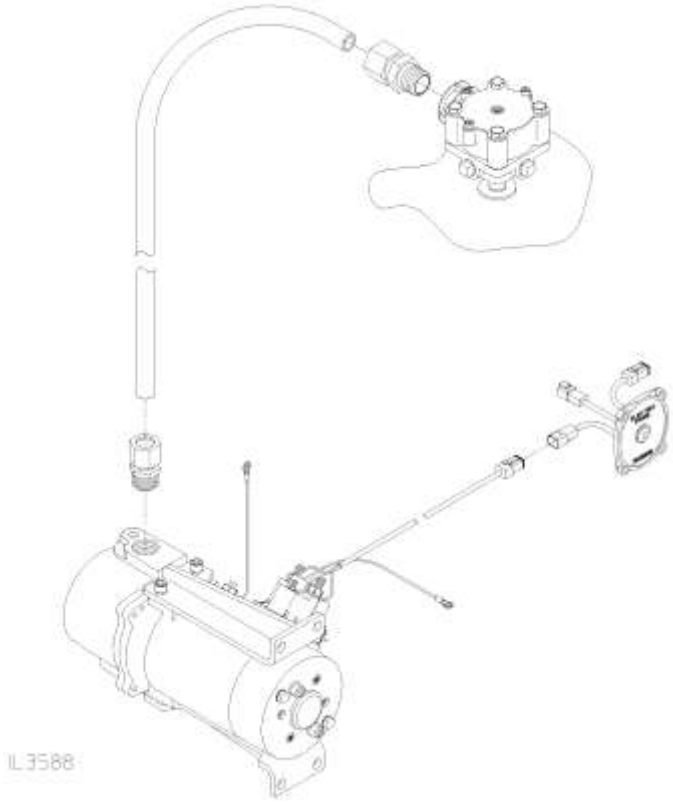
Priming Systems Installation Instructions

System Components:

Principles of Operation:

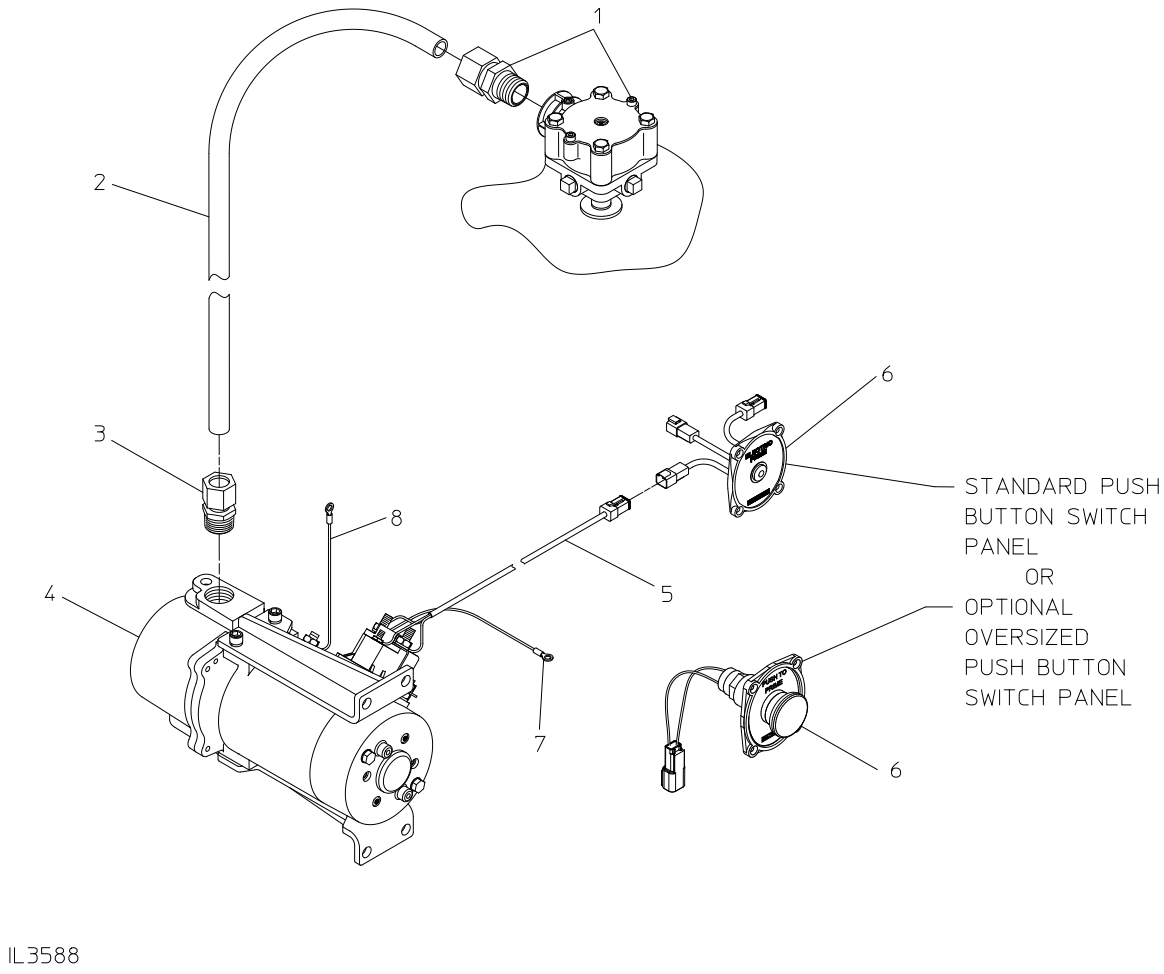


Installation:

Waterous Company 125 Hardman Avenue South, South St. Paul, Minnesota 55075 USA (651) 450-5000
www.waterousco.com

System Components – Single Priming Pump

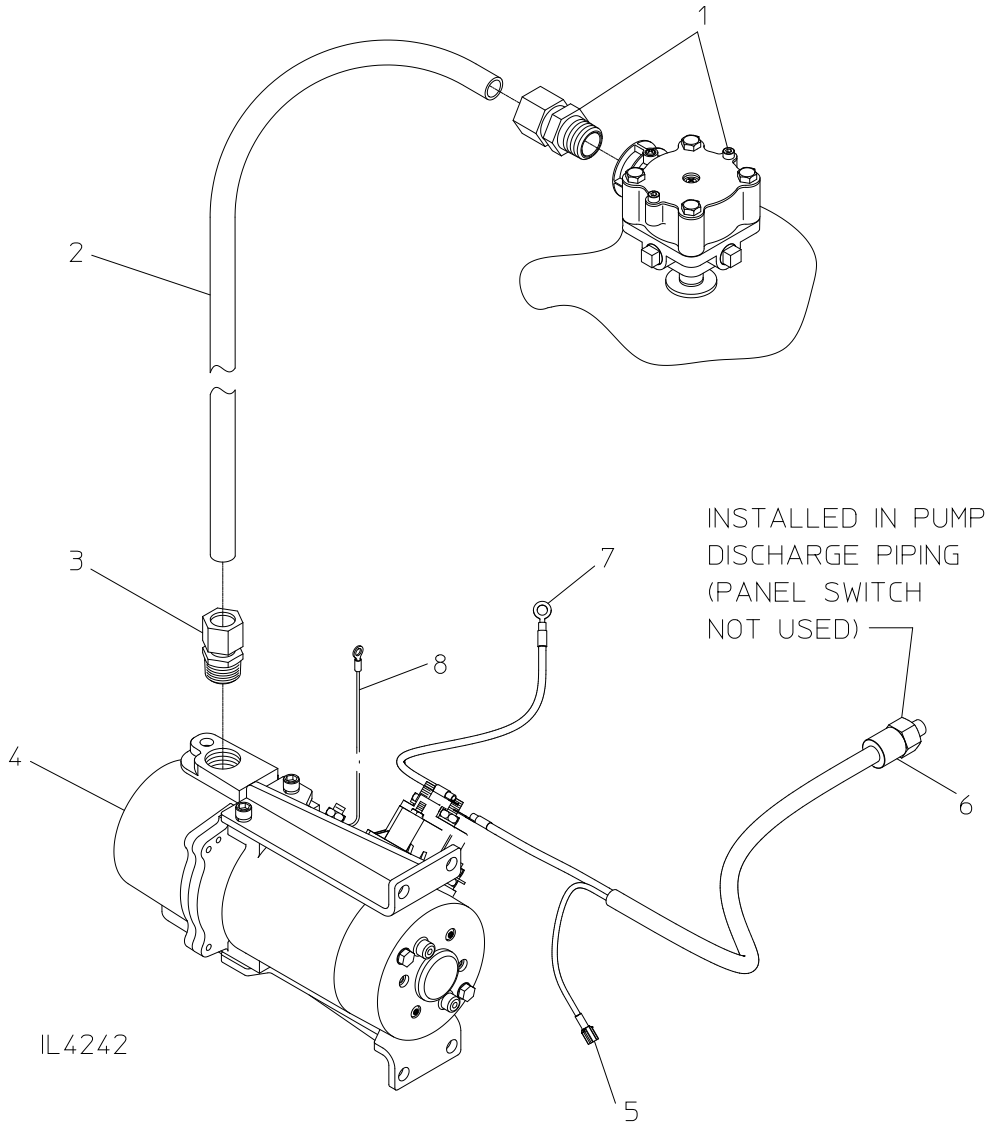
Single VAP Valve Systems
Control Panel Activated



Ref. No.	Item	Furnished By:	Specifications
1	VAP Priming Valve	Waterous	-
2	3/4 in. Tube or Hose	Truck Builder	Tube: See Table 2 on Page 13
			Hose: See Table 3 on Page 13
3	3/4 in. NPT Fitting	Truck Builder	Tube: 3/4 in. NPT Compression Fitting
			Hose: 3/4 in. NPT Pipe Fitting
4	Priming Pump	Waterous	-
5	Panel Cable	Waterous	-
6	Control Panel	Waterous	-
7	Motor Power Cable	Truck Builder	See Table 1 on Page 9
8	Motor Grounding Strap	Truck Builder	-

System Components – Single Priming Pump

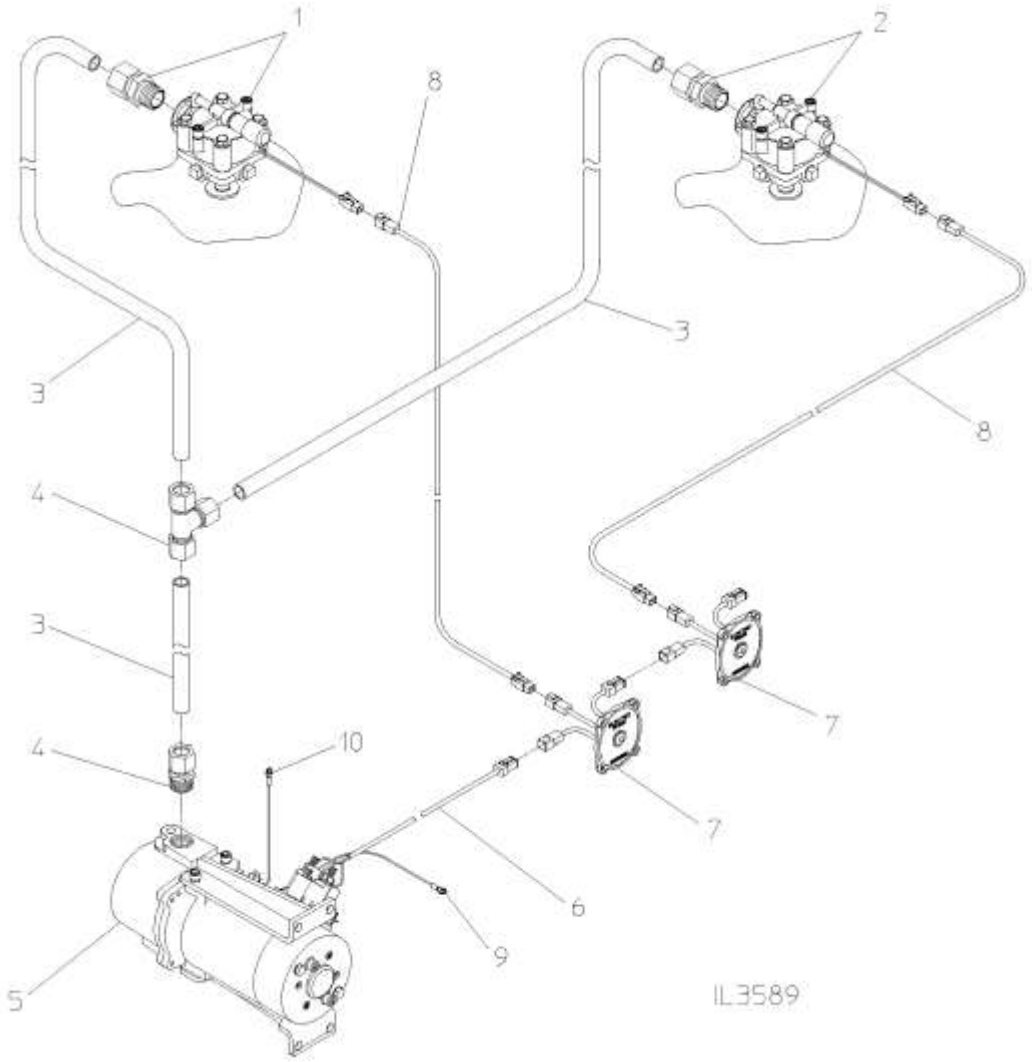
Single VAP Valve Systems
Auto Prime (Pressure Switch) Activated



Ref. No.	Item	Furnished By:	Specifications
1	VAP Priming Valve	Waterous	-
2	3/4 in. Tube or Hose	Truck Builder	Tube: See Table 2 on Page 13
			Hose: See Table 3 on Page 13
3	3/4 in. NPT Fitting	Truck Builder	Tube: 3/4 in. NPT Compression Fitting
			Hose: 3/4 in. NPT Pipe Fitting
4	Priming Pump	Waterous	-
5	PTO/Pump Engage Connector	Waterous	-
6	Pressure Switch	Waterous	-
7	Motor Power Cable	Truck Builder	See Table 1 on Page 9
8	Motor Grounding Strap	Truck Builder	-

System Components – Single Priming Pump

Multiple VAP Valve Systems
Control Panel Activated

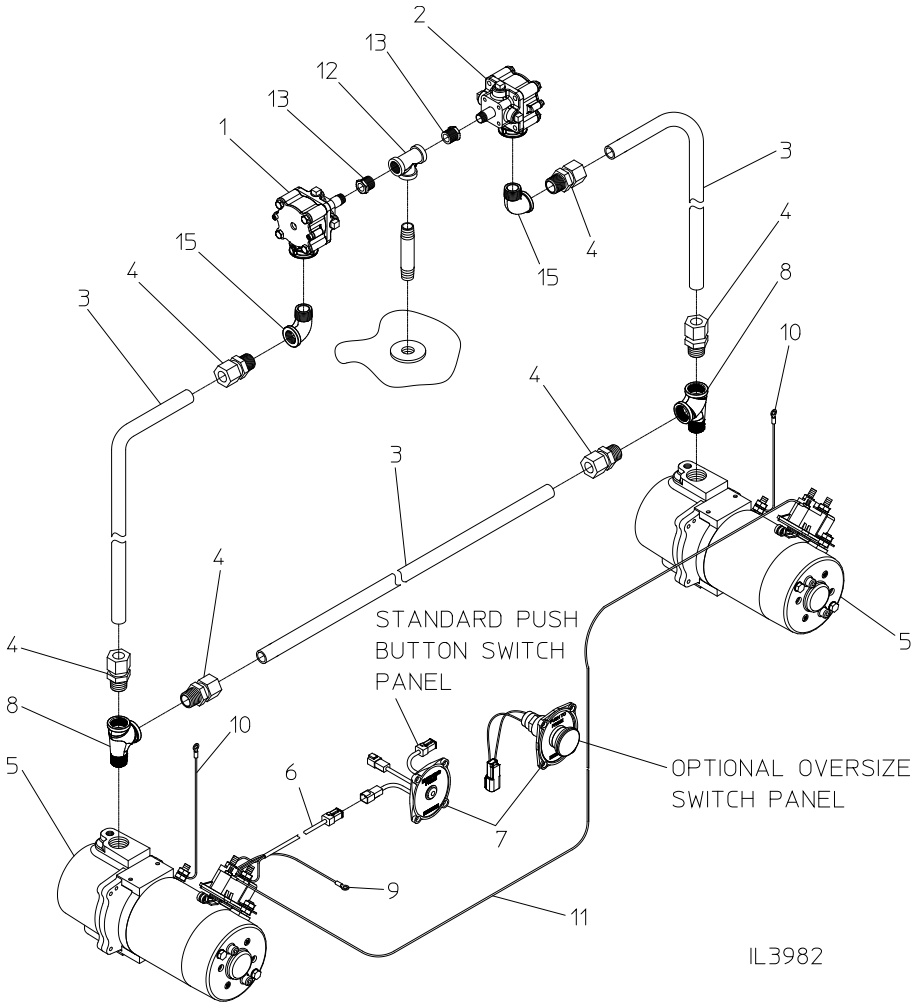


Ref. No.	Item	Furnished By:	Specifications
1	Main VAP Priming Valve	Waterous	-
2	Additional VAP Priming Valve	Waterous	-
3	3/4 in. Tube or Hose	Truck Builder	Tube: See Table 2 on Page 16
			Hose: See Table 3 on Page 16
4	3/4 in. NPT Fitting	Truck Builder	Tube: 3/4 in. NPT Compression Fitting
			Hose: 3/4 in. NPT Pipe Fitting
5	Priming Pump	Waterous	-
6	Panel Cable	Waterous	-
7	Control Panel	Waterous	-
8	Solenoid Cable	Waterous	-
9	Motor Power Cable	Truck Builder	See Table 1 on Page 9
10	Motor Grounding Strap	Truck Builder	-

Note: Up to five additional VAP valves may be installed for a total of six VAP priming valves.

System Components – Dual Priming Pumps

Dual Control Panel Activated VAP Valve System



Ref. No.	Item	Furnished By:	Specifications
1	Main VAP Priming Valve	Waterous	-
2	Additional VAP Priming Valve	Waterous	-
3	¾ in. Tube or Hose	Truck Builder	Tube: See Table 2 on Page 20
4	¾ in. NPT Fitting	Truck Builder	Hose: See Table 3 on Page 20
5	Priming Pump	Waterous	-
6	Panel Cable	Waterous	-
7	Control Panel	Waterous	-
8	Street Tee	Truck Builder	3/4 in. NPT
9	Motor Power Cable	Truck Builder	See Table 1 on Page 9
10	Motor Grounding Strap	Truck Builder	-
11	Jumper Wire	Waterous	White 18-AWG with No. 10 Ring Terminals, 18 in./457.2 mm long
12	½ in. Tee	Truck Builder	-
13	3/8 in. x ½ in. Bushing	Truck Builder	-
14	½ in. Nipple, 4 in. Long	Truck Builder	-
15	¾ in. Elbow	Truck Builder	-

Principles of Operation – Complete System

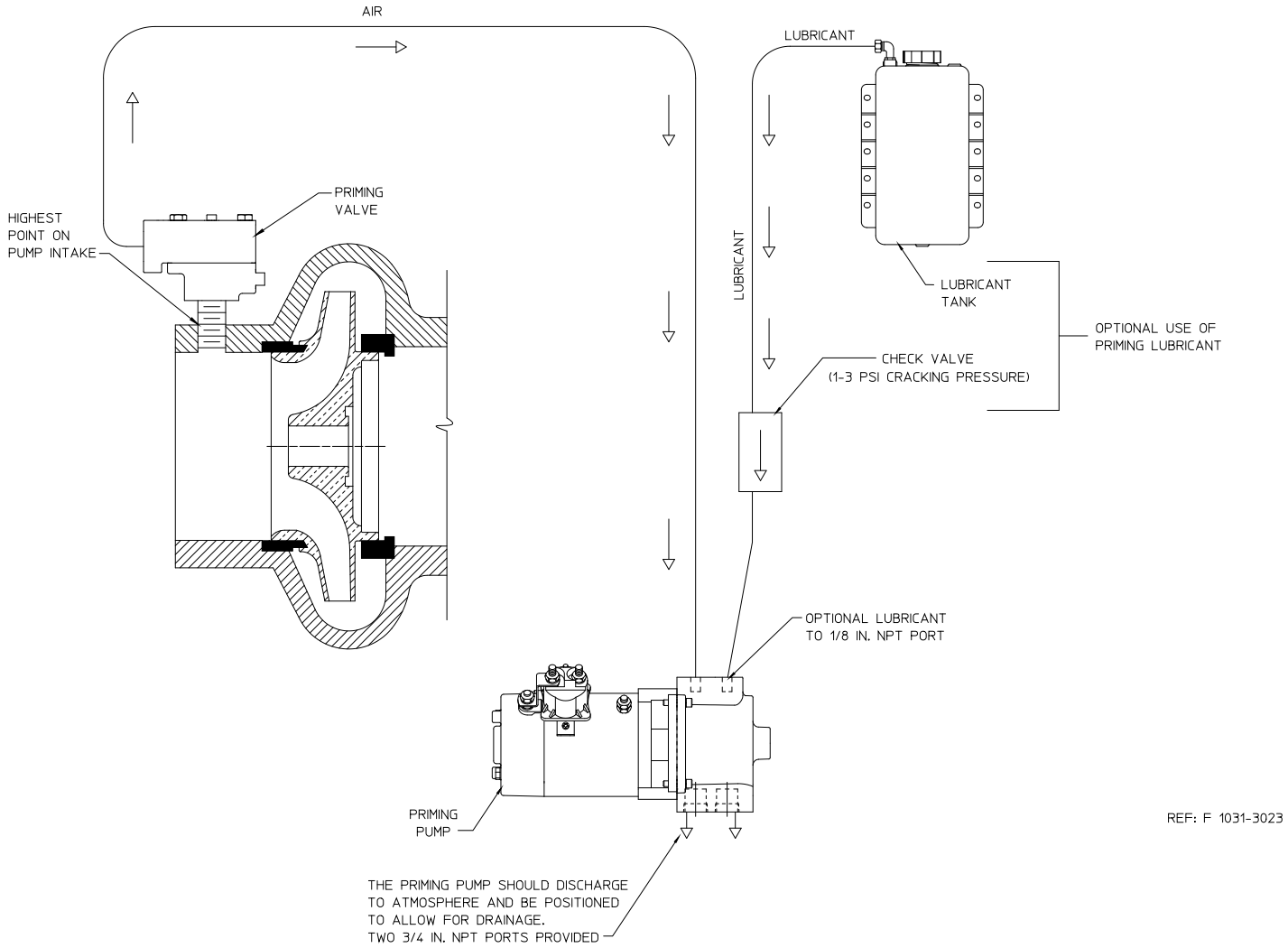
Before any centrifugal pump can be operated, it must be primed. Priming is the process of replacing air in the intake lines and portions of the pump with water. If the pump is to be operated from draft, priming must be done by means of a positive displacement pump, or some other device for creating a partial vacuum. Also, when pumping from a water tank, priming will be accomplished more quickly and positively if a priming device is used. Priming will occur naturally when pumping from hydrants or in relay, because inlet water pressure is high enough to force air out of the pump and intake lines, providing a discharge line is opened to permit the air to escape.

A Waterous priming system consists of a priming pump and a priming valve. The priming pump draws air out of the centrifugal pump through the priming valve. The priming valve must be open when priming the pump and then closed when the pump is fully primed (pumping water with all air removed).

Optional Priming Lubricant

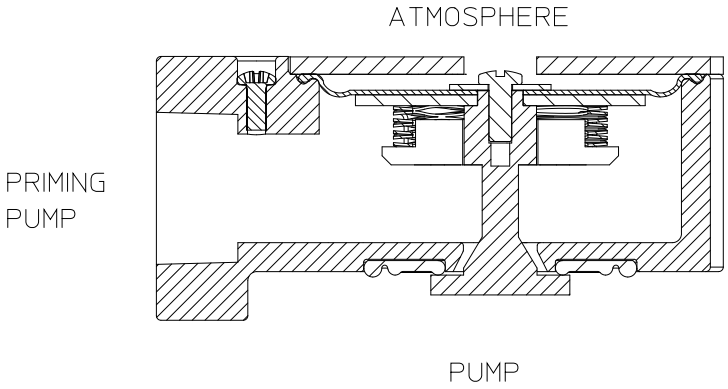
Lubricant may be used to help seal and lubricate the priming pump.

Figure 1. Priming System Schematic

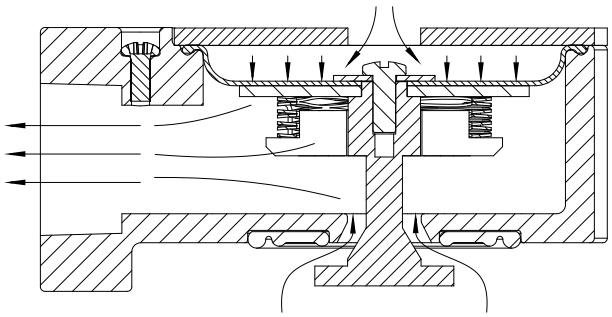


Principles of Operation – VAP Priming Valve
Single or Dual VAP Valves Systems

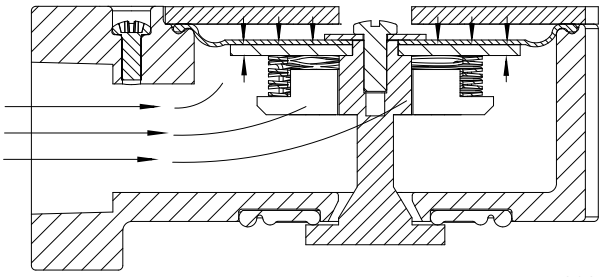
VAP normal position is closed.
Closed position is held by the spring



When the primer is activated, a low pressure area is created inside the VAP. Atmospheric pressure enters through the top and pushes down on the diaphragm, which in turn opens the valve to the pump. This allows the air to be evacuated.
Note that intake pump pressure will counter-act on the stem, so the valve will open at elevated intake pressures.



When the primer is deactivated, air enters back into the VAP equalizing the pressure on the diaphragm. The spring then takes over again, closing the VAP.



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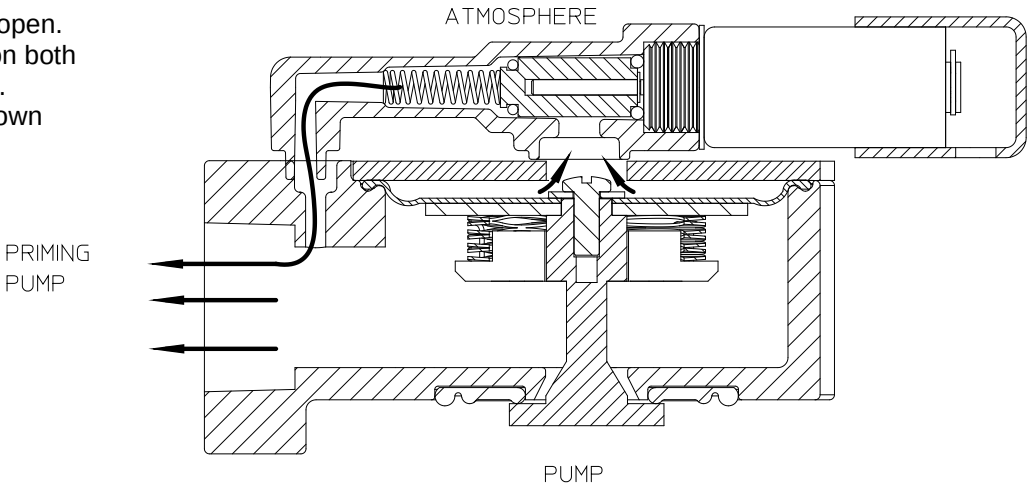
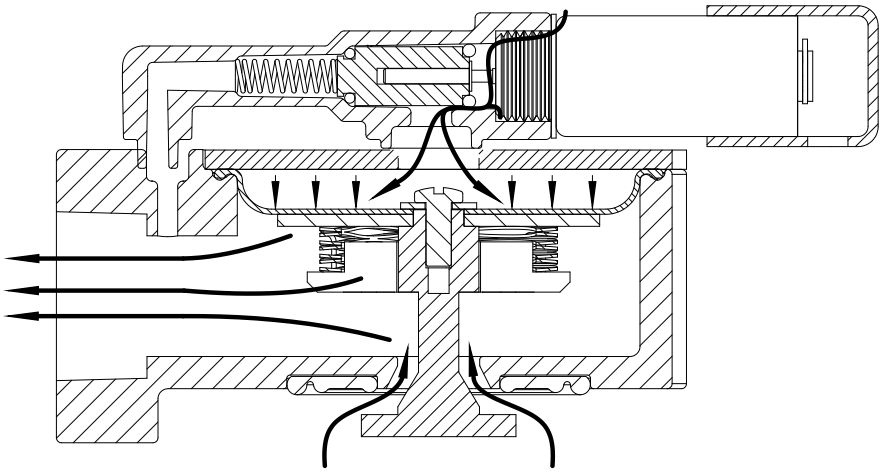
Principles of Operation – VAP Priming Valve
Multiple VAP Systems

Isolation solenoid normal position is open. This causes a vacuum to be drawn on both the top and bottom of the diaphragm. The diaphragm is not able to push down against the spring.

The normal position is isolated.



When the isolation solenoid is activated, the top of the diaphragm is unable to be vacuumed. Atmospheric pressure leaking around/through the back of the solenoid pushes down on the diaphragm, which in turn opens the valve to the pump allowing air to be evacuated.
Note that intake pump pressure will counter-act on the stem, so the valve will not open at elevated intake pressures.



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Installation – Priming Pump

Rotary vane priming pumps are available mounted on the transmission from the factory (Model VPO) or separately mounted by the OEM (Model VPOS).

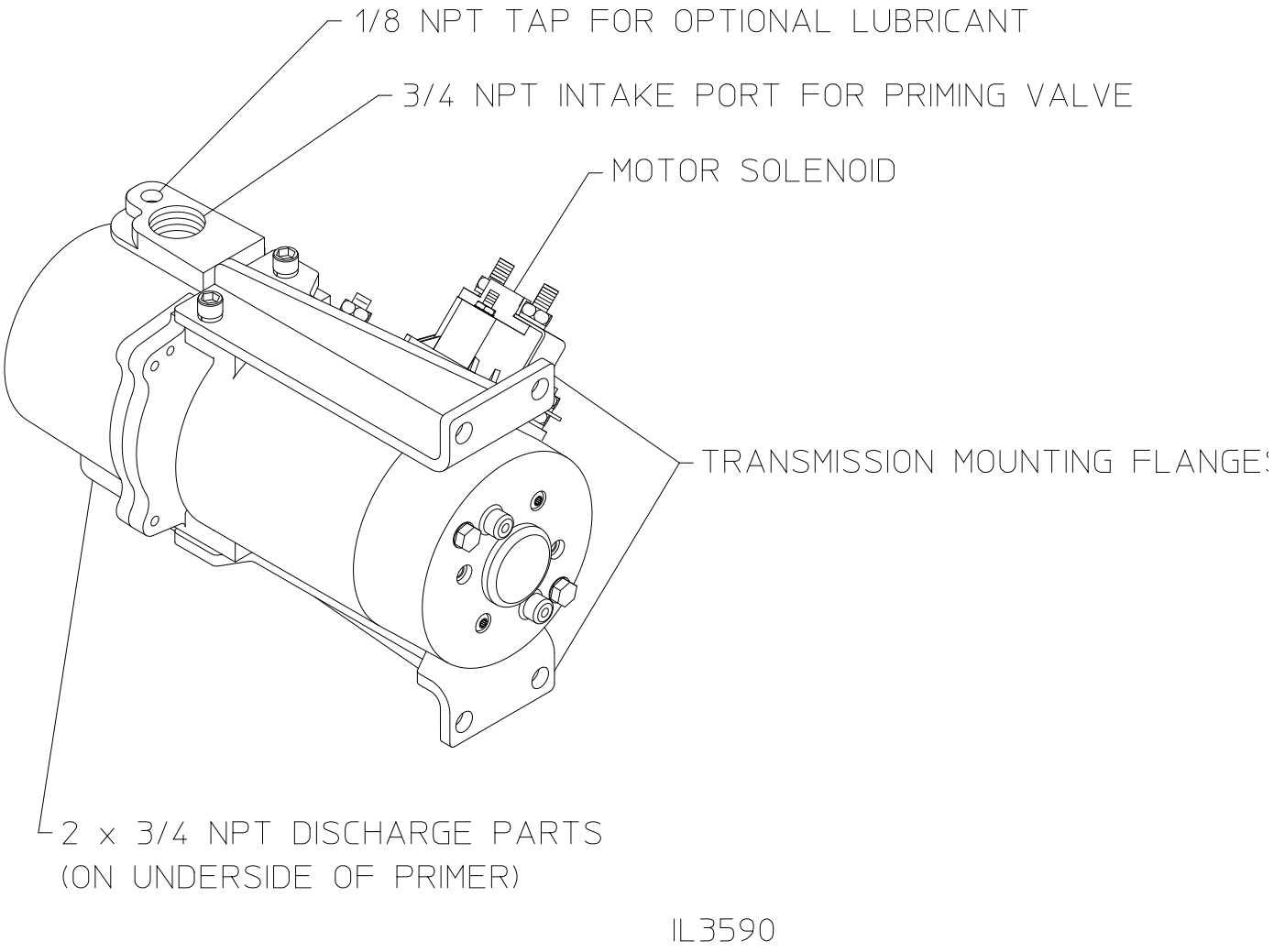
Install Priming Pump:

Model VPO Priming Pump Mounted on Pump at Factory:

On pumps with C20, C21, or W series transmissions, the priming pump will be mounted on the transmission and the priming valve mounted on the pump at the factory.

It will only be necessary to connect the battery (power) and grounding strap to the priming pump motor and install the control panel on the operator's panel.

Hoses may also be attached to the two 3/4 in. NPT discharge taps to direct primer discharge to a remote location if desired. Note that Waterous does not provide the hoses.



Installation – Priming Pump

Install Priming Pump:

Model VPOS Priming Pump installed by OEM:

Pumps with transmissions other than C10, C20, C21 or W series will have the priming pump shipped loose for installation by the OEM.

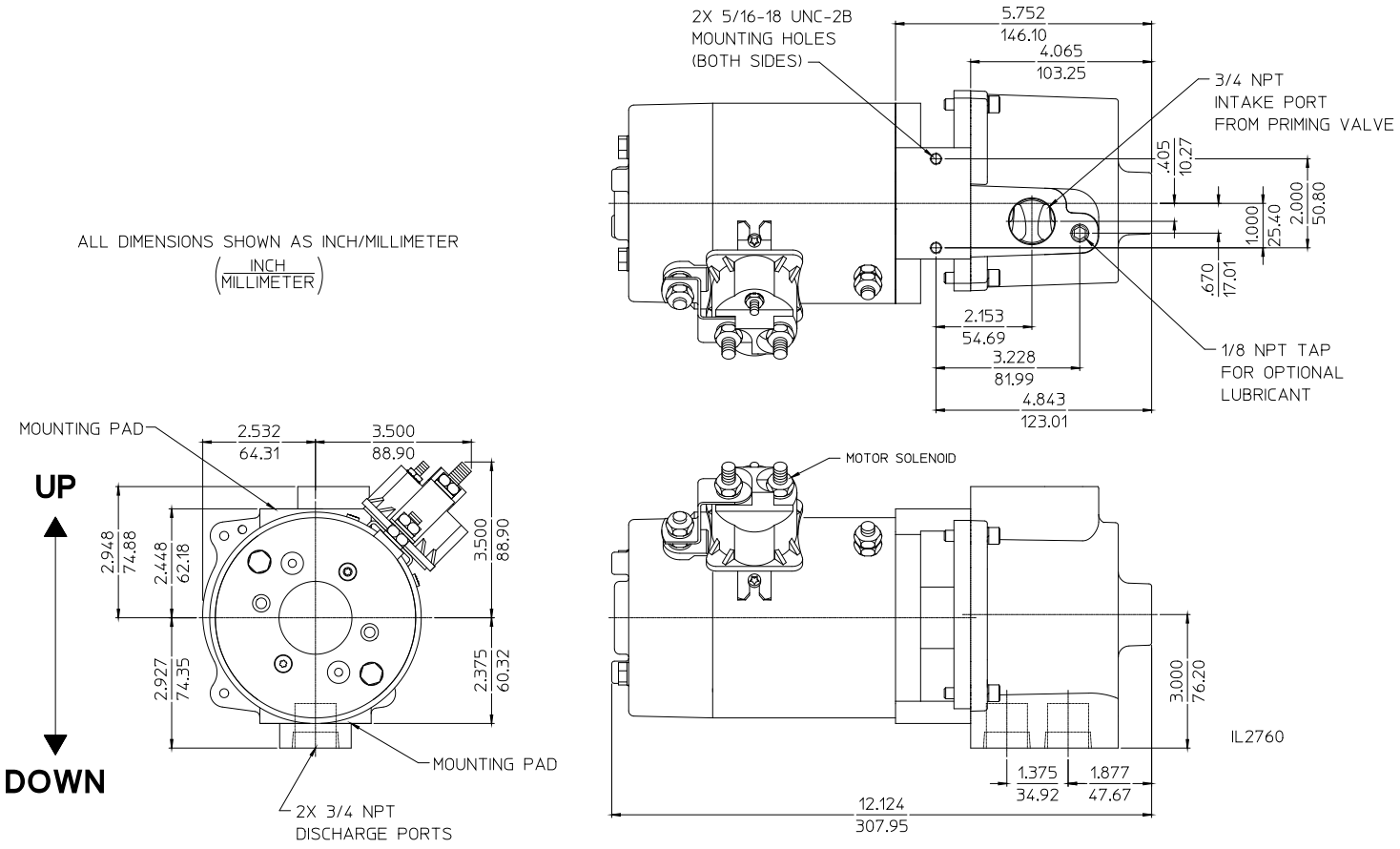
It will be necessary to connect the battery (power) and grounding strap to the priming pump motor, connect the control panel cable and install the control panel on the operator's panel.

If AUTO PRIME option is used, install pressure switch in water discharge passageway (1/4" NPT port) and connect wires.

Select a mounted location which provides access for maintenance and keeps the length of the tube between the priming pump and valve to a minimum. Ensure the routing of the tube allows for drainage back through the priming pump.

The mounting location must be rigid. Two 5/16-18 UNC tapped holes are provided on both the top and bottom mounting pads for attachment of brackets. Ensure the discharge ports face down.

Hoses may also be attached to the two 3/4 in. NPT discharge taps to direct primer discharge to a remote location if desired. Note that Waterous does not provide the hoses.



Installation – Priming Pump

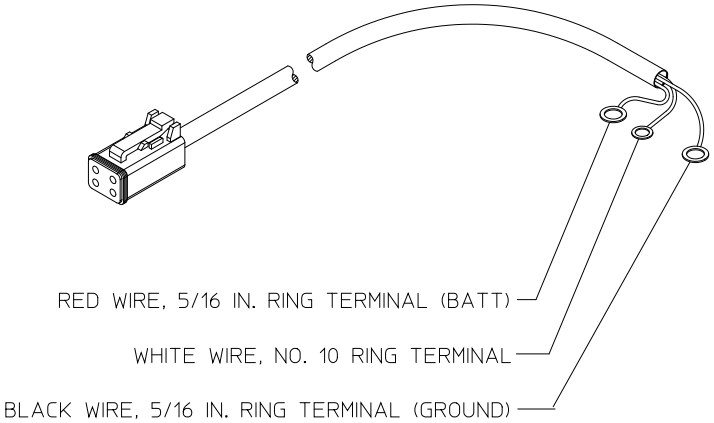
Install Switch Wire:
VAP Priming Valve with Single Priming Pump

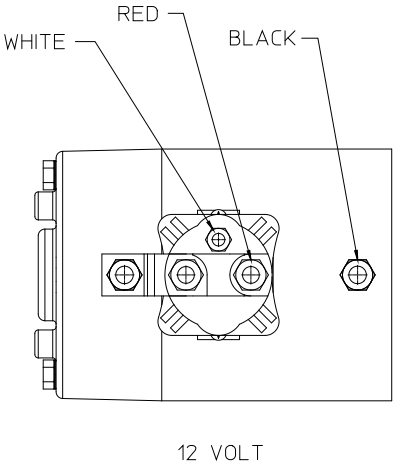
Connect Control Panel cable wires to priming pump motor solenoid.

Note that this connection may have been completed at the factory.

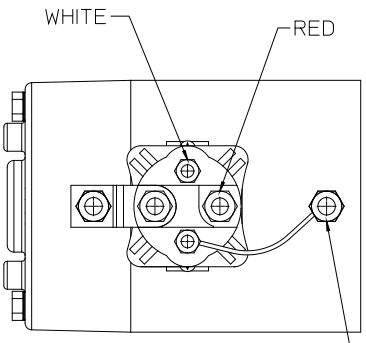
Notice:

To avoid damage, tighten nuts on solenoid studs as follows:
Large Studs: 50-60 in-lbs (4-5 lb-ft)
Small Studs: 15-20 in-lbs (1-2 lb-ft)





12 VOLT



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24 VOLT

Installation – Priming Pump

Install Switch Wire:

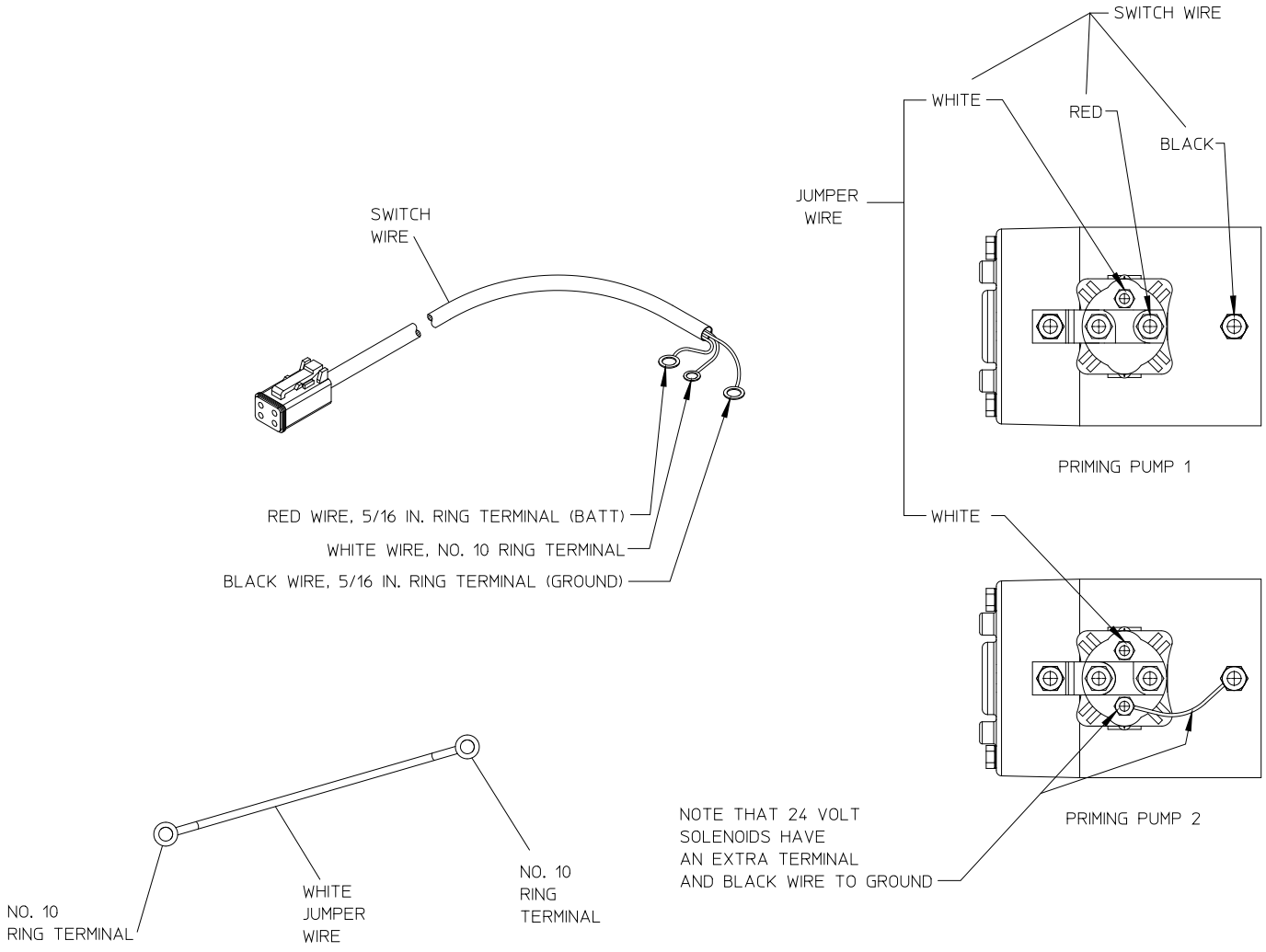
VAP Priming Valve with Single Priming Pump

Connect Control Panel cable wires to priming pump motor solenoid.

Connect jumper wire between priming pump solenoids.

Notice:

To avoid damage, tighten nuts on solenoid studs as follows:
Large Studs: 50-60 in-lbs (4-5 lb-ft)
Small Studs: 15-20 in-lbs (1-2 lb-ft)



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Installation – Priming Pump

Install Switch Wire:

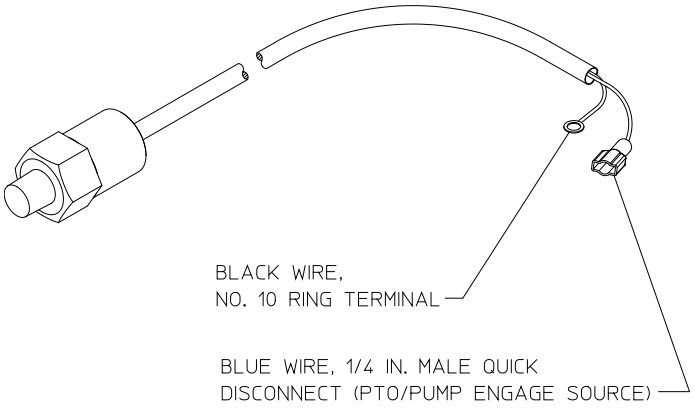
Auto Prime Wire

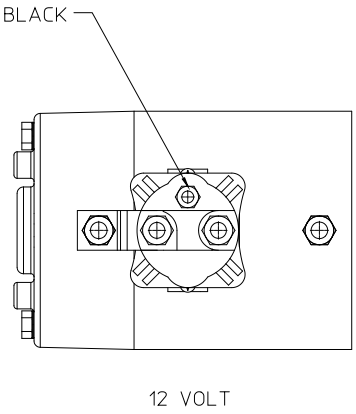
Connect Auto Prime cable wire (black) to priming pump motor solenoid
Connect Auto Prime cable wire (blue) to PTO/pump engage source.

Note that this connection may have been completed at the factory.

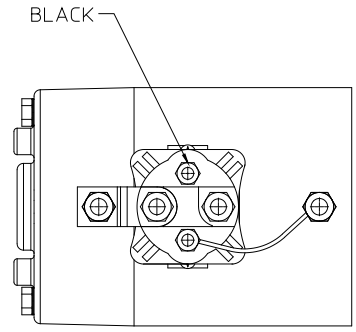
Notice:

To avoid damage, tighten nuts on solenoid studs as follows:
Large Studs: 50-60 in-lbs (4-5 lb-ft)
Small Studs: 15-20 in-lbs (1-2 lb-ft)





12 VOLT



24 VOLT

IL4243

Installation – Priming Pump

Install Power Wires:

Ground the Priming Pump Motor:

To ensure electrical conductivity, connect a grounding strap between the chassis frame and the ground stud on the priming pump motor.

Connect Battery to Priming Pump Motor: Size wiring according to Table 1. The 12 volt motor draws up to 325 amps and the 24 volt motor draws up to 170 amps.

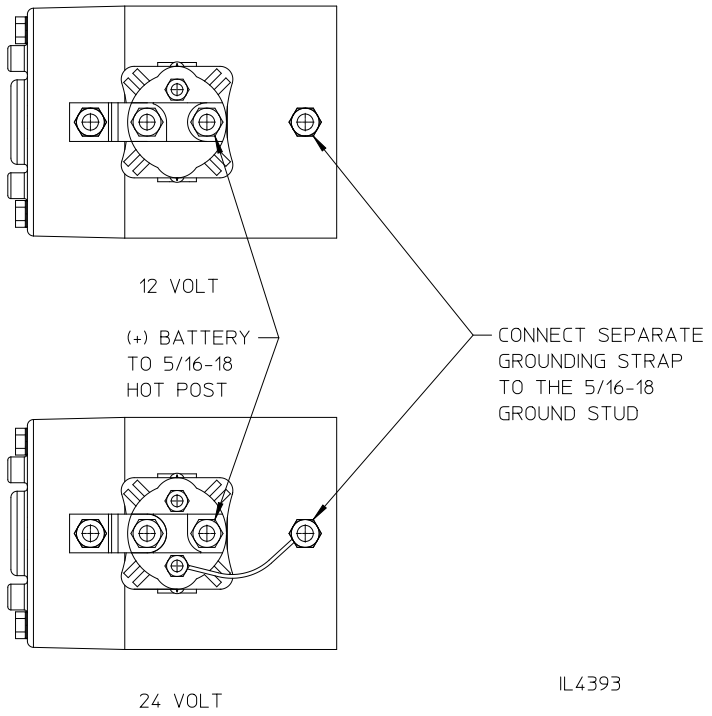


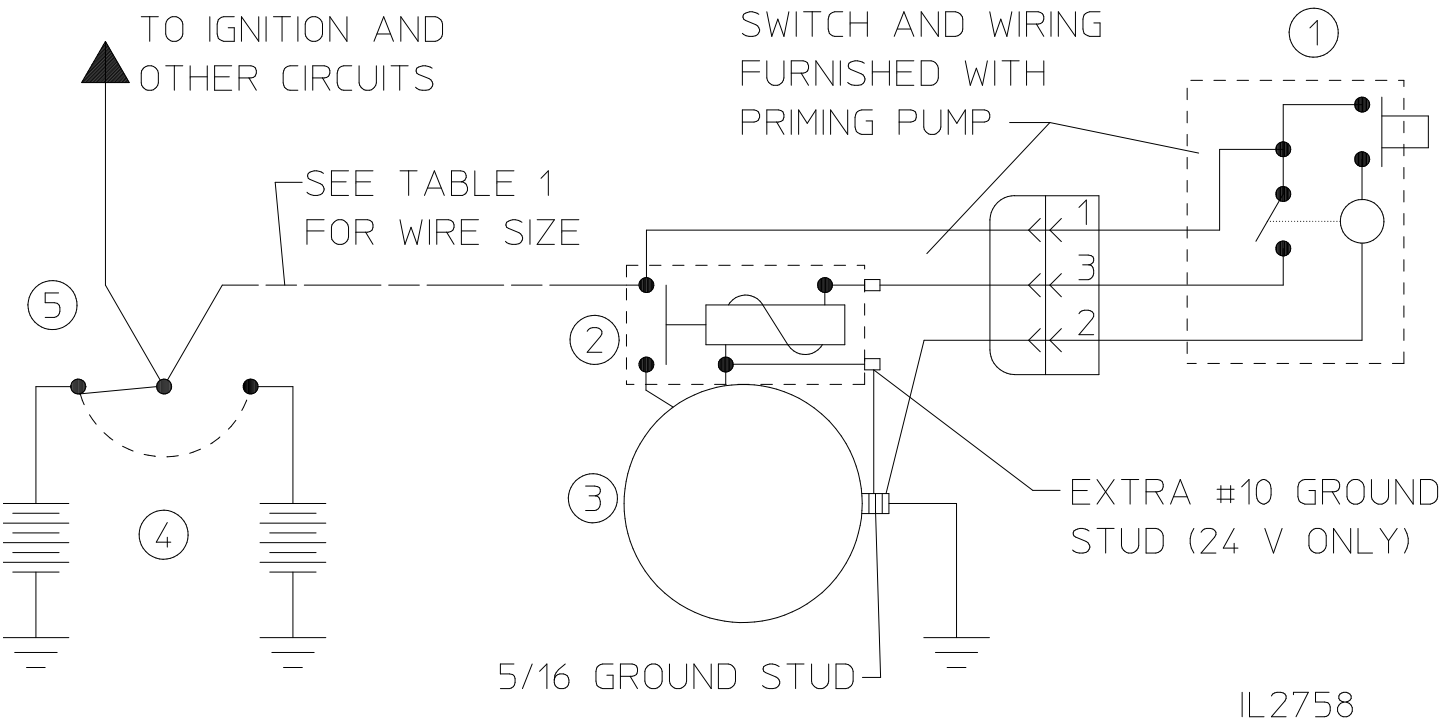
Table 1 - Priming Pump Motor Powers Supply Wire (Not Furnished by Waterous)

Amps	(Minimum Wire Size (AWG) for a 5% Voltage Drop Across One Leg of the Circuit (10% voltage drop if ground wire leg of circuit is equal in length to power wire leg)									
	Length, Feet									
	5	10	15	20	25	30	35	40	45	50
70	12	8	6	6	4	4	2	2	2	2
75	10	8	6	4	4	4	2	2	2	1
80	10	8	6	4	4	2	2	2	2	1
90	10	6	6	4	4	2	2	2	1	1
100	10	6	4	4	2	2	2	1	1	1/0
125	8	4	4	2	2	1	1	1/0	1/0	2/0
150	8	4	4	2	1	1	1/0	2/0	2/0	3/0
175	8	4	2	2	1	1/0	2/0	2/0	3/0	3/0
200	8	4	2	1	1/0	2/0	2/0	3/0	3/0	4/0
225	8	4	2	1	1/0	2/0	3/0	3/0	4/0	4/0
250	8	2	1	1/0	2/0	3/0	3/0	4/0	4/0	2 @ 2/0
275	8	2	1	1/0	2/0	3/0	4/0	4/0	2 @ 2/0	2 @ 2/0
300	4	2	1	2/0	2/0	3/0	4/0	2 @ 2/0	2 @ 2/0	2 @ 2/0
325	4	2	1/0	2/0	2/0	4/0	4/0	2 @ 2/0	2 @ 2/0	2 @ 2/0
350	4	2	1/0	2/0	2/0	4/0	2 @ 2/0	2 @ 2/0	2 @ 2/0	2 @ 2/0

Installation – Priming Pump

Install Power Wires:

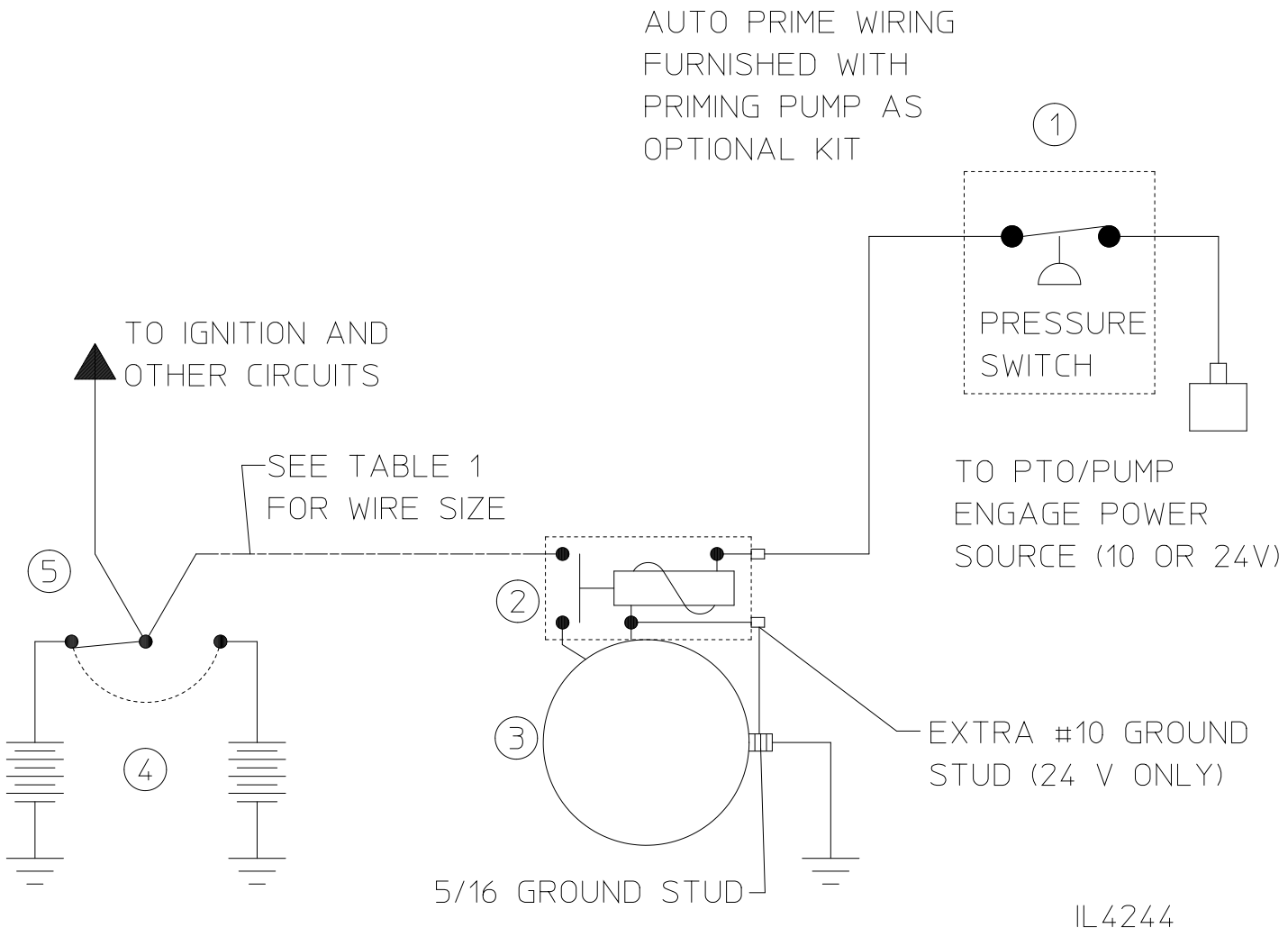
Motor Solenoid Wiring Schematic:
Single Priming Pump, Control Panel Activated



Ref No.	Item
1	Normally Open Priming Pump Switch on Panel
2	Motor Solenoid
3	Priming Pump Motor
4	Dual Batteries
5	Selector Switch

Installation – Priming Pump

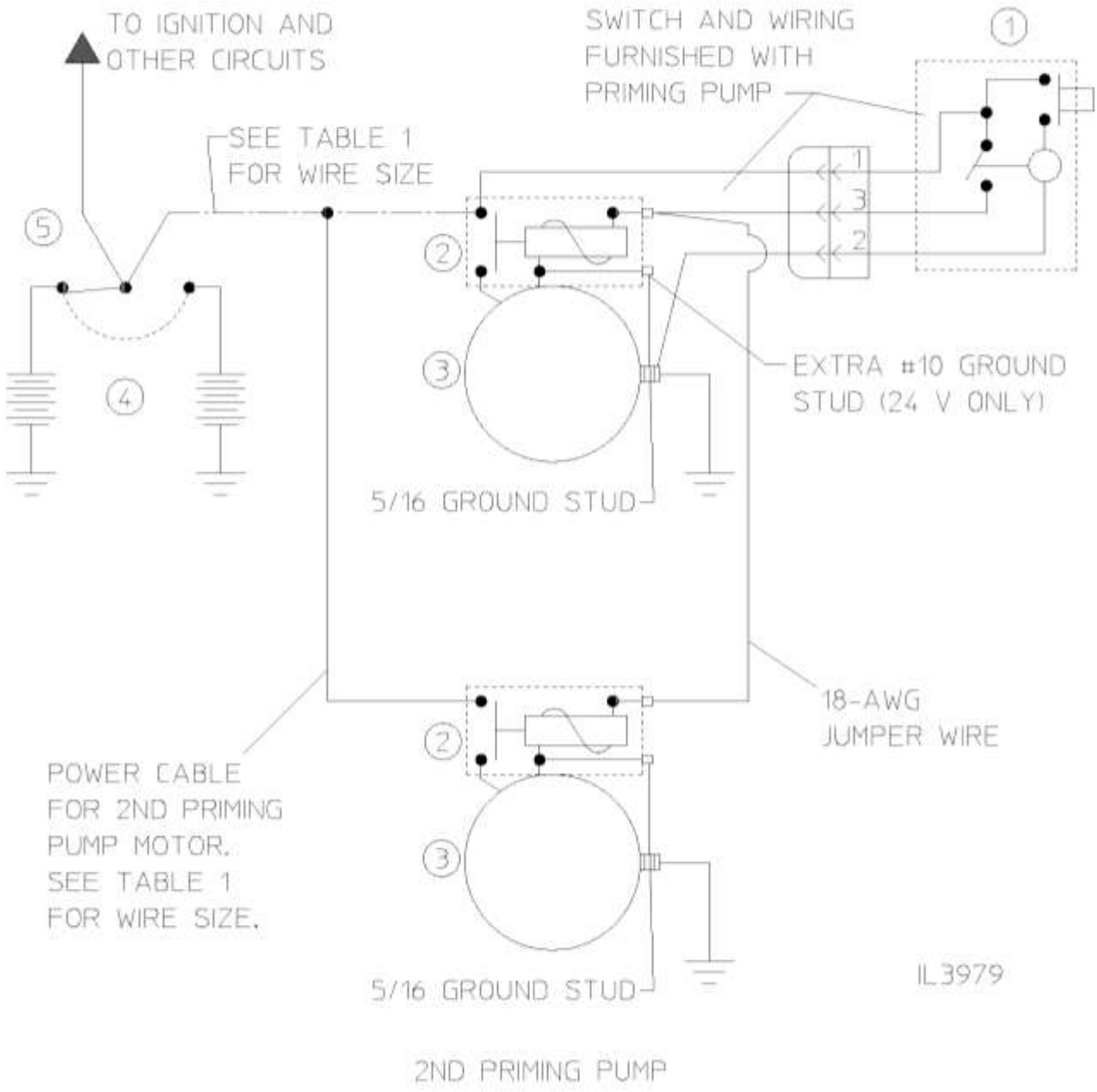
Install Power Wires:
Motor Solenoid Wiring Schematic
Auto Prime (Pressure Switch) Activated:



Ref No.	Item
1	Normally Closed Pressure Switch in Pump Discharge
2	Motor Solenoid
3	Priming Pump Motor
4	Dual Batteries
5	Selector Switch

Installation – Priming Pump

Install Power Wires:
Motor Solenoid Wiring Schematic
Dual Priming Pumps



Ref No.	Item
1	Normally Open Priming Pump Switch on Panel
2	Motor Solenoid
3	Priming Pump Motor
4	Dual Batteries
5	Selector Switch

Installation – Priming Valve

Single VAP Valve:

Valve on Pump

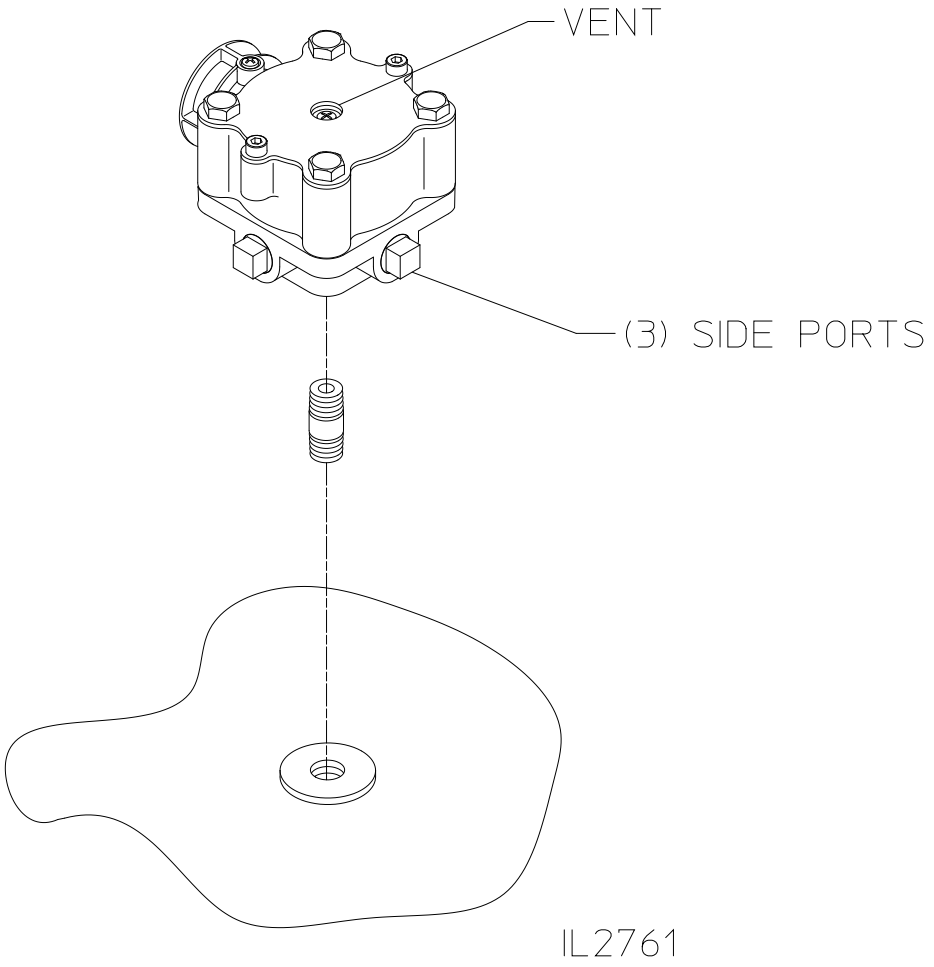
On most pumps, the priming valve will be factory installed on the pump. For those valves that are not, refer to the dimensional drawing for the pump to determine the proper mounting location.

The following points should be followed for any installation of a priming valve:

1. Be sure priming valve is mounted above the main pump and that all hoses or tubing slope upward toward the valve for proper draining.
2. The priming valve must be mounted so that the vent side of the valve is up.
3. Priming connections should be made in accordance with the following rules:
    a. If the pump is to be primed only with the impeller stationary, the priming line may be connected to the high point on the discharge passageway, or to the top of the intake passageway in the pump, plus any points in the intake piping which are higher than the intake passageway of the pump.
    b. If the pump is to be primed with the impeller rotating, a priming line **must** be connected to the top of the intake passageway in the pump, plus any points in the intake piping which are higher than the intake passageway of the pump. If desired, a priming line may be connected to the discharge passageway of the pump also.
4. There are three 3/8 inch NPT ports in the valve body.
    a. Priming lines may be connected to both discharge and intake passageways.

NOTE: It may be desirable to install a check valve in this line to the pump intake to prevent recirculation from the pump discharge to pump intake through the priming valve.

    b. If single stage pumps have a front or rear intake, install a priming line to the highest point in the piping.



Installation – Priming Valve

Single VAP Valve:

Tubing or Hose from Valve to Priming Pump:

¾ in. Diameter tubing or hose may be used. See tables 2 and 3 for specifications. Use teflon tape on all fitting threads.

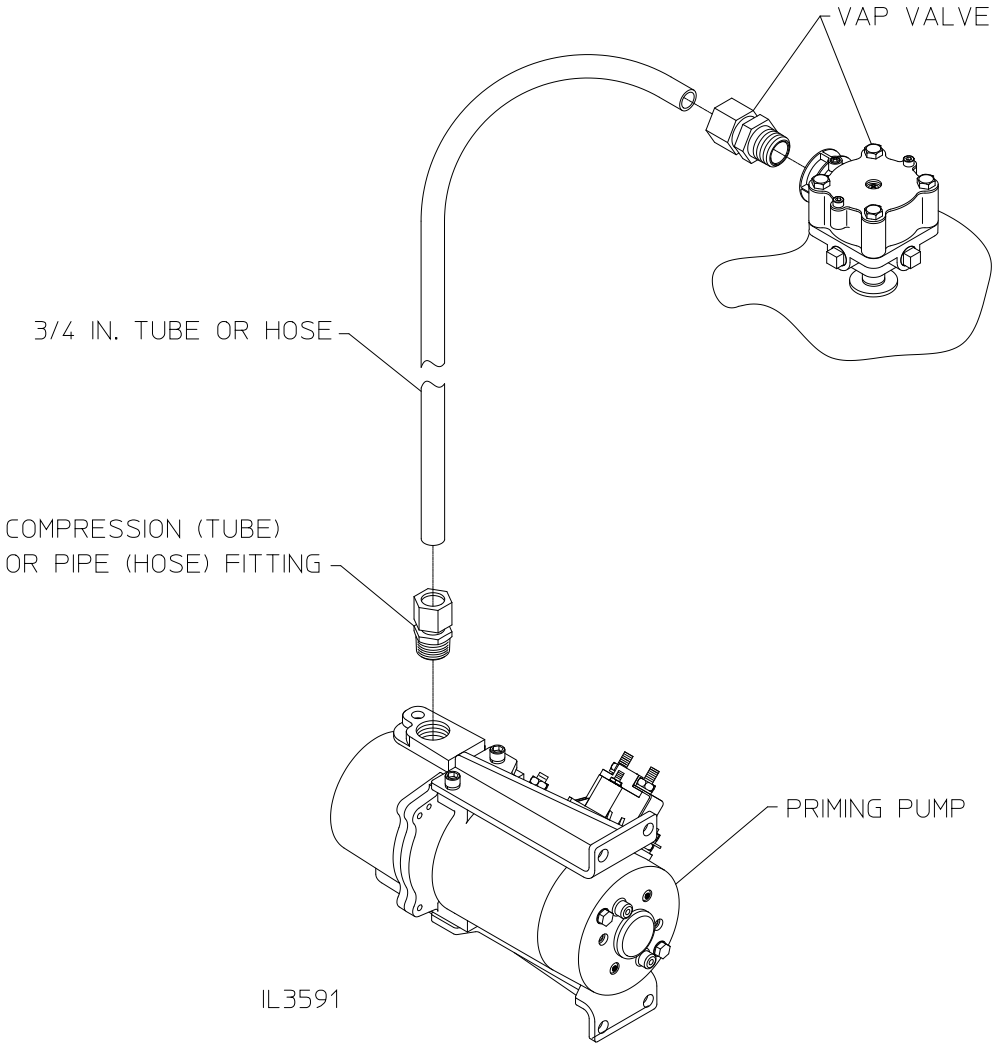
Table 2 - Tubing Specifications, Use ¾ in. Compression Fittings

Inside Diameter	1/2 in. to 5/8 in. (.500 to .625)
Outside Diameter	3/4 in. (.750)
Color	Black (UV Resistant)
Durometer	61A Minimum (Must be compatible with compression fitting)

Table 3 - Hose Specifications, Use ¾ in. Pipe Fittings

Inside Diameter	5/8 in. (.625)
Outside Diameter	1-1/8 in. (1.125)
Minimum Working Pressure	200 psi
Minimum Burst Pressure	1000 psi

Note: Hose must have two fiber braids with oil resistant jacket, 3/4 in. NPT both ends, must withstand 25 in. Hg (vacuum) and service water and lube oil**.**

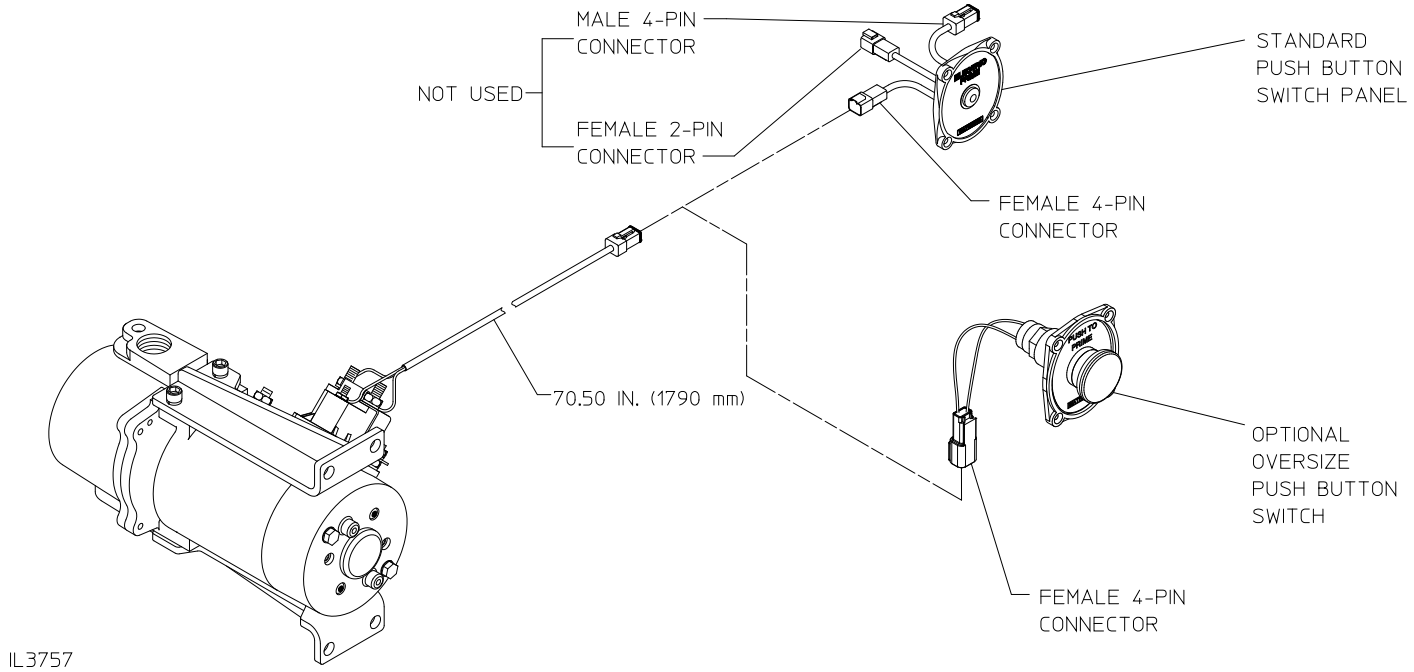


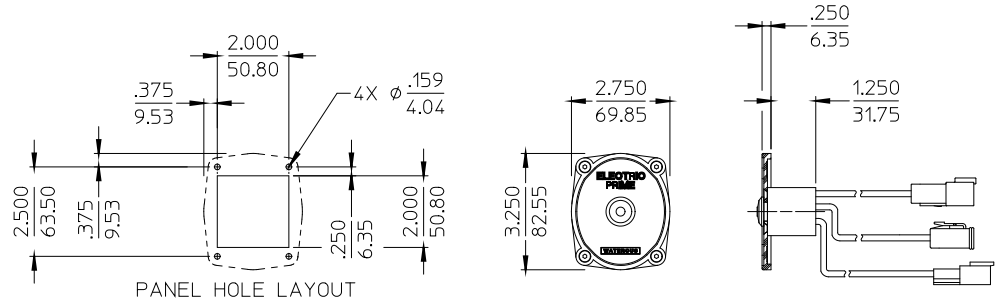
Installation – Priming Pump

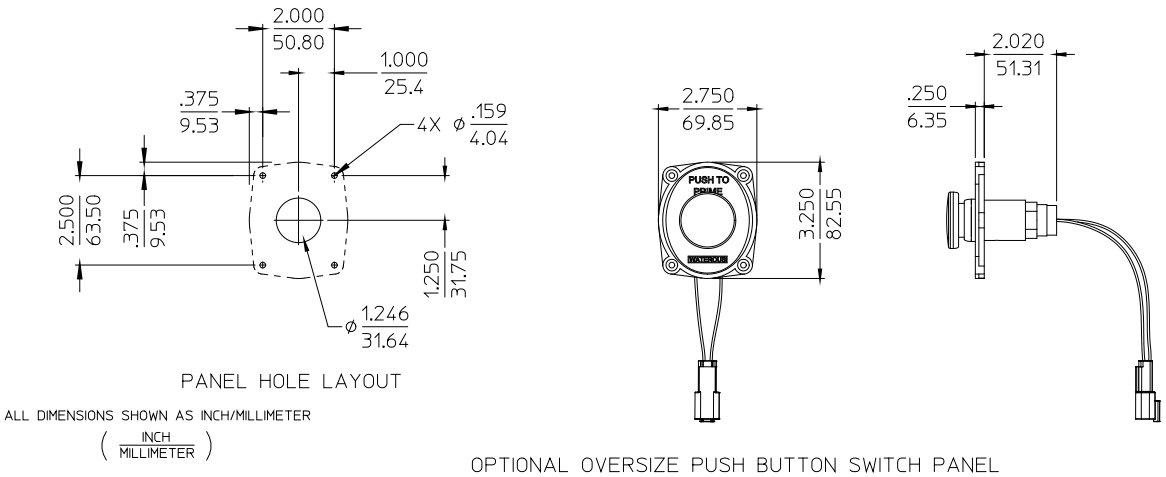
Single VAP Valve:

Control Panel on Operator's Panel:

Select a location on the operator's panel and cut openings. Install panel with hardware provided. Connect the panel wire to the priming pump. Note that the wiring from priming pump is 70.50 in. (1790 mm) long.





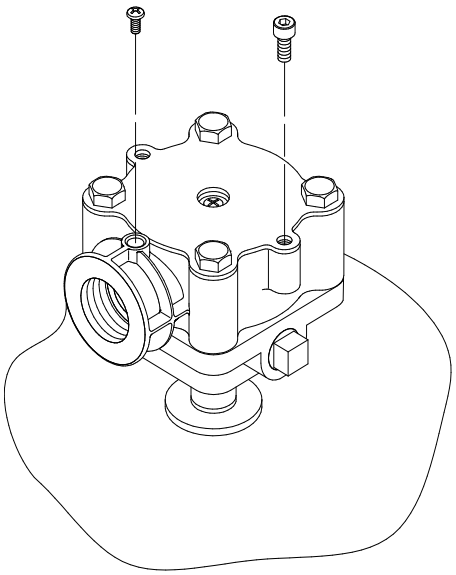


Installation – Priming Valve

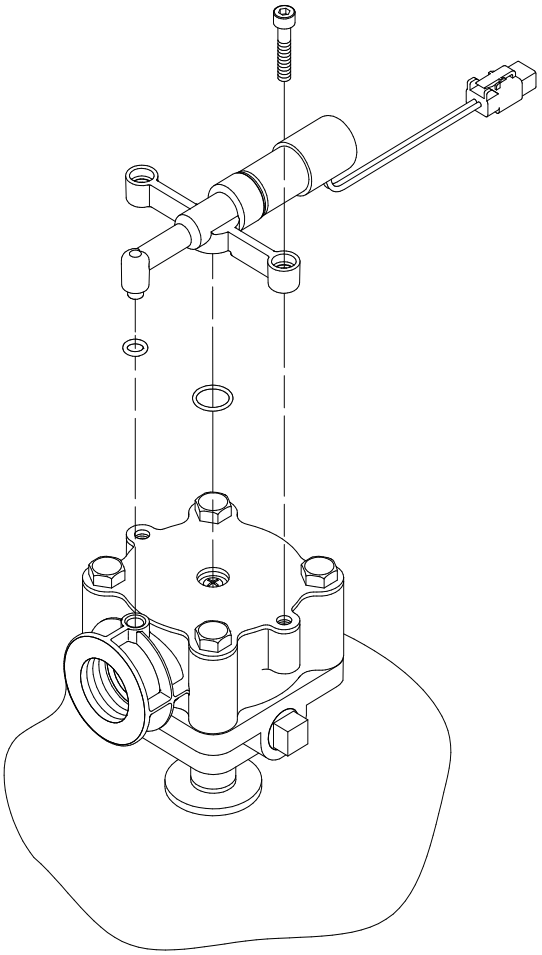
Multiple VAP Valves:

Solenoid on all VAP Valves:

1. Remove pan head screw from inlet of valve and two M5 socket head screws. Discard screws.
2. Install solenoid on top of valve with (1) 1/4 x 3/8 in., (1) 5/8 x 3/4 in. O-rings and two M5 x 16mm socket head screws. Tighten screws to 10 to 15 in/lb.



Step1



Step 2

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Installation – Priming Valve

Multiple VAP Valves:

Valves on Pump:

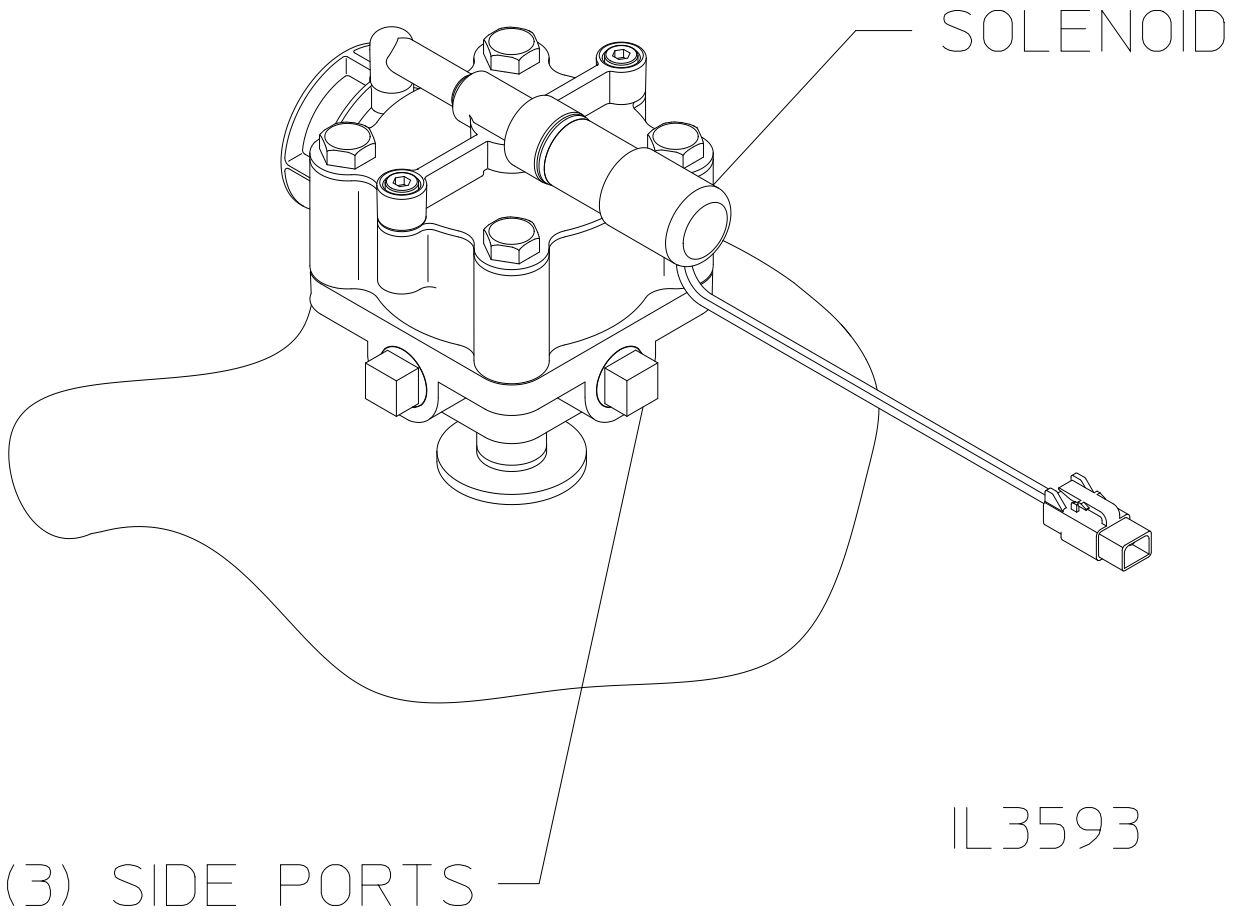
On most pumps, the main priming valve will be factory installed on the pump. For those valves that are not, refer to the dimensional drawing for the pump to determine the proper mounting location.

The following points should be followed for any installation of a priming valve:

1. Be sure priming valve is mounted above the main pump and that all hoses or tubing slope upward toward the valve for proper draining.
2. The priming valve must be mounted so that the solenoid side of the valve is up.
3. Priming connections should be made in accordance with the following rules:
   a. If the pump is to be primed only with the impeller stationary, the priming line may be connected to the high point on the discharge passageway, or to the top of the intake passageway in the pump, plus any points in the intake piping which are higher than the intake passageway of the pump.
   b. If the pump is to be primed with the impeller rotating, a priming line **must** be connected to the top of the intake passageway in the pump, plus any points in the intake piping which are higher than the intake passageway of the pump. If desired, a priming line may be connected to the discharge passageway of the pump also.
4. There are three 3/8 inch NPT ports in the valve body.
   a. Priming lines may be connected to both discharge and intake passageways.

NOTE: It may be desirable to install a check valve in this line to the pump intake to prevent recirculation from the pump discharge to pump intake through the priming valve.

   b. If single stage pumps have a front or rear intake, install a priming line to the highest point in the piping.



Installation – Priming Valve

Multiple VAP Valves:

Tubing or Hose from Valves to Priming Pump:

3/4 in. Diameter tubing or hose may be used. See tables 2 and 3 for specifications. Connect tubing or hoses so that they will drain down to the priming pump. Use teflon tape on all fitting threads.

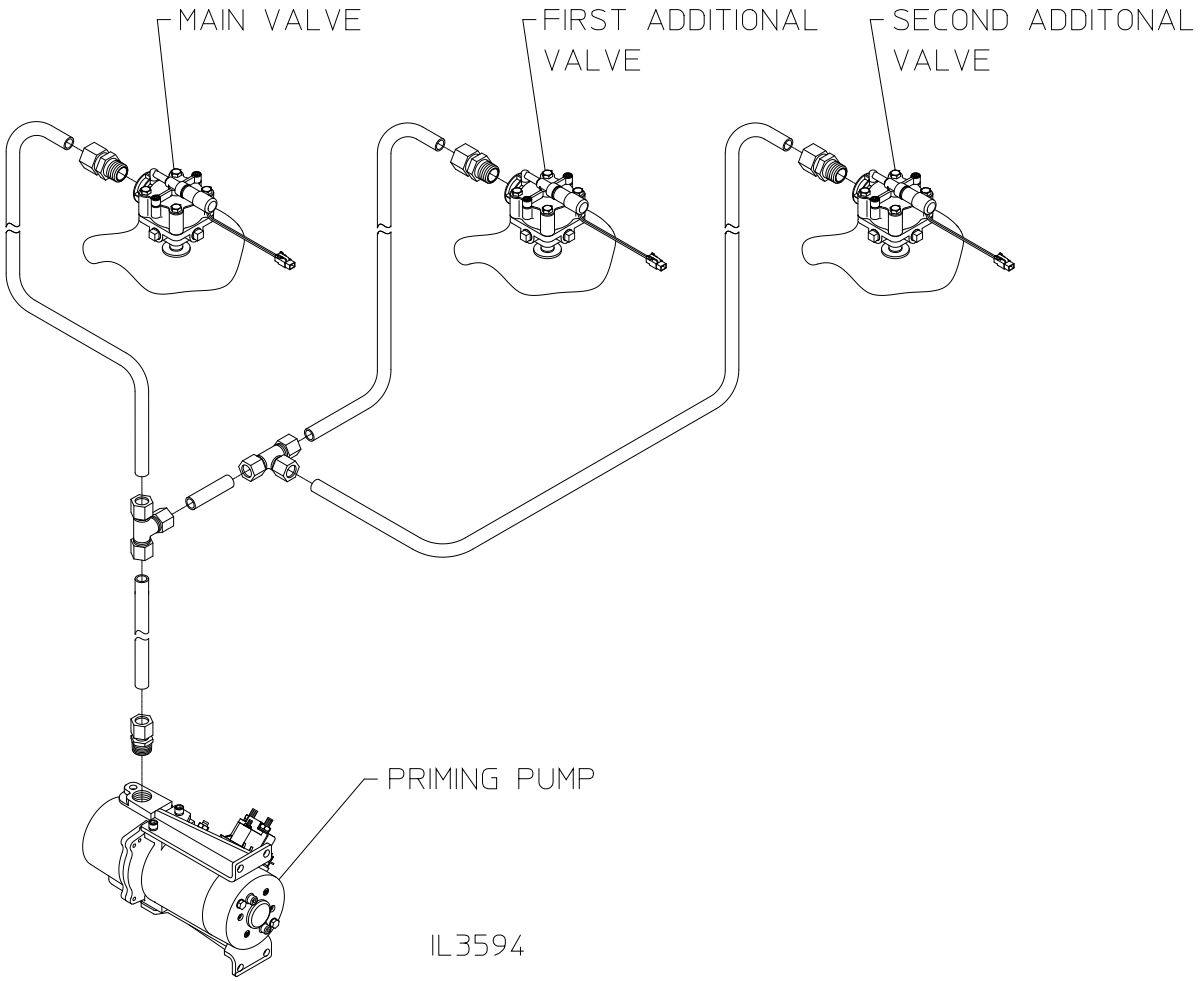
Table 2 - Tubing Specifications, Use 3/4 in. Compression Fittings

Inside Diameter	1/2 in. to 5/8 in. (.500 to .625)
Outside Diameter	3/4 in. (.750)
Color	Black (UV Resistant)
Durometer	61A Minimum (Must be compatible with compression fitting)

Table 3 - Hose Specifications, Use 3/4 in. Pipe Fittings

Inside Diameter	5/8 in. (.625)
Outside Diameter	1-1/8 in. (1.125)
Minimum Working Pressure	200 psi
Minimum Burst Pressure	1000 psi

Note: Hose must have two fiber braids with oil resistant jacket, 3/4 in. NPT both ends, must withstand 25 in. Hg (vacuum) and service water and lube oil.

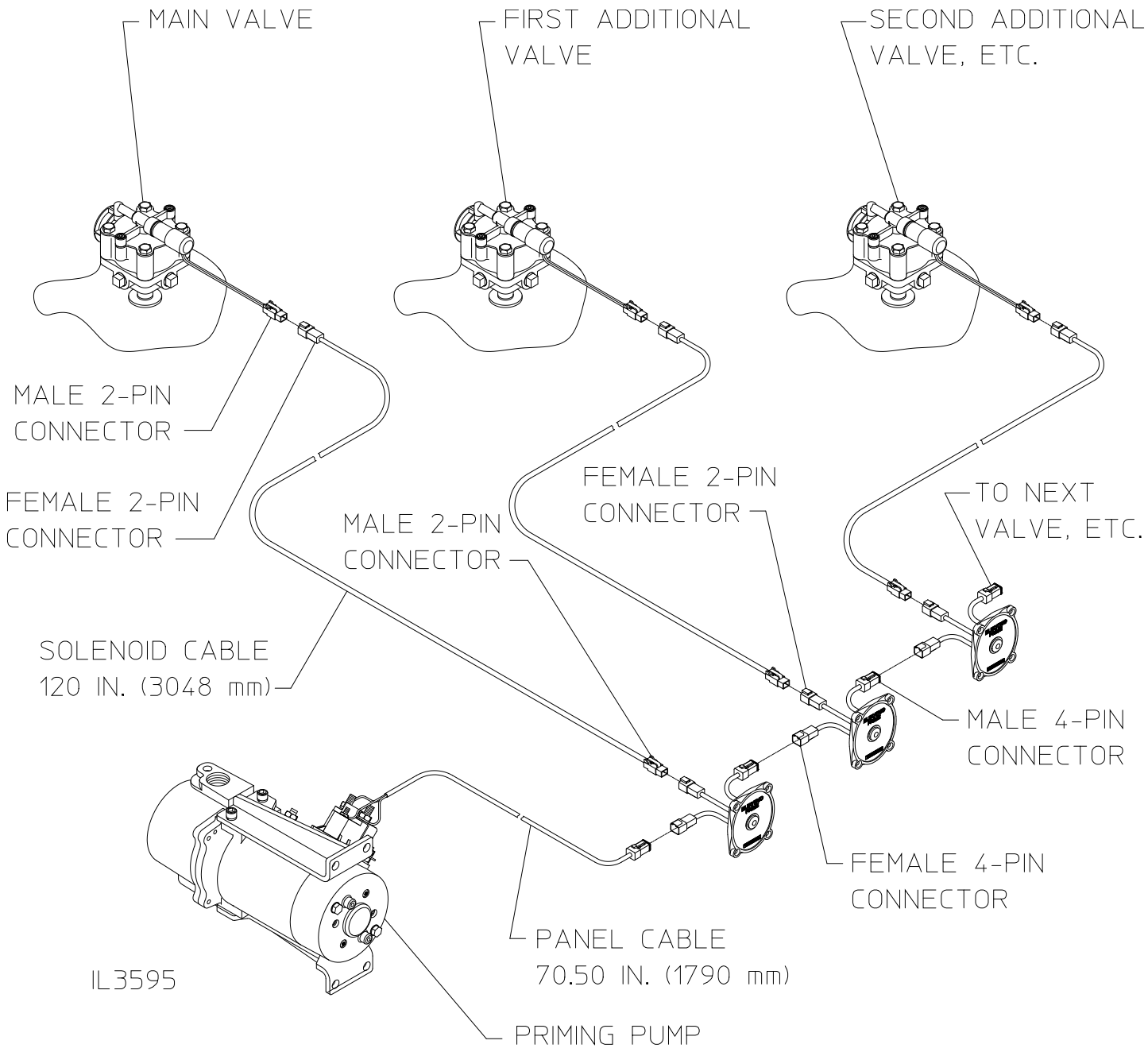


Installation – Priming Valve

Multiple VAP Valves:

Control Panels on Operator's Panel:

1. Select a location on the operator's panel and cut openings. (See Panel Hole Layout on page 20).
2. Install panels with hardware provided.
3. Connect one panel wire to the priming pump. Use female 4-pin connector from panel. Note that the wiring form priming pump is 70.50 (1790 mm) long.
4. Connect panels to each other. Connect male 4-pin connector to female 4-pin connector on next panel.
5. Connect panels to valve solenoids with wire provided. Use female 2-pin connector on panel. Wire furnished is 120.00 in. (3048 mm) long. If a longer wire is needed, order cable Waterous part no. 73176.



Installation – Priming Valve

Dual VAP Valves:

Valve on Pump:

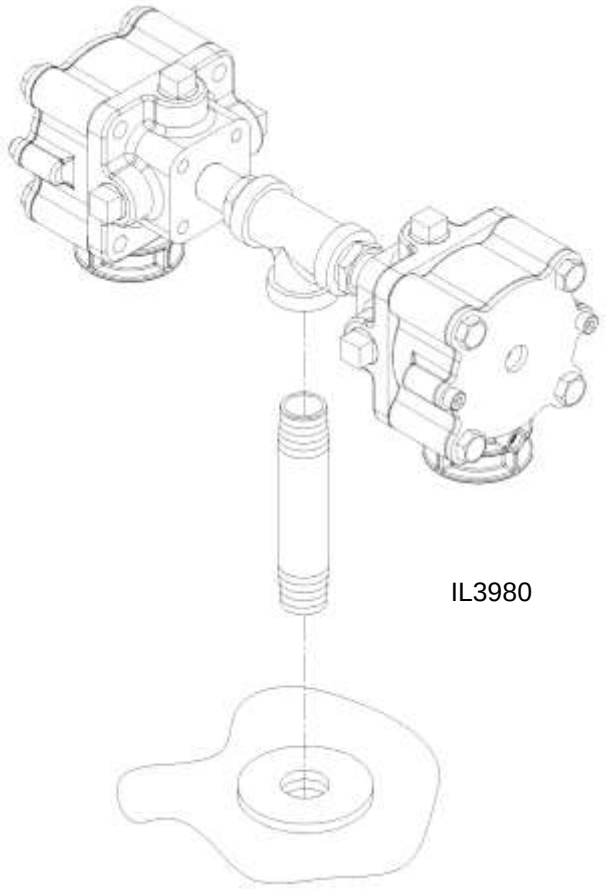
On most pumps, the priming valve will be factory installed on the pump. For those valves that are not, refer to the dimensional drawing for the pump to determine the proper mounting location.

The following points should be followed for any installation of a priming valve:

1. Be sure priming valve is mounted above the main pump and that all hoses or tubing slope upward toward the valve for proper draining.
2. Priming connections should be made in accordance with the following rules:
   a. If the pump is to be primed only with the impeller stationary, the priming line may be connected to the high point on the discharge passageway, or to the top of the intake passageway in the pump, plus any points in the intake piping which are higher than the intake passageway of the pump.
   b. If the pump is to be primed with the impeller rotating, a priming line **must** be connected to the top of the intake passageway in the pump, plus any points in the intake piping which are higher than the intake passageway of the pump. If desired, a priming line may be connected to the discharge passageway of the pump also.
3. There are four 3/8 inch NPT ports in each valve body.
   a. Priming lines may be connected to both discharge and intake passageways.

   NOTE: It may be desirable to install a check valve in this line to the pump intake to prevent recirculation from the pump discharge to pump intake through the priming valve.

   b. If single stage pumps have a front or rear intake, install a priming line to the highest point in the piping.



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Installation – Priming Valve

Dual VAP Valves:

Tubing or Hose from Valves to Pump:

3/4 in. diameter tubing or hose may be used. See Tables 2 and 3 for specifications. Use Teflon tape on all fitting threads.

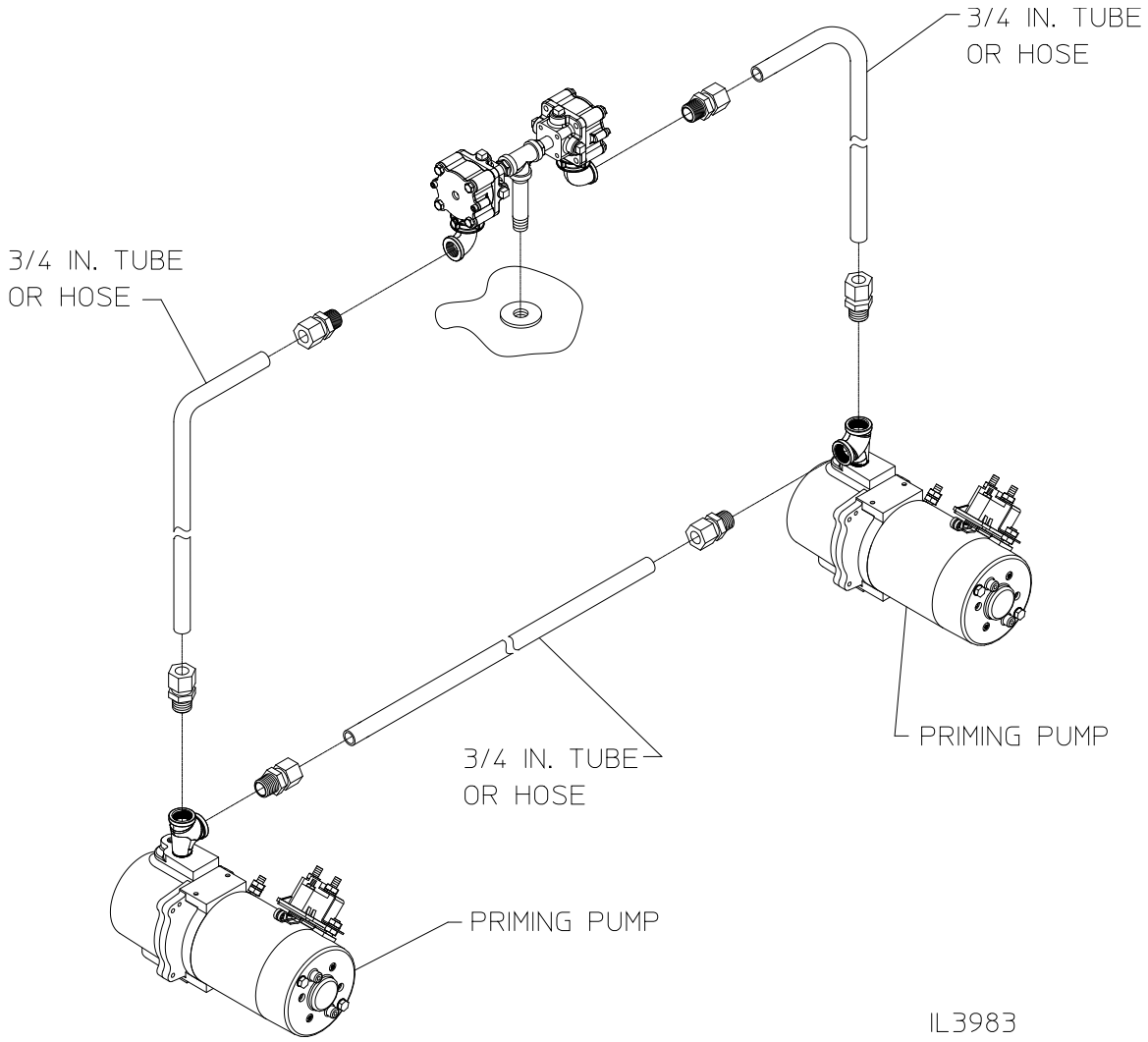
Table 2 - Tubing Specifications, Use 3/4 in. Compression Fittings

Inside Diameter	1/2 in. to 5/8 in. (.500 to .625)
Outside Diameter	3/4 in. (.750)
Color	Black (UV Resistant)
Durometer	61A Minimum (Must be compatible with compression fitting)

Table 3 - Hose Specifications, Use 3/4 in. Pipe Fittings

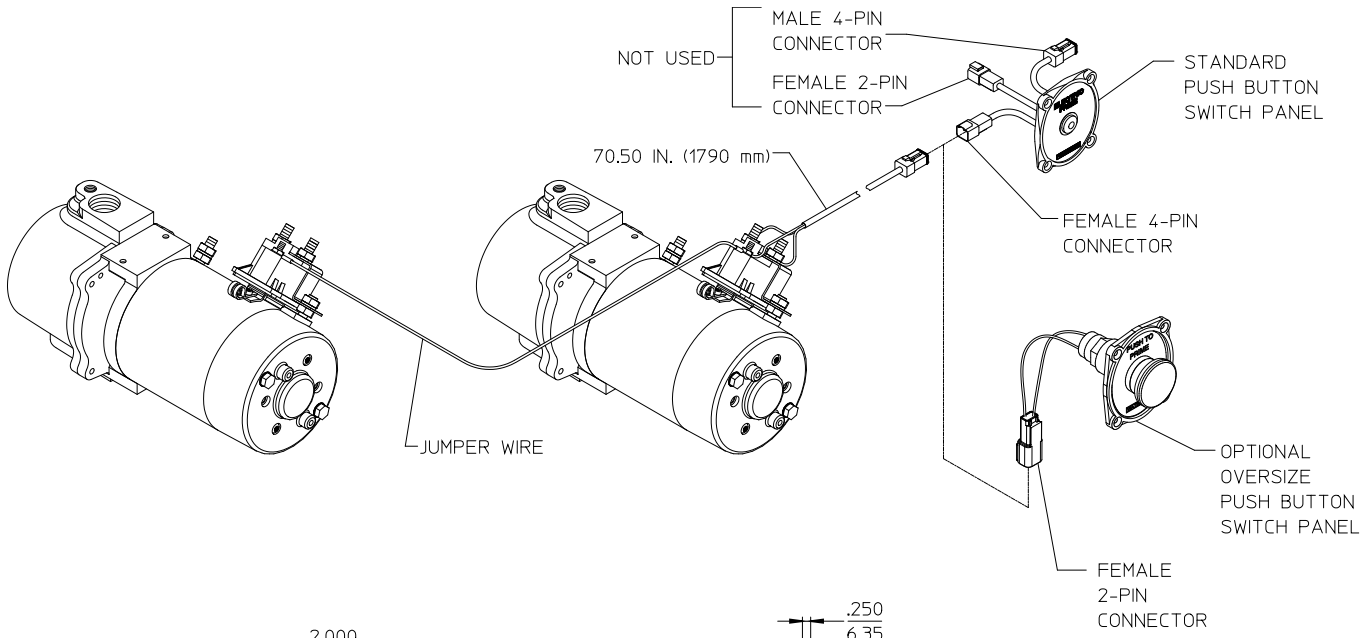
Inside Diameter	5/8 in. (.625)
Outside Diameter	1-1/8 in. (1.125)
Minimum Working Pressure	200 psi
Minimum Burst Pressure	1000 psi

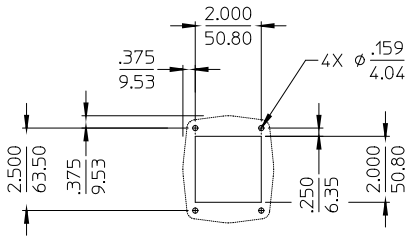
Note: Hose must have two fiber braids with oil resistant jacket, 3/4 in. NPT both ends, must withstand 25 in. Hg (vacuum) and service water and lube oil**.**



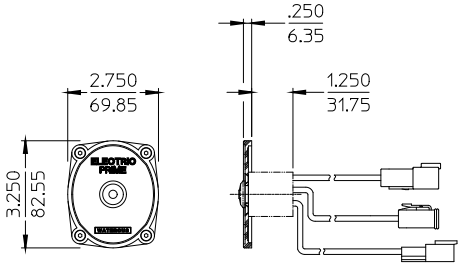
Installation – Priming Valve

Dual VAP Valves
Control Panel on Operator's Panel:





PANEL HOLE LAYOUT



STANDARD PUSH BUTTON SWITCH PANEL

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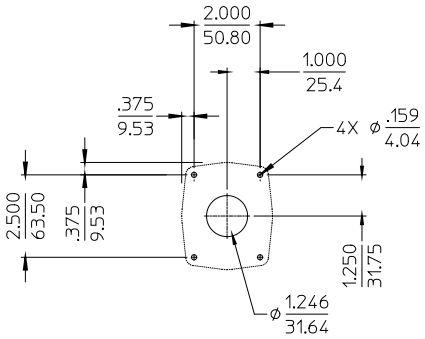
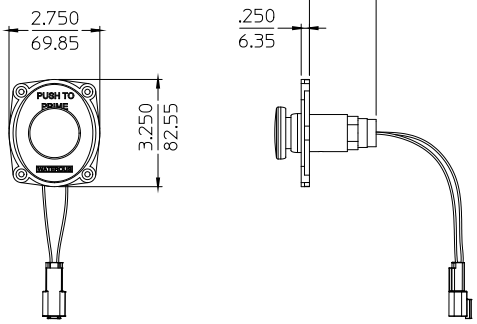


PANEL HOLE LAYOUT

ALL DIMENSIONS SHOWN AS INCH/MILLIMETER
(INCH / MILLIMETER)



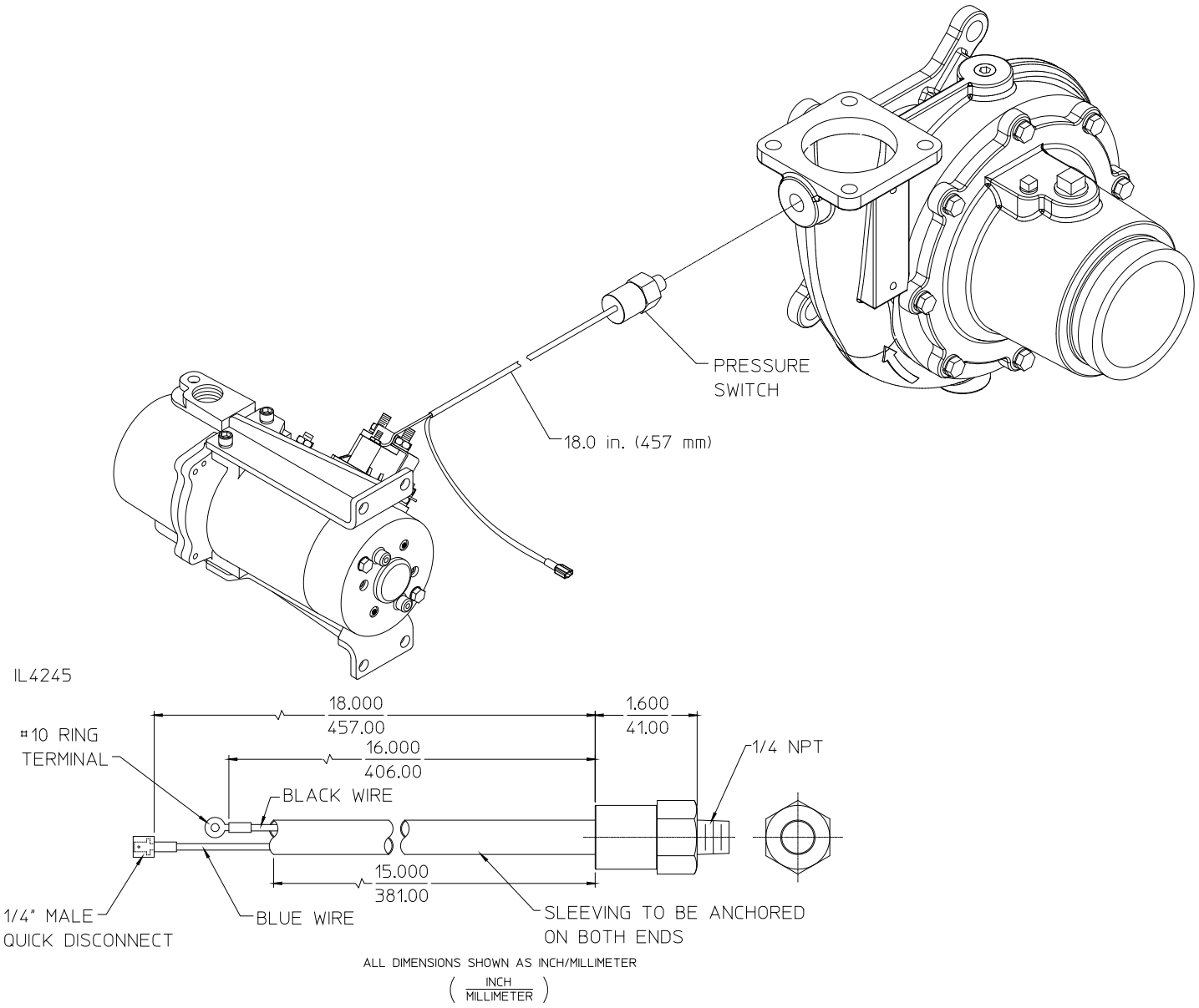
OPTIONAL OVERSIZE PUSH BUTTON SWITCH PANEL

Installation – Priming Valve

Auto Prime:

Pressure Switch on Pump

Select a location on the water pump discharge to install pressure switch (1/4” NPT). Connect the pressure switch wire to the priming pump. Note that the wiring length is 18.0 in. (457 mm) long.

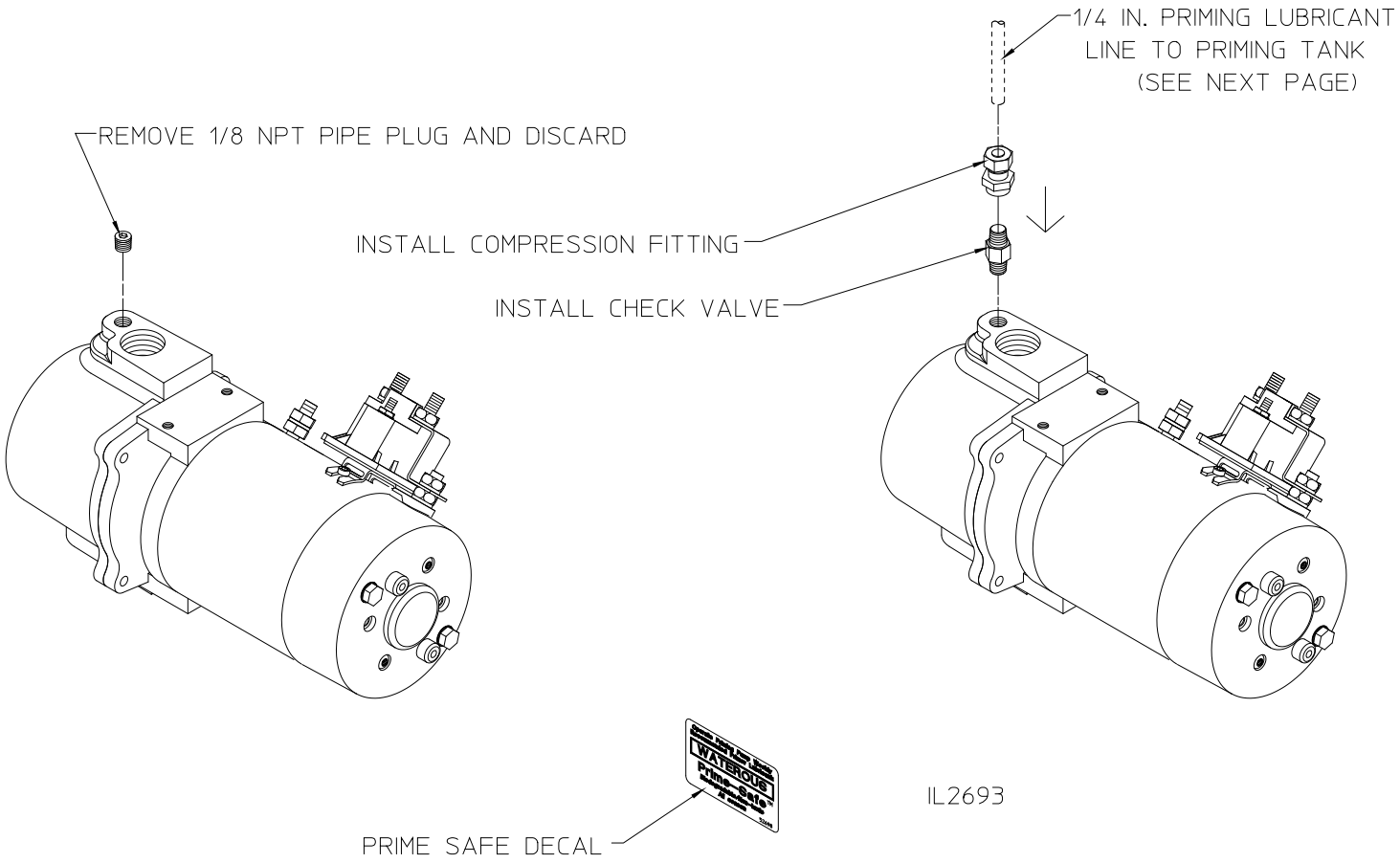


Installation – Optional Use of Priming Lubricant

Modify the Priming Pump:

Note: All priming pumps are furnished with fittings and label. If lubricant is not being used, discard fittings and label.

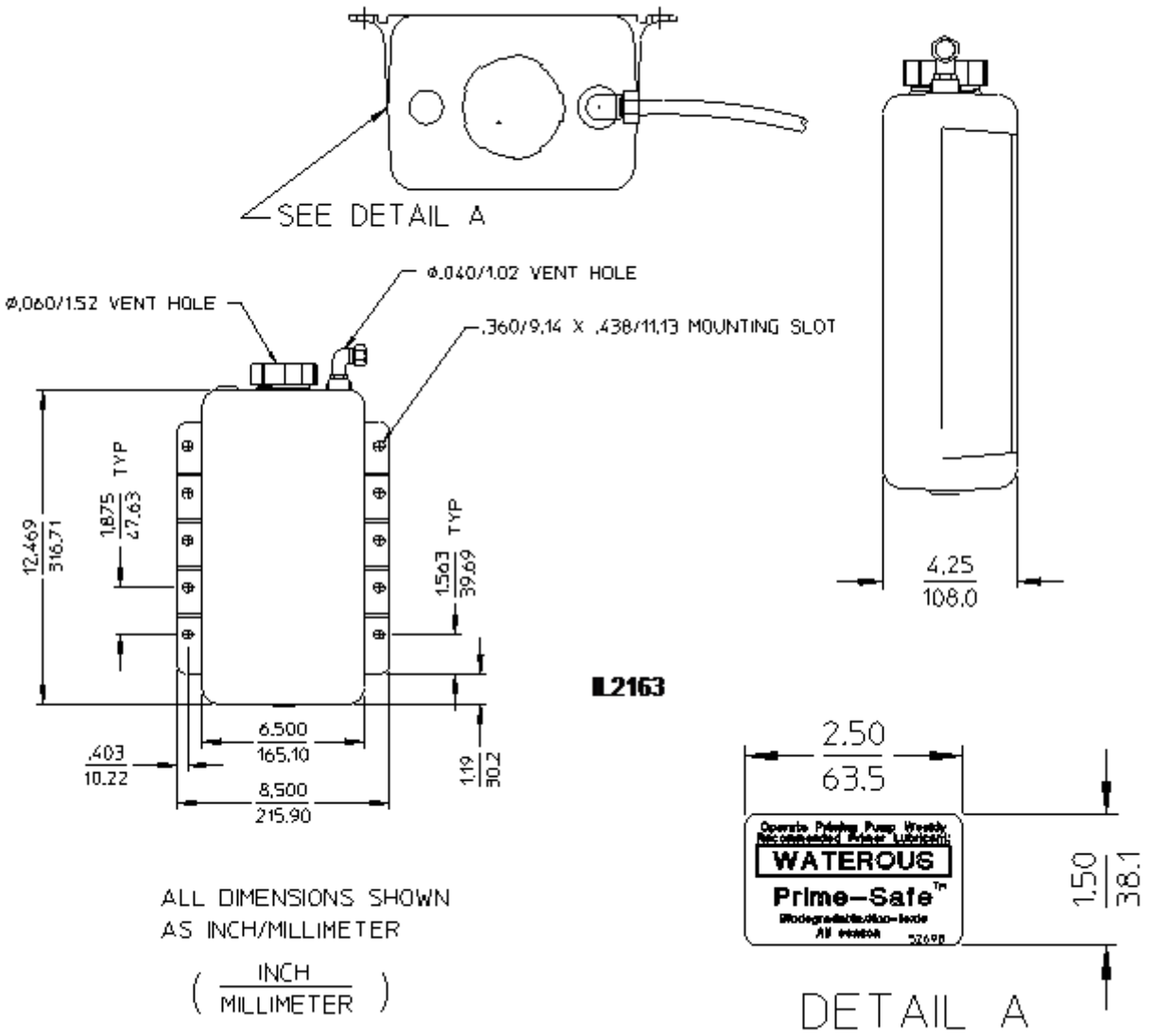
1. Remove the 1/8 NPT plug from the intake side of the primer. The plug can be discarded.
2. Using a thread sealant, insert the check valve with the stamped arrow pointing towards the priming pump, into the tapped hole from which the plug was removed.
3. Using thread sealant, thread the straight compression fitting onto the check valve.
4. Install Prime-Safe™ decal in a convenient location such as the compartment door where the priming tank is located.



Installation – Optional Use of Priming Lubricant

Lubricant Tank Installation:

1. Select a location for the priming tank which is readily accessible for checking and refilling.
2. Mount the tank level with or above the tube intake connection on the priming pump using any four mounting slots (two per side).
3. Install 1/4 inch O.D. nylon 11 or soft copper tubing between the tank and the priming pump (not furnished by Waterous).
4. If the tank is painted after installation, clean out the vent holes in top of the outlet elbow and the filler cap. Painting is not recommended.
5. Install self-adhesive priming lubricant decal 52698 on the priming tank in a location that will be visible after mounting.
6. Fill the tank with Waterous Prime-Safe™ Lubricant 72800. (Available in one, five and fifty-five gallon containers.)



Vacuum Test

Perform after the new valve is installed.

1. Remove all caps except openings without valves. Close all discharge, intake and drain valves and other similar openings. Operate priming device to create a vacuum of about 22 in. Hg/.35 atmosphere in pump, then stop primer and engine.
2. Watch the pressure gauge; if vacuum drops more than 10 in. Hg/.334 atmospheres in five (5) minutes, listen for air leaks around the packing gland, gaskets, valves, etc.
3. Replace gaskets, re-adjust packing, repack or otherwise repair source of vacuum leak.
4. Repeat test.