

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

**To Bond or Not To Bond ...
... that is the question.**

Violation : CSST gas piping is not additionally bonded with a minimum #6 AWG copper bond as required

Code Section(s) : 2014 FBC-Residential G2408.1 and G2411.1.1
2014 FBC-Fuel Gas 305.1 and 310.1.1

Comments : Contractor shall bond the CSST gas piping in accordance with the manufacturer's installation instructions and the code ... the code requires an additional bond with a minimum #6 AWG copper bonding conductor

Violation : CSST gas piping is not additionally bonded with a minimum #6 AWG copper bond as required

- A. Typical CSST with a yellow outer jacket, and which is a non-conductive jacket (not listed as a conductive jacket), requires an additional bond per the various manufacturers' installation instructions – and the code.

The following are from the major CSST manufacturers:

From the 2010 (current at this time) [Pro-Flex Installation/Training Guide](#) – *Electrical Bonding* starts on document page 28/file page 32; also see [Pro-Flex Electrical Bonding Update](#): (underlining is mine)

Pro-Flex® CSST installed inside or attached to the exterior of a building structure shall be electrically continuous and direct bonded to an effective ground-fault current path. The gas piping systems shall be considered to be direct bonded when installed in accordance with the following guidelines:

- *A bonding jumper is permanently and directly connected to the electrical service grounding system. This can be achieved through a connection to the electrical service equipment enclosure, the grounded conductor at the electrical service, the grounding electrode conductor (where of sufficient size) or to the one or more grounding electrodes used.*
- *The bonding conductor shall be no smaller than a 6 AWG copper wire or equivalent. Bonding/grounding clamps shall be attached in an approved manner in accordance with NEC and the listing of the clamp. Bonding /grounding clamps shall be listed to UL 467. The point of attachment for the bonding conductor shall be accessible. This bond is in addition to any other bonding requirements as specified by local codes.*

From the 2013 (current at this time) [Gastite Design and Installation Guide](#) – 4.10 *Electrical Bonding of Gastite/Flashshield CSST* starts on document page 73/file page 77: (underlining is mine)

The piping is permanently and directly connected to the electrical service equipment enclosure, the grounded conductor at the electrical service, the grounding electrode conductor (where of sufficient size) or to one or more of the grounding electrodes used. For single and multi-family structures, a single bond connection shall be made downstream of the individual gas meter for each housing unit and upstream of any CSST connection. The bonding conductor shall be no smaller than a 6 AWG copper wire or equivalent. The bonding wire shall be attached in an approved manner in accordance with NEC Article 250.70 and the point of attachment for the bonding wire shall be accessible. Bonding/grounding clamps shall be installed in accordance with its listing per UL 467 and shall make metal-to-metal contact with the piping. This bond is in addition to any other bonding requirements as specified by local codes.

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From the July 2014 (current at this time) [WardFlex Design and Installation Guide](#) – 4.10 WardFlex CSST Electrical Bonding starts on document page 54/file page 55; also see [Electrical Bonding FAQ](#): (underlining is mine)

- A bonding conductor is permanently and directly connected to the electrical service grounding system. This can be achieved through a connection to the electrical service equipment enclosure, the grounded conductor at the electrical service, the grounding electrode conductor (where of sufficient size) or to the one or more grounding electrodes used.
- The bonding conductor is not smaller than a #6 AWG copper wire or equivalent. The bonding conductor is installed and protected in accordance with the NEC.

From the August 2015 (current at this time) [TracPipe Flexible Gas Piping Design Guide and Installation Instructions](#) – 4.10 – Electrical Bonding/Grounding starts on document page 54/file page 56: (underlining is mine)

The piping is permanently and directly connected to the electrical service equipment enclosure, the grounded conductor at the electrical service, the grounding electrode conductor (where of sufficient size) or to one or more of the grounding electrodes used. For single and multi-family structures, a single bond connection shall be made downstream of the individual gas meter for each housing unit and upstream of any CSST connection. The bonding conductor shall be no smaller than a 6 AWG copper wire or equivalent. The bonding wire shall be attached in an approved manner in accordance with NEC Article 250.70 and the point of attachment for the bonding wire shall be accessible. Bonding/grounding clamps shall be installed in accordance with its listing per UL 467 and shall make metal-to-metal contact with the piping. This bond is in addition to any other bonding requirements as specified by local codes.

(Author's note:

The OmegaFlex TracPipe Flexible Gas Piping Design Guide and Installation Instructions references their CounterStrike conductive jacketed CSST. I contacted OmegaFlex inquiring as to whether TracPipe still produces the non-conductive yellow jacketed version, I spoke with Joe McGinnis Commercial Project - Applications Engineer OmegaFlex, Inc.

Joe McGinnis explained that the non-conductive yellow jacketed TracPipe is no longer manufactured for shipment to the United States as of 2011; however, the non-conductive yellow jacketed TracPipe is still shipped and installed in Canada – and that the Canada code requires both types to be bonded with a minimum #6 copper conductor.

Joe also confirmed that, in Florida and many other states, the conductive black jacketed CSST is still required to have the additional bond made with a minimum #6 AWG copper conductor.

He gave an example of the potential energy from even nearby lightning strikes – a neighborhood not far from their offices which has black iron gas piping had a lightning strike near several of the homes; after the lightning storm, many of the homes reported gas leaks; an investigation found that the amount of energy from the lightning strike which went through the black iron gas piping was enough to affect the pipe dope, causing leaks were at the pipe dope joints.)

B. CSST with a different color jacket, the jacket is typically black and is a conductive jacket, does not require that additional bonding per the manufacturers' installation instructions ...

... however ...

... the code does require the same additional bonding for all CSST gas piping systems, including those CSST gas piping systems which have the conductive outer jacket – see code provisions FBC-R G2408.1 and FBC-FG 305.1: *“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. Manufacturer's 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.”*

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Thus, where a code provision is not "less restrictive" than the manufacturer's installation instructions (i.e., where a code provision is 'more restrictive' than the manufacturer's installation instructions), then the installation shall meet the more restrictive provision of the code.

- C. The answer as to whether all CSST requires the "additional" bond to the electrical system grounding system is "Yes.", that "Yes." answer applies whether or not the CSST installed has the conductive outer jacket or the non-conductive outer jacket.

Some contractors have responded that the NEC permits the equipment grounding conductor to the appliance to serve as the gas piping bonding conductor:

- those contractors are correct when the gas piping system is Sch 40 steel pipe
- those contractors are not correct when the gas piping system is CSST
- both the code and the manufacturers' installation instructions require the "additional" bond be *The piping is "permanently and directly connected to the electrical service equipment enclosure, the grounded conductor at the electrical service, the grounding electrode conductor (where of sufficient size) or to one or more of the grounding electrodes used"* (the quote is from the *TracPipe Flexible Gas Piping Design Guide and Installation Instructions*).
- 'the CSST is to be bonded to the electrical system's grounding system' and 'the location of the bond to the CSST gas piping system shall be between the meter/regulator and the point of entrance into the structure' are basically the same for all CSST manufactures I have checked.

- D. From the 2014 Florida Building Code, Residential (underlining is mine)

○ CHAPTER 24 FUEL GAS

SECTION G2403 (202) GENERAL DEFINITIONS

EQUIPMENT. Apparatus and devices other than appliances.

APPLIANCE. Any apparatus or device that utilizes a fuel or raw material to produce light, heat, power, refrigeration or air conditioning.

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. Manufacturer's 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.

SECTION G2411 (310) ELECTRICAL BONDING

G2411.1.1 (310.1.1) CSST.

Corrugated stainless steel tubing (CSST) gas piping systems shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream CSST fitting. The bonding jumper shall be not smaller than 6 AWG copper wire or equivalent. Gas piping systems that contain one or more segments of CSST shall be bonded in accordance with this section.

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○ CHAPTER 36 SERVICES

SECTION E3609 BONDING

E3609.7 Bonding other metal piping.

Where installed in or attached to a building or structure, metal piping systems, including gas piping, capable of becoming energized shall be bonded to the service equipment enclosure, the grounded conductor at the service, the grounding electrode conductor where of sufficient size, or to the one or more grounding electrodes used. The bonding conductor(s) or jumper(s) shall be sized in accordance with Table E3908.12 using the rating of the circuit capable of energizing the piping. The equipment grounding conductor for the circuit that is capable of energizing the piping shall be permitted to serve as the bonding means. The points of attachment of the bonding jumper(s) shall be accessible.

(Author's note:

The requirements of E3609.7 Bonding of other metal piping (Florida Building Code, Residential – Electrical chapters) are less than the requirements in the Florida Building Code, Residential – Fuel Gas chapter, and are also less than the requirements stated in the listing and installation instructions for the CSST – the most restrictive of which shall apply. The most restrictive of which are the requirements of the Florida Building Code, Residential-Fuel Gas chapters and the Fuel Gas code, as such those requirements take precedence. This means that the “additional” bonding IS required.)

From the 2014 Florida Building Code, Fuel Gas

○ CHAPTER 3 GENERAL REGULATIONS

SECTION 305 (IFGC) INSTALLATION

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 301.3 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.

SECTION 310 (IFGS) ELECTRICAL BONDING

310.1.1 CSST.

Corrugated stainless steel tubing (CSST) gas piping systems shall be bonded to the electrical service grounding electrode system. The bonding jumper shall connect to a metallic pipe or fitting between the point of delivery and the first downstream CSST fitting. The bonding jumper shall be not smaller than 6 AWG copper wire or equivalent. Gas piping systems that contain one or more segments of CSST shall be bonded in accordance with this section.

From the 2011 National Electrical Code:

250.104 Bonding of Piping Systems and Exposed Structural Metal.

(B) Other Metal Piping. If installed in, or attached to, a building or structure, a metal piping system(s), including gas piping, that is likely to become energized shall be bonded to the service equipment enclosure; the grounded conductor at the service; the grounding electrode conductor, if of sufficient size; or to one or more grounding electrodes used. The bonding conductor(s) or jumper(s) shall be sized in accordance with 250.122, using the rating of the circuit that is likely to energize the piping system(s). The equipment grounding conductor for the circuit that is likely to energize the piping shall be permitted to serve as the bonding means. The points of attachment of the bonding jumper(s) shall be accessible.

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(Author's note:

The requirements of the 2011 National Electrical Code are less than the requirements in the Florida Building Code, Residential – Fuel Gas chapter, and are also less than the requirements stating in the listing and installation instructions for the CSST – the most restrictive of which shall apply. The most restrictive of which are the requirements of the Florida Building Code, Residential- Fuel Gas chapters and the Fuel Gas code, as such those requirements take precedence. This means that the “additional” bonding IS required.)

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I look forward to all contributions.

Respectfully submitted,



Jerry Peck

Editor/Publisher

Inspectors' Field Comments Newsletter©

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