

*The most often heard contractor phrase:
No one else makes me do that, so why do I have to ...*

Water Heater Items

Violation 1 : The material used for the water heater pan drain line piping is not suitable for this use
Code Section : 2014 FBC-R P2801.5.1 Pan Size and Drain and 2014 FBC-P 507.1 Pan Size and Drain
Comments : Contractor to replace water heater pan drain line piping with a material suitable for this use

Violation 2 : The material used for the T&P relief valve discharge pipe is not rated for this use
Code Section : 2014 FBC-R P2609.2 Installation of Materials and 2014 FBC-P 303.2 Installation of Materials
Comments : Contractor to replace T&P pipe with a pipe of material approved for this use

Violation 3 : Water heater setting in pan where water is intended to be discharged to, from the temperature and pressure (T&P) relief valve, thermal expansion pressure relief valve, or other source
Code Section : 2014 FBC-R P2801.2 Installation and 2014 FBC-P 502.1 General
Comments : Contractor to relocate discharge from T&P relief valve, thermal expansion pressure relief valve, and any other pipe which may be discharging into the pan the water heater is setting in

Violation 1 : The material used for the water heater pan drain line piping is not suitable for this use

Most water heater pan drain line piping that I see is PVC. PVC is not permitted by the code to be used as the water heater pan drain line material.

From the 2014 Florida Building Code, Residential (bold and underlining are mine)

o *Chapter 28 - Water Heaters*

SECTION 2801 General

P2801.5 Required Pan

P2801.5.1 Pan size and drain.

The pan shall be not less than 1 1/2 inches (38 mm) deep and shall be of sufficient size and shape to receive all dripping or condensate from the tank or water heater. The pan shall be drained by an indirect waste pipe of not less minimum diameter of 3/4 inch (19 mm). Piping for safety pan drains shall be of those materials listed in Table P2905.5.

o *Chapter 29 – Water Supply and Distribution*

Section 2905 Material, Joints and Connections

TABLE P2905.5 WATER DISTRIBUTION PIPE

MATERIAL	STANDARD
Brass pipe	ASTM B 43
Chlorinated polyvinyl chloride (CPVC) plastic pipe and tubing	ASTM D 2846; ASTM F 441; ASTM F 442; CSA B137.6
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, WK, L, WL, M or WM)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 447
Cross-linked polyethylene (PEX) plastic tubing	ASTM F 876; ASTM F 877; CSA B137.5
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	ASTM F 1281; ASTM F 2262; CSA B137.10M
Cross-linked polyethylene/aluminum/high-density polyethylene (PEX-AL-HDPE)	ASTM F 1986
Galvanized steel pipe	ASTM A 53
Polyethylene/aluminum/polyethylene (PE-AL-PE) composite pipe	ASTM F 1282
Polyethylene of raised temperature (PE-RT) plastic tubing	ASTM F 2769
Polypropylene (PP) plastic pipe or tubing	ASTM F 2389; CSA B137.11
Stainless steel (Type 304/304L) pipe	ASTM A 312; ASTM A 778

(Jerry's Note: PVC is not listed in this table and is therefore not suitable for use as the pan drain material.)

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From the 2014 Florida Building Code, Plumbing (bold and underlining are mine)

- Chapter 5 - Water Heaters
SECTION 504 Safety Devices
504.7 Required Pan

504.7.1 Pan size and drain.

The pan shall be not less than 1 1/2 inches (38 mm) deep and shall be of sufficient size and shape to receive all dripping or condensate from the tank or water heater. The pan shall be drained by an indirect waste pipe having a diameter of not less than 3/4 inch (19 mm). Piping for safety pan drains shall be of those materials listed in Table 605.4.

- Chapter 6 – Water Supply and Distribution
Section 605 Material, Joints and Connections

TABLE 605.4 WATER DISTRIBUTION PIPE

MATERIAL	STANDARD
Brass pipe	ASTM B 43
Chlorinated polyvinyl chloride (CPVC) plastic pipe and tubing	ASTM D 2846; ASTM F 441; ASTM F 442; CSA B137.6
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, WK, L, WL, M or WM)	ASTM B 75; ASTM B 88; ASTM B 251; ASTM B 447
Cross-linked polyethylene (PEX) plastic tubing	ASTM F 876; ASTM F 877; CSA B137.5
Cross-linked polyethylene/aluminum/cross-linked polyethylene (PEX-AL-PEX) pipe	ASTM F 1281; ASTM F 2262; CSA B137.10M
Cross-linked polyethylene/aluminum/high-density polyethylene (PEX-AL-HDPE)	ASTM F 1986
Ductile iron pipe	AWWA C151/A21.51; AWWA C115/A21.15
Galvanized steel pipe	ASTM A 53
Polyethylene/aluminum/polyethylene (PE-AL-PE) composite pipe	ASTM F 1282
Polyethylene of raised temperature (PE-RT) plastic tubing	ASTM F 2769
Polypropylene (PP) plastic pipe or tubing	ASTM F 2389; CSA B137.11
Stainless steel pipe (Type 304/304L)	ASTM A 312; ASTM A 778
Stainless steel pipe (Type 316/316L)	ASTM A 312; ASTM A 778

(Jerry’s Note: PVC is not listed in this table and is therefore not suitable for use as the pan drain material.)

Violation 2 : The material used for the T&P relief valve discharge pipe is not rated for this use

I frequently am asked if CPVC and PEX are approved for use as the temperature and pressure (T&P) relief valve discharge pipe.

My responses *in the past*, based on the code, have been: “Yes. CPVC and PEX are listed in the code in the table of materials suitable for that use. As such, CPVC and PEX are suitable for use for T&P relief valve discharge piping.”

However ...

A fellow inspector pointed something out to me several months ago (and is the reason I started putting this newsletter together back in December 2014) – some water heater installation instructions have an additional requirement for the T&P relief valve discharge pipe material – that the material “Must be capable of withstanding 250°F (121°C) without distortion.”

The additional requirement can be found in the installation instructions, and seems to be limited to GAS water heaters. I have not yet found that requirement in installation instructions for electric water heaters. There may be some gas water heaters which may not have this additional requirement, but I have not found any so far.

This is based on the installation instructions I have read to date – and I acknowledge that I have not read all water heater installation instructions.

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How will the inspector know what material is permitted by the code and the manufacturer to be used for the T&P relief valve discharge piping?

- The only way to know for sure which material may be suitable for use as the T&P relief valve discharge piping for any given water heater is to read the installation instructions.

The installation instructions are required to be on-site during the inspection and are typically attached to the side of the water heater in a plastic bag.

I would be interested in hearing from all regarding what they find – is this additional requirement only found in gas water heater installation instructions, or if someone finds this additional requirement in an electric water heater installation instruction too.

A typical gas water heater installation instruction states, at the third bullet point down in the right column (continued from the bottom of the left column), that the T&P relief valve discharge piping material "[Must be capable of withstanding 250°F \(121°C\) without distortion.](#)"

This additional requirement raises this question:

- Does CPVC and/or PEX (or any nonmetallic material) meet the requirement of being capable of withstanding 250°F (121°C) without distortion?

After sending out multiple inquiries to several plastic pipe manufacturers, both CPVC and PEX, Plastic Pipe Institute (PPI), and the Plastic Pipe and Fittings Association (PPFA), I finally received a response.

GF Harvel, a CPVC pipe manufacturer, sent this response on July 2, 2015:

Hi Jerry

CPVC is rated for applications up to 210F for liquid distribution.

There are no higher temp ratings for vent or drain piping a that I am aware of.

Gary Sample

Director of Product Management

The answer to the above question is: 'No, CPVC is not rated for being able to withstand 250°F (121°C) without distortion.'

While I have not heard back from any PEX manufacturer, it is also a nonmetallic material and probably is not rated for any higher temperature uses than CPVC is rated for – as such, neither CPVC nor PEX would be permitted by code for use as the T&P relief valve discharge piping for water heaters which have the additional requirement of "Must be capable of withstanding 250°F (121°C) without distortion." in their installation instructions (which is likely gas water heaters, based on what I have found).

From the 2014 Florida Building Code, Residential

○ *Chapter 28 - Water Heaters*

Section P2803 Relief Valves

P2803.6 Installation of Relief Valve

P2803.6.1 Requirements for discharge pipe.

The discharge piping serving a pressure-relief valve, temperature relief valve or combination valve shall:

- 13. Be constructed of those materials listed in Section P2905.5 or materials tested, rated and approved for such use in accordance with ASME A112.4.1.*

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○ Chapter 29 – Water Supply and Distribution

Section 2905 Material, Joints and Connections

TABLE P2905.5 WATER DISTRIBUTION PIPE

(Table P2905.5 is shown above at Violation 1)

(Jerry's Note: While CPVC is listed in Table P2905.5 and is suitable for use as T&P relief valve discharge piping in many water heaters [electric water heaters, based on what I have found to date], CPVC is not rated as meeting that additional requirement of "Must be capable of withstanding 250°F (121°C) without distortion." [gas water heaters, based on what I have found to date] and is therefore not suitable for use as the T&P relief valve discharge piping with water heaters which have the additional requirement of "Must be capable of withstanding 250°F (121°C) without distortion." in their installation instructions.)

From the 2014 Florida Building Code, Plumbing

○ Chapter 5 - Water Heaters

SECTION 504 Safety Devices

504.6 Requirements for discharge piping.

The discharge piping serving a pressure relief valve, temperature relief valve or combination thereof shall:

13. Be constructed of those materials listed in Section 605.4 or materials tested, rated and approved for such use in accordance with ASME A112.4.1.

○ Chapter 6 – Water Supply and Distribution

Section 605 Material, Joints and Connections

TABLE 605.4 WATER DISTRIBUTION PIPE

(Table 605.4 is shown above at Violation 1)

(Jerry's Note: While CPVC is listed in Table P2905.5 and is suitable for use as T&P relief valve discharge piping in many water heaters [electric water heaters, based on what I have found to date], CPVC is not rated as meeting that additional requirement of "Must be capable of withstanding 250°F (121°C) without distortion." [gas water heaters, based on what I have found to date] and is therefore not suitable for use as the T&P relief valve discharge piping with water heaters which have the additional requirement of "Must be capable of withstanding 250°F (121°C) without distortion." in their installation instructions.)

Violation 3 : Water heater setting in pan where water is intended to be discharged to – from the temperature and pressure (T&P) relief valve, thermal expansion pressure relief valve, or other source

I sent the following inquiry to both A. O. Smith and State in December, 2014 and again in January 2015.

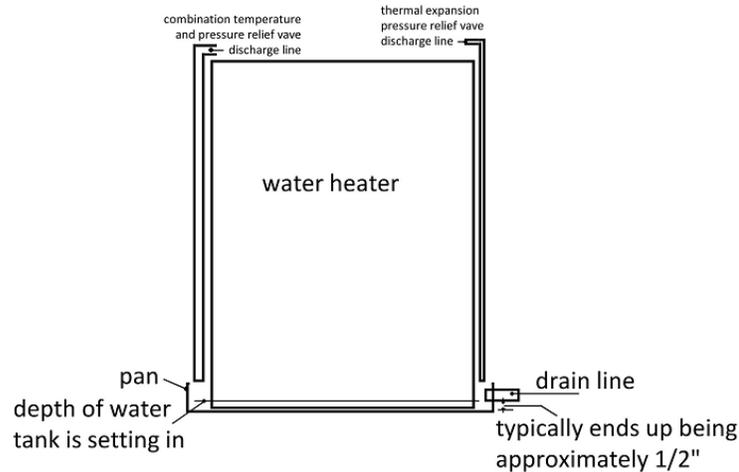
Below is a drawing of a typical installation of a water heater I find in Florida.

I have a few questions regarding the suitability and correctness of these installations:

- a) Is the water heater listed for installation partially submerged? I ask because once water discharges from either the temperature and pressure relief valve or the thermal expansion valve, and after the water drains out the pan drain, there is typically approximately 1/2 inch of water left in the pan. That water stays in the pan until it evaporates – I doubt that this condition is good for the water heater itself (rusting, etc.) or that this condition is addressed in the listing for the installation of the water heater.*
- b) Do you permit the discharge from a temperature and pressure relief valve to be discharged into the pan the water heater is setting in?*
- c) Do you permit the discharge from a thermal expansion pressure relief valve to be discharged into the pan the water heater is setting in?*
- d) How long do you permit the water heater to be setting in that water?*
- e) Should the water heater be elevated on non-absorbent blocks or spacers to be above the water line?*
- f) Should the water heater be elevated to be above the overflow lip of the drain pan?*

Typically, the discharge lines are installed just hanging down (CPVC and PEX are quite flexible, copper and steel are not as flexible but put pressure on the fittings and elbows when not secured in place) toward the floor without being strapped to anything to keep the discharge lines from moving around during a discharge – is it permitted to anchor these to the outer housing of the water heater with straps?

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I received the following reply from State water heaters on January 19, 2015: (*bold and underlining are mine*)

Good Afternoon Jerry,

*I apologize we did not receive the original email on 12/22/2014. **The water heater should never be partially submerged.** The drain pan should be piped to a drain to prevent water build up in the pan. The T&P valve should be piped to a drain, the pipe should stop about 6 inches above the floor. We do not require the water heater to be elevated but local codes may require this. If further assistance is needed, please contact our support team over the phone at 1-800-365-0024, Monday-Friday 7am-7pm Central Time and Saturday 8am-5pm Central Time.*

*Thank You,
Technical Support
Brandi*

I sent the same inquiry to A. O. Smith and did not receive a response. I then sent two more inquiries to A. O. Smith, after which I received the following response from A. O. Smith – from the same person (A. O. Smith and State):

Good Afternoon Jerry:

I apologize that you have not received a response back. Our answers to the questions would be the same, whether the water heater was a State, or A.O. Smith Brand. A.O. Smith is the parent company for State. Again I do apologize for any inconvenience this may have caused.

*Thank You,
Technical Support
Brandi*

About 15 years ago, I sent a similar inquiry to A. O. Smith. Their reply at that time was similar to the reply above.

A. O. Smith was adamant that the water heater not be allowed to set in any water, at any time, for any length of time.

When I inquired about when the T&P relief valve opens briefly (for whatever reason) or a pressure relief valve opens and water is discharged into the pan that the water heater was setting in – they responded that “someone will need to towel dry the water out immediately” as the water heater must not set in any water, at any time, for any amount of time, other than if the water heater itself is leaking, in which case the water heater will be replaced, resolving the issue.

A couple of years after my inquiry with A. O. Smith, I began to notice that their water heater installation instruction drawings began changing from showing the T&P relief valve discharge line in, at, or above the water heater pan to showing the T&P relief valve discharge line outside the pan. Most of the A. O. Smith installation instruction drawings I have seen recently show the T&P relief valve discharge pipe outside the pan at a floor drain (here are some typical installation instructions for A. O. Smith: [Residential Electric](#) – [Residential Gas](#) – [Commercial Electric](#) – [Commercial Gas](#)).

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The email replies from State/A. O. Smith, and the reply years ago from A. O. Smith, address my question about discharging the T&P relief valve and/or the thermal expansion relief valve into the pan the water heater is setting in with this statement: *"The water heater should never be partially submerged."*

If water is permitted to be discharged into the pan – from the T&P relief valve, thermal expansion relief valve, or other source – the water heater needs to be addressed in some manner which would keep the water heater out of the water as *"The water heater should never be partially submerged."* One option to keep the water heater out of the water would be to raise the water heater on water-resistant supports such that the water heater is above the overflow rim of the pan.

Another solution may be to not permit the T&P relief valve, thermal expansion relief valve, or other source to discharge into the pan the water heater is setting in – that removes the issue of the water heater setting in water from the discharge of another source. Leakage of the water heater itself is a different matter as the water heater is likely to require replacement due to the leakage.

Other solutions may be equally effective – I am simply pointing out an issue which I have observed at many water heater installations over the years and which should be addressed in some way. The end result should be that the water heater is not subject to setting in water from a source other than the water heater itself leaking.

You may be asking yourself: *What water is permitted to, or intended to, discharge into the pan?*

- a) T&P relief valves are [required to be tested](#) – see the Warning on the 1st page of the Watts T&P relief valve specification sheet states, at **WARNING**, **"Following installation, The valve lever MUST be operated AT LEAST ONCE A YEAR to ensure that the water-ways are clear."**

This same warning exists on the installation instructions of the various manufacturers for their water heaters (typical [A. O. Smith installation instructions, see page 24](#), first bullet point in center column). I've seen some water heater installation instructions in the past which required testing at least every 6 months; however, most require testing at least once per year.

If the T&P relief valve discharge pipe is located directly above the pan, the water from each test will discharge into the pan, causing the water heater to set partially submerged in water until the water evaporates.

- b) Thermal expansion valves are there to allow the thermal expansion to be released from the piping system – that is the intent of the thermal expansion relief valve – which means the released water is discharged into the pan – which is not intended to have water discharged into it, otherwise the water heater will be setting partially submerged in the pan until the water evaporates.

But ... just how much water can be expected to be released by the thermal expansion valve?

Could there really be *that much* water? Depends on how you define "that much water".

[Bradford White has a brochure for expansion tanks](#) which explains thermal expansion. [Watts has additional information and explanations](#) (click the "Play" button at the drawing), including how much water will need to be addressed for either an expansion tank or pressure relief valve discharge – "When water is heated it expands. For example, water heated from 90°F to a thermostat setting of 140°F in a 40 gallon hot water heater will expand by almost one-half gallon." ... one-half gallon of water discharging into the pan where the water heater is setting is a lot of water, and could happen every time the water is heated. Watts expansion tank sizing [calculator for volume of water being expanded](#) and expansion tank size recommendation.

Dumping a half-gallon of water on the floor makes for a rather large mess.

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Dumping that same half-gallon of water into the pan even once and letting the water heater set in it is not permitted. And – just how many times might this dumping of thermal expansion water occur per day/week/month?

The pan and drain line are there for when the water heater itself leaks. The pan is not there to serve as a drain receptor for other water. Water collecting in the pan from a leaking water heater will not 'cause' a problem – 'the problem' already exists ... the water heater is leaking. Discharging water from a T&P relief valve discharge pipe or a thermal relief valve could 'cause' a problem with the water heater, and, the water heater is not designed, intended, or listed to be partially submerged in water – not for any amount of time or in any depth of water.

From the 2014 Florida Building Code, Residential

○ *Chapter 28 - Water Heaters*

Section P2801 General

P2801.2 Installation.

Water heaters shall be installed in accordance with this chapter and Chapters 20 and 24.

○ *Chapter 20 - Boilers and Water-Heaters*

SECTION M2005 WATER HEATERS

M2005.1 General.

Water heaters shall be installed in accordance with the manufacturer's installation instructions and the requirements of this code. Water heaters installed in an attic shall comply with the requirements of Section M1305.1.3. Gas-fired water heaters shall comply with the requirements in Chapter 24. Domestic electric water heaters shall comply with UL 174. Oil-fired water heaters shall comply with UL 732. Thermo solar water heaters shall comply with Chapter 23 and UL 174. Solid-fuel-fired water heaters shall comply with UL 2523.

○ *Chapter 24 – Fuel Gas*

SECTION G2408 (305) INSTALLATION

G2408.1 (305.1) General.

Equipment and appliances shall be installed as required by the terms of their approval, in accordance with the conditions of listing, the manufacturer's instructions and this code. Manufacturers' installation instructions shall be available on the job site at the time of inspection. Where a code provision is less restrictive than the conditions of the listing of the equipment or appliance or the manufacturer's installation instructions, the conditions of the listing and the manufacturer's installation instructions shall apply.

Unlisted appliances approved in accordance with Section G2404.3 shall be limited to uses recommended by the manufacturer and shall be installed in accordance with the manufacturer's instructions, the provisions of this code and the requirements determined by the code official.

From the 2014 Florida Building Code, Plumbing

○ *Chapter 5 - Water Heaters*

SECTION 502 INSTALLATION

502.1 General.

Water heaters shall be installed in accordance with the manufacturer's installation instructions. Oil-fired water heaters shall conform to the requirements of this code and the Florida Building Code, Mechanical. Electric water heaters shall conform to the requirements of this code and NFPA 70. Gas-fired water heaters shall conform to the requirements of the Florida Building Code, Fuel Gas.

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Please, if you have any items, issues or tips you would like to share with other building officials / inspectors / plan reviewers, send the items, issues or tips to jerry@jerrypeck.com for inclusion in future newsletters.

All contributors will be acknowledged and given credit for their contributions ... please help others by sharing the items, issues, and tips you have found in the field or during plan reviews.

I look forward to all contributions.

Respectfully submitted,



Jerry Peck

Editor/Publisher

Inspectors' Field Comments Newsletter©

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