ASSE LEC #2010-2020
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ASSE International

Listing Evaluation Criteria for
Proportional Flow Control Devices, with Protection from Cross Contamination via Hydronic Water, for use in Drinking Water Installations

Endurance Test Hydronic (T2) from 140 F to 180 F
Draft C4 (2July2020)

General Information

No product may be said to be ASSE listed unless the manufacturer has applied to ASSE International, has had its product tested according to the applicable standards or listing evaluation criteria (LEC), and when the product has passed the test, it may display the ASSE Seal on the product.

Instructions for receiving the authorization to display the seal are available from the ASSE International office. Organizations wishing to adopt or list to any ASSE standard or LEC should print the ASSE number on the cover page first and in equal or larger type to that of the adopting or listing organization.

ASSE International
Mokena, Illinois

Foreword

This foreword shall not be considered a part of the listing evaluation criteria (LEC); however, it is offered to provide background information.

ASSE standards and LECs are developed in the interest of consumer safety.

ASSE International considers LEC's to be of great value in the development of improved plumbing systems.

The working group that developed this LEC was set up within the framework of the Product Standards Committee of ASSE International.

These devices are commonly found in European hydronic systems. This LEC seeks to import the requirements surrounding the product and add the appropriate US and Canadian code needs. This LEC adapts translated requirements from DVGW VP 201 Testing Specification for Flow-rate control devices with double diaphragm and safety valve and ASSE 1012 for low hazard backflow protection.

Typically these product are installed as a part of an integrated system to balance flow into both sides of a double-wall heat exchanger. One side increases the cold water supply temperature to supply domestic hot water, the other side receives hydronic hot water that is cooled to supply the hydronic loop. The device controls the flow of water of both the cold water supply and the hydronic loop based on the temperature and flow requirements of the hydronic loop. This helps minimize dead legs in the hot water distribution system to supply fittings.

Recognition is made of the time volunteered by members of the working group and of the support of the manufacturers who also participated in meetings for this LEC.

This LEC does not imply ASSE's endorsement of a product which conforms to these requirements. Compliance with this LEC does not imply acceptance by any code body.

It is recommended that these devices be installed consistent with local codes by qualified and trained professionals. It is recommended that these devices be maintained and serviced per the manufacturer's recommendation, filters are replaced at regular intervals per the manufacturer's instructions.

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1. General

1.1 Application

The purpose of the device is to control the flow of potable water based on the pressure of hydronic water from a hydronic system. The device performs this hydraulically and has integral cross contamination protection between the potable and hydronic water. This device is typically installed in conjunction with a heat exchanger and a part of a hydronic system loop.

1.2 Scope

1.2.1 Description

This device consists of a single potable cold water supply inlet and outlet, and a single hydronic supply inlet and outlet, a means of dynamic flow control, an atmospheric vent, and two sets of three dynamic seals between the potable and hydronic flow paths.

1.2.2 Connections

Pipe threads and other connections shall conform to local plumbing and mechanical codes.

1.2.3 Size Range

Inlet and outlet sizes are ¾" ISO 228.

1.2.4 Flow Range

The maximum rated flow rate on the potable flow path shall be 9.0 GPM (34 L/min).
The maximum rated flow rate on the hydronic flow path shall be 9.0 GPM (34 L/min).

1.2.5 Temperature Range

The maximum operating temperature for the device is 195 °F (90 °C).

1.2.6 Pressure Range

The maximum static pressure, on the potable and hydronic flow paths, is 180 psi (1241 kPa.)

1.3 Reference Documents

Referenced industry standards shall be to the revision stated below.

- DVGW VP 201, Testing Specification for Flow-rate control devices with double diaphragm and safety valve

- ASSE 1012-2009, Backflow Preventers with Intermediate Atmospheric Vent
- ASTM B258-18, Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors
- CSA B64.3-11 (R2016), Dual Check Valve Backflow Preventers with Atmospheric Port (DCAP)
- NSF 372-2016, Drinking Water System Components – Lead Content
- NSF 61-2019, Drinking Water System Components – Health Effects
- UL 969-2017, Marking and Labeling Systems

2. Test Specimens and Test Laboratory

2.1 Samples Submitted

Sample plan shall be in accordance with the testing laboratory or certification body.

When prepared samples are required, the manufacturer shall be responsible to correctly prepare and identify each sample for each test for the test laboratory.

2.2 Samples Tested

Tests shall be performed in the order listed in this standard on one sample of each model submitted.

When the lab is unable to foul the device, the listee may submit fouled samples for sections 3.5, 3.6 and 3.7 to the lab. The listee shall supply a sample of the wire used to foul the device and a written description explaining how the device will be fouled. Wire specifications shall be provided to the lab, (ie. gauge, material). The listee shall allow the lab to cut open the supplied samples for verification.

2.3 Documentation

Assembly drawings, installation instructions and other data which are needed to enable a testing agency to determine compliance with this standard shall accompany sample devices when submitted for examination and performance tests under this LEC.

2.4 Rejection

Failure of one sample shall result in a rejection of that type, model, and size.

3. Performance Requirements and Compliance Testing

3.1 Tightness Test

3.1.1 Purpose

The potable and hydronic water side of the device must be pressure-tight when a pressure of 232 psi (1600 KPa) is applied for 60 seconds.

3.1.2 Procedure

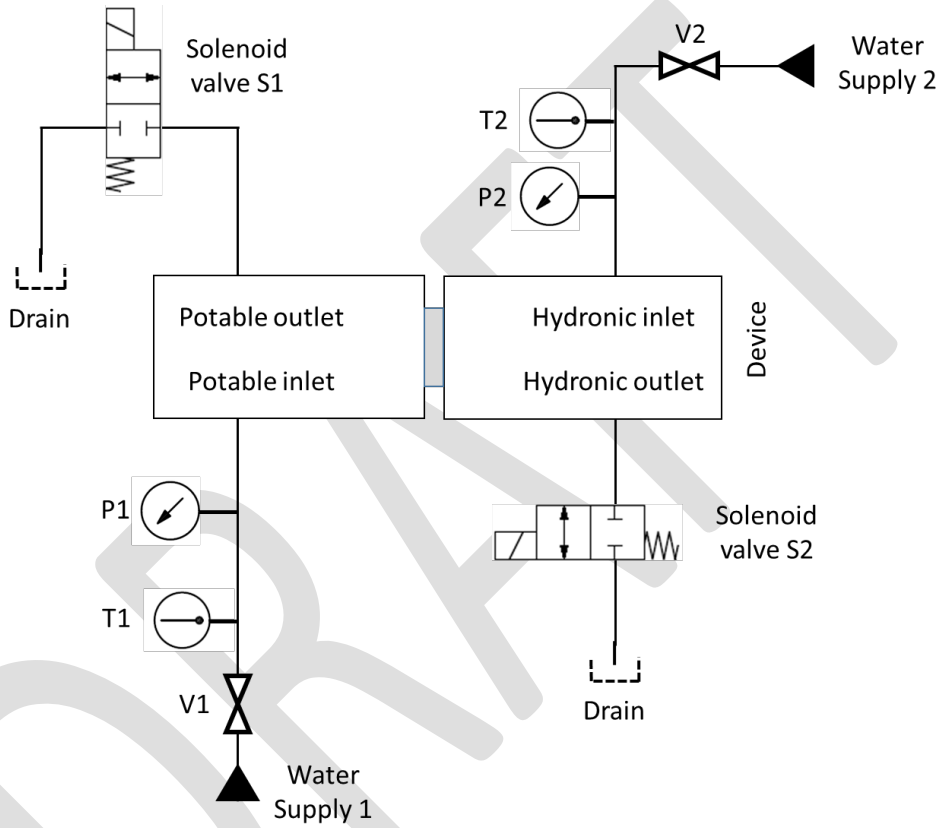

Figure 1

a. Install the sample device per Figure 1. Maintain the inlet temperature at T1 to max. 86 ± 3.5 °F (max. 30 ± 2 °C), and at T2 to 149 ± 3.5 °F (65 ± 2 °C)
b. Open valves V1 and solenoid S1 to drain to vent all air from the potable water line. Close solenoid S1.
c. Apply a pressure of 232 psi ± 14.5 psi (1600 KPa ± 100 KPa) for 60 seconds at P1.
d. Open valves V2 and solenoid valve S2 to vent all air from the hydronic water line. Close solenoid valve S2.
e. Apply a pressure of 232 psi ± 14.5 psi (1600 KPa ± 100 KPa) for 60 seconds at P2.

3.1.3 Criteria

Any leakage, cracking, or permanent deformation shall result in a rejection of the device.

3.2 Hydrostatic Pressure Test

3.2.1 Purpose

The device must not show any leakage, cracking, or permanent deformation when a pressure of 363 psi (2500 KPa), or two times the manufacturer's rated pressure, whichever is greater, is applied for a period of 10 minutes.

3.2.2 Procedure

a. Install the sample device per Figure 1. Maintain the inlet temperatures at T1 and T2 to max. 86 ± 3.5 °F (30 ± 2 °C)
b. Open solenoid S1 to drain to vent all air from the potable water line. Close solenoid S1.
c. Apply a pressure of 363 psi ± 14.5 psi (2500 KPa ± 100 KPa), or two times the manufacturer's rated pressure, whichever is greater, for a period of 10 minutes at P1.
d. Open valve V2 and solenoid valve S2 to vent all air from the hydronic water line. Close solenoid valve S2.
e. Apply a pressure of 363 psi ± 14.5 psi (2500 KPa ± 100 KPa) , or two times the manufacturer's rated pressure, whichever is greater, for a period of 10 minutes at P2.

3.2.3 Criteria

Any leakage, cracking, or permanent deformation shall result in a rejection of the device.

3.3 Suitability for Use

3.3.1 Purpose

The purpose of this test is to illustrate the proportional relationship of the device with respect to pressure loss and flow rate. The device shall be tested at each flow rate as specified in Table 1 to ensure the corresponding pressure loss does not exceed the maximum limit for its respective flow rate. This section ensures the suitability for use without failure of the seals at elevated flow rates and pressure losses and the applicability of the device for its intended purpose.

3.3.2 Procedure

1. Install the sample device per Figure 2. Flow water to purge all air from the device.
2. Begin recording the pressure loss of the potable side at P2 and the hydronic side at P4 for each specified flow rate, on the potable side at F1 and the hydronic side at F2, as outlined in Table 1.

Table 1 – Pressure and Flow on potable and hydronic portions of device

Potable side		Hydronic side	
Flow Rate (GPM)	Maximum Allowable Pressure Loss at Rated (psi)	Flow Rate (GPM)	Maximum Allowable Pressure Loss at Rated (psi)
1.0	0.400	1.0	0.20
2.0	1.20	2.0	0.50
3.0	2.30	3.0	0.90
4.0	3.80	4.0	1.5

5.0	5.80	5.0	2.3
6.0	8.20	6.0	3.2
7.0	11.1	7.0	4.3
8.0	14.4	8.0	5.5
9.0	18.0	9.0	6.8

3.3.3 Criteria

The device shall obtain pressure losses for each respective flow rate equal to or below the specified values in Table 1.

3.4 Endurance Test

3.4.1 Purpose

Purpose is to validate the ability of the device to withstand minimum of 10 years being in service (corresponds 50 taps/day for 10 years) while activating the safety valve without damage.

3.4.2 Procedure

1. Install the device per Figure 2. Open V1 of potable water side and V2, V3 of hydronic loop and flow water to purge all air from the device. Continuously record the flow rates, pressures, and temperatures. Close V4 for operation.
2. Set and maintain the temperatures at T1 to 59±9°F (15±5°C) and T2 to 180±9°F (82±5°C).
3. Set and maintain the dynamic pressures at P1 to 43.5 psi ± 1.45 psi (300 KPa ± 10 KPa) and P2 to 36.3 psi ± 1.45 psi (250 KPa ± 10 KPa).
4. Open solenoid S1 for 5 ± 1 seconds, and close solenoid S1 for 5 ± 1 seconds representing one cycle. Repeat for 182,500 cycles.
5. Repeat section 3.1.

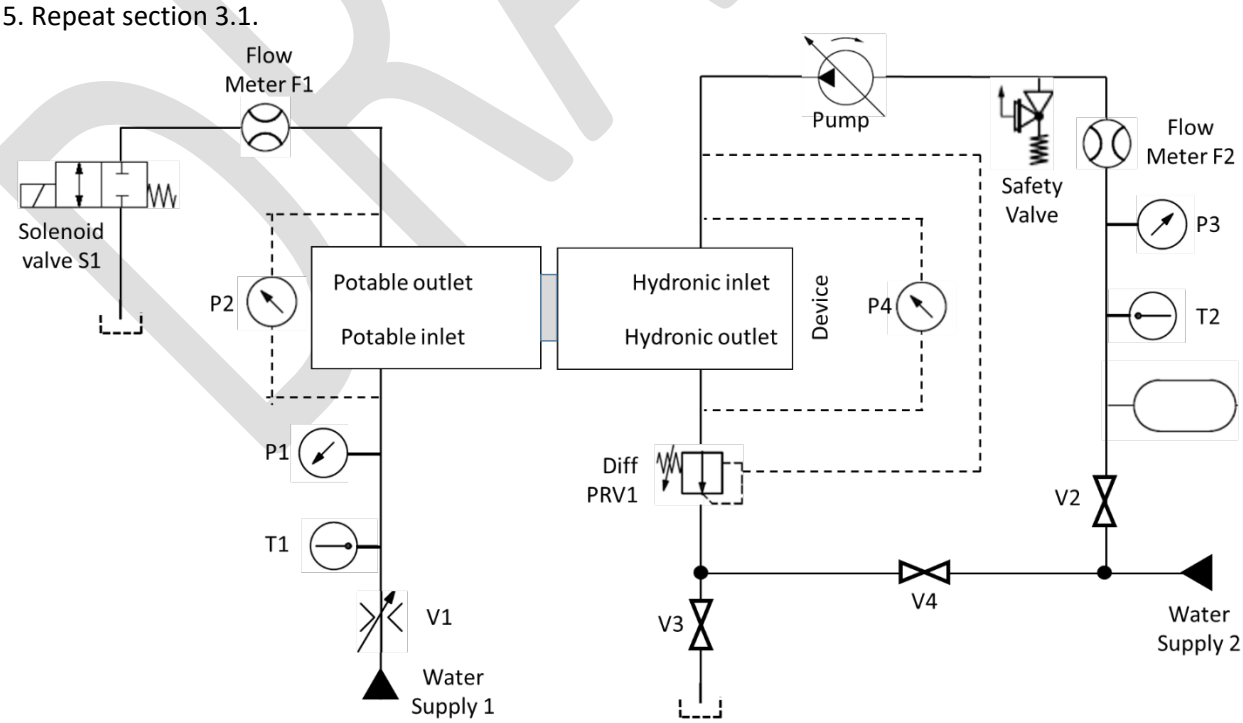

Figure 2 – Endurance Test Setup

3.4.3 Criteria

No leakage at any time shall appear from the device.

3.5 Backsiphonage - Vacuum with Air

3.5.1 Purpose

The purpose of this test is to determine if backsiphonage will occur from the hydronic piping into the potable line when all seals have failed, a vacuum is created on the potable line of the device, and the hydronic pressure is at atmospheric. An additional pre-prepared sample may be submitted for this test.

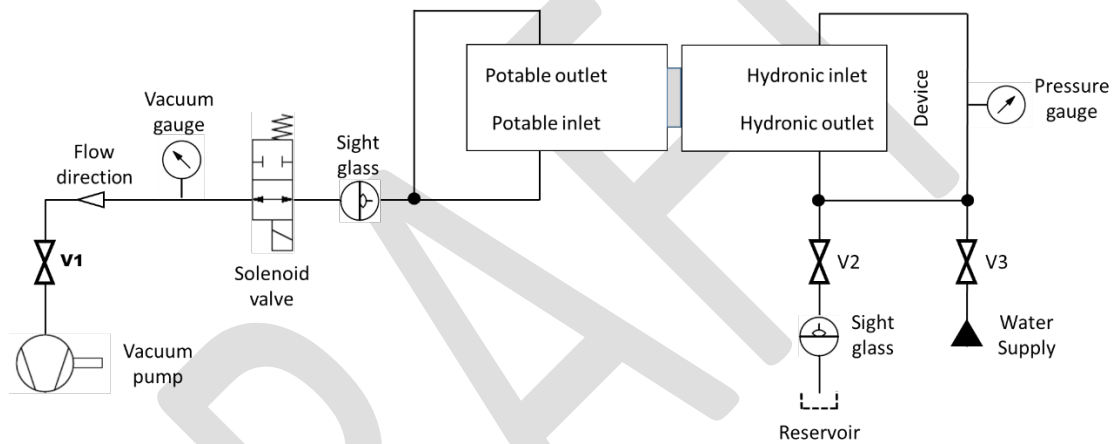

Figure 3 – Backsiphonage Test Setup

3.5.2 Procedure

a. Foul the sealing members between the atmospheric vent and the potable waterline with an appropriately sized fouling wire as shown in Table 2.
b. Remove the sealing members between the vent and the hydronic water lines.
c. Install the sample device per Figure 3.
d. Open V1 and apply and hold a vacuum of 25.0 in-Hg (635 mm-Hg, 85 kPa) at the inlet for not less than 1 minute. Open V2, V3 and fill the hydronic part with water, close V3.
e. Slowly raise the vacuum from 0 to 25.0 in-Hg (0 to 635 mm-Hg, 85 kPa) and then slowly reduce it from 25.0 to 0 in-Hg (635 to 0 mm-Hg, 85 to 0 kPa), then close V1.
f. By means of the solenoid valve, create a surge effect by quickly opening and closing the valve. During this test the vacuum shall drop from 25.0 to 0 in-Hg (635 to 0 mm-Hg, 85 to 0 kPa).

Table 2 – Fouling wire sizes

Nominal Pipe Size		Fouling Wire Diameter (nominal size)		
NPS	DN	in	mm	AWG
¼	8	(0.0320)	(0.813)	20
3/8	10	(0.0320)	(0.813)	20
½	15	(0.0320)	(0.813)	20

¾	20	(0.0403)	(1.024)	18

Wire material shall be of sufficient hardness so as to not noticeably change in cross-sectional area after undergoing a test. Recommended materials are copper alloys, 300-series stainless steels, and low carbon steels. Wire size shall conform to ASTM B258.

3.5.3 Criteria

Any rise in the water level of the sight glass shall result in a rejection of the device. The sight glass shall be 1.0 inch (25.4 mm) minimum diameter. In any test in which there is an upward bowing of the meniscus of the water in sight glass, the crown of the meniscus shall not exceed a rise of 1/8 inch (3.2 mm) above the level of the water in the reservoir or basin.

Following completion of the test, the sample shall be inspected to confirm the required fouling of the seals was implemented. Destruction of the sample may be required to allow for this inspection.

3.6 Backsiphonage - Pressurized with Water

3.6.1 Purpose

The purpose of this test is to determine that backsiphonage from the hydronic piping into the potable piping shall not occur if one set of seals become fouled, a vacuum is created at the potable piping, and there is a positive pressure on the hydronic piping. Additional pre-prepared samples may be submitted for this test.

3.6.2 Procedure

a. Foul the seals between the potable water inlet and the atmospheric vent with an appropriate size fouling wire as shown in Table 2.
b. Install the sample device per Figure 3. Close valve V2 and open valve V3.
c. Use colored water in the pressurized line connected to the hydronic side of the device.
d. Tests shall be conducted in the sequence described in section 3.5.
e. Run the test with a backpressure of 15.0 psi ± 0.5 psi (103.4 KPa ± 3.5), and again with a backpressure of 50.0 psi ± 1.5 psi (344.8 KPa ± 10.3).
f. Replace the seals that were fouled. Foul the three seals between the hydronic water outlet and the atmospheric vent with an appropriate size fouling wire as shown in Table 1.
g. Repeat steps d and e with the hydronic piping seals fouled as above and remove the fouling wire from the potable piping seals.

3.6.3 Criteria

Any backsiphonage of water from the downstream piping into the supply line shall result in a rejection of the device. Any indication of flow of colored water into the inlet piping shall result in a rejection of the device.

Following completion of the test, the sample shall be inspected to confirm the required fouling of the seals was implemented. Destruction of the sample may be required to allow for this inspection.

3.7 Backflow through the Potable Piping Seals

3.7.1 Purpose

The purpose of this test is to determine if water can flow back into the water supply system when the vent port outlet is sealed closed, the hydronic piping seals are removed, and the maximum rated working pressure is applied to the hydronic piping side of the device. An additional pre-prepared sample may be submitted for this test.

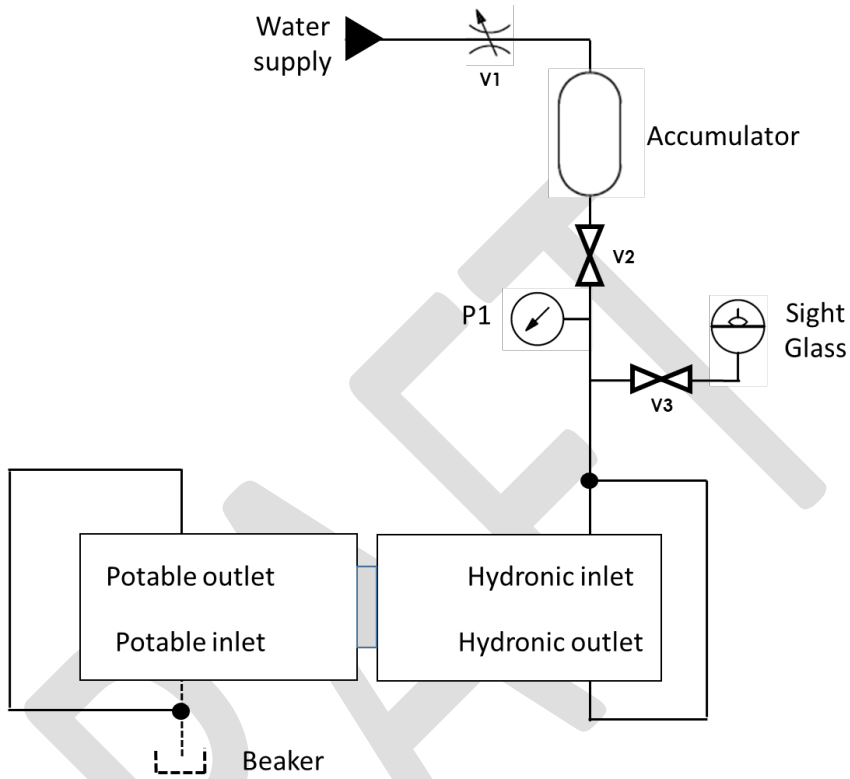

Figure 4 - Backflow through the potable piping seals test setup

3.7.2 Procedure

a. Remove the hydronic piping seals. Seal the vent outlets closed.
b. Install the sample device per Figure 4, open V1, V2, V3 with the reservoir filled with colored water.
c. Gradually raise the pressure at the outlet of the reservoir until the pressure equals 6.0 inch (152.4 mm) water column. Hold for 5 minutes. Close V1 for operation.
d. Observe for the appearance of colored water into the potable side of the device.
e. Repeat with a pressure of 15.0 psi ± 0.5 psi (103.4 KPa ± 3.5) and then with a pressure equal to the manufacturer's maximum rated working pressure of the device.

3.7.3 Criteria

Any cross contamination of water into the potable piping side of the device during the testing shall result in a rejection of the device.

Following completion of the test, the sample shall be inspected to confirm the hydronic piping seals were removed. Destruction of the sample may be required to allow for this inspection.

4. Detailed Requirements

4.1 Materials

Devices covered by this standard shall comply with the applicable requirements of NSF 61.

Solder and fluxes in contact with potable water shall not exceed, by mass, 0.2% lead content. Metal alloys in contact with potable water shall not exceed 8% lead content.

Fittings and devices intended to convey or dispense water for human consumption through drinking or cooking shall not contain a weighted average lead content in excess of 0.25% when evaluated in accordance with the test method specified in NSF 372.

4.2 Installation and Maintenance Instructions

Instructions for installing, adjusting, and maintaining the device shall be included with each device.

The installation instructions for the device shall include the following information:

a. Inlet and outlet connection sizes.
b. Manufacturer's maximum working pressure.
c. Manufacturer's stated minimum and maximum flow rate.
d. Recommended maintenance schedule and instructions

The instructions shall indicate that the device shall be accessible for replacement and repair.

4.3 Identification and Markings

Each device shall have the following information marked on the label or cast, etched, or otherwise permanently marked:

a. Name of manufacturer or trademark.
b. Information identifying the manufacturing date
c. Flow direction
d. Pressure ratings for each flow path
e. Model number.

Labels shall comply with UL 969 for permanence.

5. Definitions

Definitions not located in this section are located in the Plumbing Dictionary, Sixth Edition, published by ASSE.

AWG – American Wire Gauge