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Heat Exchangers and Indirect Water Heaters



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Heat Exchangers and Indirect Water Heaters

1 Scope

- 1.1** This Standard covers heat exchangers and indirect water heaters and specifies requirements for materials, physical characteristics, performance tests, and markings.
- 1.2** 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** Proposals for amendments to this Standard will be processed in accordance with the standards writing procedures of IAPMO.
- 1.4** The user's attention is called to the possibility that compliance with this Standard may require use of an invention covered by patent rights. By publication of this Standard, no position is taken with respect to the validity of any such claim(s) or of any patent rights in connection therewith. If a patent holder has filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, then details can be obtained from 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.

ANSI Z21.22/CSA 4.4	Relief Valves for Hot Water Supply Systems
ASME B1.20.1	Pipe Threads, general Purpose (Inch)
ASME A112.18.1/CSA B125.1	Plumbing supply fittings
ASME A112.18.2/CSA B125.2	Plumbing waste fittings
ASTM A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM B88	Standard Specification for Seamless Water Copper Tube
ASTM B359	Standard Specification for Copper and Copper-Alloy Seamless Condenser and Heat Exchanger Tubes With Integral Fins
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials

CSA C309	Performance Requirements for Glass-Lined Storage Tanks for Household Hot Water Service
IAPMO IGC 157 IAPMO/ANSI UPC 1	Ball Valves Uniform Plumbing Code
UL 174	Household Electric Storage Tank Water Heaters
ULC S102	Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies

3 Definitions and Abbreviations

Reserved

4 General Requirements

4.1 Materials

Heat exchangers and water heater tanks shall be made of the following materials:

- (a) Type M or thicker copper tube complying with ASTM B88 or ASTM B359;
- (b) stainless steel of the 300 or 400 series complying with ASTM A240;
- (c) glass-lined steel complying with the applicable requirements of UL 174 or CSA C309;
- (d) steel complying with the applicable ASTM standards; or
- (e) for wastewater applications, plastic materials complying with ASME A112.18.2/CSA B125.2.

4.2 Double- and Single-Wall Heat Exchangers

4.2.1 Double-wall heat exchangers shall

- (a) have a positive leak detection path for prevention of cross contamination; and
- (b) be vented to the atmosphere.

4.2.2 Single-wall heat exchangers used in indirect-fired water heaters shall comply with the applicable requirements of the plumbing code.

Note: The applicable IAPMO/ANSI UPC 1 requirements are found in

- (a) Section 506.4.2 of IAPMO/ANSI UPC 1-2009; and
- (b) Section 505.4.1 of IAPMO/ANSI UPC 1-2012.

4.3 Plate Heat Exchangers

4.3.1 Plate heat exchangers shall be made of 0.4 mm (0.016 in) or thicker stainless steel of the 300 or 400 series.

4.3.2 Plate heat exchangers shall have double seals around the ports so that any breach in one of the seals will leak to the atmosphere.

4.4 Pipes and Fittings

Pipes and fittings within heat exchangers shall comply with the applicable standard for the pipe and fitting material in use.

4.5 Electrical Requirements

4.5.1 Heat exchangers and indirect water heaters with electrical components or features shall comply with the applicable CSA or UL standards, as applicable.

4.5.2 Thermostats and switches shall be suitable for their intended application and shall have current and voltage ratings not less than that of the circuits which they control.

4.6 Connections

4.6.1 Threads shall comply with ASME B1.20.1.

4.6.2 Alternative connections shall comply with nationally recognized standards, as applicable.

4.7 Connections between Heat Exchangers and External Heat Sources

Connections between heat exchangers and external heat sources shall

- (a) be made in a manner that will not result in temperatures or pressures exceeding the maximum design temperatures or pressures of the heat exchangers or heat sources; and
- (b) not compromise or bypass safety devices.

4.8 Valves

Valves shall comply with IAPMO IGC 157 or ASME A112.18.1/CSA B125.1, as applicable.

4.9 Water Heater Tanks

4.9.1 The outer walls of water heater tanks shall be capable of withstanding temperatures of at least 100 °C (212°F).

4.9.2 Exposed coverings, insulation, jackets, and lapseal adhesives shall

- (a) be made of materials suitable for the intended application;
- (b) be tested as a composite product; and
- (c) have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E84 or ULC S102.

4.10 Relief Valves

Relief valves shall comply with the applicable requirements of ANSI Z21.22/CSA 4.4.

4.11 Backflow Protection

Water heaters intended for potable water applications shall be protected from cross connection in accordance with the applicable requirements of the plumbing code, with a backflow preventer or an air gap complying with the applicable ASSE or CSA standards.

Note: The applicable requirements for Canada are found in Section 2.6.2 of the 2010 National Plumbing Code of Canada.

5 Testing Requirements

5.1 Hydrostatic Test for Heat Exchanger Coils

5.1.1 Test Procedure

The hydrostatic test for heat exchanger coils shall be conducted as follows:

- (a) Close the heat exchanger outlet with a threaded fitting.
- (b) Apply a hydrostatic pressure of 2,070 kPa (300 psi) at the exchanger inlet.
- (c) Maintain the hydrostatic pressure for 30 min.

5.1.2 Performance Requirement

There shall be no damage or leakage of the heat exchanger coil.

5.2 Hydrostatic Test for Water Heater Tanks

5.2.1 Water heater tanks intended for potable water applications shall withstand a hydrostatic pressure of 2,070 kPa (300 psi) or 110% of their working pressure, whichever is greater, for 30 min without any leakage or permanent deformation of the tank.

5.2.2 Heat exchangers intended for grey water applications shall withstand a hydrostatic pressure of 35 kPa (5 psi) for 5 min without any leakage or permanent deformation.

5.3 Hydrostatic Test for Plate Heat Exchangers

Both sides of plate heat exchangers shall withstand a hydrostatic pressure of 4,480 kPa (650 psi) for 30 min without any permanent deformation.

5.4 Leak-By Test of Heat Exchangers

5.4.1 Test Procedure

The leak-by test for heat exchangers shall be conducted by applying a hydrostatic pressure of 83 kPa (12 psi) to the area between the inner and outer walls of the heat exchanger with the other end open to atmosphere.

5.4.2 Performance Requirement

There shall be water present at the open end within 30 min.

5.5 Hair Test for Heat Exchangers Intended for Wastewater Applications

5.5.1 Test Procedure

The hair test for heat exchangers intended for wastewater applications shall be conducted as follows:

- (a) Install the heat exchanger on the drain line of a shower receptor, in accordance with manufacturer's installation instructions.
- (b) Remove the shower receptor drain strainer.
- (c) Prepare a mixture of approximately 40 strands of dry human hair 400 to 460 mm (16 to 18 in) long, 20 g (0.7 oz) of hair conditioner, and 20 g (0.7 oz) of liquid soap.
- (d) Pour the mixture randomly around the drain.

- (e) Install a shower head capable of delivering 9.5 L/m (2.5 gpm) 1.5 m (5 ft) above the drain.
- (f) Adjust the shower valve flow rate to 9.5 L/m (2.5 gpm). Divert the water away from the shower receptor while adjusting the flow.
- (g) Once the flow rate is adjusted, direct the water into the shower receptor and allow it to flow for 2 min.
- (h) After the 2-min period, measure the flow rate at the outlet of the heat exchanger (i.e., downstream of the heat exchanger).

5.5.2 Performance Requirement

The flow rate at the outlet of the heat exchanger shall not be less than 9.5 L/m (2.5 gpm).

5.6 High Temperature Test for Water Heater Tanks

5.6.1 Test Procedure

The high temperature test for water heater tanks shall be conducted as follows:

- (a) Connect the inlet of the water heater tank to a heat source.
- (b) Close any other ports of the water heater tank and ensure that there is no leakage.
- (c) Fill the water heater tank with water at 82 °C (180°F).
- (d) Maintain the temperature in the water heater tank for 72 h.

5.6.2 Performance Requirement

There shall be no permanent deformation of the tank.

6 Markings and Accompanying Literature

6.1 Heat exchangers complying with this Standard shall be marked with the:

- (a) manufacturer's name or trademark;
- (b) model number;
- (c) maximum working pressure or pressure rating; and
- (d) legend "Single Wall" or "Double Wall", as applicable.

6.2 Water heater tanks complying with this Standard shall be marked with the

- (a) recommended flow rate(s) for connection to external heat sources;
- (b) manufacturer's name or trademark;
- (c) model number, where applicable;
- (d) maximum working pressure or pressure rating; and
- (e) maximum operating temperature.

6.3 Markings shall be permanent and legible.