



Operators Manual

**** M4-H ****

USE IN CONJUNCTION WITH OEM MANUALS (ENCLOSED)

Unit Serial No. _____

Hydraulic Motor

SNM2/19C106 – Serial No. _____

Gorman-Rupp Pump

GR-84B2 – Serial No. _____

Control Valve

Brand FC51 Serial No. _____

Links relating to this Manual

www.stsmixers.com

www.grpumps.com

Dealer

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Limited Warranty

United States and Canada

Surface to Surface Inc. or its subsidiary which last sold the product, warrants new products sold by it for use in the United States and Canada to be, at the time of manufacture, free from defects in workmanship and materials. This warranty covers for a period of **Twelve (12) Months** of operation from the date of delivery for initial use, whichever comes first.

Exclusions and Additional Limitations

1. This warranty relates to the condition of the product at the time of manufacture and does not cover parts or service as a result of:
 - (a) Normal wear and tear or required maintenance including, without limitation, adjustments or replacement of components subject to wear and tear, such as belts, hoses, seals and/or packing, fuses, bulbs, switches and ignition parts.
 - (b) Abuse including, without limitation, neglect, improper operation, misapplication, overloading, accident or alterations not approved by Surface to Surface Inc.
 - (c) Lack of maintenance, including, without limitation, failure to inspect and maintain, improper repair, use of "unapproved parts", cracked engine heads and blocks unless caused by the failure of an internally lubricated part or repair of engine valves, rings or guides.
 2. The Company's warranty does not apply to purchased components manufactured by others where separate warranty is made by the manufacture of such components and will be applied as interpreted by the supplier.
 3. All claims under his warranty shall be submitted in writing by the distributor to the Company, which will be the sole judge in determining the merits of the claim.
 4. The company shall have the right to have all products or parts claimed to be defective returned to it and the cost of shipping such items shall be borne by the distributor.
-

Warranty Registration Card

In order to help us provide complete service for our product, please complete this card and return it.

If not returned, all requests for warranty will be denied.

Print Name:

Address:

City:State/Province.....Zip/PC.....

Model No. Serial No.

Date of Purchase Dealer

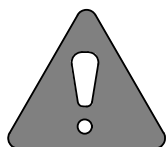
**Return to: Surface to Surface Inc.
5150 Forest Rd. RR#3
Watford, Ontario, Canada
N0M 2S0**

SAFETY STATEMENTS

Your personal safety and the safe operation of this unit are the concern of Surface to Surface Inc, and by reading and understanding this manual and understanding the safety statements, you will decrease the risk of personal and equipment damage.

Safety statements are listed here and throughout this manual to draw your attention to potential hazards that may be encountered while operating this piece of equipment. While reading this manual, you will notice that certain safety statements will relate directly to the operation, or maintenance of that particular part of the unit and should be followed carefully. Decals on the unit also follow the same format as the warnings in this manual, and therefore should be kept in good repair to alert the operator and others of the potential hazard.

The engine / motor manual also contains hazard warnings which pertain to the engine / motor and should also be followed.



This safety alert symbol appears with most safety statements.

It means attention, become alert, your safety is involved!

Please read and abide by the message that follows the safety alert symbol.

DANGER

Danger (the word "DANGER" is in white letters with a red rectangle behind it) indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury. Danger is limited to the most extreme situations.

CAUTION

Caution (the word "CAUTION" is in black letters with a yellow rectangle behind it) indicates an potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

WARNING


Warning (the word "WARNING" is in black letters with an orange rectangle behind it) indicates an potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Caution "without the safety alert symbol" indicates an potentially hazardous situation that can cause damage to the, machine, personal property and / or the environment or cause the machine to operate improperly.

SAFETY STATEMENTS

The following caution statements have been drawn from the instructions in this manual. They have been assembled here for ready reference.

 DANGER
IN AN EMERGENCY rotate the flow control valve lever to the STOP position to halt the pump, and fluid flow.

 WARNING
DO NOT REMOVE OR MODIFY SAFETY COVERS OR GUARDS. Serious personal injury will result.


 DANGER
NEVER ATTEMPT REPAIRS OR DISASSEMBLY without shutting off the hydraulic power source (customer supplied) Serious personal injury will result.

 WARNING
NEVER ATTEMPT TO REMOVE OR CLEAN THE FILTER SHEAR while the unit is in operation. Serious personal injury will result.

 DANGER
HYDRAULIC FLUID UNDER EXTREME PRESSURE Escaping fluids under pressure can penetrate the skin causing serious personal injury or death.

 CAUTION
DO NOT POSITION ANY PART OF YOUR BODY over the hopper, valve, or mixing tee while cleaning.

 WARNING
NEVER USE BODY PARTS, OR FOREIGN OBJECTS in an attempt to unplug or clean the hopper valve or mixing tee. Serious personal injury or damage will result.

 CAUTION
WHEN THE UNIT IS IN OPERATION, the fluid in the piping may reach pressures up to 50 p.s.i.

M4-H

SAFETY STATEMENTS *continued*

The following caution statements have been drawn from the instructions in this manual. They have been assembled here for ready reference.

CAUTION

TRAPPED FLUID MAY BE PRESENT
and will spill out when piping, hoses,
pump or filter shear are removed.

CAUTION

NEVER LEAVE LIQUID IN THE
PUMP CASING, PIPING, OR HOSES
during freezing weather conditions,
as damage will result.
Follow instruction for winterizing.

CAUTION

AVOID ALLOWING FOREIGN MATERIAL
into the Venturi Mixing Tee thru the
Hopper, by keeping the valve closed
when not in use.

CAUTION

**BEFORE STARTING THE HYDRAULIC MOTOR,
BE SURE THE PUMP IS PRIMED!**

Check the pump by slowly & carefully
opening the plug located on the top of the
centrifugal pump beside the discharge elbow.
A visual inspection can be made if the fluid
escapes around the plug as it is loosened.
Remove the plug to view inside fluid level.
The centrifugal pump seal WILL be
damaged if allowed to cavitate or run dry.

CAUTION

WHEN TRANSFERRING FLUID
to the drill rig, fluid pressure may
reach or exceed 50 p.s.i.
CHECK the drill rig manufacturers
specifications regarding maximum inlet
pressures allowed for their pump.

CAUTION

IMPROPER INSTALLATION OF THE
MECHANICAL or GREASE SEAL
will result in leakage and possible
damage to the seal. All maintenance,
operating and repair of this unit, must be
done per the instructions in the operators
manual for safety and reliability.

CAUTION

CARE MUST BE TAKEN WHEN
INSTALLING THE COUPLER GASKETS.
If the gaskets are not properly lubricated
and installed, a leak may develop.

SAFETY STATEMENTS *continued*

The following caution statements have been drawn from the instructions in this manual. They have been assembled here for ready reference.

CAUTION

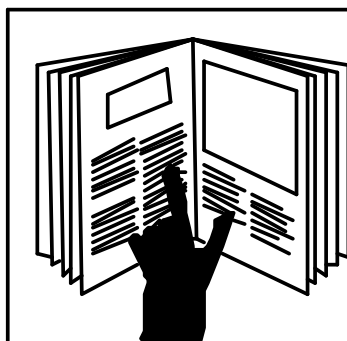
The manufacturer should be consulted when considering alternative uses for this piece of equipment.

This unit was designed for the mixing and shearing of a dry additive, into a liquid stream.

Other uses may create unforeseen safety issues and personal injury risk.

CAUTION

LIFTING LUGS OR THE LIFTING POINT(S) identified and labelled on the skid structure must be used in order to safely lift and transport the unit.



WARNING

REFER TO THE SAFETY STATEMENTS IN THE OEM SUPPLIED MANUALS AND THIS MANUAL REGARDING THESE OPERATIONS.

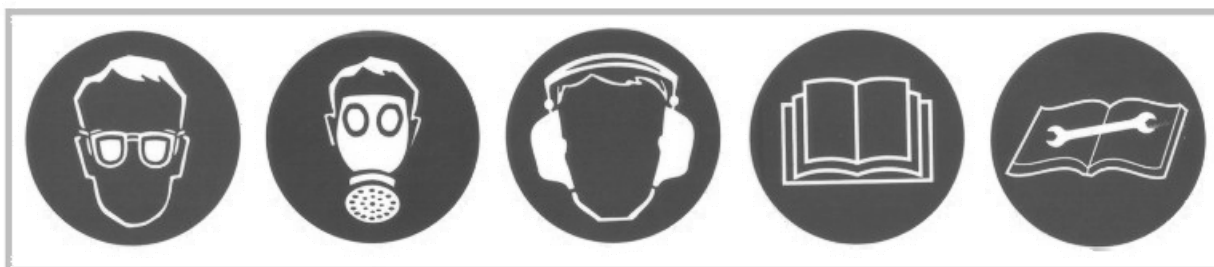
M4-H

Safety Markings

Hazard and warning markings have been placed at appropriate points on the unit. International symbols have been used, in order to ensure universal understanding of the nature of the hazard. Please comply with all warnings and markings to ensure safe use of the equipment. These include but are not limited to:

- | | |
|---------------------------|--|
| a) Lifting points | b) Flammable Liquids |
| c) High temperature areas | d) Personal Protection recommendations |
| e) Personal dangers | f) Equipment dangers |
| g) Operating instructions | h) Fluid flow direction |

SOME EXAMPLES FOUND ON THE EQUIPMENT



Personal Protection, Read and understand Operator's manual and Maintenance manual



Lifting Point



Hot Surface



Lifting Point



Fluid Flow Direction

CLEAN FILTER DAILY

Maintenance Instructions

M4-H

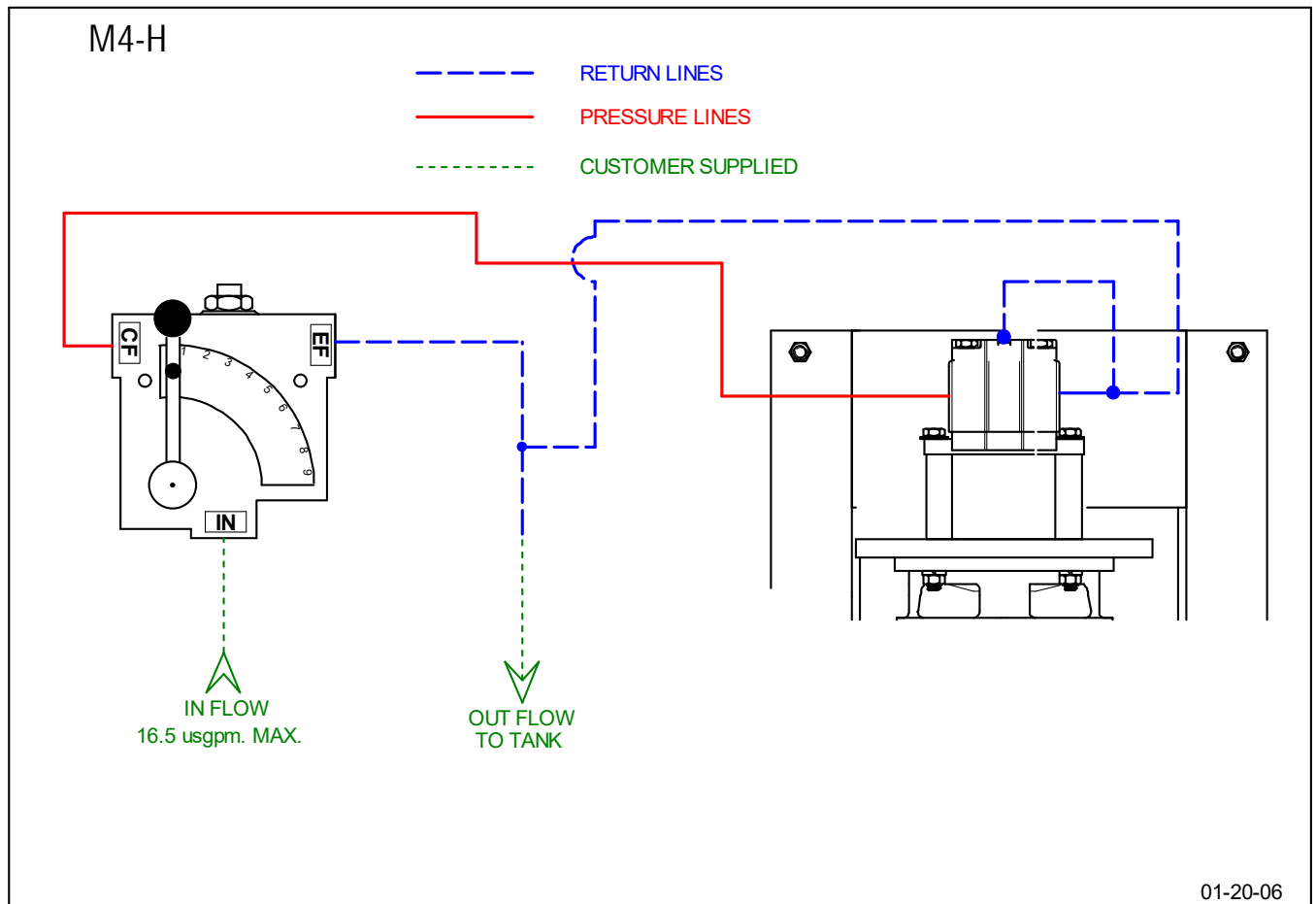
These guidelines must be followed or warrant will be voided. Any variation needs to be approved by Surface to Surface®.

SET-UP

Minimum Flow Rate: 15.0 us gpm.
 Maximum Flow Rate: 16.5 us gpm.
 Relief Setting: 2250psi.
 Inlet Hose Size: 3/4" minimum
 Outlet Hose Size: 3/4" minimum (*direct to reservoir*)

Caution:

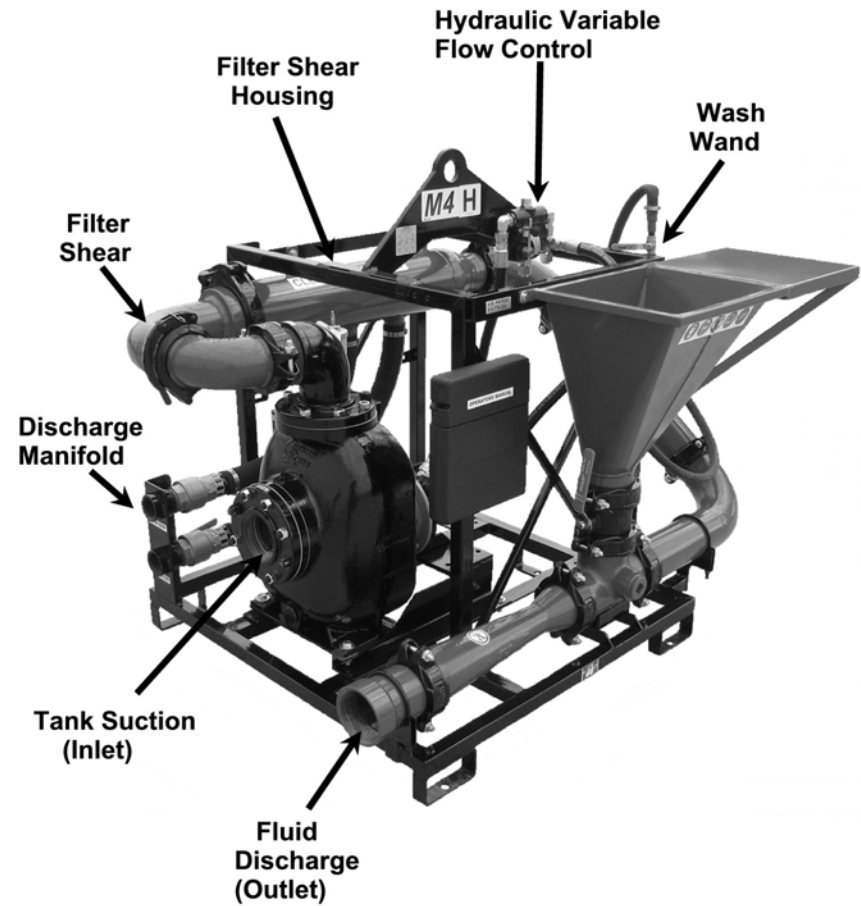
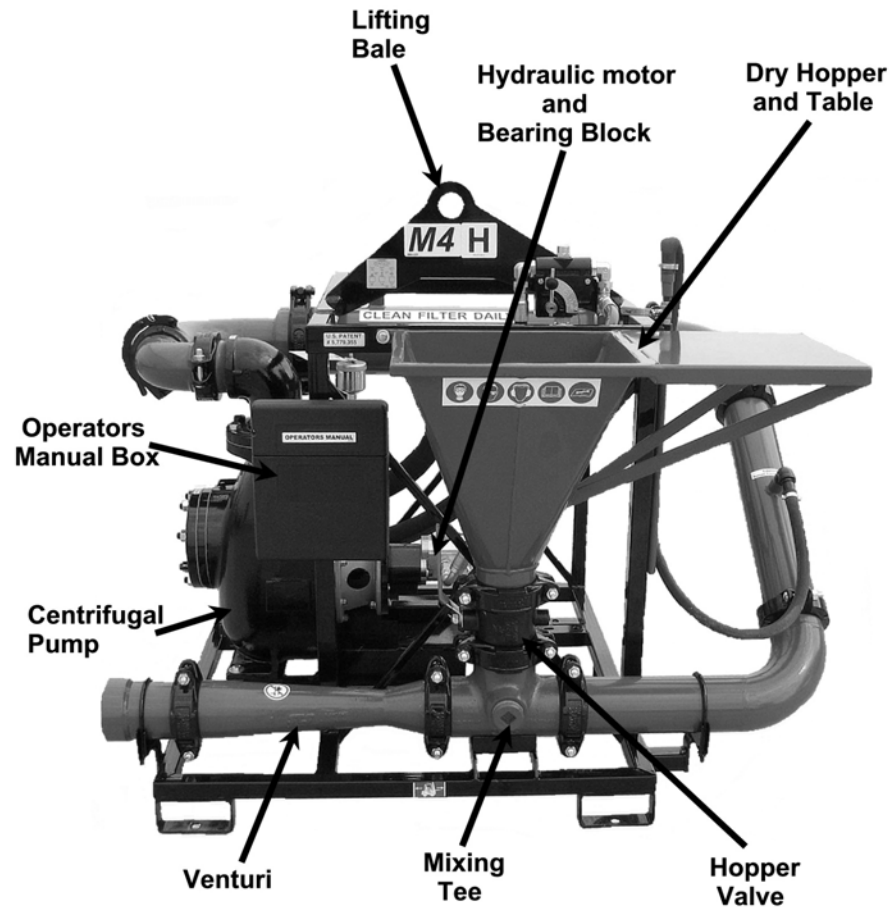
As the hydraulic oil increases in temperature the hydraulic flow rate will rise above your set rate of 15.0 – 16.5 g.p.m. of hydraulic flow. The hydraulic flow valve should then be set back to the recommended flow rate of 15.0 – 16.5 g.p.m.



Specifications on hydraulic oil, operating temperature, and filtration can be found further on in this manual, on the **Sauer Danfoss** hydraulic motor data sheets. Any problems or question may be answered by calling Surface to Surface® at (800) 567-0978 during normal business hours.

M4-H

Main Working Components



M4

(Hose Hook-ups)

DRILL FLUID OUT
[to Drill Rig]

** 2" NPT **

OUT FLOW
[to Tank Gun(s)]

** 2" NPT **

PUMP INTAKE
[in from Tank]

** 4" NPT **

*This line should have a valve installed at
the tank to facilitate shut down or repairs.*

FLUID RETURN
[out to Tank]

** 4" NPT **

*This line should discharge above the maximum fill line
of the tank. The air space will stop the siphon action of the fluid.*

"ALL HOSES SHOULD BE KEPT TO THE SHORTEST LENGTH POSSIBLE TO ACHIEVE MAXIMUM PERFORMANCE."



M4-H

Operators Manual

Congratulations on your acquisition of the world renowned M4 Mixing System. You have acquired the fastest and most efficient mixing system manufactured for mixing Bentonite drilling slurry (mud). As a manufacturer of HDD support equipment, we are well aware of the extreme conditions that HDD equipment is exposed to on a daily basis. Surface To Surface Inc. strives to overcome these conditions, with better design and manufacturing practices. Please feel free to call our toll free number (1-800-567-0978) if you have any questions or concerns about your M-4.

Thank you, for choosing the M4 series mixer.

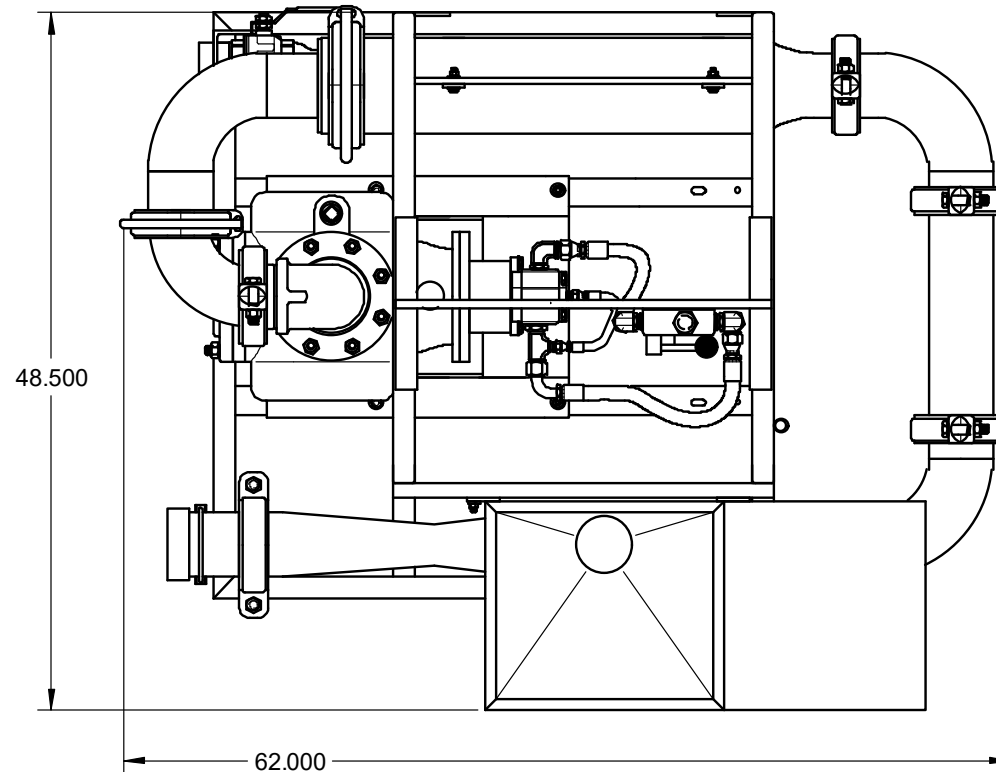
The M4 mixing unit was designed to mix dry or liquid drilling products with clean water, into a slurry. The slurry is continually circulated through the mixing cycle until it reaches the desired consistency. The operator can then transfer the final product to a holding reservoir or directly to the drilling equipment.

The M4 mixing unit consists of a hydraulic powered centrifugal pump, filter/shear unit, venturi mixing tee assembly, dry hopper with a table, a set of tank internal jets.

These components are all mounted on a frame type skid, built for lifting or solid mounting. For ease of interpretation, looking at the mixing unit hopper straight on will be considered looking at the front of the unit. Hence the other long side, will be the rear and the ends will be right or left end.

RECORD OF OWNERSHIP:

- Unit Serial No. _____
- Motor Serial No. _____
- Pump Serial No: _____
- Date Purchased/Leased: _____
- Dealer Purchased/Leased From: _____
- Special Custom Features: _____



M4-H (Hydraulic)
DRY WEIGHT
625 Lbs (284 Kg)

** Due to our continuing product improvement, specifications are subject to change without notice. **

Surface to Surface Inc.®	
DWR. NUM.	DATE. 09 / 19 / 12
M4-H	REV.



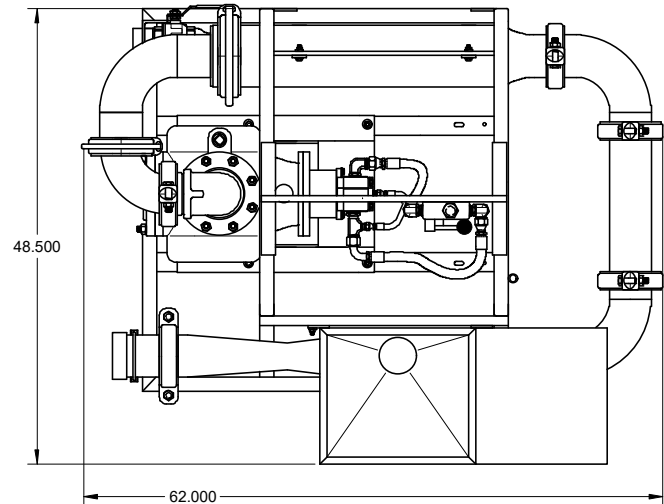
Universal 4" Mixer Model M4-H

Surface to Surface Inc.



Features and Benefits M4-H Mixer

The M4-H universal mixer is designed around the time proven M series mixers of STS. Powered by the customer's own power source. A 17gpm. hydraulic motor drives a 4" centrifugal pump, making effective use of the proprietary 4 point mixing system. The M4-H can be used as a new installation or retrofitted into an existing system of tank(s). Since the unit is connected by hoses and not hard pipe, the placement of the mixer versus the tank(s) is less restricted and a configuration to suit the needs of the contractor is easier to achieve. The small size also makes it a portable, independent unit that is easier to transport from site to site.



Specifications

Dimensions
Weight
Hopper Height
Mixing System
Flow Valves
Skid Frame
Hydraulic gear motor
Hydraulic valve
Hydraulic system
Pump
Pump Coupling
Vacuum Port
Pipe Couplers
Pressure Wand
Internal Tank Jets

M4-H Mixer

48 1/2" W x 62" L x 49" H
625 Lbs. (284 Kg.)
38" High
4" Proprietary StS Mixing System
Brass and Steel construction
1 1/2" steel tube with Lifting bale
Requires 17gpm. @ 1800psi
Variable speed controller
Open loop circuit
4" Cast iron centrifugal trash pump
Hyd. Motor direct to Bearing Block
2" NPT Inlet
Bolt & Snap-groove type
Hopper maintenance wand
TurboMix™ Eductor Nozzles

Benefits

Small space saving footprint.
Light weight for easy transportation.
Waist high hopper reduces back strain.
Fast & efficient with high shearing ability.
Withstand the abuse of daily operations
Built tough for the construction trade.
Use your own power source, no fumes in truck body
Allow mixing at various speeds
Simple, field repairable, less maintenance
Rugged & repairable for extended service life.
No expensive couplers or inserts to replace.
Draw Fluid into system without additional pump.
Fast cold weather draining of system.
Removal of blockages caused by additive.
Fast and effective rolling and mixing action.

Also available in Diesel (M4-D), Electric (M4-E) or Gasoline (M4-G) models.

Check our website for the latest products and specifications
www.stsmixers.com

Surface to Surface Inc.

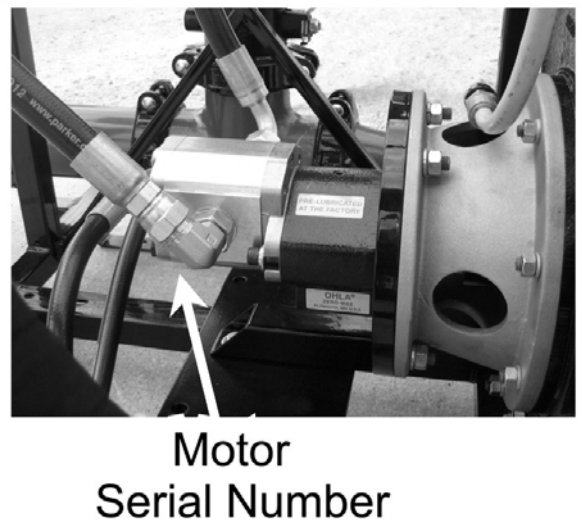
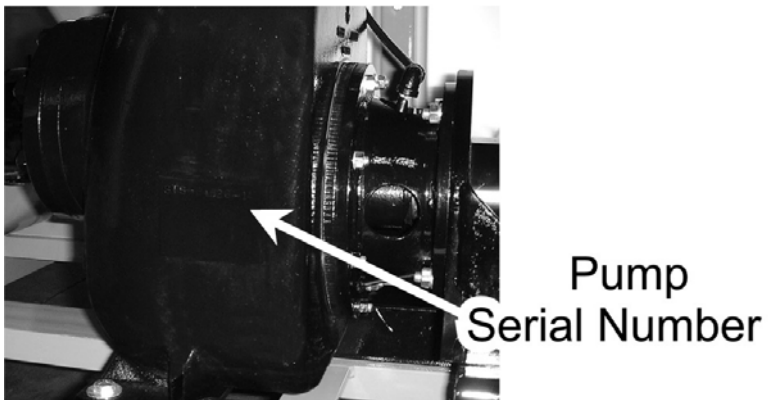
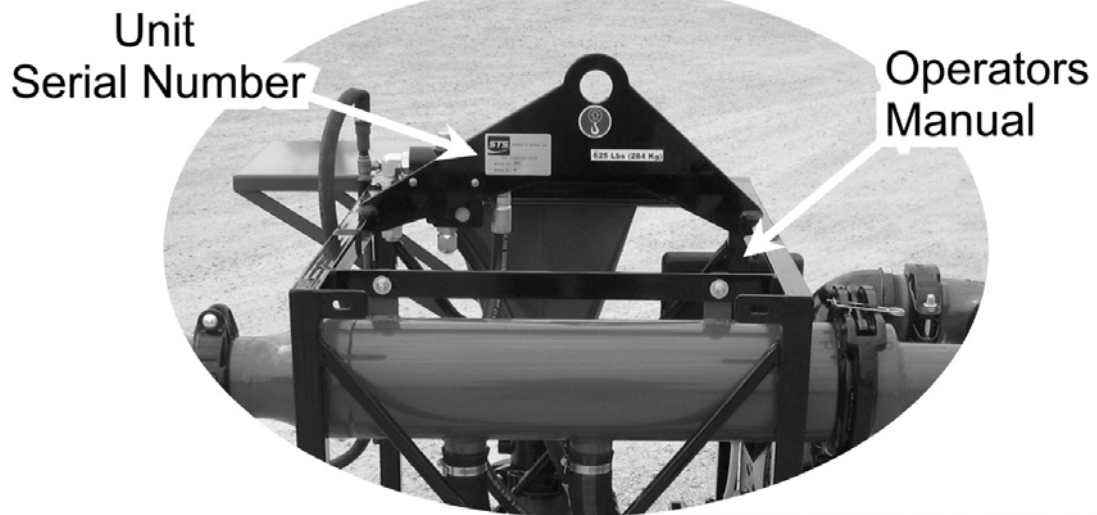
5150 Forest Road, R.R.#3, Watford, Ontario, N0M 2S0
Tel: 1-800-567-0978

09/19/12

M4-H

Identifying Your Machine & Components

Location of Tags and PIN Plates



SECTION #II

Description, Care and Maintenance



M4-H

Description, Care and Maintenance

Hydraulic Powered Centrifugal Pump

Care and maintenance of the hydraulic motor and pump are covered in this manual and/or the manufacturer operator's manuals supplied and should be read and understood. We suggest the following daily checks be carried out prior to using the system. Check the fluid level in YOUR hydraulic reservoir is sufficient. Check the hydraulic filtering system is working properly. Check the pump seal grease cup is full (see grease cup instructions Fig.5). Check that the suction valve (see Fig.3) is open and the reservoir tank has sufficient liquid to supply the centrifugal pump.

The pump is mounted directly to a bearing block and the hydraulic motor, so there is no "drive coupler" to check or maintain. The bearings in the bearing block are factory greased to provide constant lubrication. The pump is the primary component that will see the most wear due to the nature of the material it is handling therefore it will require regular checks, adjustments and maintenance.


There is a section of this manual dedicated to the pump itself and should be read and understood which will help should any problems or concerns arise in the field.

The pump should never be allowed to start or run dry, as this WILL damage the internal pump seal (grease seal) and render the unit inoperable until the seal is fixed.


To prime the pump or check to visually see if the pump is primed, slowly undo the plug (priming port) on top of the pump beside the discharge elbow (see Fig.4) and stop after about 3 turns. If the pump is primed, fluid & air will escape from around the plug threads. This indicates that the pump housing is full, and the plug can be tightened back up. If no fluid is escaping from around the threads, completely remove the plug.

Drill fluid or water can be poured into this opening to fill the pump cavity, and a visual of the fluid level inside the pump can be made. The level should be approximately to the top of the pump housing.

Another way to prime the pump is to have the tank FULL of fluid, and standing off to the side of the hopper, rotate the hopper valve SLOWLY to the open position. As the valve is opened, you will hear air escaping followed by fluid, into the hopper itself. Close the valve as the fluid enters the hopper. This means the fluid in the tank has filled the pump cavity of the pump and flowed from the outlet of the pump to the remaining piping on the unit.

 **DANGER**

IN AN EMERGENCY
rotate the flowcontrol valve
lever to the STOP position
to halt the pump, and fluid flow

 **DANGER**

**NEVER ATTEMPT REPAIRS
OR DISASSEMBLY**
without shutting off the hydraulic
power source (customer supplied)
Serious personal injury will result.

CAUTION

BEFORE STARTING THE HYDRAULIC MOTOR,
BE SURE THE PUMP IS PRIMED!

Check the pump by slowly & carefully
opening the plug located on the top of the
centrifugal pump beside the discharge elbow.
A visual inspection can be made if the fluid
escapes around the plug as it is loosened.
Remove the plug to view inside fluid level.
The centrifugal pump seal **WILL** be
damaged if allowed to cavitate or run dry.

CAUTION

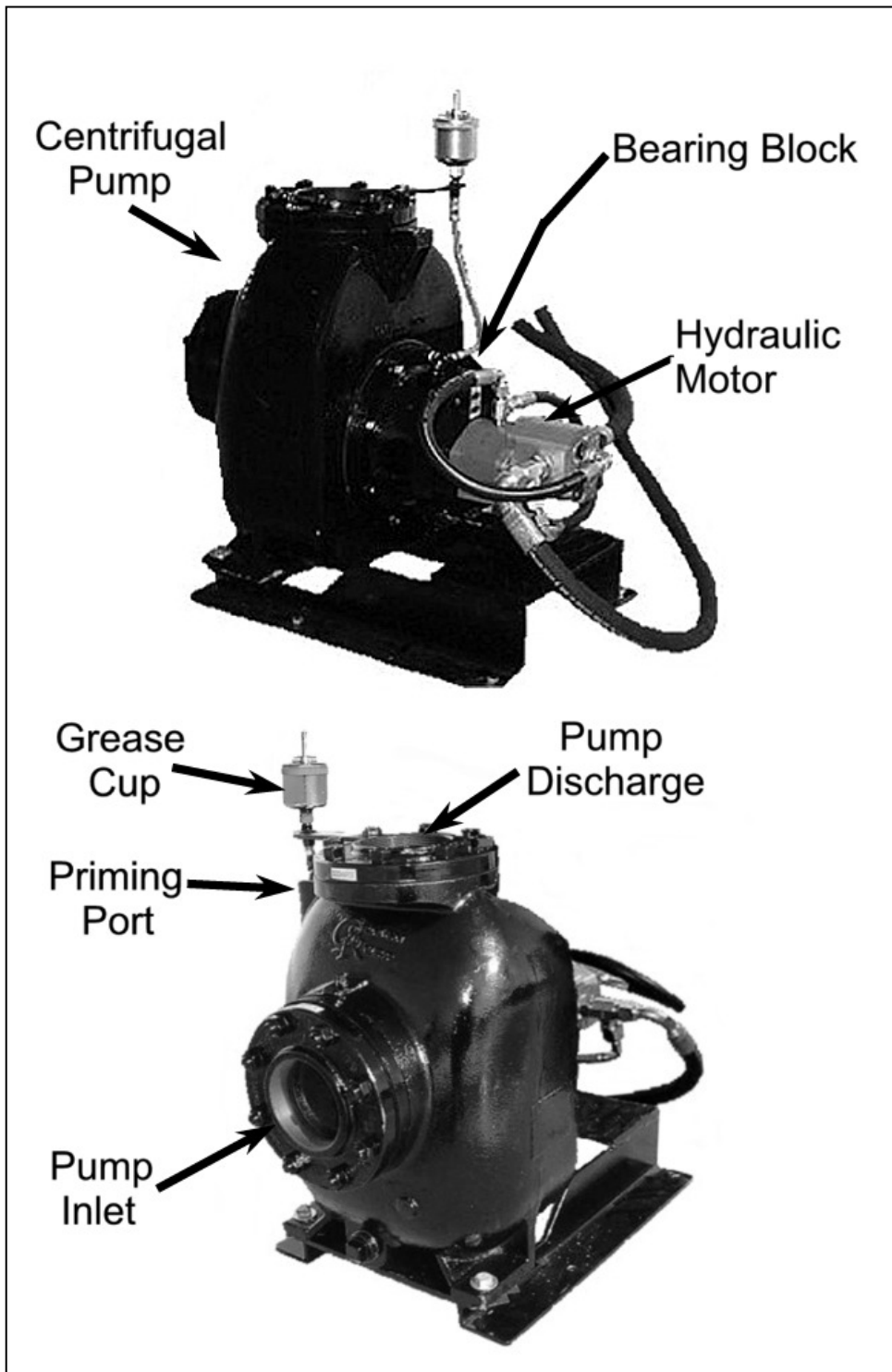
IMPROPER INSTALLATION OF THE
MECHANICAL or GREASE SEAL
will result in leakage and possible
damage to the seal. All maintenance,
operating and repair of this unit, must be
done per the instructions in the operators
manual for safety and reliability.

M4-H

Description, Care and Maintenance

Hydraulic Powered Centrifugal Pump

Fig.4



CAUTION

TRAPPED FLUID MAY BE PRESENT and will spill out when piping, hoses, pump or filter shear are removed.

CAUTION

NEVER LEAVE LIQUID IN THE PUMP CASING, PIPING, OR HOSES during freezing weather conditions, as damage will result. Follow instruction for winterizing.

CAUTION

BEFORE STARTING OR RESTARTING the hydraulic motor and centrifugal pump, make sure any valves installed on the pump suction inlet line are open, and the fluid level in the tank is above the suction line.

M4-H

Description, Care and Maintenance

Hydraulic Powered Centrifugal Pump

Grease cup instructions (Fig.5)

Fill the grease cup through the grease fitting with No. 2 lithium base grease until grease escapes from the relief hole. Turn the grease cup arm counterclockwise until it is at the top of the stem; this will release the spring to apply grease to the seal.

NOTE:

Some smoking and leakage may occur after installing a new seal assembly. This should stop after the pump has run a while and the lapped seal faces have seated in.

Fig.5

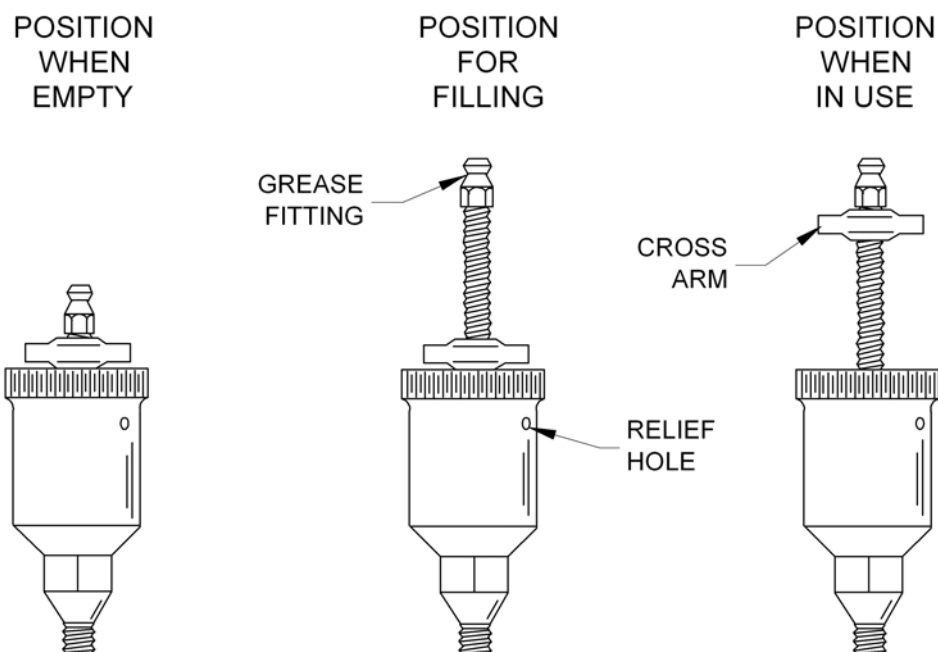


Figure 4. Automatic Lubricating Grease Cup

M4-H

Description, Care and Maintenance

Hydraulic Powered Centrifugal Pump

Grease cup instructions (Fig.5a)

GREASE CUP NEEDS TO BE CLEANED REGULARLY

The grease cup may not perform its function properly (lubricating the seal) if it is not routinely cleaned of old hard grease build-up.

If the grease cup is always “topped up” instead of allowed to run to the full stroke of the plunger, the grease may dry out and build up inside of the cup and not allow the plunger to push to the full stroke. This in turn will stop the supply of grease to the seal causing premature seal failure.

As a precaution it is strongly recommended that every 30 days, the grease cup (or the top of the grease cup) be removed and the inside of the cup and the plunger be cleaned of all old grease.

Reassemble the plunger into the cup and check that the plunger slides to the bottom of the now clean cup.

Fill with fresh grease.

FIG #5a Shows clean grease cup & plunger and old, dried grease taken out of the cup, that was causing the plunger to “hang-up”.

Fig. 5a



M4-D

Description, Care and Maintenance

Filter / Shear System

The filter / shear (Fig.6a) system on the M4 is an integral part of the mixing system and to operate efficiently requires daily cleaning of the stainless steel internal filter /shear. The filter / shear system is a two-piece unit (Fig.6b) consisting of an outside housing and an internal filter / shear. The filter / shear will trap any debris, such as parts of bags, stones, leaves grass etc. The proper procedure for cleaning the filter / shear is to close the suction valve from the reservoir tank to the pump, Rotate the “Tank Gun” & “Drill Fluid” valves to the closed position, remove the 6 inch Snap Loc coupler at the left end of the filter housing, remove the 4 inch Snap Loc coupler at the discharge port of the centrifugal pump. You will now be able to remove the internal filter / shear from the housing, after the internal filter / shear has been removed, you will see on the end of the filter / shear an end cap (Fig.6b). Remove the end cap and wash out the filter / shear with clear water. Reinstall the end cap on the filter / shear, reinstall the filter / shear in the housing (*Note the small block on the bottom of the screen, this is placed on the bottom of the filter housing to aid lining up the 6 inch Snap Loc coupler and gasket*) **do-not** clamp the 6 inch coupler until the 4 inch coupler and gasket are properly lined up. After all pieces are correctly lined up, clamp the 6 inch coupler 1st and 4 inch coupler 2nd and reinstall the safety pins. Open all of the valves that were close prior to removing the filter / shear.

Fig.6a

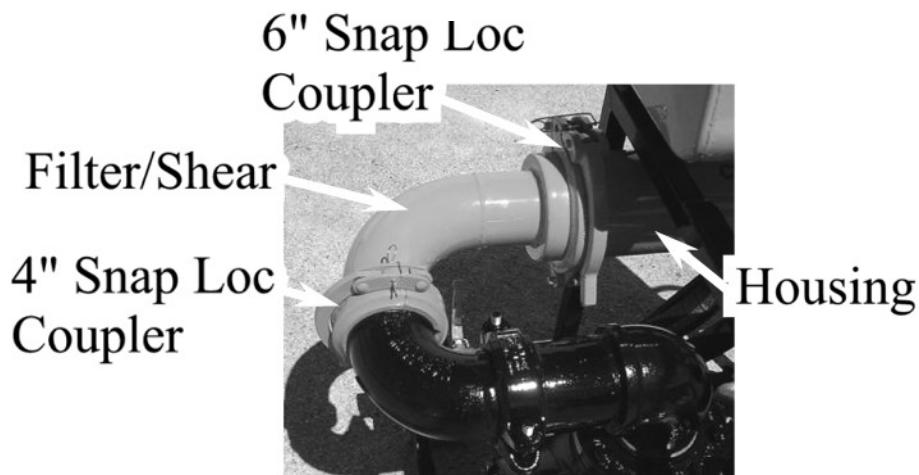
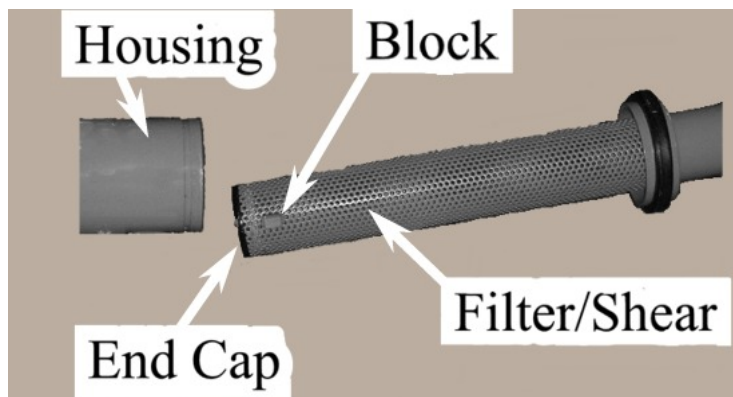


Fig.6b



⚠ DANGER

**NEVER ATTEMPT REPAIRS
OR DISASSEMBLY**

without shutting off the hydraulic
power source (customer supplied)
Serious personal injury will result.

⚠ WARNING

**NEVER ATTEMPT TO REMOVE
OR CLEAN THE FILTER SHEAR**

while the unit is in operation.
Serious personal injury will result.

CAUTION

**CARE MUST BE TAKEN WHEN
INSTALLING THE COUPLER GASKETS.**

If the gaskets are not properly lubricated
and installed, a leak may develop.

M4-H

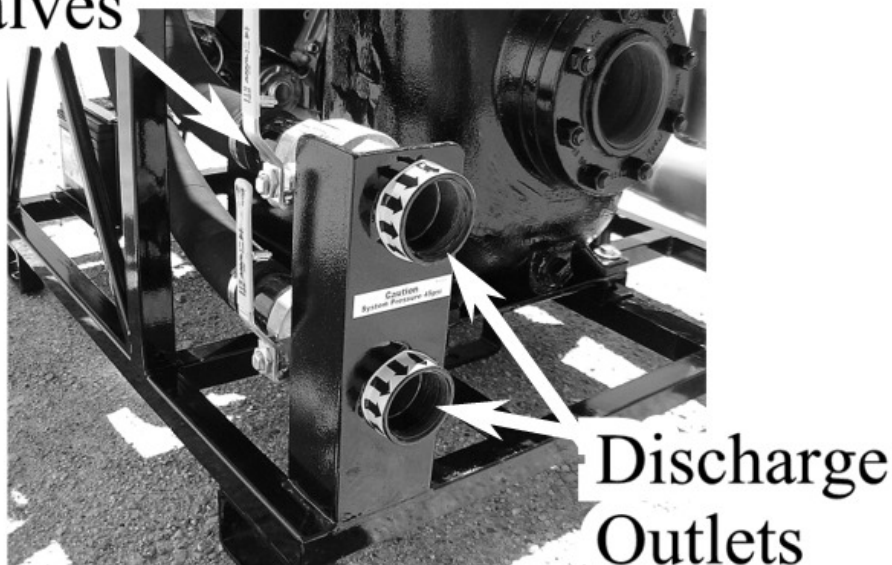
Description, Care and Maintenance

Filter / Shear System *continued*

On the left side of the unit (near the back side) is a upright “discharge manifold” (see Fig.7). The two outlets are connected to the filter shear and controlled by independent ball valves. The connections are 2” NPT thread. One of the outlets is to be connected to the internal tank jets inside of the reservoir tank (explained further on in this manual) and the other outlet is to be used as a discharge for the fluid after it is mixed. The discharge can be connected to another reservoir tank or directly to the drill rig. To control the flow of discharge, the ball valve can be used to regulate the flow. The speed of the motor and pump can also be used to control the flow and pressure of the discharge. It is up to the customer to decide the piping arrangement and how they would use the discharge options. The discharge flow can have high pressure and high volume flows associated with it, and should be treated as such. If you are unsure of the installation and routing of this flow, contact Surface to Surface Inc. for more details.

Ball
Valves

Fig.7



CAUTION

WHEN TRANSFERRING FLUID to the drill rig, fluid pressure may reach or exceed 50 p.s.i.
CHECK the drill rig manufacturers specifications regarding maximum inlet pressures allowed for their pump.

CAUTION

TRAPPED FLUID MAY BE PRESENT and will spill out when piping, hoses, pump or filter shear are removed.

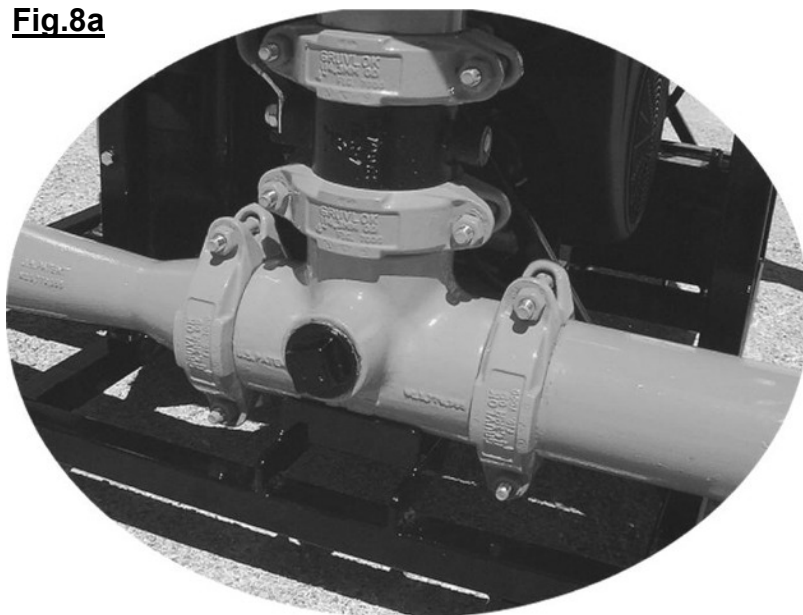
M4-H

Description, Care and Maintenance

Venturi Mixing Tee

The Venturi Mixing Tee (Fig8a.) is the very heart of this system and requires very little maintenance. However M4 unit parts may wear as a result of the application in time and require replacement. This wear will become evident, when the operator notices a reduction in the vacuum that helps pull in the dry product from the hopper. When mixing dry product, over time, you will see an accumulation of damp product inside of the mixing tee around the nozzle. If this accumulation is left unattended, over time it will build to the point of restricting the inlet of the mixing chamber. This situation is easily rendered, by using the wash wand to “flush out the accumulation, and force it back into the fluid stream.

Fig.8a



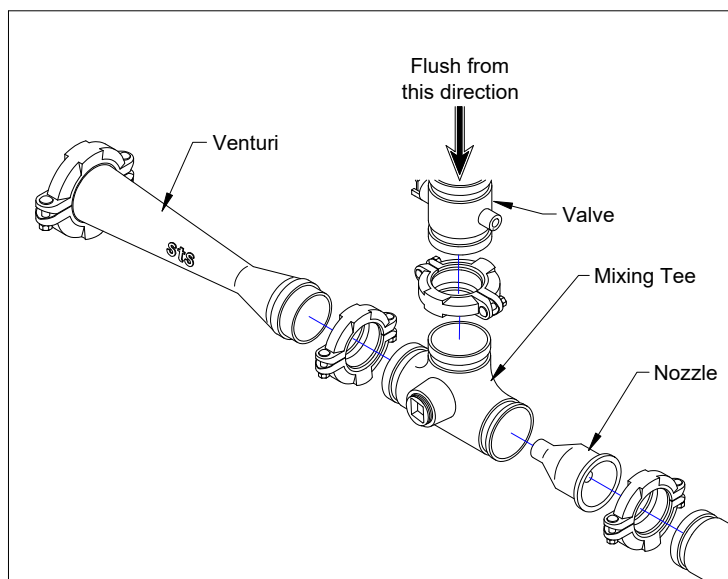
CAUTION

AVOID ALLOWING FOREIGN MATERIAL
into the Venturi Mixing Tee thru the
Hopper, by keeping the valve closed
when not in use.

Fig.8b

! WARNING

**NEVER USE BODY PARTS,
OR FOREIGN OBJECTS**
in an attempt to unplug or clean the
hopper valve or mixing tee.
Serious personal injury or
damage will result.



M4-H

Description, Care and Maintenance

Wash Wand

The M4 unit is equipped with a pressurized wash wand (Fig.9a) for clearing obstructions and accumulation in the jetting tee. It is recommended that the jetting tee be cleaned with the wash wand after the introduction of material into the hopper after each batch.

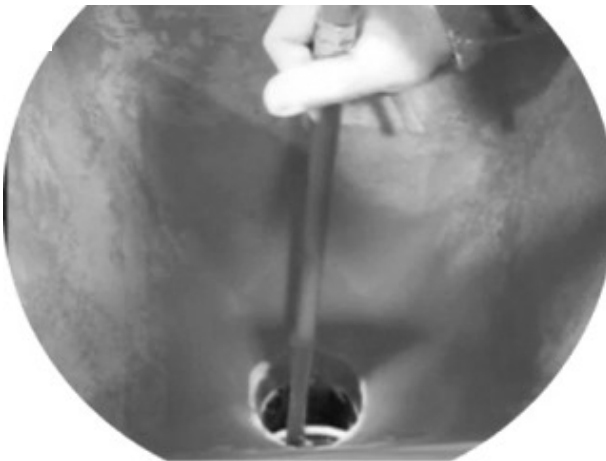
The wash wand uses the high-pressure fluid from the mixing system piping which can reach pressures of up to 50psi. **CAUTION** should always be used when handling the wash wand. A valve is located on the wash wand to regulate the flow of fluid.

The wash wand is not to be used as a poker or pry bar, but instead use the fluid from it to “wash” away accumulations. Be careful when putting the wash wand inside the mixing chamber that it does not block the fluid stream coming out of the nozzle, as it will spray back up the hopper and towards the operator.

The wash wand can also be used to get a fluid sample for testing purposes. An example of this (Fig.9b) is to check the viscosity of the fluid using a marsh funnel. Simply put the wash wand inside the hopper (with the hopper valve open) and open the small valve located on the wash wand. Rotate the valve handle to the on position, and let it flow for approx. 15 seconds, close the valve and place the wash wand in the screening area of the marsh funnel. Fill the marsh funnel to the proper volume, close the valve on the wand, and store back the small hose holder rack. Follow the instructions of the marsh funnel for the rest of the test.

The sample of fluid taken from the wash wand is the same as the fluid going out of the top discharge of the filter / shear housing to the drill rig or reservoir tank.

Fig.9a



! CAUTION

**DO NOT POSITION
ANY PART OF YOUR BODY**
over the hopper, valve,
or mixing tee while cleaning.

! CAUTION

**WHEN THE UNIT
IS IN OPERATION,**
the fluid in the piping may reach
pressures up to 50 p.s.i.

! WARNING

**NEVER USE BODY PARTS,
OR FOREIGN OBJECTS**
in an attempt to unplug or clean the
hopper valve or mixing tee.
Serious personal injury or
damage will result.

Fig.9b



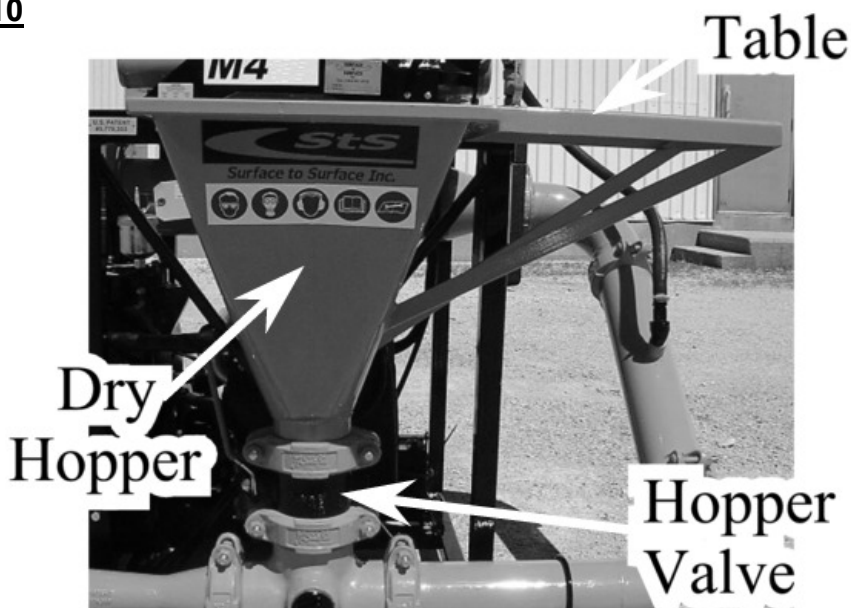
M4-H

Description, Care and Maintenance

Dry Hopper with Table and Hopper Valve

The Dry Hopper and Table (Fig.10) are used during the initial mixing of the dry product and fluid. The hopper and table require very little daily maintenance, however care should be used that this unit does not become overloaded. There should never be more than 100 lb. in or on the hopper and table at any time. The hopper and table are not ladders and should not be climbed on or sat on, damage can result. The hopper valve must be kept free of dried Bentonite, ice or other buildups to reduce the chance of damage during opening and closing. The valve operates more smoothly if the surfaces are kept damp or wet. All valves are to be opened and closed by hand. **DO NOT FORCE THE VALVE OPEN OR CLOSED**, visually check the valve if a problem occurs!

Fig.10



⚠ WARNING

NEVER USE BODY PARTS, OR FOREIGN OBJECTS in an attempt to unplug or clean the hopper valve or mixing tee. Serious personal injury or damage will result.

⚠ CAUTION

DO NOT POSITION ANY PART OF YOUR BODY over the hopper, valve, or mixing tee while cleaning.

CAUTION

AVOID ALLOWING FOREIGN MATERIAL into the Venturi Mixing Tee thru the Hopper, by keeping the valve closed when not in use.

M4-H

Description, Care and Maintenance

Internal Tank Jets

The Internal Tank Jets (Fig.11a) are supplied with the M4 unit, and are installed (by the customer) inside the reservoir tank, to keep the slurry product in the tank moving. This function assures the elimination of dead spots in the tank and a consistent mixture of fluid.

The internal tank jets are connected together in series, usually by a manifold design, (suggested by STS) where all jets receive the same amount of fluid and pressure. This manifold design is supplied with fluid from one of the outlets on the discharge manifold (Fig.11b). The manifold has a ball valve to control the flow, and should always be in the open position, unless you are cleaning the filter / shear (described earlier) or performing repairs on the system. If the valve is not closed, when performing these tasks, a siphoning action can occur, pulling fluid from the tank and into the external piping. The internal tank jets require little or no maintenance and will only require attention if they become clogged. Flushing the entire system weekly with clear water should eliminate any problems with this piece of the system. The fluid passing through the internal tank jets is at a very high pressure and extreme caution should be used when viewing the inside of the tank.

The internal tank jets also act as a relief valve to the system and relieve the pressure spikes caused when the flow to the drill rig or second reservoir tank is interrupted.

Fig.11a



DANGER

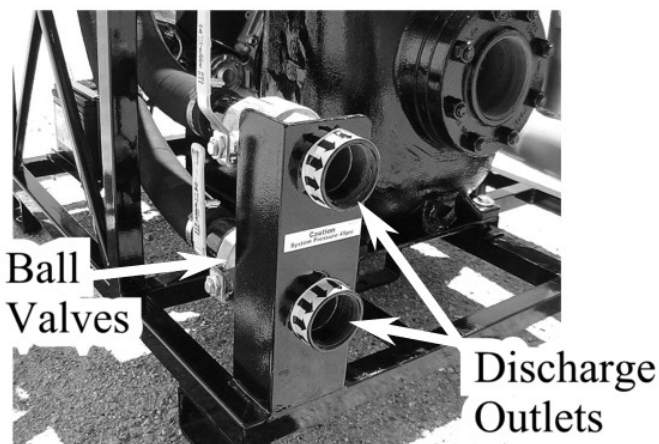
**NEVER ATTEMPT REPAIRS
OR DISASSEMBLY**

without shutting off the engine.
Serious personal injury will result.

CAUTION

ENTERING THE TANK is not recommended
Personal injury could result from
the presence of hazardous fumes,
remaining fluid or unit start-up.

Fig.11b



CAUTION

**NEVER OPERATE THE MIXING
unit with the tank lid open.**



CAUTION

**WHEN THE UNIT
IS IN OPERATION,
the fluid in the piping may reach
pressures up to 50 p.s.i.**

M4-H

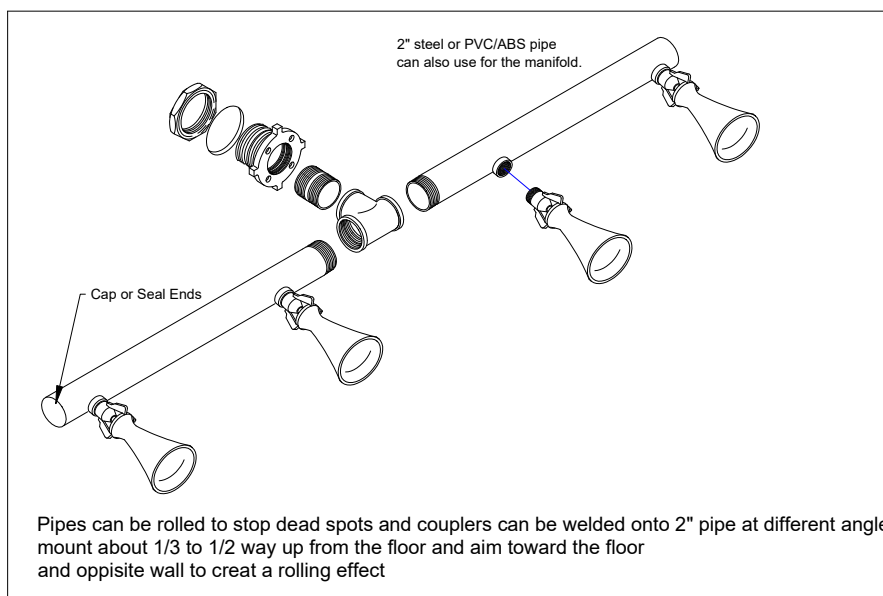
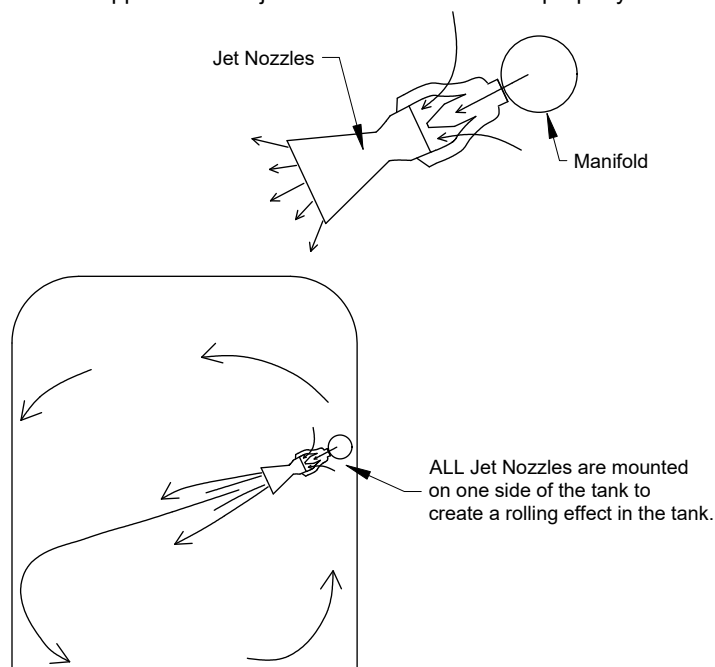
Description, Care and Maintenance

Internal Tank Jets - Installation

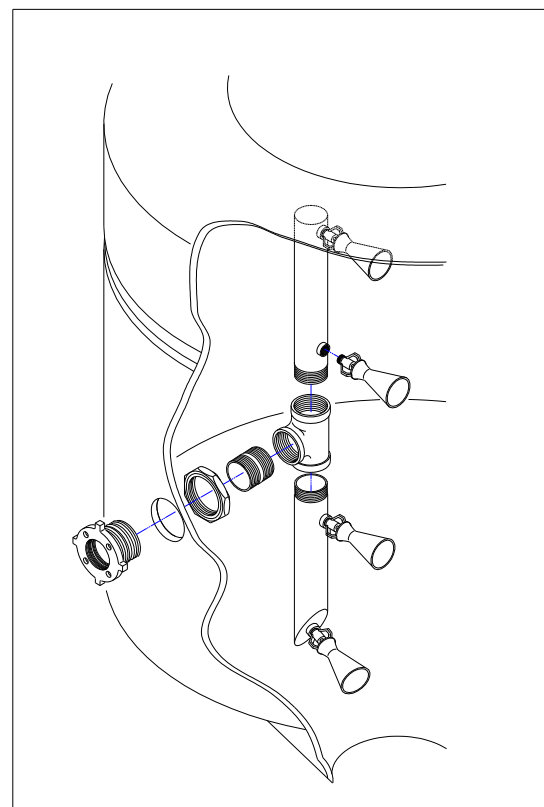
How they work.

For every gallon of fluid passing through the jet nozzle from the manifold pipe, the jet nozzle will draw in another 4-5 gallon more from around the outside of the nozzle, creating a larger volume of fluid movement in the tank.

Connect the manifold to the outlet on the filter/shear of the STS Mixing Unit. Each unit is shipped with 2-4 jet nozzles that have been properly sized for the unit.



Typical horizontal installation in a tank



Typical vertical installation in a round cone bottom tank

For help with design and placement in your tank, call Surface to Surface Inc. and they will work with you to find the best solution

SECTION #III

Set-up and Installation of Unit in Detail

M4-H

Set-up and Installation of M4 in detail

Permanent mounting of the unit

The M4 unit is built on a sub frame that can be bolted down to a permanent surface like a concrete pad, pull type trailer, flat deck of a truck or inside of a truck body. Securing the unit with adequate size and grade of fasteners is the sole responsibility of the customer and not of Surface to Surface Inc.

There are four welded, tube type feet (Fig.12a) fastened to the underside corners of the sub frame. These are structurally designed to hold and withstand any movement of the unit when properly sized fasteners are inserted into the holes in the feet. When fastening down the unit, care should be used when drilling holes into the surface below to avoid such unseen items, as gussets, cross-members, wiring or other fixtures below the surface.

Adequate space or an opening will also have to be considered when mounting, for the removal of the filter / shear cartridge for regular cleaning and inspection.

Portable use of the unit

If the M4 unit is to be used as a portable unit, there is a lifting bale (Fig.12b) connected to the sub frame to support and balance the unit when lifting or moving. Properly approved and rated lifting apparatus should be used at all times and lifting done by qualified personal only.

The M4 should only be placed on solid, level ground with a clear working area around it.



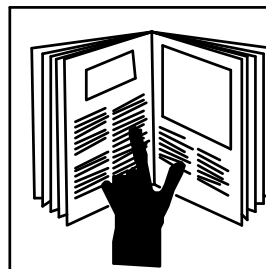
Fig.12a



Fig.12b

CAUTION

LIFTING LUGS OR THE LIFTING POINT(S) identified and labelled on the skid structure must be used in order to safely lift and transport the unit.



⚠ WARNING

REFER TO THE SAFETY STATEMENTS IN THE OEM SUPPLIED MANUALS AND THIS MANUAL REGARDING THESE OPERATIONS.

SECTION #IV

Operating the M4 Unit



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Operating the M4 Unit

Site Setup & Pre-Check

SITE SETUP

- **CHECK** for overhead hazards if unloading the unit to the ground.
- **UNLOAD** the unit by using the sub frame lifting bale (marked) with appropriate equipment.
- **SET** and position the unit on solid level surface to avoid settling or upset.
- **SET** and position the unit to have a clear unobstructed working area of 10ft (3m) on all 4 sides.
- **CONNECT** and secure all hoses onto the unit according to your layout.
- **SECURE** the truck and/or the trailer that the unit is mounted on, from movement.
- **PROTECT** any hose(s) that connect between the M4 and the drill rig, from possible damage or from being driven upon by a vehicle.

UNIT PRE-CHECK

- **READ** the operators manual for proper starting and running procedures.
- **CHECK** to assure the hydraulic oil reservoir has the proper fluid level for operating.
- **CHECK** to assure the hydraulic variable speed controller is in the stop position.
- **CHECK** to ensure the grease cup on the pump is full of grease and the winged/lugged nut on the top, is backed off to allow the shaft to retract into the grease cup.
- **CHECK** to ensure any valves installed on the suction intake line between the tank and centrifugal pump are open.
- **CHECK** to ensure there is sufficient fluid in the tank, to insure the centrifugal pump does not run dry.
- **CHECK** to ensure the centrifugal pump is primed.
- **CHECK** to ensure the ball valve on the discharge manifold connected to the “tank jets” is open.
- **CHECK** to ensure the ball valve on the discharge manifold connected to the drill rig is closed.
- **CHECK** to ensure the small ball valve connected to the Wash Wand is closed.
- **CHECK** that the hopper valve is closed.

M4-H

Operating the M4-H Unit

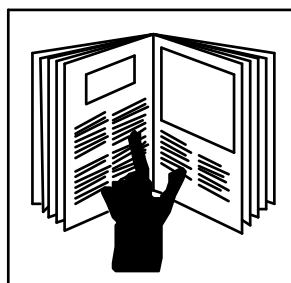
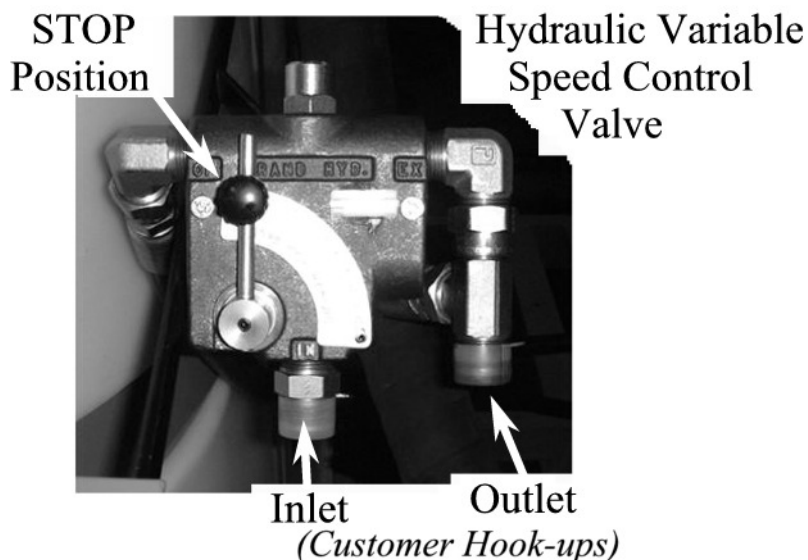
Starting the Hydraulic Motor & Pump

Starting the hydraulic driven pump

- Make sure the hydraulic variable speed control lever (Fig.13) is in the stop position (all the way over to the left stop pin).
 - Start **YOUR** hydraulic power unit as per the manufactures instructions and let the hydraulic oil reach the recommended operating temperature.
 - Make sure the centrifugal trash pump is primed and all valves are open / closed as the previous instructions indicated.
 - Do a visual check for hydraulic fluid leaks.
 - The hydraulic variable speed controller may now be **SLOWLY** rotated to the right, approximately 1/4 to start the trash pump, pumping fluid through the system. This will allow the hydraulic oil to fill the lines and come up to speed. At this point you should see drilling fluid entering your reservoir tank via the fluid return hose, from your M4.
 - Remember that the system is pumping fluid under pressure, even when the valve is at a low setting.
 - Gradually rotate the control lever (right) toward the high-speed position and set at the required speed.
- Note:*** Whenever high-speed operation is not required, rotate the speed control lever (left) to approximately 1/2 speed, to extend hydraulic motor and pump life.

The Gorman-Rupp® used on this unit is self-priming. Priming is not required as long as the pump is kept full of liquid.

Fig.13



WARNING

REFER TO THE SAFETY
STATEMENTS IN THE
OEM SUPPLIED MANUALS
AND
THIS MANUAL
REGARDING THESE
OPERATIONS.

CAUTION

BEFORE STARTING THE HYDRAULIC MOTOR,
BE SURE THE PUMP IS PRIMED!

Check the pump by slowly & carefully
opening the plug located on the top
of the centrifugal pump discharge elbow.
A visual inspection can be made if the fluid
escapes around the plug as it is loosened.
Remove the plug to view inside fluid level.
The centrifugal pump seal WILL be
damaged if allowed to cavitate or run dry.

M4-H

Operating the M4 Unit

Typical Mixing Operation


Mixing Operation

- Operate the pump at high speed.
- If not already open, open internal tank jet valve.
- Open the hopper valve at the bottom of hopper where it joins the venturi mixing tee.
- Introduce the dry or liquid raw material into the hopper.

When mixing a new batch, introduce the 1st bag of dry product at a rate of 40 lbs per minute. Once the first 40 lbs. of dry product are in the fluid stream, all dry products may be introduced as fast as the hopper will allow. This allows time for the 1st bag to be mixed well into the fluid and will now aid to suspend all remaining dry product that is added, in the fluid in the tank to achieve a better shear and stop any build-up in the tank.

- Suction created by the venturi mixing tee will draw the raw material into the jet stream for initial mixing.
- Flush jetting tee with wash wand.
- Close the butterfly valve on the hopper to keep debris out of the system.
- Allow the mixing system to circulate the product until the desired consistency is attained.
- A sample of the mixed fluid may be taken at from the wash wand as described earlier in this manual, on the wash wand description page.

Note: *Whenever high-speed operation is not required, rotate the speed control lever (left) to approximately 1/2 speed, to extend hydraulic motor and pump life.*


DANGER

IN AN EMERGENCY

rotate the flow control valve
lever to the STOP position
to halt the pump, and fluid flow.


CAUTION

AVOID ALLOWING FOREIGN MATERIAL
into the Venturi Mixing Tee thru the
Hopper, by keeping the valve closed
when not in use.


WARNING


**NEVER USE BODY PARTS,
OR FOREIGN OBJECTS**


in an attempt to unplug or clean the
hopper valve or mixing tee.
Serious personal injury or
damage will result.


CAUTION

**DO NOT POSITION
ANY PART OF YOUR BODY**

over the hopper, valve,
or mixing tee while cleaning.




WARNING

REFER TO THE SAFETY
STATEMENTS IN THE
OEM SUPPLIED MANUALS
AND
THIS MANUAL
REGARDING THESE
OPERATIONS.



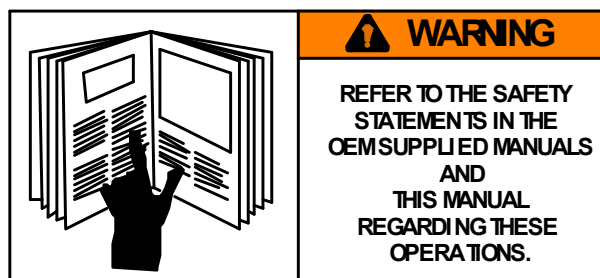
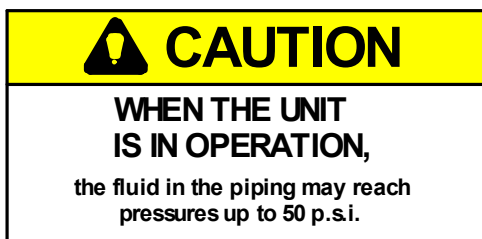
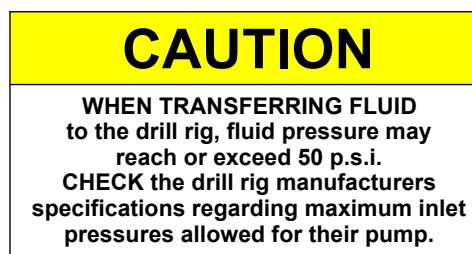
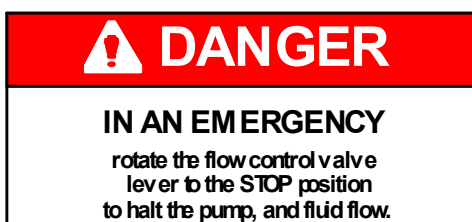
M4-H

Operating the M4 Unit

Typical Transfer/Offloading Operation

Transferring Operation

- On the discharge manifold of the M4 you will see a 2nd outlet with a ball valve (2"NPT.) that is not used.
- A transfer hose with a minimum size of 2 in. can be attached to this outlet ball valve to carry the finished product to a holding tank or directly to the drill rig.
- Make the necessary connections at the holding tank or the drill rig.
- Run the M4 pump at a favorable speed and slowly rotate the ball valve handle to the open position, to allow the fluid to flow to the holding tank or the drill rig.
- The speed and pressure of the fluid flow is determined by the hydraulic motor speed.
- If the unit is supplying the drilling rig directly, this valve is kept in the open position and a valve that is controlled by the operator of the drill rig, will be needed to stop the flow (normally mounted on the drill rig). The tank jet valve will need to be in the open position to act as a "relief" when the valve on the drill rig is closed.
- If transferring to a reservoir tank, the valve on the discharge manifold is used to start / stop the flow of fluid.
- When removing the mixed fluid from the tank (to the drill rig or reservoir), leave approximately 4" of fluid in the bottom of the tank to keep the pump from sucking air (cavitation).
- Close the valve to the reservoir, add water to the tank and begin mixing a new batch of mixed fluid.





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Operating the M4 Unit

Typical Warm Weather Shutdown & Storage

Daily Shut Down

- Do not rotate hydraulic control valve suddenly while running at high speed.
- Set the speed control lever at a low speed (1/8-1/4) position and allow the hydraulic motor to run at low speed for 2 to 5 minutes.
- Make sure the butterfly valve under the hopper is closed.
- Move the control lever to the most left position against the stop pin to stop the motor and pump.
- STOP the hydraulic power source (customer supplied).
- Close any valve(s) installed on suction line between pump and reservoir.
- Remove the filter / shear as described in maintenance section.
- Clean filter / shear as described in maintenance section.


Additional Week End Shut Down

- Pump or drain remaining mixed fluid out of the tank and dispose of it according to local environmental approved practices.
- Make sure the valves on the discharge manifold are open.
- Disconnect the 2" discharge hose that went to the drill rig or reservoir tank, at the drill rig or reservoir, and securely fasten it, back into the mixing tank to recalculate the fluid.
- Fill and rinse the tank with clear water and then start the motor and pump. By pumping this water through the entire system, it will remove buildup and dilute any remaining mixed fluid in the system.
- Open the valve on the wash wand and flush it back into the hopper. Open the hopper valve to drain then close.
- Move the control lever to the most left position against the stop pin to stop the motor and pump.
- STOP the hydraulic power source (customer supplied).
- Drain the remaining water out of the tank and dispose of it according to local environmental approved practices.
- Remove centrifugal pump front drain plug. Replace the plug when the pump is empty.
- Make sure both valves on the discharge manifold and the wash wand valve are open.
- Remove filter / shear and clean as described in the maintenance section of this manual.

 DANGER
NEVER ATTEMPT REPAIRS OR DISASSEMBLY
without shutting off the hydraulic power source (customer supplied) Serious personal injury will result.

CAUTION
TRAPPED FLUID MAY BE PRESENT and will spill out when piping, hoses, pump or filter shear are removed.

CAUTION
CARE MUST BE TAKEN WHEN INSTALLING THE COUPLER GASKETS. If the gaskets are not properly lubricated and installed, a leak may develop.

	WARNING
	REFER TO THE SAFETY STATEMENTS IN THE OEM SUPPLIED MANUALS AND THIS MANUAL REGARDING THESE OPERATIONS.

M4-H

Operating the M4 Unit

Typical Cold Weather Shutdown & Storage

Additional Winter and Freezing Weather Shut Down

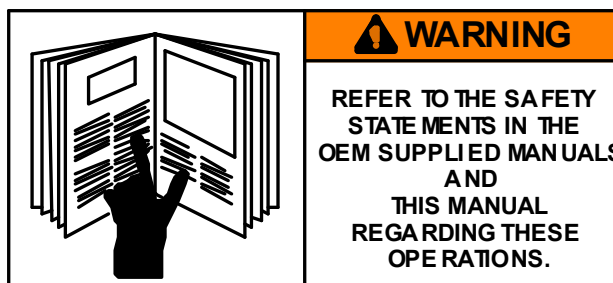
- Pump or drain remaining mixed fluid out of the tank and dispose of it according to local environmental approved practices.
- Make sure the valves on the discharge manifold are open.
- Disconnect the 1 1/2" discharge hose that went to the drill rig or reservoir tank, at the drill rig or reservoir, and securely fasten it, back into the mixing tank to recalculate the fluid.
- Fill and rinse the tank with clear water and then start the motor and pump. By pumping clear water through the entire system, it will remove buildup and dilute any remaining mixed fluid in the system.
- Open the valve on the wash wand and flush it back into the hopper. Open the hopper valve to drain, then close.
- Move the control lever to the most left position against the stop pin to stop the motor and pump.
- STOP the hydraulic power source (customer supplied).
- Drain the remaining water out of the tank and dispose of it according to local environmental approved practices.
- Disconnect all hoses and let them drain.
- Remove centrifugal pump front drain plug. Leave the pump plug out.
- Make sure both valves on the discharge manifold and the wash wand valve are open.
- Remove filter / shear and clean as described in the maintenance section of this manual. Leave filter / shear out of housing as this will allow remaining moisture to drain.
- Open the hopper valve and pour in a suitable environmentally friendly anti-freeze until it runs out of the venturi open end (hose is disconnected).
- Shut the hopper valve and pour a suitable environmentally friendly anti-freeze into the hopper until about 2" of fluid cover the valve. This will stop the valve from freezing around the edges.

CAUTION

NEVER LEAVE LIQUID IN THE PUMP CASING, PIPING, OR HOSES during freezing weather conditions, as damage will result. Follow instruction for winterizing.

CAUTION

CARE MUST BE TAKEN WHEN INSTALLING THE COUPLER GASKETS. If the gaskets are not properly lubricated and installed, a leak may develop.



M4-H

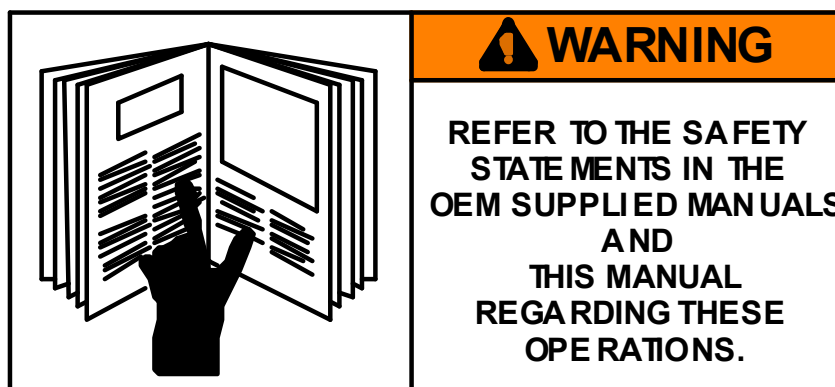
Operating the M4 Unit

Prolonged Periods of Storage

Prolonged Periods of Storage

After a thorough cleaning of the internal and external components of the M4, the following steps should be applied to extend the life of your unit.

- Prolonged periods of storage require extra care of the pump to protect from rusting internally. Separate the pump (as you would to replace the seal) to dry and spray with a protective oil film.
- Prolonged periods of storage may require other preparation. See supplied OEM manuals.



M4-H

Operating the M4 Unit

Optional Self-Loading Feature

Self Loading (*customer to install*)

If the self-loading feature of The M4 is required, you will find a 2 in. NPT (suction) port located on the venturi-mixing tee below the hopper valve (Fig.14a). All units are shipped with a plug installed in the port.

A common practice is to use this “suction port” to draw fresh water from another reservoir tank. As shown in (Fig.14b) remove the plug and install an elbow, close nipple, full flow ball valve and a type of quick coupler capable of being capped when not in use OR a hose barb and a non-collapsing hose (*hard hose*) can then be installed as a permanent connection AFTER the valve.

Caution should be used when threading in a connection into the suction port. Do not over tighten the Regardless of the configuration of the connection used, this port needs to be sealed off (valve or capped) when not being used as a suction port. The reason for this is that then the unit is shut off, fluid will fill the mixing tee and spill out the port or when the unit is in operation, it will draw air and a decrease the vacuum at the hopper inlet.

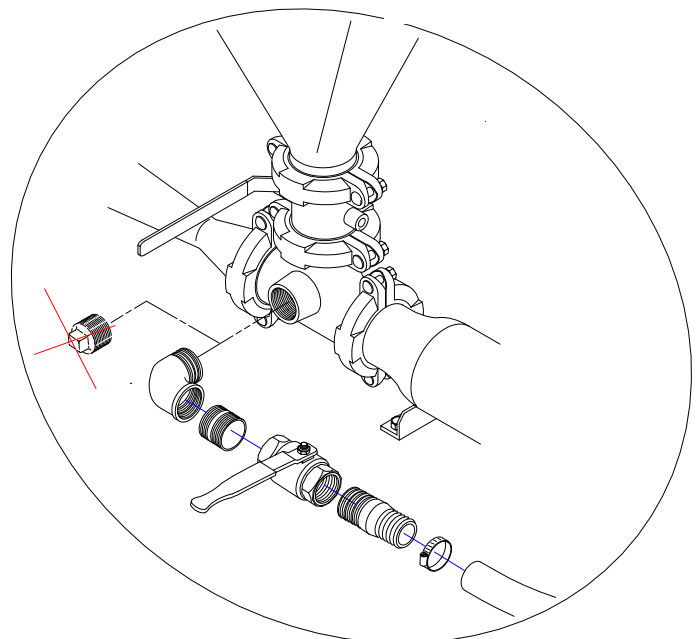
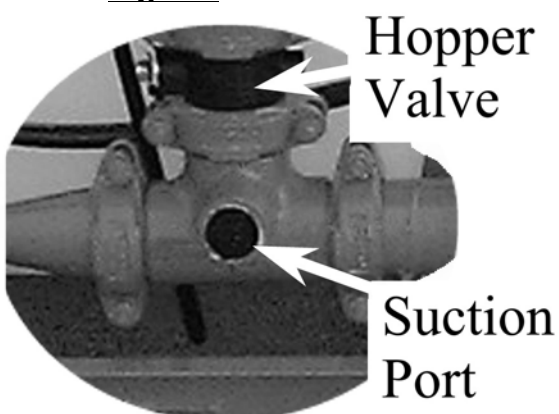
When the unit is mixing product from the hopper, this port will need to be closed. If you are using this port for suction, the hopper valve is to be closed. **THIS MEANS YOU CANNOT “MIX ON THE FLY” OR MIX AND SUCK AT THE SAME TIME!**

To use this option there must be an adequate amount of fluid in the reservoir for the pump to maintain flow and the speed of the centrifugal pump may have to be slowed at the first until the fluid is being “sucked” into the tee and the volume in the reservoir increases, then the pump may be sped up.

If the suction port is connected (as described above) but not used frequently, a build-up of dry product may form inside the port at the mixing Tee. The wash wand can usually wash this out. If you notice a decrease or stoppage in the amount of fluid being drawn in to the system through this port, then there is build-up at the port and should be cleaned.

Fig.14b

Fig.14a



SECTION #V

Troubleshooting the M4 Unit

M4H

Troubleshooting the M4 Unit

The M4 mixing unit is of a simple design with limited moving parts or consumable pieces. The basic system works with a pump that draws fluid from a reservoir tank. The fluid then exits the pump and by building pressure, and velocity, forces the fluid through the filter / shear and into the mixing Tee. The fluid enters the mixing Tee through a nozzle and exists through a venturi. As the fluid enters the venturi, it creates a vacuum in the mixing tee to aid in introducing the dry product from the hopper into the mixing Tee and fluid stream. As the fluid passes through the venturi it carries the dry product with it and into the reservoir tank.

As the fluid travels through the filter / shear, a set amount of fluid is taken from that fluid stream and forced with pressure, to the internal tank jets inside the reservoir tank. Multiple tank jets distribute the fluid through out the tank to “stir” up the tank.

The M4 can discharge fluid to the drill rig or another reservoir by allowing some fluid from the filter shear to be discharged and controlled by a valve.

**A good rule to follow when troubleshooting is as follows
Everything before the pump is being sucked, “has vacuum”.
Everything after the pump is being blown, “has pressure”.**

The following, may aid in any problems that may arise.

- *No fluid flow/ low fluid flow*
 - Pump not primed. - Prime pump**
 - Suction valve is closed - Open suction valve**
 - Suction valve is broken and not opening inside properly. - Replace valve**
 - Plugged suction inlet inside of the tank. - Clean build-up inside of the tank**
 - Not enough fluid in the tank or cavitation - Add fluid to tank**
 - Impeller wore and gap to big. - Shim the impeller or remove gaskets**
 - Pump speed to slow. - Speed up pump**
 - Blockage in pump. - Remove blockage**
 - Fluid too thick to pump. - Thin fluid by adding more water.**
 - Filter / shear is plugged. - Clean filter shear**
 - Optional Mixing Tee valve closed. - Open Mixing Tee valve**
 - Hydraulic variable speed controller (valve) not connected properly. – check connections**
 - Not enough hydraulic fluid to variable speed controller – increase hydraulic oil flow**
- *Fluid backs up into hopper*
 - No fluid flow / low fluid flow - See above solutions**
 - Large build-up in mixing Tee - Clean mixing Tee**
 - Blockage in small part of venturi. - Remove blockage in venturi**
 - Pump speed is set to low - Increase speed of the pump.**
 - Mixing Tee suction port is open - Close off valve or cap (customer installed)**
- *Dry product is slow or will not be drawn down through the hopper.*
 - No fluid flow/ low fluid flow - See above solutions**
 - Fluid is backing up into hopper - See above solutions**
 - Dry product has lumps / debris blocking hopper valve - New product or clean valve**
 - Hopper valve closed - Open hopper valve**
 - Buildup in throat of mixing Tee - Clean throat of mixing Tee**



M4-H

Troubleshooting the M4 Unit

- *Tank does not stir / roll the fluid inside.*
 - No fluid to the tank jets** - Make sure discharge manifold valve is open.
 - Tank jet holes plugged.** - Flush fresh water through system or clean Tank jets
 - Hose is disconnected from tank jets** - Reconnect hose
 - No fluid flow/ low fluid flow** - See above solutions
- *Discharge from the unit is slow or stopped.*
 - Discharge manifold valve is closed** - Make sure valve is open.
 - Discharge hose is blocked, kinked, or pinched off.** - Repair problem(s) with hose.
 - Valve installed at the end of the discharge hose is closed or damaged.** - Open or replace valve.
 - No fluid flow/ low fluid flow** - See above solutions
- *Wash wand has little or no flow or pressure.*
 - Wash wand valve is closed or damaged** - Open wash wand valve or replace.
 - Wash wand nozzle (hole in the end) is plugged** - Shut off unit and clean out wash wand hole.
 - No fluid flow/ low fluid flow** - See above solutions
- *Fluid does not seem to mix well or is slow to mix*
 - Most of the above problems will cause poor mixing or slow mixing** - See above solutions.

**For problems that can not be solved by the above steps,
call your local distributor or STSI (1-800-567-0978) and talk to a company
representative who would be glad to assist you with your problem.**

SECTION #VI

Periodic Maintenance & Repair Information

Basic M-4 Hydraulic Periodic Maintenance Schedule ***

*** Consult Your Hydraulic Power Source OEM manual(s) for a more detailed maintenance schedule of your equipment..***

STSI is not to be held liable for any discrepancies or errors in the schedule.

Maintenance Items							
<i>Hydraulic Components</i>	Every 8 hours (daily)	Every 50 hours (weekly)	Every 100 hours	Every 200 hours (monthly)	Every 400 hours	Every 2000 hours (or yearly)	
Check General Condition Visual (Temperature, Unusual Noise or Vibrations, Cracks, Leaks, Loose hardware.	0						
Visual check of hoses and connections for oil leaks	0						
Visual check of hoses for damage, wear, or kinks	0						
Visual check of variable speed controller	0						
<i>Pump Components</i>							
Check General Condition Visual (Temperature, Unusual Noise or Vibrations, Cracks, Leaks, Loose hardware.	0						
Check & Fill grease cup for mechanical seal	0						
Check pump mechanical seal for leakage (dripping)	0						
Clean old grease build-up from inside of grease cup				0			
Check front impeller clearance (wear plate)					0		
Check rear impeller clearance (seal plate)					0		
Inspect the check valve					0		
<i>Equipment Components</i>							
Wash out Jetting Tee	0						
Remove & clean shear unit	0						
General Condition Visual (Cracks, Leaks, Loose hardware	0						
Clamps are tight and safety pins installed	0						
Lube valve stems & handles		0					
Clean reservoir tank of build-up (internal)			0				
Disassemble and visually inspect piping (internal)						0	

M4-H

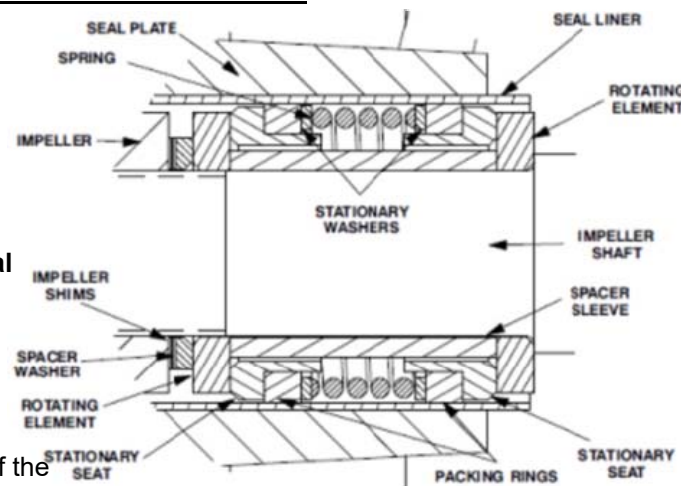
Grease Seal Installation Instructions Centrifugal Pump Application

When replacing the sea, never mix old and new parts. Wear patterns on the old seal faces cannot be realigned during reassembly, and use of old parts can result in premature failure of the new seal.

Before installing the seal, inspect the bore of the seal liner for excessive wear or grooves that might cause leakage or damage to the seal packing rings. If the seal liner must be replaced, use the new seal liner and arbor (or hydraulic) press to force the old one out. After the liner is installed, drill a 1/4" diameter hole through it to permit the flow of lubricant to the seal liner. Be Careful to center the drill in the threaded lubrication hole so not to damage the threads. Deburr the hole from the inside of the seal liner after drilling.

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent. Be sure to follow all safety precautions described on the solvent container.

Remove the new seal and inspect the precision finished faces to ensure that they are free of any foreign matter. To ease installation of the seal, lubricate the packing rings, spacer sleeve, and seal liner with water or a very small amount of oil and apply a drop of light lubrication oil on the precision finished faces. Refer to the illustration, and assemble the seal as follows.



Installation of the inboard rotating element is dictated by the configuration of the shaft shoulder. If there is a radius at the shaft shoulder, the larger chamfer on the I.D. of the inboard rotating element must be positioned toward the shaft shoulder. If there is an undercut at the shaft shoulder, the larger chamfer must be positioned away from the shaft shoulder. Determine the correct position for the rotating element and slide it onto the shaft.

Sub assemble the inboard stationary element, packing ring and spring washer, and press this subassembly into the lubricated seal liner. A push tube cut from a length of plastic will aid seal installation. The O.D. of the tube should be about the same size as the O.D. of the seal spring.

Install the spacer sleeve and spring.

Sub assemble the outboard stationary element, packing ring and spring washer. Press this subassembly into the lubricated seal liner. If the outboard rotating element has a chamfered side, install it with the chamfer facing the impeller end of the shaft.

If your pump requires a spacer washer, install the spacer washer with the chamfer on the I.D. positioned toward the seal.

Install the impeller adjusting shims and impeller (consult the operator's manual for impeller clearance and installation instructions).

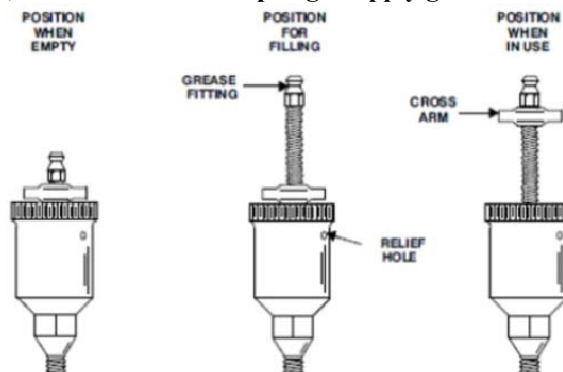
Before starting the pump, reinstall the automatic lubricating grease cup and piping (if removed for seal liner replacement). Lubricate the seal as indicated below.

LUBRICATION

Fill the grease cup through the grease fitting with No. 2 lithium base grease until grease escapes from the relief hole. Turn the grease cup arm counterclockwise until it is at the top of the stem; this will release the spring to apply grease to the seal.

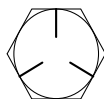
NOTE:

Some smoking and leakage may occur after installing a new seal assembly. This should stop after the pump has run a while and the lapped seal faces have seated in.

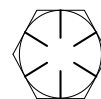


M4-H

Bolt Torque Specifications



Grade 5



Grade 8

SAE SIZE	Lubricated *		Dry **	
	N.m	ft-lbs	N.m	ft-lbs
1/4	9.5	7	12	9
5/16	20	15	25	18
3/8	35	26	44	33
7/16	55	41	70	52
1/2	85	63	110	80
9/16	125	90	155	115
5/8	170	125	215	160
3/4	300	225	375	280
7/8	490	360	625	450
1	725	540	925	675

Lubricated *		Dry **	
N.m	ft-lbs	N.m	ft-lbs
13.5	10	17	12.5
28	21	35	26
50	36	63	46
80	58	100	75
120	90	150	115
175	130	225	160
215	160	300	225
425	310	550	400
700	500	875	650
1050	750	1300	975

* "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings.

** "Dry" means plain or zinc plated without any lubrication.

Metric size

Thread size x pitch mm	N.m	ft-lbs
M6 X 1.0	10.8 ± 1.0	8.0 ± 0.5
M8 x 1.25	25.5 ± 2.9	19.0 ± 2.0
M10 x 1.5	49.0 ± 4.9	36.0 ± 4.0
M12 x 1.75	88.3 ± 9.8	65.0 ± 7.0
M14 x 1.5	137.0 ± 9.8	101.0 ± 7.0
M16 x 1.5	226.0 ± 9.8	167.0 ± 7.0

Apply 60% torque to bolts that are not listed.

Apply 80% torque when tightened to aluminum alloy.



M4-H

NOTES:

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SECTION #VII

OEM Repair Information

GR PUMP INTRODUCTION

Read this manual carefully to learn how to safely install and operate your pump. Failure to do so could result in personal injury or damage to the pump.

This Operation, and Maintenance section is designed to help you achieve the best performance and longest life from your pump.

This pump is an 80 Series, semi-open impeller, self-priming centrifugal model with a suction check valve. The pump is designed for straight-in suction where the medium being pumped enters directly into the impeller eye. It is designed for handling most non-volatile, non-flammable liquids containing specified entrained solids. The basic material of construction for wetted parts is gray iron.

This manual cannot possibly provide detailed instructions and precautions for every aspect of each specific installation by the customer. Therefore, it is the responsibility of the owner/installer of the mixing unit to ensure that applications not addressed in this manual are performed **only** after establishing that neither operator safety nor pump integrity are compromised by the installation. Pumps and related equipment **must** be installed and operated according to all national, local and industry standards.

If there are any questions regarding the pump or its application, which are not covered in this manual or in other literature accompanying this unit, please contact Surface to Surface or your STS distributor.

Surface to Surface Inc 1-800-567-0978

The following are used to alert maintenance personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:



Immediate hazards which WILL result in severe personal injury or death. These instructions describe the procedure required and the injury, which will result from failure to follow the procedure.



Hazards or unsafe practices, which COULD result in severe personal injury or death. These instructions describe the procedure required and the injury, which could result from failure to follow the procedure.



Hazards or unsafe practices, which COULD result in minor personal injury or product or property damage. These instructions describe the requirements and the possible damage, which could result from failure to follow the procedure.

NOTE

Instructions to aid in installation, operation, and maintenance, or which clarify a procedure.

SAFETY

This information applies to 80 Series basic pumps. The power source, which is used to drive the pump, may differ from unit to unit. Refer to the manual accompanying the power source before attempting to begin operation.



WARNING!

Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Lock out or disconnect the power source to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close any suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



WARNING!

This pump is designed to handle most non-volatile, non-flammable liquids containing specified entrained solids. Do not attempt to pump liquids for which the pump, driver and/or controls have not been approved, or which may damage the pump or endanger personnel as a result of pump failure.



WARNING!

Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. Suction and discharge hoses and piping must be removed from the pump before lifting.



WARNING!

Make certain that the unit and all piping or hose connections are tight, properly supported and secure before operation.



WARNING!

Do not operate the pump without the shields and/or guards in place over the drive shaft, belts, and/or couplings, or other rotating parts. Exposed rotating parts can catch clothing, fingers, or tools, causing severe injury to personnel.



WARNING!

Do not operate the pump against a closed discharge valve for long periods of time. If operated against a closed discharge valve, pump components will deteriorate, and the liquid could come to a boil, build pressure, and cause the pump casing to rupture or explode.

SAFETY continued



WARNING!

Overheated pumps can cause severe burns and injuries. If overheating of the pump occurs:

1. Stop the pump immediately.
2. Ventilate the area.
3. Allow the pump to completely cool.
4. Check the temperature before opening any covers, plates, gauges, or plugs.
5. Vent the pump slowly and cautiously.
6. Refer to instructions in this manual before restarting the pump.



WARNING!

Do not remove plates, covers, gauges, pipe plugs, or fittings from an overheated pump. Vapor pressure within the pump can cause parts being disengaged to be ejected with great force. Allow the pump to completely cool before servicing.



WARNING!

Never run this pump backwards. Be certain that rotation is correct before fully engaging the pump.



CAUTION

Pumps and related equipment must be installed and operated according to all national, local and industry standards.

OPERATION

Review all SAFETY information in this manual. Follow the instructions on all tags, labels and decals attached to the pump.



This pump is designed to handle most non-volatile, non-flammable liquids containing specified entrained solids. Do not attempt to pump liquids for which the pump, driver and/or controls have not been approved, or which may damage the pump or endanger personnel as a result of pump failure.

PRIMING

Install the unit and hoses as described in this manual.

Make sure that the piping and hose connections are tight, and that the unit is securely mounted. Check that the pump is properly lubricated (see LUBRICATION and REPAIR).

This pump is self-priming, but the pump should never be operated unless there is liquid in the pump casing.



Never operate this pump unless there is liquid in the pump casing. The pump will not prime when dry. Extended operation of a dry pump will destroy the seal assembly.

Add liquid to the pump casing when:

1. The pump is being put into service for the first time.
2. The pump has not been used for a considerable length of time.
3. The liquid in the pump casing has evaporated.

Once the pump casing has been filled, the pump will prime and re-prime as necessary.



After filling the pump casing, reinstall and tighten the fill plug. Do not attempt to operate the pump unless all connecting piping and hoses are securely installed. Otherwise, liquid in the pump forced out under pressure could cause injury to personnel.

To fill the pump, remove the pump casing fill cover or fill plug in the top of the casing, and add clean liquid until the casing is filled. Replace the fill cover or fill plug before operating the pump.

TROUBLESHOOTING

Review all SAFETY information in Section A.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Lock out or disconnect the power source to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.
4. Check the temperature before opening any covers, plates, or plugs.
5. Close the suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	Not enough liquid in casing. Suction check valve contaminated or damaged. Air leak in suction line. Leaking or worn seal or pump gasket.	Add liquid to casing. See PRIMING. Clean or replace check valve. Correct leak. Check pump vacuum. Replace leaking or worn seal or gasket.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Air leak in suction line. Leaking or worn seal or pump gasket. Impeller or other wearing parts worn or damaged. Impeller clogged.	Correct leak. Check pump vacuum. Replace leaking or worn seal or gasket. Replace worn or damaged parts. Check that impeller is properly centered and rotates freely. Free impeller of debris.

PREVENTIVE MAINTENANCE

Pump wear is directly affected by such things as the abrasive qualities, pressure and temperature of the liquid being pumped, this section is intended only to provide general recommendations and practices for preventive maintenance. Regardless of the application however, following a routine preventive maintenance schedule will help assure trouble-free performance and long life from your 80 series pump.

Record keeping is an essential component of a good preventive maintenance program. Changes in suction and discharge gauge readings (if so equipped) between regularly scheduled inspections can indicate problems that can be corrected before system damage or catastrophic failure occurs.

The appearance of wearing parts should also be documented at each inspection for comparison as well. Also, if records indicate that a certain part (such as the seal) fails at approximately the same duty cycle, the part can be checked and replaced before failure occurs, reducing unscheduled down time.

For new applications, a first inspection of wearing parts at 250 hours will give insight into the wear rate for your particular application. Subsequent inspections should be performed at the intervals shown on the chart below. Critical applications should be inspected more frequently.

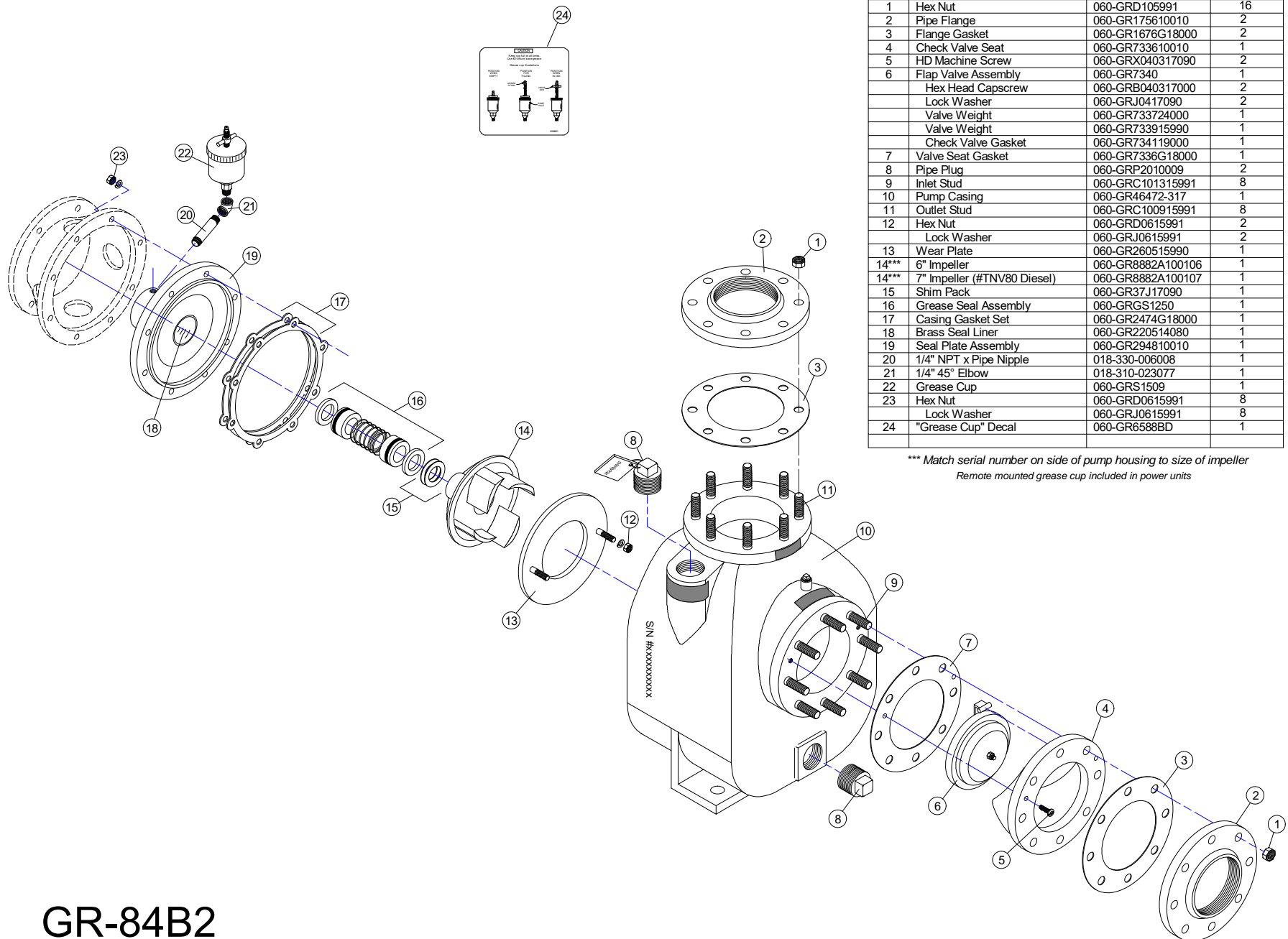
Preventive Maintenance Schedule					
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Bearing Lubrication (if so Equipped)	I	I			R
Seal Lubrication (If So Equipped)	I	I			R
Front Impeller Clearance (Wear Plate)				I	
Rear Impeller Clearance (Seal Plate)				I	
Check Valve				I	
Pump and Driver Alignment				I	
Bearings				I	
Bearing Housing				I	
Piping				I	
Driver Lubrication - See Mfgr's Literature					
Legend: I = Inspect, Clean, Adjust, Repair or Replace as Necessary R = Replace <i>* Service interval based on an intermittent duty cycle equal to approximately 4000 hours annually Adjust schedule as required for lower or higher duty cycles or extreme operating conditions.</i>					

GR-84B2 ASSEMBLY PARTS LIST

(P/N #060-GR84B2-KIT)

REF #	DESCRIPTION	STS PART NUMBER	QTY REQ.
1	Hex Nut	060-GRD105991	16
2	Pipe Flange	060-GR175610010	2
3	Flange Gasket	060-GR1676G18000	2
4	Check Valve Seat	060-GR733610010	1
5	HD Machine Screw	060-GRX040317090	2
6	Flap Valve Assembly	060-GR7340	1
	Hex Head Capscrew	060-GRB040317000	2
	Lock Washer	060-GRJ0417090	2
	Valve Weight	060-GR733724000	1
	Valve Weight	060-GR733915990	1
	Check Valve Gasket	060-GR734119000	1
7	Valve Seat Gasket	060-GR7336G18000	1
8	Pipe Plug	060-GRP2010009	2
9	Inlet Stud	060-GRC101315991	8
10	Pump Casing	060-GR46472-317	1
11	Outlet Stud	060-GRC100915991	8
12	Hex Nut	060-GRD0615991	2
	Lock Washer	060-GRJ0615991	2
13	Wear Plate	060-GR260515990	1
14***	6" Impeller	060-GR8882A100106	1
14***	7" Impeller (#TNV80 Diesel)	060-GR8882A100107	1
15	Shim Pack	060-GR37J17090	1
16	Grease Seal Assembly	060-GRGS1250	1
17	Casing Gasket Set	060-GR2474G18000	1
18	Brass Seal Liner	060-GR220514080	1
19	Seal Plate Assembly	060-GR294810010	1
20	1/4" NPT x Pipe Nipple	018-330-006008	1
21	1/4" 45° Elbow	018-310-023077	1
22	Grease Cup	060-GRS1509	1
23	Hex Nut	060-GRD0615991	8
	Lock Washer	060-GRJ0615991	8
24	"Grease Cup" Decal	060-GR6588BD	1

*** Match serial number on side of pump housing to size of impeller
Remote mounted grease cup included in power units



GR-84B2

REV.09 / 28 / 22

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

Review all **SAFETY** information in Section A.

Follow the instructions on all tags, label and decals attached to the pump.

This pump requires little service due to its rugged, minimum-maintenance design. However, if it becomes necessary to inspect or replace the wearing parts, follow these instructions, which are keyed to the sectional view (see Figure 1) and the accompanying parts list.

This manual will alert personnel to known procedures which require special attention, to those, which could damage equipment, and to those, which could be dangerous to personnel. However, this manual cannot possibly anticipate and provide detailed precautions for every situation that might occur during maintenance of the unit. Therefore, it is the responsibility of the owner/maintenance personnel to ensure that **only** safe, established maintenance procedures are used, and that any procedures not addressed in this manual are performed **only** after establishing that neither personal safety nor pump integrity are compromised by such practices.

Before attempting to service the pump, lock out or disconnect the power source to ensure that it will remain inoperative. Close all valves in the suction and discharge lines.

For power source disassembly and repair, consult the literature supplied with the power source, or contact your local power source representative.



Before attempting to open or service the pump:

1. Familiarize yourself with this manual.
2. Lock out or disconnect the power source to ensure that the pump will remain inoperative.
3. Allow the pump to completely cool if overheated.

4. Check the temperature before opening any covers, plates, or plugs.
5. Close any suction and discharge valves.
6. Vent the pump slowly and cautiously.
7. Drain the pump.



Use lifting and moving equipment in good repair and with adequate capacity to prevent injuries to personnel or damage to equipment. Suction and discharge hoses and piping must be removed from the pump before lifting.

Suction Check Valve Disassembly

Before attempting to service the pump, remove the pump casing drain plug (8) and drain the pump. Clean and reinstall the drain plug.

For access to the check valve, remove the suction hose. Remove the nuts (1) and separate the suction flange (2) and check valve (4) from the pump casing (10).

Inspect the check valve parts for wear or damage. If replacement is required, remove the hardware and separate the check valve gasket and weights.

Pump Casing and Wear Plate Removal

To service the wear plate (13), remove the nuts & lock washers (23), securing the pump casing to the seal plate (19) and bell housing. Separate the pump casing and remove the gasket set (17).

Inspect the wear plate for scoring or excessive wear.

To remove the wear plate, disengage the Hardware(12). Pull the wear plate out of the pump casing.

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

Impeller Removal

Before removing the impeller, screw the cross arm on the automatic lubricating grease cup (22) clockwise until it rests against the cover (see Figure 4) to prevent the grease in the cup from escaping. Remove the grease cup and piping.

Using a hardwood block of wood positioned against the impeller vane, strike the hardwood block with a hammer, in a counter clock-wise rotation (viewed from the impeller end).

Loosening the impeller is the same rotation as loosening a standard nut and bolt.

Inspect the impeller and replace it if cracked or badly worn. Slide the impeller adjusting shims (15) off the impeller shaft. Tie and tag the shims, or measure and record their thickness for ease of reassembly.

Seal Removal and Disassembly

Remove the outer rotating element, shaft sleeve, and remaining seal parts off the shaft as a unit. Carefully remove the stationary and rotating seal elements, packing rings and washers, seal spring and spacer sleeve from the seal plate.

Inspect the seal plate and replace it if cracked or badly worn. To remove the seal plate (19) from the bell housing, remove the bolts and lock washers, or nuts and lock washers from the studs. Inspect the seal liner (18) for wear or grooves that could cause leakage or damage to the seal packing rings. The seal liner is a press fit into the seal plate and does not normally require replacement.

If the seal liner requires replacement, remove the seal plate assembly as described above, and position it on the bed of an arbor (or hydraulic) press. Use a new sleeve to force the old one out. After the new liner is properly installed, **a 3/8-inch (9.5 mm) diameter hole must be drilled through it to permit the flow of lubricant to the seal assembly.** Be careful to center the drill in the threaded grease piping hole and not damage the threads. Deburr the hole from the inside of the seal liner after drilling.

Seal Reassembly and Installation

(Figures 1 and 3)

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent.



Most cleaning solvents are toxic and flammable. Use them only in a well ventilated area free from excessive heat, sparks, and flame. Read and follow all precautions printed on solvent containers.

The seal is not normally reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emergency, carefully wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.

Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non-oil based solvent and a clean, lint-free tissue. Wipe lightly in a concentric pattern to avoid scratching the faces.

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage.

Clean and polish the shaft sleeve, or replace it if there are nicks or cuts on either end. If any components are worn, replace the complete seal.

Never mix old and new seal parts.

If a replacement seal is being used, remove it from the container and inspect the precision finished faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the seal liner (18) with water or a very small amount of oil, and apply a drop of light lubricating oil on the finished faces. Assemble the seal as follows, (see Figure 3).

Slide the seal plate assembly over the impeller shaft and secure the seal plate to the engine using the bolts and lock washers or nuts and lock washers on studs.

Slide the inboard rotating element into the lubricated seal liner with the chamfered side toward the shaft shoulder.

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

Seal Reassembly and Installation *continued* (Figures 1 and 3)

Sub assemble the inboard stationary seat, packing ring and stationary washer. Press this unit into the lubricated seal liner until the seal faces contact.

A push tube cut from a length of plastic pipe or deep socket would aid in this installation. The I.D. of the tube or socket should be approximately the same size as the I.D. of the seal spring.

Slide the spacer sleeve onto the shaft until it seats against the inboard rotating element and install the seal spring.

Sub assemble the outboard stationary seat, packing ring and stationary washer. Press this unit into the lubricated seal liner. Install the outboard rotating element with the chamfered side toward the impeller. Lubricate the seal assembly as indicated in LUBRICATION *after the impeller has been installed.*

Impeller Installation

Inspect the impeller and replace it if cracked or badly worn.



The shaft and impeller threads must be completely clean before reinstalling the impeller. Even the slightest amount of dirt on the threads can cause the impeller to seize to the shaft, making future removal difficult or impossible without damage to the impeller or shaft.

Install the same thickness of impeller shims (15) as previously removed and screw the impeller onto the shaft until tight. Bump the impeller tight with a wood block or soft mallet.

The clearance between the back of the impeller and the seal plate should be between 0.010 and 0.020 inch (0,25 to 0,51 mm).

Measure this clearance and add or remove shims from the impeller adjusting shim set until the correct clearance is achieved.

Pump Casing and Wear Plate Installation

If the wear plate assembly (13) was removed, install the new wear plate in the pump casing and secure it with the hardware (12).

Install a new set of casing gaskets (17) and slide the pump casing over the impeller and against the gaskets.

The clearance between the face of the impeller and the wear plate should be between .010 and .020 inch (0,25 to 0,51 mm).

Remove gaskets from the gasket set until the correct clearance is achieved. Secure the pump casing to the seal plate with nuts & lock washers.

Suction Check Valve Installation

Inspect the check valve components and replace them as required. Sub assemble the check valve weights and gasket using the attaching hardware.

Install the check valve assembly on to the studs (9). Replace the suction flange onto the studs, and secure with the nuts.

Check the operation of the check valve to ensure proper seating and free movement.

Final Pump Reassembly

Be sure all hardware and drain plugs are tight, and that the pump is secure to the base and power source.

Install the suction and discharge lines / hoses and open all valves. Make certain that all piping connections are tight, and that the weight of the hose is independently supported and secure.

Before starting the pump, fill the pump casing with clean liquid.

Apply Pipe Sealant or equivalent compound to the fill plug (8). Reinstall and tighten the fill plug.

Refer back to OPERATION, before putting the pump back into service.

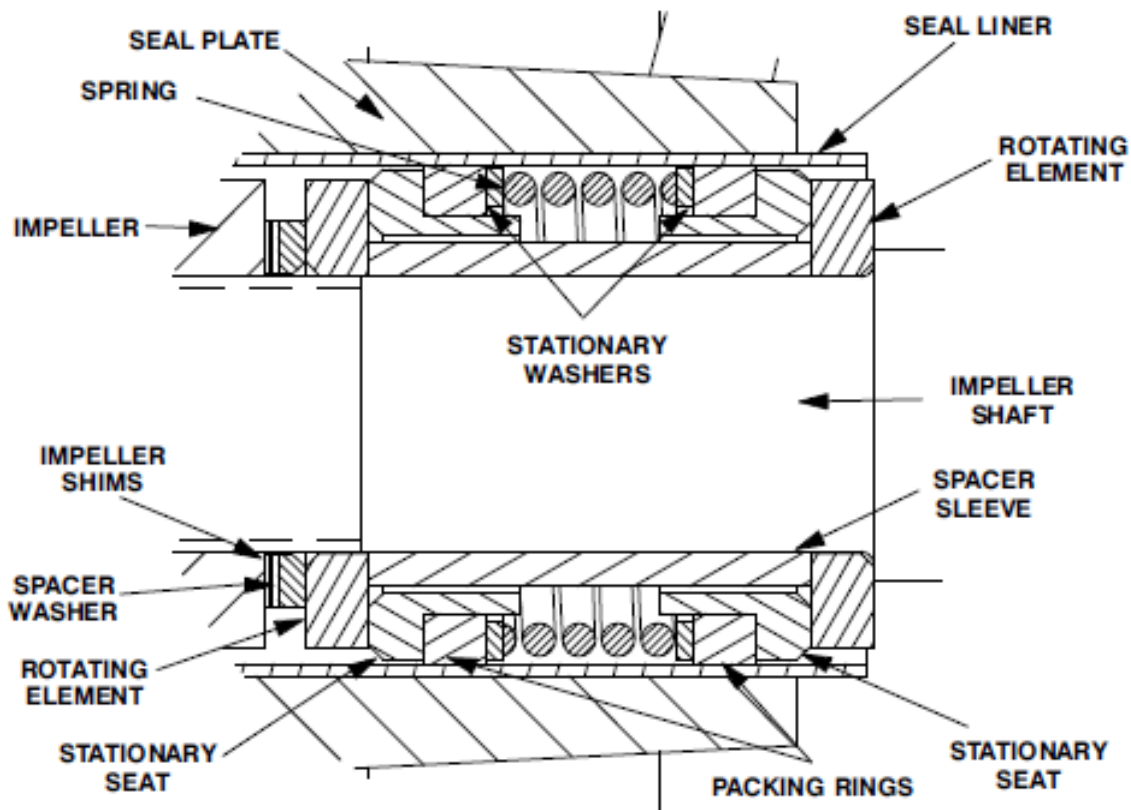


Figure 3. Seal Assembly

LUBRICATION

Fill the grease cup (11) through the grease fitting with No. 2 lithium base grease until grease escapes from the relief hole. Turn the grease cup arm counterclockwise until it is at the top of the stem; this will release the spring to apply grease to the seal (see Figure 4).

NOTE:

Some smoking and leakage may occur after installing a new seal assembly. This should stop after the pump has run a while and the lapped seal faces have seated in

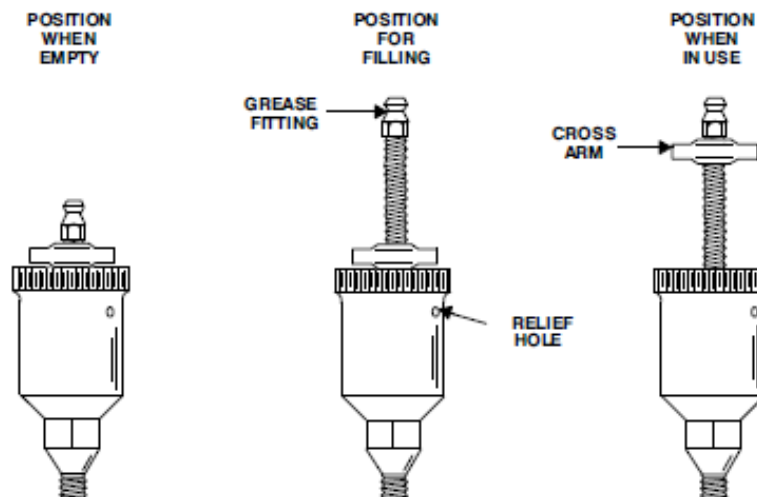


Figure 4. Automatic Lubricating Grease Cup

Grease Seal Installation Instructions

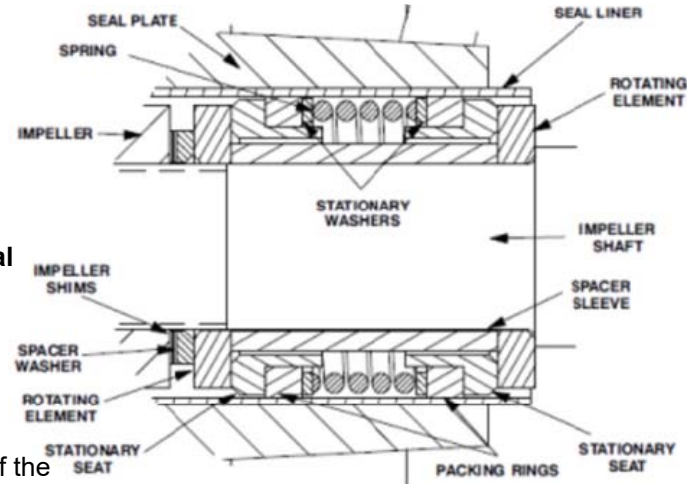
Centrifugal Pump Application

When replacing the seal, never mix old and new parts. Wear patterns on the old seal faces cannot be realigned during reassembly, and use of old parts can result in premature failure of the new seal.

Before installing the seal, inspect the bore of the seal liner for excessive wear or grooves that might cause leakage or damage to the seal packing rings. If the seal liner must be replaced, use the new seal liner and arbor (or hydraulic) press to force the old one out. After the liner is installed, drill a 1/4" diameter hole through it to permit the flow of lubricant to the seal liner. Be Careful to center the drill in the threaded lubrication hole so not to damage the threads. Debur the hole from the inside of the seal liner after drilling.

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent. Be sure to follow all safety precautions described on the solvent container.

Remove the new seal and inspect the precision finished faces to ensure that they are free of any foreign matter. To ease installation of the seal, lubricate the packing rings, spacer sleeve, and seal liner with water or a very small amount of oil and apply a drop of light lubrication oil on the precision finished faces. Refer to the illustration, and assemble the seal as follows.



Installation of the inboard rotating element is dictated by the configuration of the shaft shoulder. If there is a radius at the shaft shoulder, the larger chamfer on the I.D. of the inboard rotating element must be positioned toward the shaft shoulder. If there is an undercut at the shaft shoulder, the larger chamfer must be positioned away from the shaft shoulder. Determine the correct position for the rotating element and slide it onto the shaft.

Sub assemble the inboard stationary element, packing ring and spring washer, and press this subassembly into the lubricated seal liner. A push tube cut from a length of plastic will aid seal installation. The O.D. of the tube should be about the same size as the O.D. of the seal spring.

Install the spacer sleeve and spring.

Sub assemble the outboard stationary element, packing ring and spring washer. Press this subassembly into the lubricated seal liner. If the outboard rotating element has a chamfered side, install it with the chamfer facing the impeller end of the shaft.

If your pump requires a spacer washer, install the spacer washer with the chamfer on the I.D. positioned toward the seal.

Install the impeller adjusting shims and impeller (consult the operator's manual for impeller clearance and installation instructions).

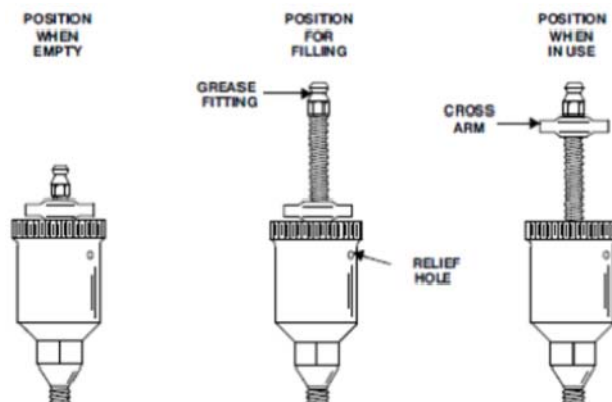
**Before starting the pump, reinstall the automatic lubricating grease cup and piping (if removed for seal liner replacement).
Lubricate the seal as indicated below.**

LUBRICATION

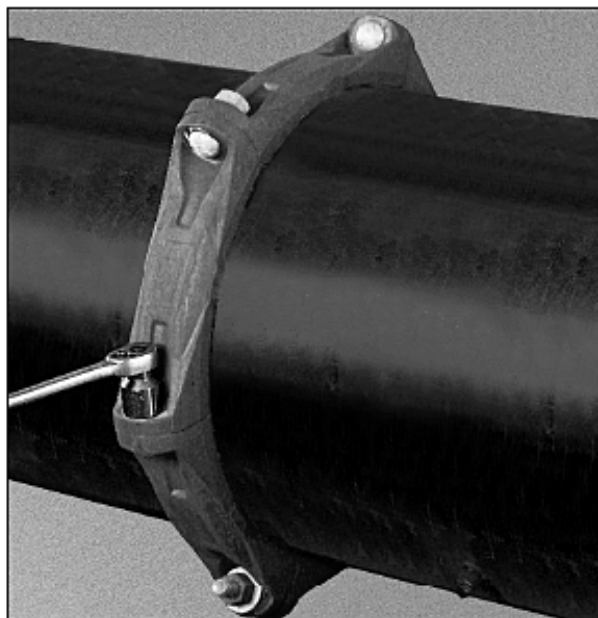
Fill the grease cup through the grease fitting with No. 2 lithium base grease until grease escapes from the relief hole. Turn the grease cup arm counterclockwise until it is at the top of the stem; this will release the spring to apply grease to the seal.

NOTE:

Some smoking and leakage may occur after installing a new seal assembly. This should stop after the pump has run a while and the lapped seal faces have seated in.



COUPLING INSTALLATION & ASSEMBLY



The instructions are based on pipe grooved in accordance with Gruklok® grooving specifications. Check pipe ends for proper groove dimensions and to assure that the pipe ends are free of indentations and projections which would prevent proper sealing.

ALWAYS USE A GRUVLOK® LUBRICANT FOR PROPER COUPLING ASSEMBLY. Thorough lubrication of the external surface of the gasket is essential to prevent pinching and possible damage to the gasket. For temperatures above 150° F (65.6° C) use Gruklok Xtreme™ Lubricant and lubricate all gasket surfaces, internal and external. See Gruklok Lubricants in the Technical Data section of the Gruklok catalog for additional important information.

SPECIFIED BOLT TORQUE

Specified bolt torque is for the oval neck track bolts used on Gruklok® couplings and flanges. The nuts must be tightened alternately and evenly until fully tightened. Caution: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

ANSI SPECIFIED BOLT TORQUE		
Bolt Size	Wrench Size	Specified Bolt Torque *
In.	In.	FT-Lbs
3/8	11/16	30-45
1/2	3/4	80-100
5/8	1 1/16	100-130
3/4	1 1/4	130-180
7/8	1 3/8	180-220
1	1 1/2	200-250
1 1/8	1 7/8	225-275
1 1/4	2	250-300

* Non-lubricated bolt torques.

METRIC SPECIFIED BOLT TORQUE		
Bolt Size	Wrench Size	Specified Bolt Torque *
mm	mm	N-m
M10	16	40-60
M12	22	110-150
M16	24	135-175
M20	30	175-246
M22	34	245-300
M24	36	270-340

* Non-lubricated bolt torques.

NOTE: Specified torques are to be used unless otherwise noted on Product installation instructions.

FIG. 7000**Lightweight Flexible Coupling**

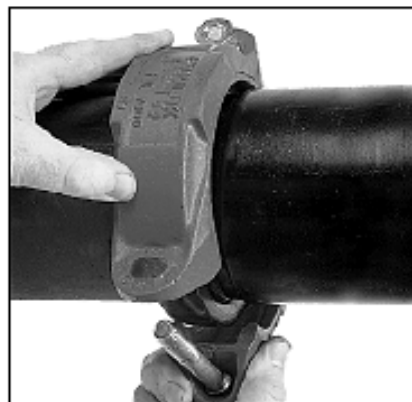
1 CHECK & LUBRICATE GASKET— Check gasket to be sure it is compatible for the intended service. Apply a thin coating of Gruvlok lubricant to outside and sealing lips of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.



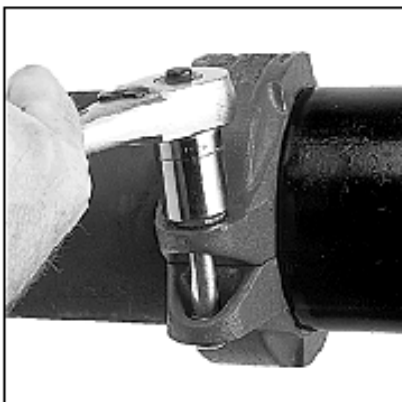
2 GASKET INSTALLATION— Slip the gasket over the pipe end, making sure the gasket lip does not overhang the pipe end.



3 ALIGNMENT— After aligning the two pipe ends together, pull the gasket into position, centering it between the grooves on each pipe. Gasket should not extend into the groove on either pipe.

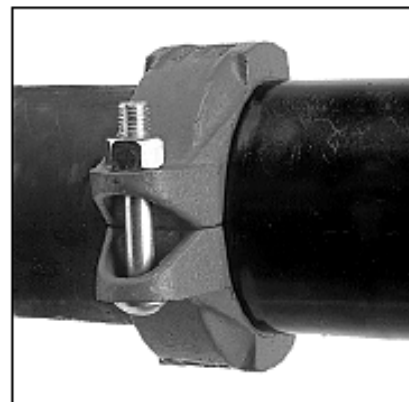


4 HOUSINGS— With one nut unthreaded to the end of the bolt, unthread the other nut completely and swing the coupling housing halves over the gasket, making sure the housing keys engage the grooves. Insert the bolt and turn the nuts finger tight.



5 TIGHTEN NUTS— Tighten the nuts alternately and equally to the specified bolt torque. The housing bolt pads must make metal-to-metal contact.

CAUTION: Uneven tightening may cause the gasket to pinch.



6 ASSEMBLY IS COMPLETE— Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves and the bolt pads are in firm even metal-to-metal contact on both sides of the coupling.

CAUTION: Use of an impact wrench is not recommended because the torque output can vary significantly due to many variables including air pressure supply, battery strength and operational variations.

CAUTION: Proper torquing of coupling bolts is required to obtain specified performance. Over torquing the bolts may result in damage to the bolt and/or casting which could result in pipe joint separation. Under torquing the bolts may result in lower pressure retention capabilities, lower bend load capabilities, joint leakage and pipe joint separation. Pipe joint separation may result in significant property damage and serious injury.

NOTE: VdS - Roll Grooving Approval Specifications, see the Technical Data/Installation Instructions section on Anvil's web site - www.anvilintl.com

FIG. 7003

Hingelok™ Coupling

NOTE: Remove locking pin from handle before opening coupling.



1 CHECK & LUBRICATE GASKET— Check gasket to be sure it's compatible for the intended service. Apply a thin coating of GUVLOK lubricant to outside and sealing lips of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.



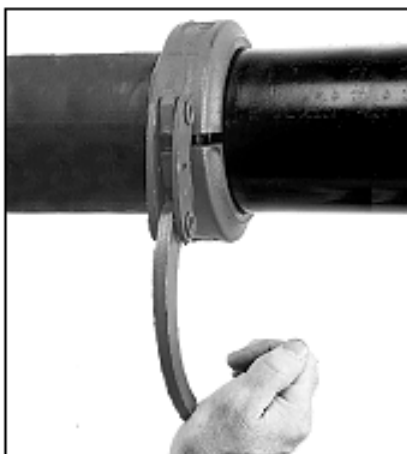
2 GASKET INSTALLATION— Slip the gasket over the pipe end making sure the gasket lip does not overhang the pipe end.



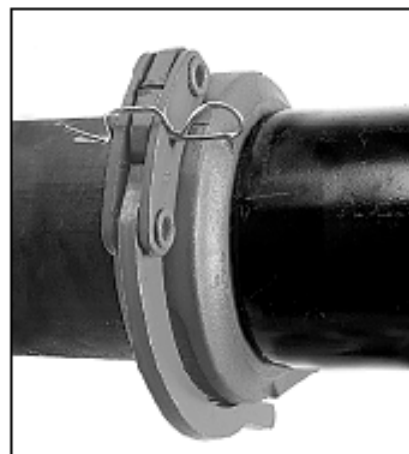
3 ALIGNMENT— After aligning the two pipe ends, pull the gasket into position centering it between the grooves on each pipe. Gasket should not extend into the groove on either pipe.



4 HOUSINGS— Put one half of the open coupling over the gasket as the coupling keys fit firmly into the grooves on each pipe and. Swing the other half of the coupling into position around the gasket and into the grooves.



5 LOCK COUPLING— Fit the nose of the locking handle in the notch of the opposite housing. Press firmly down on the handle until it makes contact with the coupling housing. Insert locking pin into handle linkage to secure handle in closed position. (See Caution.)



6 ASSEMBLY IS COMPLETE— Visually inspect the pipe joint to assure the coupling keys are fully engaged in the pipe grooves and the bolt pads are in firm even metal-to-metal contact on both sides of the coupling.

CAUTION:

- 1) Hammering or banging on the handle or coupling housing could cause serious damage to the locking device and coupling assembly. The result may be an unsuitable pipe joint and unusable coupling assembly.
- 2) Care needs to be taken so that fingers do not get caught or pinched when handle is placed in locked position as a result of cam action of handle assembly.
- 3) When re-using coupling and gasket, always inspect gasket for damage and hinge/handle assembly for looseness, distortion or any other damage.

Hydraulic fluids

Ratings and data for gear motors are based on operating with premium hydraulic fluids containing oxidation, rust, and foam inhibitors. These fluids must possess good thermal and hydrolytic stability to prevent wear, erosion, and corrosion of internal components. They include:

- Hydraulic fluids following DIN 51524, part 2 (HLP) and part 3 (HVLP) specifications•
- API CD engine oils conforming to SAE J183•
- M2C33F or G automatic transmission fluids•
- Certain agricultural tractor fluids•

Use only clean fluid in the motor and hydraulic circuit.

Caution

Never mix hydraulic fluids.

Please see Sauer-Danfoss publication *Hydraulic Fluids and Lubricants Technical Information*, **520L0463** for more information. Refer to publication *Experience with Biodegradable Hydraulic Fluids Technical Information*, **520L0465** for information relating to biodegradable fluids.

Temperature and viscosity

Temperature and viscosity requirements must be concurrently satisfied. Use petroleum / mineral-based fluids.

High temperature limits apply at the inlet port to the motor. The motor should run at or below the maximum continuous temperature. The peak temperature is based on material properties. Don't exceed it.

Cold oil, generally, doesn't affect the durability of motor components. It may affect the ability of oil to flow and transmit power. For this reason, keep the temperature at 16 °C [60 °F] above the pour point of the hydraulic fluid.

Minimum (cold start) **temperature** relates to the physical properties of component materials.

Minimum viscosity occurs only during brief occasions of maximum ambient temperature and severe duty cycle operation. You will encounter maximum viscosity only at cold start. During this condition, limit speeds until the system warms up. Size heat exchangers to keep the fluid within these limits. Test regularly to verify that these temperatures and viscosity limits aren't exceeded. For maximum unit efficiency and bearing life, keep the fluid viscosity in the recommended viscosity range.

Fluid viscosity

Maximum (cold start)	mm ² /s	1000 [4600]
Recommended range	[SUS]	12-60 [66-290]
Minimum		10 [60]

Temperature

Minimum (cold start)	°C	-20 [-4]
Maximum continuous	[°F]	80 [176]
Peak (intermittent)		90 [194]

Filtration

Filters

Use a filter that conforms to Class 22/18/13 of ISO 4406 (or better). It may be on the motor outlet (discharge filtration) or inlet (pressure filtration).

Selecting a filter

When selecting a filter, please consider:

- Contaminant ingress rate • (determined by factors such as the number of actuators used in the system)
- Generation of contaminants in the system•
- Required fluid cleanliness•
- Desired maintenance interval•
- Filtration requirements of other system components•

Measure filter efficiency with a Beta ratio (β_x). For:

- Discharge filtration, with controlled reservoir ingress, use a • $\beta_{35-45} = 75$ filter
- Pressure filtration, use a pressure filtration with an efficiency of • $\beta_{10} = 75$.

β_x ratio is a measure of filter efficiency defined by ISO 4572. It is the ratio of the number of particles greater than a given diameter ("x" in microns) upstream of the filter to the number of these particles downstream of the filter. Fluid cleanliness level and β_x ratio

Fluid cleanliness level (per ISO 4406)	Class 22/18/13 or better
β_x ratio (discharge filtration)	$\beta_{35-45} = 75$ and $\beta_{10} = 2$
β_x ratio (pressure filtration)	$\beta_{10} = 75$
Recommended inlet screen size	100-125 μm [0.004-0.005 in]

The filtration requirements for each system are unique. Evaluate filtration system capacity by monitoring and testing prototypes.

Reservoir

The reservoir provides clean fluid, dissipates heat, removes entrained air, and allows fluid volume changes associated with fluid expansion and during all system operating modes. A correctly sized reservoir accommodates maximum volume changes during all system operating modes. It promotes de-aeration of the fluid as it passes through, and accommodates a fluid dwell-time between 60 and 180 seconds, allowing entrained air to escape.

Minimum reservoir capacity depends on the volume required to cool and hold the oil from all retracted cylinders, allowing for expansion due to temperature changes. A fluid volume of 1 to 3 times the motor output flow (per minute) is satisfactory. The minimum reservoir capacity is 125% of the fluid volume.

Install the suction line above the bottom of the reservoir to take advantage of gravity separation and prevent large foreign particles from entering the line. Cover the line with a 100-125 micron screen. The motor should be below the lowest expected fluid level.

Put the return-line below the lowest expected fluid level to allow discharge into the reservoir for maximum dwell and efficient deaeration. A baffle (or baffles) between the return and suction lines promotes deaeration and reduces fluid surges.

Line sizing

Choose pipe sizes that accommodate minimum fluid velocity to reduce system noise, pressure drops, and overheating. This maximizes system life and performance. Design inlet piping that maintains continuous motor inlet pressure above 0.8 bar absolute during normal operation. The line velocity should not exceed the values in this table:

Maximum line velocity

Inlet	m/s [ft/sec]	2.5 [8.2]
Outlet		5.0 [16.4]
Return		3.0 [9.8]

Most systems use hydraulic oil containing 10% dissolved air by volume. Under high inlet vacuum conditions the oil releases bubbles. They collapse when subjected to pressure, resulting in cavitation, causing adjacent metal surfaces to erode. Over-aeration is the result of air leaks on the inlet side of the motor, and flow-line restrictions. These include inadequate pipe sizes, sharp bends, or elbow fittings, causing a reduction of flow line cross sectional area. This problem will not occur if inlet vacuum and rated speed requirements are maintained, and reservoir size and location are adequate.

SECTION #VIII

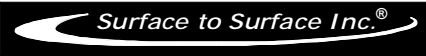
(Parts Manual)

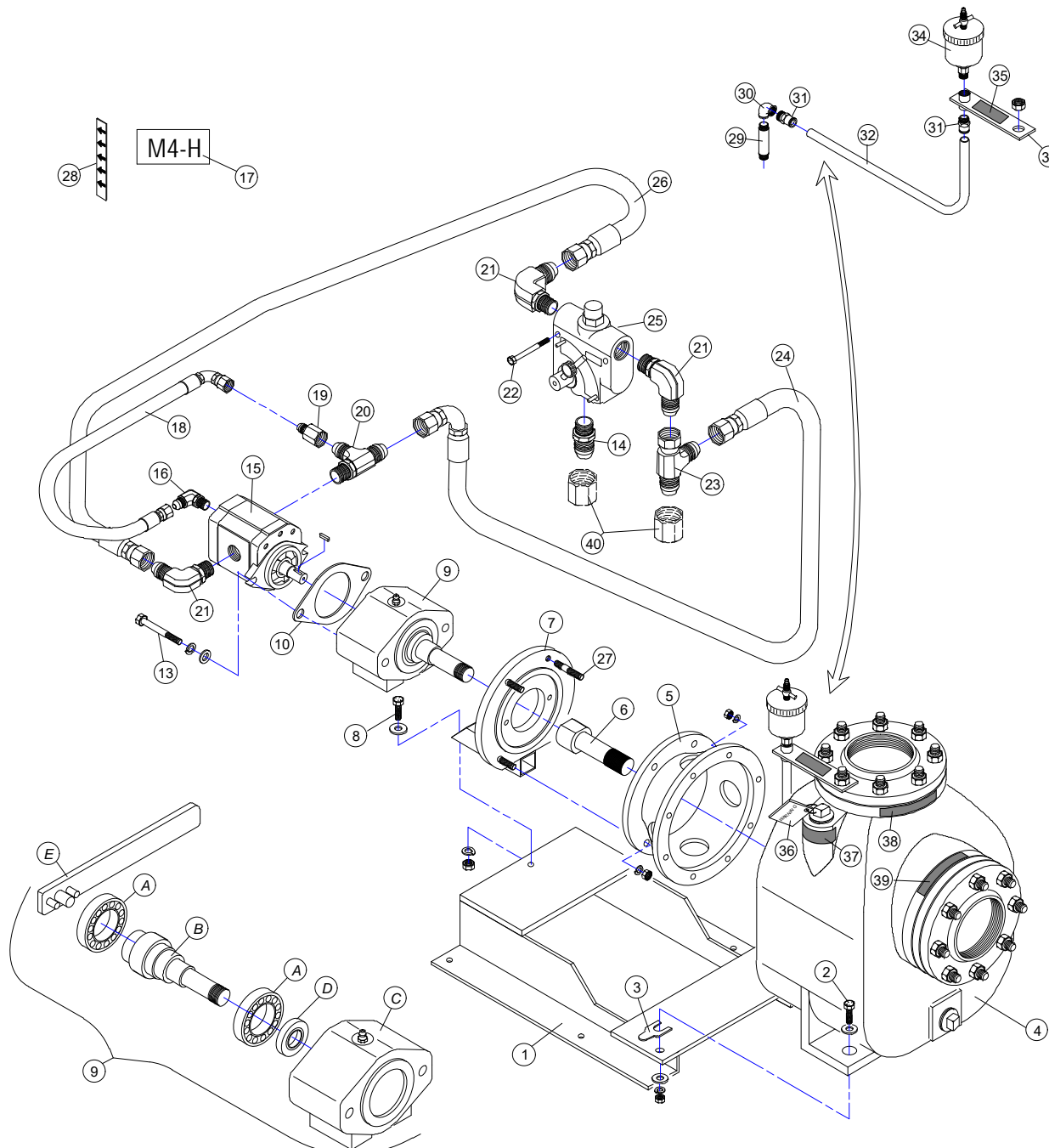
PU-M4H(GR) ASSEMBLY PARTS LIST

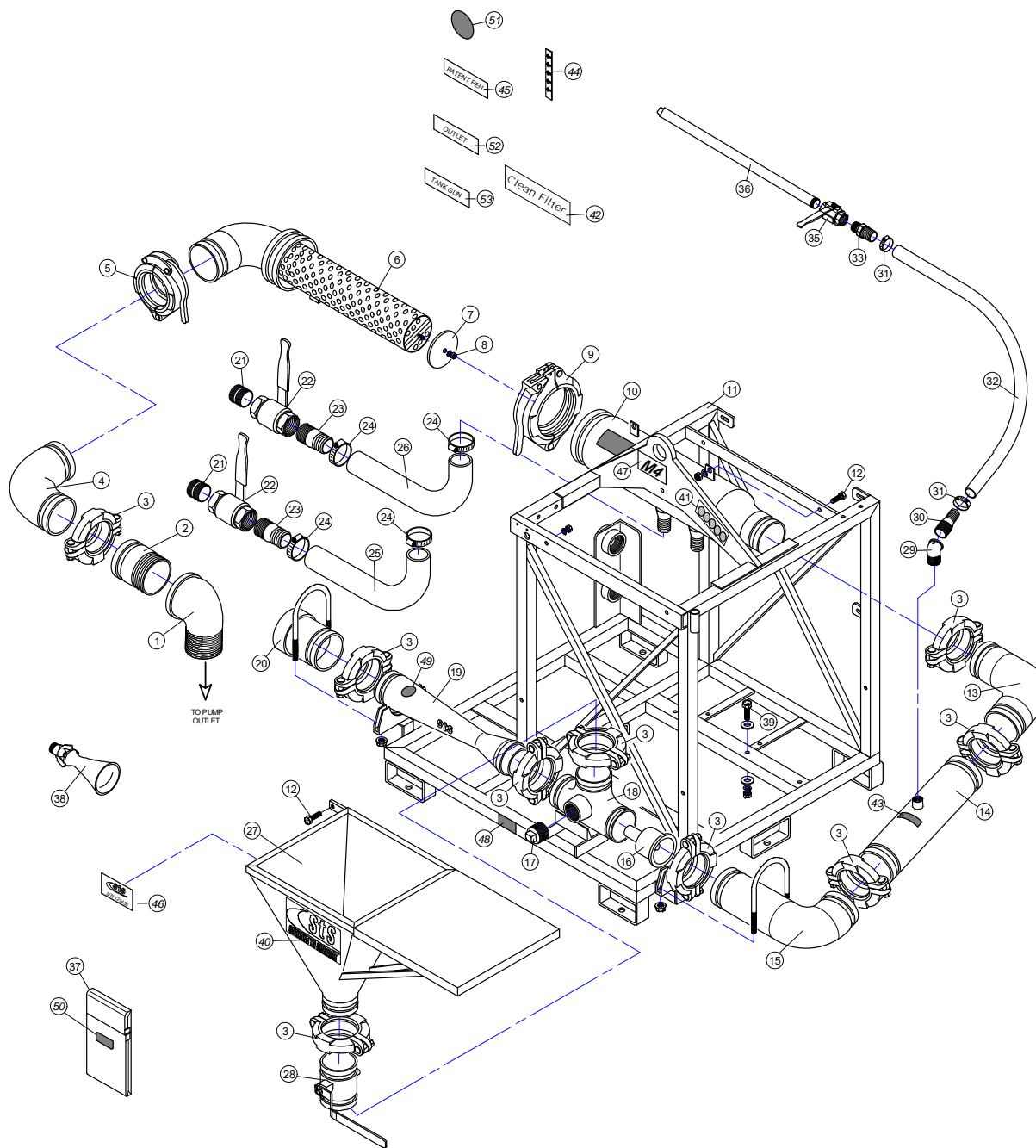
P/N #PU-M4H(GR)

REF #	DESCRIPTION	STS PART NUMBER	QTY REQ.	
1	Motor / Pump Mounting Base	060-GR84B2-10	1	B
2	1/2" x 2" Bolt	076-13211	2	
	1/2" L/W	076-33626	2	
	1/2" F/W	076-33012	4	
	1/2" Nut	076-36310	2	
3	Motor Shim S/S	034-QA SHIM PACK	2	
4	Gorman-Rupp 4" Pump	060-GR84B2-KIT	1	B
5	Bell Housing	060-GR84B2-02	1	
6	Shaft Adaptor	060-84B2-01	1	
7	Bearing Block Mount	HTSP4-15	1	B
8	3/8" x 1 1/4" Bolt	076-13107	1	
	3/8" F/W	076-33008	1	
	3/8" L/W	076-33622	1	
	3/8" Nut	076-36306	1	
9	Bearing Block	HTSP4-02	1	B
10	Bearing Block / Motor Gasket	036-200-06	1	
11				
12				
13	3/8" x 4 1/4" SHCS	076-23320	2	
	3/8" F/W	076-33008	2	
	3/8" L/W	076-33622	2	
14	3/4" JIC x 3/4" ORB Adaptor	029-0503-12-12	1	
15	Hydraulic Motor (SNM2/19)	039-B1212004900	1	
16	3/8" ORB x 3/8" JIC 90° Elbow	029-2503-6-6	1	
17	"M4-H" Decal	070-M4-020-H	1	
18	3/8" Hyd. Hose	M-750HD-H03	1	
19	3/4" x 3/8" JIC Reducing Adaptor	029-0603-12-6	1	
	3/4" JIC Sleeve Nut	029-06B-12	1	
20	3/4" JIC x 3/4" ORB TEE	029-053T-12-12	1	
21	3/4" ORB x 3/4" JIC 90° Elbow	029-2503-12-12	3	
22	1/4" x 2 1/2" Bolt	076-13013	2	
	1/4" L/W	076-33618	2	
	1/4" Nut	076-36302	2	
23	3/4" JIC Swivel Nut Run TEE	029-063T-12-12	1	
24	3/4" Hyd. Hose	M4-005-B	1	
25	Hydraulic Flow Control	046-FCR51-12SAE	1	B
26	3/4" Hyd. Hose	M4-005-A	1	
27	7/16" x 1 3/4" Studs	060-164940	4	
	7/16" L/W	076-33624	4	
	7/16" Nut	076-36308	4	
28	Directional Tape	STS-PIPEMARKER	4"	
29	1/4" NPT x Pipe Nipple	018-330-006008	1	B
30	1/4" NPT x 90 deg Elbow	018-310-000401	1	B
31	Pipe to Hose Connector	019-WEA 1868x8x4	2	
32	Nylon Hose	025-1928-07	11 1/2"	
33	Grease Cup Mount	060-GR84B2-13	1	B
34	Grease Cup	060-S1509	1	
35	"GREASE" Decal	070-ST5-021-B	1	
36	Pressure Warning Tag	060-GR6588BG	1	
37	"PRIME" Decal	060-GR6588AH	1	
38	"DISCHARGE" Decal	060-GR6588BJ	1	
39	"SUCTION" Decal	060-GR6588AG	1	
40	Cap (shipping purpose only)	029-06CP-12	2	
A	Bearing	036-6010-2RS	2	
B	Machined Shaft	036-300-S4A	1	
C	Bearing Block Housing	036-300-2	1	
D	Shaft Seal	036-CR17271	1	
E	Shaft Wrench	HTSP4-10	1	R

PAINT
Black = B
Red = R

	
DWR. NUM.	DATE. 09 / 19 / 12
PU-M4H	REV.





BU-M4 (V2) ASSEMBLY PARTS LIST (P/N #BU-M4 (V2))

REF #	DESCRIPTION	STS PART NUMBER	QTY REQ.	
1	4" NPT 90° Street Elbow	018-310-01780-1	1	B
2	Pump Discharge Pipe	M4-011	1	B
3	4" Groove-Loc Coupler	020-390-00034-7	9	B
4	4" Grooved 90° Elbow	020-390-01430-6	1	B
5	4" Hinge-Loc Coupler	020-390-20010-3	1	B
6	Filter / Shear	M4-017	1	O
7	Filter Shear Carriage End Cap	SR-75030-4	1	O
8	5/16" NC Nut	076-36304	1	
	5/16" L/W	076-33620	1	
9	6" Hinge-Loc Coupler	020-390-20060-8	1	B
10	Filter / Shear Housing	M4-016	1	O
11	Base Frame	M4-01	1	B
12	3/8" x 1 1/4" Bolt	076-13107	4	
	3/8" F/W	076-33008	4	
	3/8" L/W	076-33622	4	
	3/8" Nut	076-36306	4	
13	Filter / Shear Outlet Pipe	M4-013	1	O
14	Long Grooved End Pipe	M4-014-C	1	O
15	Mixing Tee Inlet Pipe	M4-012	1	O
16	Jetting Nozzel	SR-75020-NE	1	O
17	2" NPT Pipe Plug	018-318-90256-6	1	O
18	Jetting Tee	SR-75021	1	O
19	Venturi Tube	SR-75022	1	O
20	Discharge Adaptor	M4-010-S	1	O
21	2" NPT x Close Nipple	018-330-03700-3	2	B
22	2" Ball Valve	022-423-00014-0	2	
23	2" NPT x Hose Barb	018-1661268241	2	B
24	2" Gear Clamp	025-HS-36	4	
25	2" Rubber Hose	M4-019-A	1	
26	2" Rubber Hose	M4-019-B	1	
27	Hopper with Table	SR-75032	1	O
28	4" Grooved Butterfly Valve	023-7005-011403	1	
29	3/4" NPT Street 45° Elbow MI	018-310-02740-4	1	B
30	3/4" NPT x Hose Barb	018-1661268225	1	B
31	3/4" Gear Clamp	025-HS-12	2	
32	3/4" Rubber Hose	M4-019-C	1	
33	3/8" MNPT x 3/4" Hose Barb	018-125-12C	1	
34				
35	3/8" Ball Valve	022-423-00002-5	1	
36	Wash Wand	SR-75047	1	O
37	Operators Manual Holder	084-9000-07	1	
	3/16" Rivet	076-41228	2	
38	Mixing Nozzel (Jet Guns)	086-TM4P-L	4	
39	7/16" x 1 1/2" Bolt	076-13159	6	
	7/16" F/W	076-33010	12	
	7/16" L/W	076-33624	6	
	7/16" Nut	076-36308	6	
40	"Logo" Decal	070-ST5-029	1	
41	"Blue Safty Circles" Decal	070-ST5-038	1	
42	"Clean Filter" Decal	070-ST5-027-A	1	
43	"Caution pressure" Decal	M2-633-A	1	
44	Directional tape	STS-PIPE MARKER3/4"	18"	
45	Patent Plate	071-ST5-002-PAT	1	
46	Serial Number Plate	071-ST5-001-M4	1	
47	"M4" Decal	M4-020	1	
48	"Fork Lift" Decal	070-16072-B	1	
49	"No Step" Decal	070-15080-B	1	
50	"Operators Manual" Decal	070-ST5-036	1	
51	"Lift Point" Decal	070-16071-B	1	
52	"Outlet" Decal	M2-633-B	1	
53	"Tank Gun" Decal	M2-633-D	1	

PAINT COLORS
O - Orange
B - Black

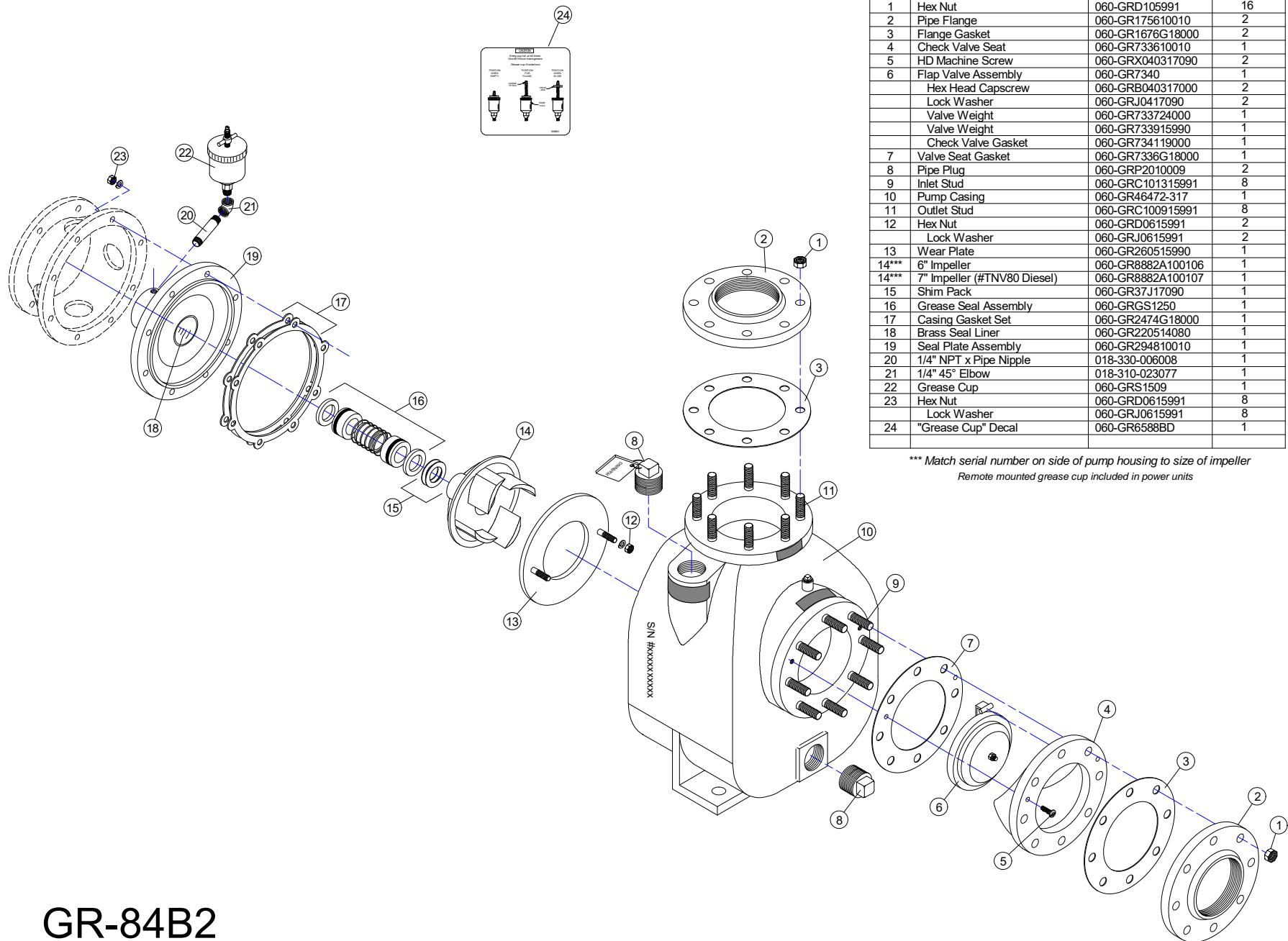
Surface to Surface Inc.®	
DWR. NUM.	DATE. 07 / 02 / 07
M4-Base Unit (V2)	REV. 02 / 08 / 23

GR-84B2 ASSEMBLY PARTS LIST

(P/N #060-GR84B2-KIT)

REF #	DESCRIPTION	STS PART NUMBER	QTY REQ.
1	Hex Nut	060-GRD105991	16
2	Pipe Flange	060-GR175610010	2
3	Flange Gasket	060-GR1676G18000	2
4	Check Valve Seat	060-GR733610010	1
5	HD Machine Screw	060-GRX040317090	2
6	Flap Valve Assembly	060-GR7340	1
	Hex Head Capscrew	060-GRB040317000	2
	Lock Washer	060-GRJ0417090	2
	Valve Weight	060-GR733724000	1
	Valve Weight	060-GR733915990	1
	Check Valve Gasket	060-GR734119000	1
7	Valve Seat Gasket	060-GR7336G18000	1
8	Pipe Plug	060-GRP2010009	2
9	Inlet Stud	060-GRC101315991	8
10	Pump Casing	060-GR46472-317	1
11	Outlet Stud	060-GRC100915991	8
12	Hex Nut	060-GRD0615991	2
	Lock Washer	060-GRJ0615991	2
13	Wear Plate	060-GR260515990	1
14***	6" Impeller	060-GR8882A100106	1
14***	7" Impeller (#TNV80 Diesel)	060-GR8882A100107	1
15	Shim Pack	060-GR37J17090	1
16	Grease Seal Assembly	060-GRGS1250	1
17	Casing Gasket Set	060-GR2474G18000	1
18	Brass Seal Liner	060-GR220514080	1
19	Seal Plate Assembly	060-GR294810010	1
20	1/4" NPT x Pipe Nipple	018-330-006008	1
21	1/4" 45° Elbow	018-310-023077	1
22	Grease Cup	060-GRS1509	1
23	Hex Nut	060-GRD0615991	8
	Lock Washer	060-GRJ0615991	8
24	"Grease Cup" Decal	060-GR6588BD	1

*** Match serial number on side of pump housing to size of impeller
Remote mounted grease cup included in power units



GR-84B2

REV.09 / 28 / 22