The use of corrugated stainless-steel tubing jacketed with yellow PVC or polyethylene (CSST) as piping for natural and LP gas has been growing rapidly since its introduction in 1989. This is because of the greatly reduced installation labor compared to using conventional black pipe with threaded fittings. Several years ago, it passed black steel pipe in quantity installed per year. Photo 1 shows a natural gas service entering a building, with a field-assembled manifold for connecting CSST to serve three gas appliances, plus a run of black pipe serving another manifold on the other side of the building. (Since the connection to the contractor’s heater is only temporary, the bonding clamp and conductor have not yet been installed.)

CSST has been extensively tested, and has received approval under several codes and standards:

- NFPA 54: National Fuel Gas Code
- NFPA 58: Standard for Storage and Handling of LP Gases
- ICC: National Mechanical Code

According to literature and instructions from the manufacturers, CSST systems must be installed by qualified installers who are trained in the methods required by that brand’s system, and who meet all of the qualifications of the state and local codes and of the authority having jurisdiction where the CSST is installed. However, we must be aware that this material is also available to do-it-yourself installers at hardware and home supply stores, where the only training provided is an installation manual that is often sold separately. We must also be aware that the instructions are not always followed; and that substandard temporary installations sometimes become permanent.
For several years, there have been reports of damage to CSST installations in buildings that were struck by lightning, including breaks in the tubing and ignition of the fuel gas and the surrounding structure. The early reports were not always considered credible, even though firefighters recognized the breaks in the system and the burning gas. It was noted that this damage could be due to the small mass of CSST compared to black steel pipe. As the documented history of these incidents developed, tests were conducted which proved that lightning could damage CSST gas piping, and which suggested a way to reduce the possibility of lightning damage.

The 2009 edition of NFPA 54, National Fuel Gas Code, includes new requirements for bonding CSST gas piping systems to the grounding conductor of the building’s electrical system, to reduce the possibility of damage by lightning strikes by reducing the electrical potential between metallic objects and building systems, including gas distribution.

“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.”

“7.13.3 Prohibited Use. Gas piping shall not be used as a grounding conductor or electrode. This does not preclude the bonding of metallic piping to a grounding system.”

“7.13.4 Lightning Protection Systems. Where a lightning protection system is installed, the bonding of the gas piping shall be in accordance with NFPA 780, Standard for the Installation of Lightning Protection Systems.”

Bonding a CSST gas distribution system requires cooperation between the installer of the system, the electrician, and the installer of the lightning protection system if the building has one.

Instructions and other literature from CSST manufacturers now include these bonding requirements from NFPA 54. Several manufacturers also recommend the upgrading of existing CSST systems to include the required bonding.

Approved methods of bonding require the installation of a UL-listed ground clamp:

- on the black steel gas pipe where it enters the building; or
- on the manifold connecting the black steel gas pipe to multiple runs of CSST; or
- on the brass fitting connecting each run of CSST to a manifold.

The bonding conductor must be 6-gauge or larger copper wire, solid or stranded, connected to the terminal on the UL-listed ground clamp. The bonding conductor must be continuous, with the other end connected to

- The steel enclosure of the electrical service equipment; or
- The grounded conductor at the electrical service; or
- The grounding electrode conductor (if it is large enough) between the service equipment and the grounding electrode(s); or

Fire Engineering, May 13, 2009
One or more of the grounding electrodes (“ground rods”) for the electrical system.

The CSST must be bonded only at the end nearest the entry of the gas service into the building. If it is bonded at both ends, or at the end nearest the gas-burning appliance, the CSST may carry stray electrical currents or act as a grounding conductor, which can damage the CSST and its fittings, and cause leaks.

Photo 2 shows a gas service which has been brought through the wall of the new house as black steel pipe, with the connector for CSST attached to take the gas to the furnace and water heater. The bonding clamp and bonding conductor have already been attached to the black pipe. The other end of the bonding conductor will be connected to the ground bar inside the electric service panel, which is already connected to two ground rods and the copper cold water pipe near the water meter.

This new safety requirement will require training updates for fire inspectors and building inspectors, who may be acquainted only with the code requirement which states that gas piping shall not be used for grounding purposes; and for utility workers who may have been taught to remove ground clamps from gas pipes when they encounter them.

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