

IAPMO IGC 353-2019^{e1}

Branch Connectors



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IAPMO Standard

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Branch Connector

1 Scope

1.1 General

1.1.1 This Standard covers branch connectors for NPS 1-1/2 through 6 intended for hydronics, compressed gas and fire sprinkler applications and specifies requirements for materials, physical characteristics, performance testing, and markings.

1.1.2 Branch connectors covered by this standard shall include a

- (a) a saddle like permanent connection mechanically fixed in place to the host pipe; and,
- (b) leak tight seal realized through the compression of a sealing element between the outer surface of the pipe and body or flange of the branch connector.

***Note:** One method of mechanically fixing the branch connection is via a swaging action which secures the fitting by mechanically deforming a flange of metal attached to the branch connector so that it matches the contour of the inside surface of a host pipe.*

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; their purpose is to separate explanatory or informative material from the text. 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.

1.5 Amendments

Proposals for amendments to this Standard will be processed in accordance with the standards-writing procedures of IAPMO.

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 B1.20.1	Pipe Threads, General Purpose, Inch
NSF/ANSI 61	Drinking Water System Components – Health Effects

3 Definitions and Abbreviations

3.1 Definitions

The following definitions shall apply in this Standard:

Branch Connector — A permanent fitting or connection that allows a NPT threaded branch connection to be added to existing piping.

3.2 Abbreviations

The following abbreviations apply in this Standard:

IPS — Iron Pipe Size
NPS — Nominal Pipe Size

4 General Requirements

4.1 Materials

4.1.1 The body of branch connectors covered by this Standard shall be made of carbon steel, stainless steel, copper nickel or other materials with similar strength properties.

4.1.2 Materials for the sealing element may include but not limited to
(a) EPDM (ethylene propylene diene monomer);
(b) FKM (fluoroelastomer); or,
(c) HNBR (Hydrogenated Nitrile Butadiene Rubber).

Note: The test report should specify the sealing element material(s).

4.2 Toxicity

4.2.1 Materials and components of a branch connector intended to convey or dispense water for human consumption through drinking or cooking shall comply with the applicable requirements of NSF/ANSI 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 Connections

4.3.1 Threaded ends shall comply with ASME B1.20.1

4.3.2 In addition to the performance requirements of this Standard, alternate connections not specified in this Standard shall comply with the dimensional and performance requirements of applicable nationally recognized standards.

4.4 Operating Temperatures

Dependent on the sealing element material, the branch connector typically operates at temperatures ranging from -40 to 150 °C (-40 to 302°F).

Note: Consult with manufacturer’s technical specifications.

5 Testing Requirements

5.1 Test Specimen and Test Apparatus

5.1.1 Test Specimen

The test specimen shall consist of a branch connector selected for testing.

5.1.2 Test Apparatus

Unless otherwise described the test apparatus shall consist of the intended schedule host pipe with closed ends capable of applying and sustaining hydrostatic pressure, vacuum, or water hammer, with the branch connector installed in accordance with the manufacturer’s instructions. The minimum and maximum host pipe and branch outlet NPS shall be provided by the manufacturer prior to testing.

5.2 Unrestrained Hydrostatic Pressure Tests

5.2.1 Unrestrained Hydrostatic Pressure Test at 20 °C (68°F)

5.2.1.1 Test Procedure

The unrestrained hydrostatic pressure test at 20 °C (68 °F) for branch connectors shall be conducted as follows:

- (a) Assemble the test specimen in accordance with Section 5.1.
- (b) Connect gauges to the test specimen to measure the joint displacement.
- (c) Fill the test specimen with water at 20 ± 3 °C (68 ± 5 °F).
- (d) Pressurize the test specimen to $4,137 \pm 48$ kPa (600 ± 7 psi) or two times the manufacturer’s rated pressure, whichever is greater.
- (e) Maintain the test temperature and pressure for 48 h.
- (f) Measure the slippage 1 h after pressurizing and at the completion of the test.

5.2.1.2 Performance Requirement

There shall be no leakage. In addition, the maximum slippage per joint shall be as specified in Table 1.

5.2.2 Unrestrained Hydrostatic Pressure Test at 93 °C (200°F)

5.2.2.1 Test Procedure

The unrestrained hydrostatic test at 93 °C (200°F) for branch connectors shall be conducted as follows:

- (a) Assemble the test specimen in accordance with Section 5.1.
- (b) Connect gauges to the test specimen to measure the joint displacement.
- (c) Fill the test specimen with water at 93 ± 3 °C (200 ± 5 °F).
- (d) Pressurize the test specimen to $4,137 \pm 48$ kPa (600 ± 7 psi) or two times the manufacturer's rated pressure, whichever is greater.
- (e) Maintain the test temperature and pressure for 48 h.
- (f) Measure the slippage 1 h after pressurizing and at the completion of the test.

5.2.2.2 Performance Requirement

There shall be no leakage. In addition, the maximum slippage per joint shall be as specified in Table 1.

5.3 Bending Moment Test

5.3.1 Test Apparatus

The apparatus for the bending moment test shall be capable of sustaining a hydrostatic pressure within the assembly and shall be configured as shown in Figure 1.

5.3.2 Test Procedure

The bending moment test shall be conducted as follows:

- (a) Install the test specimen into the test apparatus in accordance with the manufacturers installation instructions.
- (b) Fill the test specimen with water at 20 ± 3 °C (68 ± 5 °F).
- (c) Pressurize the test specimen to $1,379 \pm 48$ kPa (200 ± 7 psi)
- (d) Apply a bending moment of 200 ± 7 N•m (150 ± 5 lb•ft) to the branch connection by slowly applying a 670 N force 300 mm (150 lb force 12 in) from the pipe branch connection to the host pipe.
- (e) Maintain the test pressure and the bending moment for 10 min.

5.3.3 Performance Requirement

There shall be no leaking and no slippage.

5.4 Vacuum Test

5.4.1 Test Procedure

The vacuum test shall be conducted as follows:

- (a) Assemble the test specimen in accordance with Section 5.1.
- (b) Subject the test specimen to a vacuum of 82.9 ± 1.7 kPa (12 ± 0.25 psi).
Note: 82.9 ± 1.7 kPa (12 ± 0.25 psi) is equivalent to 622 ± 13 mm (24.5 ± 0.5 in) of mercury.
- (c) Once the vacuum is established, isolate the test specimen and monitor the vacuum for 1 h.

5.4.2 Performance Requirement

The change in vacuum shall not exceed 5 kPa (0.73 psi).

Note: 5 kPa (0.73 psi) is equivalent to 38 mm (1.5 in) of mercury.

5.5 Hydraulic Shock (Water Hammer) Test

5.5.1 Test Procedure

The hydraulic shock (water hammer) test shall be conducted as follows:

- (a) Assemble the test specimen in accordance with Section 5.1.
- (b) Fill the test specimen with water at 20 ± 3 °C (68 ± 5 °F).
- (c) Subject the test specimen to a hydraulic shock consisting of a rapid increase in pressure to $2,069 \pm 200$ kPa (300 ± 29 psi) lasting 0.01 ± 0.005 s.
- (d) Repeat the hydraulic shock once every 2 s for 10,000 times.

5.5.2 Performance Requirement

There shall be no leakage.

5.6 Vibration Test

5.6.1 Test Apparatus

The apparatus shall be capable of simultaneously vibrating while maintaining a hydraulic pressure in the test specimen. The test apparatus for the vibration test shall be configured as shown in Figure 2. The host pipe and installed branch outlet shall be Schedule 40 carbon steel pipe.

5.6.2 Test Procedure

The vibration test shall be conducted as follows:

- (a) Install the test specimen onto the host pipe in accordance with the manufacture's installation instructions.
- (b) Fill the test specimen with water at 20 ± 3 °C (68 ± 5 °F).
- (c) Pressurize the test specimen to $2,414 \pm 48$ kPa (350 ± 7 psi).
- (d) Subject the test specimen to the successive series of vibration cycles listed in Table 2:
- (e) Amplitude of the vibration shall be applied only in one axes or parallel to the length of the host pipe as shown in Figure 2.
Note: The series of tests in Table 2 are applied only in the x-axis which is parallel to the length of the host pipe and the weaker of the two (x,y) axis.
- (f) A vibration cycle shall be one complete forward and reverse movement at each of the amplitudes given in Table 2.
- (g) At the completion of all cycles, increase the test specimen pressure to $2,758 \pm 48$ kPa (400 ± 7 psi).
- (h) Maintain the pressure in step (f) for 48 h.

5.6.3 Performance Requirement

There shall be no leakage.

5.7 Thermal Cycling Test

5.7.1 Test Procedure

The thermal cycling test shall be conducted as follows:

- (a) Assemble the test specimen in accordance with Section 5.1.
- (b) Supply flowing water to the test specimen at a pressure of $1,000 \pm 48$ kPa (145 ± 7 psi), or the manufacturer's rated pressure, whichever is greater.
- (c) Subject NPS-2 and smaller test specimens to 5,000 thermal cycles by flowing water through the test specimen at:
 - (i) 20 ± 3 °C (68 ± 5 °F) for 15 min; and
 - (ii) 93 ± 3 °C (200 ± 5 °F) for 15 min.
- (d) Subject NPS 2-1/2 and larger test specimens to 2,500 thermal cycles by flowing water through the test specimen at:
 - (i) 20 ± 3 °C (68 ± 5 °F) for 30 min; and
 - (ii) 93 ± 3 °C (200 ± 5 °F) for 30 min.
- (e) Ensure that the water temperature change during each thermal cycle occurs within 2 min.

5.7.2 Performance Requirement

There shall be no leakage or separation of the joints.

5.7.3 Alternate Thermal Cycling Test

5.7.3.1 Alternate Test Procedure

Alternatively, the thermal cycling test may be conducted as follows:

- (a) Assemble six test specimens consisting of six branch connectors and the respective nominal host pipe(s) in accordance with the manufacturer's installation instructions. Multiple branch connectors shall be allowed to be installed on the same host pipe. The outer diameter of the branch connector shall be installed at least one times its outer diameter away from the end of the host pipe (See Figure 3). The host pipe ends shall be capped in any acceptable fashion but shall not be considered a joint being evaluated for performance.
- (b) Pressurize the test specimens with nitrogen or air to 690 ± 69 kPa (100 ± 10 psi).
- (c) Immerse the test specimens in water at 20 ± 3 °C (68 ± 5 °F).
- (d) Check the test specimens for leaks.
- (e) If there are no leaks, subject the test specimens to 2,500 cycles of temperatures, with each complete cycle consisting of the following four steps in the following order:
 - (i) immersion in water at 93 ± 3 °C (200 ± 5 °F) for $2 \text{ min} \pm 5 \text{ s}$;
 - (ii) immersion in air at laboratory ambient temperature for $2 \text{ min} \pm 5 \text{ s}$;
 - (iii) immersion in water at 20 ± 3 °C (68 ± 5 °F) for $2 \text{ min} \pm 5 \text{ s}$; and
 - (iv) immersion in air at laboratory ambient temperature for $2 \text{ min} \pm 5 \text{ s}$.

5.7.3.2 Performance Requirement

There shall be no visible leakage or separation of the joints.