



**Summary of Substantive Changes
between the 2014 and the 2015 editions of
ANSI Z21.10.3 • CSA 4.3 “Gas-fired water heaters, volume III,
storage water heaters with input ratings above 75,000 Btu per hour,
circulating and instantaneous”**

Presented to the IAPMO Standards Review Committee on August 8, 2016

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

- Added a new definition to classify 4 categories of water heaters other than direct vent type for use in manufactured homes (see Section 3)
- Added requirements for the construction, installation instructions, and marking of Category I, II, III, IV, vent water heaters and additional requirements for the construction, installation and marking of direct vent water heaters. (see Section 4)
- Clarified special performance provisions for Category I, II, III and IV water heaters (see Section 5.1)
- Added a method of test to determine the water heater category type (see Section 5.5)
- Added a method of test to determine the capacity of tub type water heaters (see Section 5.28)
- Included a method of testing the heat exchanger hydrostatic pressure (see Section 5.29)
- Added a method of testing the gas tightness and water-tightness of venting systems supplied with Category II, III or IV water heaters (see Section 5.32)
- Included new method of test for measuring standby loss of for tube type instantaneous water heaters with 10 or greater gallons of storage (see Annex E2)

Section 2, Reference publications: Updated the referenced publications to the current editions.

Section 3, Definitions; Added a new definition to classify 4 categories of water heaters other than direct vent type for use in manufactured homes as follows:

Water heater, Category - water heaters of other than direct vent type, for installation in manufactured homes (mobile homes), for installation in recreational vehicles or for outdoor installation are divided into four categories based on the static pressure produced in the vent and the flue loss.

Category I - a water heater that operates with a non-positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

Category II - a water heater that operates with a non-positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.

Category III - a water heater that operates with a positive vent static pressure and with a vent gas temperature that avoids excessive condensate production in the vent.

Category IV - a water heater that operates with a positive vent static pressure and with a vent gas temperature that may cause excessive condensate production in the vent.



Section 4 Construction: Added requirements for the construction, installation instructions, and marking of Category I, II, III, IV, vent water heaters and additional requirements for the construction, installation and marking of direct vent water heaters as follows:

4.1 General construction

4.1.25

A Category II, III, IV, or direct vent water heater shall be provided with the means for venting* the vent gases to the outdoors unless the necessary parts to accomplish this are either of specified types listed by a nationally recognized testing agency, or have been evaluated for use on the water heater under this Standard, and the water heater manufacturer's instructions and marking identify and specify the use of such specific parts [See Clause 4.30.2-b)-xxi)-4].

* Means for venting may be accomplished by a method controlled by the manufacturer that shall result in both the water heater and the venting means being available at the time of installation.

4.22 Condensate disposal

4.22.1

On a Category II or IV water heater, means shall be provided for the collection and disposal of condensate.

4.22.2

A venting system supplied with a Category II or IV water heater shall have means provided for the collection and disposal of condensate.

4.22.3

A condensate trap(s), if necessary for compliance with Clause 5.34, Direct vent systems, shall be supplied with the water heater and/or vent system along with instructions for proper installation and routine maintenance.

4.22.4

Condensate drain line(s) shall not be adversely affected by the composition of the condensate, and suitable for the temperatures to which they are exposed.

4.22.5

Where a condensate neutralizer is provided, either an overflow directed to the drain or

4.30 Instructions

4.30.2

Each water heater shall be accompanied by clear, concise printed instructions and diagrams, stated in terms clearly understandable to the consumer and adequate for the proper field assembly, installation, maintenance, safe use and operation of the appliance.

The instructions shall include:

b) Installation instructions indicating:

ix) For Category II and IV appliances, the following statement:

The vent for this appliance shall not terminate:

1) over public walkways; or

2) near soffit vents or crawl space vents or other areas where condensate or vapor could create a nuisance or hazard or cause papery damage; or

3) where condensate vapor could cause damage or could be detrimental to the operation of

xx) Category

1) Category designation(s)

2) For a Category I water heater, indicate if the combustion system is fan-assisted or natural draft (see Clause 3, Definitions).



xxi) Installation instructions for installing vents, venting systems, and provisions for adequate combustion and ventilation air shall include the following instructions:

1) A water heater shall not be connected to a chimney flue serving a separate appliance, designed to burn solid fuel.

2) Provisions for adequate combustion and ventilation air in accordance with one of the following:

A) the National Fuel Gas Code, ANSI Z223.1/NFPA 54 (Current Edition);

B) CSA 8149.1, Natural Gas and Propane Installation Code (Current Edition); or

C) applicable provisions of the of the local building code.

3) if the water heater is intended for use with a listed Type B vent or vent connector, the listed clearances from combustible construction shall be used [see Clause 4.31.12-j)].

4) For Category II, III, or IV water heaters, the manufacturer's instructions shall specify the type of venting material to be used, vent size, and the minimum and maximum vent lengths:

A) When the manufacturer applies the venting system, the instructions shall include a parts list and instructions covering the installation of properly identified parts to provide for the venting of the vent gases to the outdoors (see Clause 4.1.25).

B) When the parts for venting the vent gases are not provided by the water heater manufacturer and they are specific types listed by a nationally recognized testing agency, these instructions shall clearly identify and specify the use of the specific parts for the venting system (see Clause 4.31.32

5) For Category I, III and IV water heaters, the venting system shall be installed in accordance with the water heater manufacturer's instructions.

6) A water heater may be specified as Category I or III provided the installation manuals specify the venting system to be used for each category.

7) Instructions for proper venting installation:

A) For Category I water heaters, vent installation shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or CSA 8149.1, Natural Gas and Propane Installation Code (Current Editions), the local building codes, water heater and the vent manufacturer's instructions.

B) If the instructions include provision for multi-story or common venting systems, such venting systems shall be in accordance with the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or the CSA 8149.1, Natural Gas and Propane Installation Code (Current Editions), local codes, and the manufacturer's instructions. The instructions shall specify whether multi-story and common venting is permitted or prohibited. regulators, relief valves, or other equipment.

4.31 Marking

4.31.12

Water heater installation locations and clearances for safety and serviceability shall be clearly marked on the rating plate, or on a separate label of Class IIIA marking material that can be easily read when the appliance is in a normally installed position. Any clearances specified below shall be established by the various performance tests specified elsewhere in this Standard. The substance of this marking shall be as follows, as applicable.

j) A water heater tested with a Type B vent or vent connector shall be provided with a Class V marking in a location conspicuous prior to the installation clearly indicating the specific type of vent or vents with which the water heater is to be used.



4.31.32

The following marking (as applicable) shall be affixed to the water heater on Class III marking material (unless otherwise noted).

A water heater requiring special vent or marked Category II, III, or IV shall bear a marking that states: "This water heater requires a special venting system. Refer to the installation instructions for parts list and method of installation."

5 Performance

5.1 General: Clarified special performance provisions for Category I, II, III and IV water heaters as follows:

5.1.20

Special performance provisions applicable to Category I, Category II, Category III, and Category IV water heaters are outlined under Clauses 5.7, Category determination, and 5.35, Venting systems for Category water heaters.

5.5 Category determination: Added a method of test to determine the water heater category type as follows:

A water heater shall be determined to be a Category I, II, III, or IV water heaters (see Clause 3, Definitions,) by the following Method of Test.

The provisions of Clause 5.5 do not apply to the following:

- Direct vent water heaters
- Water heaters for installation in manufactured homes (mobile homes)
- Water heaters for installation in recreational vehicles
- Water heaters for outdoor installation

Method of Test

This test shall be conducted using natural gas only, unless the water heater is for use with LP gas only or if the manufacturer specifies different inputs for natural and LP gas.

The water heater shall be connected to the vent pipe as specified in the water heater manufacturer's instructions. Vent pipe elbows shall be 90 degrees (1.57 rad). The vent pipe shall be arranged as follows:

a) Applicable to water heaters having input ratings of 400,000 Btu/hr (117 228 W) or less:

i) When the flue gases are vented horizontally from the water heater, a 2 ft (610 mm) section of vent pipe extending horizontally, an elbow, and a sufficient length of vertical vent pipe shall be attached to provide a total height of 5 ft (1.52 m) measured from the highest point of the draft hood relief opening(s) or point of connection of the venting system to the water heater, to the top of the vertical vent pipe.

ii) When the flue gases are vented vertically from the water heater, an elbow, a 2 ft (610 mm) section of vent pipe extending horizontally, a second elbow and sufficient vertical vent pipe shall be attached to the flue outlet to provide a total height of 5 ft (1.52 m) measured from the highest point of the draft hood relief opening(s) or point of connection of the venting system to the water heater to the top of the vertical vent pipe.

b) Applicable to water heaters having input ratings over 400,000 Btu/hr (117 228 W):

i) When the flue gases discharge horizontally, an elbow and 5 ft (1.52 m) of vertical vent pipe shall be attached to the draft hood outlet or in the absence of a draft hood, to the flue collar.



ii) When the flue gases are vented vertically, 4 ft (1.22 m) of vertical vent pipe shall be attached to the draft hood outlet or flue collar.

The vent pipe shall be equipped with: (1) a piezo ring (see Figure 5, Piezo ring and details of typical construction) installed at the midpoint of the 2 ft (610 mm) section of vent pipe extending horizontally; and (2) a thermocouple grid (as specified in Clause 5.19, Flue gas temperature) installed 12 inches (305 mm) from the outlet of the test vent. A differential pressure gage that can be read directly to 0.005 inch water column (1.24 Pa) pressure shall be attached to the piezo ring to measure static pressure. The vent pipe shall be insulated by means of foil-faced R7 material or greater and all pipe seams and joints shall be sealed.

1) For a water heater a single input rating

The water heater shall be operated at normal inlet test pressure. Water at a temperature of 70 ± 2 °F (21 ± 1 °C) and at a working pressure of not less than 40 psi (275.8 kPa) shall be supplied to the appliance through the inlet connection. Water flow shall be regulated to stabilize the outlet water temperature at 140 ± 5 °F (60 ± 3 °C). The appliance shall be operated until equilibrium conditions are attained at which time the temperatures indicated by the thermocouples shall be recorded and a sample of the vent gases shall be secured at the outlet of the test cent and analyzed for carbon dioxide as specified in Clause 5.4.1. The net vent gas temperature shall be determined by subtracting the room temperature from the vent gas temperature. (See Figure 6, Chart for determination of water heater category.)

The static pressure of the vent shall be measured by use of the piezo ring and recorded. The category of the water heater with respect to the venting system shall be determine using Table 12, Determination of category, and Figure 6.

2) For a water heater having multiple input ratings

This test shall be conducted as specified in -1) above except as follows.

The test to determine the static pressure in the vent shall be conducted at the maximum input rating only.

The net vent gas temperature and carbon dioxide concentration shall be determined at both minimum and maximum input ratings.

Using the data obtained above, the category of the water heater with respect to the venting system shall be determined using Table 12, and Figure 6.

If 2 categories are determined during conduct of this test, the water heater shall be rated at the higher of the 2 category numbers, and the venting system specified shall be suitable for the highest flue gas temperatures determined above.

c) For instantaneous, tube type and circulating water heaters

This test shall be conducted as specified in -b)-ii)-1) above, except as follows.

Use if a recirculating line with pump (see Figure 3, Arrangement for testing water-tube type instantaneous and circulating water heaters) to control inlet water temperature as specified by the manufacturer's installation instructions may be used. Specified inlet water temperature shall not exceed 110 °F (43.5 °C).

Section 5.28, Capacities of tube type water heaters; Added a method of test to determine the capacity of tub type water heaters as follows:

The amount of water contained in a tube type water heater or in a water heater that has not been tested under Clause 5.27, Capacities of storage vessels, shall be determined if it is 10 gallons (37.9 L) or



more.

Method of Test

The volume of water contained within the water heater shall be determined. This determination shall include all water contained within the unit from the inlet connection to the outlet connection but not the capacity of any separate storage vessels. The volume of water contained within the water heater shall then be computed in gallons (liters).

Section 5.29, Hydrostatic test; Included a method of testing the heat exchanger hydrostatic pressure as follows:

5.29.2

~~Water-carrying parts of water heaters not containing a storage vessel and~~ The heat exchanger(s), the device(s) responsible for the transfer of heat from the flue gases to water, of a water heater not containing a storage vessel and that are stamped with an ASME symbol indicating compliance with the ANSI/ASME Boiler and Pressure Vessel Code are exempt from this provision.

~~Water-carrying parts~~ The heat exchanger(s) shall withstand for a period of 10 minutes a hydrostatic test pressure of ~~two~~ 2 times the manufacturers rated maximum working pressure, but not less than 300 psi (2.07 MPa), without rupture or visible permanent deformation.

Method of Test

The system shall be filled with water at 70 °F (21 °C). Pressure shall be applied to the heat exchanger and the pressure shall be increased from the stated maximum operating pressure at a rate of 20 psi (138 MPa) per minute as measured on a pressure gage readable to 5 psi (34.5 MPa).

There shall be no rupture or visible permanent deformation of the heat exchanger after 10 minutes at the required test pressure.

Section 5.32, Venting systems for Category II, III, or IV water heaters: Added a method of testing the gas tightness and water-tightness of venting systems supplied with Category II, III or IV water heaters as follows:

A venting system supplied with a Category III or IV water heater shall be gas-tight. A venting system supplied with a Category II or IV water heater shall be water-tight.

This provision shall be deemed met if leakage from the venting system is not in excess of the limit specified in the following Method of Test.

Method of Test

This test shall be conducted using the maximum vent length and number of joints, including fittings, as specified by the manufacturer. For purposes of this test, the manufacturer shall supply: (1) the venting system that incorporates the maximum specified number of fittings, and (2) a sealed test fitting incorporating the vent collar to which the venting system is to be attached. This test fitting shall also have an inlet tap(s) to which a pressure source and a pressure measuring device can be attached.

The entire venting system, including the vent connector and terminal cap, shall be installed (and sealed, if applicable) in accordance with the manufacturer's instructions.

The outlet of the venting system shall be sealed. The inlet fitting shall be connected to an air supply (pressure source) and a pressure measuring device for measuring the internal pressure of the system.

This device shall be capable of being read to 0.01 inch water column (2.5 Pa).

A suitable supply of clean air shall be permitted to flow through a metering device and into the venting



system being pressurized through the air supply fitting.

The internal air pressure in the system being pressurized shall be maintained at 2 inch water column

(498 Pa) or 2 times the maximum system operating pressure as specified by the manufacturer,

whichever is greater. The leakage rate shall be measured in cubic feet per hour (cm³/s).

This provision shall be deemed met if leakage from the venting system does not exceed 2.0 percent of the products of combustion. This value shall be determined by the following formula:*

$Le = 0.02x Vx/$

where

Le = allowable leakage rate from the venting system, cu. ft. (cm³) per hour;

V = 15 cu. ft. (0.43 m³) of flue products based on the formation of approximately 10 cu. ft. (0.28 m³) of dry flue products, plus 5 cu. ft. (0.43 m³) of excess air, when 1000 Btu (1055 Kj) of fuel gas is burned; and

= input rating, in thousands of Btu (W) per hour.

Note: Allowable leakage rates in cubic centimeters per second (cm³/s) for water heaters rated in watts (W) can be

determined by multiplying the input rating by 8.05.

* This formula may be simplified to read $Le = 0.3 x I$.

Annex E (normative), Efficiency test procedures: Included new method of test for measuring standby loss of for tube type instantaneous water heaters with 10 or greater gallons of storage.

E.2 Method of test for measuring standby loss

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Standby Loss for tank type water heater shall be determined using Clause E.2

Standby Loss for tube type water heaters that contain 10 or more gallons within the water heater, as determined under Clause 5.27, Capacities of storage vessels, shall be determined using Figure 3.

E.3 Method of test for measuring standby loss for tube type instantaneous water heaters with 10 or greater gallons of storage

The appliance shall be installed as specified...

Figure 2-A, Direct vent terminal clearances: Clarified the clearance to service regulator vent outlet requirements.

Figure 2-B, Other than direct vent terminal clearances: Changed the specific requirements for clearance to each side of center line extended above meter regulator assembly to those specified by referenced standards ANSI Z223.1/NFPA 54 or CSA B149.1.

The following new figures were added:

Figure 5

Piezo ring and details of construction

Figure 6

Chart for determination of water heater category

The following new Table was added:



[Table 12](#)
[Determination of category](#)