Installation of CSST Gas Piping Systems
(What Inspectors Need To Know)

May 2016
Installation of CSST Gas Piping Systems

Conventional

Arc-Resistant
Installation of CSST Gas Piping Systems

CSST Product Standard

- National Standard ANSI LC-1
- Performance-based standard
- Listed system installed in accordance with manufacturer’s instructions and local code
- Updated (2014) include:
  - Revised bonding instructions
  - Electrical properties testing
  - Arc-resistant jacket
Installation of CSST Gas Piping Systems

Applicable Certifications and Listings

Tested and listed by CSA (NRTL) to ANSI LC-1
Tested and listed by IAPMO R&T
Tested and listed by ICC ES
Tested and listed by UL for E-84
Installation of CSST Gas Piping Systems

Manufacturer’s Design and Installation Guide

- Used in conjunction with state and local regulations and codes
- Defer to Design Guide if no coverage in state or local codes or regulations
- If conflict exists, then more stringent practice should be applied
- Frequently updated to reflect changes in codes and technology
Installation of CSST Gas Piping Systems

Installer Requirements

Meets minimum qualifications for plumber set by local authority having jurisdiction

Attends and passes CSST manufacturer’s training program. Training card must be presented to inspector upon request.

Maintains professional proficiency through approved continuing education
Installation of CSST Gas Piping Systems
Installation of CSST Gas Piping Systems

CSST Markings
Installation of CSST Gas Piping Systems

Fitting Interface and Interchangeability
Installation of CSST Gas Piping Systems

System Configuration and Sizing
Installation of CSST Gas Piping Systems

Low Pressure Parallel System Arrangement
Installation of CSST Gas Piping Systems

Elevated Pressure Parallel System Arrangement

Either option panel box or ground rod
Installation of CSST Gas Piping Systems

Low Pressure Hybrid System Arrangement
Installation of CSST Gas Piping Systems

System Pressure Selection

• Standard delivery pressure is 6-7”-in W.C. (1/4 psig) or 11-in LP

• Higher delivery pressure (up to 5-PSI) permissible.

• Choice basically at discretion of the system design engineer provided:
  • Local gas utility can deliver the required pressure at the meter.
  • Meter has proper index and capacity
  • Pressure setting does not create excessive velocity
Installation of CSST Gas Piping Systems

Pipe Sizing Charts

- Use the charts for CSST in fuel gas code book
- Use TracPipe sizing charts in D&I Guide
- Use approved engineering method
Installation of CSST Gas Piping Systems
CSST Routing Indoors
Installation of CSST Gas Piping Systems

CSST Routing Indoors and Outdoors
Installation of CSST Gas Piping Systems

Concealed CSST Fittings

CSST fittings are ALL listed for concealed locations.

Concealed CSST fittings do not need access panels.

Do not conceal fittings at manifolds with a regulator and valve.

CSST can be used in conjunction with black iron pipe, steel pipe fittings and other brands of CSST.
Installation of CSST Gas Piping Systems

CSST Routing Inside Insulated Walls
Installation of CSST Gas Piping Systems
Installation of CSST Gas Piping Systems

Protection from Puncture Threats

Only CSA certified strike protection devices may be used.

- Listed hardened striker plates
- Schedule 40 steel pipe sleeve
- Supplemental protection methods may also be used

The best protection is to install the tubing in areas that do not require protection from mechanical threats.

Use the 3-C Rule: Constrained: Concealed: Close
Installation of CSST Gas Piping Systems
Installation of CSST Gas Piping Systems
Installation of CSST Gas Piping Systems

Appliance Connections

Fixed Appliances: directly to the shut-off valve followed by rigid pipe

Moveable Appliances: at wall/floor termination with shut-off valve and listed appliance connector
Installation of CSST Gas Piping Systems

Appliance Connections
Installation of CSST Gas Piping Systems

Meter Connection
Installation of CSST Gas Piping Systems

Outdoor Installations

- All CSST products are UV resistant.
- Protect the tubing along the side of a structure under 6-ft elevation.
- Tubing must not be in direct contact with the ground.
- Wrap exposed stainless steel with self bonding silicone tape.
- Crawl spaces and under mobile homes are considered to be outdoors.
- Permitted on roof tops with proper support and elevation.
Installation of CSST Gas Piping Systems

CSST Installation Outdoors

TracPipe CounterStrike
Flexible Gas Piping by OmegaFlex
Installation of CSST Gas Piping Systems

Underground Installations

• When gas piping is installed in contact with the earth it must be protected from corrosion by installing inside sealed conduit.

• Piping through foundation wall shall be encased in a protective sleeve which is sealed against foundation.

• PS-II meets both requirement.
Installation of CSST Gas Piping Systems

Penetration of Fire Walls

- TracPipe CSST below minimum ASTM E84 flame spread and smoke density ratings.

- Do not remove external jacket when penetrating fire walls.

- For through penetrations of fire walls refer to UL Classifications in the Appendix of the D & I Guide.
Installation of CSST Gas Piping Systems

Tubing Repair

- Interface new CSST with old CSST
- Inter-connect CSST of different brands
- Use CSST coupling(s) for splice
- Replace entire run of CSST back to manifold with new CSST (same or different brand)
Installation of CSST Gas Piping Systems

- Indirect strikes
- Partial direct strikes
- Direct strikes
Installation of CSST Gas Piping Systems
Installation of CSST Gas Piping Systems

Lightning Pathways
Installation of CSST Gas Piping Systems

What are the root causes?

- Changes in house construction/size/location
- Loss of metal piping
- Loss of copper wire for communications
- Loss of metal conduit for electric wiring
Installation of CSST Gas Piping Systems

Lightning does not discriminate. It seeks all pathways to ground. It will damage all mechanical/electrical systems.
Installation of CSST Gas Piping Systems

- Arcing damage impacts all metallic systems including wiring and all gas piping materials.
- Damage not due to lightning induced voltage levels, but due to large differential in voltage potential.
Bonding of Piping Systems and Exposed Structural Steel

(B) Other Metal Piping. Where installed in or attached to a building or structure, metal piping system(s), including gas piping, that is likely to become 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 jumper(s) shall be sized in accordance with 250.122 using the rating of the circuit that may energize the piping system(s). The equipment grounding conductor for the circuit that is likely to energize the piping shall be permitted to serve as the bonding means. The points of attachment of the bonding jumper(s) shall be accessible.
Installation of CSST Gas Piping Systems

2012 IFGC & IRC: Electrical Bonding*

**CSST.** 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.

* Informational Note in 2011 NEC
Installation of CSST Gas Piping Systems

2015 NFPA 54 Code Requirements

- Bonding is required for CSST
- Clamp located anywhere
- Single point of attachment
- Conductor of 75-ft or less
- Required for new and retrofit
- Bond all grounding electrodes
Installation of CSST Gas Piping Systems

CSST Manufacturer’s Bonding Requirements*

Downstream of point of delivery
Single point of attachment required
Bonding clamp on pipe/fitting
Conductor at least 6 AWG copper
Conductor as short as practical
Connect to grounding electrode system (NEC)

[* No product is immune from lightning damage.]
Installation of CSST Gas Piping Systems

Bonding Clamp* Attachment

* Bonding Clamps listed to UL 467
Installation of CSST Gas Piping Systems

Bonding Gas Systems After “Point of Delivery”
Installation of CSST Gas Piping Systems

Bonding Clamp* Attachment

* Bonding Clamps listed to UL 467
Installation of CSST Gas Piping Systems

Bonding Clamp Attachment

WARNING

Never place bonding clamp directly on CSST.
Installation of CSST Gas Piping Systems

Bonding Clamp Attachment

WARNING

Never place bonding clamp directly on the CSST jacket.
Installation of CSST Gas Piping Systems

Bonding Connections
Installation of CSST Gas Piping Systems

Bond Connection to Grounding System
Installation of CSST Gas Piping Systems

Bond Connection to Grounding System
Installation of CSST Gas Piping Systems

Bonding Conductor Sizing

- Conductor at least 6 AWG copper or 4 AWG aluminum
- Conductor single or multi-strand
- Conductor length and gauge are inter-related, but length is not specified in the NEC
Installation of CSST Gas Piping Systems

Bonding Requirements

Gas piping systems that contain one or more segments of CSST shall be bonded.
Installation of CSST Gas Piping Systems

No Separate Gas Grounding Electrode

**WARNING**

Gas piping shall not be used as a grounding conductor or electrode.

Bonding clamp never on customer’s side of the meter.

Only one grounding system for the house.
Installation of CSST Gas Piping Systems

Who Does the Bonding?

- On new installations, bonding should be performed (and permitted) by on-site electrical contractor.
- On retrofit job, plumbing contractor should pull both plumbing and electrical permit, but get electrical contractor for bonding
Installation of CSST Gas Piping Systems

Ground Connection of Grounding Electrode(s)

Earth resistance reading at ground rod must be less than 25 Ohms or a second driven rod must be installed.

Earth resistance can vary based on soil type, season and type of electrode.
Installation of CSST Gas Piping Systems

Bonding Effectiveness Factors

- Lightning entry point
- Equi-potential bonding
- Bonding location
- Length of conductor
- Proximity of other pathways
- Grounding electrode system
- Code requirements
Installation of CSST Gas Piping Systems

Arc-resistant protective jacket *

[* No product is immune from lightning damage.]
Inspecting CSST Gas Piping Systems

Alternative Pathway Forward

- 3 arc-resistant CSST available
  - CounterStrike/Omega Flex
  - Wardflex Max/Ward
  - FlashShield/Gastite

- Approved as alternate method and material in 15 states

- Always bond per local code and manufacturer’s instructions
Installation of CSST Gas Piping Systems

Avoid Direct Contact with Metallic Systems
Installation of CSST Gas Piping Systems

Good News and Bad News
Installation of CSST Gas Piping Systems

Routing Tubing to Avoid Hazards
Installation of CSST Gas Piping Systems

Inspection and Repair

- Dented or kink tubing: replace as required
- Strike plates listed and installed as needed
- Meter connection: per utility specifications
- Appliance connections
- Bonding connection and conductor
- Pressure test: per local practice
Installation of CSST Gas Piping Systems

Summary

- CSST systems used safely for 25 years according to manufacturer instructions and code requirements
- Training and inspection are essential elements of safe installations
- Direct bonding is effective and will reduce impact of lightning strikes on gas piping system.
- Bonding complies with 2012 NFPA 54 and NEC requirements
- Listed conductive jacket CSST offers more comprehensive approach to reducing lightning damage than bonding yellow.
- CSST industry seeking updates to building codes and standards
Questions and Answers?

Bob Torbin  
Bob.Torbin@omegaflex.net  
(413) 388-2390