



Operators Manual

**** M4-E ****

USE IN CONJUNCTION WITH OEM MANUALS (ENCLOSED)

Unit Serial No. _____

Teco-Westinghouse Motor

Optim HE PLUS – Serial No. _____

Gorman-Rupp Pump

GR-84B2 – Serial No. _____

Links relating to this Manual

www.stsmixers.com

www.twmi.com

www.grpumps.com

Dealer

***** NOTICE *****

THIS UNIT IS TO BE INSTALLED, SET-UP, AND WIRED BY A QUALIFIED ELECTRICIAN TO BE COMMISSIONED BY THE END USER (CUSTOMER). ALL CODES AND REGULATIONS ARE TO BE FOLLOWED. SURFACE TO SURFACE ASSUMES NO RESPONSIBILITY FOR DAMAGES OR PERSONAL INJURIES CAUSED BY IMPROPER INSTALLATION.

If a problem or concern is found while installation is being done, a call to the appropriate party is recommended.

Teco-Westinghouse *West 1-800-661-4023*
East 1-800-268-4770

Surface to Surface Inc. *1-800-567-0978*

******* CAUTION *******

BEFORE STARTING THIS MOTOR, DISENGAGE THE MOTOR/PUMP COUPLER (LOVE JOY) AND CHECK THE MOTOR FOR PROPER ROTATION. IF THIS STEP IS NOT FOLLOWER, THE IMPELLER MAY BECOME SEPARATED FROM THE SHAFT AND CAUSE SUFFICIENT DAMAGE TO THE PUMP AND IMPELLER AND OR PERSONAL HARM.

*To disengage the coupler, remove the guard, loosen the setscrew on each coupler and slide the couplers back away from each other and **TIGHTEN** the setscrews back up. Remove the black insert. Reinstall the guard, and then switch the motor on/off and as the shaft slows down, you will be able to see the rotation direction. If the need be, change the wiring to provide the proper rotation.*

TABLE OF CONTENTS

	PAGE
STS Inc Warranty.....	7
Safety Statements.....	8-11
Safety Markings.....	12
Main Working Components (<i>Photo</i>).....	13
M4 Hose Connections	14
Introduction to the M4-E	15
M4-E Foot Print (<i>top view</i>).....	16
M4-E General Data Sheet.....	17
Identifying Your Machine & Components.....	18

SECTION II (*Description, Care and Maintenance*)

Electric powered centrifugal pump.....	20-23
Filter shear system.....	24-25
Venturi mixing tee.....	26
Wash wand.....	27
Dry hopper with table & hopper valve.....	28
Internal tank jets	29-30

SECTION III (*Set-up and installation of unit in Detail*)

Permanent mounting of unit.....	32
Portable use of unit.....	32

TABLE OF CONTENTS

	PAGE
<u>SECTION IV</u> (<i>Operating the M4 Unit.</i>)	
Site set-up and pre-check.....	34
Starting the motor and pump.....	35
Typical mixing operation.....	36
Typical transfer / off-loading operation.....	37
Shutdown, cleanup & storage	
Warm weather.....	38
Cold/ freezing weather.....	39
Prolonged periods of storage.....	40
**Optional self-loading feature.....	41
 <u>SECTION V</u> (<i>Trouble shooting</i>)	
Trouble Shooting the M4	43-44
 <u>SECTION VI</u> (<i>Periodic Maintenance & Repair Information</i>)	
Maintenance Schedule.....	46
Centrifugal Trash Pump Seal Replacement.....	47
Bolt torque Specifications.....	48
Notes.....	49

TABLE OF CONTENTS

	PAGE
<u>SECTION VII</u> (<i>OEM Repair Information</i>)	
GR Centrifugal Pump Owner's Manual.....	51-62
Teco-Westinghouse Owner's Manual excerpts	63-69
Gruvloc® Pipe Couplings.....	70-72
Quick-Flex® Drive Coupling.....	73-76
<u>SECTION VIII</u> (<i>Parts Manual</i>)	
M4-E PARTS MANUAL.....	78-80



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

shut off all power (switch)
to halt the motor, pump, and fluid flow



WARNING

NEVER ATTEMPT TO REMOVE OR CLEAN THE FILTER SHEAR

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



DANGER

NEVER ATTEMPT REPAIRS OR DISASSEMBLY

without shutting off the motor and
disconnecting/lock-out the power source.
Serious personal injury will result.



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.



WARNING

DO NOT REMOVE OR MODIFY SAFETY COVERS OR GUARDS.

Serious personal injury will result.

M4-E

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 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.

CAUTION

BEFORE STARTING OR RESTARTING the 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.

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 adry 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.

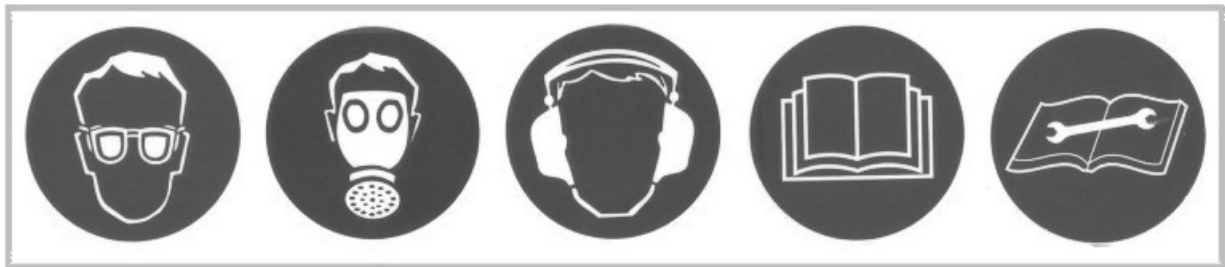
M4-E

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



Flammable Liquid



Hot Surface



Lifting Point



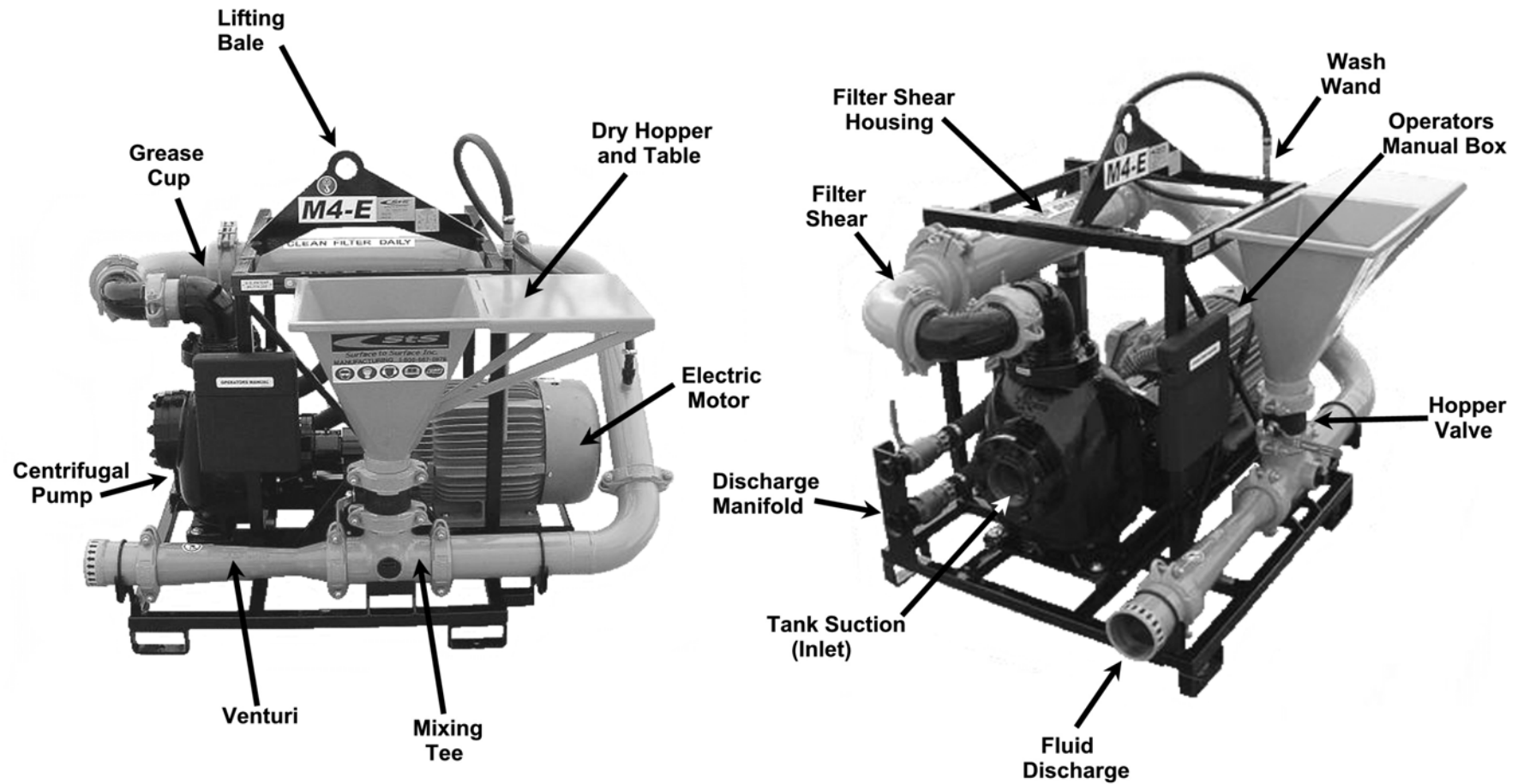
Fluid Flow Direction

CLEAN FILTER DAILY

Maintenance Instructions

M4-E

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-E

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.

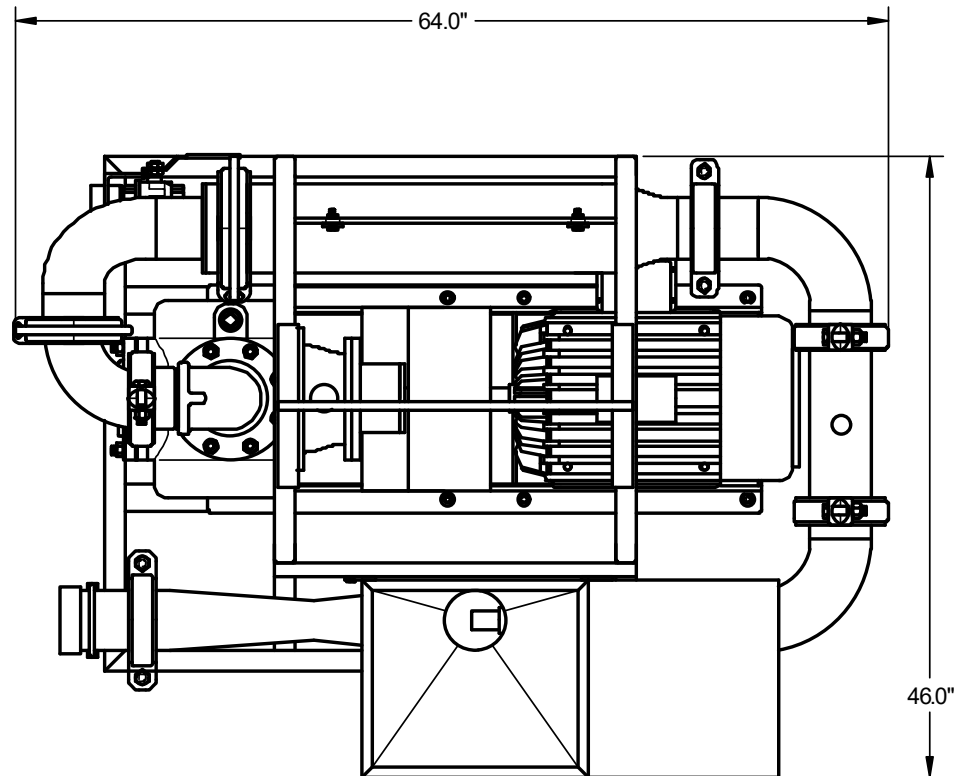
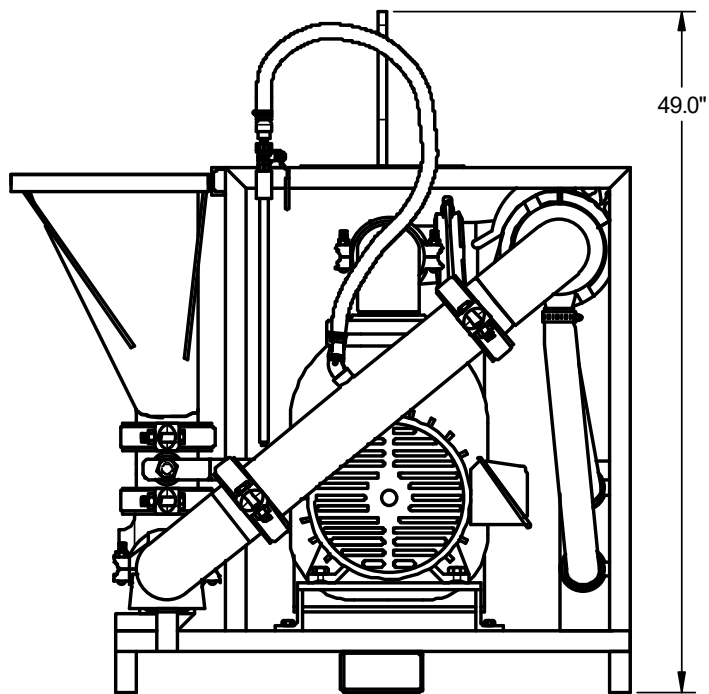
The M4 mixing unit was designed to mix dry or liquid drilling products with clean water, into a slurry. The slurry is continually circulated through the mixing cycle until it reaches the desired consistency. The operator can then transfer the final product to a holding reservoir or directly to the drilling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

The M4 mixing unit consists of an electric 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-E(GR) (Electric)
DRY WEIGHT
1275 lbs.

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

Surface to Surface Inc.®	
DWR NUM.	DATE. 03/03/11
M4-E(GR)	REV.



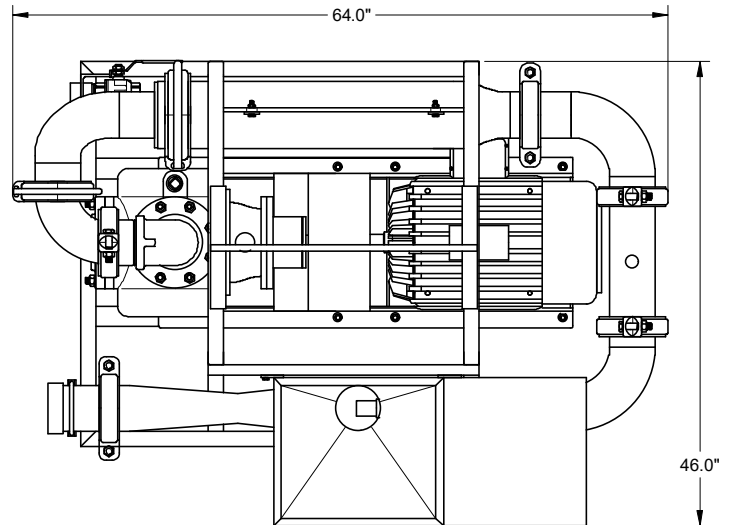
Universal 4" Mixer Model M4-E

Surface to Surface Inc.



Features and Benefits M4-E Mixer

The M4-E universal mixer is designed around the time proven M series mixers of STS. Powered by a 20 hp Teco/Westinghouse electric motor, driving a 4" centrifugal pump, it makes effective use of the proprietary 4 point mixing system. The M4-E can be used as a new installation or retrofitted into an existing system of tank(s). Since the unit is connected by hose and not hard pipe, the placement of the mixer verses the tank(s) is less restricted and a configuration to suit the needs of the contractor are easier to achieve. The small size also makes it a portable, independent unit that is easier to transport from site to site.



Specifications

M4-E Mixer

Dimensions	46" W x 64" L x 49" H
Weight	1275 Lbs
Hopper Height	38" High
Mixing System	4" Proprietary StS Mixing System
Flow Valves	Brass and Steel construction
Skid Frame	1½" steel tube with Lifting bale
Electric Motor	20 HP Teco / Westinghouse 230V/460V
Pump	4" Cast iron centrifugal trash pump
Pump Coupling	Bearing Block to Lovejoy® Coupler
Vacuum Port	2" NPT Inlet
Pipe Couplers	Bolt & Snap-groove type
Pressure Wand	Hopper maintenance wand
Internal Tank Jets	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.
 Industrial rated for longer service life.
 Rugged & repairable for extended service life.
 Large bearings & oversized coupler (service life)
 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), Gasoline (M4-G) or Hydraulic (M4-H) models.

*** All Specifications Subject to Change Without Notice ***

Check our website for the latest products and specifications

www.stsmixers.com

Surface to Surface Inc.

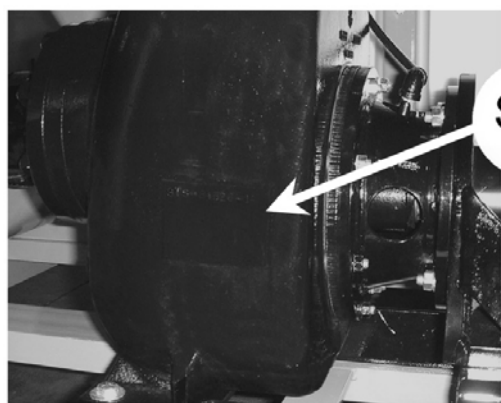
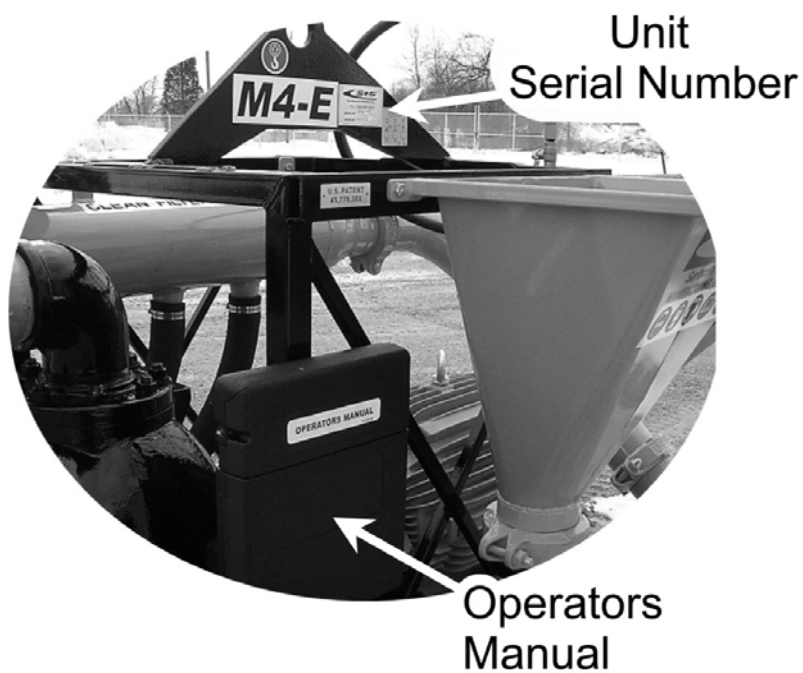
5150 Forest Road, R.R.#3, Watford, Ontario, N0M 2S0
 Tel: 1-800-567-0978

03/03/11

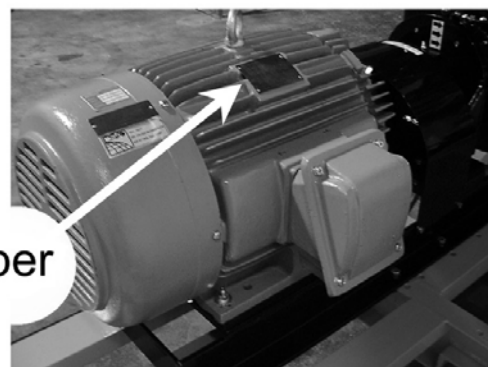
M4-E

Identifying Your Machine & Components

Location of Tags and PIN Plates



**Pump
Serial Number**



**Motor
Serial Number**

SECTION #II

Description, Care and Maintenance

Description, Care and Maintenance

Electric Powered Centrifugal Pump

Care and maintenance of the 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. Visually check all electrical connections and wiring for pinches, frays and loose or damaged parts. Check that all guards are in place and the condition of the drive coupler and bearing block seals. Check the motor's cooling fan cover and fins are clean and clear of debris. Check the pump seal grease cup is full (see grease cup instructions Fig.5). Check that any water intake valve(s) are open and the reservoir tank has sufficient liquid to supply the centrifugal pump.


The pump is connected to the motor with a drive coupler, that should be visually inspected. . 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 reservoir 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

shut off all power (switch)
to halt the motor, pump, and fluid flow


DANGER

**NEVER ATTEMPT REPAIRS
OR DISASSEMBLY**

without shutting off the motor and
disconnecting/lock-out the power source.
Serious personal injury will result.

CAUTION

**BEFORE STARTING THE 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

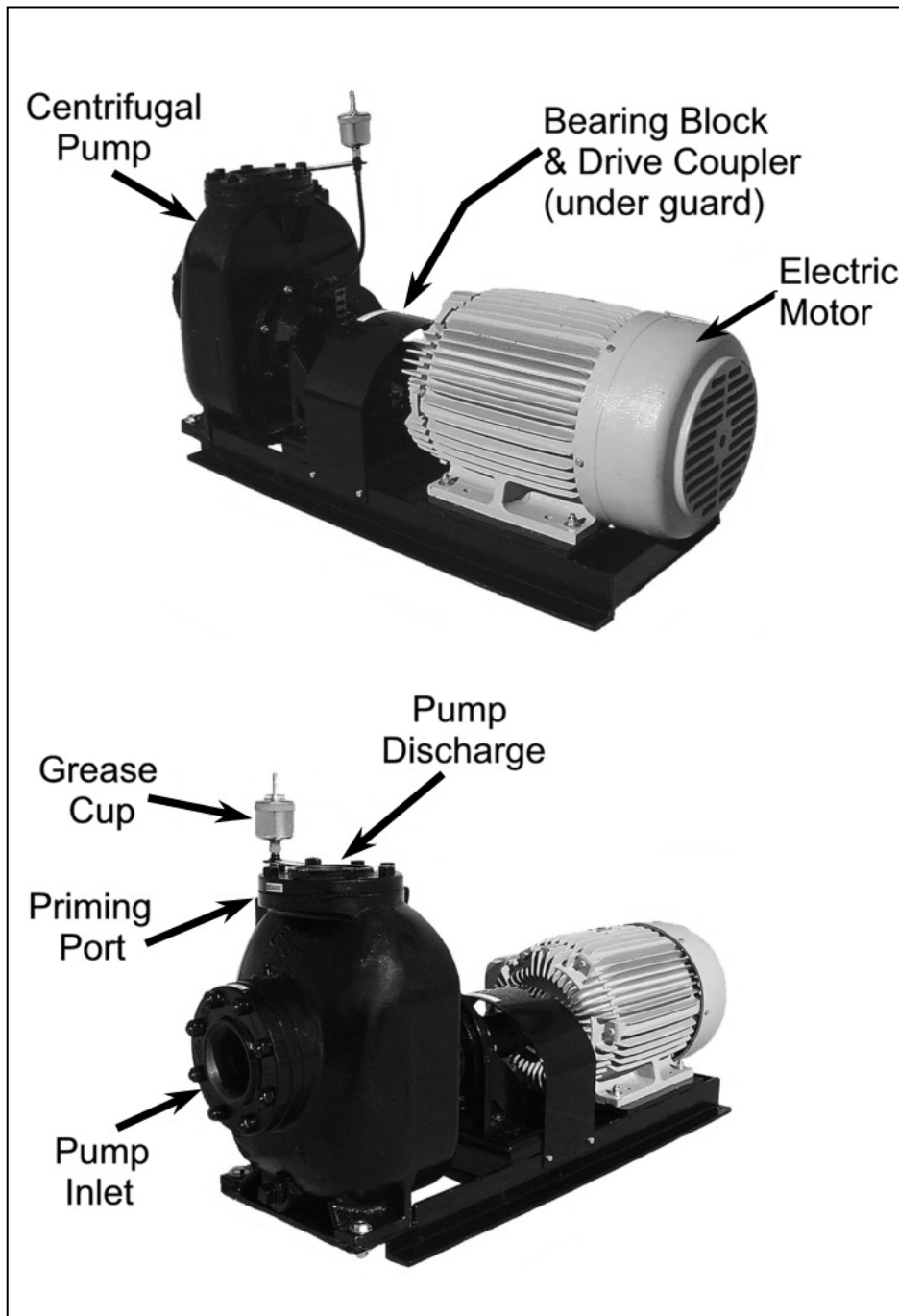
**IMPROPER INSTALLATION OF THE
MECHANICAL or GREASE SEAL**
will result in leakage and possible
damage to the seal. All maintenance,
operating and repair of this unit, must be
done per the instructions in the operators
manual for safety and reliability.

M4-E

Description, Care and Maintenance

Electric 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 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.

Description, Care and Maintenance

Electric 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

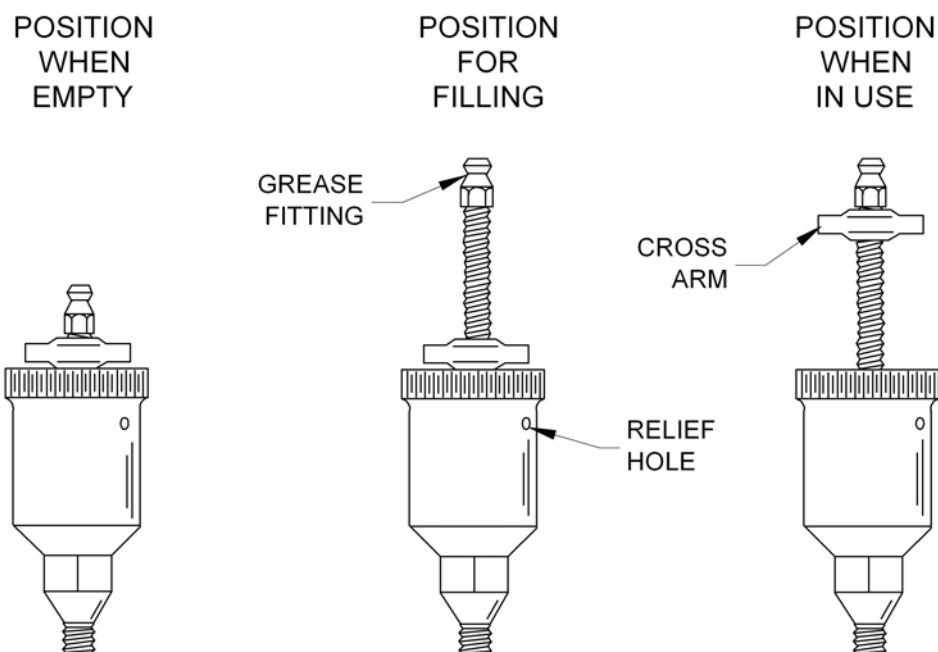


Figure 4. Automatic Lubricating Grease Cup

Description, Care and Maintenance

Electric 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-E

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

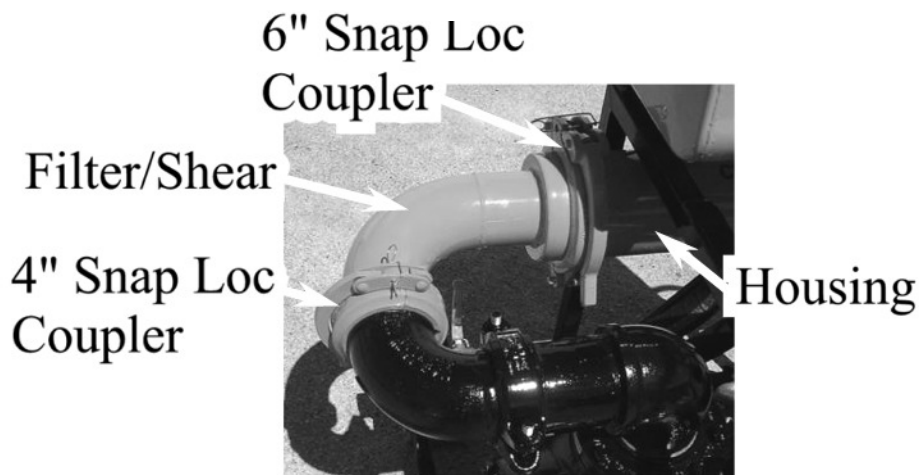
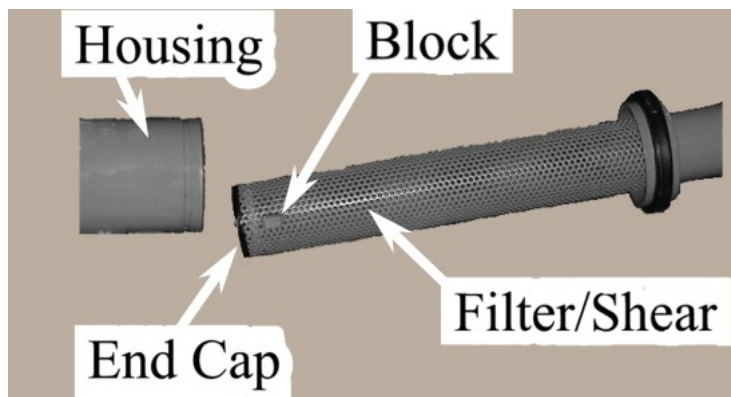


Fig.6b



DANGER
NEVER ATTEMPT REPAIRS OR DISASSEMBLY <small>without shutting off the motor and disconnecting/lock-out the power source. Serious personal injury will result.</small>

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

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

M4-E

Description, Care and Maintenance

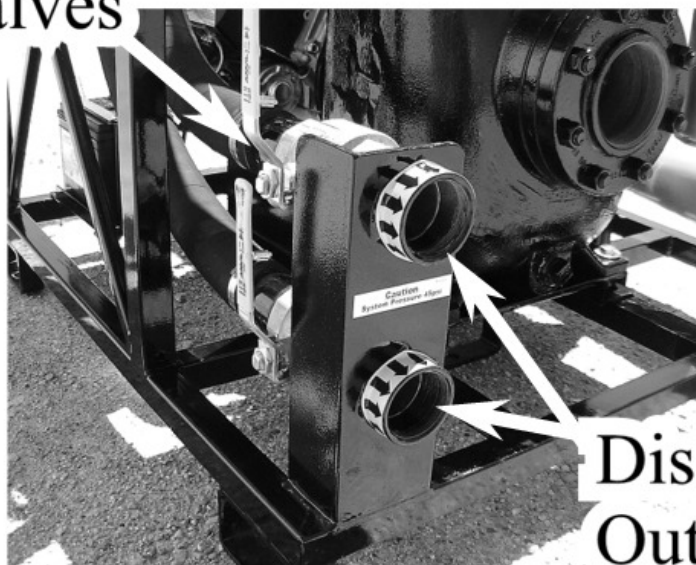
Filter / Shear System *continued*

On the left side of the unit (near the back side) is an 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.

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.

Fig.7

Ball
Valves



Discharge
Outlets

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.

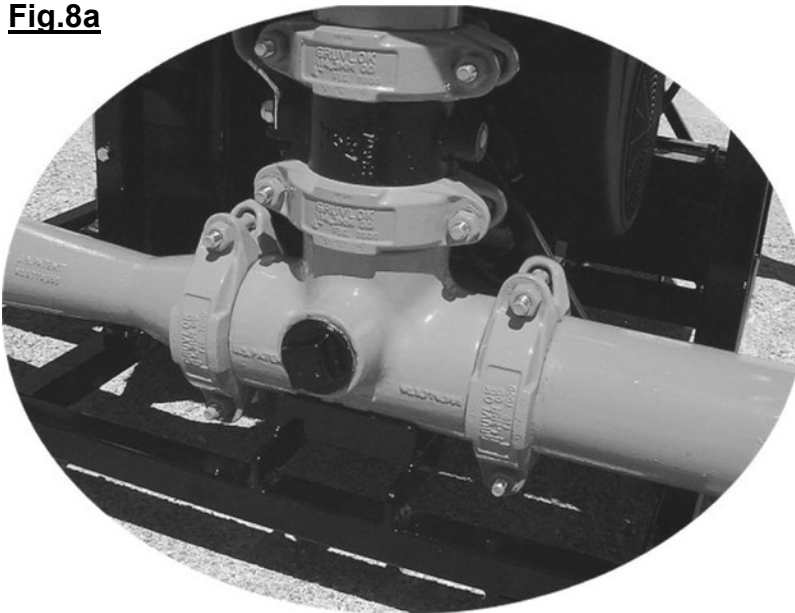
M4-E

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 pressurized wash wand (Fig.9a) to “flush out the accumulation, and force it back into the fluid stream.

Fig.8a



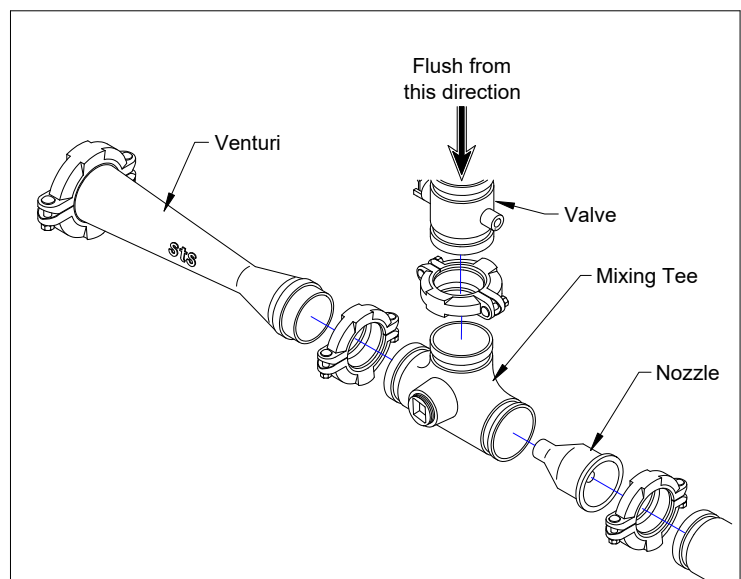
CAUTION

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-E

Description, Care and Maintenance

Wash Wand

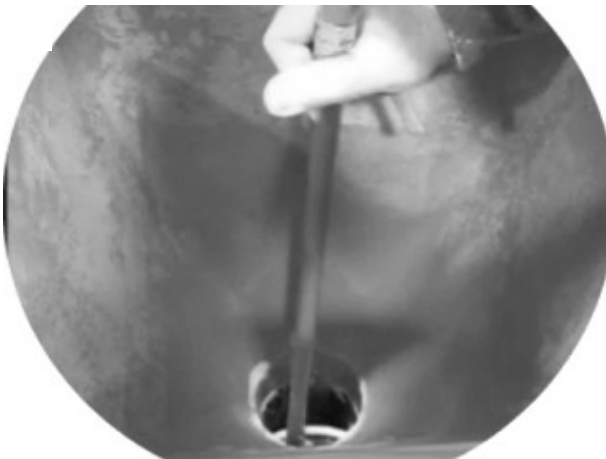
The M4 unit is equipped with a pressurized wash wand (Fig.9a) for clearing obstructions and accumulation in the jetting tee. It is recommended that the jetting tee be cleaned with the wash wand after the introduction of material into the hopper after each batch.

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 slowly 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



! 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

**WHEN THE UNIT
IS IN OPERATION,**
the fluid in the piping may reach
pressures up to 50 p.s.i.
When the engine is idling, the system is
still pumping fluid under pressure.

Fig.9b



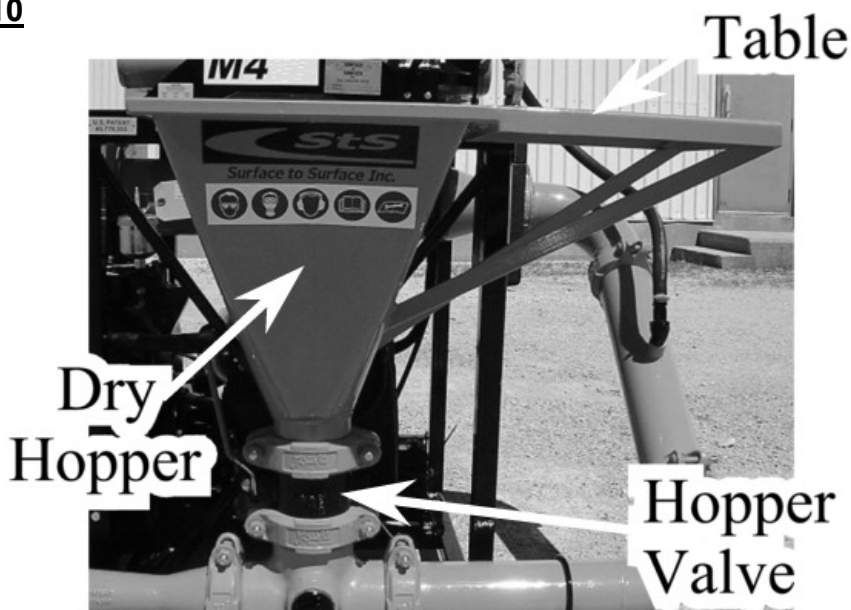
M4-E

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-E

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

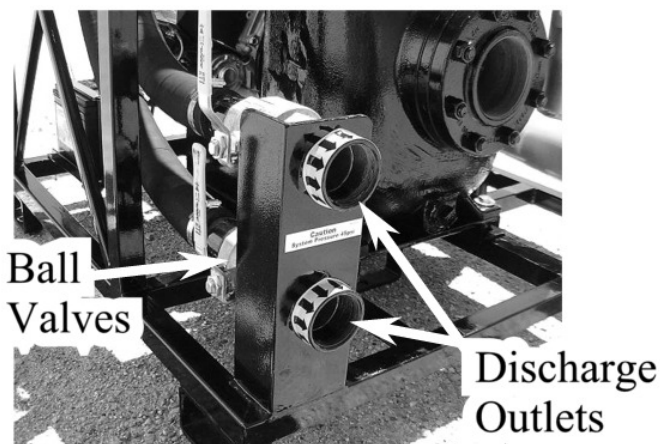
NEVER ATTEMPT REPAIRS OR DISASSEMBLY

without shutting off the motor and disconnecting/lock-out the power source. 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-E

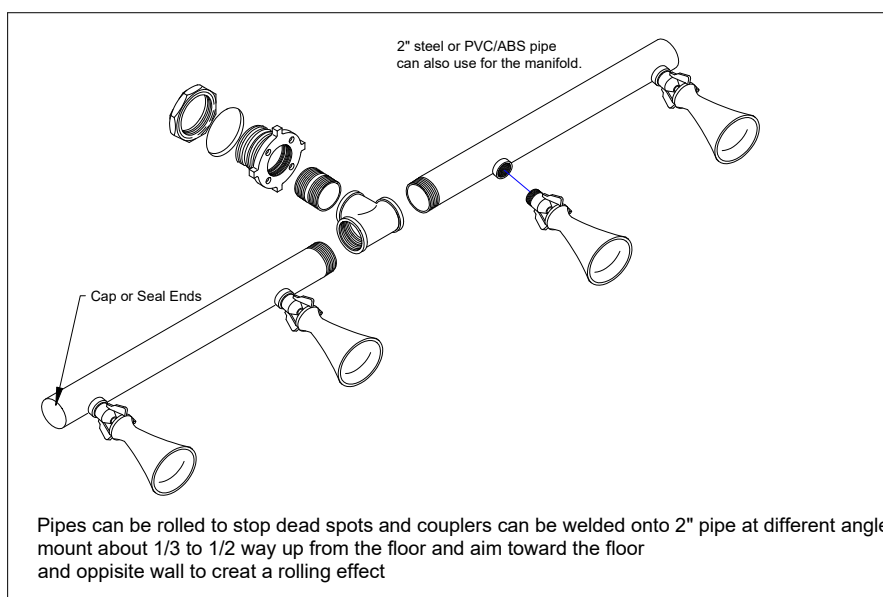
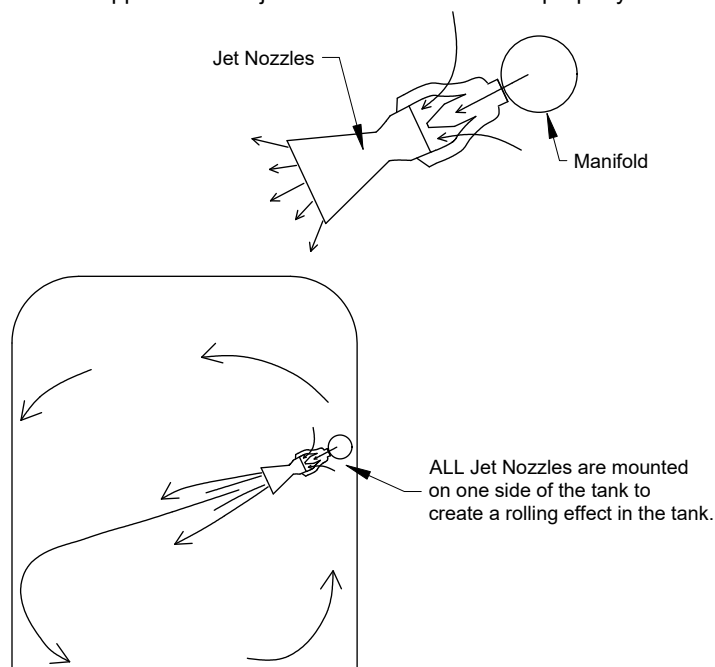
Description, Care and Maintenance

Internal Tank Jets - Installation

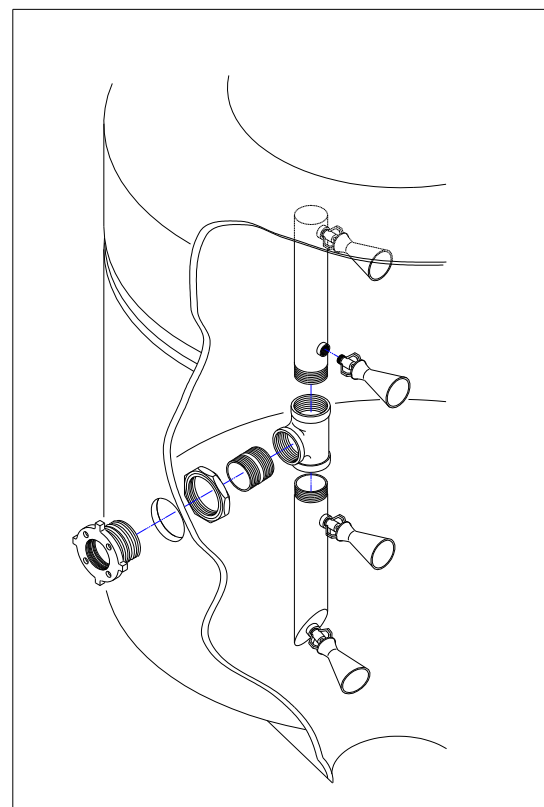
How they work.

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-E

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.



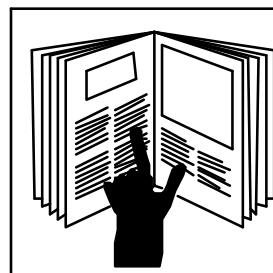
Fig.12a

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.



Fig.12b



⚠ WARNING

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

SECTION #IV

Operating the M4 Unit



M-4-E(GR)

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 motor operators manual for proper starting and running procedures.
- **CHECK** to assure all electrical switches, connections and wiring are free of damage and misuse.
- **CHECK** to assure the motors cooling fan inlet is clean and clear of debris for proper airflow.
- **CHECK** to assure all guards are in place.
- **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-E

Operating the M4-E Unit

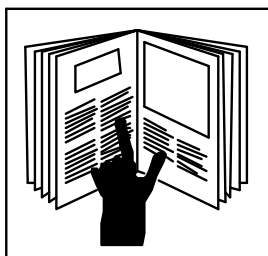
Starting the Motor & Pump

***** The Motor Operators Manual should be consulted for a more detailed start up and shut down procedures.**

Starting the M4-E Mixer

- Since the M4-E is customer installed and the electrical hook up is done by a qualified electrician hired by the customer, the switch (on – off) may differ from one unit to another, therefore the instructions as to its operation will be supplied by the switch manufacture. We will refer to this operation only as “switch on, switch off.”
- Make sure there is NO LOCK OUT or TAG on the switch. If there is, than the unit should not be switched on until the problem is rendered OK.
- With the unit full of liquid and the pump primed, and all of the precautions taken, the pump can be switched on.
- Listen for unusual noises or sounds (grinding, banging, winding, ect) as the motor and pump should sound smooth and not under load stress.
- Open the hopper valves slowly, if fluid comes up thru the valve, shut the valve immediately, shut the switch OFF, and check the motor drive assembly between the motor and the pump for problems.
- If no fluid comes up thru the valve, open the valve fully and you should hear the dull roar of the fluid passing thru the nozzle and venturi. This indicates the system is operating properly and the dry product may be introduced into the hopper.
- The M4-E unit is shut down by “switch OFF”

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



WARNING

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

CAUTION

**BEFORE STARTING THE 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.

M4-E

Operating the M4 Unit

Typical Mixing Operation

Mixing Operation

- With suction valve open and pump full of liquid, switch motor ON.
- 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.

DANGER

IN AN EMERGENCY
 shut off all power (switch)
 to halt the motor, pump, and fluid flow

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.

WARNING

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

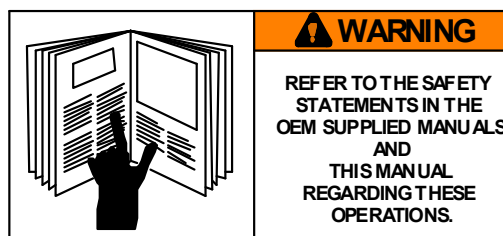
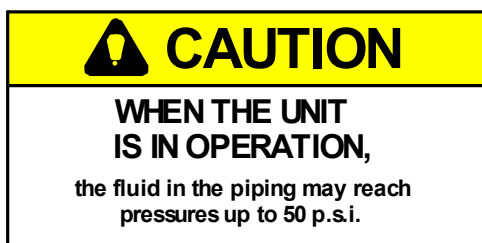
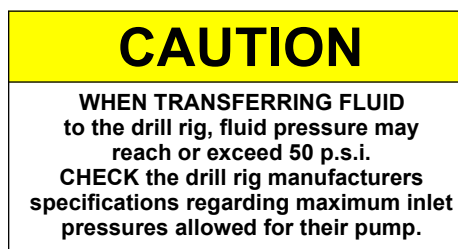
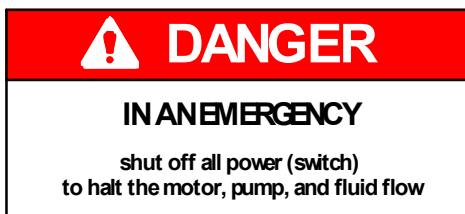
M4-E

Operating the M4-E 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.
- With the M4 pump operating, open the ball valve **SLOWLY** to allow the flow to the holding tank or drill rig.
- The flow and pressure of the drilling fluid flow is determined by open-close position of the ball valve handle.
- 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.





M4-E

Operating the M4 Unit

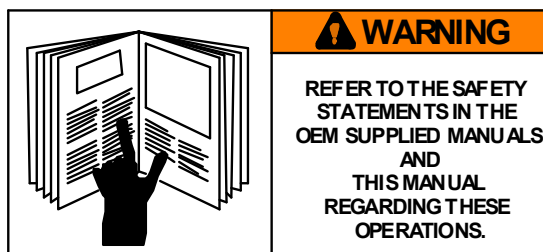
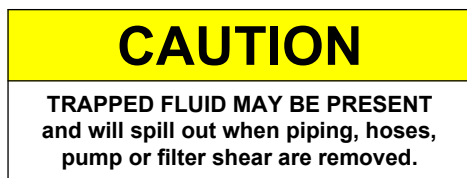
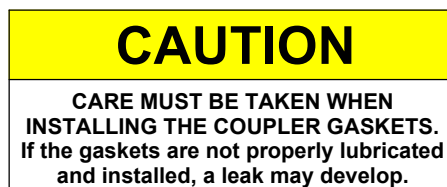
Typical Warm Weather Shutdown & Storage

Daily Shut Down

- Make sure the mixing tee is rinsed clean with the wash wand and the hopper valve is closed.
- Switch the motor OFF.
- Close the valve on the suction line between the tank and the pump.
- If fluid is left in the tank, rotate the valves on the discharge manifold to the closed position.
- 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.
- Switch off the motor and pump.
- 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.



M4-E

Operating the M4 Unit

Typical Cold Weather Shutdown & Storage

Additional Winter and Freezing Weather Shut Down

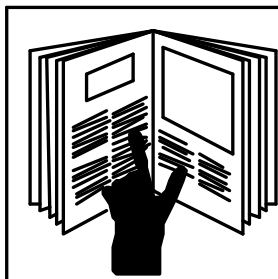
- Pump or drain remaining mixed fluid out of the tank and dispose of it according to local environmental approved practices.
- Make sure the valves on the discharge manifold are open.
- Disconnect the 2" discharge hose that went to the drill rig or reservoir tank, at the drill rig or reservoir, and securely fasten it, back into the mixing tank to re-circulate the fluid.
- Fill and rinse the tank with clear water and then start the motor and pump. By pumping this water through the 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.
- Switch off the motor and pump.
- 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.



WARNING

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

M4-E

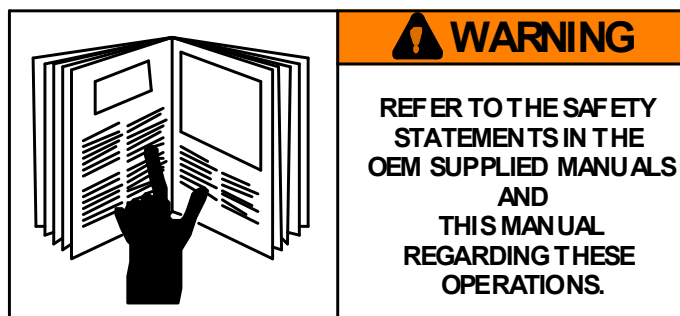
Operating the M4 Unit

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 motor preparation. See motor operator's manual.



M4-E

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.

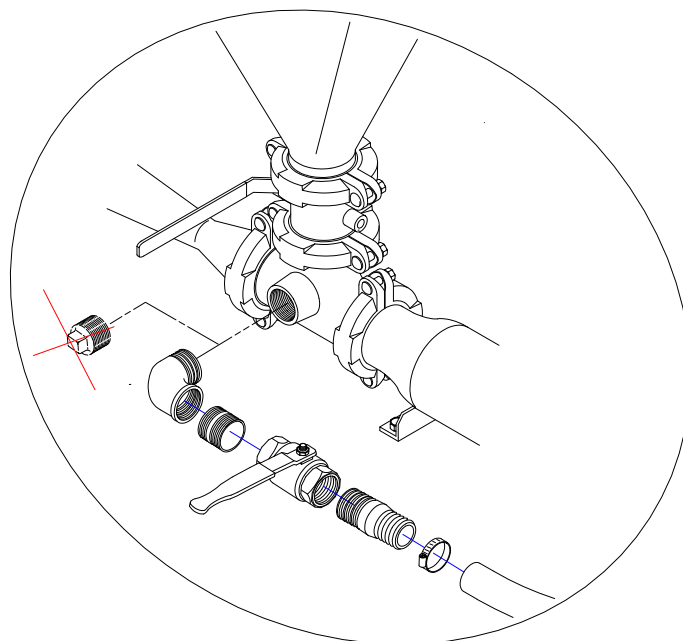
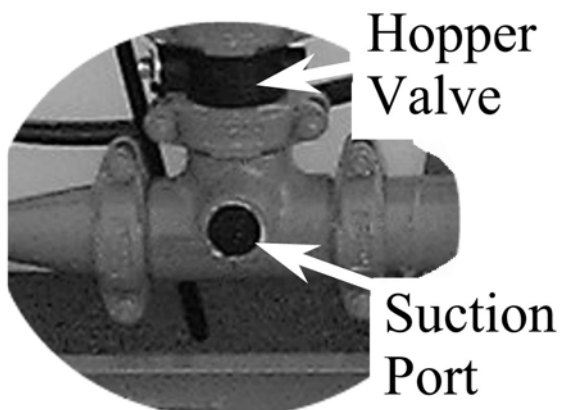
When the unit is mixing product from the hopper, this port will need to be closed. If you are using this port for suction, the hopper valve is to be closed. **THIS MEANS YOU CANNOT “MIX ON THE FLY” OR MIX AND SUCK AT THE SAME TIME!**

To use this option there must be an adequate amount of fluid in the reservoir for the pump to maintain flow.

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

M4-E

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**
 - Blockage in pump. - Remove blockage**
 - Fluid too thick to pump. - Thin fluid by adding more water.**
 - Filter / shear is plugged. - Clean filter shear**
 - Improper voltage. – Check motor voltage.**
- *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**
 - 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-E

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.
- *Motor will not start*
 - See motor operator's manual for trouble shooting motor.**
 - Improper voltage.** – Check motor voltage.

**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 M4-E Electric Periodic Maintenance Schedule ***

***** The following items have been listed as basic items to check. The OEM motor manual should be followed.
STSI is not to be held liable for any discrepancies or errors in the schedule.**

<i>Motor & Bearing Block Components</i>							
Maintenance Items	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 bearing block shaft seals	0						
Clean motor cooling fins and check bolts & nuts	0						
Check electrical connection and switch for damage	0						
Check drive coupler	0						
Check all guards and shields are in place & secure	0						
Remove guard over drive coupler and check drive coupler insert & set screws				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 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-E

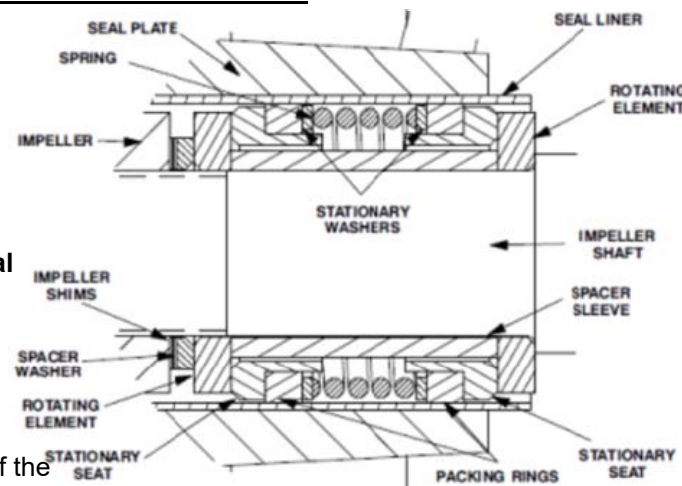
Grease Seal Installation Instructions Centrifugal Pump Application

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. 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).

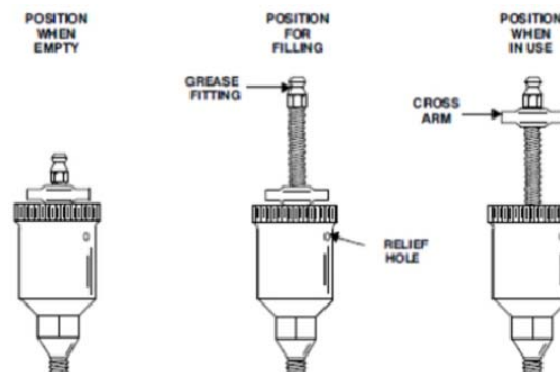
Before starting the pump, reinstall the automatic lubricating grease cup and piping (if removed for seal liner replacement). Lubricate the seal as indicated below.

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.

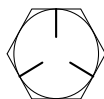
NOTE:

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.

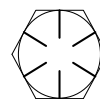


M4-E

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-E

NOTES:

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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.



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.

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.



CAUTION

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.



WARNING!

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.

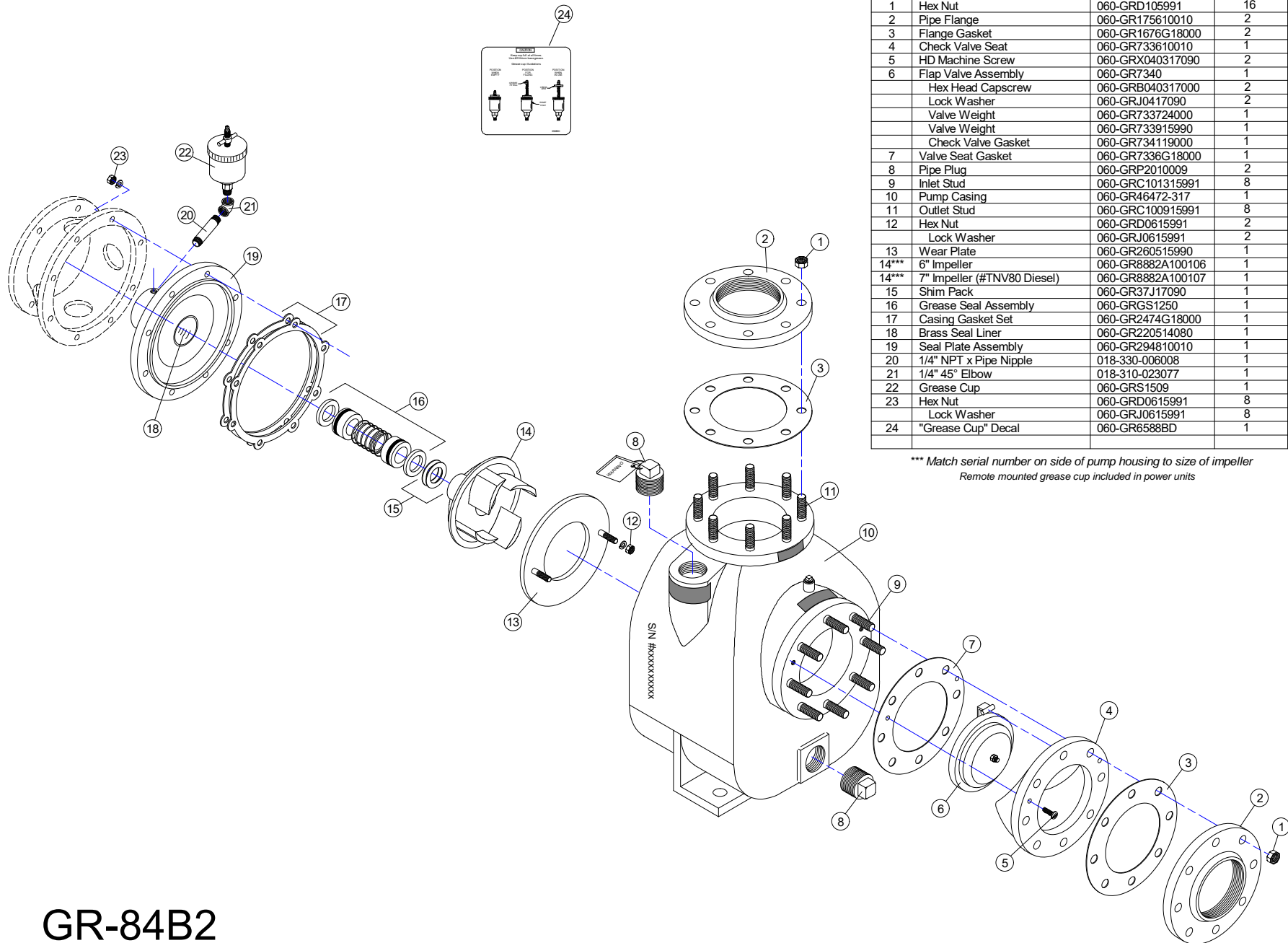
Preventive Maintenance Schedule					
Item	Service Interval*				
	Daily	Weekly	Monthly	Semi-Annually	Annually
General Condition (Temperature, Unusual Noises or Vibrations, Cracks, Leaks, Loose Hardware, Etc.)	I				
Bearing Lubrication (if so Equipped)	I	I			R
Seal Lubrication (If So Equipped)	I	I			R
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.

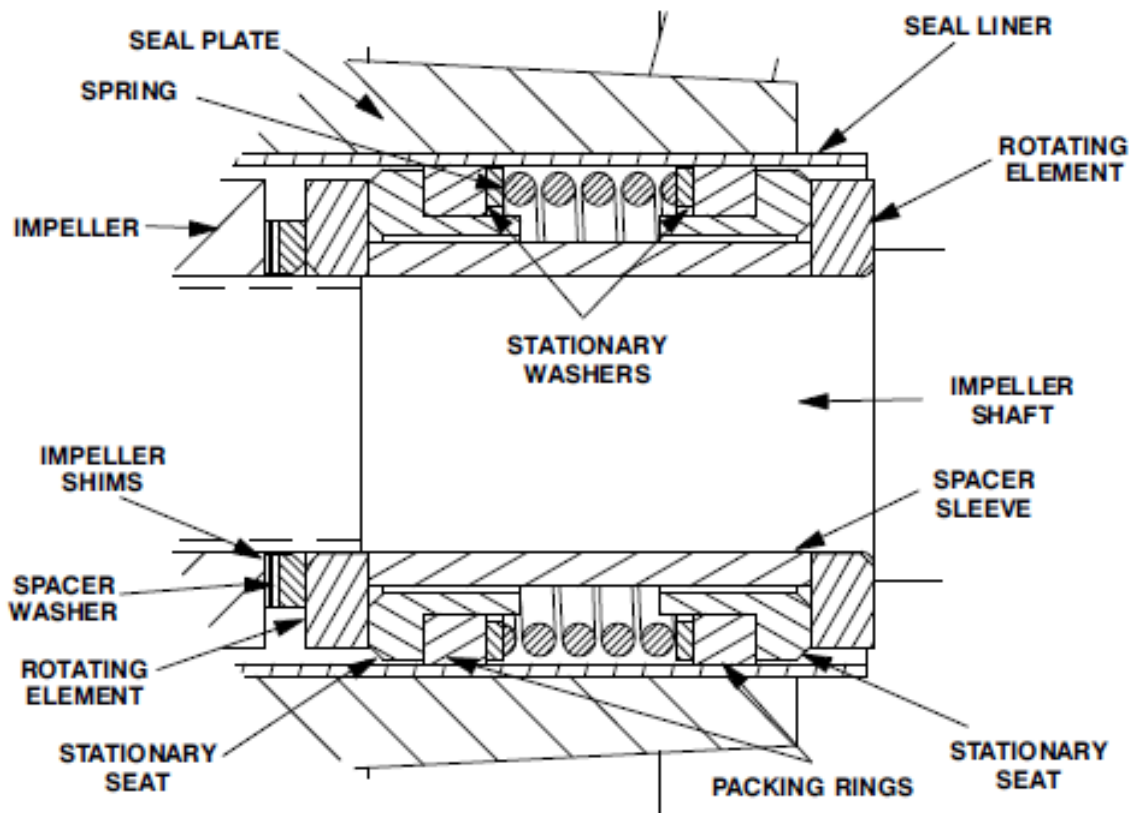


Figure 3. Seal Assembly

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

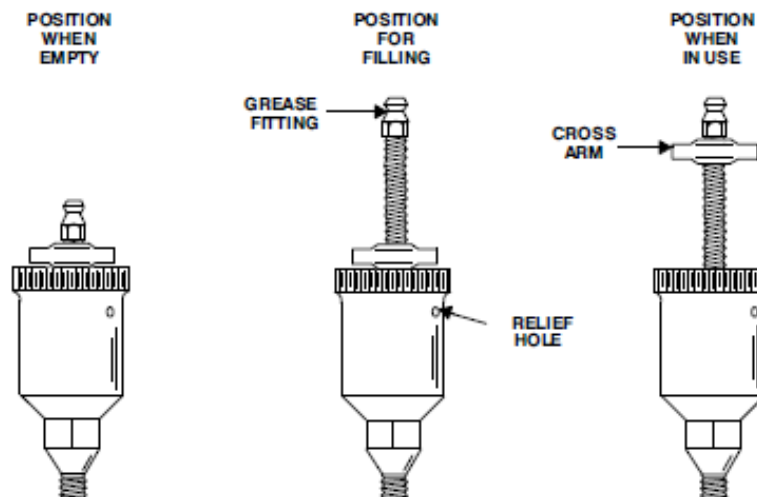


Figure 4. Automatic Lubricating Grease Cup

Grease Seal Installation Instructions

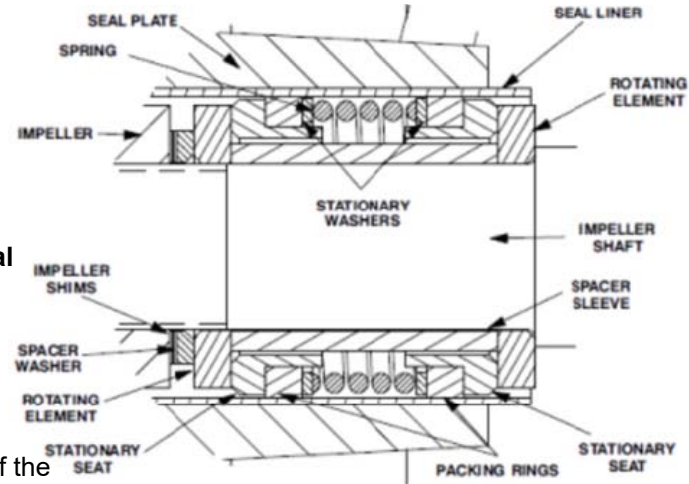
Centrifugal Pump Application

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 $\frac{1}{4}$ " 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).

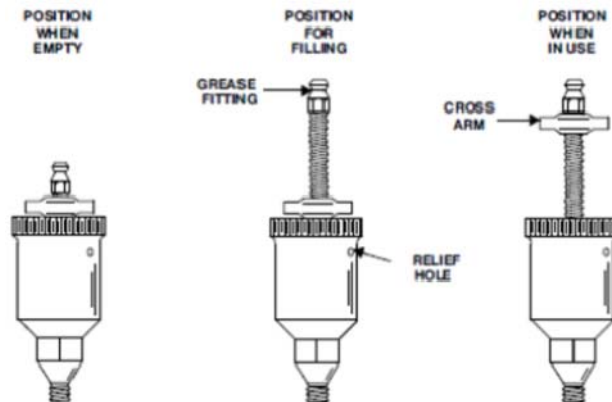
**Before starting the pump, reinstall the automatic lubricating grease cup and piping (if removed for seal liner replacement).
Lubricate the seal as indicated below.**

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.

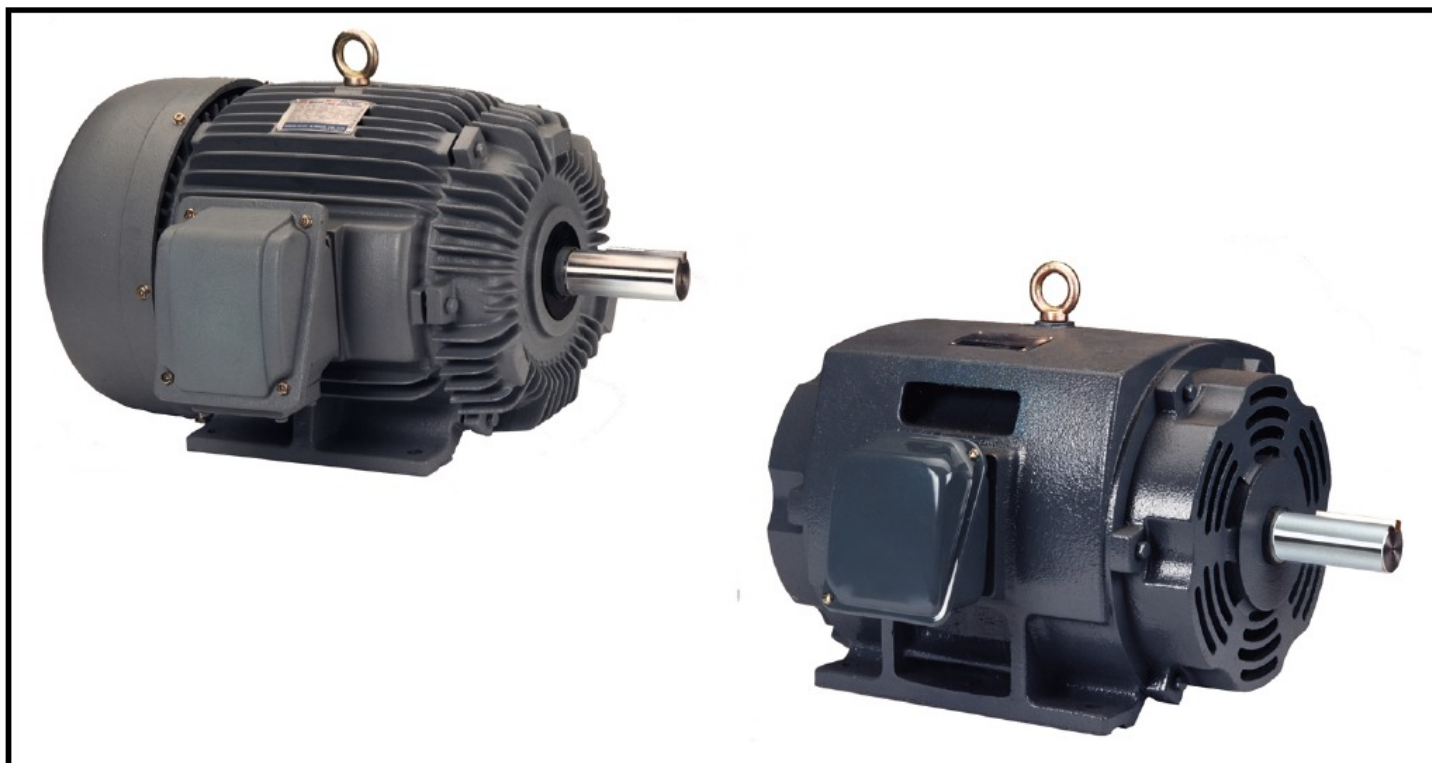
NOTE:

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.



INSTALLATION AND MAINTENANCE INSTRUCTIONS FOR THREE PHASE INDUCTION MOTORS

Frames 143T - 449T



18060-109 Ave. Edmonton, AB. T5S 2K2
Phone: 800-661-4023 Fax: 888-873-8964

RECEIVING

1. Check nameplate data.
2. Check whether any damage has occurred during transportation.
3. After removal of shaft clamp, turn shaft by hand to check that it turns freely.
4. If motor is to be reshipped (alone or installed to another piece of equipment) the shaft must again be clamped to prevent axial movement.

Note: Remove the bearing clamp before turning the shaft on 284T-449TZ frame motors.

WARNING

THE FOLLOWING SAFETY PRECAUTIONS MUST BE OBSERVED:

1. Electric rotating machinery and high voltage can cause serious or fatal injury if improperly installed, operated or maintained. Responsible personnel should be familiarized with NEMA MG2; Safety Standards for Construction and Guide Selection. Installation and Use of Electric Motors and Generators; National Electric Code and all local safety requirements.
2. When servicing, all power sources to the motor and to the accessory devices should be de-energized and disconnected and all rotating parts should be at standstill.
3. Lifting means, when supplied, are intended for lifting the motor only. When two lifting devices are supplied with the motor a dual chain must be used.
4. Suitable protection must be used when working near machinery with high noise levels.
5. Safeguard or protective devices must not be by-passed or rendered inoperative.
6. The frame of this machine must be grounded in accordance with the National Electric Code and applicable local codes.
7. A suitable enclosure should be provided to prevent access to the motor by other than authorized personnel. Extra caution should be observed around motors that are automatically or have automatic re-setting relays as they may restart unexpectedly.
8. Shaft key must be fully captive or removed before motor is started.
9. Provide proper safeguards for personnel against possible failure of motor-mounted brake, particularly on applications involving overhauling loads.
10. Explosion proof motors are constructed to comply with the label service procedure manual, repair of these motors must be made by TECO-Westinghouse Motor Company or U/L listed service center in order to maintain U/L listing.

LOCATION

1. Drip-proof motors are intended for use where atmosphere is relatively clean, dry, well ventilated and non-corrosive.
2. Totally enclosed motors may be installed where dirt, moisture, or dust are present and in outdoor locations.
3. Explosion-proof motors are built for use in hazardous locations as indicated by Underwriters label on the motor.
4. Chemical duty enclosed motors are designed for installation in high corrosion or excessive moisture locations.

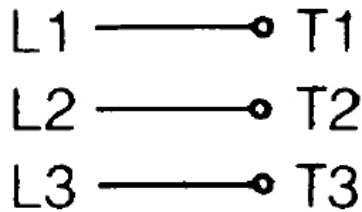
Note: in all cases, no surrounding structure should obstruct normal flow or ventilating air through or over the motor.

POWER SUPPLY & CONNECTIONS

1. Wiring of motor and control, overload protection and grounding should be in accordance with National Electrical Code and all local safety requirements.
2. Nameplate voltage and frequency should agree with power supply. Motor will operate satisfactorily on line voltage within -10% of nameplate voltage; or frequency with -5% and with a combined variation not to exceed -10%. 230-volt motors can be used on 208-volt network systems, but with slightly modified performance characteristics as shown on the nameplate.
3. Dual voltage and single voltage motors can be connected for the desired voltage by following connection diagram shown on the nameplate or inside of the conduit box.
4. All Explosion Proof motors have Temperature Limiting Devices in the motor enclosure to prevent excessive external surface temperature of the motor in accordance with U/L standards. Terminals of thermal protectors (P1 & P2) should be connected to the motor control equipment, according to the connection diagram inside of the conduit box.
5. Standard connection diagram for three phase, not thermally protected, dual rotation motors are shown in diagrams A through E.

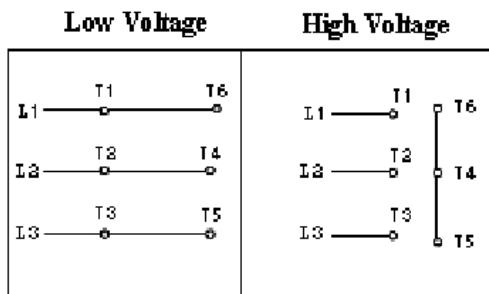
(Note: To change rotation, Interchange any two line leads)

A. 3 Lead, Single Voltage

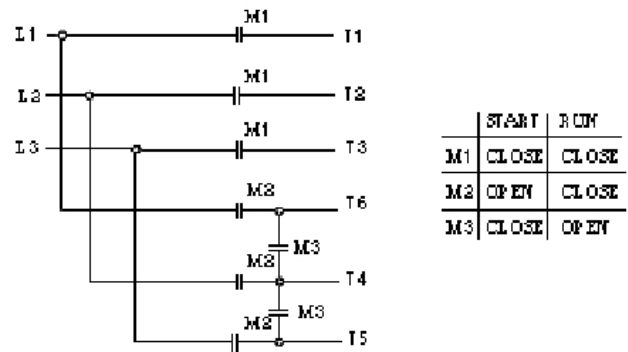


B. 6 Lead, Dual Voltage & Voltage Ration 1 to 3

B-1 Across the Line Start & Run

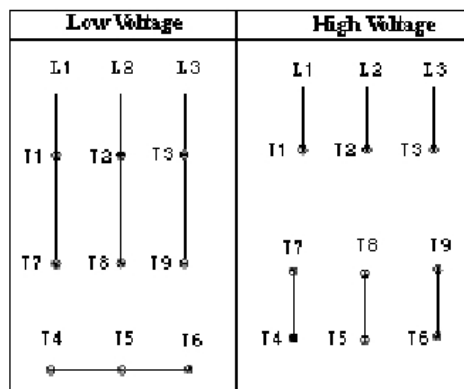


B-2 Wye Start & Delta Run
(Low Voltage only)

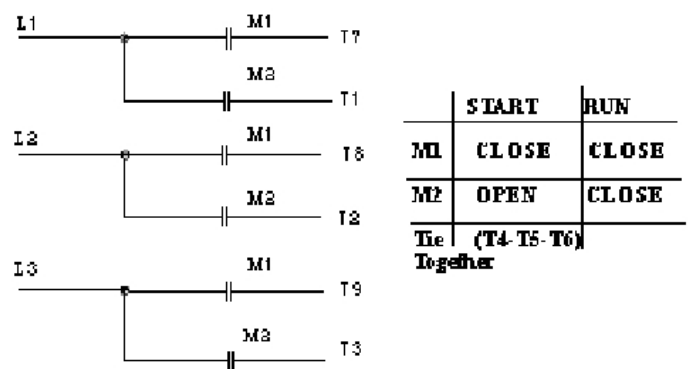


C. 9 Leads; Dual Voltage & Voltage Ratio 1 to 2, Wye Connected

C-1 Across the Line Start & Run

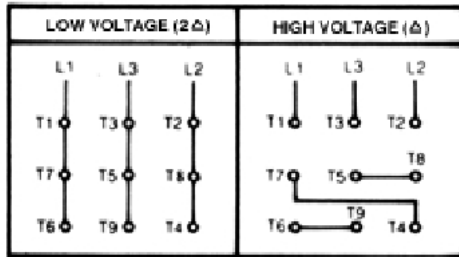


C-2 Part Winding Start
(Low Voltage only)

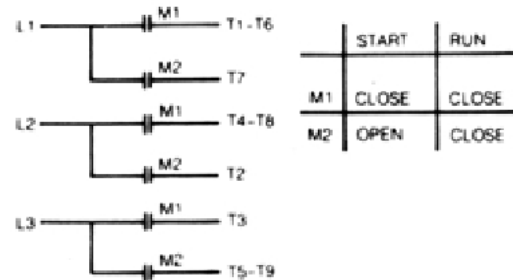


D. 9 Leads; Dual Voltage & Voltage Ratio 1 to 2, Delta Connected

D-1 Across the Line Start & Run

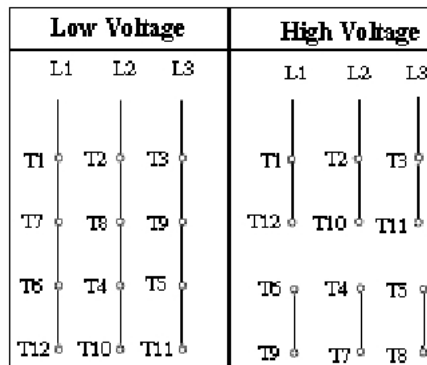


D-2 Part Winding Start
(Low Voltage only)

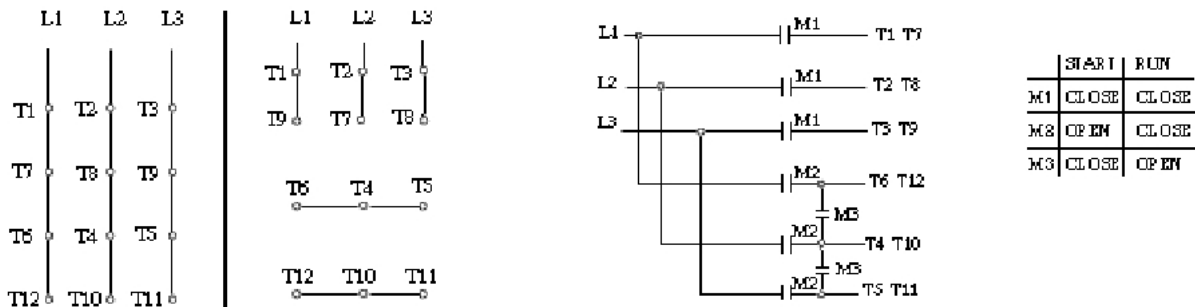


E. 12 Leads. Dual Voltage

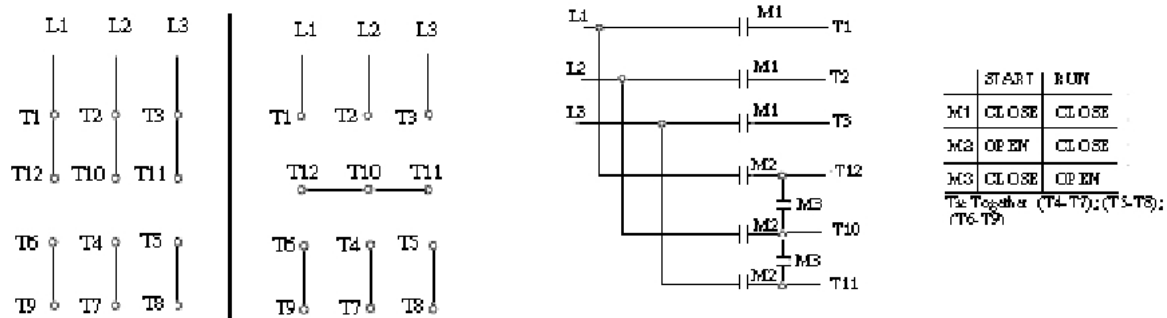
E-1 Across the Line Start & Run



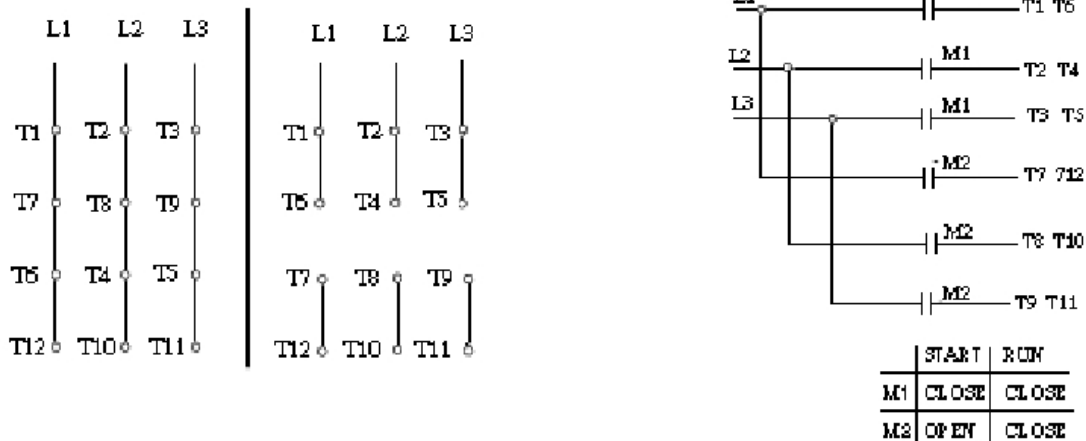
E-2-1 Wve Start & Delta Run (Low Voltage only)



E-2-2 Wve Start & Delta Run (High Voltage only)



E-3 Part Winding Start (Low Voltage only)



***Important:** For Part Winding Start, M2 contactor should be closed within two (2) seconds after M1 contactor is closed
Only 4 pole and above (e.g., 6P, 8P) motors are satisfactory for Part Winding Start at low voltage.

START UP

1. Disconnect load and start motor. Check direction of rotation. If rotation must be changed, ALLOW THE MOTOR TO STOP COMPLETELY. Interchange any two leads of a three-phase motor.
2. Connect load. The motor should start quickly and run smoothly. If no, shut power off at once. Recheck the assembly including all connections before restarting.
3. If excessive vibration is noted, check for loose mounting bolts too flexible motor support structure or transmitted vibration from adjacent machinery. Periodic vibration checks should be made; foundations often settle.
4. Operate under load for short period of time and check operating current against nameplate.

TESTING

If the motor has been in storage for an extensive period or has been subjected to adverse moisture conditions, it is best to check the insulation resistance of the stator winding with a megometer. Depending on the length and conditions of storage it may be necessary to regrease or change rusted bearings.

If the resistance is lower than one megohm the windings should be dried in one of the following two ways:

1. Bake in oven at temperatures not exceeding 194°F until insulation resistance becomes constant.
2. With rotor locked, apply low voltage and gradually increase the current through windings until temperature measured with a thermometer reaches 194°F. Do not exceed this temperature.

MAINTENANCE

INSPECTION

Inspect motor at regular intervals. Keep motor clean and ventilation openings clear.

LUBRICATION

1. Frame 143T-256T: Double shielded and pre-lubricated ball-bearing motors without grease fittings and don't need relubrication, except on MAX-E1[®] and MAX-E2[®] products which have regreasable features.
2. Frames 280TS, 320-449TZ(TS): Motors having grease fittings and grease discharge devices at brackets. Motors are shipped with grease for initial running. It is necessary to relubricate anti-friction bearing motors periodically, depending on size and type of service. See Table 2 to provide maximum bearing life. Excessive or too frequent lubrication may damage the motor.

TABLE 2

Horsepower	Standard Conditions	Severe Conditions	Extreme Conditions
1 Thru 30 Hp, 1800 rpm and below	7 years	3 years	180 days
40 Thru 75 Hp, 1800 rpm and below	210 days	70 days	30 days
100 Thru 150 Hp, 1800 rpm and below	90 days	30 days	15 days
1 Thru 20 Hp, 3600 rpm	5 years	2 years	90 days
25 Thru 75 Hp, 3600 rpm	180 days	60 days	30 days
100 Thru 150 Hp, 3600 rpm	90 days	30 days	15 days

Note:

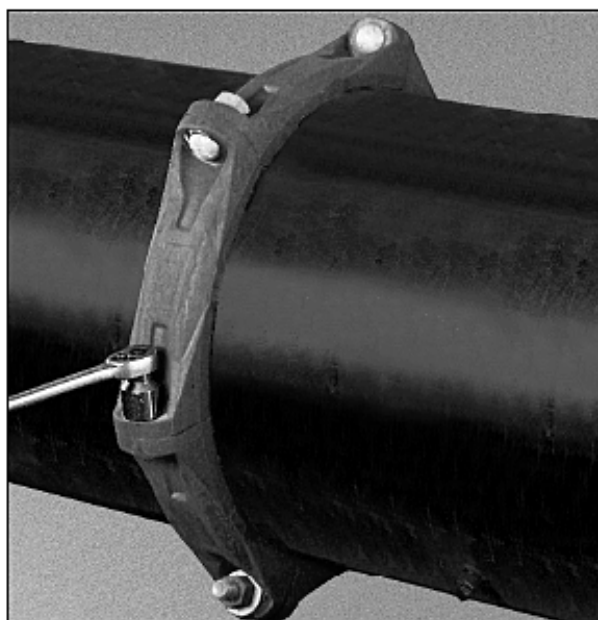
- A. Standard conditions: 8 hours operation per day, normal or light loading, clear and 40°C ambient conditions.
 - B. Severe conditions: 24-hour operation per day or light shock loading, vibration or in dirty or dusty conditions.
 - C. Extreme conditions: With heavy shock loading or vibration or dusty conditions.
 - D. For double shielded bearings, above data (lubrication frequency) means that the bearing must be replaced.
3. Be sure fittings are clean and free from dirt. Using a low-pressure grease gun, pump in the recommended grease until new grease appears at grease discharge hole.
 4. Use the ALVANIA R3 grease or equivalent lithium based grease unless special grease is specified on the nameplate.
 5. If relubrication is to be performed with the motor running, stay clear of rotating parts. After regreasing, allow the motor to run for ten to thirty minutes.

RENEWAL PARTS

1. Use only genuine TECO-Westinghouse renewal parts or as recommended by TECO-Westinghouse Motor Company.
2. When you order renewal parts please specify complete information to TECO-Westinghouse office/agent such as type, frame no., poles, horsepower, voltage, series no., quantity, etc.

FOR FURTHER INFORMATION PLEASE CONTACT TECO-WESTINGHOUSE MOTORS INC.

COUPLING INSTALLATION & ASSEMBLY



The instructions are based on pipe grooved in accordance with Gruvlok® 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 Gruvlok Xtreme™ Lubricant and lubricate all gasket surfaces, internal and external. See Gruvlok Lubricants in the Technical Data section of the Gruvlok catalog for additional important information.

SPECIFIED BOLT TORQUE

Specified bolt torque is for the oval neck track bolts used on Gruvlok® 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 *
<i>In.</i>	<i>In.</i>	<i>ft.-lbs.</i>
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 5/8	180-220
1	1 3/4	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 *
<i>mm</i>	<i>mm</i>	<i>N-m</i>
M10	16	40-60
M12	22	110-150
M16	24	135-175
M20	30	175-245
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**

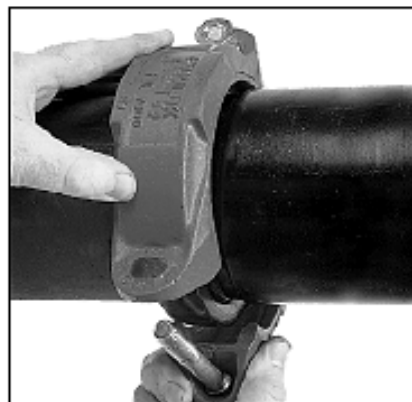
1 CHECK & LUBRICATE GASKET— Check gasket to be sure it is compatible for the intended service. Apply a thin coating of Gruvlok lubricant to outside and sealing lips of the gasket. Be careful that foreign particles do not adhere to lubricated surfaces.



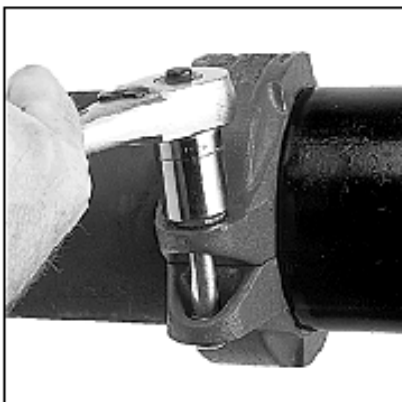
2 GASKET INSTALLATION— Slip the gasket over the pipe end, making sure the gasket lip does not overhang the pipe end.



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.

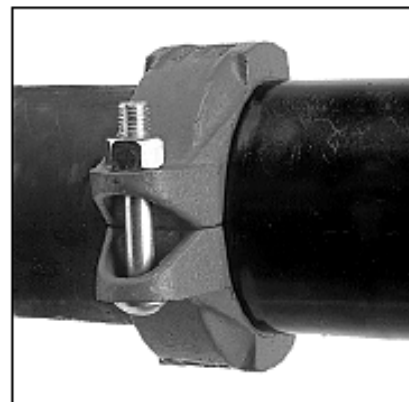


4 HOUSINGS— With one nut unthreaded to the end of the bolt, unthread the other nut completely and swing the coupling housing halves over the gasket, making sure the housing keys engage the grooves. Insert the bolt and turn the nuts finger tight.



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.



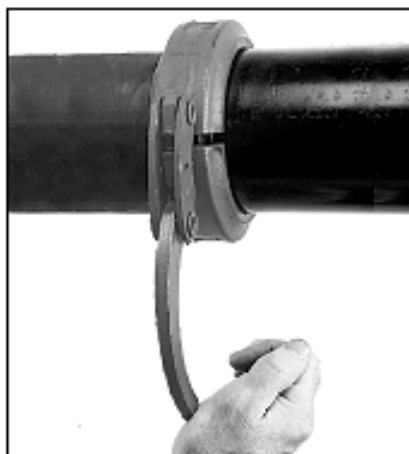
2 GASKET INSTALLATION— Slip the gasket over the pipe end making sure the gasket lip does not overhang the pipe end.



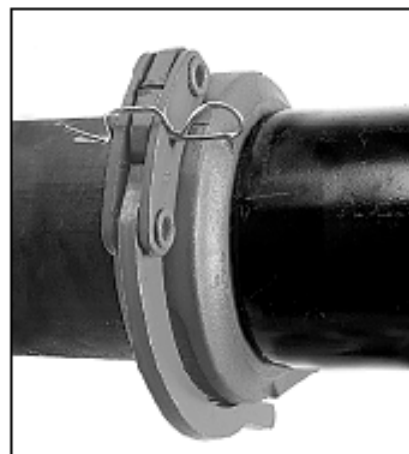
3 ALIGNMENT— After aligning the two pipe ends, pull the gasket into position centering it between the grooves on each pipe. Gasket should not extend into the groove on either pipe.



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.

Installation Guide

Timken Quick-Flex® Coupling: Standard Coupling



STANDARD COUPLING INSTALLATION

Please complete the following steps to install Timken Quick-Flex couplings.

You should have the following pieces before you start the job:

- Two Hubs
- One Insert
- One cover with included hardware

NOTE

It is critical to identify what style cover you are using, as this will change the hardware included, as well as the installation procedure. A mismatch between the coupling and the application may result in less than optimal performance.

There are four types of covers (fig. 1):

- **High-speed cover:** QF5 through QF175 use standard snap ring to secure cover in place. QF250 and larger use eight bolts with lock washers.
- **Low-speed split cover:** This cover is free-floating and is located outside the shoulders of the two hubs. All sizes come with four bolts for securing the two halves together around the insert.
- **High-speed split cover:** QF15 through QF250 use eight bolts around the rim to secure the two halves together, QF500 through QF1890 use 16 bolts, and QF3150 and larger use 20 bolts. QF250 and larger use eight bolts with lock washers to secure the cover to **one** of the hubs.
- **High-performance split cover:** This cover is free-floating and is located on the insert with an internal radial groove. All sizes come with four socket-head cap screws for securing the two halves together around the insert.

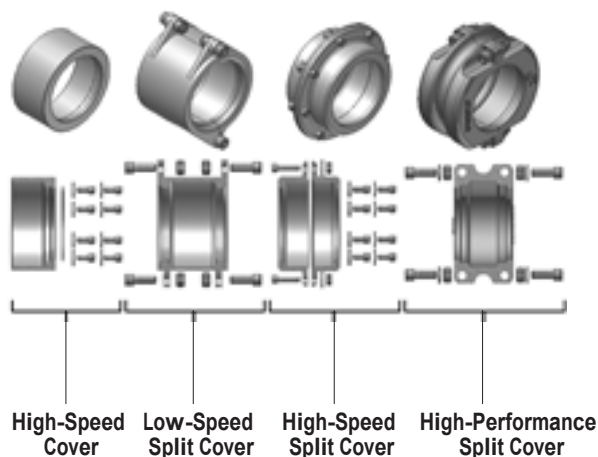


Fig. 1. Quick-Flex cover types and included hardware.

INSTALLATION

1. Check the bore size of the coupling halves and the shafts. Ensure that they are the correct bore size to fit the application.
2. If the coupling does not fit easily, clean and deburr the shafts.
3. Identify cover style:
 - a. **If using a high-speed cover**, it should be placed on the driven shaft. If space does not permit, then it can be mounted on the drive shaft. If cover uses a snap ring, slide the snap ring down the shaft, then slide the cover onto shaft with the larger opening facing the shaft separation.
 - b. **If using a low-speed or high-performance split cover**, leave cover aside and continue to step 4.
 - c. **If using a high-speed split cover, QF250 and larger**, use bolts and washers to secure in place. Slide one half down each shaft before installing hubs. Do not bolt into place until installation is complete.
4. Install the first hub. It should be mounted so the end of the shaft is flush with surface "A" as shown in fig. 2. It is acceptable for the shaft to extend past "A" as long as it is not past the teeth shown as "B."
5. Install the second hub with the insert in place. This will set the hubs at the minimum hub gap (G_{Min}) dimension, ensuring proper clearance. For specific G_{Min} and G_{Max} dimensions see table 2.
6. Tighten both hubs securely to the shafts.
7. Check coupling for misalignment (table 3) and align as necessary.

NOTE

Standard hubs are supplied with a clearance fit and should slide onto the shaft without excessive force. If the hubs have been ordered with interference fit, then industry standards suggest heating the coupling halves to approximately 300° C (572° F), before installing on shafts. If not heated properly, the couplings will not fit on the hub properly.

⚠ WARNING

Failure to observe the following warnings could create a risk of death or serious injury.

Contact with moving parts and/or rotating shafts poses a risk of serious injury. Proper guards in accordance with OSHA and American Society of Mechanical Engineers standards must be installed on all power transmission equipment. Power transmission equipment should not be started if proper guarding is not in place. Observe all required lock out/tag out procedures when servicing power transmission equipment.

8. Install the cover:

- High-speed cover:** Slide the cover over the hub and insert until fully rested against the shoulder of the hub. QF5 through QF175 use standard snap rings to hold the cover in place. QF250 and larger couplings use eight bolts and washers. Use the included hardware to secure the cover.
- Low-speed or high-performance split cover:** Place each half over the insert and secure using the four bolt/washer/nut hardware combinations supplied. For the high-performance split cover bolt tightening torque ratings, see table 1.
- High-speed split cover:** Slide the two cover halves over the hub and insert until faces meet. Install the radial outer bolts used to secure the two halves together. Install the bolts to secure the cover to **one** hub.

TABLE 1. HIGH-PERFORMANCE SPLIT COVER TIGHTENING TORQUE

Coupling Series	Bolts	Tightening Torque	
		in.	Nm ft.-lbs.
QF15HPCOVER	(4) ¼ nc x ⅝		10.8 8
QF25HPCOVER	(4) ⅜ nc x 1¼		40.7 30
QF50HPCOVER	(4) ½ nc x 1¾		101.7 75
QF100HPCOVER	(4) ½ nc x 2¼		101.7 75
QF175HPCOVER	(4) ⅝ nc x 2½		169.5 125
QF250HPCOVER	(4) ¾ nc x 2¼		203.4 150
QF500HPCOVER	(4) ¾ nc x 2¼		203.4 150

REVOLUTIONS PER MINUTE (RPM) AND BALANCE

The Timken Quick-Flex coupling is machined on all surfaces and thus its dynamic balance is good. If the coupling is run at a high speed, it is important that the keys used to attach the hubs are the same length as the hub. The set screws should also be changed to full length to fill the hole. Please refer to table 4 for maximum RPM ratings.

NOTE

Shaft should penetrate to base of teeth and hubs should be set at G_{Min} . Otherwise, the coupling may not deliver maximum torque.

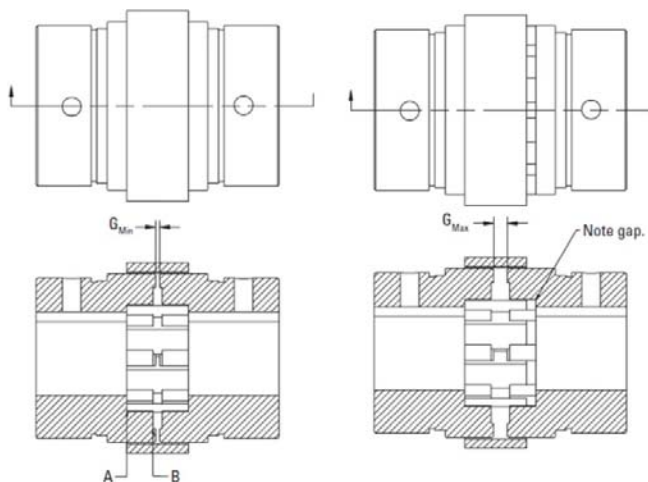


Fig. 2. Proper shaft-to-hub engagement.

TABLE 2. QUICK-FLEX STANDARD COUPLING HUB GAP (G) DIMENSIONS

Coupling Series	High-Speed Cover		Low-Speed Split Cover		High-Speed Split Cover		High-Performance Split Cover	
	G_{Min}	G_{Max}	G_{Min}	G_{Max}	G_{Min}	G_{Max}	G_{Min}	G_{Max}
	mm	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.
QF5	1.60 0.063	2.34 0.092	N/A	N/A	N/A	N/A	N/A	N/A
QF15	0.91 0.036	2.79 0.110	0.91 0.036	2.52 0.099	0.91 0.036	3.20 0.126	0.91 0.036	5.59 0.220
QF25	2.03 0.080	5.21 0.205	2.03 0.080	3.39 0.133	2.03 0.080	3.56 0.140	2.03 0.080	4.06 0.160
QF50	0.89 0.035	5.28 0.208	0.89 0.035	2.57 0.101	0.89 0.035	5.59 0.220	0.89 0.035	4.06 0.160
QF100	3.56 0.140	7.37 0.290	3.56 0.140	9.65 0.380	3.56 0.140	9.65 0.380	3.56 0.140	9.40 0.370
QF175	4.78 0.188	5.28 0.208	4.78 0.188	9.53 0.375	4.78 0.188	8.84 0.348	4.57 0.180	9.35 0.368
QF250	2.54 0.100	5.84 0.230	2.54 0.100	9.27 0.365	2.54 0.100	6.35 0.250	2.54 0.100	8.08 0.318
QF500	3.18 0.125	6.35 0.250	N/A	N/A	3.18 0.125	9.53 0.375	3.18 0.125	9.53 0.375
QF1000	4.06 0.160	9.86 0.388	N/A	N/A	4.06 0.160	10.41 0.410	N/A	N/A
QF1890	5.12 0.202	7.06 0.278	N/A	N/A	5.13 0.202	11.53 0.454	N/A	N/A
QF3150	1.78 0.070	7.75 0.305	N/A	N/A	1.78 0.070	9.65 0.380	N/A	N/A
QF10260	3.23 0.127	12.83 0.505	N/A	N/A	3.23 0.127	12.50 0.492	N/A	N/A

TABLE 3. QUICK-FLEX STANDARD COUPLING MISALIGNMENT TOLERANCES

Coupling Series	Radial Misalignment Tolerance	Axial Misalignment Tolerance	Angular Misalignment Tolerance
	mm in.	mm in.	
QF5	0.51 0.020	1.98 0.078	2°
QF15	0.99 0.039	2.95 0.116	2°
QF25	0.99 0.039	2.95 0.116	2°
QF50	0.97 0.038	2.95 0.116	2°
QF100	1.47 0.058	3.96 0.156	2°
QF175	1.47 0.058	4.45 0.175	1.3°
QF250	1.47 0.058	5.94 0.234	1.3°
QF500	1.47 0.058	5.94 0.234	1°
QF1000	1.47 0.058	5.94 0.234	1°
QF1890	1.47 0.058	7.92 0.312	1°
QF3150	1.98 0.078	7.92 0.312	1°
QF10260	1.98 0.078	7.92 0.312	1°

TABLE 4. QUICK-FLEX STANDARD COUPLING MAXIMUM RPM RATINGS⁽¹⁾

Coupling Series	High-Speed Cover	Low-Speed Split Cover	High-Speed Split Cover	High-Performance Split Cover
	RPM	RPM	RPM	RPM
QF5	12000	N/A	N/A	N/A
QF15	9000	400	9000	9000
QF25	7000	375	7000	7000
QF50	6000	350	6000	6000
QF100	4800	300	4800	4800
QF175	4200	250	4200	4200
QF250	3800	200	3800	3800
QF500	3400	N/A	3400	3400
QF1000	3000	N/A	3000	N/A
QF1890	2400	N/A	2400	N/A
QF3150	2000	N/A	2000	N/A
QF10260	1200	N/A	1200	N/A

⁽¹⁾Maximum RPM ratings are for off-the-shelf Quick-Flex couplings. If your application requires higher RPM ratings, the couplings should be dynamically balanced.

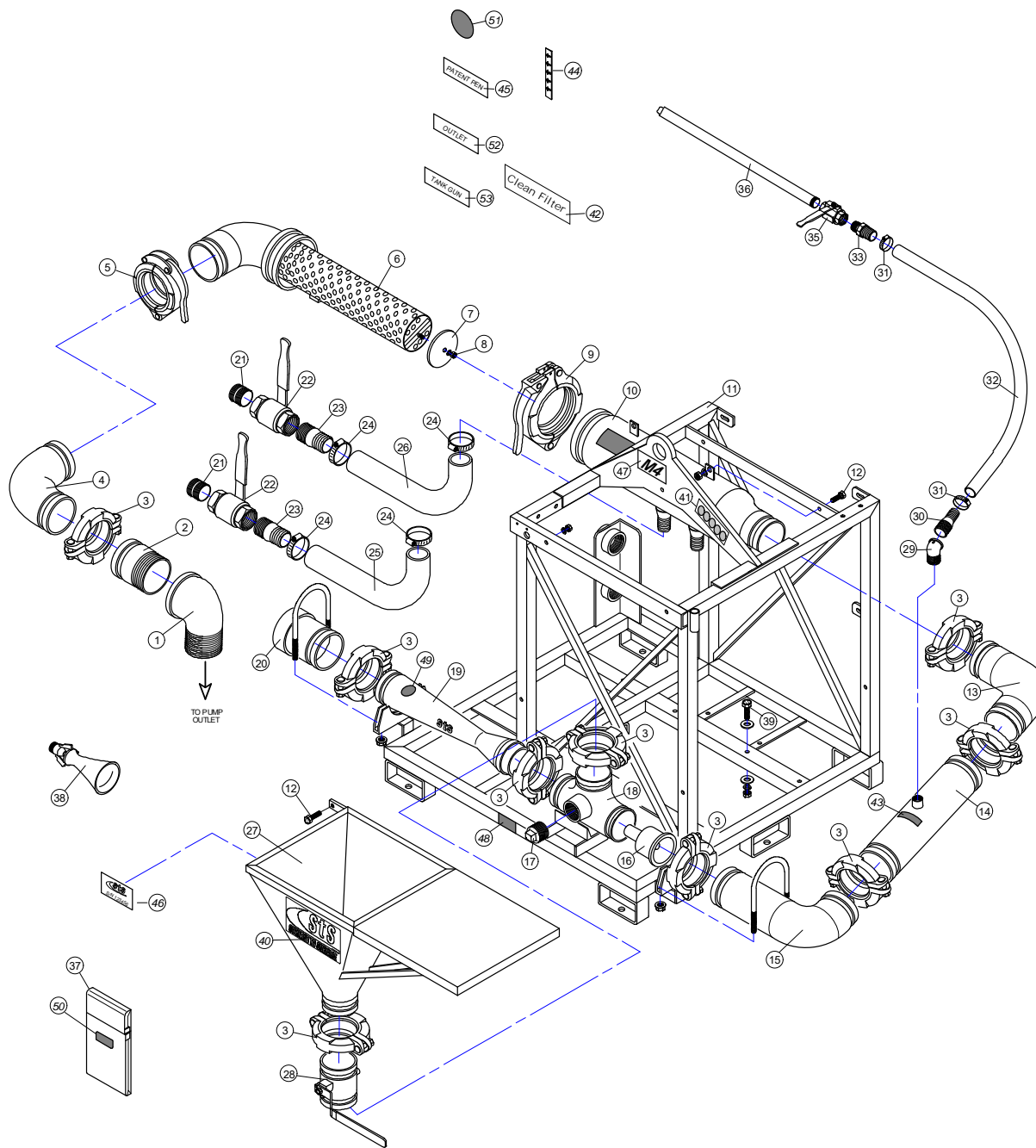
TIMKEN

The Timken team applies their know-how to improve the reliability and performance of machinery in diverse markets worldwide. The company designs, makes and markets high-performance steel as well as mechanical components, including bearings, gears, chain and related mechanical power transmission products and services.

Stronger. **Commitment.** Stronger. **Value.** Stronger. **Worldwide.** Stronger. **Together.** | Stronger. **By Design.**

SECTION #VIII

(Parts Manual)



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

PU-E4(GR) ASSEMBLY PARTS LIST
(P/N #PU-E4(GR))

REF #	DESCRIPTION	STS PART NUMBER	QTY REQ.
1	20 HP. 3520 rmp. 360/460 V	034-20HP MOTOR	1
2	Motor / Pump Coupler Hub	036-QF15 1 5/8	2
3	Motor / Pump Coupler Insert	036-QF15 INSERT	1
3A	Coupler Cover & Snap Ring	036-QF15 COVER	1
4	Bearing Block	M-750E-010-A	1
5	Guard	M-750E-012	1
6	1/4" x 1" Bolt	076-13003	4
7	1/4" L/W	076-33618	4
8	Bearing Block Mount	HTSP4-15	1
9	Shaft Adaptor	060-GR84B2-01	1
9	Bell Housing	060-GR84B2-02	1
10	Gorman Rupp 4" Pump	060-GR84B2-KIT	1
11	1/2" x 2" Bolt	076-13211	2
12	1/2" F/W	076-33012	2
13	1/2" L/W	076-33626	2
14	1/2" Nut	076-36310	2
15	Motor / Pump Mounting Base	M-750E-017	1
16	3/8" x 2" Bolt	076-13111	4
17	3/8" F/W	076-33008	4
18	3/8" L/W	076-33622	4
19	3/8" Nut	076-36306	4
20	3/8" x 4" Bolt	076-13119	2
21	3/8" L/W	076-33622	2
22	7/16" x 1 1/2" Bolt	076-13159	6
23	7/16" F/W	076-33010	6
24	7/16" L/W	076-33624	6
25	7/16" Nut	076-36308	6
26	3/8" x 1 1/4" bolt	076-13107	1
27	3/8" F/W	076-33008	1
28	3/8" L/W	076-33622	1
29	3/8" Nut	076-36306	1
30	Motor Shim S/S	034-QA SHIM PACK	4
31	Control Arm	SR-75063	1
32	3/8" x 1" bolt	076-13105	1
33	3/8" L/W	076-33622	1
34	7/16" x 1 3/4" Studs	060-164940	4
35	7/16" L/W	076-33624	6
36	7/16" Nut	076-36308	6
37	1/4" NPT x Pipe Nipple	018-330-006008	1
38	1/4" NPT x 90 deg Elbow	018-310-000401	1
39	Pipe to Hose Connector	019-WEA 1868x8x4	2
40	Nylon Hose	025-1928-07	11 1/2"
41	Grease Cup Mount	060-GR84B2-13	1
42	Grease Cup	060-S1509	1
43	"GREASE" Decal	070-ST5-021-B	1
44	Directional Tape	STS-PIPEMARKER	4"
45	"Grease Cup" Decal	060-6588BD	1
46	"E" Decal	070-ST5-030-H	1
47	"Suction" Decal	060-6588AG	1
48	"Discharge" Decal	060-6588BJ	1
49	"Prime" Decal	060-6588AH	1
50	"Warning" Tag	060-6588BG	1

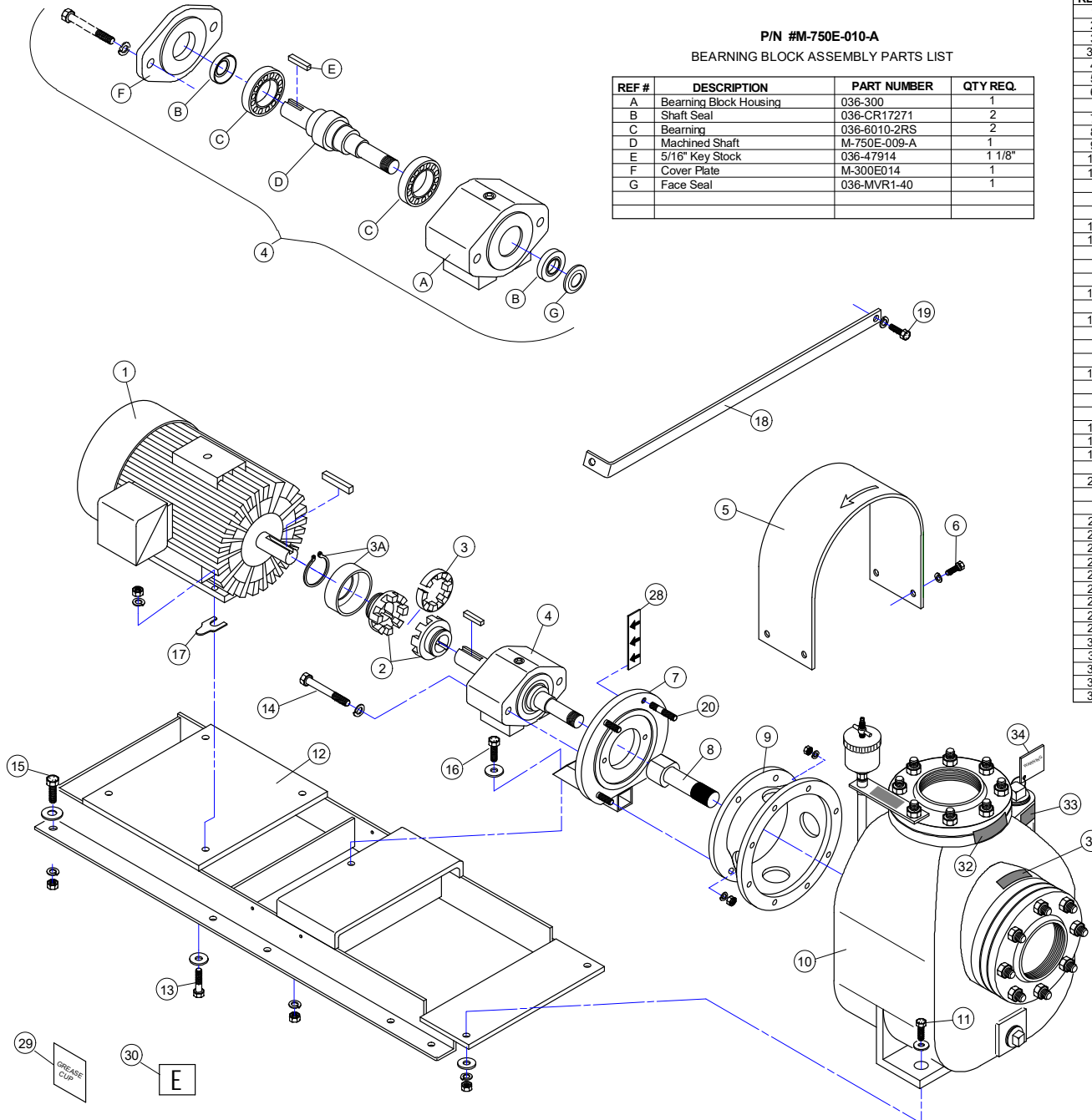
PAINT:
Black - B
Orange - O

Surface to Surface Inc.®	
DWR. NUM. PU-E4	DATE. 08 / 25 / 10 REV. 10 / 13 / 16

P/N #M-750E-010-A

BEARING BLOCK ASSEMBLY PARTS LIST

REF #	DESCRIPTION	PART NUMBER	QTY REQ.
A	Bearing Block Housing	036-300	1
B	Shaft Seal	036-CR17271	2
C	Bearing	036-6010-2RS	2
D	Machined Shaft	M-750E-009-A	1
E	5/16" Key Stock	036-47914	1 1/8"
F	Cover Plate	M-300E014	1
G	Face Seal	036-MVR1-40	1

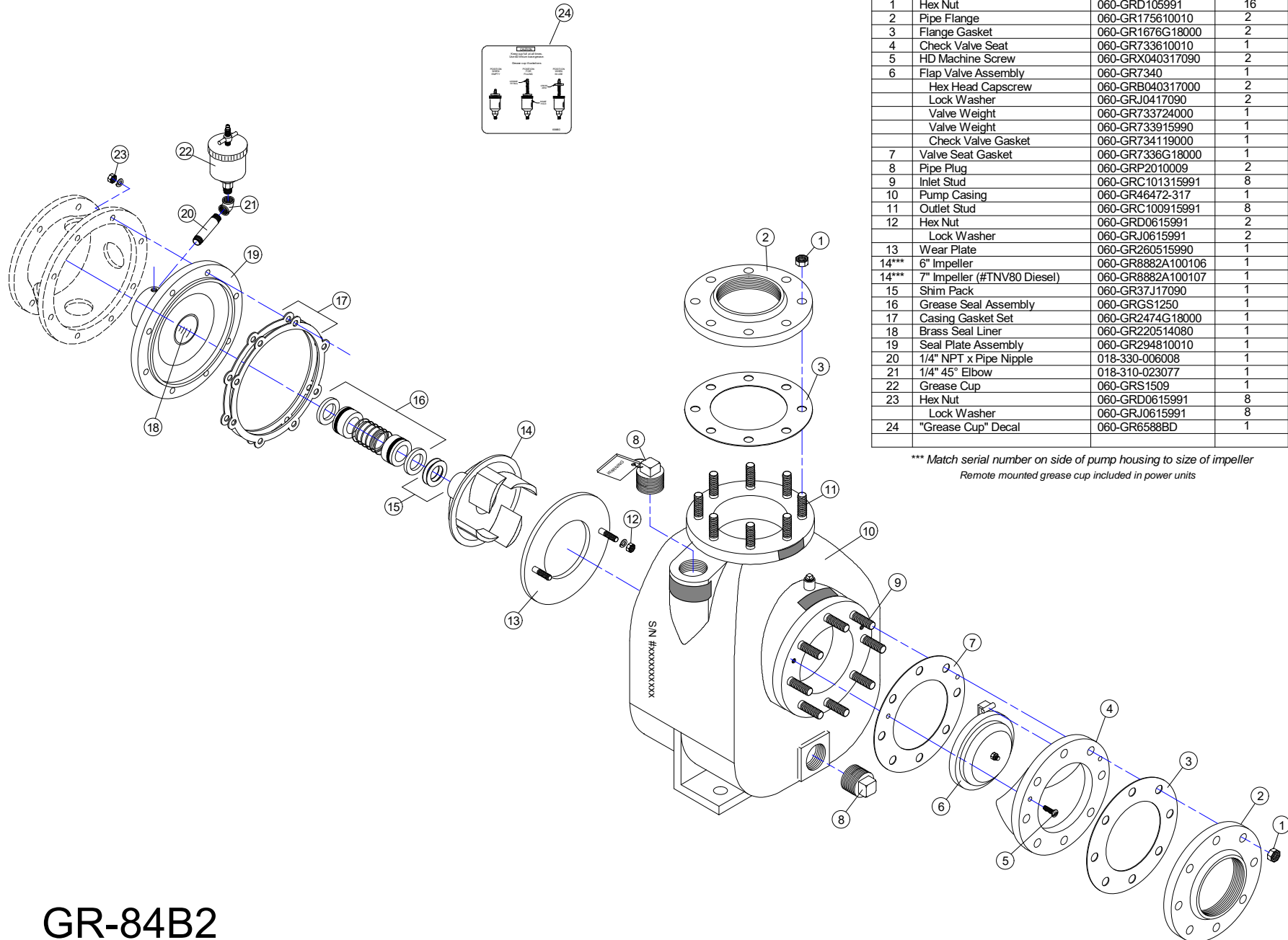


GR-84B2 ASSEMBLY PARTS LIST

(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