



ISO 9001  
Certified

*...Innovative liquid vaporizing and gas mixing solutions*

# AZEOVAIRE

*Steam Heated or Circulating Hot Water Vaporizers*

*Models: A160S through A4400S (Steam) and  
A160W through A4400W (Circulating Hot Water)*

## *Operations & Maintenance Manual*

1140 NW 46 Street, Seattle, Washington, USA 98107  
Tel: 206-789-5410 Fax: 206-789-5414 Web: [www.algas-sdi.com](http://www.algas-sdi.com)

# **WARNING**

Read the OPERATION MANUAL before operating this equipment.

**NOTE:** Algas-SDI reserves the right to use alternate manufacturers' components as vendor delivery applicability dictates. Literature contained in the Operation Manual has been supplied by vendors. Please check to be sure supplied data matches your configuration. Contact Algas-SDI if any questions exist.

This equipment uses LPG-a flammable fuel, or NH<sub>3</sub>-a toxic gas, (depending on the model), handled under pressure. Inherent hazards exist and a thorough understanding of the equipment is required to allow safe operation and maintenance.

Allow only a **TRAINED** and **FULLY QUALIFIED PERSON** to service this equipment.

Any time a component must be replaced, use the same type, model, etc. **DO NOT SUBSTITUTE!** The consequence from such actions are unpredictable and may lead to dire consequences. When components are replaced with components not approved for use in our FM/CSA listed equipment, the FM/CSA listing becomes void for that unit.

## Azeovaire & LF HotWater/Steam LPG Vaporizer Specification Sheet

Job Number: \_\_\_\_\_ Serial Number: \_\_\_\_\_  
 Part Number: \_\_\_\_\_ Year Built: \_\_\_\_\_

Equipment Drawing: \_\_\_\_\_ REV.: \_\_\_\_\_  
 Electrical Drawing: \_\_\_\_\_ REV.: \_\_\_\_\_

**Electrical Specifications:**

	Voltage	Hertz	Phase	F1-Amps	Models
<input type="checkbox"/>	110	50 / 60	1	1	A160 thru A1120, LF10 thru LF100, LFW10 thru LFW100
<input type="checkbox"/>	208-240	50 / 60	1	1	A160 thru A1120, LF10 thru LF100, LFW10 thru LFW100
<input type="checkbox"/>	110	50 / 60	1	4	A1650 thru A4400, LF150 thru LF400, LFW150 thru LFW400
<input type="checkbox"/>	208-240	50 / 60	1	2	A1650 thru A4400, LF150 thru LF400, LFW150 thru LFW400

Low Vapor Temperature Switch Set to close at: 110 Degrees F, (43 Degrees C)

**Vaporizer Specifications:** \* Propane @ 0 Deg. F & 100 PSIG ~ Hot Water Requirement Temp @ 190 Deg. F

	ASDI Azeovaire/LF MODELS	*Rated Propane Capacity (Gallons/Hr)	Energy Required Q (Btu/Hr)	Saturated Steam Required (Lbs/Hr)	~Hot Water Required (Gal./Min)	Heat Exchange Surface Area (Sq.Ft)	Outside Surface Area (Sq.Ft)
<input type="checkbox"/>	A160S, A160W LF10, LFW10HC	160	131,000	160	18	8.0	9.6
<input type="checkbox"/>	A320S, A320W LF20, LFW20HC	320	262,000	320	35	16.1	9.6
<input type="checkbox"/>	A480S, A480W LF30, LFW30HC	480	392,000	480	55	23.2	12.7
<input type="checkbox"/>	A640S, A640W LF50, LFW50HC	640	523,000	640	75	30.9	12.7
<input type="checkbox"/>	A800S, A800W LF70, LFW70HC	800	653,000	800	90	39.5	12.7
<input type="checkbox"/>	A960S, A960W LF85, LFW85HC	960	784,000	960	110	50.1	16.1
<input type="checkbox"/>	A1120S, A1120W LF100, LFW100HC	1120	914,000	1120	125	58.4	16.1
<input type="checkbox"/>	A1650S, A1650W LF150, LFW150HC	1650	1,347,000	1650	190	83.9	19.5
<input type="checkbox"/>	A2200S, A2200W LF200, LFW200HC	2200	1,796,000	2200	250	111.5	21.6
<input type="checkbox"/>	A3300S, A3300W LF300, LFW300HC	3300	2,693,000	3300	375	168.1	28.5
<input type="checkbox"/>	A4400S, A4400W LF400, LFW400HC	4400	3,591,000	4400	500	267.4	32.2

**250# Fabrication**

MDMT: -20 Deg. F @ 250 PSIG      MAWP of 250# Fab

	Material	Pressure	Temperature
<input type="checkbox"/>	Shell Side Carbon Steel	250	650
<input type="checkbox"/>	Tube Side Carbon Steel	250	650
<input type="checkbox"/>	Tube Side Stainless Steel	250	500

Steam Trap Pressure Range (PSIG)
<input type="checkbox"/> 15-30
<input type="checkbox"/> 30-70
<input type="checkbox"/> 70-120
<input type="checkbox"/> Other _____

**350# Fabrication**

MDMT: -20 Deg. F @ 350 PSIG      MAWP of 350# Fab

	Material	Pressure	Temperature
<input type="checkbox"/>	Shell Side Carbon Steel	350	650
<input type="checkbox"/>	Tube Side Carbon Steel	350	650
<input type="checkbox"/>	Tube Side Stainless Steel	350	500

All models are rated for NEC Hazardous Location Class 1, Division 1, Group D

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# *Warranty, Copyrights and Approvals*

## ***WARRANTY***

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Algas-SDI International, LLC (ASDI) warrants that the equipment is free of defects in materials and workmanship under normal use and service. ASDI agrees to repair or replace, at our option, without charge f.o.b. factory, any part which has proven defective to the satisfaction of Algas-SDI International, LLC within one (1) year from the date of the original installation or within 18 months from the date of shipment, whichever is earlier. Equipment, which in the opinion of ASDI, has been damaged by improper installation or operation, or has been abused or tampered with in any way, will not be accepted for return under warranty.

Algas-SDI International, LLC will not accept back charges for work performed by others upon or in conjunction with ASDI equipment, unless prior authorization is given by means of an Algas-SDI International, LLC purchase order. Algas-SDI International, LLC will not be liable by reason of shutdown, non-operation or increased expense of operation of other equipment, or any other loss or damage of any nature, whether direct or consequential, arising from any cause whatsoever.

Algas-SDI International, LLC makes NO other warranty of any kind, whatsoever expressed or implied; and all warranties of merchantability and fitness for a particular purpose are hereby disclaimed by Algas-SDI International, LLC and excluded from these terms of sale. No person has any authority to bind Algas-SDI International, LLC to any representation or warranty other than this warranty.

## ***COPYRIGHT***

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## ***APPROVALS***

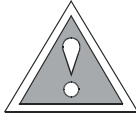
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**Factory  
Mutual  
System**  
Approved

## *Symbols and Conventions*

Special symbols are used to denote hazardous or important information. You should familiarize yourself with their meaning and take special notice of the indicated information.

Please read the following explanations thoroughly.



### ***GENERAL WARNING OR CAUTION***

---

***Indicates hazards or unsafe practices which can result in damage to the equipment or cause personal injury. Use care and follow the instructions given.***



### ***FLAMMABLE GAS HAZARD***

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***Indicates a potential hazard which can result in severe personal injury or death. Use extreme care and follow the instructions given.***



### ***ELECTRICAL DISCONNECT REQUIRED***

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***Indicates a potentially dangerous situation which can result in severe personal injury or death or damage to equipment. Use great care and follow the instruction given.***

### ***PARTS AND PRICES***

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For parts and prices contact your Algas-SDI distributor or check our web site to locate your authorized distributor.

Internet: <http://www.algas-sdi.com>

### ***ASDI CONTACT NUMBERS***

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If you have questions, need help with your equipment, or want information on other products, contact Algas-SDI at:

Telephone: 206.789.5410

Facsimile: 206.789.5414

Email: [sales@algas-sdi.com](mailto:sales@algas-sdi.com)

Internet: <http://www.algas-sdi.com>

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## DESCRIPTION

The **AZEOVAIRE** LPG vaporizer heats LPG, consisting primarily of propane and butane, and transforms it from a liquid to a vapor. The **AZEOVAIRE** vaporizer is “indirect fired”, meaning no open flame is involved with the heating process the unit complies with Class I, Division I, Group D requirements as specified in NFPA Pamphlet 70 and 58. Figure 1 is a schematic drawing that depicts the operation of the vaporizer. The **AZEOVAIRE** LPG vaporizers use steam or hot water from a plant source to convert LPG into vapor.

Referring to Figure 1: Description of Operation, dry saturated steam or hot water enters the inlet chamber, and passes through the feeder tubes, into the heat exchanger tubes, where it condenses as heat is transferred to the LPG. Condensate, or cooled water, collects in the outlet chamber, where it exits the vaporizer. LPG from a storage system enters the heat exchanger shell, and makes contact with the heat exchanger tubes, causing boiling of the LPG, allowing vapor to rise to the vapor space, above the liquid level. LPG vapor exits through the vapor outlet port.

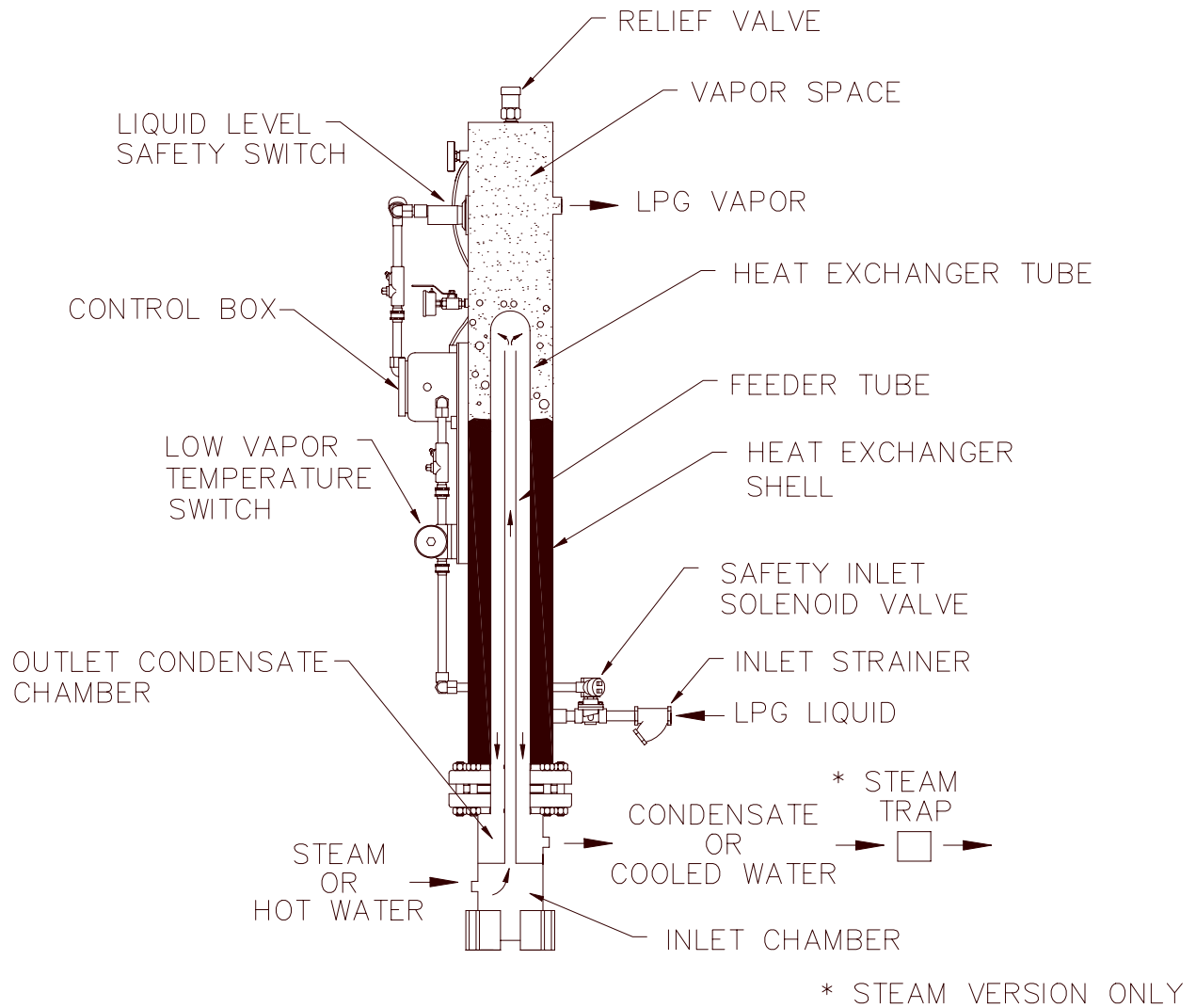
In the steam version of the vaporizer, the steam trap prevents waste of steam by allowing only liquid condensate to escape from the closed system. Vaporization of LPG utilizes the energy provided by the change-of-state from steam to condensate. During operation, condensate accumulates at a rate proportional to the quantity of steam being used. The steam in the vaporizer is self-regulating since more steam can enter the closed system only when steam presently in the system condenses making room for more steam. Steam condenses only when LPG flowing around the tubes is being vaporized.

There are two electrical safeties on the **AZEOVAIRE** that must be satisfied for the LPG inlet solenoid valve to open. First, the float switch must be closed, indicating the liquid LPG level is sufficiently below the vapor outlet. Second, the low vapor temperature switch, a normally open switch (set at approximately 115° F.), must be satisfied. This safety is a redundant safety to the float switch, ensuring sufficient heat is being provided to allow vaporization. This will prevent passing of LPG downstream of the vapor regulator.

Two basic safety devices eliminate the possibility of over-pressurization of the LPG side of the vaporizer. Increased pressure during normal operation relieves through the solenoid valve or through the externally piped liquid bypass and returns to the tank. Abnormal over-pressure relieves to the atmosphere through a 250 psig pressure relief valve.

# Introduction

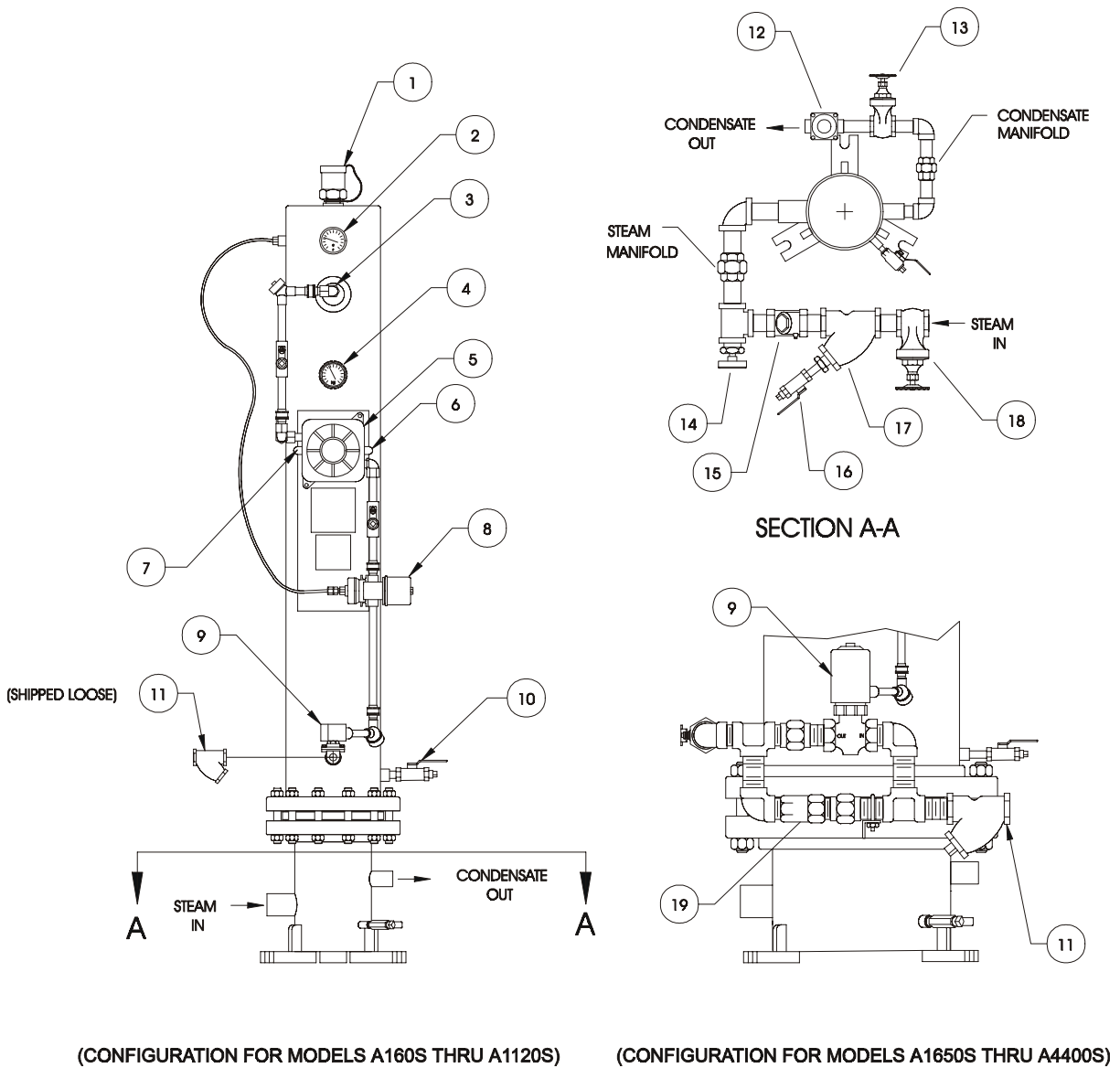
Figure 1 – Description of Operation



Operation.wmf

# Introduction

Figure 2 – Components Drawing (Steam Models)

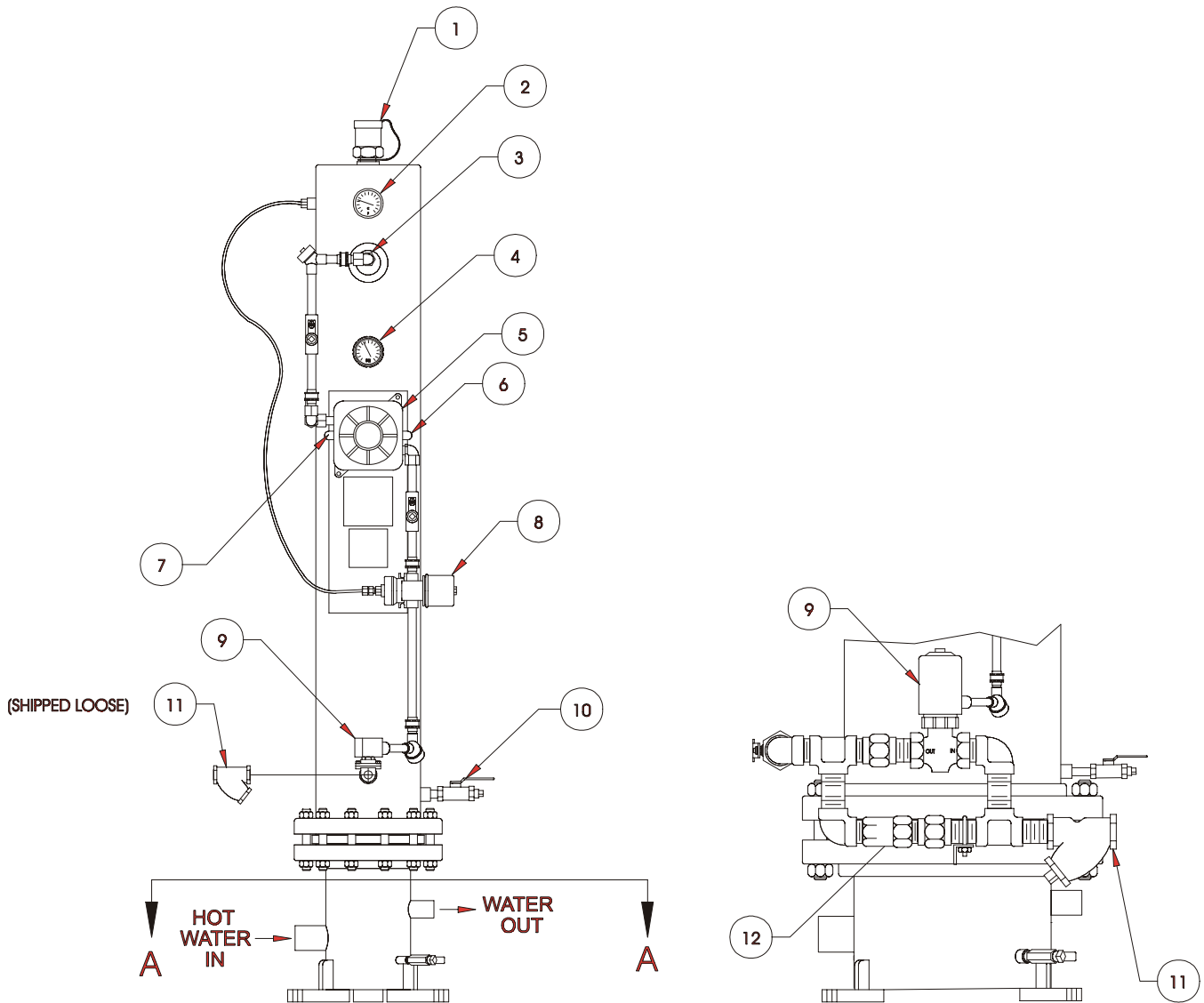


Major Components Steam.wmf

- |                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>1. Relief valve with rain cap.</li> <li>2. Temperature gauge.</li> <li>3. Liquid level float switch.</li> <li>4. Pressure gauge.</li> <li>5. Control box w/ on/off switches.</li> <li>6. Stop switch.</li> <li>7. Start switch.</li> <li>8. Low vapor temperature switch.</li> <li>9. Liquid inlet solenoid valve.</li> <li>10. Drain valve w/ plug.</li> </ul> | <ul style="list-style-type: none"> <li>11. Strainer.</li> <li>12. Steam tap.</li> <li>13. Condensate isolation valve.</li> <li>14. Inlet steam temperature gauge.</li> <li>15. Back flow check valve.</li> <li>16. Blow down drain valve w/ plug.</li> <li>17. Steam inlet strainer.</li> <li>18. Inlet steam isolation valve.</li> <li>19. Back flow check valve.</li> </ul> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

# Introduction

Figure 3 – Components Drawing (Hot Water Models)



Major Components Hot Water.wmf

- |                                    |                                  |
|------------------------------------|----------------------------------|
| 1. Relief valve with rain cap.     | 7. Start switch.                 |
| 2. Temperature gauge.              | 8. Low vapor temperature switch. |
| 3. Liquid level float switch.      | 9. Liquid inlet solenoid valve.  |
| 4. Pressure gauge.                 | 10. Drain valve w/ plug.         |
| 5. Control box w/ on/off switches. | 11. Strainer.                    |
| 6. Stop switch.                    | 12. Back flow check valve.       |

The Installation Drawings (pgs. 6) depict typical **AZEOVAIRE** steam and hot water vaporizer installations. Installation requirements vary according to local, provincial, and state requirements. Requirements often differ from those provided in NFPA Pamphlet 58. Consult the authorities having jurisdiction over your installation.

Install the **AZEOVAIRE** vaporizer on a firm, level base. Bolt it securely through the (3) mounting holes in the vaporizer base. Adequately shield the vaporizer installation against vehicular damage. Prior to making the final piping connections, clean all foreign material from the pipes.

## *General Requirements*

### **CONCRETE PAD**

The **AZEOVAIRE** vaporizer must be set on a suitable concrete pad with reinforcing steel bar, 1016 mm x 1016 mm x 305 mm as shown on ASDI Dwg. #0211-8002 (see *Appendix A*) and bolted securely through the three (3) mounting holes in the base.

If the hot water is to be returned to the boiler, a closed system, a phase separator must be used so there is no possibility of LPG entering the boiler.

### **LIQUID PIPING**

Install piping appropriately sized for the maximum flow to the vaporizer (see *Table 3: Liquid Piping, pg. 18*).

Install a pressure gauge in the liquid LPG line before the vaporizer. Thoroughly clean all foreign material and welding slag from the piping.

### **VAPOR LINE**

Install an isolation valve at the vapor outlet line and an appropriate regulator downstream of the vapor isolation valve. Pipe the LPG line from the outlet port of the regulator to the distribution system. Further reduction of the downstream pressure requires a second stage regulator close to the consuming equipment. Properly sized piping and regulators will ensure satisfactory service.

### **SYSTEM COMPONENTS**

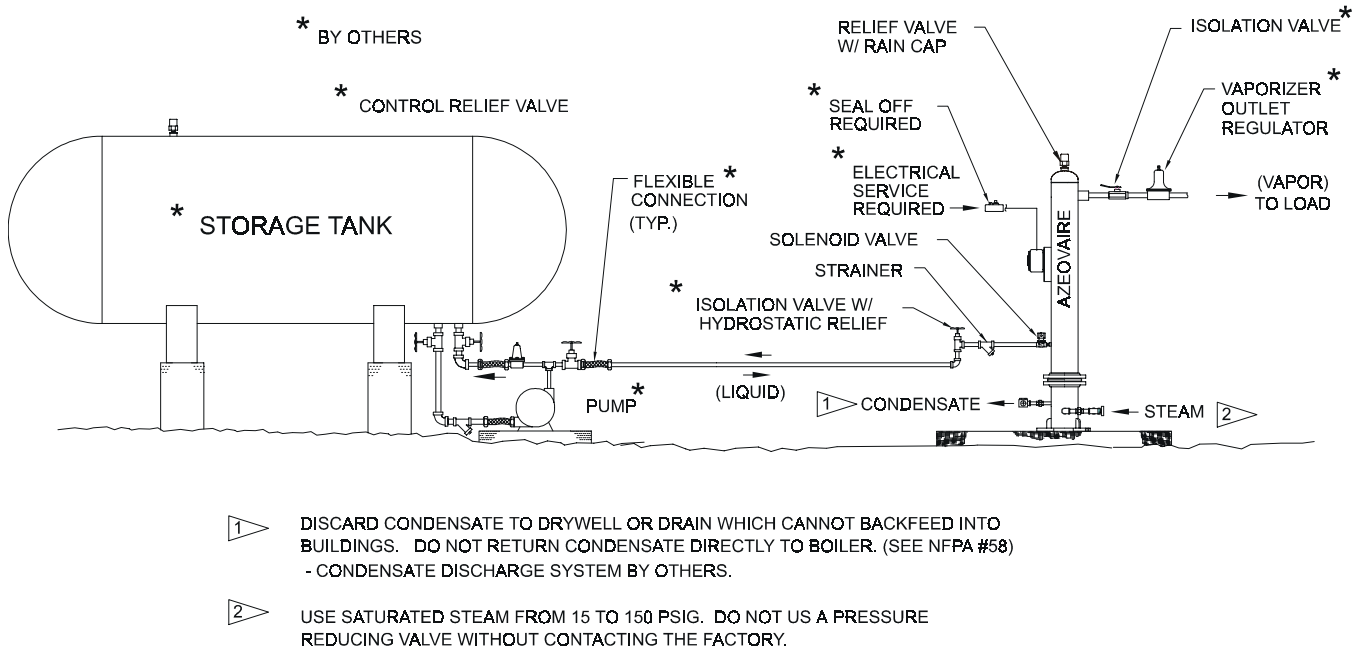
All components must be rated for the temperature and pressure of the steam or hot water supplied.

### **ELECTRICAL SERVICE**

The data sheet (see *Appendix A*) provides electrical power information, wiring requirements, and additional equipment specifications. Install the vaporizer according to all codes and standards that apply. All wiring within 15 feet (5 meters) must meet Class I, Group D electrical specifications. Enclose all wire in rigid conduit and install a seal-off within 18" (45 cm) of the connection of the service conduit to the vaporizer.

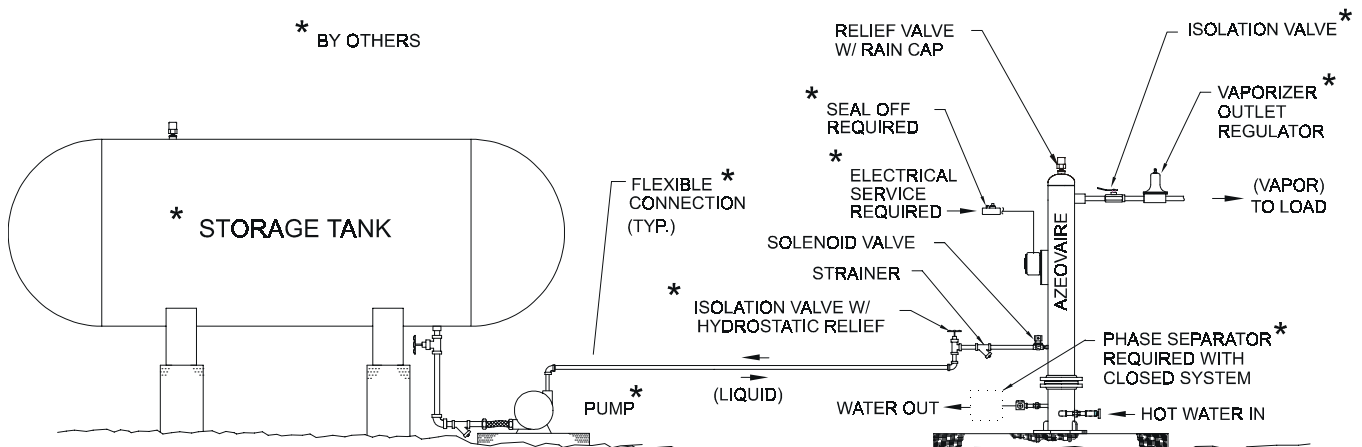
# Installation

**Figure 4 – Typical Azeovaire Steam Installation Drawing**



Installation Steam.wmf

**Figure 5 – Typical Azeovaire Hot Water Installation Drawing**



Installation Hot Water.wmf

## *Steam System*

### **STEAM SUPPLY**

Install a steam pressure gauge in the input line near the vaporizer. Use the gauge to check the operation and when used with the steam temperature gauge, to determine the quality of the steam. Refer to the saturated steam table at the end of this section.

### **STEAM CONDENSATION DRAIN**

Steam condensate must be piped to a dry well or drain. Do not return the condensate directly to the boiler. If the condensate is to be returned to the boiler, a vented condensate manifold return with a phase separator must be used so there is no possibility of LPG going to the boiler. The LPG from the separator must be vented to a safe location. The condensate manifold must include a shut-off valve, strainer, blow-down valve and steam trap in addition to the separator. Remove the plug from the condensate drain valve before the system is started to facilitate "blow down".

## *Hot Water Supply*

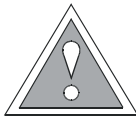
Treated hot water for the Azeovaire must be used or severe tube corrosion will occur and the warranty will be voided. If boiler treatment is not practical stainless steel vaporizer tubes must be specified. See *Appendix A* for suggested boiler water treatment specifications.

If the hot water is to be returned to the boiler, a closed system, a phase separator must be used so there is no possibility of LPG entering the boiler.

Check the data sheet (in the Appendix) for required hot water flow and temperature at the vaporizer inlet. Failure to provide specified flow and temperature will reduce vaporizer capacity.

*Installation Checklist*

- 1. Install the **AZEOVAIRE** according to all applicable codes and regulations.
- 2. Complete and check all wiring interconnections per wiring diagrams provided.
- 3. Remove all debris and welding slag from all piping runs.
- 4. Check all bolts for proper tightness, especially the bolts on the lower flange assembly.
- 5. Check all bolts for tightness, especially the bolts on the lower flange assembly.
- 6. Test entire system for leaks. Eliminate all leaks before starting the vaporizer.



***WARNING***

---

*If a closed system is used, a phase separator must be installed.*



***WARNING (STEAM ONLY)***

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*Contact Algas-SDI before using a pressure reducing valve.*



***WARNING (HOT WATER ONLY)***

---

*Do not use untreated boiler water in the vaporizer. Have the water quality tested and take appropriate action for water treatment. Check the data sheet for heat exchanger tube material supplied.*

---



## *Steam Version*

1. Turn on electricity to the control box. Leave the vaporizer in the **OFF** position.
2. Check steam pressure from boiler.
3. Open the vaporizer steam inlet valve.
4. Open the vaporizer steam inlet strainer blowdown valve.
5. Blow the steam line down until no water is present, only saturated steam.
6. Open the condensate return line when only steam is in the system.
7. Close the LPG outlet valve.
8. Open all valves from the LPG tank to the vaporizer.
9. Press the start button on the vaporizer. The LPG inlet solenoid will energize while the start button is pressed. Upon releasing the start button the solenoid will de-energize if the vapor temperature is below approximately 110° F. (43° C.), but the unit remains on. When the vapor temperature reaches the low vapor temperature switch set point (*see data sheet* for setpoint) the solenoid will energize and vaporization will start.
10. Check the system for leaks.
11. The system is now ready for operation.
12. To begin operation, open the vaporizer outlet valve and start the LPG pump is applicable.

### *Hot Water Version*

1. Turn on electricity to the control box. Leave the vaporizer in the "OFF" position.
2. Close the vaporizer LPG outlet valve.
3. Open the vaporizer water inlet and outlet valves.
4. Open a downstream valve to purge air from the water lines.
5. Start the water circulation pump and close the purge valve when the air has been removed.
6. Check the water temperature from the boiler.
7. Open all valves from the LPG tank to the vaporizer.
8. Press the start button on the vaporizer. The LPG inlet solenoid will energize while the start button is pressed. Upon releasing the start button the solenoid will de-energize if the vapor temperature is below approximately 110° F. (43° C.), but the unit remains on. When the vapor temperature reaches the low vapor temperature switch set point (*see data sheet* for setpoint) the solenoid will energize and vaporization will start.
9. Check the system for leaks.
10. The system is now ready for operation.
11. To begin operation, open the vaporizer outlet valve and start the LPG pump is applicable.

## *Steam Consumption*

To estimate steam consumption, use this rule: One pound of steam is required to vaporize one gallon of LPG or 0.1 kg of steam is required to vaporize 1 liter of LPG.

### **STEAM REQUIREMENT**

The steam fired vaporizer is designed to utilize the heat in dry saturated steam. The vaporizer derives the energy necessary for vaporization from the change of steam to water. For proper performance, the steam must be **DRY** and **SATURATED, NOT** “superheated” or “wet”. Superheated steam results whenever higher pressure steam is regulated to a lower pressure.

If “superheated steam” is used in the vaporizer, the efficiency of the vaporizer is impaired causing a significant loss in vaporizing capacity.

The lower the steam pressure the better, however the pressure must remain within the operating range of the steam trap.

### **STEAM TEMPERATURE**

LPG vapor temperature should be kept at or below 300° F (150° C). System components are designed for a maximum operating temperature of 300° F (150°C).

### ***NOTE***

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***Do not use a pressure reducing valve without first contacting the factory.***

---

## *Standby Condition*

Once the **AZEOVAIRE** has been started perform the following procedure to place the unit in a state of readiness or standby condition:

1. Close the vapor outlet valve.
2. Leave open all LPG valves from the storage system and pumps to the vaporizer liquid propane inlet.
3. Leave open all steam or hot water valves.
4. The vaporizer is ready to operate. All that is needed to activate it is to open the vapor outlet valve and push the start button.

### Shutdown

#### FOR EXTENDED PERIODS OF TIME

To fully de-activate the system for extended periods of time perform the following:

1. Push the stop button on the control box.
2. Shut off the power to the vaporizer.
3. Shut down steam or hot water operation and drain the inlet and outlet manifolds and the pressure vessel.
4. Leave open the LPG valves to the storage tank to relieve any pressure buildup.

#### ***WARNING***

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***Water must be drained completely from the system. Freezing water can cause severe damage.***

---



#### FOR MAINTENANCE

To shutdown the system in order to perform maintenance, perform the following:

1. Push the stop button on the control box.
2. Shut off the power to the vaporizer.
3. Shutdown steam or hot water operation and drain the inlet and outlet manifolds and the pressure vessel.
4. While the vaporizer cools down, leave open all LPG valves to the storage tank. When cooling is complete, close all LPG valves to the storage tanks and pumps.
5. Open LPG drain valve and completely drain off LPG.
6. Make sure all steam or water and LPG pressures are totally relieved, and electrical power is off at the power panel.



## ***CAUTION***

---

***All maintenance should be performed with the electricity off, steam input valve closed, LPG inlet valve closed, and the pressure bled off so there is no steam or vapor pressure in the system. Consult section on “Shutdown for Maintenance”.***

***Check or service the relief valves as required by local codes.***

---

## **FLOAT SWITCH**

Remove and check the float switch every year for mechanical and electrical operation.

1. Shut down the system per the “Shutdown (for Maintenance)” section.
2. Remove the float switch from the vaporizer.
3. Check the float mechanism for full movement. Clean with solvent if necessary.
4. To test the float switch, connect an ohmmeter across the electrical leads and observe the meter as the float is moved up and down. If the meter does not move, the switch does not work and must be repaired or replaced.
5. Re-install the float switch.
6. Restart the vaporizer according to the directions in the Startup section.

### SOLENOID VALVE

Remove and check the solenoid valve every year for mechanical and electrical operation.

1. Shut down the system per the Shutdown (For Maintenance).
2. To reach the moving parts, unscrew the bonnet ring with a flat wrench. Do not disturb the six lock screws in the cup.
3. If the valve leaks, check the valve disc and replace it if it is worn.

### ***CAUTION***

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***When working on the valve, hold the piston with a rubber padded vise and take care not to damage it during repair.***

---

4. To remove the pilot valve, insert a pointed tool in the slot provided in the top of the piston and pry off the clamping spring. Replace the clamping spring in the groove when re-assembling. The magnet plunger and inside of the bonnet tube should be wiped clean of sediment if an alternating current hum develops.
5. To uncover the coil, remove the six lock screws in the cup.
6. Re-assemble the valve in this sequence:  
  
The bonnet is fastened to the valve with the hexagon bonnet ring, the coil rests on the vase with the leads up, and the coil binder washer positions on the top of the coil with the prongs up.
7. Restart the vaporizer according to the directions in the Startup section. Make sure to check for leaks.

### STEAM CONDENSATE STRAINER (FOR STEAM MODELS ONLY)

Both the input and outlet strainers require periodic cleaning depending on usage and quality of steam.

1. Shut down the system per the Shutdown (for Maintenance) section.
2. Remove both strainers, clean and re-install.
3. Restart the vaporizer per the Startup Procedure section.

### LPG INLET STRAINER

The strainer on the incoming LPG manifold also requires periodic cleaning.

1. Shut down the system per the Shutdown (for Maintenance) section.
2. Remove the strainer, clean with a light solvent such as kerosene, allow to dry and replace.
3. Restart the system.

## **CLEANING THE CONDENSER TUBES AND VAPOR SPACE**

LPG may build up deposits of oil products and dirt in the condenser tubes and vapor space inside the vaporizer. Dirty conditions can only be determined visually. To check the condition of the condenser tubes and vapor space, remove the LPG inlet pipe. Visually inspect the front tubes using a suitable light source. The condenser tubes can only be cleaned by soaking them with solvent and flushing the solvent from the vaporizer.

Perform the following to clean the condenser tubes and vapor space:

1. Shut down the system per the Shutdown (for Maintenance) section.
2. With the upstream incoming LPG valve closed, remove the incoming LPG pipe. The condition of the condenser tubes and vapor space can only be determined by looking inside. A small light, held by hand, is necessary to illuminate the area. If the area is dirty, the tubes and vapor space must be cleaned with solvent.
3. To clean the vaporizer condenser tubes and vapor space, first plug the incoming LPG pipeline inlet.
4. Remove the LPG gas vapor outlet pipe.
5. Pour a light solvent, such as kerosene, into the vaporizer and fill the vapor space. Let the vaporizer soak for 24 hours.
6. Remove the incoming LPG plug and drain solvent.
7. Flush the vaporizer space with solvent until the solvent is clear.
8. Allow the vaporizer to dry thoroughly. Blowing air through the vapor space will quicken the drying time.
9. Re-install the LPG pipelines.
10. Restart the vaporizer as directed in the Startup section. Make sure to check the system for leaks.

## Maintenance

**Table 1 – Maintenance Schedule**

DESCRIPTION	FIRST MONTH	EVERY MONTH	AS REQUIRED	EVERY SIX MONTHS	EVERY YEAR	EVERY TWO YEARS
Float Switch					Check.	
Solenoid Valve				Check.	Rebuild.	
Temperature Transmitter					Recalibrate.	
Condensate Strainer		Check.	Clean.			
LPG Inlet Strainer	Check and clean.	Check.	Clean.			
Condenser Tubes						Clean as required.
Steam Strainer	Check and clean.	Check.	Clean.			
Bolt Connectors			Tighten.			



# Troubleshooting

# 6

**Table 2 – Azeovaire Troubleshooting Guide**

PROBLEM	CAUSE	SOLUTION
AZEOVAIRE shuts off electrically at startup or during operation.	High liquid level due to over-capacity. Unit is shutting down on float switch safety.	Calculate the total gas load from the burner plate specifications and match it against the vaporizer nameplate.  High pressure creates a high boiling point of the incoming LPG gas. Check operating pressure of incoming liquid LPG pipe and outgoing delivery system.
	High liquid level due to surge effect when the liquid LPG hand valve is opened too rapidly.	Close liquid LPG hand valve. Allow stored heat in the vaporizer to vaporize excess liquid propane, then <b>SLOWLY</b> open liquid propane hand valve.
	Insufficient heat to allow LPG vaporization. Liquid LPG builds up in the pressure vessel and opens the float switch, or cool vapor temperatures cause the low vapor temperature switch to open.	Check the steam pressure and temperature. Be sure both valves are open.  Check if <b>SATURATED</b> and <b>NOT</b> superheated steam is being supplied to the vaporizer.  Check if the steam trap is working properly.  Check hot water pressure and temperature. Check that the inlet and outlet valves are open.
Loss of LPG vapor pressure.	Check control relay to see if the unit is on or off.	If off, check to determine if there is a high liquid level in the vaporizer.
	LPG line obstructed.	Check strainers and valves and pressure downstream.
	Solenoid valve fails to open.	Check power and wiring to the solenoid. Verify that vapor temperature is above the vapor switch setpoint.

## Troubleshooting

**Table 3 – Liquid Piping**

CAPACITY OF UNITS		DISTANCE IN FEET FROM STORAGE TO VAPORIZER							
MMBTUH	GPH	100	200	300	400	500	750	1000	2000
1.0	11	1"	1"	1"	1 ¼"	1 ¼"	1 ¼"	1 ½"	2"
2.5	28	1"	1 ¼"	1 ¼"	1 ¼"	1 ¼"	1 ½"	2"	2"
5.0	55	1 ¼"	1 ¼"	1 ¼"	1 ¼"	1 ¼"	2"	2"	2"
10.0	110	1 ¼"	1 ¼"	1 ¼"	1 ¼"	1 ½"	2"	2"	2"
15.0	164	1 ¼"	1 ¼"	1 ¼"	1 ½"	2"	2"	2"	2"
20.0	220	1 ¼"	1 ¼"	1 ½"	2"	2"	2"	2"	2 ½"
30.0	330	1 ¼"	1 ¼"	2"	2"	2"	2"	2 ½"	2 ½"
40.0	440	1 ¼"	1 ½"	2"	2"	2"	2"	2 ½"	2 ½"
50.0	550	1 ½"	2"	2"	2"	2"	2"	2 ½"	2 ½"
60.0	660	2"	2"	2"	2"	2"	2 ½"	2 ½"	2 ½"
80.0	880	2"	2"	2"	2"	2"	2 ½"	2 ½"	2 ½"
100.0	1100	2"	2"	2"	2"	2 ½"	2 ½"	2 ½"	3"
150.0	1640	2"	2"	2"	2 ½"	2 ½"	2 ½"	3"	3"
200.0	2200	2"	2"	2 ½"	2 ½"	2 ½"	3"	3"	3 ½"
300.0	3300	2"	2 ½"	2 ½"	2 ½"	3"	3"	3 ½"	4"
400.0	4400	2 ½"	2 ½"	2 ½"	3"	3"	3 ½"	4"	4"
500.0	5500	2 ½"	3"	3"	3"	3 ½"	4"	4"	5"
750.0	8200	3"	3"	3"	3 ½"	4"	4"	5"	5"
1000.0	10950	3"	3 ½"	3 ½"	4"	4"	5"	5"	6"

For distances in excess of 2000 feet – consult the factory.

Sizes are shown for SCH.40 or SCH.80 Am. std. pipe size. Threaded piping must be SCH.80. Welded pipe may be SCH.40, except where codes take precedence over N.F.P.A. 58.

**Table 4 – Saturated Steam Pressure**

ABSOLUTE PRESSURE		TEMPERATURE (T) (°F)	HEAT of the LIQUID (BTU/LB)	LATENT HEAT of VAPORIZATION (BTU/LB)	TOTAL HEAT of STEAM (Hg) (BTU/LB)	SPECIFIC VOLUME (V) (Cu. Ft. per LB)
ABSOLUTE	GAUGE					
30.0	15.3	250.33	218.82	945.3	1164.1	13.746
35.0	20.3	259.28	227.91	939.2	1167.1	11.898
40.0	25.3	267.25	236.03	933.7	1169.7	10.498
45.0	30.3	274.44	243.36	928.6	1172.0	9.401
50.0	35.3	281.01	250.09	924.0	1174.1	8.515
55.0	40.3	287.07	256.30	919.6	1175.9	7.787
60.0	45.3	292.71	262.09	915.5	1177.6	7.175
65.0	50.3	297.97	267.50	911.6	1179.1	6.655
70.0	55.3	302.92	272.61	907.9	1180.6	6.206
75.0	60.3	307.60	277.43	904.5	1181.9	5.816
80.0	65.3	312.03	282.02	901.1	1183.1	5.472
85.0	70.3	316.25	286.39	897.8	1184.2	5.168
90.0	75.3	320.27	290.56	894.7	1185.3	4.896
95.0	80.3	324.12	294.56	891.7	1186.2	4.652
100.0	85.3	327.81	298.40	888.8	1187.2	4.432
105.0	90.3	331.36	302.10	886.0	1188.1	4.232
110.0	95.3	334.77	305.66	883.2	1188.9	4.049
115.0	100.3	338.07	309.11	880.6	1189.7	3.882
120.0	105.3	341.25	312.44	877.9	1190.4	3.728
125.0	110.3	344.33	315.68	875.4	1191.1	3.587
130.0	115.3	347.32	318.81	872.9	1191.7	3.455
135.0	120.3	350.21	321.85	870.6	1192.4	3.333
140.0	125.3	353.02	324.82	868.2	1193.0	3.220
145.0	130.3	355.76	327.70	865.8	1193.5	3.114
150.0	135.3	358.42	330.51	863.6	1194.1	3.015
160.0	145.3	363.53	335.93	859.2	1195.1	2.834
170.0	155.3	368.41	341.09	854.9	1196.0	2.675
180.0	165.3	373.06	346.03	850.8	1196.9	2.532
190.0	175.3	377.51	350.79	846.8	1197.6	2.404
200.0	185.3	381.79	355.36	843.0	1198.4	2.288
210.0	195.3	385.90	359.77	839.2	1199.0	2.183
220.0	205.3	389.86	364.02	835.6	1199.6	2.087
230.0	215.3	393.68	368.13	832.0	1200.1	1.999
240.0	225.3	397.37	372.12	828.5	1200.6	1.918
250.0	235.3	400.95	376.00	825.1	1201.1	1.844

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# ***APPENDIX A***

## ***COMPONENT INFORMATION***

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# BESTOBELL STEAM

Steam Traps and Steam Specialties

3170 Wasson Road • Cincinnati, OH 45209 USA  
Phone 513-533-5600 • Fax 513-871-0105  
E-Mail: steam@richardsind.com

# Delta Element Style Traps

## Installation & Maintenance Instructions for Bestobell Steam Delta Element Style Traps

**Warning:** Bestobell Steam products must only be used, installed and repaired in accordance with these Installation & Maintenance Instructions. Observe all applicable public and company codes and regulations. In the event of leakage or other malfunction, call a qualified service person. Continued operation may cause system failure or hazard. Prior to servicing equipment, disconnect, shut off, drain and/or bypass all pressurized fluids.

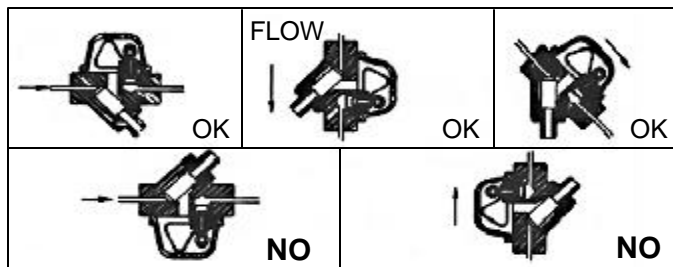
### Pre-Installation

Prior to installation:

- Blow out piping to remove any scale or dirt.
- Verify that your Bestobell steam trap will meet system conditions by checking the nameplate for operating differential pressure and maximum pressure and temperature limits of the trap body.

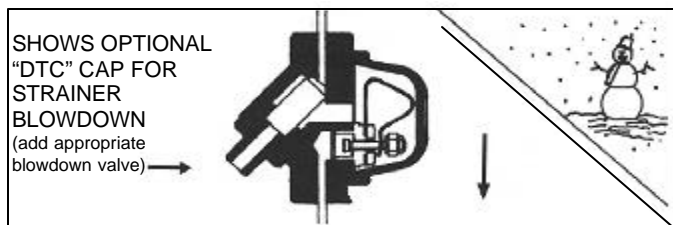
### Installation

#### General Traps



Bestobell steam traps can be installed in most positions from horizontal to vertical with exceptions as illustrated. The flow arrow forged on the body or indicated on the nameplate must be in the direction of the flow; otherwise the trap will not operate because the integral check valve will not allow flow in reverse direction.

#### Cold Climates



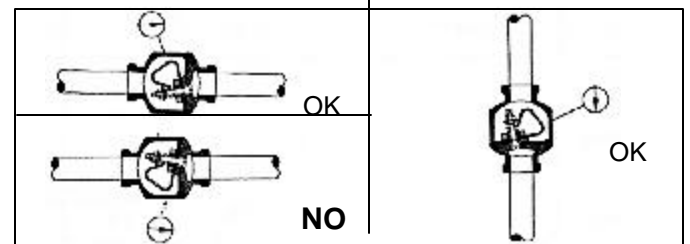
In cold climates, install in vertical piping with discharge downwards so as to be self-draining. For discharge to atmosphere, ensure that any tail pipe is short and full diameter to prevent downstream freezing. The trap and associated piping can be insulated without affecting trap operation in outdoor freezing conditions.

#### Magnum Models

Single element Magnums can be installed as shown for general traps. **Multiple element Magnums must only be installed for**

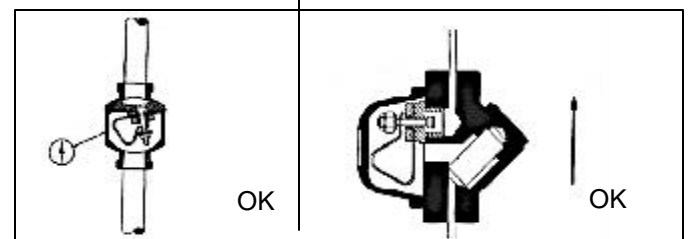
**vertical piping with downward discharge.** Consult distributor or factory for assistance.

#### Sealed Trap Models DS12, TS12



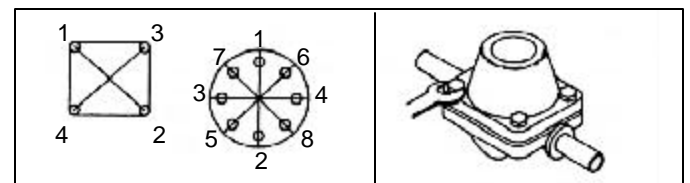
A sealed trap can be installed in any position. On a horizontal line, the flow arrow must be at the top (as shown). Flow through a sealed unit must be as indicated by the direction of arrow on body casting.

#### Air Vent Service: For Traps Marked "AV"



If ordered, and identified by "AV" stamping, for air venting service, the Bestobell trap should be installed as shown above. Trap is to be mounted on vent connection located at upper foremost point of steam space.

### Initial Warm-Up



As with all steam equipment, it is recommended that the external gasketed joints be retorqued after a warm-up/cool-down cycle. Torque the cover bolts in the diagonal sequence as shown. **Note: retorquing is essential after socket welding.**

*Wrench sizes and torque values for cover fasteners and strainer caps are shown in Torque Value Table.*

## Torque Value Table

Model	Sizes (in)	Cover Fittings (FT-LBS)	Wrench Size (in)	Strainer Cap (FT-LBS)	Wrench Size (in)	Valve Seat (FT-LBS)	Wrench Size (mm)
DMR6	1/2-3/4	120	1-1/4	N/A	N/A	20	17
3A, 6A, 10, 22, GM3 /6/10 DM25	3/8-3/4	15	1/2	50	1-3/16 or 1-1/4	30	22
16/25/40	1/2-3/4	30	5/8 11/16	70	1-3/8	30	22
GM16 /25	1/2-3/4	30	5/8 11/16	70	1-3/8	35	27
16/25/40 GM3 /6/10	1	25	5/8 11/16	90	1-1/2	35	27
16/25 GM10	1-1/4 to 2	110	7/8 1-1/4	170+	2	62	41
GM3 /6	1-1/4 to 1-1/2	110	7/8 1-1/4	170+	2	65	41
GM3 /6	2	25	3/4 7/8	170+	7/8" SQ	80	50
DM64 /100	1/2 to 1	50	7/8	70	1-7/16	35	27
40/64/100	1-1/2 to 2	85	1-1/4	170+	2	65	41
DM160 DM320	All	90	1-15/16	N/A	N/A	35	27
TM22 DM6 /12 DM10E	All	12	1/4 allen 1/2	N/A	N/A	20	17
Multi-element Magnums	Small	80	3/4	N/A	N/A	80	80
	Medium	160	15/16				
	Large	280	1-1/8				
Single El.	1-1/2 to 2	110	1-1/4, 7/8				

Note: where 2 wrench sizes are shown, one is bolt size, one is wrench size.

## Re-Assembly Precautions

- Lubricate all bolts, strainer cap, and control element threads with anti-seize compound.
- Install control element gasket.
- Follow all instructions on back cover of this brochure, and always install new gasket.
- On bonnet-to-bonnet joint:
  - Bring bolts to hand-tight.
  - Torque across corners to 50% of specified torque.
  - Torque to 100% of specified torque.
  - Check bolt torques directly following the steam test.
  - On DMR6 with copper gasket, torque to 50%, loosen and torque to 100%.

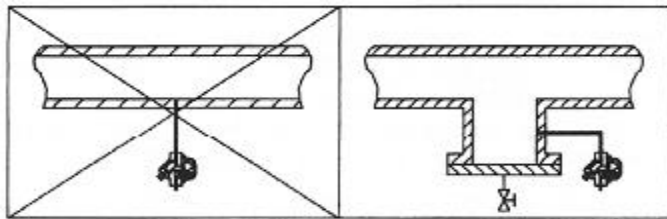
## General Installation Guidelines

For top performance of any steam trap, the pipework must be designed to provide the best condensate flow possible to the steam trap. To achieve this, follow the general guidelines shown below:

- Where possible, arrange the piping such that condensate flows to the trap by gravity.
- Trap each piece of equipment separately.
- Located the trap at the lowest point, preferably below the equipment outlet.
- On most applications, the trap should be 2 to 5 lineal feet from the equipment outlet.
- Arrange piping and trap location to be easily accessible for inspection and repair.
- Bestobell traps have very high cold start-up capacities. Install bypasses only if required for maintenance.
- Shutoff valves, unions, and test "tee" after a trap should be installed to provide easier operation, maintenance, and testing.
- Check all pipe sizes to prevent restricted flows, especially in condensate return lines. Undersized returns are a major cause of poor system performance.
- Insulation after the trap is ideal, but do not insulate the trap. Consult your local distributor for information on when piping before the trap should not be insulated.
- Observe all applicable public and company codes and regulations concerning steam and condensate piping.

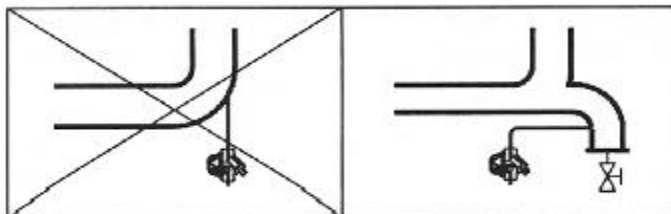


# Application Guidelines



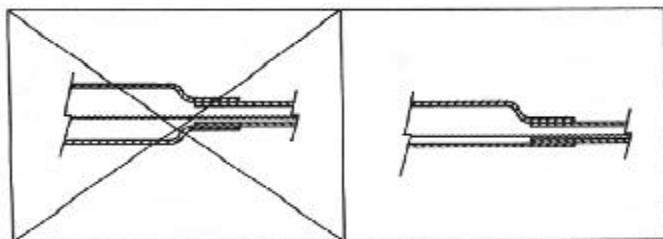
## Steam Mains

Steam mains should be drained every 150 to 250 feet or at each change of direction using a suitable pocket in the mains. Install on the side of the pocket to prevent dirt clogging. If pocket base is not removable, a blowdown valve should be fitted to remove dirt.



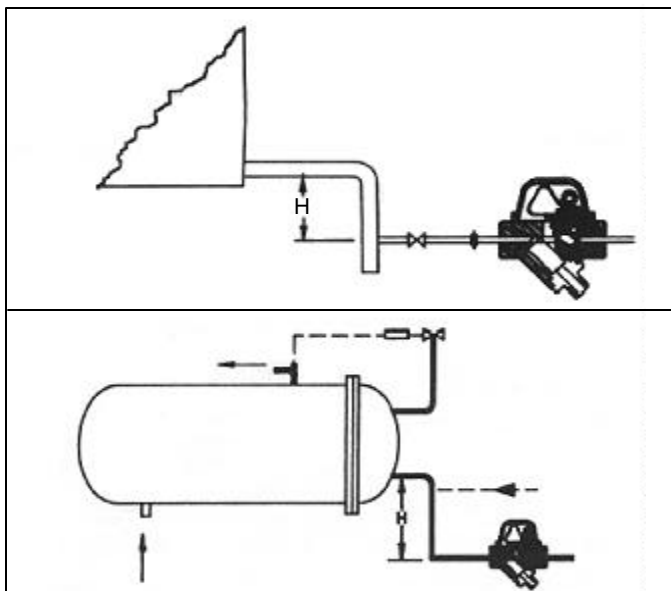
## Vertical Risers

Where steam mains rise vertically, pipework design should allow collection of condensate from both the horizontal and vertical sections.



## Drain Line Reducers

When installing a small trap on a large draining line — as on steam coils or branch line drainage — do not use a concentric reducer as this causes waterlogging of the larger lines and possible steam locking. Use an eccentric reducer with the small connection at the low point.

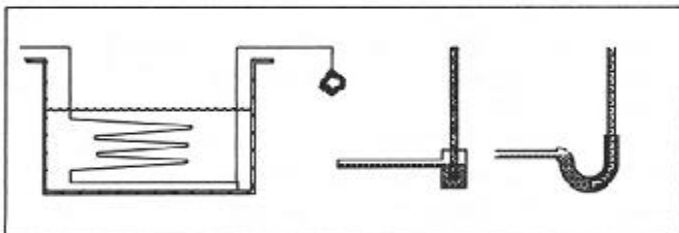


## Process Equipment

On process equipment, the trap should be installed below the outlet level. Full-size piping from the equipment outlet for a vertical drop of 1 to 2 feet provides a condensate accumulator and hydraulic head to assist discharge. (H)

High condensate rates, particularly at start-up, can cause vacuum conditions in the steam chamber. The addition of a vacuum breaker allows gravity drainage of the unit due to the head. (H)

On temperature regulated applications, condensate should be collected locally and pumped back to the boiler to eliminate back pressure conditions.



## Lifting Condensate

Where condensate must be lifted before the trap, a siphon fitting must be used to ensure that only condensate is presented to the trap.

**Note:** flow rates based on discharge to atmospheric pressure, valid for back pressures of up to 20% of inlet pressure. Higher back pressures require resetting of control element to obtain stated capacities. Consult factory for details.

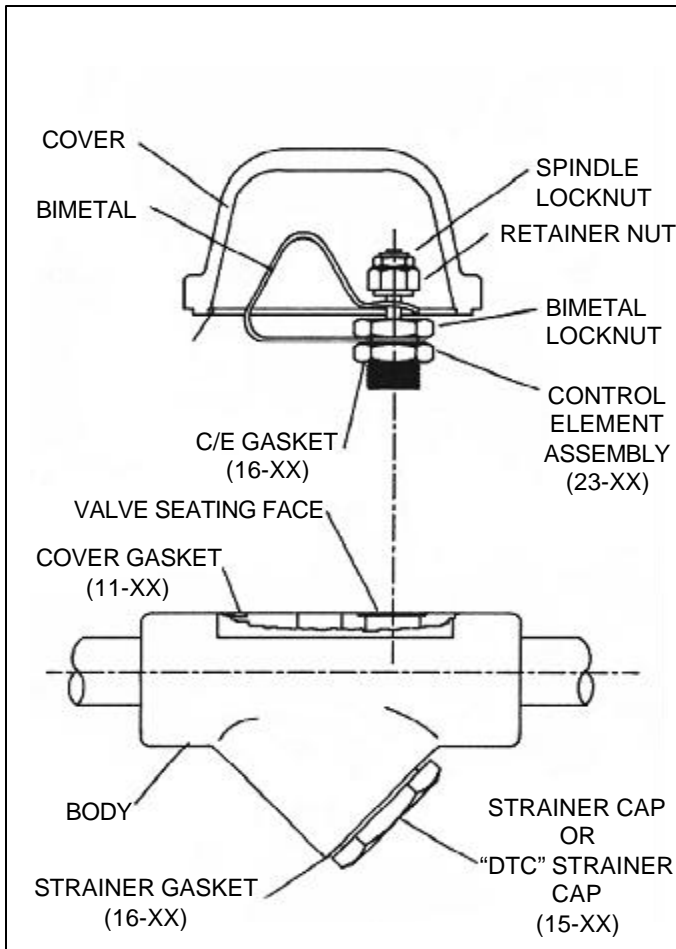
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## Replacing Element/Valve Assembly

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When needed, the Bestobell trap can be readily overhauled, by replacing the Delta control element as a **complete assembly**. A new factory replacement control element and gasket should always be used as this will be correctly calibrated to restore your trap to its original efficiency.

1. Before removing the cover, the trap must be isolated from both live steam lines and condensate return lines, and internal pressure in the trap should be relieved via venting to atmosphere or by cooling the trap to ambient temperature.
2. Loosen and remove the cover bolts and cover. (Due to long service life between maintenance, the cover bolts may become rusted in position. A clearance is provided between the cover and body to allow the use of a hack saw for removal).
3. Loosening the bimetal locknut enables insertion of an open-end wrench under the bimetal to free the valve seat. Unscrew the valve seat from the body.
4. Before installing the new element/valve assembly, clean the valve seating face on the body with a wire brush. Inspect to ensure that all gasket seating surfaces are undamaged.
5. The replacement element assembly is factory preset. It is vital that, during installation, the adjusting nut and locknut on the spindle **are not disturbed**.
6. Unscrew the bimetal locknut to allow a wrench to be placed between the bimetal and body for tightening of the seat into the body. Install the gasket on the base, and screw the valve seat into the body and tighten to the torque values shown in the *Torque Value Table*.
7. Line up the bimetal with the inlet and outlet ports to ensure clearance once the cover is replaced, then tighten the bimetal locknut. (*Note: very small control elements may not have bimetal locknuts*).
8. Before replacing the cover, clean the cover gasketing faces thoroughly and insert an appropriate replacement cover gasket.
9. Replace the cover and bolts with the bolt heads on the cover side and hand-tighten the nuts. Torque the cover bolts in two stages: initially to 50% and finally to the full values shown in the *Torque Value Table*. At each stage tighten in the diagonal pattern shown on page 1.



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## General Maintenance

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Although the Bestobell steam trap is simple and rugged with only two moving parts, it is a mechanical device for which routine inspection and maintenance is needed.

**The trap must always be isolated before any attempt is made to dismantle it.**

Under normal operation, the only item that needs attention is the strainer which should be inspected periodically by removing the strainer cap and extracting the strainer screen. It should then be cleaned and replaced using a new strainer cap gasket.

Where plant conditions dictate frequent strainer cleaning, the fitting of a double threaded strainer cap (DTC) and a blowdown valve is recommended in place of the standard strainer cap to allow cleaning under operating conditions. When a blowdown valve is installed, it should be periodically opened for 3 to 5 seconds to blow out the sludge and dirt from the strainer.

# ELECTRIC LEVEL CONTROLS

## PRODUCT DESCRIPTION

### Scope Of This Manual:

This manual describes and provides instructions and parts lists for the LINC-L471, LINC-L471SC, LINC-LV471 and LINC-L971 Series Electric Level Controls.

### Product Description:

Used as a high & low level control, the L471 & L471SC can activate alarms, provide a switch input for control systems, or perform a variety of desired electrical switch operations actuated by a liquid or liquid interface.

### Operation:

As the float is moved by varying liquid height, a magnet is moved closer to or further away from a switch enclosure. As the magnet moves closer, a reed switch in the enclosure closes. As the magnet moves further away, the switch opens. The arm containing the magnet also acts as a counterweight for the float.

The float is small and will operate in liquids with a specific gravity as low as 0.4. The interface type float will operate with a specific gravity differential as low as 0.1. The small float permits an economical installation in locations where other controls would be cost prohibitive. With the optional relay mounted in an explosion-proof case, the control of larger electrical loads can be obtained. The manual override option allows the operator to manually move the float arm to the test switch position.

The SC Series is designed to eliminate the threaded control connection in mounting with the use of a bolted ring per API recommended practice RP14E. The external cage allows for installation of the control at any elevation.

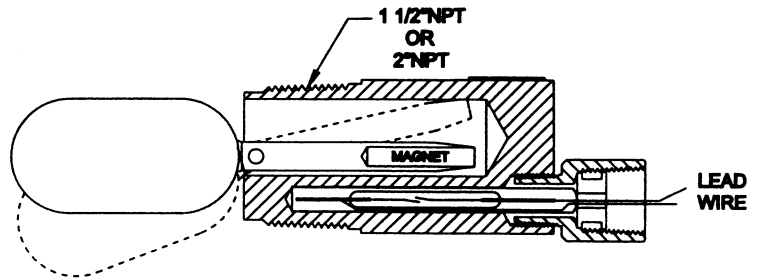


Figure 1

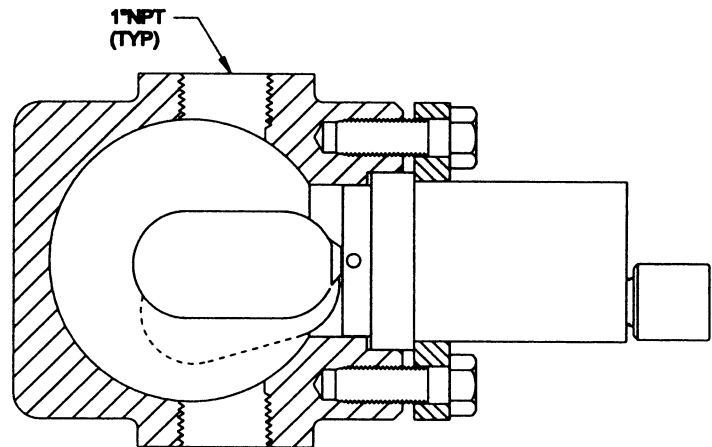


Figure 2

### Features:

- All wetted parts isolated from the environment. These level controls are safe even in the event of fire.
- \*Certified as explosion proof for Hazardous Locations: Class I, Div. 1, Groups A, B, C, D; Class II, Div. 1, Groups E, F, G; & Class III, Div. 1.
- All 316 stainless steel wetted parts provide corrosion resistance. Also available in Monel, Kynar and other plastics.
- Our sealed switch assembly prevents dust, dirt, or moisture from affecting the level control's operation. Classified "Factory Sealed" by CSA/NRTL/C.
- Cartridge switch assembly provides easy field replacement and servicing.
- High or low alarm, normally open or normally closed operation simply by inverting the level control.

\*When a relay assembly is used, Class I, Div. 1, is limited to groups C and D.

# ELECTRIC LEVEL CONTROLS

## I N S T A L L A T I O N

### Installation

Before installing the level control, inspect the unit for any damage. The float arm must pivot freely. Thread the level control into the desired connection. See Figure 3 for suggested installations. The float requires a minimum clearance of 1 1/4" from the center line of the unit for proper operation. For operation as a high level alarm, the conduit connection must be positioned to the lowest possible location. For operation as a low level alarm, the conduit connection must be positioned to the highest possible location. Wiring connections may now be made. Do not allow the wiring connections to pull on the switch assembly.

**Caution:** Do not exceed switch ratings.

**LINC-L471, LINC-L471SC:**  
SPST, 100 VA AC with 3  
AMP inrush capability,  
maximum 250 volts.

Breakdown voltage is 300 volts. Electrical ratings are given for resistive loads. For inductive loads, de-rate the switch rating by 50% and do not exceed the VA ratings on the inrush current. If the applied load is inductive, such as a relay or coil, then a protective device should be used to prevent "inductive

kick," which may burn the switch contacts. The protective device recommended is dependent on the voltage used. For DC operation, a diode similar to an IN34A should be wired in parallel with the switch. See Figure 4, wiring schematic. For AC operation, a Varistor should be wired in parallel with the switch. Recommended Varistor for

110 VAC is a G.E. #V150-LA1 and for 220 VAC a G.E. #V300-LA2. See Figure 4, Wiring Schematic.

**For SPDT Switch Cartridge Wiring:**

White - Common  
Black - Normally Closed  
Red - Normally Open

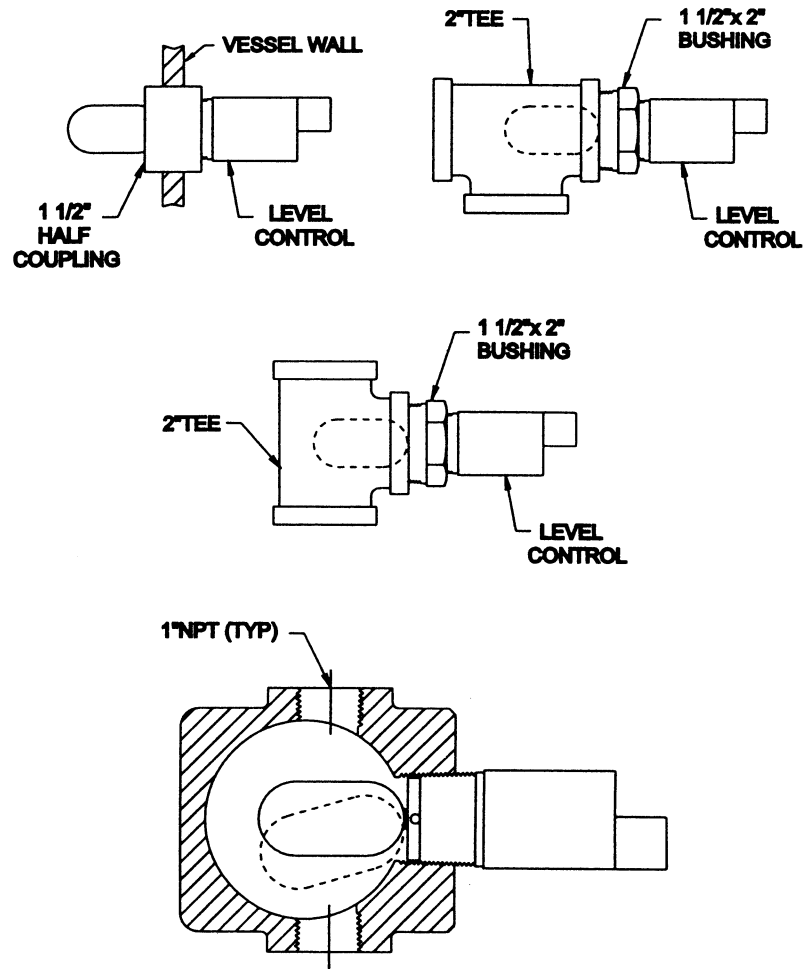


Figure 3

# **ELECTRIC LEVEL CONTROLS**

## **M A I N T E N A N C E**

### **Maintenance:**

The LINC-L471 and LINC-L471SC Series electric level controls have been designed to be as maintenance free as possible. However, the component parts are subject to normal wear and must be inspected and replaced as necessary. Inspection and maintenance frequency depend upon the severity of service conditions. Instructions are provided in this section for maintaining the controls as units, i.e., float and float arm, relay and switch cartridge.

All the maintenance procedures below assume that the control has been removed from service. The switch and relay can be serviced with the control installed. The power must be disconnected before removing the relay enclosure cover or opening the conduit fitting.

### **Float & Float Arm:**

Check the physical clearance for float operation. The float must swing freely. Solvent cleaning of the float arm chamber may be required if used in viscous or dirty liquids. If the float has collapsed or is perforated, unscrew the float from the float arm and replace with a new float. Use Loctite® to secure the float to the float arm. To remove the float arm,

drive out the pivot pin using a 1/8" punch. When installing the float arm, make certain that the threaded offset of the float arm is against the thick wall of the body.

### **Relay:**

To test for proper relay function, disconnect the switch leads from the relay socket. Apply appropriate voltage to the coil terminals and observe the relay contact closure with an ohmmeter connected across the common and normally closed contacts. Interrupt the coil power supply several times while observing the ohmmeter. No movement indicates a defective relay, coil or contacts. This procedure should be repeated for each set of contacts in service.

To remove a defective relay, simply pull the relay from the socket and replace with a new relay.

When ordering a replacement relay, be certain to specify coil voltage. After installing a new relay, reconnect the switch leads.

### **Switch:**

To test for switch malfunction, connect an ohmmeter across the electrical leads and observe the meter as the float assembly is mechanically operated. No meter move-

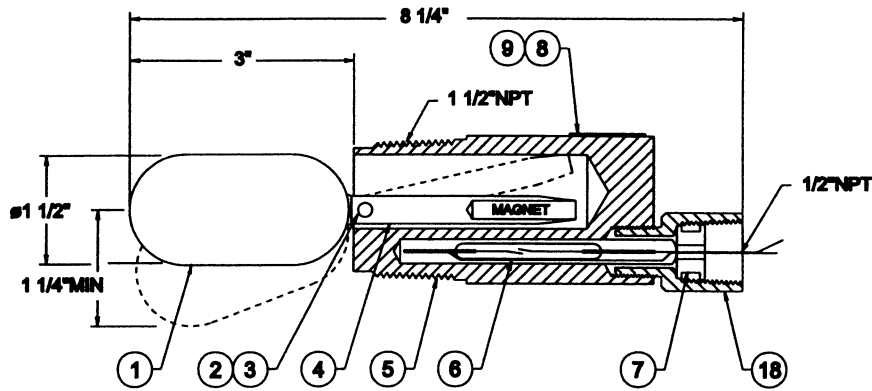
ment indicates a switch failure.

To replace a switch on the LINC-L471 or LINC-L471SC Series, pull out the switch cartridge along with the grommet through the conduit adapter. Slide the new switch cartridge into the body. Route the switch wired through the grommet and seat the grommet in the conduit adapter.

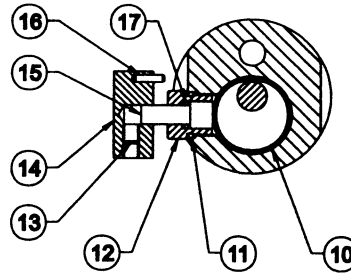
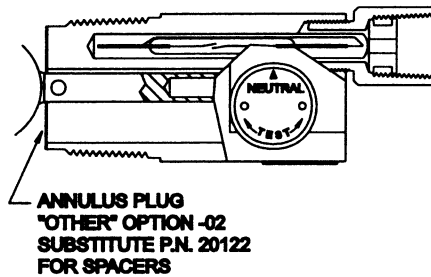
® Loctite is a trademark of the Loctite Corporation

# ELECTRIC LEVEL CONTROLS

L I N C - L 4 7 1 - 0 1



Model LINC-L471-01



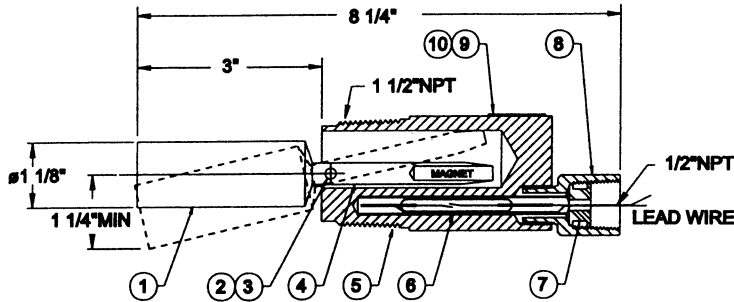
MANUAL OVERRIDE, STANDARD BODY  
Body Style -2, -4

Model	L471-01	L471-21	Description	Material	Qty
1	10245	10245	Float	316 ss	1
2	20120	20120	Pin	316 ss	1
3	20121	20121	Spacer	316 ss	2
4	20853	24883	Float Arm Assembly	316 ss	1
5	30313	30715	Body	316 ss	1
6*	20495	20495	Switch Cartridge	304 ss	1
7	10087	10087	Grommet	Nitrile	1
8	10012	10012	Name Plate	316 ss	1
9	10324	10324	Drive Screw (not shown)	18-8 ss	4
10		24885	Ring Weldment	316 ss	1
11		10996	O-Ring	Fluorocarbon	1
12		22271	Packing Gland	316 ss	1
13		10621	Set Screw	18-8 ss	1
14		22577	Knob	303 ss	1
15		24875	Stem	316 ss	1
16		11192	Roll Pin	18-8 ss	3
17		10108	O-Ring	Fluorocarbon	1
18	20119	20119	Conduit Adapter	303 ss	1
19		11193	Name Plate (not shown)	Sealed	1
20	24834	24834	Switch Cartridge SPST 500°F (Optional)	Sealed	1
21	24835	24835	Switch Cartridge SPDT 500°F (Optional)	Sealed	1
22	24836	24836	Switch Cartridge SPDT 400°F (Optional)	Sealed	1

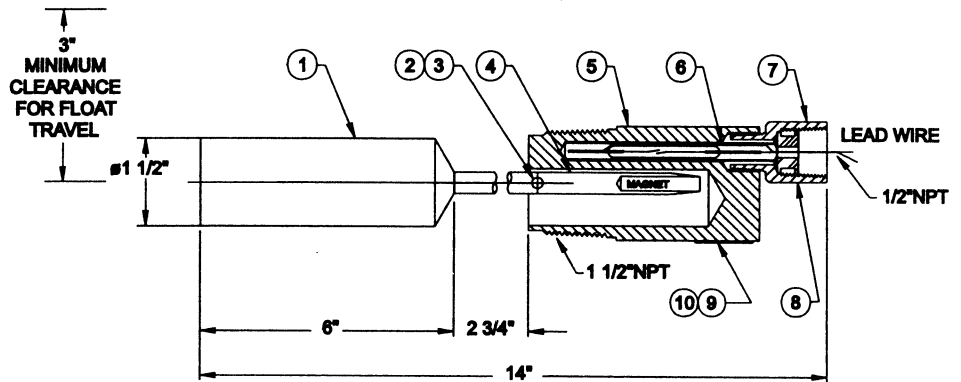
\*Recommended spare

# ELECTRIC LEVEL CONTROLS

LINC-L471-02 & LINC-L471-03



Model LINC-L471-02



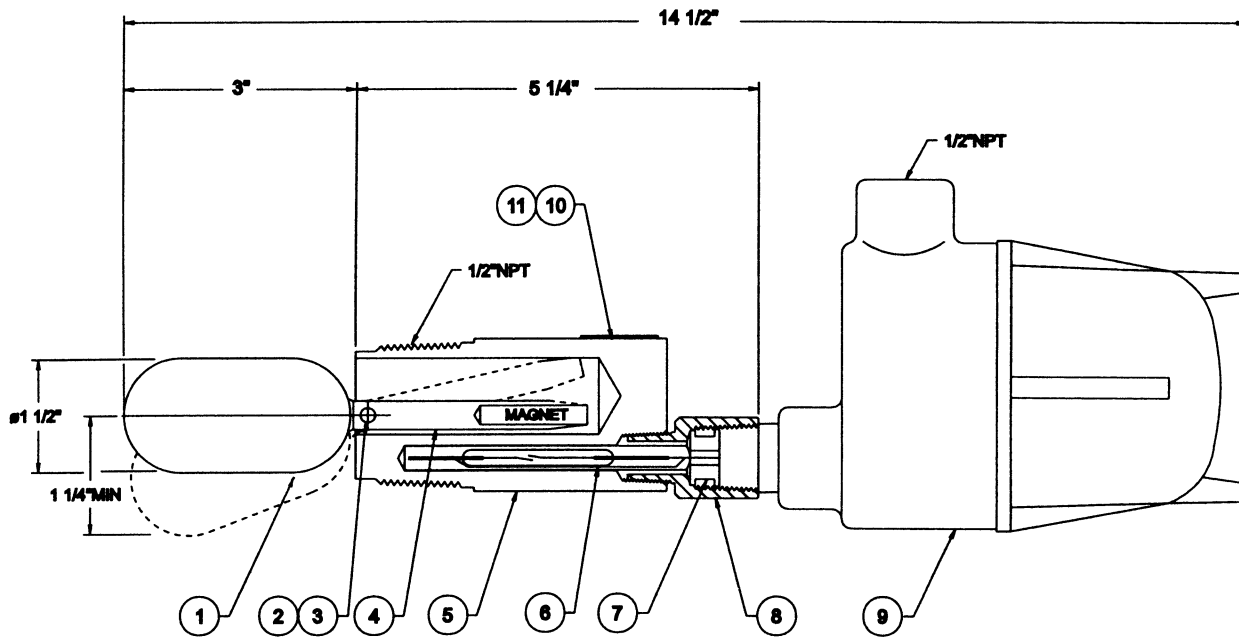
Model LINC-L471-03

Model	L471-02	L471-03	Description	Material	Qty
1	20149	20136	Float	Polypropylene	1
2	20120	20120	Pin	316 ss	1
3	20121	20121	Spacer	316 ss	2
4	20853	21671	Float Arm Assembly	316 ss	1
5	30313	30313	Body	316 ss	1
6*	20495	20495	Switch Cartridge	Sealed	1
7	10087	10087	Grommet	Nitrile	1
8	20119	20119	Conduit Adapter	303 ss	1
9	10012	10012	Name Plate	316 ss	1
10	10324	10324	Drive Screw (not shown)	18-8 ss	2
11	24834	24834	Switch Cartridge SPST 500°F (Optional)	Sealed	1
12	24835	24835	Switch Cartridge SPDT 500°F (Optional)	Sealed	1
13	24836	24836	Switch Cartridge SPDT 400°F (Optional)	Sealed	1

\*Recommended spare

# ELECTRIC LEVEL CONTROLS

L I N C - L 4 7 1 - 0 1 - 0 4



**Model** LINC-L471-01-04

Item	Part #	Description	Material	Qty
1	10245	Float	316 ss	1
2	20120	Pin	316 ss	1
3	20121	Spacer	316 ss	2
4	20853	Float Arm Assembly	316 ss	1
5	30313	Body	316 ss	1
6*	20495	Switch Cartridge	Sealed	1
7	10087	Grommet	Nitrile	1
8	20119	Conduit Adapter	303 ss	1
9	21593	Relay Assembly (110 VAC see relays)		1
10	10419	Name Plate	316 ss	1
11	10324	Drive Screw (not shown)	18-8 ss	2
12	24834	Switch Cartridge SPST 500°F (Optional)	Sealed	1
13	24835	Switch Cartridge SPDT 500°F (Optional)	Sealed	1
14	24836	Switch Cartridge SPDT 400°F (Optional)	Sealed	1

\*Recommended spare



# Installation & Maintenance Instructions



OPEN-FRAME, GENERAL PURPOSE, WATERTIGHT/EXPLOSIONPROOF SOLENOIDS

SERIES

8003G

8202G

Form No.V6584R7

## — SERVICE NOTICE —

ASCO® solenoid valves with design change letter “G” or “H” in the catalog number (ex. 8210G 1) have an epoxy encapsulated ASCO® Red Hat II® solenoid. This solenoid replaces some of the solenoids with metal enclosures and open-frame constructions. Follow these installation and maintenance instructions if your valve or operator uses this solenoid.

*See separate instructions for basic valve.*

## DESCRIPTION

Catalog numbers 8003G and 8202G are epoxy encapsulated pull-type solenoids. The green solenoid with lead wires and 1/2” conduit connection is designed to meet Enclosure Type 1—General Purpose, Type 2—Drip-proof, Types 3 and 3S—Raintight, and Types 4 and 4X—Watertight. The black solenoid on catalog numbers prefixed “EF” or “EV” is designed to meet Enclosure Types 3 and 3S—Raintight, Types 4 and 4X—Watertight, Types 6 and 6P—Submersible, Type 7 (A, B, C & D) Explosionproof Class I, Division 1 Groups A, B, C, & D and Type 9 (E, F, & G)—Dust—Ignitionproof Class II, Division 1 Groups E, F & G. The Class II, Groups F & G Dust Locations designation is not applicable for solenoids or solenoid valves used for steam service or when a class “H” solenoid is used. See *Temperature Limitations* section for solenoid identification and nameplate/retainer for service. When installed just as a solenoid and not attached to an ASCO valve, the core has a 0.250–28 UNF–2B tapped hole, 0.38 or 0.63 minimum full thread.

NOTE: Catalog number prefix “EV” denotes stainless steel construction.

Catalog numbers 8202G1, 8202G3, 8202G5 and 8202G7 are epoxy encapsulated push-type, reverse-acting solenoids having the same enclosure types as previously stated for Catalog numbers 8003G1 and 8003G2.

### Series 8003G and 8202G solenoids are available in:

- **Open-Frame Construction:** The green solenoid may be supplied with 1/4” spade, screw or DIN terminals. (Refer to Figure 4)
- **Panel Mounted Construction:** These solenoids are specifically designed to be panel mounted by the customer through a panel having a .062 to .093 maximum wall thickness. Refer to Figure 1 and section on *Installation of Panel Mounted Solenoid*.

### Optional Features For Type 1 – General Purpose Construction Only

- **Junction Box:** This junction box construction meets Enclosure Types 2,3,3S,4, and 4X. Only solenoids with 1/4” spade or screw terminals may have a junction box. The junction box provides a 1/2” conduit connection, grounding and spade or screw terminal connections within the junction box (See Figure 5).
- **DIN Plug Connector Kit No.K236034:** Use this kit only for solenoids with DIN terminals. The DIN plug connector kit provides a two pole with grounding contact DIN Type 43650 construction (See Figure 6).

## OPERATION

Series 8003G – When the solenoid is energized, the core is drawn into the solenoid base sub-assembly. **IMPORTANT: When the solenoid is de-energized, the initial return force for the core, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force for AC construction is 11 ounces, and 5 ounces for DC construction.**

Series 8202G – When the solenoid is energized, the disc holder assembly seats against the orifice. When the solenoid is de-energized, the disc holder assembly returns. **IMPORTANT: Initial return force for the disc or disc holder assembly, whether developed by spring, pressure, or weight, must exert a minimum force to overcome residual magnetism created by the solenoid. Minimum return force is 1 pound, 5 ounces.**

## INSTALLATION

Check nameplate for correct catalog number, service, and wattage. Check front of solenoid for voltage and frequency.

**⚠ WARNING: Electrical hazard from the accessibility of live parts. To prevent the possibility of death, serious injury or property damage, install the open-frame solenoid in an enclosure.**

### FOR BLACK ENCLOSURE TYPES 7 AND 9 ONLY

**⚠ CAUTION: To prevent fire or explosion, do not install solenoid and/or valve where ignition temperature of hazardous atmosphere is less than 165° C. On valves used for steam service or when a class “H” solenoid is used, do not install in hazardous atmosphere where ignition temperature is less than 180° C. See nameplate/retainer for service.**

NOTE: These solenoids have an internal non-resettable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed core, excessive ambient temperature or a shorted solenoid, etc. This unique feature is a standard feature only in solenoids with black explosionproof/dust-ignitionproof enclosures (Types 7 & 9).

**⚠ CAUTION: To protect the solenoid valve or operator, install a strainer or filter, suitable for the service involved in the inlet side as close to the valve or operator as possible. Clean periodically depending on service conditions. See ASCO Series 8600, 8601, and 8602 for strainers.**

### Temperature Limitations

For maximum valve ambient temperatures, refer to chart. The temperature limitations listed, only indicate maximum application temperatures for field wiring rated at 90°C. Check catalog number prefix and watt rating on nameplate to determine maximum ambient temperature. See valve installation and maintenance instructions for maximum fluid temperature. NOTE: For steam service, refer to *Wiring* section, *Junction Box* for temperature rating of supply wires.

Temperature Limitations For Series 8003G or 8202G Solenoids for use on Valves Rated at 10.1, 11.6, 17.1, or 22.6 Watts			
Watt Rating	Catalog Number Coil Prefix	Class of Insulation	Maximum † Ambient Temp.
10.1 & 17.1	None, FB, KF, KP, SC, SD, SF, & SP,	F	125°F (51.7°C)
10.1 & 17.1	HB, HT, KB, KH, SS, ST, SU,	H	140°F (60°C)
11.6 & 22.6	None, FB, KF, KP, SC, SD, SF, & SP,	F	104°F (40°C)
11.6 & 22.6	HP, HT, KB, KH, SS, ST, SU, & SV	H	104°F (40°C)

† Minimum ambient temperature –40° F (–40° C).

### Positioning

This solenoid is designed to perform properly when mounted in any position. However, for optimum life and performance, the solenoid should be mounted vertically and upright to reduce the possibility of foreign matter accumulating in the solenoid base sub-assembly area.

### Wiring

Wiring must comply with local codes and the National Electrical Code. All solenoids supplied with lead wires are provided with a grounding wire which is green or green with yellow stripes and a 1/2” conduit connection. To

facilitate wiring, the solenoid may be rotated 360°. For the watertight and explosionproof solenoid, electrical fittings must be approved for use in the approved hazardous locations.

**▲ CAUTION: Cryogenic Applications – Solenoid lead wire insulation should not be subjected to cryogenic temperatures. Adequate lead wire protection and routing must be provided.**

#### Additional Wiring Instructions For Optional Features:

- **Open–Frame solenoid with 1/4" spade terminals.**

For solenoids supplied with screw terminal connections use #12–18 AWG stranded copper wire rated at 90°C or greater. Torque terminal block screws to  $10 \pm 2$  in–lbs [ $1,0 \pm 1,2$  Nm]. A tapped hole is provided in the solenoid for grounding, use a #10–32 machine screw. Torque grounding screw to  $15 - 20$  in–lbs [ $1,7 - 2,3$  Nm]. On solenoids with screw terminals, the socket head screw holding the terminal block to the solenoid is the grounding screw. Torque the screw to  $15 - 20$  in–lbs [ $1,7 - 2,3$  Nm] with a 5/32" hex key wrench.

- **Junction Box**

The junction box is used with spade or screw terminal solenoids only and is provided with a grounding screw and a 1/2" conduit connection. Connect #12–18 AWG standard copper wire only to the screw terminals. Within the junction box use field wire that is rated 90°C or greater for connections. For steam service use 105°C rated wire up to 50 psi or use 125°C rated wire above 50 psi. After electrical hookup, replace cover gasket, cover, and screws. Tighten screws evenly in a crisscross manner.

- **DIN Plug Connector Kit No.K236034**

1. The open–frame solenoid is provided with DIN terminals to accommodate the plug connector kit.
2. Remove center screw from plug connector. Using a small screwdriver, pry terminal block from connector cover.
3. Use #12–18 AWG stranded copper wire rated at 90°C or greater for connections. Strip wire leads back approximately 1/4" for installation in socket terminals. The use of wire–end sleeves is also recommended for these socket terminals. Maximum length of wire–end sleeves to be approximately 1/4". Tinning of the ends of the lead wires is not recommended.
4. Thread wire through gland nut, gland gasket, washer and connector cover. NOTE: Connector housing may be rotated in 90° increments from position shown for alternate positioning of cable entry.
5. Check DIN connector terminal block for electrical markings. Then make electrical hookup to terminal block according to markings on it. Snap terminal block into connector cover and install center screw.
6. Position connector gasket on solenoid and install plug connector. Torque center screw to  $5 \pm 1$  in–lbs [ $0,6 \pm 1,1$  Nm].

NOTE: Alternating current (AC) and direct current (DC) solenoids are built differently. To convert from one to the other, it may be necessary to change the complete solenoid including the core and solenoid base sub–assembly, not just the solenoid. Consult ASCO.

#### Installation of Solenoid

Solenoids may be assembled as a complete unit. Tightening is accomplished by means of a hex flange at the base of the solenoid.

#### Installation of Panel Mounted Solenoid (See Figure 1)

1. Disassemble solenoid following instruction under *Solenoid Replacement* then proceed.
2. Install solenoid base sub–assembly through customer panel.
3. Position spring washer on opposite side of panel over solenoid base sub–assembly.
4. Replace solenoid, nameplate/retainer and red cap.
5. Make electrical hookup, see *Wiring* section.

#### Solenoid Temperature

Standard solenoids are designed for continuous duty service. When the solenoid is energized for a long period, the solenoid becomes hot and can be touched by hand only for an instant. This is a safe operating temperature.

### MAINTENANCE

**▲ WARNING: To prevent the possibility of death, serious injury or property damage, turn off electrical power, depressurize solenoid operator and/or valve, and vent fluid to a safe area before servicing.**

#### Cleaning

All solenoid operators and valves should be cleaned periodically. The time between cleaning will vary depending on medium and service conditions. In general, if the voltage to the solenoid is correct, sluggish valve operation, excessive noise or leakage will indicate that cleaning is required. Clean strainer or filter when cleaning the valve.

#### Preventive Maintenance

- Keep the medium flowing through the solenoid operator or valve as free from dirt and foreign material as possible.
- While in service, the solenoid operator or valve should be operated at least once a month to insure proper opening and closing.
- Depending on the medium and service conditions, periodic inspection of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any worn or damaged parts.

#### Causes of Improper Operation

- **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic *click* signifies that the solenoid is operating. Absence of the *click* indicates loss of power supply. Check for loose or blown fuses, open–circuited or grounded solenoid, broken lead wires or splice connections.
- **Burned–Out Solenoid:** Check for open–circuited solenoid. Replace if necessary. Check supply voltage; it must be the same as specified on nameplate/retainer and marked on the solenoid. Check ambient temperature and check that the core is not jammed.
- **Low Voltage:** Check voltage across the solenoid leads. Voltage must be at least 85% of rated voltage.

#### Solenoid Replacement

1. Disconnect conduit, coil leads, and grounding wire.

NOTE: Any optional parts attached to the old solenoid must be reinstalled on the new solenoid. For 3–way construction, piping or tubing must be removed from pipe adapter.

2. Disassemble solenoids with optional features as follows:

- **Spade or Screw Terminals**

Remove terminal connections, grounding screw, and terminal block (screw terminal type only).

NOTE: For screw terminals, the socket head screw holding the terminal block serves as a grounding screw.

- **Junction Box**

Remove conduit and socket head screw (use 5/32" hex key wrench) from center of junction box. Disconnect junction box from solenoid.

- **DIN Plug Connector**

Remove center screw from DIN plug connector. Disconnect DIN plug connector from adapter. Remove socket head screw (use 5/32" hex key wrench), DIN terminal adapter, and gasket from solenoid.

3. Snap off red cap from top of solenoid base sub–assembly. For 3–way construction with pipe adapter (Figure 3), remove pipe adapter, nameplate and solenoid. Omit steps 4 and 5.
4. Push down on solenoid. Then using a suitable screwdriver, insert blade between solenoid and nameplate/retainer. Pry up slightly and push to remove.

NOTE: Series 8202G solenoids have a spacer between the nameplate/retainer and solenoid.

5. Remove solenoid from solenoid base sub–assembly.
6. Reassemble in reverse order of disassembly. Use exploded views for identification and placement of parts.
7. Torque pipe adapter to 90 inch–pounds maximum [ $10,2$  Nm maximum]. Then make up piping or tubing to pipe adapter on solenoid.

#### Disassembly and Reassembly of Solenoids

1. Remove solenoid, see *Solenoid Replacement*.
2. Remove spring washer from solenoid base sub–assembly. For 3–way construction, remove plugnut gasket.
3. Unscrew solenoid base sub–assembly from valve body.
4. Remove internal solenoid parts for cleaning or replacement. Use exploded views for identification and placement of parts.
5. If the solenoid is part of a valve, refer to basic valve installation and maintenance instructions for further disassembly.
6. Torque solenoid base sub–assembly and adapter to  $175 \pm 25$  in–lbs [ $19,8 \pm 2,8$  Nm].

#### ORDERING INFORMATION FOR ASCO SOLENOIDS

When Ordering Solenoids for ASCO Solenoid Operators or Valves, order the number stamped on the solenoid. Also specify voltage and frequency.

## Torque Chart

Part Name	Torque Value Inch-Pounds	Torque Value Newton-Meters
solenoid base sub-assembly & adapter	175 ± 25	19,8 ± 2,8
pipe adapter	90 maximum	10,2 maximum

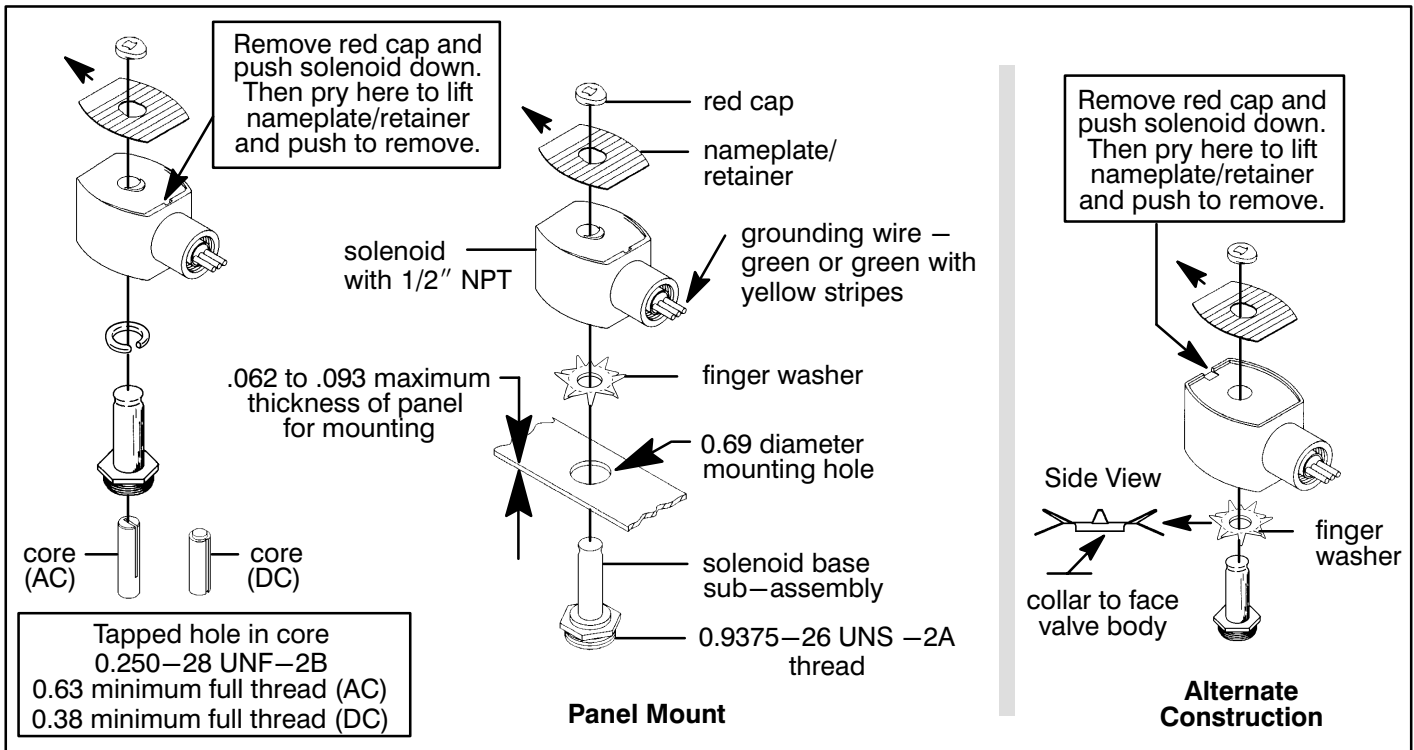


Figure 1. Series 8003G solenoids

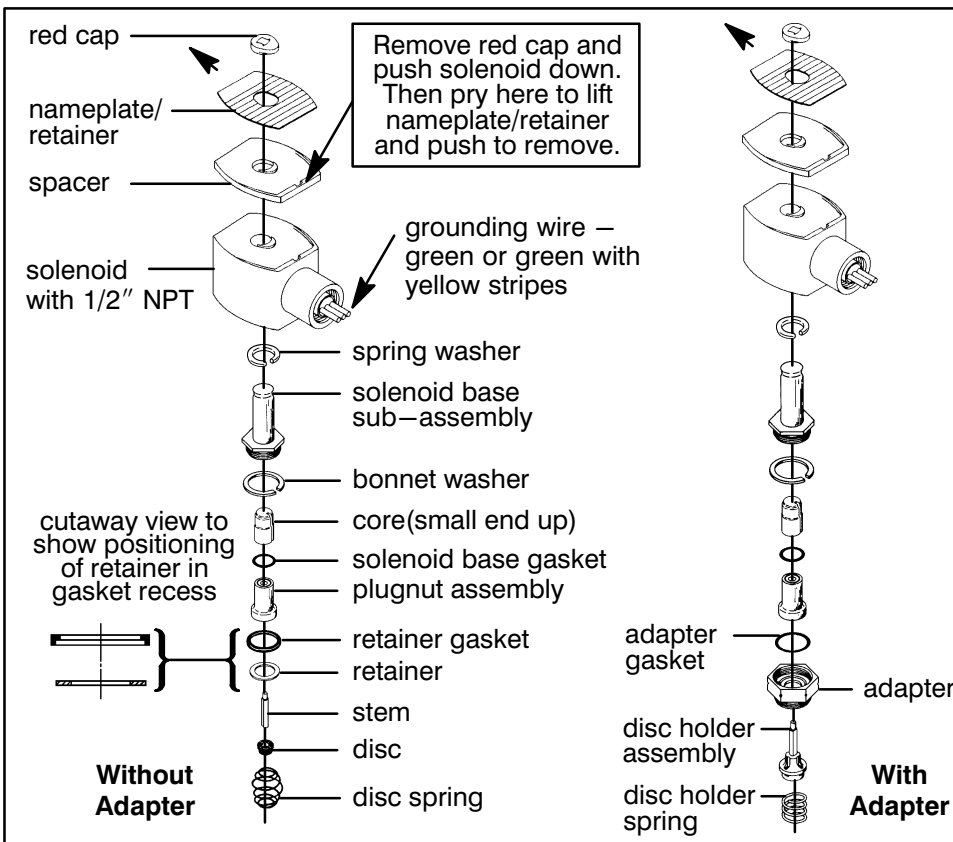


Figure 2. Series 8202G solenoids

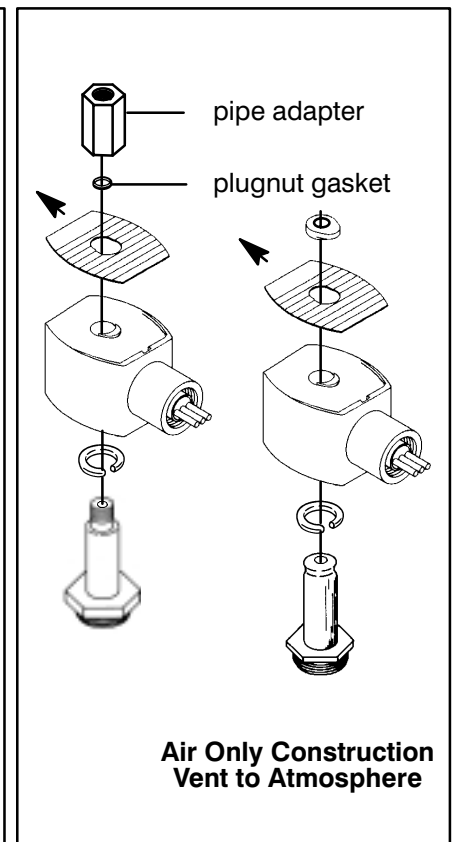
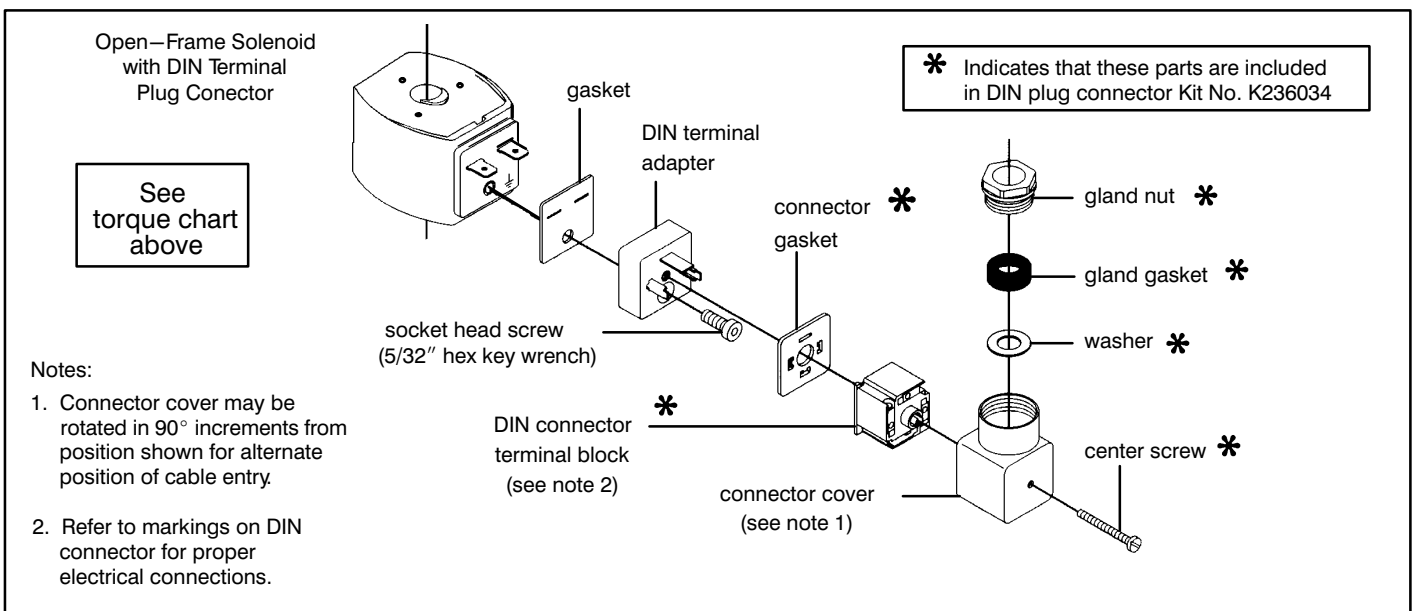
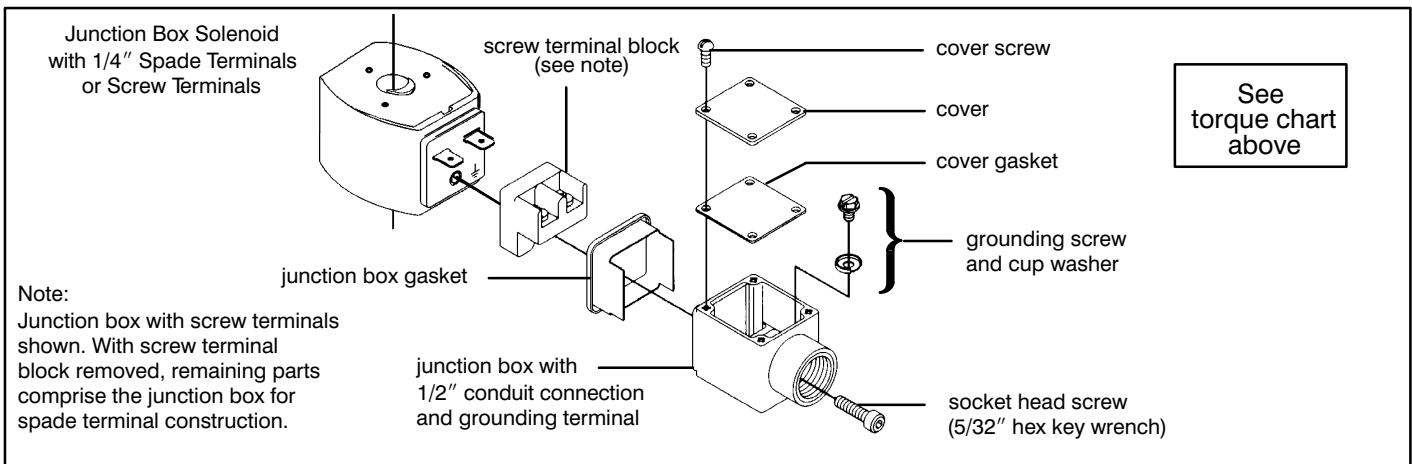
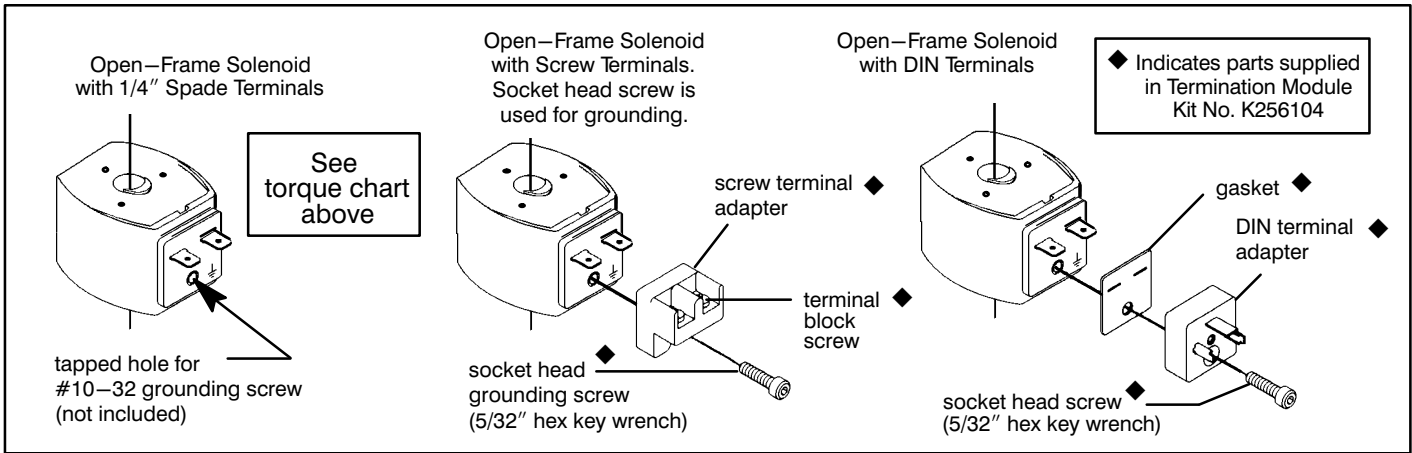


Figure 3. 3-Way Construction

## Torque Chart

Part Name	Torque Value in Inch-Pounds	Torque Value in Newton-Meters
terminal block screws	10 ± 2	1,1 ± 0,2
socket head screw	15 – 20	1,7 – 2,3
center screw	5 ± 1	0,6 ± 0,1



# Installation & Maintenance Instructions

**ASCO® TRIPPOINT®** Temperature Switches

GENERAL PURPOSE, WATERTIGHT OR EXPLOSIONPROOF SWITCH ENCLOSURES

## SERIES

SA10	SA11	SA12
SB10	SB11	SB12
SC10	SC11	SC12
SD10	SD11	SD12
SE10	SE11	SE12

Form No. P7025R1

## DESCRIPTION

These Installation and Maintenance Instructions are for the ASCO Tripoint temperature switch. Refer to the switch unit installation and maintenance instructions packaged with this form for installation and adjustment of the temperature switch. Where the word *signal* is used, substitute *Temperature* and use the related information where applicable.

The temperature switch consists of two separate units, a factory adjusted switch assembly unit and a temperature transducer unit. The temperature switch may be supplied as a complete unit, that is, the switch assembly unit and transducer unit completely assembled, or as separate units to be assembled upon installation.

Series SA10, SA11 and SA12 are Adjustable Deadband Switches.

Series SB10, SB11 and SB12 are Fixed Deadband Switches.

Series SC10, SC11 and SC12 are Two-Stage Dual Adjustment type Switches.

Series SD10, SD11 and SD12 are Manual Reset (on decreasing temperature) type Switches.

Series SE10, SE11 and SE12 are Manual Reset (on increasing temperature) type Switches.

The fourth digit in the catalog number indicates the type of switch enclosure provided. Example: Catalog SA10 indicates a General Purpose, Type 1 Enclosure. Catalog SA11 indicates a Watertight Enclosure, Types 3, 3S, 3R, 4, and 4X. Catalog SA12 indicates an Explosionproof Switch Enclosure, Type 7C and 7D (Class I, Groups C and D – Hazardous Locations) and Types 9E, 9F and G (Class II, Groups E, F and G – Hazardous Location).

**IMPORTANT:** The temperature transducers listed below may be mated with any of the temperature switches listed in the series above in the right hand corner of this sheet. *In all cases, the third digit of the switch assembly unit must be identical to the third digit of the temperature transducer unit.*

Specifications				Transducer Units			
Adjustable Operating Range (°F and °C)	Maximum Rated Overrange Temperature (°F and °C)			Direct Mount		6' Capillary and Bulb	
	Direct Mount	Capillary		Copper	316 S.S.	Copper Armored Cap.	316 S.S. Plain Capillary
		Copper	S.S.	Catalog No.	Catalog No.	Catalog No.	Catalog No.
-60 to +20°F	200°F	200°F	200°F	QA10A1	QA10A4	QA11A1	QA11A4
-51 to -7°C	93°C	93°C	93°C				
-30 to 60°F	250°F	250°F	250°F	QB10A1	QB10A4	QB11A1	QB11A4
-34 to +16°C	121°C	121°C	121°C				
0 to 90°F	260°F	300°F	300°F	QD10A1	QD10A4	QD11A1	QD11A4
-18 to +32°C	126°C	149°C	149°C				
50 to 160°F	260°F	350°F	350°F	QF10A1	QF10A4	QF11A1	QF11A4
10 to 71°C	126°C	177°C	177°C				
100 to 220°F	260°F	450°F	450°F	QJ10A1	QJ10A4	QJ11A1	QJ11A4
38 to 104°C	126°C	232°C	232°C				
160 to 260°F	260°F	500°F	500°F	QL10A1	QL10A4	QL11A1	QL11A4
71 to 127°C	126°C	260°C	260°C				
225 to 340°F	—	550°F	600°F	—	—	QN11A1	QN11A4
107 to 171°C	—	287°C	316°C				
300 to 450°F	—	550°F	700°F	—	—	QT11A1	QT11A4
149 to 232°C	—	287°C	371°C				
350 to 510°F	—	550°F	800°F	—	—	QU11A1	QU11A4
177 to 266°C	—	287°C	427°C				
425 to 640°F	—	—	890°F	—	—	—	QW11A4
218 to 337°C	—	—	476°C				

NOTE: For deadband at mid range, consult catalog.

## INSTALLATION OF TEMPERATURE TRANSDUCERS

**▲ WARNING:** To prevent the possibility of personal injury or property damage, turn off electrical power, and depressurize system before installation, inspection, or removal of switch unit.

### Position/Mounting

All switch units and sensing bulbs may be mounted in any position. Two mounting slots are provided on the switch body for 5/16 screws spaced on 3 5/32 [80.17] centers.

### Direct Mount

The direct mount (local) temperature transducer is provided with a 1/2 inch NPT connection. When installing, do not use switch unit as a lever for tightening. Use wrenching flats provided at base of transducer for tightening.

### Capillary and Bulb

The capillary and bulb (remote) temperature transducers are provided with a 6 foot capillary and 3/8 inch diameter sensing bulb.

**▲ CAUTION:** Do not bend capillary at sharp angles. For proper operation, be sure sensing bulb is completely immersed in fluid and not in contact with heating element

or anything that would directly affect the temperature of the fluid being sensed.

### Thermal Well (Optional Feature)

A thermal well may be used for capillary and bulb (remote) or direct mount (local) temperature Transducers. The thermal well affords protection for the sensing bulb and allows removal of the sensing bulb while maintaining a pressure-tight vessel. When installing sensing bulb in thermal well, be sure that it is fully inserted. Where a thermal well already exists, jam nuts may be obtained to adapt the capillary and bulb to the existing thermal well. The existing thermal well must be for a 3/8 diameter sensing bulb.

### Union Connector (Optional Feature)

A union connector will allow direct mounting of the sensing bulb in the fluid being controlled. Install union into piping connection before tightening union onto bulb. For maximum performance, the bulb should be inserted in the union connection so that the end of the sensing bulb is even with the end of the union connector nut. Do not apply excessive torque when tightening union connector nut.

For catalog numbers of various optional features  
to facilitate mounting of sensing bulb, consult ASCO

Catalog No. 506.

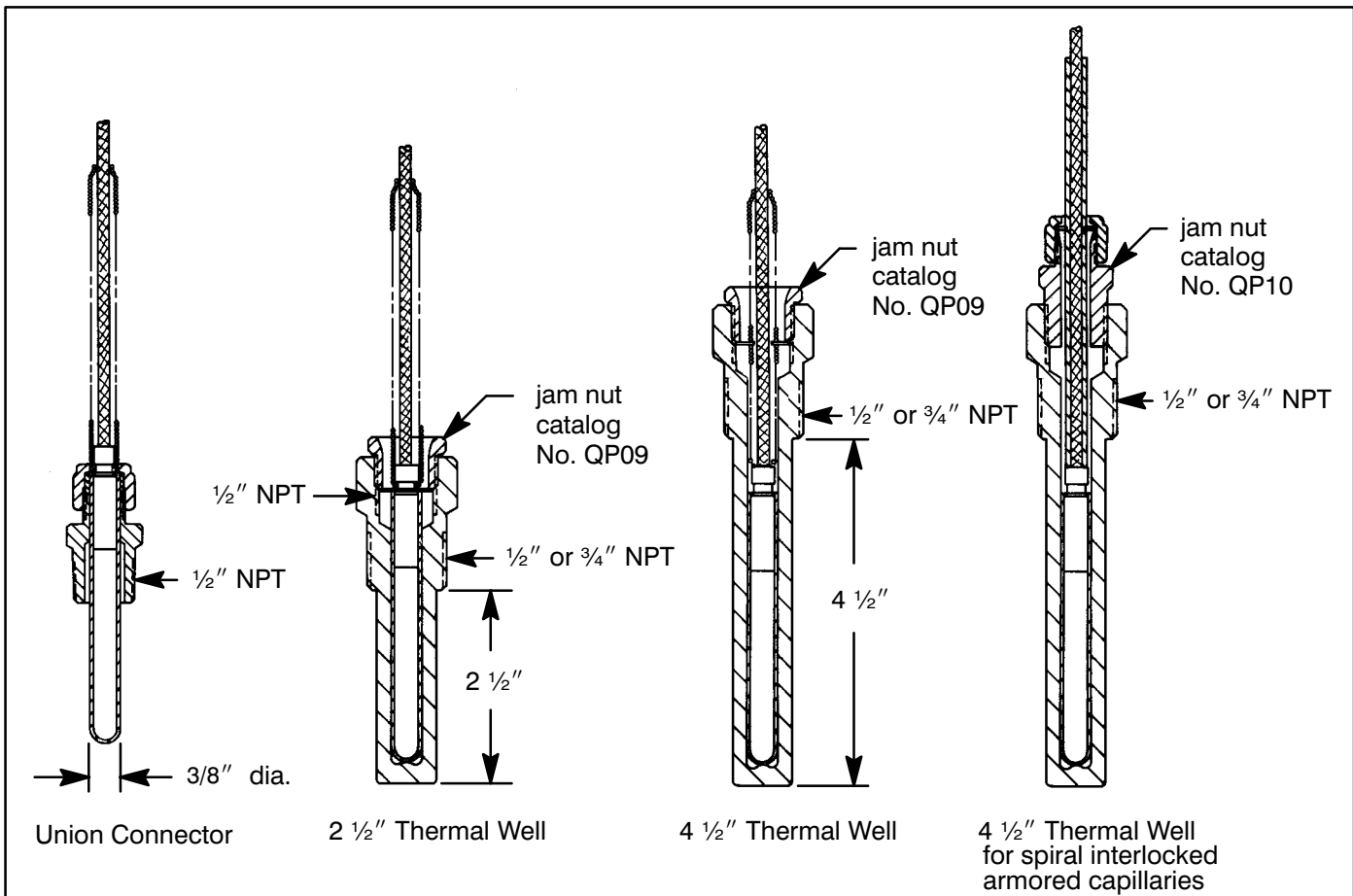


Figure 1 Union connector and thermal wells (optional features).

# Installation & Maintenance Instructions

**ASCO® TRIPPOINT® SWITCH UNIT**

**FIXED DEADBAND SWITCH UNIT WITH GENERAL PURPOSE  
WATERTIGHT, OR EXPLOSIONPROOF SWITCH ENCLOSURE**

**SB-SERIES**

Form No.V5735R2

## DESCRIPTION

The SB-Series Fixed Deadband Switch Units are used with transducer units to make Tripoint Pressure Switches or Temperature Switches. The switch units are made of aluminum alloy designed for rugged industrial use. The switch units have a general purpose, watertight, or explosionproof enclosure. All wiring terminals, adjustments, and visual scales are accessible from the front of the switch.

The switch may be supplied as a complete unit or with the switch unit and transducer completely assembled. The components may be separate units to be assembled upon installation. The actuation (set) point is adjustable over the full range of the switch. The reactivation (reset) point is fixed relative to the actuation point and cannot be adjusted. The switch assembly can be mated with a wide selection of pressure or temperature transducers to cover a broad range of pressures, fluids or temperatures. The switch will control electrical circuits in response to changes in pressure or temperature.

**IMPORTANT:** These instructions cover the installation and use of this switch on pressure and temperature transducers. Select the paragraphs that apply to your particular installation and application. The word *signal* is used in place of pressure or temperature changes.

## INSTALLATION

Check the nameplate for the correct catalog number, pressure range, temperature range, media, and proof pressure or rated overrange temperature. Never apply incompatible fluids or exceed the pressure or temperature rating of the switch. Installation and inspection to be performed by qualified personnel.

Nameplates are located on cover and on the bottom of the transducer. Check to be sure the third digit in each number is the same. If not, the unit should not be used. (Refer to Figure 3).

**IMPORTANT:** All internal adjustments have been made at the factory. Any adjustment, alteration or repair to the internal parts of the switch other than stated herein voids all warranties. The signal setting adjustments required are made by the adjusting nut on the outside of the switch.

### Temperature Limitations

Ambient temperature limits are  $-4_F(-20_C)$  to  $140_F(60_C)$ . To determine fluid temperature limitations, see form No.V5778 for Pressure Transducer catalog numbers and construction materials, then refer to chart below.

TRANSDUCER CONSTRUCTION MATERIALS	RATINGS FLUID TEMPERATURE
Buna N or Neoprene	$-4_F(-20_C)$ to $179_F(82_C)$
VITON*	$-4_F(-20_C)$ to $250_F(121_C)$
316 Stainless Steel	$-50_F(-45_C)$ to $300_F(149_C)$

For steam service, the fluid temperature with a pigtail (siphon tube or condensate loop) installed directly into the transducer will be below  $179_F(82_C)$ .

## Assembly of Switch and Transducer Units

**IMPORTANT:** The switch unit and transducer unit may be provided as a complete assembly or as separate units. If separate units are provided refer to Form No. V5778 for a complete listing of switch unit and transducer unit combinations. Form No.V5778 is provided to ensure that the proper switch unit is assembled to the proper transducer unit. Pay careful attention to exploded views provided in Figure 3 for assembly of switch unit and transducer unit. Proceed in the following manner:

**CAUTION:** The third digit in the catalog number on both the switch unit and transducer unit must be identical. If not, do not assemble to each other. If the same proceed.

1. Remove special instructions label and switch range scales from transducer unit.
2. For watertight and explosionproof construction place gasket on base of switch unit.
3. Place transducer unit on base of switch unit and assemble. Insert four bolts and torque bolts in a crisscross manner to  $80 \pm 10$  in-lbs [ $9.0 \pm 1.1$  Nm].
4. Remove backing paper from range scale and install scale on the switch body behind adjusting nut. The scale is slotted to fit over a raised boss on the body. See Figure 2.

### Positioning

Switch may be mounted in any position.

### Mounting

Figure 1 shows partial view of switch body for mounting dimensions.

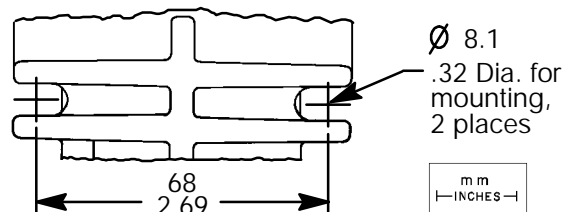


Figure 1. Mounting locations

### Piping/Tubing (Pressure Transducer)

Adequate support of piping and proper mounting of switch should be made to avoid excessive shock or vibration. To minimize the effect of vibration on a switch, mount perpendicular to vibration. Connect piping or tubing to switch at base of transducer. It is recommended that flexible tubing be used whenever possible. Apply pipe compound sparingly to male pipe threads only. If applied to female threads, it may enter the transducer and cause operational difficulty. Avoid pipe strain on switch by properly supporting and aligning piping. When tightening pipe, do not use switch as a lever. Wrenches applied to transducer body or piping are to be located as close as possible to connection point.

**IMPORTANT:** For steam service, install a condensate loop (pigtail or steam syphon tube) directly into the pressure transducer.

**CAUTION:** To avoid damage to the transducer body, DO NOT OVERTIGHTEN PIPE CONNECTIONS. If TEFLON\* tape, paste or similar lubricant is used, use extra care due to reduced friction.

**IMPORTANT:** To eliminate undesirable pressure fluctuations in the system, install a surge suppressor.

\*DuPont's Registered Trademark

## Wiring

Wiring must comply with local codes and the National Electrical Code. All switch enclosures are provided with two 3/4" NPT conduit hubs with one plugged when not in use. It is recommended that a flexible conduit connection be used. If rigid conduit is used, do not consider it or use it as a means of support (mounting). For general purpose and watertight construction, the switch cover is removed by loosening two screws then twisting slightly and lifting. For explosionproof construction, the cover unscrews. When explosion-proof cover is replaced, torque cover to 135 ± 10 in-lbs [10.7 ± 1.1 Nm]. Use No. 14 AWG copper wire rated for 60°C minimum. All switches have a grounding screw and clamp in the enclosure. For factory wired switch, black lead is common, red lead is normally open, blue lead is normally closed, and the green lead wire is a ground.

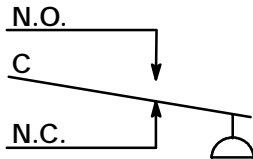
**IMPORTANT:** Electrical load must be within range stated on nameplate. Failure to stay within the electrical range of the switch rating may result in damage to or premature failure of electrical switch.

**CAUTION:** Do not exert excessive screw driver force on snap switch when making terminal connections. When connections are made, be sure there is no stress on the wire leads. Either condition may cause malfunction of switch.

ELECTRICAL RATINGS		
Switch Unit	Ratings for Limit Controls and Pressure Operated Switches	Ratings for Industrial Controls and Temperature Indicating and Regulating Equipment
Standard Switch Rating	5 Amps Res., 125/250 VAC 1/8 HP 125 VAC 1/4 HP 250 VAC 0.4 Amp Res., 125 VDC	15 Amps Res., 125 VAC 10 Amps Res., 250 VAC 1/4 HP 125 VAC 1/2 HP 250 VAC 1/2 Amp Res., 125 VDC 1/4 Amp Res., 250 VDC
Option K Switch Rating	5 Amps Res., 125/250 VAC 1/8 HP 125 VAC 1/4 HP 250 VAC 1/2 Amp Res., 125 VDC 1/4 Amp Res., 250 VDC	5 Amps Res., 125/250 VAC 1/8 HP 125 VAC 1/4 HP 250 VAC 1/2 Amp Res., 125 VDC 1/4 Amp Res., 250 VDC

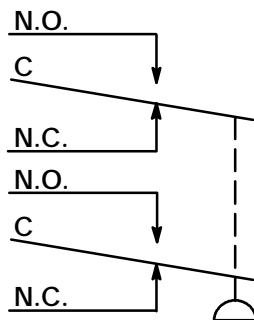
## Schematics

SPDT



Standard Switch

DPDT



Suffix K Switch

## INSTALLATION OF TEMPERATURE TRANSDUCERS

### Direct Probe

The direct probe (local) temperature transducer is provided with 1/2" NPT connection. When installing, do not use switch unit as a lever for tightening. Use wrenching flats provided at base of transducer for tightening.

### Capillary and Bulb

The capillary and bulb (remote) temperature transducers are provided with a length of capillary and a 3/8" diameter sensing bulb.

**CAUTION:** Do not bend capillary at sharp angles. For proper operation, be sure sensing bulb is completely immersed in fluid and not in contact with heating element or anything that would directly affect the temperature of the fluid being sensed.

### Thermal Well (Optional Feature)

A thermal well may be used for capillary and bulb (remote) or direct probe (local) temperature transducers. The thermal well affords protection for the sensing bulb and allows removal of the sensing bulb while maintaining a pressure tight vessel. When installing sensing bulb in thermal well, be sure that it is fully inserted. Where a thermal well already exists, jam nuts may be obtained to adapt the capillary and bulb to the existing thermal well. The existing thermal well must be for a 3/8" diameter sensing bulb.

### Union Connector (Optional Feature)

A union connector will allow direct mounting of the sensing bulb in the fluid being controlled. Install union into piping connection before tightening union onto bulb. For maximum performance, the bulb should be inserted in the union connection so that the end of the sensing bulb is even with the end of the union connector nut. Do not apply excessive torque when tightening union connector nut.

### Adjustment (Signal Setting) of Fixed Deadband Switch

To make adjustments, (signal setting) a 7/16" wrench and a pressure or temperature gage (within suitable range) are required. If electrical connection (to line of final application) of the switch is not desirable, a battery powered test lamp or ohm meter may be used. Pressure or temperature range scales should be used for initial signal setting. These will be accurate within 5%. Loosen lock ring and turn adjusting nut until red line is even with the desired range. For exact signal setting, proceed as follows:

**WARNING:** To prevent the possibility of personal injury or property damage, turn off electrical power when making permanent electrical connections to switch.

### Adjustment (Signal Setting) of Normally Closed or Normally Open Switch, Increasing Signal (Refer to Figure 2)

1. If the switch is in the line of final application when adjustment (signal setting) is made, be sure switch can be test operated without affecting other equipment.
2. Loosen lock ring on adjustment nut and turn signal adjustment nut full down using a 7/16" wrench.

**CAUTION:** Adjusting nut will turn easily until it hits a stop. Do not over torque; over torquing may cause internal damage resulting in malfunction.

3. Remove switch cover to gain access to snap switch. See section on *Wiring* for cover removal.
4. Follow the steps in the chart below to make signal setting:

Adjustment	NORMALLY CLOSED		NORMALLY OPEN	
	Switch Terminal	Test Lamp On-Off	Switch Terminal	Test Lamp On-Off
1. Starting with zero signal, connect test lamp to common.	NC	On (Closed Circuit)	NO	Off (Open Circuit)
2. Apply desired actuation signal. Then back off adjusting nut until switch actuates.	NC	Off (Open Circuit)	NO	On (Closed Circuit)
3. Lower signal to check reactuation	NC	On (Closed Circuit)	NO	Off (Open Circuit)

5. Cycle between actuation and reactuation signal and make minor adjustment to adjusting nut as required to achieve the exact signal setting.
6. After setting has been made, make permanent electrical connections.



## Adjustment (Signal Setting) of Normally Closed or Normally Open Switch, *Decreasing Signal* (Refer to Figure 2)

1. If the switch is in the line of final application when adjustment (signal setting) is made, be sure switch can be test operated without affecting other equipment.
2. Loosen lock ring on adjustment nut and turn signal adjustment nut full upwards using a 7/16 I wrench.

**⚠ CAUTION:** Adjustment nut will turn easily until it hits a stop. Do not over torque; over torquing may cause internal damage resulting in malfunction.

3. Remove switch cover to gain access to snap switch. See section on *Wiring* for cover removal.
4. Follow steps in chart below to make signal setting.

Adjustment Procedures	NORMALLY CLOSED		NORMALLY OPEN	
	Switch Terminal	Test Lamp On-Off	Switch Terminal	Test Lamp On-Off
1. Starting with initial signal above desired actuation setting, connect test lamp to common.	NC	Off (Open Circuit)	NO	On (Closed Circuit)
2. Decrease signal to desired actuation. Then advance adjusting nut until switch actuates.	NC	On (Closed Circuit)	NO	Off (Open Circuit)
3. Increase signal to check reactuation.	NC	Off	NO	On (Closed Circuit)

5. Cycle between actuation and reactuation signal and make minor adjustment to adjusting nut as required to achieve the exact signal setting.
6. After settings have been made, tighten lock ring and make permanent electrical connections.

## Testing of Installation

If the adjustment of the switch has been made outside of the line of final application, the switch should be retested when installed in the line of final application. Follow adjustment instructions. Be sure switch can be test operated without affecting other equipment.

## MAINTENANCE

**⚠ WARNING:** To prevent the possibility of personal injury or property damage, turn off electrical power and depressurize switch unit before inspection or removal.

**IMPORTANT:** Switch is not field repairable. The switch must be returned to the factory (Automatic Switch Company, Florham Park, New Jersey) or serviced only by an authorized factory representative. Address all service inquiries to Automatic Switch Company, 50-60 Hanover road, Florham Park, New Jersey 07932, Valve Service Department. The only maintenance which may be performed on the fixed deadband switch is changing the setting of the adjusting nut and replacement of the transducer unit. Replacement of transducer should be done only if external leakage is evident.

## Preventive Maintenance

- S While in service, operate the switch (cycle between desired signals) at least once a month to insure proper operation. If necessary, electrical wiring and pipe connection should be made so that switch can be test operated without affecting other equipment.
- S Periodic inspection of the switch, external surfaces only, should be carried out. Switch should be kept clean and free from paint, foreign matter, corrosion, icing, and freezing conditions.
- S Keep the medium entering the transducer as free as possible from dirt and foreign material.

## Causes of Improper Operation

Switch will not actuate or actuates and reactuates undesirable.

- S **Incorrect Electrical Connection:** Check leads to switch. Be sure they are properly connected. Switch is marked *NO* for Normally Open, *NC* for Normally Closed and *C* for Common.
- S **Faulty Control Circuit:** Check electrical power supply to switch. Check for loose or blown fuses, open-circuited or grounded wires, loose connections at terminal block or switch. See nameplate for electrical rating and range.
- S **Incorrect Pressure:** Check pressure in system with suitable pressure gauge. Pressure must be within range specified on nameplate.
- S **Incorrect Adjustment:** Check adjustment nut for proper setting. Refer to adjustment instructions.
- S **External Leakage:** Check to see that bolts (4) holding transducer to pressure switch are properly torqued to  $80 \pm 10$  in-lbs [ $9.0 \pm 1.1$  Nm]. If bolts are tight and leakage is still evident, replace transducer. Refer to paragraph on *Assembly of Switch Unit and Transducer Unit*.
- S **Excessive Vibration or Surges Causing Switch to Actuate and Reactuate:** Check for fluctuations in system and install pressure surge suppressor. Check switch mounting and be sure there is no excessive vibration.
- S **Incorrect Temperature:** Check temperature in system with suitable thermometer. Temperature must be within range specified on nameplate. Check location of capillary and bulb for incorrect mounting. Refer to paragraphs on *Installation Of Temperature Transducers*.

If the operation of the fixed deadband switch cannot be corrected by the above means, the entire switch unit should be replaced or an authorized factory representative consulted.

## Color Code Identification

When the switch cover is removed, the switch unit may be identified by the color of the sealant used on the locknuts of the snap switch. The color of the sealant will correspond directly to the third digit of the switch catalog number.

Third Digit In Catalog Number	Sealant Color Used On Snap Switch Locknuts
1	Yellow
2	Green
3	Red
4	Blue

Example: If the sealant color on the snap switch was red, this would mean that the third digit in the pressure switch catalog number would be 3, possibly SB 0D. It would not be, for example: SB 0D, SB 0D, or SB 0D.

### FOR SERVICE REPLACEMENT, OR NEW TRANSDUCER

Consult Factory, or Authorized Factory Representative or Distributors

### ORDERING INFORMATION

For Fixed Deadband Switch or New Transducer  
When Ordering, Specify Catalog Numbers, Fluid, Pressure Range, Temperature Range, Serial Numbers, and Proof Pressure or Rated Overrange Temperature.

**NAMEPLATES ARE LOCATED ON SWITCH COVER AND BOTTOM OF TRANSDUCER.**

Enlarged Isometric View Showing  
Adjusting Nut And Lock Ring

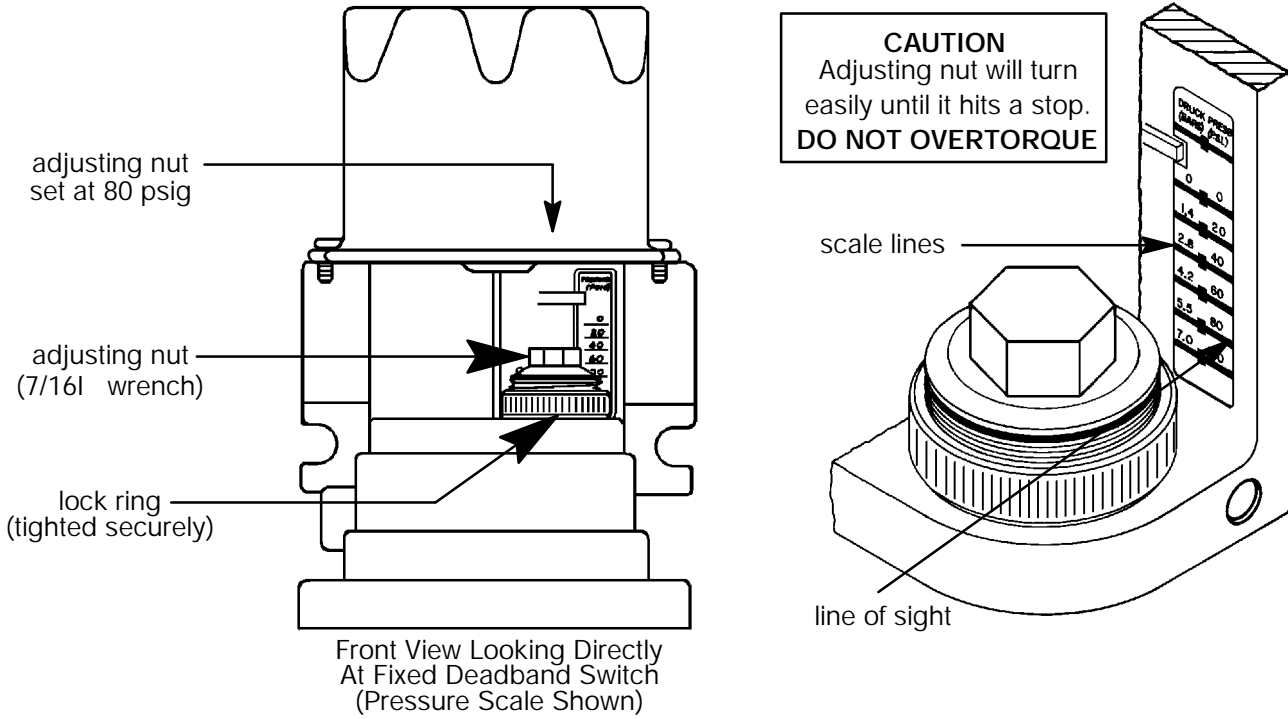


Figure 2. Adjustment (Signal Setting) of Fixed Deadband Switch.

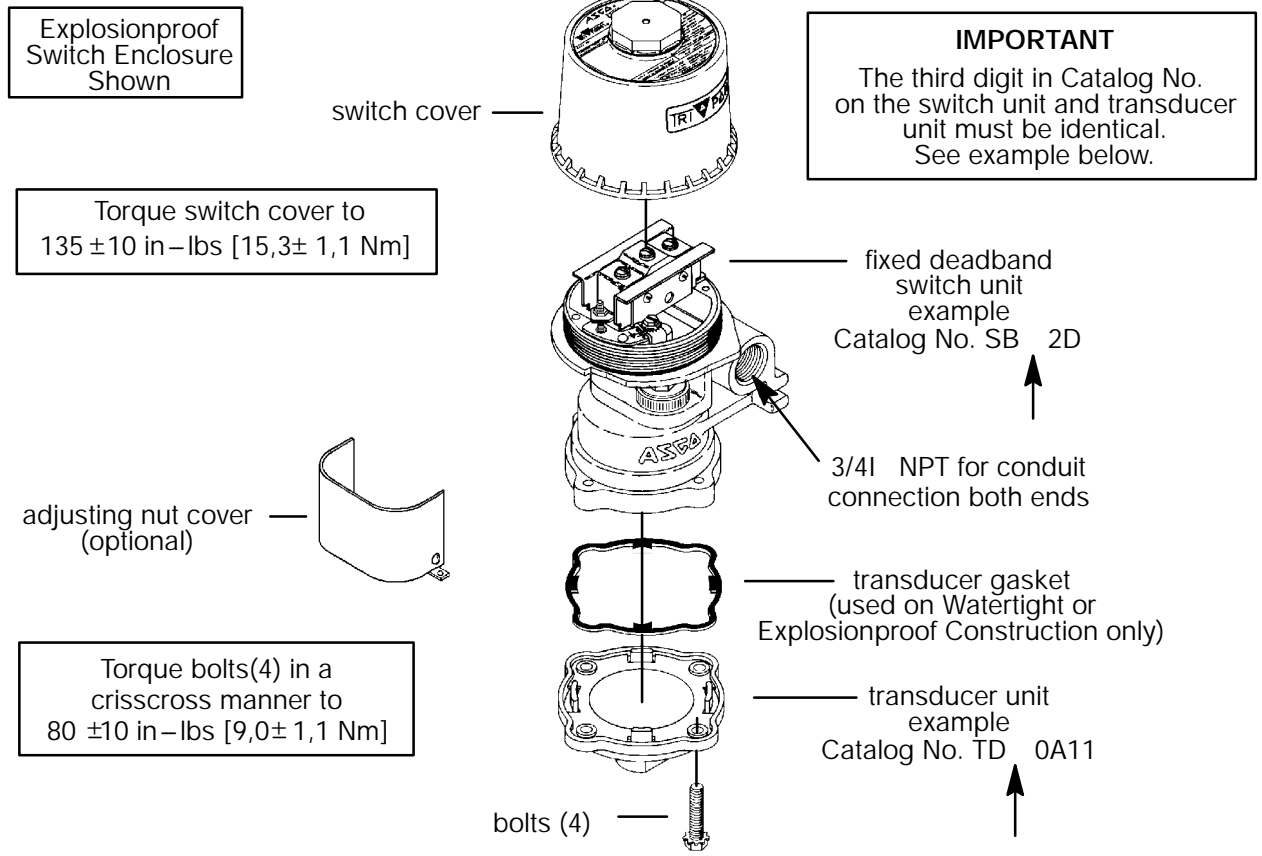


Figure 3. Switch Unit and Transducer Unit to be Assembled.

## GENERAL DIRECTIONS

### M A G N A T R O L     V A L V E S

#### Type F-18 & F-33 "A" (G)

INSTALLATION - Proper operating position of valve is with solenoid vertically on top in horizontal pipe. Flow must follow arrow on body. Apply pipe dope sparingly on male pipe threads. Support piping to avoid strains on valve. Water valves must never be subjected to freezing weather.

WIRING - Install suitable threaded conduit on conduit outlet in solenoid cup. To change angle of conduit tapping loosen the six lock screws in lower part of cup, turn cup to desired direction and tighten the lock screws well again. Single pole controls must always be wired into hot leg of line.

MAINTENANCE - The supplying circuit must be disconnected before opening valve, and remain disconnected until valve is completely assembled again.

To reach the moving parts, unscrew the bonnet ring with flat wrench. Do not disturb the six lock screws in cup.

If leakage through valve develops examine valve disc and renew if worn. Caution! Do not distort piston holding it in vise. To remove pilot valve, insert a scriber or similar pointed tool in slot provided in top of piston and pry off clamping spring. Replace clamping spring in groove when reassembling. The magnet plunger and inside of bonnet tube should be wiped clean of sediment if an A. C. hum develops.

To uncover coil, remove the six lock screws in cup. To reassemble, bonnet is fastened to valve with hexagon bonnet ring; coil rests on base with leads up; and coil binder washer positions on top of coil with prongs up. One type of coil has a separate washer on top. Pull up on all six lock screws.

## GENERAL DIRECTIONS

# MAGNATROL VALVES

TYPE F41-44 "A", "G", "S", "L", —AC—

**INSTRUCTION**—Proper operating position of valve is with solenoid vertically on top in horizontal pipe. Flow must follow arrow on body. **Apply pipe dope sparingly on valve threads.** Support piping to avoid strains on valve. Water valves must never be subjected to freezing weather.

**WIRING**—Install suitable threaded conduit outlet in solenoid housing. Single pole controls must always be wired into hot leg of line.

**MAINTENANCE**—The supplying circuit must be disconnected before opening valve, and remain disconnected until valve is completely assembled again.

To reach the moving parts, remove the lower flange bolts, then use screw driver between valve and solenoid to loosen it. Lift solenoid off vertically to avoid bending the internal parts. Do not disturb the four covers bolts on top of solenoid.

If leakage through valve develops, examine valve disc and renew if worn. **Caution! Do not distort piston holding it in vise.** To remove pilot Valve, insert a scriber or smaller pointed tool in slot provided in top of piston and pry off clamping spring. Replace clamping spring in recess when reassembling.

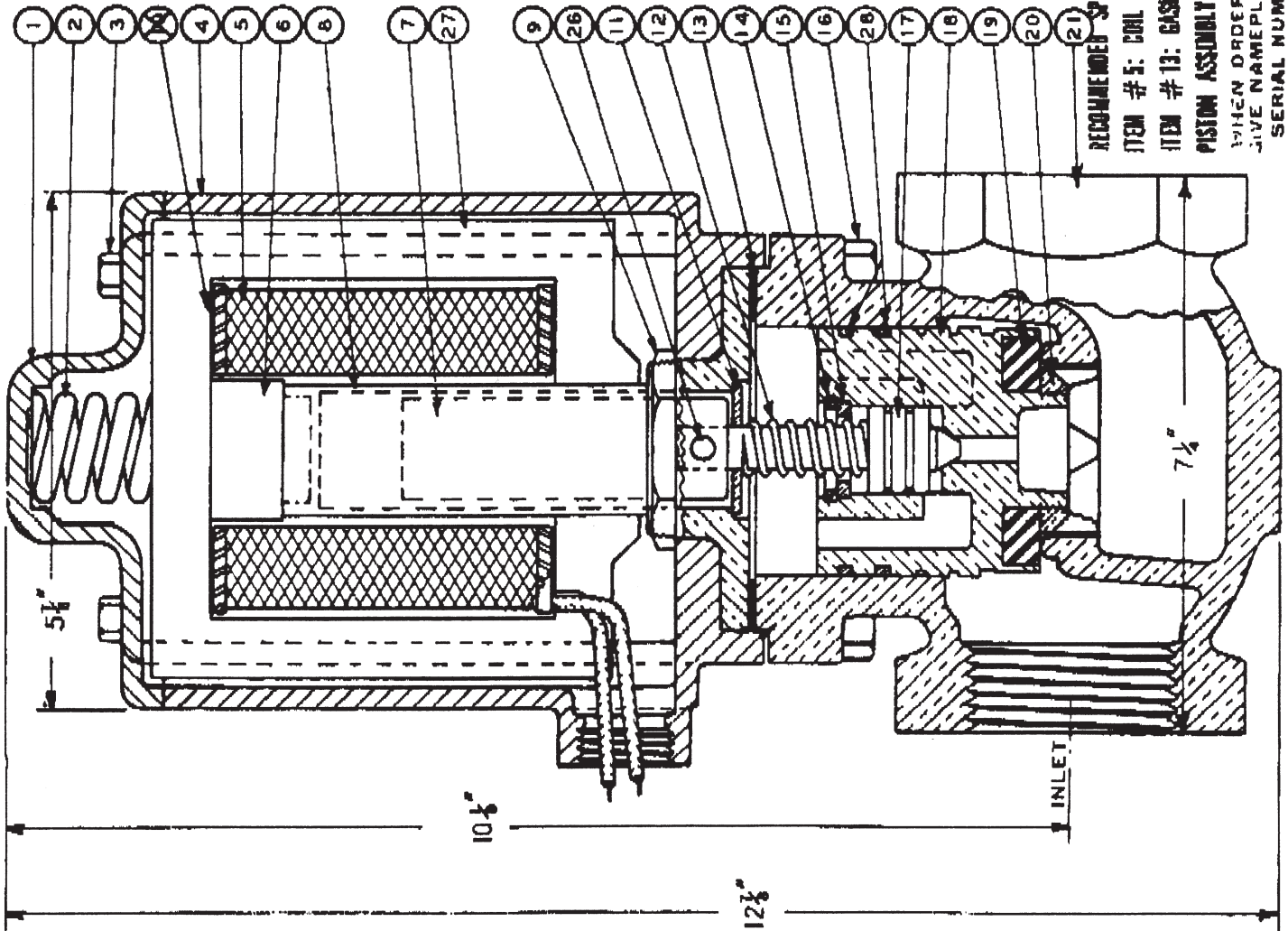
The magnet plunger and inside of bonnet tube should be wiped clean of sediment if an A.C. hum develops. Tighten flange bolts evenly when reassembling the solenoid housing on valve body.

To reach magnet coil, remove the four cover bolts. These bolts must be loosened each a few turns at a time, to decrease the spring load evenly. Likewise the bolts must be tightened gradually when remounting cover on solenoid.

### RECOMMENDED SPARE PARTS:

COIL  
GASKET  
PISTON ASSEMBLY

FOR FACTORY REPAIRS, OR TO OBTAIN PARTS  
 WRITE TO MAGNATROL VALVE CORP.  
 100 WEST 42ND STREET, NEW YORK 36, N.Y.



PART NO.	ITEM NO.	DESCRIPTION	LIST PRICE	PCS
	1	COVER		1
	2	COVER SPRING		1
	3	COVER BOLTS, SET		4
	4	SOLENOID HOUSING		1
	5	COIL, <b>120-60 (HI-TEMP)</b>		1
	6	STOP		1
	7	+ PLUNGER		1
	8	BONNET		1
	9	BONNET RING		1
	11	+ SPRING DISC		1
	12	+ VALVE SPRING		1
	13	GASKET		1
	14	+ CLAMPING SPRING		1
	15	+ STOP COLLAR		1
	16	FLANGE BOLTS, SET		6
	17	+ PILOT VALVE		1
	18	+ PISTON		1
	19	+ VALVE DISC		1
	20	+ DISC NUT		1
	21	VALVE BODY		1
	22	NAME PLATE & SCREWS		1-2
	26	+ STEM PIN		1
	27	FRAME		1
	28	+ PISTON RINGS, SET		2
		+ PISTON ASSEMBLY COMPLETE		

MAGNATROL VALVE CORP.  
 HAWTHORNE, NEW JERSEY

DWG. NO. E2-2066

B-15-55

MAGNETIC VALVE TYPE 143-A58 AC

2 1/2" IPS

300 PSI

RECOMMENDED SPARE PARTS:

ITEM # 5: COIL

ITEM # 13: GASKET

PISTON ASSEMBLY COMPLETE

WHEN ORDERING RENEWAL PARTS  
 GIVE NAMEPLATE DATA, INCLUDING  
 SERIAL NUMBER, OF THE VALVE.

CERTIFIED BY: \_\_\_\_\_



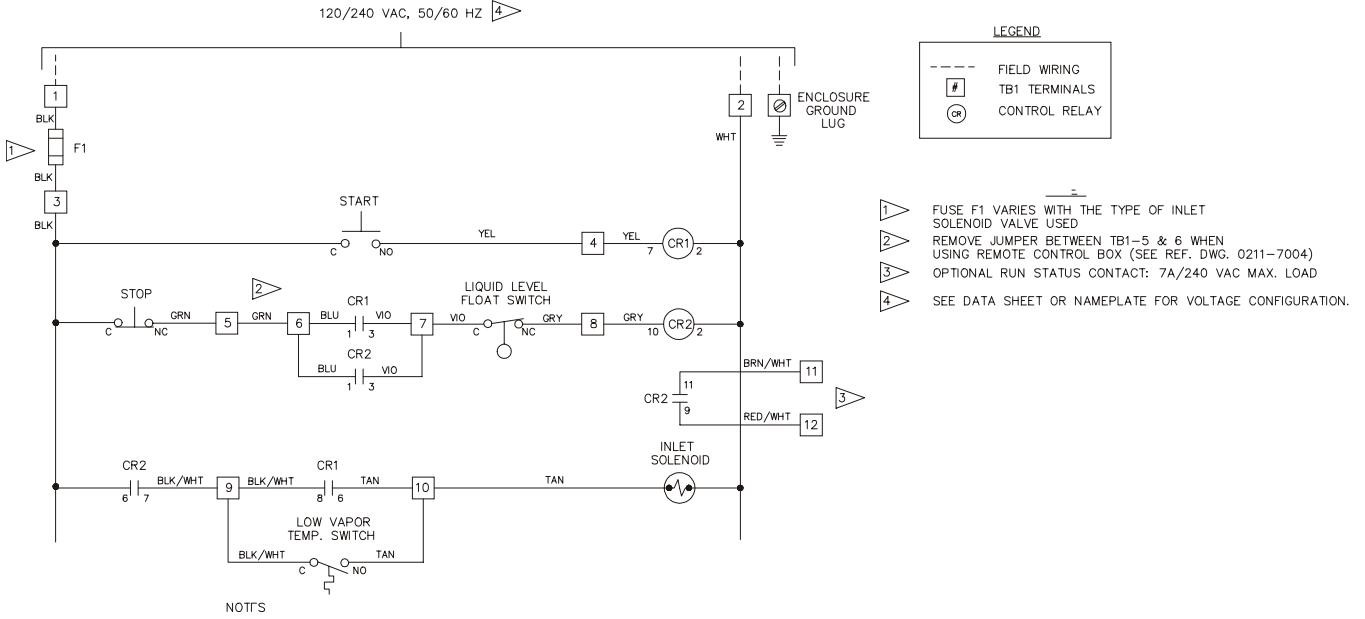
# ***APPENDIX B***

***TECHNICAL INFORMATION***

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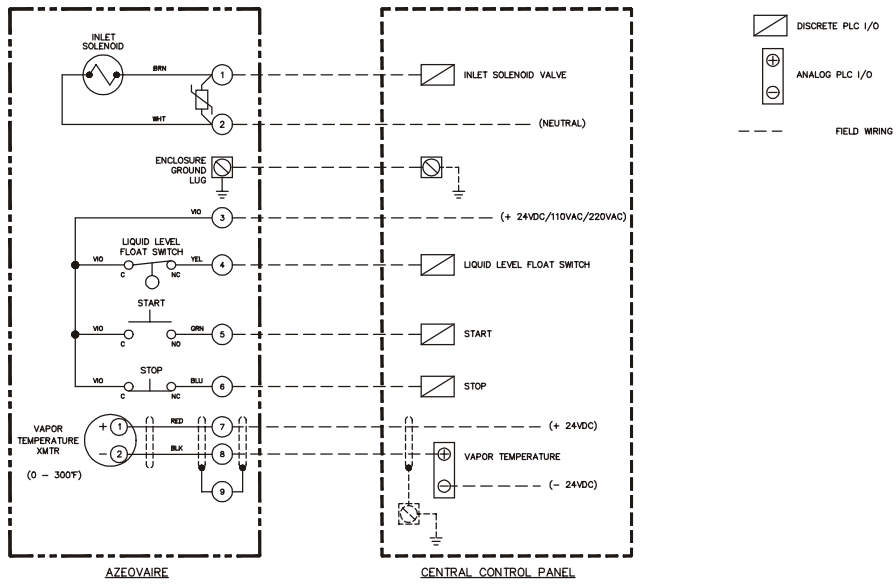


**Figure 6 -- Azeovaire electrical drawing**



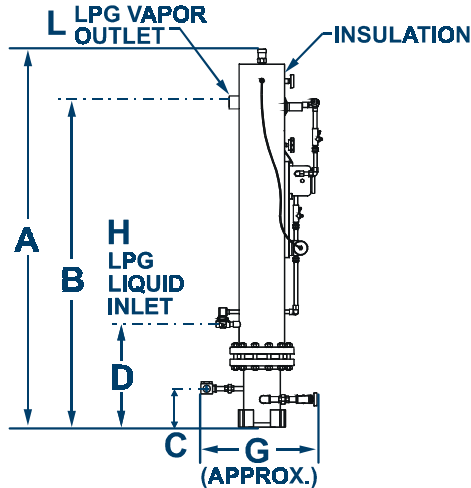
AzeoElect.wmf

**Figure 7 – Azeovaire electrical drawing for remote operation**

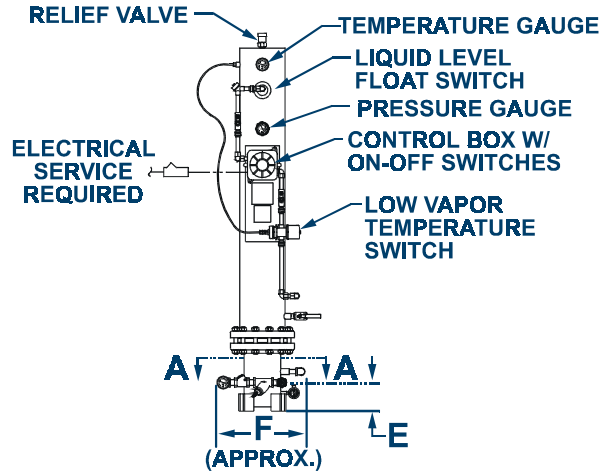


AzeoRemote.wmf

Figure 8 – Steam Azeovaire dimension info

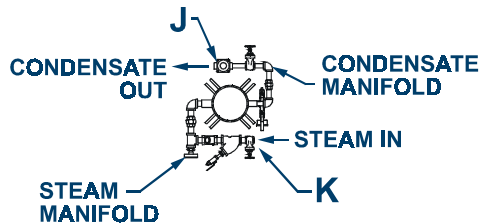


**LEFT SIDE VIEW**

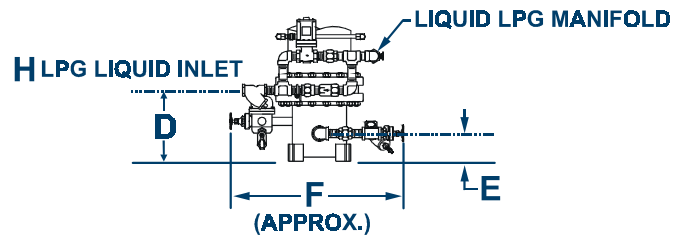


**FRONT VIEW**

(MODELS A160S THROUGH A1120S)



**LOWER SECTIONAL VIEW**



**LEFT SIDE VIEW**

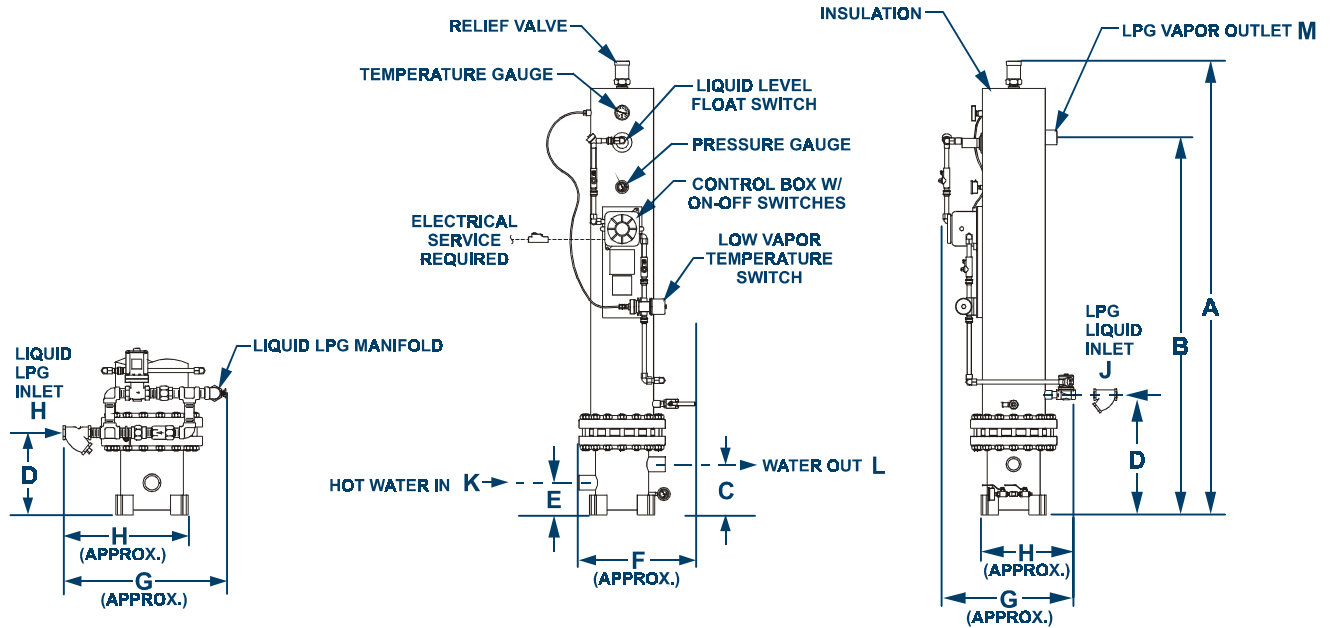
(MODELS A1650S THROUGH A4400S)

FILE: AZSPEC1C.DWG

MODEL	A	B	C	D	E	F	G	H	J	K	L
<b>A160S</b>	88" 2235 mm	75 3/4" 1924 mm	9 1/4" 235 mm	23 3/4" 603 mm	6 1/2" 165 mm	18 1/2" 470 mm	25 1/2" 648 mm	3/4" FNPT	3/4" FNPT	3/4" FNPT	1" FNPT
<b>A320S</b>	88" 2235 mm	75 3/4" 1924 mm	9 1/4" 235 mm	23 3/4" 603 mm	6 1/2" 165 mm	18 1/2" 470 mm	25 1/2" 648 mm	3/4" FNPT	3/4" FNPT	3/4" FNPT	2" FNPT
<b>A480S</b>	88 1/2" 2248 mm	76" 1930 mm	9 1/4" 235 mm	24" 610 mm	6 1/2" 165 mm	21" 533 mm	27" 685 mm	3/4" FNPT	3/4" FNPT	1" FNPT	2" FNPT
<b>A640S</b>	88 1/2" 2248 mm	76" 1930 mm	9 1/4" 235 mm	24" 610 mm	6 1/2" 165 mm	21" 533 mm	27" 685 mm	3/4" FNPT	3/4" FNPT	1" FNPT	2" FNPT
<b>A800S</b>	88 1/2" 2248 mm	76" 1930 mm	9 1/4" 235 mm	24" 610 mm	6 1/2" 165 mm	21" 533 mm	27" 685 mm	1" FNPT	1" FNPT	1 1/2" FNPT	2" FNPT
<b>A960S</b>	92" 2337 mm	76 3/8" 1940 mm	9 3/8" 238 mm	24 1/4" 616 mm	6 1/2" 165 mm	27" 686 mm	36 1/2" 927 mm	1" FNPT	1" FNPT	1 1/2" FNPT	2" FNPT
<b>A1120S</b>	92" 2337 mm	76 3/8" 1940 mm	9 3/8" 238 mm	24 1/4" 616 mm	6 1/2" 165 mm	27" 686 mm	36 1/2" 927 mm	1" FNPT	1" FNPT	1 1/2" FNPT	2" FNPT
<b>A1650S</b>	93 1/4" 2369 mm	76 3/8" 1940 mm	9 3/8" 238 mm	16 1/2" 419 mm	6 1/2" 165 mm	30" 762 mm	38 1/2" 978 mm	1 1/2" FNPT	1 1/2" FNPT	1 1/2" FNPT	2" FNPT
<b>A2200S</b>	101 3/4" 2584 mm	76 3/8" 1940 mm	9 3/4" 248 mm	16 1/2" 419 mm	6 1/2" 165 mm	33 1/2" 851 mm	42 1/2" 1080 mm	1 1/2" FNPT	1 1/2" FNPT	1 1/2" FNPT	2 1/2" FNPT
<b>A3300S</b>	103 1/2" 2662 mm	76 5/8" 1940 mm	9 11/16" 246 mm	16 1/2" 419 mm	6 1/2" 165 mm	38 1/2" 978 mm	42" 1092 mm	2" FNPT	1 1/2" FNPT	2" FNPT	3" 300# FLG
<b>A4400S</b>	105 1/2" 2680 mm	76 5/8" 1940 mm	9 11/16" 246 mm	16 1/2" 419 mm	6 1/2" 165 mm	41 1/2" 1054 mm	50" 1270 mm	2" FNPT	1 1/2" FNPT	2 1/2" FNPT	4" 300# FLG

**For Models A5500S and larger: Please request a dimensional drawing from ASDI Engineering Department.**

**Figure 9 – Hot Water Azeovaire dimension info**



**FRONT VIEW (MODELS A1650W THROUGH A4400W)**

**FRONT VIEW (MODELS A160W THROUGH A1120W)**

**RIGHT SIDE VIEW**

AZWSPEC18.DWG

MODEL	A	B	C	D	E	F	G	H	J	K	L	M
<b>A160W</b>	88" 2235 mm	75 3/4" 1924 mm	10 1/4" 260 mm	23 3/4" 603 mm	6 1/2" 165 mm	20" 508 mm	23" 584 mm	14 1/2" 368 mm	3/4" FNPT	2" FNPT	2" FNPT	1" FNPT
<b>A320W</b>	88" 2235 mm	75 3/4" 1924 mm	10 1/4" 260 mm	23 3/4" 603 mm	6 1/2" 165 mm	20" 508 mm	23" 584 mm	14 1/2" 368 mm	3/4" FNPT	2" FNPT	2" FNPT	2" FNPT
<b>A480W</b>	88 1/2" 2248 mm	76" 1930 mm	10 1/4" 260 mm	24" 610 mm	6 1/2" 165 mm	21 1/2" 546 mm	25" 635 mm	16 1/2" 419 mm	3/4" FNPT	2" FNPT	2" FNPT	2" FNPT
<b>A640W</b>	88 1/2" 2248 mm	76" 1930 mm	10 1/4" 260 mm	24" 610 mm	6 1/2" 165 mm	21 1/2" 546 mm	25" 635 mm	16 1/2" 419 mm	3/4" FNPT	2" FNPT	2" FNPT	2" FNPT
<b>A800W</b>	88 1/2" 2248 mm	76" 1930 mm	10 1/4" 260 mm	24" 610 mm	6 1/2" 165 mm	21 1/2" 546 mm	25 1/2" 648 mm	17" 432 mm	1" FNPT	2" FNPT	2" FNPT	2" FNPT
<b>A960W</b>	92" 2337 mm	76 1/2" 1943 mm	10 1/4" 260 mm	24 1/4" 616 mm	6 1/2" 165 mm	23 1/2" 597 mm	27 1/2" 698 mm	19" 483 mm	1" FNPT	2" FNPT	2" FNPT	2" FNPT
<b>A1120W</b>	92" 2337 mm	76 1/2" 1943 mm	10 1/4" 260 mm	24 1/4" 616 mm	6 1/2" 165 mm	23 1/2" 597 mm	27 1/2" 698 mm	19" 483 mm	1" FNPT	2" FNPT	2" FNPT	2" FNPT
<b>A1650W</b>	93 1/4" 2369 mm	76 1/2" 1943 mm	10 9/16" 268 mm	16 1/2" 419 mm	6 1/2" 165 mm	32 1/2" 826 mm	33" 838 mm	25 1/2" 648 mm	1 1/2" FNPT	2" FNPT	2" FNPT	2" FNPT
<b>A2200W</b>	109 1/4" 2775 mm	84" 2134 mm	13 7/8" 352 mm	24" 610 mm	9" 228 mm	38 3/4" 984 mm	33" 838 mm	26" 660	1 1/2" FNPT	3" 150# FLG	3" 150# FLG	2 1/2" FNPT
<b>A3300W</b>	111" 2819 mm	84 1/4" 2140 mm	14 1/4" 362 mm	24" 610 mm	9" 228 mm	40" 1016 mm	37" 940 mm	27" 686 mm	2" FNPT	4" 150# FLG	4" 150# FLG	3" 300# FLG
<b>A4400W</b>	113 1/4" 2877 mm	85 1/4" 2165 mm	14 1/4" 362 mm	24 1/4" 362 mm	9" 228 mm	40 3/4" 1035 mm	37" 940 mm	28" 711 mm	2" FNPT	4" 150# FLG	4" 150# FLG	4" 300# FLG

**For Models A5500W and larger: Please request a dimensional drawing from ASDI Engineering Department**



