



Lightning Safety Recommendations for Gas Piping Systems

using **CounterStrike** and **TracPipe** by OmegaFlex.



CounterStrike[®]
For Enhanced Lightning Protection by TracPipe[®]



TracPipe PS-II
Flexible Gas Piping by OmegaFlex
PATENTED


CounterStrike
For Enhanced Lightning Protection by TracPipe®
PATENTED

AutoTrip
Excess Flow Valve by OmegaFlex

Lightning Safety Recommendations for Gas Piping Systems

Lightning is unpredictable; a chance of an individual building being struck either directly or indirectly (nearby lightning strike) is based upon the geographical location and the topography of the site. Lightning has such high levels of voltage that many paths to ground with high resistance can be overcome. It is common for lightning to exceed 100,000 volts and 40,000 or more amps. The current induced by lightning strikes does NOT “take the path of least resistance” as popularly believed. Current from lightning takes ALL paths of resistance to ground. The amount of current is inversely proportional to the resistance/impedance in the path taken.

Provisions for grounding of the electrical system and bonding other metallic systems are contained in the NEC (National Electrical Code NFPA 70) and the NFGC (National Fuel Gas Code NFPA 54). The requirement for grounding per code is very specific and will be accomplished by the electrical contractor in most new home construction. Lightning protection for buildings and building systems are covered in NFPA 780.

Definitions:

Grounding: The process of making an electrical connection to the general mass of the earth. This is most often accomplished with ground rods, ground mats or some other grounding system. Low resistance grounding is critical to the operation of lightning protection techniques.

Bonding: The process of making an electrical connection between the grounding electrode and any equipment, appliance, or metal conductor: pipes, plumbing, flues, etc. Equipment bonding serves to protect people and equipment in the event of an electrical fault.

Equipotential Bonding: The process of making an electrical connection between the grounding electrode and any metal conductor: pipes, plumbing, flues, etc., which may be exposed to a lightning strike and can be a conductive path for lightning energy towards or away from the grounding electrode.

Each year, new methods, materials and standards for home construction are developed. While these methods create efficiencies for contractors and accelerate the availability of

finished housing, some of these methods have left mechanical systems increasingly vulnerable to the effects of lightning. If a building is hit by a direct lightning strike, the potential for damage and resultant insurance loss is extremely high. In nearby lightning strikes, the energy of the lightning is transmitted to the building through ground current transfer. Nearby lightning strikes change ground potential and induce voltage waves through magnetic flux and ground saturation.

Nearby strikes may present hazards for mechanical systems due to differences in potential between the grounded electrical system and any non-bonded metallic supply or communication system. Gas piping systems present a unique problem because they convey flammable fuel gas which may add to the fire hazard if any system components are damaged, including valves, regulators and appliance connectors. Black iron piping systems as well as copper tube and the newer corrugated stainless steel tubing (CSST) can all be compromised by nearby strikes causing electrical arcing and damage to components. Leakage of fuel gas from a gas piping system (iron, copper, CSST) damaged by lightning can cause a fire.

Improved CounterStrike®

CounterStrike®

As part of our ongoing process of continuing improvement, Omega Flex has developed an improved version of CounterStrike®. This is a second-generation product that is an effective but affordable tool in increasing the protection of CSST gas piping systems from the damage caused by nearby, indirect lightning strikes. This version takes CounterStrike's proven capabilities to an even higher level.

CounterStrike is a patented CSST innovation based on our existing TracPipe® CSST product, but that is engineered to significantly decrease the potential for lightning induced damage to fuel gas piping systems. CounterStrike has been designed with a proprietary jacket material in place of the standard yellow jacket. This black jacket has energy dissipating properties that will help protect the stainless steel pressure liner as well as other fuel gas system components if the CounterStrike becomes energized due to lightning.

The improved version of CounterStrike is designed to withstand significantly higher levels of lightning energy when compared to first generation CounterStrike and, of course, to conventional TracPipe with the yellow jacket. CounterStrike has been shown to be 50 times more resistant to the damaging effects of electrical energy than conventional TracPipe, and is at least 6 times more resistant to that damage than the previous version of CounterStrike.

No product, including the improved CounterStrike is immune to the damage caused by a direct lightning strike. Refer to NFPA 780 for lightning protection systems for buildings and building systems.

CounterStrike® Advantages

All metallic mechanical systems, including all forms of gas piping, are vulnerable to lightning energy which enters a building during a nearby strike. Lightning has been shown to energize the metallic systems in a house through impressed voltage and induced voltage. Once this energy is inside a building, it will seek to return to ground along every possible path. In an attempt to equalize potentials, the energy may jump or arc from one pathway to another, depending on the electrical resistance of the material. This arcing is very likely to cause damage to mechanical and electric systems. This same phenomenon is one reason that sensitive electronic equipment within buildings is protected by lightning surge arrestors.

CounterStrike's black jacket has energy dissipating properties that improves its ability to withstand damage due to arcing.

CounterStrike's energy dissipating qualities also reduce the level of energy as it moves downstream. This also reduces the attendant risks to regulators, appliance connectors and other mechanical systems, all of which could result in the potential for fire.

CounterStrike provides the same level of installation and operational convenience as conventional CSST.

Finally, with CounterStrike's improved properties, CounterStrike is to be bonded in accordance 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 be in conflict with the CounterStrike installation instructions. This may result in the avoidance of additional bonding costs which are required for conventional CSST.

For all of these reasons, CounterStrike is the obvious choice for home builder's when it comes to the health and safety of his homeowner customers.

CounterStrike® Installation

CounterStrike with the black, protective sleeve uses the same easy to install AutoFlare® fittings as conventional TracPipe® with the yellow coating. It is sold on wooden reels of varying lengths to meet the needs of the gas piping contractor.

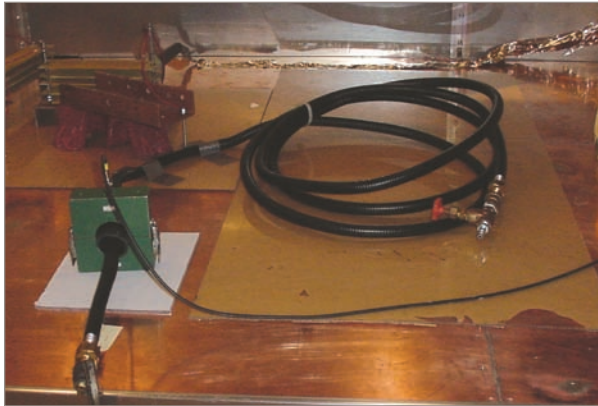
Unlike TracPipe®, there are no additional bonding requirements for CounterStrike® imposed by the manufacturer's installation instructions. CounterStrike is to be bonded in accordance with the National Electrical Code NFPA 70 Article 250.104 in the same manner as the minimum requirements for rigid metal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

CounterStrike meets building code requirements (ASTM E84) with respect to flame spread and smoke density. This permits installation in drop ceilings used as return air plenums, and is UL Listed for 1, 2, and 4 hour through penetration firestop systems without removal of the jacket. CounterStrike is also approved by Factory Mutual as a flexible piping system for flammable gases, based on its ability to withstand stresses caused by earthquakes without fracture or leakage.

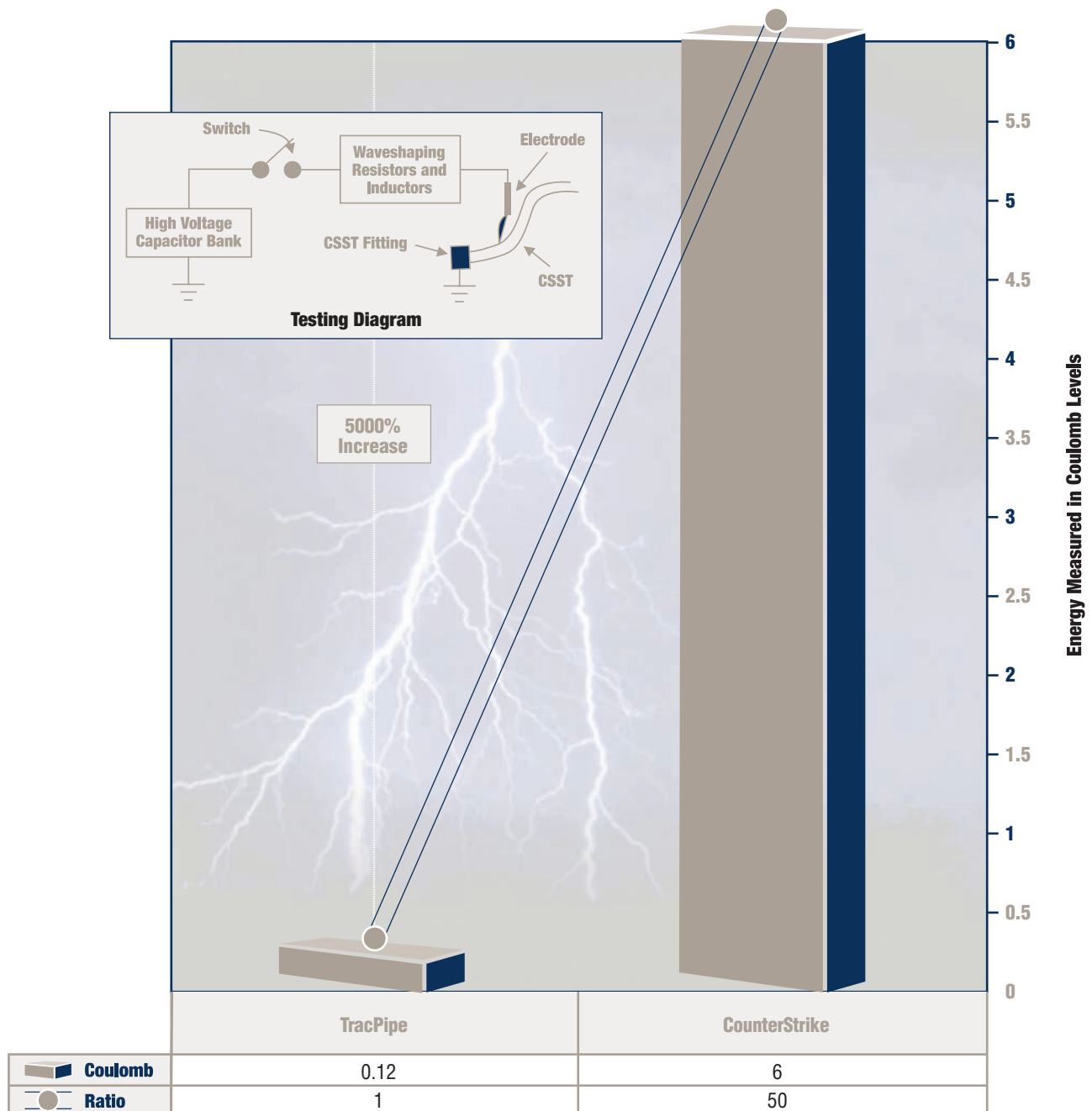
CounterStrike Part Number	Size	Reel Length	Lb/Reel
FGP-CS-375-250	3/8	250	41
FGP-CS-375-100	3/8	100	18
FGP-CS-500-250	1/2	250	52
FGP-CS-500-100	1/2	100	23
FGP-CS-500-50	1/2	50	14
FGP-CS-750-250	3/4	250	72
FGP-CS-750-100	3/4	100	32
FGP-CS-750-50	3/4	50	18
FGP-CS-100-180	1	180	65
FGP-CS-100-100	1	100	39
FGP-CS-100-50	1	50	22
FGP-CS-125-250	1¼	250	128
FGP-CS-125-150	1¼	150	82
FGP-CS-150-250	1½	250	158
FGP-CS-150-150	1½	150	91
FGP-CS-200-150	2	150	137

CounterStrike is sized exactly the same as conventional TracPipe and uses the same AutoFlare fittings

CounterStrike® Performance (Testing)



The capability of CounterStrike to withstand electrical energy has once again been tested by a leading U.S lightning laboratory. The laboratory duplicated typical field damage attributed to lightning for CSST. The electrical energy level in coulombs (the amount of electricity provided by a current of one ampere flowing for one second) that was known to cause damage to our standard CSST was used as a baseline to determine the performance level of CounterStrike. When tested against our standard CSST, the latest version of CounterStrike exceeded the TracPipe's performance by at least 5,000%.

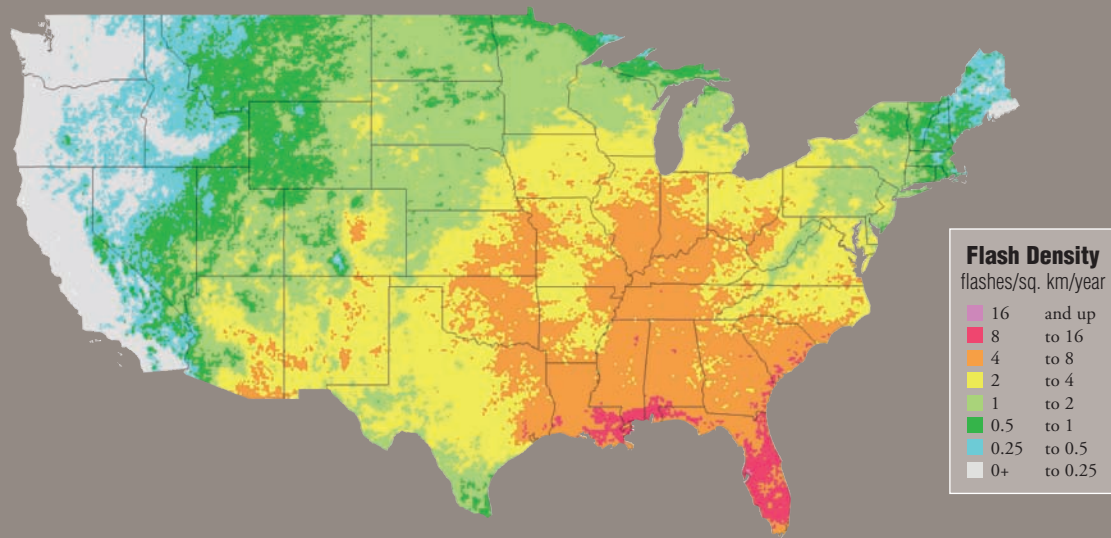


The information depicted in this graphic reflects test results obtained under specified laboratory conditions. The energy generated by actual lightning strikes cannot be duplicated in a laboratory.

Passive Lightning Protection Recommendations for Gas Piping Systems

1. The application of passive lightning protection principles is well suited to residential structures and the cost-benefit impact for implementation of passive lightning protection is within the scope of new construction costs in the US today. The areas which require close attention for passive lightning protection include:
 - A. Grounding of the electrical system per the National Electrical Code (NEC) ANSI/NFPA 70.
 - B. Bonding of the fuel gas system in accordance with the National Fuel Gas Code NFPA 54/ANSI Z223.
 - C. Bonding of all other metallic systems and exposed structural steel (ref NEC section 250.104). Bonding should include water pipe, metallic vents and flues as well as other metallic systems.
 - D. New technologies which can be integrated into a systems approach for passive protection as dictated by the lightning strike threat for a geographical region. These include CounterStrike, TracPipe PS-II and AutoTrip™ excess flow devices.
2. Bonding serves to protect people and equipment in the event of an electrical fault (equipment bonds) by eliminating touch potential differences, and bonding is also critical in protection of the structure and mechanical systems in the event of a lightning strike or nearby lightning strike.
3. Equipotential bonding of all metallic supply lines entering a building is a vital but often overlooked requirement when considering protection of a building and its contents during an electrical storm. Gas piping systems are specifically required to be bonded to a grounding electrode in accordance with the National Fuel Gas Code NFPA 54/ANSI Z223 and the National Electrical Code ANSI/NFPA 70. The grounding electrode is a requirement of the National Electrical Code.
4. Nearby lightning strikes during an electrical storm can induce differences in potential between electrical systems and unbonded mechanical systems. Bonding of these systems to a grounding electrode allows the mechanical systems to move at the same rate as the electrical system in unison with the energy wave. Near strikes change ground potential and induce voltage waves through magnetic flux and ground saturation.
5. There is a wide range of differences in a geographical area's susceptibility to lightning strikes. There are areas along the west coast of the U.S. where there is barely any occurrence of damaging lightning strikes. On the other hand, Florida is nicknamed "Lightning Alley" with the highest average amount of lightning recorded in the U.S. See map of the United States below for the average amount of lightning recorded in 1996-2000.
6. In locations subject to high lightning activity, a risk assessment per NFPA 780 (Standard for the Installation of Lightning Protection Systems) should be carried out to determine the need for a lightning protection system. See United States map on back cover.
7. **Improved CounterStrike must be bonded in accordance with the National Electrical Code NFPA 70, and with local requirements which may be in conflict with the CounterStrike installation instructions.**

The 5-year Flash Density Map below shows the average amount of lightning recorded in 1996-2000.



Lightning density map provided by Vaisala-GAI (formerly Global Atmospheric).

Additional Advanced Technology Products from OmegaFlex for Gas Piping Safety

TracPipe PS-II

Improved routing techniques which place CSST gas piping systems lower in the building or underground can reduce the amount of piping used as well as improve lightning strike resistance. Gas piping which is underground and enclosed in a non-metallic conduit provides an extra measure of safety. TracPipe PS-II is the second generation product of pre-sleeved CSST which provides contractors with an efficient and dependable method for installing gas piping underground and underneath buildings. TracPipe PS-II can be part of the total system approach to passive lightning protection. The trunk line leading from the meter can be installed beneath the building slab for protection from lightning. TracPipe PS-II has been used extensively throughout the U.S. for school science laboratory installations.



TracPipe PS-II Part Number	Size	Reel Length	Lb/Reel
FGP-UGP-375-250	3/8	250	61
FGP-UGP-500-250	1/2	250	97
FGP-UGP-500-100	1/2	100	43
FGP-UGP-750-250	3/4	250	117
FGP-UGP-750-100	3/4	100	52
FGP-UGP-100-250	1	250	160
FGP-UGP-100-100	1	100	68
FGP-UGP-125-150	1-1/4	150	125
FGP-UGP-150-150	1-1/2	150	143
FGP-UGP-200-150	2	150	205

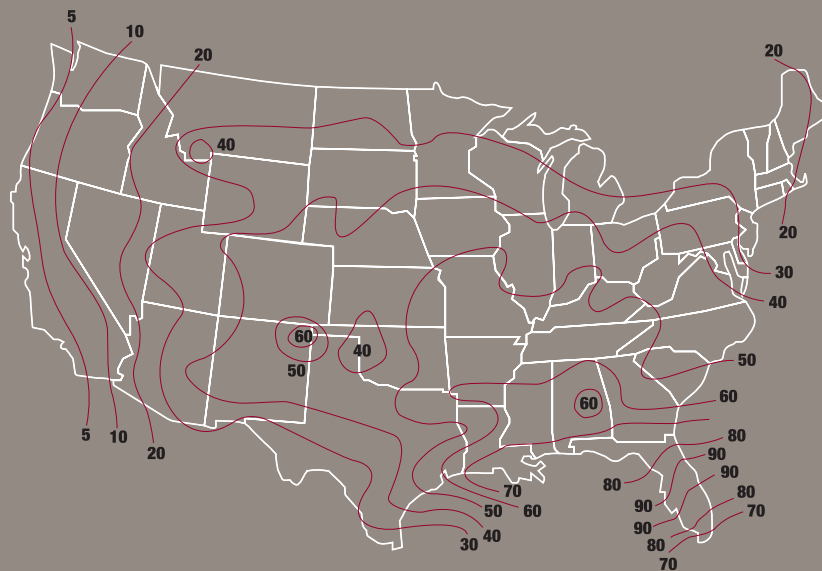
For additional information on TracPipe PS-II request OmegaFlex Brochure FGP-099

AutoTrip® Excess Flow Valve

An excess flow valve is a protective valve to help control the discharge of fuel gas in the event of a complete breakage of pipe lines or flex connector rupture. Excess flow valves have been of help in limiting gas loss in many incidents involving catastrophic fracture of piping including those caused by lightning strikes. They do provide a useful safety function in gas systems when a system component fails and the breakage or rupture leads to excess flow. AutoTrip™ valves should be installed at both the meter and appliance piping locations to provide coverage over the CSST gas piping system.



Average number of thunderstorm days per year for a specific region or state.



CounterStrike CSST is approved by CSA in accordance with requirements of ANSI LC1 CSA 6.26



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ISO 9001 REGISTERED COMPANY

OMEGAFLEX® is a manufacturer of quality flexible metal hose and piping products—metal hose, braid, braided-hose-on-reels, expansion joints, and now TracPipe, AutoFlare and CounterStrike. Our reputation in the industrial marketplace was built through excellent customer service, fully-stocked inventory, and “it’s on its way” shipping. TracPipe and its components bring our technological, manufacturing, and service capabilities to the plumbing, heating and mechanical trades.



ISO 9001

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Consultants to OmegaFlex – Power & Systems Innovations, Inc.
Orlando, FL