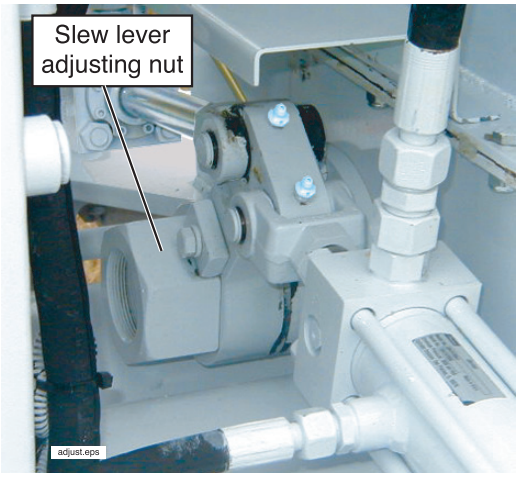


Figure 45
Cutting ring gap (top)
Adjustment nut for cutting ring (bottom)



Changing rams

When you begin to see grout in your waterbox at the end of the day, it is time to change the rams.

NOTE!

When changing rams, you will have to put your hands in the material cylinder on several occasions. YOU MUST TAKE THE FOLLOWING PRECAUTIONS TO AVOID AMPUTATION OF HANDS, ARMS AND FINGERS:

- **DO NOT REACH INTO THE MATERIAL CYLINDER WITH THE ENGINE RUNNING.**
- **DO NOT USE THE REMOTE CONTROL FOR THIS PROCEDURE! UNPLUG IT AND STORE IT.**
- **DO NOT ALLOW ANYONE ELSE NEAR THE CONTROLS WHEN YOU ARE CHANGING RAMS.** The chances of accidental amputation are greatly increased if more than one person is around. There are also less distractions when you are alone, so your attention will not become divided. If someone comes up, stop working until they leave.
- Please do not skip any of the above steps.

To remove the old rams

1. Start the engine.
2. Close the shut-off valve (also known as the ball cock and quarter turn valve Figure 46).

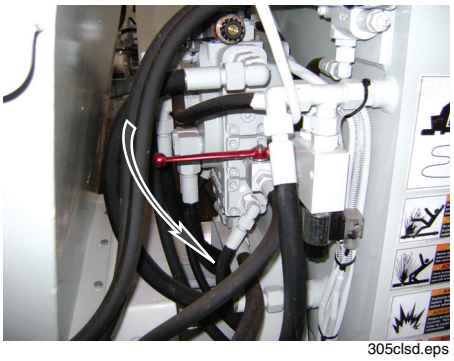


Figure 46
Concrete pump shut-off valve

3. Drain the waterbox.

4. Activate the pump in *reverse* mode, bringing the piston cup down to the end of the material cylinder. The pump will pressure out before the S-tube shifts, because the shutoff valve is closed; however, you should be able to stop the pump and have access to the piston cup before the pump pressures out.
5. Push the emergency stop button on the operator's panel and stop the engine. Put the key in your pocket, and verify that the pressure gauge is showing zero.
6. Remove the hopper on the SP 305 by removing all of the hopper mount bolts.
7. Place a 1 1/8" socket on an impact wrench, and remove the center mount bolt (Figure 47).

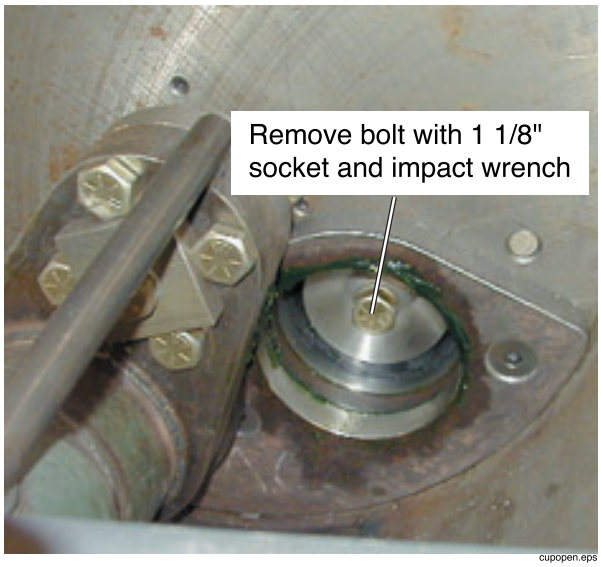


Figure 47
Piston cup mount bolt should be removed with an impact wrench

8. Remove the piston cup assembly from the material cylinder.

NOTE!

If the cup won't slide out easily: start the engine, release the e-stop, and activate the pump in *forward* mode just long enough to pull the rod away from the piston cup. Stop the pump before the cylinder reaches the end of the stroke, push the e-stop button, stop the engine, and put the key back in your pocket.
After verifying zero pressure on the gauge, use a screwdriver or small pry tool in the center bolt hole to remove the piston cup.

9. Separate the components (Figure 48), and clean all residue from the face plate and O-ring back plate, as well as the O-ring groove.

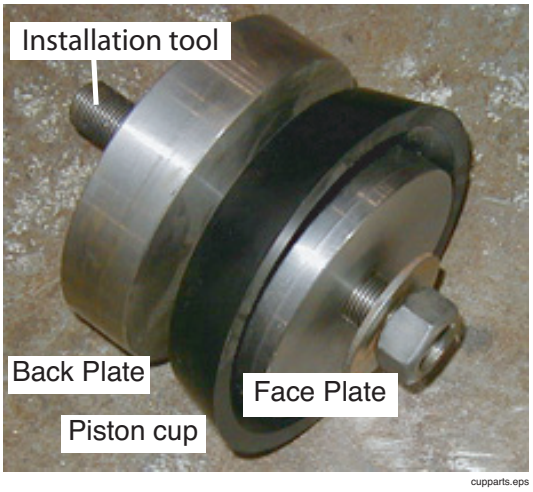


Figure 48
Piston cup components

10. Install the new O-ring on the back plate, and apply a coat of grease to the entire O-ring.

To install the new ram

1. Start the engine and run the piston rod back down to the end of the stroke, stop the engine, push the e-stop button, and put the key in your pocket.

NOTE!

An alignment/installation tool is supplied for installing the new ram. If the alignment tool is lost, it may be helpful to cut the head from a 3/4" bolt that is 3 to 4 inches long, screw the alignment bolt into the end of the rod, and slide the components over the bolt to reinstall.

2. The back side of the O-ring back plate is keyed for the purpose of rod alignment. This keyway, or pilot hole, should also be greased lightly before being placed on the alignment pin.
3. Push the back plate into the material cylinder, and align the pilot with the end of the rod.
4. Grease the new piston cup, and slide it over the alignment pin with the flat side to the back plate, as shown in Figure 48.

5. Set up the face plate as follows:
   - 3/4” bolt
   - Lock washer
   - Faceplate w/chamfer opposite bolt head
   - O-ring
   - Bushing w/chamfer facing back
   - O-ring
6. Coat threads of center bolt with *Never Sieze*.
7. Remove the alignment bolt and replace it with the 3/4” center bolt and face plate.
8. Tighten the 3/4” bolt until tight.
9. Open the shutoff valve. (Note that the unit will not cycle with this valve closed.) Repeat procedure for the other side.

Changing the material cylinders

The material cylinders also eventually wear out. They are considered worn out when the inside diameter has grown 3 millimeters beyond the specification for new. For example, a 750-18 has 180mm material cylinders. When the inside diameter reaches 183 mm, they are worn out. With 150’s they are worn out at 153, etc. Normally, it is the end attached to the valve that wears out first, because it sees the most concrete. The waterbox end may be in brand new condition, because that end never experiences concrete. For this reason, the material cylinders were designed to be able to flip them end-for-end. That way you can move the worn out part to the waterbox and the like-new part to the concrete valve for double the life. If you are going to do this, you have to catch the wear on the material cylinders before they get too thin or break through in one or more spots. When that happens you can’t flip them, because they would be structurally too weak to hold the pressure forces at the waterbox end.

The actual act of changing and aligning the material cylinders was the subject of a service bulletin in 1986. The procedure still applies today. Contact Schwing’s Service Department at (651) 429-0999 if you need a copy of the bulletin.

Inspecting hydraulic hoses

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

NOTE!

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

APPENDIX

APPENDIX

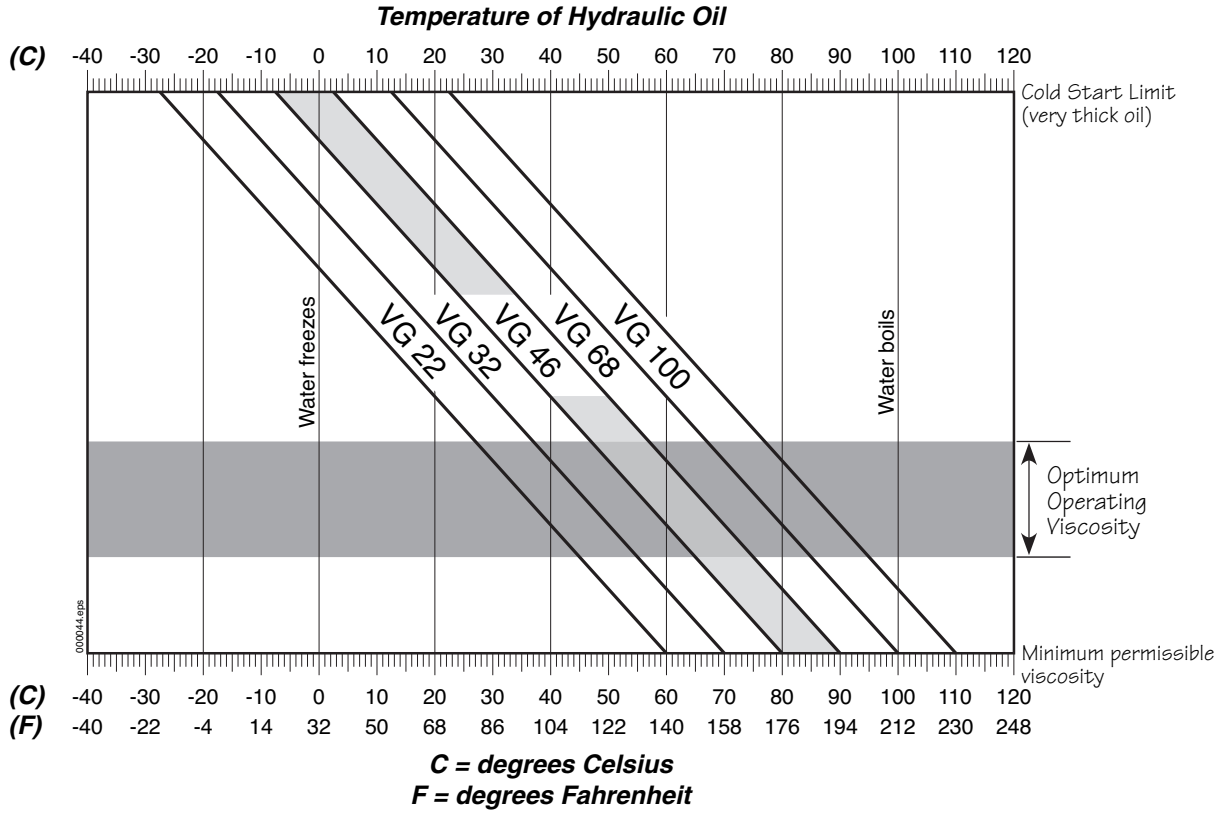
This section contains the technical information for your machine and its systems. This information is correct for your machine when it leaves the factory, but it may need to be updated from time to time.

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.

- 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°–76°C.



Torque Specifications for SAE Bolts

The following charts show the tightening torques specified for the bolts used on PH series pumps. The charts are to be followed unless a different torque specification is indicated for a particular procedure.

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 pound requirement must be within the range of 208–192 foot pounds for a dial scale torque wrench.

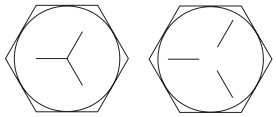
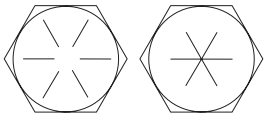
Schwing equipment uses two different types of bolts; one has a black finish and the other has a dychromate finish.

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.

GENERAL SAE BOLT TORQUE SPECIFICATION TABLE

Use the values listed unless special torques are specified. Values are for UNC and UNF thread fasteners. Values do not apply if graphite, moly-disulphide or other extreme pressure lubricant is used.

Table 1

SAE Grade Number	5		8	
Bolt head identification marks. See Note below.				
Bolt Size	lb.-ft	N•m	lb.-ft	N•m
1/4”	9-11	12-15	12-15	16-20
5/16”	17-20.5	23-28	24-29	33-39
3/8”	35-42	48-57	45-54	61-73
7/16”	54-64	73-87	70-84	95-114
1/2”	80-96	109-130	110-132	149-179
9/16”	110-132	149-179	160-192	217-260
5/8”	150-180	203-244	220-264	298-358
3/4”	270-324	366-439	380-456	515-618
7/8”	400-480	542-651	600-720	814-976
1”	580-696	787-944	900-1080	1220-1464
1-1/8”	800-880	1085-1193	1280-1440	1736-1953
1-1/4”	1120-1240	1519-1681	1820-2000	2468-2712
1-3/8”	1460-1680	1980-2278	2380-2720	3227-3688
1-1/2”	1940-2200	2631-2983	3160-3560	4285-4827
NOTE: Bolt head identification marks are shown as per grade. Manufacturer’s marks may vary.				

Recommended Emergency Hose Kit

Schwing recommends that you carry one of each of the following hoses on the unit in case you blow a hose 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 problems in the operation of the unit.

mavhoses.eps

Diameter	Length	Part Number
8	1000mm	10050174
13	500mm	10049901
16	650mm	10025659

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

Mavfittings.eps

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 / R1/4 in.	22	22	19	7/8	7/8	3/4
12 / R3/8 in.	22	27	22	7/8	1 1/16	7/8
12 / R1/2 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

mavbanjo.eps

End Cap Part of Stem

12 / R3/8 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

Maintenance Checklist

The following are the normal recommended maintenance schedules (after the specified break-in period).

SCHEDULED MAINTENANCE

Item	D	W	M	S A	A	page:
Change main return filter	When plugged					40
Check tires	X					45
Check hydraulic fluid	X					45
Bleed moisture from hyd. tank	X					45
Check differential cyl. rod packings	X					45
Inspect bolts on rock valve & rams	X					46
Grease pivot shaft and bearings	X					46
Fill optional auto greaser reservoir	X					46
Inspect for damage and leaks	X					46
Check if maintenance is due	X					46
Inspect cutting ring & rotate, if needed		X				58
Check unit mounting hardware			X			47
Check hydraulic pressures			X			47
Change oil for temp. reasons				X		48
Checking the accumulator				X		48
Change oil for age reasons					X	49

D = daily, W = weekly, M = monthly, SA = semi annually, A = annually

Weld-on Ends / Coupling Comparison

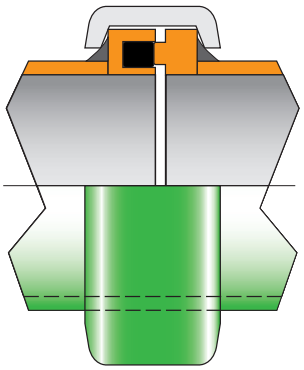
Shown is a comparison among commonly used ends/couplings. No two ends shown can be joined without the use of an adapter pipe or a special adapter clamp. Clamps and pipe strength must also be considered when determining proper system requirements. The ratios shown in the text below represent the safety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

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

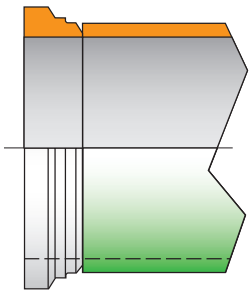
2. Heavy-Duty couplings are designed for pressures up to 2250 PSI @ 2:1. They have 20% more contact area than metric couplings, and a tapered face that draws the pipe sections together during assembly. Both the ends and clamps weigh more than metric style, and therefore should not be used on booms without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

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

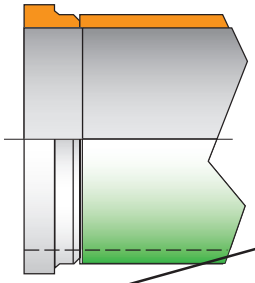
4. Grooved couplings (lip height of 0.15” or less) are designed for pressures only up to 750 PSI @ 2:1. The recessed groove is hard to clean when changing pipe on a job. The weld-on end fails before the pipe because the groove is cut into the pipe thickness, making it the weakest spot. Grooved couplings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



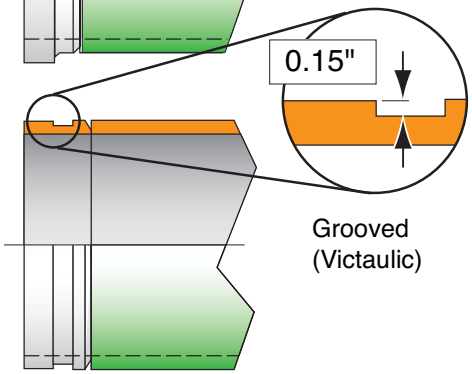
Male / Female
O-Ring
(shown with clamp)



Heavy Duty



Metric



Grooved
(Victaulic)

weldends4.eps

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

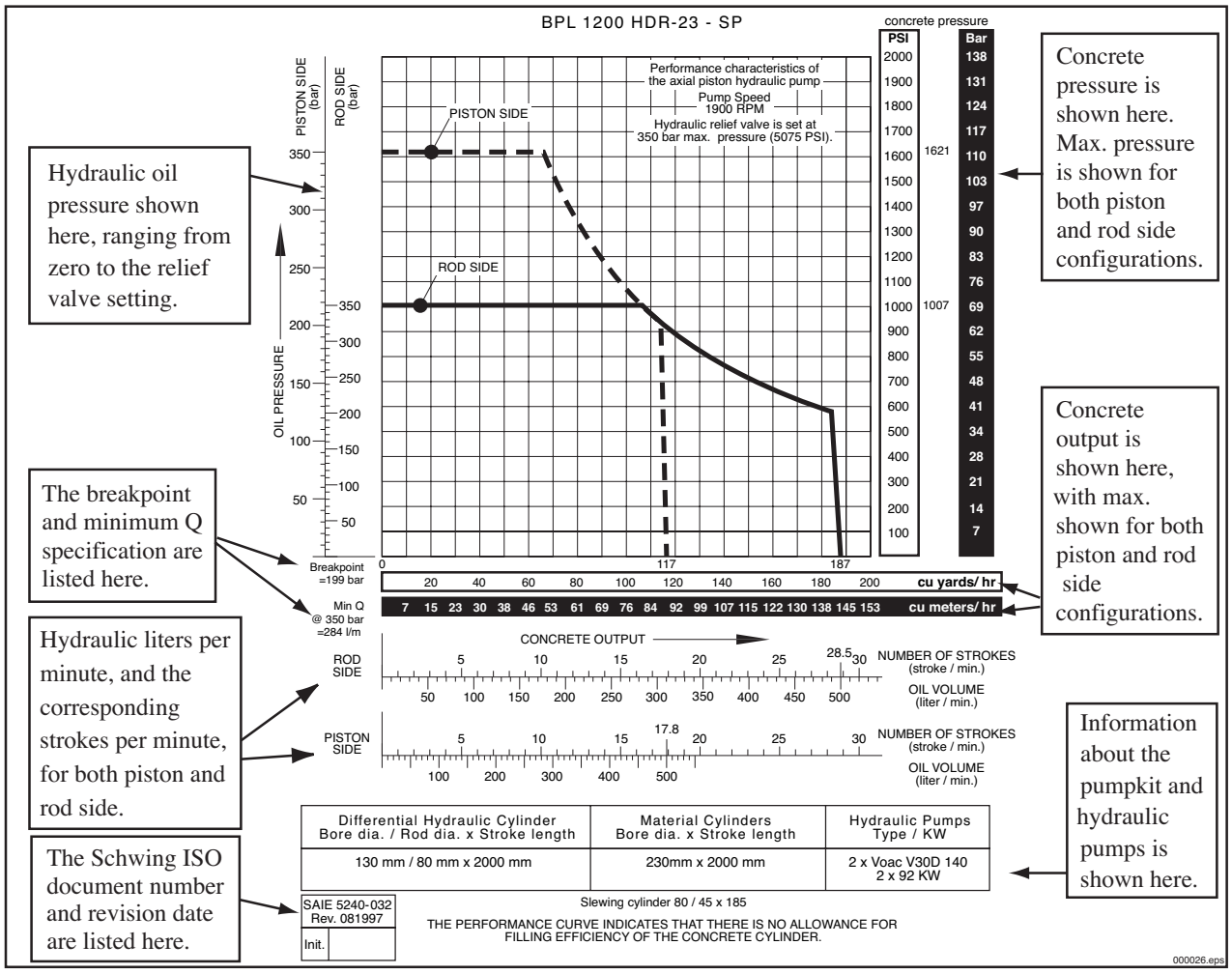
Output Charts

The hydraulic pumps that drive your concrete pump are horsepower controlled. That means that 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 model,
- maximum output (in cubic yards per hour) of the pumpkit model,
- maximum strokes per minute of your pumpkit model,
- maximum output (in liters per minute, L/min) of your hydraulic pumps,
- output that can be expected at various pumping pressures,
- condition of your hydraulic pumps when used in conjunction with a flowmeter, and
- breakpoint of your hydraulic system.

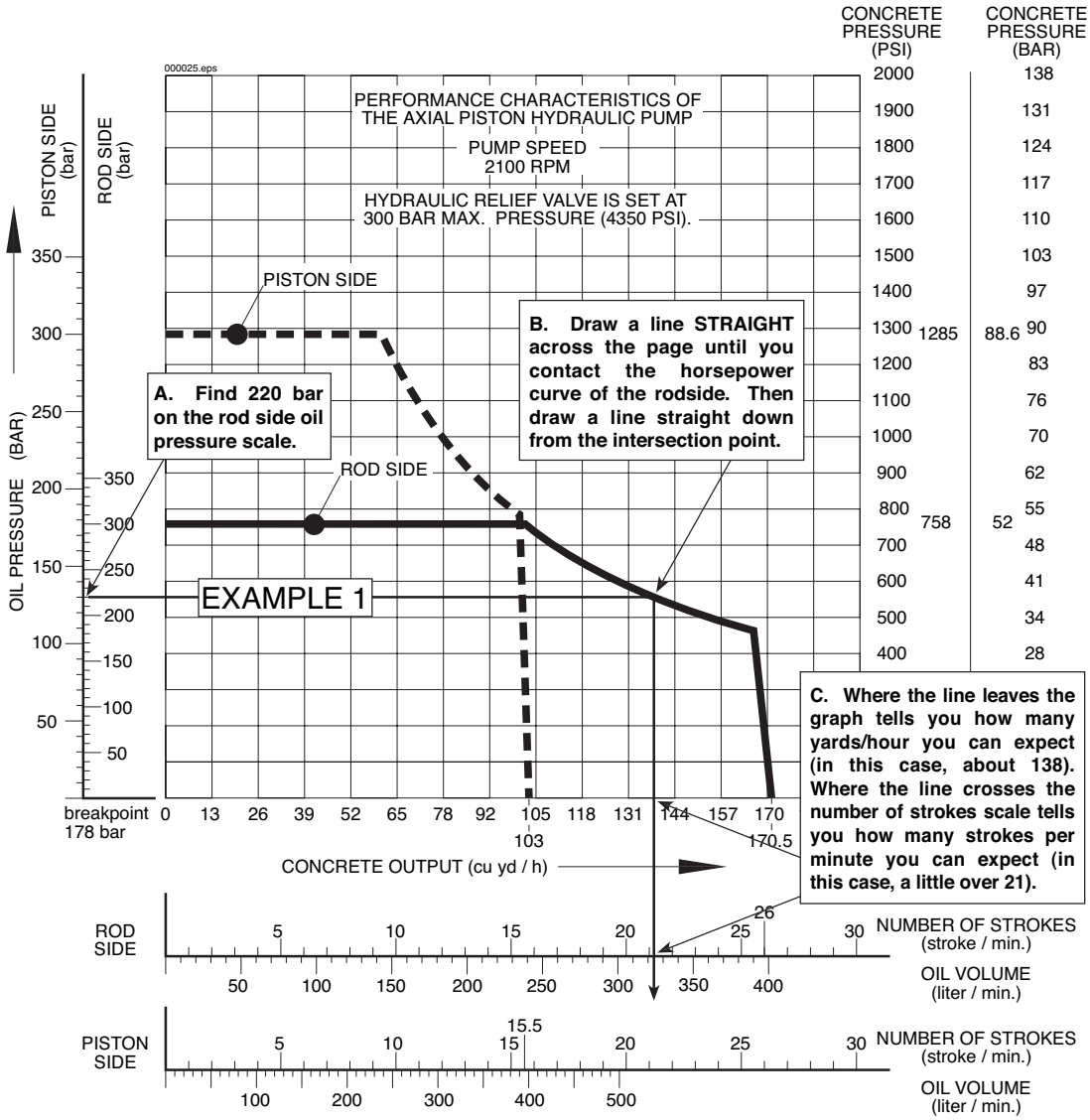
An explanation of an output chart is shown on the following pages, followed by some examples of chart usage. The output chart of the pumpkit shipped with this manual is shown later.

Using the chart



Example 1—Checking flow at a given pressure

Your unit is configured on the rod side (standard from the factory). You notice that your machine is not getting as many strokes per minute as you are used to seeing. You count the strokes and see that you are getting about 21 $^1/_2$ 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 your 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 2, 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.

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.

Breakpoint specification		1st Pump Liters/min (read on meter)		1st Pump Total (for plotting)		2nd Pump Liters/min (read on meter)		2nd Pump 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	_____

000032.eps

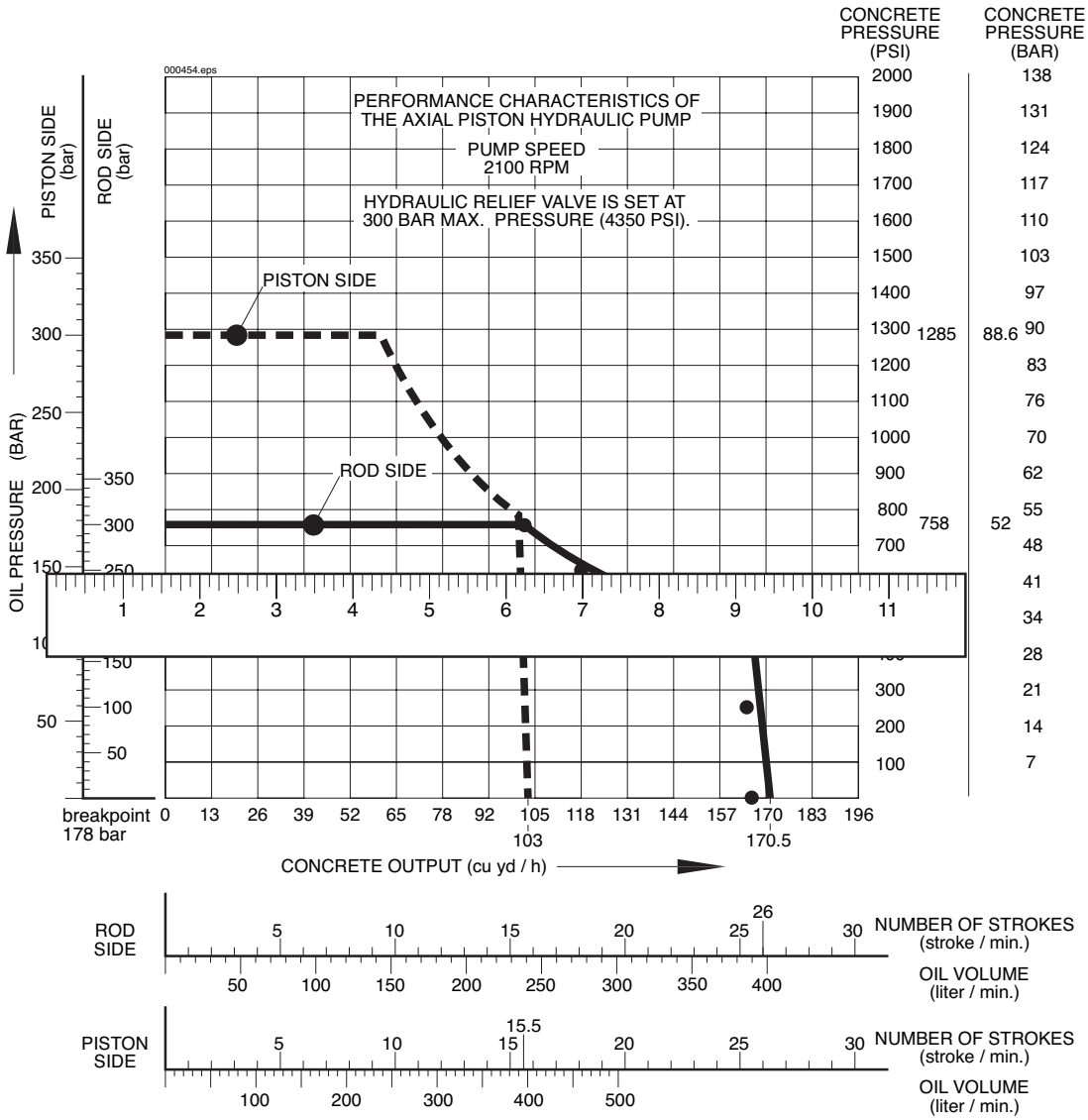
As an example, we'll assume that we have just taken the following readings:

Breakpoint specification		1st Pump Liters/min (read on meter)		1st Pump Total (for plotting)		2nd Pump Liters/min (read on meter)		2nd Pump 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	_____

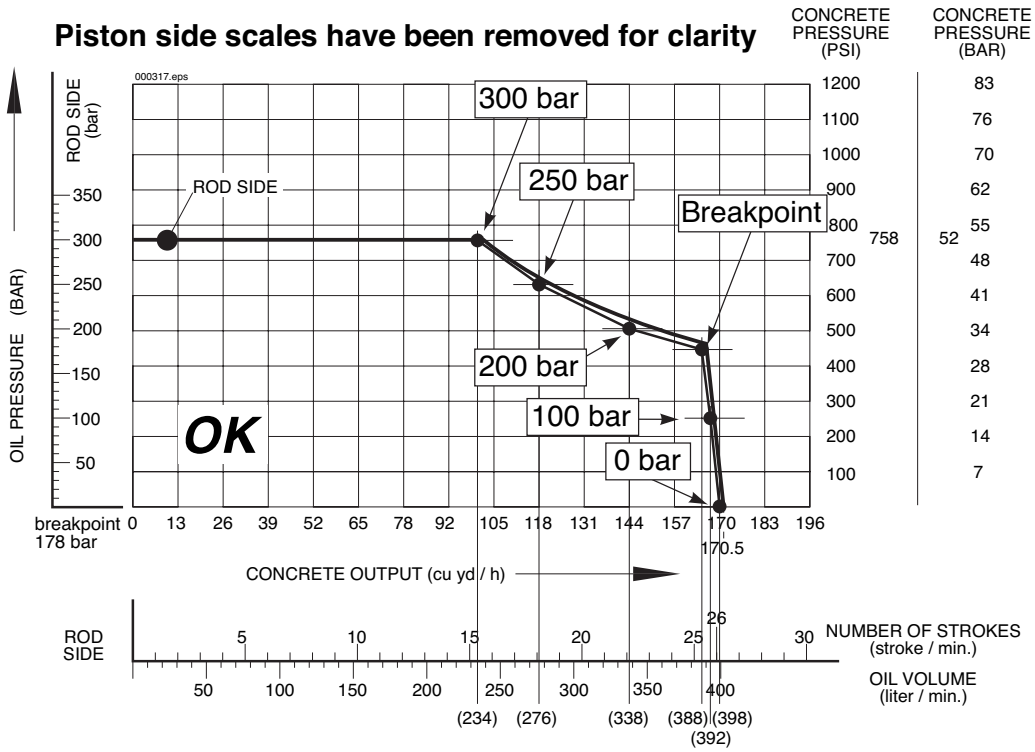
000031.eps

Now plot the readings on the output chart. Take a clean output chart and proceed as follows:

- Lay a straight edge horizontally across the page at the pressure point you are plotting. Draw a light line across the chart. In the example below, we use the rod side scales and curve (you could use the piston side scale and curve instead). The ruler is shown ready to draw a line at 250 bar hydraulic pressure.
- Turn the ruler vertically, and draw a light line up the page from the liters/minute reading you took at that pressure (remember to multiply the reading by 2). In our example, we measured 276 liters 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 your 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. (See the plot that follows.)

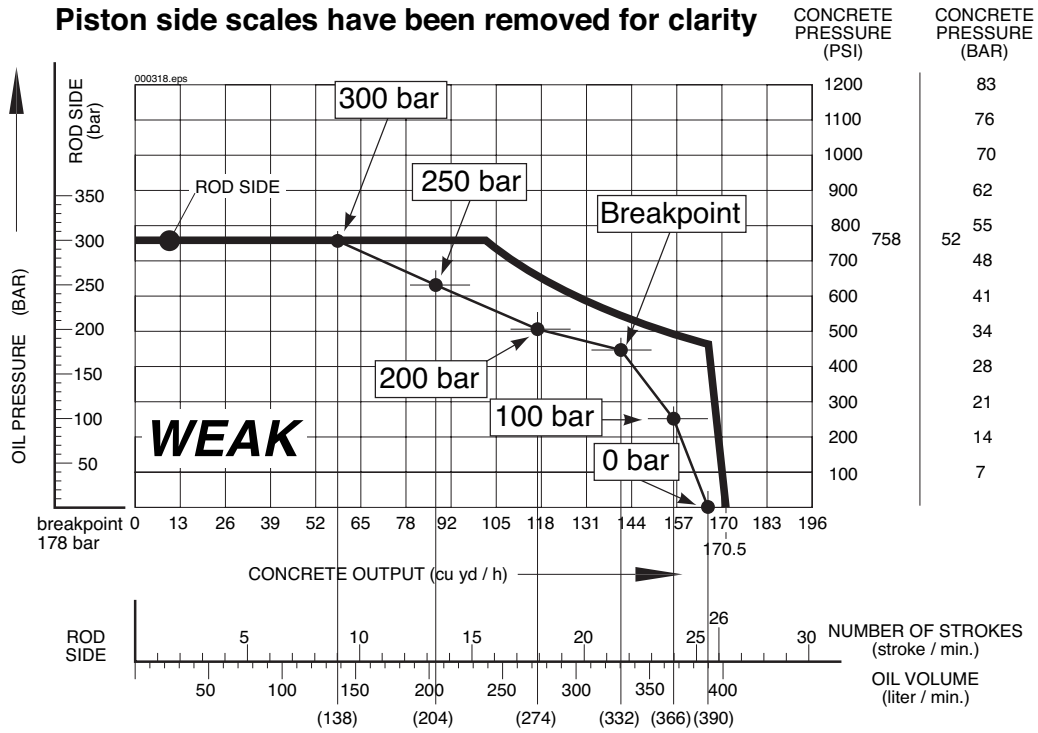


Check the second pump. Hook up the flowmeter just as when you checked the first pump. Again, be sure that you have the correct speed, gear, chart, and so on. This time our example will have worse results.

Breakpoint specification		1st Pump Liters/min (read on meter)		Total (for plotting)		2nd Pump 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

000030.eps

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



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. **Note!** Never try to make up for this 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 Schwing America's Service Department 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

General information

If you have read the original Schwing America publication *Nomographs—A Guide to Usage*, you will notice several changes in this document. Because not all of the power from the truck engine can be used for the concrete pump, the TK number of the engine has no meaning. Therefore, this section about using nomographs is being adapted especially for boom pumps. We can still figure out the TK of the job to do, but the suitability of the pump has to be determined in a different manner. To make the pump numbers and job numbers match, we will use a "Power Factor Number," which takes into account the power of the hydraulic pumps instead of the engine and is easy to use with cubic yards per hour and PSI instead of cubic meters per hour and bar.

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

1. the amount of power available,
2. the maximum concrete output available, and
3. the maximum concrete pressure available.

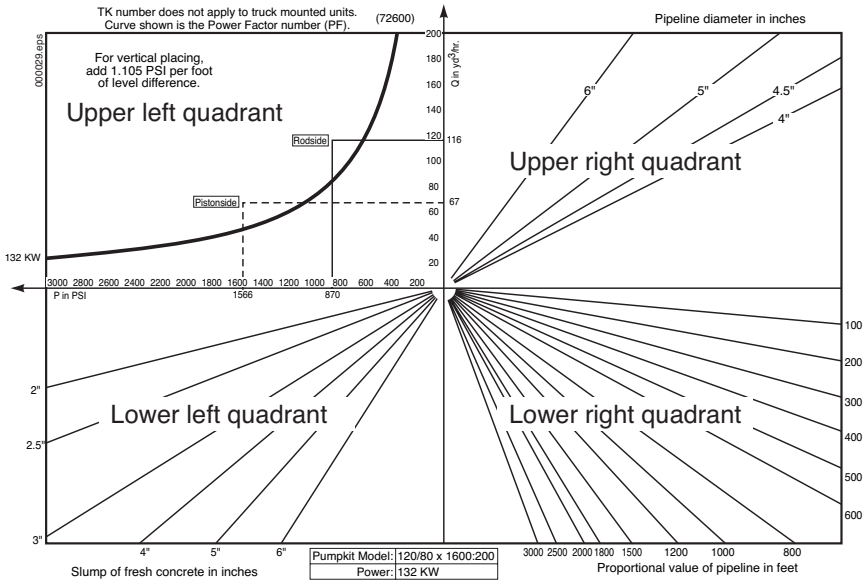
To estimate the power a pump requires to complete a particular job and to determine which pump is appropriate, a **nomograph** is used.

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 ±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 ±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÷80%).

The nomograph is divided into four quadrants (Figure 49).

Figure 49
Quadrants



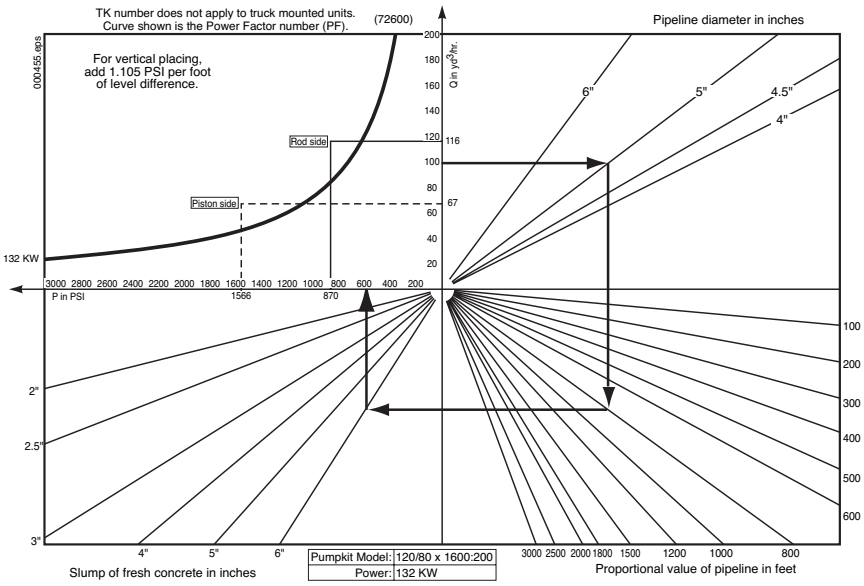


Figure 50
Moving around a nomograph

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, you 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, you make a 90° turn until you come to a point on the bottom of the upper left quadrant that shows pressure required (Figure 50).

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 ÷.75 = 100 yd^3/hr.
2. We will use 5-in.-diameter pipeline.
3. We will need the following pipeline lengths:

Separately laid pipeline:

- 40 ft. of 5-in. rubber hose
- 150 ft. of 5-in. horizontal steel pipe

Boom pipe, elbows, and deck system:

- 13 ft. of 5-in. rubber hose
- 144 ft. of 5-in. steel pipe (on the boom and pump deck)
- 5.25 ft. of 6–to–5-in. reducer (on the pump)
- 4 5-in. 45° elbows, radius 250 mm
- 11 5-in. 90° elbows, radius 250 mm
- 2 6-in. 90° elbows, radius 250 mm

4. We will specify a slump of 5-6 in. and use the 5-in. 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.

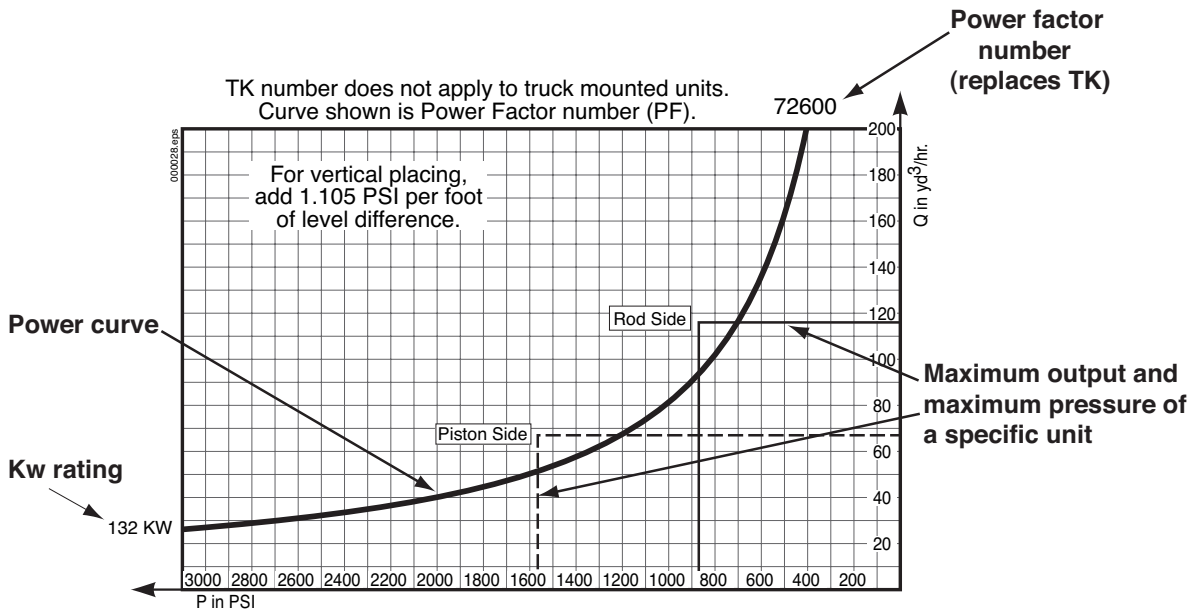


Figure 51
Upper left quadrant

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 (Figure 51).

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. Here is an example of why that is important: You contract to pump a job that requires only 20 yards per hour, but you calculate that you will need 2100 PSI pressure. The PF of this job is 42,000 (20 x 2100). The pump shown in Figure 51 has a TK of 72,600, so there is enough power available. However, the maximum pressure available from the pump is only 1570 PSI. 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-inch 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 percent, 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- or 5-inch pipe may be able to do it easily through 6-inch pipe. **Note!** Experience has taught us that 5-inch 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-inch 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 (Figure 52).

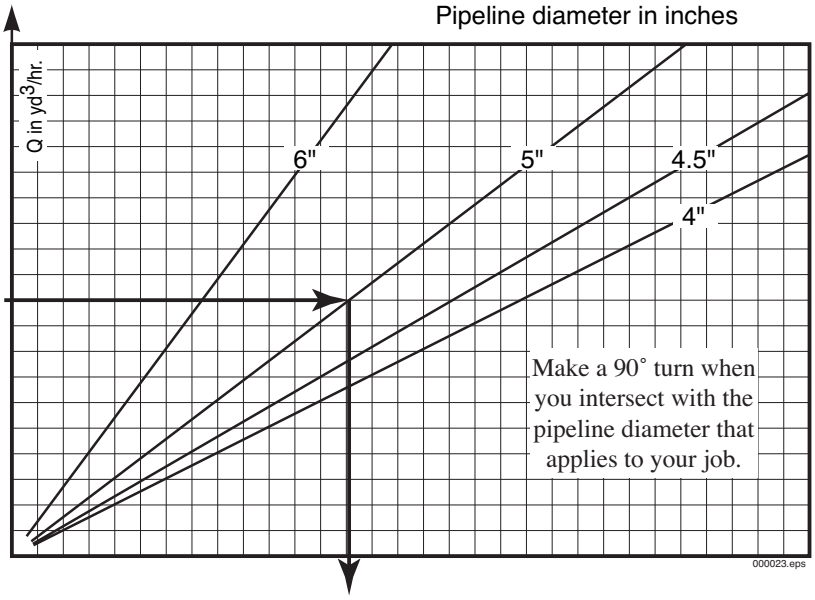
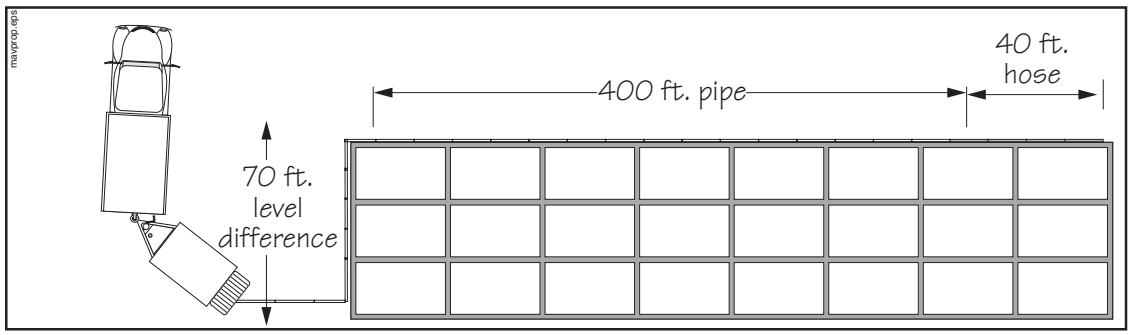


Figure 52
Upper right quadrant—Pipeline diameter

When the output line intersects the pipeline diameter that corresponds to your job, draw a line straight down into the lower right quadrant, as shown in Figure 52.

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° bend with a radius of 250 mm (boom elbow) = 3.5 feet
   - each 90° bend with a radius of 1 meter (long sweep) = 10 feet
   - each 30° or 45° bend with a radius of 1 meter **or** 250 mm = 3 feet
   - 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 (Figure 53).



elbow - 90°, r = 250 mm...3.5 feet
elbow - 90°, r = 1 meter...10 feet
elbow - 30° or 45°, r = 250mm or 1 meter...3 feet

Example: You must go 400 feet through the pipeline, then through 40 feet of rubber hose. Calculate the proportional value as follows:

40 10-foot pipe sections = 400. feet

3.5 x 2 = 7 feet (for 90˚ elbows)

40 x 3 = 120. feet (for the rubber hose)

Total = 527.0 feet

Round down to 500 feet to make it easy to use the chart (Figure 54).

Figure 53
Calculating proportional values

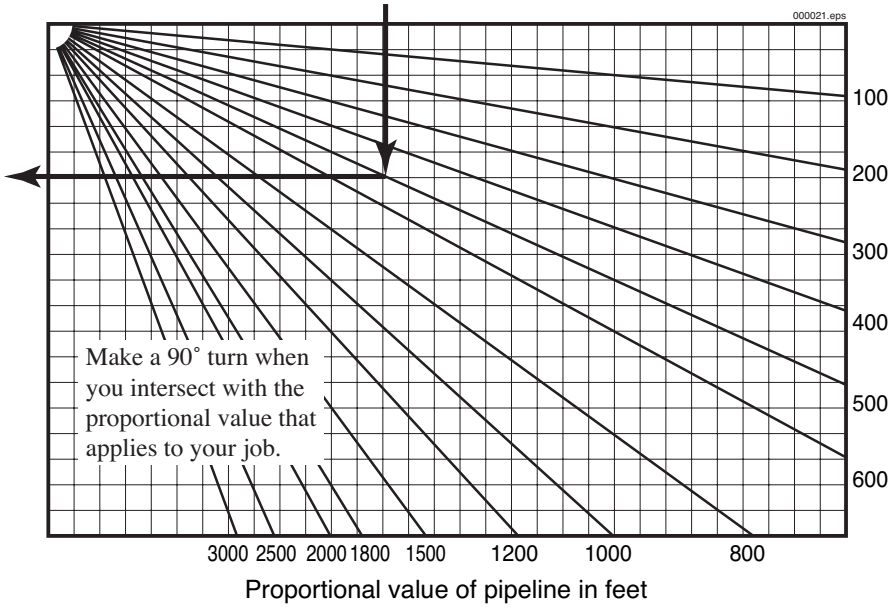
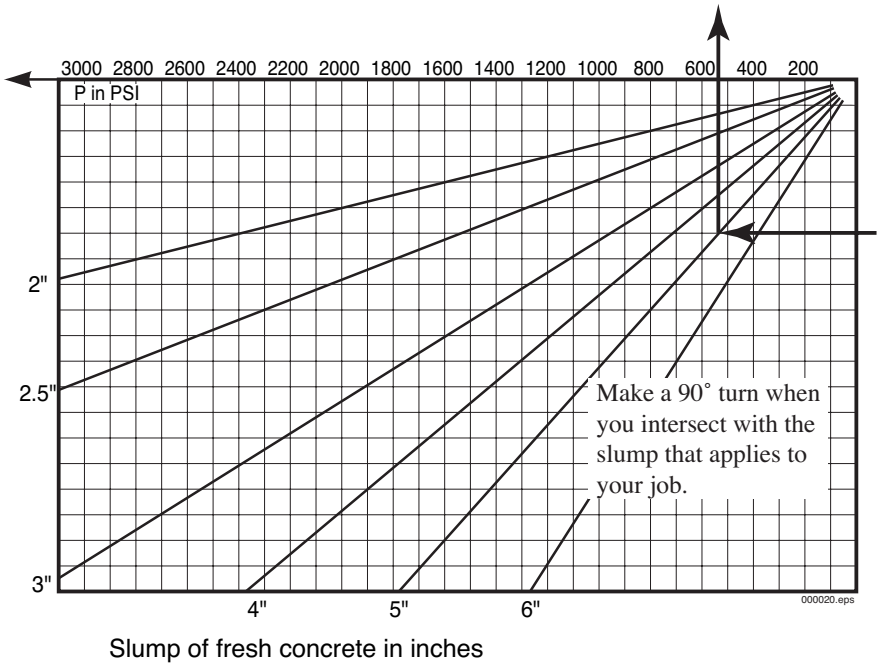


Figure 54
Lower right quadrant—Proportional value of pipeline

When 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° turn *clockwise* into the lower left quadrant. As noted previously, we are using 500 feet as our proportional value (Figure 54).

4. The **lower left quadrant** refers to the pumpability of the concrete. If the concrete specifications allow a range in slump (for example 5–6 in.), always use the lower end to be safe. In our example, we use 5-inch slump. Extend the line from the lower right quadrant until it intersects with the 5-inch slump line; then make a 90° turn *clockwise*. This will lead you back into the upper left quadrant (Figure 55) through the pressure scale.

Figure 55
Lower left quadrant—Pumpability of the concrete



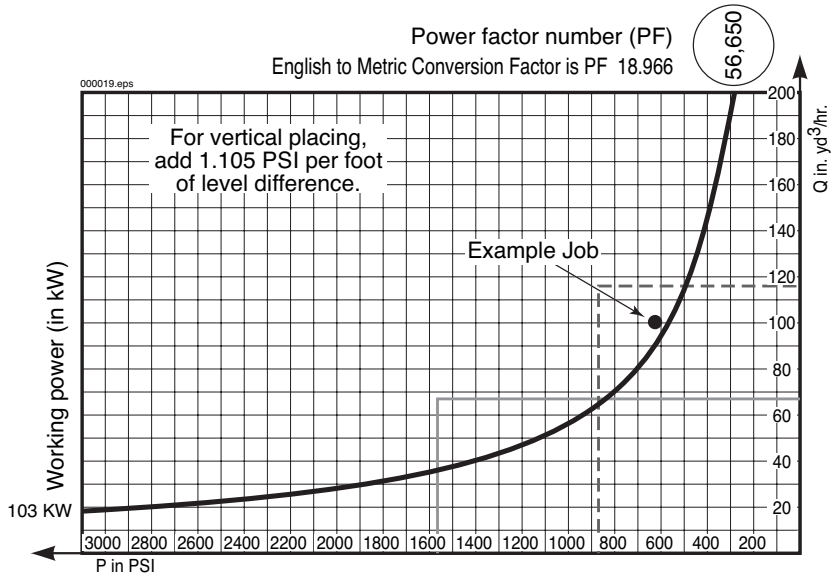


Figure 56
Is this unit sufficient for the job?

As you can see by the chart in Figure 55, we are reentering the upper left quadrant through the pressure scale at about 550 PSI. Remember, we now have to add the head pressure for our vertical rise. At 1.1 PSI per foot of level difference and our 70-foot vertical run, we must now add 1.1 x 70 = **77 PSI** to the 550 PSI from the chart.

550 PSI + 77 PSI = 627 PSI

NOTE!

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 = PSI x yd^3/hr

We need a unit that is capable of 627 PSI and 100 yd^3/hr. The PF of this job is:

PF = (627 x 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 our sample nomograph (Figure 56).

- 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 yards^3/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 yd^3/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 (Figure 57).

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 the pump in Figure 57, we should still be safe even if the pressure required were 10% greater (690 PSI).What if you already own the pump shown in Figure 56? 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 shown in Figure 56 if you can get permission to do any of the following things:

- Pump the top of the building at 85 yd^3/hr instead of 100 yd^3/hr.
- Pump the top of the building at a 6-inch slump instead of 5-inch. (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 our example, the entire vertical run was made with the boom. The boom can never support 6-inch pipeline.

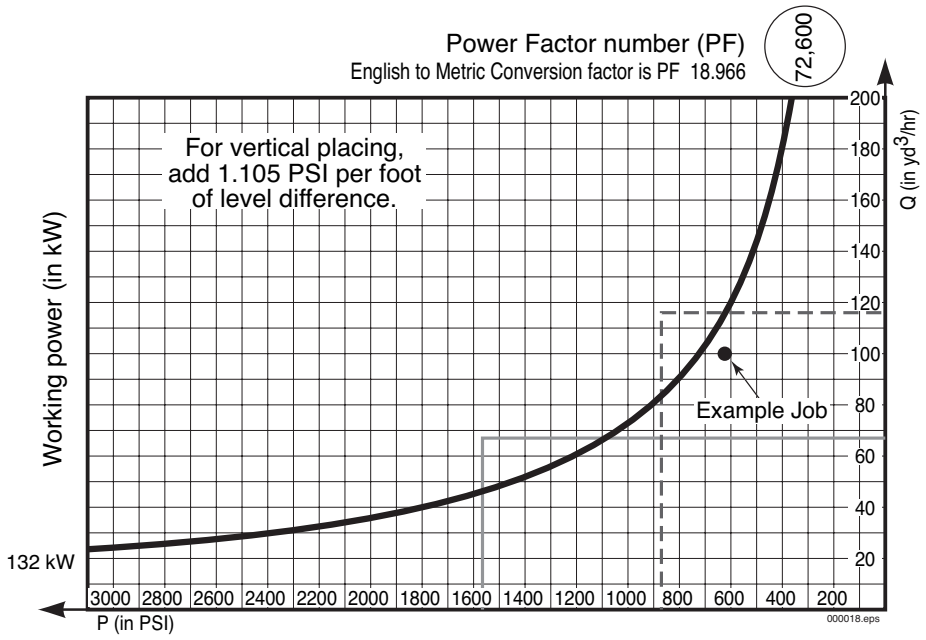
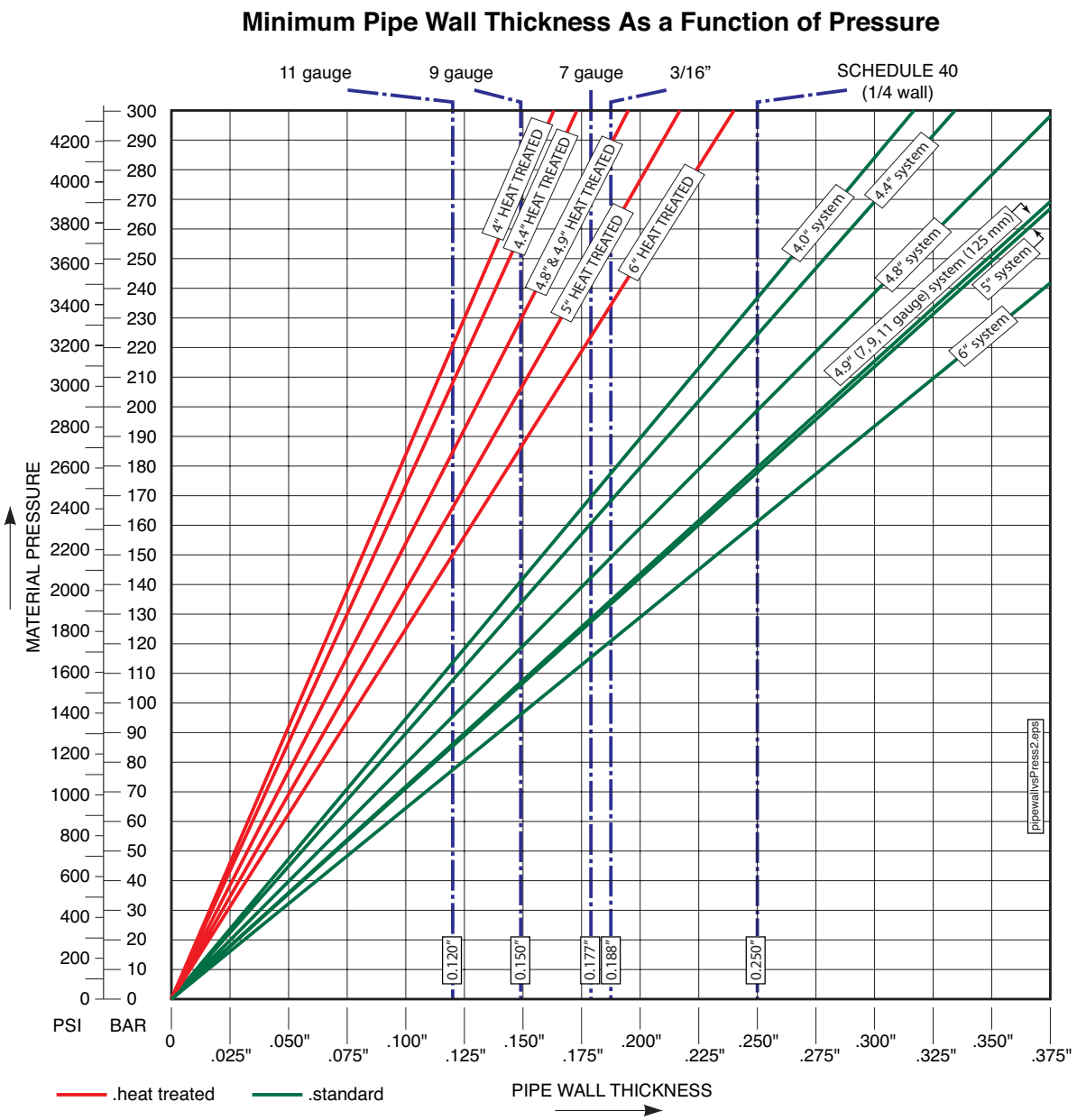


Figure 57
Same model pump with larger Kw hydraulic pumps

Minimum Pipe Wall Thickness



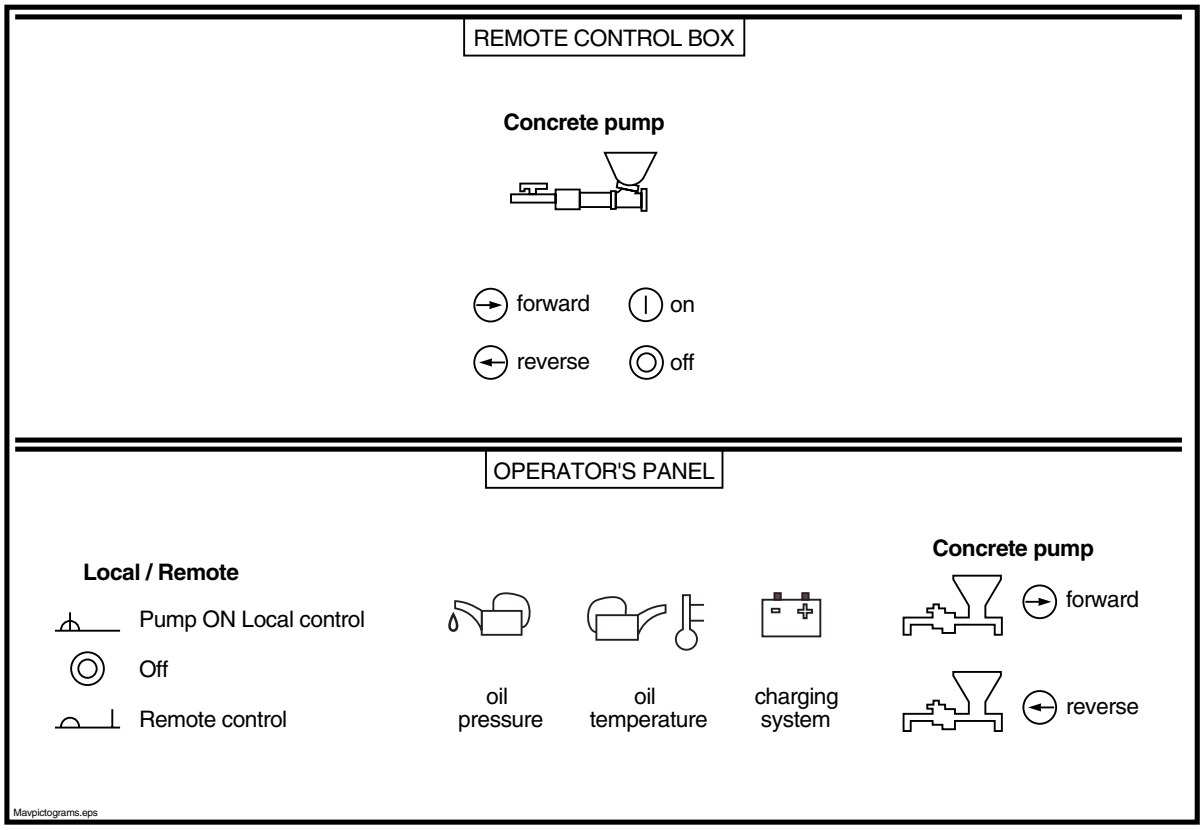
1. This chart assumes a safety factor of 2:1. Higher safety factors may be required in some circumstances.
2. Wear reduces wall thickness. Thickness must be checked on a regular basis.
3. Pressures may be limited even more by clamp style or pipe end used.
4. The chart is based on 62,000 PSI tensile strength. 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.

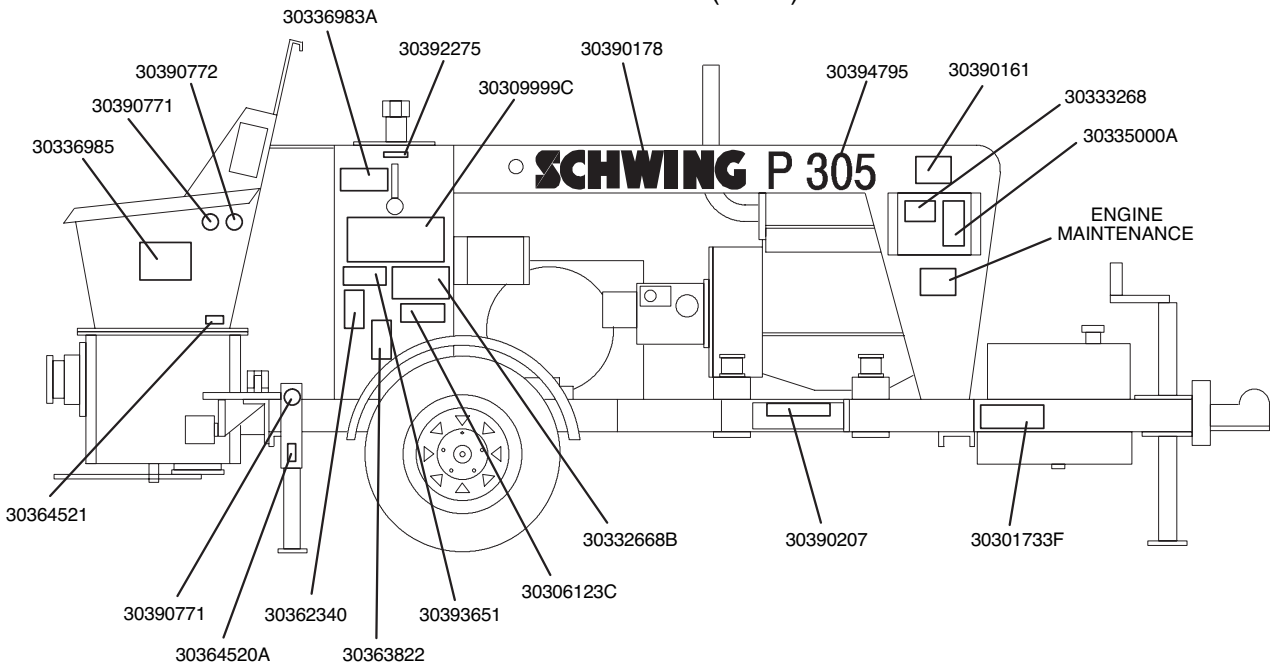
Pictograms

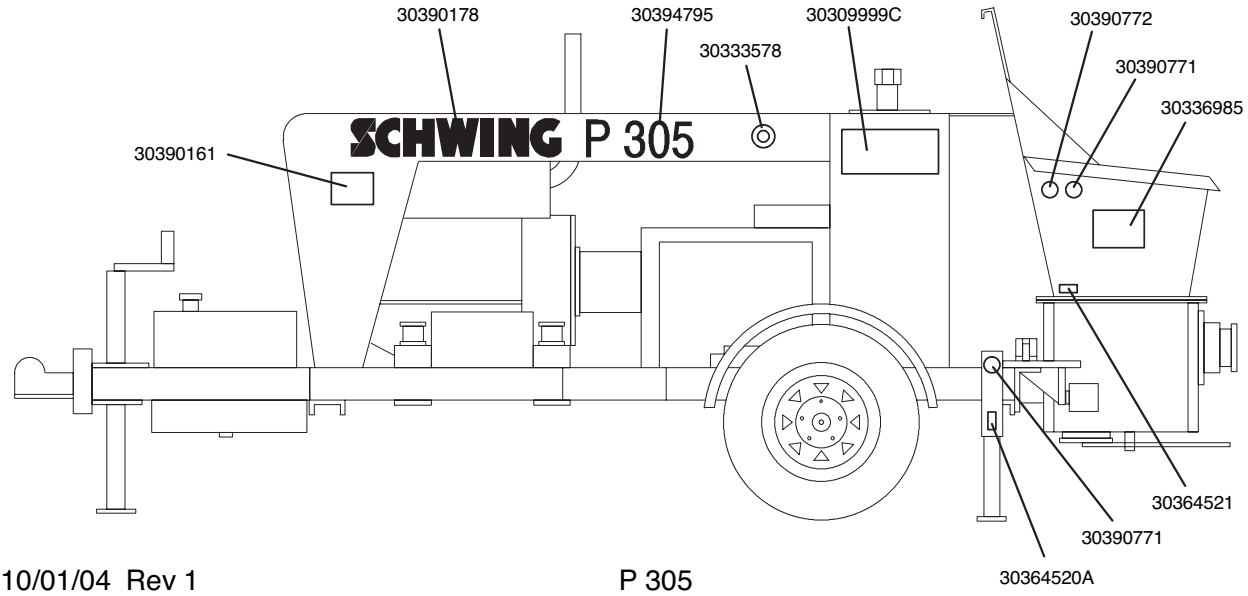
Shown below are the pictograms used on the SP 305 along with a brief description of each.



Decal Location Guide

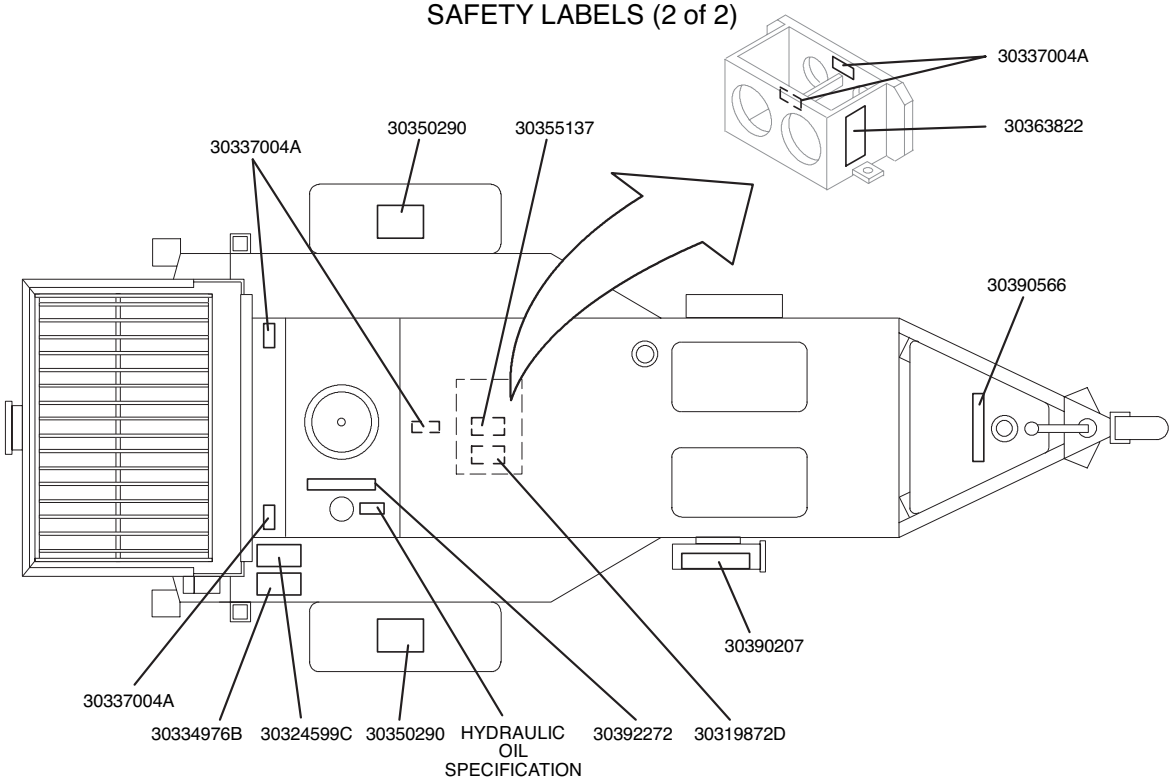
SAFETY LABELS (1 of 2)

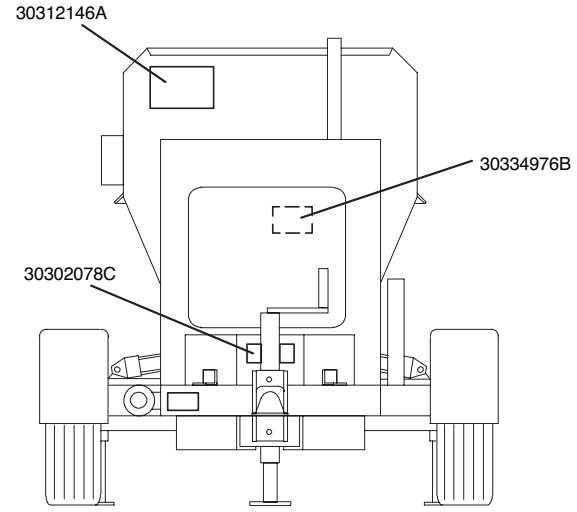


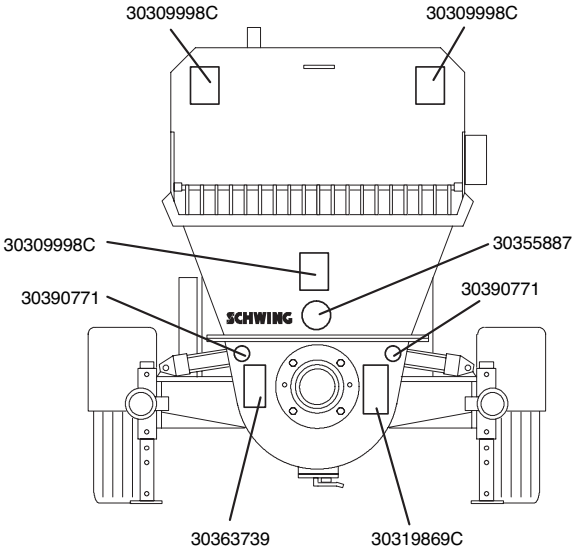


10/01/04 Rev 1 P 305

SAFETY LABELS (2 of 2)







30332962

10/01/04 Rev 1 P 305

Glossary of Terms

The following list defines some terms used in this manual.

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 or Re-Mixer

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. *See also:* Hopper Grate

AWS D1.1

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

Black and White

If a boom is black and white it means that the speed of the boom is not proportional to the movement of the joystick. Speed can only be controlled by feathering of the joystick.

Blanking Plate

Also known as a *blanking plug* or *end cap*. Its purpose is to prevent 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. The causes of blockages are detailed in section 6.18 of this manual. 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. One cubic foot of lightweight concrete weighs less than 1 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 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 cleanout 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. *See also:* Expert, Qualified Operator

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 sections 3, 5, and paragraph 9.25 of section 9 and/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. *See also*: Maximum Pressure

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 of these 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 very well, but if the voltage gets high enough, current will flow. (Lightning is a good example of this.) *See also:* Electrocution

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 8.14 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. *See also:* Prime Mover

Electrocution

Made by combining the words "electric" + "execution." It means "death by electricity." *See also:* Conductors

EN 287-1 / PREN 288-3

The code for structural welding with steel as defined by the European Norm. *See also:* Certified Welder

Expert

As used in this safety 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, cleanout 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. *See also:* Certified Operator

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. *See also:* Sponge Ball

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. *See also:* Spotter

High Voltage

For the purposes of this manual, any current over 120 volts AC is considered high voltage. In the United States, electrically driven concrete pumps normally operate the motors at 480 volts AC (high voltage) and the controls at 24 volts DC (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 to 1,000,000 volts (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.

Jacking the Outriggers

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

Licensed Electrician

A qualified electrician licensed by the state, county, or municipality where the connections are to be made. In some locations, electricians are not required to be licensed, 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. *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 or electrical wires while leaving room for errors in human judgment or machine malfunction. The distance from electrical wires in the United States is 17 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 moment.”

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 U. S. federal government that deals with job safety. It establishes and enforces safety regulations for industry and business. One of the areas over which it has authority is construction job sites and workshops.

Personal Protective Apparel

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 for when you have to stand in concrete
- hard hat

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 cleanout 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.

Proportional

Proportional movement means the speed that a boom or outrigger travels is proportional to the amount of movement on the control handle (joystick or outrigger handle).

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:

- 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 and
- 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. In these cases, the rock (larger aggregates of the mix) form 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. *See also:* Blockage

Separate Pipeline

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

Shutoff 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 shutoff valves also have the ability to divert the flow of concrete to a different pipeline; for example, to a discharge point for cleanout. The shutoff valve must be able to withstand the maximum pressure on the concrete of which the pump is capable.

Single Circuit

The plumbing method used for the pumpkit in which both the differential cylinders and the Rock Valve cylinder are moved by the main hydraulic pumps. Single-circuit machines are not equipped with an accumulator.

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. *See Also:* Go Devil

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. *See Also:* Guide

Sucking Back

The act of putting 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).

Towing Vehicle

In this manual, the term "towing vehicle" applies only to trailer- mounted concrete pumps. It is the vehicle you use to tow the trailer on the road, jobsite, or in the yard. The size and condition of the towing vehicle are extremely important in these applications. See the safety rules regarding this subject in section 4 of this safety manual.

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 authority, without 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.
- Nomographs—A Guide to Usage, Robert Edwards. Schwing America, Inc., 1992.

List of Lubricants and Nitrogen

This list describes the materials that were installed in your concrete pump unit when it left the factory. Other brands of lubricants and their usage are described in the following lists.

Hydraulic oil	Texaco Rando 46
Gearcase oil	Mobilube® HD 80w-90
Truck fluid levels	See owners manual for your specific truck
Compressor oil	Mobil Rarus 427 or 429
Grease for gears and spline couplers	Castrol Industrial-Optimoly Paste White
Grease for autogreaser	Mobil Grease HP or CM-S
Dry nitrogen	Any brand of dry nitrogen is suitable for recharging accumulators

Materials.eps

Hydraulic Oils

ISO viscosity VG 32 = Winter in northern US and Canada
ISO viscosity VG 46 = Summer in northern US and Canada
ISO viscosity VG 68 = Tropical areas, desert summers, indoor uses

Brand	Viscosity / DIN quality designation		
	VG 32 / HLP	VG 46 / HLP	VG 68 / HLP
Texaco Rando HD*	HD 32	HD 46	HD 68
Texaco Rando HDZ**	HDZ 32	HDZ 46	HDZ 68
Mobil DTE	DTE 24	DTE 25	DTE 26
Shell Tellus	32	46	68
Aral Vitam	GF 32	GF 46	GF 68
BP - Energol	HLP 32	HLP 46	HLP 68
Esso - Nuto	H 32	H 46	H 68
Total - Azolla	ZS 32	ZS 46	ZS 68
Wintershall - Wiolan	HS 32	HS 46	HS 68

* Rando HD 46 is installed in new machines at the Schwing Factory - standard
** Rando HDZ is available for installation in new machines from the Schwing Factory - optional

- The order of the list is meaningless. Any oil that meets the HLP quality designation and ISO viscosity specification may be used.
- Mixing oils by different manufacturers is not recommended. The additive packages of the manufacturers may be incompatible. Contact the oil manufacturers for information before mixing.
- New hydraulic oil is not clean enough for use in a Schwing concrete pump or placing boom and should be installed in the machine through a filter. The filtering should be done at β 25 = 200 or finer.

- The following table shows the characteristics of Rando HD 46. You may use this information for comparison with other brands.

ISO Viscosity Class	Viscosity cST @ 40 C	Viscosity cST @ 100 C	Viscosity Index	Gravity API	Flash point F	Pour point F	Foam, Seq II ml foam @ 0/10 minutes
VG 32	30.1	5.3	106	30.7	385	-25	20/0
VG 46	46.2	6.9	105	29.3	425	-20	20/0
VG 68	65.5	8.7	103	28.6	445	-20	20/0

- Some oil manufacturers offer vegetable-based hydraulic oils, which are considered environmentally friendly (the additive packages are not inert, however). These vegetable-based oils must NEVER be mixed with mineral-based oils. A complete flush of the hydraulic system must be performed when changing to this type of fluid. See the list below for a sample of the available oils and viscosities.

Vegetable Based Hydraulic Oils	
Brand	Viscosity Information
Texaco Biostar Hydraulic 32	Considered equivalent to ISO VG 32 viscosity
Texaco Biostar Hydraulic 46	Considered equivalent to ISO VG 46 viscosity
Mobil EAL 224-H	Considered equivalent to ISO VG 36 viscosity
Shell Naturelle HF-M	Considered equivalent to ISO VG 42 viscosity

OM14

Gearcase Oils

A) for distribution gearcases

Brand	Viscosity / DIN quality designation VG 220 / CLP
Texaco	Meropa 220
Mobil	Mobilgear 630
Shell	Omala Oil 220
Aral	Degol BG 220, Degol BMB 220
BP	Energol GR-XP 220
Esso	Spartan - EP 220
Wintershall	Wiolan - IT 220

B) for motor vehicle gearcases

Brand	Viscosity / Mil-L quality designation 90 (85w-90) / 2105 B
Texaco	Geartex EP-C
Mobil	Mobilube HD
Shell	Spirax HD, Spirax MB
Aral	Gearbox Oil HYP
BP	Energear Hypo 90, Hypogear 90 EP
Esso	Gear Oil GX-D, Gear Oil GX
Wintershall	Wiolan Hypoid Gearbox Oil 90

- The order of the list is meaningless. Any oil that meets the DIN quality designation and ISO viscosity specification may be used.
- The lubricants listed above are suitable for continuous ambient temperatures of -10 C (14 F) to +40 C (104 F). For conditions outside of this range, contact the oil manufacturer for recommendations.
- Viscosity class 220 roughly corresponds to SAE 90.

Compressor Oils

- Use VG 100 oil when ambient temperature is 0 to 10 C (32 to 50 F).
- Use VG 150 oil when ambient temperature is above 10 C (50 F).

Brand	ISO Viscosity / DIN quality designation	
	VG 100 / VDL	VG 150 / VDL
Texaco	Compressor Oil - EP 100	Compressor Oil - EP 150
Mobil	Rarus 427	Rarus 429
Shell	Corena - H 100	Corena - H 150
Aral	Motanol - HE 100	Motanol - HE 150
BP	Energol - RC 100	Energol - RC 150
Wintershall	Wiolan - CD 100	Wiolan - CD 150

OM15

Grease

A) For filling the automatic greasers

Brand	Viscosity / DIN quality designation EP 2 / CLP
Texaco	Starplex 2
Mobil	Mobilgrease HP
Shell	Alvania EP - 2

- Shell Alvania is installed in new machines at the Schwing factory.
- Any equivalent grease may be used.

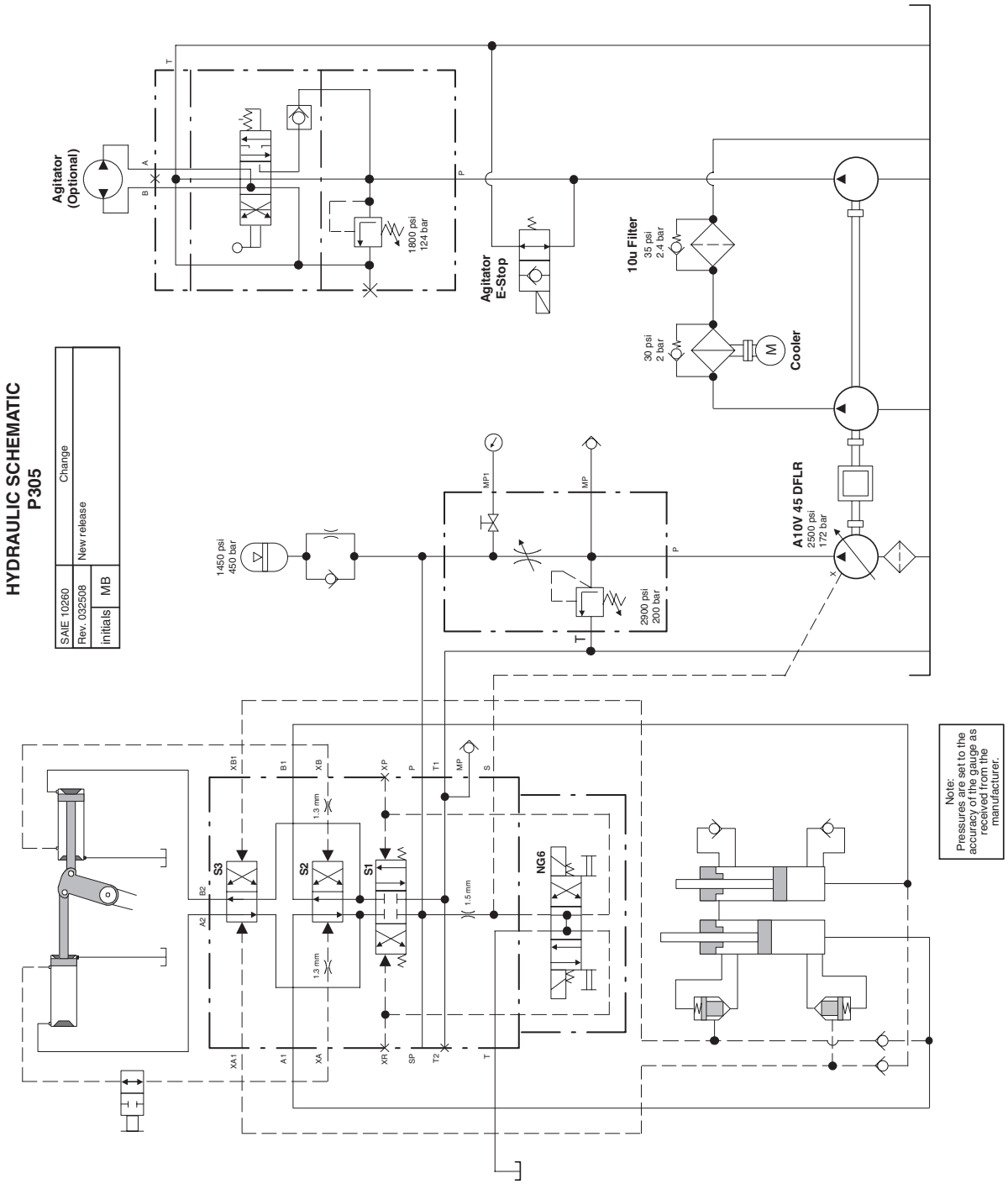
B) For all other bearings

Brand	Viscosity / Pressure rating 2 / EP
Texaco	Multifak EP-2
Mobil	Mobilith AW 2
Shell	Alvania grease R 2
Aral	HLP 2
BP	Energrease LS2
Esso	Multipurpose grease Beacon 2
Optimal	Olitsta longtime 3 EP

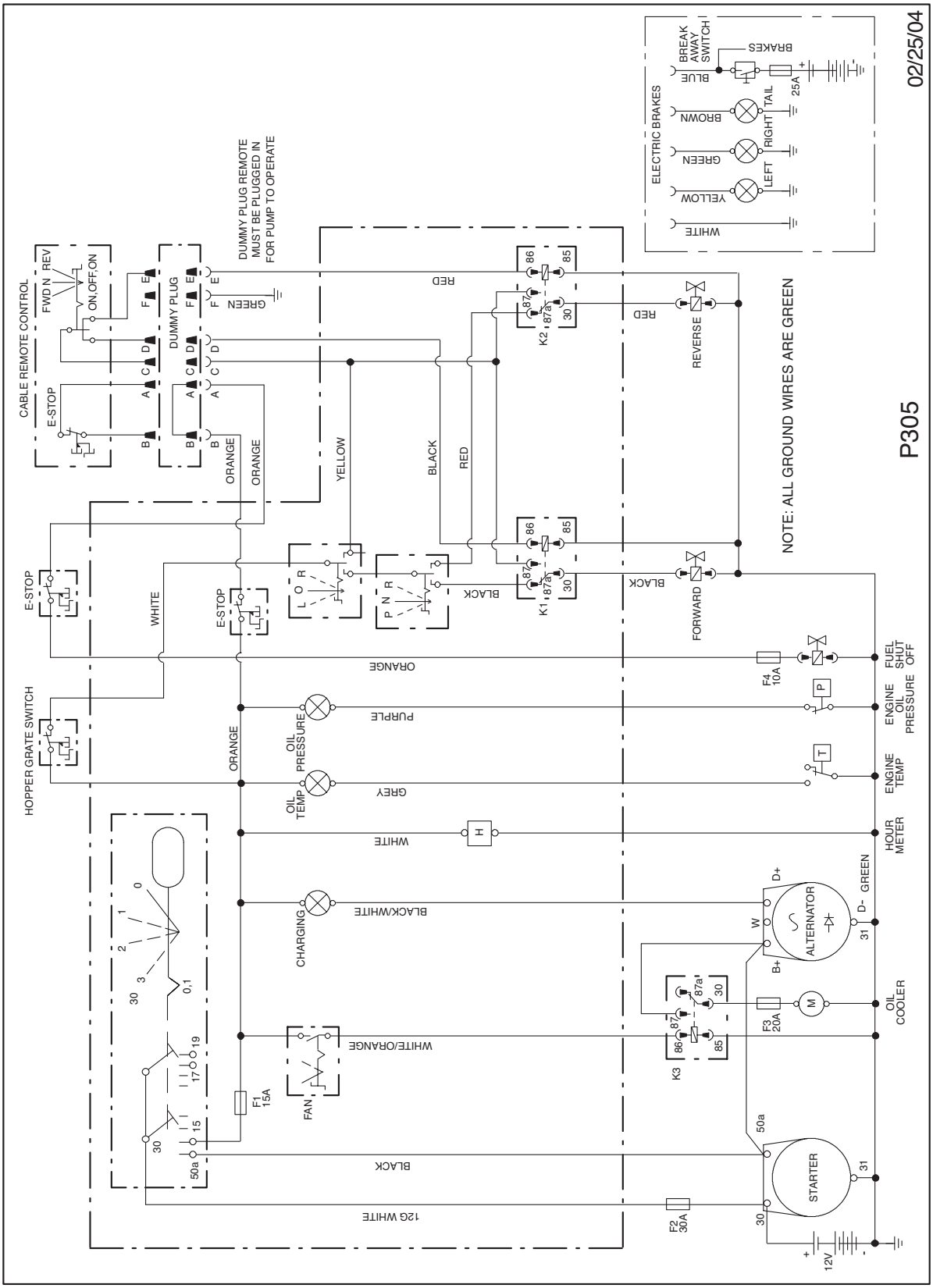
- The order of the lists is meaningless. Any grease that meets the quality designation and viscosity specification may be used.

OM19A

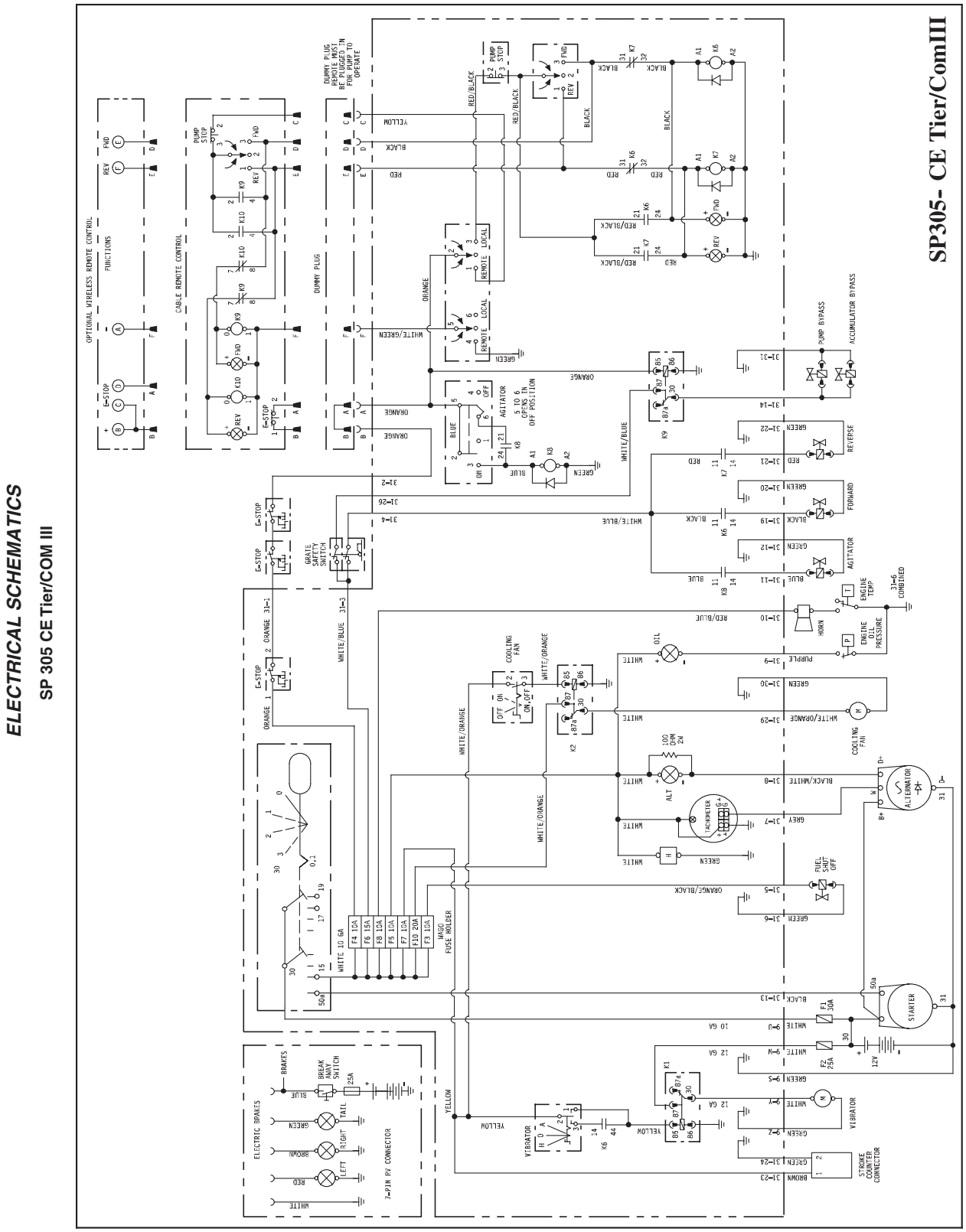
Hydraulic Schematic—Concrete Pump SP305 - Schematic



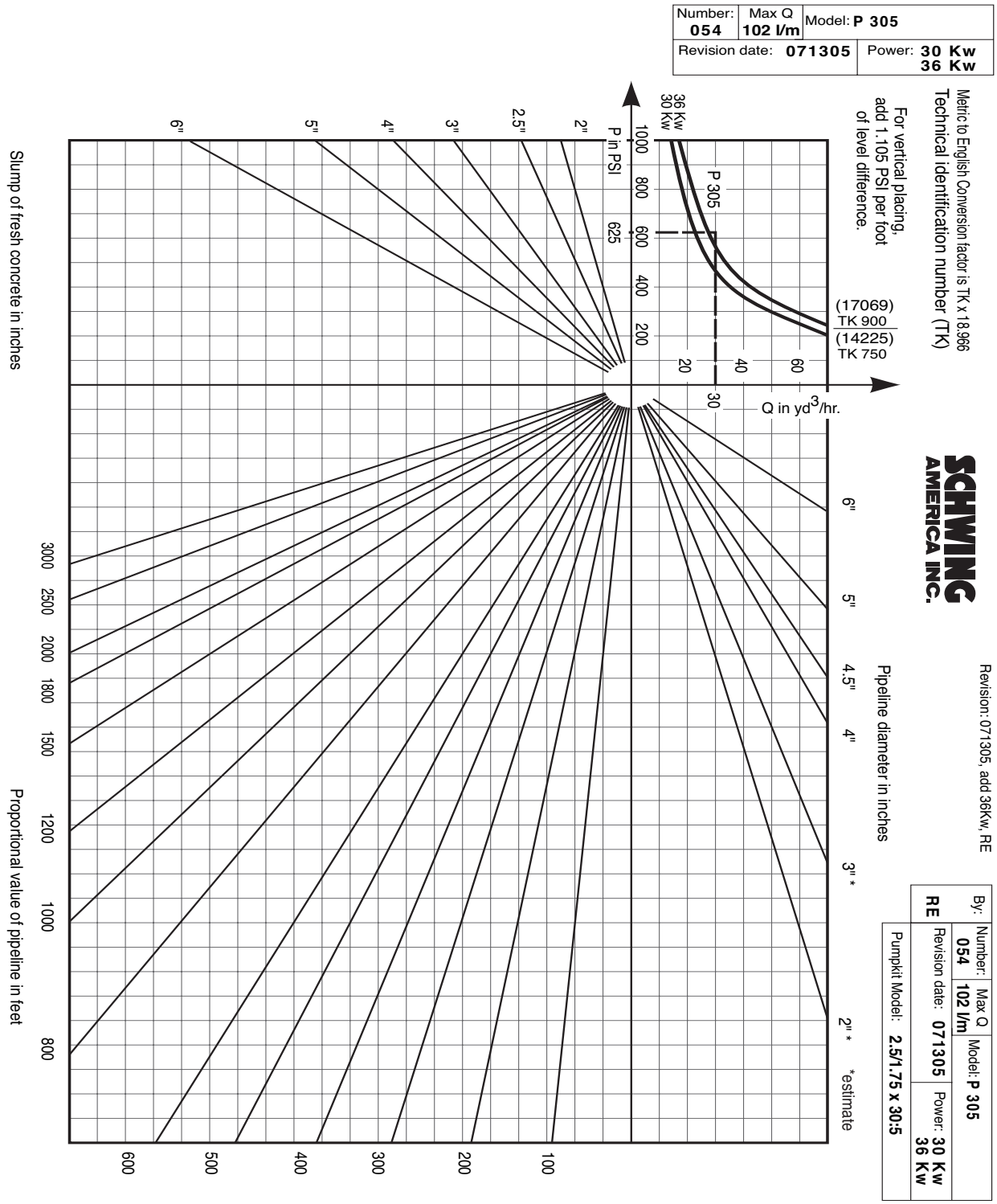
Electrical Schematic SP305 - 2004 Electric



Electric Schematic CE/Tier III SP305



Nomograph SP 305



Output Chart available upon request

NOTES

INDEX

Alphabetical Index

R

S

T

U

V

W

Z