COMMERCIAL · INDUSTRIAL · RESIDENTIAL

Design and Installation Guide

Gastite®
The System is the Solution™

XR2™ A FITTING SOLUTION™

Gastite THE DIRECT PATH TO SAFETY

October 2011
www.gastite.com

Important Gastite Lightning Safety Warning

LIGHTNING SAFETY WARNING

1 **PROPERLY BONDING** and grounding the Corrugated Stainless Steel Tubing (CSST) system may reduce the risk of damage and fire from a lightning strike. Lightning is a highly destructive force. Even a nearby lightning strike that does not strike a structure directly can cause systems in the structure to become electrically energized. Differences in potential between systems may cause the charge to arc between systems. Such arcing can cause damage to CSST, including holes. Bonding and grounding should reduce the risk of arcing and related damage. The building owner should confirm that a qualified contractor has properly bonded the CSST gas system to the grounding electrode system of the premises. Refer to Section 4.10 Electrical Bonding/ Grounding in the Gastite Design & Installation Guide for details on bonding & grounding CSST.

2 **ALL OWNERS** should consult a lightning safety consultant to determine whether installation of a lightning protection system would be required to achieve sufficient protection for all building components from lightning. Factors to consider include whether the area is prone to lightning. Areas with high lightning risk include but are not limited to: Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, New Mexico, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, Virginia and West Virginia. One currently available source of information regarding areas more prone to lighting than others is the flash density map provided by the National Weather Service which can be found at http://www.lightningsafety.noaa.gov/lightning_map.htm. Lightning protection systems are beyond the scope of this manual and installation guidelines, but are covered by National Fire Protection Association, NFPA 780, the Standard for the Installation of Lightning Protection Systems, and other standards.

3 **THE OWNER** should confirm with the local gas supply utility company that a suitable dielectric union is installed at the service entry of the structure between underground metallic piping and the gas pipes going into the building as required by code.

4 **NATIONAL ELECTRIC CODE** (NEC), Section 250.104b, states that "bonding all piping and metal air ducts within the premises will provide additional safety". Gastite recommends that all continuous metallic systems be bonded and grounded. The owner should confirm with an electrical or construction specialist that each continuous metallic system in a structure has been bonded and grounded by an electrical professional in accordance with local building codes. This should include, but is not limited to metallic chimney liners, metallic appliance vents, metallic ducting and piping, electrical cables, and structural steel.

5 **CARE SHOULD BE TAKEN** when installing any type of fuel gas piping (including CSST, iron, or copper) to maintain as much separation as reasonably possible from other electrically conductive systems in the building. Refer to sec. 4.3 Routing, in the Gastite D&I Guide for installation techniques. Consult local building codes as to required separations for CSST from such conductive systems including metallic chimney liners, metallic appliance vents, metallic ducting and piping, and electrical cables. See for instance the Indiana Residential Code, section 675 IAC 14-4.3-155.5 Section G2411.1; gas pipe bonding.

6 **LOCAL BUILDING CODES** are controlling, however, as a general practice, fuel gas piping, including CSST, should not be installed within a chase or enclosure that houses a metallic chimney liner or appliance vent that protrudes through the roof. In the event such an installation is necessary and conforms to local building codes, the metallic chimney liner or vent must be bonded and grounded by a qualified electrical professional, and a separation distance, as specifically permitted by the applicable local building code between the CSST and the metallic chimney liner or vent, is required. Physical contact between CSST and the metallic chimney liner and/or vent is prohibited. If this physical separation cannot be specifically identified in the local building code and achieved or any local building code requirements cannot be met along the entire length, then rerouting of the CSST is required unless such installation is specifically permitted by the local building inspector.

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SECTION 1.0 INTRODUCTION

1.1 General User Warnings

Please note that there are specific differences between Gastite and FlashShield™ throughout this Design and Installation Guide. Please take note of these differences as you read through the Guide.

The installation of Gastite® or FlashShield™ Flexible Gas Piping must be performed by a qualified installer who has successfully completed the Gastite®/FlashShield™ training program. The installer must meet all qualifications and requirements to install gas piping as required by the local administrative authority. Improper installation or operation of a Gastite® or FlashShield™ Flexible Gas Piping system may result in fire, explosion or asphyxiation.

This document provides the user with general guidance when designing and installing fuel gas piping using Gastite® or FlashShield™ Flexible Gas Piping. This guideline must be used in conjunction with all applicable building standards and codes. In the event that there is a conflict between this guideline and local code the more stringent requirement will take precedence.

The use of fuel gas can be dangerous. Special attention must be given to the proper design, installation, testing and application of the gas piping system. Sound engineering practices and principles must be exercised, as well as diligent adherence to the proper installation procedures to ensure the safe operation of the piping system. All installed systems must pass customary installation inspections by the local building official having authority prior to being placed into service.

Only the components provided or specified by Gastite as part of the Gastite®/FlashShield™ Flexible fuel piping system are to be used in the installation. Use of components from other flexible gas piping systems other than those specified as part of the Gastite®/FlashShield™ system is prohibited and may result in poor system performance and serious bodily injury or property damage. Where additions, repairs or replacements involve corrugated stainless steel tubing systems from manufacturers other than Gastite Division, the systems should be joined using standard pipe fittings at the interface.

This manual cannot take into account all situations or locations in which Gastite®/FlashShield™ Flexible Gas Piping will be installed. Accordingly, installers should also take into account guidance provided by the National Fuel Gas Code, ANSI Z223.1/NFPA-54, National Standard of Canada, Natural Gas and Propane Installation Code, CSA-B149.1, the Uniform Plumbing Code, the International Code Series, the Federal Manufactured Home Construction and Safety Standards, 24 CFR Part 3280, the Manufactured Housing Construction and Safety Standards, ICC/ANSI 2.0 or the Standard on Manufactured Housing, NFPA 501. Gastite Division shall have no responsibility for any misinterpretation of the information contained in this guide or any improper installation or repair work or other deviation from procedures recommended in this manual, whether pursuant to local building codes or engineering specifications or otherwise.

Gastite Division makes no representation or warranty, and nothing contained in this manual shall imply that this manual contains the best or the only approved method for installing corrugated stainless steel piping systems or that this manual's contents are appropriate for all circumstances. In the event that there is a conflict between this guideline and local code the more stringent requirement will take precedence. Performance of accessory devices, such as pressure regulators and shut off valves should be reconfirmed by contacting the accessory device manufacturer and receiving the latest technical data on sizing, installation and performance.

Continued...

1.1 General User Warnings (continued)

A Gastite®/FlashShield™ Flexible Gas Piping system offers advantages over other gas delivery systems because of its wall dimensions and corrugated design. In contrast to rigid steel pipe, Gastite®/FlashShield™ does not require intermediate joints in most installations because the tubing is capable of being installed in one continuous run, reducing not only the total number of joints, but also the potential for leaks at joints. Gastite®/FlashShield™'s flexibility also affords more installation options because an installer can avoid existing obstacles, and it eliminates the repetitive measuring, cutting, threading and joint assembly that are common with installation of rigid steel piping systems. Gastite®/FlashShield™'s flexibility offers even further safety advantages in geographic areas that are prone to seismic activity because the tubing is able to move as the ground or the structure shifts.

While Gastite®/FlashShield™ provides significant advantages over more rigid gas delivery systems, its flexible design may make it more likely than steel pipe to be punctured by a nail or other sharp objects, or damaged by other extraordinary forces such as lightning strike, depending on the circumstances.

Properly bonding and grounding the Corrugated Stainless Steel Tubing (CSST) system may reduce the risk of damage and fire from a lightning strike. Lightning is a highly destructive force. Even a nearby lightning strike that does not strike a structure directly can cause systems in the structure to become electrically energized. Differences in potential between systems may cause the charge to arc between systems. Such arcing can cause damage to CSST, including holes. Bonding and grounding should reduce the risk of arcing and related damage. The building owner should confirm that a qualified contractor has properly bonded the CSST gas system to the grounding electrode system of the premises. Refer to Section 4.10 Electrical Bonding/Grounding in the Gastite®/FlashShield™ Design & Installation Guide for details on bonding & grounding CSST.

All owners should consult a lightning safety consultant to determine whether installation of a lightning protection system would be required to achieve sufficient protection for all building components from lightning. Factors to consider include whether the area is prone to lightning. Areas with high lightning risk include but are not limited to: Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maryland, Michigan, Mississippi, Missouri, New Mexico, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas and West Virginia. One currently available source of information regarding areas more prone to lighting than others is the flash density map provided by the National Weather Service which can be found at http://www.lightningsafety.noaa.gov/lightning_map.htm. Lightning protection systems are beyond the scope of this manual and installation guidelines, but are covered by National Fire Protection Association, NFPA 780, the Standard for the Installation of Lightning Protection Systems, and other standards.
The owner should confirm with the local gas supply utility company that a suitable dielectric union is installed at the service entry of the structure between underground metallic piping and the gas pipes going into the building as required by code.

Section 250.104b of the National Electric Code (NEC) states that "bonding all piping and metal air ducts within the premises will provide additional safety". Gastite recommends that all continuous metallic systems be bonded and grounded. The owner should confirm with an electrical or construction specialist that each continuous metallic system in a structure has been bonded and grounded by an electrical professional in accordance with local building codes. This should include, but is not limited to: metallic chimney liners, metallic appliance vents, metallic ducting and piping, electrical cables, and structural steel.

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1.1 General User Warnings (continued)

Care should be taken when installing any type of fuel gas piping (including CSST, iron, or copper) to maintain as much separation as reasonably possible from other electrically conductive systems in the building. Refer to section 4.3 Routing, in the Gastite®/FlashShield™ D&I Guide for installation techniques. Consult local building codes as to required separations for CSST from such conductive systems including metallic chimney liners, metallic appliance vents, metallic ducting and piping, and electrical cables. See for instance the Indiana Residential Code, section 675 IAC 14-4.3-155.5 Section G2411.1; gas pipe bonding.

Local building codes are controlling, however, as a general practice, fuel gas piping, including CSST, should not be installed within a chase or enclosure that houses a metallic chimney liner or appliance vent that protrudes through the roof. In the event such an installation is necessary and conforms to local building codes, the metallic chimney liner or vent must be bonded and grounded by a qualified electrical professional, and a separation distance, as specifically permitted by the applicable local building code between the CSST and the metallic chimney liner or vent, is required. Physical contact between CSST and the metallic chimney liner and/or vent is prohibited. If this physical separation cannot be specifically identified in the local building code and achieved or any local building code requirements cannot be met along the entire length, then rerouting of the CSST is required unless such installation is specifically permitted by the local building inspector.

NOTE: Leak test solutions may cause corrosion in some types of material in the gas piping system. Be sure to water rinse after the test and thoroughly dry all contacted material.

1.2 Limitations of the Guidelines

This document is intended to aid the professional gas installer in the design, installation and testing of fuel gas piping systems using corrugated stainless steel tubing (CSST) for residential housing, commercial and industrial buildings. It would be impossible for this guideline to anticipate and cover every possible variation in building configurations, construction styles, appliance loads and code restrictions. Therefore, there will be applications that will not be covered by this guideline. For applications that go beyond the scope of this guideline, the installer should exercise sound engineering principles and practices and/or contact Gastite for engineering assistance.

The techniques outlined within this guideline are recommended practice for generic applications. These practices must be reviewed for compliance with all applicable local fuel gas and building codes. In the event that there is a conflict between this guide and local code, the more stringent requirement will take precedence.

Using components from other flexible gas piping systems other than those specified as part of the Gastite®/FlashShield™ system is prohibited and may result in poor system performance and serious bodily injury or property damage. Additional information pertaining to gas piping systems is available from your local gas utility or propane supplier. Please visit the Gastite Web site at www.gastite.com for additional updates and technical bulletins.

1.3 Standards, Listings and Codes

The Gastite®/FlashShield™ corrugated stainless steel tubing system complies with the following standards, listings and model codes.

Standards

ANSI LC1-2005, CSA 6.26-2006, "Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)."

Listings

- CSA – CSA International - Certificate No. 1009875
- ICC – International Code Council – Evaluation Report Number PM6 1019 + PMG 1066
- IAPMO – International Association of Plumbing and Mechanical Officials – File Number 3250

Code Compliance

- BOCA – National Mechanical Code
- CABO 1 & 2 Family Dwelling
- ICC – International Code Series
- National Standard of Canada – Nationals Gas & Propane Installation Code, CAN/CGA-B149.1
- NFPA – National Fuel Gas Code (NFPA 54)
- SBCCI – Standard Gas Code
- UMC – Uniform Mechanical Code (ICBO)
- UMC – Uniform Mechanical Code (IAPMO) "Alternate Materials & Methods"
- UMC – Uniform Mechanical Code (IAPMO) – 2003 and Later
- UPC – Uniform Plumbing Code (IAPMO) "Alternate Materials & Methods"
- UPC – Uniform Plumbing Code (IAPMO) – 2003 and Later

While every effort has been made to prepare this document in accordance with all regional model codes in effect at its printing, Gastite cannot guarantee that the local administrative authority will accept the most recent version of these codes. It is the ultimate responsibility of the installer to determine suitability and acceptance of any building component including gas piping. Gastite assumes no responsibility for labor or material for installations made without prior determination of local code authority acceptance.

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SECTION 2.0 SYSTEM DESCRIPTIONS & COMPONENTS

2.1 System Descriptions

2.1.1 Gastite® System Description

a) The Gastite® Flexible Gas Piping System has been tested in accordance with the American National Standard for Fuel Gas Systems Using Corrugated Stainless Steel Tubing, ANSI LC1-2005. This standard lists performance requirements for certification of CSST systems for use with all recognized fuel gases, including Natural Gas and Propane.

- System uses corrugated stainless steel tubing (CSST) made of type 304 alloy, ASTM A240.
- An annealing process tempers the steel giving it added flexibility and ease of bending.
- Gastite® Flexible Gas Piping is suitable for use with elevated pressure systems. The ANSI LC1 standard rates CSST for use at pressures up to 5PSI.

b) The tubing is connected using special mechanical brass fittings designed specifically for Gastite® CSST.

- Corrosion resistant brass fittings incorporate the Gastite® patented "Jacket Lock" feature. The polyethylene jacket is clamped by the fitting thereby minimizing the risk of contact with corrosives and foreign material.
- Gastite® fittings have standard NPT threads and may be used in combination with all approved fuel gas piping materials with the pipe threads as the interface. System components such as manifolds, tees and stub-outs may be fabricated from other approved materials to be used with Gastite® flexible gas piping.
- The self-flaring fitting creates a one step, reusable, metal on metal seal.

c) The polyethylene jacket is extruded over the stainless steel tubing creating a flexible, protective covering. The jacket is an added feature of the tubing and does not affect the flaring/sealing process.

- The jacket is engineered with thermal and UV resistant material making it suitable for outdoor use.
- The polyethylene is fused with flame retardant material making it ASTM E84 25/50 Compliant. As a fire rated material, it meets the requirements for flame spread and smoke density. This allows the jacket to remain intact throughout a building, thus maximizing the protection provided by the jacket.
- The polyethylene extrusion process creates a smooth outside surface; this surface greatly aids in pulling the tube through tight building spaces.

d) The corrugated stainless steel tubing system has a number of essential hardware and design differences from conventional gas piping using rigid steel pipe and copper tubing. These differences are described as follows:

- In many applications, the tubing is sized for individual gas appliance loads and is, therefore, usually small in diameter. The tubing may also be installed in a parallel fashion from a central distribution manifold rather than a series layout commonly used for rigid pipe systems.
- Corrugated Stainless Steel Tubing is pulled through the structure similar in fashion to electrical wiring and therefore requires different handling and installation techniques than rigid pipe.
- Rigid termination of the tube ends is required.
- Flexibility and strike plates protect the CSST allowing it to be run in concealed spaces.

SECTION 4.0 INSTALLATION PRACTICES

4.1 General Provisions

a) Precautions must be taken to ensure any exposed Gastite®/FlashShield™ CSST is not damaged or abused during building construction. All tubing, fittings and hardware should be stored in a clean, dry location prior to installation.

b) Open ends of the tubing are to be temporarily plugged or taped closed prior to installation to prevent entrance of dirt, dust or other debris.

c) The protective plastic jacketing should be kept in place as much as possible to protect the tubing from corrosive threats. Contact with chemicals containing chlorides must be followed by a thorough rinse and wipe dry. This includes fluxes used to solder copper tubing and acid based cleaners used to wash masonry.

d) Protect tubing from contact with sharp objects.

e) Avoid stressing the tubing or fittings with tight bends, kinks, twists, stretching or repetitive bending. Refer to Table 4-1 below for the recommended minimum bend radius for Gastite®/FlashShield™ CSST (Fig. 4-1).

Table 4-1
Bend Radius

Gastite®/ FlashShield™ Size	EHD	Absolute Min. Bend Radius	Suggested Bend Radius
3/8"	13	3/4"	3.0"
1/2"	18	3/4"	3.0"
3/4"	23	1.0"	3.0"
1"	31	3.0"	5.0"
1-1/4"	37	3.0"	5.0"
1-1/2"	47	3.0"	5.0"
2"	60	4.0"	6.0"

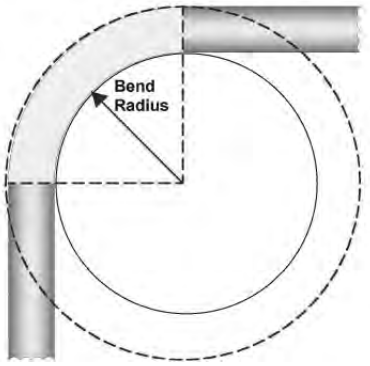

Fig. 4-1

f) Supporting Gastite®/FlashShield™ CSST - Tubing shall be supported in a workmanlike manner with pipe straps, bands or hangers suitable for the size and weight of the tubing, at intervals not to exceed those shown in Table 4-3. A proper support is one which is designed as a pipe hanger, does not damage the tubing during installation, and provides full support. "J" Hooks may not be used as they may damage the Gastite®/FlashShield™ CSST. Zip ties/cable ties are not to be used as a primary support but may be used to organize or bundle Gastite®/FlashShield™ CSST. See Table 4-5 for supporting Gastite®/FlashShield™ CSST in a rooftop application.

When supporting Gastite® CSST tubing runs, the use of other conductive metallic systems such as metallic appliance vents, metallic ducting and piping, and electrical cables must be avoided.

When supporting FlashShield™ tubing runs, contact with other conductive metallic systems is acceptable.

g) Gastite®/FlashShield™ CSST must be rigidly terminated with a Gastite® or FlashShield™ fitting. This can be achieved by terminating with a rigidly mounted fitting or by terminating with a fitting threaded onto a rigid gas-piping component.

4.2 Field Fitting Assembly Procedure

4.2.1 Gastite Field Fitting Assembly

Step 1

Cut-to-Length (Fig. 4-2)

Cut tubing to the desired length leaving approximately one inch for fitting attachment. Cut should be centered between two corrugations. Use light roller pressure with extra rotations in one direction to leave tubing round and free of burrs. Note: To ensure a quality flare, all cuts should be made on a straight section of tubing.

Fig. 4-2

Step 2

Strip Jacket (Fig. 4-3)

Using a utility knife, strip jacket back to the valley of the second corrugation.
Do not cut the jacket in such a way that the sealing surface of the tubing is scored. The short piece of jacket can easily be removed by placing the utility knife blade under the jacket to peel the jacket off.
Caution: Tube ends are sharp, use care when handling.

Fig. 4-3

Step 3

Install Nut and Bushings (Fig. 4-4)

Thread fitting body into appliance. Slide nut over tubing. Separate bushings and position, as shown in Figure 4-6, into the valley of the first corrugation leaving one corrugation exposed between the end of the bushing and tubing.

At this point, the bushings will begin to capture the jacket for a contaminant resistant seal (Fig. 4-5).

Fig. 4-4

NOTE:

- It is important to know that the jacket locking feature of the Jacket-Lock fitting is not required to produce a gas-tight seal between the fitting and the tubing (Fig. 4-6).
- Pipe dope or sealant must not be used inside the fitting prior to assembly.

Jacket Locking Feature

Fig. 4-5

Fig. 4-6

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Step 4

Position Bushings (Fig. 4-7)

Insert bushings into fitting body. A small amount of resistance indicates the bushings are being compressed to further capture the jacket. Note: The piloting feature of the bushings ensures the tubing is aligned properly with the fitting body for a uniform flare and a gas tight seal.

Fig. 4-7

Step 5

Wrench Fitting (Fig. 4-8)

Slide nut over bushings and thread onto fitting body. Some resistance will be experienced as the nut begins to compress the tubing and create the double wall flare.

Continue to thread the nut until resistance to wrenching increases greatly and the double wall flare is tightly seated.

Note: During the tightening process rotate the nut only. Do not rotate the fitting body.

Any portions of the exposed stainless steel tubing shall be wrapped with tape or sleeved to prevent threats by acids or chloride based cleaning solutions for masonry. Self-bonding silicone tape is recommended here for durability.

Fig. 4-8

4.2.2 FlashShield Field Fitting Assembly

Step 1

Cut-to-Length (Fig. 4-9)

Cut tubing to the desired length leaving approximately one inch for fitting attachment. Cut should be centered between two corrugations. Use light roller pressure with extra rotations in one direction to leave tubing round and free of burrs. Note: To ensure a quality flare, all cuts should be made on a straight section of tubing.

Fig. 4-9

Step 2

Strip Jacket (Fig. 4-10, Fig. 4-11)

Using a utility knife, strip jacket back to the valley of the second corrugation.
Do not cut the jacket in such a way that the sealing surface of the tubing is scored. The short piece of jacket can easily be removed by placing the utility knife blade under the jacket to peel the jacket off.
Caution: Tube ends are sharp, use care when handling.

Fig. 4-10

Step 3

Install Nut and Bushings (Fig. 4-12)

Thread fitting body into appliance. Slide nut over tubing. Separate bushings and position, as shown in Figure 4-13, into the valley of the first corrugation leaving one corrugation exposed between the end of the bushing and tubing.

Fig. 4-11

NOTE:

- Foil biting feature must be utilized with FlashShield.
- Pipe dope or sealant must not be used inside the fitting prior to assembly.

Fig. 4-12

Foil Biting Feature

Fig. 4-13

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Step 4

Position Bushings (Fig. 4-14)

Insert bushings into fitting body. A small amount of resistance indicates the bushings are being compressed to further capture the jacket. Note: The piloting feature of the bushings ensures the tubing is aligned properly with the fitting body for a uniform flare and a gas tight seal.

Fig. 4-14

Step 5

Wrench Fitting (Fig. 4-15)

Slide nut over bushings and thread onto fitting body. Some resistance will be experienced as the nut begins to compress the tubing and create the double wall flare.

Continue to thread the nut until resistance to wrenching increases greatly and the double wall flare is tightly seated.

Note: During the tightening process rotate the nut only. Do not rotate the fitting body.

Fig. 4-15

Gastite®/FlashShield™ Termination Fitting Assembly

1. Remove flange from brass fitting assembly.
2. Slide flange over tubing.
3. Attach brass fitting to tubing. (Steps 2 - 5)
4. Thread flange back onto fitting assembly.
5. Mount completed termination assembly.

Table 4-2

Gastite®/FlashShield™ Recommended Torque Values

Size	EHD	*Torque
3/8"	13	25 ft-lbs
1/2"	18	35 ft-lbs
3/4"	23	45 ft-lbs
1"	31	65 ft-lbs
1-1/4"	37	95 ft-lbs
1-1/2"	47	120 ft-lbs
2"	60	150 ft-lbs

* Fitting is factory lubricated to reduce field torque requirements. Lubrication must be chloride free.

* Minimum torque values supplied for lab testing reference only. Field installation requirements: system must pass pressure/leak test (See Section 6).

Term Bracket Fitting (Fig. 4-16 through Fig. 4-19)

1. Attach Bracket to stud or mounting surface.
2. Slide Jam-Nut over tubing and route tubing through Bracket.
3. Attach XR2-Fitting to tubing.
4. Slide the XR2-Fitting back onto Bracket and thread Jam-Nut.

Step 1: Fig. 4-16

Step 2: Fig 4-17

Step 3: Fig 4-18

Step 4: Fig 4-19

XROUTLETBOX (Fig. 4-20 through Fig. 4-24)

1. Mount Box and Bracket to stud or mounting surface.
2. Slide Jam-Nut over tubing and route tubing through Bracket and Box.
3. Attach Fitting to tubing.
4. Secure Jam-Nut to Fitting.
5. Attach Ball-Valve.

Step 1: Fig. 4-20

Step : Fig. 4-21

Step 3: Fig. 4-22

Step 4: Fig. 4-23

Step 5: Fig. 4-24

Note: Strike Protection (Floppy) not shown for clarity.

ANGLE STUB-OUT (Fig. 4-25 through Fig. 4-27)

1. Attach XR2 female fitting to short end of Stub-Out.
2. Insert long end of Angle Stub-Out through metal insert knockout.
3. Secure Stub-Out utilizing sheet metal screws at the four mounting points.
4. Insert CSST into the female fitting and complete fitting assembly.
5. Refer to Section 4.6.4 (g).

Fig 4-27

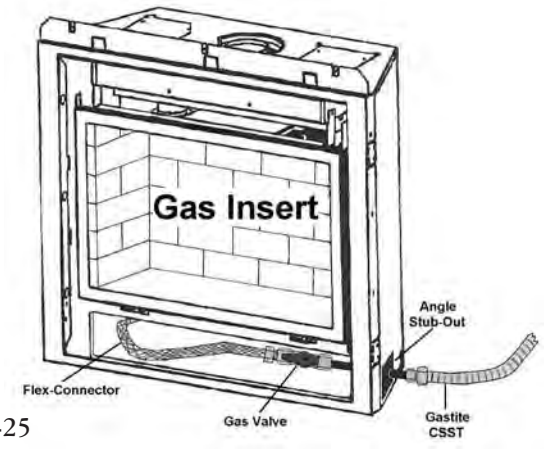

Fig 4-25

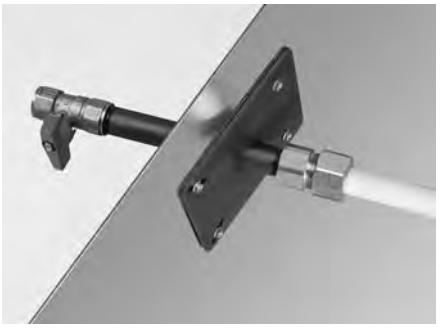

Fig 4-26

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4.3 Routing

4.3.1 Vertical Runs

Vertical runs are the preferred run method. Tubing runs should be relatively plumb and free to move within the wall cavity without any physical support between the floors. For support requirements refer to Section 4.1.f. Where any run is greater than two stories or 20-ft, additional support (appropriate to the weight of the tubing) must be provided at the point of penetration through the floor.

Care should be taken when installing vertical runs to maintain as much separation as reasonably possible from other electrically conductive systems in the building.

There is no requirement to maintain separation from other electrically conductive systems when routing FlashShield™

4.3.2 Horizontal Runs

Tubing routed on top of ceiling joists and other structural members which comply with the horizontal support spacing requirements will be considered sufficiently supported . See Figures 4-28, 4-29, 4-30 and 4-31 for examples of acceptable support configurations when routing Gastite®/FlashShield™. Gastite®/FlashShield™ may be routed beneath, through and alongside floor and ceiling joists. Due consideration must be given to future construction possibilities. Horizontal runs in concealed areas must conform to Section 4.4 Protection.

Care should be taken when installing horizontal runs to maintain as much separation as reasonably possible from other electrically conductive systems in the building.

There is no requirement to maintain separation from other electrically conductive systems when routing FlashShield™.

Fig 4-28

Fig 4-29

Fig 4-30

Fig 4-31

Table 4-3		
Support Spacing (Non-Rooftop, Non-Wall Cavity)		
Gastite®/ FlashShield™ Size	EHD	Vertical or Horizontal
3/8"	13	4 Feet
1/2"	18	6 Feet
3/4"	23	8 feet (USA) 6 feet (Canada)
1"	31	8 feet (USA) 6 feet (Canada)
1-1/4"	37	8 feet (USA) 6 feet (Canada)
1-1/2"	47	8 feet (USA) 6 feet (Canada)
2"	60	8 feet (USA) 6 feet (Canada)

Table 4-4	
Gastite®/FlashShield™ Clearance Holes	
Gastite®/ FlashShield™ Size	Drill Hole Size (min)
3/8"	1"
1/2"	1-1/4"
3/4"	1-1/2"
1"	1-3/4"
1-1/4"	2"
1-1/2"	2-1/4"
2"	3"

4.3.3 Installation Clearance Holes

Clearance holes for routing Gastite®/FlashShield™ CSST are to be approximately 1/2 inch greater than the O.D. of the Gastite®/FlashShield™ CSST. Drilling of any structural member must be in conformance with the local building code. Refer to Table 4-4 for the recommended drill hole sizing.

4.3.4 Concealed Fittings

The Gastite®/FlashShield™ Mechanical Fittings have been tested and listed per the requirements of ANSI LC-1 for concealed use. The fitting may be used for concealed attachment including, but not limited to: appliance valves, branch runs using tee fittings, length splices and stub-outs manufactured from approved fuel gas piping materials.

These guidelines address some of the most common situations where concealing the fittings is the only practical alternative. These guidelines cannot address all applications of concealed fittings, but instead, provide typical instructions to demonstrate the principles that apply to fittings listed for installation in concealed locations. (Reference National Fuel Gas Code, NFPA 54, Concealed Piping in Buildings).

a) New Installations (Fig. 4-32) – When multiple gas outlets are supplied from a single run of Gastite®/FlashShield™ CSST, each downstream outlet branch can be connected to the main run using a tee-type fitting which can be located in a concealed location.
b) Fireplace key valves (Fig. 4-33) – Gastite®/FlashShield™ CSST connections to fireplace key valves can be located in a concealed location when accessibility is not readily provided.
c) Stub-outs (Fig. 4-34) – Gastite®/FlashShield™CSST connections to stub-outs fabricated from approved fuel gas piping materials.
d) Exclusion – Manifold stations for dual pressure systems which include the multi-port manifold, shut-off valve and pressure regulator shall not be installed in concealed locations regardless of the qualifications of the tubing.

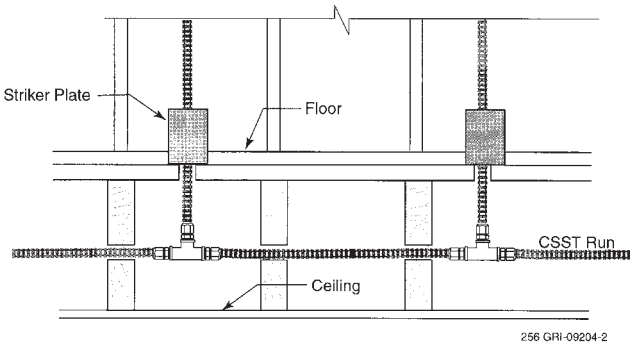

Fig 4-32

Fig 4-33
Note: Strike Protection (Floppy) not shown for clarity.

Fig 4-34

4.3.5 Modifications to Existing Systems

a) New Ceilings in Unfinished Rooms/Basements – Gastite®/FlashShield™ CSST fittings originally installed in accessible ceiling locations can be concealed in the event a ceiling is installed at a later date.
b) Extensions to Existing Tubing Runs – Concealed tubing can be modified to permit an extension to another appliance location provided there is sufficient capacity to supply both appliances at the same time. If an accessible location for the modification is not available, the existing tubing run can be modified with a tee fitting that will result in a concealed fitting behind the wallboard.
c) When modifications lead to concealed tubing, strike protection may be required. Refer to section 4.4.

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4.3.6 Outdoor

Gastite®/FlashShield™ Flexible Gas Tubing has passed all requirements of ANSI LC1, which include testing for suitability for exposure of CSST piping systems to outdoor environments.

a) Outdoors – When installed outdoors, the external jacketing shall remain intact as much as practical for the given installation. Any portions of the exposed stainless steel tubing shall be wrapped with tape or sleeved to prevent later threats by acid or chloride based cleaning solutions for masonry. Self-bonding silicone tape is recommended here for durability.

b) Along side a structure – When installed along the outside of a structure (between the ground and a height of 6 ft.) in an exposed condition, the Gastite®/FlashShield™ CSST shall be protected from mechanical damage inside a conduit or chase. A conduit or chase is not required if the tubing is installed in a location that will not subject the Gastite®/FlashShield™ CSST to mechanical damage.

4.3.7 Fire Rated Construction

The Gastite® plastic jacket on the steel tubing has a maximum ASTM E84 rating of 15 for flame spread, and 30 for smoke density. These values meet most typical requirements for building construction. Therefore, the jacket should remain intact when passing through typical building constructions such as plenums, floor and ceiling joists, rim joists, walls or other fire rated resistance construction limited to materials of ASTM E84 ratings of 25 flame and 50 smoke, or lower.

The FlashShield jacket has a maximum ASTM E84 rating of 5 for flame spread and 30 for smoke density. These values meet most typical requirements for building construction. Therefore, the jacket should remain intact when passing though typical building construction such as plenums, floor and ceiling joists, rim joists, walls, and other fire rated resistance construction limited to materials of ASTM E84 ratings of 25 flame and 50 smoke or lower.

A plenum is defined as an enclosed portion of the building structure that is designed to allow air movement, and thereby serve as part of an air distribution system. (See definition of Plenum, Section 8.0.) No gas tubing may be run within ductwork.

For tubing passing through a UL classified fire rated construction, UL Classified Systems for "Through-Penetration Firestop Systems (XHEZ)" may be found in UL Fire Resistance Volume 2. In instances that UL specifications for fire rated construction conflict with the current Gastite Design and Installation Guide, UL takes precedence.

UL Through-Penetration Firestop System information is available on the Gastite® Web site at www.gastite.com.

4.3.8 Routing Through Masonry Material

"Masonry material" includes but is not limited to brick, concrete, mortar, and stucco. The term "through masonry construction" refers to any enclosed/concealed construction spaces where CSST is routed in close proximity to masonry but does not apply to exposed CSST mounted to a set masonry surface.

When it is necessary to install Gastite®/FlashShield through masonry materials the tubing shall be routed through a conduit that is a ½" larger in diameter (to ease routing) than the OD of the CSST and appropriate for the application. The sleeve must maintain a continuous watertight barrier between the masonry material and the CSST, up to or past the edge of the masonry hole.

Masonry encasement refers to any enclosed/concealed construction within "masonry material" that produces distributed loads. For masonry encasement see Underground Installations (section 4.9).

4.3.9 Installation Within a Chimney Chase

Gastite tubing shall not be installed within a chase and/or enclosure that includes a metallic appliance vent and/or metallic chimney liner that protrudes through and/or past the roof unless:

- Permitted by local building code,
- An express separation distance as required by local code can be achieved along the entire length,
- The vent and/or liner is directly bonded to the grounding electrode system, AND
- There is no physical contact between the metallic vent and/or liner and the Gastite tubing along the entire length of the vent.

FlashShield™ CSST may be routed within a chimney chase, the restrictions of section 4.3.9 (Installation within a chase) do not apply.

4.4 Strike Protection

Concealed Gastite®/FlashShield™ CSST should be routed in areas that will minimize the opportunity for physical damage and/or installed in areas where the tubing will be free to move to avoid a potential puncture threat. The tube can be considered free to move when there is at least the tube's outside diameter of clearance on all sides of the tubing. (Fig. 4-36)

Gastite®/FlashShield™ CSST installed in locations subject to physical damage shall be adequately protected. The tubing shall be protected at points of support and when passing through structural members such as studs, joists and plates. Where all three of the following conditions exist mechanical strike protection must be used.

1. **Concealed** – View is obstructed by walls, and structural members.
2. **Constrained** – Tubing is not free to move to avoid puncture threats.
3. **Within 3 inches of a potential threat** – Tubing is routed in locations which are within 3 inches of drills, screws, or nails.

4.4.1 Strike Plates

For Gastite®/FlashShield™ CSST which meets all three of the conditions above, the required method for protecting concealed tubing is hardened steel striker plates listed for use with corrugated stainless steel tubing systems. Striker plates are used at all points of penetration through studs, joists, plates or similar structures (Figures 4-35, 4-37, 4-38, 4-39 and 4-40). Striker plates other than those provided or specified by Gastite are strictly prohibited.

The extent of protection shall be defined as follows:

a) At concealed support points and points of penetration less than 2 inches from any edge of a stud, joist, plate, etc., a listed striker plate is required at the area of support to provide coverage for 5 inches from the point of restraint in one or both directions.

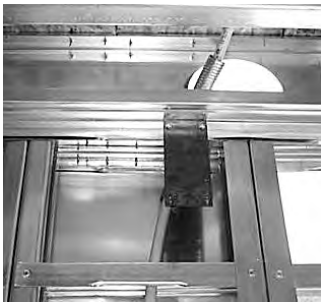

Fig 4-35

Note: Steel Stud Construction – Knock teeth off striker plate for steel stud construction. Floppy at corners aids pull-through.

Fig 4-36

Fig. 4-37

Fig. 4-38

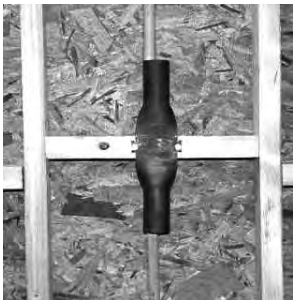

Fig. 4-39

Fig. 4-40

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b) At concealed support points and points of penetration 2 to 3 inches from any edge of a stud, joist plate, etc., listed 1/4 striker plates are required to provide protection throughout the area of penetration (Fig. 4-41 and 4-42).

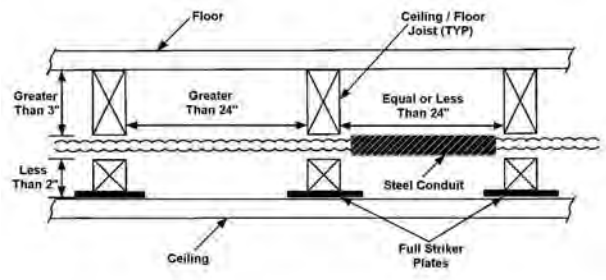

Fig. 4-41

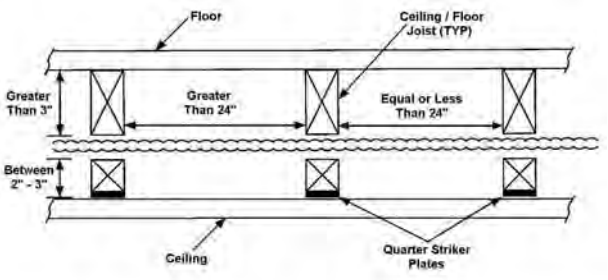

Fig. 4-42

c) When multiple runs are located between the same two studs such as manifold runs or meter bank runs, a 6" x 17" panel type striker plate may be used as an alternate to individual striker plates for each tubing run (Fig. 4-44).

Fig. 4-43

Fig. 4-44

d) When installed inside insulated exterior walls, tubing shall be routed between the face of the insulation and the interior wall surface (Fig. 4-45). If rigid insulation is used, enough space must be provided for movement of the tubing (see Section 4.4) or heavy wall conduit must run over the length of the restrained area.

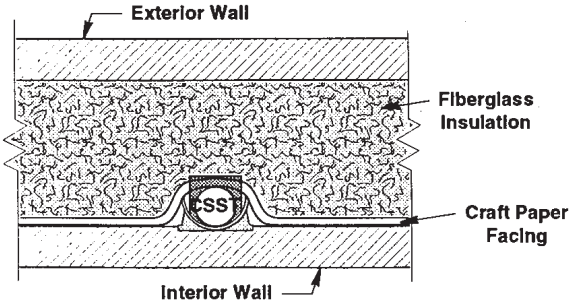

Fig. 4-45

e) At points of penetration greater than 3 inches from any edge of stud, joist, plate, etc., no protection is required.

f) Tubing routed horizontally through structural members shall be protected from puncture threats with the appropriate shielding material (Figure 4-41 and 4-42). At penetration points, listed plates of the appropriate size shall be utilized. Tubing between constraints that are less than 24 inches apart and meeting the criteria requiring full striker plates, shall be additionally protected by Steel Conduit (Fig. 4-43).

g) Gastite®/FlashShield™ CSST greater than 1" nominal diameter installed within a concealed hollow wall cavity of 2"x4" construction shall be protected along the entire concealed run length with Steel Conduit (see Section 4.4.2).

h) The width of installed striker plates shall be at least 1.5 times the outside diameter of the Gastite®/FlashShield™ CSST.

4.4.2 Steel Conduit

At termination points not covered by the ANSI standard, floppy steel conduit (heavy wall) shall be installed as additional protection (Fig. 4-46 and 4-47). Gastite®/FlashShield™ requires a minimum of six inches of conduit and supplies precut conduit in one foot lengths. Floppy Steel conduit should not be used in place of hardened steel striker plates when passing through structural members.

Fig. 4-46

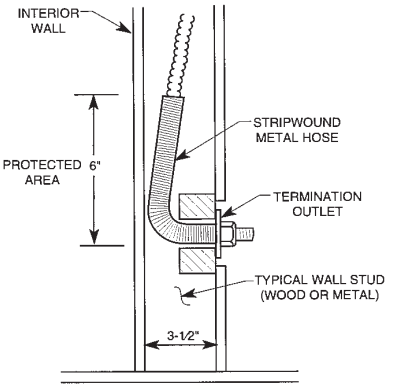

Fig. 4-47

4.5 Meter

The gas piping for the meter stub-out is usually subject to local requirements such as size, location, and material type. It is always important to confirm local code and utility requirements. Gastite®/FlashShield recommends the use of 1/2" CSST or greater as the minimum trunk line size. Size 3/8" should not be used for trunk lines. This will allow for the addition of future gas appliances and minimize the opportunity for whistling.

a) Unsupported Meters – Meters that depend on the service supply line and/or the house piping for support shall not be directly connected to the Gastite®/FlashShield™ CSST. As shown in the Figures 4-48 and 4-49, a rigid connection point is created using a Gastite®/FlashShield™ termination fitting, Gastite® designed stub-out or rigid pipe components.

Fig. 4-48

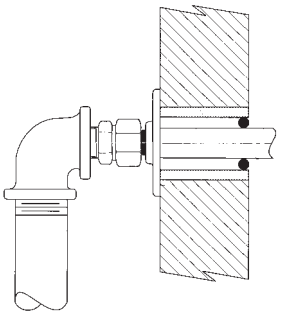

Fig. 4-49

b) Self-Supported Meters – Meters that are independently supported with a bracket can be directly connected to the Gastite®/FlashShield™ CSST as shown in Figure 4-51. If practical, direct Gastite®/FlashShield™ CSST connections shall include a 3 to 6 inch loop of tubing (as shown) to accommodate differential settling and meter movement. No mechanical protection of the tubing is required for outdoor meter connections; however, ensure that the local utility supports this practice as some utilities have regulations specifying meter attachments. Ensure that any exposed sections (jacket removed) of the stainless tubing at the fitting are wrapped with tape. This is especially important with masonry constructions.

Fig. 4-50

c) Electrical bonding connections made at the gas meter must comply with section 4.10 of this guide.

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4.6 Appliance

4.6.1 Moveable Appliance

a) For use with movable appliances, Gastite®/FlashShield™ must be rigidly terminated before the appliance connection. This fixed connection point allows for the attachment of flexible appliance connectors, drip legs (if required), and shut off valves to moveable appliances such as dryers and ranges (Figures 4-51 and 4-52).

Fig. 4-51

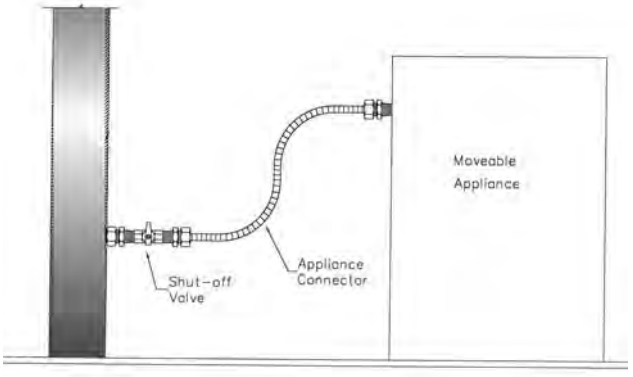

Fig. 4-52

b) The Appliance Stub-Out is mounted to a stud face (Fig. 4-53) and provides a fixed point to which a Gastite®/FlashShield™ mechanical fitting may be attached. The design of this stub-out ensures that the flexible tubing is routed away from any points of constraint that may subject the tubing to potential puncture threats.

c) The Straight Stub provides a fixed point for the Gastite®/FlashShield™ mechanical fitting and a stable platform for service meter connections. The Straight Stub may be mounted to the face of a stud (Fig. 4-54) or mounted to an optional Stub Bracket with supplied self-drilling metal screws (Fig. 4-55). The optional bracket is designed to span typical stud construction. The compact design of the straight stub allows for multiple stub-outs within the stud cavity.

The Straight Stub may also be used to pass through joist and wall constructions (Fig. 4-56). It is important to follow all requirements for sleeving when passing through masonry construction.

Fig. 4-53

Fig. 4-54

Fig. 4-55

Fig. 4-56

4.6.2 Direct Connection – Non-Moveable Appliances

Gastite®/FlashShield™ CSST may be connected directly to non-movable appliances such as water heaters, furnaces, boilers and island cook-tops (Figures 4-57) without the installation of a termination outlet or flexible appliance connector. All local codes requiring drip legs and shut-off valves must be observed. Drip legs and shut-off valves must be securely mounted.

a) When appliances such as water heaters, furnaces or fireplaces have metallic vents which extend beyond or protrude through the roof physical contact between the Gastite® CSST and the appliance cabinet or vent is prohibited. Gastite recommends that all continuous metallic systems be bonded and grounded.

Physical contact with appliance cabinets that have metallic vents which extend beyond or protrude through the roof is acceptable.

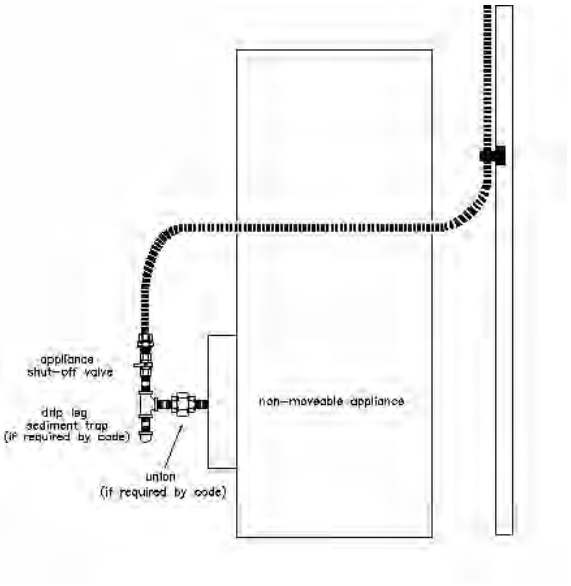

Fig. 4-57

4.6.3 Gas Convenience Outlet

a) Barbecue Grills – Movable grills shall be connected using an approved outdoor appliance connector which shall be attached to the CSST system either at a termination fitting or a quick disconnect device as shown in the figure (Fig. 4-58).

b) Permanently mounted grills located on decks (Fig. 4-59) shall be connected to the CSST system as shown in the figure and in accordance with the manufacturer's instructions. The outdoor portion of the CSST run shall be supported against the side of any of the inside deck joists.

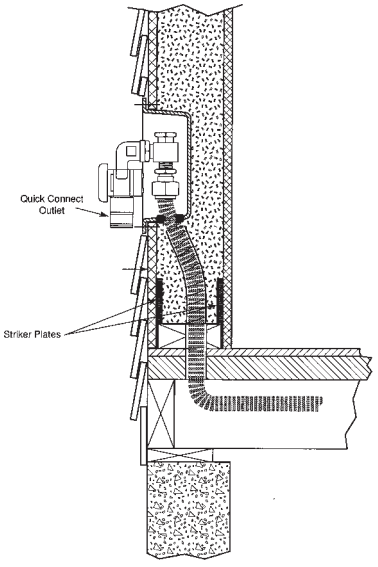

Fig. 4-58

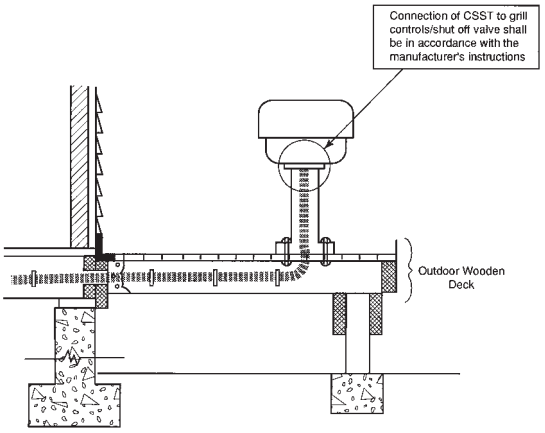

Fig. 4-59

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4.6.4 Special Applications

a) Roof Mounted Equipment (Fig. 4-60) – Gastite®/FlashShield™ Flexible Gas Piping can be used in an outdoor rooftop application. When used in this application Gastite® is to be supported off the surface of the roofing material. This support allows for adequate drainage on the roof, product protection from snow, and is commonly required by code.

When Gastite®/FlashShield™ Flexible Gas Piping is installed in an outdoor rooftop application the following requirements must be met:

1. Support materials will be selected to provide an adequate anchoring point that addresses the lightweight flexible nature of Gastite®/FlashShield™. This can be accomplished through either the weight of the support or adhering the support to the roof materials. The support materials must also be selected to be non-damaging to the roofing material. (Check with roof material manufacturer for approved adhering methods and non-damaging materials/installations.)
2. It is also important to select the appropriate metal pipe clamps or straps to firmly affix the tubing to the support.
3. The supports shall lift the tubing at least 3" from the surface of the roof, higher as required by code or local conditions. (Check with local code officials to determine height requirements as defined by the local code or conditions.)
4. Support spacing will follow the recommendations as outlined in Table 4-5 below.

Fig. 4-60

Table 4-5
Roof-Top Support Spacing

Gastite®/ FlashShield™ Size	EHD	Max Support Spacing
3/8"	13	6 Feet
1/2"	18	6 Feet
3/4"	23	6 Feet
1"	31	8 Feet
1-1/4"	37	8 Feet
1-1/2"	47	8 Feet
2"	60	8 Feet

Gastite®/FlashShield™ shall penetrate roofing in the manner and using the materials as defined by the roofing manufacturer in order to maintain the manufacturer's warranty (Figures 4-61 and 4-62). When passing through the deck Gastite®/FlashShield™ must be properly terminated or pass through an appropriate fixed conduit (Figures 4-63 and 4-64). NOTE: As roofing manufacturers generally have proprietary penetration systems and require trained installers, it is extremely important to obtain approval and instructions from the roofing manufacturer prior to performing any work. Failure to do so can result in voiding the roofing warranty.

Lengths of Gastite®/FlashShield™ CSST which run vertically up the side of the building shall be protected in accordance with the General Provisions section of these guidelines, Section 4.3.6.

Note: Roof penetration detailed prints available under "Engineering Specs" at www.gastite.com.

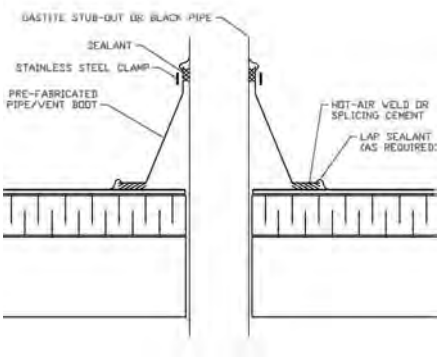

Fig. 4-61

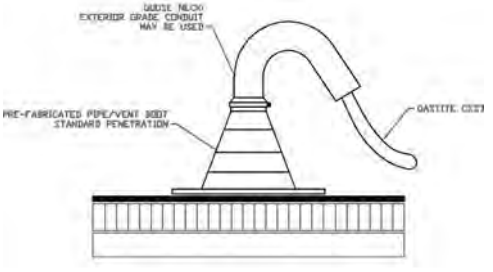

Fig. 4-62

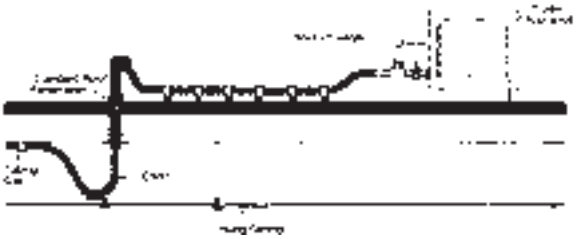

Fig. 4-63

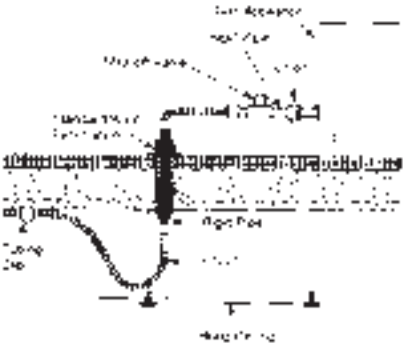

Fig. 4-64

b) Pad Mounted Equipment (Fig. 4-65) – Moveable gas appliances on concrete pads or blocks, such as heat pumps, air conditioners, pool heaters and NGV refueling systems, shall be connected to the Gastite®/FlashShield™ CSST system at a termination fitting using either rigid pipe or an approved outdoor appliance connector.

c) Gas Packs and Other Non-Moveable Equipment (Fig. 4-66) – Can be connected to the Gastite®/FlashShield™ CSST system either through a terminating fitting and rigid pipe or directly with Gastite®/FlashShield™ CSST connected to the appliance shut-off valve.

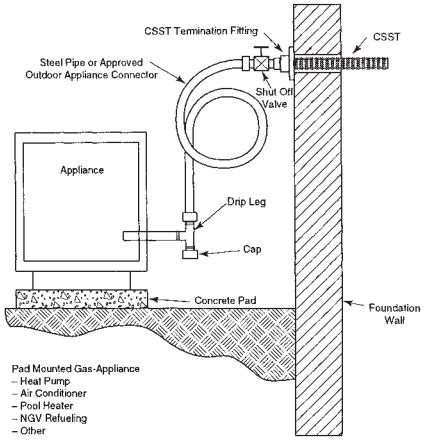

Fig. 4-65

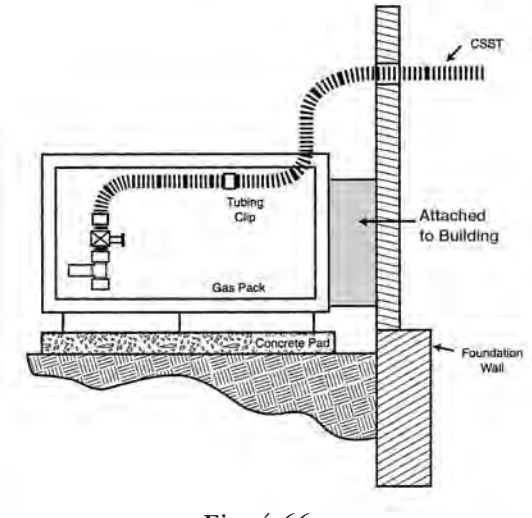

Fig. 4-66

d) Gas Lamps – Permanently mounted lights located on decks shall be connected to the Gastite®/FlashShield™ CSST system in the same fashion as permanently mounted grills as shown in the figure and in accordance with the manufacturers instructions.

e) Yard Mounted Lights – Shall be connected to the Gastite®/FlashShield™ CSST system as shown in Figure 4-67. All Gastite®/FlashShield™ CSST installed below grade shall be installed in accordance with Section 4.9.

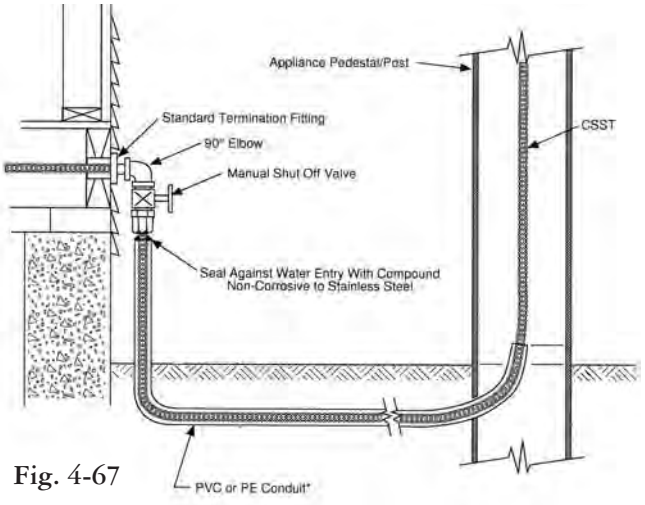

Fig. 4-67

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f) Infrared Heaters (Fig. 4-68) - Infrared heaters that are solidly mounted to ceilings and walls of structures may be connected to the Gastite®/FlashShield™ CSST system as shown in the figures below and in accordance with the manufacturers instructions. High Density infrared heaters generally fall into this category. Gastite®/FlashShield™ CSST should be mounted to a fixed point and not on the end involved with the typical expansion and contraction associated with these heaters.

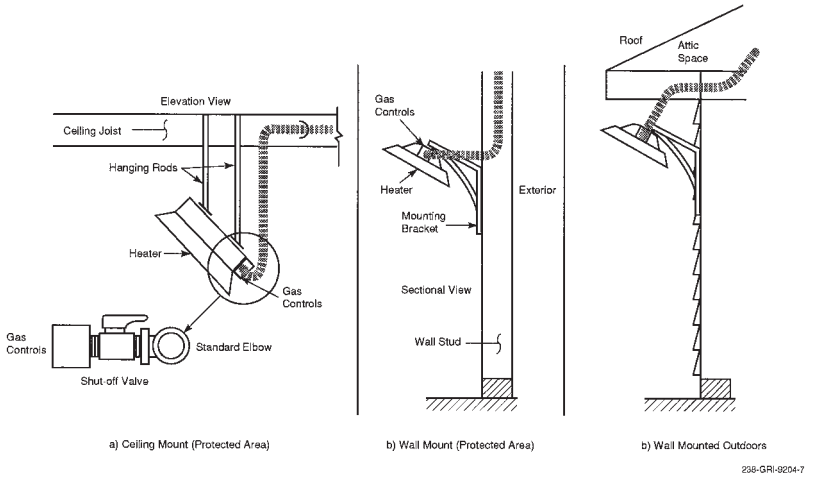


Fig. 4-68

Infrared heaters that are mounted to allow movement of the heater must use an appropriate appliance/flex connector between the heater and the properly terminated Gastite®/FlashShield™. Low Density heaters, tube heaters and heaters hung from chains fall into this category.

Heaters and installations must comply with ANSI Z83.6, "Standard for gas fired infrared heaters."

g) Gas Fireplace – Gastite®/FlashShield™ Flexible Gas Tubing may be used to deliver gas directly to the control valve of a gas fireplace (Fig. 4-69). Gastite®/FlashShield™ Flexible Gas Piping may also be used to deliver gas directly to the insert of a gas fireplace in decorative and heat generating fireplaces (Fig. 4-70). Per code valves shall be rigidly mounted.

CSST and Gastite®/FlashShield™ brass fittings should not be used inside the firebox for log lighters/gas wands or in any firebox where wood logs will be burned due to the potential for physical harm to the tubing (Fig. 4-71).

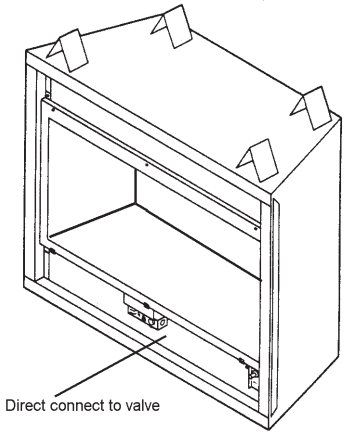


Fig. 4-69

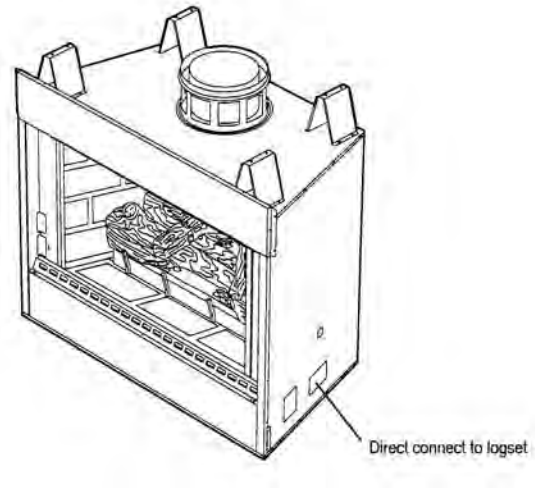


Fig. 4-70

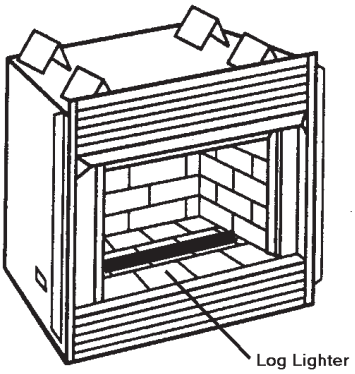
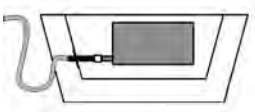


Fig. 4-71

The Gastite® Angle Stub is designed to create a secure mounting point or stub-out for the transition from Gastite®/FlashShield™ CSST to log-lighters, gas logs, or firebox insert's controls. Refer to Section 4.2 for Angle Stub Installation.

Proper Angle Stub Installation



Improper Angle Stub Installation

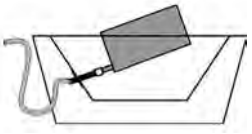


Fig. 4-72

The Gastite® Angle Stub shall not be connected in such a way that the log-lighter, gas log, or other components angle out of the fireplace. To correct for the insertion angle into the firebox, metal shims such as fender washers can be used. (See the proper and improper installation Fig. 4-72)

Gastite®/FlashShield™ Mechanical Fittings are approved to be concealed and can be connected directly to a valve controlling gas flow to a fireplace appliance. The Gastite®/FlashShield™ CSST and valve connection can be installed behind the wall, beneath the floor, hearth, or behind the brickwork of the fireplace (Fig. 4-75).

Where it is necessary to install Gastite®/FlashShield™ through masonry materials in fireplace construction, the plastic jacket shall remain intact and the tubing should be routed through sleeving that is appropriate for the application. Sleeving is not required through ceramic liners in decorative fireplaces and heat generating fireplaces.

Gastite®/FlashShield™ may not be run above the flue within a masonry chimney.

Where it is necessary to install Gastite®/FlashShield™ through sheet metal enclosures (such as fireplaces) the tubing should be routed or supported to prevent physical contact with the enclosure. If direct contact cannot be avoided a rubber grommet may be used to prevent physical contact with the enclosure. Otherwise a Gastite® angle stub or rigid pipe components must be used.

In certain configurations corrugated tubing or flexible appliance connectors feeding a fireplace or gas log set can whistle due to gas flow velocity. Acoustics can usually be avoided by restricting Gastite®/FlashShield™ CSST sizes to the maximum capacity as shown in Table 4-6 below.

No Physical Contact

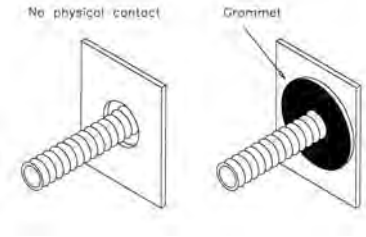


Fig. 4-73

Fig. 4-74

Fig. 4-75

Note: Strike Protection (Floppy) not shown for clarity.

Table 4-6		
Fireplace Sizing		
Gastite®/ FlashShield™ Size	**EHD**	**BTUH**
1/2"	18	45,000
3/4"	23	80,000
1"	31	125,000

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4.7 Manifold

Manifolds are installed where multiple runs are made from a common location in a parallel arrangement. The manifold may be manufactured from a one-piece malleable iron or brass casting (Fig. 4-76), a welded fabrication of steel sub-components or an assembly of approved, malleable iron tees and short nipples (Fig. 4-77). Manifolds must be rigidly installed. This can be achieved through the use of a mounted manifold bracket or by rigidly piping into a non-movable gas-piping component.

Depending on the location and available space, different mounting arrangements are permitted. A manifold may be mounted in any orientation on the surface of an interior wall, between open floor joists, in attic spaces, crawl spaces, within a partition wall, or inside an enclosure. A manifold assembly without a regulator can be concealed.

The Gastite®/FlashShield™ CSST Capacity Tables include losses for four 90° bends and two end fittings. Tubing runs with a larger number of bends and/or fittings shall be increased by an equivalent length of tubing to the following equation: L=1.3n where L is additional length of tubing and n is the number of additional fittings and/or bends. Each port of a manifold can be taken as an additional fitting. For example: the tube running from the last port of a 3-port manifold should have 3.9 feet (3 ports/fittings x 1.3) added to the run length for the purpose of sizing. This method is applicable for all manifolds whose ports are equal or greater in size than the pipe connected to the corresponding port.

The installation of manifold assemblies using a pounds-to-inches regulator must be in accordance with all local codes, and the following guidelines:

a) A manifold assembly directly integrating a pounds-to-inches regulator shall be installed in an accessible location so that the regulator can be inspected, maintained and serviced if repair or replacement is required.

b) For manifold systems that use a pounds-to-inches regulator installed behind an access panel, all tubing penetrations in the cabinet should be sealed, caulked or grommeted. The cabinet must be ventilated through the panel/door and not into a wall space.

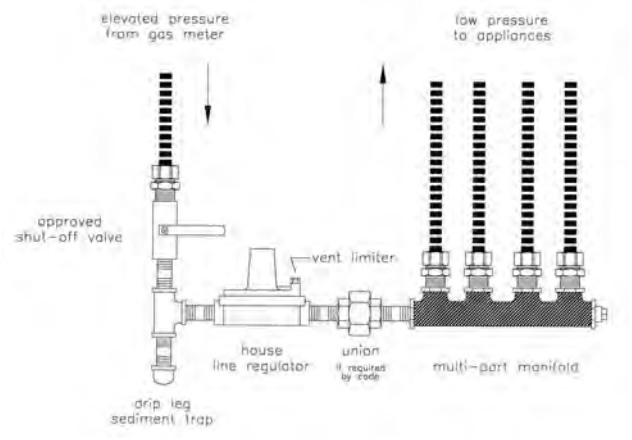


Fig. 4-76

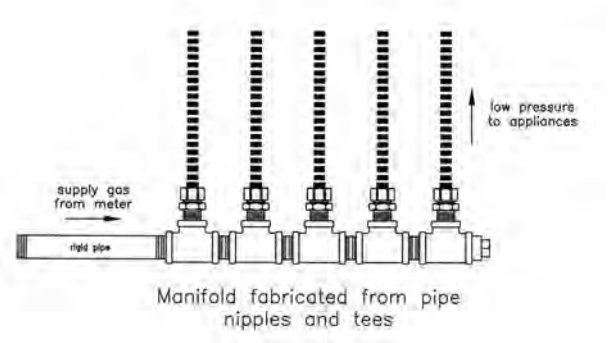


Fig. 4-77

c) Open face cabinets (Fig. 4-78), which open on to the normal room environment, may be utilized without the need for ventilation or penetration sealing requirements.

Fig. 4-78

4.8 Pressure Regulator

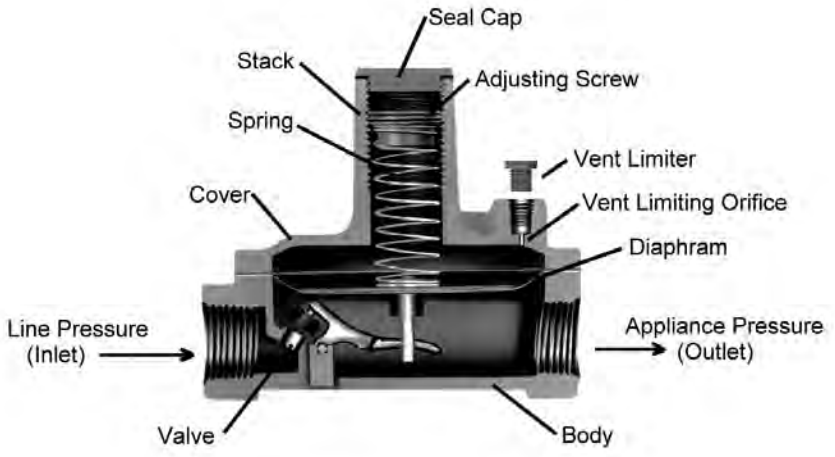
4.8.1 Introduction (Fig. 4-79)

A Gastite®/FlashShield™ CSST system using line gas pressures above the maximum appliance input rating shall use a regulator to lower the downstream appliance supply pressure to 1/2 PSI, or less. The regulator shall have a lock-up feature that will limit the downstream pressure to 1/2 PSI. Line gas pressures at or below the maximum appliance input rating does do not require the use of a line regulator.

A Line Gas Regulator is defined as a pressure regulator placed in a gas line between the service regulator and the appliance regulator. Regulators supplied by Gastite Division are designed to supply the highest performance as Line Gas Regulators and feature precise regulating control from full flow down to pilot flows.

Regulators must be rigidly installed. This can be achieved by rigidly mounting or piping into a rigid gas-piping component.

Fig. 4-79



4.8.2 Sizing Instructions

Line Pressure Regulator Selection (Tables 4-7 through 4-10)

Line pressure regulators are typically used in a 2 or 5 PSI gas piping installation to reduce supply pressure to the appliance within required operating ranges (typically 4"WC - 8"WC natural gas or 10"WC - 11"WC LP gas).

Regulators Supplied by Gastite Division:

1) For natural gas, the regulator outlet pressure is set to 8"WC and the appliance runs are sized with a 3"WC pressure drop. This will allow for 5"WC inlet pressure at the appliance.

2) For propane gas, the regulator outlet pressure is set to 11"WC and the appliance runs are sized with a 0.5"WC drop. This will allow for a 10.5"WC inlet pressure at the appliance.

To select the correct regulator for pressure regulation, the following information must be established:

- Available inlet pressure range at the regulator inlet.
- Desired outlet pressure.
- Total maximum flow rate vs. regulator model number (Table 4-7 through Table 4-9).
- Largest single appliance flow rate vs. regulator model number (Table 4-10).

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Regulator Capacity Tables

Table 4-7						
Regulator Capacity for Natural Gas with an 8" w.c. Outlet Pressure						
Capacities – 0.64 sp gr gas expressed in CFH (m^3/h)						
Model Number	Outlet Pressure	Operating Inlet Pressure				
		1/2 psi (34 mbar)	3/4 psi (52 mbar)	1 psi (69 mbar)	1-1/2 psi (103) mbar	2 psi (138 mbar)
T325-3-44/Reg8-300	8" w.c.	145 (4.1)	200 (5.7)	250 (7.1)	250 (7.1)	250 (7.1)
T325-5-44/Reg8-600	8" w.c.	335 (9.5)	475 (13.5)	550 (15.6)	550 (15.6)	550 (15.6)
T325-7L-44	8" w.c.	690 (19.5)	970 (27.5)	1000 (28.3)	1000 (28.3)	1000 (28.3)
T325-3L48 (OPD)	8" w.c.	160 (4.5)	200 (5.6)	200 (5.6)	200 (5.6)	200 (5.6)
T325-5AL600 (OPD)	8" w.c.	345 (9.6)	425 (11.9)	425 (11.9)	425 (11.9)	425 (11.9)
T325-7L-210D (OPD)	8" w.c.	650 (18.4)	900 (25.5)	900 (25.5)	900 (25.5)	900 (25.5)
30052-NG	8" w.c.	386 (10.9)	691 (19.6)	848 (24.0)	1063 (30.1)	1155 (32.7)
30053-NG	8" w.c.	386 (10.9)	899 (25.5)	1059 (30.0)	1382 (39.1)	1501 (42.5)
30153-NG	8" w.c.	3189 (90.3)	4638 (131.3)	5297 (150.0)	7230 (204.7)	7891 (223.4)
Capacity value for most typical 2 PSI parallel systems when trunk run is sized to deliver 1 PSI to regulator inlet.						

Table 4-8						
Regulator Capacity for Natural Gas with an 11 w.c. Outlet Pressure						
Capacities – 0.64 sp gr gas expressed in CFH (m^3/h)						
Model Number	Outlet Pressure	Operating Inlet Pressure				
		1/2 psi (34 mbar)	3/4 psi (52 mbar)	1 psi (69 mbar)	1-1/2 psi (103) mbar	2 psi (138 mbar)
T325-3-44P/Reg11-300	11" w.c.	93 (2.6)	172 (4.9)	225 (6.4)	250 (7.1)	250 (7.1)
T325-5-44P/Reg11-600	11" w.c.	211 (6.0)	391 (11.1)	511 (14.5)	550 (15.6)	550 (15.6)
T325-7L-44*	11" w.c.	441 (12.5)	816 (23.1)	1000 (28.3)	1000 (28.3)	1000 (28.3)
T325-3L48* (OPD)	11" w.c.	120 (3.4)	200 (5.6)	200 (5.6)	200 (5.6)	200 (5.6)
T325-5AL600* (OPD)	11" w.c.	260 (7.3)	425 (11.9)	425 (11.9)	425 (11.9)	425 (11.9)
T325-7L-210D* (OPD)	11" w.c.	490 (13.9)	821 (23.2)	900 (25.5)	900 (25.5)	900 (25.5)
30052-LP	11" w.c.	297 (8.4)	621 (17.6)	778 (22.0)	967 (27.4)	1155 (32.7)
30053-NG*	11" w.c.	297 (8.4)	807 (22.9)	1093 (31.0)	1297 (36.7)	1501 (42.5)
30153-NG*	11" w.c.	2349 (66.5)	4121 (116.7)	5264 (149.1)	6593 (186.7)	7921 (224.3)
Capacity value for most typical 2 PSI parallel systems when trunk run is sized to deliver 1 PSI to regulator inlet.						
*Regulator requires in-field adjustment to obtain output pressure of 11".						

Table 4-9						
Regulator Capacity for Propane with an 11" w.c. Outlet Pressure						
Capacities – 1.52 sp gr gas expressed in kBTUh						
		Operating Inlet Pressure				
Model Number	Outlet Pressure	1/2 psi (34 mbar)	3/4 psi (52 mbar)	1 psi (69 mbar)	1-1/2 psi (103) mbar	2 psi (138 mbar)
T325-3-44P/Reg11-300	11" w.c.	147	270	355	395	395
T325-5-44P/Reg11-600	11" w.c.	335	620	810	870	870
T325-7L-44*	11" w.c.	700	1290	1585	1585	1585
T325-3L48* (OPD)	11" w.c.	190	315	315	315	315
T325-5AL600* (OPD)	11" w.c.	410	670	670	670	670
T325-7L-210D* (OPD)	11" w.c.	775	1300	1425	1425	1425
30052-LP	11" w.c.	547	997	1285	1731	1981
30053-NG*	11" w.c.	712	1296	1671	2251	2575
30153-NG*	11" w.c.	3724	6784	8741	11775	13470
Capacity value for most typical 2 PSI parallel systems when trunk run is sized to deliver 1 PSI to regulator inlet.						
*Regulator requires in-field adjustment to obtain output pressure of 11".						

Table 4-10		
Largest Single Appliance Served by Regulator		
Regulator	Natural Gas (CFH)	Propane (kBTUh)
	0.64 SG gas	1.52 SG gas
T325-3-X / RegX-300	140	215
T325-5-X / RegX-600	300	460
T325-7L-44	900	1380
T325-3L48 (OPD)	200	305
T325-5AL600 (OPD)	425	650
T325-7L-210D (OPD)	900	1380

4.8.3 Installation

a) The regulator shall be installed in an accessible location with an approved shut-off valve and drip leg on the inlet side and a union (if required by code) on the outlet side so that it may be inspected, maintained and serviced if repair or replacement is required. The regulator must be installed with gas flow as indicated by the arrow on the casting.

b) Shut-off valves should be opened and closed slowly. A rapidly opened or closed valve can shock the regulator causing abnormal behavior.

c) The regulator is suitable for multi-poise mounting. When using a vent-limiting orifice however, the regulator must be mounted in a horizontal upright position.

d) The vent-limiting orifice (Fig. 4-80) is a fail-safe device that permits free air movement above the diaphragm during normal operation. In the unlikely event of a diaphragm rupture, the vent limiting orifice will limit gas escapement to 1.0 CFH natural gas at 2 PSI and 0.65 CFH LP at 2 PSI. Both values are below the ANSI standard of 2.5 CFH. Note: The vent-limiting orifice does not allow gas to escape to the environment during operation.

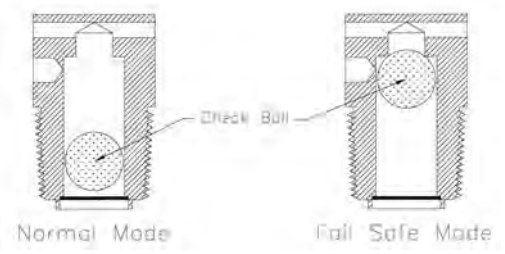

Fig. 4-80

e) Do not leak test the vent orifice with liquid leak test solution. This action will contaminate the internal check ball mechanism or plug the breathing hole resulting in erratic regulator performance

f) When using a vent-limiting orifice, the maximum inlet pressure is 2 PSI for Propane and 5 PSI for Natural Gas.

g) When using a vent line, the line must be at least the same size as the regulator vent connection for all runs up to 30 feet and shall be increased one pipe size over its entirety for every additional 30 feet that the vent runs. Vent lines may be constructed of any approved fuel gas piping, including Gastite®/FlashShield™ CSST. The vent shall be designed to prevent entry of water, insects or other foreign materials that could cause blockage of the line. Do not vent to appliance flue, pilot light or building exhaust system.

h) The regulators supplied by Gastite Division have a temperature range limit of -40 to 240 degrees F. The lower temperature limit and rust proof construction design enables the regulator to be used for outdoor installations. To minimize the potential for moisture condensation and freezing problems in or around the vent port, the vent-limiting orifice must be removed for outdoor installations.

Fig. 4-81

Outdoor Mounting Options: (Figures 4-81 through 4-83)

The regulator may be mounted upside down with the open vent port facing down. Consideration must be taken to ensure there is adequate clearance for snow buildup.

The regulator may be mounted horizontally, with a vent tube installed in the venting port. The end of the tube must be facing downward, and should be designed to prevent water and foreign material from causing a blockage. Another alternative is an outdoor plastic vent protector designed for the regulator.

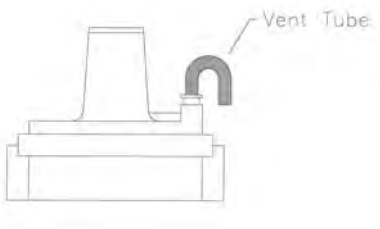

Fig. 4-82

Fig. 4-83

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4.8.4 Performance

a) A performance test should be conducted while operating all appliances at full load. This will test if adequate pressure is reaching each appliance under full-load conditions. To accomplish this, measure the line pressure at the appliance connection while operating the appliance.

b) The inlet pressure for typical gas appliances under full load conditions should be equal to but not exceeding the appliance's recommended inlet pressure range. If these pressure ranges cannot be obtained, a slight adjustment to the service regulator or the pounds-to-inches regulator may be necessary to increase line pressure.

4.8.5 Regulator Outlet Pressure Adjustment

a) Adjustment can be accomplished by first removing the regulator seal cap to expose the adjusting screw. Turning the screw clockwise will increase outlet pressure, turning it counter-clockwise will decrease pressure.

b) If spring adjustment will not produce the desired outlet pressure, check to make sure the main supply pressure is adequate. If the main supply pressure is adequate, consult factory for other line-regulator options. Do not continue to turn regulator adjusting screw clockwise if the outlet pressure readings do not continue to increase. This may result in over-firing due to loss of pressure control, should there be a subsequent increase in inlet pressure.

c) The line regulators can be adjusted with an outlet pressure ranging between 7 and 11 inches water column. The regulator must be adjusted according to the manufacturers recommended procedure. A pressure gauge mounted just downstream of the regulator can monitor the set pressure under various loads.

4.8.6 Over-Pressurization Protection

Downstream over-pressure protection must be provided in any gas piping installation where a line-pressure regulator is utilized for pressures in excess of 2 PSI to supply appliances rated for 1/2 PSI or less inlet pressure. Special line regulators of suitable control and capacity must be installed in place of the standard line regulator. This regulator contains an integral over-pressure protection device (OPD) (Fig. 4-84). This special regulator with OPD must be assembled and listed by the manufacturer in accordance with Z21.80, "Standard for line pressure regulators". Refer to Tables 4-7 through 4-9 for OPD capacities and sizing.

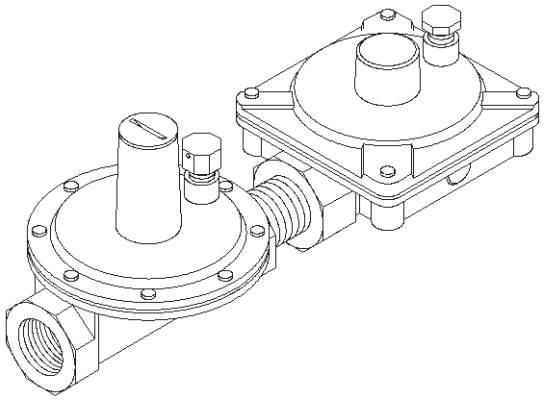

Fig. 4-84

NOTE: When using regulators other than those specified by Gastite Division for use with the Gastite® system, careful consideration must be given to the regulator performance characteristics such as required inlet pressure, flow capacity, the pressure drop through the regulator and available outlet pressure.

4.9 Underground Installations

a) Gastite®/FlashShield™ CSST shall not be buried directly in the ground or directly embedded in concrete (e.g. slab on grade construction, patio slabs, foundations and walkways). When it is necessary to bury or embed Gastite®/FlashShield™ CSST, the tubing shall be routed inside a non-metallic, watertight conduit that has an inside diameter at least 1/2 inch larger than the O.D. of the tubing (Fig. 4-85). For ends of the conduit installed outdoors, the conduit shall be sealed at any exposed end to prevent water from entering.

b) Venting of the conduit has typically been required because the use of conventional materials such as rigid pipe has usually resulted in some form of connection or union within the conduit. Unlike rigid pipe however, Gastite®/FlashShield™ CSST is continuous with only one fitting at each end of the run, and no fittings inside the conduit. As a result, the possibility of gas build-up due to fitting leaks has been eliminated. Therefore, Gastite Division does not require the sleeving to be vented to the outside of the structure.

If, however, venting is still required, Figure 4-86 below depicts gas piping installed within plastic sleeving that is vented to the outdoors. Other possible venting routes, such as the attic and roof, may also be considered but must be reviewed with the local administrative authority, and must prevent the entry of water and foreign objects.

For ends of Gastite®/FlashShield™ CSST exiting the plastic sleeving, a termination fitting (XR2TRM-#-NF) threaded into an end "plug", can be used to provide a stable platform for attachment (Fig. 4-87).

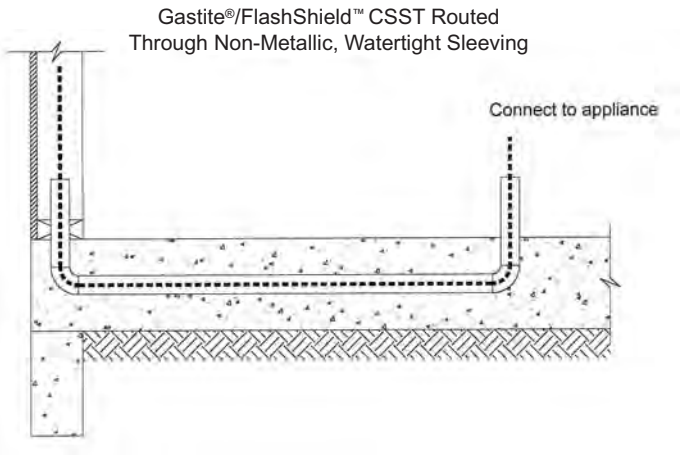

Fig. 4-85

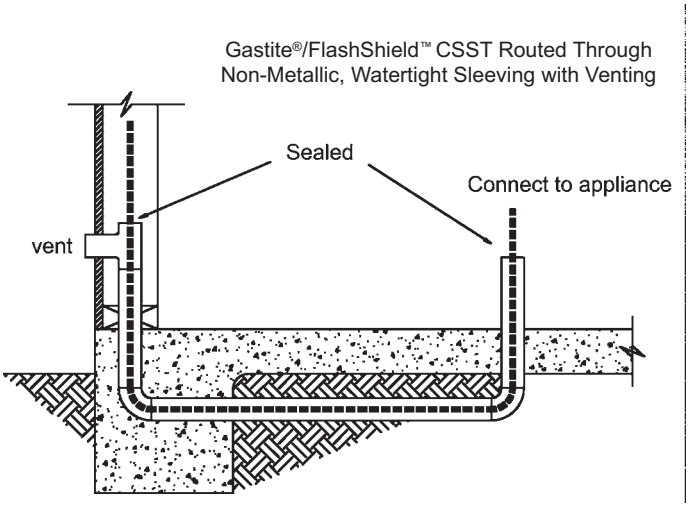

Fig. 4-86

Fig. 4-87

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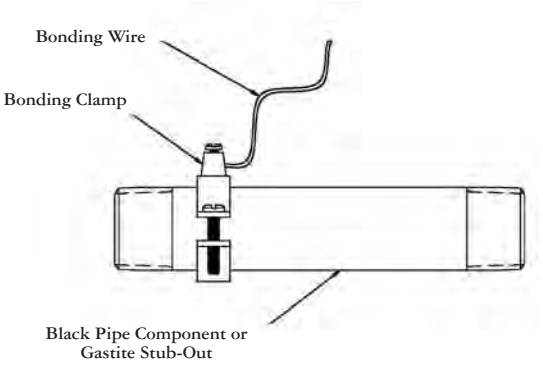
4.10 Electrical Bonding of Gastite®/FlashShield™ CSST

a) Unlike Gastite®, there are no additional bonding requirements for FlashShield™ imposed by the manufacturer's installation instructions. FlashShield™ is to be bonded in accordance with the National Electrical Code NFPA 70 Article 250.104 in the same manner as the minimum requirements for rigid metal piping. However, installers must always adhere to any local requirements that may conflict with these instructions.

b) Direct bonding of Gastite® CSST is required for all gas-piping systems incorporating Gastite® CSST whether or not the connected gas equipment is electrically powered. This requirement is provided as part of the manufacturer's instruction for single-family and multi-family buildings. A person knowledgeable in electrical system design, the local electrical code and these requirements should specify the bonding for commercial applications.

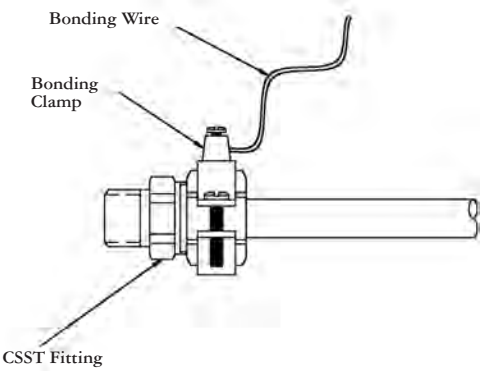
Gastite® CSST installed inside or attached to a building or structure shall be electrically continuous and direct bonded to the electrical ground system of the premise in which it is installed. The gas piping system shall be considered to be direct bonded when installed in accordance with the following:

Fig. 4-88 - Bonding Clamp on Steel Pipe Segment or Gastite Stub-Out.
(Remove any paint or coating on pipe surface beneath clamp location)



The piping is permanently and directly connected to the electrical service equipment enclosure, the grounded conductor at the electrical service, the grounding electrode conductor (where of sufficient size) or to one or more of the grounding electrodes used. For single and multi-family structures, a **single bond connection** shall be made downstream of the individual gas meter for each housing unit and upstream of any CSST connection. The bonding conductor shall be no smaller than a 6 AWG copper wire or equivalent. The bonding jumper shall be attached in an approved manner in accordance with NEC Article 250.70 and the point of attachment for the bonding jumper shall be accessible. Bonding/grounding clamps shall be installed in accordance with its listing per UL 467 and shall make metal-to-metal contact with the piping. This bond is in addition to any other bonding requirements as specified by local codes.

Fig. 4-89 - Bonding Clamp on Gastite CSST fitting.
(Clamp #CWP1JSH, CWP2JSH or CWP3JSH)



For attachment to the CSST gas piping system, a single bonding clamp must be attached to either a segment of steel pipe, a rigid pipe component or to the Gastite brass hex fitting. For attachment to a segment of steel pipe or a rigid pipe component **any** bonding clamp listed to UL467 may be used. For attachment to a Gastite hex fitting, clamps manufactured by Erico (part number CWP1JSH for 3/8" & 1/2", CWP2JSH for 3/4" thru 1-1/4" and CWP3JSH for 1 1/2" & 2") must be used. The corrugated stainless steel tubing portion of the gas piping system shall not be used as the point of attachment of the bonding conductor at any location along its length under any circumstances. See examples provided in Figures 4-88 and 4-89.

Proper bonding and grounding will reduce the risk of damage and fire from a lightning strike. Lightning is a highly destructive force. Even a nearby lightning strike that does not strike a structure directly can cause all electrically conductive systems in the structure to become energized. If these systems are not adequately bonded, the difference in electrical potential between the systems may cause the charge to arc from one system to another. Arcing can cause damage to CSST. Direct bonding and grounding as set forth above will reduce the risk of arcing and related damage over a non direct bonded system.

Depending upon conditions specific to the location of the structure in which the Gastite system is being installed, including but not limited to whether the area is prone to lightning, the owner of the structure should consider whether a lightning protection system is necessary or appropriate. Lightning protection systems are beyond the scope of this bulletin, but are covered by NFPA 780, the Standard for the Installation of Lightning Protection Systems and other standards.

SECTION 5.0 INSPECTION, REPAIR AND REPLACEMENT

5.1 Minimum Inspection Requirements

Gastite®/FlashShield™ CSST Installation Checklist

Date:	**Elevated Pressure: Yes No**
Contractor:	**Comments:**
Address:	

- ☐ Qualified Installer with Certification Card.
- ☐ Components from same manufacturer.
- ☐ Strike protection.
- ☐ System Sizing.
- ☐ Connected to fixed appliances only. Flexible connector for moveable appliances.
- ☐ Regulator isolated or removed for pressure test.
- ☐ Regulator horizontal when using vent limiter.
- ☐ Regulator is installed in an accessible location with shut-off valve and drip leg mounted ahead of regulator.
- ☐ Jacket kept in place for outdoor installations.
- ☐ Sleeved for underground and through masonry.
- ☐ Supported but not restricted.
- ☐ Bonded per section 4.10.

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5.2 Installation Checklist Description

Corrugated Stainless Steel Tubing (CSST) has been design certified by the Canadian Standards Association since 1990 for use as a fuel gas piping system. Gastite®/FlashShield™ CSST has been tested per ANSI LC1 as required for approval and as an approved gas piping material in the National Fuel Gas Code-NFPA 54 & 58, the International Fuel Gas Code-ICC, and with the Uniform Plumbing Code-IAPMO.

Approval: Conditions and Requirements

A flexible gas piping system using Gastite®/FlashShield™ CSST must be installed in accordance with all local building codes and the manufacturer's instructions. The following checklist is designed to assist the local administrative authority to perform an inspection of a fuel gas piping system using corrugated stainless steel tubing.

1. Gastite®/FlashShield™ flexible gas piping may only be installed by a qualified installer who has successfully completed the manufacturer's certification training program. A manufacturer's certification card is required to purchase and install Gastite®/FlashShield™ flexible gas piping.

2. Only the components provided or specified by the Gastite Division (including strike protection) as part of the piping system are to be used in the installation.

3. Gastite®/FlashShield™ CSST routed in a location which is concealed, constrained and within 3 inches of a potential threat must be protected against damage using protection devices listed in the manufacturer's Design and Installation Guide.

4. Sizing of the flexible gas piping system must be performed using capacity tables found in the manufacturer's Design and Installation Guide or other code approved CSST capacity tables.

5. Gastite®/FlashShield™ CSST should not be connected to moveable appliances. Connections to moveable appliances such as ranges and clothes dryers should be accomplished with a flexible appliance connector.

6. The Gastite®/FlashShield™ flexible gas piping system must be pressure tested for leaks during rough construction in accordance with all local codes. In the absence of local requirements, test in accordance with NFPA 54, National Fuel Gas Code, which is 1-1/2 times the maximum working pressure but not less than 3 PSI. To subject the entire Gastite®/FlashShield™ CSST system to pressure test, the pressure regulators should be isolated or removed.

7. Regulators are suitable for multi-poise mounting. When using a vent-limiting device however, the regulator must be mounted in a horizontal upright position.

8. A manifold assembly utilizing a pounds-to-inches regulator shall include a ball valve ahead of the regulator and installed in an accessible location so that the regulator can be inspected, maintained and serviced if repair or replacement is required.

9. When installed outdoors, the external jacket shall remain intact as much as possible. Exposed portions of the stainless steel tubing shall be wrapped to provide protection from corrosive threats.

10. For installations buried underground, under concrete/asphalt or embedded in concrete, Gastite®/FlashShield™ CSST must be routed in a non-metallic watertight conduit which has an inside diameter at least 1/2 in. larger than the outside diameter of the tubing. Under concrete/asphalt slab, sleeved CSST must be buried in accordance with all local codes. No mechanical joints are permitted within the conduit.

11. Installation must be properly supported to not only keep the job professional and organized but also to prevent excess strain on the bends and fittings. Supports installed in addition to the practices outlined by Gastite Division, restricts the tubing and increases susceptibility to strike damage.

12. Gas piping systems must be properly bonded to the structure's electrical service. A qualified professional following the NEC approved methods as outlined in section 4.10 shall perform the bonding installation.

13. Gastite® CSST must be physically separated from other continuous metallic systems in accordance with section 4.3 of this guide.

5.3 Repair of Damaged CSST

5.3.1 Determine Damage

Crushed, dented or kinked tubing may result in restricted flow conditions. Use the following guidelines to determine the severity of damage and whether repair or replacement is necessary.

a) Gastite®/FlashShield™ CSST gas tubing must be repaired if damaged by puncture of any kind, e.g. nails, screws, drill bits, etc.

b) No repairs or replacement of the tubing is necessary if the Gastite®/FlashShield™ CSST tubing is only slightly dented due to impact or crushing and the overall crush depth is less than 1/3 the diameter of the tubing. Minimal flow reduction will occur at this limited damage level.

c) Repair or replacement is necessary if the overall crush depth is greater than 1/3 the diameter of the tubing. Restricted flow may occur at this damage level.

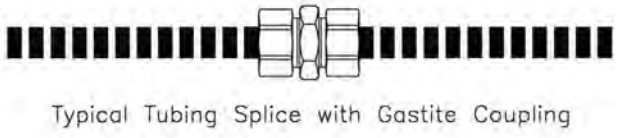
d) Gastite®/FlashShield™ CSST tubing bent beyond its minimum bend radius so that a crease or kink remains must be repaired. Restricted flow may occur at this damage level.

5.3.2 Method of Repair

A line splice can be made, but if the tubing run is short and easily accessible, the preferred repair method is to replace the entire length. Often, a tubing run can be replaced faster than repairing the damaged section. The Gastite®/FlashShield™ mechanical joint fittings can be removed and easily re-attached. This is the preferred method because it does not add any additional fitting joints to the system.

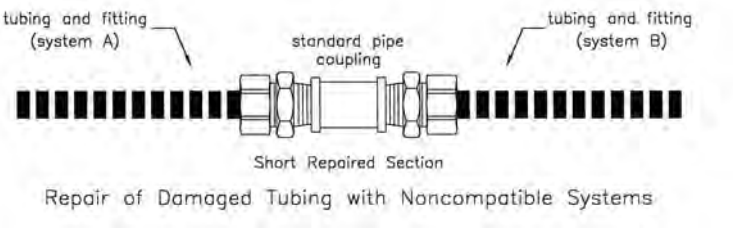
Where repairs or replacements involve only the Gastite®/FlashShield™ CSST, the tubing can be joined with standard pipe couplings or Gastite®/FlashShield™ CSST coupling (Fig. 5-1).

Where repairs or replacements involve CSST systems of different manufacturers, the systems can be joined through standard pipe couplings and each manufacturer's recommended CSST fitting (Fig. 5-2).



Typical Tubing Splice with Gastite Coupling

Fig. 5-1



Repair of Damaged Tubing with Noncompatible Systems

Fig. 5-2

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Section 6.0 Pressure/Leakage Testing

6.1 General Guidelines for Pressure Testing

a) The final installation must be inspected and tested for leaks in accordance with the local/state codes. In the absence of local codes, installation must be in accordance with the current edition of the National Fuel Gas Code, ANSI Z223.1/NFPA-54 (USA), or Installation Codes CSA-B149.1 (Canada). Pressure testing must comply with these guidelines or local codes. When local codes are more stringent, local codes must be followed.

b) Pressure testing must be performed during rough construction of the facility (before interior walls are finished). This will permit a more complete inspection of the piping system during the pressure testing.

c) Do not connect appliances or pressurize with fuel gas until after the pressure test has been passed.

d) All gas outlets for appliance connections should be capped during pressure testing.

6.2 Elevated Pressure Systems

If an elevated pressure system requires a pressure test of 10 PSI or greater, the regulator must be removed or isolated prior to pressure testing.

The test may be performed as a one-part test replacing the regulator with a suitable jumper pipe length for pressure testing the entire system (Figures 6-1 and 6-2).

Fig. 6-1

Fig. 6-2

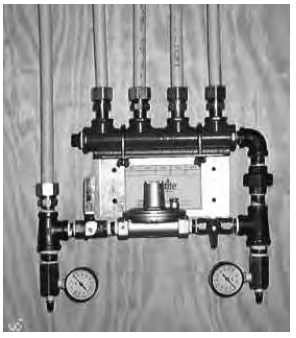

Fig. 6-3

Or a two-part test may be performed as shown in Figure 6-3:

- The first test is performed on the elevated pressure section, between the meter connection and the pounds-to-inches line regulator.

- The second test is performed on the low-pressure section, between the outlet of the pounds-to-inches line regulator and the gas appliance outlets.

- For a two-part test, it is important to remember to close both gas shut-off valves to avoid damage to the regulator.

- When opening the shut-off valves it is important to open them slowly. A quickly opened valve can shock the regulator and cause abnormal regulator behavior.

6.3 Appliance Connection Leakage Check Procedure

After the final pressure test, inspection and final construction is complete (finished interior walls), connect the appliances to the system. This connection can be made using an approved flexible connector for movable appliances, or with Gastite®/FlashShield™ CSST tubing or rigid black pipe for fixed appliances. Turn the gas on at the meter and inspect for leakage before operating the appliances.

a) Connections made at the appliances should be leak checked with a chloride-free bubble solution. Leak check solutions must comply with ASTM E515, or be labeled as non-corrosive.

b) Before placing the appliances in operation, the tubing system should be purged. This displaces the air in the system with fuel gas. Be sure to vent into a well-ventilated area.

NOTE: Leak test solutions may cause corrosion in some types of material in the gas tubing system, be sure to water rinse after the test and thoroughly dry all contacted material. Also, the vent limiter should not be leak tested with a liquid test solution. This will contaminate the internal ball check mechanism or plug the breathing hole, resulting in erratic regulator operation.

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SECTION 8.0 DEFINITIONS

APPLIANCE (EQUIPMENT) – Any device which utilizes gas as a fuel or raw material to produce light, heat, power, refrigeration or air conditioning.

APPROVED – Acceptable to the authority having jurisdiction.

AUTHORITY HAVING JURISDICTION – The organization, office or individual responsible for "approving" equipment, an installation or procedure.

BONDING (BONDED) – The permanent joining of metallic parts to form an electrically conductive path that ensures electrical continuity and the capacity to conduct safely any current likely to be imposed. As per the National Electrical Code.

CAPACITY, FLOW – As used in this standard, the amount of a specified gas that will flow through a specific length and configuration of tubing, a manifold, fitting or other component at a specified pressure drop in a fixed period of time.

CONCEALED GAS TUBING – Gas tubing, which, when in place in a finished building, would require removal of permanent construction to gain access to the piping.

CONNECTOR, GAS APPLIANCE – A factory-fabricated assembly of gas conduit and related fittings designed to convey gaseous fuel, and used for making connections between a gas supply piping outlet and the gas to an appliance. It is equipped at each end for attachment to standard taper pipe threads.

DIRECT BONDING – Bonding, as above, where the electrical connection is made using a clamp and wire at the piping connected directly to the electrical panel. Refer to Section 4.10 Electrical Bounding of Gastite®/FlashShield™ CSST.

EFFECTIVE GROUND-FAULT CURRENT PATH – An intentionally constructed, permanent, low impedance electrically conductive path designed and intended to carry under ground fault conditions from the point of a ground fault on a wiring system to the electrical supply source.

EQUIVALENT HYDRAULIC DIAMETER (EHD) – A theoretical size, which reflects the hydraulic performance of the tubing. It is not true physical measurement.

EXPOSED GAS TUBING – Gas tubing which will be in view in the finished structure.

FUEL GAS – A commonly distributed gas used for fuel such as natural gas, manufactured gas, undiluted liquefied petroleum gas (vapor phase only), liquefied petroleum gas-air mixtures of these gases (includes propane and butane).

GAS UTILIZATION EQUIPMENT – Any device that utilizes gas as a fuel or raw material or both.

INCHES OF WATER COLUMN ("WC) – Method of pressure measured in inches of water column by a manometer or pressure gauge. Commonly used in the gas industry when the pressure is less than 1 PSI.

LEAK TEST SOLUTION – A solution of commercial leak-testing fluids may be used. The use of soap buds or household detergents and water is not considered a satisfactory leak-test fluid for a bubble test, because of a lack of sensitivity due to masking by foam. The fluid should be capable of being applied free of bubbles so that a bubble appears only at a leak. The fluid selected should not bubble except in response to a leak.

LISTED – Equipment or materials including a list published by an organization acceptable to the authority having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or materials meets appropriate standards or has been tested and found suitable for use in a specified manner.

LOCKUP PRESSURE, REGULATOR – The system pressure, immediately downstream of the regulator, at which the regulator valve will completely close (leak tight) under no-flow conditions to prevent the downstream pressure from exceeding a predetermined level.

MAXIMUM ACTUAL OPERATING PRESSURE – The maximum pressure existing in a piping system during a normal annual operating cycle.

OVER-PRESSURE PROTECTION DEVICE (OPD) – System component that is intended to protect all downstream components from high pressures in the event of a system failure. OPDs are required in gas systems using more than 2psi line pressure.

PIPING SYSTEM – As used in this standard, an assembly of corrugated stainless steel tubing and tubing connection fittings, intended for field assembly and installation in residential or commercial buildings to distribute fuel gas to gas utilization equipment within the building. The piping system may also include a gas pressure regulator(s), a shutoff valve(s), tube shielding devices, distribution manifold(s), and other approved devices or components.

PLENUM – A plenum is an enclosed portion of the building structure that is designed to allow air movement, and thereby serve as part of an air distribution system.

PRESSURE DROP – The loss in static pressure of flowing fuel gas due to friction or other flow resistance in tubing, fittings, valves, regulators, or other devices in the piping system.

QUALIFIED INSTALLER – Any individual, firm, corporation or company which either in person or through a representative is engaged in and is responsible for the installation or replacement of building gas piping systems, who is experienced in such work, familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction.

QUICK-DISCONNECT DEVICE – A hand-operated device which provides a means for connecting and disconnecting an appliance or an appliance connector to a gas supply, and which is equipped with an automatic means to shut off the gas supply when the device is disconnected.

REGULATOR, PRESSURE – A device placed in a gas line for reducing, controlling and maintaining the pressure in that portion of the piping system downstream of the device.

SHIELDING DEVICE – A component of the piping system used to protect the installed corrugated tubing from accidental puncture by nails, screws or similar hardware at concealed tubing support points.

STRIKER PLATE – A special type of shielding device used when concealed tubing is run through wall studs, floor and ceiling joists or other structural members where tubing movement is restricted.

VALVE, SHUTOFF – A device used in piping to control the gas supply to any section of the piping system or to an appliance.

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