



ITT

Goulds Pumps

Mechanical Installation, Operation, and Maintenance Manual

AquaForce Variable Speed Package System



Engineered for life

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Introduction and Safety

Introduction

Purpose of this manual

The purpose of this manual is to provide necessary information for:

- Installation
- Operation
- Maintenance



CAUTION:

Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:

Save this manual for future reference, and keep it readily available at the location of the unit.

Safety



WARNING:

- The operator must be aware of safety precautions to prevent physical injury.
 - Any pressure-containing device can explode, rupture, or discharge its contents if it is over-pressurized. Take all necessary measures to avoid over-pressurization.
 - Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by ITT. If there is a question regarding the intended use of the equipment, please contact an ITT representative before proceeding.
 - This manual clearly identifies accepted methods for disassembling units. These methods must be adhered to. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to impellers, propellers, or their retaining devices to aid in their removal.
 - Do not change the service application without the approval of an authorized ITT representative.
-

**CAUTION:**

You must observe the instructions contained in this manual. Failure to do so could result in physical injury, damage, or delays.




Safety terminology and symbols

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published to help prevent these hazards:

- Personal accidents and health problems
- Damage to the product
- Product malfunction

Hazard levels

Hazard level	Indication
 <p>DANGER:</p>	A hazardous situation which, if not avoided, will result in death or serious injury
 <p>WARNING:</p>	A hazardous situation which, if not avoided, could result in death or serious injury
 <p>CAUTION:</p>	A hazardous situation which, if not avoided, could result in minor or moderate injury
<p>NOTICE:</p>	<ul style="list-style-type: none"> • A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Hazard categories

Hazard categories can either fall under hazard levels or let specific symbols replace the ordinary hazard level symbols.

Electrical hazards are indicated by the following specific symbol:



Electrical Hazard:

These are examples of other categories that can occur. They fall under the ordinary hazard levels and may use complementing symbols:

- Crush hazard
- Cutting hazard
- Arc flash hazard

Environmental safety

The work area

Always keep the station clean to avoid and/or discover emissions.

Waste and emissions regulations

Observe these safety regulations regarding waste and emissions:

- Appropriately dispose of all waste.
- Handle and dispose of the processed liquid in compliance with applicable environmental regulations.
- Clean up all spills in accordance with safety and environmental procedures.
- Report all environmental emissions to the appropriate authorities.

Electrical installation

For electrical installation recycling requirements, consult your local electric utility.

Recycling guidelines

Always follow local laws and regulations regarding recycling.

User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Helmet
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:

Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections.

Precautions during work

Observe these safety precautions when you work with the product or are in connection with the product:

- Never work alone.
- Always wear protective clothing and hand protection.
- Stay clear of suspended loads.
- Always lift the product by its lifting device.
- Beware of the risk of a sudden start if the product is used with an automatic level control.
- Beware of the starting jerk, which can be powerful.
- Rinse the components in water after you disassemble the pump.
- Do not exceed the maximum working pressure of the pump.
- Do not open any vent or drain valve or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.
- Never operate a pump without a properly installed coupling guard.

Wash the skin and eyes

Do the following if chemicals or hazardous fluids have come into contact with your eyes or your skin:

If you need to wash your...	Then...
Eyes	<ol style="list-style-type: none"> 1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Skin	<ol style="list-style-type: none"> 1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least one minute. 3. Seek medical attention, if required.

Product warranty

Coverage

ITT undertakes to remedy faults in products from ITT under these conditions:

- The faults are due to defects in design, materials, or workmanship.
- The faults are reported to an ITT representative within the warranty period.
- The product is used only under the conditions described in this manual.
- The monitoring equipment incorporated in the product is correctly connected and in use.
- All service and repair work is done by ITT-authorized personnel.
- Genuine ITT parts are used.
- Only Ex-approved spare parts and accessories authorized by ITT are used in Ex-approved products.

Limitations

The warranty does not cover faults caused by these situations:

- Deficient maintenance
- Improper installation
- Modifications or changes to the product and installation made without consulting ITT
- Incorrectly executed repair work
- Normal wear and tear

ITT assumes no liability for these situations:

- Bodily injuries
- Material damages
- Economic losses

Warranty claim

ITT products are high-quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, then contact your ITT representative.

Transportation and Storage

Inspect the delivery

Inspect the package

1. Inspect the package for damaged or missing items upon delivery.
2. Note any damaged or missing items on the receipt and freight bill.
3. File a claim with the shipping company if anything is out of order.
If the product has been picked up at a distributor, make a claim directly to the distributor.

Inspect the unit

1. Remove packing materials from the product.
Dispose of all packing materials in accordance with local regulations.
2. Inspect the product to determine if any parts have been damaged or are missing.
3. If applicable, unfasten the product by removing any screws, bolts, or straps.
For your personal safety, be careful when you handle nails and straps.
4. Contact your sales representative if anything is out of order.

Transportation guidelines

Lifting methods



WARNING:

- Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.
- Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
- Tip over hazard. Do not use component eyebolts to lift the pump station. The eyebolts are only designed to lift the components to which they are attached.
- Do not attach sling ropes to the panel stand.

Storage guidelines

Storage location

The product must be stored in a covered and dry location free from heat, dirt, and vibrations.

NOTICE:

- Protect the product against humidity, heat sources, and mechanical damage.
- Do not place heavy weights on the packed product.

Storage between use

Observe the following for long-term storage of a pump station.

- Insure system is drained of any water.
- Remove transducers to ensure that they do not freeze.
- System may be top-heavy, brace to keep from tipping.

Long-term storage

If the unit is stored for more than 6 months, these requirements apply:

- Store in a covered and dry location.
- Store the unit free from heat, dirt, and vibrations.
- Rotate the pump shaft by hand several times at least every three months.

Treat bearings and machined surfaces so that they are well preserved. Refer to the drive unit and coupling manufacturers for their long-term storage procedures.

For questions about possible long-term storage treatment services, please contact your local ITT sales representative.

Product Description

General description

Description

A pump station is a pre-engineered and fabricated line of packaged booster systems that provides:

- Energy efficiency
- System protection
- Hydraulic capability up to 1600 GPM
- Boost pressures up to 300 PSI

Intended applications

The pump station is intended for these applications:

- High rise buildings
- Industrial plants
- Municipal and rural water districts
- Agriculture / irrigation
- General water pressure boosting

Operational limits

Pressure

This table describes the pressure ratings for a pump station using the pump model shown

Pump system type	Max. discharge pressure
NPE pumps	125 PSI
SSH Pumps	230 PSI
e-SV Pumps	300 PSI

Nameplate information


Important information for ordering

Every pump station has a nameplate that provides information about the pump station. The pump station nameplate is located on the inside of the control enclosure door.

When ordering spare parts, be prepared to identify the nameplate information when contacting the factory.

- Model
- Size

- Serial number
- Item numbers of the required parts.

Model Number	
Serial Number	
Station Voltage	
System FLA	
SCCR	
Largest Motor HP	
Station Flow	
Suction Pressure	
Discharge Pressure	
Pump Boost	
Date Code	
 ITT Engineer ed for life	Residential & Commercial Water Dallas, Texas, U.S.A. Customer Service 1.800.786.7480 x4

Nameplate field	Explanation
Model number	The manufacturer's number to indicate the particular type of product which has been acquired.
Serial number	A set of characters that uniquely identifies a single unit and can be used for traceability and warranty purposes.
Station voltage	The rated voltage at which the station has been designed for. Should match the application site supply voltage.
System FLA	The full-load-amperage at which the station can operate.
SCCR	“Short-Circuit Current rating”. Represents the maximum level of short-circuit current that a component or assembly can withstand.
Largest motor HP	The rated HP for the largest pump in the system.
Station flow	The designed duty point, in GPM, LPH, etc.
Suction pressure inlet	The line pressure on the input side of the pump station.
Discharge pressure	The line pressure on the output side of the pump station
Pump boost	The difference between the input side of the pump station and the output side of the pump station.
Date code	Marking of products to indicate their date of manufacture.

Installation

Field connections

Diagrams

Actual equipment manufacturers/models installed are system specific. Refer to specific manufacturer Installation, Operation, and Maintenance manuals for details unique to each component. The pump instruction manual is supplied with the system.

Review the wiring diagrams and dimensional drawings before you install and operate the unit.

Electrical precautions



WARNING:

Electrical shock hazard. The electrical supply must match the control panel nameplate specification. Incorrect voltage can cause a fire, which damages the electrical components and voids the warranty. Failure to follow these instructions could result in serious personal injury or death, or property damage.

NOTICE:

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.

Fastening



WARNING:

- Only use fasteners of the proper size and material.
 - Replace all corroded fasteners.
 - Make sure that all fasteners are properly tightened and that there are no missing fasteners.
-

Earth (ground) connections



WARNING:

Electrical shock hazard. Conduit grounds are not adequate. You must attach a separate earth (ground) wire to the earth (ground) lug provided in the enclosure in order to avoid potential safety hazards. Failure to follow these instructions can result in serious personal injury, death, or property damage.

A grounding terminal is provided for a dedicated earth (ground) wire connection. You must follow all provisions of the National Electrical Code and local codes.

Pump package location guidelines



WARNING:

Assembled units and their components are heavy. Failure to properly lift and support this equipment can result in serious physical injury and/or equipment damage. Lift equipment only at the specifically identified lifting points. Lifting devices such as eyebolts, slings, and spreaders must be rated, selected, and used for the entire load being lifted.

Guideline	Explanation/comment
Make sure that the space around the pump package is sufficient.	This facilitates ventilation, inspection, maintenance, and service.
If you require lifting equipment such as a hoist or tackle, make sure that there is enough space above the pump package.	This makes it easier to properly use the lifting equipment and safely remove and relocate the components to a safe location.
Protect the unit from weather and water damage due to rain, flooding, and freezing temperatures.	This is applicable if nothing else is specified.
Do not install and operate the equipment in closed systems unless the system is constructed with properly-sized safety and control devices.	Acceptable devices: <ul style="list-style-type: none"> • Pressure relief valves • Compression tanks • Pressure controls • Temperature controls • Flow controls If the system does not include these devices, consult the engineer or architect in charge before you operate the pump.
Take into consideration the occurrence of abnormal noise and vibration.	The best pump location for noise and vibration absorption is on a concrete floor with subsoil underneath.

Foundation requirements



WARNING:

Electrical shock hazard. An electrical conduit installed below the surface may require a corrosion-resistant protective coating in order to prevent conduit corrosion and electrical shock. Failure to follow these instructions can result in serious personal injury, death, or property damage.

Requirements

- The foundation must be able to absorb any type of vibration and form a permanent, rigid support for the unit.
- The foundation must weigh at least 2-1/2 times the weight of the pump unit.
- Provide a flat, substantial concrete foundation in order to prevent strain and distortion when you tighten the foundation bolts.
- Sleeve-type and J-type foundation bolts are most commonly used. Both designs allow movement for the final bolt adjustment.
- Tie the concrete pad in with the finished floor.

Level the base on a concrete foundation

1. Place the pump package on its concrete foundation.
2. Place 1.00 in./ (25.40 mm) thick steel shims or wedges on both sides of each anchor bolt in order to support the pump package.

Make sure you also place the shims or wedges midway between the bolts.

This also provides a means of leveling the base.

Grout the baseplate

Required equipment:

- Cleaners: Do not use an oil-based cleaner because the grout will not bond to it. See the instructions provided by the grout manufacturer.
 - Grout: Non-shrink grout is required.
1. Clean all the areas of the baseplate that will come into contact with the grout.

2. Build a dam around the foundation.
3. Thoroughly wet the foundation that will come into contact with the grout.
4. Pour grout into the baseplate up to top of the base rails.
To hold wedges or shims in place, allow the grout to flow around them.
Follow grout manufacturer's instructions for removing air pockets from grout during pour.
5. Allow the grout to set.
The grout needs to set for at least 48 hours. Follow any additional instructions from the grout manufacturer.
6. Tighten the foundation bolts.

Piping checklist



WARNING:

- The heating of water and other fluids causes volumetric expansion. The associated forces can cause the failure of system components and the release of high-temperature fluids. In order to prevent this, install properly sized and located pressure-relief valves. Failure to follow these instructions can result in serious personal injury or death, or property damage.
- Avoid serious personal injury and property damage. Make sure that the flange bolts are adequately torqued.
- Never force piping to make a connection with a pump.

Check	Explanation/comment	Checked
Check that the suction and discharge pipes are supported independently by use of pipe hangers near the pump station.	This eliminates pipe strain on the pump station.	
Check that there is a strong, rigid support for the suction and discharge lines.	As a rule, ordinary wire or band hangers are not adequate to maintain proper alignment.	
Check that the suction or discharge lines are not forced into position.	Component failure will result if suction or discharge lines are forced into position.	
Check that fittings for absorbing expansion are installed in the system when considerable temperature changes are expected.	This helps to avoid strain on the pump.	
Check that you have a foot valve of equal or greater area than the pump suction piping when you use an open system with a suction lift.	Prevent clogging by using a strainer at the suction inlet next to the foot valve. Make sure that the strainer has an area three times that of the suction pipe with a mesh hole diameter of no less than 0.25 in. (0.64 cm).	

Commissioning, Startup, Operation, and Shutdown

Preparation for startup



DANGER:

Electrical hazard sufficient to kill. Always disconnect and lock out the power before you service the unit.



WARNING:

- Failure to follow these precautions before you start the unit will lead to serious personal injury and equipment failure.
- Do not operate the pump below the minimum rated flows or with the suction or discharge valves closed. These conditions can create an explosive hazard due to vaporization of pumped fluid and can quickly lead to pump failure and physical injury.
- Never operate the pump without the coupling guard correctly installed.
- Always disconnect and lock out power to the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.
- Operating the pump in reverse rotation can result in the contact of metal parts, heat generation, and breach of containment.

Precautions

NOTICE:

- Verify the driver settings before you start any pump.

You must follow these precautions before you start the pump:

- Flush and clean the system thoroughly to remove dirt or debris in the pipe system in order to prevent premature failure at initial startup.
- Verify controller settings match site conditions and motor nameplate data before starting station.

Prestartup checklist



CAUTION:

Risk of leaks or flooding. Make sure to reinstall the drain plugs properly. Check all joints for tightness and flange bolts for the proper torque.

Checks	Checked
Check that the pump is properly aligned. Refer to these manual numbers for more information: <ul style="list-style-type: none"> • eSV pumps = IM228 • NPE pumps = IM013 • SSH pumps = IM084 	
Check that the drain plugs are installed before filling system.	
Inspect all piping joints for tightness. Joints can become loose during transit due to vibration and shock.	
Check all flanged joints for the proper torque.	
Check that the system is full of liquid.	

Checks	Checked
Check that all high points in the piping system are vented in order to remove trapped air.	
Check that all pumps and drivers are properly lubricated.	
Check that the piping is clean and has been flushed.	

Final installation checks

Installation checklist



CAUTION:

Serious damage to the pump may result if it is started dry. Make sure that the pump is completely filled with liquid before it is started.

Check	Checked
Check that the unit base is properly leveled, grouted, and secured.	
Check that all lubrication points are properly lubricated.	
Check that the outlet side of the high-temperature relief valve assembly (if option is purchased) is connected to the drain with tubing or pipe sized 1/2 in. or greater.	
Check that the shut-off valves to the transmitters are open.	
Check that the pump and motor shafts are properly aligned.	
Check that the pump rotation is correct.	
Check that the piping is properly supported. This prevents strains on the unit.	

Final adjustments

Make the final adjustments on these adjustable devices in order to match the exact system requirements.

Thermal relief valve

An optional thermal relief valve is installed on the pump discharge in order to prevent potentially dangerous thermal pressure buildup. The valve automatically opens on a temperature increase and closes on a temperature decrease. This valve acts as a safety device; do not remove or plug it. It is factory set to open and discharge when the water temperature in the discharge header reaches between 125°F to 135°F (51°C to 57°C). Make sure that the 1/2 in. NPT opening of this valve assembly is piped to a floor drain in accordance with local codes.

After long periods of operation, the valve seat and disc can become worn or pitted. This allows leaks through the valve in the closed position. You can replace internal parts, if desired.

Low suction pressure switch (optional)

Adjust the setting to 10 psi below the rated suction pressure.

Pump station startup

Confirm the job site voltage

1. Check these items before you apply power or close the disconnect:
 - a) Check all of the power wiring connections and secure them as required.
 - b) Confirm with the owner/installing contractor if there are plans for any required building automation or remote connections.
 - c) Inspect and/or install any customer remote terminations.
2. Make note of the design data supplied on the data label. The label is located on the inside of the control panel door.
3. Use a volt meter to check the voltage on the incoming power terminals at the disconnect.
4. Compare the voltage to the data on the nameplate.

Connect the storage tank



DANGER:

Explosion hazard. Prevent tank explosion. Do not install the tank when the system shut-off pressure exceeds the tank pressure rating.



DANGER:

Explosion hazard. Prevent tank explosion. Install a pressure relief valve on the tank inlet with a set point no greater than tank rating.

1. Precharge the storage tank before you connect it to the system.
The air precharge needs to be 5 to 10 psi less than the system operating pressure.
2. If the storage tank has already been installed and not precharged, then disconnect the system piping from the tank and equalize it to atmospheric pressure. If an isolation valve and drain are provided, then use them.
3. Apply air pressure to the tank through the air charging valve and pressurize to field conditions.
This needs to be equal to the NFSD restart pressure of 5 to 10 psi below the operating pressure.
4. Reconnect the tank to the system piping. Tank should be installed on the discharge side of the system.

Check for available suction water

1. Open all supply, discharge, and pump isolation valves. Also open any other package valves.
2. Close the bypass valve if it is installed in the piping by others.
3. Inspect the capillary tubing from the pump discharge to the suction header:
 - a) Open the petcocks that feed the tubing.
 - b) Make sure that the plastic tubing does not touch any metal surface. Protect the tubing with insulation in order to prevent abrasion where it can possibly touch metal.
4. Open a faucet in order to create a demand for water on the system pressure piping.
5. Observe the suction pressure and confirm that it is equal to or greater than the suction pressure listed on the nameplate. System is designed for a specific suction pressure. Deviation results in degraded system performance. Contact factory if suction pressure varies from design specifications.

Start the package

1. Close the disconnect in order to apply power to the package.
2. Turn the panel switch to the local position.
3. Watch the screen as the boot-up progresses and note the serial number of the unit.
This is the password that you use for the setup menu.
4. If the unit starts, press the Stop button in order to stop the unit.

Check the pump rotation

1. Select the hand mode on the controller.
2. Enable the pump with the blinking green light.
Do not select any of the other pumps (no green light).
3. Press the start button and spin the first pump.
4. Immediately press the Stop button.
5. Observe the spinning shaft for rotation.
6. Repeat steps 1 through 5 for each pump.
7. If all pumps run backwards, reverse the two leads of the incoming power.
8. If only one of the pumps run backwards, reverse the two leads on the pump motors that are incorrect.

Set the system operating pressure

1. Open a faucet or some other demand for water from the discharge of the package.
This can be anywhere in the building being served by the package.
2. In hand, run one pump.
3. Repeat these steps for each pump in the package. Run only one pump at a time.

Enter the setup menu

1. For each pump, confirm the settings entered for the pump motor data.
2. Review all settings for the compatibility with the installed application.
3. Make sure that these settings are in place:
 - Auto alt. prd. - 24 or 168 hours
 - Forced destage timer - 10 to 15 minutes
 - NFSD restart psi - Enter a value 5 to 10 psi less than the site-adjusted discharge pressure
 - NSFD minimum run timer - 5 minutes
 - NFSD test PR timer - 20 seconds
4. Adjust any other settings in order to meet the needs of your system.

Test the package

1. Exit the setup menu.
2. Stop the package.
3. Press the Auto key and then Start.
4. Observe the pressures and temperatures for normal operation.
5. Press the Alternation key and observe the operation of each pump.
6. Close the running water faucet.
It is assumed that no demand for water is required. For example, no flow.
7. Observe the No Flow Shutdown sequence. All minimum run timers must elapse for this sequence to occur.
8. Demand water from the system and observe the restart of the package.

If you encountered no problems, then you are done.

Maintenance

Precautions



DANGER:

Electrical hazard sufficient to kill. Always disconnect and lock out the power before you service the unit.



WARNING:

- This manual clearly identifies accepted methods for disassembling units. These methods must be adhered to. Trapped liquid can rapidly expand and result in a violent explosion and injury. Never apply heat to impellers, propellers, or their retaining devices to aid in their removal.
 - Make sure that each pump and the package are isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, open vent or drain valves, or disconnect the package piping.
 - Always disconnect and lock out power to the package and the driver before you perform any installation or maintenance tasks. Failure to disconnect and lock out driver power will result in serious physical injury.
 - Crush hazard. The unit and the components can be heavy. Use proper lifting methods and wear steel-toed shoes at all times.
 - Rotating shaft. Make sure that the packing adjustment is performed by qualified personnel only.
-



CAUTION:

Equipment damage hazard. Silt buildup is a sign of problems with the wet well and/or intake screen. Failure to follow these instructions indicates a potentially hazardous situation, which, if not avoided, may result in property damage.

Monthly maintenance

Control panel checks

- Verify that all of the operator interface keys and LEDS operate properly (see controller manual).
- Review the station operation, fault history, and data log for station operation.
- Verify that all surge devices are visually sound, where applicable.
 - Check the surge device for the station which is mounted on the back of the control panel.
 - Black soot on or around the device indicates that it has taken a surge and needs to be replaced.

Motor lubrication checks

- For grease-filled bearings, make sure that grease is not all over the inside of the motor and in the bottom of the motor. This could be a sign of overfilling. Refer to the lubrication instructions from the motor manufacturer.

Close-coupled pumps

- For a horizontal pump, verify that the mechanical seal is not leaking between the pump and the motor.

Sound and visual checks of the whole station

- Listen for any odd sounds that rub or grind, electrical arcing, and check for anything that is binding or unusual. These conditions can indicate a serious problem.

Note that there is going to be some harmonic vibration with the pumps and motor. Listen for excessive vibration or noise as this requires immediate service. Do not operate the pump if there is excessive vibration.

- Confirm that the building cooling and ventilation systems are operating and clear of all obstructions. The maximum operating range for equipment is 104°F (40°C).
- Verify that water, grease, oil, and hardware are not leaking or loose on the pump station.

Station skid

- Visually inspect for leaks in the station piping, valves, and other components.
- Visually inspect the piping and skid for any stress cracks in the welds.
- Visually inspect the station for loose or damaged paint or areas of rust.

Troubleshooting

Pump station troubleshooting



DANGER:

- Personal injury hazard. Troubleshooting a live control panel exposes personnel to hazardous voltages. Electrical troubleshooting must be done by a qualified electrician. Failure to follow these instructions will result in serious personal injury, death, and/or property damage.
- Electrical hazard sufficient to kill. Always disconnect and lock out the power before you service the unit.



WARNING:

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local rules.

Note that some troubleshooting procedures apply to only constant speed systems or only variable speed systems.

Use these Installation, Operation, and Maintenance manuals for more information:

- e-SV pumps = IM228
- NPE pumps = IM013
- SSH pumps = IM084

The pump station does not power up

Cause	Remedy
The site voltage does not match the pump station voltage.	Make sure that the site voltage matches the pump station design voltage.
Line-to-line voltage is not balanced.	Check incoming voltage and amperage. Line-to-line voltage should be balanced. Line-to-ground voltage should also be balanced.
The power fuses are blown or breakers are tripped.	Check power fuses and breakers. Breakers are shipped in the OFF position. Replace blown fuses.
The pump station is not properly grounded (earthed).	Check that proper grounding (earthing) techniques have been used for the pump station.
There is a fault.	Check for fault codes or fault lights on the PLC. Correct the fault.

The station powers up, but the pumps do not run

Cause	Remedy
Pumps are not enabled.	Check the PLC to make sure that the pumps are enabled. Check for faults. Correct any faults.
The desired pressure is satisfied.	Check to see if the desired pressure is satisfied. If the actual pressure is greater than the set point pressure, then the pumps are automatically stopped.
There is a fault.	Check for fault codes or fault lights on the PLC. Correct the fault.
The motor is tripped.	Check for a tripped motor thermal protector. Allow motor to cool, and then reset the thermal protector.
The fuses are blown or breakers are tripped.	Check circuit breaker and fuses.
Transducer isolation valves are closed.	Make sure that the transducer isolation valves are in the open position.
Automatic mode is faulty.	Check to see if the pump can be run in Manual mode on the PLC.

Cause	Remedy
The impeller is bound.	Check to see if you can turn the pump by hand. Check for a bound impeller.
A pressure transducer is faulty.	Replace faulty pressure transducers.
Motor wiring is loose.	Make sure that motor wiring is securely connected.
Motor windings have lost insulation strength.	Test the motor leads with a megger in order to check the motor windings.
Variable speed drive is wired incorrectly.	Check corresponding variable speed drive. Make sure drive is wired correctly.
Motor is defective.	Repair or replace motor.

The pumps run but do not build desired pressure

Cause	Remedy
Pumps are running off their design curve.	Check the application. Is the system running in an open discharge condition (excessive flow rate)? For example, is the system filling a large irrigation line for the first time of the season?
Pumps are running at less than full speed.	Check to see if the pumps are running at full speed. If they are running less than full speed, they could be experiencing electrical issues. Check the panel for power status.
The inlet pressure does not match the project specifications.	Check to see if the inlet pressure matches the project specifications. Variations in inlet pressure can have detrimental effects on performance.
A pipe is broken.	Check for broken pipes.
The transducer isolation valves are closed.	Check to be sure that the transducer isolation valves are in the open position.
The NPSH is insufficient.	Check the NPSH. Are proper flooded conditions or positive pressure being delivered to the pump station? Check for air in the supply lines. Check for properly filled supply tanks (if applicable). Excessive suction lift or piping losses will limit the life expectancy of the pumps.
The pump station has lost its prime.	Check to be sure that the pump station has been primed properly. Make sure that all pumps and components are properly filled with water.
The pump rotation is incorrect.	Check the pump rotation. Proper rotation is indicated on the pump volute. (See the pump IOM.)
A suction or discharge valve is closed or clogged.	Check the isolation valves and check valves. Are all suction/discharge valves open? Could any valves be plugged? Could the pumps be plugged?
The motor is not operating at the rated RPM.	Check the voltage and amperage. Check for possible phase loss to the motor.
The impeller is worn or plugged.	Take the pump to an authorized pump repair facility.
The pump bearings are worn.	Take the pump to an authorized pump repair facility.

The pump station experiences excessive vibration

Cause	Remedy
The motor, pump, or piping is loose.	Make sure that all fasteners and components are properly tightened.
Pump station vibration dampers are missing or improperly installed.	Check for properly installed pump station vibration dampers.
Pumps are running off their design curve.	Check the application. Is the system running in an open discharge condition (excessive flow rate)? For example, is the system filling a large irrigation line for the first time of the season?
Air or gases are present in the pumped liquid.	Check water supply lines and tanks. Check for air or gases in liquid. Bleed the lines.

Cause	Remedy
Discharge piping is plugged.	Check discharge piping/valves. Could the piping be plugged? Could the pump be plugged? Are the isolation valves open? Clear any clogs.
Supply piping has excessive suction/lift conditions or friction loss.	Check for excessive suction/lift conditions or friction loss on supply piping.
The impeller is bound or worn.	Take the pump to an authorized pump repair facility.
Pumps and pipes are not properly aligned.	Correct the alignment between pumps and pipes.

The pump station does not shut down and no water is used

Cause	Remedy
The pump station is in Hand or Manual mode.	Put the system in the AUTO position.
The system pressure is set beyond capability of the station.	Check the system set pressure. Is this duty point beyond the capability of the pump station?
There are leaks or broken pipes.	Check for broken pipes or leaks. Does the system pressure decrease if the pump station is turned off?
The diaphragm tank is faulty.	Check for a properly installed diaphragm tank. Has the tank failed? Has the tank been charged to the proper operating pressure before installation? (~10 psi below the desired set point)
The pressure transducers are faulty.	Check the pressure transducers. Does the actual mechanical gauge pressure match the pressure displayed on the VFDs and the PLC?
The VFDs are in Local mode.	Put the VFDs in Remote mode.
A check valve is malfunctioning.	Check for malfunctioning check valves. Does the system hold pressure when the pump package is shut down? Replace faulty valves.

The pump station cycles or hunts erratically

Cause	Remedy
The pumps are oversized for the current demand.	Check the application. Possibly increase the size of the bladder tank for low demand situations.
The inlet pressure is fluctuating.	Check the application. Possibly increase the size of the bladder tank for low demand situations.
There are leaks or broken pipes.	Check for broken pipes or leaks. Does the system pressure decrease when the pump station is turned off?
The diaphragm tank is faulty.	Check for a properly installed diaphragm tank. Has the tank failed? Has the tank been charged to the proper operating pressure before installation? (~10 psi below the desired set point)
The pressure transducers are faulty.	Check the pressure transducers. Does the actual mechanical gauge pressure match the pressure displayed on the VFDs and the PLC?
A check valve is malfunctioning.	Check for malfunctioning check valves. Replace faulty valves.
There is an error in the PLC programming.	Check the customer programming on the PLC. Correct any errors.

Technical Reference

Pump station numbering system

The pump station label located on the inside of the control enclosure door identifies the product code number for the various versions of the pump systems. This number is also the catalog number for the pump station. The pump station numbering systems describe the meaning of each digit.

Not all combinations are possible.

Pump station with e-SV pumps

Example product code

V	2	VF	C	2	A	2	1	A	1	BCD
---	---	----	---	---	---	---	---	---	---	-----

Numbering system definitions

First character: Variable or constant speed	
V = variable speed	C = constant speed

Second character: Number of pumps	
2, 3, or 4	

Third character: Pump type and size	
VA = 1SV	VG = 33SV
VB = 3SV	VH = 46SV
VC = 5SV	VJ = 66SV
VD = 10SV	VK = 92SV
VE = 15SV	VM = 125SV
VF = 22SV	

Fourth character: Header size	
C = 3 in.	E = 6 in.
D = 4 in.	F = 8 in.

Fifth character: Supply voltage	
2 = 208 V / 1 PH / 60 Hz	6 = 460 V / 3 PH / 60 Hz
3 = 230 V / 1 PH / 60 Hz	7 = 575 V / 3 PH / 60 Hz
4 = 208 V / 3 PH / 60 Hz	8 = 380 V / 3 PH / 60 Hz
5 = 230 V / 3 PH / 60 Hz	9 = 380 V / 3 PH / 50 Hz

Sixth character: HP rating				
A = 1/2	E = 2	J = 10	N = 30	T = 75
B = 3/4	F = 3	K = 15	P = 40	U = 100
C = 1	G = 5	L = 20	R = 50	V = 125
D = 1-1/2	H = 7-1/2	M = 25	S = 50	W = 150

Seventh character: Stages / impeller size	
1 = 1, 2 = 2, 3 = 3, and so forth	

Eighth character: reduced number of stages	
0 = 0 reduced, 1 = 1 reduced, 2 = 2 reduced, and so forth	

Ninth character: Branch	
A = 1.5 in. Chk	D = 3 in. Chk
B = 2 in. Chk	E = 4 in. Chk

Ninth character: Branch	
C = 2.5 in. Chk	F = 6 in. Chk

Tenth character
For factory use

Eleventh character: Options
B = Suction pressure switch
G = Suction pressure sensor
J = LOP
C = High temperature relief valve
D = System flex connectors
F = Lightning arrestor

Special options for B, G, J	Constant	Variable
Lift/flooded	LOP (option J)	
Boost (greater than 10 PSI)	Switch (option B)	Switch (option B)

Pump station with NPE pumps

Example product code

C	2	N2	C	2	A	B	G	2	BCD
---	---	----	---	---	---	---	---	---	-----

Numbering system definitions

First character: Variable or constant speed	
V = variable speed	C = constant speed

Second character: Number of pumps	
2, 3, or 4	

Third character: Pump type and size	
N1 = 1ST	N3 = 3ST
N2 = 2ST	

Fourth character: Header size		
C = 3 in.	E = 6 in.	G = 10 in.
D = 4 in.	F = 8 in.	H = 12 in.

Fifth character: Supply voltage	
2 = 208 V / 1 PH / 60 Hz	6 = 460 V / 3 PH / 60 Hz
3 = 230 V / 1 PH / 60 Hz	7 = 575 V / 3 PH / 60 Hz
4 = 208 V / 3 PH / 60 Hz	8 = 380 V / 3 PH / 60 Hz
5 = 230 V / 3 PH / 60 Hz	9 = 380 V / 3 PH / 50 Hz

Sixth character: HP rating	
A = 1/2	E = 2
B = 3/4	F = 3
C = 1	G = 5
D = 1-1/2	H = 7-1/2

Seventh character: Trim			
	1ST	2ST	3ST
A	6-1/8	5-1/4	4-3/4
B	5-3/4	5-1/16	4-5/8
C	5-3/16	4-7/8	4-3/8

Seventh character: Trim			
D	4-3/4	4-5/8	4-1/16
E	4-7/16	4-1/4	3-5/8
F	4-1/16	3-7/8	—
G	—	5-15/16	5-3/8
H	—	5-1/2	5
K	—	6-1/8	5-3/8

Eighth character: Branch size / discharge valve type		
A = 1.5 in. Chk	D = 3 in. Chk	G = 1.5 in. Chk
B = 2 in. Chk	E = 4 in. Chk	
C = 2.5 in. Chk	F = 6 in. Chk	

Ninth character
For factory use

Tenth character: Options
B = Suction pressure switch
G = Suction pressure sensor
J = LOP
C = High temperature relief valve
D = System flex connectors
F = Lightning arrestor

Special options for B, G, J	Constant	Variable
Lift/flooded	LOP (option J)	
Boost (greater than 10 PSI)	Switch (option B)	Switch (option B)

Pump station with SSH pumps

Example product code

V	2	HE	F	4	P	A	L	2	BCD
---	---	----	---	---	---	---	---	---	-----

Numbering system definitions

First character: Variable or constant speed	
V = variable speed	C = constant speed

Second character: Number of pumps
2, 3, or 4

Third character: Pump type and size			
H9 = 9SH	HA = 10SH	HB = 11SH	H4 = 4SH
H7 = 7SH	H5 = 5SH	H8 = 8SH	H6 = 6SH
HC = 24SH	HD = 25SH	HE = 22SH	HF = 27SH
HG = 23SH	HH = 28SH	—	—

Fourth character: Header size		
C = 3 in.	E = 6 in.	G = 10 in.
D = 4 in.	F = 8 in.	H = 12 in.

Fifth character: Supply voltage	
2 = 208 V / 1 PH / 60 Hz	6 = 460 V / 3 PH / 60 Hz
3 = 230 V / 1 PH / 60 Hz	7 = 575 V / 3 PH / 60 Hz
4 = 208 V / 3 PH / 60 Hz	8 = 380 V / 3 PH / 60 Hz
5 = 230 V / 3 PH / 60 Hz	9 = 380 V / 3 PH / 50 Hz

Sixth character: HP rating				
A = 1/2	E = 2	J = 10	N = 30	T = 75
B = 3/4	F = 3	K = 15	P = 40	U = 100
C = 1	G = 5	L = 20	R = 50	V = 125
D = 1-1/2	H = 7-1/2	M = 25	S = 50	W = 150

Seventh character: Trim														
	9SH	10SH	11SH	4SH	7SH	5SH	8SH	6SH	22SH	23SH	24SH	25SH	27SH	28SH
A	6-5/8	8-27/64	10-3/32	6-3/4	8-1/4	6-7/8	8-1/4	7-5/16	9-1/16	9-1/16	9-7/8	9-7/8	10-3/8	10-5/8
B	6-7/16	8-1/16	9-17/32	6-3/8	7-13/16	6-7/16	7-3/4	7-1/8	8-3/4	8-11/16	9-1/2	9-1/2	9-15/16	10-1/4
C	5-11/16	7-11/16	9-1/8	6-1/16	7	5-13/16	7-1/2	6-15/16	8-1/2	8-6/16	9-3/16	9-1/8	9-9/16	9-13/16
D	5-3/8	7-3/8	8-3/4	5-5/8	6-3/4	5-1/2	7-3/16	6-11/16	8-1/4	8-1/16	8-7/8	8-13/16	9-1/4	9-7/16
E	—	7-1/8	—	5-5/16	6-7/16	5-1/8	6-7/8	6-3/8	7-7/8	7-11/16	8-9/16	8-3/16	8-3/4	9-1/16
F	—	—	—	4-11/16	6-1/8	4-13/16	6-3/16	6-1/16	7-1/2	7-1/2	8-1/4	7-15/16	—	—
G	—	—	—	4-3/8	—	4-7/16	—	5-5/8	7-1/8	7-1/8	—	7-11/16	—	—
H	—	—	—	4-3/16	—	4-1/4	—	—	6-11/16	6-7/8	—	—	—	—
J	—	—	—	3-7/8	—	—	—	—	6-1/2	6-1/2	—	—	—	—
K	—	—	—	—	—	—	—	—	—	6	—	—	—	—
L	—	—	—	—	—	—	—	—	—	5-1/2	—	—	—	—

Eighth character: Branch size / discharge valve type		
A = 1.5 in. Chk	D = 3 in. Chk	G = 1.5 in. Chk
B = 2 in. Chk	E = 4 in. Chk	
C = 2.5 in. Chk	F = 6 in. Chk	

Ninth character
For factory use

Tenth character: Options
B = Suction pressure switch
G = Suction pressure sensor
J = LOP
C = High temperature relief valve
D = System flex connectors
F = Lightning arrestor

Special options for B, G, J	Constant	Variable
Lift/flooded	LOP (option J)	
Boost (greater than 10 PSI)	Switch (option B)	Switch (option B)



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