Summary of Substantive Changes
between the 2017 and the 2019 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 December 7, 2020.

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

- Added construction requirements for venting including corrosion resistance metallic vents and a strength test for non-metallic vents (see Sections 4.1.25, 4.2.11, and 4.26)
- Added maintenance and marking requirements for condensing appliances and venting (see Sections 4.31.2, 4.32.3, and 4.32.27)
- Restructured and revised performance requirements for non-metallic venting, and added a test for condensate disposal systems (see Sections 5.5, 5.18, and 5.33)
- Expanded Table 14 to allow additional materials for non-metallic venting including polypropylene and different types of PVC and CPVC (see Table 14)
- Revised Figure 9 for clarification (see Figure 9)

Section 4, Construction: Added construction requirements for venting including corrosion resistance metallic vents and a strength test for non-metallic vents as follows:

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, joining means, and methods 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~~31.2b) ~~xxi~~xxiii) 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.*

4.2.11
A venting system supplied with a Category II or IV appliance shall be constructed of material resistant to corrosion by condensate. Non-metallic material shall be judged on its temperature limitations, strength, and resistance to the action of condensate.

4.26 Non-metallic vent and air intake connection strength test
Venting and air intake system parts, including parts within a water heater, shall not break, disassemble, or become damaged when subjected to a longitudinal force of 50 lb (223 N) and a torque of 25 ft-lb (34 N•m).
Method of Test

A section of non-metallic vent material of sufficient length to perform this test shall be connected to the exhaust outlet of the water heater.
The water heater venting system shall be installed on the water heater in accordance with the appliance or vent manufacturer's instructions. If cemented joints are included in the assembly of the water heater vent system, the cement shall be allowed to dry as specified in the manufacturer's instructions.
A 50 lb (223 N) force shall be applied along the longitudinal center-line of the vent pipe in a direction tending to pull the vent from the water heater for 5 minutes. The vent shall not become disconnected. A similar force is then applied in the opposite direction for 5 minutes. The vent shall not become disconnected.
A torque of 25 ft-lb (34 N•m) is applied to the center-line of the assembly for 1 minute, from one rotation direction. The torque shall then be applied in the opposite direction for 1 minute.
After forces and torques have been applied, there shall be no signs of leakage, breakage, or disassembly of the venting and air intake system parts when visually examined.

Section 4.31, Instructions: Added maintenance and marking requirements for condensing appliances and venting as follows:

~~4.30.2~~4.31.2

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.

…….

Instructions shall bear the seal or symbol of the testing agency.

The instructions shall include:

…….

2) For condensing appliances, the following statement:

…..

xx) Unless design certified for coverage with insulation, the instructions shall prohibit covering non-metallic vent pipe and fittings with thermal insulation. If coverage with insulation is not prohibited, the instructions shall specify the type, thickness, and thermal resistance value of the design certified insulation covering.

7) Instructions for proper venting installation:

……

B) For Category II, III, and IV appliances, the venting system shall be installed in accordance with the appliance manufacturer's installation instructions and, if applicable, the venting manufacturer's installation instructions.

The instructions for the installation of the venting system shall specify that the horizontal portions of the venting system shall be supported to prevent sagging; the methods of and intervals for support shall be specified. These instructions shall also specify that the venting system:

i) for Category I and II appliances, have horizontal runs sloping upwards not less than 1/4 in/ft (21 mm/m) from the appliance to the vent terminal;

ii) for Category III and IV appliances, slope shall be as specified in the appliance manufacturer's instructions; and

iii) for Category II and IV appliances, be installed with a means for condensate disposal.

…….

8) If an appliance is marked, "Category I or Category III", the installation manuals shall specify the venting system to be used for each category.

xxiii) When an existing Category I appliance is removed or replaced, the original venting system may no longer be sized to properly vent the attached appliances. Instructions shall also indicate effects of an improperly sized venting system (formation of condensate, leakage, spillage, etc.).

c) Maintenance instructions (including recommended frequency guidelines) suggesting:

i) lubrication of moving parts (when applicable), including type and amount of lubricant.

ii) periodic cleaning of the screens in the vent terminal (where applicable);

……

x) a condensate neutralization maintenance schedule, if a condensate neutralization means is provided;

xi periodic cleaning of the condensate collection and disposal system(s) (if applicable); and

xii) for horizontally vented appliances, information on preventing blockage by snow.

~~4.31.3~~4.32.3

Rating plate(s)

Each water heater shall bear a plate, or a combination of adjacent plates, of Class IIIA marking material, located so as to be easily read when the appliance is in a normally installed position~~, on which shall appear the following~~:

A plate visible after removal of an access panel is satisfactory.

A rating plate(s) attached to the inner surface of a control compartment or door is considered acceptable if the door cannot be separated from the appliance using ordinary hand tools.

This plate(s) shall include the following information:

…….

u) Category of water heater, as applicable:

i) "Category I" (Fan-Assisted or Natural Draft);

ii) "Category II";

iii) "Category III";

iv) "Category IV"; and

v) "Category I or III (see manufacturer's installation instructions)".

The above marking is not required for direct vent water heaters, water heaters for installation in manufactured homes (mobile homes), water heaters for installation in recreational vehicles or water heaters for outdoor installation.

4.32.27

If a water heater may be installed as a direct vent water heater or installed to use indoor combustion air, it shall bear the following marking: "FOR EITHER DIRECT VENT INSTALLATION OR FOR INSTALLATION USING INDOOR COMBUSTION AIR (see manufacturer's installation instructions)".

Section 5, Performance: Restructured and revised performance requirements for non-metallic venting, and added a test for condensate disposal systems as follows:

5.5 Category determination

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.

…..

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.

……

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

i) The vent pipe shall be equipped with: (1) a piezo ring (see Figure ~~6~~5, Piezo ring and details of typical construction) ~~at the midpoint of the 2 ft (610 mm) section of vent pipe extending horizontally;~~ installed 12 in (305 mm) from the inlet of the test vent; and (2) a thermocouple grid (as specified in Clause 5.18, Flue gas temperature) installed 12 in (305 mm) from the outlet of the test vent. A differential pressure gauge that can be read directly to 0.005 in wc (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.

~~i~~ii) 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; or

iii) 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.

5.18 Non-metallic vent material temperatures

~~5.17.1~~*The temperatures of the non-metallic venting system of a water heater shall not exceed the temperature for which the venting system material has been determined to be acceptable. The allowable temperatures of typical venting system materials are specified in Table 14, Maximum allowable temperatures of typical non-metallic vent material used in water heaters*

Method of Test

~~a)For venting materials having a Heat Deflection Temperature (HDT) only.~~

The water heater shall be installed in an enclosure as specified in Clause ~~5.16, Evaluation of burn hazard potential of exterior surfaces~~ 5.17, Wall, floor, and ceiling temperatures. The venting system shall be installed in accordance with the manufacturer's instructions at maximum vent length and at the clearances from combustible materials specified by the manufacturer. The first elbow of the vent system shall be located at the closest possible distance from the outlet of the appliance permitted by the manufacturer's instructions but not more than 4 ft from the appliance outlet connection.

Five 24 AWG (0.20 mm2) bead-type iron-constantan thermocouples shall be imbedded in the vent material within 1/32 in (0.79 mm) of the inside wall of the material. The thermocouple positions shall be along the outside radius of the first elbow of the venting system. The thermocouples shall be spaced one inch apart with the first thermocouple located at the start of the radius at the outlet connection of the elbow. The remaining thermocouples shall be spaced back towards the water heater.

This test shall be conducted at normal inlet test pressure following the conduct of Clause 5.17. The appliance shall be placed in operation and temperature readings obtained by means of the thermocouples, individually connected to a potentiometer. Temperature readings shall then be recorded at 15-minute intervals until equilibrium conditions have been attained as indicated by temperature changes of not more than ± 5 °F (± 3 °C) between readings. The temperature of the venting systems shall be the maximum temperature of the five thermocouples imbedded in the wall of the vent material. When maximum temperatures have been attained, the maximum temperature recorded shall not exceed the temperature indicated by Table 14, Maximum allowable temperatures of typical non-metallic vent material used in water heaters.

~~b)For venting materials having a Heat Deflection Temperature (HDT) and a Relative Thermal Index (RTI).~~

~~*Four thermocouples, spaced 90 degrees (1.57 rad) apart, will be secured to the inside surface of the vent pipe. They shall be located as close as possible to the outlet of the appliance vent or in the highest temperature area, which may be at the closest elbow. An additional four thermocouples shall be located around the outside circumference of the plastic pipe directly opposite the thermocouples on the inside surface. See Figure 9, Thermocouple locations on pipe.*~~

5.33 Condensate disposal system(s)

A water heater having a condensate disposal system(s) shall, under conditions of a blocked condensate drain line(s), continue to operate satisfactorily or shall shut off main burner gas during conduct of the following Method of Test.

Method of Test

The condensate disposal system(s) shall be installed in accordance with the manufacturer's installation instructions. The condensate drain line(s) shall be blocked at or upstream of the narrowest point in the system(s). When the condensate disposal system(s) is provided with an overflow port, blockage shall be applied upstream of the overflow port or the port shall be plugged.

The water heater shall be placed in operation at normal input rate(s) and normal inlet test pressure. The condensate disposal system(s) shall be filled to the maximum level of water obtainable or to the point just prior to causing the water heater to shut off (the method of filling shall be at the discretion of the testing agency). The combustion shall be monitored during filling. At no time shall the combustion level [concentration of carbon monoxide in an air-free sample of the flue (vent) gases when tested in an atmosphere having a normal oxygen supply] exceed 0.04 percent or the water heater shall shut off main burner gas before the carbon monoxide level reaches 0.04 percent.

The safety shutoff device shall be bypassed, if necessary, and the water heater cycled as it would be under normal operating conditions. The main burner(s) and ignition device(s) shall ignite without delayed ignition, flame rollout, or flashback.

The bypass shall be removed. The water heater shall comply with the leakage current and dielectric withstand tests. A water heater that cannot be placed into operation under conditions of blocked condensate drain line(s) shall be deemed to comply with this test.

Table 3, Maximum safety control timings: Table 3 was revised. A new footnote was added for clarification as follows:

i) Permitted only when the total input at ignition is less than or equal to 2,500,000 Btu/hr (732 678 W).

Table 14, Maximum allowable temperatures of typical non-metallic bent material used in water heaters: The table was expanded to allow additional materials for non-metallic venting including polypropylene. Foot notes were added as follows:

** Based on Heat Deflection Temperature (ASTM D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position, referenced in above ASTM's: HDT @ 264 psi).*

† The HDT for polypropylene shall be provided by the material manufacturer as determined by ASTM D648.

‡ Applicable to Canada only.

§ Applicable to the United States only.

Figure 2-A, Direct vent terminal clearances: Figure 2-A was revised. The footnotes were revised and added to ensure minimum clearance requirements are met as follows:

*~~*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, one of the following shall be indicated: a minimum clearance value determined by testing in accordance with Clause 5.21, Draft hoods; or a reference to the following footnote:*~~

~~"Clearance in accordance with local installation codes and the requirements of the gas supplier."~~ The manufacturer shall specify a minimum clearance or state "Not applicable" in the table and/or instructions. The minimum distance from adjacent public walkways, adjacent buildings, openable windows, and building openings shall not be less than those values specified in the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CSA B149.1; Information on preventing blockage by snow; and Information on protecting building materials from degradation by flue gases.

† *A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.*

‡ *Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.*

Notes:

1) *In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code.*
2) *In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code.*
3) *If locally adopted installation codes specify clearances different than those illustrated, then the most stringent clearance shall prevail.*

Figure 2-B, Other than vent terminal clearances: Figure 2-B was revised. The footnotes were revised and added to ensure minimum clearance requirements are met as follows:

*~~*For clearances not specified in ANSI Z223.1/NFPA 54 or CSA B149.1, one of the following shall be indicated: a minimum clearance value determined by testing in accordance with Clause 5.21, Draft hoods; or a reference to the following footnote:*~~

~~"Clearance in accordance with local installation codes and the requirements of the gas supplier."~~ The manufacturer shall specify a minimum clearance or state "Not applicable" in the table and/or instructions. The minimum distance from adjacent public walkways, adjacent buildings, openable windows, and building openings shall not be less than those values specified in the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CSA B149.1; Information on preventing blockage by snow; and Information on protecting building materials from degradation by flue gases.

† *A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.*

‡ *Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.*

Notes:

1) *In accordance with the current CSA B149.1, Natural Gas and Propane Installation Code.*
2) *In accordance with the current ANSI Z223.1/NFPA 54, National Fuel Gas Code.*
3) *If locally adopted installation codes specify clearances different than those illustrated, then the most stringent clearance shall prevail.*

Figure 9, Thermocouple locations on pipe: Figure 9 was revised.