Thrush Co.Inc.

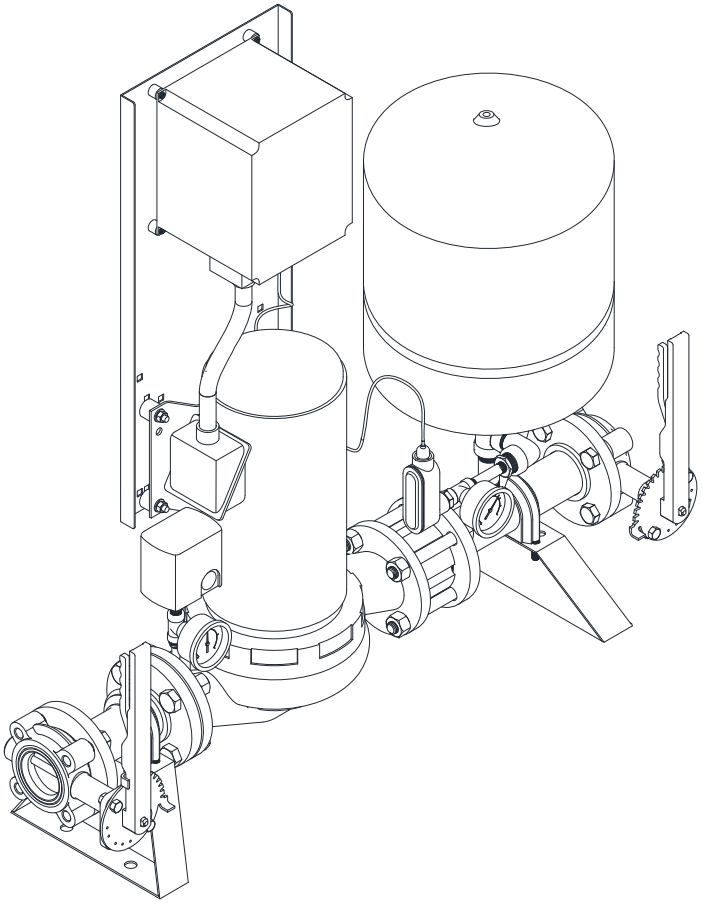
Pressurizer-VS™

PB-VSI Series

Variable Speed Water Booster System

Manual # 9636-1400 Rev. B

Operation & Maintenance Manual



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Section 1
General Product Information

1.1 Overview

The Thrush *Pressurizer-VS*™ (Figure 1-1) has been carefully assembled and factory tested to provide years of trouble-free service. This manual provides information to allow the installer/operator to install, operate, service and maintain the *Pressurizer-VS.* In this manual the installer/operator will find multiple *Pressurizer-VS* models are covered. Visually these different models will look very similar. The main difference between models is the flow and boost capabilities of the unit (Figure 4-4). The unit is shown with optional equipment throughout this manual. If the *Pressurizer-VS* will be stored prior to installation, it should be stored in a clean, dry environment.

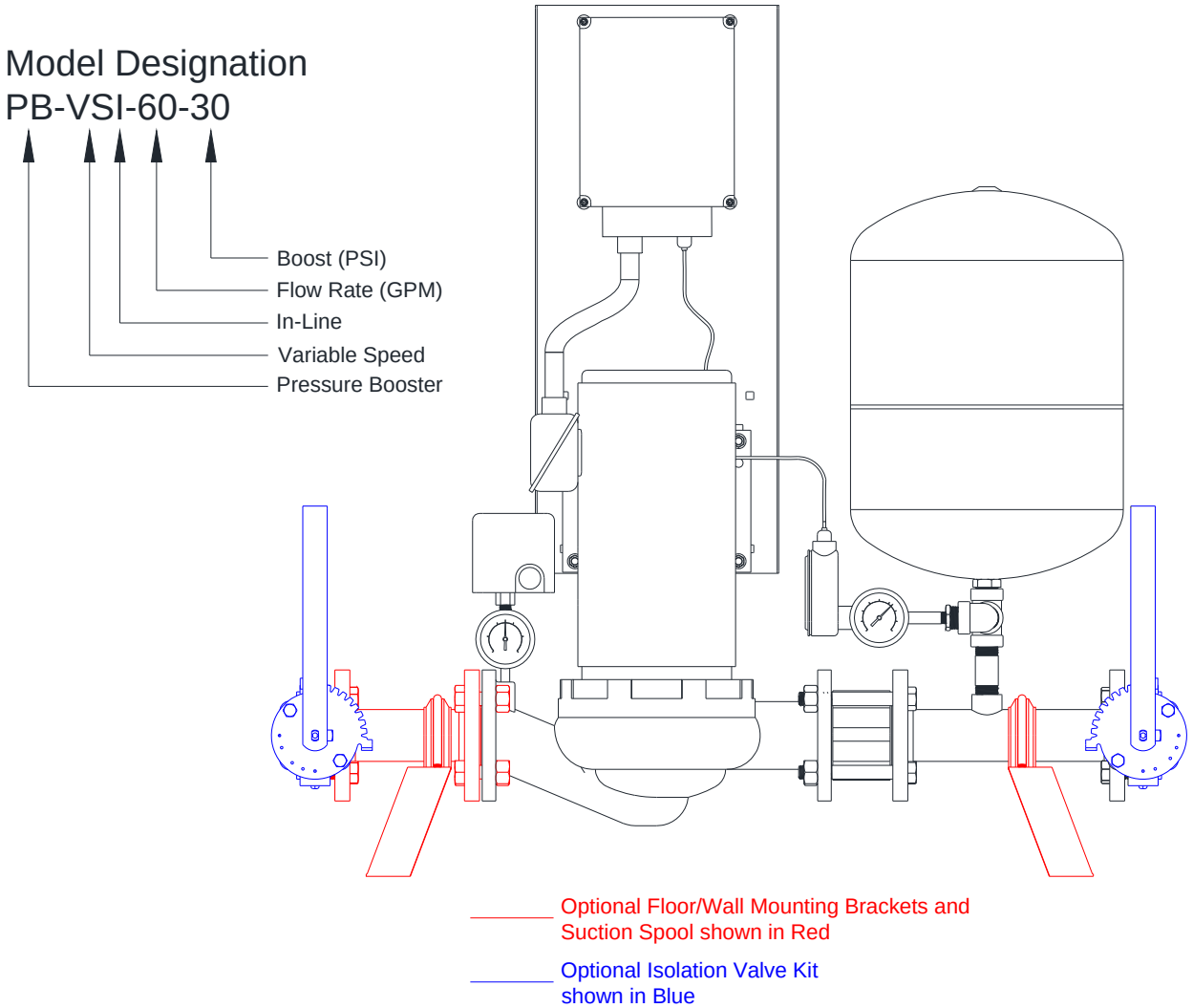


Figure 1-1 Overview

Section 2
Safety Information/Warnings

2.1 Safety Information

Practical safety features have been incorporated into the design and manufacture of the Thrush *Pressurizer-VS*. If questions are not answered by this manual, or if specific installation, operation, and/or maintenance procedures are not clearly understood, contact your Thrush representative before proceeding. Personnel must, at all times, observe all safety regulations while performing maintenance or repairs.

All installation, operation, and maintenance procedures should be performed by experienced, trained, personnel. The *Pressurizer-VS* utilizes electricity. The potential exists for severe personal injury or death if proper procedures are not followed.

There is a potential for severe personal injury or death if proper electrical installation procedures are not followed. A qualified electrician should make all electrical connections.

Before installation and or servicing electricity to the VFD, refer to the VFD manufacturers' user manual supplied with the *Pressurizer-VS* for all safety warnings and cautions.

Do not connect and or operate the *Pressurizer-VS* with volts, hertz, or phase other than that specified on the VFD. This may cause damage to the VFD and will VOID the product warranty.

Before making any piping connections, assure that all piping is clean and free of any foreign materials such as debris or scale. Foreign material in the piping can cause damage to the unit and or affect the performance and operation. Manual shutoff valves should be installed upstream and downstream of the system to act as an isolation device. These valves should be in the closed position and remain so until the installation is complete.

Section 3
Component Identification and Information

3.1 Component Identification

The following paragraphs contain functional descriptions for each of the major components of a Thrush *Pressurizer-VS*. This manual provides information for multiple *Pressurizer-VS* models. All the components listed have the same functional purpose throughout each model. In Figure 3-1, the *Pressurizer-VS* illustrates available optional equipment.

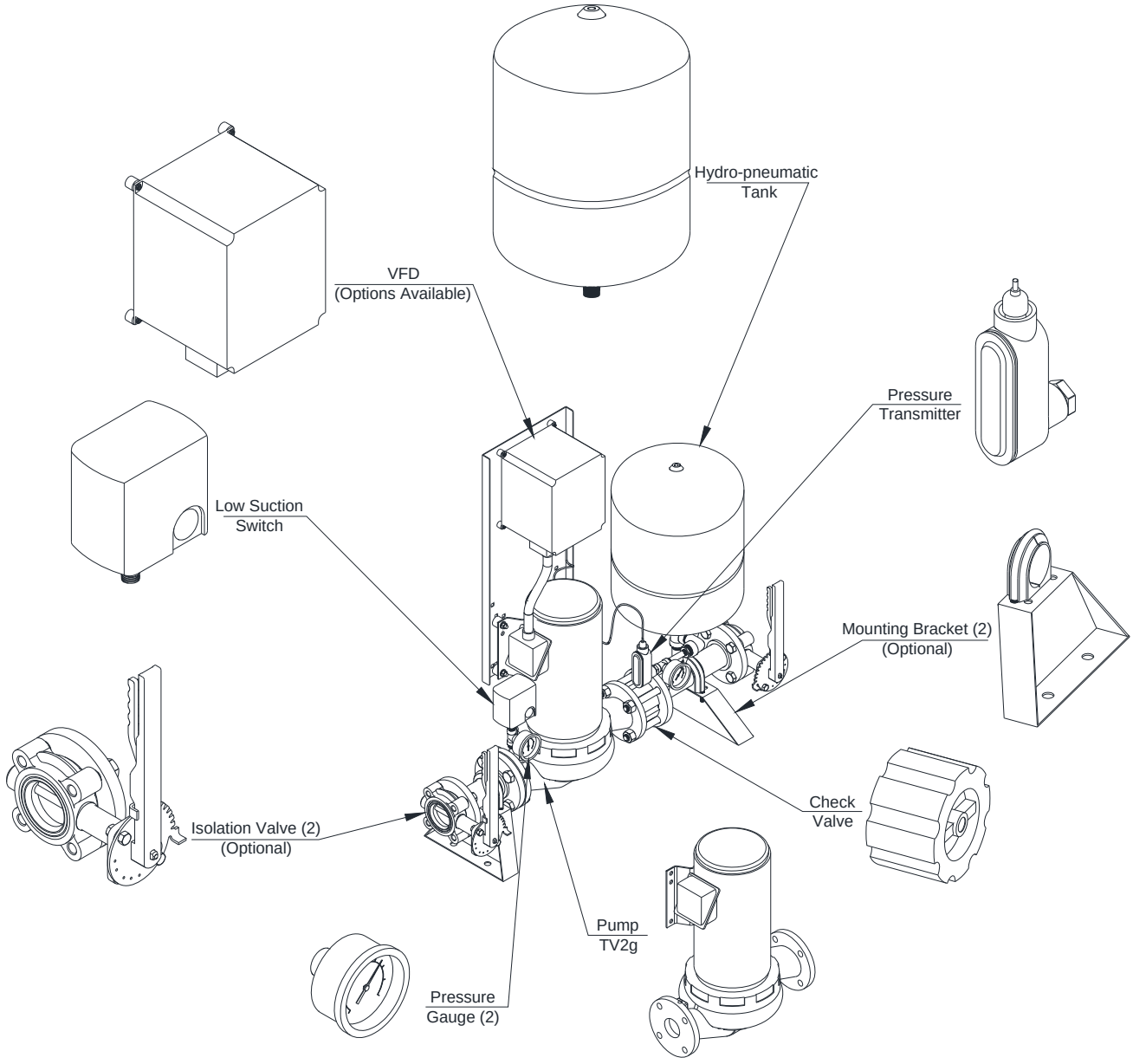
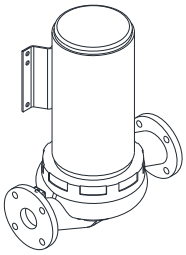
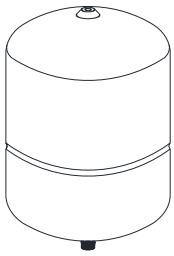


Figure 3-1 Components



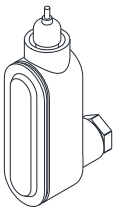
3.1.1 TV2g Pump

The TV2g series pump utilized on the *Pressurizer-VS* is designed to mount in-line to reduce the overall footprint of the system. The top pull out feature allows maintenance of the pump mechanical seal without disturbing the piping.



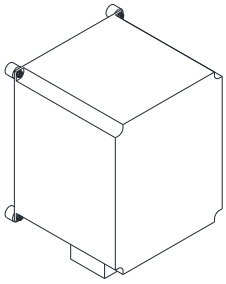
3.1.2 Hydro-Pneumatic Tank

The hydro-pneumatic tank is a pre-pressurized tank that enables the system to react instantaneously upon demand. It also prevents the pump from short cycling from small infrequent demands, this feature is called “Sleep Boost”. An optional ASME Code tank is also available.



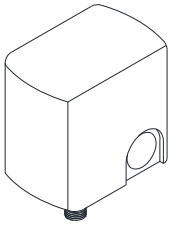
3.1.3 Pressure Transmitter

The pressure transmitter measures pressure at the discharge side of the system. When pressure on the discharge side of the system reaches the set-point, the pressure transmitter sends a signal to shut the pump off. The pump will not turn back on until the discharge pressure of the system drops below the set-point.



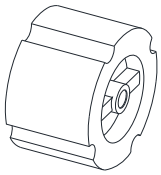
3.1.4 VFD (Variable Frequency Drive)

The VFD regulates the motor and provides a constant output pressure, regardless of fluctuating supply pressure or changing flow demand. The VFD allows for a narrower pressure deadband (the amount of pressure that must be removed before the pressure switch contacts reset after actuation level has been reached) which insures a constant pressure supply at fixtures.



3.1.5 Low Suction Switch

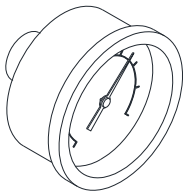
The low suction switch acts as a safeguard for the pump. If suction pressure is below the factory set-point, the low suction switch will prevent the pump from turning on and potentially causing damage.



3.1.6 Inline Check Valve

The inline check valve is located at the pump discharge to prevent possible damage to the pump from water backflow and back pressure. This compact design reduces the overall footprint of the *Pressurizer-VS*.

3.1.7 Pressure Gauge

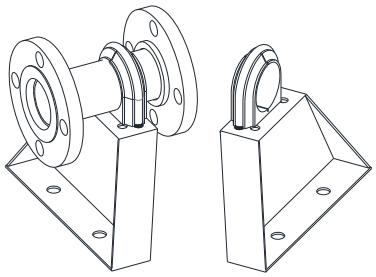


Pressure gauges are located on the suction (inlet) and discharge (outlet) sides of the pump. These gauges allow the user to monitor activity of the piping system and troubleshoot potential problems.
Discharge pressure – suction pressure = total system boost.

3.2 Optional Equipment

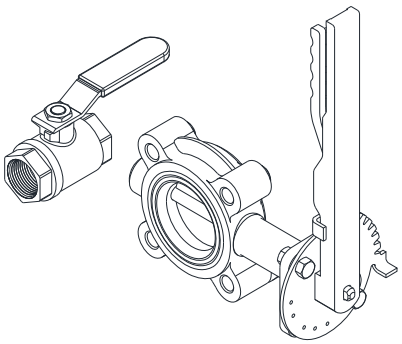
Although the standard *Pressurizer-VS* was designed to meet customer requirements, the need for optional equipment may arise. Thrush can provide options to ensure that our *Pressurizer-VS* meets your needs. Listed below are some of the options available.

3.2.1 Suction Spool / Mounting Brackets



The optional suction spool and mounting brackets can be used to mount the unit to the floor or wall. These brackets also help properly support the piping system. If these brackets are not used, pipe supports must be installed following common plumbing guidelines.

3.2.2 Isolation Valves



Isolation valves are used to isolate the unit from system piping for maintenance or repair. Depending on the *Pressurizer-VS* model, isolation valves will be ball valves with NPT connections or lug style butterfly valves for use with class 125#/150# flanges.

Section 4
Installation, Initial Start-Up and Operation

4.1 Piping Installation

The following procedures are to aid the operator in installing, operating and maintaining the Thrush *Pressurizer-VS*. All procedures are to be performed by experienced, trained, and certified personnel only.

Before the unit is installed, the unit should be visually inspected for any irregularities that may have occurred during shipping. If any parts are missing or damaged, contact your representative. If no issues are detected, continue with installation.

Before making any piping connections, assure that all piping is clean and free of any foreign materials such as debris or scale. Foreign material in the piping can cause damage to the unit and or affect the performance and operation. Manual shutoff valves should be installed upstream and downstream of the system to act as an isolation device. These valves should be in the closed position and remain so until the installation is complete.

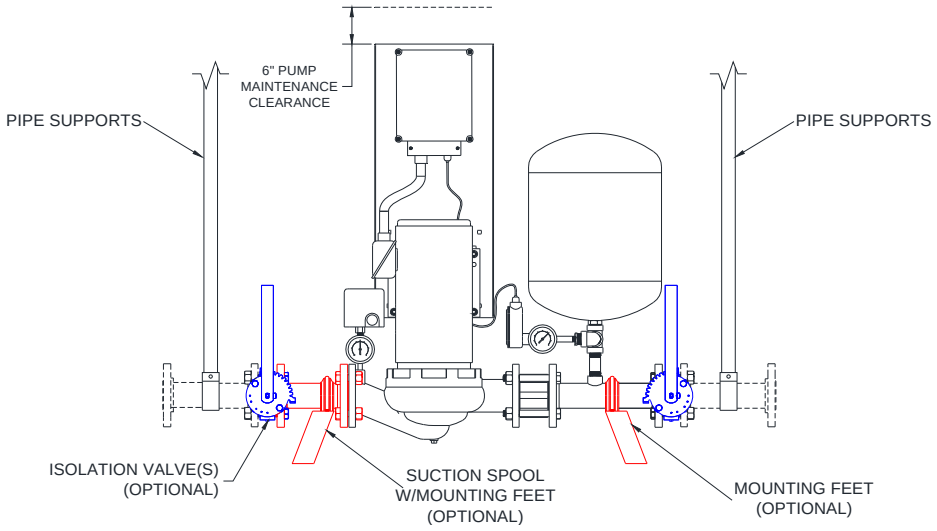


Figure 4-1 Pipe Supports

1. The *Pressurizer-VS* should be located in a clean open area, where it is easily accessible for inspection, service and repair.
2. A standard *Pressurizer-VS* is installed in-line of the system piping. Optional mounting feet can be used for floor mounted or wall mounted installations. See paragraph 3.2.1. and Figure 4-1
3. Note that a minimum 6” of clearance above the drive mounting bracket is recommended to allow for maintenance and repair of the motor and pump.

4.1 Piping Installation (Continued)

4. Suction piping directly affects the overall operation of the *Pressurizer-VS* and is critical to performance. The pipe size should be sized to allow adequate flow at a minimal head loss, and be, at minimum, the same size as the *Pressurizer-VS* connections. The use of fittings (elbows, tees and couplings) should be kept to a minimum as well. The same considerations should be applied when sizing and laying out the discharge piping.

5. Isolation valves are required to allow mechanical seal changes and other maintenance operations. A by-pass line is recommended to allow service of the *Pressurizer-VS* without system shutdown during maintenance operations.

4.2 Electrical Installation

There is a potential for severe personal injury or death if proper electrical installation procedures are not followed. A qualified electrician should make all electrical connections.

Before installation and or servicing electricity to the VFD, refer to the VFD manufacturers' user manual supplied with the *Pressurizer-VS* for all safety warnings and cautions.

Do not connect and or operate the *Pressurizer-VS* with volts, hertz, or phase other than that specified on the VFD. This may cause damage to the VFD and will VOID the product warranty

1. Each *Pressurizer-VS* model has a specific (voltage/hertz/phase) 'supply power' requirement. This information can be found on the side of the VFD on the tag. Verify that the on-site power being 'supplied' to the VFD is as stated on the tag located on the VFD. The motor on the *Pressurizer-VS* will always be a 3 phase motor regardless of the VFD 'supply power' phase requirements of your model.

   For example, if your specific model has been ordered to hook up to single phase 'supply power' to the VFD it will still be equipped with a 3 phase motor.

   Always verify that the VFD is being supplied with the correct (voltage/hertz/phase) 'supply power'.

2. Check the VFD and all electrical devices for any loose or damaged connections. See figures in Section 6.1 (ABB Drive) or 6.2 (Yaskawa Drive). Do not operate the *Pressurizer-VS* until all loose or damaged connections have been repaired.

3. All electrical components are wired at the factory. Only main power connections to the VFD are required. The main power wires should be brought into the bottom side of the VFD and connected to the power input terminal lugs, see Figure 6.1.1 or 6.1.2. An additional disconnect panel located near the VFD may be required to meet et local electrical codes. All electrical wiring should meet standard and local code requirements.

4.3 Initial Startup Procedure

The Standard *Pressurizer-VS* is equipped with an ABB Drive (Figure 4-3-1), also available is an optional Yaskawa Drive (Figure 4-3-2). Displays and controls for each controller are described below.

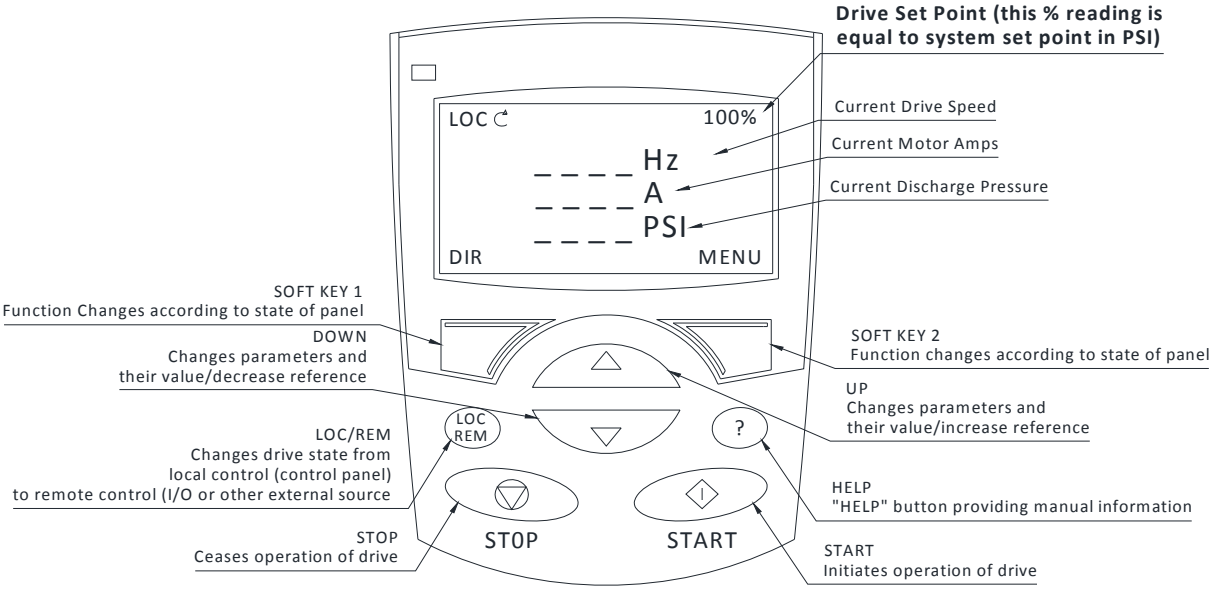


Figure 4-3-1 ABB Controller (Standard)

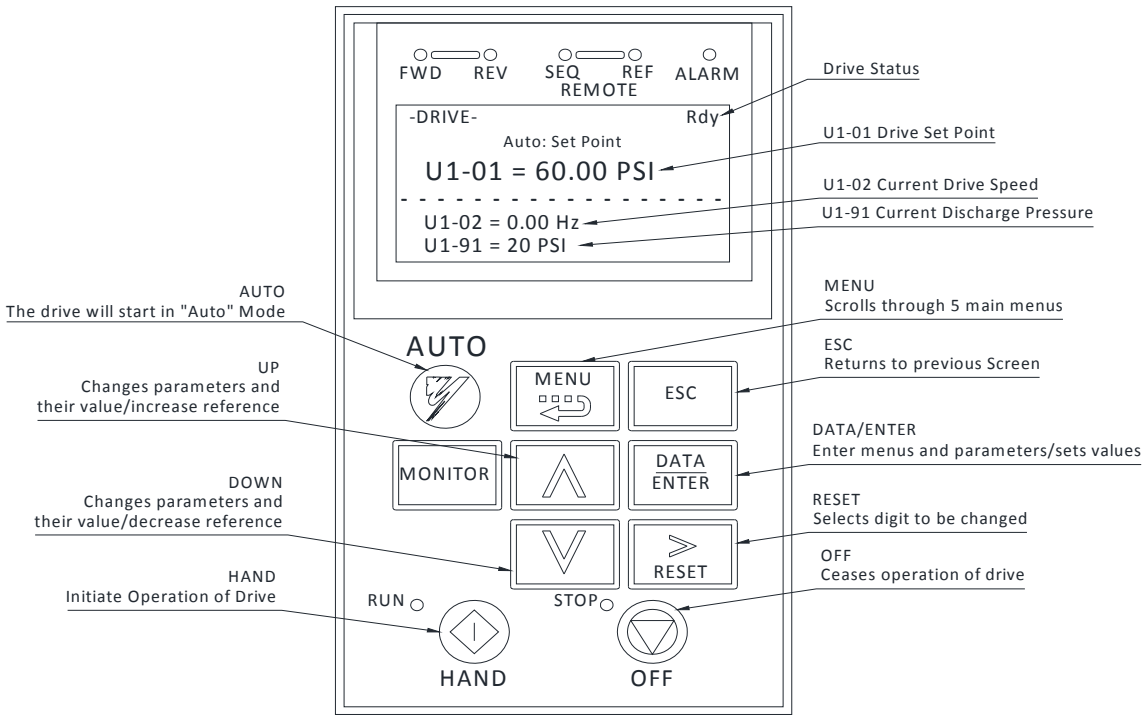


Figure 4-3-2 YASKAWA Controller (Optional)

4.3 Initial Startup Procedure (Continued)

Read and fully understand Safety Information/Warnings in Section 2 before continuing

1. Never work on the VFD, wiring, motor or other component when electrical power is energized. Disconnect the power and verify that power to the Pressurizer-VS is off.

2. Assure that the suction and discharge isolation valves are closed.

3. Verify that the tank pre-charge pressure is set per Figure 4-4. Make pressure adjustments to the tank pre-charge if necessary using the air charging valve stem on the tank.

4. Slowly open the suction isolation valve to fill the *Pressurizer-VS* and check for any leaks. Repair any leaks before proceeding. If the suction pressure gauge indicates suction pressure equal to or above suction pressure per Figure 4-4 you may continue to step 5. If the suction pressure gauge indicates the suction pressure is below that shown in Figure 4-4, you do not have adequate incoming pressure. You must correct this before continuing to step 5, see Section 4.1 paragraph 4.

5. Slowly open the discharge isolation valve and check for any leaks in the discharge piping.

6. Turn on the electrical power; the VFD controller will be illuminated when power is energized.

7. Introduce 6 to 10 GPM of flow into the system by opening 3 or 4 plumbing fixtures such as faucets. A typical faucet delivers approximately 2.5 GPM.

8. To initiate operation of the VFD, press “Start” (ABB) or “Auto” (Yaskawa) on the VFD controller. The VFD should bring the pump up to speed to the factory discharge set pressure as shown in Figure 4-4. See step 9 if adjustment is necessary, if adjustment is not necessary go to Step 10.

9. To adjust the discharge set pressure, press the Up or Down arrow (Figure 4-3-1 or 4-3-2) on the VFD controller until desired discharge set pressure is achieved. This is labeled “Drive Set Point” on the VFD controller. See Figure 4-4 for capabilities of each *Pressurizer-VS*.

10. To verify the low suction pressure switch is working properly, cease the operation of the VFD by pressing “Stop” (ABB) or “Off” (Yaskawa) on the VFD controller. Close the suction isolation valve. The VFD controller will display an error when pressure drops below the suction pressure in Figure 4-4. Open the suction isolation valve and press “Start” (ABB) or “Auto” (Yaskawa) on the VFD controller to resume normal operation.

4.4 Operation

The *Pressurizer-VS* was designed to accommodate your booster application needs. Depending on the model, water pressure can be boosted from 30-80 psi with flow rates up to 200 GPM. Figure 4-4 lists the various *Pressurizer-VS* models, factory settings and their performance capabilities

Model	Maximum Flow (GPM)	Maximum Boost (PSI)	Factory Discharge Set Pressure (PSI) *	Suction Pressure (PSI)	Cut-Out after Sleep Boost (PSI)	Wake Level from Sleep (PSI)	Tank Pre-Charge (PSI)
PB-VSI-60-30	60	30	60	30	65	58	50
PB-VSI-60-40		40		25			
PB-VSI-60-60		60		25			
PB-VSI-60-80		80		25			
PB-VSI-100-30	100	30	60	30	65	58	50
PB-VSI-100-45		45		25			
PB-VSI-100-65		65		25			
PB-VSI-100-80		80		25			
PB-VSI-200-35	200	35	60	25	65	58	50
PB-VSI-200-50		50		25			
PB-VSI-200-60		60		25			

* This is field adjustable to fit specific duty points provided you stay within the capabilities of the pump.

Figure 4-4 Factory Settings & Performance Capabilities

4.5 Definition of Terms in Figure 4-4

Maximum Flow: The total amount of water that the specific *Pressurizer-VS* is capable of pumping while maintaining the boost capabilities of the unit.

Maximum Boost: The amount of water pressure increase (boost) that the specific Pressurizer-VS is capable of adding to of the suction pressure over the flow capabilities of the unit. Suction Pressure + boost pressure = discharge (delivery) pressure. Maximum boost can only be achieved if maximum flow is not exceeded.

Factory Discharge Set Pressure: The factory set point for the *Pressurizer-VS.*

Suction Pressure: The pressure supplied to the suction of the *Pressurizer-VS* during factory setting of the Discharge Set Pressure. Site conditions with suction pressure other than this will affect the sleep speed activation points and other settings of the VFD.

Cut-Out after Sleep Boost: The *Pressurizer-VS* incorporates a unique Sleep Boost feature which will speed up the motor and adds additional pressure to fill the hydro-pneumatic tank before going into sleep mode.

Wake Level from Sleep: The pressure in which the VFD starts the pump after sleep mode.

Tank Pre-Charge: The pressure in the air side of the hydro-pneumatic tank with zero pressure (no water in tank and connection is open to atmosphere) in the water side of the tank. This pressure should be checked and corrected upon installation of the *Pressurizer-VS*. **If the operating conditions of the unit need to be adjusted in the field, the pre-charge in the tank should be adjusted also. For optimal performance, the pre-charge in the tank should be set to 10 PSIG below the Discharge Set Pressure**.

Section 5
Maintenance Information

5.1 Maintenance Information

The information in this section details the proper maintenance procedures for the components of the *Pressurizer-VS.* Because this manual serves multiple models of *Pressurizer-VS*, the information may be general in some instances. If there are any questions concerning maintenance procedures that are not clearly explained in this manual, contact your representative. The design simplicity of the Thrush *Pressurizer-VS* results in a minimum of required maintenance.

Electrical Components: The VFD, pressure switch, and pressure transmitter should require only periodic inspection to avoid possible problems such as loose connections, worn contacts, etc. Refer to Section 6 for wiring of components.

Pump Seal Replacement: A Cartridge Seal Kit includes the mechanical seal, a pump body gasket and installation instructions.

Pump Motor: Consult the motor manufacturer maintenance manual via their website for recommended maintenance intervals. Refer to the motor nameplate for manufacturer and model number.

VFD to Motor Compatibility: The VFD on the *Pressurizer-VS* has parameters programmed specifically for the make and model of the motor originally installed by Thrush.

Motor Rotation: The VFD to motor wiring is factory checked to ensure proper motor rotation. If the drive is disconnected from the motor, proper rotation should be verified before returning the *Pressurizer-VS* back to full service conditions. See Figure 6-1-2 (ABB) or 6-2-2 (Yaskawa) for proper wiring terminals that dictate rotational direction. VFD output is not phase sensitive to the supply phase. Reversing the power wires feeding the VFD will not change rotation. To change rotation, reverse two wires from VFD to motor. See Figure 6-1-2 (ABB) or 6-2-2 (Yaskawa).

5.2 Replacement Parts

Replacement parts for the *Pressurizer-VS* are available through your representative.

Section 6
Electrical Drawings

6.1 Electrical Drawings (for use with ABB Drive)

Before installation and or servicing electricity to the VFD, refer to the ABB user manual supplied with the *Pressurizer-VS* for all safety warnings and cautions.

The figures in this section illustrate factory wiring for reference in the event a component or the wiring needs replaced on the Pressurizer-VS. Figure 6-1-1 illustrates incoming power and ground connections to the VFD. Figure 6-1-2 motor to VFD, 6-1-3 low-pressure switch to VFD, and 6-1-4 pressure transmitter to VFD.

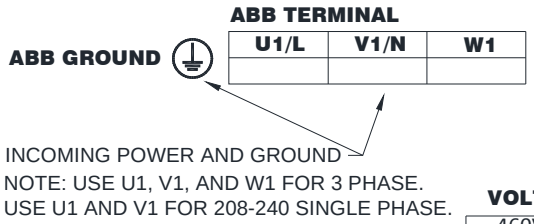


Figure 6-1-1

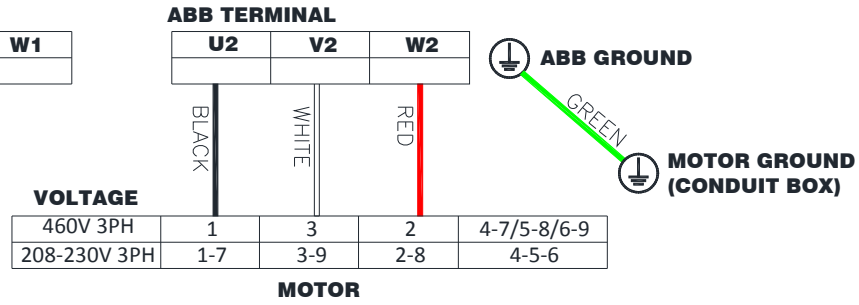
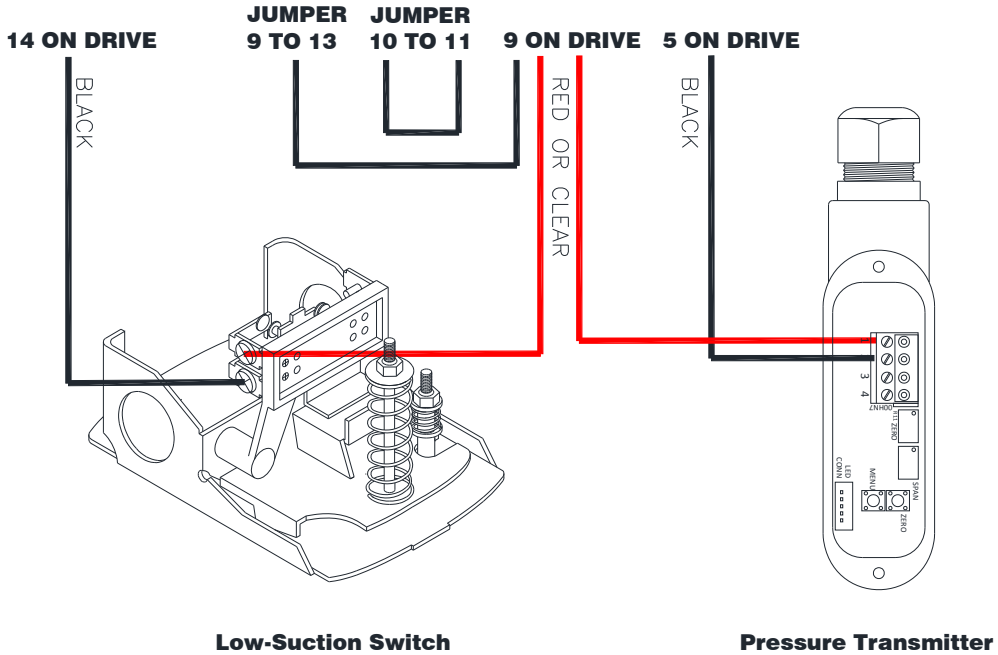


Figure 6-1-2



Low-Suction Switch

Figure 6-1-3

Pressure Transmitter

Figure 6-1-4

6.2 Electrical Drawings (for use with Yaskawa Drive)

Before installation and or servicing electricity to the VFD, refer to the Yaskawa user manual supplied with the *Pressurizer-VS* for all safety warnings and cautions.

The figures in this section illustrate factory wiring for reference in the event a component or the wiring needs replaced on the Pressurizer-VS. Figure 6-2-1 illustrates incoming power and ground connections to the VFD. Figure 6-2-2 motor to VFD, 6-2-3 low-pressure switch to VFD, and 6-2-4 pressure transmitter to VFD.

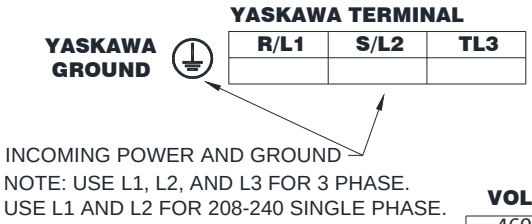


Figure 6-2-1

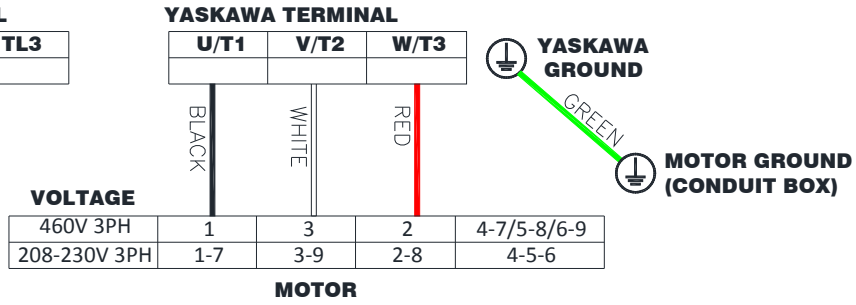
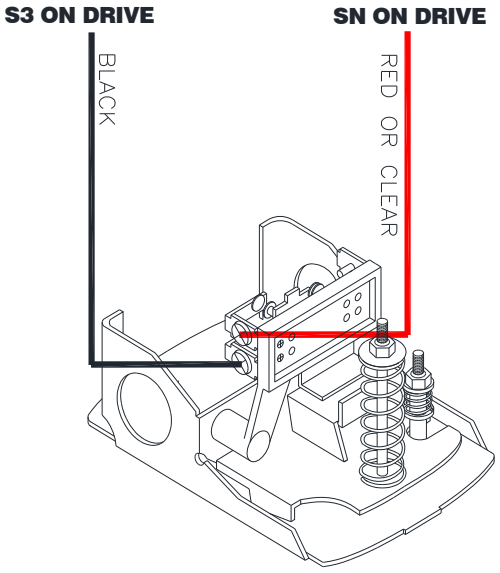
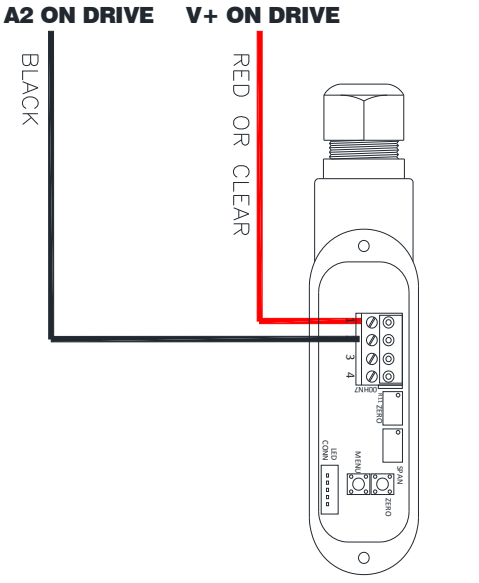


Figure 6-2-2



Low-Suction Switch

Figure 6-2-3



Pressure Transmitter

Figure 6-2-4