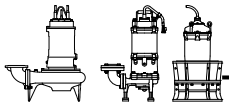
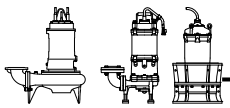


AMERICAN-MARSH PUMPS

INSTALLATION, OPERATION & MAINTENANCE MANUAL FOR SERIES 330 SSE, SGV, SNC & SAF SUBMERSIBLE PUMPS

25 JANUARY 2008



AMERICAN-MARSH PUMPS

CONTENTS Page #

SAFETY CONSIDERATIONS

The American-Marsh SSE, SGV, SNC & SAF submersible pumps have been designed and manufactured for safe operation. In order to ensure safe operation, it is very important that this manual be read in its entirety prior to installing or operating the pump. American-Marsh Pumps shall not be liable for physical injury, damage or delays caused by a failure to observe the instructions for installation, operation and maintenance contained in this manual.

Remember that every pump has the potential to be dangerous, because of the following factors:

- parts are rotating at high speeds
- high pressures may be present
- high temperatures may be present
- highly corrosive and/or toxic chemicals may be present

Paying constant attention to safety is always extremely important. However, there are often situations that require special attention. These situations are indicated throughout this book by the following symbols:

⚠DANGER

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

⚠WARNING

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

⚠CAUTION

CAUTION – Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

Maximum Lifting Speed: 15 feet/second.

If in a climate where the fluid in the casing could freeze, never leave liquid in the pump casing. Drain the casing completely. During winter months and cold weather, the liquid could freeze and damage the pump casing.

Do not run the equipment dry or start the pump without the proper prime (casing flooded).

Never operate the pump for more than a short interval with the discharge valve closed. The length of the interval depends on several factors including the nature of the fluid pumped and its temperature. Contact American-Marsh Engineering for additional support if required.

Never operate the pump with a closed suction valve.

Excessive pump noise or vibration may indicate a dangerous operating condition. The pump must be shutdown immediately.

Do not operate the pump for an extended period of time below the recommended minimum flow. See Figure 4, page 10.

The pump shaft MUST turn clockwise when viewed from the motor end. It is absolutely essential that the rotation of the motor be checked before installation and starting the pump. Incorrect rotation of the pump for even a short period of time can unscrew the impeller nut, which can cause severe damage to the pumping assembly.

If the liquid is hazardous, take all necessary precautions to avoid damage and injury before emptying the pump casing.

Residual liquid may be found in the pump casing, head and suction line. Take the necessary precautions if the liquid is hazardous, flammable, corrosive, poisonous, infected, etc.

Always lockout power to the driver before performing pump maintenance.

Do not apply heat to disassemble the pump or to remove the impeller. Entrapped liquid could cause an explosion.

If any external leaks are found while pumping hazardous product, immediately stop operations and repair.

Vent sewage or septic tank according to local requirements or standards.

Check for proper oil level in seal housing periodically. Check for water in the seal housing periodically.

Do not install pumping assembly into any location classified as hazardous (unless the motor is rated for hazardous duty).

PUMP IDENTIFICATION

MANUFACTURER

American-Marsh Pumps
185 Progress Road
Collierville, TN 38017
United States of America

TYPE OF PUMP

American-Marsh Pumps submersible solids handling pumps are used for pumping sewage from water & waste water treatment plants, tank dewatering, liquid transfer, circulation, dewatering and flood control in municipal, commercial and industrial applications. American-Marsh submersible solid handling pumps family consists of the following ranges.

SSE – Light Duty Submersible Pumps
SGV – Grinder Submersible Pumps
SNC – Heavy Duty, Engineered Submersible Pumps
SAF – Propeller Submersible Pumps

All American-Marsh Pumps motors are built with a thermal overload protection device with automatic reset that protects the motor and pump from overload and dry running. The mechanical seal and bearings are oil lubricated. The pump is designed for use with inflammable liquids, in a non hazardous environment with liquids up to 131ºF for liquids which are compatible with the materials of construction.

DATE OF MANUFACTURE

The date of manufacture is indicated on the pump data plate.

INSTALLATION, OPERATION & MAINTENANCE MANUAL IDENTIFICATION

Prepared: January, 2005 **Edition:** 01
Revision: **Date of Revision:**

NAMEPLATE INFORMATION

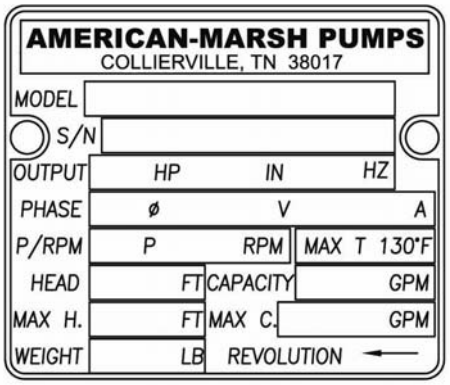
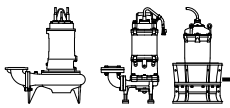


FIGURE 1 – Pump Data Plate

MODEL	:	Pump model designation.
S/N	:	Serial number of pump unit (issued by Production Control).
OUTPUT	:	Motor size in horsepower.
IN	:	Discharge size of pump in inches.
HZ	:	Rated input frequency of motor.
PHASE	:	Rated input phase of motor.
V	:	Rated voltage of motor.
A	:	Rated current draw of motor.
P	:	Number of poles motor rated for.
RPM	:	Speed of the pump
HEAD	:	Best efficiency head.
CAPACITY	:	Best efficiency capacity.
MAX. H	:	Maximum head of the pump.
MAX. C	:	Maximum capacity of the pump.
WEIGHT	:	Weight of the pump & motor in pounds.



WARRANTY

American-Marsh Pumps guarantees that only high quality materials are used in the construction of our pumps and that machining and assembly are carried out to high standards.

The pumps are guaranteed against defective materials and/or faulty craftsmanship for a period of one year from the date of shipment unless specifically stated otherwise.

Replacement of parts or of the pump itself can only be carried out after careful examination of the pump by qualified personnel.

The warranty is not valid if third parties have tampered with the pump.

This warranty does not cover parts subject to deterioration or wear and tear (mechanical seals, pressure and vacuum gauges, rubber or plastic items, bearings, etc.) or damage caused by misuse or improper handling of the pump by the end user.

Parts replaced under warranty become the property of American-Marsh Pumps.

Contact the American-Marsh Pumps' factory:

American-Marsh Pumps
185 Progress Road
Collierville, TN 38017
United States Of America

Phone: **(901) 860-2300**
Fax: **(901) 860-2323**
www.american-marsh.com

GENERAL INSTRUCTIONS

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

The pumps must be used only for applications for which the manufacturers have specified:

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

In case of doubt, contact the manufacturer.

American-Marsh Pumps submersible solids handling pumps are used for pumping sewage from water & waste water treatment plants, tank dewatering, liquid transfer, circulation, dewatering and flood control in municipal, commercial and industrial applications. American-Marsh submersible solid handling pumps family consists of the following ranges.

SSE – Light Duty Submersible Pumps
SGV – Grinder Submersible Pumps
SNC – Heavy Duty, Engineered Submersible Pumps
SAF – Propeller Submersible Pumps

All American-Marsh Pumps motors are built with a thermal overload protection device with automatic reset that protects the motor and pump from overload and dry running. The mechanical seal and bearings are oil lubricated. The pump is designed for use with inflammable liquids, in a non hazardous environment with liquids up to 100ºF for liquids which are compatible with the materials of construction.

HANDLING AND TRANSPORT

METHOD OF TRANSPORT

The pump must be transported in the vertical position

INSTALLATION

During installation and maintenance, all components must be handled and transported securely by using suitable slings. Handling must be carried out by specialized personnel to avoid damage to the pump and persons. The lifting rings attached to various components should be used exclusively to lift the components for which they have been supplied.

⚠DANGER

Do not install the pump into any location classified as hazardous.

Do not install or operate the pump unless electrically grounded to a suitable electrical ground.

⚠WARNING

Do not lift the pump and motor assembly by the power cable.

⚠CAUTION

Maximum lifting speed: 15 feet/second

Install the pump and motor assembly on a hard level surface. Never place the pump directly on the earth, clay or gravel surface.

To ease in the installation and removal of the pump and motor assembly, install the unit with the American-Marsh Easy Lift Guide Rail System. This will allow quick and efficient access to the unit for servicing.

STORAGE

SHORT-TERM STORAGE

Normal packaging is designed to protect the pump during shipment and for dry, indoor storage for up to two months or less. The procedure followed for this short-term storage is summarized below:
Standard Protection for Shipment :

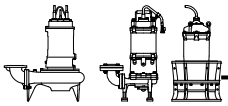
a. Loose unmounted items, including, but not limited to, oilers, packing, coupling spacers, stilts, and mechanical seals are packaged in a water proof plastic bag and placed under the coupling guard. Larger items are cartoned and metal banded to the base plate. For pumps not mounted on a base plate, the bag and/or carton is placed inside the shipping carton. All parts bags and cartons are identified with the American-Marsh 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. After a performance test, if required, 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.
d. 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 available at extra cost.
e. All assemblies are bolted to a wood skid which confines the assembly within the perimeter of the skid.
f. Assemblies with special paint are protected with a plastic wrap.

LONG-TERM STORAGE

Long-term storage is defined as more than two months, but less than 12 months. The procedure American-Marsh follows for long-term storage of pumps is given below. These procedures are in addition to the short-term procedure.

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 mechanical seals, bearings, lip seals, etc. due to humidity, salt laden air, dust, etc. After unpacking, protection will be the responsibility of the user. Addition of oil to the bearing housing will remove the inhibitor. If units are to be idle for extended periods after addition of lubricants, inhibitor oils and greases should be used.

Every three months, the shaft should be rotated approximately 10 revolutions.



INSTALLATION & ALIGNMENT

FACTORY PRELIMINARY ALIGNMENT PROCEDURE

All SSE, SGV, SNC & SAF submersible pumps are of the close-coupled type. No alignment in the field is required.

PIPING CONNECTION – DISCHARGE

All piping must be independently supported, accurately aligned and be capable of handling semi-solids.

⚠WARNING

Piping Forces: *Take care during installation and operation to minimize pipe forces and/or moments on the pump casing.*

SUCTION PIPING

All pump models covered in this manual are intended for use in a wet, flooded sump. Due to this intended service, no suction piping is required.

DISCHARGE PIPING

Install a check valve in the discharge line. This valve is required for regulating flow and/or to isolate the pump for inspection and maintenance. In an effluent system, the check valve prevents a backflow of liquid into the sump basin. The check valve should be a free flow type that will easily pass solids. For best performance of the check valve assembly, do not install it with the discharge more than 45º above the horizontal. Do not install the check valve in a vertical position as solids may settle in the valve and prevent it from operating correctly.

⚠WARNING

When fluid velocity in the pipe is high, for example, 10 ft/s (3 m/s) or higher, a rapidly closing discharge valve can cause a damaging pressure surge. A dampening arrangement should be provided in the piping.

The flow rate in the discharge piping MUST keep any solids present in suspension in the fluid. To meet this requirement, the fluid requires a minimum velocity of 2 ft/s (0.6 m/s).

MECHANICAL SEAL

All American-Marsh submersible pumps covered in this manual feature a double mechanical seal with a third oil lip seal designed to keep larger solids from gathering on the seal faces. These mechanical seals are located in the rear cover area and are lubricated with dielectric oil. **The mechanical seal housing has no oil present when shipped from the factory.** These mechanical seals and oil lip seal assembly should be checked every three months in heavy duty service or every six months in light duty service.

⚠WARNING

Failure to ensure that the seal chamber is properly filled with dielectric oil will result in complete mechanical seal failure. NO OIL IS PRESENT IN THE SEAL CHAMBER WHEN SHIPPED FROM THE FACTORY.

Mechanical seal condition is extremely important due to the fact that if both mechanical seals fail, liquid will be permitted to enter the motor enclosure which will cause the motor to fail.

BEARING LUBRICATION

Reasonable care and proper lubrication of American-Marsh Pump bearings will result in many years of service.

SEALED BEARINGS

SSE, SGV, SNC & SAF pumps are supplied with sealed bearings and are shipped from the factory pre-lubricated. No additional lubrication of the bearings is required once the unit is installed in the field.

PUMP ROTATION

All submersible pumps covered in this manual turn clockwise as viewed from the motor end or, conversely, counterclockwise when viewed from the suction end.

⚠CAUTION

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, can dislodge the impeller which may cause serious damage to the pump.

ELECTRICAL

⚠WARNING

Electricity is dangerous. It can burn, shock or cause death. When installing, operating or servicing this pump, following the instructions below.

1. DO NOT splice the power cord.
2. DO NOT handle or service the pump while it is connected to the power supply.
3. DO NOT operate the pump and motor assembly unless it is properly grounded. Wire the pump directly to a grounded terminal block in the automatic float or pump control panel. Be sure to follow all local electrical codes where the unit is installed.
4. Make sure the supply frequency and voltage corresponds to the nameplate frequency and voltage requirements. Supply voltage must be within 10% of nameplate voltage. Incorrect voltage can seriously damage the motor and could cause a fire which would invalidate the warranty. If in doubt consult a qualified electrician.
5. Pump must rotate in a clockwise direction (viewed from the top of the pump in its vertical position.) NEVER operate pump and motor in reverse. If the pump runs in reverse during pre-installation check, change two of the three phases on a three phase motor to achieve correct rotation.

⚠DANGER

Keep hands out of the impeller when checking the direction of rotation.

6. For automatic operation, wire the pump into an automatic float switch or pump controls panel. For manual control, wire into a suitable motor starter.
7. Connect the pump to its own circuit with nothing else on the same circuit.
8. Install the pump in accordance with all applicable electrical codes. Install a fused disconnect switch or a circuit breaker.

WIRING DIAGRAMS

Use a control panel or starter sized to meet the requirements of the pump. Refer to the appropriate wiring diagram for connection details.

PUMP OPERATION

ROTATION CHECK

⚠CAUTION

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, can dislodge and damage the impeller, casing, shaft and shaft seal.

All pumps covered in this manual turn clockwise as viewed from the motor end. A direction arrow is located on the nameplate. Make sure the motor rotates in the same direction.

An automatic thermal overload protector in the motor will protect the motor from damage due to overheating and overloading. When the motor cools down, the thermal overload will automatically reset and start the motor.

If the thermal overload trips frequently, investigate this cause as this can cause the pump and motor to prematurely fail. Issues that could cause this include:

- Incorrect or low voltage
- Bad thermal overload protector located in motor
- An electrical failure within the motor

⚠CAUTION

For continuous pump operation, the liquid level must be at least over the motor enclosure to prevent motor from overheating. See the appropriate dimensional drawing and refer to the indicated Minimum Water Level (M.W.L.).

PRE START-UP CHECKS

Prior to starting the pump it is essential that the following checks are made. These checks are all described in detail in the Maintenance Section of this booklet.

- All fasteners tightened to the correct torques
- Rotation check, see above

THIS IS ABSOLUTELY ESSENTIAL.

- Shaft seal properly installed
- Seal chamber completely filled with dielectric oil
- Pump instrumentation is operational
- Pump is primed
- Rotation of shaft by hand

As a final step in preparation for operation, it is important to rotate the shaft by hand to be certain that all rotating parts move freely, and that there are no foreign objects in the pump.

ENSURING PROPER $NPSH_A$

Net Positive Suction Head – Available ($NPSH_A$) 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 in the pump. It is critical because a centrifugal pump is designed to pump a liquid, not a vapor. Vaporization in a pump will result in damage to the pump, deterioration of the Total Differential Head (TDH), and possibly a complete stopping of pumping. Net Positive Suction Head – Required ($NPSH_R$) 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 in the inlet region of the pump, and particularly accelerations as the fluid enters the impeller vanes. The value for $NPSH_R$ for the specific pump purchased is given in the pump data sheet, and on the pump performance curve.

For a pump to operate properly the $NPSH_A$ must be greater than the $NPSH_R$. Good practice dictates that this margin should be at least 5 ft (1.5 m) or 20%, whichever is greater.

⚠CAUTION

Ensuring that $NPSH_A$ is larger than $NPSH_R$ by the suggested margin will greatly enhance pump performance and reliability. It will also reduce the likelihood of cavitation, which can severely damage the pump.

MINIMUM FLOW

Minimum continuous stable flow is the lowest flow at which the pump can operate and still conform to the bearing life, shaft deflection and bearing housing vibration limits. Pumps may be operated at lower flows, but it must be recognized that the pump may not conform to one or more of these limits. For example, vibration may exceed the limit set by the ASME standard. The size of the pump, the energy absorbed, and the liquid pumped are some of the considerations in determining the minimum flow. The following are the recommended minimum flows for these specific pumps:

Pump Size	60 Hz		50 Hz	
	RPM	Minimum Flow (% of BEP)	RPM	Minimum Flow (% of BEP)
All Other Sizes	ANY	20%	ANY	20%

FIGURE 4 - Minimum Continuous Safe Flow

Note: "Minimum intermittent flow" value of 50% of the "minimum continuous flow" as long as that flow is greater than the "minimum thermal flow."

All submersible pumps covered in the manual also have a "Minimum Thermal Flow." This is defined as the minimum flow that will not cause an excessive temperature rise. Minimum Thermal Flow is application dependent.

⚠WARNING

Do not operate the pump below Minimum Thermal Flow, as this could cause an excessive temperature rise. Contact an American-Marsh Sales Engineer for determination of Minimum Thermal flow.

STARTING THE PUMP AND ADJUSTING FLOW

1. A standard centrifugal pump will not move liquid unless the pump is primed. A pump is said to be "primed" when the casing and the suction piping are completely filled with liquid. Open discharge valve a slight amount. This will allow any entrapped air to escape and will normally allow the pump to prime, if the suction source is above the pump. When a condition exists where the suction pressure may drop below the pump's capability, it is advisable to add a low pressure control device to shut the pump down when the pressure drops below a predetermined minimum.
2. Start the electric motor.
3. Slowly open the discharge valve, if used, until the desired flow is reached, keeping in mind the minimum flow restrictions listed above.

⚠DANGER

It is important that the discharge valve be opened within a short interval after starting the driver. Failure to do this could cause a dangerous build up of heat, and possibly an explosion.

4. *Reduced capacity*
   Avoid running a centrifugal pump at drastically reduced capacities or with discharge valve closed for extended periods of time. This can cause severe temperature rise and the liquid in the pump may reach its boiling point. If this occurs, the mechanical seal will be exposed to vapor, with no lubrication, and may score or seize to the stationary parts. Continued running under these conditions when the suction valve is also closed, can create an explosive condition due to the confined vapor at high pressure and temperature. The motor has an overload device that will turn the pump off if run for extended periods at low flow. Once the motor has cooled down, the overload device will reset itself and the pump can be used as normal.

   Safeguards should also be taken against possible operation with a closed discharge valve, such as installing a bypass back to the suction source. The size of the bypass line and the required bypass flow rate is a function of the input horsepower and the allowable temperature rise.
5. *Reduced Head*
   Note that when discharge head drops, the pump's flow rate usually increases rapidly. Check motor for temperature rise as this may cause overload. If overloading occurs, throttle the discharge.
6. *Surging Condition*
   A rapidly closing discharge valve can cause a damaging pressure surge. A dampening arrangement should be provided in the piping.

OPERATION IN SUB-FREEZING CONDITIONS

When using the pump in sub-freezing conditions where the pump is periodically idle, the pump should be properly drained or protected with thermal devices which will keep the liquid in the pump from freezing.

SHUTDOWN CONSIDERATIONS

When the pump is being shutdown, the procedure should be the reverse of the start-up procedure. First, slowly close the discharge valve, shutdown the driver, then close the suction valve. Remember, closing the suction valve while the pump is running is a safety hazard and could seriously damage the pump and other equipment.

TROUBLESHOOTING

The following is a guide to troubleshooting problems with American-Marsh pumps. 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 the examples, then contact a local American-Marsh Sales Engineer or Distributor/Representative for assistance.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Problem #1 Pump not reaching design flow rate.	1.1 Insufficient $NPSH_A$. (Noise may not be present)	Recalculate NPSH available. It must be greater than the NPSH required by pump at desired flow. If not, redesign suction piping, holding number of elbows and number of planes to a minimum to avoid adverse flow rotation as it approaches the impeller.
	1.2 System head greater than anticipated.	Reduce system head by increasing pipe size and/ than or reducing number of fittings. Increase impeller diameter. NOTE: Increasing impeller diameter may require use of a larger motor.
	1.3 Entrained air. Air leak from atmosphere on suction side.	1. Check suction line gaskets and threads for tightness. 2. If vortex formation is observed in suction tank, install vortex breaker. 3. Check for minimum submergence.
	1.4 Entrained gas from process.	Process generated gases may require larger pumps.
	1.5 Speed too low.	Check motor speed against design speed. Low line voltage will cause the motor to operate at a slower speed.
	1.6 Direction of rotation wrong.	After confirming wrong rotation, reverse any two of three leads on a three phase motor. The pump should be disassembled and inspected before it is restarted.
	1.7 Impeller too small.	Replace with proper diameter impeller. NOTE: Increasing impeller diameter may require use of a larger motor.
	1.8 Plugged impeller, suction line or casing which may be due to a product or large solids.	1. Reduce length of fiber when possible. 2. Reduce solids in the process fluid when possible. 3. Consider larger pump.
	1.9 Wet end parts (casing cover, impeller) worn, corroded or missing.	Replace worn part.
Problem #2.0 Pump not reaching design head (TDH).	2.1 Refer to possible causes under Problem #1.0.	Refer to remedies listed under Problem #1.0 and #3.0.
Problem #3.0 No discharge or flow	3.1 Not properly primed.	Repeat priming operation, recheck instructions. If pump has run dry, disassemble and inspect the pump before operation.
	3.2 Direction of rotation wrong.	After confirming wrong rotation, reverse any two of three leads on a three phase motor. The pump should be disassembled and inspected before operation.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Cont. Problem #3.0 No discharge or flow	3.3 Entrained air. Air leak from atmosphere on suction side.	Refer to recommended remedy under Problem #1.0, Item #1.3.
	3.4 Plugged impeller, suction line or casing which may be due to a fibrous product or large solids.	Refer to recommended remedy under Problem #1.0, Item #1.8.
	3.5 Damaged pump shaft, impeller.	Replace damaged parts.
	3.6 No electrical supply	Check that the proper voltage and frequency power is securely connected to the motor starter or control panel. Disconnect power from pump before handling the pump and motor unit.
	3.7 Defective motor power cable.	Replace the motor power cable.
	3.8 Fuse or circuit breaker trip.	Replace the fuse with the proper size. Reset the circuit breaker.
	3.9 Defective motor.	Rebuild or replace the motor.
Problem #4.0 Pump operates for short period, then stops operating.	4.1 Insufficient NPSH.	Refer to recommended remedy under Problem #1.0, Item #1.1.
	4.2 Entrained air. Air leak from atmosphere on suction side.	Refer to recommended remedy under Problem #1.0, Item #1.3.
	4.3 Defective motor coil	Rewind or replace the motor.
	4.4 Viscosity of liquid too high.	More liquid needs to be added to the pump fluid to decrease it's viscosity. If this is not possible, a centrifugal pump may not be the pump required.
	4.5 Temperature of pump liquid is too high	Submersible pump and motor units are not intended for service in liquids above 135ºF. If the pump fluid is hotter than this, another type of pump must be selected.
Problem #5.0 Excessive noise from wet end.	5.1 Cavitation - insufficient NPSH available.	Refer to recommended remedy under Problem #1.0, Item #1.1.
	5.2 Abnormal fluid rotation due to complex suction piping.	Redesign suction piping, holder number of elbows and number of planes to a minimum to avoid adverse fluid rotation as it approaches the impeller.
	5.3 Impeller rubbing.	1. Check thrust bearing assembly for axial end play. 2. Reset impeller clearance.

Problem #6.0 Excessive noise from power end.	6.1 Bearing contamination appearing on the raceways as scoring, pitting, scratching, or rusting caused by adverse environment and entrance of abrasive contaminants from atmosphere.	1. Work with clean tools in clean surroundings. 2. Remove all outside dirt from housing before exposing bearings. 3. Handle with clean dry hands. 4. Treat a used bearing as carefully as a new one. 5. Use clean solvent and flushing oil. 6. Protect disassembled bearing from dirt and moisture. 7. Keep bearings wrapped in paper or clean cloth while not in use. 8. Clean inside of housing before replacing bearings. 9. Check oil seals and replace as required. 10. Check all plugs and tapped openings to make sure that they are tight.
	6.2 Brinelling of bearing identified by indentation on the ball races, usually caused by incorrectly applied forces in assembling the bearing or by shock loading such as hitting the bearing or drive shaft with a hammer.	When mounting the bearing on the drive shaft use a proper size ring and apply the pressure against the inner ring only. Be sure when mounting a bearing to apply the mounting pressure slowly and evenly.
	6.3 False brinelling of bearing identified again by either axial or circumferential indentations usually caused by vibration of the balls between the races in a stationary bearing.	1. Correct the source of vibration. 2. Where bearings are oil lubricated and employed in units that may be out of service for extended periods, the drive shaft should be turned over periodically to re-lubricate all bearing surfaces at intervals of one-to three months.
	6.4 Thrust overload on bearing identified by flaking ball path on one side of the outer race or in the case of maximum capacity bearings, may appear as a spalling of the races in the vicinity of the loading slot. These thrust failures are caused by improper mounting of the bearing or excessive thrust loads.	1. Follow correct mounting procedures for bearings.
	6.5 Misalignment identified by fracture of ball retainer or a wide ball path on the inner race and a narrower cocked ball path on the outer race. Misalignment is caused by poor mounting practices or defective drive shaft. For example bearing not square with the centerline or possibly a bent shaft due to improper handling.	Handle parts carefully and follow recommended mounting procedures. Check all parts for proper fit and alignment.

PROBLEM	POSSIBLE CAUSE	RECOMMENDED REMEDY
Cont. Problem #6.0 Excessive noise from power end.	6.6 Bearing damaged by electric arcing identified as electro-etching of both inner and outer ring as a pitting or cratering. Electrical arcing is caused by a static electrical charge eminating from belt drives, electrical leakage or short circuiting.	1. Where current shunting through the bearing cannot be corrected, a shunt in the form of a slip ring assembly should be incorporated. 2. Check all wiring, insulation and rotor windings to be sure that they are sound and all connections are properly made. 3. Where pumps are belt driven, consider the elimination of static charges by proper grounding or consider belt material that is less generative.
	6.7 Bearing damage due to improper lubrication, identified by one or more of the following: 1. Abnormal bearing temperature rise. 2. A stiff cracked grease appearance. 3. A brown or bluish discoloration of the bearing races.	1. Be sure the lubricant is clean. 2. Be sure proper amount of lubricant is used.

MAINTENANCE

PREVENTIVE MAINTENANCE

The following sections of this manual give instructions on how to perform a complete maintenance overhaul. However, it is also important to periodically repeat the "Pre start-up checks" listed on page 9. These checks will help extend pump life as well as the length of time between major overhauls.

NEED FOR MAINTENANCE RECORDS

A procedure for keeping accurate maintenance records is a critical part of any program to improve pump reliability. There are many variables that can contribute to pump failures. Often long term and repetitive problems can only be solved by analyzing these variables through pump maintenance records.

NEED FOR CLEANLINESS

One of the major causes of pump failure is the presence of contaminants in the bearing housing. This contamination can be in the form of moisture, dust, dirt and other solid particles such as metal chips. Contamination can also be harmful to the mechanical seal (especially the seal faces) as well as other parts of the pumps. For example, dirt in the impeller threads could cause the impeller to not be seated properly against the shaft. This, in turn, could cause a series of other problems. For these reasons, it is very important that proper cleanliness be maintained. Some guidelines are listed below.

After draining the oil from the bearing housing, periodically send it out for analysis. If it is contaminated, determine the cause and correct. The work area should be clean and free from dust, dirt, oil, grease, etc. Hands and gloves should be clean. Only clean towels, rags, and tools should be used.

CLEANING/INSPECTION

All parts should now be thoroughly cleaned and inspected. New bearings, O-rings, gaskets, and lip seals should be used. Any parts that show wear or corrosion should be replaced with new genuine American-Marsh parts.

⚠WARNING

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

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 a serious shortcoming 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 formed 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 shutting off flow. For this reason, American-Marsh does not recommend the use of PTFE tape as a thread sealant.

American-Marsh has investigated and tested alternate sealants and has identified two that provide an effective seal, have the same chemical resistance as the 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. American-Marsh recommends using one of these paste sealants.

Full thread length engagement is required for all fasteners.

BOLT SIZE		TIGHTENING TORQUE	
Metric	Standard	Lbf ft	Nm
4 mm	5/32"	2.7	3.6
5 mm	3/16"	5.2	7.0
6 mm	1/4"	8.9	12.0
7 mm	9/32"	14.6	19.8
8 mm	5/16"	21.8	29.6
9 mm	11/32"	28.0	38.0
10 mm	3/8"	38.7	52.5
12 mm	1/2"	65.6	89.0
14 mm	9/16"	99.6	135
16 mm	5/8"	151	205
18 mm	11/16"	190	257
20 mm	3/4"	264	358
22 mm	7/8"	321	435
24 mm	15/16"	411	557

FIGURE 5 - Bolt & Cap Screw Torque Ratings

MECHANICAL SEAL DISASSEMBLY

Refer to the parts list shown in Figures 6, 7, 8 & 9 for item number references used throughout this section.

SNC, SBF, SGF, SHF MODELS

1. Before performing any maintenance, disconnect the driver from its power supply and lock it off line.

⚠DANGER

Lock out power to driver to prevent personal injury.

2. Hoist the pump out of the sump and place in an area where the unit can be cleaned.
3. Remove all scale and deposits from inside and outside of the pump.
4. Submerge the entire pump and motor assembly in a disinfectant solution or neutralizing agent for at least one hour BEFORE disassembly.

⚠WARNING

Be prepared to deal with a large quantity of oil when emptying the seal lubrication chamber. Inspect o-rings and castings for damage or evidence of leaks. Inspect all wires and be sure that none of them have been pinched or damaged.

5. Lay the pump on its side and remove the mechanical seal housing plug (#411D) and o-ring from the pump. Completely drain all oil (#331L) out of the seal lubrication chamber. Place the oil in a clean container and inspect for water contamination and opacity.

⚠WARNING

Water is heavier than the oil. Look for water at the bottom of your container. Water may appear as small bubbles. If water is present in the oil (#331L), the mechanical seal assembly (#331A/B) or o-ring (#331D/F) will need to be replaced. If no water is present in the oil (#331L) the mechanical seal (#331A/B) and o-ring (#331D/F) are alright.

6. Remove the three capscrews and lock washers from the base (#424A), if equipped, and remove the base (#424A) from the pump volute (#1A)
7. Use an impact wrench to remove the impeller nut (#24B), flat washer and lock washer (#27A).
8. Stand the pump right side up on a 2”x4” or 4”x4” piece of wood. Lift the pump up slightly and carefully drop it onto the wood support, jarring the impeller (#11C) free. Repeat as many times as necessary. The impeller key (#24A) should come off of the shaft with the impeller (#11C). If not, remove the impeller key (#24A) manually.
9. Remove the oil lip seal (#104P) behind the impeller (#11C).
10. Remove the four capscrews and lock washers that hold the pump volute (#1A) to the seal plate (#2E). Tap around the parting line with a lead hammer or dead blow hammer to loosen the pump volute (#1A). Remove the volute (#1A) from the mechanical seal bracket (#2E).
11. Remove the volute o-ring (#331D) and clean the o-ring groove. Remove the three screws that hold the mechanical seal retaining ring to the mechanical seal bracket (#2E). Remove the seal retaining ring and the mechanical seal stationary seat.

⚠WARNING

The mechanical seal assembly (#331A/B) consists of 5 parts – the upper and lower stationary ceramic or silicon carbide seats and two rotating faces, plus the spring. Take great care not to scratch or damage the seal faces or shafting when removing the mechanical seal (#331A/B). If the shaft has accumulated material in the mechanical seal area, this area must be cleaned prior to installing a new mechanical seal (#331A/B).

12. Carefully remove the mechanical seal stationary faces from the bearing bracket (#2D) and mechanical seal bracket (#2E).

INSTALLING NEW MECHANICAL SEAL ASSEMBLY

⚠DANGER

Lock out power to driver to prevent personal injury.

Install all new o-rings, mechanical seals, oil lip seals and gaskets during re-assembly. It is a good practice to replace all of the o-rings each time the pump is serviced.

1. Clean the mechanical seal bracket (#2E) and the bearing bracket (#2D) to ensure that no contaminants are located in the mechanical seal chamber lubrication reservoir.
2. Lubricate the mechanical seals (#331A/B) with a very small amount of oil.
3. Inspect the pump shaft (#497G) for nicks and scratches.
4. With finger pressure only, press the stationary seal faces into the mechanical seal bracket (#2E) and bearing bracket (#2D).

⚠WARNING

Use great caution when handling mechanical seal faces as they are very brittle and extremely fragile. Be sure to be extremely careful when installing the mechanical seal faces over the shaft assembly. Be sure that the polished side of each of the seal faces is in contact with each other.

5. Reinstall the lower seal retaining ring.
6. Slide the rotating seals and the spring (#331A/B) onto the shaft assembly (#497G).
7. Clean the o-ring groove in the volute (#1A) and install a new o-ring (#331D).
8. Carefully lift and remount the pump on the volute (#1A). Reinstall and tighten the lock washers and cap screws.
9. Lay the pump on its side and reinstall the impeller drive key (#24A) into the keyway on shaft (#497G).
10. Reinstall the oil lip seal (#104P) on the impeller (#11C).
11. Using the impeller key (#24A) as a guide, reinstall the impeller (#11C) on the shaft (#497G). Reinstall the impeller flat washer, lock washer, and locknut (#27A).
12. Reinstall the pump volute (#1A) onto the mechanical seal bracket (#2E).
13. Refill the seal chamber with clean dielectric oil (#331L) and replace the o-ring and plug (#411D).
14. Stand pump back on its feet. Ensure that the impeller is free to rotate a full 360º rotation. Pump is now ready for installation in sump.

MOTOR DISASSEMBLY

⚠DANGER

Lock out power to driver to prevent personal injury.

Perform steps 1 through 12 in previous section “Mechanical Seal Disassembly.

1. With the pump lying on its side, remove the 4 cap screws and lock washers that hold the upper cover (#497B) to the motor housing (#497A). Pry the upper cover (#497B) from the motor housing (#497A) and check for water.

⚠WARNING

Mark the position/alignment of the upper cover (#497B) to the motor housing (#497A). During reinstallation the alignment will need to be duplicated to ensure proper seating of the upper cover (#497B).

2. Inspect the motor lead base (#497E) and motor lead base cover (#497C) for evidence of moisture. If moisture is present inside of the motor lead base cover (#497C), wipe all moisture out of the motor lead base cover and replace the motor lead base o-ring.
3. Remove the spring washer and the motor protector device (#497H) from the upper cover (#497B). Clean all moisture out of the protector cavity before reassembly.
4. Wipe all moisture out of the upper cover (#497B) before removing the wire protector gasket.
5. Inspect the wire protector gasket for nicks or gouges and replace if necessary.
6. Check for pinched or damaged wires and replace as needed.
7. Remove the 4 cap screws and lock washers that connect the motor housing (#497A) to the bearing bracket (#2D). Pry the motor housing (#497A) off of the bearing bracket (#2D).

The motor housing (#497A) and stator coil will slide off of the shaft as one piece. These two items are considered a single unit.

8. Remove the up-thrust bearing retainer (#81T) from the bearing bracket (#2D).

9. Remove the motor shaft and rotor (#497G) from the bearing bracket (#2D).
10. If replacing rotor windings, press the top bearing (#81N) off of the shaft (#497G). Press the shaft (#497G) out of the rotor windings.
11. If replacing bearings (#81N & #81P), press both old bearings off the shaft.

MOTOR REASSEMBLY

⚠DANGER

Lock out power to driver to prevent personal injury.

Perform steps 1 through 14 in previous section "Installing Mechanical Seal Assembly.

Install all new o-rings. It is good practice to replace the o-rings and gaskets each time the pump is serviced.

1. If the rotor windings were removed, install new rotor winding onto motor shaft (#497G) at this time.
2. Press new bearing (#81N) onto shaft (#497G). Place the up-thrust bearing retainer (#81T) onto shaft (#497G). Press new bearing (#81P) onto shaft (#497G).
3. Reinstall shaft (#497G) into bearing bracket (#2D) and tighten the three screws in the up-thrust bearing retainer (#81T).
4. Reinstall motor protector device (#497H) in motor cover (#497B).
5. Clean o-ring groove in bearing bracket (#2D) and install a new o-ring (#331C). Place motor housing (#497) on bearing bracket (#2D), insert cap screws and lock washers and tighten.
6. Reinstall wire protector gasket and spring washer on motor housing unit (#497A).
7. Clean o-ring groove in motor housing (#497A) and install new o-ring (#31G).
8. Place the upper housing cover (#497B) on the motor housing (#497A).

Be certain the wires do not get caught in the joint between the upper housing cover (#497B) and the motor housing (#497A).

Turn the upper housing cover (#497B) to pull the wires in and reseat the upper housing cover (#497B). The upper housing cover (#497B) is properly seated when the original alignment has been duplicated (See Step 1 under "Motor Disassembly").

9. Reinstall and tighten cap screws and lock washers.
10. Refill the seal chamber with clean dielectric oil (#331L) and replace the o-ring and plug (#411D).
11. Stand pump back on its feet. Ensure that the impeller is free to rotate a full 360º rotation. Pump is now ready for installation in sump.

PUMP REINSTALLATION

The pump is now ready to be returned to service. It should be reinstalled as described in the installation section.

SPARE PARTS

RECOMMENDED SPARE PARTS – STANDARD SSE, SGV, SNC & SAF PUMP

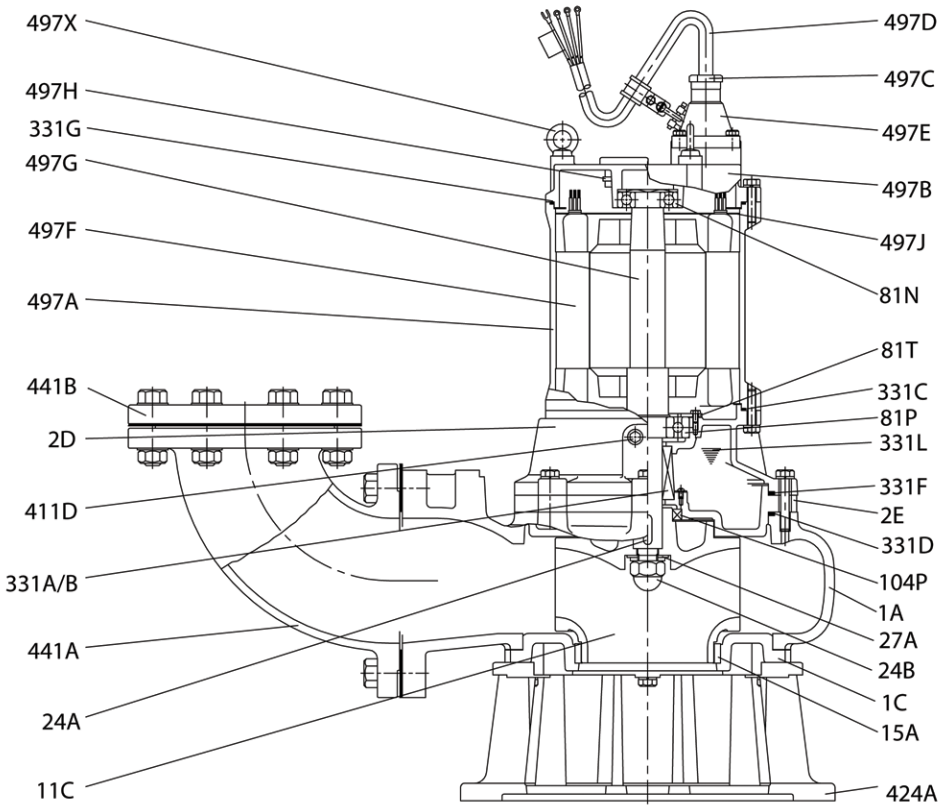
The decision on what spare parts to stock varies greatly depending on many factors such as the criticality of the application, the time required to buy and receive new spares, the erosive/corrosive nature of the application,

HOW TO ORDER SPARE PARTS

Spare parts can be ordered from the local American-Marsh Sales Engineer, or from the American-Marsh Distributor or Representative. The pump size and type can be found on the name plate on the motor stand. See Figure 3. Please provide the item number, description, and alloy for the part(s) to be ordered.

To make parts ordering easy, American-Marsh has created a catalog titled "American-Marsh Pump Parts Catalog." A copy of this book can be obtained from the local American-Marsh Sales Engineer or Distributor/Representative.

FIGURE 6 – SNC Sectional Drawing



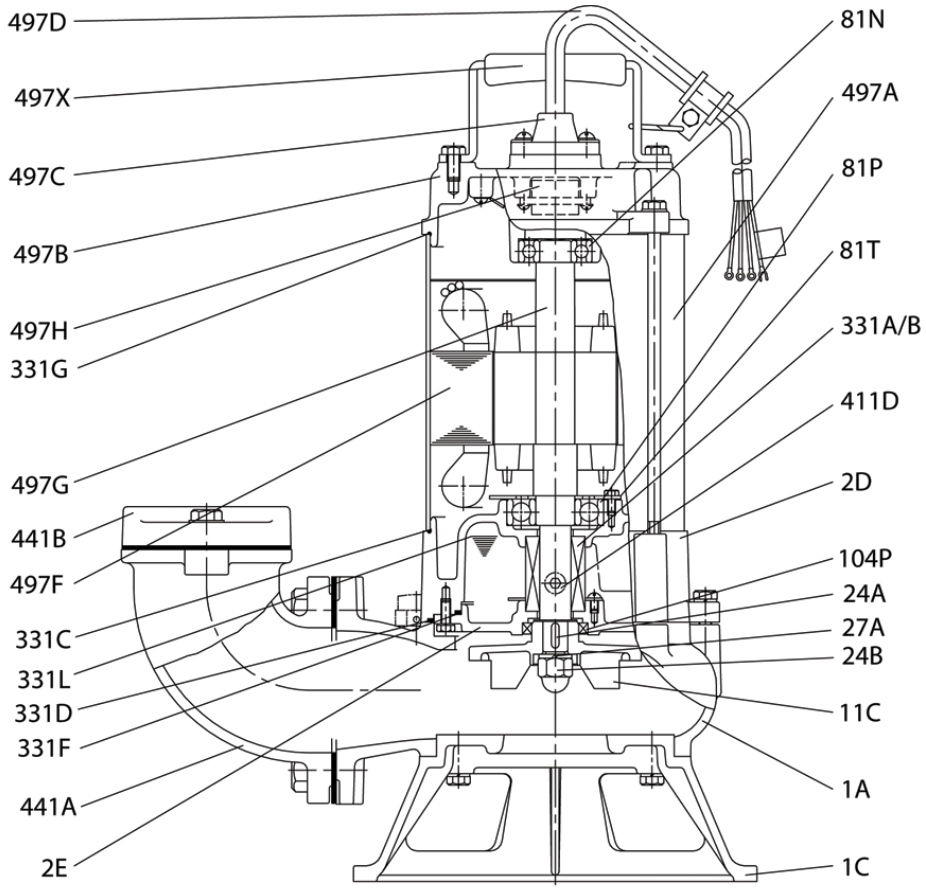
Item Number	Item Description	Num. Req.
1A	Casing	1
1C	Casing Cover	1
2D	Bearing Bracket	1
2E	Mechanical Seal Bracket	1
11C	Impeller	1
15A	Casing Wear Ring	1
24A	Impeller Key	1
24B	Impeller Locknut	1
27A	Impeller Lockwasher	1
81N	Outboard Bearing	1
81P	Inboard Bearing	1
81T	Inboard Bearing Thrust Plate	1
104P	Oil Lip Seal	1
331A	Mechanical Seal (Motor Side)	1
331B	Mechanical Seal (Pump Side)	1
331C	Motor Housing O-Ring	1
331D	Mechanical Seal Bracket O-Ring	1
331F	Casing O-Ring	1
331G	Upper Housing Cover O-Ring	1
331L	Mechanical Seal Lubricant	1

Item Number	Item Description	Num. Req.
331M	Upper Housing Cover O-Ring	1
331N	Motor Lead Base O-Ring	1
331X	Mechanical Seal Moisture Sensor	1
331XC	Mech. Seal Moisture Cable Base	1
331XD	Mech. Seal Moisture Sensor Cable	1
331X	Mechanical Seal Moisture Sensor	1
411D	Oil Plug	2
424A	Casing Foot/Strainer	1
441A	Discharge Elbow	1
441B	Companion Flange	1
497A	Motor Housing	1
497B	Upper Housing Cover	1
497C	Motor Lead Base Cover	1
497D	Motor Lead	1
497E	Motor Lead Base	1
497F	Stator	1
497G	Shaft (with Rotor)	1
497H	Motor Overload Protection	1
497J	Motor Overload Protection Plate	1
497X	Stainless Steel Eyehook	3

* Not shown in sectional.

Recommended spare parts are in BOLD.

FIGURE 7 – SSE Sectional Drawing



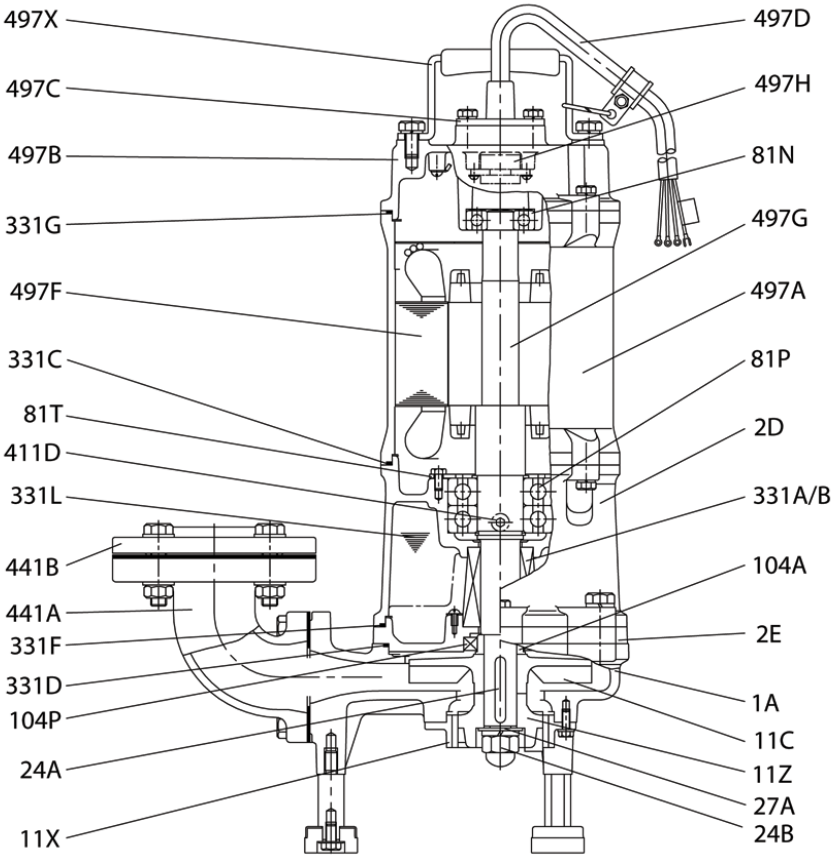
Item Number	Item Description	Num. Req.
1A	Casing	1
1C	Casing Cover	1
2D	Mechanical Seal Bracket	1
2E	Bearing Bracket	1
11C	Impeller	1
24A	Impeller Key	1
24B	Impeller Locknut	1
27A	Impeller Lockwasher	1
81N	Outboard Bearing	1
81P	Inboard Bearing	1
81T	Inboard Bearing Thrust Plate	1
104P	Oil Lip Seal	1
331A	Mechanical Seal (Motor Side)	1
331B	Mechanical Seal (Pump Side)	1
331C	Motor Housing O-Ring	1
331D	Mechanical Seal Bracket O-Ring	1
331F	Casing O-Ring	1
331G	Upper Housing Cover O-Ring	1

Item Number	Item Description	Num. Req.
331L	Mechanical Seal Lubricant	1
331M	Upper Housing Cover O-Ring	1
331N	Motor Lead Base O-Ring	1
331X	Mechanical Seal Moisture Sensor	1
331XC	Mech. Seal Moisture Cable Base	1
331XD	Mech. Seal Moisture Sensor Cable	1
411D	Oil Plug	2
441A	Discharge Elbow	1
441B	Companion Flange	1
497A	Motor Housing	1
497B	Upper Housing Cover	1
497C	Motor Lead Base Cover	1
497D	Motor Lead	1
497F	Stator	1
497G	Shaft (with Rotor)	1
497H	Motor Overload Protection	1
497X	Stainless Steel Eyehook	Varies

* Not shown in sectional.

Recommended spare parts are in BOLD.

FIGURE 8 – SGV Sectional Drawing



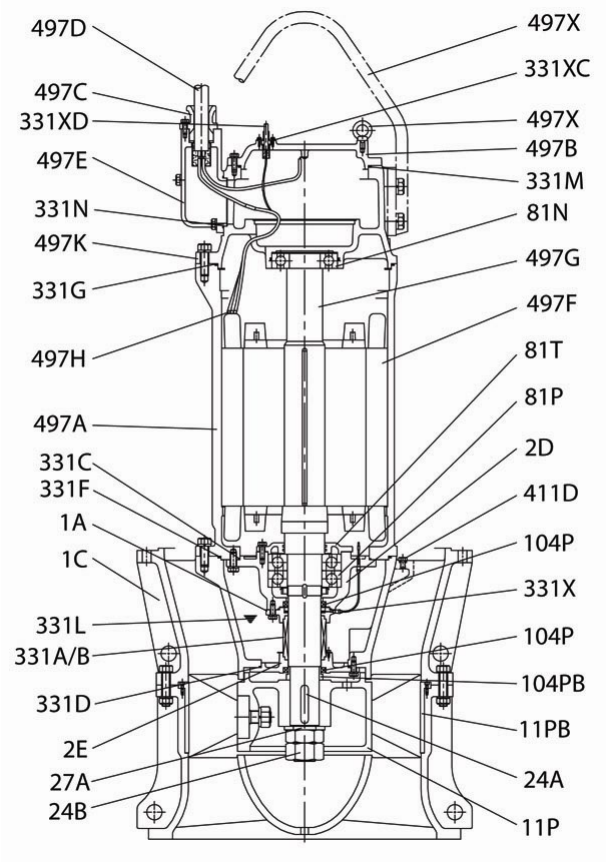
Item Number	Item Description	Num. Req.
1A	Casing	1
2D	Mechanical Seal Bracket	1
2E	Bearing Bracket	1
11C	Impeller	1
11X	Radial Cutter	1
11Z	Radial Cutter Ring	1
24A	Impeller Key	1
24B	Impeller Locknut	1
27A	Impeller Lockwasher	1
81N	Outboard Bearing	1
81P	Inboard Bearing	1
81T	Inboard Bearing Thrust Plate	1
104A	Oil Lip Seal Bushing	1
104P	Oil Lip Seal	1
331A	Mechanical Seal (Motor Side)	1
331B	Mechanical Seal (Pump Side)	1
331C	Motor Housing O-Ring	1
331D	Mechanical Seal Bracket O-Ring	1
331F	Casing O-Ring	1

Item Number	Item Description	Num. Req.
331G	Upper Housing Cover O-Ring	1
331L	Mechanical Seal Lubricant	1
331M	Upper Housing Cover O-Ring	1
331N	Motor Lead Base O-Ring	1
331X	Mechanical Seal Moisture Sensor	1
331XC	Mech. Seal Moisture Cable Base	1
331XD	Mech. Seal Moisture Sensor Cable	1
411D	Oil Plug	2
441A	Discharge Elbow	1
441B	Companion Flange	1
497A	Motor Housing	1
497B	Upper Housing Cover	1
497C	Motor Lead Base Cover	1
497D	Motor Lead	1
497F	Stator	1
497G	Shaft (with Rotor)	1
497H	Motor Overload Protection	1
497X	Stainless Steel Eyehook	3

* Not shown in sectional.

Recommended spare parts are in BOLD.

FIGURE 9 – SAF Sectional Drawing



Item Number	Item Description	Num. Req.
1A	Casing	1
1C	Casing Cover	1
2D	Mechanical Seal Bracket	1
2E	Bearing Bracket	1
11P	Impeller	1
11PB	Impeller Liner	1
24A	Impeller Key	1
24B	Impeller Locknut	1
27A	Impeller Lockwasher	1
81N	Outboard Bearing	1
81P	Inboard Bearing	1
81T	Inboard Bearing Thrust Plate	1
104P	Oil Lip Seal Bushing	1
104PB	Oil Lip Seal	1
331A	Mechanical Seal (Motor Side)	1
331B	Mechanical Seal (Pump Side)	1
331C	Motor Housing O-Ring	1
331D	Mechanical Seal Bracket O-Ring	1
331F	Casing O-Ring	1

Item Number	Item Description	Num. Req.
331G	Upper Housing Cover O-Ring	1
331L	Mechanical Seal Lubricant	1
331M	Upper Housing Cover O-Ring	1
331N	Motor Lead Base O-Ring	1
331X	Mechanical Seal Moisture Sensor	1
331XC	Mech. Seal Moisture Cable Base	1
331XD	Mech. Seal Moisture Sensor Cable	1
411D	Oil Plug	2
497A	Motor Housing	1
497B	Upper Housing Cover	1
497C	Motor Lead Base Cover	1
497D	Motor Lead	1
497E	Motor Lead Base	1
497F	Stator	1
497G	Shaft (with Rotor)	1
497H	Motor Overload Protection	1
497K	Motor Housing Upper Cover	1
497X	Stainless Steel Eyehook	3

* Not shown in sectional.

Recommended spare parts are in BOLD.

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