

Memorandum

Date:	June 5, 2015
To:	Municipal Building Officials and Fire Marshals
From:	Joseph V. Cassidy, P.E., Acting State Building Inspector William Abbott, State Fire Marshal
Subject:	Bonding of Corrugated Stainless Steel Tubing (CSST)

The purpose of this memorandum is to clarify the requirements for bonding Corrugated Stainless Steel Tubing (CSST) gas piping systems. The recent adoption of the 2015 Fire Prevention Code and amendment to the State Building Code have led to much confusion what standards apply to which building types.

Until recently Connecticut General Statute (CGS) 29-329 provided the requirements for installation of gas equipment and gas piping in all buildings. This statute was changed to mandate that the State Fire Marshal adopt regulations within the Fire Prevention Code to regulate these installations. Similar changes were made in CGS 29-331 relating to liquefied petroleum gas installations.

The 2015 Connecticut Fire Prevention Code (CFPC) was adopted on May 7, 2015 and includes NFPA 54 National Fuel Gas Code as the standard for installation of gas equipment and piping. The scope of the CFPC excludes one and two family homes and townhouses, meaning the NFPA 54 standard in the CFPC cannot be enforced in these building types. The enforceable code for **one and two family homes and townhouses** is the 2009 International Residential Code (IRC) portion of the State Building Code.

For all installations **other than one and two family homes and townhouses** the bonding requirement is NFPA 54-2012 section 7.13.2, which states:

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 not be 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.

For installations in **one and two family homes and townhouses** the CSST bonding requirement is found in the 2009 IRC section G2411.1.1 as amended, which states:

Corrugated stainless steel tubing (CSST). CSST gas piping shall be bonded in accordance with manufacturer's installation instructions.

Most manufacturer's instructions we have reviewed do point to NFPA 54 as the standard for installation of their product, so the NFPA 54 bonding configuration will be the norm. However, there may be manufacturers that provide specific bonding instructions or refer to other standards, such as the National Electrical Code (NFPA 70). Having and understanding the manufacturer's installation instruction will be critical in properly inspecting residential CSST installations.

In the near future we will be adopting the 2012 IRC as part of the State Building Code. The bonding requirement in the 2012 IRC is the same as the section 7.13.2 NFPA 54-2012 requirement. Once the 2012 IRC is adopted into the State Building Code, all installations will be required to be bonded in this manner.

more grounding electrodes used. The bonding jumper shall be sized in accordance with Table E3603.1. The points of attachment of the bonding jumper(s) shall be accessible.

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.

**SECTION E3610
GROUNDING ELECTRODE CONDUCTORS**

E3610.1 Continuous. The grounding electrode conductor shall be installed in one continuous length without splices or joints and shall run to any convenient grounding electrode available in the grounding electrode system where the other electrode(s), if any, are connected by bonding jumpers in accordance with Section E3608.2, or to one or more grounding electrode(s) individually. The grounding electrode conductor shall be sized for the largest grounding electrode conductor required among all of the electrodes connected to it.

Exception: Splicing of the grounding electrode conductor by irreversible compression-type connectors listed as grounding and bonding equipment or by the exothermic welding process shall not be prohibited.

E3610.2 Securing and protection against physical damage. Where exposed, a grounding electrode conductor or its enclosure shall be securely fastened to the surface on which it is carried. Grounding electrode conductors shall be permitted to be installed on or through framing members. A 4 AWG or larger conductor shall be protected where exposed to physical damage. A 6 AWG grounding conductor that is free from exposure to physical damage shall be permitted to be run along the surface of the building construction without metal covering or protection where it is and securely fastened to the construction; otherwise, it shall be in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride (PVC), nonmetallic conduit, reinforced thermosetting resin (RTRC) nonmetallic conduit, electrical metallic tubing or cable armor. Grounding electrode conductors smaller than 6 AWG shall be in rigid metal conduit, intermediate metal conduit, rigid polyvinyl chloride (PVC) nonmetallic conduit, reinforced thermosetting resin (RTRC) nonmetallic conduit, electrical metallic tubing or cable armor.

Bare aluminum or copper-clad aluminum grounding electrode conductors shall not be used where in direct contact with masonry or the earth or where subject to corrosive conditions. Where used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be installed within 18 inches (457 mm) of the earth.

E3610.3 Enclosures for grounding electrode conductors. Ferrous metal enclosures for grounding electrode conductors shall be electrically continuous from the point of attachment to cabinets or equipment to the grounding electrode, and shall be securely fastened to the ground clamp or fitting. Nonferrous metal enclosures shall not be required to be electrically continuous. Ferrous metal enclosures that are not physically continuous from cabinet or equipment to the grounding electrode shall be made electrically continuous by bonding each end to the grounding electrode conductor. Bonding methods in compliance with Section E3609.4 for installations at service equipment locations and with E3609.4.2(B)(2) through E3609.4.4 for other than service equipment locations shall apply at each end and to all intervening ferrous raceways, boxes, and enclosures between the cabinets or equipment and the grounding electrode. The bonding jumper for a grounding electrode conductor raceway shall be the same size or larger than the required enclosed grounding electrode conductor.

Where a raceway is used as protection for a grounding conductor, the installation shall comply with the requirements of Chapter 38.

E3610.4 Prohibited use. An equipment grounding conductor shall not be used as a grounding electrode conductor.

**SECTION E3611
GROUNDING ELECTRODE CONDUCTOR
CONNECTION TO THE GROUNDING ELECTRODES**

E3611.1 Methods of grounding conductor connection to electrodes. The grounding or bonding conductor shall be connected to the grounding electrode by exothermic welding, listed lugs, listed pressure connectors, listed clamps or other listed means. Connections depending on solder shall not be used. Ground clamps shall be listed for the materials of the grounding electrode and the grounding electrode conductor and, where used on pipe, rod or other buried electrodes, shall also be listed for direct soil burial or concrete encasement. Not more than one conductor shall be connected to the grounding electrode by a single clamp or fitting unless the clamp or fitting is listed for multiple conductors. One of the methods indicated in the following items shall be used:

1. A pipe fitting, pipe plug or other approved device screwed into a pipe or pipe fitting.
2. A listed bolted clamp of cast bronze or brass, or plain or malleable iron.
3. For indoor communications purposes only, a listed sheet metal strap-type ground clamp having a rigid metal base that seats on the electrode and having a strap of such material and dimensions that it is not likely to stretch during or after installation.
4. Other equally substantial approved means.

E3611.2 Accessibility. All mechanical elements used to terminate a grounding electrode conductor or bonding jumper to the grounding electrodes that are not buried or concrete encased shall be accessible.

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