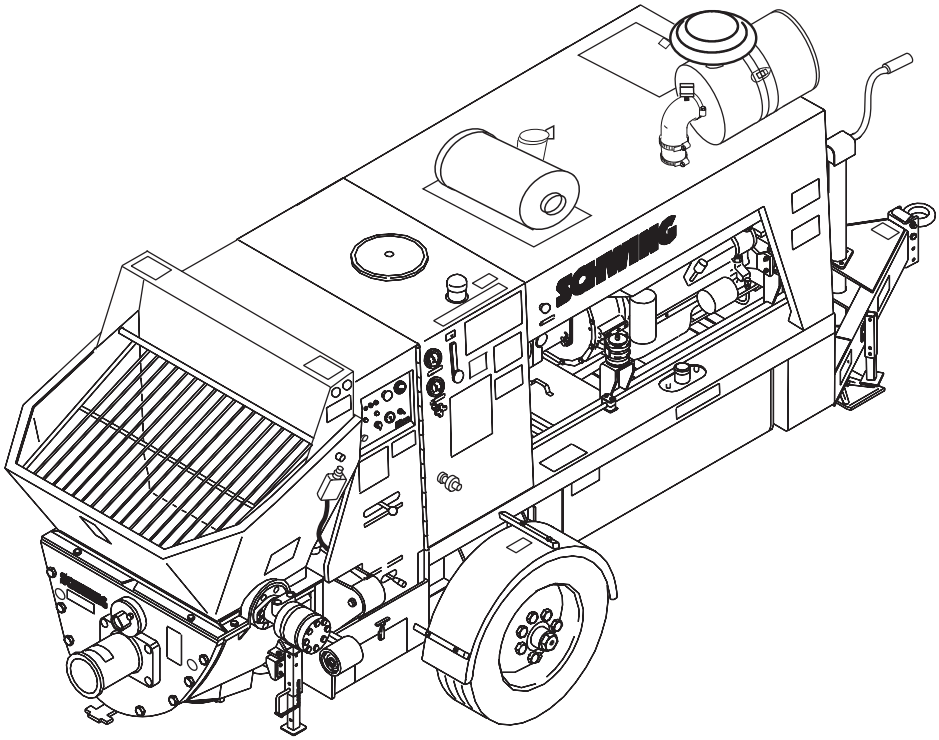
# OPERATION MANUAL

**ORIGINAL INSTRUCTIONS FOR CONCRETE LINE PUMPS**

# All SP “Rock Valve” Models




**Part Number 30100750**

SCHWING

Line Pump Division
5900 Centerville Rd
White Bear, MN. 55127
1-888-SCHWING (724-9464)
www.schwing.com

**CALIFORNIA**

**Proposition 65 Warning**

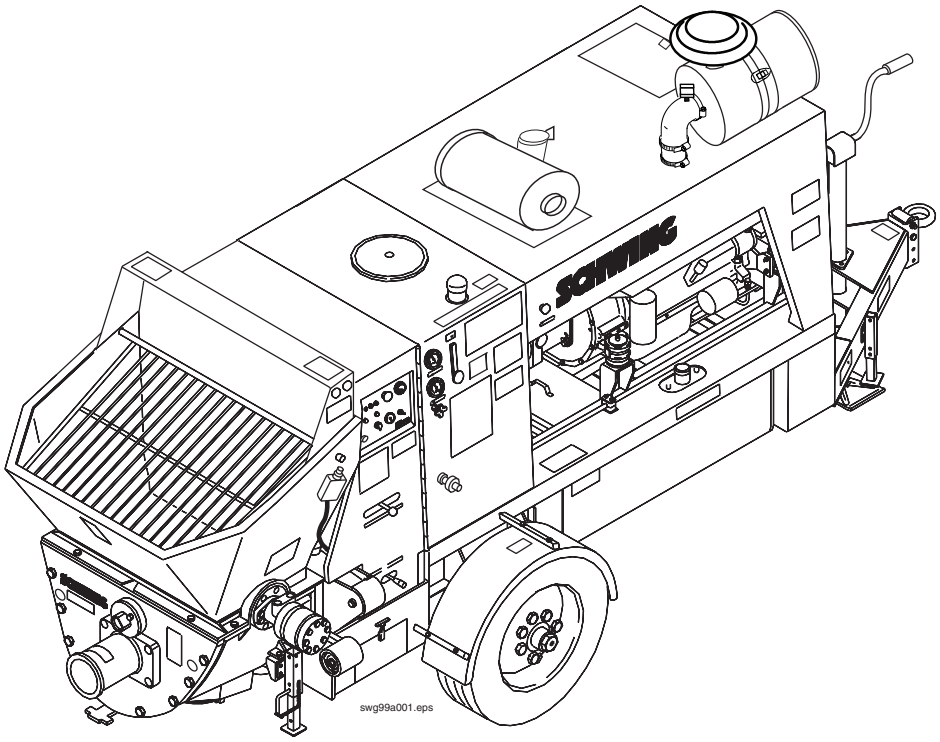
**Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.**

# Version
# 3.0.8

# Revision date
# 05/14

SCHWING

# ORIGINAL OPERATING INSTRUCTIONS FOR
# ALL SP ROCK VALVE ” MODELS




**Part Number 30100750**

**Version 3.0.8**

# Introduction



# Specifications



# Safety



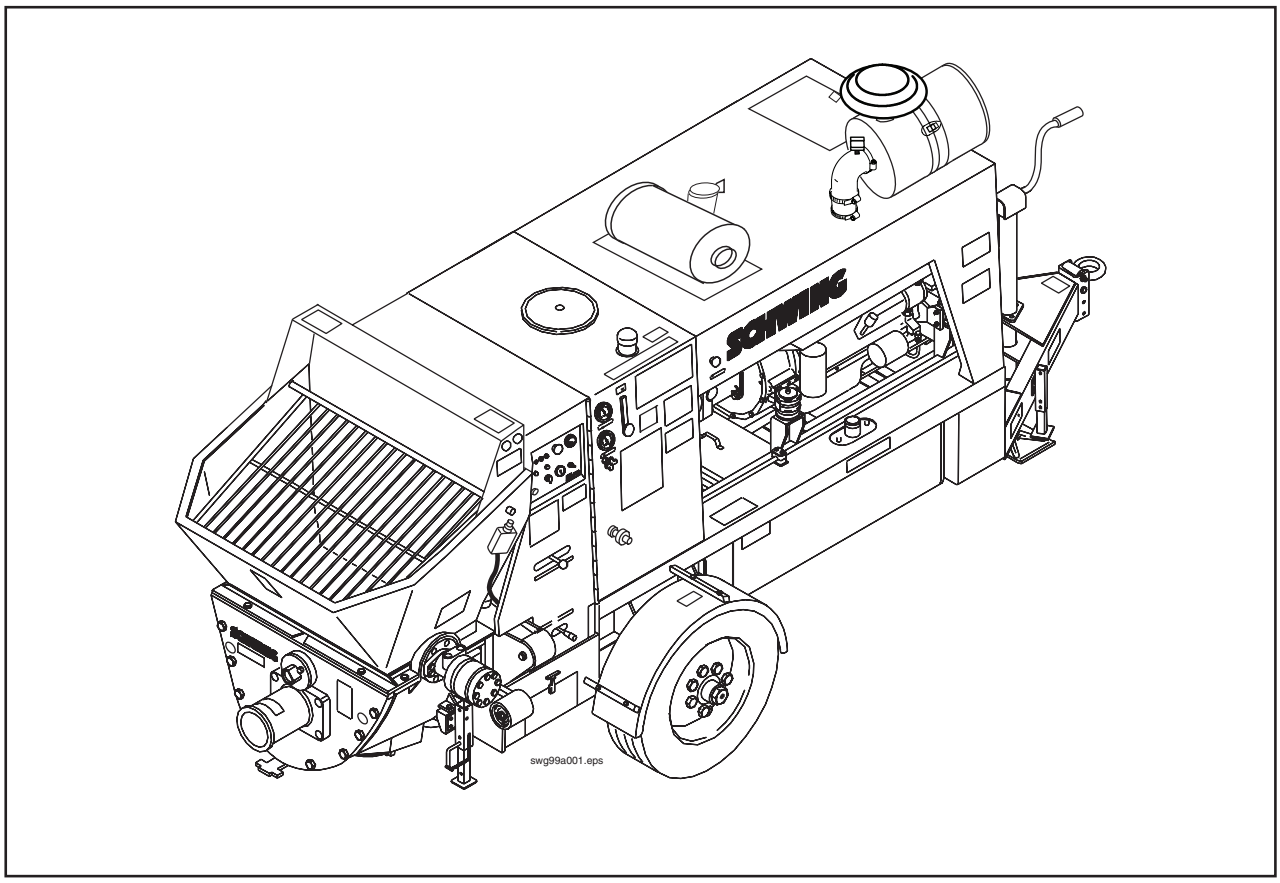
# Product Overview

# Operation

# Maintenance



# Appendix




# 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.**




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**

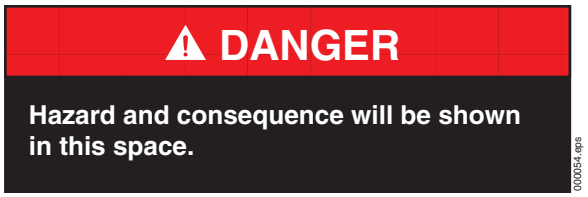
**Caution**

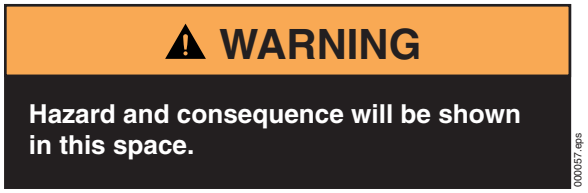
- If the safety alert symbol is followed by the signal word **DANGER**, it indicates a hazardous situation which, if not avoided, **WILL** lead to **death or serious injury.**
- If the safety alert symbol is followed by the signal word **WARNING**, it indicates a potentially hazardous situation which,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





## 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, 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. For future reference, the model number and serial number of your machine can be found on this page.

**NOTE!**

**When replacing parts always use original Schwing replacement parts**

## Model Number:

## Serial Number:

## ID Tag Location

The ID tag for this machine is located on the right hand side of the tongue on the passenger side as shown in Figure 1.

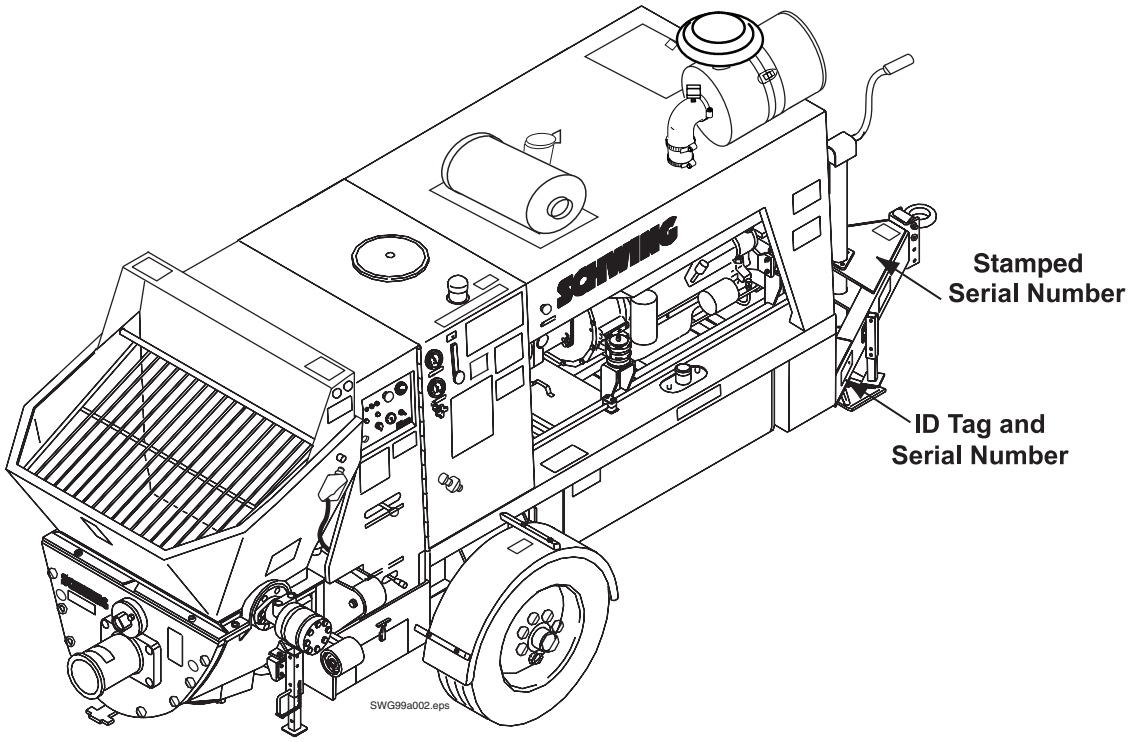



**Figure 1**
**Location of ID tag and serial number**

# ID Tag


**Figure 2**
**ID Tag and serial number**

The ID Tag provides information about the entire unit the pumpkit, the hydraulic systems, and the year of manufacture. The unit serial number is on the tag and also stamped into the subframe directly below the ID tag, as shown in Figure 2.

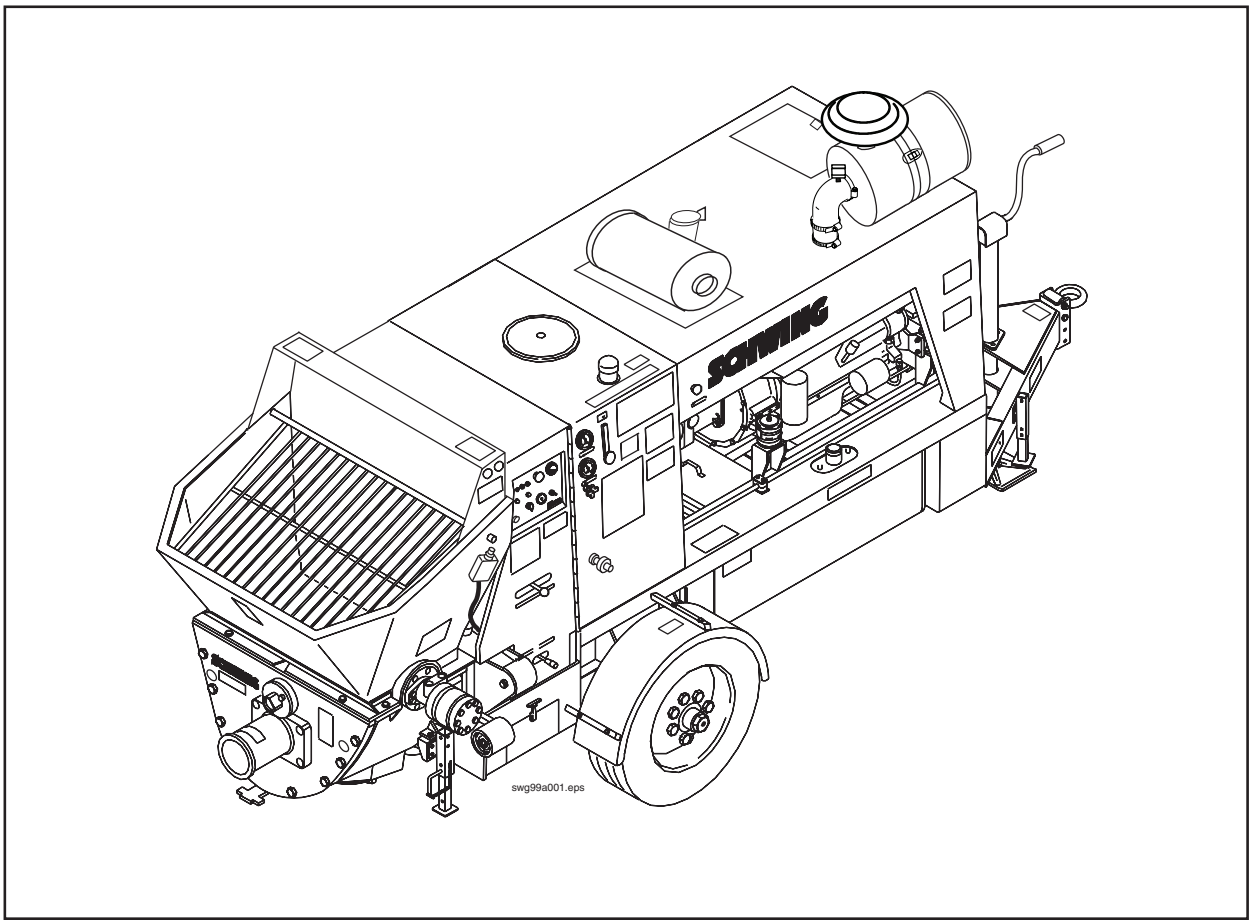
**NOTE!**

**All numbers used on ID tag illustrations in this book are for reference only and should not be used in any calculations regarding your unit. For information specific to your unit, check the ID tag and serial number affixed to the unit itself as shown in Figure 1.**

## If your ID tag is missing

If the tag has been removed from the unit and you need information about your concrete pump unit, read the unit serial number that is stamped into the steel subframe. The unit serial number is located on the tongue directly below the ID tag as shown in Figure 2. When you locate the number, call the Schwing Service Department for the information. The unit files are arranged by this serial number and the service personnel can find out anything about the unit from the file that corresponds to this number. New ID tags are available from the Service Department when you provide the unit serial number.

# NOTES




# SPECIFICATIONS

# Specifications

## Unit Specifications

| MODEL | SP 1250 | SP 1000 HP | SP 1000 |
|---|---|---|---|
| **CONCRETE PUMP KIT** | 80/55 x 1400:180 | 90/50 x 1000:150 | 90/50 x 1000:180 |
| | **Piston side** | **Piston side** | **Piston side** |
| **Strokes/minute** (max.) | 34 | 26 | 35 |
| Max. Output | 95 $yd^3$/hr | 35 $yd^3$/hr | 70 $yd^3$/hr |
| **Power** | C6.6TA-ECU (Tier3) 129.5Kw (173 Hp) | C4.4TA-ECU (Tier3) 104 Kw (139 Hp) | C4.4TA-ECU (Tier3) 104 Kw (139 Hp) |
| **Power** (Current Electric Motor) | NA | 75 Kw (100 Hp) | 75 Kw (100 Hp) |
| **Power** (hyd. pumps) | 100 Kw | 80 Kw | 80 Kw |
| **Output** (hyd. pumps) Req'd. | 284 L/min (70 gpm) | 181 L/min (48 gpm) | 246 L/min (65 gpm) |
| **Speed** (hyd. pumps) Diesel | 2200 rpm | 2200 rpm | 2200 rpm |
| Electric | 1800 rpm | 1800 rpm | 1800 rpm |
| **Pressure** (max. hyd.) | 330 bar (4785 psi) | 278 bar (4050 psi) | 300 bar (4350 psi) |
| Theoretical Concrete Output | 95 $yd^3$/hr | 35 $yd^3$/hr | 70 $yd^3$/hr |
| Max. Pressure on Concrete | 64.9 bar (942 psi) | 100 bar (1450 psi) | 75.8 bar (1100 psi) |
| Max. Horizontal Pumping Distance | 297.8 m (977 ft.) | 463.3 m (1520 ft.) | 353.6 m (1160 ft.) |
| Max. Vertical Pumping Distance | 86.9 m (285 ft.) | 146.3 m (480 ft.) | 100.6 m (330 ft.) |
| Max. Aggregate Size | 38.1 mm (1.5 in.) | 12.7 mm (0.5 in.) | 38.1 mm (1.5 in.) |
| Min. Concrete Slump | 0 mm (0 in.) | 0 mm (0 in.) | 0 mm (0 in.) |
| Pumping Cylinder Diameter | 177.8 mm (7 in.) | 152.4 mm (6 in.) | 180mm (7 in.) |
| Stroke Length | 1397 mm (55 in.) | 990.6 mm (39 in.) | 990.6 mm (39 in.) |
| Differential Cylinder Diameter | 79.8 mm (3.14 in.) | 89.9 mm (3.54 in.) | 89.9 mm (3.54 in.) |
| Concrete Valve | Long Rock | HP Short Rock | Long Rock |
| Charging Hopper Height | 1295.4 mm (51 in.) | 1295.4 mm (51 in.) | 1295.4 mm (51 in.) |
| Fuel Tank Capacity | 189.3 L (50 gal.) | 113.6 L (30 gal.) | 113.6 L (30 gal.) |
| Gross Weight | 4182 kg (9200 lbs.) | 3295 kg (7250 lbs.) | 3295 kg (7250 lbs.) |
| Length | 5486.4 mm (216 in.) | 4165.6 mm (164 in.) | 4165.6 mm (164 in.) |
| Width | 1930.4 mm (76 in.) | 1651 mm (65 in.) | 1651 mm (65 in.) |
| Height | 2209.8 mm (87 in.) | 1879.6 mm (74 in.) | 1879.6 mm (74 in.) |
| Remote Control Cable Length | 30.5 m (100 ft.) | 30.5 m (100 ft.) | 30.5 m (100 ft.) |

| MODEL | SP 750-18 | SP 750-15 | SP 2000 | SP 500 |
|---|---|---|---|---|
| **CONCRETE PUMP KIT** | 90/50 x 1000:180 | 80/50 x 1000:150 | 120/80 X 1600:200 | 80/50 x 1000:150 |
| | **Piston side** | **Piston side** | **Piston/Rod side** | |
| **Strokes/minute** (max.) | 35 | 35 | 30/24 | 32.5 @ 2500 RPM |
| Max. Output | 70 $yd^3$/hr | 50 $yd^3$/hr | 91 $yd^3$/hr/118 $yd^3$/hr | 45 $yd^3$/hr |
| **Power** (Tier3/Stage 3 A engine) | C4.4T (Tier3) 75 Kw (100Hp) | C4.4T (Tier3) 75 Kw (100Hp) | C6.6TA-ECU (Tier3) 129.5 Kw (173 Hp) | C4.4T (Tier3) 60 Kw (80 Hp) |
| **Power** (Tier4 engine) | C3.4T4i/IIIB | C3.4T4i/IIIB | NA | C3.4T4F/IV |
| **Power** (Current Electric Motor) | 56 Kw (75 Hp) | 56 Kw (75 Hp) | 113 Kw (150 Hp) | 56 Kw (75 Hp) |
| **Power** (hyd. pumps) | 60 Kw | 52 Kw | 122 Kw | 41 Kw |
| **Output** (hyd. pumps) Req'd. | 240 L/min (65 gpm) | 209 L/min (54 gpm) | 430 L/min (114 gpm) | 193 L/min (50 gpm) |
| **Speed** (hyd. pumps) Diesel | 2200 rpm* | 2200 rpm* | 2300 rpm* | 2200 RPM* |
| electric | 1800 rpm | 1800 rpm | 1800 rpm | |
| **Pressure** (max. hyd.) | 300 bar (4350 psi) | 266.7 bar (3867 psi) | 300 bar (4350 psi) | 266 bar (3867 psi) |
| Theoretical Concrete Output | 70 $yd^3$/hr | 50 $yd^3$/hr | 118 $yd^3$/hr | 45 $yd^3$/hr |
| Max. Pressure on Concrete | 75.8 bar (1100 psi) | 75.8 bar (1100 psi) | 108 bar (1566 psi)/60 bar (870 psi) | 76 bar (1100 psi) |
| Max. Horizontal Pumping Distance | 353.6 m (1160 ft.) | 353.6 m (1160 ft.) | 457 m (1500 ft.) | 353.6 m (1160 ft.) |
| Max. Vertical Pumping Distance | 100.6 m (330 ft.) | 100.6 m (330 ft.) | 121 m (400 ft.) | 100.6 m (330 ft.) |
| Max. Aggregate Size | 38.1 mm (1.5 in.) | 38.1 mm (1.5 in.) | 63 mm (2.5 in.) | 38.1 mm (1.5 in.) |
| Min. Concrete Slump | 0 mm (0 in.) | 0 mm (0 in.) | 0 mm (0 in.) | 0 mm (0 in.) 152.4 |
| Pumping Cylinder Diameter | 177.8 mm (7 in.) | 152.4 mm (6 in.) | 200 mm (8 in.) | mm (6 in.) 990.6 |
| Stroke Length | 990.6 mm (39 in.) | 990.6 mm (39 in.) | 1600 mm (63 in.) | mm (39 in.) 79.8 |
| Differential Cylinder Diameter | 89.9 mm (3.54 in.) | 79.9 mm (3.14 in.) | 120 mm (4.75 in.) | mm (3.14 in.) Short |
| Concrete Valve | Long Rock | Long Rock | M Rock | Rock 1219.2 mm |
| Charging Hopper Height | 1295.4 mm (51 in.) | 1295.4 mm (51 in.) | 1373 mm (54 in.) | (48 in.) 75.7 L (20 |
| Fuel Tank Capacity | 113.6 L (30 gal.) | 75.7 L (20 gal.) | 189 L (50 gal.) | gal.) |
| Gross Weight | 3357 kg (7400 lbs.) | 2994 kg (6600 lbs.) | 5724 kg 12,620 (lbs.) | 2948 kg (6500 lbs.) |
| Length | 4165.6 mm (164 in.) | 4165.6 mm (164 in.) | 5816 mm (229 in.) | 4318 mm (170 in.) |
| Width | 1651 mm (65 in.) | 1651 mm (65 in.) | 1930 mm (76 in.) | 1676.4 mm (66 in.) |
| Height | 1879.6 mm (74 in.) | 1879.6 mm (74 in.) | 2373 mm (93.4 in.) | 1879.6 mm (74 in.) |
| Remote Control Cable Length | 30.5 m (100 ft.) | 30.5 m (100 ft.) | 30.5 m (100 ft.) | 30.5 m (100 ft.) |

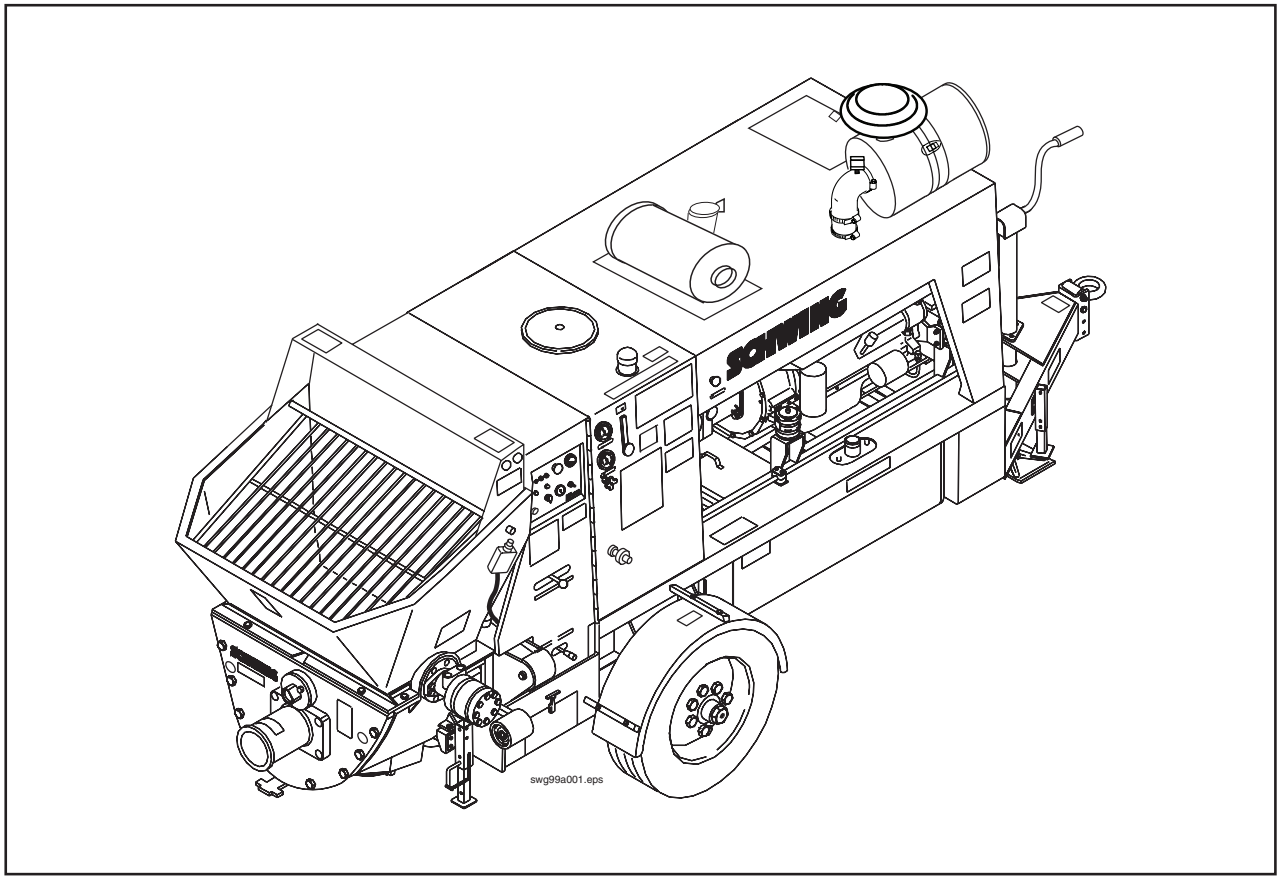
* Max RPM of the hydraulic pumps is calculated while the pump is under a full load. Depending on the unit, it is acceptable for the max RPM to vary slightly from the published estimate.

## Hydraulic Pressure Specifications

Oil should be at 40° to 50° Celsius before testing.

| Concrete Pump | bar (PSI) |
|---|---|
| SP-1250 | 330 (4785) |
| SP-1000HP | 280 (4050) |
| SP-1000 | 300 (4350) |
| SP-750-18 | 300 (4350) |
| SP-750-15 | 266 (3867) |
| SP 500 | 266 (3867) |
| SP-2000 | 300 (4350) |
| Agitator | 125 (1812) |
| Accumulator dump valve | 200 (2900) |
| Accumulator secondary relief | 220 (3200) |
| Soft switch relief | 100 (1450) |
| Stroke limiter circuit | 0-25 (0-363) |
| Nitrogen pressure | 100 (1450) |

| Noise emission levels | Decibels |
|---|---|
| SP 500 | 107 dB |
| SP 750 | 110 dB |
| SP 1000 | 113 dB |
| SP 1250 | 113 dB |
| SP 2000 | 113 dB |




# 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 - 6:00 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
- Spanish: . . . . . .30381024

Co-worker Safety Rules, laminated,

- English: . . . . . .30381022
- Spanish: . . . . . .30381027

Co-worker Safety Rules, unlaminated,

- English: . . . . . .30381023
- Spanish: . . . . . .30381028

Small line Safety Manual,

- English: . . . . . .30381680
- Spanish: . . . . . .30381841

**Schwing phone numbers**

- Spare Parts . . . . . .(888) SCHWING
- 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 20, 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**

August 29, 2008

Safety/Service Bulletin 1023-08

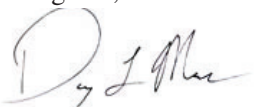
Subject: Release of *Safety Manual* version 6.x.1

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 set of manuals free of charge for each unit that is listed with its serial number 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 wouldn't 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.

Please complete this form and mail to:
5900 Centerville Road
White Bear, Mn. 55127
Telephone (651) 429-0999
Attention: Publications

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 |



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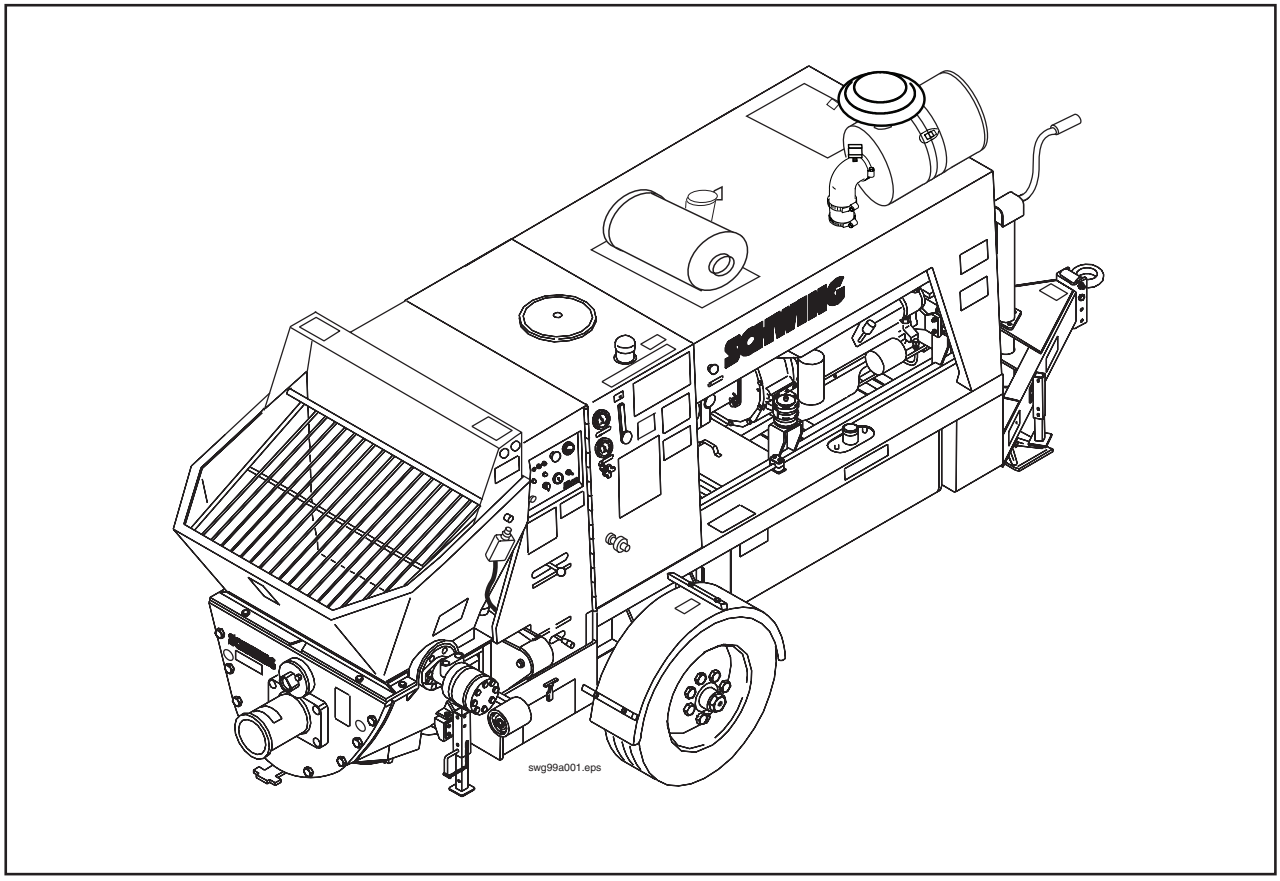



# OVERVIEW

# Product Overview

## First Commissioning

### Installation of your new unit

When your new Schwing was delivered, it was accompanied by several documents in addition to this operation manual. One of those important documents is called the "DELIVERY INSPECTION REPORT". Each of the applicable 35 items listed should be checked before your new pump is sent to the first job.

| | Operational | Repair Required | Comments* (If repair is required) |
|---|---|---|---|
| 1. Engine Coolant | | | |
| 2. Engine oil level | | | |
| 3.Transmission oil level | | | |
| 4. Oil level system l and ll | | | |
| 5. Oil level system lll | | | |
| 6. Transfer case or FTD oil level | | | |
| 7. Oil in gear compartment of Hyd. Pump 1 | | | |
| 8. Oil level in dist. gear box (banana pumps) | | | |
| 9. Oil level in agitator gear box | | | |
| 10. Flushing oil level (gate valve system) | | | |
| 11. Oil level in compressor | | | |
| 12. Agitator greased | | | |
| 13. Rock valve greased (if equipped) | | | |
| 14. Drive line greased | | | |
| 15. Outriggers & boom greased | | | |
| 16. Manual & remote throttles set to proper RPM ( RPM) | | | |
| 17. Setting of relief valve system l | | | |
| 18. Setting of relief valve system ll | | | |
| 19. Setting of relief valve system lll | | | |
| 20. Pressure gauges work system l&ll&lll | | | |
| 21. Hydraulic lines checked for leakage (heat oil to 80˚ c) | | | |
| 22. Hydraulic oil cooler checked for leakage and proper air flow | | | |
| 23. Water pump | | | |
| 24. Agitator | | | |
| 25. Forward-reverse for pumpkit | | | |
| 26. Outriggers | | | |
| 27. Remote control (boom) functions | | | |
| 28. Manual check of all hand valves | | | |
| 29. Holding valves on boom | | | |
| 30. All boom pin retainers in place | | | |
| 31. End hose cable hook installed | | | |
| 32. Tail light and clearance lights | | | |
| 33. Safety decals (see decal sheet) | | | |
| 34. Tools/Spare Parts (see tool check list) | | | |
| 35. Visual inspection of paint job | | | |

* Please note any other comments on back of white copy

# Machine Description

It is recommended that you read this section of the manual while you are near the concrete pump so that you can identify the components that are discussed.

The Schwing trailer-mounted concrete pump is mounted on a trailer chassis. The pump is hydraulically or electrically driven.

## Emergency Stop switches

Pressing one of the RED EMERGENCY PUSH STOP switches (Figure 3) will stop the engine.

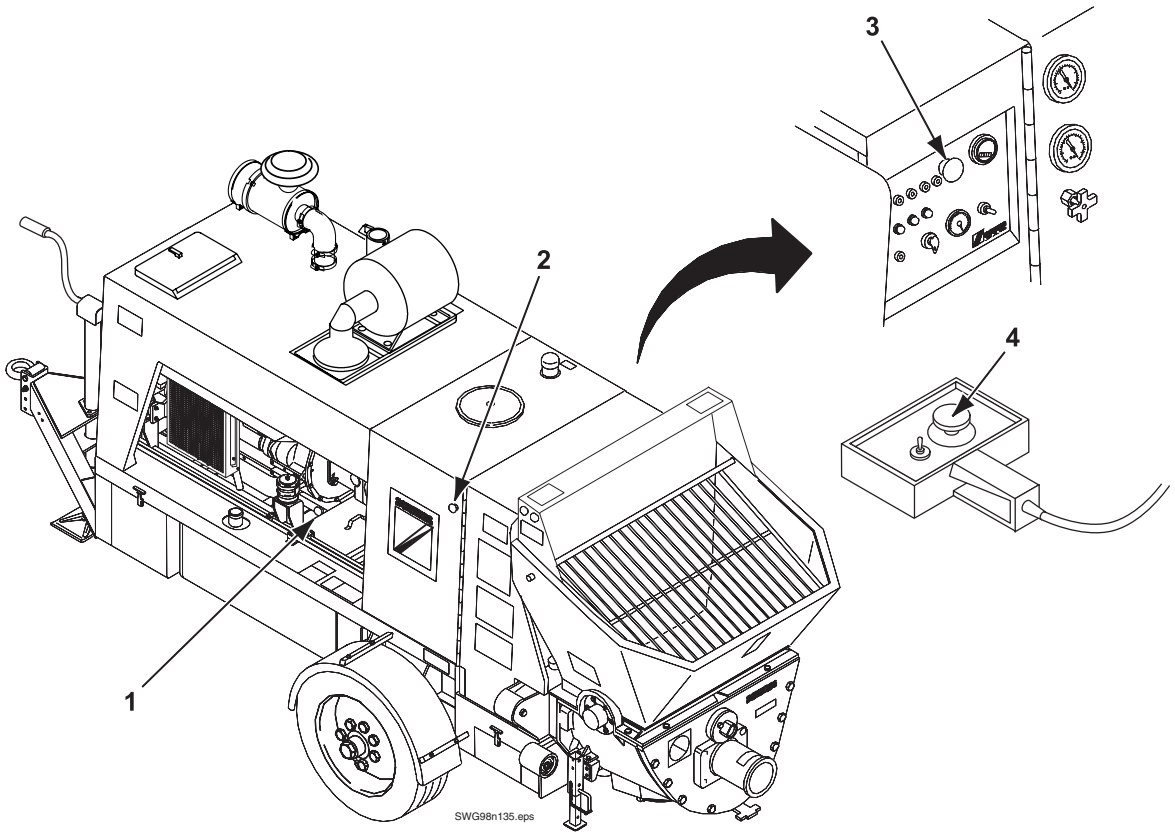



**Figure 3**
**Emergency Stop Switches (4)**

## Concrete pump hydraulic pumps

The hydraulic pumps for the concrete pump circuit are variable displacement piston pumps. They are horsepower controlled, which means that as pressure rises, the flow decreases, so the power consumption remains constant. We use this type of pump so the engine will not bog down under hard pumping conditions. The pumps also accept external signals for control of the output. At Schwing, we route signals to the pump from the hydraulic stroke limiter. The net effect is to tell the pump to put out less oil per revolution, as required by the pump operator (Figure 4).

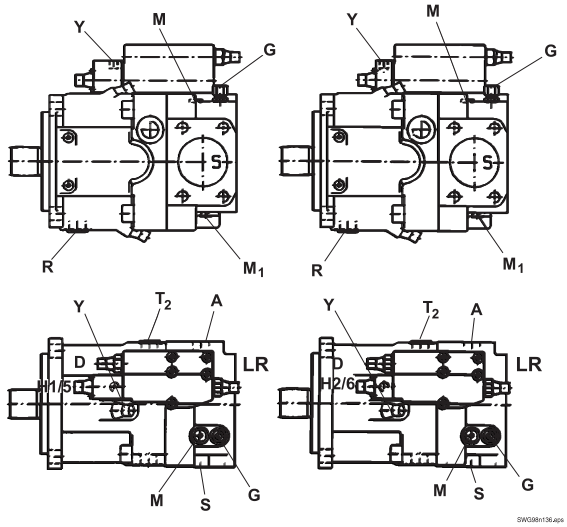



**Figure 4**
**Main Hydraulic Pump and External Connections**

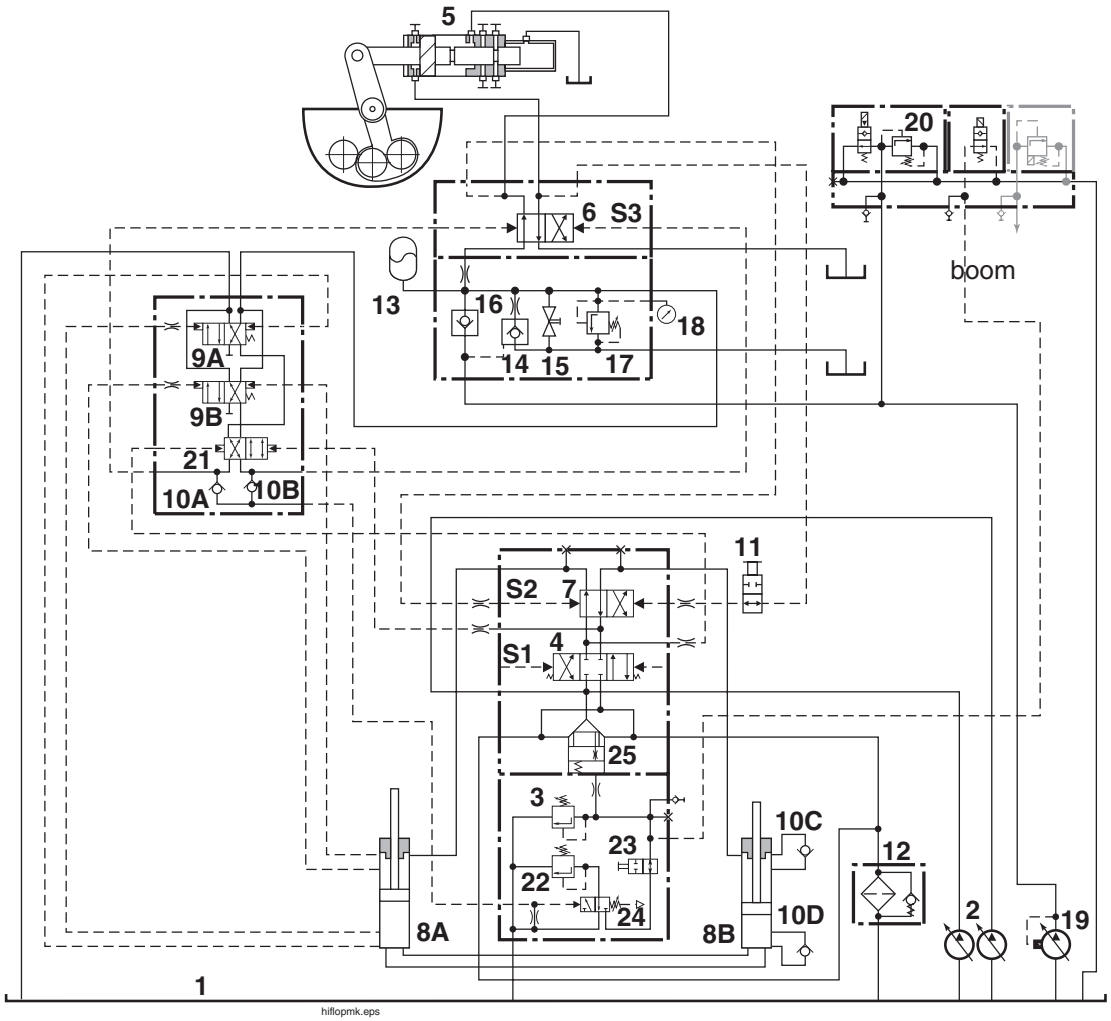
## Concrete Pump Circuit

The method of getting the hydraulic cylinders to change direction at the appropriate times is the subject of several paragraphs on the following pages.

The hydraulic pumps that supply oil to the concrete pump kit are made to be able to adjust the amount of oil they deliver both by internal pressure sensing devices and by adjustment of external valves (the stroke limiter).

This Operation Manual will deal with a rock type of concrete valve. Contact Schwing Service Department at 1 - (888) SCHWING for questions regarding flat gates.

Shown in Figure 5 are the components of the concrete pump control system.




1. Hydraulic oil reservoir
2. Main hydraulic pumps
3. Main pressure relief valve
4. Directional control valve S1
5. Rock Valve slewing cylinder
6. Directional control valve S3
7. Directional control valve S2

8A - 8B. Differential hydraulic cylinders

9A - 9B. Reversing valves (MPS)

10A - 10D. Check valves

11. Main shutoff valve (Ball cock)
12. Hydraulic return filter with bypass valve
13. Accumulator
14. Pilot to close accumulator dump valve
15. Manual accumulator dump valve
16. Accumulator pressure maintenance check valve
17. Accumulator relief valve
18. Accumulator pressure gauge
19. Accumulator hydraulic pump
20. Accumulator redundant relief, E-stop manifold
21. NG 10 valve for forward/reverse
22. Soft switch relief valve
23. Soft switch shutoff valve
24. Soft switch reversing valve
25. Main flow poppet valve

**Figure 5**
**The fully hydraulic pump control system (for hi-flo pumpkit)**

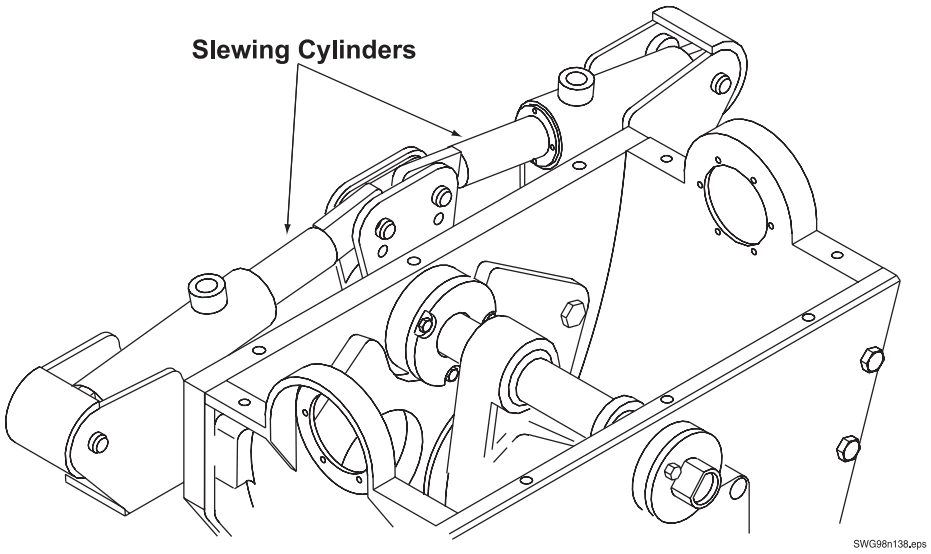



**Figure 6**
**The rock valve slewing cylinders (shown as item 5 in Figure 3)**

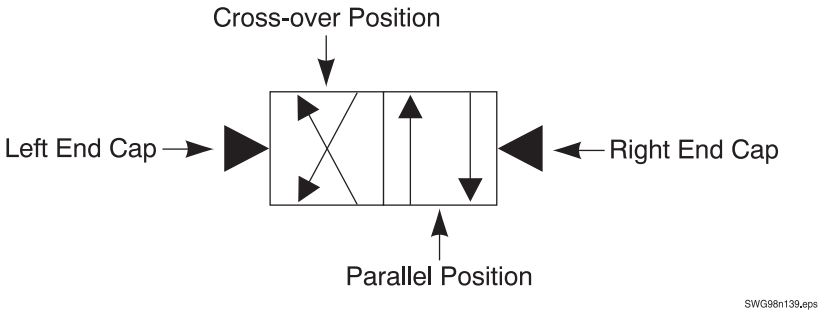



**Figure 7**
**"S" valve diagram explanation for S2 and S3 valves**
**(shown as items 6 and 7 in Figure 3)**

The term "differential cylinder" refers to the fact that each of the hydraulic cylinders that push the concrete have an area difference (referred to as an "area differential") between the two sides of the piston. This area differential is due to the fact that the rod extends only from one side of the piston, and not the other. The rock slewing cylinders on this model are single acting. They have no piston, other than a false piston to prevent the rod from coming out of the cylinder.

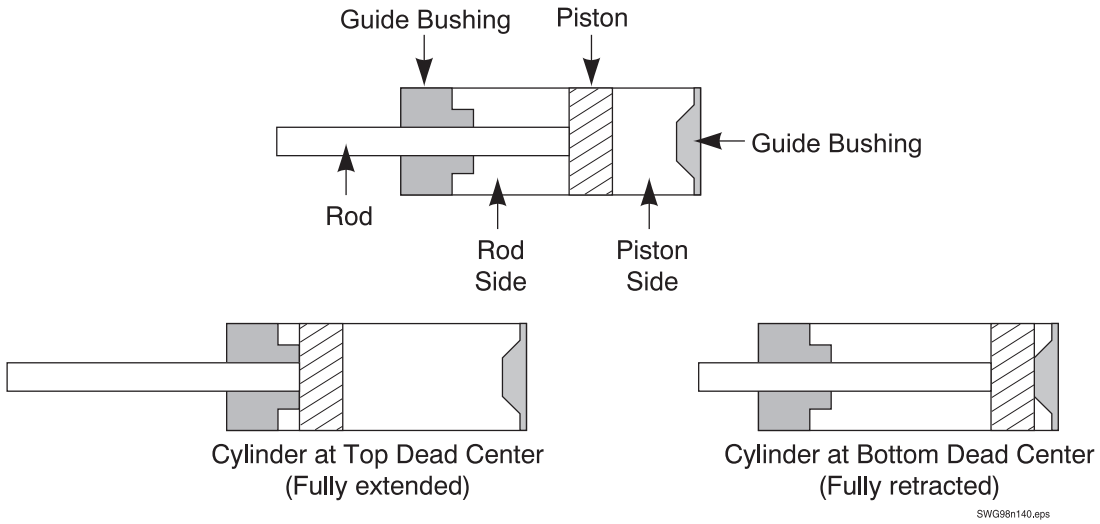



**Figure 8**
**Differential hydraulic cylinder diagram explanation**
**(shown as items 8A and 8B in Figure 3)**

The switching valves have a logic function, in that they sense multiple pressures simultaneously and will route oil from the poppet end port to the output port ONLY if the pressure from the poppet end port exceeds the pressure at the spring end port by more than 2:1.

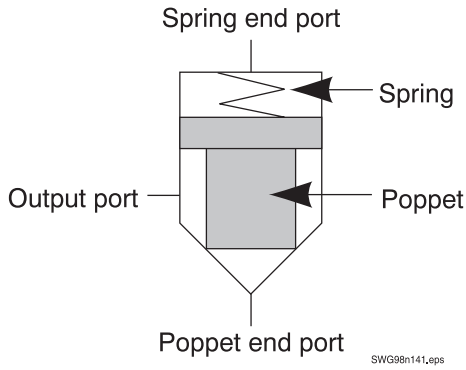



**Figure 9**
**Switching valve diagram explanation**

# SP Circuit Diagram

The following diagrams A through D show the switching functions of the fully hydraulic pump control system plumbed on PISTON SIDE with simplified schematics. The agitator circuits are not shown.

## Phase A

Please note that right and left refer to the orientation you would have if you were looking from the trailer hitch towards the front of the unit.

- As soon as you start the engine, the accumulator hydraulic pump (19) begins pumping high pressure oil (red) to charge the accumulators.(13).

- Shown in the beginning position in phase A schematic. High pressure oil (red) continues to flow into the accumulator circuit until the accumulators (13) are charged to the pressure cut-off point of the accumulator hydraulic pump (19). When the cut-off point is reached, the accumulator pump reduces the hydraulic oil flow until there is just enough to maintain the cut-off pressure.

- The high pressure oil (red) from the accumulator circuit flows through the S3 directional control valve (6), which is in the parallel position, into the right-hand rock slewing cylinder port(5).

- The rod of the rock slewing cylinder (5) fully extends to the right, if not already extended.

- The S1 directional control valve (4), which controls whether the unit pumps in forward, neutral, or reverse, is put into the forward position by energizing one of the coils on the solenoid valve(20).

- A pilot signal (high pressure oil) is routed from the accumulator circuit to the end cap of the S2 directional control valve (7), which moves into the parallel position.

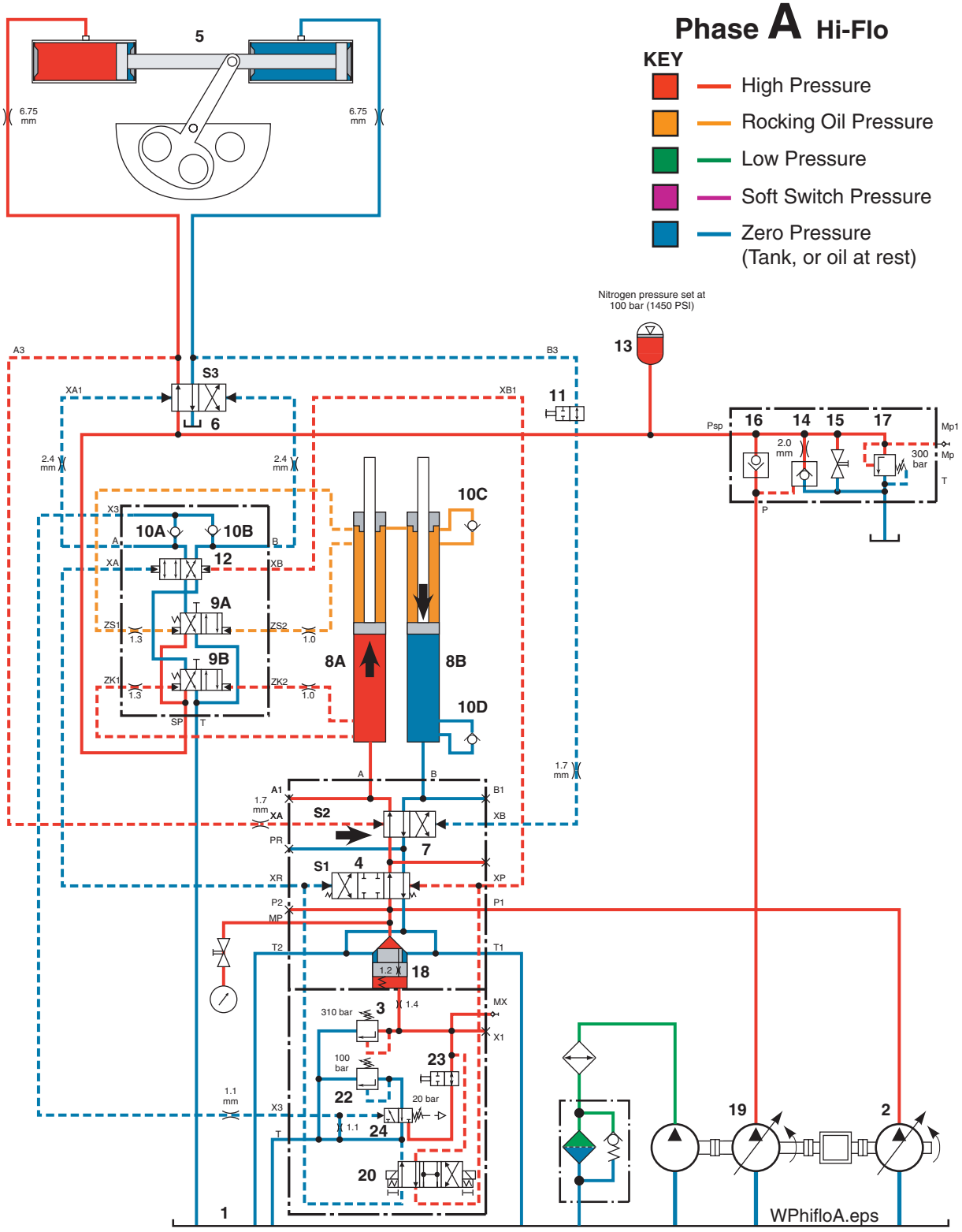
- High pressure oil (red) flows from the main hydraulic pump (2) through the parallel position of the S2 valve (7) into the piston side of the left hand differential cylinder (8A). The cylinder extends, pushing concrete out of the material cylinder, through the rock valve, and into the pipeline. (This is called the pressure stroke.)

- The oil that is forced out of the rod side of the right differential cylinder (8A) flows through hoses into the rod side of the right differential cylinder (item 8B). This oil is called rocking oil (orange).

- The rocking oil forces the right side differential cylinder (8B) to retract, which creates a vacuum in the material cylinder. The right side material cylinder fills with concrete. (This is called the suction stroke.)

- The oil from the piston side of the right differential cylinder (8B) is routed back to the tank.

- The oil shown as blue, such as the oil in the reservoir, is at rest, or pressureless.


Phase A Hi-Flo
KEY
High Pressure
Rocking Oil Pressure
Low Pressure
Soft Switch Pressure
Zero Pressure
(Tank, or oil at rest)
Nitrogen pressure set at
100 bar (1450 PSI)
5
6.75 mm
6.75 mm
13
11
S3
6
S2
7
S1
4
10A
10B
12
9A
9B
10C
8A
8B
10D
16
14
15
17
2.0 mm
300 bar
Psp
Mp1
Mp
T
P
2.4 mm
2.4 mm
1.7 mm
1.7 mm
1.3
1.0
1.3
1.0
1.2
18
310 bar
3
1.4
100 bar
23
22
20 bar
24
1.1 mm
1.1
20
19
2
1
WPhifloA.eps

## Phase B

Please note that right and left refer to the orientation you would have if you were looking from the trailer hitch towards the front of the unit.

- The right side differential cylinder (8B) reaches top dead center. If there is extra rocking oil in the loop that the right side differential cylinder (8A) cannot retract to the bottom dead center position, then oil is removed now through check valve 10D.

- The right side differential cylinder (8A) reaches bottom dead center. As the piston reaches the guide bushing, it exposes a port to the end cap of the switching valve (9A), which becomes connected to high pressure oil (red). The left end cap of the switching valve (9A) is connected to low pressure oil (orange), so the switching valve slides into the parallel position, sending high pressure oil (red) toward the end cap of the S3 valve (6).

- The pressure signal reaches the S3 valve end cap (6), pushing the valve into the cross-over position.

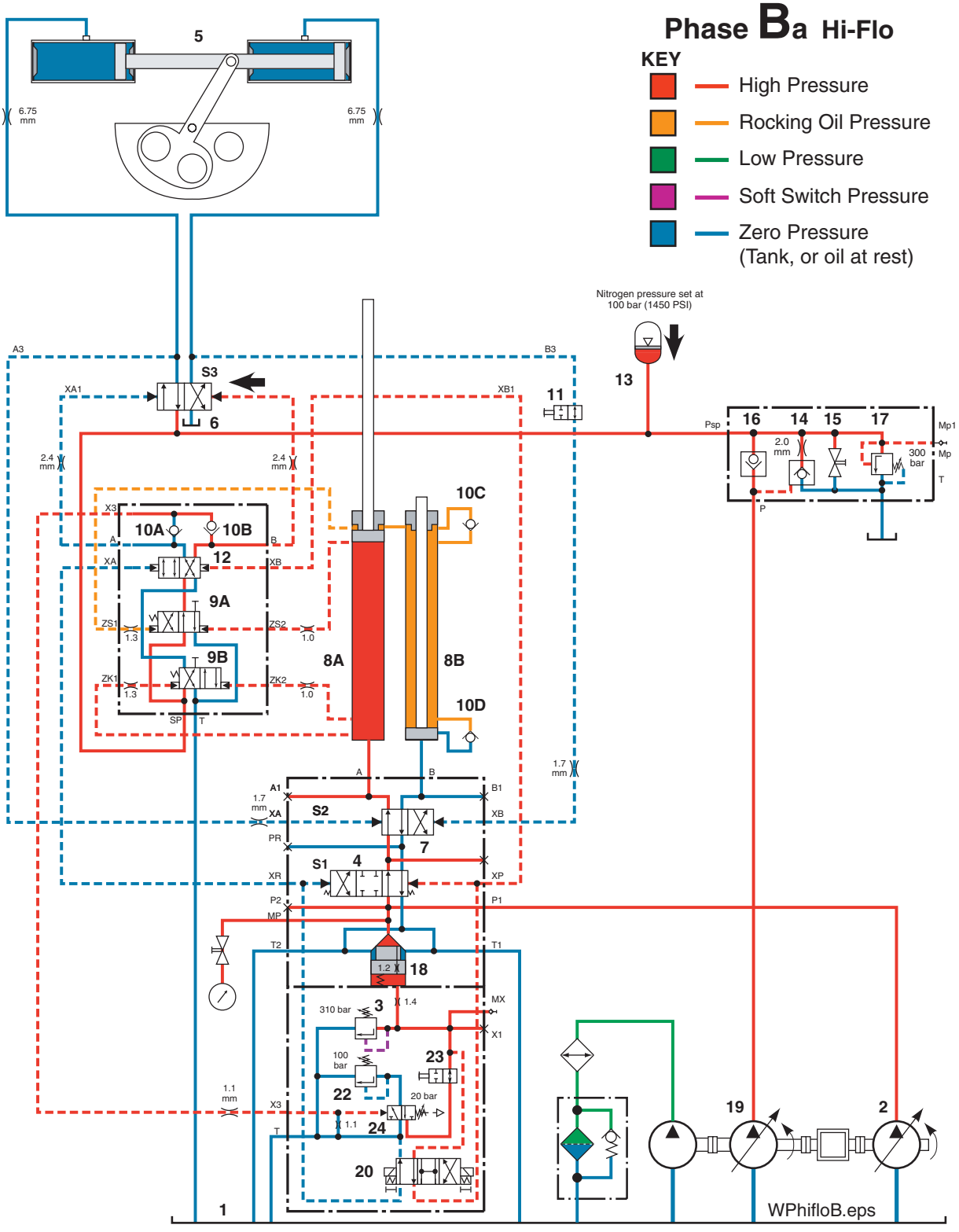
- The oil on the right end cap of the S3 valve (6) flows back to tank (1).

- In the cross-over position, the S3 valve (6) routes oil from the accumulator to the port on the right-hand rock valve slewing cylinder (5). The cylinder begins to extend.

- The oil from the left hand side of the rock valve slewing cylinder (5) is routed back to tank (1).

- Shown in beginning position in phase B schematic. A pilot signal (high pressure oil) is routed from the accumulator circuit to the left side end cap of the S2 directional control valve (7). The S2 valve slides into the cross-over position.

- As the rock slewing cylinder (5) retracts, pressure in the accumulator circuit falls. When it drops below the set point of the accumulator hydraulic pump cut-off pressure, the accumulator hydraulic pump (19) increases the flow of hydraulic oil to charge the accumulator circuit (13).


Phase Ba Hi-Flo
KEY
High Pressure
Rocking Oil Pressure
Low Pressure
Soft Switch Pressure
Zero Pressure
(Tank, or oil at rest)
Nitrogen pressure set at
100 bar (1450 PSI)
5
6.75 mm
6.75 mm
13
A3
B3
S3
6
XA1
XB1
11
2.4 mm
2.4 mm
Psp
16
14
15
17
2.0 mm
300 bar
Mp1
Mp
T
P
10C
X3
10A
10B
A
B
12
XA
XB
9A
ZS1
1.3
ZS2
1.0
9B
8A
8B
ZK1
1.3
ZK2
1.0
SP
T
10D
1.7 mm
A
B
A1
1.7 mm
XA
S2
B1
XB
PR
7
S1
4
XR
XP
P2
MP
P1
T2
T1
1.2
18
MX
310 bar
3
1.4
X1
100 bar
23
22
20 bar
1.1 mm
X3
1.1
24
T
20
19
2
1
WPhifloB.eps

## Phase C

Please note that right and left refer to the orientation you would have if you were looking from the trailer hitch towards the front of the unit.

- The rock valve slewing cylinder (5) has fully extended

- High pressure oil (red) continues to flow into the accumulator circuit until the accumulator (13) is charged to the pressure cut-off point of the accumulator hydraulic pump (19). When the cut-off point is reached, the accumulator pump reduces the hydraulic oil flow until there is just enough to maintain the cut-off pressure.

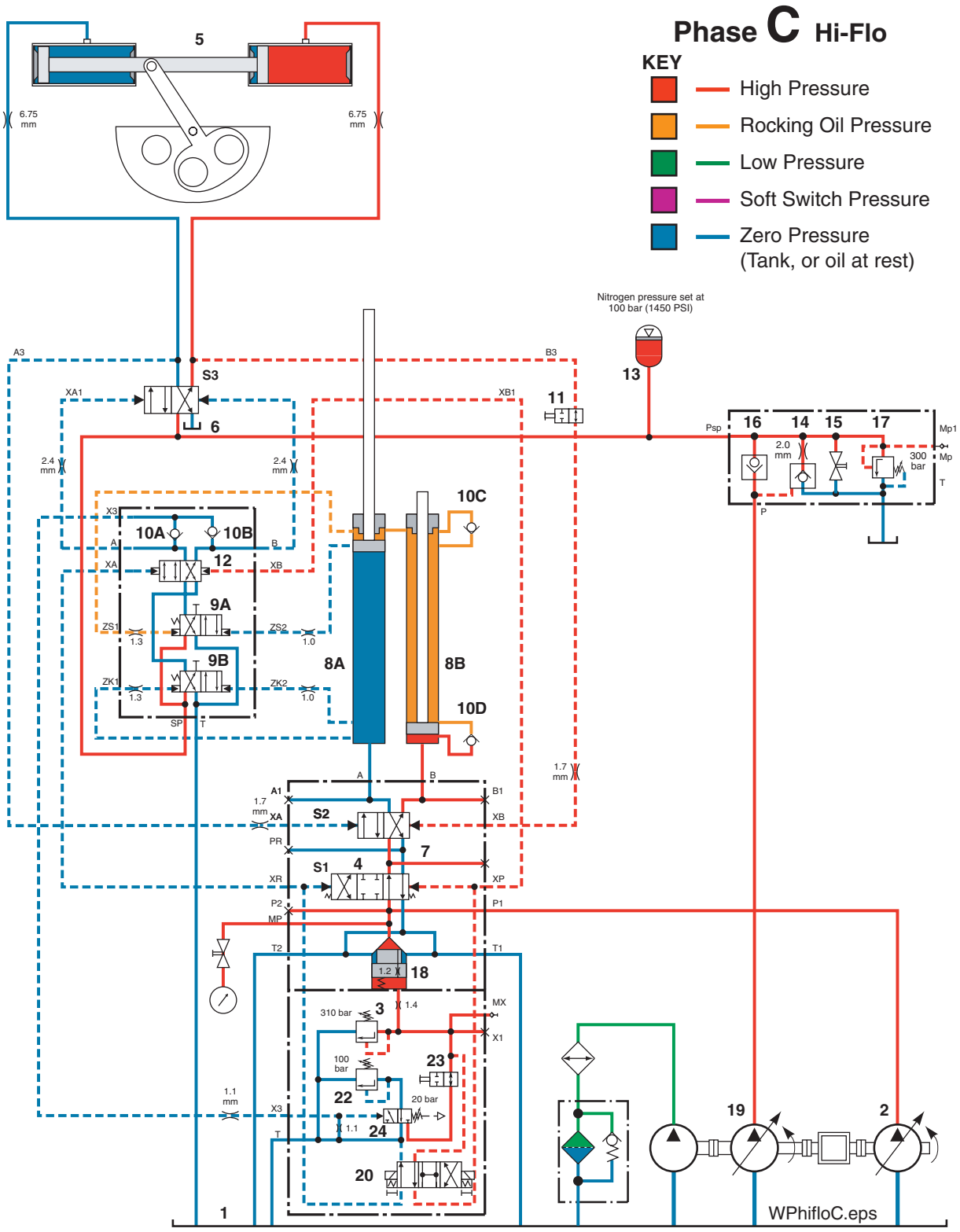
- The S2 valve (7) has finished sliding. Oil is now routed from the main hydraulic pump (2) to the piston side of the right hand differential cylinder (8B).

- As the right hand differential cylinder (8B) moves, rocking oil (orange) reaches the left end cap of the switching valve (9A). The valve closes by the pressure applied and the force of the return spring. This removes the pilot signal to the left side of the S3 directional control valve (6).

- As the right side differential cylinder (8B) extends, the concrete in the material cylinders from stage A is forced out into the delivery pipeline. (Pressure stroke.)

- The oil from the rod side of the right side differential cylinder (8B) travels through the hoses to the rod side of the right hand differential cylinder (8A), forcing it to retract which it creates a void in the material cylinder and concrete begins to flow in to fill that void. (Suction stroke.)

- The oil from the piston side of the left hand differential cylinder (8A) is routed through the S2 valve (7), and back to tank (1).


Phase C Hi-Flo
KEY
High Pressure
Rocking Oil Pressure
Low Pressure
Soft Switch Pressure
Zero Pressure
(Tank, or oil at rest)
Nitrogen pressure set at
100 bar (1450 PSI)
5
6.75 mm
6.75 mm
13
11
S3
6
S2
S1
4
7
18
3
310 bar
100 bar
22
20 bar
23
24
20
10A
10B
12
9A
9B
10C
8A
8B
10D
16
14
15
17
2.0 mm
300 bar
Psp
Mp1
Mp
T
P
19
2
1
WPhifloC.eps

## Phase D

Please note that right and left refer to the orientation you would have if you were looking from the trailer hitch towards the front of the unit.

- The right side differential cylinder (8B) extends to top dead center. The right side differential cylinder (8A) approaches bottom dead center.

- If there is not enough rocking oil to completely extend cylinder 8A, rocking oil will now be added through check valve 10C.

- When the left side differential cylinder is in the top dead center position, pressure is applied to the right end cap of the switching valve (9B). The left end cap of the switching valve is connected to low pressure, so the valve slides into the parallel position. The switching valve routes the pilot signal to the right side end cap of the S3 valve (6).

- The S3 valve (6) moves to the parallel position in response to the pilot signal. The oil in the left side end cap of the S3 valve (6) escapes to tank.

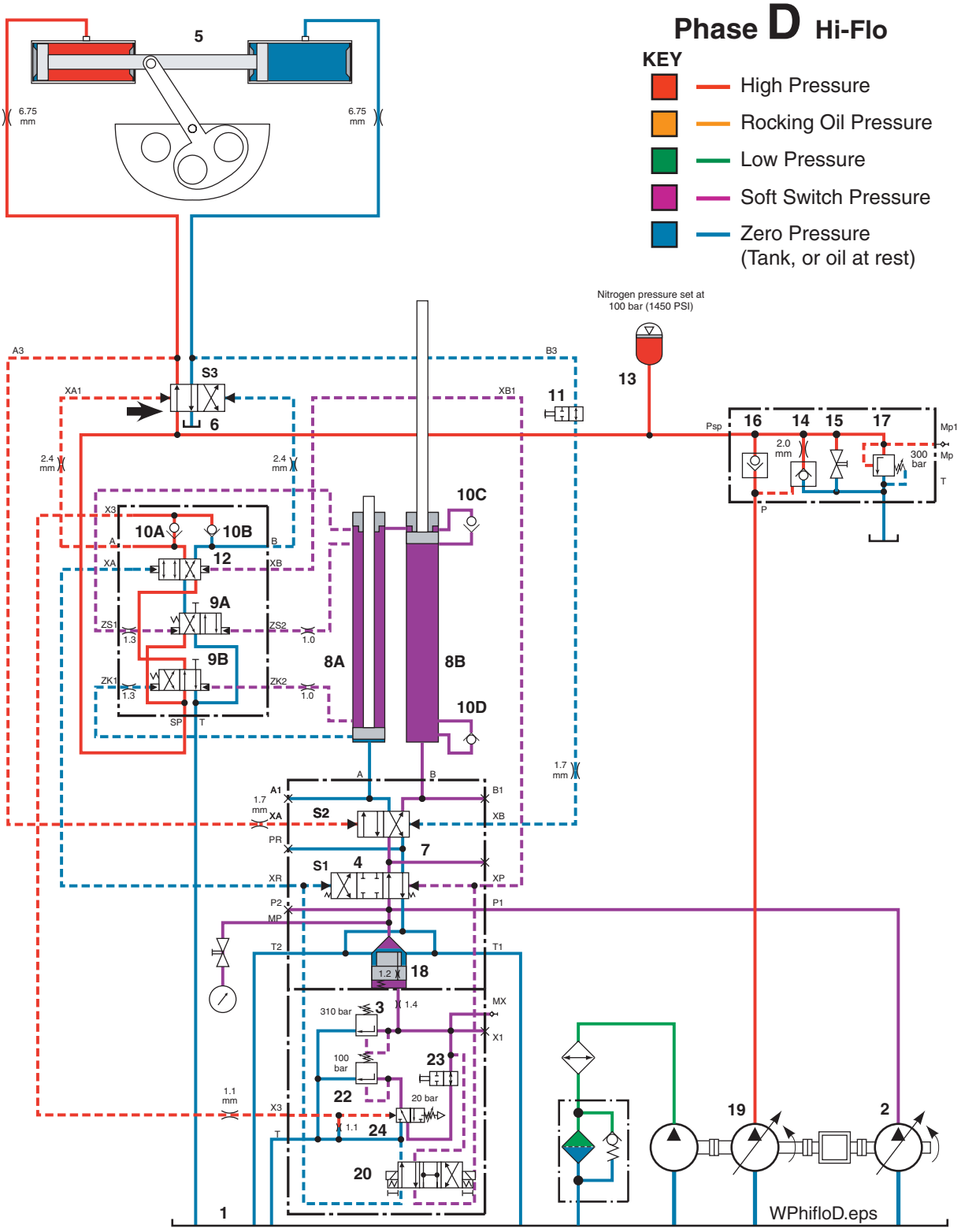
- High pressure oil (red) is routed from the accumulator circuit through the S3 valve (6) to the extend port of the rock valve slewing cylinder (5).

- The rock valve slewing cylinder (5) extends to the right, sending the retract side oil back to tank (1) through the S3 valve (6).

- As the rock slewing cylinder (5) extends, pressure in the accumulator circuit falls. When it drops below the set point of the accumulator hydraulic pump cut-off pressure, the accumulator hydraulic pump (19) increases the flow of hydraulic oil to charge the accumulator circuit (13).

- At the same time that the rock valve cylinder is extending, a high pressure pilot signal is sent to the right end port of the S2 spool. It slides into the parallel position. When it has completed the travel, oil is routed from the main pump (2) to the rod side of the right hand differential cylinder (8A).

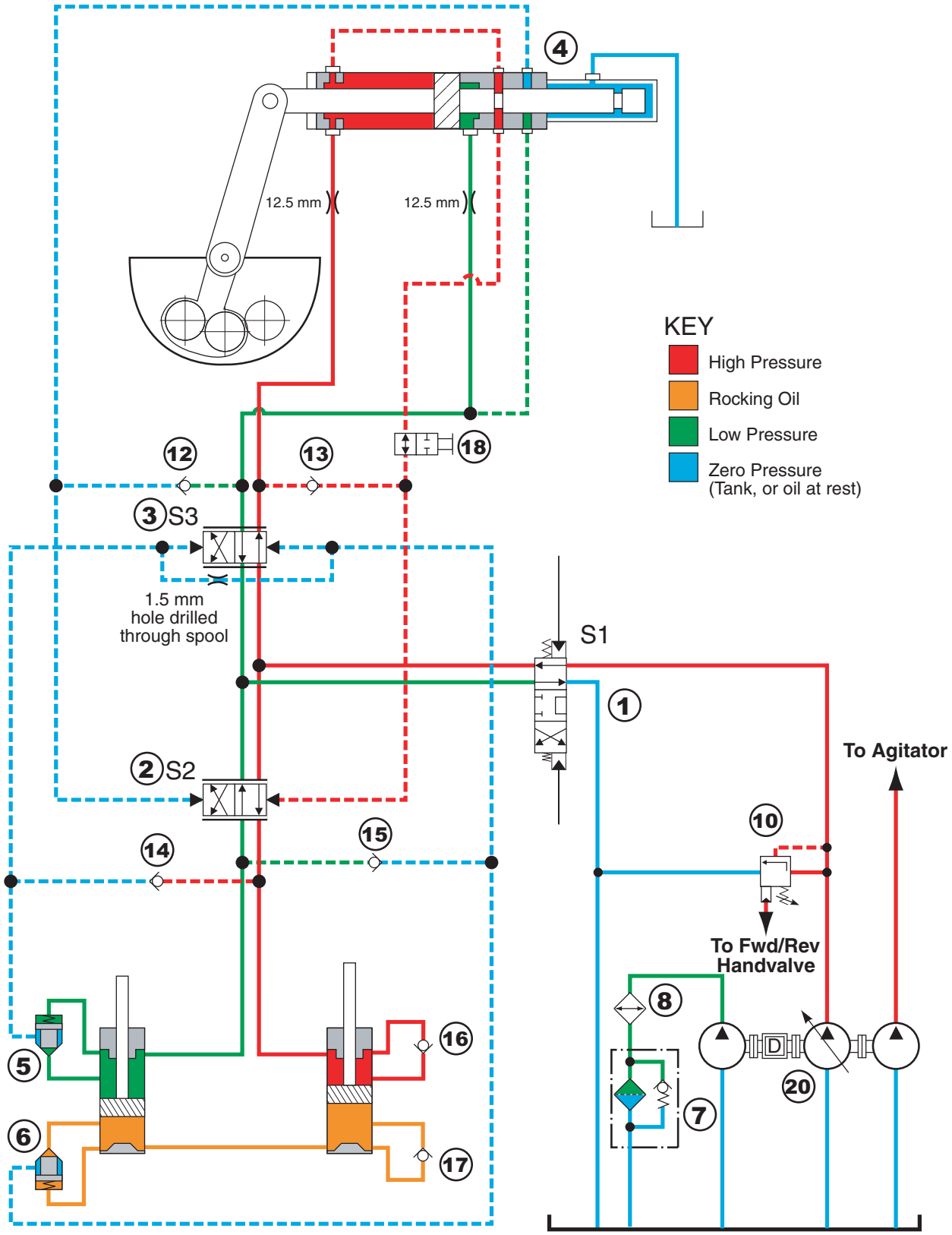
This brings us back to phase A. The machine has made one complete cycle, which consists of two suction strokes and two pressure strokes.


Phase D Hi-Flo
KEY
High Pressure
Rocking Oil Pressure
Low Pressure
Soft Switch Pressure
Zero Pressure
(Tank, or oil at rest)
Nitrogen pressure set at
100 bar (1450 PSI)
WPhifloD.eps

# SP 2000 Circuit Diagram

## Phase A

With S1 valve (1) in the forward position, and the S2 valve (2) in the left position oil flows to the right hand differential acting on the rod side. Oil from the piston side of the right hand differential oil is passed to the piston side of the left hand differential and the rod side oil of the left hand differential is directed back to tank via valves S2 and S1 and through the filter (7). Oil directed through the S3 has the rock valve shift cylinder held in the retracted (right) position so that concrete from the left hand material cylinder is being pushed into the delivery pipe line. Concrete from the hopper is being sucked into the right hand material cylinder.

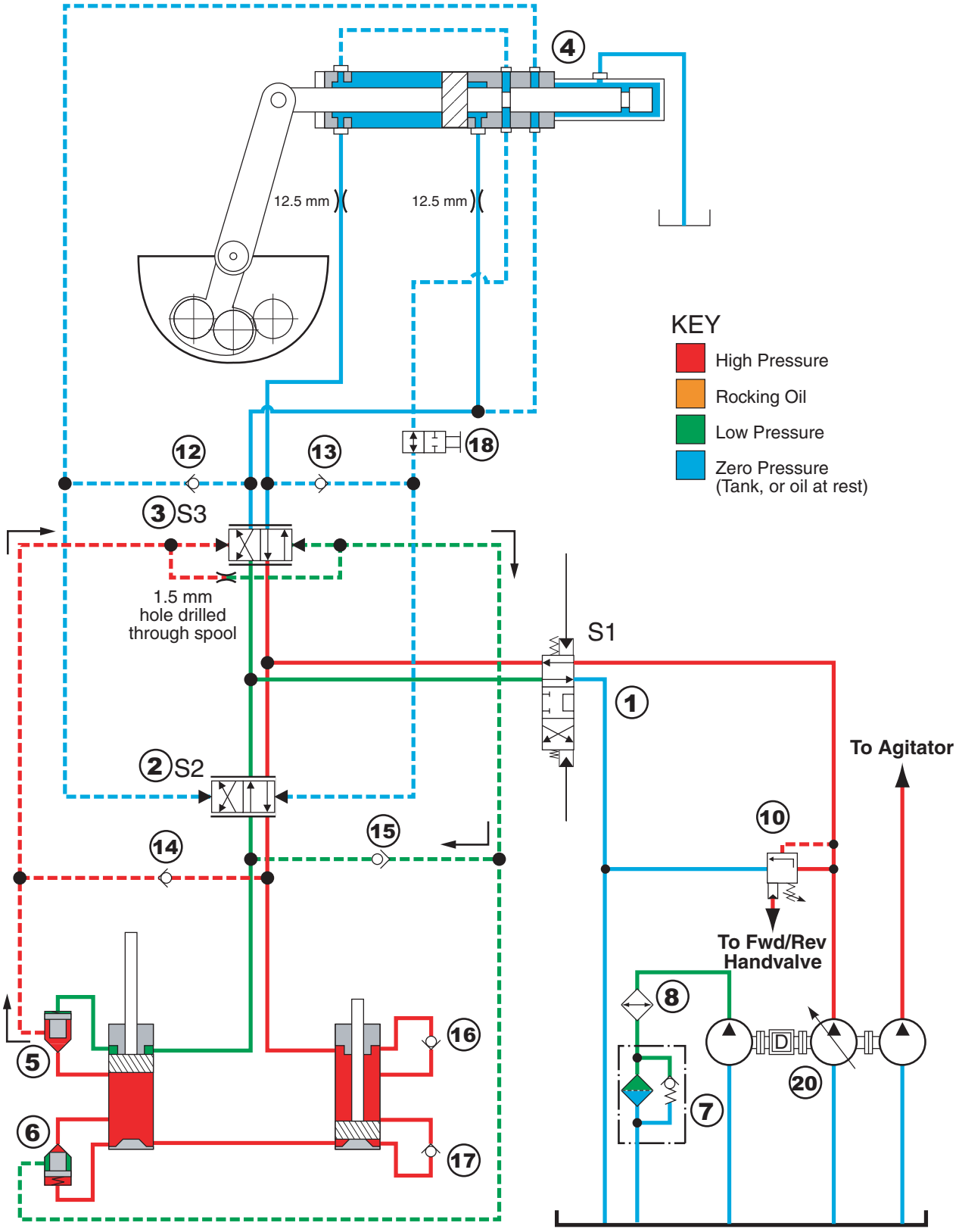

4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
14
15
To Agitator
10
To Fwd/Rev
Handvalve
8
5
16
6
17
7
20

## Phase B

The differential cylinders have reached the end of their stroke position*. Switching valve (5) is sending a high pressure signal to the left hand end cap of S3 valve (3). Oil from the right hand end cap of the S3 valve (3) is relieved via check valve (15), the S2 valve (2), S1 valve (1), filter (7) and back to the hydraulic tank.

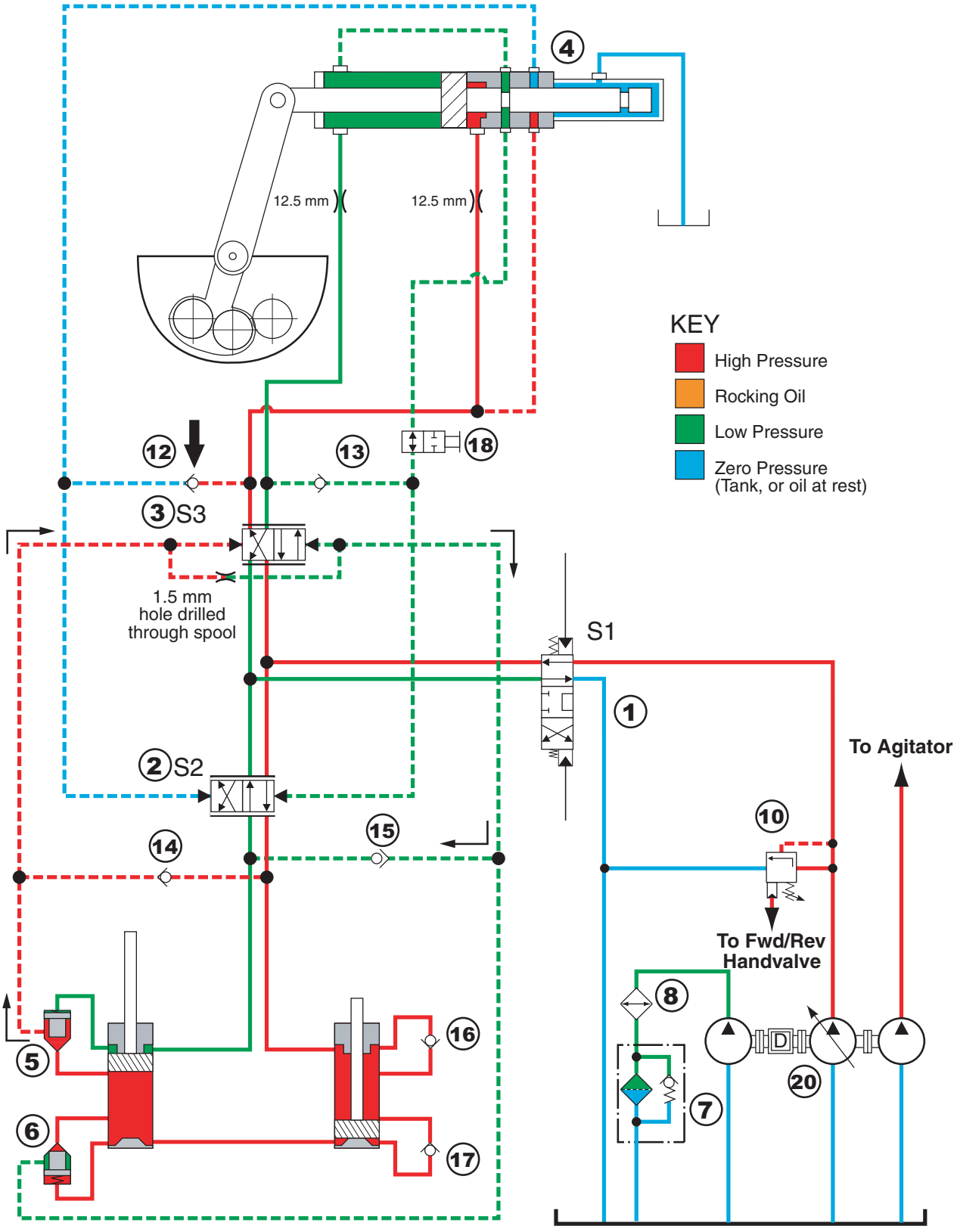
**NOTE!**

**If the left hand differential has not fully extended at this point due to not enough loop oil, high pressure oil will continue to flow through check valve (17) on the right hand differential until the left hand differential is fully extended.**


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
14
15
To Agitator
10
To Fwd/Rev
Handvalve
8
16
5
6
17
7
20

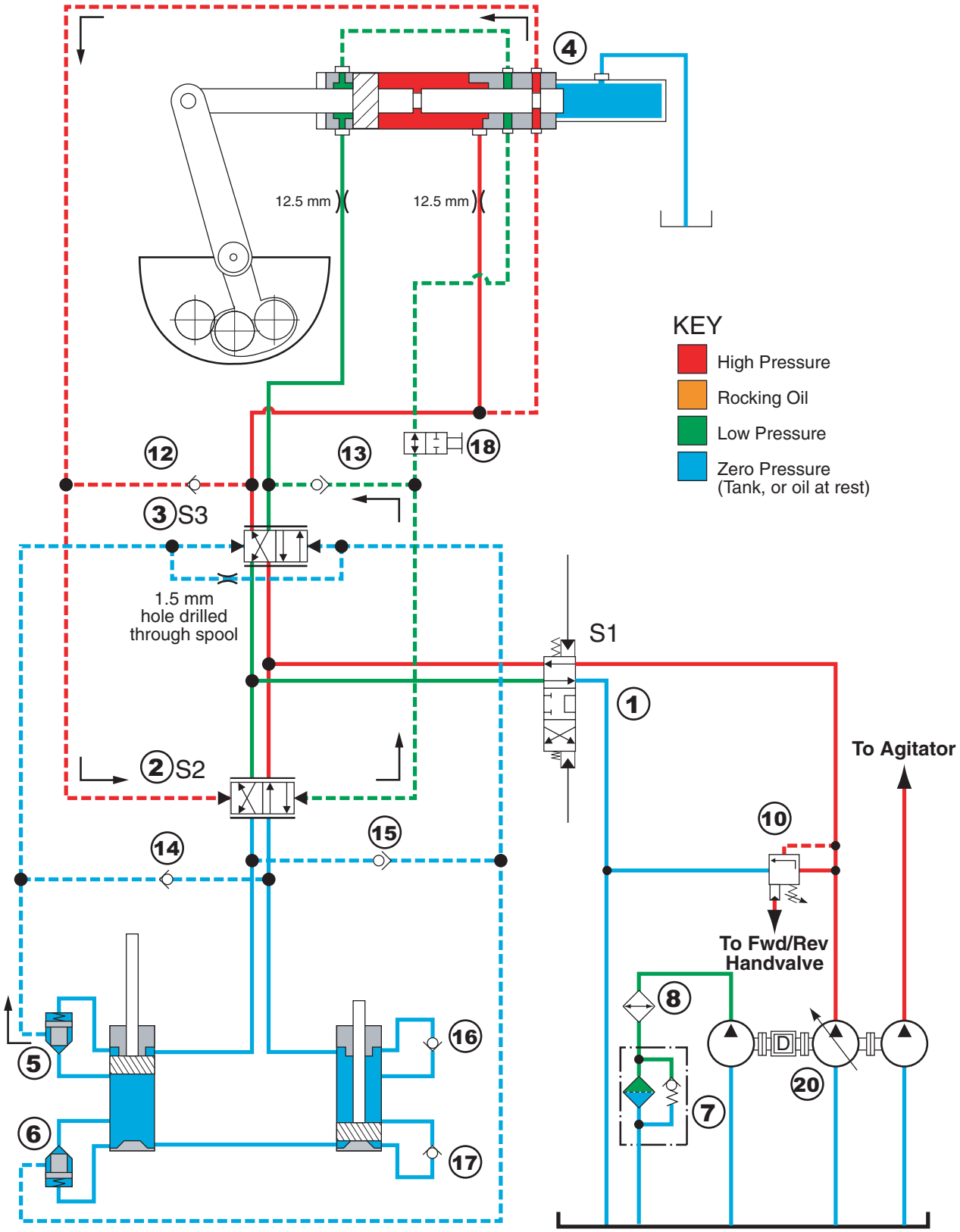
## Phase C

High pressure oil from switching valve (5) has now shifted the S3 valve (3) fully to the right hand position. At this point the pressure oil to the rock valve shift cylinder (4) is changed and the right hand side of the cylinder is getting oil so that the cylinder will extend. Oil from the left hand side of the rock valve shift cylinder is routed to tank via valves (3, 1) and filter (7).


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
15
14
To Agitator
10
To Fwd/Rev
Handvalve
8
16
5
6
7
20
17

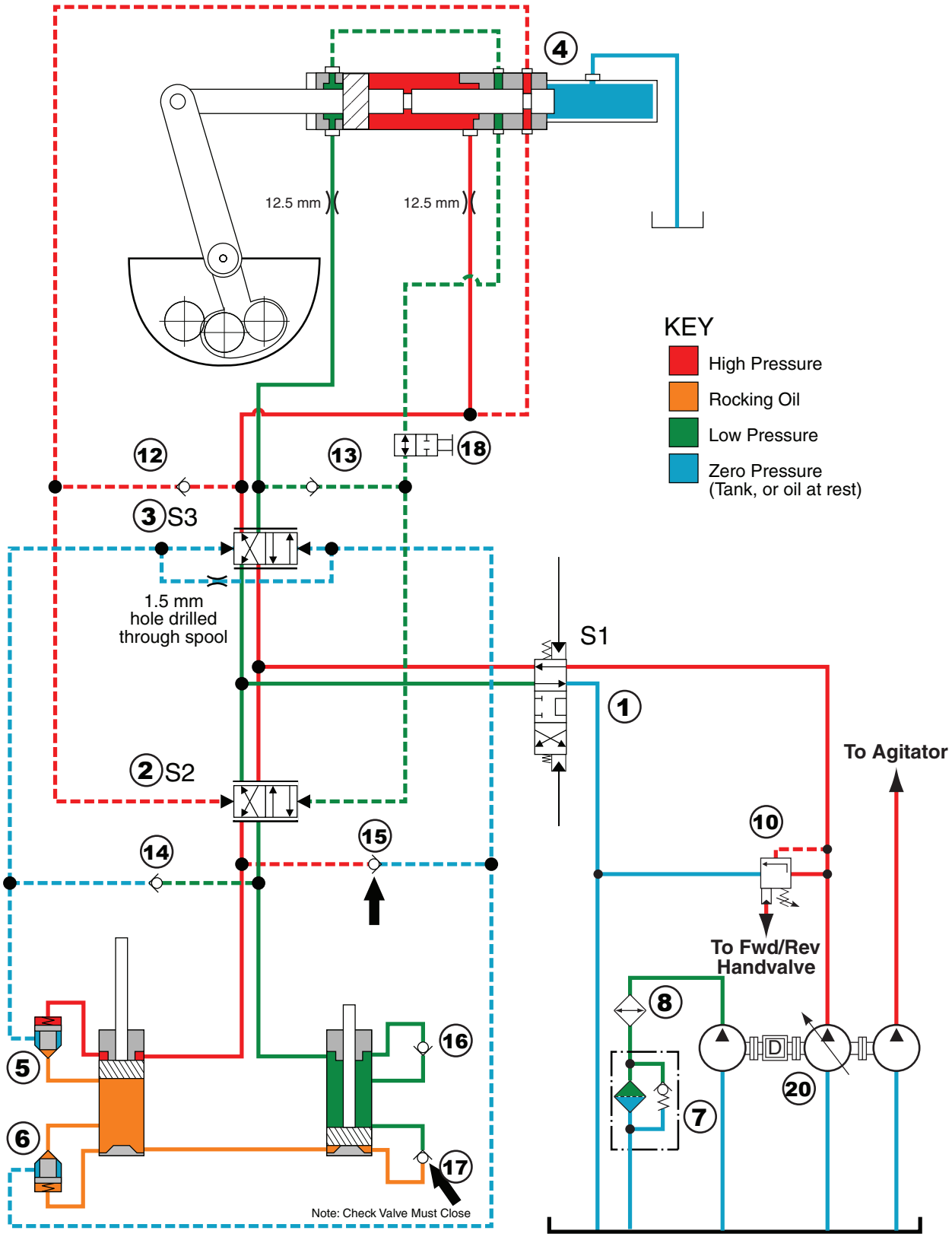
## Phase D

The rock valve shift cylinder (4) has now fully extended. At this point a signal is sent to the left hand end cap of the S2 valve (2) from a signal port on the rock valve shift cylinder (4). As the S2 valve (2) shifts to the right oil from the right hand end cap of the S2 valve (2) is routed to the hydraulic tank via check valve (13), valves (3, 1) and the filter (7).


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
14
15
To Agitator
10
To Fwd/Rev
Handvalve
8
5
16
6
17
7
20

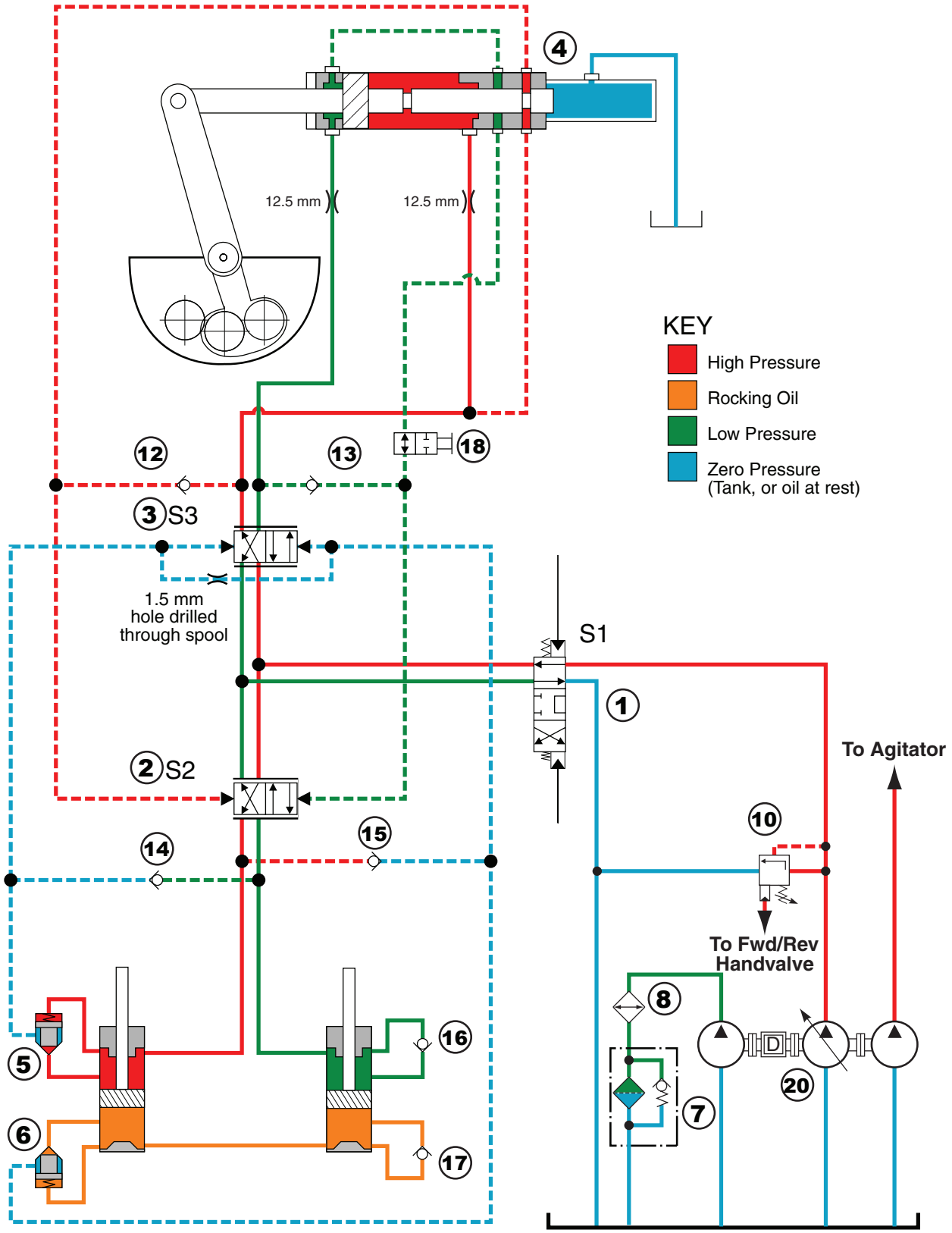
## Phase E

With the S2 valve (2) fully shifted and held in the right hand position, pressure oil is routed through the S1 valve (1) and the S2 valve (2) to the rod side of the left hand differential cylinder. Please note that while the left hand differential cylinder is starting to retract, check valve (17) must close otherwise the right hand differential cylinder will not extend.


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
14
15
10
To Agitator
To Fwd/Rev
Handvalve
8
5
16
6
7
20
17
Note: Check Valve Must Close

## Phase F

Pressure oil is being routed through the S1 valve (1) and S2 valve (2) to the rod side of the left hand differential cylinder causing it to retract. Oil from the piston side of the left hand differential cylinder is passed to the piston side of the right hand differential via the loop hose. The oil on the rod side of the right hand differential is going through valves (2 and 1), filter (7) and back to the tank. Oil directed through the S3 valve has the rock valve shift cylinder held in the extended position so that concrete from the right hand material cylinder is being pushed into the delivery pipe line and concrete from the hopper is being sucked into the left hand material cylinder.

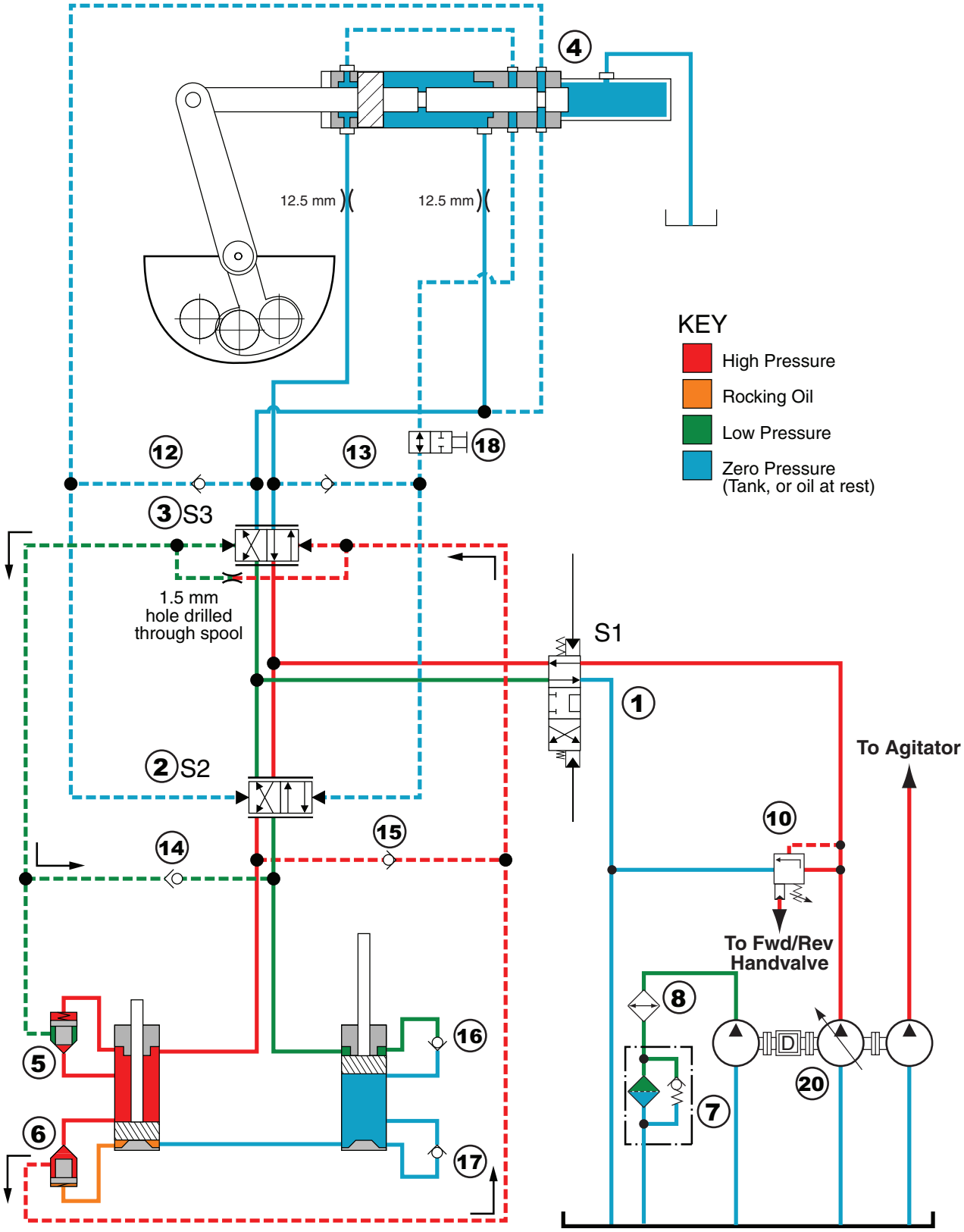

4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
14
15
To Agitator
10
To Fwd/Rev
Handvalve
8
5
16
6
17
7
20

## Phase G

The left hand differential cylinder has now fully retracted*. Switching valve (6) is sending a high pressure signal to the right hand end cap of the S3 valve (3). Oil from the left hand end cap of the S3 valve (3) is relieved via check valve (14), the S2 valve (2), S1 valve (1), filter (7) and back to the hydraulic tank.

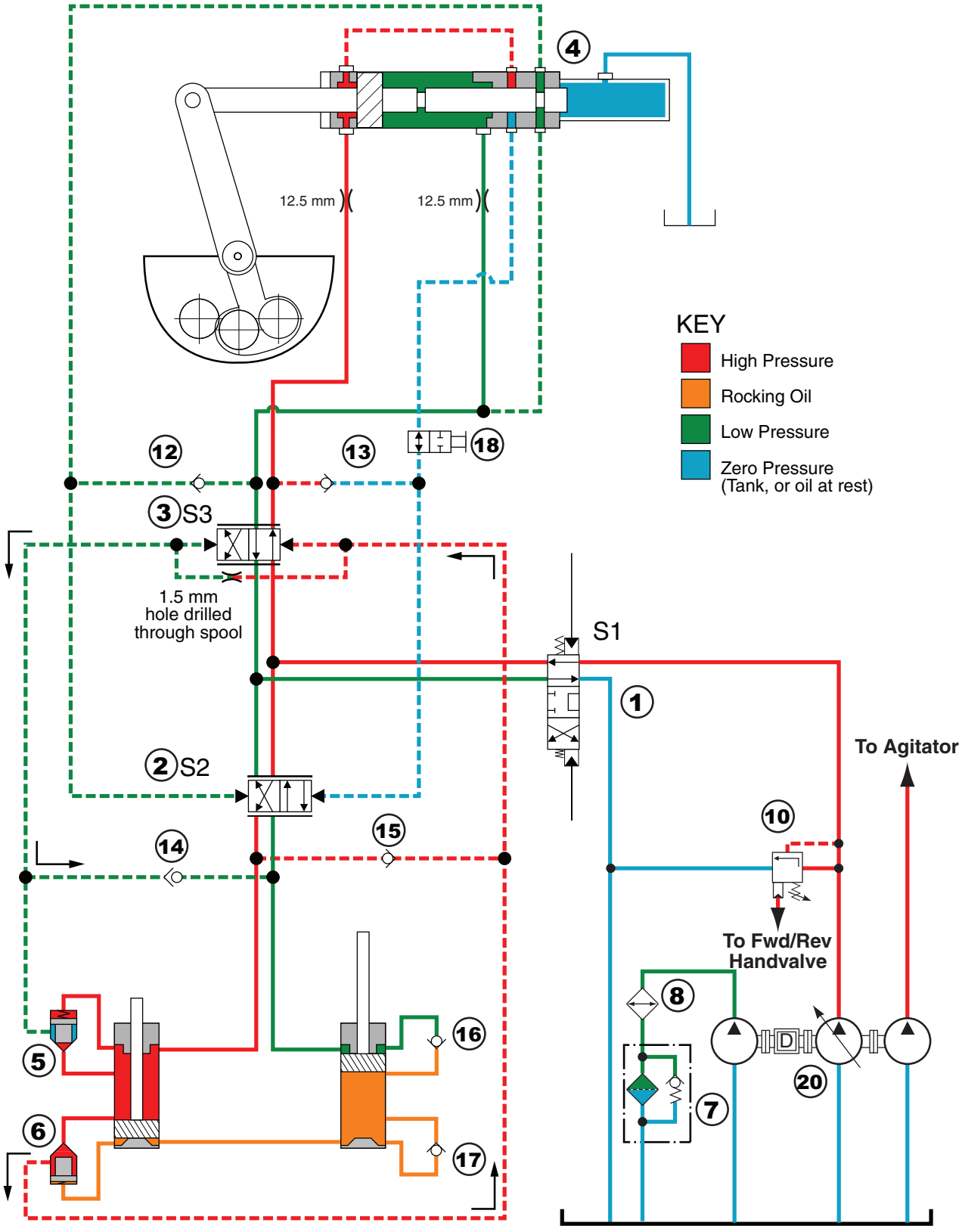
**NOTE!**

**If the left hand differential cylinder has not fully retracted at this point because of to much loop oil, high pressure oil will continue to flow through check valve (16) and back to the hydraulic tank until the left hand differential cylinder is fully retracted.**


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
15
14
To Agitator
10
To Fwd/Rev
Handvalve
8
5
16
6
17
7
20

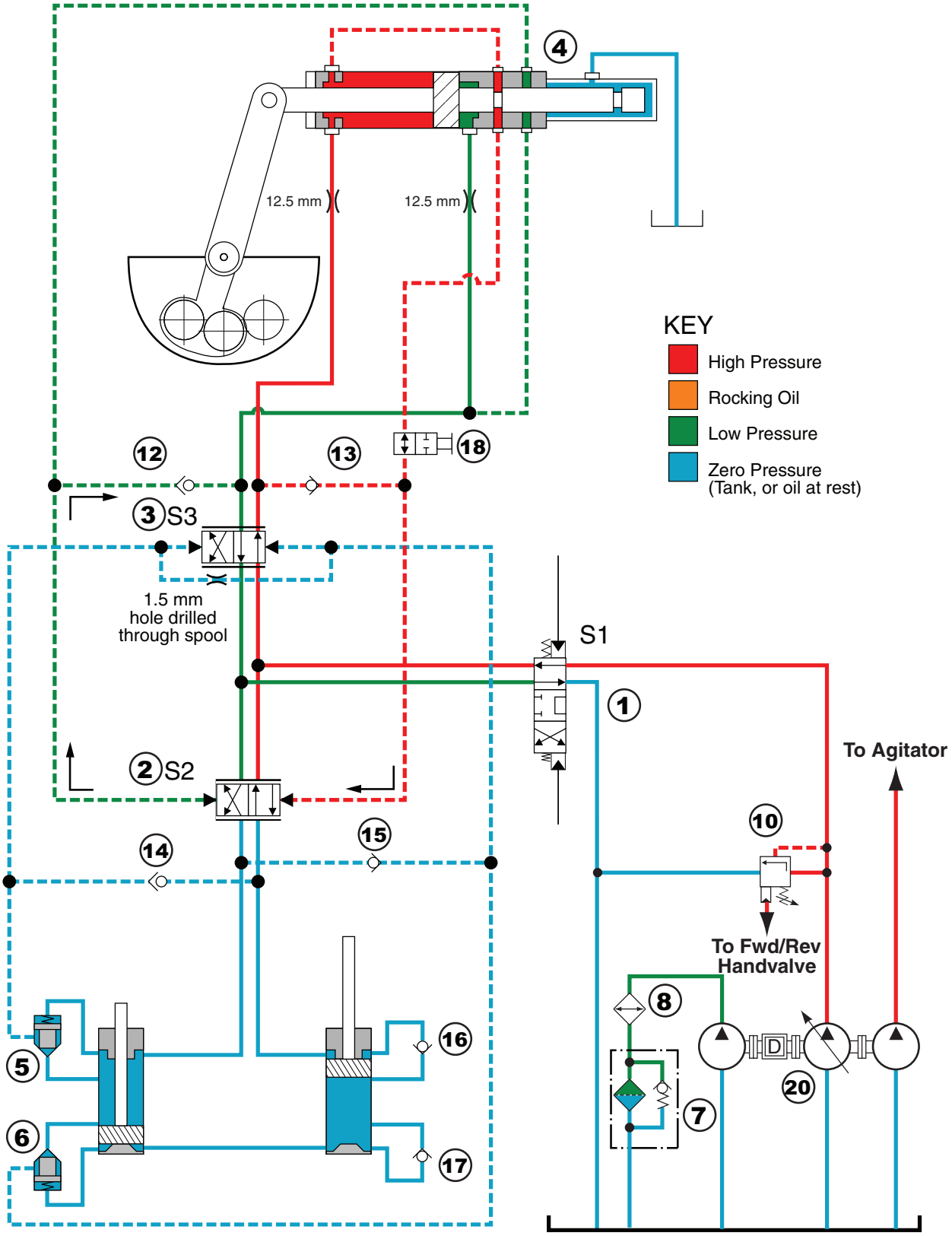
## Phase H

High pressure oil from the switching valve (6) has not shifted the S3 valve (3) fully to the left hand position. At this point the pressure oil to the rock valve shift cylinder (4) is changed and the left hand side of the cylinder is getting oil so that the cylinder will retract. Oil from the right hand side of the rock valve shift cylinder (4) is being routed to tank via valves (3, 1) and filter (7).


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
15
14
To Agitator
10
To Fwd/Rev
Handvalve
8
5
16
6
17
7
20

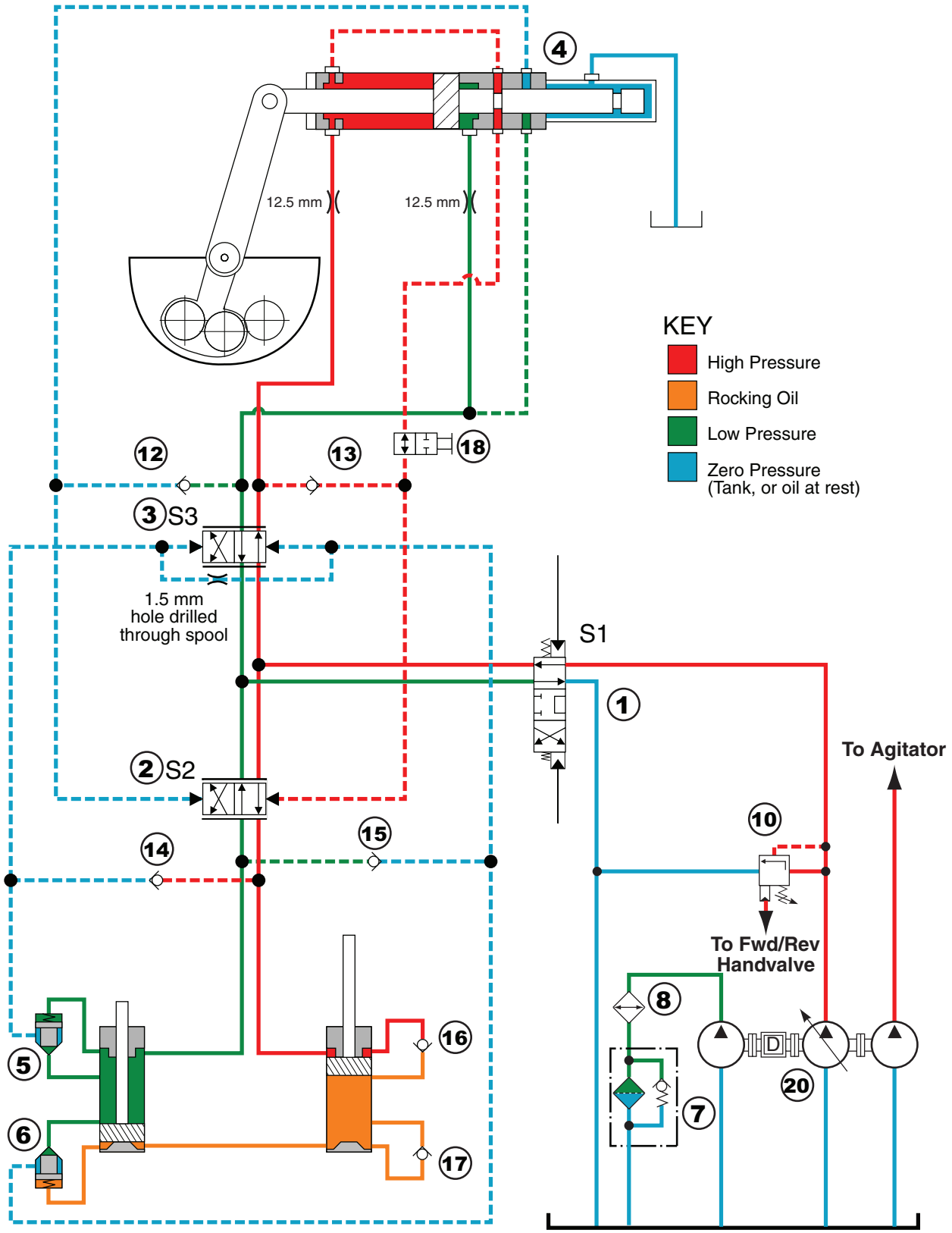
## Phase I

The rock valve shift cylinder (4) has now fully retracted. At this point a signal is sent to the right hand end cap of the S2 valve (2) from a signal port on the on the rock valve shift cylinder (4). As the S2 valve (2) shifts to the left oil from the right hand end cap of the S2 valve (2) is routed to the hydraulic tank via check valve (12), valves (3, 1) and filter (7).


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
14
15
To Agitator
10
To Fwd/Rev
Handvalve
8
16
5
6
17
7
20

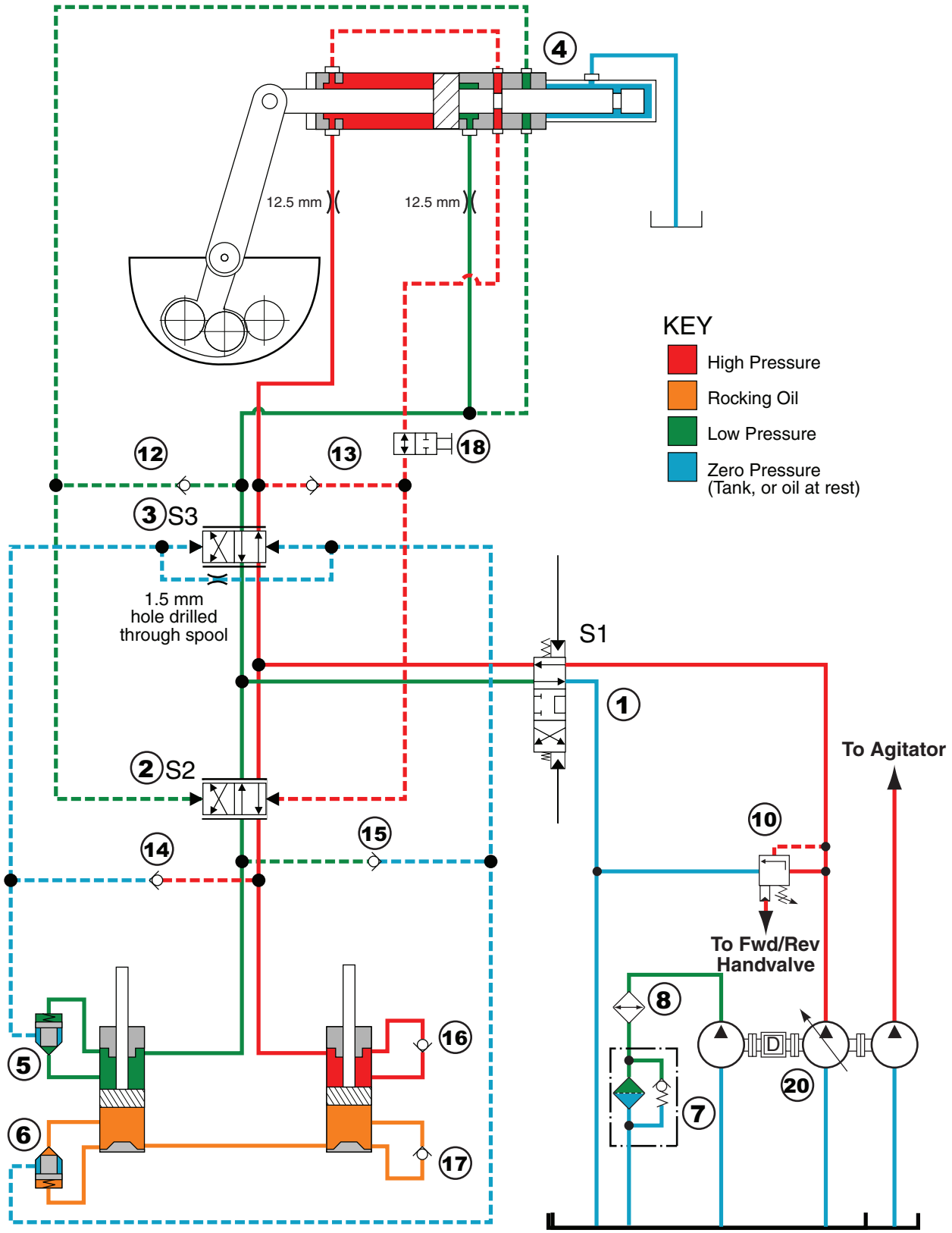
## Phase J

With the S2 valve (2) fully shifted and held in the left position, pressure oil is routed through the S1 valve (1) and the S2 valve (2) to the rod side of the right hand differential cylinder. Please note that check valve (16) must close otherwise the right hand differential cylinder will not retract.


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
14
15
To Agitator
10
To Fwd/Rev
Handvalve
8
5
16
6
17
7
20

## Phase K

Refer to diagram 1 for explanation of first working stroke.


4
12.5 mm
12.5 mm
KEY
High Pressure
Rocking Oil
Low Pressure
Zero Pressure
(Tank, or oil at rest)
12
13
18
3 S3
1.5 mm
hole drilled
through spool
S1
1
2 S2
14
15
To Agitator
10
To Fwd/Rev
Handvalve
8
5
16
6
17
7
20

## Component Locations

**The control panel** (Figure 10) contains:

- 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.
- Diesel glow plug lamp - Lamp will illuminate until the glow plug is warm enough to start the diesel engine.
- 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.
- Engine coolant 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.
- 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.
- 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 RPM gauge - Supplies information about engine speed.
- Electronic throttle control switch (optional)- This switch is only utilized when it has been included as an option on the unit.
- Pump Off switch - Controls the concrete pump on and off function.
- 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*.
- Key switch - Starts and stops the diesel engine, and supplies power to the rest of the electrical system.
- 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.
- 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.
- Oil cooler switch - Allows the operator to activate the oil cooler when the oil begins to heat up too much.
- Agitator On-Off switch - Allows the operator to control the movement of the agitator.
- Vibrator Auto-Off-Manual switch - Allows the operator to utilize the vibrator in any of the three modes available.

a. When in the *Auto* position, the vibrator will run any time the pump is activated.

b. When *Off*, the vibrator will not run at all.

c. When the *Manual* position is selected the vibrator will run continuously.

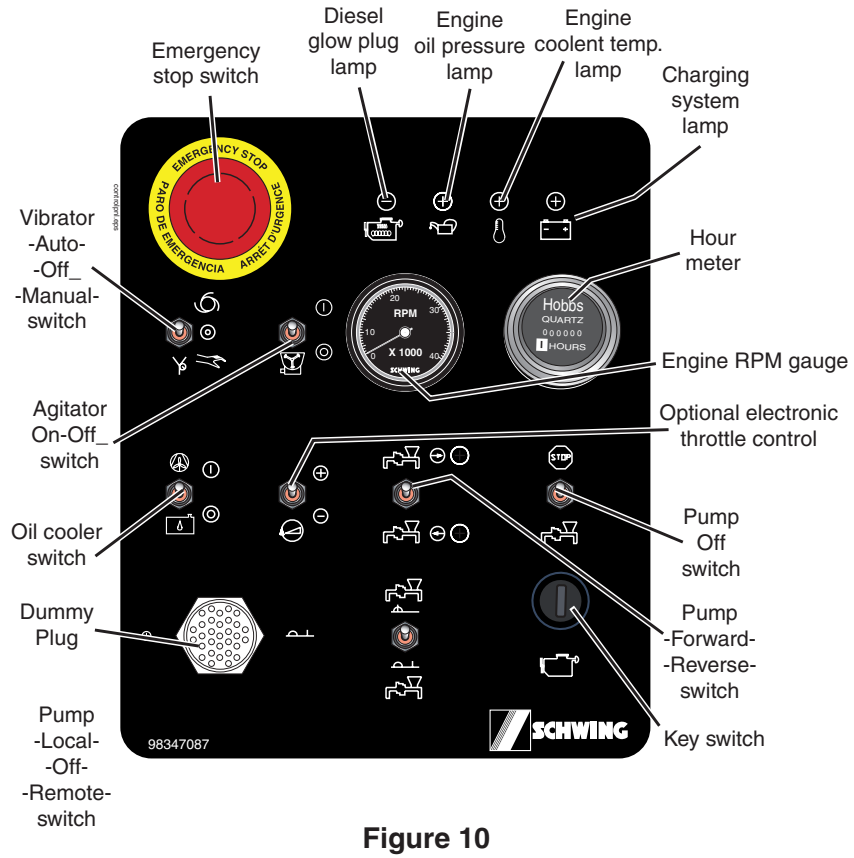
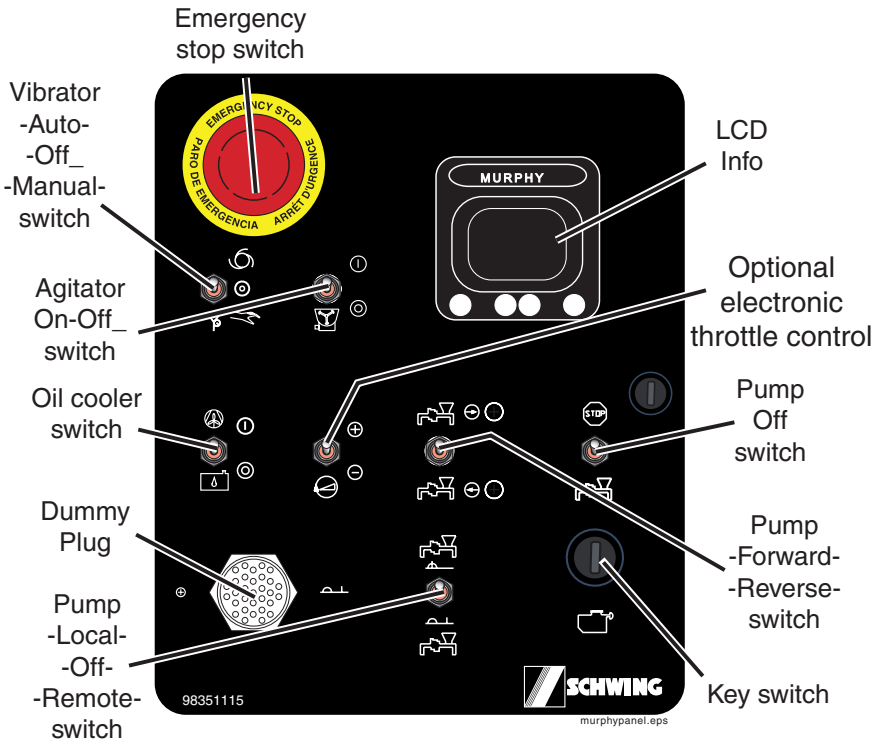



**Figure 10**
**Components of the Main Control panels for SP 305, 500, 750 and (top), and SP 1000, 1250, and 2000 (bottom)**



- Your pump is designed with a soft switch system that reduces main system pressure during the shifting of the Rock Valve. In the event of a failure in the soft switch system, it is possible that your main system pumping pressure could be reduced to the continuous pressure of the soft switch system (100 bar). In an emergency, it is possible to disable the soft switch function by turning the soft switch shutoff valve 90˚ (Figure 11).

**NOTE!**

**The stroke limiter must be turned down to 60% or less before disabling the soft switch function to prevent damaging the hydraulic system.**

This procedure causes an extreme pressure spike of on the system with each stroke. Have the system repaired, and enable the soft switch as soon as possible.

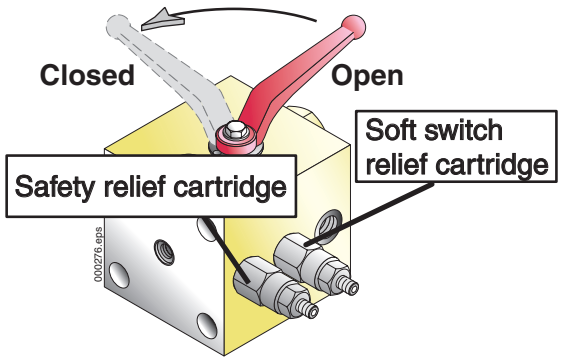



**Figure 11**
**The Soft Switch Valve found on the Brain**

- The tool components (Figure 12). There is a storage compartment on the drivers side; however, all accessories are shipped in a crate.

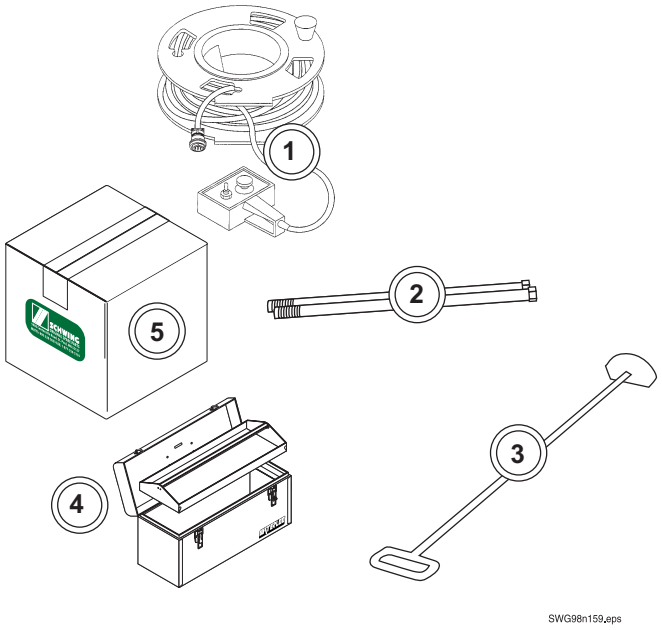



**Figure 12**
**Supplied Accessories**

The supplies accessories include the following:

1. Remote control with 30 meters of cable
2. Rock valve cover alignment bolts
3. Clean-out rake
4. Tool box complete with tools
5. Box containing parts books, operator manuals, and other literature

- Battery Compartment (Figure 13).

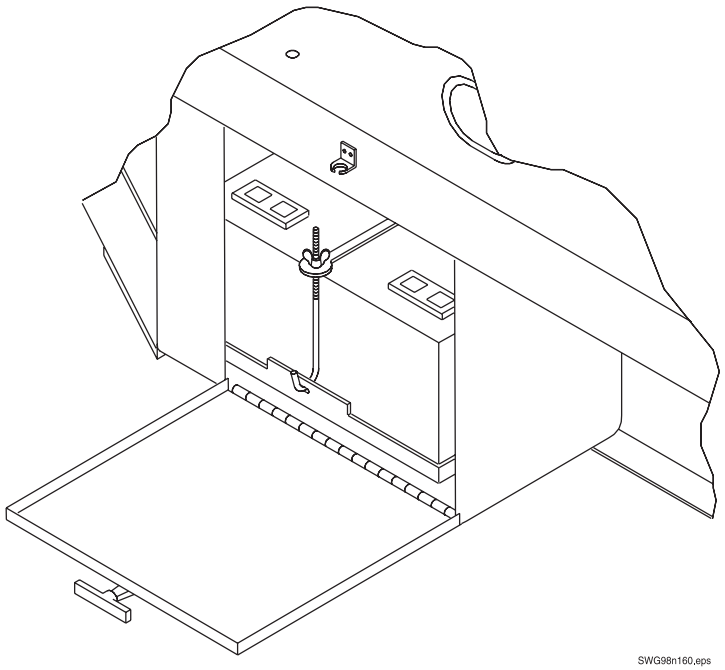



**Figure 13**
**Engine Battery**

- Emergency Stop Switch (Figure 14). Pushing this switch shuts off the engine and dumps all hydraulic oil circuits to the reservoir, thereby preventing machine movement.

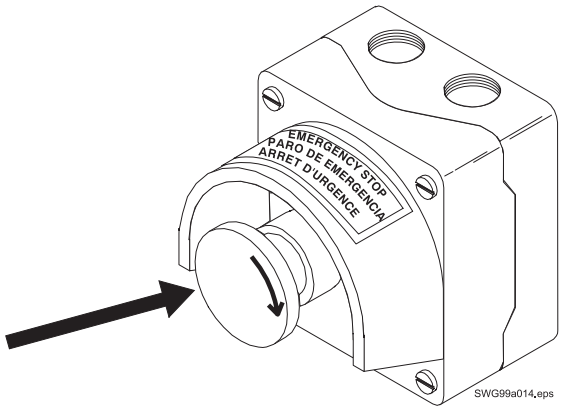



**Figure 14**
**Emergency Stop Switch**

## Hopper Area

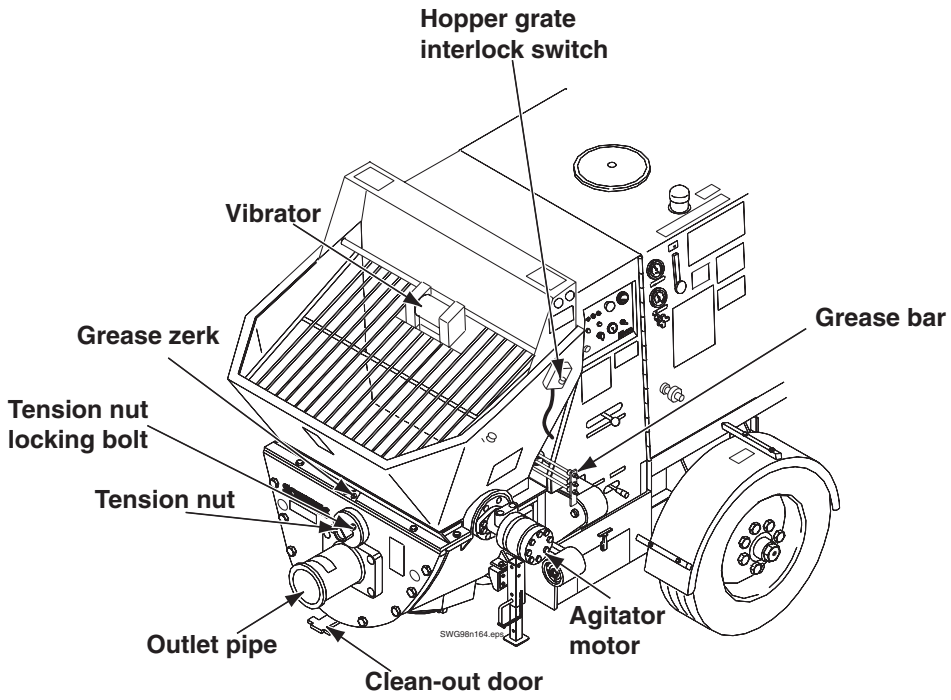



**Figure 15**
**Components of the Hopper Area**

- Agitator motor (Figure 16) is a hydraulically driven motor that is directly coupled to the agitator shaft.

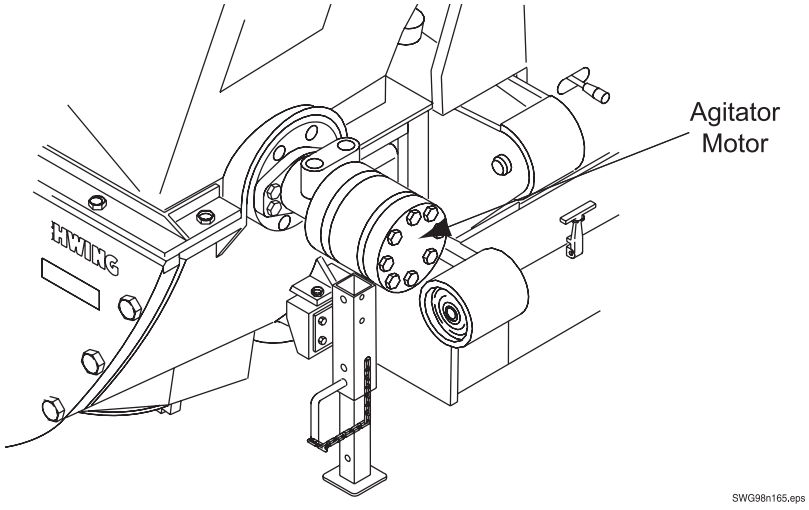



**Figure 16**
**Agitator Motor**

- Rock valve grease manifold (Figure 17). From this manifold, you can grease all points on the rock valve assembly that would normally not be easily accessible to a grease gun. There are other points on the rock valve assembly that must be greased, but they are in accessible locations.

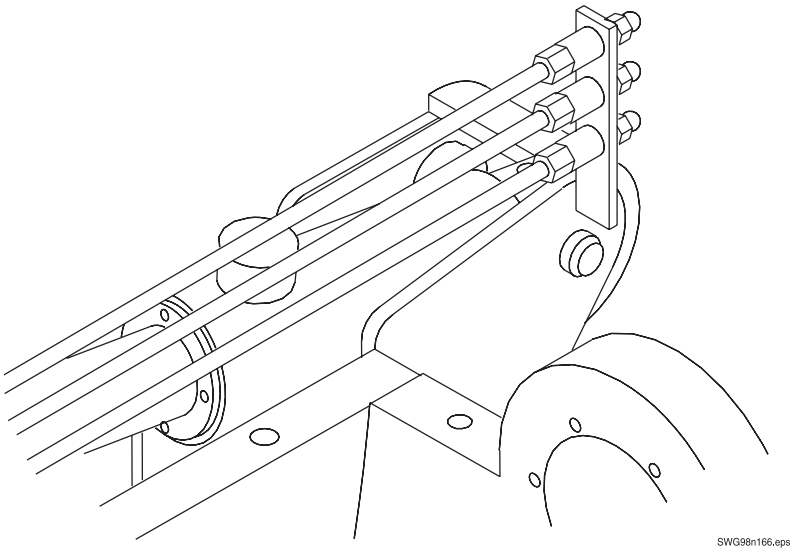
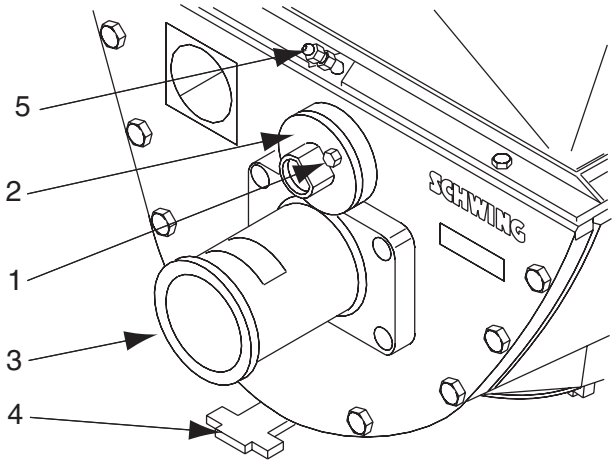



**Figure 17**
**Grease Manifold**

- Rock valve assembly (Figure 18). Maintenance of the rock valve components are covered in detail in Section 6 of this manual. Here we will just note some of the external component names and locations.




1 Tension Nut Locking Bolt
2 Tension Nut
3 Outlet Pipe
4 Clean-out Cover
5 Grease Zerk

**Figure 18**
**Components of the Rock Valve Area**

- Optional electric vibrator (Figure 19). This device is an electric motor that has eccentric weights attached to a shaft at each end. When the motor spins, the weights shake the unit, and whatever is attached to it (the hopper grate or hopper, in our case). The purpose of this device is to assist low slump concrete in falling through the grate, and into the concrete cylinders. If your use of this machine includes pumping of low slump concrete, you will find this option invaluable.

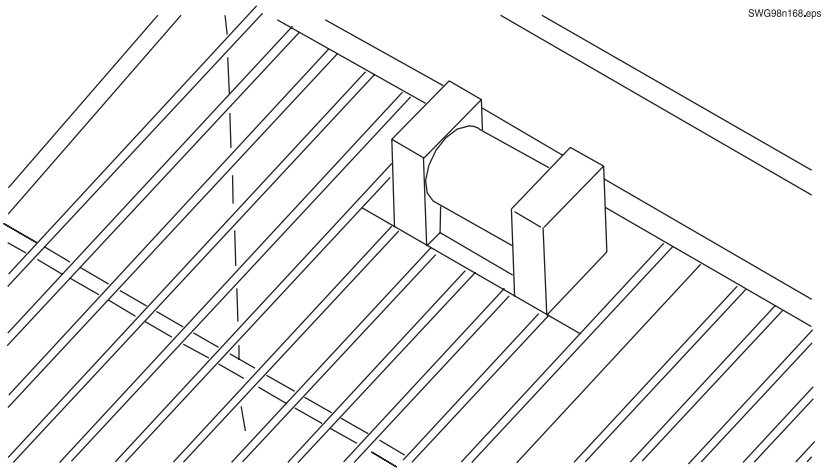
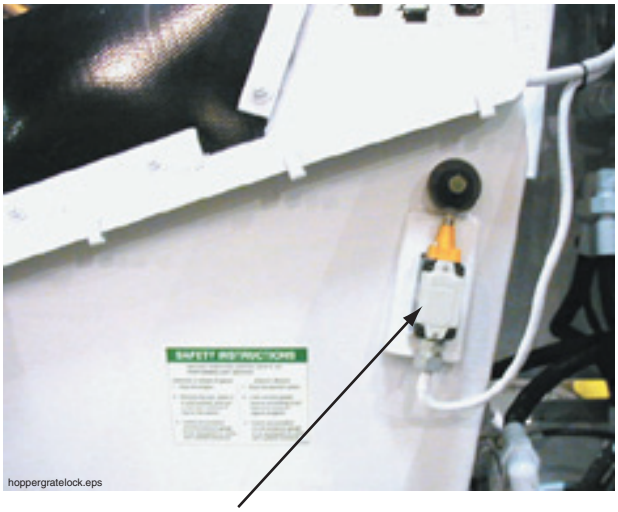



**Figure 19**
**Vibrator mounted on the hopper grate**

- Hopper grate interlock safety switch. Hopper grate must be completely down to close safety switch or pump will not operate.




SP hopper grate interlock switch

**Figure 20**
**Hopper grate interlock switch SP units**

# Safety Devices

The following is a separate grouping of just the safety devices found on the pump. The items listed here MUST be kept in good working condition, or injury may result. Bypassing a safety device for servicing or emergency fold-up or clean-out should only be done by persons that know what systems are disabled by the bypass procedure, and must be set back to the original position upon completion of the service or emergency procedure.

## Emergency Stop Switches

In addition to the emergency stop switch on the main control panel, there is an emergency stop switch on the opposite side of the hopper and at the top side of the waterbox. If you are operating from the remote control box, you will find another emergency stop switch there. All emergency stop switches are wired in series, so they do the exact same thing. The emergency stop switch on the remote control box will not work if it is not plugged in, because the remote control box is electrically removed from the system at this time. The emergency stop switches cut off electricity to the concrete pump forward/reverse/pilot valve. In addition, they stop the electricity path to the normally open bypass valve (dump valve).

## Automatic Shut-off Circuit Agitator

The agitator hydraulic circuit runs through a separate dump valve that routes oil directly from the pump back to tank if the following safety conditions are compromised:

- electricity is lost on the unit
- the hopper grate is raised
- the hopper grate is removed

In spite of this safety device it is important to remember that it is made of machine parts which, according to Murphy's law, will fail at the worst possible moment. Never put your hands, arms, legs or any other body part into the hopper while the hydraulic system is ready to operate.

## Safety Valves (Pressure relief valves)

The pressures listed on hydraulic schematics and in manuals and literature are not nominal figures. They are the pressures that the machine was designed to work with, and that the components were designed to accommodate. There are a very few instances where pressures may be "tweaked" to accomplish certain things, but they must only be done with the advice and step by step instructions of an authorized Schwing representative familiar with the system and safety devices, such as a serviceman. Under no circumstances should you raise pressures arbitrarily, or because you "think it might help". Conversely, lowering pressure settings may cause poor machine performance, heat and its related premature component degradation, and in some extreme cases, could cause dangerous operation.

## Safety Guards

In addition to the aforementioned safety devices, there are guards placed over moving parts. Following is a list of the guards:

- waterbox grate and covers
- hopper grate
- slewing cylinder cover

These were placed for YOUR protection. Don't operate the machine without all safety guards in place. If they become damaged, lost, stolen or inoperable because of any other circumstances, they must be replaced before operation continues.

## Fuses

Fuses are devices that are intended to protect against complete system failure, fire, and dangerous operation. They do so by melting when the current in an electrical circuit becomes higher than it is allowed to get. Here are a couple of examples of causes of over current:

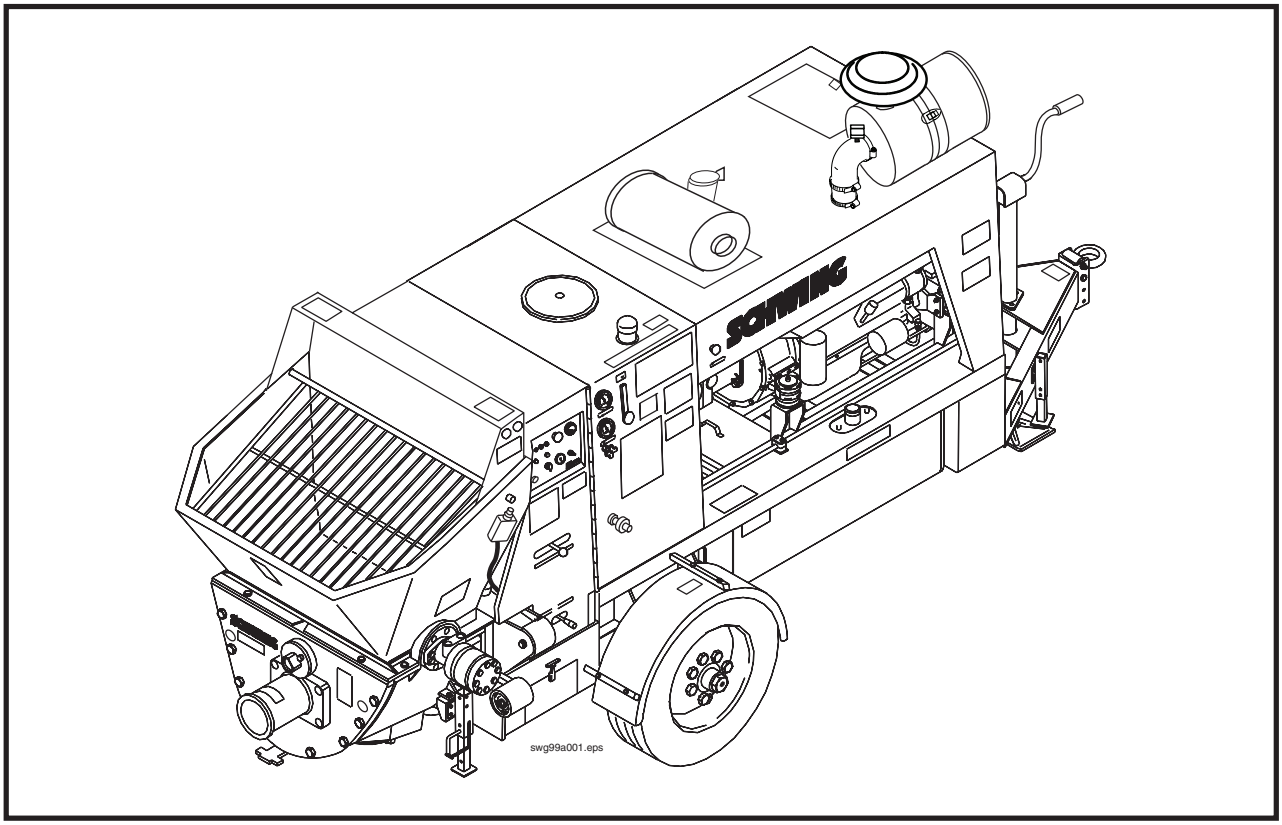
- Short circuits (positive goes to negative without resistance).
- Component malfunction (a coil that has to move a sticky valve).
- Mechanical interference (a shovel handle stuck through the oil cooler fan blade).

In order to maintain this safety device, you simply replace a blown fuse with the correct size and type fuse, and NEVER bypass a fuse. A very good rule of thumb for fuses is this: If it blows once, replace it. If it blows again, there is something very wrong. Find the cause of the problem and repair it before activating the circuit again.

## Warning Labels

Each machine is equipped with a set of warning labels that are installed based on model and installed options. These labels will fade in time from ultraviolet radiation, rain, steam cleaning, etc. It is very important that the machine has a complete and readable set of the warning labels at all times. To address the problem of fading labels, Schwing has made the decision to supply warning labels at cost for as long as the machine is in service. To get replacement labels, identify which label(s) you need from the decal location guide shown in your parts book, get the serial number of the unit off the serial number plate and call our Spare Parts Department at 1 (888) SCHWING. The person taking the order will make a note of the serial number of the unit for our files, and send you the labels that you need. Complete sets or single labels may be ordered. 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

## Preparation

Before you pump the first job with this machine, you must know what you are doing. If you have never pumped concrete before, become familiar with this entire manual, the safety rules for pumping concrete as described in the Schwing Safety Manual (included as Section 3 of this manual), the features of the machine, and the procedures for pumping concrete. It would be a very good idea to set up the machine in a safe location and practice with the pump controls before you ever put concrete in the machine. Once you are on a job site with the machine, you will have the safety of many other people in your hands and it will be inappropriate and unsafe to make mistakes. Only experience in running the unit will give you the confidence and fine control that your coworkers expect and deserve.

If you are an experienced pump operator already, read this manual cover to cover anyway, to be sure you understand the particulars of your new machine. Set up the unit for a trial run before you take it to a job. You will not regret knowing the location of the controls and devices.

This manual will discuss specific setup, cleanout, maintenance, and operation techniques ONLY as they relate to this particular machine. It is not the intention of this manual to teach you how to be an expert concrete pump operator. For that, you will need the information from this manual, plus information from several other sources (listed under the heading of "Additional Reading Material" in the Appendix section of this manual, starting on page 7-40) and extensive on the job experience.

### Arrive to work on time, with a clear head.

A professional pump operator knows that the day will go better if you have time to do the pre-checks outlined in the following paragraphs. If you skip them because you are late for work, you are setting yourself up for at least a bad day, and perhaps an accident. Wandering around the shop in a stupor because of a hangover or lack of sleep is no better than showing up late. Either way, you will not be certain that the machine is in tip top shape and all necessary equipment and accessories are present and in good working order until it's too late to do anything about it.

### Have the right machine for the job.

Concrete pumps are limited in what jobs they can do. Be sure you have the appropriate pump for your particular job. Schwing's Sales and Service Department can assist you with pump application questions.

### Have the equipment that you will need for the job.

Will you need extra pipe sections to make the pour? Use the following checklist for pipeline needs:

- Pipe sections
- Adapter pipes, if all pipe ends are not identical (see the pipe end comparison in the Appendix section of this manual, beginning on page 7-32).
- End hoses
- Reducers
- Clamps for all pipe end styles and sizes
- Clamp Pins

Have all pipe and pipe accessories inspected for condition, loaded, and secured for travel before moving the unit. Keep in mind the pressure rating of your unit when you inspect the condition of pipe accessories - see the chart regarding pipewall thickness versus pressure in the Appendix section of this manual, beginning on page 7-33.

You will also need normal everyday pumping accessories. Use the following list as a minimum for normal pumping requirements:

- Shovel
- Barrel for mixing slurry, if required. It is recommended that the barrel remain with the unit if you ever use it, even if you don't need it for today's job.
- Pipeline lubrication mixes, enough for the day's job. Either commercial lubricating powder or portland cement for mixing slurry. **NOTE!** This is not always required, in some cases slurry will be delivered to you, in other cases the portland cement will be supplied at the job site. In all cases, you must know how your lubrication will be accomplished before you leave the yard.
- Grease gun and grease tubes

- Spray can filled with form oil (not necessary, but very helpful)
- Clean-out balls
- Water hose and nozzle
- Clean-out rake
- Working lamps for night work
- An approved air blow-out cap (see the Safety Manual for blow out cap requirements)
- 5 gallon bucket
- Hand tools
- Hammer

Of all of the above mentioned items, the hammer is the tool that you will need the most often. It can be used for pipeline setup and removal. It can be used to tap pipe to locate blockages (follow the safety instructions found in the Safety Manual portion of this Operation Manual for this procedure). It makes a good persuasion device for rusted nuts and bolts, and for knocking out concrete that has set up in clamps and hoppers. Many pumpers take the head off of the wooden handle and have it installed on a steel pipe. This makes it perfect for pipeline installation, because the handle can be used to pry clamp handles up or down. Experienced pump operators never walk from the pump to the pipeline without a hammer. A four or five pound sledge works best.

Last, **but not least**, you will need the things required by law for operation of a motor vehicle, things related to safety of the motor vehicle, and paperwork needed for the job, such as:

- Valid driver's license
- Fuel permit
- Cab card
- Registration
- Insurance card
- First aid kit
- Flares
- Reflector signs
- Fire extinguisher
- Job ticket
- Map(s)
- Job site phone number and contact person

### Have the right personal protective equipment for the job.

- Concrete is made from lime, which is very alkaline. If it stays on your skin long enough, it will cause severe burns, and in extreme cases the affected skin will simply fall off. Because of this, always wear water resistant work boots and gloves, and if you will be working IN the concrete, wear water PROOF gloves and boots. In either case, the boots should have steel toes. There are boots made especially for concrete work that will protect your feet from lime and accidental impact (Figure 21).
- Falling objects on a job site are not uncommon. Hard hats were made to protect you from this hazard, but they only work if you wear them.
- Safety goggles may very well keep you from getting splashed concrete in your eyes.
- Snug fitting work clothes will help prevent accidents involving moving parts.
- Concrete pumps may generate higher sound pressure levels than O.S.H.A. allows for constant exposure. You can protect yourself by wearing hearing protection when on or near the machine.
- When mixing your grout in the morning, or anytime that there will be airborne cement or other fine powder nearby, wear breathing protection.
- Anytime that there is danger of ricocheted rocks or sand (when shotcreting, for example), wear a full face shield.

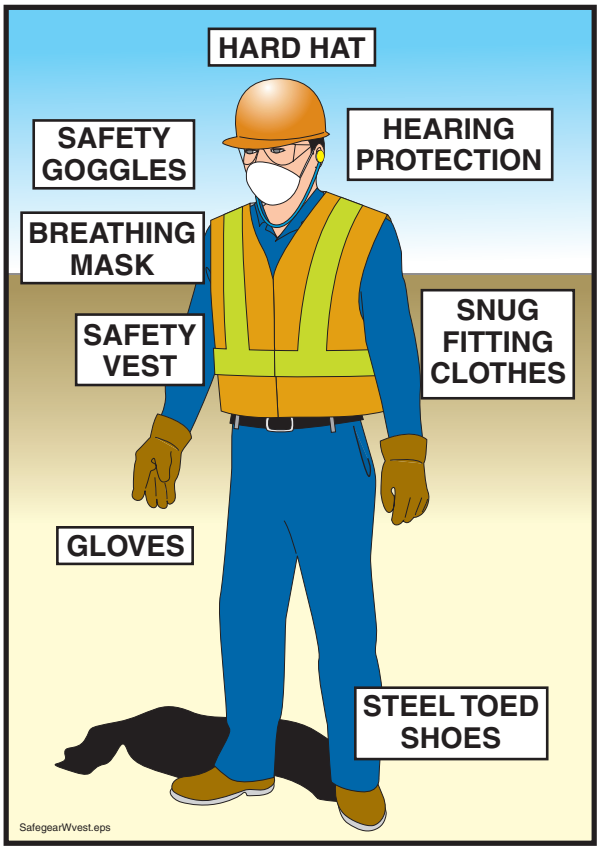



**Figure 21**
**Wear personal protective equipment**

## Check the equipment before leaving the yard.

Check the following items each day before the pump is taken from the yard. It is easier to remedy a problem in the yard then at a work site.

### On The Towing Truck

- Truck engine oil level and condition.
- Antifreeze / coolant level in the radiator.
- Battery fluid level and condition.
- Tire condition and proper air pressure.
- Brake system air pressure and condition (bleed water from air tanks).
- Clean the windows of ice, frost, mud, etc.
- Clean the mirrors of ice, frost and mud, and properly align for clear vision.
- Keep the cab free of debris, especially on the floor. Accidents can happen when foreign objects get stuck between the clutch or brake pedal and the fire wall.

### On The Pump

- Check diesel fuel level in all tanks.
- Verify diesel engine oil level.
- Radiator coolant level should be full.
- Check that battery and battery cable connections are clean and tight.
- Check condition of belts and hoses. Replace as necessary.
- Verify all safety guards are in place.
- Grease Agitator bearings.
- Grease Rock Valve lubrication points.
- Clean any dirt or debris from engine air intake.
- Check condition of tires and air pressure.
- Structural integrity of the unit. Give the unit a visual inspection. Look for cracks, chipped paint, rust (especially rust under the paint), and missing parts. Clean and repaint areas that have chipped paint to avoid damage to structural steel. Replace missing parts before using the unit. Report any structural abnormalities to the Schwing Engineering Department before using the unit. If the engineers determine that repair is necessary for safe operation, DO NOT OPERATE THE UNIT UNTIL REPAIRS ARE COMPLETED. Pipeline must be complete and free of dents, cracks and holes. Pipe must have sufficient wall thickness to handle the maximum pressure of the pump. (Inspect weekly with an ultrasonic thickness tester. See Maintenance section of this manual, beginning on page 6-10.) All safety guards must be in place and secure for travel.
- Hydraulic oil level and condition. The oil should be clear and clean looking. 'Milky' looking oil, or oil with a lot of air bubbles entrained is oil that needs replacement before the next job begins. (**NOTE!** Oil that is holding air bubbles overnight should be replaced, but it is not an oil problem if it is becoming bubbly on the job. In that cases, it will be a problem with the integrity of the hydraulic seals somewhere in the system.) Top up oil levels ONLY with the same type of oil that is in the reservoir. Do not mix name brands, even if they have the same viscosity. Each oil manufacturer uses different additive packages to accomplish anti-foaming, silt settling, anti-wear, etc. The mixing of these different chemical additive packages may render them useless.
- Drain water from the hydraulic reservoir each morning. This is done by removing the pipe plug and opening the drain valve located under the hydraulic reservoir, and allowing the fluid to run into a pan until it changes from water to oil. (Water is heavier than oil, so it sits on the bottom of the tank, and therefore drains out first.)
- Visually check the unit for hydraulic leaks, and repair any leaks before operating the machine. Lost hydraulic oil harms the environment, and it is expensive to clean up and replace the lost oil.
- Be sure that everything on the unit is ready for road travel. This includes securing all accessories and miscellaneous equipment.

# Towing the unit

Many accidents involving concrete pumps are traffic accidents. To avoid accidents, you must remember this one point...**you are not driving a car**. You know those yellow caution signs posted on the roads? The ones that say 50 M.P.H. under the symbol for a curve in the road? Those signs are meant for you, when you are towing a pump. Most people ignore those signs when they are in their car, because the car they drive feels safe going around that curve at 60 M.P.H. When towing a trailer-mounted concrete pump, this is NOT the case. All caution signs will apply to you when you are towing a pump. Slippery when wet, bridge out ahead, and all the rest. Trailer-mounted concrete pumps are heavy, which results in longer stopping distances. They are top heavy, which can lead to rollovers at speeds that would be no problem for a car. You can't see directly behind you, so backing up becomes dangerous, etc. You know the rules of the road for trucks, or you wouldn't have passed the commercial driver's license exam. This section of the manual deals with the specifics that they can't include in the driver's manual...the way a trailer-mounted concrete pump acts under various driving conditions.

## Licensing.

If you don't have a valid commercial driver's license, DO NOT TOW THIS UNIT.

## Backing up.

You will be able to see the road behind you on the left and right sides, but YOU WILL NOT BE ABLE TO SEE DIRECTLY BEHIND YOU. If you must back up, and there is any chance at all that there may be traffic or pedestrians behind you, you must use a guide. A guide is a person that watches for traffic, pedestrians, and other obstructions, and stands in such a position that you can see him (her) giving you instructions. Installing a back up warning device such as a horn or bell will give you some measure of safety, but you can't rely on it. For example, a child walking behind your unit when you begin to back up may become frightened by the back up warning sound and freeze where they stand.

If you are in an isolated area where there will not be traffic or pedestrians, you can get out of the cab and look for obstructions before beginning to back up.

## Changing lanes.

When towing a pump, you will have blind spots to your right and left sides. Unfortunately, many drivers are unaware of these spots, and will travel in them for extended time periods. These spots are avoidable with the use of convex mirrors, which attach on or below the rear view mirrors. Before changing lanes, check these convex mirrors for other drivers who may be 'hiding' there. Signaling well in advance will warn other drivers of your intentions.

## Loading the unit for shipment.

If the unit will be transported (such as by railroad or ship), care must be taken to see that people and property are protected during the loading process. In these cases, remember the following points:

### For Ramp Loading

- Use only ramps that provide adequate and stable support for loading purposes. Ensure that no one would be hurt if the unit were to tip or slip off of the ramps.
- Be sure that the ramps will not cause the unit to pivot beyond the ability of the hitch.
- If you are using guides to provide instructions, they must not remain in the driving zone.
- Secure the machine on the transport vehicle against rolling, slipping or tipping over.

### For Crane Or Forklift Loading/unloading

- If lifting the unit with a forklift, be sure that the forks do not damage any components that sit below the bottom of the subframe.

**NOTE!**

**Do not attempt to lift the unit with a forklift unless the unit is equipped with fork channels.**

- Concrete pumps may only be moved by crane if they have been equipped with slinging rings that were designed for that purpose. Slinging rings that were designed for this purpose can be ordered from Schwing for installation on new units, or for field retrofits.
- Never hook lifting devices to standard pump parts, like the concrete valve, hopper, or anything else. These parts were definitely NOT designed to support the entire unit load.

- Check the load bearing capacity of any slings, cables or other lifting devices that will be used to lift the machine. Never exceed the rated working capacity of the lifting device.
- No one is allowed to walk, stand, or work under suspended loads. Keep the area free of personnel.

# Unit Set-Up

### Selecting the proper set up location on the job site.

Sometimes, the person in charge of the pour will have a spot ready for you. If he is experienced, he will pick an appropriate spot that will allow a safe and efficient pour. Other times, the person in charge will only tell you what is to be poured, and it will be up to you to select the set-up location. In still other cases, the person in charge will have picked a totally inappropriate spot for you. In these cases, your ability to be an effective diplomat may dictate how the day is going to go for you. If it is not already so, you will have to make the location safe and efficient on your own. In all cases, the set-up point MUST allow at least one ready-mix truck to get safely to and from your hopper and if you are pumping in an area where exhaust fumes may linger or be confined, proper ventilation must be assured.

In addition to the above mentioned **requirements**, it is desirable that the set-up point also have these features:

- Able to handle the safe arrival and departure of 2 or more ready-mix trucks. This means obeying the 1 to 1 rule by staying at least one foot back from excavations or cliffs for every one foot of distance to the base edge.
- Out of the way of major traffic flow patterns for the job site. If no one can move on the site because of your setup position, you will have to move anyway...you might as well plan for it at the start.
- If your unit has hydraulic stabilizers, jack them down only until they feel the weight of the unit. Always leave the tires in contact with the ground.
- The area to be utilized must be as level as possible.
- If the workplace has inadequate lighting, don't begin the pour until proper lighting is provided

### Laying out the pipeline

We will not cover the do's and don'ts of pipeline layout in this manual. If you don't know how to correctly lay out a pipeline, read and understand the chapters on concrete pipeline in one of the books about pumping concrete. Several of these books are listed under the heading "Additional Reading Material", found on page 7-42 in the Appendix section of this manual. We will, however, cover of few specific points that are common to pumping jobs in North America.

Start at the point of discharge and work your way back to the pump. In the majority of cases, you will need rubber hose at the point of discharge, and usually the placing crew will prefer 3" or 4" rubber hose to 5". This means that you will need a reducer at the discharge end.

If you will have to reduce to smaller diameter pipe or hose for the placing crew, always make the long part of the run with the larger diameter, and reduce as close as possible to the point of discharge. There is one instance where it may be desirable to run the entire distance with the smaller size, and that is if you will be pumping very, very slowly on a hot day. In that case, the concrete may start to set before it reaches the point of discharge, and it will resist the change of size that is required inside of a reducer. If you suspect that you may have a job like this booked, call the Schwing Service Department for advice before you set up the job.

Use as few hoses as possible. Hoses have more resistance to flow than pipe does, therefore it will take higher pressure to push through hoses than pipe.

Use the largest diameter hose that the crew will let you use. The diameter of the hose directly affects the largest size stone that you will be able to pump. If you will be pumping stone larger than 1", you will not be able to use 3" or smaller hose. To attempt to do so will result in blockages.

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

### Setting the Stabilizers

- Position the dunnage pads (use scrap plywood, 2x4's, etc.) on the ground where the stabilizer will be positioned after extension.
- Drop each stabilizer to its pad and insert the locking pin. Jack the front of the unit using the tongue jack until the weight of the unit is on both stabilizers.

**NOTE!**

**When unit is stabilized and level the wheels should remain in contact with the ground to lessen any possible movement of the machine while pumping**

- If the unit has hydraulic stabilizers, you must be sure the faucet valves (Figure 22) are open to supply hydraulic fluid to the system and activate the stabilizer hand valves to the extend position until the unit is supported properly. Generally, that means each stabilizer must begin to feel the weight of the unit. Then close the valves.

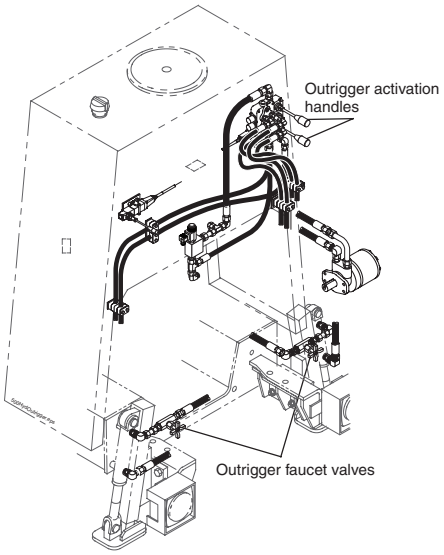



**Figure 22**
**Optional hydraulic outrigger controls shown here on the SP 500**

## Operating the Pump

- Connect the remote control cable or dummy plug into the control panel.

**NOTE!**

**The pump will not function without one of these plugged in.**

- 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, 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.
- For cold weather starts use the following procedure:

a. Move the throttle lever to the low idle position before you start the engine.

**NOTE!**

**If necessary, increase the throttle slightly so the engine will start in cold conditions. The engine should not exceed 1500 RPM until the oil pressure has increased.**

b. Turn the engine start switch two clicks, which should illuminate the glow plug lamp, and hold in that position for at least 6 seconds. This will activate the glow plug and aid in the starting of the engine.

**NOTE!**

**Do not operate the glow plugs for more than 30 seconds at a time. Damage to the glow plugs could occur.**

c. After 6 to 10 seconds, turn the engine start switch to the START position and crank the engine.

d. Release key when engine starts.

e. Slowly return the throttle to idle

**NOTE!**

**If the glow plug indicator light flashes rapidly for two to three seconds, or if the light fails to illuminate, a malfunction exists in the cold start system. Do not use ether or other starting fluids to start the engine.**

f. If the engine does not start, release the key and allow the electric starter motor to cool, then repeat steps b through e.

g. Turn the engine start switch to the off position in order to stop the engine.

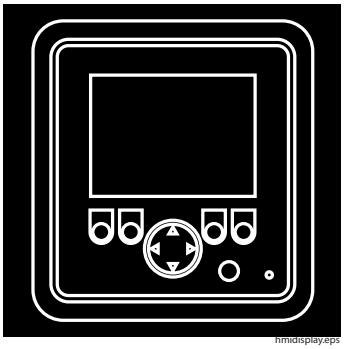
**NOTE!**

**Most of our pumps have Turbo-Charged Diesel engines. To avoid damage to the turbo when starting, do not run the engine to high speed immediately from a cold start. Bearing damage will result due to insufficient lube oil supply. Let the engine warm up for at least 30 seconds before going to full speed. Failure can also occur when shutting down the engine under full load. The oil in the supply tube can burn and plug the line. Let the engine idle for 2 minutes before shutdown.**

- Set throttle to 1800 RPM's. (2500 RPM Maximum)

CAUTION On the SP1000, 1250 and 2000 units, if **OIL PRESSURE, ALTERNATOR CURRENT, or COOLANT LEVEL** is not what it should be when the engine is started, you will be notified by a fault warning in the LCD window (Figure 23). To correct a fault shown in the window, See the *HMI User's Guide* included with other documentation.
***Do not operate until situation is corrected.***

**Figure 23**
**HMI display**




## Basic Troubleshooting

**Engine won't start:**

- Radio remote transmitter is not linked with the receiver. Activate the remote by following the sequence shown under *Operating the Pump* above.
- No fuel.
- Emergency stop switch in OFF position.
- Dead battery.

**Engine running but pump won't operate:**

- Turn stroke limiter knob out fully.
- Verify hopper grate is completely down and safety switch is activated.
- Check fuse for pump circuit.

**Engine quit running:**

- Check diesel fuel level.
- Check fuse for fuel shut-off / E-stop switch circuit (See schematic).

**Agitator won't operate:**

- Check fuse for agitator bypass circuit (See schematic).

**Hourmeter not operating:**

- Check hourmeter fuse inside (See schematic).

**Dead Battery**

- Possible problem with the alternator indicator light connection on the control panel.

- When the key switch is turned clockwise one click, the indicator light for the alternator (found on control panel) will illuminate and will not go out until the engine starts.

- If the light does not come on when the key is turned one click clockwise, the engine may not charge the battery. The first step should to be to check the LED. If it is bad, be sure to replace it. The second step would be to check the connection and receptacle internally and externally. Look for green evidence of corrosion.
- Remember that the only time the LED is illuminated is when engine is off with the key switch on. If the light does not go out after the engine starts the alternator has a fault.
- If corrosion exists, the receptacle should be replaced. When the circuit is not able to be completed properly as a result of corrosion the alternator is not receiving a signal and the engine may not charge the battery when started.
- If an oversized light bulb is used during replacement, the alternator may overcharge the battery causing premature battery failure.

## Before the first truck backs up to your hopper

If you have completed setup before the first ready mix truck is due to arrive on the job (a highly recommended practice), this is a good time to get some things ready for the day.

- Find out who will be giving you signals throughout the day. There must be only one person that gives you signals, so as to avoid conflicts in instructions. Talk to the person about the signals that you will use, and come to an agreement before you start pumping. The American Concrete Pumping Association has standardized hand signals for concrete pumping that are shown on decals on the unit. This decal is also shown in the Appendix section of the Safety Manual, which is included as one chapter of this Operation Manual. In many cases, the job site management will give you a walkie-talkie that is on their own frequency so that you may speak directly to your signal man. Be aware that in some cases, this walkie-talkie may cause interference with the Schwing radio remote control system. Check it out before the pour begins.
- Talk to the foreman of the placing crew. Be sure that the crew is aware of the safety rules for the placing crew as described in the Safety Manual. If they are not familiar with the rules, show them the rules that apply to them from the quick index that was supplied with your unit. Make sure they understand about not kinking the tip hose.
- Go over the safety rules with any oilers or laborers that have been assigned to work with you at the pump. Show them the emergency stop switches. If they will be backing ready-mix trucks to your hopper, explain about the danger of putting themselves between the pump and the ready-mix truck.
- Position your remote box and cable in a place that you won't trip over the cable, but you will be able to move around at will once the pour begins. It is critical to be able to see the point of discharge once the pour begins. If this is not possible, arrange for a spotter NOW.
- Get your breathing mask ready for mixing the slurry. Have all of your personal protective devices on or nearby.
- Fill your waterbox with water, if it is not already full (Figure 24).

**NOTE!**

**THE PUMP MUST BE SHUT OFF ANYTIME YOU REMOVE THE WATERBOX COVER OR GRATE. Secure the controls so that no one can turn it on without your knowledge.**

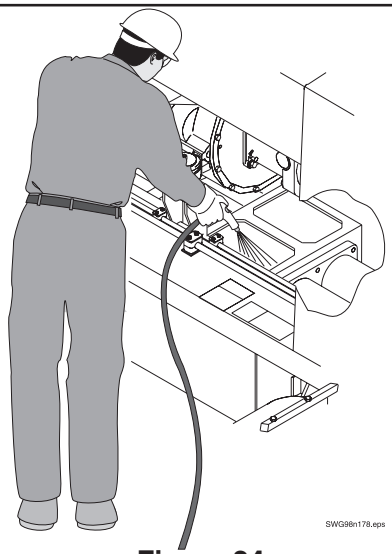



**Figure 24**
**Be sure the waterbox is full of water**

- Put a couple of shovelfuls of sand or dirt in the bottom of the rock valve housing, above the clean-out door. This will prevent concrete from filling the door area and setting during the course of the day. (Figure 25).
- Be sure the clean-out door is closed tightly and locked by tapping on the end of the "T" handle with your hammer (Figure 26).

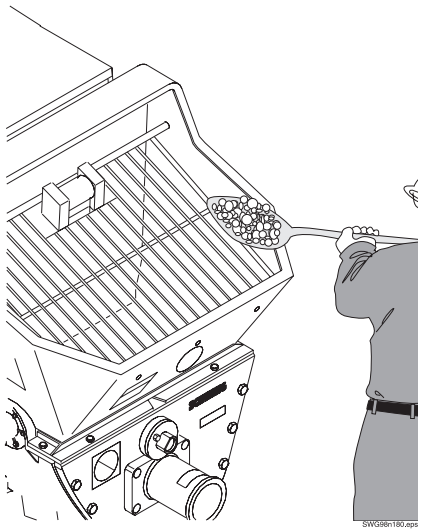


**Figure 25**
**Put a couple of shovelfuls of sand in the bottom of the hopper, over the clean-out door.**

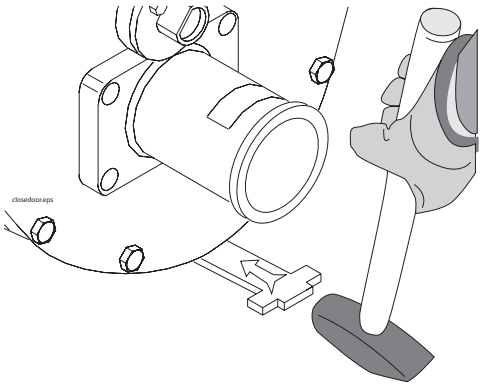


**Figure 26**
**Tapping on "T" handle to lock the clean out door**

- If you will be using portland cement and water to make your lubricating slurry, prepare for it now (Figure 27). Position your barrel, shovel, and sack of portland cement on the ground behind your hopper. Fill your barrel with about 25 or 30 gallons of water. (Of course, this step can be skipped if slurry is to be delivered to you from the ready mix company, or if you are using powdered slurry mix.)
- Get your clean-out rake in a position that you will not trip on it, but you will be able to grab it when you begin clean-out. Many times, cleaning the pump is done when you are in a hurry, because concrete is setting, that is no time to have to look for the rake or, worse yet, to use your hands to pull loose material out of the pump because you don't have time to look for it.

**NOTE!**

**NEVER use your hands for a clean-out rake.**

**⚠ WARNING**

**Amputation hazard. Stop pump before cleaning the Rock Valve and hopper.**

000015.eps

**Figure 27**
**Spray 25 to 30 gallons of water into the barrel**

Grease your agitator bearings (Figure 28). There is one zerk on each side of the hopper. Re-grease every two or three hours, as the pour allows.

**NOTE!**

**You don't grease agitator bearings like you grease most other bearings. That is, if you normally pump in grease until you see it squirting out somewhere, you will ruin your agitator seals. When you grease the agitator bearings, watch the rubber grease cones that are located inside the hopper. You want the cones to bulge out slightly because they are full of grease, but you don't want to have the grease come out around the shaft, because where the grease comes out concrete will be able to go in. Once concrete makes it inside of the grease cone, you will quickly wear out the bearings. When re-greasing after the hopper is full of concrete and you can no longer see the cones, just give the zerks a couple of squirts. This is one of the few times when it is better to under grease than to over grease.**

Grease the rock valve lubrication points before the pour begins (Figure 28). Once started, grease them every couple of hours. There are 4 zerks to grease for the rock valve, plus the two for the agitator.

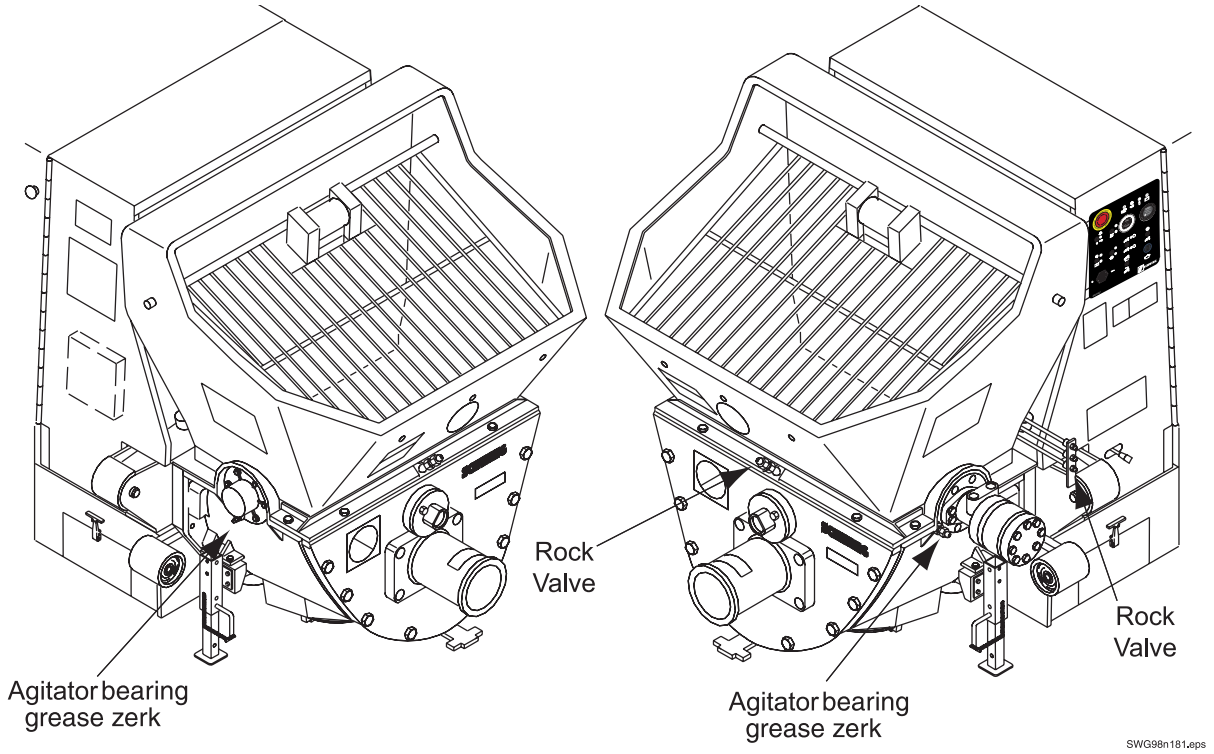



**Figure 28**
**Showing the location of the grease points**

You can keep your hopper and splash guard looking better, and help yourself at clean-out time by spraying them with form oil before the pour begins. This oil is specifically formulated to prevent concrete from sticking to forms, and it works just as well at preventing concrete from sticking to your unit. It doesn't hurt to spray it on the other areas that are likely to get splashed by concrete, either.

## Lubricate your pipeline.

Once the ready mix truck(s) arrive on the job, you can lubricate your pipeline. Schwing highly recommends that you pre-lubricate the separately laid pipeline each time you must pump into dry pipe. In some parts of the United States and Canada, the concrete is so rich with cement fines that operators do not pre-lubricate to begin pumping operations. This practice is NOT recommended. The amount of time saved by not pre-lubricating cannot begin to make up for the hassle of having to remove pipe sections from a separately laid pipeline. Most importantly, the blockages caused by failure to lubricate can be dangerous (see the section on blockages in the Safety Manual section of this Operation Manual).

There are commercially available products that will lubricate a pipeline with much less volume (meaning much less weight) than portland cement and water. These products usually come in sandwich sized plastic bags, and lubricate about 100 feet of 5" pipe per bag. Instructions for mixing vary by the different manufacturers. These products are less expensive than portland cement, and do not set like cement. If you use these products, pay close attention to the instructions and warnings on the package.

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

If you have help in the form of a laborer assigned to work at the pump, or an oiler or other handy guy, you can mix the best slurry in a barrel. By mixing it on the ground in a barrel, you can get good consistency and break up clumps of cement that tend to form, not unlike lumps in mashed potatoes. However, this method has the disadvantage of having to lift the barrel and pour the slurry into the hopper, which is why you will need help. To use this method, lay a sack of portland on top of the barrel which has been filled with about 25 gallons of water. Take a shovel and break open the sack with the blade, allowing the cement to fall into the barrel. When the bag is empty, set it off to the side and mix the cement and water with the shovel blade. Break up any cement clumps that are encountered and continue mixing until the mixture is smooth and creamy. Get your helper and pour the mixture into the hopper. It will not cover the openings to the material cylinders, but for now, don't worry about it. Make one barrel of mix for each 100 feet of laid pipeline that the concrete will see, but if you will be going through more than 200 feet of pipe, you, your boss, or the concrete superintendent on the job site should have arranged to have a grout mixture brought to you by the ready mix plant. Unless you have at least a half a yard of slurry delivered to the pump, do not try to pump this mix yet. Using the barrel method, you can add a little sand, if needed, to stretch the amount of slurry mixed. This would be helpful if you have to pump through 300 feet of line, but only have 2 sacks of cement available.

If you are alone at the pump, you will not be able to lift the barrel to pour the slurry into the hopper (it will weigh 250 to 300 pounds...not many people would be able to lift it alone). In this case, lay the sack of cement on the hopper grate, and break it open.

**NOTE!**

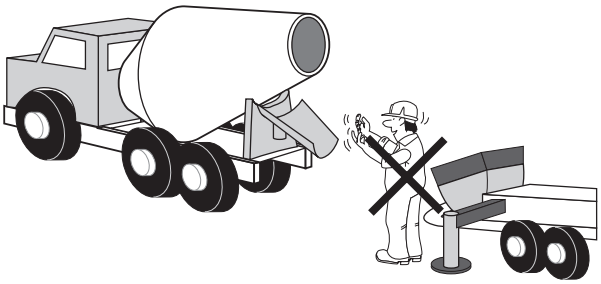
**Do not stand on the hopper grate for this, or any other, procedure. The "NO POINT RULE" applies to the hopper grate.**

Get a water hose and direct the spray into the hopper, aiming at the edge of the pile of cement. This will wash the cement into the bottom of the valve housing, mixing as you go. Try to break up clumps of cement with the spray, but do not put your hands or any other body part into the hopper. Mix more slurry as needed for the length of the pipeline, as described above. When the cement has all been washed to the bottom, you can cycle the rock valve back and forth a few times to agitate the mix a little more. Do not try to pump this mix until you can back it up with concrete immediately.

**NOTE!**

**When initially starting the pump, or when restarting for any reason, personnel should stay a reasonable and prudent distance beyond the reach of the discharge hose until the concrete runs steadily and the line is free of compressed air. Air will be in the line when first starting, restarting, or after the line has been taken apart or opened for any reason. Compressed air can cause the hose to whip violently. For more detailed information see the *Safety Manual*.**


**Figure 29**
**Mixing the slurry in a barrel**




NEVER STAND BETWEEN THE PUMP AND THE READY MIX TRUCK!

After the correct amount of slurry has been placed in the hopper, back up the first ready mix truck to your hopper.

**NOTE!**

**DO NOT stand between the ready mix truck and the pump. If the driver's foot would slip off of the clutch while he was backing, you could be crushed between the two machines.**

Look at the concrete before putting it into your hopper. If the mixing fins of the truck are badly worn, the mix will not be homogenous (that is, the rock, sand, cement and water will not be properly mixed). Do not allow a chute full of grey colored rocks to be put into your hopper...it is almost a certainty that you will plug the line before you get concrete out of the pipe. If this is the case, have the driver dump the first chute off to the side, and then display the next chuteful. In most cases, the mix will look a lot better after the first chuteful is dumped. If not, dump the next chute to the side also. You will learn by experience what mixes can and can't be pumped and how the two look. Once the mix looks good, turn on the pump in the 'forward' mode, and have the driver fill the hopper.

Pump slowly and watch the concrete pump circuit pressure gauge until the slurry starts to escape from the pipe and/or hose. If the pressure approaches the relief valve setting of 300 bar, immediately switch the pump to 'reverse' mode, and notify the ready mix driver to stop dumping. Give the unit one or 2 strokes in reverse, then go back to 'forward'. If the concrete continues to slide without high pressure, then you're OK. If pressure again rises towards the relief setting, repeat the reverse cycle. In many cases you can prevent a blockage by "rocking" it back and forth. In fewer cases, the plug will not cooperate and you will need to find the source of the blockage and remove it manually.

**NOTE!**

**You must not open a blocked pipeline without first sucking the concrete back into the hopper! the act of putting the pump into reverse for several strokes will release the pressure on the blockage. Cover the hopper before reversing pump and understand the safety rules for opening a blocked pipe as shown in the *Safety Manual* section of this *Operation Manual*.**

With an accumulator, speed control is available as soon as the engine is started. You do not have to wait for a steady hydraulic pressure in the concrete pump circuit before you can use the stroke limiter to change the strokes per minute of the pump.

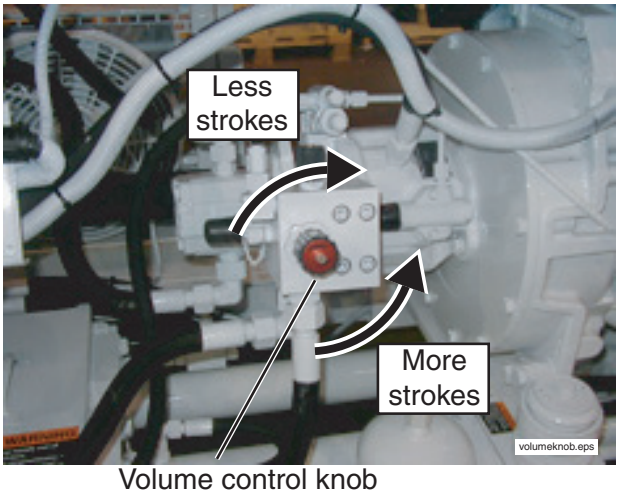
Once concrete has emerged from the point of discharge, stop pumping. If you are pumping into a pipeline, wait for the start signal before you begin to pour.

## To control the speed of the unit

There are two ways to control the speed on this unit: by the stroke limiter by the engine throttle.

The stroke limiter is a hydraulic device that can be adjusted at the operator's panel. Its function is to raise and lower the output of the hydraulic pumps that operate only the concrete pump. This has the advantage of allowing the engine to remain at higher RPM, where horsepower is at the maximum. With an accumulator, there is pressure in the system as soon as the engine is started, and therefore you can use the stroke limiter immediately to control the speed. Basically, it will work whenever there is 50 bar or more showing on the concrete pump circuit pressure gauge. It has an adjustment range of 100%. That is, it can go from zero strokes per minute to maximum strokes per minute. Beware...because it can go to zero strokes per minute,

it is possible to stop pumping altogether by adjusting this valve. That means that when the differential cylinders are stopped at the end of the stroke and the rock valve is moving, the pumps return to maximum output until the rock valve cylinder has completed its travel. This interruption of the stroke limiter signal is known as 'fast switch'. It is recommended that all output control be done by the stroke limiter and not the engine throttle (Figure 30).




Volume control knob
(stroke limiter)

**Figure 30**
**Showing adjustment of the manual stroke limiter**

To control the speed of the unit by the engine throttle, simply speed up or slow down the engine. This has the effect of turning the hydraulic pumps slower, which results in less hydraulic fluid output. This method of speed control is primarily used when you want to limit ALL of the hydraulic circuits...agitator, concrete pump, etc. It has the disadvantage of lowering the horsepower output of the engine. It is possible to kill the engine with the hydraulics of the unit, if you lower the RPM too much.

Try to match your pumping speed to the needs of the placement crew and with the supply of concrete. It doesn't do any good to bury the crew with concrete, then wait for half an hour for the next truckload of concrete to arrive.

## Pump the job

If you are not able to see the point of discharge from where you must operate the unit, be sure your spotter is in position before starting the pump.

Once you get the start signal, put the pump in forward, and alert the ready mix driver to start dumping.

Concrete must always cover the openings of the material cylinders or you will suck air into the material cylinders. If this happens, there will be a sudden expulsion of concrete on the next stroke as the now compressed air escapes. This could be dangerous, so be sure that the ready mix driver understands the situation. If you have taken air in to the material cylinders, you can cushion the expulsion by stopping the concrete pump and filling the hopper with concrete before the next stroke. The mass of the concrete will prevent the compressed air from pushing anything out of the hopper. Once the hopper is full, it is safe to resume pumping. Even with the hopper full of concrete, some compressed air will be introduced into the delivery pipeline. When it reaches the discharge point, the air will cause a sudden expulsion of concrete. If the hose person is walking a wall or column, or is otherwise in a precarious position when this expulsion happens, it could cause an accident. Best is to avoid ever sucking air into the material cylinders, but if it does happen, **YOU MUST WARN THE HOSE PERSON.**

**NOTE!**

**Keep an eye on the oil temperature during the pour. If it gets over 80° C (176°F) you must be sure the oil cooler fan is running. If that isn't enough to keep the oil below 80°, refill the waterbox with fresh water and run water over the oil tank to help with cooling. If that doesn't work, shut the pump down and find the source of the overheating.**

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

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

As the day progresses and the crew removes pipe sections from the end of the slickline, wash the pipes, clamps and gaskets with water (Figure 31). If you don't wash them until the pour is finished, you will not be able to get the hardened concrete out of them. This job can be done between loads of concrete, or by an oiler or laborer at almost any time.

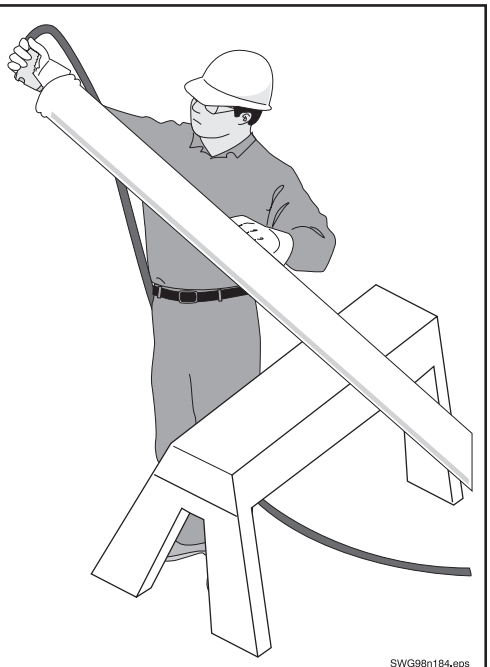



**Figure 31**
**Wash slickline as it is removed from the pour**

## Time Constraints

Remember, if anything goes wrong on the unit while it is pumping, you only have 15 to 30 minutes to solve it before the concrete sets (less with old concrete on a hot day, more with fresh concrete on a cool, cloudy day). If you know that it will take longer than that to fix, clean out before you begin repairs. If concrete is beginning to set, you will have to clean out in a very quick and efficient manner. There are special instructions for quick clean-out, which you will find in this section (Section 5), starting on page 96. If you keep your head and keep moving, you can usually avoid the dreaded "pipe party", even with unfavorable pumping circumstances. Old concrete and hot days make up the worst case scenario. Under certain hot weather and old concrete circumstances, the concrete may go from being pumpable to setting very, very quickly. This is called "flashing", and if it happens to you, you may lose some pipe. See also the section on delays described in Item  on page 86.

If you are pumping in very cold conditions (below +10° F.) the concrete could freeze. In this case, the machine will act like the concrete has set, but all is not lost. As long as the concrete is frozen, it cannot continue to set. If this happens to you, you are done pumping for the day. You will not be able to clean out at the job, unless they have a heated area where you could move the pump for clean-out. If not, inform site management and your company, load the pipe and hose, gather up your things and find a heated area for clean-out. Further information can be found in the chapter entitled, "Cold weather pumping" beginning on page 96.

## To disable the entire unit in an emergency

If an emergency arises that requires that the hydraulic system be disabled completely, for example if a hose or fitting broke, you must stop the engine. If you are faced with this, do not hesitate or investigate first. Shut off the engine, then investigate. It is recommended that a long length hose of each of the possible 4 diameters be kept with the unit for such emergencies. See page 4 of the Appendix (Section 7), for a list of the 4 hose diameters, and the recommended length of each for emergency use.

If you lose electricity on the unit for any reason, the dump valve will open. This will route oil from the hydraulic pump directly back to the tank. This is also what happens when any emergency stop button is pushed. To continue pumping, you will have to find out what happened and fix it. If you cannot find out what has happened within 10 minutes or so, you will have to take action to prevent the concrete from setting up or freezing. For information on where to look and what to do if you lose electricity on the unit, contact the Schwing Service Department at (651) 429-0999.

## Delays

There will be delays. Sometimes you will have to wait for concrete, sometimes the workers will be scrambling to finish the next form to be pumped, sometimes a form will fail through no fault of your own, or half a dozen other reasons. You can make good use of this idle time by washing pipe, clamps and gaskets that have been removed from the delivery system, washing splashed concrete from your hopper area, eating lunch or whatever. The important thing to remember is that concrete begins to set as soon as it becomes motionless. Every 5 minutes or so, give the pump a stroke, which will make the concrete in the elbows and reducers change their shape, thus breaking the set. If you have to wait more than one or two 5 minute periods, you will have to continue differently for different situations. In either case, remember this: **Concrete setting in the pipe acts like a blockage. Blockages can be dangerous, because the pump will create maximum pressure on the concrete.**

If you are waiting for concrete to arrive, **Do not let the hopper become less than half full.** If the concrete is getting stiff, add water to the hopper while you are waiting. A word of warning regarding this procedure...The concrete will eventually set up anyway. If you have to wait so long that the concrete is setting, it would be better to clean out and start over when the fresh concrete has arrived. This has the added advantage of making Murphy's Law work for you...as soon as you begin to clean out, the concrete will arrive.

If you are waiting for a form to be finished or repaired, or anytime that the delay has nothing to do with waiting for concrete, you can give the pump one or two strokes in 5 minute intervals for a longer time, because the ready mix truck will be able to refill your hopper. Be careful about where the concrete is going when you are giving the machine these one or two stroke cycles. If the form is broken, you will be complicating matters by putting more concrete in there. Eventually, you have to make the call...once concrete begins to set while it is being pumped, you have only minutes to get the machine cleaned out. For this procedure, see the chapter on clean-out. Another thing to consider is the condition of the concrete in the ready mix trucks. If you have 3 or 4 trucks lined up behind the pump and they have been waiting with you, their concrete is also setting. Let's say you have been waiting for 45 minutes while a form is being repaired. The ready mix plant is 25 minutes away from the job, and the driver was waiting to get to your pump for 35 minutes before the form broke. His concrete is now an hour and 45 minutes old. If it is a hot day, you are risking a "pipe party" by pumping his concrete. You are the one that has to make the call. Hey, nobody said the job would be easy, did they?

## Keep the waterbox full

Don't forget to check the water in the waterbox regularly (and don't forget to stop the pump before you open the waterbox covers). The water is very important for cooling the differential cylinders, and lubrication of the rubber rams.

## Use of the vibrator

If you are pouring very stiff concrete and it isn't flowing well through the hopper grate, turn on your vibrator. If you didn't buy a vibrator with the unit, they are available for field retrofit. Under no circumstances should you remove the hopper grate while the machine is operating, nor should the machine be operated when the grate is not in place. You wouldn't believe some of the stuff that comes out of ready mix trucks. Mixer fins, clumps of unmixed cement, cats, dogs, rebar, golf clubs (you have to assume someone had a very bad round), tools of all sorts, etc. Your grate will catch it before it goes into the hopper (providing it is in place).

If any of the listed items made it into your hopper, they would probably cause a blockage, which is always dangerous. Worse would be if you fell into the hopper. In any case, **it is dangerous to operate without the grate over the hopper.**

## Blockages

If you have a blockage in your pipeline that you cannot remove by the backward / forward rocking motion described on page 83, you will have to disassemble the pipeline to find it. Before you disassemble the pipeline, you MUST relieve the pressure by pumping in reverse for several strokes. **You must not forget this step!**

- When you go to the pipeline to find the blockage, take your hammer with you. Wear ALL of your personal protective devices for this procedure. 99.9% of the time, you will find the blockage in a reducer, hose or elbow. The act of reversing the pump will make the pipeline sound differently, when tapped with a hammer, than if it were pressurized. 'Tapped' is a key word here. You can damage the pipe by striking it hard. You should be able to hear the difference. An empty pipe has a definite reverberating "tong" sound. A relieved pipe will have a meaty "thak" sound, and a pressurized pipe will have a thin "tik" sound because the forces on the steel will not allow it to vibrate. Once you have located the blockage, CAREFULLY remove the clamp(s) from the blocked piece(s). If you are not wearing a full face shield, turn away from the clamp as you pull the handle. Providing you have relieved pressure by stroking in reverse, you should be OK, but sometimes a blockage will store pressure because there is another blockage up or down stream. It's better to be safe than sorry. Once the clamps are removed, the danger is past. Displace the blocked piece enough that you can push a piece of rebar or other long poking device into it. If the blockage is in a hose, it will help to hit the outside of the hose with the hammer. Again, do not damage the hose by hitting it so hard that the steel braids inside get permanently disfigured.
- Once the blockage is removed, clean up the clamp, gasket, and pipe end with a rag or, in a pinch, wipe the concrete off with your hands. Reassemble the pieces, and pin the clamp(s) if they will hang overhead. Return to the pump and start pumping in forward again, slowly at first, until you are sure that there are no more blockages. If another blockage is encountered, remember to relieve the pressure again by pumping in reverse for several strokes, before finding the remaining blockages.
- Do not use compressed air to remove a blockage. Your concrete pump has at least 6 times more pressure available than an air compressor. If the pump won't push the plug, air certainly won't. In addition, air that is compressed builds a reservoir of pressure that will continue to be dangerous even when the compressor is shut off.

## Clean-out

It is an unfortunate truth, in many cases, that you will have to wait for the "balance load" of concrete. This is usually 1 or 2 yards that weren't ordered by the contractor until the last minute. It usually happens late in the day, so typically 4 of the 5 ready mix drivers that you were seeing all day have gone home, and the same man that brought the next to the last load will have to go and get the balance load. This gives you time to get ready for clean-out and to stow pipeline, clamps, etc., but it has the disadvantage that the concrete in your machine will be old by the time he returns. This is the most dangerous time for setting in the machine. Be aware of it, and take any steps necessary to keep the concrete alive. Clean out if you have to, but if the balance load is very small, refilling the hopper, material cylinders and pipeline may use up the entire balance load without ever delivering concrete to the form. In that case, they would have to order another balance load, and no one is going to be happy about it. When the balance load arrives, it is usually fresh concrete. That means that if you pump at least 1/2 yard, your machine will be filled with fresh concrete for clean-out, which is to your advantage. The worst thing that can happen is: On a hot day, the balance load is only 1 wheel barrow full. You will not be able to get fresh concrete all the way through the pipe when you pump the balance load, so the concrete that is in the end of the pipe for cleaning is as old as the next to the last load. BE CAREFUL! With old concrete it is imperative that the pipe is cleaned immediately upon finishing the pour.

Check Your Water Supply! You Will Need Water For Clean-out.

If you will be cleaning the pipeline by pressing a sponge ball through the line with air or water, you should wet the ball first. A lot of operators simply fill their 5 gallon bucket with water and throw the ball in to soak when there's about a half hour of pumping left. Other operators start soaking the ball first thing in the morning, but the ball won't last as long if it is always in water.

**⚠ WARNING**

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

hosewhipwarn.eps

## Disposing of excess concrete

If you can't dump extra concrete on the ground and don't have an eco pan on the job, you may be able to spread a plastic sheet under the pump and drop it on that to be picked up after it sets.

If you choose to pump the concrete from the hose out into the ready-mix truck, use a candy cane or goose neck to secure the delivery line to the hopper. Never climb the ladder holding the hose on your shoulder or hang it over the edge of the hopper for several reasons. Climbing the ladder with the hose makes it very difficult to obey the three point rule, which then creates a falling hazard. Plus, the hose is very likely to kink because of the rapid change in direction from the ground up to the hopper and back down into the drum. If it kinks while your holding it, you could be thrown to the ground or struck by the hose. And finally, the pump hopper almost never holds enough water to push out the entire line, so if you're holding the hose as the hopper goes empty, the line will now have compressed air being pushed through, creating the risk of a hose whip as it is released into the drum.

## Clean the hopper

Tap on the "T" handle that opens the clean-out door on the bottom of the hopper with your hammer (Figure 32). When the door opens, the concrete at the bottom of the hopper should fall out. If it doesn't, put the pump in "REVERSE" mode for a couple of strokes. If that doesn't work, turn the pump to the "NEUTRAL", or "OFF" position. **WARNING! Do not do the following procedure while the pump is engaged in either 'forward' or 'reverse'. The pump must be "OFF".** Aim your hammer upwards and pound any material that is lodged in the clean-out door. More than likely, a couple of taps will free the material. If not, you will have to keep tapping until it is free. This procedure can be minimized or eliminated by putting sand in the bottom of the rock valve housing before you begin pumping, as documented on page 79.

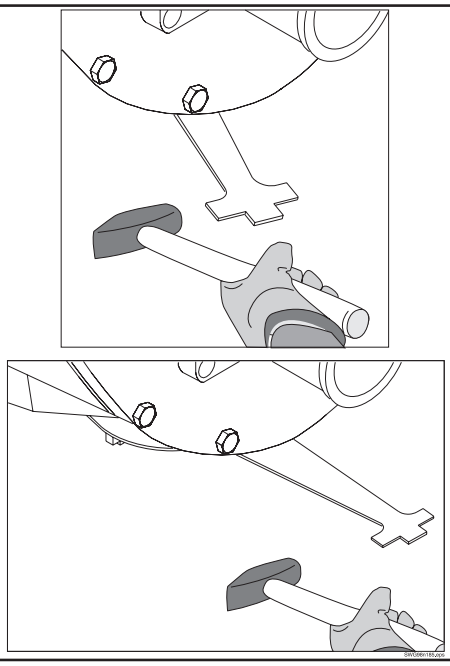


**Figure 32**
**Open the clean-out door**

Be sure of your footing and keep the hopper grate in place for the following procedure. Spray water into the hopper from above (Figure 33). Keep the agitator turning until you have sprayed the blades clean. Wash the material from the hopper out of the clean-out door on the bottom.

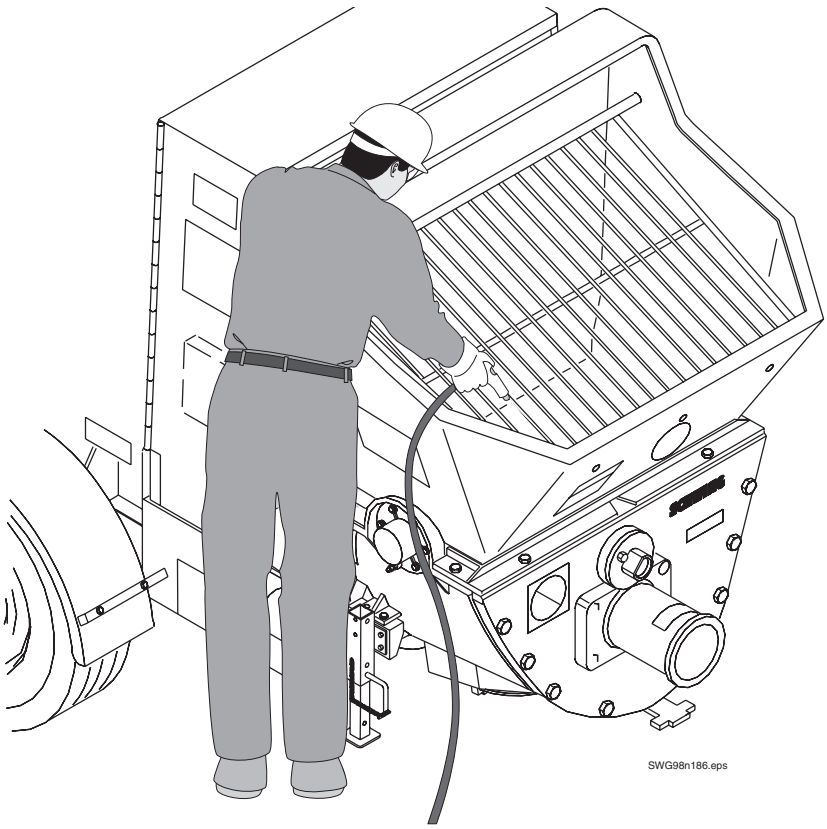



**Figure 33**
**Clean the agitator and hopper through the grate with water**

Stop the agitator from turning by placing the agitator switch on the control panel in the "OFF" position. Do not proceed to the next step until this is done. You will be able to visually confirm that the agitator has stopped by looking in the hopper (Figure 34).

**NOTE!**

**This switch will only work while the unit is in "Local" control. The best way to confirm that the agitator is stopped is use the manual control lever. It can be found on the curb side of the unit.**

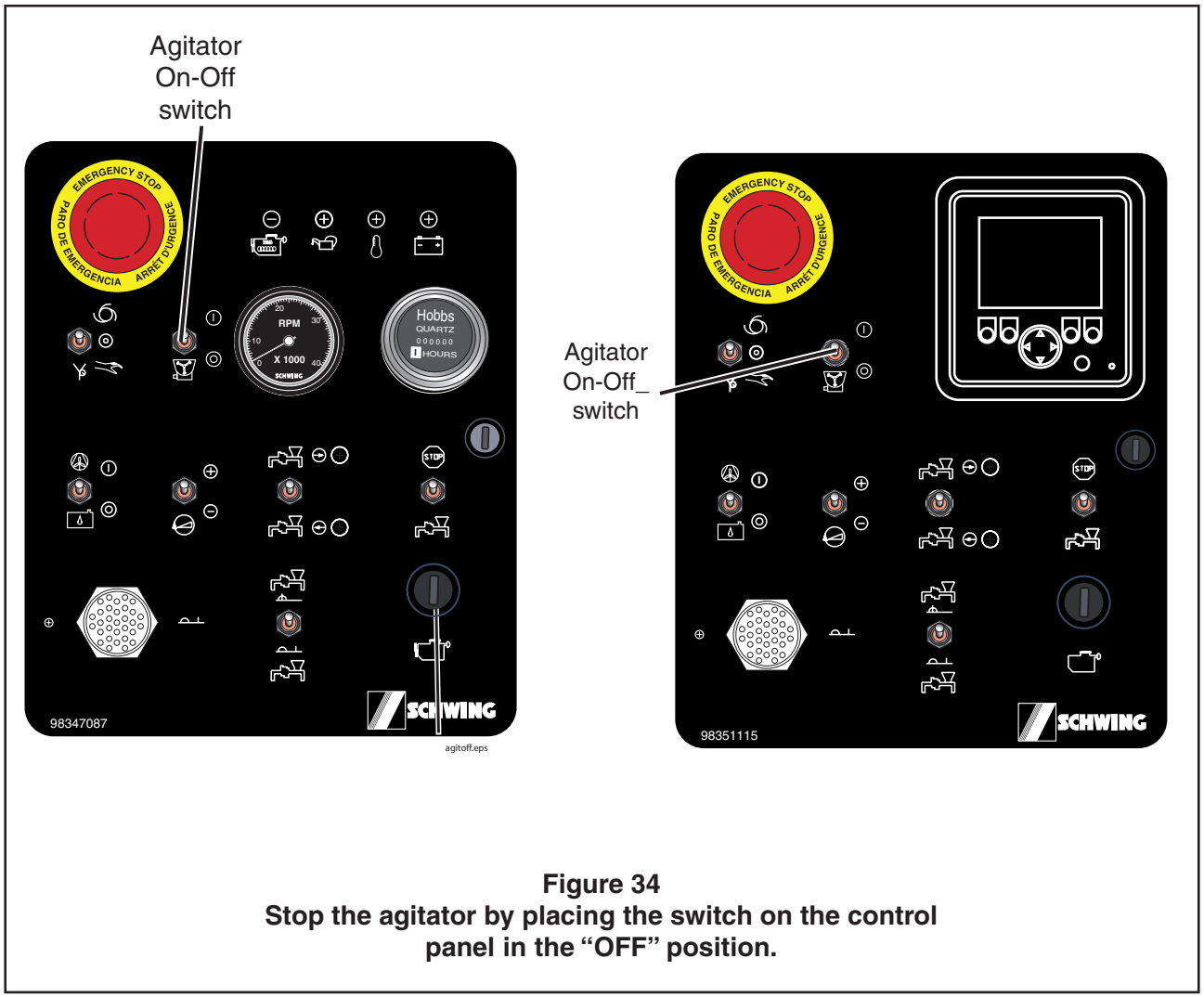



**Figure 34**
**Stop the agitator by placing the switch on the control panel in the "OFF" position.**

Poke any material that has set in the corners of your hopper with a piece of rebar or other stiff, long bar (Figure 35). **Do not remove the hopper grate for this, or any other clean-out procedure**. This procedure can, and must be done with the hopper grate in place.

Don't spend too much time on this procedure, or the concrete will have time to set up in the rock valve and material cylinders.

If concrete in the hopper has completely set, you will need to use a chipping hammer or other power tool to clean it. The grate is removable for this purpose, but **the hydraulic system must first be disabled by stopping the engine and removing the key**. For safety reasons, it is recommended that you return to your shop before removing any concrete that has completely set. Once the concrete has set, there is no advantage to chipping it away at the job site.

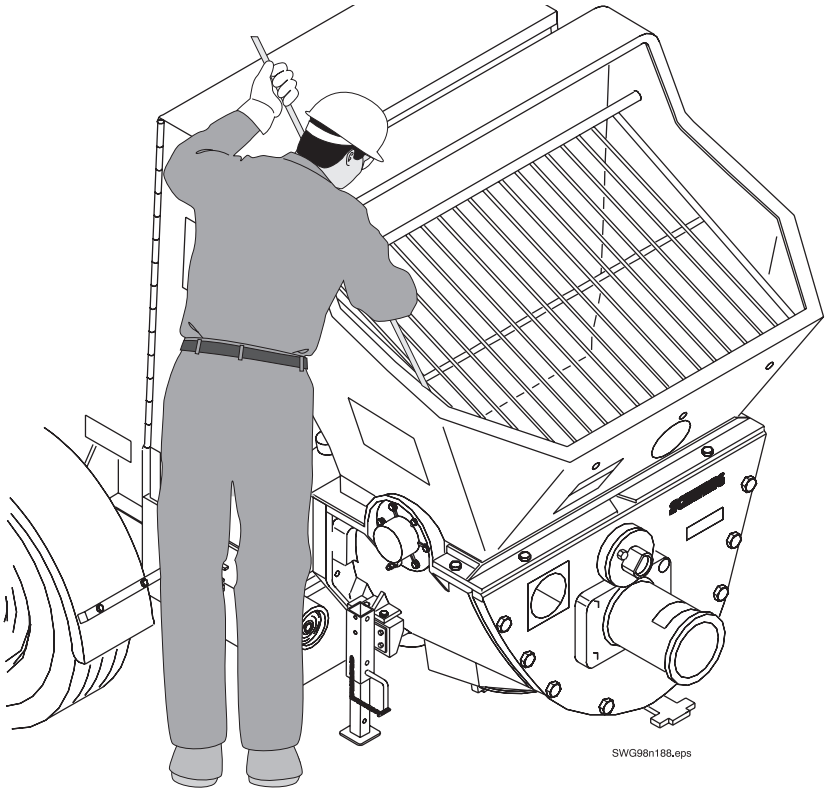



**Figure 35**
**Remove built up concrete from the hopper with a piece of rebar or similar device**

## Clean the rock valve and material cylinders

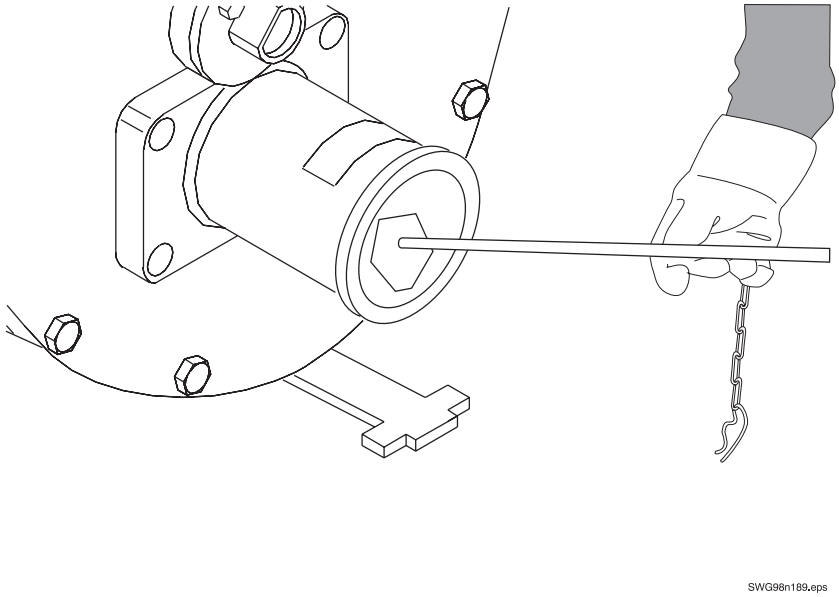



**Figure 36**
**Use the rake to remove material from the rock valve and material cylinders**

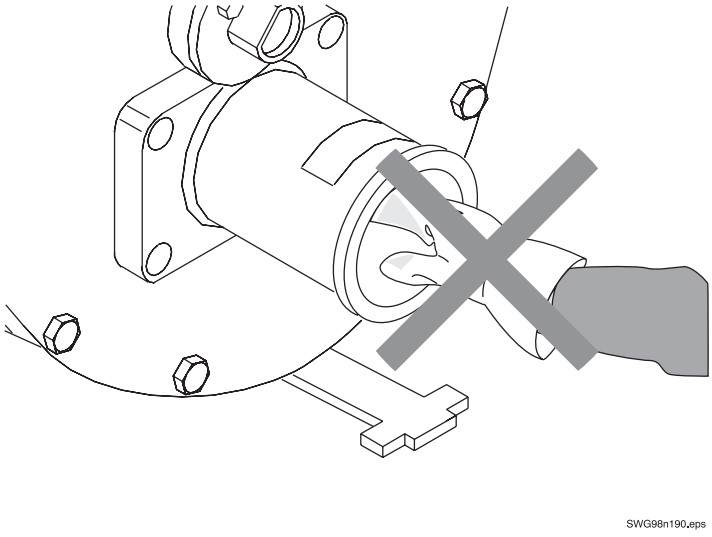



**Figure 37**
**Never put your hands in the concrete valve**

Once the hopper is clean, you should clean out the rock valve and material cylinders. Before you begin this step, bring the engine speed to an idle. Stroke the concrete pump one complete stroke in “REVERSE”, until the rock valve shifts across, then stop the pump. This step assures that the material cylinder that is exposed will have the rubber ram extended to the end, thereby eliminating the need to pull material from deep inside the cylinder. Be sure that the concrete pump is turned to the “OFF” position before proceeding. Get your clean-out rake, and pull any material from the exposed material cylinder, the rock valve, and the outlet pipe (Figure 36).

**⚠ WARNING**

**Amputation hazard. Stop pump before cleaning the Rock Valve and hopper.**

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**NOTE!**

**DO NOT PUT YOUR HANDS INTO THE VALVE HOUSING AT ANY TIME (Figure 37)!**

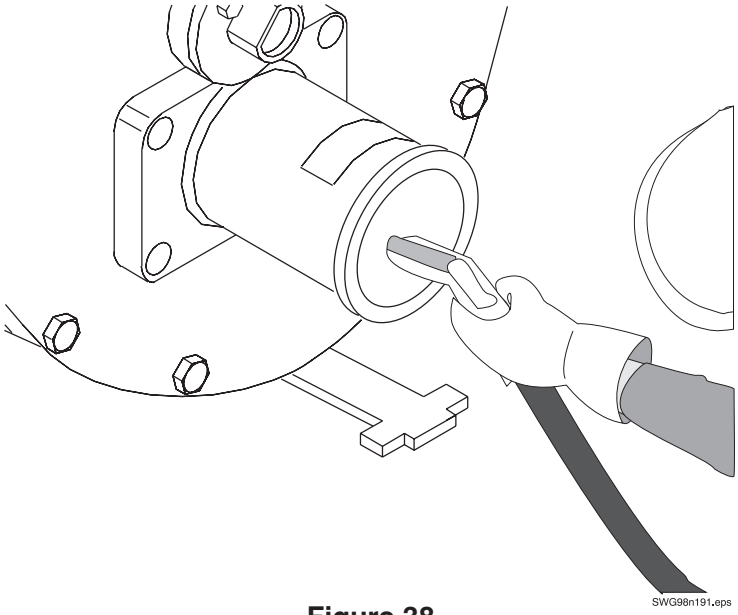



**Figure 38**
**Spray out the rock valve and material cylinder**

Spray water into the opening, washing the end of the rubber ram, the material cylinder, the rock valve and the outlet pipe. Continue washing until the water that leaves the valve is clear and clean. Visually inspect that no rocks, sand or clumps of concrete remain. If there is still material, continue spraying (Figure 38).

Be sure that your rake, and everything else is out of the valve area, then cycle the machine in reverse for one more stroke. This will expose the opposite material cylinder, and completely extend its rubber ram. Pull any loose material out with the clean-out rake, then spray out the material cylinder as in the previous step.

By putting the pump in the “REVERSE” mode, you are sucking from the pipeline (which is not connected during the clean-out procedure) and pumping into the hopper. Because of this, you may find that you now have some material in the bottom of the hopper again. You should now wash this material out.

Spray off the clamps, gaskets and wedges.

Close the hopper clean-out door, and reattach the bungy cord, if used.

### Be careful with acid

**CAUTION**

**Chrome and rubber seal damage. Be very careful when using aggressive cleaners around chrome and rubber seals.**

Caution.eps

Many aggressive cleaning compounds can do damage to chrome and rubber seals. Always follow directions very carefully when using such cleansers.

## Clean the waterbox

**NOTE!**

**The waterbox is an integral part of the pump kit and provides lubrication and cooling to the pumping cylinders and hydraulic system.**

**The waterbox needs to be cleaned and flushed *daily*. Dirty water will not have the same flushing or cooling effect as clean water. Hydraulic oil expands up to 5% when heated. It is for this reason the waterbox has to be drained after every job. As the oil cools, it shrinks up in the differential cylinders, and can actually pull water in over the rod packings.**

To clean the waterbox, start by lowering the engine RPM to an idle. Leave the waterbox cover in place, for now. Open the drain and allow the existing water to flow out the bottom. When water stops flowing, give the unit a stroke or two in either forward or reverse. This will force the water in the extended cylinder back into the waterbox, and therefore out of the drain. The waterbox is empty when no more water flows out of the drain, even after the unit is cycled. **STOP THE PUMP** and secure it against unintentional starting by pushing the emergency stop button. Be sure of your footing. Remove the waterbox covers, and spray the waterbox and cylinders until all cement fines and grout are loose (Figure 39).

If you will not be filling the waterbox again until just before the next pour (a highly recommended practice), then you should do the following procedure:

- Replace the waterbox cover.
- Put the pump into "FORWARD" or "REVERSE" for 1 or 2 strokes, to force the clean water out of the drain.
- Close the drain.

If you need to refill the waterbox immediately, simply close the drain, and finish filling the waterbox. Don't forget to replace the waterbox cover before restarting the unit.

**IMPORTANT!**

**If the machine will be transported or stored in below freezing temperatures, you must drain all the water out of the waterbox. See the section on cold weather operation for further details.**

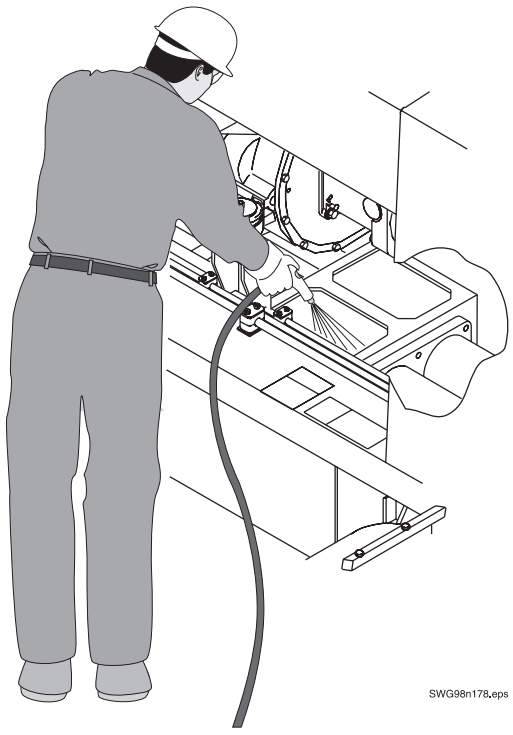



**Figure 39**
**Stop the pump, be sure of your footing, then spray out the waterbox.**

### Preparation for travel

Store your clean-out rake, sponge ball, grease gun, hammer, shovel, and all other accessories securely for travel.

If the job was set up that you were keeping track of the concrete delivery tickets, you should turn them over to the concrete supervisor when you have him sign your job ticket.

Before you get into the cab to drive, take a walk around the trailer. Look for items that you may be forgetting, look under the unit for personnel and obstructions, and check for air pressure, tire pressure and wear, etc. Many driving accidents happen on the way back to the shop after a job, or on the way to a second job. Think about your route, bearing in mind the time of day, road construction, etc. As hard as it may be, you want to begin driving with a fresh attitude and clear head.

**NOTE!**

**If your unit is equipped with hydraulic stabilizers, be sure the faucet valves are closed prior to leaving the job.**

## Special Pumping Situations

### Rod side to piston side pumping (SP 2000)

The hydraulic system for the 900 and 1200 series concrete pump can be configured for *ROD SIDE* or *PISTON SIDE* pumping, as shown in Figure 40.

*Rod side* pumping allows maximum yards per hour output, while *piston side* pumping allows maximum pressure to be exerted on the concrete. (See specific instructions for pumping on piston side in the *Operation* section of this manual). *Piston side* operation dramatically raises the maximum pressure on the concrete. For this reason it is crucial that your entire material delivery system be rated to handle the available pressure and kept in “like new” condition. Remember that pipe wears with each yard pumped. Inspect the wall thickness regularly. The maximum material pressure available on *piston side* depends on which differential and material cylinders you purchased with your unit and is stamped into the main ID tag.

When configured on ROD SIDE, the hydraulic oil is routed from the S2 valve to the differential cylinders at the port on the rod end (the end from which the rod protrudes). The rocking oil loop hose is connected from one cylinder to the other on the piston end.

When configured on the PISTON SIDE, the hydraulic oil is routed from the S2 valve to the differential cylinders at the port that is on the piston end (the end away from where the rod protrudes). The rocking oil loop is connected from one cylinder to the other on the rod end. Note that the rods are moving the same direction in both examples shown, whether they are configured for rod side or piston side pumping. This is accomplished by crossing the lines from the S2 valve as shown, and is necessary for the purpose of maintaining the proper sequence of action so the concrete valve is timed with the movement of the differential cylinders.


**Figure 40**
**Hose configuration for rod side pumping with a SP 2000**

## Quick Clean-out

If concrete is setting up in the machine, you will have to clean out in a hurry. It is important that you remember the safety rules when cleaning a setting machine. Accidents happen when you panic. Stay calm and work as fast as you can without skipping any safety rules.

You should prioritize the order of clean-out with regards to the extent of the setting action. Basically, you should keep in mind the amount of time and money involved to replace any components that are ruined by failure to clean before the concrete completely sets. To help you make this decision, we have included the following list which is arranged in order from most expensive and difficult to replace, to easiest and cheapest to replace. We are not suggesting that you clean out in the same order, but it may help in determining where you want to start.

- Rock valve cast housing
- Rock valve
- Material cylinders
- Hopper
- Pipeline

In practice, an experienced operator will dump the hopper and material cylinders, and rake out the bulk of the material from the valve in just a couple of minutes, moving immediately to the pipeline. The rest of the material in the hopper and valve can be chipped out if it won't wash clean. Be sure to disable the hydraulic system on the unit by stopping the engine, putting the key in your pocket, and putting a "DO NOT OPERATE" tag on the ignition switch before entering the valve/hopper area for chipping.

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

## Cold weather pumping

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

- Water in waterbox freezes while you are driving to the job.
- Hydraulics are slow and sluggish.
- If it's very cold, concrete can freeze in the pipeline while you are pumping.
- Concrete freezes in the hopper.
- The concrete will be loaded with calcium chloride or an equivalent to allow the concrete to set before it freezes. This will accelerate setting, in much the same manner as a hot day accelerates setting.
- Anything you wash with water becomes coated with ice, which will not melt and evaporate until the temperature raises above freezing.
- Machine parts that you touch become very slippery if they contact any water.

Some of these potential problems can be solved or tolerated, others cannot. A majority of the time the concrete will be mixed using very hot water, to keep the concrete from freezing during the delivery and waiting period. Some tips for cold weather pumping:

Store the machine indoors in locations that have cold winters, like the northern U.S. and Canada. If you don't have a heated shop for the winter, consider renting one.

Do not put water in the water tank or the waterbox before driving to the job. If possible, contact the ready mix company and arrange for the first driver to be loaded with hot water to fill your waterbox and to mix your slurry. Arrange for the last driver to be full with hot water and prepared to let you clean out using this water.

**NOTE!**

**Your Schwing unit was delivered with Mobil Univis N46 hydraulic oil. This multi viscosity oil should work nicely for any temperature between -20˚ F and 100˚ F. If you have chosen to change to a regular viscosity oil, pay close attention to the following paragraphs.**

If you are expecting cold weather for extended periods of time, such as winter in the northern United States and Canada, you should change your oil to a thinner viscosity type, such as an ISO VG 32, which will give you a lower pour point. Be aware, however, that this oil cannot protect the components to as high a temperature as the standard oil shipped with your unit (DTE 15).

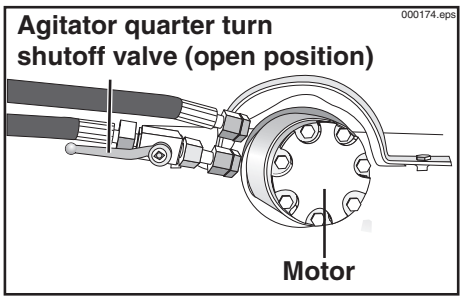



**Figure 41**
**Quarter turn valve installed in the agitator circuit.**

## Preheating the hydraulic oil

Another option is to preheat the oil before beginning the pour. This will require that you order a hydraulic shut-off valve, and install it as shown in Figure 41. The part number of this valve is 10004680. You will have to arrive at the job early enough to do the procedure. Allow about 10 or 15 extra minutes. To preheat the oil:

- Start the motor, but do NOT rev the engine to full RPM until the hydraulic oil is warm (at least 20° Centigrade). If you do, the hydraulic pumps will not be able to suck the thick oil as fast as they are turning, resulting in pump cavitation and damage to the pumps. Leave the engine at an idle.
- Close the quarter turn valve.
- Let the machine idle until the oil is at 20° Centigrade, then rev the engine to half throttle.
- Continue heating the oil to 50° or 60° Centigrade.
- Open the quarter turn valve.

There's nothing you can do about a separately laid pipeline. In most cases, pours that require a separate pipeline will cancel if it is very cold. If they don't cancel, there is a good chance that you will not be able to get concrete through the line because the slurry will freeze against the walls of the pipe, then the concrete will have to be pushed through the pipe dry. This could result in a blockage. To clear the line, all normal blockage steps should be taken and additionally, you have to work fast enough that the concrete doesn't freeze before you get it moving.

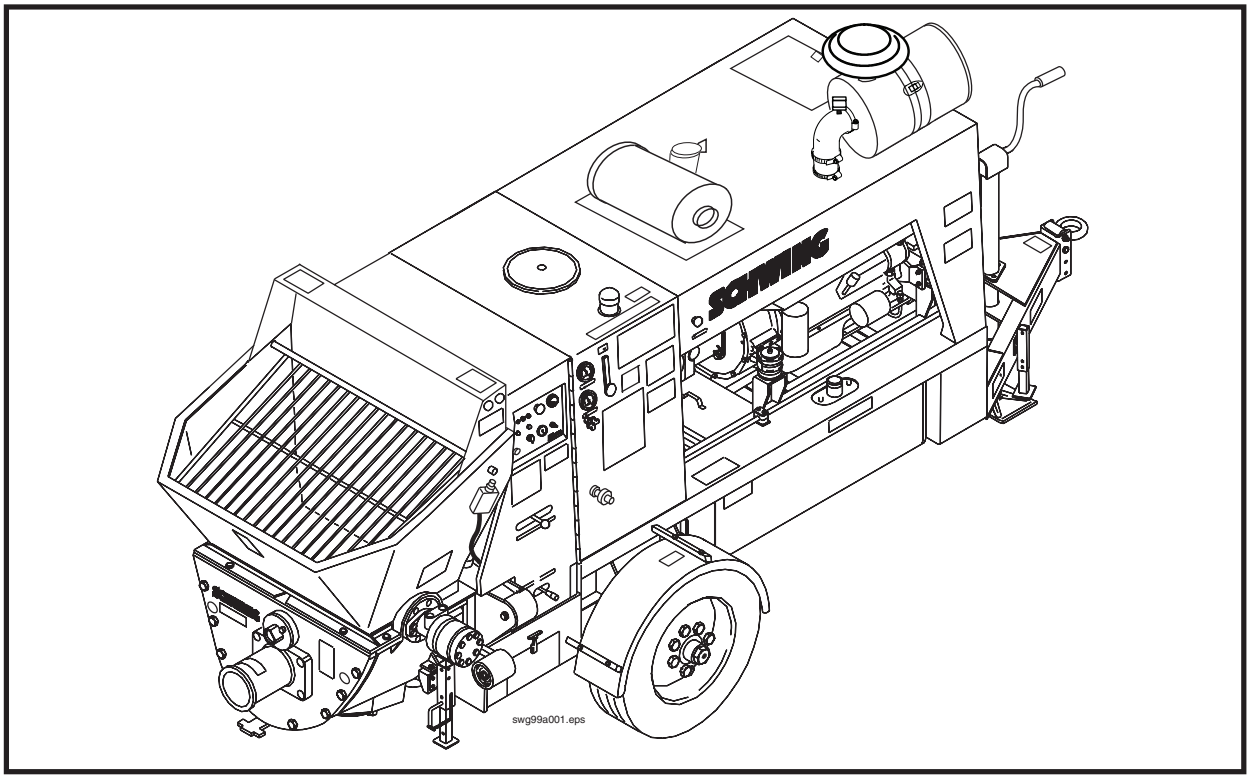
If the concrete freezes in the pipeline, you are done pumping until you have warmed up the machine. The good news is: the concrete will stop setting when it has frozen. Once you bring the machine into a warm place, you will be able to clean it.

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

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

Be very careful of ice when pumping in cold conditions. Ice can form on all objects and surfaces.

# NOTES!




# 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 daily, some weekly, some monthly, some quarterly, some semiannually and some annually. It is a good idea to make a checklist that will tell you what maintenance is due, and when it is due. A checklist is included in the Appendix section of this manual. 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 tube, and by internal wear in the components themselves. 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 a Schwing 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.

**NOTE!**

**It is recommended that after an initial 100 hour break in period, both the hydraulic oil and filter and motor oil and filter be replaced. Check with Schwing service for the correct lubricants and filter to use in your climate.**

### Specific Information

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

As delivered from the factory, each Schwing is equipped with a return filter that is rated at 12 micron (shown as 12µ) absolute.

The beta ratio is $\beta 12 = 200$. In our case, the beta ratio means that for every 200 particles of dirt that hit the filter media that are 12 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 A) the components don't require it, and B) 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 an extremely high quality element with very good trapping characteristics.

The clean element pressure drop is about 6 PSI at 200 liters per minute (element only) + 2 PSI for the housing, for a total of 8 PSI $\Delta P$ when the element is clean. The pressure drop varies with the viscosity of the oil, which is why you can ignore the delta P pop out indicator until the oil is heated to normal operating temperatures.

It will hold between 75 and 80 grams of dirt, when operating at a flow rate of 200 l/m. 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 return filter is equipped with an integral bypass check valve, with a spring force of 50 pounds. That means that 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 tank raises. This pressure difference (commonly referred to as a *pressure differential*) is called delta P, and is shown as ΔP. When the ΔP reaches 50 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 would put all of the dirt that it ever trapped directly into the system, plus the element itself would become a contaminant.

The pumps are equipped with a medium pressure filter assembly that has been manufactured especially for us (Figure 42). It is equipped with an integral bypass check valve, set at 50 PSI. The bypass valve protects the filter element from damage due to running with a clogged filter or cold starts. The assembly is equipped with an anti-back flow check valve, which prevents oil from draining out of the tank while you are changing elements. There is a delta P indicator to tell you when the element is dirty (set at 35 PSI). You should replace the element whenever the indicator pops out and the oil is 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 job site breakdowns (beta 12 = 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.

To change the element:

a. Make sure the engine is shut off.
b. Position a pan or bucket under the filter housing to catch drips.
c. Use a filter wrench to remove the old filter.


**Figure 42**
**The main return filter**

The type of filters installed on your unit are the result of years of experience and testing. We recommend that you DO NOT change the housing or element to some other type. You may learn that, in the long run, sometimes cheaper is more expensive.

# Hydraulic Oils

## General Information

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

Recently, a few manufacturers have introduced biodegradable hydraulic oils onto the market. These oils are based on vegetable extracts instead of mineral extracts. They are considered safer for the environment in the event of a spill, although the additive packages are not inert. **None of them has yet been accepted for use in Schwing pumps, but are under consideration and testing**. These oils 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 want to use this type of hydraulic oil, please contact the Schwing Service Department at (651) 429-0999 for instructions on making the change from mineral oil to biodegradable.

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, and you no longer use our Mobil Univis oil, 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 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 back of 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 UNIVIS N46 hydraulic oil unless otherwise requested by the customer. The multi viscosity nature of this oil should work nicely for any temperature between -20˚ F and 100˚ F. 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:

- Mobil DTE 25
- Shell Tellus oil
- BP Energol
- Aral Vitam
- Esso Nuto
- Esso Univis
- Total Azolla
- Wintershall Wiolan

The brands listed have been approved; however, any oil that 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 then 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

Most concrete pump hydraulic systems run with fairly high pressures, in the 2000 to 5000 PSI range. The maximum pressure is determined by adjustment of the

main relief valve, and the machines are designed to handle this pressure safely. Concrete pressure is just a ratio of the hydraulic pressure.

If you lower the pressure at which the system runs, you can harm the system. For example, you ask the machine to develop 3000 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 relief valve setting from 4350 PSI to 2500 PSI. What is the result? The concrete still requires 3000 PSI to get where you want it, but your relief valve opens at 2500. Now the oil that should be pushing the concrete is traveling back to tank instead. All of the horsepower that it took to send the oil out of the pumps at 2500 PSI is turned to heat, which will boil the oil. The oil (in this example) loses its lubricating qualities at 80° Centigrade, so components begin to wear, sending debris down stream, which adds to the wear. The system would be destroyed in minutes if it continued to operate under these conditions.

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 4900 PSI hydraulic pressure to push it where you need it. Your machine is factory set to run at a maximum of 4350 PSI, so you raise the setting of the main relief to do the job. The hydraulic pump can't withstand 4900 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 and if you take a job that needs more pressure than your machine is capable of, 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 below tells you what the sizes are, and what they will attach to.

All block threads are metric or BSPP.

Instructions for setting the relief functions are shown in the preventative Maintenance section of this manual.

hose/fittings chart.eps

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

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

**Figure 43**
**Showing hose, fitting and tube sizes and equal connection sizes.**

# General Maintenance Tips

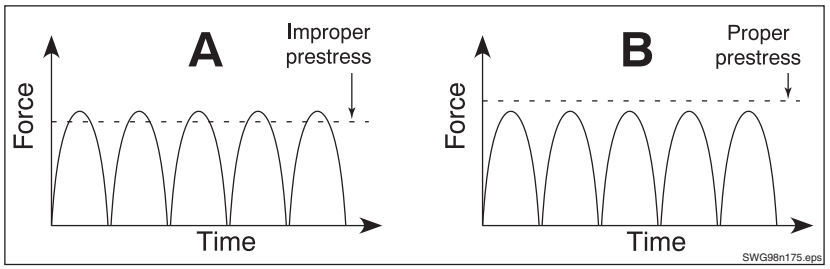



**Figure 44**
**Showing the effects of proper prestressing of a bolt.**

## 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 44).

The graphs in Figure 44 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 that don't know better will have a problem with a machine and begin trouble shooting by raising the relief valve setting. When that doesn't help, they forget to lower it back down. Now when you check the pressure by creating a hydraulic dead 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. Lock out tags were provided with you pump when it was delivered (Figure 45).

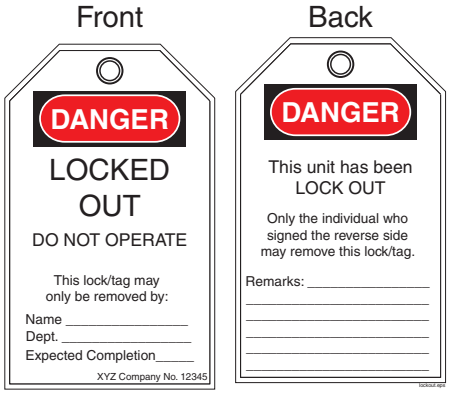



**Figure 45**
**Lockout/Tagout provided with unit**

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 the Appendix of this manual, beginning on page 130.**

## Daily Maintenance

- Check the levels and condition of the lubricants and coolant in the towing truck. Follow the manufacturers recommendations for quantity and type.
- 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.
- 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. Check the wheel hubs on the trailer for lubricant. Fill the hubs halfway with 90 wt. gear lube, if fluid is below that point.
- Check the level and condition of the hydraulic oil (Figure 46). 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 the Schwing Service Department at (651) 429-0999.

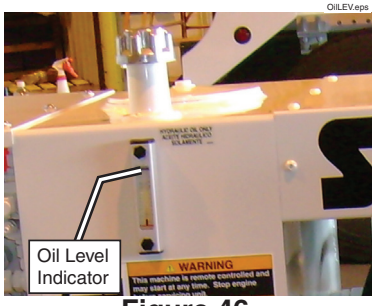



**Figure 46**
**The hydraulic oil level indicator.**

- 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 47). 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 and 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 clear, not milky.
- Check the differential cylinder rod packings. Note! In order to conform to new European regulations, beginning after 4th quarter of 1995 the waterbox will be fitted with a bolt down grate under the waterbox covers. This will make manually checking the rod packings each day, like we have instructed you to do in the past, impractical. To check for rod packing wear, fill 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 waterbox, 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.

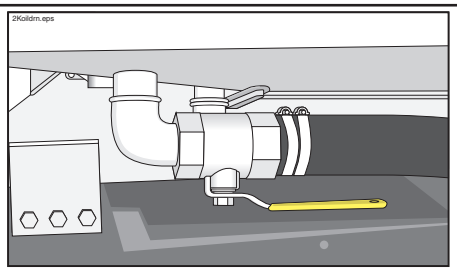



**Figure 47**
**The drain cock used to drain water from the reservoir.**

- Each day you should visually inspect the bolts on the rock valve and the rubber rams. Notice if there is any play. If you see something suspicious, shut off the engine, put the key in your pocket and remove the hopper grate or waterbox covers and inspect with a wrench. If you find that they are loose, tighten with a torque wrench to the torque specifications found on page 127 of the Appendix section of this manual. Don't forget to replace the hopper grate and/or waterbox covers before using the machine.
- Grease the rock valve and agitator bearings. This can be done on the job as described in the Operation section of this manual beginning on page 80, providing you have remembered to bring your grease gun and grease tubes.
- Visually inspect the unit for damage or leaks each day. Repairs should be made before the unit is operated.
- Once a day you should check your maintenance checklist to see if any weekly, monthly, semiannual or annual maintenance is due.
- Check daily, the fluid level in the radiator. Add 50% water and 50% ethylene glycol if needed.
- A heavy duty, dry air cleaner filters all of the air entering the engine. Excessive restriction of the air intake system reduces the flow of air to the engine affecting horsepower output, fuel consumption and engine life. An air restriction indicator is installed in the air intake manifold. Visually inspect the restriction indicator daily to assure the filter is not restricted. Service the air filter when the red diaphragm is exposed. Press the reset button on the restriction indicator after servicing the air filter.

## Weekly Maintenance

- Check the rock valve tension nut for play once each week (Figure 48). To check this nut, remove the 16mm keeper bolt, grasp the tension nut by hand and turn clockwise. There are many holes for the keeper bolt on the spacer behind the tension nut. The object is to place the keeper bolt in the furthest hole that you can reach when you turn the tension nut BY HAND. If the tension nut will only turn enough to get part way to a new bolt hole, then turn the it BACK to the previous hole. DO NOT put a wrench on the tension nut to get it to go to a new hole. Overtightening the tension nut will cause premature wear on the kidney seal. The tension nut adjusts the free play of the rock valve on the kidney seal end. Wear on the cutting ring end is compensated for automatically by the pressure spring.
  Replace and tighten the keeper bolt. You do NOT have to tighten the keeper bolt according to the torque specifications that normally are used for that bolt size. Just be sure the bolt is tight enough that it won't fall out.

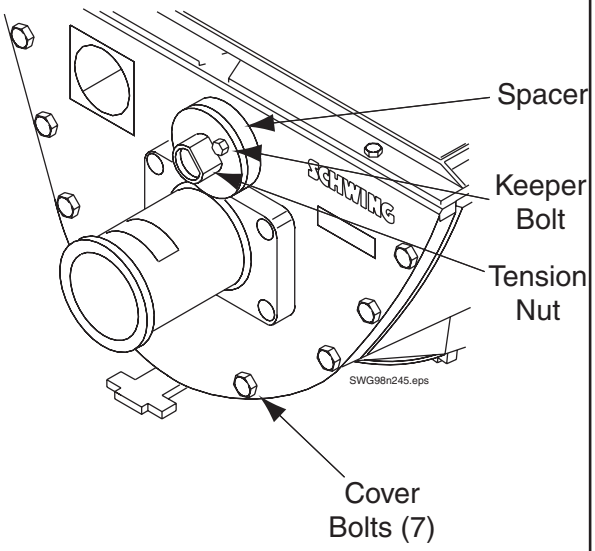



**Figure 48**
**Rock valve tension nut assembly and housing cover bolts.**

- Check the hopper grate interlock switch to be sure it is secure. Never put your hands, arms, legs or any other body part into the hopper while the hydraulic system is ready to operate or without verifying zero pressure on the accumulator. It is important that the switch be checked on a regular basis to be sure that it is functioning properly and that all mounting screws are secure. If the screws are ever found to be loose, they should be removed and replaced using Loctite or other similar product to assure they remain secure.

- Rotate the cutting ring. Actually, this is more dependent on the type of concrete and the number of cubic yards pumped than on a time schedule, but you should check it for wear at least once per week, and rotate it as needed. To rotate:

a. First shut off the engine and put the key in your pocket

b. Raise hopper grate and secure with “T” bolt.

c. Loosen the tension nut Figure 48.

d. Loosen the 8 cover bolts a couple of threads, but do not remove the bolts.

e. Loosen the 12 x 35 bolt on the end of the rock shaft by the slewing lever.

f. The rock valve will slide far enough out for you to rotate the cutting ring 90°.

g. Remove the hopper grate.

h. From inside of the hopper, tap the cutting ring forward, towards the spectacle plate. The ring should pop loose (if not, loosen the cover bolts a little more, then gently pry the rock valve rearwards a little more). Rotate the ring 90° clockwise. It doesn’t really matter which way you rotate, but to keep from forgetting which way you went last time, we recommend going clockwise each time. That way the rotation will always bring up a new side.

i. Be sure that the ring is centered in the rock valve. Tighten the cover bolts slightly, if needed, to be sure that the ring isn’t cocked one way or the other.

j. **Be sure there is no debris between the back cover and the rock valve housing (if so, clean it out).** Tighten the cover bolts just enough to bring the back plate up against the rock housing. Then tighten each bolt equally, using a torque wrench. Alternate which bolts you tighten, like you would when tightening a wheel on a car. The torque specs for these bolts (M20 x 65, 8.8 hardness) is 300 foot/lbs.

k. Lower the hopper grate and secure it with the grate lock.

l. Tighten the tension nut according to the instructions in 5.2-1. Tighten the keeper bolt.

Lubricate mechanical moving parts with oil, or a WD-40 type of lubricant.

- Drain the moisture from the fuel filter at least once per week. On the bottom of the fuel filter is a drain cock, drain until moisture ceases to come out. Also drain the water out of the bottom of the fuel tanks. Using the drain cocks on the bottom of the fuel tanks.

## Monthly maintenance

- Check the mounting hardware of the subframe, the oil tank, the pump kit, the differential cylinders, and the material cylinders. Check for bolt tightness, cracks and other abnormalities.
- 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 TEMPERATURES (40° to 60° C). To heat the oil to operating temperature:

a. When the oil is very cold (at or below the pour point of your hydraulic oil),

- Bring engine RPM to an idle.
- Let the engine idle until the temp. gauge on the operator’s panel reads 20°.

b. When the oil is warm (above the pour point of your hydraulic oil), follow instructions a. through g below. Shut off the concrete pump when the oil shows 40° C on the temperature gauge of the operator’s panel.

**Setting the concrete pump pressure**

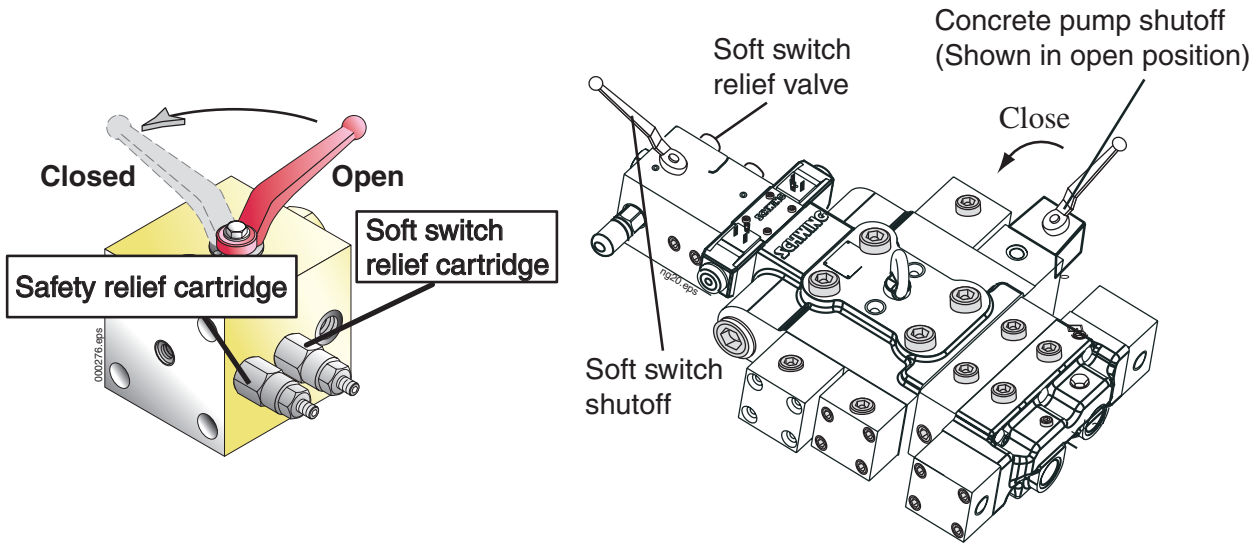



**Figure 49**
**The main relief valve, concrete pump circuit.**

The Schwing concrete pump circuit on the WP Series pumps are designed to be operated at a maximum pressure of 330 bar (4785 PSI). It is controlled by a pressure compensated pump. To check the main system pressure see Figure 49:

a. Be sure that the waterbox covers are installed on the waterbox. We do not recommend using the remote control box for the following procedure.
b. Wear safety glasses when setting pressures.
c. Start the engine.
d. Close the quarter turn shut-off valves shown in Figure 49.
e. Put the operator's panel switch "remote / local" into the "local" position.
f. Using the throttle control near the operator's panel, rev the engine up to full RPM.
g. Using the concrete pump "forward / neutral / reverse" switch, put the concrete pump into the "FORWARD" position. The unit will stroke no more than once, then the rock cylinder will retract. Oil will have nowhere to go except over the main relief valve.
h. Read the pressure on the gauge, as shown. It should read 330 bar for the WP 1250, 300 for the WP 1000 and the 750-18, or 286 for the 750-15 and the BPA 450 and 500. Return the pump to "neutral" whether in needs adjustment or not.
i. Put the concrete pump into the "FORWARD" position again. The machine will not stroke this time, but will again develop maximum pressure. Read the pressure on the gauge. If more adjustment is needed, return the pump to "NEUTRAL", then repeat the steps until you achieve the desired pressure.

**NOTE!**

**If you cannot achieve the desired pressure, you have a problem. In this case, unscrew the adjustment knob by several turns so that your pressure isn't too high once the problem is found. Contact the Schwing Service Department for advice on how to continue.**

j. Return the pump to the "NEUTRAL" position.
k. Open the quarter turn valve.
l. Return the RPM to an idle and go on to the other pressure settings, as required.

### Setting the agitator pressure

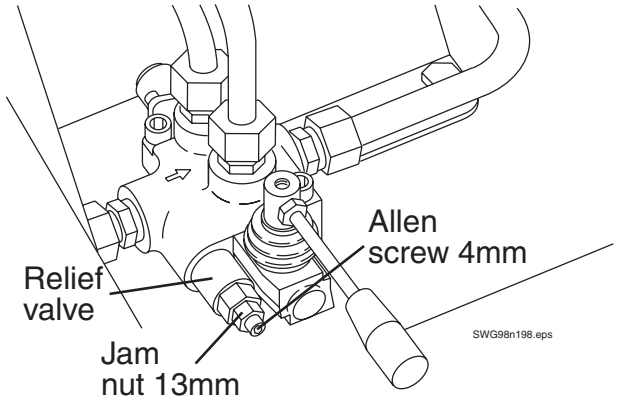



**Figure 50**
**Showing the agitator hand valve and gauge port.**

The agitator circuit has a maximum pressure of 125 bar (1812 PSI), limited by the relief valve located in the agitator hand valve (Figure 50). There is a gauge port for checking or setting the pressure in this circuit. The port is located on the agitator hand valve.

#### To set the circuit pressure:

a. Stop the unit, and put the key in your pocket.
b. Remove one of the hoses from the agitator motor and plug both the hose and the fitting with high pressure hydraulic plugs (this step can be skipped if you have installed a quarter turn valve as shown in Figure 41 on page 97. In that case, simply close the quarter turn valve).
c. Install the 0-300 bar gauge on the hose.
d. Locate the relief valve on the agitator hand valve.
e. Be sure that any personnel are clear.
f. Restart the engine and bring it to full RPM.
g. Activate the agitator hand valve. This will send the oil against the high pressure plug. The oil will have nowhere to go, so it will return to the tank over the relief valve in the hand valve. The pressure at which it relieves can be seen on the gauge. It should read 125 bar.
h. To adjust the pressure, use a 13mm wrench to loosen the jam nut and a 4mm allen wrench to turn the relief valve. Turn it clockwise to increase pressure, or counter clockwise to decrease pressure, until 125 bar is showing on the gauge.
i. Return the agitator hand valve to the neutral position.
j. Stop the engine and put the key in your pocket.
k. Remove the high pressure plugs and fittings from the agitator hose and reinstall the hose on the agitator motor.
l. Remove the pressure gauge. Replace the gauge port cover.
m. The unit can now be restarted, if necessary. Don't forget to put the key back in the engine before you go home.

### Clean the oil cooler fins

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

## Quarterly Maintenance

Change the engine oil, oil filter, fuel filter and check the air breather element after the first 100 hours of operation. Schwing recommends changing the oil and filters every 500 hours or once a year, which ever comes first. Schwing uses Mobile 10W-30 in all engines. For specific grades of motor oil and general maintenance of your engine, refer to your Duetz operation manual.

## Semiannual maintenance

### Change hydraulic oil for temperature reasons

**NOTE!**

**Your Schwing unit was delivered with Mobil Univis N46 hydraulic oil. This multi viscosity oil should work nicely for any temperature between -20˚ F and 100˚ F. If you have chosen to change to a regular viscosity oil, pay close attention to the paragraph below.**

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.

### Charging the Accumulator

Charge the accumulator every six months or 1000 hours.

a. Before you begin, you will need a charging kit (Figure 51). Do not attempt to charge the accumulator without one. You can order the kit from Schwing, using part number 30390139.

b. The nitrogen bottle should only be used with a high pressure regulator. If it was not supplied with the bottle, order one before proceeding with this job.

c. You cannot charge the accumulator with the engine running. The key switch must be in the "OFF" position. Put a "DO NOT OPERATE" tag over the key switch, and put the key in your pocket so that no one can start the unit.

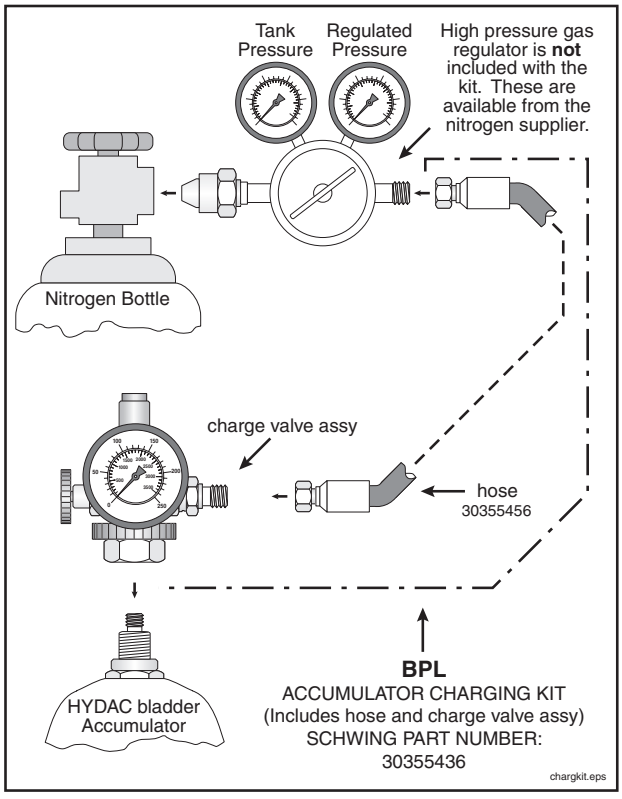



**Figure 51**
**Showing the charging kit for the accumulator and a high pressure gas regulator.**

d. Remove the valve guard and gas valve cap from the accumulator (Figure 52).

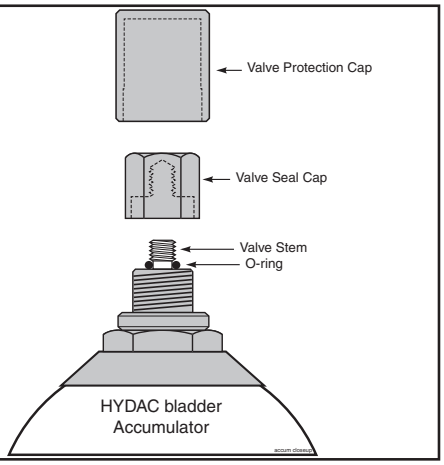



**Figure 52**
**Showing the accumulator gas valve cap and valve guard**

e. Back the T handle of the gas chuck all the way out (counter clockwise) before attaching the charging assembly to the accumulator gas valve.

f. Close the bleed valve and disconnect the hose from the valve body. This will insure that the initial pressure reading is accurate, and prevent the pressure from escaping out of the filling hose.

g. Screw the swivel nut to the gas valve of the accumulator and tighten to 10 to 15 inch/ pounds.

h. Grasp the T handle on the gas chuck and turn it clockwise all the way down. This will press a pin into the gas valve, opening it. Read the pressure before you even hook up the nitrogen bottle. This prevents you from trying to add gas to an already overcharged accumulator. If the pressure is at or above the desired setting of 1450 PSI, skip to point l. If the pressure is low, continue to the next step.

i. Make sure that the nitrogen supply is shut off. Attach the regulator assembly to the nitrogen bottle. Attach the hose to the high pressure regulator and to the gas valve on the charge valve assembly.

j. Back off the high pressure regulator adjustment handle by turning counter clockwise.

k. Crack open the nitrogen valve (on the nitrogen bottle), raise the pressure of the regulator adjustment handle, and **SLOWLY** fill the accumulator. Shut off the supply when the gauge indicates the desired nitrogen pre-charged pressure. **NOTE!** If the nitrogen bottle doesn't have at least 1450 PSI pressure, you will not be able to charge the accumulator to 1450 PSI.

l. If the desired pre-charge is exceeded, close the nitrogen bottle valve, then **SLOWLY** open the bleed valve. Close the bleed valve when the desired 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!**

m. Let the pre-charge sit for 10 or 15 minutes. This allows the gas temperature to stabilize.

n. Recheck the gauge pressure. Add or release nitrogen until the pre-charge is correct. Be sure that the bleed valve is closed before adding pressure.

o. When finished pre-charging, screw the T handle of the gas chuck all the way out, then open the bleed valve.

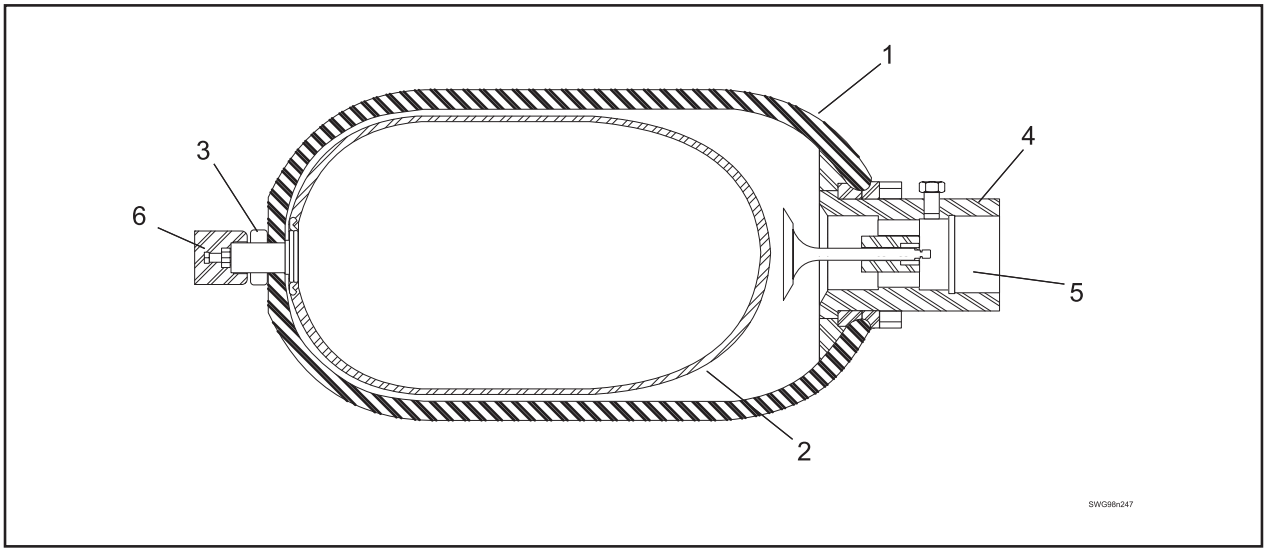
p. Hold the gas valve on the accumulator, and unscrew the swivel nut. Remove the assembly.

q. Mix some soap and water to make a bubbly mixture. Spread it around the gas valve cap to check for leaks. If a leak is found, replace the accumulator, or have it repaired by qualified personnel. Do not attempt the repair yourself.

r. Replace the gas valve cap (tighten to 10-15 inch/pounds). Replace the valve guard. The job is complete.


**BLADDER ACCUMULATOR**

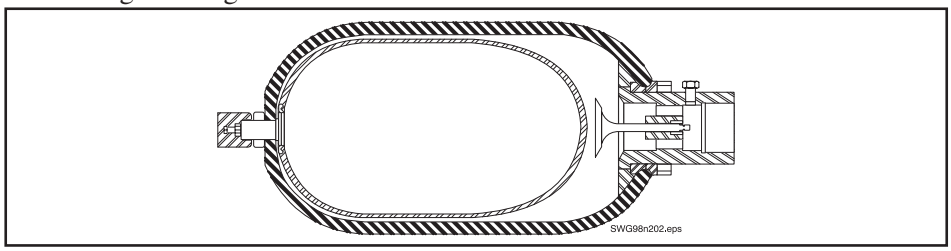
Cross Section of the Accumulator



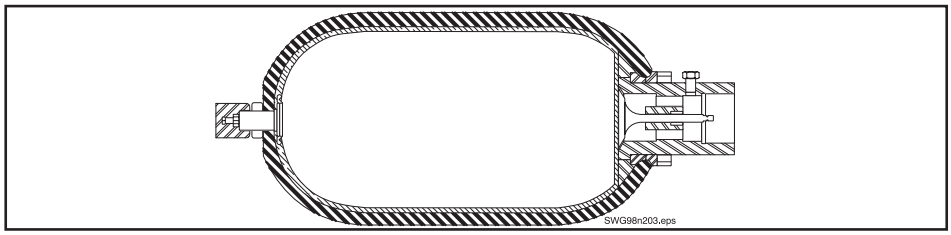

1. Steel Shell
2. Bladder
3. Bladder Stem
4. Port Assemblies
5. Fluid Ports
6. Gas Valve

Stages of Bladder Accumulator Operation

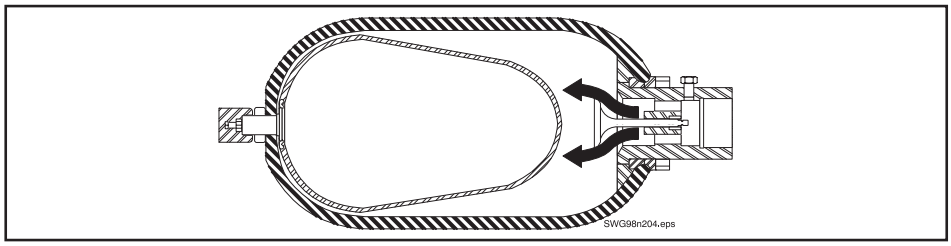
1. Without Nitrogen Charge



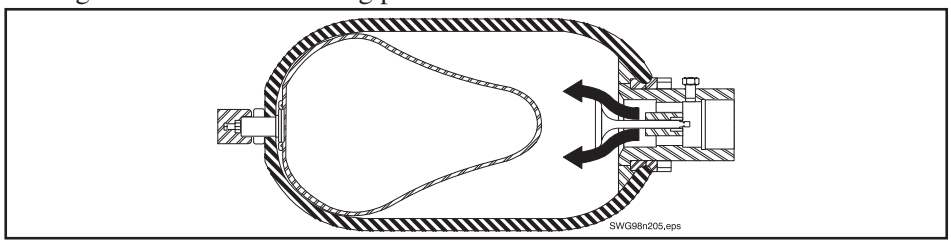

2. With Nitrogen Charged to pressure P1



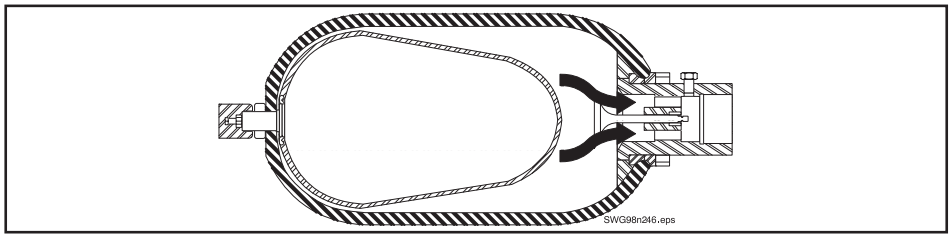

3. Influx of hydraulic oil for storage



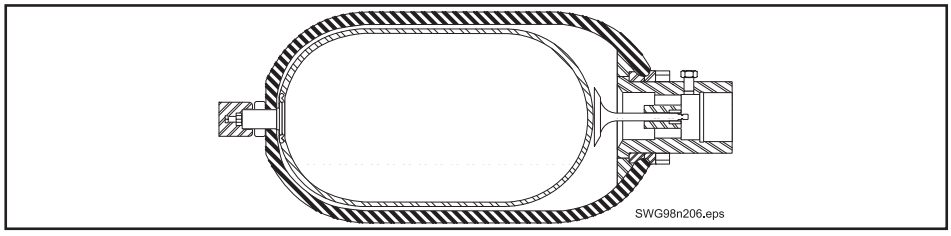

4. Fluid charged to maximum working pressure P3




5. Discharge of hydraulic oil




6. Fluid discharged down to minimum working pressure p2



## 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:

a. The engine must be shut off. Put the key in your pocket.

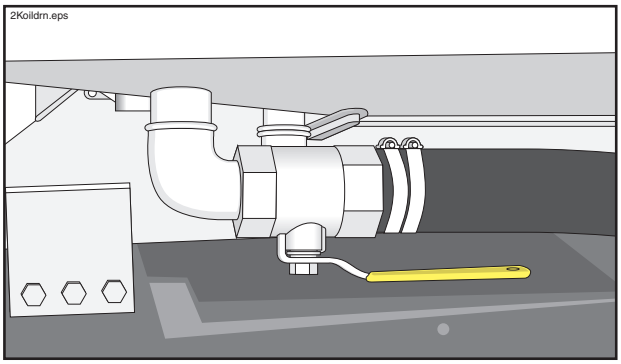



**Figure 53**
**Change hydraulic oil**

b. The oil should be cool. This is for safety reasons. Do not change oil that is above 120° F (50° C).

c. 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 53 ).

d. 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.

e. 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.

f. Change the main return filter before restarting the unit.

# Scheduled maintenance checklist

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

| Task | Daily | Weekly | Monthly | Semi-annually | Annually | As Needed | Page Number |
|---|---|---|---|---|---|---|---|
| Check Engine Fluid Levels | √ | | | | | | 105 |
| Check Tires | √ | | | | | | 105 |
| Check Hydraulic Oil | √ | | | | | | 105 |
| Bleed Moisture From Hydraulic Tank | √ | | | | | | 105 |
| Check Differential Cylinder Rod Packings | √ | | | | | | 105 |
| Inspect Bolts On Rams | √ | | | | | | 106 |
| Grease Rock Valve and Agitator Bearings | √ | | | | | | 106 |
| Inspect For Damage and Leaks | √ | | | | | | 106 |
| Check If Maintenance Is Due | √ | | | | | | 106 |
| Check Rock Valve Tension Nut | | √ | | | | | 106 |
| Inspect Cutting Ring/Rotate If Needed | | √ | | | | | 107 |
| Lubricate Mechanical Moving Parts | | √ | | | | | 107 |
| Check Unit Mounting Hardware | | | √ | | | | 107 |
| Check Hydraulic Pressures | | | √ | | | | 107 |
| Set Concrete Pump Pressure | | | √ | | | | 108 |
| Set Agitator Pressure | | | √ | | | | 109 |
| Clean Hydraulic Oil Cooler Fins | | | √ | | | | 109 |
| Change Hydraulic Oil For Temperature Reasons | | | | √ | | | 110 |
| Check the Pre-Charge Of The Accumulator | | | | √ | | | 110 |
| Change Hydraulic Oil For Age Reasons | | | | | √ | | 114 |
| Change Hydraulic Oil Return Filter | | | | | | √ | 114 |

# 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.

## 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.**

## Changing rams

When you begin to see not just cement dust in your waterbox at the end of the day, but also small bits of sand or even pebbles, it is time to change the rams.

**NOTE!**

**When changing rams, you will have to put your hands in the waterbox on several occasions. In the past, we instructed you to stop the engine each and every time before putting your hands into the waterbox, and we still highly recommend the practice.**

**However, If You Insist On Changing Rams With The Motor Running, You Must Take The Following Precautions To Avoid Amputation Of Hands, Arms And Fingers:**

- **Do Not Use The Remote Control For This Procedure! Unplug It And Store It.**
- **Do Not Allow Anyone Else At The Passenger Side 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.
- Reduce engine r.p.m. to absolute minimum, and adjust the stroke limiter to minimum strokes. The slower the hydraulic pumps are turning, the slower the differential cylinder rods will move. This buys extra time in case the unexpected happens.
- Where possible, use a nylon strap or towel to remove and replace the dogbone and ram. This will help to keep your hands out of the waterbox as much as possible.
- Please do not skip any of the above steps. If you leave the engine running, you are already skipping the one step that makes an accident impossible.

## Preparation for long term storage

If the unit will be stored for long periods of time the following precautions must be taken:

- Fully retract both differential rod cylinders
- Fill hydraulic reservoir to the base of the filler neck
- Drain fuel tanks
- Disconnect the battery
- Coat Rock Valve components with light weight oil

**NOTE!**

**Contact Schwing service for instructions**

## Restarting unit after long term storage

When the unit is being removed from long term storage, precautions must be taken before restarting using the following steps:

- Restore differential cylinders to operating position
- Drain condensation from the hydraulic reservoir
- Be sure the level of hydraulic oil is at appropriate level
- Perform a complete visual inspection of entire unit
- Add fuel and reconnect the battery
- Start engine and run at low RPM until unit reaches operating temperature and cycle pump.

**To remove the old rams**

Close the shut-off valve (Figure 54). This gives you control over the direction of travel of the differential cylinders.

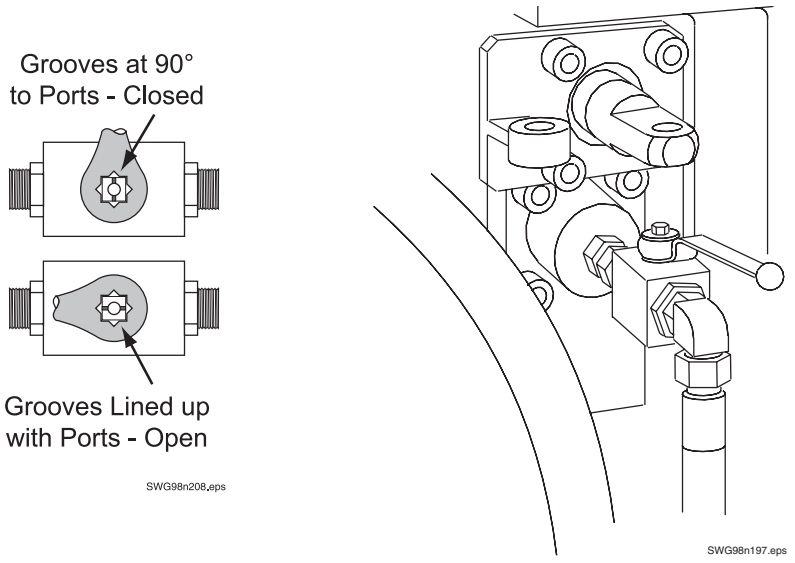



**Figure 54**
**Showing the concrete pump shut-off valve (dump valve).**

Drain the waterbox. Remove the waterbox cover, and the bolt down grate.

Retract the left side differential rod almost all the way into the waterbox (Figure 55). Leave about 1.5 inches of travel, which will allow you to remove the spacer coupling (dogbone).

Push the emergency stop button on the operator's panel. Stop the engine and put the key in your pocket (stopping the engine before putting your hands in the waterbox is mentioned at every appropriate spot).

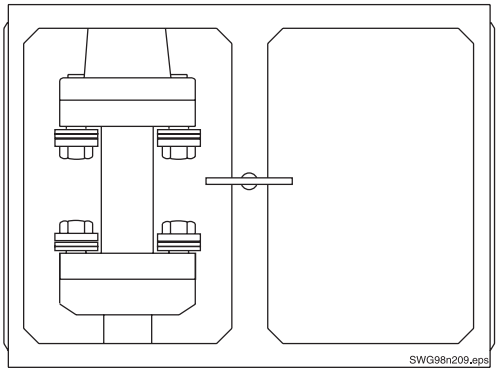



**Figure 55**
**Retract the left side rod into the waterbox all but about an inch and a half**

A 55 mm open end wrench and a 24 - 30 mm box end wrench were supplied with the unit. You will need them for this step. Locate the 55 mm wrench on the dog bone to hold the assembly from turning. You can rest the handle against the side of the waterbox as shown in Figure 56. Unscrew the 4 M20 bolts that hold the assembly together.

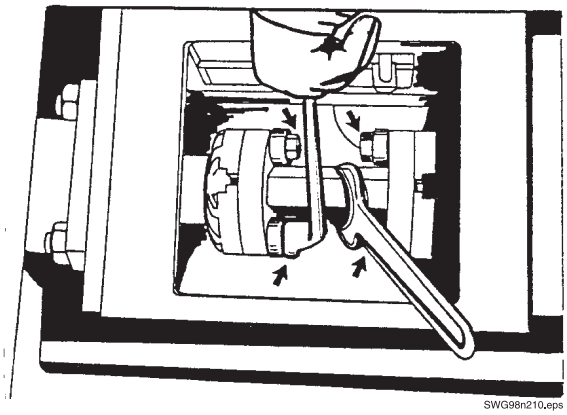



**Figure 56**
**Remove the bolts from the dog bone**

Be sure all personnel and tools are out of the waterbox, then start the engine. Release the emergency stop button. Finish retracting the left side rod into the waterbox. The dogbone will fall out.

Push the emergency stop button on the operator's panel. Stop the engine and put the key in your pocket. Remove the dogbone from the waterbox as shown in Figure 57.

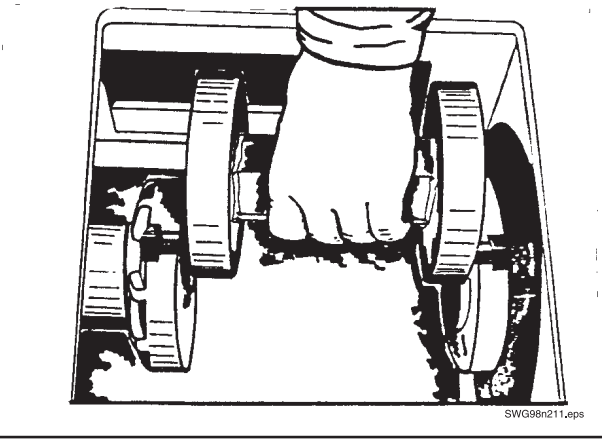



**Figure 57**
**Remove the dogbone**

Start the engine. Release the emergency stop button. Slowly extend the cylinder rod until it just contacts the rubber ram flange. Be Careful Not To Drive The Rubber Ram Into The Material Cylinder.

**NOTE!**

**If it happens that you accidentally knock the ram into the material cylinder so far that you can't reach it, you will have to remove it by knocking it out from the rock valve end of the unit. Call the Schwing Service Department at (651) 429-0999 for instructions on this procedure.**

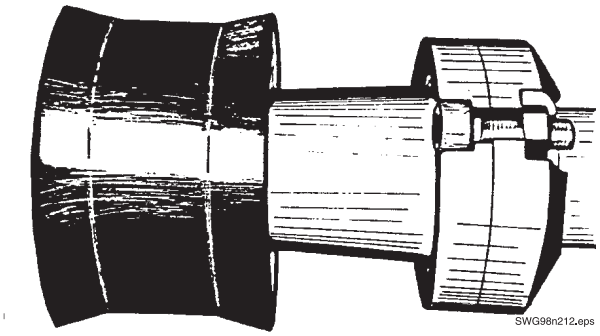



**Figure 58**
**Showing the removal bolt grooves on the flanges**

Push the emergency stop button on the operator's panel. Stop the engine and put the key in your pocket. There is a groove in the ram flange that will line up with a groove in the cylinder flange. A 1/2 inch x 2 1/2 inch bolt with nut will drop into this groove and allow you to pull the ram out (Figure 58). The fit should be snug, but there's no need to tighten the nut with tools, and note that the ram flange and cylinder flange are shown outside of the waterbox for clarity of the illustration.

Start the engine. Release the emergency stop button, and slowly retract the cylinder rod until the ram is clear of the material cylinder (Figure 59).

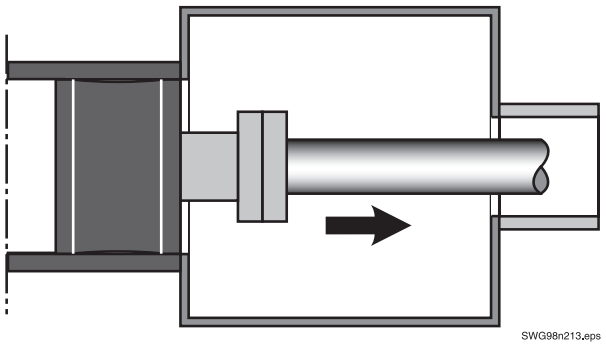



**Figure 59**
**Slowly bring the ram into the waterbox**

Push the emergency stop button on the operator's panel. Stop the engine and put the key in your pocket. Remove the nut and bolt, and the ram will be free to come out of the waterbox.

Clean and inspect the bolts and cone washers, the dog bone, and the cylinder flange. Replace any damaged or worn parts with new ones.

### To install the new rams

Apply Loctite primer (or equivalent) to the M20 bolts. Allow the primer to dry.

While the primer is drying, apply a liberal coat of clean grease to the new rams. There is no such thing as too much grease here, because the excess will be wiped off by the material cylinders during installation.

With the engine still stopped, hold the new ram up to the cylinder flange. Line up the grooves, and drop your nut and bolt into place to hold the assembly together. Again, you should only tighten the nut finger tight.

Start the engine. Release the emergency stop button. Slowly extend the cylinder until the ram is installed in the material cylinder, but the mounting flange is still exposed enough to remove the nut and bolt (Figure 60).

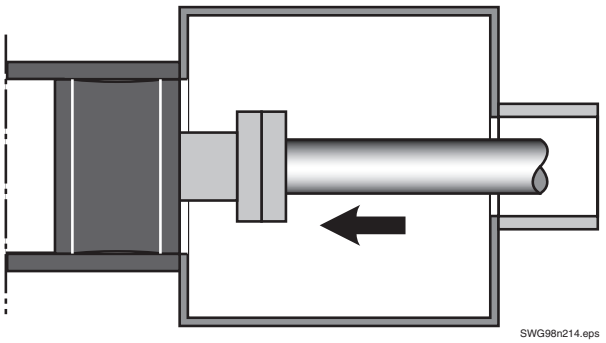



**Figure 60**
**Slowly push the new ram into the material cylinder**

Push the emergency stop button on the operator's panel. Stop the engine and put the key in your pocket. Remove the nut and bolt.

Start the engine. Release the emergency stop button. Slowly retract the rod again, until there is room to install the dog bone.

Push the emergency stop button on the operator's panel. Stop the engine and put the key in your pocket. Apply Loctite 242 or equivalent to 2 of the M20 bolts. Place the dog bone up against the flange of the new ram. Install 2 of the M20 bolts (with Loctite) And The Cone Washer Sets. At this time finger tighten only.

**NOTE!**

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

Start the engine. Release the emergency stop button. Slowly move the cylinder down to where it's flange butts up to the dogbone. Be careful not to go too far (Figure 61)!

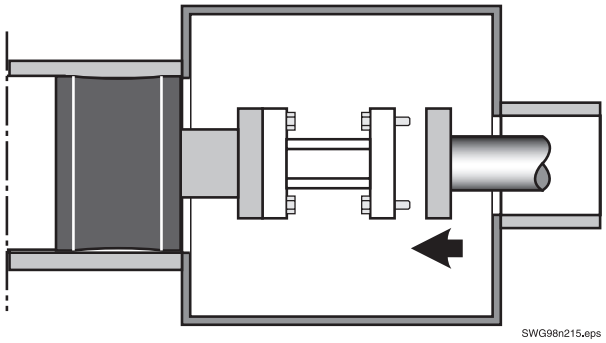



**Figure 61**
**Slowly move the cylinder to meet the dog bone**

Push the emergency stop button on the operator's panel. Stop the engine and put the key in your pocket. You may have to slightly rotate the dog bone to align the bolt holes with the cylinder flange. When aligned, coat the 2 remaining M20 bolts with Loctite and install, including the cone washer sets. Once all 4 bolts are started, you may tighten the bolts to the torque spec for M20 10.9 bolts (420 ft/lbs).

Repeat the previous steps for the right side ram.

Open the shut-off valve. Note that the unit will not cycle with this valve closed.

### Changing the Material Cylinders.

The material cylinders eventually wear out. They are considered worn out when the chrome starts to wear off the barrel. Normally, the end attached to the Rock Valve wears out first, because it sees the most concrete. The waterbox end may be in like-new condition, because that end never experiences concrete. For this reason, the material cylinders were designed to be able to flip end for end. That way, you can move the worn out part to the waterbox, and the like-new part to the concrete valve for double the life. If you are going to do this, you have to catch the wear on the material cylinders before they get too thin or break through in one or more spots. Once that happens, you cannot flip them, because they will be structurally too weak to hold the pressure forces at the waterbox end.

The procedure for changing and aligning the material cylinders is the subject of Service Bulletin G-102/88. Contact the Schwing Service Department at (651) 429-0999 or 678-560-9801 if you need a copy of the bulletin.

## Tier IV engine Regeneration Control Logic

### Regeneration Operation:

The following section explains how the engine control system monitors and manages the exhaust after treatment system. Primarily the system works passively, using the Diesel Oxidations Catalyst (DOC) to reduce particulates and promote the production of NO 2, which is used for oxidations of Particulate Matter (PM) in the Diesel Particulate Filter (DPF). These chemical reactions will occur when the gas temperature into the DOC is greater than 250°C. This chemical process is known as 'Passive Regeneration'. The engine control system will monitor the exhaust system temperature and engine duty to predict the amount of soot accumulating (if any) in the particulate filter. The engine control system will elevate exhaust system temperatures to initiate 'Active Regeneration' if there is insufficient passive regeneration or if the maximum time between active regenerations has been reached. When triggered the engine control system will elevate the exhaust system temperature to increase the DOC temperature. Once the target DOC temperature is reached the control system will introduce hydrocarbons into the exhaust gas stream. The hydrocarbons will oxidize across the DOC, for thermal oxidation of the particulates in the filter.

### Regeneration Normal Operation States

### State 1 - Primary Operation.

The system is designed to passively regenerate during engine operation. A typical machine duty cycle should be sufficient to promote good levels of passive regeneration. The solid line in Figure 63, State 1, shows the level of soot rising and falling over time. The system passively regenerates at different levels dependant on machine duty and DOC temperature, the soot level always staying below 90% soot loading.

### State 2 - Active Regeneration

The engine control system predicts the level of soot accumulation in the particulate filter. If the engine duty cycle does not allow sufficient exhaust temperature for passive regeneration, soot accumulation will continue to rise.

When optimum soot loading is reached, between 90%-130% and all of the preconditions are met, an active regeneration will start. Active regeneration will reduce soot loading to approximately 20% at which point active regeneration will stop. During automatic active regeneration normal operation of the machine can be continued. State 2 shown in Figure 64 shows an accumulation of soot above 90%. The conditions for automatic regeneration are met at point A 'Regeneration Active Lamp' is illuminated, soot is reduced to 20%.Active regeneration will be triggered 20 engine hours from the last active regeneration if the soot model has not triggered sooner. If regeneration is required and the engine speed is above 1200rpm automatic regeneration will start. Once started the engine speed may fall below 1200rpm, however the speed must not fall below 950rpm.The low idle speed will be temporarily modified to 950rpm during regeneration if it is normally below this threshold.

## Regeneration Monitoring and Warning Levels

### State 3 – DPF Elevated Soot Loading

If an active regeneration does not occur between 90%-130% the DPF warning lamp will illuminate at 130% (Figure 64 Point C). This may occur due to conditions for active regeneration not being met or if the operator has disabled the active regeneration. The DPF lamp is used to indicate that regeneration of the DPF is required. It is recommended that if applicable the DPF regeneration disable switch be deactivated. If the system has not been disabled then a manual regeneration should be performed using the switch on the control panel (Figure 62). If the DPF lamp is on for one of the above reasons, then it will remain on until regeneration has been completed.

### State 4 (D) –DPF Excessive Soot Loading

If the DPF Regeneration disable switch continues to be activated or a manual regeneration has not been performed then the soot load will continue to increase to 170% (Figure 64 Point D) at this point the warning lamp will illuminate and the DPF lamp will remain illuminated. The engine control system will invoke a 25% derate. At this point automatic regeneration is disabled by the engine ECM, only a manual regeneration can be completed.

### State 4 (E) – DPF Non Recoverable

If soot is allowed to accumulate to 230% the engine should be stopped, the shutdown lamp will illuminate. If the engine monitoring system is configured to shutdown the engine will shutdown automatically. The engine may be restarted but will shutdown after 30 seconds of operation.

### State 5 – DPF Delta Pressure Monitoring (Wall Flow Only)

The pressure differential measured across the DPF is used as an input to a flow resistance model. This model allows a comparison of the DPF soot load against the primary soot load estimation model. Under normal operating conditions the delta pressure based model will predict soot load below the engine software model. Active regeneration can be triggered from the flow resistance model if the DPF is becoming blocked at a higher rate than expected (according to the soot load estimation model) (Figure 64 Point F).

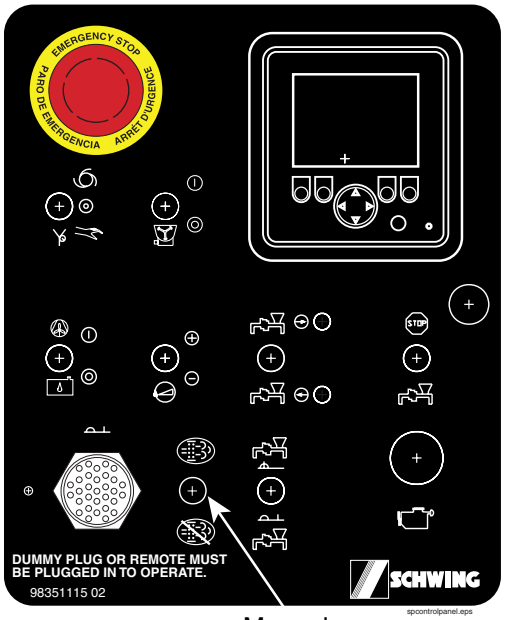



**Figure 62**
**Switch on panel for manual regeneration**

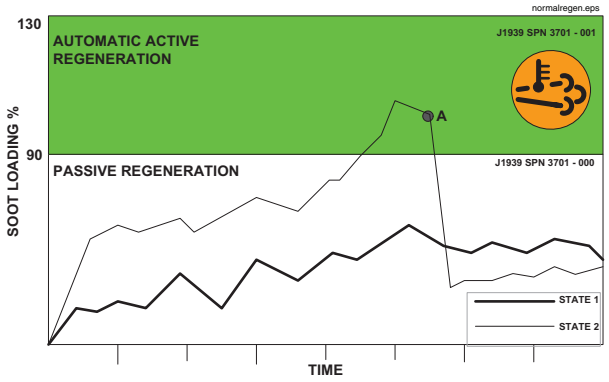



**Figure 63**
**Normal regeneration**

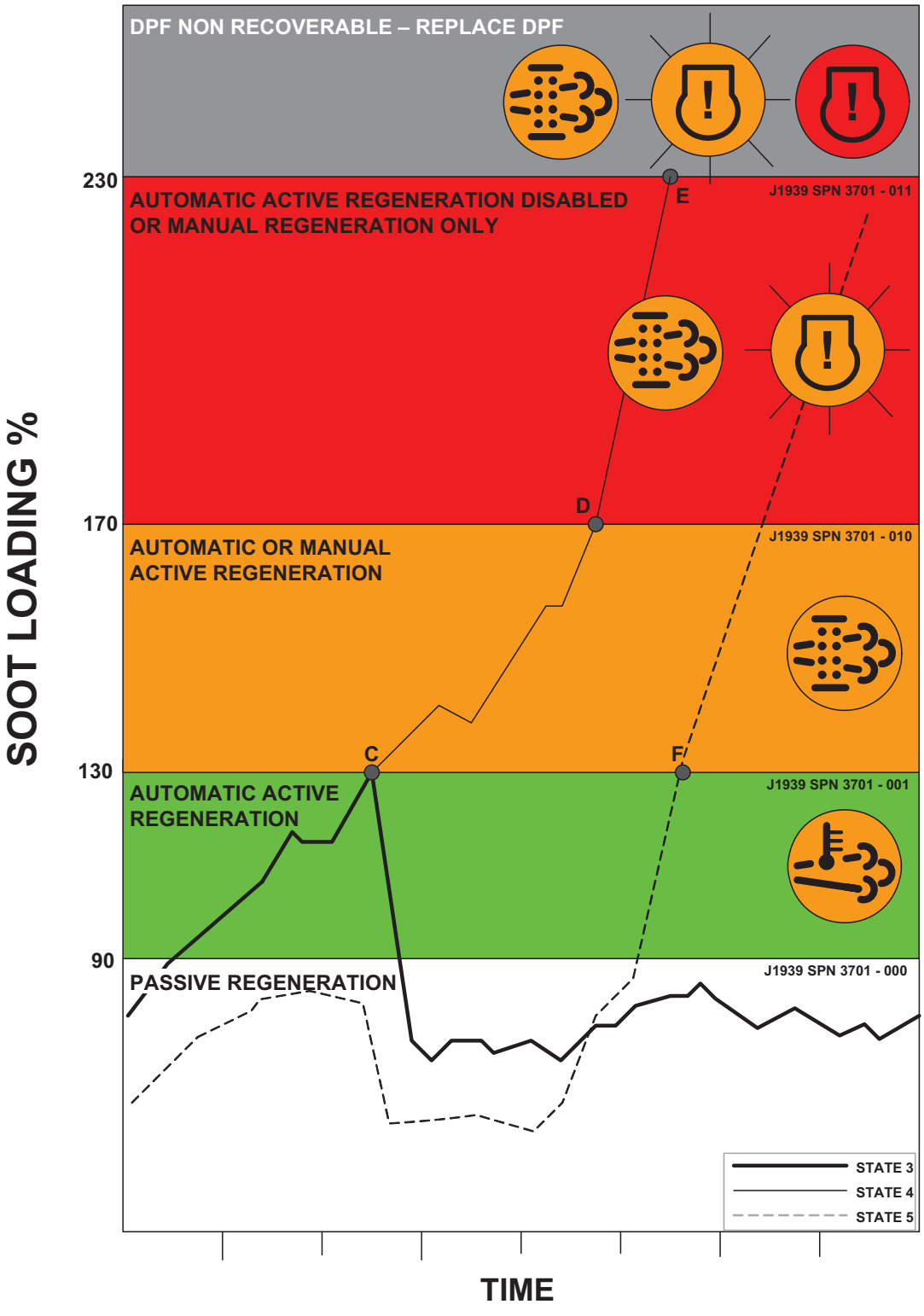
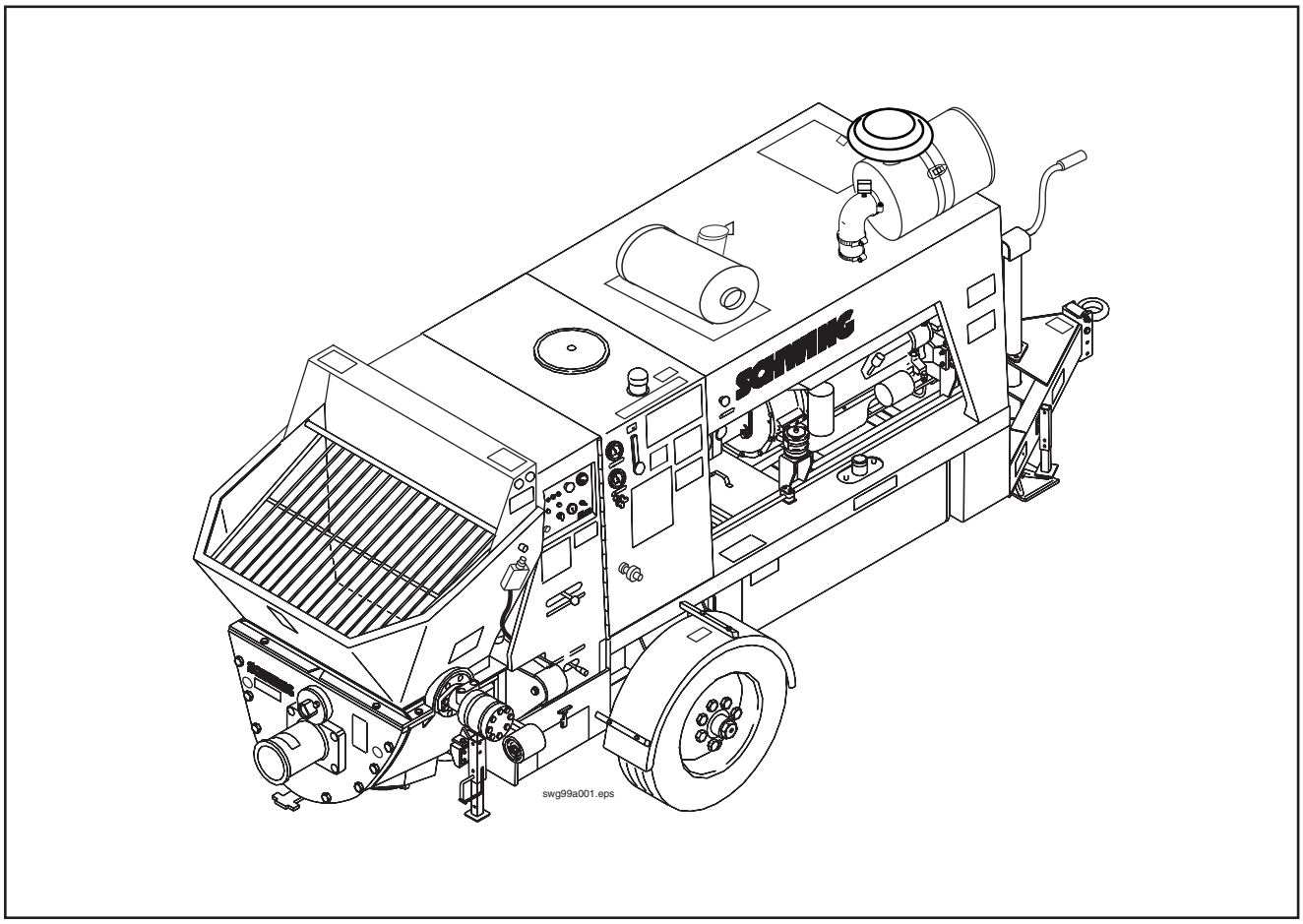



**Figure 64**
**Monitoring and warning levels**

# NOTES!




# APPENDIX

# Appendix

The Appendix contains the technical documentation of your machine and its systems. This documentation is correct for your machine when it left the factory, but it may need to be updated from time to time.

## Hydraulic Oil Viscosity Chart

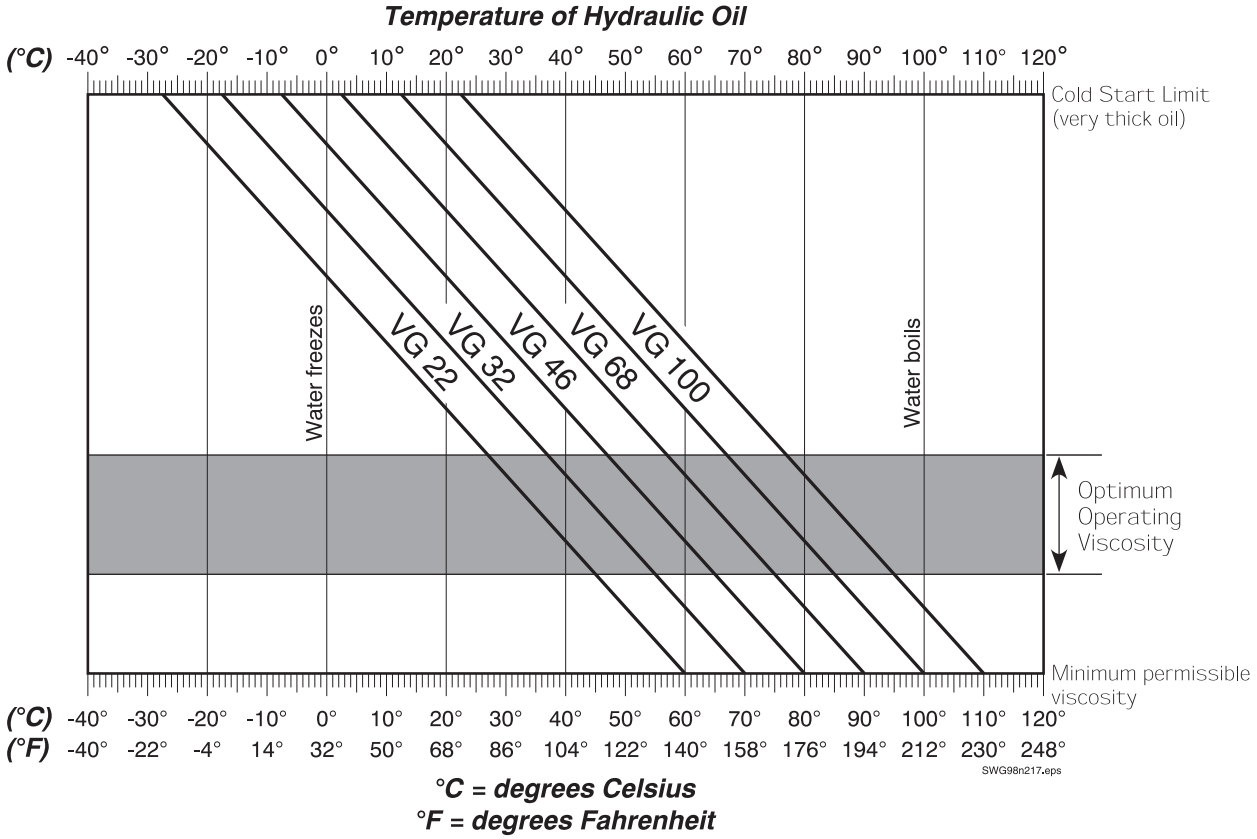
**NOTE!**

**Your Schwing unit was delivered with Mobil Univis N46 hydraulic oil. This multi viscosity oil should work nicely for any temperature between -20˚ F and 100˚ F. If you have chosen to change to a regular viscosity oil, pay close attention to the following.**

The chart 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. Anything colder, and the pumps would not be able to suck 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. Anything warmer, and the components will have metal to metal contact (thermal breakdown).
- The optimum operating viscosity is the range of oil thickness where the oil will work the best (thin enough to flow easily, thick enough to protect the system components).

For an example of how to read the chart, look at the range for VG-46 oil 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 at about 50° C to 76° C.




*°C = degrees Celsius*
*°F = degrees Fahrenheit*

# Torque Specifications for Metric Bolts

The following charts show the tightening torques specified for the bolts used on Schwing equipment. The charts are to be followed unless there is different torque spec. indicated for a particular procedure.

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

### 1. Nuts and Bolts as per DIN 912 – 931 – 933 – 934 – 6914 - 6915

Applicable to: **1. Geomet/Dacromet 500 coating.**

**2. Black and silver-chromated nuts and bolts fitted with mounting paste such as Cu or $MOS_2$.**

Assuming a friction coefficient of $\mu = 0.1$.

**Coarse-Pitch Thread**

| Bolt Size / Thread Designation | * Fitting Tightening Torque (Nm, ft lb) | | | | | |
|---|---|---|---|---|---|---|
| | Grade | | | | | |
| | 8.8 | | 10.9 | | 12.9 | |
| | N m | ft lb | N m | ft lb | N m | ft lb |
| M 4 X 0.7 | 2.2 | 1.6 | 3.2 | 2.4 | 3.8 | 2.8 |
| M 5 X 0.8 | 4.3 | 3.2 | 6.4 | 4.7 | 7.5 | 5.5 |
| M 6 X 1 | 7.5 | 5.5 | 10.8 | 8 | 12.6 | 9.3 |
| M 8 X 1.25 | 18 | 13 | 27 | 20 | 31 | 23 |
| M 10 X 1.5 | 36 | 27 | 53 | 39 | 62 | 46 |
| M 12 X 1.75 | 62 | 46 | 90 | 66 | 108 | 80 |
| M 14 X 2 | 100 | 74 | 140 | 103 | 170 | 125 |
| M 16 X 2 | 150 | 111 | 225 | 166 | 260 | 192 |
| M 18 X 2.5 | 220 | 162 | 310 | 228 | 365 | 269 |
| M 20 X 2.5 | 300 | 221 | 440 | 324 | 510 | 376 |
| M 22 X 2.5 | 420 | 310 | 590 | 435 | 700 | 516 |
| M 24 X 3 | 530 | 391 | 750 | 553 | 880 | 649 |
| M 27 X 3 | 780 | 575 | 1120 | 826 | 1300 | 958 |
| M 30 X 3.5 | 1080 | 796 | 1530 | 1128 | 1750 | 1290 |
| M 36 X 4 | - | - | **2000 | **1475 | - | - |

**Fine-Pitch Thread**

| Bolt Size / Thread Designation | * Fitting Tightening Torque (Nm, ft lb) | | | | | |
|---|---|---|---|---|---|---|
| | Grade | | | | | |
| | 8.8 | | 10.9 | | 12.9 | |
| | N m | ft lb | N m | ft lb | N m | ft lb |
| M 8 X 1 | 20 | 15 | 28 | 21 | 33 | 24 |
| M 10 X 1 | 40 | 29 | 57 | 42 | 68 | 50 |
| M 10 X 1.25 | 37 | 27 | 55 | 41 | 64 | 47 |
| M 12 X 1.25 | 67 | 49 | 100 | 74 | 115 | 85 |
| M 12 X 1.5 | 65 | 48 | 95 | 70 | 110 | 81 |
| M 14 X 1.5 | 105 | 77 | 155 | 114 | 180 | 133 |
| M 16 X 1.5 | 160 | 118 | 235 | 173 | 280 | 206 |
| M 18 X 1.5 | 240 | 177 | 345 | 254 | 400 | 295 |
| M 20 X 1.5 | 335 | 247 | 475 | 350 | 590 | 435 |
| M 20 X 2 | | | | | 560 | 413 |
| M 22 X 1.5 | 460 | 339 | 650 | 479 | 750 | 553 |
| M 24 X 2 | 560 | 413 | 810 | 597 | 940 | 693 |
| M 27 X 2 | 820 | 604 | 1170 | 862 | 1390 | 1025 |
| M 30 X 2 | 1170 | 862 | 1660 | 1224 | 1930 | 1423 |
| | | | | | | |

* The fitting tightening torque corresponds to the axial force in the bolt at which the limit of elasticty of the latter is utilised 90 % by tension and torsion.

** only Octagonal column

### 2. Nuts and Bolts as per DIN 912 – 931 – 933 – 934 – 6914 - 6915

Applicable to: **Black and silver chromated nuts and bolts.**

Assuming a friction coefficient of $\mu = 0.14$.

**Coarse-Pitch Thread**

| Bolt Size / Thread Designation | * Fitting Tightening Torque (Nm, ft lb) | | | | | |
|---|---|---|---|---|---|---|
| | Grade | | | | | |
| | 8.8 | | 10.9 | | 12.9 | |
| | N m | ft lb | N m | ft lb | N m | ft lb |
| M 4 X 0.7 | 2.7 | 2 | 4 | 3 | 4.6 | 3 |
| M 5 X 0.8 | 5.3 | 4 | 7.8 | 6 | 9 | 7 |
| M 6 X 1 | 8 | 6 | 13.5 | 10 | 16.2 | 12 |
| M 8 X 1.25 | 22 | 16 | 32 | 24 | 38 | 28 |
| M 10 X 1.5 | 44 | 32 | 64 | 47 | 75 | 55 |
| M 12 X 1.75 | 76 | 56 | 112 | 83 | 130 | 96 |
| M 14 X 2 | 120 | 89 | 180 | 133 | 210 | 155 |
| M 16 X 2 | 185 | 136 | 275 | 203 | 325 | 240 |
| M 18 X 2.5 | 270 | 199 | 385 | 284 | 450 | 332 |
| M 20 X 2.5 | 380 | 280 | 550 | 406 | 640 | 472 |
| M 22 X 2.5 | 520 | 384 | 740 | 546 | 870 | 642 |
| M 24 X 3 | 650 | 479 | 940 | 693 | 1095 | 808 |
| M 27 X 3 | 990 | 730 | 1390 | 1025 | 1620 | 1195 |
| M 30 X 3.5 | 1300 | 959 | 1890 | 1394 | 2200 | 1623 |
| M 36 X 4 | - | - | **2000 | **1475 | - | - |

**Fine-Pitch Thread**

| Bolt Size / Thread Designation | * Fitting Tightening Torque (Nm, ft lb) | | | | | |
|---|---|---|---|---|---|---|
| | Grade | | | | | |
| | 8.8 | | 10.9 | | 12.9 | |
| | N m | ft lb | N m | ft lb | N m | ft lb |
| M 8 X 1 | 24 | 18 | 35 | 26 | 41 | 30 |
| M 10 X 1 | 50 | 37 | 70 | 52 | 85 | 63 |
| M 10 X 1.25 | 46 | 34 | 65 | 48 | 80 | 59 |
| M 12 X 1.25 | 83 | 61 | 120 | 89 | 145 | 107 |
| M 12 X 1.5 | 80 | 59 | 115 | 85 | 140 | 103 |
| M 14 X 1.5 | 130 | 96 | 190 | 140 | 230 | 170 |
| M 16 X 1.5 | 200 | 148 | 295 | 218 | 350 | 258 |
| M 18 X 1.5 | 300 | 221 | 435 | 321 | 510 | 376 |
| M 20 X 1.5 | 425 | 313 | 610 | 450 | 710 | 524 |
| M 20 X 2 | | | | | 680 | 502 |
| M 22 X 1.5 | 580 | 428 | 825 | 608 | 940 | 693 |
| M 24 X 2 | 720 | 531 | 1030 | 760 | 1210 | 892 |
| M 27 X 2 | 1030 | 760 | 1480 | 1092 | 1750 | 1291 |
| M 30 X 2 | 1480 | 1092 | 2110 | 1556 | 2470 | 1822 |
| | | | | | | |

* The fitting tightening torque corresponds to the axial force in the bolt at which the limit of elasticty of the latter is utilised 90 % by tension and torsion.

** only Octagonal column

12_09

| GENERAL SAE BOLT TORQUE SPECIFICATION TABLE<br>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. | | | | |
|---|---|---|---|---|
| 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. Manufacturers marks may vary.

## Recommended Emergency Hose Kit

We recommend that you carry one of each of the following hoses on the unit for use if you would blow a hose on the job. Each size listed represents the longest hose of each diameter that is installed on the unit in the factory. Keep the inside of the hoses clean until needed by capping the ends and taping the cap into place. Dirt introduced into your hydraulic system by installing a hose that was not kept clean will cause a variety of problems in the operation of the unit.

WPhose lengths.eps

| Diameter | Length | Part Number |
|---|---|---|
| 8 | 1000mm | 10050174 |
| 13 | 1200mm | 10049906 |
| 16 | 800mm | 10049943 |
| 20 | 1250mm | 10049962 |
| 25 | 1100mm | 30347674 |

# Fitting Wrench Sizes

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

## Straight Fittings

| Fitting or Tube size | CORRECT METRIC WRENCH SIZES | | NEAREST AMERICAN WRENCH SIZES | |
|---|---|---|---|---|
| | Capnut | Coupling Body | Capnut | Coupling Body |
| 8mm | 17mm | 17mm | 11/16" | 11/16" |
| 12mm | 22mm | 19mm | 7/8" | 3/4" |
| 16mm | 30mm | 27mm | 1 3/16" | 1 1/16" |
| 20mm | 36mm | 32mm | 1 7/16" | 1 1/4" |
| 25mm | 46mm | 41mm | 1 13/16" | 1 5/8" |
| 38mm | 60mm | 55mm | 2 3/8" | 2 3/16" |

SWG98n220.eps

## Banjo Fittings

### End Cap Separate from Stem

| Fitting or Tube size | CORRECT METRIC WRENCH SIZES | | | NEAREST AMERICAN WRENCH SIZES | | |
|---|---|---|---|---|---|---|
| | Capnut | Coupling Body | Endcap | Capnut | Coupling Body | Endcap |
| 8mm | 17mm | 22mm | 19mm | 11/16" | 7/8" | 3/4" |
| 12mm-R1/4" | 22mm | 22mm | 19mm | 7/8" | 7/8" | 3/4" |
| 12mm-R3/8" | 22mm | 27mm | 22mm | 7/8" | 1 1/16" | 7/8" |
| 12mm-R1/2" | 22mm | 30mm | 24mm | 7/8" | 1 3/16" | 15/16" |
| 16mm | 30mm | 32mm | 27mm | 1 3/16" | 1 1/4" | 1 1/16" |
| 20mm | 36mm | 41mm | 32mm | 1 7/16" | 1 5/8" | 1 1/4" |
| 25mm | 46mm | 50mm | 41mm | 1 13/16" | 2" | 1 5/8" |
| 38mm | 60mm | 70mm | 55mm | 2 3/8" | 2 13/16" | 2 3/16" |

### End Cap Part of Stem

| | | | | | | |
|---|---|---|---|---|---|---|
| 12mm-R3/8" | 22mm | 24mm | 22mm | 7/8" | 15/16" | 7/8" |
| 16mm | 30mm | 30mm | 27mm | 1 3/16" | 1 3/16" | 1 1/16" |
| 25mm | 46mm | 46mm | 41mm | 1 13/16" | 1 13/16" | 1 5/8" |
| 38mm | 60mm | 65mm | 55mm | 2 3/8" | 2 9/16" | 2 3/16" |

SWG98n221.eps

# Maintenance checklist

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

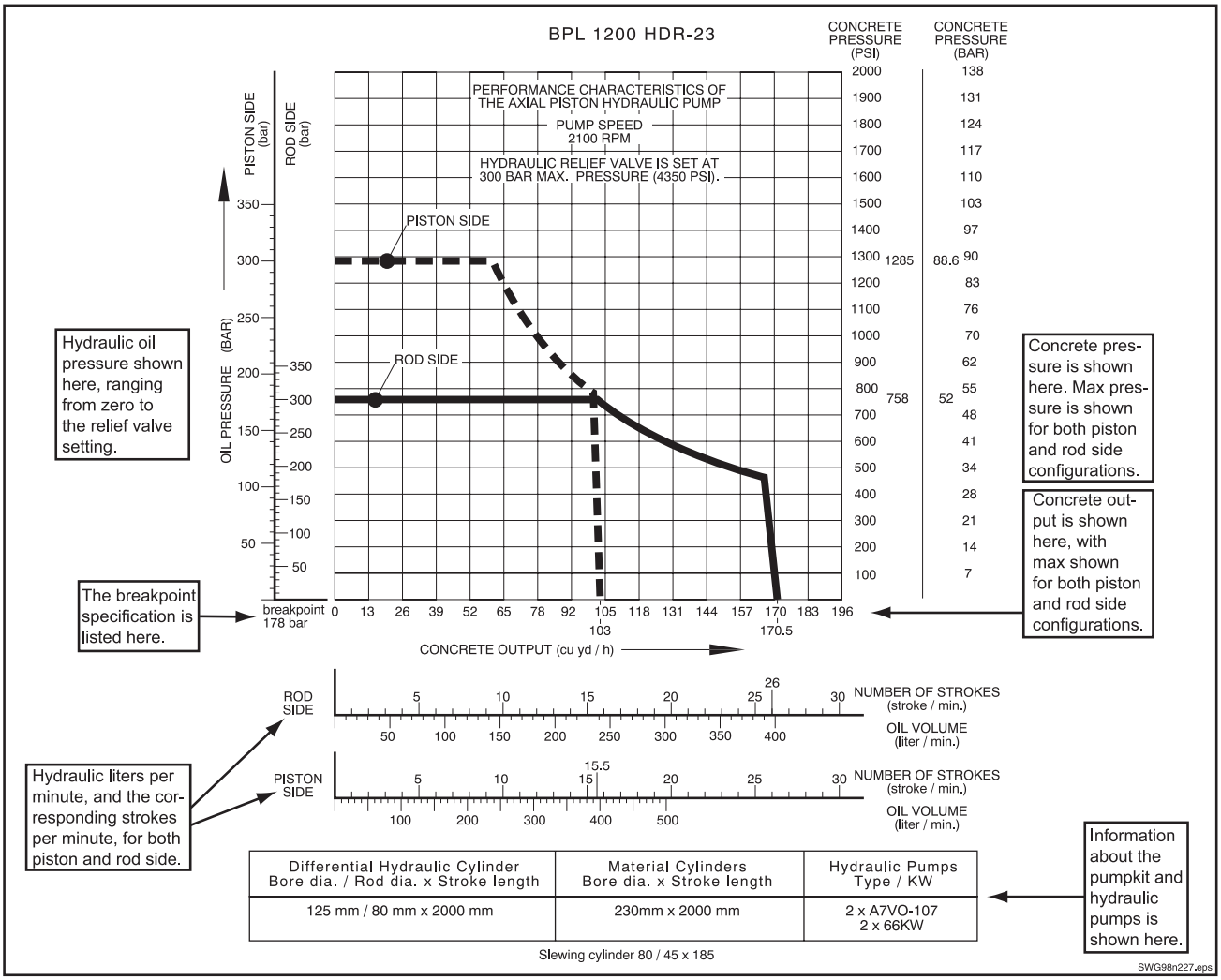
| Task | Daily | Weekly | Monthly | Semi-annually | Annually | As Needed | Page Number |
|---|---|---|---|---|---|---|---|
| Check Engine Fluid Levels | √ | | | | | | 105 |
| Check Tires | √ | | | | | | 105 |
| Check Hydraulic Oil | √ | | | | | | 105 |
| Bleed Moisture From Hydraulic Tank | √ | | | | | | 105 |
| Check Differential Cylinder Rod Packings | √ | | | | | | 105 |
| Inspect Bolts On Rams | √ | | | | | | 106 |
| Grease Rock Valve and Agitator Bearings | √ | | | | | | 106 |
| Inspect For Damage and Leaks | √ | | | | | | 106 |
| Check If Maintenance Is Due | √ | | | | | | 106 |
| Check Rock Valve Tension Nut | | √ | | | | | 106 |
| Inspect Cutting Ring/Rotate If Needed | | √ | | | | | 107 |
| Lubricate Mechanical Moving Parts | | √ | | | | | 107 |
| Check Unit Mounting Hardware | | | √ | | | | 107 |
| Check Hydraulic Pressures | | | √ | | | | 107 |
| Set Concrete Pump Pressure | | | √ | | | | 108 |
| Set Agitator Pressure | | | √ | | | | 109 |
| Clean Hydraulic Oil Cooler Fins | | | √ | | | | 109 |
| Change Hydraulic Oil For Temperature Reasons | | | | √ | | | 110 |
| Check the Pre-Charge Of The Accumulator | | | | √ | | | 110 |
| Change Hydraulic Oil For Age Reasons | | | | | √ | | 114 |
| Change Hydraulic Oil Return Filter | | | | | | √ | 114 |

# 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 will change their displacement per revolution resulting in less flow and less 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 pump kit model.
- the maximum output (in cubic yards per hour) of the pump kit model.
- the maximum strokes per minute of your pump kit model.
- the maximum output (in liters per minute) of your hydraulic pumps.
- the output that can be expected at various pumping pressures.
- the condition of your hydraulic pumps (when used in conjunction with a flow meter).
- the break point of your hydraulic system.

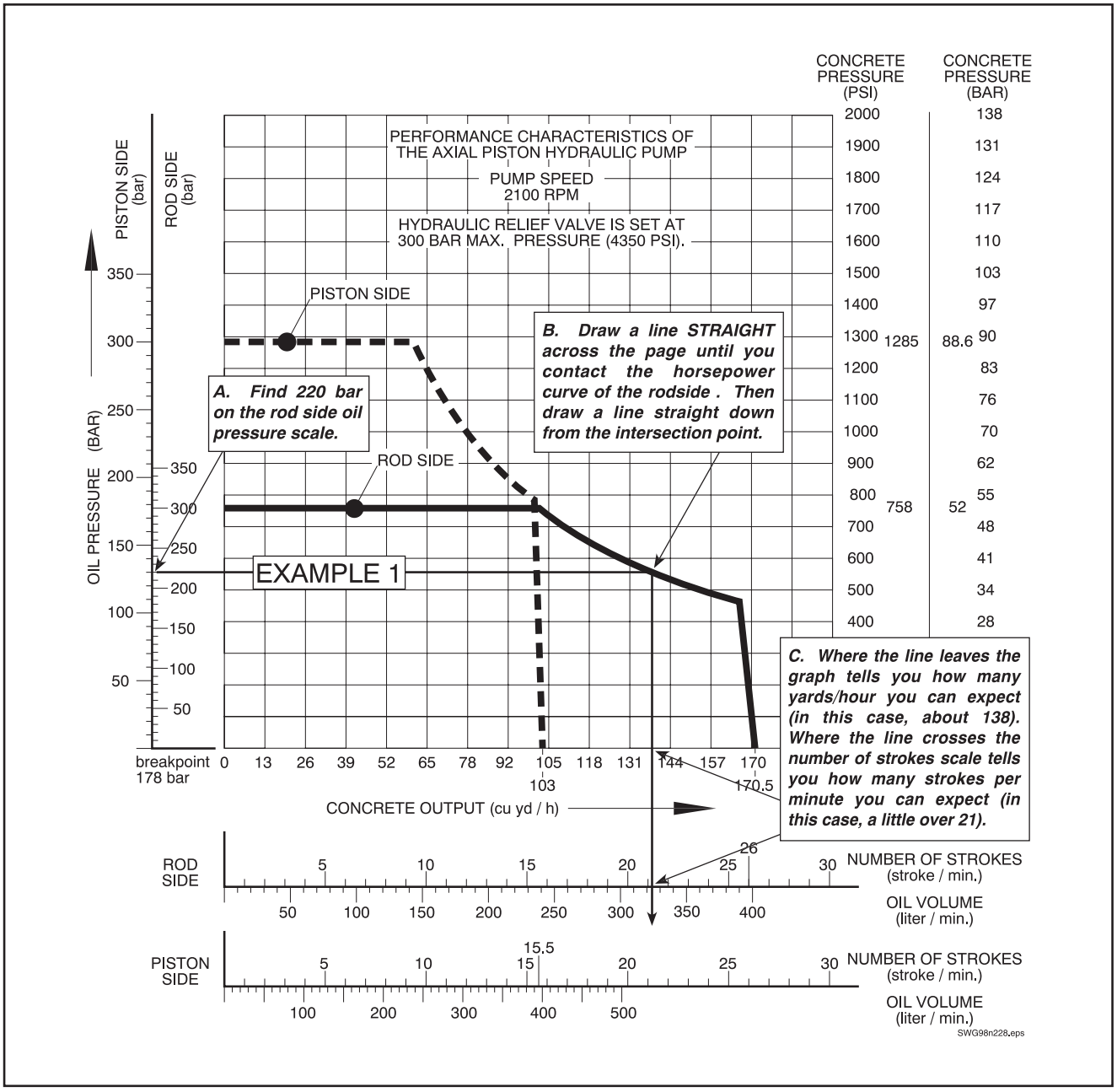
An explanation of an output chart is shown in the chart following, by some examples of chart usage. The output chart of the pump kit shipped with this manual is shown in the *Appendix*.



## 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 if your unit is acting normally: Locate the 220 bar oil pressure marking on the rod side scale (item A in the example below). Next, you draw a line straight across the page until you intersect with the horsepower curve (item B in the example below). 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 if your pumps are still in good working condition, you use the output chart and a flow meter. You test one pump at a time, multiply the readings by 2, and chart the result. You 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 that you are using the chart that applies to your unit.
- Be sure to set the RPM to the correct setting. Even a few RPM difference will give you a bad reading. Check it with a digital tach, if one is available.
- Be sure that you know how to use your flow meter. Read the instructions that came with it. Flow meters must be calibrated periodically.
- Make 2 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. You also document the breakpoint. The breakpoint is where the flow drops off rapidly. You will be able to notice it on the flow meter. If you think it would be helpful, copy the chart below. Check which reading (150 or 200 bar) you used. The breakpoint will be very close to either 150 or 200 bar, so it's not necessary to take them both. The breakpoint specification is shown on each output chart.

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

SWG98n229.eps

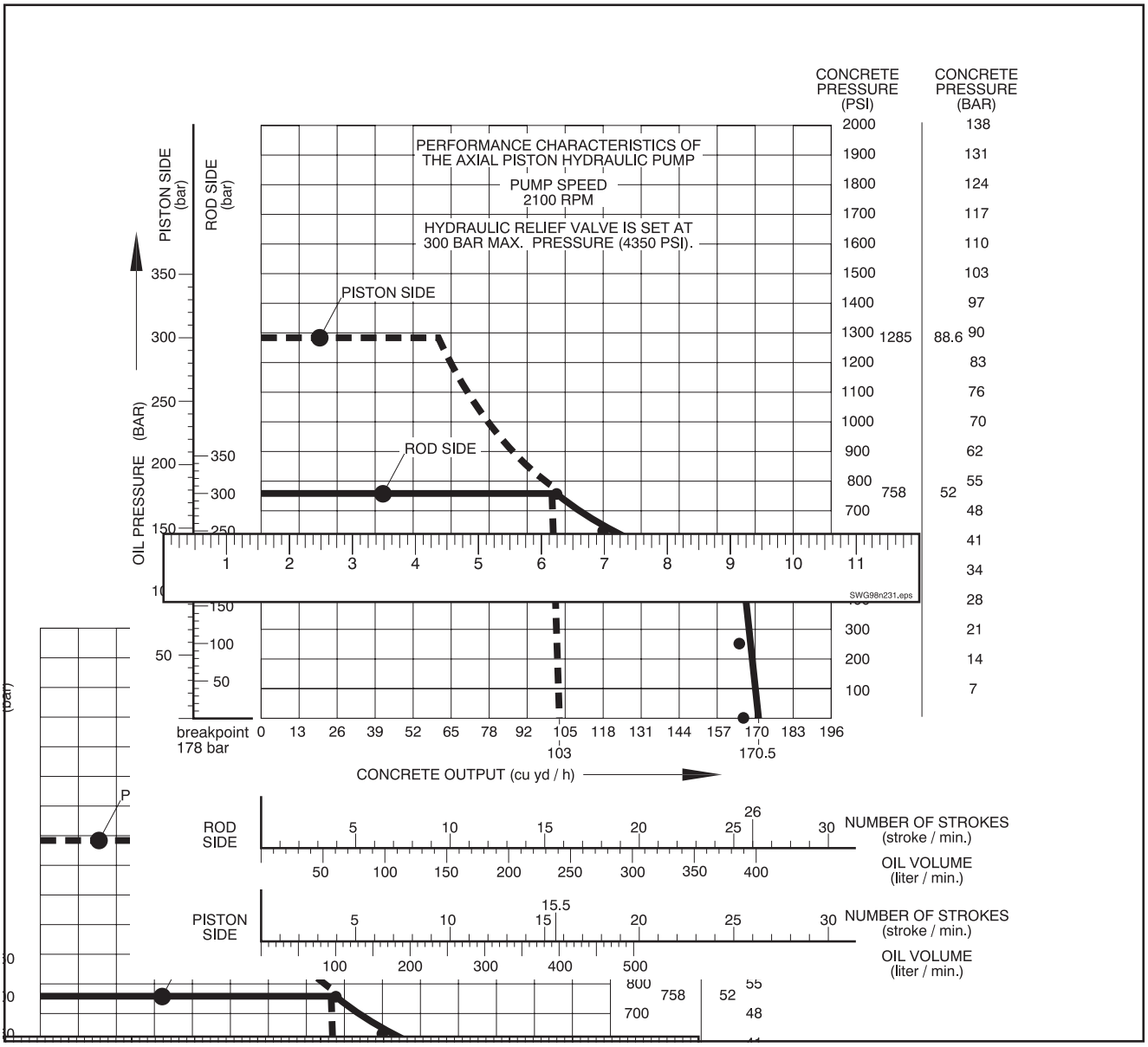
As an example, we'll pretend that we have just taken these readings:

| 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 | | | x 2 | |
| | 100 bar | 196 | x 2 | 392 | | | x 2 | |
| 178 | breakpoint | 194 | x 2 | 388 | _____ | | x 2 | |
| ☐ 150 or ☑ | 200 bar | 169 | x 2 | 338 | breakpoint | | x 2 | |
| | 250 bar | 138 | x 2 | 276 | | | x 2 | |
| | 300 bar | 117 | x 2 | 234 | | | x 2 | |

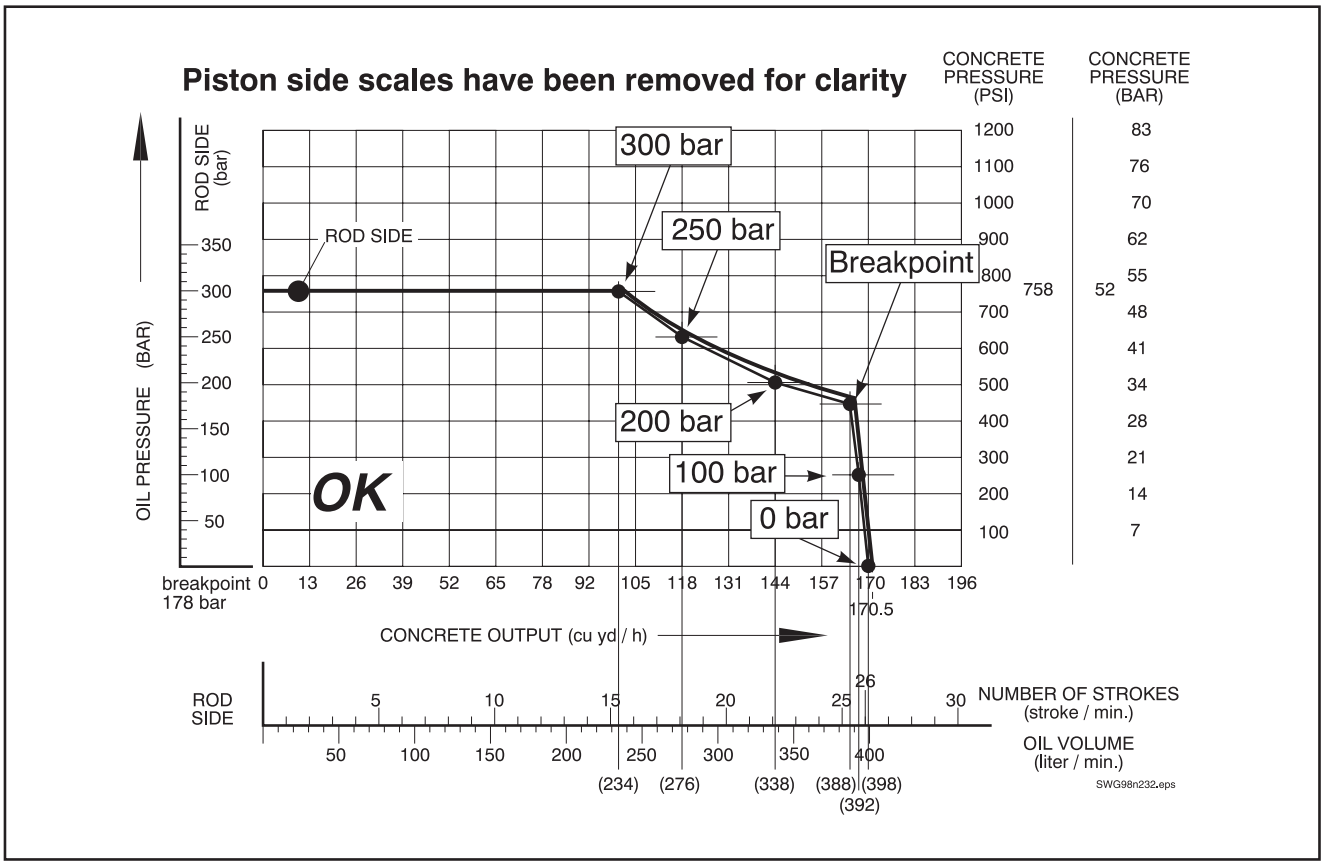
SWG98n230.eps

The next step would be to plot the readings on the output chart. Take one of your clean out put chart copies and proceed as follows:

- Lay a straight edge (a ruler or similar device) horizontally across the page, at the pressure point that you are plotting. Make a light line across the chart. In the example below we are using 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 sideways and draw a light line up the page from the liters/minute reading you took at that pressure (don't forget to multiply the reading by 2). In our example, we measured 276 liters at 250 bar.
- At the point where the two lines intersect, put a dot.
- Do the same thing with each pressure reading. You should end up with 6 dots.



Next, connect the dots. If your plotted line reasonably matches the specification plot on the chart, the pump is OK. If your line is to the lower left of the spec, the pump is getting weak. If your line is to the upper right of the spec, you've done the test incorrectly, or you are using the wrong chart. In our example, the pump is OK (see the plot below).

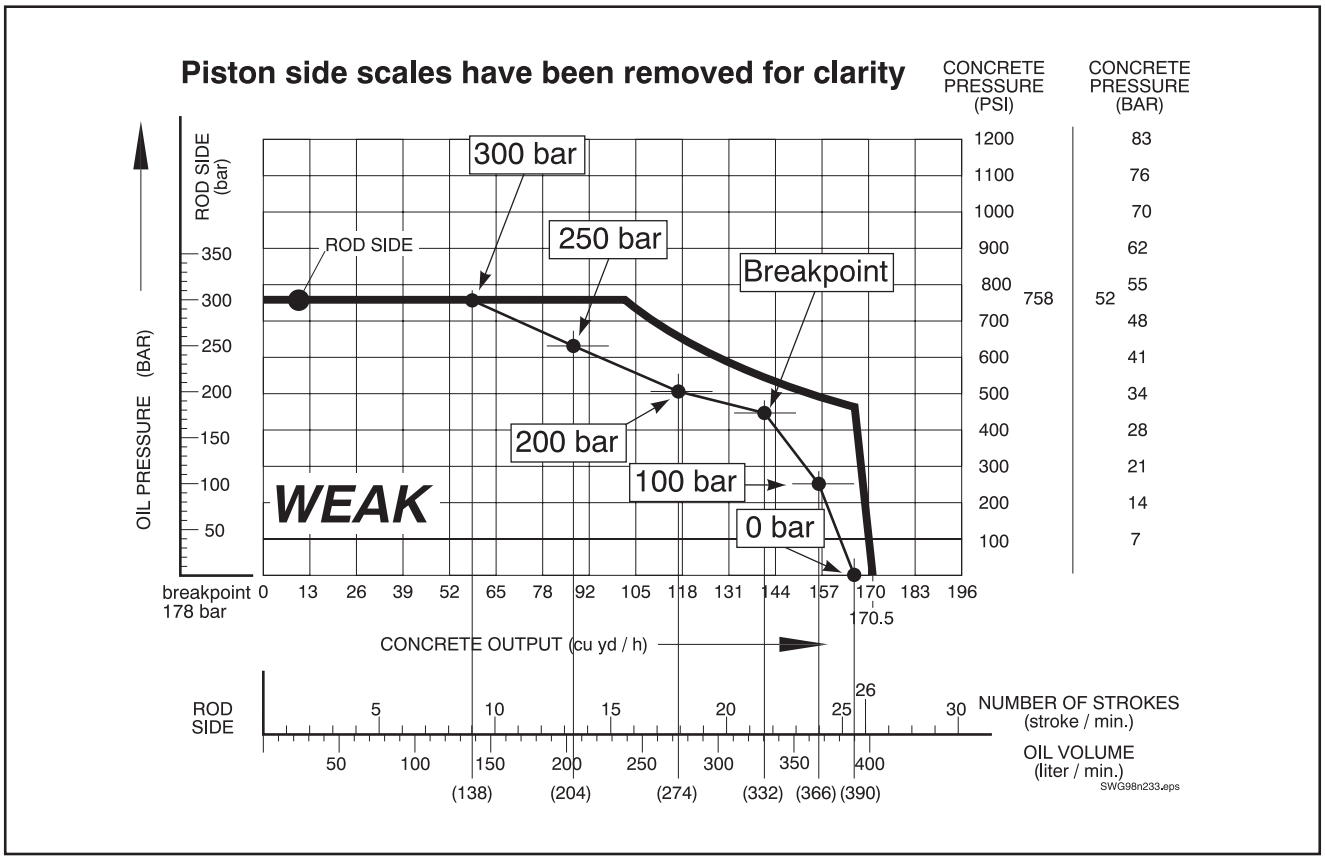



Next we need to check the 2nd pump. We hook up the flow meter just as when we checked the first pump. Again, be sure that you have the correct speed, gear, chart, etc. This time our example will have worse results.

| 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 | 166 | x 2 | 332 |
| ☐ 150 or ☑ | 200 bar | 169 | x 2 | 338 | breakpoint | 137 | x 2 | 274 |
| | 250 bar | 138 | x 2 | 276 | | 102 | x 2 | 204 |
| | 300 bar | 117 | x 2 | 234 | | 69 | x 2 | 138 |

SWG98n234.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 the chart 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. As the pump turns faster than specification, it will not be able to suck oil as fast as it is turning (it is called "cavitation" if this happens), and immediate failure could result.

If the plotted curve matches the spec for a while, but the breakpoint is too high or too low, it is possible to make an adjustment. Contact the Schwing Service Department for the procedure.

There are many different possible pump kits and power settings for each 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.

# Nomograph

## Using a Nomograph

### General Information

Concrete pumps are limited in what jobs they can do by 3 things:

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

To determine the suitability of a particular pump for a particular job, a tool is needed to estimate the power required by the job. The nomograph is this tool.

In the case of a concrete pump that is driven by it's own prime mover, such as a trailer mounted concrete pump, or a truck mounted pump with separate drive engine, the power rating (in Kw) is shown for the engine or electric motor. In the case of 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).

Assuming that you know the required output for the job, the nomograph will help you to calculate the required pressure. With known output and pressure, the power requirement can be found. The nomograph was developed by extensive trial and error testing and has proven to be accurate to within ±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. In translating the charts from spread measure to slump some approximations are used, but the ±10% accuracy will still apply. In all cases it is assumed that you will receive fresh, 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 only provide 80% filling of the cylinders, then you should multiply the output required by 1.25.

**The nomograph is divided into 4 quadrants.**

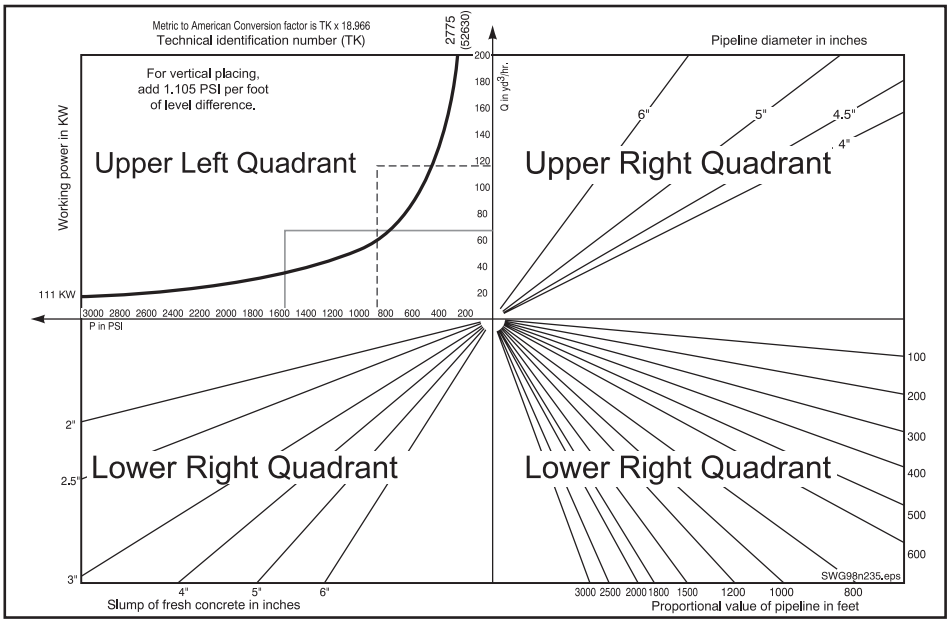



**Figure 65**
**Quadrants**

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

To use the nomograph, you begin at output required and move in a clockwise direction 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 66).

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

- We will need an average output of 45 cubic yards/hr, 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, etc. This means that when we are actually pumping, we will need an output rate of 45 ÷ .75 = **60** $yd^3$/hr.
- We will use 5" diameter pipeline for our job.
- We will have the following pipeline lengths: 30 ft. horizontal, 1 long sweep elbow, 250 ft. vertical, 2 long sweep elbows, 150 feet horizontal, 40 feet of 5" rubber hose.
- We will specify a slump of 3-4", and use the 3" line on the chart.

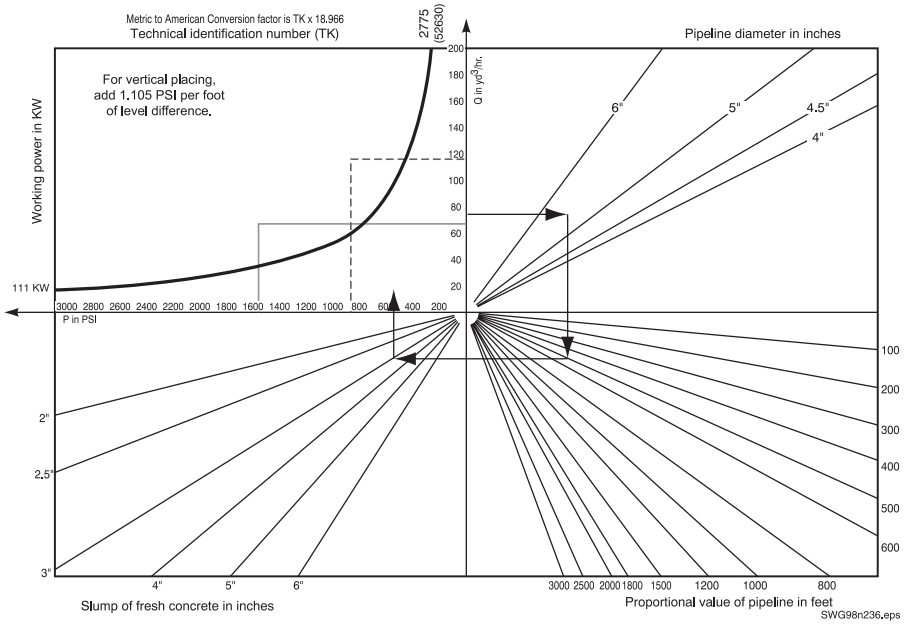



**Figure 66**
**Moving around a nomograph**

- In addition, when we add the pressure for the vertical run we will have to add 1.1 times 250 ft. = 275 PSI.

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

### A Description of the Quadrants

a. The upper left quadrant describes the power curve of a given Kw rating, and the maximum flow and maximum pressure of a particular concrete pump.

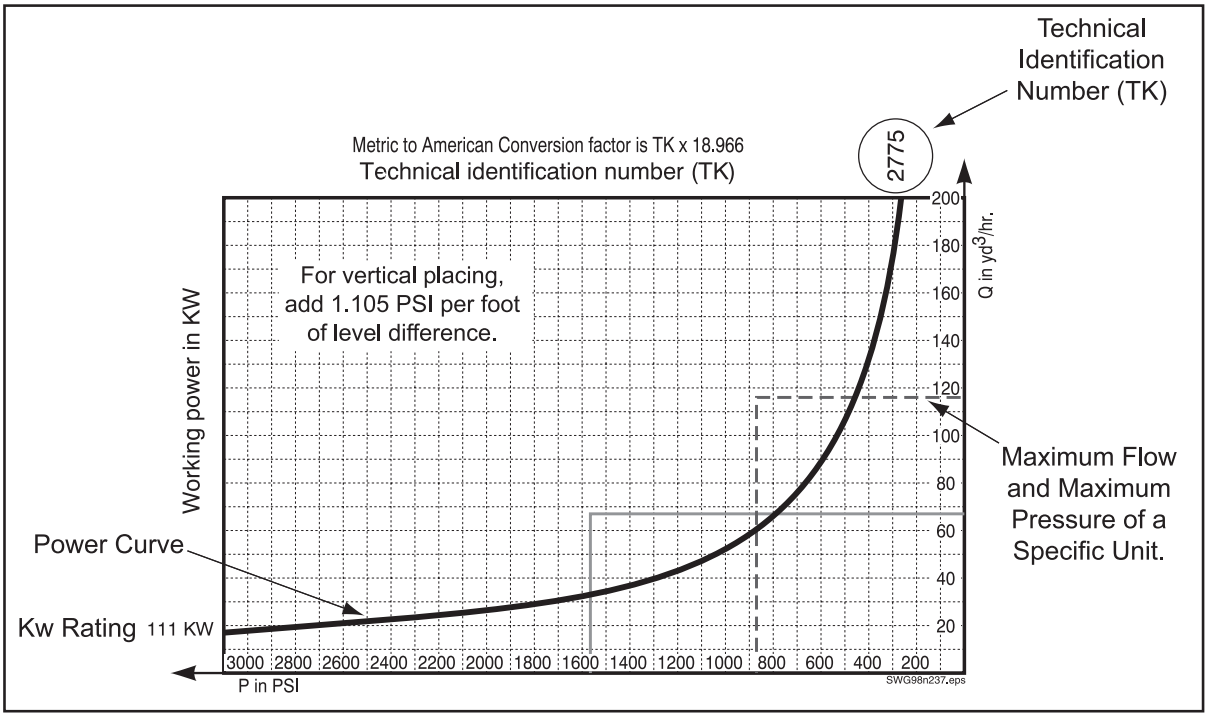



**Figure 67**
**Upper left quadrant**

Any concrete pump selected for a certain job must meet 3 technical parameters:

1. The TK number of the pump must be equal to or greater than the TK number of the job,
2. the maximum output required by the job must be available from the pump, and
3. the maximum pressure required by the job must be available from the pump.

It is important to notice the pump max. pressure and max. output even if the TK of the pump is larger than the job requirement. An example of the reason for this is illustrated in point #3 below. These parameters are decided during the design stage of the unit and cannot be adjusted on the job. If the unit has the ability 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 an equivalent amount.

1. The **Technical Identification Number** (abbreviated as TK) is the Kw multiplied by 25, and the number 25 is a constant that has several efficiency factors figured in. When using a metric nomograph (pressure in bar and flow in cubic meters per hour), the pressure multiplied by the flow will always directly relate to the TK. For example, if you needed 50 cubic meters/hour and determined that this will require 60 bar you can multiply 50 x 60, which equals 3000. Any pump you select must have a TK of 3000 or greater. If you are using a nomograph that has been converted to American units of measure (pressure in PSI and flow in cubic yards/hour) you can still multiply the pressure times the flow, but you must divide the answer by the conversion factor between metric and US units of measure to get the TK. The conversion factor for yards$^3$ to meters$^3$ and bar to PSI is 18.966. For all practical purposes you can use 19. For example, if you need 60 cubic yards/hour and determine that your job set-up will require 950 PSI, you can multiply 60 x 950, which equals 57,000. Divide this by 19 and you find that your TK requirement is 3000. Again, any pump you select should have a TK of 3000 or greater.

2. 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. Usually, the unit is designed so maximum output can be achieved only at less than maximum pressure.

3. **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 only need 20 yards/hour, but you calculate that you will need 1900 PSI pressure. The TK of this job is 2000. The pump has a TK of 2775, so there is enough power available, **BUT**... the maximum pressure available from the pump is only 1570 PSI. This pump wouldn't do the job.

b. 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" pipeline than, for example, a 4" 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" pipeline has more surface area to coat than a 4" pipeline (49% more), the volume of concrete that can move on the layer is increased by 125% which results in lower velocity of the concrete (in feet per second), lower friction, and therefore lower pressure. A pump that may not be capable of completing a difficult job through 4" or 5" pipe may very well be able to do it through 6" pipe.

**NOTE!**

**Experience has taught us that 5" is the optimum pipeline size for lengthy vertical runs such as those found on a high rise building. It is large enough for most aggregate, but small enough that you minimize backers when the concrete valve cycles. You must also consider the men at the point of placement. There are very few, if any, hose men that can move 6" 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" to 4" pipe you should calculate the chart as if you were using 4" pipe for the entire distance. This will not be completely accurate, but you will be safe in your pressure calculation. In our example, we will use 5" pipeline (Figure 68).**

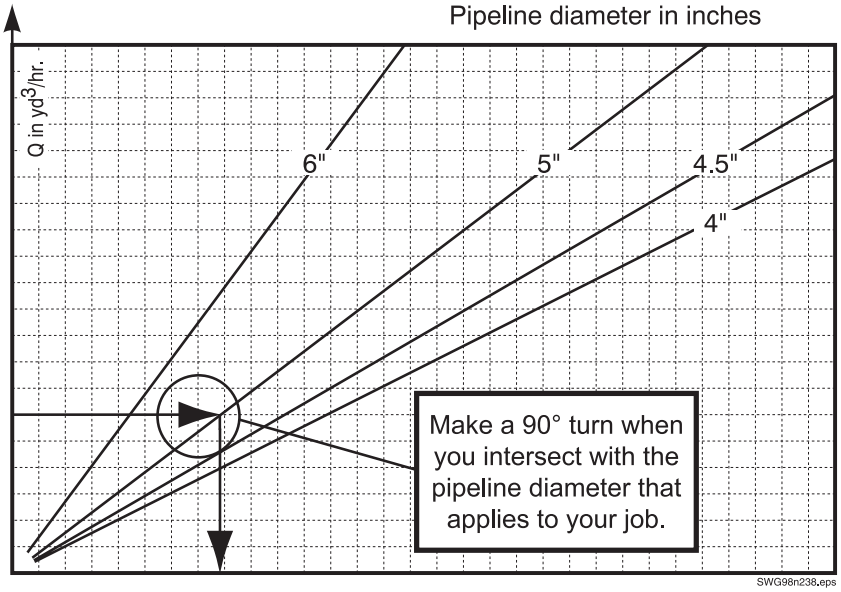
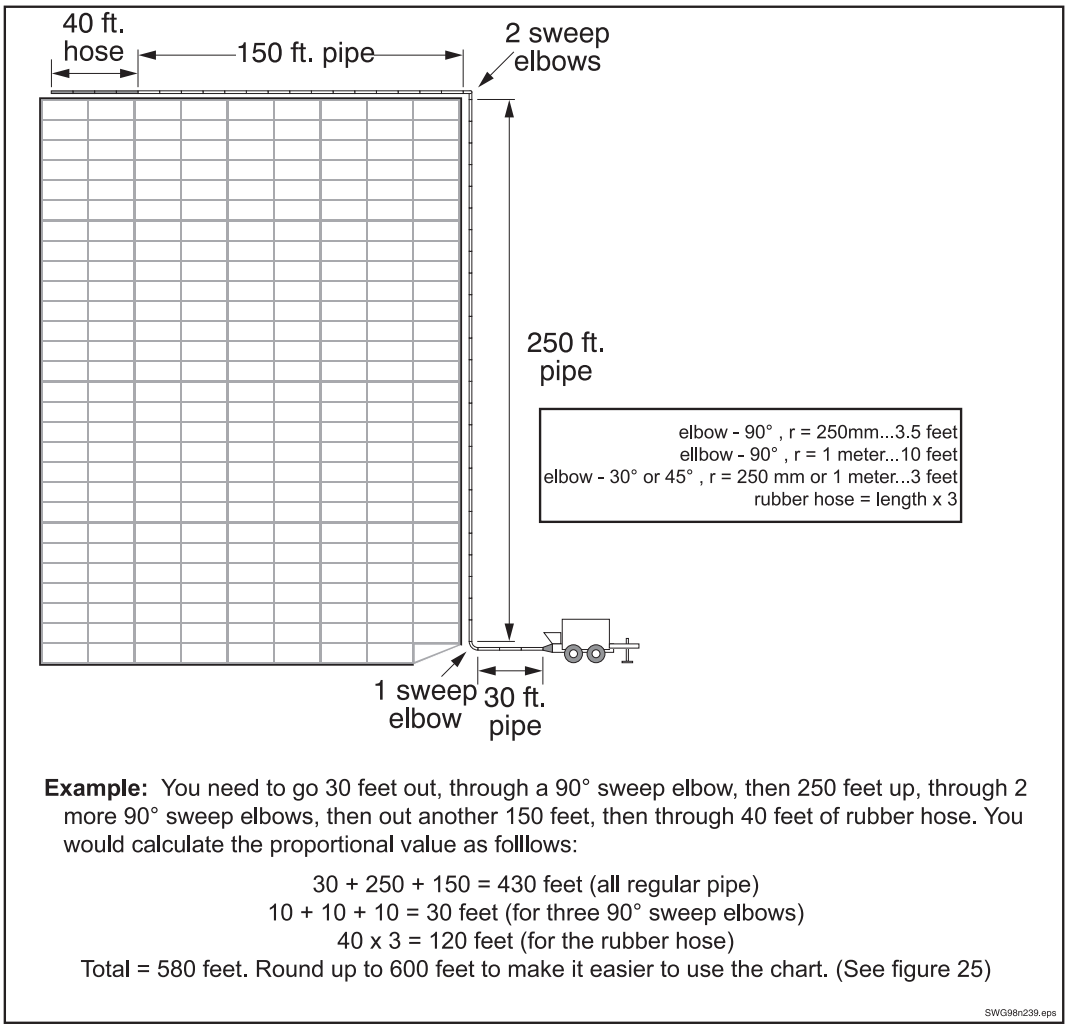



**Figure 68**
**Upper right quadrant - Pipeline diameter**

When the output line intersects the pipeline diameter that corresponds to your job, you should draw a line straight down into the lower right quadrant, as shown in Figure 68.

c. 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 amount of bends, the increased resistance of flow in rubber hose, etc. It is more a measure of the resistance to flow than a length measurement. To calculate the proportional value of your pipeline, the following criteria will apply:

- 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 3 times as much resistance as the same length of steel pipe (e.g. 12 feet of rubber hose has the same resistance as 36 feet of pipeline).
- all distances should be figured equally whether they are horizontal and vertical. The increased pressure required to push concrete vertically is accounted for by adding pressure, not distance. Our example pipeline is shown below (Figure 69).




**Example:** You need to go 30 feet out, through a 90° sweep elbow, then 250 feet up, through 2 more 90° sweep elbows, then out another 150 feet, then through 40 feet of rubber hose. You would calculate the proportional value as folllows:

30 + 250 + 150 = 430 feet (all regular pipe)
10 + 10 + 10 = 30 feet (for three 90° sweep elbows)
40 x 3 = 120 feet (for the rubber hose)
Total = 580 feet. Round up to 600 feet to make it easier to use the chart. (See figure 25)

SWG98n239.eps

**Figure 69**
**Calculating Proportional Values**

Once you have calculated the proportional value of your pipeline, you can 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 above, we will use 600 feet as our proportional value (Figure 70).

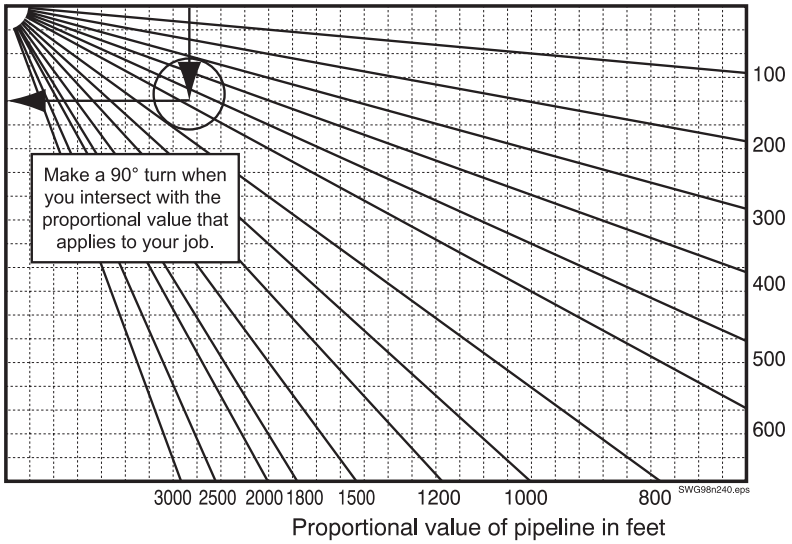



**Figure 70**
**Lower right quadrant - Proportional Value of Pipeline**

d. The **lower left quadrant** refers to the pumpability of the concrete. If the concrete specifications allow a range in slump (for example 3 - 4"), you should always use the lower end to be safe. In our example, we use 3" slump. You extend the line from the lower right quadrant until it intersects with the 3" slump line, then make a 90° turn clockwise, which will lead you back into the upper left quadrant through the pressure scale (Figure 71).

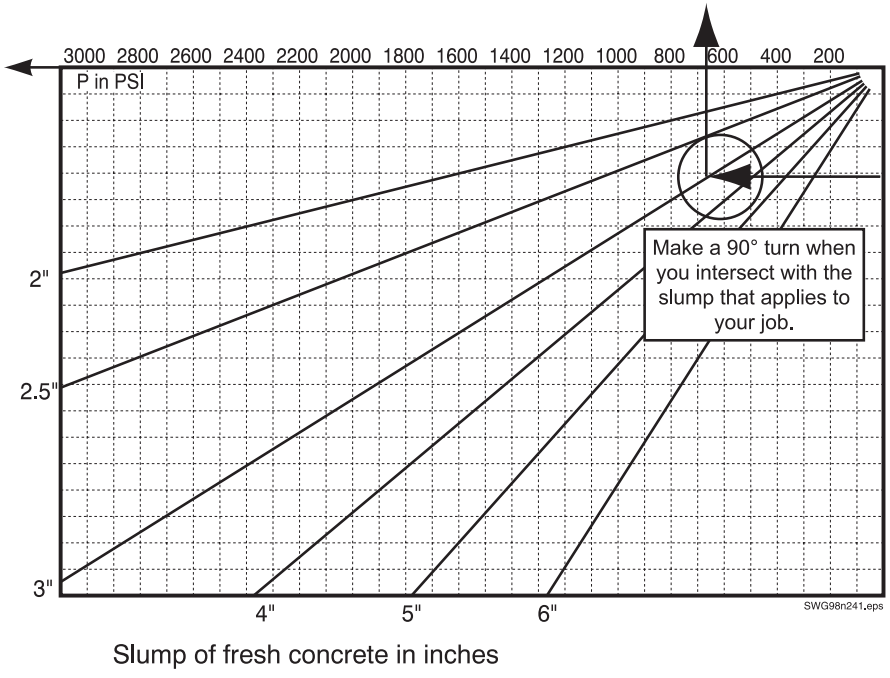



**Figure 71**
**Lower left quadrant - Pumpability of the Concrete**

As you can see by the chart in Figure 71, we are re-entering the upper left quadrant through the pressure scale at about 650 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 250 foot vertical run, we must now add 1.1 x 250 = **275 PSI** to the 650 PSI from the chart.

**650 PSI+ 275 PSI = 925 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 TK of our job can be calculated like this:

**TK = (PSI x yd$^3$/hr) ÷ 19**

We need a unit that is capable of 925 PSI, and 60 yd$^3$/hr. The TK of this job is:

**TK = (925 x 60) ÷ 19**

**TK = 55,500 ÷ 19**

**TK = 2921**

The unit must have a TK of over 2921 and it must be able to pump 60 yd$^3$/hr and 925 PSI **Simultaneously.** Look at the pump shown in our sample nomograph (Figure 72).

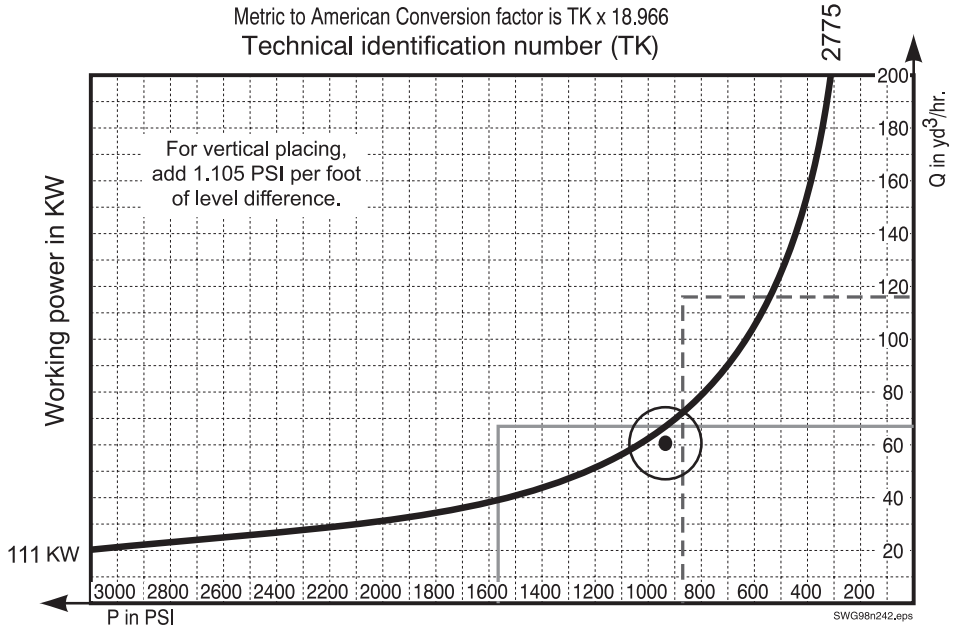



**Figure 72**
**Is this unit sufficient for the job?**

- Can the unit pump at 925 PSI - YES
- Can the unit pump 60 yd3/hr? - YES
- Can the unit pump both simultaneously? - NO! This unit will not do the job.

The engine is a little bit too small. The intersection of 60 yards$^3$/hr and 925 PSI has been plotted for visual representation, but you can see immediately that the TK of the job (2921) is bigger than the TK of the unit (2775). The curved black line represents the TK of the unit. If the unit is going to be able to handle the job, the intersection of pressure and yds$^3$/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 engine. What if we could order this same unit with a slightly bigger engine? The TK of the bigger engine is 3300. This should work. Plotting the intersection of our hypothetical job again, you can see that it falls within the power zone of the engine (Figure 73).

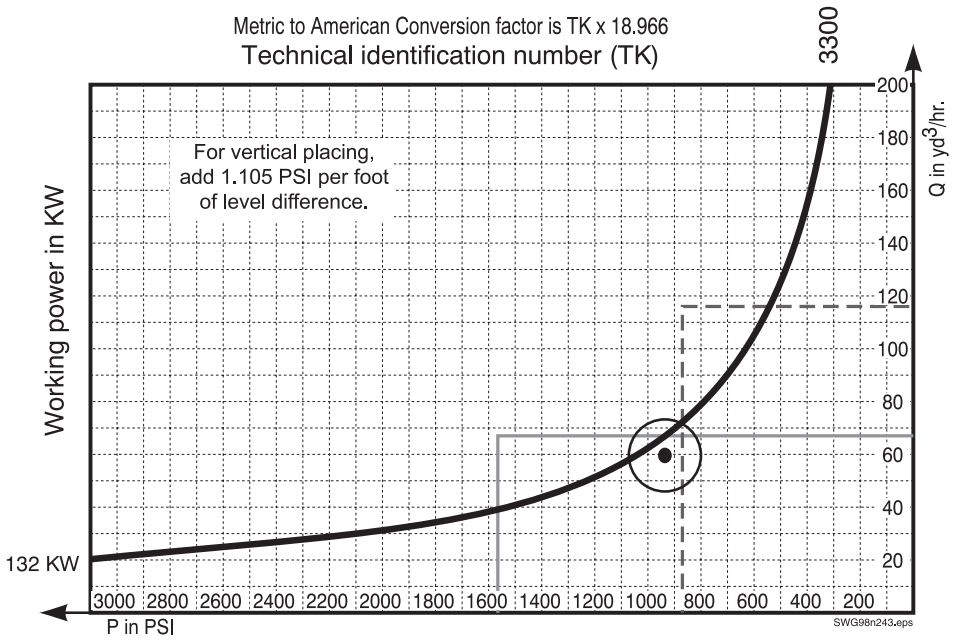



**Figure 73**
**Same model pump with a bigger engine.**

Bearing in mind that the nomograph should only be considered accurate to within ± 10%, you should always calculate conservatively, and allow for the graph tolerance. In the case of the pump in Figure 73, we should still be safe even if the pressure required were 10% greater (1017 PSI).

What if you already own the pump shown in Figure 72? Is there anything that can be done to the job specifications to make the pump with the smaller engine work? You could use the smaller TK unit shown if Figure 72 if you can get an OK to do any of the following things:

- Pump the top of the building at 50 $yd^3$/hr instead of 60 $yd^3$/hr.
- Pump the top of the building at a 4" slump instead of 3" (this would still be within specifications).
- Remove some of the rubber hose at the end of the horizontal run.

With job circumstances that did not require a substantial vertical run, you could also use 6" instead of 5" diameter pipeline.

# Weld On Ends / Coupling Comparison

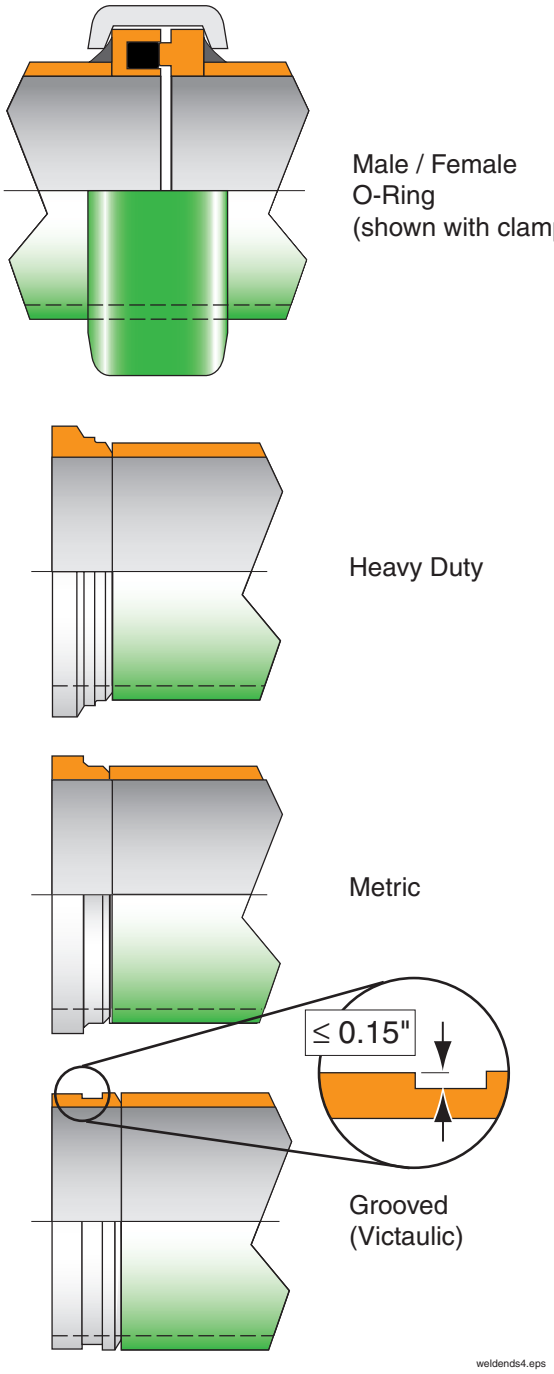
Shown is a comparison among commonly used ends/couplings. No two ends shown can be joined without the use of an adapter pipe or a special adapter clamp. Clamps and pipe strength must also be considered when determining proper system requirements. The ratios shown in the text below represent the safety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

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

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

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

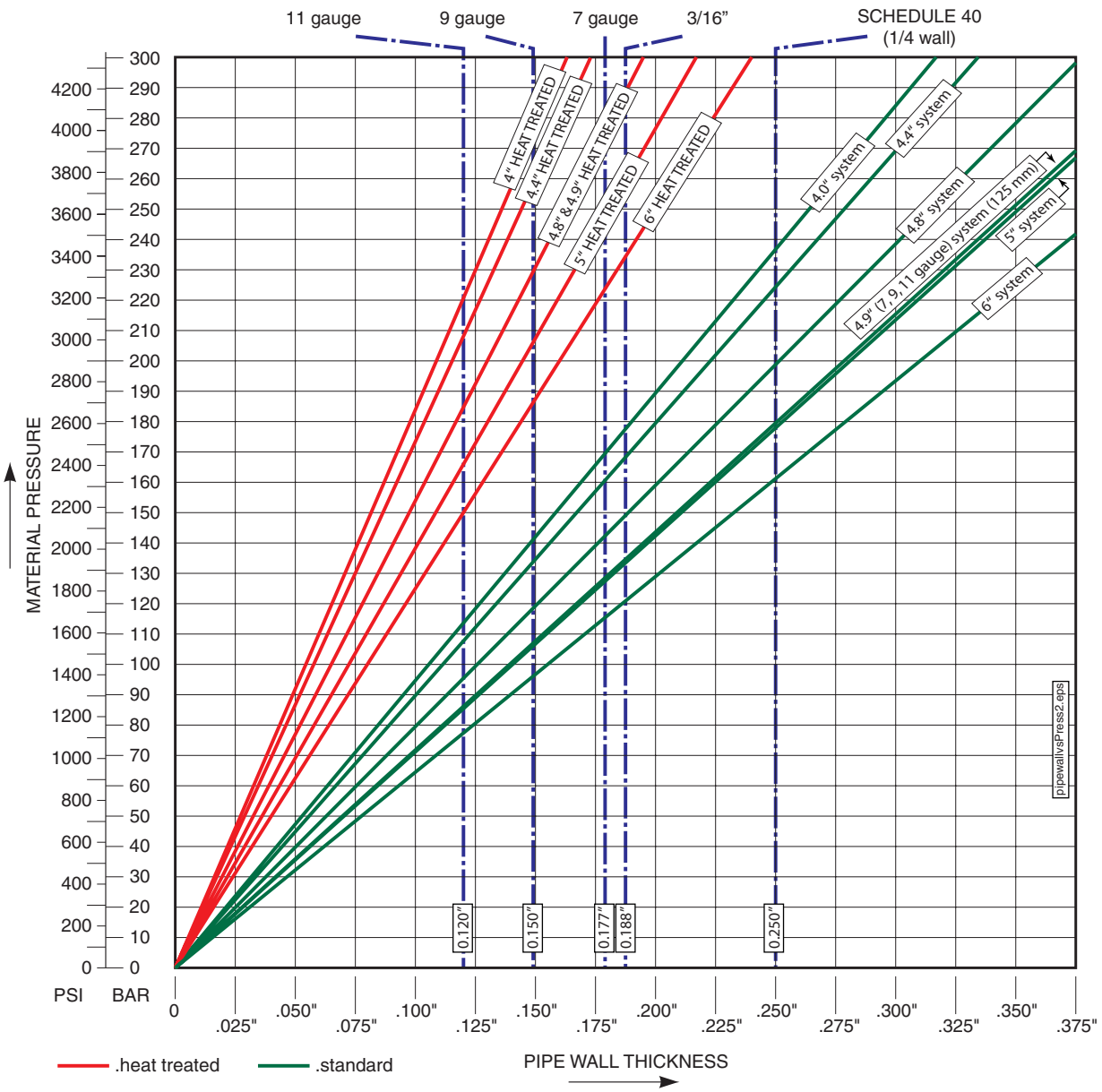
4. Grooved couplings (lip height of 0.15” or less) are designed for pressures only up to 750 PSI @ 2:1. The recessed groove is hard to clean when changing pipe on a job. The weld-on end fails before the pipe because the groove is cut into the pipe thickness, making it the weakest spot. Grooved couplings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




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

# MInimum Pipe Wall Thickness

## Minimum Pipe Wall Thickness As a Function of Pressure




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.

# Glossary of Terms

The following is a list with descriptions of some of the terms used in this manual (this includes the glossary of terms found in the Safety Manual Appendix section):

## Accumulator

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

## Agitator

A device 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

## 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

Simply put, if the pump is pushing and concrete fails to come out at the point of discharge, it is called a blockage. The causes of blockages are detailed in Section 6 of this manual. In all cases, blockages can create a dangerous situation by causing high concrete pressure, combined with the sometimes uncoordinated efforts of untrained workmen to remedy the problem.

## Bulk Density

The mass of a substance per volume. For example, 1 cubic foot of air weighs much less than 1 cubic foot of water. 1 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 that has been issued a certification card by the American Concrete Pumping Association. There are several classes of certification, each relating to a different category of pump. For an operator to become certified, he (she) must pass the tests given regarding operation, set up, and clean-out for each category of pump, plus pass the safety rules test which is common to all certification categories, plus meet the experience requirements set forth for each category, plus maintain a safe and clean driving record. Certified operators are considered qualified operators (in regards to 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 that 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, outriggers, towers, etc. must be certified to AWS D1.1 Sections 3, 5, and paragraph 9.25 of Section 9 AND/OR EN287-1/ PREN288-3.

## Concrete Pressure

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

## Conductors

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

## Decibels

One tenth of a bel. Abbreviated dB. It is a measurement of volume. 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, O.S.H.A. has developed guidelines for time limits on exposure to sound at different volume levels. The chart can be found in Section 6 of this manual.

## Drive Engine

The primary source of power for a hydraulic system. Typically, the word “engine” denotes an internal combustion device, where as the word “motor” denotes an electrical device. *See also:* Prime Mover

## Electrocution

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

## EN 287-1 / PREN 288-3

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

## Expert

As used in this Safety Manual, an expert is defined as: persons that, on the basis of their specialized training and experience, have developed a high degree of knowledge and skill in the areas of concrete pumps, concrete pumping, clean-out procedures, generally accepted engineering norms, and safety regulations to the point that they are able to evaluate equipment and processes as they relate to job safety. They would 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

## Foreign Material

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

## Go Devil

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

## Guide

An assistant brought in to help in backing up a truck or trailer, or other circumstances where the driver cannot

see enough to assure safety. *See also:* Spotter

## High Voltage

For the purposes of this manual, anything over 120 volts AC will be considered high voltage. In the U.S., electrically driven concrete pumps normally operate the motors at 480 volts AC (high voltage) and the controls at 24 volt DC (low voltage). When dealing with electric wires in residential or industrial areas the voltage will be approx. 8000 volts to ground, or 13,800 volts from phase to phase (distribution voltage). When dealing with electric wires that are mounted on steel towers, high above the ground, the voltage will range from 100,000 to 1,000,000 volts (transmission voltage).

## Hopper Grate

A meshwork placed over the concrete hopper, typically made from steel bars. It serves the functions of keeping human body parts away from the agitator (when left in its proper position), and keeping large foreign objects from falling into the hopper, which could cause blockages if they were pumped. The hopper grate MUST be secured into position 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, and in these cases the work should still be carried out by competent professionals. Under no circumstances should high voltage connections be made by a concrete pump operator or related personnel.

## Maintenance

All procedures for 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, electrical wires, etc. and still leave room for errors in human judgement or machine malfunction. With electrical wires under 350 Kv in the U.S., this distance is 20 feet, as recommended by the American Concrete Pumping Association. This distance may have other values in different countries.

## Murphy’s Law

An old saying that goes like this: “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 due to the nature of the machinery or process in use. Do not allow unauthorized presence in this area for safety reasons.

## O.S.H.A.

Occupational Safety and Health Administration. A branch of the United States federal government that deals with job safety. They establish and enforce safety regulations for industry and business. Among the areas over which they have authority are construction job sites and work shops.

## Personal Protective 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 when you have to stand in concrete
- Hard hat

## Point of Discharge

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

## Pour

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

## Prime Mover

The primary power source for a hydraulic system. The term “prime mover” is generic in that is denotes neither an internal combustion engine nor an electric motor.

## PTO

Power Take Off. A switchable output from the transmission or an intermediate gearcase. On a concrete pump it is used to divert the power from the engine and drive train to turn the hydraulic pumps.

## Qualified Operator

An individual that has:

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

## Qualified Personnel

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

## Qualified Workshop Personnel

An individual that:

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

duties, as assigned, in a reliable manner.

## Rock Jam

A specific type of blockage caused when the cement and fines of the concrete are not present in sufficient quantity to fully coat the larger aggregates and the walls of the delivery system. In these cases, the rock (larger aggregates of the mix) will form a wedge inside of the pipe. Resistance to movement then becomes overpowering and the concrete stops. 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 that is laid between the concrete pump and the point of discharge, other than the placing boom pipeline.

## Shut-Off Valve

In hydraulics: a valve with the ability to stop the flow or pressure of hydraulic oil. Must be able to withstand the maximum pressure of the hydraulic circuit that it controls. In concrete: A manually or hydraulically operated valve that will prevent the flow of concrete in either direction. Some concrete shut-off valves also have the ability to divert the flow of concrete to a different pipeline, for example, to a discharge point for clean-out. The shut-off valve must be able to withstand the maximum pressure on the concrete of which the pump is capable.

## Soil Pressure

The force per square area that is exerted on the ground by the outrigger legs. The amount of pressure that the soil will support varies with the composition and compaction of the soil. To make a determination on the stability of the soil, see the chart in Section 5 of this manual.

## Sponge Ball

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

## Spotter

A spotter is a person that stands at a vantage point where he (she) can see both the point of discharge and the operator of the pump. The spotter would then direct the operator to operate the unit as required by the job circumstances with 2 way radios or hand signals. A spotter can be anyone that 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 lateral stabilization of the pipeline. It stabilizes and supports the vertical run by virtue of its enormous mass (normally one cubic yard or larger).

## Towing Vehicle

In this manual, “Towing Vehicle” applies only to trailer mounted concrete pumps. It is the vehicle that you will use to tow the trailer on the road,

job site, or in the yard. Size and condition of the towing vehicle is extremely important in these applications. See the safety rules regarding this subject in Section 4 of the Safety section.

### Transport Position

This relates to the position of the boom. Boom is completely folded and lowered into the rests. For traveling, the boom straps must be secured. When stowing in the traveling position because of a thunderstorm, for example, but no travel is imminent, the boom straps need not be secured.

### 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 manufacturers 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 would be 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 not in immediate use.

### Vertical Run

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

### Water Jet

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

## Additional Reading Material

This is a partial listing of the books that have been written on the subject of concrete pumping. Books that were omitted were done so unintentionally.

- "Pumping Concrete and Concrete Pumps" by Karl Ernst v. Eckardstein, published by F. W. Schwing GmbH
- "Pumping Concrete - Techniques and Applications" by Robert Allen Crepas, published by the Aberdeen Group
- "Nomographs - A guide to usage" by Robert Edwards, © 1992, Schwing America, Inc.

# 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 | Mobile UNIVIS N46 |
| Gearcase oil | HD 80w-90 |
| Truck fluid levels | See owners manual for your specific truck |
| Compressor oil | Mobil Rarus 427 or 429 |
| Grease for spline and couplers | Optimoly Paste White T - 250 grams |
| Grease for autogreaser | EP2/NLGI No. 2 |
| Dry nitrogen | Any brand of dry nitrogen is suitable for recharging accumulators |

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### Hydraulic Oils other than Mobil UNIVIS

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 |

- 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 $\beta$ 25 = 200 or finer.

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- The following table shows the characteristics of Mobil UNIVIS N46. You may use this information for comparison with other brands.

| ISO Viscosity Class | Viscosity cST @ 40° C | Viscosity cST @ 100° C | Viscosity Index | Flash point °F | Pour point °F |
|---|---|---|---|---|---|
| VG 32 | 32 | 6.39 | 151 | 208 | -48 |
| VG 46 | 46 | 8.19 | 152 | 216 | -48 |
| VG 68 | 68 | 11.0 | 151 | 222 | -42 |

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- 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. If you're considering using biodegradable oils, please contact Schwing Service Department for advice about which might be acceptable for use in your Schwing.

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## Gearcase Oils

A) for distribution gearcases

| Brand | Viscosity / DIN quality designation<br>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<br>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<br>VG 100 / VDL | <br>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 |

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### Grease

A) For filling the automatic greasers

| Brand | Viscosity / DIN quality designation<br>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<br>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 |

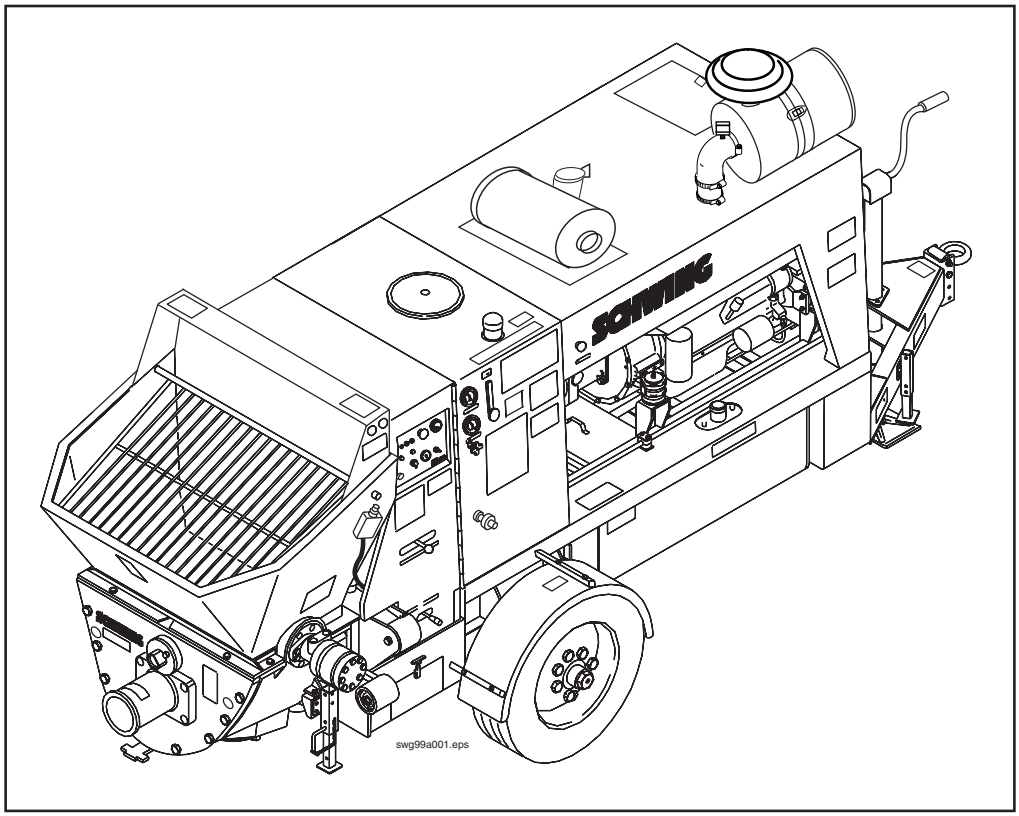
- The order of the lists is meaningless. Any grease that meets the quality designation and viscosity specification may be used.

OM19A

## End of Life Protocol

Schwing is committed to preserving the earth in a usable state for generations to come through proper recycling.

When your concrete pump reaches the end of its life cycle and is no longer usable, it is very important to dispose of it properly. The most practical method of doing so would be to ship it back to Schwing. If you choose to dispose of it yourself, you must be sure to separate all electronic and hydraulic components, and break them down to remove all precious metals and hazardous materials which must be disposed of individually.




# ALPHABETICAL INDEX

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## B



## C



## D



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## P



## R



## S

## T



## V



## W