Summary of Substantive Changes
between the 2004 and the 2020 edition of
ASSE 1020 "Pressure Vacuum Breaker Assemblies"

Presented to the IAPMO Standards Review Committee on May 18, 2020

General: The changes to this standard may have an impact on currently listed products. The significant changes are:

- Revised the requirements for working pressure and temperature (see Sections 1.2.3, and 1.2.4)
- Added types of connections including compression, soldered, push fit, and press fit (see Section 1.3.5)
- Revised the sample requirements to be in accordance with the testing lab or certification body guidelines (see Section 2.0)
- Revised the pressure drop test procedure and added Figure 4 (see Section 3.3.2, and Figure 4)
- Revised the drip tightness of check valve test procedure and added Figure 5 (see Section 3.5, and Figure 5)
- Revised the life cycle test and removed the field testing option referenced in ASSE 5000 (see Section 3.10)
- Added a requirement for compliance with NSF 372 for materials in contact with potable water (see Section 4.1.1)
- Added dezincification resistance requirement (see Section 4.1.9)
- Included an allowance for markings to be applied as a permanent label in accordance with UL 969 and removed securely attached plates (see Section 4.2)
- Revised the installation instructions to be in accordance with the manufacturer's instructions and the authority having jurisdiction (AHJ) (see Section 4.3)

Section 1.2, Scope: Moved the classification types of vacuum breakers to a note in the front matter (Page iii) of the standard as follows:

Page iii: ASSE Vacuum Breaker Standards

ASSE Standard Number	Standard Name	Typical Use	Highlights
1001	Atmospheric Type Vacuum Breakers	• Faucet with hose thread spout • Water closet fill valve	Prevents Backsiphonage: • Outlet is open to atmosphere • Not subjected to backpressure • Not be subjected to more than twelve (12) hours of continuous water pressure
1011	Hose Connection Vacuum Breakers	• Hose connections, such as hose bib, wall hydrant, yard hydrant	• Prevents backflow by use of a SINGLE CHECK valve • Prevents backsiphonage by use of AIR PORTS • Prevents backpressure by use of check valve and relief of backpressure through air ports. i.e. relieves pressure in the hose. • Non-removable and non-testable
1020	Pressure Vacuum Breakers	• Irrigation systems • Industrial processes	Prevents Backsiphonage: • Uses a SINGLE CHECK • Not subjected to backpressure • Can be subjected to continuous water pressure in excess of twelve (12) hours
1052	Hose Connection Backflow Preventers	• Hose connections, such as hose bib, wall hydrant, yard hydrant	Same as a 1011 device except there are two check valves. One check valve holds the pressure in the hose. The Intermediate chamber between check vales becomes atmospheric. Device is non-removable but is testable.
1056	Spill Resistant Vacuum Breakers	• Indoor plumbing assemblies • Medical equipment	Same as 1020 but does not spill water when pressurized.

1.2.1 Description
The assembly shall contain an independently acting check valve force loaded to the closed position, and an independently acting air inlet valve located downstream of the check valve that is force loaded to the open position. The assembly shall also include two tightly closing shutoffs, one at the inlet of the assembly and one at the outlet of the assembly, and two tightly closing test cocks, one immediately upstream and one immediately downstream of the check valve.
~~*Vacuum breakers, other than air gaps, shall be classified into three general types:*~~
~~*a. Atmospheric Type (See ASSE Standard #1001);*~~
~~*b. Pressure Type (ASSE #1020, as described in this standard); and*~~
~~*c. Back Siphonage (See ASSE Standard #1056).*~~

Section 1.2.3, Static Pressure Range: Revised the requirements for working pressure and temperature as follows:
1.2.3 ~~*Working*~~ *Static* ***Pressure Range***
The ~~*minimum*~~ *maximum rated* ~~*working*~~ *static pressure of the device shall not be less than 150.0 psi (1034.3 kPa).*
1.2.4 Temperature Range
a. The device shall be able to operate with cold water ~~*service shall range*~~ *ranging in temperature between 33.0 °F to 110.0 °F (0.6 °C to 43.3 °C).*
b. The device shall be able to operate with hot water ~~*service shall range*~~ *ranging in temperature between 33.0 °F to not less than 180.0 °F (0.6 °C to 82.2 °C).*

Section 1.3.3, Test Cocks: Added additional requirements for test cocks as follows:
1.3.3 Test Cocks
Test cocks shall be resilient seated, and as part of the device, shall meet all material specifications and hydrostatic requirements of this standard. Test cocks shall be replaceable or repairable.
Pipe size connections of test cocks shall not be smaller than the sizes indicated in Table 1. The test cock shall be full port, and internal diameters shall not be smaller than the nominal size of the test cock.

Section 1.3.4, Inspection and Repair: Changed the title of the section from Accessibility to Inspection and Repair as follows:
1.3.4 ~~*Accessibility*~~ *Inspection and Repair*
a. The check and air inlet valves shall be accessible for inspection, repairs or replacements.
b. All replaceable parts of the assemblies of the same size and model shall be interchangeable with the original parts.

Section 1.3.5, Connections: Added requirements for types of connections including compression, soldered, push fit, and press connections as follows:
1.3.5 Connections
Pipe threads and other connections shall conform to the applicable standards.
• Tapered pipe threads shall comply with ASME B1.20.1.
• Dry seal pipe threads shall comply with ASME B1.20.3.
• Compression assemblies shall comply with SAE J 512.
• Soldered connections shall comply with ASME B16.18 or ASME B16.22.
• Push fit connections shall comply with ASSE 1061.
• Press connections shall comply with ASME B16.51.

Section 1.4, Reference Documents: Reference standards were added, deleted, or updated as follows:

~~*Reference to industry standards shall mean the latest edition.*~~

Referenced industry standards shall be to the revision stated below.

- *ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch)*
- *ASME B1.20.3-1976 (R2013), Dryseal Pipe Threads (Inch)*
- *ASME B16.18-2018, Cast Copper Alloy Solder Joint Pressure Fittings*
- *ASME B16.22-2018, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings*
- *ASME B16.51-2018, Copper and Copper Alloy Press-Connect Pressure Fittings*
- *ASSE 1061-2015, Performance Requirements for Push-Fit Fittings*
- *ISO 6509-1:2014, Corrosion of Metals and Alloys – Determination of Dezincification Resistance of Copper Alloys with Zinc – Part 1: Test Method*
- *NSF 372-2016, Drinking Water System Components - Lead Content*
- *SAE J 512-1997, Automotive Tube Fittings*
- *UL 969-2017, Marking and Labeling Systems*
- *University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research, Manual of Cross-Connection Control, Tenth Edition*

Section 2.0, Test Specimens and Test Laboratory: Revised the sample requirements to be in accordance with the testing lab or certification body guidelines as follows:

~~***2.1 Samples Submitted***~~

~~*Three (3) assemblies of each size and model shall be submitted by the manufacturer. Tests shall be performed in the order listed on one (1) device of each size.*~~

~~***2.2 Samples Tested***~~

~~*The testing agency shall select one (1) of each size and model for full test.*~~

~~***2.3 Drawings***~~

~~*Assembly drawings and other data which are needed to enable a testing agency to determine compliance with this standard, together with installation drawings, shall accompany assemblies submitted for examination and performance test under this standard.*~~

~~***2.4 Rejection***~~

~~*Failure of one (1) device shall be cause for rejection of that size and model until the manufacturer has corrected the fault and submitted new assemblies for testing.*~~

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

Section 3.1, Hydrostatic Test of the Complete Device: Revised the test setup to be in accordance with the manufacturer's instructions as follows:

3.1 Hydrostatic Test of the Complete Device

3.1.2 Procedure

Install the device as shown in Figure ~~1~~2 per the manufacturer's instructions. Purge the system of air and pressurize to test pressure. Maintain the pressure for five (5) minutes. Observe the device for external leaks.

Section 3.2, Hydrostatic Test of the Check Valve: Revised the test setup to be in accordance with the manufacturer's instructions as follows:

3.2 Hydrostatic Test of the Check Valve

3.2.2 Procedure

Install the device as shown in Figure 2A or 2B. Connect the device inlet to a water supply and the #2 test cock to a source which will produce an adequate hydrostatic pressure. Purge the system of air. Install a sight glass (Figure 3), with a drain cock on test cock #1 and per the manufacturer's instructions. Close the #2 shut-off valve and then close the #1 shut-off valve. Open the drain cock under the sight glass and lower the water level in the sight glass to a height corresponding to the top of the device on test. Slowly raise the pressure on the downstream side of the check valve to the required test pressure, observing for indications of leakage or damage to the check valve. Maintain this pressure for five (5) minutes. The water level in the sight glass shall reach and maintain a steady level.

Section 3.3, Pressure Drop at Rated Flow: Revised the test procedure and performance requirements to capture the pressure drop at rated flow rate without any leakage detected as follows:

3.3 Pressure Drop at Rated Flow and Maximum Allowable Pressure Loss

3.3.2 Procedure

The test system (Figure 1) shall be equipped with means of measuring the rate of flow through the device and indicating or recording pressure loss. Pressure gauges shall be located in accordance with ANSI/ISA S75.02. The supply system shall be capable of supplying a volume of cold water to meet the maximum flow requirements of the device on test while sustaining a steady inlet pressure of not less than twenty-five per cent (25%) of the rated pressure of the device.

1. *Install the assembly per Figure 4.*
2. *Purge the air from the system and then open the throttling valve until the minimum required rate of flow per Table 2 for the size of the assembly is reached or the maximum allowable pressure loss is obtained and record the data observed.*
3. *Record the maximum pressure loss, Ptotal, and the corresponding flow rate, F.*
4. *Remove the assembly from the system. Connect the upstream and downstream pipe connections. Flow water at flow rate, F. Record the pressure loss between as Pcorr.*
5. *Subtract Pcorr from Ptotal to equal P in order to adjust for pressure loss in piping between the gauges and the device on test.*

3.3.3 Criteria

Pressure loss across the device greater than the maximum allowable pressure loss of 10.0 psi (69.0 psi) plus any adjustments as noted in section 3.3.2 prior to or at the rated flow shall result in a rejection of the device. See Table 2 for the minimum flow rates.

Any indication of leakage shall result in rejection of the device.

Section 3.4, Atmospheric Vent: Revised the test setup to be in accordance with the manufacturer's instructions as follows:

3.4 Air Inlet Valve Opening Pressure Test Atmospheric Vent

3.4.2 Procedure

With the device installed as shown in Figure 2A or Figure 2B, install a sight glass (Figure 3) in test cock #2 and per the manufacturer's instructions. Remove the air inlet valve protective canopy or other shielding means so as to expose the valve for observation. Open the test cock, in which the sight glass is installed, and pressurize the system to close the air inlet valve. Clear any accumulated water from around the well above the air inlet valve. Slowly drain water from the system until the air inlet valve starts to open. Record the water level in the sight glass. It should not be less than 28.0 inches (711.2 mm). Continue to drain water *from the test system until the pressure at the air inlet valve is atmospheric. The air inlet valve shall be fully open when the water drains from the body.*

Section 3.5, Drip Tightness of Check Valve Test: Revised the test purpose and procedure to ensure that the static pressure drop in the direction of flow across the check valve meets the minimum requirement as follows:

3.5 Drip Tightness of Check Valve Test

3.5.1 Purpose

The purpose of this test is to determine if the static pressure drop in the direction of flow across the check valve ~~prevents flow at~~ is a minimum of 1.0 psi (6.9 kPa).

3.5.2 Procedure

1. *Install the ~~device~~ assembly ~~as in Figure 1, with a sight glass (Figure 3) shut-off and drain cock assembly installed in the tee upstream of the inlet check valve~~ per Figure 5.*
2. *Close the shut-off cock to the sight glass.*
3. *Fully open both shut-off valves on the assembly. Open the throttling valve to atmosphere. Purge the device of air. Close the #1 shut-off valve.*
4. *~~and o~~Open the shut-off cock to the sight glass. ~~With the #2 shut-off valve and throttling valve open to atmosphere,p~~Pressurize the inlet of the device until ~~there is flow from the outlet of the valve filling~~ the sight glass is filled to a column ~~to~~ of at least 42.0 inches (1066.8 mm).*
5. *Close the ~~fitting or~~ supply valve tightly.*
6. *Open the #1 shut-off valve.*
7. *Allow the water level in the sight glass to drop for 5 minutes.*
8. *Record the static water level in the ~~tube~~ sight glass.*

Section 3.6, Air Passage Comparative Areas: Editorially revised the test procedure as follows:

3.6 Air Passage Comparative Areas

3.6.2 Procedure

3.6.2.1. *Install the ~~device~~ assembly as shown in Figure ~~4~~6 in the normal operating position with the check or moving member held fully open and the air valve held closed.*

3.6.2.2. *Connect the outlet of the device by means of 12.~~0~~ inch (30~~4~~5~~.8~~ mm) length of the same size or larger size pipe to a quick opening valve of the same size or larger which in turn is connected to a vacuum tank capable of providing at least ~~a (~~10~~)~~ seconds of air flow.*

3.6.2.3. *With the inlet open, connect a 12.~~0~~ inch (30~~4~~5~~.8~~ mm) reamed nipple, of corresponding size to the device, to the inlet of the device.*

3.6.2.4. *Dissipate the vacuum in the tank from 25.0 ± 0.5 inches of Hg to 5.0 ± 0.5 inches Hg (84.4 kPa to 16.9 kPa) through the check valve orifice by operating the quick opening valve ~~[~~that fully opens in less than ~~one (~~1~~)~~ second~~]~~.*

3.6.2.5. *Record the time it takes to dissipate the vacuum.*

~~3.6.2.2~~3.6.2.6. *With the outlet still connected to the vacuum tank and the check held in a closed position, hold the air valve open and dissipate the vacuum in the tank from 25.0 ± 0.5 inches of Hg to 5.0 ± 0.5 inches Hg (84.4 kPa to 16.9 kPa) in the same manner through the air port or ports. Record the time it takes to dissipate the vacuum.*

~~3.6.2.3~~ 3.6.3 Criteria

~~Failure to meet the requirements in Section 3.6.2.3 shall result in a rejection of the device~~

The time for the evaluation described in Section ~~3.6.2.2~~ 3.6.2.6 shall be equal to or less than the evaluation described in Section ~~3.6.2.1~~ 3.6.2.5, based on the average result of not less than three (3) test runs.

Section 3.7, Backsiphonage Test: Editorially revised the test procedure as follows:
3.7 Backsiphonage Test:

3.7.2 Procedure

3.7.2.1. *Foul the check or moving member of the device with a wire sized in accordance with Table 3, applied to the seat. Test wires may be furnished by the manufacturer and shall be shaped or formed to fit the contour of the seat ~~of tube~~. ~~The fouling wire shall not cause leakage.~~*

3.7.2.2. *The test wire shall be placed in the lower quadrant of a suspended check opposite the hinge or point of suspension (See Figure ~~5~~7). When testing a device in which the check member is not hinged, but moves vertically, the wire or spacer shall be placed at a single point of suspension on the seating area, on center line in the direction of the outlet port, as illustrated (See Figure ~~6~~8 and ~~7~~9). Devices having other types of moving parts shall have parts spaced or defaced equal to the spacing of the wire diameter in accordance with Table 3.*

3.7.2.3. *Install ~~T~~the device in its ~~normal~~ upright orientation and per Figure ~~4~~10. The check member shall be fouled with the wire or spacer in the proper position, or by defacement, depending on the type of check member, and the outlet of the device and the lower end of such tube submerged in water to within 8.0 inches (203.2 mm) of the bottom or critical installation level (CIL) point of the device.*

….

3.7.2.5. *The following tests shall be repeated to obtain five (5) successive measurements under each set of conditions:*

a. *Instantly apply a constant vacuum of at least ~~280.0~~25.0 inches of Hg (84.~~0~~4 kPa) for a period of at least thirty (30) seconds*
b. *Instantaneously apply intermittent vacuums of ~~35.0~~3.0 inches Hg, ~~60.0~~6.0 inches Hg, ~~120.0~~10.0 inches Hg, ~~180.0~~15.0 inches Hg, and ~~280.0~~25.0 inches Hg (~~10.5~~10.1 kPa, ~~18.0~~16.9 kPa, ~~36.0~~33.8 kPa, ~~54.0~~50.7 kPa, and ~~84.0~~84.4 kPa). Each application shall be for 5 seconds on and 5 seconds off.*
c. *~~First, s~~Slowly apply a vacuum increasing at a uniform rate from 0 inches of Hg to ~~280.0~~25.0 inches of Hg (0 kPa to ~~84.0~~84.4 kPa).*
d. *~~Second, s~~Slowly apply a vacuum decreasing at a uniform rate from ~~280.0~~25.0 inches of Hg to 0 inches of Hg (~~84.0~~84.4 kPa to 0 kPa).*

In tests (a) through (d), vacuum levels are sea level values; at high altitudes, corrections shall be made so as to produce the same vacuum in terms of fractional parts of an atmosphere at the higher altitude.

Section 3.9, Deterioration at Extremes of Manufacturer's Temperature: Clarified the test procedure as follows:

3.9 Deterioration at Extremes of Manufacturer's Temperature

3.9.2 Procedure

Cold water devices shall be tested at 40.0 °F (4.4 °C) and 110.0 °F (43.3 °C), or the manufacturer's maximum rated temperature, whichever is greater. Hot water devices shall be tested at 40.0 °F (4.4 °C) and also at 180.0 °F (82.2 °C), or the manufacturer's maximum rated temperature, whichever is greater.

Install the device with a heat source capable of maintaining the required temperature and pressure. Install a pump capable of circulating water in accordance with Table 4, continuously through the ~~device~~ assembly at the maximum rated pressure and temperature.

Section 3.10, Life Cycle Test: Revised the purpose of the life cycle test and removed the field-testing option referenced in ASSE 5000 from the test procedure as follows:

3.10 Life Cycle Test

3.10.1 Purpose

The purpose of this test is to determine if ~~(a)T~~ the device passes the tests in Sections 3.4 and 3.5 after being subjected to ~~simulated field conditions; or~~ the life cycle test

~~(b) The device passes field tests as described in ASSE 5000 standard 5020 after the device has been subjected to field conditions.~~

~~3.10.5 Procedure - Field Test~~

~~A minimum of three (3) devices of each size and type shall be field tested. When devices are identical except for inlet and outlet connections, only the larger size needs to be tested. Field locations shall provide a minimum of two (2) flowing sites. Flows shall be appropriate to the size of the device. Each field site shall be supplying water from different plumbing systems. The device shall be tested quarterly per the series 5000 test procedures for one (1) year test period.~~

~~3.10.6 Criteria~~

~~Failure of any of the devices to pass the field test at any time during the twelve (12) months shall result in the rejection of the device.~~

Section 4.1.1, Material in Contact with Water: Added requirement for compliance with NSF 372 for materials in contact with potable water as follows:

4.1.1 Material in Contact with Water

Solder and fluxes ~~containing lead in excess of 0.2% shall not be used~~ 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.

Section 4.1.7, Test Cocks: Clarified the requirements for test cocks as follows:

4.1.7 Test Cocks

Test cocks shall have a resilient seat and ~~bronze ASTM B584 Alloy UNS #C84400 or of a non-ferrous material at least equal~~ be equal or greater in strength and corrosion resistance ~~of not less than eighty-one percent (81%) copper. They shall be installed on the device by either a male thread on the inlet of the cock or by a brass or stainless steel nipple~~ as ASTM B584 Alloy UNS #C84400.

Section 4.1.8, Pipe Threads: Editorially revised as follows:

4.1.8 Pipe Threads

a. Tapered pipe threads, except dryseal, shall be in compliance with ANSI/ASME B1.20.1.

b. Dryseal pipe threads shall be in compliance with ANSI/ASME B1.20.3.

Section 4.1.9, Dezincification Resistance: Added dezincification resistance requirement as follows:

4.1.9 Dezincification Resistance

Copper alloys in contact with water and containing more than 15% zinc (Zn) by weight shall be resistant to dezincification. When tested in accordance with ISO 6509-1, the maximum depth of dezincification shall not exceed 200 µm (7.87 mil).

Section 4.2, Identification and Markings: Included an allowance for markings to be applied as a permanent label in accordance with UL 969 and removed securely attached plates and as follows:

4.2 Identification and Markings

Each device shall have the following information marked on it, where it is visible after the device has been installed:

a. Manufacturer's name or trademark.
b. Type and model number of the device.
c. Maximum rated working pressure.
d. Maximum rated water temperature for which the device is designed.
e. Serial number consistent with the manufacturer's standard practice.
f. Nominal valve size.
g. The direction of water flow through the device.

Labels shall comply with UL 969 for permanence.

~~*The markings shall be cast, etched, stamped or engraved on the body of the device or on a corrosion resistant plate securely attached to the device by a corrosion resistant means.*~~

Section 4.3, Installation and Maintenance Instructions: Revised the installation instructions to be in accordance with the manufacturer's instructions and the authority having jurisdiction (AHJ) as follows:

4.3 Installation and Maintenance Instructions

~~***4.3.1***~~ ~~*Complete i*~~*Instructions for* ~~*installation of*~~ *installing, adjusting, and maintaining the device shall be* ~~*packaged with it*~~ *included with each device.*

~~***4.3.2*** *All devices shall be capable of being maintained or repaired. Complete detailed instructions shall be furnished by the manufacturer.*~~

~~***4.3.3*** *Manufacturer's instructions for field testing shall be furnished.*~~

The installation instructions shall include the following information:

a. Inlet and outlet connection sizes.
b. Manufacturer's maximum working pressure.
c. Manufacturer's stated maximum flow rate.

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

The instructions shall include the phrases:

a. "The backflow assembly test procedure shall be per the local authority having jurisdiction (AHJ)."
b. "The assembly shall not be installed in a concealed or inaccessible location, nor where the venting of water from the assembly may cause damage. The serial number shall be visible after installation."

~~***4.4 Installation Instructions***~~

~~*The device shall not be installed in a concealed or inaccessible location, nor where the venting of water from the device during its normal functioning causes damage.*~~

Table 1, Minimum Test Cock Size. The title was revised as follows:

Table 1 – Minimum Test Cock Size

Figure 1, Device component configurations in the vertical-up-horizontal (VUH) orientation: A new figure was added as follows:

Figure 1 – Device component configurations in the vertical-up horizontal (VUH) orientation

Figure 1 – Device component configurations in the vertical-up-horizontal (VUH) orientation.

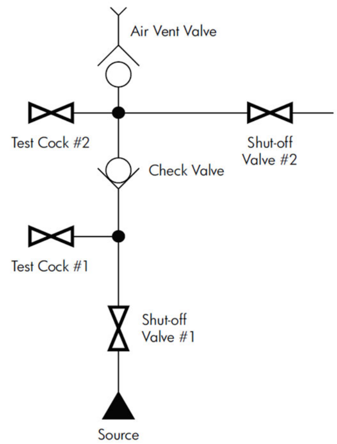

Figure 2, Hydrostatic Test setup: Figure 1 was renumbered and revised as follows:

Figure ~~1~~2 Hydrostatic Test setup

Figure 1

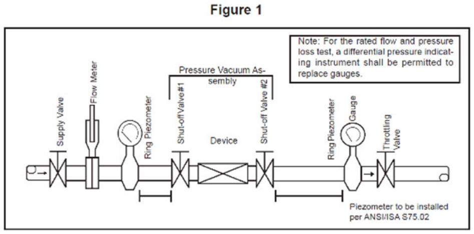

Figure 2 – Hydrostatic test setup.

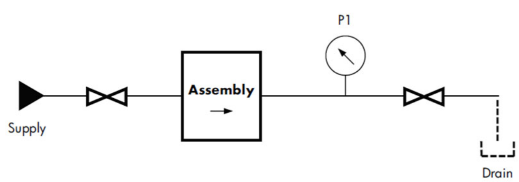

Figure 3: Figure 3 revised and a note was added as follows:

Figure 3-*Note: Sight glass is 0.5in (12.7mm) diameter and 48in (122cm) tall.*

Figure 3

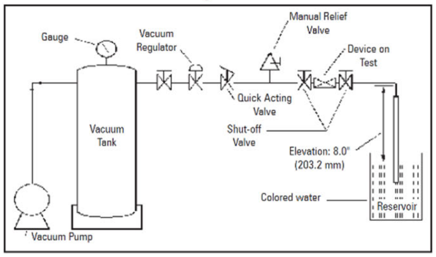

Figure 3 – Note: Sight glass is 0.5in (12.7mm) diameter and 48in (122cm) tall.

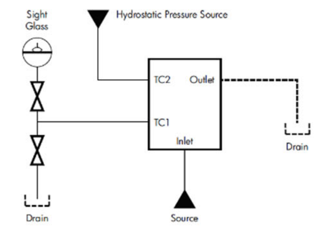

Figure 4: Figure 4 revised and a note was added as follows:

Note: D is the diameter of the pipe, which matches the size of the device. Position the pressure gauges at the minimum distances prescribed in the figure from the outside edges of the device's shut-off valves.

Figure 4

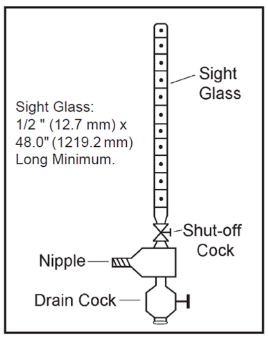

Figure 4 – Note: D is the diameter of the pipe, which matches the size of the device. Position the pressure gauges at the minimum distances prescribed in the figure from the outside edges of the device's shut-off valves.