

**CSST: Direct Bonding Required for All Brands**

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*All opinions expressed are the personal opinions of the author, and do not necessarily represent the official position of any particular CSST manufacturer. The practices described in this paper are neither intended, nor should they be relied upon, to supersede the current CSST installation requirements in effect for any jurisdiction.*

There exists much confusing and contradictory information surrounding the technical issues affecting the requirement to bond the corrugated stainless steel tubing (CSST) gas piping system directly to the grounding electrode system. This confusion involves not only why CSST should be directly bonded, but also how to bond these systems to the grounding system of the building in which it is installed. Cutting Edge Solutions LLC has completed a review of the current situation and offers the following assessment of the requirements for the bonding of CSST systems.

### **Technical Drivers**

There have been accounts of damage to corrugated stainless steel tubing from both direct and indirect lightning strikes on or near residential structures containing this type of gas piping system. The damage is typically an arc-induced perforation that is created through the tubing wall from a voltage imbalance between the CSST and another electrically conductive system in close proximity. It is well known that direct bonding of metallic systems to the grounding electrode system will reduce the chances of arcing between electrically conductive pathways when energized by a high voltage source. Direct bonding (using a 6 AWG copper wire) of metallic piping systems, as well as other metal systems, to the building grounding electrode system allows these systems to be energized at (or near) the same voltage level as the electrical system, and in unison with the voltage pulse caused or induced by a direct or indirect lightning strike.

### **Model Codes and Standards**

The NFPA 780 Standard for the Installation of Lightning Protection Systems recommends the “equipotential” bonding of all underground metallic systems to reduce the potential for damage when energized by indirect lightning strikes. This interconnection is recommended for all underground metallic systems entering a building including the electric service, communications wires and piping systems. If the gas piping can be “safely” connected to the grounding electrode system under these circumstances, then it should logically follow that the bonding of CSST to the same grounding system should also be safe and effective whether or not there is a lightning protection system installed.

### **NEC: 250.104(B) and 110.3**

The mandatory direct bonding of CSST to the grounding electrode system (for lightning protection) is not specifically covered within Article 250.104(B) of the NEC. Although this type of bonding is not prohibited, the current coverage is intended for ground fault protection. Therefore, the bonding of CSST directly to the grounding electrode system, in accordance with the manufacturer bonding instructions, is above the minimum NEC requirements. However,

under Article 110.3(B), the NEC requires that “*listed or labeled equipment shall be installed and used in accordance with any instructions included in the listing or labeling.*”

### ANSI LC-1 and CSA Listing

CSST is a listed fuel gas system and is certified by CSA in accordance with a nationally recognized standard: ANSI LC-1-2005. There is no coverage or testing requirements in this standard for a lightning resistant coating. In accordance with this standard, the manufacturer’s Design and Installation Guide is considered part of the listed system. The CSA listing description for CSST states that the current edition of NFPA 54 should be used for installation guidance. Furthermore, the ANSI LC-1 Standard for CSST requires that the manufacturer’s installation instructions include the statement that CSST shall be installed in accordance with the National Fuel Gas Code in the absence of local codes.

### Manufacturer’s Installation Instructions

The Design Guide and Installation Instructions for each CSST manufacturer require that the CSST must be bonded to the grounding electrode system of the building and/or structure in which it is installed. The CSST must be installed in accordance with the current edition of the National Fuel Gas Code (NFPA 54) as well as the NEC. This is true for all CSST brands.

### NFPA 54: Section 7.13.2

The 2009 edition of NFPA 54 was approved by ANSI on September 5, 2008. The 2009 editions of the ICC International Fuel Gas Code and the IAPMO Uniform Plumbing Code also have exactly the same language and requirements. The latest editions of these codes require the following:

**7.13.1 Pipe and Tubing Other Than CSST.** 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 ground-fault 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.

**7.13.2 CSST.** 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 requirement should be enforced on all CSST brands and installations regardless of the fuel gas code in effect within the state, or the particular edition of the state code, and in addition to other gas piping requirements that are stipulated within the state fuel gas code. This is a self-imposed requirement stated through the CSA standard and listing, and the installation instructions of each manufacturer. In other words, compliance with the 2009 NFPA 54 should be in effect for all CSST brands for all installations in all states starting September 5, 2008. There were no exemptions included or implied by these bonding requirements.

### **Local Code and Jurisdiction Enforcement**

This code enforcement issue has been raised by many states and local jurisdictions around the United States. Essentially, every jurisdiction in the United States adopts some version of the

NEC, and, as previously noted, there is an absence of coverage in this code for the direct bonding of CSST for lightning protection. Most jurisdictions have, therefore, accepted the manufacturer's instructions and enforce the bonding through these requirements. However, in some cases, a state amendment and/or local code ordinance has been submitted, sent through a public review process and enacted. Most recently, the State of New York, through its Building Code Council, approved new regulations requiring the bonding of CSST that are consistent with the manufacturer's instructions, but with additional state imposed restrictions. Over the past year, code changes or administrative acceptances have been achieved in several states including Indiana, Virginia, Georgia and Minnesota. However, until there is comparable bonding coverage within the National Electric Code, CSST installers and electrical contractors are cautioned to get local concurrence (regarding the direct bonding of CSST) from the electrical inspection department in the jurisdiction where the work will be performed.

### **Who is Responsible?**

While the plumbing/CSST contractor must file for a plumbing permit to install a new piping system, the bonding of CSST must be performed by a qualified contractor recognized by the Authority Having Jurisdiction as capable of performing such work. In jurisdictions where bonding is considered electrical work, the electrician should include this activity in the general electrical permit. In other jurisdictions, the CSST bonding is being handled with a special electrical permit until such time that the NEC is modified.

However, it is not uncommon (particularly on remodeling jobs and in rural areas) for the HVAC or plumbing contractor with a limited electrical license to install the bonding clamp and conductor provided the connection to the grounding electrode system is outside the service enclosure. However, if the HVAC contractor only pulls a plumbing permit, the electrical inspector may not become aware that an electrical inspection is needed. It is the responsibility of the CSST installer to be familiar with the installation requirements contained within the Design and Installation Guide of the CSST manufacturer and local regulations. In some cases, the CSST installer will be required to hire an electrician (who is familiar with the local electrical code requirements for bonding) to complete this portion of the installation for both new and existing piping systems. Until the NEC is modified, the CSST installer is responsible to ensure that all proper permits pertaining to the complete gas piping installation are issued.

### **Summary**

The direct bonding of CSST systems to the grounding electrode system of the building in which it is installed will reduce the possibility of arcing damage caused by indirect lightning strikes. The installation of an electrical bonding connection for CSST gas piping systems is required for all CSST systems (both new and retrofit) regardless of the type of gas appliances connected. In the absence of specific state/local code coverage on this type of bonding, the installer should follow the manufacturer's installation instructions, the requirements of the 2009 edition of the NFPA 54 code as well as local regulations. The AHJ should determine the proper course of action should there be any conflict between these requirements and local regulations.