



## Technical Bulletin

**Topic:** Requirements for the Grounding of Corrugated Stainless Steel Tubing (CSST) for Gas Supply Lines

Subject:  
**Gas Piping Supply Code Requirements**

Sub-Category:  
**Corrugated Stainless Steel Tubing (Flexible Gas Line) Grounding Requirements**

**Purpose:** To ensure that all field staff and contractors understand the grounding requirements for CSST gas supply lines.

**Background:** In the early 1990s corrugated stainless steel tubing was introduced into the residential market as a quicker, easier alternative to installing black iron pipe for the purpose of supplying natural gas (NG) or liquid propane (LP) to heating and domestic hot water appliances. In the years since CSST has been used it has become apparent that if the CSST is not properly grounded or electrically bonded it can fail when the building is either directly or indirectly struck by lightning. This failure occurs due to the increased difference in electrical potential between metallic objects in the building and the gas piping system after a lightning strike.

Properly grounding or bonding the system to a ground reduces that electrical potential and reduces risk.





### *Code Required Grounding Specifications:*

While both traditional black iron piping and CSST serve the same purpose, the 2011 National Electric Code, 2009 National Fuel Gas Code, and the 2009 International Residential Code all agree that they shall be electrically grounded in very different ways.

The *2009 National Fuel Gas Code Handbook*, Section 7.13.1 and the *2009 IRC*, Section, Section G2411.1 have identical language when specifying the grounding requirements of *any* type of gas piping system *other* than CSST. The text follows:

*“Each aboveground portion of a gas piping system other than CSST that is likely to become energized shall be electrically continuous and bonded to an effective groundfault current path. Gas piping, other than CSST, shall be considered to be bonded when it is connected to appliances that are connected to the appliance grounding conductor of the circuit supplying that appliance.”*

Plainly stated this says that if an appliance gas piping system is not CSST it can be considered safely grounded if the appliance it supplies is hard-wired to the building's electrical service (including ground) or plugged into a three prong, properly grounded, electric outlet.

This requirement is very different from the grounding requirements of CSST. The text of the *2009 National Fuel Gas Code*, Section 7.13.2 and the *2009 IRC*, Section G2411.1.1 follow:

*“CSST gas piping systems shall be bonded to the electrical service grounding electrode system at the point where the gas service enters the building. The bonding jumper shall not be smaller than 6 AWG copper wire or equivalent.”*

This text states that the CSST shall be separately grounded to the electric service of the building, independent of the appliance(s) it may be attached to. That ground must have a minimum diameter of 6 AWG because it needs to be capable of dissipating huge amounts of energy fast enough to avoid electrical arcing, which may damage the CSST; the grounding wires of appliances are generally not capable of dissipating such severe electrical transients, caused by lightning strike.

The National Association of State Fire Marshalls provides safe and clear guidance on the proper way to ground or bond CSST to a home's electrical service. See:

[www.csstsafety.com/Images/CSST-Direct-Bonding-Tech-Bulletin.pdf](http://www.csstsafety.com/Images/CSST-Direct-Bonding-Tech-Bulletin.pdf)

(The document is reproduced on the last page for convenience).

See [csstsafety.com](http://csstsafety.com) for more information.

The photo below shows proper method for attaching the ground wire to CSST.



**Photo courtesy of the State of NH, Fire Marshalls Office.**

CSST is typically yellow jacketed as in the photo above. Manufacturers of black jacketed CSST products which have been tested and listed to ICC-ES LC 1024, “CSST Utilizing a Protective Jacket”, may not require or include in their instructions the additional direct bonding step that is required with standard (yellow) CSST products. However, New York State code does not currently recognize ICC-ES LC 1024 compliant CSST and therefore electrical bonding may still be required. Local codes are governing and must be adhered to.

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**Produced by Mark Hutchins of Conservation Services Group for NYSERDA  
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## Direct Bonding of Standard (Yellow) CSST

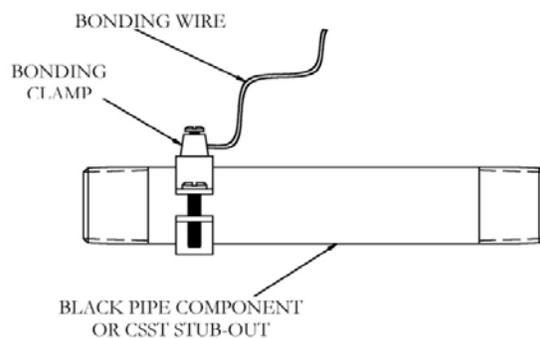
Direct bonding is required for all gas-piping systems incorporating standard (yellow) CSST whether or not the connected gas equipment is electrically powered. This requirement is provided as part of the manufacturer's instruction for single-family and multi-family buildings and required by the National Fuel Gas Code, the International Fuel Gas Code and the Uniform Plumbing Code. A person knowledgeable in electrical system design, the local electrical code and these requirements should specify the bonding for commercial applications.

Standard CSST installed inside or attached to a building or structure shall be electrically continuous and direct-bonded to the electrical ground system of the premise in which it is installed. The gas piping system shall be considered to be direct-bonded when installed in accordance with the following:

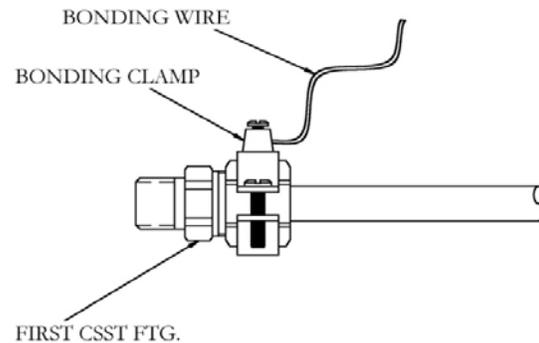
The piping is permanently and directly connected to the electrical service equipment enclosure, the grounded conductor at the electrical service, the grounding electrode conductor, or to one or more of the grounding electrodes used. For single and multi-family structures, **a single bond connection** shall be made downstream of the individual gas meter for each housing unit and upstream of the first CSST connection. The bonding conductor shall be no smaller than a 6 AWG copper wire or equivalent. The bonding jumper shall be attached in an approved manner in accordance with NEC Article 250.70 and the point of attachment for the bonding jumper 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 a steel pipe component or first CSST fitting. This bond is in addition to any other bonding requirements as specified by local codes.

The corrugated stainless steel tubing portion of the gas piping system shall not be used as the point of attachment of the bonding clamp at any location along its length under any circumstances. See examples provided in Figures 1 and 2.

**Fig. 1. Bonding Clamp on Steel Pipe**



**Fig. 2. Bonding Clamp on First CSST Fitting**



*Manufactures of black jacketed CSST products which have been tested and listed to ICC-ES LC 1024, "CSST Utilizing a Protective Jacket", may not require or include in their instructions the additional direct-bonding step that is required with standard (yellow) CSST products. However local codes are controlling and may differ from manufacturer's requirements. Local codes are governing and must be adhered to.*