

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

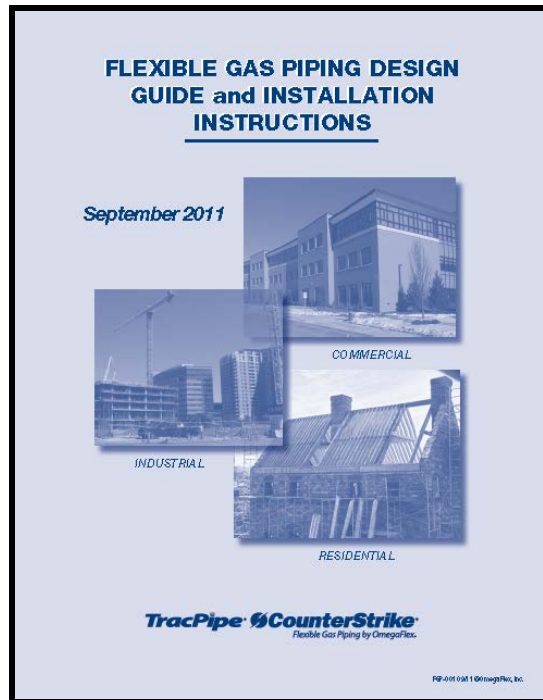
Tested and listed by ICC ES

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

TracPipe CounterStrike Flexible Gas Piping by OmegaFlex.	
The person named below has completed the TracPipe CounterStrike training program and is hereby awarded the CERTIFICATE OF TRAINING	
Installers Name _____	Company _____
Instructor _____	OMEGAFLEX INC. 1-800-355-1039
Certificate No. 1425921	Date _____

Installation of CSST Gas Piping Systems



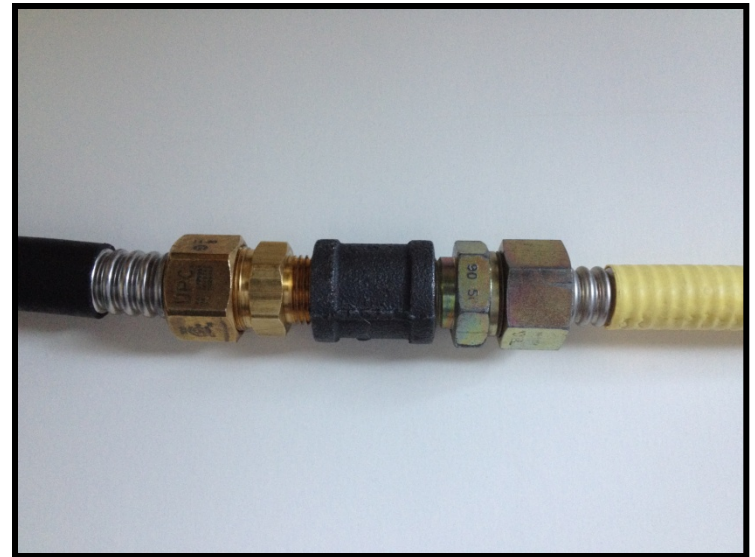
Installation of CSST Gas Piping Systems

CSST Markings



Installation of CSST Gas Piping Systems

Fitting Interface and Interchangeability

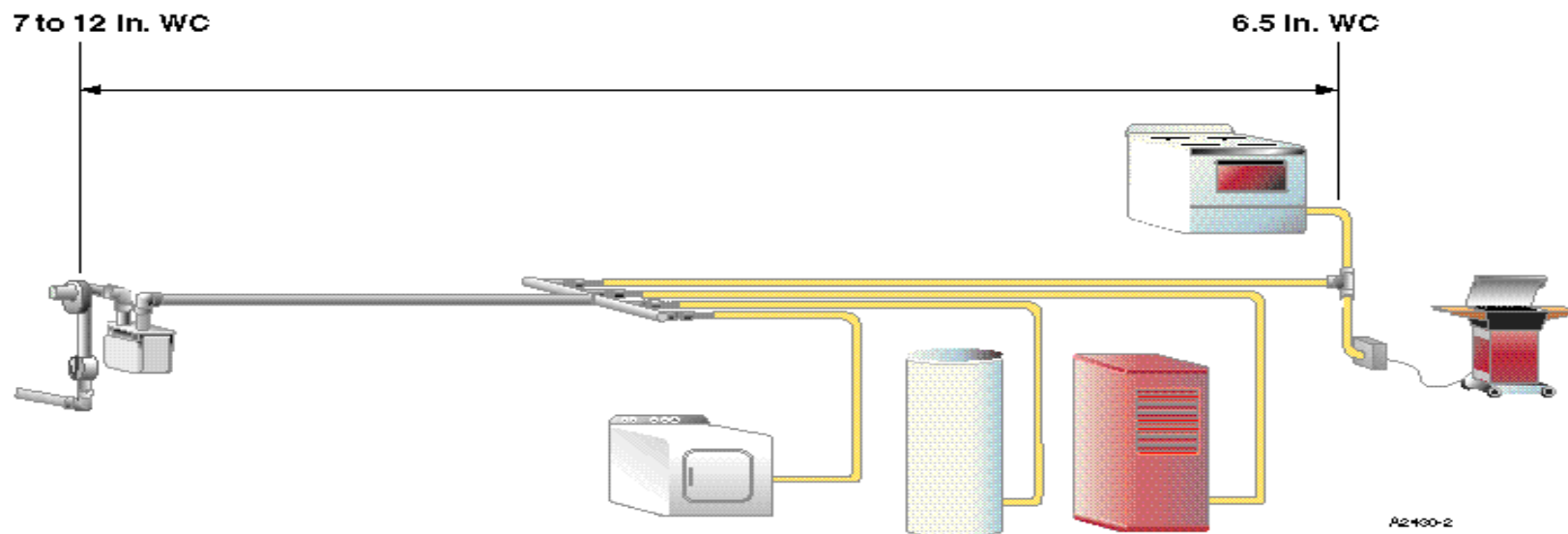


Installation of CSST Gas Piping Systems

System Configuration and Sizing

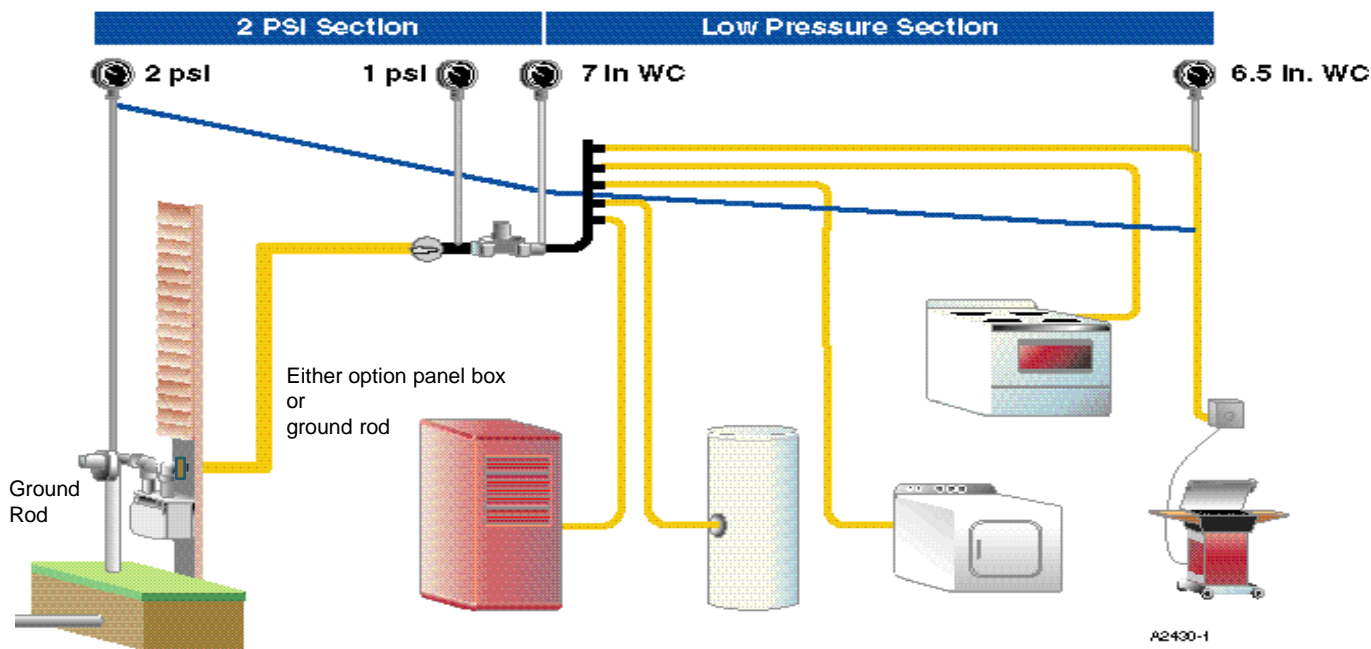
Installation of CSST Gas Piping Systems

Low Pressure Parallel System Arrangement



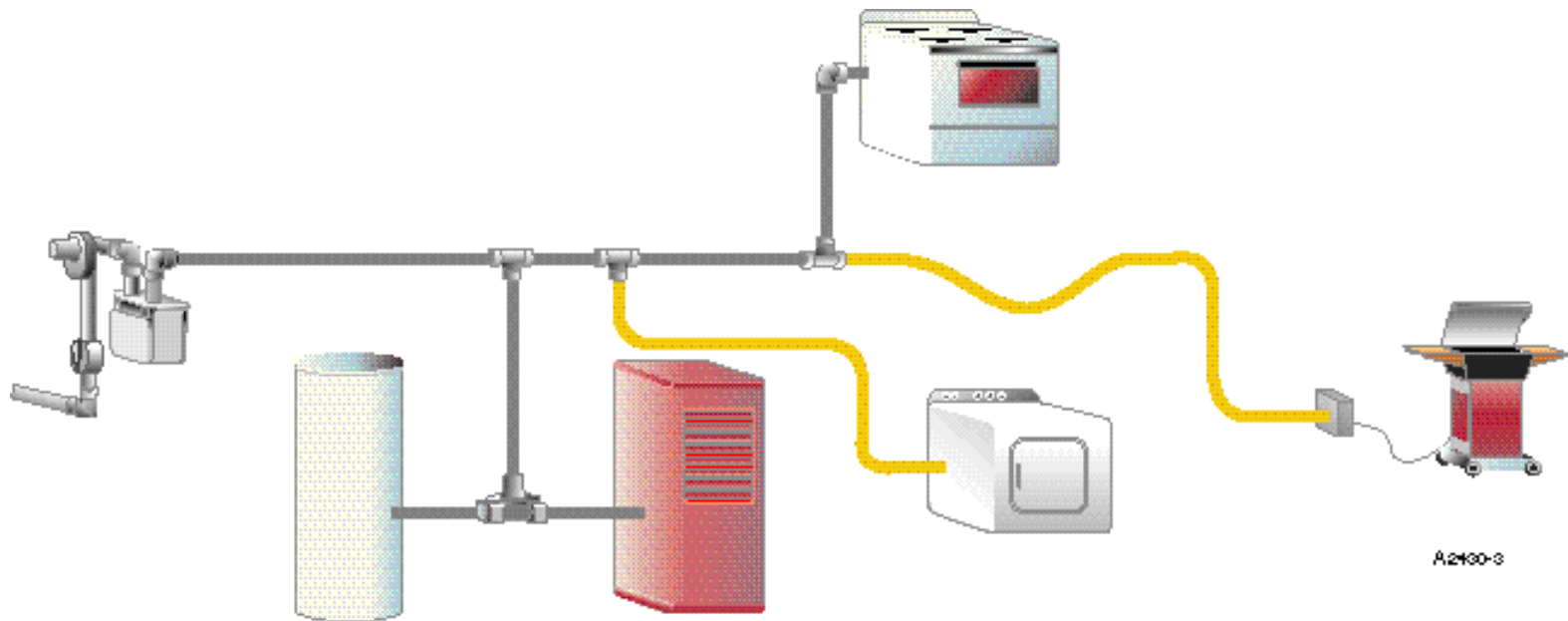
Installation of CSST Gas Piping Systems

Elevated Pressure Parallel System Arrangement



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

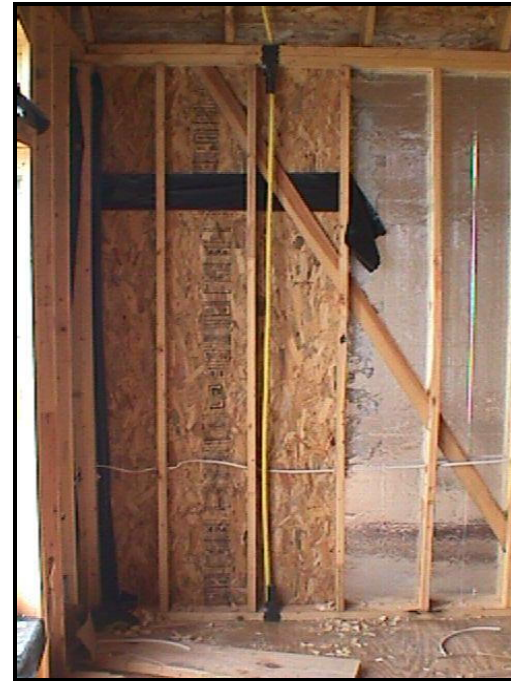
Installation of CSST Gas Piping Systems

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.

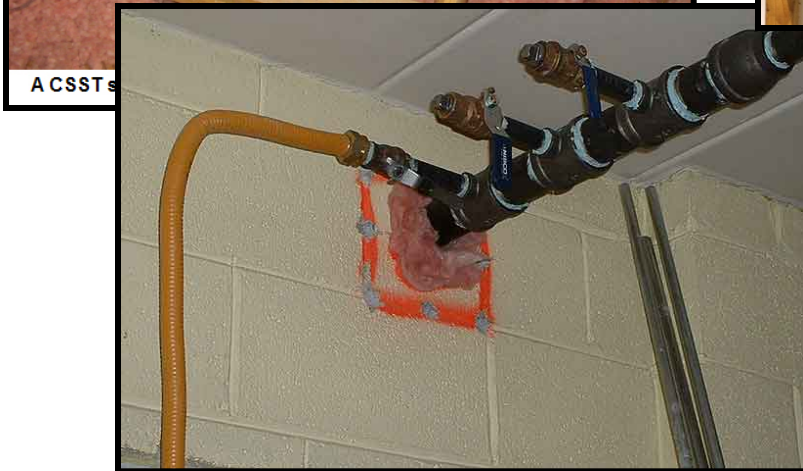


Installation of CSST Gas Piping Systems

CSST Routing Inside Insulated Walls



Installation of CSST Gas Piping Systems



Installation of CSST Gas Piping Systems

Protection from Puncture Threats

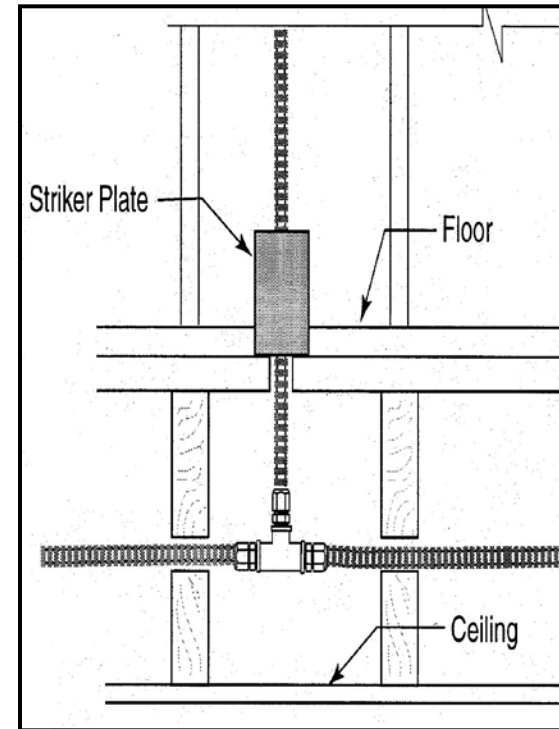
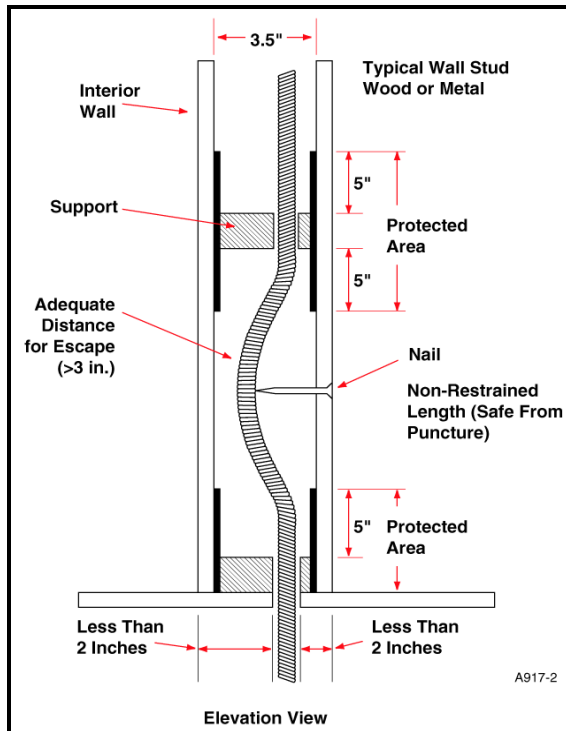
Only CSA certified strike protection devices may be used.

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

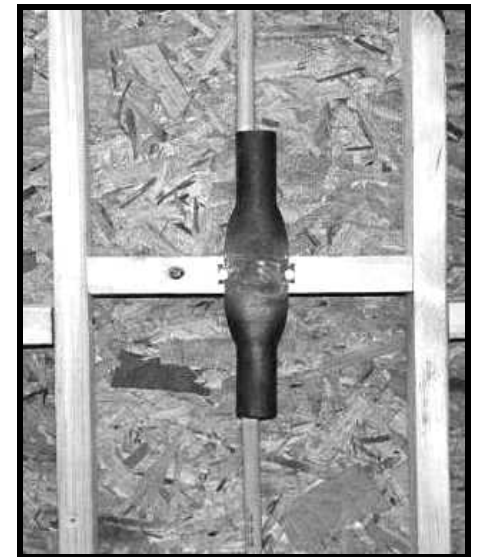
The best protection is to install the tubing in areas that do not require protection from mechanical threats.

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



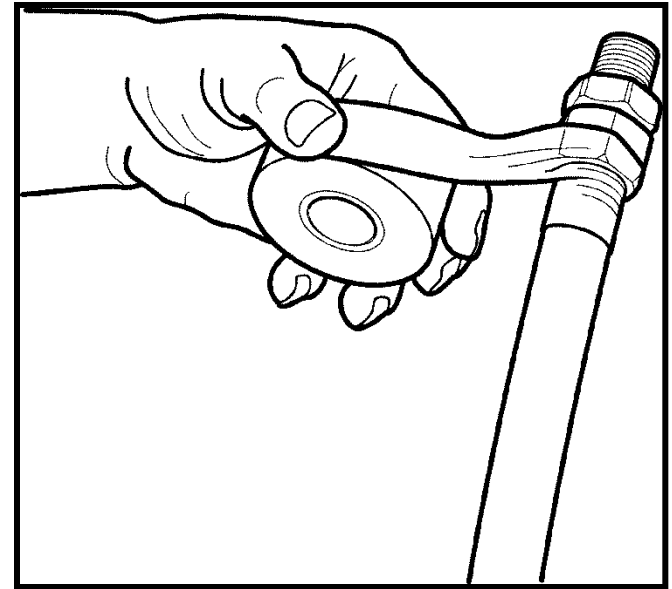
Installation of CSST Gas Piping Systems

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

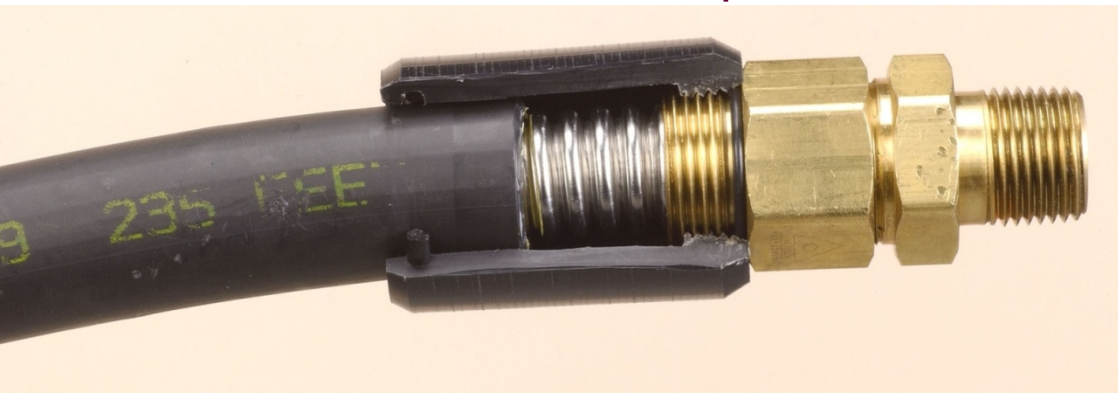
CSST Installation Outdoors



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

**APPENDIX A
UL CLASSIFICATION**

System No. W-J-1106

F-Rating - 1 & 2 Hr
T-Rating - 3/4 and 1-1/4 Hr

The UL Through Penetration Firestop Systems in Appendix A are only a sample of the complete UL database. See NOTE on Page 90.

Underwriters Laboratories, Inc.®

SECTION A-A

1. **Wall Assembly**- Min 4-7/8 in. or 6-1/8 in. thick lightweight or normal weight (100-150 pcf) concrete for 1 or 2 hr rated assemblies, respectively. Wall may also be constructed of any UL Classified **Concrete Blocks***. Max diam of opening is 3-1/2 in.
See **Concrete Blocks (CAZT)** category in the Fire Resistance Directory for names of manufacturers.
2. **Through Penetrating Products*-Flexible Metal Piping**-Nom. 2 in. diam (or smaller) steel flexible metallic piping. Max one flexible metal piping to be installed either concentrically or eccentrically within opening. The annular space between piping and periphery of opening shall be min 0 (point contact) in. to max 1 in. Piping to be rigidly supported on both sides of wall assembly. Plastic covering on piping may or may not be removed on both sides of wall assembly.
3. **Fill, Void, or Cavity Material*-Sealant** -Min. 5/8 and 1 in. thickness of fill material for 1 and 2 hr fire-rated wall assemblies, respectively, applied within the annulus, flush with both surfaces of wall. An additional 1/2 in. diam of fill material applied at gypsum board/penetrant interface at point contact location on both surfaces of wall.

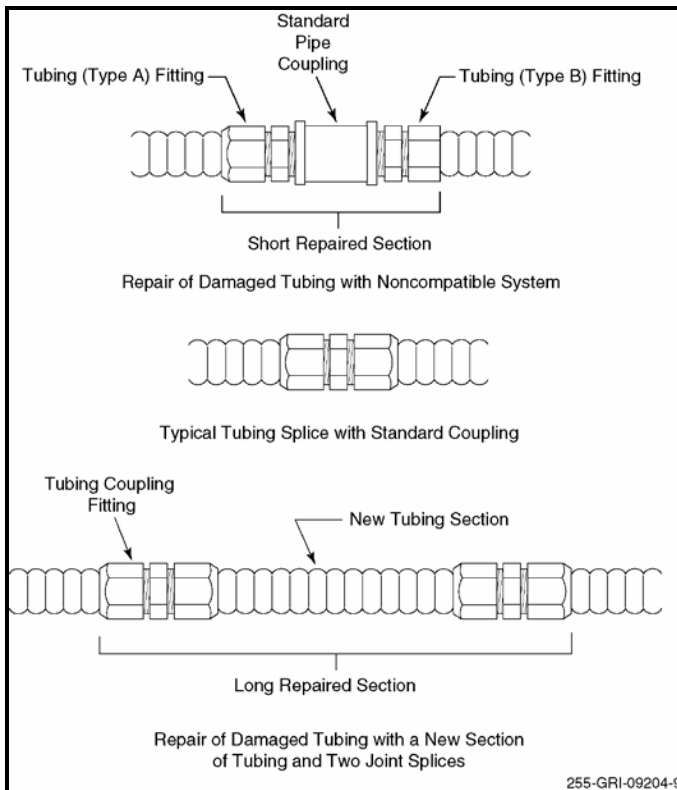
Omegaflex Inc. — Counterstrike Flexible Gas Piping.
Johns Manville International, Inc. — Firetemp™ CI

*Bearing the UL Classification Marking

- 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



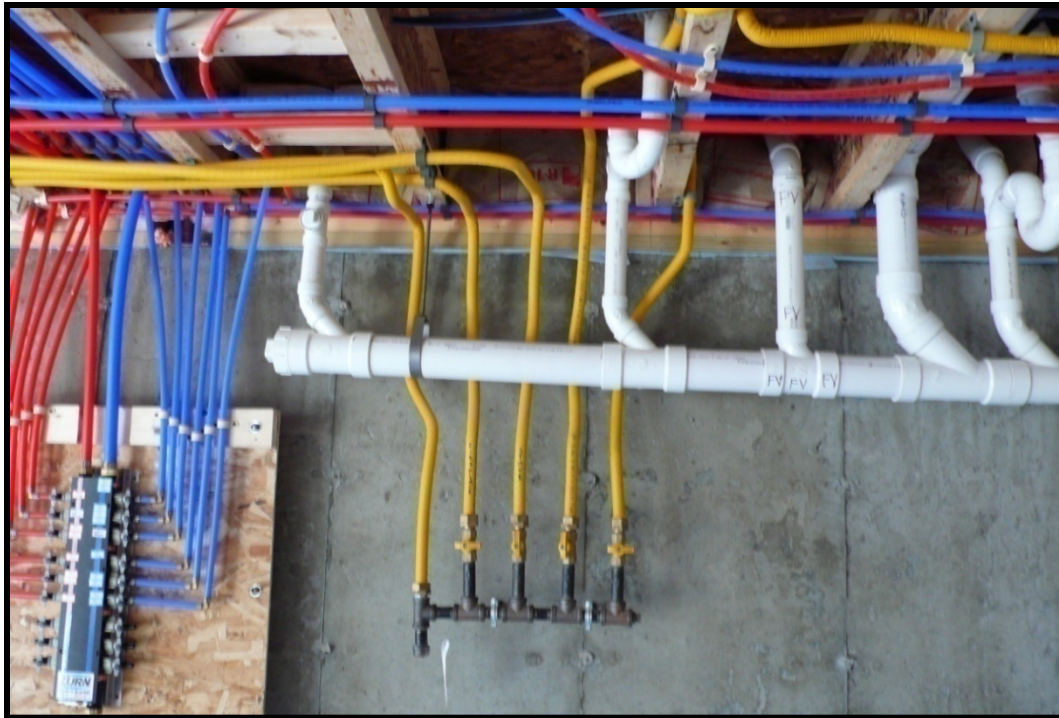
Installation of CSST Gas Piping Systems

Lightning Pathways



Installation of CSST Gas Piping Systems

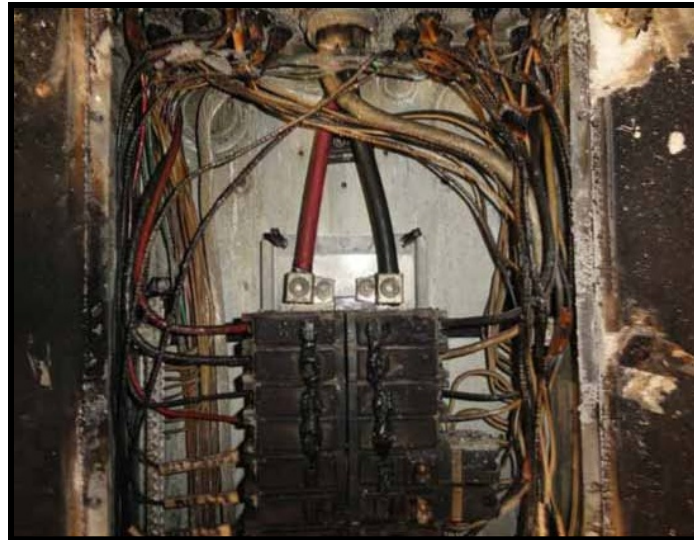
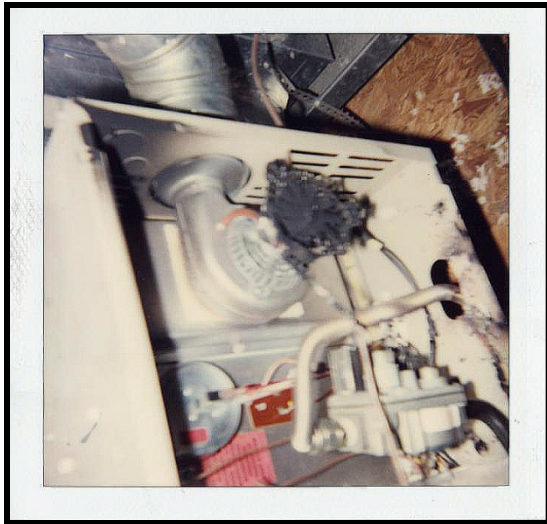
What are the root causes?



- 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.



Installation of CSST Gas Piping Systems

National Electrical Code (NFPA 70)

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

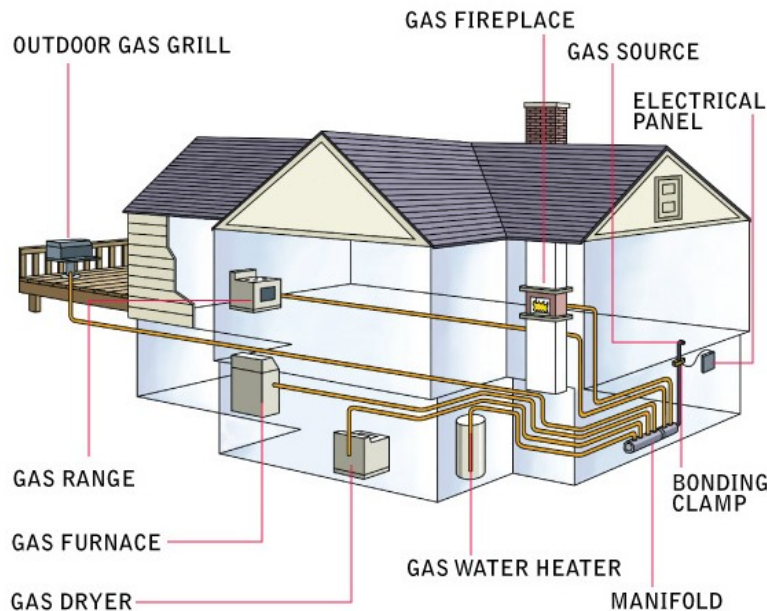
2012 IFGC & IRC: Electrical Bonding*

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

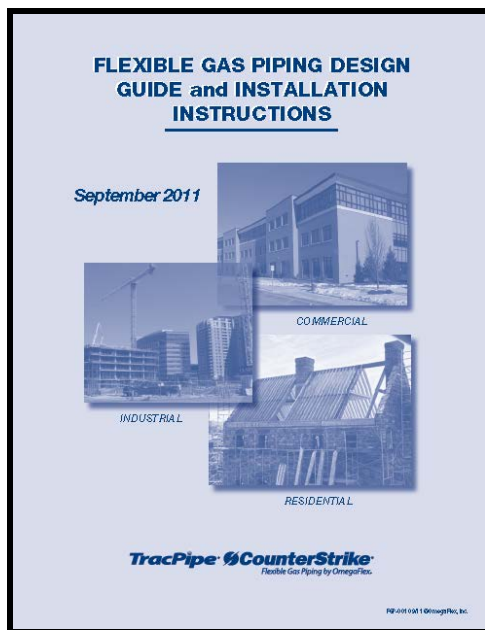
2015 NFPA 54 Code Requirements



- 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



Never place bonding clamp directly on CSST.



Installation of CSST Gas Piping Systems

Bonding Clamp Attachment

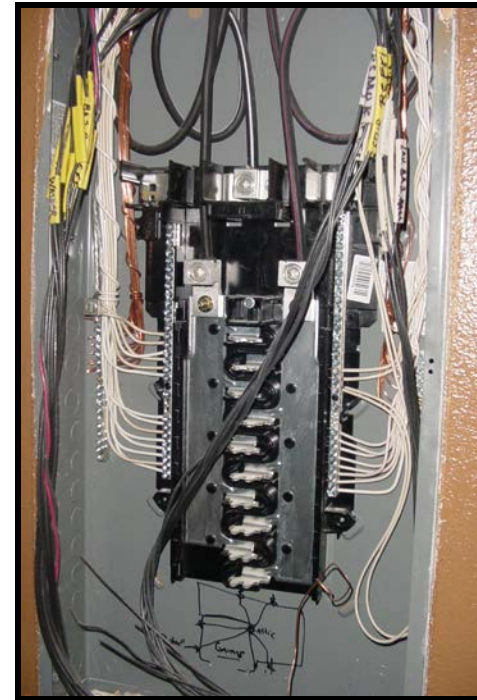
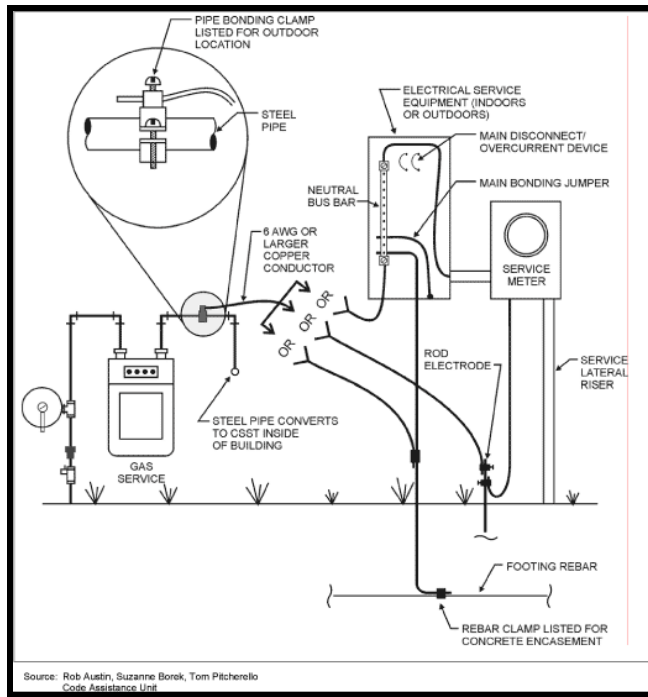


Never place bonding clamp directly on the CSST jacket.



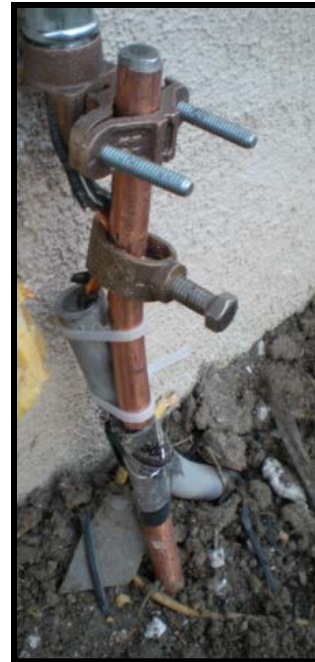
Installation of CSST Gas Piping Systems

Bonding Connections



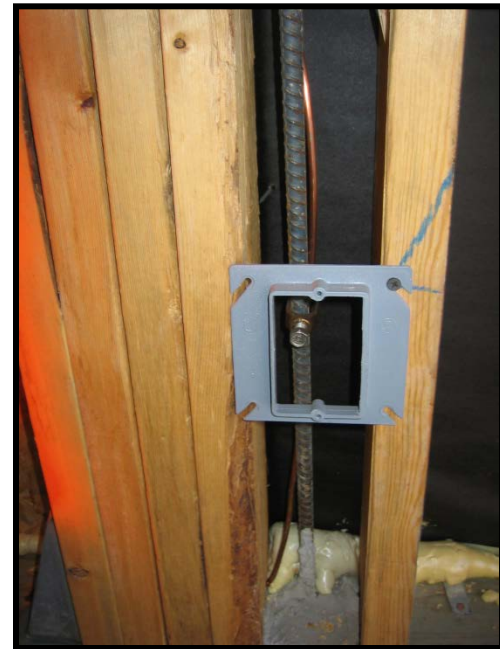
Installation of CSST Gas Piping Systems

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



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

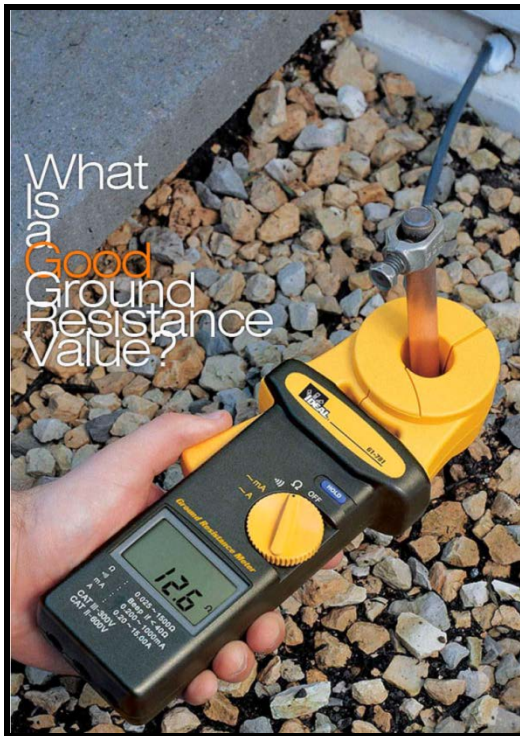
Who Does the Bonding?



- 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

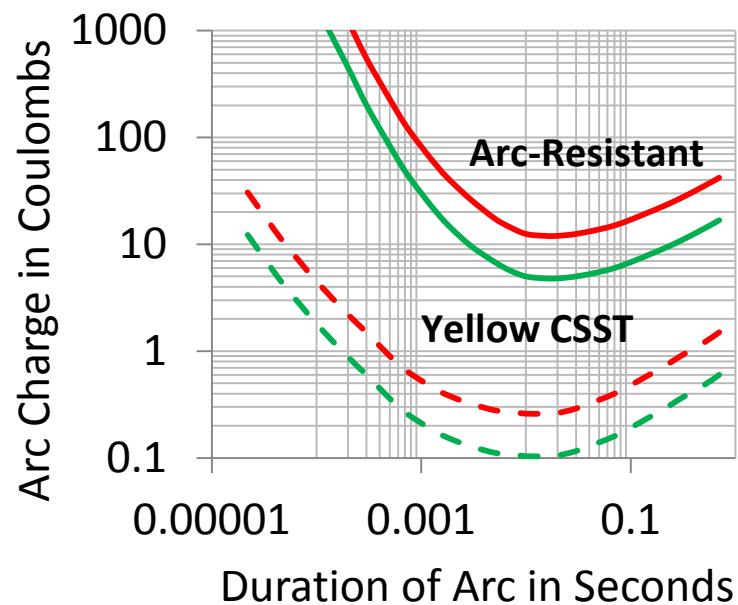
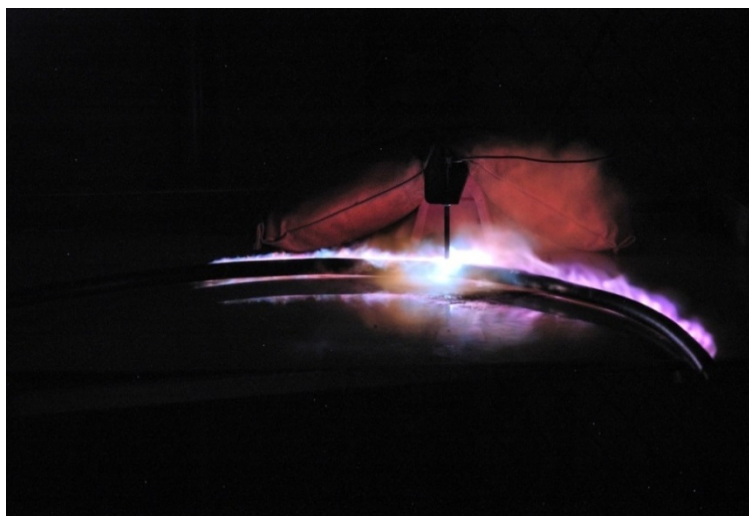
Bonding Effectiveness Factors

- 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

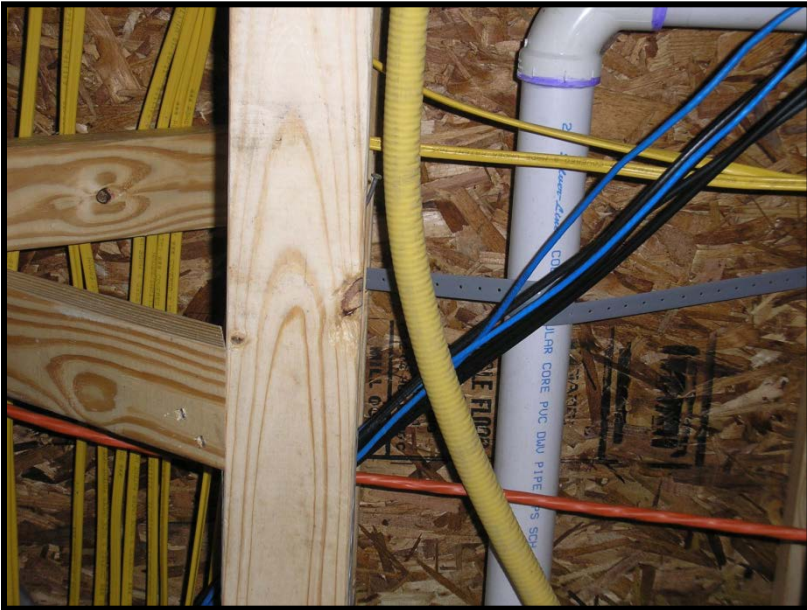
Alternative Pathway Forward



- 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



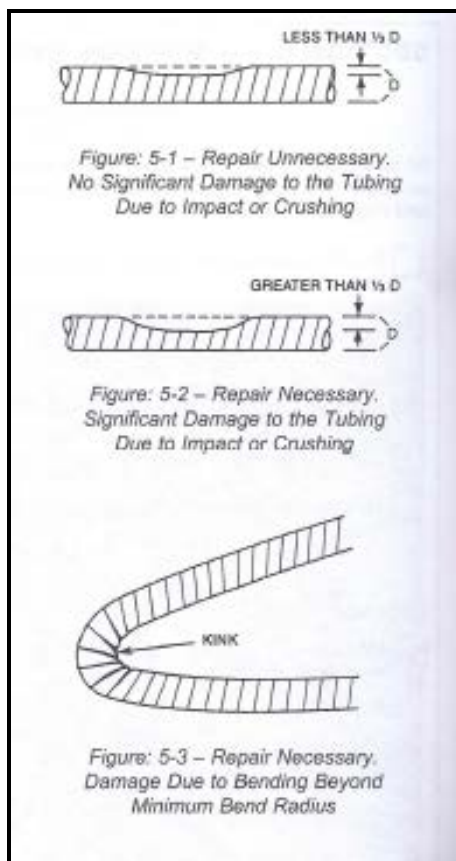
Installation of CSST Gas Piping Systems

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?



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