

IAPMO IGC 302-2019

Potable Water Hygiene Systems



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Published by

International Association of Plumbing and Mechanical Officials (IAPMO)

4755 East Philadelphia Street, Ontario, California, 91761, USA

1-800-854-2766 • 1-909-472-4100

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Printed in the United States of America

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Preface

This is the fourth edition of IAPMO IGC 302, Potable Water Hygiene Systems. This Standard supersedes IAPMO 302-2017, Potable Water Hygiene Systems. The previous editions of this standard are: April 2017, November 2013, October 2013

This Standard was developed by the IAPMO Standards Review Committee (SRC) in accordance with the policies and procedures regulating IAPMO industry standards development, Policy S-001, Standards Development Process. This Standard was approved as an IAPMO Industry Standard on September 09, 2019.

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 - (b) *relevant section, table, or figure number, as applicable;*
 - (c) *wording of the proposed change, tracking the changes between the original and the proposed wording; and*
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 - (a) *the edition of the standard for which the interpretation is being requested;*
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IAPMO IGC 302–2019

Potable Water Hygiene Systems

1 Scope

1.1 General

1.1.1 This Standard covers potable water hygiene systems consisting of valves and fittings, electronic sensors, actuators, and control devices intended to ensure the hygienic transport of potable water and specifies requirements for materials, physical characteristics, performance testing, and markings.

1.1.2 Hygiene systems covered by this Standard are intended to be installed in water supply systems with a pipe size not larger than NPS-2.

1.2 Alternative Materials

The requirements of this Standard are not intended to prevent the use of alternative materials or methods of construction provided such alternatives meet the intent and requirements of this Standard.

1.3 Terminology

In this Standard,

- (a) “shall” is used to express a requirement, i.e., a provision that the user is obliged to satisfy to comply with the Standard;
- (b) “should” is used to express a recommendation, but not a requirement;
- (c) “may” is used to express an option or something permissible within the scope of the Standard; and
- (d) “can” is used to express a possibility or a capability.

Notes accompanying sections of the Standard do not specify requirements or alternative requirements; the purpose of those notes is to separate from the text explanatory or informative material. Notes to tables and figures are considered part of the table or figure and can be written as requirements.

1.4 Units of Measurement

SI units are the primary units of record in global commerce. In this Standard, the inch/pound units are shown in parentheses. The values stated in each measurement system are equivalent in application, but each unit system is to be used independently. All references to gallons are to U.S. gallons.

2 Reference Publications

This Standard refers to the following publications, and where such reference is made, it shall be to the current edition of those publications, including all amendments published thereto.

ASME International (The American Society of Mechanical Engineers)

ASME A112.18.1/CSA B125.1

Plumbing Supply Fittings

ASME A112.1.3

Air Gap Fittings for Use with Plumbing Fixtures, Appliances, and Appurtenances

ASME B1.20.1

Pipe Threads, General Purpose (Inch)

ASME B16.18

Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.22

Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

ASSE International

ASSE 1011

Performance Requirements for Hose Connection Vacuum Breakers

CSA Group (Canadian Standards Association)

CSA C22.2 No. 14

Industrial Control Equipment

CSA C22.2 No. 68

Motor-Operated Appliances (Household and Commercial)

CSA C22.2 No. 223

Power Supplies with Extra-Low-Voltage Class 2 Outputs

CAN/CSA C22.2 No. 60335-1

Household and Similar Electrical Appliances – Safety - Part 1: General requirements

UL

UL 508

Standard for Industrial Control Equipment

UL 1310

Standard for Class 2 Power Units

UL 1951

Standard for Electric Plumbing Accessories

UL 60335-1

Safety of Household and Similar Electrical Appliances, Part 1: General Requirements

NSF International
NSF/ANSI/CAN 61
Drinking Water System Components - Health Effects

3 Definitions and Abbreviations

3.1 Definitions

The following definitions shall apply in this Standard:

Control System — A collection of electronic devices that monitors, controls, and operates sensors and valves of the potable water hygiene system.

Note: *The components of the control system can be at a central position or distributed throughout the building.*

Double Angular Valve — A valve for connecting a sink to the supply piping that allows connecting loops of piping between the valve and the sink faucet.

Thermostatic Flow-Control Valve — A valve for compensating different flow resistances in a hot potable water system that operates automatically depending on the water temperature.

Manually-Operated Flow-Control Valve — A valve for compensating different flow resistances in a hot potable water system that is operated manually.

Flushing Device — A device comprised of sensors, valves, and a drain that directs water from the potable water hygiene system to the drainage system when certain pre-established conditions are met.

Venturi Splitter — A device with a Venturi nozzle that connects a secondary piping loop to a main supply pipe so that a given portion of the water flows through the secondary piping loop.

Note: *The Venturi nozzle can have a constant or variable cross section area.*

Venturi Splitter Box — A special version of the Venturi splitter used to connect the double angular valve to the main supply pipe.

3.2 Abbreviations

The following abbreviations apply in this Standard:

NPS — Nominal pipe size
UNS — Unified numbering system

4 General Requirements

4.1 Hygiene System Description

4.1.1 Cold Water System

Cold water hygiene systems typically consist of a Venturi splitter and the following optional components:

- (a) temperature sensor;
- (b) volume flow sensor;
- (c) shutoff valve with servo drive with or without a constant flow regulator;

Notes:

(1) A constant flow regulator is an optional component of a valve that limits the volume flow rate.

(2) A servo-drive shutoff valve is a motor-operated valve that is operated only when electrical energy is available and, in case of a power loss, it will stay at the last position before the power loss.

- (d) shutoff valve with servo drive and spring-reset with or without constant flow regulator;
- (e) drain with overflow monitoring;

Note: A drain with overflow monitoring is a drain with a sensor that detects if an overflow of the drained water occurs and generates a signal for the control system to close the corresponding flushing valve (e.g. in case of clogging of the wastewater drainage system).

- (f) control system;
- (g) flushing device;
- (h) Venturi splitter box; and
- (i) double angular valve.

4.1.2 Hot Water Systems

Hot water hygiene systems typically consist of a Venturi splitter and thermostatic or manually operated flow-control valves and the following optional components:

- (a) temperature sensor
- (b) volume flow sensor;
- (c) control system;
- (d) flushing device;
- (e) Venturi splitter box; and
- (f) double angular valve.

4.2 Materials

4.2.1 Bodies of potable water hygiene system components carrying potable water shall be made of

- (a) copper alloys complying with or exceeding the properties of alloys UNS C87700 or C87710; or
- (b) stainless steel alloys specified in Annex C of NSF/ANSI/CAN 61.

4.2.2 Double angular valves shall be made of copper alloys complying with or exceeding the properties of alloy UNS C87850.

4.3 Toxicity and Lead Content

4.3.1 Components intended to convey or dispense water for human consumption through drinking or cooking shall comply with the applicable requirements of NSF/ANSI/CAN 61 and the applicable low-lead requirements.

Note: “Low-lead” requirements are also known as “lead-free” and “reduction of lead” requirements. Such requirements are found in federal, state, or local laws and also in standards.

4.3.2 Solders 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.

4.4 Sealing

Hygiene systems shall be capable for bi-directional, drip-tight sealing at any pressure up to their full rated working pressure.

4.5 Pipe Threads

Pipe threads shall comply with ASME B1.20.1.

4.6 Soldered Joints

Ends for soldering to copper tubes shall comply with the dimensional requirements of ASME B16.18 or ASME B16.22.

4.7 Electrical Requirements

Hygiene systems incorporating electrical or electronic components or features shall comply with the applicable CSA or UL standards (e.g., CSA C22.2 No. 14, CSA C22.2 No. 68, CAN/CSA C22.2 No. 60335-1, UL 508, UL 1951, or UL 60335-1) except when powered by a:

- (a) direct plug-in Class 2 power supply that complies with the applicable CSA or UL standards (e.g., CSA C22.2 No. 223 or UL 1310);
- (b) low-voltage circuit (i.e., a circuit involving a peak open-circuit potential of not more than 42.2 V supplied by a battery or a Class 2 power supply); or
- (c) battery.

4.8 Sensors

4.8.1 Temperature Sensor

The temperature sensor shall be capable of measuring the water temperature within $\pm 1^{\circ}\text{C}$ ($\pm 2^{\circ}\text{F}$) at continuous temperatures from $+5^{\circ}\text{C}$ (41°F) up to 93°C (200°F).

4.8.2 Volume Flow Sensor

The volume flow sensor shall

- (a) have a measuring range with an upper limit of 2.5 times the flow coefficient C_v ;
- (b) have an accuracy of at least
 - (i) 1% of the full scale value in the range lower than 50% full scale; and
 - (ii) 2% of the measuring value in the range greater than 50% full scale;
- (c) have a response time of 0.5 s or less; and
- (d) shall be capable of measuring the flow at continuous temperatures up to 93°C (200°F).

4.9 Air Gap Fittings

Potable water hygiene systems shall have an air gap fitting that complies with ASME A112.1.3, to allow the hygiene system to drain into the sanitary drainage system.

4.10 Overflow Monitoring

Potable water hygiene systems shall have an overflow monitoring device to prevent flooding.

Note: *The overflow monitoring device closes the corresponding flushing systems valves and prevents further outflow of water.*

5 Testing Requirements

5.1 Pressure and Temperature Tests

5.1.1 Static and Dynamic Seals

Hygiene systems shall be tested for pressure and temperature in accordance with Clause 5.3.1, Static and Dynamic Seals of ASME A112.18.1/CSA B125.1.

5.1.2 Burst Pressure

Hygiene systems shall be tested for pressure and temperature in accordance with Clause 5.3.2, Burst Pressure of ASME A112.18.1/CSA B125.1, except that the hydrostatic pressure shall be

- (a) 2,400 kPa (350 psi); and
- (b) sustained for 10 min.

5.2 Functional Test for Venturi Splitters with Constant Nozzles

Note: *Venturi splitters with constant nozzles are characterized by a particular volume flow and pressure differential behavior, where the pressure difference is proportional to the square of the volume flow rate and characterized by an approximately constant value, known as the flow coefficient (C_v). Since the Venturi splitter connects a secondary piping loop to the main supply pipe (see Figure 1) two different pressure differentials can be observed. The first pressure differential describes the pressure drop in the main pipe, (Δp_m) and the second one describes the driving pressure difference of the secondary piping loop (Δp_r). Although differences for Δp_m and Δp_r can be observed it is sufficient to specify Δp_m in order to characterize the behavior of the splitter. The main supply pipe flow coefficient (C_{v_m}) is calculated using the pressure differentials and the flow rate (F) through the main pipe. During the test procedure the values for C_{v_m} specified in Table 1 must be achieved for an averaged flow velocity of 1.5 m/s (4.9 ft/s) in the main pipe with the corresponding nominal diameter.*

5.2.1 Test Apparatus

The test apparatus shall

- (a) have a throttling valve to control the flow rate;
- (b) have a means for accurately measuring the pressure loss and volume flow rate; and
- (c) be capable of flowing 190 L/min (50 gpm).

5.2.2 Test Procedure

The functional test for Venturi splitters with constant nozzles shall be conducted as follows:

- (a) Install the Venturi splitter with the two main connectors in accordance with Figure 2 of ASSE 1011.
- (b) Connect the two remaining openings of the Venturi splitter to 2 shut off valves and a secondary piping loop of the same nominal diameter as the Venturi splitter secondary connectors.
- (c) Open the 2 shut off valves and purge the air.
- (d) Close the 2 shut off valves
- (e) Flow water through the test specimens at the flow rates specified in Table 1 at a flow velocity of 1.5 m/s (4.9 ft/s).
- (f) Measure the pressure drop across the main flow path, Δp_m , of the Venturi splitter.
- (g) Calculate the main supply pipe flow coefficient, Cv_m , using the following equation:

$$Cv_m = F \times (1 \div \Delta p_m)^{1/2}$$

where

Cv_m = flow coefficient for the main supply pipe

Δp_m = pressure drop in the main supply pipe

F = flow

5.2.3 Performance Requirements

The flow coefficient, Cv_m , shall be within $\pm 20\%$ of the values specified in Table 1.

5.3 Functional Test for Venturi Splitters with Variable Nozzles

Note: Venturi splitters with variable nozzles are characterized by a particular volume flow and pressure differential behavior, where the pressure difference is a function of the volume flow and three regimes of volume flow with particular pressure difference behavior can be identified (see Figure 2). In contrast to the Venturi splitters with constant nozzles, the Cv_m and Cv_r values for Venturi splitters with variable nozzles are very similar, and such similarity is sufficient for full functionality. Thus, for Venturi splitters with variable nozzles only the pressure difference across the splitter is measured and used for calculating Cv_m , defined as Cv for simplicity. In order to identify the correct flow rate through the splitter the connectors of the loop must be closed (after having purged the air) avoiding any additional flow through the loop.

The first and the last of the three regimes of volume flow are calculated using flow coefficient Cv_a and Cv_b . The values for Cv_a and Cv_b differ depending on the splitter's size (see Table 2). The second (intermediate) regime is calculated using the initial, Δp_a , and final, Δp_b , pressure differences. The values for Δp_a and Δp_b differ depending on the size of the splitter and are listed in Table 2.

5.3.1 Test Apparatus

The test apparatus shall be as specified in Section 5.2.1.

5.3.2 Test Procedure

The functional test for Venturi splitters with variable nozzles shall be conducted as follows:

- (a) Install the Venturi splitter with the two main connectors in accordance with Figure 2 of ASSE 1011.
- (b) Connect the two remaining openings of the Venturi splitter to 2 shut off valves and a piping loop of the same nominal diameter as the Venturi splitter secondary connectors.
- (c) Open the 2 shut off valves and purge the air.
- (d) Close the 2 shut off valves.
- (e) Close and slowly reopen the throttling valve until all three flow/pressure regimes are achieved.
- (f) Use the readings from Step (e) to determine the limits of the regimes, namely Δp_a and Δp_b (see Figure 2) and the corresponding flow rates F_a and F_b .
- (g) Calculate the flow coefficient Cv_a using the equation: $Cv_a = F_a \times (1 \div \Delta p_a)^{1/2}$
where
 Cv_a = first regime flow coefficient
 Δp_a = first regime pressure drop
 F_a = first regime flow
- (h) Calculate the flow coefficient Cv_b using the equation: $Cv_b = F_b \times (1 \div \Delta p_b)^{1/2}$
where
 Cv_b = third regime flow coefficient
 Δp_b = third regime pressure drop
 F_b = third regime flow

5.3.3 Performance Requirements

At the completion of the test:

- (a) Cv_a and Cv_b shall be within $\pm 20\%$ of the values specified in Table 2;
- (b) the three flow regimes shall be clearly identifiable by the two border points B_a and B_b (see Figure 2);
- (c) the pressure differences Δp_a at B_a and Δp_b at B_b shall be within $\pm 25\%$ of the values specified in Table 2

5.4 Test for Thermostatic Flow-Control Valves

Note: Thermostatic flow-control valves are used to compensate for different resistances to the flow in the hot water system due to different lengths and diameters of pipes and other components to ensure a relatively constant temperature across the entire water hygiene system by throttling the flow paths with lower resistances and higher temperatures. This temperature dependence is characterized by five different flow regimes, as follows (see Figure 3):

- (1) Flow Regime 1 is the maximum through flow at low temperatures (Cv_{max}).
- (2) In Flow Regime 2 the valve starts to throttle the flow up to the maximum throttled point of operation.
- (3) In Flow Regime 3, the throttled point of operation is constant (Cv_{min}).
- (4) In Flow Regime 4, the thermostatic flow control valve(s) again start to open above a certain temperature, until a constant intermediate throttling position has been achieved.
- (5) In Flow Regime 5, a constant intermediate throttling position called the thermal disinfection point of operation is maintained (Cv_{TD}).