

Natural Gas Piping Pressure Testing, Purging, and Equipment Restarts – How to Avoid Ten Hazards

Safety Note

The Danger

Whenever gas piping is repaired, extended, or newly installed it must be purged. The rules and best practices for handling these situations are often misunderstood, even by those conducting the work. This has led to deaths, explosions, and the loss of billions of dollars in industrial assets. This document seeks to clear up some misconceptions and provide the insights needed to make sure this work is done safely at any facility by applying the codes and standards such as OSHA 1910, NFPA 54, and the equipment standards like NFPA 85 or NFPA 86.

There are two codes that directly apply to this kind of situation. The first is OSHA 1910.147 for lockout/tagout of hazardous energy sources. There's been a lot written about this issue and most people make some attempt to comply with it, at least on the electrical side. However, while it seems to be followed religiously on the electrical side, we find it's only followed less than half the time for gas piping, steam, and other items that could be dangerous in a pipe. Many times, a lock is found on an electrical disconnect, yet the gas valve is just closed and not locked.

Even when people try to isolate equipment correctly, they often do not understand the issues surrounding lubricated plug valves and their need to be sealed in order to hold properly. Lubricated plug valves (which represents 60 to 80% of natural gas piping system valves) have a small gap between the plug and the valve body.

If the sealant is not applied annually, as required by code and the manufacturer, gas will leak past the plug even when the valve is in the closed position. Most plants do not have the knowledge or the equipment to seal these and have never sealed them in the life of the valve. Hence, closing or locking out a valve in this condition does not necessarily isolate the energy source.

The other code that applies to this issue is NFPA 54, which is also called the National Fuel Gas Code. It is a rather large document and takes some time to study and truly understand, so many consulting engineering firms and/or contractors do not fully understand it, and in some cases, have not even heard of it. This is proven by the lack of isolation points (i.e. blanks, blinds, pancakes, etc.) and the lack of purge points installed in most industrial plants. There seems to be little forethought given to the actual installation of the gas pipe and how the gas pipe will be put into service and the equipment started up. Here are some highlights from NFPA 54 about getting piping into service or the more complex matter of adding to an existing system.

10 Gas Piping & Equipment Start-up Hazards and How to Avoid

Shown below are ten hazards involved in purging natural gas piping as well as instructions on how to avoid them. These tips and techniques should be incorporated into a comprehensive documented procedure for natural gas piping purging, piping system design, and equipment start-ups.

Design/Planning

1. Purge Points

Purge points are pipe nipples installed at strategic locations in the piping system for the purpose of introducing or removing nitrogen and natural gas at various stages of the process.

These are generally 1" schedule 80 nipples with natural gas rated ball valves on the ends. It is important to select locations or orientations to make sure these are not susceptible to damage from things like vehicle traffic (for example, being run into with a tow motor or scissors lift).

2. Isolation Points

You must be careful that fuel trains are not exposed to excessive pressures that can damage components during pressure testing. This can be done with the use of line blinds. Valves can be left open or leak through in the closed position. Blinds provide positive isolation and eliminate the possibility of damaging devices in a fuel train that are not rated for the elevated test pressures (like regulators and pressure switches). In some cases, blinds also help to conduct pressure testing correctly, as pressure testing cannot be done against a valve.

3. Piping Support

During repairs, sections of piping may be disconnected to allow the addition of tees or to install blinds. It is important to ensure that adequate pipe supports exist to ensure that sections of pipe will not fall when disconnected. The closest support may be on the other side of the disconnected joint.

4. Gaskets

NFPA 54 does not allow the reuse of flange gaskets even if they appear to be in good shape. To ensure leak free joints, it is important that new gaskets are used as well as properly rated bolts for the flanges. Remember that if you are mating up flanges, it is raised face to raised face and flat face to flat face.

5. Material Specifications

It is important that proper rated pipe and fittings are used. Validate that reputable suppliers are used and material is free from manufacturing and installation defects. This would include things like pinholes in cast fittings, fittings where the threads are misaligned, and pipe that is not of the proper grade.

Implementation

6. Nitrogen

The air we breathe is 78% Nitrogen, but two full breaths of pure Nitrogen can kill you. Make sure everyone understands this hazard and make sure purge points are marked and located in well ventilated areas. Also, verify pressure ratings of hoses and regulators; large liquid nitrogen tanks are capable of producing high discharge pressures. When discharging Nitrogen, the purge discharge areas need to be monitored. Everyone involved in the purging and pressure testing needs to be trained on the safe handling of Nitrogen.

7. Discharge Locations

Make sure that purge end points where natural gas may be released are outside and at least 25' from any ignition source. Have areas roped off for security to keep ignition sources (including vehicles) and people away

ABOUT US

Honeywell Combustion Safety is a part of Honeywell Thermal Solutions, an industry leader in commercial and industrial combustion solutions. Honeywell Combustion Safety, formerly known as CEC Combustion Safety, has been in business since 1984. With engineers and staff members that sit on Code committees such as NFPA 56, NFPA 85, NFPA 86, and NFPA 87, our inside expertise is integrated within all of our practices, and our global reach ensures that customers around the world are kept safe. Honeywell offers testing and inspections, engineering & upgrades/retrofits, gas hazards management, training, and field services for all industrial facilities and different types of fuel fired equipment. By assisting organizations and their personnel with the safe maintenance and operation of their combustion equipment, Honeywell aims to save lives and prevent explosions while increasing efficiency and reliability of combustion equipment.

8. Sampling Devices

Do not use a combustion flue gas analyzer; use a good quality, recently calibrated lower explosive limit (LEL) meter during natural gas introduction and removal. A four gas meter can be used to monitor oxygen levels during Nitrogen post repair purging. Make sure that two LEL meters are available. Stopping the process due to instrumentation error can create a hazard. One LEL meter can be used as a barrier protector for the people near the purge end point and the other for use with at least a 6' long sensing tube that can monitor conditions at the actual discharge point. Don't stand in harm's way at the discharge point. Instead, do a timed and measured discharge and then with the flow stopped carefully approach to do an LEL check in the end of the purge hose.

9. Piping Integrity

During repairs or additions, piping may not be installed properly or disturbed during work. NFPA 54 requires that you have documentation of pressure testing for new or repaired piping systems prior to introducing natural gas. The results of these tests should be retained for the life of the piping system. Any section of piping that has undergone recent additions or repairs should be evaluated if no test records exist. Honeywell has established as a best practice the use of pressure chart recorders. These paper and pen battery powered recorders come with very small pressure increment gradations (1 psig) and provide excellent records of pressure and hold times of tests.

10. Emergency Isolation

During the reintroduction of natural gas after the post repair purge, it is imperative that the natural gas valve source valve be continuously attended during the reintroduction process. Communication with this individual should be continuously maintained. If a problem is detected, the supply of natural gas can be immediately isolated. In addition, valves should be serviced, handles installed and valve function verified.

Anytime natural gas piping systems are designed or worked on, these potential hazards should be evaluated and addressed. While the process is not simple, it can be completed safely if planned and properly implemented.

For more information

Learn more about Honeywell Combustion Safety, contact info@combustionsafety.com, visit www.combustionsafety.com or contact your Honeywell Sales Engineer.

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