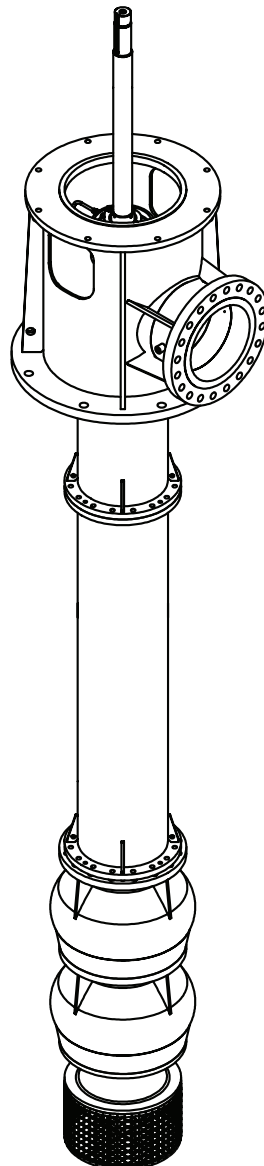




## **4810 SERIES**

### **VERTICAL TURBINE PUMPS**

# **INSTALLATION, OPERATION & MAINTENANCE MANUAL**



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AMERIFLO has used the most current and advanced technology for research and design when engineering the pumps & system components of the product line. A concentrated focus on state-of-the-art quality control during the manufacturing process ensures safety and reliability as primary goals.

This manual is designed so that the end user becomes familiar with the characteristics and proper operation of the VT vertical turbine product line.

This manual provides very important guidance for the installation, reliable operation and efficient maintenance when the need arises. The operating procedures must be strictly followed to ensure reliability of the product and to maximize the service life of the pump with a focus on avoiding injury and hazards.

Local laws & regulations are not taken into account in this manual as they can vary greatly from region to region. Operators must ensure total and strict compliance with local laws and regulations, including proper procedures required during the installation process.

Do not operate any equipment in excess of it's limits as specified in this operating manual, including transmission medium, flow, rated speed, density, pressure and temperature. The end user must ensure the operation of the pump & system is in accordance with this manual.

If you have any questions, please contact AMERIFLO with your serial number & nameplate information. AMERIFLO can assist you if damage has occurred to the equipment and/or if the need arises for spare parts.

## **SAFETY PRECAUTIONS**

This installation, operation & maintenance manual contains general installation, operation and maintenance instructions that must be followed. This manual must be read and understood in it's entirety by the responsible personnel/operators prior to installation and commissioning and the manual must be kept readily available at the job site for easy access.

To minimize risk of injury or death, the "safety" provisions of this entire manual **MUST** be followed. AMERIFLO shall not be liable for physical injury, damage or delays caused by a failure to observe the instructions for installation, operation & maintenance contained in this manual.

Paying constant attention to safety is always extremely important. This manual covers areas of danger that require additional attention. These areas of precaution are identified by using the following symbols:



**DANGER** - Immediate hazards which **WILL** result in severe personal injury or death.



**WARNING** - Hazards or unsafe practices which **COULD** result in severe personal injury or death.



**CAUTION** - Hazards or unsafe practices which **COULD** result in minor personal injury or property damage.



**SHOCK HAZARD - ELECTRICAL** Hazards are present which **COULD** result in severe personal injury or death.



**ROTATING EQUIPMENT** - Hazards are present which **COULD** result in severe personal injury or death.

Equipment maximum lifting speed of 15 FT/S [4.6 M/S] should not be exceeded.



In colder climates where liquid could freeze in the pump or engine, precautions must be made to make sure the fluid never freezes. Freezing fluid can damage equipment. Drain fluid from any piece of equipment in this environment.

Never start or run equipment without a proper submergence. Significant damage to the equipment can occur.

Never operate any pump for an extended period of time with a closed discharge valve. The allowable amount of time a pump can operate in this condition depends on several variables at the job site. Contact AMERIFLO for proper engineering support.

Never operate any pump for an extended period of time below minimum flow. Temperature rise and extreme damage can occur.

If excessive noise is heard from any rotating piece of equipment, shut the equipment down immediately.

Always lockout power before doing any maintenance on the pump or driver.

Never operate the pump & driver without a proper coupling guard in place.



If any leaks of hazardous fluids are identified, shut the unit down immediately and address the issue.

## PERSONNEL QUALIFICATION

All personnel involved in the installation, operation & maintenance must be fully qualified to manage, operate, maintain, inspect and install the pump assembly. The responsibilities, competence and supervision of all personnel involved in installation, operation and maintenance must be clearly defined by the end user. Lack of knowledge must be addressed by means of training and instruction provided by sufficiently trained personnel. Upon request, the end user can contact AMERIFLO to train the operators and end user. In addition, it is the responsibility of the operator to ensure that the operating instructions contained in this manual are fully understood by all parties involved with the equipment.

## NON-COMPLIANCE

Non-compliance with the safety instructions contained in this manual can result in an accident causing damage to equipment, the site and to personal injury or death. The end user is solely responsible for correctly installing all equipment and a safely run operation after installation.

## INSPECTION & INSTALLATION

The operator will ensure that maintenance, inspection and installation is performed by authorized, qualified personnel who are thoroughly familiar with this manual and the operation of this equipment. **WORK MUST BE PERFORMED ON A PUMP OR DIESEL ENGINE ONLY AFTER THE PIECE IF EQUIPMENT HAS BEEN COMPLETELY LOCKED OUT OF OPERATION.** When taking the pump unit out of service always adhere to the strict procedures described in the manual. Properly decontaminate pumps which handle fluids posing a health hazard. As soon as the work has been completed, re-install and re-activate any safety-relevant devices and protective devices. Before returning the product to service, review all instructions before restarting any equipment.

## UNAUTHORIZED MODIFICATION

Modifications or alterations to the pump unit are only permitted with the manufacturer's prior written consent. Use only original spare parts or parts authorized by AMERIFLO. The use of other parts will invalidate any remaining warranty. Warranty relating to the pump and driver unit is only valid if the equipment is used in accordance with its intended use and only authentic AMERIFLO parts are used for maintenance and repair. Never operate the pump & driver outside of the limits stated in the pump data sheet and information contained in this manual.

## GENERAL INSTRUCTIONS

The pump and driver must be examined upon arrival to ascertain any damage caused during shipment. If damaged, immediately notify the carrier and/or the sender. Confirm that the goods correspond exactly to the description on the shipping documents and report any differences as soon as possible to AMERIFLO. Always reference the pump type and serial number stamped on the data plate.

The pumping unit must be used only for applications for which AMERIFLO has specified:

- The construction materials
- The operating conditions (flow, pressure, temperature, etc.)
- The field of application

In case of doubt, contact AMERIFLO.

## TRANSPORT & LIFTING

The pump and driver must be transported in the horizontal position.

Proper handling measures must be followed during transportation of equipment. Observe the following precautions.



CAUTION - Maximum lifting speed is 15 FT/S (4.6 M/S)

During all phases of transportation (truck, rail & ocean) all components must be handled and transported by using suitable slings and hoists. All handling should be carried out by specially trained personnel to avoid damage to the equipment and persons. The lifting rings attached to various components should be used exclusively to lift the components for which they have been supplied.



**CAUTION** - All equipment shall be bolted to a suitable pallet or strapped down appropriately during transport. All loose parts should be crated accordingly.



**CAUTION** - The lugs on the pump and driver are only designed to lift that piece of equipment separately. When lifting the pump set attention needs to be placed on the tension direction. See below figure for proper lifting.

It is important to exercise extreme care in handling and installing all components. Certain items are precision machined for proper alignment and if dropped or mistreated in any way, misalignment and malfunction can result. The insulation on all wire must be protected. Parts which are too heavy to be lifted from the transporting vehicle should be skidded slowly and carefully to the ground to prevent damage. Never unload any item by dropping parts directly from the truck to the ground.

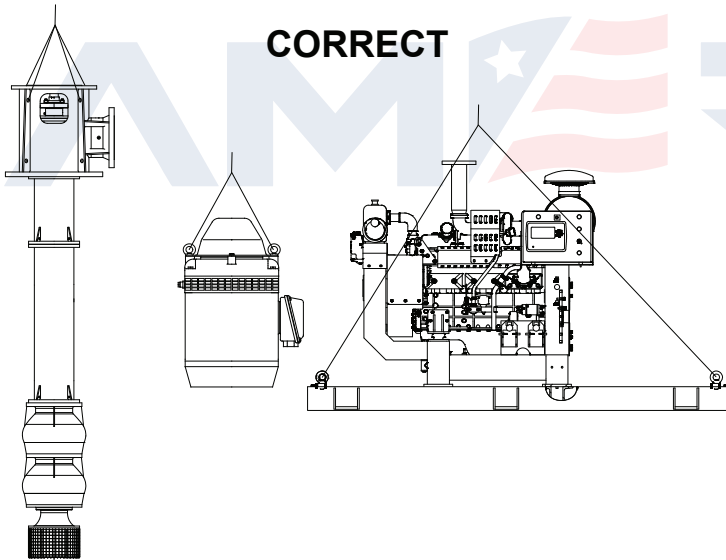


FIGURE 1 - CORRECT LIFTING

If job site conditions permit, you may be able to install directly from the truck that delivered the equipment. If not, move the components to the installation area and lay them out in a clean and protected space convenient to the work location.

If installation cannot begin within a few days after delivery, segregate and identify all components of the shipment so they will not be confused with other equipment arriving at the job site.

Read and follow the storage instructions carefully as care of the pump during this period before installation can be as important as maintenance after operation has begun.

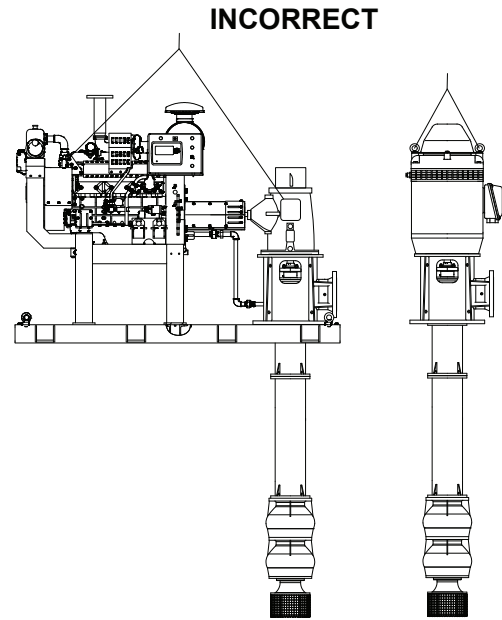


FIGURE 2 - INCORRECT LIFTING

Check all parts against the packing list to make sure nothing is missing. It is much better to find out now than during the installation. If damage occurred during transportation report it to the carrier immediately. Freight claims **MUST** be reported by the recipient. Report any item discrepancies immediately to AMERIFLO.

## STORAGE

### SHORT-TERM STORAGE

Normal shipment packaging is designed to protect the pump and driver during shipment and for dry, indoor storage for up to two months or less.

If the pump is not to be installed or operated soon after delivery, store the unit in a clean, dry place, having slow changes in environmental conditions. Steps should be taken to protect the pump against moisture, dirt and foreign particulate intrusion. The procedure followed for this short-term storage is summarized below:

#### Standard Protection for Shipment:

a. Loose unmounted items, including, but not limited to, packing and coupling spacers are packaged in a water proof plastic bag and placed under the coupling guard. Larger items are boxed and metal banded to the base plate. All bags and cartons are identified with the AMERI-



FLO sales order number, the customer purchase order number and the pump item number (if applicable).

- b. Inner surfaces of the bearing housing, shaft (area through bearing housing) and bearings are coated with Cortec VCI-329 rust inhibitor or equal.
- c. Re-greasable bearings are packed with grease.
- d. After a performance test, the pump is tipped on the suction flange for drainage (some residual water may remain in the casing). Then, internal surfaces of ferrous casings, covers, flange faces and the impeller surface are sprayed with Calgon Vestal Labs RP-743m or equal. Exposed shafts are taped with Polywrap.
- e. Flange faces are protected with plastic covers secured with plastic drive bolts. 3/16 in (7.8 mm) steel or 1/4 in (6.3 mm) wood covers with rubber gaskets, steel bolts and nuts are all available for extra cost.
- f. All assemblies are bolted to a wood skid which confines the assembly within the perimeter of the skid.
- g. Assemblies with special paint are protected with a plastic wrap.
- h. Bare pumps, when not mounted on base plates, are bolted to wood skids.
- i. All assemblies having external piping (seal flush and cooling water plans), etc. are packaged and braced to withstand normal handling during shipment. In some cases components may be disassembled for shipment. The pump must be stored in a covered, dry location.

It is recommended that the following procedure is taken:

1. Ensure that the bearings are packed with the recommended grease to prevent moisture from entering the bearing housings.
2. Remove all glands, packing and lantern rings from the stuffing box.
3. Ensure that the suction and discharge flanges are covered and secured with cardboard, plastic or wood to prevent foreign objects from entering the pump.
4. If the pump is to be stored outdoors with no overhead covering, cover the unit with a tarp or other suitable covering.

## LONG-TERM STORAGE

Long-term storage is defined as more than two months, but less than 12 months. The procedure AMERIFLO

follows for long-term storage of pumps is given below. These procedures are in addition to the short-term procedure above.

Solid wood skids are utilized. Holes are drilled in the skid to accommodate the anchor bolt holes in the base plate or the casing and bearing housing feet holes on assemblies less base plate. Tackwrap sheeting is then placed on top of the skid and the pump assembly is placed on top of the Tackwrap. Metal bolts with washers and rubber bushings are inserted through the skid, the Tackwrap and the assembly from the bottom of the skid and are then secured with hex nuts. When the nuts are “snugged” down to the top of the base plate or casing and bearing housing feet, the rubber bushing is expanded, sealing the hole from the atmosphere. Desiccant bags are placed on the Tackwrap. The Tackwrap is drawn up around the assembly and hermetically (heat) sealed across the top. The assembly is completely sealed from the atmosphere and the desiccant will absorb any entrapped moisture. A solid wood box is then used to cover the assembly to provide protection from the elements and handling. This packaging will provide protection up to twelve months without damage to bearings, lip seals, etc. due to humidity, salt laden air, dust, etc. After unpacking, protection will be the responsibility of the user. If units are to be idle for extended periods, the addition of lubricants, inhibitor oils and greases should be used.

Every three months, the shaft should be rotated approximately 10-15 revolutions. When the unit is ready to be installed, replace all old lubricant with new lubricant.

## PUMP IDENTIFICATION

### MANUFACTURER

AMERIFLO  
4034 Mint Way, Dallas TX 75237  
United States of America

[www.ameriflo-usa.com](http://www.ameriflo-usa.com)



**CONSTRUCTION FEATURES**

The VT product line is a vertical, single or multistage stage, vertical turbine centrifugal pump. It is designed with a suction bell with strainer and a horizontal outlet with a fabricated discharge head assembly. The pump features packing with a packing gland. The discharge flange is raised face and rated for 250 pounds per square inch (PSI). The pump is standard clockwise rotation (as viewed from the driver end).

The bowl assembly flanged construction with o-rings between stages. The impellers feature a front and back bowl wear ring with hydraulic balancing holes for axial load reduction. Column features flanges construction for easy assembly and disassembly.

Discharge head is fabricated steel with packing housing.

**DATE OF MANUFACTURER**


The date of manufacture is indicated on the Sales Order paperwork.

**INSTALLATION, OPERATION & MAINTENANCE MANUAL IDENTIFICATION**


PREPARED: MARCH 1, 2021  
REVISION:

EDITION: 01  
DATE:

**NAMEPLATE INFORMATION**

 4034 MINT WAY DALLAS, TX 75237 UNITED STATES OF AMERICA			
<b>CENTRIFUGAL FIRE PUMP - VERTICAL TURBINE</b>			
MODEL	SERIAL NO.	NO. STAGES	
<input type="text"/>	<input type="text"/>	<input type="text"/>	
RATED GPM	RATED RPM	RATED HEAD	MAX. PSIG
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
RATED BHP	MAX. BHP	IMP DIA. IN	OVERALL LENGTH
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**FIGURE 3 - DISCHARGE HEAD NAMEPLATE**

 4034 MINT WAY DALLAS, TX 75237 UNITED STATES OF AMERICA	SERIAL NO.
	<input type="text"/>
	MODEL
	<input type="text"/>

**FIGURE 4 - BOWL ASSEMBLY NAMEPLATE****MODEL:**

Model of the pump

**SERIAL NUMBER:**

Serial number of the pump issued by Production Control

**NO. STAGES:**

Number of stages

**RATED GPM:**

Rated flow rate of pump in Gallons Per Minute

**RATED RPM:**

Rated speed of the pump in Revolutions Per Minute

**RATED PSIG.:**

Rated discharge pressure of the pump in Pounds Per Square Inch Gauge

**MAX. PSIG.:**

Maximum discharge pressure of the pump in Pounds Per Square Inch Gauge

**RATED BHP:**

Rated Brake Horsepower at duty point

**MAX. BHP:**

Maximum Brake Horsepower

**IMP DIA. IN:**

Impeller diameter in inches

**PSIG @ 150% FLOW:**

Rated discharge pressure of the pump at the 150% flow-rate

**DRIVER MANUFACTURER & SERIAL NUMBER:**

Driver manufacturer and serial number

**MAX. PSIG@SUCTION:**

Maximum pressure in Pounds Per Square Inch Gauge at suction flange

**CONTROLLER MANUFACTURER & SERIAL NUMBER:**

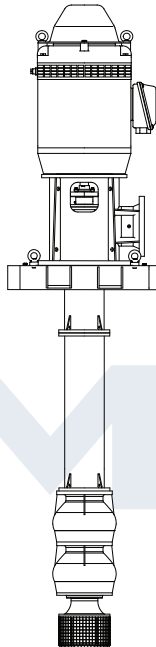
Controller manufacturer and serial number

# —AMERIFLO— WARRANTY

SECTION **4810** PAGE **10** OF **50**  
DATE **APRIL 2021**

AMERIFLO offers new equipment manufactured by seller or service supplied by seller to be warranted to be free from defects in material and craftsmanship under normal use and service for a period of one year from date of shipment. Further details of the AMERIFLO warranty can be obtained from your AMERIFLO customer service representative.

Do not remove the pump warranty seal PRIOR to contacting AMERIFLO for warranty consideration. Removing the pump warranty seal without PRIOR AMERIFLO permission can invalidate a potential warranty claim.



**FIGURE 5 - ELECTRIC INSTALLATION  
INSTALLATION**

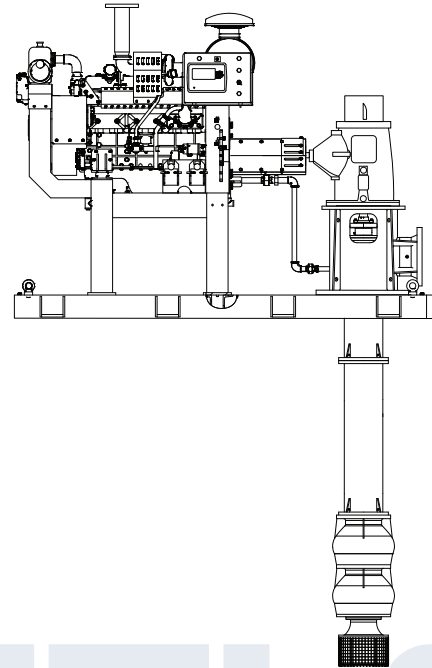
## PREPARATION

Prior to installation, clean the discharge flange on the discharge thoroughly. It is very important that the discharge flange is clean so that a good seal can be made to the system piping. FIGURE 5 shows a typical VHS electric motor installation and FIGURE 6 shows a typical diesel engine installation for a vertical turbine.

If the pump was placed into short-term or long-term storage and was prepared in a manner described above, it is very important to remove all grease and/or oil from the bearings. All bearings should be flushed with an appropriate fluid to remove any contamination prior to placing the pump into service.



**WARNING** - The height of the lifting equipment must be sufficient to lift the longest component to be installed.



**FIGURE 6 - DIESEL ENGINE INSTALLATION  
THE SUMP**

The design of the sump the pump will be placed into can influence both the mechanical and hydraulic characteristics of the pump assembly. The sump should be designed in such a way as to provide fluid to the vertical turbine assembly free of turbulence and of surface and sub-surface vortices. Vortexing can be visible on the surface of the sump but can also be submerged making it invisible from above.

The Hydraulic Institute standard offers guidelines for good sump design. AMERIFLO recommends sump design per HI standards and always recommends that the end user consult an engineer that specializes in sump design.

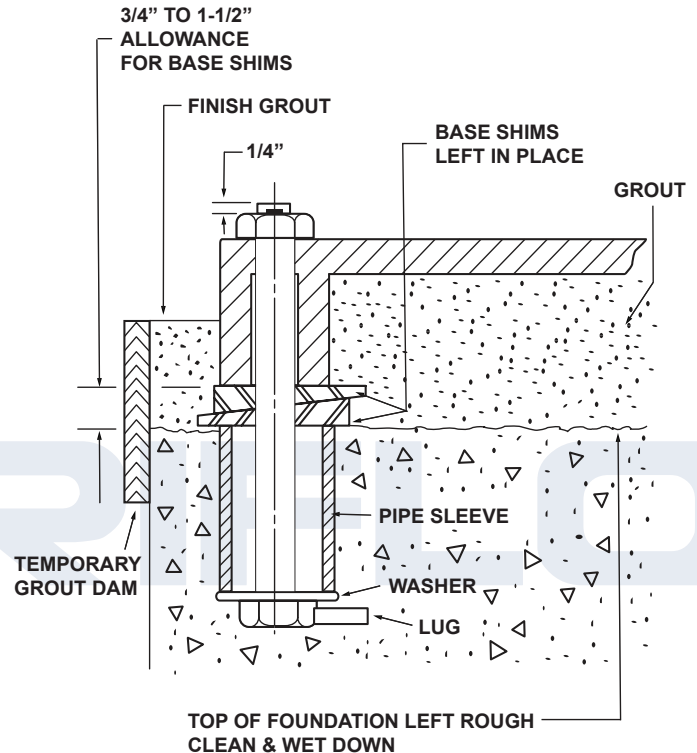
Before installing the pump inspect the column and bowl assembly thoroughly. Measure the overall length and confirm that the sump depth will accommodate the pump, including the strainer. Confirm that the sump is free of all debris and trash and make sure precautions are made to make sure future debris cannot enter the sump.

## RECOMMENDED PROCEDURE FOR BASE PLATE INSTALLATION

### NEW GROUTED BASE PLATES

1. The pump foundation should be located as close to the source of the fluid to be pumped as practical. There should be adequate space for workers to install, operate and maintain the pump including room to remove the unit for maintenance at a future date. The foundation should be sufficient enough to absorb any vibration and should provide a rigid support for the pump and driver. The foundation's mass should be three (3) times that of the complete installed assembly (at a minimum). Recommended alignment of the baseplate is accomplished by adjusting the mounting hardware. After alignment, the baseplate is supported by metallic shims or wedges. These metallic shims or wedges are used to support the baseplate during the process of concrete pouring (grouting) of the anchor bolts. In order to avoid torsional twisting of the baseplate during the installation process, metallic shims or wedges should be placed as close to the anchor bolt locations as possible. The metallic shims or wedges are fixed permanently in location by pouring grout at a later step.
2. Special attention must be paid to the baseplate during the foundation installation making sure stress is not induced on the baseplate. Recommended mass of the concrete foundation should be three (3) times that of the complete installed assembly (at a minimum). Note that foundation bolts are imbedded in the concrete inside a sleeve to allow some movement of the bolt making installation easier.
3. Level the pump baseplate assembly. The proper surfaces to reference when leveling the pump baseplate assembly is the pump discharge flange. **DO NOT** stress the baseplate. **DO NOT** bolt the discharge flange of the pump to the system piping until the baseplate foundation is completely installed. Use shims and wedges to level the baseplate to the foundation. See FIGURE 7. Check for level in both the longitudinal and lateral directions. Shims or wedges should be placed at all baseplate anchor bolt locations and in the middle of the baseplate if the base is more than five feet [1.5 meters] long. Do not rely on the bottom of the baseplate to be flat. Standard base plate bottoms are not machined and it is not likely that the field foundation surface is flat either.
4. After leveling the baseplate, tighten the anchor bolts in a diagonal pattern evenly. See FIGURE 8. If shims or wedges were used, make sure that the baseplate

was shimmed near each anchor bolt before tightening. Failure to do this may result in a torsional twisting of the baseplate, which could make it impossible to obtain a final and correct field alignment. Check the level of the baseplate to make sure that tightening of the anchor bolts did not disturb the level of the baseplate in any manner. If the anchor bolts did change the level, adjust the jackscrews or shims as needed to level the base plate again. Continue adjusting the jackscrews or shims and tightening the anchor bolts until the base plate is level.



**FIGURE 7 - BASEPLATE FOUNDATION**

5. **GROUT THE BASEPLATE.** A non-shrinking grout should be used. Grout compensates for uneven foundation, distributes weight of the unit and prevents the entire installation from shifting. Use only an approved, non-shrinking grout after setting and leveling the unit.
  - a. Build a strong form around the foundation to contain the grout.
  - b. Soak the top of the concrete foundation thoroughly and remove all surface water.
  - c. A raised motor pedestal should also be completely filled with grout during this process.
  - d. After the grout has thoroughly hardened, check the foundation bolts and tighten if necessary.
  - e. Approximately 14 days after the grout has been poured or when the grout has thoroughly cured,

apply an oil base paint to the exposed edges of the grout to prevent air and moisture from coming in contact with the grout.

Make sure that the grout completely fills the area under the baseplate or in the case of an I-beam base, all compartments are completely filled to the top. After the grout has cured, check for voids and repair them.



**CAUTION** - Once the baseplate is grouted, the baseplate cannot be adjusted so it is extremely important that all alignment procedures be completed **PRIOR** to grouting.

6. Run the system piping to the discharge flange of the pump. There should be no piping loads transmitted to the pump after connection is made. Recheck the alignment to verify that there are no significant loads being transferred to the pump. Remember, pipe strain is invisible and alignment checks must be made after system connection to make sure none exist.
7. Operate the pump for at least an hour or until it reaches final operating temperature. Shut the pump down and recheck alignment while the pump is hot. Piping thermal expansion may change the alignment. Realign the pump as necessary.

## EXISTING GROUTED BASE PLATES

When a pump is being installed on an existing grouted baseplate, the procedure is somewhat different from the previous section “New Grouted Base Plates.”

1. Mount the pump on the existing baseplate.
2. Level the pump by putting a level on the discharge flange. If not level, add or delete shims between the pump foot and the baseplate.
3. Run the piping to the discharge flange of the pump. (Step 6 above)

All piping must be independently supported, accurately aligned and preferably connected to the pump by a short length of flexible piping. The pump should not have to support the weight of the pipe or compensate for misalignment. It should be possible to install discharge bolts through mating flanges without pulling or prying either of the flanges. See FIGURE 8.

All piping must be tight. Pumps may air-bind if air is allowed to leak into the piping. If the pump flange(s) have tapped holes, select flange fasteners with thread engagement at least equal to the fastener diameter but that do not bottom out in the tapped holes before the joint is tight.

## PIPING - DISCHARGE

### DISCHARGE PIPING

Discharge piping should be installed per Hydraulic Institute and NFPA 20 standards. Do not use the pump as an anchorage point for the piping.

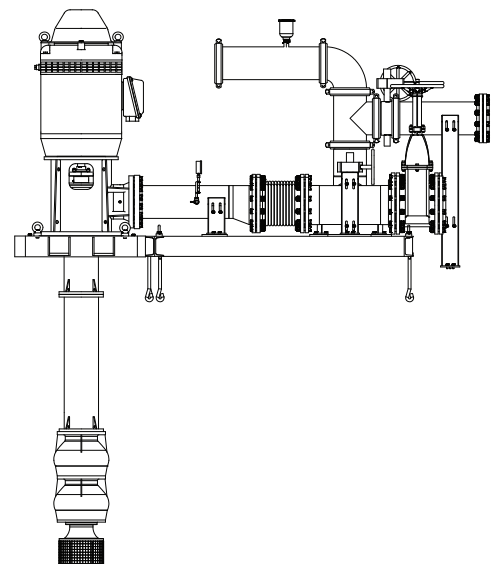


FIGURE 9 - PROPER VT DISCHARGE PIPING

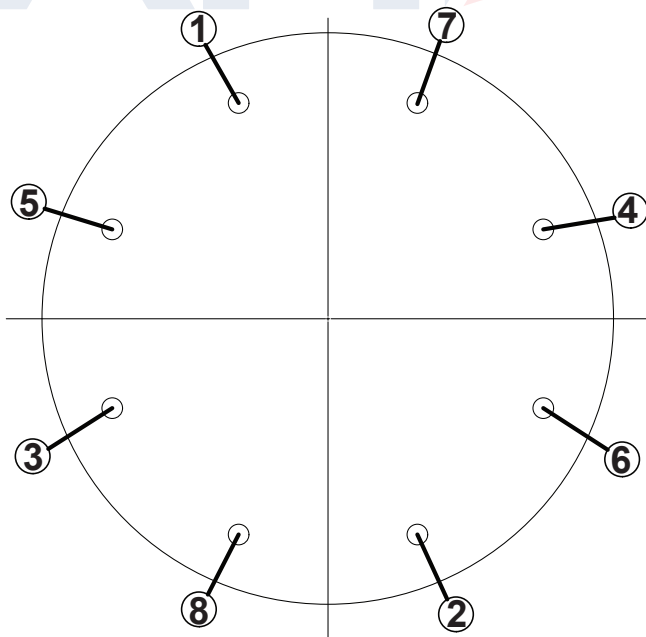


FIGURE 8 - BASEPLATE FOUNDATION

DATE **APRIL 2021**

Tie bolts should be used with expansion joints to prevent pipe strain being transferred to the pump casing. Do not install expansion joints next to the pump or in any way that would cause a strain on the pump resulting from system pressure changes.

It is usually advisable to increase the size of both suction and discharge pipes at the pump connections to decrease the loss of head from friction. When reducing the piping to the suction opening diameter, use an eccentric reducer with the eccentric side down to avoid air pockets.

Piping should be supported independently of the pump so as to not transfer any strain to the pump casing. Piping runs should be as short as possible with the nominal diameter of the piping equal to or greater than the diameter of the pump suction. The additional loads on the nozzles are mainly the weight of piping filled with water. The fluctuation of medium temperature leads to the change of pipeline length. The stress caused by the unsupported auxiliary equipment shall not exceed the limit.

Before installing the pump in the piping, remove the flange covers on the discharge nozzle of the pump. After all piping connections have been made, the alignment should be checked again.

If the discharge piping is short, the pipe diameter can be the same as the pump discharge opening. If the piping is long, pipe diameter should be one or two sizes larger than the pump discharge opening. On long horizontal runs, it is desirable to maintain as even a grade as possible.



**WARNING** - When fluid velocity in the pipe is high, for example, at or above 10 ft/s [3 m/s], a rapidly closing discharge valve can cause a damaging pressure wave. A dampening arrangement should be provided in the piping.

## PRESSURE GAUGES

Properly sized pressure gauges are installed on both the suction and discharge nozzles in supplied gauge taps. Stainless steel tubing (with integral pulsation damping) are supplied standard at both the suction and discharge locations. These gauges will allow the end user a proper differential pressure reading that the pump is generating. These gauges will enable the operator to easily observe the operation of the pump and also determine if the pump is operating in conformance with the performance curve. If cavitation, vapor binding or other unstable operation should occur, widely fluctuating discharge pressure readings will be noted.

## ACCESSORIES

Dimensions and installation locations of accessories (control panel, main relief valves, fuel tank, battery, etc.) are specified in the equipment installation and piping layout drawings. More detailed installation instructions are provided in the operating instructions for each component. These accessories will ensure the normal operation of the pump and driver.

## ALIGNMENT PROCEDURE

The vertical turbine product line uses NEMA vertical motors in an electric installation and a right angle gear drive in a diesel engine installation. In both of these scenarios, the motor and gear have a P-base register to aid in alignment during installation. This P-base register makes installation very easy and no further alignment procedure is needed during installation. See FIGURE 10 for VHS motor and FIGURE 11 for right angle gear drive.

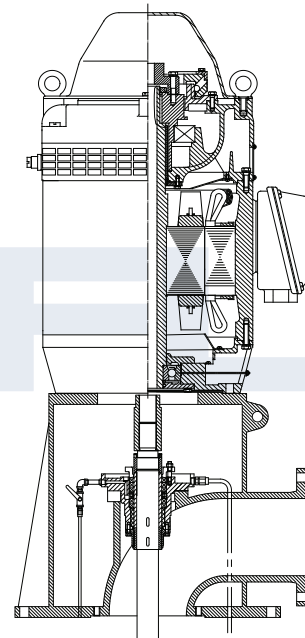
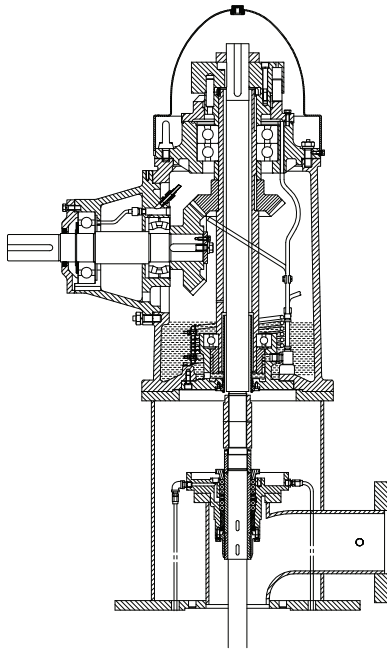


FIGURE 10 - VHS ELECTRIC MOTOR





**FIGURE 11 - RIGHT ANGLE GEAR DRIVE**



**DANGER - NEVER** stand under a load as it hangs in a sling. Inspect and clean the register on the motor or gear drive before installation. If any damage to the register is found it must be repaired **PRIOR** to installation.

Inspect the register on the discharge head and make sure there is no damage or debris present.

## PUMP AND SHAFT ALIGNMENT

### ELECTRIC MOTOR

After connecting the suction and discharge piping, rotate the pump drive shaft clockwise (as view from driver end) by hand several complete revolutions to be sure there is no binding and that all parts are free to rotate. Recheck the shaft alignment one more time. If suction or discharge piping caused the unit to be out of alignment, correct the piping issue to relieve strain on the pump before starting up the unit.

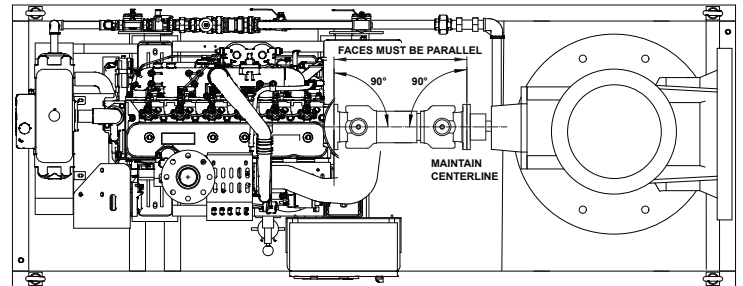
### DIESEL ENGINE

During the factory alignment of diesel engine driven units, the concentricity between the pump and the diesel engine has been adjusted, however, movement during transportation is possible. Make sure that the driveshaft and all mounting hardware are checked **PRIOR** to pump start up.

After the diesel engine is connected to the pump through the driveshaft and universal couplings, make sure that the

two coupling end faces of the universal coupling are kept parallel.

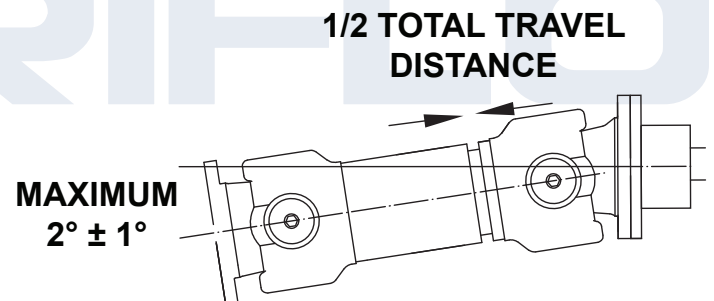
The diesel bearing center and the pump bearing center must be aligned with the centerline of the driveshaft, allowing for a maximum deviation of  $\pm 0.03$  in [ $\pm 0.76$  mm]. See FIGURE 12.



**FIGURE 12 - DIESEL ENGINE DRIVESHAFT**

Confirm that the distance from the driveshaft to the universal joint is only half of the total travel available. There should still be space available for movement when ready to operate.

The diesel engine bearing centerline and the pump bearing centerline angle must be kept to  $2^\circ$  (with a  $\pm 1^\circ$  deviation). See FIGURE 13.



**FIGURE 13 - DIESEL ENGINE OFFSET ANGLE & SPACING**

## PACKING

All fire protection equipment supplied by AMERIFLO are equipped with shaft packing. It is AMERIFLO standard practice to install the packing in the stuffing box prior to shipment. Bring the packing gland up squarely against the last packing ring and tighten the nuts evenly to finger pressure. Turn the shaft to ensure it does not bind on the bore of the gland assembly. After start-up break in the packing as described later in the PUMP START-UP section.



**CAUTION -** It is very important to inspect and ensure that the packing is installed correctly. Failure to do so could result in serious leakage of the pumped fluid.

Refer to Section "PACKING REPLACEMENT" at the end of this manual for proper packing break-in and adjustment procedure.

## COUPLING GUARDS

It is very important that all coupling guards (at the driver coupling and near the pump packing housing locations) be installed PRIOR to startup. Failure to do so can cause serious injury or death.



**ROTATING EQUIPMENT** - Severe injury and/or death can occur if all coupling guards are not properly installed PRIOR to pump startup.

A direction arrow is cast on the pump casing. Make sure the motor rotates in the correct direction before coupling the motor to the pump. Three phase wiring can be connected in an incorrect manner allowing the motor to operate in the incorrect direction.

It is absolutely essential that the rotation of the motor be checked before connecting the shaft coupling. Incorrect rotation of the pump, for even a short time period, can dislodge the impeller nut which may cause serious damage to the rotating assembly.

The coupling should be installed as advised by the coupling manufacturer. Pumps are shipped without the spacer installed to make sure proper rotation and the proper alignment procedures are followed. If the spacer has been installed to facilitate alignment, then it must be removed prior to checking rotation. Remove all protective material from the coupling and any exposed portions of the shaft before installing the coupling itself.

## VENTILATION

Pumps with electric and diesel engine drivers MUST have adequate ventilation in the pump room. During operations, the pump & driver assembly will emit heat and a significant temperature rise will affect the efficiency of the unit. Therefore, it is necessary to take measures to ensure that the pumping unit remains cool. Cooler air should enter the room at a level near the floor and the warmer air should be ventilated out of the top of the room.

If the unit is diesel engine driven, all heat and exhaust gases must be properly vented out of the pump room. See Appendix at the end of this manual for proper drawing.

## DIESEL ENGINE FLUIDS

It is essential that the fluids in the diesel engine are monitored for proper operation. These fluids include oil, coolant and fuel.

### OIL

When checking the proper oil level, the engine must have been shut down for a minimum of 10 minutes before taking any oil reading. The oil level should never be below the minimum dipstick indication or above the maximum dipstick indication. The target of proper oil level should be at the 80% mark between the upper and lower indicators. Refer to the proper diesel engine Installation, Operation & Maintenance manual for all engine details.



**WARNING** - Operating the engine with oil level indication out of the range as indicated on the dipstick can cause catastrophic engine damage.

### COOLANT

The AMERIFLO diesel engines utilize an internal, closed cooling loop connected to an external, open cooling loop. The external cooling loop uses water from the pump and then discards the fluid to an external drain. Never operate the diesel engine while disconnected from the pump as fluid in the outer cooling loop will be absent not allowing the internal cooling loop a means for dissipating heat. Refer to the proper diesel engine Installation, Operation & Maintenance manual for all engine details.



**DANGER** - Never open the coolant cap on the engine while the engine is running or while the engine is hot. Doing so can cause severe injury and/or death.

### FUEL

Be sure that the proper grade of diesel fuel is used. Alternative grades can drastically reduce power generated by the engine. PRIOR to starting the engine make sure all fuel lines are open and there are no obstructions in any fuel lines or fuel filters. Refer to the proper diesel engine Installation, Operation & Maintenance manual for all engine details.



**DANGER** - Diesel fuel is a toxic fuel that can cause fire or explosion. Take all precautions necessary to eliminate any dangers and quickly clean up any spilled fuel.



## BATTERY CONNECTIONS

All AMERIFLO engines operate on a 24 volt negative ground system. Wiring of any battery should only be done by qualified persons. Refer to the proper diesel engine Installation, Operation & Maintenance manual for all engine details. See FIGURE 30.



**DANGER** - If sulfuric acid makes direct contact with the eyes, it can cause permanent blindness. If ingested, this chemical may cause internal burns, irreversible organ damage, and possibly death. Exposure to sulfuric acid aerosols at high concentrations leads to severe eye and respiratory tract irritation and tissue damage.

## INSTALLING THE PUMP



**CAUTION** - Before proceeding to install the unit make sure that all instructions in the **BASEPLATE INSTALLATION** section above have been followed.

The vertical turbine pump must be designed with an overall length that maintains the minimum submergence during all phases of operation.

The vertical turbine unit has been factory assembled by qualified personnel. Install the unit complete and do not disassemble unless authorized by the factory. When you lift the unit, make sure that the crane or hoist has an effective length that exceeds the length of the vertical turbine pump, including the strainer.

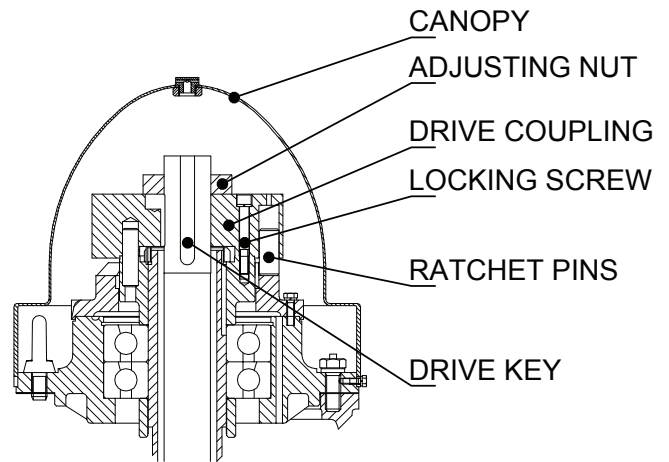


**CAUTION** - Confirm that the sump has depth exceeds the overall length of the pump (including the strainer).

## AXIAL IMPELLER ADJUSTMENT

After the complete vertical turbine pump has been installed you can proceed to mounting the motor or right angle gear drive. Make sure that both the motor or gear drive register and the discharge head register are clean and free of debris.

Remove the canopy from the motor or gear drive unit. Remove the drive coupling, the adjusting nut, locking screw and shaft key from the unit. See FIGURE 14.



**FIGURE 14 - CLUTCH ASSEMBLY DRAWING**

Place these items in a safe place and make sure no parts fall into the motor or gear drive. If this happens ALL parts must be retrieved **PRIOR** to startup.

Lower the motor or gear drive slowly onto the fabricated discharge head so that the NEMA P-base register is engaged. Install the shaft into the motor or gear drive and thread into the coupling that is above the stuffing box. Install the adjusting nut.

Use the adjusting nut to raise the impellers a lateral distance equal to half of the total available. This can be easily accomplished in the field by raising the impellers until they begin to rub on the top of the bowls. Measure this total distance and place the impellers at the halfway point.

When finished, install the drive key and locking screw. Place the canopy back onto the electric motor or right angle gear drive.

After completing the shaft installation, install the canopy and hardware. Be sure that you check the oil level in the motor or gear drive **PRIOR** to start-up.

If using a right angle gear drive, make sure that the bearing cooler is also plumbed to water.

Refer to PRE-START UP and START-UP sheets at the end of this manual for proper start-up procedures.

## SUBMERGENCE

Proper submergence must be maintained at all times during operation.



**WARNING** - It is **EXTREMELY** important that the rotation of the motor is confirmed before installing the shaft coupling. Incorrect rotation, even for a short period, can cause catastrophic damage to the pumping unit.

Double check the rotation PRIOR to starting up the pump unit.

## PRE START-UP CHECKS

In order to have a smooth start-up, the following list **MUST** be checked.

- The pump and driver are securely bolted to the foundation.
- The motor rotation has been confirmed.
- The system piping is connected correctly, is liquid tight and is not transmitting any pipe strain to the fabricated steel discharge head.
- The shaft assembly is free to rotate without any binding.
- The coupling guards are installed correctly.
- Confirm that no damage is present to any system device including the pump and driver.
- Confirm that all safety devices are installed correctly (casing relief valve, main relief valve, diesel engine cooling loop, right angle gear drive cooling loop, etc.) according to their respective installation instructions.
- Pump, driver and/or right angle gear drive has been properly lubricated.
- The sump is filled with liquid and the pump has proper submergence..
- Packing is installed correctly and the gland bolts are loose.



**WARNING** - Failure to ensure that the pump has proper submergence PRIOR to start-up can cause catastrophic damage to the pumping assembly and Diesel engine (if supplied).

## ENSURING PROPER NPSHA

Net Positive Suction Head – Available (NPSHA) is the measure of the energy in a liquid above the vapor pressure. It is used to determine the likelihood that a fluid will vaporize within the pump. It is a critical number because a centrifugal pump is designed to pump a liquid, not a vapor. Vaporization within a pump will result in damage to the pump, deterioration of the Total Differential Head (TDH) and possible catastrophic damage to the pump.

Net Positive Suction Head – Required (NPSHR) is the decrease of fluid energy between the inlet of the pump and the point of lowest pressure in the pump. This decrease occurs because of friction losses and fluid accelerations near the inlet region of the pump suction as the fluid enters the impeller vanes. The value for NPSHR for the specific pump is given in the pump data sheet and on the pump performance curve.

For a pump to operate properly the NPSHA must be greater than the NPSHR. Good design practice dictates that this margin should be at least 5 ft (1.5 m) or 20% more than NPSHR, whichever is greater. By using this guideline, it will reduce the likelihood of cavitation which can severely damage the pump and cause possible catastrophic damage.



**WARNING** - It is important to make sure that the NPSHA is larger than the NPSHR by the suggested margin above. Incorporating this into the system design will enhance pump performance & reliability.

## STARTING THE PUMP & ADJUSTING FLOW

1. Any throttling of the pump to control flowrate should always be done with the valve located in the discharge piping.



**DANGER** - Never operate the pump with the discharge valve in the closed position. This could cause the fluid within the pump to vaporize and cause an explosion which could cause personal injury and/or death.

2. The pump must be properly submerged for correct operation. The system air release valve should help evacuate any air from the pump and system.
3. Be sure that all cooling lines are connected to the pump and that all fluids are at proper levels in the diesel engine, right angle gear drive or electric motor.
4. Be sure that all fuel lines are open if using a diesel engine.
5. Start the driver.
6. Slowly open the discharge valve until the correct flow-rate is achieved. Be sure that the unit does not operate a lower than specified flows for extended periods as this could cause damage to the pump and/or other system equipment.



**DANGER** - Never allow the pump to operate for an extended period of time at shut-off. This could cause the fluid within the pump to vaporize and cause an explosion which could cause personal injury and/or death.

7. Monitor the pump performance, motor performance (if equipped), diesel engine fluid levels (if equipped) and any other overall performance measures to make sure the unit is operating as it should be.
8. Allow the pump to operate for some time and then proceed to adjust the packing leakage in the following section below.

The pump and driver assembly should be shut down immediately if any of the following situations exist.

- No liquid is delivered.
- A significantly lower amount of fluid is being delivered.
- A significantly lower discharge pressure is being delivered.
- Loss of liquid after the pump starts up.
- Excessive vibration from the pump and/or driver.
- Electric motor or diesel engine is running hot or overheating.

- Pump bearings are running very hot and outside of design limits.



**WARNING** - Pump bearings should not exceed 250°F [121°C]. If the temperature exceeds this number shut the pump down immediately and investigate the cause.

## ADJUSTING THE PACKING

The purpose of a stuffing box is to limit leakage of the pump fluid and to prevent air from entering the suction area along the pump shaft. Pumps are equipped with packing. Normally, the pumped liquid is used to lubricate the stuffing box. If the liquid is dirty, gritty or contains material that would gum or jam up the packing, an external fluid must be used. For pumps equipped with packing, there must always be a slight leakage from the gland. The amount of leakage is hard to define, but a steady dripping of liquid through the gland is a must. Stuffing box glands should be adjusted after the pump is started. When leakage is excessive, tighten the gland bolts evenly a little at a time. Allow 10 minutes for the packing to adjust to it's new position. Never tighten the gland to completely eliminate all leakage as this will cause overheating and undue wear on the shaft sleeve.



**WARNING** - Failure to allow for an initially higher amount of fluid to leak through the packing and then gradually adjusted over the first hour of operation can damage the packing and score the shaft sleeve.

## OPERATION IN SUB-FREEZING CONDITIONS

If the unit will operate in sub-freezing temperatures, measures must be taken to ensure that no fluid is allowed to freeze within the pump, system piping and/or diesel engine. Frozen fluid can cause catastrophic damage to the pump and system. A heater or other means for keeping the equipment warm must be placed in the field for proper pump operation.

## SHUTDOWN CONSIDERATIONS

When the pump is ready to be shutdown, follow the start-up procedures in reverse. Slowly shut the discharge valve (if desired), shutdown the driver and then close the suction valve (if desired).

The following is a guide to troubleshooting problems with AMERIFLO Pumps & Engines. Common problems are analyzed and solutions are offered. Obviously, it is impossible to cover every possible scenario. If a problem exists that is not covered by one of these examples, then contact a local AMERIFLO Engineer or Distributor/Representative for assistance. Refer to the appropriate AMERIFLO diesel engine Installation, Operation & Maintenance manual for specific engine service and troubleshooting instructions.



## TROUBLESHOOTING

EXCESSIVELY LOW DISCHARGE PRESSURE	EXCESSIVELY HIGH DISCHARGE PRESSURE	FLOW RATE TOO HIGH	FLOW RATE TOO LOW	MOTOR HIGH AMPERAGE	NO LIQUID AFTER PUMP START-UP	NO LIQUID PRESENT IN SYSTEM	NOISY OPERATION & EXCESSIVE VIBRATION	HIGH PUMP TEMPERATURE	HIGH PUMP BEARING TEMPERATURE	EXCESSIVE PACKING LEAKAGE	PUMP LEAKAGE (NOT AT PACKING GLAND)	POSSIBLE CAUSE	REMEDY
★	★	★	★	★	★		★	★				PUMP DUTY POINT NOT COMPATIBLE WITH SYSTEM HEAD CURVE	<ul style="list-style-type: none"> <li>RE-EVALUATE THE PUMP DUTY AND MAKE A NEW HYDRAULIC SELECTION</li> </ul>
							★					PUMP AND/OR SYSTEM PIPING ARE NOT PRIMED AND VENTED	<ul style="list-style-type: none"> <li>VENT AND/OR PRIME THE PUMP AND SYSTEM PIPING</li> </ul>
★			★		★	★	★	★				SUCTION PIPING PLUGGED OR IMPELLER OBSTRUCTION	<ul style="list-style-type: none"> <li>INSPECT/CLEAN IMPELLER</li> <li>INSPECT THE SUCTION PIPING</li> <li>REMOVE OBSTRUCTIONS IN THE IMPELLER OR SYSTEM PIPING</li> <li>REMOVE DEBRIS FROM ANY STRAINERS IN THE SYSTEM</li> </ul>
						★	★	★				CAVITATION SOUND IN PIPING	<ul style="list-style-type: none"> <li>ADJUST THE SYSTEM PIPING WITH A FOCUS ON NPSHA &amp; NPSHR</li> <li>ALTER THE SYSTEM PIPING TO IMPROVE NPSHA</li> </ul>
★			★		★	★	★					INADEQUATE NPSHA	<ul style="list-style-type: none"> <li>CHECK PUMP OPERATION</li> <li>IMPROVE SUCTION PIPING</li> <li>IMPROVE NPSHA</li> <li>THROTTLE THE PUMP</li> <li>INSTALL THE PUMP AT A LOWER POINT IN THE SYSTEM</li> <li>MODIFY THE SUCTION PIPING BY CHANGING SIZE AND LENGTH</li> </ul>
★			★	★			★					INCORRECT ROTATION	<ul style="list-style-type: none"> <li>CHECK MOTOR WIRING</li> <li>CONFIRM CONTROL PANEL WIRING</li> <li>CONFIRM IMPELLER INSTALLED CORRECTLY</li> </ul>
★			★				★					SPEED IS TOO LOW	<ul style="list-style-type: none"> <li>INCREASE THE SPEED</li> <li>INSPECT SYSTEM CONTROLS</li> <li>INSTALL A LARGER IMPELLER</li> </ul>
★			★	★	★	★						WORN INTERNAL COMPONENTS	<ul style="list-style-type: none"> <li>CONFIRM DUTY POINT REQUIREMENTS</li> <li>THROTTLE THE PUMP</li> <li>INSPECT PUMP FLUID FOR ABRASIVES OR CHEMICAL ATTACK</li> <li>REPLACE WORN COMPONENTS</li> </ul>
				★								NEEDED DISCHARGE PRESSURE IS LOWER THAN ORDERED	<ul style="list-style-type: none"> <li>READJUST THE DUTY POINT</li> <li>THROTTLE THE PUMP</li> </ul>
				★								HIGHER VISCOSITY OF PUMPED FLUID	<ul style="list-style-type: none"> <li>REDUCE THE SPEED</li> <li>INSPECT THE PUMP &amp; MOTOR</li> </ul>
	★	★		★			★					SPEED IS TOO HIGH	<ul style="list-style-type: none"> <li>REDUCE THE SPEED</li> <li>INSPECT THE PUMP &amp; MOTOR</li> </ul>

## TROUBLESHOOTING

EXCESSIVELY LOW DISCHARGE PRESSURE	EXCESSIVELY HIGH DISCHARGE PRESSURE	FLOW RATE TOO HIGH	FLOW RATE TOO LOW	MOTOR HIGH AMPERAGE	NO LIQUID AFTER PUMP START-UP	NO LIQUID PRESENT IN SYSTEM	NOISY OPERATION & EXCESSIVE VIBRATION	HIGH PUMP TEMPERATURE	HIGH PUMP BEARING TEMPERATURE	EXCESSIVE PACKING LEAKAGE	PUMP LEAKAGE (NOT AT PACKING GLAND)	POSSIBLE CAUSE	REMEDY
										★		CAPSCREWS/STUDS ARE LOOSE OR DEFECTIVE	<ul style="list-style-type: none"> <li>INSPECT CAPSCREWS/STUDS</li> <li>RE-TIGHTEN THE FASTENER</li> <li>REPLACE THE HARDWARE</li> <li>INSPECT THE PIPING AND MAKE SURE ALL HARDWARE IS TIGHT</li> </ul>
										★		WORN PACKING	<ul style="list-style-type: none"> <li>INSPECT FLUSHING SYSTEM &amp; FLUSHING SYSTEM PRESSURE</li> <li>CLEAN THE STUFFING BOX AND FLUSH LINES</li> <li>INSTALL NEW PACKING</li> <li>REPLACE WORN COMPONENTS</li> </ul>
★		★					★	★				INSUFFICIENT FLUID AT SUCTION	<ul style="list-style-type: none"> <li>CORRECT SYSTEM PIPING</li> <li>INSPECT SYSTEM PIPING FOR WEAR AND/OR DAMAGE</li> </ul>
								★		★		PACKING GLAND INSTALLED INCORRECTLY	<ul style="list-style-type: none"> <li>CHANGE PART</li> <li>REPLACE PART</li> <li>CORRECT INSTALLATION</li> <li>REPLACE PACKING</li> <li>REPLACE WORN COMPONENTS</li> </ul>
								★		★		COOLING FLUID INADEQUATE	<ul style="list-style-type: none"> <li>CHECK FLUSHING SYSTEM</li> <li>CLEAN FLUSHING SYSTEM OR INCREASE PRESSURE OF LIQUID</li> <li>INCREASE AMOUNT OF LIQUID</li> <li>LOOSEN GLAND ASSEMBLY</li> </ul>
							★		★			COUPLING MISALIGNMENT AND VIBRATION	<ul style="list-style-type: none"> <li>REALIGN PUMP &amp; DRIVER</li> <li>CHECK SYSTEM PIPING FOR PIPE STRAIN</li> <li>INSTALL ANTI-VIBRATION ACCESSORIES</li> </ul>
									★			HIGH AXIAL THRUST	<ul style="list-style-type: none"> <li>CONFIRM THE DUTY POINT</li> <li>CHECK THE SYSTEM</li> <li>CHECK THE SUCTION FLOW RATE</li> </ul>
									★			EXCESSIVE LUBRICATION	<ul style="list-style-type: none"> <li>CLEAN THE BEARINGS</li> <li>RE-LUBRICATE</li> <li>CHANGE TYPE OF GREASE</li> </ul>
★		★	★									MOTOR RUNNING ON ONLY TWO-PHASES	<ul style="list-style-type: none"> <li>CHECK FUSES</li> <li>INSPECT ELECTRICAL CONNECTIONS</li> <li>INSPECT CONTROL PANEL</li> </ul>
							★		★	★		ROTOR IMBALANCE	<ul style="list-style-type: none"> <li>CLEAN THE IMPELLER</li> <li>CHECK ROTOR BALANCE</li> <li>RE-BALANCE THE IMPELLER</li> </ul>
							★		★	★		DEFECTIVE BEARINGS	<ul style="list-style-type: none"> <li>REPLACE</li> </ul>



## TROUBLESHOOTING

EXCESSIVELY LOW DISCHARGE PRESSURE	EXCESSIVELY HIGH DISCHARGE PRESSURE	FLOW RATE TOO HIGH	FLOW RATE TOO LOW	MOTOR HIGH AMPERAGE	NO LIQUID AFTER PUMP START-UP	NO LIQUID PRESENT IN SYSTEM	NOISY OPERATION & EXCESSIVE VIBRATION	HIGH PUMP TEMPERATURE	HIGH PUMP BEARING TEMPERATURE	EXCESSIVE PACKING LEAKAGE	PUMP LEAKAGE (NOT AT PACKING GLAND)	POSSIBLE CAUSE	REMEDY
							★	★				FLOW RATE IS TOO LOW	<ul style="list-style-type: none"> <li>RE-ADJUST THE DUTY POINT</li> <li>OPEN THE SUCTION VALVE COMPLETELY</li> <li>OPEN THE DISCHARGE VALVE COMPLETELY</li> <li>RE-CALCULATE SYSTEM FRICTION LOSSES</li> </ul>
★			★									STAR-DELTA MOTOR STUCK IN DELTA MODE	<ul style="list-style-type: none"> <li>CHECK THE ELECTRICAL CABLE CONNECTIONS</li> <li>CHECK THE CONTROL PANEL</li> </ul>
★			★				★					ENTRAPPED AIR IN THE FLUID	<ul style="list-style-type: none"> <li>VENT THE SYSTEM</li> <li>INSPECT THE PACKING AREA</li> </ul>
★			★		★	★	★					AIR ENTERING SYSTEM THROUGH SUCTION PIPING	<ul style="list-style-type: none"> <li>IMPROVE SUCTION PIPING</li> <li>REDUCE FLUID VELOCITY IN SUCTION PIPING</li> <li>INSPECT THE PACKING SEAL AREA</li> <li>REPLACE DAMAGED PIPING</li> </ul>
							★					CAVITATION NOISE	<ul style="list-style-type: none"> <li>REDUCE FLUID VELOCITY IN SUCTION PIPING</li> <li>INSPECT SYSTEM PIPING</li> <li>SHORTEN SUCTION PIPING</li> <li>INSTALL THE PUMP AT A LOWER POINT IN THE SYSTEM</li> </ul>
							★		★			BASE PLATE FLEXING	<ul style="list-style-type: none"> <li>INSPECT</li> <li>REPLACE</li> </ul>
★			★		★	★	★					PARALLEL PUMP OPERATION ISSUES	<ul style="list-style-type: none"> <li>RE-ADJUST THE DUTY POINT</li> <li>ALTER THE PUMP PERFORMANCE</li> </ul>
							★		★			SHAFT SIZE INCORRECT	<ul style="list-style-type: none"> <li>REPLACE</li> </ul>
				★		★	★	★				IMPELLER WEAR ON PUMP CASING	<ul style="list-style-type: none"> <li>CHECK THE ROTOR</li> <li>CHECK THE IMPELLER POSITION</li> <li>CONFIRM NO PIPE STRAIN PRESENT</li> </ul>



**MAINTENANCE OF PUMP DUE TO FLOOD DAMAGE**

Due to the location of many pump rooms, flooding is a common occurrence. Servicing the pump is a fairly straightforward process.

The bearings in the rotor assembly need the most attention during this time period. Completely remove the pump from the installation and proceed to the later section for DISASSEMBLY. AMERIFLO's recommendation is that all gaskets and roller bearings be replaced as all most likely have been in contact with water.

Inspect the stuffing boxes and make sure that they are clear of any foreign debris. AMERIFLO also recommends that the stuffing boxes be repacked with new packing to make sure foreign debris will not score any shaft sleeves while in service.

Dismantle all couplings and thoroughly clean them.

**ROUTINE MAINTENANCE CHART**

ROUTINE MAINTENANCE CHART		
SCHEDULE	# PEOPLE	TASK
EVERY WEEK	1	<ul style="list-style-type: none"> <li>VISUALLY CHECK FOR LEAKS</li> <li>CHECK FOR LUBRICATION</li> <li>ADJUST GLANDS AS NECESSARY TO MAINTAIN PROPER LEAKAGE</li> <li>HAND TEST BEARING HOUSING FOR ANY SIGN OF TEMPERATURE RISE</li> </ul>
EVERY MONTH	1	<ul style="list-style-type: none"> <li>CHECK BEARING TEMPERATURE WITH INSTRUMENTATION</li> </ul>
EVERY 6 MONTHS	1	<ul style="list-style-type: none"> <li>CHECK THE PACKING AND REPLACE IF NECESSARY</li> <li>CHECK ALIGNMENT OF THE PUMP AND MOTOR</li> <li>CHECK HOLDING DOWN BOLTS FOR TIGHTNESS</li> <li>CHECK COUPLING FOR WEAR</li> </ul>
EVERY YEAR	1	<ul style="list-style-type: none"> <li>CHECK ROTATING ELEMENT FOR WEAR</li> <li>CHECK WEAR RING CLEARANCES CHECK AND REGREASE BEARINGS</li> <li>MEASURE TOTAL DYNAMIC SUCTION AND DISCHARGE HEAD</li> </ul>
EVERY C HOURS	2	<ul style="list-style-type: none"> <li>BEARING INSPECTION</li> </ul>
EVERY 4 YEARS	2	<ul style="list-style-type: none"> <li>COMPLETE PUMP INSPECTION</li> </ul>

**PREVENTATIVE MAINTENANCE**

The MAINTENANCE section of this manual will give the end user a complete procedure for giving the pump a complete overhaul. There are also sub-sections that detail other important maintenance procedures that may come up during normal pump & driver operation. It is also important to note that periodically the PRE START-UP checklist should be reviewed to make sure that site conditions have not changed since the initial start-up.

**NEED FOR MAINTENANCE RECORDS**

It is very important that the end user keep a record of daily, weekly, monthly and yearly maintenance records. These records are important when certain milestone events that need to be performed are recorded in a central location. From these records other important information can be gathered including trending in certain data. The analysis of this data can help with future maintenance issues and also help with eliminating certain issues that may be affecting pump or driver performance. Lastly, when and if a warranty claim is ever addressed at some future date, AMERIFLO personnel will ask for all pertinent maintenance records so that they have a clear picture of what has been done to the unit.

**NEED FOR CLEANLINESS**

Perhaps the major cause of pump & driver failure has to do with contamination at the job site. Contamination can be in the form of moisture, dust, dirt or other foreign debris from the job site. This contamination is very harmful to the bearings in the pump. Dust and other debris can plug air and fuel filters in diesel engine drivers.

It is very important to maintain as clean of an area as job site conditions permit. When preventative maintenance is being performed on the pump & driver, make sure this maintenance is done in a clean area as well. Do not unpack bearings until they are ready to be immediately installed. Make sure filters and engine fluids are changed per the recommended intervals. Work should be done in an area free of moisture, dust, dirt, oil or grease. Never re-use bearings, gaskets, lip seals, o-rings and filters. Only use clean towels, shop rags and other tools when performing maintenance.

The purpose of a stuffing box is to limit leakage of the pump fluid and to prevent air from entering the suction areas of the pump casing along the pump shaft. All UL/FM pumps are equipped with packing. In a normal application, the pumped liquid is used to lubricate the stuffing box and packing. If the liquid is dirty, gritty or contains material that would clog the stuffing box, use a sealing liquid from an external source. If suction pressure is above atmospheric pressure, external seal piping may not be required. For pumps equipped with packing, there must always be a slight leakage from the gland. The amount of leakage is hard to define, but AMERIFLO recommends a steady dripping of liquid through the gland assembly. Stuffing box glands should be adjusted after the pump is started. When leakage is excessive, tighten gland bolt nuts evenly a quarter turn at a time. Allow 10 minutes for packing to adjust to it's new position. Never tighten the gland nuts to completely eliminate all leakage, as this will cause overheating and undue wear on shaft sleeves.



**CAUTION** - Overtightening gland bolt nuts can cause damage to the packing gland, packing and shaft sleeve. NEVER attempt to completely eliminate all leakage. Make sure proper packing break-in procedure is followed.

### PACKING REPLACEMENT

Replace the stuffing box packing as follows. Refer to FIGURE 15 for item numbers.

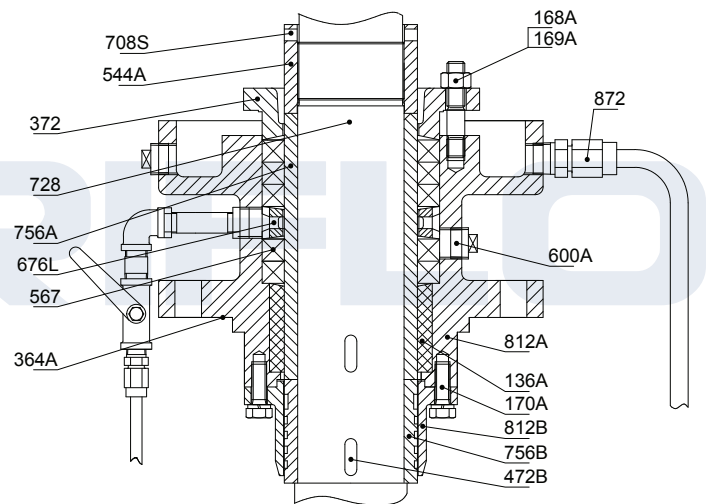
- Shutdown the pump and follow all rotating equipment safety protocols.
- Take precautions to prevent the driver from being inadvertently started. Proper lockout procedures MUST be followed.



**DANGER** - Lockout power to the driver to prevent personal injury or death.

- Remove the gland bolt nuts (#168A & #169A) and packing gland (#372).
- Remove and discard old packing rings (#567) – note the location of the lantern ring (#676L). When re-packing stuffing box, the lantern ring (#676L) must be positioned such that the flush port connection (#872) is lined up with the lantern ring (#676L).

- Clean out the stuffing box.
- Inspect the upper shaft sleeve (#756A) and the lower shaft sleeve (#756B) for wear – if either part is scored or grooved, they should be replaced.
- Insert the rings of packing (#567) and tap lightly to seat in the stuffing box bore. Be sure the packing rings (#567) are of the proper size and length and installed with all cuts staggered. The lantern ring (#676L) must be positioned to line up with the flush port connection.
- Install the packing gland (#372) and finger tighten the packing gland nuts and washer (#168A & #169A). With the pump running, adjust the gland nuts (#168A & #169A) as described previously. Care should be taken during the first hour of operation to gradually tighten up on the gland nuts (#168A & #169A) just enough to maintain the required amount of leakage.



**FIGURE 15 - VT STUFFING BOX**

## DRIVER & RIGHT ANGLE GEAR

Refer to the specific Installation, Operation and Maintenance manual for the driver.

## DISCHARGE HEAD & COLUMN REMOVAL

Refer to FIGURES 19 - 22 for item numbers used in the disassembly process.



**DANGER** - Lockout power to the driver to prevent personal injury or death.

Whenever any disassembly work is to be done on the pump, disconnect the power source to the driver to eliminate any possibility of the unit starting. Close the valves in the suction and discharge line. Allow the pump set to cool to ambient temperature. Properly depressurize and drain the pump.

Always have repair work and maintenance work performed by specially trained, qualified personnel. Only use original authentic parts from AMERIFLO. Contact AMERIFLO if any questions regarding disassembly or assembly arise.

No special tools are required to remove the coupling. Please refer to the manufacture instructions for proper disassembly.

### REMOVING THE ELECTRIC MOTOR OR GEAR DRIVE

- Remove the canopy on the electric motor or right angle gear drive. Remove the locking screw, adjusting nut and key. Disconnect the coupling above the packing housing and remove the shaft from the electric motor or right angle gear drive. See FIGURE 14.
- Unbolt and remove the electric motor or right angle gear drive (#500) from the fabricated discharge head (#190). Remove the top lineshaft coupling (256B) from the lineshaft.
- Unbolt and remove the fabricated discharge (#190) head from the column assembly (#872C). Remove the packing housing assembly from the fabricated discharge head (#180D). Remove and discard all packing (#567).
- Remove the packing gland nuts (#168A) from the gland studs (#169A). Remove the packing glands

(#372) from the pump. See FIGURE 23.

- Remove the column (#872C) from the pump assembly. With each piece of column (#872C) also remove the shafting (#728) from the threaded (FIGURE 24) or flanged (FIGURE 25) lineshaft couplings.

For the stuffing box area of shafting, remove the shaft sleeve setscrew (708S) and locking collar (#544A) from the shaft (#728). Remove the upper shaft sleeve (#756A) and lower shaft sleeve (#756B) from the shaft (#728). Remove the two shaft sleeve keys (#472B) from the shaft (#728). See FIGURE 23.

If shaft sections have bearing locations, remove the setscrew (#708S) and remove the shaft sleeve (#756S) and shaft sleeve key (#472B). See FIGURE 26.

Remove and discard all o-rings (#364A) used at any flange location.



**CAUTION** - While removing the fabricated discharge head (#190) be careful to not damage the shafting (#728).



**DANGER** - The fabricated discharge head (#190) is very heavy. It is very important to follow plant safety guidelines when removing it from the column assembly.

## BOWL ASSEMBLY

### 10MC BOWL ASSEMBLY

Refer to FIGURE 21 for component breakdown of the 10MC bowl assembly. The 10MC bowl assembly is disassembled from the top stage down to the suction bell.

- Remove the bolting (#168A, #169A & #968) between the top bowl (#180D) and the suction bell (#180B) if a single stage or from the next stage (#180A) if a multistage assembly. Remove the bowl (#180D) from the bowl assembly by carefully sliding it off of the shaft (#728). Remove and discard the bowl o-ring (#364A).
- Pull the shaft assembly (#728) in the direction toward the discharge of the bowl assembly so that there is clearance between the impeller (#443) and suction bell (#180B) or next stage (#180A) depending on construction. Use a collet knocker to remove the collet (#225) from the impeller (#443). Remove the collet (#225) and impeller (#443) from the shaft (#728). Keep the impellers in order of installation as they can vary in

trim.

- Repeat the above steps until all parts are removed from the bowl assembly.
- Remove the suction strainer (#997) from the suction bell (#180B) and protect from damage.

## ALL OTHER BOWL ASSEMBLIES

Refer to FIGURE 22 for component breakdown of all bowl assemblies except for the 10MC (see above). The remainder of all bowl assemblies are disassembled from the bottom of the suction bell up to the top stage.

- Remove the suction strainer (#997) from the suction bell (#180B) and protect from damage.
- Remove the bolting between the suction bell (#180B) and the first bowl (#180A). Remove and discard the suction bell o-ring (#364A). Remove the shaft locknut (#544A) and lockwasher (#708) from the shaft (#728). Remove the shaft sleeve (#756S) and sleeve key (#472B). Remove the impeller locknut (#544B) from the shaft. Remove the impeller (#443) from the shaft (#728). Remove the impeller key (#472A) from the shaft (#728). Remove the bowl (#180A) from the shaft (#728). Remove and discard the bowl o-ring (#364A).
- If the unit is a single stage, remove the shaft sleeve (#756) and sleeve key (#472C). Disassembly is complete. For multistage assembly, continue below.
- Remove the bolting (#168A, #169A & #968) between the bowl (#180A) and the next bowl (#180A). Remove the bowl (#180A) from the bowl assembly by carefully sliding it off of the shaft (#728). Remove the shaft sleeve (#756) and the shaft sleeve key (#472C) from the shaft (#728).
- Repeat the above steps until all parts are removed from the bowl assembly.

## BEARING (BUSHING) REMOVAL

Bearings (or bushings) are present in the suction bell, each bowl, column sections with weld in spiders and in the packing housing. During the disassembly process, AMERIFLO recommends that these bearings be removed and replaced.

## SUCTION BELL & BOWL

For each bearing location, remove the capscrew (#170B) and lockwasher (#968B). Remove the bearing retainer (#710). Use a press to remove the bearing from the bowl

(#136B) or suction bell (#136S). Make sure that this process is repeated for all stages.

## COLUMN SPIDERS

For each bearing location, remove the capscrew (#170B) and lockwasher (#968B). Remove the bearing retainer (#710). Use a press to remove the bearing (#136C) from the weld in spider location located at the top of each column section. Make sure that this process is repeated for all bearing locations.

## PACKING HOUSING

Prior to removing bearings from the stuffing box, make sure that all packing (#567) and the lantern ring (#676L) are removed first. Remove the hardware (#170A) that holds the lower stuffing box (#812B) to the upper stuffing box housing (#812A). Use a press to remove the bearing (#136A) from the upper stuffing box housing (#812A).

## INSPECTION

All parts should be thoroughly cleaned.



**WARNING** - It is important that only non-flammable, non-contaminated cleaning fluids are used. These fluids must comply with plant safety and environmental guidelines.

Visually inspect all parts for any damage that could effect performance. Replace all o-rings, gaskets, packing and bearings. Make sure all stages are addressed. Install the shaft (#728) between centers and check the concentricity over it's entire length. Concentricity should not exceed 0.002 in [0.051 mm]. Bearing surfaces should be smooth with square shoulders and no other scoring marks. Replace any parts that are outside of factory tolerances.

Inspect the bowl wear rings (#676A & #676B) and the impeller hubs (#443) on every stage (including the suction bell) for any excessive wear. Confirm that the running clearances between the impellers (#443) and bowl wear rings (#676A & #676B) are within factory tolerances. Surfaces must be smooth and concentric. Inspect impeller passages for any cracks, dents or foreign material. Replace any parts that are outside of factory tolerances.

Check all shaft sleeves for wear and replace if necessary.

When replacing parts only use genuine AMERIFLO parts. Refer to the appropriate AMERIFLO aftermarket repair manual for the correct part numbers.

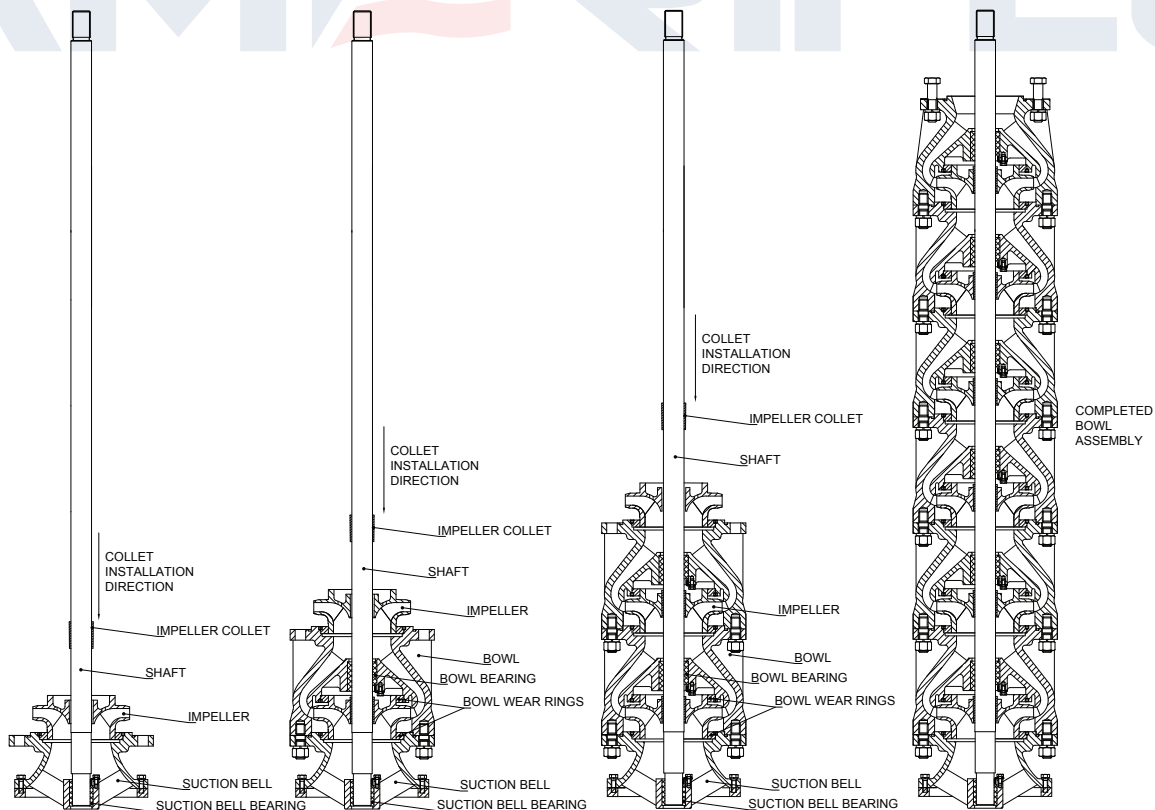


**ASSEMBLY**

Refer to TABLE 1 for all bolt tightening torque information. Refer to FIGURE 14 (SCF) and FIGURE 15 (SCF(2)) for bolt tightening sequence.

BOLT SIZE		TIGHTENING TORQUE	
METRIC	STANDARD	LB-FT	N-M
4 MM	5/32 IN	2.7	3.6
5 MM	3/16 IN	5.2	7.0
6 MM	1/4 IN	8.9	12.0
7 MM	9/32 IN	14.6	19.8
8 MM	5/16 IN	21.8	29.6
9 MM	11/32 IN	28.0	38.0
10 MM	3/8 IN	38.7	52.5
12 MM	1/2 IN	65.6	89.0
14 MM	9/16 IN	99.6	135
16 MM	5/8 IN	151	205
18 MM	11/16 IN	190	257
20 MM	3/4 IN	264	358
22 MM	7/8 IN	321	435
24 MM	15/16 IN	411	557

**TABLE 1 - CAPSCREW & NUT TIGHTENING TORQUE RATINGS**



**FIGURE 16 - 10MC BOWL ASSEMBLY**

It is very important that all pipe threads be sealed properly. PTFE tape provides a very reliable seal over a wide range of fluids but it has serious shortcomings if not used properly. If, during application to the threads, the tape is wrapped over the end of the male thread, strings of the tape will be sheared off when threaded into the female fitting. This string can then tear away and lodge in the piping system. If this occurs in the seal flush system, small orifices can become blocked effectively eliminating the flow. For this reason, AMERIFLO does not recommend the use of PTFE tape as a thread sealant.

AMERIFLO has investigated and tested alternate sealants and has identified two that provide an effective seal, have the same chemical resistance as the PTFE tape and will not plug flush systems.

These are La-co SlicTite and Bakerseal. Both products contain finely ground PTFE particles in an oil based carrier. They are supplied in a paste form which is brushed on the male pipe threads. AMERIFLO recommends using one of these paste sealants.

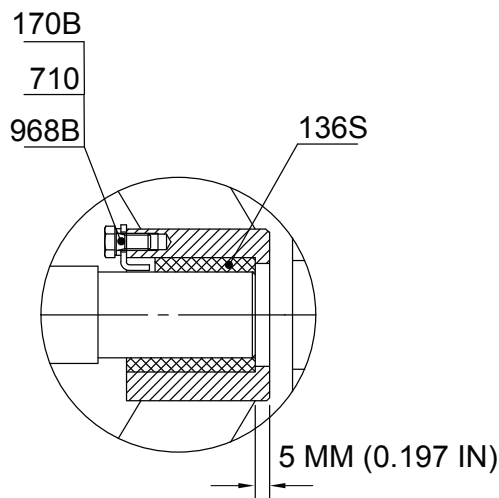
Full thread length engagement is required for all fasteners.

Reassembly of the pump can be accomplished in the reverse order. Specific installation instructions are listed below for the bowl assemblies.

Refer to FIGURE 21 for component breakdown of the 10MC bowl assembly. The 10MC bowl assembly is assembled from the suction bell to the top stage. See FIGURE 16.

A set-up tool is required to assemble the 10MC bowl assembly correctly. This tool makes sure that all impellers are installed in a consistent fashion that allows for proper axial adjustment after assembly. Assembly can begin after this tool has been installed.

- Install the shaft (#728) into the suction bell (#180B) and attach the set-up tool to create the proper amount of space as seen in FIGURE 17.
- Install new suction bell o-ring (#364A). Slide impeller (#443) until it rests in the suction bell (#180B). Slide the collet (#225) down the shaft with a screw driver inserted into the split area until it seats in the taper bore of the impeller (#443). Use a collet hammer to force the collet (#225) into proper position.
- Slide the bowl (#180A) carefully down the shaft until it engages the register on the suction bell. Install mounting hardware (#168A, #169A & #968A). Tighten all hardware (#168A, #169A & 968A) by using a star pattern sequence.
- Repeat the above steps until all parts are installed in the bowl assembly.



**FIGURE 17 - 10MC SET-UP TOOL MEASUREMENT**

- Once the last stage has been properly mounted, remove the set-up tool and make sure that there is adequate lateral movement of the rotor assembly within the bowl assembly after assembly is complete.



**CAUTION** - If, after assembly, the rotor assembly does not have proper lateral movement available, the unit must be disassembled to find the cause.

- Install the strainer (#997) to the suction bell (#180B).

## **ALL OTHER BOWL ASSEMBLIES**

Refer to FIGURE 22 for component breakdown of all bowl assemblies except for the 10MC (see above). The remainder of all bowl assemblies are assembled from the top stage down to the suction bell.

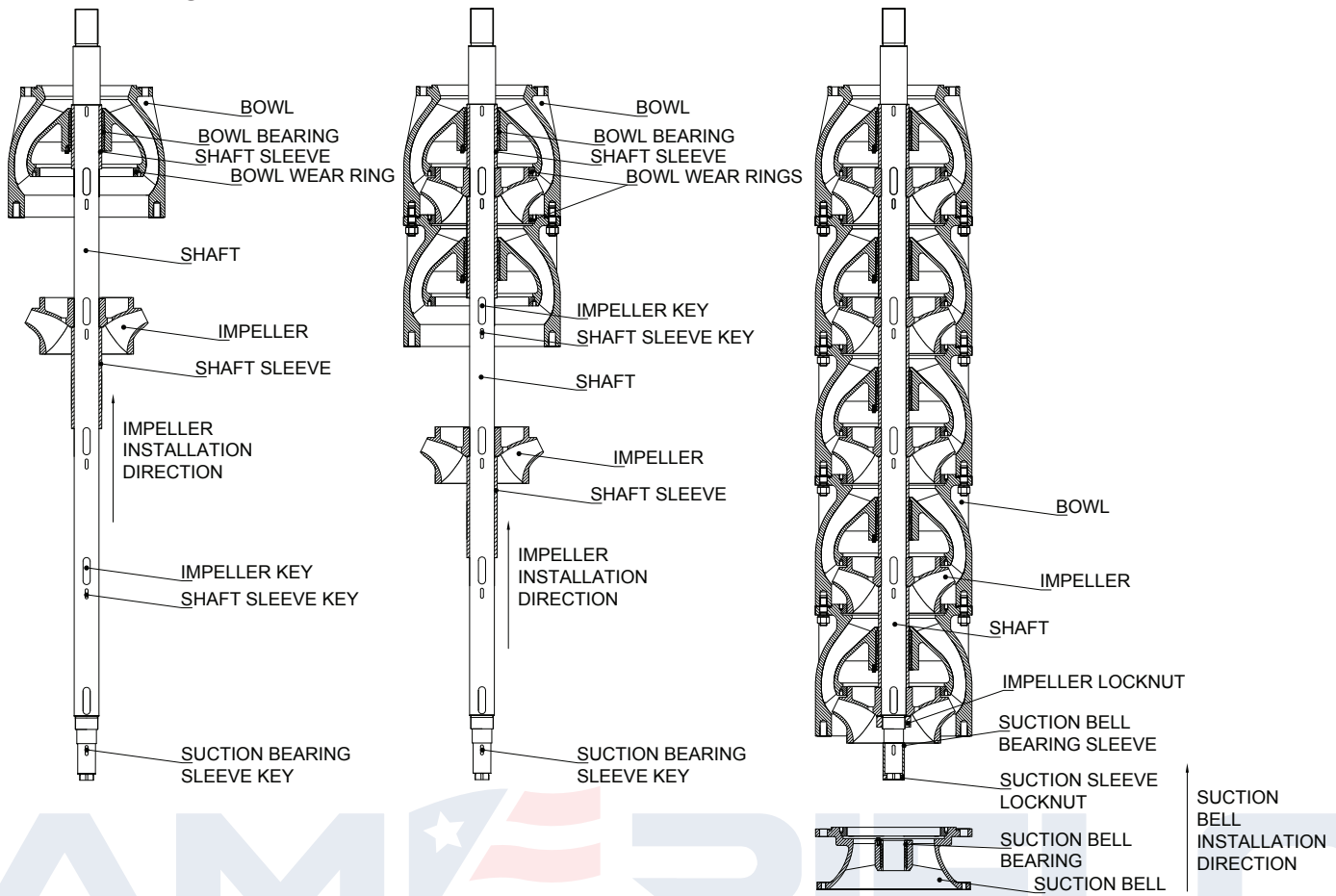
No set-up tool is required to assemble any bowl assembly except for the 10MC model. See FIGURE 18.

## **SINGLE STAGE ASSEMBLY**

- Install the top stage shaft sleeve key (#472C) into the shaft (#728) and carefully slide the shaft sleeve (#756) over the shaft sleeve key (#472C) installing it from the bottom of the shaft (#728) until it seats against the shaft shoulder at the top stage location.
- Install the top bowl (#180D) and slide it carefully over the previously installed shaft sleeve (#756).
- Install the top stage impeller key (#472A) into the shaft (#728). Carefully slide the impeller (#443) over the impeller key (#472A) installing it from the bottom of the shaft (#728) until it seats against the previously installed shaft sleeve (#756) at the top stage location.
- Install the impeller locknut (#544B) and tighten to torque value listed in TABLE 1. Install the suction bell sleeve key (#472B) and carefully slide the suction bell shaft sleeve (#756S) into position. Install the suction bell sleeve lockwasher (#708) and suction bell sleeve locknut (#544A) and tighten to torque value listed in TABLE 1.
- Install the suction bell (#180B) and bolt it to the first stage bowl (#180A). Make sure that there is adequate lateral movement of the rotor assembly within the bowl assembly after assembly is complete. Tighten all hardware by using a star pattern sequence.

## **MULTISTAGE ASSEMBLY**

- Install the top stage shaft sleeve key (#472C) into the shaft (#728) and carefully slide the shaft sleeve (#756) over the shaft sleeve key (#472C) installing it from the bottom of the shaft (#728) until it seats against the



**FIGURE 18 - ALL BOWL ASSEMBLIES (EXCEPT 10MC MODEL)**

shaft shoulder at the top stage location.

- Install the top bowl (#180D) and slide it carefully over the previously installed shaft sleeve (#756).
- Install the top stage impeller key (#472A) into the shaft (#728). Carefully slide the impeller (#443) over the impeller key (#472A) installing it from the bottom of the shaft (#728) until it seats against the previously installed shaft sleeve (#756) at the top stage location.
- Install the next stage shaft sleeve key (#472C) into the shaft (#728) and carefully slide the shaft sleeve (#756) over the shaft sleeve key (#472C) installing it from the bottom of the shaft (#728) until it seats against the previously installed impeller (#443) at the top stage location.
- Install the next bowl (#180A) and slide it carefully over the previously installed shaft sleeve (#756). Tighten all hardware (#168A, #169A & 968A) by using a star pattern sequence.
- Repeat the above steps until all stages have been assembled.

- When all stages have been assembled, install the impeller locknut (#544B) and tighten to torque value listed in TABLE 1. Install the suction bell sleeve key (#472B) and carefully slide the suction bell shaft sleeve (#756S) into position. Install the suction bell sleeve lockwasher (#708) and suction bell sleeve locknut (#544A) and tighten to torque value listed in TABLE 1.



**CAUTION** - If, after assembly, the rotor assembly does not have proper lateral movement available, the unit must be disassembled to find the cause.

- Install the strainer (#997) to the suction bell (#180B).

## COLUMN ASSEMBLY

Once the bowl assembly is complete, it is time to move onto the column assembly.

- Install a new discharge bowl o-ring (#364A) onto the flange.
- If there is more than one column piece, install the line-



shaft sleeve key (#472B) and carefully install the line-shaft sleeve (#756S) onto the first piece of lineshaft (#728A). Install the lineshaft sleeve setscrew (#708S) to secure the lineshaft sleeve into place.

- Connect the lineshaft coupling (#256A) to the bowl shaft and column lineshaft (#728A). Carefully attach the first piece of column pipe (#872C) to the bowl assembly and tighten all hardware (#168A, #169A & 968A). See FIGURE 19 & 20.
- Repeat the above step until all shaft and column pieces have been installed. Make sure each flange (including the top flange) has a newly installed o-ring (#364A) in place.
- When all intermediate column pieces have been installed proceed to mounting the fabricated discharge head (#190). Install the two lineshaft sleeve keys (#472B) for the upper and lower stuffing box shaft sleeves (#756A & #756B) and carefully install the shaft sleeves (#756A & #756B) onto the top piece of line-shaft (#728A). Install the shaft sleeve locking collar (#544A) and install the locking collar setscrew (#708S) to secure the shaft sleeves into place. See FIGURE 23.
- Install the completely refurbished packing housing assembly into the fabricated discharge head (#190). Connect and reinstall all flush plan piping (#872). Carefully lower the fabricated discharge head (#190) onto the top column piece (#872C) by guiding the top piece of shafting through the stuffing box bore. Tighten all hardware (#168A, #169A & 968A). See FIGURE 19 & 20.
- Install the electric motor or right angle gear drive per above instructions AXIAL IMPELLER ADJUSTMENT.

## RECOMMENDED SPARE PARTS

PART	NUMBER OF INSTALLED PUMPS						
	2	3	4	5	6	8	≥ 10
	QUANTITY OF SPARE PARTS ❶						
IMPELLER	1	1	1	2	2	2	30%
CASE WEAR RING	4	4	4	6	6	6	50%
HARDWARE	1	1	2	2	2	3	30%
BEARING	2	2	4	4	6	8	100%
SHAFT SLEEVE	4	4	4	6	6	8	50%
LIP SEAL	4	6	8	8	10	12	150%
PACKING	4	6	8	10	12	16	150%

❶ Recommended spare parts for 2 years of operation

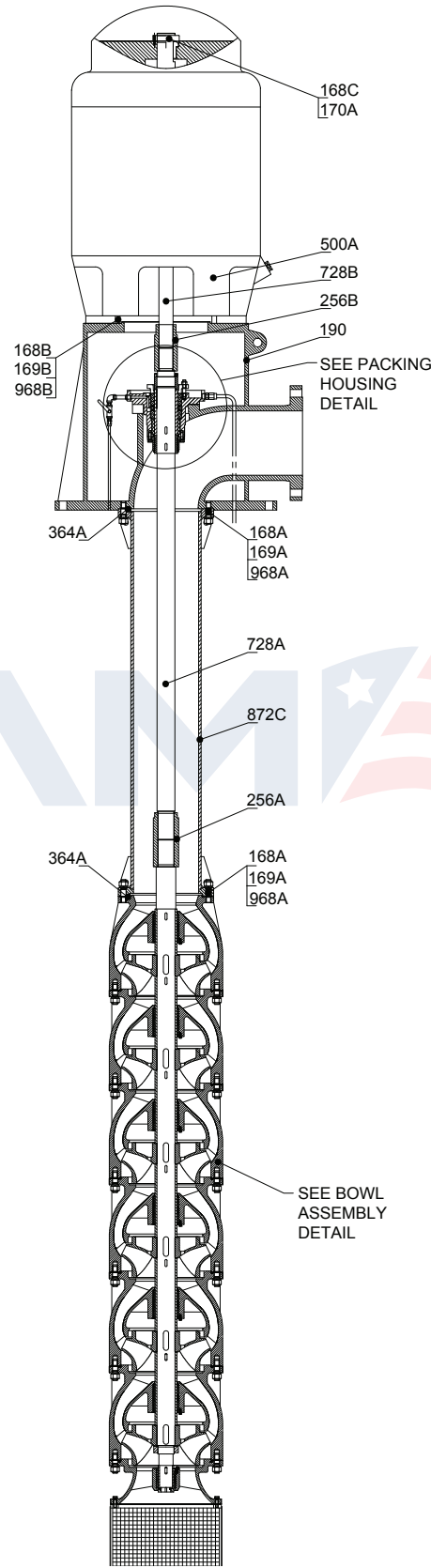
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DATE APRIL 2021

AMERIFLO

MODEL VT - OVERALL LENGTH ASSEMBLY (MOTOR)

COMPONENT BREAKDOWN

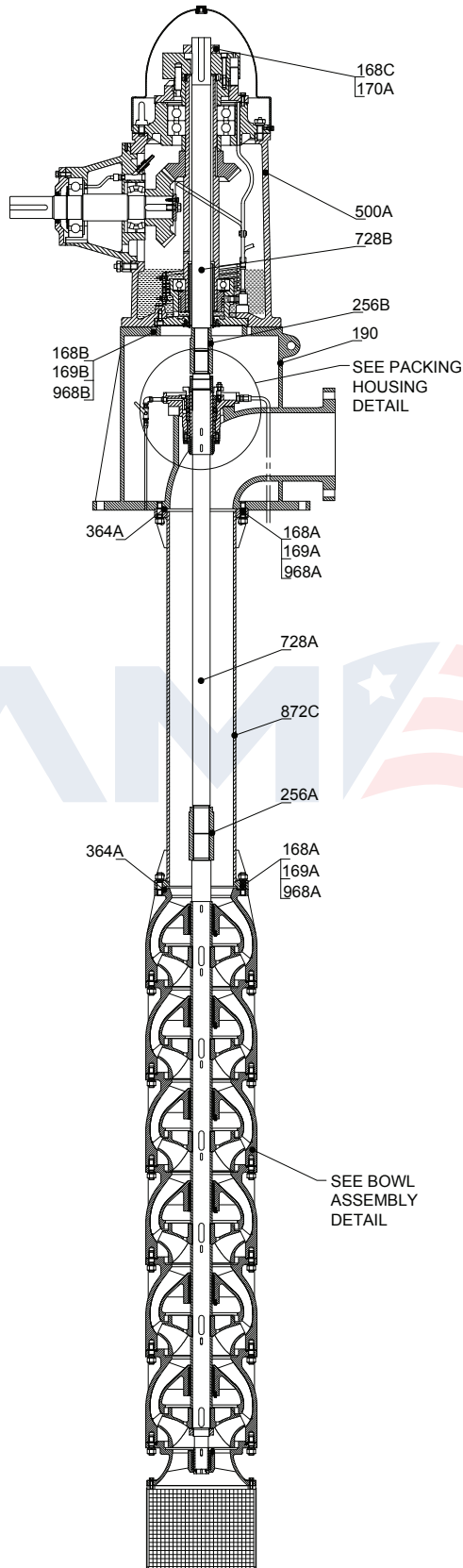


ITEM	DESCRIPTION
168A	NUT, COLUMN
168B	NUT, DISCHARGE HEAD
168C	NUT, ADJUSTING
169A	STUD, COLUMN
169B	STUD, DISCHARGE HEAD
170A	CAPSCREW
190	DISCHARGE HEAD, FABRICATED
256A	COUPLING, SHAFT
256B	COUPLING, HEADSHAFT
<b>364A</b>	O-RING, COLUMN
500A	ELECTRIC MOTOR
728A	SHAFT, COLUMN
728B	SHAFT, HEADSHAFT
872C	COLUMN, FLANGED
968A	LOCKWASHER, COLUMN
968B	LOCKWASHER, DISCHARGE HEAD

❶ RECOMMENDED SPARE PARTS ARE IN BOLD.

FIGURE 19

# MODEL VT - OVERALL LENGTH ASSEMBLY (GEAR) COMPONENT BREAKDOWN



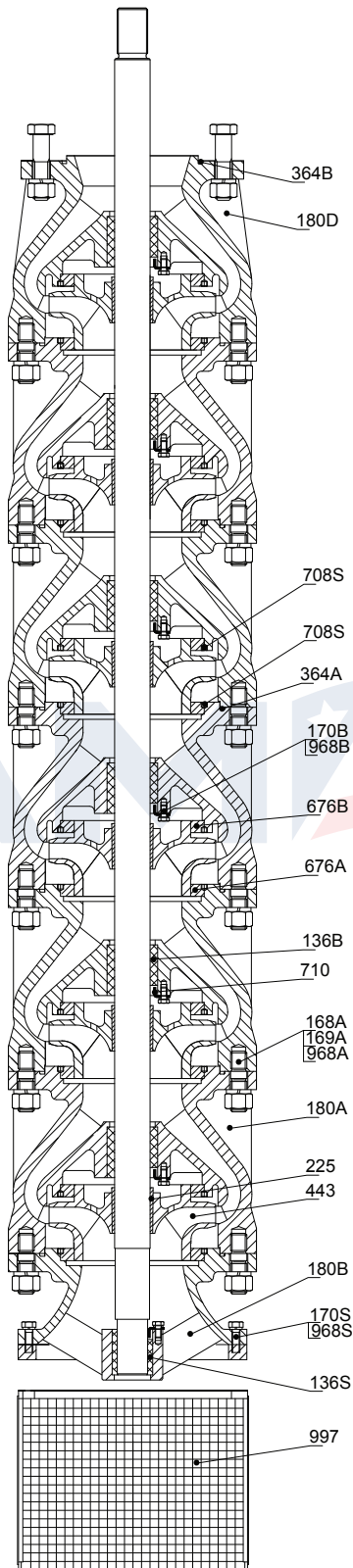
ITEM	DESCRIPTION
168A	NUT, COLUMN
168B	NUT, DISCHARGE HEAD
168C	NUT, ADJUSTING
169A	STUD, COLUMN
169B	STUD, DISCHARGE HEAD
170A	CAPSCREW
190	DISCHARGE HEAD, FABRICATED
256A	COUPLING, SHAFT
256B	COUPLING, HEADSHAFT
<b>364A</b>	O-RING, COLUMN
500A	RIGHT ANGLE GEAR DRIVE
728A	SHAFT, COLUMN
728B	SHAFT, HEADSHAFT
872C	COLUMN, FLANGED
968A	LOCKWASHER, COLUMN
968B	LOCKWASHER, DISCHARGE HEAD

❶ RECOMMENDED SPARE PARTS ARE IN BOLD.

**FIGURE 20**

# MODEL VT - 10MC BOWL ASSEMBLY

## COMPONENT BREAKDOWN

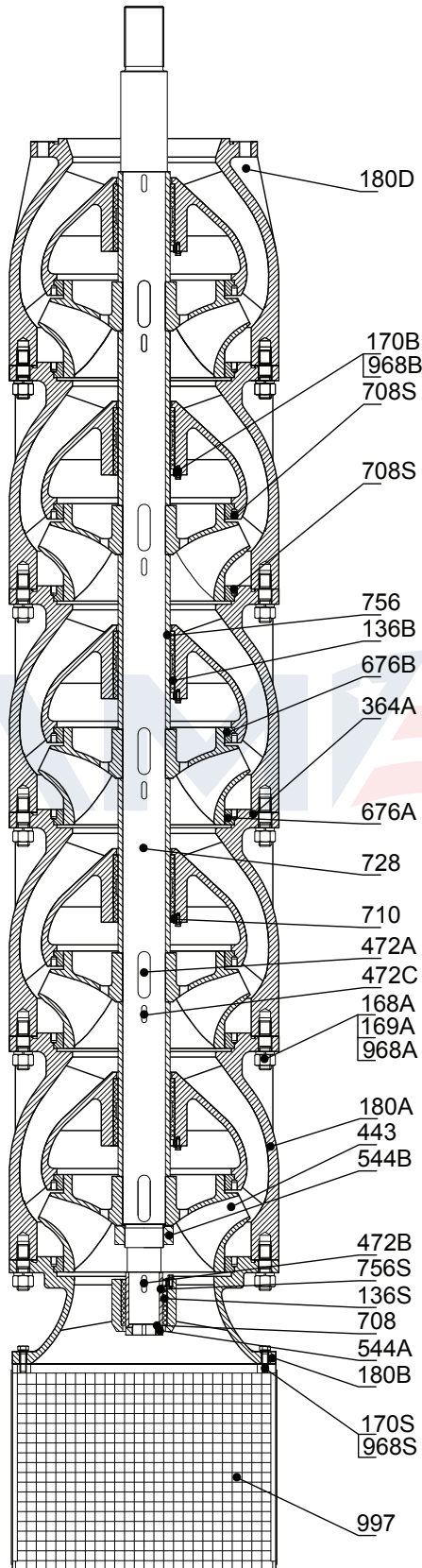


ITEM	DESCRIPTION
<b>136B</b>	BEARING, BOWL
<b>136S</b>	BEARING, SUCTION BELL
168A	NUT, BOWL
169A	STUD, BOWL
170S	CAPSCREW, SUCTION BELL
170B	CAPSCREW, BEARING RETAINER
180A	BOWL, INTERMEDIATE
180B	SUCTION BELL
180D	BOWL, DISCHARGE
<b>225</b>	IMPELLER COLLET
<b>364A</b>	O-RING, BOWL
<b>443</b>	IMPELLER
<b>676A</b>	WEAR RING, BOTTOM
<b>676B</b>	WEAR RING, TOP
<b>708</b>	LOCKWASHER, BEARING
<b>708S</b>	SET SCREW, WEAR RING
<b>710</b>	RETAINER, BEARING
728	SHAFT
<b>968A</b>	LOCKWASHER, BOWL
<b>968B</b>	LOCKWASHER, BEARING RETAINER
<b>968S</b>	LOCKWASHER, SUCTION BELL
997	STRAINER

① RECOMMENDED SPARE PARTS ARE IN BOLD.

## FIGURE 21

# MODEL VT - ALL BOWL ASSEMBLIES (EXCEPT 10MC) COMPONENT BREAKDOWN

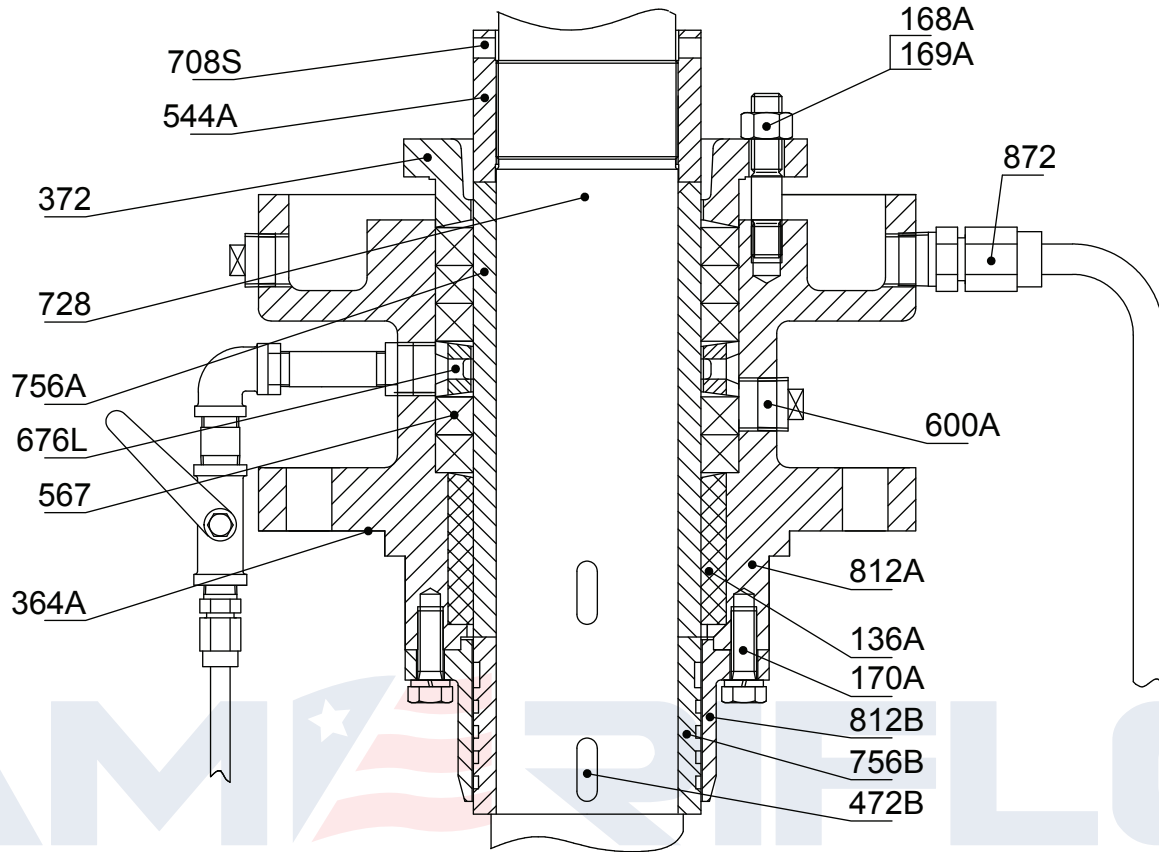


ITEM	DESCRIPTION
<b>136B</b>	BEARING, BOWL
<b>136S</b>	BEARING, SUCTION BELL
168A	NUT, BOWL
169A	STUD, BOWL
170S	CAPSCREW, SUCTION BELL
170B	CAPSCREW, BEARING RETAINER
180A	BOWL, INTERMEDIATE
180B	SUCTION BELL
180D	BOWL, DISCHARGE
<b>364A</b>	O-RING, BOWL
<b>443</b>	IMPELLER
<b>472A</b>	KEY, IMPELLER
<b>472B</b>	KEY, SHAFT SLEEVE
<b>544A</b>	LOCKNUT, SUCTION
<b>544B</b>	LOCKNUT, BOWL
<b>676A</b>	WEAR RING, BOTTOM
<b>676B</b>	WEAR RING, TOP
<b>708</b>	LOCKWASHER, BEARING
<b>708S</b>	SET SCREW, WEAR RING
<b>710</b>	RETAINER, BEARING
728	SHAFT
<b>756</b>	SLEEVE, BOWL
<b>756S</b>	SLEEVE, SUCTION
<b>968A</b>	LOCKWASHER, BOWL
<b>968B</b>	LOCKWASHER, BEARING RETAINER
<b>968S</b>	LOCKWASHER, SUCTION BELL
997	STRAINER

❶ RECOMMENDED SPARE PARTS ARE IN BOLD.

**FIGURE 22**

# MODEL VT - VERTICAL TURBINE PACKING HOUSING COMPONENT BREAKDOWN

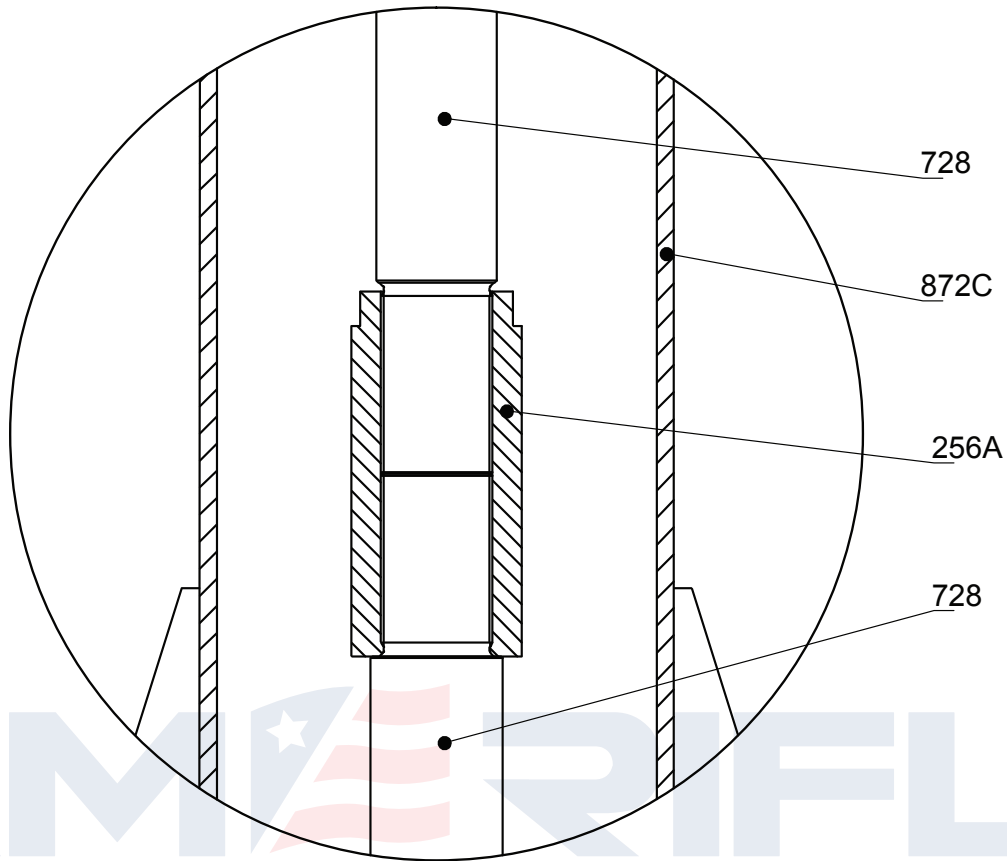


ITEM	DESCRIPTION
<b>136A</b>	BUSHING, PACKING HOUSING
168A	NUT, GLAND
169A	STUD, GLAND
170A	CAPSCREW, LOWER HOUSING
364A	GASKET, PACKING HOUSING
<b>372</b>	GLAND, PACKING
<b>472B</b>	KEY, SHAFT SLEEVE
<b>544A</b>	LOCKING COLLAR
<b>567</b>	PACKING
600A	PLUG
<b>676L</b>	RING, LANTERN
708S	SETSCREW
728	SHAFT
<b>756A</b>	SLEEVE, UPPER SHAFT
<b>756B</b>	SLEEVE, LOWER SHAFT
812A	UPPER PACKING HOUSING
812B	LOWER PACKING HOUSING
872	FLUSH PLAN, DRAIN

● RECOMMENDED SPARE PARTS ARE IN BOLD.

## FIGURE 23

# MODEL VT - VERTICAL TURBINE THREADED COUPLING COMPONENT BREAKDOWN



ITEM	DESCRIPTION
<b>256A</b>	COUPLING, LINESHAFT
728	SHAFT
872C	FLUSH PLAN, DRAIN

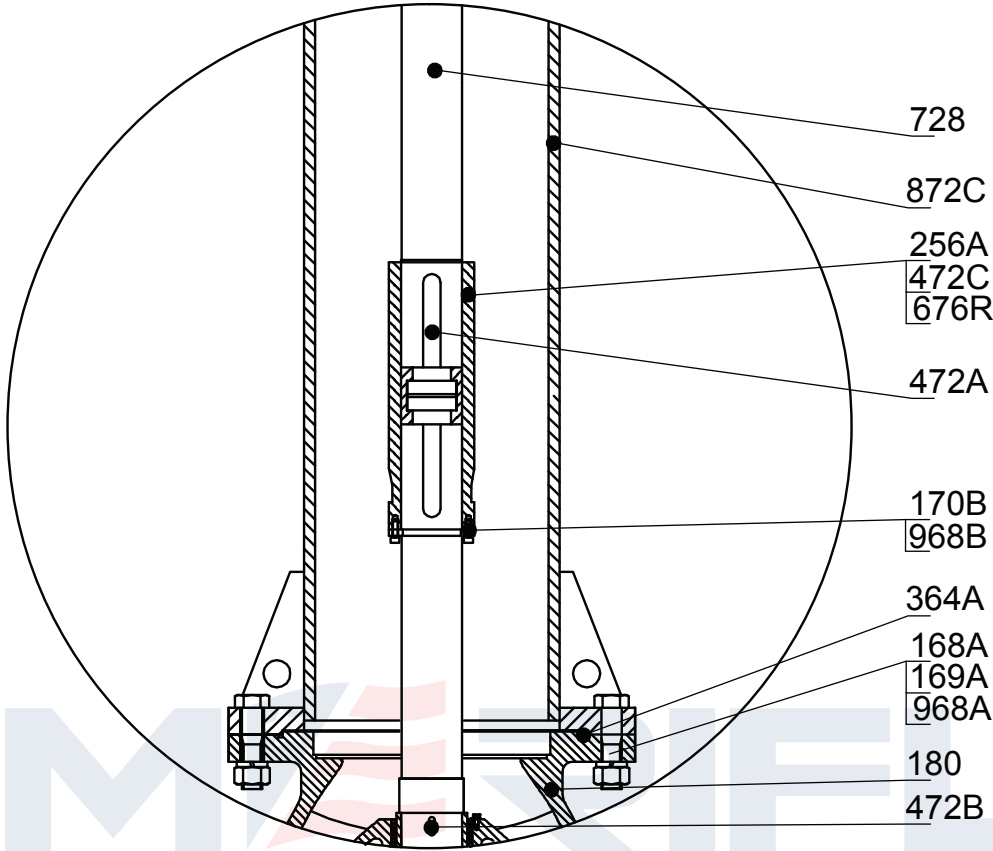
● RECOMMENDED SPARE PARTS ARE IN BOLD.

## FIGURE 24



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DATE **APRIL 2021**

**AMERIFLO**  
**MODEL VT - VERTICAL TURBINE FLANGED COUPLING**  
**COMPONENT BREAKDOWN**

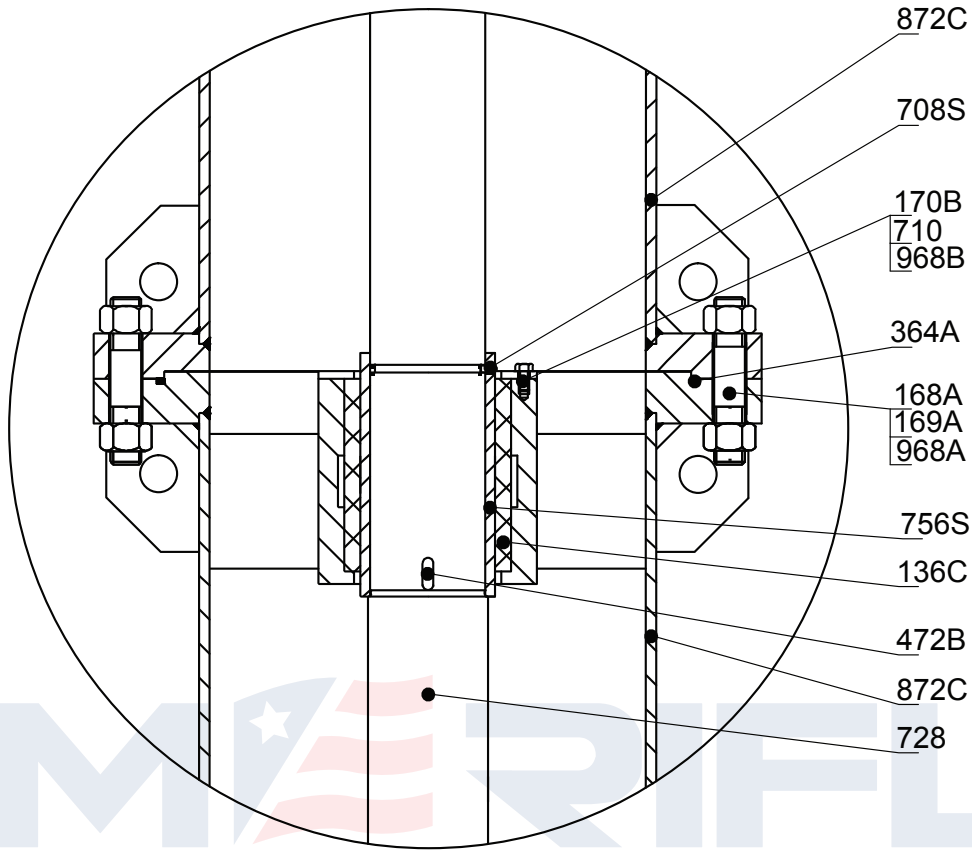


ITEM	DESCRIPTION
168A	NUT, COLUMN
169A	STUD, COLUMN
170B	CAPSCREW
180	BOWL
256A	COUPLING, LINESHAFT
<b>364A</b>	O-RING
<b>472A</b>	KEY, LINESHAFT
<b>472B</b>	KEY, LINESHAFT SLEEVE
<b>472C</b>	KEY, AXIAL
<b>676R</b>	RING, SNAP
728	SHAFT
872C	COLUMN
968A	LOCKWASHER, COLUMN
968B	LOCKWASHER, FLANGED COUPLING

● RECOMMENDED SPARE PARTS ARE IN BOLD.

**FIGURE 25**

# MODEL VT - VERTICAL TURBINE FLANGED COUPLING COMPONENT BREAKDOWN



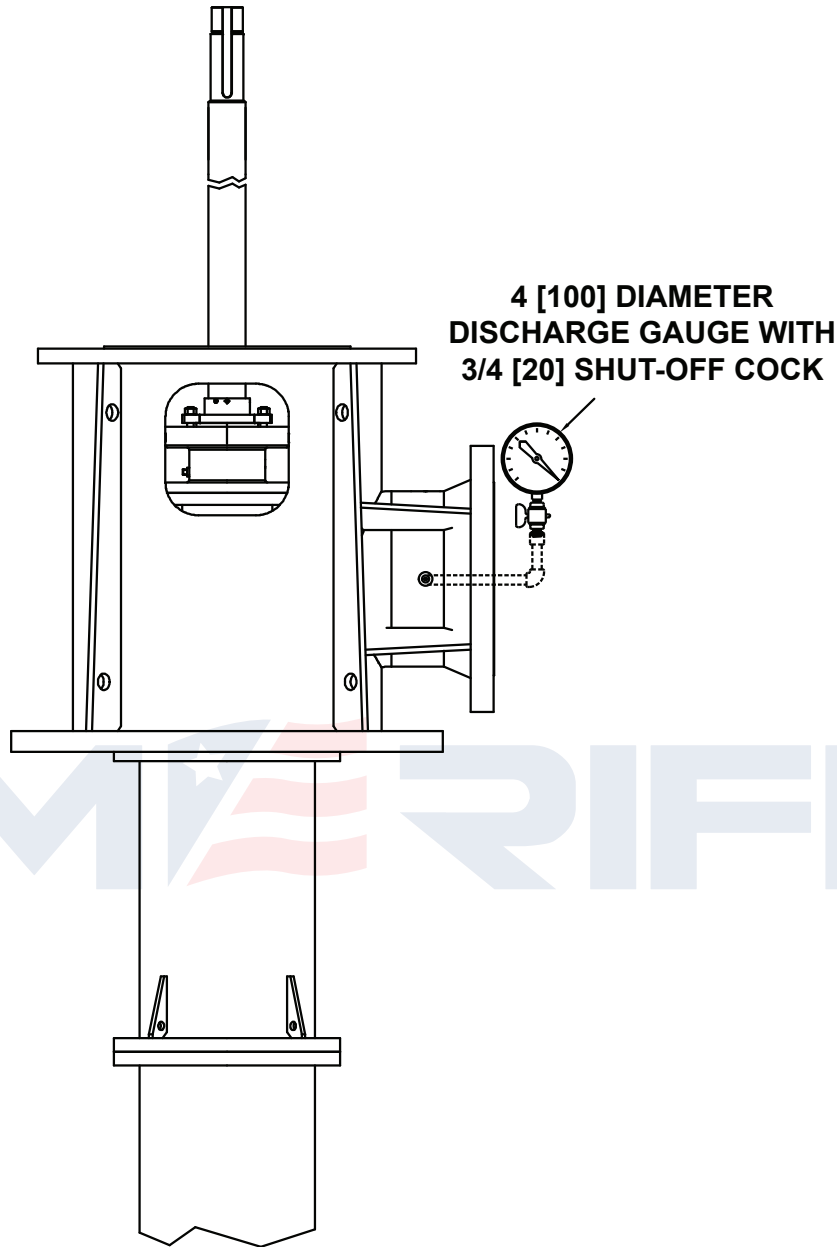
ITEM	DESCRIPTION
<b>136C</b>	BEARING, COLUMN
168A	NUT, COLUMN
169A	STUD, COLUMN
170B	CAPSCREW, COLUMN BEARING
<b>364A</b>	O-RING
<b>472B</b>	KEY, SHAFT SLEEVE
708S	SET SCREW, SHAFT SLEEVE
<b>710</b>	RETAINER, BEARING
728	SHAFT
<b>756S</b>	SLEEVE, LINESHAFT
872C	COLUMN
<b>968A</b>	LOCKWASHER, COLUMN
<b>968B</b>	LOCKWASHER, BEARING RETAINER

● RECOMMENDED SPARE PARTS ARE IN BOLD.

## FIGURE 26

## MODEL VT - VERTICAL TURBINE, ACCESSORIES

## GENERAL ARRANGEMENT DRAWING



## NOTES:

- ❶ ALL DIMENSIONS ARE IN INCHES (MM) AND MAY VARY  $\pm 0.375$  INCHES.
- ❷ REFER TO AMERIFLO INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR PROPER PUMP INSTALLATION.
- ❸ ACCESSORIES ARE SHIPPED LOOSE FOR FIELD INSTALLATION.
- ❹ DISCHARGE GAUGE IS 0 - 300 PSI FOR PUMPS WITH RATED DISCHARGE PRESSURE UP TO 150 PSI OR 0 - 600 PSI FOR PUMPS WITH RATED PRESSURE OVER 150 PSI.
- ❺ THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED BY AMERIFLO.

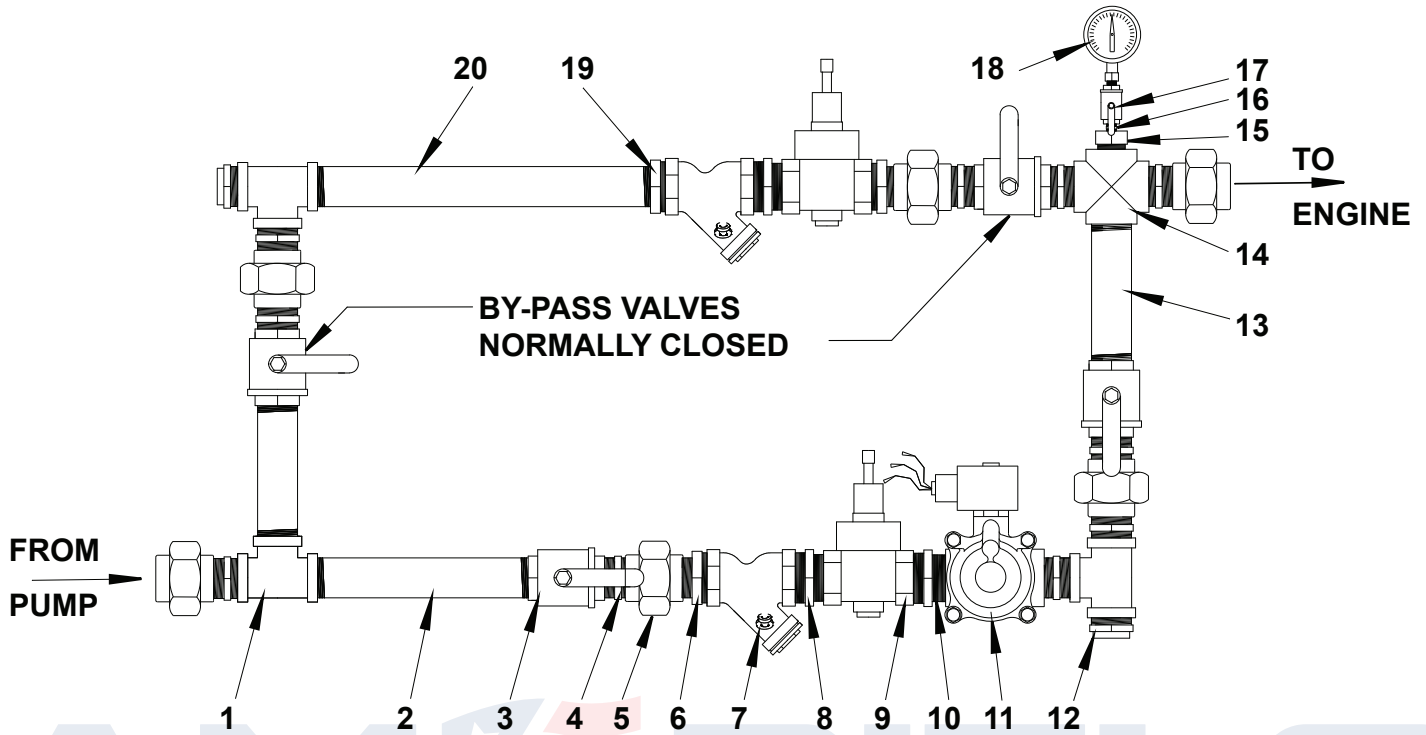
FIGURE 27

# AMERIFLO

## DIESEL COOLING LOOP

### AMERIFLO DIESEL ENGINES

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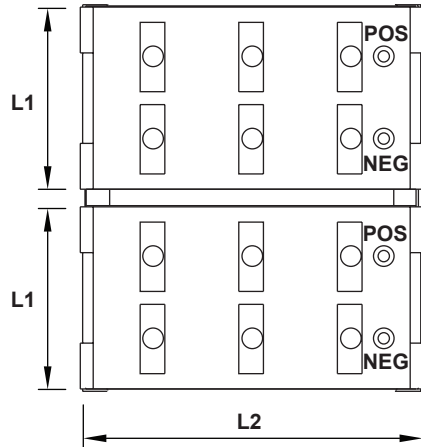


AMERIFLO DIESEL ENGINE COOLING LOOP			
ITEM #	NAME	DESCRIPTION	QTY
1	TEE JOINT	1"	3
2	PIPE	1" x 9"	1
3	BALL VALVE	1"	4
4	INNER JOINT	1"	8
5	UNION	1"	4
6	INNER JOINT	1-1/2" x 1"	1
7	FILTER	1-1/2"	2
8	INNER JOINT	1-1/2" x 1-1/4"	2
9	RELIEF VALVE	1-1/4"	2
10	INNER JOINT	1-1/4" x 1"	2
11	SOLENOID VALVE	1"	1
12	PLUG	1"	2
13	PLUG	1" x 4.75"	2
14	CROSS TEE	1"	1

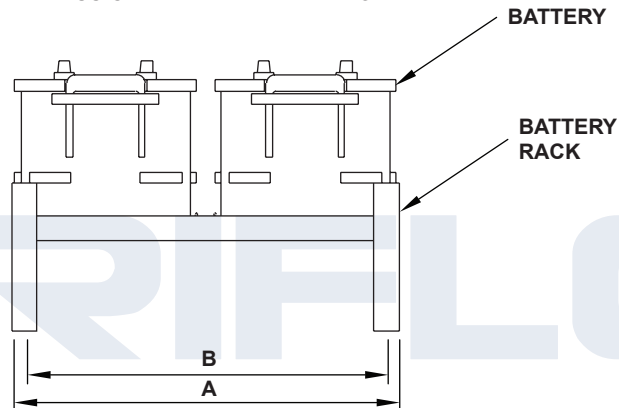
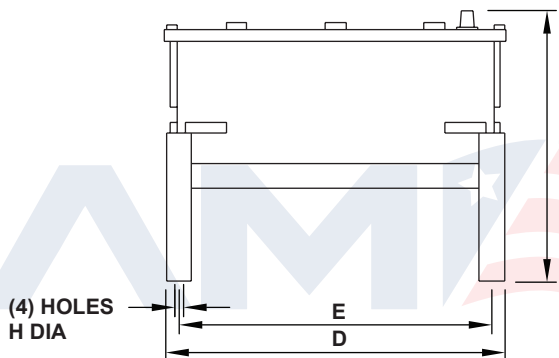
AMERIFLO DIESEL ENGINE COOLING LOOP			
ITEM #	NAME	DESCRIPTION	QTY
15	BUSHING	1" x 1/2"	1
16	INNER JOINT	1-1/5" x 1/4"	1
17	BALL VALVE	1/4"	1
18	PRESSURE GAUGE	1/4", 0 - 100 PSI	1
19	BUSHING	1-1/2" x 1"	1
20	PIPE	1" x 14-1/4"	1

① TYPICAL COOLING LOOP DETAIL.

## FIGURE 28

**DIESEL ENGINE BATTERIES, RACKS & CABLES****AMERIFLO DIESEL ENGINES****NOTES:**

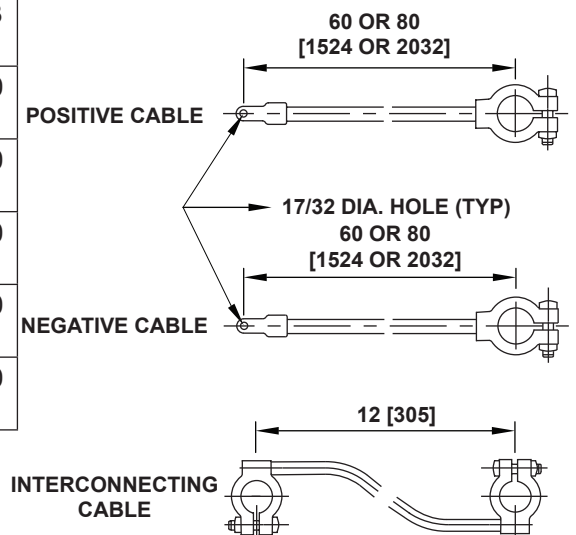
- ❶ ALL DIMENSIONS ARE IN INCHES [MM] AND MAY VARY  $\pm 0.375$  INCHES.
- ❷ BATTERIES ARE 12 VOLT, LEAD-ACID TYPE 8-8D. APPROXIMATELY 95 POUNDS DRY, EACH.
- ❸ BATTERIES ARE SHIPPED DRY. ELECTROLYTE (APPROXIMATELY 19 QUARTS PER BATTERY) MUST BE PROCURED LOCALLY.
- ❹ REFER TO GENERAL ARRANGEMENT DRAWING "DIESEL BATTERIES & CABLE DIAGRAM" FOR PROPER 24 VOLT CABLE DIAGRAM.
- ❺ BATTERY RACKS ARE FABRICATED STEEL AND WEIGH APPROXIMATELY 20 POUNDS EACH.
- ❻ EACH BATTERY RACK HOLDS TWO BATTERIES. RACKS ARE NOT TO BE STACKED.
- ❼ THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED BY AMERIFLO.



BATTERY CAPACITY	A	B	C	D	E	H	L1	L2
80AH	26.00 [660]	24.44 [620]	15.00 [380]	15.38 [390]	13.75 [350]	0.50 [14]	6.60 [168]	11.13 [283]
100AH	33.88 [860]	32.25 [820]					6.80 [173]	13.00 [330]
120AH							6.75 [171]	13.00 [330]
150AH	41.75 [1060]	40.19 [1020]		18.13 [460]	16.50 [420]		8.00 [203]	15.00 381]
180AH				18.88 [480]	17.38 [440]		8.00 [203]	16.00 [406]
200AH				23.25 [590]	21.63 [550]		8.00 [203]	20.00 [508]

**NOTES:**

- ❶ ALL CABLES ARE SAE J55BA TYPE SGT WITH TENSILE ATTACHMENT OF 700-800 POUNDS.
- ❷ POSITIVE AND NEGATIVE CABLES ARE 60 INCHES [1524 MM] AND ARE 2/0 GAUGE OR POSITIVE AND NEGATIVE CABLES ARE 80 INCHES [2032 MM] AND ARE 3/0 GAUGE.
- ❸ TERMINAL CLAMPS HAVE STEEL REINFORCED INSERTS.

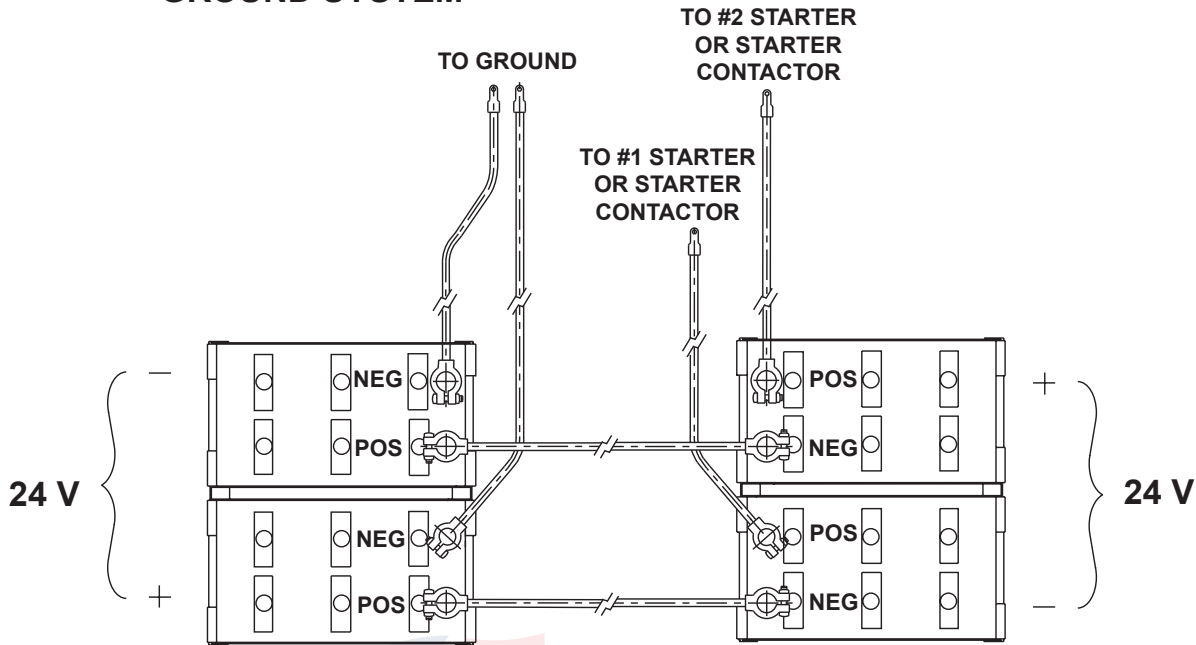
**FIGURE 29**



**—AMERIFLO—**  
**DIESEL ENGINE BATTERY CABLE DIAPHRAGM**  
**AMERIFLO DIESEL ENGINES**

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**24 VOLT NEGATIVE  
GROUND SYSTEM**



**24 VOLT SYSTEM CONSISTS OF:**

- (2) BATTERY RACKS
- (4) BATTERIES
- (2) POSITIVE CABLES
- (2) NEGATIVE CABLES
- (2) INTERCONNECTING CABLES

● THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION UNLESS CERTIFIED BY AMERIFLO.

**FIGURE 30**

**PRESTART-UP CHECKLIST**

AMERIFLO REPRESENTATIVE: \_\_\_\_\_  
 CONTRACTOR: \_\_\_\_\_  
 PROJECT ENGINEER: \_\_\_\_\_  
 PROJECT NAME: \_\_\_\_\_

REP PHONE NUMBER: \_\_\_\_\_  
 CONTRACTOR PHONE NUMBER: \_\_\_\_\_  
 ENGINEER PHONE NUMBER: \_\_\_\_\_  
 PUMP LOCATION: \_\_\_\_\_

**EQUIPMENT INFORMATION**

PUMP MODEL: \_\_\_\_\_ PUMP S/N: \_\_\_\_\_ ES: ☐  
 MOTOR MODEL: \_\_\_\_\_ MOTOR S/N: \_\_\_\_\_ VI: ☐  
 ENGINE MODEL: \_\_\_\_\_ ENGINE S/N: \_\_\_\_\_ SC: ☐  
 GEAR MODEL: \_\_\_\_\_ GEAR S/N: \_\_\_\_\_ VT: ☐

**PROCEDURE**

PROCEDURE	YES	NO	N/A	COMMENTS
<b>1. SHIPMENT</b>				
WAS THERE ANY DAMAGE DURING SHIPMENT?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
WERE ALL ORDERED ITEMS RECEIVED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>2. STORAGE</b>				
HAS EQUIPMENT BEEN PROTECTED FROM THE WEATHER?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
WAS EQUIPMENT SUBJECT TO DAMAGE IN STORAGE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HAVE ALL BEARINGS BEEN PROTECTED FROM MOISTURE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>3. INSTALLATION</b>				
IOM MANUAL COMPLETELY READ AND UNDERSTOOD?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
WERE FASTENERS USED IN SHIPPING AND REMOVED PRIOR TO INSTALLATION?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IS GROUTING UNDER BASE PROPERLY COMPACTED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IS GROUT OF THE NON-SHRINK TYPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HAVE PROPER ANCHOR BOLTS BEEN USED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HAVE SUCTION AND DISCHARGE PIPING BEEN CHECKED FOR THE PRESENCE OF PIPE STRAIN?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ARE LUBRICATION LINES AND COOLING LINES CONNECTED PROPERLY?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ARE ACCESSORIES MOUNTED AND PROPERLY INSTALLED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ARE ALL SAFETY GUARDS INSTALLED PROPERLY?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HAVE IMPELLERS BEEN CHECKED FOR PROPER CLEARANCE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IS ALL WIRING CONNECTED PROPERLY AND CHECKED FOR VOLTAGE, PHASE, FREQUENCY, ETC.?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>4. ALIGNMENT</b>				
HAS THE PUMP & DRIVER ALIGNMENT BEEN CHECKED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HAVE INDICATOR READINGS BEEN TAKEN?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>5. ROTATION</b>				
HAS THE DRIVER ROTATION BEEN CHECKED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
COUPLING & SHAFT TURNED AND FREE TO ROTATE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>6. SYSTEM</b>				
IS THE SYSTEM FREE OF FOREIGN DEBRIS?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IS LIQUID PRESENT IN SYSTEM?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ALL SYSTEM PIPING IS PROPERLY SUPPORTED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ARE THE PUMPS AND CONTROLS ACCESSIBLE AND UNLOCKED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
CUSTOMER'S REPRESENTATIVE WITNESSING START-UP	AMERIFLO REPRESENTATIVE WITNESSING START-UP:			
NAME: _____ DATE: _____	NAME: _____	DATE: _____		

## START-UP CHECKLIST

AMERIFLO REPRESENTATIVE: \_\_\_\_\_  
 CONTRACTOR: \_\_\_\_\_  
 PROJECT ENGINEER: \_\_\_\_\_  
 PROJECT NAME: \_\_\_\_\_

REP PHONE NUMBER: \_\_\_\_\_  
 CONTRACTOR PHONE NUMBER: \_\_\_\_\_  
 ENGINEER PHONE NUMBER: \_\_\_\_\_  
 PUMP LOCATION: \_\_\_\_\_

## EQUIPMENT INFORMATION

PUMP MODEL: \_\_\_\_\_ PUMP S/N: \_\_\_\_\_ ES: ☐  
 MOTOR MODEL: \_\_\_\_\_ MOTOR S/N: \_\_\_\_\_ VI: ☐  
 ENGINE MODEL: \_\_\_\_\_ ENGINE S/N: \_\_\_\_\_ SC: ☐  
 GEAR MODEL: \_\_\_\_\_ GEAR S/N: \_\_\_\_\_ VT: ☐

## DESIGN CONDITIONS

FLOW: \_\_\_\_\_ RPM: \_\_\_\_\_ VOLTAGE: \_\_\_\_\_  
 PRESSURE: \_\_\_\_\_ HP: \_\_\_\_\_ PHASE: \_\_\_\_\_

PROCEDURE	YES	NO	N/A	COMMENTS
<b>1. PRESTART-UP</b>				
HAS THE PROCEDURE CHECKLIST FOR PRE-START-UP BEEN COMPLETED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
VERIFY PUMP ROTATION:				<input type="checkbox"/> CW <input type="checkbox"/> CCW (AS VIEWED FROM THE MOTOR)
VERIFY DRIVER ROTATION:				<input type="checkbox"/> CW <input type="checkbox"/> CCW (AS VIEWED FROM THE MOTOR)
<b>2. IMPELLER CLEARANCE SETTING</b>				
HAS IMPELLER BEEN PROPERLY ADJUSTED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
VT AXIAL IMPELLER CLEARANCE: _____ IN				
<b>3. LUBRICATION</b>				
HAVE THE BEARINGS BEEN PROPERLY LUBRICATED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HAS THE COUPLING BEEN PROPERLY LUBRICATED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HAS THE MOTOR BEEN PROPERLY LUBRICATED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
DIESEL ENGINE COOLANT LEVEL CHECKED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
DIESEL ENGINE OIL LEVEL CHECKED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
DIESEL ENGINE FUEL LEVEL CHECKED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>4. SYSTEM</b>				
HAS FLOW BEEN ESTABLISHED?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
HAVE GAUGE READINGS BEEN TAKEN?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
EXCESSIVE VIBRATION PRESENT?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
BEARING TEMPERATURE NORMAL?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ENGINE TEMPERATURE NORMAL?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>5. PACKING</b>				
PACKING BROKEN IN CORRECTLY?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
PACKING LEAKAGE IS ACCEPTABLE AFTER BREAK-IN PERIOD?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
CUSTOMER'S REPRESENTATIVE WITNESSING START-UP:		AMERIFLO LLC REPRESENTATIVE WITNESSING START-UP:		
NAME:	DATE:	NAME:	DATE:	

DATE **APRIL 2021****AMERIFLO****FIELD TEST REPORT**

AMERIFLO REPRESENTATIVE: \_\_\_\_\_  
 CONTRACTOR: \_\_\_\_\_  
 PROJECT ENGINEER: \_\_\_\_\_  
 PROJECT NAME: \_\_\_\_\_

REP PHONE NUMBER: \_\_\_\_\_  
 CONTRACTOR PHONE NUMBER: \_\_\_\_\_  
 ENGINEER PHONE NUMBER: \_\_\_\_\_  
 PUMP LOCATION: \_\_\_\_\_

**EQUIPMENT INFORMATION**

PUMP MODEL: \_\_\_\_\_ PUMP S/N: \_\_\_\_\_ ES: ☐  
 MOTOR MODEL: \_\_\_\_\_ MOTOR S/N: \_\_\_\_\_ VI: ☐  
 ENGINE MODEL: \_\_\_\_\_ ENGINE S/N: \_\_\_\_\_ SC: ☐  
 GEAR MODEL: \_\_\_\_\_ GEAR S/N: \_\_\_\_\_ VT: ☐

**DESIGN CONDITIONS**

FLOW: \_\_\_\_\_ RPM: \_\_\_\_\_ VOLTAGE: \_\_\_\_\_  
 PRESSURE: \_\_\_\_\_ HP: \_\_\_\_\_ PHASE: \_\_\_\_\_

**PROCEDURE****1. PRESTART-UP**

HAS THE PROCEDURE CHECKLIST FOR PRE-  
START-UP BEEN COMPLETED?

YES NO N/A COMMENTS

☐ ☐ ☐

**2. START-UP**

HAS THE PROCEDURE CHECKLIST FOR START-UP  
BEEN COMPLETED?

☐ ☐ ☐

**3. SYSTEM**

SUCTION VALVE OPEN?

☐ ☐ ☐

SUMP LIQUID LEVEL CORRECT?

☐ ☐ ☐

SUMP CLEAR OF DEBRIS?

☐ ☐ ☐

ARE ALL SYSTEM VALVES IN THE CORRECT POSI-  
TION?

☐ ☐ ☐

IS ALL PIPING SECURE AND FLOW PROPERLY  
ROUTED?

☐ ☐ ☐

**4. RECORDED DATA**

POINT 1

POINT 2

POINT 3

POINT 4

POINT 5

SPEED (RPM):

FLOW (GPM):

DISCHARGE PRESSURE (PSIG):

SUCTION PRESSURE (PSIG):

LIFT (WATER LEVEL TO DISCHARGE CENTERLINE) (FEET):

INPUT POWER (KW):

CURRENT (AMPS):

VOLTAGE (VOLTS):

ESTIMATED FRICTION LOSS TO DISCHARGE GAUGE (FEET):

MOTOR EFFICIENCY:

**5. CALCULATED DATA**

POINT 1

POINT 2

POINT 3

POINT 4

POINT 5

TOTAL DYNAMIC HEAD (TDH):

PUMP BHP (KW x MOTOR EFFICIENCY / 0.746):

PUMP EFFICIENCY (TDH x SG x GPM) / BHP x 3960):

CUSTOMER'S REPRESENTATIVE WITNESSING START-UP:

AMERIFLO LLC REPRESENTATIVE WITNESSING START-UP:

NAME:

DATE:

NAME:

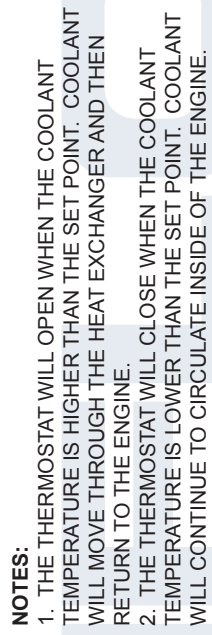
DATE:



- COOLING LOOP WATER DIRECTION OF FLOW





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- WARNING:** THE BACK PRESSURE TO THE ENGINE EXHAUST CONSIDERABLY INFLUENCES THE POWER OF THE ENGINE AND IT'S THERMAL LOADING. EXCESSIVE BACK PRESSURE MEASURED AT THE ENGINE EXHAUST OUTLET CONNECTION (POINT A) WILL DECREASE POWER, INCREASE THE TEMPERATURE OF THE EXHAUST GAS, PRODUCE SMOKE, INCREASE FUEL CONSUMPTION, SULPHURISES THE INTERNAL COOLING WATER (WITH SUBSEQUENT DAMAGE TO THE LUBRICANTS) AND PRODUCES SERIOUS CONSEQUENCES FOR OTHER ENGINE ELEMENTS (I.E. TURBOCHARGER, ETC.).

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**NOTES:**

1. REFER TO THE LATEST EDITION OF NFPA 20 FOR ADDITIONAL REQUIREMENTS.

2. THE FUEL SUPPLY TANK SHALL HAVE A CAPACITY OF AT LEAST 1 GALLON [5.07 LITERS] PER HP [KW] PLUS 5% FOR EXPANSION AND 5% FOR THE PUMP.
3. DOWN PIPE RECOMMENDED FOR FUEL RETURN LINE TO PREVENT FOAMING OF THE FUEL WITHIN THE TANK IS TO TERMINATE IT AT ONE HALF THE TANK HEIGHT.
4. DOWN PIPE RECOMMENDED FOR FUEL FILLING LINE TO PREVENT FOAMING OF THE FUEL WITHIN THE TANK IS TO TERMINATE IT AT 3 - 6 INCHES [76.2 - 152.4 MILLIMETERS] FROM THE TANK BOTTOM.

5. THE ENGINE MANUFACTURER'S FUEL PUMP STATIC HEAD PRESSURE LIMITS SHALL NOT BE EXCEEDED WHEN THE LEVEL OF THE FUEL TANK IS AT ITS MAXIMUM LEVEL.

7. THE FUEL SUPPLY TANK SHALL BE LOCATED SO THAT THE FUEL SUPPLY PIPE CONNECTION TO THE ENGINE IS NOT LOWER THAN THE CENTERLINE OF THE ENGINE FUEL PUMP.

8. THE FUEL RETURN LINE SHALL BE INSTALLED ACCORDING TO THE ENGINE MANUFACTURERS RECOMMENDATION. IN CLIMATES

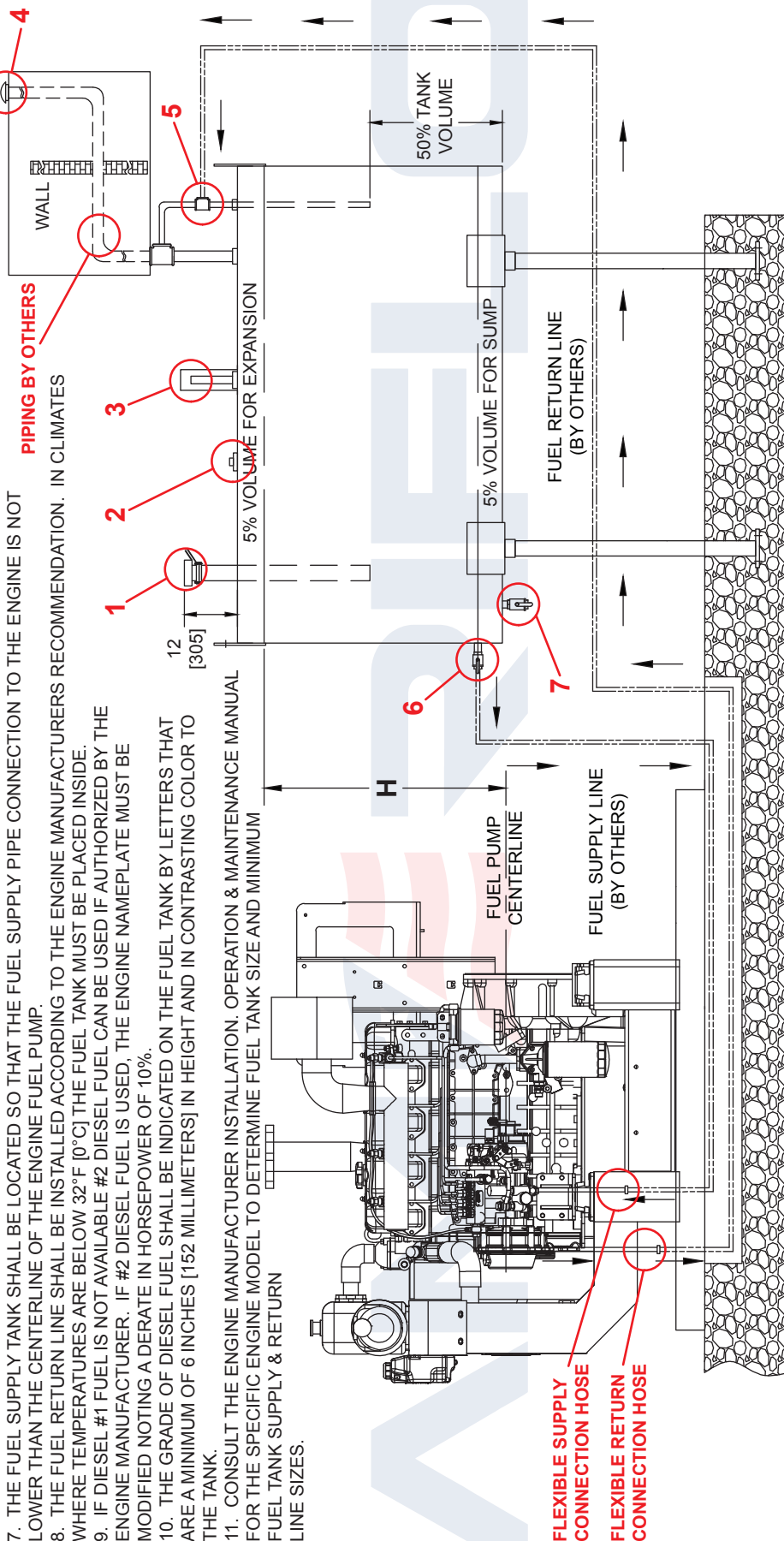
- WHERE TEMPERATURES ARE BELOW 32°F [0°C] THE FUEL TANK MUST BE PLACED INSIDE.

9. IF DIESEL #1 FUEL IS NOT AVAILABLE #2 DIESEL FUEL CAN BE USED IF AUTHORIZED BY THE ENGINE MANUFACTURER. IF #2 DIESEL FUEL IS USED, THE ENGINE NAMEPLATE MUST BE

- MODIFIED NOTING A DERATE IN HORSEPOWER OF 10%.

10. THE GRADE OF DIESEL FUEL SHALL BE INDICATED ON THE FUEL TANK BY LETTERS THAT ARE A MINIMUM OF 6 INCHES [152 MILLIMETERS] IN HEIGHT AND IN CONTRASTING COLOR TO THE TANK.

11. CONSULT THE ENGINE MANUFACTURER INSTALLATION, OPERATION & MAINTENANCE MANUAL FOR THE SPECIFIC ENGINE MODEL TO DETERMINE FUEL TANK SIZE AND MINIMUM FUEL TANK SUPPLY & RETURN LINE SIZES.



ITEM	DESCRIPTION
1	...
2	...
3	...
4	...
5	...
6	...
7	...
8	...
9	...
10	...
11	...
12	...
13	...
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100	...

- |   |   |
|---|---|
| 1 | LOCKABLE FUEL CAP COMBINED WITH A REMOVABLE STRAINER (MAX. 0.06 MESH) |
| 2 | LOW FUEL LEVEL SWITCH   |
| 3 | FUEL GAUGE  |
| 4 | SCREENED TANK VENT  |
| 5 | FUEL RETURN   |
| 6 | MANUAL VALVE WITH PROVISION FOR PADLOCK                               |
| 7 | DRAIN BALL VALVE, 1 INCH WITH PROVISION FOR PADLOCK                   |

**NOTES:**

1. MAXIMUM ALLOWABLE FUEL HEIGHT ABOVE FUEL PUMP IS 9.8 FEET [3 METERS].
2. CHECK VALVE OPENING PRESSURE IS 5 PSI [34.3 KPA].

[illegible]