



STATE FIRE MARSHAL

Advisory on CSST (Corrugated Stainless Steel Tubing)

This document is provided by the Iowa Dept. of Public Safety-State Fire Marshal, Home Builders Association of Iowa, and the Iowa Fire Marshal's Association.

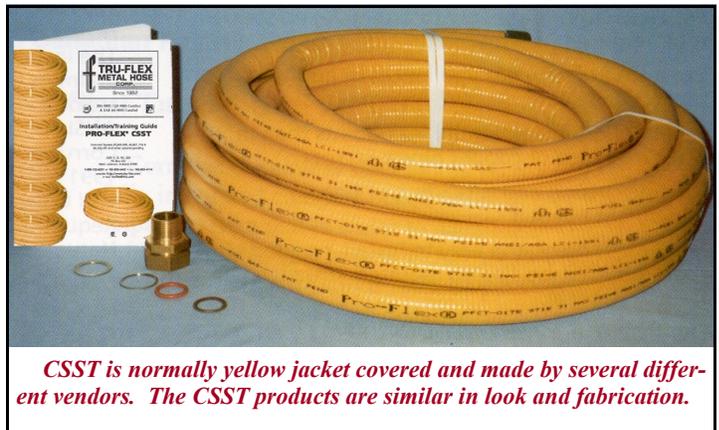
NOTE: The State Fire Marshal of Iowa does not have jurisdiction over single family residences in Iowa. CSST is predominantly used in these types of occupancies. However, a noticeable trend is developing in which CSST failures are occurring when exposed to direct or indirect lightning strikes. This document is provided to render advice on best practices in the interest of public safety.

What is CSST?

Corrugated stainless steel tubing (CSST) is a common alternative to traditional, threaded black-iron gas piping for residential, commercial and industrial applications. Its light weight, flexibility, and need for fewer connections and fittings, make it easier to install than traditional threaded black-iron piping. The product causes substantial labor savings for installers and cost savings for builders.

Since 1989 over 150 million feet has been installed in residential, commercial, and industrial structures. During 2002, approximately 45 million feet of CSST was sold and installed in the U. S. - an indication of the rapid increase in use of CSST in recent years.

Corrugated stainless steel gas tubing (CSST) consists of a continuous, flexible, stainless steel pipe with an exterior PVC covering. It is most often installed in a central manifold configuration (also called parallel configuration) with "home run" lines that extend to gas appliances. Flexible gas piping is light-weight and requires fewer connections than traditional gas piping because it can be easily bent and routed around obstacles. Unfortunately, the product is vulnerable to damage from both direct and indirect lightning strikes. The voltage may cause the piping to break and thus lead to a home/structure fire that is then fed by the natural gas within the CSST.



CSST is normally yellow jacket covered and made by several different vendors. The CSST products are similar in look and fabrication.

CSST and Builders/Contractors

What can you as the builder and installer do to continue to protect the safety of the home or structure you are constructing?

1. Contact the product manufacturer to insure the CSST piping is correctly installed and inquire about potential remedies to reduce damage from lightning strikes. This may include additional grounding, bonding or a protective jacket for the CSST;

2. Do not create additional or unnecessary tight bends (elbows) of the CSST piping through the structure;
3. Contact the local utility provider to insure the CSST installation meets their standards.
4. The gas meter with steel piping will normally be placed on the exterior of the home leading into the home or structure. Connect the bonding clamp to the black pipe inside the home closest to the CSST connection. Once the clamp is connected to the black pipe, the #6 copper grounding wire can be connected to a home grounding stake usually located under the electrical panel or connected to the bus grounding side of the main electrical panel.
5. DO NOT attach the bonding clamp directly to CSST.



CSST in a normal configuration for gas fired appliances.

Post-construction remedies will vary:

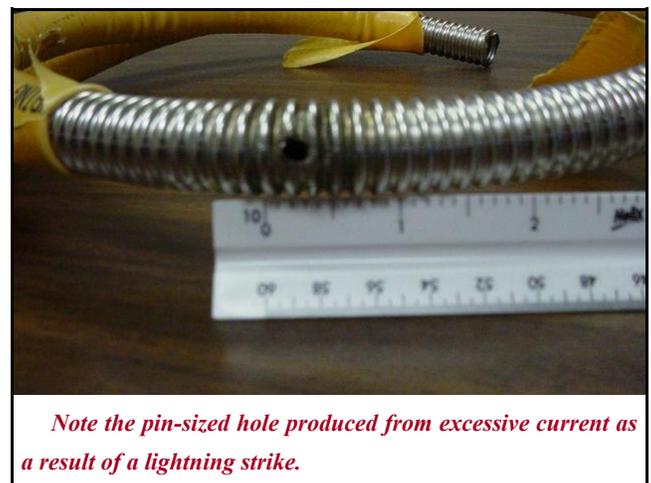
1. If the piping into the home is steel pipe, consider adding a grounding post/bar near the panel and running a grounding line from the black pipe inside the home to this post. Make sure the grounding post is correctly anchored;
2. It is not possible to properly ground/bond CSST if the piping from the exterior meter is CSST running into the home as there will not be the steel piping to ground from. The gas meter is owned by the utility company and bonding the meter is not a safe practice because the gas meter will serve as the path to ground for electric current from the lightning strike. This practice is prohibited and will likely cause a catastrophic failure of the gas meter.
3. Bonding outside the home directly to the earth ground is also not recommended. The entire gas line will then becomes the only ground for the home. Bonding is designed to dissipate current from lightning strikes using all systems of your home acting in equal potential.

Although steel pipe will reduce the likely impact of an electrical strike, it is not immune and connected appliances, may be damaged from the lightning strikes.

National Electric Code, section 250.104b, states that “bonding all piping and metal air ducts within the premises will provide additional safety”. Several manufacturers of CSST recommend all continuous metallic systems be bonded and grounded. This should include, but is not limited to, metallic chimney liners, metallic appliance vents, metallic ducting and piping, electrical cables, and structural steel.

Firefighter Implications/Operations

Fire Chiefs, fire officers and firefighters should be aware of the inherent dangers of CSST when exposed to any electrical charge mostly attributed to indirect and direct lightning strikes. This product may fail and in most cases will feed a fire to intensify the fire. Additional damage, especially to light-weight construction, can be expected.



Note the pin-sized hole produced from excessive current as a result of a lightning strike.

The danger truly begins when fire departments arrive on scene. Having an ability to recognize homes built with lightweight construction is imperative to safe fire ground operations. A high index of suspicion should be considered if gas systems and flooring units are compromised during lightning conditions.

The building industry has been working with lightweight building components for several years. Of particular concern to firefighters are the "I" joist or "I" beam flooring systems made of composite engineered lumber. As revealed in several major studies, when exposed to fire, these lightweight construction "I" joist floor systems may fail in 3 to 4 minutes.

What steps should you take as a firefighter during fires involving CSST combined with pre-engineered flooring systems?

1. Fire crew should be trained to recognize lightweight construction and anticipate collapse where fires are fully developed.
2. Fire crews must assure a sound floor before entering the property.
3. Recognize other signs of potential collapse and reevaluation of floor deflection or sloping should be evaluated before making an interior fire attack.
4. Firefighters should immediately evacuate from interior operations if fire and smoke conditions change or the fire can not be immediately located. Incident Commanders should be leery of conditions where the fire cannot be easily located. This may indicate the potential of advancing fire in hidden areas fed with leaking natural gas from CSST pinhole leaks.
5. Talk to the local Building Official in your jurisdiction and make sure CSST is being installed properly with bonding throughout and identify homes built with lightweight construction. Typically homes under \$300,000 are being sold with unfinished basements and this will give you an idea where they may be in your jurisdiction.



CSST failure in 2010 shortly after a lightning strike. Fortunately, the plastic water pipe melted from the fire and extinguished the fire.

Note: If you suspect lightweight construction or CSST may have been use in the construction, the TIC (Thermal Image Camera) could give false readings of floor temperatures in situations where a fire occurred in an unfinished basement. Use caution as imminent floor collapse may be possible, even if the TIC is showing normal room temperatures. The carpet, padding or ceramic tile will insulate the area above the fire showing temperatures within the normal range. Sounding of the floor with axes or other tools may be the only way to detect if a floor is unable to support the weight of a firefighter or crew.

Synopsis:

CSST is a legal product to use as an alternative to steel black pipe. CSST can become structurally vulnerable under certain conditions of lightning strikes or improper installations. Builders should consider other materials, or assure manufacturer's installation recommendations are followed if CSST is to be used.

Firefighters should be aware of the risks versus the benefits of making aggressive interior fire attacks when responding to lightning strike fires, especially if CSST failure is suspected.