



# CodeNotes™

## Bonding of Corrugated Stainless Steel Tubing (CSST) Gas Piping System



### General

The bonding of corrugated stainless steel tubing (CSST) piping system to the grounding electrode system of the structure in which the CSST is installed will lower the voltage build-up on the CSST caused by unintentional energizing from outside sources such as power surges and lightning strikes. The bonding will help achieve an equi-potential state between the CSST and other similarly bonded metallic systems (such as the water piping, structural steel, electrical raceways and coax cable). The bonding will help reduce the possibility and severity of arcing between these conductive systems when energized by a lightning strike on or nearby the premises.

The 2015 editions of the *International Fuel Gas Code* and the *International Residential Code* include revisions to the requirements for the electrical protection of corrugated stainless steel tubing through an extra bonding connection (Section 310.1.1). This is in addition to the bonding required in Section 310.1 for ground fault protection. The CSST must be permanently bonded directly to the grounding electrode system of the electrical service of the home in which the CSST is installed. Bonding of gas piping systems is considered to be electrical work and should be performed by a qualified contractor who is recognized by the AHJ as capable of doing such work. The following highlights the various steps, hardware and practices needed to successfully bond and inspect the CSST gas piping system.

### Grounding vs. Bonding

**Ground:** A direct connection to the earth. Only the electrical distribution system is grounded.

**Bonding:** A conductor intentionally installed to electrically connect metallic gas piping to the grounding electrode system to create a low-impedance pathway to ground.

**Grounding Electrode:** Electrodes must be metallic and in contact with the Earth. The following items are typically used as electrodes:

- Plates
- Rods
- Structural steel
- Concrete encased reinforcing steel

All electrodes used must be bonded together into one common grounding electrode system. A separate grounding electrode and grounding system cannot be established just for the fuel gas piping system.

**Grounding Electrode System:** The system includes the grounding electrodes and the grounding electrode conductors.

The installation of the grounding electrodes and grounding systems is the responsibility of the electrical contractor and electrical inspector.

## Bonding Conductor

The bonding conductor can be a solid or stranded copper or aluminum conductor. The conductor can be installed indoors or outdoors.



Example of Bonding Conductor

The bonding conductor must not be smaller than a 6 AWG copper wire or the equivalent size if made of aluminum.

The means for attaching the bonding conductor to the grounding electrode system must be in accordance with NFPA 70.

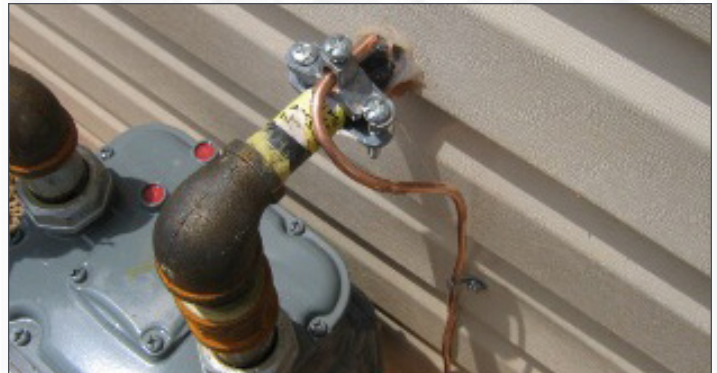


Grounding Electrode Connection

The bonding conductor must be not longer than 75 feet (22,860 MM). The location of the bonding clamp on the gas piping system must be selected so as to comply with the maximum allowable conductor length.

## Bonding Clamp and Locations

The bonding conductor must be attached to the CSST gas piping system downstream of the point of delivery (either the natural gas meter or the LP 2nd stage regulator). The bonding clamp can be located at any location within the piping system. In general, the shortest bonding conductor will be the most effective.



Bonding at the Service Entrance



Bonding at the Downstream LP 2nd Stage Regulator

The corrugated stainless steel tubing must never be used as a point of attachment of the bonding clamp.

Only a single point of attachment is required regardless of the length or complexity of the piping system. A CSST piping system is considered to be electrically continuous (using CSST and other code-approved piping materials) and only requires one clamp.

The conductor must be attached to the piping system using a listed bonding clamp based on UL 467. The bonding clamp must be accessible and can be located outdoors or indoors.

The clamp can be attached to a length of rigid pipe, a malleable iron pipe fitting, a prefabricated manifold, or a brass CSST fitting. The clamp used must be listed for the location and type of mechanical attachment.



Bonding of CSST Gas Piping

Where the clamp is attached to rigid pipe, the pipe surface must be clean and free of paint and coatings to permit a metal-to-metal connection.



Clamp Attachment on CSST Fitting

## A HISTORY NOTE:

Corrugated stainless steel tubing (CSST) originated in Japan as a solution to damaged gas piping caused by earthquakes.

## Piping System Considerations

All new CSST systems must be bonded regardless of whether the systems include only CSST or include other piping materials (steel pipe or copper pipe/tubing) in combination with CSST. Existing non-CSST piping systems must be bonded when CSST is added to the system regardless of the length of CSST added.

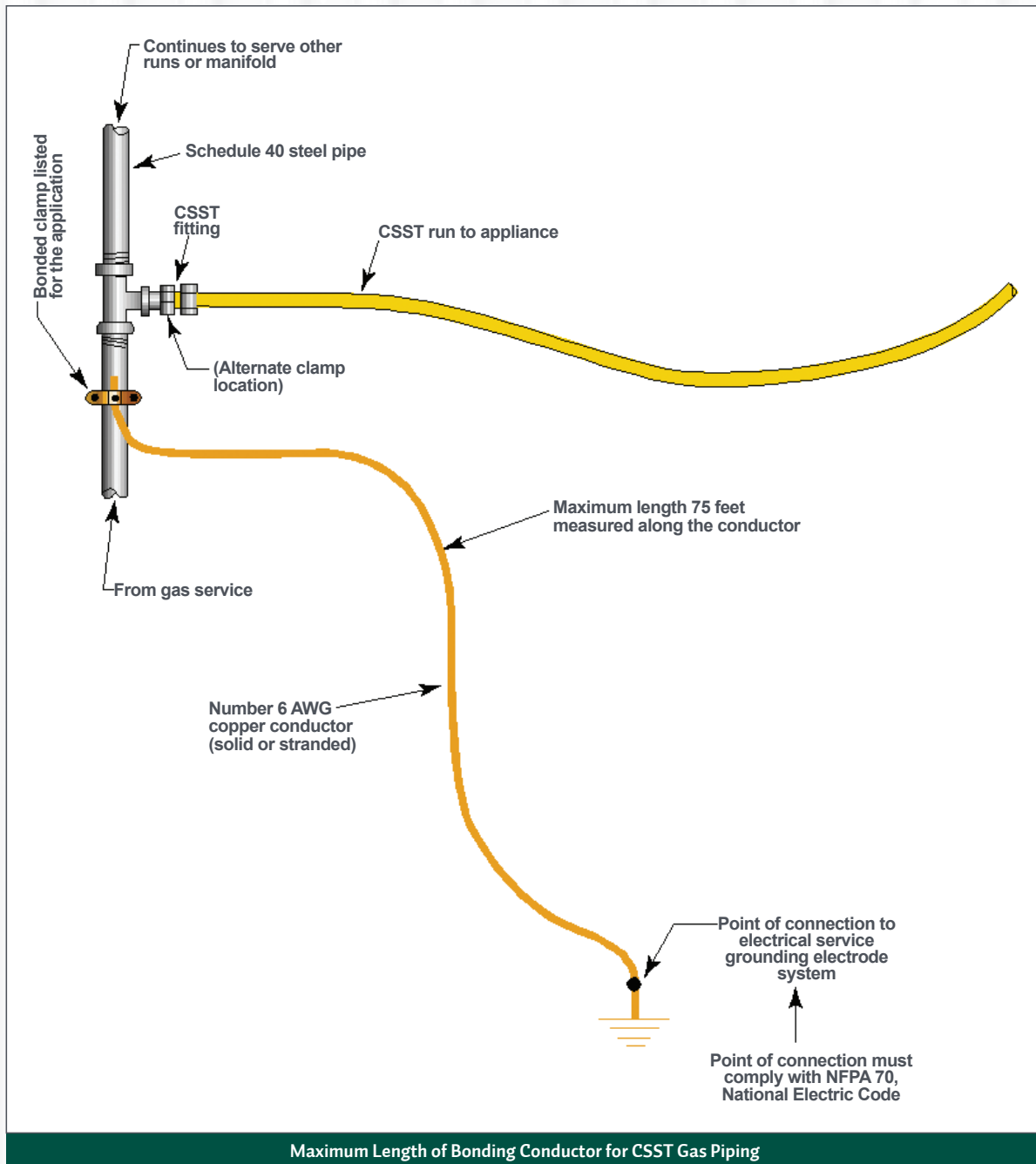


Example of Multi-piping Material System



## ICC Evaluation Service PMG Listing Directory

For additional information on the installation of CSST from a specific manufacturer, please search the ICC-ES PMG Listing Directory at visit [www.icc-es-pmg.org](http://www.icc-es-pmg.org). An ICC-ES PMG listing is a document issued on a product that has demonstrated compliance with the specified standard and has also demonstrated compliance with one or more of the following codes: *International Plumbing Code*®, *International Mechanical Code*®, *International Fuel Gas Code*®, *Uniform Plumbing Code*, *Uniform Mechanical Code* or *International Residential Code*®. ICC-ES requires an ongoing inspection of the manufacturing facility to ensure the product continuously meets the listing requirements.



The bonding requirements for arc-resistant CSST (black jacket) are the same as for the yellow jacket CSST except where the AHJ allows otherwise based on the jurisdiction's authority under the alternate approval provisions of the adopted codes and ordinances.



For complete coverage of the IFGC, please contact the International Code Council to order the *International Fuel Gas Code*, *International Residential Code*, the *IFGC or IRC Code and Commentary*, and other code support publications.  
[www.iccsafe.org/store](http://www.iccsafe.org/store) | 1-800-786-4452

