BARNES®

INSTALLATION And OPERATION MANUAL
Submersible Solids Handling Pump

ES21 Frame

3ESDSG	Scroll Impeller, 7.5HP, 1750RPM
3ESDSE	Scroll Impeller, 10HP, 1750RPM
3ESDSF	Scroll Impeller, 15HP, 1750RPM
3ESDVD	Vortex Impeller, 7.5HP, 1750RPM
3ESDVDH	Vortex Impeller, 10HP, 1750RPM
4ESDSA	Scroll Impeller, 15HP, 1750RPM
4ESDSAH	Scroll Impeller, 15HP, 1750RPM

This product may be covered by one or more of the following patents and other patent(s) pending: US 63/703848, US 63/703852

IMPORTANT! ***Read all instructions in this manual before operating pump. As a result of Crane Pumps & Systems PFT Corp, constant product improvement program, product changes may occur. As such Crane Pumps & Systems reserves the right to change product without prior written notification.***

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SWPA MEMBER

Form No 150221: Rev. A

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Safety Guide

Please Read This Before Installing Or Operating Pump. This information is provided for **SAFETY and to PREVENT EQUIPMENT PROBLEMS**. To help recognize this information, observe the following symbols:

IMPORTANT! Warns about hazards that can result in personal injury or Indicates factors concerned with assembly, installation, operation, or maintenance which could result in damage to the machine or equipment if ignored.

CAUTION! Warns about hazards that can or will cause minor personal injury or property damage if ignored. Used with symbols below.

WARNING! Warns about hazards that can or will cause serious personal injury, death, or major property damage if ignored. Used with symbols below.

 Hazardous fluids can cause fire or explosions, burns or death could result.

 Biohazard can cause serious personal injury.

 Rotating machinery Amputation or severe laceration can result.

 Extremely hot - Severe burns can occur on contact.

 Hazardous fluids can Hazardous pressure, eruptions or explosions could cause personal injury or property damage.

 Hazardous voltage can shock, burn or cause death.

Only qualified personnel should install, operate and repair pump. Any wiring of pumps should be performed by a qualified electrician.

 **HIGH VOLTAGE**

To reduce risk of electrical shock, pumps and control panels must be properly grounded in accordance with the National Electric Code (NEC) or the Canadian Electrical Code (CEC) and all applicable state, province, local codes and ordinances.

Prior to energizing the pump, a verification of the pump ground circuit should be made. between the pump case and panel ground.

WARNING! To reduce risk of electrical shock, always disconnect the pump from the power source before handling or servicing. Lock out power and tag.

WARNING! Cable should be protected at all times to avoid punctures, cut, bruises and abrasions - inspect frequently. Never handle connected power cords with wet hands.

WARNING! To reduce risk of electrical shock, all wiring and junction connections should be made per the NEC or CEC and applicable state or province and local codes. Requirements may vary depending on usage and location.

WARNING! Submersible Pumps are not approved for use in swimming pools, recreational water installations, decorative fountains or any installation where human contact with the pumped fluid is common.

 **HIGH HEAT**

Operation against a closed discharge valve will cause premature bearing and seal failure on any pump, and on end suction and self priming pump the heat build may cause the generation of steam with resulting dangerous pressures. It is recommended that a high case temperature switch or pressure relief valve be installed on the pump body.

 **CAUTION!** Pumps build up heat and pressure during operation-allow time for pumps to cool before handling or servicing.

 **BIOHAZARD**

WARNING! Products returned must be cleaned, sanitized, or decontaminated as necessary prior to shipment, to insure that employees will not be exposed to health hazards in handling said material. All applicable laws and regulations shall apply.

Bronze/brass and bronze/brass fitted pumps may contain lead levels higher than considered safe for potable water systems. Lead is known to cause cancer and birth defects or other reproductive harm. Various government agencies have determined that leaded copper alloys should not be used in potable water applications. For non-leaded copper alloy materials of construction, please contact factory.

 **FLAMMABLE**

WARNING! DO NOT pump hazardous materials (flammable, caustic, etc.) unless the pump is specifically designed and designated to handle them.

IMPORTANT! Do not block or restrict discharge hose, as discharge hose may whip under pressure.

 **SHARP OBJECTS**

WARNING! DO NOT wear loose clothing that may become entangled in the impeller or other moving parts.

WARNING! Keep clear of suction and discharge openings. DO NOT insert fingers in pump with power connected.

 **EYE PROTECTION**

IMPORTANT! Always wear eye protection when working on pumps.

IMPORTANT! Make sure lifting handles are securely fastened each time before lifting. DO NOT operate pump without safety devices in place. Always replace safety devices that have been removed during service or repair. Secure the pump in its operating position so it can not tip over, fall or slide. DO NOT exceed manufacturers recommendation for maximum performance, as this could cause the motor to overheat. DO NOT remove cord and strain relief. Do not connect conduit to pump.

IMPORTANT! Crane Pumps & Systems PFT Corp. is not responsible for losses, injury, or death resulting from a failure to observe these safety precautions, misuse or abuse of pumps or equipment.

Section A: General Information

A-1) To the Purchaser:

Congratulations! You are the owner of one of the finest pumps on the market today. CP&S pumps are products engineered and manufactured of high-quality components. Over one hundred years of pump building experience along with a continuing quality assurance program combine to produce a pump which will stand up to the toughest applications. This manual will provide helpful information concerning installation, maintenance, and proper service guidelines.

A-2) Receiving:

Upon receiving the pump, it should be inspected for damage or shortages. If damage has occurred, file a claim immediately with the company that delivered the pump. **MAKE CERTAIN TO RETAIN THIS MANUAL!**

A-3) Storage:

Short Term

CP&S Pumps are manufactured for efficient performance following short inoperative periods in storage. For best results, pumps can be retained in storage, as factory assembled, in a dry atmosphere with constant temperatures for up to six (6) months.

Long Term

Any length of time exceeding six (6) months, but not more than twenty-four (24) months. The unit should be stored in a temperature-controlled area, a roofed over walled enclosure that provides protection from the elements (rain, snow, wind-blown dust, etc.), and whose temperature can be maintained between +40° F and +120° F. (4.4 - 49°C). Pump should be stored in its original shipping container. On initial startup, rotate impeller by hand to assure seal and impeller rotate freely.

If it is required that the pump be installed and tested before the long-term storage begins, such installation will be allowed provided:

- The pump is not installed under water for more than one (1) month.
- Immediately upon satisfactory completion of the test, the pump is removed, thoroughly dried, repacked in the original shipping container, and placed in a temperature-controlled storage area.

A-4) Service Centers:

For the location of the nearest service center, check with your Crane Pumps & Systems representative or Crane Pumps & Systems PFT Corp., Service Department in Piqua, Ohio, telephone (937) 778-8947 or Crane Pumps & Systems Canada, in Brampton, Ontario, (905) 457-6223.

Section B: Installation

B-1) Location:

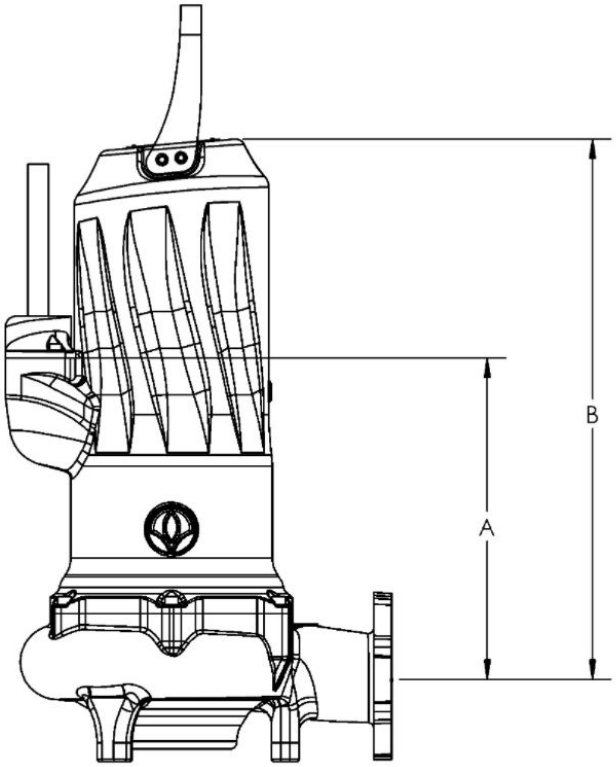
These self-contained pumping units are recommended for use in a sump, lift station or basin. This pump is designed for continuous duty, pumping sewage, effluent, wastewater or other nonexplosive or noncorrosive liquids not above 104°F (40°C). Never install the pump in a trench, ditch, or hole with a dirt bottom; the legs will sink into the dirt and the suction will become plugged.

NOTE

For proper lubrication, outer shaft seal must remain submerged in liquid during normal operation regardless of installation type.

B-1.1) Minimum Submergence:

The pump is recommended to run fully submerged to achieve optimum performance. However, it is designed for continuous duty operation with the sump liquid level at the junction of the cord entry (SS cord housing) and the motor housing cord boss (CI), ensuring proper heat transfer to maintain optimal motor running temperature. Refer to the below image and table.



SyFlo Minimum Submergence

Hydraulic Series	Dimension "A" Minimum Continuous Duty Submergence	Dimension "B" Recommended Continuous Duty Submergence
4SAH	17.31	29.10
4SA	17.31	29.10
3VDH	16.39	28.19
3VD	16.39	28.19
3SE	16.56	28.36
3SF	17.44	29.23
3SG	16.56	28.36

B-2) Discharge:

Discharge piping should be as short as possible. Both a check valve and a shut-off valve are recommended for each pump being used. The check valve is used to prevent backflow into the sump. Excessive backflow can cause flooding and/or damage to the pump. The shut-off valve is used to stop system flow during pump or check valve servicing.

B-3) Liquid Level Controls:

It is recommended to use a liquid level control system that allows the on and off point to be separated by at least twelve inches. An additional set point (lag point) should be incorporated with an alternator switching system for a duplex (two pump) station. A high level alarm may be required to alert maintenance personnel that there is a high water situation in the wet well should the output of the pump station drop below the inflow rate. A low level cut off may be installed to provide system shutdown if the main level control system malfunctions. The off point should be positioned so that the liquid level never drops below the top of the volute.

WARNING

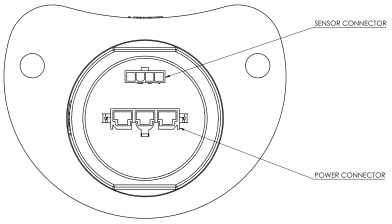
WARNING!All model pumps and control panels must be properly grounded per the NATIONAL ELECTRIC CODE or CANADIAN ELECTRIC CODE, State, Province and local codes. Improper grounding voids warranty.

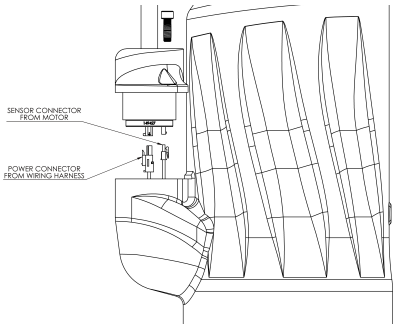
B-4) Power/Control Cord:

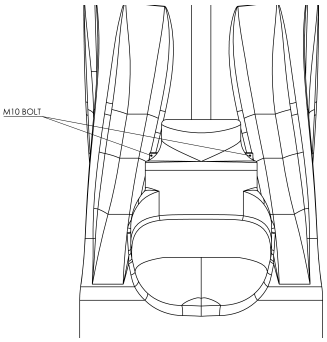
The voltage connection for the motor is determined by the wiring harness used. Low voltage pumps (208 & 230 Volt) utilize a wiring harness that is colored black. High voltage pumps (460 Volt) utilize a wiring harness that is colored white. High voltage pumps (575 Volt) do not utilize a wiring harness and are connected directly to the motor. It is important to verify that the cord being used is rated for the nameplate voltage and amperage rating shown on the pump nameplate. Refer to the Motor Data Table. Always consult the factory before making a voltage change. No internal wiring adjustments are necessary for dual voltage pumps. All jumper connections to set the proper voltage are made by the wiring harness itself.

To install the cord assembly, ensure the cord sealing O-ring is in place on the cord. Install the three-terminal power connector from the wiring harness to the corresponding three terminal connector on the cord assembly. Install the four-terminal sensor connector from the to the corresponding four terminal connector on the cord assembly. Insert the cord assembly into the cord entry of the pump housing. Ensure that the bolt holes on the cord assembly are aligned with the bolt holes on the pump housing. Install the two 10mm socket head cap screws and torque to 35 ft-lbs.

The cord assembly mounted to the pump must not be modified in any way except for shortening to a specific application. Any splice between the pump and the control panel must be made in accordance with all applicable electric codes. It is recommended that a junction box (if used) be mounted outside the sump or be of at least NEMA 6 or 6P construction with NEMA 6 or 6P watertight cord grips if located within the wet well. A water and vapor tight seal fitting MUST be used in conduit leaving the wet well to prevent moisture and gases from reaching the control panel. Prior to installation, the pump power cable should be inspected for nicks or damage. If damaged, the cord should be replaced before installation.







WARNING

WARNING!⚠CORD CLAMPING PLATE SHOULD BE DRAWN METAL TO METAL (35 FT/LBS BOLT TORQUE). IF A GAP EXISTS CONTINUE TO TIGHTEN BOLTS.

DO NOT USE THE POWER CORD TO LIFT PUMP.

B-4.1) Electrical Connections:

When the electrical connections are made, the lead wires from the power cable should be stripped so that the ground wire is at least two inches longer than the power leads. This will ensure that if the cable is inadvertently pulled out of the connection point, the ground wire will be the last lead to break the circuit.

B-4.2) Wire Size:

If additional cable is required consult a qualified electrician for proper wire size. Voltage drop due to wire resistance between the pump and power connection point should be limited to 3% when additional cable is added.

NOTE

WARRANTY NOTE: Both the temperature sensor and moisture detection system must be connected to the motor circuitry such that the motor will be de-energized or sound alarm if excessive motor temperatures are reached and/or if water is detected in the seal chamber and/or motor chamber. Failure to have the above mentioned systems installed and operative, nullifies warranty.

Installation Types

Wet-Pit Installation

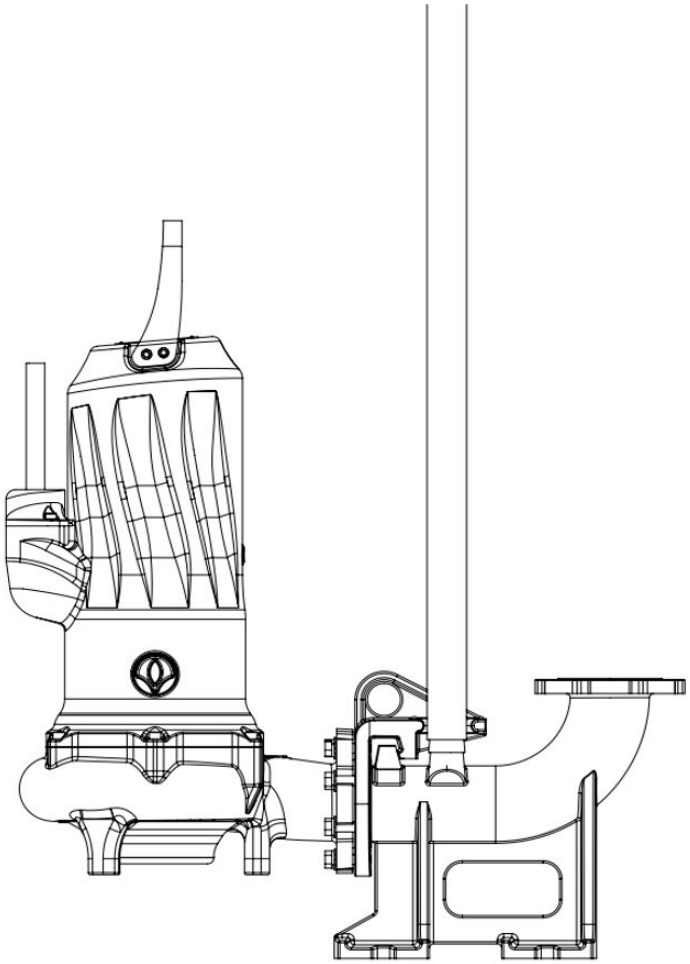


FIGURE 1 – Vertical Installation using BAF

The Break Away Fitting (BAF) discharge system is designed to allow the submersible wastewater pump to be installed or removed without requiring personnel to enter the wet well. Place the Break Away Fitting (BAF) in position. Temporarily secure the guide rails in the upper mounting brackets and locate the base elbow on the bottom of the wet well. Level the base elbow with grout and/or shims. Install the intermediate support brackets, if required. Make sure the rails are in a true vertical position so the pump will clear the access opening and will slide freely down the rails into place on the discharge base elbow. Once the rails are in proper alignment, bolt the base elbow into the floor of the station and connect the discharge pipe to the elbow. Connect the movable portion and other supplied fittings of the BAF onto the pump and lower into wet well. See the Break Away Fitting manual for more information.

NOTE
For suction clearance refer to station drawings.

Motor Data

Horse-power	Voltage	Phase	Hz	RPM (Nominal)	Service Factor	NEMA Start Code	FLA	LRA	Winding Resist-ance (Ω)	Driver	Power Cord ▲	Cord Size
7.5	208-230	3	60	1750	1.15	H	20.4 / 18.7	109.0 / 126.0	0.306	ES21	149431	12/4 & 18/4
7.5	460	3	60	1750	1.15	H	9.7	60.0	1.22	ES21	149431	12/4 & 18/4
7.5	575	3	60	1750	1.15	H	7.5	50.0	1.94	ES21	149431	12/4 & 18/4
10	208-230	3	60	1750	1.15	H	27.5 / 25.6	146.0 / 170.0	0.225	ES21	149431	12/4 & 18/4
10	460	3	60	1750	1.15	H	12.8	81.0	0.901	ES21	149431	12/4 & 18/4
10	575	3	60	1750	1.15	H	10.2	69.0	1.38	ES21	149431	12/4 & 18/4
15	208-230	3	60	1750	1.15	J	40.0 / 38.0	262.0 / 302.0	0.119	ES21	149479	8/4 & 18/4
15	460	3	60	1750	1.15	J	19.2	151.0	0.478	ES21	149431	12/4 & 18/4
15	575	3	60	1750	1.15	J	15.2	121.0	0.789	ES21	149431	12/4 & 18/4
10	208-230	3	60	3450	1.15	H	25.9 / 22.8	136.0 / 158.0	0.22	ES21	149431	12/4 & 18/4
10	460	3	60	3450	1.15	H	11.4	79.0	0.879	ES21	149431	12/4 & 18/4
10	575	3	60	3450	1.15	H	9.2	65.0	1.46	ES21	149431	12/4 & 18/4

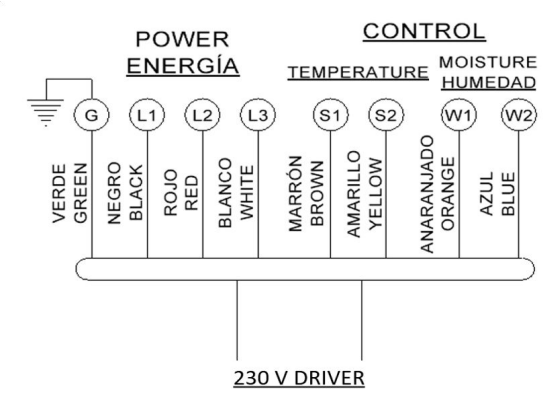
NOTE
Moisture and Temperature sensor leads are integral to power cord.

Winding resistance measured in OHMS @ 25°C (Between Lines) at motor leads. Winding Resistance ± 7.5%

Pump rated for operation at ± 10% voltage at motor.

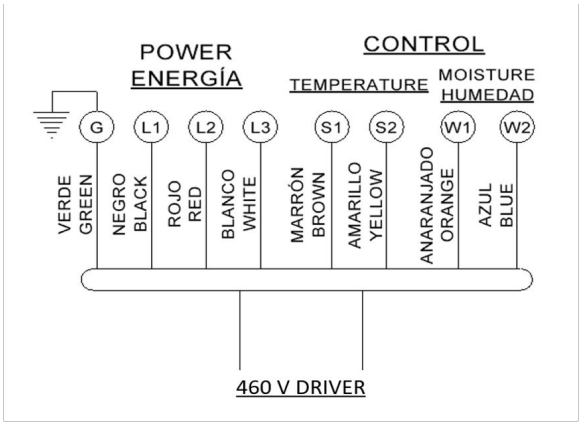
▲ Cord Suffix: XC - 30 Feet, XF - 50 Feet, XJ - 75 Feet, or XL - 100 Feet

Three Phase 208-230 Volt AC



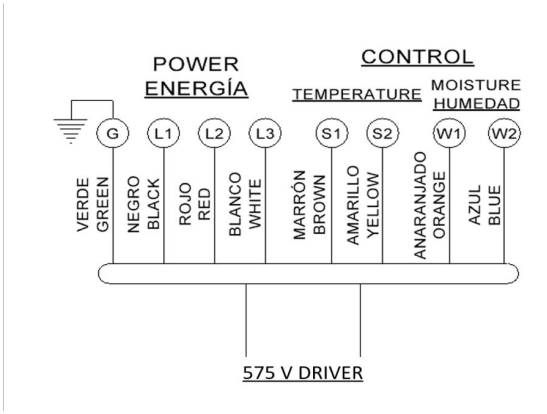
Power Cable	Motor Lead ID
Green	Ground
Black	L1
Red	L2
White	L3

Three Phase 460 Volt AC



Power Cable	Motor Lead ID
Green	Ground
Black	L1
Red	L2
White	L3

Three Phase 575 Volt AC



Power Cable	Motor Lead ID
Green	Ground
Black	L1
Red	L2
White	L3

Ground Note

External Ground Note: (Ground symbol) An external ground screw is provided on the side of the motor cap which can be used for supplemental bonding connection where local codes permit or require such connection.

Wiring Diagram

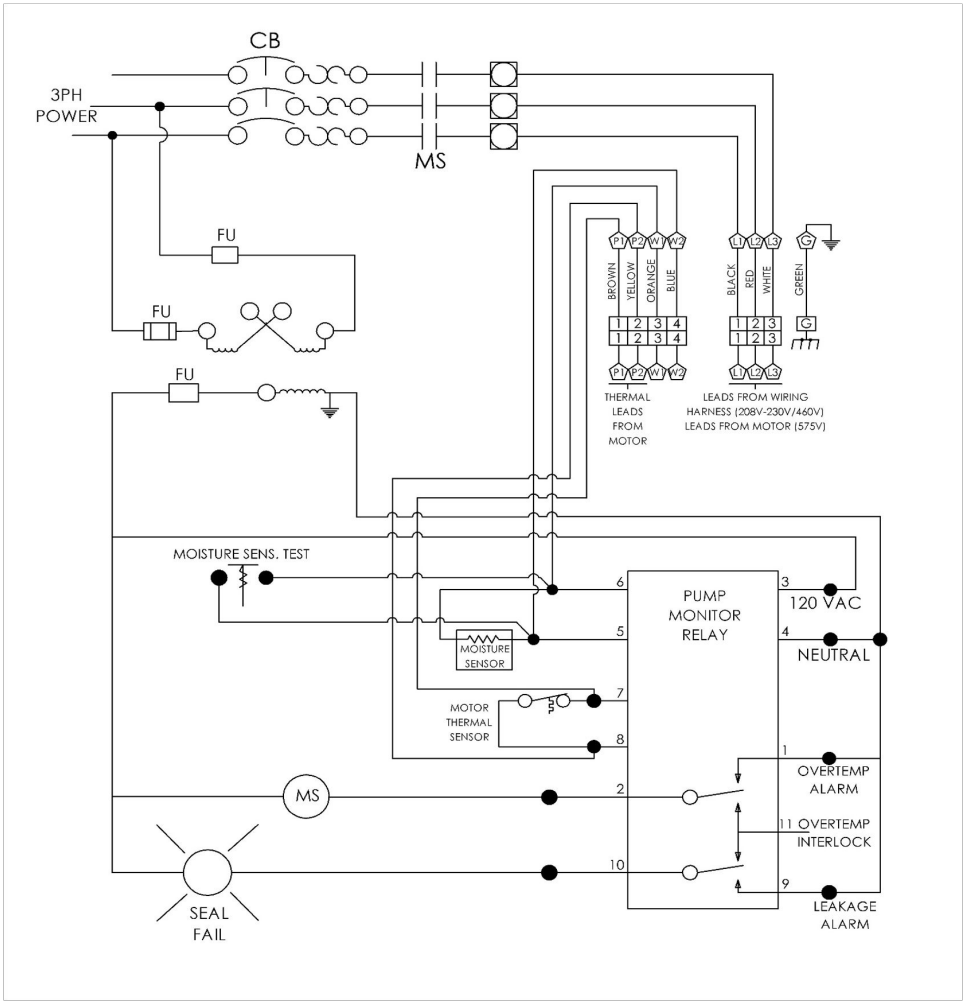


FIgure 7

B-4.3) Overload Protection:

Current sensing overloads must be provided in the pump control panel and should be properly sized for the full load current of the pump. Three normally closed (N/C) thermal sensors wired in series (one per phase) are embedded in the motor windings and will detect excessive heat in the event an overload condition occurs. Upon sensing the over temperature condition, the normally closed contact in the sensors will open and turn the pump off when wired in series with the motor contactor control circuit. The thermal sensor leads marked P1 and P2 MUST be connected in series with the pilot circuit of the magnetic motor controller located in the control panel so that the thermostat will open the circuit before dangerous temperatures are reached.

A manual momentary start switch is required to prevent the automatic restarting of the motor when the thermostat resets, refer to Figure 7.

In the event of an over temperature condition, the source of this condition should be determined and rectified before the pump is put back into normal operation. **DO NOT LET THE PUMP CYCLE OR RUN IF AN OVER TEMPERATURE CONDITION OCCURS!**

If current through the temperature sensor exceeds the values listed, an intermediate control circuit relay must be used to reduce the current or the sensor will not work properly.

TEMPERATURE SENSOR ELECTRICAL RATINGS

Volts	Continuous Amperes	Inrush Amperes
110-120	3.00	30.0
220-240	1.50	15.0
440-480	0.75	7.5

B-4.4) Moisture Sensor:

A normally open (N/O) float is installed in the pump moisture chamber, which can be used detect any moisture present. A 330 K-Ohm, 1 watt test resistor is mounted between the leads to allow for verification that the moisture sensor circuit is in-tact using a multi-meter. The moisture sensor MUST be connected to moisture detector control in the control panel. The normally closed (N/C) contact of the moisture detector MUST be connected in series with the control circuit of the motor contactor. Wiring must be provided from the moisture detector sensor leads of the motor designated W1 and W2. In the event of moisture detection, the pump should be pulled and the source of the failure located and repaired. **IF MOISTURE DETECTION HAS OCCURRED, SCHEDULE MAINTENANCE AS SOON AS POSSIBLE!**

B-4.5) Control Panel and Electrical System:

The control panel and the electrical system MUST be properly designed and wired to include at least, but not limited to the following;

a. Proper grounding per NEC.

b. A temperature sensing circuit (See Fig. 7)

c. A moisture detection circuit with continuity test circuit (See Fig. 7)

d. A level control system.

e. A main power manual disconnect and lock out.

f. A motor starter and overload system.

It is recommended that the Crane Pumps & Systems Pump Monitor Relay (P/N 134667) be installed in the control panel to perform the control circuit functions for the Temperature and Moisture Sensor Monitoring described in sections B4.3 and B4.4. The Pump Monitor Relay was designed to perform these functions in a compact module that can be base or panel mounted and is resistant to noise issues found with some VFD's. Indicator lights on the front display notify the operator in the event of a fault condition for either temperature, moisture or both. Normally open and normally closed contacts are flexible to accommodate nearly any wiring scenario and the moisture sensor sensitivity can be adjusted to prevent nuisance alarms.

B-5) When Used with a Variable Speed Drive:

Maximum turndown should not exceed 50%. Drive should be set to operate in constant torque mode.

Section C: Start Up Operation

C-1) Check Voltage and Phase:

Before operating pump, compare the voltage and phase information stamped on the pump's identification plate to the available power. Prior to energizing the pump, a verification of the pump ground circuit should be made between the pump case and panel ground using a continuity tester or ohm meter.

C-2) Check Pump Rotation:

Before putting pump into service for the first time, the motor rotation must be checked. Improper motor rotation will result in poor pump performance and can damage the motor and/or pump. To check the rotation, suspend the pump freely, momentarily apply power and observe the kickback. Kickback should always be in a counter-clockwise direction as viewed from the top of the pump motor housing and will always be in the opposite direction of the rotation arrows cast in the pump volute.

C-2.1) Incorrect Rotation for Three-Phase Pumps:

In the event that the rotation is incorrect for a three-phase installation, interchange any two power cable leads at the control box. Recheck the kickback rotation again by momentarily applying power.

C-2.2) Test Procedure For Moisture Sensor Control:

With a moisture detection control, a normally open push button is typically provided as a means of checking the moisture sensing components. When the push button is depressed, the probes will be shorted simulating water. While being held, the seal leakage indicating lamp will be illuminated to indicate (A) power is supplied to the control, (B) the control is operative, and (C) wiring to the moisture sensing probes in the pump is intact. This procedure should be performed periodically to confirm integrity of the circuit.

C-3) Start-Up Report:

The Start-Up report is located on our website: https://www.cranepumps.com/ProductRegistration, this report is to be completed as applicable. Return a copy to Crane Pumps & Systems and store a copy in the control panel or with the pump manual. It is important to record this data at initial start-up since it will be useful to refer to should servicing the pump be required in the future.

C-3.1) Identification Plate:

Record the numbers from the pump's identification plate on the Start-Up report.

C-3.2) Insulation Test:

Before the pump is put into service, an insulation (megger) test should be performed on the motor. The resistance values (ohms) as well as the voltage (volts) and current (amps) should be recorded on the start-up report. Pumps/systems with an insulation value of less than 5 M-Ohms should be investigated for moisture or damaged cables before proceeding.

C-3.3) Pump-Down Test:

After the pump has been properly wired and lowered into the basin, sump or lift station, it is advisable to check the system by filling with liquid and allowing the pump to operate through it's pumping cycle. The time needed to empty the system, or pump-down time along with the volume of water, should be recorded on the start-up report.

IMPORTANT

IMPORTANT! THE MAXIMUM ALLOWABLE STARTS PER HOUR IS 30, EVENLY SPACED.

Section D: Preventative Maintenance

Generally CP&S Pumps will give very reliable service and can be expected to operate for years of normal sewage pumping without failing. However, as with any mechanical piece of equipment a preventive maintenance program is recommended and suggested to include the following checks:

1. Test moisture detector control "Test Switch" for continuity of circuit. Water in the seal chamber will energize a seal leak warning light at the control panel. This is a warning light only and does not stop the motor. It indicates the seal has leaked and must be repaired. This should be done within 2 or 3 weeks to prevent further damage. See section C-2.2.
2. Inspect impeller and body for excessive build-up or clogging and repair as required per section E-2.
3. Inspect outer shaft seal and replace as required per section E-3.
4. Check motor for ground leakage and proper amp draw.

Section E: Service and Repair

NOTE
All item numbers in Section E refer to the pump exploded view.

WARNING

 **WARNING!**Electrical power to the pump motors must be disconnected and locked out to prevent any dangerous electrical hazards or personnel danger before any service work is done to the pump.

CAUTION

 **CAUTION!**Operating pump builds up heat and pressure; allow time for pump to cool to room temperature before handling or servicing.

E-1) Oil

E-1.1) Checking Oil

1. Place pump on it's side, and drain oil into a clean, dry container.
2. If oil is found to be clean and uncontaminated, refill the oil chamber as per section E-1.2.
3. If it is found to be dirty or contaminated, the pump must be carefully inspected for leaks at the shaft seal (10), before refilling with oil. To locate the leak, perform a pressure test as per section E-1.3. After leak is repaired, refill with new oil as per section E-1.2.

E-1.2) Replacing Oil:

Drain oil from oil chamber and dispose of properly. Refill with new oil, which must be 100% dielectric oil. ES21 Frame pumps require 6.175 quarts of oil. Note that the amounts are estimates, and an air gap must be left to compensate for oil expansion. Ensure that the unit is filled in an upright position.

E-1.3) Pressure Test:

Seal Chamber - Before checking the pump for leaks around the shaft seal, the coolant level should be full. Remove pipe plug. Apply pipe sealant to pressure gauge assembly and tighten into pipe plug hole. Pressurize seal chamber to 12 P.S.I. Use a soap solution around the sealed area and inspect joints for air bubbles. If, after three minutes, the pressure is still holding constant, and no bubbles are observed, slowly bleed the pressure and remove the gauge assembly. Replace the pipe plug using a sealant. If the pressure does not hold, then the leak must be located. Refer to service manual for more details on pressure test.

CAUTION

 Pressure builds up extremely fast, increase pressure by “tapping” air nozzle. Too much pressure will damage seal. Do not exceed 10 P.S.I. in seal chamber.

E-2) Impeller and Volute Service:

E-2.1) Disassembly and Inspection:

To clean out the volute, or clean out or replace impeller, disconnect power, remove cap screws then vertically lift motor assembly from the pump body. Clean out the volute, if necessary, clean and examine impeller for pitting or wear, replace if required. To remove Impeller, remove cap screw. The impeller is keyed onto the shaft with a square key and to remove, pull impeller straight off the shaft using a wheel puller if required. Before reinstallation, check the motor shaft and impeller bore for damage.

E-2.2) Reassembly:

To install impeller, apply a thin film of oil to motor shaft and slide impeller straight onto shaft, keeping keyways lined up. Drive key into keyway. Thread cap screw into shaft and torque to 45 ft. lbs. Rotate impeller to check for binding. Loctite cap screws, insert into volute and motor assembly and torque to 35 ft. lbs. Check for free rotation of motor and impeller.

E-3) Outer Shaft Seal Service:

CAUTION

⚠Handle seal parts with extreme care. DO NOT scratch or mar lapped surfaces.

E-3.1) Disassembly and Inspection:

To expose outer shaft seal (4) for examination, remove Impeller and Volute per Section E-2.1. Set motor assembly in the inverted position to prevent loss of oil. Remove snap ring from motor shaft, then retaining ring, spring and rotating member from shaft, See Figure 10. Examine all seal parts and especially contact faces. Inspect seal for signs of wear such as uneven wear pattern on stationary members, chips and scratches on either seal face. DO NOT interchange seal components, replace the entire shaft seal. If replacing seal, remove stationary from mounting plate by prying out with flat screwdriver.

E-3.2) Reassembly:

Lightly oil (DO NOT use grease) outer surface of stationary member. Press stationary member firmly into mounting plate using a seal pusher aligning seal with pin, nothing but the seal pusher is to come in contact with seal face (See Fig. 11).

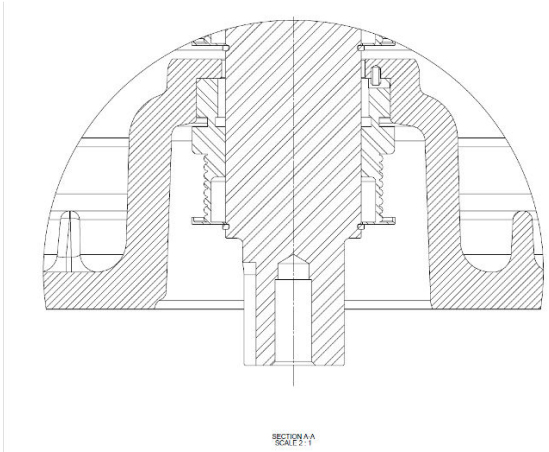


FIGURE 10

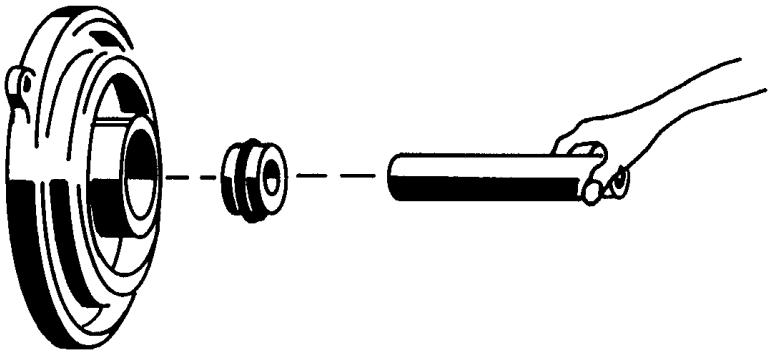


FIGURE 11

Make sure the stationary member is in straight and that the rubber ring is not out of it's groove. Lightly oil (DO NOT use grease) shaft and inner surface of bellows on rotating member see Figure 11. With lapped surface of rotating member facing inward toward stationary member (4A), slide rotating member onto shaft using a seal pusher, until lapped faces of and are together (See Fig. 12).

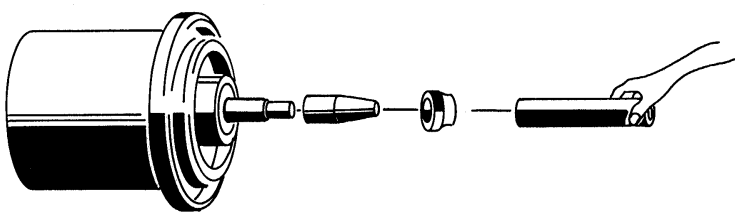


FIGURE 12

Place spring over shaft and in place on rotating member, making sure it is seated on retainer and not cocked or resting on bellows tail. Slide retaining ring over shaft and let rest on spring. Replace snap ring onto motor shaft. Inspect gasket and replace if cut or damaged. Assemble impeller and volute as outlined in paragraph E-2.2.

IMPORTANT

⚠It is extremely important to keep seal faces clean during assembly. Dirt particles lodged between these faces will cause the seal to leak.

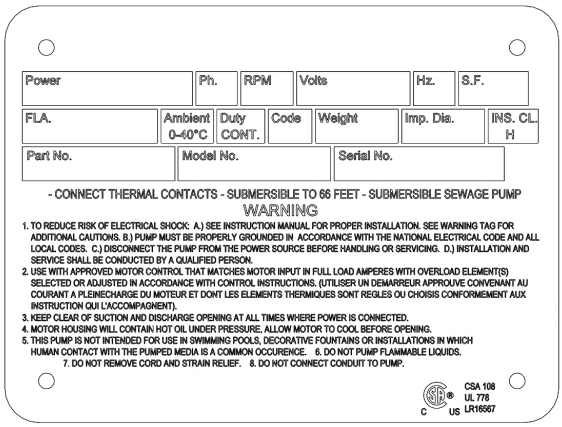
Section F: Replacement Parts

F-1 Ordering Replacement Parts

When ordering replacement parts, ALWAYS furnish the following information:

1. Pump serial number and date code. (Paragraph F-4)
2. Pump model number. (Paragraph F-3)
3. Pump part number. (Paragraph F-2)
4. Part description.
5. Item part number.
6. Quantity required.
7. Shipping instructions.
8. Billing Instructions.

Nameplate



F-2 Part Number:

This number is used for ordering and obtaining information.

F-3 Model Number:

This designation consists of numbers and letters which represent the discharge size, series, horsepower, motor phase and voltage, speed and pump design. This number is used for ordering and obtaining information.

F-4 Serial Number:

The serial number block will consist of a six digit number, which is specific to each pump and may be preceded by an alpha character, which indicates the plant location. This number will also be suffixed with a four digit number, which indicates the date the unit was built (Date Code). EXAMPLE: T012345 0490.

Reference the first portion (Serial Number) of this number when referring to the product.

Nomenclature

Example Model Number: 4(X)ESDSA15094

4	(X)ESD	S	A	150	9	4
Pump Discharge Size	Pump Series	Impeller Type	Hydraulic Set	Power Rating	Voltage & Frequency	No. of Poles/ Speed

Trouble Shooting

CAUTION
Always disconnect the pump from the electrical power source before handling. If the system fails to operate properly, carefully read instructions and perform maintenance recommendations. If operating problems persist, the following chart may be of assistance in identifying and correcting them:

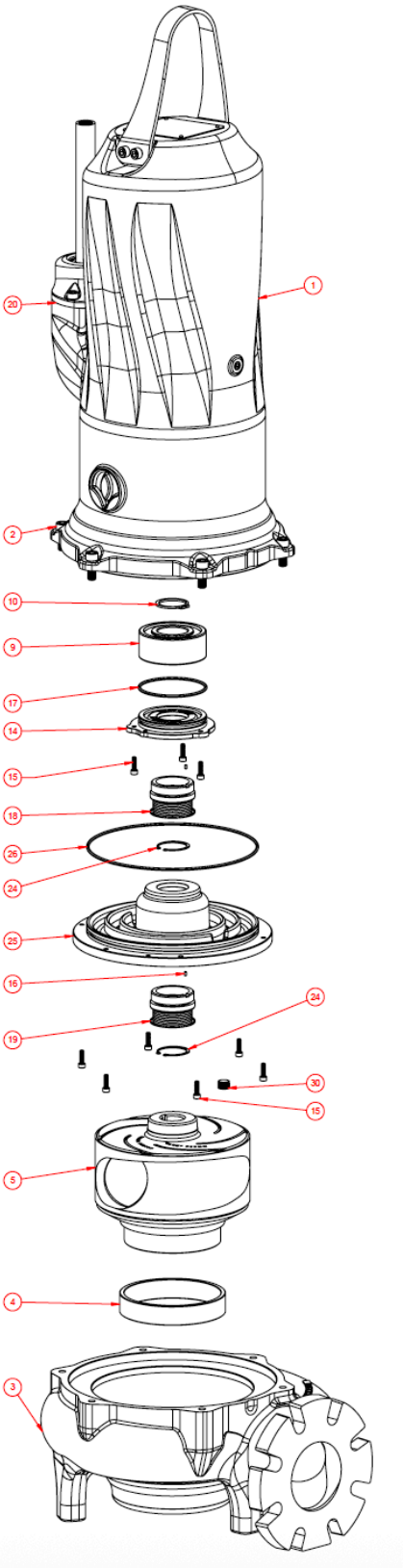
MATCH "CAUSE" NUMBER WITH CORRELATING "CORRECTION" NUMBER.

NOTE
Not all problems and corrections will apply to each pump model.

PROBLEM	CAUSE	CORRECTION
Pump will not run	1. Poor electrical connection, blown fuse, tripped breaker or other interruption of power, improper power supply. 2. Motor or switch inoperative (to isolate cause, go to manual operation of pump). a. Float movement restricted. b. Switch will not activate pump or is defective. c. Defective motor 3. Insufficient liquid level.	1. Check all electrical connections for security. Have electrician measure current in motor leads, if current is within ±20% of locked rotor Amps, impeller is probably locked. If current is 0, overload may be tripped. Remove power, allow pump to cool, then recheck current. 2a. Reposition pump or clean basin as required to provide adequate clearance for float. 2b. Disconnect level control. Set ohmmeter for a low range, such as 100 ohms full scale and connect to level control leads. Actuate level control manually and check to see that ohmmeter shows zero ohms for closed switch and full scale for open switch. (Float Switch). 2c. Check winding insulation (Megger Test) and winding resistance. If check is outside of range, dry and recheck. If still defective, replace per service instructions. 3. Make sure liquid level is at least equal to suggested turn-on point. 4. Recheck all sizing calculations to determine proper pump size. 5. Check discharge line for restrictions, including ice if line passes through or into cold areas. 6. Remove and examine check valve for proper installation and freedom of operation. 7. Open valve. 8. Check impeller for freedom of operation, security and condition. Clean impeller and inlet of any obstruction. 9. Loosen union slightly to allow trapped air to escape.Verify that turn-off level of switch is set so that the suction is always flooded. Clean vent hole. 10. Check rotation. If power supply is three phase, reverse any two of three power supply leads to ensure proper impeller rotation. 11. Repair fixtures as required to eliminate leakage. 12. Check pump temperature limits & fluid temperature. 13. Replace portion of discharge pipe with flexible connector. 14. Turn to automatic position. 15. Check for leaks around basin inlet and outlets.
Pump will not turn off	2a. Float movement restricted. 2b. Switch will not activate pump or is defective. 4. Excessive inflow or pump not properly sized for application. 9. Pump may be airlocked 14. H-O-A switch on panel is in "HAND" position	
Pump hums but does not run	1. Incorrect voltage 8. Impeller jammed or loose on shaft, worn or damaged, impeller cavity or inlet plugged.	
Pump delivers insufficient capacity	1. Incorrect voltage. 4. Excessive inflow or pump not properly sized for application. 5. Discharge restricted. 6. Check valve stuck closed or installed backwards. 7. Shut-off valve closed. 8. Impeller jammed or loose on shaft, worn or damaged, impeller cavity or inlet plugged. 9. Pump may be airlocked. 10. Pump running backwards	
Pump cycles too frequently or runs periodically when fixtures are not in use	6. Check valve stuck closed or installed backwards. 11. Fixtures are leaking. 15. Ground water entering basin	
Pump shuts off and turns on independent of switch, (trips thermal overload protector). **CAUTION!** Pump may start unexpectedly. Disconnect power supply.	1. Incorrect voltage. 4. Excessive inflow or pump not properly sized for application. 8. Impeller jammed, loose on shaft, worn or damaged, impeller cavity or inlet plugged. 12. Excessive water temperature (internal protection only)	
Pump operates noisily or vibrates excessively	2c. Worn bearings, motor shaft bent. 5. Debris in impeller cavity or broken impeller 10. Pump running backwards 13. Piping attachments to building structure too rigid or too loose.	

SyFlo - ESD Pump Series - Exploded Views

Vortex and Scroll Impellers



ITEM NO	QTY	PART NO	DESCRIPTION	MATERIAL
1	1	SEE TABLE	HOUSING,MOTOR,ES21	CLASS 35 CI
2	6	136284	SCREW,SHCS,M12X1.75X30	300 SS
3	1	SEE TABLE	VOLUTE	CLASS 35 CI
4	1	SEE TABLE	WEAR,RING	LEAD FREE BRONZE
5	1	SEE TABLE	MACH,IMP	SS
6	1	127223-35	SCREW,SHCS,M12X1.75X35	300 SS
7	1	149883	KEY,.31X.31X1.25",303 SS	300 SS
8	1	149077	BRACKET,BEAR,ES21	CLASS 35 CI
9	1	146941	BEARING,BALL,3309,SEALED	
10	1	149309	RING,SNAP,45mm,HD,STL	1060-1090 STL
11	1	146961	BEARING,BALL,6306	
12	1	149629	SENSOR,MOIST,ES,W-RESIST	
13	1	2-31003-272	ORING,2-272,BUNA-N,70 DURO	BUNA-N
14	1	149083	RETAINER,BEARING,LSE21	CLASS 35 CI
15	10	147592-20	SCREW,SKHD,M6X1.0X20,SS	A2-70 SS
16	2	145212	PIN,SPRING,3MMX6MM	SPRING STEEL
17	1	2-31003-239	O-RING,-239,BUNA,3.60"ID	BUNA-N
18	1	125852A	SEAL,MECH-TYP21,1.75",C/SC/B	SC/SC/B
19	1	125852	SEAL,MECH-TYP21,1.75",C/CE/B	C/CE/B
20	1	149428	HOUSING,CORD,OUTER	CF8 SS304
21	1	149796	WASHER,GROMMET,COMP,SS	SS
22	1	147645-10	SCREW,SHCS,M5X.8x10	316 SS
23	1	2-31003-232	ORING,2-232,BUNA-N,70 DURO	BUNA-N
24	2	129381	RING,RETAIN,EXT,5100-175-H	PH 15-7 Mo SS
25	1	149078	PLATE,SEAL,ES21	CLASS 35 CI
26	1	2-31003-272	ORING,2-272,BUNA-N,70 DURO	BUNA-N
27	1	149082	RING,RETAINER,VH-975	CARBON STEEL
28	1	127271	WASHER,SPRING,WAVY,72MM	STEEL
29	1	127269	PLUG,PIPE,.250-18 NPT,SS	300 SERIES SS
30	1	014270-SS	PLUG,PIPE,.375-18NPT,C'SUNK	300 SERIES SS

SyFlo - Parts List

ESD Pump Series Power Cable Chart

Part Number	Length (feet)	Volt	Max. Amps	Cord Size	Cord O.D. ±0.2in (0.5mm)
149431XC	30	208-600	31.7	12/4 - 18/4	0.86in (22.0mm)
149431XF	50	208-600	31.7	12/4 - 18/4	0.86in (22.0mm)
149431XJ	75	208-600	31.7	12/4 - 18/4	0.86in (22.0mm)
149431XL	100	208-600	31.7	12/4 - 18/4	0.86in (22.0mm)
149479XC	30	208-600	59.0	8/4 - 18/4	1.12in (28.4mm)
149479XF	50	208-600	59.0	8/4 - 18/4	1.12in (28.4mm)
149479XJ	75	208-600	59.0	8/4 - 18/4	1.12in (28.4mm)
149479XL	100	208-600	59.0	8/4 - 18/4	1.12in (28.4mm)

Seal Kit

Seal Kit Part No.	I.B. Seal Part No.	I.B. Seal Material	O.B. Seal Part No.	O.B. Seal Material
150170	125852	Carbon/Ceramic	125852SD	Silicon Carbide / Silicon Carbide
149880	125852A	Carbon / Silicon Carbide	125852SD	Silicon Carbide / Silicon Carbide
Seal Kit Includes: O-rings, Retaining Rings, Key, Inboard Seal, Outboard Seal				

Volute Kit

Model	Volute Part Number
3ESDSE	149555W
3ESDVD	149445
3ESDVDH	149445
3ESDSF	149478W
4ESDSA	149419W
4ESDSAH	149419W
3ESDSG	149555W
Volute Kit Includes: Volute (painted), Wear Ring (pressed) on non-vortex (V) models	

Impeller

Model	Impeller Part Number Cast Iron	Impeller Part Number White Iron
4ESDSA	149558	149558N
4ESDSAH	149417	149417N
3ESDSE	149573	149573N
3ESDSF	149618	149618N
3ESDVD	N/A	149446A
3ESDVDH	N/A	149446
3ESDSG	149574	149574N

Hardware Kit

Hardware Kit Part Number	Impeller Type
149878	Scroll, Mono, Dual
149878V	Vortex
Hardware Kit Includes: Screws, Washer (Vortex Only)	

Impeller Attachment Kit

Impeller Attachment Kit Part Number	Impeller Type
149881	Scroll, Mono, Dual
149881V	Vortex
Impeller Attachment Kit Includes: Impeller Bolt, Impeller Washer (Vortex Only)	

Leg Kits

Model	Leg Kit Part Number	Leg Kit Height Inches (mm)
3ESDSE	125506B	6.50 (165)
3ESDVD	125506B	6.50 (165)
3ESDVDH	125506B	6.50 (165)
3ESDSF	125506B	6.50 (165)
4ESDSA	125506B	6.50 (165)
4ESDSAH	125506B	6.50 (165)
3ESDSG	125506B	6.50 (165)
Leg Kit Includes: 3 Legs (painted), Attachment Hardware		

Motor/Driver Kit

Motor Rating	Motor Part Number	Wiring Harness Part Number	Motor/Driver Kit Part Number
15HP 4P 208-230V	149072-40-431	149452	150070
15HP 4P 460V	149072-40-431	149453	150071
15HP 4P 575V	149072-40-440	N/A	150072
10HP 4P 208-230V	149072-30-431	149452	150073
10HP 4P 460V	149072-30-431	149453	150074
10HP 4P 575V	149072-30-440	N/A	150075
10HP 2P 208-230V	149071-20-231	149452	150076
10HP 2P 460V	149071-20-231	149453	150077
10HP 2P 575V	149071-20-240	N/A	150078
7.5HP 4P 208-230V	149072-20-431	149452	150079
7.5HP 4P 460V	149072-20-431	149453	150080
7.5HP 4P 575V	149072-20-440	N/A	150081
Motor Kit Includes: Driver, Cord Covering			

Wiring Harness Kit

Wiring Harness Part Number	Voltage	Wiring Harness Kit Part Number
149452	203-230	150094
149453	460	150095
Wiring Harness Kit Includes: Wiring Harness, Packaging		

Bearing Kit Includes	Bearing Kit Part Number
Snap Ring, Large Ball Bearing, Small Ball Wearing, Wavy Spring Washer	149877

Bearing Bracket Kit Includes	Bearing Bracket Kit Part Number
Bearing Bracket (painted)	149879

Moisture Sensor Kit Includes	Moisture Sensor Kit Part Number
Moisture Sensor, Packaging	149882

3-4" Adapter Kit Includes	3-4" Adapter Kit Part Number
Stainless Steel Adapter, 3" Gasket, 4" Gasket, Socket Head Screws, Hex Head Screws, Nuts	149861

IMPORTANT!
WARRANTY REGISTRATION

Your product is covered by a warranty:
https://cranepumps.com/wp-content/uploads/2023/12/Terms_And_Conditions_USA.pdf

START UP GUIDE: https://www.cranepumps.com/productregistration

If you have a claim under the provisions of the warranty, contact your local Crane Pumps & Systems, Inc. Distributor.

RETURNED GOODS
RETURN OF MERCHANDISE REQUIRES A "RETURNED GOODS AUTHORIZATION".
CONTACT YOUR LOCAL CRANE PUMPS & SYSTEMS, INC. DISTRIBUTOR.

Products Returned Must Be Cleaned, Sanitized, Or Decontaminated As Necessary Prior To Shipment, To Insure That Employees Will Not Be Exposed To Health Hazards In Handling Said Material. All Applicable Laws And Regulations Shall Apply.