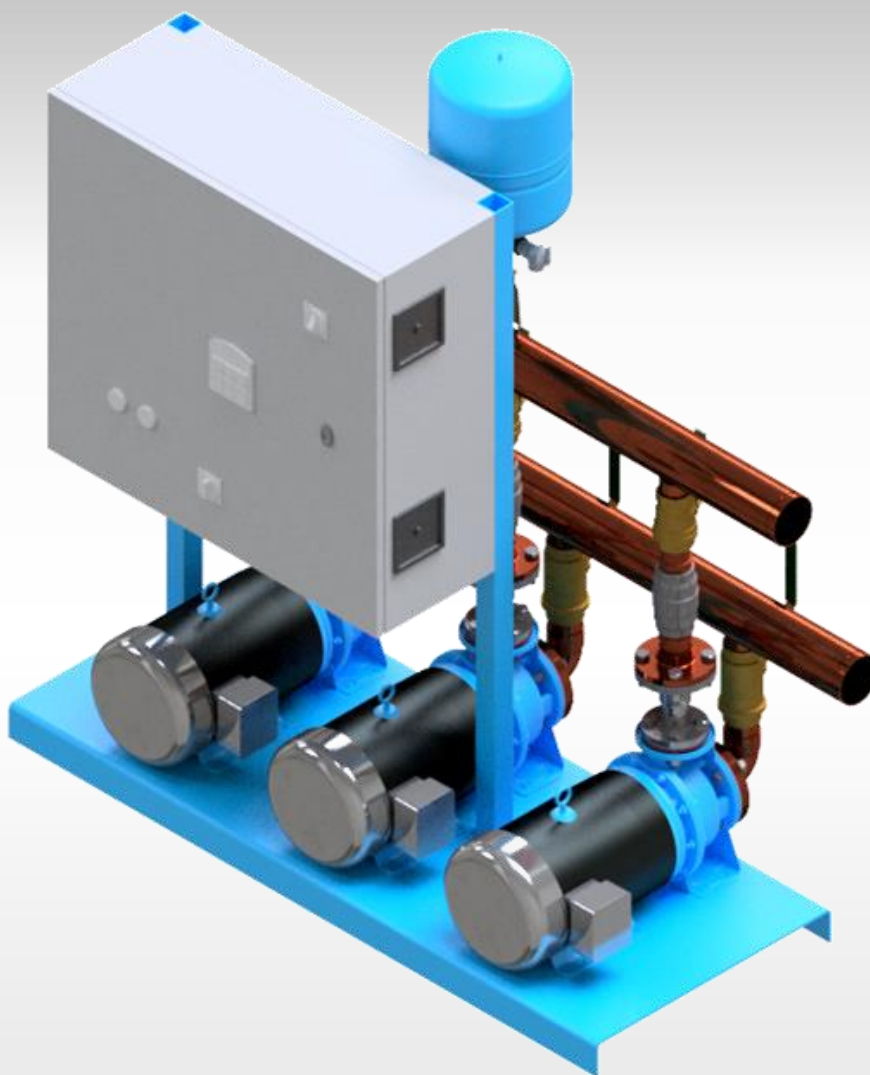


BOOSTER SYSTEM (IOM MANUAL)



APPLICABLE TO TYPE:

- | | |
|------|---|
| SP | Constant Speed Booster System (End Suction) |
| VSPS | Variable Speed Booster System (End Suction) |
| VSPV | Variable Speed Booster System (Vertical Multi-stage) |
| VSPH | Variable Speed Booster System (Horizontal Split-case) |
| VSPM | Variable Speed Booster System (Radial Split-case) |

INTRODUCTION

Booster systems are pre-assembled and pre-wired units which provide control to the water pressure in buildings' risers having varying water demand and changing suction pressure, using pressure switches, pressure and flow transducers, pressure regulating valves, hydro-pneumatic tank, and/or variable speed drives

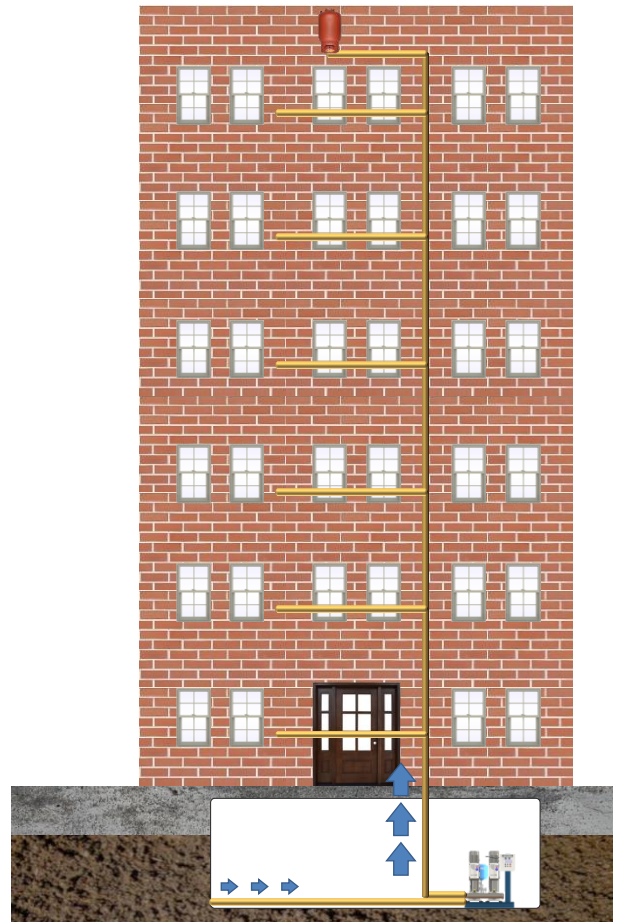
The system includes lead-free pumps, isolation valves, a temperature purge valve, suction and discharge headers, header pressure gauges, control switches or transducers, a steel base, (and variable speed drives) – monitor panels are optional. Operation of the systems is as follows:

Simplex System: The system anticipates a signal for water demand set to a water pressure. Once signaled, the pump turn on to pressurize the riser. System will remain on, and rest when a pre-set water pressure in the riser is met.

Duplex System: The system anticipates a signal for water demand set to a water pressure. Once signaled, the lead pump turn on to pressurize the building riser. When required, the lag pump is automatically started to run in parallel with the lead pump until the water pressure is met. The lag pump will then shut down. Lead and lag pumps are automatically alternated every 24 hours.

Triplex System: The system anticipates a signal for water demand set to a water pressure. Once signed, the lead pump turn on to pressurize the building riser. When required, the lag pump is automatically started to run in parallel with the

lead pump until the water level is met. The lag pump will then shut down. Lead and lag pumps are automatically alternated every 24 hours. Third pump is used for standby operation.





INSTALLATION MANUAL

RECEIVING & PREPARING THE EQUIPMENT

RECEIVING: All Federal Pump prefabricated Booster Type systems are assembled, factory wired, and tested prior to shipment. A protective plastic wrapping protects the system and manifold flanges during shipment. Immediately upon receipt of the shipment, inspect and check with the packing list and report to the transportation company's local agent of any damage or shortage. Inspect carton and wrappings before discarding. Parts and accessories may sometimes be wrapped individually and packed in the carton. Should you find the plastic wrapping removed or damaged upon the arrival of the equipment, note the incident on the carrier's Bill of Lading.

STORAGE: The plastic wrapping is not meant as mean to protect the equipment from the environment during storage. If the unit is received sometime in advance of when it can be put into use, it should be inspected, rewrapped or re-boxed and stored in a dry location. If the unit is to be stored for a long period of time, rotate the pump shaft periodically to protect the bearings. Units should not be stored where temperatures will be below 20°F or above 130°F. **SYSTEM SHOULD NEVER BE STORED OUTDOOR**

LOCATION: The location in which the system is to be installed must be dry and free of debris. Allow for three feet of clearance in front and behind the system base (The NEC requires a minimum of 36" clearance in front of the control panel door for access to the internals). There must also be sufficient room above the system for installation and removal of the motor (especially on vertical multistage pumps).

ANCHORING: Prefabricated systems should be leveled and bolted to a foundation or inertial base using all of the anchoring holes provided on the frame. These holes are typically $\frac{5}{8}$ " in diameter. It is recommended that the base frame be grouted to increase stability and base longevity.

PIPING: Prior to piping the system manifold to the water supply and discharge piping, identify a nearby operational floor drain with a minimum three inch drainage pipe. Failure to keep the floor drain clear and clean can result in significant water damage.

The diameter of the pipe connections to the system manifold must be equal to or larger in diameter. Federal Pump recommends that isolation valves and vibration isolation fittings to be installed in both the suction and discharge sides of the system. Bypass valve (or check valve) and piping is also recommended in the event that the system has to be isolated completed for major overhaul or replacement.



INSTALLATION MANUAL

CAUTIONS AND WARNINGS

▲ CAUTION: To prevent injury, ensure that all water pressure is relieved from the booster system, and system is bypassed prior to working being performed. Ensure that the electrical connection is disconnected locally, and tagged out.

▲ WARNING: It is strongly recommended that the system is protected by a form of thermal relief. Failure to install a thermal relief valve can result in premature pump failure, over pressurization, and/or leaks, resulting in property damage, series personal injury or death.

▲ WARNING: If the system shows any signs of corrosion, wear, and/or leaks, do not install the equipment and contact the manufacturer for more information.

PLEASE READ ALL INSTRUCTIONS PRIOR TO START-UP ON THE FEDERAL PUMP CORPORATION BOOSTER SYSTEM

The following instructions have been specifically prepared to familiarize you with the method of installing and operation your booster system. We would advise you to read this document and follow the recommendations given. If there is any question or concern regarding the installation of the equipment, you should contact the factory or the factory's representative.

ELECTRIC POWER: Check the electrical voltage to insure that it matches the control panel and motor voltage ratings.

PUMP ROTATION: Using the "HAND" position of the "H-O-A" switch, 'Bump' each pump (turn the pump on for one second) to be sure that the pump is rotating in the direction of the rotation arrow on the pump casing.

SYSTEM PRESSURE: Determine the required system pressure at the discharge of the booster system. Check the discharge isolation valve to ensure that it can endure the system pressure

VALVING: Insure that all gate valves on the pump suction and discharge connections are fully open. If there is a valved bypass line around the booster system, the bypass line valve should be completely closed.

ADJUSTING THE LOW SUCTION SWITCH: The unit is furnished with a PENN Series P70 low suction pressure cut-off switch, adjust the PENN switch to stop the pump at 10# below the normal available suction pressure.

INSTALLATION MANUAL

DESIGNS OPTIONS AND CONTROLS

DESIGN OPTION INSTALLATION

Pressure Regulating Valve (SP ONLY) - Constant Speed

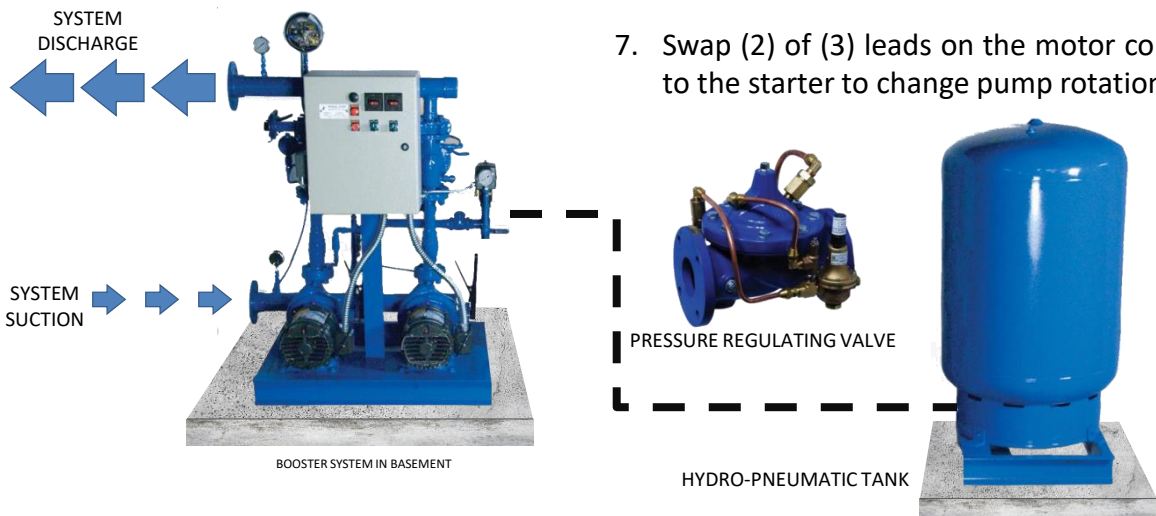
Before proceeding with the installation go through the following material check list to ensure that parts are present:

- ☐ Pressure Regulating Valve (QTY. Equal to the number of pump(s) in operation by design)
- ☐ Hydro-pneumatic bladder tank mounted on steel base. Note that the tank could be mounted near the system or at the top of the riser (QTY. 1)

System Connection:

1. Anchor the booster system onto an inertial base using its steel base frame.

2. Connect the corresponding suction and discharge piping to the header. The system's manifold diameter should never be large than that of the riser.
3. Refer to engineering drawing to confirm for installation of isolating valve before the suction manifold, and after the discharge manifold for complete system bypass.
4. If a remote cushion tank is provided, connect the cushion tank water line to a tee provided on the system between the pressure regulating valve and the pump check valve.
5. Bring and connect the specified power requirement to the Booster system's control panel.
6. Turn on the control panel to check for system power and pump rotation.
7. Swap (2) of (3) leads on the motor connection to the starter to change pump rotation



INSTALLATION MANUAL

DESIGNS OPTIONS AND CONTROLS

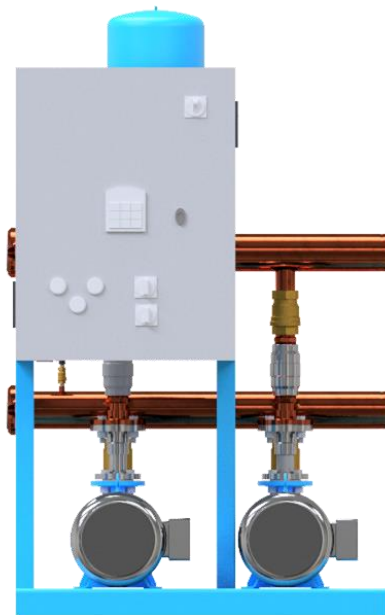
DESIGN OPTION "A" INSTALLATION (ALL NON-SP BOOSTER) – Variable Speed

Before proceeding with the installation go through the following material check list to ensure that parts are present:

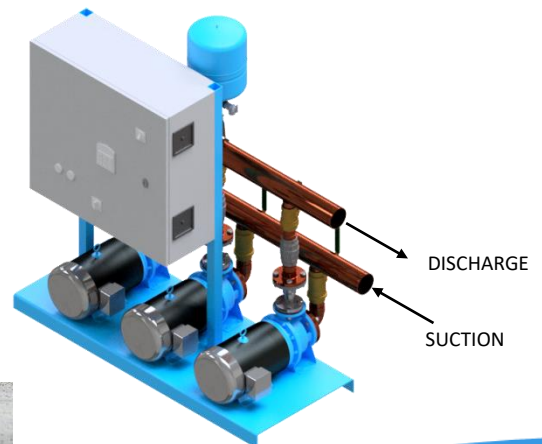
- ☐ Variable Speed Drive (QTY. Equal to the number of pump(s) in operation by design)
- ☐ Option Adder: Hydro-pneumatic bladder tank (over 5 Gallon) mounted on steel base. Note that the tank could be mounted near the system or at the top of the riser (QTY. 1)

System Connection:

1. Anchor the booster system onto an inertial base using its steel base frame.



2. Connect the corresponding suction and discharge piping to the header. The system's manifold diameter should never be large than that of the riser.
3. Refer to engineering drawing to confirm for installation of isolating valve before the suction manifold, and after the discharge manifold for complete system bypass.
4. If a remote cushion tank is provided, connect the cushion tank water line to a tee provided on the system between the pressure regulating valve and the pump check valve.
5. Bring and connect the specified power requirement to the Booster system's control panel.
6. Turn on the control panel to check for system power and pump rotation.
7. Swap (2) of (3) leads on the motor connection to the VFD to change pump rotation





INSTALLATION MANUAL

DESIGNS OPTIONS AND CONTROLS

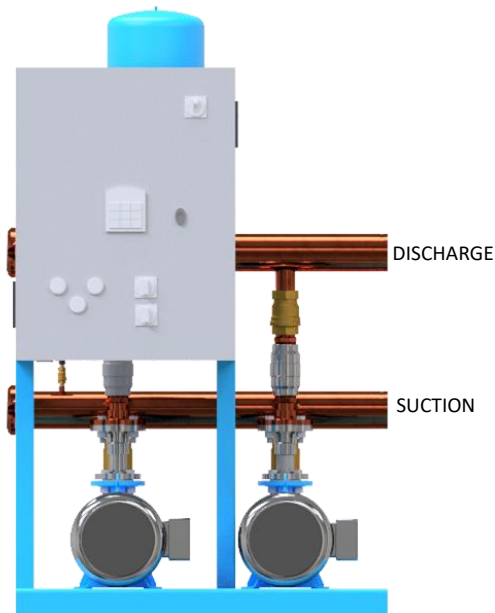
DESIGN OPTION “B” INSTALLATION (ALL NON-SP BOOSTER) – Variable Speed

Before proceeding with the installation go through the following material check list to ensure that parts are present:

- ☐ Variable Speed Drive (QTY. Equal to the number of pump(s) in operation by design)
- ☐ Flow Transmitter Spool Assembly
- ☐ Option Adder: Hydro-pneumatic bladder tank (over 5 Gallon) mounted on steel base. Note that the tank could be mounted near the system or at the top of the riser (QTY. 1)

System Connection:

1. Anchor the booster system onto an inertial base using its steel base frame.



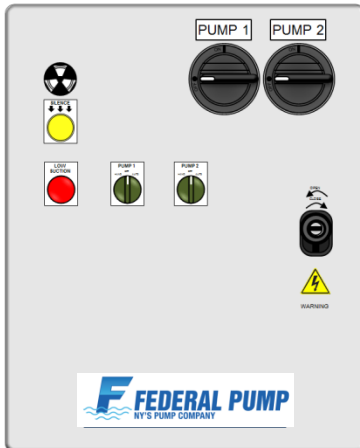
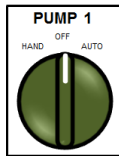
2. Connect the corresponding suction and discharge piping to the header. The system's manifold diameter should never be large than that of the riser.
3. Refer to engineering drawing to confirm for installation of isolating valve before the suction manifold, and after the discharge manifold for complete system bypass.
4. If a remote cushion tank is provided, connect the cushion tank water line to a tee provided on the system between the pressure regulating valve and the pump check valve.
5. Install the Flow Transmitter Spool Assembly along the piping at the discharge of the pump system.
6. Bring and connect the specified power requirement to the Booster system's control panel and connect the contact from the control panel to the Flow Transmitter Spool Assembly.
7. Turn on the control panel to check for system power and pump rotation.
8. Swap (2) of (3) leads on the motor connection to the VFD to change pump rotation

OPERATION MANUAL

MANUAL OPERATION

(SP ONLY) - Constant Speed

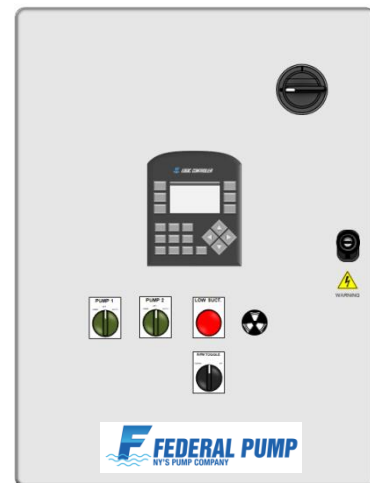
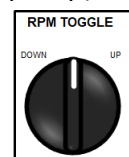
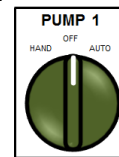
For constant speed system, in order to operate the system or individual pump in the HAND position, first make sure the pump is off. This would ensure that parameters can be modified and that pump does not start unexpectedly. Refer to the control panel shown and twist the HAND-OFF-AUTO switch to the “HAND” position. The switch’s pilot light should turn on once the “HAND” is selected and the pump associated with the switch turned would turn on. Pay attention to the pump’s rotation and motor AMP draw while running and make sure that the data do not exceed those shown on the pump’s motor (turn the pump off by turning the switch to the “OFF” position immediately if the data are exceeded).



(ALL NON-SP BOOSTER) – Variable Speed

On VFD controlled systems, to operate the system or individual pump in the HAND position, first make sure the pump is off. This would ensure that the pump does not start unexpectedly.

Refer to the control panel shown and twist the HAND-OFF-AUTO switch to the “HAND” position. The pump will start to run at a pre-set RPM. To modify the output pressure and RPM of the pump, adjust the toggle switch shown (The switch will be limited by the maximum and minimal operable RPM of the pump).



- ▲ **CAUTION:** By running pumps in HAND, system alarm will continue to operate.
- ▲ **CAUTION:** If the system is experiencing a low suction condition, operation of the pump is NOT suggested
- ▲ **WARNING:** If one or more pump continues to operate on hand, the temperature of the water can reach high enough to cause first degree burn. Temperature relief valve will be installed on the system to relieve the system of water heated to higher than 140F, and must be redirected to a drain.



OPERATION MANUAL

AUTOMATIC OPERATION

Pressure Regulating Valve (SP ONLY) - Constant Speed

▲ WARNING: DO NOT run the pumps in automatic prior to system startup. Failure to start-up equipment so could void the system warranty, over-pressurize the discharge piping, cause leaks or explosion, overheat the system, and cause mechanical seal failure.

Prior to putting the system in automatic, first check that all the valves (except for the system bypass) are open, that the suction cutoff switch is adjusted for proper operation, and locate the system hydro-pneumatic tank. Make sure the tank is charged – 35PSI for remote tank, and system design pressure for local tank. Refer to the equipment summary for the shipped components.

Automatic operation would begin once one or more pump is put in “HAND”. The commissioning agent or representative would adjust the system pressure using the pressure regulating valve as well as the cushion switch. In automatic, the pumps would turn ON/OFF based on the water pressure in the building riser or equipment which the system serves.

When the system starts automatically, the lead pump will turn on until the system's set PSI is satisfied. Once the pressure is met, the pump will turn off.

Any additional (lag & lag-lag) pump will turn on based on the Mercoid lag switch; if the lead

pump's operation cannot keep up with the water demand, the riser pressure will continue to drop.

The lag switch will turn on the lag pump once the pressure drops to a pre-set point. When the lag or lag-lag pumps are on, the riser pressure should increase to disengage the lag switch, thus turning off the lag pump(s). In a similar fashion, the lead will turn off once the pump meet the pressure to disengage the cushion switch.



OPERATION MANUAL

AUTOMATIC OPERATION

(ALL NON-SP BOOSTER) – Variable Speed

▲ WARNING: DO NOT run the pumps in automatic prior to system startup. See APPENDIX A for a copy of the startup package that our certified technician are instructed to follow. Failure to do so could void the system warranty, over-pressurize the discharge piping, overheat the system, and cause mechanical seal failure.

Prior to putting the system in automatic, first check that all the valves (except for the system bypass) are open, that the suction cutoff switch is adjusted for proper operation, and locate the system hydro-pneumatic tank. Make sure the tank is charged – 15PSI for remote tank, and system's design discharge pressure for local tank. Tank should only be charged when it is emptied of all water. Refer to the equipment summary for the shipped components.

Automatic operation would begin once one or more pump is put in AUTO on the H-O-A switch. The commissioning agent or representative will define the set RPM that is necessary to pressurize the building/zone, the operation set points, as well as the alarm set point. In automatic, the pumps would turn ON/OFF based on the water pressure in the building riser or equipment which the system serves.

When the system starts automatically, the lead pump will ramp up to until the system's set PSI is satisfied. Once the pressure is met, the pump will attempt to slow down. Once pump slows down to the pre-set "sleep RPM", the system will begin to

countdown for shutdown. The countdown timer reset whenever the running RPM reaches above the "sleep RPM".

The lag pump will turn on based on the PLC pressure setting and will turn off once the pumps meet the preset pressure. Once the system is off the PLC will anticipate the next pump cycle and alternate the lead pump accordingly. If a third pump is available in the system design, it will operate at a stand-by pump is standard design operation

System design options B is provided with a flow transmitter spool assembly. The HMI will display the system's flow in GPM, and sets off an alarm if flow becomes excessive.

All design options are equipped with low suction cut-off and thermal purge as a standard to prevent the system from cavitating and the end user from the burns.

OPERATION MANUAL

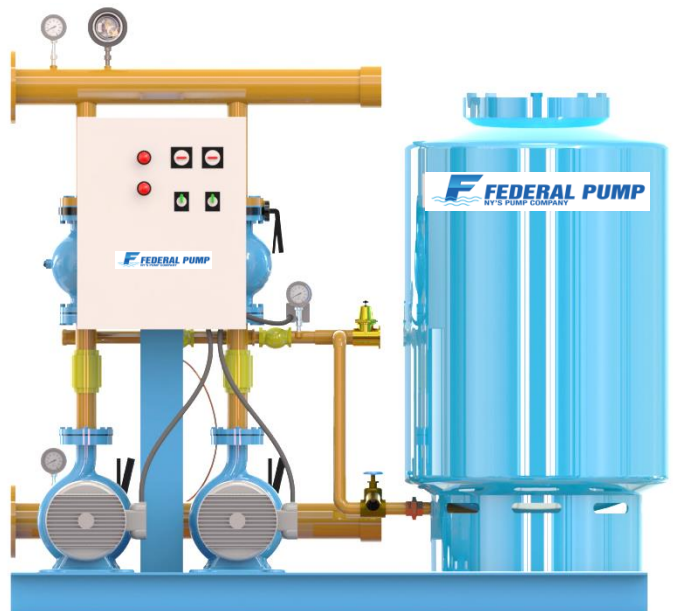
SEQUENCE OF OPERATION

(SP ONLY) - Constant Speed

Upon drop in system set point pressure, the cushion tank will provide pressurized water to the system and initiate the lead pump once system pressure drops below the set point. Lead pump will continue operation and satisfy system pressure and flow requirements. Lead pump will operate until such time that the pressure regulating valve closes and directs the flow and pressure to the cushion tank. The cushion tank, once filled and pressurized, will terminate lead pump operation at the given set point. Lead and lag pumps will alternate every 24 hours.

If lead pump cannot satisfy system demands, the lag pump will start and work in parallel with the lead pump until such time that system pressure is satisfied and terminate lag pump operation.

In the event the suction pressure drop below a pre-set condition (low suction pressure), the low suction pressure switch will terminate all pump operation and sound an alarm horn and light signaling low suction pressure.



OPERATION MANUAL

SEQUENCE OF OPERATION (DESIGN OPTION "A") (ALL NON-SP BOOSTER) – Variable Speed

The system discharge pressure transducers will monitor the discharge pressure of the system to ensure system pressure requirements are maintained. In the event of a drop in system pressure below the set point the pressure transducer will signal the variable speed drive to initiate lead pump operation and increase motor speed thereby increasing pressure output from the pump. The pump will continue increasing speed until such time that system pressure conditions are met. The pump will increase or decrease speed as required by system demand. When system demand is satisfied, the variable speed controller will, after a time delay, terminate pump operation. If system demand is not met and pressure falls below the set point, the lag pump will start and run in parallel with the lead pump to meet system conditions. The controller will include system set point adjustments that allow the pressure settings and time delay settings to be adjusted as may be required by the system. The controller will include digital display of those set points. Upon meeting system conditions the lag pump will terminate operation followed by the lead pump, after a timed delay. The system will select the lead pump for the next cycle based upon the least run time of each of the pumps. Provide system factory performance test from 0-100% system flow requirements.



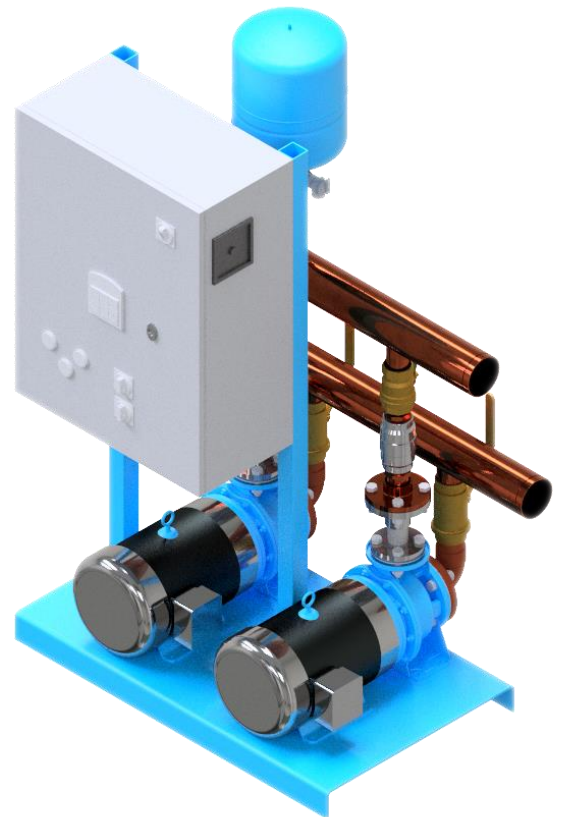
OPERATION MANUAL

SEQUENCE OF OPERATION (DESIGN OPTION "B") (ALL NON-SP BOOSTER) – Variable Speed

The system discharge pressure transducers will monitor the discharge pressure of the system to ensure system pressure requirements are maintained. In the event of a drop in system pressure below the set point the pressure transducer will signal the variable speed drive to initiate lead pump operation and increase motor speed thereby increasing pressure output from the pump. The pump will continue increasing speed until such time that system pressure conditions are met. The pump will increase or decrease speed as required by system demand. When system demand is satisfied, the variable speed controller will, after a time delay, terminate pump operation. If system demand is not met and pressure falls below the set point, the lag pump will start and run in parallel with the lead pump to meet system conditions. The controller will include system set point adjustments that allow the pressure settings and time delay settings to be adjusted as may be required by the system. The controller will include digital display of those set points. Upon meeting system conditions the lag pump will terminate operation followed by the lead pump, after a timed delay. The system will select the lead pump for the next cycle based upon the least run time of each of the pumps. Provide system factory performance test from 0-100% system flow requirements.

The system will be shipped with a flow transmitter spool assembly that would be installed and wired after the discharge manifold of the system as shown on plans. The purpose of

the assembly is to monitor the flow rate of the system and to alert the user in times to unusually high flow.



MAINTENANCE MANUAL

SET POINTS AND MAINTENANCE

⚠ CAUTION: Prior to powering down any system for maintenance, take a photo of the display or alarm lights. Note any changes after maintenance and contact the factory or its local representative if help is needed.

For each of the design, the following set points are necessary in order for the system to function as designed (set point adjust can be made either through VFD, pressure switch, PRV, or HMI display input):

- Low Suction Cut Off
- Lead Pump Pressure Set Point
- Lag Pump Pressure Set Point
- High Pressure Alarm (VFD systems only)

For all standard systems, digital output for alarm conditions shown above are provided in the control panel. BMS and Fire Alarm contractors would connect their inputs from these terminals.

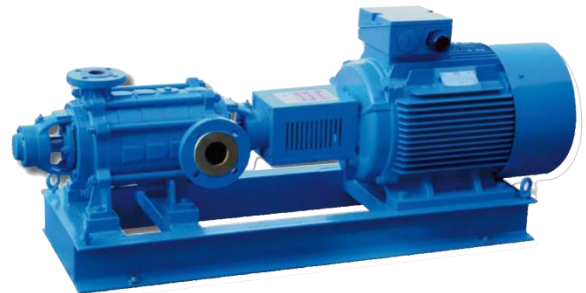
Since the following manual can apply to an array of Federal Pump pump models, please refer to the following chart and use the maintenance manual for the associated pump to service the pump.

SYSTEM SERIES	PUMP SERIES USED
SP, VSPS	CC, CG, CK
VSPV	VM
VSPH	SC
VSPM	RS

Pumps and motors in the system are expected to be serviced at least once a year. Pumps should never idle for more than (3) months without rotation.



SC



RS



CC, CG, CK



VM

[illegible]

Federal Pump Factory Warranty

Equipment or parts manufactured by Federal Pump Corporation ("Seller") which fail to function properly because of defects in material or workmanship and which are returned to Seller with shipping charges prepaid, within one year from date of shipment (invoice date) will be repaired or replaced by Seller, FOB the factory, at Seller's expense. Equipment or parts furnished by Seller, but manufactured by others (such as motors, switches, control panels, etc.) are the responsibility of the manufacturer under its warranty, if any, and Buyer's sole recourse will be to such manufacturer. If Seller determines that the failure to function properly (of equipment or parts returned) is not due to defective material or workmanship but rather to misapplication or mishandling after receipt by Buyer, Seller will repair or replace the equipment or parts upon Buyer's authorization, and bill Buyer for material and labor required for the repair or replacement. The forgoing sets forth Seller's only warranty with respect to, and Seller's entire liability, for any claim or damages whatsoever arising out of the supplying of the equipment hereunder or its use. The foregoing warranty is made by Seller and accepted by the person to whom Seller's applicable invoice is directed ("Buyer") in lieu of all other warranties, express or implied, of Seller and in lieu of all other obligations or liabilities of Seller. No other representation or warranty on the part of seller, express or implied, shall apply to the equipment supplied hereunder or referred to herein, or to its performance, all such other warranties (including any warranty of merchantability or fitness for any purpose) being hereby disclaimed. In no event will Seller be responsible for loss of business or profits or any other similar or dissimilar consequential or incidental damages or losses. If warranty repairs or replacements of parts are to be accomplished locally in lieu at Seller's factory, they must be agreed to in writing, by Seller in advance of the work being done, and with the exact cost of the work stated in a letter of authorization from Seller. No expenses incurred will be paid by Seller unless so agreed to in advance. Seller's standard warranty extends for twelve months from date of shipment. If the standard warranty is to be extended to eighteen months from date of shipment, add 6% to the purchase price of the equipment. If the standard warranty is to be extended to twenty-four months from the date of shipment, add 12% to the purchase price of the equipment. If the standard warranty is to be extended to thirty months from date of shipment, add 18% to the purchase price of the equipment. If the standard warranty is to be extended to thirty-six months from date of shipment, add 24% to the purchase price of the equipment. Extended warranties are effective only if the equipment is properly stored and adequately protected from weather, excessive condensation, atmospheric conditions and physical damage, and only if the equipment has been properly installed and not misused or mishandled.

If you have a claim under the provision of the warranty,
contact Federal Pump Corporation or your local authorized
representative.