

PERIODIC INSPECTION OF REGULATORS AND RELIEF VALVES

Mark T. Winsor

Atmos Energy
1774 N Hwy 14
Groesbeck, TX. 76642

INTRODUCTION

I spent ten years as the instructor of Pressure Control for one the largest Natural gas companies in the United States. At least 200 days of each year, I taught in the field working with individuals responsible for all equipment used for pressure control and overpressure protection in more than 350 cities and towns. All classes were conducted in the field working on active stations. Students were taught to methodically research each station before any attempt at an inspection was made. Each student was first trained to comfortably control the station they were assigned “manually,” using block valves before conducting the inspection process.

What should be shared here is that this was the advanced training class, and admittance was only allowed after passage of a week long Basic class. Basic class was extremely challenging. Students spent four days of the five day class, overhauling, building, installing, troubleshooting, repairing and operating large capacity regulators and relief valves.

The purpose of the law and the purpose of an inspection should be the same. Review every attached piece or extended piece of equipment at a facility in an orderly manner to identify design strengths and operational characteristics, before attempting any control. This careful review will not only help to determine the safest and most effective way to test the overpressure protection and regulating equipment; but it will pay off big dividends in enhancing your skills while making sure all the emergency valves are tested along with the automatic equipment. Then test all equipment to ensure it is connected and functioning properly.

Having a program of inspection which results in a thorough understanding of the unique characteristics of load that “each station”, must provide; and a program which will prove to the inspector that, each station “is” able to provide consistent, safe delivery of a prescribed pressure, with all the supporting equipment working properly, will meet the inspection process. The real challenge facing companies, is

training personnel to apply the program each and every time comfortably, with the results being a high quality inspection. This type of inspection “will” result in the identification of equipment failure, poor system response and many times provides answers to long term pressure delivery problems throughout a system.

On our system, we continue to improve on delivering gas to our customers at lower pressures, resulting in an increase in the safety of the system. In addition to savings in leakage, as well as increased accuracy in measurement, both significantly reduce Loss of Unaccounted for Gas (LUG).

Federal and State laws are currently in place, which identify various types of measurement, regulating, and over pressure protection device test frequencies. Additionally, each individual company may add to these policies. It is important the inspector become extremely familiar with all laws and company policies before conducting any testing.

INSPECTION PROCESS

Let me introduce you to a process of inspection. I will try to talk briefly about each step in the process. Please understand, this paper is for your consideration. It has definitely proven to be an effective process, especially if you are visiting an area, unfamiliar to you. Believe me, most days I was in a new area, and needed full proof a method ensure no mistakes were made while inspections were done on stations supplying looped or dead end systems. I have well over 20,000 inspections and overhauls behind me and stopped counting five years ago. As we go through the process, experienced inspectors please feel free to take part. Evaluate the process by determining how much of the information you can answer about your stations. Then ask yourself, why do I know that about my stations? When did I learn it and why? Am I testing and evaluating the equipment for weaknesses? Or, am I just following the steps I was shown and writing down the readings I see on a gauge?

STATION OVERVIEW

Whether you are responsible for your own City Gate Stations with connected District Regulator Stations, or you have an area of stations which belong to you. It is important to learn as much about that station as possible before attempting an inspection.

- Review the station with local personnel.

Discuss connected load and operating pressure, both inlet and outlet. Determine if any problems or abnormalities have been noticed by company personnel who work in the area the station provides gas for such as customer service personnel or construction personnel.

- Is the station looped?

How many other stations are attached to the same main lines of both the inlet and outlet sides? A poorly planned and executed inspection can affect the operation of an entire town plant. Failure to recognize a poorly balanced system before a test will also cause delivery problems.

- Is the system remotely controlled?

What contacts must be made to make personnel responsible for automated control aware of testing to be performed. Many times with their help stations and systems can be prepared even before arrival. Deliveries and pressures can be adjusted so that the inspector can complete the testing with little or no effect on either the inlet or outlet side of the station. After the test, normal operation can be resumed automatically with the inspector on site to verify operating response to the automatic load request. This can be extremely valuable for tuning of a station and can enhance the balance of the stations supplying the main.

- Check maps for direction of gas flow.

This step is related to the last; however additional information can be obtained by reviewing maps. Size of mains, upstream emergency control; if applicable can be identified. These valves are in most cases also required to be inspected. Finally, length of lines to each point of intersection (PI's) can be known. PI placement can be used to determine if water exists in outlet mains. This can be discovered while using the main block valves to test regulator station equipment.

- On initial approach to the station, observe station for visibility appearance.

- Park as the law and your company requires. Follow all safety practices.
- Put on all required protective equipment, use combustible gas and oxygen testing equipment as required before entry and if necessary while conducting activities if required.
- Check condition of signs, fences, gates, power lines and ground surface. Remember your safety is a number one concern. Develop a habit of testing fences and piping with the back of an uncovered part of the hand. If you detect an electrical sensation, don't grab with the hand. I have personally received just enough voltage to do myself physical harm by the surprise. Many times the charge is not felt until more physical pressure is needed to operate equipment, such as when operating a bypass valve. Just recently, I broke my old record of 5+ volts AC, with 6.13 volts AC discovered while bypassing a station. In large cities ground voltage is not at all unusual.
- Check for evidence of corrosion.
- Eliminate all sources of ignition. Another safe habit is not carrying any sources of ignition into a station.
- If conducting inspections inside an enclosure or fenced station, open all gates, doors and windows. Make sure all avenues of escape are working and kept clear of obstacles. Keep the station well ventilated at all times. Continually monitor air quality for hazardous atmosphere if required or anytime you believe it is necessary.
- Make sure all your tools and test equipment is functioning properly, meets its inspection criteria and is safe to use each time. All test gauges, small test valves, crosses, test fittings, hoses and tanks, etc. must be capable of withstanding not only the working pressures of the facility but should be able to handle the maximum operating pressure of any system that is connected to it. Ex: high pressure nitrogen bottles. If hoses are to be used, another good safety habit is to tie off the hose. A broken hose can cause severe physical damage, even if it was not suppose to burst.

INSPECTION OVERVIEW

Many of the following steps can be completed at the same time. Occasionally the order may also be altered depending on what the station is doing at the time of arrival and how often it changes flow characteristics during the time of the pre-inspection review. However, completion of all of the steps listed will result in the testing of all the equipment at each station, regardless of design or equipment type at every station. The actual steps for completing an inspection process on each type of equipment should be done with hands on training. It is important to realize that manufacturers and company operators sometimes have completely different ideas for installing the equipment.

Be aware that just because a station appears to be functioning properly does not mean it is. Many, many problems with operating systems were discovered throughout the years, while completing these inspection steps. Let's start by allowing you to determine if you may need additional training. Answer the following questions. Can you define the different meanings and where the following types of tests are performed? Transfer, transfer fail high combined, fail high, lockup, pop a relief valve, buildup, reseal. These are some of the most popular. There are others, and I am not listing any that I do not consider safe. Are you equipped and capable of servicing and maintaining block valves used to isolate regulator stations?

INSPECTION STEPS

- Review the path of gas.

Determine where the inlet is and follow the flow of all gas from the inlet to the outlet. Methodically determine the purpose of each control line, method of attachment. The strength, integrity installation of all materials and fittings used and point of each termination should be examined. After the examination, an inspector should be able to answer two questions correctly which will greatly enhance the safe inspection of the station.

If the gas stops flowing in this line, how will the station react? If this line is broken in two, how will the station react?

“Visually” determine the position of all valves, (open/close) on all valves located on control lines. While completing the visual path inspection, locks may be removed and serviced, vent integrity and placement, leak testing solution may be applied, and

equipment tags may be reviewed for accuracy with station records. In addition the beginning of valve preparation for testing may be started.

- Install test gauges. Minimum gauges required would be inlet and outlet gauges.

A methodical inspection up to this point will allow the inspector to determine where the gauges should be placed so that operation of the main block valves will determine if the regulators are capable of flow control and lock up.

After the gauges are installed, take the time to review pressures to assure that the settings on the equipment represent what the equipment is showing. For instance, does the amount of spring used for the regulator set point; reflect what the gauge readings for the inlet and outlet pressures exhibit. Most regulators have many different styles of parts which may be used in the same regulator. Many trained operators will choose specific parts for a regulator or relief valve in order to obtain specific response time.

Watch all gauges installed for a few minutes. Look for signs and sounds which indicate the station is not handling the load or load characteristics'

- Service all block valves if necessary and prepare to operate. If applicable upstream emergency control valves for the station should be inspected. Some company's also install isolation valves downstream from a station.

I have found, the first sign of a station having poor performance is that the main block valves are not operating correctly, or do not operate at all. This fact will help you be prepared for what is about to happen next.

The methodical path review done earlier, and answering the two questions about the control lines will serve the inspector well. If the answers to questions about blockage or breakage reveal a regulator will fail open more than closed, then the block valve to control overpressure may be needed to control a failure.

If the answer to the question determines that the regulator closes most of the time, then the bypass block valve may be the first valve used in a failure for that regulator.

During the operation of block valves, regulators may be flushed out, opened completely, closed completely. Using block valves will allow regulator

to be tested for response to minimum or maximum load conditions. Help determine a station's pressure set point overall performance with many other stations in a looped system. Determine if restrictions have developed in either the inlet or outlet piping system, preventing the station from providing constant pressure to a system.

Most important, use of the inlet, outlet, or bypass while testing a station's performance prevents an inspector from changing set points of equipment the inspector is may not responsible for. Also, the use of block valves coupled with properly placed gauges ensures that the pressure supplying our customer is never allowed to go above or below what the inspector determined before hand is the safe level.

During the operation of valves, I will use manual control of the block valves to slow down or stop the flow through the pressure control equipment. This allows me to set change positions of control line valves or lines in order to set up testing for different overpressure control protection systems, such as monitor regulators, or double cut system with monitor override pilots. Use of the block valves then allows me to set points and lockup of the equipment, without causing pressure swings on the system, and without changing set points. This is extremely important, since changing a set point while the load has changed significantly, causes many control problems. Pressure control professionals will agree that balancing a system is difficult at best and changing one set point will affect the whole system.

Many companies complete their inspections during low flow seasons. Setting regulator station to respond to a given area of a looped city without overrunning another station is difficult, but extremely important.

- Determine if insulators are present.

Review of mapping during the station review will allow the inspector information regarding cathodic protection. However if insulators are present, they should be tested. I have found many occasions where control lines installed for remote control equipment provide direct shorts on a protected zone.

On all my assigned stations, when I have completed servicing, partially rotating the bypass and in nearly all cases fully rotating the inlet and outlet valves. I have completed flow testing and lock up tests on all regulating equipment, including monitors. I am then ready to begin a reverse inspection. During the reverse, I reinstall all locking devices and verify the proper position of all valves.

If a relief valve is present, I will isolate the relief valve before performing a reverse inspection so that I may monitor the performance of the regulating equipment while I have the relief valve out of service for inspection. I do not do relief valve inspections without inspecting regulating equipment. I do not believe this is a safe practice.

- Relief Valve Testing

Relief valves require the same methodical testing. The information for the relief valve should be part of the original station overview. The capacity of the relief should equal or exceed the failed capacity of the regulator it provides protection for relief valves should be equipped with stop valve below the relief valve. The stop valve allows the relief valve to be tested for proper operation in accordance to federal and state code. This valve should be locked in the open position. The stack used for the escape of gas should be vented to a location, where the gas is not going to accumulate or come in contact with ignition sources. The stack should be equipped with a cap which prevents the entry of moisture, bugs, wildlife or any other objects which may affect the operation of the relief or restrict the flow of escaping gas.

CONCLUSION

The purpose of this paper is to provide more information about the testing of pressure control equipment used in the Natural Gas Industry. Over the years we have developed an itemized check list of tasks which must be performed when completing our scheduled station inspections. All the points in the check list are represented in this paper. It has been proven that when this type of inspection is completed with no tasks omitted, a high quality inspection is the result.

When the results are reviewed any items found which were unsafe or did not meet federal, state or company policy were immediately repaired. All other items were recorded and prioritized for necessary changes, upgrades or repair.

The knowledge for operating systems safely, efficiently and at significantly lower pressures can only be gained conducting these types of inspections. The acquisition of critical information is especially enhanced when inspections are done year round during all types of weather and load conditions. I taught station inspections in the field for ten years and would not feel comfortable writing step by step instructions for testing stations supplying customers.